Report on the Radio Testing

For

AGD Systems Ltd

on

326

Report no. TRA-043537-45-01B

2 April 2020

Report Number: TRA-043537-45-01B
Issue: B

REPORT ON THE RADIO TESTING OF A
AGD Systems Ltd
326
WITH RESPECT TO SPECIFICATION
FCC 47CFR 15.245

TEST DATE: 2019-12-23 to 2020-01-07

Tested by: A Tosif & A Wong

Written by: A Tosif
Radio Test Engineers

Approved by: J Charters
Lab Manager

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Reason: I am approving this document
Date: 2020.04.02 16:42:29 +01'00'

Date: 2 April 2020

1 Revision Record

Issue Number	*Issue Date*	*Revision History*
A	24 January 2020	Original
B	2 April 2020	Section 14.6 updated

2 Summary

TEST REPORT NUMBER:	TRA-043537-45-01B
WORKS ORDER NUMBER:	TRA-043537-00
PURPOSE OF TEST:	Certification
TEST SPECIFICATION:	47CFR15.245
EQUIPMENT UNDER TEST (EUT):	326
FCC IDENTIFIER:	WH3326505
MANUFACTURER/AGENT:	AGD Systems Ltd
ADDRESS:	White Lion House Gloucester Road Staverton Cheltenham Gloucestershire GL51 0TF United Kingdom
CLIENT CONTACT:	Richard Ellis ☎ +44 (0) 1452 854212 ✉ richard.ellis@agd-systems.com
ORDER NUMBER:	404826
TEST DATE:	2019-12-23 to 2020-01-07
TESTED BY:	A Tosif & A Wong 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).

3 Contents

4 Introduction

This report TRA-043537-45-01B presents the results of the Radio testing on a AGD Systems Ltd, 326 to specification 47CFR15 Radio Frequency Devices.

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

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

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

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

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

Throughout this report EUT denotes equipment under test.

FCC Site Listing:
Element is accredited for the above sites under the US-EU MRA, Designation number UK0009.

IC Registration Number:
Element Hull 3483A

The test site requirements of ANSI C63.4-2014 are met up to 1 GHz.

The test site SVSWR requirements of CISPR 16-1-4:2010 are met over the frequency range 1 GHz to 18 GHz.

5 Test Specifications

5.1 Normative References

- FCC 47 CFR Ch. I – Part 15 – Radio Frequency Devices.
- ANSI C63.10-2013 – American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.
- ANSI C63.4-2014 – American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

5.2 Deviations from Test Standards

There were no deviations from the test standard.

6 Glossary of Terms

§	denotes a section reference from the standard, not this document
AC	Alternating Current
ANSI	American National Standards Institute
BW	bandwidth
C	Celsius
CFR	Code of Federal Regulations
CW	Continuous Wave
dB	decibel
dBm	dB relative to 1 milliwatt
DC	Direct Current
DSSS	Direct Sequence Spread Spectrum
EIRP	Equivalent Isotropically Radiated Power
ERP	Effective Radiated Power
EUT	Equipment Under Test
FCC	Federal Communications Commission
FHSS	Frequency Hopping Spread Spectrum
Hz	hertz
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: 326
- Model Number: 326-500-021
- Software Revision: MI-197 Ver 4
- Build Level / Revision Number: Prototype
- Serial Number: 114856-0023

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 PC
Bench-top Power Supply

7.3 EUT Mode of Operation

The EUT was placed in a continuous transmit mode on channel 1 and 2. Both channels are centred on 24.125 GHz with a 70 MHz bandwidth. The difference is the direction of the sweep of the FMCW modulation.

7.4 EUT Radio Parameters

Frequency of operation:	24.125 GHz
Modulation type:	FMCW
Nominal Supply Voltage:	12 Vdc - 24 Vdc & 24 Vac
Duty cycle:	100 %

7.5 EUT Description

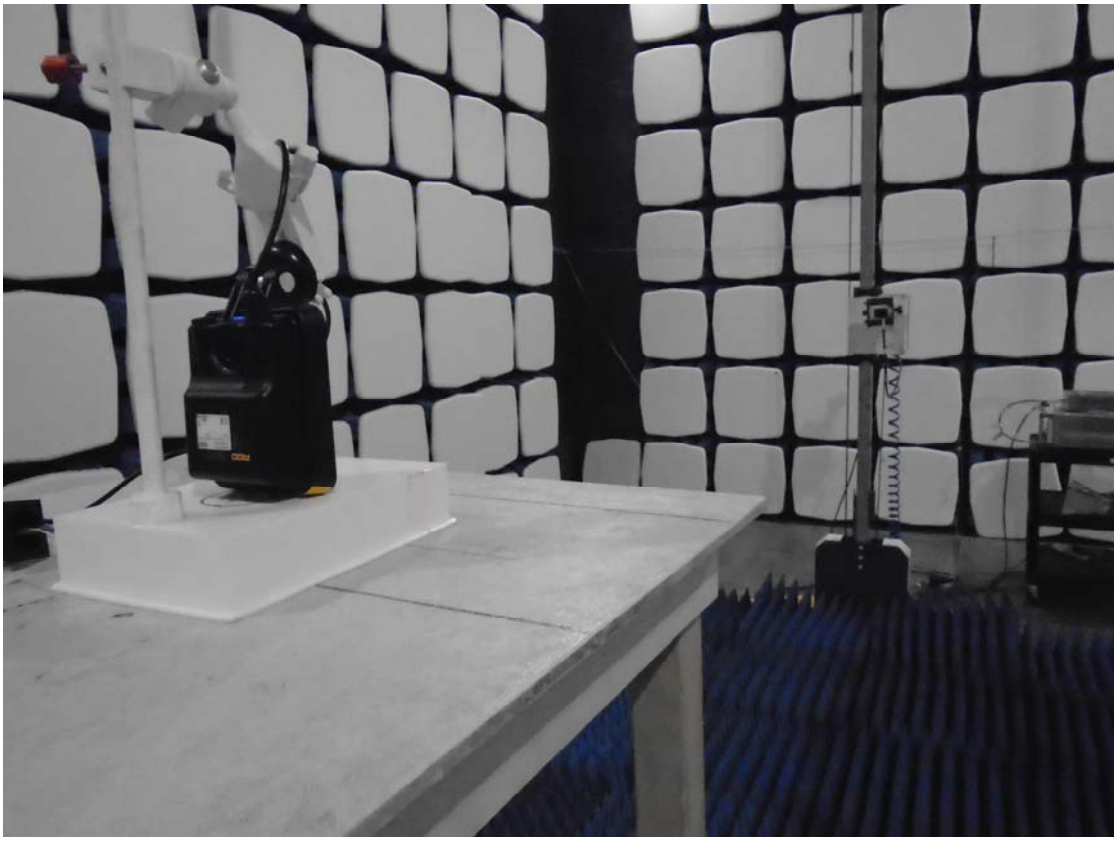
The EUT is a pedestrian detector that uses 24 GHz radar for use in pedestrian crossings.

8 Modifications

No modifications were performed during this assessment.

