

# QUANTUM DIGITAL LABORATORIES Pty Ltd

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## ENGINEERING NOTE QDL071005.E

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Work was undertaken to characterise the emission profile of a ALLTIME Electronic Time Recorder, Model: AT-900D, (Equipment Under Test = EUT).

Testing was performed using AS/NZS CISPR 22:2006 Class A procedures (– Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement), at a three metre synthetic test site (M.A.G.I.C.5) using a calibrated EMI Compliance Receiver system (HP 8546A, CISPR 16 compliant).

No conducted emission violations were detected.  
No radiated emission violations were detected.

## RECOMMENDATIONS

The unit as tested should pass a formal AS/NZS CISPR 22:2006 Class A test.

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**Roman Gdowski** :.....  
B.Eng

**Roman Gdowski** :.....  
B.Eng  
(PDF signature)

## **INTERPRETATION OF RESULTS (Emissions Test)**

### **Radiated Emissions**

#### Tabulated Data

The results shown in the radiated emissions tabulated columns are genuine close-in QP (quasi-peak) CISPR compliant measurements taken with a fully CISPR16 compliant receiver system. Each measurement is taken after antenna polarisation, height and EUT rotation are optimised for maximum emissions.

The peak amplitude column (Peak Amp) represents a fast method of finding emission signals for subsequent measurement by the quasi-peak detector (QP Amp). The QP detector determines compliance or non-compliance of a particular emission.

The Margin (QP) column represents the degree of compliance safety margin below the limit (if positive) and the degree of failure (if negative). The Limit column represents the actual limit at that particular frequency.

#### Graphical Data

The spectrographs represent a real-time scan over a broad frequency range to show at a glance where emissions of a particular EUT occur. Three traces are usually taken, one horizontal scan, one vertical scan, and a worst case ambient scan with the EUT turned off.

A solid green or orange line indicates the compliance boundary. In some cases a 6dB dotted margin line (green or orange) is also shown as a visual aid.

Due to the ambient being present all the time (typically at pre-compliance sites), the three traces will merge together at local ambients. These ambients are easily identifiable and will sometimes breach the compliance boundaries.

Even though the spectrographs are visually appealing and represent a wealth of data in terms of characterising the EUT profile, they are not used for compliance determination. Typically the peak graph will breach the compliance limit but the actual compliance measurement will not. The tabulated data is used for compliance determination since these are genuine CISPR16 compliant measurements.

### **Conducted Emissions**

#### Tabulated Data

The results shown in the conducted emissions tabulated columns are genuine close-in CISPR compliant measurements taken with a fully CISPR 16 compliant receiver system. Both average and quasi-peak measurements are taken using the CISPR 16 compliant detectors. It is these two detectors which determine whether the EUT passed or fails the conducted emissions test.

The Margin (QP) column represents the degree of compliance safety margin below the limit (if positive) and the degree of failure (if negative). The Margin (Avg) column represents the degree of compliance safety margin below the limit (if positive) and the degree of failure (if negative). The limit columns represent the actual limits (QP and Average) at that particular frequency.

#### Graphical Data

The spectrographs represent a real-time scan (using a peak detector) over a broad frequency range to show at a glance where emissions of a particular EUT occur. Three traces are usually taken, one active scan, one neutral scan, and a worst-case ambient scan with the EUT turned off.

