



Radio Test Report

OTT Hydromet GmbH

OTT SVR 100

47 CFR Part 15.245 Effective Date 1st October 2019

FDS: Part 15 Field Disturbance Sensor

Test Date: 10th March 2020 to 18th March 2020

Report Number: 03-11830-1-20 Issue 02

Supersedes Report Number: 03-11830-1-20 Issue 01

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Certificate of Test 11830-1

The equipment noted below has been fully tested by R.N. Electronics Limited and, where appropriate, conforms to the relevant subpart of 47 CFR Part 15C. This is a certificate of test only and should not be confused with an equipment authorisation. Other standards may also apply.

Equipment:	OTT SVR 100
Model Number:	OTT SVR 100
Unique Serial Number:	SVR1-000200
Applicant:	OTT Hydromet GmbH Ludwigstrasse 16 87437 Kempten Germany

Full measurement results are detailed in Report Number:	03-11830-1-20 Issue 02
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Test Standards:	47 CFR Part 15.245 Effective Date 1st October 2019 FDS: Part 15 Field Disturbance Sensor
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DEVIATIONS:

No deviations have been applied.

This certificate relates only to the unit tested as identified by a unique serial number and in the condition at the time it was tested. It does not relate to any other similar equipment and performance of the product before or after the test cannot be guaranteed. Whilst every effort is made to assure quality of testing, type tests are not exhaustive and although no non-conformances may be found, this doesn't exclude the possibility of unit not meeting the intentions of the standard or the requirements of the Federal Regulations, particularly under different conditions to those during testing. Any compliance statements are made reliant on (a) the application of the product and use of the assigned band being acceptable to the FCC and (b) the modes of operation as instructed to us by the Customer based on their specific knowledge of the application and functionality of the EUT. Statements of compliance, where measurements were made, do not include the measurement uncertainty. The measurement uncertainty, where stated, is the expanded uncertainty based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95%.

Date Of Test:	10th March 2020 to 18th March 2020
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Test Engineer:	
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Approved By: Radio Manager	
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Customer Representative:	
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0 Revision History

Issue Number	Revision History	Page Reference(s)
01	First Issue	-
02	47 CFR 15 effective date changed to 2019	1, 2, 7 and 8
	Corrected lower restricted band edge frequency range closest to band and added plot ref note, removed unnecessary additional upper restricted band edge plot ref	19
	Added duplicate of radiated emissions plot 21-24GHz to band edge plot section and removed unnecessary upper restricted band pots	49

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2 Equipment under test (EUT)

2.1 Equipment specification

Applicant	OTT Hydromet GmbH Ludwigstrasse 16 87437 Kempten Germany	
Manufacturer of EUT	Geolux d.o.o.	
Full Name of EUT	OTT SVR 100	
Model Number of EUT	OTT SVR 100	
Serial Number of EUT	SVR1-000200	
Date Received	6th February 2020	
Date of Test:	10th March 2020 to 18th March 2020	
Purpose of Test	To demonstrate design compliance to the relevant rules of Chapter 47 of the Code of Federal Regulations.	
Date Report Issued	22 nd April 2020	
Main Function	Water surface velocity measurement using Doppler Radar	
Information Specification	Height	135 mm
	Width	114 mm
	Depth	90 mm
	Weight	0.75 kg
	Voltage	9 - 27 VDC
	Current	112 mA

2.2 Configurations for testing

General Parameters	
EUT Normal use position	Outdoor applications
Choice of model(s) for type tests	Sample
Antenna details	Integral 16 dBi gain
Antenna port	No
Baseband Data port (yes/no)?	No
Highest Signal generated in EUT	24.125 GHz
Lowest Signal generated in EUT	32.768 kHz
Hardware Version	Rev D
Firmware Version	6.0.8
Technology Type	Doppler Radar
Geo-location (yes/no)	No
TX Parameters	
Alignment range – transmitter	24.125 GHz
EUT Declared Modulation Parameters	CW
EUT Declared Power level	20 dBm EIRP
EUT Declared Signal Bandwidths	CW
EUT Declared Channel Spacing's	Single frequency
EUT Declared Duty Cycle	100%
Unmodulated carrier available?	Yes
Declared frequency stability	35 ppm
RX Parameters	
Alignment range – receiver	24.125 GHz
EUT Declared RX Signal Bandwidth	15 kHz
FCC Parameters	
FCC Transmitter Class	FDS: Part 15 Field Disturbance Sensor

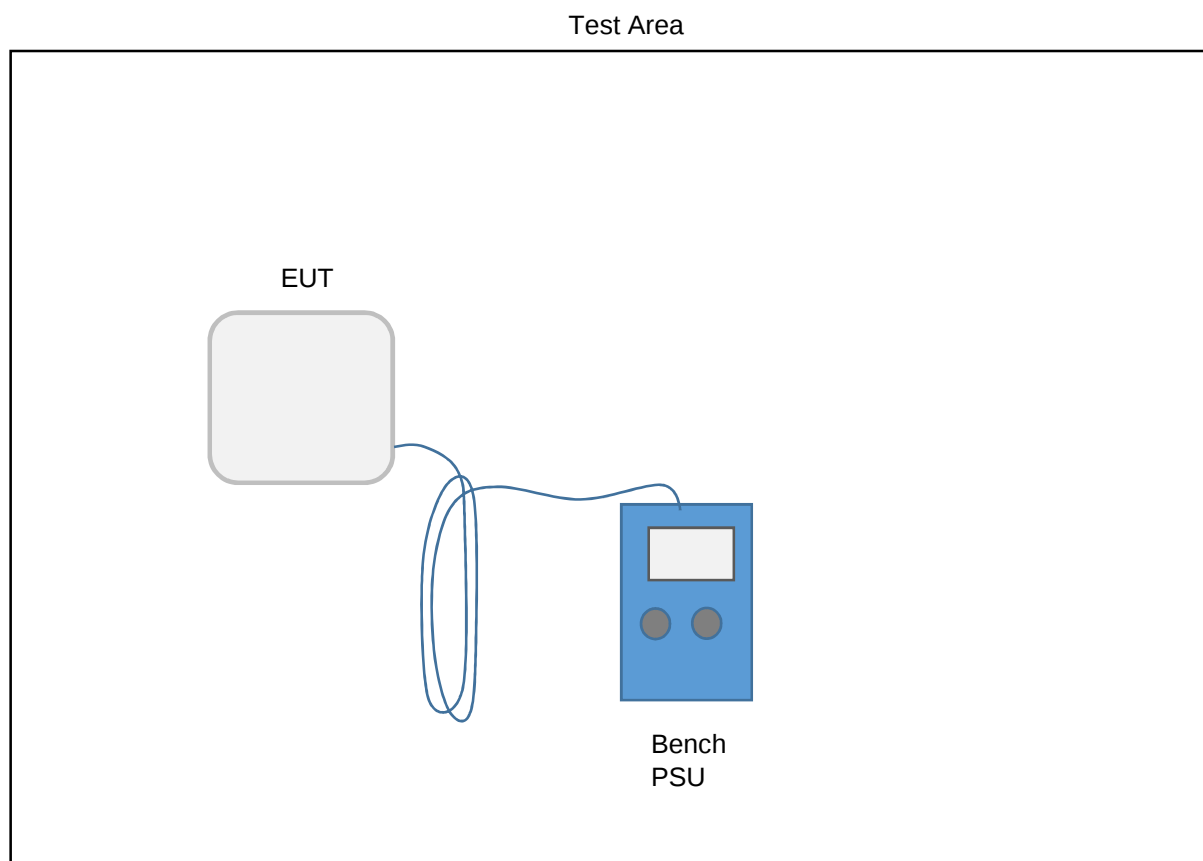
2.3 Functional description

Doppler radar in 24 GHz band for measurement of the speed of moving water. Sensor is measuring Doppler shift in radar reflection to determine surface velocity of the water.

2.4 Modes of operation

Mode Reference	Description	Used for testing
TX1	Transmitting continuously at 24.125 GHz (CW)	Yes

2.5 Emissions configuration



The unit was powered from a bench power supply via the cable assembly supplied with the EUT. Upon power-up, the EUT transmitted at 100% duty. The maximum RF output power was set by the manufacturer during production. For radiated emissions, a pre-test was performed to check for the worst-case emissions configuration. The supply voltage from the power supply was varied from 9 – 27 VDC and emissions were assessed. It was found that there was no perceivable difference in emissions relating to the supply voltage, and therefore for full-test the power supply was set to 12 VDC.

For AC conducted emissions, tests were performed with the EUT powered using the bench top power supply.

2.5.1 Signal leads

Port Name	Cable Type	Connected
J1	12-pin M12 connector, 10 metre cable	Yes

3 Summary of test results

The OTT SVR 100 was tested for compliance to the following standard:

47 CFR Part 15.245 Effective Date 1st October 2019
FDS: Part 15 Field Disturbance Sensor

Any compliance statements are made reliant on (a) the application of the product and use of the assigned band being acceptable to the FCC and (b) the modes of operation as instructed to us by the Customer based on their specific knowledge of the application and functionality of the EUT. Whilst every effort is made to assure quality of testing, type tests are not exhaustive and although no non-conformances may be found, this doesn't exclude the possibility of equipment not meeting the intentions of the standard or the essential requirements of the directive, particularly under different conditions to those during testing. Statements of compliance, where measurements were made, do not include the measurement uncertainty. The measurement uncertainty, where stated, is the expanded uncertainty based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

Title	References	Results
Transmitter Tests		
1. AC power line conducted emissions	47 CFR Part 15C Part 15.207	PASSED
2. Radiated emissions 9 - 150 kHz	47 CFR Part 15C Part 15.209	PASSED
3. Radiated emissions 150 kHz - 30 MHz	47 CFR Part 15C Part 15.209	PASSED
4. Radiated emissions 30 MHz -1 GHz	47 CFR Part 15C Part 15.245 & 15.209	PASSED
5. Radiated emissions above 1 GHz	47 CFR Part 15C Part 15.245 & 15.209	PASSED ¹
6. Effective radiated power field strength	47 CFR Part 15C Part 15.245	PASSED
7. Occupied bandwidth	47 CFR Part 15C Part 15.215(c)	PASSED
8. Band Edge Compliance	47 CFR Part 15C Part 15.245 & 15.209	PASSED
9. Duty cycle	47 CFR Part 15C Part 15.35(c)	NOT APPLICABLE ²

¹ Spectrum investigated up to a frequency of 100GHz based on highest channel/ signal generated in equipment of 24.125 GHz.

² No test requirement. The applicant has confirmed the duty cycle to be 100%.

4 Specifications

The tests were performed and operated in accordance with R.N. Electronics Ltd procedures and the relevant standards listed below.

4.1 Relevant standards

Ref.	Standard Number	Version	Description
4.1.1	47 CFR Part 15C	2019	Federal Communications Commission PART 15 – RADIO FREQUENCY DEVICES
4.1.2	ANSI C63.10	2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
4.1.3	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

4.2 Deviations

No deviations were applied.

5 Tests, methods and results

5.1 AC power line conducted emissions

5.1.1 Test methods

Test Requirements:	47 CFR Part 15C Part 15.207 [Reference 4.1.1 of this report]
Test Method:	ANSI C63.10 Clause 6.2 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15C Part 15.207 [Reference 4.1.1 of this report]

5.1.2 Configuration of EUT

The EUT was placed on a wooden table 0.8m above the ground plane and was powered using a bench top power supply at 120 V AC 60Hz. The power supply was connected to a LISN via a 1m mains cable.

Details of the Peripheral and Ancillary Equipment connected for this test are listed in section 10.
The EUT was operated in TX1 mode which was the only operational mode available.

5.1.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment listed in the 'Test Equipment' Section. Measurements were made on the live and neutral conductors using both average and quasi-peak detection.

At least 6 signals within 20dB and/or all signals within 10dB of the limit were investigated. Tests were performed in Test Site F.

5.1.4 Test equipment

E150, E035, ZSW1, E624, E411, TMS937, TMS938

See Section 9 for more details

5.1.5 Test results

Temperature of test environment	20°C
Humidity of test environment	50%
Pressure of test environment	101kPa

Band	24075-24175 MHz
Power Level	20 dBm
Channel Spacing	Single Channel
Mod Scheme	CW
Single channel	24125 MHz

Plot refs
11830-1 Cond 1 AC Live 150k-30M Average
11830-1 Cond 1 AC Live 150k-30M Quasi-Peak
11830-1 Cond 1 AC Neutral 150k-30M Average
11830-1 Cond 1 AC Neutral 150k-30M Quasi-Peak

Peak detector "Max held" Analyser plots against the Quasi-Peak / Average limit line(s) can be found in Section 6 of this report.

LIMITS:

15.207: as given in the above tables / drawn on the respective plots.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:

150kHz to 30MHz ± 3.6 dB

5.2 Radiated emissions 9 - 150 kHz

5.2.1 Test methods

Test Requirements:	47 CFR Part 15C Part 15.209 [Reference 4.1.1 of this report]
Test Method:	ANSI C63.10 Clause 6.4 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15C Part 15.209/15.245 [Reference 4.1.1 of this report]

5.2.2 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The EUT was rotated in all three orthogonal planes. Radiated Emissions testing was performed whilst powered using a bench top power supply.

The EUT was operated in TX1 mode.

5.2.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. Measurements were made in a semi-anechoic chamber (pre-scan) with any final measurements required performed on an OATS without a ground plane. The antenna was placed 1m above the ground. The equipment was rotated 360 degrees to record the worst case emissions.

At least 6 signals within 20dB and all signals within 10dB of the limit were investigated.

Tests were performed using Test Site H.

5.2.4 Test equipment

TMS81, ZSW1, E534, E535

See Section 9 for more details

5.2.5 Test results

Temperature of test environment	20°C
Humidity of test environment	50%
Pressure of test environment	101kPa

Band	24075-24175 MHz
Power Level	20 dBm
Channel Spacing	Single Channel
Mod Scheme	CW
Single channel	24125 MHz

Plot refs
11830-1 Rad 1 9k-150kHz Para
11830-1 Rad 1 9k-150kHz Perp

No emissions were observed within 20dB of limits.

Peak detector "Max held" Analyser plots against the Quasi-Peak / Average limit line(s) can be found in Section 6 of this report.

LIMITS:

15.209 limits are applicable in the restricted bands of 15.205 with the relevant detector.

15.245 other emissions, outside the intentional band, must be attenuated by at least 50dB from the level of the fundamental or meet the general limits of 15.209 whichever is the lesser attenuation.

The general limits of 15.209 are as drawn on the respective plots.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:

9kHz - 30MHz ± 3.9 dB

5.3 Radiated emissions 150 kHz - 30 MHz

5.3.1 Test methods

Test Requirements: 47 CFR Part 15C Part 15.209 [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 6.4 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15C Part 15.209/15.245 [Reference 4.1.1 of this report]

5.3.2 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The EUT was rotated in all three orthogonal planes. Radiated Emissions testing was performed whilst powered using a bench power supply. The EUT was operated in TX1 mode.

5.3.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. Measurements were made in a semi-anechoic chamber (pre-scan) with any final measurements required performed on an OATS without a ground plane. The antenna was placed 1m above the ground. The equipment was rotated 360 degrees to record the worst case emissions. At least 6 signals within 20dB and all signals within 10dB of the limit were investigated.

Tests were performed using Test Site H.

5.3.4 Test equipment

TMS81, ZSW1, E534, E535

See Section 9 for more details

5.3.5 Test results

Temperature of test environment 20°C
Humidity of test environment 50%
Pressure of test environment 101kPa

Band	24075-24175 MHz
Power Level	20 dBm
Channel Spacing	Single Channel
Mod Scheme	CW
Single channel	24125 MHz

Plot refs
11830-1 Rad 1 150k-30MHz Para
11830-1 Rad 1 150k-30MHz Perp

No emissions were observed within 20dB of limits.

Peak detector "Max held" Analyser plots against the Quasi-Peak / Average limit line(s) can be found in Section 6 of this report.

LIMITS:

15.209 limits are applicable in the restricted bands of 15.205 with the relevant detector.
15.245 other emissions, outside the intentional band, must be attenuated by at least 50dB from the level of the fundamental or meet the general limits of 15.209 whichever is the lesser attenuation.
The general limits of 15.209 are as drawn on the respective plots.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:

9kHz - 30MHz ± 3.9 dB

File Name: OTT Hydromet GmbH.11830-1 Issue 02
QMF21J - Issue 05 - RNE Issue 03; 47 CFR Part 15C 2019

5.4 Radiated emissions 30 MHz -1 GHz

5.4.1 Test methods

Test Requirements: 47 CFR Part 15C Part 15.245 & 15.209 [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 6.5 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15C Part 15.209/15.245 [Reference 4.1.1 of this report]

5.4.2 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The EUT was rotated in all three orthogonal planes. Radiated Emissions testing was performed whilst powered using a bench power supply. The EUT was operated in TX1 mode.

5.4.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. The equipment was rotated 360 degrees and the antenna scanned 1 – 4 metres in both horizontal and vertical polarisations to record the worst case emissions.

