Report on the Radio Testing

For

AGD Systems Ltd

on

343

Report no. TRA-065980-47-03A

23rd December 2025

0026

Report Number: TRA-065980-47-03A
Issue: A

REPORT ON THE RADIO TESTING OF A
AGD Systems Ltd
343
WITH RESPECT TO SPECIFICATION
FCC 47CFR 15.245

TEST DATE: 8th October-31st October 2025

Tested by: S Garwell/S Hodgkinson
Radio Test Engineer

Written 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: 2025-12-23 09:43Z

p.p. S Hodgkinson
Radio Test Engineer

Approved by: Digitally signed by John Charters
Date: 2025.12.23 10:55:12 Z

J Charters
Lab Manager

Date: 23rd December 2025

1 Revision Record

Issue	*Issue Date*	*Revision History*
A	23rd December 2025	Original

2 Summary

TEST REPORT NUMBER:	TRA-0659803-47-03A
WORKS ORDER NUMBER:	TRA-065980-02
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:	47CFR15
EQUIPMENT UNDER TEST (EUT):	343
FCC IDENTIFIER:	WH3343506
MANUFACTURER/AGENT:	AGD Systems Ltd
ADDRESS:	White Lion House Gloucester Road Staverton Cheltenham Gloucestershire GL51 0TF United Kingdom
CLIENT CONTACT :	Richard Ellis ☎ 01452 688187 ✉ richard.ellis@agd-systems.com
ORDER NUMBER:	411775
TEST DATE:	8th October-31st October 2025
TESTED BY:	S Garwell/S Hodgkinson Element

2.1 Test Summary

Test Method and Description	*Requirement Clause 47CFR15*	*Applicable to this equipment*	*Result*
Radiated spurious emissions	15.245(b)	☒	Pass
AC power line conducted emissions	15.207	☒	Pass
Occupied bandwidth	15.215(c)	☒	Pass
Field strength of fundamental	15.245(b)	☒	Pass

notes:

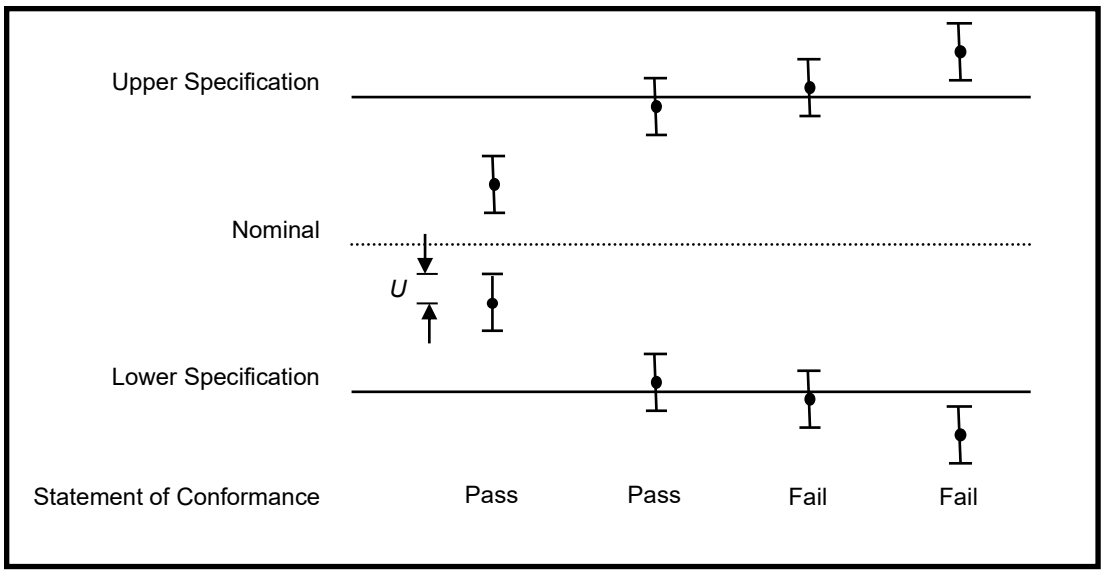
The results contained in this report relate only to the items tested, in the condition at time of test, and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

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).

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



● = Measured value
U = 95 % expanded measurement uncertainty

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4 Introduction

This report TRA-065980-47-03A presents the results of the Radio testing on a AGD Systems Ltd, 343 to specification 47CFR15 Radio Frequency Devices.

The testing was carried out for AGD Systems 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

This report details the configuration of the equipment, the test methods used and any relevant modifications where appropriate.

All test and measurement equipment under the control of the laboratory and requiring calibration is subject to an established programme and procedures to control and maintain measurement standards. The quality management system meets the principles of ISO 9001, and has quality control procedures for monitoring the validity of tests undertaken. Records and sufficient detail are retained to establish an audit trail of calibration records relating to its test results for a defined period. Under control of the established calibration programme, key quantities or values of the test & measurement instrumentation are within specification and comply with the relevant traceable internationally recognised and appropriate standard specifications, which are UKAS calibrated as such where these properties have a significant effect on results. Participation in inter-laboratory comparisons and proficiency testing ensures satisfactory correlation of results conform to Elements own procedures, as well as statistical techniques for analysis of test data providing the appropriate confidence in measurements.

Throughout this report EUT denotes equipment under test.

FCC Site Listing:
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 C63.10-2020 – 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 are 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
FMCW	Frequency Modulated Continuous Wave
Hz	hertz
ITU	International Telecommunication Union
LBT	Listen Before Talk
m	metre
max	maximum
MIMO	Multiple Input and Multiple Output
min	minimum
MRA	Mutual Recognition Agreement
N/A	Not Applicable
PCB	Printed Circuit Board
PDF	Portable Document Format
Pt-mpt	Point-to-multipoint
Pt-pt	Point-to-point
RF	Radio Frequency
RH	Relative Humidity
RMS	Root Mean Square
Rx	receiver
s	second
SVSWR	Site Voltage Standing Wave Ratio
Tx	transmitter
UKAS	United Kingdom Accreditation Service
V	volt
W	watt
Ω	ohm

7 Equipment under Test

7.1 EUT Identification

- Name: 343
- Model Number: 326-5xx-xxx
- Software Revision: MI-248-R
- Build Level / Revision Number: Pre-production
- Serial Number: Test Sample S8

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.

- *Laptop Computer – Dell*
- *EDIMAX EW7612UAn V2 Wi-Fi dongle*

7.3 EUT Mode of Operation

The EUT was programmed in a continuous transmit mode (CW) on bot / mid / top channels with sweep disabled.

7.4 EUT Radio Parameters

Frequency of operation:	24.103 GHz to 24.147 GHz
Modulation type:	FMCW
Occupied channel bandwidth(s):	45 MHz
Channel spacing:	Wideband
Nominal Supply Voltage:	12 Vdc - 24 Vdc
Duty cycle:	100 %

7.5 EUT Description

The EUT is a highways monitoring radar utilising a 24 GHz radar.

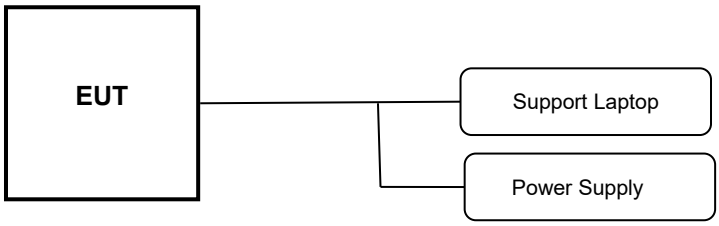
8 Modifications

No modifications were performed during this assessment.

