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Test Report Summary

HT06005

General Testing of
Archer Kontrol (M55 Series) Connectors

ARCHER KONTROL

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1. Introduction

1.1. Description and Purpose

Archer Kontrol (M55 Series) is a range of board-to-board and cable-to-board 1.27mm pitch connectors, with polarised, shrouded mouldings, hold-down SMT board fixing, location pegs, and a choice of orientation and connector heights in both male and female halves.

The Archer Kontrol range is designed to perform as an improved specification connector over existing 1.27mm pitch (M50 and M52 series) connectors, whilst still maintaining the compact size. The following tests were carried out to confirm the requirements of this design intent.

1.2. Conclusion

The following data has been collated from Harwin Test report numbers 1559, 1695, 1702, 1746, QA000109, and QA000307. The results were used to define the Component Specification for the Archer Kontrol range. The tests indicate that the product fulfils the criteria of an improved connection system over the existing 1.27mm connector products.

NOTE: Some results mention a 24-contact connector - these connectors were manufactured during the product development phase, but were not added to the final launch product sizes.

2. Test Requirements

2.1. Specification Parameters

Tests were carried out in general accordance with EIA 364 standards. The list of tests covered in this summary are as follows:

Testing Standard	Description of Test	Section	Page No.
EIA-364-23B	Contact Resistance	3.1	3
EIA-364-20C	Dielectric Withstanding Voltage	3.2	3
EIA-364-21C	Insulation Resistance	3.3	3
EIA-364-70A	Temperature Rise Versus Current	3.4	4
EIA-364-32C	Thermal Shock (Temperature Cycling)	3.5	5
EIA-364-17B	Temperature Life	3.6	5
EIA-364-26B	Salt Spray	3.7	5-6
EIA-364-31B	Humidity	3.8	6
EIA-364-28D	Vibration	3.9	6
EIA-364-13C	Durability, Insertion and Withdrawal Forces	3.10	7-8
EIA-364-29C	Contact Retention Force	3.11	8
n/a	Plating Finish Thicknesses	3.12	8
n/a	Frequency Range	3.13	9-10

2.2. Test Samples

The test samples selected for each test will be detailed within the test method.

3. Test Methods and Results

3.1. Contact Resistance: EIA-364-23B

Methodology: The following combinations were tested:

- Horizontal-to-Horizontal: 26-contact connectors, taking results of 5 different sets of pins for initial contact resistance.
- Vertical-to-Vertical: 26-contact connectors, taking results of 5 different sets of pins for initial contact resistance.
- Cable-to-Vertical: 12-contact connectors were measured, taking results from all pins for initial contact resistance.

Specification: 25mΩ maximum.
Results:

Male Connector	Female Connector	Average (mΩ)	Maximum (mΩ)	Minimum (mΩ)
M55-7102642R *Horizontal connector*	M55-6102642R *Horizontal connector*	17.7	18.7	17.2
M55-7002642R *Vertical connector*	M55-6002642R *Vertical connector*	12.2	12.7	11.7
M55-7021242R *Vertical connector*	M55-8001242-0150A *Cable Assembly*	12.6	15.7	10.3

3.2. Dielectric Withstanding Voltage: EIA-364-20C

Methodology: Combinations of 26 & 12-contact connectors were tested to Condition I (sea level altitude), Method B.
Results:

Male Connector	Female Connector	Condition	Result
M55-7102642R *Horizontal connector*	M55-6102642R *Horizontal connector*	500V AC for 1 minute	PASS (no breakdown)
M55-7002642R *Vertical connector*	M55-6002642R *Vertical connector*	500V AC for 1 minute	PASS (no breakdown)
M55-7021242R *Vertical connector*	M55-8001242-0150A *Cable Assembly*	500V AC for 1 minute	PASS (no breakdown)
M55-7001242R *Vertical connector*	M55-8201242 *Cable connector*	500V AC for 1 minute	PASS (no breakdown)

3.3. Insulation Resistance: EIA-364-21C

Methodology: The following combinations were tested:

- PCB Connectors: 26-contact connectors, tested to 10GΩ by stimulating adjacent pins at a voltage difference of 500V DC for 1 minute
- Cable Connectors/Assembly: 12-contact connectors, tested to 1GΩ by stimulating adjacent pins at a voltage difference of 500V DC for 1 minute.

