REPORT ON THE EMC TESTING

FOR

GUIDANCE NAVIGATION LTD

ON A

RANGEGUARD

DOCUMENT NO. TRA-025840-44-00A

0026

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REPORT ON THE EMC TESTING OF A
GUIDANCE NAVIGATION LTD
RangeGuard
WITH RESPECT TO SPECIFICATION
FCC RULES CFR 47:2013 PART 15.107 AND 15.109 CLASS B

TEST DATES:31/03/15 to 15/04/15

Written by: _____ M.Baker
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Approved by: _____ M.Leach
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Date: 16th April 2015

Distribution:

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1 Revision Record

Issue Number	*Issue Date*	*Revision History*
A	16/04/15	Original

2 Summary

TEST REPORT NUMBER:	TRA-025840-44-00A
PURPOSE OF TEST:	Electromagnetic Compatibility – Emissions
TEST SPECIFICATION:	FCC Rules CFR 47:2013 Part 15.107 and 15.109 Class B
DEVIATIONS FROM SPECIFICATION:	Not Applicable (refer to individual sections)
EQUIPMENT UNDER TEST (EUT):	RangeGuard
EUT SERIAL NUMBER:	120023
EUT CATEGORY:	Information Technology Equipment (ITE)
TEST RESULT:	Measured As Compliant Given any modifications stated in the relevant section of this report.
MANUFACTURER/AGENT:	Guidance Navigation Ltd
ADDRESS:	4 Dominus Way Meridian Business Park Leicester LE19 1RP
CLIENT CONTACT:	Mr Tom Coggins ☎ 01162292624 ✉ tom.coggins@guidance.eu.com
ORDER NUMBER:	255629
TEST DATES:	31/03/15 to 15/04/15
TESTED BY:	M.Baker and Greg Ashe TRaC Global Ltd.

3 Contents

4 Introduction

This report TRA-025840-44-00A presents the results of the EMC testing on a Guidance Navigation LTD, RangeGuard to specification FCC Rules CFR 47:2013 Part 15.107 and 15.109 Class B.

The testing was carried out for Guidance Navigation LTD by TRaC Global Ltd., an independent test house, at their EMC test facility located at:

☐ TRaC Malvern
100 Frobisher Business Park
Leigh Sinton Road
Malvern
Worcestershire
WR14 1BX
UK

FCC Site Registration Number: 452983

☒ TRaC North West
Unit 1
Pendle Place
Skelmersdale
West Lancashire
WN8 9PN
UK

FCC Site Registration Number: 444512

☐ TRaC South
74-78 Condor Close
Woolsbridge Industrial Park
Three Legged Cross
Wimborne
Dorset
BH21 6SU
UK

FCC Site Registration Number: 430273

☒ TRaC Hull
Unit E
South Orbital Trading Park
Hedon Road
Hull
East Yorkshire
HU9 1NJ
UK

FCC Site Registration Number: 378340

This report details the configuration of the equipment, the test methods used and any relevant modifications where appropriate.

All test and measurement equipment under the control of the laboratory and requiring calibration is subject to an established programme and procedures to control and maintain measurement standards. The quality management system meets the principles of ISO 9001, and has quality control procedures for monitoring the validity of tests undertaken. Records and sufficient detail are retained to establish an audit trail of calibration records relating to its test results for a defined period. Under control of the established calibration programme, key quantities or values of the test & measurement instrumentation are within specification and comply with the relevant traceable internationally recognised and appropriate standard specifications, which are UKAS calibrated as such where these properties have a significant effect on results. Participation in inter-laboratory comparisons and proficiency testing ensures satisfactory correlation of results conform to TRaC's own procedures, as well as statistical techniques for analysis of test data providing the appropriate confidence in measurements.

It is TRaC Global Ltd. policy to always use the latest version of any applicable base test standards. Where a product specification calls up a superseded dated revision or an undated basic standard, the latest version will be used. This may be a deviation to the product standard if dated references have been used.

Throughout this report EUT denotes equipment under test.

The results obtained within this FCC CFR 47 Part 15 report are deemed satisfactory evidence to comply with the requirements of Industry Canada Interference-Causing Equipment Standard ICES-003 Issue 5:2012.

5 Normative References

- *ANSI C63.4-2003, American National Standard for Methods of measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz.*

- *CISPR 22:2008 'Information technology equipment - Radio disturbance characteristics – Limits and methods of measurement'*

*Indicates a specification or standard or specific amendment that is not listed on the TRaC Global Ltd. UKAS scope of accreditation.

6 Equipment Under Test

6.1 EUT Identification

- Name: RangeGuard (Sensor)
- Serial Number: 120023
- Model Number: 20-0183
- Software Revision: FPGA V1.15
- Build Level / Revision Number: Prototype
- TRaC Sample 2

- Name: RangeGuard (Processing module – Embedded PC and DAC combined)
- Serial Number:
  - Embedded PC: SD5001365
  - DAC: 120022
- Model Number:
  - Embedded PC: EC700-BT4051-E454
  - DAC: 21-0391-1
- Software Revision: Version 0.4.2.86-09.1.0
- Build Level / Revision Number: Prototype
- TRaC Sample 3

- Name: EDACPOWER ELEC in-line PSU
- Model Number:EA10521C-120
- TRaC Sample 4

Incorporating the following external cables / test ports on embedded PC;

Type		***Description***	***Shielded/ Un-shielded***	***Test Length***	***Max Installation Length***
1	dc power (PC)	2 core	Un-shielded	1m	1m
2	ac power (PC in-line PSU)	3 core	Un-shielded	1m	>3m
3	USB 1	USB cable	Shielded	0.15m	0.15m
4	USB 2 - 4*	None	N/A	N/A	N/A
5	VGA display port	None	N/A	N/A	N/A
6	HDMI port	None	N/A	N/A	N/A
7	COM port 1 - 4	None	N/A	N/A	N/A
8	LAN port	CAT5e SCTP 24 AWG Marine Grade	Shielded	10m	10m

Incorporating the following external cables / test ports on DAC;

Type		***Description***	***Shielded/ Un-shielded***	***Test Length***	***Max Installation Length***
1	ac power (PC in-line PSU)	3 core	Un-shielded	1m	>3m
2	Sensor port 1	CAT5e SCTP 24 AWG Marine Grade	Shielded	100m	100m
3	Sensor port 2 – 4*	None	N/A	N/A	N/A
4	USB	USB cable	Shielded	0.15m	0.15m

*-During normal installation these ports are un-used and therefore not connected or under test as part of this assessment

Incorporating the following external cables / test ports on Sensor;

Type		*Description*	*Shielded/ Un-shielded*	*Test Length*	*Max Installation Length*
1	LAN port	CAT5e SCTP 24 AWG Marine Grade	Shielded	10m	10m

6.2 System Equipment

Equipment listed below forms part of the overall test setup and is required for equipment functionality and/or monitoring during testing. The compliance levels achieved in this report relate only to the EUT and not items given in the following list.