At least 6 signals within 20dB and all signals within 10dB of the limit were investigated.

Tests were performed using Test Site H.

5.4.4 Test equipment

E914, E745, NSA-H, ZSW1, E624, E411

See Section 9 for more details

5.4.5 Test results

Temperature of test environment 20°C
Humidity of test environment 50%
Pressure of test environment 101kPa

Band	24075-24175 MHz
Power Level	20 dBm
Channel Spacing	Single Channel
Mod Scheme	CW
Single channel	24125 MHz

Plot refs
11830-1 Rad 1 VHF Horiz
11830-1 Rad 1 VHF Vert
11830-1 Rad 1 UHF Horiz
11830-1 Rad 1 UHF Vert

Vertical signal list

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	QP Amp (dBuV/m)	QP -Lim (dB)
1	46.551	27.9	22.3	-17.7
2	160.000	30.3	28.6	-14.9
3	200.000	39.4	38.5	-5.0
4	240.000	32.6	30.3	-15.7
5	280.005	28.8	24.2	-21.8

6	481.770	30.2	24.3	-21.7
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Horizontal signal list

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	QP Amp (dBuV/m)	QP -Lim (dB)
1	46.578	28.1	22.4	-17.6
2	120.000	26.9	23.8	-19.7
3	150.000	25.1	22.0	-21.5
4	160.000	31.9	30.7	-12.8
5	200.000	42.6	42.0	-1.5
6	240.000	39.1	37.6	-8.4
7	280.000	32.8	30.1	-15.9
8	508.439	30.5	24.8	-21.2

Peak detector "Max held" Analyser plots against the Quasi-Peak / Average limit line(s) can be found in Section 6 of this report.

LIMITS:

15.209 limits are applicable in the restricted bands of 15.205 with the relevant detector.

15.245 other emissions, outside the intentional band, must be attenuated by at least 50dB from the level of the fundamental / meet the general limits of 15.209.

The general limits of 15.209 are as drawn on the respective plots.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:

30MHz - 1000MHz ± 6.1 dB

5.5 Radiated emissions above 1 GHz

5.5.1 Test methods

Test Requirements:	47 CFR Part 15C Part 15.245 & 15.209 [Reference 4.1.1 of this report]
Test Method:	ANSI C63.10 Clause 6.6 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15C Part 15.245 & 15.209 [Reference 4.1.1 of this report]

5.5.2 Configuration of EUT

The EUT was placed on a 1.5 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The EUT was rotated in all three orthogonal planes. Radiated Emissions testing was performed whilst powered using a bench top power supply.

The EUT was operated in TX1 mode.

5.5.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below.

Measurements were made in a semi-anechoic chamber with appropriate absorbing material for use in this range. Horn antennas were used at heights where the whole of the EUT was contained within the main beam. The EUT was rotated through 360 degrees to record the worst case emissions. A measurement distance of 3m was used between the test range 1 - 6GHz, 1.2m was used in the test range 6 - 18GHz and 0.3m was used in the test range 18 - 40GHz. A measurement distance of 0.1m was used in the test range 40 - 100GHz. Measurements were performed with the measurement antenna configured in both horizontal and vertical polarisations up to 18 GHz and above this frequency range volumetric measurements were performed.

At least 6 signals within 20dB and all signals within 10dB of the limit were investigated.

Tests were performed using Test Site A and Test Site H.

5.5.4 Test equipment

E296-2, E296-4, E296-5, E296-6, E330, E412, E485, E487, E550, E580, E717, E718, E777, F015, TMS78, TMS79

See Section 9 for more details

5.5.5 Test results

Temperature of test environment	20°C
Humidity of test environment	50%
Pressure of test environment	101kPa

Setup Table

Band	24075-24175 MHz
Power Level	20 dBm
Channel Spacing	Single Channel
Mod Scheme	CW
Single channel	24125 MHz

Spurious Frequency (MHz)	Measured Peak Level (dBµV/m)	Difference to Peak Limit (dB)	Measured Average Level (dBµV/m)	Difference to Average Limit (dB)	EUT Polarisation	Antenna Polarisation
No emissions within 20 dB of the limit were observed						

Plots
11830-1 Rad 1 1-2GHz Horiz
11830-1 Rad 1 1-2GHz Vert
11830-1 Rad 1 2-5GHz Horiz
11830-1 Rad 1 2-5GHz Vert
11830-1 Rad 1 5-6GHz Horiz
11830-1 Rad 1 5-6GHz Vert
11830-1 Rad 1 6upto10GHz Horiz
11830-1 Rad 1 6upto10GHz Vert
11830-1 Rad 1 10upto12_5GHz Horiz
11830-1 Rad 1 10upto12_5GHz Vert
11830-1 12.5 - 15 GHz Horiz
11830-1 12.5 - 15 GHz Vert
11830-1 15 - 18 GHz Horiz
11830-1 15 - 18 GHz Vert
11830-1 18 - 21 GHz Volumetric
11830-1 21 - 24 GHz Volumetric
11830-1 24 - 26.5 GHz Volumetric
11830-1 TX Radiated Emissions (Volumetric) 26.5 - 30 GHz
11830-1 TX Radiated Emissions (Volumetric) 30 - 34 GHz
11830-1 TX Radiated Emissions (Volumetric) 31.1 - 31.4 GHz
11830-1 TX Radiated Emissions (Volumetric) 31.4 - 31.7 GHz
11830-1 TX Radiated Emissions (Volumetric) 31.7 - 32 GHz
11830-1 TX Radiated Emissions (Volumetric) 34 - 38 GHz
11830-1 TX Radiated Emissions (Volumetric) 36.3 - 36.6 GHz
11830-1 TX Radiated Emissions (Volumetric) 38 - 40 GHz
11830-1 TX Radiated Emissions (Volumetric) 40 - 44 GHz
11830-1 TX Radiated Emissions (Volumetric) 44 - 48 GHz
11830-1 TX Radiated Emissions (Volumetric) 48 - 52 GHz
11830-1 TX Radiated Emissions (Volumetric) 52 - 56 GHz
11830-1 TX Radiated Emissions (Volumetric) 56 - 60 GHz
11830-1 TX Radiated Emissions (Volumetric) 60 - 64 GHz
11830-1 TX Radiated Emissions (Volumetric) 64 - 68 GHz
11830-1 TX Radiated Emissions (Volumetric) 68 - 72 GHz
11830-1 TX Radiated Emissions (Volumetric) 72 - 75 GHz
11830-1 TX Radiated Emissions (Volumetric) 75 - 79 GHz
11830-1 TX Radiated Emissions (Volumetric) 79 - 83 GHz
11830-1 TX Radiated Emissions (Volumetric) 83 - 87 GHz
11830-1 TX Radiated Emissions (Volumetric) 87 - 91 GHz
11830-1 TX Radiated Emissions (Volumetric) 91 - 95 GHz
11830-1 TX Radiated Emissions (Volumetric) 95 - 99 GHz
11830-1 TX Radiated Emissions (Volumetric) 99 - 100 GHz

Max held analyser plots against the Average limit line can be found in Section 6 of this report.

LIMITS:

Harmonic emissions in the restricted bands below 17.7 GHz, as specified in §15.205, shall not exceed the field strength limits shown in §15.209. Harmonic emissions in the restricted bands at and above 17.7 GHz shall not exceed the following field strength limits: For the second and third harmonics of field disturbance sensors operating in the 24075-24175 MHz band and for other field disturbance sensors designed for use only within a building or to open building doors, 25.0 mV/m. For all other field disturbance sensors, 7.5 mV/m.

15.245 other emissions, outside the intentional band, must be attenuated by at least 50dB from the level of the fundamental / meet the general limits of 15.209.

The general limits of 15.209 are as drawn on the respective plots.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:
1 – 18 GHz ± 3.5 dB, 18 – 26.5 GHz ± 3.9 dB, 26.5 – 60 GHz ± 3.9 dB, 60 – 100 GHz ± 4.4 dB

5.6 Effective radiated power field strength

5.6.1 Test methods

Test Requirements:	47 CFR Part 15C Part 15.245 [Reference 4.1.1 of this report]
Test Method:	ANSI C63.10 Clause 6.6 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15C Part 15.245 & 15.209(a) [Reference 4.1.1 of this report]

5.6.2 Configuration of EUT

The EUT was placed on a 1.5 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was rotated in all three orthogonal planes to maximise emissions. Final measurements were taken at 3m. The EUT was operated in TX1 mode.

5.6.3 Test procedure

Tests were made in accordance with the Test Method noted above using the measuring equipment listed in the 'Test Equipment used' section. The power stated is Peak field strength in maximised EUT orientation and measuring antenna polarisation. Tests were performed in test site H.

5.6.4 Test equipment

E411, E624, LPE333, TMS79

See Section 9 for more details

5.6.5 Test results

Temperature of test environment	20°C
Humidity of test environment	50%
Pressure of test environment	101kPa

Band	24075-24175 MHz
Power Level	20 dBm
Channel Spacing	Single Channel
Mod Scheme	CW
Single channel	24125 MHz

	Single channel
Peak Level (dBµV/m) @3m	117.9
Plot reference	11830-1 FS 3 metres
Antenna Polarisation	Vert
EUT Polarisation	Side

Plot can be found in section 6.

LIMITS:

FCC 15.125: Fundamental frequency 24075 - 24175 MHz, 2500 millivolt/metre @ 3 metres (128 dBuV/m)

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:

±3.9dB

5.7 Occupied bandwidth

5.7.1 Test methods

Test Requirements: 47 CFR Part 15C Part 15.215(c) [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 6.6 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15C Part 15.215(c) [Reference 4.1.1 of this report]

5.7.2 Configuration of EUT

The EUT was placed on a 1.5 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The EUT was operated in TX1 mode.

5.7.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. A 510 Hz RBW, 5.1 kHz VBW, auto sweep time and max hold settings were used for the 20dB bandwidth.

Tests were performed using Test Site H.

5.7.4 Test equipment

E411, E624, LPE333, TMS79

See Section 9 for more details

5.7.5 Test results

Temperature of test environment 20°C
Humidity of test environment 50%
Pressure of test environment 101kPa

Band	24075-24175 MHz
Power Level	20 dBm
Channel Spacing	Single Channel
Mod Scheme	CW
Single channel	24125 MHz

	Single channel
20dB Bandwidth (MHz) at Nominal Temp & Volts	0.0168
Plot for 20dB bandwidth	11830-1 OBW 0.5kHz RBW

LIMITS:

The 20dB bandwidth of the emission must be contained within the designated frequency band.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:
<± 1.9 %

5.8 Band Edge Compliance

5.8.1 Test methods

Test Requirements: 47 CFR Part 15C Part 15.245 & 15.209 [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 6.6 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15C Part 15.209/15.245 [Reference 4.1.1 of this report]

5.8.2 Configuration of EUT

The EUT was placed on a 1.5 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres.

The EUT was operated in TX1 mode.

5.8.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. The EUT was placed on a 1.5 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The EUT was rotated in all three orthogonal planes. Radiated Emissions testing was performed whilst powered using a bench power supply.

The EUT was operated in TX1 mode.

5.8.4 Test equipment

E296-2, E296-4, E296-5, E296-6, E330, E412, E485, E487, E550, E580, E717, E718, E777, F015

See Section 9 for more details

5.8.5 Test results

Temperature of test environment 20°C
Humidity of test environment 50%
Pressure of test environment 101kPa

Band	24075-24175 MHz
Power Level	20 dBm
Channel Spacing	Single Channel
Mod Scheme	CW
Single channel	24125 MHz

Restricted Band Edges	Single channel
Average Plot reference	11830-1 TX Radiated Emissions (Volumetric) 31.1 - 31.4 GHz
	11830-1 TX Radiated Emissions (Volumetric) 31.4 - 31.7 GHz
	11830-1 TX Radiated Emissions (Volumetric) 31.7 - 32 GHz
	11830-1 21 - 24 GHz Volumetric

The restricted bands closest to the EUT intentional transmit carrier are 23.6 – 24 GHz and 31.2 – 31.8 GHz. Closest lower restricted band plot (referenced in table above) is included within radiated emissions plot section.

Plots can be found in section 6.

LIMITS:

AV = 54dBuV/m at restricted band edges. Authorised band edges: other emissions, outside the intentional band, must be attenuated by at least 50dB from the level of the fundamental.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:

<± 3.9 dB

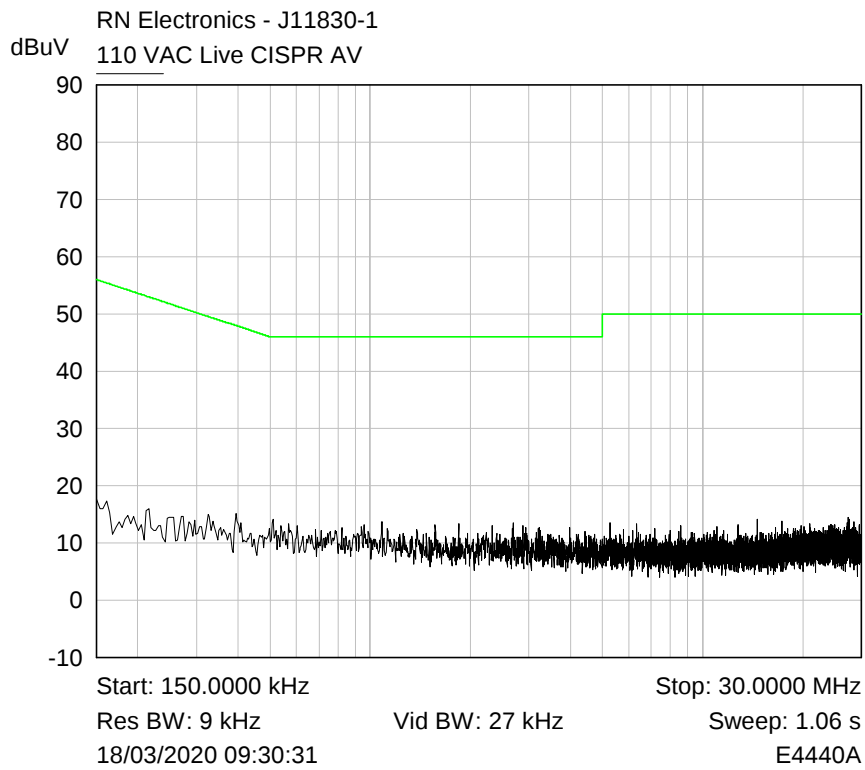
5.9 Duty cycle

NOT APPLICABLE: No test requirement. The applicant has confirmed the duty cycle to be 100%.

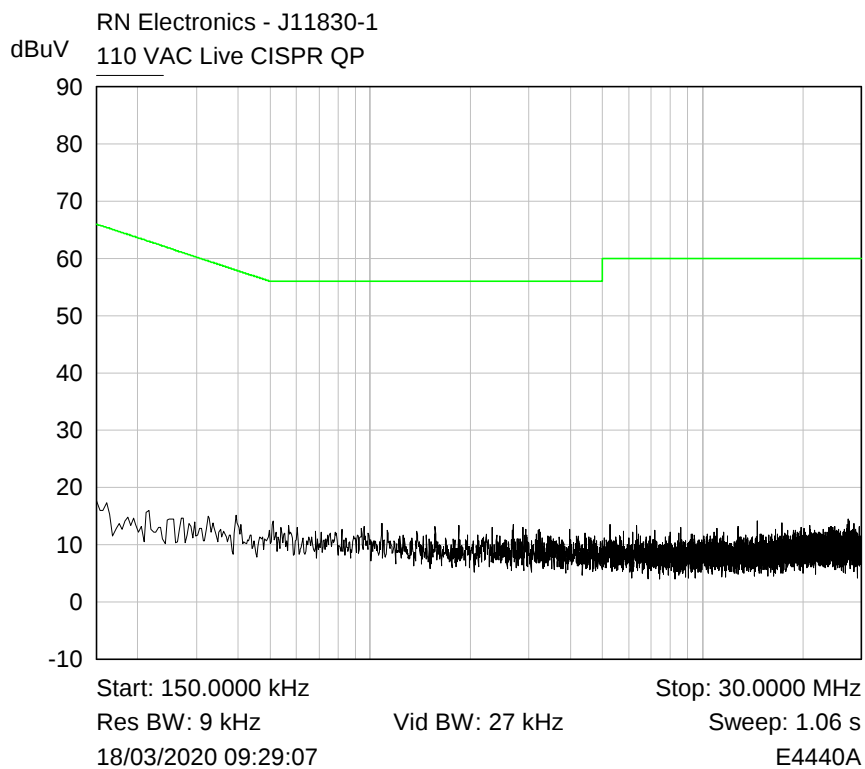
6 Plots/Graphical results

6.1 AC power line conducted emissions

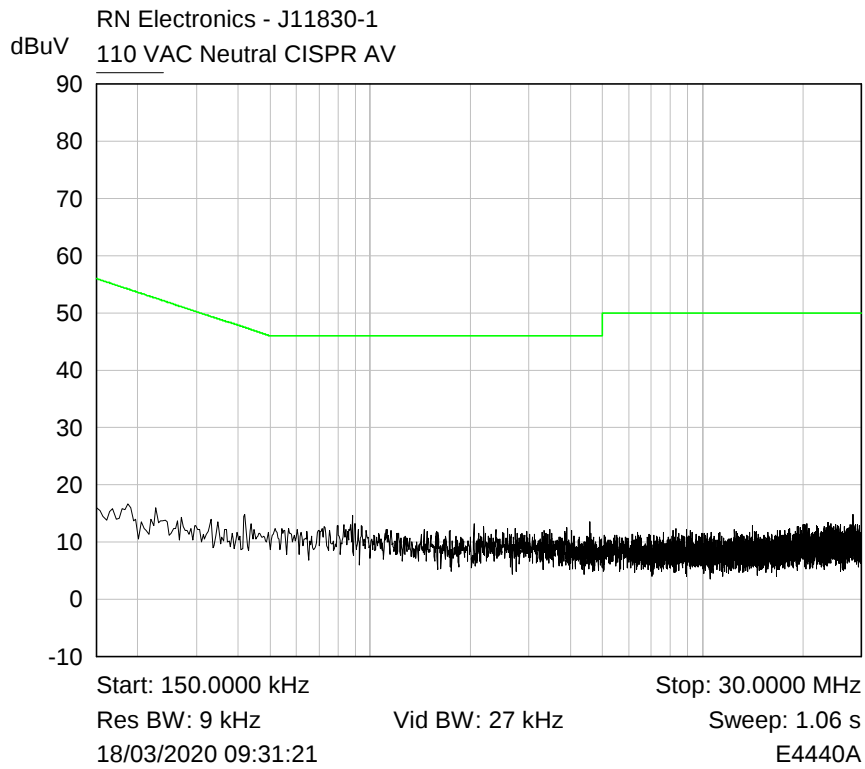
RF Parameters: Band 24075-24175 MHz, Power 20 dBm, Channel Spacing Single Channel,
Modulation CW, Channel 24125 MHz



