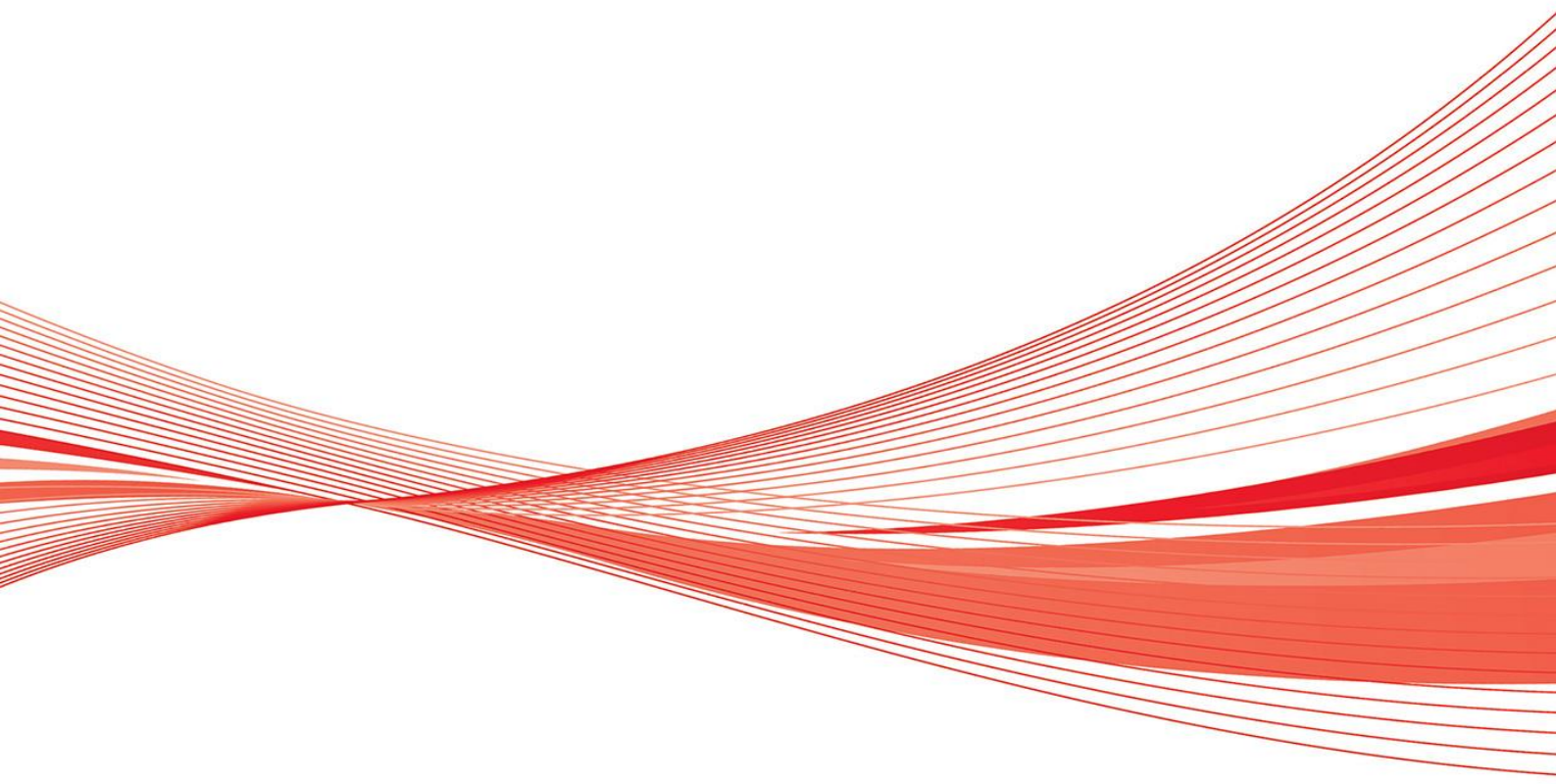
Harwin Test Report Summary

HT07501

Gecko-SL Backshell and Shielded Cable attenuation



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1. Introduction

1.1. Description and Purpose

Testing to determine the RF Attenuation provided on Gecko-SL Cable Assemblies, with metal Backshells and full cable braiding.

1.2. Conclusion

This report has established the attenuation rates over a specified frequency range of 0.01 MHz to 400.00 MHz for the G125-SL Shielded Cables and Backshells range. The full external report has been attached as the last section of this document.

For further information please contact one of our Experts at www.harwin.com/contact.

2. Test Method and Requirements

2.1. Specification Parameters

Tests were carried out in general accordance with MIL-STD 1377 (1971). The list of tests covered in this summary are as follows:

Testing Standard	Description of Test
MIL-STD 1377 (1971)	Shielding Effectiveness Test – 6 Way Cable Assembly
	Shielding Effectiveness Test – 16 Way Cable Assembly
	Shielding Effectiveness Test – 50 Way Cable Assembly

2.2. List of Connectors & Assemblies

The following female-to-female cable assemblies were used for the test programme:

- G125-FC10605F1-1000F1 – 6 contact unshielded cable assembly
- G125-FC10669F1-1000F1 – 6 contact shielded cable assembly
- G125-FC10669F1-1000F1 + Cu tape – 6 contact shielded cable assembly with copper tape on backshell
- G125-FC11605F1-1000F1 – 16 contact unshielded cable assembly
- G125-FC11669F1-1000F1 – 16 contact shielded cable assembly
- G125-FC11669F1-1000F1 + Cu tape – 16 contact shielded cable assembly with copper tape on backshell
- G125-FC15005F1-1000F1 – 50 contact unshielded cable assembly
- G125-FC15069F1-1000F1 – 50 contact shielded cable assembly
- G125-FC15069F1-1000F1 + Cu tape – 50 contact shielded cable assembly with copper tape on backshell

The copper tape was applied to the Backshells to cover the holes in the metal, to see if this made a difference to the results.

The cables were mated to the following connectors:

- G125-MV10605M2P & G125-9600602 – 6 contacts throughboard male connector and backshell
- G125-MV11605M2P & G125-9601602 – 16 contacts throughboard male connector and backshell
- G125-MV15005M2P & G125-9605002 – 50 contacts throughboard male connector and backshell

3. Summary test results

Assembly	Attenuation (dB)					
	Frequency 0.10MHz – 1.00MHz		Frequency 1.00MHz – 100.00MHz		Frequency 100.00MHz – 400.00MHz	
	Min	Max	Min	Max	Min*	Max
6 contact Shielded cable	34	52	52	64	26	56
6 contact Shielded cable & Cu Tape	32	50	48	58	28	58
16 contact Shielded cable	34	52	44	60	16	56
16 contact Shielded cable & Cu Tape	34	50	48	54	24	62
50 contact Shielded cable	34	44	42	50	8	46
50 contact Shielded cable & Cu Tape	32	44	44	56	20	48

All attenuation measurements rounded to the nearest 2dB (see Appendix, Figures 2.1.8, 2.2.8, and 2.3.8).

*As cable length approaches wavelength, shielding effectiveness is reduced.

4. Appendix – Complete 3rd Party Test Report

See following attached pages.

CONTENTS

This report has been up issued to Issue 2 to correct grammatical errors and remove test equipment photos that were not required.

SECTION 1

REPORT SUMMARY

Shielding Effectiveness Testing of the
Harwin PLC
Gecko Metal Back-shells Cable Assembly

1.1 INTRODUCTION

The information contained in this report is intended to show the RF attenuation provided by the Harwin PLC Gecko metal back-shells the heavy-weight braided screened cables with reference to MIL-STD 1377 (1971), for the tests listed in Section 1.2.

Any general explanatory information can be detailed here, can be taken from Test Plan if applicable.