- Name: Dell Laptop -
- Model Number: Latitude D520
- TRaC Sample 5

- Name: Corner target
- TRaC Sample 6

6.3 EUT Mode of Operation

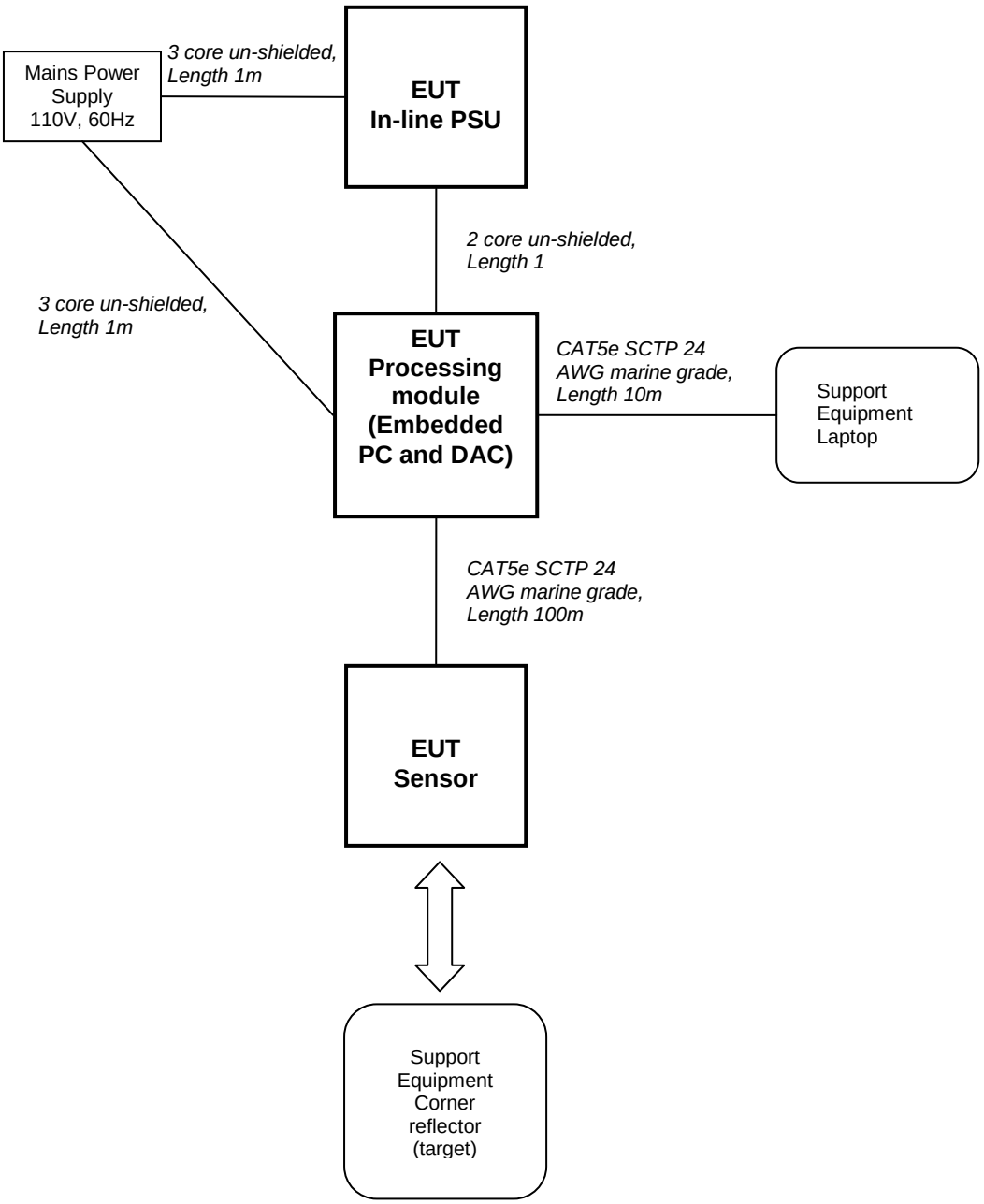
During emissions testing the RangeGuard systems was scanning for objects in sight of it sensor operating at 24.25GHz. The sensor continuously sweeps for targets and the processing module connected to the sensor updates the position of any objects in sight 3-12 times per second (depending on number of sensors connected). The position data was displayed on the supporting laptop.

6.4 EUT Description

The RangeGuard system is comprised of up to 4 sensors connected to a single processing module which connects to a monitor / navigation console. The sensors are placed around the outer hull of a marine vessel, operating at 24.25GHz continuously scanning for object in line of sight. The sensor data is processed by the processing module and the resultant object data is displayed on a connected navigation display, allowing collision detection.

7 Block Diagram

The following diagram shows basic EUT interconnections with cable type and cable lengths identified in Section 6.1.



8 Test Standard Selection

8.1 Product Standard

The following product standard was used as the basis of the test levels required and has been deemed the most appropriate product standard to apply to the RangeGuard, or has been requested by the manufacturer:

FCC RULES CFR 47	Federal Communications Commission Title 47 CFR Part 15: Radio Frequency Devices

8.2 Basic Test Standard Selection

Basic Test Standard	***Applicable***		***Notes***
	Class A	***Class B***	
ANSI C63.4:2003 – Radiated Electromagnetic Emissions	☐	☒	
ANSI C63.4:2003 – Conducted Electromagnetic Emissions	☐	☒	

Notes:
[1] Not applicable, EUT contains no test ports.