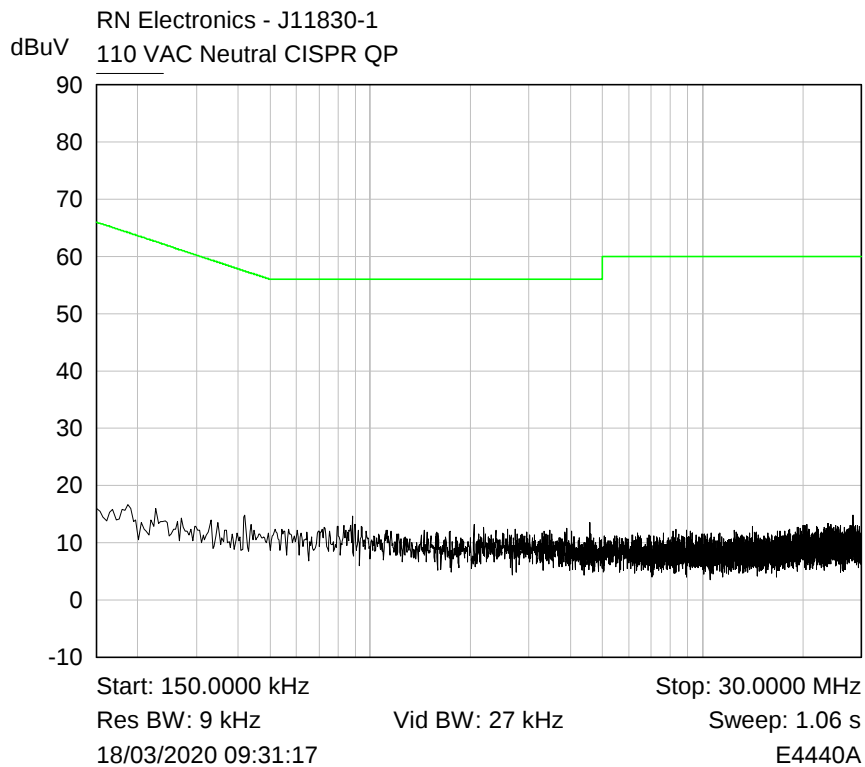
Plot of Live150k-30M Average



Plot of Live150k-30M Quasi-Peak



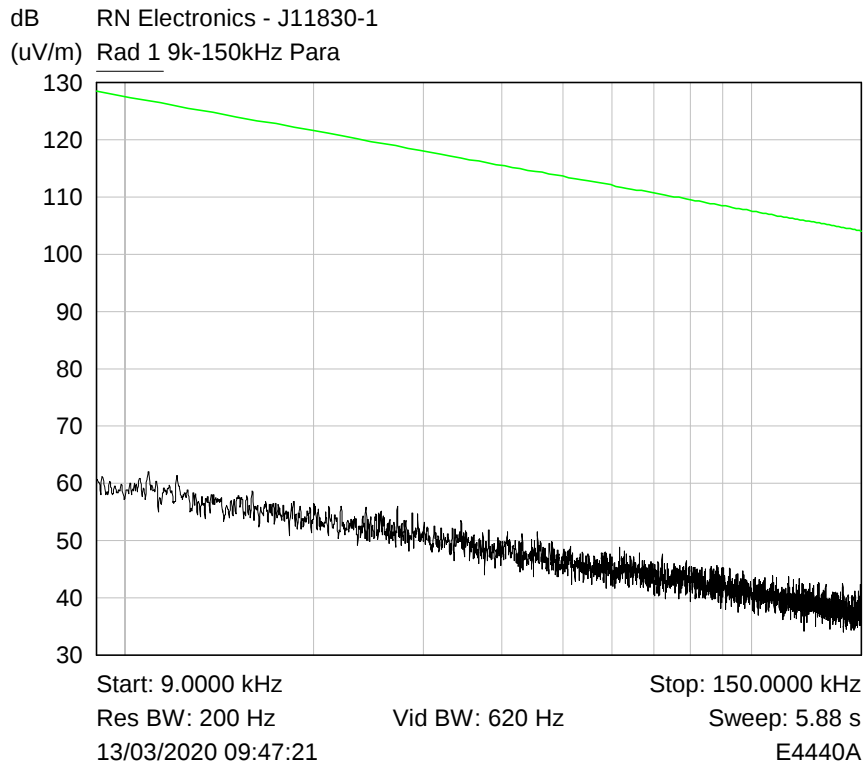
Plot of Neutral150k-30M Average



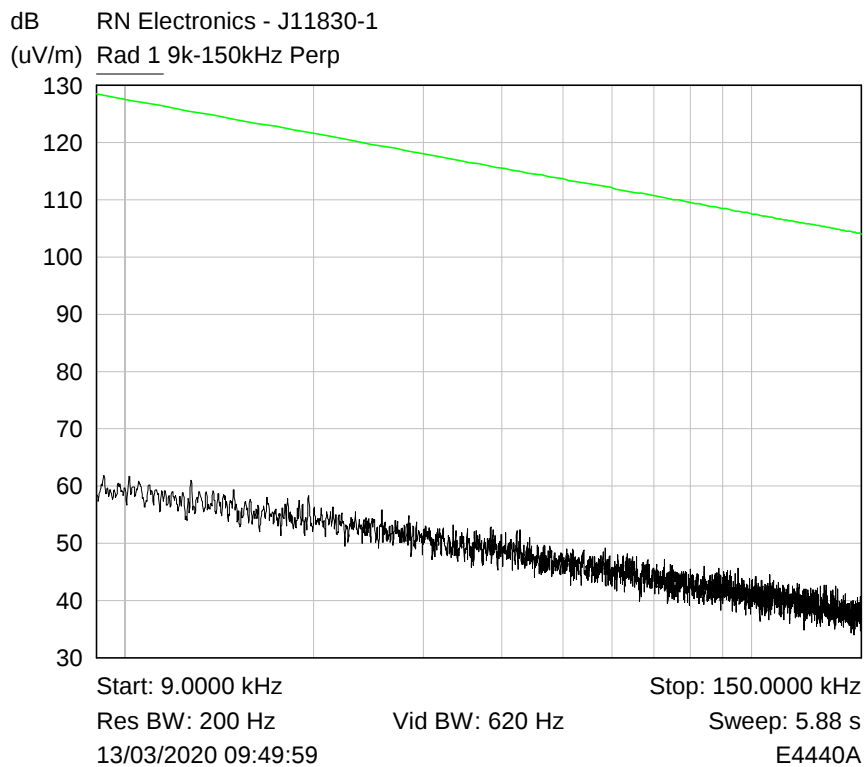
Plot of Neutral150k-30M Quasi-Peak

6.2 Radiated emissions 9 - 150 kHz

RF Parameters: Band 24075-24175 MHz, Power 20 dBm, Channel Spacing Single Channel,
Modulation CW, Channel 24125 MHz



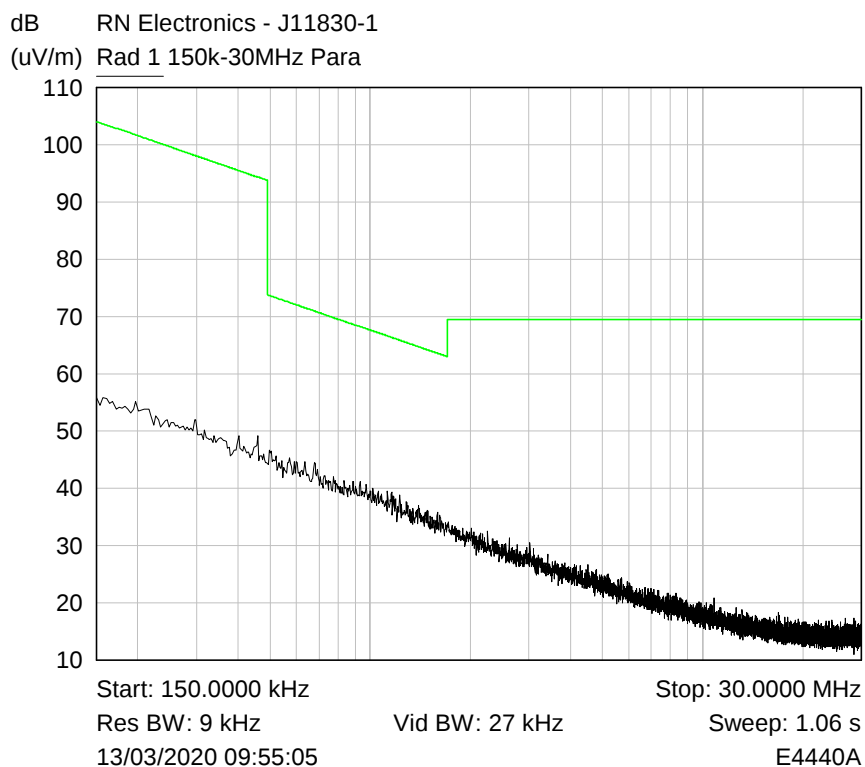
Plot of 9k-150kHz Parallel



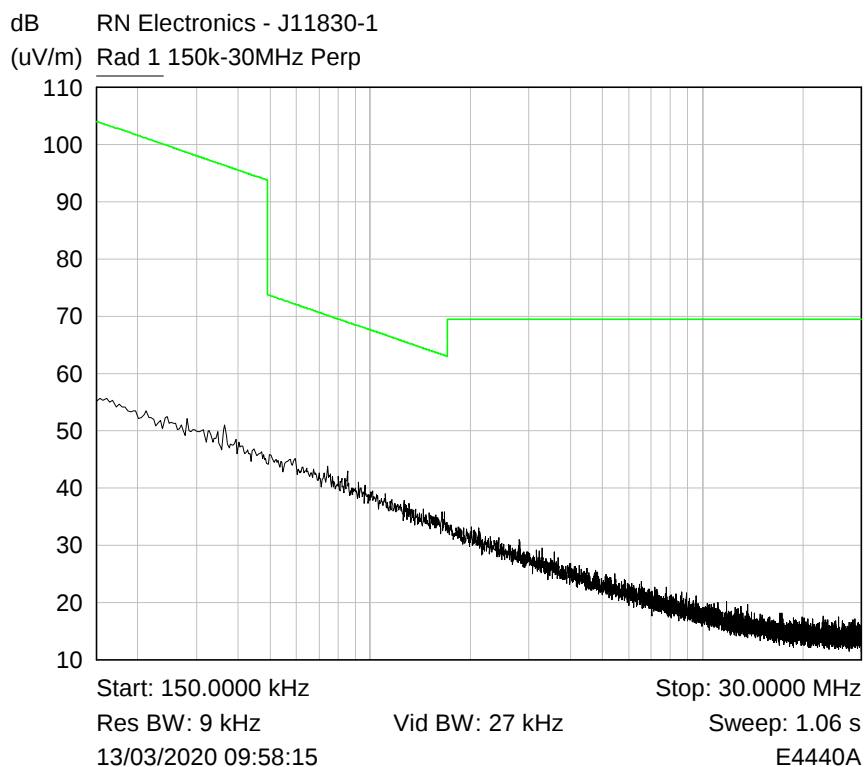
Plot of 9k-150kHz Perpendicular

6.3 Radiated emissions 150 kHz - 30 MHz

RF Parameters: Band 24075-24175 MHz, Power 20 dBm, Channel Spacing Single Channel,
Modulation CW, Channel 24125 MHz