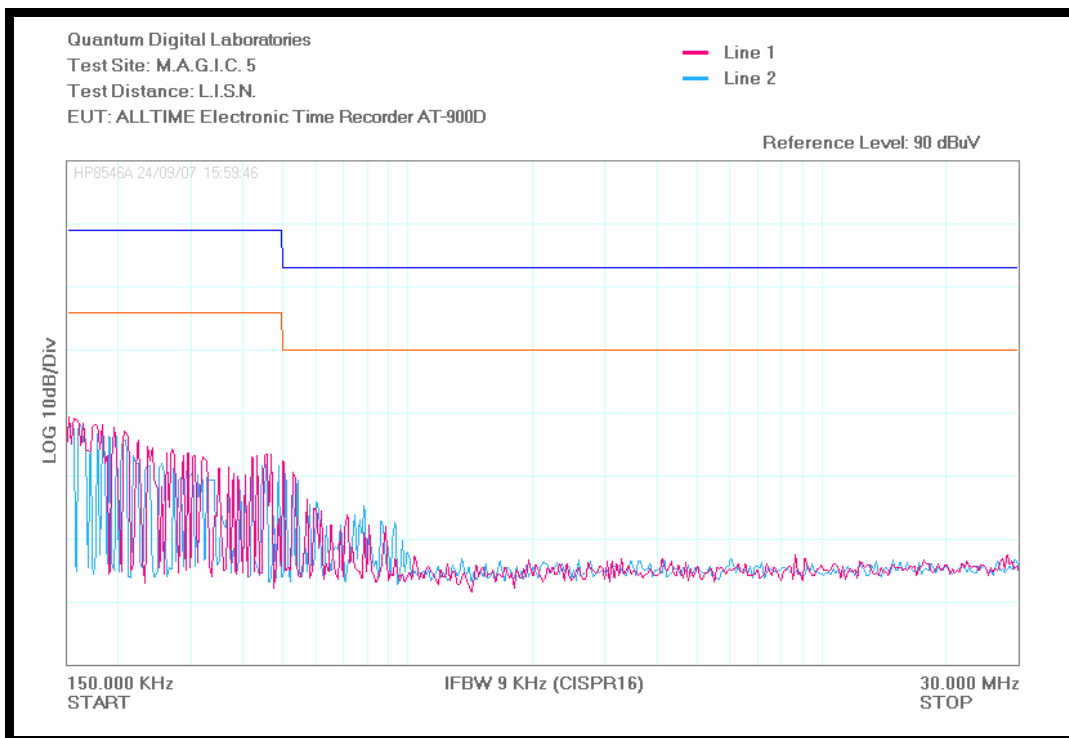
A solid green line (for QP) or orange (for Avg) line indicates the compliance boundary. In some cases a 6dB dotted margin line (green or orange) is also shown as a visual aid.

Even though the spectrographs are visually appealing and represent a wealth of data in terms of characterising the EUT profile, they are not used for compliance determination. Typically the peak graph will breach the compliance limit but the actual compliance measurement will not. The tabulated data is used for compliance determination since these are genuine CISPR16 compliant measurements.

Signal	Freq	QP Amp	QP Limit	QP Margin	Avg Amp	Avg Limit	Avg Margin
	MHz	dBuV	dBuV	dB	dBuV	dBuV	dB
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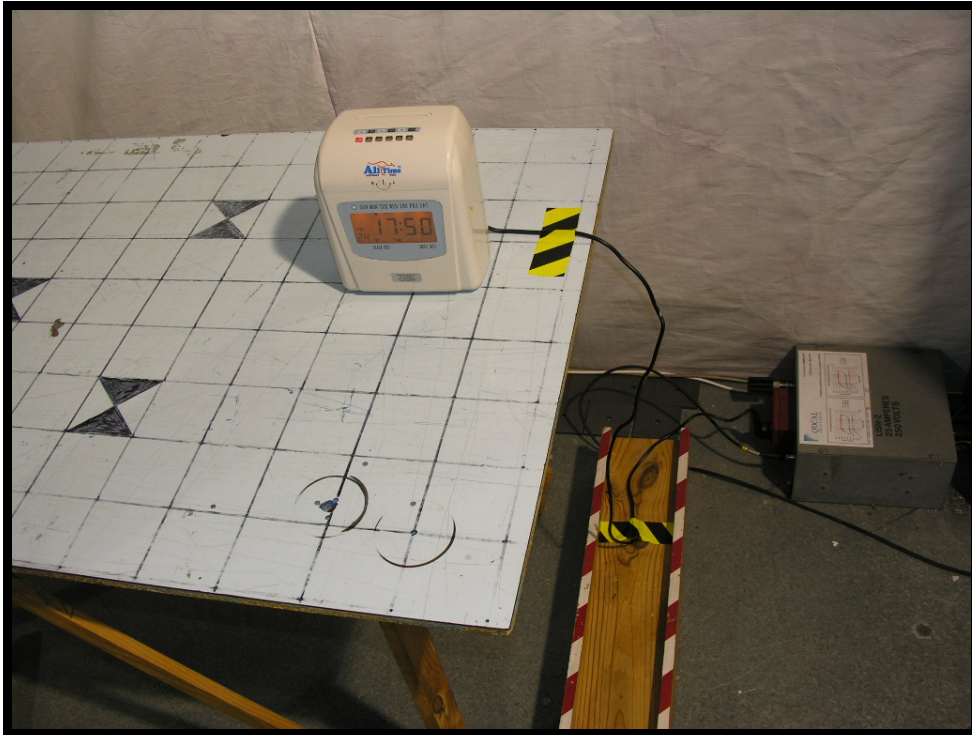
**Plate 1: CISPR List - Conducted Emissions Reference Data.**

\*\*All signals more than 10dB under limit hence no list data required.



