NoiseKen

INSTRUCTION MANUAL

Electromagnetic Field Visualization System

MODEL EPS-02Ev3

NOISE LABORATORY CO., LTD.

Edition 3.00
AEA00088-00E-2

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1. Usage Limitations
   Please use the Software for the purposes described in the instruction manuals or the specifications. Do not use the Software for purposes other than these.

2. Intended Users
   Please ensure that individuals who use the Software have received the appropriate training and practice with regard to the entire system in which the Software runs, including the usage environment, equipment safety, and operating methods.

3. Ability to Make Copies
   The Software may be installed and used on multiple personal computers by individuals who are members of the business location (factory, branch office, business office, etc.) that purchased the Software.

4. Handling of Intellectual Property Rights
   The Software and the intellectual property rights including copyrights for the Software belong to NoiseKen.

5. Usage Period
   The usage period designated by NoiseKen shall take effect when the installation of the Software or the prescribed procedure for use, whichever is later, has been completed by the Customer, and the Customer's right to use the Software shall be deemed to have expired at the end of this usage period.

6. Usage Termination Conditions
   If the Customer has violated any of the provisions in this document, or has infringed on the copyrights or other intellectual property rights of NoiseKen, NoiseKen shall have the ability to revoke the Customer's license to use the Software.

7. Procedures Upon Usage Termination
   The Customer shall promptly uninstall the Software. (If other instructions have been issued by NoiseKen, these shall be followed by the Customer.)

8. Disclaimer
   NoiseKen and its dealers and affiliates will not be liable for any customer damages arising from the use of this software or for claims of damages by third parties against customers except in the case of intentional or gross negligence by NoiseKen, its dealer, or affiliates.

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   (4) Storing the Software, or the information, documentation, and the like provided by NoiseKen for the Software, on a network in a state wherein it may be conveyed to a third party

10. Handling of USB and other protection keys
    The software provided by NoiseKen may require USB or other protection keys.
    (1) If a protection key is included in the accessories, the protection key must be mounted in the computer where the software is used.
    (2) As a general rule, the protection key is not reissued. In the event that the protection key is damaged or lost, please contact the NoiseKen Sales (or Repair) Division.

2. IMPORTANT SAFETY PRECAUTIONS

This software performs visualization of electromagnetic field emissions in space. Important information for safe operation when performing visualization using this software is provided below, and so be sure to read it carefully before use.
Also, be sure to carefully read this manual and the instruction manual for each device to be used before using this software.

1. **Incorrect or careless operation could result in a fatal injury.**

2. **Avoid use in locations exposed to high humidity and large amounts of dust.**

3. **When making connections, electric shock can occur due to contact with the supply voltage, and so before performing any connection work, be sure to turn off the power to the each device, and check that no power is flowing.**

4. **Do not turn off the power to the each device or disconnect any cables while this software is running. This could cause PC operation to become unstable or the OS to malfunction. Be sure to always exit this software before turning off the power to the each device.**

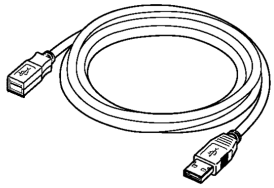
3. Item Check List

Before starting use, check that the parts and accessories below are included with the product.

A

B

C



D

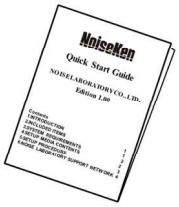
E

F

G

H

I



J

A: Web camera
- Main part ····· 1
- Warranty ····· 1

B: LAN cable (2 m) ····· 1
C: USB extension cable (2 m) ····· 1
D: Setup media (EPS-02Ev3) ····· 1
E: USB protect key ····· 1
F: Camera tripod
- Main part ····· 1
- Storage bag ····· 1

G: Extension pole ····· 1
H: Japanese Quick Start Guide ····· 1
I: English Quick Start Guide ····· 1
J: Storage case ····· 1

* The key of D, E, H and I are included in the upgrade version, and the key of D is disk media.
* The key of D, H and I are included in the minor upgrade version, and the key of D is disk media.
* If the software version at the time of purchase is earlier than Ver.3.1.4.0, refer to the instruction manual at the time of purchase.

4. Introduction

Thank you for purchasing the EPS-02Ev3 Electromagnetic Field Visualization System. Before using the EPS-02Ev3, be sure to carefully read this manual to ensure that you maximize its performance when operating the EPS-02Ev3.

- **This manual is provided to ensure that people who follow the operating procedures and safety information can safely use the EPS-02Ev3 and maximize its performance.**
- **Place this manual in a location where it is easily accessible whenever operating the EPS-02Ev3.**

4－1. Features

Enabling visualization of electromagnetic field emissions in space

- An electromagnetic field measurement sensor is used to perform frequency analysis with a spectrum analyzer and to map to the emission location of the actual image.
- The emission location is mapped relative to the sensor location recognized using the web camera.
- An area of up to 64 blocks × 48 blocks can be measured.
- A superimposed image of the measurement strength distribution diagram and web camera image are displayed for enabling easy identification of the emission source. The density of the strength distribution and frequency range can be specified.
- Measured results can be saved to a file, and the content of the measurement results and file can be compared for enabling visualization of the effects of corrective actions.
- Measurement sensor location detection by hand instead of using a positioner is possible for enabling easy measurement in cramped spaces, outdoors, and other difficult-to-access locations.

Temporal changes of magnetic field emissions can be displayed.

- The spectrum analyzer performs frequency analysis of the signals measured by the electromagnetic field measurement sensor and displays the data on three dimensions of time, frequency, and strength.
- By detecting the position of the fixed electromagnetic field measurement sensor on the camera image, data of temporal changes can be saved in linkage with visualization of electromagnetic field emissions in space.

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6. Overview

6－1. Notation Used in This Guide

The marks used in this guide and their meanings are provided below.

	Provides an additional explanation.
	Indicates a location for further reference.
	Indicates a setting restriction.
	Indicates that you must check before usage.
【　】	Indicates information inscribed on the panel of this testing device.

6－2. EPS-02Ev3 Features

＊ **Measurement sensor is detected from the image for recognizing the measurement location**

The measurement object and measurement sensor are captured by a camera, and the measurement sensor is found within the image for identifying the measurement location. The recognized measurement location is a relative location within the camera image.

Any user-selected color can be specified for the measurement sensor. However, selecting a color with the same tone as the background color will result in a reduced rate of recognition and even mistaken recognition in certain cases.

The measurable range is the area shown in the camera, but it is restricted to a range that can be recognized by the measurement sensor.

＊ **Automatic control by software**

Measurement sensor recognition from the camera image and control of the spectrum analyzer are performed automatically. The measurement results can be output as a CSV file, and the image can be output in BMP format.

＊ **Visual display of measurement results**

The measurement strength distribution and camera image are displayed as a superimposed image on the computer screen. Also, the mouse pointer in the image can be used to confirm measurement results for any selected position.

In addition, an interpolation view of the surrounding strength can be used to provide easier assessment of the generation points.

＊ **Full emission analysis function for measurement points**

Data can be collected for the entire measurement frequency range generated from the measured object in a single measurement. The emission map for each frequency band is also redisplayed by simply specifying the frequency band.

6－3. Measurement Principle

The EPS-02 system performs two main operations for enabling visualization of the electromagnetic field. First, it performs image recognition that identifies the measurement sensor location from the recording image. Second, it provides a color-coded distribution on the image indicating the strength of the signals detected by the measurement sensor.

In image recognition, 640 x 480 pixel video from the camera is monitored in real time, and a specific color only is extracted based on the specified parameters for "hue", "brightness", and "saturation". By finding the focal point of the area with the specific color, the location of the specific object (measurement sensor) can be found in the image.

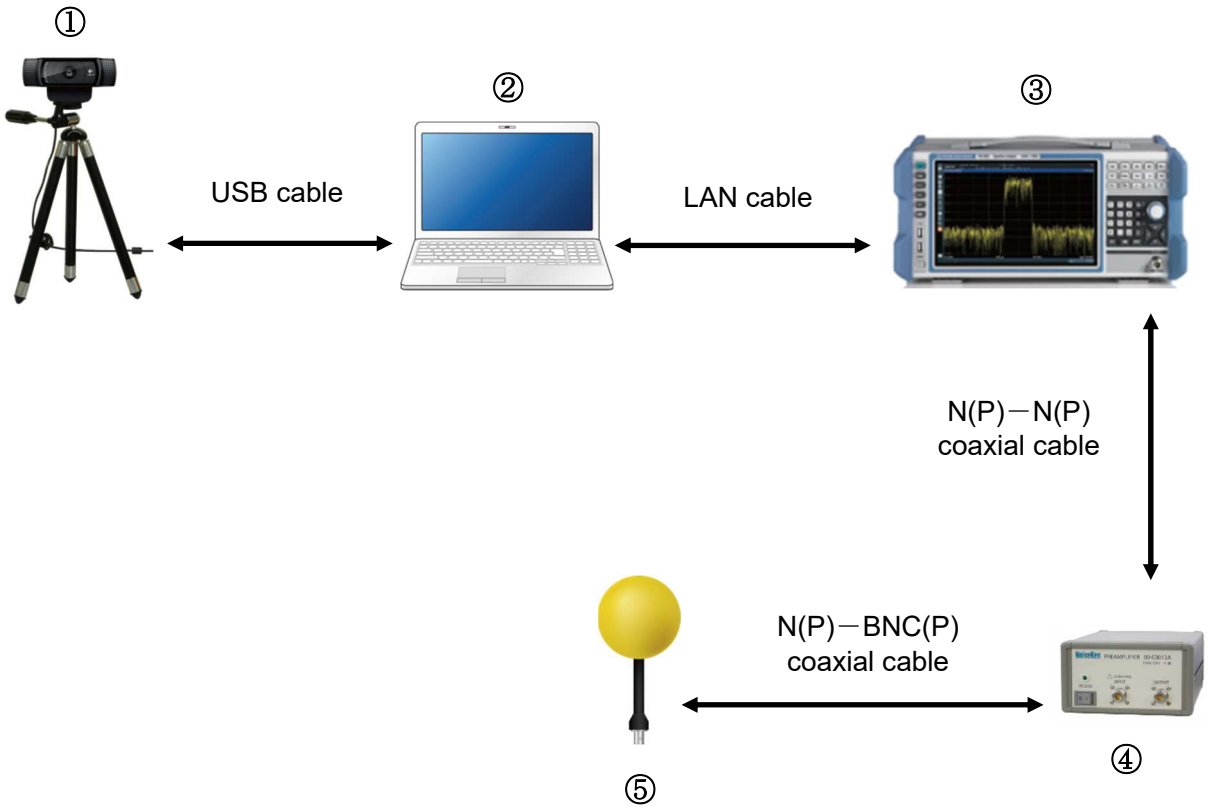
If an object with the same color as the specified color, but that is not the measurement sensor, appears in the image, the measurement sensor location cannot be recognized correctly because the focal point of all objects of this color is calculated. Therefore, the parameter settings for "hue", "brightness", and "saturation" that are used to detect the measurement sensor, the brightness and light exposure in the recording location, and selection of the lighting are important factors. Also, the cover of the measurement sensor must be adjusted based on the color of the measurement object.
Substances suitable for the measurement range are used for the measurement sensor, and a spectrum analyzer is used as the measuring instrument for enabling measurement of the electromagnetic field area. The spectrum import count and frequency range vary depending on the measurement sensor and measuring instrument. The measurement data is mapped to a position specified by image recognition. The method of capturing data at the same position can be selected from MAX HOLD, MAX PEAK DATA, FREE RUN, and SINGLE.

After measurement is completed, the frequency range that you want to view can be selected for creating a strength distribution combined with the image.

There are no guidelines or restriction values for the electrical field strength of the proximity field.

7. System Configuration Diagram

7－1. System Configuration Diagram



① Web camera
This captures the image of measurement object.

② Control PC
This controls the various devices and conducts electromagnetic field measurement.

③ Spectrum analyzer
Support is provided for some spectrum analyzers described in “12－2.Supported Spectrum Analyzers” on page 97. Please consult with NoiseKen for use of spectrum analyzers that are not supported.

④ Preamplifier (Optional)
This is a high-performance preamplifier that can be used for EPS-02 series and other various applications.

⑤ Measurement sensor (Optional)
The electrical field probe, magnetic field probe, and other measurement sensors are selected based on the frequency application. NoiseKen optional probes and commercially-available electromagnetic field probes can be used.

7－2. Functions of Each Device

① Web camera
This is a general-purpose web camera. The image of measurement object is captured and transferred to the PC. The web camera is connected to the PC by a USB cable. If necessary, the connection can be extended by a USB extension cable.

② Control PC
This enables running of system control software. This software imports images from the web camera, identifies the measurement sensor within the image, and finds its location. After frequency analysis is performed by the spectrum analyzer, the control PC receives the measurement results and maps them to that location.

③ Spectrum analyzer
This performs frequency analysis of the signals from the measurement sensor and sends the spectrum data to the PC. The spectrum analyzer is connected to the PC using the supplied GP-IB or LAN cable.

④ Preamplifier (Optional)
This amplifies the signal detected by the measurement sensor. Connect the measurement sensor to the INPUT terminal and the spectrum analyzer to the OUTPUT terminal.

⑤ Measurement sensor (Optional)
A sensor (probe) is used based on the measurement target frequency and electrical or magnetic field. Attaching a special cover to the sensor is recommended for improving the recognition rate.

8. Preparation

CAUTION
Environments having poor signal reception
In environments exposed to extremely large amounts of external noise, the equipment may be unable to realize its maximum performance.
Even when indoors, the equipment can be affected by lighting and other electronic devices. During measurement, try to minimize the effect of the electromagnetic environment to prevent external noise from affecting the equipment. Also, certain PCs may generate large amounts of noise emissions and may not be suitable for measurement systems.

8－1. System Backup

NoiseKen provides an optional service (additional charges apply) for installing the EPS-02Ev3 program in your PC before providing the program, but if the program is erased, install it from the supplied setup media. Copy the content of the setup media to a hard disk, removable disk, or other location and store it there in case of loss. For details of setup, see "10. Setup" (P90).

8－2. System Connections

① Connect the web camera to the PC using the USB cable. Any commercially-available USB cable can be used, but it must be a cable that supports the USB 2.0 standards. Be aware that the USB 2.0 standards limit the cables to a maximum of 1 extension and maximum length of 5 m.

② The spectrum analyzer and PC are connected by a LAN cable. A commercially-available cable can be used for the LAN cable. Use a one-to-one local connection without passing through the site LAN or hub.

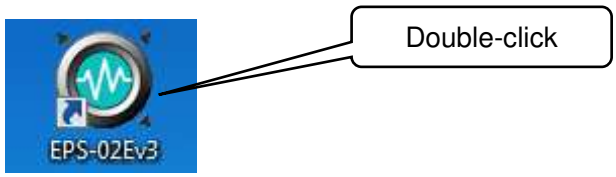
③ Connect the measurement sensor and spectrum analyzer. Use the proper conversion cable that matches the sensor output connector.

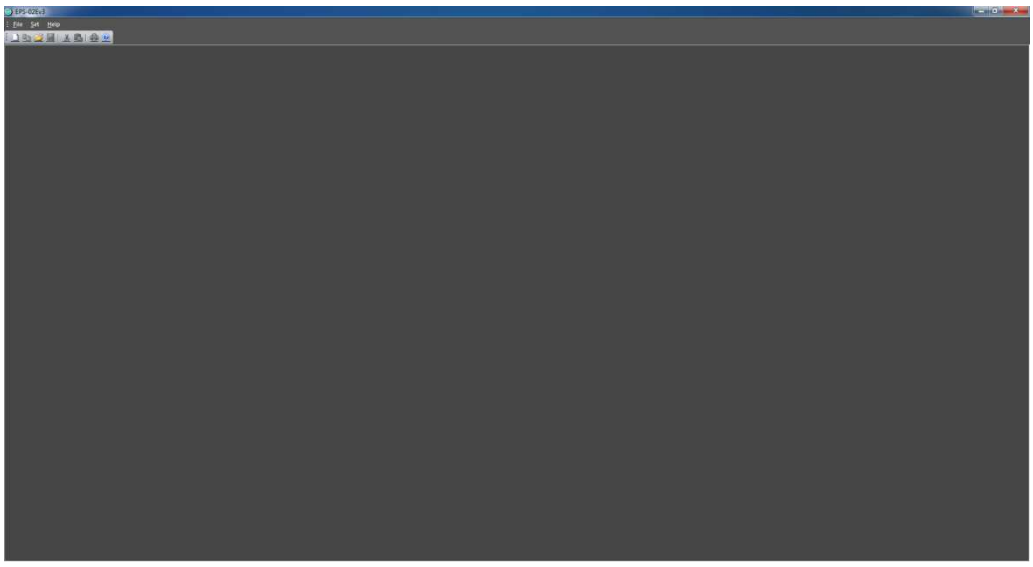
9. Operation Procedure

9－1. Starting and Exiting the Software

Starting the Software

To start the software, double-click the EPS-02Ev3 shortcut icon on the desktop.



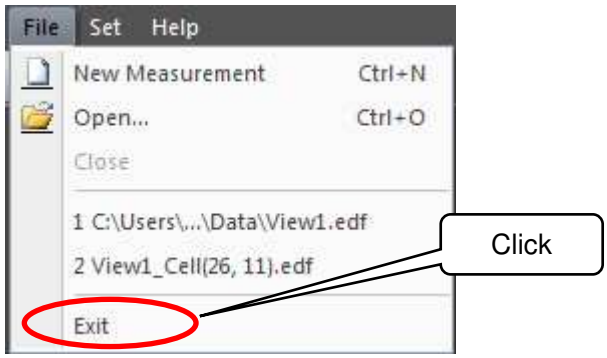


Screen displayed immediately after the software is started

Exiting the Software

To exit the software, click the close button on the right end of the title bar or click **Exit** from the **File** menu.

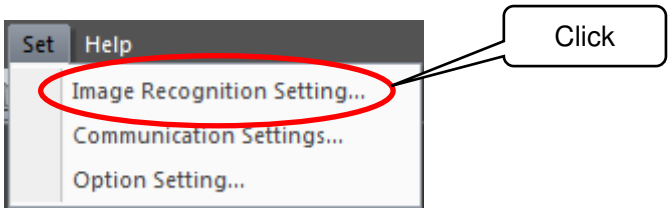
Because the software cannot be closed during measurement, finish measurement before exiting the software.



9−2. Image Recognition Settings

Image Recognition Setting Dialog Box

To open the **Image Recognition Setting** dialog box, click **Image Recognition Setting** from the **Set** menu.



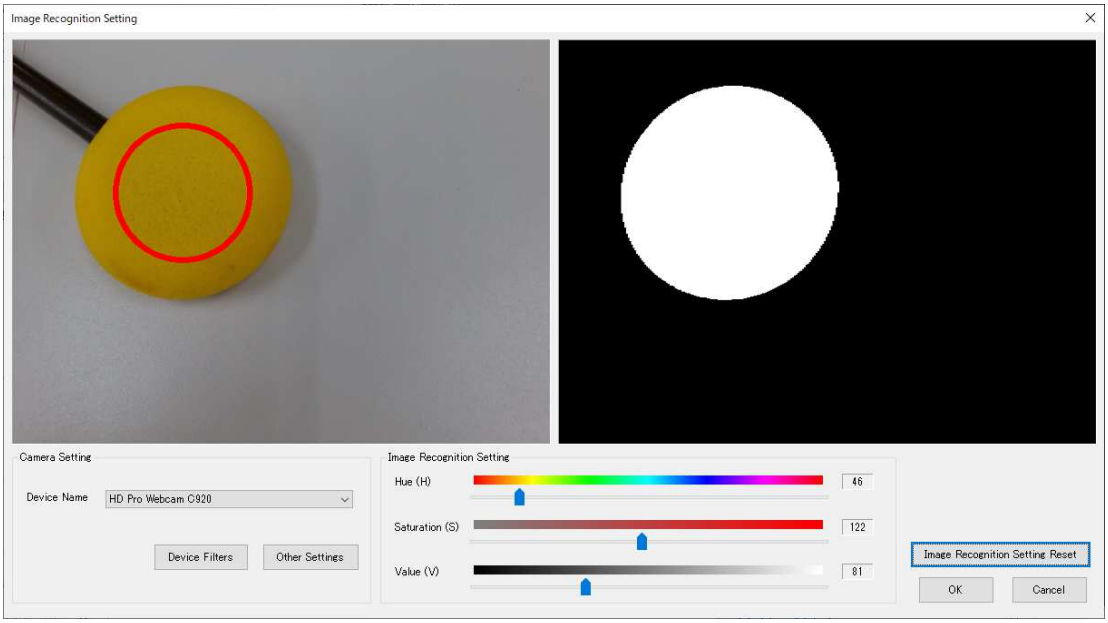


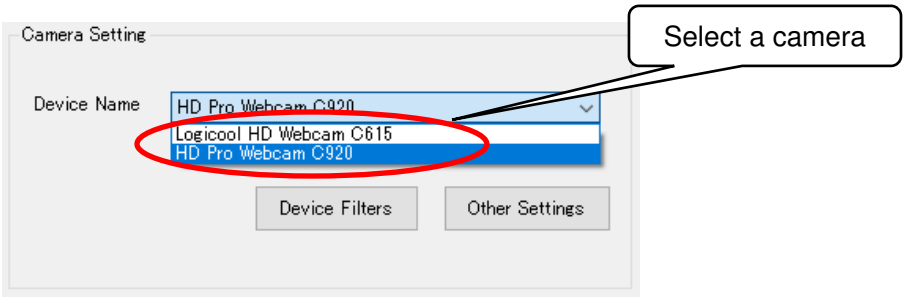
Image Recognition Setting dialog box

Adjust the camera position so that the measurement object can be captured by the camera. Take the following conditions into account during adjustment. Changing camera properties or adjusting the lighting may be required depending on the circumstances.

- Sufficient brightness is provided so that the measurement object and the measurement sensor can be fully recognized.
- There is no object whose color is similar to that of the measurement sensor.

Device Name

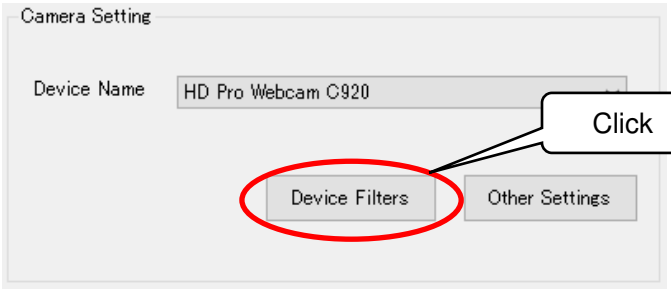
Camera names are displayed in the **Device Name** list. If multiple cameras are connected, select the camera to be used from the device name list.

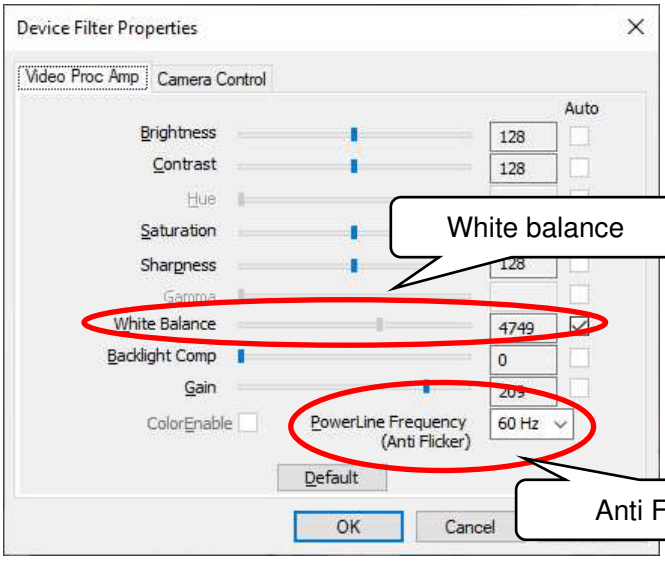


Device Filters

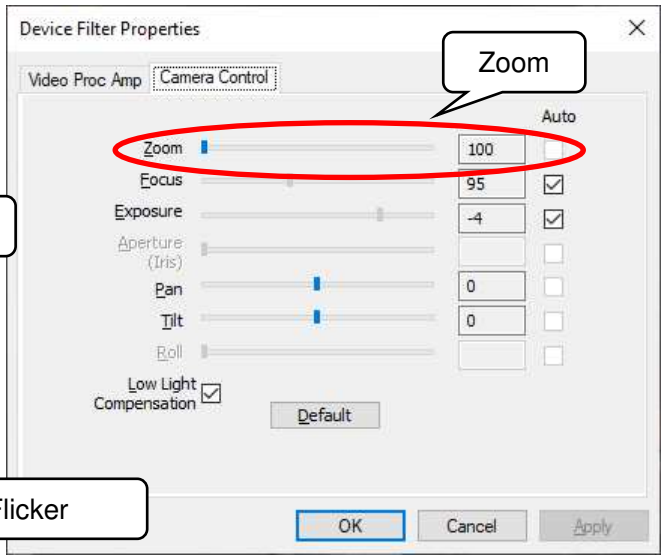
To open the **Webcam Properties** dialog box, click the **Device Filters** button.

In the dialog box, the camera properties, such as zoom, white balance, and anti flicker, can be set.





Video Proc Amp screen



Camera Control screen

- White balance

  White balance is a function to perform color correction so that a white object appears white. If the light source, such as sunlight, light bulb, or fluorescent, makes the white object look bluish or reddish, adjust white balance.

- Anti Flicker

  Anti Flicker is a function to reduce flicker in images.

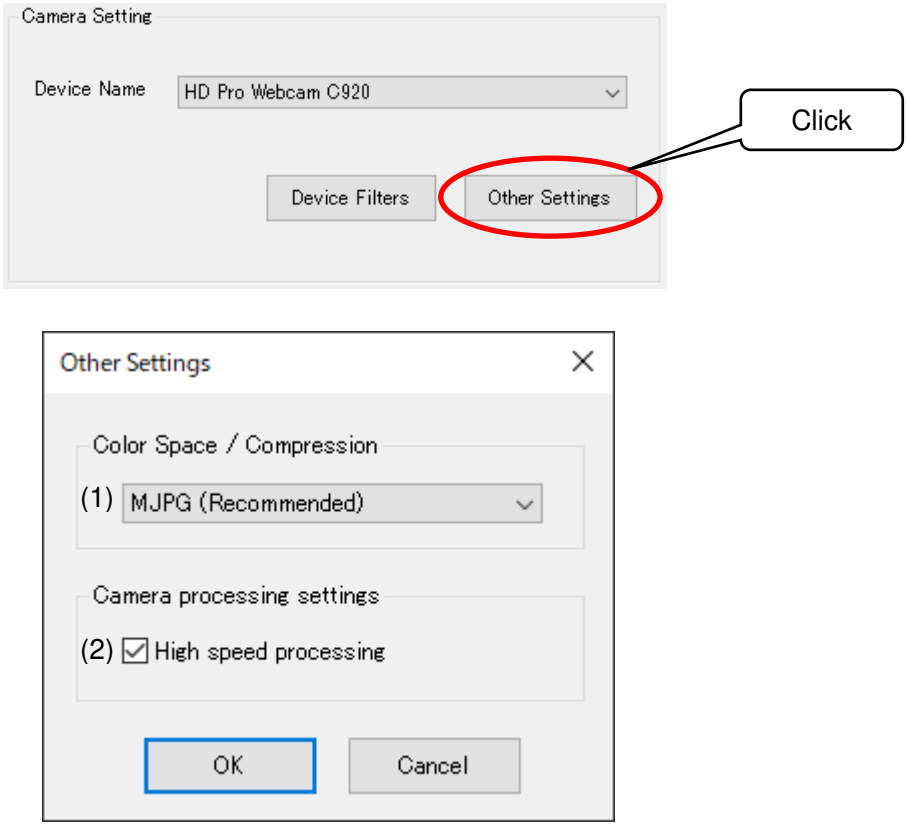
- Zoom

  Zooming may not be possible depending on the model, driver, or color space / compression settings. Refer to “Other Settings” on page 17 for the color space / compression.

The Properties screen may vary depending on the model or driver version of the connected camera.

Other Settings

To open the **Other Settings** dialog box, click the **Other Settings** button.
In the dialog box, the color space / compression and camera processing can be set.



Other Settings dialog box

(1) Color Space / Compression

The color space / compression of the camera can be changed. If the camera is not working properly, changing it may improve the situation. The first item in the list is the recommended method.

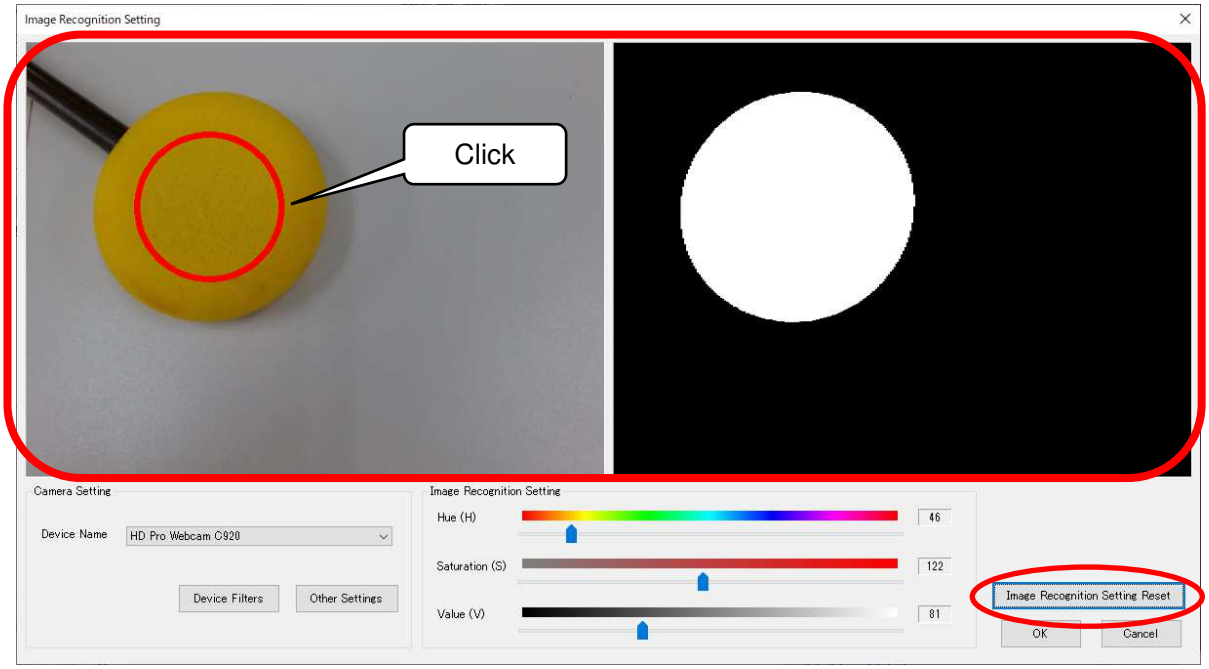
(2) High speed processing

Speed up camera processing. If the camera is not working properly, unchecking the checkbox may improve the situation.

Image Recognition Setting

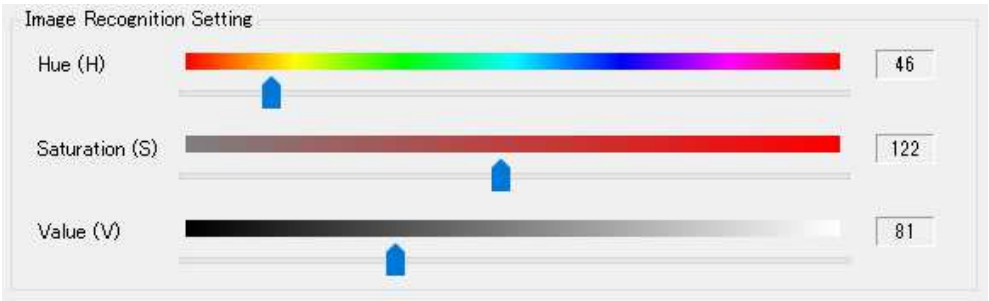
Adjust the three parameters, **Hue**, **Saturation**, and **Value**, in the **Image Recognition Setting** so that the color of the electromagnetic sensor can be recognized. Left-clicking the position of the electromagnetic field measurement sensor on the camera image adjusts the hue, saturation, and brightness at the clicked position and changes the binarized image. Each left click configures the image recognition setting based on the previous image recognition setting and the color information of the clicked position. Right-clicking returns the image recognition setting to the previous one.

Clicking the **Image Recognition Setting Reset** button resets the image recognition setting and the information obtained by clicking on the camera image.



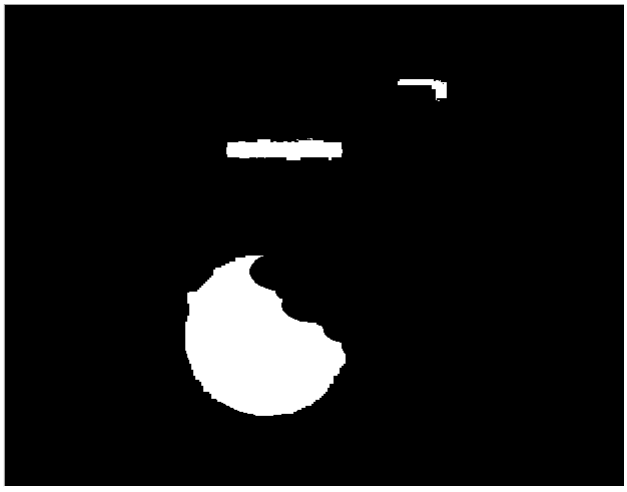
Moving the sliders can also adjust color recognition.

Hue: Sets the hue, such as red, blue, or yellow
Saturation: Sets the intensity and purity of a hue
Value: Sets the lightness of a color.



Adjust the parameters until the electromagnetic field measurement sensor is recognized as a circle and no other object is recognized. If there is any object whose color is similar to that of the sensor in the background, hide the object or change the color of the sensor.
Once the sensor is recognized as a circle, click **OK** to complete adjustment.

Desirable recognition state
The shape of the sensor is almost circular.
There are no recognized areas in the background.



Not desirable recognition state
The shape of the sensor is not circular.
There are recognized areas in the background.

Procedure for successful sensor recognition setting
[Adjustment by clicking on the image]

1. Left-click the position of the sensor on the camera image.
2. If there are other recognized areas than the sensor or the sensor is not circular, left-click other part of the sensor
3. Repeat Step 2 until the sensor is correctly recognized.
4. If the sensor is not correctly recognized after repeating the action several times, click the **image recognition setting reset** button and do the same procedure from step 1 or try [Adjustment by sliders] shown below.

[Adjustment by sliders]

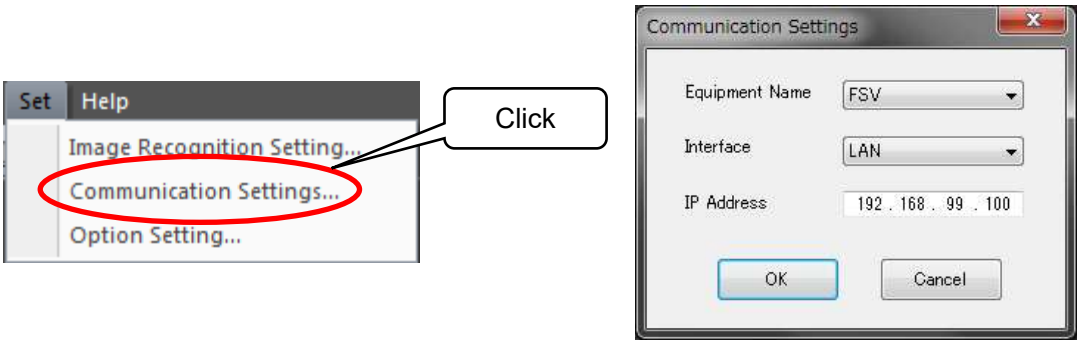
1. Set the **Saturation** and **Value** to 0.
2. Adjust the **Hue** so that the sensor is most clearly recognized.
3. Increase the **Saturation** gradually to remove other recognized areas around the sensor. Do not increase the **Saturation** excessively to prevent the recognized sensor area from being impaired.
4. Increase the **Value** in the same manner.
5. Finally, move the sensor outside of the camera view, and make sure that there is no object to be recognized.
   If any other object is recognized, repeat steps 3 and 4.
   When the mal-recognition is not solved even if steps 3 and 4 are repeated, start over from step 1.

9－3. Communication Settings

Communication Settings Dialog Box

To open the **Communication Settings** dialog box, click **Communication Settings** from the **Set** menu.

In this dialog box, a remote-controlled spectrum analyzer can be set up.

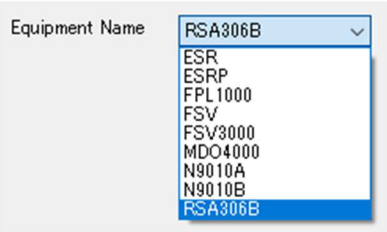


Communication Settings dialog

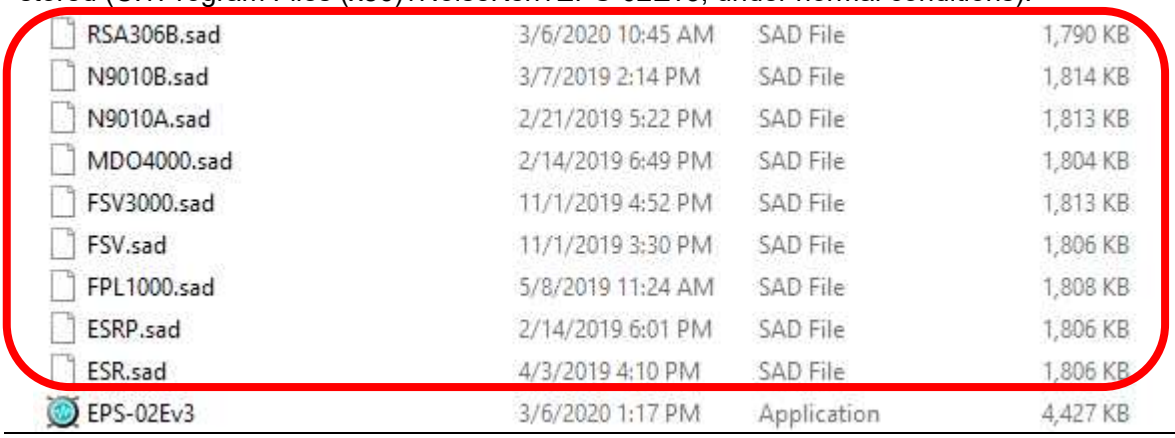
Equipment Name

Select the equipment name of the connected spectrum analyzer.