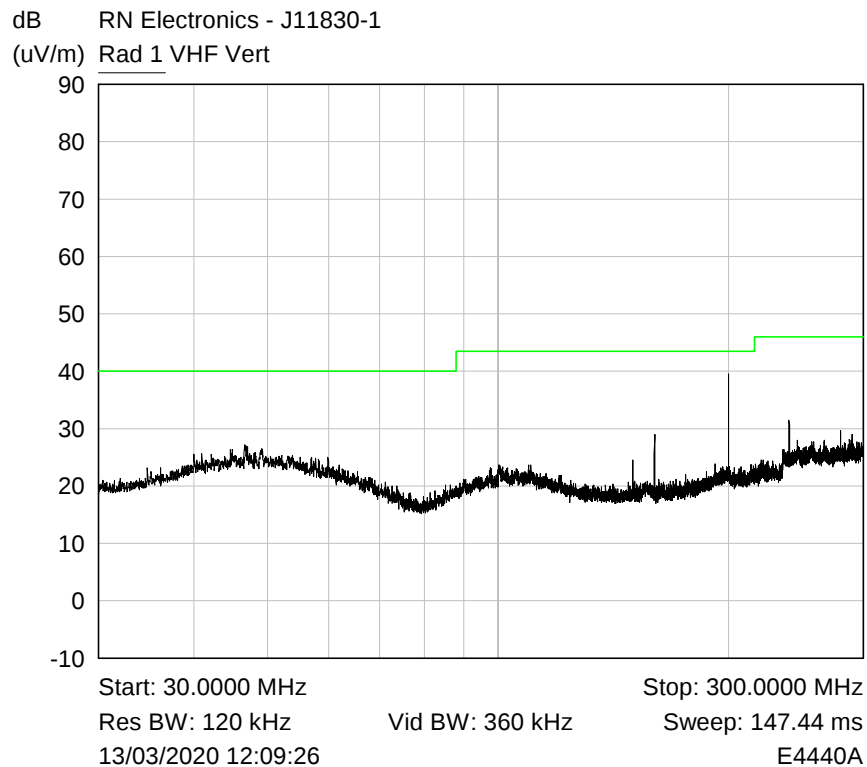
Plot of 150kHz-30MHz Parallel



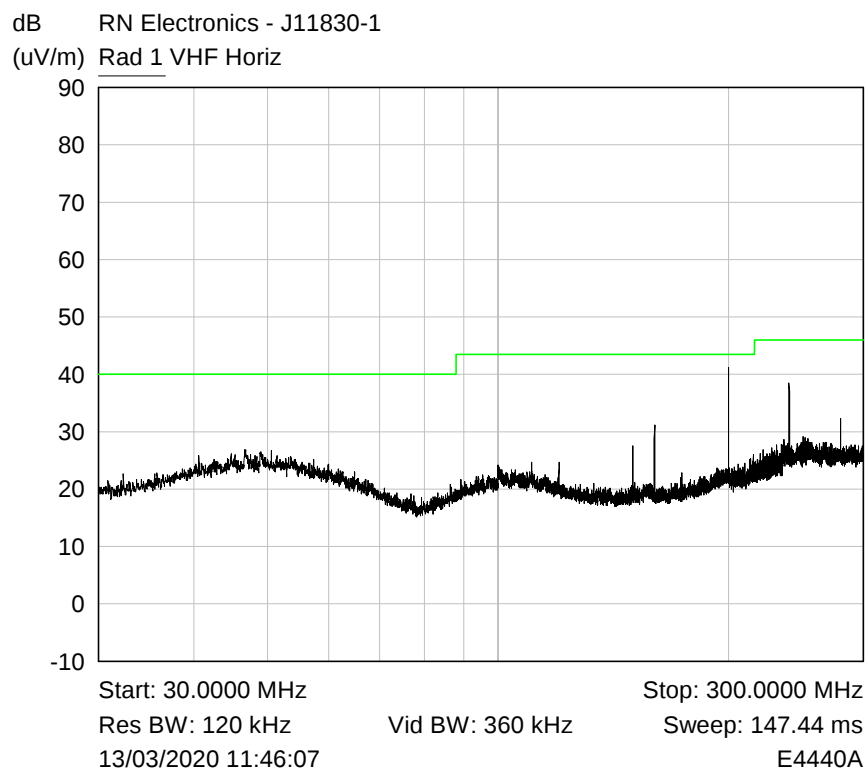
Plot of 150kHz-30MHz Perpendicular

6.4 Radiated emissions 30 – 1000 MHz

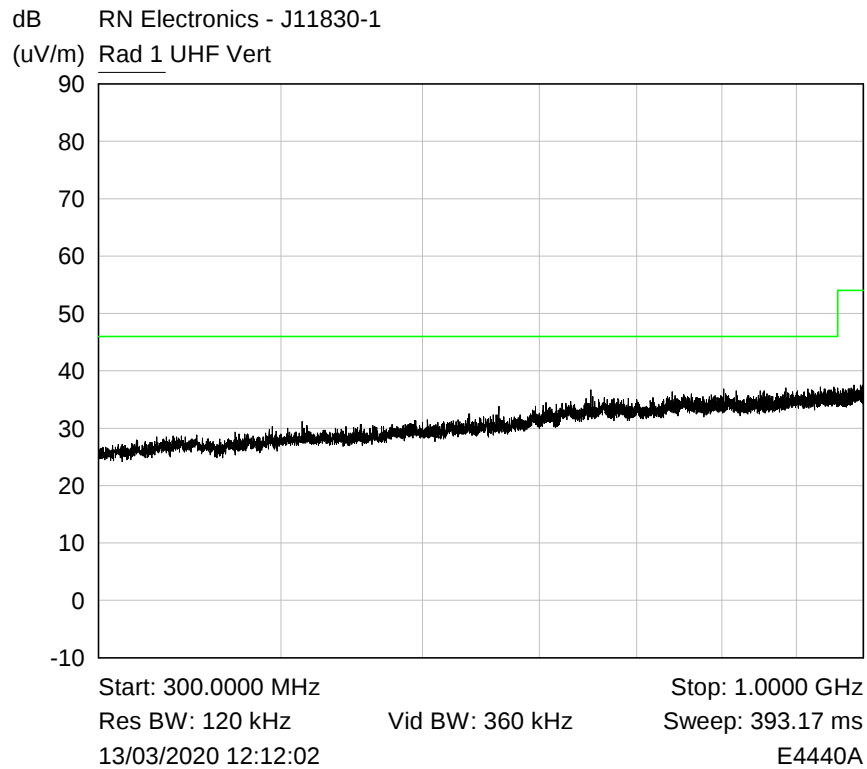
RF Parameters: Band 24075-24175 MHz, Power 20 dBm, Channel Spacing Single Channel,
Modulation CW, Channel 24125 MHz



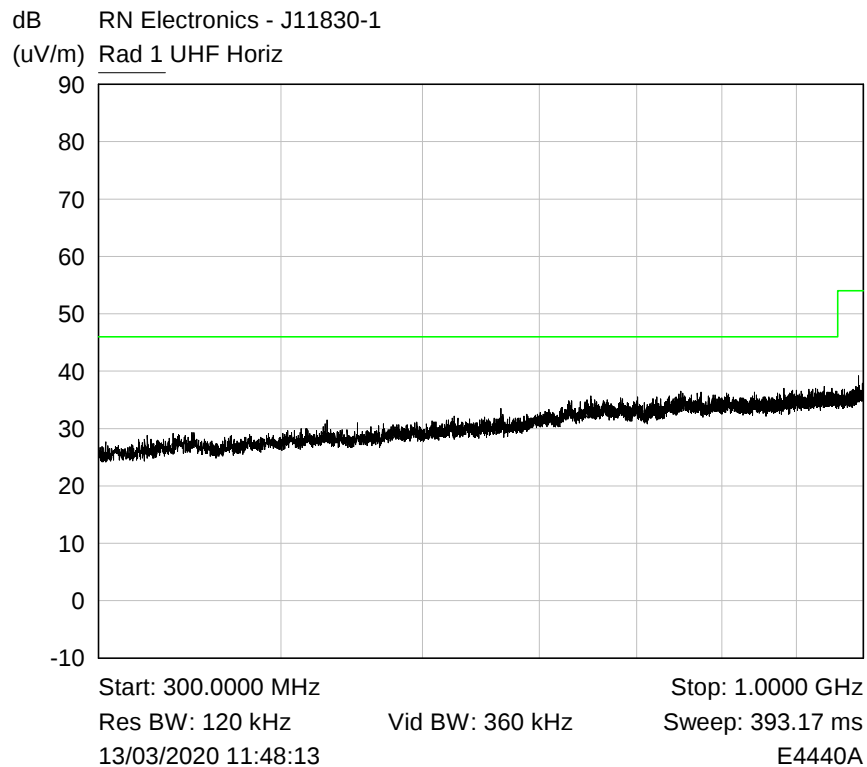
Plot of 30 – 300 MHz Vertical



Plot of 30 – 300 MHz Horizontal



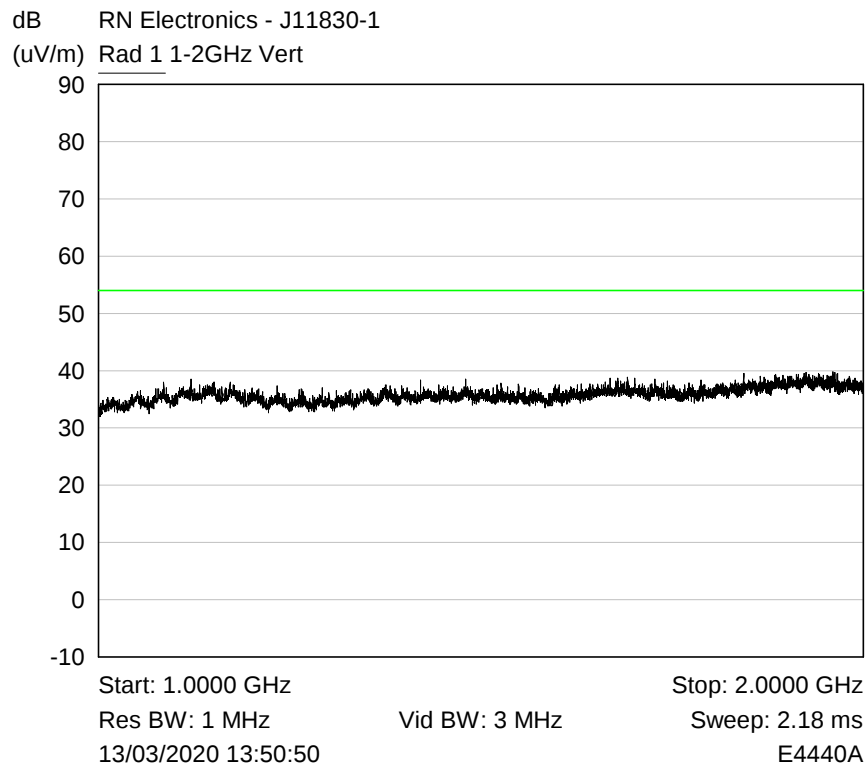
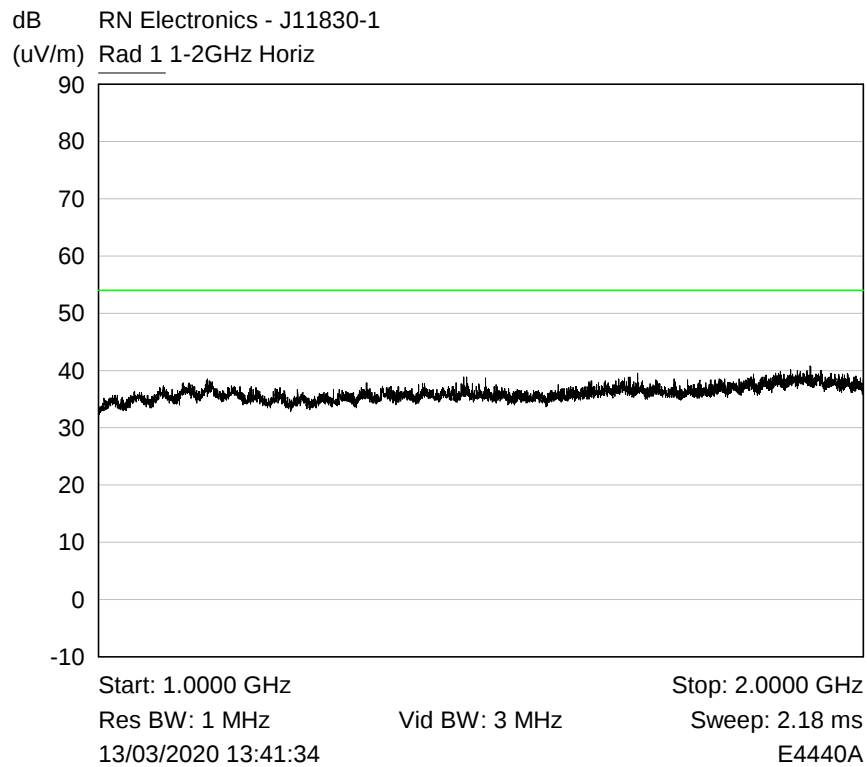
Plot of 300 – 1000 MHz Vertical

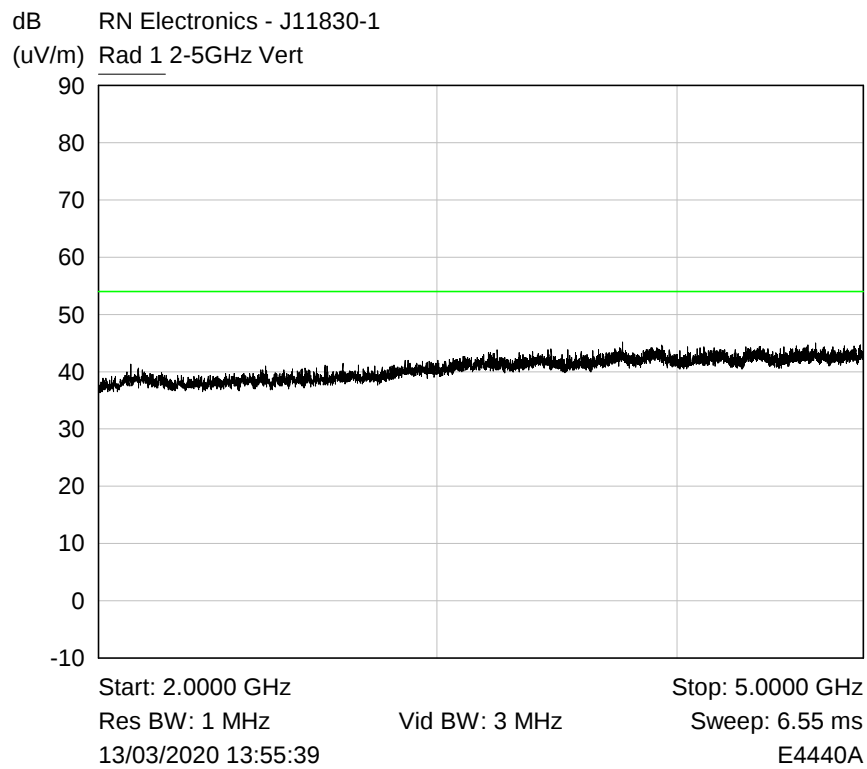
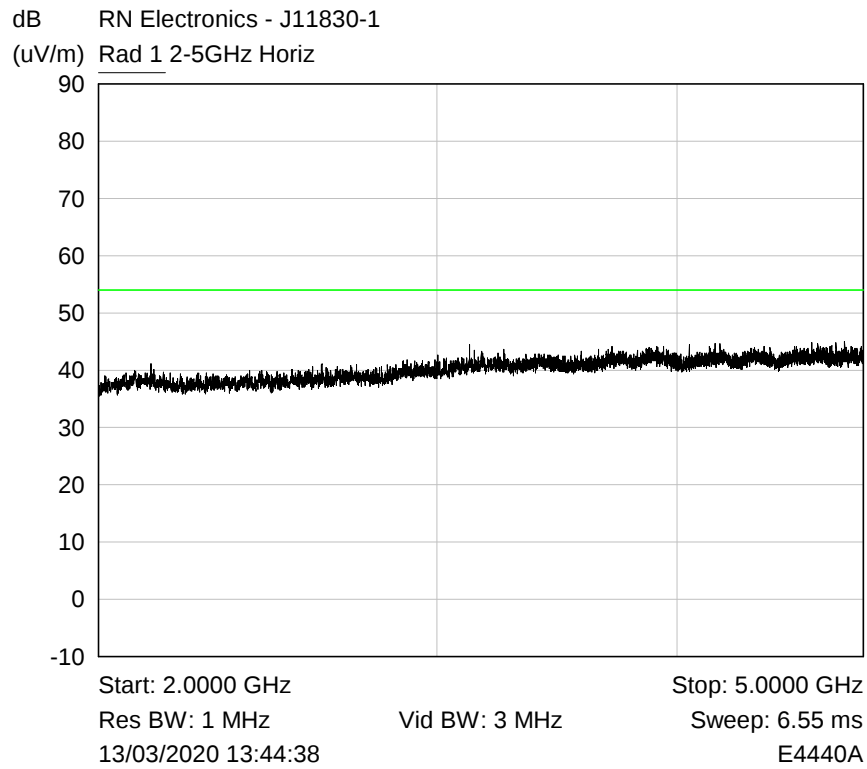


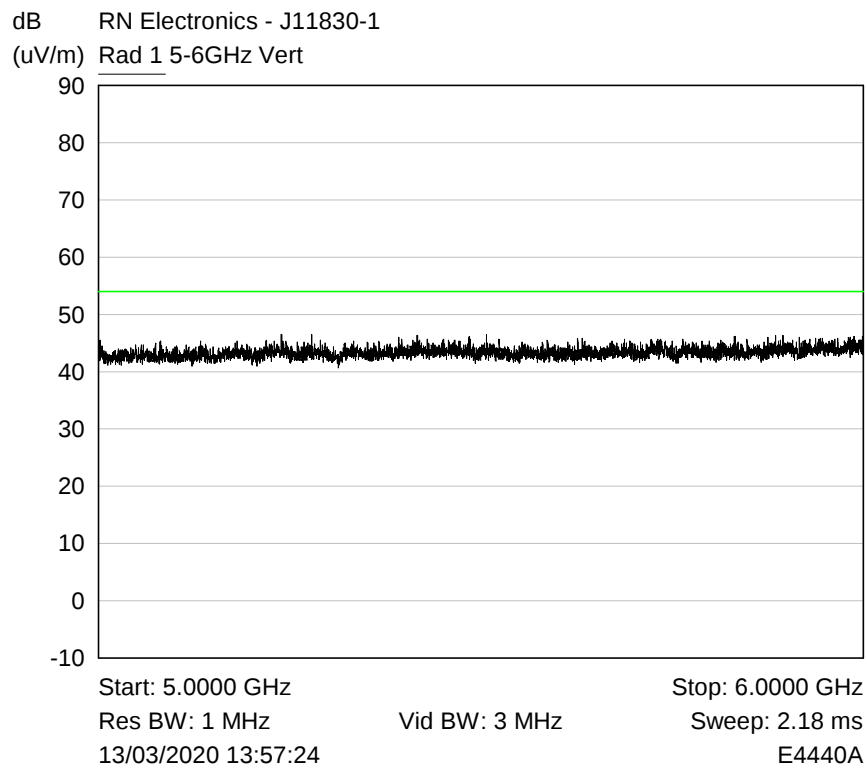
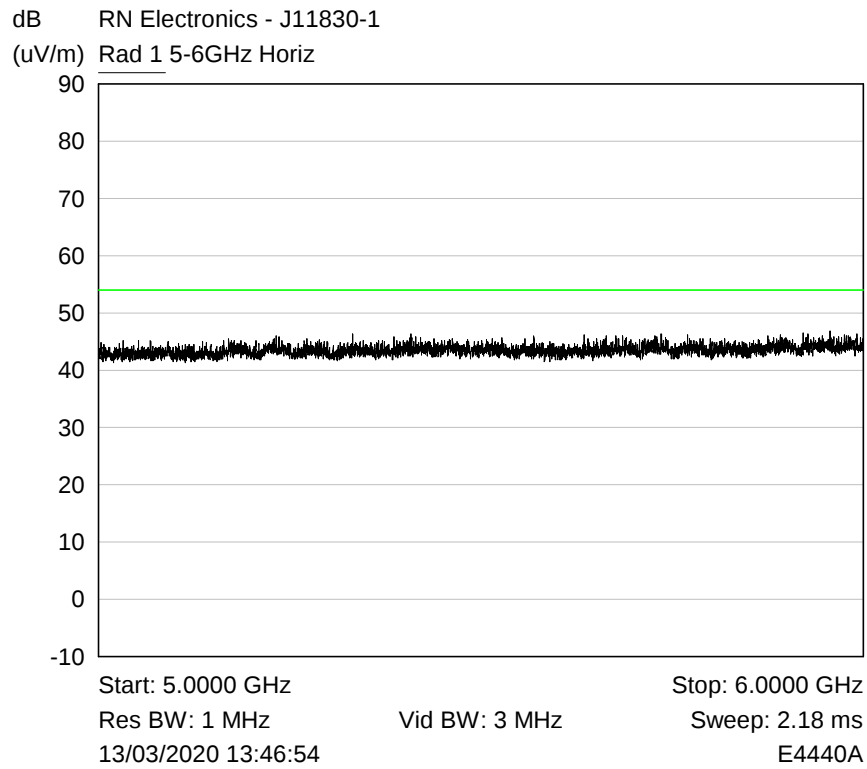
Plot of 300 – 1000 MHz Horizontal

