

Report Number: TRA-066598-47-00C
Issue: C

Report on The Radio Testing of a
Checkit Europe Ltd
Gigabit Ethernet Signal Repeater
With Respect to Specification
FCC 47CFR 15.249

Test Date: 2025-02-28 to 2025-03-04

Tested by: S Garwell

Written by:



S Garwell
Radio Test Engineer

Approved by:



Digitally signed by John
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Date:

2025-06-12

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- [2] The results contained in this document relate only to the item(s) tested

RF922 9



1 Revision Record

<i>Issue</i>	<i>Issue Date</i>	<i>Revision History</i>
A	2025-03-19	Original
B	2025-05-23	Correction to transmitter power setting
C	2025-06-11	Correction to document page numbering, added additional peak measurements in section 11 (radiated emissions)

2 Summary

Test Report Number:	TRA-066598-47-00C
Works Order Number:	TRA-066598-00
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 Specifications:	47CFR15.249
Equipment Under Test (EUT):	Gigabit Ethernet Signal Repeater
FCC Identifier:	2A9Q3SPRT200G
EUT Serial Numbers:	SN: 40-84-32-9C-06-10 and SN: 40-84-32-9C-06-AB
Manufacturer:	Checkit Europe Ltd
Address:	Broers Building 21 JJ Thomson Ave Cambridge CB3 0FA United Kingdom
Client Contact:	Stefan Chiforeanu ☎ +44 7490 469064 ✉ stefan.chiforeanu@checkit.net
Order Number:	PO-003493
Test Date:	2025-02-28 to 2025-03-04
Tested By:	S Garwell Element

2.1 Test Summary

<i>Test Method and Description</i>	<i>Requirement Clause</i>	<i>Applicable to this Equipment</i>	<i>Result / Note</i>
	47CFR15		
Radiated Spurious Emissions	15.249(d)	☒	Pass
AC Power Line Conducted Emissions	15.207	☒	Pass
Occupied Bandwidth	15.215(c)	☒	Pass
Field Strength of Fundamental	15.249(a)	☒	Pass
Calculation of Duty Correction	15.35(c)	☐	N/A

General 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.

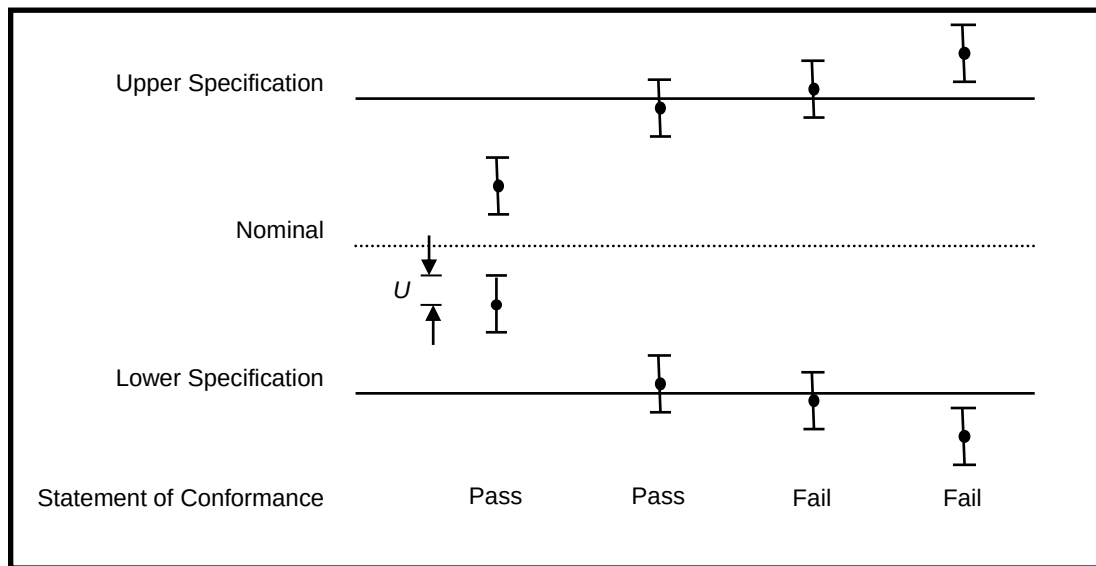
The apparatus was set up and exercised using the configurations, modes of operation and arrangements defined in this report only. Any modifications made are identified in Section 8 of this report.

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

The decision rule for compliance is inherent within this specification. The measured value related to the corresponding limit is used to decide whether an equipment meets the requirements of the test specification.

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.

Graphical Representation of a Pass / Fail Binary Statement - Simple Acceptance



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4 Introduction

This report TRA-066598-47-00C presents the results of the Radio testing on a Checkit Europe Ltd, Gigabit Ethernet Signal Repeater to specification 47CFR15 Radio Frequency Devices.

The testing was carried out for Checkit Europe Ltd 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
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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 ISO/IEC 17025:2017 accredited 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:

The test laboratory is accredited for the above sites under the following US-UK MRA, Designation numbers.

Element Surrey Hills	UK2027
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 C63.10-2013 – 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

S	denotes a section reference from the standard, not this document
AC	Alternating Current
ANSI	American National Standards Institute
BW	bandwidth
°C	Degrees 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
EUT	Equipment Under Test
e.i.r.p.	Equivalent Isotropically Radiated Power
e.r.p.	Effective Radiated Power
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
SISO	Single Input and Single Output
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: Gigabit Ethernet Signal Repeater
- Serial Numbers: SN: 40-84-32-9C-06-10 and SN: 40-84-32-9C-06-AB
- Model Number: GENII/SRPT/200G
- Software Revision: Firmware v1.12 (+2 dBm Firmware)
- Build Level / Revision Number: Issue 2

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.

Not Applicable – No support/monitoring equipment required.

7.3 EUT Mode of Operation

7.3.1 Transmission

The mode of operation for Transmitter tests was as follows...

The transmitter was transmitting a modulated carrier on the frequencies as indicated.

7.4 EUT Radio Parameters

7.4.1 General

Frequency of Operation:	915.0 MHz
Modulation Type:	FSK
Occupied Channel Bandwidth:	300 kHz
Channel Spacing:	790 kHz
Declared Output Power:	0 dBm
Nominal Supply Voltage:	110 Vac 60 Hz
Duty Cycle:	0.061%

7.4.2 Antennas

Type:	FLEXI-M4-868
Frequency Range:	902 MHz – 928 MHz
Impedance:	50 Ω
Gain:	2.0 dBi
Connector Type:	M4 Screw Thread
Length:	85 mm
Environmental Limits:	-30°C to +60°C

7.5 EUT Description

The EUT is a Gigabit Ethernet Signal Repeater (GENII/SRPT/200G) that contains MiWi 915MHz radio.

