

**S-CEM/EMCD/TR/2008-2009/127**

**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**

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**July 2009**

**EMI/EMC TEST REPORT FOR TORQUE MEASUREMENT SYSTEM  
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-15.209,15.223; 2004
05. Manufacturer : M/s. Honeywell Technology solutions (P) Ltd., Bangalore
06. Model number of EUT : TMS 9000-92014
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 02, 2009
10. Test date(s) : July 03, 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***



Equipment Under Test : Torque Measurement System  
 Model Number of EUT : TMS 9000-92014  
 Serial Number of EUT : Prototype  
 Manufacturer by : M/s. Honeywell Technology solutions (P) Ltd., Bangalore



## 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	Emission level <b>exceeding</b> the limitline
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 Torque measurement system is used to measure torque in Dynamo Meters and other applications. The EUT was powered by 110 V, 60 Hz and made operational. The measurement is based on strain gauge sensor and data transmission is wireless. During the test, the communication lines were not monitored (inactive). Annexure – 1 shows the block diagram of EUT.

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

Frequency	Quasipeak Limits (dB $\mu$ V)	Average (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 peak limit line, Quasi Peak detection 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 show the Conducted Emissions from the EUT. (110V, 60Hz)  
Annexure - 2 shows the Conducted Emission Test Setup.

*Test Conducted by:*



(A. Albin)  
Scientific Assistant-A



(T. Bhavani)  
Project Assistant



Equipment Under Test : Torque Measurement System  
 Model Number of EUT : TMS 9000-92014  
 Serial Number of EUT : Prototype  
 Manufacturer by : M/s. Honeywell Technology solutions (P) Ltd., Bangalore



## 2. RADIATED EMISSION TEST

**2.1. Applicable Standards:** As per FCC part-15.209 and 15.223, 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
Above 960	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 Torque measurement system used to measure torque in Dynamo Meters and other applications. The EUT was powered by 110 V, 60 Hz and made operational. The measurement is based on strain gauge sensor and data transmission is wireless. During the test, the communication lines were not monitored (inactive). Annexure – 1 shows the block diagram of EUT.

### 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 orientation in the frequency range 1 MHz – 30MHz.



Equipment Under Test : Torque Measurement System  
 Model Number of EUT : TMS 9000-92014  
 Serial Number of EUT : Prototype  
 Manufacturer by : M/s. Honeywell Technology solutions (P) Ltd., Bangalore



Certificate No.T-0464

## 2.6. Test Observation:

FCC part-15.209:2004(Class B)

Table-1:30 MHz - 1000 MHz

Freq. (MHz)	Table Posn (°)	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	Quasipeak limit (dB $\mu$ V/m) L	Delta Level (dB) D=L-E	Test Result
<b>VERTICAL POLARIZATION</b>									
450	110	1.12	25.36	17.65	0.15	43.16	46	2.84	Within the Limit
257.68	50	1	23.08	13.55	0.14	36.78	46	9.22	Within the Limit
244.12	80	1.3	21.31	12.94	0.14	34.40	46	11.60	Within the Limit
264.44	50	1	20.03	13.58	0.14	33.76	46	12.24	Within the Limit
433.96	180	1	20.34	17.37	0.15	37.86	46	8.14	Within the Limit
60.36	0	1	8.01	8.12	0.13	16.26	40	23.74	Within the Limit
52.36	180	1	11.02	9.49	0.13	20.64	40	19.36	Within the Limit
33.24	0	1	7	17.02	0.12	24.14	40	15.86	Within the Limit
<b>HORIZONTAL POLARIZATION</b>									
257.68	0	1	38.26	13.55	0.14	51.96	46	-5.96	Exceeding the Limit
244.12	360	1	35.4	12.94	0.14	48.49	46	-2.49	Exceeding the Limit
264.44	0	1	33.61	13.58	0.14	47.34	46	-1.34	Exceeding the Limit
271.24	0	1	33.03	14.04	0.14	47.22	46	-1.22	Exceeding the Limit
230.56	0	1.2	25.04	12.51	0.14	37.69	46	8.31	Within the Limit
284.8	280	1	22.8	13.71	0.14	36.66	46	9.34	Within the Limit
250.8	0	1	21.91	13.27	0.14	35.33	46	10.67	Within the Limit
150	80	1.5	20.79	9.52	0.14	30.44	43.5	13.06	Within the Limit
189.84	360	1.7	17.56	11.40	0.14	29.10	43.5	14.40	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</b>									
6.78	60	1	36.10	17.23	0.24	53.57	69.52	15.95	Within the Limit
13.56	200	1	25.34	16.51	0.33	42.18	69.52	27.34	Within the Limit
<b>PERPENDICULAR</b>									
6.78	320	1	36.28	17.23	0.24	53.69	69.52	15.83	Within the Limit
13.56	60	1	21.29	16.51	0.33	38.13	69.52	31.39	Within the Limit
27.21	60	1	11.830	15.72	0.46	28.02	69.52	41.5	Within the Limit



