

Report on the FCC and IC Testing of:

DETNET SOUTH AFRICA (PTY) LTD

Free standing blast controller,

Model: DigiShot 300RF

Omni directional aerial, Model: 2.4 GHz Antenna Universal

Mains Charger, Model: GS25B18

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

Prepared for: DETNET SOUTH AFRICA (PTY) LTD
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FCC ID: 2ARNH-14521010

IC: 24476-14521010

COMMERCIAL-IN-CONFIDENCE

Document Number: 75943833-04 | Issue: 02

SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Simon Bennett	Chief Engineer	Authorised Signatory	09 April 2019

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD 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. 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		Testing	09 April 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 and Industry Canada RSS-210: Issue 09 (08-2016).



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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	18 December 2018
2	To amend the FCC and IC IDs and model name	09 April 2019

Table 1

1.2 Introduction

Applicant	DETNET SOUTH AFRICA (PTY) LTD
Manufacturer	DETNET SOUTH AFRICA (PTY) LTD
Model Number(s)	Free standing blast controller, DigiShot 300RF Omni directional aerial, 2.4 GHz Antenna Mains Charger, GS25B18
Serial Number(s)	Free standing blast controller, 073000218 Omni directional aerial, 1120001B8# Mains Charger,10100041D
Hardware Version(s)	Hardware rev.8 PCB rev.5
Software Version(s)	SVN 2772
Number of Samples Tested	1 plus ancillaries
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2017 Industry Canada RSS-210: Issue 09 (08-2016)
Order Number	4500351687
Date	18-September-2018
Date of Receipt of EUT	25-September-2018
Start of Test	21-November-2018
Finish of Test	27-November-2018
Name of Engineer(s)	Graeme Lawler
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, Industry Canada RSS-210 is shown below.

Section	Specification Clause		Test Description	Result	Comments/Base Standard
	Part 15C	RSS-210			
Configuration and Mode: 2.4 GHz DSSS Transmitter					
2.1	15.249 (a)	B.10 (b)	Authorised Band Edges	Pass	ANSI C63.10 (2013)
2.2	15.249 (a)	B.10 (a)	Field Strength of Fundamental	Pass	ANSI C63.10 (2013)
2.3	15.249 (a)(d)	B.10 (a)	Field Strength of Emissions	Pass	ANSI C63.10 (2013)

Table 2



1.4 Application Form

EQUIPMENT DESCRIPTION	
Model Name/Number	DigiShot 300RF
Part Number	1450000B8
Hardware Version	Hardware rev.8 PCB rev.5
Software Version	SVN 2772
FCC ID (if applicable)	2ARNH-14521010
Industry Canada ID (if applicable)	24476-14521010
Technical Description (Please provide a brief description of the intended use of the equipment)	Free standing electronic detonator blast controller. T he DigiShot 300RF uses the EDP-111 (RC2500 transceiver) in the 2.4 GHz frequency band. It uses DSSS technology over 83 channels and an output power of approximately 1 dBm. The units also include an AC PSU for charging and/or operation, a serial port to download / printing of the blast plan and an omni directional antenna.

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
RF	2400	1	2.1	2400 - 2483	GFSK / MSK		2400	2440.75	2483

UN-INTENTIONAL RADIATOR	
Highest frequency generated or used in the device or on which the device operates or tunes	2483 MHz
Lowest frequency generated or used in the device or on which the device operates or tunes	1200 Hz
Class A Digital Device (Use in commercial, industrial or business environment) ☒	
Class B Digital Device (Use in residential environment only) ☐	

Power Source			
AC	Single Phase	Three Phase	Nominal Voltage
External DC	Nominal Voltage		Maximum Current
Battery	Nominal Voltage		Battery Operating End Point Voltage
	12		11V
Can EUT transmit whilst being charged?			Yes ☐ No ☒

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



Ancillaries
Please list all ancillaries which will be used with the device.
Moulded Dipole Antenna with magnetc base

ANTENNA CHARACTERISTICS			
☒	Antenna connector	State impedance	50 Ohm
☐	Temporary antenna connector	State impedance	Ohm
☐	Integral antenna	Type	
☐	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:2018-10-01



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
Free standing blast controller, Serial Number: 073000218			
0	As supplied by the customer	Not Applicable	Not Applicable
Omni directional aerial, Serial Number: 1120001B8#			
0	As supplied by the customer	Not Applicable	Not Applicable
Mains Charger, Serial Number: 10100041D			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3

1.8 Test Location

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

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: 2.4 GHz DSSS Transmitter		
Authorised Band Edges	Graeme Lawler	UKAS
Field Strength of Fundamental	Graeme Lawler	UKAS
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 Authorised Band Edges

2.1.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.249 (a),
Industry Canada RSS-210, Clause B.10(b)

2.1.2 Equipment Under Test and Modification State

Free standing blast controller, S/N: 073000218 - Modification State 0
Omni directional aerial, S/N: 1120001B8# - Modification State 0
Mains Charger, S/N: 10100041D - Modification State 0

2.1.3 Date of Test

21-November-2018

2.1.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.3, 6.5 and 6.6.

2.1.5 Environmental Conditions

Ambient Temperature 17.9 °C
Relative Humidity 39.2 %

2.1.6 Test Results

2.4 GHz DSSS Transmitter

Frequency (MHz)	Measured Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBµV/m)
2401.75	2400.0	57.79	39.39
2483	2483.5	48.54	38.23

