Report on the Radio Testing

For

G4S Technology Ltd T/AS AMAG Technology

on

Javelin S870-KP Proximity Card Reader

Report no. TRA-062608-47-01C

11th December 2025

RF959 6.0

Report Number: TRA-062608-47-01C
Issue: C

REPORT ON THE RADIO TESTING OF A
G4S Technology Ltd T/AS AMAG Technology
Javelin S870-KP Proximity Card Reader
WITH RESPECT TO SPECIFICATION
FCC 47CFR 15.209

TEST DATE: 12th December to 14th December 2023

Tested by: 

Digitally signed by Daniel Winstanley
DN: cn=Daniel Winstanley gn=Daniel Winstanley c=GB United Kingdom l=GB United Kingdom
Reason: I am the author of this document
Date: 2025-12-11 16:14Z

D Winstanley
Senior Radio Test Engineer

Approved by:

J Charters
Lab Manager

Date: 11th December 2025

1 Revision Record

Issue	*Issue Date*	*Revision History*
A	**Error! Reference source not found.**	Original
B	1st November 2024	General updates throughout document
C	11th December 2025	Update of ANSI C63.10 to 2020 version

2 Summary

TEST REPORT NUMBER:	TRA-062608-47-01C
WORKS ORDER NUMBER:	TRA-062608-00
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):	Javelin S870-KP Proximity Card Reader
FCC IDENTIFIER:	OE5S870C
EUT SERIAL NUMBER:	Not stated
MANUFACTURER/AGENT:	G4S Technology Ltd T/AS AMAG Technology
ADDRESS:	Challenge House International Drive Tewkesbury Gloucestershire GL20 8UQ United Kingdom
CLIENT CONTACT:	Ian Williams ☎ 01684 850977 ✉ ian.williams@amag.com
ORDER NUMBER:	PUR002139
TEST DATE:	12th December to 14th December 2023
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, below 30 MHz	15.209	☒	Pass
Radiated spurious emissions	15.209	☒	Pass
AC power line conducted emissions	15.207	☒	Pass
Occupied bandwidth	-	☒	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).

General notes

The decision rule for compliance is not inherent within this specification and compliance is based on the customer requesting a simple acceptance rule based on understanding and acceptance of Elements Measurement Uncertainty values.

3 Contents

4 Introduction

This report TRA-062608-47-01C presents the results of the Radio testing on a G4S Technology Ltd T/AS AMAG Technology, Javelin S870-KP Proximity Card Reader to specification 47CFR15 Radio Frequency Devices

The testing was carried out for G4S Technology Ltd T/AS AMAG Technology by Element, at the address detailed below.

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

☐ Element Surrey Hills
Unit 15 B
Henley Business Park
Pirbright Road
Normandy
Guildford
GU3 2DX
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.

FCC Site Listing:
The test laboratory is accredited for the above sites under the following US-UK MRA, Designation number.

Element Skelmersdale UK2020

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 C63.10-2020 – 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.

ANSI C63.10-2020 is ISO/IEC 17025:2017 accredited under Element's flexible scope of accreditation.

5.2 Deviations from Test Standards

1) 20 dB bandwidth requirement.

Note: The resolution bandwidth requirement of meeting the 1% to 5% of the resulting 20 dB bandwidth for AM RFID type radio devices cannot be resolved.

As the resolution bandwidth is reduced, the 20 dB bandwidth will also reduce. This scenario will continue, and the resulting 20 dB bandwidth measurement will just continue to reduce to nothing. Therefore, a wider resolution bandwidth was used, which was greater than the 5% requirement.

The frequency Span wide enough to capture all the side bands of the signal.

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
CISPR	Comité International Spécial des Perturbations Radioélectriques
CW	Continuous Wave
dB	decibel
dBm	dB relative to 1 milliwatt
DC	Direct Current
EIRP	Equivalent Isotropically Radiated Power
ERP	Effective Radiated Power
EUT	Equipment Under Test
FCC	Federal Communications Commission
Hz	hertz
IC	Industry Canada (now ISED)
ISED	Innovation, Science and Economic Development Canada
ITU	International Telecommunication Union
m	metre
max	maximum
min	minimum
MRA	Mutual Recognition Agreement
N/A	Not Applicable
PCB	Printed Circuit Board
PDF	Portable Document Format
QP	Quasi-Peak
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: Javelin S870-KP Proximity Card Reader
- Serial Number: Not stated
- Model Number: 870-KP-V4
- Software Revision: Issue 1.0
- 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.

Client supplied Alarm Panel

7.3 EUT Mode of Operation

7.3.1 Transmission

The mode of operation for transmitter tests was as follows:-

The unit was powered up and a RFID card was placed close to the keypad.

7.4 EUT Radio Parameters

7.4.1 General

Frequency of operation:	125 kHz
Modulation type(s):	AM
Nominal Supply Voltage:	12.0 Vdc
Antenna Type:	Inductive loop

7.5 EUT Description

The EUT is a 125 kHz RFID Access Control Unit.

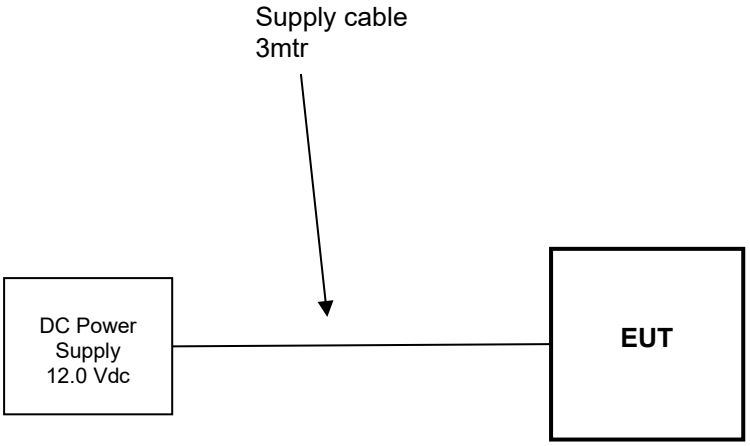
8 Modifications

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:

9.3 Measurement software

Where applicable, the following software was used to perform measurements contained within this report.

Element Emissions R5 (See Note)
Element Transmitter Bench Test (See Note)
ETS Lindgren EMPower V1.0.4.2

Note:

The version of the Element software used is recorded in the results sheets contained within this report.

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 12.0 Vdc from the adaptor, 110 V ac, 60 Hz, from the mains.

10.2 Varying Test Conditions

Variation of temperature is required to ensure stability of the declared fundamental frequency. During frequency error testing the following variations were made:

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***
☒	Power supply	12.0 Vdc	85 % and 115 %
☐	Battery	New battery	N/A

1 Radiated emissions below 30 MHz

1.1 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.

1.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Chamber 1
Test Standard and Clause:	ANSI C63.10-2020, Clause 6.4
Frequencies Measured:	125 kHz
Deviations from Standard:	None
Measurement Distance and Site:	3 m
EUT Height:	1m
Measurement Antenna and Height:	60cm shielded loop; 1m
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 – 490 kHz: Average, RMS Other frequencies below 30 MHz: Quasi-peak.

Environmental Conditions (Normal Environment)

Temperature: 17 °C	+15 ºC to +35 ºC (as declared)
Humidity: 46 %RH	20%RH to 75%RH (as declared)
Supply: 12.0 Vdc	12.0 Vdc (as declared)

Test Limits
Radiated emissions shall comply with the field strength limits shown in the Table 6. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission.