9 Radiated Emissions as per ANSI C63.4:2003

9.1 General

This test measures radiated electromagnetic emissions that may emanate from EUT enclosures and cables. This test ensures the protection of broadcast and telecommunication services used in the vicinity of the EUT.

The test set-up used complies with all the dimension requirements set out in ANSI C63.4:2003. The semi-anechoic chamber used meets the site attenuation measurements required by ANSI C63.4:2003 Clause 5.4.6.5.

Measurement instrumentation used meets the requirements of CISPR16-1-1:2003, and expanded laboratory uncertainties U_{lab} are less than or equal to U_{cispr}.Table 1. Therefore no compensation is required to the actual measured level in determining compliance with the applied limit.

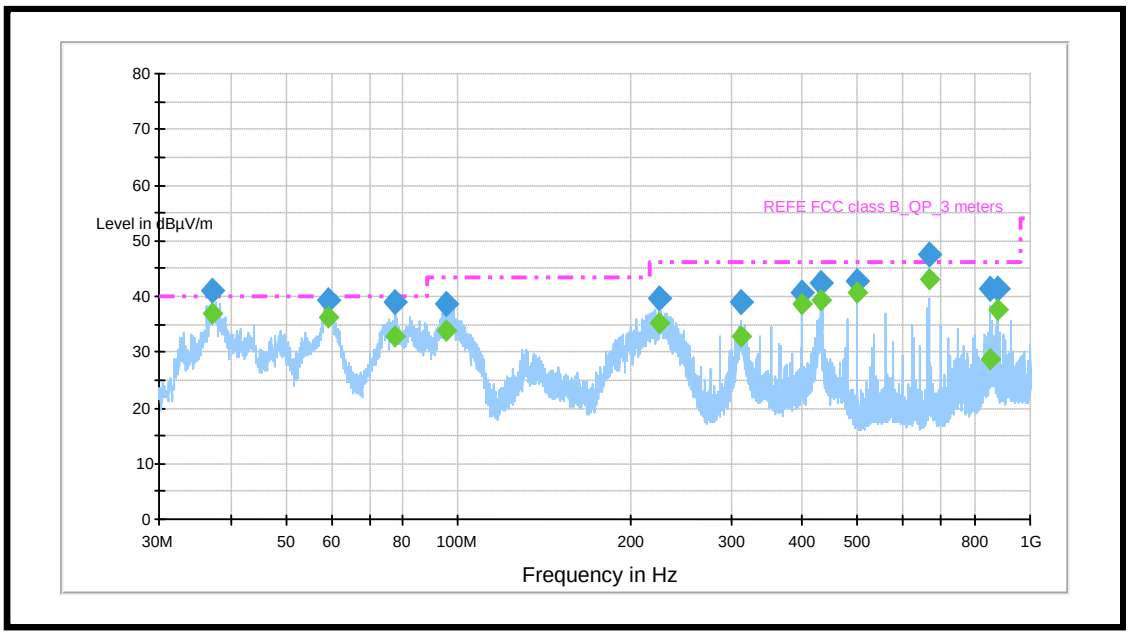
An initial scan is carried out in order to establish a frequency list that is attributable to the EUT. Any emissions measurements that fall within 20dBµV/m of the limit line are then maximised by rotating the equipment through 360° and raising/lowering the antenna through 1-4m height for each frequency of interest.

9.2 Radiated Emission Test Parameters

EUT Classification:	☐ A ☒ B
Highest EUT Frequency:	24.25GHz (if >1GHz upper frequency of measurement will be 5th harmonic of highest EUT frequency or 40GHz whichever is lower)
Frequency Range:	30MHz to 1GHz ☒ 1GHz to 2GHz ☐ N/A – Max EUT Freq Used <108MHz ☒ 2GHz to 5GHz ☐ N/A – Max EUT Freq Used <500MHz ☒ 5GHz to 40GHz ☐ N/A – Max EUT Freq Used <1GHz
Measurement Bandwidth:	120kHz (Measurements ≤1GHz) 1MHz (Measurements ≥1GHz)
Video Bandwidth:	>500kHz (Measurements ≤1GHz) 3MHz (Measurements ≥1GHz)
Detectors:	Peak (≤1GHz scan / ≥1GHz Final Measurements) Average (≥1GHz Final Measurements) Quasi-peak (≤1GHz Final Measurements)
Receiver Frequency Step Size:	50kHz (Measurements <1GHz) 450kHz (Measurements >1GHz)
Analyser Frequency Sweep Point Size:	≤50kHz (Measurements <1GHz) ≤450kHz (Measurements >1GHz)
Quasi-peak Detector Dwell:	Minimum 2s per Frequency Point
Antenna Height:	1–4 Metres
EUT to Antenna Distance:	☒ 1m ☒ 3m
EUT Measurement Height:	☒ 0.8m Insulated Table ☐ 0.1m Insulated Support/Pallet
EUT Operation Voltage:	120Vac
EUT Operating Frequency:	☒ 60Hz ☐ dc

