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## Shielding Effectiveness Report

### HQDP



Mates with

QSH-DP, QTH-DP



**Description:**  
**0.50mm 100Ω Differential 30 AWG Twinax Cable Assembly**

**Series:** HQDP

**Description:** 100Ω Q Pairs® Differential Twinax Cable Assembly, 0.50mm pitch

### Table of Contents

Product Overview .....	1
Test Overview .....	1
Shielded Room Noise Floor Verification .....	1
Shielding Effectiveness Summary Data .....	3
Characterization Details .....	4
Measured Response.....	4
Product and Test System Descriptions .....	4
Product Description .....	4
Test System Fixturing .....	4
Appendix A– Test and Measurement Setup.....	6
Test Instruments .....	8
Measurement Station Accessories .....	8

**Series:** HQDP

**Description:** 100Ω Q Pairs® Differential Twinax Cable Assembly, 0.50mm pitch

## Product Overview

HQDP is a 100Ω differential double-row 0.5mm pitch cable assembly. The assemblies use 30 AWG twinax cable. HQDP is available in any length up to 2.5 meters. Systems are available at up to 60 differential pairs.

A pair of one meter HQDP-020-39.37-TTR-STL-1-N cable assemblies was tested for shielding effectiveness. The samples were mated to QSH-DP and QTH-DP test boards.

## Test Overview

IEC 61000-4-22 Annex F provides a standard test procedure for shielding effectiveness of cable assemblies and serves as the baseline test procedure for this test. Shielding effectiveness is a measure of an electromagnetic shield's performance. Typically, apertures, seams, slots, and holes result in leakage and reduces shielding performance from theoretical limits of >120dB to values in the 20-100dB range. Fixturing required to interface a cable assembly to instrumentation is custom for multi-position high-density cable assemblies and can affect test results. For this reason, the test fixtures are documented in detail in this report. For comparison purposes, the sample tested is compared to a 1 meter RG-316 coax cable assembly. This cable uses a single braid, terminated with SMA connectors, and serves as a reference standard.

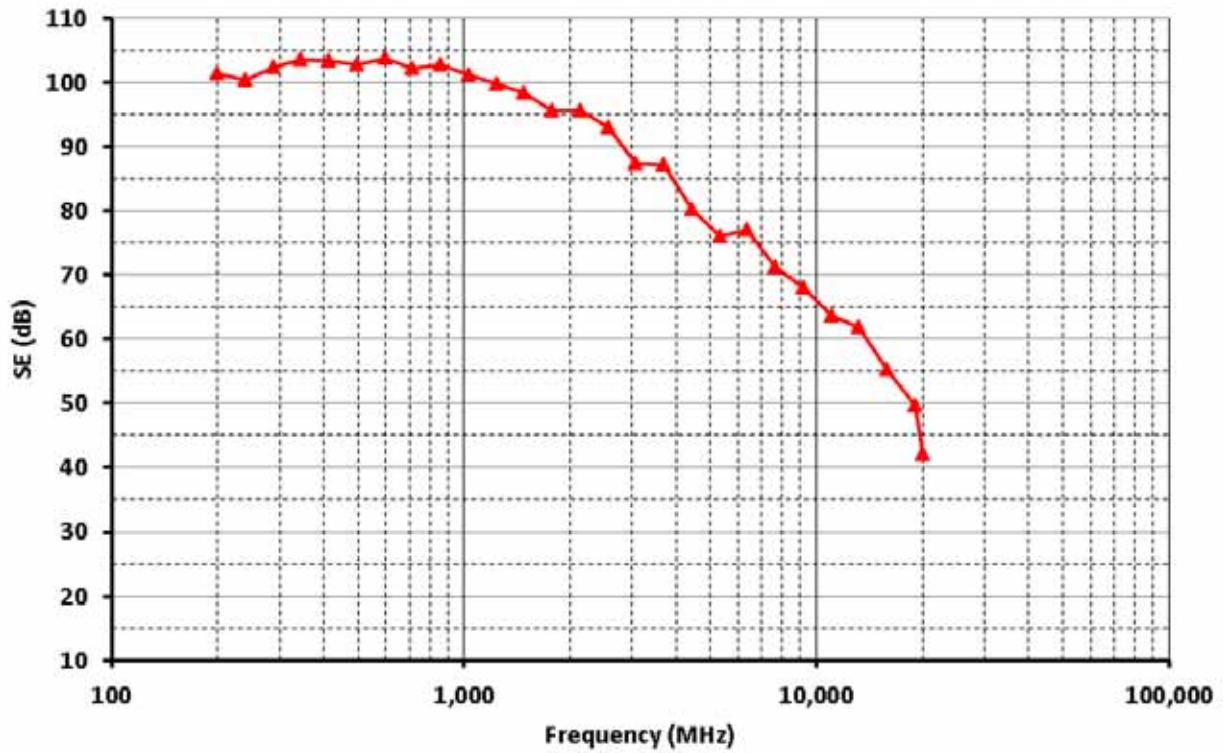
## Shielded Room Noise Floor Verification

