

**S-CEM/EMCD/TR/2008-2009/157**

**EMI/EMC TEST REPORT FOR TORQUE MEASUREMENT SYSTEM  
MANUFACTURED BY  
M/s. HONEYWELL TECHNOLOGY SOLUTIONS (P) LTD., BANGALORE**

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**SAMEER - CENTRE FOR ELECTROMAGNETICS**

(An Institution Set-up by Ministry of Communications and Information Technology, Government of India),  
2<sup>nd</sup> Cross Road, CIT Campus, Taramani, Chennai - 600 113.

**July 2009**

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MANUFACTURED BY  
M/s. HONEYWELL TECHNOLOGY SOLUTIONS (P) LTD., BANGALORE**

**Test Request Particulars**

01. Test request from : M/s. Honeywell Technology solutions (P) Ltd., Bangalore

02. Equipment under test (EUT) : Torque Measurement System

03. Number of test sample(s) : One

04. Types of tests requested : 1. Conducted Emission Test as per FCC part-15.207; 2004  
2. Radiated Emission Test as per FCC part-15.209,223; 2004

05. Manufacturer : M/s. Honeywell Technology solutions (P) Ltd., Bangalore

06. Model number of EUT : TMS 9000-92013

07. Serial number of EUT : Prototype

08. Test plan concurred by : Mr. Vijay.Tippanna.Talikoti, Senior Engineer  
Honeywell Technology solutions (P) Ltd., Bangalore

09. EUT Arrived on : July 16, 2009

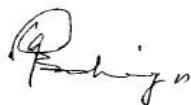
10. Test date(s) : July 16, 2009

11. Test Venue : SAMEER-CEM, Chennai

12. Status of the EUT on receipt : Functional

Certified that the data reported in this report are valid only for the test sample(s) mentioned above at the time of and under the stated conditions of measurement. Particulars on Manufacturer / Supplier, given in this report, are based on the information given by the customer, along with test request and SAMEER-CEM does not assume any responsibility for the correctness of that information for the above mentioned equipment under test.

***Test Plan & Reviewed By:***



**(Sanjay Baisakhiya)**  
Scientist-D

***Approved By:***



**(Dr. B. Subbarao)**  
Head, EMC Division

***Office Seal***



## EMI/EMC TEST RESULTS AND SUMMARY FOR TORQUE MEASUREMENT SYSTEM

### EMC EMISSION TESTS AND RESULTS

Name of the Test	Basic Standard	AC/DC/ Signal Port	Specification	Notes
Conducted Emission Test	FCC part-15.207	110V/ 60Hz Power Port	<u>Quasipeak Limit</u>  <b>150kHz -500kHz</b> : 66 – 56 dB $\mu$ V <b>500kHz -5MHz</b> : 56 – 60 dB $\mu$ V <b>5MHz-30MHz</b> : 60 dB $\mu$ V  <u>Average limit</u>  <b>150kHz -500kHz</b> : 59 – 46 dB $\mu$ V <b>500kHz -5MHz</b> : 46 – 50 dB $\mu$ V <b>5MHz-30MHz</b> : 50 dB $\mu$ V	Within the limit
Radiated Emission Test	FCC part-15.209	Enclosure port	<u>Quasipeak Limit</u>  <b>30 MHz -88MHz</b> : 40 dB $\mu$ V/m <b>88 MHz -216 MHz</b> : 43.5 dB $\mu$ V/m <b>216 MHz -960 MHz</b> : 46 dB $\mu$ V/m <b>960 MHz- 1GHz</b> : 54 dB $\mu$ V/m	Within the limit
Radiated Emission Test	FCC part-15.209	Enclosure port	<u>Average Limit</u>  <b>1 MHz -30MHz</b> : 69.52dB $\mu$ V/m	Within the limit
Radiated Emission Test	FCC part-15.223	Enclosure port	<u>Average Limit</u>  <b>6.78MHz</b> : 63.52 dB $\mu$ V/m	Within the limit

## 1. CONDUCTED EMISSION TEST

**1.1 Applicable Standard:** As per FCC part-15.207

### 1.2 Test Instrumentation:

Description	Make	Model Number	Serial Number	Calibration due date
EMI Receiver	R&S	ESI B7	100319	14/02/2010
Line Impedance Stabilization Network (LISN)	R&S	ESH2 Z5	893606 / 023	19/11/2009
Transient Limiter	HP	11947A	3107A03845	31/10/2009

### 1.3 EUT Configuration:

The EUT is Torque Measurement System (Torque Measurement System) which is intended to be used in industrial applications. The EUT is a torque measurement system used to measure torque in Dynamo Meters and other applications. The measurement is based on strain gauge sensor and data transmission is wireless. During the test, the communication lines were not monitored (inactive). The EUT was energized by 110V/ 60Hz ac and made operational.

**1.4 Test Frequency Range and Limits:** As per FCC part-15.207

Frequency	Quasipeak Limits (dB $\mu$ V)	Average Limits (dB $\mu$ V)
150 kHz - 5 MHz	66-56	56-46
500 KHz - 5 MHz	56-60	46-50
5.0 MHz - 30 MHz	60	50

### 1.5 Test Procedure:

The RF Conducted Emissions from the EUT sent back to the mains input were coupled using a Line Impedance Stabilization Network and measured using an Electromagnetic Interference (EMI) receiver. The measurement was done initially in Peak & Average Detection Modes and wherever the emission was closer to the limit line in peak detection mode, Quasi Peak Detection Mode was employed. The measurement was carried out in the frequency range of 150 kHz to 30 MHz.

### 1.6 Test Observation:

The RF conducted emissions from the EUT was found to be within the limit in the above specified frequency range in both Line and Neutral.

### 1.7 Enclosed Documents:

Plots 1 – 2: Conducted Emissions from the EUT .  
Annexure – 1: Block Diagram of EUT & Photograph of EUT.  
Annexure – 2: Conducted Emission Test Setup.