**Plate 2: Conducted Emissions 150kHz-30MHz Reference Trace (Magenta = Active, Blue = Neutral).**





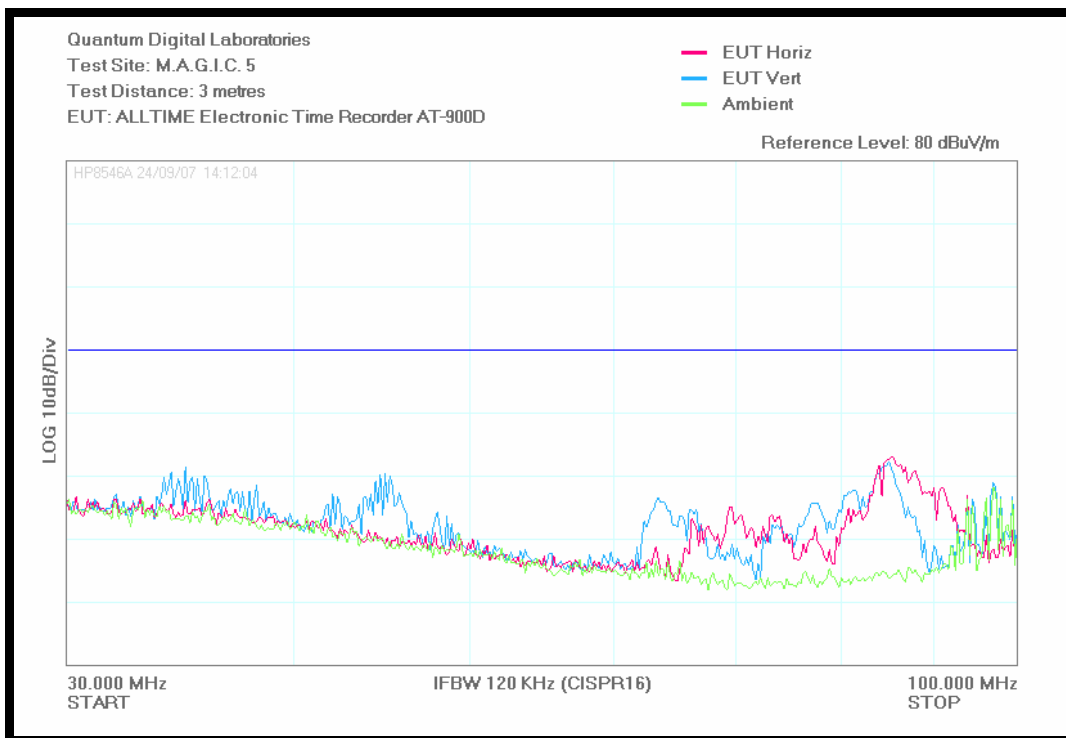
**Plate 3: Equipment Under Test Undergoing Conducted Emissions Testing.**



Signal	Freq MHz	QP Amp dBuV/m	QP Limit dBuV/m	QP Margin dB
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**Plate 4: CISPR List - Radiated Emissions Reference Data.**