Results:

Connector	Type	Specification	Result (initial)	Result after humidity test
M55-6102642R	Male Horizontal connector	10GΩ	PASS	PASS
M55-7102642R	Female Horizontal connector	10GΩ	PASS	PASS
M55-6002642R	Male Vertical connector	10GΩ	PASS	PASS
M55-7002642R	Male Vertical connector	10GΩ	PASS	PASS
M55-8001242-0150A	Female Cable Assembly	1GΩ	PASS	PASS
M55-8201242	Female Cable connector	1GΩ	PASS	PASS

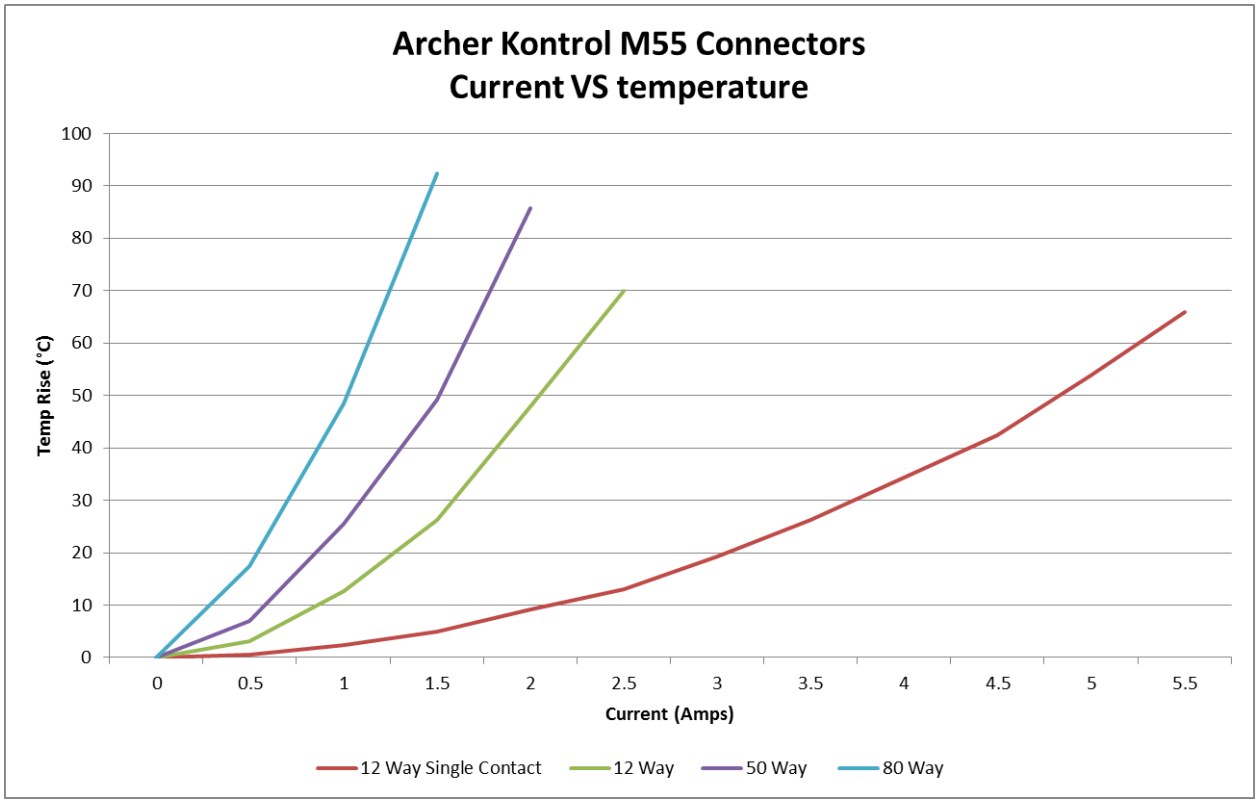
3.4. Temperature Rise Versus Current: EIA-364-70A, Method 2

3.4.1. Vertical PCB Connectors

Methodology: The test demonstrates the current carrying capability of a single pin, 12-contact, 50-contact and 80-contact connectors at elevated ambient temperatures. Each mating pair was soldered to a PCB to create a circuit in series. 0.5A increments were applied and the temperature rise above ambient recorded in each case. The test was stopped at either 4A or until a 60°C rise was recorded.
Results:

Number of contacts	Male Connector	Female Connector	Assembly Resistance ‡ (Ω)	
			Pre-conditioning	Post-conditioning
Single Pin (on 12-contact)	M55-7021242R	M55-6021242R	0.046	0.046
12	M55-7021242R	M55-6021242R	0.201	0.2
50	M55-7025042R	M55-6025042R	0.890	0.9
80	M55-7028042R	M55-6028042R	1.560	1.57

‡ Assembly Resistance includes both the resistance of the contacts, PCB, and connecting wires to the test equipment.



3.4.2. Cable Connectors

Methodology: The test demonstrates the current carrying capability of a 26-contact connector at elevated ambient temperatures. The mating pair was soldered to a PCB to create a circuit in series. 0.5A was applied and the temperature rise above ambient recorded.
Results:

Male Connector	Female Connector	Temperature Rise (°C)						
		1	2	3	4	5	6	Average
M55-7022642R	M55-8002642-0150A	13.89	15.41	11.03	12.99	11.87	12.91	**13.02**

3.5. Thermal Shock to EIA-364-32C, Condition III

3.5.1. Vertical PCB Connectors

Methodology: A mated pair of M55-6002442R and M55-7002442R (24-way PCB vertical connectors) were used for the test. Contact resistance before and after the thermal shock conditioning were measured, and the difference calculated. The results shown in the table are the results over 10 pins.
Specification: The change in Contact Resistance must be less than 10mΩ, and the connectors must show no evidence of physical damage.
Results:

Change in Contact Resistance (mΩ)			Visual Inspection
Average	Maximum	Minimum	
0.77	1.64	0.08	PASS

3.5.2. Cable Connectors

Methodology: Six mated pairs of M55-8002642-0150A (26-contact female cable assembly) and M55-7022642R (26-contact male PCB vertical connectors) were used for the test. Contact resistance before and after the thermal shock conditioning were measured, and the difference calculated. The results shown in the table are the results over 10 pins.
Specification: The Contact Resistance must be less than 1,000mΩ, and the connectors must show no evidence of physical damage.
Results:

Pre-Conditioning (mΩ)			Post-Conditioning (mΩ)			Visual Inspection
Max	Min	Average	Max	Min	Average	
128.9	106.7	**111.2**	154.2	117.9	**132.3**	PASS

3.6. Temperature Life: EIA-364-17B, Condition 5, Method A

Methodology: The mated pair of connectors were subject to 96 hours at 125±2°C.
Specifications:

- PCB Connectors: change in Contact Resistance must be less than 10mΩ, and the connectors must show no evidence of physical damage
- Cable Connectors/Assembly: Contact Resistance must be less than 1,000mΩ

Results:

Pre-Conditioning (mΩ)			Post-Conditioning (mΩ)			Visual Inspection
Max	Min	Average	Max	Min	Average	
131.1	117.2	**123.3**	143.3	128.9	**134.1**	PASS

3.7. Salt Spray: EIA-364-26B

3.7.1. PCB Connectors

Methodology: A mated pair of connectors were measured for contact resistance, then subjected to 24 hours continuous exposure to a 5% salt spray concentration, with ambient temperature at 35 +1/-2°C.
Specification: The change in Contact Resistance must be less than 10mΩ, and the connectors must show no evidence of physical damage.
Results:

Change in Contact Resistance (mΩ)			Visual Inspection
Average	Maximum	Minimum	
0.72	1.30	0.30	PASS

3.7.2. Cable Connectors

Methodology: A mated pair of connectors were measured for contact resistance, then subjected to 24 hours continuous exposure to a 5% salt spray concentration, with ambient temperature at 35 +1/-2°C.
Specification: The Contact Resistance must be less than 1,000mΩ, and the connectors must show no evidence of physical damage.
Results:

Pre-Conditioning (mΩ)			Post-Conditioning (mΩ)			Visual Inspection
Max	Min	Average	Max	Min	Average	
128.9	106.7	**111.2**	154.2	117.9	**132.3**	PASS

