802.3bp RTPGE Mode Conversion Measurements for Automotive Link Segments

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Ahmad Chini & Mehmet Tazebay

Broadcom Corporation

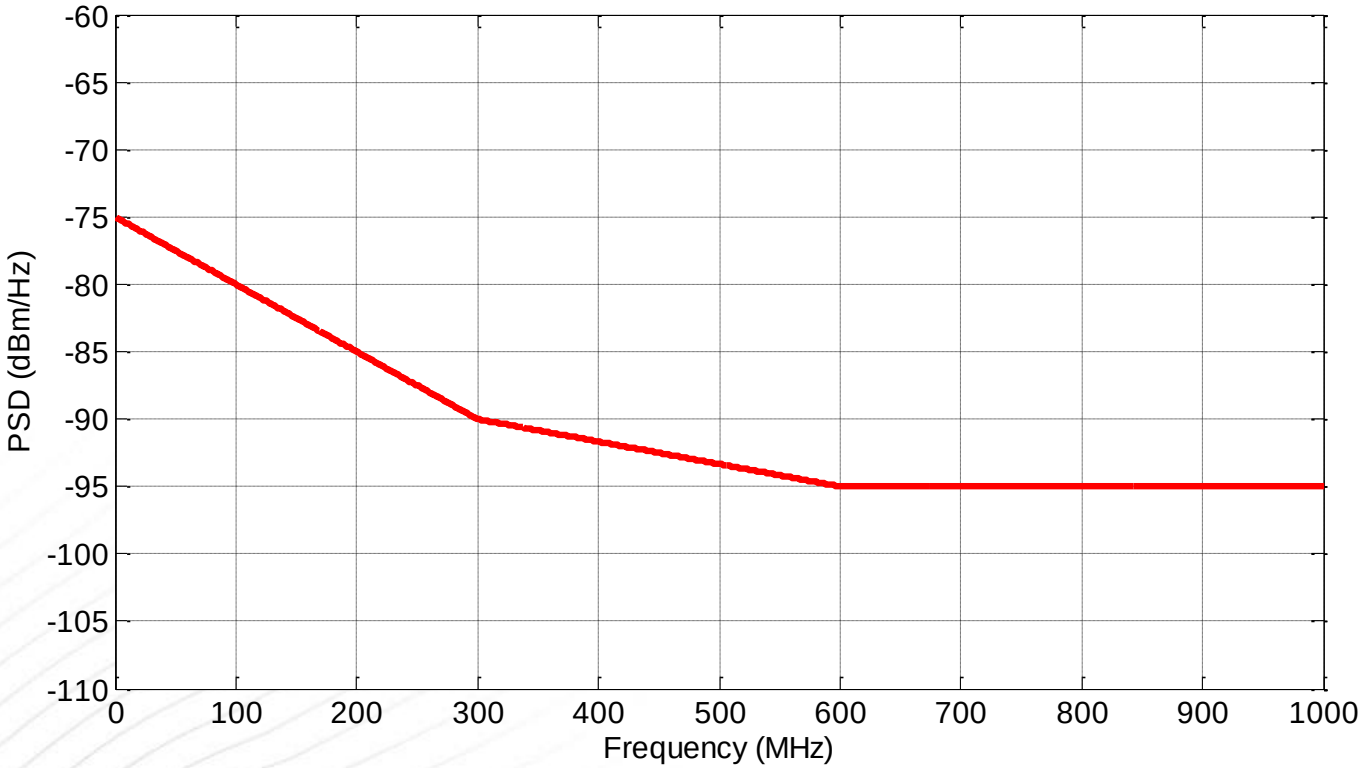
Overview

- System EMC Testing (as previously proposed)
  - Stripline for emissions testing
  - BCI for immunity testing

- EMC Measurement Setup
  - DUT 5cm over a ground plane (commonly used by automotive OEMs)
    - Will provide a consistent CM impedance among different measurements & setups
  - Components' Testing (cables, connectors, magnetics, etc.)
    - 3-port VNA measurements / 4-port VNA measurements with strictly balanced/calibrated setup.
    - Designing good test heads is most critical

- Critical parameter for RTPGE utilizing UTP solutions
  - → Mode conversion limit line which directly defines the emissions and immunity.
  - → The proposed value corresponds to the most stringent emission limit line (15dBuV) and BCI immunity level (200mA).
  - → Relaxing the proposed limit line will have an impact for tolerable EMC performance.

