

Report on the FCC and IC Testing of:

DETNET SOUTH AFRICA (PTY) LTD
Handheld Electronic Detonator Tester, Model: CE4 Tagger

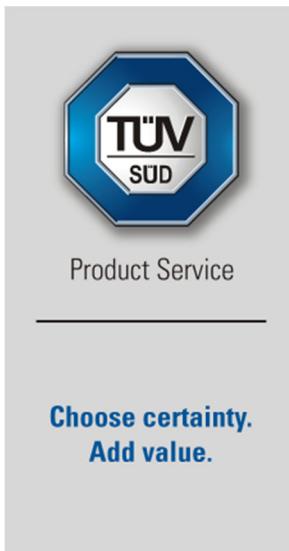
In accordance with FCC 47 CFR Part 15C and
Industry Canada RSS-210 and Industry Canada
RSS-GEN

Prepared for: DETNET SOUTH AFRICA (PTY) LTD
Block 1B, Founders Hill Office Park
Centenary Road
Modderfontein P O Box 10
1645
SOUTH AFRICA

FCC ID: 2ARNH-16541610 IC: 24476-16541610

COMMERCIAL-IN-CONFIDENCE

Document Number: 75943624-04 | Issue: 02



SIGNATURE

A handwritten signature of Simon Bennett.

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Simon Bennett	Chief Engineer	Authorised Signatory	04 February 2019

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service document control rules.

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15C and Industry Canada RSS-210 and Industry Canada RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

SIGNATURE

A handwritten signature of Graeme Lawler.

A handwritten signature of Daniel Bishop.

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Graeme Lawler	Senior Engineer	Testing	04 February 2019
Daniel Bishop	Test Engineer	Testing	04 February 2019

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory Industry Canada Accreditation
IC2932B-1 Octagon House, Fareham Test Laboratory

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15C: 2017, Industry Canada RSS-210 Issue 09 (08-2016) and Industry Canada RSS-GEN: Issue 05 (04-2018).

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TÜV SÜD Product Service
is a trading name of TUV SUD Ltd
Registered in Scotland at East Kilbride,
Glasgow G75 0QF, United Kingdom
Registered number: SC215164

TUV SUD Ltd is a
TÜV SÜD Group Company

Phone: +44 (0) 1489 558100
Fax: +44 (0) 1489 558101
www.tuv-sud.co.uk

TÜV SÜD Product Service
Octagon House
Concorde Way
Fareham
Hampshire PO15 5RL
United Kingdom

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1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	21 November 2018
2	To amend the FCC and IC ID's.	04 February 2019

Table 1

1.2 Introduction

Applicant	DETNET SOUTH AFRICA (PTY) LTD
Manufacturer	DETNET SOUTH AFRICA (PTY) LTD
Model Number(s)	CE4 Tagger
Serial Number(s)	Not Serialized (75943624- TSR0005)
Hardware Version(s)	V4
Software Version(s)	36230B
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2017 Industry Canada RSS-210: Issue 09 (08-2016) Industry Canada RSS-GEN: Issue 05 (04-2018)
Order Number	4500348610
Date	23-August-2018
Date of Receipt of EUT	07-September-2018
Start of Test	17-September-2018
Finish of Test	31-October-2018
Name of Engineer(s)	Graeme Lawler and Daniel Bishop
Related Document(s)	ANSI C63.10 (2013)

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C and Industry Canada RSS-210 and Industry Canada RSS-GEN is shown below.

Section	Specification Clause			Test Description	Result	Comments/Base Standard
	Part 15C	RSS-210	RSS-GEN			
Configuration and Mode: Tagger Version 4 - 13.56 MHz TX						
2.1	15.215 (c)	-	6.6	20 dB Bandwidth	Pass	ANSI C63.10 (2013)
2.2	15.225 (a)(b)(c)(d)	B.6	6.13	Field Strength of any Emission	Pass	ANSI C63.10 (2013)
2.3	15.225 (e)	B.6	6.11	Frequency Tolerance Under Temperature Variations	Pass	ANSI C63.10 (2013)

Table 2



1.4 Application Form

EQUIPMENT DESCRIPTION	
Model Name/Number	CE4 Tagger
Part Number	
Hardware Version	V4
Software Version	36230B
FCC ID (if applicable)	2ARNH-16541610
Industry Canada ID (if applicable)	24476-16541610
Technical Description (Please provide a brief description of the intended use of the equipment)	Hand held electronic tester for use us with electronic detonators in the mining and blasting industry.

INTENTIONAL RADIATORS									
Technology	Frequency Band (MHz)	Conducted Declared Output Power (dBm)	Antenna Gain (dBi)	Supported Bandwidth (s) (MHz)	Modulation Scheme(s)	ITU Emission Designator	Test Channels (MHz)		
							Bottom	Middle	Top
WiFi	2400	18		2412 – 2457			2412	2450	2457
NFC	13.56	6		13.56			-	13.56	-

UN-INTENTIONAL RADIATOR	
Highest frequency generated or used in the device or on which the device operates or tunes	3117.2 MHz
Lowest frequency generated or used in the device or on which the device operates or tunes	32.768 kHz
Class A Digital Device (Use in commercial, industrial or business environment) <input checked="" type="checkbox"/>	
Class B Digital Device (Use in residential environment only) <input type="checkbox"/>	

Power Source			
AC	Single Phase	Three Phase	Nominal Voltage
External DC	Nominal Voltage		Maximum Current
Battery	Nominal Voltage		Battery Operating End Point Voltage
	3.7		3.3
Can EUT transmit whilst being charged?		Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	

EXTREME CONDITIONS					
Maximum temperature	60	°C	Minimum temperature	-30	°C

Ancillaries	
Please list all ancillaries which will be used with the device.	