Table 5 - Authorised Band Edge Results

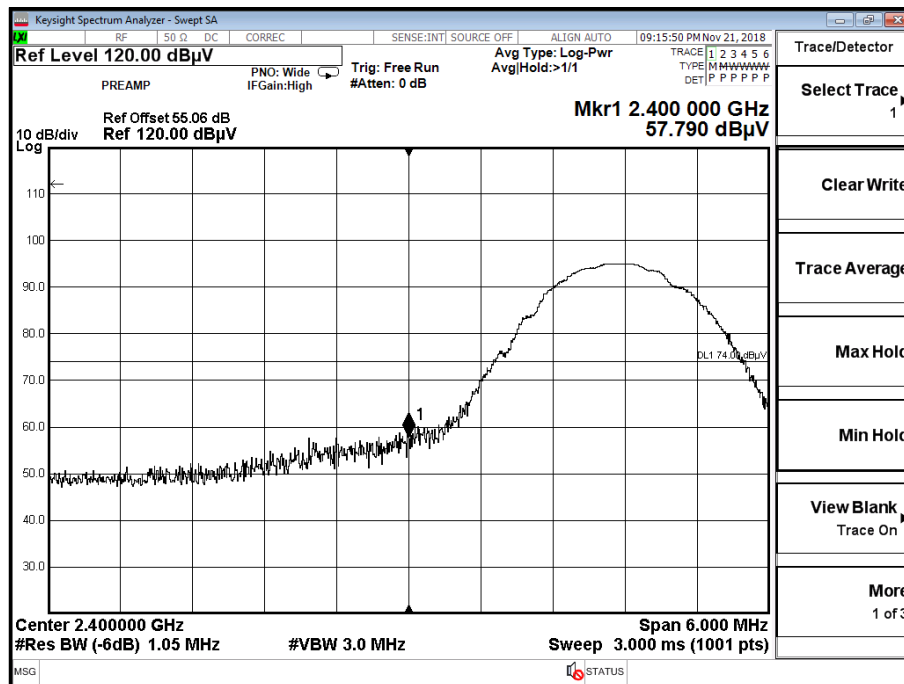


Figure 2 – 2401.75 MHz, Measured Frequency 2400.0 MHz, Peak

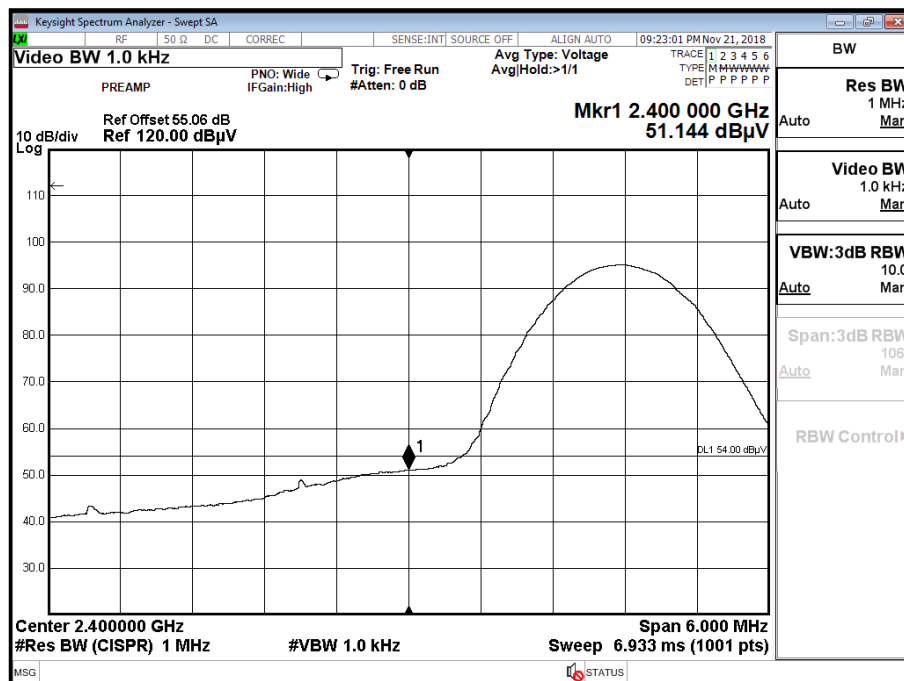


Figure 3 – 2401.75 MHz, Measured Frequency 2400.0 MHz, Average

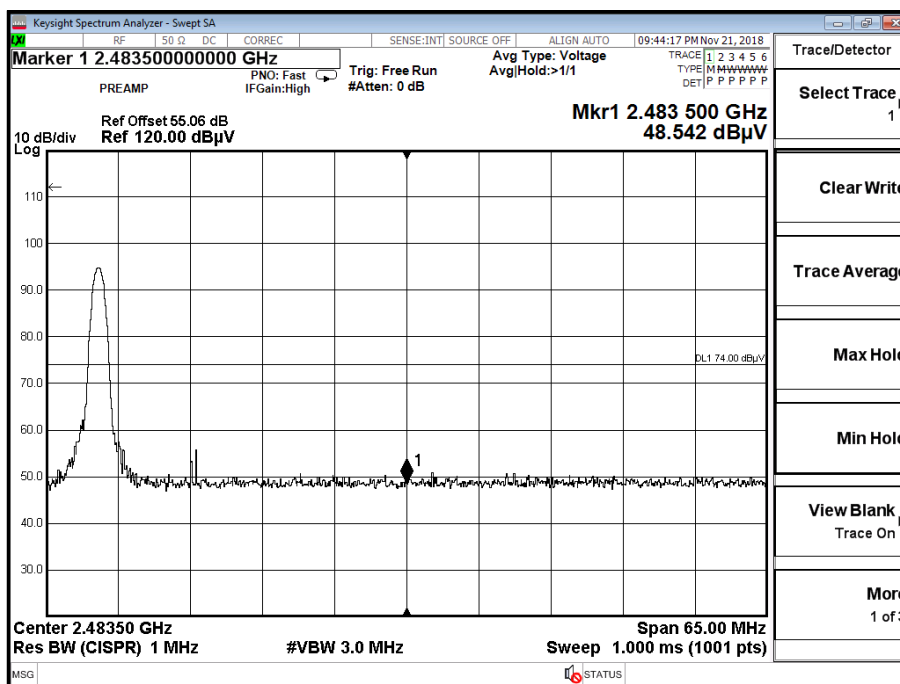


Figure 4 - 2483 MHz, Measured Frequency 2483.5 MHz, Peak

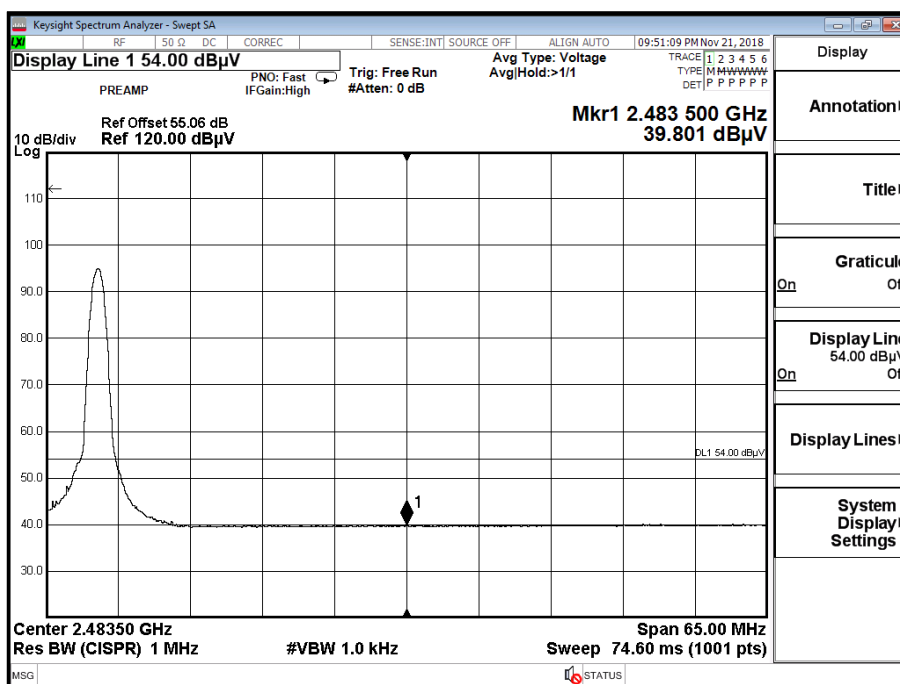


Figure 5 - 2483 MHz, Measured Frequency 2483.5 MHz, Average



FCC 47 CFR Part 15, Limit Clause 15.249 (d)

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

FCC 47 CFR Part 15, Limit Clause 15.209

Frequency (MHz)	Field Strength ($\mu\text{V/m}$ at 3 m)
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

Table 6

Industry Canada RSS-210, Limit Clause B.10 (b)

Emissions radiated outside of the specified frequency bands, except for harmonic emissions, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

Industry Canada RSS-GEN, Limit Clause 8.9

Frequency (MHz)	Field Strength ($\mu\text{V/m}$ at 3 m)
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

Table 7



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
Screened Room (5)	Rainford	Rainford	1545	36	23-Jan-2021
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Cable (Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4526	6	26-Apr-2019
PXA Signal Analyser	Keysight Technologies	N9030A	4653	12	05-Feb-2019
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	01-Mar-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
Hygrometer	Rotronic	HP21	4989	12	26-Apr-2019
EMI Test Receiver	Rohde & Schwarz	ESW44	5084	12	12-Sep-2019

Table 8

TU - Traceability Unscheduled



2.2 Field Strength of Fundamental

2.2.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.249 (a),
Industry Canada RSS-210, Clause B.10 (a)

2.2.2 Equipment Under Test and Modification State

Free standing blast controller, S/N: 073000218 - Modification State 0
Omni directional aerial, S/N: 1120001B8# - Modification State 0
Mains Charger, S/N: 10100041D - Modification State 0

2.2.3 Date of Test

21-November-2018

2.2.4 Test Method

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

The fundamental was found to be pulsed in nature and was measured in accordance with ANSI C63.10 clause 7.5. A peak measurement was performed and then a duty cycle correction factor was added to the peak measurement.

Duty cycle correction factor (dB) = $20\log(\text{On Time}/(\text{On Time}+\text{Off Time}))$
= $20\log(16.18\text{ms}/(16.18\text{ms}+1565.00\text{ms})) = -39.80\text{dB}$

2.2.5 Environmental Conditions

Ambient Temperature 17.9 °C
Relative Humidity 39.2 %

2.2.6 Test Results

2.4 GHz DSSS Transmitter

Frequency MHz	Field Strength (dBµV/m)	
	Peak	Average
2401.75	95.10	55.30
2427.75	95.85	56.05
2455.75	94.77	54.97