Equipment Under Test : Torque Measurement System  
 Model Number of EUT : TMS 9000-92014  
 Serial Number of EUT : Prototype  
 Manufacturer by : M/s. Honeywell Technology solutions (P) Ltd., Bangalore



**FCC part-15.223:2004(Class B)-**

Freq. (MHz)	Resolution bandwidth	Table Post. (°)	Ant. Ht. (m)	Measured level in (dB $\mu$ V) A	Ant. Factor (dB) B	Cable loss (dB/m) 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</b>										
6.78	9kHz	60	1	36.10	17.23	0.24	53.57	63.52	9.95	Within the Limit
<b>PERPENDICULAR</b>										
6.78	9kHz	320	1	36.28	17.23	0.24	53.69	63.52	9.83	Within the Limit

**2.7. Enclosed Documents:**

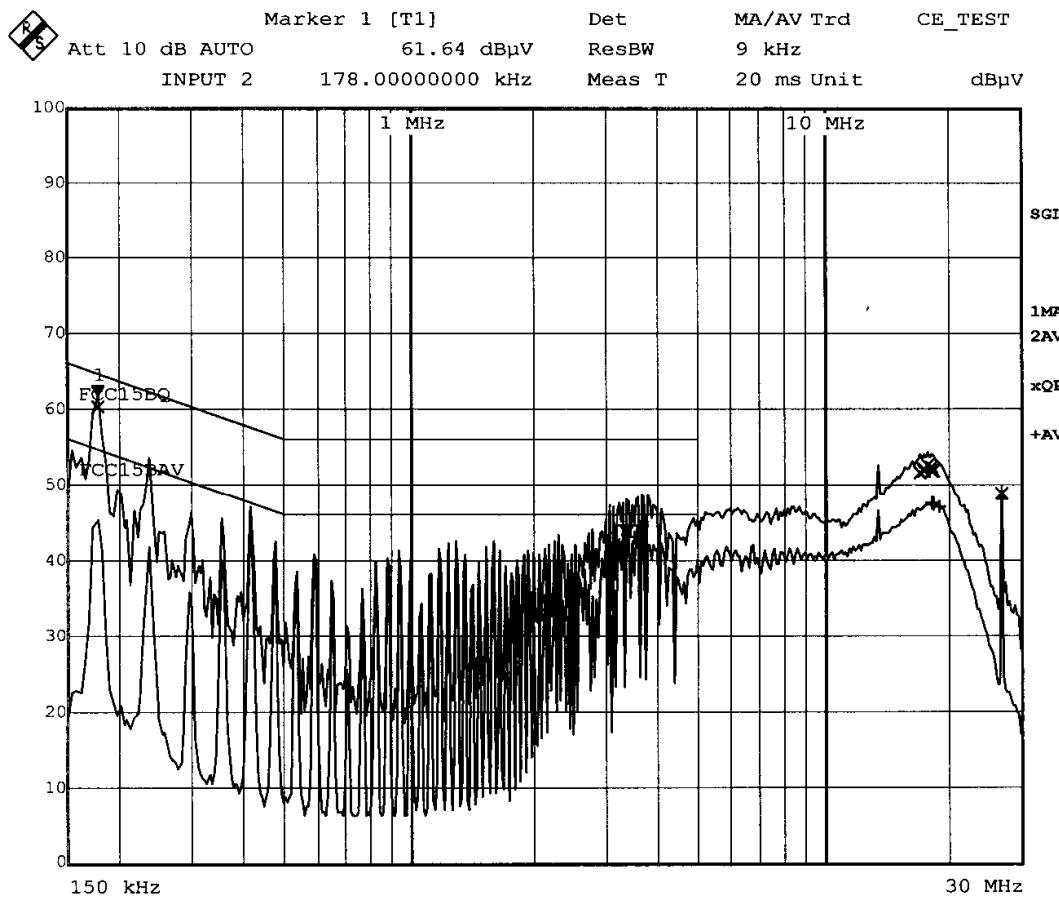
Plots 3- 6 show the Radiated Emission spectrum from EUT.  
 Annexure – 3 shows the Photograph of Radiated Emission Test Setup.

