

Table of Contents

Report Cover Page 1

Table of Contents 2

Figures 3

1. GENERAL INFORMATION..... 4

 1.1 Verification of Compliance 4

 1.2 Equipment Modifications 5

 1.3 Product Information 6

 1.4 Test Methodology 6

 1.5 Test Facility 6

 1.6 Test Equipment..... 6

 1.7 Statement for the Document Use 7

2. PRODUCT LABELING 8

3. SYSTEM TEST CONFIGURATION 9

 3.1 Justification 9

 3.2 Special Accessories 9

 3.3 Configuration of Tested System 9

4. SYSTEM SCHEMATICS 12

 Figure 4.1 System Schematics 12

5. CONDUCTED EMISSION DATA..... 13

 5.1 Test Methods and Conditions..... 13

 5.2 Test Data 13

6. RADIATED EMISSION DATA 15

 6.1 Field Strength Calculation 15

 6.2 Test Methods and Conditions..... 15

 6.3 Test Data 15

 6.4 EUT RECEIVING MODE VERIFICATION 19

7. PHOTOS OF TESTED EUT 20

Figures

Figure 2.1 ID Label.....	8
Figure 2.2 Location of ID Label on EUT.....	8
Figure 3.1 Radiated Test Setup.....	10
Figure 3.2 Conducted Test Setup.....	11
Figure 3.3 Conducted Test Setup.....	11
Figure 4.1 EUT Schematics.....	12
Figure 5.1 Conducted Emission - Line	14
Figure 5.2 Conducted Emission- Neutral	14
Figure 7.1 Front View	21
Figure 7.2 Back View	22
Figure 7.3 Inside View.....	23
Figure 7.4 PCB Component View.....	24
Figure 7.5 PCB Foil View.....	25
Figure 7.6 AC-DC adaptor	26

1. GENERAL INFORMATION

1.1 Verification of Compliance

EUT: PRECISION SOIL SENSOR

Model: 53852

Applicant: THE TORO COMPANY

Test Type: FCC Part 15C CERTIFICATION
 IC RSS-210 (Issue 8) & RSS-Gen CERTIFICATION

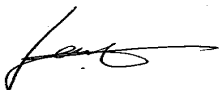
Result: PASS

Tested by: ADVANCED COMPLIANCE LABORATORY

Test Date: 11/30/2010 - 01/24/2011

Report Number: 0048-111021-02

The above equipment was tested by Compliance Laboratory, Advanced Technologies, Inc. for compliance with the requirement set forth in the FCC/IC rules and regulations Part 15 subpart C. This said equipment in the configuration described in the report, shows the maximum emission levels emanating from equipment are within the compliance requirements.



Wei Li
Lab Manager
Advanced Compliance Lab

Date March 6, 2012

1.2 Equipment Modifications

N/A

1.3 Product Information

System Configuration

ITEM	DESCRIPTION	FCC/IC ID	CABLE
Product	PRECISION SOIL SENSOR (1)	FCC ID: OF753852 IC: 3575A-53852	
Housing	PLASTICS		
Power Supply	AC-DC adapter, I/P:120Vac, O/P:24Vac		
Operation Freq.	906MHz ~ 922MHz		
Receiver	53852(RX)	Verification	

(1) EUT submitted for grant.

1.4 Test Methodology

Radiated tests were performed according to the procedures in ANSI C63.4-2003 at an antenna to EUT distance of 3 meters.

1.5 Test Facility

The open area test site and conducted measurement facility used to collect the radiated and conducted data are located at Hillsborough, New Jersey. This site has been accepted by FCC to perform measurements under Part 15 or 18 (Registration No. 886209) and designated by IC as “Site IC 3130A”. The NVLAP Lab code for accreditation of FCC EMC Test Method is: 200101-0.