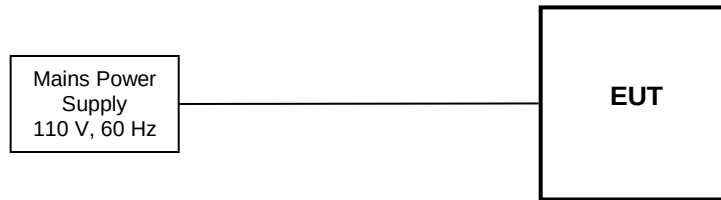
8 Modifications

No modifications were performed during this assessment.

9 EUT Test Setup

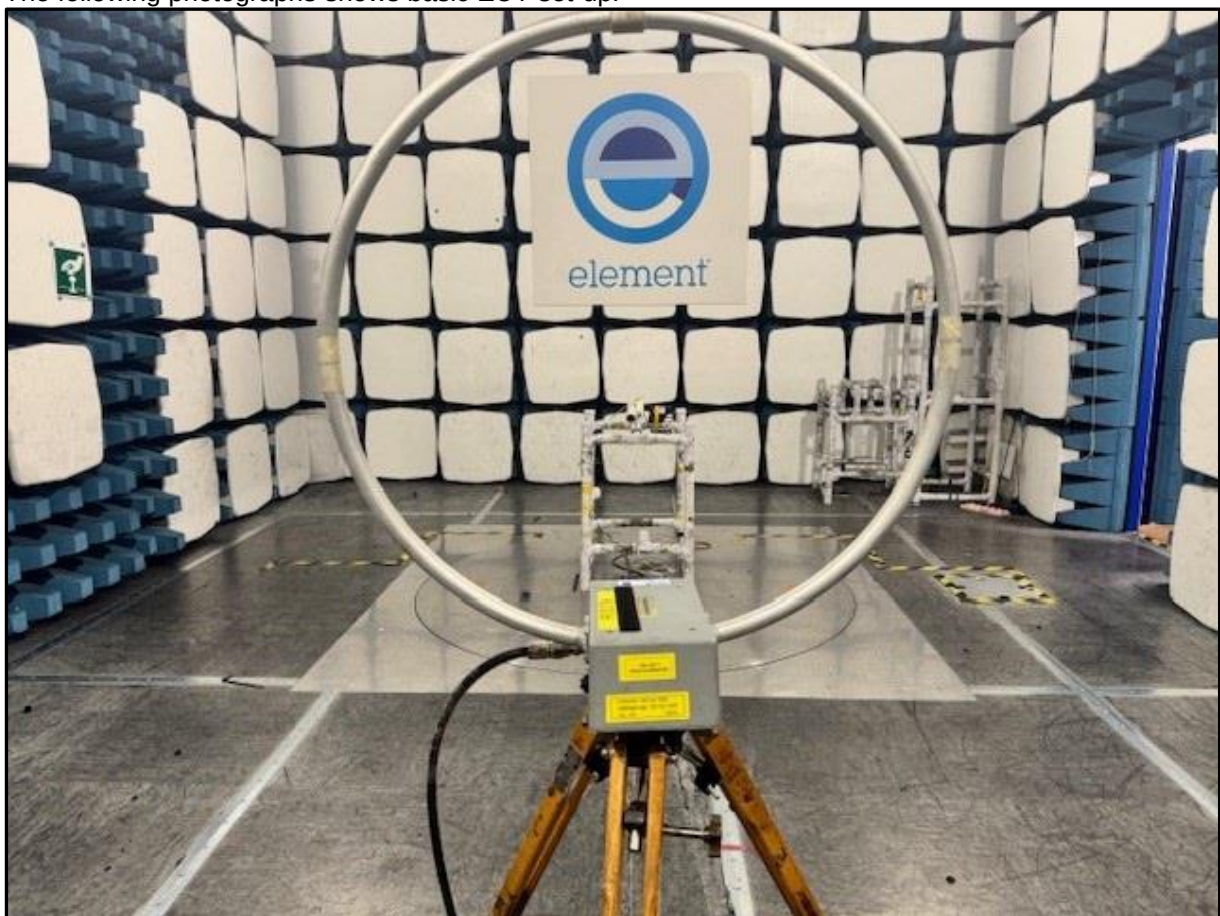
9.1 Block Diagram

The following diagram shows basic EUT interconnections:



