Report on the Radio Testing

For

G4S Technology Ltd T/AS AMAG Technology

on

S874 Javelin Mifare Card Reader

Report no. TRA-016463-47-02B

12th December 2025

Report Number: TRA-016463-47-02B
Issue: B

# REPORT ON THE RADIO TESTING OF A
# G4S Technology Ltd T/AS AMAG Technology
# S874 Javelin Mifare Card Reader
# WITH RESPECT TO SPECIFICATION
# FCC 47CFR 15.225

TEST DATE: 23rd May 2023 to 09th June 2023

Tested by: Digitally signed by Steve Garwell
DN: cn=Steve Garwell, o=Element, email=steve.garwell@element.com, c=GB
Date: 2025.12.12 07:10:13 Z

Steven Garwell
Radio Test Engineer

Approved by: Digitally signed by John Charters
Date: 2025.12.15 12:16:58 Z

John Charters
Department Manager - Radio

Date: 12th December 2025

# 1 Revision Record

| *Issue* | *Issue Date* | *Revision History* |
|---|---|---|
| A | 12th September 2024 | Original |
| B | 12th December 2025 | Update of ANSI C63.10 to 2020 version |

## 2 Summary

| | |
|---|---|
| TEST REPORT NUMBER: | TRA-016463-47-02B |
| WORKS ORDER NUMBER: | TRA-061463-00 |
| 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): | 47CFR15.225 |
| EQUIPMENT UNDER TEST (EUT): | S874 Javelin Mifare Card Reader |
| FCC IDENTIFIER: | OE5S874C |
| EUT SERIAL NUMBER: | 2315001985 |
| MANUFACTURER/AGENT: | G4S Technology Ltd T/AS AMAG Technology |
| ADDRESS: | Challenge House<br>International Drive<br>Tewkesbury<br>Gloucestershire<br>GL20 8UQ<br>United Kingdom |
| CLIENT CONTACT: | Ian Williams<br>☎ 01684 850977<br>✉ ian.williams@amag.com |
| ORDER NUMBER: | PUR102087 |
| TEST DATE: | 23rd May 2023 to 09th June 2023 |
| TESTED BY: | Steven Garwell<br>Element |

## *2.1 Test Summary*

| *Test Method and Description* | *Requirement Clause 47CFR15* | *Applicable to this equipment* | *Result / Note* |
|---|---|---|---|
| Radiated spurious emissions, below 30 MHz | 15.225(d) | ☒ | *PASS* |
| Radiated spurious emissions | 15.209 | ☒ | *PASS* |
| AC power line conducted emissions | 15.207 | ☒ | *PASS* |
| Occupied bandwidth | 15.215(c) | ☒ | *PASS* |
| Field strength of fundamental | 15.225(a), (b) and (c) | ☒ | *PASS* |
| Frequency stability | 15.225(e) | ☒ | *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.

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# 4 Introduction

This report TRA-016463-47-02B presents the results of the Radio testing on S874 Javelin Mifare 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 numbers.

| | |
|---|---|
| Element Hull | UK2007 |
| 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*

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 (now ISED) |
| **ISED** | Innovation, Science and Economic Development 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: S874 Javelin Mifare Card Reader
- Serial Number: 2315001985
- Model Number: 874 MKII
- Software Revision: Not Stated
- 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.

*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 EUT was forced to permanently read a 13.56 MHz access card.

## *7.4 EUT Radio Parameters*

### *7.4.1 General*

| | |
|---|---|
| ***Frequency of operation:*** | 13.56 MHz |
| ***Modulation type:*** | ASK |
| ***Occupied channel bandwidth(s):*** | N/A |
| ***Channel spacing:*** | N/A |
| ***Declared output power(s):*** | Not Stated |
| ***Warning against use of alternative antennas in user manual (yes/no):*** | No |
| ***Nominal Supply Voltage:*** | 12 Vdc |

## *7.5 EUT Description*

The EUT is an Access control system card reader, for reading access card credentials, obtaining a credential PIN, indicating the door status, and allowing user to send keypad commands to the access control system.

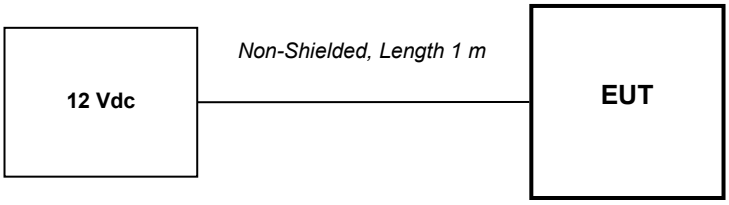
# 8 Modifications

No modifications

# 9 EUT Test Setup

## *9.1 Block Diagram*

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




***General Set-up Photograph***

The following photographs shows basic EUT set-up:


### *9.2 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.

# General Technical Parameters

### *9.3 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 Vdc from an external power supply

### *9.4 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:

| | ***Category*** | ***Variation*** |
|---|---|---|
| ☒ | Standard | -20 to +50 C in 10 degree steps |
| ☐ | Extended | |

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

| | ***Category*** | ***Nominal*** | ***Variation*** |
|---|---|---|---|
| ☐ | Mains | 110 V ac +/-2 % | 85 % and 115 % |
| ☒ | Power Supply | 12 Vdc | 10.2 Vdc – 14.3 Vdc |

# 10 Radiated emissions below 30 MHz

## *10.1 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.

## *10.2 Test Parameters*

| | |
|---|---|
| Test Location: | Element Skelmersdale |
| Test Chamber: | SK03 Radio Chamber |
| Test Standard and Clause: | ANSI C63.10-2020, Clause 6.4 |
| EUT Frequencies Measured: | 13.56 MHz |
| Deviations From Standard: | None |
| Measurement Distance and Site | 3m Radio Chamber |
| EUT Height: | 1 m |
| Measurement Antenna and Height: | 60 cm shielded loop; 1 m |
| Measurement BW: | 9 kHz to 150 kHz: 200 Hz;<br>150 kHz to 30 MHz: 9 kHz |
| Measurement Detector: | 9 kHz to 90 kHz and 110 kHz to 490 kHz: Average, RMS<br>Other frequencies below 30 MHz: Quasi-peak. |

**Environmental Conditions (Normal Environment)**

| | |
|---|---|
| Temperature: 20 °C | +15 ºC to +35 ºC (as declared) |
| Humidity: 48 % RH | 20 % RH to 75 % RH (as declared) |
| Supply: 12 Vdc | 12 Vdc (as declared) |

### *10.3 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)<br>2,400 / f (µV/m) | 300 |
| 490 to 1,750 | 24,000 / 377.f (µA/m)<br>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.