9 EUT Test Setup

9.1 Block Diagram

The following diagram shows basic EUT interconnections:

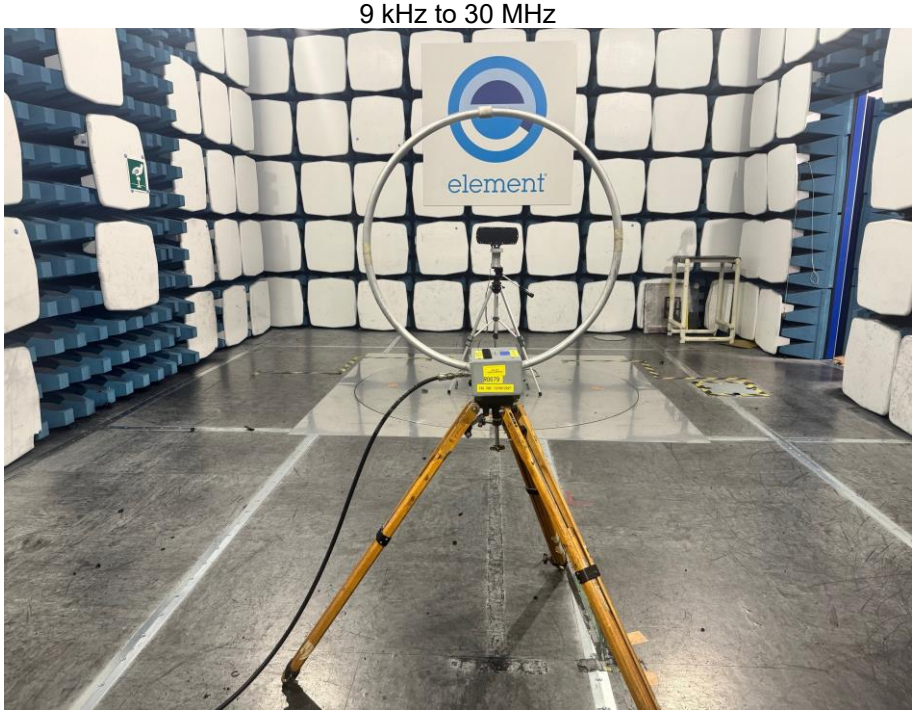


For all tests the EUT was configured with a customer provided support laptop and diagnostic cable. An application program was run on the support laptop to configure the EUT.

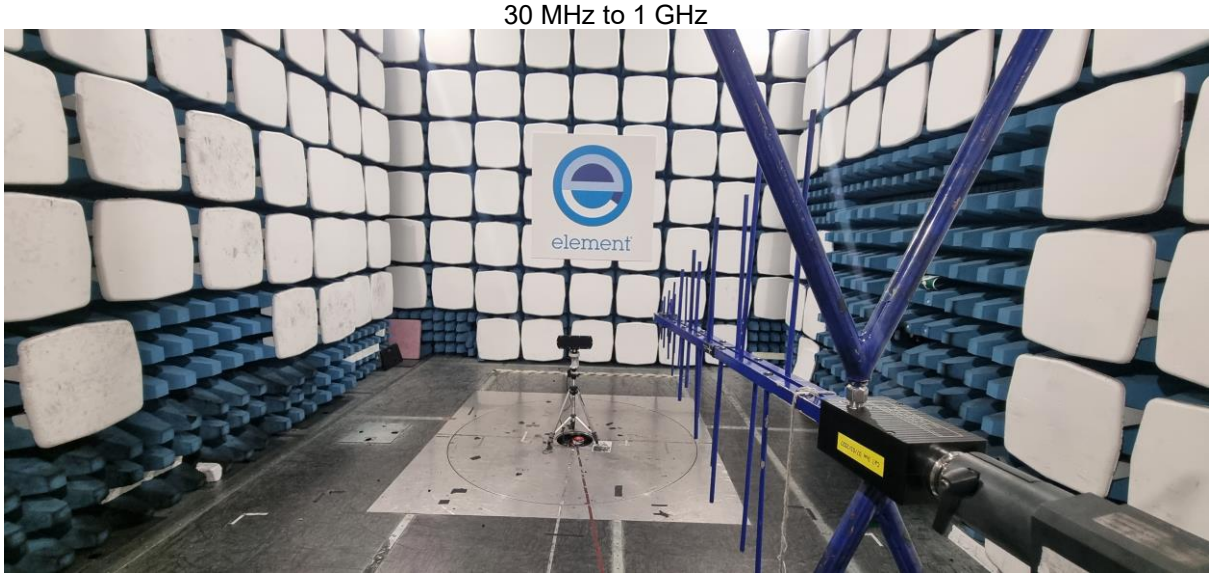
9.2 EUT Test Setup Photographs

The following photographs show basic EUT set-up:

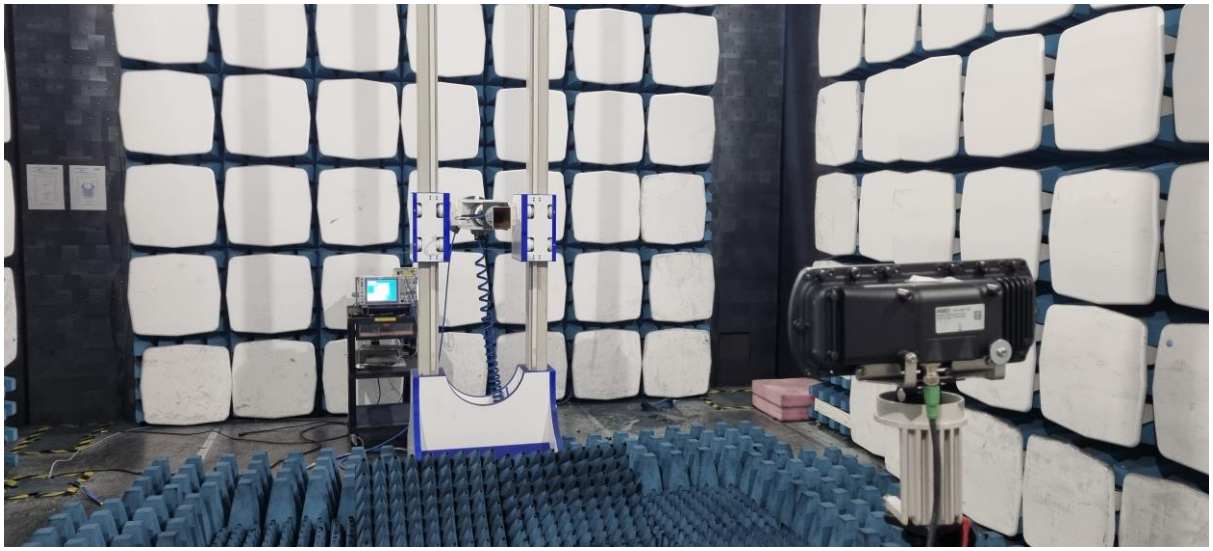
9 kHz to 30 MHz



30 MHz to 1 GHz



Above 1 GHz



Above 1 GHz

9.3 Measurement software

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

Element Emissions R5 V2025.04.30.2

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. Unless otherwise stated in a specific section, the normal power source applied was 24 Vdc.

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.

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

Type	*Nominal*	*Variation*
DC	12 – 24 Vdc	85% to 115 %

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 C63.10-2020, Clause 6.5 and 6.6
Frequencies Measured:	24.103 GHz, 24.125 GHz & 24.147 GHz
Modulation Mode:	CW (FMCW Sweep Stopped)
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: 23 °C	+15 ºC to +35 ºC (as declared)
Humidity: 51 % RH	20 % RH to 75 % RH (as declared)
Supply: 24 Vdc	As declared

11.3 Test Limit

The average field strength of emissions measured at 3 m shall not exceed:

(a) 2500 mV/m for fundamental emission; and

(b) 25 mV/m for harmonic emissions for devices operating in the 24.075 GHz - 24.175 GHz band

Harmonic emissions falling into restricted bands and which are below 17.7 GHz shall meet the general field strength limits.

Harmonic emissions falling into restricted bands which are at and above 17.7 GHz shall not exceed the following strength limits measured at a distance of 3 m:

(a) 25 mV/m for the second and third harmonic emissions of devices operating in the band 24.075 - 24.175 GHz; and

(b) 7.5 mV/m for all other devices.

Emissions radiated outside of these specified operating frequency bands, except for harmonic emissions, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits specified, whichever is less stringent.

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. peak limit is 20 dB above average.

11.4 Test Method

With the EUT connected as per Figure i, the emissions from the EUT were measured on a spectrum analyzer / EMI receiver.