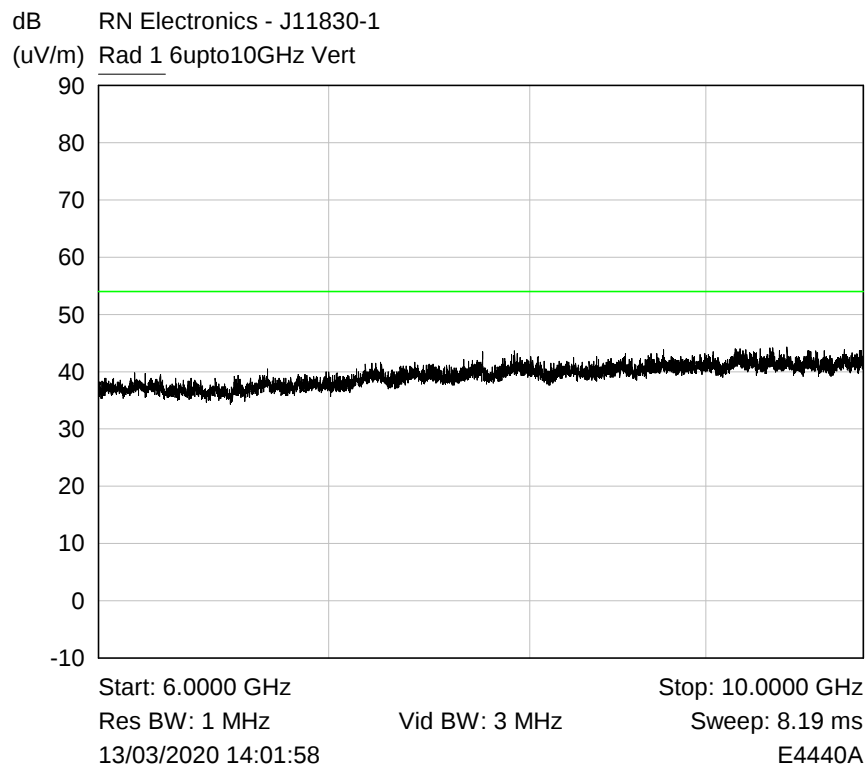
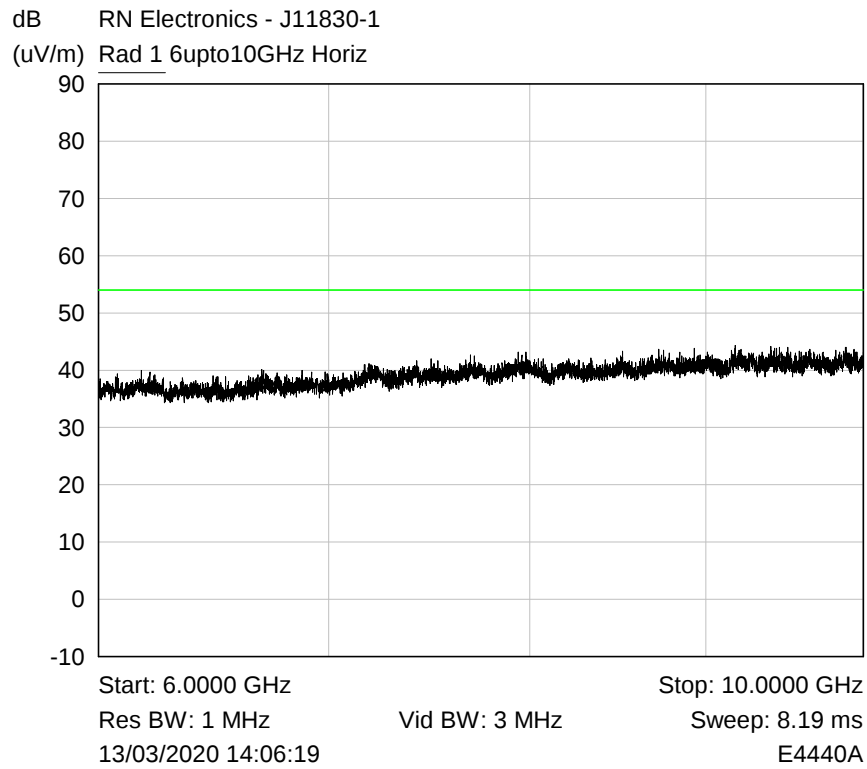
6.5 Radiated emissions above 1 GHz

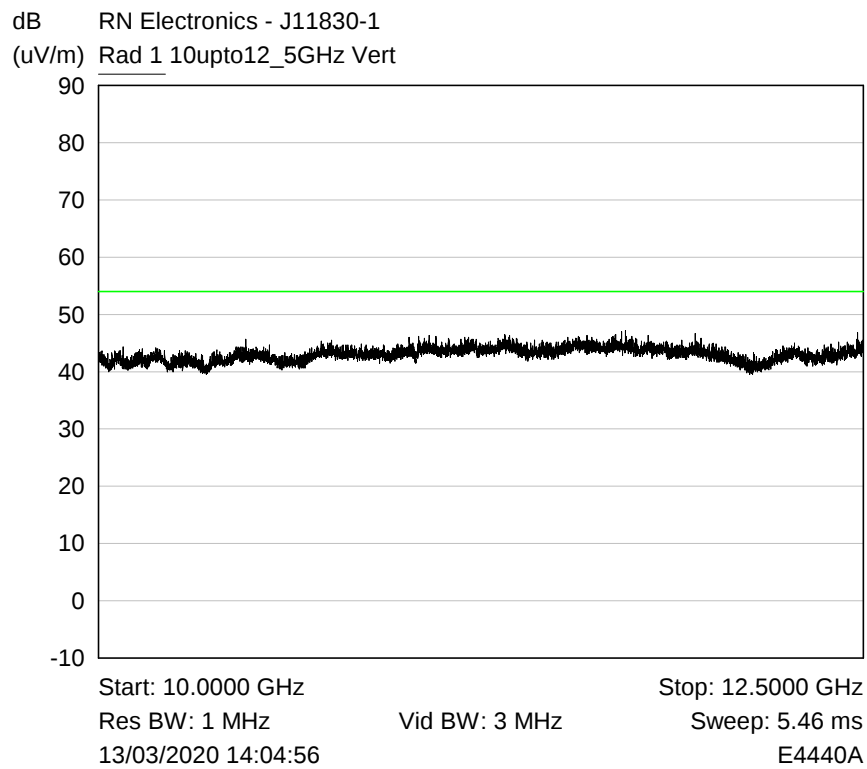
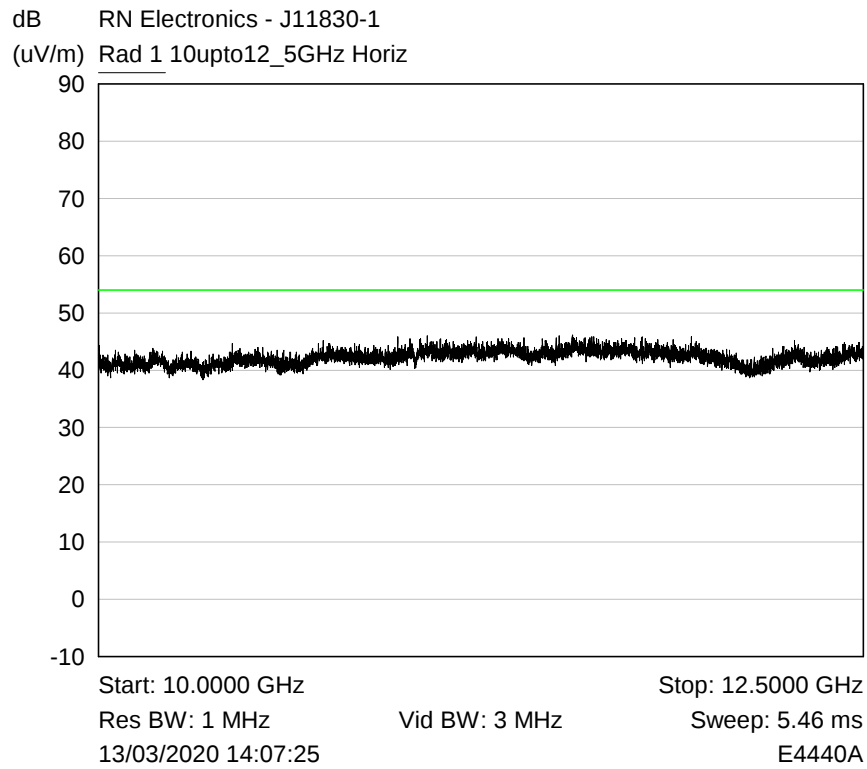
RF Parameters: Band 24075-24175 MHz, Power 20 dBm, Channel Spacing Single Channel,
Modulation CW, Channel 24125 MHz

