

Rimex Supply Ltd.

TRS Sensor DIA

EMC Directive Compliance Test Report

Per

FCC CFR47 Part 15 Subpart C §15.249

FCC ID: RHCTMS1005

Revision 1.0

Sept 3rd, 2009

Approval		
Checked By:	 <hr/> Dan Petruilian, P Eng.	 <hr/> Date

Protocol Data Systems Inc, EMC Lab,
 Abbotsford BC, Canada.
 SCC ISO/17025 (CAN-P-4E) Accredited Laboratory No. 612
 FCC O.A.T.S. Registration Number 96437
 Industry Canada O.A.T.S. Registration Number IC3384

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Section I: Report of Measurements Testing Information

GENERAL INFORMATION:

Applicant Company Name	Rimex Supply Ltd.
Address	9726 - 186 Street.
	Surrey, British Columbia V4N 3N7 Canada
	Phone: 604-290-2465
	Fax: 6048887642
Contact Person	Mr. Dave Laird
Email	dave@tyresense.com
Product Name	TRS Sensor DIA
FRN	RHCTMS1005
Applicable Standard	FCC Part 15.249, ANSI C63.4:2003
Test Results	Pass
Related Report/s Approval	03444 _Rev 1.0.pdf
Statement of Compliance	This equipment has been tested in accordance with the standards identified in the referenced test report. To the best of our knowledge and belief, these tests were performed using the measurement procedures described in this report and demonstrate that the equipment complies with the appropriate standards. – Signature on Front Cover Page.

EQUIPMENT UNDER TEST SPECIFICATIONS:

Manufacturer	Rimex Supply Ltd
Product Description	Tyre pressure sensing and transmitting equipment
FCC ID	RHCTMS1005
Model Number	TRS Sensor DIA
Name	TRS Sensor DIA
Operating Frequency	916MHz
Emission Designator	DXX
EUT Power Source	3.6 Vdc Battery
Test Item	Production Unit
Type of Equipment	Fixed
Antennas	Loop Antenna
Antenna Connector	Permanently Attached
Test Voltage	3.6Vdc Battery

TEST DATA:

Test Facility	Protocol Data Systems Inc.
	28945 McTavish Road
	Abbotsford, BC V4X 2E7
	Phone: 604-607-0012
	Fax: 604-607-0019
	Email: info@protocol-emc.com
	Website: www.protocol-emc.com
Test Facility ID's	SCC ISO/17025 (CAN-P-4E) Accredited Laboratory No. 612
	FCC O.A.T.S. Registration Number 96437
	Industry Canada O.A.T.S. Registration Number IC3384
Date Tested	6 th August 09
Tested By	Dan Petruian

TEST SET-UP

Test Supporting Equipment	None required
Test Conditions	Temperature and Humidity: 25°C, 54%
Test Exercise E.g. software description, test signal, etc.	The EUT was set for continuous transmit mode of operation. It only has 1 frequency. The options were for a CW and modulated frequency.
Deviation from Standard/s	No deviation from Standard
Modification to the EUT	No modifications were made.

TEST EQUIPMENT LIST

Manufacturer	Model	Equipment Description	Serial No.	Next Cal
HP	85650A	CDN Quasi-Peak Adapter	2043A00240	18/09/09
HP	85662A	Spectrum Analyzer Display	2318A05184	18/09/09
HP	8566B	Spectrum Analyzer RF Section	2241A02102	18/09/09
HP	85685A	RF-Preselector	3107A01222	18/09/09
HP	8349A	Microwave Amplifier [2-20GHz]	2512A00824	14/12/2009
EMCO	CPA-30	Ant Log Periodic 200-1000MHZ	563	5/12/2009
EMCO	3110B	Ant Biconical 20-300MHz	9401-1850	5/12/2009
EMCO	3115	DGR Horn At. 1-18GHzMHz	3429	15/12/09
Rhientech	Custom	Antenna Mast	N/A	N/A
Protocol EMC	Custom	Turntable	N/A	N/A

MEASUREMENT UNCERTAINTY

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-5}$
Total RF power, conducted	$\pm 1,5$ dB
RF power density, conducted	± 3 dB
Spurious emissions, conducted	± 3 dB
All emissions, radiated	± 3 dB
Temperature	± 1 °C
Humidity	± 5 %
DC and low frequency voltages	± 3 %

EQUIPMENT UNDER TEST:**TEST SYSTEM:**

EUT : TRS Sensor DIA
Manufacturer: Rimex Supply Ltd.
Model Number: TRS-SENSOR-DIA

CABLING DESCRIPTION:

Ref.	Cable	Connector	Pins	Terminated	Shielded	Ferrites
A	Power	SwitchCraft EN3 CPC	5	N/A	No	No
B	Display	SwitchCraft EN3 CPC	6	N/A	Yes	No
C	GPS	BNC COAX	2	50 ohm	Yes	No
D	Cellular	TNC COAX	2	50 ohm	Yes	No
E	Blue Tooth	SMA COAX	2	50 ohm	Yes	No
F	RF Data	RPSMA	2	50 ohm	Yes	No
G	USB	STANDARD USB A/B	4	N/A	Yes	No