**Test Conducted by:**



(A. Albin)  
Scientific Assistant-A



(A. Saravanan)  
Project Assistant

## 2. RADIATED EMISSION TEST

**2.1. Applicable Standards:** As per FCC part-15.209, 223 Class B: 2004

### 2.2. Test Instrumentation:

Description	Make	Model Number	Serial Number	Cal. Due Date
EMI Receiver	R&S	ESI B7	100319	14/02/2010
Biconilog Antenna	ETS	3142B	00026416	18/04/2010
Shielded Semi Anechoic Chamber	Siepel-Hyfral	---	F276	30/11/2009
Active loop antenna	EMCO	6507	1484	17/10/2009

### 2.3. Test Frequency Range & Limits( 3m Distance):

FCC part-15.209:2004(Class B)

Frequency (MHz)	Limit (dB $\mu$ V/m)
1-30	69.52
30 - 88	40.0
88 – 216	43.5
216-960	46.0
960-1000	54.0

FCC part-15.223:2004(Class B)

Frequency (MHz)	Limit (dB $\mu$ V/m)
6.78	63.52

### 2.4. EUT Configuration:

The EUT is Torque Measurement System (Torque Measurement System) which is intended to be used in industrial applications. The EUT is a torque measurement system used to measure torque in Dynamo Meters and other applications. The measurement is based on strain gauge sensor and data transmission is wireless. During the test, the communication lines were not monitored (inactive). The EUT was energized by 110V/60Hz AC and made operational.

### 2.5. Test Procedure:

The Radiated Emission from the EUT in the frequency range of 1 MHz – 30 MHz and 30 MHz – 1000 MHz was picked up at a distance of 3 m using Active Loop antenna and Biconilog Antenna respectively. The measurement was carried out inside the shielded semi anechoic chamber. The EUT was rotated 0 to 360 degrees and the antenna height was varied from 1 to 4 meters to maximize the picked up emission in the frequency range 30 MHz – 1000 MHz. The measurement was done in peak detection mode, in both vertical and horizontal polarization in the frequency range 30 MHz – 1000MHz. The worst case emission and corresponding frequencies were noted and analyzed thoroughly in quasi-peak detection mode. The EUT was rotated 0 to 360 degrees to maximize the picked up emission in the frequency range 1 MHz – 30MHz. The measurement was done in average detection mode, in both parallel and perpendicular position of the Loop antenna in the frequency range 1 MHz – 30MHz.



Equipment Under Test : Torque Measurement System  
 Model Number of EUT : TMS 9000-92013  
 Serial Number of EUT : Prototype  
 Manufacturer by : M/s. Honeywell Technology solutions (P) Ltd., Bangalore



## 2.6. Test Observation:

### FCC part-15.209:2004(Class B)

Table -1: 30 MHz - 1000 MHz

Freq. (MHz)	Table Position (°)	Ant. Ht. (m)	Measured level in (dB $\mu$ V) A	Antenna Factor (dB/m) B	Cable loss (dB) C	Total Emission (dB $\mu$ V/m) E=A+B+C	QP limit (dB $\mu$ V/m) L	Delta Level (dB) D=L-E	Test Result
<b>VERTICAL POLARIZATION</b>									
150	210	1	22.36	9.52	1.05	32.93	43.50	10.57	Within the Limit
271.2	65	1	17.38	14.01	1.41	32.79	46.00	13.21	Within the Limit
350	215	1.45	16.37	16.00	1.58	33.95	46.00	12.05	Within the Limit
61.08	350	1.75	16.3	8.22	0.67	25.20	40.00	14.80	Within the Limit
264.44	55	1	15.39	13.60	1.39	30.38	46.00	15.62	Within the Limit
<b>HORIZONTAL POLARIZATION</b>									
271.2	360	1.2	27.82	14.01	1.41	43.23	46.00	2.77	Within the Limit
350	345	1	18.85	16.00	1.58	36.43	46.00	9.57	Within the Limit
278	0	1.15	28.95	13.92	1.43	44.30	46.00	1.70	Within the Limit
311.88	95	1	22.98	14.85	1.51	39.33	46.00	6.67	Within the Limit
150	150	1.4	26.75	9.52	1.05	37.32	43.50	6.18	Within the Limit
264.44	10	1	20.28	13.60	1.39	35.27	46.00	10.73	Within the Limit
284.8	115	1	19.69	13.72	1.45	34.86	46.00	11.14	Within the Limit
300	105	1	21.51	10.19	1.51	33.21	46.00	12.80	Within the Limit

### FCC part-15.209:2004(Class B)

Table – 2: 1 MHz - 30 MHz

Freq. (MHz)	Table Position (°)	Ant. Height (m)	Measured level in (dB $\mu$ V) A	Antenna Factor (dB/m) B	Cable loss (dB) C	Total Emission (dB $\mu$ V/m) E=A+B+C	Average limit (dB $\mu$ V/m) L	Delta Level (dB) D=L-E	Test Result
<b>PARALLEL POSITION</b>									
6.78	260	1	37.76	17.22	0.23	55.20	69.52	14.32	Within the Limit
13.56	30	1	20.04	16.56	0.32	36.92	69.52	32.60	Within the Limit
27.12	30	1	12.99	15.76	0.46	29.21	69.52	40.31	Within the Limit
<b>PERPENDICULAR POSITION</b>									
6.78	170	1	38.83	17.22	0.23	56.27	69.52	13.25	Within the Limit
13.56	55	1	24.01	16.56	0.32	40.89	69.52	28.63	Within the Limit
27.12	80	1	18.24	15.76	0.46	34.46	69.52	35.06	Within the Limit



Equipment Under Test : Torque Measurement System  
 Model Number of EUT : TMS 9000-92013  
 Serial Number of EUT : Prototype  
 Manufacturer by : M/s. Honeywell Technology solutions (P) Ltd., Bangalore



FCC part-15.223:2004

Table -3: 6.78MHz

Freq. (MHz)	Table Post. (°)	Ant. Ht. (m)	Measured level in (dB $\mu$ V) A	Ant. Factor (dB/m) B	Cable loss (dB) C	Total Emission (dB $\mu$ V/m) E=A+B+C	Average Limit (dB $\mu$ V/m) L	Delta Level (dB) D=L-E	Test Result
<b>PARALLEL POSITION</b>									
6.78	260	1	38.65	17.22	0.23	56.09	63.52	7.43	Within the Limit
<b>PERPENDICULAR POSITION</b>									
6.78	170	1	39.12	17.22	0.23	56.56	63.52	6.96	Within the Limit

**7. Enclosed Documents:**

Plots 3- 6: Radiated Emission spectrum from EUT.