TX PSD Mask Proposal

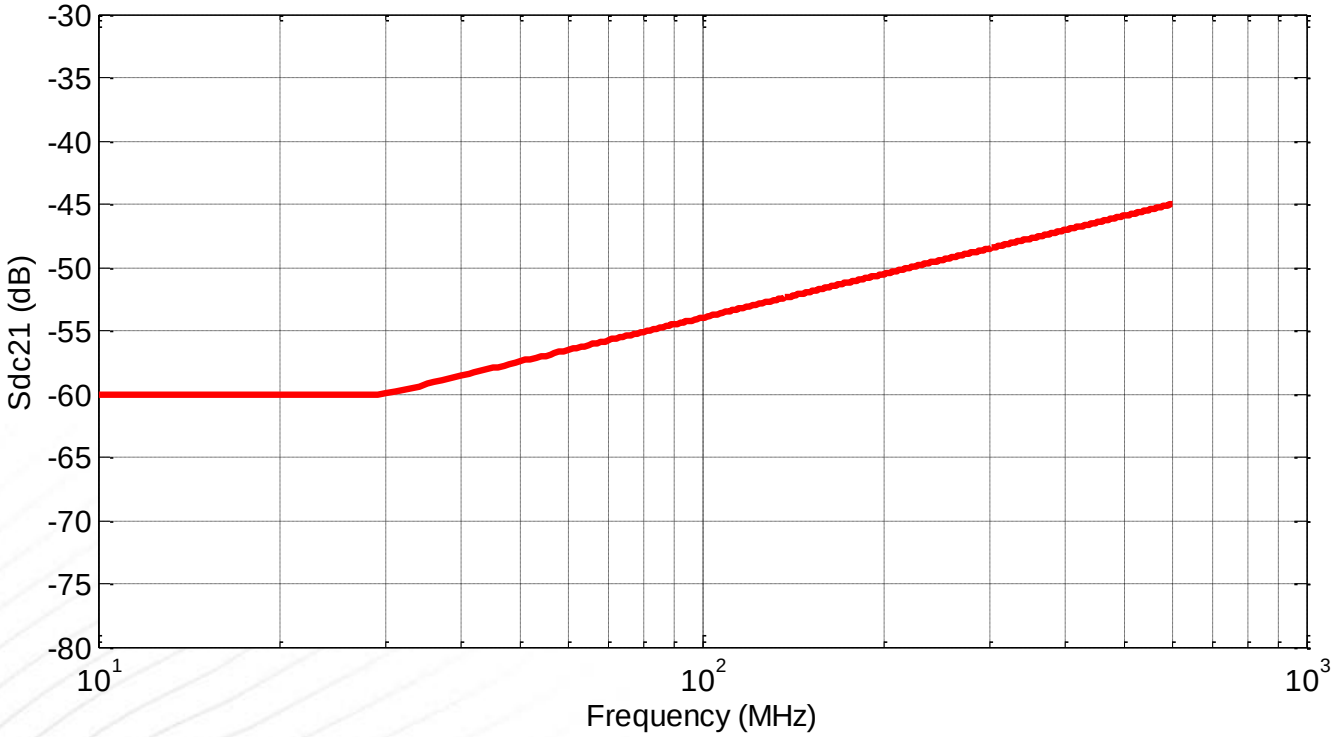


$[- f_{MHz} / 20 - 75]$ dBm/Hz $0 < f_{MHz} < 300$

$[- f_{MHz} / 60 - 85]$ dBm/Hz $300 < f_{MHz} < 600$

$- 95$ dBm/Hz $600 < f_{MHz} < 1000$

Mode Conversion Limit Line Proposal

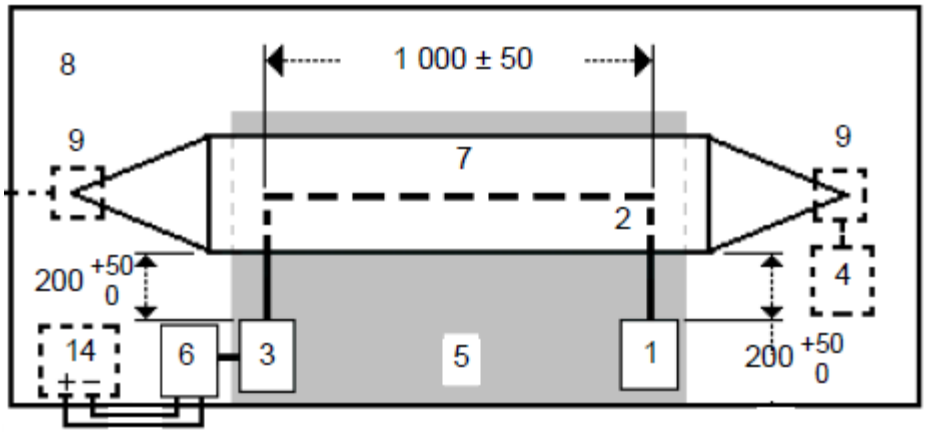