Section II: Report of Measurements Test Procedure

RADIAION INTERFERENCE:

The measurement was made per ANSI C63.4-2003 using an Agilent model 8566B spectrum analyzer, a model 85685A Preselector, a model 85650A quasi-peak adapter, and the appropriate antenna. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The resolution bandwidth was 100kHz with an appropriate sweep speed and the video bandwidth was 300kHz up to 1GHz and 1MHz with a VBW greater than or equal to the RBW above 1GHz. When an emission was found, the table was rotated to produce the maximum, signal strength. The antenna was placed in both the horizontal and vertical planes and the worse case emissions were reported. The EUT was re-positioned to produce the highest emission level. The spectrum was searched to at least the tenth (10) harmonic of the fundamental.

FORMULA OF CONVERSION FACTORS:

The field strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dB μ V) to the antenna correction factor supplied by the antenna manufacturer. The antenna correction factors are stated in terms of dB. The gain of the Preselector was accounted for in the spectrum analyzer meter reading.

Example:

Freq (MHz)	Meter Reading	+ACF	+CL	= FS
330	20 dB μ V	+10.36 dB	+0.5	= 30.86 dB μ V/m @ 3m

Where the field strength was too low to get an accurate reading at the required distance of 3meters, the Antenna was moved closer to 1 meter. The resulting measurement was distance corrected for 3 meters by using the formula:

$$(1 \text{ meter result}) - (20\text{Log}(\text{measured distance}/\text{required distance})) = (3 \text{ meter result})$$

Example:

1 meter result + distance correction = 3 meter result

54.5 dB μ V + -9.54dB = 45 dB μ V

POWER LINE CONDUCTED INTERFERENCE:

The procedure used was ANSI C63.4-2003 using a 50 μ H LISN. Both lines were observed. The bandwidth of the spectrum analyzer was 10kHz with an appropriate sweep speed. The spectrum was scanned from 0.15 to 30MHz. The measurement was performed on an Open Air Test Site at 0.8meters above the horizontal ground plane.

OCCUPIED BANDWIDTH:

A sample of the transmitter output detected by an antenna was fed into the spectrum analyzer and the attached plot was printed. The vertical scale is set to 10dB per division.

ANSI C63.4-2003 MEASUREMENT PROCEDURES:

The EUT was placed in a horizontal orientation, lying flat, on top of a table 80 cm high and with dimensions of 1m by 1.5m. The EUT was placed in the center of the table (1.m side). The table used for radiated measurements is capable of continuous rotation.

When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes.

Due to the construction of the EUT, the EUT was also placed in a vertical orientation and rotated on its axis and the emissions were maximized again to identify the highest emission level.

Frequencies less than 1GHz were measured using the Quasi-Peak receiver. Frequencies equal to and greater than 1GHz were measured using the Average receiver

Section III: Report of Measurements to Radiation Interference

TEST STANDARD: FCC Part 15 Subpart C

REQUIREMENTS: §15.249 Operation within the bands of 902-928 MHz, 2400– 2483.5 MHz, 5725-5875 MHz, and 24.0–24.25 GHz.

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
902 – 928 MHz	50	500
2400 – 2483.5 MHz	50	500
5725 – 5875 MHz	50	500
24.0 – 24.25 GHz	250	2500

MODIFICATIONS: No modifications were made to pass this test.

MEASURED TEST DATA FOR FUNDAMENTAL AND HARMONICS:

Frequency (MHz)	Antenna Polarization (V/H)	Field Strength at 1m (dBµV/m)	Field Strength at 3m (dBµV/m)	**Correction Factor	Final Corrected Signal at 3m (dBµV/m)	Limit at 3m (dBµV/m)	Margin dB
916.324	V	*N/R	81.9	-3.4	78.5	94	-15.5
916.324	H	*N/R	81.4	-3.4	78	94	-16
1832.73	V	48.9	39.36	1.1	40.46	54	-13.54
1832.73	H	50.3	40.76	1.1	41.86	54	-12.14
2749.25	V	48	38.46	1.9	40.36	54	-13.64
2749.25	H	48.2	38.66	1.9	40.56	54	-13.44
3665.76	V	46.1	36.56	13.4	49.96	54	-4.04
3665.70	H	45.9	36.36	13.4	49.76	54	-4.24

*N/R (Not Required): Field strength of fundamental measured directly at 3m. For harmonics the field strength was too low to get an accurate reading at the required distance of 3meters, the Antenna was moved closer to 1 meter.

**Correction Factor= Antenna Factor+Cable Loss-Amplifier Gain

MEASUREMENT PLOTS: See Appendix A for Plots.

PERFORMANCE: The radiated emissions for the EUT meet the requirements for FCC CFR47 Part 15.249 and other applicable standards for Intentional Radiators. No other emissions or Harmonics were detected. The spectrum was checked to the tenth harmonic.