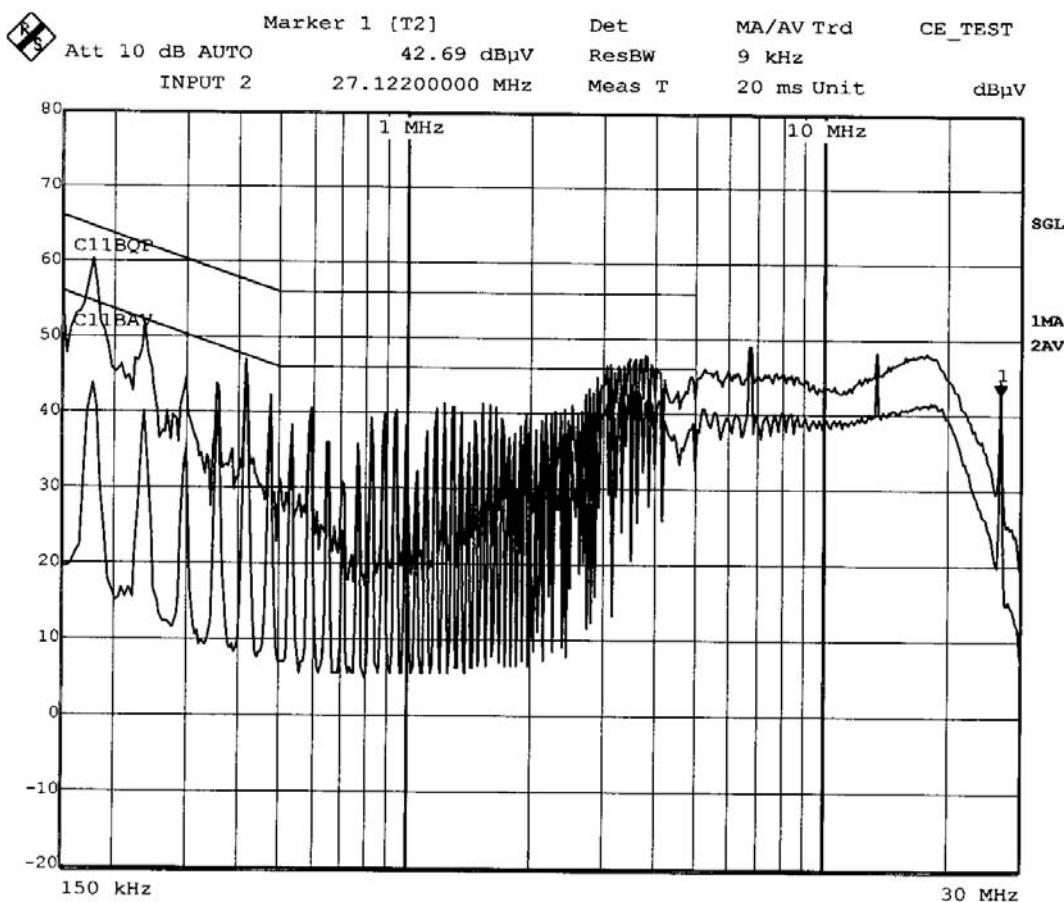
Annexure – 3: Photograph of Radiated Emission Test Setup.

*Test Conducted by:*

(A. Albin)  
Scientific Assistant-A

(A. Saravanan)  
Project Assistant

## PLOT-1



Title: CONDUCTED EMISSION TEST AS PER FCC PART 15 CLASS-B  
Comment B: EUT:TORQUE MEASUREMENT SYSTEM,MODEL:TMS 9000(92013),MAKE:HONEYWELL,MEAS:LINE(SHIELDED CORD)  
Date: 16.JUL.2009 12:18:41

**PLOT-1A**

Trace1: C11BQP		Trace2: ---	
Trace3: ---		Trace4: ---	
TRACE	FREQUENCY	LEVEL dB $\mu$ V	DELTA LIMIT dB
1	Quasi Peak 178.0000 kHz	59.18	-5.39
1	Quasi Peak 6.7820 MHz	48.52	-11.47
1	Quasi Peak 13.5620 MHz	46.85	-13.15
1	Quasi Peak 3.6780 MHz	39.68	-16.31
1	Quasi Peak 27.1220 MHz	42.96	-17.03
1	Quasi Peak 3.6180 MHz	38.87	-17.12
1	Quasi Peak 3.5580 MHz	37.79	-18.20
1	Quasi Peak 3.4980 MHz	36.41	-19.58
1	Quasi Peak 3.9140 MHz	35.13	-20.87
1	Quasi Peak [REDACTED]	35.07	-20.92
1	Quasi Peak 3.8540 MHz	34.34	-21.65
1	Quasi Peak 3.7940 MHz	33.21	-22.78
1	Quasi Peak 3.7340 MHz	31.65	-24.34

