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**Test Method for Distortion of 2-way Amplifiers Caused
by Insufficient Isolation of Built in Diplex Filter**

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1. Introduction

1.1. Executive Summary

This test procedure applies as a method to measure distortion created in a 2-way amplifier caused by an upstream signal.

1.2. Scope

The purpose of this document is to establish the standard methodology to measure an amplifier's distortion caused by an upstream signal leaking through the diplex filter that is built inside of the amplifier of a Cable Telecommunications System (see Figure 1).

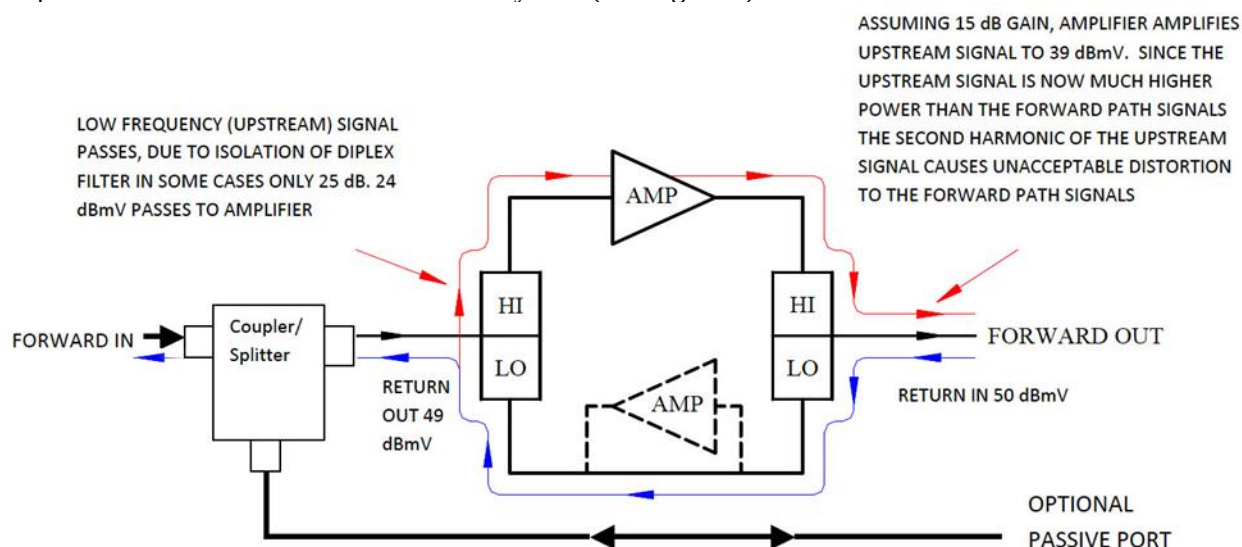


Figure 1 – Amplifier with diplex filters

In a two way Cable Telecommunication Systems, amplifiers are commonly used to amplify downstream signals. These amplifiers are designed as shown in Figure 1. They consist of two diplex filters with amplifier inserted in the high pass path, also known as the forward or downstream path. The low pass path (return or upstream) in most cases needs no amplification, and is used for upstream communication of modems, telephony, etc. In some cases, a return amplifier is used. Upstream communication uses high-level signals, reaching in some cases up to 55 dBmV. Serious problems with second harmonics can arise due to insufficient diplex filter isolation of amplifiers, as it can be seen in Figure 1. Diplex filter isolation is usually the worst in the last 2 MHz. of the high frequency end of the upstream pass band. If high-level signals are applied at these frequencies, second harmonics can be created causing distortion on the corresponding channel. If the amplifier also has a built in return amplifier, distortion problems can be even more serious, since the harmonic levels are higher by the gain of the return amplifier.

Measurement of this distortion is most practical by measuring the 2nd harmonic of a CW carrier, since signal generators and spectrum analyzers are commonly used in many other test procedures.

Please note that this procedure is a very unique procedure for testing 2-way amplifiers and distinguishes itself from other similar procedures in the following ways:

It is designed for two-way active measurement, is single port, measures energy that leaks around the loop, injects reverse frequency into reverse input (forward output), measures 2nd harmonic distortion at the same port, and is designed to measure leakage due to insufficient isolation of built-in diplex filter.

The procedure requires measurements at multiple frequencies because this is a very frequency sensitive measurement.

For similar procedures, please reference the following:

- ANSI/SCTE 115 2011: Test Method for Reverse Path (Upstream) Intermodulation Using Two Carriers
- ANSI/SCTE 145 2015: Test Method for Second Harmonic Distortion of Passives Using a Single Carrier
- ANSI/SCTE 109 2016: Test Method for Common Path Distortion

Each of these procedures targets a different measurement for a unique purpose. They are independent, are specifically applicable to the device being measured, use the test equipment commonly available at the manufacturing sites used to make the device being tested, and directly measure the impairment that must be controlled. The key differences are whether they are designed for actives or passives and whether they are single port or two port measurements. Other differences are the types of distortion products being measured and the filters required to do so.

1.3. Benefits

This test procedure provides a common method that can be used by both manufacturers and end users to test whether a 2-way amplifier meets second order distortion specifications when an upstream signal is input to the amplifier. Without such a common test procedure the testing used to prove amplifier distortion performance can vary and lead to uncertainty as to whether the amplifier distortion specifications are being met.

1.4. Intended Audience

The intended audience for this test procedure are manufacturers, evaluation laboratories, and end user technicians and engineers with the proper equipment to perform this testing.

1.5. Areas for Further Investigation or to be Added in Future Versions

At this time there are no areas for further investigation for this test procedure.

2. Normative References

The following documents contain provisions, which, through reference in this text, constitute provisions of this document. At the time of Subcommittee approval, the editions indicated were valid. All documents are subject to revision; and while parties to any agreement based on this document are encouraged to