Objective	Testing to determine the RF Attenuation provided by the metal back-shells and the braided screened cable with the MIL-STD 1377 (1971), for the series of tests carried out.
Manufacturer	Harwin PLC
Model Number(s)	6-way cable assembly Base cable: P805402-1-1, TSR1 Screened cable and back-shell: P803968-1-1, TSR 24 Screened cable and unscreened back-shell: P803968-1-1, TSR 23 16-way cable assembly Base cable: P805402-2-1, TSR 11 Screened cable and back-shell: P803968-2-1, TSR 22 Screened cable and unscreened back-shell: P803968-2-1, TSR 21 50-way cable assembly Base cable: P805402-3-1, TSR 5 Screened cable and back-shell: P803968-3-1, TSR 20 Screened cable and unscreened back-shell: P803968-3-1, TSR 19
Serial Number(s)	6-way cable assembly Base cable: G125-FC10605F1-1000F, TSR1 Screened cable and back-shell: G125-FC10669F1-1000F1, TSR 24 Screened cable and unscreened back-shell: G125-FC10669F1-1000F1, TSR 23 16-way cable assembly Base cable: G125-FC11605F1-1000F, TSR 11

	Screened cable and back-shell: G125-FC11669F1-1000F1, TSR 22 Screened cable and unscreened back-shell: G125-FC11669F1-1000F1, TSR 21 <u>50-way cable assembly</u> Base cable: G125-FC15005F1-1000F, TSR 5 Screened cable and back-shell: G125-FC15069F1-1000F1, TSR 20 Screened cable and unscreened back-shell: G125-FC15069F1-1000F1, TSR 19
Cables were mounted to the following connectors	06-way - G125-MV10605M2P & G125-9600602 back-shell 16-way - G125-MV11605M2P & G125-9601602 back-shell 50-way - G125-MV15005M2P & G125-9605002 back-shell
Software Version	N/A
Hardware Version	N/A
Number of Samples Tested	12
Test Specification/Issue/Date	MIL-STD 1377, 1971
Test Plan/Issue/Date	N/A
Incoming Release Date	06 March 2020
Disposal Reference Number Date	Pending collection
Order Number Date	P804473 17 February 2020
Start of Test	16 April 2020
Finish of Test	30 April 2020
Related Documents	C04205 issue 5, 12 October 2017 Scope of Work

1.2 BRIEF SUMMARY OF RESULTS

Section	Accreditation	Test Description	Result
2.1	NUA	Shielding Effectiveness Test – 6 Way Cable Assembly	N/A
2.2	NUA	Shielding Effectiveness Test – 16 Way Cable Assembly	N/A
2.3	NUA	Shielding Effectiveness Test – 50 Way Cable Assembly	N/A

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a Harwin PLC Gecko Cable Assembly with two different configurations shown in Figures 1.3.1 and 1.3.2 (16-way connector shown as set up examples). The braided cable assembly shown in Figure 1.3.2 was modified to modification state 1 for a third configuration for each of the three-cable way as requested by Harwin, details can be found in section 1.5. The figures below are examples of the 16-way cable assembly; the 6-way cable assembly and the 50-way cable assembly had an identical configuration.

Figure 1.3.1 Equipment Under Test: Base Cable - 16-way cable assembly

Figure 1.3.2 Equipment Under Test: Braided cable with back shells - 16-way cable assembly

1.3.2 Test Configuration

The cable assembly under test was set up on a non-conductive PVC platform and interconnected between two interface boxes.

The interface boxes were bonded to a ground plane.

A general test setup photo is shown at Figure 1.3.3.

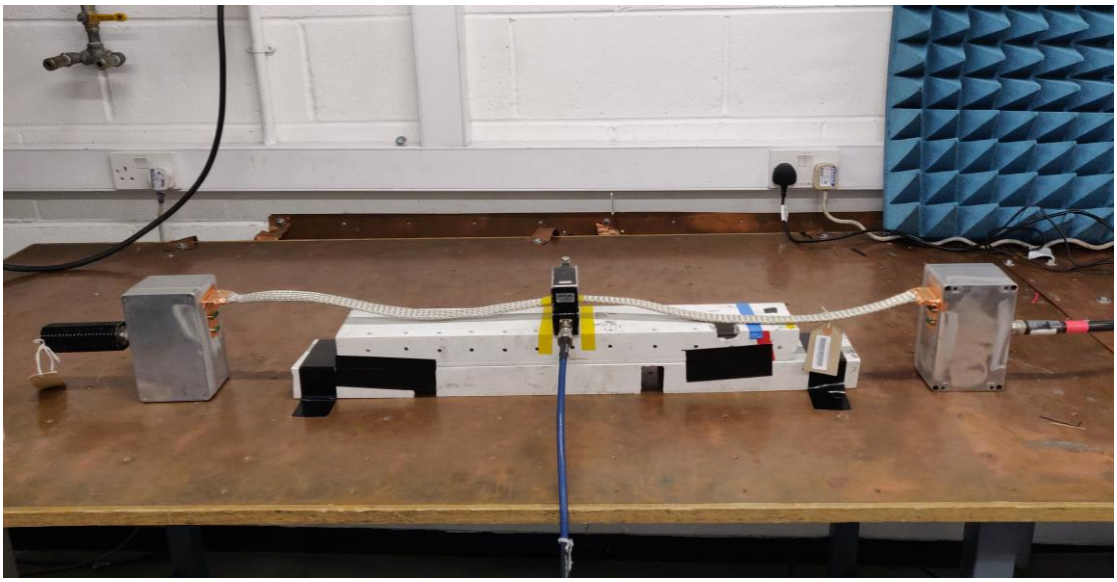

Figure 1.3.3 General Test Setup

The cable assembly was set up in between two interface boxes with its corresponding cable adapters/connectors.

One interface box was configured with a 50-ohm Termination. The second interface box supplied 10 Watts to the cable assembly.

The major items of test equipment used that were not specific to a particular test are identified under General Test Equipment of the table in Section 3.1.

1.4 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing covered by this test report.

1.5 MODIFICATION RECORD

The table below details modifications made to the EUT during the test programme. The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
0	As supplied by the customer	N/A	N/A
1	Copper taping was applied to the back-shell of the assembly to cover the holes present. This was done for the set of braided cable assembly for 6-way, 16-way and 50-way connectors as requested by the customer. This formed the test configuration for the shielded cable and shielded back-shells part of the test.	Daniel Binns	20-Apr-2020

SECTION 2

TEST DETAILS

Shielding Effectiveness Testing of the
Harwin PLC
Gecko Metal Back-shells and Heavy Weight Braided Screened Cable

2.1 SHIELDING EFFECTIVENESS TEST – 6 WAY CABLE ASSEMBLY - NUA

2.1.1 Specification Reference

MIL-STD 1377 (1971)
Scope of Work

2.1.2 Equipment Under Test

6-Way Base Cable Assembly, SN: G125-FC10605F1-1000F, TSR1
6-Way Screened Cable and Back-shells Cable Assembly,
SN: G125-FC10669F1-1000F1, TSR 24
6-Way Screened Cable and Unscreened Back-shells Cable Assembly,
SN: G125-FC10669F1-1000F1, TSR 23

2.1.3 Date of Test and Modification State

16 April 2020 and 30 April 2020, Modification State 1, Modification State 0

2.1.4 Test Location and Test Equipment Used

This test was carried out in Test Laboratory 4 and Shielded Enclosure 7. The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.5 Test Procedure

The cable assembly was set up between two interface boxes with a 50-ohm termination at one end. A signal of 10 watts was applied at the other end over the frequency range of 10 kHz to 400 MHz.

The Current was measured at the mid-point of the cable using 2 current Probes (1 for 10 kHz to 1 MHz, and 1 for 1 MHz to 400 MHz)

The signal was swept at a rate of 100 steps/decade with a dwell time of 20 ms.

The Testing was repeated on all 3 cable assemblies.

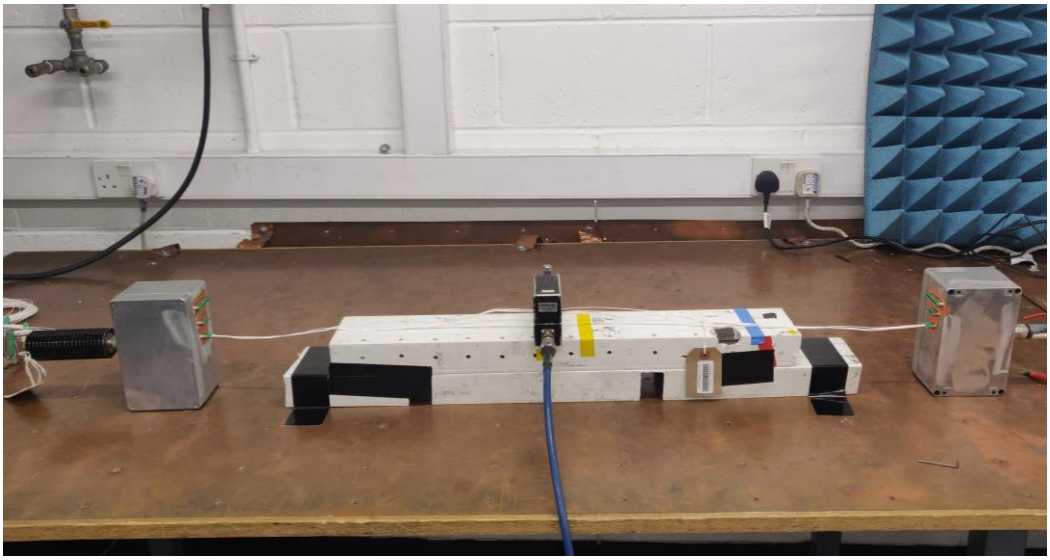

Figure 2.1.1 Test Setup: Base cable assembly, no braided cable with no screened back shells