Section IV: Measurements of Radiated Spurious Emissions

TEST STANDARD: FCC Part 15 Subpart C

REQUIREMENTS: §15.249 Operation within the bands of 902-928 MHz, 2400– 2483.5 MHz, 5725-5875 MHz, and 24.0–24.25 GHz

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

Frequency	Field Strength of Fundamental (millivolts/meter)	Measurement Distance (meters)
9 to 490 kHz	2400/F (kHz) mV/m	300
490 to 1705 kHz	24000/F (kHz) mV/m	30
1705 to 30 MHz	29.54 dBmV/m	30
30 – 88	40.0 dBmV/m	3
80 – 216	43.5 dBmV/m	3
216 - 960	46.0 dBmV/m	3

MODIFICATIONS: No modifications were made to the EUT to pass this test.

MEASUREMENTS PLOTS: See Appendix C for Plots.

PERFORMANCE: The radiated emissions for the EUT meet the requirements for FCC Part 15.249 and 15.209 and other applicable standards for Intentional Radiators. No emissions other than fundamental Harmonics were detected. The spectrum was checked from 30MHz –14GHz.

Section V: Restricted Bands of Operation

TEST STANDARD: FCC Part 15 Subpart C, §15.205

REQUIREMENTS: §15.205 Restricted Bands of Operation

(a) Except as shown in paragraph (d) of this section, only spurious emission are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
10.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(2)
13.36-13.41			

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

MODIFICATIONS: No modifications were made to the EUT to pass this test.

MEASURED TEST DATA FOR EMISSIONS FALLING IN RESTRICTED FREQUENCY BANDS:

Frequency (MHz)	Antenna Polarization (V/H)	Field Strength at 1m (dBµV/m)	Field Strength at 3m (dBµV/m)	*Correction Factor	Final Corrected Signal at 3m (dBµV/m)	Limit at 3m (dBµV/m)	Margin (dB)
2749.25	V	48	38.46	1.9	40.36	54	-13.64
2749.25	H	48.2	38.66	1.9	40.56	54	-13.44
3665.26	V	46.1	36.56	13.4	49.96	54	-4.04
3665.7	H	45.9	36.36	13.4	49.76	54	-4.24

*Correction Factor= Antenna Factor+Cable Loss-Amplifier Gain

PERFORMANCE: The radiated emissions for the EUT meet the requirements for FCC 15.205 restricted bands of operation. There were no measurable emissions in the restricted bands other than those recorded in this report. Other emissions were present with amplitudes at least 20 dB below the required limits.

Section VI: Antenna Requirements

TEST STANDARD: FCC Part 15 Subpart C §15.203

Requirements:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

TEST DATA:

The unit is produced with a permanently attached antenna inside the enclosure. No provisions for modification or alterations of the antenna configuration are available. The requirements of 15.203 are met there are no deviations or exceptions to the specification.

Section VII: Report of Measurements to Power Line Conducted Interference

TEST STANDARD: FCC Part 15 Subpart C §15.207

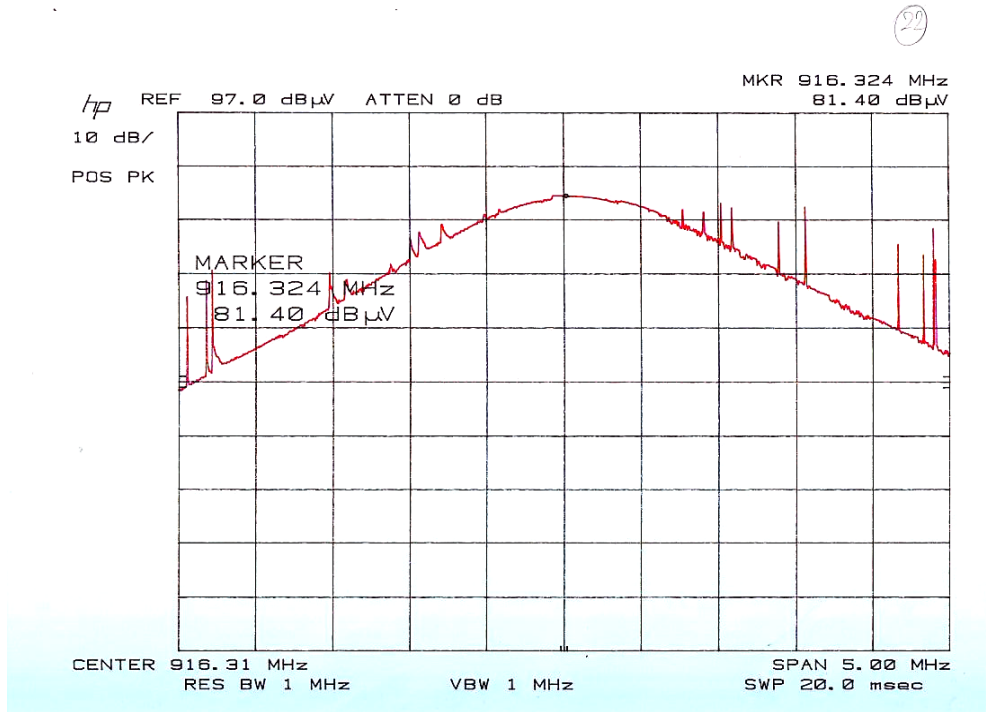
REQUIREMENTS: (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency MHz	Quasi Peak Limits dB μ V	Average Limits dB μ V
0.15 – 0.5	66 – 56	56 – 46
0.5 – 5.0	56	46
5.0 – 30	60	50