9 EUT Test Setup Photographs

The following photograph shows basic EUT set-up:



9.1 Measurement software

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

Element Emissions R5

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	10.2 Vdc & 27.6 Vdc
AC	24 Vac	20.4 Vac & 27.6 Vac

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 Hull
Test Chamber:	Wireless Lab 2
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.5 and 6.6
Frequencies Measured:	24.125 GHz
EUT Channel Bandwidth:	70 MHz
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: 20 °C	+15 ºC to +35 ºC (as declared)
Humidity: 39 % 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:

$$FS = PR + CL + AF – PA + DC – CF$$

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

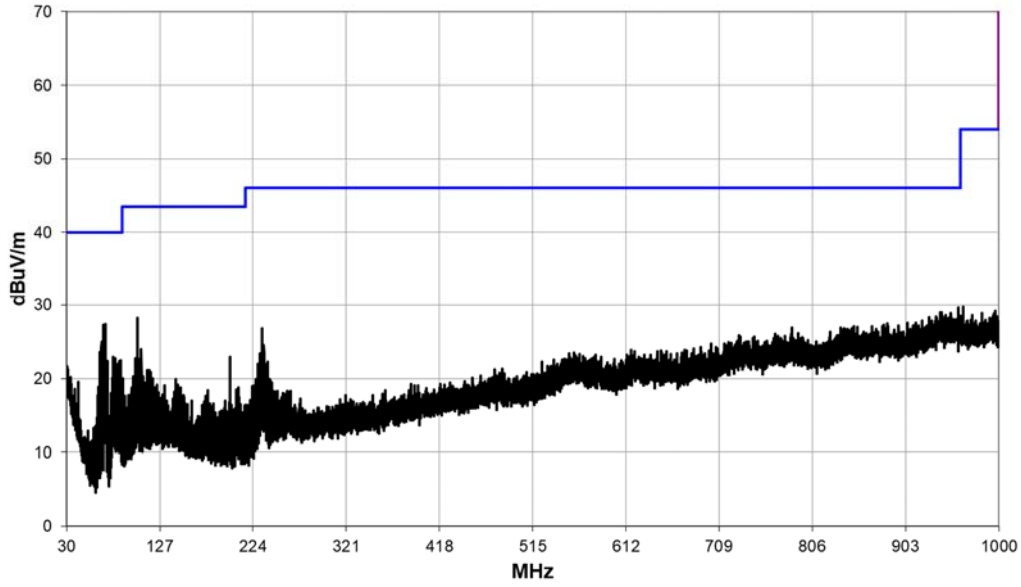
11.5 Test Equipment

Equipment Type	*Manufacturer*	*Equipment Description*	*Element No*	*Due For Calibration*
CBL6111B	Chase	Bilog Antenna	REF2233	2020-08-17
3115	EMCO	Horn Antenna	RFG129	2020-02-12
QSH20S20S	Q-Par	Horn Antenna	RFG629	2021-10-09
LB-180400-25-C-KF	A Info Inc	Horn Antenna	REF2246	2020-07-25
ATS	Rainford	Ferrite Lined Chamber	REF886	2020-07-29
ESU40	R&S	Receiver	RFG701	2020-01-18
N9030A	Agilent	Spectrum Analyser	REF2167	2020-08-12
11970Q	Agilent	Harmonic Mixer (33-50)	U365	2022-05-06
11970V	Agilent	Harmonic Mixer (50-75)	U366	2022-05-06
11970W	Agilent	Harmonic Mixer (75-110)	U367	2022-05-17
25240-20	Flann	Standard Gain Horn (50-75)	U368	2020-05-05
27240-20	Flann	Standard Gain Horn (75-110)	U369	2020-05-04
23240-20	Flann	Standard Gain Horn 33-50	L264A	2020-05-17
310	Sonoma	Pre-Amp (9 kHz - 1 GHz)	REF927	2020-05-29
8449B	Agilent	Pre-Amp (1 - 26.5 GHz)	REF913	2020-02-06
Emissions R5	Element	Radiated Test Software	REF9000	N/A

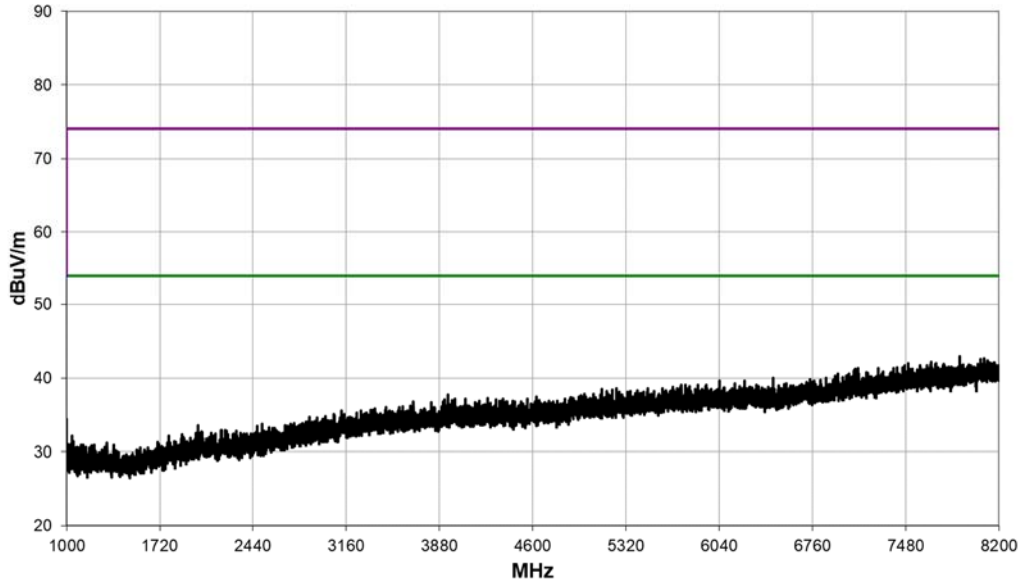
11.6 Test Results

Channel 1; Frequency: 24.125 GHz						
Detector	***Frequency (MHz)***	***Amplitude (dBµV)***	***Factor (dB)***	***Emission level (dBµV/m)***	***Field Strength (µV/m)***	***Limit (µV/m)***
Quasi peak	66.3	48.5	-19.8	28.7	27.2	100.0
Quasi peak	68.3	50.3	-19.5	30.8	34.7	100.0
Quasi peak	69.3	45.5	-19.4	26.1	20.2	100.0
Quasi peak	70.4	49.2	-19.2	30.0	31.6	100.0
Quasi peak	78.4	42.4	-17.9	24.5	16.8	100.0
Quasi peak	82.4	40.6	-17.4	23.2	14.5	100.0
Quasi peak	84.4	41.4	-17.0	24.4	16.6	100.0
Quasi peak	233.1	40.5	-14.8	25.7	19.3	200.0
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						