### *10.4 Test Method*

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

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

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

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

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

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

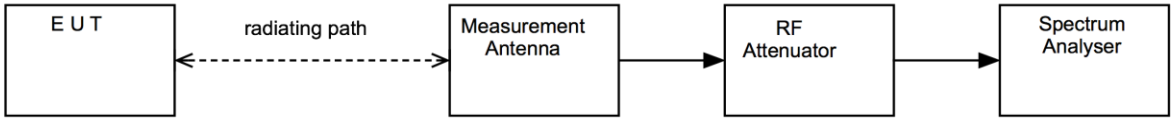
Where,

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

Per FCC 47CFR15.31(f)(2), 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**

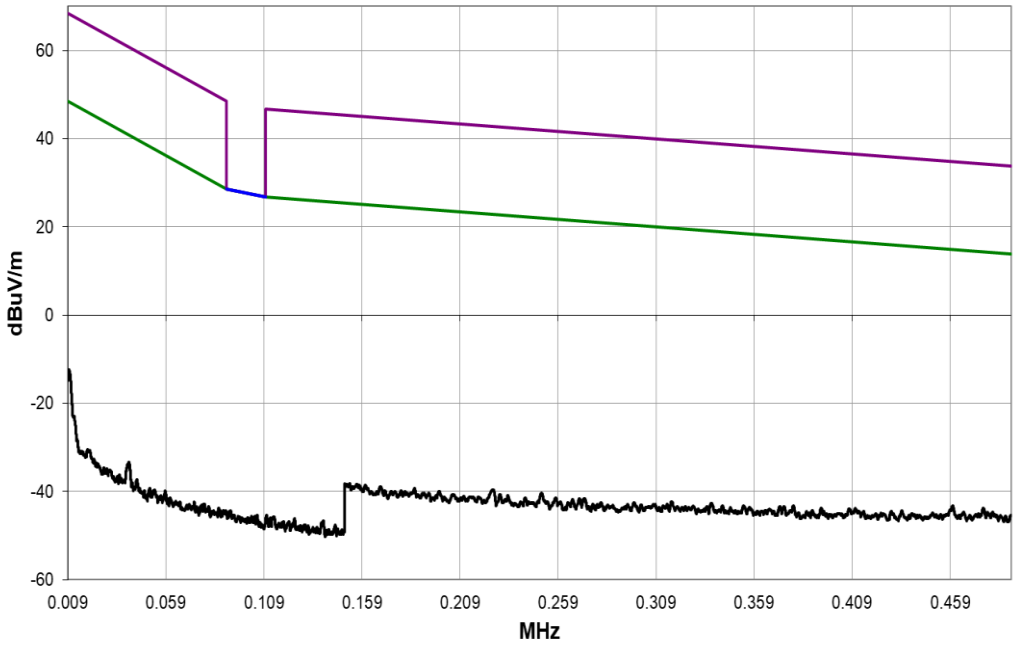



### *10.5 Test Set-up Photograph*

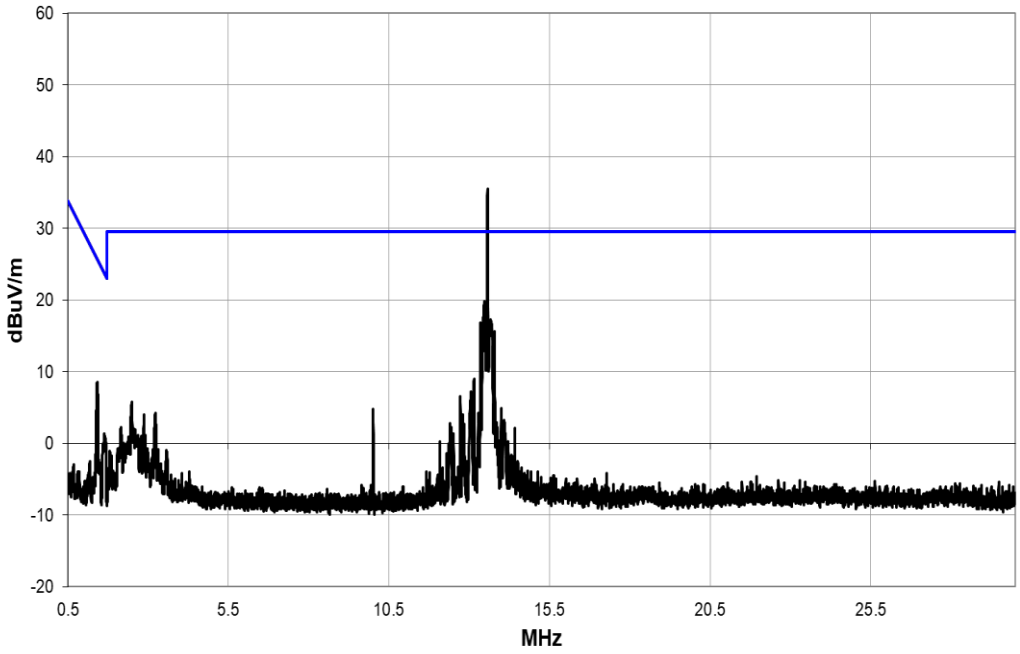

### *10.6 Test Equipment*

| *Equipment Type* | *Manufacturer* | *Equipment Description* | *Element No* | *Due For Calibration* |
|---|---|---|---|---|
| EMI Receiver | R&S | ESR26 | U489 | 2023-09-30 |
| Loop Antenna | R&S | hfh2 | L007 | 2023-09-09 |
| Radio Chamber - PP | Rainford EMC | ATS | REF940 | 2023-11-06 |
| Radiated Test Software | Element | Emissions R5 | REF9000 | Cal not required |

### *10.7 Test Results*




9 kHz to 490 kHz




490 kHz to 30 MHz

| *Modulation: ASK; Frequency: 13.56 MHz* | | | | | | |
|---|---|---|---|---|---|---|
| ***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 20 dB of the limit | | | | | | PASS |

Note the signal shown at 13.56 MHz is the fundamental

# 11 Radiated emissions above 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: | SK03 Radio Chamber |
| Test Standard and Clause: | ANSI C63.10-2020, Clause 6.5 |
| EUT Frequencies Measured: | 13.56 MHz |
| Deviations From Standard: | None |
| Measurement BW: | 30 MHz to 1000 MHz: 120 kHz |
| Measurement Detector: | Quasi-peak |

**Environmental Conditions (Normal Environment)**

| | |
|---|---|
| Temperature: 20 °C | +15 ºC to +35 ºC (as declared) |
| Humidity: 48 % RH | 20 % RH to 75 % RH (as declared) |
| Supply: 12 Vdc | 12 Vdc (as declared) |

## *11.3 Test Limit*

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

**General Field Strength Limits for License-Exempt Transmitters at Frequencies 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 |