The following nine drivers are available as standard options: FSV, FSV3000, FPL1000, ESR, ESRP, MDO4000, N9010A, N9010B, and RSA306B. Customized spectrum analyzer drivers are also included in this list.



If the **Equipment Name** list is blank, no spectrum analyzer driver may exist. Check to see that spectrum analyzer drivers (*.sad) are stored in the folder where the EPS-02Ev3 executable file is stored (C:¥Program Files (x86)¥NoiseKen¥EPS-02Ev3, under normal conditions).

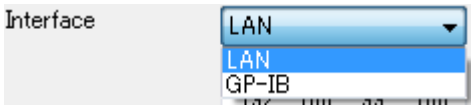


When NI-VISA (National Instruments) has not been installed, the **Equipment Name** list is blank even if spectrum analyzer drivers exist. In such cases, install NI-VISA according to “10－3. Installing the Software” in page 91.

Interface

Selectable interface types vary depending on the selected equipment.

Equipment supports GP-IB only, LAN/GP-IB, or LAN/GP-IB/USB.



IP Address

The **IP Address** is displayed when **LAN** is selected as the interface with the analyzer.

For how to set the IP address, see “10－2. Network Address Settings” on page 90.

GP-IB Address

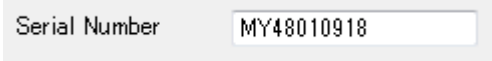
The **GP-IB Address** is displayed when **GP-IB** is selected as the interface with the analyzer.

Set the address to the same value as the GP-IB address of the selected equipment.

Serial Number

The **Serial Number** is displayed when **USB** is selected as the interface with the analyzer.

Check the serial number of the selected equipment using the system confirmation screen for the equipment.

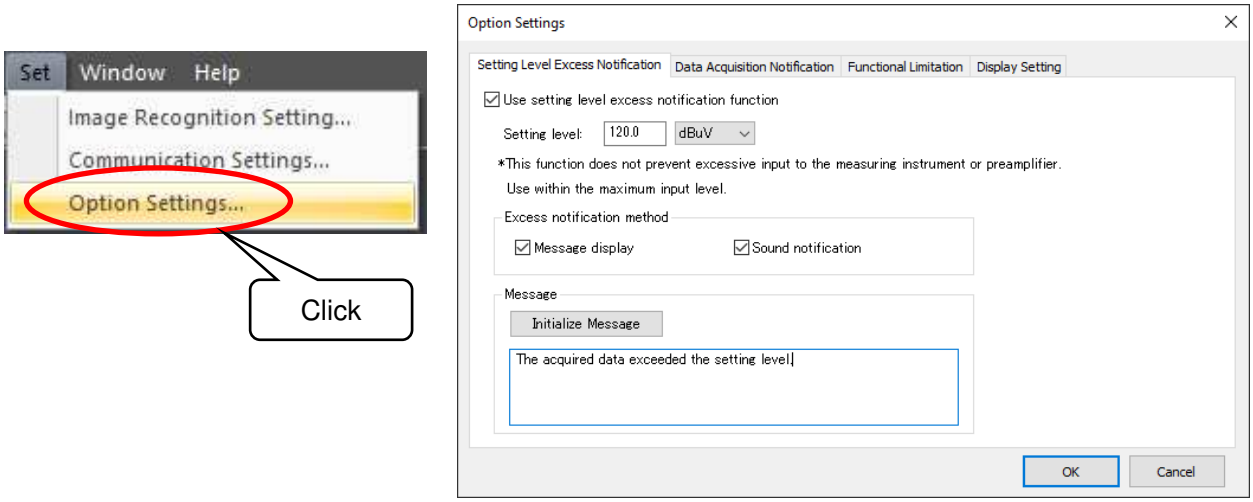


9－4. Option Settings

Option Settings Dialog Box

To open the **Option Settings** dialog box, click **Option Settings** on the **Set** menu.

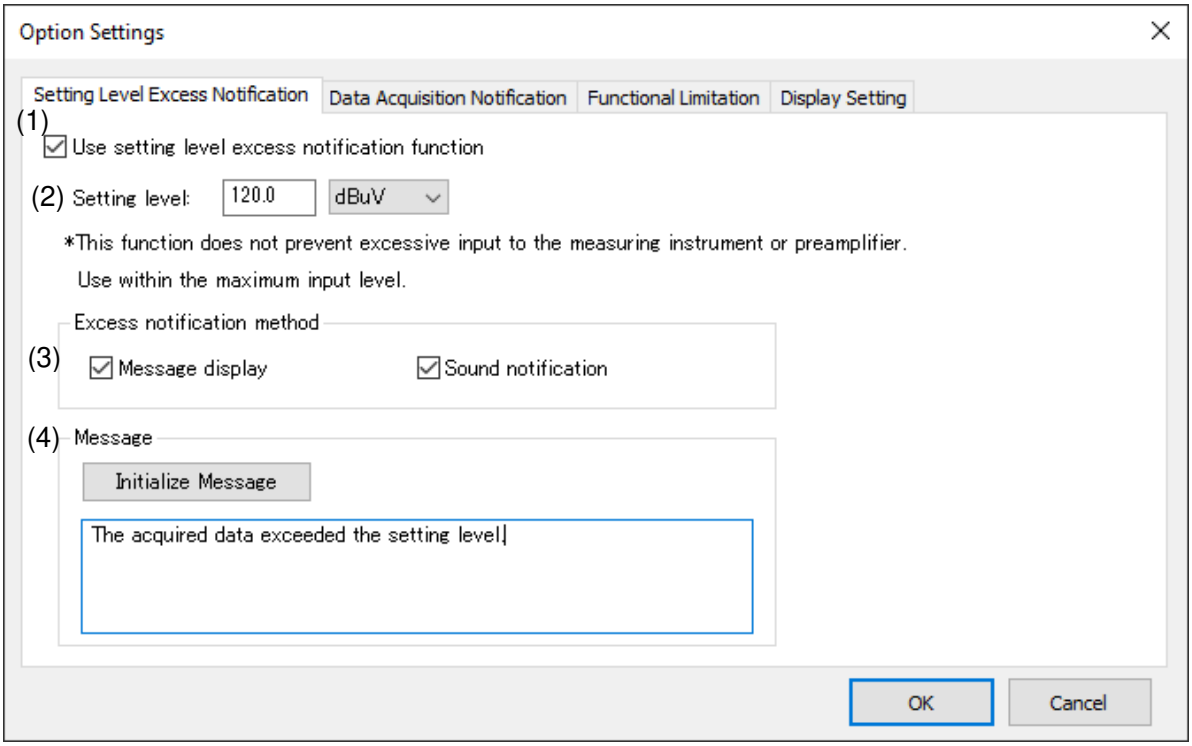
Optional function is set here.



Option Settings dialog

Setting Level Excess Notification

A function that displays a message or notifies by sound when the setting level is exceeded can be set.



(1) Use setting level excess notification function

To enable this function, check the checkbox.

(2) Setting level

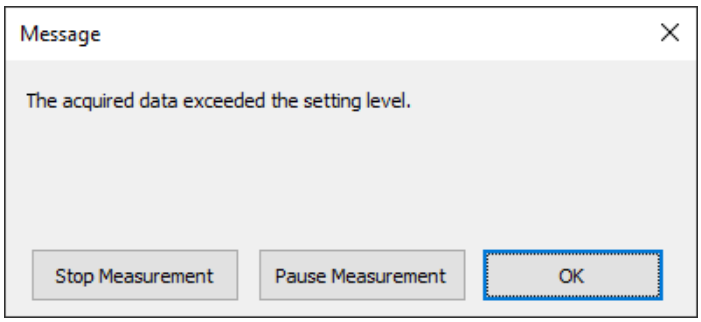
Sets a level.

(3) Excess notification method

Specifies the notification method for when the setting level is exceeded. Selecting **Message display** displays a message. Selecting **Sound notification** notifies by sound.

(4) Message

Sets a message to be displayed when the setting level is exceeded. To initialize the message, press the **Initialize Message** button.

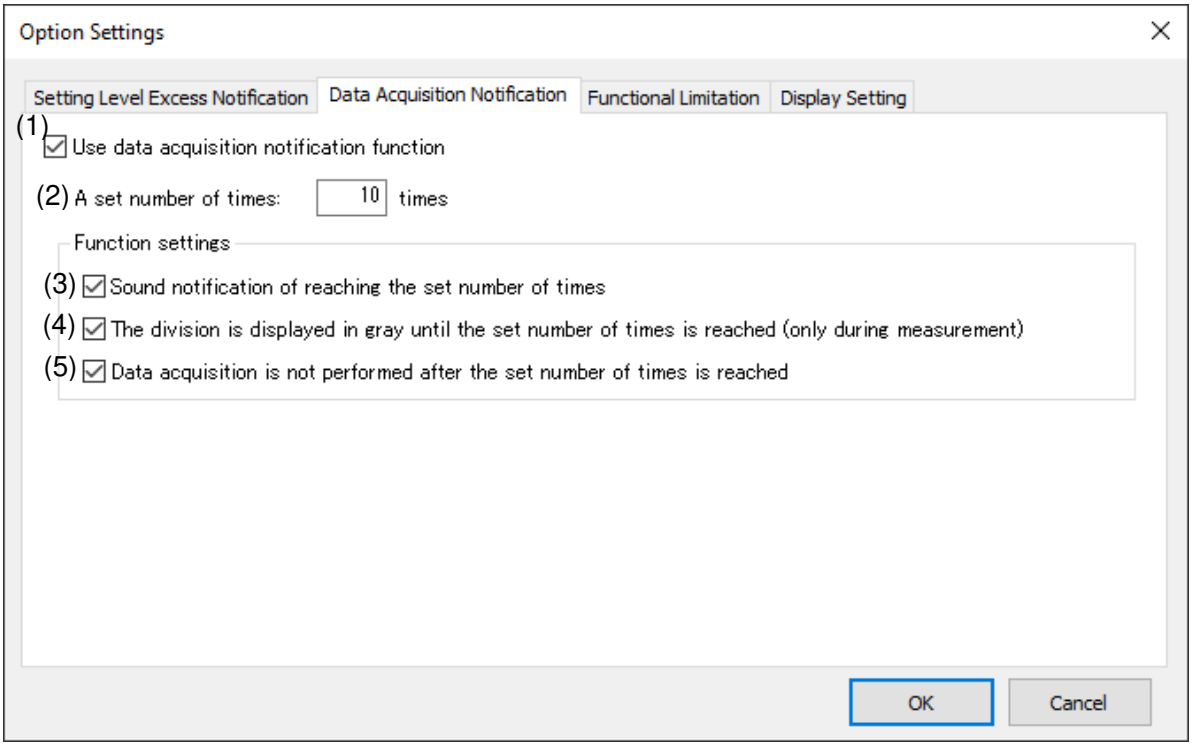


Message

Setting level excess detection is performed before interpolation by Antenna Factor.

Data Acquisition Notification

A function that notifies whether the number of data acquisitions of each division has reached the set number can be set.



(1) Use data acquisition notification function

To enable this function, check the checkbox.

(2) A set number of times

Sets a set number of times.

(3) Sound notification of reaching the set number of times

If the checkbox is checked, reaching the set number of times is notified by sound. A low tone will continue to sound in the divisions that have not reached the set number. A high tone will sound in the divisions that have reached the set number.

(4) The division is displayed in gray until the set number of times is reached (only during measurement)

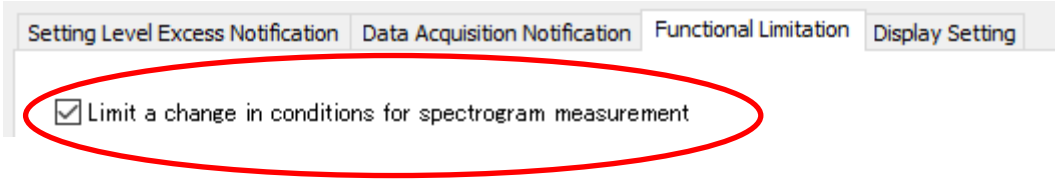
If the checkbox is checked, the divisions that have not reached the set number of times will be displayed in gray. After the measurement is completed, the color coding is displayed.

(5) Data acquisition is not performed after the set number of times is reached

If the checkbox is checked, data will not be acquired in the divisions that have reached the set number of times.

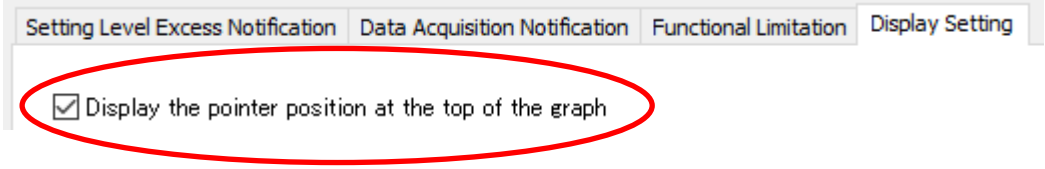
Functional Limitation

It is possible to set limitation of changing the conditions for new spectrogram measurement. If the checkbox is checked, the settings for the frequency, spectrum analyzer, and Antenna Factor in the measurement condition tab cannot be changed. Functional limitation can be changed only when the window is active before spectrogram measurement. Refer to “Spectrogram Measurement (Setting Measurement Conditions)” on page 59 for the spectrogram measurement.



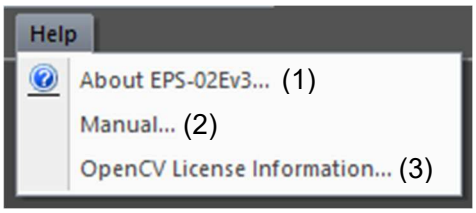
Display Setting

Checking the checkbox displays the pointer position at the top of the graph. The pointer is not displayed when the data comparison is displayed.



9－5. Help

The version information, etc. are displayed.



(1) About EPS-02Ev3

The version information of this software is displayed.

(2) Manual

The instruction manual of this software is displayed.

(3) License Information

The license information is displayed.

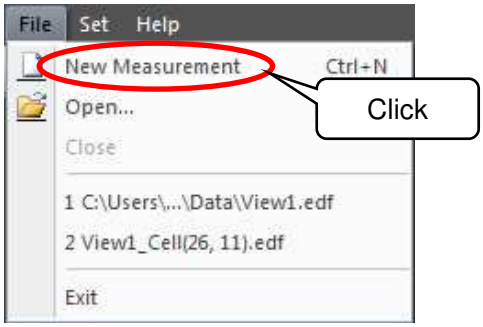
9－6. New Measurement (Setting Measurement Conditions)

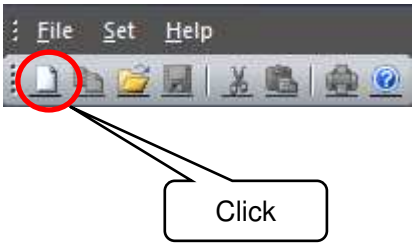
View Window

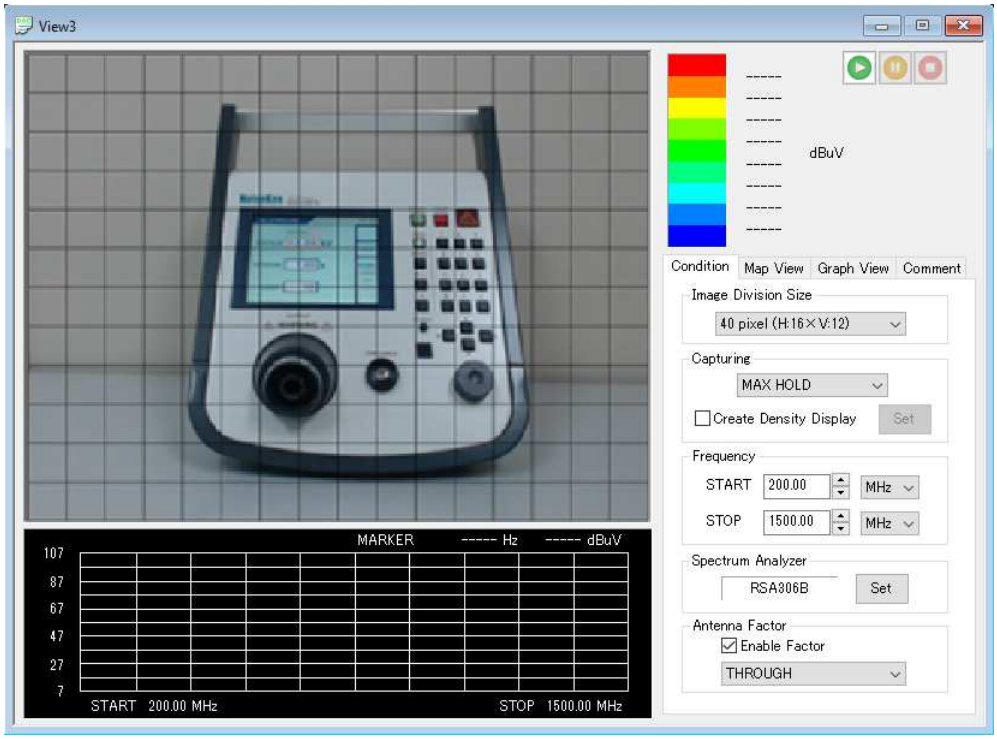
To open a **View** window, click **New Measurement** from the **File** menu or click the **New Measurement** button on the toolbar.

Whenever a **View** window is newly opened, it is numbered as follows: View1, View2, View3 ... These names can be changed freely when the file is saved after measurement.

Before starting measurement, set an image division size, properties for the spectrum analyzer, and other conditions in the **View** window.





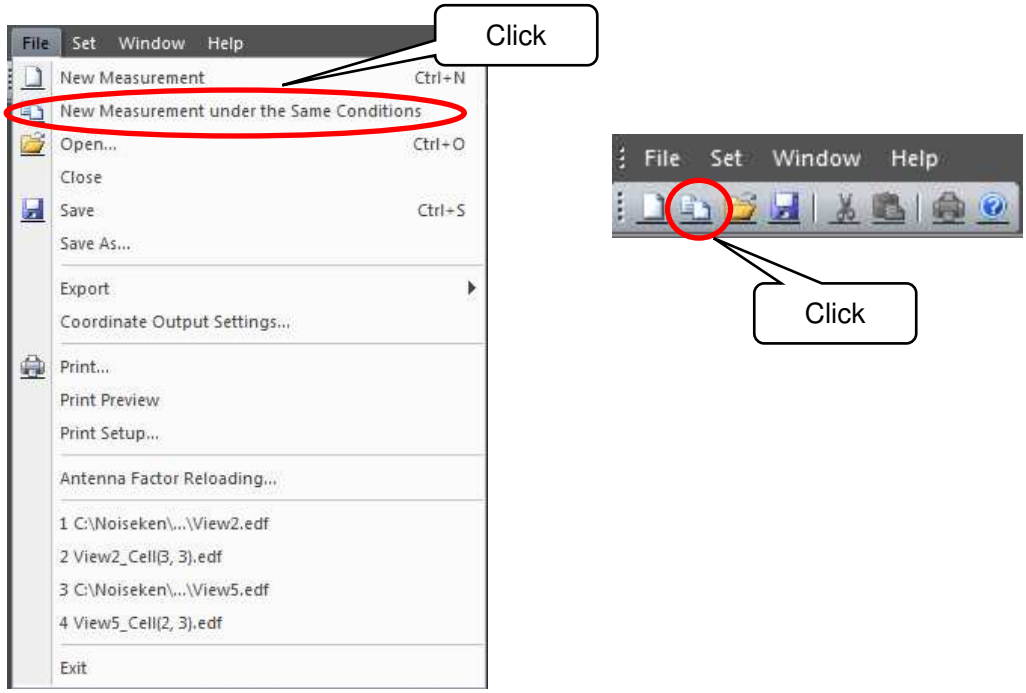


View window (before measurement)

If a web camera or USB protect key is not connected, new measurement is not possible.

New Measurement under the Same Condition

When the **View** window is active after measurement, click **New Measurement under the Same Conditions** on the **File** menu or the **New Measurement under the Same Conditions** button on the tool bar to open the **View** window whose measurement conditions and display settings are partly matched. At this time, the communication settings are also changed to the settings in the **View** window after measurement. Use this function to perform measurement using the same settings as before.



The settings that can be used are as follows.

Menu / Tab	Settings
Set Menu	Communication Settings
Condition Tab	Image Division Size, Capturing, Frequency, Spectrum Analyzer, Antenna Factor
Map View Tab	Allocation setting of Intensity Distribution, Image Inversion, Method for Comparison
Graph View Tab	Level Range, Unit Switch, Frequency Axis Switch

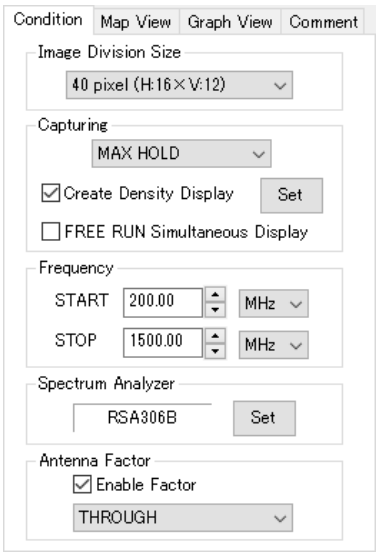
By saving measurement data for frequently used measurement conditions, multiple measurement conditions can be used properly.

If the same spectrum analyzer driver or antenna factor file does not exist, the settings will not be the same. Also, note that the communication settings and spectrum analyzer settings will not be the same for data measured with the software versions earlier than EPS-02Ev3.

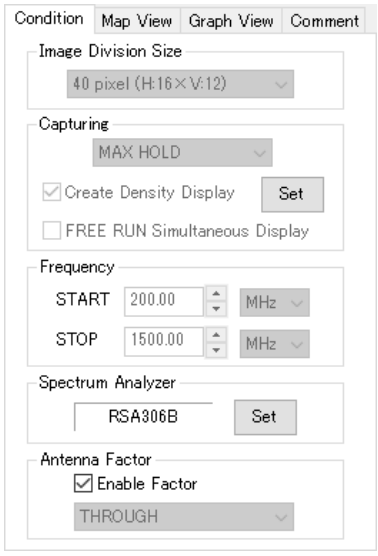
Condition Tab

In the **Condition** tab, set the image division size, properties for the spectrum analyzer, and other conditions.

Each item of the measurement conditions can be set only before the measurement except for **Enable Factor**. After measurement, all items except for **Enable Factor** are displayed but cannot be changed.



Conditions (before measurement)



Conditions (after measurement)

Image Division Size

Set the division size by which a camera image is divided.

The image division size can be selected from 10 pixels (H: 64 × V: 48 squares), 16 pixels (H: 40 × V: 30 squares), 20 pixels (H: 32 × V: 24 squares), 32 pixels (H: 20 × V: 15 squares), 40 pixels (H: 16 × V: 12 squares), 80 pixels (H: 8 × V: 6 squares), or 160 pixels (H: 4 × V: 3 squares).

Select 20 or 32 pixels normally.

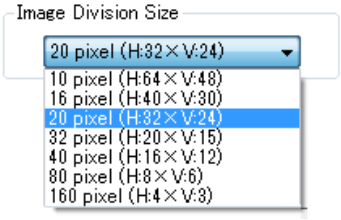
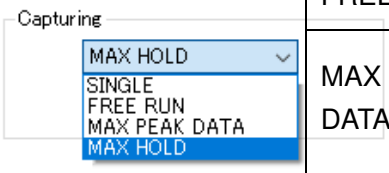


Image division size: 10 pixels

Image division size: 160 pixels

Capturing

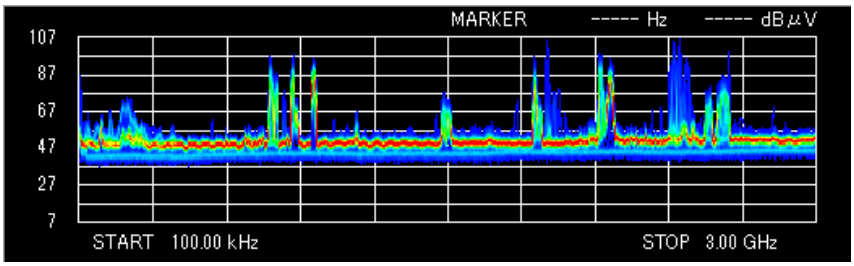
How to store spectrum data at the same measurement point (the same square of the grid) can be selected from **SINGLE**, **FREE RUN**, **MAX PEAK DATA**, or **MAX HOLD**.



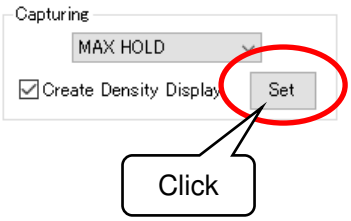
SINGLE	Performs measurement only one time.
FREE RUN	Always overwrites the data.
MAX PEAK DATA	Compares the maximum values of the spectrum waveforms, and overwrites the retained value if it is not the largest.
MAX HOLD	Compares the maximum values of the spectrum waveforms on a point basis, and overwrites the retained values if it is not the largest.

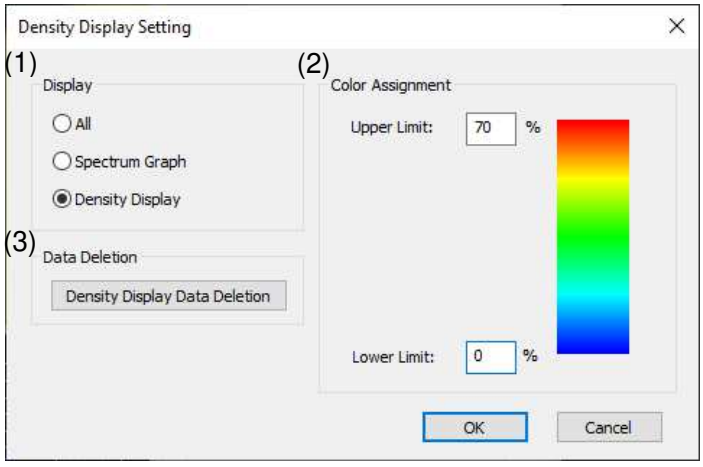
Density Display

Selecting Create Density Display generates data required for density display during measurement. With this function, the temporal density of signals is represented in colors. On the graph, the warmer the color, the more frequently signals appear; the colder the color, the less frequently signals appear.



Clicking the **Set** button opens the **Density Display Setting** dialog box to change the settings for the density display.





(1) Display

Selecting **All** displays the spectrum graph over the density display. Selecting **Spectrum Graph** displays the spectrum graph only. Selecting **Density Display** displays the density only.

(2) Color Assignment

Sets the upper and lower limits for color assignment. Areas above the upper limit are displayed in red, and those below the lower limit are displayed in blue. If the upper limit is set to 70%, areas with a frequency of 70% or more are displayed in red.

(3) Data Deletion

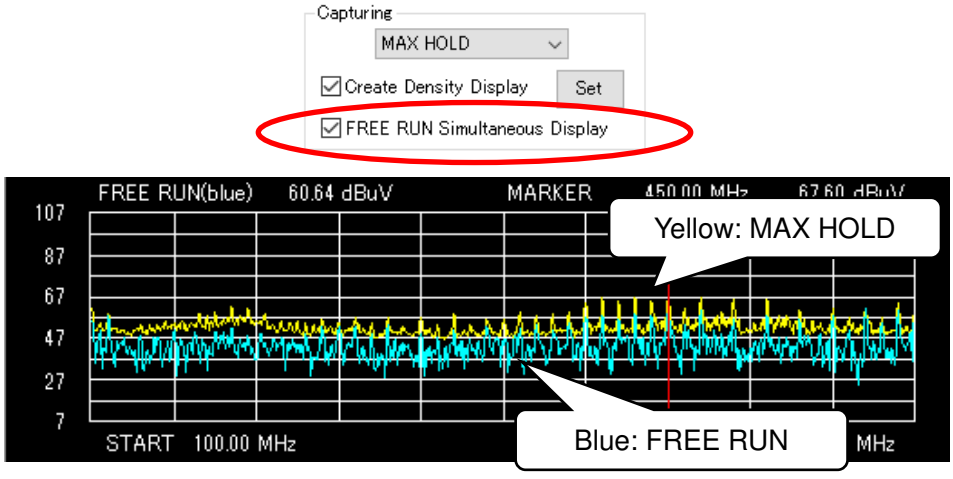
Deletes the density display data when selected. Use this function if the data volume is large. However, doing so disables the density display. Data deletion is possible only after measurement.

In the case of the following settings, the density is not displayed. To enable the density display, change the settings. If the Antenna Factor is changed after measurement, the density display data is deleted.
- Frequency Range: Enlarge Specified Range
- Display Data Comparison
- Level Range: Specified Level
- Frequency Axis Switch:Log

There may be slight differences between the spectrum graph and the density display because their display methods are different. Also, the upper limit of the count used for density calculation is 65535 times. If the number of sweeps exceeds the upper limit, the density will be displayed higher than it actually is.

FREE RUN Simultaneous Display

When the **FREE RUN Simultaneous Display** is checked, the waveform when **FREE RUN** is selected in the **Capturing** is displayed at the same time. It can be displayed only during **MAX PEAK DATA** or **MAX HOLD** measurement, and **FREE RUN** waveform is not saved after measurement.



FREE RUN Simultaneous Display is checked

Frequency

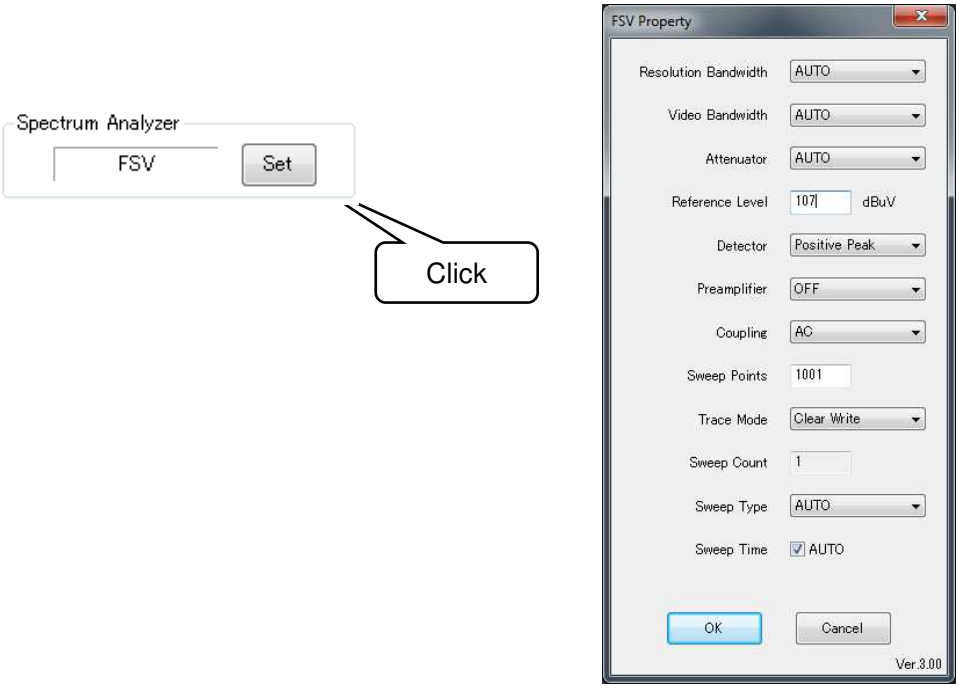
The measurable frequency range depends on the spectrum analyzer and electromagnetic field measurement sensor.

The frequency unit can be selected from Hz, kHz, MHz, and GHz.

Spectrum Analyzer

To configure advanced settings for the spectrum analyzer, click the **Set** button next to the equipment name of the analyzer to open the **Property** dialog box.

For details of each item, refer to the instruction manual for the spectrum analyzer.



Items shown in the **Property** dialog box may vary depending on the selected spectrum analyzer driver.

Even for spectrum analyzers that can set the number of sweep points to 60001 points or more, the maximum number of sweep points is limited to 60001 points except for the RSA306B.

Notes for property settings

- Resolution Bandwidth (RBW)
  The bandwidth of the IF filter. A smaller setting value induce sharper spectrum and noise floor level goes down, however sweep time is increased.
- Video Bandwidth (VBW)
  The bandwidth of the averaging filter. A smaller setting value eliminate noise components of signal, however sweep time is increased.
- Reference Level
  The vertical reference positions of spectrum on screen. Adjust value to fit on the

screen.

- Attenuator
  An attenuation of input signal. A higher value reduces miss match reflection, and noise floor level goes up.

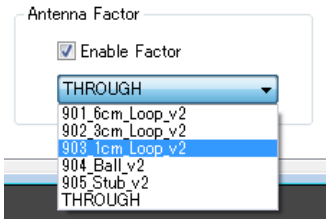
Antenna Factor

When using Antenna Factor, check **Enable Factor** and select the file with the same name as the electromagnetic field measurement sensor to be used.

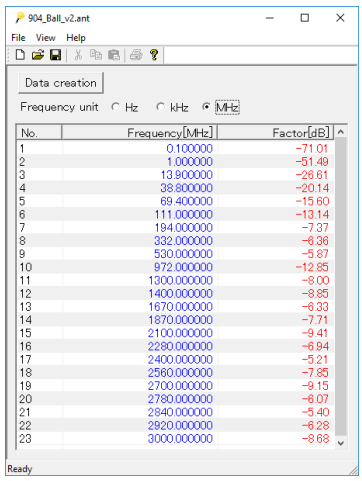
In the initial state after installation, **THROUGH** is the only available antenna factor. The factor files for the electromagnetic field probes (PN7405) are included on the attached setup media. To use them, follow the steps below.

(1) Log into Windows using an ID having administrator privileges.
(2) Load the attached setup media, and open the **FACTOR** folder.
(3) Open the **00-00013A** or **00-00019A** folder according to your preamplifier.
(4) Copy the factor files (*.ant) in the folder to the folder where the EPS-02Ev3 executable file is located (C:\Program Files (x86)\NoiseKen\EPS-02Ev3, under normal conditions).

This factor file is used for correction to make the frequency characteristics of the sensor flatness. It is not for convert absolute field strength.
When the **THROUGH** file is selected or **Enable Factor** is unchecked, the spectrum data from the spectrum analyzer are acquired as it is, without interpolation.



If the original sensor is used, a factor file can be created using Antenna Factor Editor. For details, see “11. Antenna Factor Editor” on page 92.



Antenna Factor Editor Screen

9－7. New Measurement (Performing Measurement)

Performing Measurement

To start measurement, click the **START** button in the upper right of the **View** window. During measurement, the **PAUSE** and **STOP** buttons are enabled.

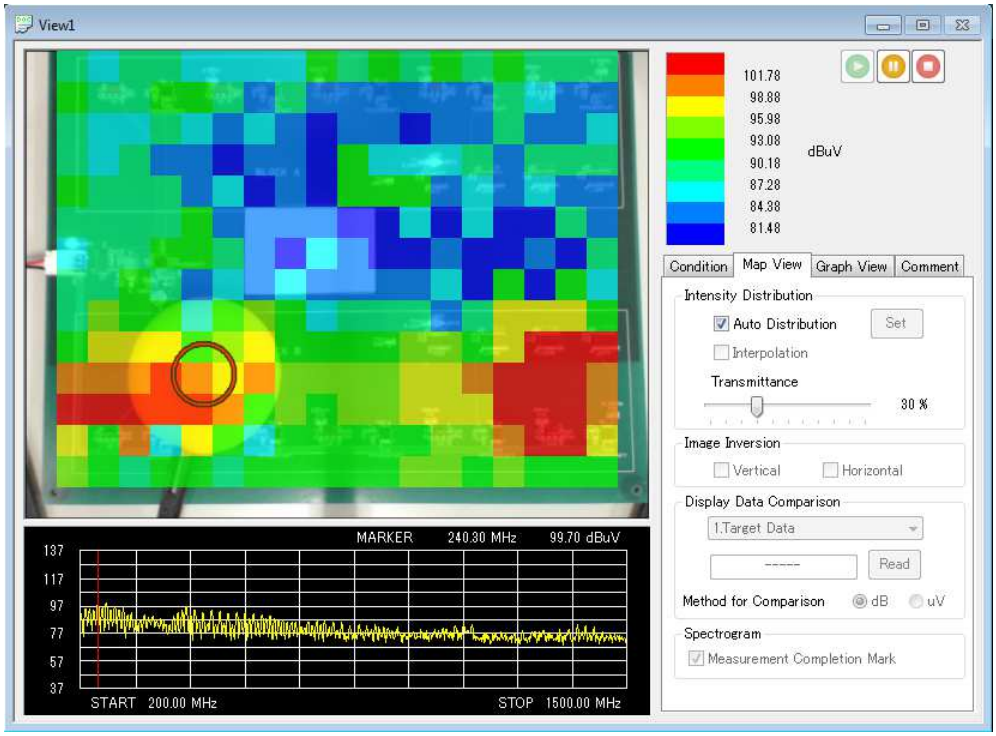
To suspend measurement, click the **PAUSE** button to suspend measurement, and to finish measurement, the **STOP** button.

After completion of measurement, all buttons are disabled. When performing measurement again, click **New Measurement** from the **File** menu or click the **New Measurement** button on the toolbar.

Before measurement　　During measurement　　After measurement

In the **Condition** tab, only **Capturing** can be changed. In the **Map View** tab, only allocation setting of **Intensity Distribution** and **Transmittance** can be changed. In the **Graph View** tab, only **Unit Switch** and **Frequency Axis Switch** can be changed.

Points (squares of the grid) that have been measured are color-coded according to the peak value and overlaid on the camera image during measurement. In addition, the spectrum data measured by the spectrum analyzer is displayed in the spectrum graph area located in the lower part of the **View** window, on a point-by-point basis.



If a directional sensor is used, maintain the same direction.
In addition, move the sensor parallel to the measurement object.

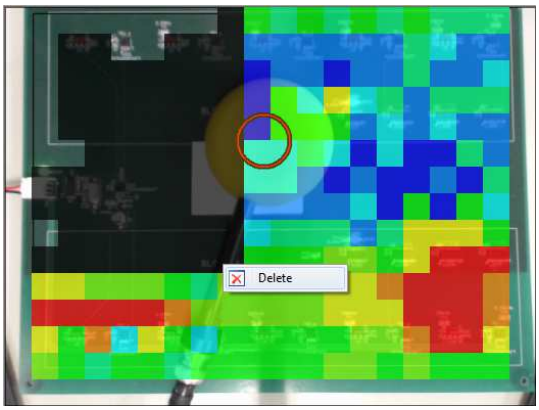
The EPS-02Ev3 software sends a sweep start command to the spectrum analyzer immediately after the sensor is recognized. After completion of sweeping, the software recognizes the sensor position again, and only when the sensor is found at the same point (position) where it was placed at the start of the analyzer sweeping, the spectrum data is stored.
If the sensor is moved quickly, the point at the start of sweeping differs from that at the completion of sweeping, and as a result, measurement data is not stored. For spectrum analyzers with slow response speed, move the sensor more slowly.