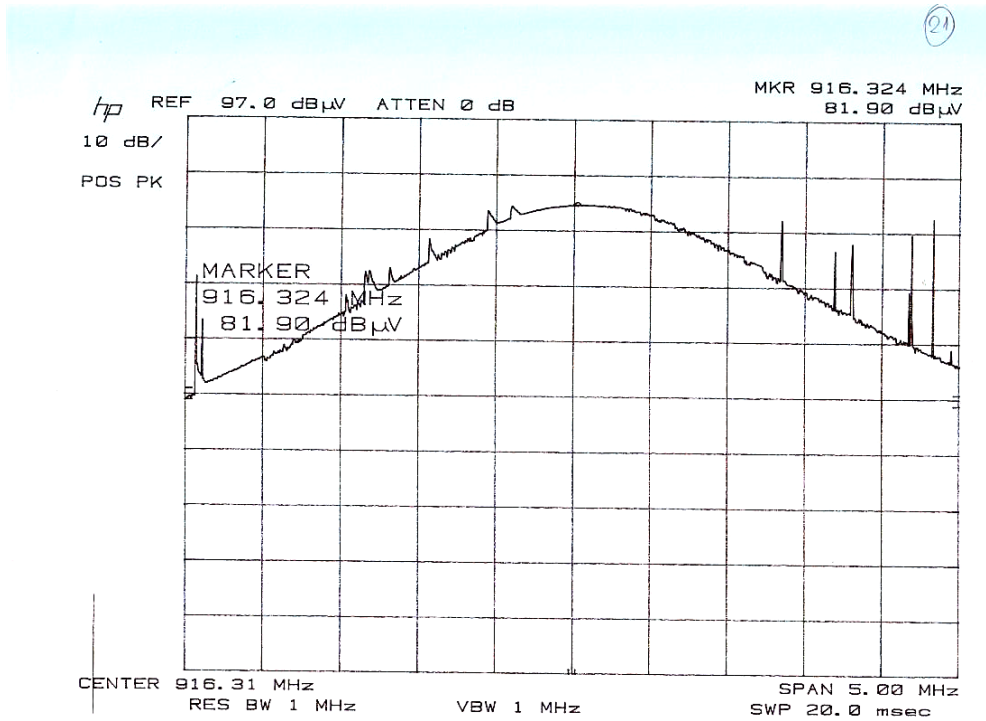
TEST DATA:

The transmitter operates from internal batteries only and offers no connection to utility power systems. Therefore, no AC line conducted emissions testing was required.

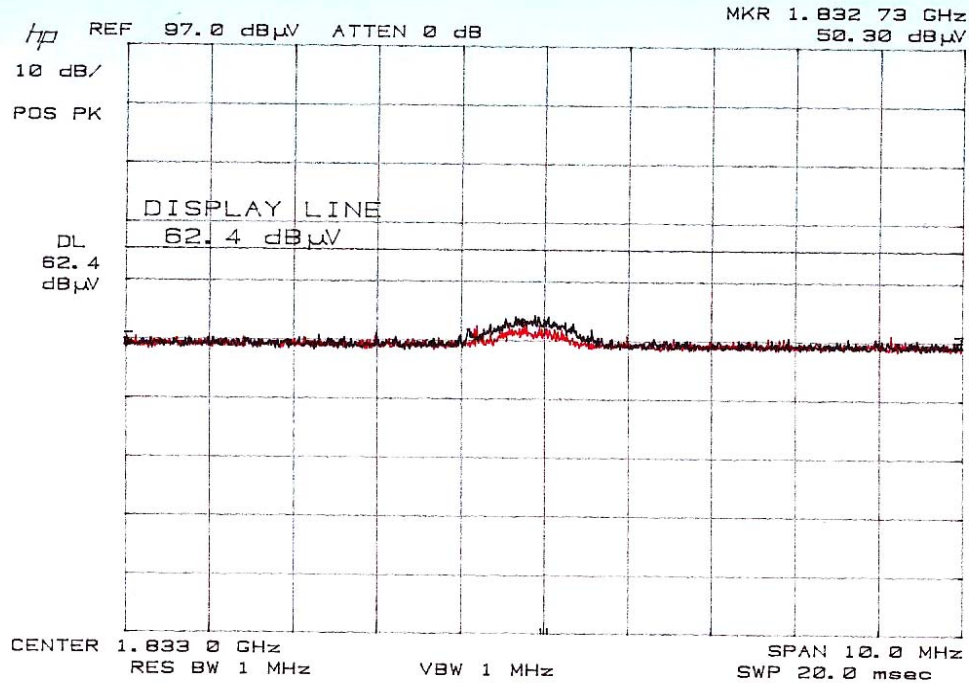
Appendix A: Measurement Plots Fundament and Harmonics