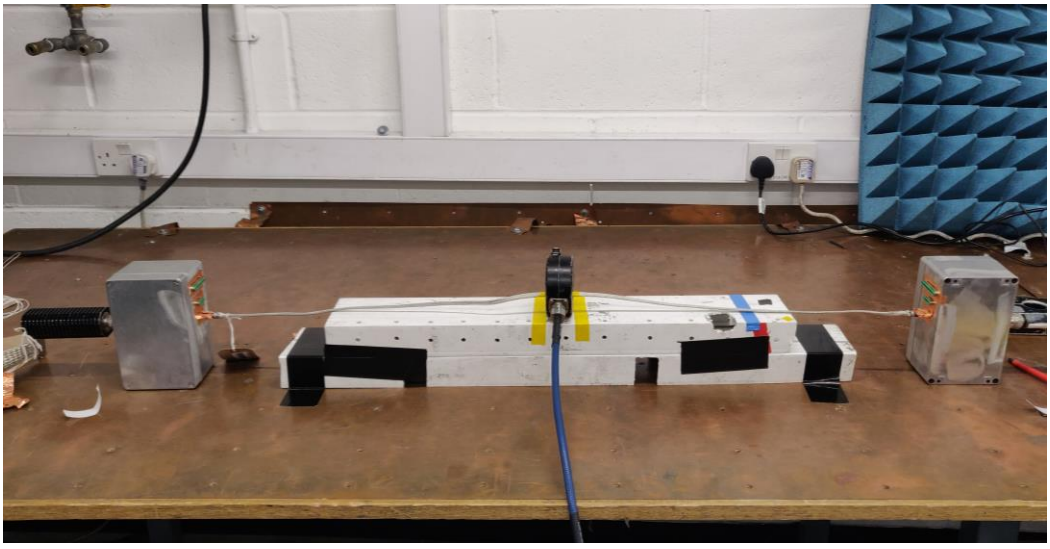

Figure 2.1.2 Test Setup: Braided cable assembly with copper taping on the back shells

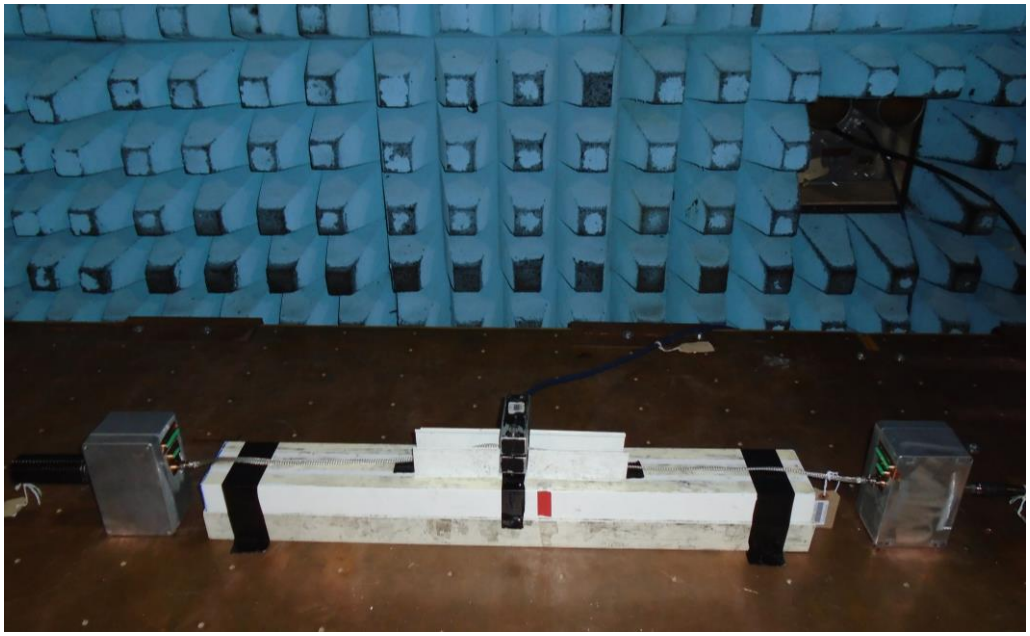

Figure 2.1.3 Test Setup: Braided cable assembly with unscreened back shells

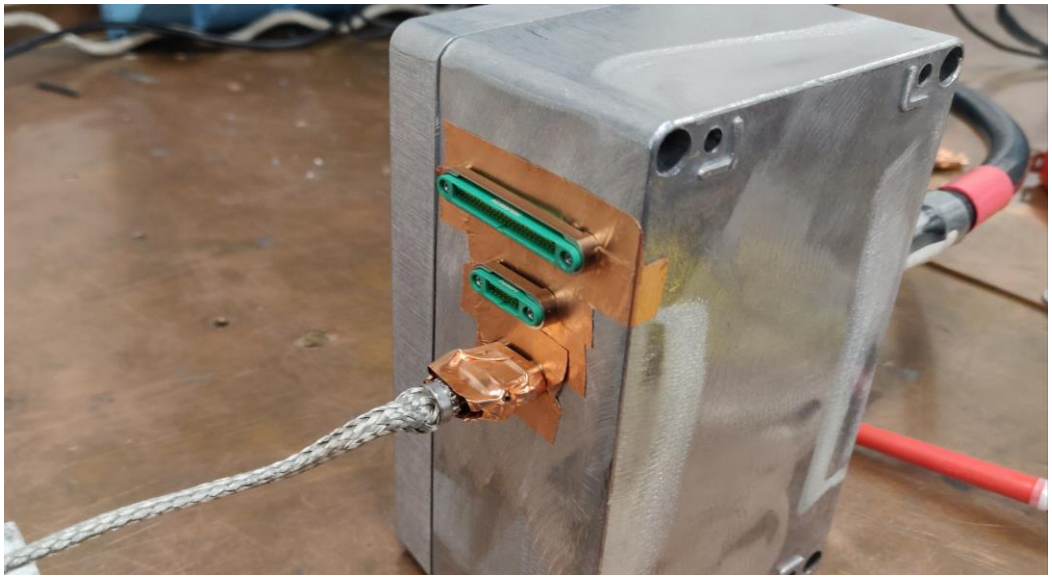

Figure 2.1.4 Copper Screening on the Back shells: 6-way cable assembly

2.1.6 Test Results

The measurements of the shielding effectiveness are as follows:

Shielding comparison for braided cable assembly with copper taping on the back shells	Figure 2.1.5
Shield comparison for braided cable assembly with unscreened back shells	Figure 2.1.6
Measured current of the three cable assembly configuration.	Figure 2.1.7
Attenuation achieved: Braid shielded cable with screened back shells V Shielded Cable with unscreened back shells.	Figure 2.1.8

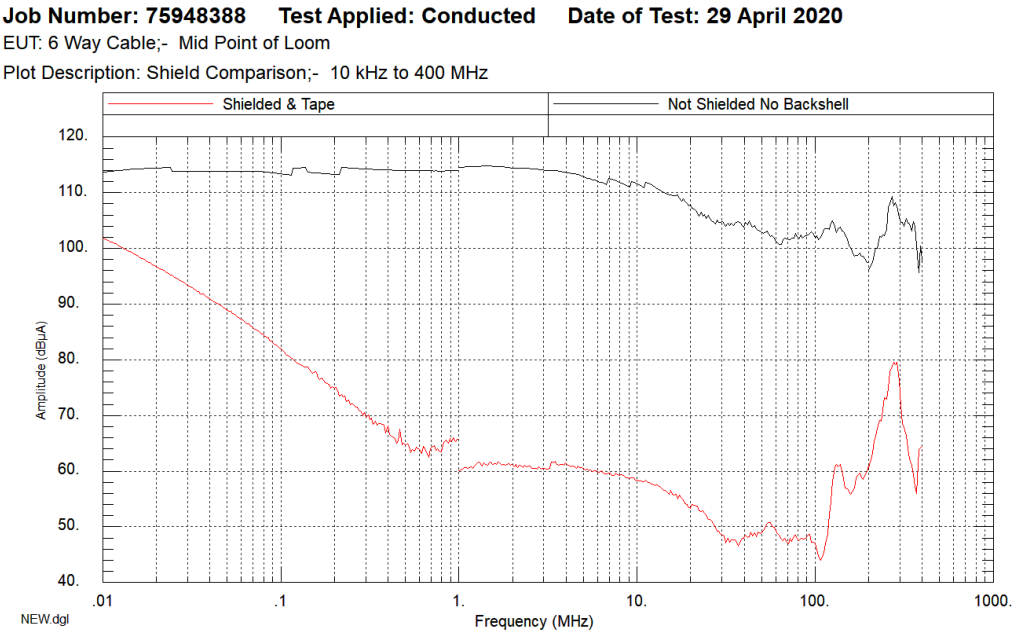

Figure 2.1.5 Shield comparison: Unscreened cable and no back shells V braid shielded cable with copper taping on the back shells