Table 6 - General field strength limits at frequencies below 30 MHz

Frequency, f (kHz)	*Field Strength*	*Measurement Distance (m)*
9 – 490[1]	6.37 / f (µA/m) 2,400 / f (µV/m)	300
490 – 1,750	63.7 / f (µA/m) 24,000 / f (µV/m)	30
1,705 – 30,000	0.08 (µA/m) 30 (µV/m)	30

Note 1: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

1.3 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:

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

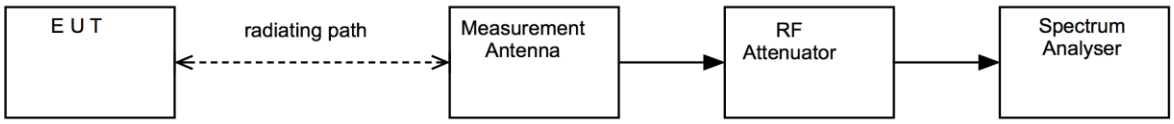
Where,

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);

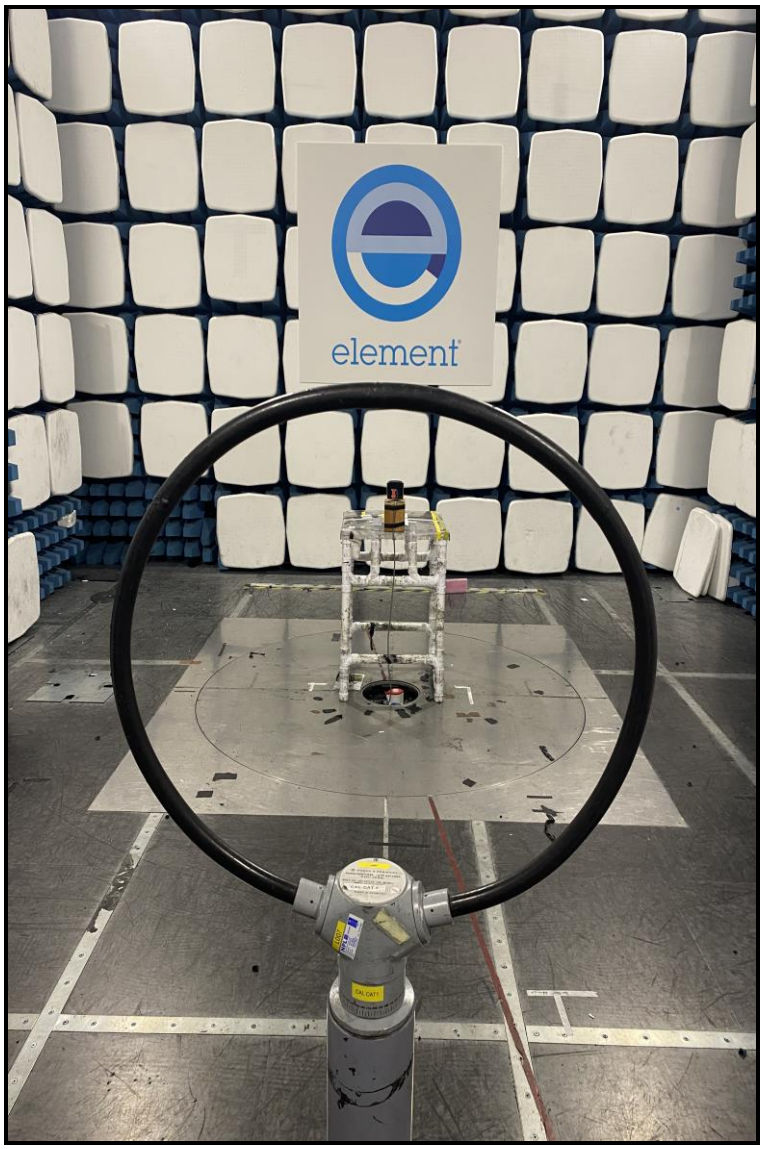
Per FCC 47CFR15.31(f)(2) / ISED RSS-Gen 6.5, an extrapolation factor of 40 dB per decade was used for measurements at distances closer than specified.