**Test Conducted by:**

(A. Albin)  
 Scientific Assistant-A

(T. Bhavani)  
 Project Assistant

## PLOT-1



Title: CONDUCTED EMISSION TEST AS PER FCC15 CLASS B  
Comment B: EUT:TORQUE MEASUREMENT SYSTEM,MAKE:HONEYWELL,MODEL:TMS 9000,  
SL.NO:92014,MEASUREMENT ON LINE,110V/60Hz  
Date: 3.JUL.2009 10:26:36



Equipment Under Test : Torque Measurement System  
Model Number of EUT : TMS 9000-92014  
Serial Number of EUT : Prototype  
Manufacturer by : M/s. Honeywell Technology solutions (P) Ltd., Bangalore



### PLOT-1A

Trace1: FCC15BQ		Trace2: FCC15BAV	
Trace3: ---		Trace4: ---	
TRACE	FREQUENCY	LEVEL dB $\mu$ V	DELTA LIMIT dB
2	Average	44.48	-1.52
2	Average	3.6700 MHz	-1.72
2	Average	3.3140 MHz	-1.73
2	Average	3.3740 MHz	-1.85
2	Average	27.1220 MHz	-1.96
2	Average	27.1220 MHz	-1.96
2	Average	27.1220 MHz	-2.07
2	Average	18.2260 MHz	-2.71
2	Average	18.5220 MHz	-2.71
2	Average	18.4620 MHz	-2.98
2	Average	3.5500 MHz	-3.00
2	Average	19.1740 MHz	-3.15
1	Quasi Peak	178.0000 kHz	-4.57
1	Quasi Peak	17.9300 MHz	-7.68
1	Quasi Peak	18.2260 MHz	-7.98
1	Quasi Peak	17.6340 MHz	-8.23
1	Quasi Peak	17.5740 MHz	-8.26
1	Quasi Peak	18.3460 MHz	-8.27
1	Quasi Peak	17.4580 MHz	-8.33
1	Quasi Peak	18.4620 MHz	-8.37

Title: CONDUCTED EMISSION TEST AS PER FCC15 CLASS B  
Comment B: EUT:TORQUE MEASUREMENT SYSTEM,MAKE:HONEYWELL,MODEL:TMS 9000,  
SL.NO:92014,MEASUREMENT ON LINE,110V/60Hz  
Date: 3.JUL.2009 10:28:23



Equipment Under Test : Torque Measurement System  
Model Number of EUT : TMS 9000-92014  
Serial Number of EUT : Prototype  
Manufacturer by : M/s. Honeywell Technology solutions (P) Ltd., Bangalore