3.8. Humidity: EIA-364-31B, Condition A

3.8.1. PCB Connectors

Methodology: A mated pair of connectors were measured for contact resistance, then subjected to 96 hours at relative humidity of 90-95%, 40±-2°C.
Specification: The change in Contact Resistance must be less than 10mΩ, and the connectors must show no evidence of physical damage. Insulation Resistance and Dielectric Withstanding Voltage are also checked after the exposure test, to >1,000MΩ and 500V AC for 1 minute respectively.
Results:

Change in Contact Resistance (mΩ)			Visual Inspection	Insulation Resistance	Dielectric Withstanding Voltage
Average	Maximum	Minimum			
0.84	1.40	0.30	PASS	PASS	PASS

3.8.2. Cable Connectors

Methodology: A mated pair of connectors were measured for contact resistance, then subjected to 96 hours at relative humidity of 90-95%, 40±-2°C.
Specification: The Contact Resistance must be less than 1,000mΩ, and the connectors must show no evidence of physical damage. Insulation Resistance and Dielectric Withstanding Voltage are also checked after the exposure test, to >5MΩ and 300V AC for 1 minute respectively.
Results:

Pre-Conditioning (mΩ)			Post-Conditioning (mΩ)			Visual Inspection	Insulation Resistance	Dielectric Withstanding Voltage
Max	Min	Average	Max	Min	Average			
128.9	106.7	111.2	154.2	117.9	132.3	PASS	PASS	PASS

3.9. Vibration: EIA-364-28D

Methodology: Test conditions:

- Amplitude: 1.52mm peak to peak
- Sweep: 10 to 2,000 to 10Hz in 20 minutes
- Acceleration: 196.1m/s² (20G) at peak
- Duration: 4 hours in each axis, 12 hours total

Test samples:

- Mated pair of M55-6022442R and M55-7022442R (24-contact female and male vertical PCB connectors), soldered to a PCB
- Mated pair of M55-6102442R and M55-7102442R (24-contact female and male horizontal PCB connectors), soldered to a PCB
- Mated pair of M55-8002642-0150A (26-contact female cable assembly), and two M55-7022642R (26-contact male vertical PCB connectors) soldered to a PCB

Results:

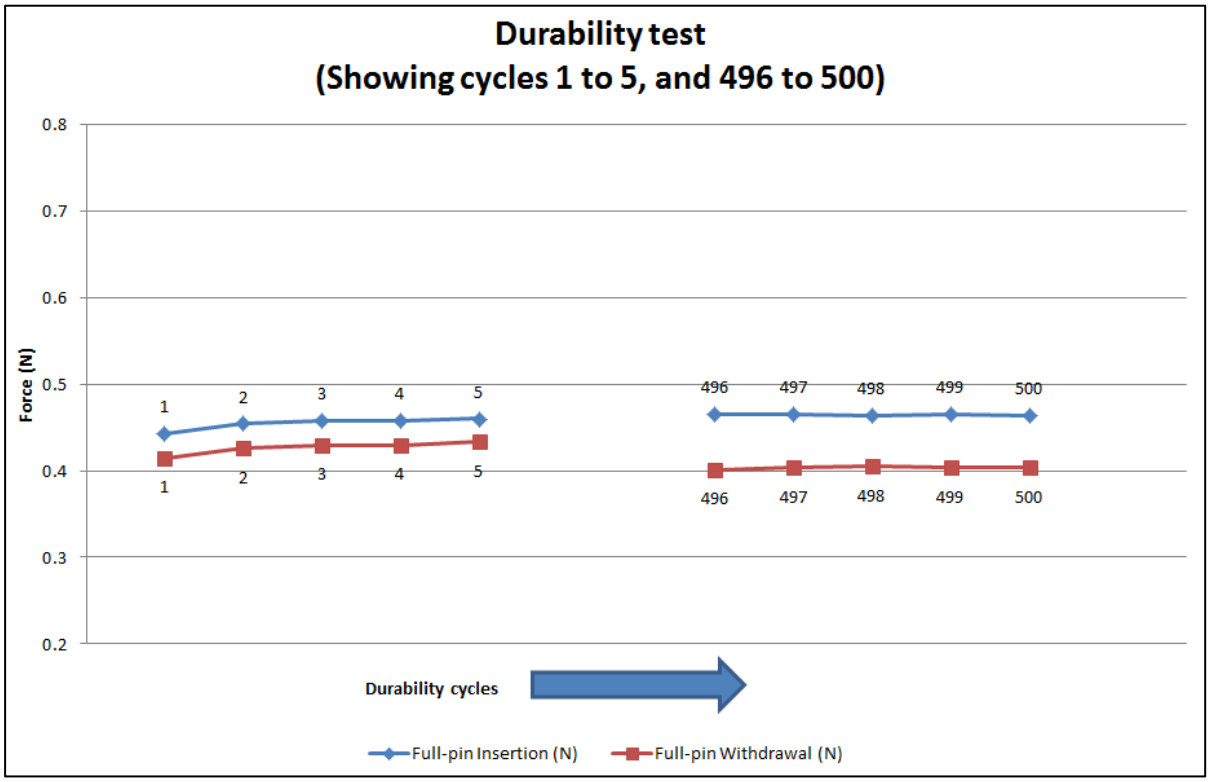
- No evidence of physical damage and meets the electrical requirements.
- No discontinuity measured.