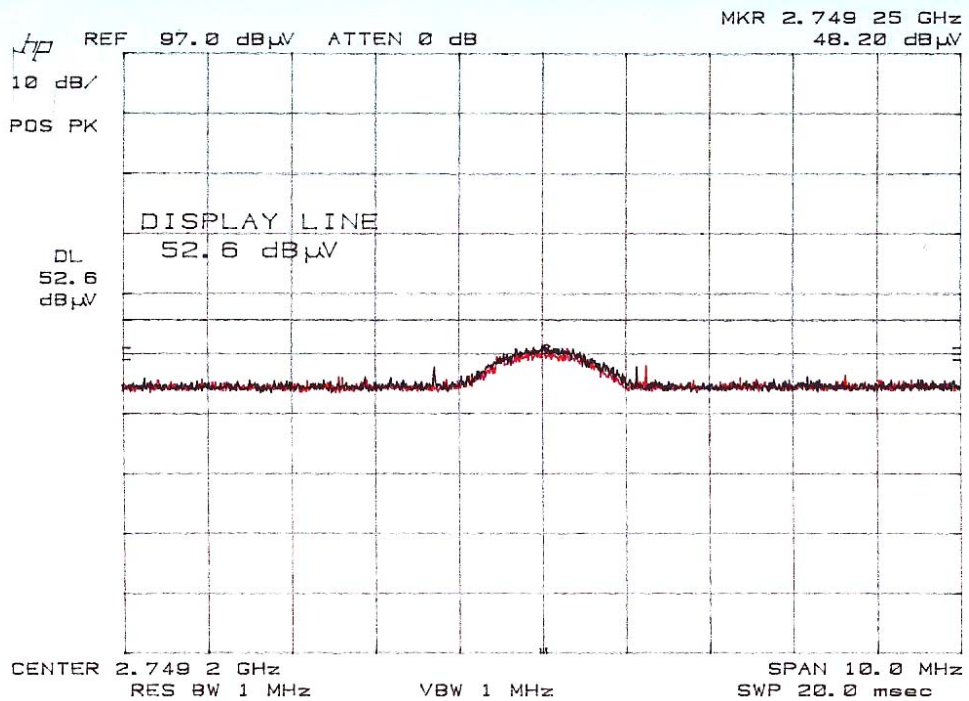
Plot 1: Fundamental Measured at 3m with Horizontal Antenna Polarization



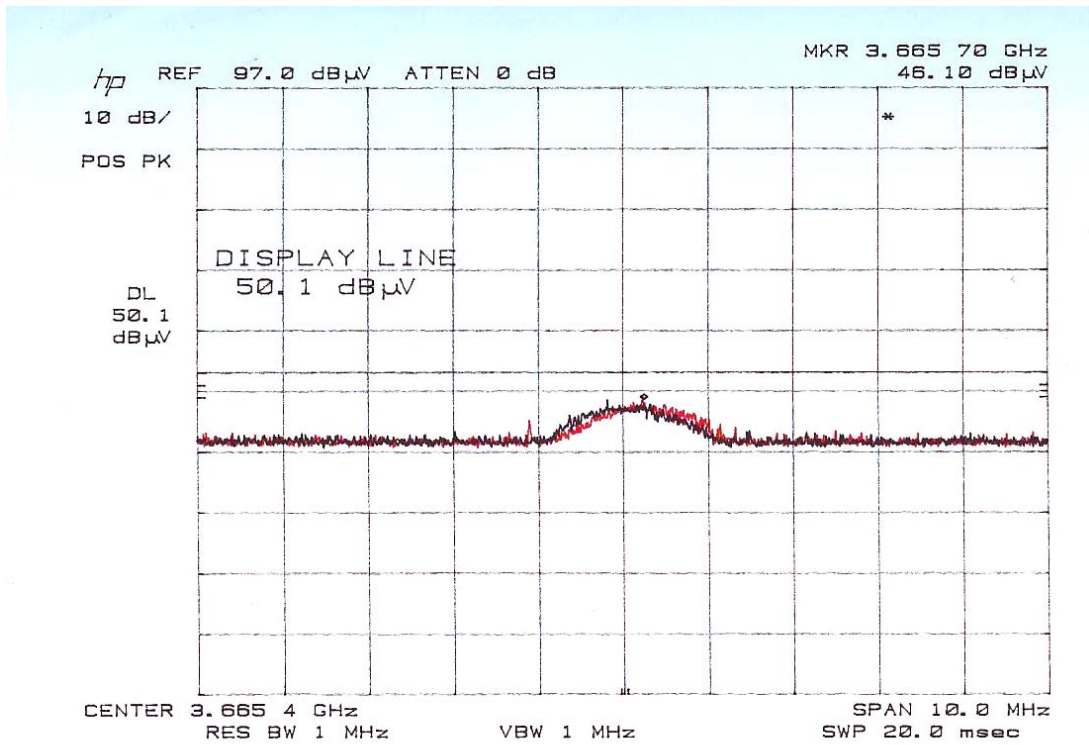
Plot 2: Fundamental Measured at 3m with Vertical Antenna Polarization



Plot 3: First Harmonic Measured at 1m (Black Trace for Horizontal and Red for Vertical Antenna Polarization).