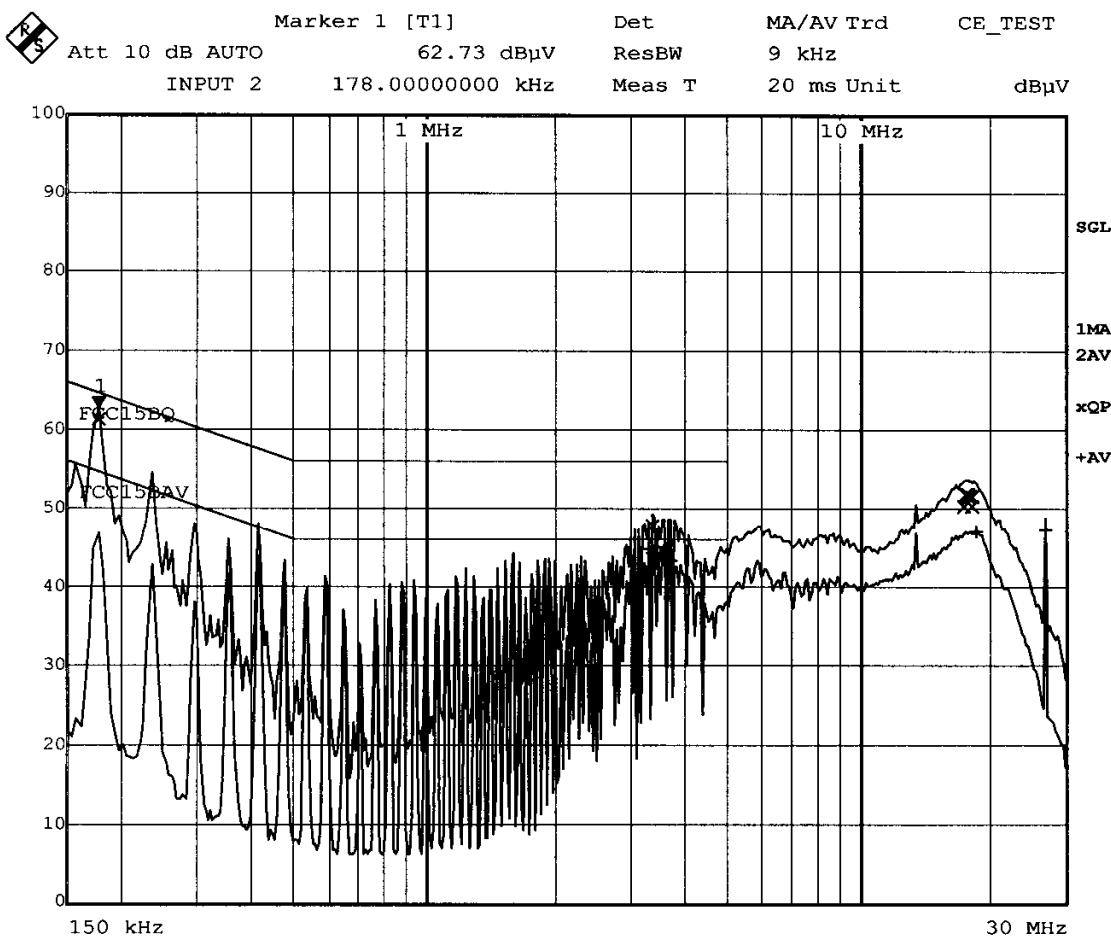


### PLOT-1B

Trace1: FCC15BQ		Trace2: FCC15BAV	
Trace3: ---		Trace4: ---	
TRACE	FREQUENCY	LEVEL dB $\mu$ V	DELTA LIMIT dB
1	Quasi Peak	51.58	-8.41
1	Quasi Peak	17.2180 MHz	-8.55
1	Quasi Peak	27.1220 MHz	-11.32

Title: CONDUCTED EMISSION TEST AS PER FCC15 CLASS B  
Comment B: EUT:TORQUE MEASUREMENT SYSTEM,MAKE:HONEYWELL,MODEL:TMS 9000,  
SL.NO:92014,MEASUREMENT ON LINE,110V/60Hz  
Date: 3.JUL.2009 10:28:58

## PLOT-2



Title: CONDUCTED EMISSION TEST AS PER FCC15 CLASS B  
Comment B: EUT:TORQUE MEASUREMENT SYSTEM,MAKE:HONEYWELL,MODEL:TMS 9000,  
SL.NO:92014,MEASUREMENT ON NEUTRAL,110V/60Hz  
Date: 3.JUL.2009 10:19:14



Equipment Under Test : Torque Measurement System  
Model Number of EUT : TMS 9000-92014  
Serial Number of EUT : Prototype  
Manufacturer by : M/s. Honeywell Technology solutions (P) Ltd., Bangalore