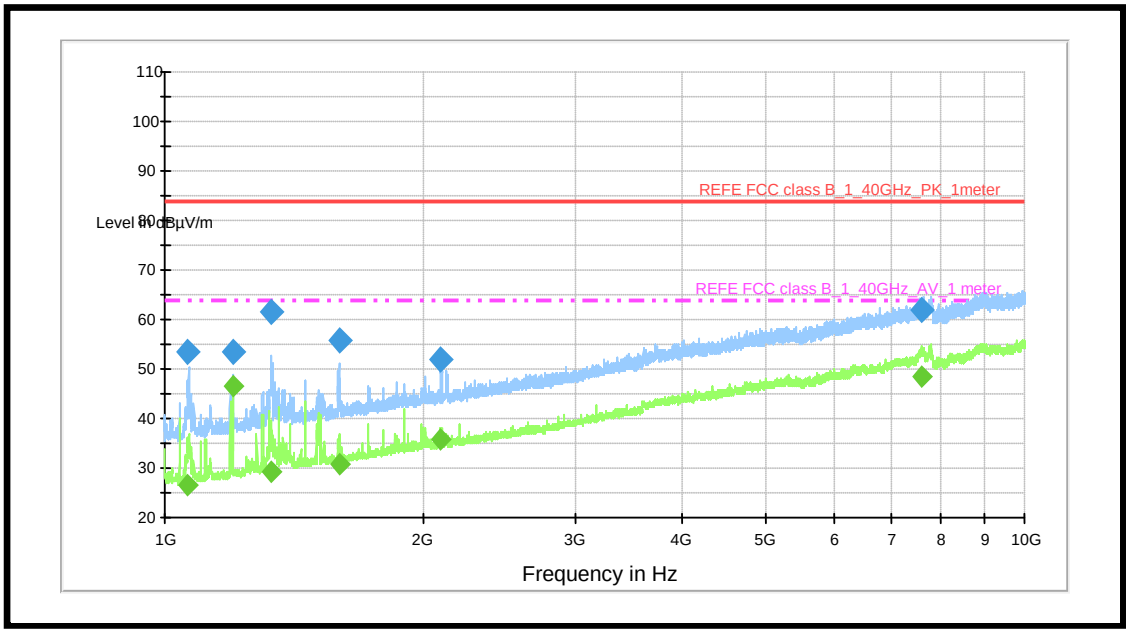
9.3 EUT Test Results

9.3.1 Radiated Emissions Test Data – 30MHz to 1GHz



Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
37.040680	37.0	15000.0	120.000	100.0	V	189.0	-15.5	3.0	40.0
59.149587	36.4	15000.0	120.000	100.0	V	239.0	-25.0	3.6	40.0
77.243320	32.9	15000.0	120.000	143.0	V	67.0	-23.3	7.1	40.0
95.395533	33.9	15000.0	120.000	125.0	V	237.0	-20.6	9.6	43.5
224.597000	35.3	15000.0	120.000	148.0	H	111.0	-20.3	10.7	46.0
312.454613	33.0	15000.0	120.000	120.0	H	44.0	-16.3	13.0	46.0
399.991293	38.8	15000.0	120.000	98.0	H	309.0	-13.7	7.2	46.0
431.992173	39.2	15000.0	120.000	100.0	H	15.0	-13.1	6.8	46.0
500.011013	40.7	15000.0	120.000	193.0	H	113.0	-11.7	5.3	46.0
666.660787	42.9	15000.0	120.000	186.0	H	79.0	-9.2	3.1	46.0
849.517947	28.7	15000.0	120.000	339.0	H	99.0	-5.8	17.3	46.0
879.996360	37.4	15000.0	120.000	103.0	H	127.0	-5.9	8.6	46.0

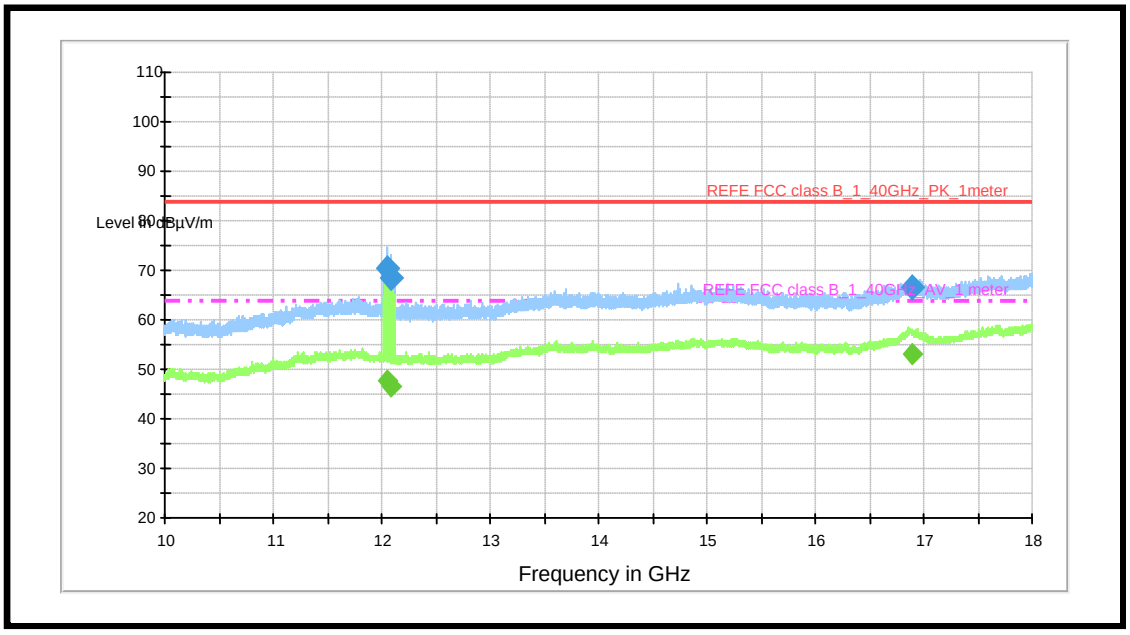
9.3.2 Radiated Emissions Test Data – 1GHz to 10GHz



Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1062.448000	53.6	15000.0	1000.000	100.0	V	325.0	-7.2	30.4	84.0
1199.872000	53.6	15000.0	1000.000	116.0	V	229.0	-5.6	30.4	84.0
1329.764000	61.7	15000.0	1000.000	100.0	H	320.0	-4.2	22.3	84.0
1598.878000	55.7	15000.0	1000.000	103.0	V	132.0	-1.8	28.3	84.0
2091.752000	52.1	15000.0	1000.000	105.0	V	0.0	1.4	31.9	84.0
7577.258000	61.9	15000.0	1000.000	156.0	H	56.0	19.1	22.1	84.0

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1062.448000	26.7	15000.0	1000.000	100.0	V	325.0	-7.2	37.3	64.0
1199.872000	46.4	15000.0	1000.000	116.0	V	229.0	-5.6	17.6	64.0
1329.764000	29.1	15000.0	1000.000	100.0	H	320.0	-4.2	34.9	64.0
1598.878000	30.9	15000.0	1000.000	103.0	V	132.0	-1.8	33.1	64.0
2091.752000	35.6	15000.0	1000.000	105.0	V	0.0	1.4	28.4	64.0
7577.258000	48.6	15000.0	1000.000	156.0	H	56.0	19.1	15.4	64.0

