

2

# Site Survey on Electromagnetic Environment for Wolsong Nuclear Power Plant Unit 2

150

260

2 (Radiated Emission) MIL-STD-462D  
 (DCC : Digital Control Computer) Clamp (MIL-STD-461D)  
 (EPRI) (Equipment Emission Level) 가  
 가

### Abstract

This paper presents the result of the electromagnetic site survey conducted in the CER(Control Equipment Room) of Wolsong Nuclear Power plant Unit 2. The measurement was performed according to MIL-STD-462D. However, the conducted emission was measured by a current probe through the entire frequency range. The measured values and profiles of the electromagnetic noise were represented on the frequency domain graphs with the related EMI equipment emission level requirements such as military standards and EPRI guidelines. It is recommended that more plant-wide measurements should be carried out to identify the electromagnetic environment of nuclear plants and to build up the more reliable and various database.

1.

가

가 [1-6]. 가  
 가 (Electromagnetic Site Survey)  
 [7], (EPRI: Electric Power  
 Research Institute) ORNL(Oak Ridge National Laboratory)  
 EMI(Electromagnetic Interference)  
 [1,2,5]. [8,9]  
 가 (KEPRI), 3 가  
 2 EMI Site Survey 가 MIL-STD-  
 461D[10] EPRI 3 Data

## 2. EMI

### 2.1. Site Survey

(Electromagnetic Environment) (Conducted) (Radiated)  
 [5]. (Scan)  
 (Peak) (RMS : Root Mean Square)  
 EMI , Site Survey  
 MIL-STD-462D[11] CE101, CE102, RE101, RE102

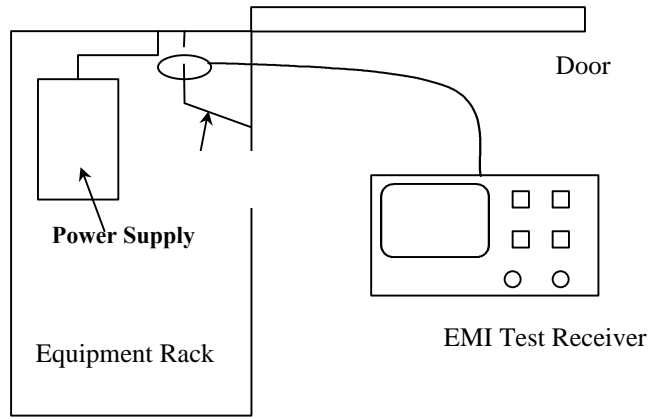
1.

CE101: Conducted Emissions	30 Hz – 10 kHz	Power Leads	[dB $\mu$ A]
CE102: Conducted Emissions	10 kHz – 10 MHz	Power Leads	[dB $\mu$ V]
RE101: Radiated Emissions (Magnetic field)	30Hz – 100 kHz		[dBpT]
RE102: Radiated Emissions (Electric Field)	10kHz – 7GHz		[dB $\mu$ V/m]

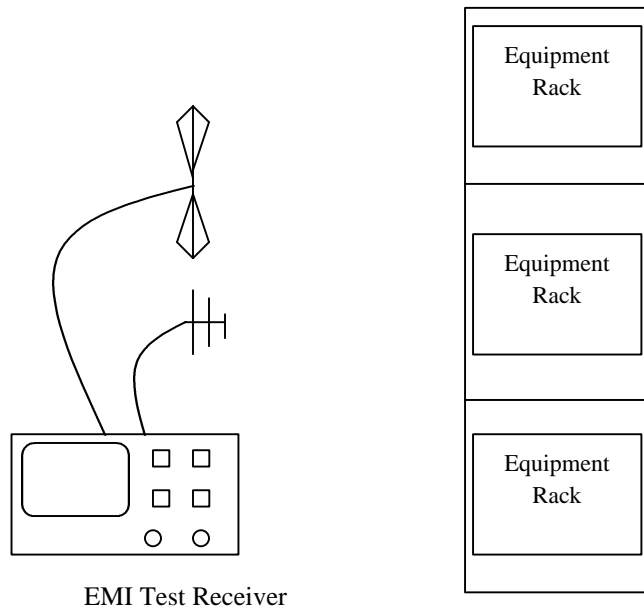
EPRI ORNL Probe 가 dB $\mu$ A

1 2

EMI Receiver 1 2 RE102 RE102 7GHz 가 가 4



1. Probe



2.

2.2.

MIL-STD-462D Emission

RMS Peak  
Dwelling Time [11]. 2  
Dwelling Time( )  
100Hz 15 msec 60Hz  
(Response Time) ( 1/60 Hz = 0.01666 sec.).  
(Scan) Synthesized(Digital) Receiver  
Step Measurement Time  
MIL-STD-462D Dwelling Time Synthesized  
Step Size( 가 )  
EMI [12] 0.4 Step Size 가  
Step Size 가

2.

