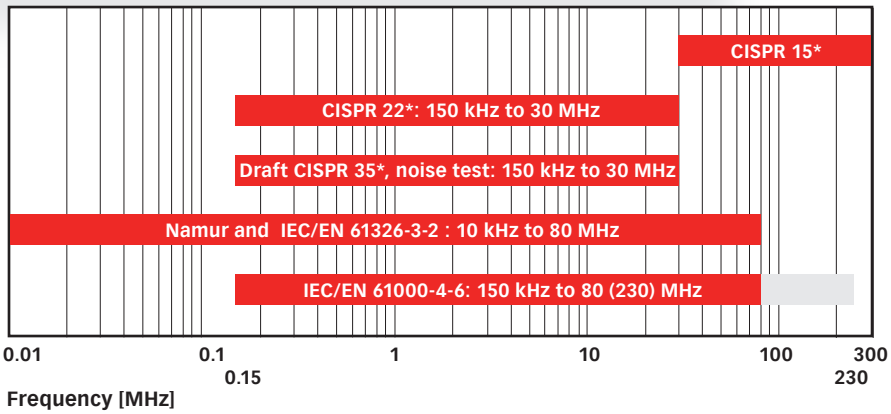
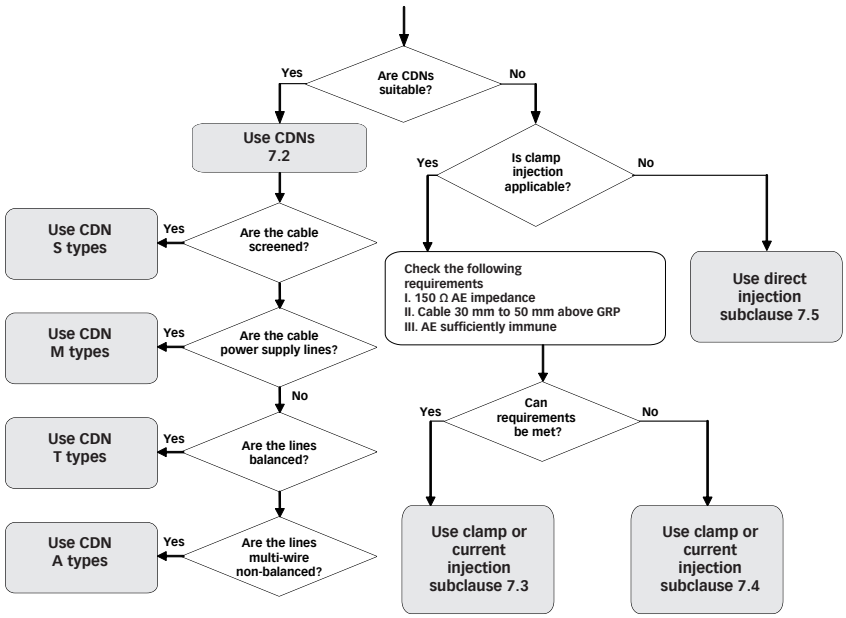
COUPLING DECOUPLING NETWORKS FOR IEC/EN 61000-4-6

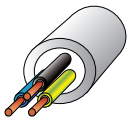
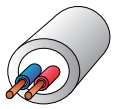
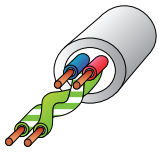
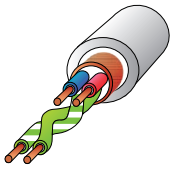
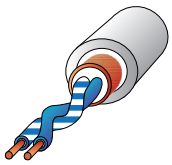
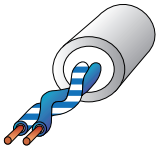
IEC/EN 61000-4-6 specifies the design and performance of a range of coupling/decoupling networks (CDNs). Each CDN is specific to the type of cable and the intended signal carried on the cable. Teseq offers an extensive range of CDNs which fully comply with the requirements of the standard and provide a simple and reliable method of injecting RF energy into the equipment under test (EUT). Each CDN is also useable for emission testing, special types are meet the requirements of CISPR 15, CISPR 22, CISPR 35, NAMUR NE 21 and IEC/EN 61326-3-2.