### *11.4 Test Method*

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

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

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

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

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

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

$$FS = PR + CL + AF – PA + DC – CF$$

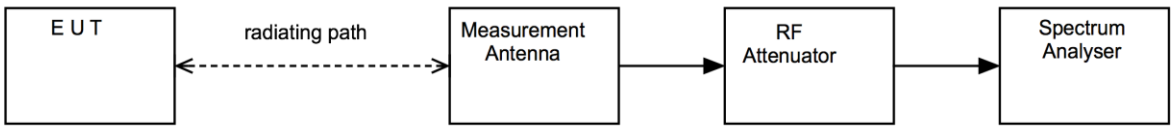
$$Factor = PR + CL + AF$$

Where,

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

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

**Figure ii Test Setup**

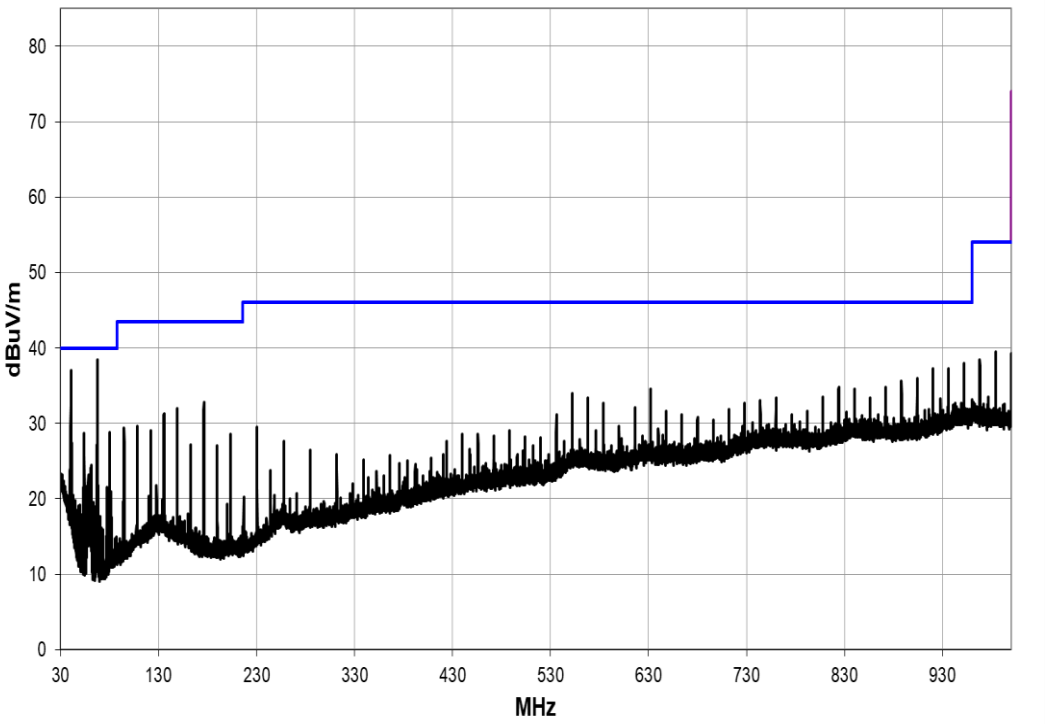


### *11.5 Test Set-up Photograph*


### *11.6 Test Equipment*

| *Equipment Type* | *Manufacturer* | *Equipment Description* | *Element No* | *Due For Calibration* |
|---|---|---|---|---|
| EMI Receiver | R&S | ESR26 | U489 | 2023-09-30 |
| Bilog | Chase | CBL611/B | U573 | 2024-10-14 |
| PreAmp | Watkins Johnson | 6201-69 | U372 | 2024-03-07 |
| Radio Chamber - PP | Rainford EMC | ATS | REF940 | 2023-11-06 |
| Radiated Test Software | Element | Emissions R5 | REF9000 | Cal not required |

## *11.7 Test Results*




30 MHz to 1 GHz

| 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.712 | 45.3 | -9.5 | 1.0 | 269.9 | 3.0 | 0.0 | Vert | QP | 0.0 | 35.8 | 40.0 | -4.2 |
| 67.837 | 49.8 | -15.9 | 1.5 | 3.9 | 3.0 | 0.0 | Vert | QP | 0.0 | 33.9 | 40.0 | -6.1 |
| 952.019 | 31.0 | 6.1 | 1.35 | 185.1 | 3.0 | 0.0 | Horz | QP | 0.0 | 37.1 | 46.0 | -8.9 |
| 920.019 | 31.6 | 4.9 | 1.08 | 359.0 | 3.0 | 0.0 | Vert | QP | 0.0 | 36.5 | 46.0 | -9.5 |
| 936.020 | 30.1 | 5.5 | 1.1 | 1.0 | 3.0 | 0.0 | Vert | QP | 0.0 | 35.6 | 46.0 | -10.4 |
| 952.019 | 29.0 | 6.1 | 1.0 | 8.1 | 3.0 | 0.0 | Vert | QP | 0.0 | 35.1 | 46.0 | -10.9 |
| 904.020 | 30.8 | 4.2 | 1.21 | 244.0 | 3.0 | 0.0 | Vert | QP | 0.0 | 35.0 | 46.0 | -11.0 |
| 936.018 | 29.1 | 5.5 | 1.5 | 200.0 | 3.0 | 0.0 | Horz | QP | 0.0 | 34.6 | 46.0 | -11.4 |
| 920.019 | 29.2 | 4.9 | 1.44 | 88.1 | 3.0 | 0.0 | Horz | QP | 0.0 | 34.1 | 46.0 | -11.9 |
| 176.337 | 43.5 | -12.2 | 1.0 | 4.9 | 3.0 | 0.0 | Vert | QP | 0.0 | 31.3 | 43.5 | -12.2 |
| 54.277 | 43.6 | -15.9 | 1.0 | 5.1 | 3.0 | 0.0 | Vert | QP | 0.0 | 27.7 | 40.0 | -12.3 |
| 80.023 | 38.5 | -14.8 | 2.0 | 301.0 | 3.0 | 0.0 | Vert | QP | 0.0 | 23.7 | 40.0 | -16.3 |

# 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 C63.10-2020, Clause 6.2 |
| EUT Frequencies Measured: | 13.56 MHz |
| EUT Modulation: | ASK |
| Deviations From Standard: | None |
| Measurement BW: | 9 kHz |
| Measurement Detectors: | Quasi-Peak and Average, RMS |

**Environmental Conditions (Normal Environment)**

| | |
|---|---|
| Temperature: 22 °C | +15 ºC to +35 ºC (as declared) |
| Humidity: 46 % RH | 20 % RH to 75 % RH (as declared) |
| Supply: 12 Vdc | 12 Vdc (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.

