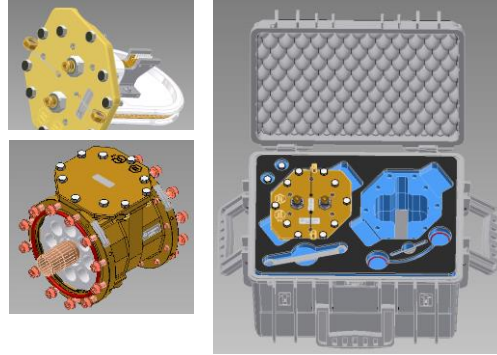


TD-00178

DIRECT ACCESS UNITS (DAU)



1 Motivation

Problem:

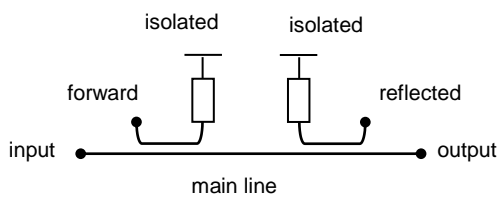
The RF performance of coaxial systems is usually measured by simply unplugging the DUT (device under test) and connecting it to a network analyser or similar instrument.

But semi-flexible feeders bigger than 1" and rigid lines cannot simply be unplugged. It is necessary to partially dismantle the system to get access to the ends of the coaxial lines and use adaptors to reduce the diameter before starting any measurement.

This process is time consuming and does not allow measuring the performance of the complete system in final position.

Solutions:

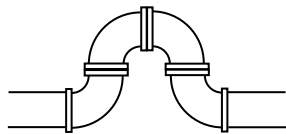
Permanently installed directional couplers



The installation of directional couplers is useful for monitoring the signals running along the line, but does not allow complete and reliable measurement of all RF parameters:

- The signals of such directional couplers are sufficient to detect changes of the RF performance but can't be used for a VNA (vector network analyser) measurement because the phase relations of the probe signals are not defined.
- The calibration of the directional couplers cannot be verified without dismantling the system, which is problematic especially if they are installed outdoor on the mast where they are subject to weather and vibrations (remember that usually all measurement instruments are calibrated in regular intervals).

Line access by a set of 4 elbows



A simple way to get access to coaxial line systems is to install elbows at the ends and use a pair of elbows like a U-link. But this has significant disadvantages:

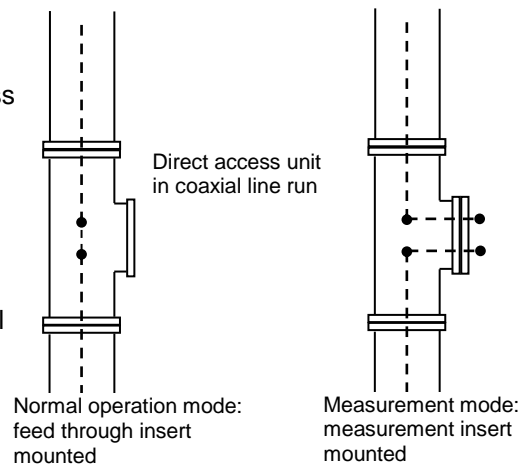
- The reflexions produced by 4 consecutive elbows will deteriorate the matching of the coaxial system, especially at higher frequencies.
- Adaptors need to be mounted on the line ends before measurements can be started.
- Significant time is required for measurements and eventually interruption of service (flange screws need to be opened and adaptors fixed instead of the elbow).

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Direct access units

The most versatile and sophisticated solution are direct access units which grant excellently matched, full galvanic contact to the coaxial line system for measurements and unlimited performance for normal operation.

- All kinds of measurements can be performed in few minutes without dismantling any part of the coaxial system.
- No degradation of VSWR or power rating during normal operation with feed through insert.
- No need for adaptors, because measurement ports are equipped with high quality 7-16 DIN or N-female connectors.