Prior to performing shielding effectiveness testing of a particular sample, it is important to establish the noise floor of the anechoic test chamber by measuring the shielding effectiveness of the receive line while terminated at the bulkhead connector with a precision short. This is, in effect, a perfectly shielded sample. The difference between this measurement and that of an "in-band" antenna (per IEC 6100-4-21) is the maximum dynamic range of the measurement system. Any sample that has a shielding effectiveness greater than the dynamic range will therefore not be adequately characterized. The Samtec reverb chamber and instrumentation provides a dynamic range of roughly 100dB up to 1GHz and gradually degrades to 50dB at 20GHz. The measurement dynamic range degradation is due to increasing loss in the reverberation chamber metal walls.

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## Shielding Effectiveness - Dynamic Range



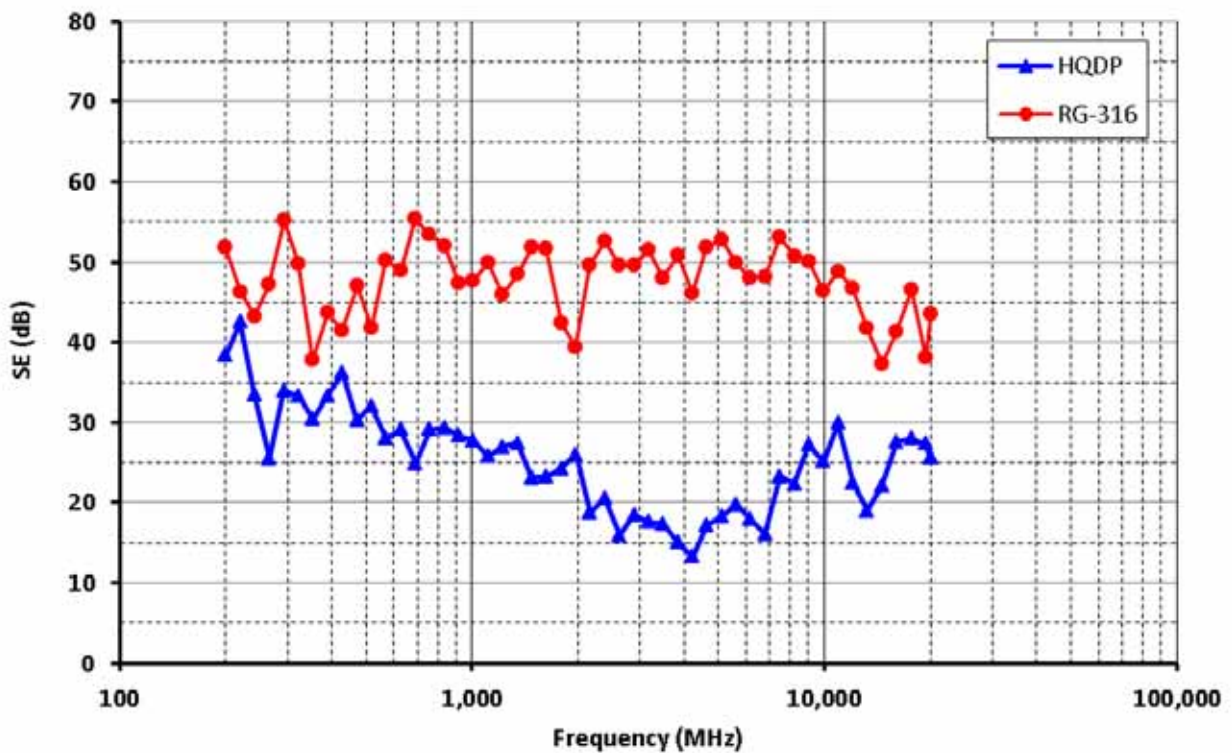
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## Shielding Effectiveness Summary Data

The graph below shows that the HQDP cable assembly provides roughly 25-35dB shielding effectiveness in the 200-500MHz range, roughly 20-30dB to 2GHz, and 15dB above 2GHz. In contrast, the RG-316 coax with single braid shield provides roughly 50dB of shielding effectiveness.