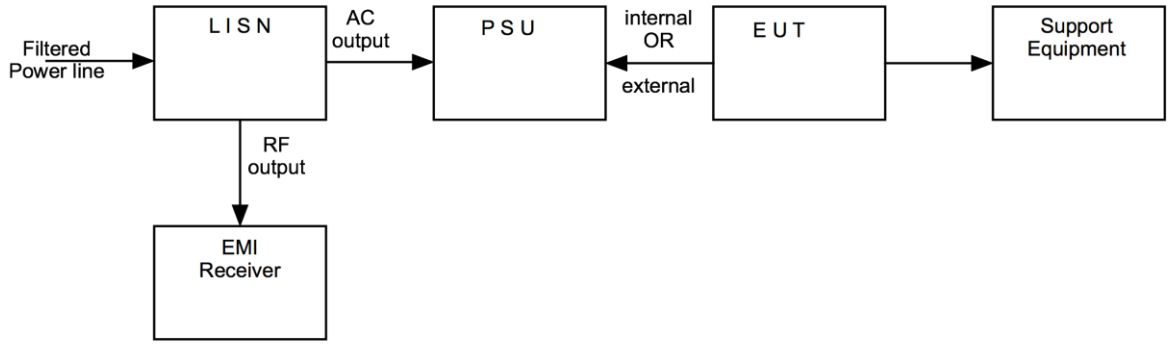
### *12.4 Test Method*

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

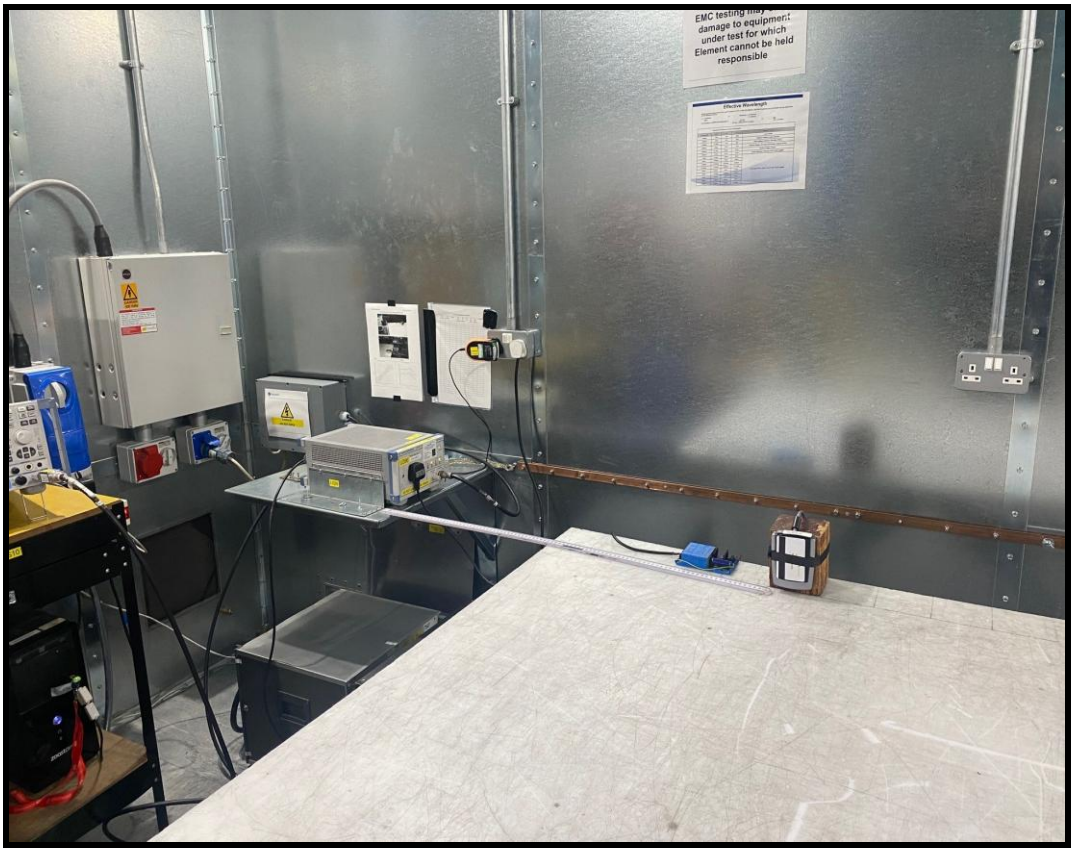
AC power line conducted emissions from the EUT are checked first by preview scans with peak and average detectors covering both live and neutral lines. A spectrum analyzer is used to determine if any periodic emissions are present.

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**




### *12.5 Test Set-up Photograph*

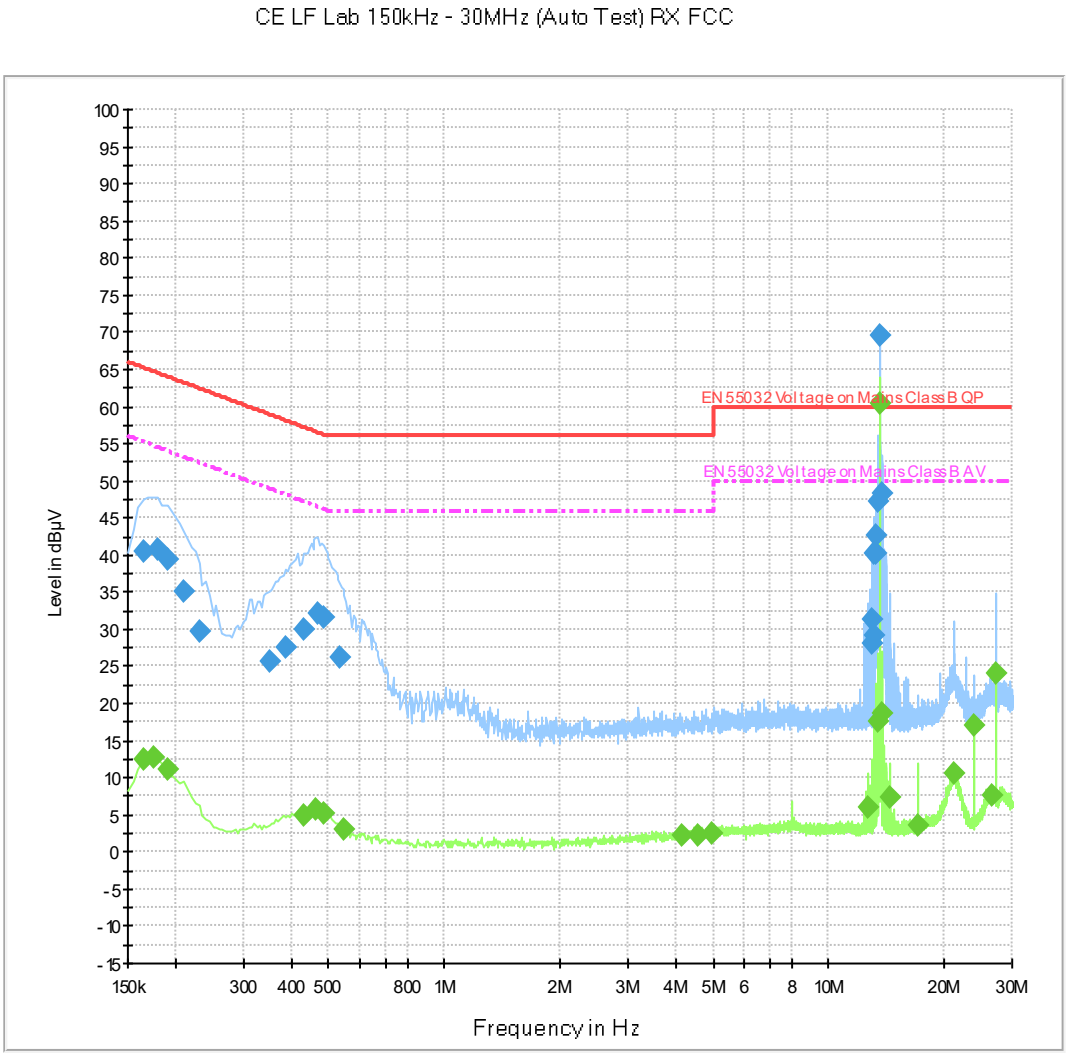


### *12.6 Test Equipment*

| *Equipment Type* | *Manufacturer* | *Equipment Description* | *Element No* | *Due For Calibration* |
|---|---|---|---|---|
| EMI Receiver | R&S | ESR7 | U456 | 2024-02-06 |
| Pulse Limiter | R&S | ESH3-Z2 | U443 | 2024-02-22 |
| Lisn | R&S | ENV216 | U396 | 2024-05-22 |