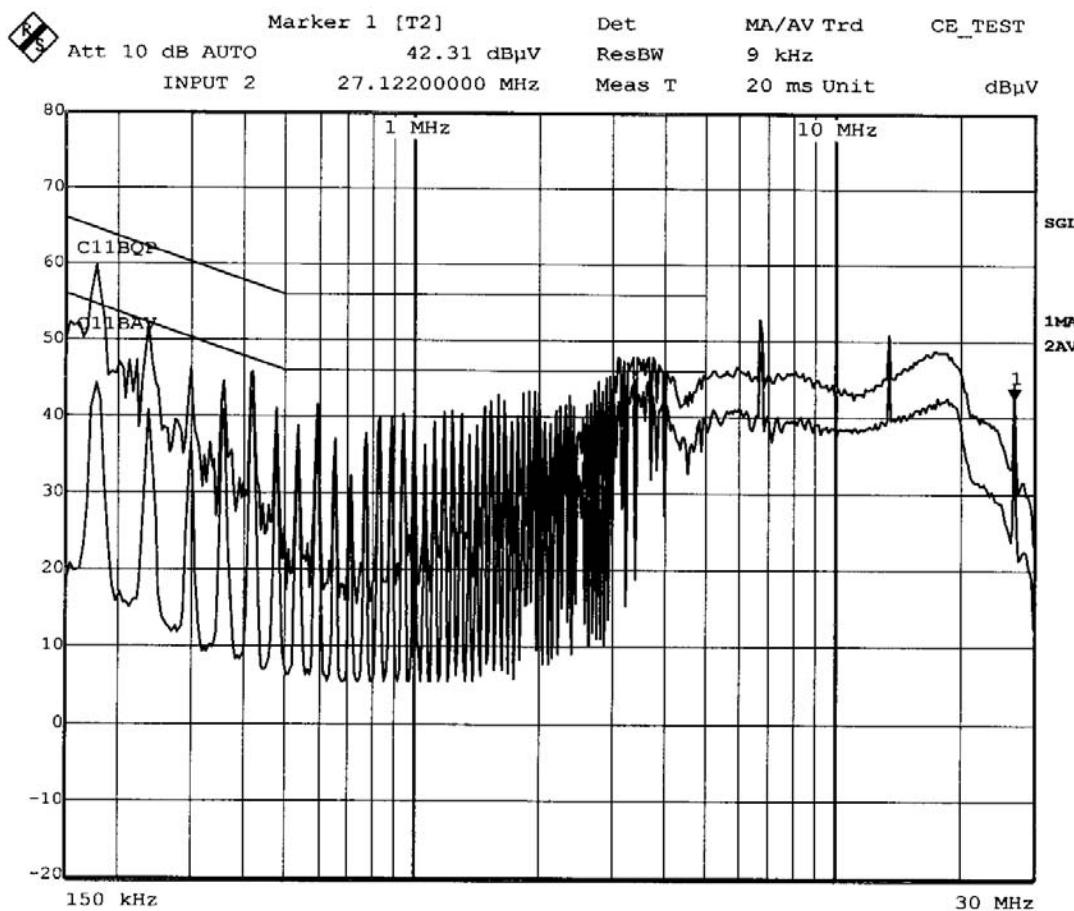
Title: CONDUCTED EMISSION TEST AS PER FCC PART 15 CLASS-B  
Comment B: EUT:TORQUE MEASUREMENT SYSTEM,MODEL:TMS 9000(92013),MAKE:HONEYWELL,MEAS:LINE(SHIELDED CORD)  
Date: 16.JUL.2009 12:21:13

**PLOT-1B**

Trace1: ---		Trace2: C11BAV	
Trace3: ---		Trace4: ---	
TRACE	FREQUENCY	LEVEL dB $\mu$ V	DELTA LIMIT dB
2 Average	6.7820 MHz	48.04	-1.95
2 Average	6.7820 MHz	48.03	-1.96
2 Average	13.5620 MHz	46.10	-3.89
2 Average	13.5620 MHz	46.09	-3.91
2 Average	414.0000 kHz	42.61	-4.95
2 Average	27.1220 MHz	42.52	-7.47
2 Average	3.3220 MHz	34.18	-11.81
2 Average	3.6780 MHz	32.69	-13.30
2 Average	3.6180 MHz	30.90	-15.09
2 Average	3.5580 MHz	28.27	-17.72
2 Average	3.4380 MHz	26.57	-19.42
2 Average	[REDACTED]	25.96	-20.04
2 Average	3.8540 MHz	24.70	-21.29
2 Average	3.7340 MHz	23.18	-22.81
2 Average	4.0900 MHz	21.53	-24.46

Title: CONDUCTED EMISSION TEST AS PER FCC PART 15 CLASS-B  
Comment B: EUT:TORQUE MEASUREMENT SYSTEM,MODEL:TMS 9000(92013),MAKE:HONEYWELL,MEAS:LINE(SHIELDED CORD)  
Date: 16.JUL.2009 12:23:40

## PLOT-2



Title: CONDUCTED EMISSION TEST AS PER FCC PART 15 CLASS-B  
Comment B: EUT:TORQUE MEASUREMENT SYSTEM,MODEL:TMS 9000(92013),MAKE:HONEYWELL, MEAS:NEUTRAL(SHIELDED CORD)  
Date: 16.JUL.2009 12:28:37



Equipment Under Test : Torque Measurement System  
Model Number of EUT : TMS 9000-92013  
Serial Number of EUT : Prototype  
Manufacturer by : M/s. Honeywell Technology solutions (P) Ltd., Bangalore



## PLOT-2A

Trace1:	C11BQP	Trace2:	---
Trace3:	---	Trace4:	---
TRACE	FREQUENCY	LEVEL dB $\mu$ V	DELTA LIMIT dB
1	Quasi Peak 178.0000 kHz	58.96	-5.61
1	Quasi Peak 6.7780 MHz	51.22	-8.77
1	Quasi Peak 6.7780 MHz	50.86	-9.13
1	Quasi Peak 3.4460 MHz	46.83	-9.16
1	Quasi Peak 3.3900 MHz	46.23	-9.76
1	Quasi Peak 3.6260 MHz	46.02	-9.97
1	Quasi Peak 3.6860 MHz	45.92	-10.07
1	Quasi Peak 3.7460 MHz	45.86	-10.13
1	Quasi Peak 3.5060 MHz	45.81	-10.18
1	Quasi Peak [REDACTED]	45.72	-10.27
1	Quasi Peak 3.0900 MHz	45.61	-10.38
1	Quasi Peak 13.5580 MHz	47.68	-12.31
1	Quasi Peak 27.1220 MHz	42.91	-17.08

Title: CONDUCTED EMISSION TEST AS PER FCC PART 15 CLASS-B  
Comment B: EUT:TORQUE MEASUREMENT SYSTEM, MODEL:TMS 9000(92013) , MAKE:HONEYWELL, MEAS:NEUTRAL(SHIELDED CORD)  
Date: 16.JUL.2009 12:31:15



