NS-1100M

(WIRELESS LANCARD)

MIRAE TECHNOLOGY

NOTICES

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions.

   1. This device may not cause harmful interference.

   2. This device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

• Reorient or relocate the receiving antenna

• Increase the separation between the equipment and the receiver

• Connect the equipment into an outlet on a circuit different from
  that to which the receiver is connected

• Consult the dealer or an experienced ratio/TV technician for help

  WARNING!

  Any changes or modifications of equipment not expressly approved by MIRAE could void the user's authority to operate the equipment.

NS-1100M Technical Support

Your comments and suggestion help us to improve the quality and usefulness of our documentation, you may response to the following contact e-mail.
If you encounter problems when installing or using this product, or would like more information about our other products, you can contact us with the telephone numbers listed below.

Useful information

TEL:82-2-3485-9763
FAX:82-2-3485-9759
E-Mail: dhyoo@sandc.co.kr
World Wide Web: http://www.nanospeed.com
211-15, NONHYUN-DONG
KANGNAM-GU, 135-010 SEOUL, KOREA

Important Safety Information

- Read these simple guidelines. Breaking the rules may be dangerous or illegal. MIRAE will not be responsible for any damages caused by breaking the rules.
- Wireless LAN Card described in this document is approved for use in a wireless local area network.
- Remember to make backup copies of important data.
- MIRAE Wireless PCMCIA LAN card supports 3.3V Notebook computers only.
- When you are transferring data, keep your laptop computer stationary Roaming between access points (AP) may break the connection.
- Only qualified service personnel must repair the equipment.
- All wireless devices may get interference, which could affect performance.
- Use only the region settings appropriate for the area where the wireless LAN Card is used at the present time. Using the card in any other region or with an incorrect region setting is prohibited and may be illegal.
- Operation of any radio transmitting equipment, including a Wireless LAN Card, may cause interference with the functionality of inadequately protected medical devices.
- Do not use the wireless LAN Card on aircraft.
- Do not use the wireless LAN Card at a refueling point.
- Do not use the wireless LAN Card near inflammable materials or chemicals.
- Do not use the wireless LAN Card where blasting is in progress.
- Do not use the wireless LAN Card when the use of wireless device may cause interference or danger.
- Do not use the wireless LAN Card where the use of cellular terminals is prohibited.
- Microwave oven degrades the performance of wireless LAN drastically. So do not use the wireless LAN Card in the environment where Microwave oven is being used.

CONTENT

1. GENERAL

1-1 Overview of IEEE 802.11

The IEEE 802.11 specification is a standard for wireless connectivity for fixed, portable, and moving stations within a local area.

The IEEE 802.11 standard describes the services required by a compliant device to operate within an "ad hoc" or "infrastructure" network, as well as dealing with the issues related to mobility within those networks. Spread spectrum techniques are used to tolerate mobility and multipath effects. They are also a requirement for compliance with FCC, ETSI and those of other regulatory authorities when operating within the Industrial, Scientific, and Medical (ISM) frequency band.

An ad hoc communications network is created quickly and informally for a temporary time period. An infrastructure network usually requires more planning so that wireless stations can communicate over longer distances through access points, and may also communicate with existing wired LANs using portals.

The IEEE 802.11 standard describes Media Access Control (MAC) procedures. The principal method of communication is the Carrier Sense Multiple Access with Collision Avoidance (CSMA-CA) protocol. Using this protocol, each station senses the communications medium (RF channel), and does not transmit until the channel is clear. This avoids collisions and minimizes the re-transmission of subsequent packets.

The standard also supports the operation of a station within a wireless LAN that may coexist with several overlapping wireless LANs. To accomplish this, a scheme of channelization and spread spectrum techniques is used. Direct Sequence (DSSS) and Frequency Hopping (FHSS) spread spectrum techniques are supported by the standard and both operate in the 2.4 to 2.4835GHz frequency band (the unlicensed ISM band). An infrared technique is also supported for indoor applications. The standard supports a 1 and 2Mbps data rate for both DSSS and FHSS and has recently introduced a high data rate standard supporting 5.5 and 11Mbps DSSS using Complementary Code Keying (CCK) modulation.