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ANTENNA CHARACTERISTICS				
<input checked="" type="checkbox"/> Antenna connector		State impedance	50	Ohm
<input type="checkbox"/> Temporary antenna connector		State impedance		Ohm
<input checked="" type="checkbox"/> Integral antenna	Type	PCB Trace Antenna		
<input type="checkbox"/> External antenna	Type			

I hereby declare that the information supplied is correct and complete

Name: H van der Walt

Position held: Quality and Compliance Manager

Date: 2018-09-12

1.5 Product Information

1.5.1 Technical Description

Hand held electronic tester for use with electronic detonators in the mining and blasting industry.

1.6 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

1.7 EUT Modification Record

The table below details modifications made to the EUT during the test programme.
The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Serial Number: Not Serialised (75943624- TSR0005)			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3

1.8 Test Location

TÜV SÜD Product Service conducted the following tests at our Fareham Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: Tagger Version 4 - 13.56 MHz TX		
20 dB Bandwidth	Daniel Bishop	UKAS
Field Strength of any Emission	Graeme Lawler	UKAS
Frequency Tolerance Under Temperature Variations	Daniel Bishop	UKAS

Table 4

Office Address:

Octagon House
Concorde Way
Segensworth North
Fareham
Hampshire
PO15 5RL
United Kingdom

2 Test Details

2.1 20 dB Bandwidth

2.1.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.215 (c)
Industry Canada RSS-GEN, Clause 6.7

2.1.2 Equipment Under Test and Modification State

CE4 Tagger, S/N: Not Serialised (75943624- TSR0005) - Modification State 0

2.1.3 Date of Test

31-October-2018

2.1.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.9.1 and RSS-GEN clause 6.7.

2.1.5 Environmental Conditions

Ambient Temperature 22.8 °C
Relative Humidity 29.0 %

2.1.6 Test Results

Tagger Version 4 - 13.56 MHz TX

Frequency (MHz)	20 dB Bandwidth (Hz)	99% Occupied Bandwidth (Hz)	F _{LOWER} (MHz)	F _{UPPER} (MHz)
13.56	157.051	474.359	13.560115	13.560272

Table 5

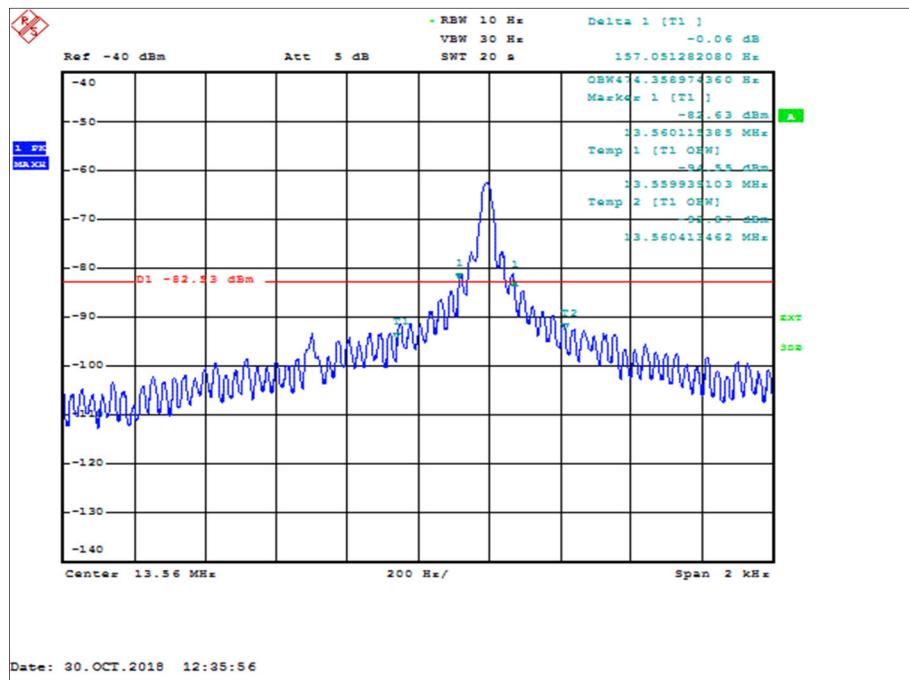


Figure 1 - 20 dB Bandwidth and 99% Occupied Bandwidth

FCC 47 CFR Part 15, Limit Clause 15.215 (c)

The 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

Industry Canada RSS 210 and Industry Canada RSS GEN Limit Clause

None specified.

