Report on the Radio Testing

For

Pektron Group Ltd

on

Keyless Control Unit 2

Report no. TRA-040439-47-00A

18 September 2018

Report Number: TRA-040439-47-00A
Issue: A

REPORT ON THE RADIO TESTING OF A
Pektron Group Ltd
Keyless Control Unit 2
WITH RESPECT TO SPECIFICATION
FCC 47CFR 15.209

TEST DATE: 13th - 18th July 2018

Written by: D Winstanley
Radio Senor Test Engineer

Approved by: J Charters
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Date: 2018.09.18 09:07:12 +01'00'

Date: 18 September 2018

Element Materials Technology Warwick Ltd.
Registered in England and Wales. Registered Office: 5 Fleet Place, London, EC4M 7RD
Company Reg No. 02536659

1 Revision Record

Issue Number	*Issue Date*	*Revision History*
A	18 September 2018	Original

2 Summary

TEST REPORT NUMBER:	TRA-040439-47-00A
WORKS ORDER NUMBER:	TRA-040439-01
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):	Keyless Control Unit 2
FCC IDENTIFIER:	AQO009
EUT SERIAL NUMBER:	Not Stated
MANUFACTURER/AGENT:	Pektron Group Ltd
ADDRESS:	Alfreton Road Derby Derbyshire DE21 4AP United Kingdom
CLIENT CONTACT:	Tony Blyth ☎ 01332832424 ✉ ablyth@pektron.co.uk
TEST DATE:	13th - 18th July 2018
TESTED BY:	D Winstanley Element

2.1 Test Summary

Test Method and Description	*Requirement Clause 47CFR15*	*Applicable to this equipment*	*Result / Note*
Radiated spurious emissions	15.209 / 15.109	☒	*Pass*
AC power line conducted emissions	15.207 / 15.107	☐	*N/A Battery Only*
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-040439-47-00A presents the results of the Radio testing on a Pektron Group Ltd, Keyless Control Unit 2 to specification 47CFR15 Radio Frequency Devices.

The testing was carried out for Pektron Group Ltd by Element, at the address detailed below.

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

☒ Element North West
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.

IC Registration Number(s):
Element North West 3930B

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
IC	Industry Canada
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: Keyless Control Unit 2
- Brand: Triumph
- Serial Number: Not Stated
- Model Number: 0811G03
- Software Revision: P0811A0.2
- Build Level / Revision Number: 0811G03A

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.

Description: Manual test set including Loads and Harness
Make: Pektron

Description: 433 MHz RF Transmitter
Make: Pektron

Description: Note Book PC running CANalyzer
Make: Dell

Description: CAN Case Number 27 CANalyzer Package
Make: Vector
Model No: VN1611
Serial No: 27

Description: AC/DC Power Adapter
Make: Dell

Description: 1x Smart Keyfobs
Make: Triumph / Pektron
Serial No: 1

7.3 EUT Mode of Operation

CANalyzer panel was used to put the KCU2 into a normal motorcycle running mode of operation with the LF and UHF transmitting and receiving.

7.4 EUT Radio Parameters

7.4.1 General

Frequency of operation:	134.2 kHz
Modulation type(s):	ASK
Occupied channel bandwidth(s):	Wideband
Channel spacing:	Wideband
Nominal Supply Voltage:	13.5 Vdc
Duty cycle:	100 %
Antenna Type:	Ferrite Core Magnetic Coil
Antenna Mounting:	Bike Mounted

7.5 EUT Description

The EUT is a motorcycle keyless control unit, controls ignition and tyre pressure monitoring