1.6 Test Equipment

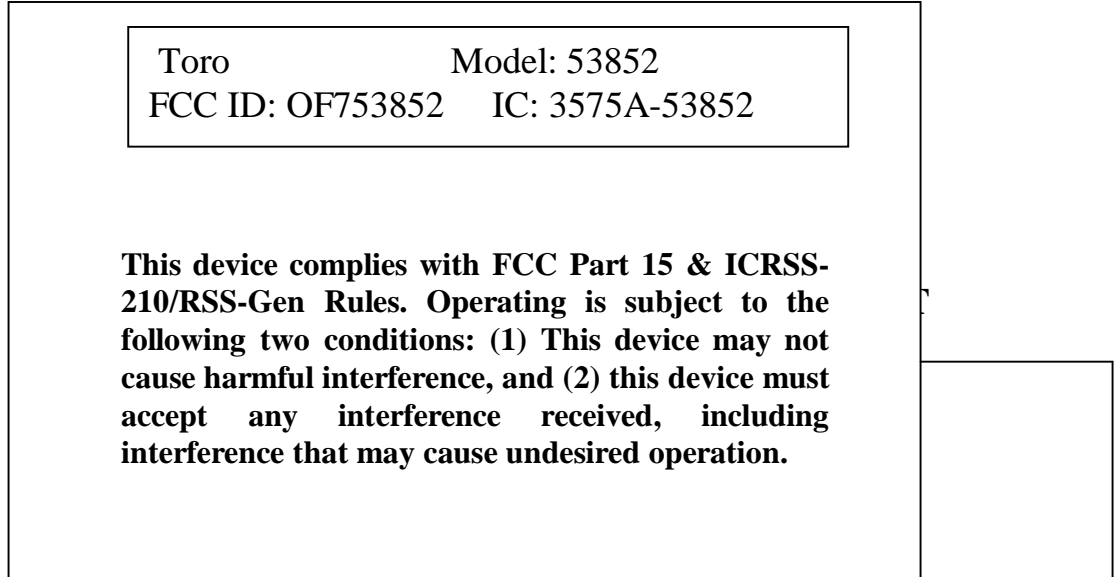
Manufacture	Model	Serial No.	Description	Cal Due dd/mm/yy
Hewlett-Packard	HP8546A	3448A00290	EMI Receiver	25/09/12
Agilent	E4440A	US40420700	3Hz-26.5GHz Spec. Analyzer	17/06/12
EMCO	3104C	9307-4396	20-300MHz Biconical Antenna	19/10/12
EMCO	3146	9008-2860	200-1000MHz Log-Periodic Antenna	19/10/12
Fischer Custom	LISN-2	900-4-0008	Line Impedance Stabilization Networks	05/10/12
Fischer Custom	LISN-2	900-4-0009	Line Impedance Stabilization Networks	18/10/12
EMCO	3115	4945	Double Ridge Guide Horn Antenna	17/10/12

All Test Equipment Used are Calibrated Traceable to NIST Standards.

1.7 Statement for the Document Use

This report shall not be reproduced except in full, without the written approval of the laboratory. And this report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. / Canada Government.

2. PRODUCT LABELING



**Figure 2.1 ID Label
(Only ID shown on EUT)**



Figure 2.2 Location of ID Label on EUT

3. SYSTEM TEST CONFIGURATION

3.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it). And its antenna was permanently attached to the EUT with max length, 3”.

Testing was performed as EUT was continuously operated at the following frequency channels:

Low=906MHz, Middle= 914MHz, High=922MHz.

If applicable, fresh external battery shall be used for extended operating time.

3.2 Special Accessories

N/A

3.3 Configuration of Tested System

Figure 3.1 illustrate this system, which is tested standing along.



Figure 3.1 Radiated Test Setup



Figure 3.2 Conducted Setup- Front



Figure 3.3 Conducted Setup- Rear

4. SYSTEM SCHEMATICS

See Attachment.