9.2 General Set-up Photographs

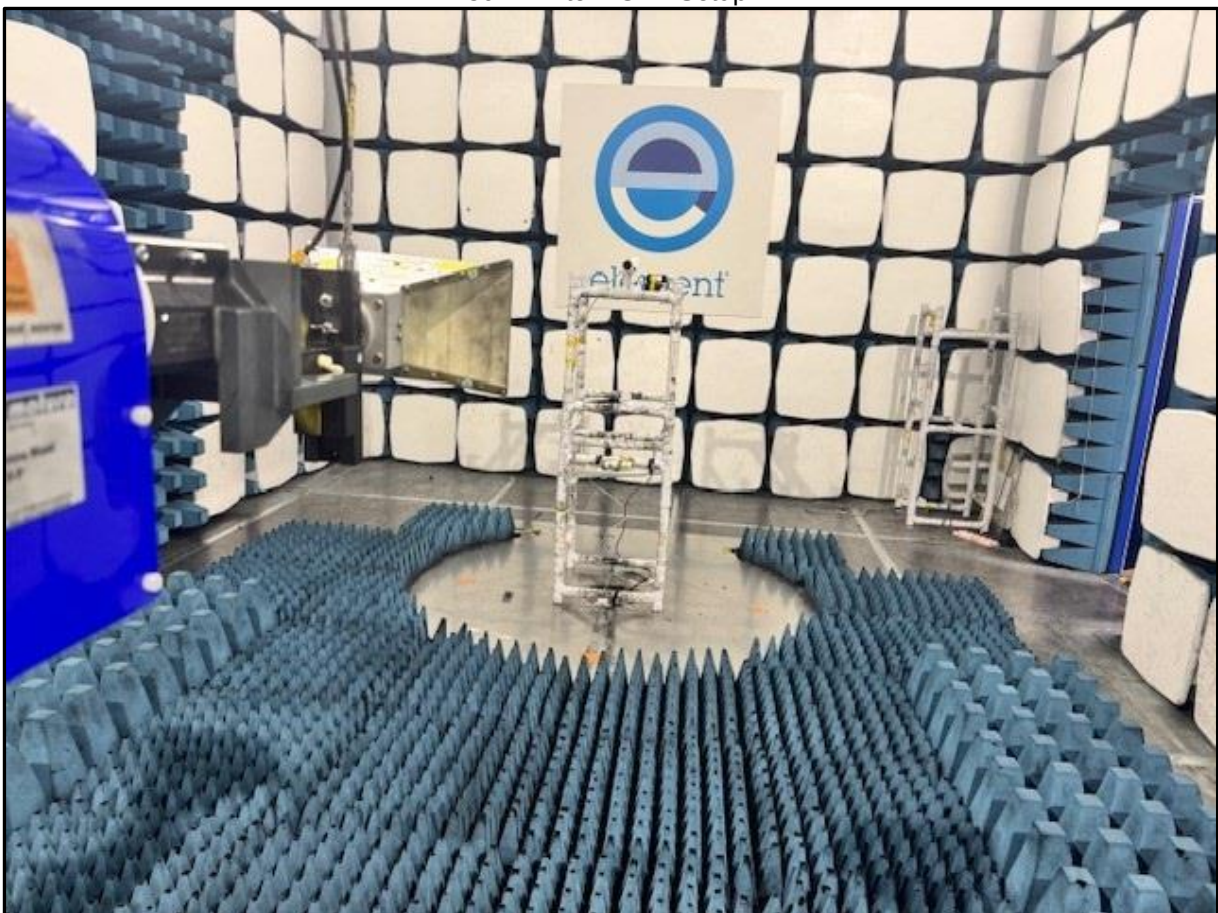
The following photographs shows basic EUT set-up:



9 kHz to 30 MHz Setup



30 MHz to 1 GHz Setup



Above 1 GHz Setup

9.3 Measurement Software

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

Element Emissions R5 (See Note)

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 EUT was tested under the normal environmental conditions of the test laboratory, except where otherwise stated. The normal power source applied was 110 Vac 60 Hz from the mains 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 VAC +/- 2 %	85 % and 115 %
☐	Battery	New Battery	N/A

11 Radiated emissions

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:	REF940
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.5 and 6.6
EUT Frequency Measured:	915.0 MHz
EUT Channel Bandwidths:	300 kHz
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

Environmental Conditions (Normal Environment)

Temperature: 25 °C	+15 °C to +35 °C (as declared)
Humidity: 32 % RH	20 % RH to 75 % RH (as declared)
Supply: 110 Vac	110 Vac (as declared)

11.3 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.

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 dB μ V/m at the regulatory distance, using:

$$FS = PR + CL + AF - PA + DC - CF$$

$$\text{Factor} = CL + AF - PA$$

Where,

PR is the power recorded on the receiver / spectrum analyzer in dB μ V;

CL is the cable loss in dB;

AF is the test antenna factor in dB/m;

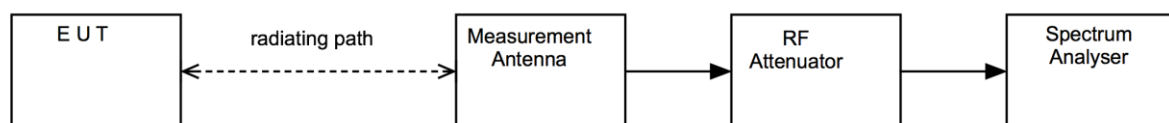
PA is the pre-amplifier gain in dB (where used);

DC is the duty correction factor in dB (where used, e.g. harmonics of pulsed fundamental);

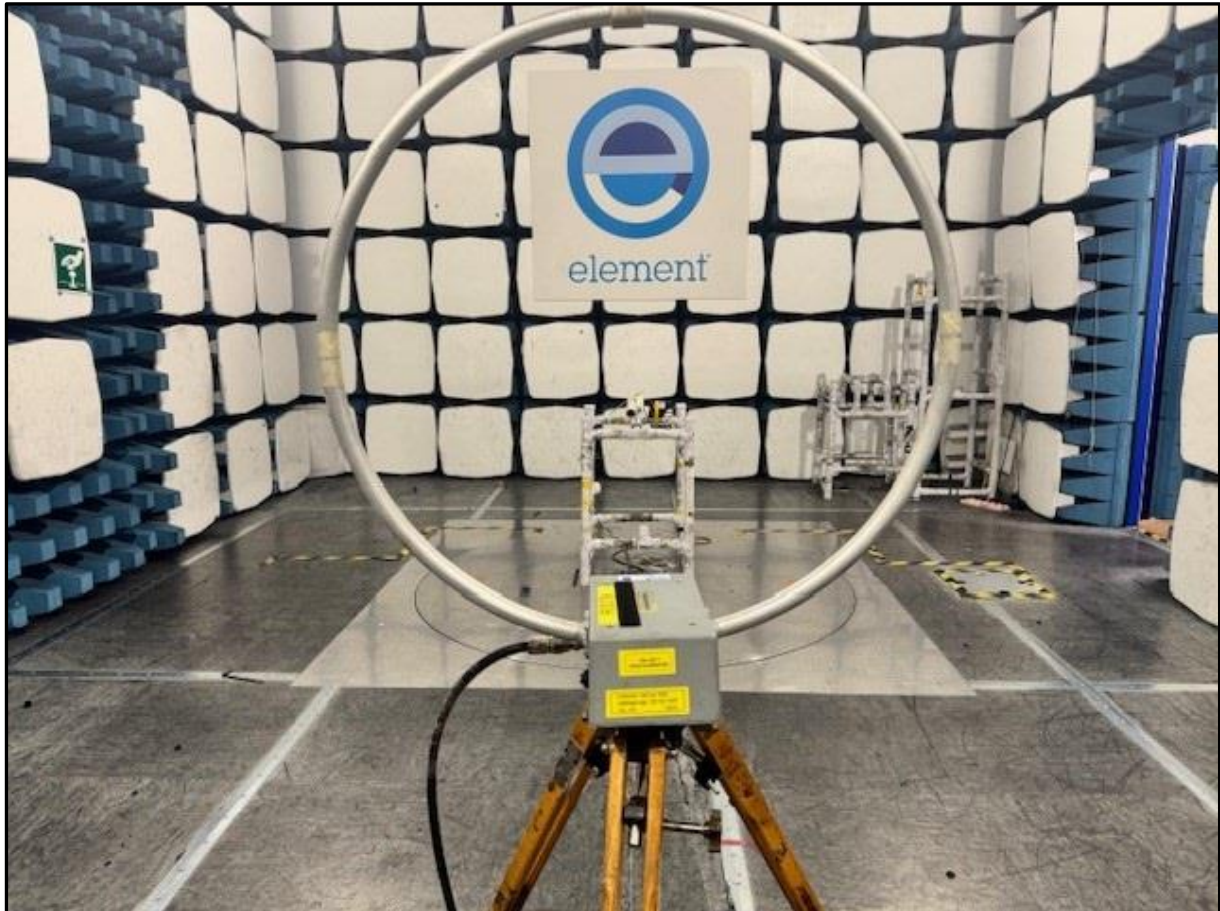
CF is the distance factor in dB (where measurement distance different to limit distance);