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

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

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

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

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

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

$$Factor = CL + AF - PA$$

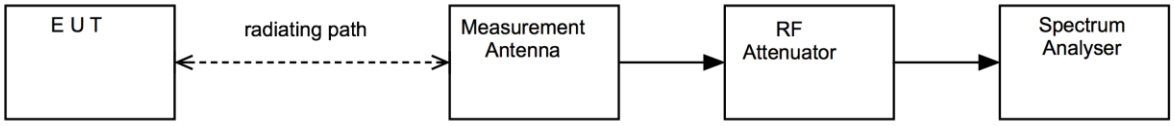
Where,

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



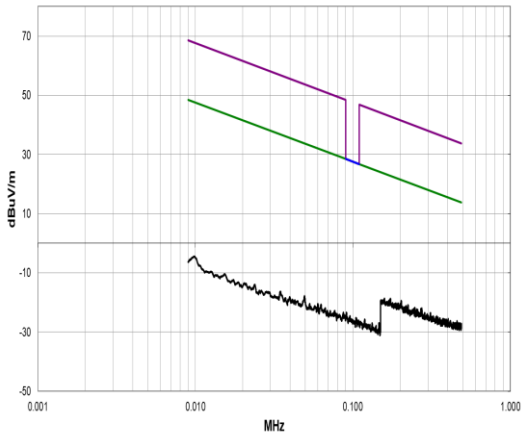
11.5 Test Equipment

Equipment Type	*Manufacturer*	*Equipment Description*	*Element No*	*Due For Calibration*
EMI Receiver	R&S	ESR26	U489	2025-11-05
Spectrum Analyser	Agilent	N9030A	REF2167	2026-05-06
Horn Antenna	EMCO	3115	L138	2026-06-11
Pre Amp	Agilent	8449B	L572	2025-11-13
Bilog	Chase	CBL611/B	U573	2026-11-04
PreAmp	Watkins Johnson	6201-69	U372	2026-03-17
Loop Antenna	EMCO	6502	R0079	2026-01-13
Horn Antenna	A Info Inc	LB-180400-25-C-KF	REF2246	2026-10-08
Pre-Amp (18 – 40 GHz)	Com-Power	PAM-840A	REF2390	2025-10-17
Harmonic Mixer (33-50)	Agilent	11970Q	U365	2028-05-21
Harmonic Mixer (50-75)	Agilent	11970V	U366	2028-05-21
Harmonic Mixer (75-110)	Agilent	11970W	U367	2028-05-20
Standard Gain Horn (50-75)	Flann	25240-20	U368	2028-05-22
Standard Gain Horn (75-110)	Flann	27240-20	U369	2028-05-22
Standard Gain Horn 33-50	Flann	23240-20	L264A	2028-07-24
2.4G Band Stop Filter	BSC	SN 4478	U543	2026-02-17
High Pass Filter	Atlantic Microwave	AFH-07000	U558	2026-02-17
Radio Chamber – PP	Rainford EMC	ATS	REF940	2026-01-29
Radiated Test Software	Element	Emissions R5	REF9000	Cal Not Required

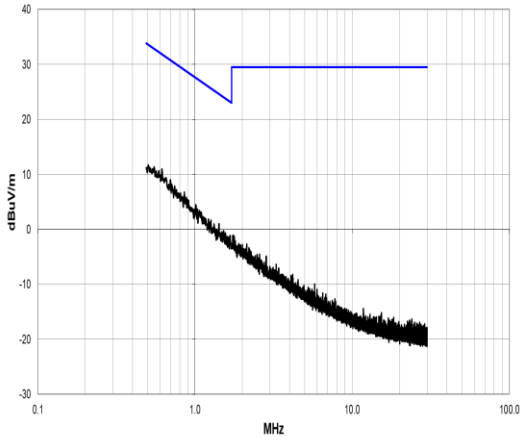
Note: REF2390 was in calibration at the time of use.

11.6 Test Results

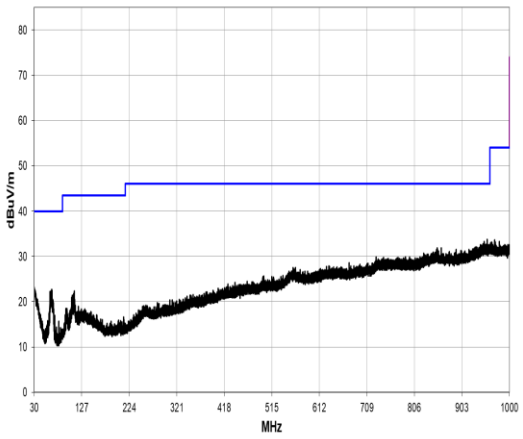
24 GHz Radar; Mode: CW; Frequency: 24.103 GHz