Figure 4.1 System Schematics

5. CONDUCTED EMISSION DATA

5.1 Test Methods and Conditions

The EUT was under normal operational mode during the conducted emission test. EMI Receiver was scanned from 150KHz to 30MHz with maximum hold mode for maximum emission. Recorded data was sent to the plotter to generate output in linear format. At the input of the spectrum analyzer, a HP transient limiter is inserted for protective purpose. This limiter has a 10 dB attenuation in the range of 150KHz to 30MHz. That factor was automatically compensated by the receiver, so the readings are the corrected readings. The reference of the plot is the CISPR 22 Class B limit in Figure 5.1 through Figure 5.2.

Conducted Emission Technical Requirements				
Frequency Range	Class A		Class B	
	Quasi-Peak dBuV	Average dBuV	Quasi-Peak DBuV	Average dBuV
150kHz -0.5MHz	79 (8912uV)	66 (1995uV)	66-56	56-46
0.5MHz-30MHz	73 (4467uV)	60 (1000uV)	---	---
0.5MHz- 5MHz	---	---	56	46 (250uV)
5MHz-30MHz	---	---	60	50

Emissions that have peak values close to the specification limit (if any) are also measured in the quasi-peak/average mode to determine compliance.

5.2 Test Data

Figure 5.1-5.2 show the neutral and line conducted emissions for the standard operation.

Highest Data for AC Line Conducted Emissions						
Frequency (MHz)	0.41	0.54	0.61	0.69	1.72	1.92
Peak Reading (dBuV)	45.9	43.3	45.1	38.1	42.6	42.0
Average Reading (dBuV*)			38.2			

* no need to show the average reading if the peak value is under average limit.

Test Personnel:



Tester Signature: _____

Typed/Printed Name: Edward Lee

Date: March 6, 2012



MARKER
610 kHz
45.11 dB μ V

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 610 kHz
45.11 dB μ V

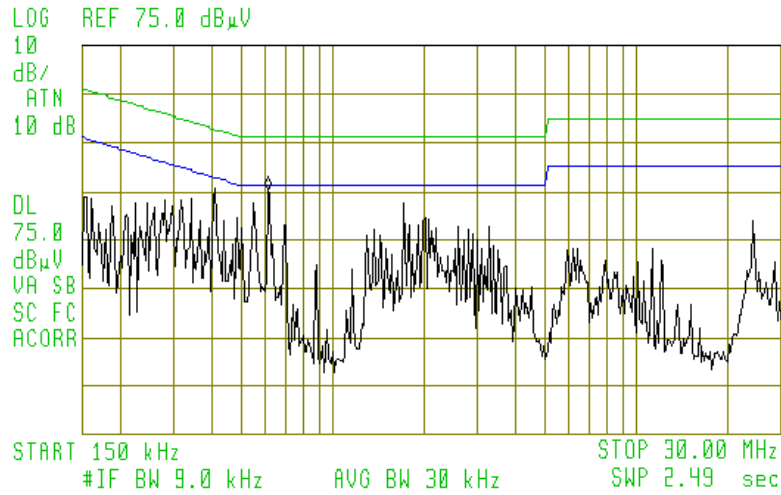


Fig. 5.1 Conducted Emission-Line



MARKER
540 kHz
43.26 dB μ V

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 540 kHz
43.26 dB μ V

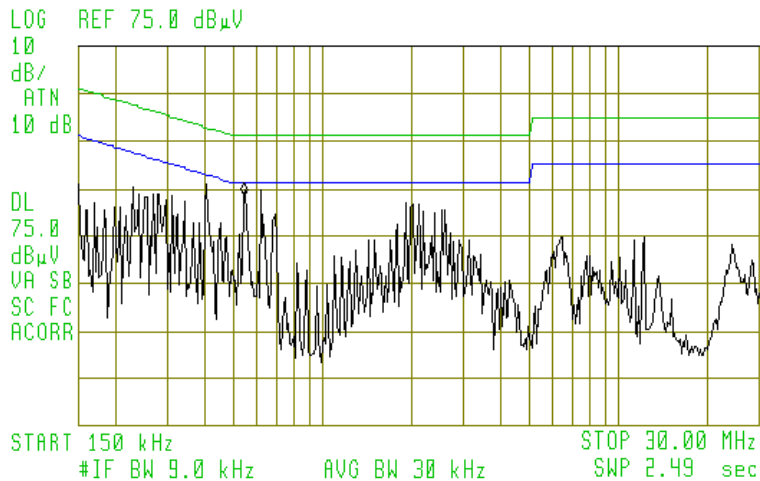


Fig. 5.2 Conducted Emission- Neutral

6. RADIATED EMISSION DATA

6.1 Field Strength Calculation

The corrected field strength is automatically calculated by EMI Receiver using following:

$$FS = RA + AF + CF + AG$$

where FS: Corrected Field Strength in dB μ V/m

RA: Amplitude of EMI Receiver before correction in dB μ V

AF: Antenna Factor in dB/m

CF: Cable Attenuation Factor in dB

AG: Built-in Preamplifier Gain in dB (Stored in receiver as part of the calibration data)

THE "DUTY CYCLE CORRECTION FACTOR" FOR SPURIOUS RADIATED EMISSIONS IS;
 $20 \log * (23.8 \text{ ms} / 100 \text{ ms}) = -12.5 \text{ dB}$, WHICH WAS USED TO CORRECT THE AVERAGE
 RADIATED EMISSION READINGS.

6.2 Test Methods and Conditions

The initial step in collecting radiated data is a EMI Receiver scan of the measurement range below 30MHz using peak detector and 9KHz IF bandwidth / 30KHz video bandwidth. For the range 30MHz - 1GHz, 100KHz IF bandwidth / 100KHz video bandwidth are used. Both bandwidths are 1MHz for above 1GHz measurement. Up to 10th harmonics were investigated.

6.3 Test Data

The following data lists the significant emission frequencies, polarity and position, peak reading of the EMI Receiver, the FCC/IC limit, and the difference between the peak reading and the limit. Explanation of the correction and calculation are given in section 5.1.

Test Personnel: _____



Typed/Printed Name: Edward Lee

Date: March 6, 2012

Radiated Test Data (CH-906MHz/914MHz/922MHz)

Frequency (MHz)	Polarity (V,H) Position (X,Y,Z)	Antenna Height (m)	Azimuth (Degree)	Peak Reading at 3m (2) (dBuV/m)	Peak Reading After Correction (dBuV/m)	FCC/IC 3m Limit (1) (dBuV/m)	Difference (dBuV/m)
906	V	1.2	090	101.4	88.9	94	-5.1
1812	V	1.1	180	65.1	52.6	54	-1.4
2718	V	1.1	180	54.5	42.0	54	-12.0
906	H	1.2	015	98.7	86.2	94	-7.8
1812	H	1.1	015	57.5	45.0	54	-9.0
2718	H	1.1	000	55.3	42.8	54	-11.2
914	V	1.2	090	100.9	88.4	94	-5.6
1828	V	1.1	180	63.2	50.7	54	-3.3
2712	V	1.0	180	62.1	49.6	54	-4.4
914	H	1.2	015	99.0	86.5	94	-7.5
1828	H	1.1	015	57.0	44.5	54	-9.5
2742	H	1.0	015	53.0	40.5	54	-13.5
922	V	1.2	180	100.7	88.2	94	-5.8
1844	V	1.0	180	64.1	51.6	54	-2.4
2766	V	1.0	090	62.9	50.4	54	-3.6
922	H	1.2	015	99.4	86.9	94	-7.1
1844	H	1.1	015	57.0	44.5	54	-9.5
2766	H	1.0	015	55.5	43.0	54	-11.0