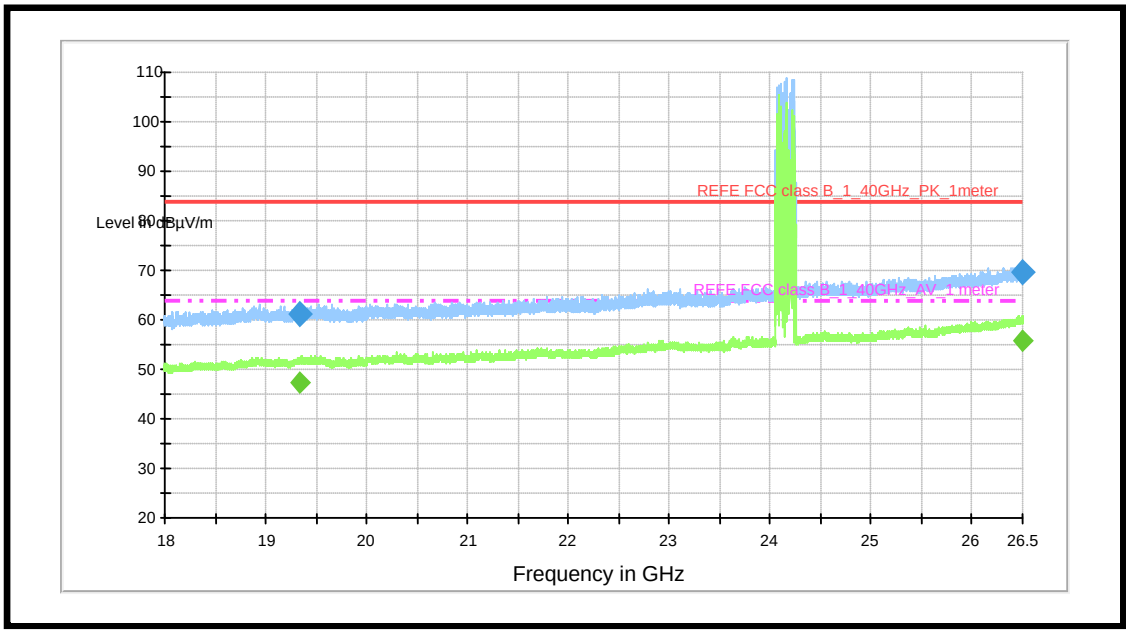
9.3.3 Radiated Emissions Test Data – 10GHz to 18GHz



Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
12049.23400	70.5	15000.0	1000.000	167.0	V	330.0	17.2	13.5	84.0
12084.67000	68.3	15000.0	1000.000	176.0	V	330.0	17.1	15.7	84.0
16891.40400	66.4	15000.0	1000.000	272.0	V	-5.0	23.6	17.6	84.0

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
12049.23400	47.7	15000.0	1000.000	167.0	V	330.0	17.2	16.3	64.0
12084.67000	46.7	15000.0	1000.000	176.0	V	330.0	17.1	17.3	64.0
16891.40400	52.9	15000.0	1000.000	272.0	V	-5.0	23.6	11.1	64.0

9.3.4 Radiated Emissions Test Data – 18GHz to 26.5GHz

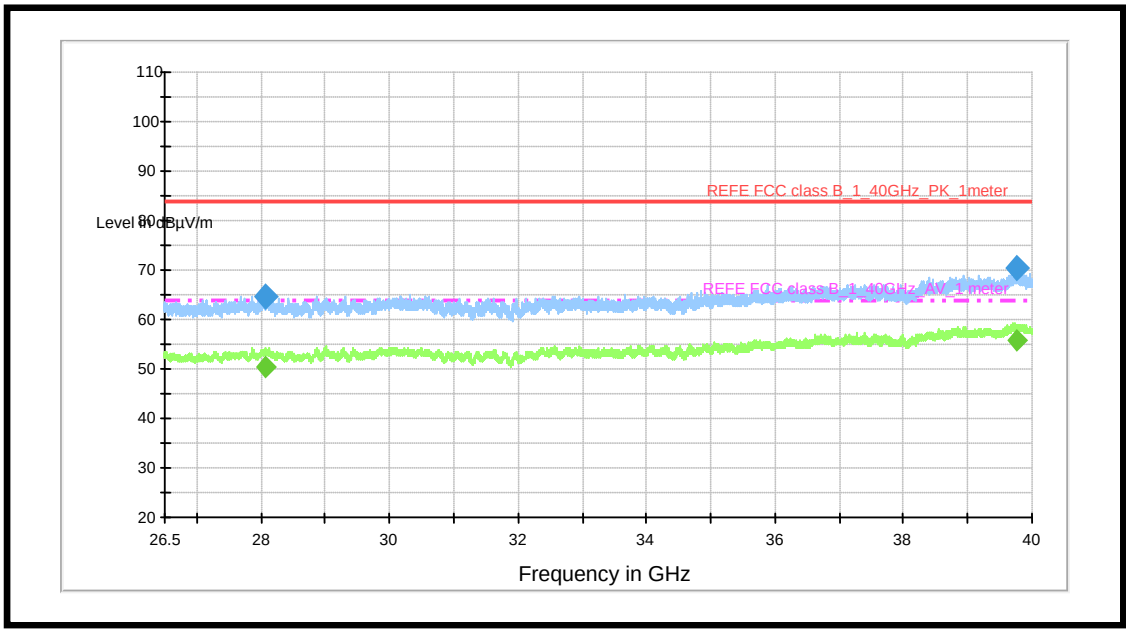


Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
19340.31200	61.0	15000.0	1000.000	110.0	V	59.0	18.2	23.0	84.0
26491.95805	69.5	15000.0	1000.000	110.0	H	5.0	23.9	14.5	84.0

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
19340.31200	47.4	15000.0	1000.000	110.0	V	59.0	18.2	16.6	64.0
26491.95805	55.7	15000.0	1000.000	110.0	H	5.0	23.9	8.3	64.0

Note: The emissions between 24.071GHz and 24.236GHz is the wanted Tx of the EUT forming part of the device primary function and therefore does not form part of this assessment on unwanted spurious emissions.