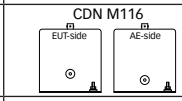
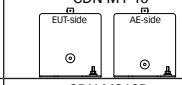
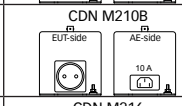
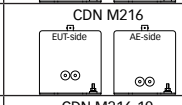
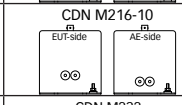
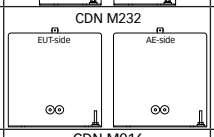
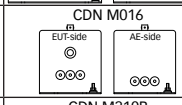
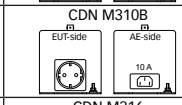
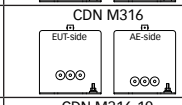
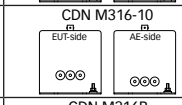
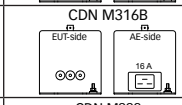
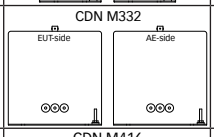
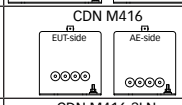
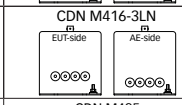
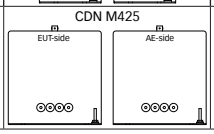


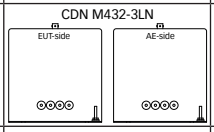
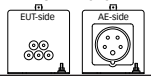
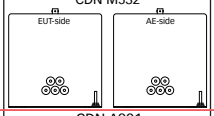
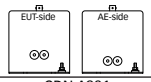
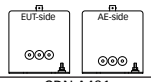
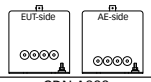
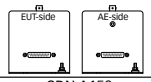
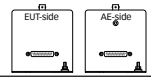
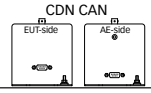
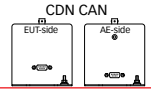
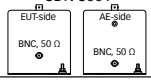
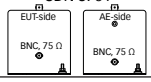
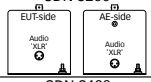
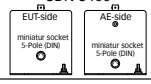
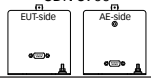
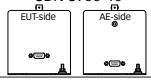
* Standard contains additional requirements for the CDN.

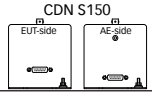
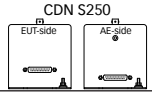
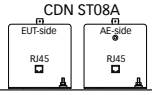
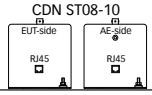
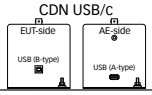
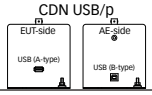
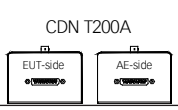
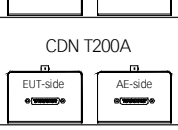
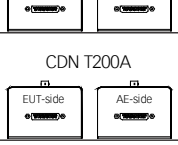
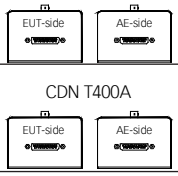
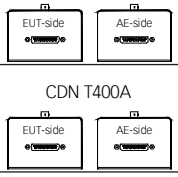
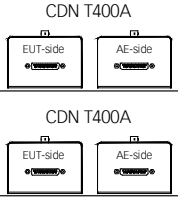
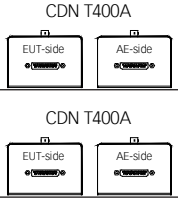
IEC/EN 61000-4-6: Rules for selecting the injection method



Cable type	CDN type	Application	Product range
	**M type**	Used for unscreened AC or DC power supply applications.	CDN M116 CDN M016, M210B, M216, M310B, M316, M316B CDN M416, M416-3LN, M516 CDN M232, M332, M432, M432-3LN , M532
	**AF type**	Used for all unscreened, unbalanced lines, carrying low current.	CDN A201, A301, A401 CDN A800, A150
	**CAN bus type**	Specially designed to test the unscreened CAN bus.	CDN CAN-U4, CDN CAN-U5
	**S type**	Used for screened cables.	CDN S150, S200, S250, S400, S900
	**S type coaxial**	Used for coaxial cables.	CDN S501, S751 See also product range Impedance Stabilization Networks for ISN S501.
	**USB type**	Specially designed to test the universal serial bus,	CDN USB/c, USB/p
	**ST type**	Used for testing screened, balanced lines for telecommunication ports on ITE equipment.	CDN ST08A See also product range Impedance Stabilization Networks for ISN ST08..
	**T type**	Used for unscreened, balanced lines. for telecommunication ports on ITE equipment.	CDN T210A...T246AS, CDN T411A...T4AS CDN T8 See also product range Impedance Stabilization Networks for ISN T2A, T4A, ISN T8 and ISN T8-CAT6..