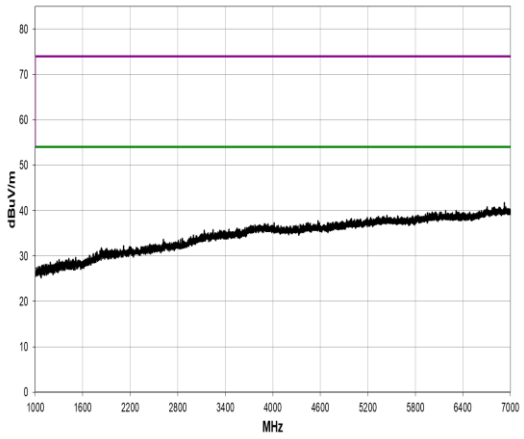
9 kHz to 490 kHz



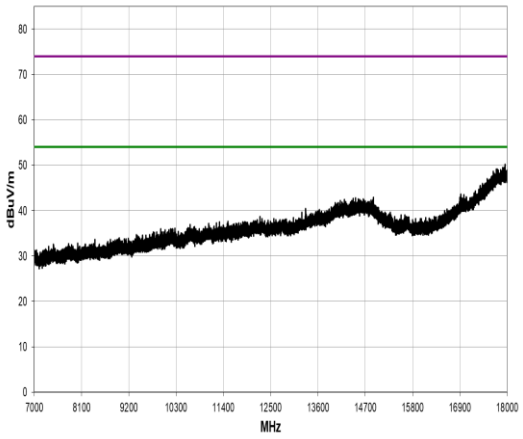
490 kHz to 30 MHz



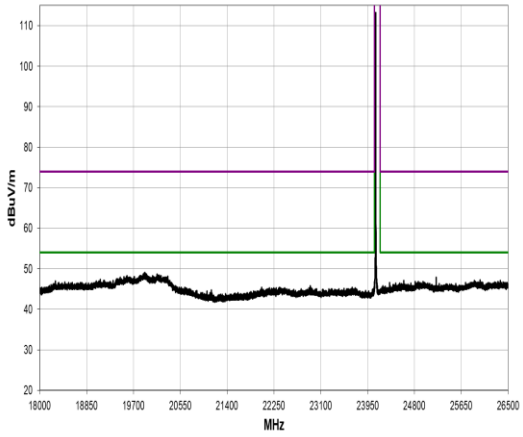
30 MHz to 1 GHz



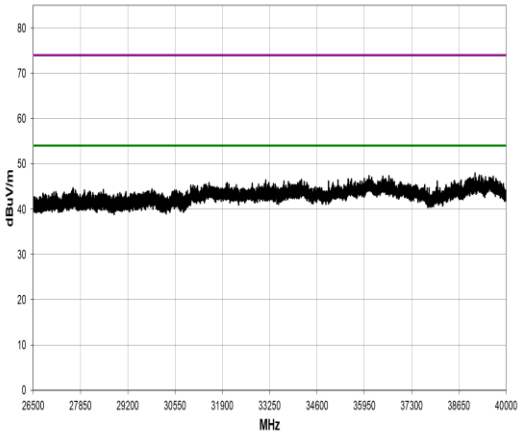
1 GHz to 7 GHz



7 GHz to 18 GHz



18 GHz to 26.5 GHz



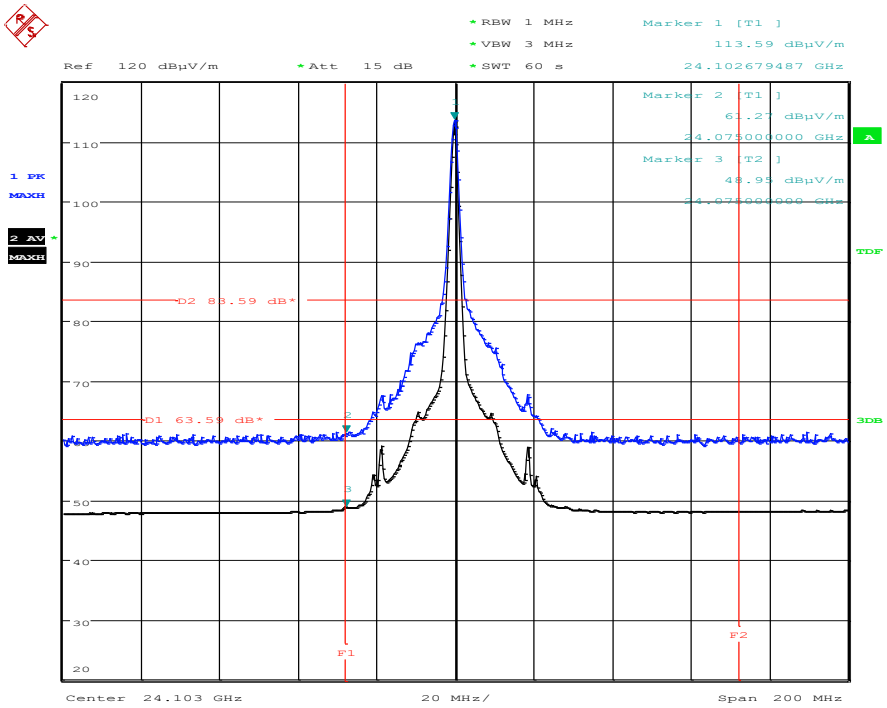
26.5 GHz to 40 GHz

TX; Frequency: 24.103 GHz; Mode: CW								
Detector	***Freq. (GHz)***	***Meas'd Emission (dBµV)***	***Factor (dB/m)***	***Duty Cycle Corr'n (dB)***	***Distance Extrap'n Factor (dB)***	***Field Strength (dBµV/m)***	***Field Strength (mV/m)***	***Limit (mV/m)***
Pk	48.20553	16.93	66.83	0	-29.5	54.26	0.516	25

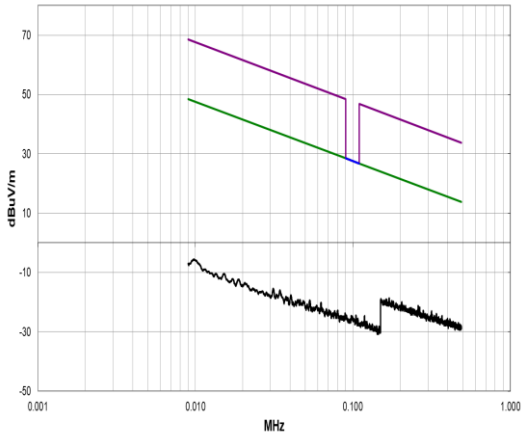
Note: Radiated Spurious Emission investigations have been performed up to 100 GHz,
No Further Significant Emissions Within 20 dB of Limit or above the measurement system noise floor were found.

Peak emissions below average limits.

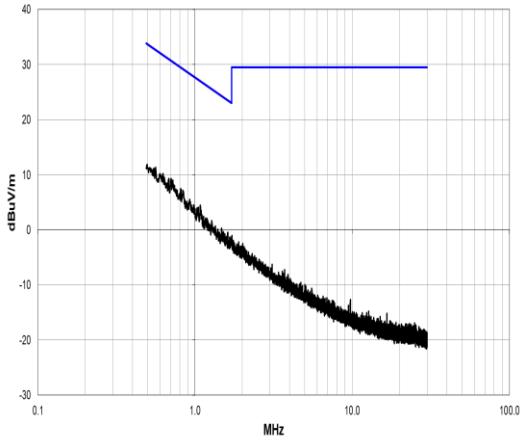
Radiated Band Edge (low)



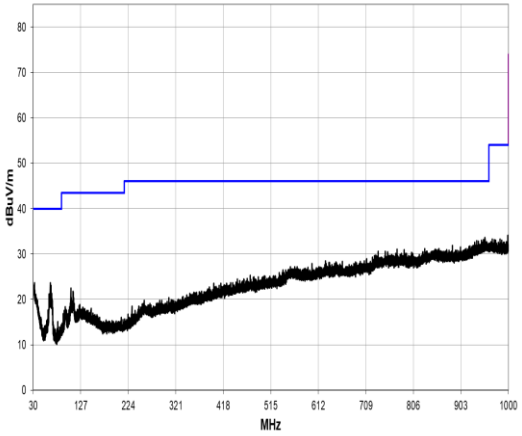
24 GHz Radar; Mode: CW; Frequency: 24.125 GHz