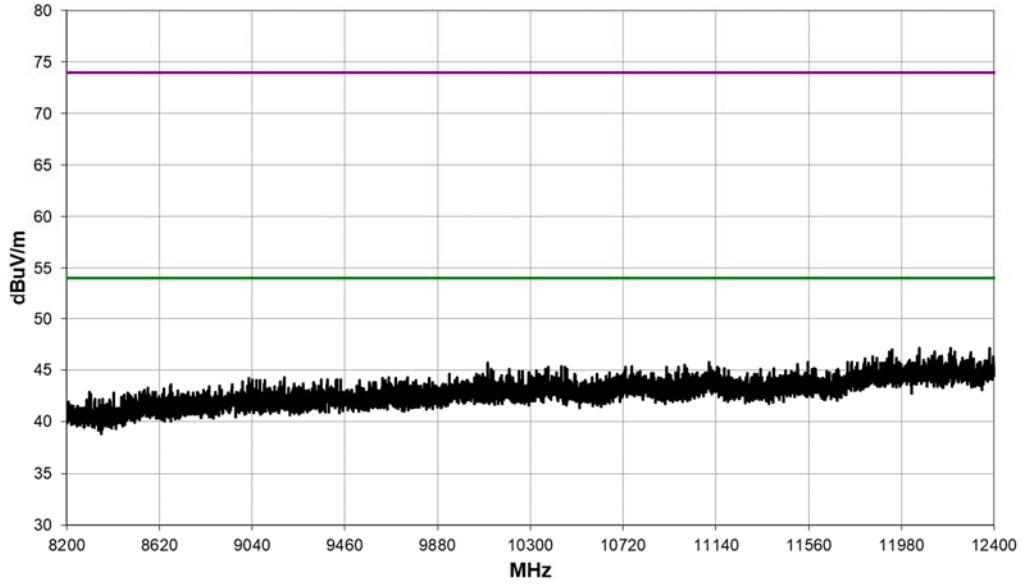
30 MHz to 1 GHz



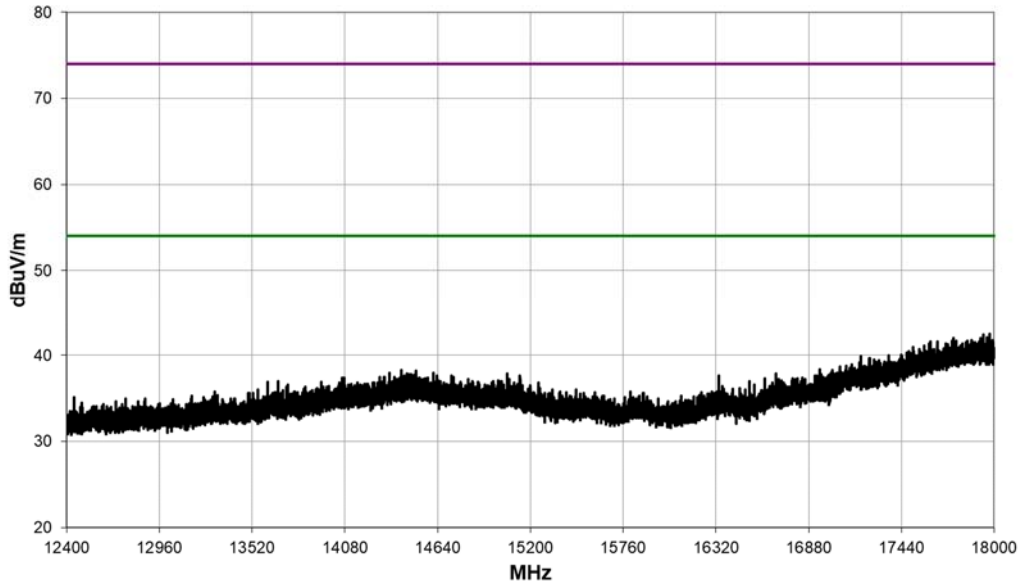
1 GHz to 8.2 GHz



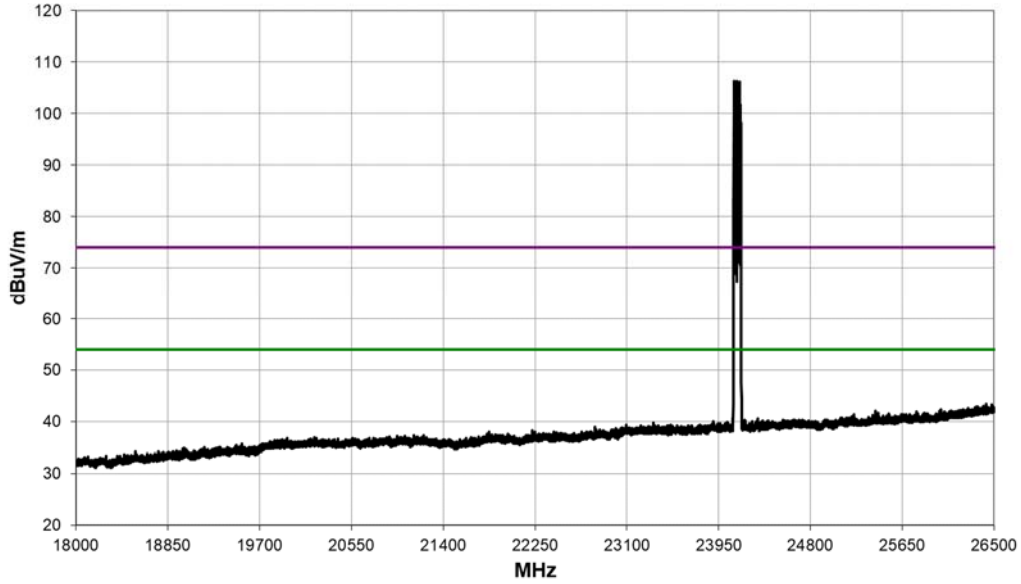
8.2 GHz to 12.4 GHz



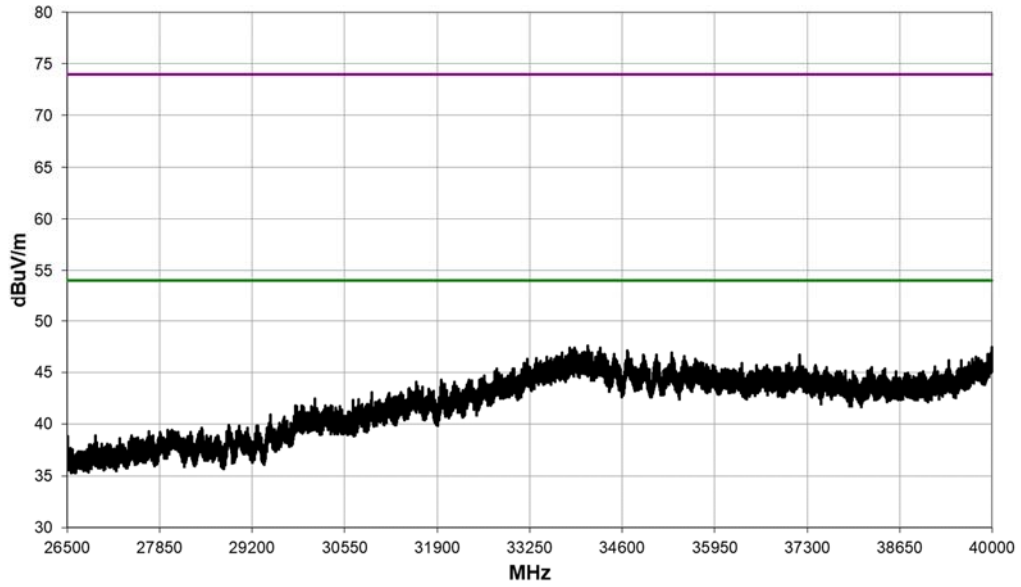
12.4 GHz to 18 GHz



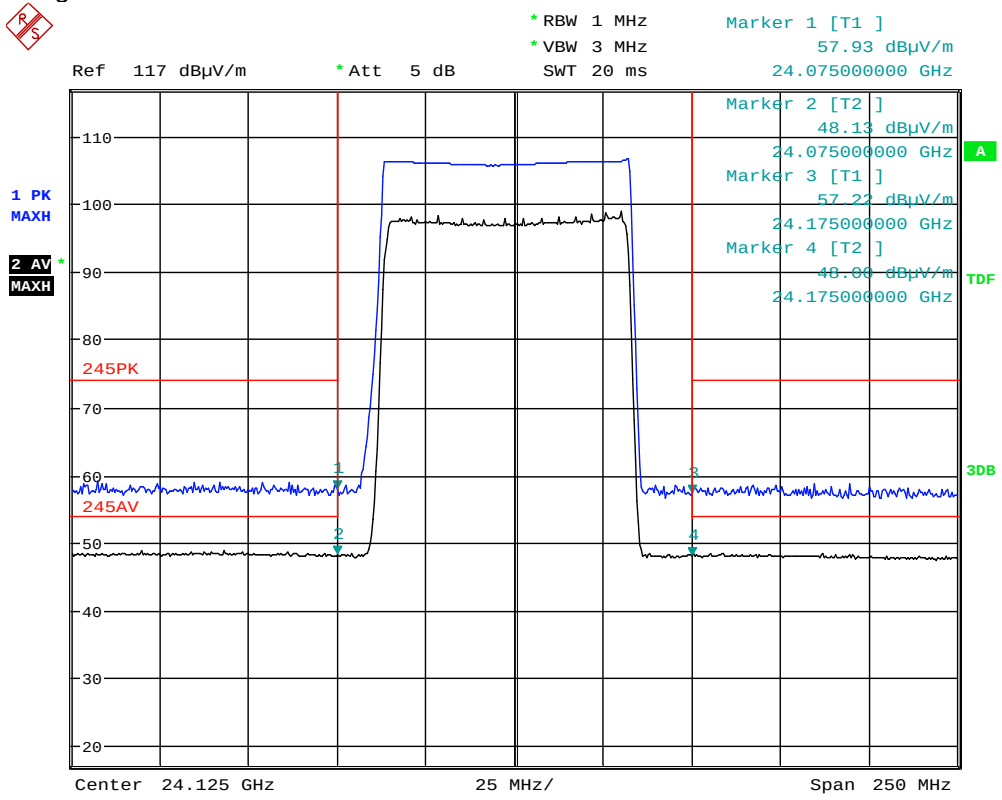
18 GHz to 26.5 GHz



26.5 GHz to 40 GHz

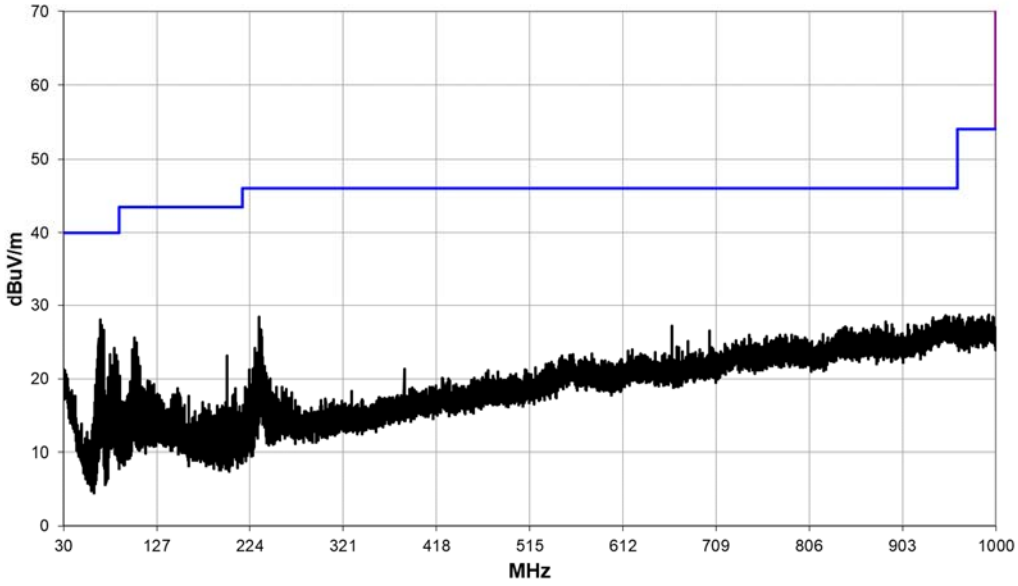


Band Edge

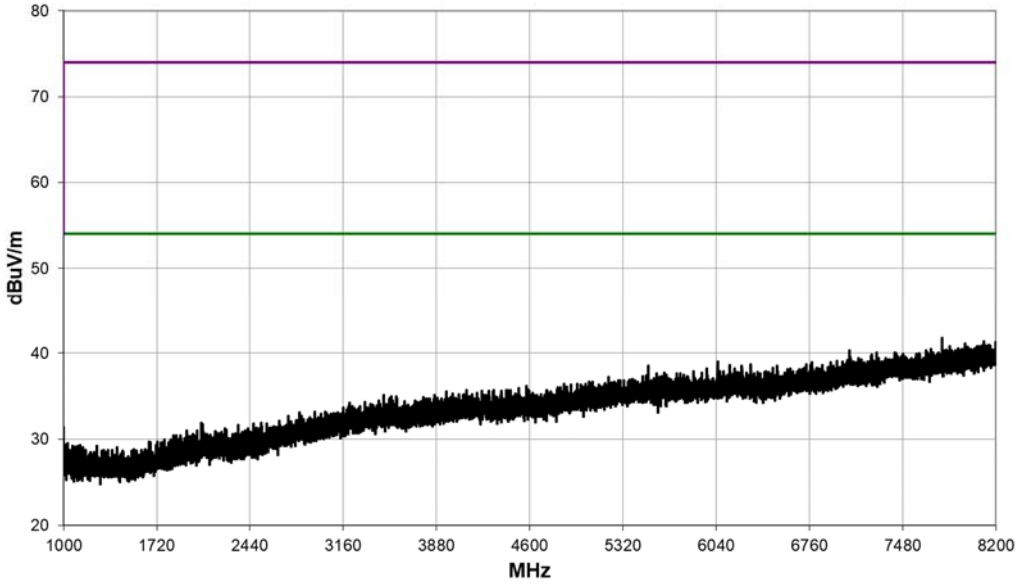

RBW 1 MHz
VBW 3 MHz
SWT 20 ms
Marker 1 [T1]
57.93 dBµV/m
24.075000000 GHz
Marker 2 [T2]
48.13 dBµV/m
24.075000000 GHz
Marker 3 [T1]
57.22 dBµV/m
24.175000000 GHz
Marker 4 [T2]
48.00 dBµV/m
24.175000000 GHz
Ref 117 dBµV/m
Att 5 dB
1 PK
MAXH
2 AV
MAXH
A
TDF
3DB
245PK
245AV
110
100
90
80
70
60
50
40
30
20
Center 24.125 GHz
25 MHz/
Span 250 MHz

Channel 2; Frequency: 24.125 GHz						
Detector	***Frequency (MHz)***	***Amplitude (dBµV)***	***Factor (dB)***	***Emission level (dBµV/m)***	***Field Strength (µV/m)***	***Limit (µV/m)***
Quasi peak	66.3	48.5	-19.8	28.7	27.2	100.0
Quasi peak	68.3	50.3	-19.5	30.8	34.7	100.0
Quasi peak	69.3	45.5	-19.4	26.1	20.2	100.0
Quasi peak	70.4	49.2	-19.2	30.0	31.6	100.0
Quasi peak	78.4	42.4	-17.9	24.5	16.8	100.0
Quasi peak	82.4	40.6	-17.4	23.2	14.5	100.0
Quasi peak	84.4	41.4	-17.0	24.4	16.6	100.0
Quasi peak	233.1	40.5	-14.8	25.7	19.3	200.0
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						