	Drawing	Frequency range	CDN type and application	Connector type	Immunity testing IEC/EN 61000-4-6	Immunity testing 10 kHz to 80 MHz	Emission testing CISPR 15/22	Number of lines	Max. EUT current in A	Max. EUT voltage in V for AC	Max. RF voltage V	3 dB bandwidth (sinusoidal)
CDN M116		150 kHz to 230 MHz	CDN M 1 1 PE line	AE: banana EUT: banana	■			1	1	—	20	—
CDN M1-10		10 kHz to 80 MHz	CDN M 1 1 PE line	AE: banana EUT: banana	■	■		1	1	—	20	—
CDN M210B		150 kHz to 230 MHz	CDN M2 2 power lines	AE: IEC 60320 C14 EUT: CEE 7/17	■			2	10	250	30	—
CDN M216		150 kHz to 230 (300) MHz	CDN M2 2 power lines	AE: banana EUT: banana	■		■	2	16	250	30	—
CDN M216-10		10 kHz to 80 MHz	CDN M2 2 power lines	AE: banana EUT: banana	■	■		2	16	250	30	—
CDN M232		150 kHz to 230 (300) MHz	CDN M2 2 power lines (L+N or DC+/DC-)	AE: banana EUT: banana	■		■	3	32	250	30	—
CDN M016		150 kHz to 230 MHz	CDN M2/3 switchable 2/3 power lines (L+N or L+N+PE)	AE: banana EUT: banana	■			2/3	16	250	30	—
CDN M310B		150 kHz to 230 MHz	CDN M3 3 power lines (L+N+PE)	AE: IEC 60320 C14 EUT: Schuko CEE 7/4	■			3	10	250	30	—
CDN M316		150 kHz to 230 (300) MHz	CDN M3 3 power lines (L+N+PE)	AE: banana EUT: banana	■		■	3	16	250	30	—
CDN M316-10		10 kHz to 80) MHz	CDN M3 3 power lines (L+N+PE)	AE: banana EUT: banana	■	■		3	16	250	30	—
CDN M316B		150 kHz to 230 MHz	CDN M3 3 power lines (L+N+PE)	AE: IEC 60320 C20 EUT: banana	■			3	16	250	30	—
CDN M332		150 kHz to 230 (300) MHz	CDN M3 3 power lines (L+N+PE)	AE: banana EUT: banana	■		■	3	32	250	30	—
CDN M416		150 kHz to 80 MHz	CDN M4 4 power lines (3L+PE)	AE: banana EUT:banana	■			4	16	250	30	—
CDN M416-3LN		150 kHz to 80 MHz	CDN M4 4 power lines (3L+N)	AE: banana EUT: banana	■			4	16	250	30	—
CDN M432		150 kHz to 230 (300) MHz	CDN M4 4 power lines (3L+PE)	AE: banana EUT: banana	■		■	4	32	250	30	—