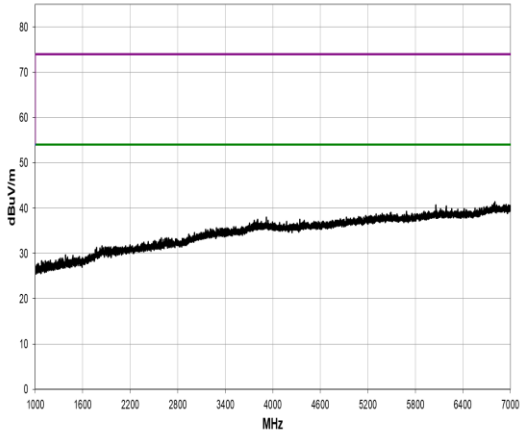
9 kHz to 490 kHz



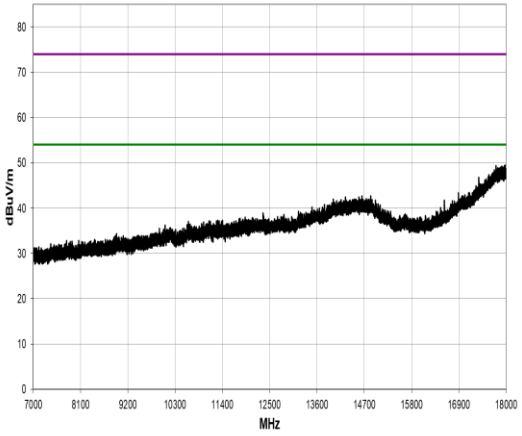
490 kHz to 30 MHz



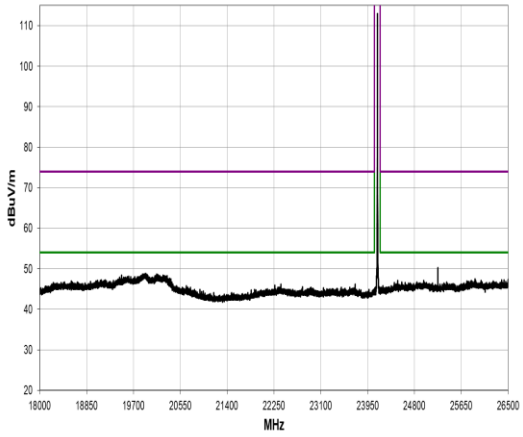
30 MHz to 1 GHz



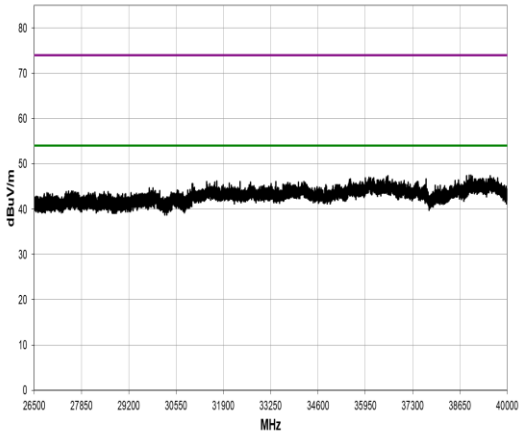
1 GHz to 7 GHz



7 GHz to 18 GHz



18 GHz to 26.5 GHz



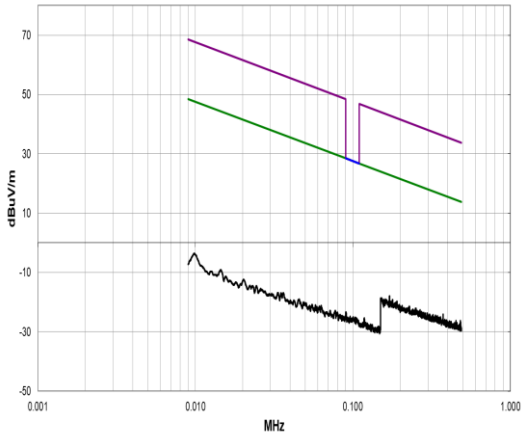
26.5 GHz to 40 GHz

TX; Frequency: 24.125 GHz; Mode: CW								
Detector	***Freq. (GHz)***	***Meas'd Emission (dBµV)***	***Factor (dB/m)***	***Duty Cycle Corr'n (dB)***	***Distance Extrap'n Factor (dB)***	***Field Strength (dBµV/m)***	***Field Strength (mV/m)***	***Limit (mV/m)***
Pk	48.24943	17.04	66.83	0	-29.5	54.37	0.523	25

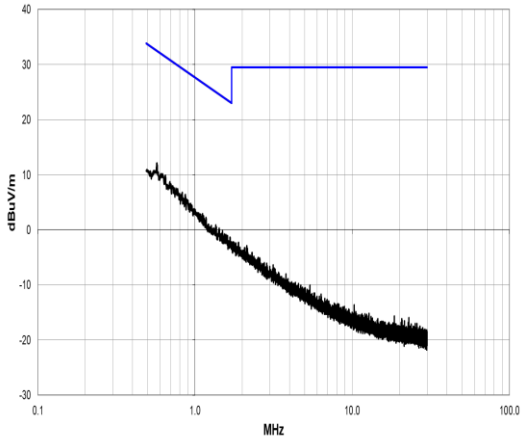
Note: Radiated Spurious Emission investigations have been performed up to 100 GHz,
No Further Significant Emissions Within 20 dB of Limit or above the measurement system noise floor were found.

Peak emissions below average limits.

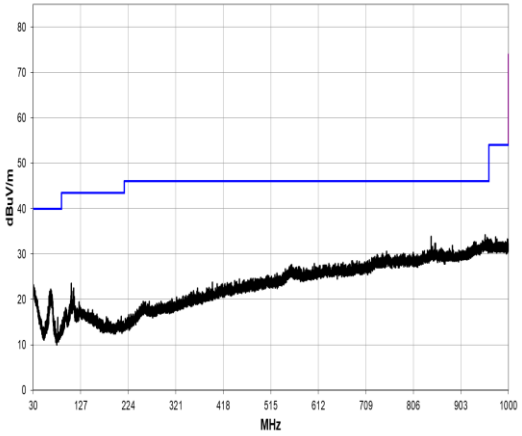
24 GHz Radar; Mode: CW; Frequency: 24.147 GHz



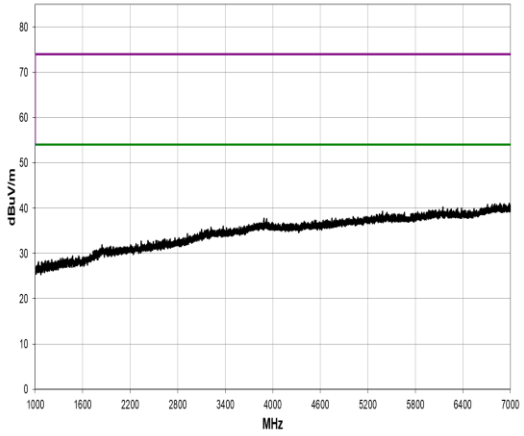
9 kHz to 490 kHz



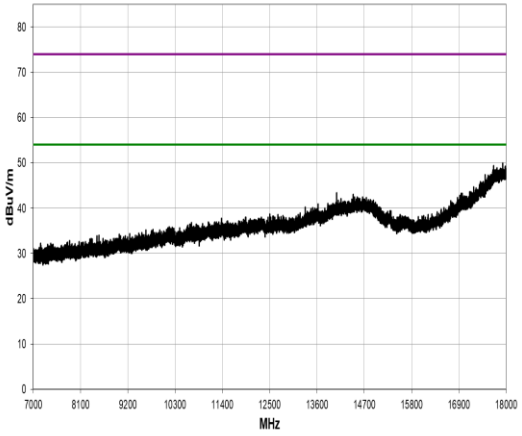
490 kHz to 30 MHz



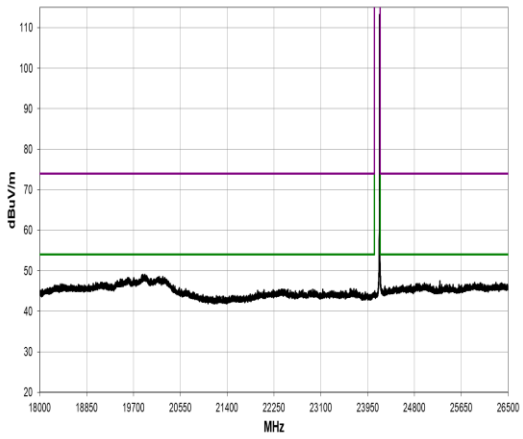
30 MHz to 1 GHz



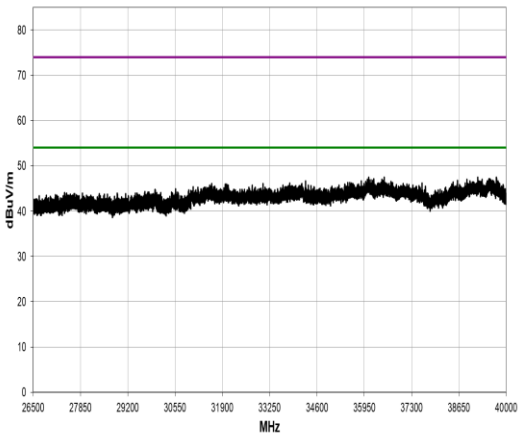
1 GHz to 7 GHz



7 GHz to 18 GHz



18 GHz to 26.5 GHz



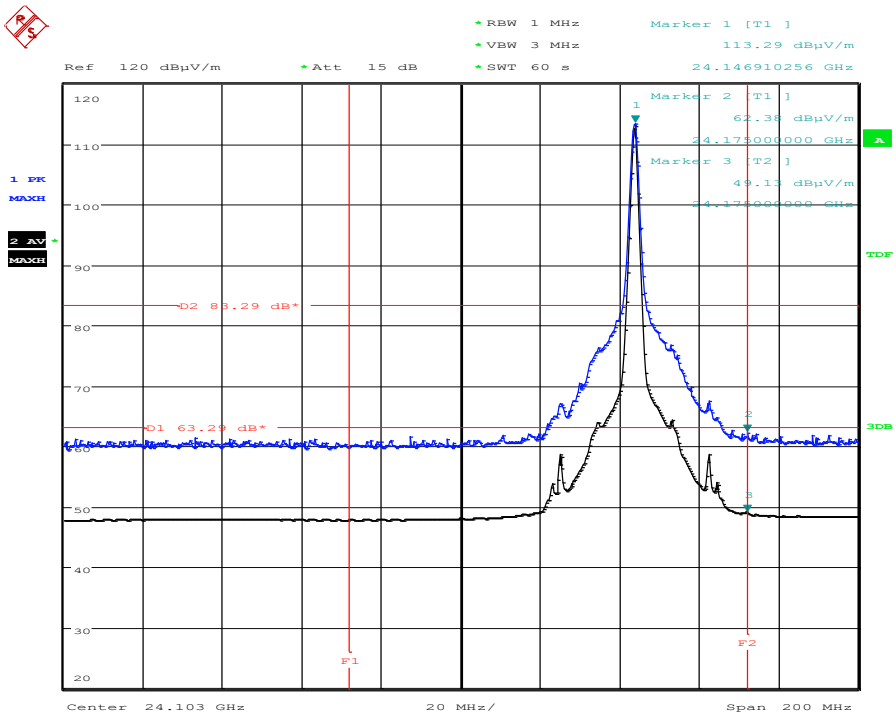
26.5 GHz to 40 GHz

TX; Frequency: 24.147 GHz; Mode: CW								
Detector	***Freq. (GHz)***	***Meas'd Emission (dBµV)***	***Factor (dB/m)***	***Duty Cycle Corr'n (dB)***	***Distance Extrap'n Factor (dB)***	***Field Strength (dBµV/m)***	***Field Strength (mV/m)***	***Limit (mV/m)***
Pk	48.29340	17.75	66.83	0	-29.5	55.08	0.568	25

Note: Radiated Spurious Emission investigations have been performed up to 100 GHz,
No Further Significant Emissions Within 20 dB of Limit or above the measurement system noise floor were found.

