

ANAMET REPORT

ANAMET Report 007
May 1997

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exercise: ANAMET-963

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LIVE DIAL GAUGE COMPARISON EXERCISE: ANAMET-963

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Abstract

This report presents results obtained from a comparison exercise of coaxial connector dial gauge measurements made during the seventh ANAMET meeting, which took place at Marconi Instruments, Stevenage, on the 20th November 1996. The results of the nine participants in the exercise were analysed at the meeting - this report provides a general summary of the exercise.

Introduction

This report presents results obtained from a second "live" comparison exercise of coaxial connector dial gauge measurements. The measurements were made during the seventh ANAMET meeting, which took place at Marconi Instruments, Stevenage, on the 20th November 1996. The comparison was assigned the identifier ANAMET-963, in line with other exercises in the ANAMET series of comparisons.

The decision to undertake the exercise was made following the success of the first "live" dial gauge comparison exercise, which took place during the previous (sixth) ANAMET meeting, and has been reported in an earlier ANAMET Report [1]. For this second "live" dial gauge comparison, it was decided to measure items fitted with a different type of coaxial connector, *i.e.*, the GPC-3.5 connector. Specifically, the items used previously for the second "round-robin" ANAMET comparison exercise (identified as ANAMET-941 and described in [2]) were used to provide four male and four female GPC-3.5 connectors for the "live" dial gauge comparison.

Prior to the meeting, it was suggested that participants wishing to participate in the dial gauge comparison should bring their own gauges to the meeting during which a session would be set aside so that the items could be circulated freely to all wishing to measure the items.

This report summarises the results obtained by the participants. The variation in the results is compared with that achieved when the connectors were gauged during the ANAMET-941 exercise.

Comparison details

The comparison exercise consisted of measuring the connector pin recession depths for four coaxial attenuators, each fitted with a male and a female GPC-3.5 connector. This provided four male and four female connectors for gauging. The results were input into the ANAMET

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data analysis program, as they were generated, for processing. The resulting summary statistics were given to the participants at the meeting enabling them to assess their results with respect to the summary data. As with the earlier "live" dial gauge comparison, the entire exercise took less than an hour to complete (*i.e.*, to do all the measurements, process the results and provide the participants with the statistical summary).

Results - summary statistics

The participants' results for each item were summarised in terms of:

- an average value, in terms of the median [3] of the values;
- a measure of dispersion, in terms of the median absolute deviation (MAD) [4] from the median;
- the range, in terms of the maximum and minimum values obtained by the participants.

The summary statistics are given below.

HP 8493C attenuators		Dial gauge measurement summary ($\times 10^{-3}$ inch)			
Connector type	Serial number	Minimum	Median	Maximum	MAD
Male	01145	0.8	0.9	1.2	0.10
	05351	0.9	1.1	1.2	0.10
	02328	1.1	1.3	1.5	0.10
	01403/01432	0.6	0.8	1.0	0.15
Female	01145	0.0	0.1	0.4	0.05
	05351	0.5	0.6	0.8	0.10
	02328	0.7	0.8	1.5	0.04
	01403/01432	0.7	0.8	1.0	0.05

Observations

(i) Generally, the agreement between all participants' results was very encouraging, especially since the measurements were not made in a laboratory environment. The good agreement is demonstrated by the small MAD values³ (between 0.04×10^{-3} inch and 0.15×10^{-3} inch) and the small differences between maximum and minimum values (differences ranging from 0.3×10^{-3} inch to 0.8×10^{-3} inch). This shows there is a very tight grouping around a notional central value (indicated by the MAD values) with no significant outlying measurements (indicated by the differences between the maximum and minimum values.)

The maximum value of 1.5×10^{-3} inch for the female connector on attenuator serial number 02328 could be classified as outlying, especially when viewed in context with the very small

³ The interval \pm MAD contains half of the participants' results.

MAD value of 0.04×10^{-3} inch for this set of results. However, the comparison did not produce the extreme outlying measurements found in the first ANAMET "live" dial gauge comparison exercise [1].

(ii) The variations in the results of the exercise (represented by the MAD values) can be compared with the variations found when the items were gauged by the participants in the ANAMET-941 "round robin" exercise. (The inter-quartile range (IQR) values obtained in the ANAMET-941 exercise can be converted to the equivalent MAD values since $IQR \approx 2 \times MAD$.) The maximum MAD values (MAD_{max}) and the minimum MAD values (MAD_{min}) obtained on the two occasions are given in the table below (to two decimal places).

	$MAD_{min} (\times 10^{-3} \text{ inch})$	$MAD_{max} (\times 10^{-3} \text{ inch})$
"Live" comparison (ANAMET-963)	0.04	0.15
"Round-robin" comparison (ANAMET-941)	0.02	0.11

The values obtained during the "live" comparison exercise are slightly larger than the values obtained in the "round robin" exercise, but not by much (remembering that the "round robin" measurements were made by participants at their own premises under laboratory conditions).

Conclusions

The exercise has demonstrated once again that on-the-spot measurement comparisons of a relatively simple parameter can be performed successfully. The analysis of the results showed very good agreement between all the participants' values (largest difference between maximum and minimum values of 0.8×10^{-3} inch) and a comparable calibre of measurement to that achieved during a similar comparison exercise performed under laboratory conditions (comparable MAD values in both cases).

Acknowledgements

The authors, on behalf of ANAMET, would like to thank all those who participated in the comparison exercise.

References

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