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

Figure i Test Setup



11.5 Test Set-up Photographs



9 kHz to 30 MHz Setup



30 MHz to 1 GHz Setup



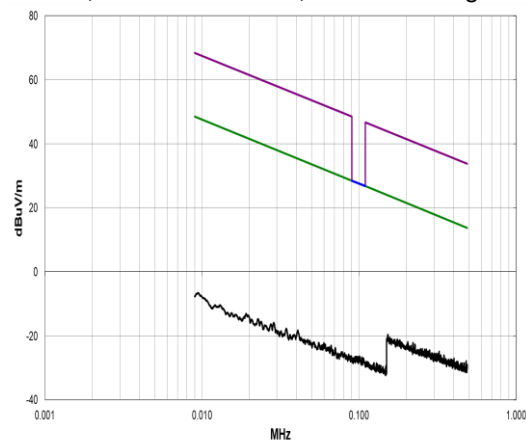
Above 1 GHz Setup

11.6 Test Equipment

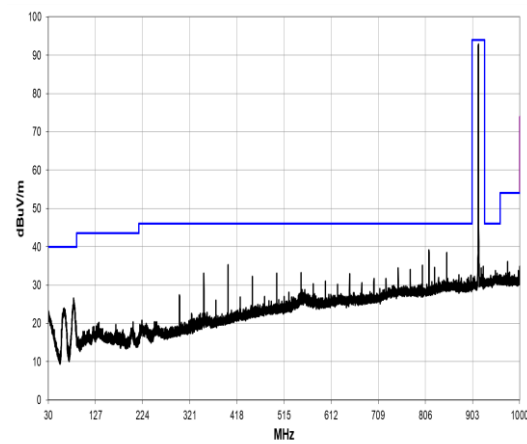
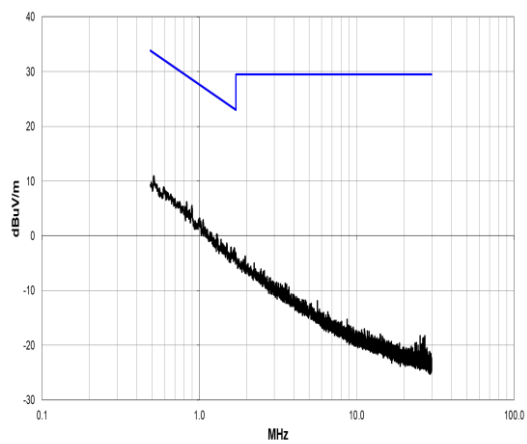
<i>Equipment Type</i>	<i>Manufacturer</i>	<i>Equipment Description</i>	<i>Element No</i>	<i>Due For Calibration</i>
Spectrum Analyser	R&S	ESR 7	U727	2025-05-17
Spectrum Analyser	R&S	FSU26	U405	2025-06-07
Active Loop Antenna	EMCO	6502	R0079	2026-01-10
1-18GHz Horn	EMCO	3115	L139	2025-08-21
Pre Amp	Agilent	8449B	L572	2025-11-13
Bilog	Chase	CBL611/B	U573	2025-11-04
PreAmp	Watkins Johnson	6201-69	U372	2025-03-15
Radio Chamber - PP	Rainford EMC	ATS	REF940	2026-01-29
Radiated Test Software	Element	Emissions R5	REF9000	Cal Not Required

11.7 Test Results

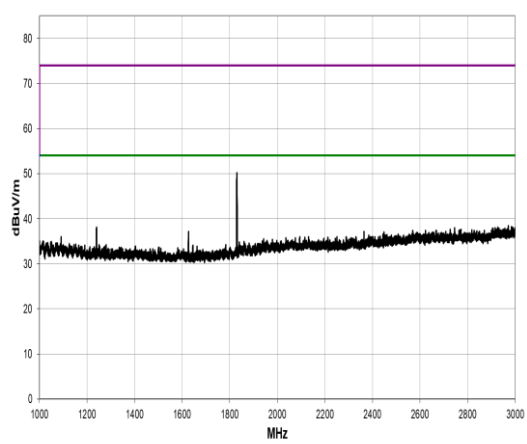
Frequency: 915 MHz; Modulation: FSK; Power Setting: -2 dBm Firmware



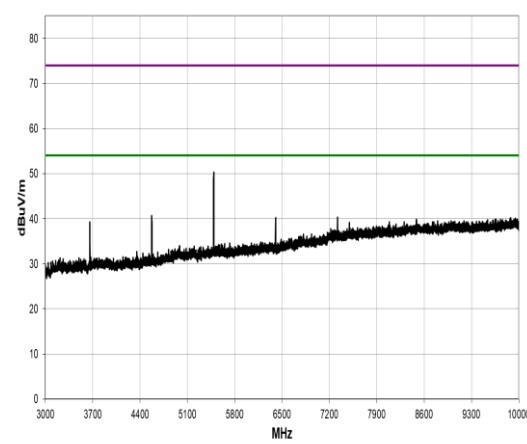
9 kHz to 490 kHz



490 kHz to 30 MHz



30 MHz to 1 GHz



1 GHz to 3 GHz

3 GHz to 10 GHz

Final Measurements:

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)
849.990	33.1	4.6	1.0	285.1	3.0	0.0	Horz	QP	0.0	37.7	46.0	-8.3
813.371	33.7	3.4	1.0	70.1	3.0	0.0	Horz	QP	0.0	37.1	46.0	-8.9
799.975	30.1	3.6	1.5	247.1	3.0	0.0	Vert	QP	0.0	33.7	46.0	-12.3
400.002	37.5	-4.0	1.0	266.0	3.0	0.0	Horz	QP	0.0	33.5	46.0	-12.5
813.345	30.1	3.4	2.06	347.0	3.0	0.0	Vert	QP	0.0	33.5	46.0	-12.5
800.000	29.7	3.6	1.0	294.0	3.0	0.0	Horz	QP	0.0	33.3	46.0	-12.7
849.991	28.5	4.6	2.0	325.0	3.0	0.0	Vert	QP	0.0	33.1	46.0	-12.9
824.974	29.1	3.8	1.0	296.0	3.0	0.0	Horz	QP	0.0	32.9	46.0	-13.1
749.981	29.2	3.5	1.0	296.1	3.0	0.0	Horz	QP	0.0	32.7	46.0	-13.3
349.989	38.1	-5.5	1.0	290.0	3.0	0.0	Horz	QP	0.0	32.6	46.0	-13.4
749.976	29.0	3.5	1.5	67.0	3.0	0.0	Vert	QP	0.0	32.5	46.0	-13.5
774.979	29.0	3.4	1.5	215.0	3.0	0.0	Vert	QP	0.0	32.4	46.0	-13.6
449.990	34.2	-2.5	2.06	275.0	3.0	0.0	Horz	QP	0.0	31.7	46.0	-14.3
449.981	32.9	-2.5	1.0	140.0	3.0	0.0	Vert	QP	0.0	30.4	46.0	-15.6
349.971	32.8	-5.5	1.34	156.1	3.0	0.0	Vert	QP	0.0	27.3	46.0	-18.7
81.909	35.3	-14.4	1.5	184.1	3.0	0.0	Vert	QP	0.0	20.9	40.0	-19.1
1829.792	59.5	-7.0	1.87	287.0	3.0	0.0	Horz	PK	0.0	52.5	74.0	-21.5
1829.942	55.0	-7.0	1.86	165.0	3.0	0.0	Vert	PK	0.0	48.0	74.0	-26.0
1239.967	51.4	-8.4	2.03	292.0	3.0	0.0	Vert	PK	0.0	43.0	74.0	-31.0
1626.775	49.9	-8.0	1.8	313.0	3.0	0.0	Horz	PK	0.0	41.9	74.0	-32.1
1626.842	49.2	-8.0	1.11	209.1	3.0	0.0	Vert	PK	0.0	41.2	74.0	-32.8
1240.133	49.4	-8.4	1.5	229.0	3.0	0.0	Horz	PK	0.0	41.0	74.0	-33.0
5489.533	58.0	4.6	1.57	354.0	1.0	0.0	Vert	PK	-9.5	53.1	74.0	-20.9
5490.450	56.4	4.6	1.34	146.9	1.0	0.0	Horz	PK	-9.5	51.5	74.0	-22.5
6404.417	51.1	5.2	1.64	348.1	1.0	0.0	Horz	PK	-9.5	46.8	74.0	-27.2
4575.317	52.0	2.5	1.54	81.9	1.0	0.0	Vert	PK	-9.5	45.0	74.0	-29.0
3660.383	52.2	0.8	1.5	92.0	1.0	0.0	Vert	PK	-9.5	43.5	74.0	-30.5
6404.367	47.4	5.2	1.43	315.0	1.0	0.0	Vert	PK	-9.5	43.1	74.0	-30.9
4575.625	49.7	2.5	1.5	132.9	1.0	0.0	Horz	PK	-9.5	42.7	74.0	-31.3
3659.625	49.4	0.8	1.5	241.9	1.0	0.0	Horz	PK	-9.5	40.7	74.0	-33.3

Note: for frequencies above 1 GHz peak emissions are below average limits so only peak emissions are listed.

12 AC power-line conducted emissions

12.1 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.

12.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Transient Laboratory
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.2
EUT Frequencies Measured:	915.0 MHz
EUT Modulation:	FSK
Deviations From Standard:	None
Measurement BW:	9 kHz
Measurement Detectors:	Quasi-Peak and Average, RMS

Environmental Conditions (Normal Environment)

Temperature: 25 °C	+15 °C to +35 °C (as declared)
Humidity: 32 % RH	20 % RH to 75 % RH (as declared)
Supply: 110 Vac	110 Vac (as declared)

12.3 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.