9.3.5 Radiated Emissions Test Data – 26.5GHz to 40GHz



Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
28078.08300	64.5	15000.0	1000.000	195.0	V	282.0	40.2	19.5	84.0
39753.21600	70.3	15000.0	1000.000	185.0	V	348.0	41.9	13.7	84.0

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
28078.08300	50.4	15000.0	1000.000	195.0	V	282.0	40.2	13.6	64.0
39753.21600	56.0	15000.0	1000.000	185.0	V	348.0	41.9	8.0	64.0

10 Sample Calculation

The radiated emission levels used in the report are calculated thus:

Frequency (MHz)	*Measured Value (dBµV)*	*Combined Antenna & Cable Factor (dB/m)*	*Emission Level (dBµV/m)*
37.04068	21.5	15.5	37.0
666.660787	33.7	9.2	42.9
59.149587	11.4	25.0	36.4
500.011013	29.0	11.7	40.7
431.992173	26.1	13.1	39.2
77.24332	9.6	23.3	32.9

11 Conducted Emissions as per ANSI C63.4:2003

11.1 General

This test measures conducted noise that may be present on an EUT's power supply cable. This test ensures the protection of broadcast and telecommunication services used in the vicinity of the EUT.

The test setup used complies with all the dimension requirements set out in ANSI C63.4:2003. Measurement instrumentation used meets the requirements of CISPR16-1-1:2003, and expanded laboratory uncertainties U_{lab} are less than or equal to U_{cispr}.Table 1. Therefore no compensation is required to the actual measured level in determining compliance with the applied limit.

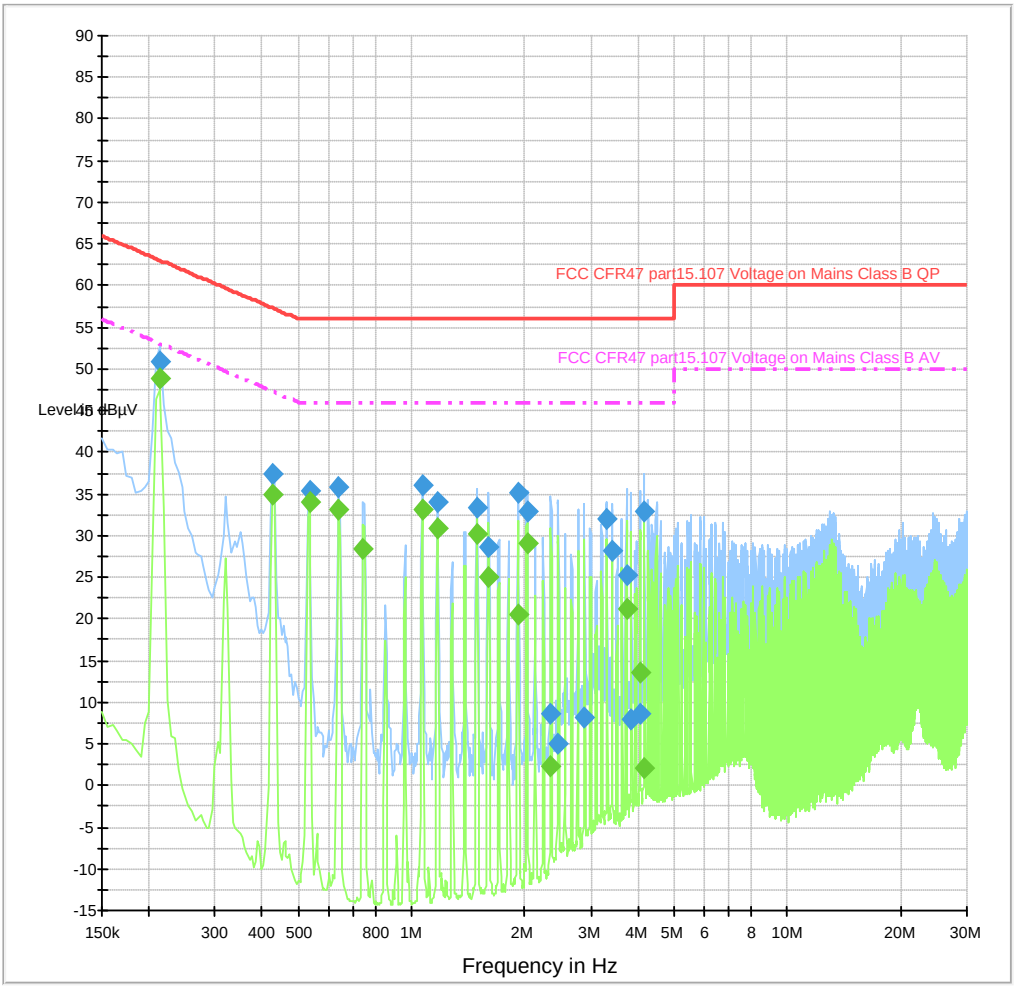
11.2 Conducted Emission Test Parameters

EUT Classification:	☐ A	☒ B
Frequency Range:	150kHz to 30MHz	
Receiver Frequency Step Size:	4.5kHz/5kHz	
Analyser Frequency Sweep Point Size:	≤4.5kHz	
Measurement Bandwidth:	9kHz/10kHz	
Video Bandwidth:	>30kHz	
Detectors:	Peak (Pre-scan) Quasi-peak (Final Measurements) Average (Final Measurements)	
Quasi-peak Detector Dwell:	Minimum 2s per frequency point	
EUT Measurement Height:	☒ 0.8m Insulated Table ☐ 0.1m Insulated Support/Pallet Mounted	
EUT Operation Voltage:	120Vac	
EUT Operating Frequency:	☒ 60Hz	☐ dc