### Shielding Effectiveness - HQDP and RG-316



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## Characterization Details

This report presents data that characterizes the shielding effectiveness of a cable assembly in a controlled printed circuit board (PCB) environment. All efforts are made to reveal typical responses inherent to the system under test (SUT).

In this report, the SUT includes the cable assembly and mating connectors. The mating connectors are attached to test boards constructed with Samtec recommended footprints and routing practices.

## Measured Response

IEC 61000-4-21 does not specifically address fixturing aspects or measurement of high-speed differential cable assemblies. For this test, all twinax cables in the assembly are illuminated with RF energy in the reverberation chamber. The common mode response is obtained using a power splitter that combines energy from each signal conductor in one of the twinax. The remaining signal pairs are open circuited. While the cable assembly is intended to be used in differential applications, the common mode shielding effectiveness is reported. This is reasonable as it is generally accepted that common mode signals on cable assemblies are the dominant EMI mechanism.

## Product and Test System Descriptions

### Product Description

The product test sample was a one meter long HQDP cable assembly. The cable is terminated by soldering a small transition PCB (termination board) at each end. Each termination board has a connector soldered to it. Each cable assembly was tested by mating it to a QTH-DP/QSH-DP test board connector. The actual part numbers that were tested are shown in Table 1, which also identifies End 1 and End 2 of the assembly.

Length	Part Number	End 1	End 2
1000mm	HQDP-020-39.37-TTR-STL-1-N	QTH-DP	QSH-DP

### Test System Fixturing

All measurements were performed using QTH-DP/QSH-DP Final Inch® test boards. The test boards have trace lengths of 123mm and provide for the interconnection to the cable assemblies by use of replaceable SMA connectors. The test board and stackup are shown in the following pictures.

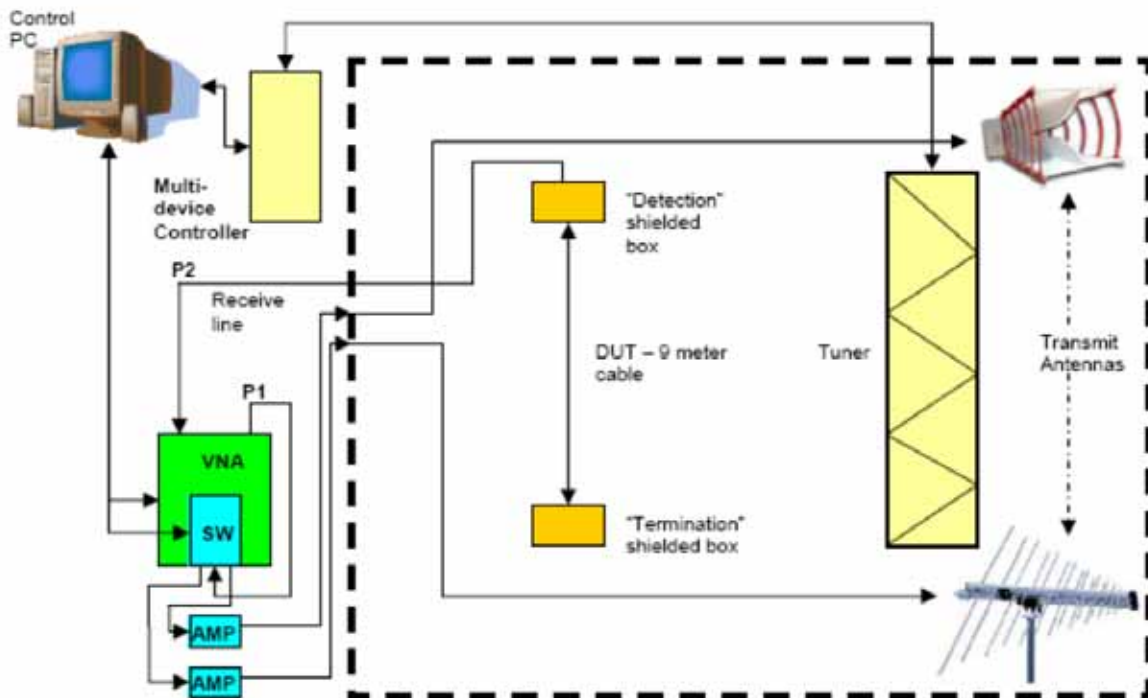


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## Appendix A– Test and Measurement Setup