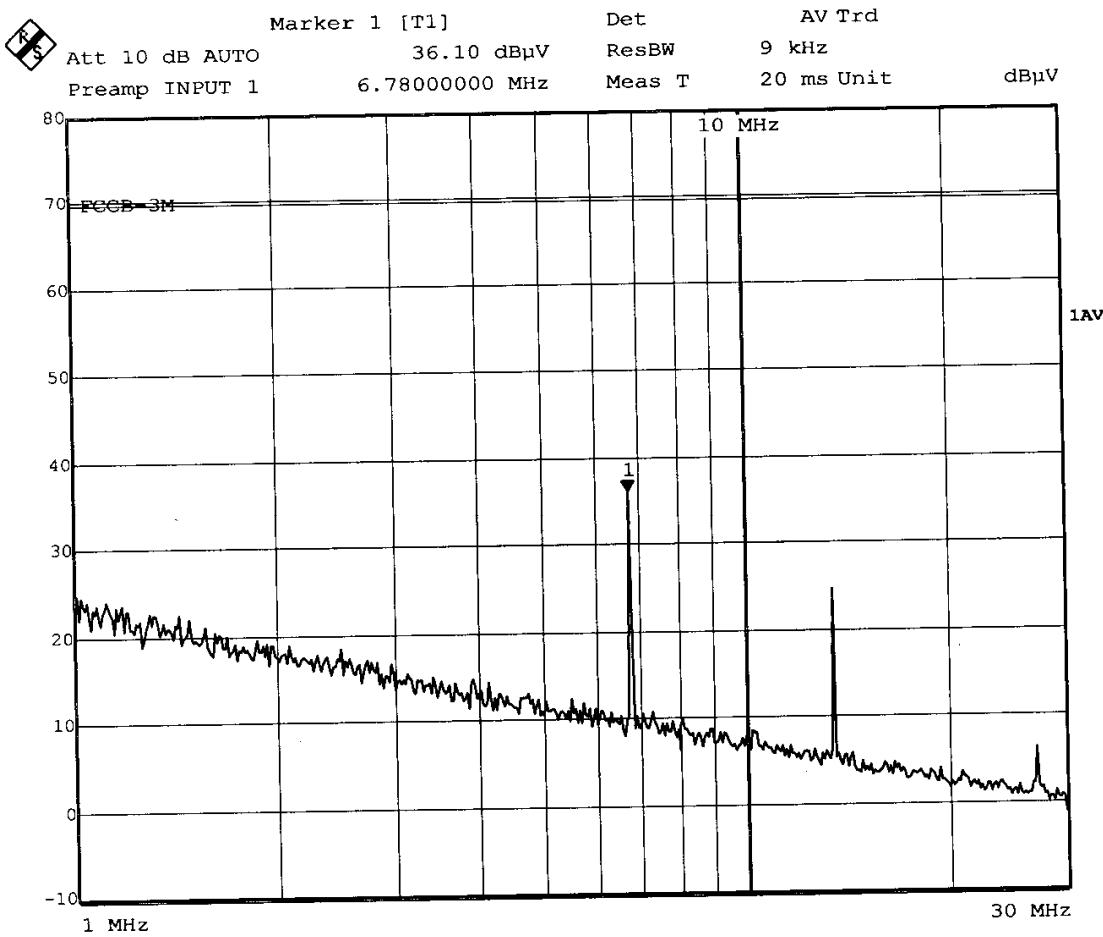


## PLOT-2A

Trace1: FCC15BQ		Trace2: FCC15BAV	
Trace3: ---	Trace4: ---	LEVEL dB $\mu$ V	DELTA LIMIT dB
TRACE	FREQUENCY		
2	Average	44.97	-1.02
2	Average	3.3140 MHz	-1.45
2	Average	3.6700 MHz	-1.65
2	Average	3.3740 MHz	-1.82
2	Average	3.5500 MHz	-2.08
2	Average	3.7260 MHz	-2.77
2	Average	3.4900 MHz	-2.79
2	Average	27.1220 MHz	-2.92
2	Average	18.6380 MHz	-3.22
1	Quasi Peak	178.0000 kHz	-3.49
2	Average	3.4340 MHz	-3.76
1	Quasi Peak	3.3740 MHz	-8.44
1	Quasi Peak	17.8100 MHz	-8.44
1	Quasi Peak	17.9260 MHz	-8.47
1	Quasi Peak	17.8660 MHz	-8.52
1	Quasi Peak	18.1660 MHz	-8.60
1	Quasi Peak	18.1060 MHz	-8.60
1	Quasi Peak	18.2260 MHz	-8.67
1	Quasi Peak	18.4060 MHz	-9.80
1	Quasi Peak	17.5780 MHz	-9.93

Title: CONDUCTED EMISSION TEST AS PER FCC15 CLASS B  
Comment B: EUT:TORQUE MEASUREMENT SYSTEM,MAKE:HONEYWELL,MODEL:TMS 9000,  
SL.NO:92014,MEASUREMENT ON NEUTRAL,110V/60Hz  
Date: 3.JUL.2009 10:19:39

