Report on the FCC and IC Testing of:

DETNET SOUTH AFRICA (PTY) LTD
Handheld Electronic Detonator Tester, Model: CE4 Tagger
Belkin Wireless Charging Pad, Model: F7U050
Switching Adapter, Model: ADS-26FSG-12 15023EPB

In accordance with FCC 47 CFR Part 18, Industry Canada RSS-216 and Industry Canada RSS-GEN

Product Service

Choose certainty.
Add value.

Prepared for: DETNET SOUTH AFRICA (PTY) LTD
Block 1B, Founders Hill Office Park
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1645, SOUTH AFRICA

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

COMMERCIAL-IN-CONFIDENCE

Document Number: 75943624-06 | Issue: 02

SIGNATURE			
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 18 and Industry Canada RSS-216 and Industry Canada RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

SIGNATURE			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Graeme Lawler	Senior 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 18: 2017, Industry Canada RSS-216: Issue 2 (2016) and Industry Canada RSS-GEN: Issue 5 (2018).

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ACCREDITATION

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Product Service

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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	20 December 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)	Handheld Electronic Detonator Tester, CE4 Tagger Belkin Wireless Charging Pad, F7U050, Switching Adapter, ADS-26FSG-12 15023EPB
Serial Number(s)	Handheld Electronic Detonator Tester, Not Serialised (75943624- TSR0005) Belkin Wireless Charging Pad, 26S10EH58A9725 Switching Adapter, RF7K30S5CTJCIS
Hardware Version(s)	V4
Software Version(s)	36230B
Number of Samples Tested	1 plus ancillaries
Test Specification/Issue/Date	FCC 47 CFR Part 18: 2017 Industry Canada RSS-216: Issue 2 (2016) Industry Canada RSS-GEN: Issue 5 (2018)
Order Number Date	4500348610 23-August-2018
Date of Receipt of EUT	18-November-2018
Start of Test	18-November-2018
Finish of Test	19-November-2018
Name of Engineer(s)	Graeme Lawler
Related Document(s)	ANSI C63.10 (2013) ICES-001 Issue 4 (2006) CISPR 11 Fourth Edition (inc Amend.1 IEC:2004) ANSI C63.4 (2014)

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 18, Industry Canada RSS-216 and Industry Canada RSS-GEN. is shown below.

Section	Specification Clause			Test Description	Result	Comments/Base Standard
	Part 18	RSS-216	RSS-GEN			
Configuration and Mode: Tagger Version 4 - Wireless Charging						
2.1	18.305(b)	6.2.2.2	6.4, 6.5 and 6.13	Field Strength of Emissions	Pass	ANSI C63.10 (2013) ICES-001 Issue 4 (2006) CISPR 11 Fourth Edition (inc Amend.1 IEC:2004)

Table 2

Product Service

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.

EQUIPMENT SUPPLIED	
WPT Source	☐
WPT Client	☒
WPT System (Client and source designed to work exclusively together)	☐

WPT SOURCE				
☒	Type 1	No intelligent communication transmitted wirelessly		
☐	Type 2	Transmission is modulated including load modulation techniques where: 1. Fundamental is < 490 kHz and ; 2. All emissions are > 40 dB below RSS-GEN field strength limits.		
☐	Type 3	Neither type 1 or type 2, but uses some form of modulation to transmit intelligent communication.		
Is the device intended for us in any of the following?:				
☐	High power WPT device (e.g charging electric vehicles)			
☐	WPT over a distance of > 10 cm			
☐	Medical Device			
☐	WPT source operating at a frequency > 400 MHz			
Does the device support power management transfer?			No	
Can the source and client operate at different separation distances?			No	
Minimum Distance:	0 mm	Maximum Distance	5 mm	
Does the EUT contain any other wireless modules (excluding WPT device)?			Yes	
Can the device transmit secondary frequencies?			No Bluetooth	
State Frequencies:	2400 to 2483 MHz			

WPT SOURCE DESIGN	
☒	Single fixed power transfer zone – single client
☐	Multiple fixed power transfer zone – single client
☐	Multiple non-fixed power transfer zone – single client
☐	Multiple power transfer zone – multiples clients

Product Service

POWER SOURCE			
☒	AC mains	State voltage 220	
AC supply frequency	50	(Hz)	
220	VAC		
100mA	Max Current		
50	Hz		
☒	Single phase	☐	Three phase
And / Or			
☐	External DC supply		
	Nominal voltage	V	Max Current A
	Extreme upper voltage	V	
	Extreme lower voltage	V	
Battery			
☐	Nickel Cadmium	☐	Lead acid (Vehicle regulated)
☐	Alkaline	☐	Leclanche
☐	Lithium	☒	Other Details: LiPo
3.7	Volts nominal.		
End point voltage as quoted by equipment manufacturer		3.3	V

FREQUENCY INFORMATION			
Frequency Range	0.08 to 0.2	MHz	
Channel Spacing (where applicable)			
Receiver Frequency Range (if different)	to	MHz	
Channel Spacing (if different)			
Test Frequencies*	Bottom	MHz	Channel Number (if applicable)
	Middle	MHz	Channel Number (if applicable)
	Top	MHz	Channel Number (if applicable)
Intermediate Frequencies		MHz	
Highest Internally Generated Frequency:		MHz	