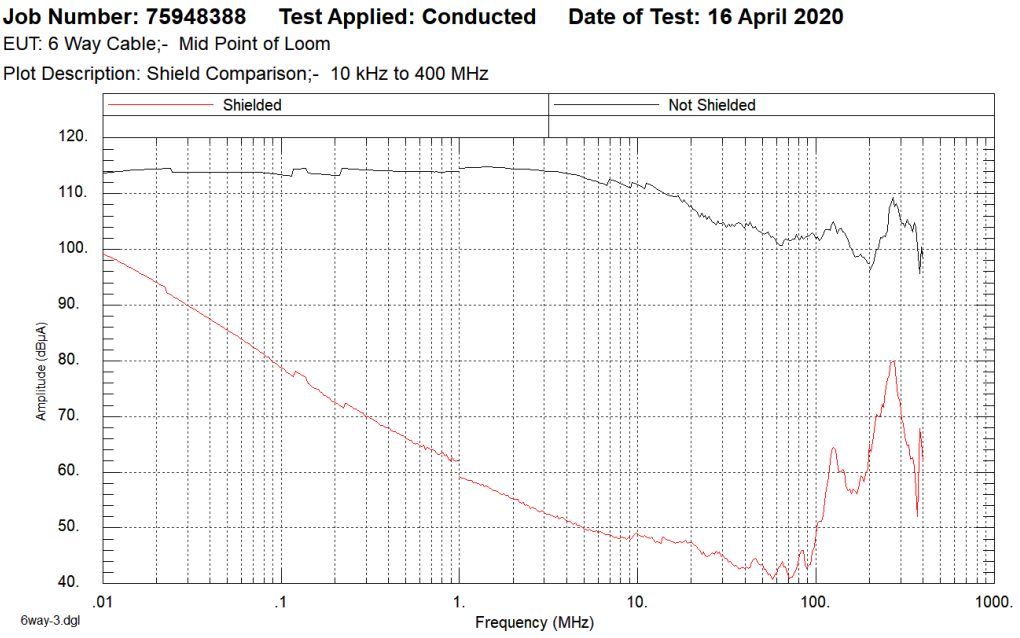

Figure 2.1.6 Shield comparison: Unscreened cable and no back shells V braid shielded cable with unshielded back shells

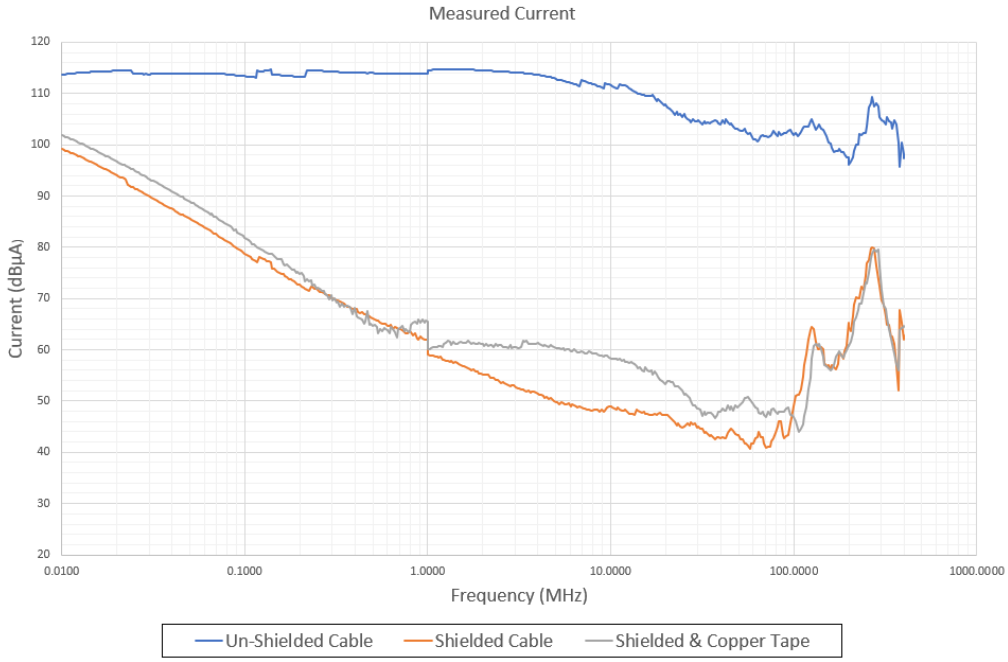

Figure 2.1.7 Measured current of the three-cable assembly configuration.

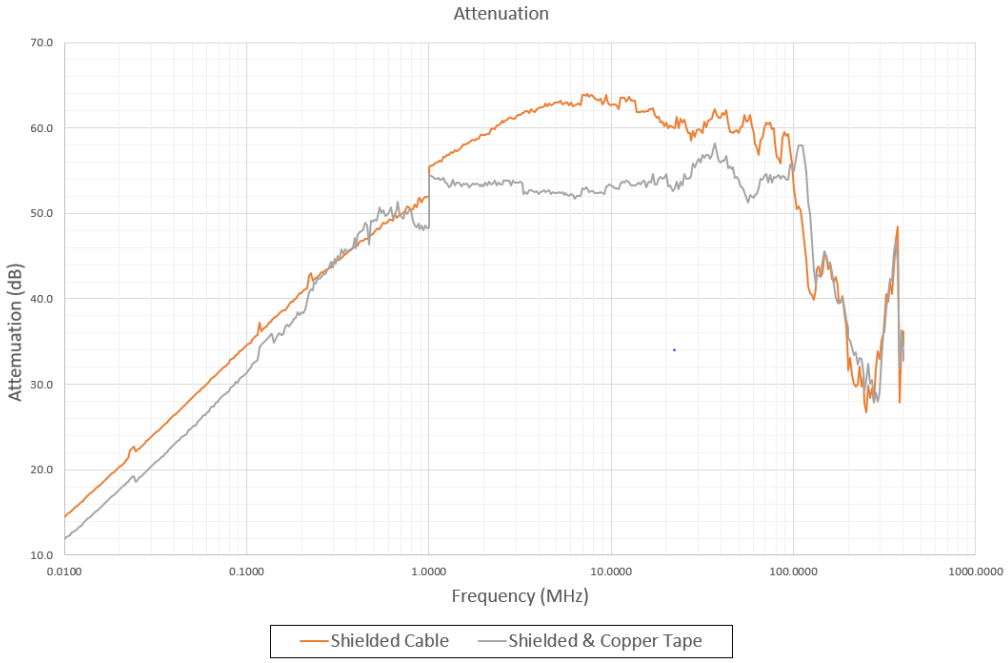

Figure 2.1.8 Attenuation achieved: Braid shielded cable with screened back shells V Shielded Cable with unscreened back shells.

2.2 SHIELDING EFFECTIVENESS TEST – 16 WAY CABLE ASSEMBLY - NUA

2.2.1 Specification Reference

MIL-STD 1377 (1971)
Scope of Work

2.2.2 Equipment Under Test

16-Way Base Cable Assembly, SN: G125-FC11605F1-1000F, TSR 11
16-Way Screened Cable and Unscreened Back-shells Cable Assembly,
SN: G125-FC11669F1-1000F1, TSR 21
16-Way Screened Cable and screened Back-shells Cable Assembly,
SN: G125-FC11669F1-1000F1, TSR 22

2.2.3 Date of Test and Modification State

16 April 2020 and 30 April 2020, Modification State 1, Modification State 0

2.2.4 Test Location and Test Equipment Used

This test was carried out in Shielded Enclosure 7. The major items of test equipment used for the above tests are identified in Section 3.1. effectiveness

2.2.5 Test Procedure

The cable assembly was set up between two interface boxes with a 50 ohm termination at one end. A signal of 10 watts was applied at the other end over the frequency range of 10 kHz to 400 MHz.

The Current was measured at the mid-point of the cable using 2 current Probes (1 for 10 kHz to 1 MHz, and 1 for 1 MHz to 400 MHz)

The signal was swept at a rate of 100 steps/decade with a dwell time of 20 ms.

The Testing was repeated on all 3 cable assemblies.

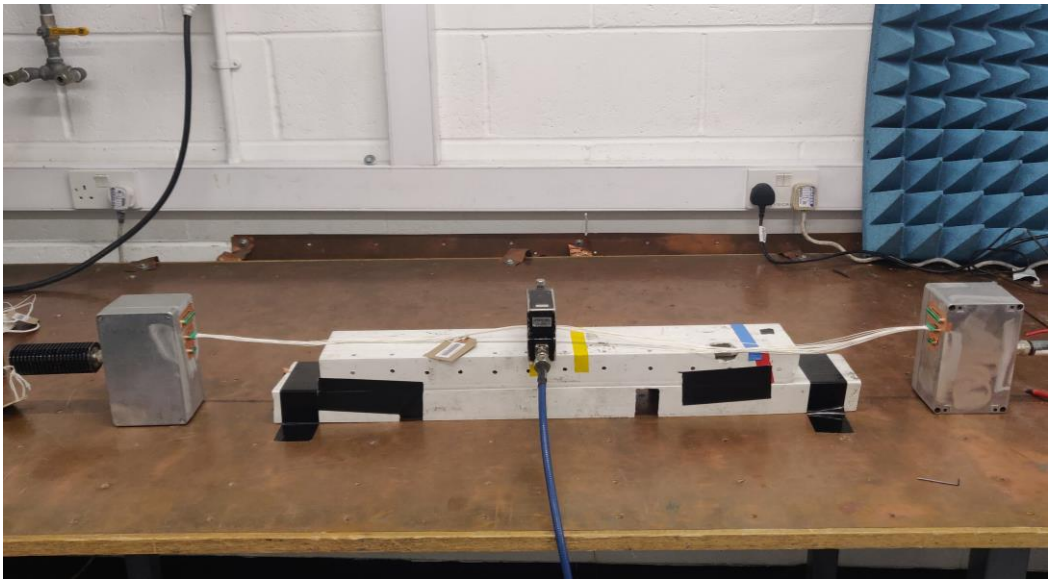

Figure 2.2.1 Test Setup: Base cable assembly, no braided cable with no screened back shells