Peak emissions below average limits.

Radiated Band Edge (high)



12 AC powerline 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 Skelemersdale
Test Chamber:	Transient Laboratory 1
Test Standard and Clause:	ANSI C63.10-2020, Clause 6.2
EUT Frequency Measured:	24.125 GHz
Deviations From Standard:	None
Measurement Detectors:	Quasi-Peak and Average

Environmental Conditions (Normal Environment)

Temperature: 23 °C	+15 ºC to +35 ºC (as declared)
Humidity: 50 % RH	20 % RH to 75 % RH (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.

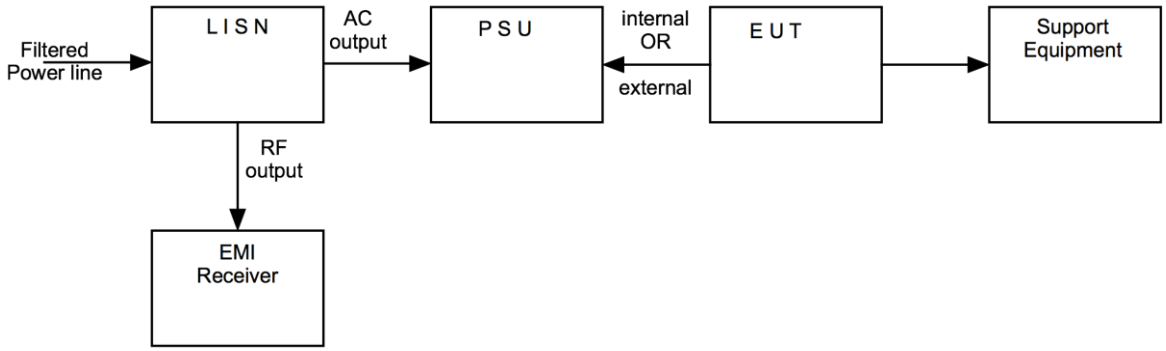
12.4 Test Method

With the EUT setup in a screened room, as per 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 mode.

Figure ii Test Setup

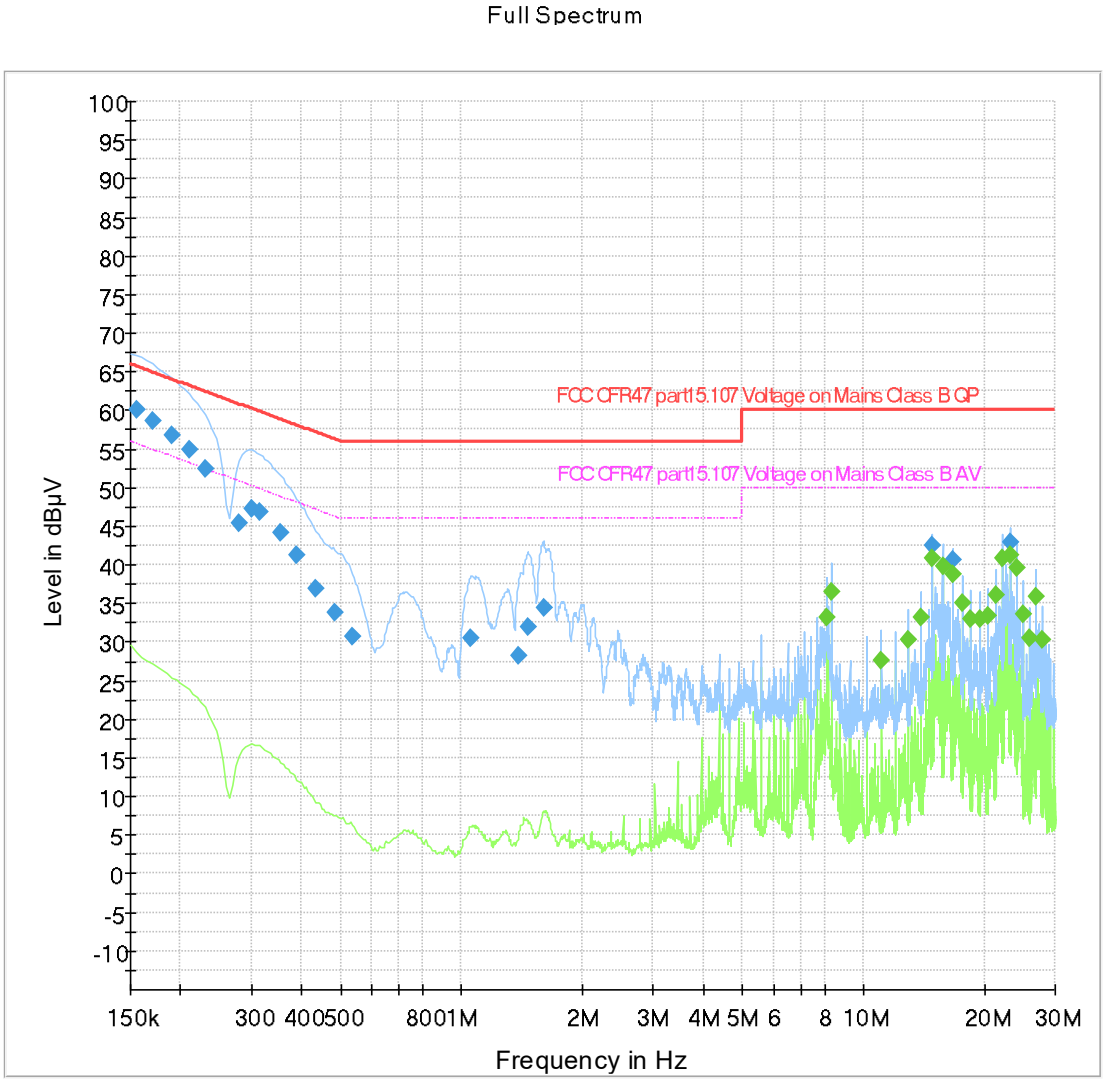


12.5 Test Set-up Photographs

12.6 Test Equipment

Equipment Description	*Manufacturer*	*Equipment Type*	*Element No*	*Due For Calibration*
EMI Receiver	R&S	ESR7	U456	2026-03-26
Lisn	R&S	ENV216	U396	2025-12-05
Pulse Limiter	R&S	ESH3-Z2	U559	2026-02-25

12.7 Test Results



QuasiPeak Result						
Frequency (MHz)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line
0.155000	59.99	65.73	5.74	5000.0	9.000	N
0.170000	58.64	64.96	6.32	5000.0	9.000	N
0.190000	56.84	64.04	7.20	5000.0	9.000	N
0.210000	55.00	63.21	8.21	5000.0	9.000	N
0.230000	52.37	62.45	10.08	5000.0	9.000	N
0.280000	45.49	60.82	15.33	5000.0	9.000	N
0.300000	47.29	60.24	12.95	5000.0	9.000	N
0.315000	46.84	59.84	13.00	5000.0	9.000	N
0.355000	44.24	58.85	14.61	5000.0	9.000	N
0.390000	41.33	58.06	16.73	5000.0	9.000	N
0.435000	36.94	57.16	20.22	5000.0	9.000	N
0.485000	33.87	56.25	22.38	5000.0	9.000	N
0.535000	30.78	56.00	25.22	5000.0	9.000	N
1.055000	30.42	56.00	25.58	5000.0	9.000	L1
1.385000	28.29	56.00	27.71	5000.0	9.000	N
1.465000	31.91	56.00	24.09	5000.0	9.000	N
1.600000	34.34	56.00	21.66	5000.0	9.000	N
14.815000	42.58	60.00	17.42	5000.0	9.000	N
16.665000	40.56	60.00	19.44	5000.0	9.000	N
23.150000	42.92	60.00	17.08	5000.0	9.000	N

