Report on the Radio Testing

For

MysteryVibe Ltd

on

Dock Charger

Report no. TRA-021996-47-03C

18th August 2016

Report Number: TRA-021996-47-03C
Issue: C

REPORT ON THE RADIO TESTING OF A
MysteryVibe Ltd
Dock Charger
WITH RESPECT TO SPECIFICATION
FCC 47CFR 15.209

TEST DATE: 1st - 21st June 2016

Tested by: D Winstanley

D Winstanley
Radio Senior Test Engineer

Approved by: John Charters

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J Charters
Department Manager - Radio

Date: 18th August 2016

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Company Reg No. 02536659

ilac-MRA UKAS TESTING 0026

1 Revision Record

Issue Number	*Issue Date*	*Revision History*
A	18th August 2016	Original
B	8th August 2016	Addition of extrapolation / calculation
C	18th August 2016	Updated the correct voltage, correct model no., and table & comments on page 40.

2 Summary

TEST REPORT NUMBER:	TRA-021996-47-03C
WORKS ORDER NUMBER:	TRA-021996-03
PURPOSE OF TEST:	USA: Testing of radio frequency equipment per the relevant authorization procedure of chapter 47 of CFR (code of federal regulations) Part 2, subpart J.
TEST SPECIFICATION(S):	47CFR15.209
EQUIPMENT UNDER TEST (EUT):	Dock Charger
FCC IDENTIFIER:	2AHVA-6900DK
EUT SERIAL NUMBER:	not applicable
MANUFACTURER/AGENT:	MysteryVibe Ltd
ADDRESS:	68 Whalley Drive Bletchley Milton Keynes Buckinghamshire MK3 6HS United Kingdom
CLIENT CONTACT:	Soumyadip Rakshit ☎ ✉ soumyadip@mysteryvibe.com
ORDER NUMBER:	Not Applicable
TEST DATE:	1st - 21st June 2016
TESTED BY:	D Winstanley Element

2.1 Test Summary

Test Method and Description	*47CFR15*	*Applicable to this equipment*	*Result / Note*
Radiated spurious emissions, below 30 MHz	15.209	☒	*Pass*
Radiated spurious emissions	15.209	☒	*Pass*
AC power line conducted emissions	15.207	☒	*Pass*
Occupied bandwidth	15.215	☒	*Pass*
Field strength of fundamental	15.209	☒	*Pass*

Notes:

The results contained in this report relate only to the items tested, in the condition at time of test, and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

The apparatus was set up and exercised using the configurations, modes of operation and arrangements defined in this report only. Any modifications made are identified in Section 8 of this report.

Particular operating modes, apparatus monitoring methods and performance criteria required by the standards tested to have been performed except where identified in Section 5.2 of this test report (Deviations from Test Standards).

3 Contents

4 Introduction

This report TRA-021996-47-03B presents the results of the Radio testing on a MysteryVibe Ltd, Dock Charger to specification 47CFR15 Radio Frequency Devices.

The testing was carried out for MysteryVibe Ltd by Element, at the address(es) detailed below.

☐ Element Hull
Unit E
South Orbital Trading Park
Hedon Road
Hull
HU9 1NJ
UK

☒ Element Skelmersdale
Unit 1
Pendle Place
Skemersdale
West Lancashire
WN8 9PN
UK

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 Elements own procedures, as well as statistical techniques for analysis of test data providing the appropriate confidence in measurements.

Throughout this report EUT denotes equipment under test.

FCC Site Listing:
Element is accredited for the above sites under the US-EU MRA, Designation number UK0009.

The test site requirements of ANSI C63.4-2014 are met up to 1 GHz.

The test site SVSWR requirements of CISPR 16-1-4:2010 are met over the frequency range 1 GHz to 18 GHz.

5 Test Specifications

5.1 Normative References

- FCC 47 CFR Ch. I – Part 15 – Radio Frequency Devices.
- ANSI C63.10-2013 – American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.
- ANSI C63.4-2014 – American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

5.2 Deviations from Test Standards

There were no deviations from the test standard.

6 Glossary of Terms

§	denotes a section reference from the standard, not this document
AC	Alternating Current
ANSI	American National Standards Institute
BW	bandwidth
C	Celsius
CFR	Code of Federal Regulations
CW	Continuous Wave
dB	decibel
dBm	dB relative to 1 milliwatt
DC	Direct Current
DSSS	Direct Sequence Spread Spectrum
EIRP	Equivalent Isotropically Radiated Power
ERP	Effective Radiated Power
EUT	Equipment Under Test
FCC	Federal Communications Commission
FHSS	Frequency Hopping Spread Spectrum
Hz	hertz
ITU	International Telecommunication Union
LBT	Listen Before Talk
m	metre
max	maximum
MIMO	Multiple Input and Multiple Output
min	minimum
MRA	Mutual Recognition Agreement
N/A	Not Applicable
PCB	Printed Circuit Board
PDF	Portable Document Format
Pt-mpt	Point-to-multipoint
Pt-pt	Point-to-point
RF	Radio Frequency
RH	Relative Humidity
RMS	Root Mean Square
Rx	receiver
s	second
SVSWR	Site Voltage Standing Wave Ratio
Tx	transmitter
UKAS	United Kingdom Accreditation Service
V	volt
W	watt
Ω	ohm

7 Equipment Under Test

7.1 EUT Identification

- Name: Dock Charger
- Serial Number: not applicable
- Model Number: 6900DK
- Software Revision: 0_7_15_15_400
- Build Level / Revision Number: Pre Production

7.2 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.

AC Adaptor
Manufacture - Winna
Model - YN6W-0500100BU

7.3 EUT Mode of Operation

7.3.1 Transmission

The mode of operation for Tx tests was as follows…

The EUT was powered from a mains – USB adaptor and had a crescendo resting atop of the dock charging a discharged battery, in this mode there is a data exchange between the EUT and charging device.
The device was also tested without a crescendo on charge

7.3.2 Reception

Not Applicable

7.4 EUT Radio Parameters

7.4.1 General

Frequency of operation:	110kHz to 205kHz
Occupied channel bandwidth(s):	Wideband
Channel spacing:	Not Applicable
Nominal Supply Voltage:	+5Vdc

7.4.2 Antennas

Type:	Integral
Frequency range:	110 – 205 kHz
Impedance:	unknown
SWR:	unknown
Gain:	unknown
Polarisation:	unknown
Beam width:	Not Applicable
Connector type:	Not Applicable

7.5 EUT Description

The EUT is an inductive charging station operating using Qi Low Power Format (WPC-1.1.2)

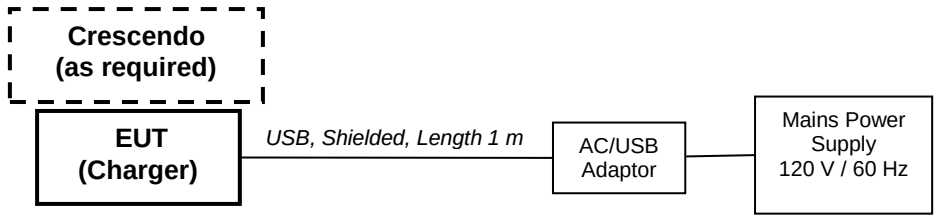
8 Modifications

No modifications were performed during this assessment.

