

## Application Note #66

### *Conducted Immunity Test System for BCI and TWC Methods of Automotive, Military and Commercial Test Standards from 10 kHz to 3 GHz*

AR RF/Microwave Instrumentation provides systems that are among the most reliable in the industry. These systems take the guess work out of mixing and matching various hardware components from different vendors and hoping that they can work together as desired. This is accomplished through careful consideration of test system component specifications and applicable test standard requirements. The addition of emcware, a user-friendly test software tool, further increases end user success.

This application note specifically gives a description of a Conducted Immunity (CI) system configuration that will satisfy many standards' conducted immunity requirements over a range of 10 kHz to 3 GHz and can generate levels up to 500 mA, providing capability for testing to all of the standards listed in Table 1. Since this system covers a wide frequency band, both bulk cable injection (BCI) and tubular wave coupler (TWC) injection methods can be used. As examples, see Figures 1 and 2 for achievable automotive BCI and TWC limits. Note that these requirements may differ based on specific automotive manufacturer requirements and that limits will be different for other Military and Commercial standards. In addition, Table 2 provides an equipment list and indications of equipment required for each injection method.

The appropriate usage of these AR products is determined by the required frequency range of the test. Depending on which injection method is intended, the equipment will be configured as per the appropriate BCI or TWC method described in the applicable standards. General automotive test setups are provided for both BCI and TWC in Figure 3 as examples.

The CI system discussed herein is, as with all AR systems, is fully tested prior to delivery and arrives at the customer's destination as one complete unit, capable of automated testing and report generation.

**Table 1: 10 kHz – 3 GHz CI System Applicable Test Standards**

ISO 11451-4	CISPR 14-2
ISO 11452-4	CISPR 24
MIL-STD-461 CS114	GMW 3097
DO-160	Ford EMC_CS_2009
EN/IEC 61000-4-6	Chrysler DC-11224
IEC 60601-1-2	BMW GS95002
EN 50130-4	Peugeot B217110
EN 61000-6-1/2	Renault 36-00-808
EN 55024	Other Auto Standards