	Drawing	Frequency range	CDN type and application	Connector type	Immunity testing IEC/EN 61000-4-6	Immunity testing 10 kHz to 80 MHz	Emission testing CISPR 15/22	Number of lines	Max. EUT current in A	Max. EUT voltage in V for AC	Max. RF voltage V	3 dB bandwidth (sinusoidal)
CDN M432-3LN		150 kHz to 230 (300) MHz	CDN M4 4 power lines (3L+N)	AE: banana EUT: banana	■		■	4	32	250	30	—
CDN M516		150 kHz to 80 MHz	CDN M5 5 power lines (3L+N+PE)	AE: CEE 17, 5 pins EUT: banana	■			5	16	250	30	—
CDN M532		150 kHz to 230 (300) MHz	CDN M5 5 power lines (3L+N+PE)	AE: banana EUT: banana	■		■	5	32	250	30	—
CDN A201		150 kHz to 230 (300) MHz	CDN AF2 for unscreened unbalanced 2 lines application	AE: banana EUT: banana	■		■	2	0.25	160	30	20 kHz
CDN A301		150 kHz to 230 (300) MHz	CDN AF3 for unscreened unbalanced 3 lines application	AE: banana EUT: banana	■		■	3	0.25	160	30	20 kHz
CDN A401		150 kHz to 230 MHz	CDN AF4 for unscreened unbalanced 4 lines application	AE: banana EUT: banana	■			4	0.25	160	30	20 kHz
CDN A800		150 kHz to 230 (300) MHz	CDN AF8 for unscreened unbalanced 8 lines application	AE: 25 pin D-sub EUT: 25 pin D-sub	■		■	8	0.2	63	15	20 kHz
CDN A150		150 kHz to 230 (300) MHz	CDN AF15 for unscreened unbalanced 15 lines application	AE: 25 pin D-sub EUT: 25 pin D-sub	■		■	15	0.2	63	15	20 kHz
CDN CAN-U4		150 kHz to 230 MHz	CDN for unscreened CAN bus with 4 lines	AE: 9 pin D-sub EUT: 9 pin D-sub	■			4	3 /0.5	48	20	30 MHz
CDN CAN-U5		150 kHz to 230 MHz	CDN for unscreened CAN bus with 5 lines	AE: 9 pin D-sub EUT: 9 pin D-sub	■			5	3 /0.5	48	20	30 MHz
CDN S501		150 kHz to 230 MHz	CDN S1 for coaxial line 50 Ω	AE: BNC 50 Ω EUT: BNC 50 Ω	■		■	1	0.25	250	20	2 GHz
CDN S751		150 kHz to 230 MHz	CDN S1 for coaxial line 75 Ω	AE: BNC 75 Ω EUT: BNC 75 Ω	■		■	1	0.25	250	20	2 GHz
CDN S200		150 kHz to 230 MHz	CDN S2 for 2 wires, screened line	AE: XLR EUT: XLR	■			2	0.25	150	20	20 kHz
CDN S400		150 kHz to 230 MHz	CDN S4 for 4 wires, screened line	AE: 5 pin DIN EUT: 5 pin DIN	■			4	0.25	34	20	20 kHz
CDN S900		150 kHz to 230 MHz	CDN S9 for 9 wires, screened line	AE: 9 pin D-sub EUT: 9 pin D-sub	■			9	0.25	150	20	20 kHz
CDN S900-10		10 kHz to 80 MHz	CDN S9 for 9 wires, screened line	AE: 9 pin D-sub EUT: 9 pin D-sub	■	■		9	0.25	150	20	20 kHz