9 EUT Test Setup

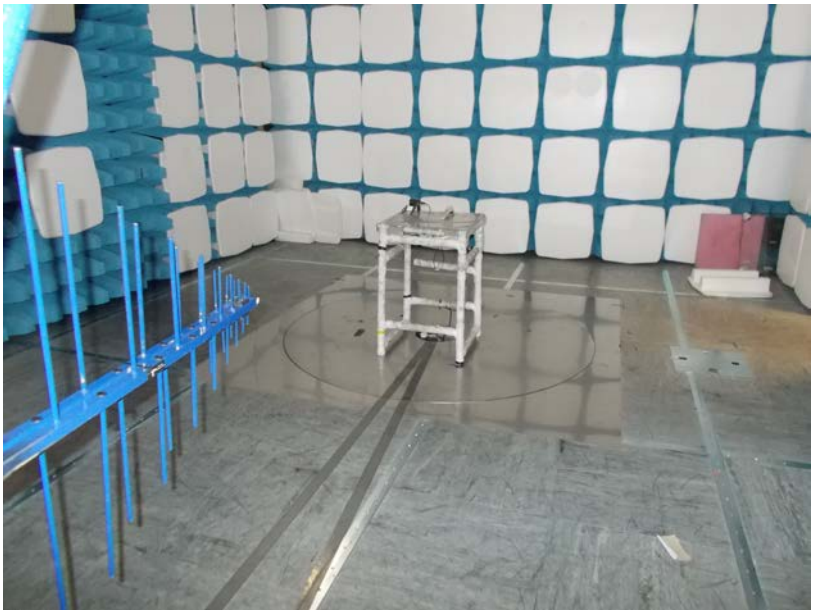
9.1 Block Diagram

The following diagram shows basic EUT interconnections with cable type and cable lengths identified:



9.2 General Set-up Photograph

The following photograph shows basic EUT set-up:



10 General Technical Parameters

10.1 Normal Conditions

The E U T was tested under the normal environmental conditions of the test laboratory, except where otherwise stated. The normal power source applied was approx. 5 V dc from the mains adaptor.

Variation of supply voltage is required to ensure stability of the declared output power and frequency. During carrier power and frequency error testing the following variations were made:

	Category	***Nominal***	***Variation***
☒	Mains	120 V ac +/-2 %	85 % and 115 %
☐	Battery	New battery	N/A

11 Radiated emissions below 30 MHz

11.1 Definitions

Out-of-band emissions
Emissions on a frequency or frequencies immediately outside the necessary bandwidth which result from the modulation process, but exclude spurious emissions.

Spurious emissions
Emissions on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

Restricted bands
A frequency band in which intentional radiators are permitted to radiate only spurious emissions but not fundamental signals.

11.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Chamber
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.4
Deviations From Standard:	None
Measurement Distance and Site	10 m, OATS without ground plane. Preview measurements 3 m
EUT Height:	1 m
Measurement Antenna and Height:	60 cm shielded loop; 1 m
Measurement BW:	9 kHz to 150 kHz: 200 Hz; 150 kHz to 30 MHz: 9 kHz
Measurement Detector:	9 kHz to 90 kHz and 110 kHz to 490 kHz: Average, RMS Other frequencies below 30 MHz: Quasi-peak.

Environmental Conditions (Normal Environment)

Temperature: 21 °C	+15 ºC to +35 ºC (as declared)
Humidity: 44 % RH	20 % RH to 75 % RH (as declared)
Supply: 120 V ac	120 V ac ±15 % (as declared)

11.3 Test Limit

Emissions from license-exempt transmitters shall comply with the field strength limits shown in the table below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

General Field Strength Limits for License-Exempt Transmitters at Frequencies Below 30 MHz

Frequency, f (kHz)	*Field Strength*	*Measurement Distance (m)*
9 to 490	2,400 / 377.f (µA/m) 2,400 / f (µV/m)	300
490 to 1,750	24,000 / 377.f (µA/m) 24,000 / f (µV/m)	30
1,750 to 30,000	30 (µV/m)	30

11.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure i, the EUT fundamental frequency was maximised by rotating the EUT through 360º, in three orthogonal planes, and adjusting the measurement antenna azimuth.

Radiated electromagnetic emissions from the EUT are checked first by preview scans. Preview scans for all spectrum and modulation characteristics are checked, using a peak detector and where applicable worst-case determined for function, operation, orientation, etc. for both vertical and horizontal polarisations. Pre-scan plots are shown with a peak detector and 9 kHz RBW.

If the EUT connects to auxiliary equipment and is table or floor standing, the configurations prescribed in ANSI C63.10 are followed. Alternatively, a layout closest to normal use (as declared by the provider) is employed, (see EUT setup photographs for more detail).

Emissions between 9 kHz and 30 MHz are measured using a calibrated 60cm active loop antenna. Pre-amplifiers and filters are used where required. Care is taken to ensure that test receiver resolution bandwidth, video bandwidth and detector type(s) meet the regulatory requirements.

Power values measured on the test receiver / analyzer are converted to field strength, FS, in µV/m at the regulatory distance, using:

$$FS = 10^{(PR - CF) / 20}$$

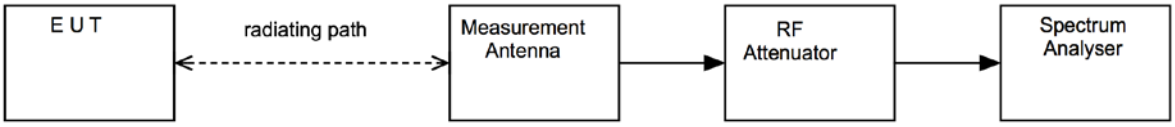
Where,

PR is the power recorded on the receiver / spectrum analyzer in dBµV and includes any cable loss, antenna factor and pre-amplifier gain;
CF is the distance extrapolation factor in dB (where measurement distance different to limit distance);

Per FCC 47CFR15.31(f)(2) / RSS-Gen 6.4, an extrapolation factor of 40 dB per decade was used for measurements at distances closer than specified.

This field strength value is then compared with the regulatory limit.