2.1.7 Test Location and Test Equipment Used

This test was carried out in RF Lab 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
RF Coupler	TÜV SUD Product Service	RFC1	414	-	TU
RF Coupler	TÜV SUD Product Service	TÜV	415	-	TU
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	16-Apr-2019
Hygrometer	Rotronic	A1	1388	12	20-Jun-2019
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	14-Mar-2019
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	16-Apr-2019

Table 6

TU - Traceability Unscheduled

2.2 Field Strength of any Emission

2.2.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.225 (a)(b)(c)(d)
Industry Canada RSS-210, Clause B.6
Industry Canada RSS-GEN, Clause 6.13.

2.2.2 Equipment Under Test and Modification State

CE4 Tagger, S/N: Not Serialised (75943624- TSR0005) - Modification State 0

2.2.3 Date of Test

23-September-2018 to 24-September-2018

2.2.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.3, 6.4 and 6.5.

Pre-scan measurements were made at a distance of 3 m as shown by the plots below using a peak detector. Final emission measurements were then made using a Quasi-Peak detector and recorded in the tables below. The limit lines shown on the plot were extrapolated from either 300 m or 30 m to the measurement distance of 3 m in accordance with ANSI C63.10 Clause 6.4.4.2.

2.2.5 Environmental Conditions`

Ambient Temperature 20.0 °C
Relative Humidity 44.0 %

2.2.6 Test Results

Tagger Version 4 - 13.56 MHz TX, Carrier Results

Frequency (MHz)	Quasi-Peak Level (dB μ V/m) at 3m	Quasi-Peak Level (dB μ V/m) at 30m	Quasi-Peak Level (μ V/m) at 3m	Quasi-Peak Level (μ V/m) at 30m
13.56	40.68	19.29	108.14	9.22

Table 7

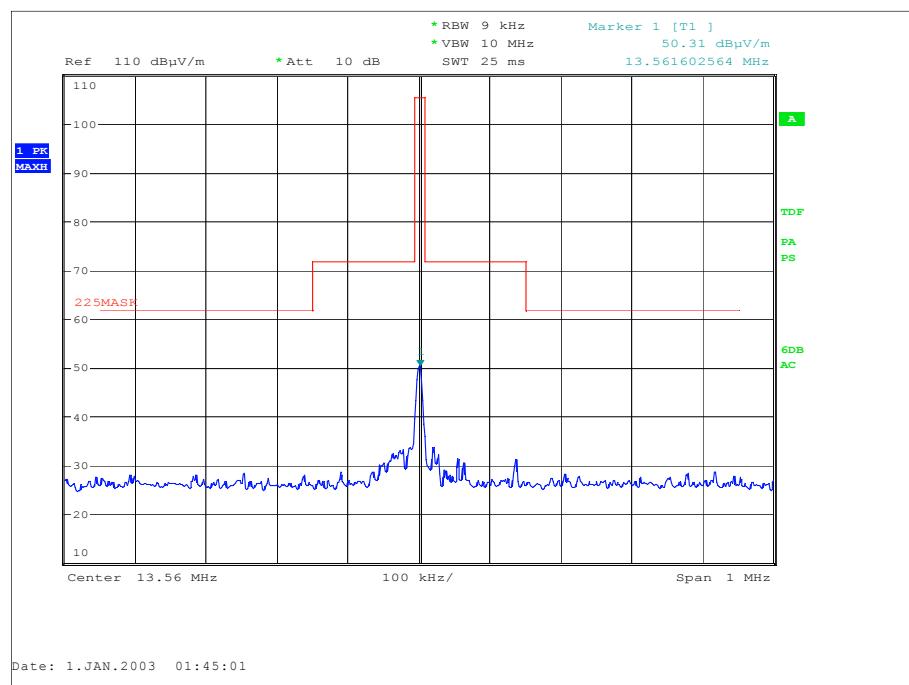


Figure 2 - Plot of the Fundamental - 13.56 MHz

Frequency MHz	Quasi-Peak Level (dB μ V/m) at 3 m	Quasi-Peak Level (dB μ V/m) at 30 m	Quasi-Peak Level (μ V/m) at 3 m	Quasi-Peak Level (μ V/m) at 30 m

Table 8 - Emissions Results - 9 kHz to 30 MHz

No emissions were detected within 10 dB of the limit.