### BCI Test Level

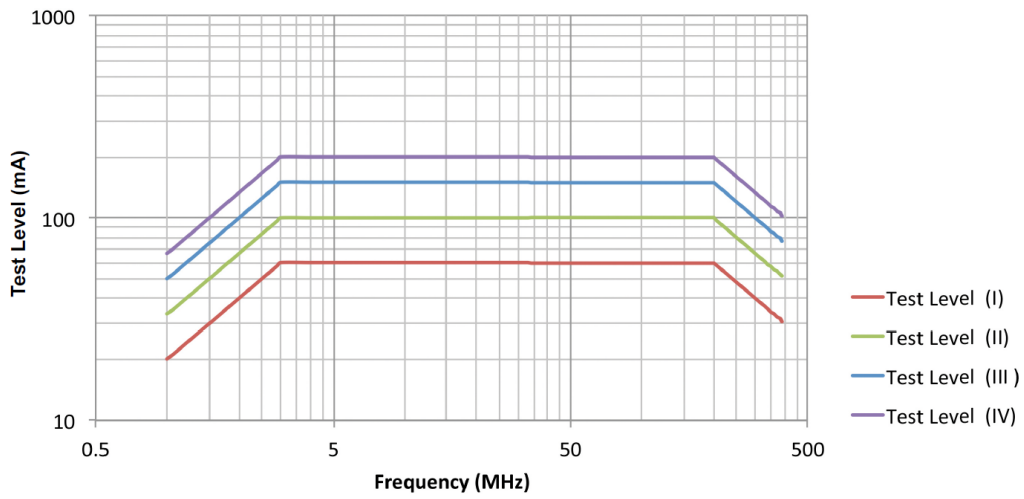


Figure 1: Automotive BCI Test Levels

### TWC Test Level

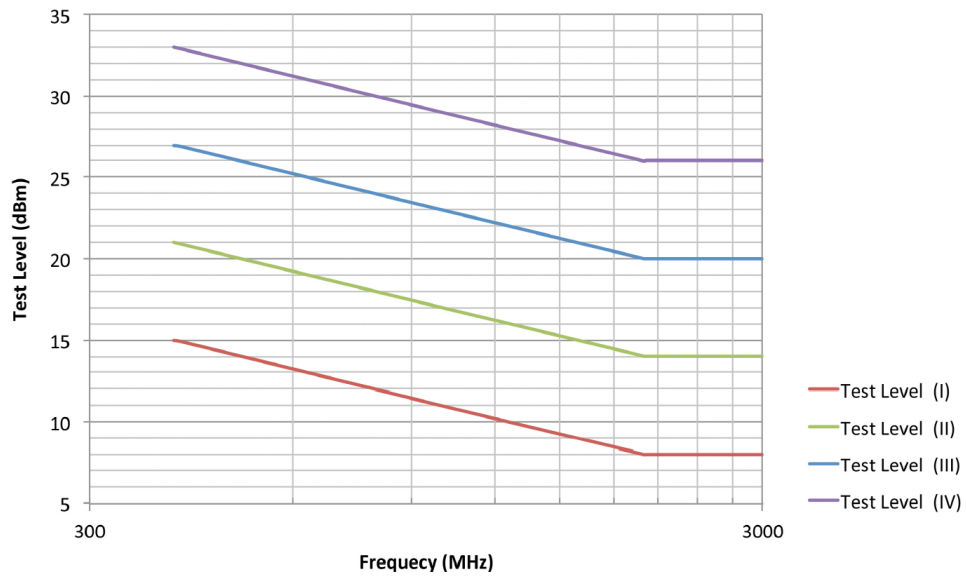


Figure 2: Automotive TWC Test Levels

**Table 1: 10 kHz – 3 GHz CI System Equipment Applicability**

Item	BCI	TWC
Model 125A400M3, RF Amplifier, 10kHz-400MHz, 125 Watts CW	X	
Model 30W1000BM3, RF Amplifier, 1-1000MHz, 30 Watts CW		X
Model 20SIG4M3, RF Amplifier, 700MHz-4.2GHz, 20 Watts CW		X
Model DC3400A, Dual Directional Coupler, 10kHz-400MHz, 200 Watts CW	X	
Model DC3001A, Dual Directional Coupler, 100kHz-1000MHz, 100 Watts CW		X
Model DC7144A, Dual Directional Coupler, 800MHz-4.2GHz, 400 Watts CW		X
Signal Generator, 9kHz-3GHz, AM, FM, PM, Pulse Modulation	X	X
Model PM2003, 3 Channel Power Meter	X	X
Model PH2000, Power Head, 10kHz-8GHz, -60dBm to +20dBm	X	X
Spectrum Analyzer, 9kHz-3GHz	X	X
Network Analyzer, 100kHz-3GHz		X
Model SC1000M1, System Controller (RF Switch Matrix)	X	X
Model BI00400, Bulk Current Injection Clamp, 10kHz-400MHz	X	
Model CF00400, Calibration Fixture for BI00400 Clamp	X	
Model BP00400, Current Monitoring Probe, 10kHz-400MHz	X	
Model AF20050, 20dB Attenuator, 50W	X	
Model AF10050, 10dB Attenuator, 50W	X	
Model TL50050, Termination, 50 Ohm, 50W	X	X
Model BI30413, Tubular Wave Coupler, 400MHz-3GHz, 13mm ID		X
Model CF30000, Tubular Wave Coupler Calibration Kit, 400MHz-3GHz		X
Adapter, Coaxial, SMA (male) to N (female)		X
Model CC21111015, Coaxial Cable, N(m)-N(m), 1.5m long	X	X
Model CC21111003, Coaxial Cable, N(m)-N(m), 0.3m long	X	X
Control PC with emcware® software preloaded, includes IEEE-488 control interface (Desktop or Laptop specified at time of order)	X	X
LISN available upon request	X	X