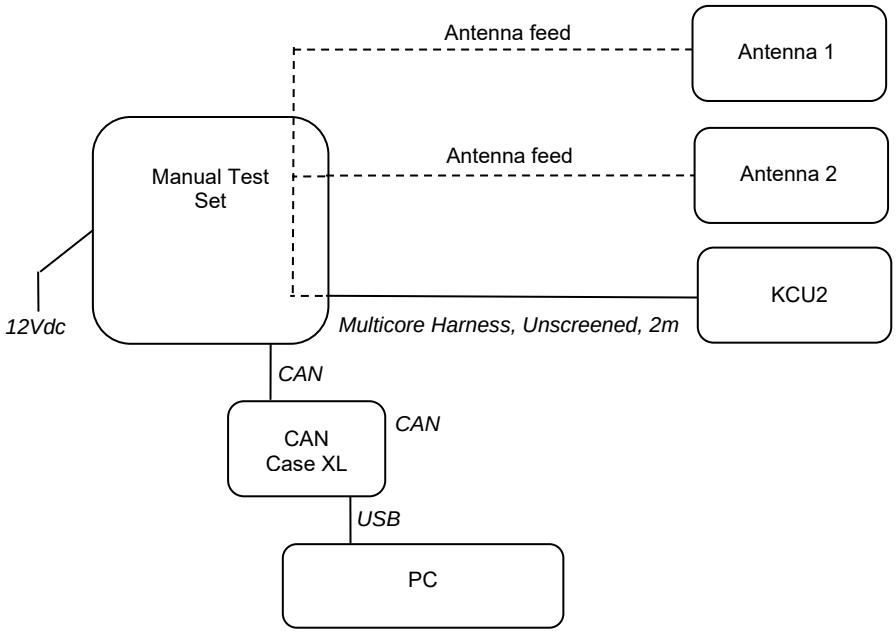
8 Modifications

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. +13.5 V dc from a supply

10.2 Varying Test Conditions

There are no specific frequency stability requirements for the type of device. The results contained in this report demonstrate that the occupied bandwidth is contained within the authorised band and the manufacturer has declared sufficient frequency stability (refer to section 7.4).

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

	Category	***Nominal***	***Variation***
☐	Mains	110 V ac +/-2 %	85 % and 115 %
☒	Battery	13.5 Vdc	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 6.5 and 6.6
EUT Frequency Measured:	134.4 kHz
EUT Channel Bandwidths:	Wideband
Deviations From Standard:	None
Measurement Distance and Site	10 m, OATS without ground plane. (3m ATS for Previews)
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: 22 °C	+15 ºC to +35 ºC (as declared)
Humidity: 48 % RH	20 % RH to 75 % RH (as declared)
Supply: +12 V dc	

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

n.b. Devices operated pursuant to §15.225 / RSS-210 A2.6 are exempt from complying with the restricted band requirements for the 13.36–13.41 MHz band only.

11.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure i, 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:

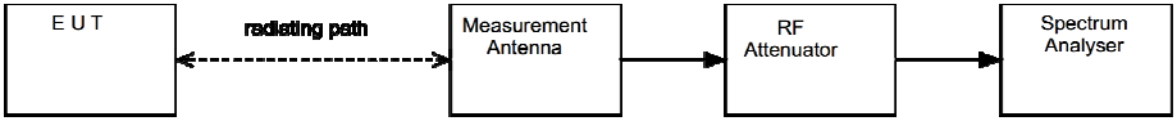
$$FS = PR + CL + AF – PA + DC – CF$$

Where,

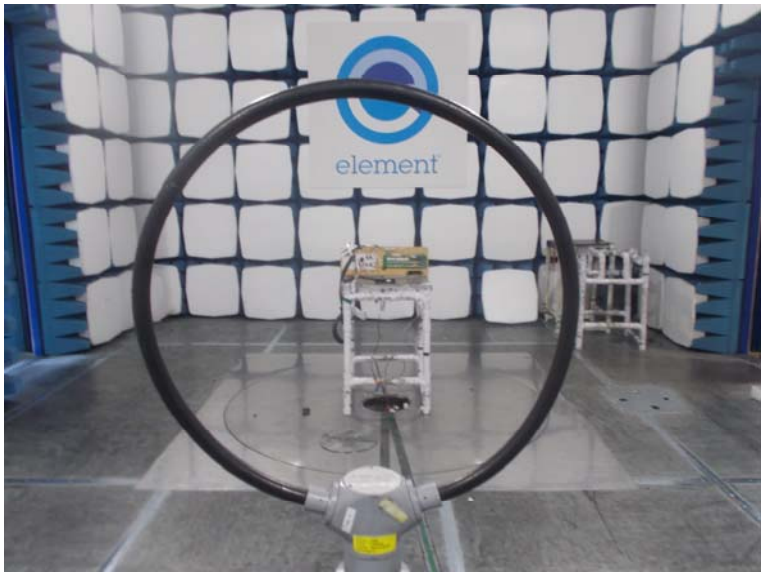
PR is the power recorded on the receiver / spectrum analyzer in dBµV;
CL is the cable loss in dB;
AF is the test antenna factor in dB/m;
PA is the pre-amplifier gain in dB (where used);
DC is the duty correction factor in dB (where used, e.g. harmonics of pulsed fundamental);
CF is the distance factor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