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

Figure i Test Setup



Test Setup Photograph

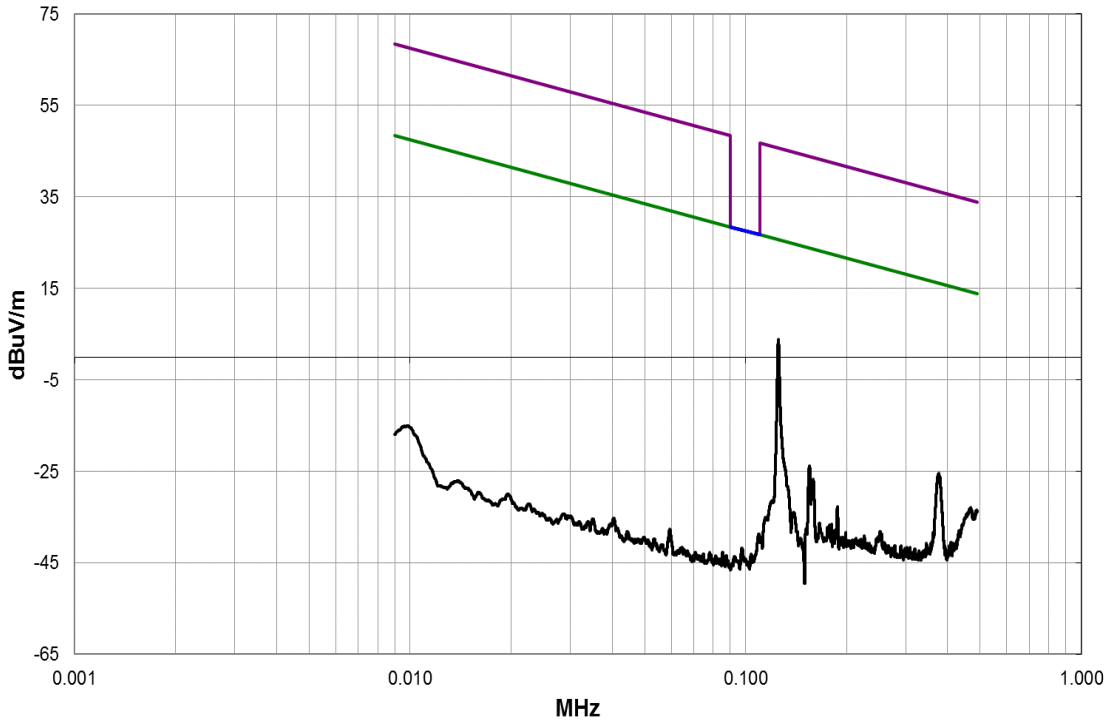


1.4 Test Equipment

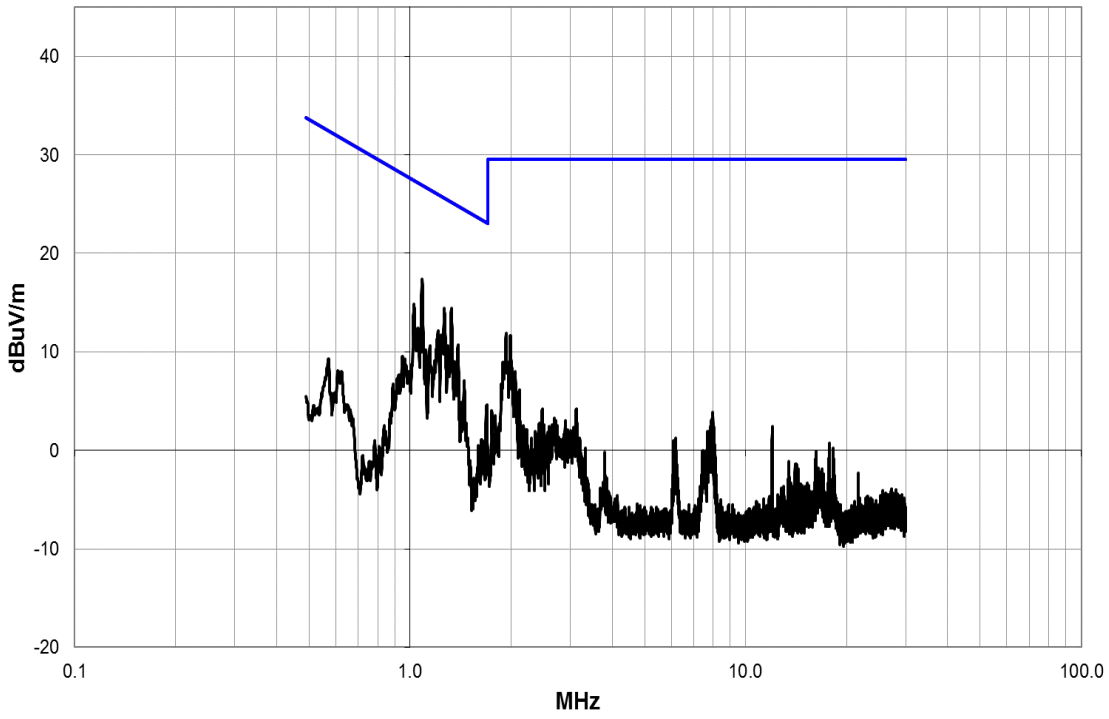
Equipment Description	*Manufacturer*	*Equipment Type*	*Element No*	*Last Cal Calibration*	*Calibration Period*	*Due For Calibration*
Loop Antenna	R&S	hfh2	L007	2023-10-11	12	2024-10-11
EMI Receiver	R&S	ESR26	U489	2023-10-11	12	2024-10-11

1.5 Test Results

9 kHz to 490 kHz



490 kHz to 30 MHz



Test Results

Freq (MHz)	Amplitude (dBuV)	Preamp (dB)	Antenna Height (meters)	Transducer (dB/m)	Cable (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
1.086	38.3	0.0	1.0	19.1	0.0	0.0	Horz	PK	-40.0	17.4	26.9	-9.5
1.327	35.2	0.0	1.0	19.2	0.0	0.0	Horz	PK	-40.0	14.4	25.2	-10.8
1.263	35.2	0.0	1.0	19.2	0.0	0.0	Horz	PK	-40.0	14.4	25.6	-11.2
1.026	35.7	0.0	1.0	19.1	0.0	0.0	Horz	PK	-40.0	14.8	27.4	-12.6
1.211	33.0	0.0	1.0	19.1	0.0	0.0	Horz	PK	-40.0	12.1	26.0	-13.9
1.388	31.5	0.0	1.0	19.2	0.0	0.0	Horz	PK	-40.0	10.7	24.8	-14.1
1.294	31.4	0.0	1.0	19.2	0.0	0.0	Horz	PK	-40.0	10.6	25.4	-14.8
1.145	31.5	0.0	1.0	19.1	0.0	0.0	Horz	PK	-40.0	10.6	26.4	-15.8
1.358	29.8	0.0	1.0	19.2	0.0	0.0	Horz	PK	-40.0	9.0	25.0	-16.0
1.113	31.1	0.0	1.0	19.1	0.0	0.0	Horz	PK	-40.0	10.2	26.7	-16.5
1.448	27.9	0.0	1.0	19.2	0.0	0.0	Horz	PK	-40.0	7.1	24.4	-17.3
1.931	32.7	0.0	1.0	19.2	0.0	0.0	Horz	PK	-40.0	11.9	29.5	-17.6
1.988	32.4	0.0	1.0	19.2	0.0	0.0	Horz	PK	-40.0	11.6	29.5	-17.9
1.692	25.4	0.0	1.0	19.2	0.0	0.0	Horz	PK	-40.0	4.6	23.1	-18.5
0.964	30.2	0.0	1.0	19.1	0.0	0.0	Horz	PK	-40.0	9.3	27.9	-18.6

2 Radiated emissions above 30 MHz

2.1 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.

2.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Chamber 1
Test Standard and Clause:	ANSI C63.10-2020, Clause 6.5
Frequencies Measured:	125 kHz
Deviations from Standard:	None
Measurement BW:	30 MHz to 1 GHz: 120 kHz
Measurement Detector:	Quasi-peak

Environmental Conditions (Normal Environment)

Temperature: 17 °C	+15 ºC to +35 ºC (as declared)
Humidity: 46 %RH	20%RH to 75%RH (as declared)
Supply: 12.0 Vdc	12.0 Vdc (as declared)

Test Limits
Emissions shall comply with the field strength limits shown in the Table 5. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

Table 5 - General field strength limits at frequencies above 30 MHz

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

n.b. per FCC 47CFR15.35(b) / ISED RSS-Gen 8.1, where an average measurement is specified, the peak limit is 20dB above the average limit.

2.3 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 100kHz 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:

$$FS = PR + CL + AF – PA + DC – CF$$

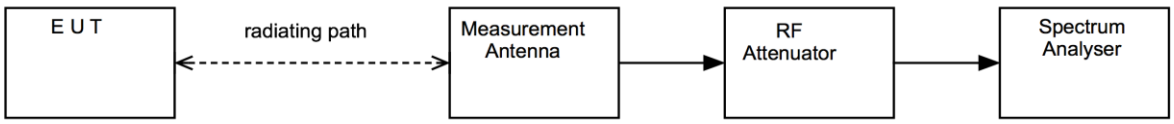
$$Factor = CL + AF – PA$$

Where,

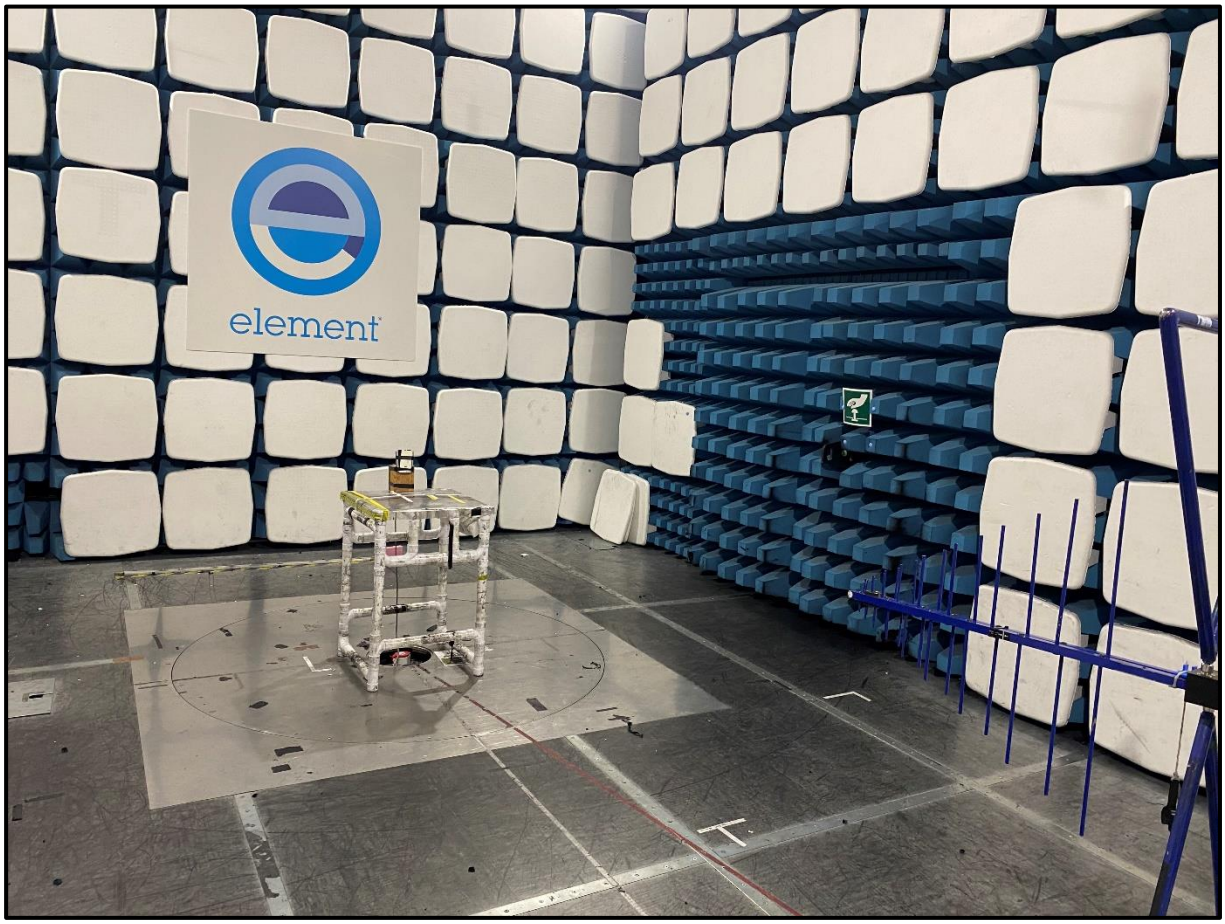
PR is the power recorded on the receiver / spectrum analyzer in dBµV;
CL is the cable loss in dB;
AF is the test antenna factor in dB/m;
PA is the pre-amplifier gain in dB (where used);
DC is the duty correction factor in dB (where used, e.g. harmonics of pulsed fundamental);
CF is the distance factor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

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

Figure i Test Setup



Test Setup Photograph

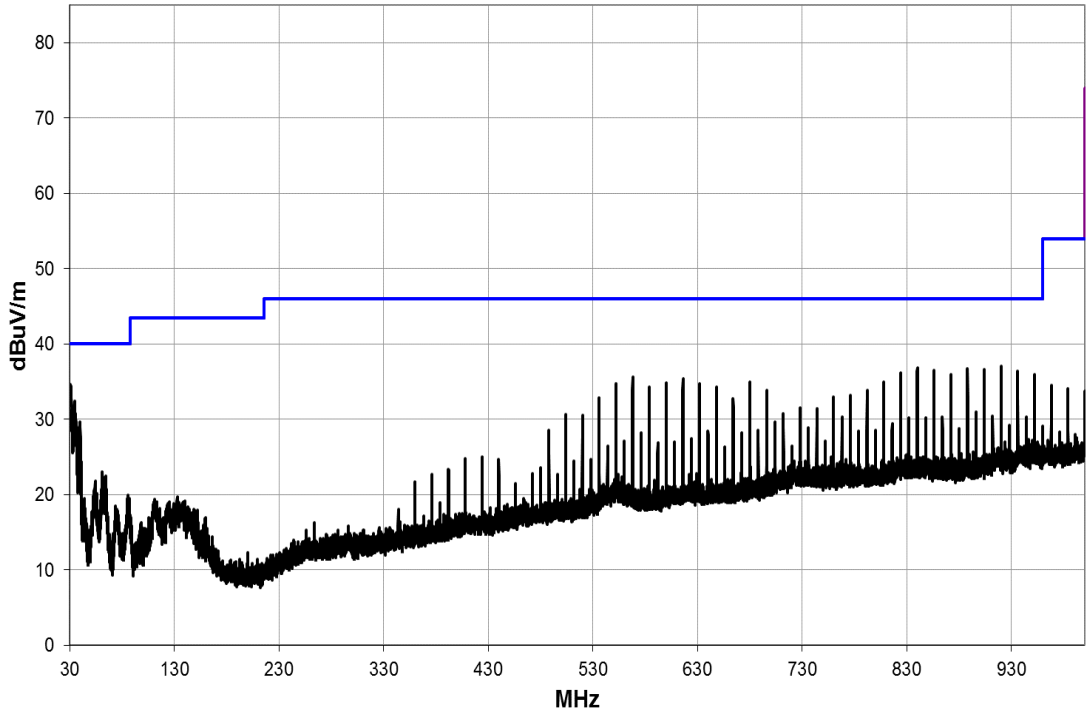


2.4 Test Equipment

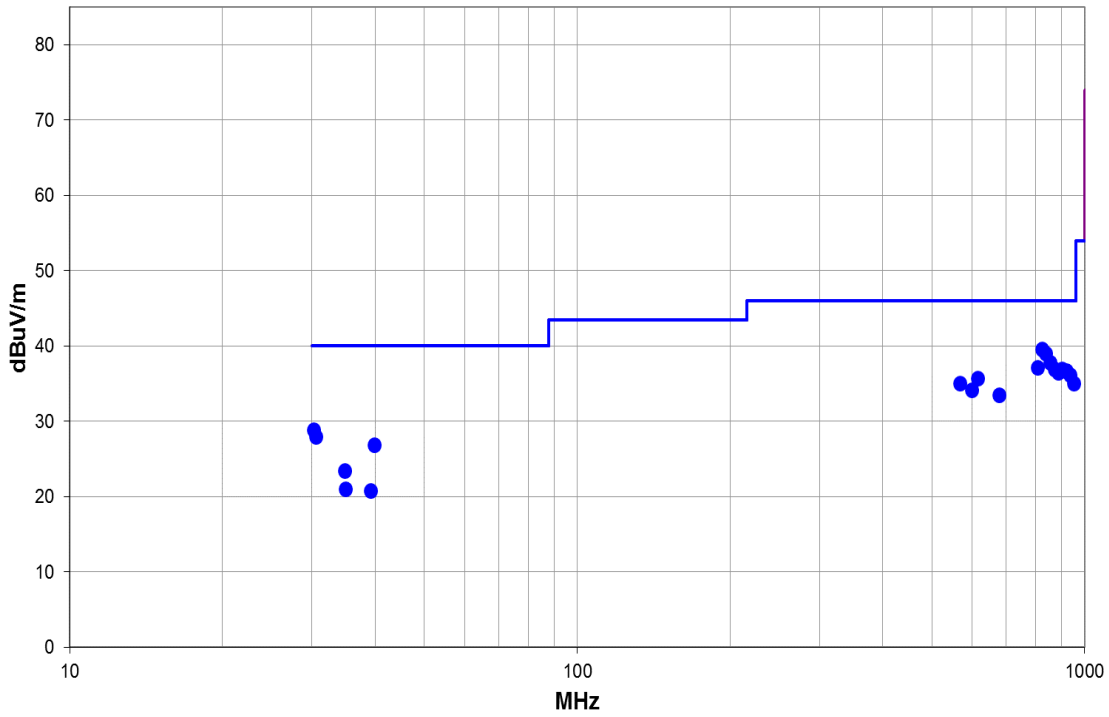
Equipment Description	*Manufacturer*	*Equipment Type*	*Element No*	*Last Cal Calibration*	*Calibration Period*	*Due For Calibration*
Pre Amp	AMETEK	LNA6901	U711	2023-04-12	12	2024-04-12
Bilog	Chase	CBL611/A	U191	2023-08-11	24	2025-08-11
EMI Receiver	R&S	ESR26	U489	2023-10-11	12	2024-10-11

