LPT-3000 Remote User's Guide

LP Technologies Tech Support
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Chapter 1

Specifications

Chapter 1. Specifications

1. Product Specifications

- Frequency

Range : 9 kHz to 3.0 GHz

Resolution : minimum 1 Hz

Span Range : 100 Hz / div to 300 MHz / div

Selection of 1,2,5 steps (automatic), ZERO Span,

FULL Span (9 kHz to 3.0 GHz)

Frequency Selection : Start, Stop, Center, Span set-up

Span Accuracy : ±3 % of the Indicated Span Width

Readout Accuracy : ≤±([Indicated frequency × Reference frequency accuracy] + [Span × Span accuracy]

+ 50% of RBW)

Phase Noise : ≤−90 dBc/Hz @10 kHz offset

- Amplitude

Range : +20 dBm ~ −105 dBm ; +20 dBm ~ -135 dBm(Pre Amp On)

Avg. Noise Level (1 kHz RBW, 10 Hz VBW)

≤−105 dBm, ≤−135 dBm(Pre Amp On) : 150 kHz ~ 1 GHz ;

≤−100 dBm, ≤−130 dBm(Pre Amp On) : 1 GHz ~ 2.4 GHz, 50 kHz ~ 150 kHz

≤−95 dBm, ≤−120 dBm(Pre Amp On) : 2.4 GHz ~ 3 GHz ;

Amplitude Unit : dBm, dBmV, dBuV

Display Scale Linearity

≤±1.5 dB / 70 dB (10 dB / div), ≤±1.5 dB / 40 dB (5 dB / div)

≤±0.5 dB / 8 dB (1 dB / div), ≤±0.5 dB / 16 dB (2 dB / div)

Frequency Response (0 dB attenuation) : −3.5 dB ~ 1.5 dB (100 kHz ~ 10 MHz)

±1.5 dB (10 MHz ~ 3 GHz)

Reference Level

Range : +20 dBm ~ −90 dBm

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Resolution : 0.1 dB step

Accuracy : ±1.5 dB

Second Harmonic Distortion : ≤−60 dBc, −40 dBm input

Intermodulation Distortion : ≤−70 dBc, −40 dBm input

Residual Spurious : ≤−85 dBm (Input terminated, 0 dB attenuation)

Other Input Spurious : ≤−60 dBc, −30 dBm input

Resolution Bandwidth

Selections : 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz, 1 MHz, 3 MHz, 9 kHz, 120 kHz

Accuracy : ±20 %

Selectivity : 60 dB / 3 dB ratio < 15 : 1

60 dB / 6 dB ratio < 12 : 1 (9 kHz, 120 kHz)

Switching Error : ≤±1.0 dB (1 kHz Reference RBW)

Video Bandwidth : 10 Hz to 3 MHz in 1-3-10 step

- Sweep

Time : 100 ms to 1000 sec, 40 ms to 1000 sec (zero span)

Accuracy : ≤±20 %

- Storage

Setup Storage : 20

- Screen Display

Type : PC or Notebook

Display Resolution : 640 (H) × 480 (V) active display area

Marker Mode : Peak search, Delta marker, Peak Hold, Min Hold

- Input

RF Input Connector : N-type Female, 50 Ω nominal

VSWR : 150 kHz to 3.0 GHz, VSWR < 1.5 : 1 (with 0 dBm Ref Level)

Maximum Input Level : 0 Vdc, +20 dBm

- Standard Frequency (10 MHz, Ref.)

  Temperature Stability : ±0.5 ppm

  Aging : ±0.5 ppm / Year

- Interface

  RS-232C : Null Modem Remote Control

  Ethernet 10-Base-T Ethernet : supports Internet remote control

- General Specifications

  Size : 436 (width) × 88 (height) × 485 (length) mm

  Weight : 10 kg

  Warming-up Time : 20 minutes for precise measurement

  Power

    Supply Electrical Power : 100-240 VAC at 50 / 60Hz

    Consumption Power : 80 watts maximum (without a built in option)

  Operating Temperature : 0 ℃to 40 ℃

  Temperature for Storage : −20 ℃to 70 ℃

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Chapter 2

Preparation for Use

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Chapter 2. Preparation for Use

1. Initial Inspection

Please inspect the box contents and make sure all listed items are included. Keep the shipping box and all packing materials until the inspection of the LPT Spectrum Analyzer is complete.

Table 2-1 (below) shows all accessories offered with the LPT-3000R Spectrum Analyzer. Please contact LP Technologies Customer Support for any damaged parts, missing items, or any other issue that you may need assistance with.

To clean the surface of the unit, please use a wet/dry cloth. Do not clean the inside of the case.

WARNING! In order to prevent electrical shock, please unplug the power cord from the main power supply on the back of the spectrum analyzer before cleaning.

Accessories	Note:
Operation Manual CD	Included in the package
Power Cable (AC Power Cable 3 Holes)	Included in the package

[Table 2-1] Accessories offered with the LPT 3000R Spectrum Analyzer

2. Power Requirements

The LPT 3000R does not need any additional external devices; use only the power cord provided. For more information, see Table 2-2 below.

Source Voltage	100 - 120 VAC (50 - 60 Hz)
Source Voltage	220 - 240 VAC (50 - 60 Hz)

Power Consumption	Less than 80W

[Table 2-2] Requirements for AC Power

3. Fuse Check

A spare fuse should be included with the LPT 3000R. The holder is located in the upper part of the power switch on the back of the device. The spare is contained behind the fuse currently in use. If there is no longer a spare fuse in this location, a replacement should be acquired that matches the following properties. (250 VAC, 3.15 A type T 5 × 20 mm).

WARNING! To reduce the risk of fire, please use only the recommended fuses. Using a fuse with a different power rating may cause serious damage to the spectrum analyzer.

4. Power Cable

In accordance with International Safety Standards, the LPT 3000R's power cable uses 3 lines including "Ground". When connected to a power outlet, the cable grounds the cabinet of the unit.

WARNING! Please use a grounded power cable with three lines, or connect the spectrum analyzer to a protective "Ground" line. Operating the unit without following these requirements may put you at risk of an electric shock. It is also important to check the source voltage, because if it exceeds the recommended value, the spectrum analyzer may be permanently damaged or catch fire.

5. Environmental Conditions

The LPT-3000R Spectrum Analyzer will operate normally between the temperatures of 0 ℃ and 40 ℃. However, for best performance, it is important to avoid exposing the unit to conditions

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involving severe vibration, high moisture, direct sun rays, or areas where the source voltage changes constantly.

WARNING! To prevent short-circuits due to condensation make sure the spectrum analyzer is fully dry before using it in normal conditions, after storing, or when using it in low temperature environments for long periods of time.

WARNING! In order to prevent the inner temperature of the unit from rising, there is a cooling fan on the rear panel. Please leave at least 10 cm between the back panel and walls or other nearby devices in order to allow proper air circulation.

6. Turning on Power

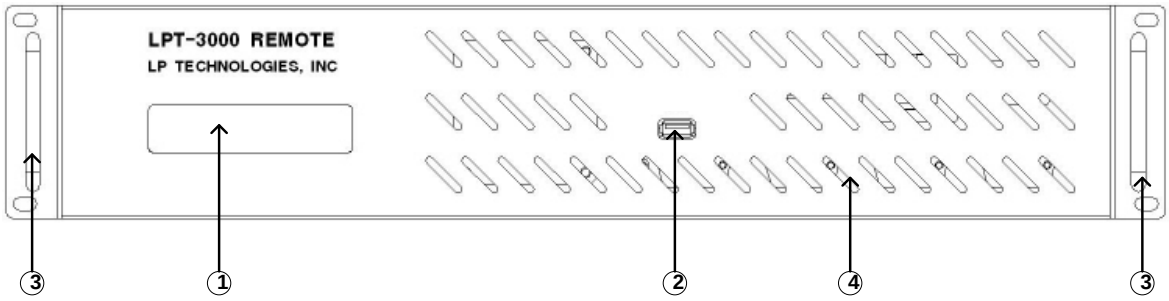
Please connect the power cord to the back panel of the LPT-3000R Spectrum Analyzer, before use, and then press the "On" button. Allow the unit to warm up for approximately 20 minutes before measuring.

Chapter 3

Starting

Chapter 3. Starting

1. Front Panel



[Figure 3-1] Overview of the Front Panel

1. 20x2 character LCD for frequency and span display.

2. USB interface for system update and screenshot memory using flash drive.

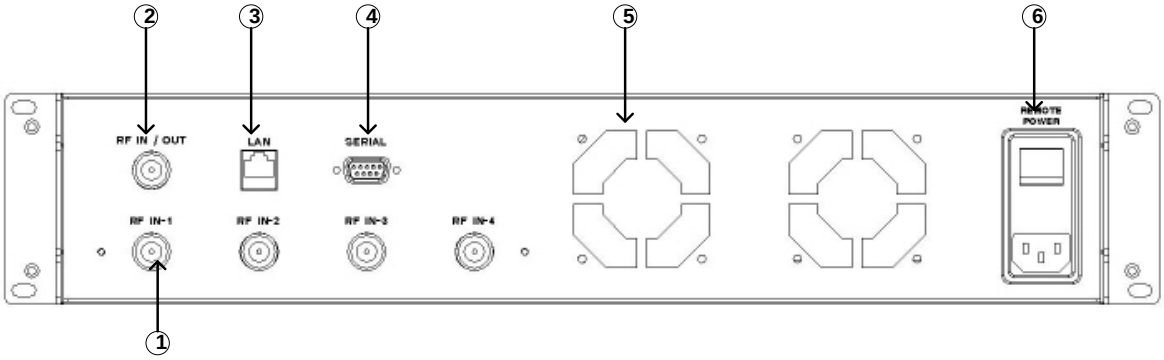
3. Rack mount for convenient storage.

4. Air passages on the front panel for proper ventilation.

After the LPT-3000R Spectrum Analyzer is turned on, "INITIALIZE…" is displayed on the LCD in order to indicate that setup is in progress. When normal operation begins, the default Frequency and Span set in the equipment are displayed on the LCD.

The USB port is designed to administer firmware installation and upgrades using a USB flash memory stick.

2. Rear Panel



[Figure 3-2] Overview of the Rear Panel

1. ① RF IN-1, IN-2, IN-3, and IN-4 Port

   The LPT-3000R has a built in 4:1 switching option. Therefore this model can connect up to 4 signals on its back panel. Please see the inputs IN-1, IN-2, IN-3 and IN-4 as shown in the above figure.

