Harwin Test Report Summary

HT06002

General Testing of Archer Kontrol (M55 Series) Connectors

harwin.com

1. Introduction.

1.1. Description and Purpose.

Archer Kontrol (M55 Series) is a range of board-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 and 1746. 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.

2. Test Requirements.

2.1. Test Samples.

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

2.2. Specification Parameters.

Tests were either 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	Page No.
EIA-364-23B	Contact Resistance	3
EIA-364-20C	Dielectric Withstanding Voltage	3
EIA-364-21C	Insulation Resistance	3
EIA-364-70A	Temperature Rise Versus Current	4
EIA-364-32C	Thermal Shock (Temperature Cycling)	5
EIA-364-17B	Temperature Life	5
EIA-364-26B	Salt Spray	5
EIA-364-31B	Humidity	5
EIA-364-28D	Vibration	6
EIA-364-13C	Durability, Insertion and Withdrawal Forces	6
EIA-364-29C	Contact Retention Force	7
n/a	Plating finish thicknesses	7
n/a	Frequency range	7

3. Test Methods and Results.

3.1. Contact resistance to EIA-364-23B.

Combinations of 26-contact connectors were measured, taking results of 5 different sets of pins for initial contact resistance. The specification set at 25mΩ maximum.

Male connector	Female Connector	Average (mΩ)	Maximum (mΩ)	Minimum (mΩ)
M55-7102642R *Horizontal polarization*	M55-6102642R *Horizontal polarization*	17.7	18.7	17.2
M55-7002642R *Vertical polarization*	M55-6002642R *Vertical polarization*	12.2	12.7	11.7

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

Combinations of 26-contact connectors were used and tested to Condition I (specifying altitude of sea level), Method B.

Male connector	Female Connector	Condition	Result
M55-7102642R *Horizontal polarization*	M55-6102642R *Horizontal polarization*	500V AC for 1 minute	PASS (No breakdown)
M55-7002642R *Vertical polarization*	M55-6002642R *Vertical polarization*	500V AC for 1 minute	PASS (No breakdown)

3.3. Insulation resistance to EIA-364-21C.

Four 26-contact connectors were used to test the Insulation Resistance to 10GΩ by stimulating adjacent pins at a voltage difference of 500V DC for 1 minute.

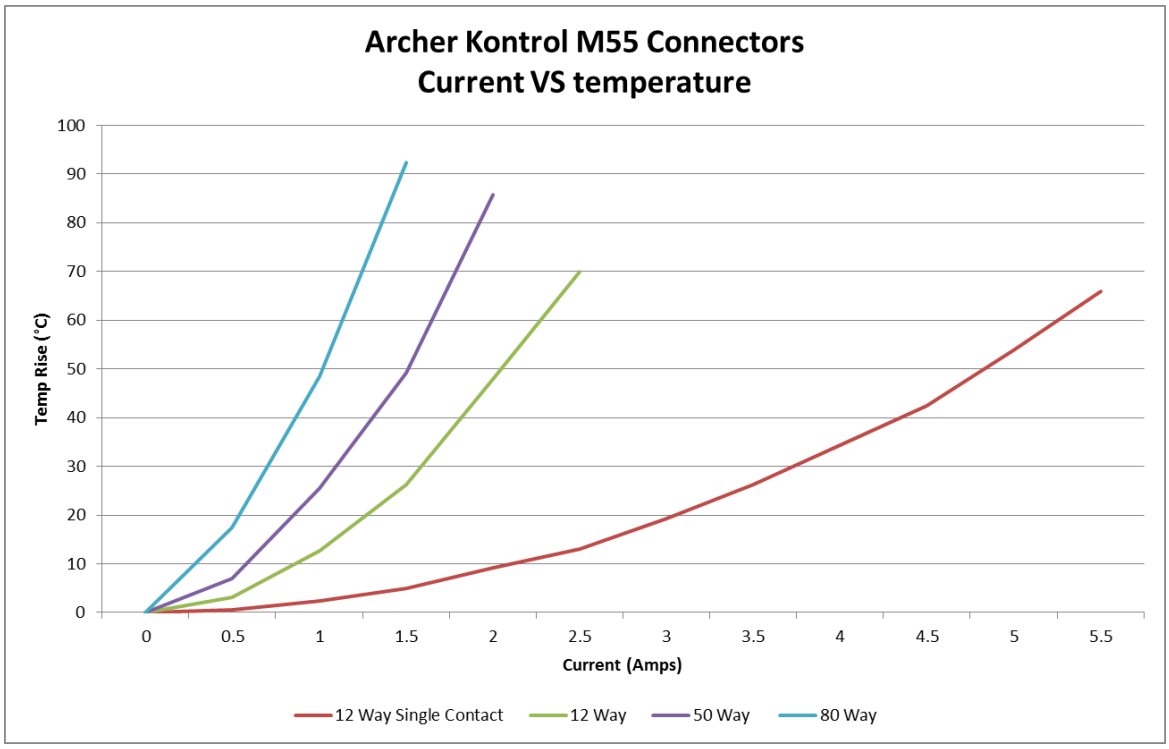
Connector	Type	Result (Initial)	Result after humidity test
M55-6102642R	Male, Horizontal polarization	PASS	PASS
M55-7102642R	Female, Horizontal polarization	PASS	PASS
M55-6002642R	Male, Vertical polarization	PASS	PASS
M55-7002642R	Male, Vertical polarization	PASS	PASS