2.5 Test Results

30 MHz to 1 GHz



Maximised measured emissions



Results Table

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
824.004	43.3	-3.8	1.24	180.1	3.0	0.0	Vert	QP	0.0	39.5	46.0	-6.5
839.996	42.6	-3.6	1.19	187.0	3.0	0.0	Vert	QP	0.0	39.0	46.0	-7.0
855.985	41.5	-3.7	1.16	354.1	3.0	0.0	Vert	QP	0.0	37.8	46.0	-8.2
807.997	41.6	-4.5	1.25	193.2	3.0	0.0	Vert	QP	0.0	37.1	46.0	-8.9
904.008	40.1	-3.2	1.05	0.0	3.0	0.0	Vert	QP	0.0	36.9	46.0	-9.1
871.994	40.9	-4.0	1.11	6.1	3.0	0.0	Vert	QP	0.0	36.9	46.0	-9.1
920.005	39.0	-2.3	1.09	8.2	3.0	0.0	Vert	QP	0.0	36.7	46.0	-9.3
888.004	40.3	-3.8	1.04	189.9	3.0	0.0	Vert	QP	0.0	36.5	46.0	-9.5
935.998	38.2	-2.1	1.02	0.1	3.0	0.0	Vert	QP	0.0	36.1	46.0	-9.9
616.001	42.8	-7.1	1.0	8.1	3.0	0.0	Vert	QP	0.0	35.7	46.0	-10.3
952.002	36.8	-1.8	1.0	14.8	3.0	0.0	Vert	QP	0.0	35.0	46.0	-11.0
568.005	42.8	-7.8	1.98	4.9	3.0	0.0	Vert	QP	0.0	35.0	46.0	-11.0
30.277	37.5	-8.7	3.77	282.1	3.0	0.0	Vert	QP	0.0	28.8	40.0	-11.2
600.010	41.8	-7.7	1.04	0.1	3.0	0.0	Vert	QP	0.0	34.1	46.0	-11.9
30.565	36.8	-8.9	4.0	161.2	3.0	0.0	Horz	QP	0.0	27.9	40.0	-12.1
679.989	40.2	-6.7	1.0	339.8	3.0	0.0	Horz	QP	0.0	33.5	46.0	-12.5
39.835	40.6	-13.8	1.0	308.2	3.0	0.0	Vert	QP	0.0	26.8	40.0	-13.2
34.917	34.6	-11.2	2.82	130.0	3.0	0.0	Horz	QP	0.0	23.4	40.0	-16.6
35.042	32.3	-11.3	1.15	178.1	3.0	0.0	Vert	QP	0.0	21.0	40.0	-19.0
39.270	34.3	-13.5	1.0	288.2	3.0	0.0	Vert	QP	0.0	20.8	40.0	-19.2

3 AC power-line conducted emissions

3.1 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.

3.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Transient Lab 2
Test Standard and Clause:	ANSI C63.10-2020, Clause 6.2
Frequencies Measured:	125 kHz
EUT Modulation:	AM
Deviations from Standard:	None
Measurement BW:	9 kHz
Measurement Detectors:	Quasi-Peak and,Average,

Environmental Conditions (Normal Environment)

Temperature: 18.4 °C	+15 ºC to +35 ºC (as declared)
Humidity: 43 %RH	20%RH to 75%RH (as declared)
Supply: 120 Vac	120 Vac (as declared)

Test Limits

For radio apparatus that are designed to be connected to the public utility (AC) power network, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the range 150 kHz to 30 MHz shall not exceed the limits in Table 4, as measured using a 50 µH / 50 Ω line impedance stabilization network. This requirement applies for the radio frequency voltage measured between each power line and the ground terminal of each AC power-line mains cable of the EUT.

For an EUT that connects to the AC power lines indirectly, through another device, the requirement for compliance with the limits in Table 4 shall apply at the terminals of the AC power-line mains cable of a representative support device, while it provides power to the EUT. The device used to power the EUT shall be representative of typical applications.

The lower limit applies at the boundary between the frequency ranges.

Table 4 – AC power-line conducted emissions limits

Frequency (MHz)	*Conducted limit (dBµV)*	
	Quasi-Peak	*Average***
0.15 – 0.5	66 to 56[1]	56 to 46[1]
0.5 – 5.0	56	46
5.0 – 30.0	60	50

Note 1: The level decreases linearly with the logarithm of the frequency.