POWER CHARACTERISTICS				
Maximum TX power	10	W		
Minimum TX power		W (if variable)		
Is transmitter intended for:				
Continuous duty			☒ Yes	☐ No
Intermittent duty			☐ Yes	☒ No
If intermittent state DUTY CYCLE				
Transmitter ON	seconds			
Transmitter OFF	seconds			

Product Service

ANTENNA CHARACTERISTICS					
☐	Antenna connector			State impedance	Ohm
☐	Temporary antenna connector			State impedance	Ohm
☐	Integral antenna	Type		State impedance	dBi
☒	External antenna	Type	Charging Coil	State impedance	dBi

MODULATION CHARACTERISTICS			
☒	Amplitude	☐	Frequency
☐	Phase	☐	Other (please provide details):
Can the transmitter operate un-modulated?		☐ Yes	☒ No

CLASS OF EMISSION USED
ITU designation or Class of Emission:
1
(if applicable) 2
(if applicable) 3
If more than three classes of emission, list separately:

BATTERY POWER SUPPLY			
Model name/number	Li-ION	Identification/Part number	KJ0521400157 LP6055900-PCM-NTC-LC
Manufacturer	EEMB	Country of Origin	China/Hong Kong

ANCILLARIES (If applicable)	
Model name/number	Identification/Part number
Manufacturer	Country of Origin

EXTREME CONDITIONS					
Extreme test voltages (Max)	4.2	V	Extreme test voltages (Mix)		V
Nominal DC Voltage	3.7	V	DC Maximum Current		A
Maximum temperature	60	°C	Minimum temperature	-30	°C

I hereby declare that the information supplied is correct and complete.

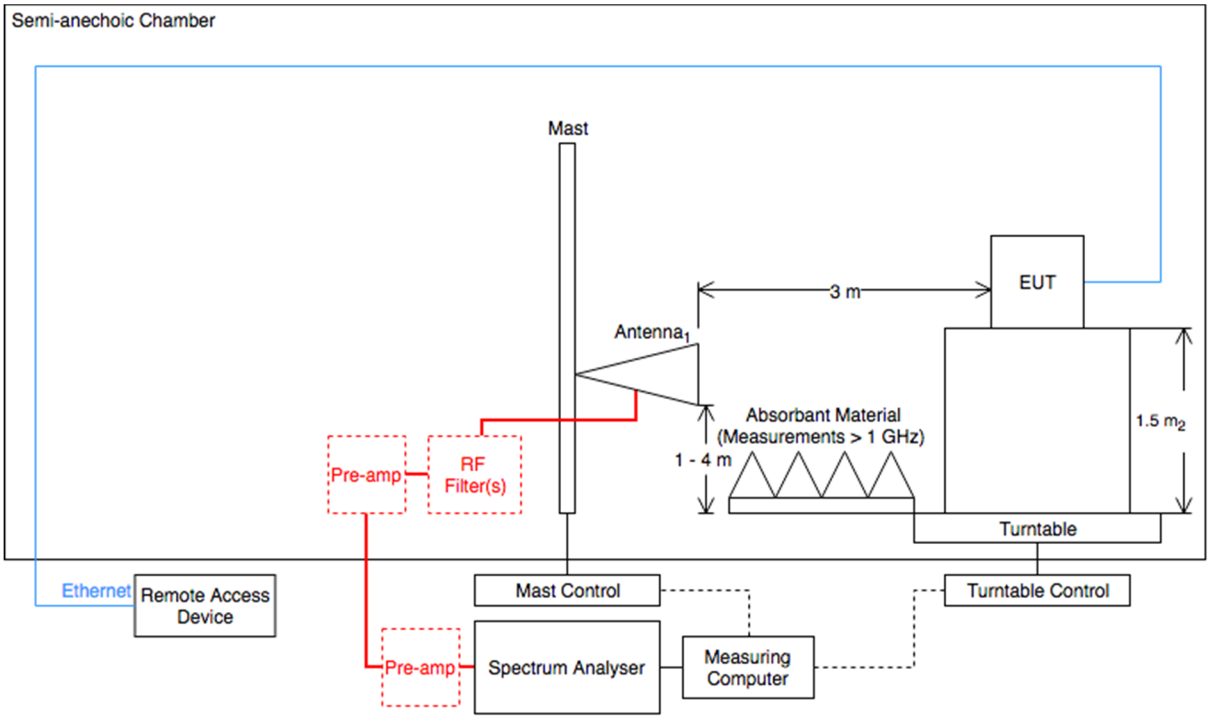
Name: H van der Walt Position held: Quality and Compliance Manager
Date: 2018-09-12

1.5 Product Information

1.5.1 Technical Description

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

1.5.2 Test Setup Diagram(s)



1 Antenna is boresighted for measurements < 1 GHz.
2 Height from the EUT to ground is 0.8 m for measurements < 1 GHz.

Figure 1 - Radiated Spurious Emissions

NOTE: For magnetic field strength measurements (150 kHz to 30 MHz) the antenna and mast was replaced with a magnetic-loop antenna at a height of 1.5m situated on a tri-pod at a measurement distance of 3m. A photograph of this setup can be found in section 3.

1.5.3 EUT Configuration and Rationale for Radiated Spurious Emissions

The EUT was placed on the non-conducting platform in a manner typical of a normal installation.