If the sensor is not recognized or other object is falsely recognized, reconfigure the image recognition setting. Click **Image Recognition Setting** from the **Set** menu to change the setting. Please note that it is possible during measurement.

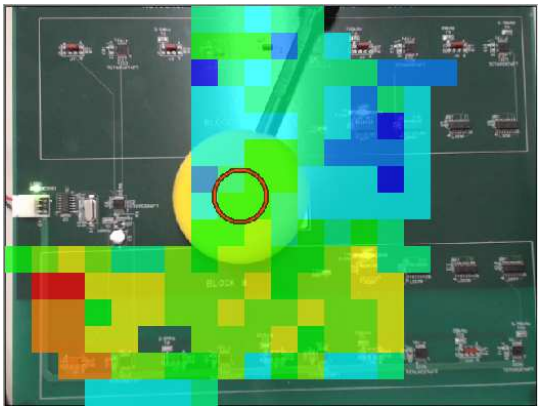
Note that if the noise level emitted from the EUT is high, the spectrum analyzer and preamplifier may be damaged by excessive input.

Deleting Measurement Data

Stored measurement data can be deleted on a point-by-point basis.
When data to be deleted is left-clicked during measurement, the data turns black and the **Delete** menu appears. Also, when the range of data to be deleted is dragged, a black frame appears and the data in the frame turns black. If the d n this state, the **Delete** menu appears. Clicking this menu deletes the measurement data displayed in black.



Before deleting data

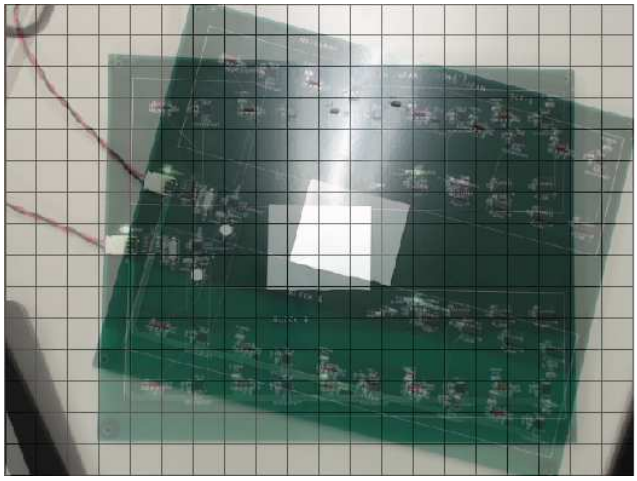


After deleting data

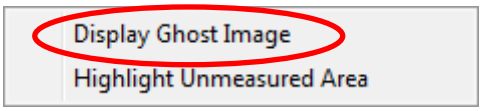
Data can be deleted only during measurement and cannot be deleted after completion of measurement.

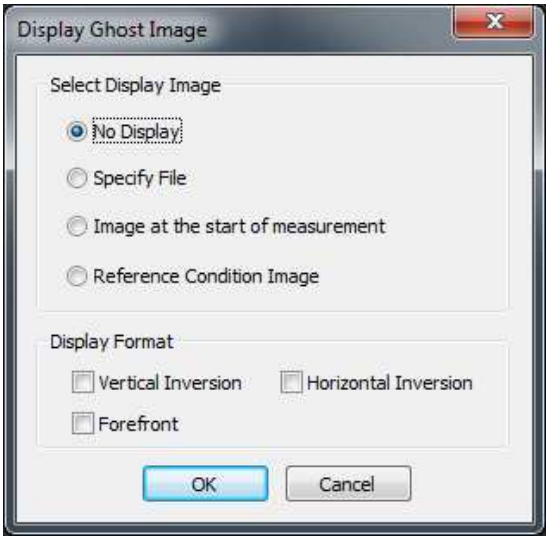
Display Ghost Image

Past camera images can be overlaid to adjust the position. Use this function to perform measurement using the same camera settings as before

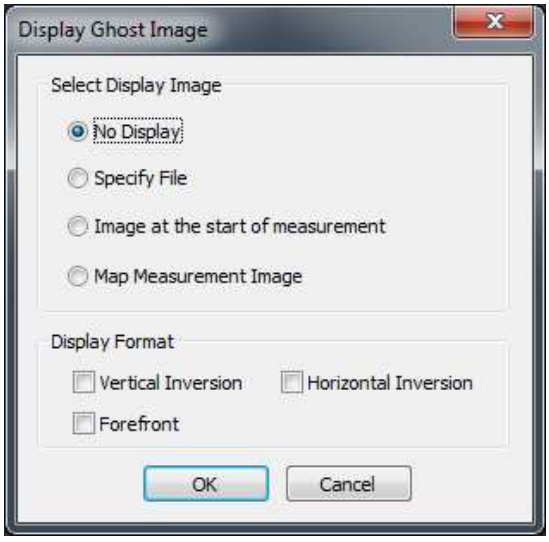


Right click on the camera image before and during the measurement and select **Display Ghost Image** to display the **Display Ghost Image** dialog box. Select an image to be displayed in **Select Display Image** and click **OK** to display the selected image in an overlaid manner. Transmittance of the overlaid past images can be changed by changing the transmittance of the **Map View** tab, and the image becomes invisible if the transmittance is set to 100%. Refer to “Transmittance” on page 42 for the transmittance.





Map Measurement

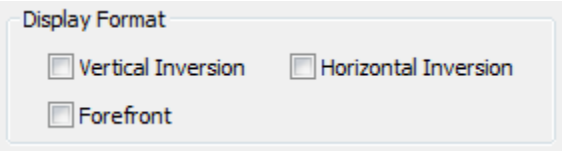


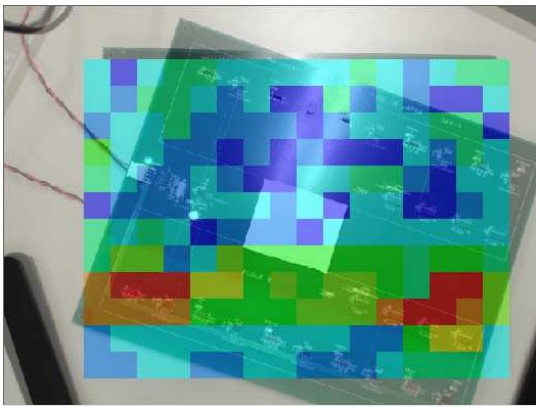
Spectrogram Measurement

Selectable images to be overlaid are as follows.

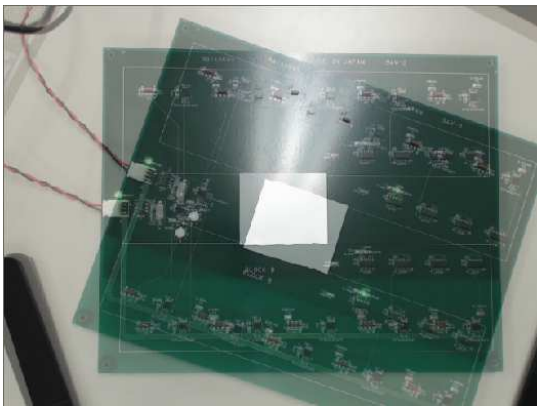
No Display	No past image is displayed.
Specify File	Select an image to overlay from the files. Selectable images are files with the extension ".emg". The camera image at the end of measurement is saved with this extension when the measurement data are saved.
Image at the start of measurement	Selectable only during measurement. The image at the start of measurement is overlaid. Use this when a misalignment has occurred during measurement.
Reference Condition Image	Selectable only in the **View** window when **New Measurement under the Same Conditions** is selected. The camera image in the **View** window referred to for measurement conditions is overlaid. Use this to perform measurement using the same settings as before.
Map Measurement Image	Selectable only before and during the spectrogram measurement. The image at the end of map measurement is overlaid. Refer to "Spectrogram Measurement (Setting Measurement Conditions)" on page 59 for the spectrogram measurement.

In **Display Format**, the display format of an overlaid image can be changed. Select **Vertical Inversion** or **Horizontal Inversion** to invert the image vertically or horizontally. **Forefront** can be selected only during measurement. Select this not to display the measured data. Use this when the camera image is not visible behind the measured data.





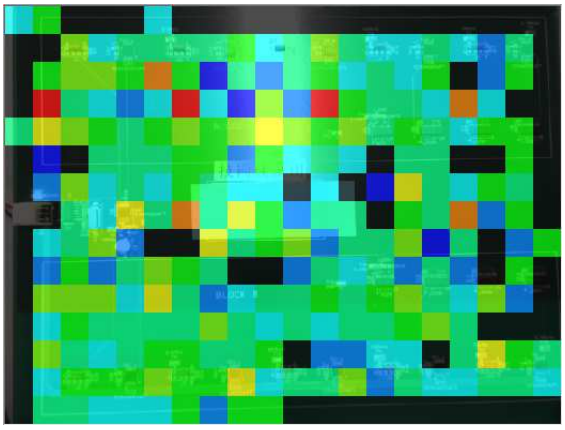
Forefront is unchecked



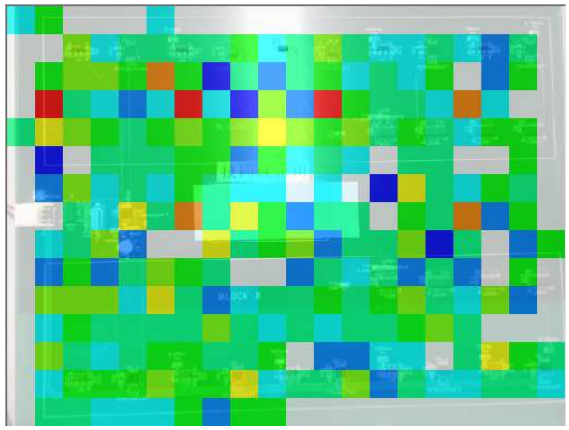
Forefront is checked

Highlight Unmeasured Area

Unmeasured areas can be displayed in black and white blinking during measurement. Use this to confirm unmeasured image divisions.

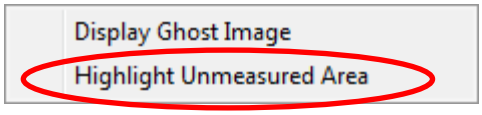


Unmeasured area displayed in black



Unmeasured area displayed in white

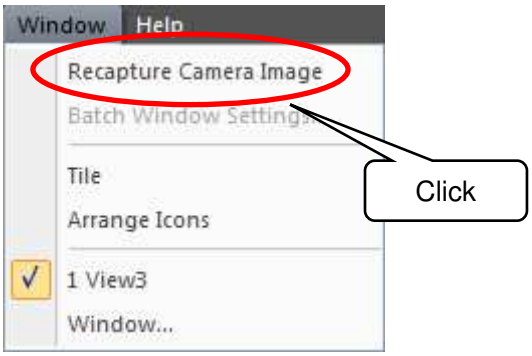
Right click on the camera image during the measurement and select **Highlight Unmeasured Area**.



Recapturing Camera Image

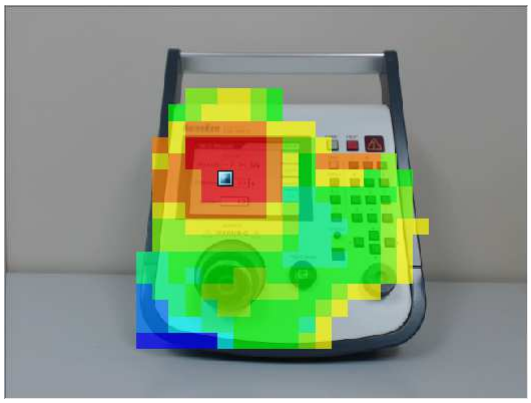
If the **STOP** button is clicked after completion of measurement, the camera image switches from video to still image. If the still camera image includes an unnecessary object, such as the sensor, the camera image can be recaptured.

Click **Recapture Camera Image** from the **Window** menu. The still image will switch to video and the following message will be displayed.



Clicking the **OK** button switches the camera image from video to still image to capture a new camera image. To return the original camera image, click the **Cancel** button.

Before recapturing



After recapturing

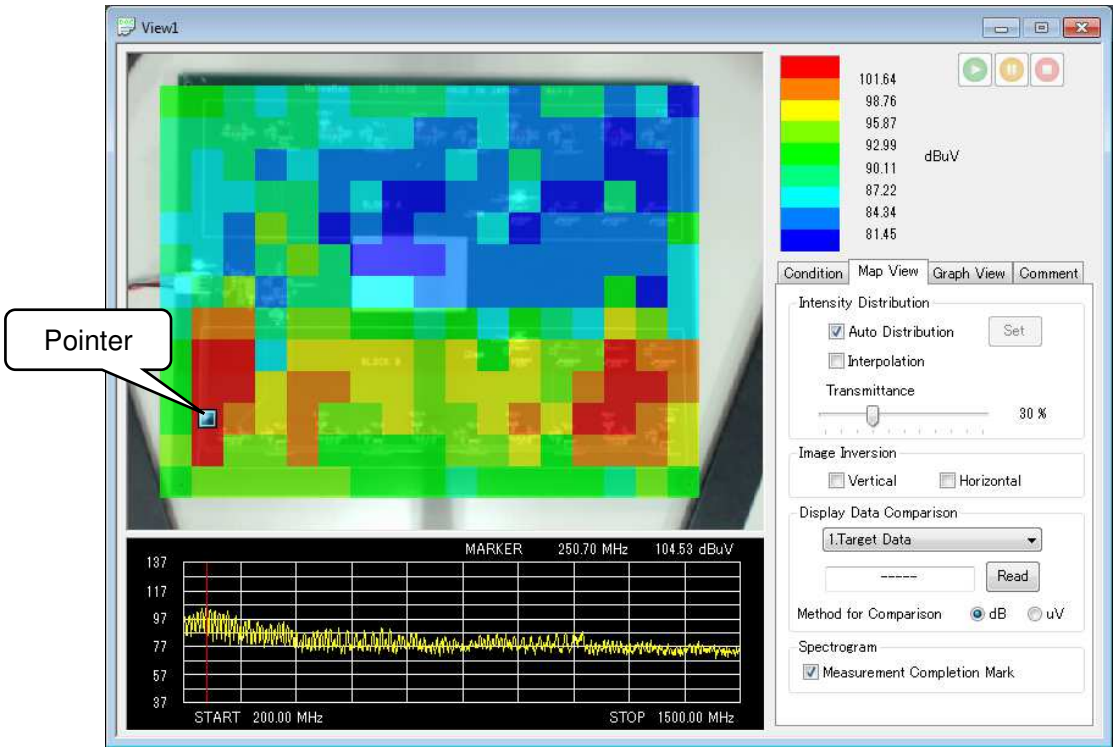
Recapturing is possible as many times as needed before the file is saved.
Note that recapturing is not possible once the file is saved.

9－8. Measurement Data Analysis

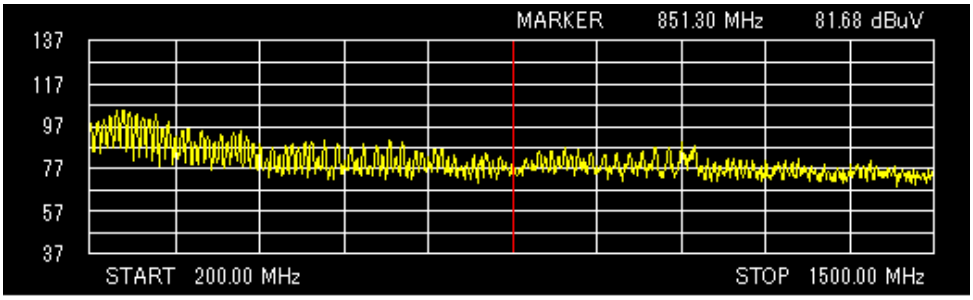
Measurement Data

After completion of measurement, a square pointer will be displayed on the camera image. Dragging this pointer to the desired point can display the spectrum data at the relevant point.

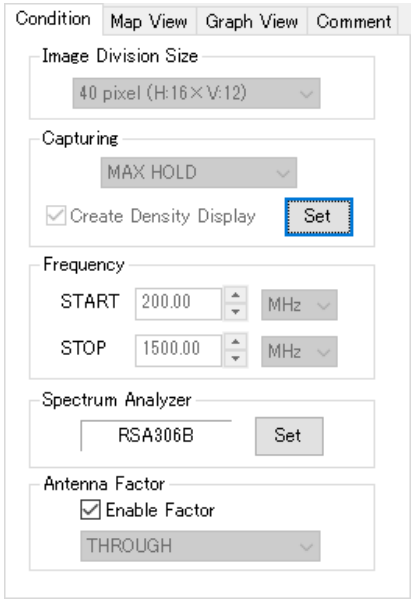
The pointer automatically moves to the highest level point immediately after measurement is complete or the file is opened.



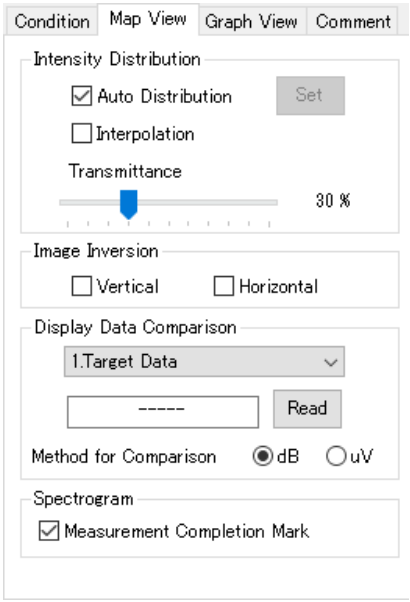
Clicking on the graph moves the position of the red line, and shows frequency and level values of its position on the top of the graph. The red line automatically moves to the maximum peak value after five seconds.



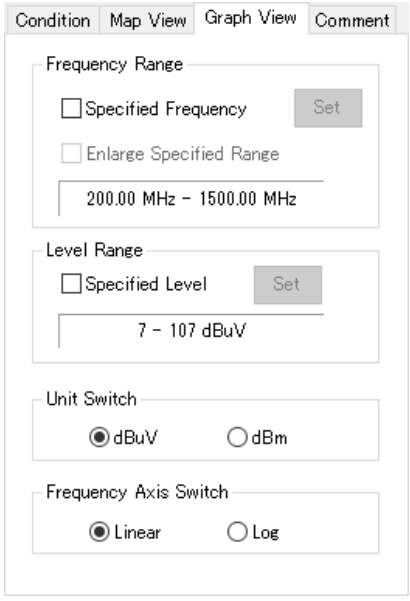
In the **Condition** tab, the conditions configured before measurement can be checked. The representation of measurement data can be changed in the **Map View** tab and **Graph View** tab. In the **Comment** tab, measurement information and other comments can be entered.



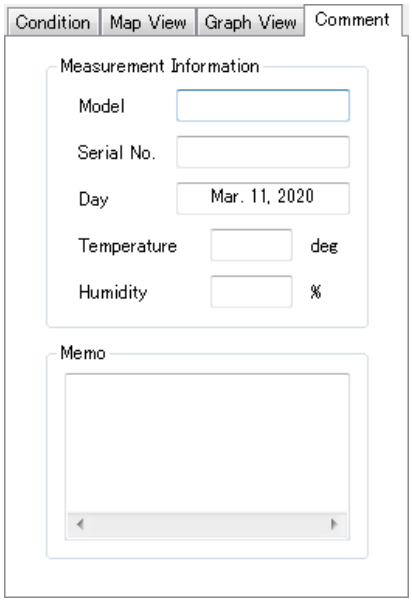
Condition tab



Map View tab



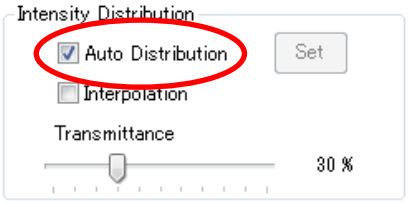
Graph View tab



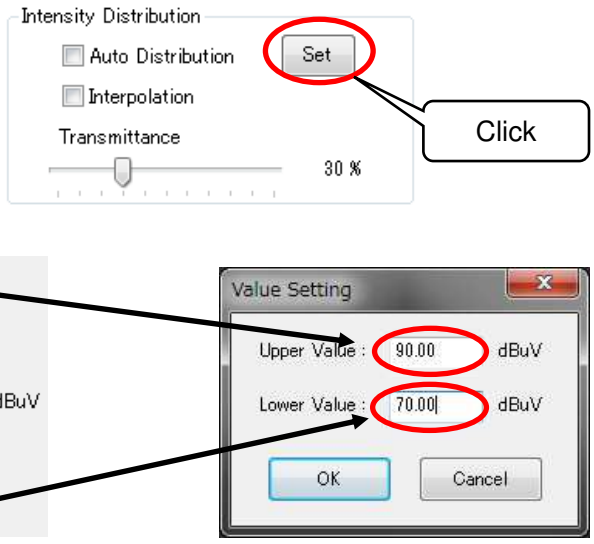
Comment tab

Auto Distribution

When the **Auto Distribution** checkbox is checked, the color map is made according to automatic distribution between the highest and lowest intensity.



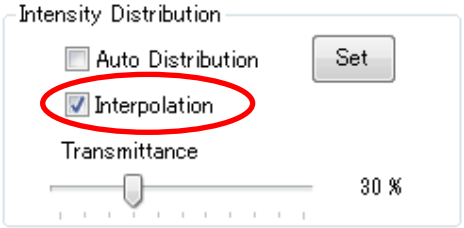
To change the **Upper/Lower Value** to desired values, uncheck the **Auto Distribution** checkbox and click the **Set** button. The set upper/lower value settings will be reflected applied to the color bar.

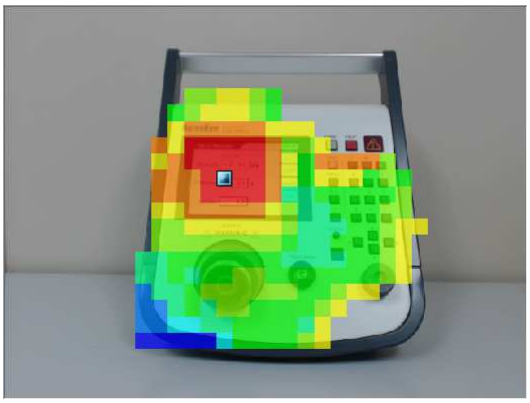


The upper and lower limit values can be fixed to any before or during measurement. Adjusting them with the upper and lower limit values at the previous measurement can make changes easy to perceive visually.

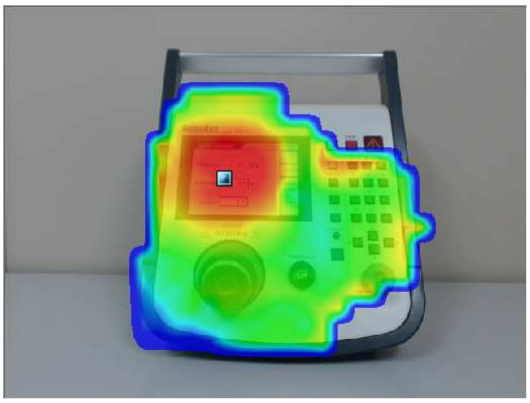
Interpolation

When the **Interpolation** checkbox is checked, the map data image is smoothly displayed by interpolation of the boundaries between divisions.





Without interpolation

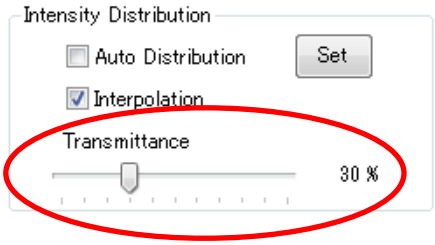


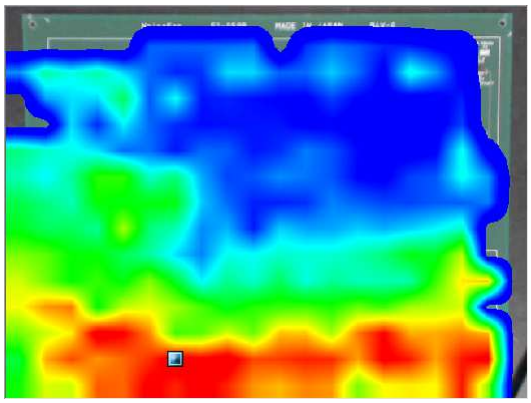
With interpolation

Transmittance

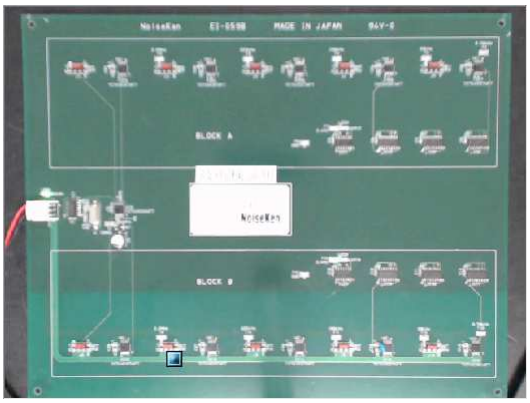
The transparency of the color map can be changed.

When **Transmittance** is set to 100%, the map is invisible and only the camera image will be displayed. When **Transmittance** is set to 0%, the camera image is invisible at the points where data exist.





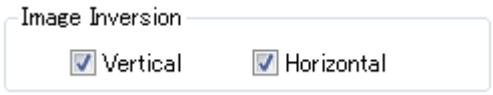
Transmittance: 0%

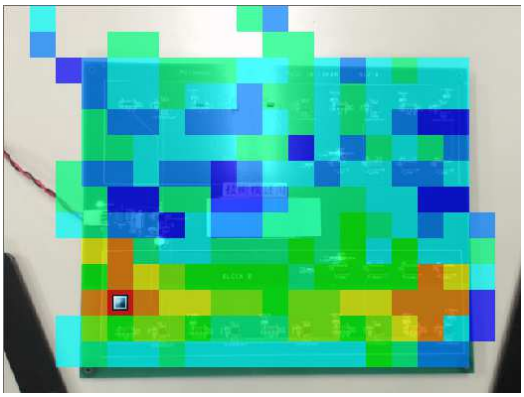


Transmittance: 100%

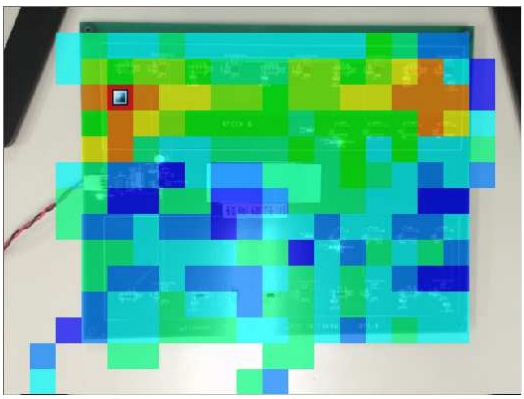
Image Inversion

If the boxes are checked, the camera image and measurement data are inverted vertically and/or horizontally. The inversion status cannot be changed during measurement. When the measurement is stopped, the status can be changed again.

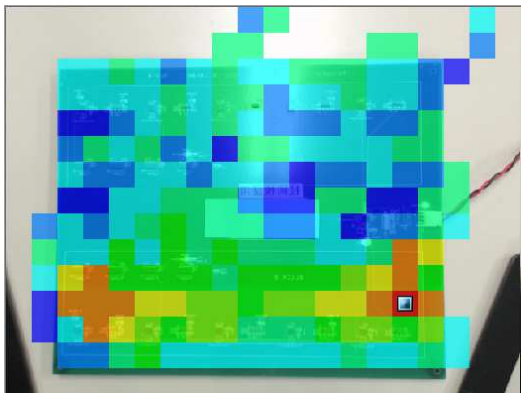




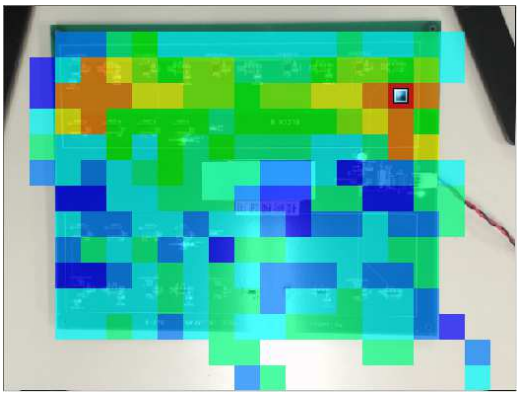
No inversion



Vertical inversion



Horizontal inversion

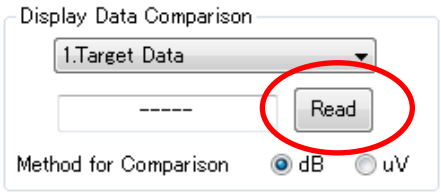


Vertical and horizontal inversion

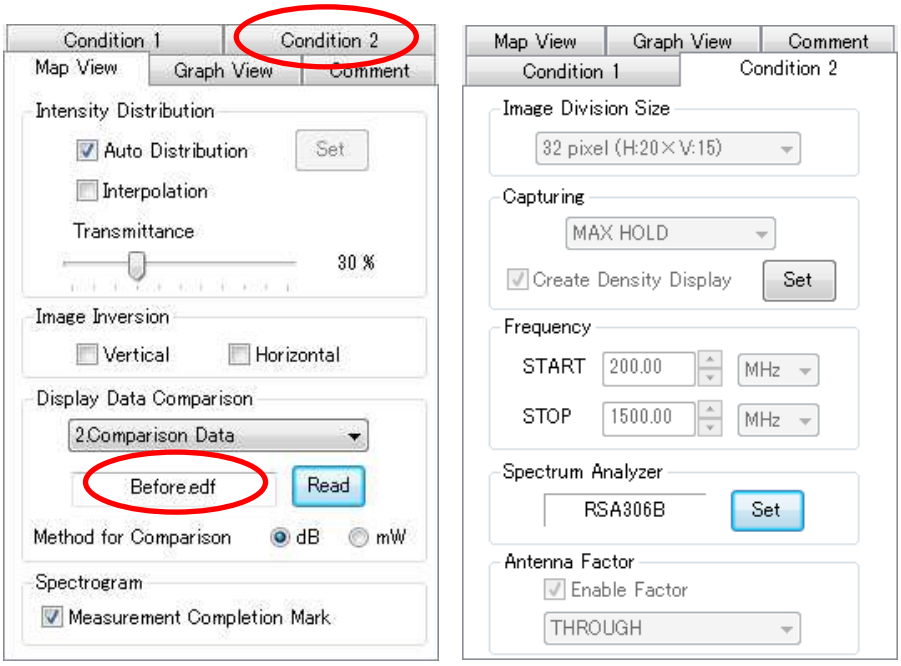
When the movement of the electromagnetic field sensor on the camera image is inverted from the actual movement, inverting the camera image makes the measurement easier.

Display Data Comparison

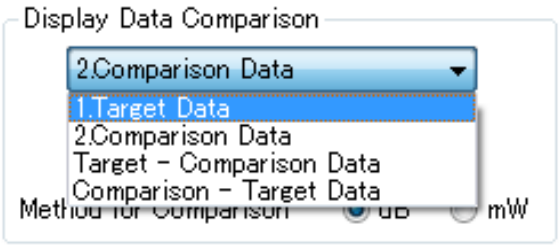
Two data can be displayed for comparison by reading the measurement data saved previously. Click **Read** to display the dialog box and read the data to be used for comparison. The data to be read must have the same image division size, start frequency, end frequency, and number of measurement points by the spectrum analyzer.



After the data is read, its file name appears next to the **Read** button. Also, a new tab for **Condition 2** appears, and when the tab is selected, the measurement conditions of the read data can be confirmed. For **Condition 2**, **Enable Factor** cannot be changed.



Data to be displayed can be selected from the following four types. Spectrum waveforms are displayed in yellow for the target measurement data and in blue for the data to be compared.

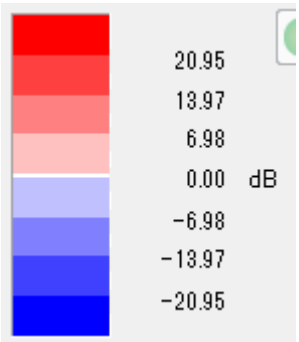


1.Target Data	The target measurement data is displayed.
2.Comparison Data	The read data to be compared is displayed.
Target - Comparison Data	For each image division, the difference between the peak of the target measurement data and the peak of the comparison data is calculated and color-coded.
Comparison - Target Data	For each image division, the difference between the peak of the comparison data and the peak of the target measurement data is calculated and color-coded.

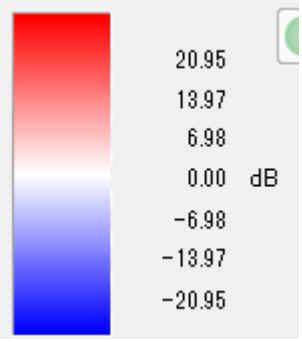
When the difference is displayed, the color bar changes and divisions showing level increase are displayed in red, those showing level decrease in blue, and those showing no difference in white. As the difference increases in a division, its color becomes darker. The method for difference comparison can be selected from the following.

dB	The difference is calculated in decibel value.
uV (when unit is dBuV)	The difference is calculated after the unit is converted from dBuV to uV.
mW (when unit is dBm)	The difference is calculated after the unit is converted from dBm to uV. The unit is converted to mW after calculation.

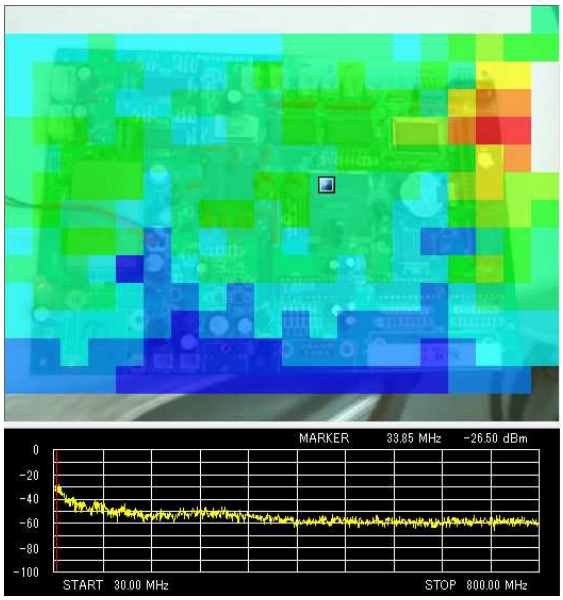
When the **Interpolation** checkbox is checked, the map data image is smoothly displayed by interpolation of the boundaries between divisions.



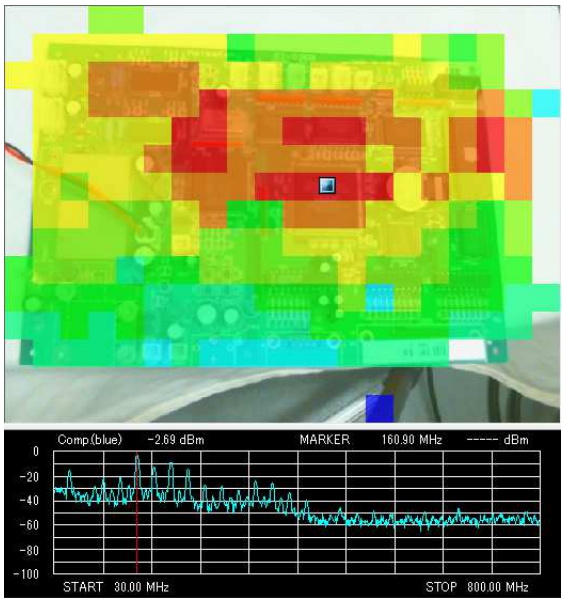
Color Bar



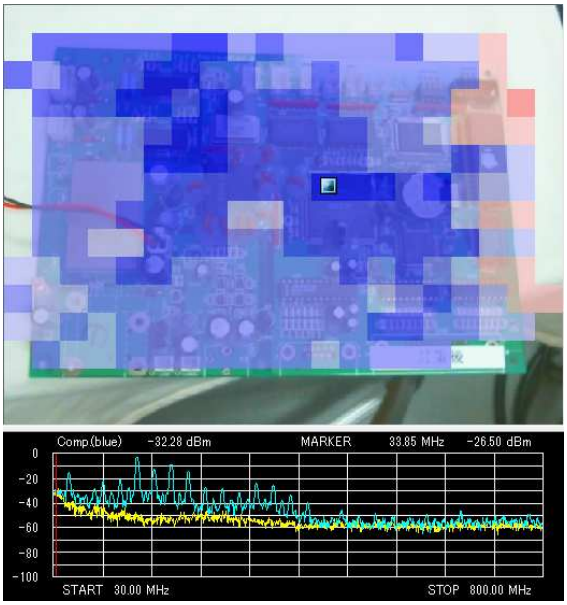
Color Bar (Interpolation)



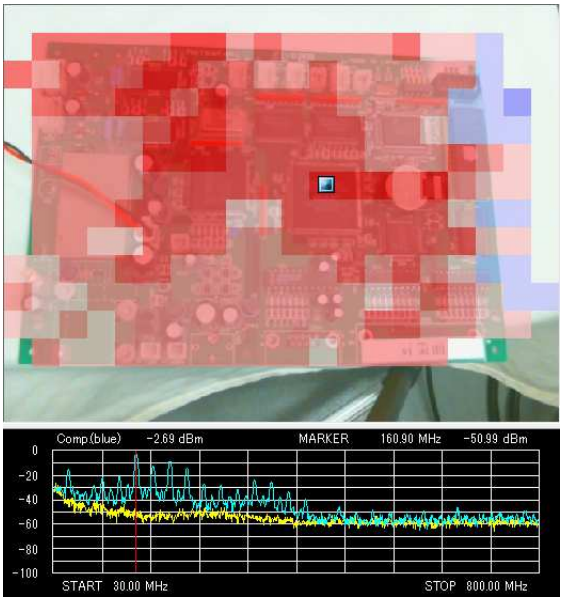
1.Target Data



2.Comparison Data

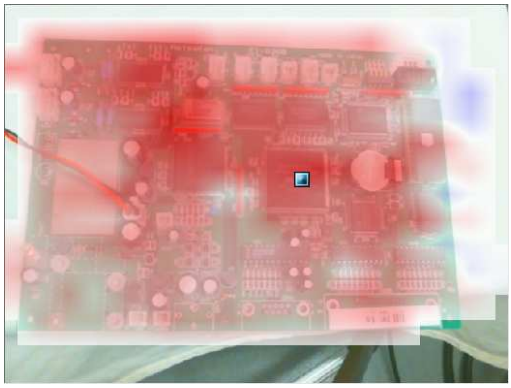


Target - Comparison Data



Comparison - Target Data

Target - Comparison Data (Interpolation)

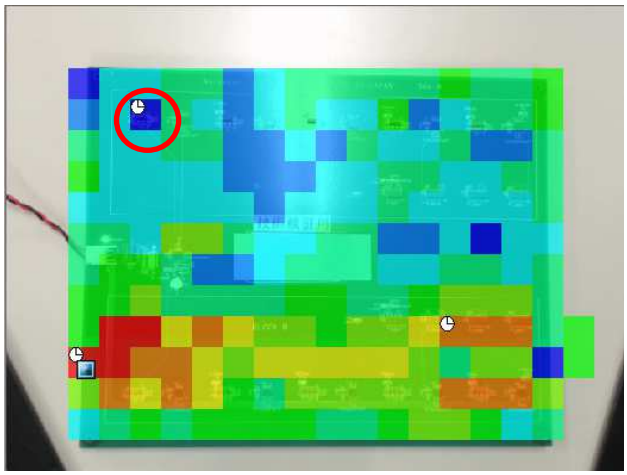


Comparison - Target Data (Interpolation)

The comparison can be easier when “New Measurement under the Same Condition” on page 27 or “Display Ghost Image” on page 35 is referred to together.