Equipment Under Test : Torque Measurement System  
Model Number of EUT : TMS 9000-92013  
Serial Number of EUT : Prototype  
Manufacturer by : M/s. Honeywell Technology solutions (P) Ltd., Bangalore

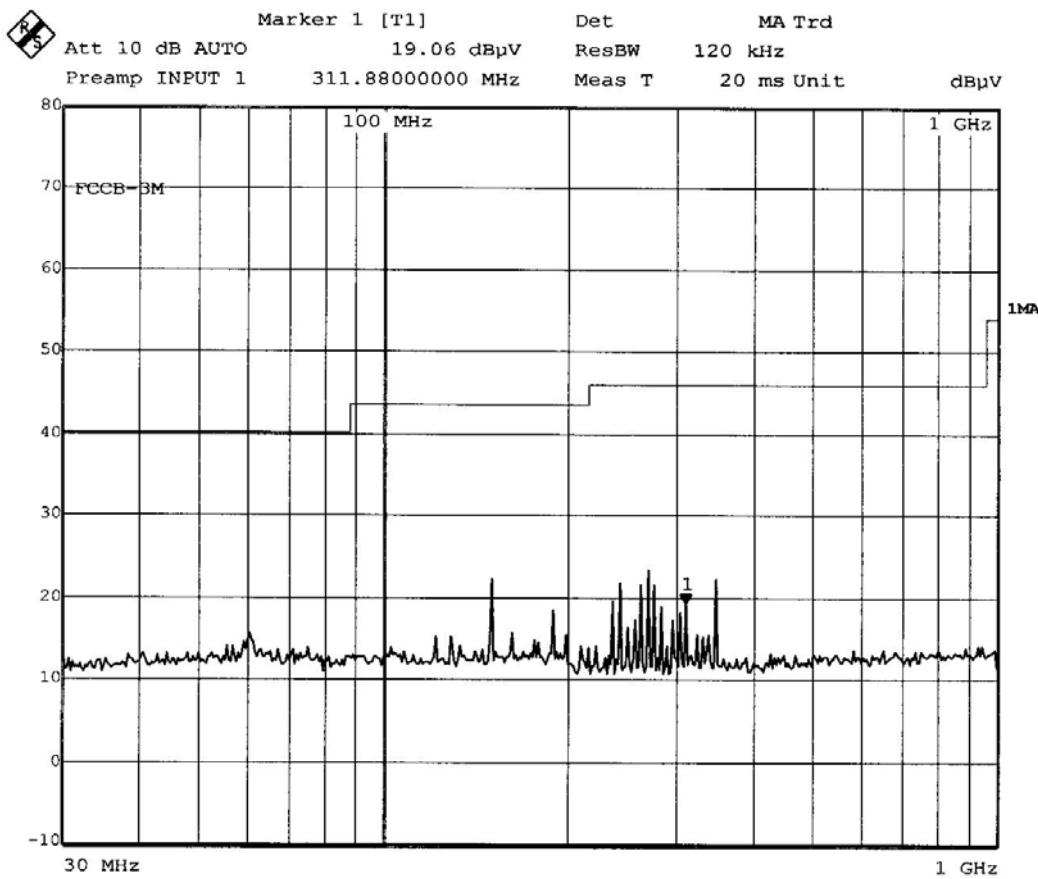


## PLOT-2B

Trace1: ---	Trace2: C11BAV		
Trace3: ---	Trace4: ---		
TRACE	FREQUENCY	LEVEL dB <sub>P</sub> V	DELTA LIMIT dB
2 Average	6.7780 MHz	48.35	-1.64
2 Average	6.7780 MHz	48.33	-1.66
2 Average	3.6860 MHz	44.02	-1.97
2 Average	3.3300 MHz	43.99	-2.00
2 Average	3.3900 MHz	43.99	-2.00
2 Average	3.6260 MHz	43.79	-2.20
2 Average	3.7460 MHz	42.61	-3.38
2 Average	3.5660 MHz	42.59	-3.40
2 Average	3.4460 MHz	42.55	-3.44
2 Average	3.2700 MHz	42.49	-3.50
2 Average	3.5060 MHz	42.26	-3.74
2 Average	13.5620 MHz	45.89	-4.10
2 Average	3.0900 MHz	41.44	-4.55
2 Average	418.0000 kHz	42.64	-4.83
2 Average	1.9020 MHz	41.11	-4.88
2 Average	3.1500 MHz	41.04	-4.95
2 Average	3.0300 MHz	40.96	-5.04
2 Average	██████████	40.80	-5.19
2 Average	3.9820 MHz	40.47	-5.52
2 Average	27.1220 MHz	42.18	-7.81

Title: CONDUCTED EMISSION TEST AS PER FCC PART 15 CLASS-B  
Comment B: EUT:TORQUE MEASUREMENT SYSTEM,MODEL:TMS 9000(92013),MAKE:HONEYWELL,MEAS:NEUTRAL(SHIELDED CORD)  
Date: 16.JUL.2009 12:32:28