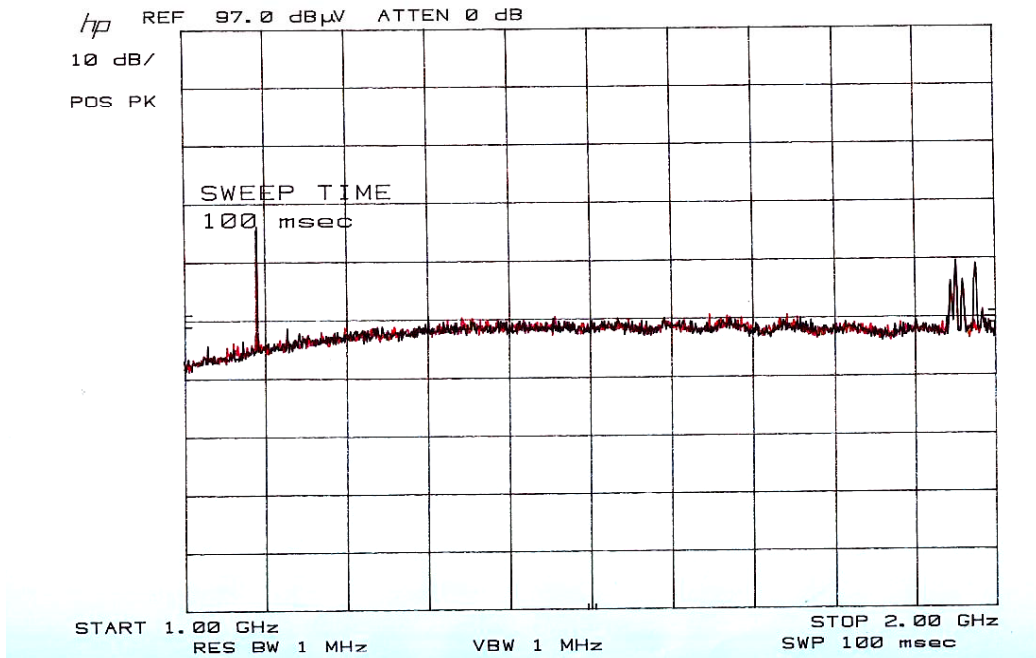
Plot 4: Second Harmonic Measured at 1m (Black Trace for Horizontal and Red for Vertical Antenna Polarization)



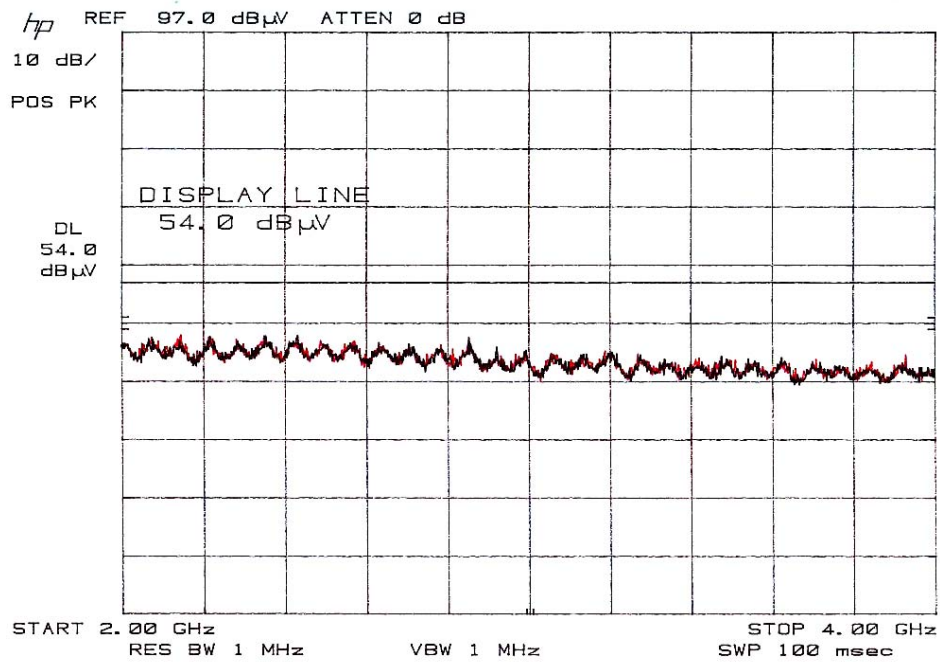
Plot 5: Third Harmonic Measured at 1m (Black Trace for Horizontal and Red for Vertical Antenna Polarization)