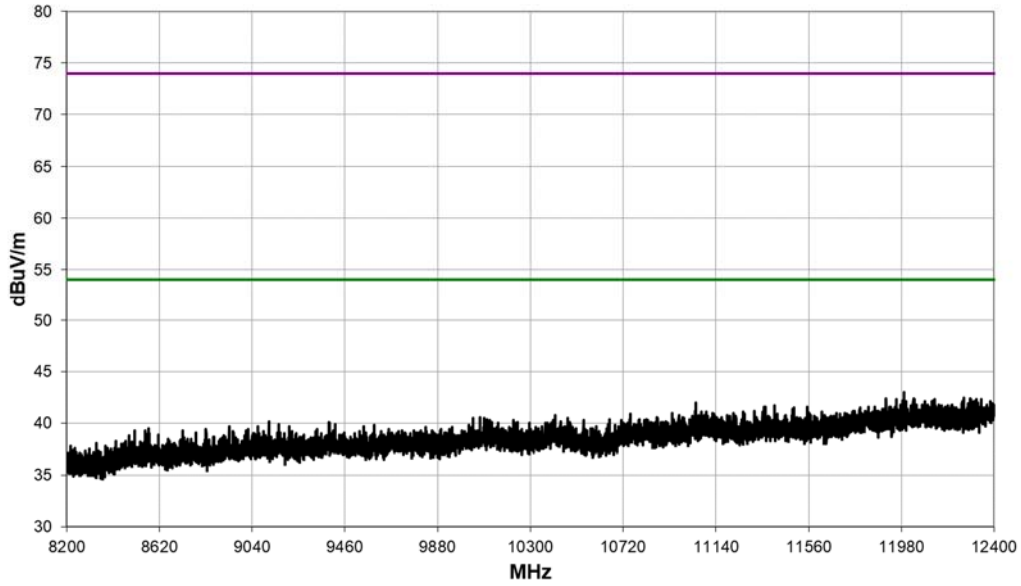
30 MHz to 1 GHz



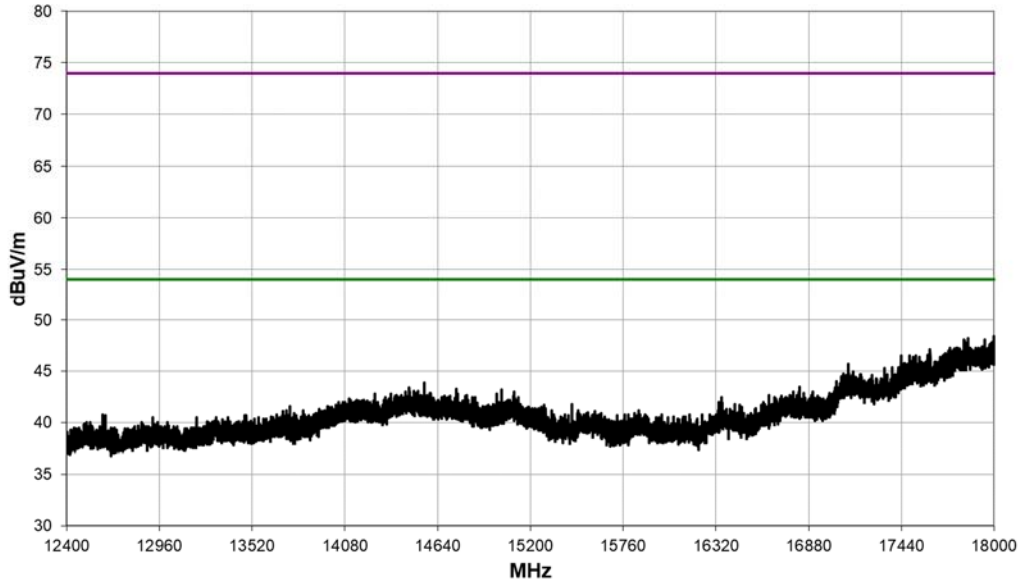
1 GHz to 8.2 GHz



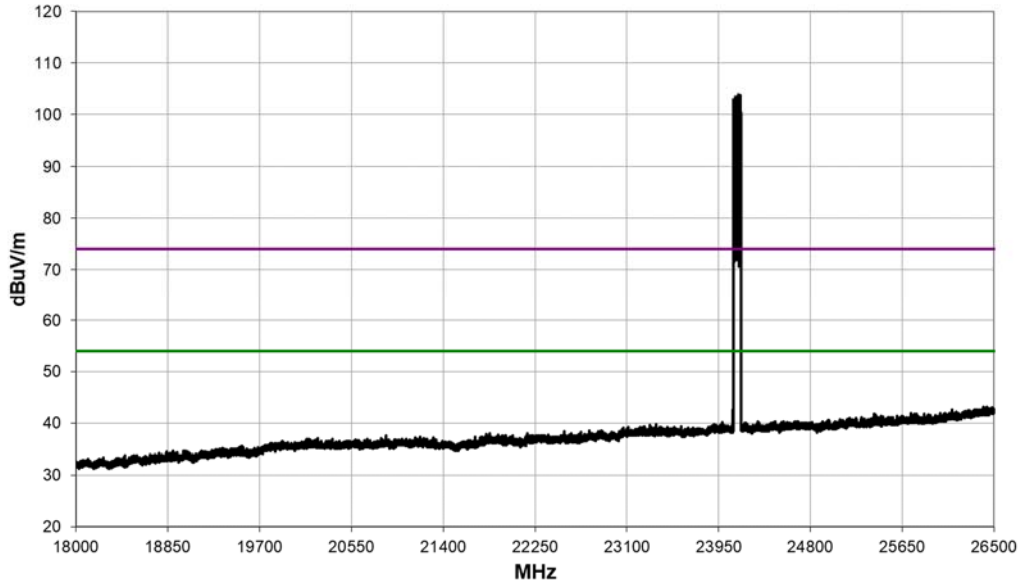
8.2 GHz to 12.4 GHz



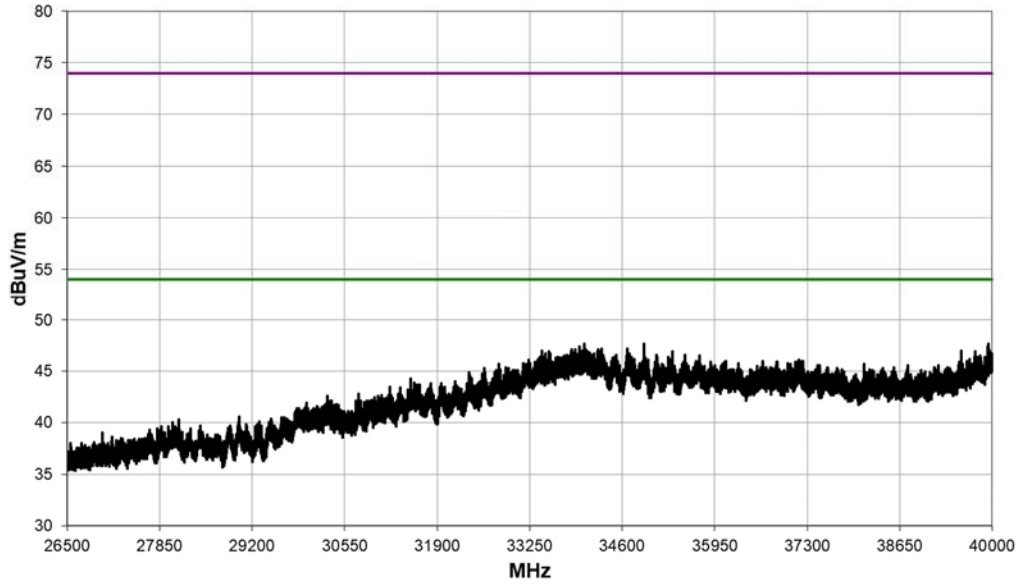
12.4 GHz to 18 GHz



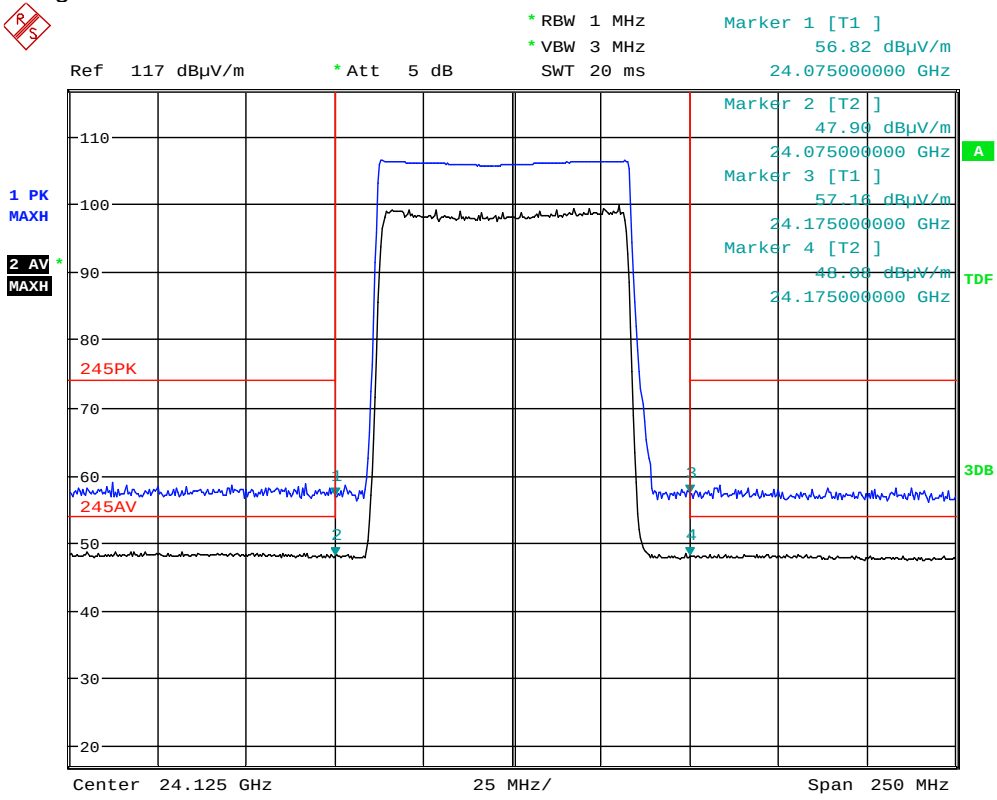
18 GHz to 26.5 GHz



26.5 GHz to 40 GHz



Band Edge


RBW 1 MHz
VBW 3 MHz
SWT 20 ms
Marker 1 [T1]
56.82 dBµV/m
24.075000000 GHz
Marker 2 [T2]
47.90 dBµV/m
24.075000000 GHz
Marker 3 [T1]
57.16 dBµV/m
24.175000000 GHz
Marker 4 [T2]
48.08 dBµV/m
24.175000000 GHz
Ref 117 dBµV/m
Att 5 dB
1 PK
MAXH
2 AV
MAXH
A
TDF
3DB
245PK
245AV
110
100
90
80
70
60
50
40
30
20
Center 24.125 GHz
25 MHz/
Span 250 MHz

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 Hull
Test Chamber:	Screen Room 2
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.2
EUT Frequency Measured:	24.125 GHz
Deviations From Standard:	None
Measurement Detectors:	Quasi-Peak and Average

Environmental Conditions (Normal Environment)