11.3 EUT Test Results

11.3.1 Conducted Emissions Test Data

Conducted emissions on Mains 9kHz-30MHz ESHS10 + UH396



Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.215000	50.8	2000.0	10.000	N	9.5	12.2	63.0
0.425000	37.4	2000.0	10.000	L1	9.5	20.0	57.3
0.535000	35.3	2000.0	10.000	N	9.6	20.7	56.0
0.640000	35.7	2000.0	10.000	L1	9.6	20.3	56.0
1.070000	36.1	2000.0	10.000	N	9.6	19.9	56.0
1.175000	33.9	2000.0	10.000	N	9.6	22.1	56.0
1.495000	33.3	2000.0	10.000	N	9.6	22.7	56.0
1.600000	28.7	2000.0	10.000	L1	9.6	27.3	56.0
1.925000	35.1	2000.0	10.000	N	9.6	20.9	56.0
2.030000	32.8	2000.0	10.000	N	9.6	23.2	56.0
2.345000	8.5	2000.0	10.000	L1	9.6	47.5	56.0
2.450000	4.9	2000.0	10.000	L1	9.6	51.1	56.0
2.880000	8.1	2000.0	10.000	L1	9.6	47.9	56.0
3.315000	31.9	2000.0	10.000	N	9.6	24.1	56.0
3.420000	28.2	2000.0	10.000	N	9.6	27.8	56.0
3.740000	25.4	2000.0	10.000	N	9.7	30.6	56.0
3.840000	7.9	2000.0	10.000	L1	9.7	48.1	56.0
4.055000	8.6	2000.0	10.000	L1	9.7	47.4	56.0
4.170000	32.8	2000.0	10.000	N	9.7	23.2	56.0

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.215000	48.8	2000.0	10.000	L1	9.5	4.2	53.0
0.425000	35.0	2000.0	10.000	L1	9.5	12.4	47.3
0.535000	34.0	2000.0	10.000	N	9.6	12.0	46.0
0.640000	33.1	2000.0	10.000	N	9.6	12.9	46.0
0.745000	28.5	2000.0	10.000	L1	9.6	17.5	46.0
1.070000	33.1	2000.0	10.000	N	9.6	12.9	46.0
1.175000	30.8	2000.0	10.000	N	9.6	15.2	46.0
1.495000	30.1	2000.0	10.000	N	9.6	15.9	46.0
1.600000	24.9	2000.0	10.000	L1	9.6	21.1	46.0
1.920000	20.5	2000.0	10.000	L1	9.6	25.5	46.0
2.030000	29.0	2000.0	10.000	N	9.6	17.0	46.0
2.345000	2.4	2000.0	10.000	L1	9.6	43.6	46.0
3.740000	21.1	2000.0	10.000	N	9.7	24.9	46.0
4.060000	13.6	2000.0	10.000	N	9.7	32.4	46.0
4.160000	2.0	2000.0	10.000	L1	9.7	44.0	46.0

12 Test Equipment List – TRaC Hull

The following test equipment was used:

Type of Equipment	*Maker/Supplier*	*Model Number*	*Serial Number*	*TRaC Number*	*Actual Equipment Used*	*Calibration Date*	*Interval*
RF Pre-Amplifier 100kHz – 1.3GHz	Hewlett Packard	8447D	2727A05574	H008	☐		
Bi-Cone Antenna 20MHz – 300MHz	Eaton	96002	2500	H95	☐		
Receiver 9kHz – 30MHz	Rohde & Schwarz	ESHS10	830051/002	H125	☐		
Analyser/Receiver 20Hz – 1GHz	Rohde & Schwarz	ESVS 20	872890/004	H126	☐		
DRG Horn Antenna 1 – 18GHz	EMCO	3115	9303-4027	H130	☐		
LISN/AMN	Rohde & Schwarz	ESH3-Z5	838576/002	H189	☐		
Log Periodic Antenna 200MHz – 1GHz	EMCO	3146	9412-3925	H191	☐		
3 Phase LISN/AMN	Rohde & Schwarz	ESH2-Z5	832769/010	H233	☐		
Microwave Pre-Amplifier 1 – 26.5GHz	Hewlett Packard	8449B	3008A00873	H307	☒	21 JAN2014	24 Months
Spectrum Analyser 9kHz – 26.5GHz	Agilent	E4407B	US39441062	H404	☐		
Horn Antenna 18GHz – 26.5GHz	Q-Par Angus Ltd	QSH20S	5134	H630	☐		
Spectrum Analyser 100Hz – 6.7GHz	Agilent	E4404B	US40240716	H657	☐		
Pulse Limiter DC – 30MHz	Rohde & Schwarz	ESH3-Z2	101157	H674	☐		
Bi-Log Antenna 30MHz – 1GHz	Teseq	CBL6111	31217	H679	☒	1 MAY 2014	24 Months
Pulse Limiter DC – 30MHz	Rohde & Schwarz	ESH3-Z2	0357.8810.54	H680	☐		
Log Periodic Antenna 0.85 – 26.5GHz	Rohde & Schwarz	HL050	100540	H682	☐	8 JUL 2014	24 Months
Analyser/Receiver 20Hz - 40GHz	Rohde & Schwarz	ESU40	100005	H701	☐	11 NOV 14	12 months
RF Chamber	Belling Lee	Lab 5	None	H705	☐		
RF Chamber	Ray Proof	Lab 6	None	H706	☐		
RF Chamber	Ray Proof	Lab 7	None	H707	☐		
RF Chamber	Panashield	Lab 10	None	H710	☐	20 JUL 2014	12 month
Ground plane area	TRaC	Lab 17	None	H717	☐		
Horn Antenna 26.5 - 40GHz	FM Ltd	2240-2S	160356	REF820	☐		
Pre-amp	Sonoma	310	-	RFG673	☐	6 MAR 2015	24 month
Horn anteena 18 - 26.5GHz	Q-PAR	QSH20S20S	-	REF673	☐	19 SEP 2013	36 month
Horn antenna 26.5 – 40GHz	Flann	22240-25	-	REF821	☐	11 FEB 2008*	-

* The Flann 22240-25 horn antenna calibration is the manufacture supplied antenna factors at the time of purchase; the antenna has no calibration period due to antenna type being a ridged horn antenna and therefore has no requirements for calibration under the FCC rules.