	Bandwidth	Measurement Time /Dwelling Time( )	Step Size	( )
30 Hz – 1 kHz	10 Hz	0.2 s (0.15 sec)	4 Hz	Magnetic Loop
1 kHz – 10 kHz	100 Hz	0.02s (0.015 sec)	40Hz	Magnetic Loop
10 kHz – 250 kHz	1 kHz	0.02 s (0.015 sec)	400Hz	Active Rod /100kHz magnetic field magnetic loop
250 kHz – 30 MHz	10 kHz	0.02 s (0.015 sec)	4kHz	Active Rod
30 MHz – 200 MHz	100 kHz	0.02 s(0.015 sec)	40kHz	Bicornical
200 MHz – 1 GHz	100 kHz	0.02 s (0.015 sec)	40kHz	LogPeriodic
1 GHz – 7GHz	1 MHz	0.02 s (0.015 sec)	400kHz	Horn

2.3.

EMI Receiver (

) 3

3.

1	EMI Test Receiver	ESI7	Rohde Schwarz	20 Hz – 7 GHz, CE RE
2	Current Probe	EZ-17	Rohde Schwarz	5 Hz – 2 MHz
3	Biconical Antenna	HK116	Rohde Schwarz	20 MHz – 300 MHz,

4	Rod Antenna	HFH2-Z6	Rohde Schwarz	9 kHz – 30 MHz
5	Log Periodic Antenna	HL223	Rohde Schwarz	200 MHz – 1300 MHz
6	Magnetic Pickup Coil	HZ-10	Rohde Schwarz	5 Hz – 10 MHz
7	Horn		( )	1GHz – 18GHz
8	Cable			Probe
9	Diskettes	3.5		

4 . 6 ,  
 4 A D  
 DCC CPU(Central  
 Processing Unit)Board

4.

A	DCC-X DCC-Y 가	Electric Field
B	(CER : Control Equipment Room)	
C	Terminal Block Train Shut-off Rod Logic(63733-PL178)	
D	Emergency Core Cooling 가	
E		
F	120V Power Distribution Panel 0.5m	Magnetic Field
G	DCC-Y 120VAC	(Differential mode)
I	DCC-Y CPU Board	(Common mode)

3.

3.1. CE101(30Hz – 10MHz)

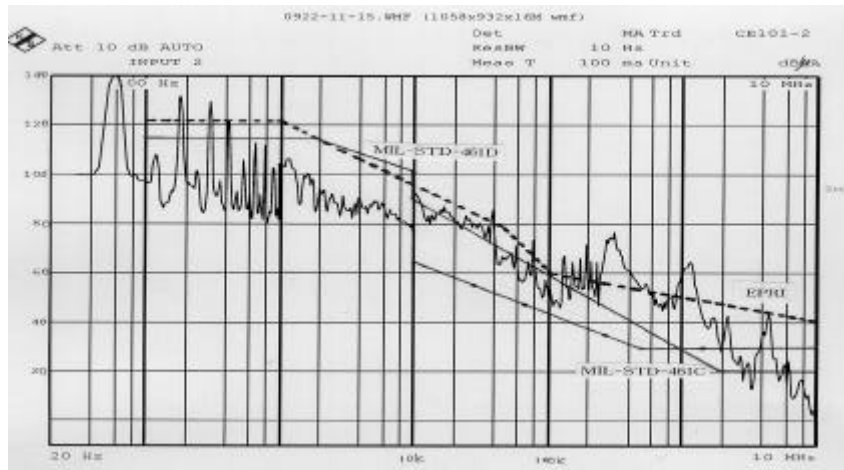
Site Survey Noise  
 LISN(Line Impedance Stabilization Network)

MIL-STD-461D [10kHz – 10MHz] dBμV ,

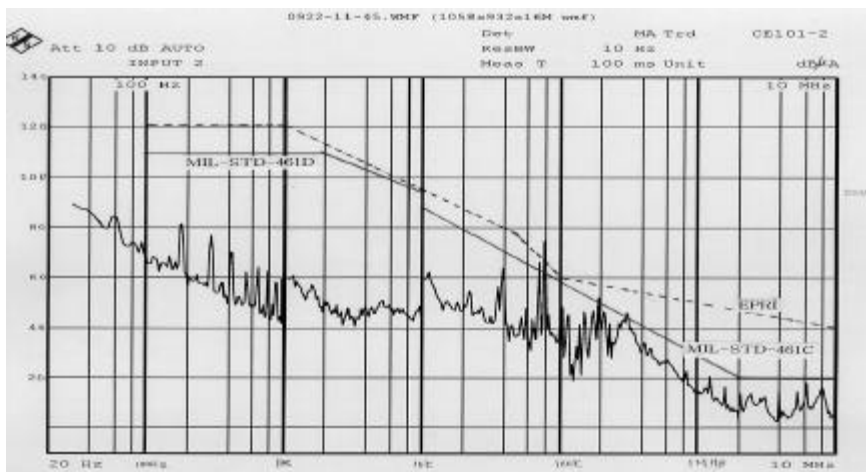
EPRI  
 dB $\mu$ A  
 가 , 120Hz 10kHz  
 20A 가 가 dB $\mu$ A  
 500hm 가 (dB $\mu$ A)  
 3 , EPRI