Figure i Test Setup



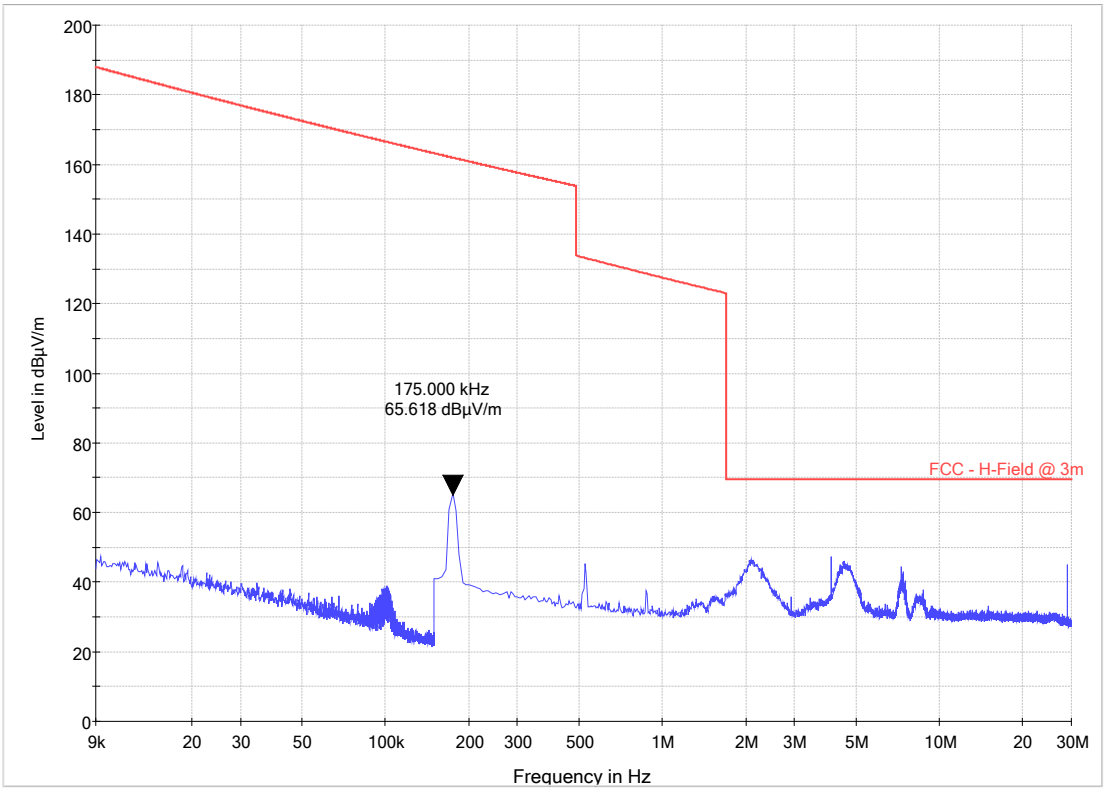
11.5 Test Set-up Photograph

11.6 Test Equipment

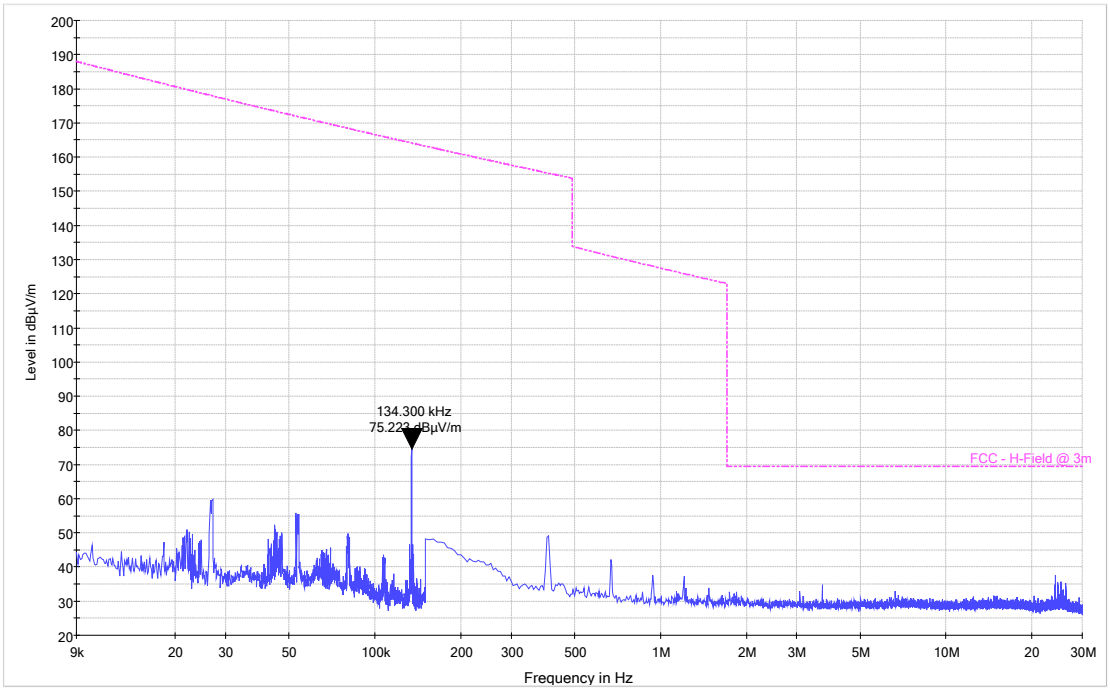
Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
hfh2	R&S	Loop Antenna	L007	10/04/2017
ESHS10	R&S	Receiver	U187	29/10/2016

11.7 Test Results

Charger Only						
Emission Frequency (MHz)	***Receiver Level (dBµV/m)***	***Measurement Distance (m)***	***Limit Distance (m)***	***Extrapolation Factor (dB)***	***Field Strength (µV/m)***	***Result***
No significant emissions within 10 dB of limit						PASS



Charger and Crescendo						
Emission Frequency (MHz)	***Receiver Level (dBµV/m)***	***Measurement Distance (m)***	***Limit Distance (m)***	***Extrapolation Factor (dB)***	***Field Strength (µV/m)***	***Result***
No significant emissions within 10 dB of limit						PASS



12 Radiated emissions

12.1 Definitions

Out-of-band emissions
Emissions on a frequency or frequencies immediately outside the necessary bandwidth which result from the modulation process, but exclude spurious emissions.

Spurious emissions
Emissions on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

Restricted bands
A frequency band in which intentional radiators are permitted to radiate only spurious emissions but not fundamental signals.

12.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Chamber
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.5
Deviations From Standard:	None
Measurement BW:	30 MHz to 1000 MHz: 120 kHz
Measurement Detector:	Quasi-peak

Environmental Conditions (Normal Environment)

Temperature: 22 °C	+15 ºC to +35 ºC (as declared)
Humidity: 46 % RH	20 % RH to 75 % RH (as declared)
Supply: 120 V ac	120 V ac

12.3 Test Limit

Emissions from license-exempt transmitters shall comply with the field strength limits shown in the table below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

General Field Strength Limits for License-Exempt Transmitters at Frequencies above 30 MHz

Frequency (MHz)	***Field Strength (µV/m at 3 m)***
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

12.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure ii, the emissions from the EUT were measured on a spectrum analyzer / EMI receiver.

Radiated electromagnetic emissions from the EUT are checked first by preview scans. Preview scans for all spectrum and modulation characteristics are checked, using a peak detector and where applicable worst-case determined for function, operation, orientation, etc. for both vertical and horizontal polarisations. Pre-scan plots are shown with a peak detector and 100 kHz RBW.

If the EUT connects to auxiliary equipment and is table or floor standing, the configurations prescribed in ANSI C63.10 are followed. Alternatively, a layout closest to normal use (as declared by the provider) is employed, (see EUT setup photographs for more detail).

Emissions between 30 MHz and 1 GHz are measured using calibrated broadband antennas. Emissions above 1 GHz are characterized using standard gain horn antennas. Pre-amplifiers and filters are used where required. Care is taken to ensure that test receiver resolution bandwidth, video bandwidth and detector type(s) meet the regulatory requirements.

For both horizontal and vertical polarizations, the EUT is then rotated through 360 degrees in azimuth until the highest emission is detected. At the previously determined azimuth the test antenna is raised and lowered from 1 to 4 m in height until a maximum emission level is detected, this maximum value is recorded.

Power values measured on the test receiver / analyzer are converted to field strength, FS, in dBµV/m at the regulatory distance, using:

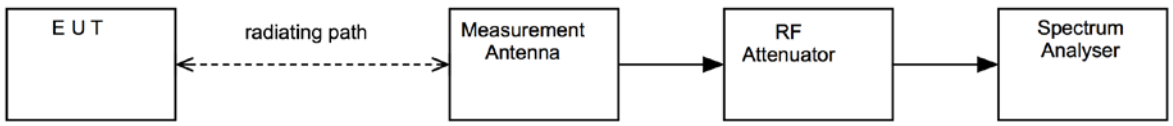
$$FS = PR + CL + AF – PA + DC – CF$$

Where,

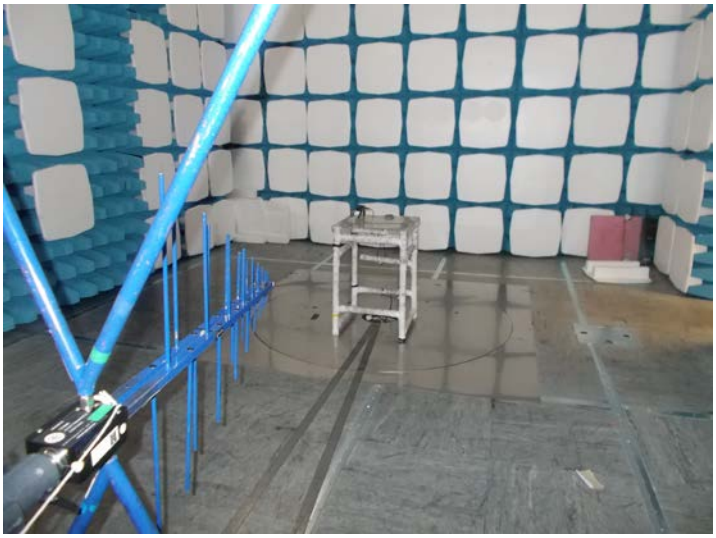
PR is the power recorded on the receiver / spectrum analyzer in dBµV;
CL is the cable loss in dB;
AF is the test antenna factor in dB/m;
PA is the pre-amplifier gain in dB (where used);
DC is the duty correction factor in dB (where used, e.g. harmonics of pulsed fundamental);
CF is the distance factor in dB (where measurement distance is different to limit distance);

This field strength value is then compared with the regulatory limit.