Average Result						
Frequency (MHz)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line
8.080000	33.23	50.00	16.77	5000.0	9.000	N
8.335000	36.50	50.00	13.50	5000.0	9.000	N
11.110000	27.65	50.00	22.35	5000.0	9.000	N
12.965000	30.26	50.00	19.74	5000.0	9.000	N
13.890000	33.21	50.00	16.79	5000.0	9.000	N
14.815000	40.80	50.00	9.20	5000.0	9.000	N
15.740000	39.77	50.00	10.23	5000.0	9.000	N
16.665000	38.83	50.00	11.17	5000.0	9.000	N
17.590000	35.00	50.00	15.00	5000.0	9.000	N
18.520000	32.91	50.00	17.09	5000.0	9.000	N
19.445000	33.07	50.00	16.93	5000.0	9.000	N
20.370000	33.40	50.00	16.60	5000.0	9.000	N
21.295000	36.12	50.00	13.88	5000.0	9.000	N
22.220000	40.79	50.00	9.21	5000.0	9.000	L1
23.150000	41.19	50.00	8.81	5000.0	9.000	N
24.075000	39.55	50.00	10.45	5000.0	9.000	N
25.000000	33.66	50.00	16.34	5000.0	9.000	N
25.925000	30.51	50.00	19.49	5000.0	9.000	N
26.850000	35.85	50.00	14.15	5000.0	9.000	N
27.775000	30.34	50.00	19.66	5000.0	9.000	N

13 Occupied Bandwidth

13.1 Definitions

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:	Blocking Laboratory
Test Standard and Clause:	ANSI C63.10-2020, Clause 6.9
EUT Frequencies Measured:	24.103 GHz, 24.125 GHz & 24.147 GHz
Deviations From Standard:	None
Measurement BW:	10 kHz
Spectrum Analyzer Video BW:	30 kHz
Measurement Span:	2 MHz
Measurement Detector:	Peak

Environmental Conditions (Normal Environment)

Temperature: 23 °C	+15 ºC to +35 ºC (as declared)
Humidity: 49 % RH	20 % RH to 75 % RH (as declared)

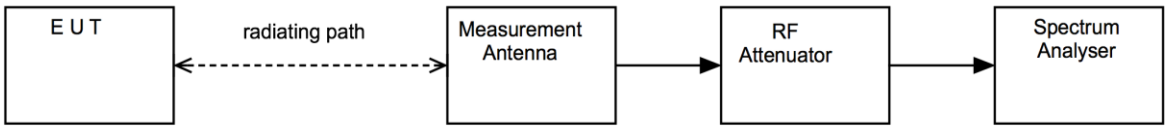
13.3 Test Limit

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 en- sure 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 connected as per Figure iii, the bandwidth of the EUT was measured on a spectrum analyser.

Figure iii Test Setup

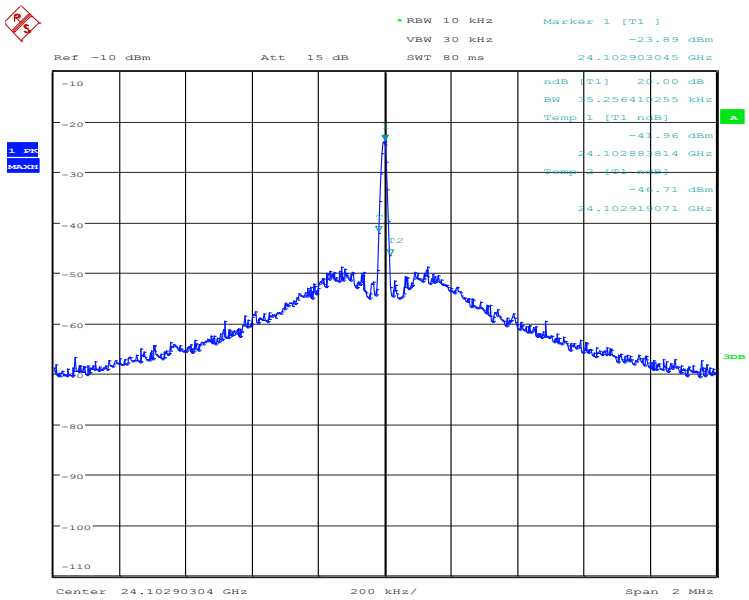


13.5 Test Equipment

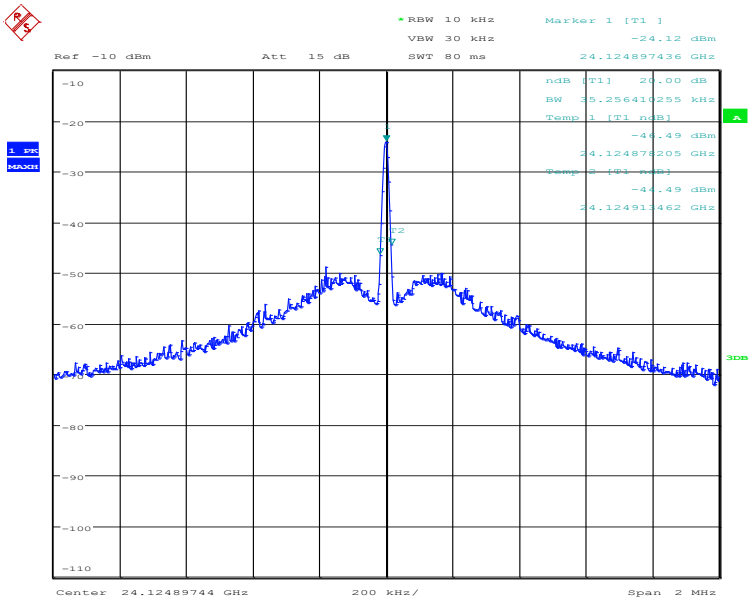
Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
Spectrum Analyser	R&S	FSU50	U544	2025-12-16
Horn 18-26GHz (&U330)	Flann	20240-20	L300	2026-09-10

13.6 Test Results (FCC)

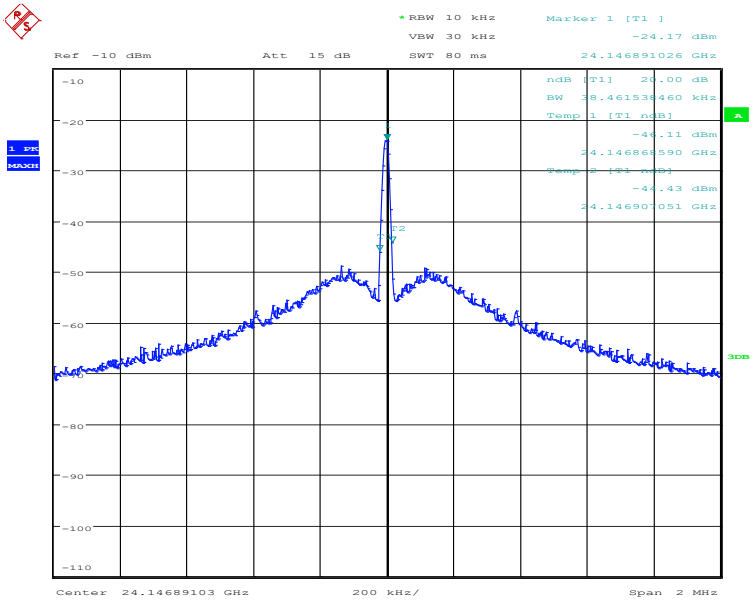
Channel Low				
Channel Frequency (GHz)	***F_L (GHz)***	***F_H (GHz)***	***20 dB Bandwidth (kHz)***	***Result***
24.103	24.102883814	24.102919071	35.256	Pass



Channel Mid				
Channel Frequency (GHz)	**F_L (GHz)**	**F_H (GHz)**	**20 dB Bandwidth (kHz)**	**Result**
24.125	24.124878205	24.124913462	35.256	Pass



Channel High				
Channel Frequency (GHz)	**F_L (GHz)**	**F_H (GHz)**	**20 dB Bandwidth (MHz)**	**Result**
24.147	24.146868590	24.146907051	38.462	Pass



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 C63.10-2020, Clause 6.5 / 6.6
EUT Frequency Measured:	24.103 GHz, 24.125 GHz & 24.147 GHz
Deviations From Standard:	None
Measurement Detector:	Average RMS and Peak

Environmental Conditions (Normal Environment)

Temperature: 23 °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 3 meters shall not exceed the limit in the following table:

Field Strength Limits

Fundamental frequency (GHz)	*Field strength (mV/m at 3 m)*	*Detector*
24.00 to 24.25	2500	Average, RMS

n.b. peak limit is 20 dB above average.