There were no interconnecting ports or cabling on the EUT. The EUT was placed on a Belkin Qi-enabled Wireless Charging pad, model number: F7U050myBLK.

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
Handheld Electronic Detonator Tester, Serial Number: Not Serialised (75943624- TSR0005)			
0	As supplied by the customer	Not Applicable	Not Applicable
Belkin Wireless Charging Pad, Serial Number: 26S10EH58A9725			
0	As supplied by the customer	Not Applicable	Not Applicable
Switching Adapter, Serial Number: RF7K30S5CTJCIS			
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: Wireless Charging		
Field Strength of Emissions	Graeme Lawler	UKAS

Table 4

Office Address:

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

2 Test Details

2.1 Field Strength of Emissions

2.1.1 Specification Reference

FCC 47 CFR Part 18, Clause 18.305(b)
Industry Canada RSS-216, Clause 6.2.2.2
Industry Canada RSS-GEN, Clause 6.4, 6.5 and 6.13

2.1.2 Equipment Under Test and Modification State

Handheld Electronic Detonator Tester, S/N: Not Serialised (75943624- TSR0005) - Modification State 0
Belkin Wireless Charging Pad, F7U050, S/N: 26S10EH58A9725 - Modification State 0
Switching Adapter ADS-26FSG-12 15023EPB, S/N: N/A - Modification State 0,

2.1.3 Date of Test

18-November-2018 to 19-November-2018

2.1.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 6.3 and 6.4 and Industry Canada RSS-GEN, clause 6.13.

Testing was performed with the EUT in its typical orientation and with the internal battery completely discharged.

FCC

FCC measurements were performed at a measurement distance of 3 meters. The limit line was extrapolated to either 300 or 30 meters in accordance with ANSI C63.10-2013 clause 6.4.4.2 equation 4 if both measurement and limit distance are less than the wavelength / 2π.
Where the measurement distance is less than wavelength / 2π and the limit distance greater, then the limit line was extrapolated in accordance with ANSI C63.10-2013 clause 6.4.4.2 equation 2.

Equation 4 example calculation at 9kHz limit = 15uV/m @ 300m = 20log(15) dBuV/m = 23.52dBuV/m @ 300m.

$FS_{limit} = FS_{max} – (40Log(d_{limit}/d_{measure}))$
$FS_{max} = FS_{limit} + (40Log(d_{limit}/d_{measure}))$
$FS_{max} = 23.52 + (40Log(300/3))$
$FS_{max} = 103.52$ dBuV/m

Equation 2 example calculation at 169kHz limit = 15uV/m @ 300m = 20log(15) dBuV/m = 23.52dBuV/m @ 300m.

$FS_{limit} = FS_{max} – (40Log(d_{near\ field}/d_{measure})) - (20Log(d_{limit}/d_{near\ field}))$
$FS_{max} = FS_{limit} + (40Log(d_{near\ field}/d_{measure})) + (20Log(d_{limit}/d_{near\ field}))$
$FS_{max} = 23.52 +(40Log(282.52/3)) + (20Log(300/282.52))$
$FS_{max} = 102.99$ dBuV/m

The extrapolation factor is $FS_{max} - FS_{limit}$

Where

FS_{max} is the extrapolated limit at 3m in terms of dBuV/m

FS_{limit} is the field strength limit at the specification distance in terms of dBuV/m
$d_{near\ field}$ is the wavelength / 2π
$d_{measure}$ is the measurement distance
d_{limit} is the specification limit distance

RSS

Measurements below 30MHz were performed at a distance of 3 meters in accordance with table 3b of CISPR 11. These are the most stringent limits.

Measurements above 30 MHz were performed at a distance of 3 meters and extrapolated to 10 meters. A 30 dBuV/m limit at 10 meters has been applied from 30 MHz to 230 MHz for pre-scan purposes. Any emissions detected with the ranges 80.872 MHz to 81.848 MHz and 134.786 MHz to 136.414 MHz had the specification limit applied.