3.10. Durability, Insertion and Withdrawal Forces: EIA-364-13C

3.10.1. Vertical PCB Connectors

Methodology: A mating pair of 26-contact connectors (M55-6022642R and M55-7022642R) was used during this test. Insertion and withdrawal forces per pin were measured during the first 5 mating cycles. The parts were then mated 500 times, with further force measurements for insertion and withdrawal carried out on the last 5 cycles.
Specification: 0.8N max insertion force per contact, 0.2N min withdrawal force per contact
Results:

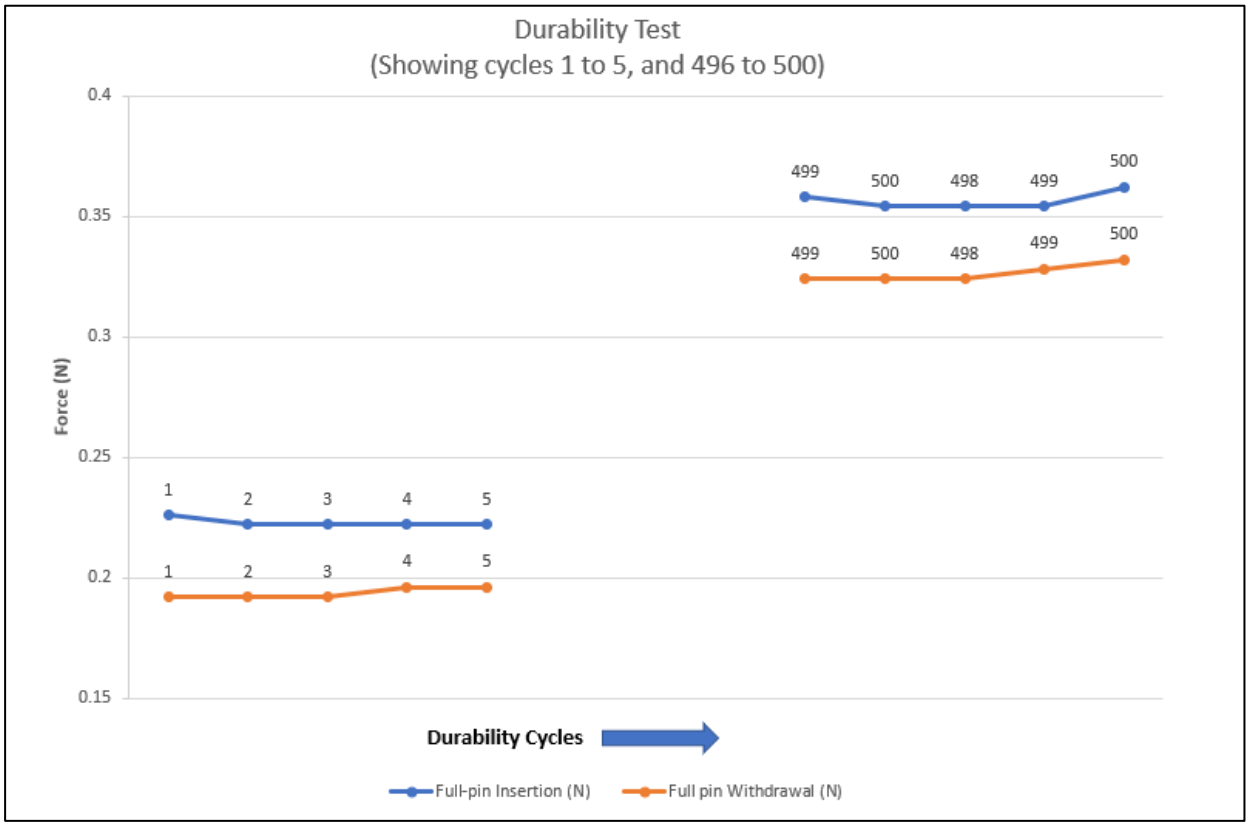
Force per pin (N)	Average	Maximum	Minimum	Result
Insertion	**0.46**	0.47	0.44	PASS
Withdrawal	**0.41**	0.43	0.40	PASS