Figure ii Test Setup



12.5 Test Set-up Photograph

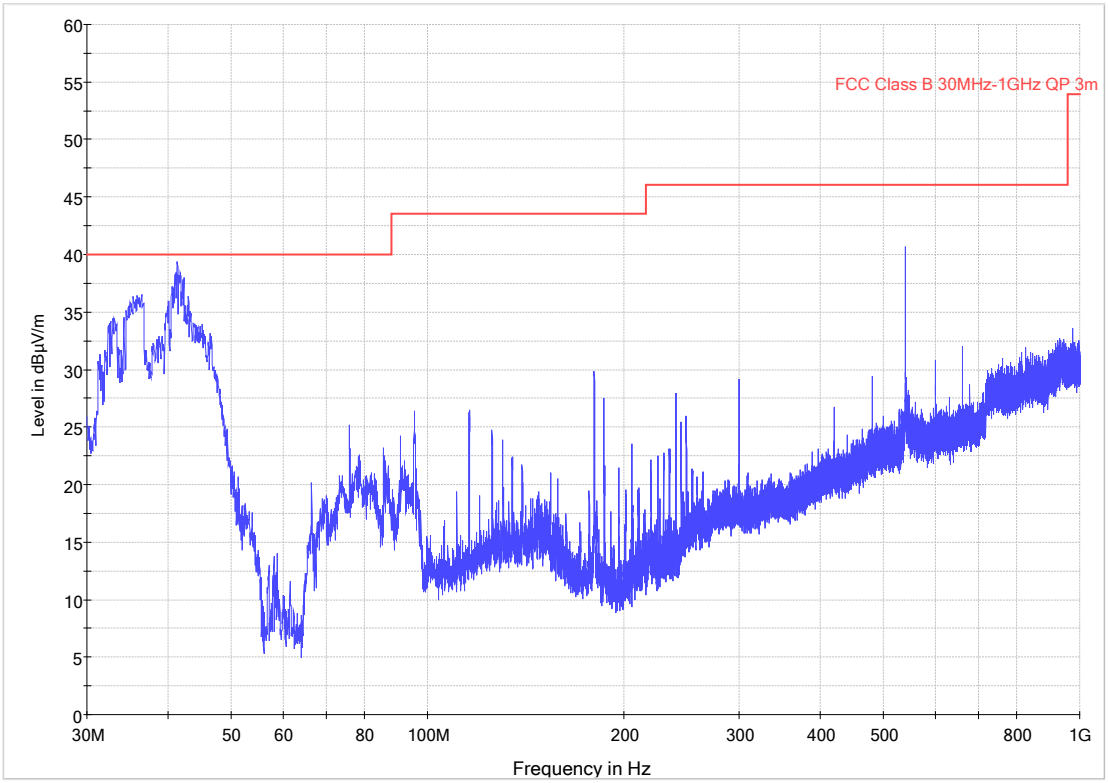


12.6 Test Equipment

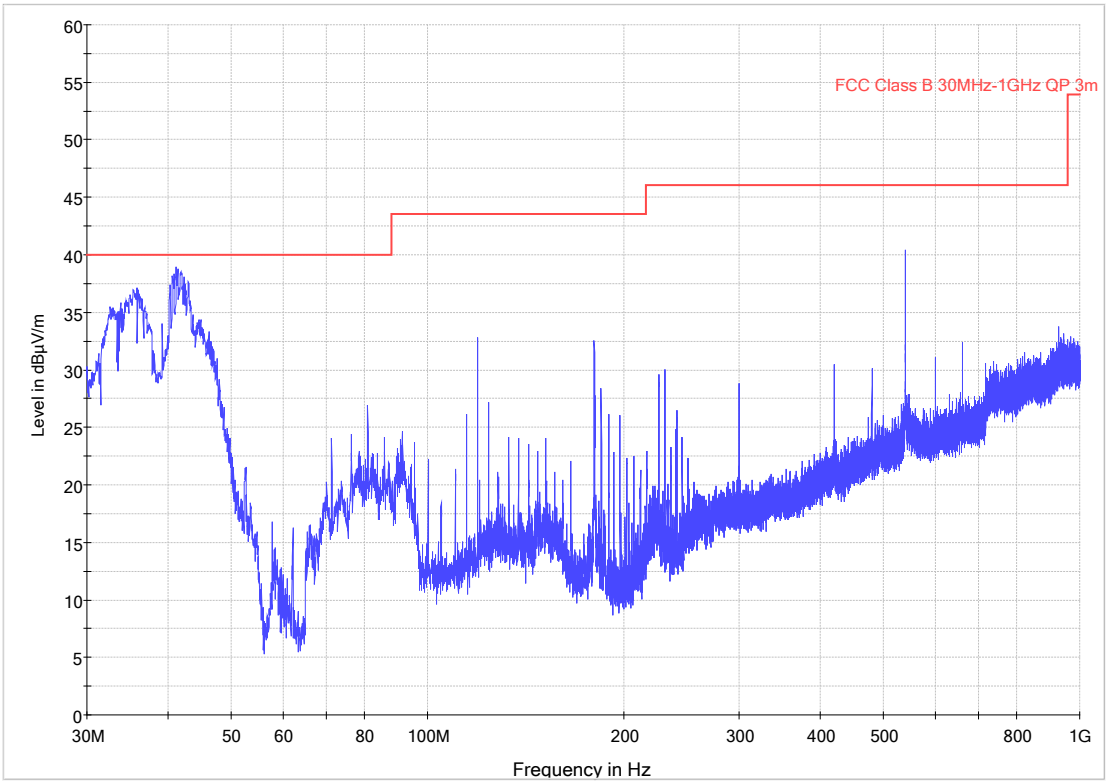
Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
CBL611/A	Chase	Bilog	U191	26/02/2017
ESVS10	R&S	Receiver	L317	11/03/2017

12.7 Test Results

Charger Only										
Detector	***Freq. (MHz)***	***Meas'd Emission (dBµV)***	***Cable Loss (dB)***	***Antenna Factor (dB/m)***	***Pre-amp Gain (dB)***	***Duty Cycle Corr'n (dB)***	***Distance Extrap'n Factor (dB)***	***Field Strength (dBµV/m)***	***Field Strength (µV/m)***	***Limit (µV/m)***
QP	32.15	14.55	0.90	17.83	N/A	0.00	0.00	33.28	46.13	100
QP	33.85	16.30	1.00	17.06	N/A	0.00	0.00	34.36	52.24	100
QP	35.55	19.22	1.00	16.13	N/A	0.00	0.00	36.35	65.69	100
QP	39.70	20.82	1.00	13.78	N/A	0.00	0.00	35.60	60.26	100
QP	40.85	25.40	1.00	13.18	N/A	0.00	0.00	39.58	95.28	100
QP	42.85	24.31	1.00	12.08	N/A	0.00	0.00	37.39	74.05	100
QP	45.70	16.11	1.19	10.48	N/A	0.00	0.00	27.78	24.49	100
QP	72.65	18.86	1.30	6.63	N/A	0.00	0.00	26.79	21.85	100
QP	97.35	19.17	1.50	10.00	N/A	0.00	0.00	30.67	34.16	150
QP	102.15	16.46	1.50	10.60	N/A	0.00	0.00	28.56	26.79	150
QP	112.90	13.48	1.60	11.49	N/A	0.00	0.00	26.57	21.31	150
QP	117.70	16.31	1.60	12.10	N/A	0.00	0.00	30.01	31.66	150
QP	125.45	15.89	1.68	12.56	N/A	0.00	0.00	30.13	32.10	150
QP	127.00	17.84	1.70	12.60	N/A	0.00	0.00	32.14	40.46	150
QP	130.55	12.83	1.70	12.50	N/A	0.00	0.00	27.03	22.46	150
QP	165.15	18.33	1.80	10.19	N/A	0.00	0.00	30.32	32.81	150
QP	179.95	18.10	1.92	9.50	N/A	0.00	0.00	29.52	29.92	150
QP	185.05	15.15	1.98	9.10	N/A	0.00	0.00	26.23	20.49	150
QP	195.20	15.43	2.00	8.40	N/A	0.00	0.00	25.83	19.57	150
QP	299.90	18.99	2.33	12.90	N/A	0.00	0.00	34.22	51.40	200
QP	420.05	15.58	2.86	16.20	N/A	0.00	0.00	34.64	53.95	200
QP	540.10	16.13	3.20	19.41	N/A	0.00	0.00	38.74	86.50	200
QP	600.10	6.77	3.30	19.11	N/A	0.00	0.00	29.18	28.77	200
QP	829.90	5.48	3.86	22.60	N/A	0.00	0.00	31.94	39.54	200
QP	931.30	5.51	4.10	24.03	N/A	0.00	0.00	33.64	48.08	200
QP	941.95	5.21	4.12	24.20	N/A	0.00	0.00	33.53	47.48	200