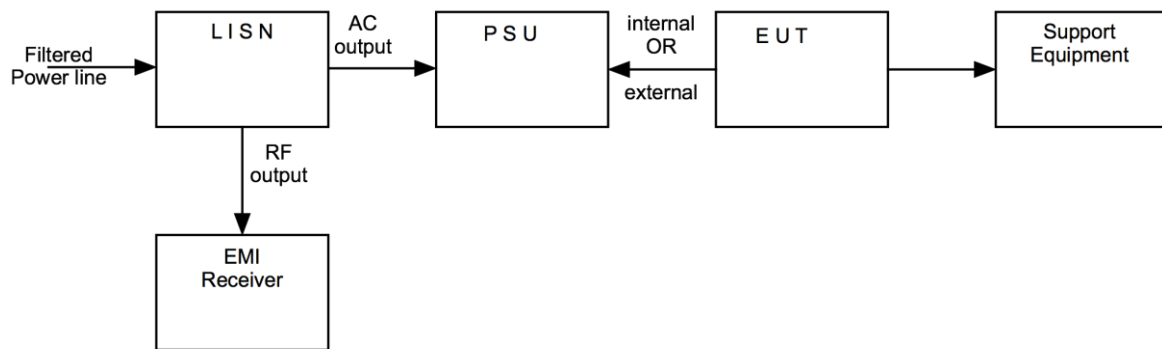
12.4 Test Method

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

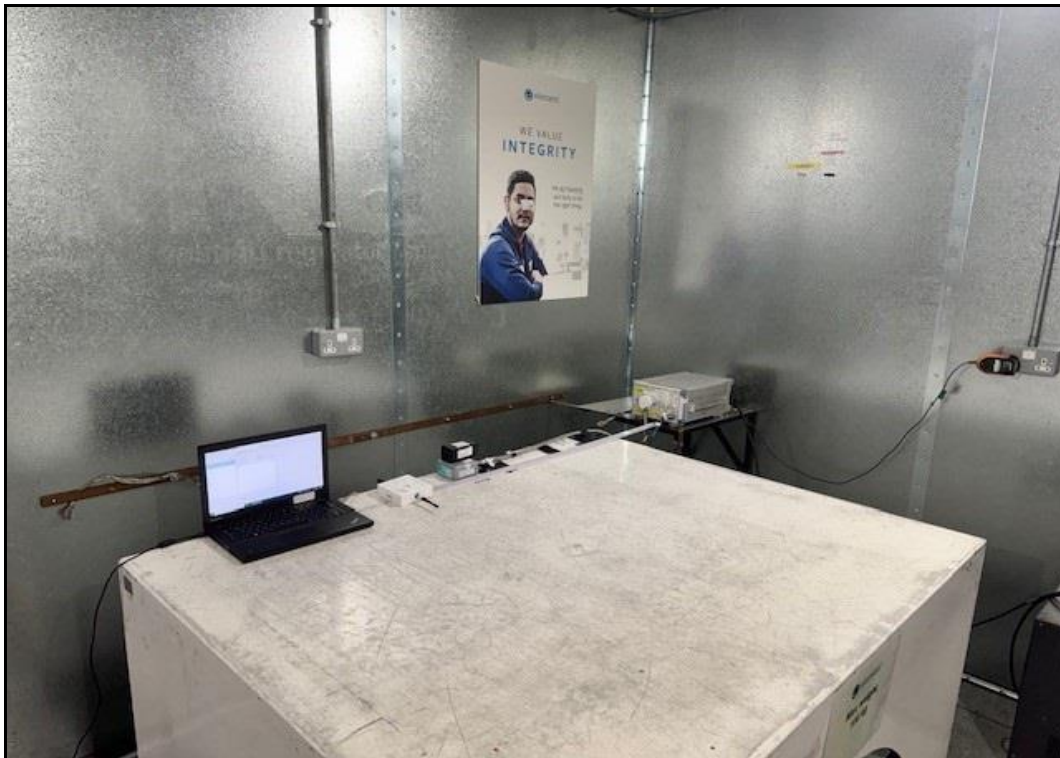
AC power line conducted emissions from the EUT are checked first by preview scans with peak and average detectors covering both live and neutral lines. A spectrum analyzer is used to determine if any periodic emissions are present.

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 ii Test Setup



12.5 Test Set-up Photograph

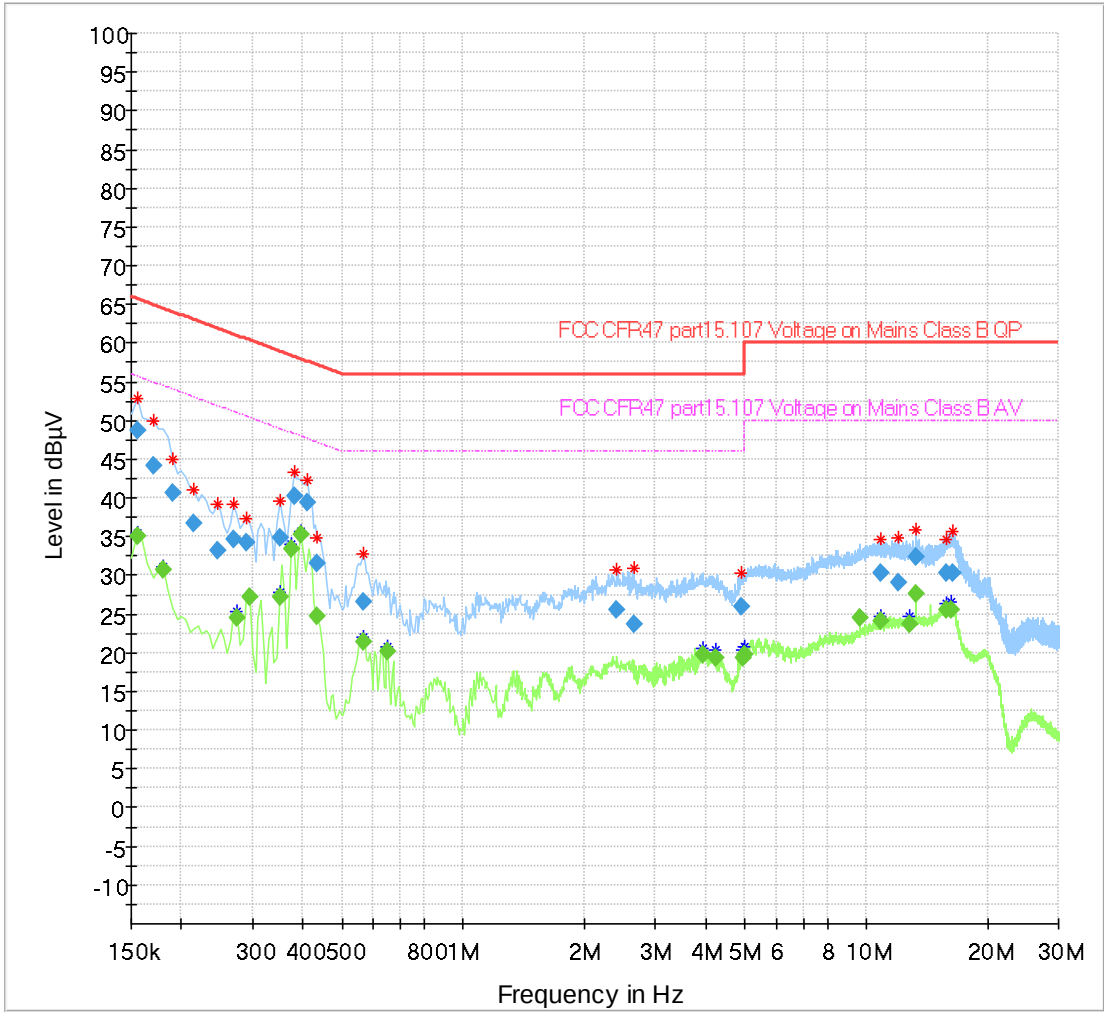


12.6 Test Equipment

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
ENV216	R&S	Lisn	U396	2025-05-16
Spectrum Analyser	R&S	ESR 7	U727	2025-05-17
ESH3-Z2	R&S	Pulse Limiter	U559	2026-02-27