## *12.7 Test Results*

Antenna – inductive loop

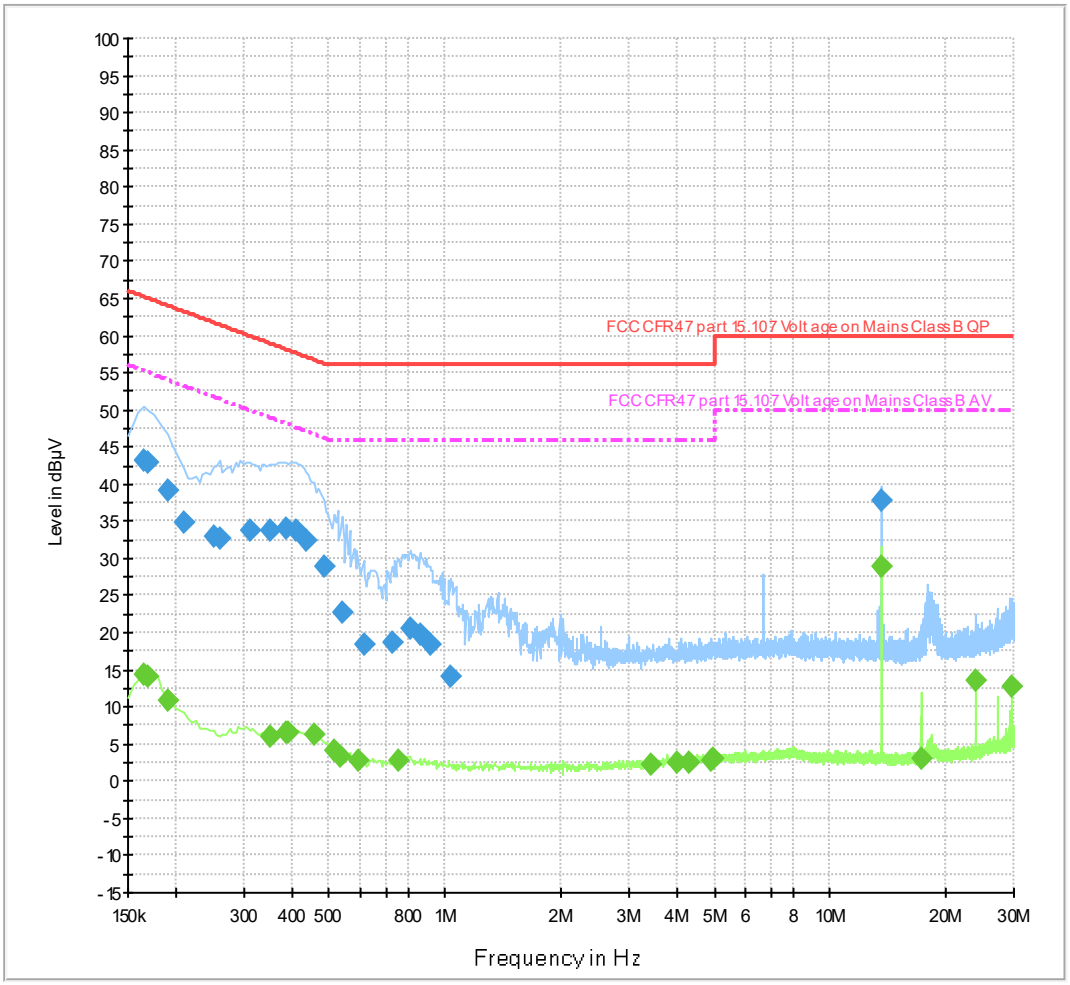


| QuasiPeak Results – Integral Antenna | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | QuasiPeak (dBµV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) |
| 0.165000 | 40.5 | 2000.0 | 9.000 | Off | N | 19.5 | 24.7 | 65.2 |
| 0.180000 | 40.8 | 2000.0 | 9.000 | Off | N | 19.5 | 23.6 | 64.5 |
| 0.190000 | 39.4 | 2000.0 | 9.000 | Off | N | 19.5 | 24.6 | 64.0 |
| 0.210000 | 35.1 | 2000.0 | 9.000 | Off | N | 19.6 | 28.1 | 63.2 |
| 0.230000 | 29.6 | 2000.0 | 9.000 | Off | N | 19.6 | 32.8 | 62.4 |
| 0.350000 | 25.8 | 2000.0 | 9.000 | Off | L1 | 19.7 | 33.2 | 59.0 |
| 0.385000 | 27.4 | 2000.0 | 9.000 | Off | L1 | 19.7 | 30.7 | 58.2 |
| 0.430000 | 30.0 | 2000.0 | 9.000 | Off | L1 | 19.7 | 27.3 | 57.3 |
| 0.470000 | 32.1 | 2000.0 | 9.000 | Off | N | 19.6 | 24.4 | 56.5 |
| 0.485000 | 31.5 | 2000.0 | 9.000 | Off | N | 19.6 | 24.8 | 56.3 |
| 0.535000 | 26.1 | 2000.0 | 9.000 | Off | N | 19.6 | 29.9 | 56.0 |
| 13.015000 | 28.2 | 2000.0 | 9.000 | Off | N | 20.1 | 31.8 | 60.0 |
| 13.030000 | 31.2 | 2000.0 | 9.000 | Off | L1 | 20.3 | 28.8 | 60.0 |
| 13.070000 | 29.3 | 2000.0 | 9.000 | Off | N | 20.1 | 30.7 | 60.0 |
| 13.140000 | 40.3 | 2000.0 | 9.000 | Off | N | 20.1 | 19.7 | 60.0 |
| 13.345000 | 40.3 | 2000.0 | 9.000 | Off | L1 | 20.4 | 19.7 | 60.0 |
| 13.355000 | 42.7 | 2000.0 | 9.000 | Off | L1 | 20.4 | 17.3 | 60.0 |
| 13.450000 | 47.3 | 2000.0 | 9.000 | Off | N | 20.1 | 12.7 | 60.0 |
| 13.565000 | 69.5 | 2000.0 | 9.000 | Off | L1 | 20.4 | -9.5 | 60.0 |
| 13.775000 | 48.3 | 2000.0 | 9.000 | Off | N | 20.1 | 11.7 | 60.0 |

| Average Results – Integral Antenna | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Average (dBµV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) |
| 0.165000 | 12.4 | 2000.0 | 9.000 | Off | N | 19.5 | 42.8 | 55.2 |
| 0.175000 | 12.6 | 2000.0 | 9.000 | Off | N | 19.5 | 42.1 | 54.7 |
| 0.190000 | 11.2 | 2000.0 | 9.000 | Off | N | 19.5 | 42.9 | 54.0 |
| 0.430000 | 5.0 | 2000.0 | 9.000 | Off | L1 | 19.7 | 42.3 | 47.3 |
| 0.465000 | 5.7 | 2000.0 | 9.000 | Off | N | 19.6 | 40.9 | 46.6 |
| 0.485000 | 5.3 | 2000.0 | 9.000 | Off | N | 19.6 | 41.0 | 46.3 |
| 0.545000 | 3.1 | 2000.0 | 9.000 | Off | N | 19.6 | 42.9 | 46.0 |
| 4.145000 | 2.1 | 2000.0 | 9.000 | Off | L1 | 19.9 | 43.9 | 46.0 |
| 4.575000 | 2.2 | 2000.0 | 9.000 | Off | N | 19.9 | 43.8 | 46.0 |
| 4.995000 | 2.4 | 2000.0 | 9.000 | Off | L1 | 19.9 | 43.6 | 46.0 |
| 12.720000 | 6.1 | 2000.0 | 9.000 | Off | L1 | 20.3 | 43.9 | 50.0 |
| 13.450000 | 17.5 | 2000.0 | 9.000 | Off | N | 20.1 | 32.5 | 50.0 |
| 13.560000 | 60.4 | 2000.0 | 9.000 | Off | L1 | 20.4 | -10.4 | 50.0 |
| 13.775000 | 18.7 | 2000.0 | 9.000 | Off | N | 20.1 | 31.3 | 50.0 |
| 14.410000 | 7.4 | 2000.0 | 9.000 | Off | N | 20.1 | 42.6 | 50.0 |
| 17.165000 | 3.6 | 2000.0 | 9.000 | Off | L1 | 20.6 | 46.4 | 50.0 |
| 21.195000 | 10.5 | 2000.0 | 9.000 | Off | L1 | 20.9 | 39.5 | 50.0 |
| 24.000000 | 17.1 | 2000.0 | 9.000 | Off | N | 20.6 | 32.9 | 50.0 |
| 26.510000 | 7.5 | 2000.0 | 9.000 | Off | L1 | 21.2 | 42.5 | 50.0 |
| 27.125000 | 24.1 | 2000.0 | 9.000 | Off | N | 20.7 | 25.9 | 50.0 |