2.1.5 Environmental Conditions

Ambient Temperature	17.3 °C
Relative Humidity	42.3 %

2.1.6 Test Results

Wireless Charging

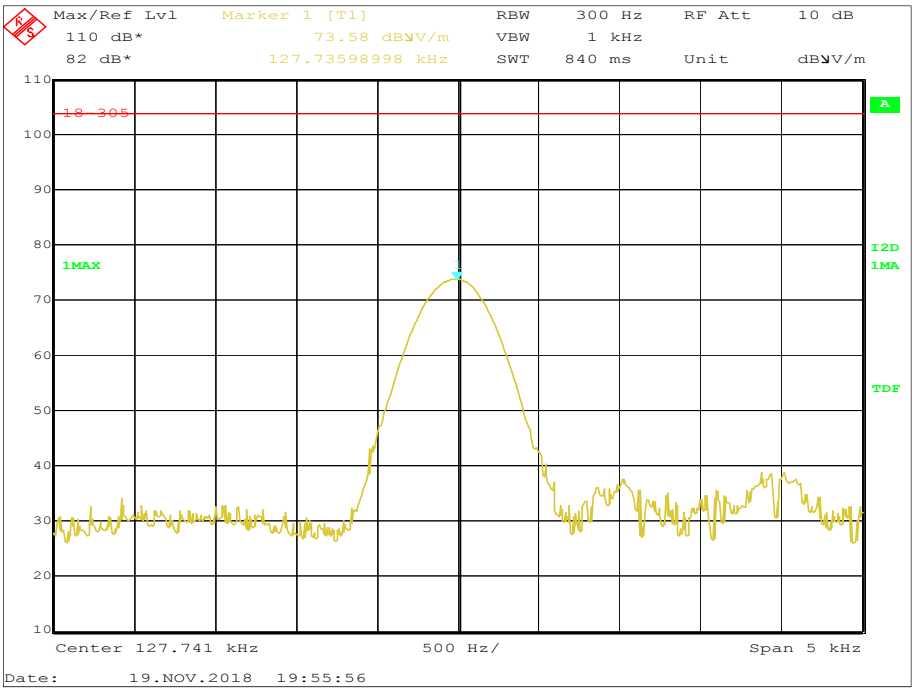


Figure 2 - 127.736 kHz (FCC)

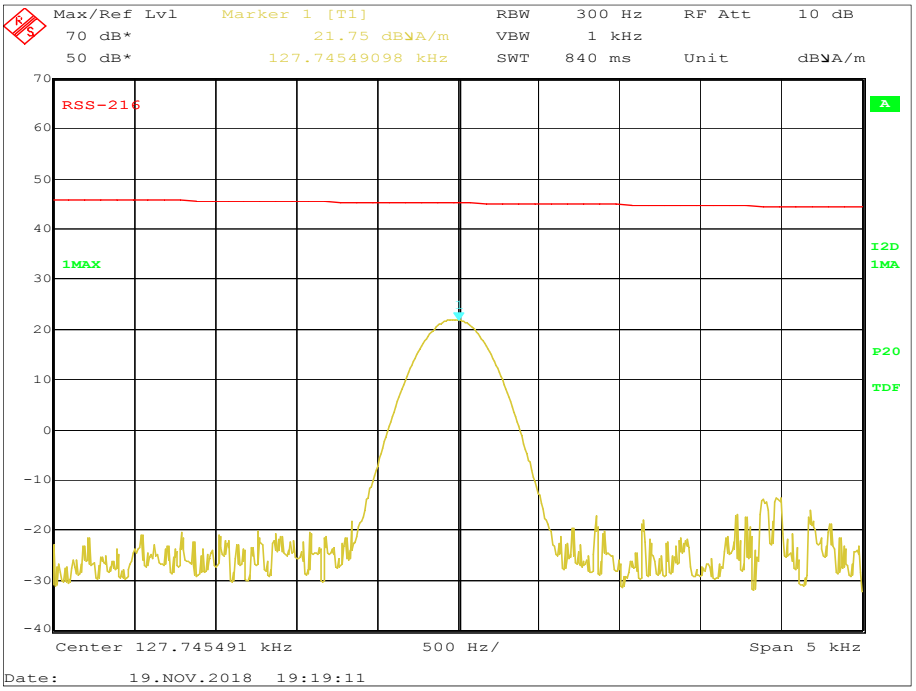


Figure 3 - 127.745 kHz (IC)

Frequency (MHz)	QP Level at 3m (dBµV/m)	QP Limit at 3m (dBµV/m)	Angle	Height (m)	Polarity
127.736	72.98	103.52	077	1.5	Face On

Table 5 - Field Strength of Emissions, 9 kHz to 30 MHz (FCC)

Frequency (MHz)	QP Level at 3m (dBµV/m)	QP Limit at 3m (dBµV/m)	Angle	Height (m)	Polarity
127.745	20.48	45.02	241	1.5	Face On

Table 6 - Field Strength of Emissions, 9 kHz to 30 MHz (IC)

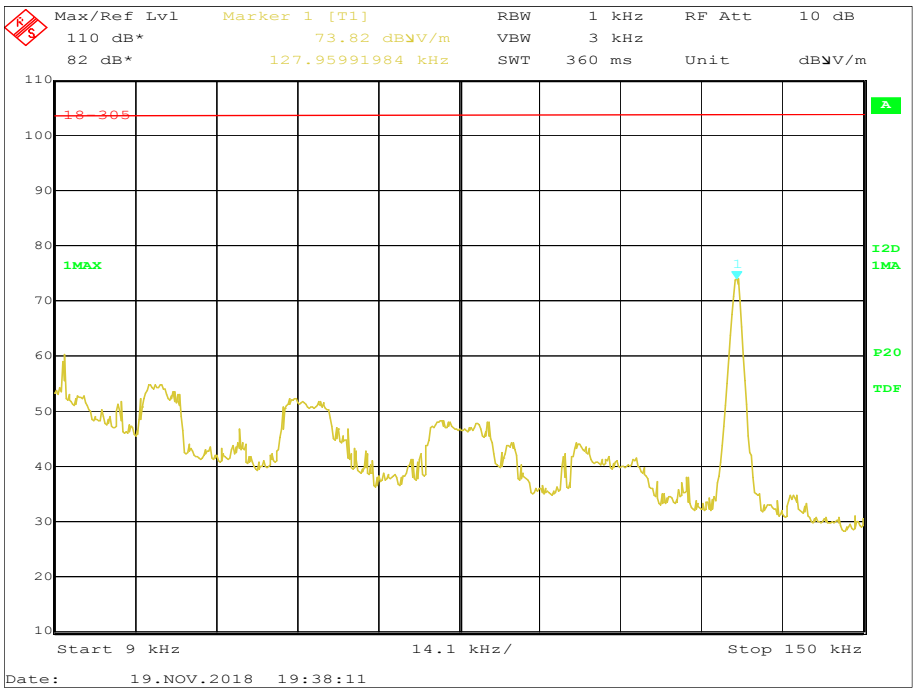


Figure 4 - 9 kHz to 150 kHz (FCC)

Remark: The above measurement was performed at 3m, the limit was extrapolated to the distance specified for the limit. See section 2.1.4 for details.