Clamp 3  
 30Hz 3 DCC-Y  
 10 MHz  
 MIL-STD-461D  
 MIL-STD-461D 가  
 MIL-STD-461C[13] (dB $\mu$ V)  
 MIL-STD-461D  
 MIL-STD-461D 가  
 MIL-STD

Spike 60Hz 3, 5, 7 (180Hz,  
 300Hz, 420Hz) 120 dB $\mu$ A(=1A) Spike



3. DCC-Y -Differential Mode



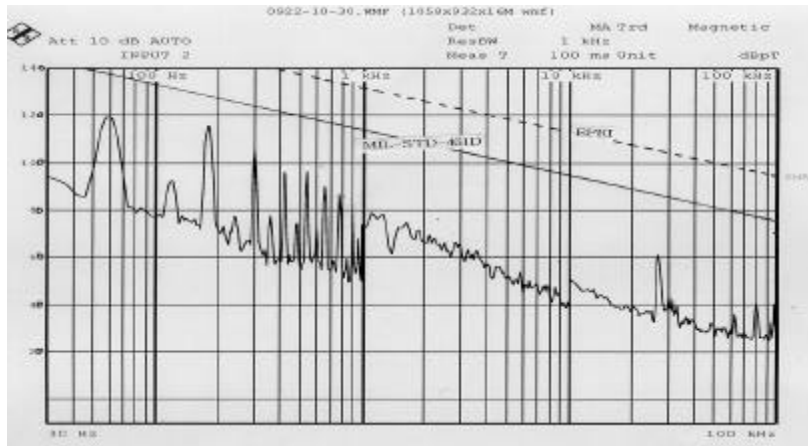
4. DCC-Y CPU Common -Mode

4 DCC-Y CPU Common-Mode

가 , Differential Mode  
가

**3.2. Magnetic Field (RE101 : 30 Hz ~ 100 kHz)**

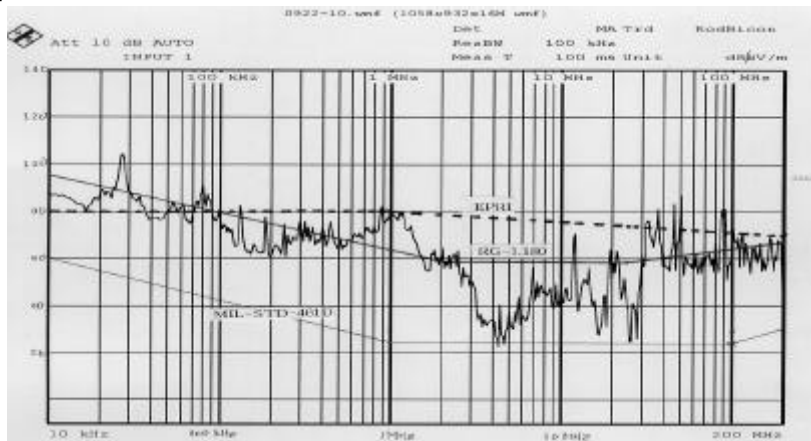
(EM Source) (CRT, Relay, Transformer, )  
5 가  
120V Power Distribution Panel 50cm  
60Hz Spike 가  
(Magnetic Field) MIL-STD-461D  
EPRI



5. Magnetic Field

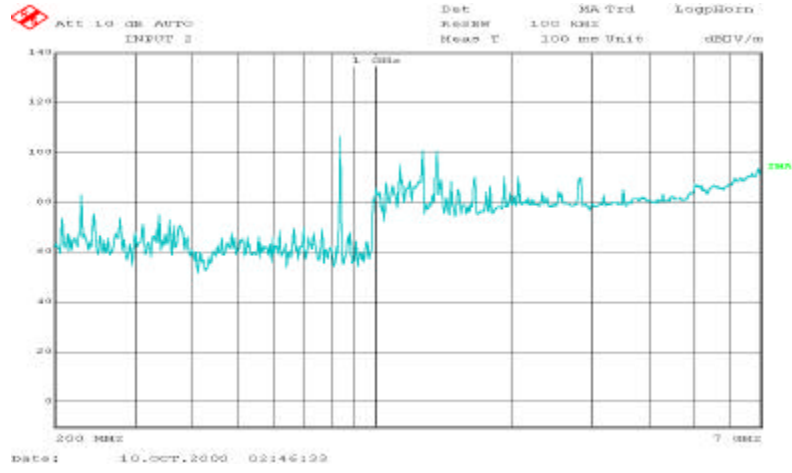
**3.3. (Electric Field : RE 102 (10 kHz ~ 7GHz))**