	Drawing	Frequency range	CDN type and application	Connector type	Immunity testing IEC/EN 61000-4-6	Immunity testing 10 kHz to 80 MHz	Emission testing CISPR 15/22	Number of lines	Max. EUT current in A	Max. EUT voltage in V for AC	Max. RF voltage V	3 dB bandwidth (sinusoidal)
CDN S150		150 kHz to 230 MHz	CDN S15 for 15 wires, screened line	AE: 15 pin D-sub EUT: 15 pin D-sub	■			15	0.25	150	20	20 kHz
CDN S250		150 kHz to 230 MHz	CDN S25 for 25 wires, screened line	AE: 25 pin D-sub EUT: 25 pin D-sub	■			25	0.25	150	20	20 kHz
CDN ST08A		150 kHz to 230 MHz	CDN ST for screened and balanced telecommunication lines, Ethernet 10BaseT, 100BaseT, 1000BaseT, 10GBaseT and others	AE: RJ45 EUT: RJ45	■		■	8	1	100	20	250 MHz
CDN ST08-10		10 kHz to 80 MHz	see CDN ST08A	AE: RJ45 EUT: RJ45	■	■		8	1	100	20	250 MHz
CDN USB/C		150 kHz to 230 MHz	CDN USB for central devices (screened USB lines)	AE: USB "A"type EUT: USB "B"type	■			4	1	100	20	80 MHz
CDN USB/P		150 kHz to 230 MHz	CDN USB for peripheral devices (screened USB lines	AE: USB "B"type EUT: USB "A"type	■			4	1	100	20	80 MHz
CDN T210A		150 kHz to 80 MHz	T2 for 1 unscreened balanced wire pair, pin arrangement customer specific	AE: D-sub/RJ11 EUT: D-sub/RJ11	■			2	0.4	63	15	100 MHz
CDN T240A		150 kHz to 80 MHz	T2 for 1 unscreened balanced wire pair, pin arrangement customer specific	AE: D-sub/RJ45 EUT: D-sub/RJ45	■			2	0.4	63	15	100 MHz
CDN T246A		150 kHz to 80 MHz	T2 for 1 unscreened balanced wire pair, German Telecom, Siemens, UP0	AE: D-sub/RJ45 EUT: D-sub/RJ45, with ADR T246	■			2	0.4	63	15	100 MHz
CDN T410A		150 kHz to 80 MHz	T4 for up to 2 unscreened balanced wire pairs, pin arrangement customer specific	AE: D-sub/RJ11, EUT: D-sub/RJ11	■			4	0.4	63	15	100 MHz
CDN T411A		150 kHz to 80 MHz	T4 for up to 2 unscreened balanced wire pairs, German Telecom, US standard	AE: D-sub/RJ11, EUT: D-sub/RJ11, with ADR T411	■			4	0.4	63	15	100 MHz
CDN T440A		150 kHz to 80 MHz	T4 for up to 2 unscreened balanced wire pairs, pin arrangement customer specific	AE: D-sub/RJ45, EUT: D-sub/RJ45	■			4	0.4	63	15	100 MHz
CDN T442A		150 kHz to 80 MHz	T4 for up to 2 unscreened balanced wire pairs, ISDN basic rate access S0	AE: D-sub/RJ45, EUT: D-sub/RJ45, with ADR T442	■			4	0.4	63	15	100 MHz
CDN T443A		150 kHz to 80 MHz	T4 for up to 2 unscreened balanced wire pairs, ISDN primary rate access (2Mbps)	AE: D-sub/RJ45, EUT: D-sub/RJ45, with ADR T443	■			4	0.4	63	15	100 MHz

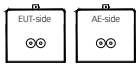
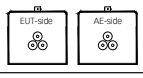
	Drawing	Frequency range	CDN type and application	Connector type	Immunity testing IEC/EN 61000-4-6	Immunity testing 10 kHz to 80 MHz	Emission testing CISPR 15/22	Number of lines	Max. EUT current in A	Max. EUT voltage in V for AC	Max. RF voltage V	3 dB bandwidth (sinusoidal)
CDN T444A	CDN T400A 	150 kHz to 80 MHz	T4 for up to 2 unscreened balanced wire pairs, Ethernet 10BaseT, 100BaseT	AE: D-sub/RJ45, EUT: D-sub/RJ45, with ADR T444	■			4	0.4	63	15	100 MHz
CDN T445A	CDN T400A 	150 kHz to 80 MHz	T4 for up to 2 unscreened balanced wire pairs, ATM, FDDI	AE: D-sub/RJ45, EUT: D-sub/RJ45, with ADR T445	■			4	0.4	63	15	100 MHz
CDN T4A	CDN T400A 	150 kHz to 80 MHz	T4 for up to 2 unscreened balanced wire pairs with 5 adapter sets	AE: D-sub/RJxx, EUT: D-sub/RJxx, with ADR T411, T442, T443, T444, T445	■			4	0.4	63	15	100 MHz
CDN T8	CDN T800 	150 kHz to 80 MHz	T8 for up to 4 unscreened balanced wire pairs with 2 adapter sets, Ethernet 10BaseT, 100BaseT, 1000BaseT and others	AE: D-sub/RJxx, EUT: D-sub/RJxx, with ADR T811, T800	■			8	0.4	63	15	100 MHz

COUPLING DECOUPLING NETWORK FOR EMISSION MEASUREMENT

The publication of EN 55015, based on CISPR 15 A1 Ed.7, has introduced an independent method of measurement of radio disturbance characteristics of electrical lighting equipment. This method specifies the use of a coupling/decoupling network (CDN) as defined in IEC 61000-4-6 for emission measurement in the frequency range 30 MHz to 300 MHz.

An analysis of results with existing CDN designs showed the need for closer CDN impedance tolerances. A standard working group was founded for improving the CDN design and for transferring the new emissions measuring equipment requirements to CISPR 16-1-x and methods to CISPR 16-2-x. The result describes a specific coupling/decoupling network for emissions (CDNE). In addition to closer tolerances for the asymmetrical impedance, the phase angle, symmetrical impedance and the internal attenuation are also defined.