3.10.2. Cable Connectors

Methodology: 26-contact connectors M55-8002642-0150A (female cable assembly) and M55-7022642R (male vertical PCB connector) was used during this test. Insertion and withdrawal forces per pin were measured during the first 5 mating cycles. The parts were then mated 500 times, with further force measurements for insertion and withdrawal carried out on the last 5 cycles.
Results:

Force per pin (N)	Average	Maximum	Minimum	Result
Insertion	0.29	0.36	0.22	PASS
Withdrawal	0.26	0.33	0.19	PASS



3.11. Contact Retention Force: EIA-364-29C

Methodology: A sample of each type of gender and orientation of connector was tested for individual contact retention in the housing.
Specification: 3.9N minimum. The contacts are extracted at 25.4mm/minute.
Results:

Connector type	Average (N)	Maximum (N)	Minimum (N)	Result
Female Horizontal	**11.3**	11.9	10.4	PASS
Female Vertical	**12.1**	13.5	11.3	PASS
Male Horizontal	**11.9**	14.0	11.1	PASS
Male Vertical	**19.7**	21.3	17.8	PASS

3.12. Plating Finish Thicknesses

Methodology: Plating thicknesses were checked at various key areas of the contacts.
Results:

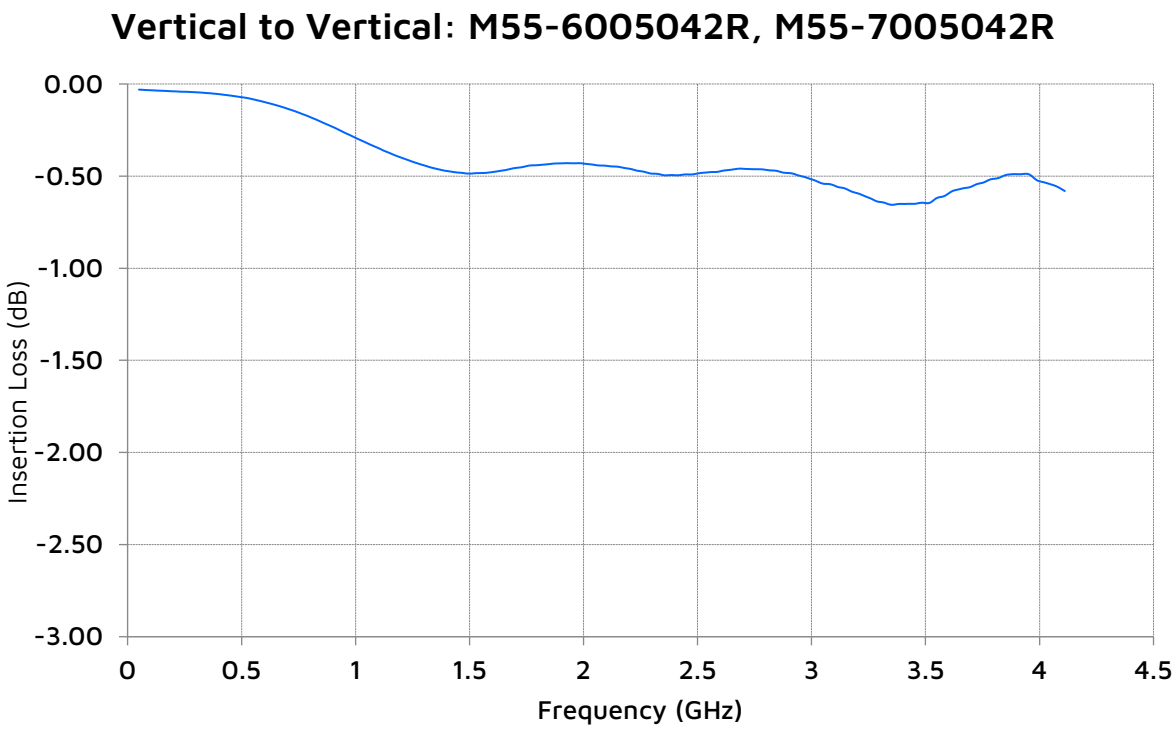
Inspection area	Required min thickness (µm)	Average (µm)	Maximum (µm)	Minimum (µm)	Result
Contact area, Gold	0.025	0.030	0.042	0.026	PASS
Contact area, Nickel underplating	2	2.48	3.19	2.17	PASS
Solder area, Tin	2.5	2.72	3.00	2.55	PASS
SMT Hold-down retainer, Tin	2.5	3.07	3.25	2.80	PASS
SMT Hold-down retainer, Nickel underplating	1	1.39	1.51	1.27	PASS