Table 9

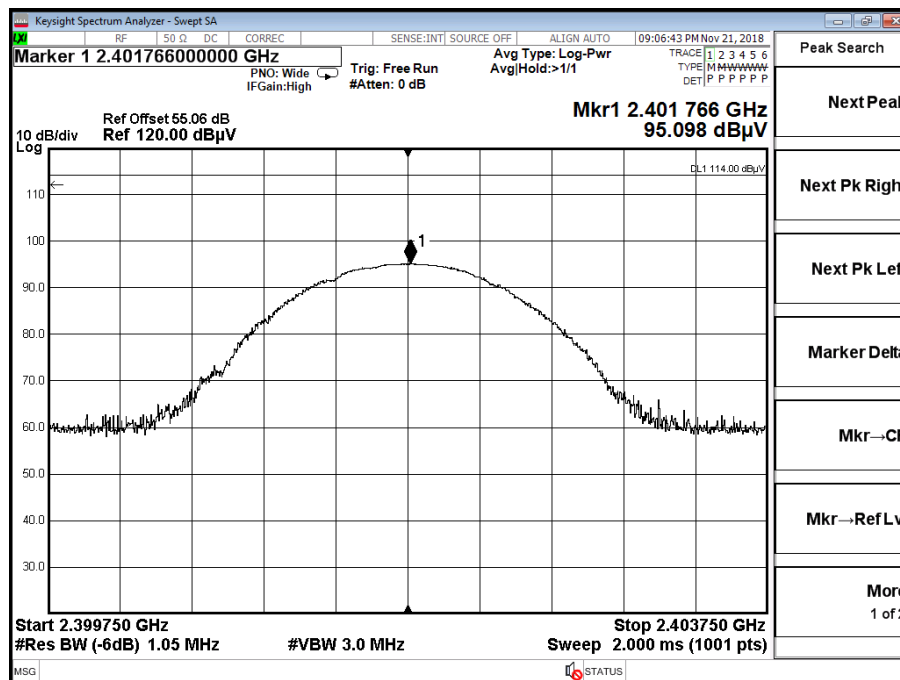


Figure 6 – 2401.75 MHz

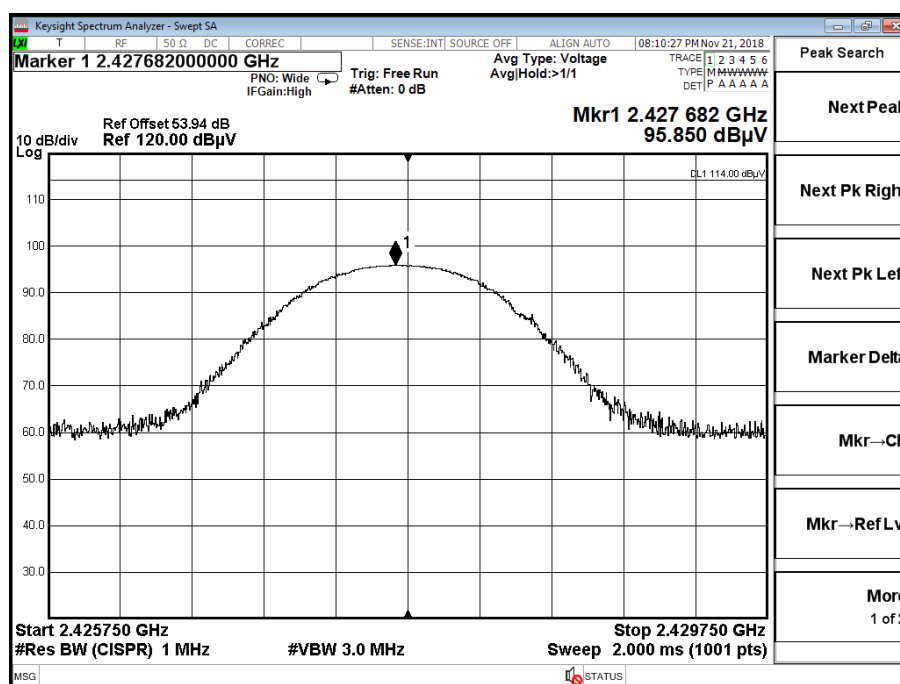


Figure 7 – 2427.75 MHz

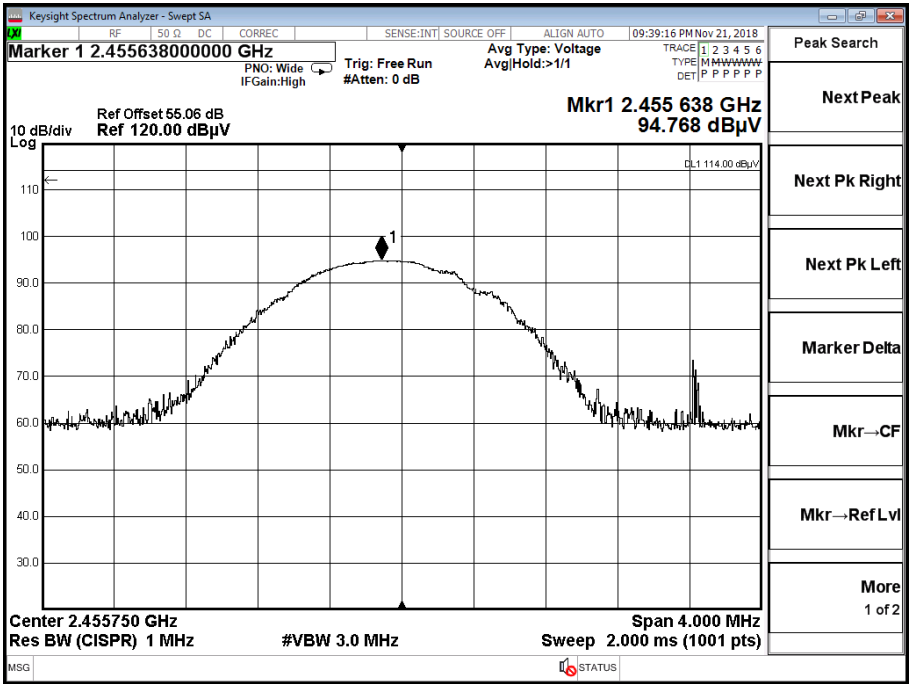


Figure 8 - 2455.75 MHz



FCC 47 CFR Part 15, Limit Clause 15.249 (a)

Fundamental Frequency (MHz)	Field Strength of Fundamental (mV/m)
902 to 928	50
2400 to 2483.5	50
5725 to 5875	50
24000 to 24250	250

Table 10

Industry Canada RSS-210, Limit Clause B.10 (a)

The field strength of fundamental and harmonic emissions, measured at 3 m, shall not exceed 50 mV/m and 0.5 mV/m respectively.

2.2.7 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
Screened Room (5)	Rainford	Rainford	1545	36	23-Jan-2021
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Cable (Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4526	6	26-Apr-2019
PXA Signal Analyser	Keysight Technologies	N9030A	4653	12	05-Feb-2019
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	01-Mar-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
Hygrometer	Rotronic	HP21	4989	12	26-Apr-2019

Table 11

TU - Traceability Unscheduled



2.3 Field Strength of Emissions

2.3.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.249 (a)(d)
Industry Canada RSS-210, Clause B.10 (a)

2.3.2 Equipment Under Test and Modification State

Free standing blast controller, S/N: 073000218 - Modification State 0
Omni directional aerial, S/N: 1120001B8# - Modification State 0
Mains Charger, S/N: 10100041D - Modification State 0

2.3.3 Date of Test

26-November-2018 to 27-November-2018

2.3.4 Test Method

This test was performed in accordance with ANSI C63.10-2013 clause 6.3, 6.5 and 6.6. For frequencies > 1 GHz, plots for average measurements were taken in accordance with ANSI C63.10 clause 4.1.4.2.3 to characterize the EUT. Where emissions were detected, final average measurements were taken in accordance with ANSI C63.10 clause 4.1.4.2.2.

For average measurements where the pre-scan data exceeds the limit line as shown on the plots below, the following method was used to determine the average level of emissions:

Where emissions were found to be pulsed in nature they were measured in accordance with ANSI C63.10 clause 7.5. A peak measurement was performed and then a duty cycle correction factor was added to the peak measurement.

Duty cycle correction factor (dB)
= $20\log(\text{On Time}/(\text{On Time}+\text{Off Time})) = 20\log(16.18\text{ms}/(16.18\text{ms}+1565.00\text{ms})) = -39.80\text{dB}$
The following conversion can be applied to convert from dB $\mu\text{V}/\text{m}$ to $\mu\text{V}/\text{m}$:
 $10^{(\text{Field Strength in dB}\mu\text{V}/\text{m}/20)}$.

2.3.5 Environmental Conditions

Ambient Temperature 18.4 °C
Relative Humidity 35.0 %

2.3.6 Test Results

2.4 GHz DSSS Transmitter

Frequency (MHz)	Level	Limit	Margin	Detector	Unit	Angle (°)	Height (cm)	Polarisation
44.245	33.40	40.00	6.60	Q-Peak	dBuV/m	8	100	Vertical
66.356	32.46	40.00	7.54	Q-Peak	dBuV/m	139	100	Vertical