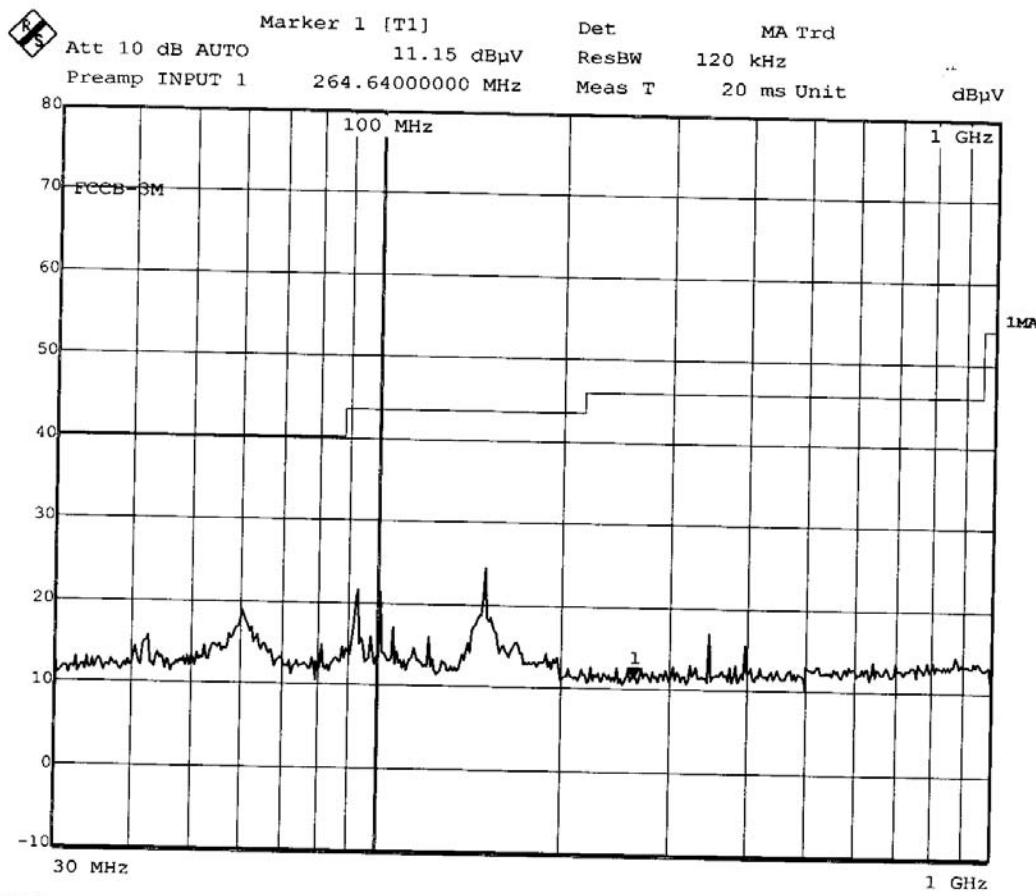
## PLOT-3



Title: RADIATED EMISSION TEST AS PER FCC PART 15 CLASS-B  
Comment B: EUT:TORQUE MEASUREMENT SYSTEM, MODEL:TMS 9000(92013), MAKE:HONEYWELL, POS:0°, ANT Ht:1.15m, POL:HOR, (SHIELDED CORD)  
Date: 16.JUL.2009 17:31:07

Note: The plot shows only the emission pattern from the EUT with peak detector and the values in the plot are not maximized emission as required by standard. For maximized emission please refer table

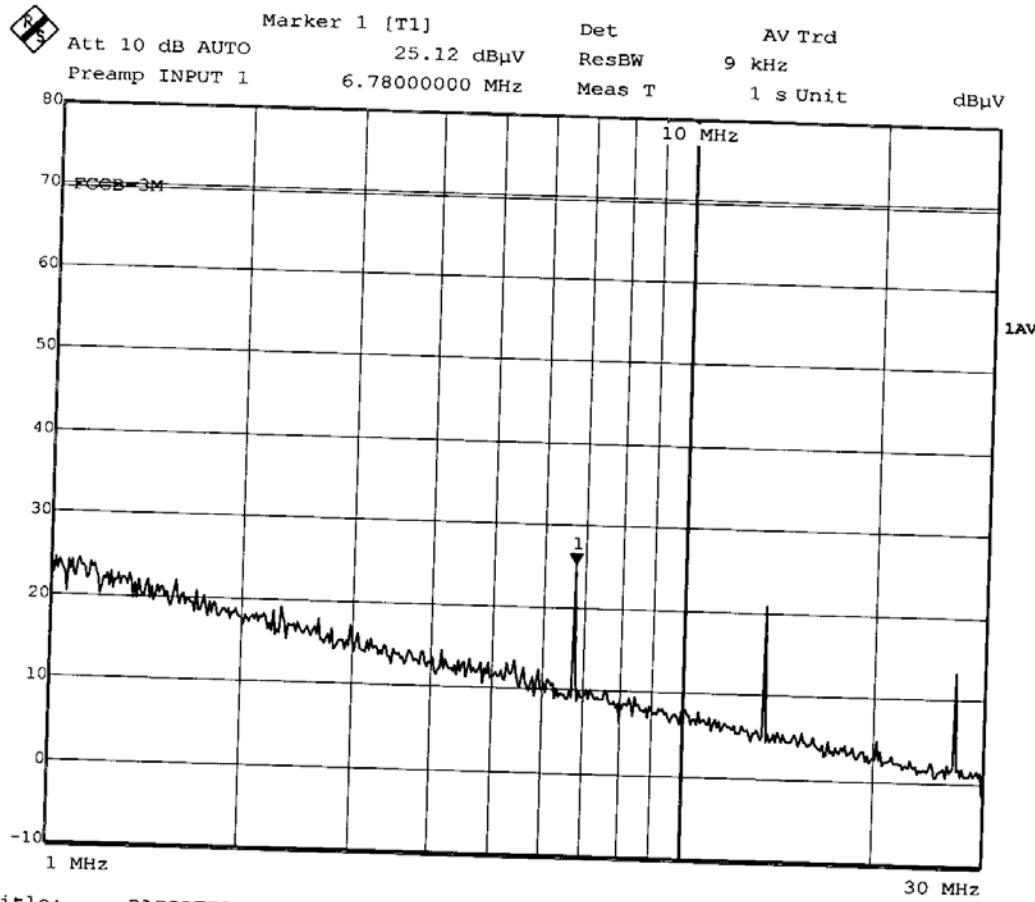
## PLOT-4



Title: RADIATED EMISSION TEST AS PER FCC PART 15 CLASS-B  
Comment B: EUT:TORQUE MEASUREMENT SYSTEM, MODEL:TMS 9000(92013), MAKE:HONEYWELL, POS:210°, ANT Ht:1m, POL:VER, (SHIELDED CORD)  
Date: 16.JUL.2009 16:44:05

*Note: The plot shows only the emission pattern from the EUT with peak detector and the values in the plot are not maximized emission as required by standard. For maximized emission please refer table*