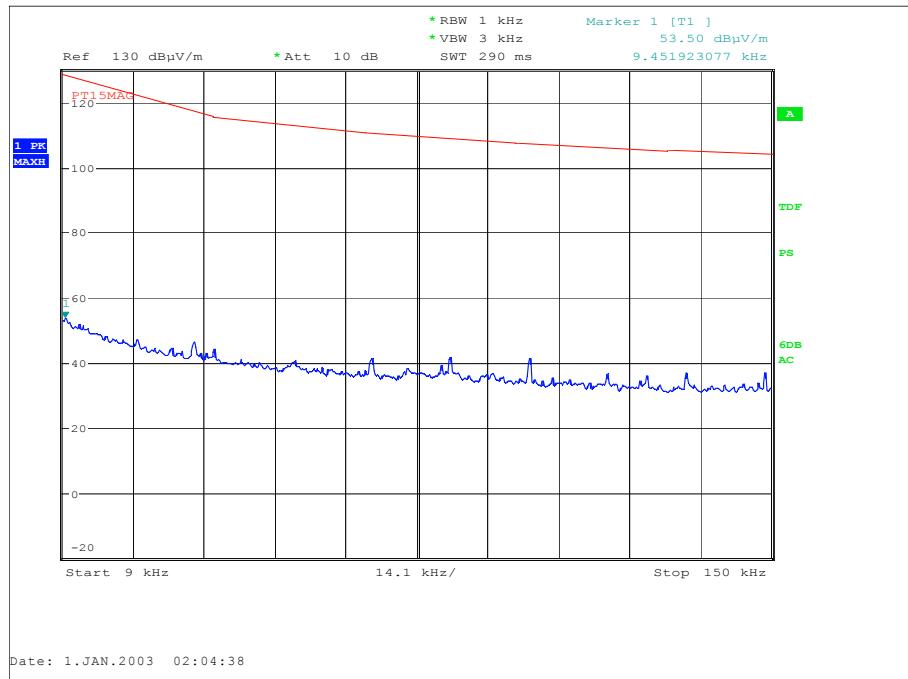


Figure 3 - 9 kHz to 150 kHz - X Orientation

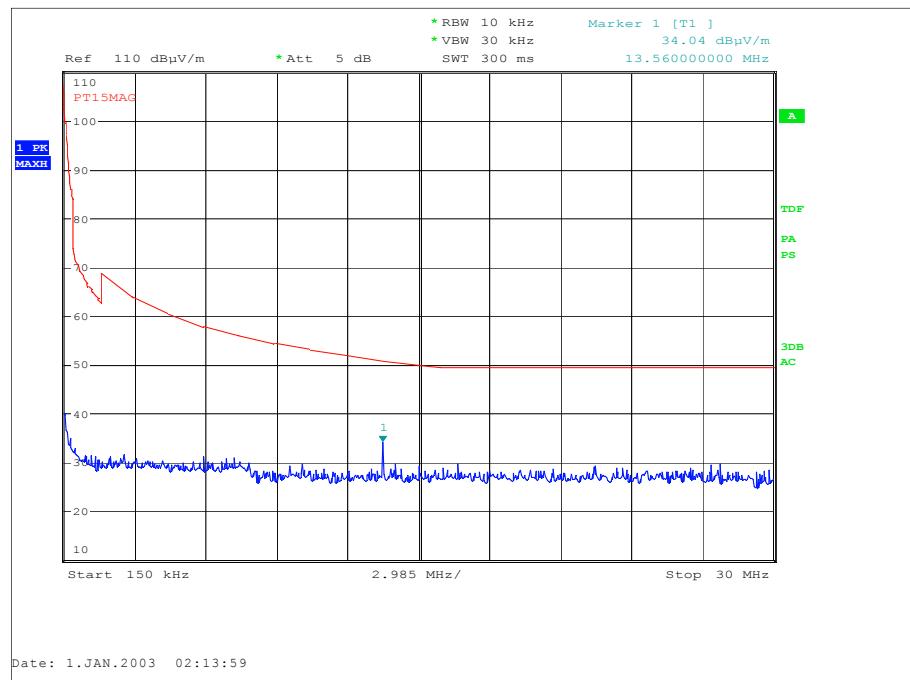


Figure 4 - 150 kHz to 30 MHz - X Orientation

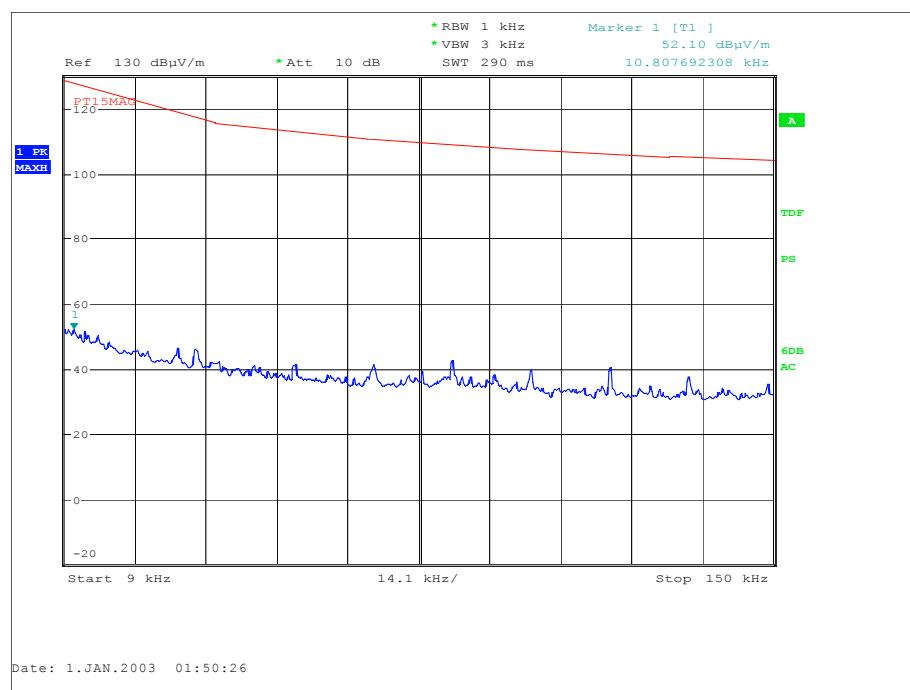


Figure 5 - 9 kHz to 150 kHz - Y Orientation

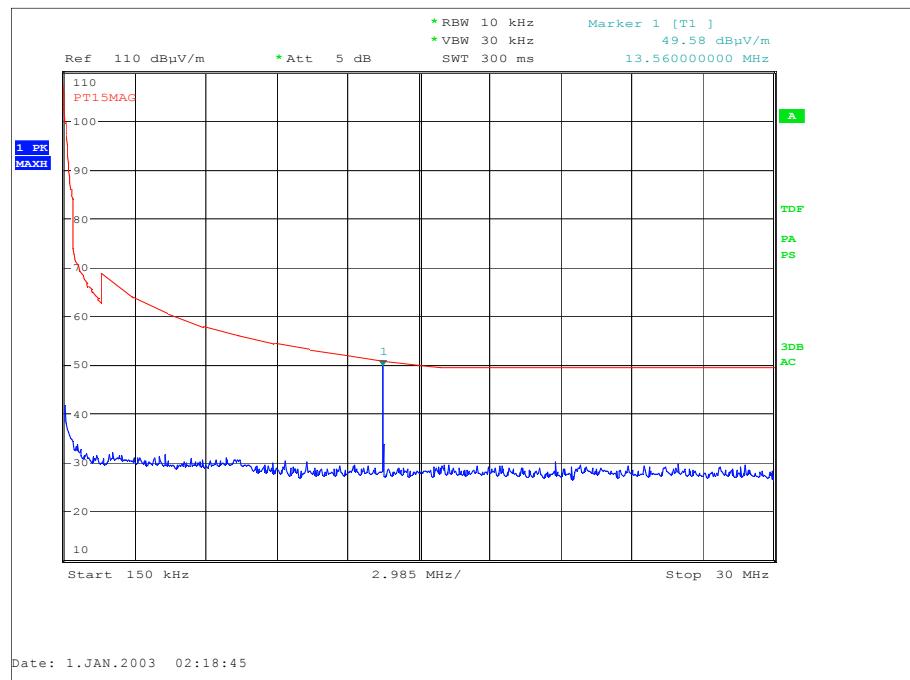


Figure 6 - 150 kHz to 30 MHz - Y Orientation

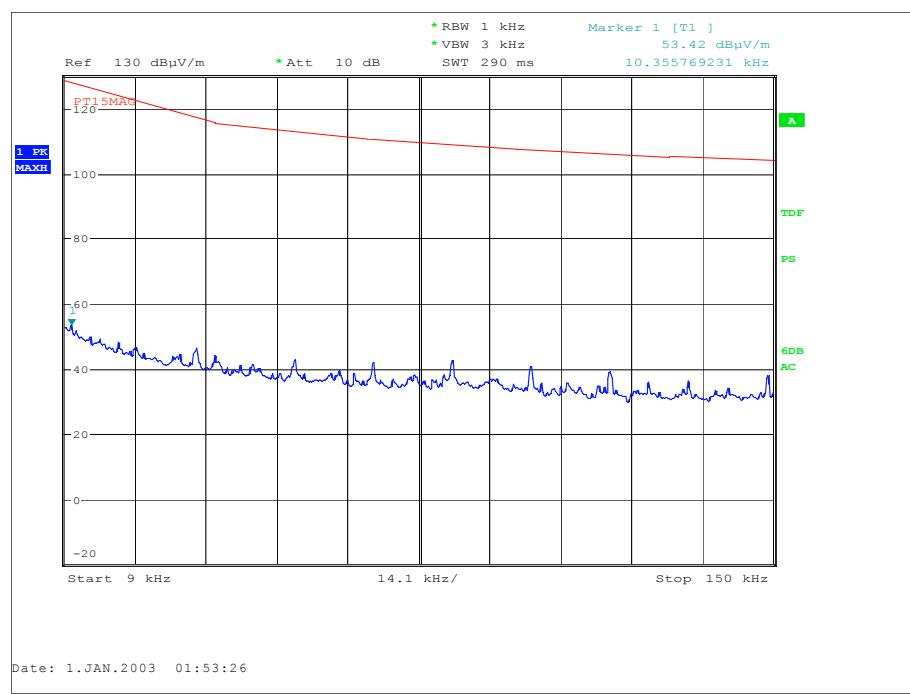


Figure 7 - 9 kHz to 150 kHz - Z Orientation

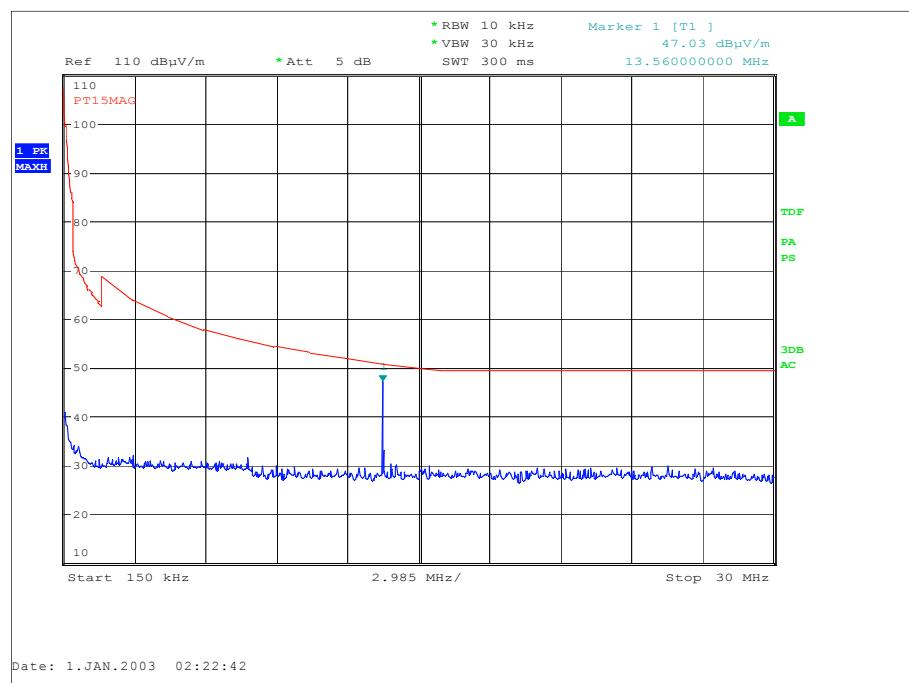