2. RF IN/OUT Port

   For an RF signal entering the RF IN-1 port, the RF IN/OUT port uses the internal RF power divider and produces the output. In general, the output is produced with the loss of approximately -6dB. General signals from the antenna port are measured as they enter RF IN-1 and are produced as outputs through the RF IN/OUT port.

3. Ethernet interface

   Communication is established between the PC and the LPT-3000R Spectrum Analyzer through the RJ-45 connector using Remote TCP application software.

4. RS-232C Connector

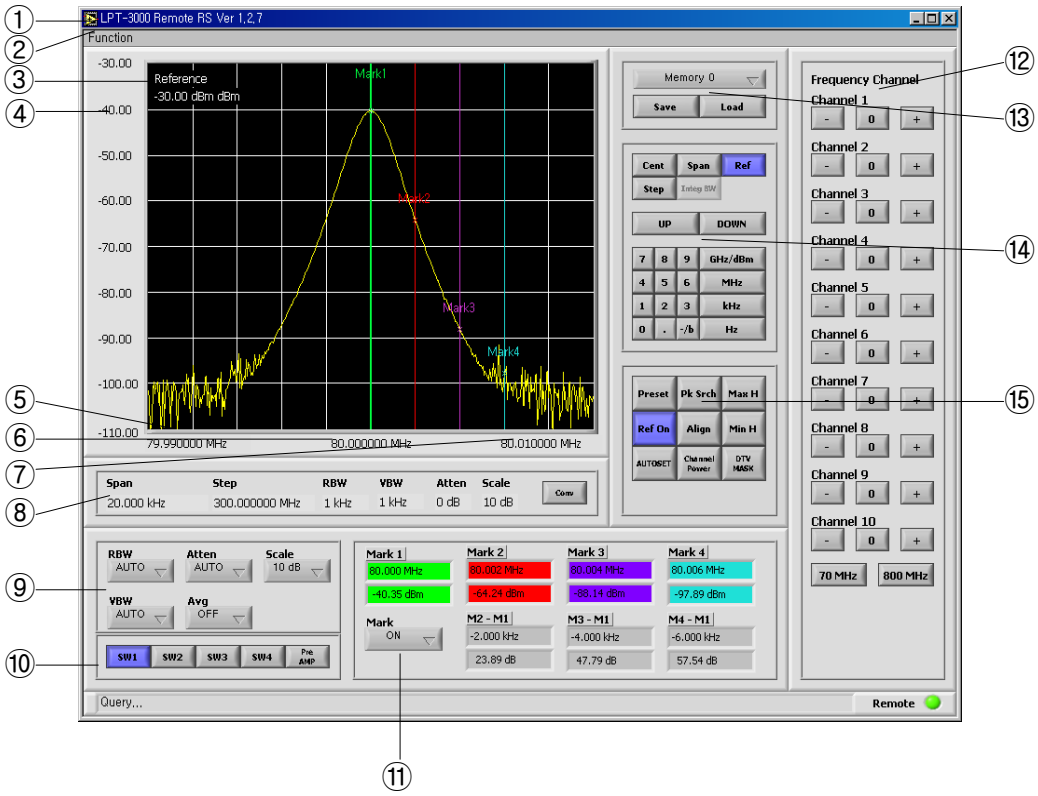
   Communication is established between the PC and the LPT-3000R Spectrum Analyzer through the RS-232C connector using SA_Comm_RS_R application software.

5. The Ventilation fan is installed to discharge heat generated inside the equipment.

6. The AC Power Switch is used to turn ON and OFF the equipment power.

3. Display

This is a screen shot of the communication program display. A description of each item listed is provided below.



[Figure 3-3] Screen Display

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1. Program title and version are displayed.

2. Menu

   Comm Setup: Allows setting of a Comm port

   Print Window: Allows you to print the screen displayed

   Save Window Image: To save the displayed screen as an image file

   Graph Color Change: Lets you invert colors in the grid area where the spectrum is displayed

   Firmware Update: Updates the firmware for the LPT-3000R

   System Info: Displays the serial number of the unit and the version of the LPT-3000R installed

   Switch name change: Allows you to rename the RF switches/ports

3. Displays the active function block.

4. Level per grid is displayed.

5. Starting frequency is displayed.

6. Center frequency is displayed.

7. Stopping frequency is displayed.

8. Currently set values are displayed.

   Span, frequency step, RBW, VBW, attenuation, and screen scale are displayed.

9. Allows the operator to set up the following parameters: RBW, VBW, attenuation, screen scale, as well as the average function.

10. Allows the operator to activate the Pre Amp option module.

11. Allows the operator to turn ON the Marker function.

12. Allows the operator to set frequency channel.

13. Allows the operator to view the memory.

14. Allows the operator to input information using the keypad.

15. Allows to operator to activate the following functions: Preset, Peak Search, Max and Min Hold, Reference ON/OFF, Align, Auto-set, Channel Power, DVT Mask, and Status Hold.

4. Measurement Methods

A 80MHz standard signal is generated inside the equipment and is used as a test signal.

1. Turn ON the AC switch button on the rear panel of the LPT-3000R Spectrum Analyzer. After the power authorization and the initialization processes are completed, the LCD will display the Center Frequency and the Span.

2. Run the Remote TCP program.
   - In case of SA_Comm_RS_R (RS232 connection), select the Comm port connected to your PC.
   - In case of Remote TCP (Ethernet connection), select an IP address corresponding to the unit. The default IP address is 192.168.1.244 if it has not been changed manually.

3. Press Ref OFF button to turn ON the internal standard signal of 80MHz. Notice that the button is now highlighted and the caption changes to Ref ON.

4. Set the Frequency.

   Press Cent button on the keypad to activate Center Frequency. The button is now highlighted and the top left hand corner of the screen displays Center Frequency. The values can be entered or changed using the numeric key pad and as well as the up/ down button. Using numeric keypad, set the Center Frequency to 80MHz.

5. Set the Span.

   Press the Span button on the keypad to activate Span frequency.
   The button is now highlighted and the top left hand corner of the screen displays Span Frequency. Using numeric keypad, set the Span Frequency to 50kHz.

6. Set the Amplitude.

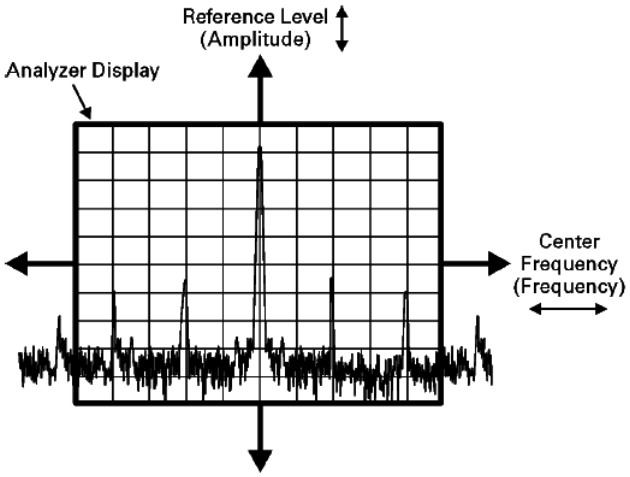
   Adjust Amplitude level on the screen if the maximum value of signal is not displayed. Press Ref button to activate Amplitude level function. Ref button is now highlighted and the top left hand corner of the screen displays the Reference level. The highest bar on the grid and is set at 0.0 dBm. When the value of reference level is changed, the Amplitude level of the highest grid line also changes.

7. Set the Marker.

   Marker function measures the Frequency and Amplitude of a signal. Frequency and amplitude of a signal can be found by placing x-shaped marker on the maximum value of the signal. Press the Mark button to activate marker. When using the Pk Srch button, marker No. 1 will automatically be set at the maximum (highest point of trace). The result of the Frequency and Amplitude reading of the marker will be displayed in marker window.

Figure 3-4 (below) illustrates the relationship between the Center Frequency and the Reference level. Changing the Center Frequency will result in changing the signal position of the signal on the horizontal line on display screen. Changing the Reference level will result in changing the vertical position of the Signal on the display screen.
When the Span frequency is increased, the range of the frequency shown on the display also increases

horizontally.



[Figure 3-4] Relationship between Frequency and Amplitude

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Chapter 4

Program installation and Startup

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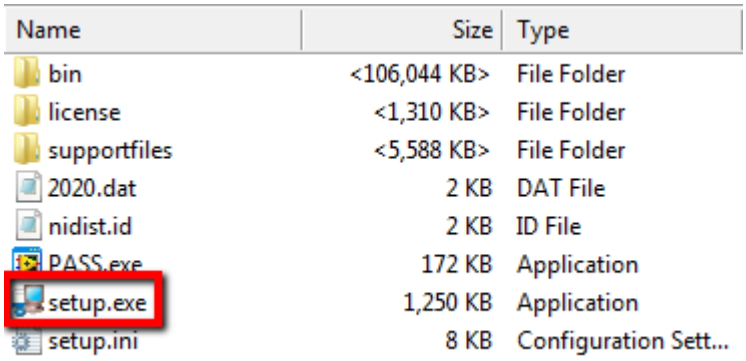
Chapter 4. Program Installation and Start-up

1. Ethernet Graphic User Interface (Remote TCP) Program Installation

The Remote TCP software can be installed directly from CD included, or can be downloaded from our website using the link provided to you.