Temperature: 22 °C	+15 ºC to +35 ºC (as declared)
Humidity: 38 % 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.

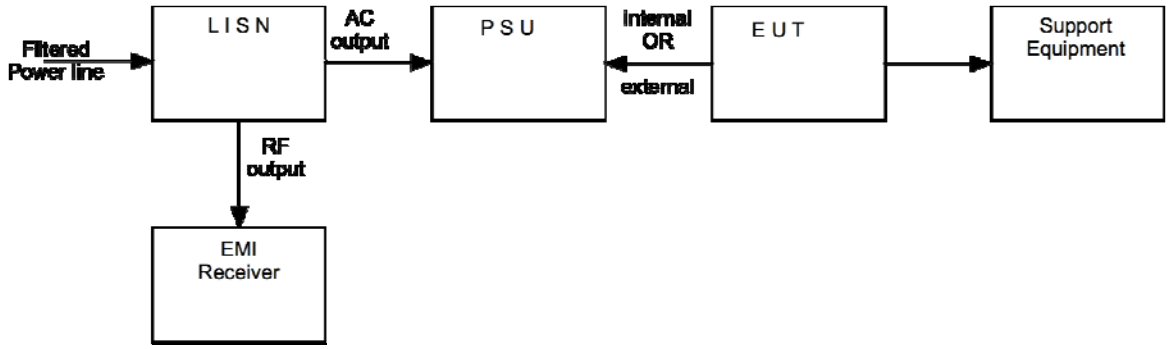
12.4 Test Method

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 Photograph

12 Vdc and 24 Vdc Set-up Photograph

24 Vac Set-up Photograph

12.6 Test Equipment

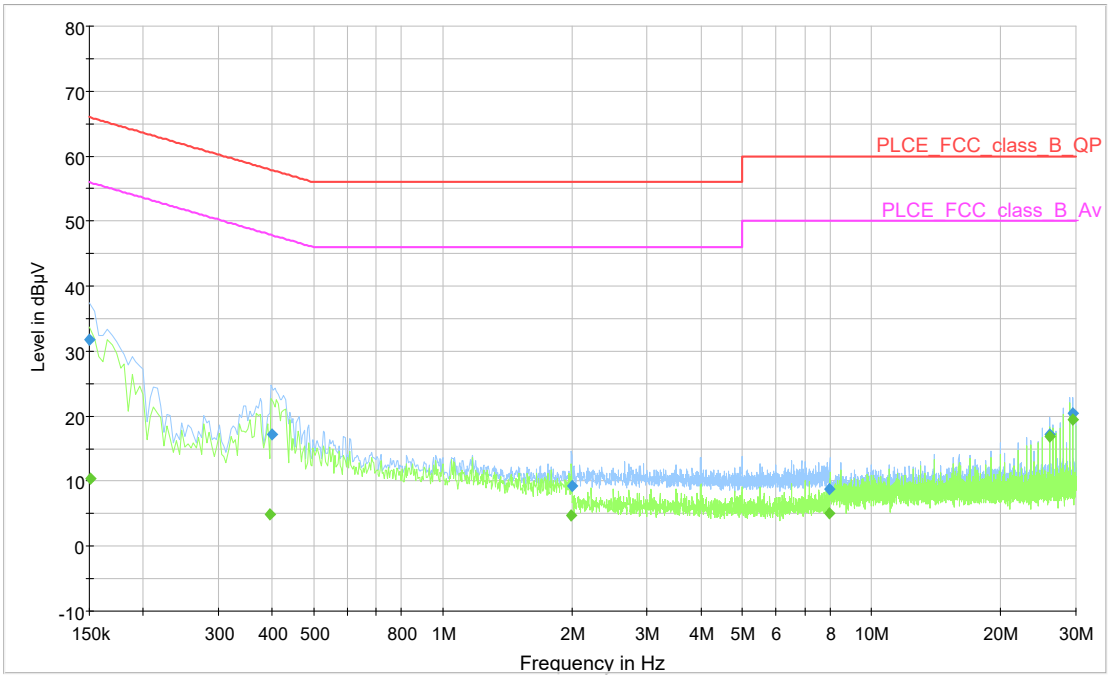
Equipment Description	*Manufacturer*	*Equipment Type*	*Element No*	*Due For Calibration*
Receiver	R&S	ESU40	RFG701	2020-01-18
LISN	R&S	ESH3-Z5	RFG732	2020-05-28
Pulse Limiter	R&S	ESH3-Z2	RFG674	2020-04-15

12.7 Test Results

12 Vdc Supply

Results measured using the quasi-peak detector						
Reference Number	***Frequency (MHz)***	***Conductor***	***Result (dBuV)***	***Specification Limit (dBuV)***	***Margin (dB)***	***Result Summary***
1	0.150	N	31.7	66.0	34.3	PASS
2	0.400	N	17.3	57.9	40.6	PASS
3	2.000	L1	9.2	56.0	46.8	PASS
4	7.999	L1	8.7	60.0	51.3	PASS
5	25.998	L1	17.1	60.0	42.9	PASS
6	29.499	N	20.4	60.0	39.6	PASS