13 Test Equipment List – TRaC North West

The following test equipment was used:

Type of Equipment	*Maker/Supplier*	*Model Number*	*Serial Number*	*TRaC Number*	*Actual Equipment Used*	*Calibration Due Date*	*Interval*
Receiver	Rohde & Schwarz	ESHS10	830051/001	UH03	☐		
Receiver	Rohde & Schwarz	ESVS10	825892/006	UH04	☐		
LISN	Rohde & Schwarz	ESH3-Z5	863906/018	UH05	☐		
RF Cable	TRaC	N/A	None	UH21	☒	12 NOV 2014	12 months
Log Periodic Antenna	Schwarzbeck	UHALP 9108	AC2404C/1	UH28	☐		
Biconical Antenna	Schwarzbeck	VHBA 9123	None	UH29	☐		
Log Periodic Antenna	Amplifier Research	15342	AT1080	UH65	☐		
Voltage Probe	TRaC	None	None	UH78	☐		
3 Phase Variac	TRaC	None	None	UH80	☐		
Bi-Log Antenna	Chase	CBL6112B	2803	UH93	☐		
Temp/Humid/Barometer	RS	None	None	UH110	☐		
Receiver	Rohde & Schwarz	ESVS10	841431/014	UH186	☐		
Receiver	Rohde & Schwarz	ESHS10	841429/012	UH187	☒	3 MAR 2015	12 months
Bi-Log Antenna	York EMC	CBL611/A	1618	UH191	☐		
Biconical Antenna	AH Systems	2101-3	396	UH193	☐		
Power Supply	Farnell	AP60/50	000795	UH194	☐		
LISN	Rohde & Schwarz	ESH3-Z5.831.5	8407 31/015	UH195	☐		
DRG Horn	Eaton	3115	2035	UH222	☐		
Spectrum Analyser	Advantest	TR4131	76370450	UH255	☐		
RF Cable	TRaC	None	None	UH262	☐		
Spectrum Analyser	Rohde & Schwarz	FSU26	200034	UH281	☐		
Spectrum Analyser	Rohde & Schwarz	FSH6	101670	UH357	☐		
Log Periodic Antenna	Rohde & Schwarz	HL050	100457	UH385	☐		
CISRP 16 Chamber	Rainford EMC	31241	472-CH1-001	UH387	☐		
CISRP 16 Chamber	Rainford EMC	31144	472-CH2-001	UH388	☐		
Transient Chamber 4	Rainford EMC	31950	472-CH4-001	UH390	☒	N/A	N/A
Temp/Humid/Barometer	Innovative	888R05	None	UH391	☐		
Temp/Humid/Barometer	Innovative	888R05	None	UH392	☐		
AC Power Source	Schaffner	360AMX UPC12.S	0188	UH394	☐		
LISN	Rohde & Schwarz	ENV216	101027	UH396	☒	22 MAY 2014	12 months
Receiver/Analyser	Rohde & Schwarz	ESCI7	100850	UH403	☐		
Screened Room	Rainford EMC	35685	515-TR-001	UH404	☐		
RF Cable	Rosenberger	FB293C1025005050	70557-01	UH406	☐		
RF Cable	Rosenberger	FB293C1025005050	70557-02	UH407	☐		
RF Cable	Rosenberger	FB293C1078005050	70561-01	UH408	☐		
RF Cable	Rosenberger	FB293C1078005050	70561-02	UH409	☐		
RF Cable	Reynolds	269-0078-10M0	066	UH410	☐		
RF Cable	Andrews	None	None	UH411	☐		
RF Cable	Andrews	None	None	UH412	☐		
Spectrum Analyser	Rohde & Schwarz	FSH8	105512	UH414	☐		
LISN	Cranage	VN3-635	001959	UH417	☐		

Type of Equipment	*Maker/Supplier*	*Model Number*	*Serial Number*	*TRaC Number*	*Actual Equipment Used*	*Calibration Due Date*	*Interval*
Bi-Log Antenna	Chase	CBL6112	2053	UH420	☐		
SMA RF Cable	Rosenberger	None	None	UH430	☐		
RF Cable	Rosenberger	3899-001	None	UH435	☐		
RF Cable	TRaC	N/A	None	UH436	☐		
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	0357.8810.54	UH443	☐		
RF Cable	TRaC	N/A	None	UH445	☐		
DRG Horn Antenna	EMCO	3115	9010-3580	L138	☐		
Bi-Log Antenna	Chase	CBL6111	1945	L290	☐		
Microwave Pre-Amplifier	Agilent	8449B	3008A016	L572	☐		
CISRP 16 Chamber	Rainford EMC	35864	515-3M-001	REF940	☐		

14 EMC Modifications

No modifications were performed during this assessment.

15 Conclusion

The EUT meets the performance requirements of the specification, when tested in a system configuration described in section 6 of this report.

Note should be taken of any modifications listed in the relevant section of this report.

The EUT achieved the following performance criteria during the test programme.

Test Standard	*Test Order*	*Class*		*Pass*
ANSI C63.4:2003 – Radiated Electromagnetic Emissions	2	A ☐	B ☒	☒
ANSI C63.4:2003 – Conducted Electromagnetic Emissions	1	A ☐	B ☒	☒

15.1 Conformity in Production

TRaC Global Ltd. has based this test report on results from the equipment sample(s) provided.

The manufacturer is advised that they may have an obligation to demonstrate that production samples are in conformity with the Standards noted.

The EMC performance reported above was achieved after incorporation of any modifications as detailed in Section 16 of this report.

16 Measurement Uncertainty

SCHEDULE A – EMC MEASUREMENT UNCERTAINTY (LAB BASED)

All uncertainties listed are standard uncertainties multiplied by a coverage factor K=2.00 to give a 95% confidence level.

Conducted Emissions Including Discontinuous Emissions

[1] Conducted Emissions 150kHz to 30MHz = **3.4dB**

Radiated Emissions

[1] Radiated Emissions 30MHz to 1GHz using CBL6111/2 Bilog Antenna = **4.6dB**
[2] Radiated Emissions 1 to 6GHz using HL050 Log Periodic Antenna = **5.1dB**
[3] Radiated Emissions 6 to 26.5GHz using HL050 Log Periodic Antenna = **5.2dB**
[4] Radiated Emissions 26.5 to 40GHz using 22240-25 Horn Antenna = **3.8dB**

Spurious Emissions up to 40GHz

[1] Uncertainty in test result = **4.75dB**

Cable Calibrations

[1] Cable calibration up to 40GHz = **0.4dB**

17 APPENDIX A – PHOTOGRAPHS

Radiated Emissions <1GHz

Conducted Emissions