

## Conductive Testing—Isolating the Environment

Conductive testing could be used for many reasons, but the most common use is to isolate the Bluetooth® test setup from the surrounding environment. Interference from radio frequency (RF) sources is the most common reason for isolating the test from the environment. This is especially important when the environment contains RF sources using the industrial, scientific, and medical (ISM) radio bands from 2.4 to 2.485 GHz that are the bands used for *Bluetooth*.

“Conductive” in this context means that you are not “air sniffing”, that is, capturing *Bluetooth* transmissions on the ComProbe analyzer antenna. The conductive test setup uses coaxial cable to directly connect the Device Under Test (DUT) to the analyzer antenna connectors. The coaxial cable provides the isolation from the environment through shielding.

### **Bluetooth Transmitter Classes**

*Bluetooth* transmitters are categorized by power classes, that is, by the amount of RF power output. A *Bluetooth* Class maximum operating range is directly related to the power output. The class is important in conductive testing because the DUTs and the ComProbe Soderia are connected directly to each other, usually over small distances. The absence of power loss, which occurs during over-the-air transmission, means that larger than normal power levels may be present at the receiving port. Attenuation may be necessary to protect both the DUT and the ComProbe Soderia from excessive power input and to ensure reliable operation.

The table lists the maximum power and operating range for each Bluetooth Class.

Table 1.1 - *Bluetooth* Power Classes

Class	Maximum Power	Operating Range
1	100 mW (20 dBm)	100 meters
2	2.5 mW (4 dBm)	10 meters
3	1 mW (0 dBm)	1 meter

### **Test Equipment**

While exact conductive test setups are dependent on the specific circumstances surrounding the DUT RF interface, the following equipment is required for all test setups.

1. Coaxial cable with adapter for connecting to DUT 1.
2. Coaxial cable with adapter for connecting to DUT 2.
3. Coaxial T-connectors: 1 for ComProbe Sodera, 2 for ComProbe BPA 600.
4. SMA adapters for connecting coaxial cable or attenuators to the ComProbe antenna connectors: 1 for ComProbe Sodera, 2 for ComProbe BPA 600.
5. Attenuators depending on the *Bluetooth* Class being tested.
6. Frontline ComProbe analyzer that can be either of the following
  - a. ComProbe Sodera Wideband *Bluetooth* Protocol Analyzer or
  - b. ComProbe BPA 600 Dual Mode *Bluetooth* Protocol Analyzer
7. Personal computer for running ComProbe software.

### Test Setup

The following figure show the conductive test setup. For information on setting up and operating the ComProbe Sodera and ComProbe BPA 600, refer to the ComProbe User Manuals at [fte.com](http://fte.com).