3.4. Temperature Rise Versus Current to EIA-364-70A.

The test demonstrates the current carrying capability of a single pin and 12-contact, 50-contact and 80-contact connectors at elevated ambient temperatures, and is carried out in accordance with EIA-364-70A, Method 2. 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.

Number of contacts	Male Connector	Female Connector	Assembly resistance❇ pre-conditioning (Ω)	Assembly resistance❇ post-conditioning (Ω)
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.*



3.5. Thermal Shock to EIA-364-32C.

The test was carried out to EIA-364-32C, Condition III. A mated pair of M55-6002442R and M55-7002442R (24-way 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. The change in Contact Resistance must be less than 10mΩ, and the connectors must show no evidence of physical damage.

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

* *24-contact connectors were manufactured during the product development phase, but were not added to the final launch product sizes.*

3.6. Temperature Life to EIA-364-17B.

The test was carried out to EIA-364-17B, condition 5, method A; the mated pair of connectors were subject to 96 hours at 125±2°C. The change in Contact Resistance must be less than 10mΩ, and the connectors must show no evidence of physical damage – all samples passed.

3.7. Salt Spray to EIA-364-26B.

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. The change in Contact Resistance must be less than 10mΩ, and the connectors must show no evidence of physical damage.

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

3.8. Humidity to EIA-364-31B.

A mated pair of connectors were measured for contact resistance, then subjected to 96 hours at relative humidity of 90-95%, 40±-2°C in accordance with EIA-364-31B Condition A. 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 >1000MΩ and 500V AC for 1 minute respectively.

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

3.9. Vibration to EIA-364-28D.

Test samples:

- Mated pair of M55-6022442R* and M55-7022442R*, soldered to a PCB
- Mated pair of M55-6102442R* and M55-7102442R*, soldered to a PCB

Test conditions:

- Amplitude: 1.52mm peak to peak
- Sweep: 10 to 2000 to 10Hz in 20 minutes
- Acceleration: 196.1m/s^2 (20G) at peak
- Duration: 4 hours in each axis, 12 hours total

Test results:

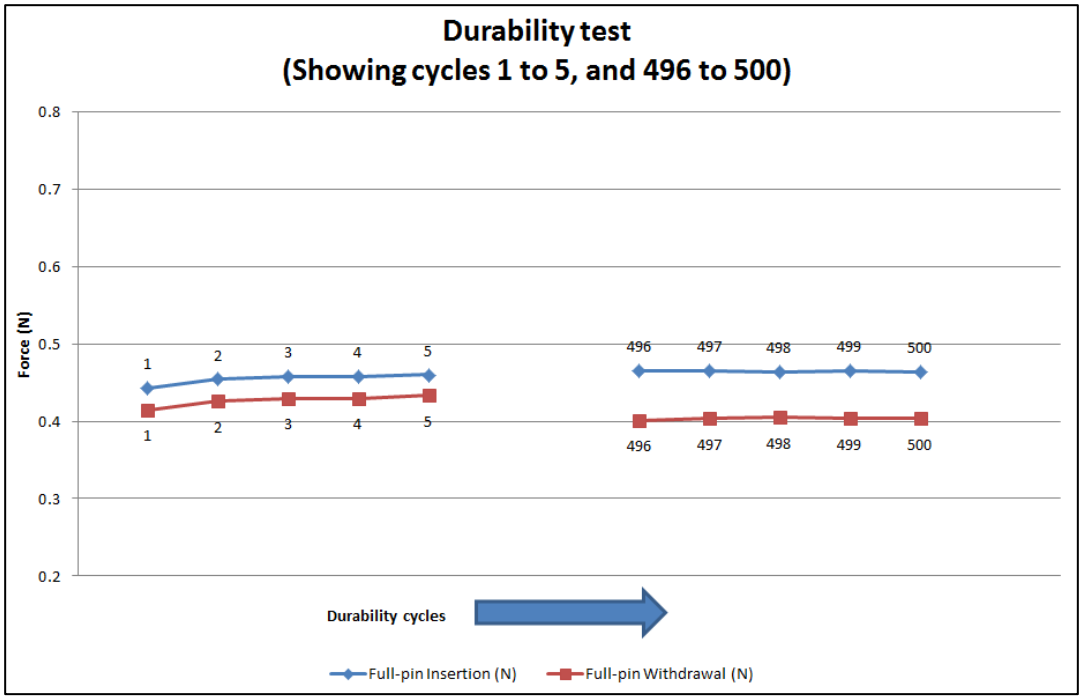
- No evidence of physical damage and meets the electrical requirements.
- No discontinuity measured.

❊ *24-contact connectors were manufactured during the product development phase, but were not added to the final launch product sizes.*

3.10. Durability, Insertion and Withdrawal forces to EIA-364-13C.

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.

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



The specification is set at (per pin) 0.8N max insertion force, 0.2N min withdrawal force.

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

A sample of each type of gender and orientation of connector was tested for individual contact retention in the housing. The specification is set at 3.9N minimum. The contacts are pulled out of the housing at a speed of 25.4mm/minute.

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.

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

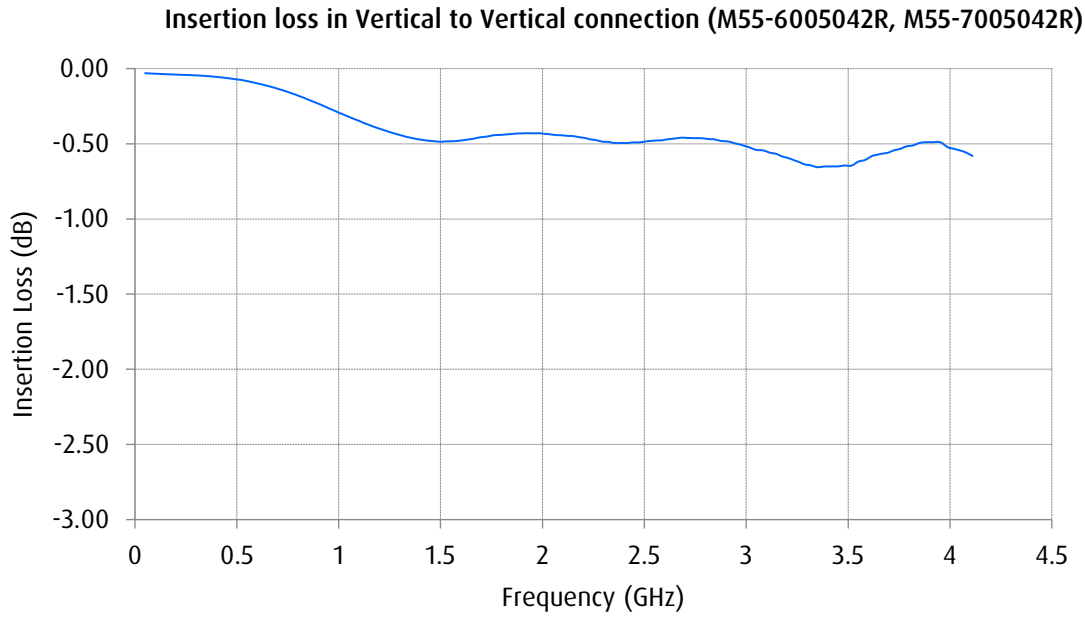
Inspection area	Required minimum thickness	Average (µm)	Maximum (µm)	Minimum (µm)	Result
Contact area, Gold	0.025µm	0.030	0.042	0.026	PASS
Contact area, Nickel underplating	2µm	2.48	3.19	2.17	PASS
Solder area, Tin	2.5µm	2.72	3.00	2.55	PASS
SMT Hold-down retainer, Tin	2.5µm	3.07	3.25	2.80	PASS
SMT Hold-down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