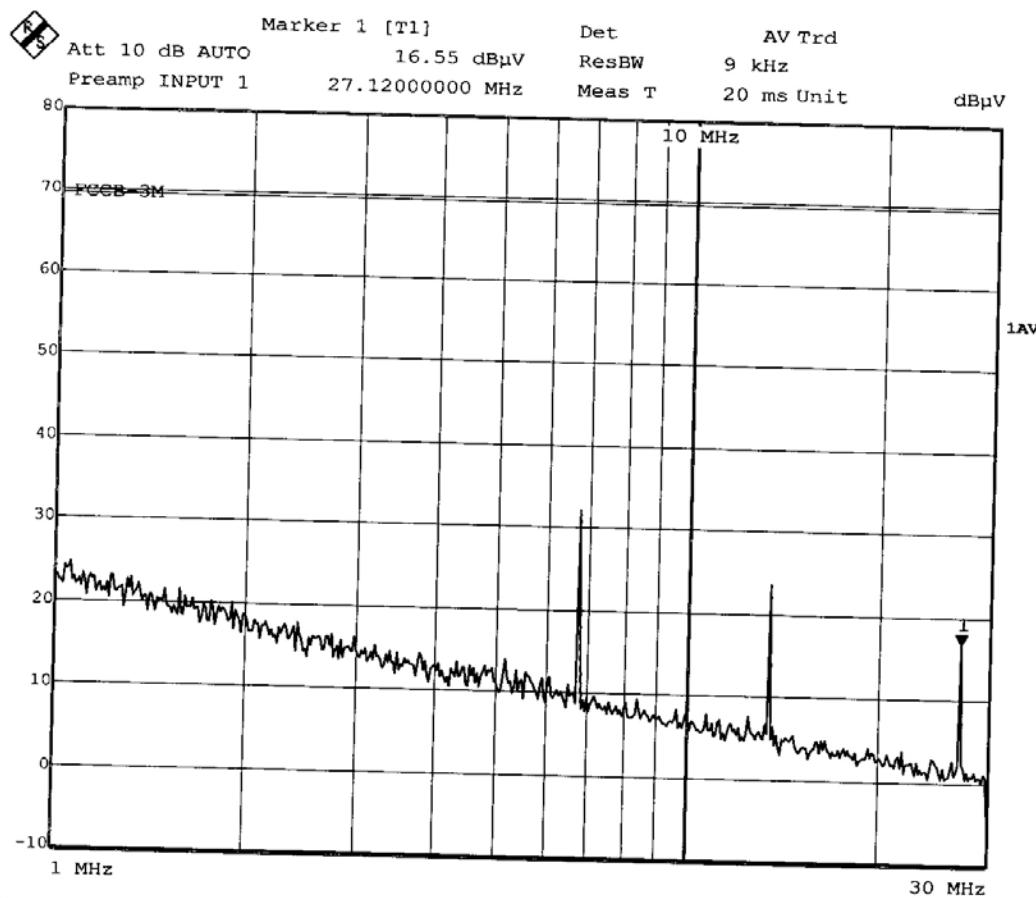
## PLOT-5



Title: RADIATED EMISSION TEST AS PER FCC PART 15 CLASS-B  
Comment B: EUT:TORQUE MEASUREMENT SYSTEM,MODEL:TMS 9000(92013),MAKE:HONEYWELL, POS:260°, ANT Ht:1m, PARALLEL(SHIELDED CORD)  
Date: 16.JUL.2009 15:54:08

Note: The plot shows only the emission pattern from the EUT with peak detector and the values in the plot are not maximized emission as required by standard. For maximized emission please refer table

## PLOT-6

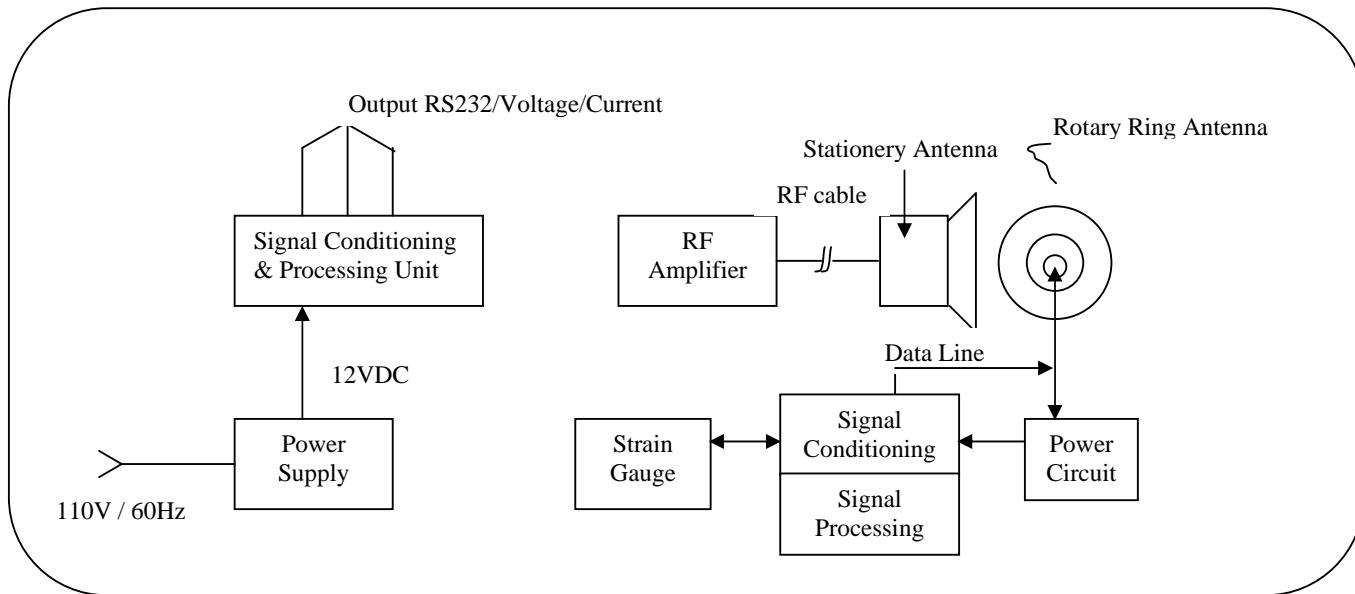


Title: RADIATED EMISSION TEST AS PER FCC PART 15 CLASS-B  
Comment B: EUT:TORQUE MEASUREMENT SYSTEM, MODEL:TMS 9000(92013), MAKE:HONEYWELL, POS:170°, ANT Ht:1m, PERPENDICULAR(SHIELDED CORD)  
Date: 16.JUL.2009 15:45:20

