Isolation Testing Procedure

Only when the "Donor Antenna Testing Procedure" and "DAS Testing Procedure" have both been performed can the Isolation Testing take place. This is because the first two testing methods make sure that each individual component (the Donor and the DAS) are working properly before measuring the signal strength between the two, otherwise the isolation reading will not be a meaningful result.

The results of Isolation Testing are very important to the overall system. This is the value that will determine the maximum amount of gain that we can safely use on the system without creating the oscillation problem.

Isolation Value = Signal In – Signal Out

The isolation value is a measurement of signal losses between the donor antenna on the roof and the DAS inside the building. The test will be performed twice, first by generating a test signal into the DAS and measuring the test signal at the donor antenna, and again generating a test signal into the Donor antenna and measuring the testing signal into the DAS.

Isolation testing is most commonly performed using the spectrum analyzer tracking generator as the signal source and the spectrum analyzer as the receiver but can be performed using the portable radio as the signal sources and the spectrum analyzer as the receiver.

Sample Units:

- 800MHz Public Safety Band
- Downlink (DL): 851MHz - 860MHz
- Uplink (UL): 806 - 815MHz

Sub-Procedures:

1. Set the Spectrum Analyzer - Frequency Span
2. Set the Spectrum Analyzer - Markers
3. Set the Spectrum Analyzer - Resolution Bandwidth
4. Set the Spectrum Analyzer - Amplitude
5. Set the Spectrum Analyzer - Tracking Generator
6. Measure DAS to Donor Isolation
7. Measure Donor to DAS Isolation
8. Measure Isolation with Portable Radio

Requirements:

- Radio Solutions, Inc. (RSI) Test Accessory Kit
- Rigol DSA-815 Spectrum Analyzer with Tracking Generator (TG)

Note: **Bold, green text** indicates a selection on the Spectrum Analyzer

1. Set the Spectrum Analyzer – Frequency Span

Set the spectrum analyzer to show the full frequency span as to include both the uplink and downlink bands, +/- 10MHz.

Adding the 10MHz will show the passband cut-off / roll-off, verifying that there are no spurious emissions coming from the BDA.

An 800MHz band (UL: 806-815 and DL: 851MHz-860MHz) requires a span with a 796MHz start frequency and 870MHz stop frequency.

Procedure:

1. Power up the Spectrum Analyzer, which will default to factory settings

2. Set the Start Frequency:
   FREQ > Start Freq > 796 > MHz

3. Set the Stop Frequency:
   Stop Freq > 870 > MHz

2. Set the Spectrum Analyzer – Markers

A "Marker" is a Point-of-Interest that show measurements taken on a specific frequency. The spectrum analyzer can display up to four (4) markers on the screen. For example: to derive the signal level of 850MHz, one must set the marker to 850MHz and then see its corresponding marker measurement value.

The four (4) markers need to be set to the following frequencies:

- Median frequency of the Downlink Passband; the passband frequency range is labeled on the BDA module (e.g. the median frequency between 851MHz and 860MHz is 855.5MHz)

- Downlink user-specific frequency (i.e. Fire Radio Channel Downlink)

- Median frequency of the Uplink Passband; the passband frequency range is labeled on the BDA module (e.g. the median frequency between 806MHz and 815MHz is 810.5MHz)

- Uplink user-specific frequency (i.e. Fire Radio Channel Uplink)

When markers are set, one can measure and verify the gain and power values for both the frequency of interest (i.e. the actual user frequency), as well as the median frequency of the passband (i.e. the reference value on the BDA control panel display).