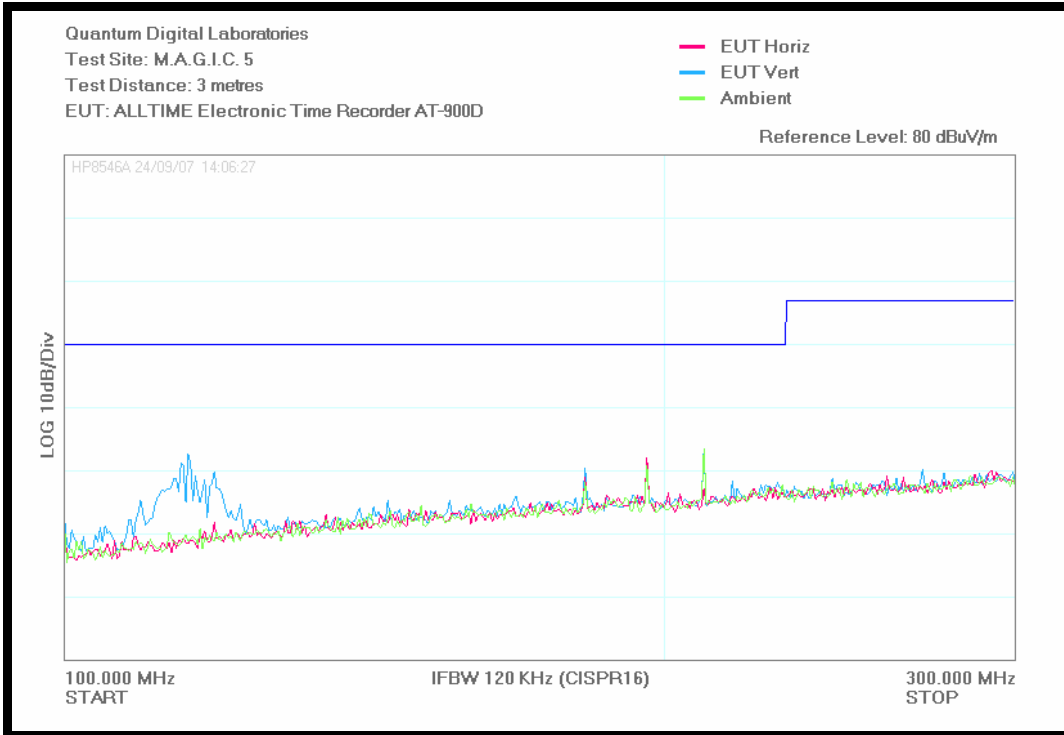
**\*\*All signals more than 10dB under limit hence no list data required.**



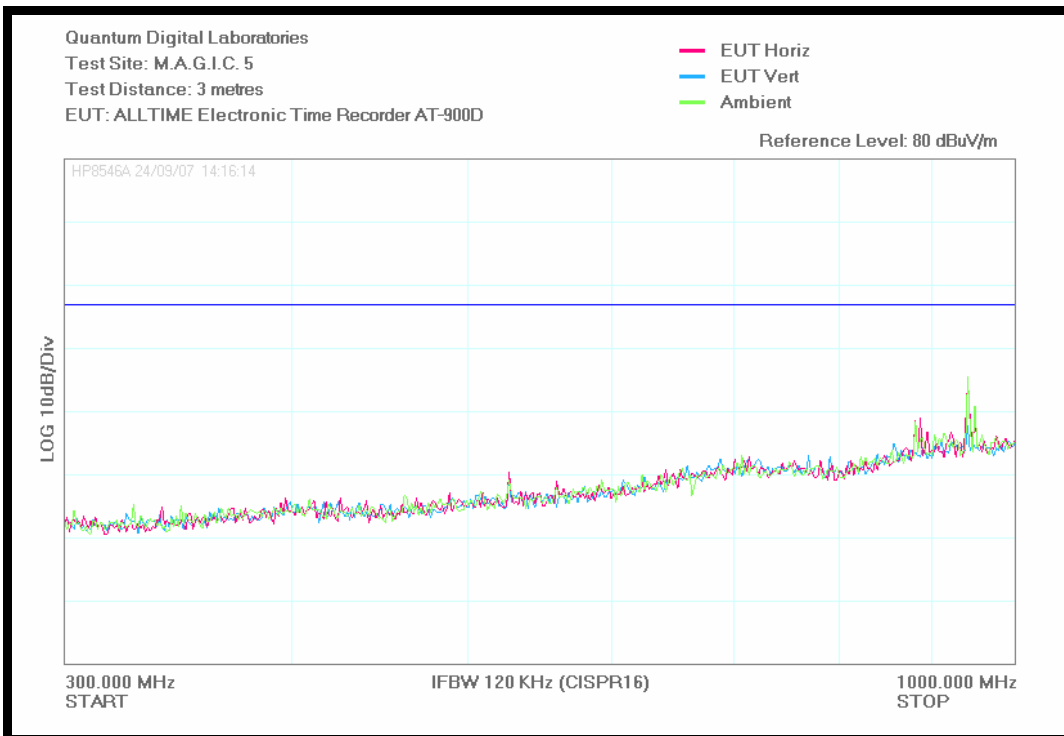
**Plate 5: Radiated Emissions 30MHz-100MHz Reference Trace**