Table 12 – 2401.75 MHz - 30 MHz to 1 GHz

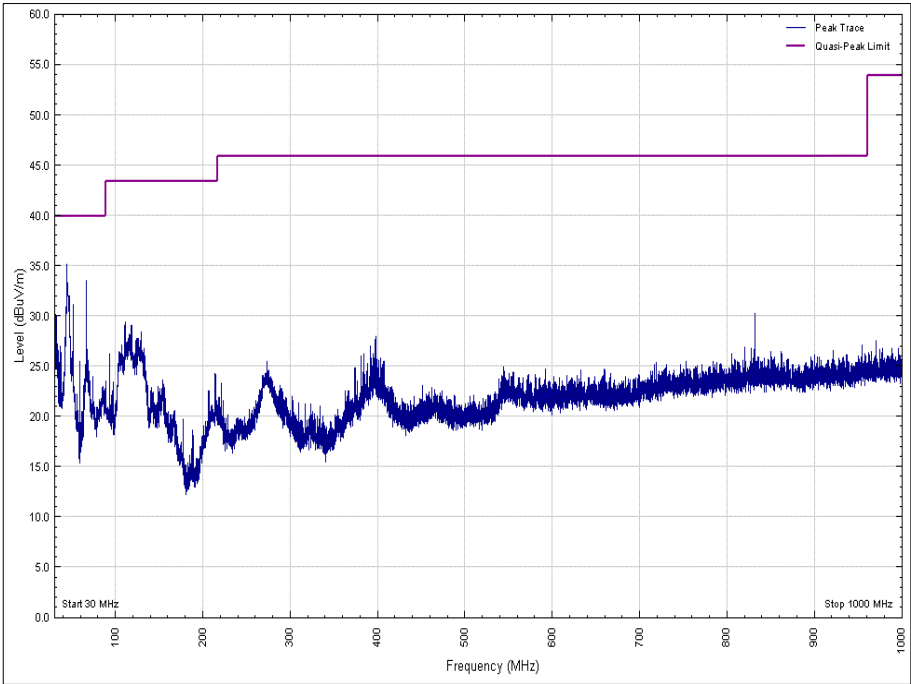


Figure 9 – 2401.75 MHz - 30 MHz to 1 GHz - Vertical

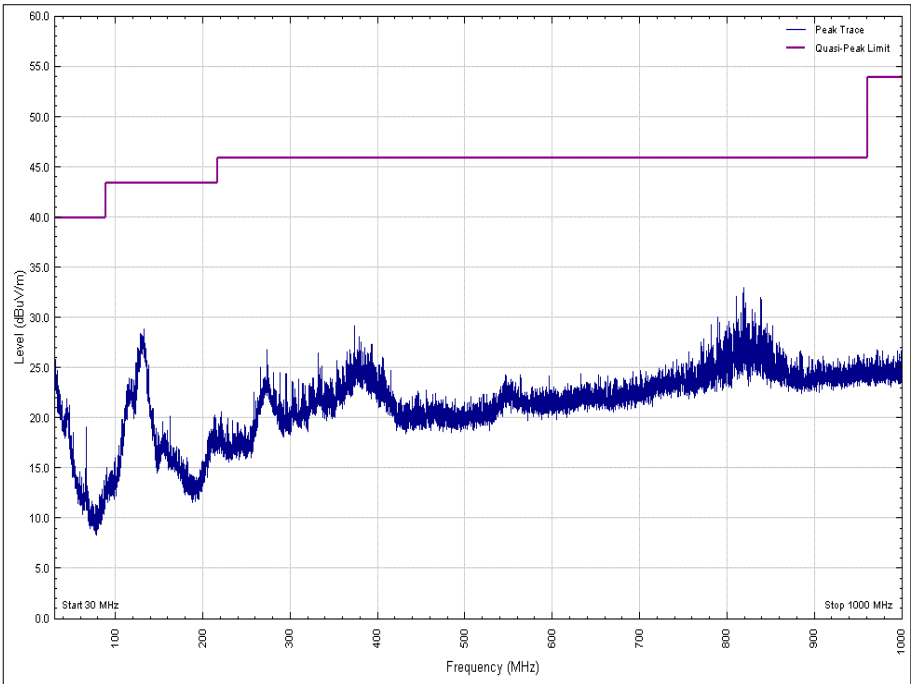


Figure 10 – 2401.75 MHz - 30 MHz to 1 GHz - Horizontal

Frequency (MHz)	Final Peak (dB μ V/m)	Final Average (dB μ V/m)	Final Peak (μ V/m)	Final Average (μ V/m)	Angle (°)	Height (m)	Polarisation
7205.238	65.50	25.70	1883.65	19.28	348	1.09	Vertical

Table 13 – 2401.75 MHz - 1 GHz to 25 GHz

No other emissions were detected within 10 dB of the limit.