Procedure:

Using the spectrum analyzer, prompt the Marker Table by configuring the following frequencies (see Figure 1.1):

1. **Mkr > 855.5 > MHz**
   (sets the first marker to the median frequency of the downlink passband)

2. **Mkr > Normal > 857 > MHz**
   (sets the second marker to the downlink user-specific frequency)

3. **Mkr > Normal > 810.5 > MHz**
   (sets the third marker to the median frequency of the uplink passband)

4. **Mkr > Normal > 812 > MHz**
   (sets the fourth marker to the uplink user-specific frequency)

5. Scroll Down to **"1/2" > Mkr Table**
   (will display the marker table that consists of all four (4) markers)

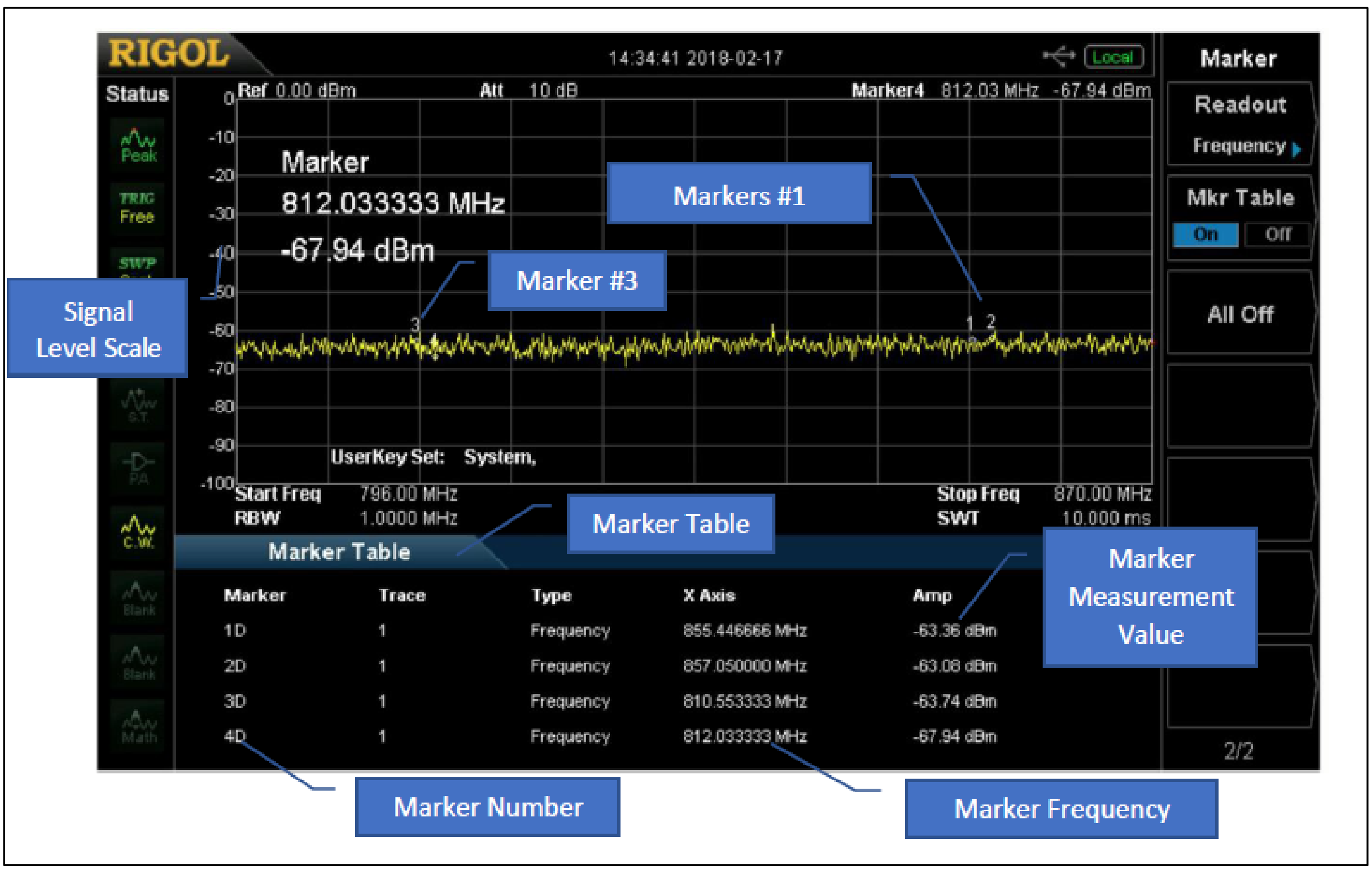

Figure 1.1

3. Set the Spectrum Analyzer – Resolutions Bandwidth

Procedure:

1. **BW / Det > RBW**

2. Use the rotary knob to adjust the RBW value to **10KHz** (see Figure 1.2)

Figure 1.2

4. Set the Spectrum Analyzer – Amplitude

The Amplitude is going to be used to increase the sensitivity of the Spectrum Analyzer to received signals. This will give a clearer display of signals at the lower levels we would expect to see with this test.