Figure 8 - 150 kHz to 30 MHz - Z Orientation

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle(Deg)	Height(m)	Polarity
73.875	19.2	40.0	-20.8	131	1.00	Vertical
272.214	34.1	46.0	-11.9	286	1.65	Horizontal
274.674	36.3	46.0	-9.7	80	1.00	Horizontal
277.112	36.2	46.0	-9.8	115	1.00	Horizontal
277.120	30.2	46.0	-15.8	11	1.00	Vertical
282.080	36.0	46.0	-10.0	125	1.00	Horizontal
300.008	41.0	46.0	-5.0	271	1.00	Horizontal

Table 9 - Emissions Results – 30 MHz to 1 GHz – X Orientation

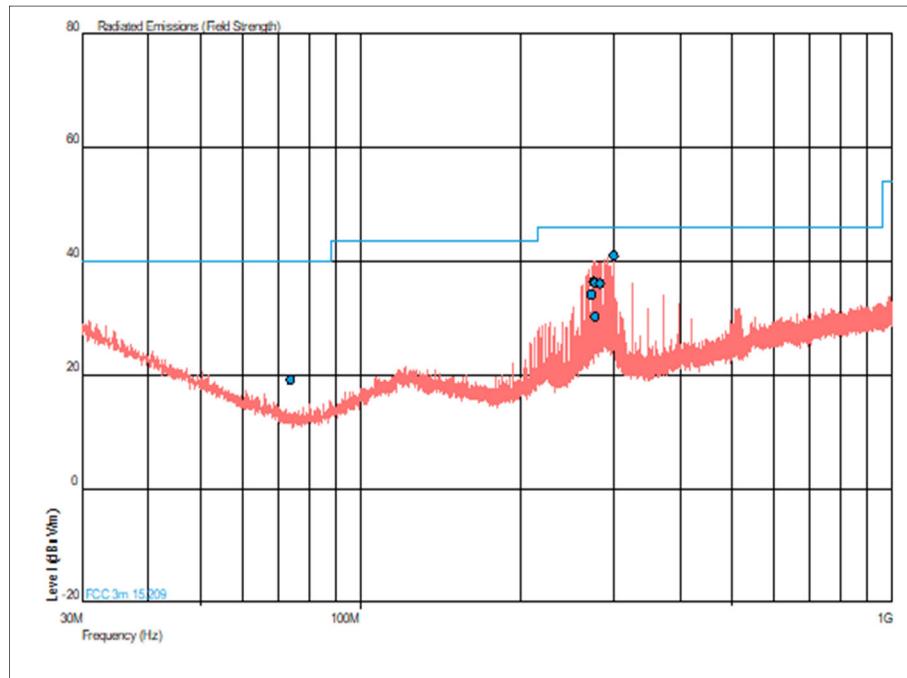


Figure 9 - 30 MHz to 1 GHz – X Orientation

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle(Deg)	Height(m)	Polarity
269.655	30.8	46.0	-15.2	213	1.00	Vertical
300.000	33.9	46.0	-12.1	81	1.00	Horizontal
300.000	37.4	46.0	-8.6	234	1.84	Vertical
372.014	34.9	46.0	-11.1	136	1.51	Vertical
504.690	33.9	46.0	-12.1	202	1.00	Vertical
517.006	35.9	46.0	-10.1	163	1.00	Vertical