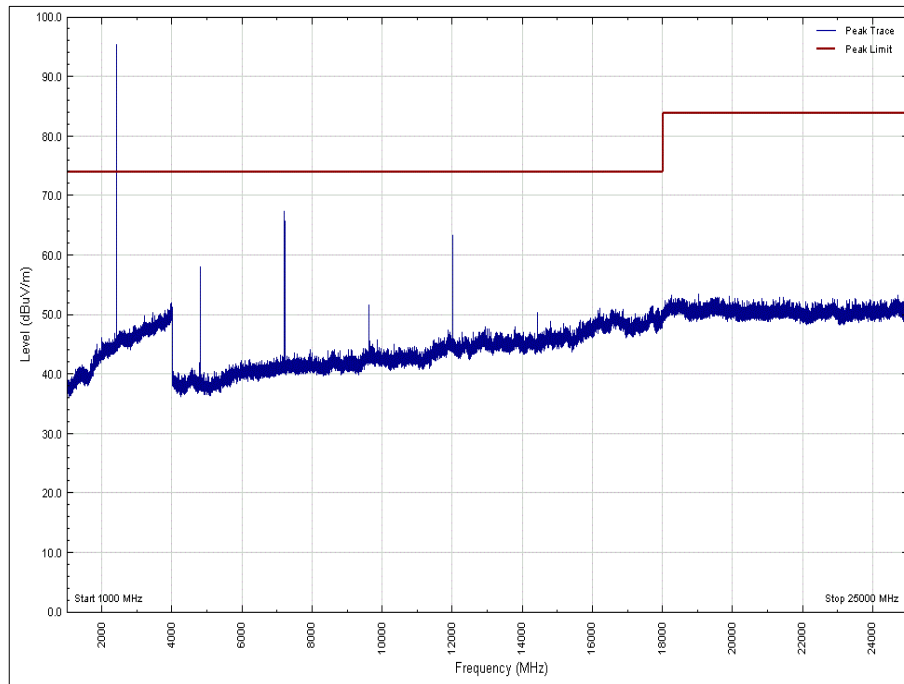


Figure 11 - 2401.75 MHz - 1 GHz to 25 GHz – Vertical - Peak

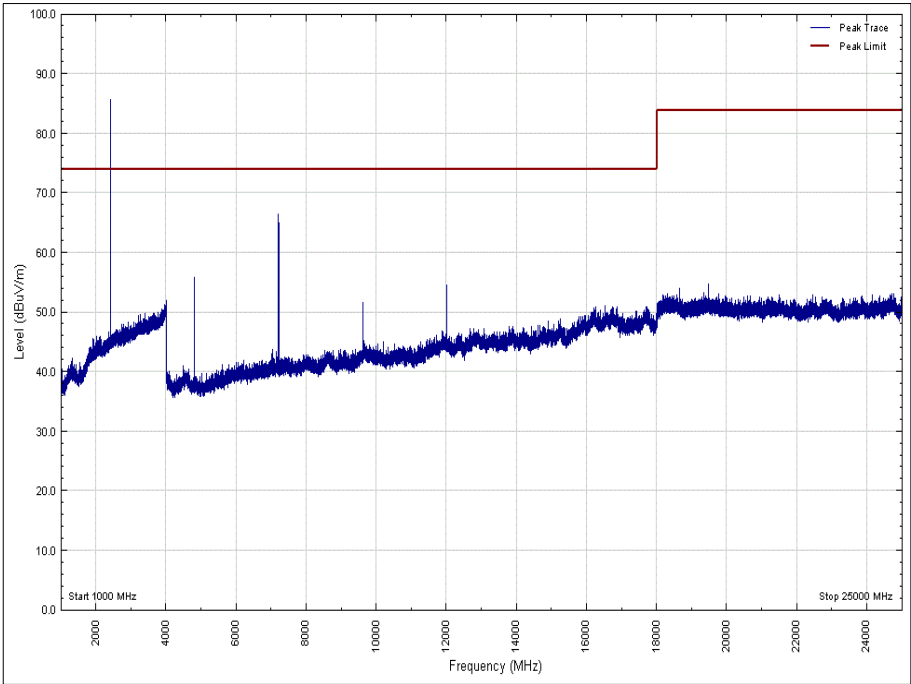


Figure 12 - 2401.75 MHz - 1 GHz to 25 GHz – Horizontal - Peak

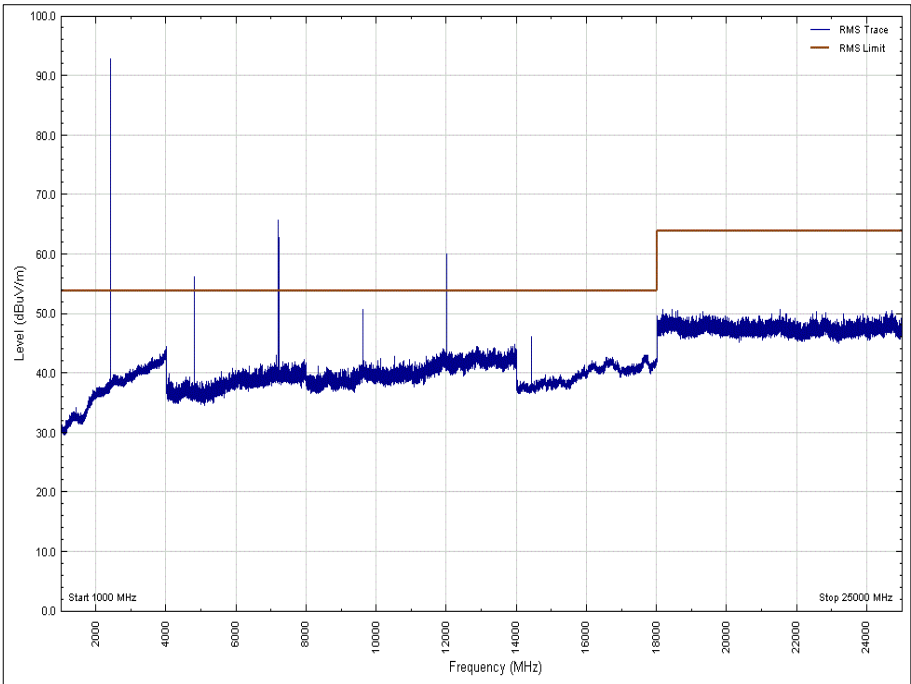


Figure 13 - 2401.75 MHz - 1 GHz to 25 GHz - Vertical - Average

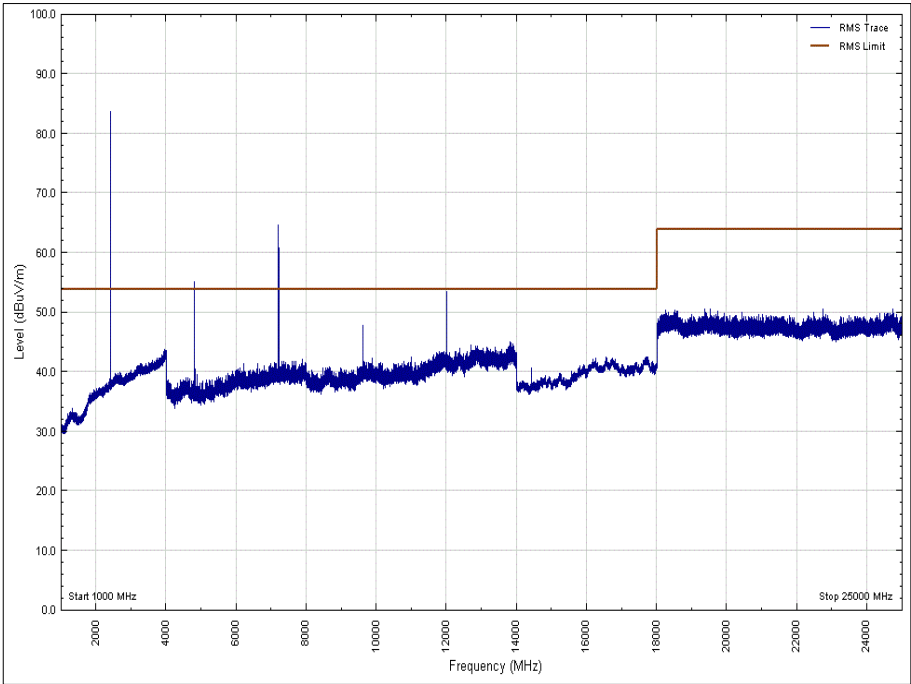


Figure 14 - 2401.75 MHz - 1 GHz to 25 GHz – Horizontal - Average

Frequency (MHz)	Level	Limit	Margin	Detector	Unit	Angle (°)	Height (cm)	Polarisation
44.239	32.84	40.00	7.16	Q-Peak	dBuV/m	106	109	Vertical
66.354	31.88	40.00	8.12	Q_Peak	dBuV/m	312	100	Vertical

Table 14 – 2427.75 MHz - 30 MHz to 1 GHz

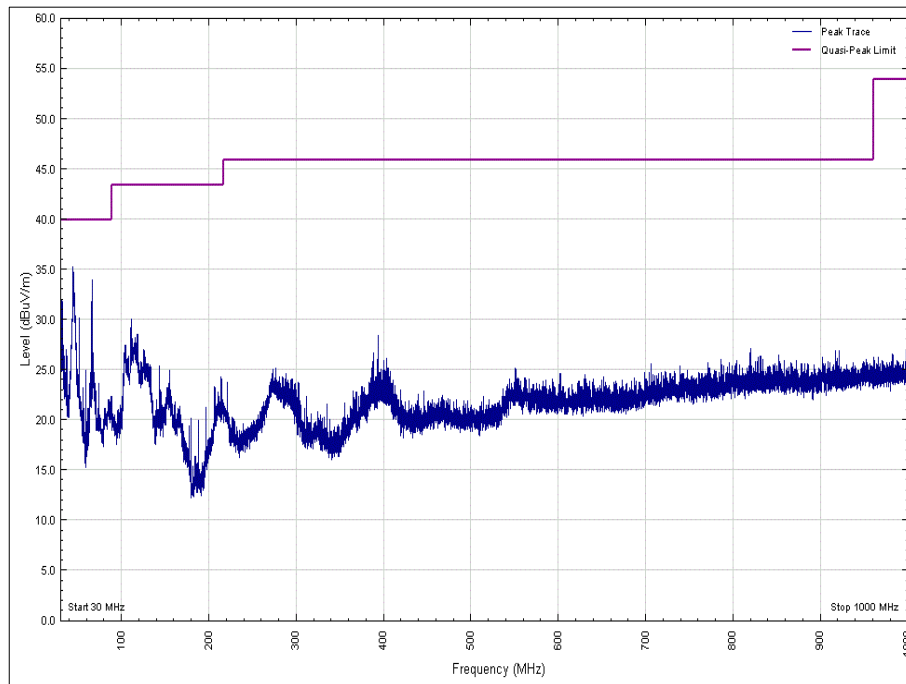


Figure 15 - 2427.75 MHz - 30 MHz to 1 GHz - Vertical

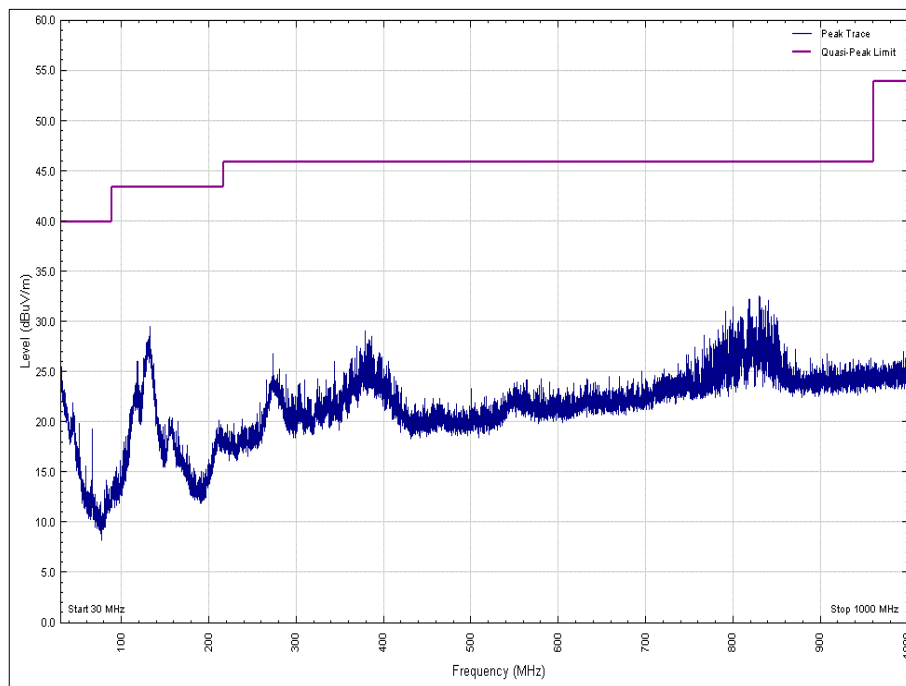


Figure 16 - 2427.75 MHz - 30 MHz to 1 GHz - Horizontal



Frequency (MHz)	Final Peak (dBµV/m)	Final Average (dBµV/m)	Final Peak (µV/m)	Final Average (µV/m)	Angle (°)	Height (m)	Polarisation
7283.157	66.71	26.91	2165.21	22.16	0	1.00	Vertical

Table 15 - 2427.75 MHz - 1 GHz to 25 GHz

No other emissions were detected within 10 dB of the limit.