Appendix B: Measured Plots for Spurious Emission

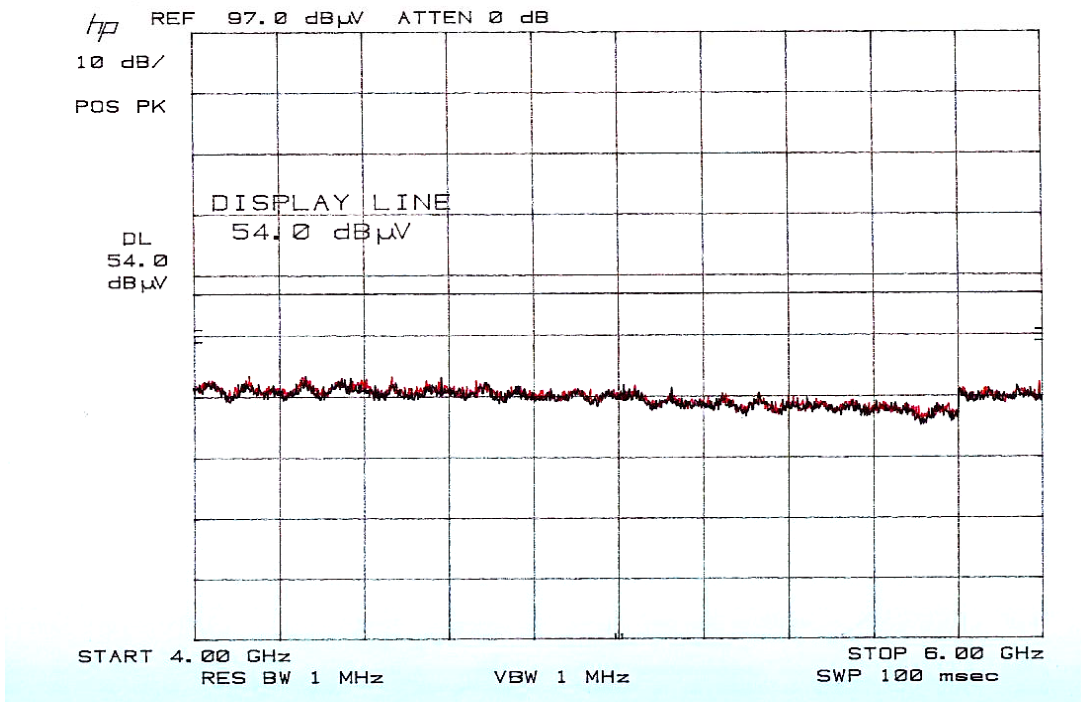
Below plots shows that there are no emissions other than fundatmental and harmonics at 3m distance:



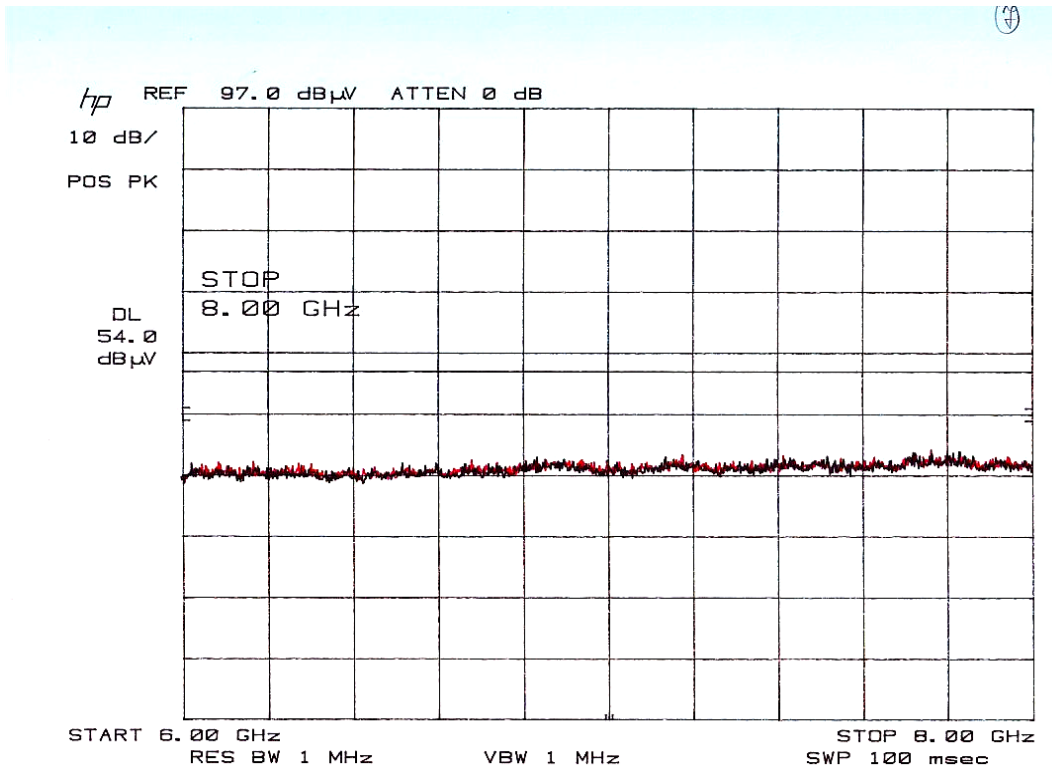
Plot 1: Radiated Emissions for frequency range 1-2GHz