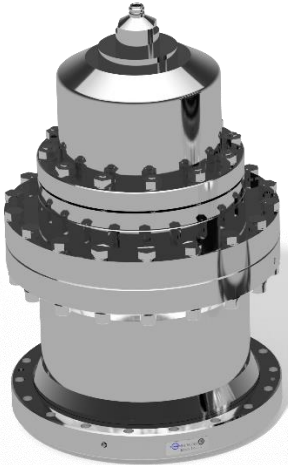
SPINNER offers direct access units for all big coaxial systems. Please ask for a quote via <https://products.spinner-group.com/>

	1 5/8" EIA 50 Ω	3 1/8" EIA 50 Ω	3 1/8" EIA 50 Ω	4 1/2" EIA 50 Ω	6 1/8" EIA 50 Ω	6 1/8" EIA 50 Ω	9 3/16" EIA 50 Ω
Direct access unit	BN 390906	BN 847712	BN 847710	BN 876610	BN 876706	BN 876730	BN 876760
Measurement insert	BN 495951	BN 290903	BN 590302	BN 590302	BN 315401	BN 876735	BN 876765

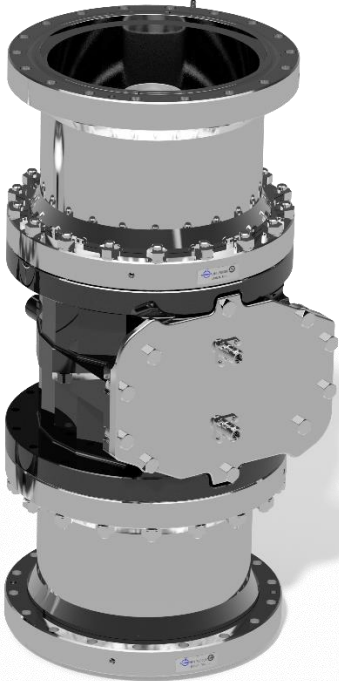
	6 1/8" EIA 75 Ω	7 3/16" EIA 75 Ω	8 3/16" EIA 75 Ω
Direct access unit	BN 876770	BN 876740	BN 876750
Measurement insert	BN 876775	BN 876745	BN 876755

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Direct access units versus conventional adaptors – advantages of DAUs:



conventional adaptors



DAU

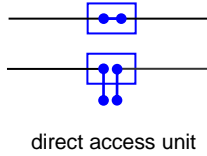
Time and efforts	
Hours to dismantle and install adaptors	Minutes to change insert No adaptor required
Accuracy and validity of measurement	
Return loss of one or more adaptors unknown (accumulation of reflections)	return loss of test insert typically 40 dB
System cannot be measured in working condition (dismantling and reassembling of flanges, elbows, adaptors)	System is measured in working condition

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2 General Information

See NAB ENGINEERING HANDBOOK, edition 11 (2018), chapter 10.7, “TV Transmission Line and Antenna System Measurements” by Todd R. Loney and Stephen N. Heazlewood.