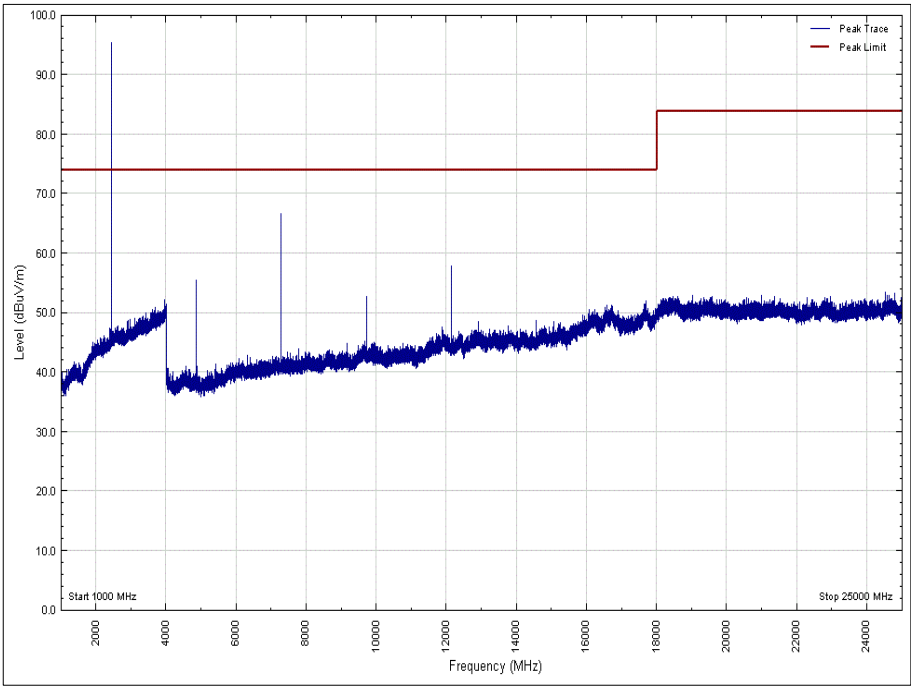


Figure 17 - 2427.75 MHz - 1 GHz to 25 GHz – Vertical – Peak

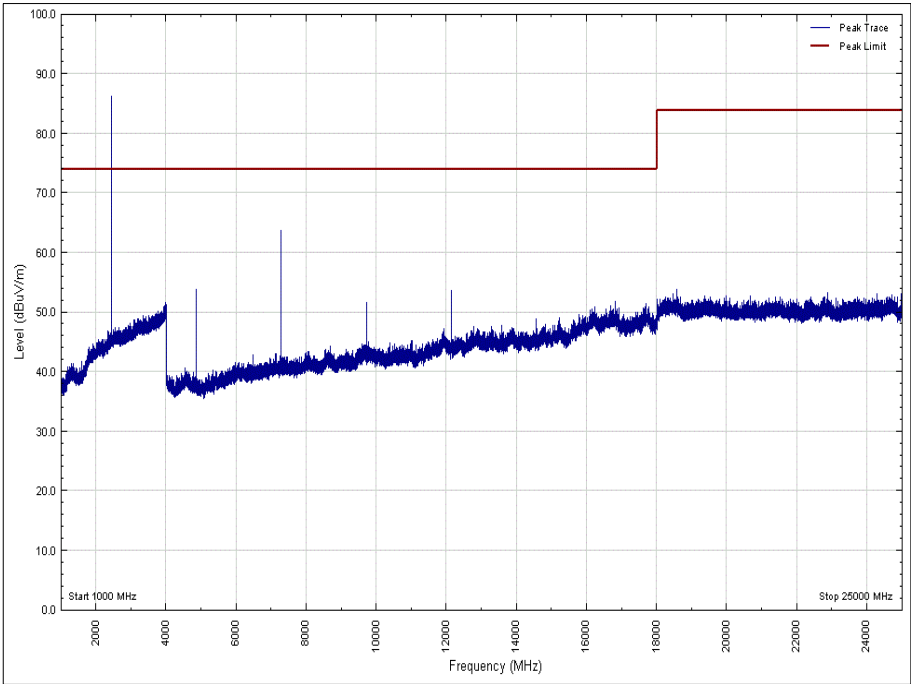


Figure 18 - 2427.75 MHz - 1 GHz to 25 GHz – Horizontal- Peak

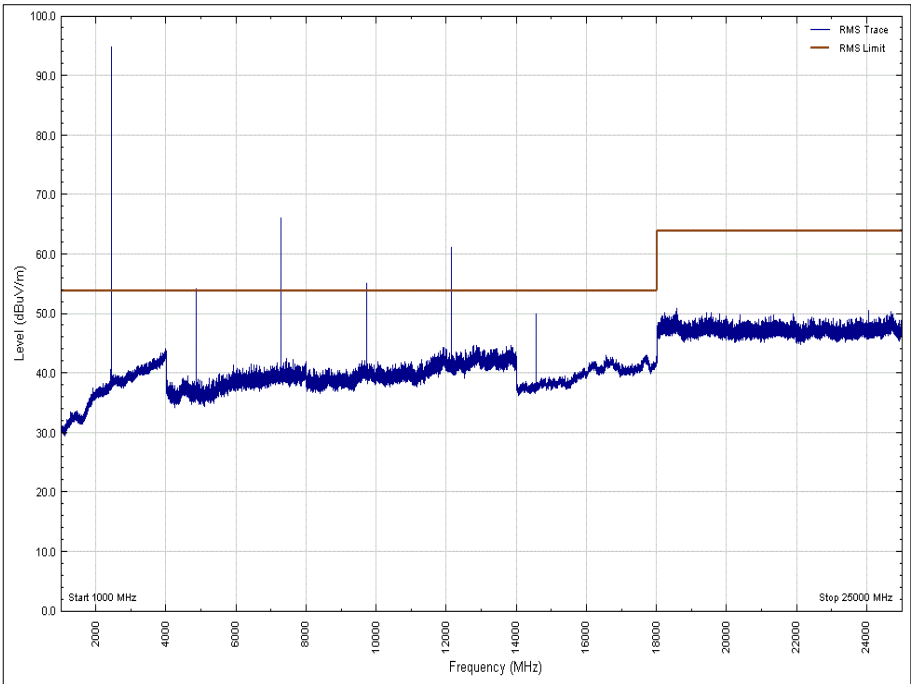


Figure 19 - 2427.75 MHz - 1 GHz to 25 GHz – Vertical –Average

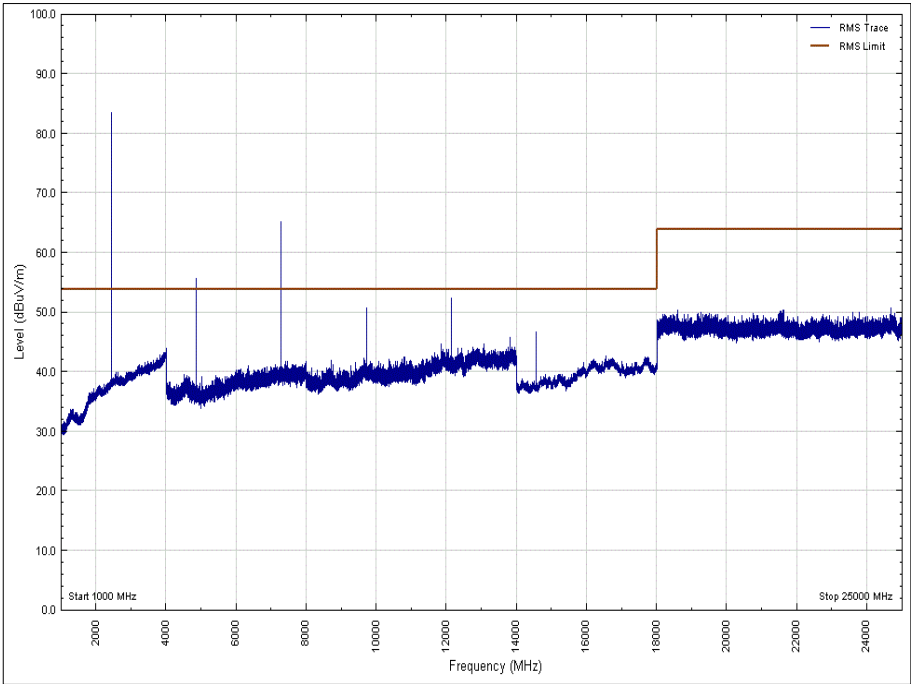


Figure 20 - 2427.75 MHz - 1 GHz to 25 GHz – Vertical - Peak

Frequency (MHz)	Level	Limit	Margin	Detector	Unit	Angle (°)	Height (cm)	Polarisation
44.236	32.41	40.00	7.59	Q-Peak	dBuV/m	353	110	Vertical
66.351	32.54	40.00	7.46	Q_Peak	dBuV/m	152	100	Vertical