The standard has also specified the requirements and services that enable private and secure communications to occur.

1-2 CHARACTERISTIC

• The NS-1100M is wireless LAN adapter cards that provide wireless connection between computers.

• The NS-1100M is designed to operate with IEEE 802.11 (wireless LAN International Standard) wireless compliant radio cards and uses a CSMA/CA (Collision Sense Multiple Access with Collision Avoidance) algorithm as the media access scheme, which makes high speed communication (with minimal collision probability) possible.

• The NS-1100M supports DSSS (Direct Sequence Spread Spectrum) physical layer. This is a radio technique, which scrambles the data prior to transmission and uses a correlation technique on receiver to improve the signal to noise ratio and makes it possible to communicate in the office having a wall and a compartment.

• The NS-1100M for Notebook PC is small and portable as a roaming function is provided for users who need network services while maintaining mobility.

• The NS-1100M has an LED (Light Emitting Diode) on the part of the card.

• The yellow LED will illuminate when the power is supplied and the card is inserted properly.

• The NS-1100M support various network software. The network driver is provided to support network software such as Windows 95(OSR2)/98, and Windows NT 4.0.

1-3 COMPOSITION

• NanoSpeed LAN CARD (PC Card Type II)
• Installation CD

2. SPECIFICATION

2-1 GENERAL SPECIFICATIONS

*type : PC Card Type II

*Coverage Area

    Open Space : Up to 350m at 2Mbps / Up to 200m at 11Mbps

    Office Environment : Up to 70m at 2Mbps / Up to 50m at 11Mbps

*Operating voltage : 3.3V ±5%

*Current consumption : Tx - Max. 350mA / Rx – Max. 220mA

*Security : WEP 40bits encryption

2-2 NETWORK SPECIFICATIONS

*Network architecture : Ad-hoc, infrastructure

*Wireless standatd : IEEE 802.11b

*Operating system : Win 95 OSR2 / 98, Win NT, Win 2000

*Roaming : IEEE 802.11 compliant with enhanced roaming features

2-3 RADIO SPECIFICATIONS

*Center Frequency range : 2,412 ~ 2,462MHz

*Channel Capacity : 11 channel

  *Frequency Stability : < fc ±25ppm

  *Oscillation Method : PLL SYNTHESIZER

*Wireless medium : Direct Sequence Spread Spectrum

*Modulation Techniques : 1Mbps/BPSK, 2Mbps/QPSK, 5.5Mbps/CCK,
               11Mbps/CCK

*If frequency : 374MHz

*If bandwidth : 17MHz

*RX/TX Switching speed : 2us (Typ)

*Transmit spectral mask : -30dBc at First Side Lobes

*Sensitivity : Min. –80dBm at 2Mbps / Min. –76dBm at 11Mbps

*Output power : Max. 100mW (Typ. 13dBm)
*Antenna Interface : Dual Diversity Printed Antenna

2-4 ENVIRONMENTAL SPECIFICATIONS

*Temperature : 0°C to 40°C in operation / -20°C to 70°C in storage
*Humidity : 95% non-condensing

2-5 PHYSICAL CHARACTERISTICS

*Dimension : 115(H) X 54(W) X 5.5(D) mm
*Weight : 40g

USA CHANNEL LIST

CHANNEL NUMBER	CHANNEL FREQUENCY
1	2412MHz
2	2417MHz
3	2422MHz
4	2427MHz
5	2432MHz
6	2437MHz
7	2442MHz
8	2447MHz
9	2452MHz
10	2457MHz
11	2462MHz

3. INSTALLATION for Windows 95(OSR2) / 98

* **Install the Access Point at first. AP is need in case of In** mode.

* **Install the network protocol required to communicate on your network. Most likely you will need the TCP/IP protocol.**

3-1 Installation Procedure

<u>**Do not insert the PCMCIA card until you are asked to do so, failure of which may result in unsuccessful installation of your PCMCIA WLAN card.**</u>

Please follow the following step one by one in order to install the PCMCIA card successfully.