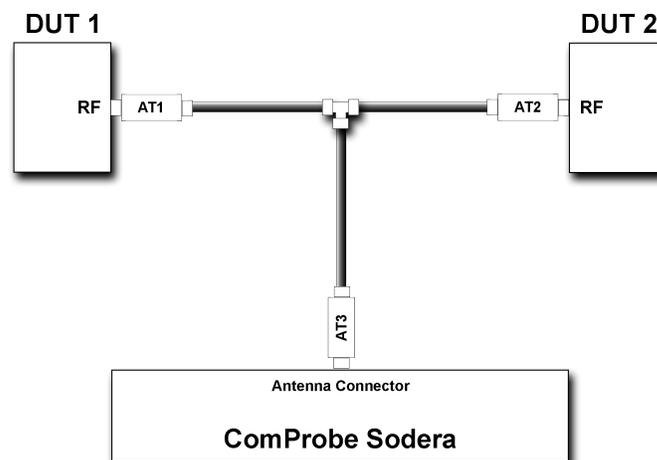


Figure 1 Sodera Conductive Test Setup



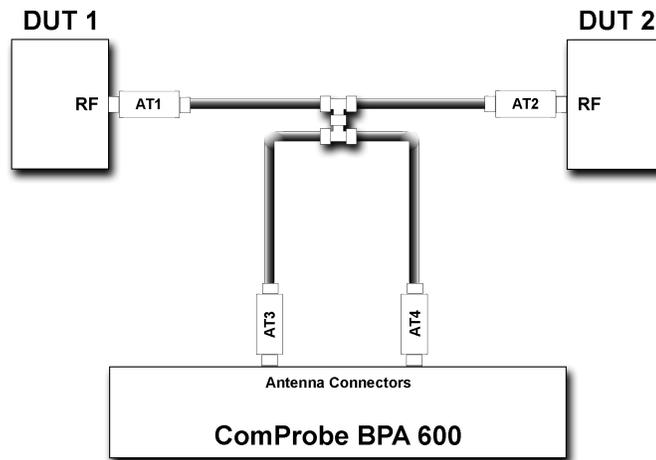


Figure 2 BPA 600 Conductive Test Setup

Both ComProbe BPA 600 antennas must be connected as shown.

The AT1 through AT4 attenuator values will depend on the DUT1 and DUT2 transmitter Class. At higher power levels all four attenuators may be needed. In all cases, use good engineering practices to protect the devices under test and the ComProbe hardware from damage, and to ensure reliable operation.

Assuming that there is no attenuation in the test setup:

- For Soderia
  - At the T-connector the power will split in half. For example, if DUT1 is a Class 1 device transmitting +20 dBm (100 mW), at the T-connector it will split with +17 dBm (50 mW) going to DUT2 and +17 dBm (50 mW) going to the ComProbe Soderia.
  - If DUT1 or DUT2 is a Class 2 device, +10 dBm (12.5 mW) will reach the ComProbe analyzer antenna connector. If they are Class 3 devices, -3 dBm (0.5 mW) will reach the antenna connector.
- For BPA 600
  - At each T-connector the power will split in half. Therefore the power reaching the ComProbe protocol analyzer will be one-fourth the transmitted power. For example if DUT1 is a Class 1 device transmitting +20 dBm (100 mW), at the first T-connector it will split with +17 dBm (50 mW) going to DUT2 and +17dBm (50 mW) going to the ComProbe analyzer.
  - The +17dBm (50 mW) going to the ComProbe analyzer splits again. Each coaxial cable going to a ComProbe analyzer antenna connector carries +14 dBm (25 mW).
  - If DUT1 or DUT2 is a Class 2 device, +8 dBm (6.25 mW) will reach each ComProbe analyzer antenna connector. If they are Class 3 devices, -6 dBm (0.25 mW) will reach each antenna connector.

Attenuation should be selected to limit the received power levels to prevent equipment damage, and to provide sufficient power to reliably operate the equipment. If using attenuation follow these recommendations:

- If the devices are of the same class, the attenuators AT1 and AT2 should be of equal value.
- For ComProbe BPA 600 attenuators AT3 and AT4 should be of equal value.



- Determine the maximum power received at the ComProbe antenna jacks. Then select an appropriate attenuator value to limit the input power to -20 dBm (10  $\mu$ W) maximum.

## Test Process

After connecting DUT1, DUT2, and the ComProbe Soderia or ComProbe BPA 600, follow these steps to capture *Bluetooth* data.

1. Pair DUT 1 and DUT 2.
2. Establish data transmission between DUT 1 and DUT 2.
3. Begin capture of the data with the ComProbe Soderia or ComProbe BPA 600. (Refer to the ComProbe User Manuals at [fte.com](http://fte.com).)
4. Conduct protocol analysis with the ComProbe software on the personal computer or save the capture file for future analysis.

For any questions concerning conductive testing, contact Frontline technical support at 434-984-4500 or email [tech\\_support@fte.com](mailto:tech_support@fte.com).

## Technical Support

Technical support is available in several ways. The online help system provides answers to many user related questions. Frontline's website has documentation on common problems, as well as software upgrades and utilities to use with our products.

Web: <http://www.fte.com>, click Support

Email: [tech\\_support@fte.com](mailto:tech_support@fte.com)

If you need to talk to a technical support representative, support is available between 9am and 5pm, U.S. Eastern time, Monday through Friday. Technical support is not available on U.S. national holidays.

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