EMC ad hoc
BCI limit line survey

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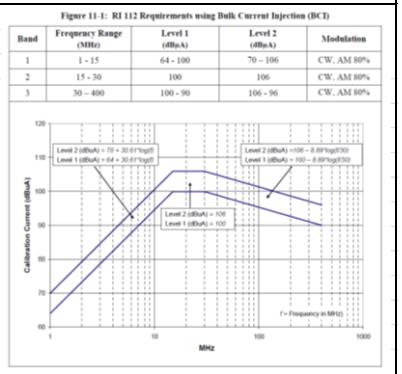
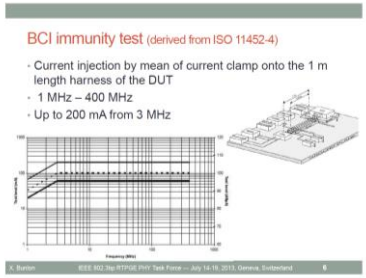
overview

1. Survey outcome

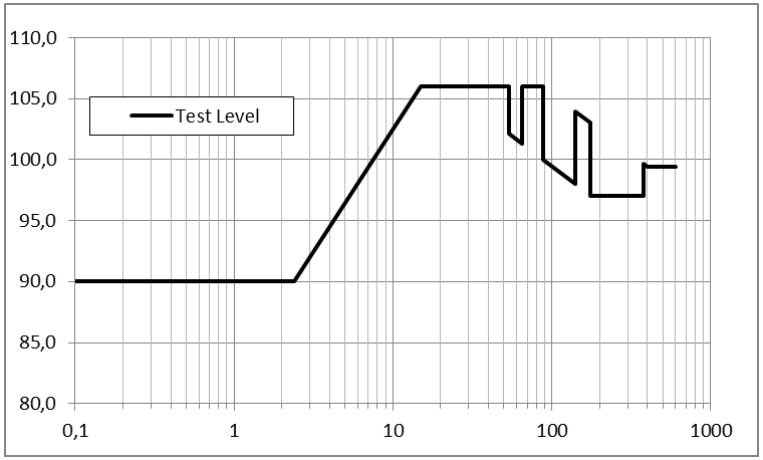
OEM	1. What is the proposed frequency range for 802.3bp RTPGE bulk current injection immunity tests defined according to ISO-11452-4?		2. What is the limit type and maximum level of the BCI tests for minimum error (<1e-10) operation?			3. What is the limit type and maximum value of the BCI tests for 1% packet error rate operation (if the requirement is available)?			Remarks
	Minimum	Maximum	constant/variable	value/function[f] f[MHz] | I_RMS [dBµA]		constant/variable	value/function[f] f[MHz] | I_RMS [dBµA]		
Daimler	0,1 MHz	600MHz *(extended from 400MHz value in ISO standard)*	variable	0,1 … 2,38	90	variable *Remark (this limits are also valid for category 3 with the requirement "function as defined, e.g. BER<1e-10)*	0,1 … 2,38	86	Daimler has 3 different categories for reliability of functions/systems: - Category 1 (Lowest reliability requirements, e.g. for comfort functions the user does not recognize directly if they fail) - Category 2 (Mid reliability requirements, e.g. recognizable failures of comfort systems) - Category 3 (Highest reliability requirements, all functions/systems not listed in other categories, e.g. relevant functions for driving) Category 3 always require "function as designed (e.g. BER<1e-10)", and would here be tested to the limits mentioned in question 3. Category 2 (which limits are written down here) and Category 1 disitinguish between "function as designed (e.g. BER<1e-10, question 2)" and "not function as designed (e.g. 1% packet loss, question 3, which is 4dB reduced)" For category 1 the level for "not functioned as designed, the test level is again 4dB reduced compared to category 2 **For all ECU tests Daimler finally categorizes the effects which occur during testing of an ECU**
				2,38 … 15	106-20 lg (15/f)		2,38 … 15	102-20 lg (15/f)	
				15 … 30	106		15 … 30	102	
				30 … 54	106		30 … 54	102	
				54 … 65	100-10 lg (f/88)		54 … 65	100-10 lg (f/88)	
				65 … 88	106		65 … 88	102	
				88 … 140	100-10 lg (f/88)		88 … 140	100-10 lg (f/88)	
				140 … 174	106-10 lg (f/88)		140 … 174	102-10 lg (f/88)	
				174 … 278,3	97		174 … 278,3	97	
				278,3 … 380	97		278,3 … 380	102-10 lg (f/88)	
				380 … 400	106-10 lg (f/88)		380 … 400	102-10 lg (f/88)	
				400… 600	*99,4*		*400… 600*	*95,4*	
BMW	100% like Daimler								
Audi	like Daimler								
Ford	no answer, for shown limits refer to www.fordemc.com EMC-CS-2009.1 (not an offical answer by Ford, just put out of the www)		variable	1…15	70 + 30,61*log(f)	variable	1…15	64 + 30,61*log(f)	
				15…30	106 flat		15…30	100 flat	
				30…400	106 - 8,98*log(f/30)		30…400	100 - 8,98*log(f/30)	
Renault	1 MHz	400 MHz	variable (see graph from	1..3	MAX x F/3 (mA)	No such requirement			MAX = 60 or 100 or 200 mA CW and AM (1 kHz 80%) modulation Closed loop method with limitation of applied
				3…400	MAX				
	see also slides from July: http://www.ieee802.org/3/bp/public/jul13/bunlon_3bp_01_0713.pdf. In this test the cable harness is 1m, also the complete harness of a DUT (including all conections from DUT to the harness) is placed in the BCI clamp. Different test levels for different applications (?)								

Daimler limit line graphs

Functional Status Classes

Status I Shall performed as designed (e.g. BER<10e-10)

Status II Does not perform as designed (e.g. 1% packet loss) during test, but automatically returns to normal function (Status I) after test



Test Levels

Maximum Test level (see on the right): Level applied during test

Required Immunity (see following slide)

L1 Test Level 1 (lower test level): all functions shall stay in status I up to L1

L2 Test Level 2 (higher test level): all functions shall at least stay in status II (or I) up to L2

Functional categories and according requirements

- Category 3 Highest reliability: All functions shall stay in status I up to L1
- Category 2 Mid category: functions shall stay in Status I up to L1 and in status II up to L2
- Category 1 Low category: functions shall stay in Status I up to L1 and in status II up to L2

Daimler limit line graphs

- Depending on application, different categories apply:
- Here BER and PL as examples