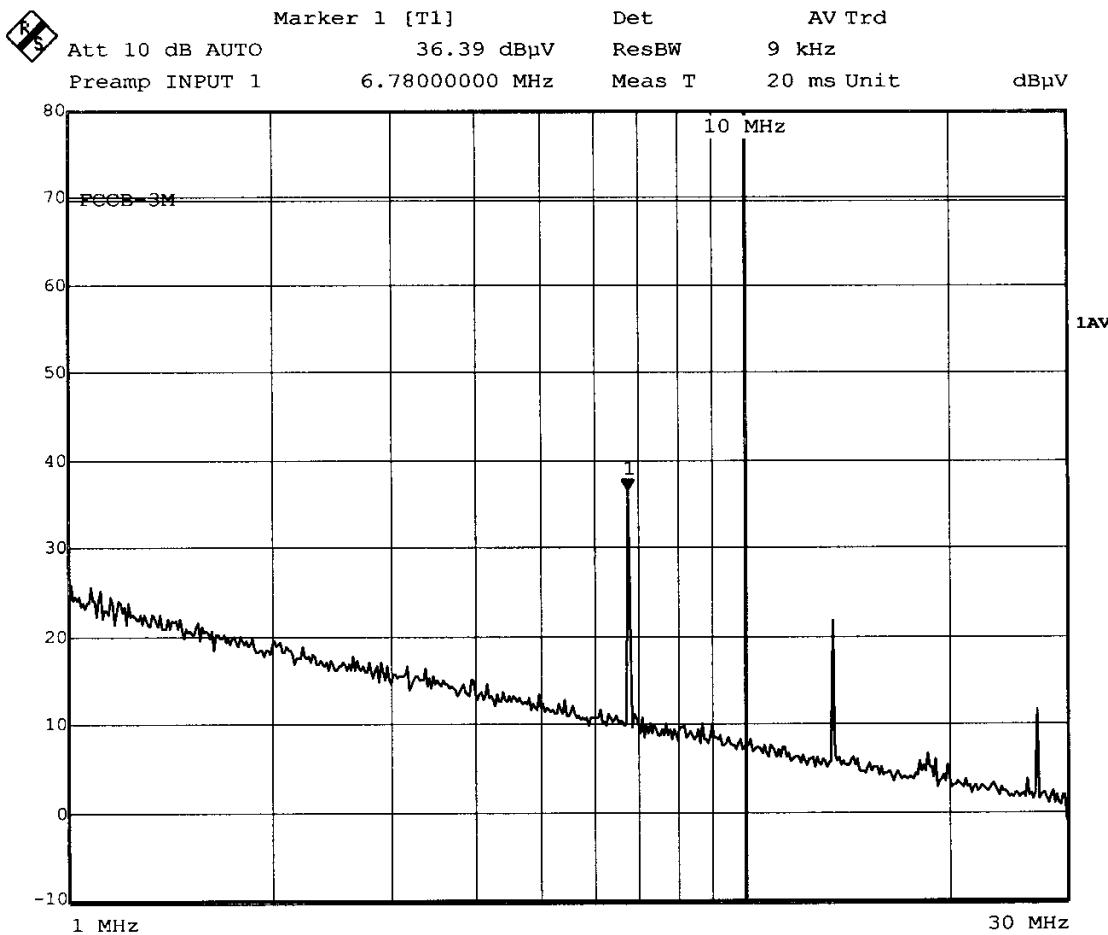
## PLOT-3



Title: RADIATED EMISSION TEST AS PER FCC15 CLASS B  
 Comment B: EUT:TORQUE MEASUREMENT SYSTEM,MAKE:HONEYWELL,MODEL:TMS 9000-92014, POL:PARALLEL, POS:60°, 110V/60Hz  
 Date: 3.JUL.2009 13:22:59

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

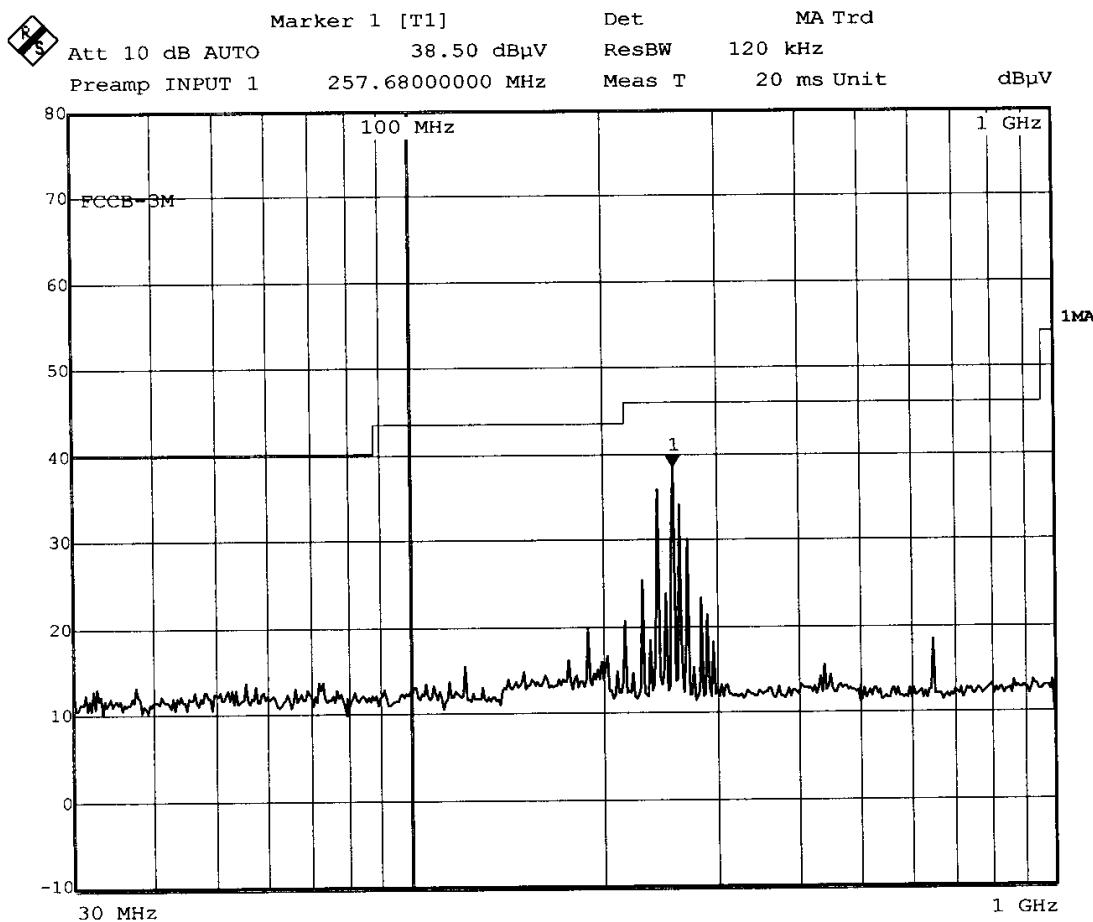
## PLOT-4



Title: RADIATED EMISSION TEST AS PER FCC15 CLASS B  
 Comment B: EUT:TORQUE MEASUREMENT SYSTEM,MAKE:HONEYWELL,MODEL:TMS 9000-92014, POL:PERPENDICULAR, POS:60°, 110V/60Hz  
 Date: 3.JUL.2009 13:35:01