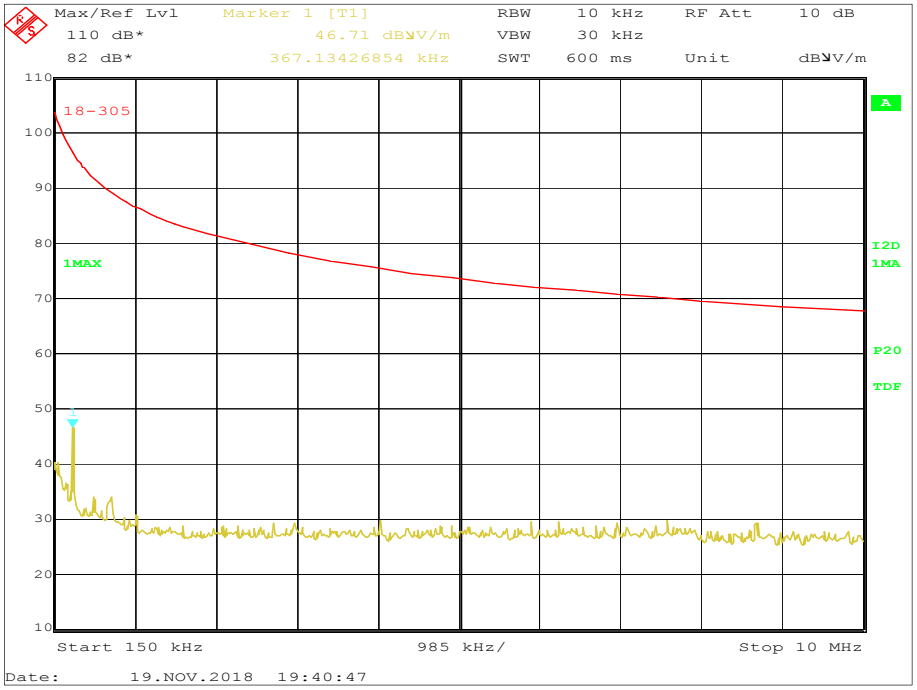


Figure 5 - 150 kHz to 10 MHz (FCC)

Remark: The above measurement was performed at 3m, the limit was extrapolated to the distance specified for the limit. See section 2.1.4 for details.

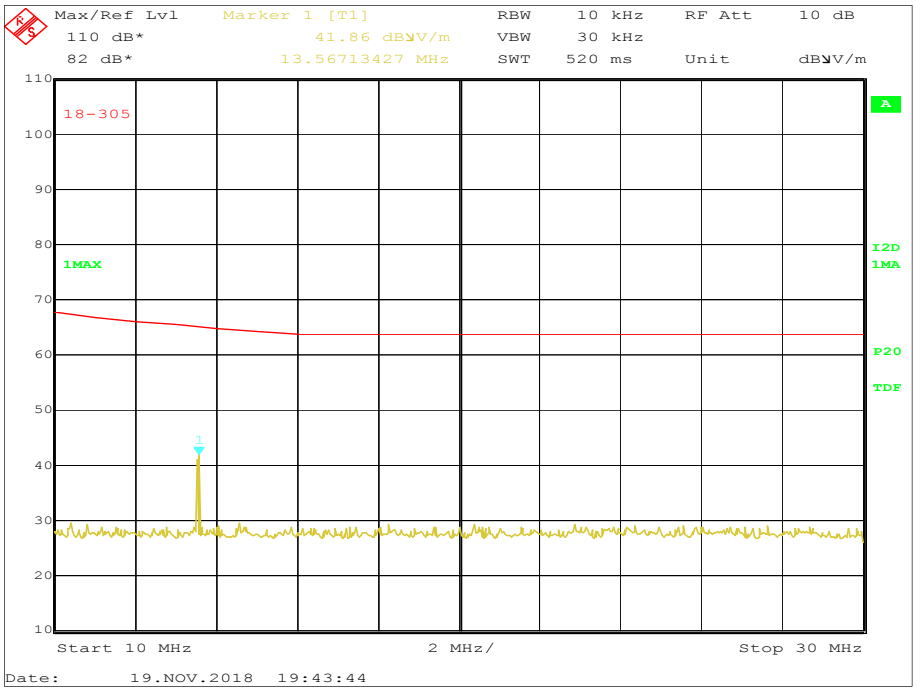


Figure 6 - 10 MHz to 30 MHz (FCC)

Remark: The above measurement was performed at 3m, the limit was extrapolated to the distance specified for the limit. See section 2.1.4 for details.