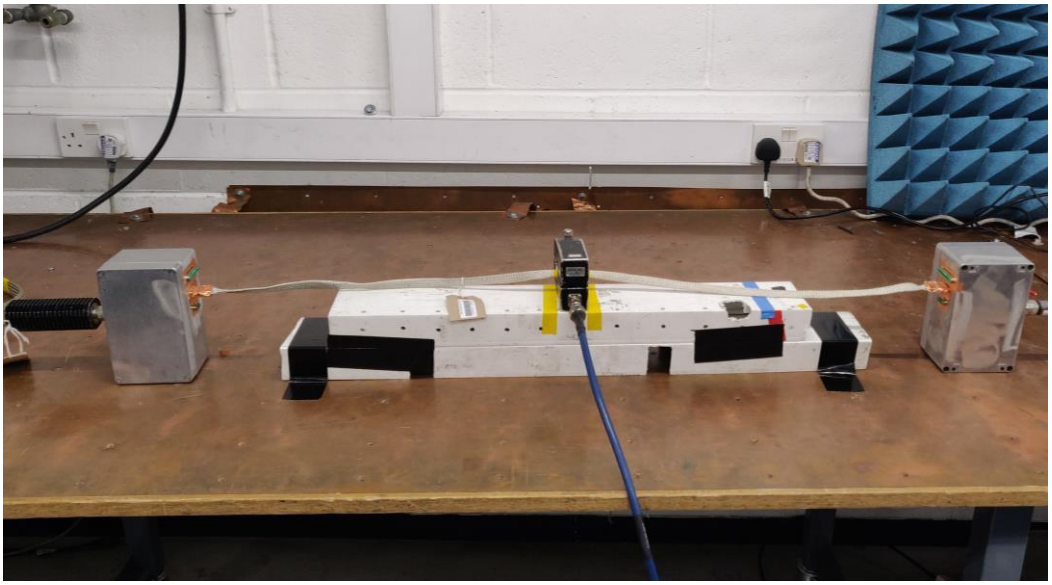

Figure 2.2.2 Test Setup: Cable assembly, braided cable with copper taping on back shells

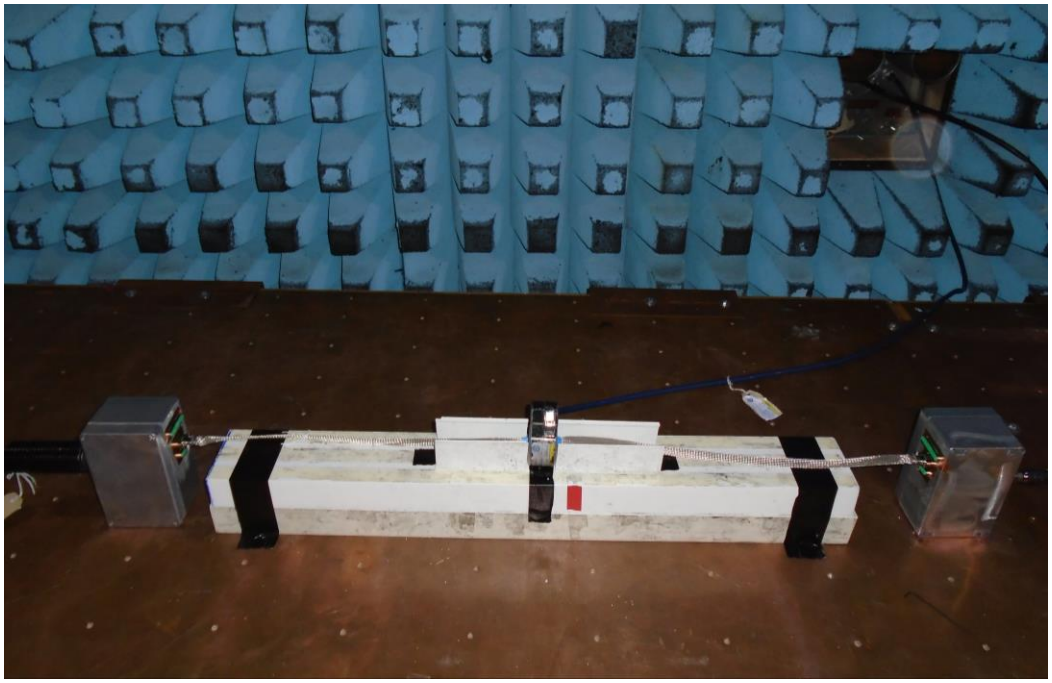

Figure 2.2.3 Test Setup: Cable assembly, braided cable with unscreened back shells

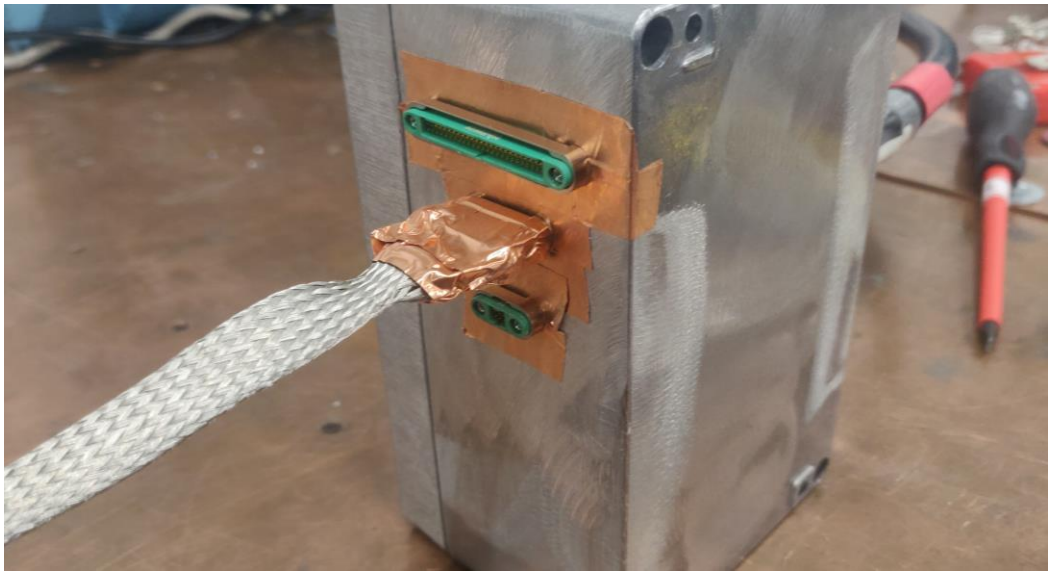

Figure 2.2.4 Copper Screening on the Back shells: 16-way cable assembly

2.2.6 Test Results

The measurements of the shielding effectiveness are as follows:

Shield comparison for braided cable assembly with copper taping on the back shells	Figure 2.2.5
Shield comparison for braided cable assembly with unscreened back shells	Figure 2.2.6
Measured current of the three cable assembly configuration.	Figure 2.2.7
Attenuation achieved: Braid shielded cable with screened back shells V Shielded Cable with unscreened back shells.	Figure 2.2.8

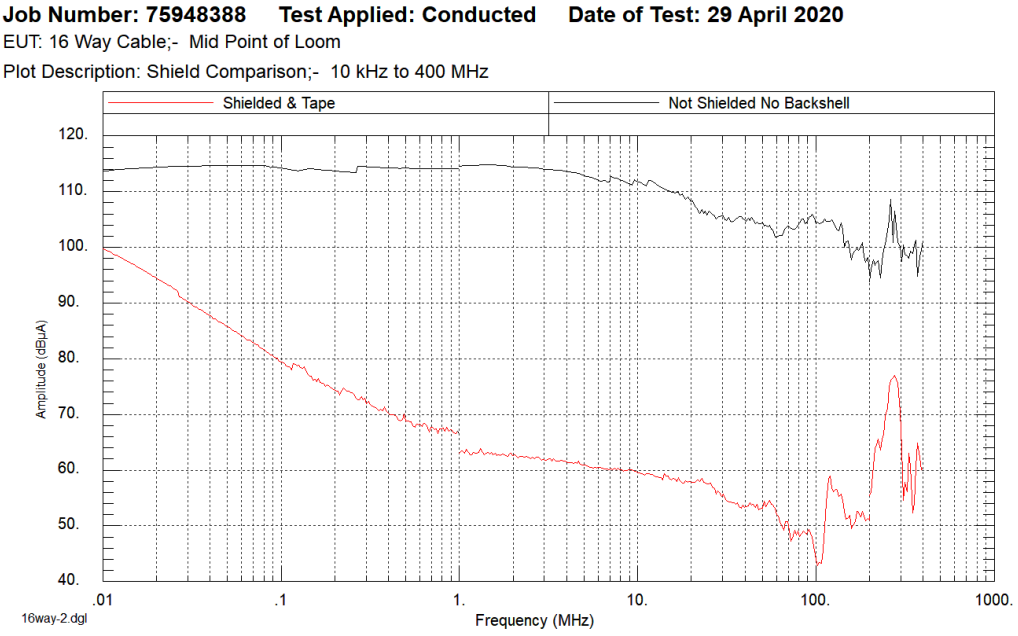

Figure 2.2.5 Shield comparison: Unscreened cable and no back shells V braid shielded cable with copper taping on the back shells