Step 1: Open CD > Software > Remote TCP/

Step 2: Double click on "setup.exe"



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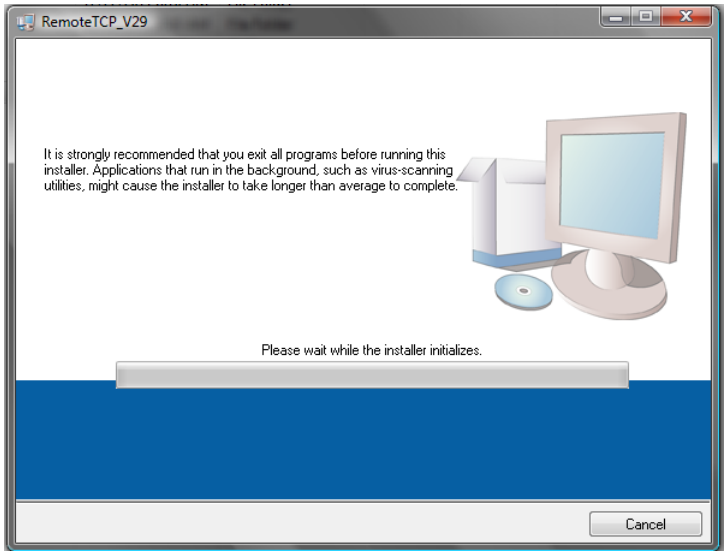
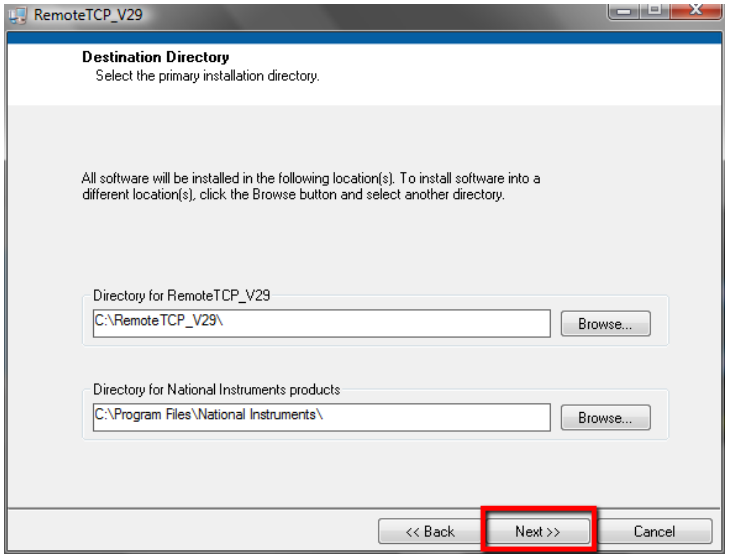
Step 3: Continue with the installation process





Step 4: Click "Next" to continue with the installation process

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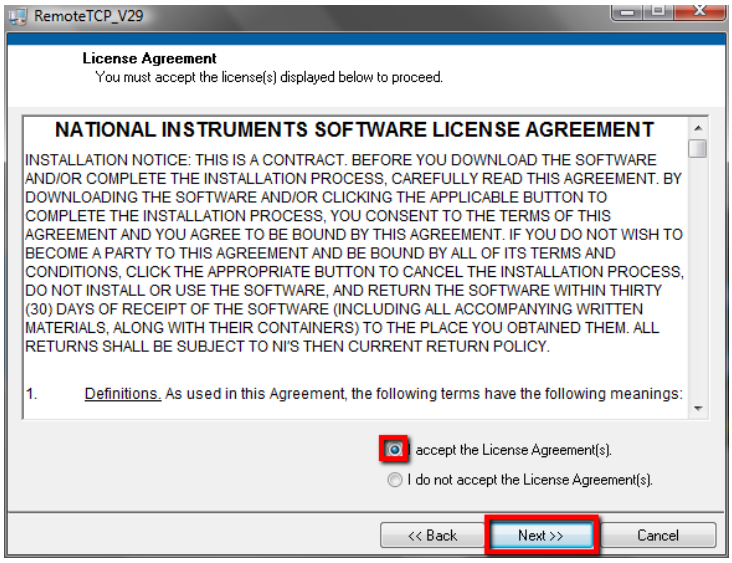

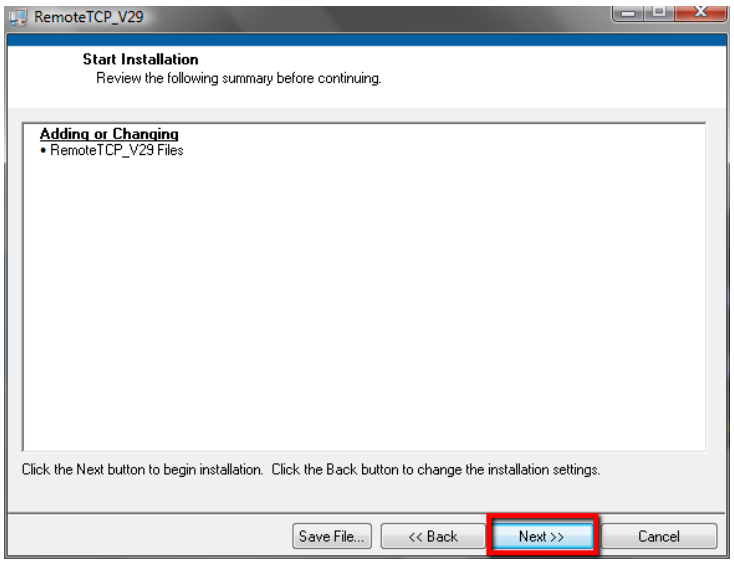

Step 5: Click "Finish" to complete the installation process

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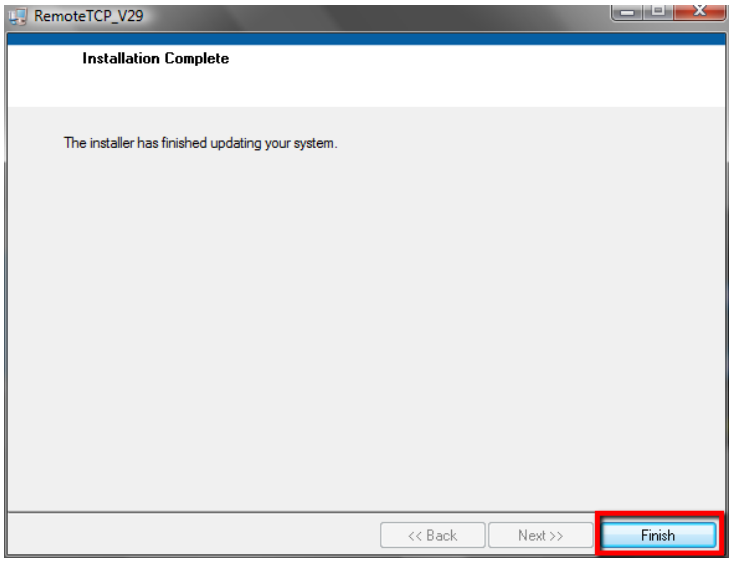
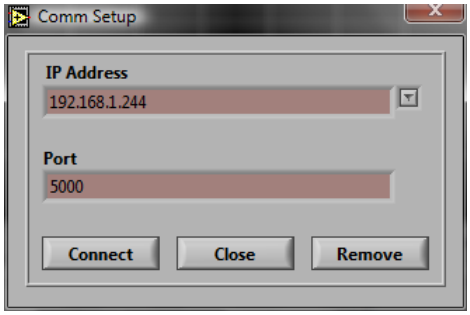


2. Program execution

To run the Remote TCP software, click on Start > Program > Remote TCP_V18 and double click the icon.

3. IP Connection Setup

By default, IP address 192.168.1.244 and port number 5000 are already filled in. Please click "Connect" to start the session.



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Chapter 5

Interface

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Chapter 5. Interface

1. TCP/IP Connection with an External Control Device

Communication is possible by connecting the RJ-45 connector on the rear panel of the analyzer to the RJ-45 connector of your computer by using a LAN cable.

The table below shows connection between standard, straight-through wiring and cross-over wiring based on EIA/TIA 568B wiring information. Cross-over cable is used when repetitively connecting hub or for point-to-point connection without a LAN hub.

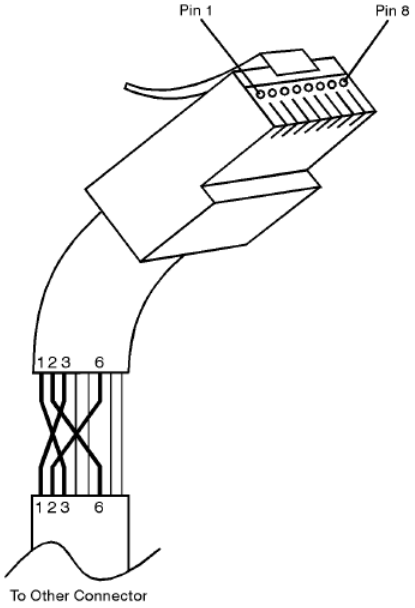
Standard, Straight-Through Wiring (each end)			
Signal Name	**RJ-45 Pin #**	**Wire Color**	**Pair #**
RX+	1	white/orange	2
RX-	2	orange	
TX+	3	white/green	3
TX-	6	green	
Not Used	4	blue	1
	5	white/blue	
	7	white/brown	4
	8	brown	

[Table 5-2] Straight-Through Cable (Unshielded-twisted-pair(UTP) cable with RJ-45 connectors)

Cross-Over Wiring			
Connector A		**Connector B**	
Signal Name	**RJ-45 Pin #**	**RJ-45 Pin #**	**Signal Name**
RX+	1	3	TX+
RX-	2	6	TX-
TX+	3	1	RX+

TX-	6	2	RX-
Not Used	4	4	Not Used
	5	5	
	7	7	
	8	8	

[Table 5-3] Cross-Over Cable (Unshielded-twisted-pair (UTP) cable with RJ-45 connectors)



[Figure 5-2] Cross-Over Patch Cable Wiring (cross-over end)

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2. How to change IP Address, Subnet Mask, Gateway

1. Ethernet

A. Using Client3 Application

Please follow the instructions listed below very carefully.

1. Download the Client at www.lptech.com/Client3.zip
2. Run the application Client3.exe
3. Click "Server Connect"
4. Enter the units IP address (default is 192.168.1.244), then click "Connect"
5. Enter or paste copy for the command listed below replacing the XXX by the correct parameters provided by your IT department. Click SEND

   :syst:comm:tcp:address XXX.XXX.XXX.XXX;:syst:comm:tcp:gateway

   XXX.XXX.XXX.XXX;:syst:comm:tcp:netmask XXX.XXX.XXX.XXX

   Example:

   :syst:comm:tcp:address 192.168.1.9;:syst:comm:tcp:gateway

   192.168.1.1;:syst:comm:tcp:netmask 255.255.255.0

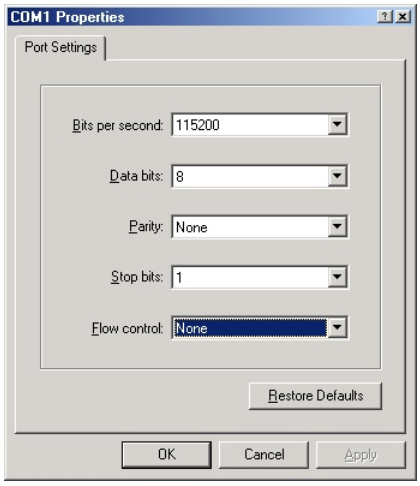
6. Reboot the unit by powering it down, waiting ten seconds, and powering it back on. The switch for this is on the rear of the unit near the AC power cord entry.