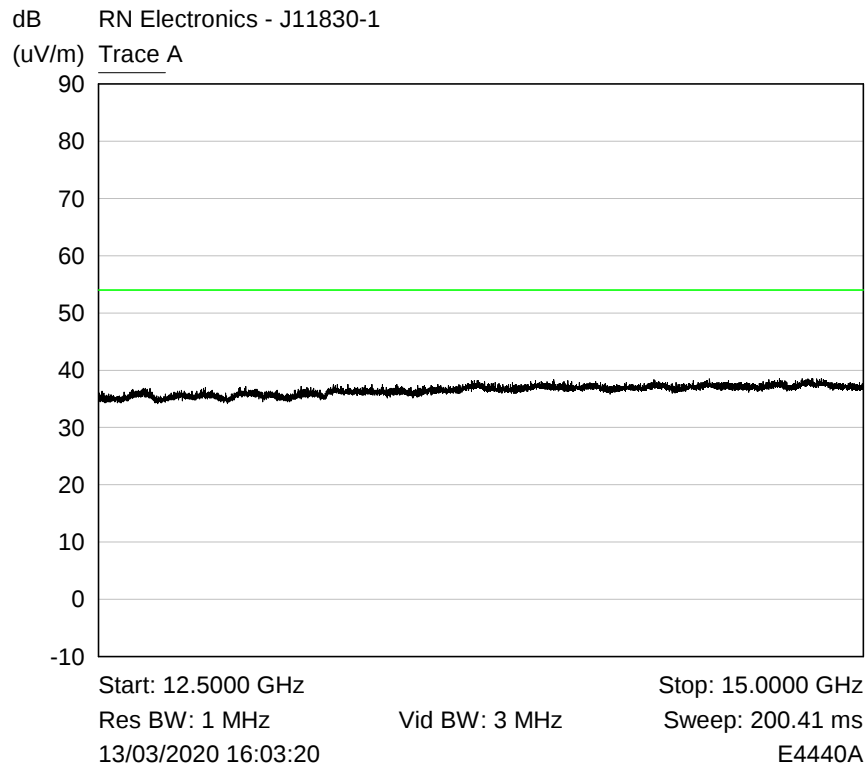




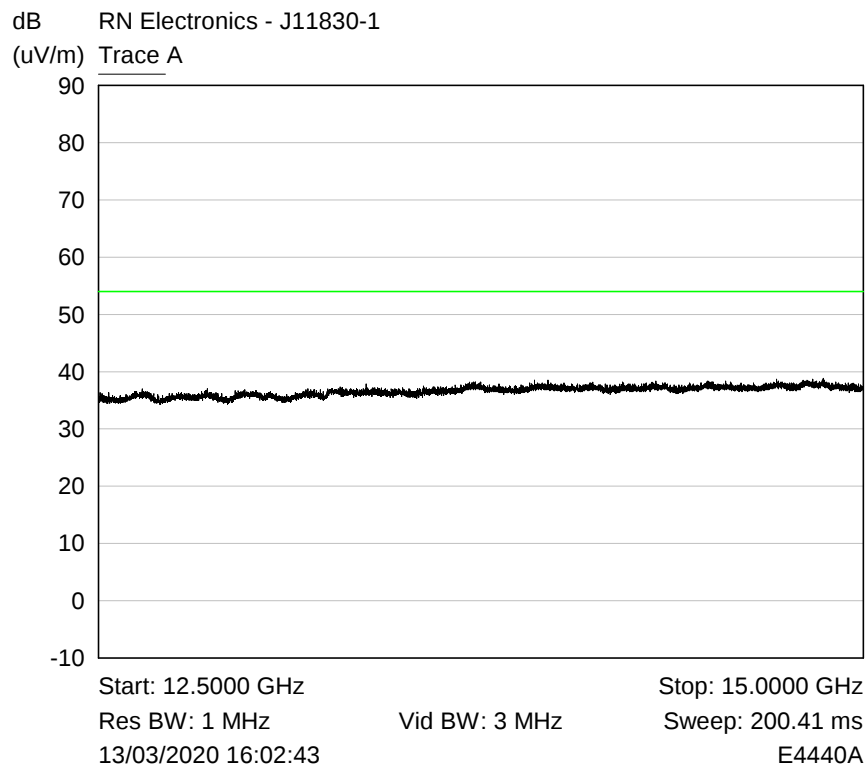




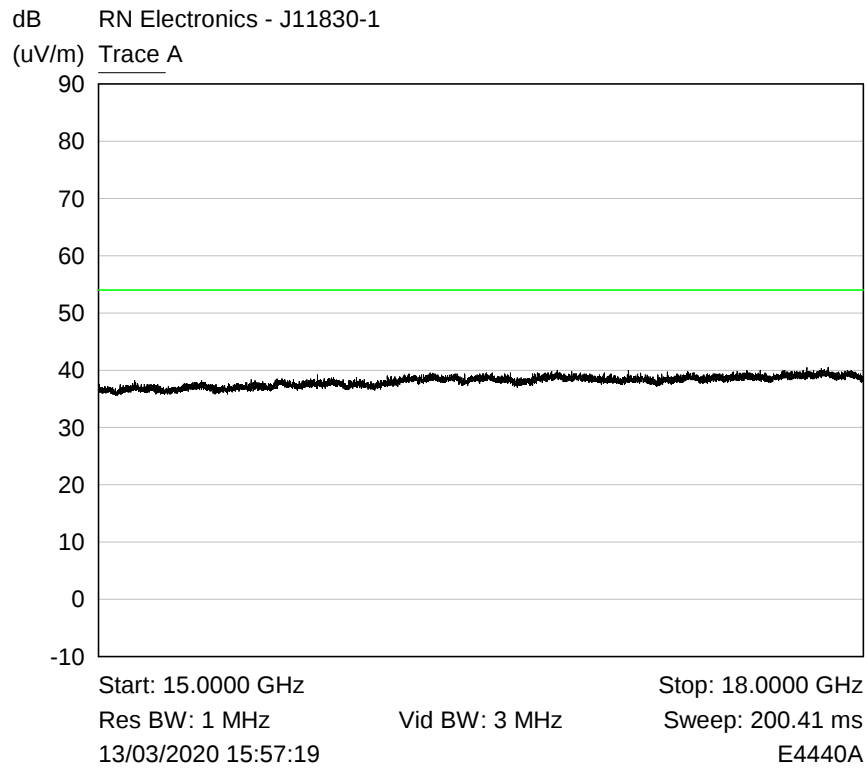




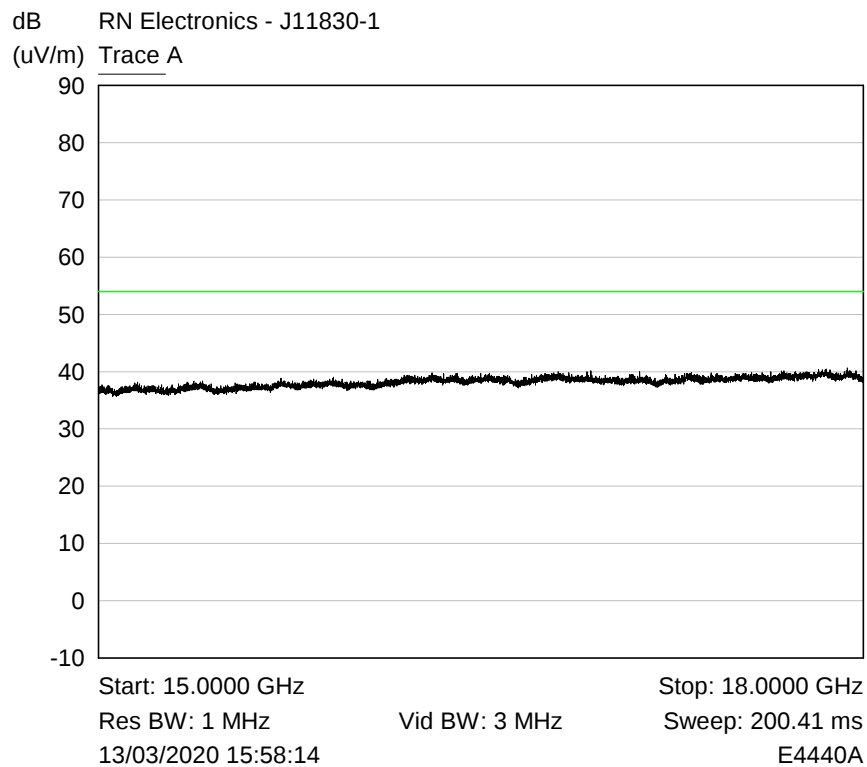
Horizontal



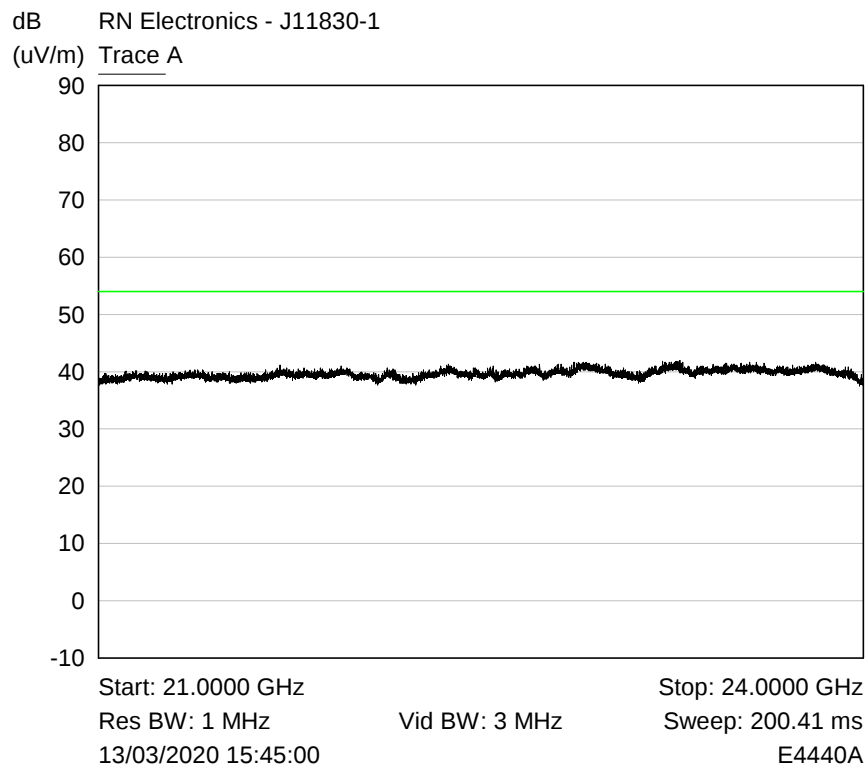
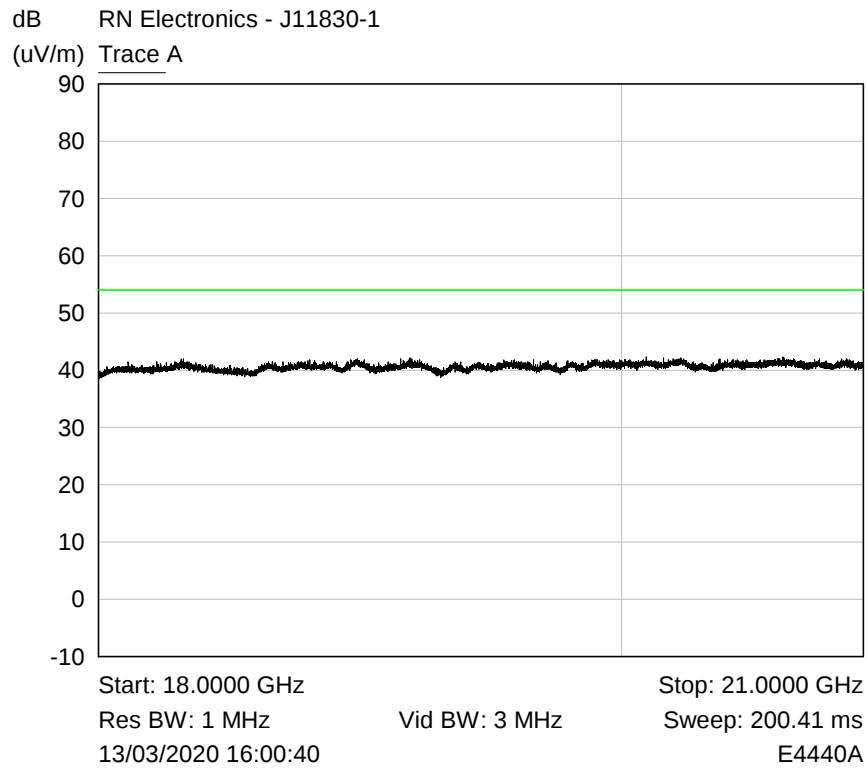
Vertical

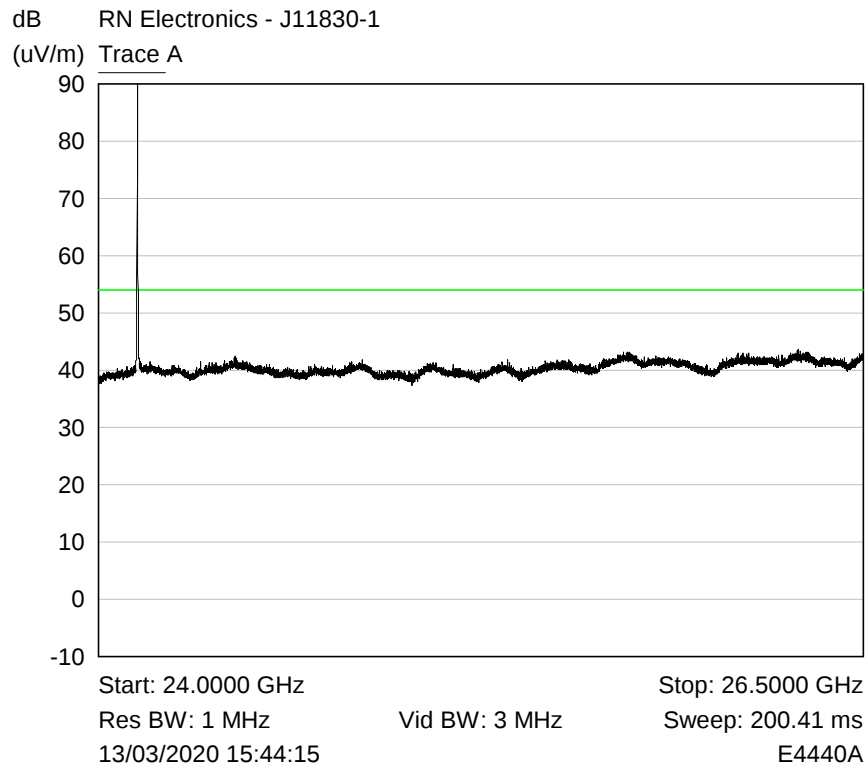


Horizontal

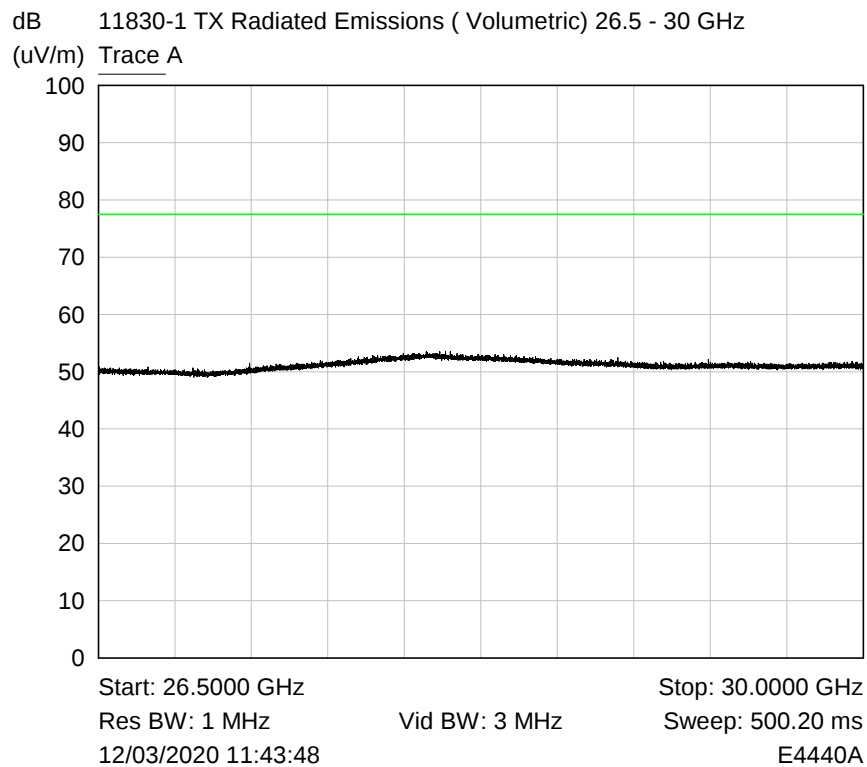


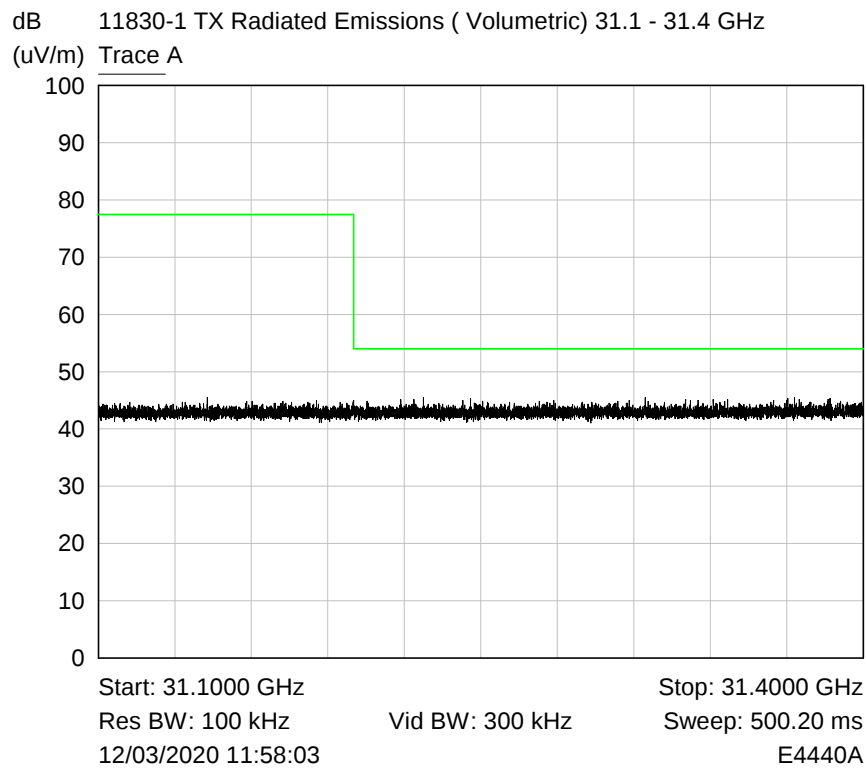
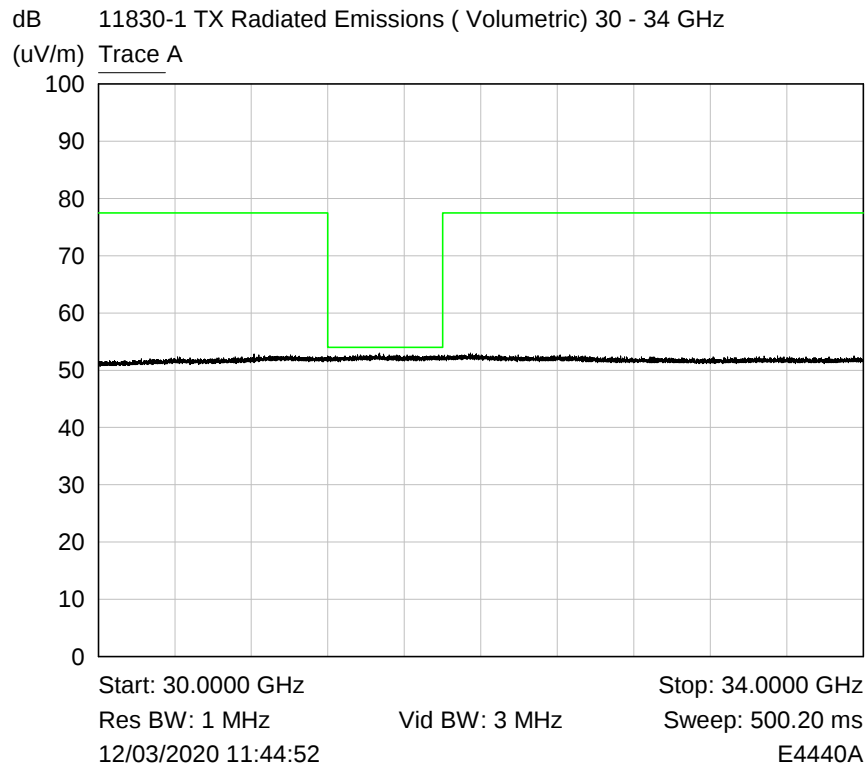
Vertical

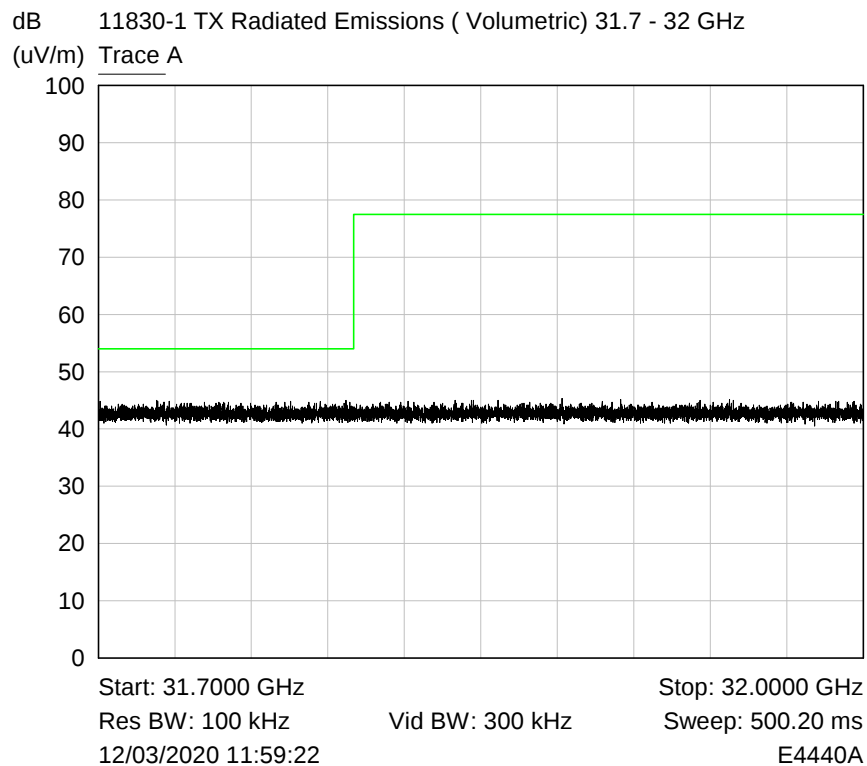
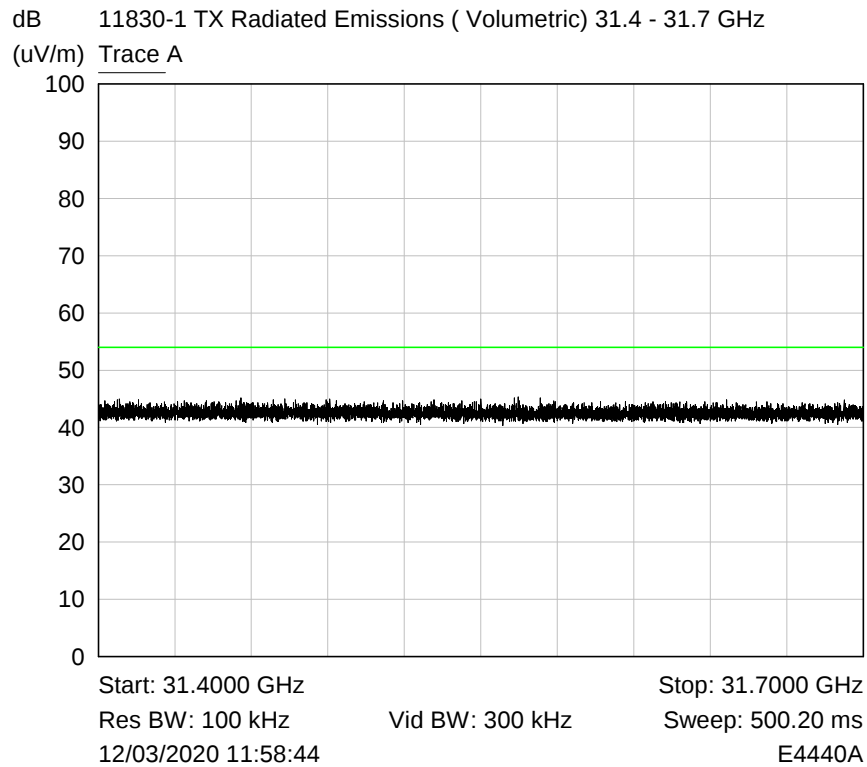