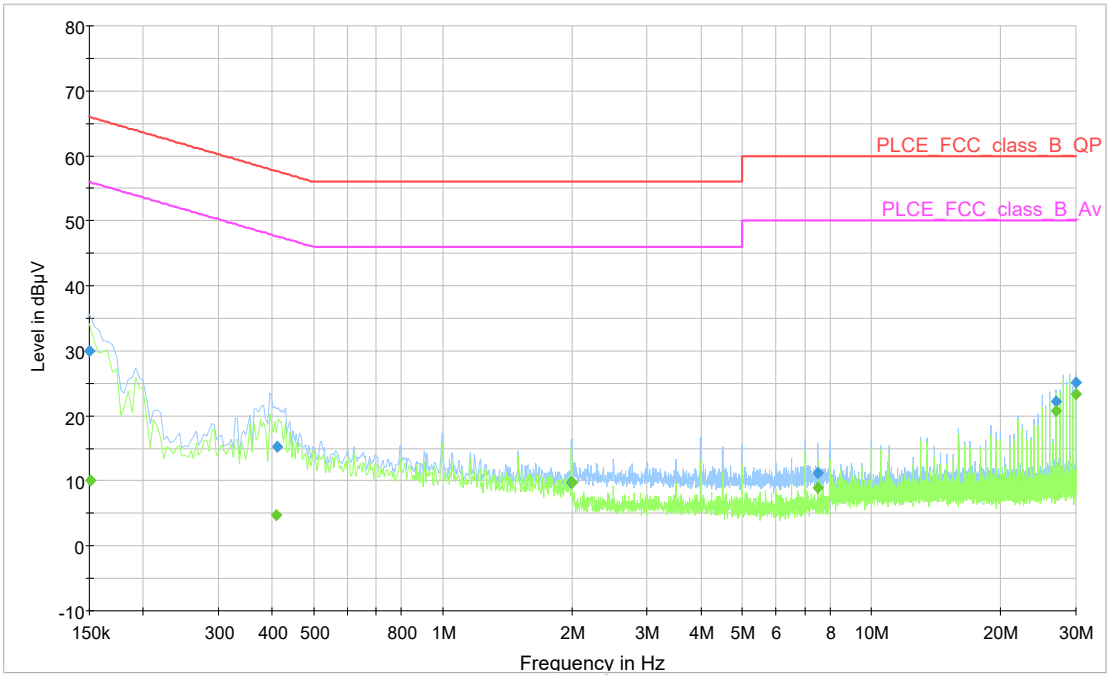
Results measured using the average detector						
Reference Number	***Frequency (MHz)***	***Conductor***	***Result (dBuV)***	***Specification Limit (dBuV)***	***Margin (dB)***	***Result Summary***
1	0.151	N	10.4	56.0	45.5	PASS
2	0.395	N	5.0	48.0	43.0	PASS
3	1.999	L1	4.7	46.0	41.3	PASS
4	7.998	N	5.0	50.0	45.0	PASS
5	25.999	N	16.9	50.0	33.1	PASS
6	29.498	N	19.5	50.0	30.5	PASS



24 Vdc Supply

Results measured using the quasi-peak detector						
Reference Number	***Frequency (MHz)***	***Conductor***	***Result (dBuV)***	***Specification Limit (dBuV)***	***Margin (dB)***	***Result Summary***
1	0.150	N	30.0	66.0	36.0	PASS
2	0.412	N	15.3	57.6	42.3	PASS
3	1.997	N	9.8	56.0	46.2	PASS
4	7.500	L1	11.2	60.0	48.8	PASS
5	26.999	N	22.3	60.0	37.7	PASS
6	30.000	N	25.1	60.0	34.9	PASS

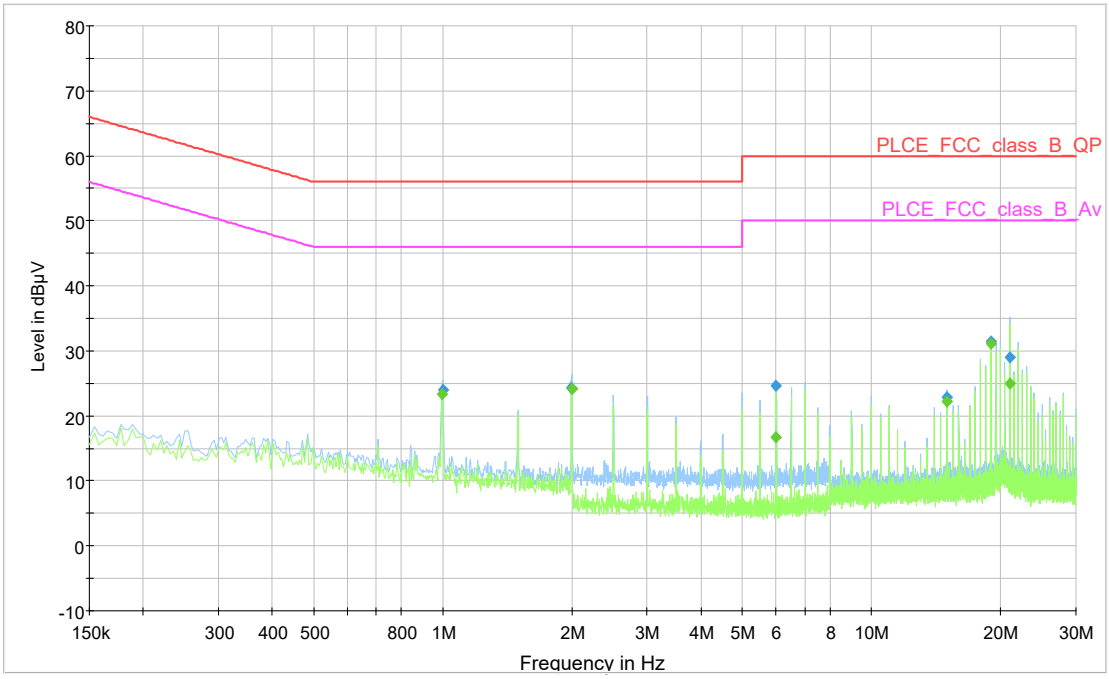
Results measured using the average detector						
Reference Number	***Frequency (MHz)***	***Conductor***	***Result (dBuV)***	***Specification Limit (dBuV)***	***Margin (dB)***	***Result Summary***
1	0.151	N	10.0	56.0	45.9	PASS
2	0.408	N	4.7	47.7	43.0	PASS
3	2.000	N	9.7	46.0	36.3	PASS
4	7.500	L1	9.0	50.0	41.0	PASS
5	27.000	N	20.8	50.0	29.2	PASS
6	30.000	N	23.3	50.0	26.7	PASS



24 Vac Supply

Results measured using the quasi-peak detector						
Reference Number	***Frequency (MHz)***	***Conductor***	***Result (dBuV)***	***Specification Limit (dBuV)***	***Margin (dB)***	***Result Summary***
1	1.000	N	24.0	56.0	32.0	PASS
2	1.999	N	24.4	56.0	31.6	PASS
3	6.000	N	24.6	60.0	35.4	PASS
4	15.000	L1	22.9	60.0	37.1	PASS
5	19.000	L1	31.4	60.0	28.6	PASS
6	21.001	L1	29.1	60.0	30.9	PASS

Results measured using the average detector						
Reference Number	***Frequency (MHz)***	***Conductor***	***Result (dBuV)***	***Specification Limit (dBuV)***	***Margin (dB)***	***Result Summary***
1	0.999	N	23.4	46.0	22.6	PASS
2	2.000	N	24.2	46.0	21.8	PASS
3	5.995	N	16.7	50.0	33.3	PASS
4	15.000	L1	22.2	50.0	27.8	PASS
5	19.000	L1	31.1	50.0	18.9	PASS
6	21.000	L1	25.0	50.0	25.0	PASS