FCC Class B 30MHz-1GHz QP 3m
Level in dBµV/m
Frequency in Hz
60
55
50
45
40
35
30
25
20
15
10
5
0
30M
50
60
80
100M
200
300
400
500
800
1G

Charger & Crescendo										
Detector	***Freq. (MHz)***	***Meas'd Emission (dBµV)***	***Cable Loss (dB)***	***Antenna Factor (dB/m)***	***Pre-amp Gain (dB)***	***Duty Cycle Corr'n (dB)***	***Distance Extrap'n Factor (dB)***	***Field Strength (dBµV/m)***	***Field Strength (µV/m)***	***Limit (µV/m)***
QP	31.65	6.90	0.90	18.08	N/A	0.00	0.00	25.88	19.68	100
QP	33.50	12.80	0.98	17.20	N/A	0.00	0.00	30.98	35.40	100
QP	35.15	13.89	1.00	16.33	N/A	0.00	0.00	31.22	36.39	100
QP	39.70	15.51	1.00	13.78	N/A	0.00	0.00	30.29	32.70	100
QP	41.70	20.35	1.00	12.68	N/A	0.00	0.00	34.03	50.29	100
QP	42.65	19.72	1.00	12.18	N/A	0.00	0.00	32.90	44.16	100
QP	47.10	16.57	1.12	9.84	N/A	0.00	0.00	27.53	23.80	100
QP	66.85	14.35	1.30	6.19	N/A	0.00	0.00	21.84	12.36	100
QP	925.60	-1.64	4.10	23.72	N/A	0.00	0.00	26.18	20.37	200
QP	934.25	-1.66	4.10	24.20	N/A	0.00	0.00	26.64	21.48	200



13 AC power-line conducted emissions

13.1 Definition

Line-to-ground radio-noise voltage that is conducted from all of the EUT current-carrying power input terminals that are directly (or indirectly via separate transformers or power supplies) connected to a public power network.

13.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	U404
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.2
EUT Channels / Frequencies Measured:	Mid
Deviations From Standard:	None
Measurement BW:	10 kHz
Measurement Detectors:	Quasi-Peak and Average, RMS

Environmental Conditions (Normal Environment)

Temperature: 21 °C	+15 ºC to +35 ºC (as declared)
Humidity: 42 % RH	20 % RH to 75 % RH (as declared)
Supply: 120 V ac	120 V ac (as declared)

13.3 Test Limit

A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz, shall not exceed the limits in Table 3.

Table 3 – AC Power Line Conducted Emission Limits

Frequency (MHz)	***Conducted limit (dBµV)***	
	Quasi-Peak	***Average*** **
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5	56	46
5 to 30	60	50

*The level decreases linearly with the logarithm of the frequency.
**A linear average detector is required.

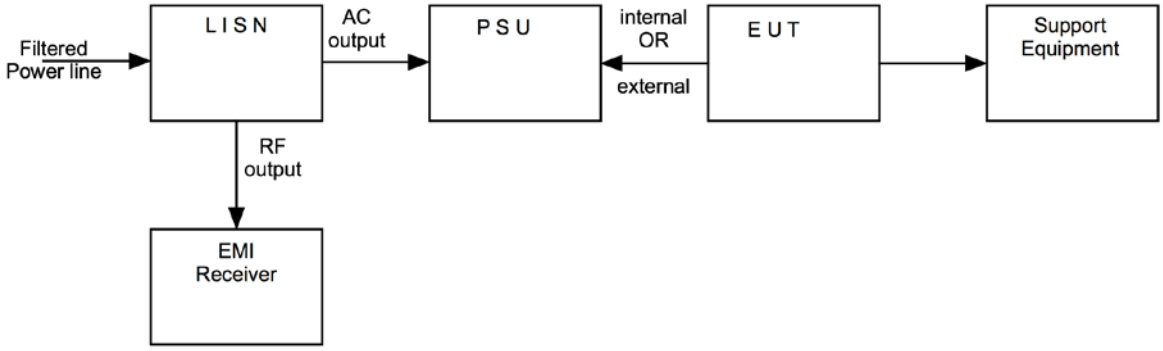
13.4 Test Method

With the EUT setup in a screened room, as per section 9 of this report and connected as per Figure iii, the power line emissions were measured on a spectrum analyzer / EMI receiver.

AC power line conducted emissions from the EUT are checked first by preview scans with peak and average detectors covering both live and neutral lines. A spectrum analyzer is used to determine if any periodic emissions are present.

Formal measurements using the correct detector(s) and bandwidth are made on frequencies identified from the preview scans. Final measurements were performed with EUT set at its maximum duty in transmit and receive modes.

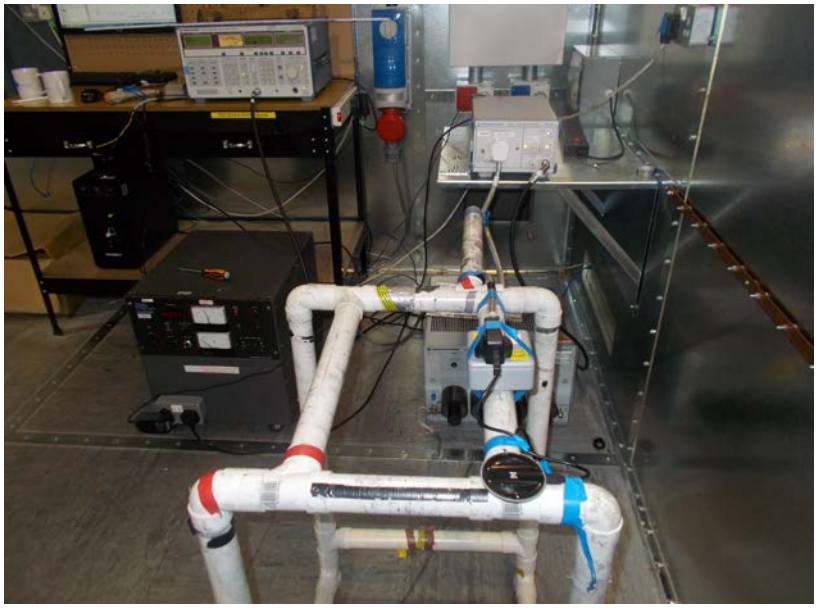
Figure iii Test Setup



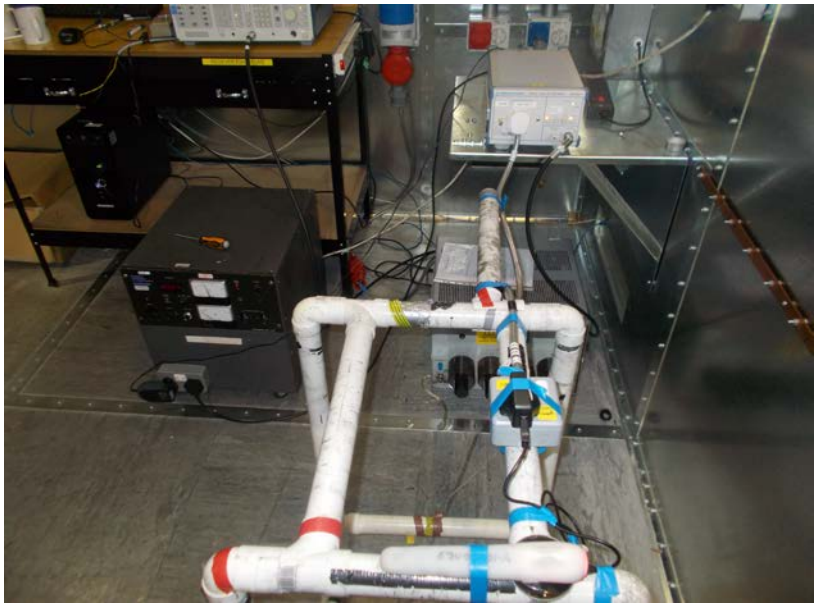
13.5 Test Equipment

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
ENV216	R&S	Lisn	U396	01/07/2016
ESHS10	R&S	Receiver	U003	25/06/2017