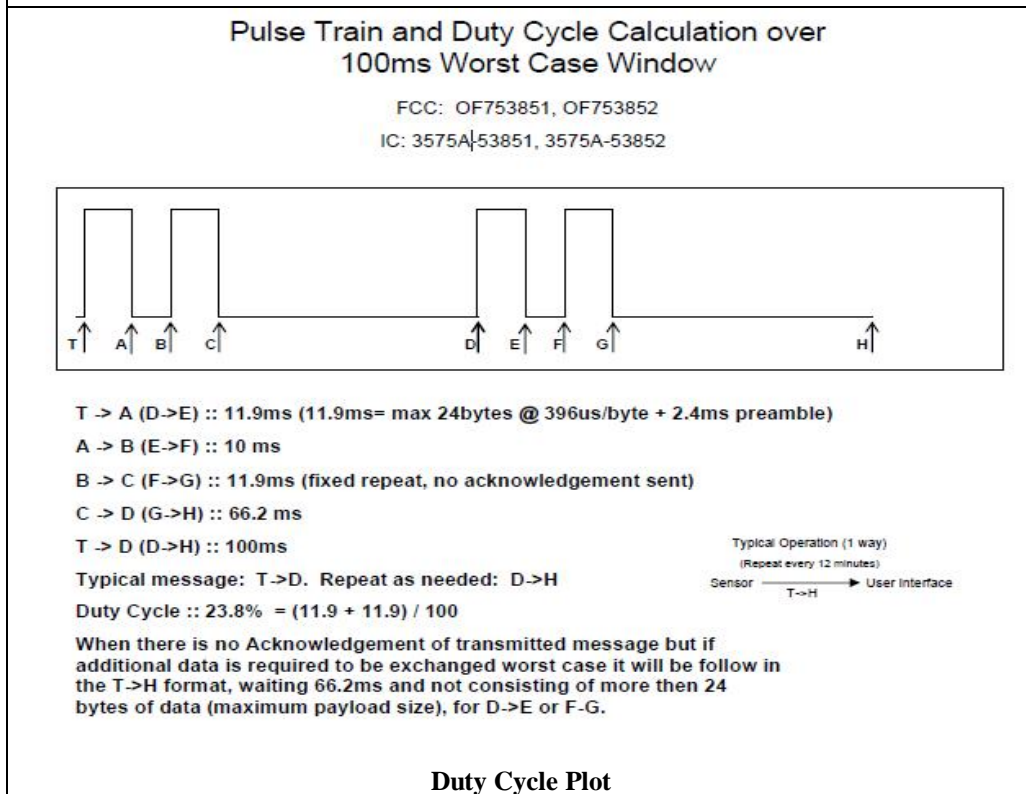
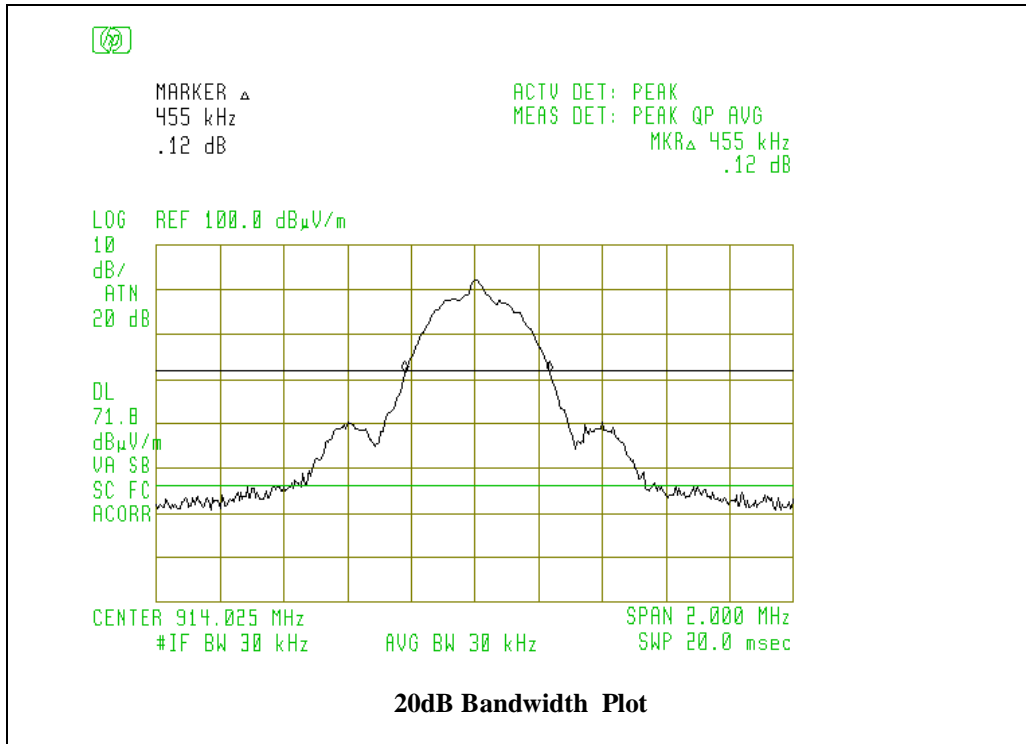
(1) The limit for emissions within the 902-928MHz band is 50mV(94dB) per FCC Part 15 Sec. 15.249 and IC RSS-210 Annex 2.9. The limit for its harmonics is 500uV (54dB). Other spurious emissions shall be lower than either its fundamental by 50dB or the limit defined in FCC Part 15 Sec. 15.209 and IC RSS-210 Annex 7, whichever is higher.