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

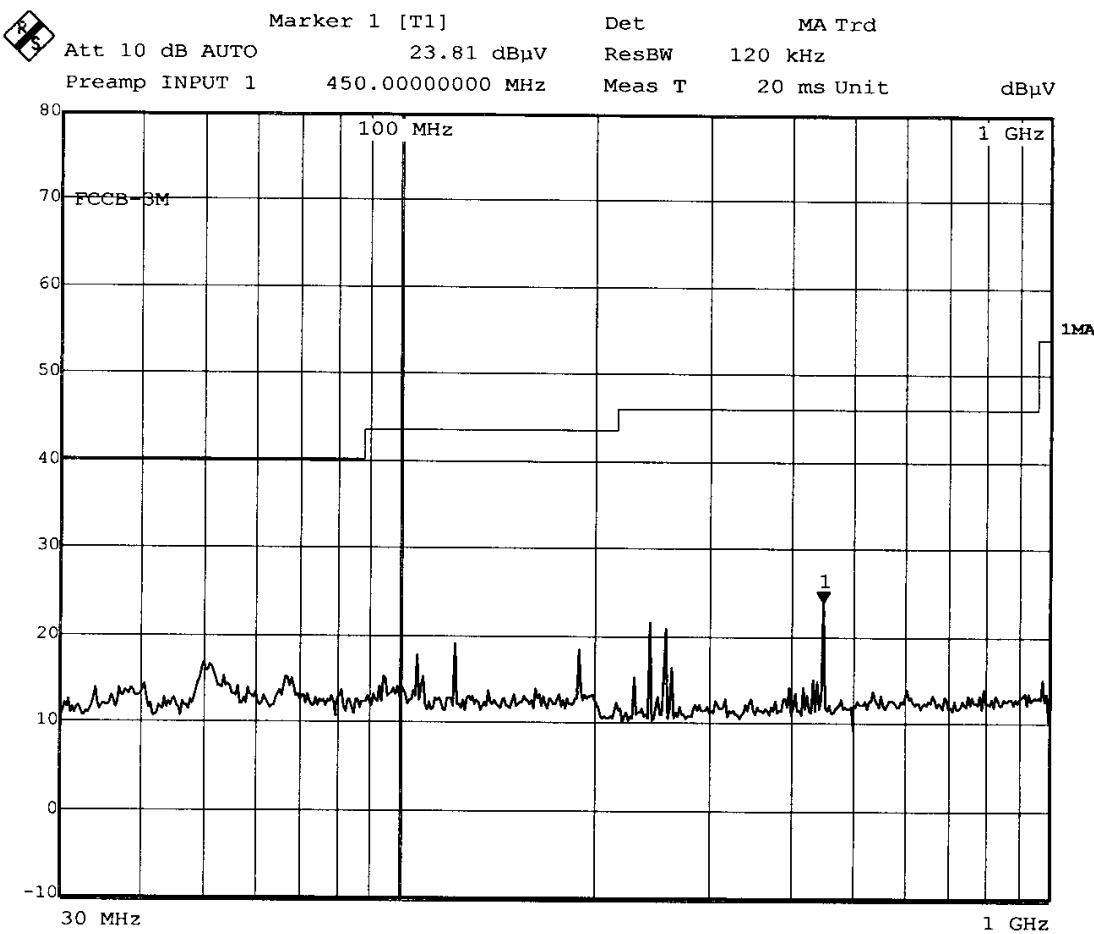
## PLOT-5



Title: RADIATED EMISSION TEST AS PER FCC15 CLASS B  
 Comment B: EUT:TORQUE MEASUREMENT SYSTEM, MAKE:HONEYWELL, MODEL:TMS 9000-92014, POL:HOR, POS:0°, ANT HT:1m, 110V/60Hz  
 Date: 3.JUL.2009 12:47:30