13.6 Test Set-up Photograph



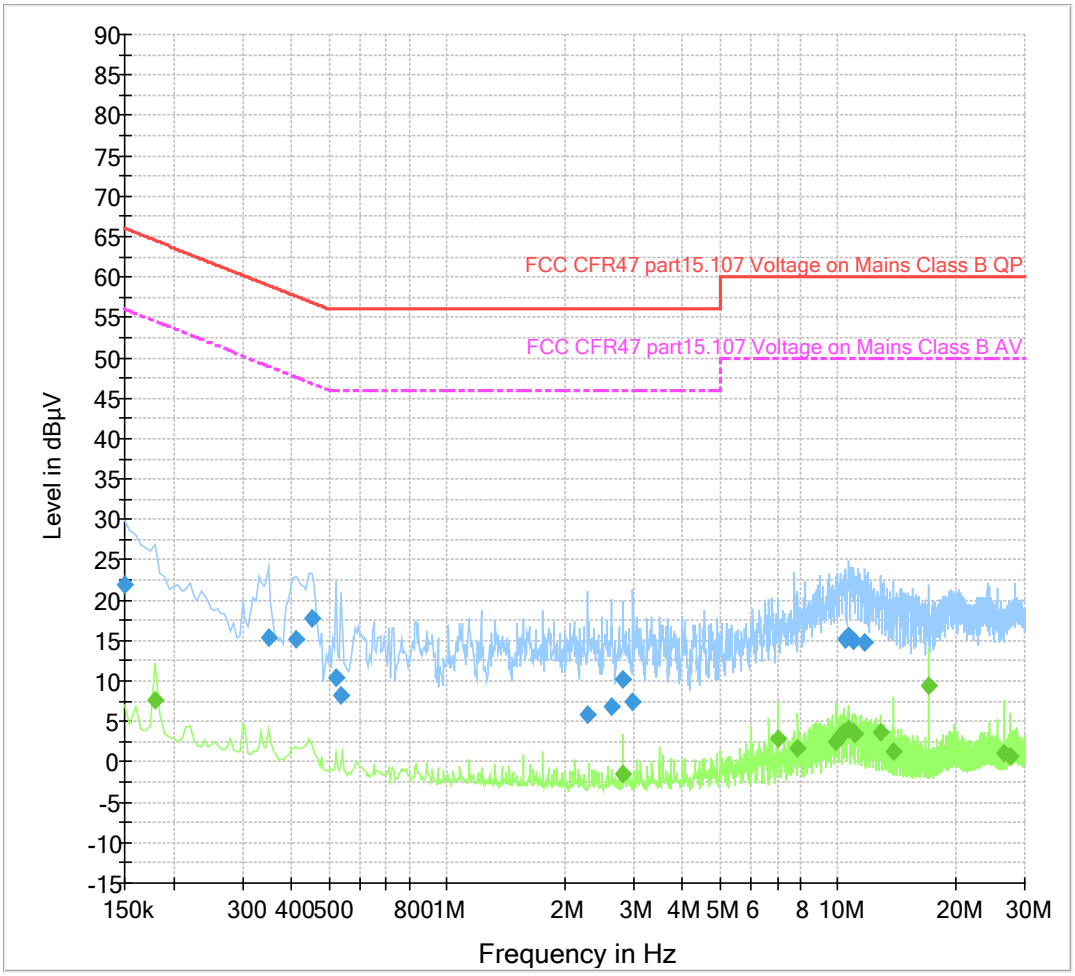
Charger Only



Charger and Crescendo

13.7 Test Results

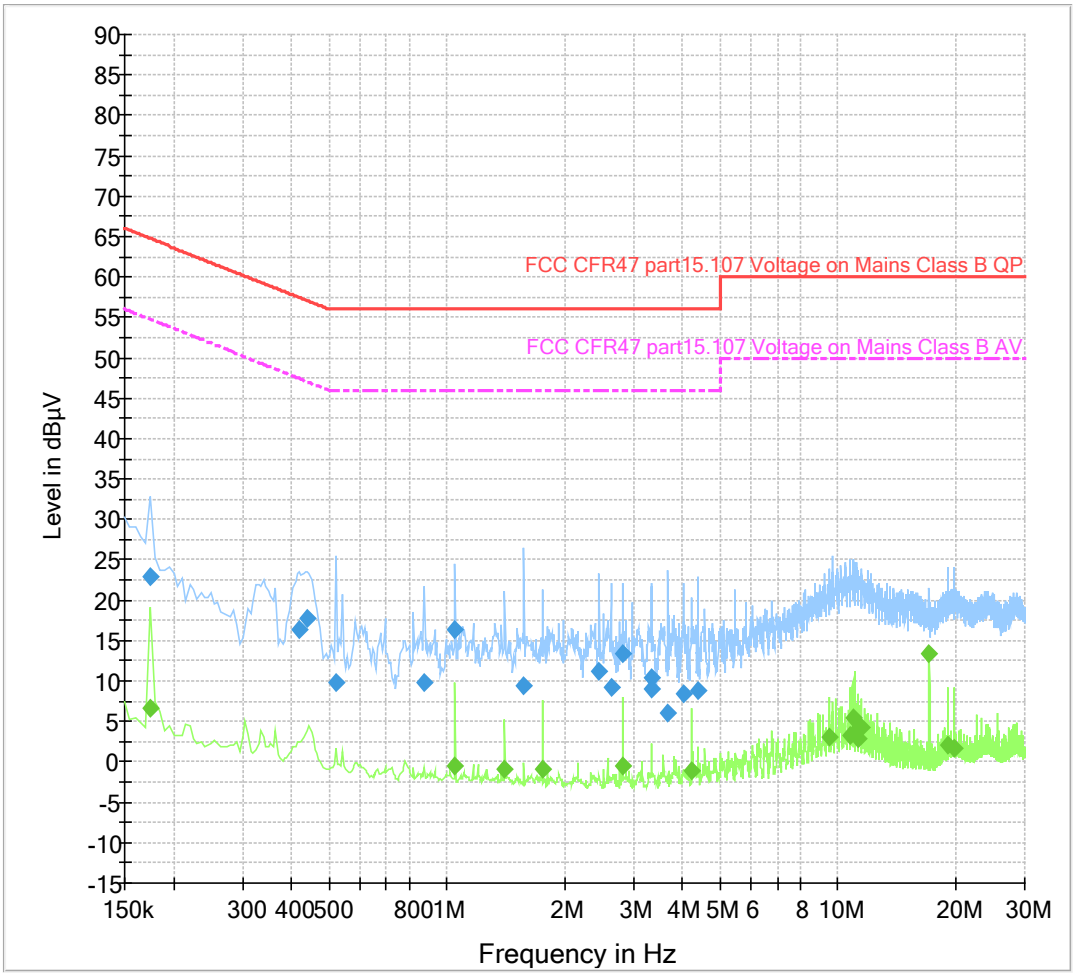
Conducted emissions on Mains 9kHz-30MHz ESHS10 + UH396