1) **Power in your computer and allow Windows 95 (OSR2)/98 to load fully.**

2) **Be sure that there is no PCMCIA adapter inserted yet.**

3) **Insert the given Installation CD in the CD-ROM. Select the Setup directory and then click on the SETUP.**

4) **Accept the license agreement.**

5) **Select the ESSID. Default ESSID is IEEE 802.11 LAN. You can change this later also using the configuration utility or network configuration. Click on Next.**

6) **Select network type and click on Next. Default is Infrastructure.**

7) **Give the path of the destination folder. To set the path of your choice click on Browse and then click Next.**

8) **It takes a few seconds for copying the utility files. Select the "No, I will restart my computer later." and then click on Finish.**

9) **Insert the PCMCIA card. Illuminating LED and SOUND confirms the detection of your PC card. Also you will see the PCMCIA Card icon on the right bottom of your screen.**

10) **Check for the MIRAE 11Mbps Wireless PCMCIA LAN Card by right clicking on My Computer using the mouse. Select the Device manager and then Network Adapters. If you find the Yellow (?) sign on the adapter, it shows the installation is not successful. Select the adapter and click on Remove. Restart your computer after uninstalling the driver to make the**

changes effective.

11) **Right click on the Network Neighborhood using the mouse.**

12) **Select Properties from the pop up menu. The network box appears and you see three main tabs : Configuration, Identification and Access Control.**

13) **Click on the Configuration tab and then click on the Add button. Select Network Component Type box appears. Click on the Protocol then click Add button.**

14) **Select Network Protocols box appears. From the list of manufactures, click on Microsoft. From the list of network protocols list, select NetBEUI, then click OK.**

15) **The NetBEUI protocol is now installed. After clicking on OK return back to Network Component Type box.**

16) **Repeat the step 13 and 14 to add IPX/SPX protocol.**

17) **Repeat the step 13 and 14 to add TCP/IP protocol.**

18) **Click on the TCP/IP option for setting the IP address for your computer. You can select either Static or DHCP settings. If you use the static IP setup then enter the IP value, Subnet masking, DNS, Domain/Workgroup name, and Gateway Address values. After setting these parameters appropriately, click OK to return to Network Component Type and you can select the File and Printer Sharing options as well as the Access to your computer by other users connected to that network by setting the computer sharing options. Click OK.**

19) **Screen message do you want to restart your Computer will pop up. Select Yes. It will shut down your computer and will restart.**

3-2 Uninstallation Method

If you want to unistall the PCMCIA card under Win 95 (OSR2)/98, click on the Start at the left bottom of your screen. Select the Programs. Click on the MIRAE 802.11 and click on Uninstall. Confirm message about removing the "Mirae uninstall" and all of its components appear. Click on Yes. UnistallShield removes the software "Mirae uninstall" successfully. Click on OK to finish the uninstall procedure.

3-3 Configuration utility

during the installation of your Mirae Wireless LAN Card, c[...]
also installed. You can see the icon at the right bottom of [...]
**clicking on that icon will show you the screen as shown below.**
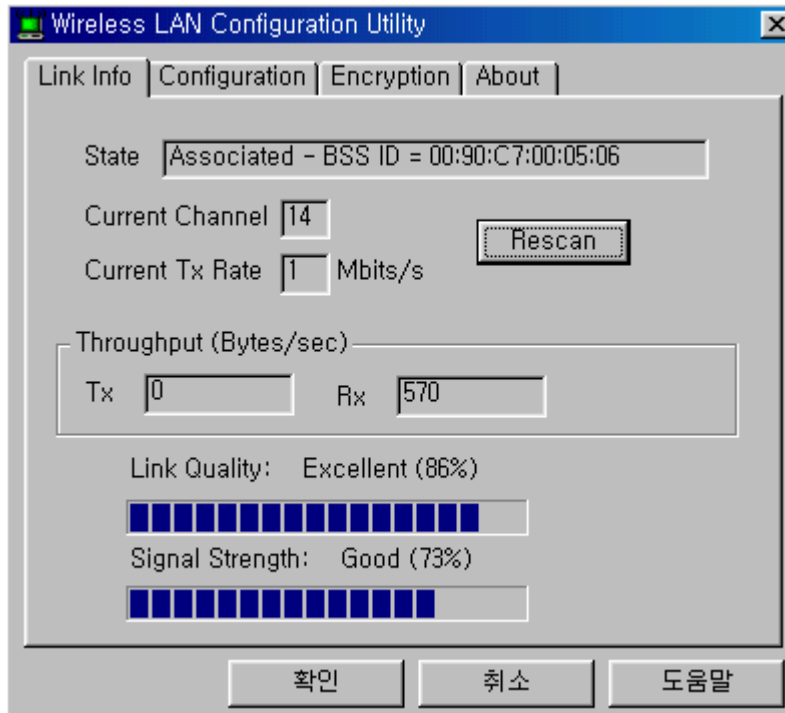
State : State explains whether the client is connected to ESS or not. It also shows the identification MAC address of the BSS to which this is connected currently.