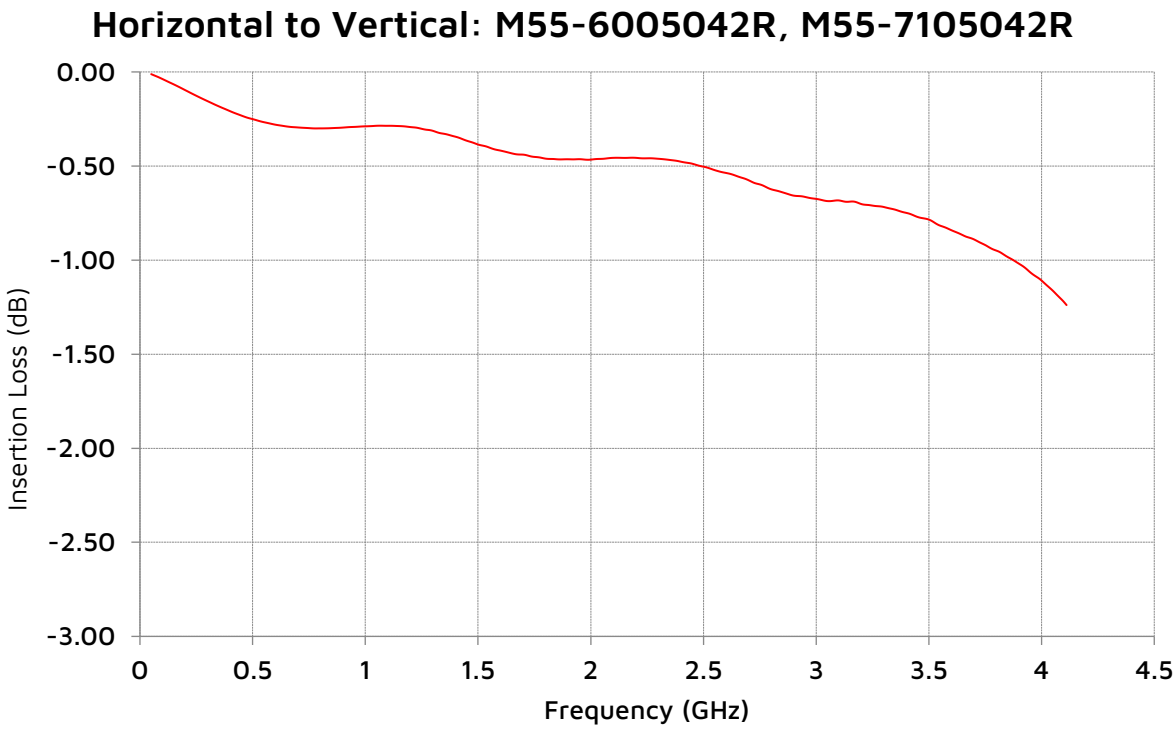
3.13. Frequency Range

Methodology: A selection of 50-contact connectors (Vertical: M55-6005042R, M55-7005042R; Horizontal: M55-6105042R, M55-7105042R) were mounted to specially made test boards, which were attached to a network analyser. The network analyser created signal to measure insertion loss for a differential signal, and Near End Cross Talk (NEXT) in 3 different arrangements.