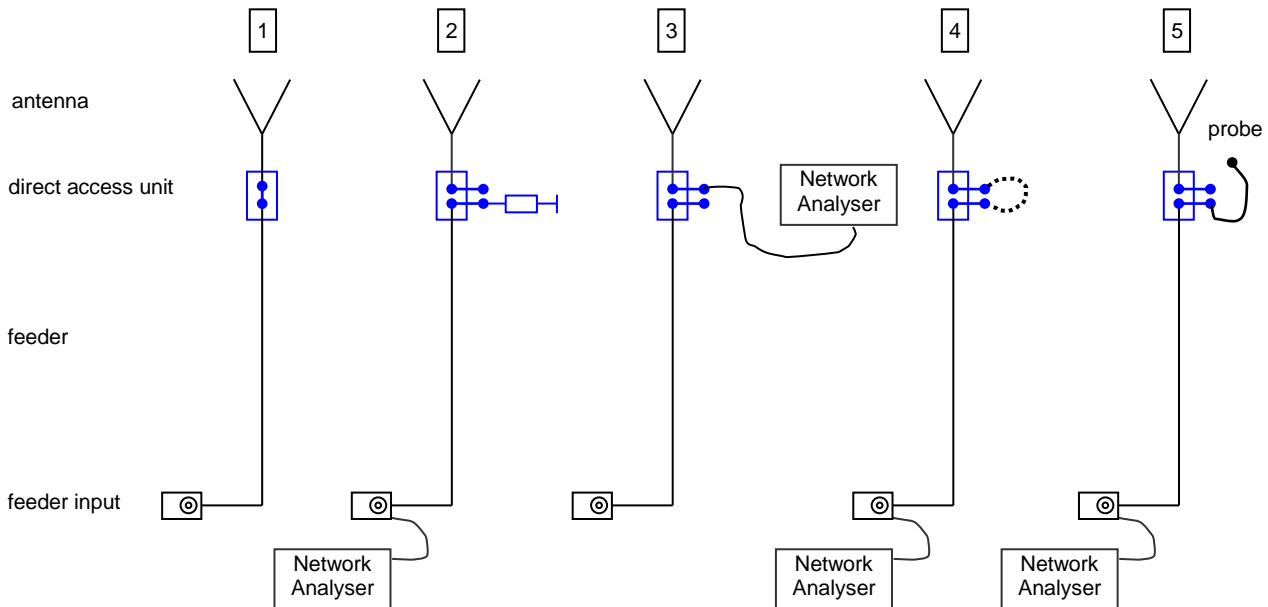
3 Installation of Direct Access Units



A direct access unit which is installed in a coaxial system allows measurements in both directions using all capabilities of the test instrument without loss of accuracy, because the measurement insert gives full access to both ends of the inner conductors with excellent matching.

Direct access units are typically installed between upper feeder end and antenna input, but they may be as well installed at the lower feeder end to provide a test point if there is no U-link panel.

4 Single Feeder Systems



The following paragraphs describe measurement methods for single feeder systems ¹ depending on the position of the analyser.

Feeder Measurement ²

The VSWR of the feeder line can be measured using a Network Analyser connected to the lower end of the feeder line, if the measurement insert is installed in the direct access unit and the test port which is connected to the upper end of the feeder line is matched by an absorber.

Antenna Measurement and Tuning on Top ³

The antenna can be measured and tuned without dismantling any cable or power splitter via the direct access unit if the Network Analyser is placed on top.

Antenna Measurement and Tuning via Feeder ⁴

The antenna impedance can be measured from the ground with a Vector Network Analyser, if the reference plane is placed at the end of a jumper connected to the upper end of the feeder (calibration kit at end of dashed cable).

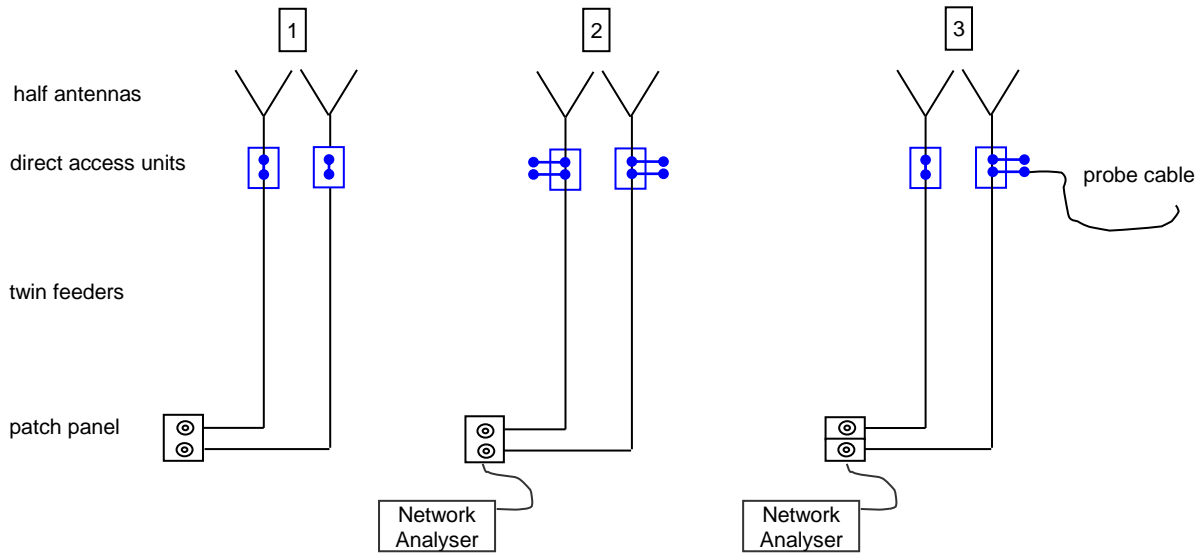
Feeder as low loss Extension Cables for Phase or Field Strength Measurements ⁵