**(Green = Ambient, Magenta = EUT Horizontal, Blue = EUT Vertical).**

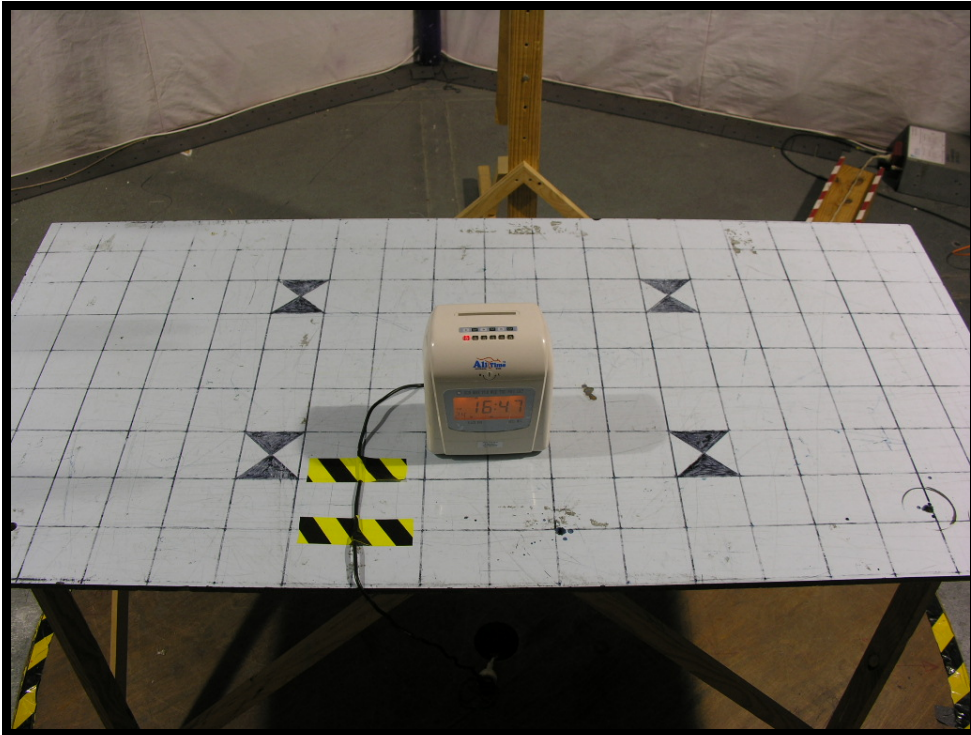




**Plate 6: Radiated Emissions 100MHz-300MHz Reference Trace (Green = Ambient, Magenta = EUT Horizontal, Blue = EUT Vertical).**



**Plate 7: Radiated Emissions 300MHz-1000MHz Reference Trace (Green = Ambient, Magenta = EUT Horizontal, Blue = EUT Vertical).**