2. RS232 / Hyper Terminal

1. *Connection Set Up*

To communicate with the LP Technologies spectrum analyzer using Hyper-Terminal, please set up a new connection with the following parameters:

- Bits per Seconds: 115200
- Data Bits: 8
- Parity: None
- Stop bit: 1
- Flow control: None



2. *Communication*

- Remote start

Step 1: Connect to the unit with the new Hyper-Terminal connection described in the section above. You will get a blank screen with the bottom displaying: "Connected / Auto detect / 115200 8-N-1"

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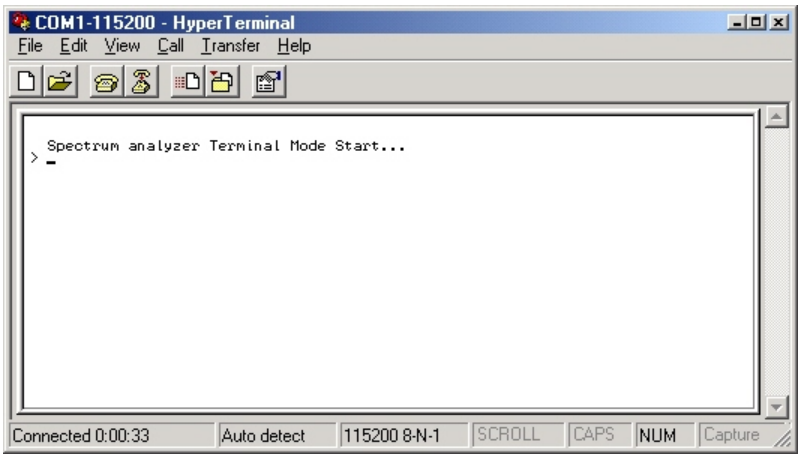
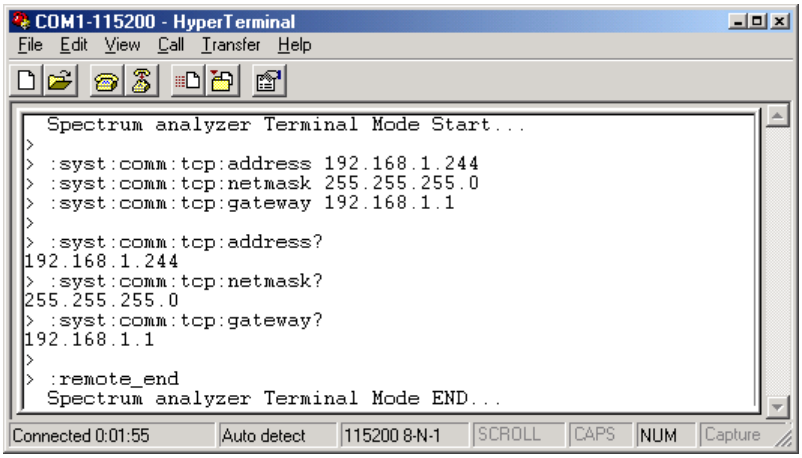
Step 2: Press the "#" Key (Shift 3) to initiate the communication.
When 'Spectrum analyzer Terminal Mode Start' is displayed on the screen, the spectrum analyzer will be ready to receive commands and queries.



Step 3: Enter the following command codes:
:syst:comm:tcp:address XXX.XXX.XXX.XXX

:syst:comm:tcp:gateway XXX.XXX.XXX.XXX

:syst:comm:tcp:netmask XXX.XXX.XXX.XXX



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Example:

:syst:comm:tcp:address 192.168.1.9

:syst:comm:tcp:gateway 192.168.1.1

:syst:comm:tcp:netmask 255.255.255.0

Query

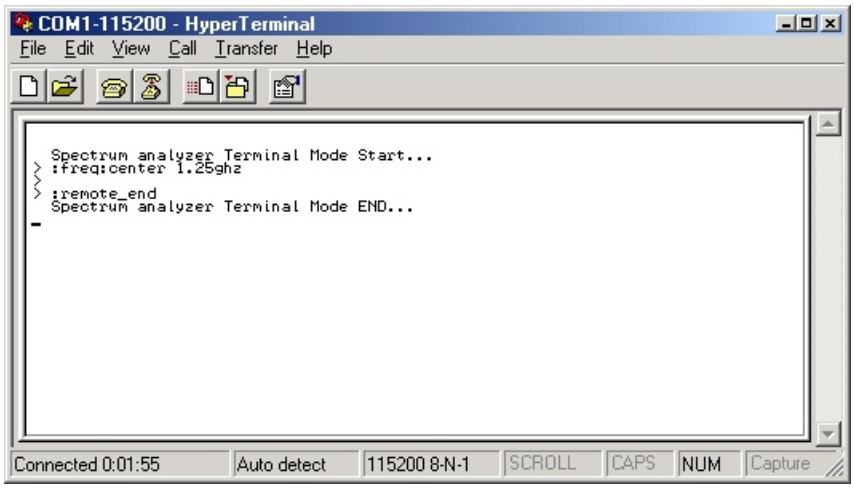
syst:comm:tcp:address?

:syst:comm:tcp:gateway?

:syst:comm:tcp:netmask?

3. *Remote Termination*

To end the session, send the command :REMOTE_END



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Chapter 6

Menu and Operations

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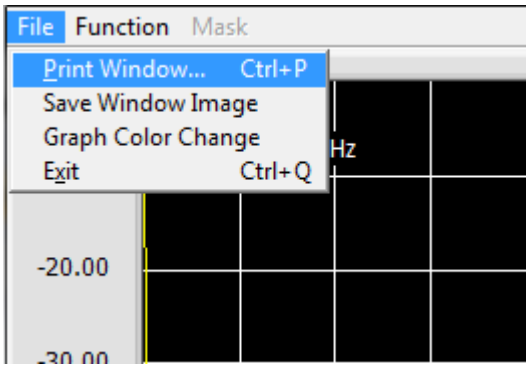
Chapter 6. Menu and Operations

1. File Menu



- Print Window

Prints the screen displayed.

- Save Window Image

Saves e-mail ready screen shots in .jpg format.

- Graph Color Change

Changes background, grid and trace colors to Black and White colors.

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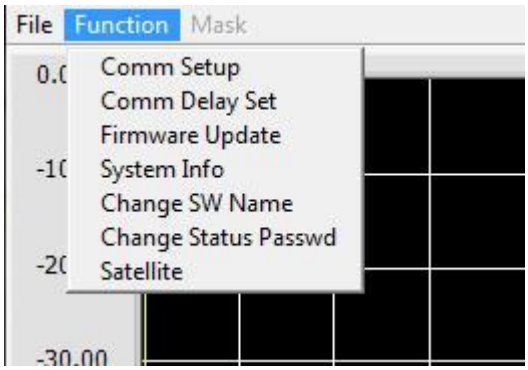
2. Function Menu

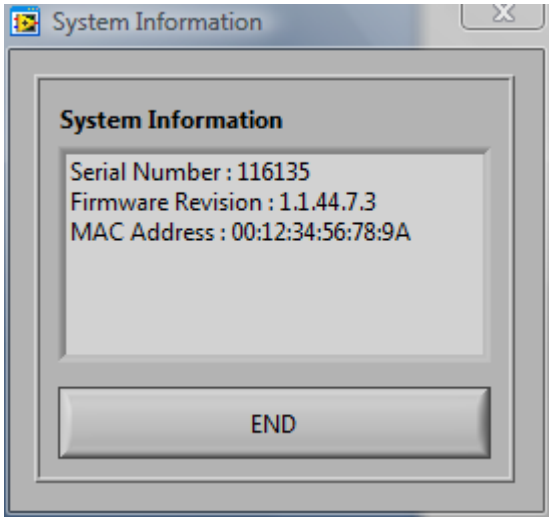


- Comm Setup

This function allows the user to connect to different units.

- System Info

Displays the serial number, installed firmware version and MAC address of unit.



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- Change SW Name

Users can use this function to rename the LPT-3000R 4 RF switch ports

- Change Status Passwd

Allows the user to change the Status password. Default password is 0000

3. State Setup

- **RBW**

This button is used to set RBW. For RBW setup, Auto Mode for automatic control according to span frequency and Manual Mode to randomly enter settings are available. Range of setting is 3MHz, 1MHz, 300kHz, 100kHz, 30kHz, 10kHz, 3kHz, 1kHz, 120kHz and 9kHz.

- **VBW**

This button is used to set VBW. For VBW setup, Auto Mode for automatic control according to VBW/ RBW and Manual Mode to randomly enter settings are available. Range of setting is 3MHz, 1MHz, 300kHz, 100kHz, 30kHz, 10kHz, 3kHz, 1kHz, 300Hz, 100Hz, 30Hz and 10Hz.

- **Atten**

Input attenuation value is set in the unit to 10dB. The input attenuator of the LPT-3000R decreases the power level of the input signal being fed into the input mixer. When the Auto Mode is selected, the appropriate input attenuation value is automatically set in accordance with the reference level currently set. Range of attenuation to be set with manual mode is 0dB, 10dB, 20dB, 30dB, 40dB, and 50dB.

- **Avg**

This button is used to turn on or off the average function.

- **Scale**

Allows the user to set scale value.

Selections: 1dB, 2dB, 5dB, 10dB, and 20dB per vertical grid zone.

- **Sweep Time**

Allows the user set the Sweep manually or set it on Automatic mode.

3. Port Switch & Pre-Amp

Allow the user to instantly switch between the 4 RF inputs built in the LPT-3000R.

The Pre-Amp allows the user to turn the Pre Amplifier ON and OFF, allowing the operator to find signals hidden below the noise floor.

4. Memory Setup

Save: Saves an unlimited number of presets in Fixed and User Defined locations.

Load: Brings up any saved traces instantly. The systems will remember all parameters including marker positions and Pre-Amp Status, etc.

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8. Keypad Setup

- Center Frequency Setup Function

This function is used to set the center frequency. The button is highlighted when activated and the top left hand corner of the screen displays the Center Frequency. The values can be entered or changed using the numeric key pad and as well as the up/ down button. The level of changes made by the Up/ Down button are determined by step frequency.

- Span Frequency Setup Function

This function is used to set Span Frequency. The button is highlighted when this function is activated and the top left hand corner of the screen displays Span Frequency.

- Reference Level Setup Function

This function is used to change the reference level. The Ref button is highlighted when the function is activated, and the top left hand corner of the screen displays the Reference level. Changes can be made by using the Up/ Down buttons in 10 db steps.

- Step Setup Function

This function changes step value operated by the Up/ Down step button. The button color will change when you press the Step button, providing it is possible to change the function. Changes can be made by using the numeric keypad.

- Integ BW Setup Function

This function is used to set Integ BW. The button is highlighted when this function is activated and the Integ BW change can be set. Integ BW can be changed using the Up/Down step button or the numeric keypad. This function needs to be activated only when measuring channel power.