Table 16 – 2455.75 MHz - 30 MHz to 1 GHz

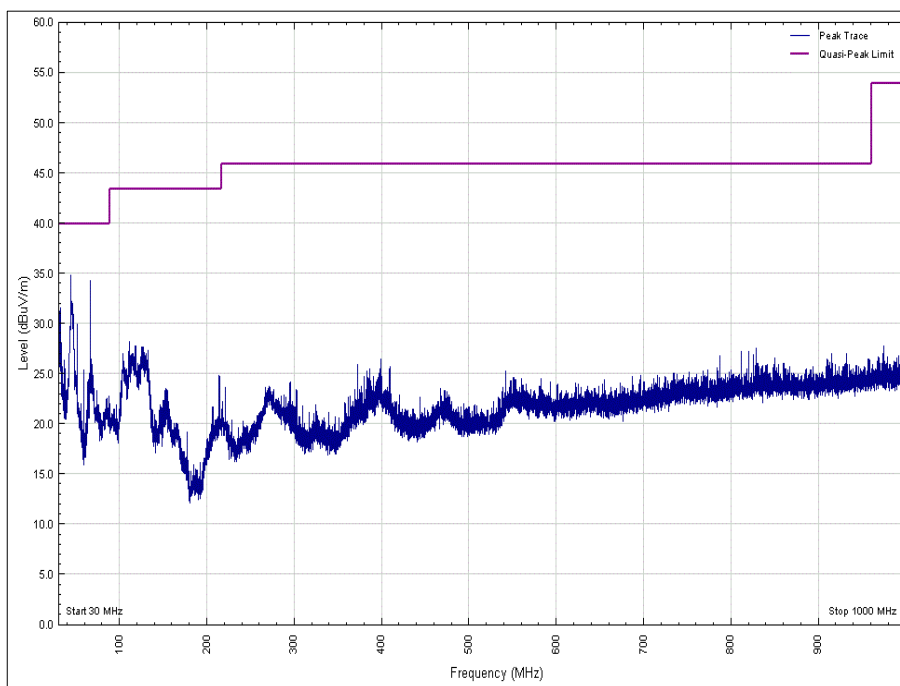


Figure 21 - 2455.75 MHz - 30 MHz to 1 GHz - Vertical

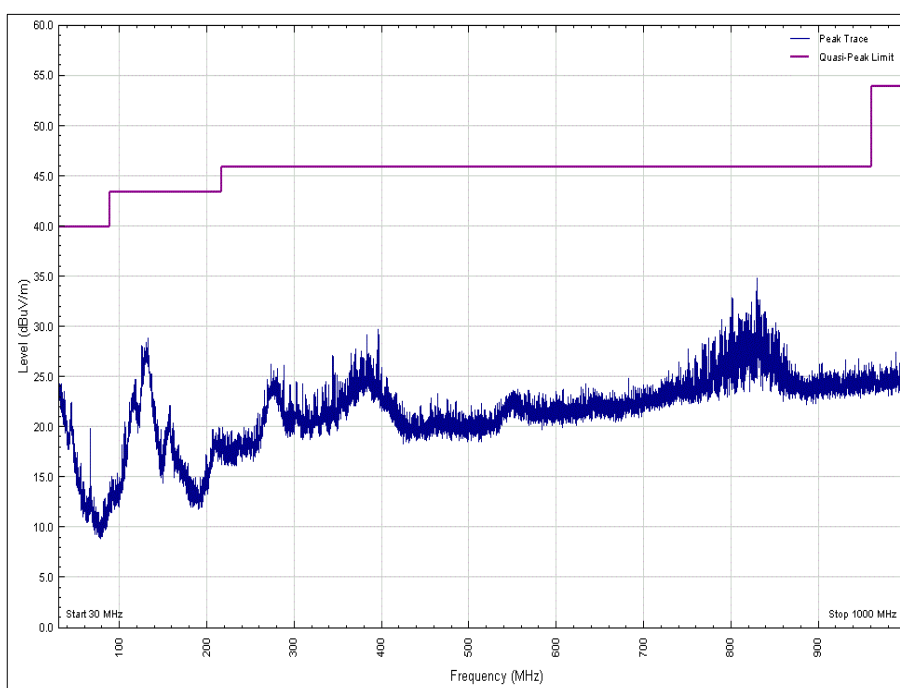


Figure 22 - 2455.75 MHz - 30 MHz to 1 GHz - Horizontal

Frequency (MHz)	Final Peak (dB μ V/m)	Final Average (dB μ V/m)	Final Peak (μ V/m)	Final Average (μ V/m)	Angle (°)	Height (m)	Polarisation
7366.981	65.62	25.82	1989.85	19.54	353	1.00	Vertical

Table 17 – 2455.75 MHz - 1 GHz to 25 GHz

No other emissions were detected within 10 dB of the limit.