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 Hull
Test Chamber:	Wireless Lab 2
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.9
EUT Frequency Measured:	24.125 GHz
Deviations From Standard:	None
Measurement BW:	1 MHz
Spectrum Analyzer Video BW:	3 MHz
Measurement Span:	200 MHz
Measurement Detector:	Peak

Environmental Conditions (Normal Environment)

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

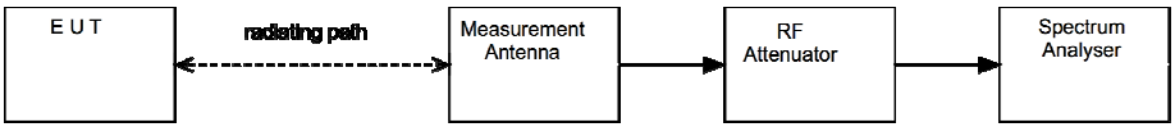
13.3 Test Limit

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

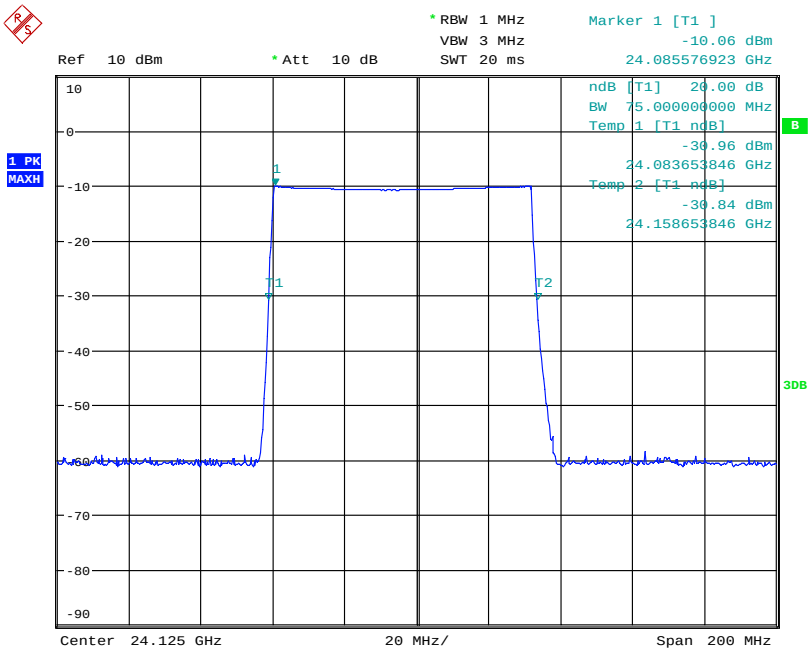


13.5 Test Equipment

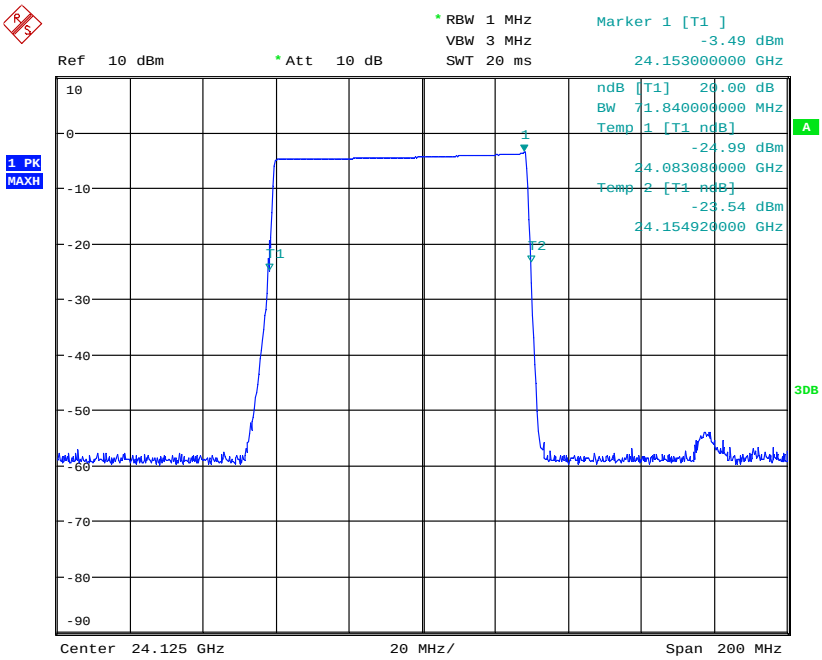
Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
LB-180400-25-C-KF	A Info Inc	Horn Antenna	REF2245	2020-07-25
FSU26	R&S	Spectrum Analyser	REF909	2020-06-21

13.6 Test Results

Channel: 1				
Channel Frequency (GHz)	**F_L (GHz)**	**F_H (GHz)**	**20 dB Bandwidth (MHz)**	**Result**
24.125	24.083654	24.158654	75.000	PASS



Channel: 2				
Channel Frequency (GHz)	**F_L (GHz)**	**F_H (GHz)**	**20 dB Bandwidth (MHz)**	**Result**
24.125	24.083080	24.154920	71.840	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 Hull
Test Chamber:	Wireless Lab 1
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.5 / 6.6
EUT Frequency Measured:	24.125 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: 34 % 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

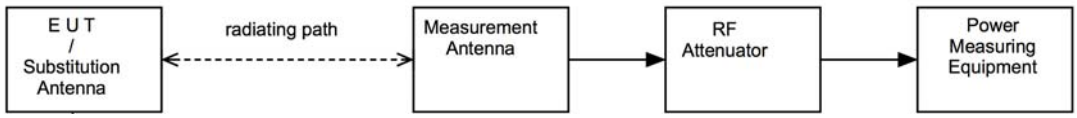
n.b. peak limit is 20 dB above average.

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.

Figure iv Test Setup



14.5 Test Equipment

Equipment Description	*Manufacturer*	*Equipment Type*	*Element No*	*Due For Calibration*
Ferrite Lined Chamber	Rainford	ATS	REF886	2020-07-29
Pre-Amp (1 - 26.5 GHz)	Agilent	8449B	REF913	2020-02-06
Horn Antenna	A Info Inc	LB-180400-25-C-KF	REF2246	2020-07-25
Power Meter	Agilent	N1911A	REF836	2020-08-28
Power Sensor	Agilent	N1922A	REF835	2020-08-28

14.6 Test Results

Channel: 1								
Detector	*Channel Frequency (MHz)*	*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	24125.0	98.0	11.7	34.0	34.4	109.3	291.7	PASS
Average	24125.0	97.5	11.7	34.0	34.4	108.8	275.4	PASS

Channel: 2								
Detector	*Channel Frequency (MHz)*	*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	24125.0	98.0	11.7	34.0	34.4	109.3	291.7	PASS
Average	24125.0	97.6	11.7	34.0	34.4	108.9	278.6	PASS

15 Measurement Uncertainty

Calculated Measurement Uncertainties

All statements of uncertainty are expanded standard uncertainty using a coverage factor of 1.96 to give a 95% confidence:

[1] Carrier power

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

[2] Spurious emissions

Uncertainty in test result (30 MHz to 1 GHz) = **4.6 dB**
Uncertainty in test result (1 GHz to 18 GHz) = **4.7 dB**

[3] AC power line conducted emissions

Uncertainty in test result = **3.4 dB**

[4] Occupied bandwidth

Uncertainty in test result = **15.5%**

[5] Maximum frequency error

Uncertainty in test result (Power Meter) = **0.113 ppm**
Uncertainty in test result (Spectrum Analyser) = **0.265 ppm**

[6] Duty cycle

Uncertainty in test result = **7.98%**