Teseq's CDNE series fulfills these new requirements and offers improved reproducibility for current EN 55015 measurements.

	Drawing	Frequency range	CDN type and application	Connector type	Immunity testing	Emission testing CISPR 15	Emission testing CIS/A/946/CD	Number of lines	Max. EUT current in A	Max. EUT voltage in V for AC	Transducer factor in dB	Internal attenuator
CDNE M210	CDNE M210 	30 MHz to 300 MHz	M2, L, N	AE: banana EUT: banana		■	■	2	10	250	20	■
CDNE M310	CDNE M310 	30 MHz to 300 MHz	M3, L, N, PE	AE: banana EUT: banana		■	■	3	10	250	20	■

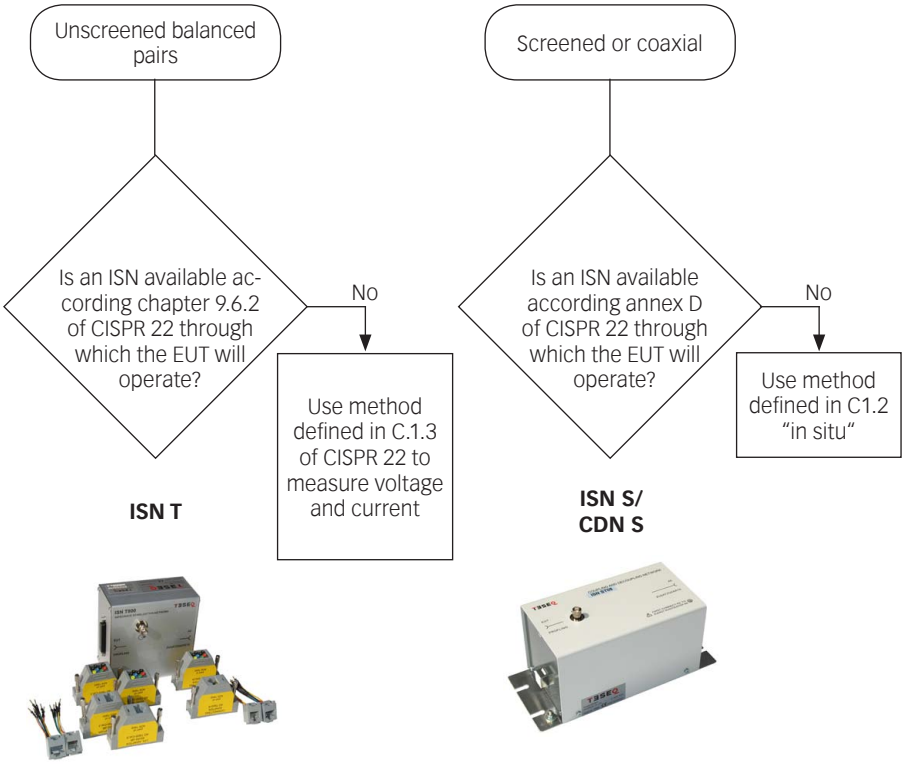
IMPEDANCE STABILIZATION NETWORK (ISN)

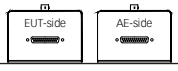
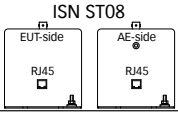
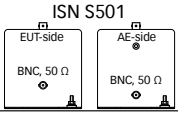
Impedance stabilization networks (ISN) are coupling/decoupling networks according to CISPR 22 (EN 55022) for measurement of conducted common mode disturbances of information technology equipment (ITE). The ISN is placed between the equipment under test (EUT) and the auxiliary equipment (AE) or load which is necessary for the operation of the EUT. The ISN establishes the common mode termination impedance seen by the telecommunication port during measurement.

Impedance stabilization networks (ISN) are defined in CISPR 22 and CISPR 16-1-2. The CISPR 16-1-2 gives additional requirements and provides examples and measurements for the networks. The ITU-T recommendations G.117 and O.9 offers the background knowledge for measurements on symmetrical telecommunication lines.

Further the ISNs (with exception ISN T8) can be used as coupling/decoupling network defined in IEC/EN 61000-4-6 „Immunity to conducted disturbances, induced by radio frequency fields".