(2) If each peak reading is less than the FCC/IC average limit, it'll be not necessary to show the measured/ calculated average reading.

Other Spurious outside of the band 902-928MHz
 (the worst case of investigated L, M, H channel operation modes)

Frequency (MHz)	Polarity (V,H) Position X	Antenna Height (m)	Azimuth (Degree)	Peak Reading at 3m (2) (dBuV/m)	Peak Reading After Correction (dBuV/m)	FCC/IC 3m Limit (1) (dBuV/m)	Difference (dBuV/m)
39.7	V	1.1	120	31.9		40.0	-8.1
143.3	V	1.1	120	33.8		43.5	-9.7
162.0	V	1.1	180	33.9		43.5	-9.6
47.0	H	1.4	000	30.0		40.0	-10
138.8	H	1.4	000	32.8		43.5	-10.7
159.4	H	1.4	080	33.2		43.5	-10.3

Comparing to the limit defined in FCC Part 15 Sec. 15.209 and IC RSS-210, no other significant emissions were found.



6.4 EUT RECEIVING MODE VERIFICATION

Radiated Test Data for Receiving Mode

(the worst case of investigated L, M, H channel operation modes)

Frequency (MHz)	Polarity (V,H) Position X	Antenna Height (m)	Azimuth (Degree)	Peak Reading at 3m (2) (dBuV/m)	Peak Reading After Correction (dBuV/m)	FCC/IC 3m Limit (1) (dBuV/m)	Difference (dBuV/m)
47.4	V	1.1	135	30.7		40.0	-9.3
138.0	V	1.1	135	33.0		43.5	-10.5
159.6	V	1.1	180	34.5		43.5	-9.0
336.0	V	1.1	090	27.0		46.5	-19.5
478.0	V	1.0	225	27.3		46.5	-19.2
854.0	V	1.0	000	29.6		46.5	-16.9
39.8	H	1.4	000	29.4		40.0	-10.6
143.5	H	1.4	000	32.0		43.5	-11.5
162.2	H	1.4	090	34.6		43.5	-8.9
336.0	H	1.1	090	27.5		46.5	-19.0
500.0	H	1.0	090	26.5		46.5	-20.0
758.0	H	1.0	225	30.9		46.5	-15.6

(1) Receiving mode spurious emissions shall be lower than the limit defined in FCC Part 15 Sec. 15.209 and IC RSS-Gen.

(2) If each peak reading is less than the FCC/IC average limit, it'll be not necessary to show the measured/ calculated average reading.