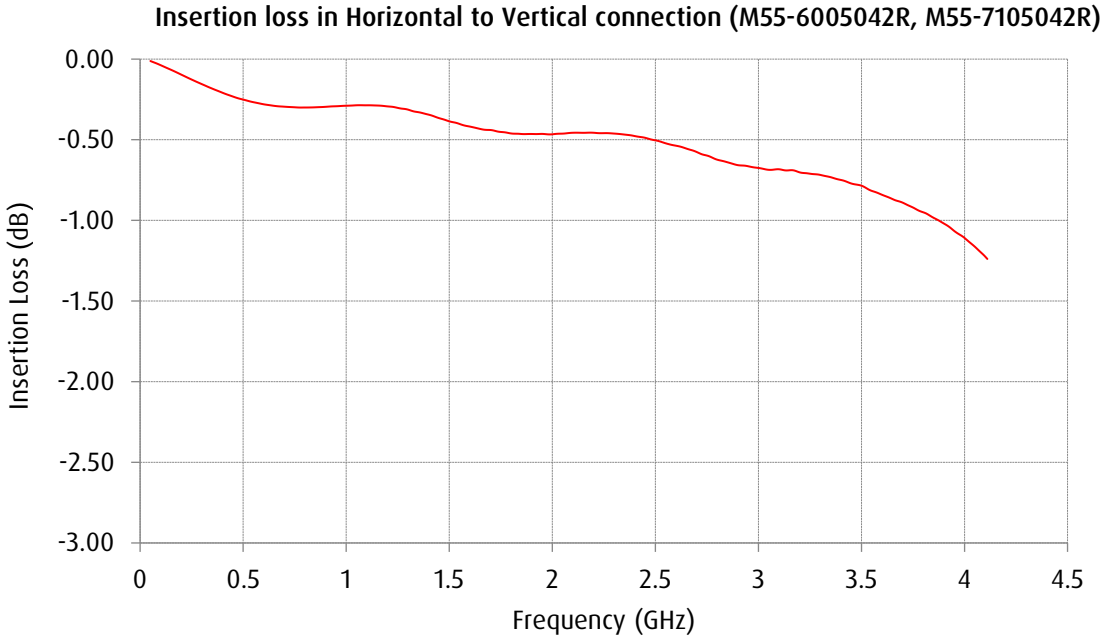
3.13. Frequency range.

A selection of 50-contact connectors (M55-6005042R, M55-7005042R, M55-6105042R and 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.