10kHz ~ 200MHz, 200MHz ~ 7GHz  
6 Block Train 10kHz ~ 200MHz  
. EPRI  
10V/m(=140 dBμV/m)  
가



6.

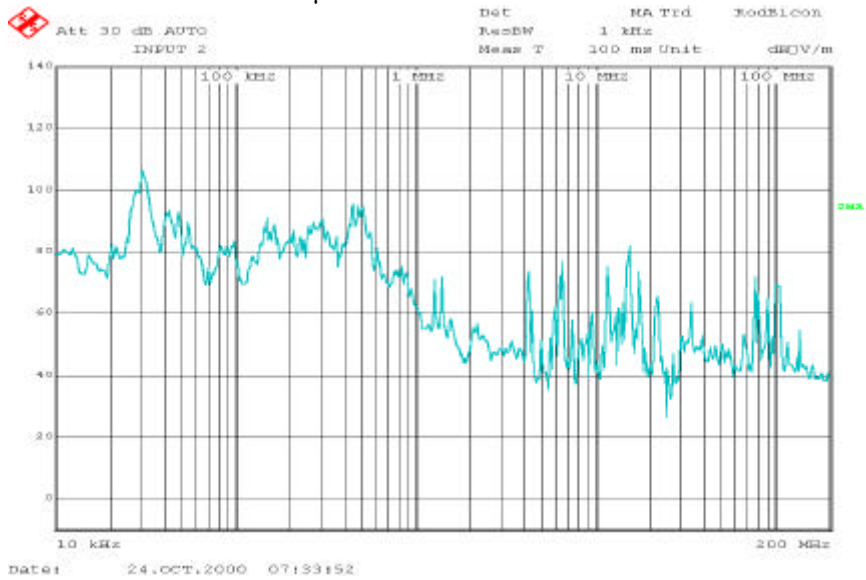
7 200MHz ~ 7GHz  
 Spike 가 가 (Worst Case) 850MHz  
 가 110 dB $\mu$ V/m



7. 200MHz - 7GHz

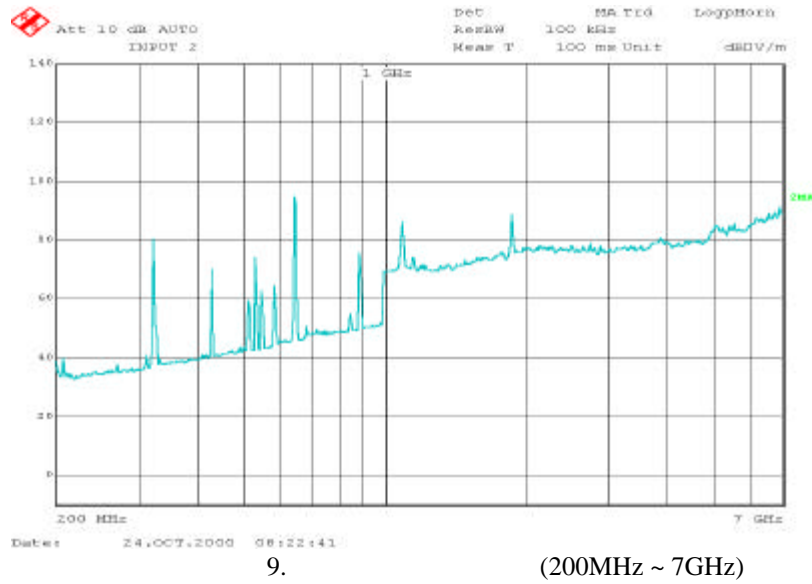
3.4.

8 9 80m 가  
 Spike 가 100 dB $\mu$ V  
 200MHz ~ 1GHz



8. (10 kHz ~ 200 MHz)





4.

2 가  
 Conducted Emission Radiated Emission KAERI, KEPRI 1  
 Site Survey 가 Radiated Emission  
 , DCC-Y Conducted  
 Emission  
 , Relay (Electric Field)  
 140 dB $\mu$ V/m(10 V/m)  
 가 1  
 (Profile)  
 Conducted Emission 60Hz Radiated Emission  
 Spike Site Survey  
 가 1, 3, 4 Site

**Acknowledgement**

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