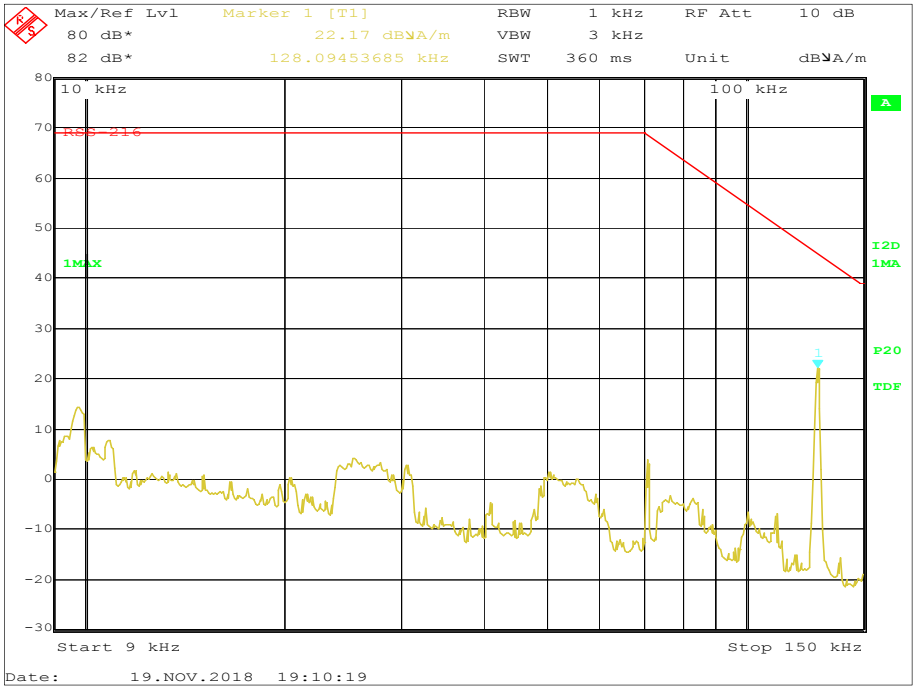


Figure 7 - 9 kHz to 150 kHz (IC)

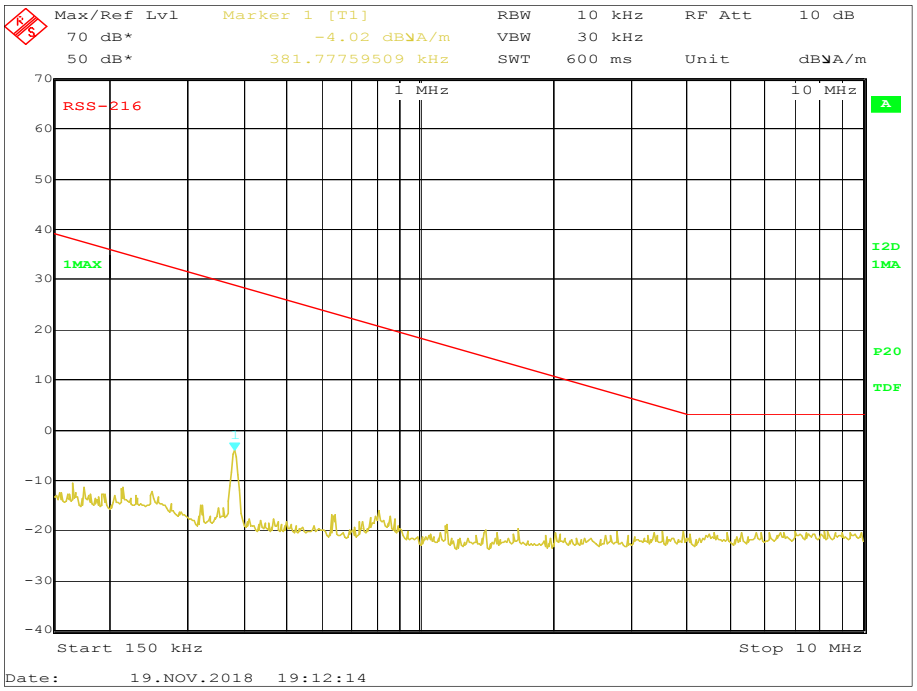


Figure 8 - 150 kHz to 10 MHz (IC)

Remark: The above measurement was performed at 3m despite the limit being stated at 10m, trace data was not corrected however this was considered an over-test and compliance is demonstrated.