Charger Only – Quasi Peak Detector								
Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	21.9	2000.0	10.000	On	N	9.5	44.1	66.0
0.350000	15.3	2000.0	10.000	On	N	9.5	43.6	59.0
0.410000	15.3	2000.0	10.000	On	N	9.5	42.4	57.6
0.450000	17.7	2000.0	10.000	On	N	9.6	39.2	56.9
0.520000	10.3	2000.0	10.000	On	L1	9.5	45.7	56.0
0.535000	8.3	2000.0	10.000	On	N	9.6	47.7	56.0
2.285000	5.9	2000.0	10.000	On	N	9.6	50.1	56.0
2.640000	6.8	2000.0	10.000	On	N	9.6	49.2	56.0
2.810000	10.1	2000.0	10.000	On	L1	9.6	45.9	56.0
2.990000	7.5	2000.0	10.000	On	L1	9.6	48.5	56.0
10.390000	15.1	2000.0	10.000	On	N	9.7	44.9	60.0
10.420000	15.2	2000.0	10.000	On	N	9.7	44.8	60.0
10.675000	15.6	2000.0	10.000	On	N	9.7	44.4	60.0
10.940000	14.9	2000.0	10.000	On	N	9.7	45.1	60.0
11.660000	14.7	2000.0	10.000	On	N	9.7	45.3	60.0

Charger Only – Average Detector								
Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.180000	7.7	2000.0	10.000	On	N	9.5	46.8	54.5
2.810000	-1.5	2000.0	10.000	On	L1	9.6	47.5	46.0
7.020000	2.8	2000.0	10.000	On	N	9.7	47.2	50.0
7.900000	1.7	2000.0	10.000	On	L1	9.7	48.3	50.0
9.830000	2.4	2000.0	10.000	On	L1	9.7	47.6	50.0
10.165000	3.3	2000.0	10.000	On	N	9.7	46.7	50.0
10.355000	3.7	2000.0	10.000	On	N	9.7	46.3	50.0
10.630000	4.0	2000.0	10.000	On	L1	9.7	46.0	50.0
10.910000	3.6	2000.0	10.000	On	N	9.7	46.4	50.0
11.095000	3.5	2000.0	10.000	On	N	9.7	46.5	50.0
12.815000	3.8	2000.0	10.000	On	L1	9.7	46.2	50.0
13.865000	1.3	2000.0	10.000	On	L1	9.7	48.7	50.0
17.080000	9.4	2000.0	10.000	On	L1	9.8	40.6	50.0
26.505000	1.1	2000.0	10.000	On	N	9.9	48.9	50.0
27.555000	0.8	2000.0	10.000	On	N	9.9	49.2	50.0

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



Charger and Crescendo – Quasi Peak Detector								
Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.175000	22.8	2000.0	10.000	On	L1	9.5	41.9	64.7
0.420000	16.3	2000.0	10.000	On	N	9.5	41.1	57.4
0.440000	17.7	2000.0	10.000	On	N	9.6	39.4	57.1
0.520000	9.7	2000.0	10.000	On	L1	9.5	46.3	56.0
0.875000	9.9	2000.0	10.000	On	L1	9.6	46.1	56.0
1.050000	16.3	2000.0	10.000	On	L1	9.6	39.7	56.0
1.575000	9.5	2000.0	10.000	On	L1	9.6	46.5	56.0
2.455000	11.1	2000.0	10.000	On	L1	9.6	44.9	56.0
2.630000	9.2	2000.0	10.000	On	L1	9.6	46.8	56.0
2.810000	13.5	2000.0	10.000	On	L1	9.6	42.5	56.0
3.330000	8.9	2000.0	10.000	On	N	9.6	47.1	56.0
3.340000	10.4	2000.0	10.000	On	L1	9.6	45.6	56.0
3.680000	6.0	2000.0	10.000	On	N	9.6	50.0	56.0
4.035000	8.5	2000.0	10.000	On	N	9.6	47.5	56.0
4.390000	8.8	2000.0	10.000	On	N	9.6	47.2	56.0

Charger and Crescendo – Average Detector								
Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.175000	6.7	2000.0	10.000	On	L1	9.5	48.0	54.7
1.050000	-0.6	2000.0	10.000	On	L1	9.6	46.6	46.0
1.405000	-0.9	2000.0	10.000	On	L1	9.6	46.9	46.0
1.755000	-0.9	2000.0	10.000	On	L1	9.6	46.9	46.0
2.810000	-0.5	2000.0	10.000	On	L1	9.6	46.5	46.0
4.210000	-1.1	2000.0	10.000	On	N	9.6	47.1	46.0
9.480000	3.0	2000.0	10.000	On	L1	9.7	47.0	50.0
10.715000	3.3	2000.0	10.000	On	L1	9.7	46.7	50.0
10.890000	5.5	2000.0	10.000	On	L1	9.7	44.5	50.0
11.065000	3.6	2000.0	10.000	On	N	9.7	46.4	50.0
11.245000	2.8	2000.0	10.000	On	L1	9.7	47.2	50.0
11.420000	4.3	2000.0	10.000	On	L1	9.7	45.7	50.0
17.120000	13.4	2000.0	10.000	On	L1	9.8	36.6	50.0
19.140000	2.1	2000.0	10.000	On	L1	9.8	47.9	50.0
19.850000	1.7	2000.0	10.000	On	L1	9.8	48.3	50.0

14 Occupied Bandwidth

14.1 Definition

Occupied bandwidth
The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0.5 % of the emitted power. This is also known as the *99 % emission bandwidth*. For transmitters in which there are multiple carriers, contiguous or non-contiguous in frequency, the occupied bandwidth is to be the sum of the occupied bandwidths of the individual carriers.

20 dB bandwidth
The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal.

14.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Chamber
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.9
Deviations From Standard:	None
Measurement BW: (Irequirement: 1% to 5% OBW)	
Spectrum Analyzer Video BW: (requirement at least 3x RBW)	10Hz
Measurement Span: (requirement 2 to 5 times OBW)	500Hz
Measurement Detector:	Peak

Environmental Conditions (Normal Environment)

Temperature: 20 °C	+15 ºC to +35 ºC (as declared)
Humidity: 65 % RH	20 % RH to 75 % RH (as declared)
Supply: 120 V ac/dc	120 V ac ±10 % (as declared)

14.3 Test Limit

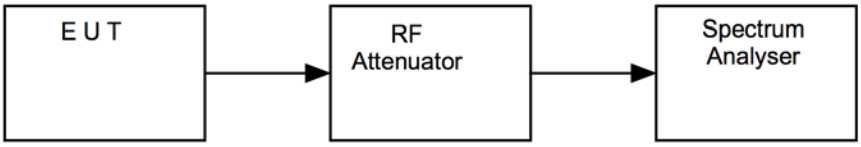
Federal Communications Commission:
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise 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.

14.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure iv, the bandwidth of the EUT was measured on a spectrum analyser.

The measurements were performed with EUT set at its maximum duty. All modulation schemes, data rates and power settings were used to observe the worst-case configuration in each bandwidth.