9. Special Functions

- Preset (Reset)

This button resets all settings to factory default. For status of preset setup, refer to the table below for factory preset conditions.

Amplitude Unit	dBm
Display and Grid Display	On
Attenuation	30 dB
Center Frequency	1.5GHz
Start Frequency	0Hz
Stop Frequency	3GHz
CF Step	10% of span frequency
Log Scale	10dB per zone
Reference Level	0dBm
Marker	Off
RBW	3MHz (Auto)
VBW	3MHz (Auto)
Video Average	Off
Span Frequency	3GHz

[Table 6-1] Factory Preset Conditions

- Pk Srch

This button is used to detect and mark the highest point on the trace. Peak search function operates

only for Mark1.

- Ref Off/On

This button is used to turn ON or OFF internal 80 MHz standard signal. When Ref is ON, the LPT-3000R will not display any RF input signal connected to it. This function is used mainly for unit testing purposes.

- Align

This button is used to re-calibrate the LPT-3000R spectrum analyzer for increased accuracy.

- Autoset

The Autoset function searches for the RF signal and automatically sets the parameter.

- Channel Power

This function measures Channel Power and Power Spectrum Density within a selected channel bandwidth.

- DTV MASK

This function measures the Shoulder Attenuation used for digital TV measurement.

-Trace

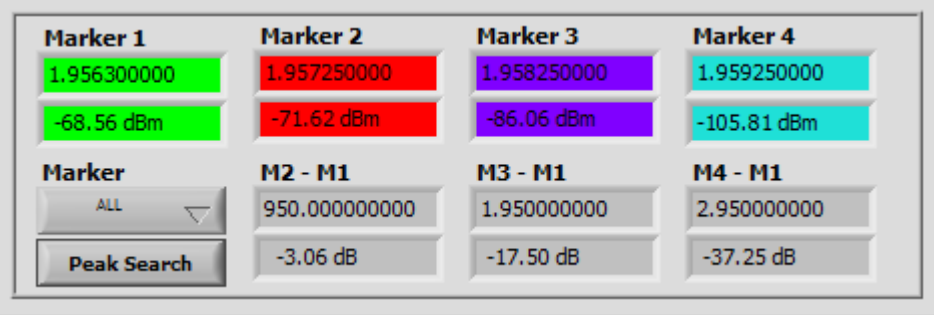
This function Allows the user to display a trace in Max, Min, Pause and Live mode at a time or simultaneously. Operators can also pause a trace by selecting "View".

-Status Hold

This tool allows users to hide all controls and display only the trace.

To release the controls, the default password is "0000" or you can simply close the session and reconnect.

10. Marker Menu



-Marker 1-4

The Marker function allows the user to select any points on the trace and display frequency and level data in real time. The LPT-3000R has a total of 4 markers. Marker 1, Marker 2, Marker 3, and Marker 4 can be displayed simultaneously. The Delta values obtained by subtracting Mark1 from Mark2, Mark3, and Mark4 are also displayed.

-**Peak Search**

Sets Marker 1 at the highest point on the trace.

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12. Firmware Update Process

Step 1

Reboot the unit by powering it down, waiting ten seconds, and powering it back on. The switch for this is on the rear of the unit near the AC power cord entry.

Step 2

1. Download the attached "firmware.latest_version.img" into the root directory of your USB 2.0 compatible memory stick.
2. Plug it in the USB flash drive in the appropriate slot on the front panel of the unit.
3. Run LPT Remote TCP software with IP connection to the unit.
4. Update the system firmware by
    a. Clicking on **Function** menu drop down
    b. Scrolling down and selecting **Firmware Update**
    c. Entering the full file name ***firmware.latest_version.img*** in the dialogue box
    d. Clicking on **Update** in the dialogue box
    e. Waiting until process is completed and a confirmation message displayed on the screen
    f. Closing the LPT Remote software application

Step 4

Reboot the unit by powering it down, waiting ten seconds, and powering it back on. The switch for this is on the rear of the unit near the AC power cord entry.

Step 5

1. Check the current firmware on the unit by
    a. Clicking on **Function** menu drop down
    b. Scroll down and select **System Info**
    c. Verify firmware version is the most current

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Chapter 7

Measurement Applications

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Chapter 7. Measurement guide

We will now review a few experiments that will allow an operator to use some of the functions the LPT-3000R Spectrum Analyzer discussed above while taking simple measurements and learning how to use the unit.

We will look at:

- Utilization of delta marker ; Comparison of signals
- Utilization of RBW ; Distinction of a small signal
- Measurement of a small signal
- Use of a Pre Amplifier
- Measurement of a Shoulder Attenuation

1. Utilization of Delta Marker ; Comparison of Signals

Using an LPT-3000R, the frequency and amplitude differences between radio, wireless telegraphy, mobile communication devices, and CATV spectrum signals can be easily compared. Using the delta marker function of the LPT-3000R, the power difference between two signals can be compared.

- Example of Use (Delta Marker Function)

Comparing Power differences between two signals.

(a) Set the signal generator to a frequency of 10MHz and a level of 0dBm.

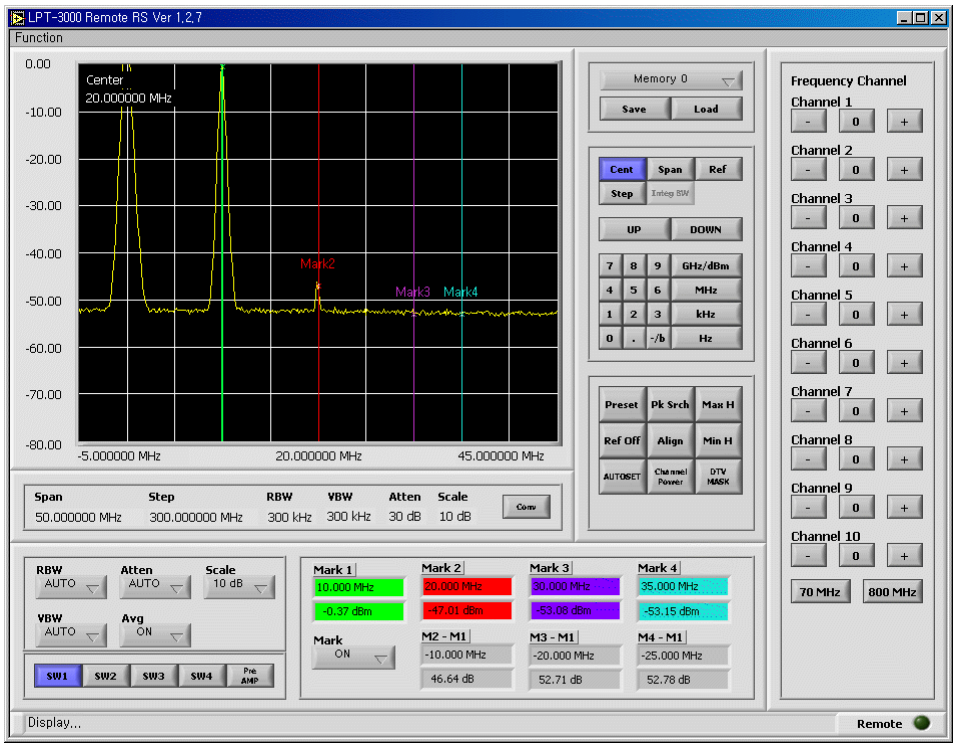
(b) Set the LPT-3000R program as follows.
Center Frequency - 20MHz, Span Frequency - 50MHz, Reference Level - 0dBm.

(c) Turn on Average.

(d) Turn on Marker.

(e) Using a mouse, place Marker1 at 10MHz and Marker2 at 20MHz.

(f) Frequency and amplitude differences between Marker1 and Marker2 are displayed in the marker window located at the bottom of program.



[Figure 7-1] Delta Marker Function

2. Utilization of RBW ; Distinction of a Small Signal

To distinguish between two signals of similar frequencies, it is required to consider configuration characteristics and 3dB bandwidth of the analyzer IF (RBW) filter. The configuration characteristics of the filter are defined by selectivity, the ratio of the 3dB and the 60dB bandwidths. If a small signal is located too close to a large signal, the small signal may become blocked by IF (RBW) filter selection.

- Example of Use (IF (RBW) Selection)

Characteristics and measuring method of IF (RBW) can be obtained by measuring two input signals with a frequency difference of 200 kHz and an amplitude difference.

(a) Connect the spectrum analyzer as shown in Figure 7-2 to obtain a signal with a frequency difference of 200kHz. Set the first signal generator as 100MHz and -30dBm.

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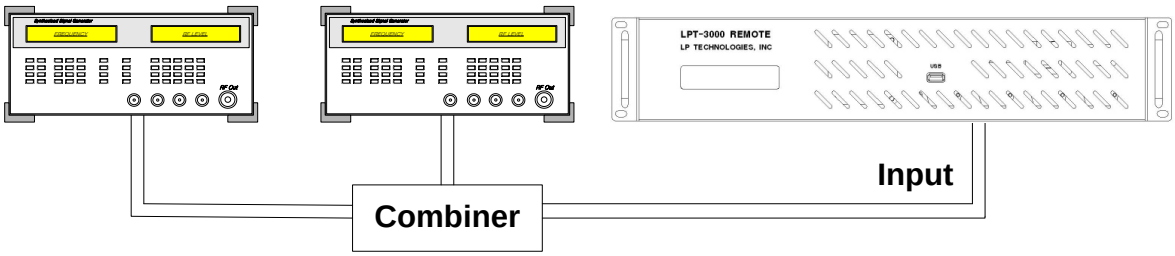


[Figure 7-2] Setup for Input of Two Signals

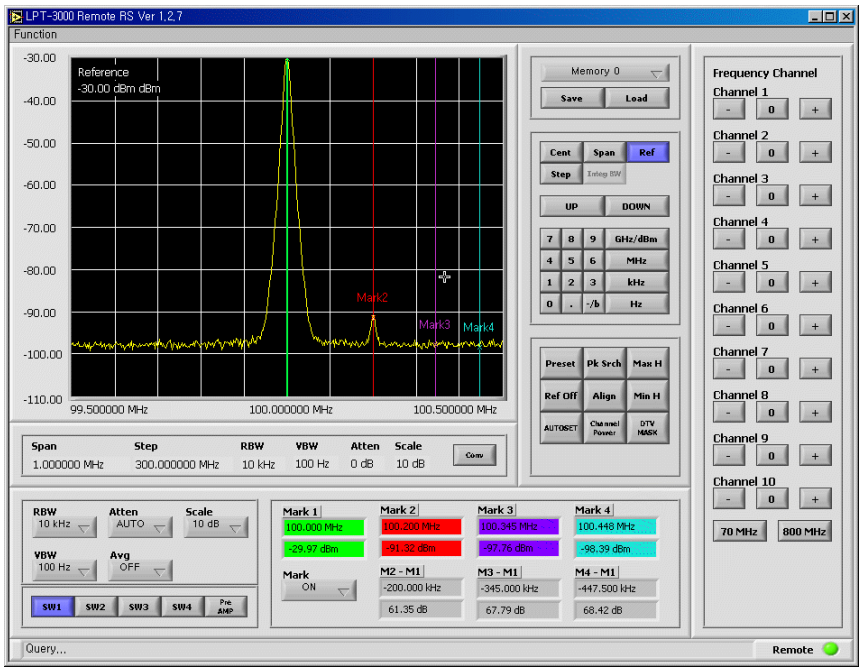
(b) Set the Center Frequency and the Span Frequency of the LPT-3000R communication program to 100MHz, and 1MHz/ VBW 100Hz respectively.