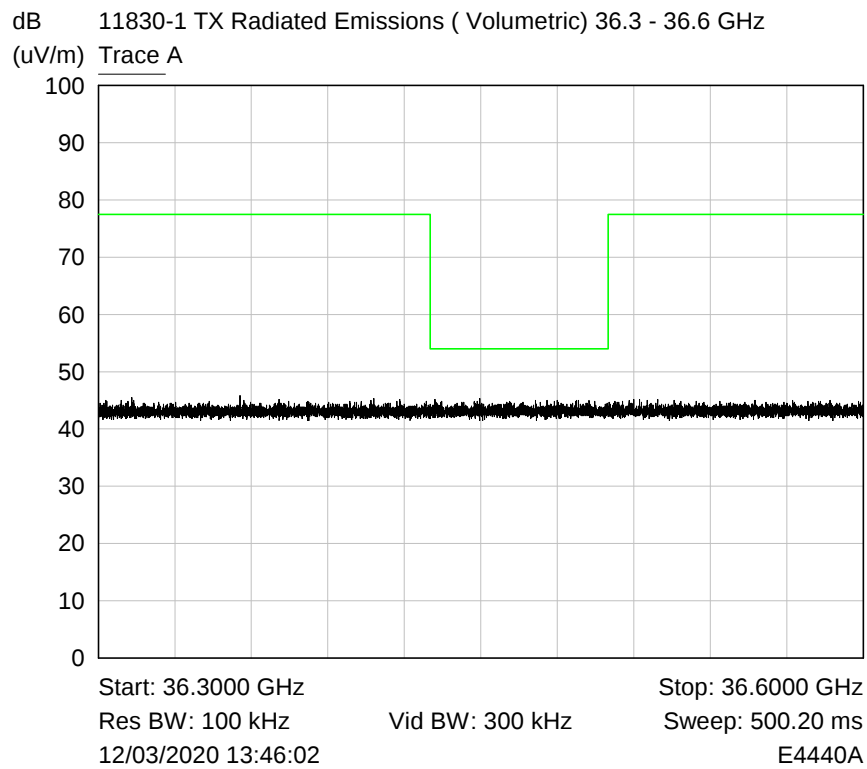
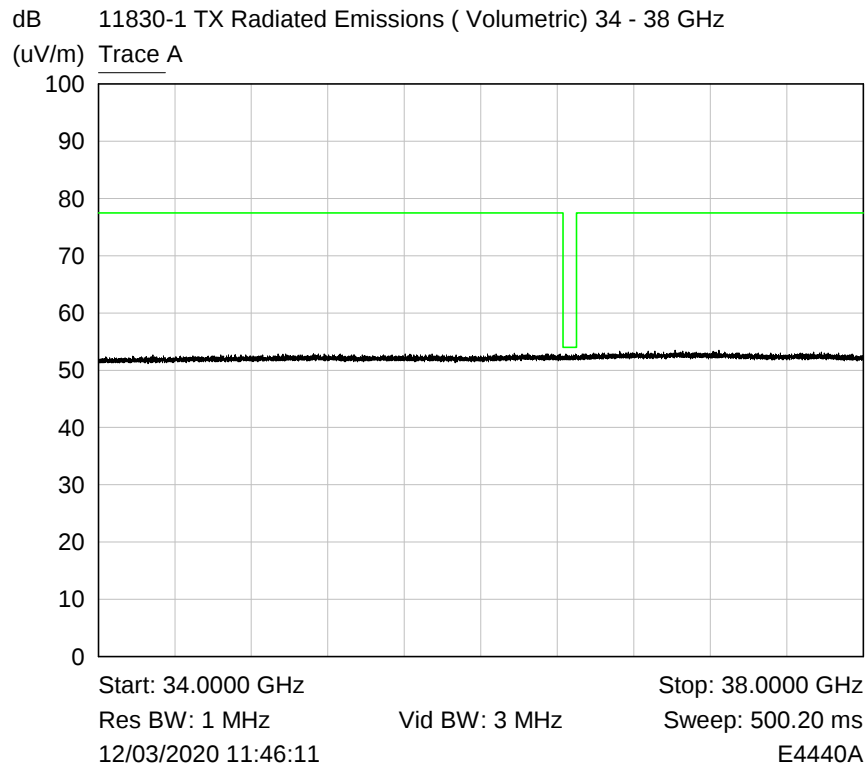


The emission that exceeds the limit line is the fundamental transmit carrier.



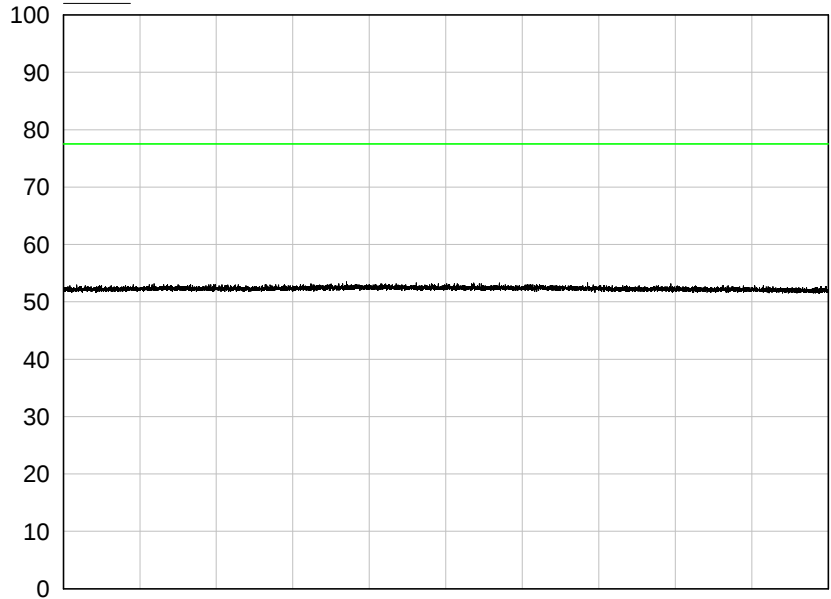






dB 11830-1 TX Radiated Emissions (Volumetric) 38 - 40 GHz

(uV/m) Trace A



Start: 38.0000 GHz

Stop: 40.0000 GHz

Res BW: 1 MHz

Vid BW: 3 MHz

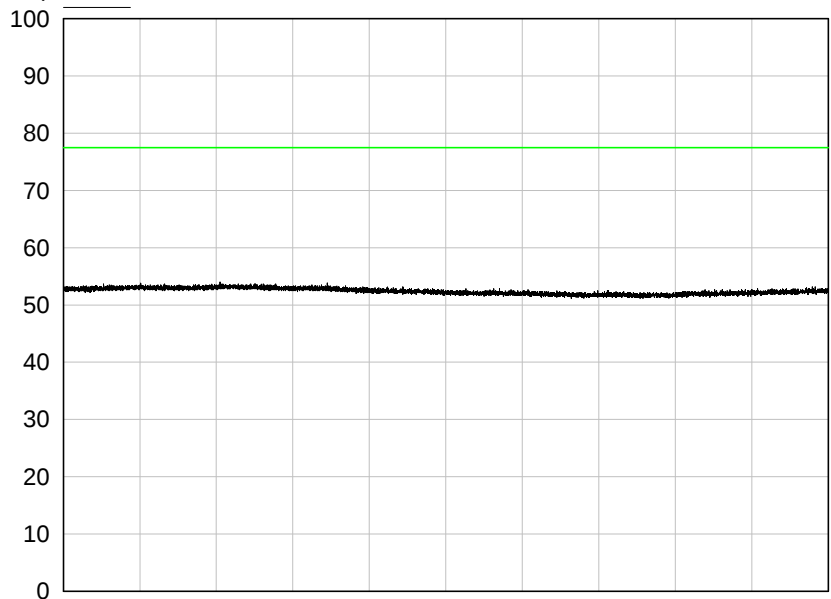
Sweep: 500.20 ms

12/03/2020 11:47:58

E4440A

dB 11830-1 TX Radiated Emissions (Volumetric) 40 - 44 GHz

(uV/m) Trace A



Start: 40.0000 GHz

Stop: 44.0000 GHz

Res BW: 1 MHz

Vid BW: 3 MHz

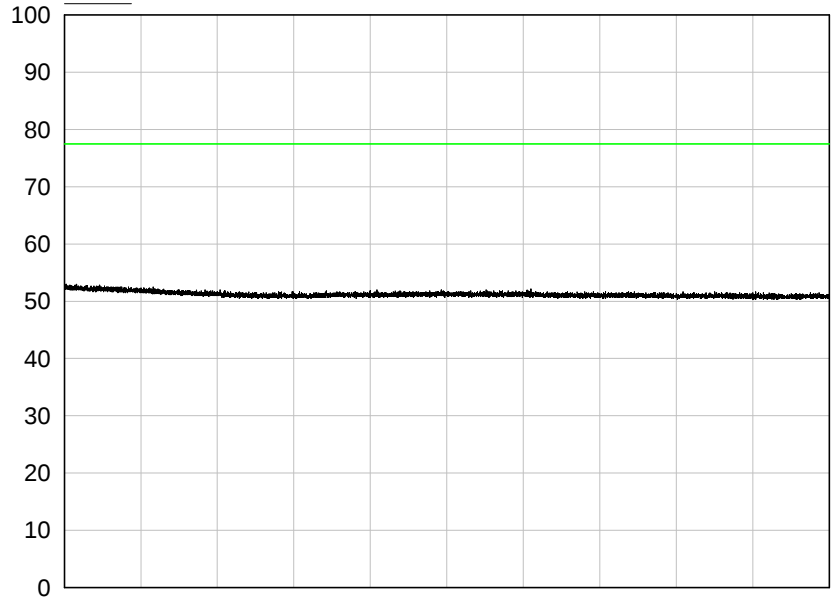
Sweep: 500.20 ms

12/03/2020 12:21:21

E4440A

dB 11830-1 TX Radiated Emissions (Volumetric) 44 - 48 GHz

(uV/m) Trace A



Start: 44.0000 GHz

Stop: 48.0000 GHz

Res BW: 1 MHz

Vid BW: 3 MHz

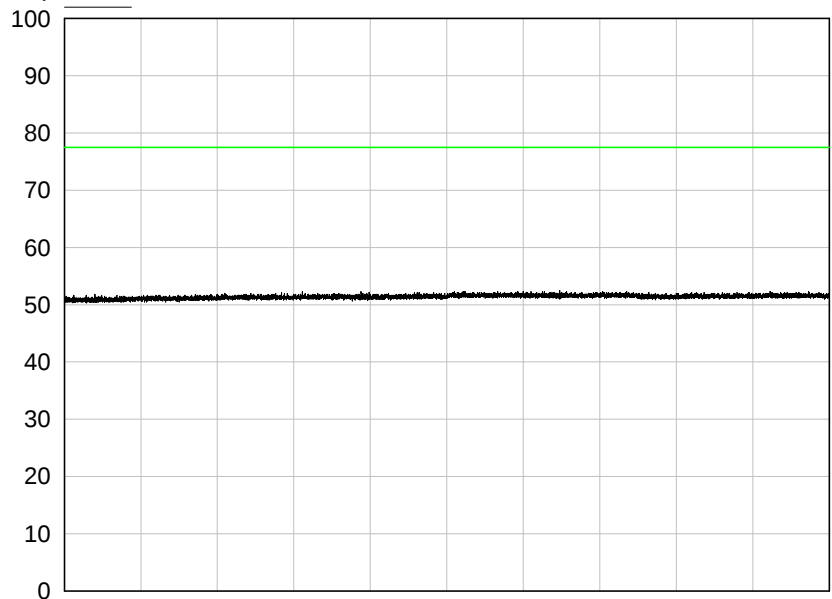
Sweep: 500.20 ms

12/03/2020 12:22:04

E4440A

dB 11830-1 TX Radiated Emissions (Volumetric) 48 - 52 GHz

(uV/m) Trace A



Start: 48.0000 GHz

Stop: 52.0000 GHz

Res BW: 1 MHz

Vid BW: 3 MHz

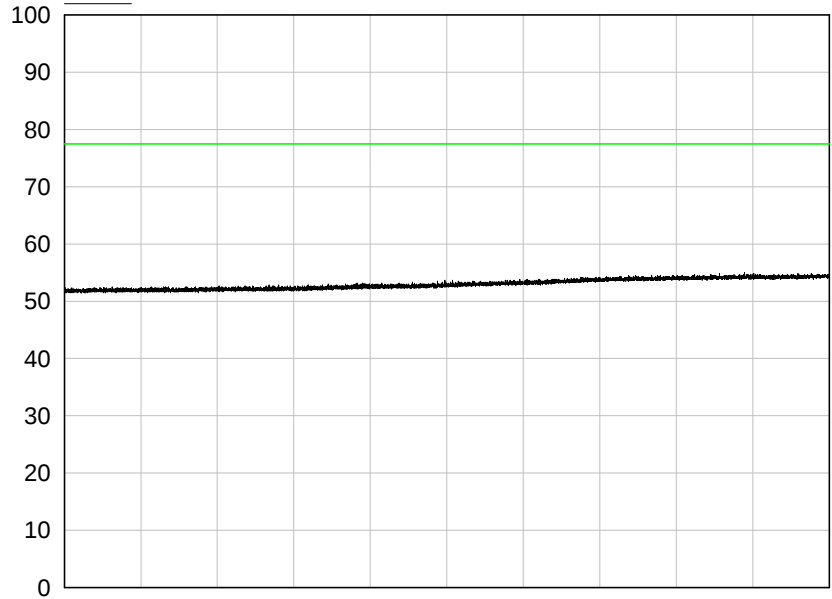
Sweep: 500.20 ms

12/03/2020 12:22:40

E4440A

dB 11830-1 TX Radiated Emissions (Volumetric) 52 - 56 GHz

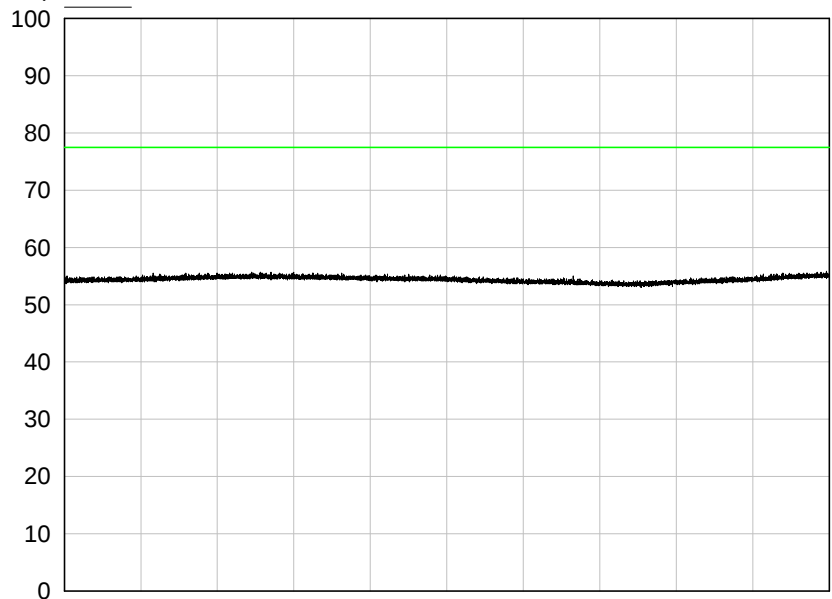
(uV/m) Trace A



Start: 52.0000 GHz Stop: 56.0000 GHz
Res BW: 1 MHz Vid BW: 3 MHz Sweep: 500.20 ms
12/03/2020 12:25:27 E4440A