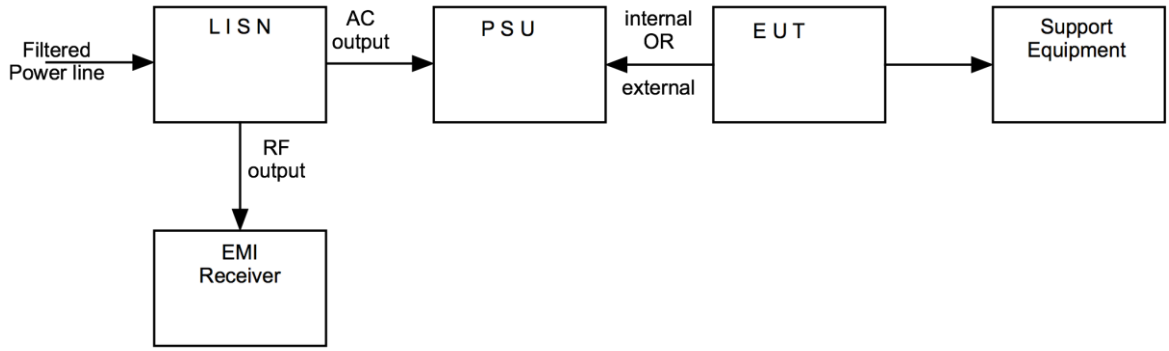
3.3 Test Method

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

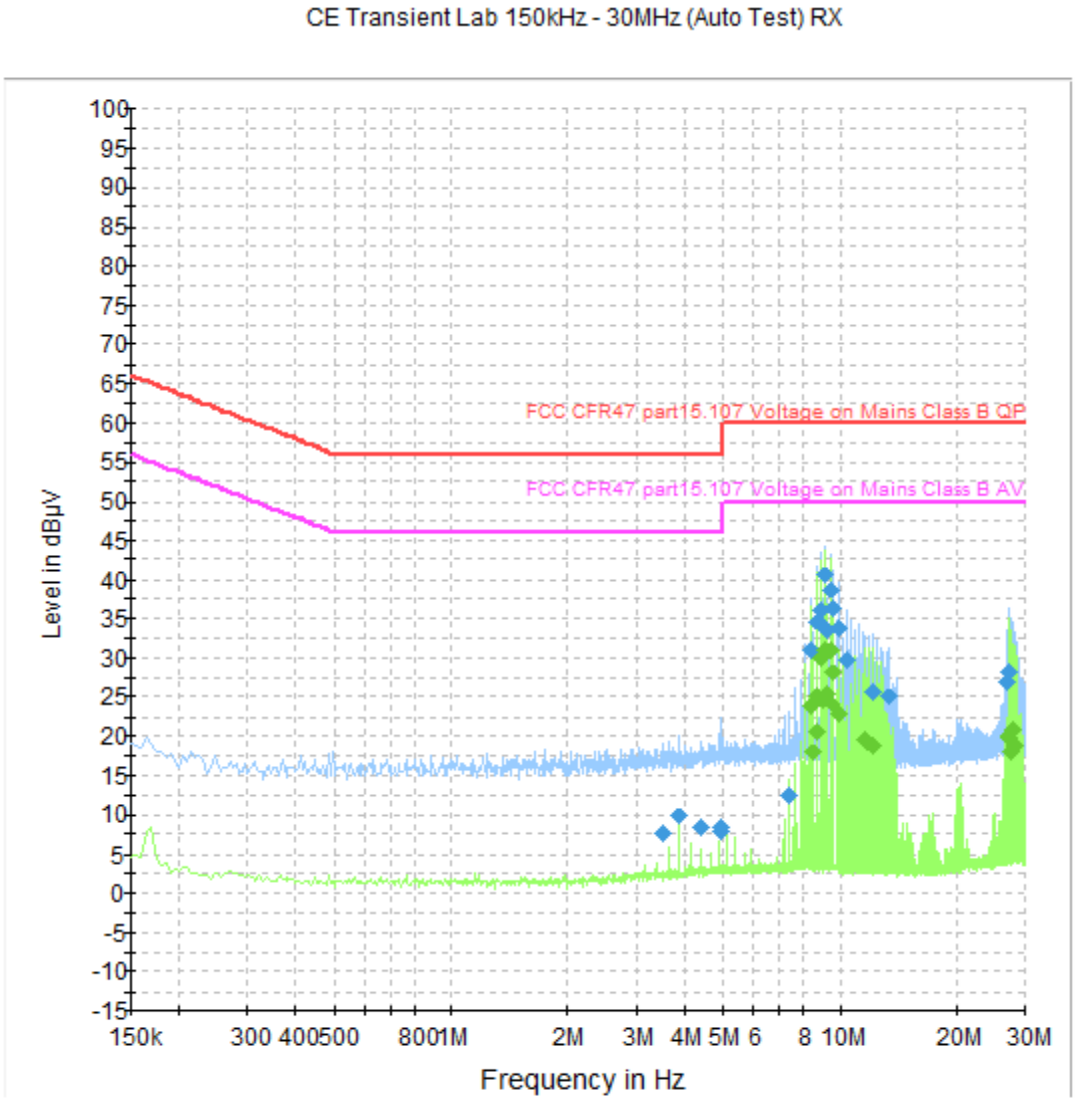


Test Setup Photograph

3.4 Test Equipment

Equipment Description	*Manufacturer*	*Equipment Type*	*Element No*	*Last Cal Calibration*	*Calibration Period*	*Due For Calibration*
Lisn	R&S	ENV216	U396	2023-05-22	12	2024-05-22
Pulse Limiter	R&S	ESH3-Z2	U559	2023-02-01	12	2024-02-01
Spectrum Analyser	R&S	ESR 7	U727	2023-05-09	12	2024-05-09
AC Power Supply	Kikusui		U580	Use REF976		
Multimeter	Agilent	34405a	REF976	2023-01-24	12	2024-01-24

3.5 Test Results



Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
3.525000	7.6	2000.0	9.000	Off	N	19.9	48.4	56.0
3.885000	9.7	2000.0	9.000	Off	N	19.9	46.3	56.0
4.385000	8.5	2000.0	9.000	Off	N	19.9	47.5	56.0
4.935000	8.1	2000.0	9.000	Off	L1	20.0	47.9	56.0
4.975000	8.5	2000.0	9.000	Off	L1	20.0	47.5	56.0
7.390000	12.6	2000.0	9.000	Off	L1	20.5	47.4	60.0
8.395000	31.1	2000.0	9.000	Off	L1	20.7	28.9	60.0
8.645000	34.7	2000.0	9.000	Off	L1	20.5	25.3	60.0
8.895000	36.0	2000.0	9.000	Off	L1	20.3	24.0	60.0
9.025000	34.0	2000.0	9.000	Off	L1	20.2	26.0	60.0
9.150000	40.5	2000.0	9.000	Off	L1	20.2	19.5	60.0
9.275000	33.5	2000.0	9.000	Off	L1	20.3	26.5	60.0
9.400000	38.7	2000.0	9.000	Off	L1	20.3	21.3	60.0
9.650000	36.2	2000.0	9.000	Off	L1	20.4	23.8	60.0
9.900000	33.8	2000.0	9.000	Off	L1	20.4	26.2	60.0
10.400000	29.8	2000.0	9.000	Off	N	20.2	30.2	60.0
12.155000	25.6	2000.0	9.000	Off	N	20.3	34.4	60.0
13.410000	25.0	2000.0	9.000	Off	N	20.3	35.0	60.0
26.820000	27.0	2000.0	9.000	Off	N	20.9	33.0	60.0
27.320000	28.4	2000.0	9.000	Off	N	20.9	31.6	60.0

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
8.395000	23.8	2000.0	9.000	Off	L1	20.7	26.2	50.0
8.520000	18.1	2000.0	9.000	Off	L1	20.6	31.9	50.0
8.645000	25.4	2000.0	9.000	Off	L1	20.5	24.6	50.0
8.770000	20.7	2000.0	9.000	Off	L1	20.4	29.3	50.0
8.900000	30.0	2000.0	9.000	Off	L1	20.3	20.0	50.0
9.025000	24.7	2000.0	9.000	Off	L1	20.2	25.3	50.0
9.150000	30.9	2000.0	9.000	Off	L1	20.2	19.1	50.0
9.275000	25.5	2000.0	9.000	Off	L1	20.3	24.5	50.0
9.400000	31.0	2000.0	9.000	Off	L1	20.3	19.0	50.0
9.525000	24.1	2000.0	9.000	Off	L1	20.3	25.9	50.0
9.650000	28.1	2000.0	9.000	Off	L1	20.4	21.9	50.0
9.905000	22.8	2000.0	9.000	Off	L1	20.4	27.2	50.0
11.655000	19.5	2000.0	9.000	Off	N	20.2	30.5	50.0
11.905000	19.1	2000.0	9.000	Off	N	20.2	30.9	50.0
12.155000	18.7	2000.0	9.000	Off	N	20.3	31.3	50.0
27.070000	20.3	2000.0	9.000	Off	N	20.9	29.7	50.0
27.320000	19.7	2000.0	9.000	Off	N	20.9	30.3	50.0
27.570000	17.9	2000.0	9.000	Off	N	20.9	32.1	50.0
27.825000	20.8	2000.0	9.000	Off	N	20.9	29.2	50.0
28.075000	18.7	2000.0	9.000	Off	N	20.9	31.3	50.0

4 Occupied Bandwidth

4.1 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.

20dB 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.

4.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Chamber 1
Test Standard and Clause:	ANSI C63.10-2020, Clause 6.9
Frequencies Measured:	125 kHz
EUT Test Modulations:	AM
Deviations from Standard:	See section 5.2
Measurement BW: (requirement: 1% to 5% OBW)	200 Hz
Spectrum Analyzer Video BW: (requirement at least 3x RBW)	1 kHz
Measurement Span: (requirement 2 to 5 times OBW)	10 kHz
Measurement Detector:	Peak

Environmental Conditions (Normal Environment)

Temperature: 17 °C	+15 ºC to +35 ºC (as declared)
Humidity: 46 %RH	20%RH to 75%RH (as declared)
Supply: 12.0 Vdc	12.0 Vdc (as declared)

Test Limits

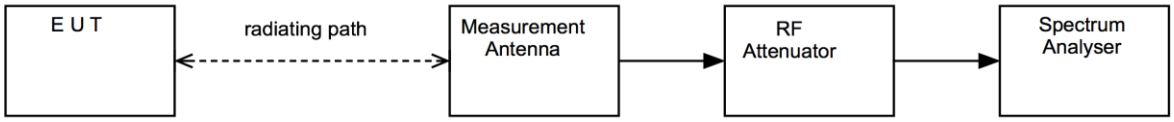
FCC 47CFR15:

No requirement specified.