Current Channel : Channel number is the channel available for the Communicat ions between the clients and AP or between the clients only. In case of the Infrastructure Network Mode, the channel number is scanned automatically (Need not to worry about setting the channel number), while in case of the Ad-hoc Network Mode; the channel number is set by the client and can be changed by the client later.

Link Quality : This is the measure of the radio link.

Signal Strength : This is the measure of the signal Strength. The measured signal Strength gives the overall Link Quality and Connection Status.

You can change the configuration by clicking on the Configuration Change. When you click on the Configuration Change, you see the screen given below.
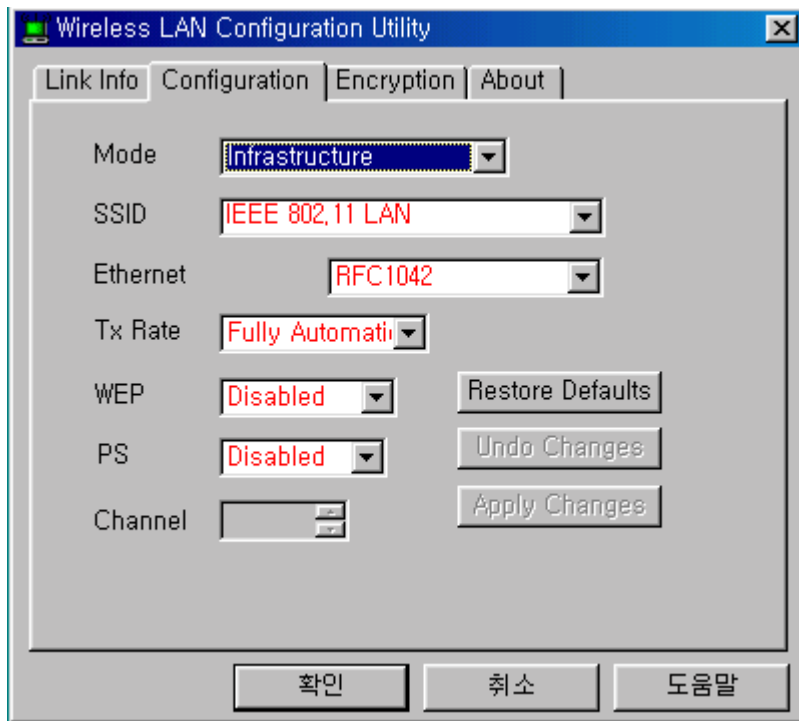
Configuration Change screen allows you to set the parameters as explained below.

Mode : You can set the Network Mode to Infrastructure or Ad-hoc.

SSID : The SSID can be changed to any value. But that should be the same that of AP.

Ethernet : The default is RFC1042. You can also choose Encapsulation.

TX Rate : The transmission rate at which the data packets are transmitted by the client or AP. You can set this to Auto select 1 or 2 Mbps, Fixed 1 Mbps, Fixed 2 Mbps, Fixed 5.5 Mbps, Fixed 11Mbps or Full Auto (1 to 11Mbps).

Important : You must know the TX Rate that your AP can support. Failure to which may cause the undesired results.