$- 60_{dB}$ $\quad 10 < f_{MHz} < 30$

$[\, 5 \log_n (f_{MHz}) - 77 \,]_{dB}$ $\quad 30 < f_{MHz} < 600$

CISPR25 Edition 3.0 2008-03

Figure G.1: strip line test set up



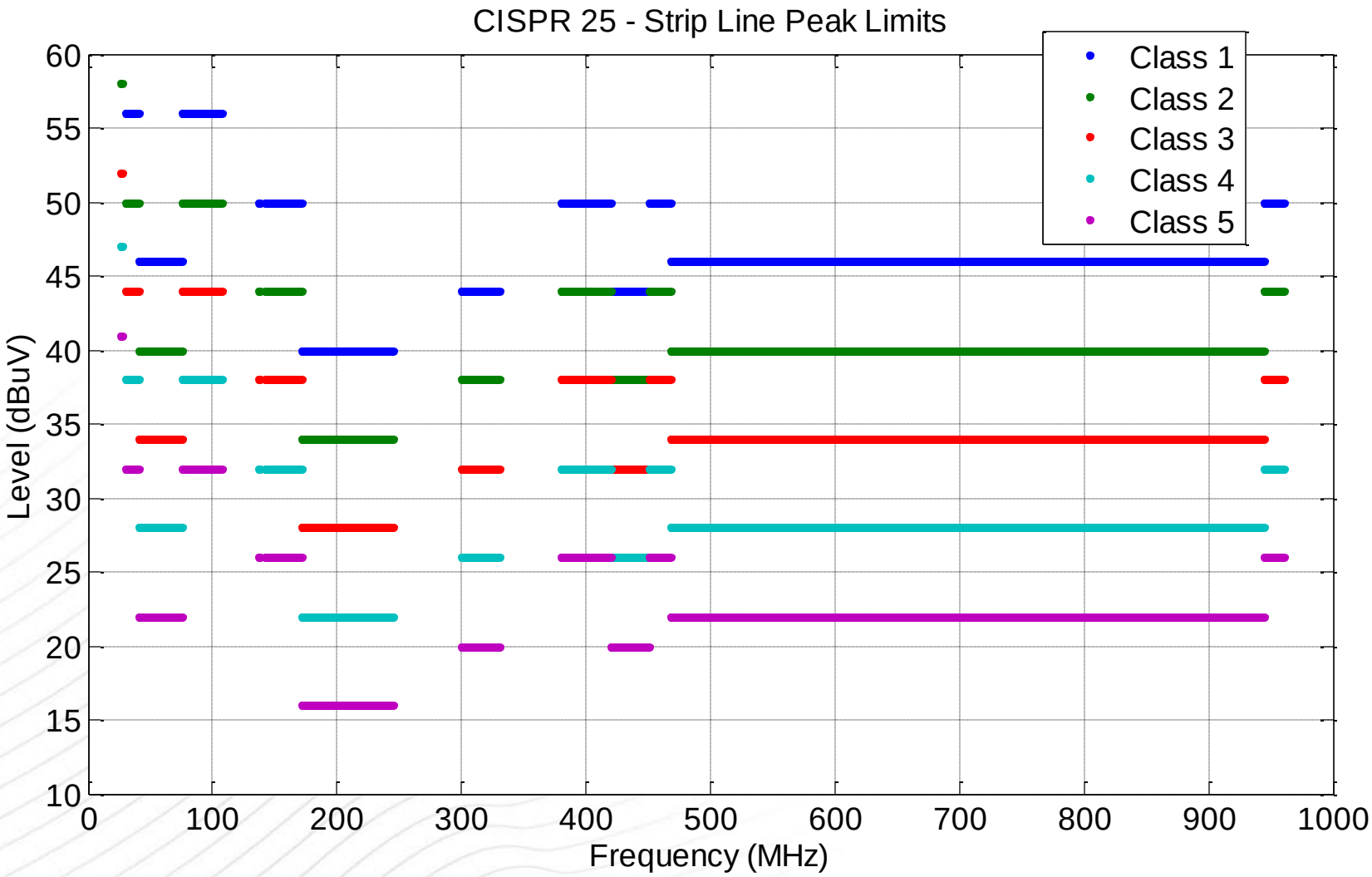
- CISPR25 set up suggests 1000mm cable width under strip line, deviation to 1500mm is