4.3 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



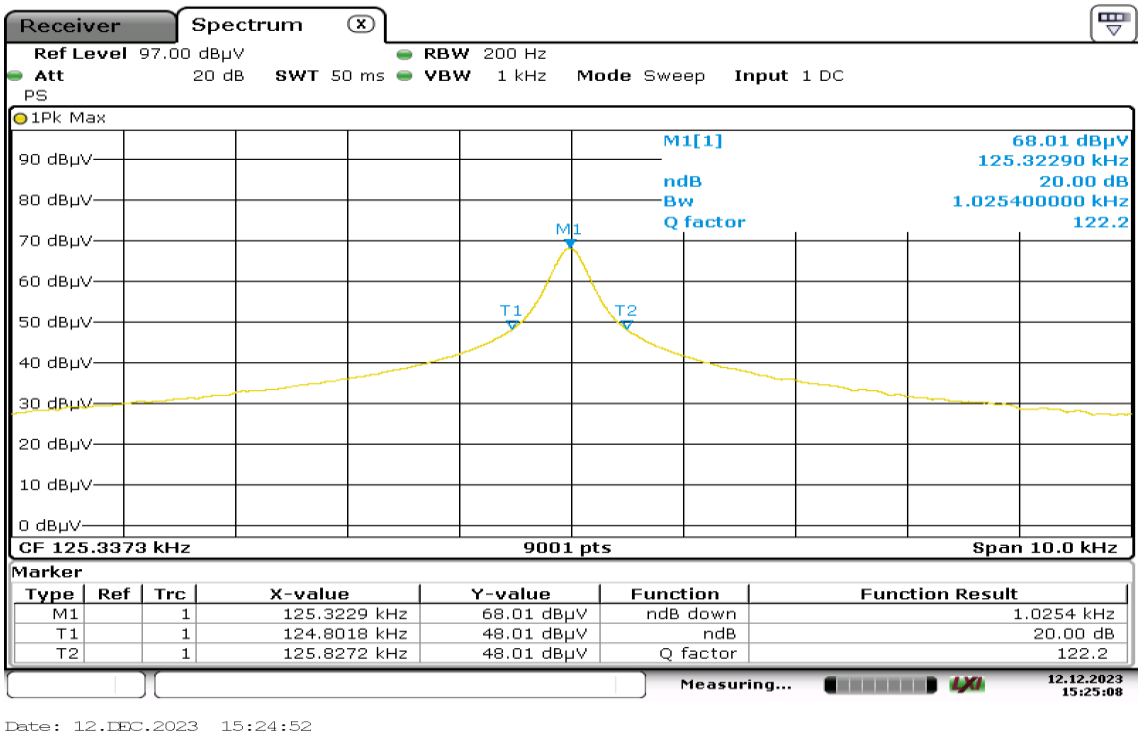
4.4 Test Equipment

Equipment Description	*Manufacturer*	*Equipment Type*	*Element No*	*Last Cal Calibration*	*Calibration Period*	*Due For Calibration*
EMI Receiver	R&S	ESR26	U489	2023-10-11	12	2024-10-11
Loop Antenna	R&S	hfh2	L007	2023-10-11	12	2024-10-11

4.5 Test Results

15.225			
Channel Frequency (kHz)	***F_L (MHz)***	***F_H (MHz)***	***20 dB Bandwidth (kHz)***
125.0	124.80180	125.82720	1.0254

20 dB Bandwidth



Note: The resolution bandwidth requirement of meeting the 1% to 5% of the resulting 20 dB bandwidth for AM RFID type radio devices cannot be resolved.
As the resolution bandwidth is reduced, the 20 dB bandwidth will also reduce.
This scenario will continue, and the resulting 20 dB bandwidth measurement will just continue to reduce to nothing. Therefore, a wider resolution bandwidth was used, which was greater than the 5% requirement.

The frequency Span wide enough to capture all the side bands of the signal.

5 Transmitter output power (fundamental radiated emission)

5.1 Definition

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

5.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Chamber 1
Test Antenna:	Active 60 cm Loop
Test Standard and Clause:	ANSI C63.10-2020, Clause 6.3 / 6.4
Frequencies Measured:	125 kHz
Deviations from Standard:	None
Measurement BW:	200 Hz
Spectrum Analyzer Video BW: (requirement at least 3x RBW)	1 kHz
Measurement Detector:	Average

Environmental Conditions (Normal Environment)

Temperature: 17 °C	+15 ºC to +35 ºC (as declared)
Humidity: 46 %RH	20%RH to 75%RH (as declared)

Test Limits

FCC 47CFR15.209(a):
Except as provided in § paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 MHz, 76– 88 MHz, 174–216 MHz or 470–806 MHz. However, operation within these frequency bands is permItted under other sections of this part, e.g., §§ 15.231 and 15.241.

Table of the general field strength limits per 15.209 / RSS-Gen

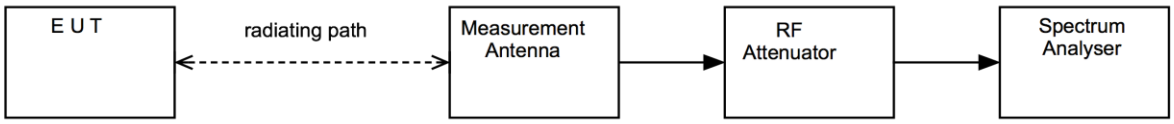
General Field Strength Limits for License -Exempt Transmitters at Frequencies Below 30 MHz

Frequency (MHz)	*Field Strength (µV/m)*	*Measurement distance (m)*
0.009-0.490	2400/f(kHz)	300
0.490-1.705	24000/f(kHz)	30
1.705-30	30	30

5.3 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.

Figure v Test Setup



5.4 Test Equipment

Equipment Description	*Manufacturer*	*Equipment Type*	*Element No*	*Last Cal Calibration*	*Calibration Period*	*Due For Calibration*
Loop Antenna	R&S	hfh2	L007	2023-10-11	12	2024-10-11
EMI Receiver	R&S	ESR26	U489	2023-10-11	12	2024-10-11

5.5 Test Results

40 log (wanted distance ÷ measurement distance)

40 log (300÷10) distance correction factor = 59.08

125 kHz							
Channel Frequency (kHz)	*Receiver Level dBµV/m)*	*Distance Measurement (m)*	*Limit Distance (m)*	*Extrapolation Factor (dB)*	*Field Strength (µV/m)*	*Limit (µV/m)*	*Result*
125.0	41.30	10	300	59.08	0.129	19.15	Pass

6 Measurement Uncertainty

Radio Testing – General Uncertainty Schedule

All statements of uncertainty are expanded standard uncertainty using a coverage factor of 1.96 to give a 95 % confidence where no required test level exists.