WEP Required : WEP stands for Wired Equivalent Privacy. WEP is an encryption scheme that provides the secure wireless data communications to the users. WEP uses a 40-bit key to control the network access. In order to decode the data transmission, each wireless client on the network must use the identical 40-bit key.

PS Mode : PS stands for Power Saving Mode.

Channel : You can change the channel number. In case of the Ad-hoc Network

Mode, the change in the channel number is effective. In case of the Infrastructure Network Mode, changing the channel number is of no concern as the channel is scanned automatically. Please see the table for the requirements of different countries and the channel frequency.

After changing the settings in the Configuration Change Dialog box, click on Apply Changes. It takes a few seconds to set the changes that you made. Then you can visualize the Connection State, Link Quality, Signal Strength respectively.
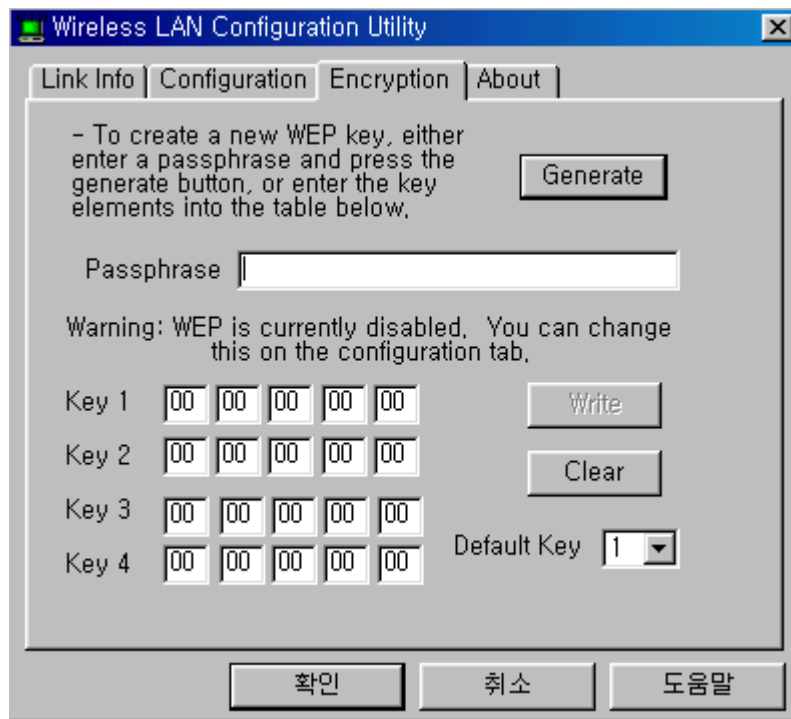
WEP Security : To provide the secure communication over the wireless medium, we have provided the WEP key. There are two ways of generating this key. This key is an important in protecting the illegal access to the wireless networks.

You have to set the key at the Access Point also. And all the users who want to contact/share the resources must type the same key. The WEP key works in the infrastucture mode only. There are two option in case of the WEP. You can select either of Disable, and Mandatory. If you select Disabled, the communications between clients and clients and AP is not secure. If you select mandatory, you need to setup the AP also and enter the same Key for communicating other clients associated with the AP or with AP itself.

WEP Key Generation : There are two ways of generating the
by entering any text in the Passphrase. And click on Generate WEP keys Key 1, Key 2, Key 3, and Key 4. You can select any If you do not select any Key, Key 1 is selected, as it is default key. Then click on Write and it will update the registry and driver.

Another WEP key generation method is by inserting the Key values directly from the keyboard. And click on the Write to update driver and registry. Select the Key number and use that Key for accessing the Access Point. If the Key is not entered correctly, a client cannot access the resources. This Key value protects the illegal access to the wireless network resources. As the wireless channel is more prone to the illegal access, WEP provides the users safe access.

Warning : Use of the WEP key makes your data secure but there is degradation in the throughput performance when we employ the WEP key.

5. ADJUST AND MEASUREMENT

5-1 Test Utility Software Installation

NOTE: <u>Perform after Windows Driver Installation.</u>
Step 1. Insert the Test Utility CD into the CDROM drive.
Step 2. On the Desktop, left click on <Start> -> <RUN>
      then type D:\TestUtil <Enter>. Follow the on-screen instructions.
      Accept all defaults. When the installation is complete, an icon should
      automatically appear on the Desktop.