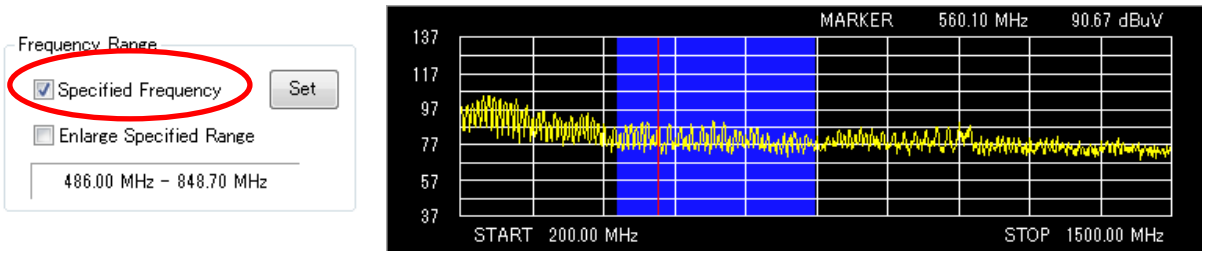
Measurement Completion Mark

If **Measurement Completion Mark** is checked on the **Map View** tab, clock marks are displayed in the image divisions where spectrogram measurement is completed. Refer to “Spectrogram Measurement (Setting Measurement Conditions)” on page 59 for the spectrogram measurement.

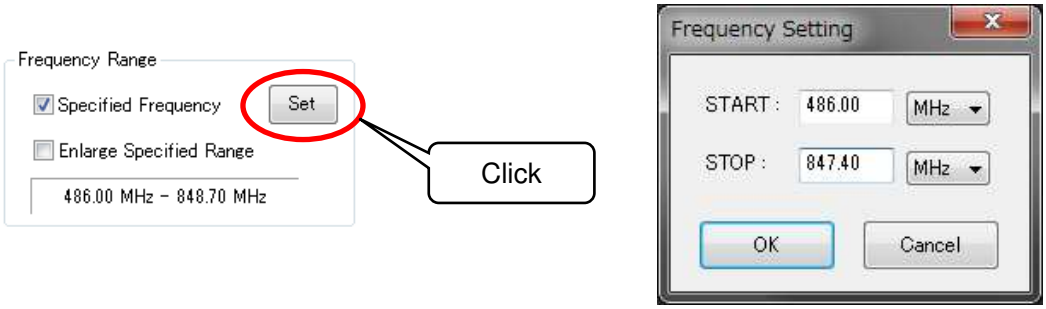


Frequency Range

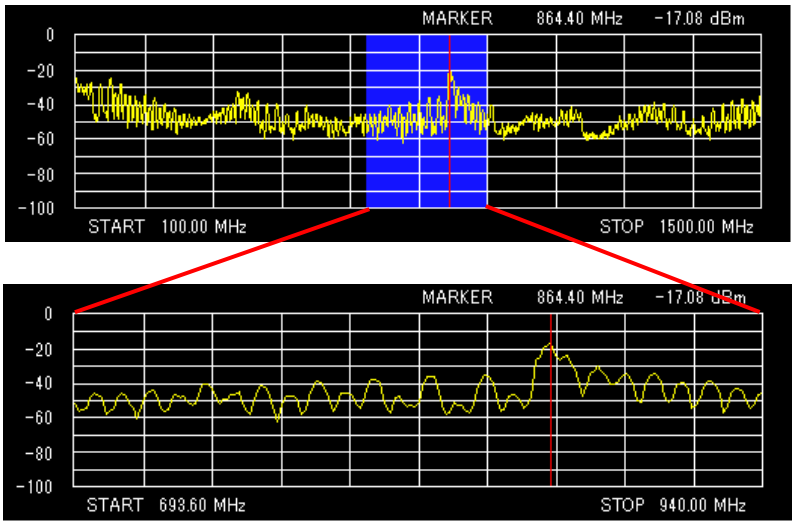
If the **Specified Frequency** checkbox is checked under **Frequency Range**, the map is color-coded not using the peak values of the whole frequency range but using those of the specified frequency range, and the relevant blue zone band is displayed in the spectrum graph.
This zone band can be moved to the right or left by dragging it, and thereby the color-map on the camera image changes. In addition, the width of the zone band can be changed by dragging an end of the band to the right or left.



Clicking the **Set** button opens the **Frequency Setting** dialog box, where the frequency range for the zone band can be directly entered.



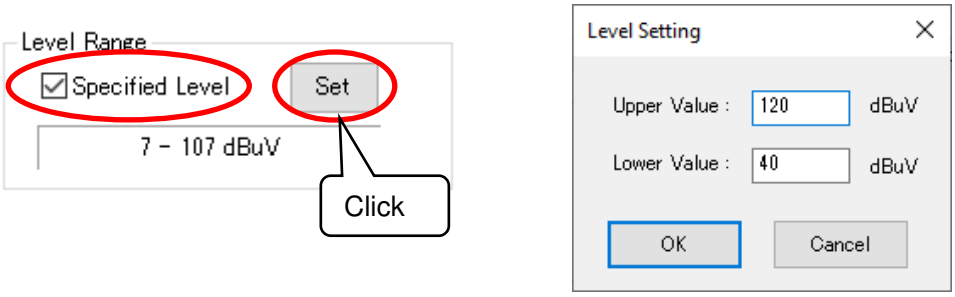
If **Enlarge Specified Range** is checked, the frequency range in the graph changes to the specified frequency range.

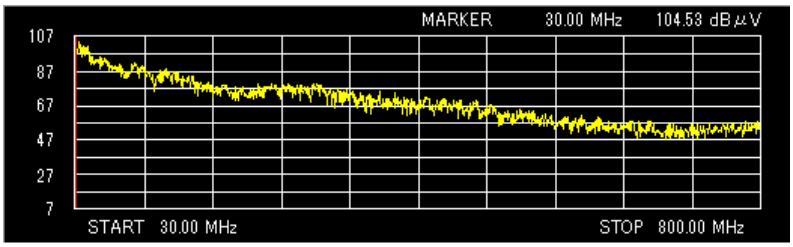


Enlarge Specified Range is checked

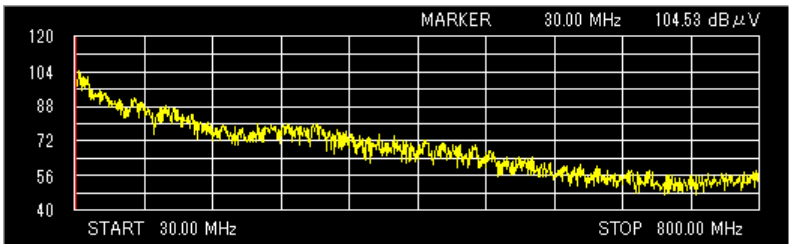
Level Range

If **Specified Level** is checked, the level range can be changed. Clicking the **Set** button opens the **Level Setting** dialog box to change the upper and lower limits for the level range. If **Specified Level** is unchecked, the level range during measurement is restored.





Specified level is unchecked (7 dBuV – 107 dBuV)

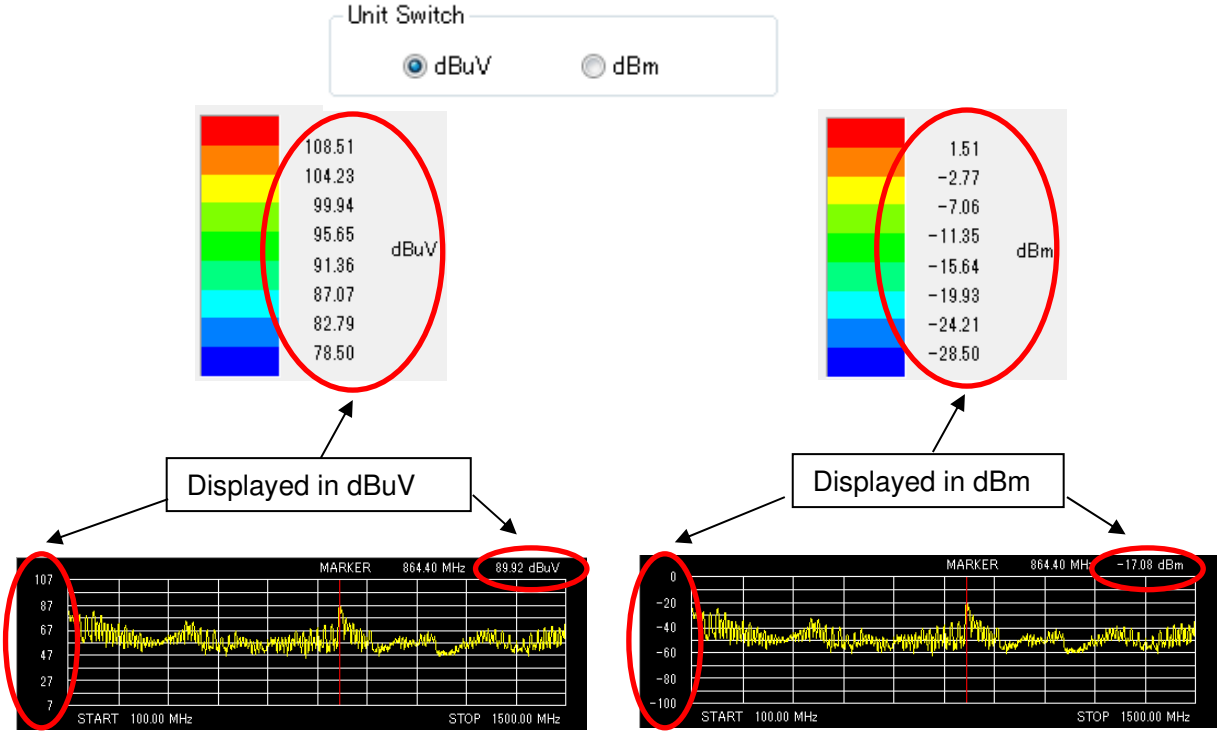


Level range is changed (40 dBuV – 120 dBuV)

The level range can be changed before, during, and after measurement.
The upper value is automatically adjusted so that the vertical scale values become integer.

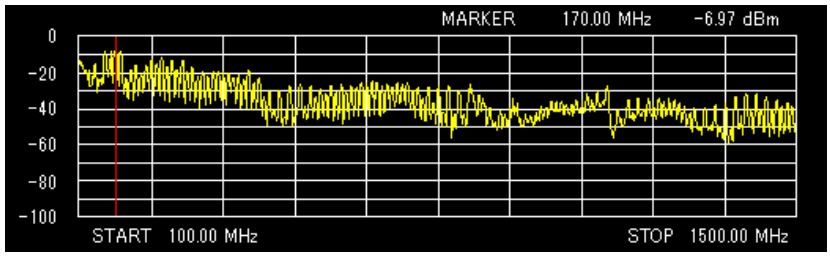
Unit Switch

The unit used to display measured intensity can be selected from dBuV and dBm.
The change of unit will be applied to the color bar and spectrum graph.

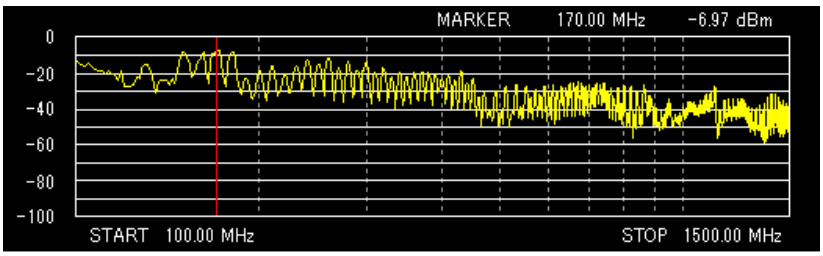


Frequency Axis Switch

Linear (Linear axis) or Log (Logarithmic axis) can be selected as the frequency axis in the spectrum graph. Log uses a logarithmic scale.



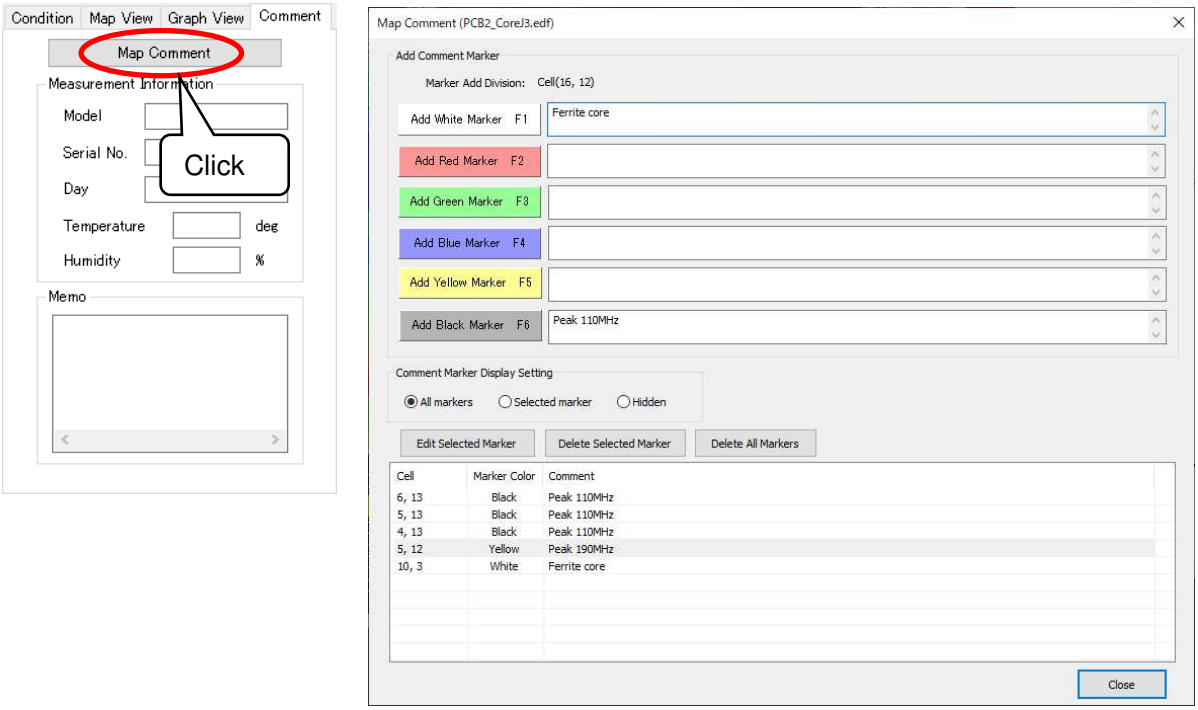
Linear (Linear axis)



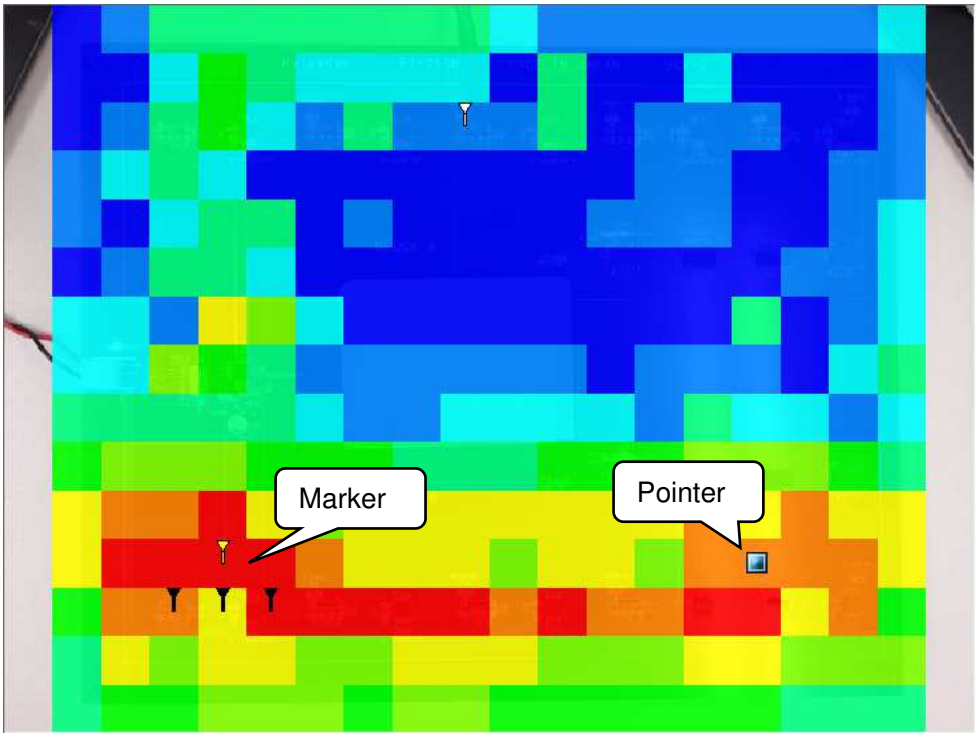
Log (Logarithmic axis)

Map Comment

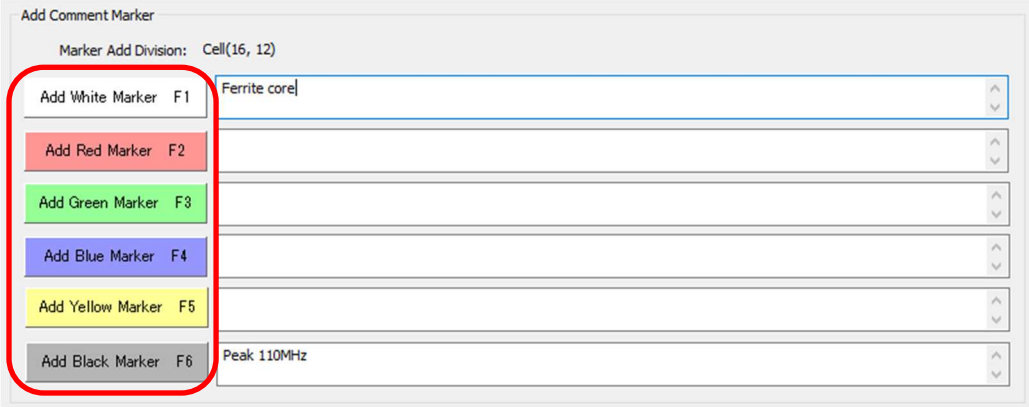
Clicking the **Map Comment** button opens the **Map Comment** dialog box. In the **Map Comment** dialog box, markers can be added to the image division at the current pointer position. Comments can be registered for each marker. The **Map Comment** dialog box can be displayed only after measurement.



Map Comment dialog box

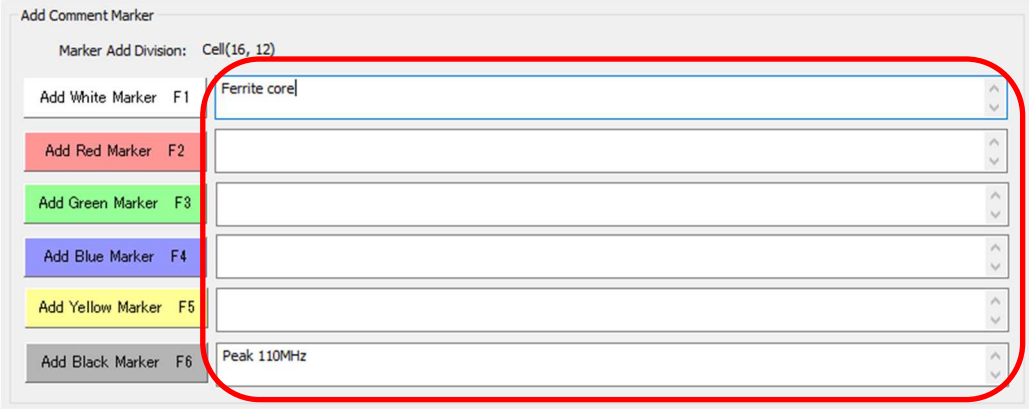


Clicking the **Add** button for each color adds a marker in that color. The function keys (F1 to F6) on the buttons can also be added using the keyboard.

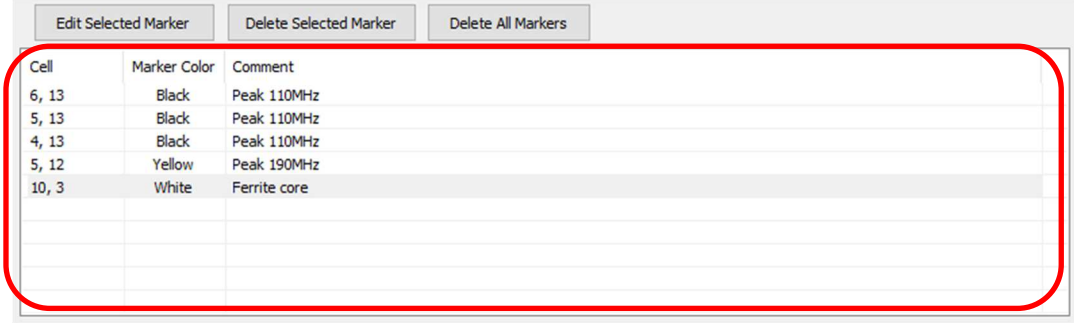


The **Marker Add Division** shows the current pointer position, and the marker is added to this division. If a marker is already registered for a division, it will be overwritten.

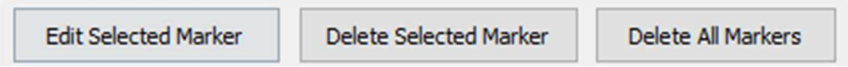
The content entered in the edit box to the right of the **Add** button is registered as a comment when a marker is added.



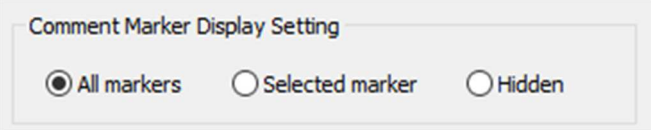
The added markers are listed on the list. Comments registered to markers can be checked here. Clicking on the list automatically moves the pointer to the position of the selected marker in the list.



Clicking the **Edit Selected Marker** button edits the color and comment of the marker selected on the list. Clicking the **Delete Selected Marker** button deletes the selected marker on the list. Clicking the **Delete All Markers** button deletes all markers.



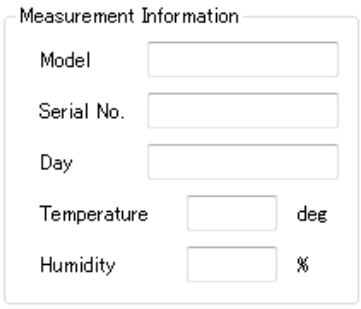
The marker display method can be selected from the following three types.



All markers	All added markers are displayed.
Selected marker	Only marker selected on the list is displayed.
Hidden	Markers are not displayed.

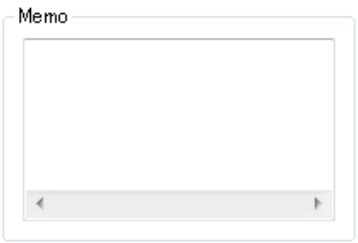
Measurement Information

The measurement date is automatically input in the **Day** field. For other items, enter information freely. If no information is required, leave the field blank.



Memo

Any information about measurement can be entered freely. In the **Memo** field, there is no limit of the number of characters.



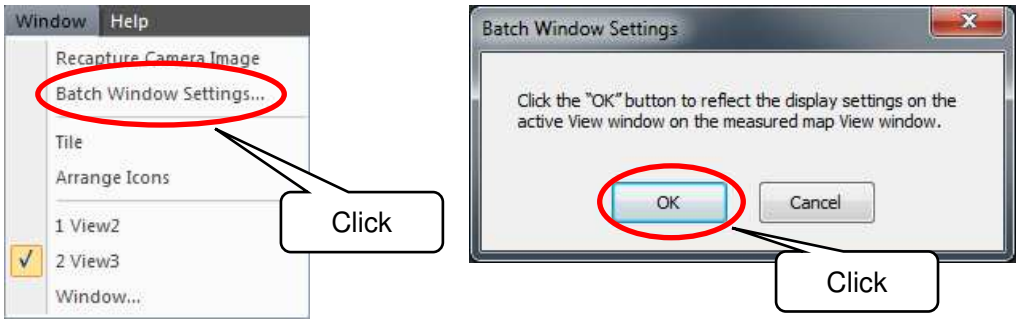
Batch Window Settings

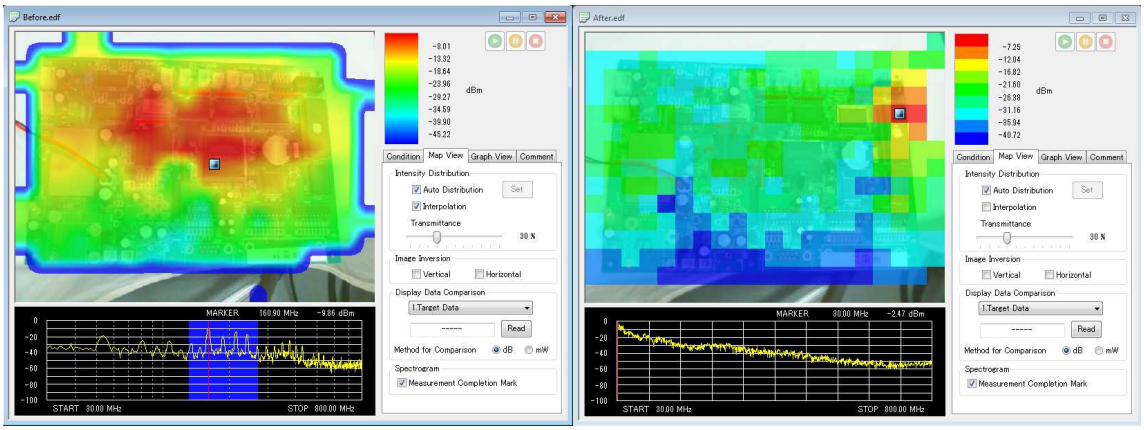
The same settings can be applied to part of the map view and the graph view on the **Map Data View** windows that are currently open. Click **Batch Window Settings** on the **Window** menu to display the **Batch Window Settings** dialog box. Click the **OK** button to reflect the map view and graph view settings on the last active **View** window on the measured map **View** window that is currently open.

The reflected settings are as follows:

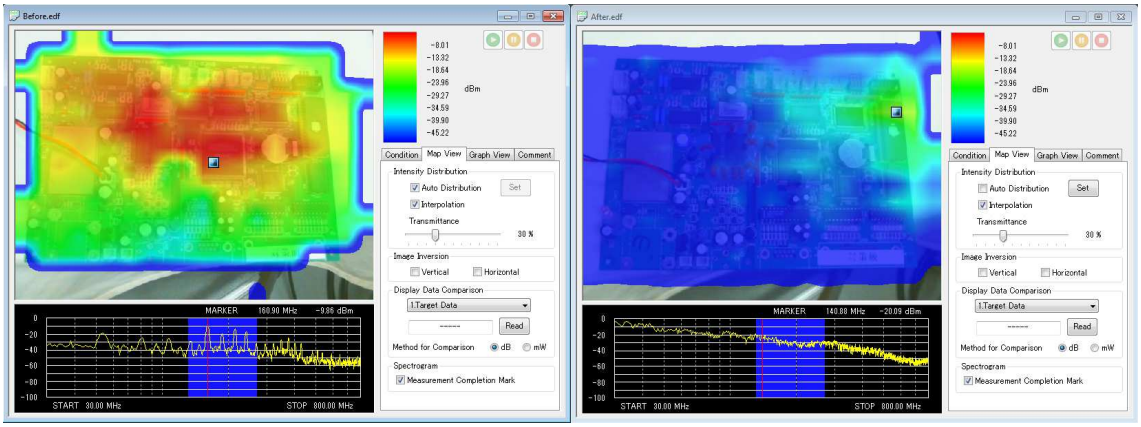
Upper/Lower Value, **Interpolation**, **Transmittance**, **Image Inversion**, **Display Data Comparison** (when comparison data is read), **Method for Comparison**, **Display of Measurement Completion Mark**, **Specified Frequency** (the **START** and **STOP** frequencies are the same among Windows), **Enlarge Specified Range** (the **START** and **STOP** frequencies are the same among Windows), **Unit Switch**, **Frequency Axis Switch**, the **Upper/Lower limits** for the level range (the **Specified Level** is checked), and **Display/Color Assignment** (the **Create Density Display** is checked).

Use this function to compare measurement data put side by side.





Before batching window settings

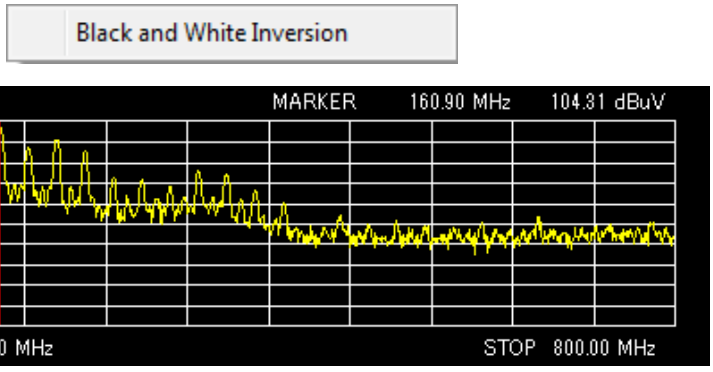


After batching window settings

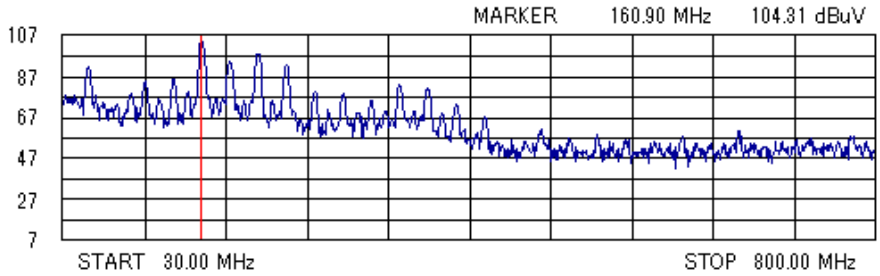
Black and White Inversion

The spectrum graph can be displayed inversely in black and white.

Right click on the spectrum graph and click **Black and White Inversion** to invert the color of the graph. Use this function to print the graph.



Normal

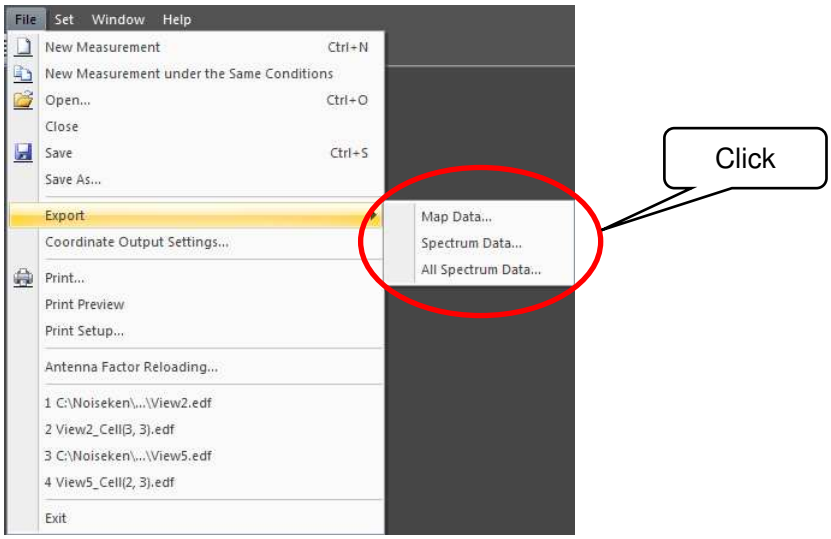


Black and White Inversion

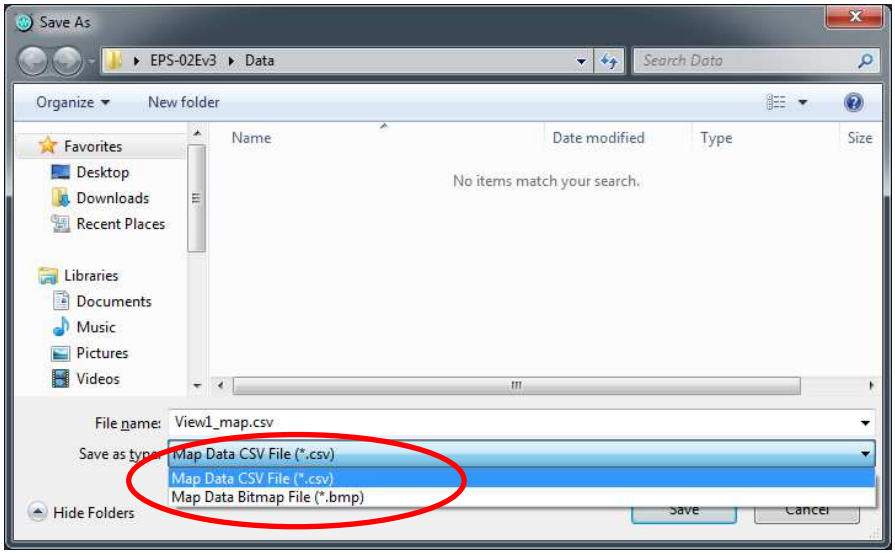
Exporting Measurement Data

Measurement data can be exported to an external file.

Select **Export** from the **File** menu, and choose one from **Map Data**, **Spectrum Data**, and **All Spectrum Data**. The **Save As** dialog box will appear.



In **Save as type** on the **Save As** dialog box, either **CSV File** or **Bitmap File** can be specified.



- **Map Data**

  CSV file: The peak values for each measurement point are exported. When difference is displayed in “Display Data Comparison” on page 44, the difference for each measurement point is output.

  BMP file: The map data image pasted on the camera image is exported.

- **Spectrum Data**

  CSV file: The spectrum waveform data for the point indicated by the pointer is exported.

  BMP file: The spectrum graph image for the point indicated by the pointer is exported.

- **All Spectrum Data**

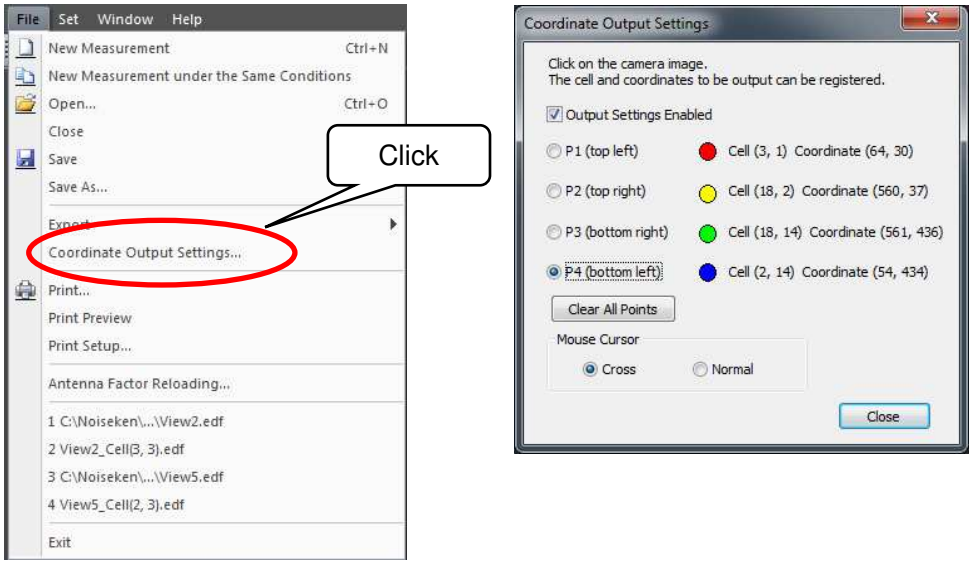
  CSV file: The spectrum data for all measurement points are exported. This cannot be selected when the difference is displayed in “Display Data Comparison” on page 44.

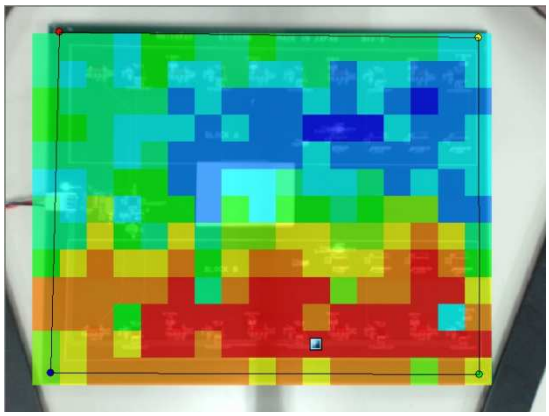
When the comparison data is read in “Display Data Comparison” on page 44, the displayed data is exported.

Coordinate Output Settings

By specifying a point on the Map View, the image division and coordinates of the specified point can be output as explained in “Exporting Measurement Data” on page 54. Use this function for data linkage with software supplied by another company.

When **Coordinate Output Settings** is selected in the **File** menu, the **Coordinate Output Settings** dialog box appears, and checking **Output Settings Enabled** enables the function. Coordinates can be specified at four points: P1 (top left), P2 (top right), P3 (bottom right), and P4 (bottom left). Select each radio button and click or drag on the Map View to register the positions. Click **Clear All Points** to clear the registered information.