seen in some vehicle manufacturers suggested set up.
- 2m cable length is suggested for which the cable width under strip line is calculated to be 1300mm (200+150+1300+150+200).

CISPR25 Edition 3.0 2008-03

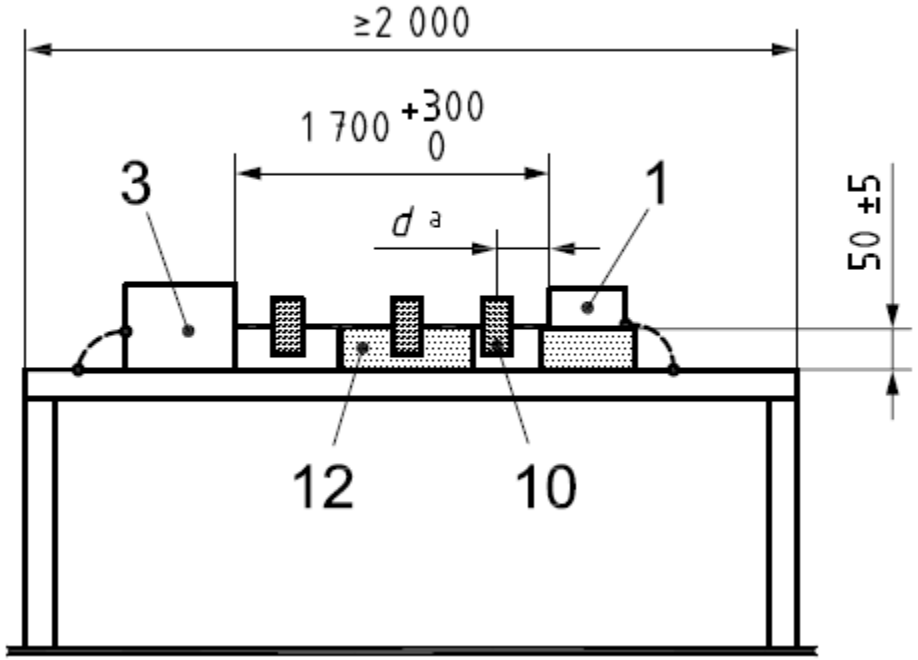
Table G.1 radiated disturbances strip line