Figure iv Test Setup

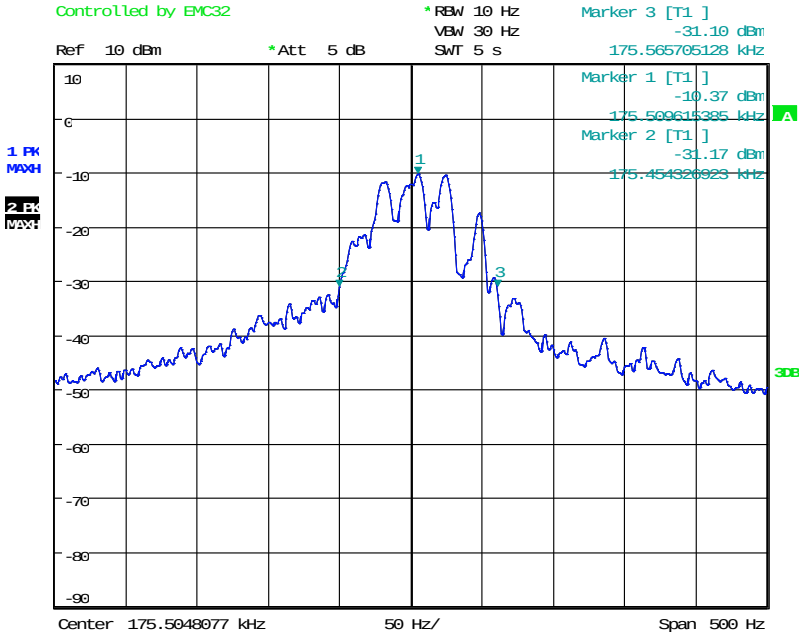


14.5 Test Equipment

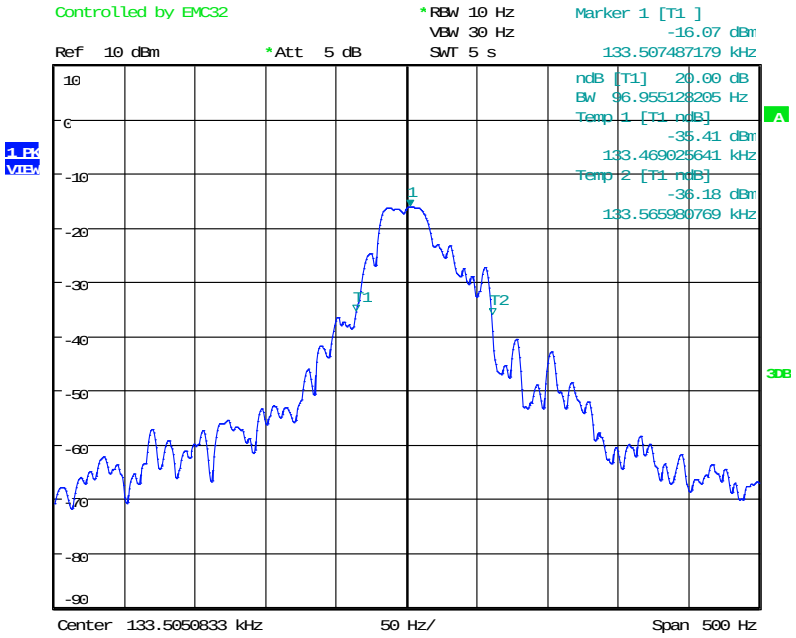
Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
FSU26	R&S	Spectrum Analyser	U405	02/06/2017

14.6 Test Results

Charger only			
Channel Frequency (MHz)	***F_L (kHz)***	***F_H (kHz)***	***20 dB Bandwidth (Hz)***
175 kHz	175.454326	175.5657051	111.379128



Charger and Crescendo			
Channel Frequency (MHz)	***F_L (kHz)***	***F_H (kHz)***	***20 dB Bandwidth (Hz)***
134 kHz	133.4690256	133.5659808	96.955128



15 Transmitter output power (fundamental radiated emission)

15.1 Definition

The RF power dissipated in the standard output termination when operating under the rated duty cycle selected by the applicant for approval.

15.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Chamber
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.4
Deviations From Standard:	None
Measurement Antenna and Height:	60 cm shielded loop; 1 m
EUT Height:	1 m
Measurement BW:	9 kHz to 150 kHz: 200 Hz; 150 kHz to 30 MHz: 9 kHz
Measurement Detector:	9 kHz to 90 kHz and 110 kHz to 490 kHz: Average, RMS Other frequencies below 30 MHz: Quasi-peak.
Voltage Extreme Environment Test Range:	Mains Power = 85 % and 115 % of Nominal

Environmental Conditions (Normal Environment)

Temperature:21 °C	+15 ºC to +35 ºC (as declared)
Humidity: 44 % RH	20 % RH to 75 % RH (as declared)

15.3 Test Limit

The field strength measured shall not exceed the limits in the following table:

General Field Strength Limits for License-Exempt Transmitters at Frequencies Below 30 MHz

Frequency, f (kHz)	*Field Strength*	*Measurement Distance (m)*
9 to 490	2,400 / 377.f (µA/m) 2,400 / f (µV/m)	300
490 to 1,750	24,000 / 377.f (µA/m) 24,000 / f (µV/m)	30
1,750 to 30,000	30 (µV/m)	30

15.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure v, the resolution bandwidth of the spectrum analyser was increased above the EUT occupied bandwidth and the peak emission data noted.

The measurements were performed with EUT set at its maximum duty. All modulation schemes, data rates and power settings were used to observe the worst-case configuration in each bandwidth.

Power values measured on the test receiver / analyzer are converted to field strength, FS, in µV/m at the regulatory distance, using:

$$FS = 10^{(PR - CF) / 20}$$

Where,

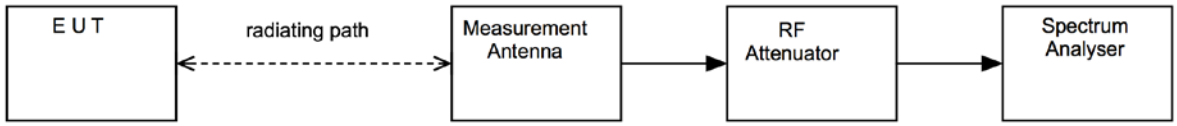
PR is the power recorded on the receiver / spectrum analyzer in dBµV and includes any cable loss, antenna factor and pre-amplifier gain;
CF is the distance extrapolation factor in dB (where measurement distance different to limit distance);

Per FCC 47CFR15.31(f)(2) / RSS-Gen 6.4, an extrapolation factor of 40 dB per decade was used for measurements at distances closer than specified.

Per FCC 47CFR15.31(f)(2) / RSS-Gen 6.4, an extrapolation between 1 and 3 metres was determined from measurements.

This field strength value is then compared with the regulatory limit.

Figure v Test Setup



15.5 Test Equipment

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
hfh2	R&S	Loop Antenna	L007	10/04/2017
ESHS10	R&S	Receiver	U187	29/10/2016

15.6 Test Results

Charger & Crescendo							
Emission Frequency (kHz)	***Receiver Level (dBµV)***	***Antenna Factor (dB/m)***	***Measurement Distance (m)***	***Limit Distance (m)***	***Extrapolation Factor (dB)***	***Field Strength (µV/m)***	***Result***
134.078	81.02	19.85	1	300	105.60	0.58	PASS
134.078	55.42	19.85	3	300	80.00	0.58	PASS

Charger Only							
Emission Frequency (kHz)	***Receiver Level (dBµV)***	***Antenna Factor (dB/m)***	***Measurement Distance (m)***	***Limit Distance (m)***	***Extrapolation Factor (dB)***	***Field Strength (µV/m)***	***Result***
175.0	59.80	19.85	1	300	106.30	0.05	PASS
175.0	33.50	19.85	3	300	80.00	0.05	PASS

Receiver Level (dBuV) – Extrapolation Factor (dB) + Antenna Factor (dB/m) = Field strength @ limit distance (converted to uV/m)

1 - 3 meter extrapolation as measured (Receiver level @ 1m – Receiver level @ 3m)
3 – 300 meter extrapolation 80 dB as per 15.31
1 – 300 meter extrapolation 80 dB + (1-3 meter extrapolation)

16 Measurement Uncertainty

Calculated Measurement Uncertainties

All statements of uncertainty are expanded standard uncertainty using a coverage factor of 1.96 to give a 95 % confidence:

[1] Radiated emissions below 30 MHz

Uncertainty in test result (9 kHz to 30 MHz) = **2.3 dB**

[2] Spurious emissions

Uncertainty in test result (30 MHz to 1 GHz) = **4.6 dB**
Uncertainty in test result (1 GHz to 18 GHz) = **4.7 dB**

[3] AC power line conducted emissions

Uncertainty in test result = **3.4 dB**

[4] Occupied bandwidth

Uncertainty in test result = **15.5 %**

[5] Maximum frequency error

Uncertainty in test result (Power Meter) = **0.113 ppm**
Uncertainty in test result (Spectrum Analyser) = **0.265 ppm**