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

Figure i Test Setup



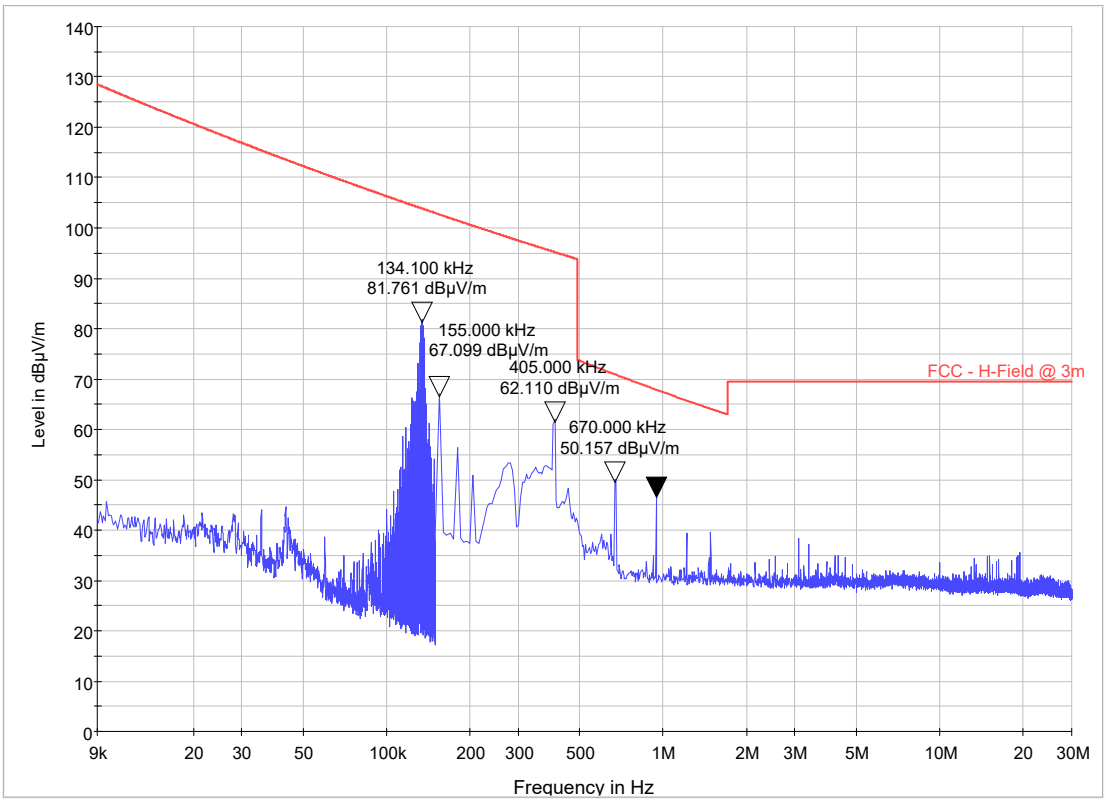
11.5 Test Set-up Photograph



11.6 Test Equipment

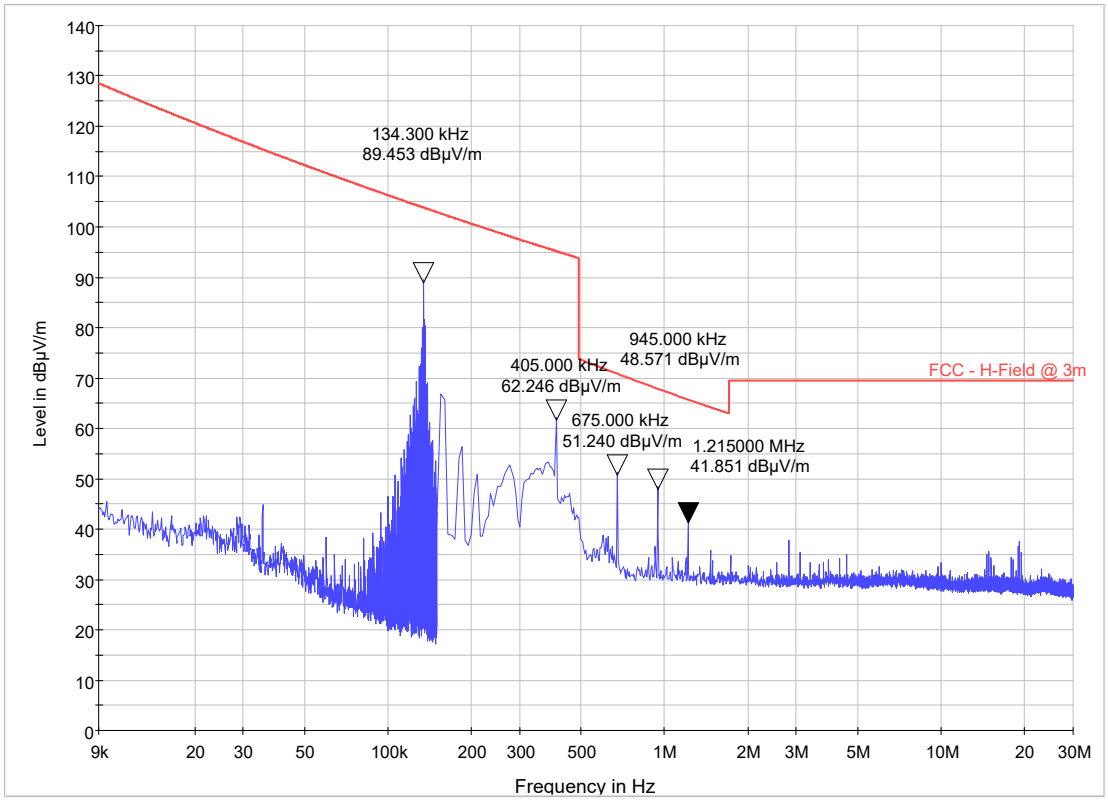
Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
hfh2	R&S	Loop Antenna	L007	2019-05-10
ESHS10	R&S	Receiver	U003	2018-08-29

11.7 Test Results – LF Antenna 1



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 20dB of Limit						PASS

11.8 Test Results – LF Antenna 2



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 20dB 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 and 6.6
EUT Frequency Measured:	134.4 kHz
EUT Channel Bandwidths:	Wideband
Deviations From Standard:	None
Measurement BW:	30 MHz to 1 GHz: 120 kHz; Above 1 GHz: 1 MHz
Measurement Detector:	Up to 1 GHz: quasi-peak; Above 1 GHz: RMS average and Peak

12.3 Environmental Conditions (Normal Environment)

Temperature: 24 °C	+15 ºC to +35 ºC (as declared)
Humidity: 46 % RH	20 % RH to 75 % RH (as declared)
Supply: 13.5 V dc	

12.4 Test Limit

Except for harmonics, out-of-band emissions shall be attenuated by at least 50 dB below the level of the fundamental or to the general field strength limits listed in FCC 47CFR15.209 / RSS-Gen {see table below}, whichever is less stringent.

Harmonics shall be limited to a maximum level of 0.5 mV/m measured at 3 metres.

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

n.b. per FCC 47CFR15.35(b) / RSS-Gen 8.1, peak limit is 20 dB above average.