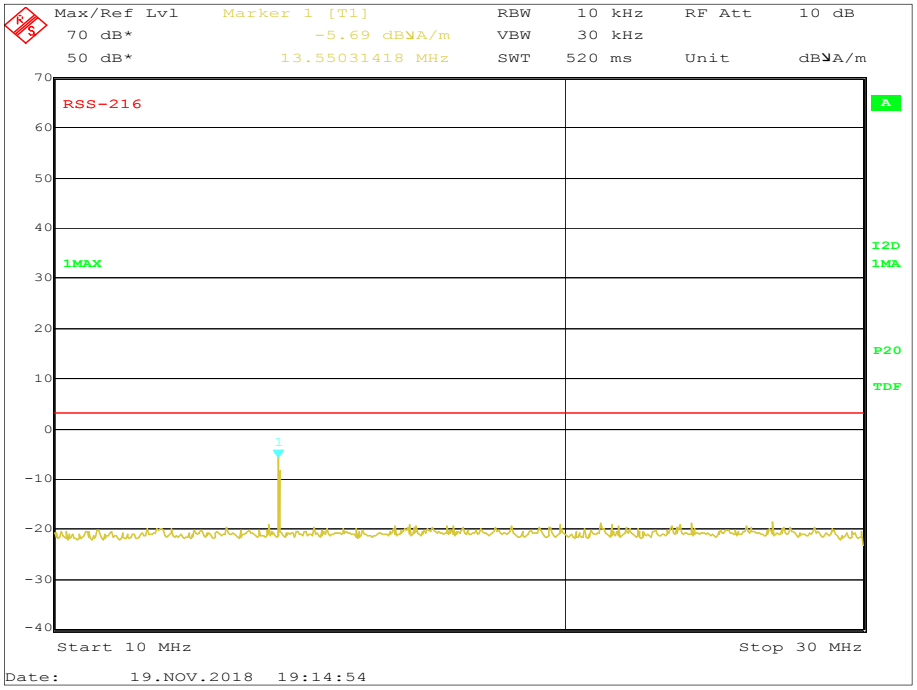


Figure 9 - 10 MHz to 30 MHz (IC)

Remark: The above measurement was performed at 3m despite the limit being stated at 10m, trace data was not corrected however this was considered an over-test and compliance is demonstrated.

Frequency (MHz)	QP Level at 10m (dBµV/m)	QP Level at 10m (µV/m)	QP Limit at 10m (dBµV/m)	QP Limit at 10m (µV/m)	Angle	Height (m)	Polarity
36.108	21.5	11.89	30.0	31.62	360	1.50	Vertical
40.685	20.6	10.72	30.0	31.62	112	1.50	Vertical
220.065	23.1	14.29	30.0	31.62	238	1.50	Vertical
272.015	30.4	33.11	37.0	70.79	0	1.50	Horizontal
279.425	30.6	33.88	37.0	70.79	172	1.50	Horizontal
286.826	29.3	29.17	37.0	70.79	8	1.50	Horizontal
299.991	29.3	29.17	37.0	70.79	339	1.50	Horizontal

Table 7 - Field Strength of Emissions, 30 MHz to 1 GHz (IC)

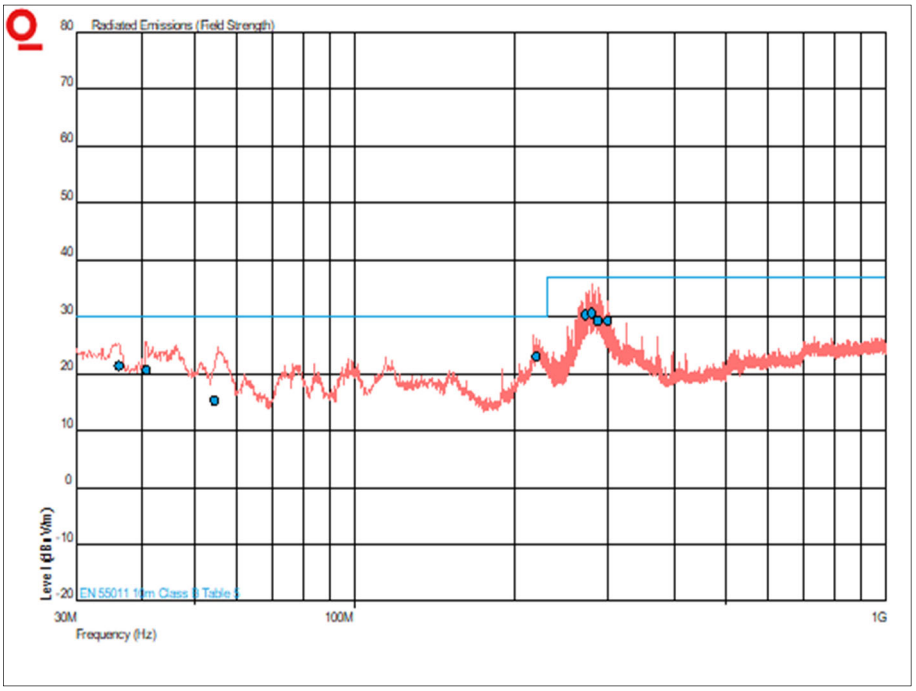


Figure 10 - 30 MHz to 1 GHz (IC)

Remarks:

The limit line on the above plots shows the most stringent limit between 30 MHz and 230 MHz of 30 dBµV/m. Emissions were measured that had the least amount of margin between to the applicable limit.

The measurement was performed at a distance of 3m and the trace data was corrected by 20*LOG(10/3).

FCC 47 CFR Part 18, Limit Clause 18.305 (b)

Equipment	Operating Frequency	RF Power generated by equipment (Watts)	Field Strength Limit (µV/m)	Distance (Meters)
Any type unless otherwise specified (miscellaneous).	Any ISM frequency	Below 500	25	300
		500 or more	25 x $\sqrt{P/500}$	300
	Any non-ISM frequency	Below 500	15	300
		500 or more	15 x $\sqrt{P/500}$	300

Table 8 - Limit Table

Industry Canada RSS-216, Limit Clause 6.2.2.2, ICES-001, Limit Clause 7.1.1 and CAN/CSA-CEI/IEC CISPR 11, Clause 5.2 - Table 3b

Table 15 limit was used for measurements above 150 kHz but no limit is specified from 9 kHz to 150 kHz., it was therefore determined that the limits in table 14 should be applied below 150 kHz.