Table 10 - Emissions Results – 30 MHz to 1 GHz – Y Orientation

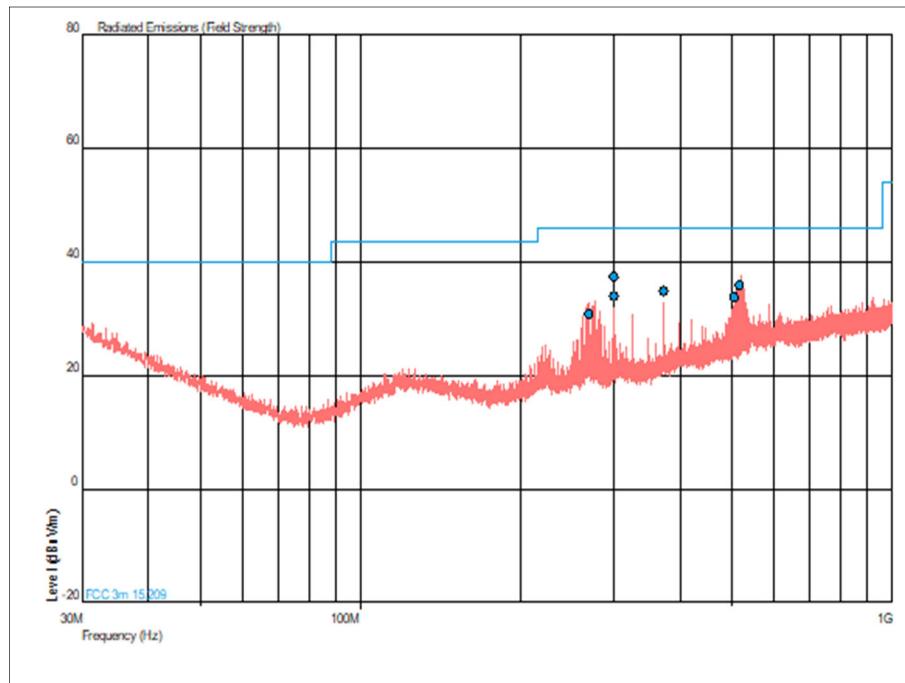


Figure 10 - 30 MHz to 1 GHz – Y Orientation

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle(Deg)	Height(m)	Polarity
274.592	36.3	46.0	-9.7	20	1.00	Horizontal
277.044	37.7	46.0	-8.3	195	1.00	Horizontal
279.470	35.8	46.0	-10.2	164	1.00	Horizontal
281.987	36.7	46.0	-9.3	15	1.00	Horizontal
284.542	34.0	46.0	-12.0	212	1.00	Horizontal
286.934	36.8	46.0	-9.2	164	1.00	Horizontal
300.004	42.0	46.0	-4.0	198	1.00	Horizontal

Table 11 - Emissions Results – 30 MHz to 1 GHz - Z Orientation

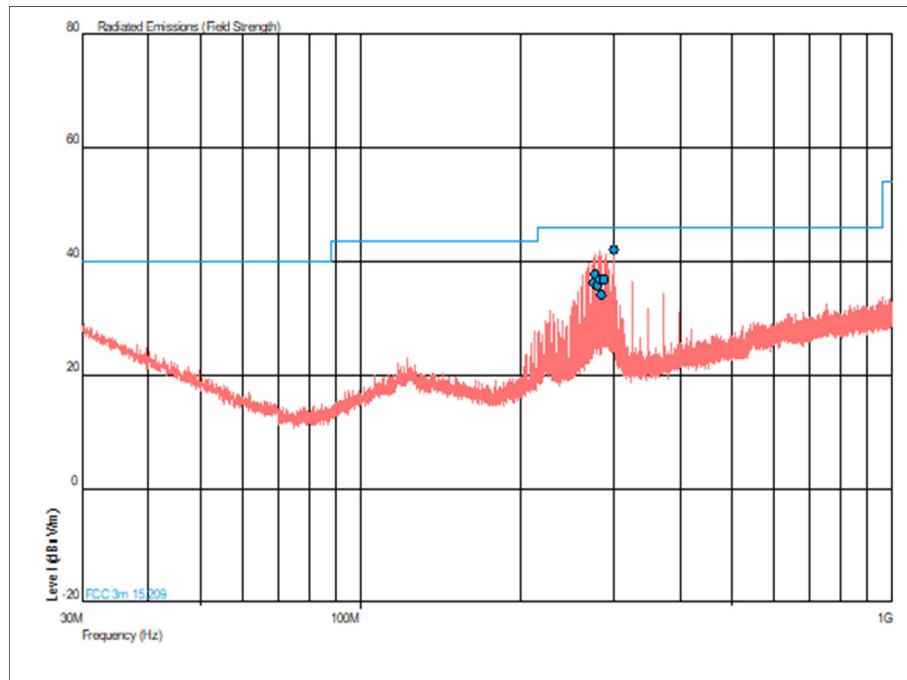


Figure 11 - 30 MHz to 1 GHz – Z Orientation



FCC 47 CFR Part 15, Limit Clause 15.225 (a)(b)(c)(d)

- (a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 m.
- (b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 m.
- (c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 m.
- (d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

FCC 47 CFR Part 15, Limit Clause 15.209

Frequency (MHz)	Field Strength (μ V/m)	Measurement Distance (m)
0.009 to 0.490	2400/F (kHz)	300
0.490 to 1.705	24000/F (kHz)	30
1705 to 30	30	30
30 to 88	100**	3
88 to 216	150**	3
216 to 960	200**	3
Above 960	500	5

Table 12 - FCC Radiated Emission Limit

Industry Canada RSS-210, Limit Clause B.6

The field strength of any emission shall not exceed the following limits:

- (a) 15.848 mW/m (84 dB μ V/m) at 30 m, within the band 13.553 – 13.567 MHz.
- (b) 334 μ V/m (50.5 dB μ V/m) at 30 m, withing the bands 13.410 – 13.553 MHz and 13.567 – 13.710 MHz.
- (c) 106 μ V/m (40.5 dB μ V/m) at 30 m, within the bands 13.110 – 13.410 MHz and 13.710 – 14.010 MHz.
- (d) RSS-GEN general field strength limits for frequencies outside the band 13.110 – 14.010 MHz.