For more detail on this test and further explanation on the conclusion, see Test Report 1746.

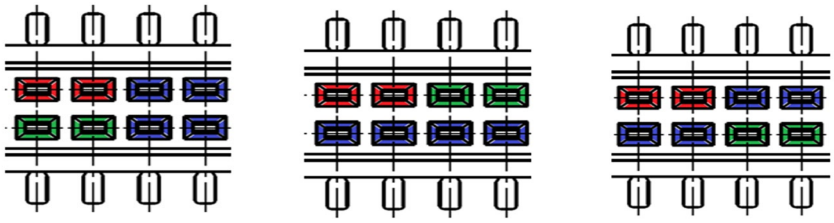
3.13.1. Insertion Loss





3.13.2. Near End Cross Talk (NEXT)

Methodology: Three different combinations of cross talk were measured with differential signals:



NEXT Config 1 NEXT Config 2 NEXT Config 3

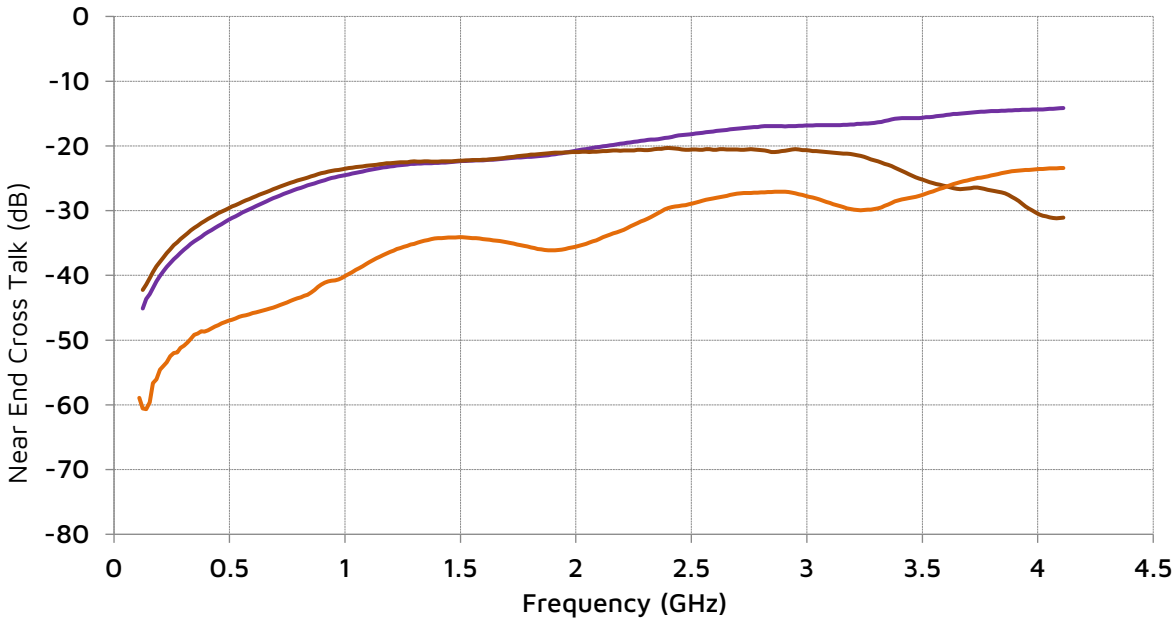
Contact colours:

Ground

Signal

Aggressor

Results:



From the results in these two tests, common 'rules of thumb' are applied to establish a data rate:

- Double the signal bandwidth (Hz) for the data rate in Bits per second. For example, a 1GHz bandwidth would mean a 2Gbit/s signal can be transmitted through a connector.
- The bandwidth cut-off frequency of a connector is at -3dB (half the power) on insertion loss.
- Bandwidth of a connector is also limited when a neighbouring transmission line has crosstalk at -20dB (1/10th the voltage) into the signal line.

The conclusion is drawn that a conservative estimate (to the nearest integer) establishes a data rate of 3Gbit/s for this connector system.