The feeder can be used for any measurements on top of the tower via the direct access unit.

Template TD-000011

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5 Twin Feeder Systems



In addition to the measurement applications described for single feeder systems a direct access unit offers following options when installed in twin feeder systems. ¹

Phasing of the Two Feeder Lines ²

The two feeder lines need to have the same electrical length (within a tolerance of $\pm 2^\circ$) for proper combination of the half antenna signals in the air; otherwise the main lobe will be steered in the wrong elevation.

In practice the feeders must be installed in final position before their length is measured and equalized by cutting the longer one.

If direct access units are installed at the upper ends of the feeders it is only necessary to remove the feed through inserts (both feeders open ended) to measure the electrical length of the feeders from the bottom. After cutting one feeder at the lower end the result can be verified from the bottom.

Measuring the Feed Parameters of the Antennas forming the Array ³

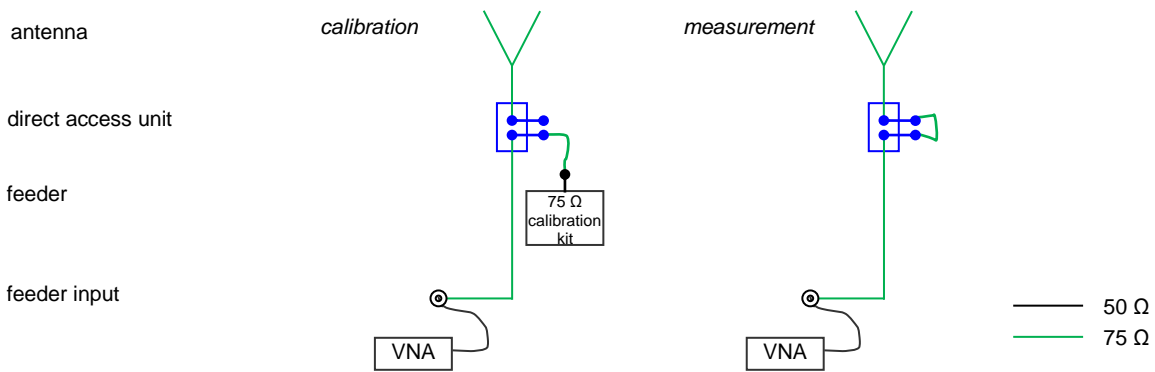
The radiation pattern of antenna arrays is mostly determined by the parameters (amplitude and phase) of the feeding network.

In order to measure these parameters

- the signal is fed into the feeder of one half antenna (forward line)
- the other feeder is extended from the direct access unit onwards by a flexible probe cable which allows to go to every individual antenna panel and measure the amplitude and the phase of the signal (return line to network analyser).

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6 Measuring 75Ω Systems with a 50Ω VNA



75 Ω systems can be measured with a 50 Ω VNA using a 75 Ω calibration kit (and a proper mechanical adaptor to avoid damage).

Spinner offers calibration kits and adaptors.

Please ask for a quote via <https://products.spinner-group.com/>