Industry Canada RSS-GEN, Limit Clause

Frequency	Magnetic Field Strength (H-Field) (μ A/m)	Measurement Distance (m)
9 - 490 kHz	6.37/F (F in kHz)	300
490 - 1,705 kHz	63.7/F (F in kHz)	30
1,705 kHz - 30 MHz	0.08	30

Table 13 - Industry Canada Radiated Emission Limit - Less than 30 MHz

Frequency (MHz)	Field Strength (μ V/m at 3 m)
30 - 88	100
88 - 216	150
216 - 960	200
> 960	500

Table 14 - Industry Canada Radiated Emission Limit - 30 MHz to 1 GHz

2.2.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 7.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Turntable Controller	Heinrich Diesel	HD 050	280	-	TU
Antenna with permanent attenuator (Bilog)	Schaffner	CBL6143	287	24	15-May-2020
Antenna (Active Loop, 9kHz-30MHz)	Rohde & Schwarz	HFH2-Z2	333	24	09-Dec-2018
Antenna (Dish/Tripod/Adaptor, 1GHz-18GHz)	Rohde & Schwarz	AC-008	334	-	TU
Screened Room (7)	Siemens	S M	1547	-	21-Jan-2021
Hygrometer	Rotronic	A1	2138	12	21-Feb-2019
Comb Generator	Schaffner	RSG1000	3034	-	TU
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Nov-2018
Tilt Antenna Mast	Maturo GmbH	TAM 4.0-P	3916	-	TU
Mast Controller	Maturo GmbH	NCD	3917	-	TU
N to N cable, 4m	Rhophase	2303-002-TUVS	4849	12	18-Dec-2018
N to N cable, 4m	Rhophase	2303-002-TUVS	4850	12	18-Dec-2018
Cable (26.5GHz)	Rosenberger	LU7-133-5000	5019	-	O/P Mon

Table 15

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment

2.3 Frequency Tolerance Under Temperature Variations

2.3.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.225 (e),
Industry Canada RSS-210, Clause B.6
Industry Canada RSS-GEN, Clause 6.11.

2.3.2 Equipment Under Test and Modification State

CE4 Tagger, S/N: Not Serialised (75943624- TSR0005) - Modification State 0

2.3.3 Date of Test

17-September-2018 to 18-September-2018

2.3.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 6.8 and RSS-GEN, clause 6.11.

2.3.5 Environmental Conditions

Ambient Temperature 22.4 °C
Relative Humidity 66.5 %

2.3.6 Test Results

Tagger Version 4 - 13.56 MHz TX

Temperature	Voltage	Measured Frequency (MHz)	Frequency Deviation (%)	Frequency Error (ppm)
-20.0 °C	3.7 V DC	13.560200	0.001474904	14.74926254
-10.0 °C	3.7 V DC	13.560205	0.001511777	15.11799410
0.0 °C	3.7 V DC	13.560215	0.001585521	15.85545723
+10.0 °C	3.7 V DC	13.560215	0.001585521	15.85545723
+20.0 °C	3.7 V DC	13.560200	0.001474904	14.74926254
+30.0 °C	3.7 V DC	13.560175	0.001290544	12.90560472
+40.0 °C	3.7 V DC	13.560155	0.001143055	11.43067847
+50.0 °C	3.7 V DC	13.560140	0.001032438	10.32448378

Table 16 - Frequency Tolerance Under Temperature Variation

Temperature	Voltage	Measured Frequency (MHz)	Frequency Deviation (%)	Frequency Error (ppm)
+20.0 °C	3.14 V DC	13.560190	0.00140116	14.01179941
+20.0 °C	3.70 V DC	13.560190	0.00140116	14.01179941
+20.0 °C	4.26 V DC	13.560190	0.00140116	14.01179941

Table 17 - Frequency Tolerance Under Voltage Variation

FCC 47 CFR Part 15, Limit Clause 15.225 (e)

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency.

Industry Canada RSS-210, Limit Clause B.6

Carrier frequency stability shall be maintained to $\pm 0.01\%$ (± 100 ppm)

2.3.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	20-Oct-2018
Hygrometer	Rotronic	A1	1388	12	20-Jun-2019
Multimeter	Fluke	79 Series II	3057	12	20-Jul-2019
Thermocouple Thermometer	Fluke	51	3172	12	29-Nov-2018
Loop Antenna	ETS-Lindgren	7604	4134	24	27-Oct-2018
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	20-Oct-2018
Climatic Chamber	Aralab	FitoTerm 300E45	4823	-	O/P Mon
Quad Power Supply	Rohde & Schwarz	HMP4040	4954	-	O/P Mon
EXA	Keysight Technologies	N9010B	4969	12	21-Dec-2018

Table 18

O/P Mon – Output Monitored using calibrated equipment

3 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Test Name	Measurement Uncertainty
Frequency Tolerance Under Temperature Variations	± 48.35 Hz
Field Strength of any Emission	9 kHz to 30 MHz: ± 3.4 dB 30 MHz to 1 GHz: ± 5.2 dB
20 dB Bandwidth	± 19.50 Hz.

Table 19