Procedure:

1. **AMPT > Input ATT >** Using **Rotary Knob** adjust Att to **0dB**

2. **Page Down > RF PreAmp > On**

5. Set the Spectrum Analyzer – Tracking Generator

The Tracking Generator ("TG") is a signal producer that creates a radio signal on the same frequency as the one received by the spectrum analyzer.

Procedure:

1. **TG > TG Level**

2. Use the rotary knob to adjust the desired level to **0dBm**

6. Measure DAS to Donor Isolation

Procedure:

1. Connect the test cable to the "Gen Output" on spectrum analyzer and connect the other end of the test cable to the DAS cable head-end.

2. Connect a second test cable to the "RF Input" on the spectrum analyzer and connect the other end of the test cable to the Donor Antenna cable head-end. (See Figure 1.3)

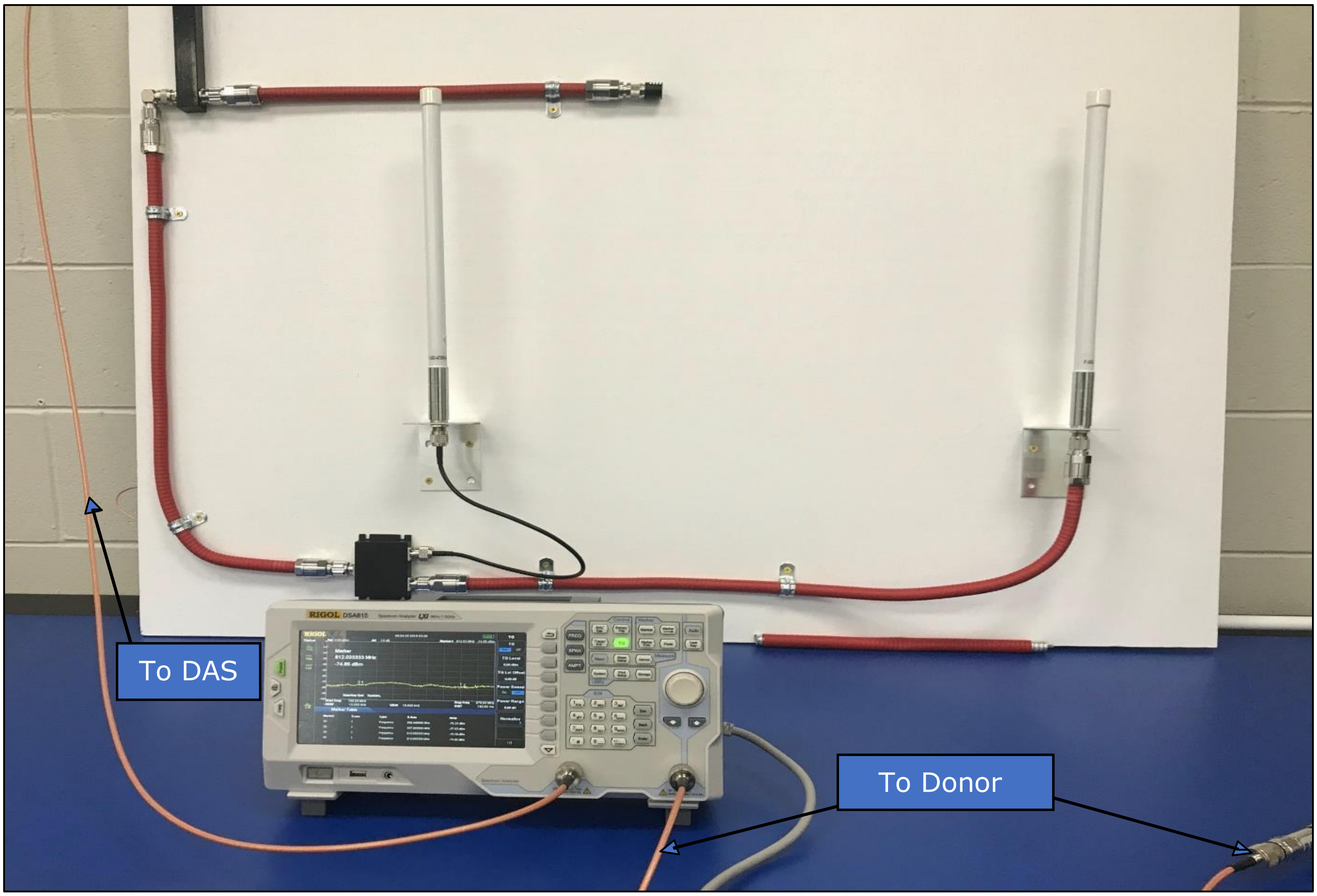

Figure 1.3

3. **TG ON**

The results should appear as shown in Figure 1.4:

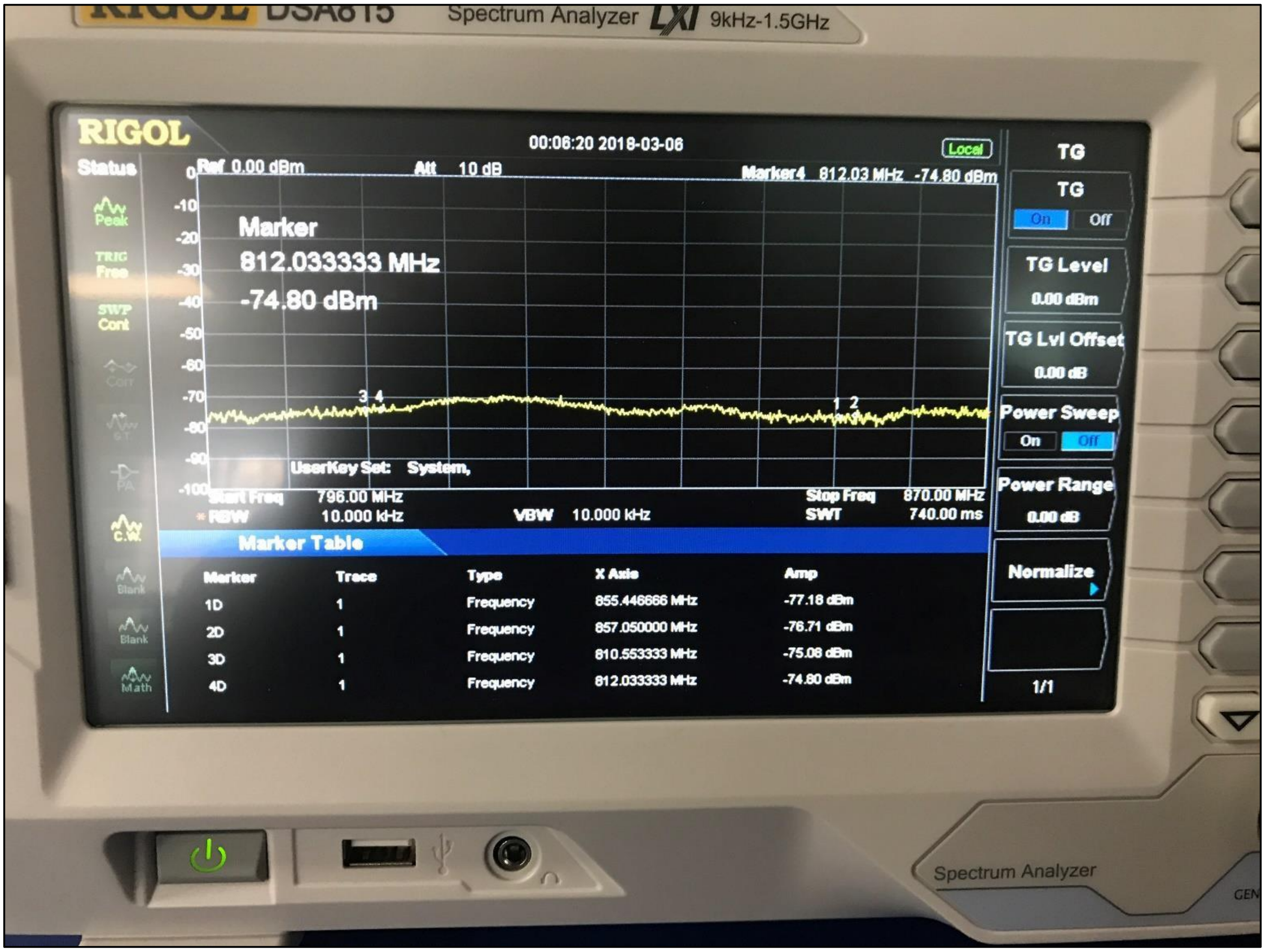

Figure 1.4

3. Record the Readings of Markers 1,2,3 & 4

4. Calculate the Isolation.

The highest reading of the recorded markers will be the value used to calculate the Isolation. In this example the highest reading is on marker 1D, with an approximate -77dB loss.

(Set Gain) **–** (dB Loss Reading) **=** Isolation

(0dBm) **–** (- 77dB) **=** 77dB Isolation

Note: If the isolation value is high (greater than 110dB), refer to sub-procedure 7 "Measure Isolation with Portable Radio".

5. **TG OFF**

6. Disconnect the test cable from the "Gen Output" on the spectrum analyzer

7. Disconnect the test cable from the "RF Input" on the spectrum analyzer.

7. Measure Donor to DAS Isolation

Procedure:

1. Connect the test cable to the "Gen Output" on spectrum analyzer and connect the other end of the test cable to the Donor Antenna cable head-end.

2. Connect a second test cable to the "RF Input" on the spectrum analyzer and connect the other end of the test cable to the DAS cable head-end.

3. **TG ON**

4. Record the Readings of Markers 1,2,3 &4

5. Calculate Isolation:

The highest reading of the recorded markers will be the value used to calculate the Isolation.

(Set Gain) **–** (dB Loss Reading) **=** Isolation

It is normal for the isolation to vary between the uplink and downlink because of interactions of a nearby BDA in other locations

Note: If the isolation value is high (greater than 110dB), refer to sub-procedure 7 "Measure Isolation with Portable Radio".

6. **TG OFF**

7. Disconnect the test cable from the Donor Antenna cable head-end and disconnect the other end from the "Gen Output" on the spectrum analyzer.

8. Disconnect the test cable from the DAS cable head-end and disconnect the other end from the "RF Input" on the spectrum analyzer.

9. Reconnect the DAS cable head-end to the DAS port of the BDA.

10. Reconnect the Donor Antenna cable head-end to the Donor Antenna port of the BDA.

8. Measure Isolation with Portable Radio

When performing Isolation testing, if the isolation value is high (greater than 110dB) the TG generated 0dBm, from the spectrum analyzer, may not be enough signal strength to display isolation due to noise floor and limitations of the instrument.

An alternative method, using the portable radio, may be keyed in to generate a greater signal of 32dBm.

Procedure:

A. DAS to Donor Isolation

1. Disconnect the portable radio's antenna and, using a test cable, directly attach the portable radio to the DAS cable head-end.

2. Connect a second test cable to the "RF Input" on the spectrum analyzer and connect the other end of the test cable to the Donor Antenna cable head-end (See Figure 1.5).