5-2 Hardware Installation

Step 1. Ensure that power to the PCMCIA slot is OFF by noting that the PCMCIA icon does not appear in the System Tray on the Desktop. If unsure, re-boot the computer.
Step 2. Insert the Wireless LAN Card into the PCMCIA slot.
Step 3. The NS-1100M is a 3.3V only device. Do not therefore force it in a
      5V-keyed system as permanent damage may occur.

5-3 Using the PRISM Test Utility (PTU) Software

The Test Utility permits continuous operation of the transmitter. It is therefore convenient for performing RF measurements such as Transmitter Power. It also provides a handy method of changing channels within the ISM band, Use of the Mirae Transmitter Test Utility is basically self explanatory.
An icon was automatically created on the desktop when the Test Utility installation was performed. It may be run by double-clicking on this icon.

5-4 Using the LANEVAL Software

LANEVAL provides a convenient method of analyzing Packet Error Rate (PER) and Receiver Sensitivity. An icon for starting LANEVAL was automatically placed on the desktop when the Test Utility installation was performed.
In order for LANEVAL to form a successful link, the same packet parameters (e.g., Packet Length, Packet Pad Words, etc.) most be programmed at each end of the link.
LANEVAL runs in conjunction with the NDC Driver. The Driver permits selection of Data Rate and Channel. It is normally run in the Pseudo IBSS mode as this provides a simple wireless Ad Hoc link between two computers. The NDC Driver

may be easily accessed by double-clicking on its.

5-5 Transmit Tests

The following tests assume that all losses have been ca̲ equipment (attenuators, power splitters, cables, ...)

"DUT" is the MIRAE wireless LAN card which should be tested, and "REF-SET" is the MIRAE LAN card with known characteristics.

1. **The RF switch should be set to allow use of Antenna 1(CR9 : value A0).**
   PTU test program – Alige BBP mode (Baseband Processor CR9 : A0) seting.
2. **Set DUT as follows: Antenna 1 (Baseband Processor register CR9 : value A0), Channel 1 select , Continuous 11Mb Transmit Mode select.**
3. **Set the Spectrum Analyzer as follows:**
   Center Frequency: 2412MHz (1st Channel)
   Span: 66MHz , VID BW 10KHz , RES BW 300KHz
   Reference Level: 0dBm
   Leave all other Spectrum Analyzer settings at "Automatic"
4. **Allow the transmitter to warm up for 1 minute before continuing.**

5-5-1 Adjust and Measure Output Power for -30dBc first side lobe
1. **Change the output power by Manual Tx Control (Baseband Processor register CR31) in order to achieve the difference between the signal level at center frequency and higher first side lobe of 30dBc (monitor at the Spectrum Analyzer).**
2. **Record power output level from the Power Meter and Tx Power Measurement (Baseband Processor register CR58), and the value of Manual Tx Control (Baseband Processor register CR31).**
4. **Record values for the first and the second sidelobes. Second side lobe must be -50dBc even if in the noise floor.**

5-5-2 Carrier Frequency Accuracy Test (Channel 6)
1. **Set the Spectrum Analyzer as follows:**
   Center Frequency: 2437MHz (6th channel),
   Span: 10MHz

Amplitude: 0dBm

2. **Turn off DUT spreading and scrambling codes. (Baseband Processor register CR9 : value 18)**

3. **Record the carrier level and frequency (Spectrum Analyze**

5. **Turn on DUT spreading and scrambling codes.**

5-5-3 Transmitter FER Test (Channel 6, -40dBm at the Receiver Antenna)

1. **Set DUT and REF-SET in the Broadcast mode.**

2. **Set DUT as follows: transmit mode FER test (packet transmission), Channel 6, 11Mb data rate.**

3. **Set the REF-SET to receive mode FER test with data rate of 11Mb on Ch 6.**

4. **Adjust the attenuators for -40dBm receive level at the REF-SET unit RF connector.**

