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APPLICATION NOTE 40
Power Analysis in Avionics

Manufacturers of electronic devices intended for use in commercial or military aircraft are required to confirm compliance with power immunity standards specifically targeting this application.
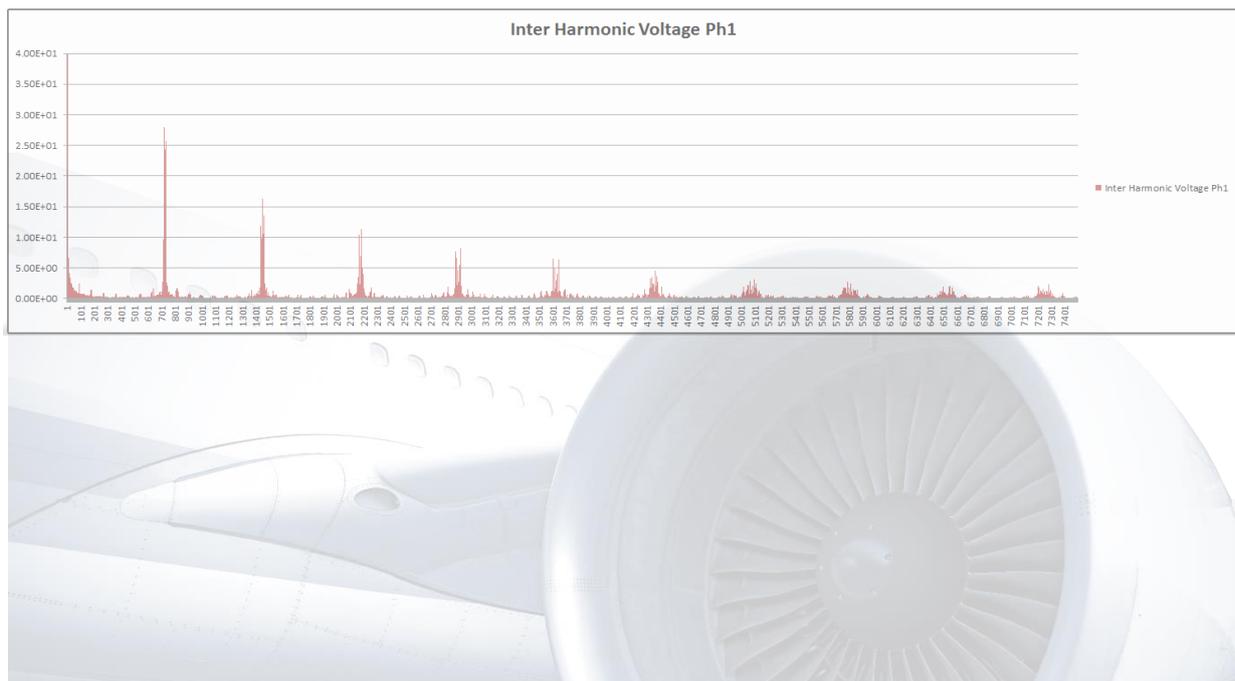
The associated standards are substantial documents that cover a wide range of equipment types in a necessarily generic manner, so an equipment supplier is required to establish which parts of the standards apply to them.

Given standards that cover a broader range of criteria than will apply to any one device, it becomes impractical for test instrument manufacturers to make a predetermined set of tests that confirm compliance of a specific device to for example DO160 or MIL-STD-704. However, since the standards have a common objective to quantify; voltage, current, phase, power and harmonic parameters of airborne equipment, the general bound of these standards are largely comparable, so a measurement product capable of meeting the key requirements of recognised standards in this field, can provide the measurement functionality that equipment suppliers will need.

The key differentiating function in this field of power measurement is harmonic measurement ability, where the number of harmonics and the associated accuracy requirement is beyond the ability of most commercially available power measurement instruments.

In the following table, we summarise specific requirements defined within recognised avionics standards and the associated product specification of the PPA5500 series power analyzer, which has always offered market leading harmonic measurement functionality.

The PPA5500 series power analyzers and associated PC software offer an ideal solution for precision power analysis in recognised avionic applications.

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	Requirement	PPA5500	Comment
DO-160G			
Harmonic content	400Hz to 50kHz	Yes	400Hz to 166.8kHz (417 Orders max) Selectable to 375 Orders i.e. 150kHz
Amplitude error	< 3% to 50kHz	0.5%	
Phase error	< 5º to 50kHz	0.5 º	
Sampling rate	≥100kHz	667kHz	kHz unit defined for consistency with the spec but should be samples/sec
Anti-aliasing filter	25kHz to 50kHz	Not required	667k samples/sec (kHz) guarantee no aliasing
Windowing	Rectangular, Hanning, Hamming or Blackman-Harris	Rectangular	Gapless
Harmonic Bandwidth	6dB – 10Hz to 10th H 100Hz to 40th H	Not required	DFT process results in greater selectively than a bandwidth filter
Max hold	Detection option	Yes	Harmonic 2 to 417 real time update and max hold

ABD0100.8.1E			
Harmonic content	400Hz to 150kHz	Yes	400Hz to 166.8kHz (417 Orders max) Selectable to 375 Orders i.e. 150kHz
Amplitude error	5% of permissible limit	1%	Compliant assuming limit is ≥ 10% of fund
Harmonic data	Fundamental Magnitude Phase Angle Integer frequency from Fund to 150kHz Dc current	Yes Yes Yes Yes Yes	All measurements taken with no minimum limit. However, data exportable to spreadsheet where min limits can be applied to the data table

ABD100.1.8.1C			
As - ABD0100.8.1E plus:			
Subharmonics	0 to 150kHz	20Hz to 150kHz	20Hz steps therefore 7500 point sweep available when using our TVF105 interharmonic mode (Mil-std 704) with our PC SW
Amplitude error V&I	3% to 150kHz	1%	

AMD-24C			
As - ABD0100.8.1C without subharmonics			

Boeing 787B30147 RevC			
As – DO-160G except			
Sampling rate	≥200kHz	667kHz	kHz unit defined for consistency with the spec but should be samples/sec
Anti-aliasing filter	75kHz to 125kHz	Not required	667k samples/sec (kHz) guarantee no aliasing
Tabulation of harmonic magnitude and phase (optional)	360Hz to 22.32kHz and 800Hz to 49.6kHz (equal to 62 harmonics)	Yes	360Hz to 150kHz (417 Orders max) Selectable to 62 Orders i.e. 22.32kHz or 49.6kHz for 360/800Hz respectively