Test/Measurement	***Budget Number***	***MU***
Conducted RF Power, Power Spectral Density, Adjacent Channel Power and Spurious emissions		
Absolute RF power (via antenna connecter) Sampling Power Meter to 8 GHz	MU4001	**0.9 dB**
Carrier Power and PSD - Spectrum Analysers	MU4004	**1.7 dB**
Adjacent Channel Power	MU4002	**1.9 dB**
Transmitter conducted spurious emissions (Including emissions due to intermodulation)	MU4041	**0.9 dB**
Conducted power and spurious emissions 40 GHz to 50 GHz	MU4042	**2.4 dB**
Conducted power and spurious emissions 50 GHz to 75 GHz	MU4043	**2.5 dB**
Conducted power and spurious emissions 75 GHz to 110 GHz	MU4044	**2.4 dB**
Radiated RF Power and Spurious emissions ERP and EIRP		
Effective Radiated Power Reverb Chamber	MU4020	**3.7 dB**
Effective Radiated Power	MU4021	**4.7 dB**
TRP Emissions 30 MHz to 1 GHz using CBL6111 or CBL6112 Bilog Antenna	MU4046	**5.3 dB**
TRP Emissions 1 GHz to 18 GHz using HL050 Log Periodic Antenna	MU4047	**5.1 dB**
TRP Emissions 18 GHz to 26.5 GHz using Standard Gain Horn	MU4048	**2.7 dB**
TRP Emissions 26.5 GHz to 40 GHz using Standard Gain Horn	MU4049	**2.7 dB**
In-band (3450-3650 MHz) TRP using CATR_ASH_B2	MU4051	**4.1 dB**
Cellular Radiated Spurious Emissions in a SAC 30 MHz to 180 MHz	MU4052	**6.3 dB**
Cellular Radiated Spurious Emissions in a SAC 180 MHz to 18 GHz	MU4052	**3.6 dB**
Cellular Radiated Spurious Emissions in a FAR 30 MHz to 180 MHz	MU4052	**5.4 dB**
Cellular Radiated Spurious Emissions in a FAR 180 MHz to 18 GHz	MU4052	**3.0 dB**
Spurious Emissions Electric and Magnetic Field		
Radiated Spurious Emissions 30 MHz to 1 GHz (Including emissions due to intermodulation)	MU4037	**4.7 dB**
Radiated Spurious Emissions 1-18 GHz (Including emissions due to intermodulation)	MU4032	**4.5 dB**
E Field Emissions 18 GHz to 26 GHz	MU4024	**3.2 dB**
E Field Emissions 26 GHz to 40 GHz	MU4025	**3.3 dB**
E Field Emissions 40 GHz to 50 GHz	MU4026	**3.5 dB**
E Field Emissions 50 GHz to 75 GHz	MU4027	**3.6 dB**
E Field Emissions 75 GHz to 110 GHz	MU4028	**3.6 dB**
Radiated Magnetic Field Emissions	MU4031	**2.3 dB**

Test/Measurement	*Budget Number*	*MU*
Frequency Measurements		
Frequency Deviation	MU4022	**3.7 kHz**
Frequency error using CMTA test set	MU4023	**113.441 Hz**
Frequency error using GPS locked frequency source	MU4045	**0.0413 ppm**
Bandwidth/Spectral Mask Measurements		
Channel Bandwidth	MU4005	**3.87%**
Transmitter Mask Amplitude	MU4039	**1.3 dB**
Transmitter Mask Frequency	MU4040	**2.59%**
Time Domain Measurements		
Transmission Time	MU4038	**4.40%**
Dynamic Frequency Selection (DFS) Parameters)		
DFS Analyser - Measurement Time	MU4006	**678.984 µs**
DFS Generator - Frequency Error	MU4007	**91.650 Hz**
DFS Threshold Conducted	MU4008	**1.3 dB**
DFS Threshold Radiated	MU4009	**3.2 dB**
Receiver Parameters		
EN 300 328 Receiver Blocking	MU4010	**1.1 dB**
EN 301 893 Receiver Blocking	MU4011	**1.1 dB**
EN 303 340 Adjacent Channel Selectivity	MU4012	**1.1 dB**
EN 303 340 Overloading	MU4013	**1.1 dB**
EN 303 340 Receiver Blocking	MU4014	**1.1 dB**
EN 303 340 Receiver Sensitivity	MU4015	**0.9 dB**
EN 303 372-1 Image Rejection	MU4016	**1.4 dB**
EN 303 372-1 Receiver Blocking	MU4017	**1.1 dB**
EN 303 372-2 Adjacent Channel Selectivity	MU4018	**1.1 dB**
EN 303 372-2 Dynamic Range	MU4019	**0.9 dB**
Receiver Blocking Talk Mode Conducted	MU4033	**1.2 dB**
Receiver Blocking Talk Mode- radiated	MU4034	**3.4 dB**
Rx Blocking, listen mode, blocking level	MU4035	**3.2 dB**
Rx Blocking, listen mode, radiated Threshold Measurement	MU4036	**3.4 dB**
Adjacent Sub Band Selectivity	MU4003	**4.2 dB**

Test/Measurement	*Budget Number*	*MU*
Rohde & Schwarz TS8997		
Carrier frequency	MU4050	**5.2 ppm**
RF Output Power	MU4050	**1.0 dB**
Peak Power	MU4050	**0.8 dB**
Power Spectral Density	MU4050	**1.0 dB**
Occupied Channel Bandwidth	MU4050	**2.08 %**
Transmitter unwanted emissions in-band	MU4050	**0.9 dB**
Transmitter unwanted emissions in the spurious domain 30 MHz to 1 GHz	MU4050	**0.6 dB**
Transmitter unwanted emissions in the spurious domain 1 GHz to 12.75 GHz	MU4050	**1.8 dB**
Receiver Spurious emission 30 MHz to 1 GHz	MU4050	**0.6 dB**
Receiver Spurious emission 1 GHz to 12.75 GHz	MU4050	**1.8 dB**
Duty Cycle	MU4050	**0.02 %**
Tx Sequence	MU4050	**0.02 %**
Tx Gap	MU4050	**0.02 %**
Medium Utilisation	MU4050	**0.1 %**
Accumulated Transmit Time	MU4050	**0.01 %**
Minimum Frequency Occupation Time	MU4050	**0.01 %**
Hopping Frequency Separation	MU4050	**0.6 %**
Receiver blocking (for bit streams)	MU4050	**3.0 dB**
Channel Access Mechanism / Adaptivity / DFS / Contention Based Protocol	MU4050	**1.8 dB**

Test/Measurement	Budget Number	MU
Receiver Parameters		
EN300328 Receiver Blocking	MU4010	**1.1 dB**
EN301893 Receiver Blocking	MU4011	**1.1 dB**
EN303340 Adjacent Channel Selectivity	MU4012	**1.1 dB**
EN303340 Overloading	MU4013	**1.1 dB**
EN303340 Receiver Blocking	MU4014	**1.1 dB**
EN303340 Receiver Sensitivity	MU4015	**0.9 dB**
EN303372-1 Image Rejection	MU4016	**1.4 dB**
EN303372-1 Receiver Blocking	MU4017	**1.1 dB**
EN303372-2 Adjacent Channel Selectivity	MU4018	**1.1 dB**
EN303372-2 Dynamic Range	MU4019	**0.9 dB**
Receiver Blocking Talk Mode Conducted	MU4033	**1.2 dB**
Receiver Blocking Talk Mode- radiated	MU4034	**3.4 dB**
Rx Blocking, listen mode, blocking level	MU4035	**3.2 dB**
Rx Blocking, listen mode, radiated Threshold Measurement	MU4036	**3.4 dB**
Adjacent Sub Band Selectivity	MU4003	**4.2 dB**