## Antenna replaced by load

CE LF Lab 150kHz - 30MHz (Auto Test) RX FCC



| QuasiPeak Results – Antenna Replaced with Load | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | QuasiPeak (dBµV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) |
| 0.165000 | 43.1 | 2000.0 | 9.000 | Off | N | 19.5 | 22.1 | 65.2 |
| 0.170000 | 42.9 | 2000.0 | 9.000 | Off | N | 19.5 | 22.1 | 65.0 |
| 0.190000 | 39.2 | 2000.0 | 9.000 | Off | N | 19.5 | 24.8 | 64.0 |
| 0.210000 | 34.9 | 2000.0 | 9.000 | Off | N | 19.6 | 28.3 | 63.2 |
| 0.250000 | 32.8 | 2000.0 | 9.000 | Off | N | 19.6 | 28.9 | 61.8 |
| 0.260000 | 32.8 | 2000.0 | 9.000 | Off | N | 19.6 | 28.6 | 61.4 |
| 0.310000 | 33.6 | 2000.0 | 9.000 | Off | L1 | 19.7 | 26.3 | 60.0 |
| 0.350000 | 33.7 | 2000.0 | 9.000 | Off | L1 | 19.7 | 25.2 | 59.0 |
| 0.385000 | 34.0 | 2000.0 | 9.000 | Off | L1 | 19.7 | 24.2 | 58.2 |
| 0.410000 | 33.8 | 2000.0 | 9.000 | Off | L1 | 19.7 | 23.8 | 57.6 |
| 0.435000 | 32.3 | 2000.0 | 9.000 | Off | L1 | 19.7 | 24.8 | 57.2 |
| 0.485000 | 28.8 | 2000.0 | 9.000 | Off | N | 19.6 | 27.4 | 56.3 |
| 0.540000 | 22.6 | 2000.0 | 9.000 | Off | N | 19.6 | 33.4 | 56.0 |
| 0.615000 | 18.4 | 2000.0 | 9.000 | Off | N | 19.6 | 37.6 | 56.0 |
| 0.730000 | 18.7 | 2000.0 | 9.000 | Off | N | 19.7 | 37.3 | 56.0 |
| 0.815000 | 20.6 | 2000.0 | 9.000 | Off | N | 19.7 | 35.4 | 56.0 |
| 0.860000 | 19.8 | 2000.0 | 9.000 | Off | N | 19.7 | 36.2 | 56.0 |
| 0.915000 | 18.4 | 2000.0 | 9.000 | Off | N | 19.7 | 37.6 | 56.0 |
| 1.035000 | 14.1 | 2000.0 | 9.000 | Off | N | 19.7 | 41.9 | 56.0 |
| 13.565000 | 37.7 | 2000.0 | 9.000 | Off | L1 | 20.4 | 22.3 | 60.0 |

| Average Results – Antenna Replaced with Load | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Average (dBµV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) |
| 0.165000 | 14.2 | 2000.0 | 9.000 | Off | N | 19.5 | 41.0 | 55.2 |
| 0.170000 | 14.0 | 2000.0 | 9.000 | Off | N | 19.5 | 40.9 | 55.0 |
| 0.190000 | 11.0 | 2000.0 | 9.000 | Off | N | 19.5 | 43.1 | 54.0 |
| 0.350000 | 6.1 | 2000.0 | 9.000 | Off | L1 | 19.7 | 42.9 | 49.0 |
| 0.385000 | 6.6 | 2000.0 | 9.000 | Off | L1 | 19.7 | 41.5 | 48.2 |
| 0.390000 | 6.6 | 2000.0 | 9.000 | Off | L1 | 19.7 | 41.4 | 48.1 |
| 0.455000 | 6.3 | 2000.0 | 9.000 | Off | N | 19.6 | 40.5 | 46.8 |
| 0.515000 | 4.1 | 2000.0 | 9.000 | Off | N | 19.6 | 41.9 | 46.0 |
| 0.535000 | 3.4 | 2000.0 | 9.000 | Off | N | 19.6 | 42.6 | 46.0 |
| 0.595000 | 2.7 | 2000.0 | 9.000 | Off | N | 19.6 | 43.3 | 46.0 |
| 0.755000 | 2.8 | 2000.0 | 9.000 | Off | N | 19.7 | 43.2 | 46.0 |
| 3.425000 | 2.2 | 2000.0 | 9.000 | Off | L1 | 19.9 | 43.8 | 46.0 |
| 3.990000 | 2.5 | 2000.0 | 9.000 | Off | L1 | 19.9 | 43.5 | 46.0 |
| 4.320000 | 2.6 | 2000.0 | 9.000 | Off | L1 | 19.9 | 43.4 | 46.0 |
| 4.900000 | 2.8 | 2000.0 | 9.000 | Off | L1 | 19.9 | 43.2 | 46.0 |
| 4.975000 | 3.0 | 2000.0 | 9.000 | Off | L1 | 19.9 | 43.0 | 46.0 |
| 13.565000 | 28.9 | 2000.0 | 9.000 | Off | N | 20.1 | 21.1 | 50.0 |
| 17.290000 | 3.2 | 2000.0 | 9.000 | Off | L1 | 20.6 | 46.8 | 50.0 |
| 24.000000 | 13.5 | 2000.0 | 9.000 | Off | L1 | 21.1 | 36.5 | 50.0 |
| 29.490000 | 12.8 | 2000.0 | 9.000 | Off | L1 | 21.3 | 37.2 | 50.0 |

# 13 Occupied Bandwidth

## *13.1 Definition*

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

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

## *13.2 Test Parameters*

| | |
|---|---|
| Test Location: | Element Skelmersdale |
| Test Chamber: | Radio Laboratory |
| Test Standard and Clause: | ANSI C63.10-2020, Clause 6.9 |
| EUT Frequencies Measured: | 13.56 MHz |
| EUT Test Modulations: | ASK |
| Deviations From Standard: | None |
| Measurement BW:<br>(Irequirement: 1% to 5% OBW) | 1 kHz |
| Spectrum Analyzer Video BW:<br>(requirement at least 3x RBW) | 3 kHz |
| Measurement Span:<br>(requirement 2 to 5 times OBW) | 20 kHz |
| Measurement Detector: | Peak |

**Environmental Conditions (Normal Environment)**

| | |
|---|---|
| Temperature: 21 °C | +15 ºC to +35 ºC (as declared) |
| Humidity: 47 % RH | 20 % RH to 75 % RH (as declared) |
| Supply: 12 Vdc | 12 Vdc (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.