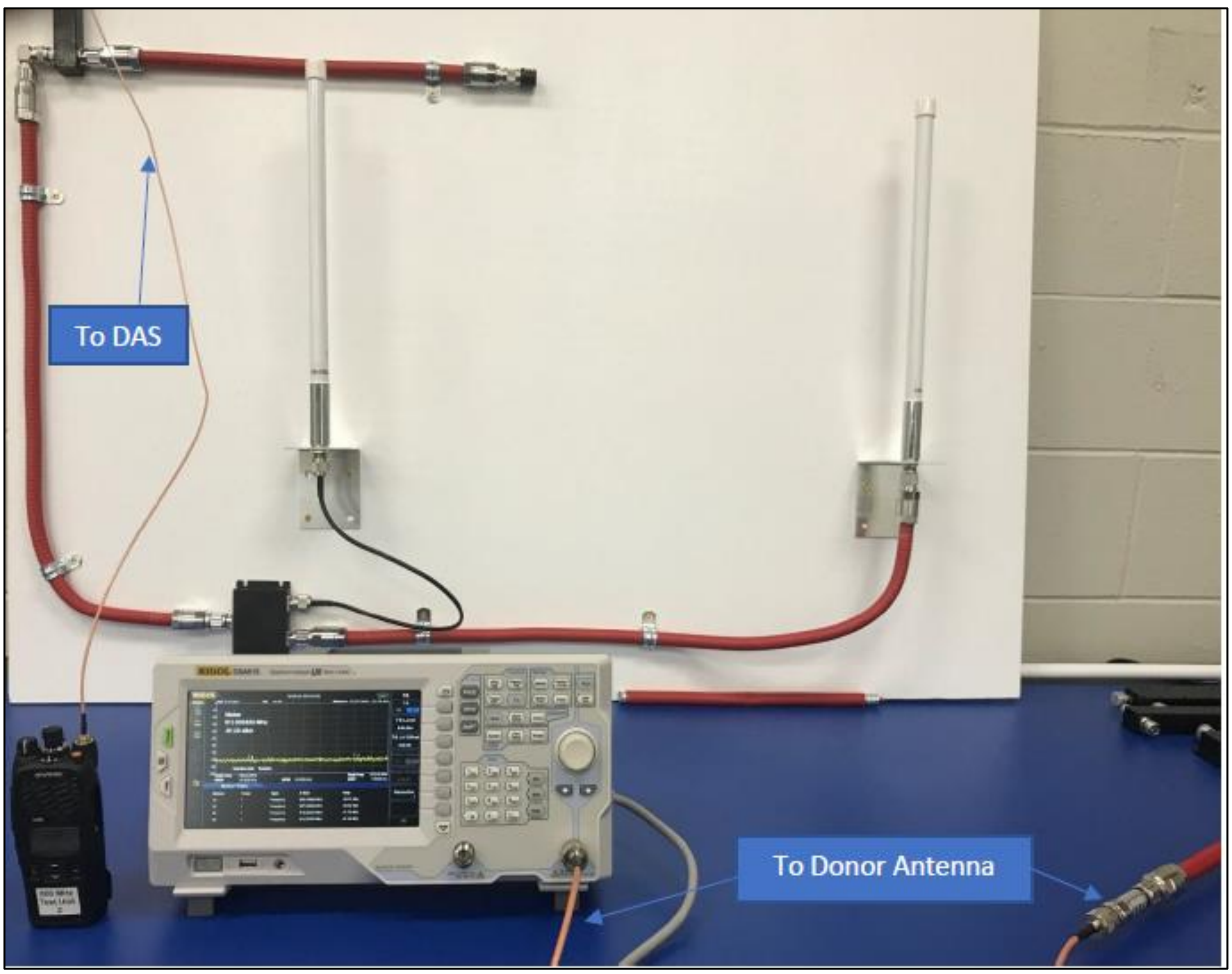

Figure 1.5

3. Without turning the TG ON, key the radio and hold the key.

4. Select **Mkr**

5. Select **Peak**

6. Release the radio key.

7. Record the reading of Marker 4D (see figure 1.6).

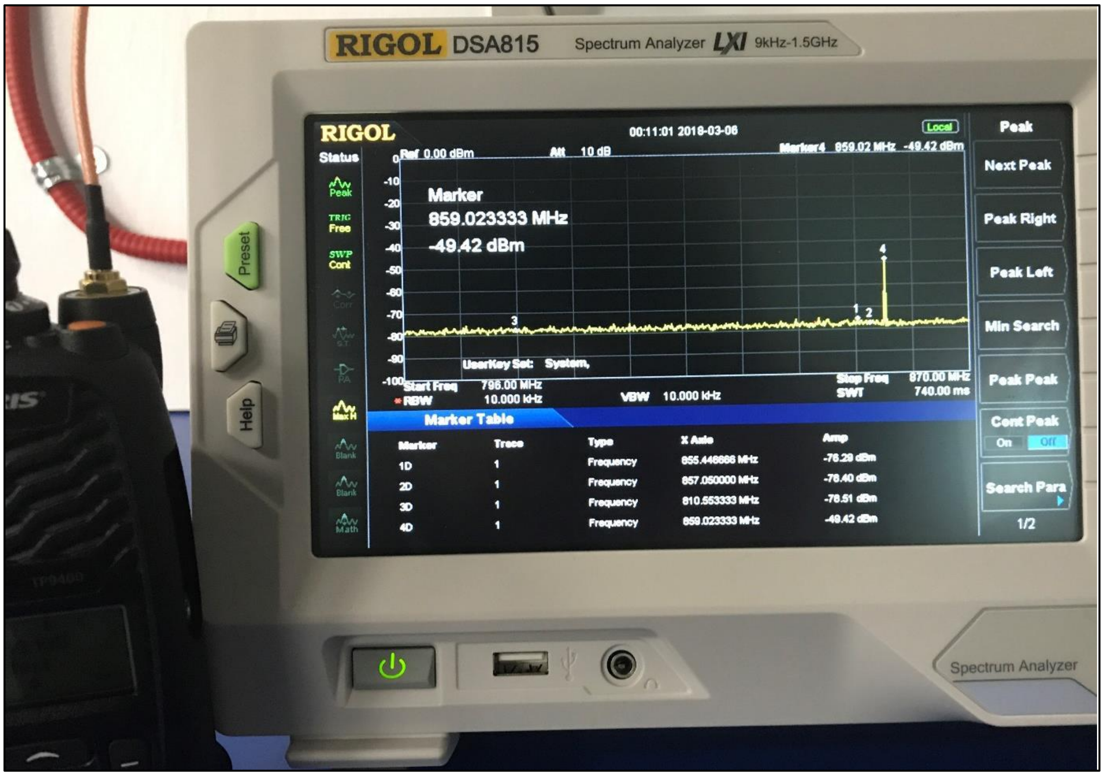

Figure 1.6

8. Calculate the Isolation. The portable radio transmits a signal of +32dBm. In this example, the signal reading at 4D (the frequency at which the radio is keyed into) is reading an approximate -49dB loss.

(Set Gain) **–** (dB Loss Reading) **=** Isolation

(+32dBm) **-** (-49dB) **=** 81dB Isolation

9. Disconnect the test cable from the DAS cable head-end.

10. Disconnect the test cable from the Donor Antenna cable head-end.

B. Donor to DAS Isolation

This test will be performed just as before, but in reverse order:

1. Disconnect the portable radio's antenna (if not already disconnected) and, using a test cable, directly attach the portable radio to the Donor Antenna head-end.

2. Connect a second test cable to the "RF Input" on the spectrum analyzer and connect the other end of the test cable to the DAS cable head-end.

3. Without turning the TG ON, key the radio and hold the key.

4. Select **Mkr**

5. Select **Peak**

6. Release the radio key.

7. Record the reading of Marker 4D.

8. Calculate the Isolation. The portable radio transmits a signal of +32dBm. In this example, the signal reading at 4D (the frequency at which the radio is keyed into) is reading an approximate -49dB loss.

(Set Gain) **–** (dB Loss Reading) **=** Isolation

(+32dBm) **-** (-49dB) **=** 81dB Isolation

9. Disconnect the test cable from the DAS cable head-end.

10. Disconnect the test cable from the Donor Antenna cable head-end.