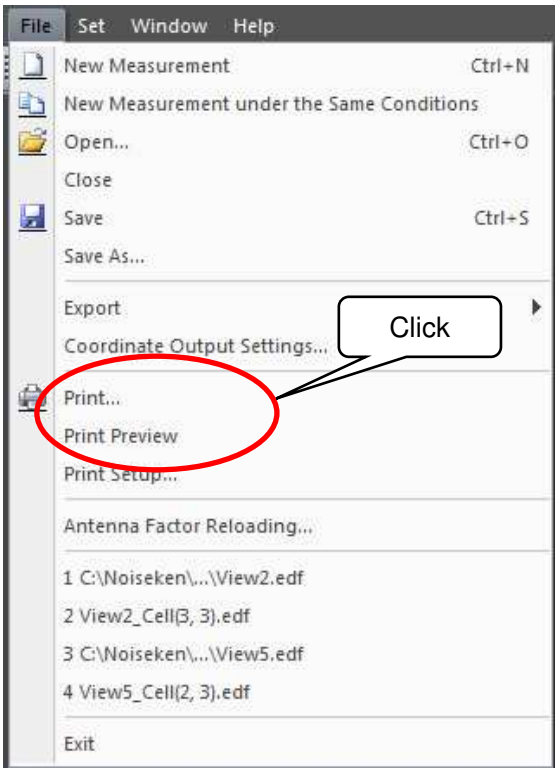


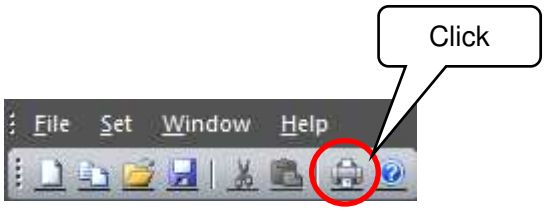
When the function is enabled, the mouse cursor can be selected from cross and normal. Select a cursor that can easily specify the positions.

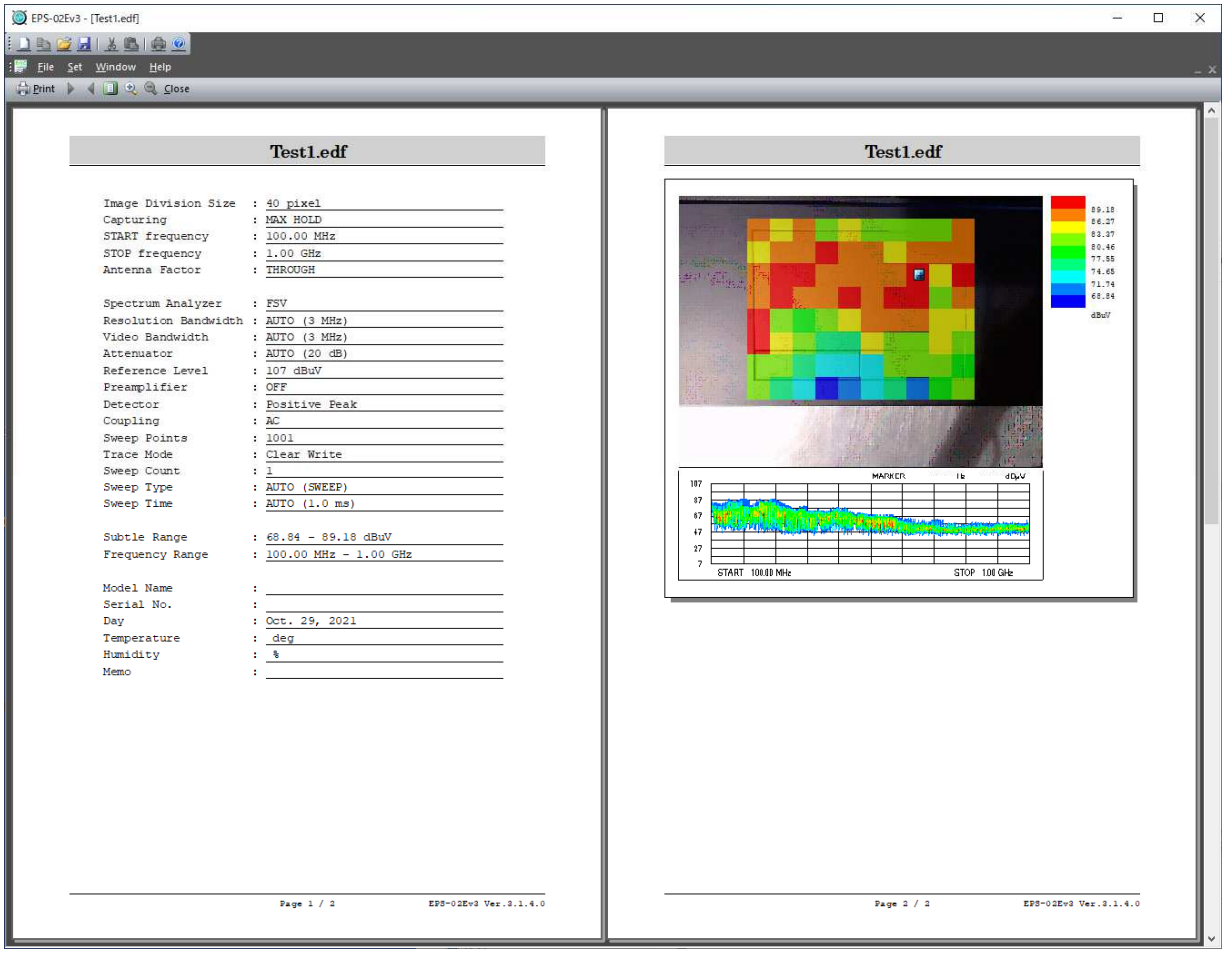
Print

The measurement conditions, map image, and spectrum graph can be printed.

Select **Print** or **Print Preview** from the **File** menu or select the **Print** button on the toolbar.





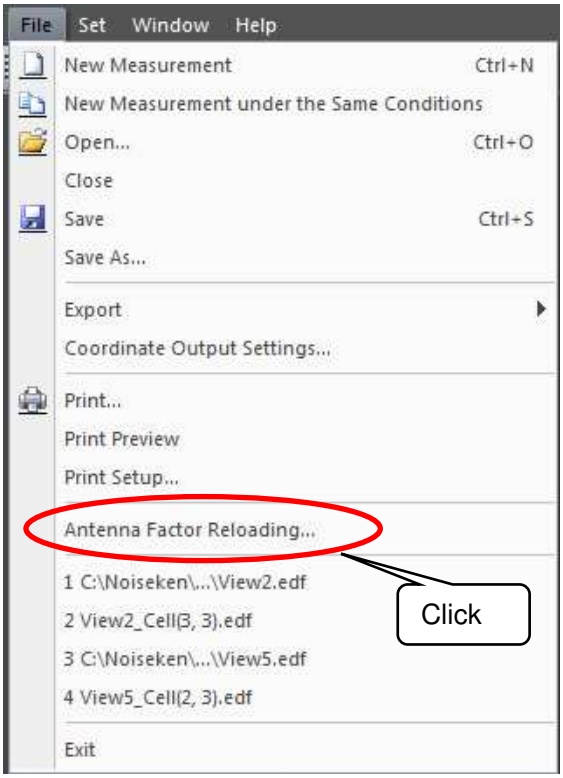


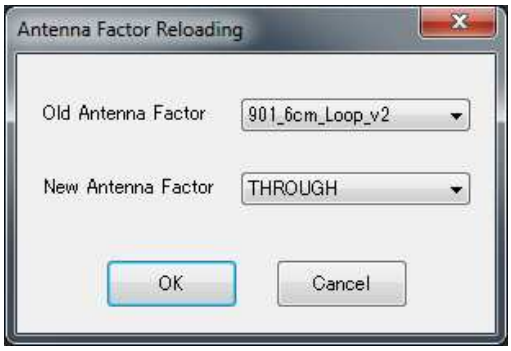
Print Preview

Antenna Factor Reloading

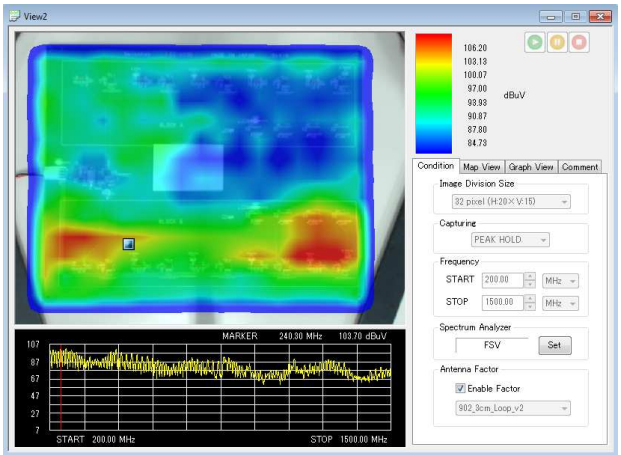
The Antenna Factor of the measured data can be reloaded. Refer to “Antenna Factor” on page 32 for the Antenna Factor.

Click **Antenna Factor Reloading...** from the **File** menu. The **Antenna Factor Reloading** dialog box will appear and allow the desired Antenna Factor to be specified.

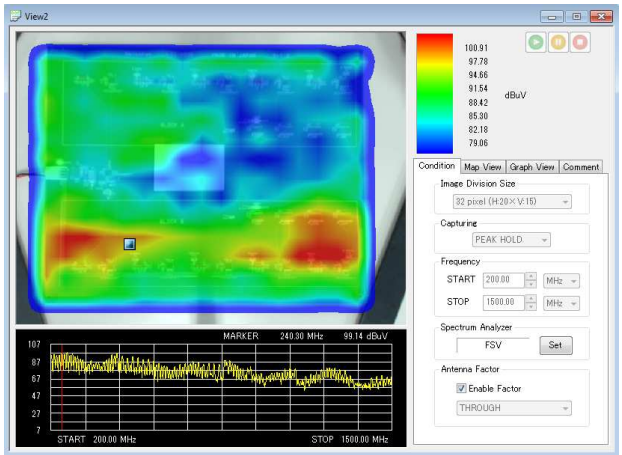




To save the reloaded Antenna Factor, click **Save As...** from the **File** menu and save the file under a different name.



Old Antenna Factor: 901_6cm_Loop_v2



New Antenna Factor: THROUGH

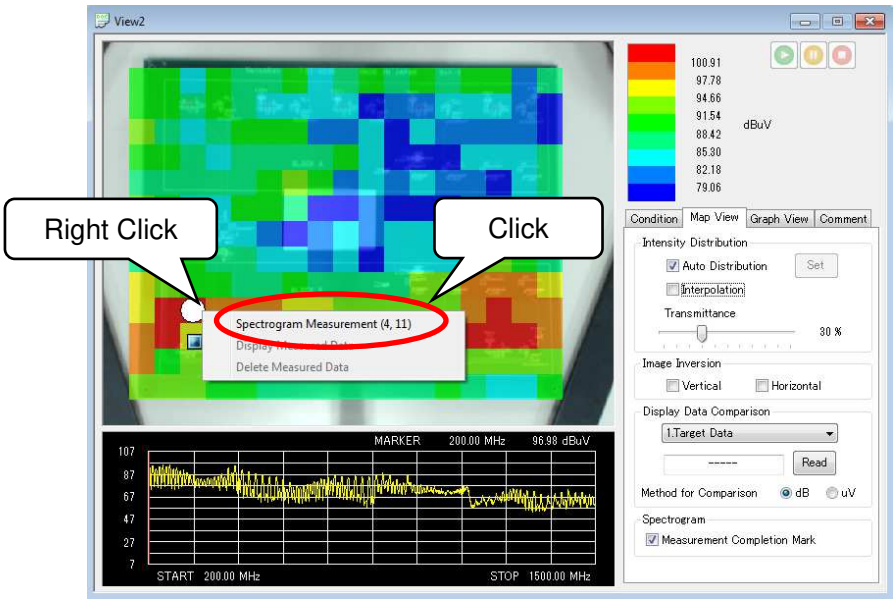
9－9. Spectrogram Measurement (Setting Measurement Conditions)

Here, spectrogram measurement is available. It is a temporally continuous measurement for each image division of measured data that displays the result in three dimensions: time, frequency, and strength. The following section describes how to operate spectrogram measurement.

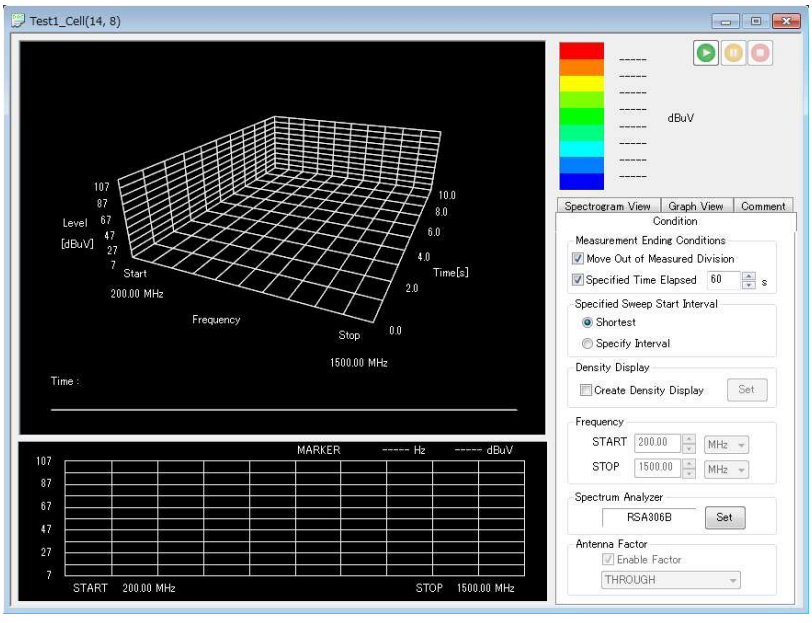
New Measurement

Spectrogram measurement specifies image divisions of measured map data and performs measurement for the divisions.

Right click the desired division of the measured map data where spectrogram measurement should be performed to display the menu. Click **Spectrogram Measurement** in the menu to display the **View** window for spectrogram measurement. The values displayed to the right of **Spectrogram Measurement** indicate the selected division.



Measured Map Data Window



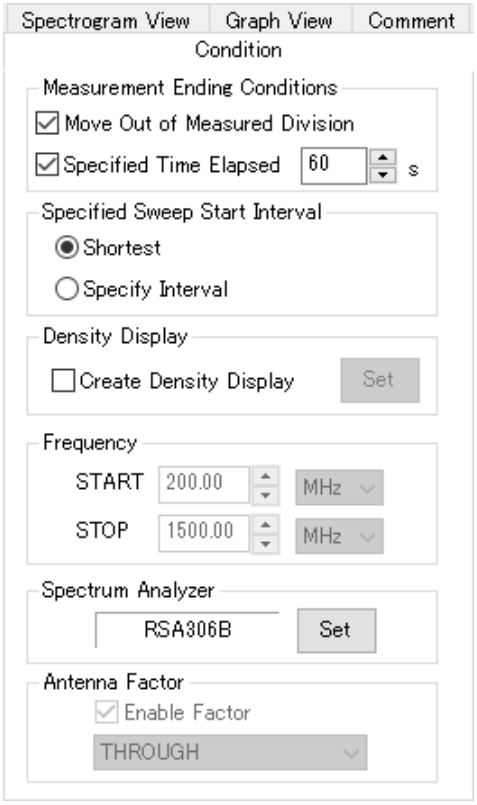
Spectrogram Measurement View Window

The name of the **View** window is the “Saved file name of map data_Cell (clicked division)”. When map data is saved with a name after the measurement by clicking **Save As...** from the **File** menu, the associated spectrogram measurement data is also saved as the “Saved file name of map data_Cell (clicked division)”.

Before spectrogram measurement, the measured map data needs to be saved. The spectrogram measurement data is automatically saved in the same folder as the map data. Also, to perform spectrogram measurement, the image inversion of map data needs to be canceled.

Condition Tab

In the **Condition** tab, set the measurement ending conditions, properties for the spectrum analyzer, and other conditions.



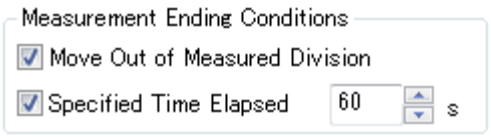
The settings of frequency, spectrum analyzer and Antenna Factor take over the settings for the specified division of map data.

The settings of **Frequency**, **Spectrum Analyzer** and **Antenna Factor** can be changed only when the functional limitation is canceled. Refer to “Functional Limitation” on page 24 for the functional limitation.

Refer to “Density Display” on page 29 for the **Density Display**.
Refer to “Frequency” on page 31 for the **Frequency**.
Refer to “Spectrum Analyzer” on page 31 for the **Spectrum Analyzer**.
Refer to “Antenna Factor” on page 32 for the **Antenna Factor**.

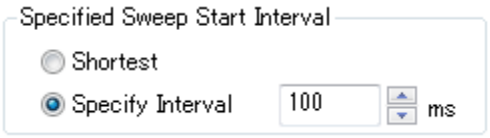
Measurement Ending Conditions

Conditions for automatically ending measurement are specified here. If **Move Out of Measured Division** is checked and the electromagnetic field measurement sensor moves out of the clicked division, the measurement automatically ends. If **Specified Time Elapsed** is checked, the measurement automatically ends when a specified time has elapsed.



Specified Sweep Start Interval

An interval for sending the sweep start command to the spectrum analyzer is specified here. If **Shortest** is selected, the command is sent at the shortest possible interval. If **Specify Interval** is selected, the command is sent at the specified interval.

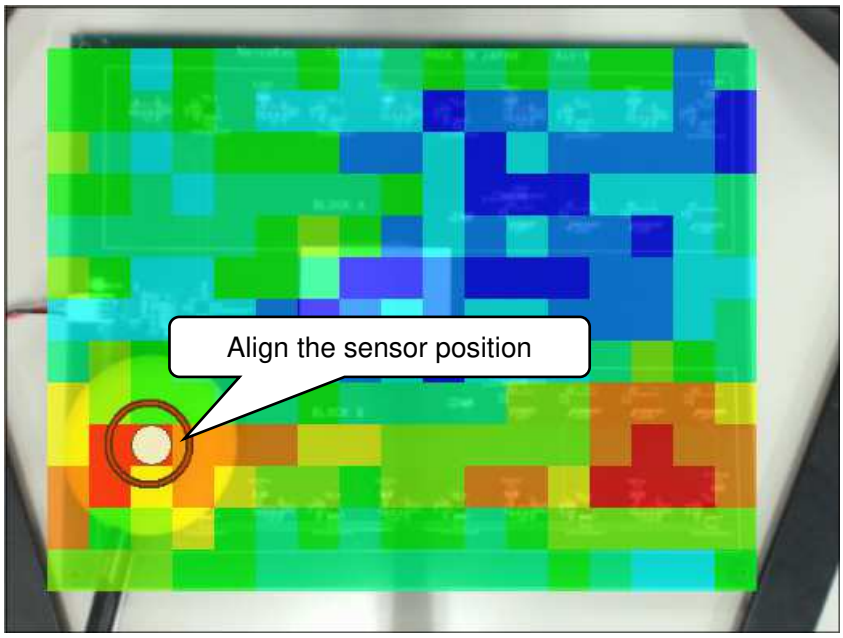


If the sweep start command is not successfully sent at the specified interval, the message, “There is data exceeding the specified sweep start interval.” is displayed at the top of the 3D graph screen.

9－10.Spectrogram Measurement (Performing Measurement)

Performing Measurement

When the **View** window of spectrogram measurement is displayed, the map data screen switches to video display. Align the position of the electromagnetic field measurement sensor with the selected image division which is blinking in black and white on the video, and fix the sensor. When the sensor position is aligned, the blinking light turns white.



Display Ghost Image is available before and during the spectrogram measurement. Refer to “Display Ghost Image” on page 35 for the **Display Ghost Image**.

To start measurement, click the **START** button in the upper right of the **View** window. During measurement, the **PAUSE** and **STOP** buttons are enabled.

To suspend measurement, click the **PAUSE** button to suspend measurement, and to finish measurement, the **STOP** button. When measurement ending conditions are set, the measurement automatically ends according to the conditions.

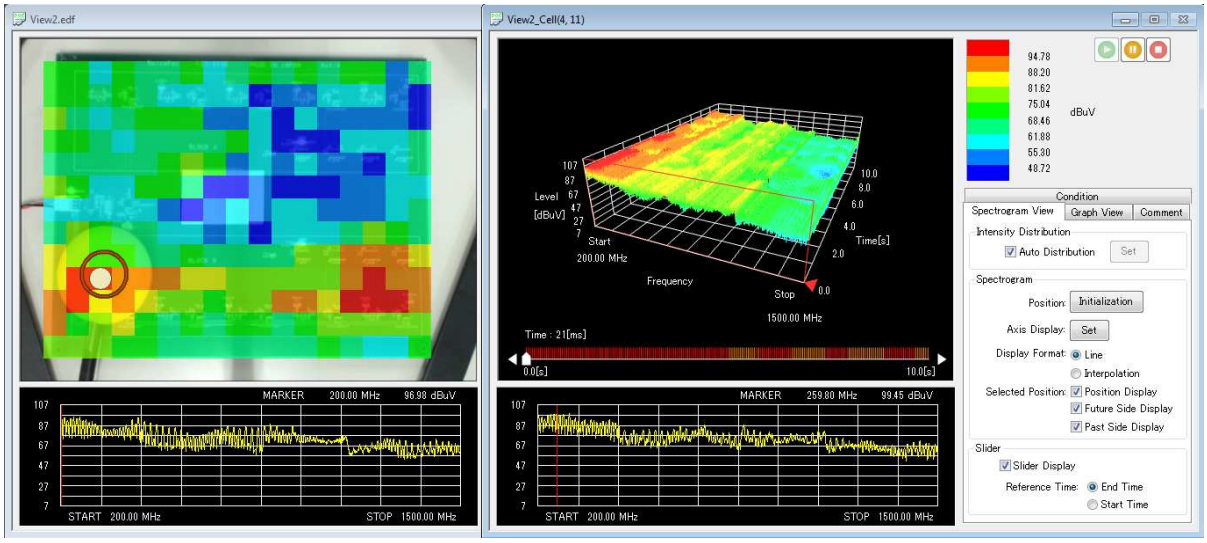
After completion of measurement, all buttons are disabled. To perform measurement again, right click on the map data and select **Spectrogram Measurement**.

Before measurement　During measurement　After measurement

While measurement is in progress, the settings in the **Condition** tab cannot be changed. All items in the **Spectrogram View** tab can be changed. In the **Graph View** tab, only **Unit Switch** and **Frequency Axis Switch** are active.

During the measurement, waveform data is displayed in a 3D graph of frequency, level and time. In

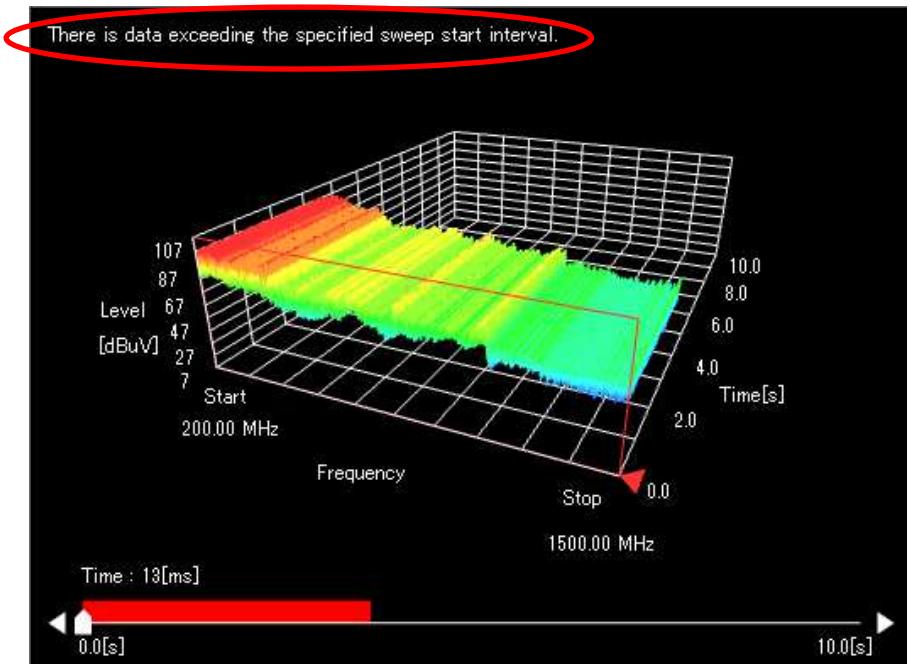
addition, the latest waveform data measured by the spectrum analyzer is displayed in the spectrum graph at the bottom of the **View** window.



Note that if the noise level emitted from the EUT is high, the spectrum analyzer and preamplifier may be damaged by excessive input.

Messages

During or after measurement, messages may be displayed at the top of the 3D graph. The messages and their descriptions are as follows.



- "Reading data from the file"

  Displayed when reading measurement data saved in the file.

- "Saving data to the file."

  Displayed when saving measurement data in the memory to the file.

- “Failed to generate a peak. The maximum number of peaks displayed is changed. If the failure persists, closing other windows may improve the situation.”

  Displayed when generation of the peaks that make up the 3D graph fails. When multiple view windows of spectrogram measurement are displayed, closing all of them and reopening the View window may improve the situation.

- “Failed to create index buffer. The number of displayed data is limited.”

  Displayed when creation of index buffer for displaying a 3D graph fails. The number of displayed data to create index buffer is limited.

- “Some data are not displayed because the maximum number of displayed peaks is exceeded.”

  In EPS-02Ev3, since the upper limit of the number of peaks that make up the spectrogram is set, when the set value is exceeded, only a part of the spectrogram is displayed, resulting in the appearance of this message. The upper limit of the number of peaks changes depending on the hardware performance as well.

- “The addition of sweep data is temporarily stopped because the sweeping speed exceeds the data saving speed.”

  Displayed when the speed for acquiring data exceeds the speed for saving data in the file, and the data acquisition is temporarily stopped.

- “There is data exceeding the specified sweep start interval.”

  Displayed when there is data that cannot be acquired at the specified interval when measurement is performed with the sweep start interval set to the specified interval.

- “As the display time range exceeds the data range in the memory, some data may not be displayed.”

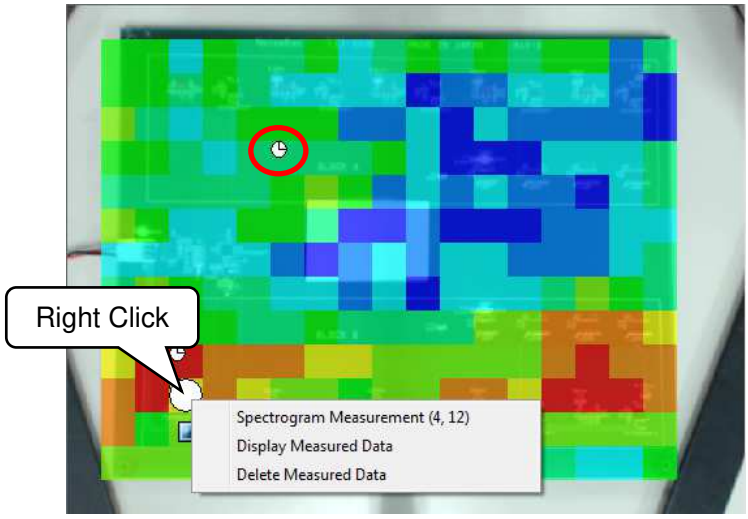
  Displayed when the display time range of the 3D graph exceeds the data range in the memory, and some data may not be displayed. To display the data, the display time range needs to be shortened. For the change of the display time range, refer to “Axis Display Settings” on page 69.

9－11.Spectrogram Measurement (Measurement Data Analysis)

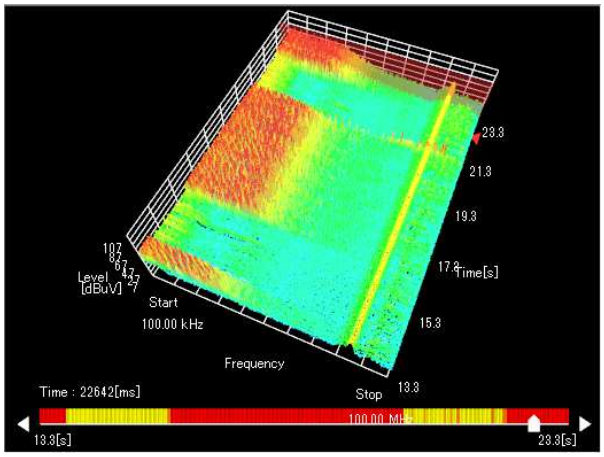
Measurement Data

After the measurement, a clock mark is displayed in the division of measured map data. Right click a division with the clock mark to display the menu. The menu items are described as follows.

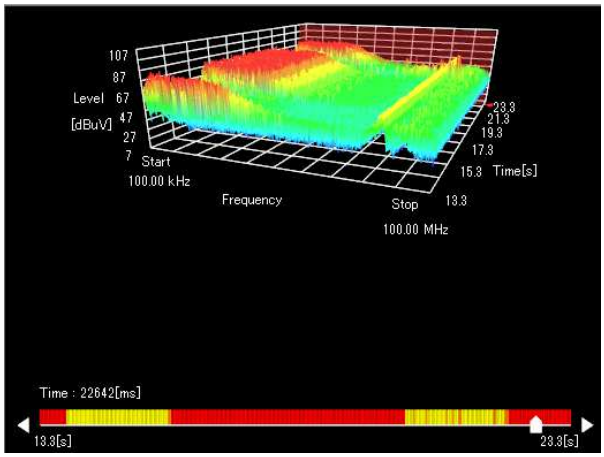
Spectrogram Measurement	Displays a new measurement **View** window and performs measurement again. Note that the original data is deleted when the new measurement is performed.
Display Measured Data	Displays the measured data **View** window.
Delete Measured Data	Deletes measured spectrogram data. Note that the data cannot be restored once deleted.



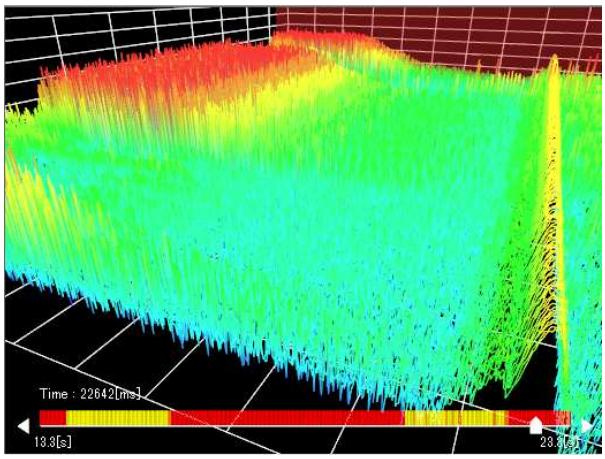
The shape of the mouse pointer turns on the 3D graph screen, and dragging it rotates the graph. Clicking the wheel button turns the shape of the mouse pointer, and dragging it moves the 3D graph. Moving the wheel button up and down zooms in and out the 3D graph.



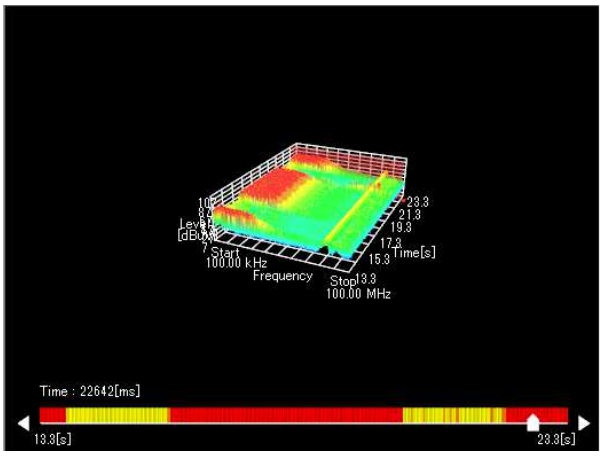
Rotation



Movement

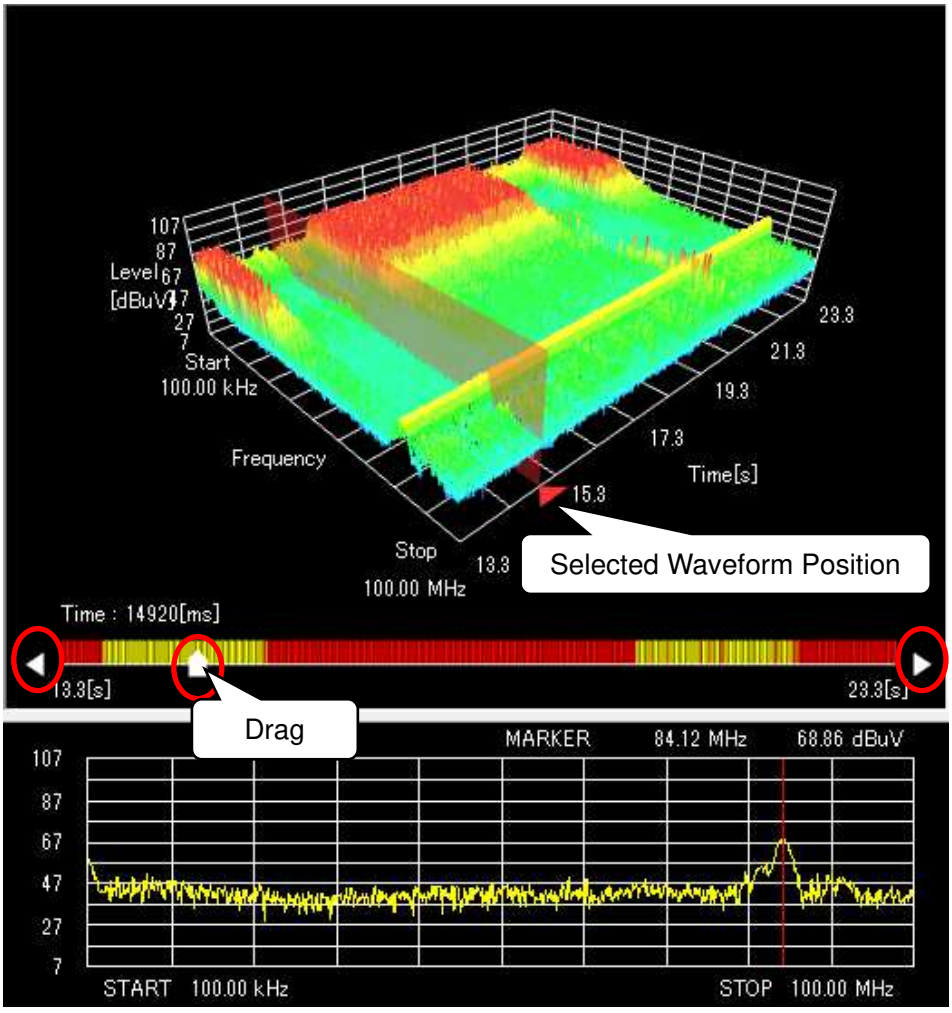


Zoom in



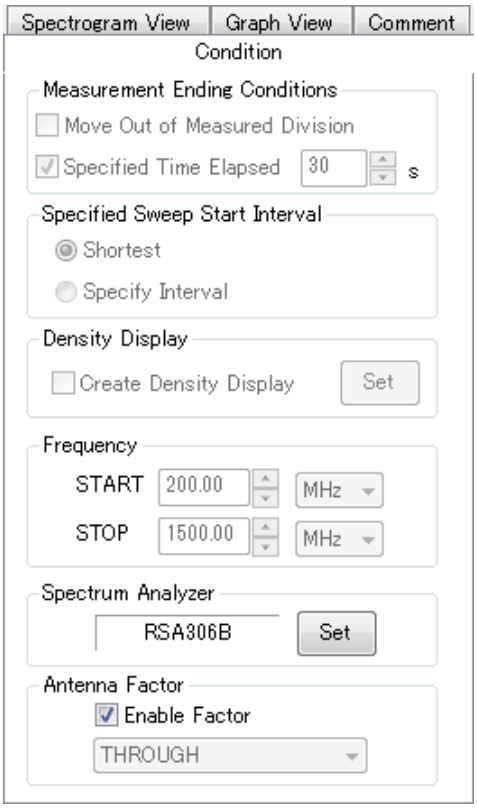
Zoom out

Dragging the slider displayed below the 3D graph or selecting the triangle on the right or left specifies a spectrum waveform to be displayed. The scale on the slider bar is color-coded by the peak values of the corresponding waveforms. The sweep start time of the specified waveform based on the reference time is displayed at the top of the slider. Also, the selected waveform position in the 3D graph is displayed as a red rectangle. Refer to “Slider” on page 73 for the reference time.

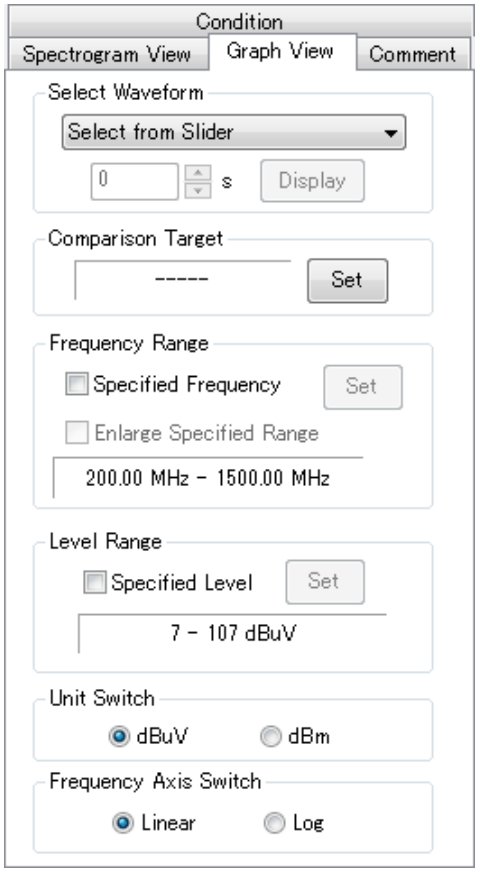


Click the triangle on the left or right of the slider bar to move to the next waveform. Press and hold it to move continuously.

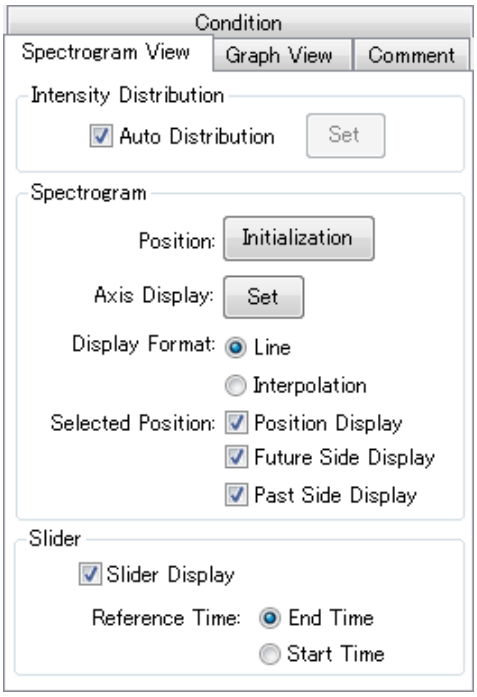
In the **Condition** tab, the conditions configured before measurement can be checked. The representation of measurement data can be changed in the **Spectrogram View** tab and **Graph View** tab. In the **Comment** tab, measurement information and other comments can be entered.