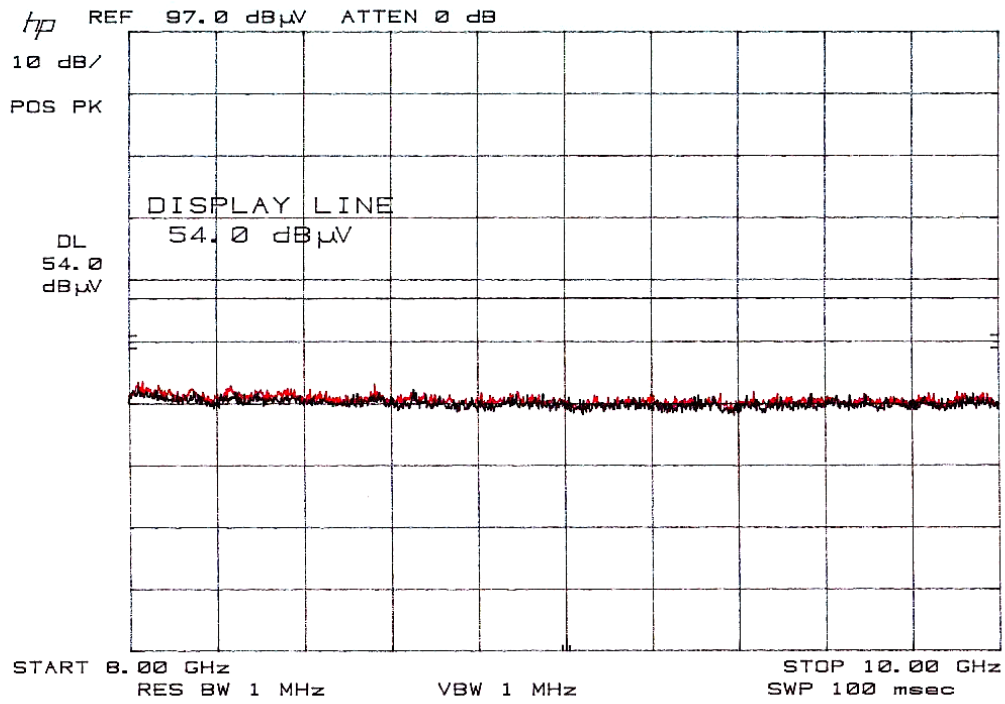
Plot 2: Radiated Emissions for frequency range 2-4GHz



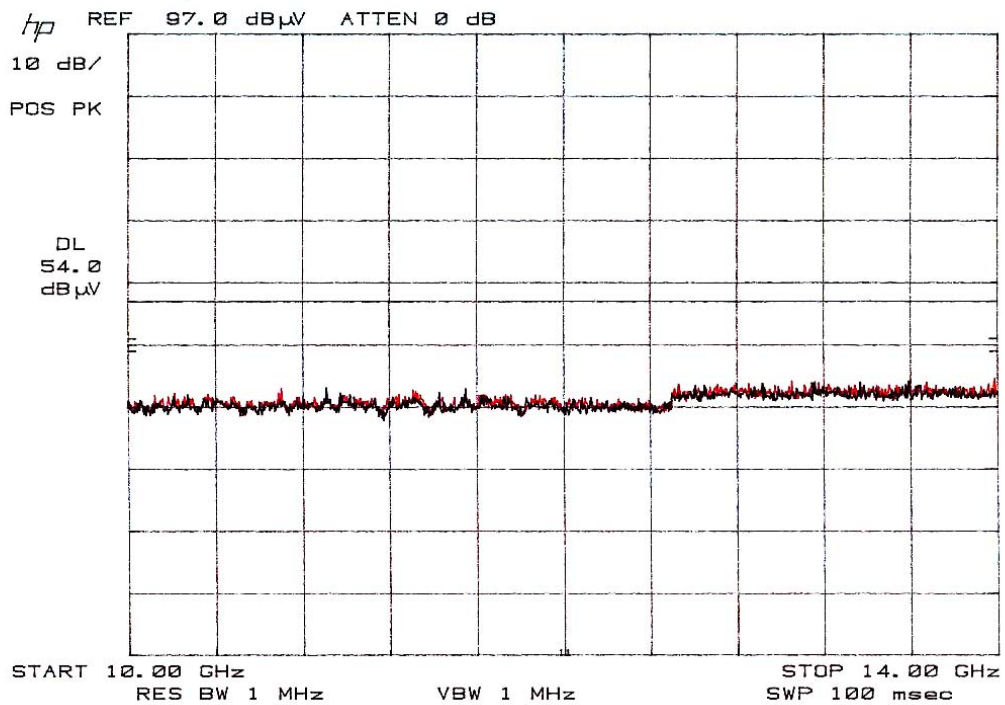
Plot 3: Radiated Emissions for frequency range 4-6GHz



Plot 4: Radiated Emissions for frequency range 6-8GHz



Plot 5: Radiated Emissions for frequency range 8-10GHz



Plot 6: Radiated Emissions for frequency range 10-14GHz

Appendix C: EUT and Test Set Up Pictures



Pic 1: Emissions Test Set-up of EUT during Radiated Emissions Testing



Pic 2: Emissions Test Set-up of EUT during Radiated Emissions Testing



Pic 3: Emissions Test Setup of EUT during Radiated Emissions Testing



Pic 4: Emissions Test Set-up of EUT during Radiated Emissions Testing