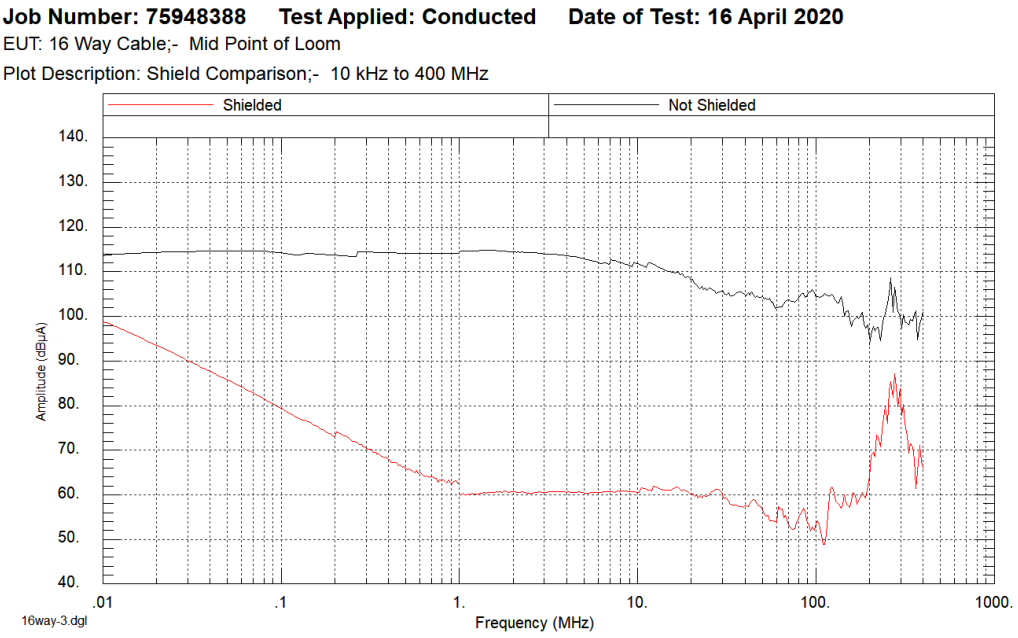

Figure 2.2.6 Shield comparison: Unscreened cable and no back shells V braid shielded cable with unshielded back shells

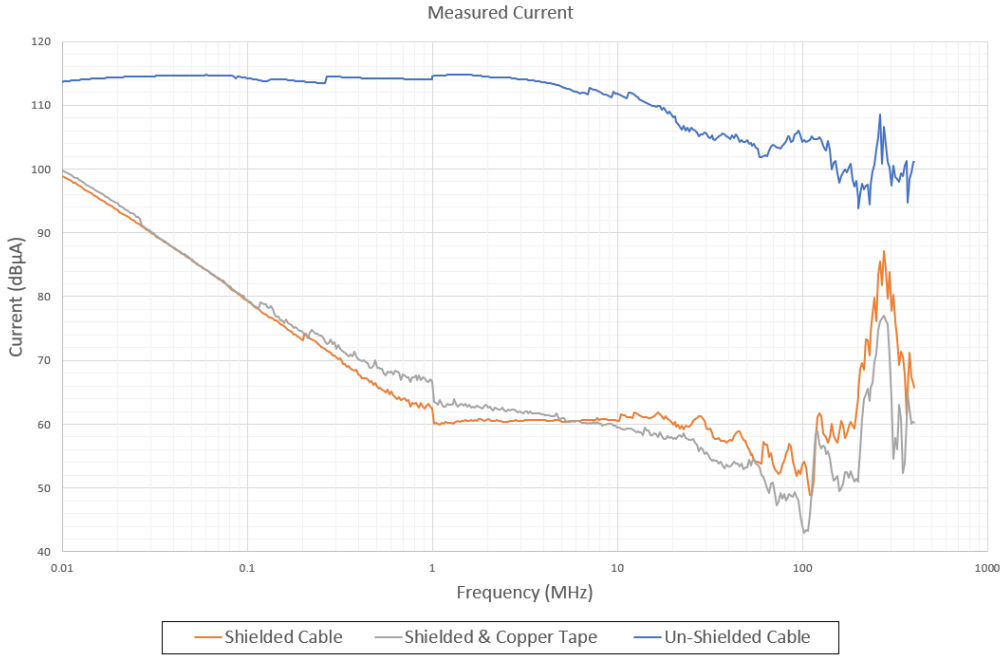

Figure 2.2.7 Measured current of the three cable assembly configuration.

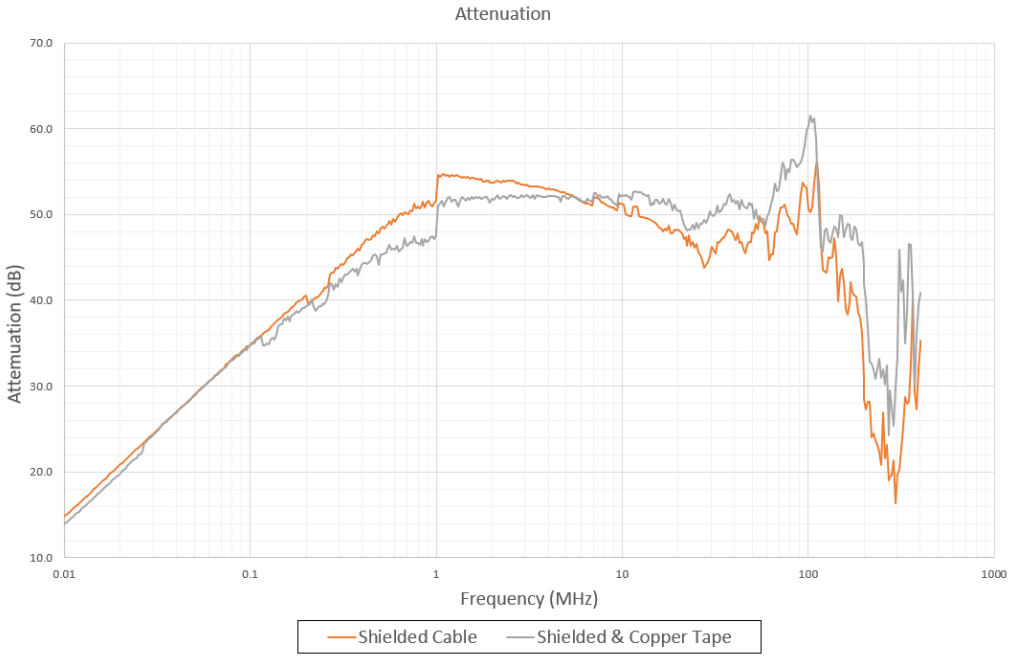

Figure 2.2.8 Attenuation achieved: Braid shielded cable with screened back shells V Shielded Cable with unscreened back shells.

2.3 SHIELDING EFFECTIVENESS TEST – 50 WAY CABLE ASSEMBLY - NUA

2.3.1 Specification Reference

MIL-STD 1377 (1971)
Scope of Work

2.3.2 Equipment Under Test

50-Way Base Cable Assembly, SN: G125-FC15005F1-1000F, TSR 5
50-Way Screened Cable and Unscreened Back-shells Cable Assembly,
SN: G125-FC15069F1-1000F1, TSR 19
50-Way Screened Cable and Screened Back-shells Cable Assembly,
SN: G125-FC15069F1-1000F1, TSR 20

2.3.3 Date of Test and Modification State

15 April 2020, Modification State 0

2.3.4 Test Location and Test Equipment Used

This test was carried out in Shielded Enclosure 7. The major items of test equipment used for the above tests are identified in Section 3.1. effectiveness

2.3.5 Test Procedure

The cable assembly was set up between two interface boxes with a 50 ohm termination at one end. A signal of 10 watts was applied at the other end over the frequency range of 10 kHz to 400 MHz.

The Current was measured at the mid-point of the cable using 2 current Probes (1 for 10 kHz to 1 MHz, and 1 for 1 MHz to 400 MHz)

The signal was swept at a rate of 100 steps/decade with a dwell time of 20 ms.

The Testing was repeated on all 3 cable assemblies.