(c) Set the second signal generator as 100.2MHz so that the signal is higher than the first signal by 200kHz. Set signal amplitude as -90dBm (lower than the first signal by 60dB).

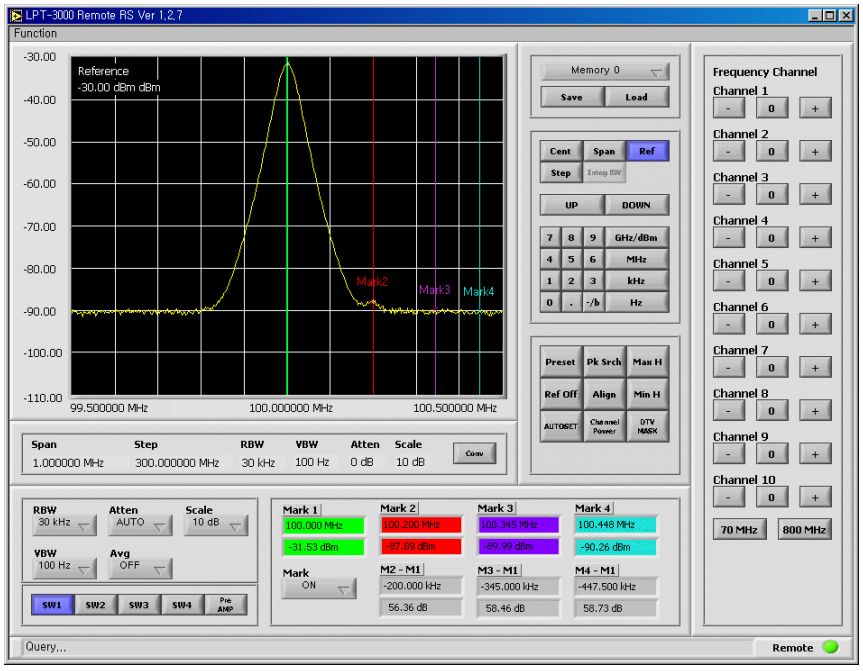
(d) When using a RBW 10kHz filter with selectivity of 15 : 1 or less, the bandwidth of the filter becomes 150kHz or less at the point of 60dB. Also, the half value of the resolving power bandwidth (75kHz or less) becomes smaller than the frequency difference. Therefore, input signals can be distinguished.

(e) When using a RBW 30kHz filter, 60dB bandwidth becomes 450kHz or less. The half value of bandwidth (225kHz) is wider than the frequency difference (200kHz). Therefore, signals are almost undistinguishable.

(f) When using a RBW 100kHz filter, a signal with drop of 200kHz is located within the band of RBW 100kHz. Therefore, the signals cannot be distinguished at all. As such, signals can be distinguished by adjusting RBW.



[Figure 7-3] Signal Resolution where RBW is 10kHz



[Figure 7-4] Signal Resolution where RBW is 30kHz

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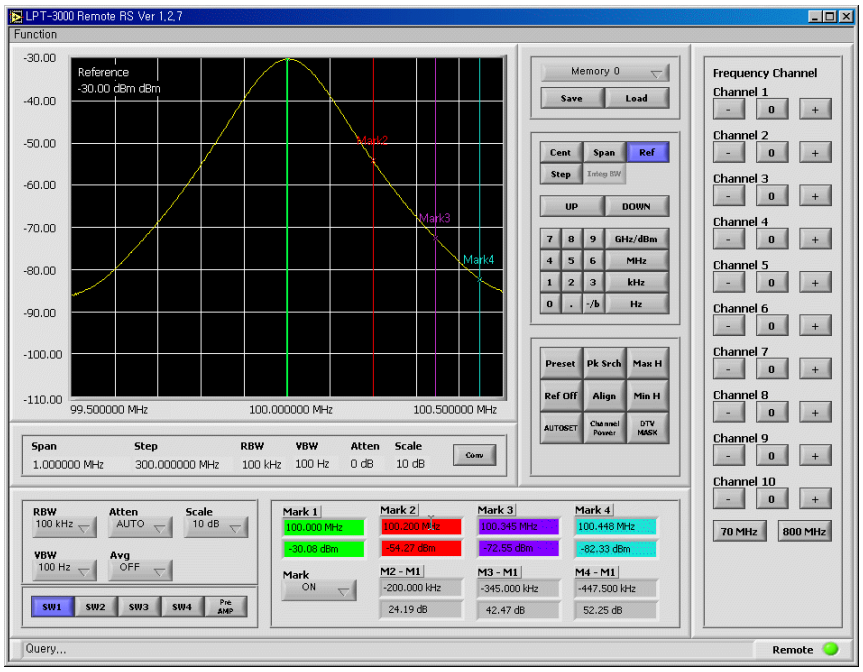


[Figure 7-5] Signal Resolution where RBW is 100kHz

3. Measurement of a Small Signal

The small signal measuring capacity of the LPT-3000R is restricted by its internally generated noise level. Small signals with low power level may become blocked by the LPT-3000R noise level. For sensitivity of small signal measurement, equipment setup is the most important element. Setup status influences the internal noise level of the LPT-3000R.

RBW setup places the most significant impact on the internal noise level of the LPT-3000R and the input terminal attenuator influences the level of signals measured. Ultimately, S/N ratio (signal to noise ratio) must be set high to be able to accurately measure small signals (RBW, Atten ➔ Set relatively low). A number of examples of how to measure small signals are listed below. In case it is still difficult to distinguish between small signals and noise after RBW and attenuator setup, visibility can be improved by using bandwidth reduction and the video average function. Video bandwidth reduction and average function are used to average the irregularly generated noise.

- Example of Use (Input Terminal Attenuator Setup)

In case the signal is very close to the noise level, reduce the input terminal attenuator to 0dB and adjust the reference level to maximize the signal output.

(a) Connect a signal generator to the RF INPUT of the LPT-3000R.

(b) Set the Frequency of the signal generator to 100 MHz and Amplitude to -90 dBm.

(c) Set the Center Frequency to 100 MHz.

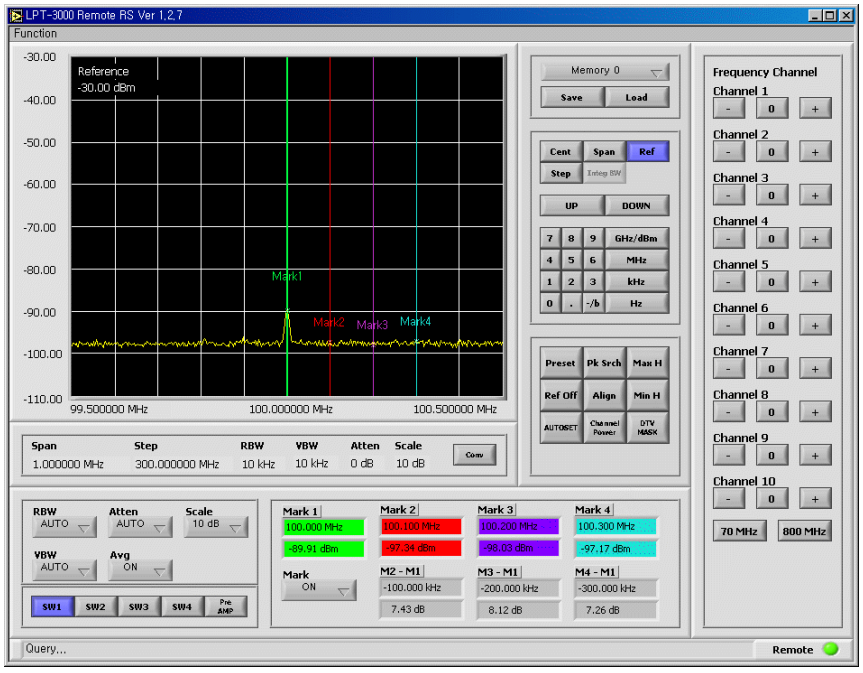
(d) Set the Span Frequency to 1 MHz.

(e) Set the Reference level to -30 dBm.

(f) Execute trace averaging.

(g) Using the Atten combo box, set the attenuation to 10dB.

(h) For better measurement, set the attenuator to 0dB or to Auto. Attenuator in order to more clearly display the signal.



[Figure 7-6] 0dB Attenuation Rate Setup

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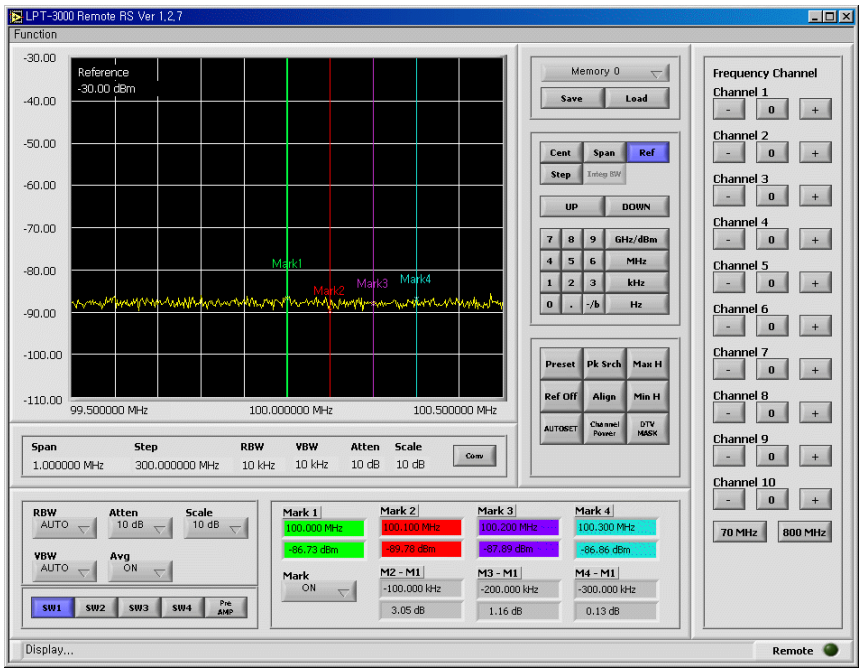

[Figure 7-7] 10dB Attenuation Rate Setup

- Example of Use (RBW Selection)

Small signals can be measured when lowering the noise level of the LPT-3000R by reducing RBW.