Frequency Band (MHz)	Limits in dBµA/m at 3 m distance
0.009 to 0.070	69
0.070 to 0.1485	69 Decreasing linearly with logarithm of frequency to 39
0.1485 to 4.0	39 Decreasing linearly with logarithm of frequency to 3
4.0 to 30	3
NOTE The limits of Table 3b apply to induction cooking appliances for commercial use and those for domestic use with a diagonal diameter of more than 1.6 m. Measurements are performed at 3 m distance with a 0.6 m loop antenna as described in 5.5.2.1 of CISPR 16-1. The antenna shall be vertically installed, with the lower edge of the loop at 1 m height above the floor.	

Table 9 – Limit Table (<150 kHz) Magnetic Field Strength

Frequency Band (MHz)	Electric Field Measurement Distance 10m		Magnetic Field Measurement Distance 10 m Quasi-peak limits (dBµA/m)
	Quasi-Peak Limits (dBµ/V/m)	Average Limits (dBµ/V/m) [1]	
0.15 to 30	-	-	39 Decreasing linearly with logarithm of frequency to 3
30 to 80.872	30	25	-
80.872 to 81.848	50	45	-
81.848 to 134.786	30	25	-
134.786 to 136.414	50	45	-
136.141 to 230	30	25	-
230 to 1000	37	32	-
[1] The average limits apply to magnetron driven equipment only. If magnetron driven equipment exceeds the quasi-peak limit at certain frequencies, then the measurement shall be repeated at these frequencies with the average detector and the average limits specified in this table apply.			

Table 10 – Limit Table (>150 kHz) Electromagnetic Radiation Disturbance Limits for Group 2, Class B Equipment Measured on a Test Site

2.1.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Test Receiver	Rohde & Schwarz	ESIB26	242	12	04-Jul-2019
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 (5)	Rainford	Rainford	1545	36	23-Jan-2021
Screened Room (7)	Siemens	S M	1547	36	21-Jan-2021
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Hygromer	Rotronic	A1	2138	12	21-Feb-2019
Digital Multimeter	Iso-tech	IDM-101	2895	12	04-Oct-2019
Antenna with permanent attenuator (Bilog)	Chase	CBL6143	2904	24	08-Aug-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
Cable (Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4526	6	26-Apr-2019
Mast Controller	Maturo Gmbh	NCD	4810	-	TU
Tilt Antenna Mast	Maturo Gmbh	TAM 4.0-P	4811	-	TU
9m N type RF cable	Rosenberger	2303-0 9.0m PNm PNm	4827	6	04-Jan-2019
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
4dB Attenuator	Pasternack	PE7047-4	4935	12	28-Nov-2018
Hygrometer	Rotronic	HP21	4989	12	26-Apr-2019
Cable (26.5GHz)	Rosenberger	LU7-133-5000	5019	-	O/P Mon

Table 11

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment

3 Photographs

3.1 Test Setup Photographs

Figure 11 - Field Strength of Emissions - 150 kHz to 30 MHz

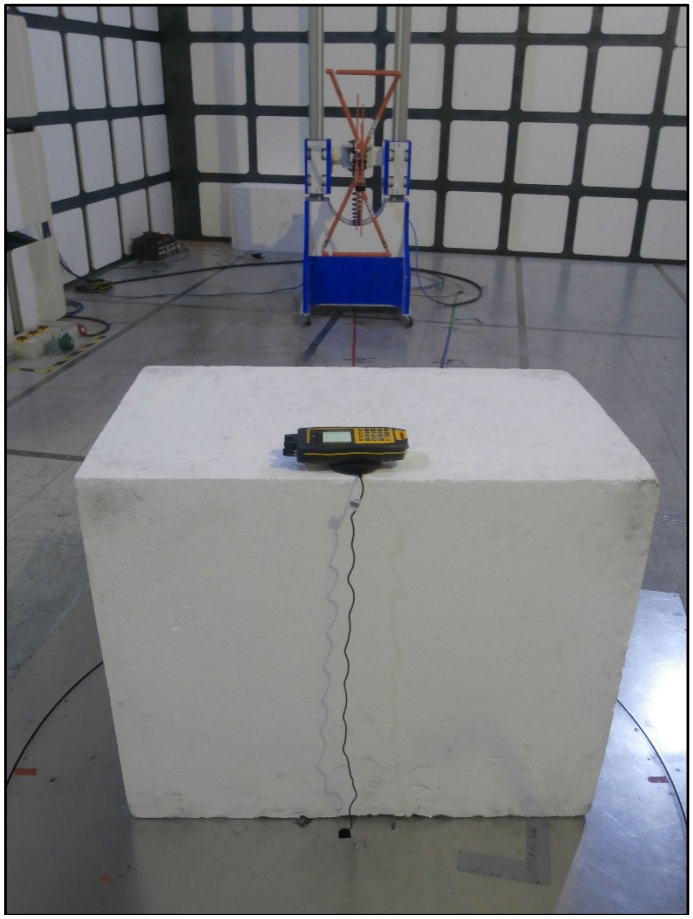


Figure 12 - Field Strength of Emissions - 30 MHz to 1 GHz

4 Measurement Uncertainty

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

Test Name	Measurement Uncertainty
Field Strength of Emissions	30 MHz to 1 GHz: ± 5.2 dB

Table 12