Shielding Effectiveness Report

EQDP-014-39.37-TTR-STL-1

Mated with:
QSE-014 and QTE-014

Description:
High-Speed Twin-Ax Cable Assembly, 0.8mm Pitch
Shielding Effectiveness Report

Series: EQDP
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Product Overview
EQDP cable assemblies are available in four standard lengths (6”, 12”, 0.5m and 1 meter) and can support up to 56 differential pairs. These cable assemblies use Eyespeed™ twinax ribbon cable, which is 30 AWG and has 100-ohm differential impedance. The product is available in surface mount or edge mount configurations.

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 >120 dB to values in the 20-100 dB 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 61004-21) is the maximum dynamic range of the measurement system. Any sample that has a shielding effectiveness greater than the dynamic range will not be adequately characterized. The Samtec reverb chamber and instrumentation provides a dynamic range of roughly 100 dB up to 1 GHz and gradually degrades to 50 dB at 20 GHz. The measurement dynamic range degradation is due increasing loss in the reverberation chamber metal walls.
Shielding Effectiveness Summary Data
The graph below shows that the EQDP cable assembly provides roughly 40 dB shielding effectiveness in the 200-400 MHz range and roughly 20-30 dB of shielding effectiveness above 400 MHz. In contrast, RG316 coax cable assembly with single braid shield provides roughly 50 dB of shielding effectiveness.
Characterization Details
This report presents data that characterizes the shielding effectiveness of a cable assembly in a typical customer usage scenario. Efforts are made to reveal typical responses inherent to the system under test (SUT).

In this report, the SUT includes the cable assembly, mating connectors and test fixturing. The mating connectors attached to test boards are 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 the energy from each signal conductor in one of the twinax. The remaining signal pairs in the cable assembly 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 1-meter long EQDP 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. The cable assembly was tested by mating it to a QSE/QTE test board connector. The Samtec part number for the cable assembly is EQDP-014-39.37-TTR-STL-1

Test System Fixturing
All measurements were performed using QTE/QSE Case 4 Test boards. The test boards have trace lengths of 3.70 inches and provide for the interconnection to the cable assemblies by use of replaceable SMA connectors. The test board has 6 layers and the signal traces are routed on stripline layers. The test boards and board stackup are shown in the following pictures.
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QTE/QSE Test board Layer Stackup

QSE Test Board (left), QTE Test Board (right)
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
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Shielding Effectiveness Test Setup and Comparison Cable

EQDP Cable Assembly in Reverberation Chamber

RG-316 Single Braid Coax Cable Tested for Comparison
Series: EQDP  
Description: High-Speed Twin-Ax Cable Assembly, 0.8mm Pitch

### Test Instruments

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<tr>
<th>QTY</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>ETS/Lindgren Smart200 Reverberation Chamber</td>
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<tr>
<td>1</td>
<td>ETS/Lindgren 2090 Multi-Device Controller w/ Smart IMM Software</td>
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<tr>
<td>1</td>
<td>HP8720ES 50 MHz – 20 GHz Vector Network Analyzer</td>
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### Measurement Station Accessories

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