Limits of 20 dB bandwidth

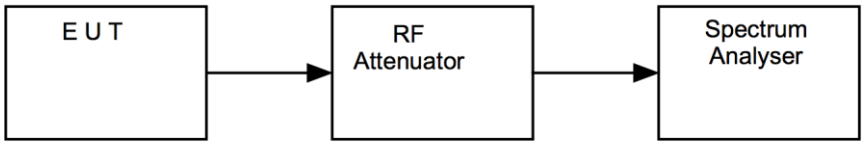
The 20 dB bandwidth shall be specified within the operating frequency band (13.110 MHz – 14.010 MHz).

### *13.4 Test Method*

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

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

**Figure iv Test Setup**

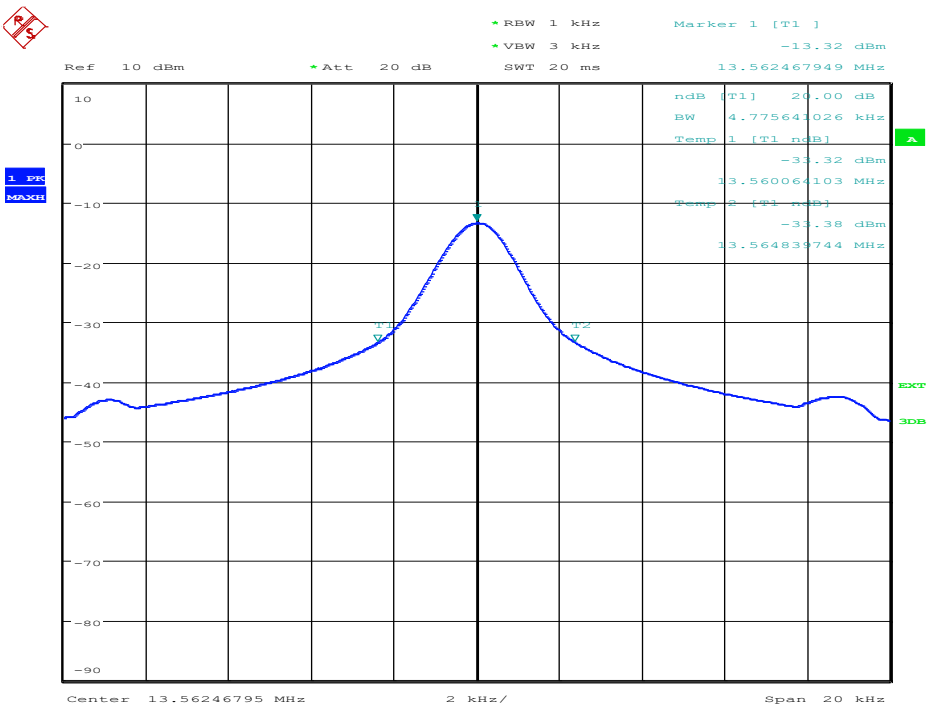



### *13.5 Test Equipment*

| *Equipment Type* | *Manufacturer* | *Equipment Description* | *Element No* | *Due For Calibration* |
|---|---|---|---|---|
| Spectrum Analyser | R&S | FSU46 | REF910 | 2024-01-10 |

### *13.6 Test Results*

| *15.225. Modulation: ASK* | | | |
|---|---|---|---|
| *Channel Frequency (MHz)* | *$F_L$ (MHz)* | *$F_H$ (MHz)* | *20 dB Bandwidth (kHz)* |
| 13.56 | 13.5600641 | 13.56483974 | 4.775641 |



# 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: | OATS / Radio Laboratory |
| Test Antenna: | Active 60cm loop |
| Test Standard and Clause: | ANSI C63.10-2020, Clause 6.3 / 6.4 |
| EUT Frequencies Measured: | 13.56 MHz |
| Deviations From Standard: | None |
| Measurement BW: | 9 kHz |
| Spectrum Analyzer Video BW: (requirement at least 3x RBW) | 30 kHz |
| Measurement Detector: | Quasi-peak |

**Environmental Conditions (Normal Environment)**

| | |
|---|---|
| Temperature: 20 °C | +15 ºC to +35 ºC (as declared) |
| Humidity: 49 % RH | 20 % RH to 75 % RH (as declared) |

## *14.3 Test Limit*

The field strength measured at 30 m shall not exceed the limits in the following table:

**Field Strength Limits for License-Exempt Transmitters for Any Application**

| *Frequency range (MHz)* | *Field strength (µV/m at 30m)* | *Field strength (dBµV/m at 30m)* |
|---|---|---|
| 13.110 – 13.410 | 106 | 40.5 |
| 13.410 – 13.553 | 334 | 50.5 |
| 13.553 – 13.567 | 15,848 | 84.0 |
| 13.567 – 13.710 | 334 | 50.5 |
| 13.710 – 14.010 | 106 | 40.5 |

### *14.4 Test Method*

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

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

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

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

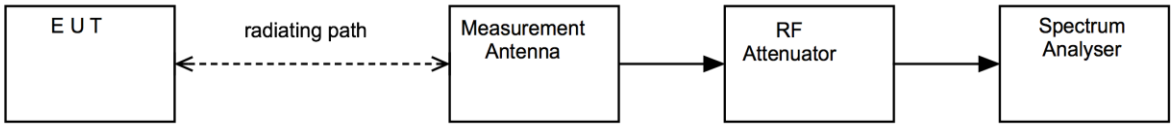
Where,

PR is the level 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), an extrapolation factor of 19.08 dB was calculated between 10 metres and 30 metres.