12.7 Test Results

Full Spectrum



Final results Quasi-Peak

Frequency (MHz)	QuasiPeak (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.155000	48.77	65.73	16.96	2000.0	9.000	N	OFF	19.5
0.170000	44.09	64.96	20.87	2000.0	9.000	N	OFF	19.5
0.190000	40.66	64.04	23.37	2000.0	9.000	N	OFF	19.5
0.215000	36.62	63.01	26.39	2000.0	9.000	L1	OFF	19.5
0.245000	33.21	61.93	28.71	2000.0	9.000	N	OFF	19.5
0.270000	34.55	61.12	26.57	2000.0	9.000	N	OFF	19.5
0.290000	34.16	60.52	26.37	2000.0	9.000	N	OFF	19.5
0.350000	34.93	58.96	24.03	2000.0	9.000	N	OFF	19.6
0.380000	40.30	58.28	17.97	2000.0	9.000	N	OFF	19.6
0.410000	39.44	57.65	18.21	2000.0	9.000	N	OFF	19.6
0.435000	31.46	57.16	25.70	2000.0	9.000	N	OFF	19.6
0.565000	26.66	56.00	29.34	2000.0	9.000	L1	OFF	19.6
2.410000	25.49	56.00	30.51	2000.0	9.000	N	OFF	19.8
2.645000	23.71	56.00	32.29	2000.0	9.000	N	OFF	19.8
4.900000	25.99	56.00	30.01	2000.0	9.000	L1	OFF	19.8
10.845000	30.24	60.00	29.76	2000.0	9.000	L1	OFF	20.0
11.995000	29.15	60.00	30.85	2000.0	9.000	L1	OFF	20.1
13.255000	32.36	60.00	27.64	2000.0	9.000	L1	OFF	20.2
15.835000	30.35	60.00	29.65	2000.0	9.000	L1	OFF	20.4
16.365000	30.26	60.00	29.74	2000.0	9.000	L1	OFF	20.4

Final results Cispr-Average

Frequency (MHz)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.155000	34.98	55.73	20.74	2000.0	9.000	N	OFF	19.5
0.180000	30.65	54.49	23.84	2000.0	9.000	N	OFF	19.5
0.275000	24.49	50.97	26.47	2000.0	9.000	N	OFF	19.5
0.295000	27.25	50.38	23.13	2000.0	9.000	N	OFF	19.5
0.350000	27.15	48.96	21.82	2000.0	9.000	N	OFF	19.6
0.375000	33.45	48.39	14.94	2000.0	9.000	N	OFF	19.6
0.395000	35.23	47.96	12.73	2000.0	9.000	N	OFF	19.6
0.435000	24.67	47.16	22.49	2000.0	9.000	N	OFF	19.6
0.565000	21.44	46.00	24.56	2000.0	9.000	N	OFF	19.6
0.650000	20.07	46.00	25.93	2000.0	9.000	N	OFF	19.7
3.925000	19.73	46.00	26.27	2000.0	9.000	L1	OFF	19.8
4.225000	19.37	46.00	26.63	2000.0	9.000	L1	OFF	19.8
4.935000	19.37	46.00	26.63	2000.0	9.000	L1	OFF	19.8
4.995000	19.83	46.00	26.17	2000.0	9.000	L1	OFF	19.8
9.640000	24.42	50.00	25.58	2000.0	9.000	L1	OFF	20.0
10.845000	24.12	50.00	25.88	2000.0	9.000	L1	OFF	20.0
12.755000	23.60	50.00	26.40	2000.0	9.000	L1	OFF	20.1
13.255000	27.54	50.00	22.46	2000.0	9.000	L1	OFF	20.2
15.845000	25.47	50.00	24.53	2000.0	9.000	L1	OFF	20.4
16.235000	25.51	50.00	24.49	2000.0	9.000	L1	OFF	20.4

13 Occupied Bandwidth

13.1 Definitions

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.

13.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	REF940
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.9
EUT Frequencies Measured:	915.0 MHz
EUT Test Modulations:	FSK
Deviations From Standard:	None
Measurement BW:	10 kHz
(requirement: 1 % to 5 % OBW)	
Spectrum Analyzer Video BW:	30 kHz
(requirement at least 3x RBW)	
Measurement Span:	1 MHz
(requirement 2 to 5 times OBW)	
Measurement Detector:	Peak

Environmental Conditions (Normal Environment)

Temperature: 25 °C	+15 °C to +35 °C (as declared)
Humidity: 32 % RH	20 % RH to 75 % RH (as declared)
Supply: 110 Vac	110 Vac (as declared)

13.3 Test Limit

Federal Communications Commission:

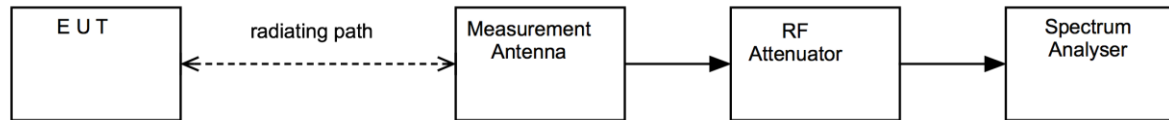
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

13.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure iii, 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 iii Test Setup