Note: The plot shows only the emission pattern from the EUT with peak detector and the values in the plot are not maximized emission as required by standard. For maximized emission please refer table

## Annexure - 1

## EUT Configuration



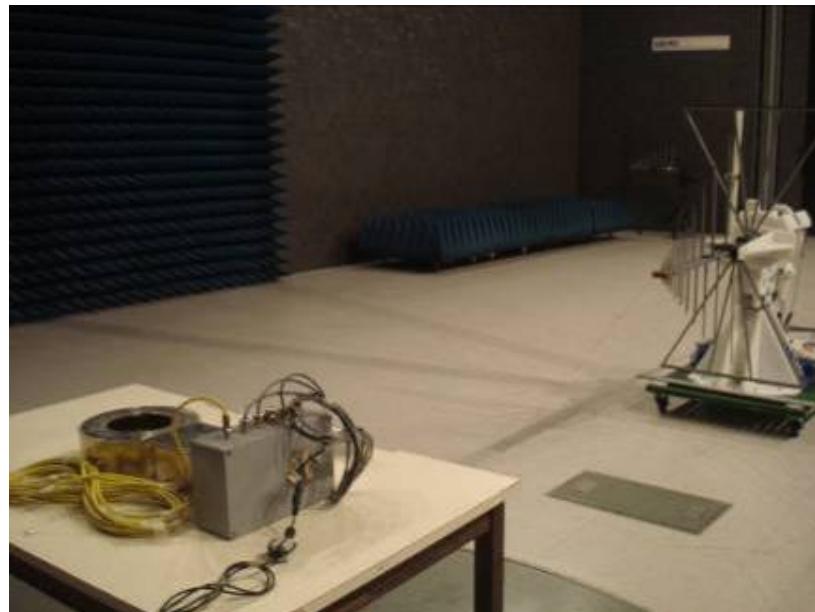
Photograph of EUT

### Annexure – 2



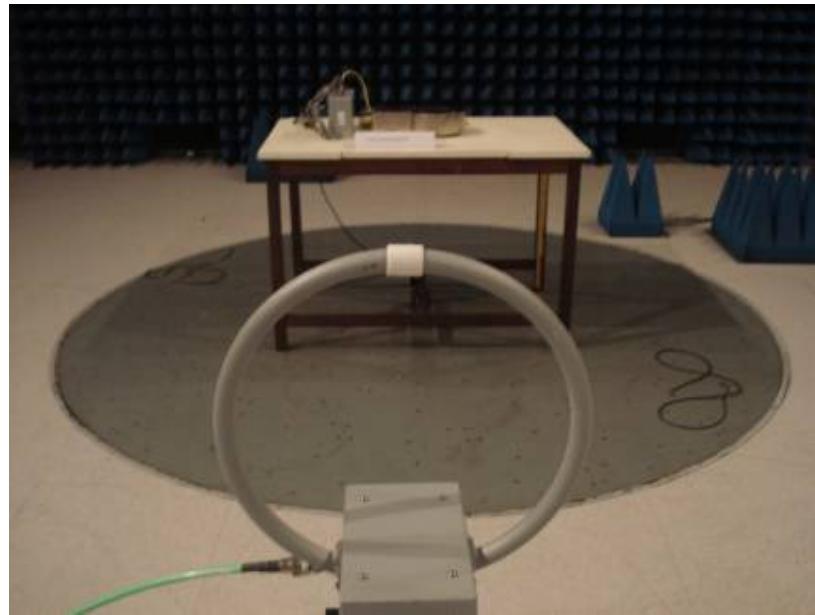
**Conducted Emission Test Setup**

### Annexure -3



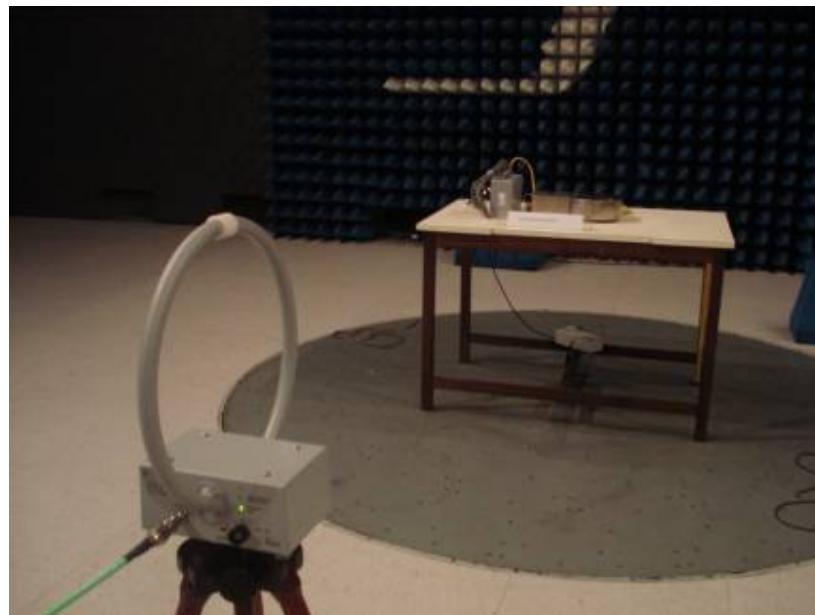
**Radiated Emission Test Setup**

### Annexure -3A



**Radiated Emission Test Setup (Parallel)**

### Annexure – 3B



**Radiated Emission Test Setup (Perpendicular)**