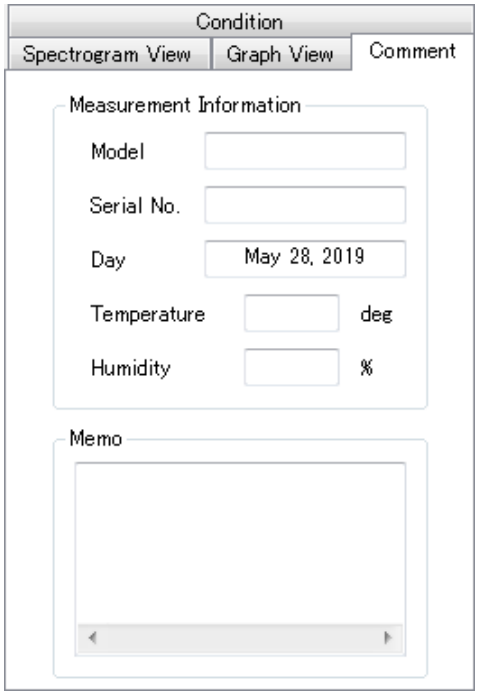
Condition tab



Graph View tab



Spectrogram View tab

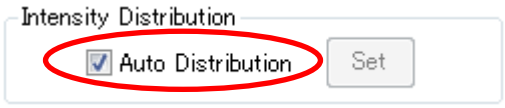


Comment tab

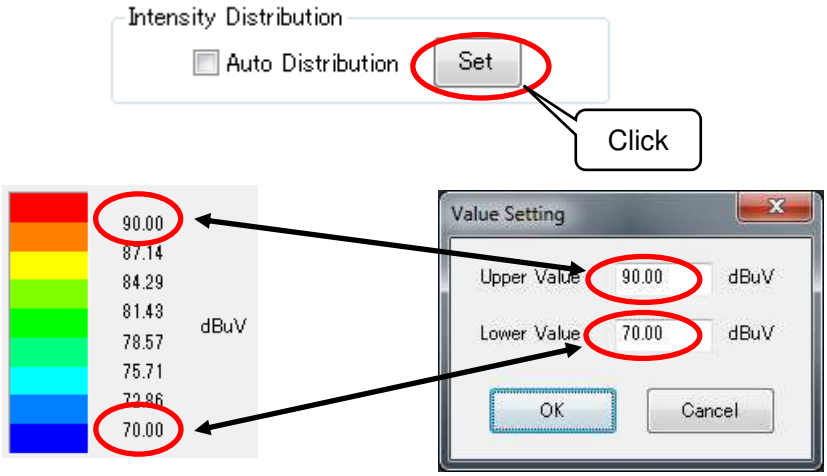
Refer to “Measurement Information” on page 52 and “Memo” on page 52 for the **Comment** tab.

Auto Distribution

Check **Auto Distribution** to color-code the 3D graph according to the maximum and minimum values of data within the display time range of the graph.



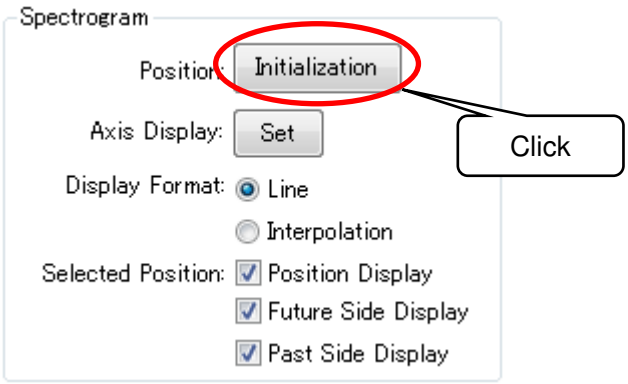
To change the Upper/Lower Value to desired values, uncheck the Auto Distribution checkbox and click the Set button. The set upper/lower value settings will be reflected applied to the color bar.



The upper and lower limit values can be fixed to any before or during measurement. Adjusting them with the upper and lower limit values at the previous measurement can make changes easy to perceive visually.

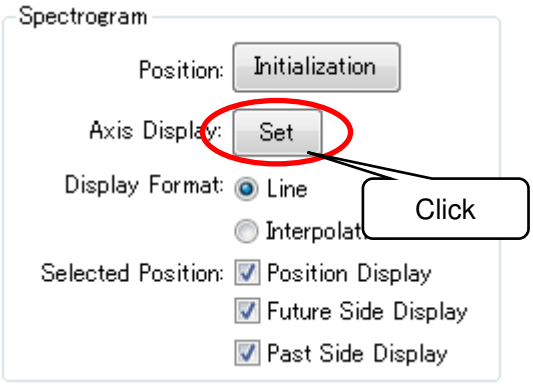
Initialization

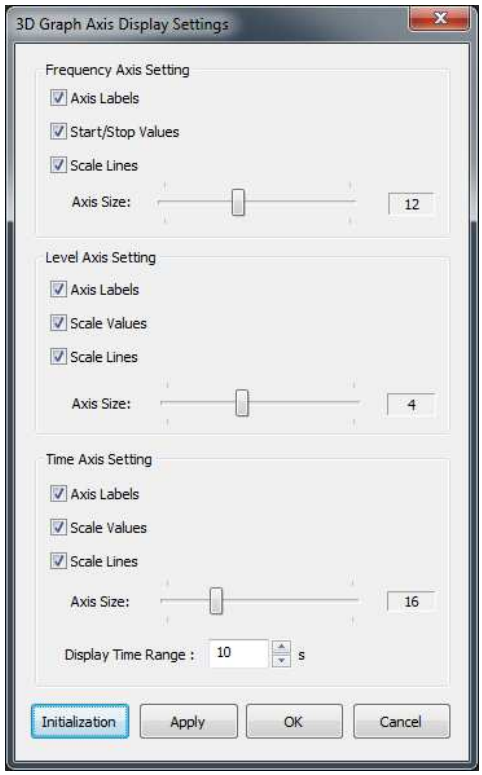
Click the **Initialization** button to reset the rotation, movement and scaling of the 3D graph to its initial state.



Axis Display Settings

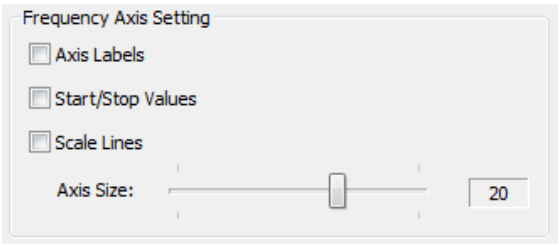
Click the **Set** button to display the **3D Graph Axis Display Settings** dialog box and change the display of the frequency axis, level axis, and time axis.

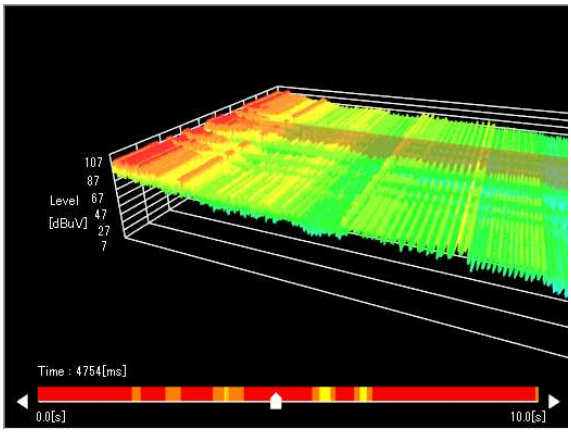




3D Graph Axis Display Settings dialog

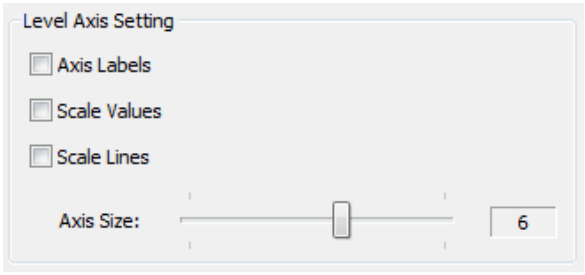
In the frequency axis setting, the display of axis labels, Start/Stop values, and scale lines can be switched and the size of the frequency axis can be changed.

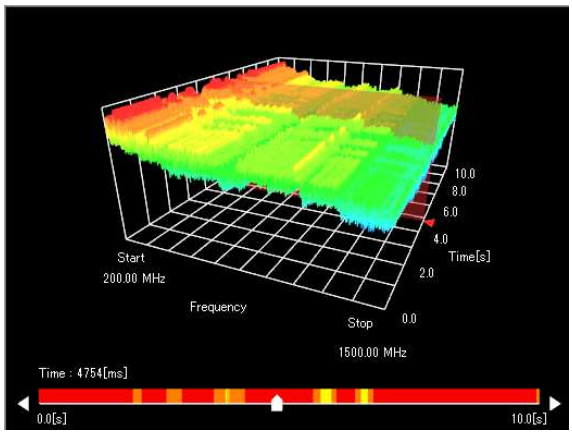




Change of Display by Frequency Axis

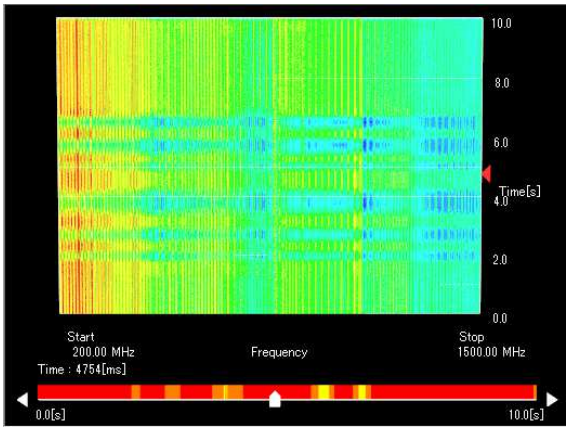
In the level axis setting, the display of axis labels, scale values, and scale lines can be switched and the size of the level axis can be changed.



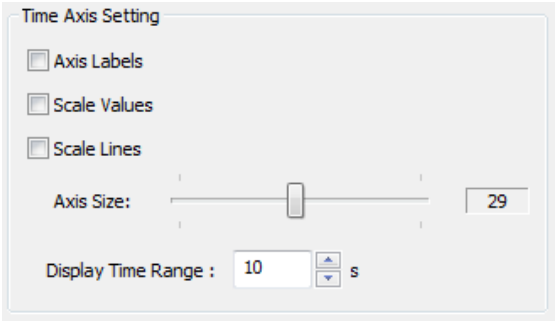


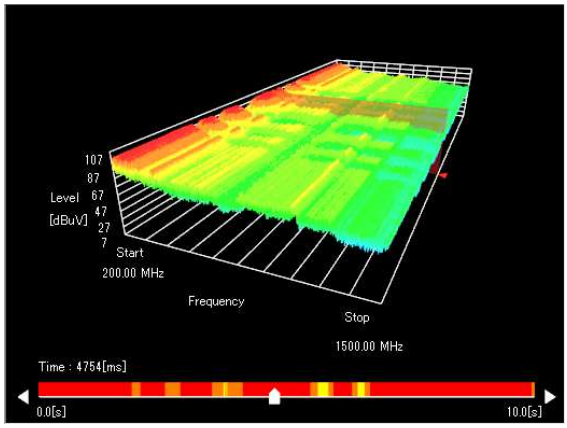
Change of Display by Level Axis

If the size of the level axis is set to zero, the level is displayed only by color.

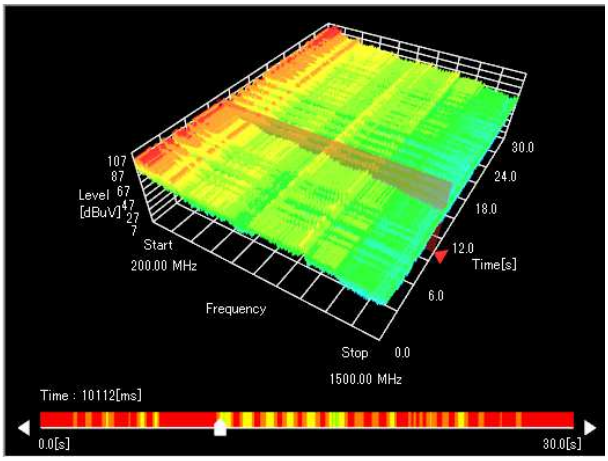


In the time axis setting, the display of axis labels, scale values, and scale lines can be switched and the size of the time axis can be changed. If the display time range is changed, the time axis range can be changed in seconds.

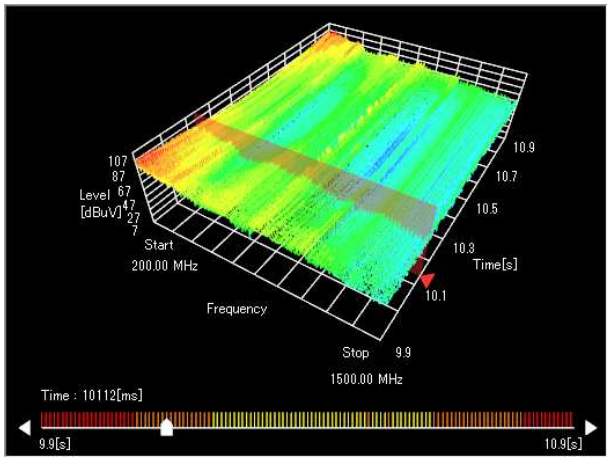




Change of Display by Time Axis



Display Time Range: 30 seconds



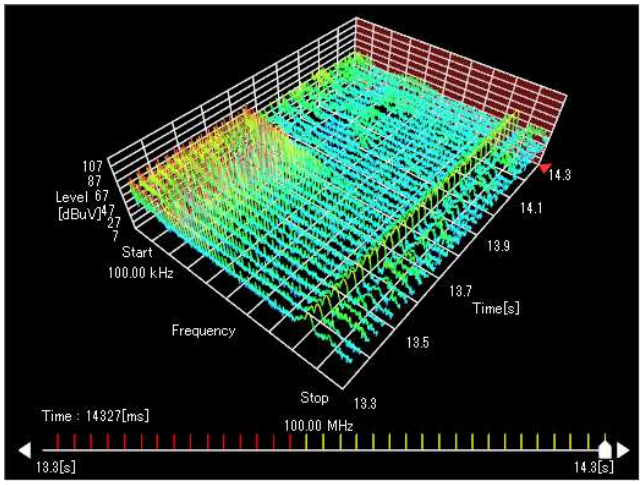
Display Time Range: 1 second

If a long display time range is set, part of the spectrogram may not be displayed beyond the maximum number of peaks that can be displayed on EPS-02Ev3. In this case, the message "Some data are not displayed because the maximum number of displayed peaks is exceeded" is displayed at the top of the 3D graph screen.

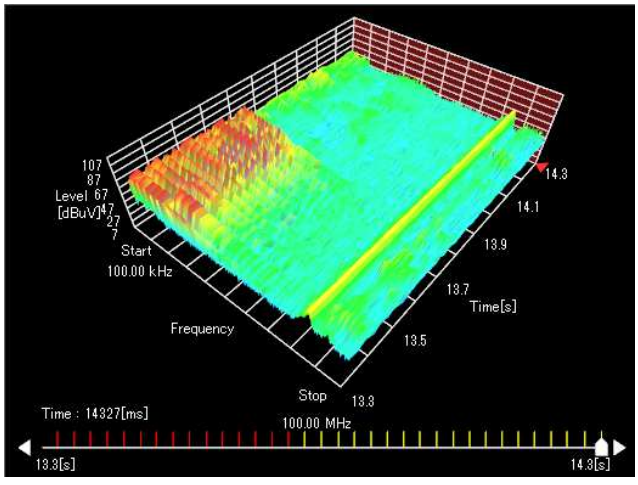
Click the **Initialization** button to reset all items to their initial states. Click the **Apply** button to apply the settings to the 3D graph while displaying the dialog box. Click the **OK** button to apply the settings and close the dialog box. Click the **Cancel** button to close the dialog box without applying the settings.

Display Format

The display format of the spectrogram can be changed. Select **Line** to display spectrum waveforms in line along the time axis. Select **Interpolation** to interpolate and display adjacent spectrum waveforms on the time axis.



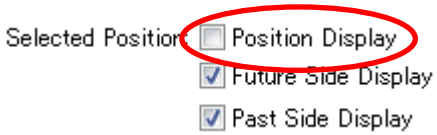
Line Display

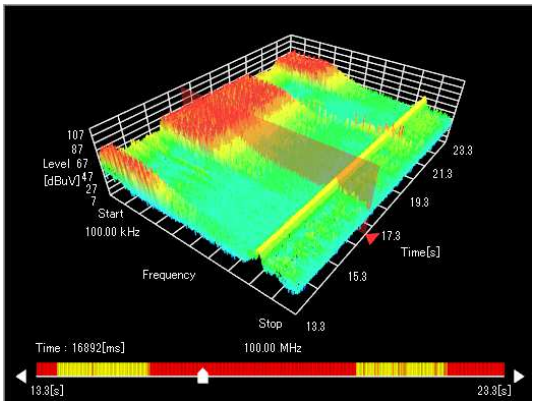


Interpolation Display

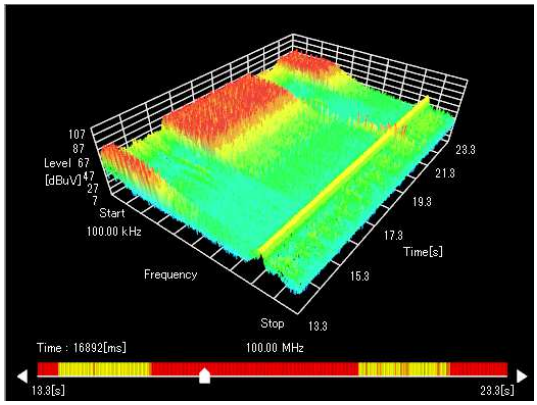
Selected Position

Uncheck **Position Display** not to display the selected waveform position on the 3D graph.



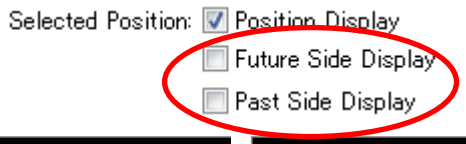


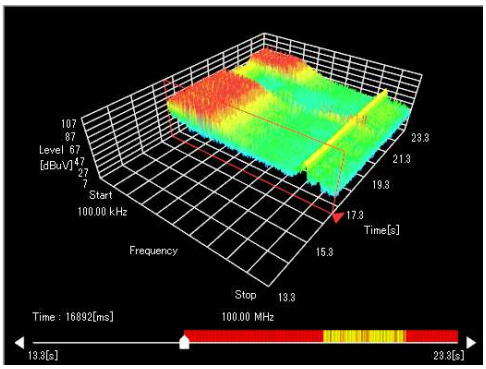
Position Display is checked



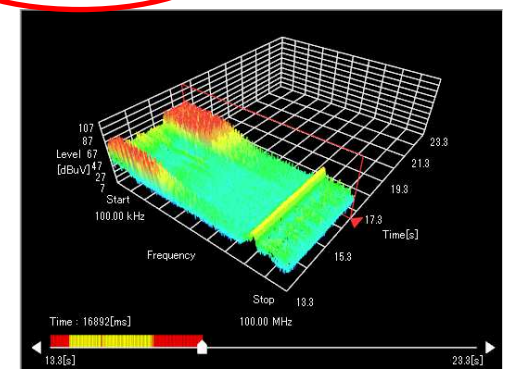
Position display is unchecked

Uncheck **Future Side Display** not to display waveforms on the future side of the selected waveform position on the 3D graph. Uncheck **Past Side Display** not to display waveforms on the past side of the selected waveform position on the 3D graph.

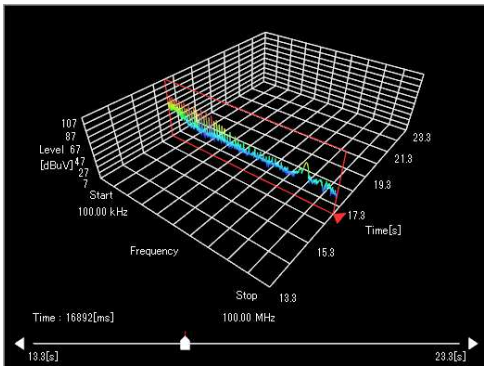




Future Side Display is unchecked



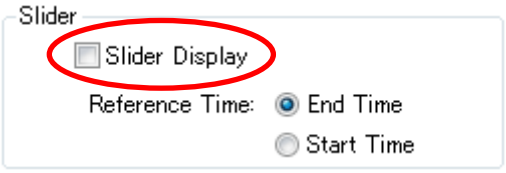
Past Side Display is unchecked

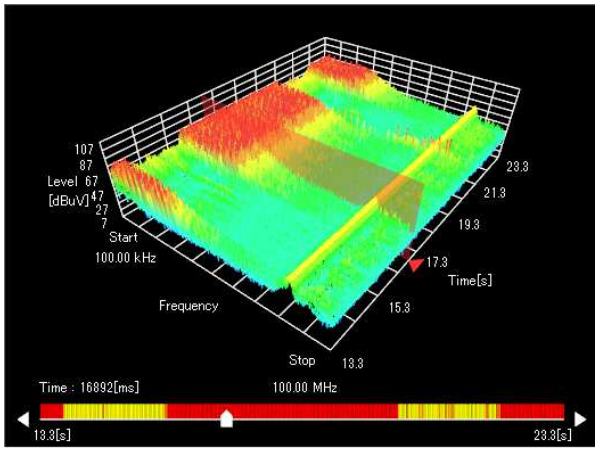


Both are unchecked

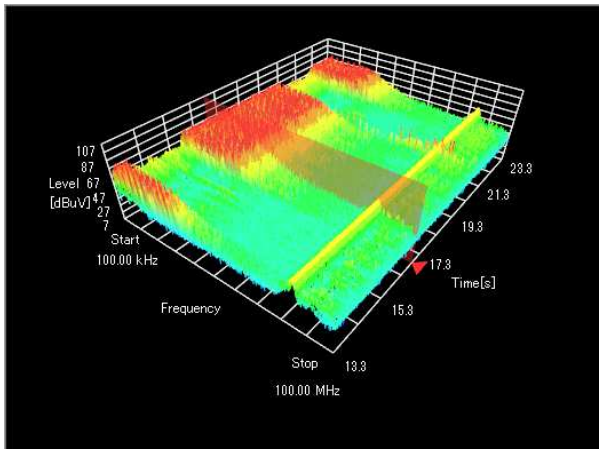
Slider

Uncheck **Slider Display** not to display the slider.



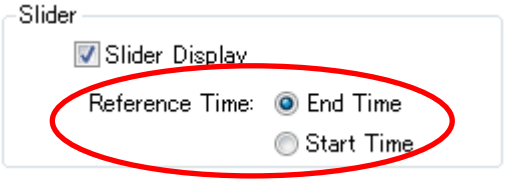


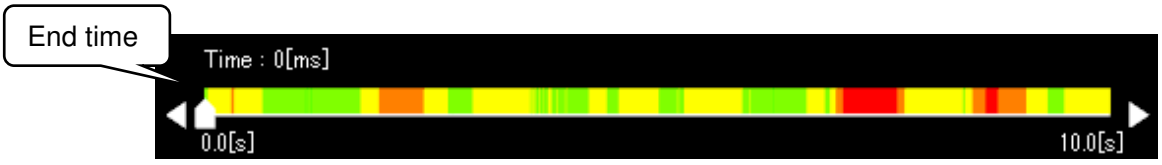
Slider Display is checked



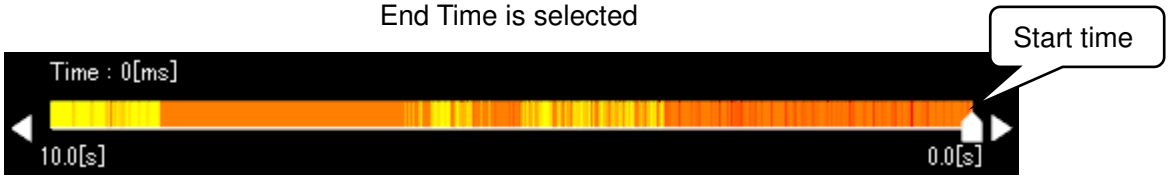
Slider Display is unchecked

As a reference time, either **End Time** or **Start Time** can be selected. Select **End Time** to set the sweep start time of the waveform at the end of measurement as the reference time 0. Select **Start Time** to set the sweep start time of the waveform at the start of measurement as the reference time 0.





End Time is selected

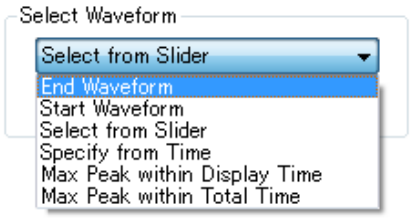


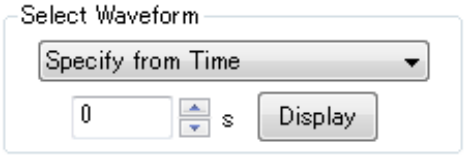
Start Time is selected

Immediately after the measurement and after opening the measured spectrogram data, the waveform of the reference time is selected.

Select Waveform

A method for selecting a spectrum waveform is specified here.

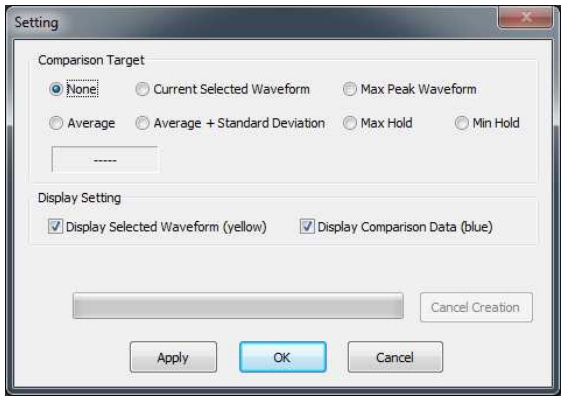


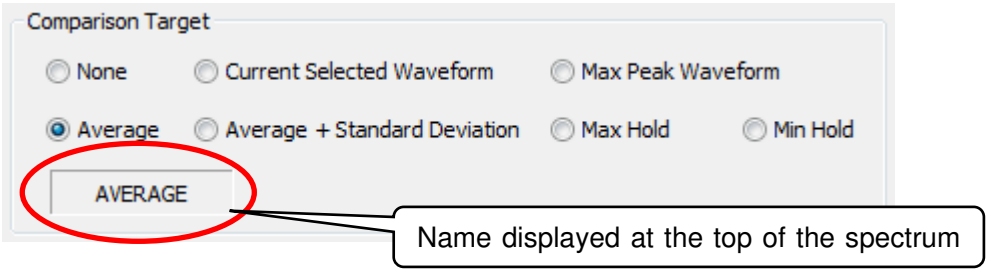


End Waveform	The waveform at the end of measurement is selected.
Start Waveform	The waveform at the start of measurement is selected.
Select from Slider	Selected from the slider. If the slider is clicked, the setting automatically switches to this.
Specify from Time	Specify the number of seconds and click the **Display** button to select the waveform closest to the specified time.
Max Peak within Display Time	The waveform with the maximum peak is selected within the display time range of the 3D graph.
Max Peak within Total Time	The waveform with the maximum peak is selected within the total measurement time.

Comparison Target

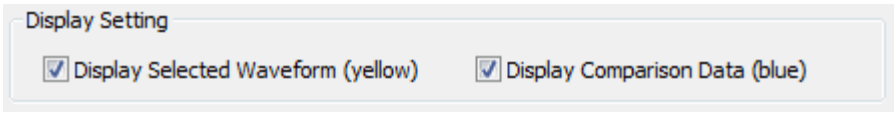
The comparison data can be overlaid on the spectrum graph at the bottom of the **View** window. Click the **Set** button to display the **Setting** dialog box, select a comparison target, and click the **Apply** or **OK** button.

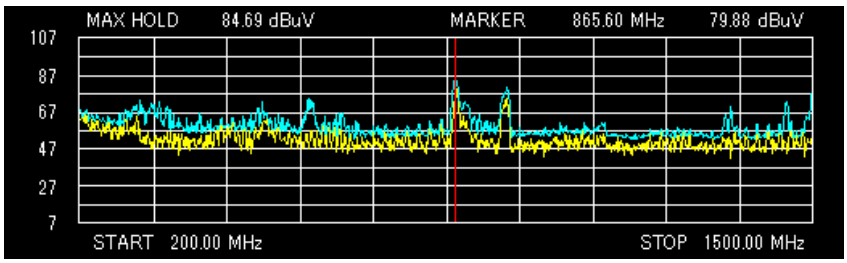




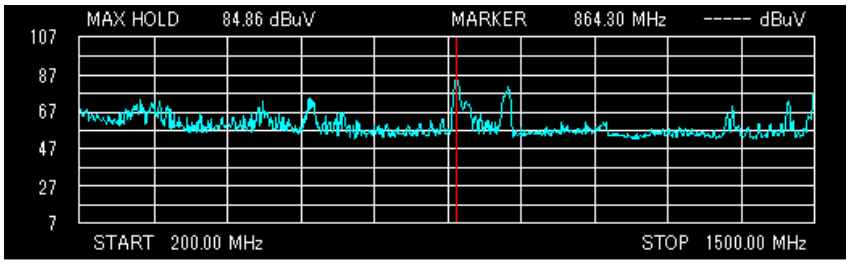
None	No comparison target is displayed.
Current Selected Waveform	The waveform currently displayed on the spectrum graph is displayed as the comparison target. Change selected graphs to select any waveform for comparison.
Max Peak Waveform	The waveform with the maximum peak in the total measurement data is displayed.
Average	Averages for all frequency points are calculated for the total measurement data and displayed by connecting them with a straight line.
Average + Standard Deviation	Averages and standard deviations for all frequency points are calculated for the total measurement data and displayed. The average is displayed as a blue line, and the standard deviation as a purple T at each frequency point.
Max Hold	Maximum values for all frequency points are calculated for the total measurement data and displayed by connecting them with a straight line.
Min Hold	Minimum values for all frequency points are calculated for the total measurement data and displayed by connecting them with a straight line.

In **Display Setting**, **Display Selected Waveform** and/or **Display Comparison Data** can be selected. Unchecking the boxes and clicking **Apply** or **OK** cancels display. Use this function to display only one of the data.



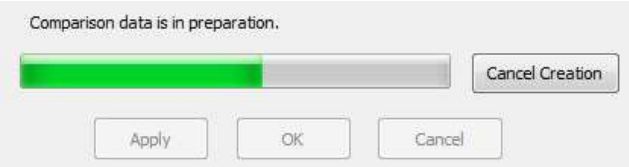


Both are checked

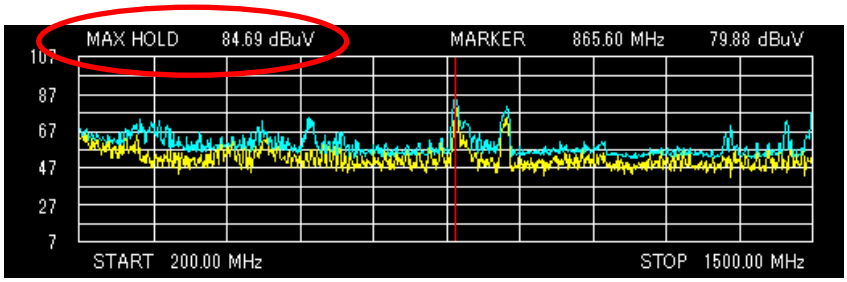


Display Selected Waveform is unchecked

Click **Apply** to create the comparison data and apply it to the spectrum graph without closing the dialog box. Click **OK** to create the comparison data only when no data is created, and apply it to the spectrum graph after closing the dialog box. While the comparison data is being created, the progress bar shows the progress. Click **Cancel Creation** to cancel the process.



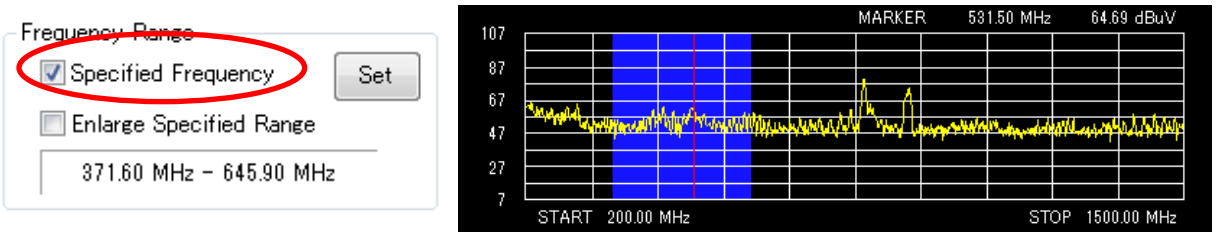
Click on the spectrum graph to move the position of the red line, and the comparison data value at the position is displayed on the upper left of the graph.



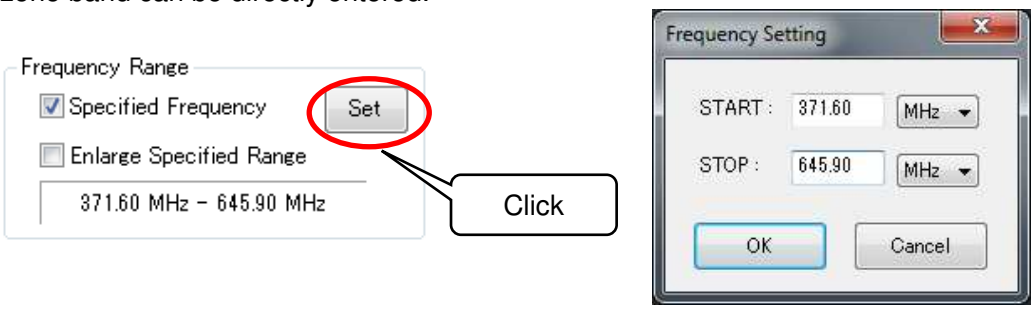
Frequency Range

If the **Specified Frequency** checkbox is checked under **Frequency Range**, the display frequency range in the spectrogram changes to the specified frequency range, and the relevant blue zone band is displayed in the spectrum graph.

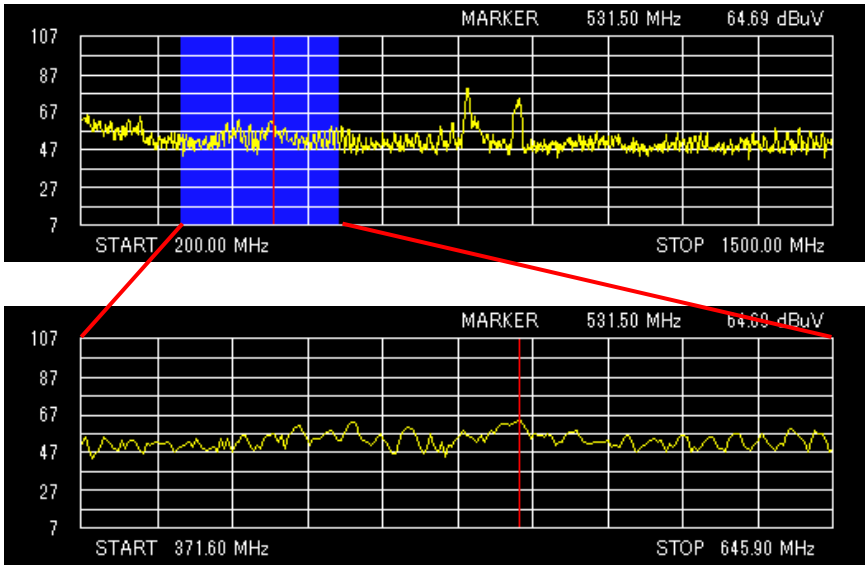
This zone band can be moved to the right or left by dragging it, and thereby the display frequency range in the spectrogram changes. In addition, the width of the zone band can be changed by dragging an end of the band to the right or left.



Clicking the **Set** button opens the **Frequency Setting** dialog box, where the frequency range for the zone band can be directly entered.



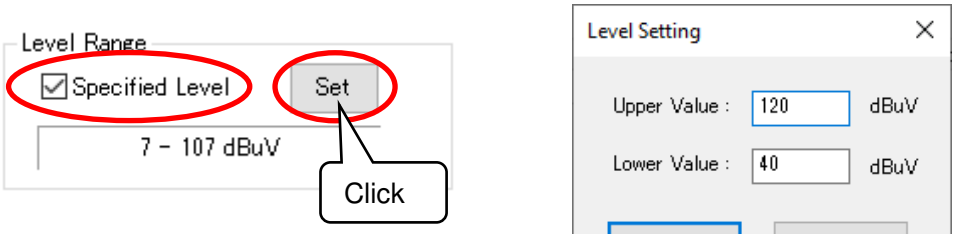
If **Enlarge Specified Range** is checked, the frequency range in the spectrum graph changes to the specified frequency range.

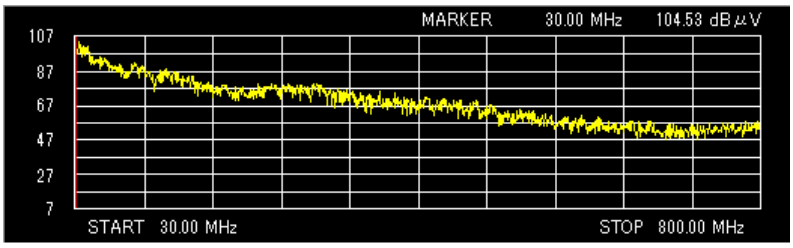


Enlarge Specified Range is checked

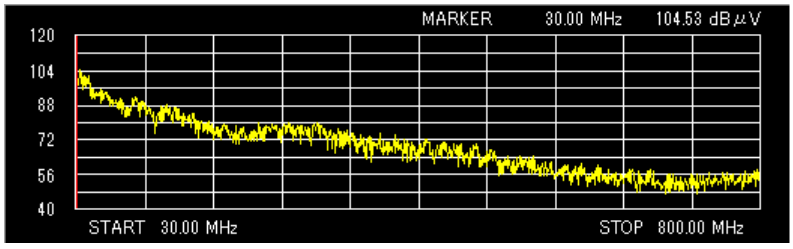
Level Range

If **Specified Level** is checked, the level range can be changed. Clicking the **Set** button opens the **Level Setting** dialog box to change the upper and lower limits for the level range. If **Specified Level** is unchecked, the level range during measurement is restored.