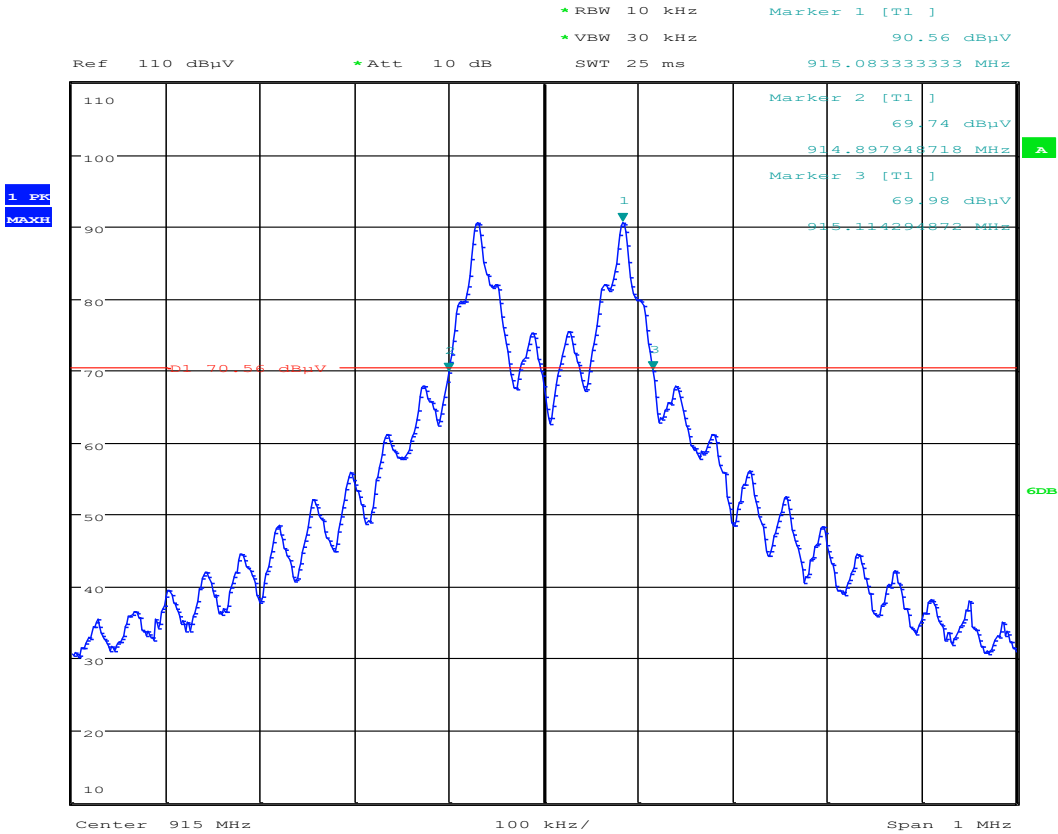


13.5 Test Equipment

<i>Equipment Type</i>	<i>Manufacturer</i>	<i>Equipment Description</i>	<i>Element No</i>	<i>Due For Calibration</i>
Spectrum Analyser	R&S	ESR 7	U727	2025-05-17
Bilog	Chase	CBL611/B	U573	2025-11-04
PreAmp	Watkins Johnson	6201-69	U372	2025-03-15
Radio Chamber - PP	Rainford EMC	ATS	REF940	2026-01-29
Radiated Test Software	Element	Emissions R5	REF9000	Cal Not Required

13.6 Test Results

FCC 15.249. Modulation: FSK; Power Setting: -2 dBm Firmware				
Channel Frequency (MHz)	F_L (MHz)	F_H (MHz)	20dB Bandwidth (kHz)	Result
915.000	914.897948718	915.114294872	216.346154	Pass



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14 Transmitter output power (fundamental radiated emission)

14.1 Definition

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

14.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	REF940
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.5 / 6.6
EUT Frequencies Measured:	915.0 MHz
Deviations From Standard:	None
Measurement BW:	1 MHz
Spectrum Analyzer Video BW: (requirement at least 3x RBW)	3 MHz
Measurement Detector:	Up to 1 GHz: Quasi-peak Above 1 GHz: Average RMS and Peak
Voltage Extreme Environment Test Range:	Mains Power = 85 % and 115 % of Nominal (FCC only requirement); Battery Power = new battery.

Environmental Conditions (Normal Environment)

Temperature: 19 °C	+15 °C to +35 °C (as declared)
Humidity: 37 % RH	20 % RH to 75 % RH (as declared)

14.3 Test Limit

The field strength measured at 3 metres shall not exceed the limits in the following table:

Field Strength Limits for License-Exempt Transmitters for Any Application

<i>Fundamental frequency (MHz)</i>	<i>Field strength (mV/m at 3 m)</i>	<i>Detector</i>
902 to 928	50	Quasi-Peak
2400 to 2483.5	50	Average RMS
5725 to 5875	50	Average RMS

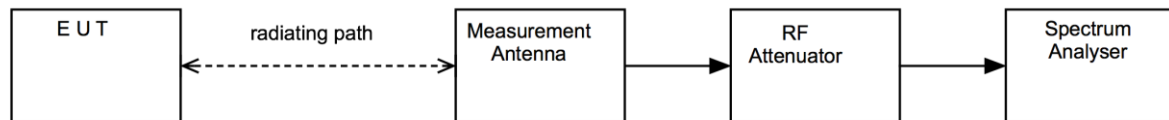
n.b. per FCC 47CFR15.249(e) / RSS-Gen 8.1, peak limit is 20 dB above average.

14.4 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



14.5 Test Equipment

<i>Equipment Type</i>	<i>Manufacturer</i>	<i>Equipment Description</i>	<i>Element No</i>	<i>Due For Calibration</i>
Spectrum Analyser	R&S	ESR 7	U727	2025-05-17
Bilog	Chase	CBL611/B	U573	2025-11-04
PreAmp	Watkins Johnson	6201-69	U372	2025-03-15
Radio Chamber - PP	Rainford EMC	ATS	REF940	2026-01-29
Radiated Test Software	Element	Emissions R5	REF9000	Cal Not Required

14.6 Test Results

Frequency: 915 MHz; Modulation: FSK; Power Setting: -2 dBm Firmware

<i>Detector</i>	<i>Freq. (MHz)</i>	<i>Meas'd Emission (dBμV)</i>	<i>Factor (dBm)</i>	<i>Duty Cycle Corr'n (dB)</i>	<i>Meas'd Distance (m)</i>	<i>Field Strength (dBμV/m)</i>	<i>Field Strength (mV/m)</i>	<i>Limit (mV/m)</i>
QP	915.0	88.4	4.9	0	3	93.3	46.238	50

Note: Radiated Measurement

15 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 connector) 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 (3450-3980 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

16 RF Exposure

16.1 General SAR test reduction & exclusion guidance

KDB 447498

Section 4.3 General SAR test reduction and exclusion guidance

For Standalone SAR exclusion consideration, when 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.

The SAR Test Exclusion Threshold for frequencies in the range 100 MHz to 6 GHz, and for test separation distance of ≤ 50 mm, is determined as follows.

$$\text{SAR Exclusion Threshold (SARET)} = (\text{NT} \times \text{TSD}_A) / \sqrt{f_{\text{GHz}}}$$

Where,

NT = Numeric Threshold (3.0 for 1-g SAR and 7.5 for 10-g SAR)

TSD_A = Minimum Test separation distance or 50 mm (whichever is lower)

f_{GHz} = Transmit frequency in GHz

<i>Channel Frequency (MHz)</i>	<i>Maximum Conducted Power (mW)</i>	<i>SAR Exclusion Threshold at 5 mm (mW)</i>	<i>SAR Evaluation</i>
915.0	0.4	15.7	Not Required

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