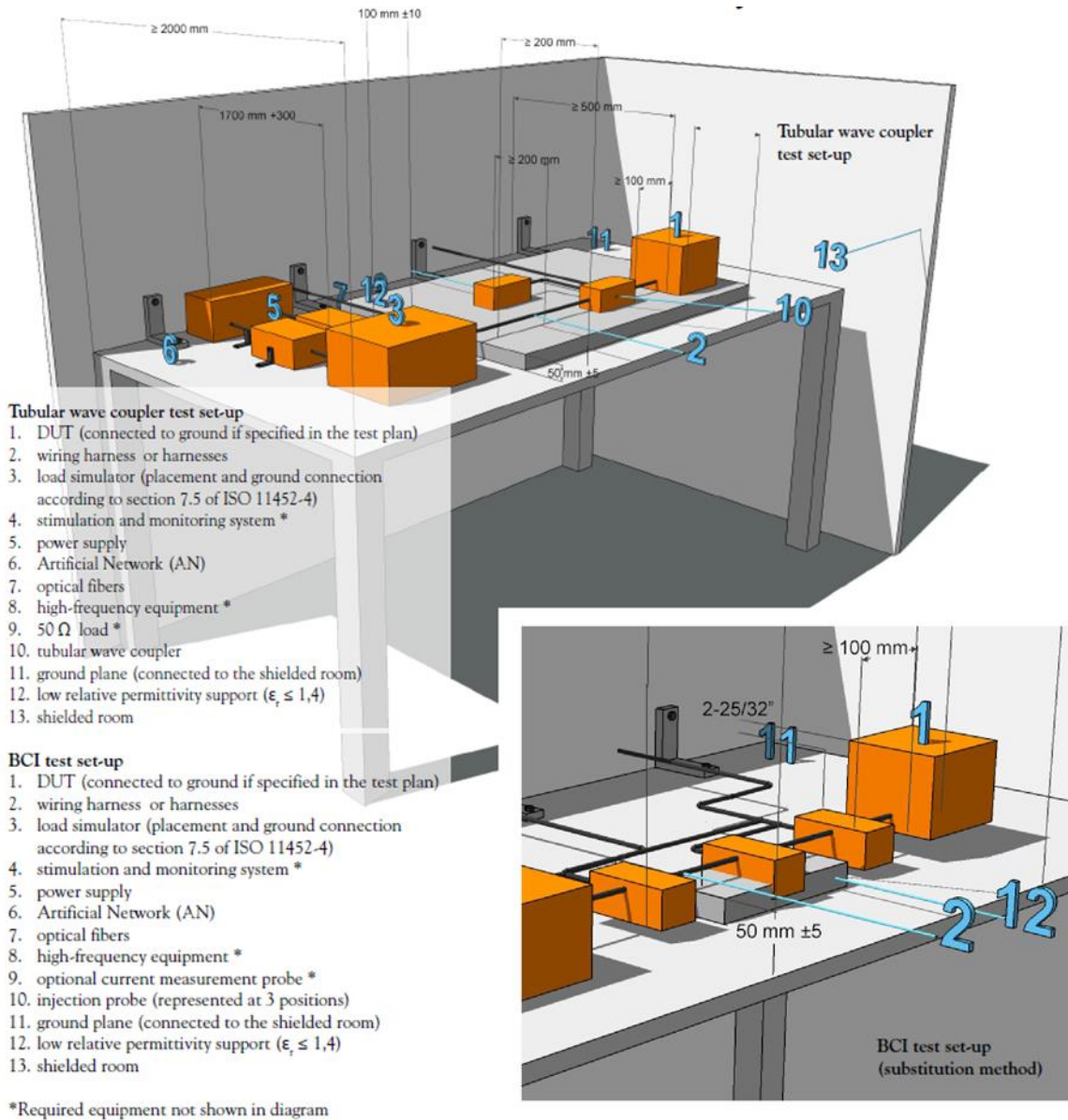


Figure 3: 10 kHz – 3 GHz CI System Automotive BCI and TWC General Setups