*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

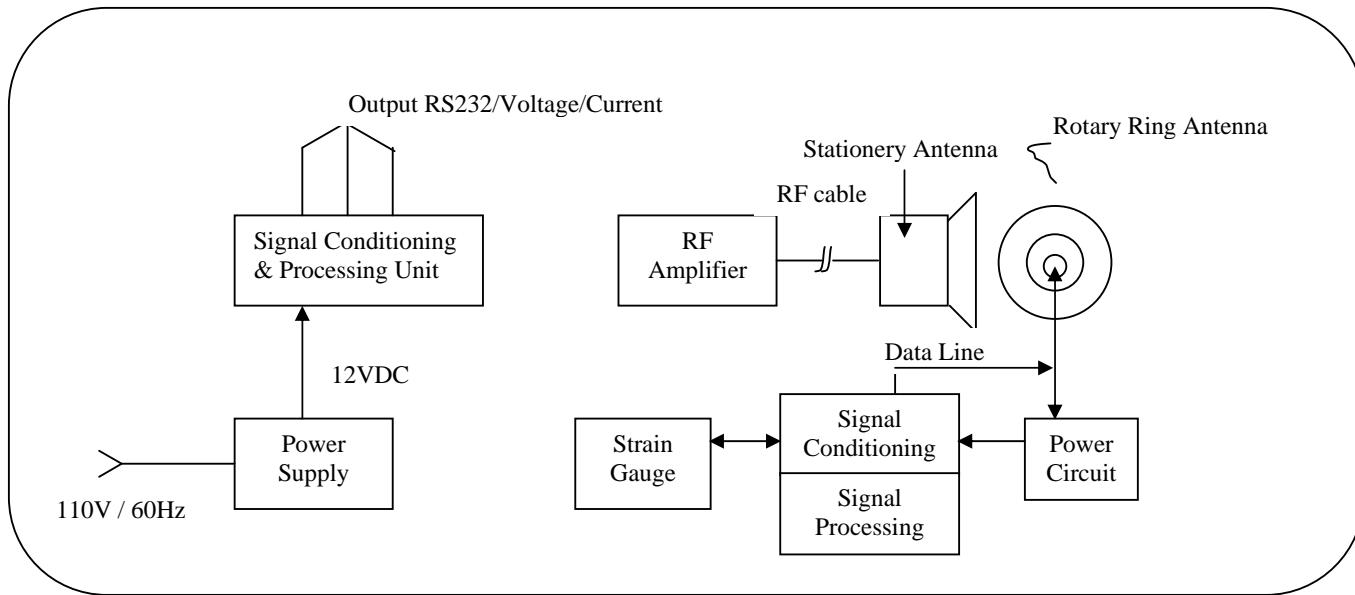


Title: RADIATED EMISSION TEST AS PER FCC15 CLASS B  
 Comment B: EUT:TORQUE MEASUREMENT SYSTEM,MAKE:HONEYWELL,MODEL:TMS 9000-92014,POI:VER,POS:110°,ANT HT:1.12m,110V/60Hz  
 Date: 3.JUL.2009 12:50:14

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

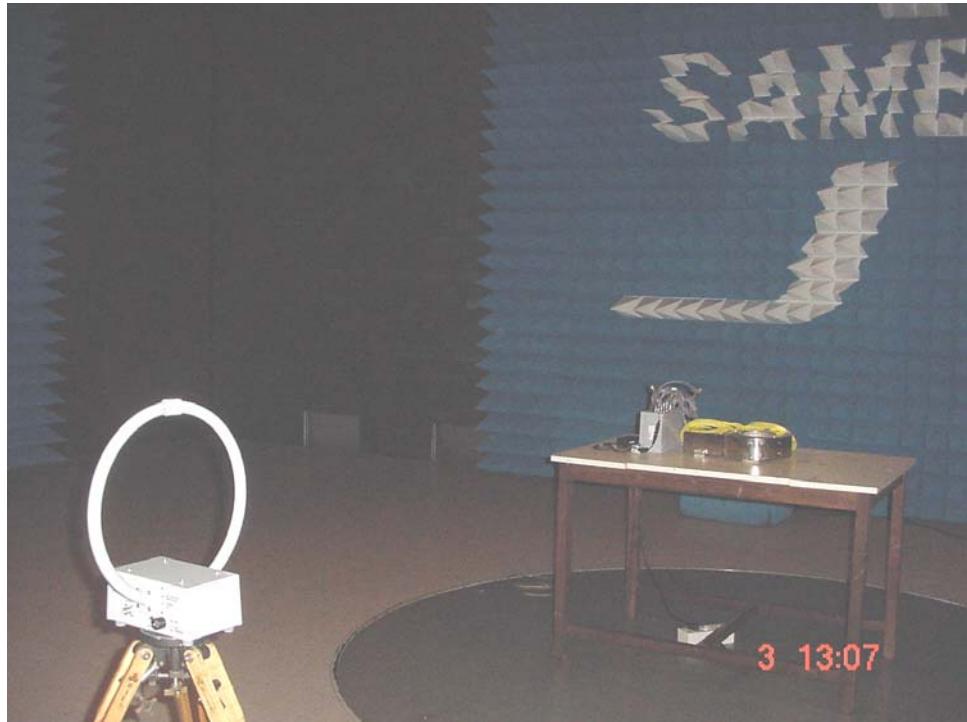


### Annexure – 2



**Conducted Emission Test Setup**

### Annexure -3



**Radiated Emission Test Setup**