Specified level is unchecked (7 dBuV – 107 dBuV)



Level range is changed (40 dBuV – 120 dBuV)

The level range can be changed before, during, and after measurement.

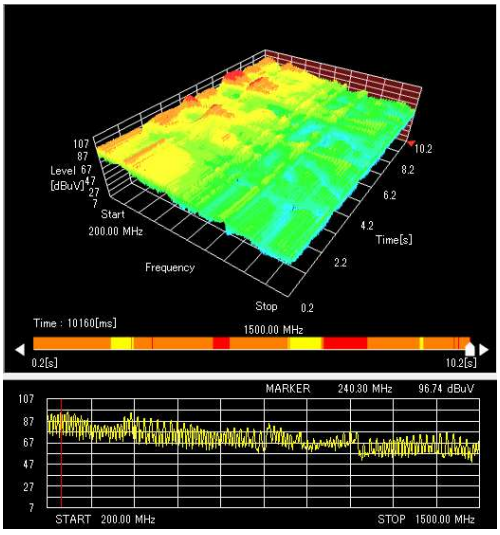
Unit Switch

The unit used to display measured intensity can be selected from dBuV and dBm.

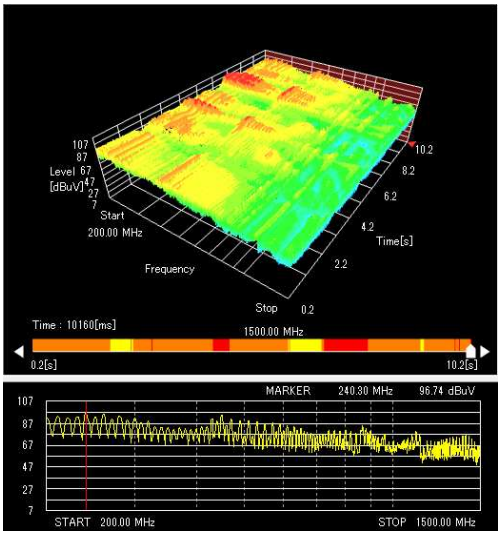
The change of unit will be applied to the color bar, 3D graph, and spectrum graph.

Frequency Axis Switch

Linear (Linear axis) or Log (Logarithmic axis) can be selected as the frequency axis in the 3D graph and spectrum graph. Log uses a logarithmic scale.



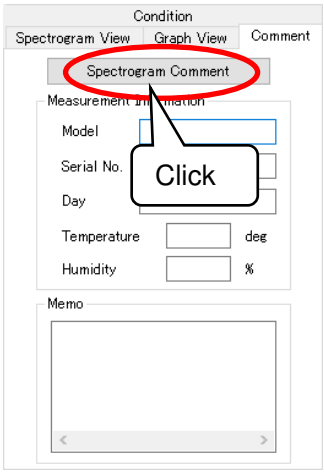
Linear (Linear axis)

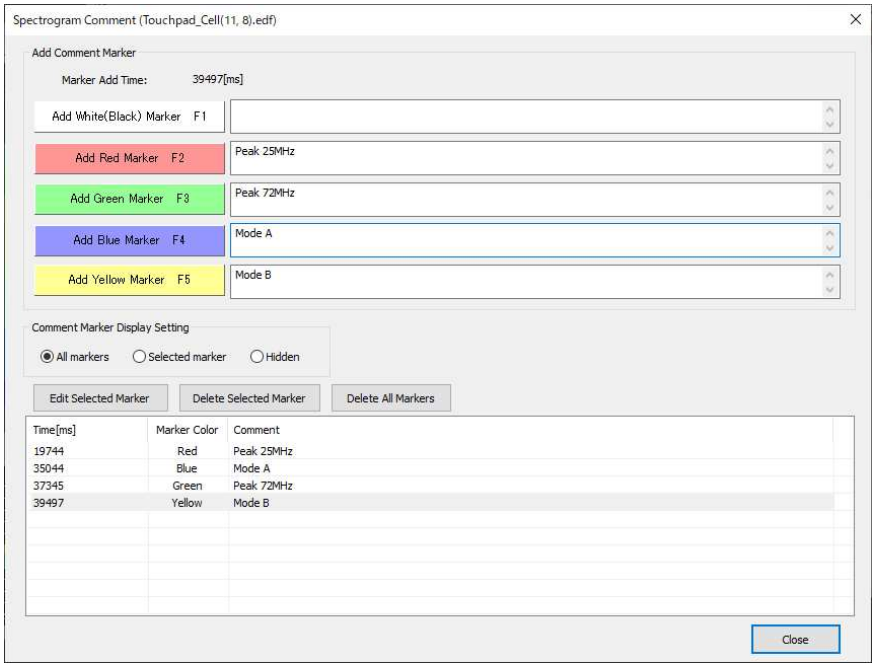


Log (Logarithmic axis)

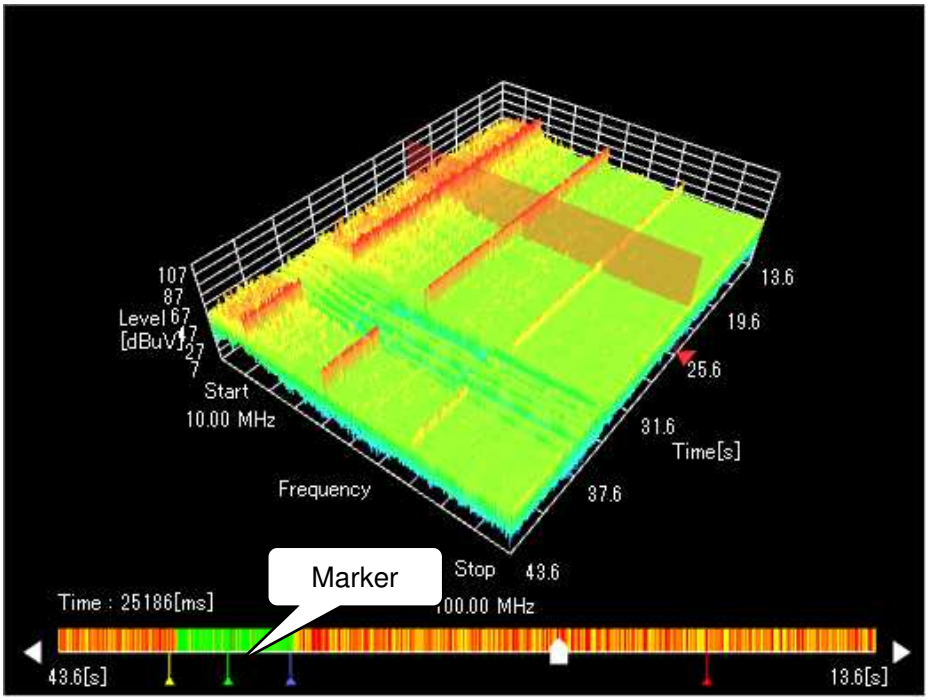
Spectrogram Comment

Clicking the **Spectrogram Comment** button opens the **Spectrogram Comment** dialog box. In the **Spectrogram Comment** dialog box, markers can be added at the bottom of the slider. Comments can be registered for each marker.





Spectrogram Comment dialog box

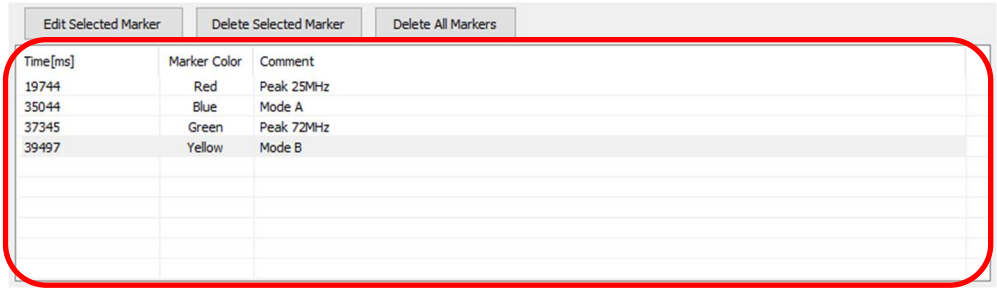


Clicking the **Add** button for each color adds a marker at the bottom of the slider in that color. The function keys (F1 to F5) on the buttons can also be added using the keyboard.

During measurement, the current time is displayed at the **Marker Add Time**. After measurement, the time selected with the slider is displayed. The marker is added at this time. If a marker is already registered, it will be overwritten.

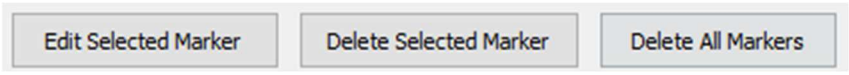
The content entered in the edit box to the right of the **Add** button is registered as a comment when a marker is added.

The added markers are listed on the list. Comments registered to markers can be checked here. Clicking on the list after measurement automatically moves the slider to the time vicinity of the marker selected on the list.

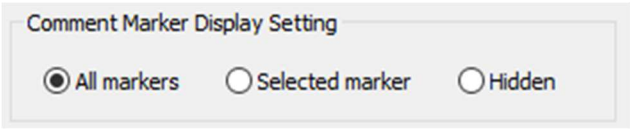


The maximum number of markers that can be added is 1000.

Clicking the **Edit Selected Marker** button edits the color and comment of the marker selected on the list. Clicking the **Delete Selected Marker** button deletes the selected marker on the list. Clicking the **Delete All Markers** button deletes all markers.



The marker display method can be selected from the following three types.



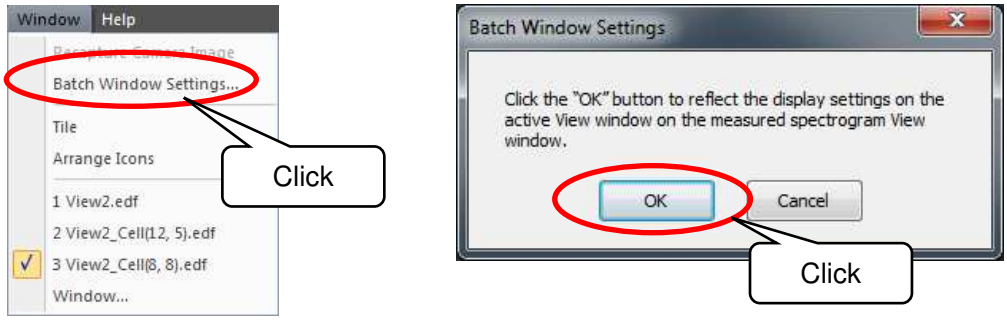
All markers	All added markers are displayed.
Selected marker	Only marker selected on the list is displayed.
Hidden	Markers are not displayed.

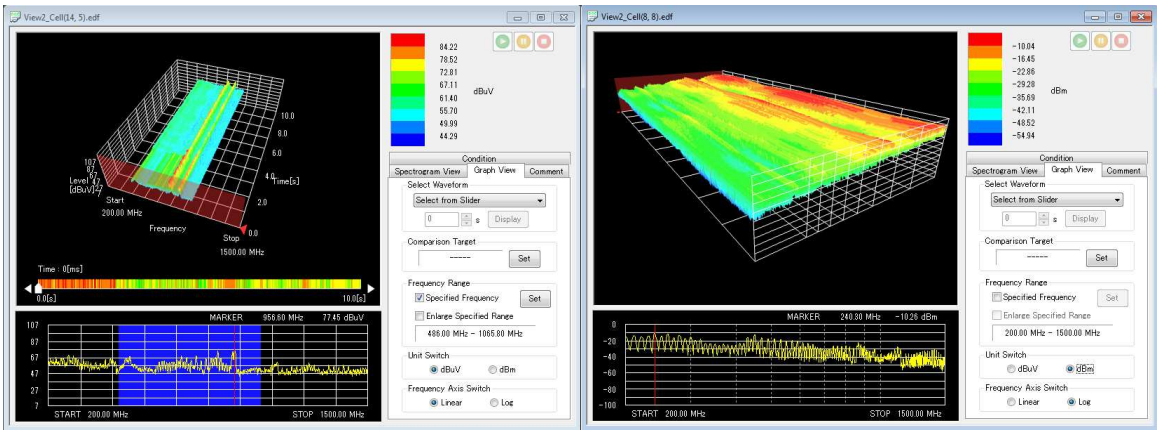
Batch Window Settings

The same settings can be applied to part of the spectrogram view and the graph view on the **Spectrogram Data View** windows that are currently open. Click **Batch Window Settings** on the **Window** menu to display the **Batch Window Settings** dialog box. Click the **OK** button to reflect the map view and graph view settings on the last active **View** window on the measured spectrogram **View** window that is currently open.

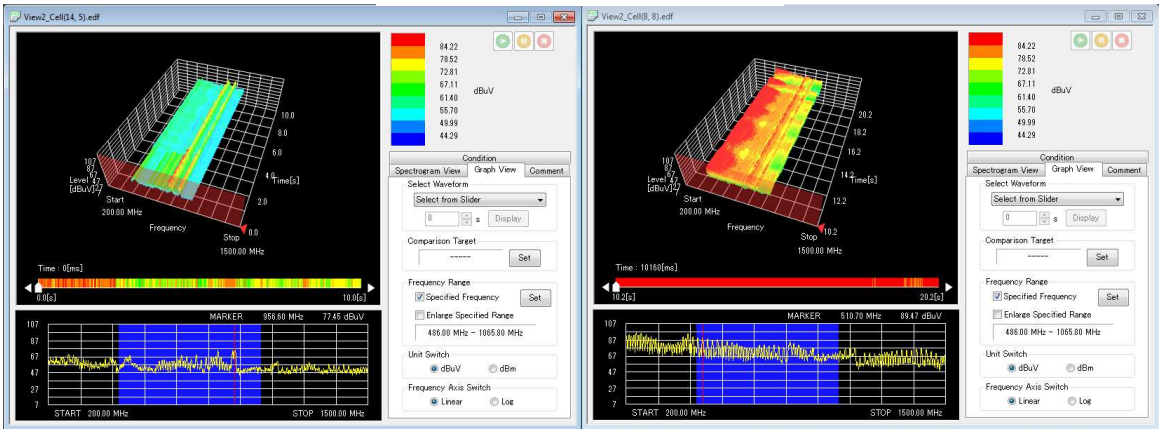
The reflected settings are as follows:
Upper/Lower Value, the rotation, movement and scaling of the 3D graph, **Axis Display Settings**, **Display Format**, **Position Display**, **Future Side Display**, **Past Side Display**, **Slider Display**, the reference time, **Specified Frequency** (the **START** and **STOP** frequencies are the same among Windows), **Enlarge Specified Range** (the **START** and **STOP** frequencies are the same among Windows), **Unit Switch**, **Frequency Axis Switch**, the **Upper/Lower limits** for the level range (the **Specified Level** is checked), and **Display/Color Assignment** (the **Create Density Display** is checked).

Use this function to compare measurement data put side by side.





Before batching window

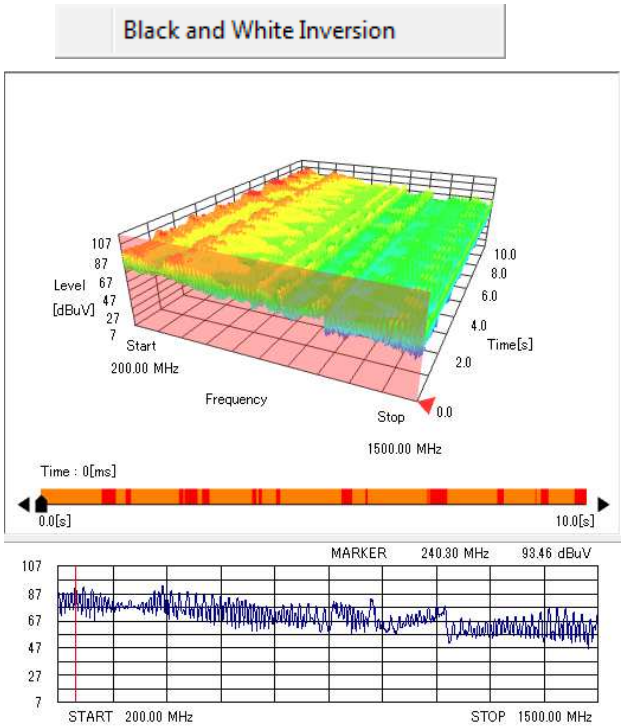


After batching window settings

Black and White Inversion

The 3D graph and spectrum graph can be displayed inversely in black and white.

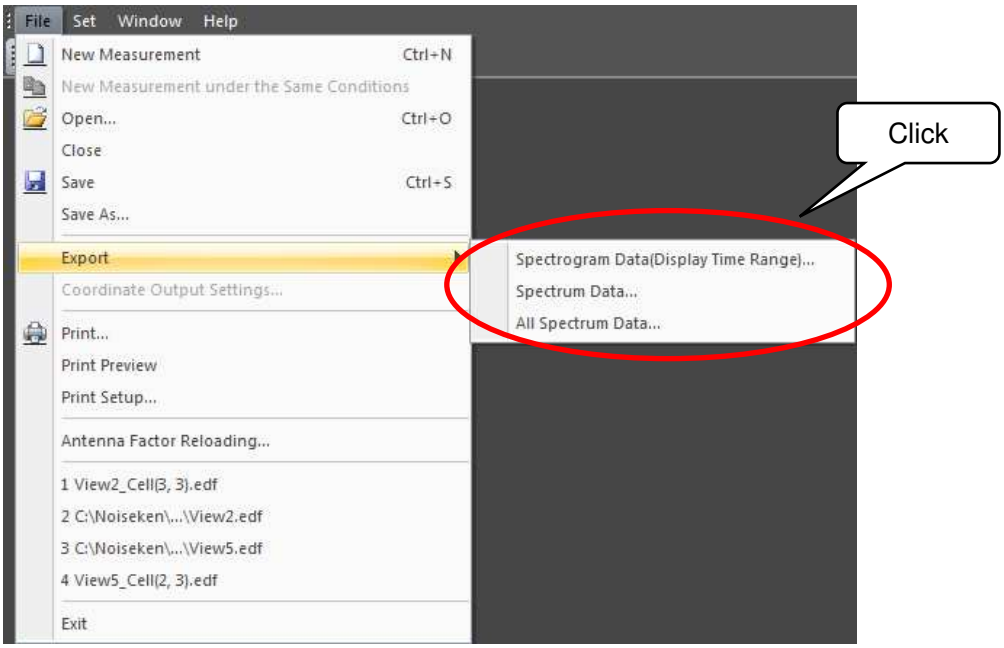
Right click on the 3D graph or spectrum graph and click **Black and White Inversion** to invert the color of the graph. Use this function to print the graph.



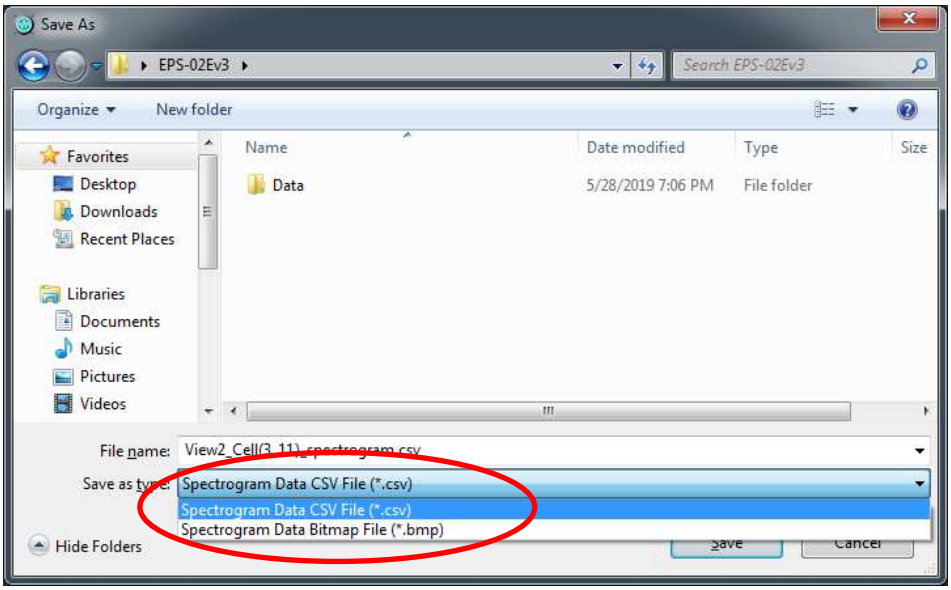
Exporting Measurement Data

Measurement data can be exported to an external file.

Select **Export** from the **File** menu, and choose one from **Spectrogram Data(Display Time Range)**, **Spectrum Data**, and **All Spectrum Data**. The **Save As** dialog box will appear.



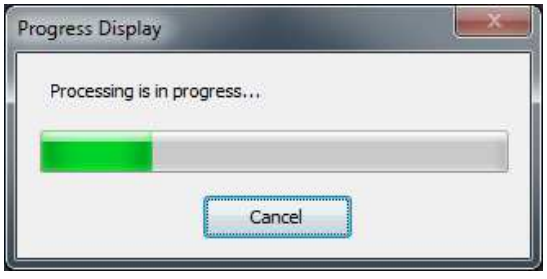
In **Save as type** on the **Save As** dialog box, either **CSV File** or **Bitmap File** can be specified.



- **Spectrogram Data(Display Time Range)**
  CSV file: Waveform data for the time range displayed on the screen is output. The progress bar in the **Progress Display** dialog box indicates the progress of the export process, and clicking **Cancel** cancels the export.
  BMP file: The 3D graph image is exported.

- **Spectrum Data**
  CSV file: The data of the selected waveform is output. When comparison data is selected, the comparison data is also output.
  BMP file: The spectrum graph image is exported.

- **All Spectrum Data**
  CSV file: The spectrum waveform data for the total measurement time is output. The progress bar in the **Progress Display** dialog box indicates the progress of the export process, and clicking **Cancel** cancels the export.

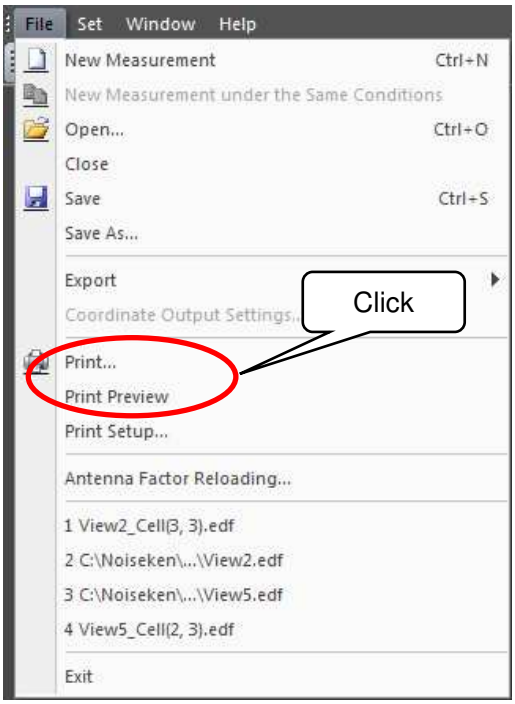


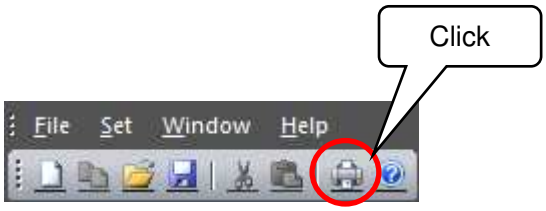
When data volume to be exported is large, exporting may take a long time. Data volume to be exported can be adjusted by using export within the display time range.

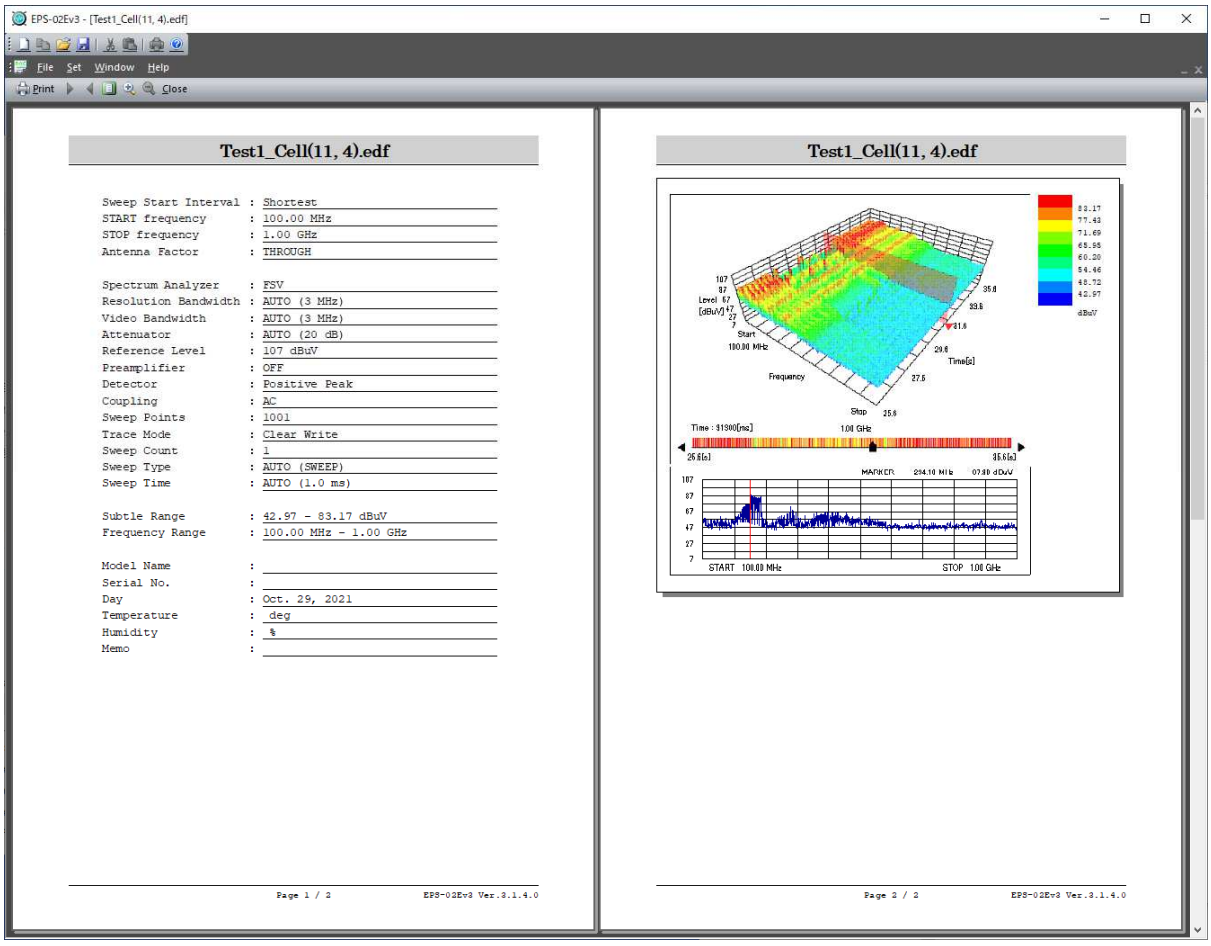
Print

The measurement conditions, spectrogram image, and spectrum graph can be printed.

Select **Print** or **Print Preview** from the **File** menu or select the **Print** button on the toolbar.





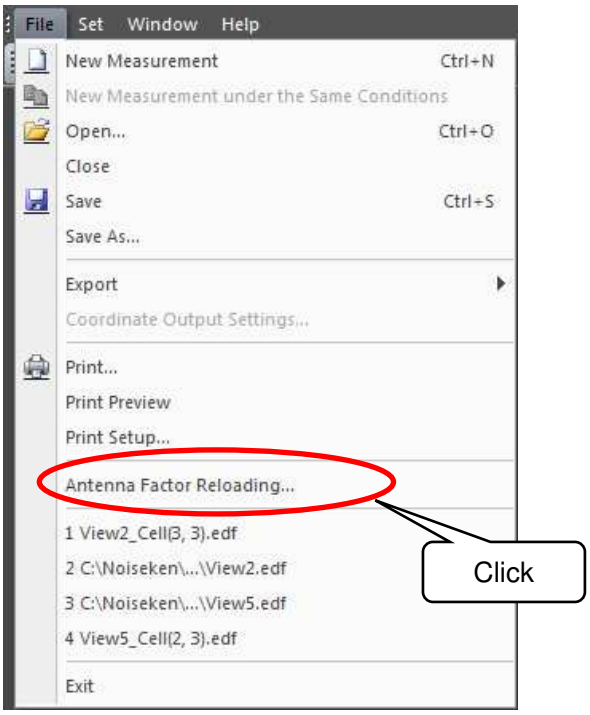


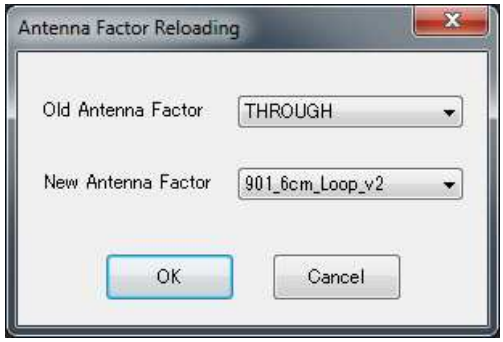
Print Preview

Antenna Factor Reloading

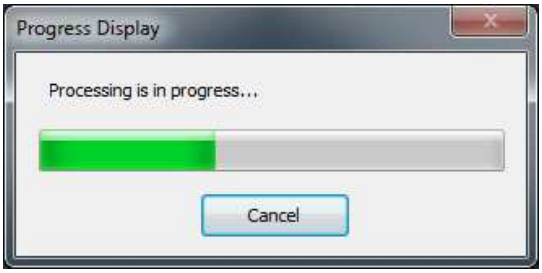
The Antenna Factor of the measured data can be reloaded. Refer to “Antenna Factor” on page 32 for the Antenna Factor.

Click **Antenna Factor Reloading...** from the **File** menu. The **Antenna Factor Reloading** dialog box will appear and allow the desired Antenna Factor to be specified.





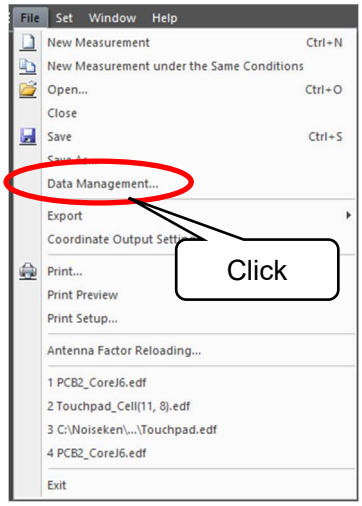
When data volume is large, reloading the Antenna Factor may take a long time. The progress bar in the **Progress Display** dialog box indicates the progress of the reloading process, and clicking **Cancel** cancels reloading the Antenna Factor.

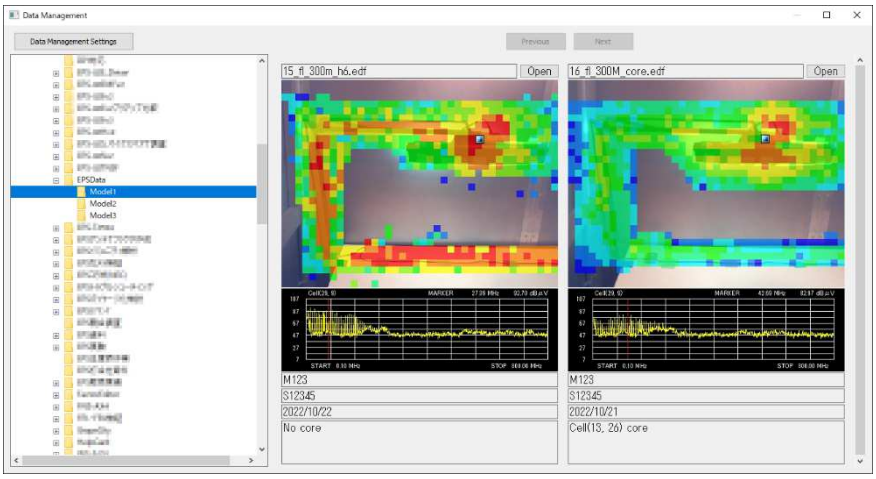


Reloading the Antenna Factor of the spectrogram measurement data rewrites the data saved in the file.

9－12. Data Management

Click **Data Management...** from the **File** menu to display the **Data Management** dialog box. In the **Data Management** dialog box, measurement data in a folder can be displayed with thumbnail images. A Folder is selected in the folder tree on the left side of the dialog box.

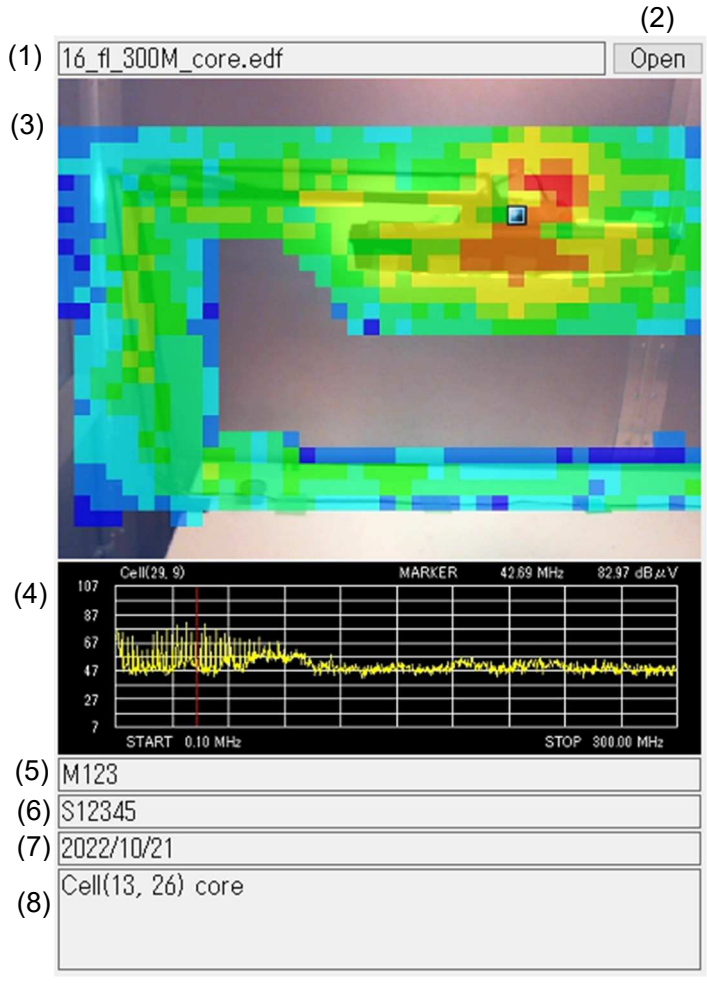




Data Management dialog box

Display Items

The items displayed in Data Management are as follows.



(1) File name

The file name of the displayed data.

(2) Open

Select to open the file.

(3) Map / Spectrogram

Thumbnail image of the map or spectrogram. The image at the time of data saving is displayed.

(4) Spectrum graph

Thumbnail image of the spectrum graph. The image at the time of data saving is displayed.

(5) Model

The content entered in the **Model** of the **Measurement Information**.

(6) Serial No.

The content entered in the **Serial No.** of the **Measurement Information**.

(7) Day

The content entered in the **Day** of the **Measurement Information**.

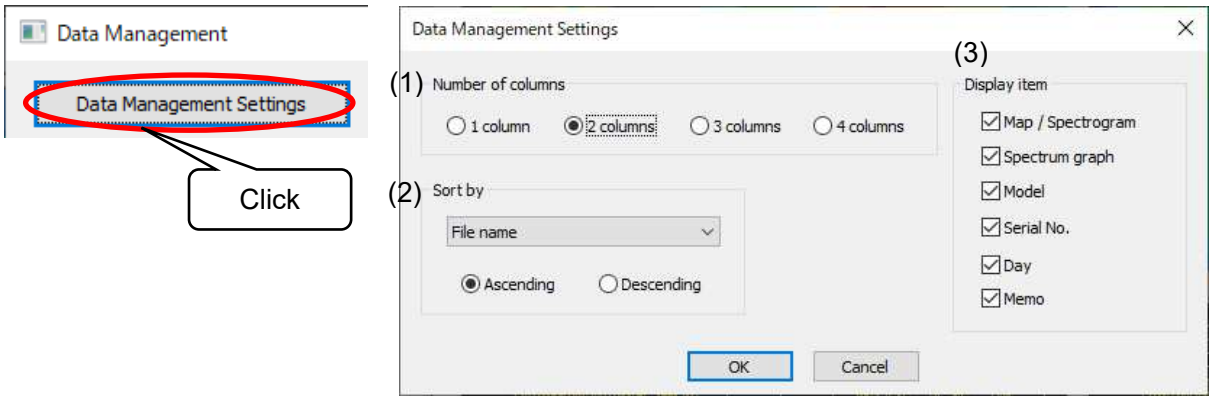
(8) Memo

The content entered in the **Memo**.

Thumbnail images may not be displayed for measurement data saved with older software versions. In this case, overwrite the data and the thumbnail image will be displayed.

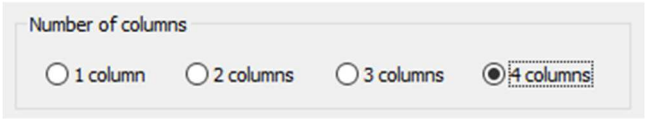
Data Management Settings

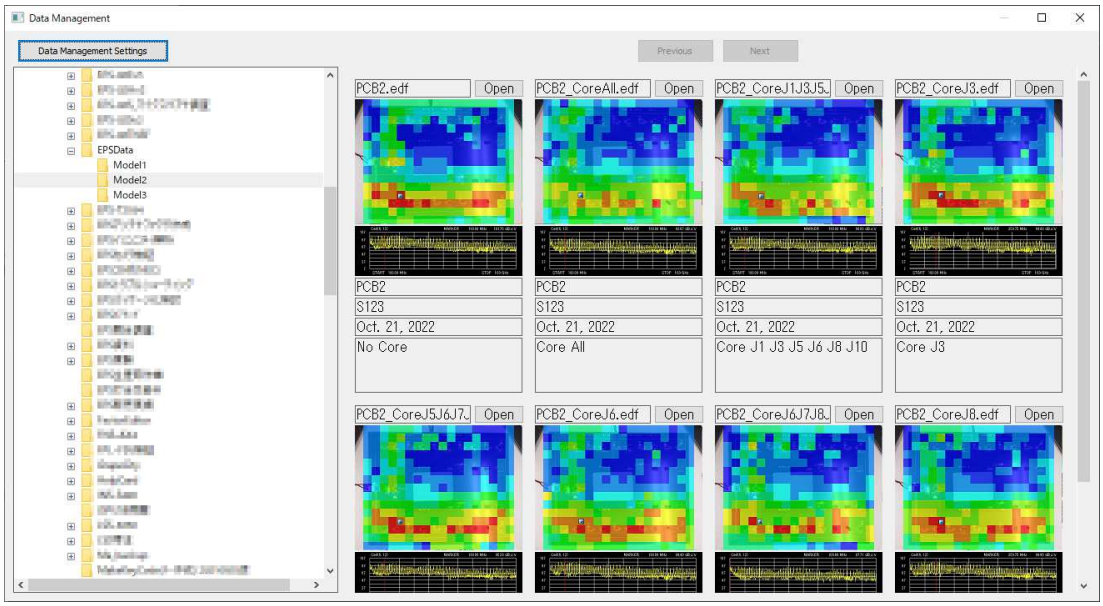
Click the **Data Management Settings** button to change settings related to data management.