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

**Figure v Test Setup**

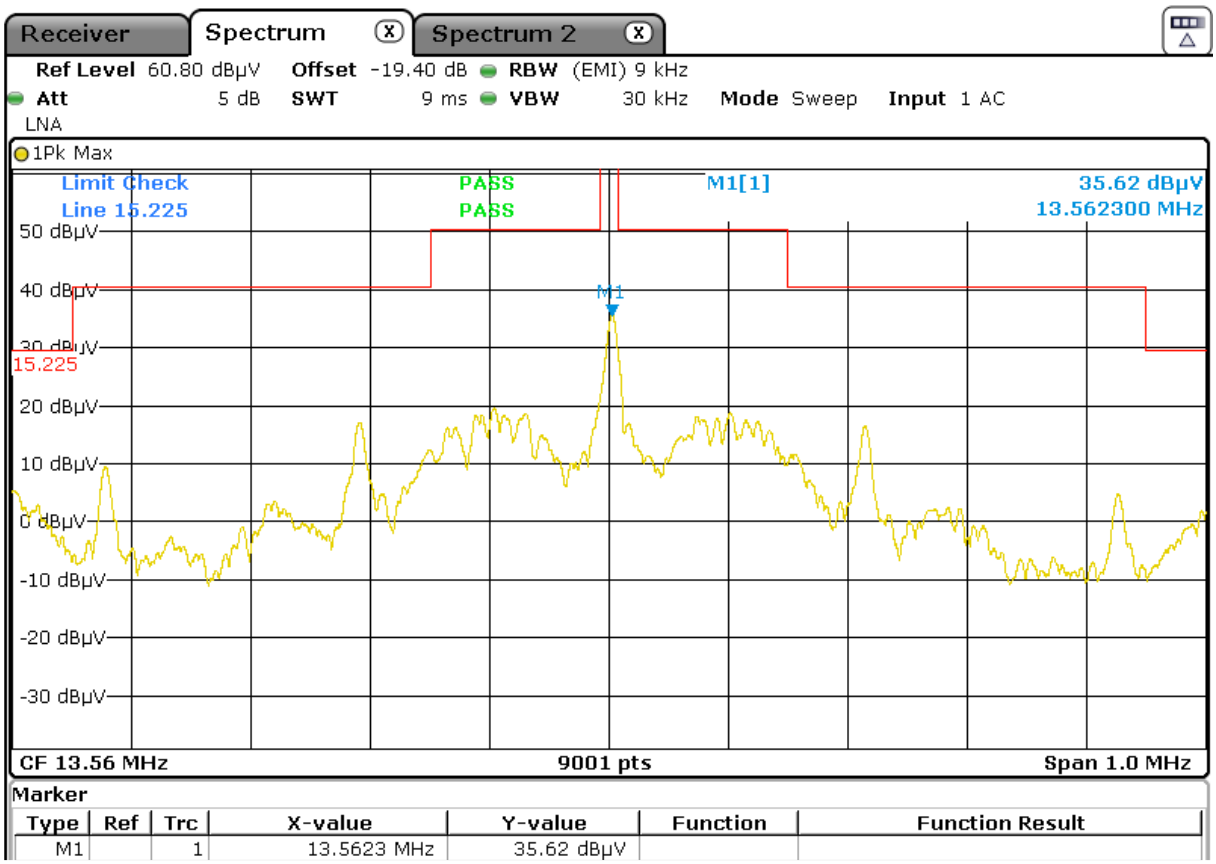



### *14.5 Test Equipment*

| *Equipment Type* | *Manufacturer* | *Equipment Description* | *Element No* | *Due For Calibration* |
|---|---|---|---|---|
| EMI Receiver | R&S | ESR7 | U456 | 2024-02-06 |
| Spectrum Analyser | R&S | FSU46 | REF910 | 2024-01-10 |
| Loop Antenna | R&S | hfh2 | L007 | 2023-09-09 |

### *14.6 Test Results*

| *Modulation: ASK* | | | | | | |
|---|---|---|---|---|---|---|
| *Channel Frequency (MHz)* | *Receiver Level (dBµV/m)* | *Measurement Distance (m)* | *Limit Distance (m)* | *Extrapolation Factor (dB)* | *Field Strength (µV/m)* | *Result* |
| 13.56 | 54.68 | 10 | 30 | 19.08 | 35.60 | PASS |




15.225 Mask

# 15 Frequency stability

## *15.1 Definition*

Frequency stability is a measure of frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at an appropriate reference temperature and the rated supply voltage.

## *15.2 Test Parameters*

| | |
|---|---|
| Test Location: | Element Skelmersdale |
| Test Chamber: | Radio Laboratory |
| Test Standard and Clause: | ANSI C63.10-2020, Clause 6.8 |
| EUT Frequencies Measured: | 13.56 MHz |
| Modulation: | Off |
| Deviations From Standard: | None |
| Temperature Extreme Environment Test Range: | -20 to +50 C |
| Voltage Extreme Environment Test Range: | 10.2 Vdc – 14.3 Vdc (as declared) |

**Environmental Conditions (Normal Environment)**

| | |
|---|---|
| Temperature: 21 °C | Standard Requirement: +20 ºC |
| Humidity: 47 %RH | 20 % RH to 75 % RH (as declared) |

## *15.3 Test Limit*

Carrier frequency stability shall be maintained to ±0.01% (±100 ppm).

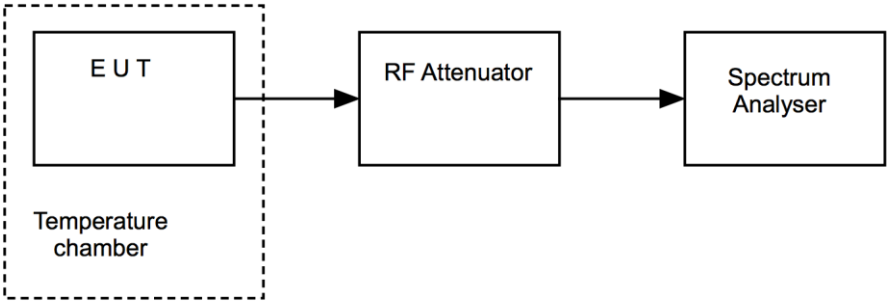
### *15.4 Test Method*

With the EUT setup as per section 9 of this report and connected as per Figure v, the frequency was measured under varying conditions of temperature and supply voltage.

The measurements were performed with EUT set in a CW mode of operation.

Per ANSI C63.4, measurements were made, once temperature stabilisation was reached at intervals of zero, two, five and ten minutes after switching on the EUT. Only the worst case results are given.

**Figure v Test Setup**




### *15.5 Test Equipment*

| *Equipment Description* | *Manufacturer* | *Equipment Type* | *Element No* | *Due For Calibration* |
|---|---|---|---|---|
| Spectrum Analyser | R&S | FSU46 | REF910 | 2024-01-10 |
| Power Supply | ISO-Tech | IPS 303A | U748 | Use REF976 |
| Multimeter | Agilent | 34405a | REF976 | 2024-01-24 |
| Temperature Chamber | Votsch | VT 4002 | U521 | Use L426 |
| Temperature Indicator | Fluke | 52 Series II | L426 | 2023-07-18 |

### *15.6 Test Results*

| *EUT Frequency: 13.56 MHz* | | | | |
|---|---|---|---|---|
| ***Test Environment*** | | ***Measured Frequency (MHz)*** | ***Frequency error (kHz)*** | ***Result*** |
| -20 C | $V_{nominal}$ | 13.56321413 | 0.0090 | PASS |
| -10 C | $V_{nominal}$ | 13.56320513 | 0.0000 | PASS |
| 0 C | $V_{nominal}$ | 13.56320513 | 0.0000 | PASS |
| +10 C | $V_{nominal}$ | 13.56320513 | 0.0000 | PASS |
| +20 C | $V_{minimum}$ | 13.56320513 | 0.0000 | PASS |
| | $V_{nominal}$ | 13.56320513 | N/A | N/A |
| | $V_{maximum}$ | 13.56320513 | 0.0000 | PASS |
| +30 C | $V_{nominal}$ | 13.56320513 | 0.0000 | PASS |
| +40 C | $V_{nominal}$ | 13.56320513 | 0.0000 | PASS |
| +50 C | $V_{nominal}$ | 13.56321051 | 0.0054 | PASS |

Limit = ± 0.01%= 1.3563 kHz

# 16 Measurement Uncertainty

*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<br>(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<br>(Including emissions due to intermodulation) | MU4037 | **4.7 dB** |
| Radiated Spurious Emissions 1-18 GHz<br>(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** |

# 17 Appendix A

## *17.1 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 below 100 MHz, and for test separation distance of ≤ 50 mm, is determined as follows.

SAR Exclusion Threshold (SARET) = [(NT x TSDA) / √ 0.1] x [1 + Log (100 / fMHz)] x 1/2

Where,

NT = Numeric Threshold (3.0 for 1-g SAR and 7.5 for 10-g SAR)
TSDA = 50 mm
fMHz = Transmit frequency in MHz

| *Channel Frequency (MHz)* | *Maximum Conducted Power (mW)* | *SAR Exclusion Threshold at 5 mm (mW)* | *SAR Evaluation* |
|---|---|---|---|
| 13.56 | 1.0 | 443.0 | Not Required |

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