12.5 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure i, 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:

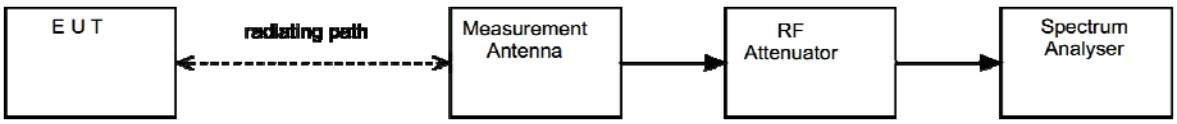
$$FS = PR + CL + AF – PA + DC – CF$$

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 different to limit distance);

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

Figure i Test Setup



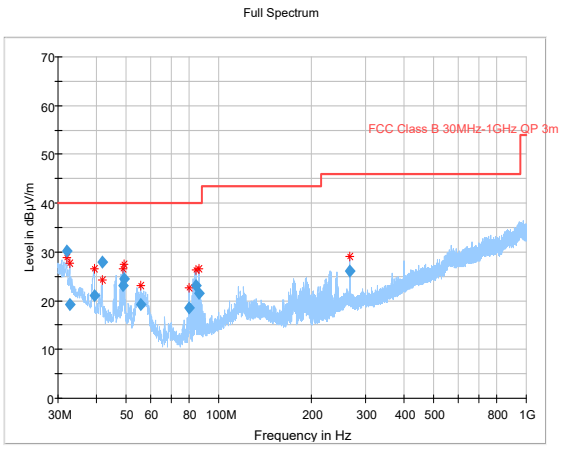
12.6 Test Set-up Photograph

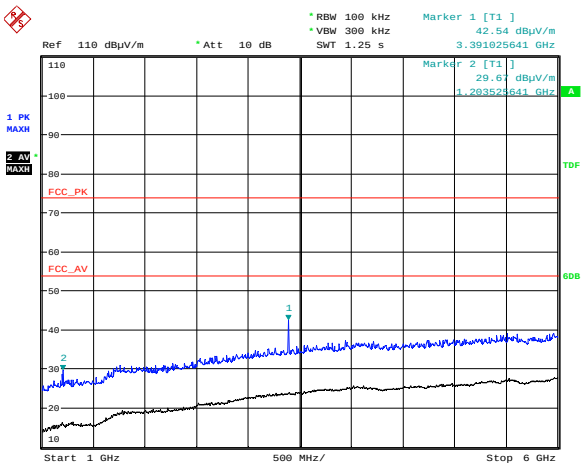
12.7 Test Equipment

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
CBL611/A	Chase	Bilog	U573	2019-08-02
ESVS10	R&S	Receiver	L317	2019-03-22
8449B	Agilent	Pre Amp	L572	2018-09-28
3115	EMCO	1-18GHz Horn	L139	2019-09-25
FSU46	R&S	Spectrum Analyser	REF910	2018-07-13