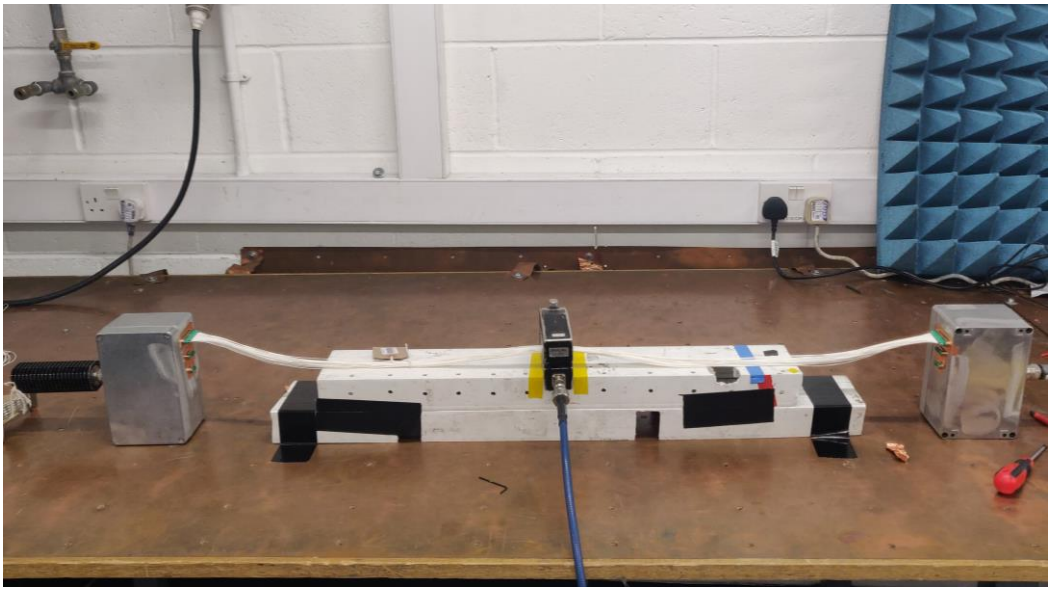

Figure 2.3.1 Test Setup: Base cable assembly, no braided cable with no screened back shells

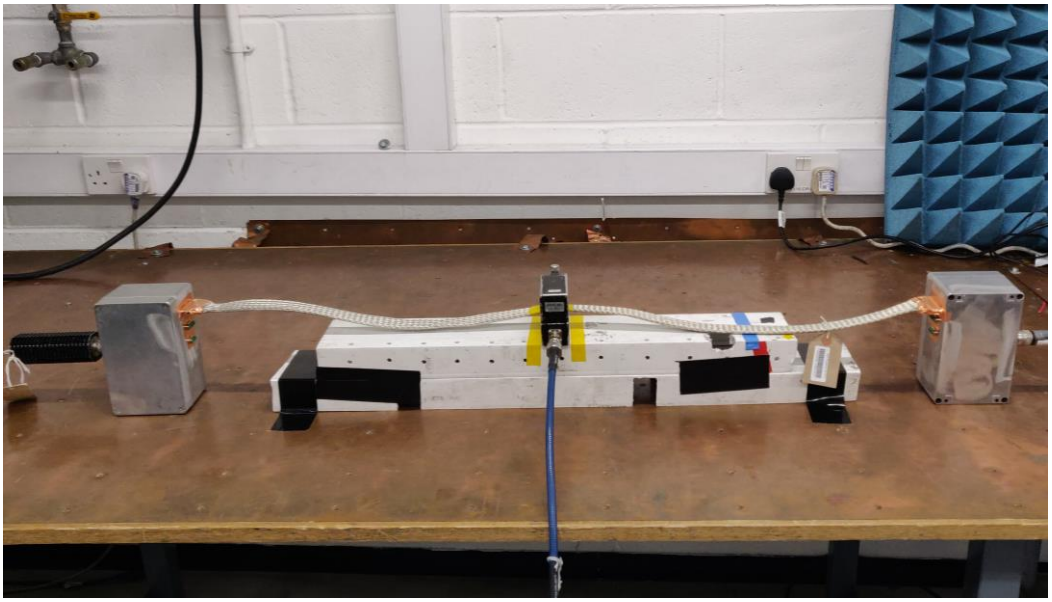

Figure 2.3.2 Test Setup: Cable assembly, braided cable with copper taping on back shells

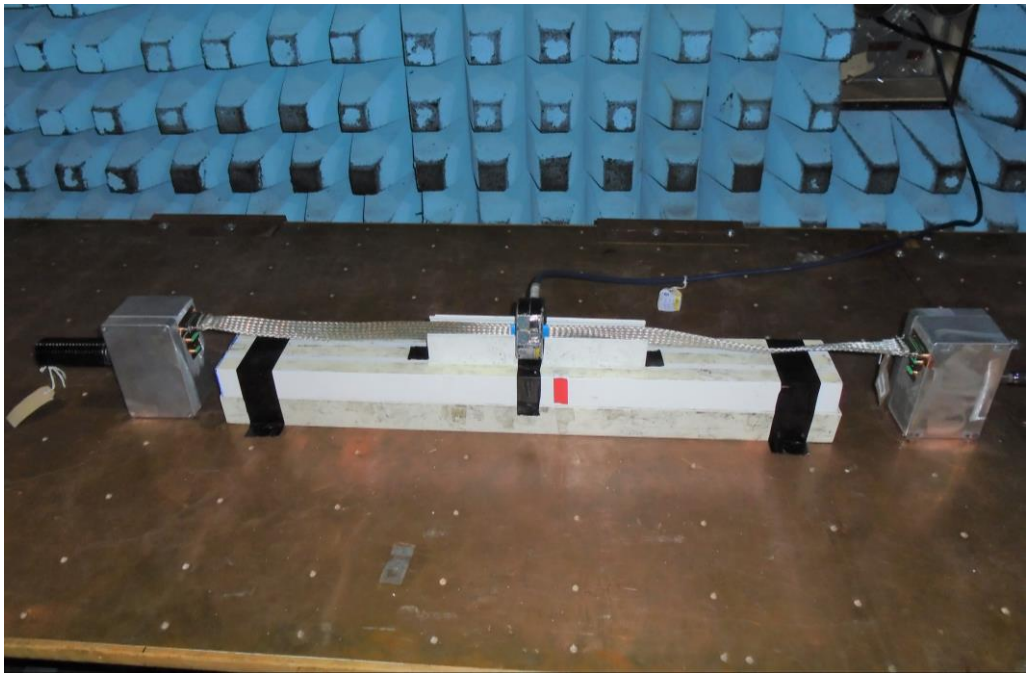

Figure 2.3.3 Test Setup: Cable assembly, braided cable with unscreened back shells

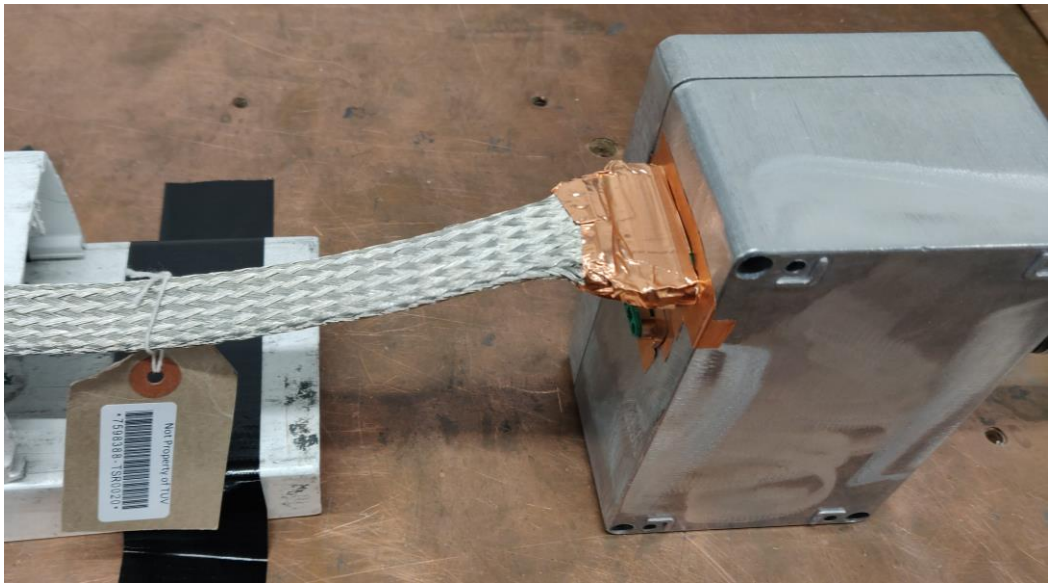

Figure 2.3.4 Copper Screening on the Back shells: 50-way cable assembly

2.3.6 Test Results

The measurements of the shielding effectiveness are as follows:

Shield comparison for braided cable assembly with copper taping on the back shells	Figure 2.3.5
Shield comparison for braided cable assembly with unscreened back shells	Figure 2.3.6
Measured current of the three cable assembly configuration.	Figure 2.3.7
Attenuation achieved: Braid shielded cable with screened back shells V Shielded Cable with unscreened back shells.	Figure 2.3.8