(a) Set the frequency of the signal generator to 100MHz and the amplitude to -90dBm.

(b) Set the Center Frequency to 100MHz.

(c) Set the Span Frequency to 1MHz.

(d) Set the Reference level to -30 dBm.

(e) Execute trace averaging.

(f) Reduce RBW in the LPT-3000R communication program. The Small signal is more clearly displayed because the noise level has been reduced.

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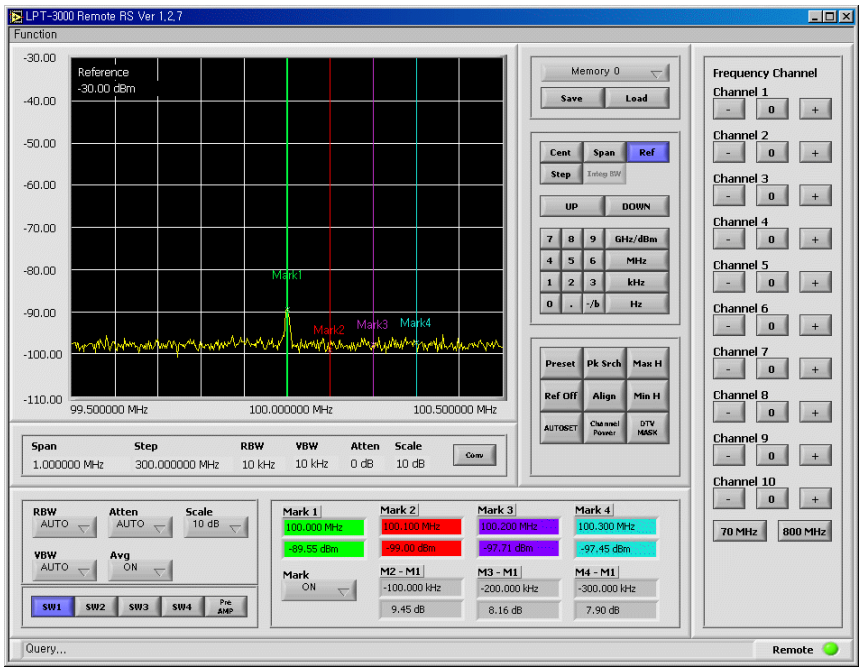
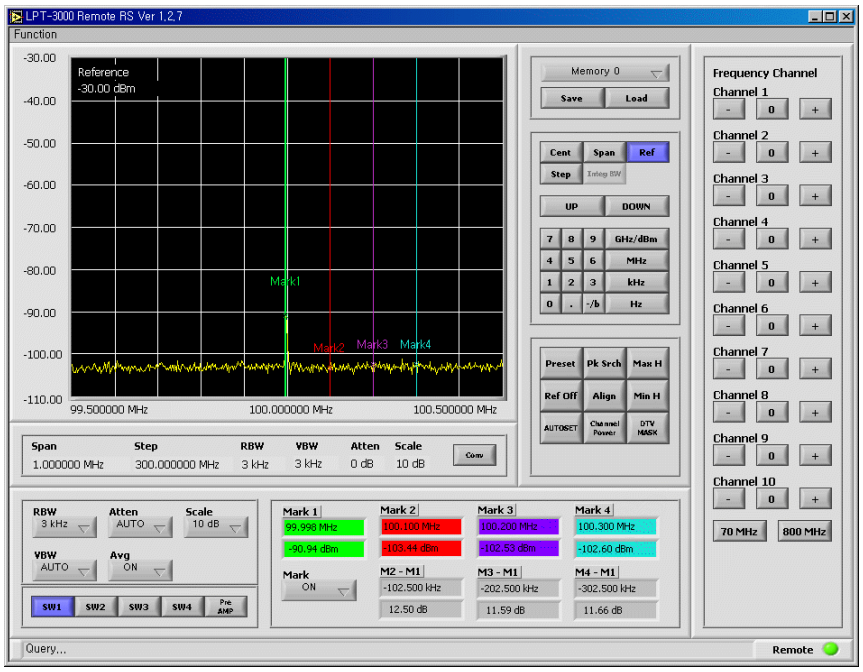


[Figure 7-8] RBW 10kHz Signal



[Figure 7-9] RBW 3kHz Signal

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- Example of Use (VBW Reduction)

Setting the video filter to a small value is useful for measuring noise or a very small signal. The video filter passes through a low frequency zone. In case it is difficult to visually distinguish between a signal near noise level and noise, irregular random noise can be reduced and the signal can be clearly visible by making the video filter smaller. Sweep time increases when video bandwidth decreases.

Measure level of a small signal by using the video bandwidth function.

(a) Set the frequency of the signal generator to 100 MHz and the amplitude to -90 dBm.

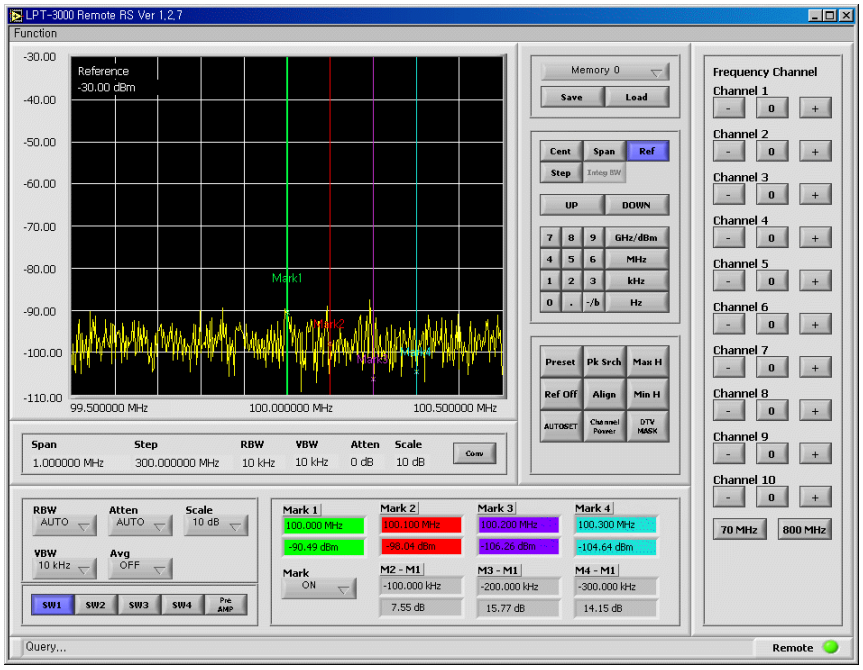
(b) Set the Center Frequency to 100 MHz.

(c) Set the Span Frequency to 1 MHz.

(d) Set the Reference level to -30dBm.

(e) Reduce VBW in the LPT-3000R communication program.

The Noise level is reduced to produce a clearer signal. This improves signal level measurement.



[Figure 7-10] VBW 10kHz Signal

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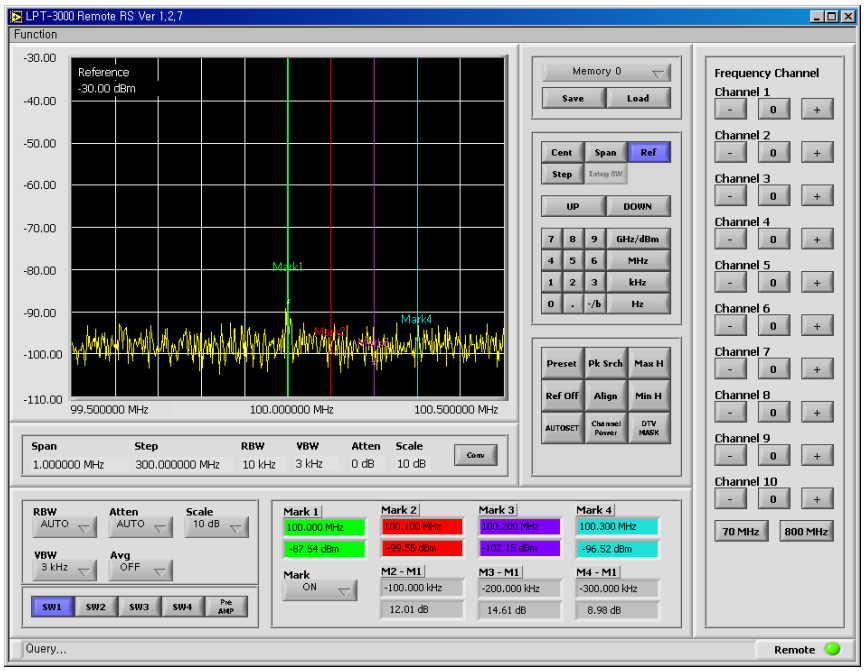
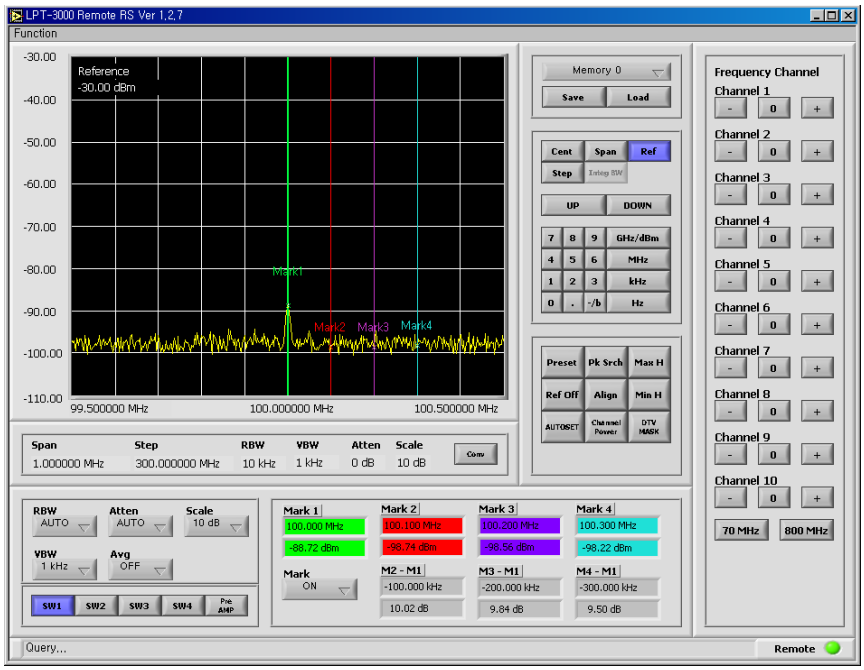
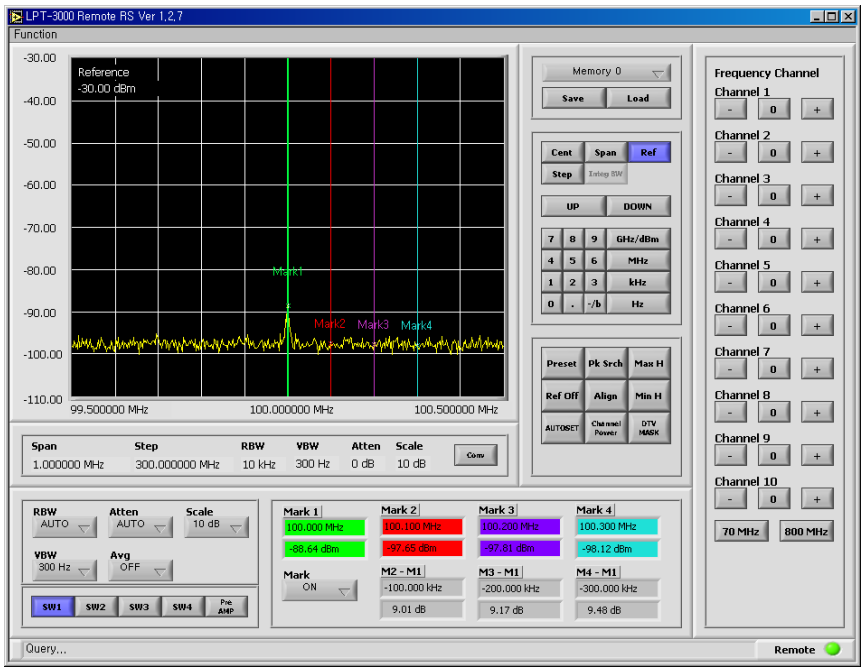