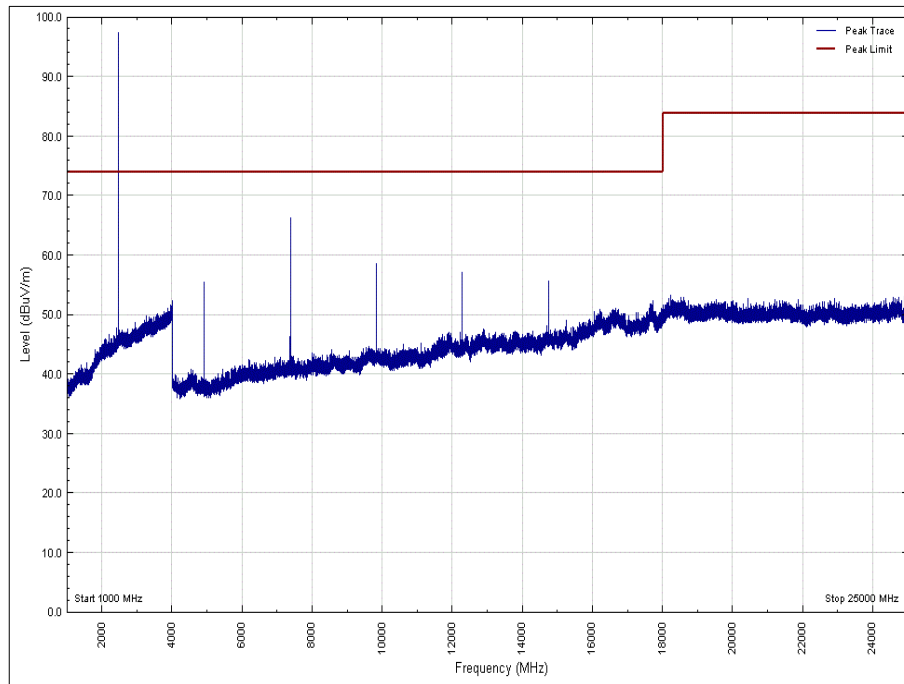


Figure 23 - 2455.75 MHz - 1 GHz to 25 GHz – Vertical – Peak

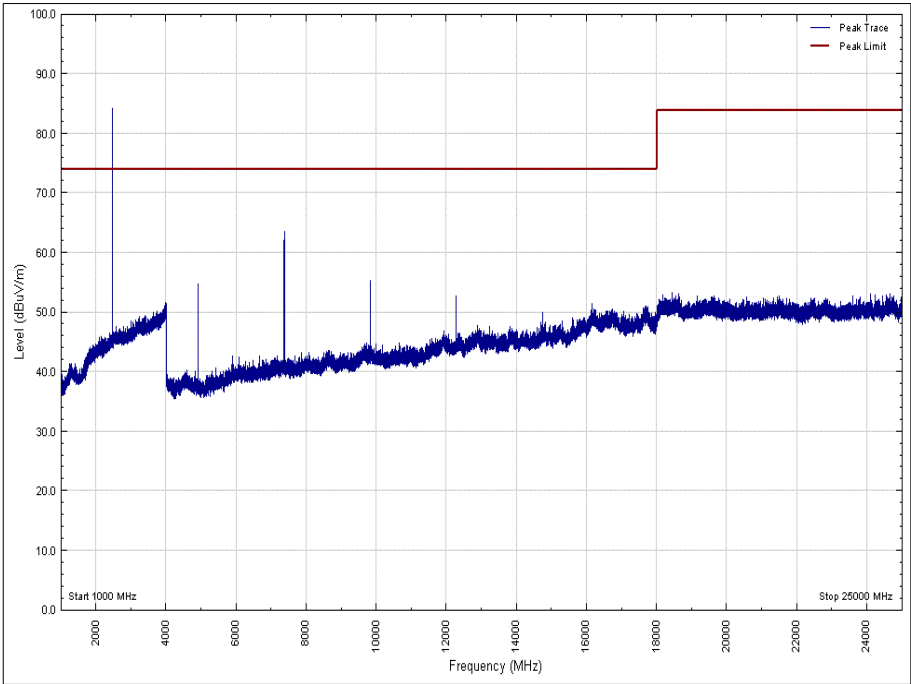


Figure 24 - 2455.75 MHz - 1 GHz to 25 GHz – Horizontal- Peak

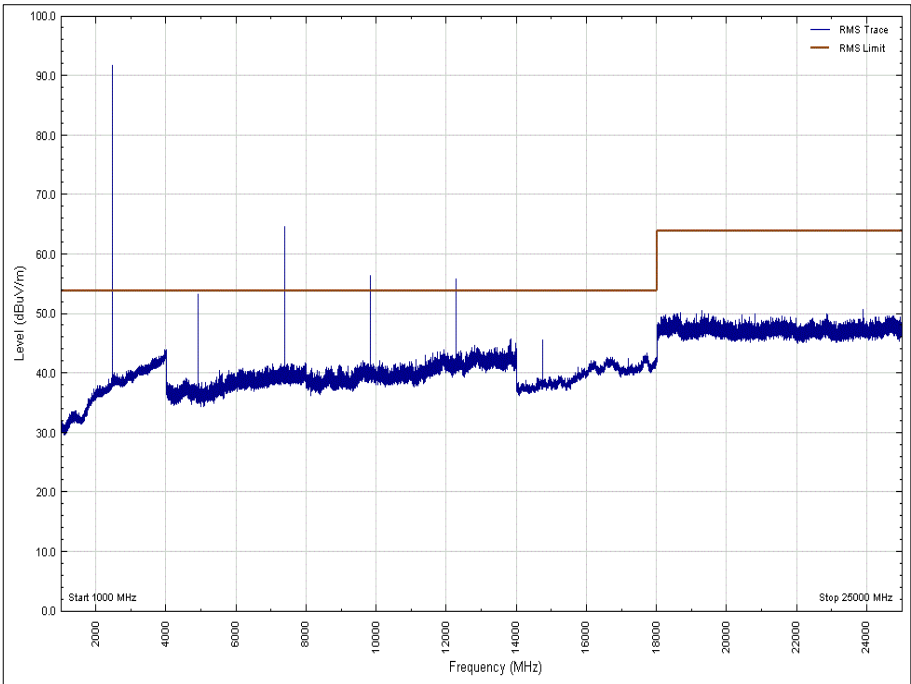


Figure 25 - 2455.75 MHz - 1 GHz to 25 GHz - Vertical - Average

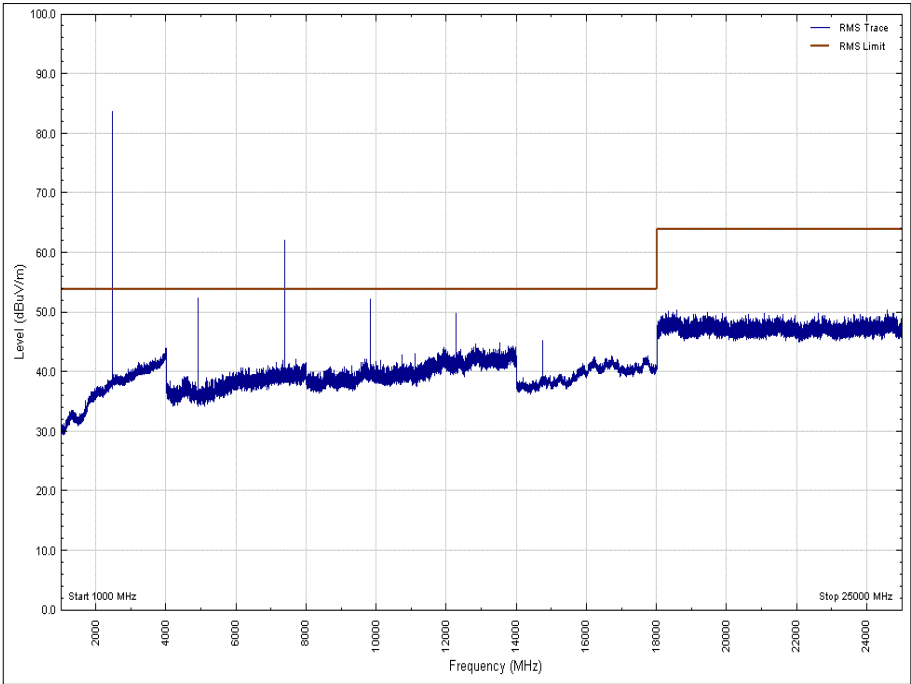


Figure 26 - 2455.75 MHz - 1 GHz to 25 GHz - Horizontal - Average



FCC 47 CFR Part 15, Limit Clause 15.249 (d)

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

FCC 47 CFR Part 15, Limit Clause 15.209

Frequency (MHz)	Field Strength ($\mu\text{V/m}$ at 3 m)
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

Table 18

Industry Canada RSS-210, Limit Clause B.10

The field strength of fundamental and harmonic emissions, measured at 3 m, shall not exceed 50 mV/m and 0.5 mV/m respectively.

The field strength limits shall be measured using an average detector, except for the fundamental emission in the frequency band 902-928 MHz, which is based on measurements using an International Special Committee on Radio Interference (CISPR) quasi-peak detector.

Emissions radiated outside of the specified frequency bands, except for harmonic emissions, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

Industry Canada RSS-GEN, Limit Clause 8.9

Frequency (MHz)	Field Strength ($\mu\text{V/m}$ at 3 m)
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

Table 19



2.3.7 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
Antenna 18-40GHz (Double Ridge Guide)	Link Microtek Ltd	AM180HA-K-TU2	230	24	02-May-2020
Pre-Amplifier	Phase One	PS04-0086	1533	12	12-Jan-2019
18GHz - 40GHz Pre-Amplifier	Phase One	PS04-0087	1534	12	02-Feb-2019
Screened Room (5)	Rainford	Rainford	1545	36	23-Jan-2021
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Antenna with permanent attenuator (Bilog)	Chase	CBL6143	2904	24	08-Aug-2019
Comb Generator	Schaffner	RSG1000	3034	-	TU
1501A 4.0M Km Km Cable	Rhophase	KPS-1501A-4000-KPS	4301	12	19-Feb-2019
1GHz to 8GHz Low Noise Amplifier	Wright Technologies	APS04-0085	4365	12	25-Oct-2019
1 metre K-Type Cable	Florida Labs	KMS-180SP-39.4-KMS	4520	12	13-Feb-2019
Cable (Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4526	6	26-Apr-2019
High Pass Filter (4GHz)	K&L Microwave	11SH10-4000/X18000-0/0	4599	12	04-Sep-2019
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	01-Mar-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
4dB Attenuator	Pasternack	PE7047-4	4935	12	28-Nov-2018
Hygrometer	Rotronic	HP21	4989	12	26-Apr-2019
EMI Test Receiver	Rohde & Schwarz	ESW44	5084	12	12-Sep-2019
EmX Software	TUV SUD Product Service	EmX	5125	-	Software

Table 20

TU - Traceability Unscheduled

3 Photographs

3.1 Test Setup Photographs

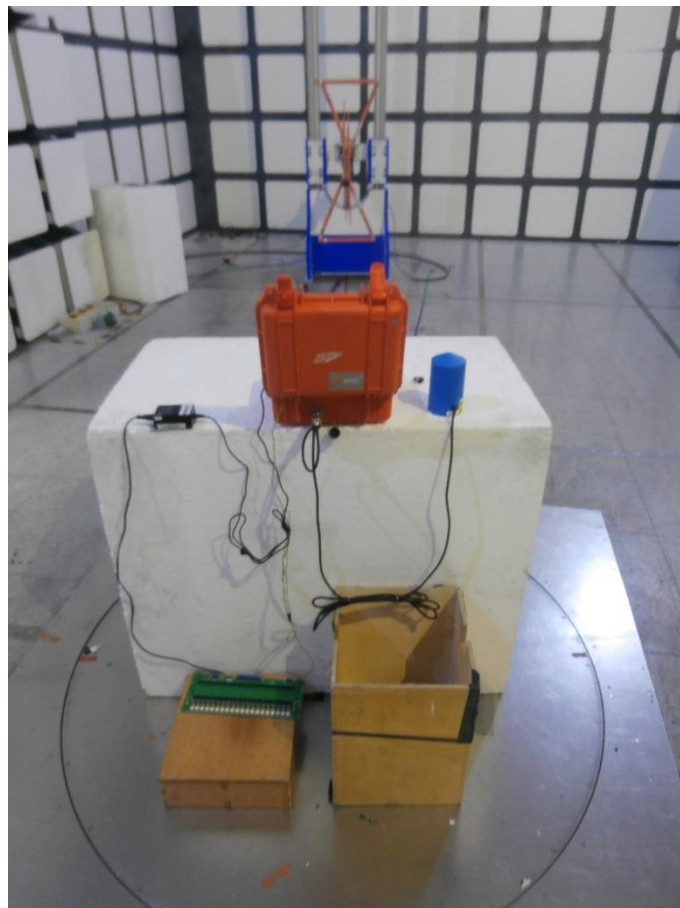


Figure 27 - Field Strength of Emissions - 30 MHz to 1 GHz



Figure 28 - Field Strength of Emissions - 1 GHz to 18 GHz



Figure 28 - Field Strength of Emissions - 18 GHz to 25 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 1 GHz to 40 GHz: ± 6.3 dB
Field Strength of Fundamental	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB
Authorised Band Edges	Conducted: ± 3.08 dB Radiated: 30 MHz to 1 GHz: ± 5.1 dB Radiated: 1 GHz to 40 GHz: ± 6.3 dB

Table 21