Below is shown a simplified selection chart of testing methods of the CISPR 22 using ISNs / CDNs.



	Drawing	Frequency range	CDN type and application	Connector type	Immunity testing IEC/EN 61000-4-6	Emission testing CISPR 22	Regaring figure in CISPR 22	Number of lines	Changeable adapter wiring	LCL values	Max. EUT current in A (per wire)	Max. EUT voltage in V for AC / DC	Max. RF voltage in V	3 dB bandwidth (sinusoidal) in MHz
ISN T2A	ISN T200A 	150 kHz to 30 (80) MHz	T2 for 1 unscreened balanced wire pair with adapter ADS T246 and ADS T2X0	RJ11 RJ45 1 mm	■	■	D.2	2	■	55/40 65/50	0.4	63/100	15	100
ISN T216A	ISN T200A 	150 kHz to 30 (80) MHz	T2 for 1 unscreened balanced wire pair, UP0 with RJ11, with adapter ADS T216	RJ11	■	■	D.2	2		55/40 65/50	0.4	63/100	15	100
ISN T246A	ISN T200A 	150 kHz to 30 (80) MHz	T2 for 1 unscreened balanced wire pair, UP0 with RJ45, with adapter ADS T246	RJ45	■	■	D.2	2		55/40 65/50	0.4	63/100	15	100
ISN T4A	ISN T400A 	150 kHz to 30 (80) MHz	T4 for up to 2 unscreened balanced wire pairs, with adapter ADS T411, T442, T443, T444 and T4x0	RJ11 RJ45 1 mm	■	■	D.2	2 4	■	55/40 65/50	0.4	63/100	15	100
ISN T411A	ISN T400A 	150 kHz to 30 (80) MHz	T4 for up to 2 unscreened balanced wire pairs, German Telecom, US standard, with adapter ADS T411	RJ11	■	■	D.2	2 4		55/40 65/50	0.4	63/100	15	100
ISN T442A	ISN T400A 	150 kHz to 30 (80) MHz	T4 for up to 2 unscreened balanced wire pairs, ISDN basic rate access S0, with adapter ADS T442	RJ45	■	■	D.2	2 4		55/40 65/50	0.4	63/100	15	100
ISN T443A	ISN T400A 	150 kHz to 30 (80) MHz	T4 for up to 2 unscreened balanced wire pairs, ISDN primary rate access (2Mbps), with adapter ADS T443	RJ45	■	■	D.2	2 4		55/40 65/50	0.4	63/100	15	100
ISN T444A	ISN T400A 	150 kHz to 30 (80) MHz	T4 for up to 2 unscreened balanced wire pairs, Ethernet 10BaseT, 100BaseT, with adapter ADS T444	RJ45	■	■	D.2	2 4		55/40 65/50	0.4	63/100	15	100
ISN T4X0A	ISN T400A 	150 kHz to 30 (80) MHz	T4 for up to 2 unscreened balanced wire pairs, with changeable adapter ADS T4X0	RJ11 RJ45 1 mm	■	■	D.2	2 4	■	55/40 65/50	0.4	63/100	15	100
ISN T8	ISN T800 	150 kHz to 30 MHz	T8 for up to 4 unscreened balanced wire pairs, Ethernet 10BaseT, 100BaseT, 1000 BaseT and others, with adapter ADS T800 and T8X0	RJ11 RJ45 1 mm		■	D.3	2 4 6 8	■	55/40 65/50	0.4	63/100	15	100
ISN T8-Cat6	ISN T8-Cat6 	150 kHz to 30 (80) MHz	T4 for up to 2 unscreened balanced wire pairs, Ethernet 10BaseT, 100BaseT, 1000 BaseT and others	RJ45	■	■	D.3	2 4 6 8		75/60	0.4	63/100	15	250
ISN ST08	ISN ST08 	150 kHz to 230 MHz	For screened and balanced telecommunication lines, Ethernet 10BaseT, 100BaseT, 1000BaseT, 10GBaseT and others	RJ45	■	■	D.11	8			1	100	20	250
ISN S501	ISN S501 	150 kHz to 230 MHz	For coaxial telecommunication lines with 50 Ω	BNC	■	■	D.9	1			0.25	250	20	2000