(1) Number of columns

Specify the number of columns to list.

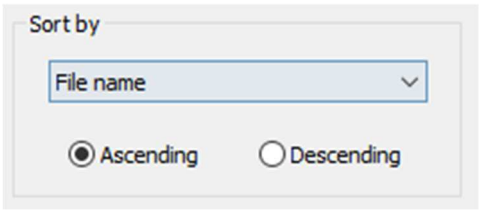


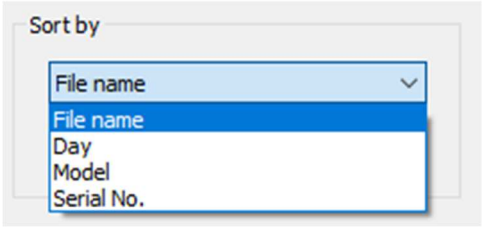


4 columns

(2) Sort by

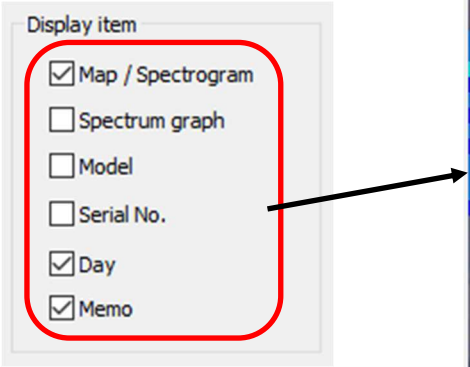
Specify the sorting criteria. The criteria can be selected from **File name**, **Day**, **Model**, and **Serial No.** The sort order can be selected from ascending or descending. Sorting is performed by comparing strings.

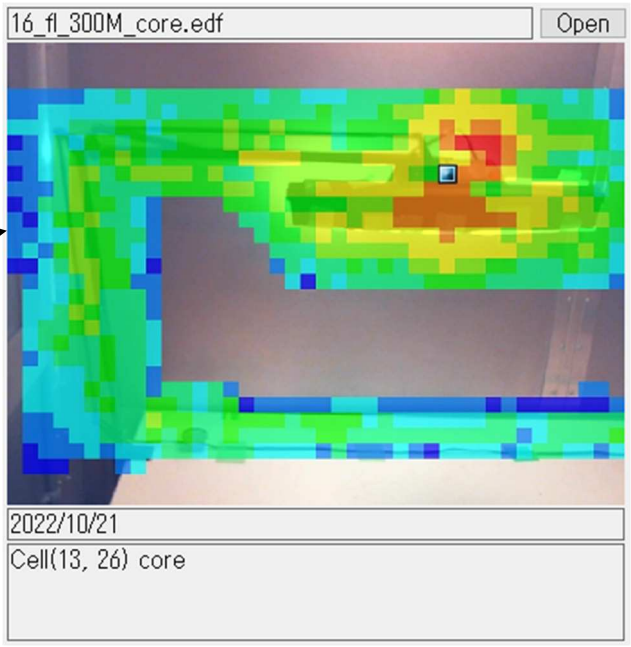




(3) Display item

Specify items to be displayed. Only checked items will be displayed. The **File name** and the **Open** button are always displayed.





The number of data that can be displayed at one time is limited to 48, regardless of the data management settings. Clicking the **Next** button at the top of the **Data Management** dialog box displays data after the currently displayed data. Clicking the **Previous** button displays the data before the currently displayed data.

10. Setup

10－1. Important Notes on Setup

This section describes setup for the software and peripheral devices. To perform setup, you must be logged in with administrator privileges.
Also, it is recommended that setup be performed by some engineer with a certain degree of proficiency in computers, including having an understanding of Ethernet addresses and other terminology.
Be aware that some details may vary for different OS versions, PC display settings, and other environments.

10－2. Network Address Settings

1) Setting the IP Address of the PC

From the **Control Panel**, select **Network and Sharing Center**, and click **Change adapter settings** from the list on the left side.

<How to open Control Panel>
[Windows 10]

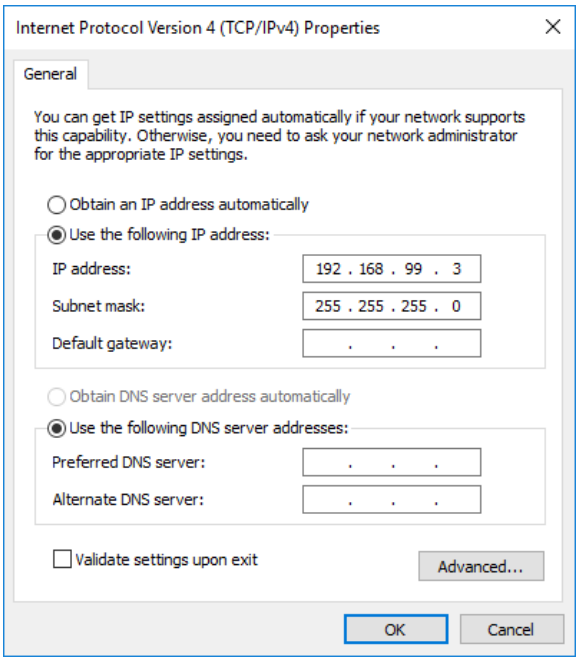
In the search box on the taskbar, type **Control Panel,** and then select **Control Panel**.

[Windows 7]

Click the Start button, and then click **Control Panel.**

The adapters that can connect to the network are displayed. Double-click the adapter (local area connection) that is connected to the spectrum analyzer to display its properties. Select "Internet Protocol Version 4", and click to display the properties.

Enter "192.168.99.3" for the IP address and "255.255.255.0" for the subnet mask, and click **OK**.
This completes the IP address settings for the PC.



2) Set the IP address of the spectrum analyzer
For details on the spectrum analyzer settings, see the instruction manual for the spectrum analyzer.
Set the IP address to "192.168.99.100" and the subnet mask to "255.255.255.0".

10−3. Installing the Software

1) Installing NI-VISA
Load the supplied setup media, and open the "NI-VISA" folder. Run Install.exe to start the installation process. Then, perform installation by following the instructions from the installer. When installing, make sure that the installation items include NI-VISA.

2) Installing the EPS-02Ev3 Software
Load the supplied setup media, and open the "EPS-02Ev3" folder.
Run EPS-02Ev3_En.msi to start the installation process. Then, perform installation by following the instructions from the installer.

3) Use of the supplied USB protect key
The supplied protect key is not required for checking the measurement data. For carrying out a measurement by controlling the peripherals, the supplied protect key is required.

It is required to install the driver of the USB protect key before use. The driver file is in “JSP USB” folder in the supplied setup media. After you insert the USB protect key into a USB port of the PC where EPS-02Ev3 software in installed, open Device Manager and select “unknown devices” or “HardKey” of “other devices” and install the driver.

The program can run a measurement only when the USB protect key is inserted into the PC. The USB protect key can be plugged into any USB port.

4) Use of the RSA306B

Load the supplied setup media, and open the **RSAAPI** folder. Open the 32bit or 64bit folder according to the PC. Run setup.exe to start the installation process. Then, perform installation by following the instructions from the installer.

* This operation is required only when RSA306B is used as a spectrum analyzer.

11. Antenna Factor Editor

11－1. Overview

Antenna Factor Editor is a Windows application by which an Antenna Factor file can be created and edited in the EPS-02Ev3 Electromagnetic Field Visualization System.

11－2. Starting and Exiting the Software

Starting the Software

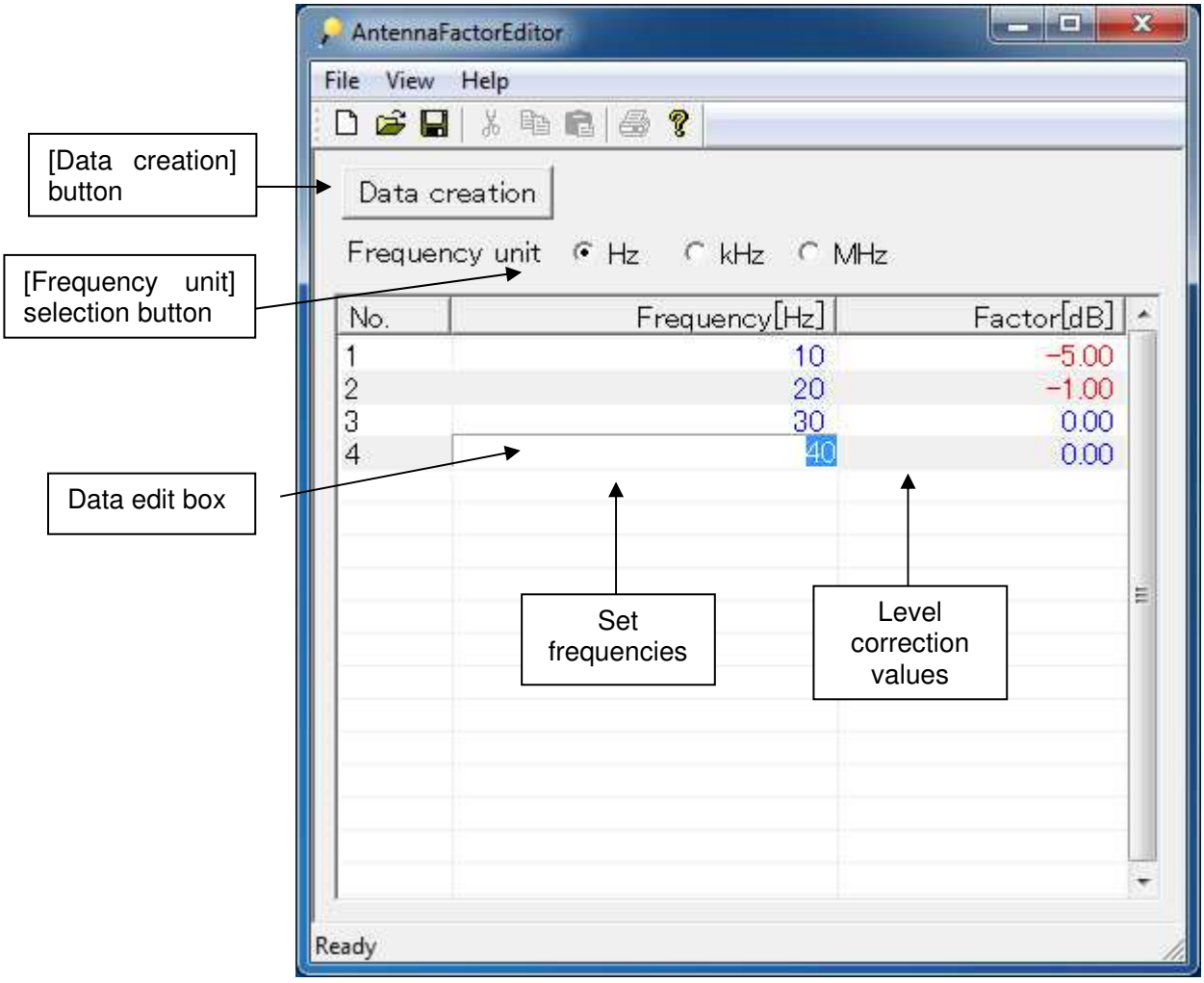
Double-click FactorEditor.exe stored in the folder where the EPS-02Ev3 executable file is stored (C:¥Program Files (x86)¥NoiseKen¥EPS-02Ev3, under normal conditions).

Exiting the Software

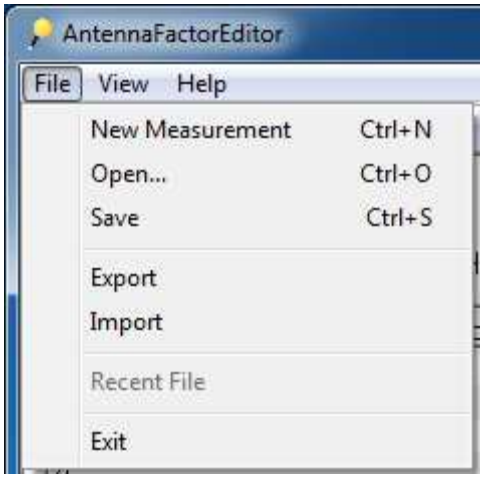
Click the close button on the right end of the title bar or click **Exit** from the **File** menu.

11－3. Description of the Screen

Entire Screen



File Menu



① New Measurement
Creates a new correction data file.

② Open...
Opens an existing correction data file (*.ant).

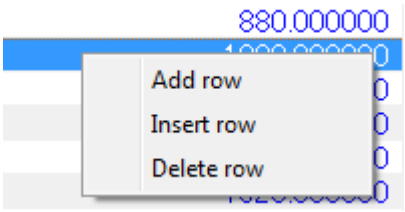
③ Save
Saves the correction data file being edited.

④ Export
Exports the correction data being edited to a CSV file.

⑤ Import
Imports correction data from a CSV file.

⑥ Exit
Exits the application.

Pop-up Menu (Right-Click)



① Add row
Adds a row to the end of the correction data list.

② Insert row
Adds a row to the front of the selected correction data list.

③ Delete row
Deletes a row of the selected correction data list.

11－4.Operation Procedure

New Measurement

On the menu bar, select **File** → **New Measurement**. By double-clicking on the empty list, one record can be added. Then, set Frequency and Factor to the desired values. Up to 99 records can be added.

When the necessary data input is complete, click the **Data creation** button to create a data file. The file is only available by putting it in the folder where the EPS-02Ev3 executable file is stored (C:¥Program Files (x86)¥NoiseKen¥EPS-02Ev3, under normal conditions).

Open...

On the menu bar, select **File** → **Open...**, and select a file with the extension .ant in the Open dialog box to display the data list.

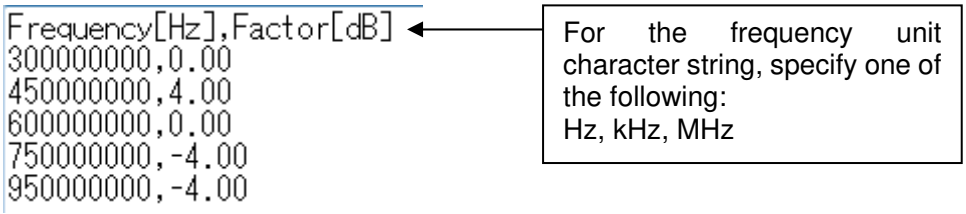
By double-clicking a data item, the data can be edited. By clicking the **Data creation** button after editing, a data file with the edited data can be created.

Import

This tool can import a CSV file that was edited by another editor.

On the menu bar, select **File** → **Import**, and select a file with the extension .csv in the Open dialog box to display the data list. By double-clicking a data item, the data can be edited. By clicking the **Data creation** button after editing, a data file with the edited data can be created.

The first row of the file to be imported must be a header row including the frequency unit character string.



Export

This tool can export Antenna Factor correction data to a CSV file.

On the menu bar, select **File** → **Export**, and specify a file name in the Save as dialog box to export the data in a CSV file. In addition, the tool can import and edit the Antenna Factor correction data that was once exported.

The first row of the file to be exported is a header row including the frequency unit character string. (Note: Refer to “Import.”)

11－5.Editing Correction Data

Set frequencies

① Checking Consistency Between Records
Since the frequencies set for the records are checked when creating a data file, be sure to set the frequency of the following record to a larger one than that of the previous record.

Frequency[Hz]
10
20
30
40
50

Set the frequency of the following record to a larger one than that of the previous record.

② Treatment of fractions
If the number of significant digits of a set frequency is seven or more, the first seven digits can be rounded to six digits.

③ Checking the maximum and minimum settings
The maximum and minimum set frequencies are checked.
The minimum and maximum set frequencies are 1 Hz and 32 GHz, respectively.

Level correction values

① Positive/negative numbers
Specify plus or minus relative values to the reference level (usually 0 dB) for level correction values. Plus and minus values are displayed in blue and red, respectively.

Factor[dB]
-10.00
-5.00
0.00
5.00
10.00

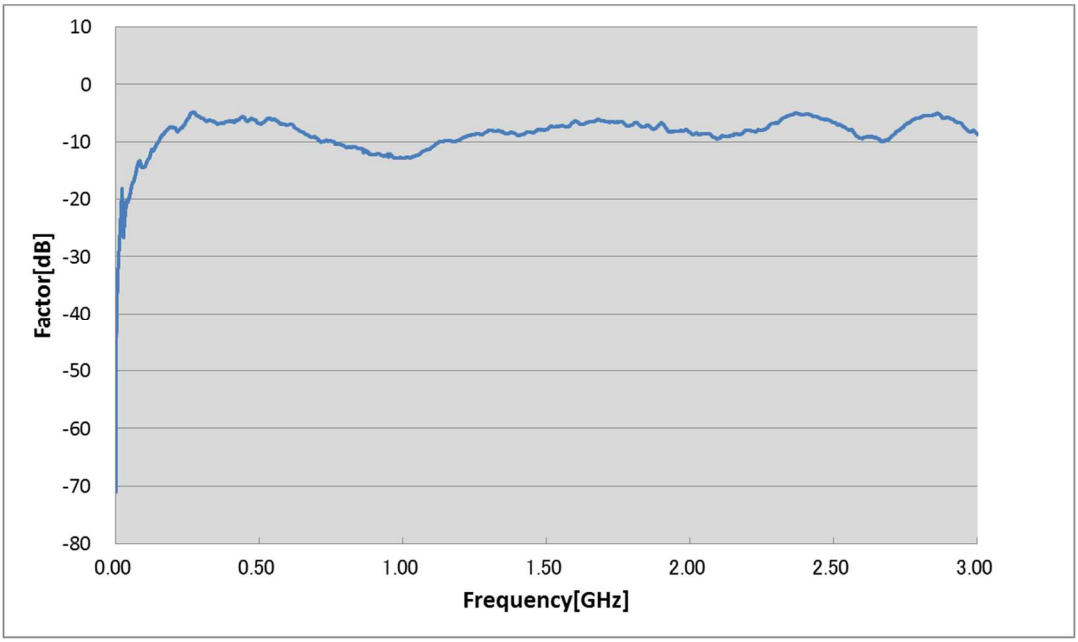
② Treatment of fractions
Level correction values can be rounded to two decimal places.

③ Checking the maximum and minimum settings
The maximum and minimum level correction values are checked.
The minimum and maximum level correction values are -320 dB and 32 dB, respectively.

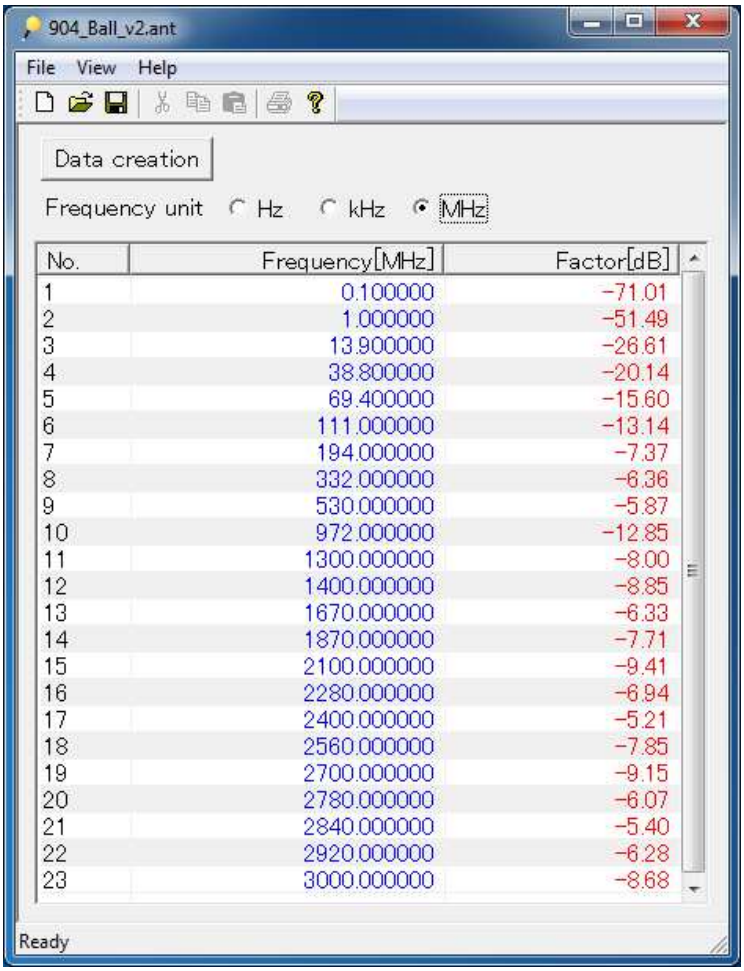
11－6.Sample Antenna Factor

The following is a sample Antenna Factor corresponding to characteristic curve data.

Frequency characteristic curve



Antenna Factor corresponding to the above



No.	Frequency[MHz]	Factor[dB]
1	0.100000	-71.01
2	1.000000	-51.49
3	13.900000	-26.61
4	38.800000	-20.14
5	69.400000	-15.60
6	111.000000	-13.14
7	194.000000	-7.37
8	332.000000	-6.36
9	530.000000	-5.87
10	972.000000	-12.85
11	1300.000000	-8.00
12	1400.000000	-8.85
13	1670.000000	-6.33
14	1870.000000	-7.71
15	2100.000000	-9.41
16	2280.000000	-6.94
17	2400.000000	-5.21
18	2560.000000	-7.85
19	2700.000000	-9.15
20	2780.000000	-6.07
21	2840.000000	-5.40
22	2920.000000	-6.28
23	3000.000000	-8.68

12. Specifications

12－1. System Requirements

OS	:	Microsoft Windows 10 (Japanese / English version) Microsoft Windows 11 (Japanese / English version)
CPU	:	Intel Core i5 or better (i7 or better recommended)
Memory	:	8 GB or more recommended
Storage	:	10 GB or more free space
Display	:	1366 × 768 dots or more 1920 × 1080 dots recommended

Other requirements:

- Operation cannot be guaranteed when using online storage or software that uses cloud services.
- 2 or 3 empty USB ports

* The upgrade version and the minor upgrade version require a DVD drive for installation.
* If software with high CPU utilization is running, the operation may become unstable.
* The spectrum analyzer RSA306B may not work in combination with HP ProBook series. Please check in advance.
* Refer to the manufacturer's website for the latest operation warranty of each device such as camera and spectrum analyzer.

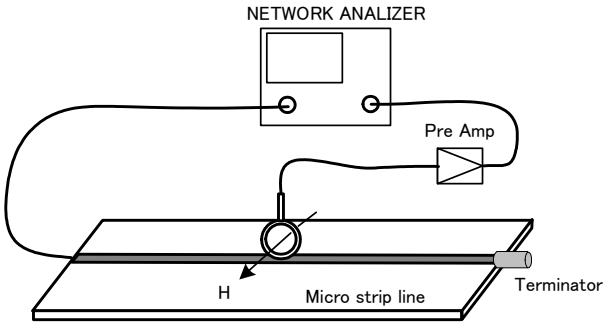
12－2. Supported Spectrum Analyzers

Rohde & Schwarz	FSV
	FSV3000
	FPL1000
	ESR
	ESRP
Keysight Technologies	N9010A
	N9010B
Tektronix	MDO4000series
	RSA306B

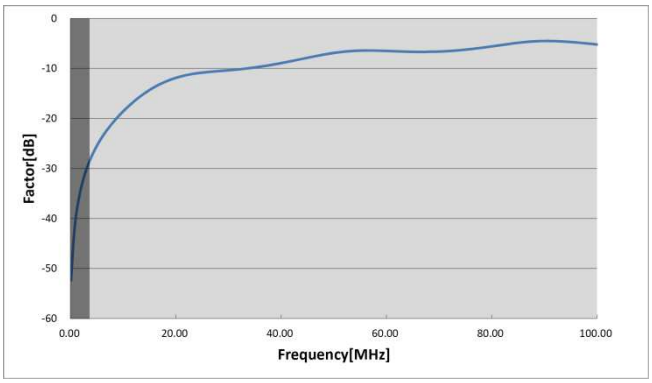
12－3.Antenna Frequency Characteristics

Model	Probe Type	Primary Sensor	Structure	Recommended Frequency Band
901	6 cm Loop	H-Field	Shielded Loop	3 MHz ～ 500 MHz
902	3 cm Loop		Shielded Loop	5 MHz ～ 1 GHz
903	1 cm Loop		Shielded Loop	10 MHz ～ 3 GHz
904	3.6 cm Ball	E-Field	Spherical Dipole	10 MHz ～ 3 GHz
905	6 mm Stub Tip		Short Monopole	50 MHz ～ 3 GHz

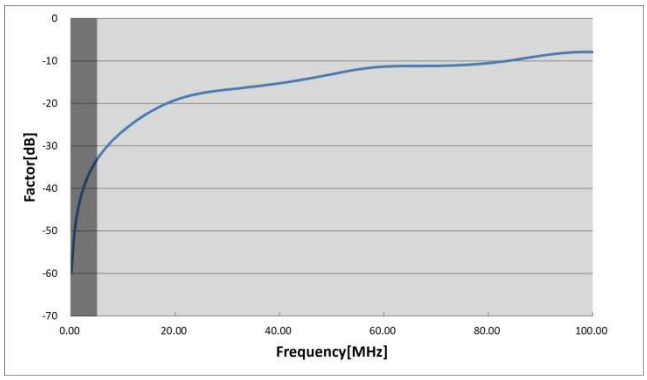
*Near field probe set of ETS-LINDGREN
*The below frequency responses are measured by micro-strip line of Noise laboratory Co., LTD.



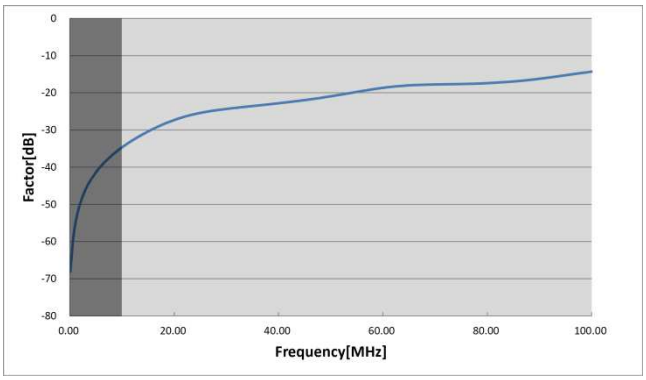
■100 kHz ～ 100 MHz



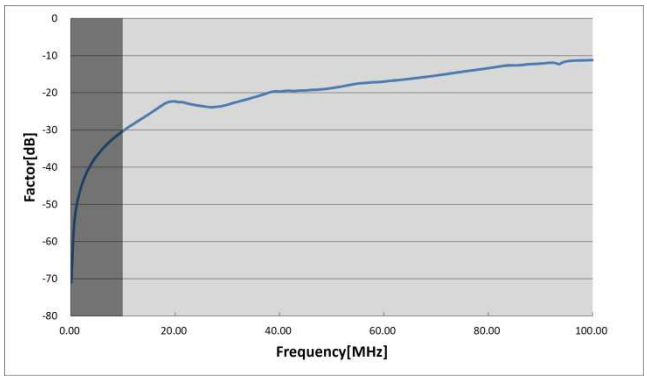
901（6 cm Loop）



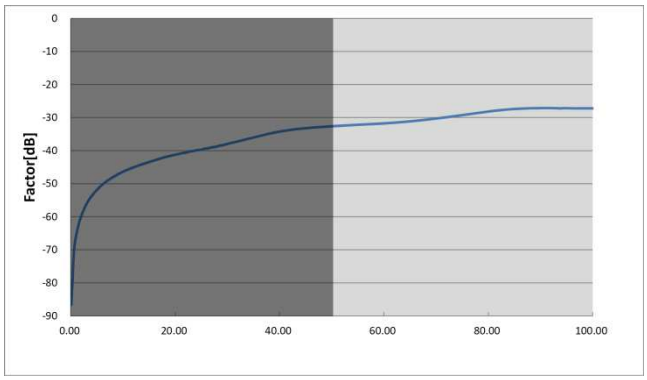
902（3 cm Loop）



903（1 cm Loop）

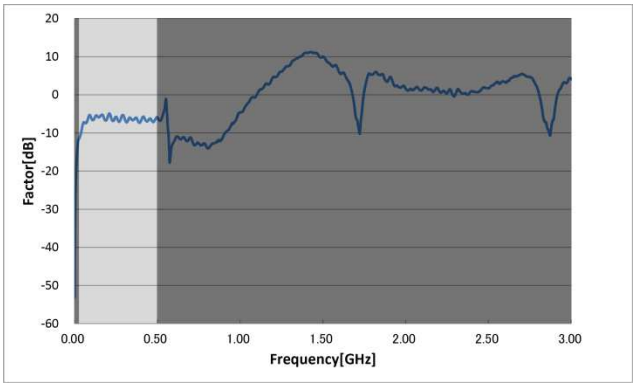


904（3.6 cm Ball）

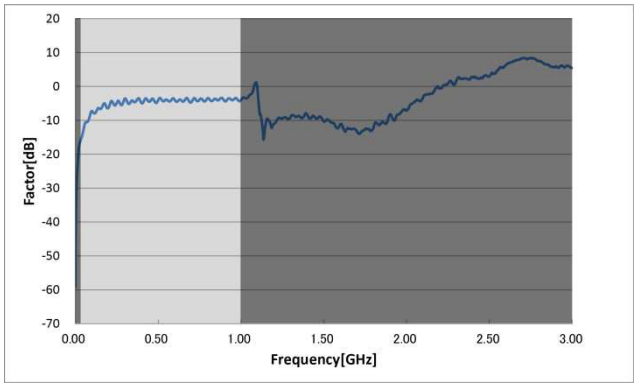


905(6 mm Stub Tip)

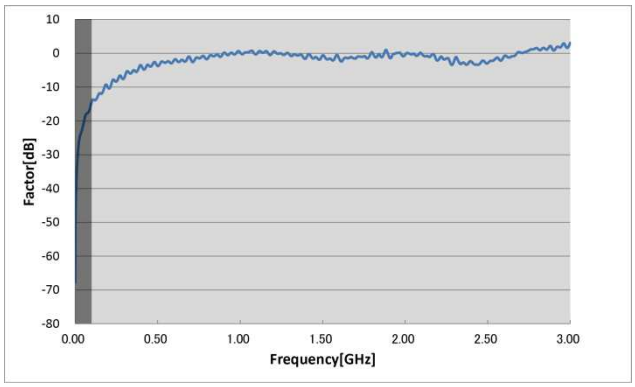
■100 kHz ～ 3 GHz



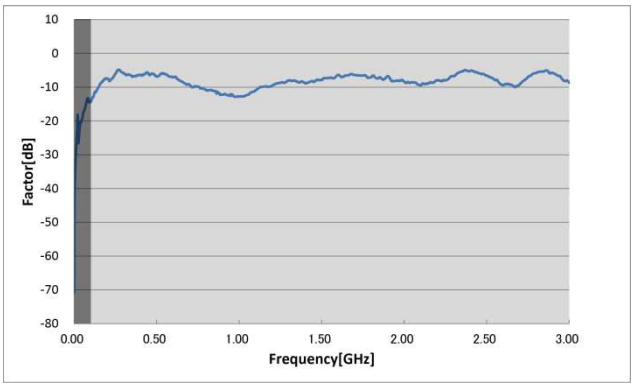
901(6 cm Loop)



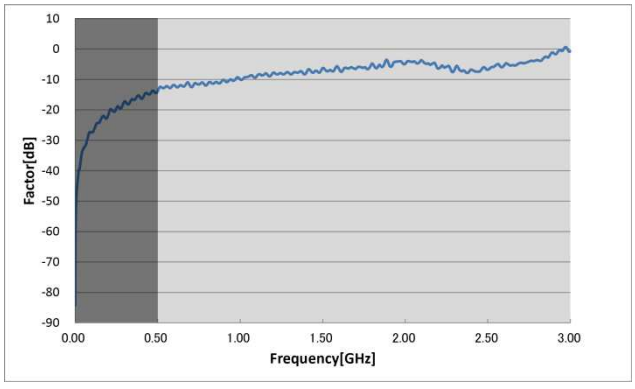
902(3 cm Loop)



903(1 cm Loop)



904(3.6 cm Ball)



905(6 mm Stub Tip)

13. Warranty

Repair Service Warranty

This repair service warranty applies to the repair services provided for maintaining the designated functions and performance of NoiseKen products.

1. Warranty Coverage
   This warranty covers NoiseKen products and their accessories.

2. Technology and Work Fees
   If a breakdown occurs in a NoiseKen product, NoiseKen will provide repair services free of charge based on the warranty terms and conditions as long as the warranty period is still valid. If the warrant period has expired, the customer will bear the actual costs associated with technology and work for the repair.

3. Ownership of Replacement Parts
   The ownership of all defective parts replaced in the course of performing the repair belong to NoiseKen. If the repair service fees are borne by the customer, NoiseKen will receive the replaced defective parts unless the customer specifically requests otherwise.

4. Limitation of Liability
   If the customer incurs any damages due to the repair service or breakdown of the NoiseKen product purchased by the customer, the liability of compensation for damages by NoiseKen to the customer is limited to the amount paid by the customer for the applicable NoiseKen product or the applicable non-NoiseKen product (product by other manufacturer) only if these damages are due to the willful intent or negligence by NoiseKen. However, for damages incurred by the customer due to the above-described repair service provided by NoiseKen or breakdown of the applicable NoiseKen product, under no circumstances will NoiseKen be liable for any loss of potential income occurring directly or indirectly or any direct or indirect damages due to compensation by the customer to a third party.

5. Wrong Parts, Missing Parts, or Breakage
   If the product cannot be used when a wrong part, missing part, or breakage occurs in a NoiseKen product purchased by the customer, NoiseKen will not be liable for any damages whatsoever for losses incurred by the customer due to loss of sales or other derived losses, special losses, or indirect or punitive damages, or any damages due to compensation by the customer to a third party.

6. Decline to Repair
   The company may not accept a repeair order in the following cases.
   - More than 5 years have passed since manufacture of a product discontinued.
   - More than 8 years have passed after delivery.
   - Required component for servicing already discontinued and no alternative is avaaiable.
   - Product changed, repaired or remodeled without obtaining a prior permission from the Company.
   - Product severely damaged to the extent it has lost its original form.

Product Warranty

For breakdowns that occur within the product warranty period, NoiseKen will repair or replace the product free of charge. The extent and content of the repair work for the equipment will be determined by NoiseKen. This product warranty is valid in Japan only.

1. Device Coverage
   This warranty covers NoiseKen products and their accessories.

2. Product Warranty Period
   - This warranty is for one year starting from the delivery date of the product.
     If the same breakdown at the same location is repaired, the warranty period is six months from the date that the repair was completed.
   - For non-NoiseKen products, the product warranty of the supplier (manufacturer) applies.

3. Exceptions
   Regardless of the above stipulations, the warranty does not cover breakdowns due to one of the following.

   - ✧ Replacement of consumable parts, including the replacement (for used products) of mercury relays, high-voltage relays, coaxial cords, coaxial connectors, automatic switchers, contactors, and other consumables
   - ✧ Damage or breakdowns that occurred due to failure to follow proper operating procedures.
   - ✧ Product failures resulting from damage or breakdowns due to modifications not involving NoiseKen
   - ✧ Product failures resulting from damage or breakdowns that occurred when someone unauthorized by NoiseKen attempted to perform repairs
   - ✧ Product failures resulting from damage or breakdowns caused directly or indirectly by natural disasters, war, riots, civil strife, or other force majeure
   - ✧ Product failures resulting from damage or breakdowns caused by transportation, vibrations, dropping, impact, or other misuse after delivery
   - ✧ Product failures resulting from damage or breakdowns caused by the usage environment
   - ✧ When the customer takes the product outside Japan

Software Warranty

A warranty is provided for the software produced by NoiseKen and its update files under the following terms and conditions. This warranty is valid in Japan only.

1. Scope of Warranty
   This warranty applies to the software produced by NoiseKen and its update files.

2. Free Support
   If a fault occurs in the system as a result of this software by NoiseKen, NoiseKen will provide support free of charge through software fixes and updates or other means only within the warranty period. However, please be aware that we may discuss when to implement corrective measures for minor issues.

3. Total Maximum Liability
   If the customer incurs losses or damages due to a fault of this NoiseKen software purchased by the customer, unless the losses or damages are the result of willful or negligent actions, the maximum amount of NoiseKen's liability for compensation for these losses or damages to the customer is equal to the amount that the customer paid for this NoiseKen software. But, NoiseKen assumes no liability for any losses or damages incurred by the customer due to faults arising from this software by NoiseKen, including but not limited to, direct or indirect potential lost earnings and direct or indirect damages due to third party claims for compensation against the customer.

4. Warranty Period
   The warranty period is the support period of the OS by the provider (including extended support periods) for the OS where operation is guaranteed by NoiseKen. When the support period of this OS ends, support for this software in this OS will also come to an end.
   The after service of the software ends support when the production and sales of the specific control equipment are discontinued.

5. Exclusions
   These terms and conditions do not constitute a full and complete guarantee of operation or compatibility with the customer's system. Also, the following situations are outside the scope of support.
   [Combining with products]
   Although every effort will be made to provide comprehensive software support, in combination with products other than those recommended by NoiseKen, some faults may be unable to be resolved due to lack of compatibility or conflicts with PCs, peripherals, and other hardware, and OS and other software. In addition, even in combination with products recommended by NoiseKen, faults may be unable to be resolved due to serious defects occurring in the recommended products.
   [Added functions and OS upgrades]
   Please note that support for added functions and OS upgrades are outside the scope of free support.

14. NOISE LABORATORY SUPPORT NETWORK

- If a symptom which seems a trouble is found, check the symptom, software version, model name of connected device, and serial number, and inform this information to Noise Laboratory or your nearest sales agent of Noise Laboratory.

NOISE LABORATORY CO., LTD.

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