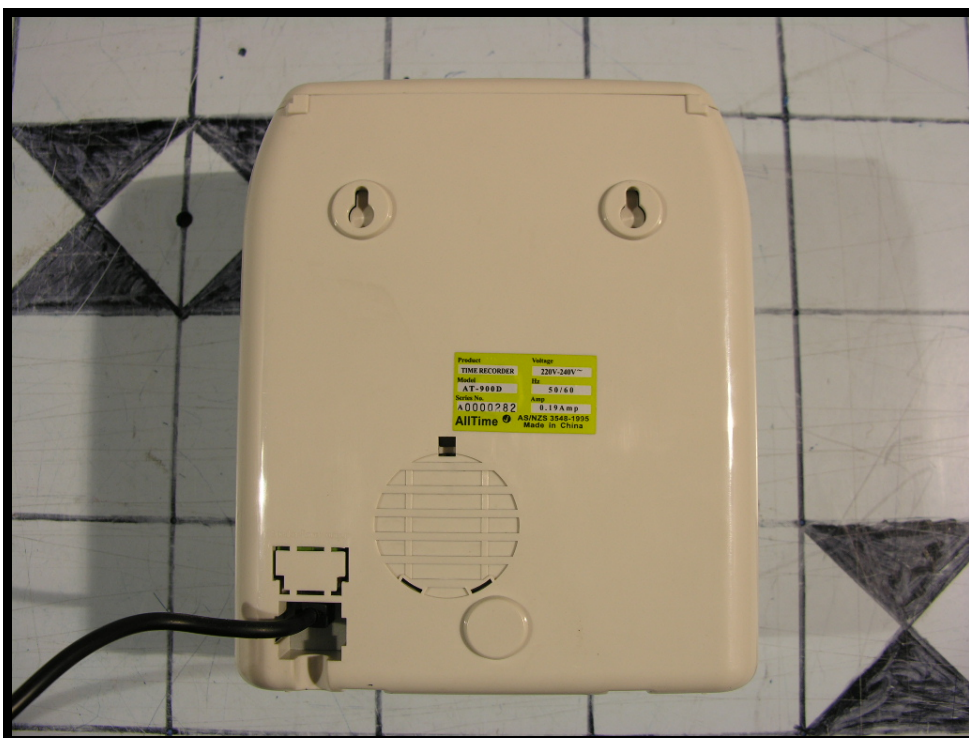
**Plate 8: Equipment Under Test Undergoing Radiated Emissions Testing.**







**Plate 9: Equipment Under Test Identification – Front.**



**Plate 10: Equipment Under Test Identification – Rear.**



## TEST SITE DESCRIPTION (NTF02)

Noise Testing Facility Zero Two is located approximately 100km north of Perth in a low lying rural area about 15km from Gingin township. This test site is positioned in a relatively difficult reception area and is oriented perpendicular to Perth broadcast transmitters. The area surrounding the site is predominantly sand with the odd Gum and Blackbutt tree.

The test area itself is levelled ground with a 6m by 6m galvanised 0.8mm steel sheet. The ground plane is composed of 3m x 1.5m galvanised sheets fully soldered along all seams.

The site attenuation characteristic comes within 3dB of an ideal site.

The motorised antenna mast is fabricated from a 6m kiln dried Douglas Fir structural beam with cross boom and supports all being composed of plastic and marine ply assembled with high grade epoxy resins.

The rotator is of similar construction with Teflon bearings and other composites to ensure an RF transparent assembly.

Antenna feed is via low loss semi-rigid heliax with a broad band amplifier and suitable connectors to fit the compliance receiver.

D.U.T. power, antenna cable, and rotator controls are run 0.5m underground perpendicular to the plane at the antenna position in order to minimise reflections and to optimise the fact that the antenna cannot "see" at this angle.

The test position is located approximately 25m away again at the minimum reflection position.

Power is supplied by a 4.5W diesel generator. The power is filtered and fed to the test position underground by fully shielded Pyrotenax cable. All power and control from the ground plane also uses shielded Pyrotenax cable.

## TEST SITE DESCRIPTION ( M.A.G.I.C. 5 )

M.A.G.I.C. 5.(Multiple Absorption Graded Index Composite) is a synthetic open area test site located in a northern residential suburb of Perth (QDL premises).

The Facility is an enclosed volume and contains a 7.5m by 9.6m galvanised 1.0mm steel ground plane and 6m ceiling height. The ground plane is composed of 3m x 1.5m galvanised sheets fully soldered along all seams. Local ambient are suppressed to allow low level measurements to be made

The site attenuation characteristic comes within 6dB of an ideal site at low frequencies (below 50MHz) and within 4dB of an ideal site at high frequencies (above 50MHz).

The motorised antenna mast is fabricated from a 6m kiln dried Douglas Fir structural beam with cross boom and supports all being composed of plastic and marine ply assembled with high grade epoxy resins.

The rotator is of similar construction with Teflon bearings and other composites to ensure an RF transparent assembly.

Antenna feed is via low loss coaxial with suitable connectors to fit the compliance receiver.

Filtered three phase is supplied to the ground plane testing area to facilitate low level conducted emissions testing.