[Figure 7-11] VBW 3kHz Signal



[Figure 7-12] VBW 1kHz Signal



[Figure 7-13] VBW 300Hz Signal

4. Use of a Pre Amplifier

The small signal measuring capacity of the LPT-3000R can be improved by using the pre-amplifier in addition to the method described in Section 7-4.

(a) Set the frequency of the signal generator to 100 MHz and the amplitude to -80 dBm.

(b) Set the Center Frequency to 100 MHz.

(c) Set the Span Frequency to 1MHz.

(d) Set the Reference level to -30dBm.

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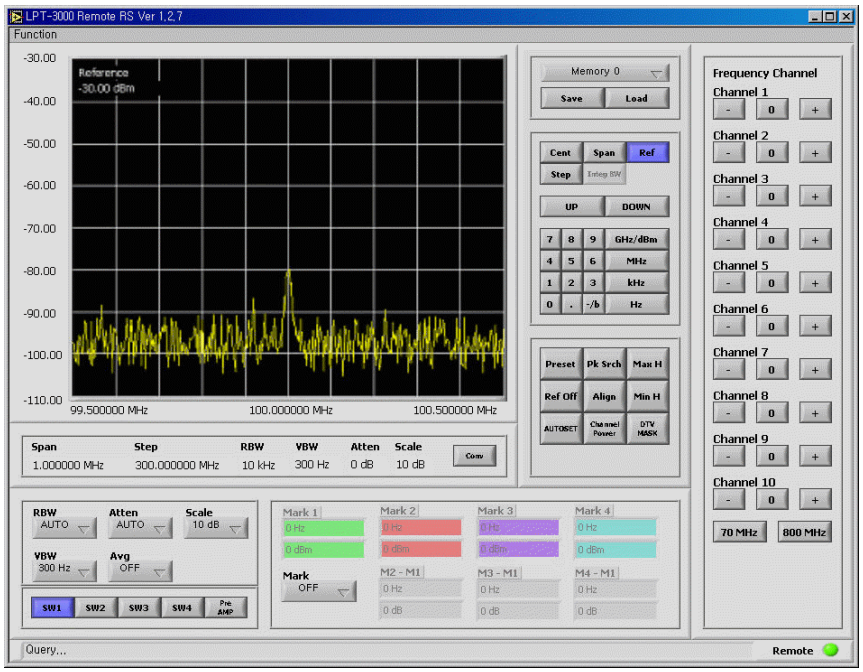
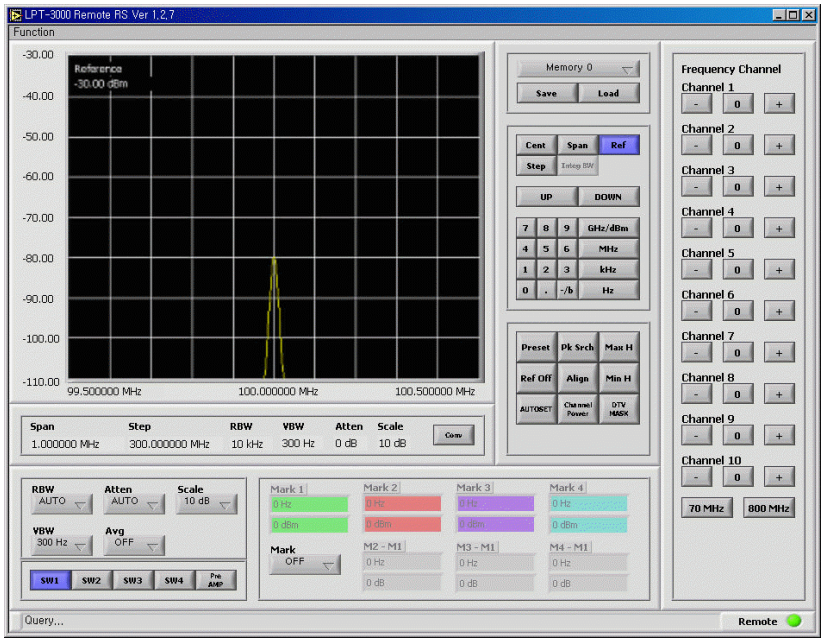


[Figure 7-14] Pre Amplifier Turned Off

(e) Set the pre-amplifier to ON.



[Figure 7-15] Pre Amplifier Turned On

(f) Set the reference level to -60dBm.

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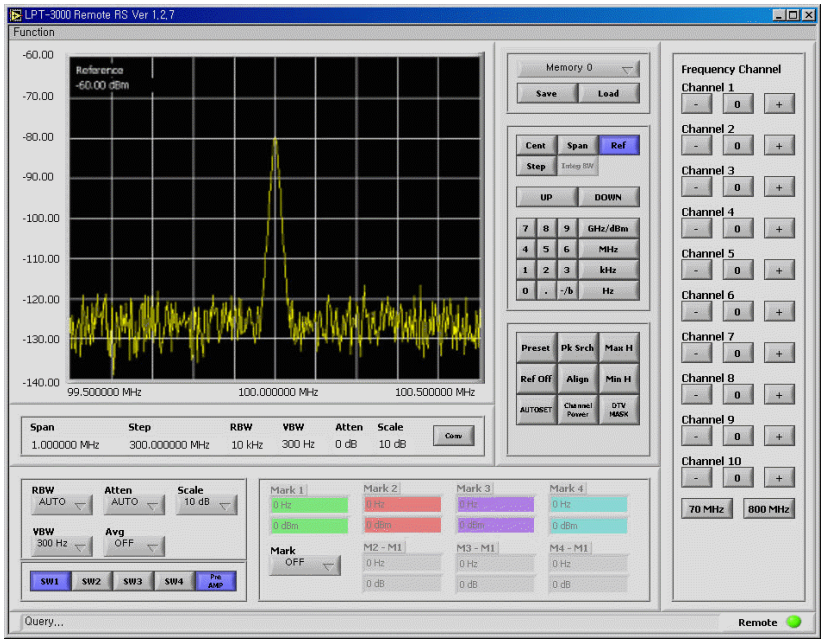
The Noise level is lowered by approximately 30dB.



[Figure 7-16] Pre Amplifier Turned On

5. Measurement of Shoulder Attenuation

The LPT-3000R is equipped with a Shoulder Attenuation Measuring function to satisfy the 8VSB/ATSC standard.

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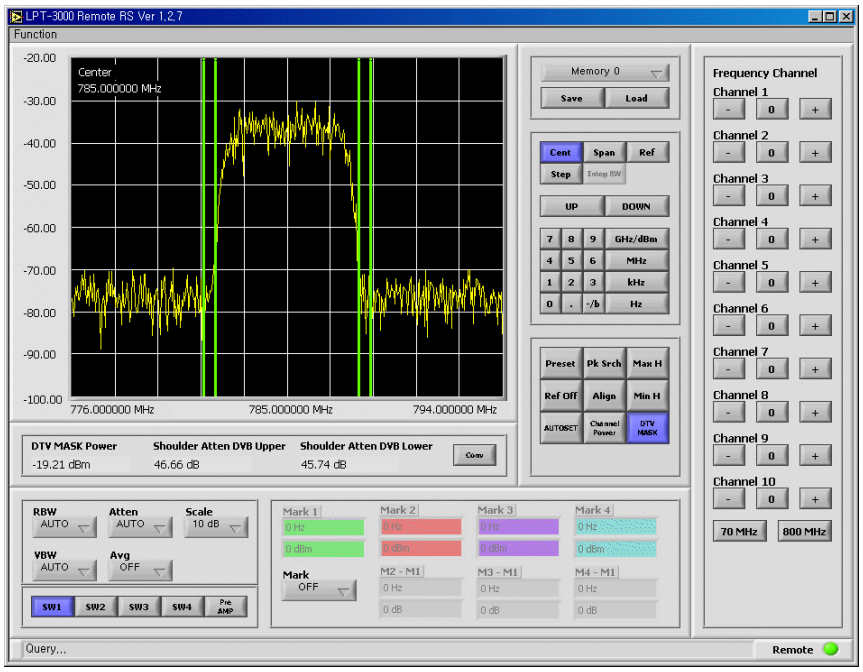

[Figure 7-17] Shoulder Attenuation Measurement

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