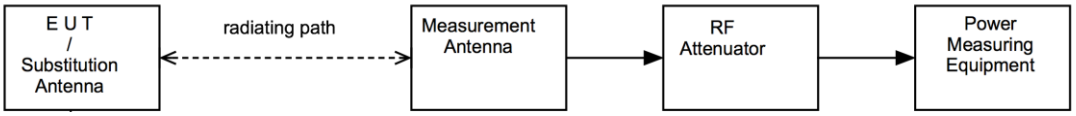
14.4 Test Method

With the EUT connected as per Figure iv, the peak and average power was measured on the power meter.

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.

For FMCW operation the sweep is stopped and measurements are made a low middle and high frequency range of operation.

Figure iv Test Setup



14.5 Test Equipment

Equipment Description	*Manufacturer*	*Equipment Type*	*Element No*	*Due For Calibration*
Radio Chamber - PP	Rainford EMC	ATS	REF940	2026-01-29
Pre-Amp (18 – 40 GHz)	Com-Power	PAM-840A	REF2390	2025-10-17
Pre Amp	Agilent	8449B	L572	2025-11-13
Horn Antenna	A Info Inc	LB-180400-25-C-KF	REF2246	2026-10-08
EMI Receiver	R&S	ESR26	U489	2025-11-05

Note: REF2390 was in calibration at the time of test.

14.6 Test Results

Channel: Low								
Detector	***Channel Frequency (GHz)***	***Meas'd Emission (dBµV)***	***Cable Loss (dB)***	***Antenna Factor (dB/m)***	***Pre-amp Gain (dB)***	***Field Strength (dBµV/m)***	***Field Strength (mV/m)***	***Result***
Peak	24.103	105.1	11.5	33.8	35.6	114.8	549.54	Pass

Channel: Mid								
Detector	***Channel Frequency (GHz)***	***Meas'd Emission (dBµV)***	***Cable Loss (dB)***	***Antenna Factor (dB/m)***	***Pre-amp Gain (dB)***	***Field Strength (dBµV/m)***	***Field Strength (mV/m)***	***Result***
Peak	24.125	111.4	11.5	33.8	42.4	114.3	518.80	Pass

Channel: High								
Detector	***Channel Frequency (GHz)***	***Meas'd Emission (dBµV)***	***Cable Loss (dB)***	***Antenna Factor (dB/m)***	***Pre-amp Gain (dB)***	***Field Strength (dBµV/m)***	***Field Strength (mV/m)***	***Result***
Peak	24.147	111.3	11.5	33.9	42.4	114.3	518.80	Pass

Note: Peak below average limits.

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 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 (3450-3980 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

OVERVIEW

Section 1.3 of KDB 44798 D04 v01 states that, “Under the new rules, all radio services and operations are subject to Routine Evaluation [§§ 1.1307(b)(1), 2.1033(f), etc.], unless shown to qualify under the exemptions provided in the rules and OET Lab policies for equipment authorization.”

The glossary of KDB 447498 D04 v01 specifies that an exempt RF device is defined “solely from the obligation to perform a routine environmental evaluation to demonstrate compliance with the RF exposure limits in § 1.1310; it is not exemption from the equipment authorization procedures described in 47 CFR Part 2, not exemption from general obligations of compliance with the RF exposure limits in § 1.1310 of this chapter, and not exemption from determination of whether there is no significant effect on the quality of the human environment under § 1.1306.” Compliance with the exemption criteria defined in 1.1307(b) confirm compliance with the limits in § 1.1310.

COMPLIANCE WITH FCC 1.1310

Per 1.1307(b)(3), (i) For single RF sources (*i.e.,* any single fixed RF source, mobile device, or portable device, as defined in paragraph (b)(2) of this section): A single RF source is exempt if:

(A) The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(ii)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(ii)(A);

(B) Or the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by:

$$P_{th}(mW) = \begin{cases} ERP_{20\ cm}(d/20\ cm)^x & d \le 20\ cm \\ ERP_{20\ cm} & 20\ cm\ < d\ \le 40\ cm \end{cases}$$

Where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\ cm}\sqrt{f}}\right)\ and\ f\ is\ in\ GHz\,;$$

And

$$ERP_{20\ cm}(mW) = \begin{cases} 2040f & 0.3\ GHz\ \le f\ < 1.5\ GHz \\ 3060 & 1.5\ GHz\ \le f\ \le 6\ GHz \end{cases}$$

(C) Or using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least λ/2π, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of λ/4 or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

TABLE 1 TO §1.1307(b)(3)(i)(C)—SINGLE RF SOURCES SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION

RF Source Frequency (MHz)	*Threshold ERP (watts)*
0.3-1.34	1,920 R^2.
1.34-30	3,450 R^2/f^2.
30-300	3.83 R^2.
300-1,500	0.0128 R^2f.
1,500-100,000	19.2R^2.

(ii) For multiple RF sources: Multiple RF sources are exempt if:

(A) The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required). This exemption may not be used in conjunction with other exemption criteria other than those is paragraph (b)(3)(i)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(i)(A).

(B) in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

$$\sum_{i=1}^{a} \frac{P_i}{P_{th,i}} + \sum_{j=1}^{b} \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^{c} \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

Where:

a = number of fixed, mobile, or portable RF sources claiming exemption using paragraph (b)(3)(i)(B) of this section for P_{th}, including existing exempt transmitters and those being added.

b = number of fixed, mobile, or portable RF sources claiming exemption using paragraph (b)(3)(i)(C) of this section for Threshold ERP, including existing exempt transmitters and those being added.

c = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters.

P_i = the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source *i* at a distance between 0.5 cm and 40 cm (inclusive).

$P_{th,i}$ = the exemption threshold power (P_{th}) according to paragraph (b)(3)(i)(B) of this section for fixed, mobile, or portable RF source *i.*

ERP_j = the ERP of fixed, mobile, or portable RF source *j.*

$ERP_{th,j}$ = exemption threshold ERP for fixed, mobile, or portable RF source *j,* at a distance of at least λ/2π according to the applicable formula of paragraph (b)(3)(i)(C) of this section.

$Evaluated_k$ = the maximum reported SAR or MPE of fixed, mobile, or portable RF source *k* either in the device or at the transmitter site from an existing evaluation at the location of exposure.

$Exposure\ Limit_k$ = either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable RF source *k,* as applicable from §1.1310

The relationship between EIRP and ERP is:

$$ERP\ (dBm) = EIRP\ (dBm) - 2.14\ dB$$

Where EIRP is the sum of the conducted power (dBm) and the antenna gain (dBi).

ASSESSMENT

The exemption from RF exposure evaluation is summarized in the following table(s):

Radio	*Transmit Frequency (GHz)*	*Field Strength (dBuV/m) @ 3m*	*Power Tolerance (dB)*	*Duty Cycle (%)*	*Antenna Gain (dBi)*	*Minimum Separation Distance (cm)*	Calculated Radiated Exposure Power (W) ERP	*Limit (W)*	*Compliant*
24 GHz Radar	24.103 24.147	114.8	0	100	14	20	0.0180	1.0	yes
Max Ratio:					0.02				