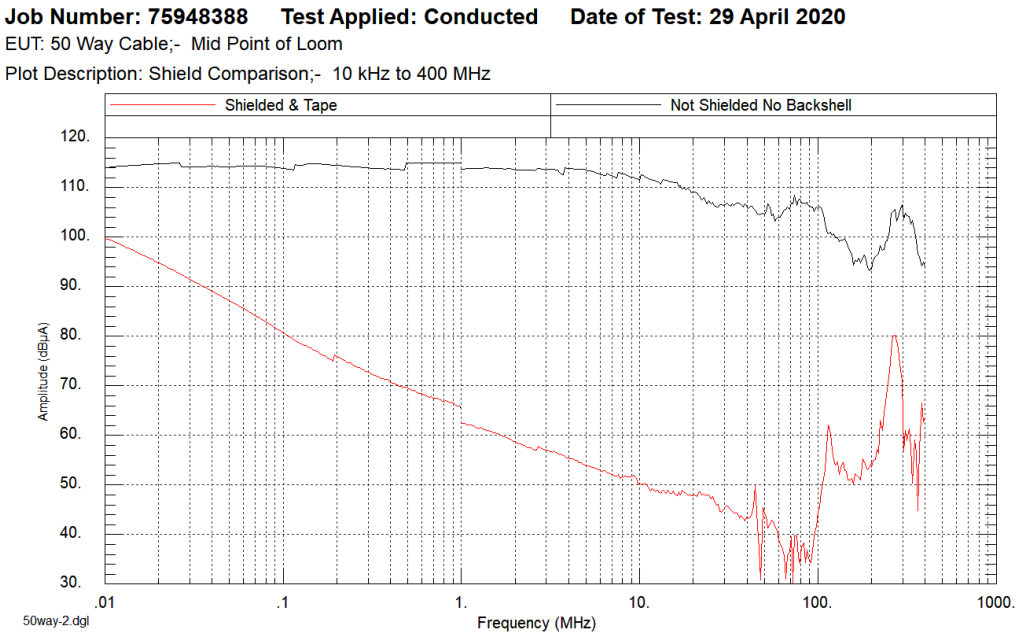

Figure 2.3.5 Shield comparison: Unscreened cable and no back shells V braid shielded cable with copper taping on the back shells

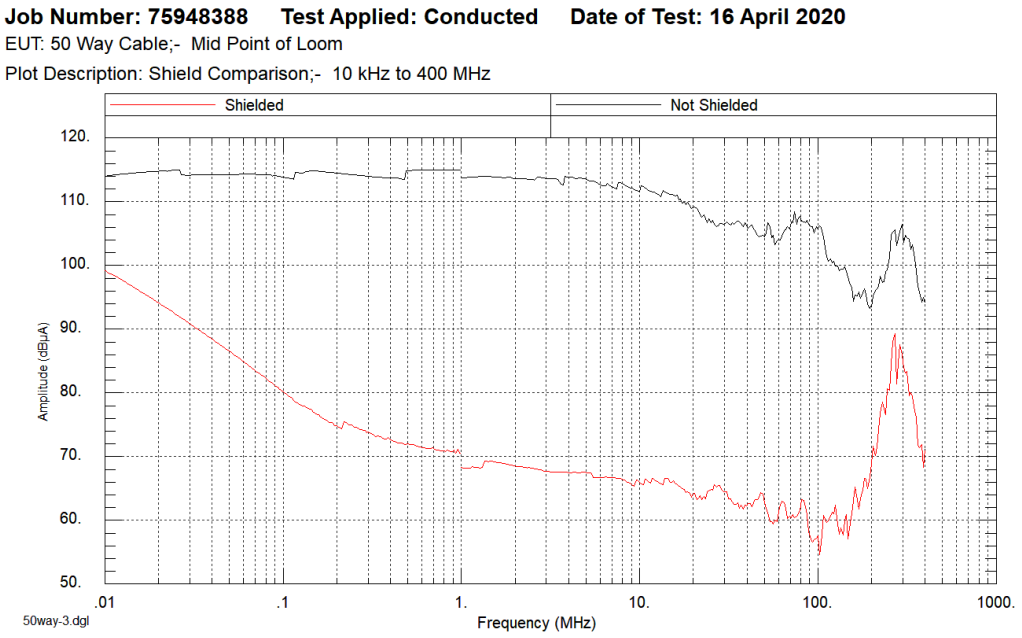

Figure 2.3.6 Shield comparison: Unscreened cable and no back shells V braid shielded cable with unshielded back shells

Figure 2.3.7 Measured current of the three cable assembly configuration.

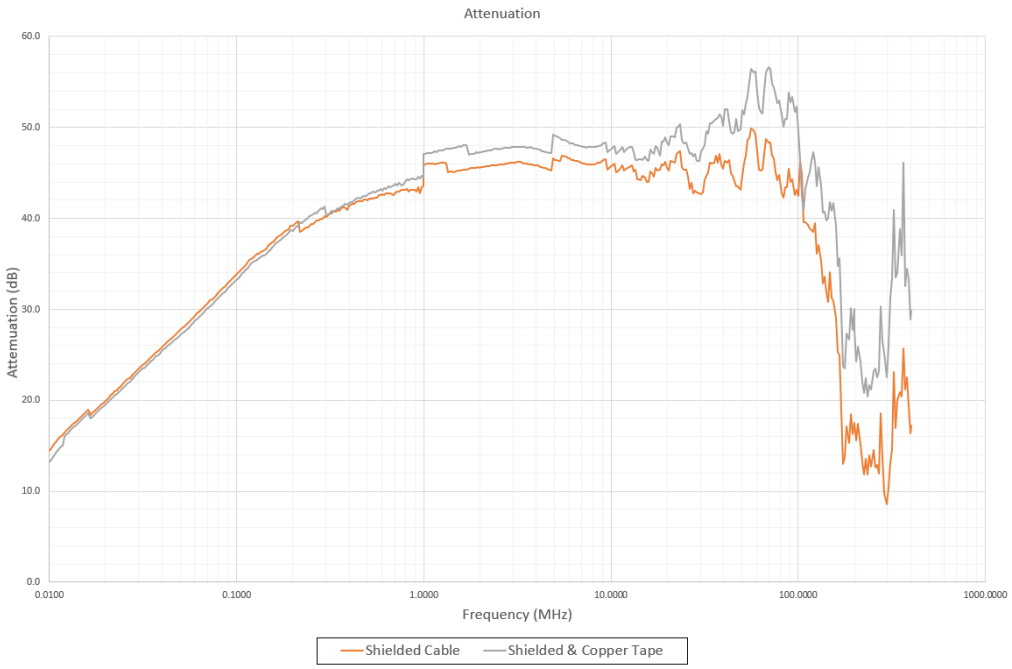

Figure 2.3.8 Attenuation achieved: Braid shielded cable with screened back shells V Shielded Cable with unscreened back shells.

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.1 to 2.3 – Shielding Effectiveness Test (10 kHz to 400 MHz)					
RF Power Amplifier (25 MHz-1 GHz)	Amp Research	30W1000M7	259	-	TU
Current Probe	Ailtech	94111-1	522	12	17-Jun-2020
Current Probe	Solar	9205-1	527	12	06-Apr-2021
RF Power Amplifier	Amp Research	150L	578	-	TU
Directional Coupler	Amp Research	DC2035M4	768	12	14-Nov-2020
Signal Generator	Rohde & Schwarz	SML01	1590	12	29-Apr-2020
Termination	Tyco Electronics	1329823-1	3249	12	16-Dec-2020
Termination	Diamond Antenna	DL-30N	3400	12	15-Nov-2020
Spectrum Analyser	Rohde & Schwarz	FSP3	3488	12	23-Jul-2020
Spectrum Analyser	Rohde & Schwarz	FSP3	3489	12	23-Jul-2020
Cable (Rx, Nm-Nm, 2 m)	Scott Cables	SLU18-NMNM-02.00M	4486	6	TU
Cable (2.5kW Tx, Nm-Nm, 2 m)	Scott Cables	9918-NMNM-2000	4610	6	TU
Cable (1.0kW Tx, Nm-Nm, 2 m)	Scott Cables	9918-NMNM-2000	4613	6	TU
Triaxial Accelerometer	Endevco	66F50	5120	6	13-Aug-2020
1 Meter Cable	Teledyne	PR90-088-1MTR	5191	12	10-Mar-2021

TU – Traceability Unscheduled

3.2 TEST EQUIPMENT DATA

Not Applicable

3.3 SOFTWARE DATA

The following software was used for data presentation of results obtained during Emissions testing.

1. Waveform Reporting, Version 2.1
2. Automated Bulk Current Injection, Version 2.0.1

3.4 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:

Test Discipline	Frequency / Parameter	MU
Conducted Emissions Current	10 Hz – 150 MHz	4.20 dB

Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115:2007, clause 4.4.3 and 4.5.1.

SECTION 4

INCIDENT REPORTS

4.1 INCIDENT REPORTS ISSUED

No incident reports were issued for the tests referenced in this report.

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

This report relates only to the actual item/items tested.

Our report does not cover opinions and interpretations

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).