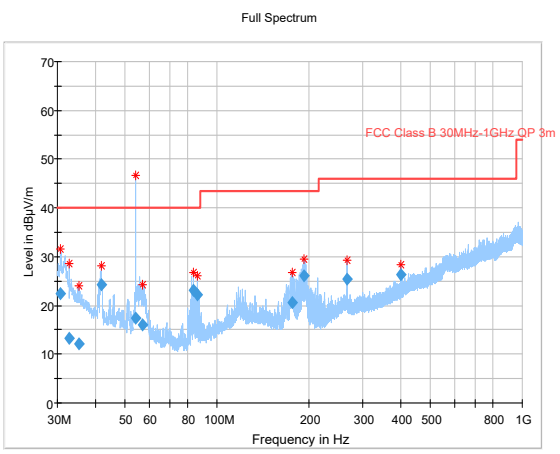
12.8 Test Results

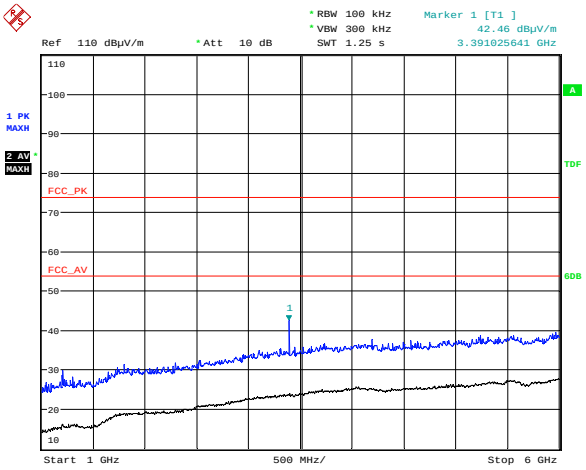
Antenna 1										
Detector	**Freq. (MHz)**	**Meas'd Emission (dBµV)**	**Cable Loss (dB)**	**Antenna Factor (dB/m)**	**Pre-amp Gain (dB)**	**Duty Cycle Corr'n (dB)**	**Distance Extrap'n Factor (dB)**	**Field Strength (dBµV/m)**	**Field Strength (µV/m)**	**Limit (µV/m)**
QP	32.00	5.74	0.83	23.60	N/A	0.00	0.00	30.17	32.25	100
QP	39.40	0.27	0.88	19.90	N/A	0.00	0.00	21.05	11.28	100
QP	41.80	8.16	0.93	18.91	N/A	0.00	0.00	28.00	25.12	100
QP	48.80	6.01	0.98	16.21	N/A	0.00	0.00	23.20	14.45	100
QP	49.10	7.35	0.98	16.10	N/A	0.00	0.00	24.43	16.65	100
QP	84.50	8.05	1.27	13.79	N/A	0.00	0.00	23.11	14.31	100
QP	86.00	6.28	1.27	13.98	N/A	0.00	0.00	21.53	11.93	100
QP	266.65	4.48	2.22	19.43	N/A	0.00	0.00	26.13	20.25	200





Antenna 2										
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	30.70	-2.66	0.80	24.25	N/A	0.00	0.00	22.39	13.17	100
QP	41.85	4.34	0.93	18.89	N/A	0.00	0.00	24.16	16.14	100
QP	83.50	8.15	1.27	13.66	N/A	0.00	0.00	23.08	14.26	100
QP	86.00	6.84	1.27	13.98	N/A	0.00	0.00	22.09	12.72	100
QP	192.40	8.96	1.89	15.25	N/A	0.00	0.00	26.10	20.18	150
QP	400.00	1.64	2.72	21.90	N/A	0.00	0.00	26.26	20.56	200





13 Transmitter output power (fundamental radiated emission)

13.1 Definition

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

13.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Chamber / OATS
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.5 / 6.6
EUT Frequency Measured:	134.4 kHz
EUT Channel Bandwidths:	Wideband
Deviations From Standard:	None
Measurement BW:	10 kHz
Spectrum Analyzer Video BW: (requirement at least 3x RBW)	N/A
Measurement Detector:	Average
Voltage Extreme Environment Test Range:	85 % and 115 % of Nominal (FCC only requirement);

Environmental Conditions (Normal Environment)

Temperature: 22 °C	+15 ºC to +35 ºC (as declared)
Humidity: 48 % RH	20 % RH to 75 % RH (as declared)

13.3 Test Limit

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

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

Strength Limits for License-Exempt Transmitters at Frequencies Above 30 MHz

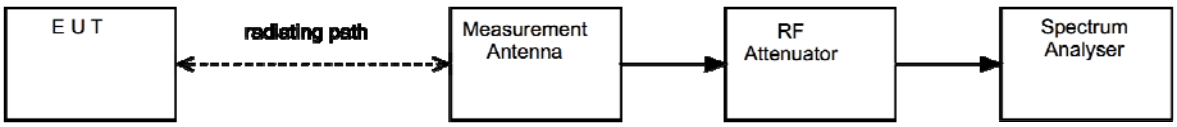
Frequency (MHz)	*Field Strength (µV/m at 3 m)*
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

13.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure iv, 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.