Service / Band	Frequency MHz	Levels in dB(µV)									
		Class 1		Class 2		Class 3		Class 4		Class 5	
		Peak	Quasi-peak	Peak	Quasi-peak	Peak	Quasi-peak	Peak	Quasi-peak	Peak	Quasi-peak
BROADCAST											
LW	0,15 - 0,30	87	74	77	64	67	54	57	44	47	34
MW	0,53 - 1,8	73	60	65	52	57	44	49	36	41	28
SW	5,9 - 6,2	65	52	59	46	53	40	47	34	41	28
FM	76 - 108	56	43	50	37	44	31	38	25	32	19
TV Band I	41 - 88	46	-	40	-	34	-	28	-	22	-
TV Band III	174 - 230	46	-	40	-	34	-	28	-	22	-
DAB III	171 - 245	40	-	34	-	28	-	22	-	16	-
TV Band IV/V	468 - 944	46	-	40	-	34	-	28	-	22	-
DTTV	470 - 770	50	-	44	-	38	-	32	-	26	-
DAB L band	1447 - 1494	Radiated emission – Stripline									
SDARS	2320 - 2345	Not applicable									
MOBILE SERVICES											
CB	26 - 28	64	52	58	46	52	40	47	34	41	28
VHF	30 - 54	56	43	50	37	44	31	38	25	32	19
VHF	68 - 87	50	37	44	31	38	25	32	19	26	13
VHF	142 -175	50	37	44	31	38	25	32	19	26	13
Analogue UHF	380 - 512	50	37	44	31	38	25	32	19	26	13
RKE	300 - 330	44	-	38	-	32	-	26	-	20	-
RKE	420 - 450	44	-	38	-	32	-	26	-	20	-
Analogue UHF	820 - 960	50	37	44	31	38	25	32	19	26	13
GSM 800	860 - 895	56	-	50	-	44	-	38	-	32	-
EGSM/GSM 900	925 - 960	56	-	50	-	44	-	38	-	32	-

CISPR 25 stripline Peak Emission Limits



ISO 11452-4 BCI set up



- Deviation to use up to 2000mm cable is seen in some vehicle manufacturers suggested setup.

Estimated Differential Noise for Various BCI Thresholds

Flat 200mA BCI noise level → 100mVpp Differential at MDI

Flat 100mA BCI noise level → 50mVpp Differential at MDI

Flat 50mA BCI noise level → 25mVpp Differential at MDI

Notes:

- The values suggested here are for single UTP cable which is assumed to be worst case BCI testing.
- The proposed Sdc21 is used to calculate the worst-case differential noise at MDI

Effecting of Relaxing Mode Conversion Limit Line & TX PSD

Channel Mode Conversion Relative to the proposed level	**TX PSD** Relative to the proposed level	**SNR** Reduction	**CISPR 25** Stripline Peak Level	**200mA BCI** Differential Noise Level at MDI	**100mA BCI** Differential Noise Level at MDI
0dB	0dB	0dB	15dBuV, Class 5 All Freq. Bands	100mVpp	50mVpp
+6dB	0dB	6dB	21dBuV, Class 4 or 5 Depending on Freq. Bands	200mVpp	100mVpp
+12dB	0dB	12dB	27dBuV, Class 3 or 4 Depending on Freq. Bands	400mVpp	200mVpp
+6dB	-6dB	12dB	15dBuV, Class 5 All Freq. Bands	200mVpp	100mVpp
+12dB	-6dB	18dB	21dBuV, Class 4 or 5 Depending on Freq. Bands	400mVpp	200mVpp