5. **Record FER value at receiver side (REF-SET) after 1000 packets.**

5-6 Receiver Tests

5-6-1 Receiver FER Test

1. **Set DUT and REF-SET in the Broadcast mode.**

2. **Set DUT as follows: receive mode FER test, 11Mb data rate, Channel 1.**

3. **Set REF-SET to transmit mode FER test, 11Mb data rate, Channel 1.**

4. **Allow the transmitter to warm up for 1 minute before continuing.**

5-6-2 Receiver High and Low Power FER Test

1. **Apply -40dBm at the DUT antenna by setting the variable attenuator values (use the known value for REF-SET output power and offset attenuator settings for used passive components, like power splitters, and attenuators).**

2. **Record FER.**

3. **Increase attenuation value (by setting variable attenuators) in order to provide -75dBm level at the DUT antenna.**
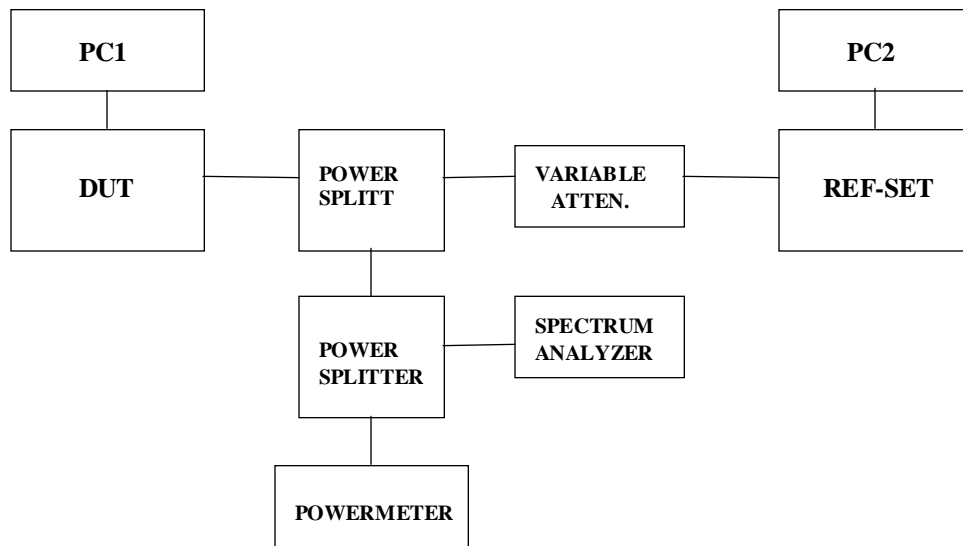
4. **Record FER.**

5-6-2 CW Jammer Adjacent Channel Rejection Test

1. **Set DUT and REF-SET in the Broadcast mode.**

2. **Set both, DUT and REF-SET, to channel 6.**

3. **Set data rate to 11Mb on both, DUT and REF-SET.**

4. **Set variable attenuation in order to provide -40dBm level at the DUT antenna.**

6. **Set Signal Generator to frequency 2412MHz (25MHz offset)and apply -48.4dBm jammer to the DUT antenna.**

6. **Record FER (DUT).**

7. **Turn off the Signal Generator.**

MIRAE TECHNOLOGY

FCC ID: O6ANANOSPEED

EXHIBIT #: 7R

Test equipment set up

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┌──────────┐                                    ┌──────────┐
│   PC1    │                                    │   PC2    │
└────┬─────┘                                    └────┬─────┘
┌────┴─────┐   ┌──────────┐   ┌──────────┐   ┌────┴─────┐
│   DUT    │───│  POWER   │───│ VARIABLE │───│ REF-SET  │
│          │   │  SPLITT  │   │  ATTEN.  │   │          │
└──────────┘   └────┬─────┘   └──────────┘   └──────────┘
                    │
               ┌────┴─────┐   ┌──────────┐
               │  POWER   │───│ SPECTRUM │
               │ SPLITTER │   │ ANALYZER │
               └────┬─────┘   └──────────┘
                    │
               ┌────┴─────┐
               │POWERMETER│
               └──────────┘
```