Figure iv Test Setup



13.5 Test Equipment

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
hfh2	R&S	Loop Antenna	L007	2019-05-10
ESHS10	R&S	Receiver	U003	2018-08-29

13.6 Test Results

LF Antenna 1						
Channel Frequency (kHz)	***Receiver Level (dBµV/m)***	***Measurement Distance (m)***	***Limit Distance (m)***	***Extrapolation Factor (dB)***	***Field Strength (µV/m)***	***Result***
134.4	74.60	3	300	82.18	0.418	PASS
134.4	51.50	10	300	59.08	0.418	PASS

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 factor of 23.1 dB per was determined from measurements between 3 and 10 metres.

LF Antenna 2						
Channel Frequency (kHz)	***Receiver Level (dBµV/m)***	***Measurement Distance (m)***	***Limit Distance (m)***	***Extrapolation Factor (dB)***	***Field Strength (µV/m)***	***Result***
134.4	74.50	3	300	84.08	0.332	PASS
134.4	49.50	10	300	59.08	0.332	PASS

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 factor of 25.0 dB per was determined from measurements between 3 and 10 metres.

14 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] Carrier power

Uncertainty in test result (Power Meter) = **1.08 dB**
Uncertainty in test result (Spectrum Analyser) = **2.48 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**

[6] Duty cycle

Uncertainty in test result = **7.98 %**

15 RF Exposure

General SAR test reduction and exclusion guidance KDB 447498

Section 4.3 General SAR test reduction and exclusion guidance

For Standalone SAR exclusion consideration, when the considering SAR exclusion Threshold requirement in KDB 447498 is satisfied standalone SAR evaluation for general population exposure conditions by measurement or numerical simulation is not required.

In the frequency range below 100 MHz and test separation distance ≤ 50mm, the SAR Test Exclusion Threshold will be determined as follows

SAR Exclusion Threshold (SARET)

SAR Exclusion Threshold = ([Step 1 + Step2] * Step 3a) * Step 3b

Step 1

$$NT = [(MP/TSD^{A}) * \sqrt{f_{GHz}}]$$

NT	=	Numeric Threshold (3.0 for 1-g SAR and 7.5 for 10-g SAR)
MP	=	Max Power of channel (mW) (inc tune up)
TSD^{A}	=	Min Test separation Distance or 50mm (whichever is lower) = 5
f_{GHz}	=	Transmit frequency (or 100MHz if lower)

We can transpose this formula to allow us to find the maximum power of a channel allowed and compare this to the measured maximum power.

$$MP = [(NT \times TSD^{A}) / \sqrt{f_{GHz}}]$$

For Distances Greater than 50 mm Step 2 applies

Step 2

$$(TSD^{B} - 50mm) * f_{(MHz)}/150$$

Where:

f_{MHz}	=	Transmit frequency
TSD^{B}	=	Min Test separation Distance (mm) = 5

Step 3

3a) The power threshold at the corresponding test separation distance at 100 MHz in step 2) is multiplied by [1 + log(100/f(MHz))] for *test separation distances* > 50 mm and < 200 mm

3b) The power threshold determined by the equation in steps 1 and 2 for 50 mm and 100 MHz is multiplied by ½ for *test separation distances* ≤ 50 mm

$$SARET = (\{ [(NT \times TSD^{A}) / \sqrt{f_{GHz}}] + (TSD^{B} - 50) * [0.13440/150] \} * (1 + Log [100 / F_{MHz}])) * {}^{1}/_{2}$$
$$SARET = (\{ [(3.0 \times 5) / \sqrt{0.1}] + (5 - 50) * [0.13440/150] \} * (1 + Log [100 / F_{MHz})]) * {}^{1}/_{2}$$
$$SARET = ([47.43 + -0.04] * (1 + Log [100 / 0.13440)) * {}^{1}/_{2}$$
SARET = 91.73 mW

The calculated output power is 0.53 nW (eirp) is less than the SAR Exclusion Threshold of 91.64 mW, at 5mm test separation distance, for general population and uncontrolled exposure.

Therefore standalone SAR evaluation for general population exposure conditions by measurement or numerical simulation is not required.