The Mode Stirred Chamber (Reverberation) Method is documented in IEC 61000-4-21 and was used in this testing. The method relies on exposing a device to electromagnetic energy in a large resonant cavity (shielded room). An electrically large tuner perturbs the boundary conditions of the cavity resulting in different standing wave patterns and a randomized excitation of the device. Multiple device measurements are made at different tuner positions, and the results are averaged. Shielding effectiveness is defined to be relative to an in-band reference antenna for IEC 61000-4-21. If the shielding effectiveness is 20 dB, it means that the received power with the sample in place is 20 dB lower than the received power when a reference antenna is in place. A log periodic antenna serves as the reference from 200 MHz to 2 GHz, and a double-ridge guide horn antenna is the reference from 2 GHz to 20 GHz. This method has a practical high frequency limit determined by the instrumentation used, in this case 20 GHz. The low frequency limit is determined by the size of the chamber, which in this case is 200 MHz. The system used for this testing is a SMART 200 system by ETS-Lindgren and is shown in Figure 1.



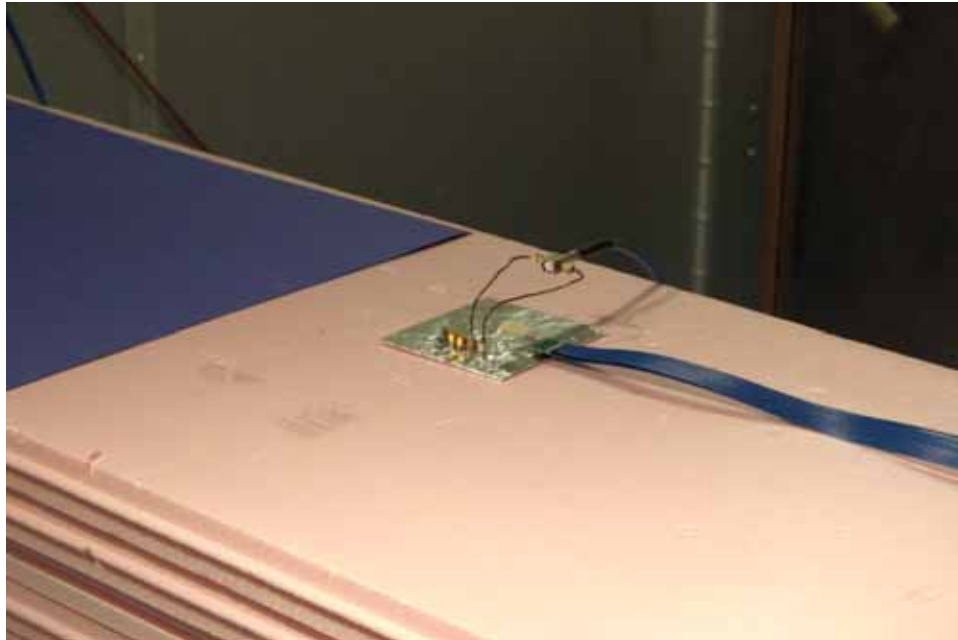
**Mode Stirred Chamber Method**

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**ETS/Lindgren 2090 Multi-Device Controller and HP Vector Network Analyzer**



**HQDP cable assembly in reverb chamber**

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**RG-316 single braid coax cable tested for comparison**

### **Test Instruments**

<u>QTY</u>	<u>Description</u>
1	ETS/Lindgren Smart200 Reverberation Chamber
1	ETS/Lindgren 2090 Multi-Device Controller w/ Smart IMM Software
1	HP8720ES 50 MHz – 20 GHz Vector Network Analyzer

### **Measurement Station Accessories**

<u>QTY</u>	<u>Description</u>
1	Agilent 3499B Switch Controller
1	Agilent 8762C Coaxial Switch (DC – 26.5 GHz)
1	Mini-Circuits ZHL – 42W Coaxial Amplifier (10 MHz – 4.2 GHz, +30 dB gain)
1	Microwave Power L0218-30 Wideband Amplifier (2–18 GHz, +30 dB gain)
1	Weinschel 93459 Model 1515-1 Resistive Power Divider (DC – 18.0 GHz)