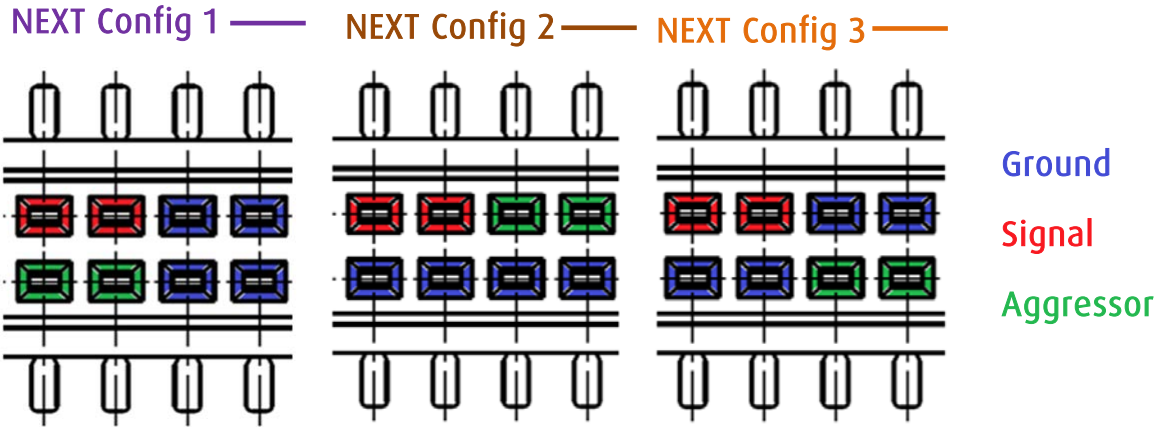
For more detail on this test and further explanation on the conclusion, see Test Report 1746.

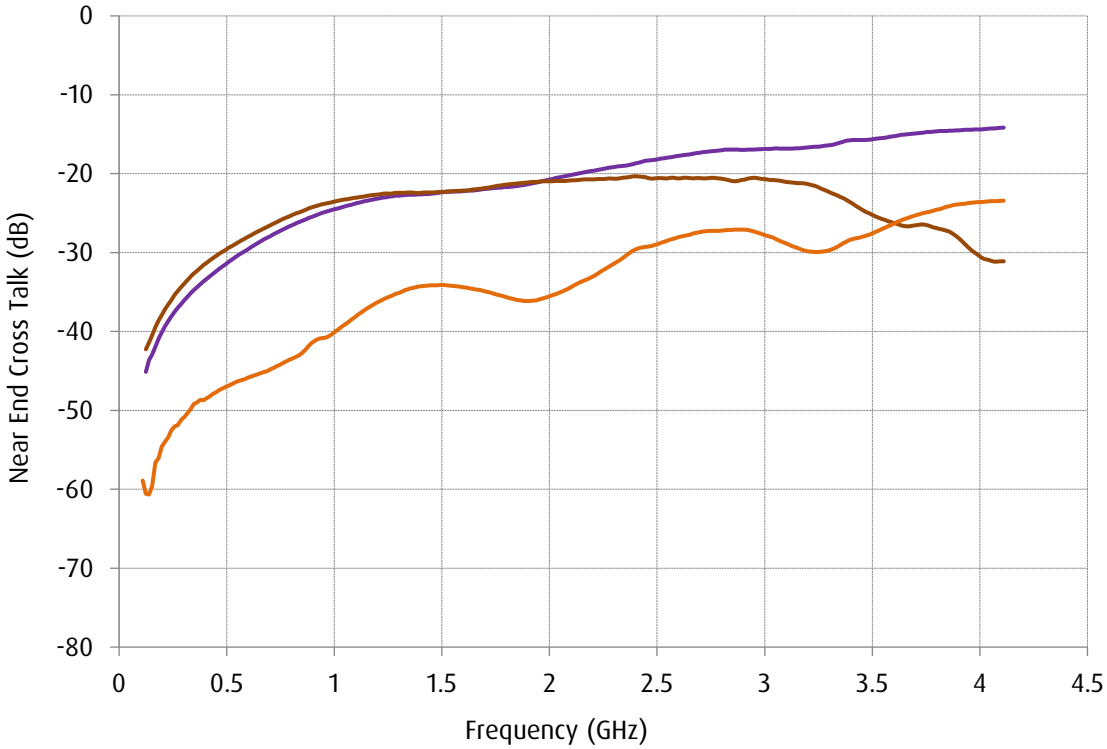
- **Insertion Loss**





- **Near End Cross Talk (NEXT)**
  Three different combinations of cross talk were measured with differential signals:





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.