dB 11830-1 TX Radiated Emissions (Volumetric) 56 - 60 GHz

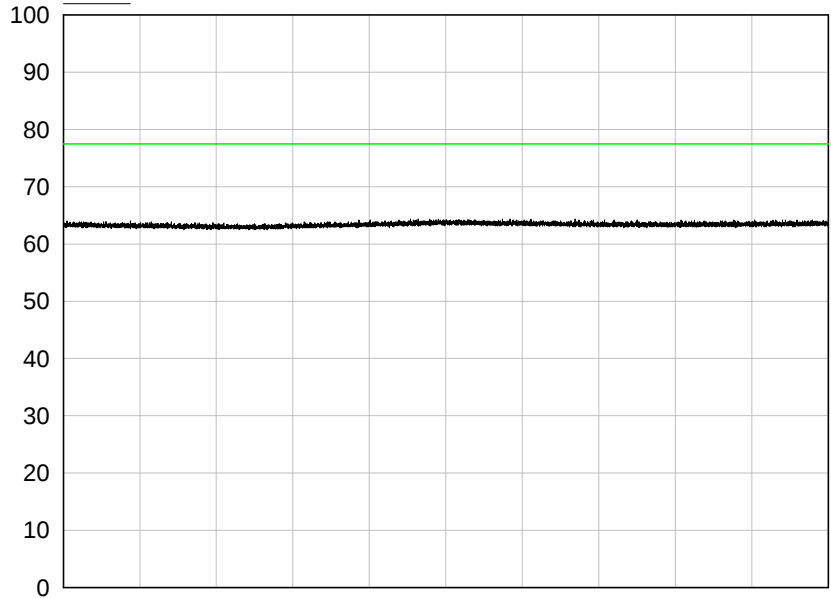
(uV/m) Trace A



Start: 56.0000 GHz Stop: 60.0000 GHz
Res BW: 1 MHz Vid BW: 3 MHz Sweep: 500.20 ms
12/03/2020 12:26:09 E4440A

dB 11830-1 TX Radiated Emissions (Volumetric) 60 - 64 GHz

(uV/m) Trace A



Start: 60.0000 GHz

Stop: 64.0000 GHz

Res BW: 1 MHz

Vid BW: 3 MHz

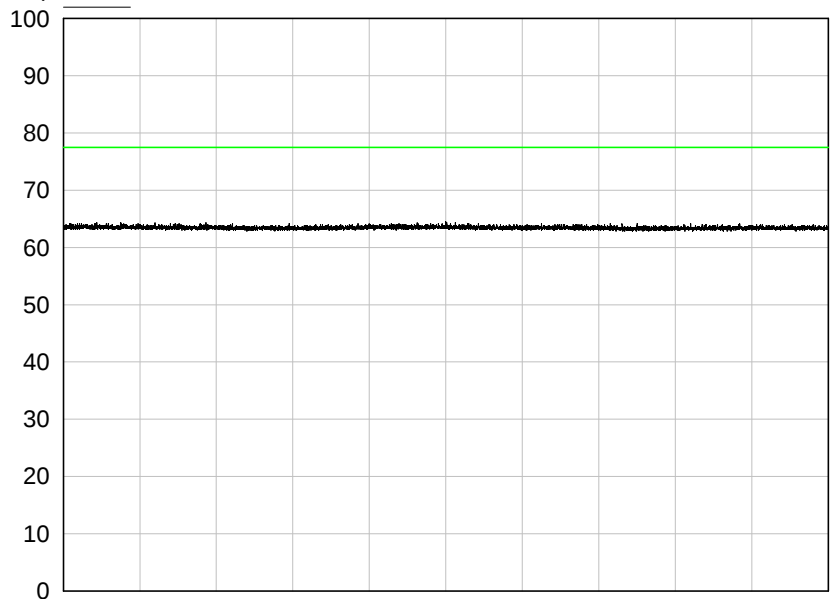
Sweep: 500.20 ms

12/03/2020 13:29:02

E4440A

dB 11830-1 TX Radiated Emissions (Volumetric) 64 - 68 GHz

(uV/m) Trace A



Start: 64.0000 GHz

Stop: 68.0000 GHz

Res BW: 1 MHz

Vid BW: 3 MHz

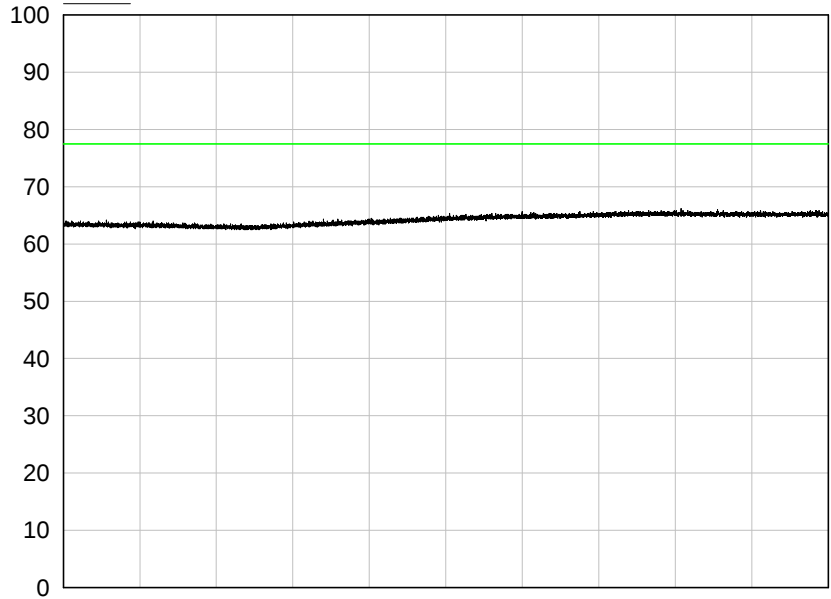
Sweep: 500.20 ms

12/03/2020 13:30:06

E4440A

dB 11830-1 TX Radiated Emissions (Volumetric) 68 - 72 GHz

(uV/m) Trace A



Start: 68.0000 GHz

Stop: 72.0000 GHz

Res BW: 1 MHz

Vid BW: 3 MHz

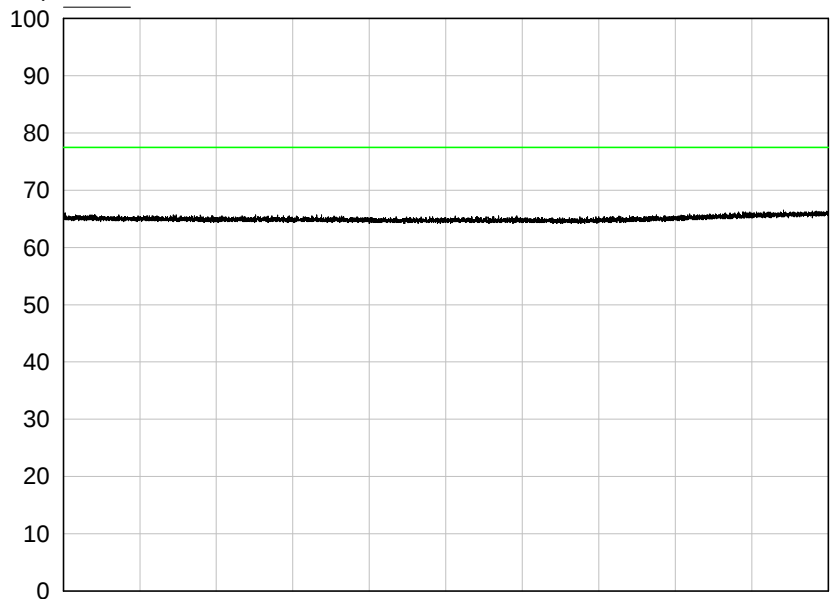
Sweep: 500.20 ms

12/03/2020 13:31:01

E4440A

dB 11830-1 TX Radiated Emissions (Volumetric) 72 - 75 GHz

(uV/m) Trace A



Start: 72.0000 GHz

Stop: 75.0000 GHz

Res BW: 1 MHz

Vid BW: 3 MHz

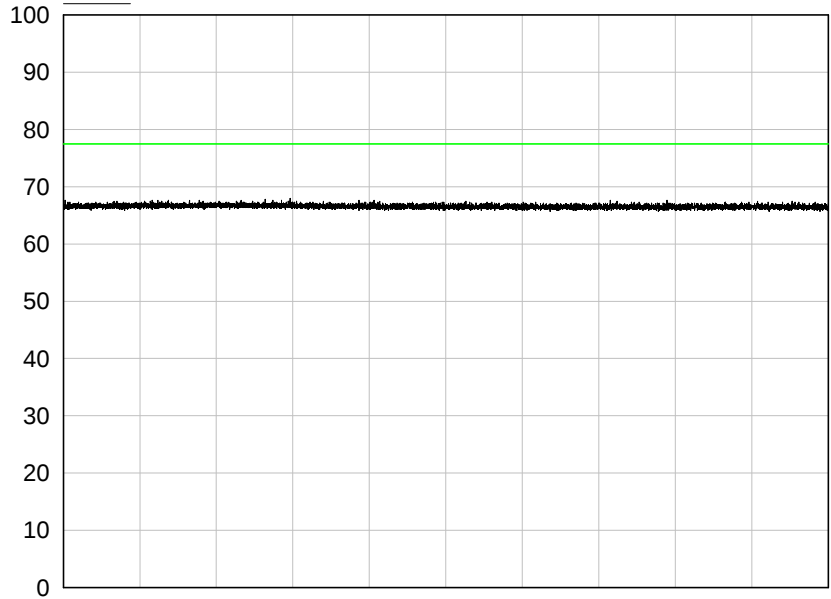
Sweep: 500.20 ms

12/03/2020 13:31:49

E4440A

dB 11830-1 TX Radiated Emissions (Volumetric) 75 - 79 GHz

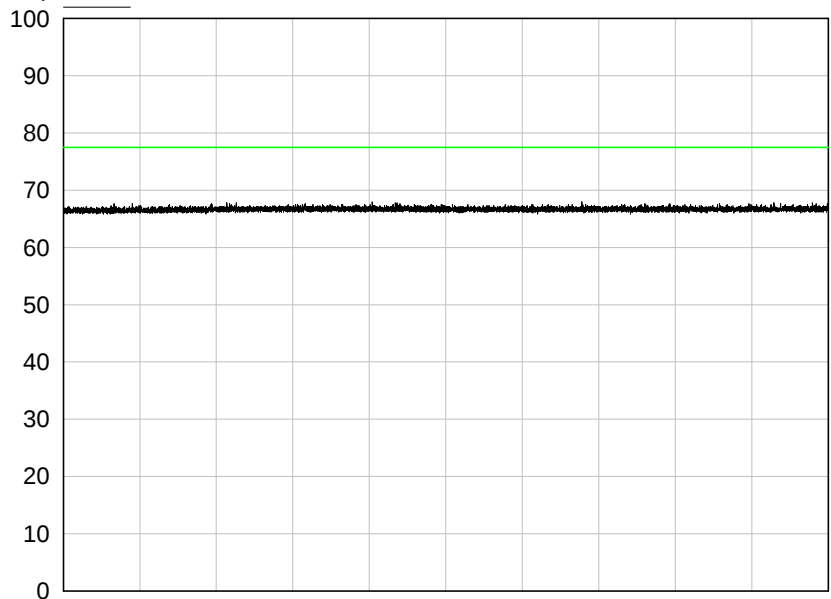
(uV/m) Trace A



Start: 75.0000 GHz Stop: 79.0000 GHz
Res BW: 1 MHz Vid BW: 3 MHz Sweep: 200.41 ms
10/03/2020 15:56:32 E4440A

dB 11830-1 TX Radiated Emissions (Volumetric) 79 - 83 GHz

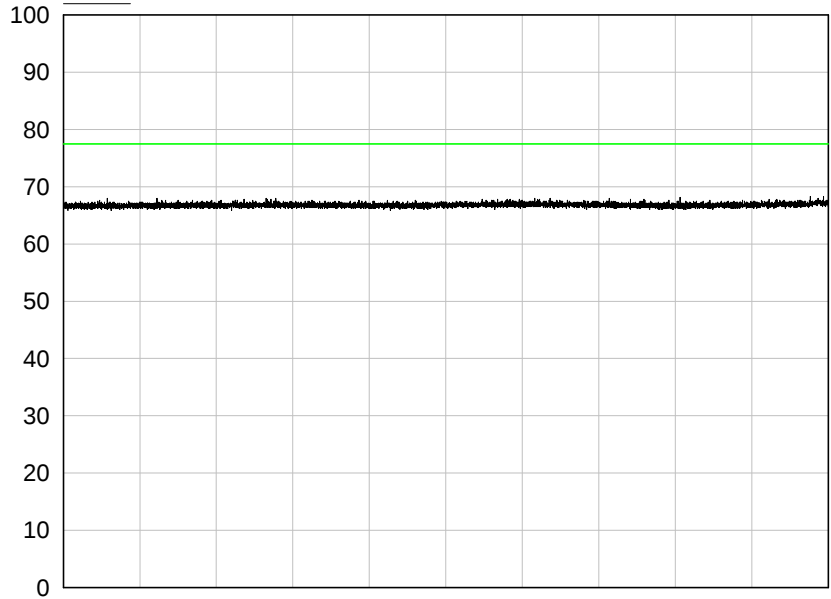
(uV/m) Trace A



Start: 79.0000 GHz Stop: 83.0000 GHz
Res BW: 1 MHz Vid BW: 3 MHz Sweep: 200.41 ms
10/03/2020 16:05:28 E4440A

dB 11830-1 TX Radiated Emissions (Volumetric) 83 - 87 GHz

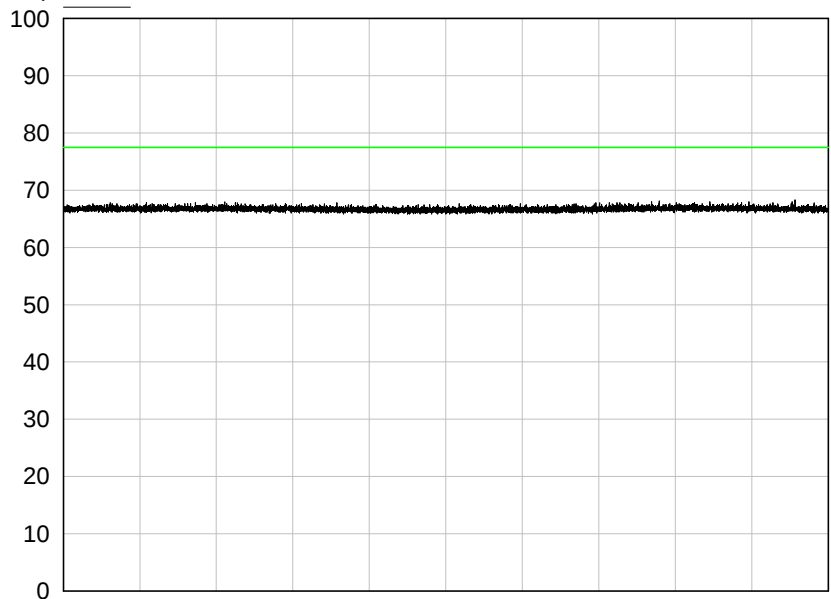
(uV/m) Trace A



Start: 83.0000 GHz Stop: 87.0000 GHz
Res BW: 1 MHz Vid BW: 3 MHz Sweep: 200.41 ms
10/03/2020 16:06:06 E4440A

dB 11830-1 TX Radiated Emissions (Volumetric) 87 - 91 GHz

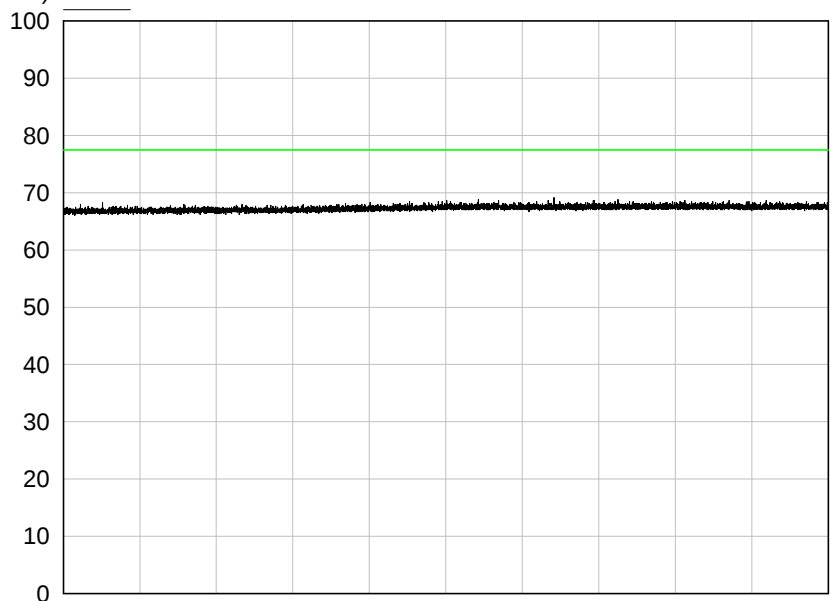
(uV/m) Trace A



Start: 87.0000 GHz Stop: 91.0000 GHz
Res BW: 1 MHz Vid BW: 3 MHz Sweep: 200.41 ms
10/03/2020 16:06:41 E4440A

dB 11830-1 TX Radiated Emissions (Volumetric) 91 - 95 GHz

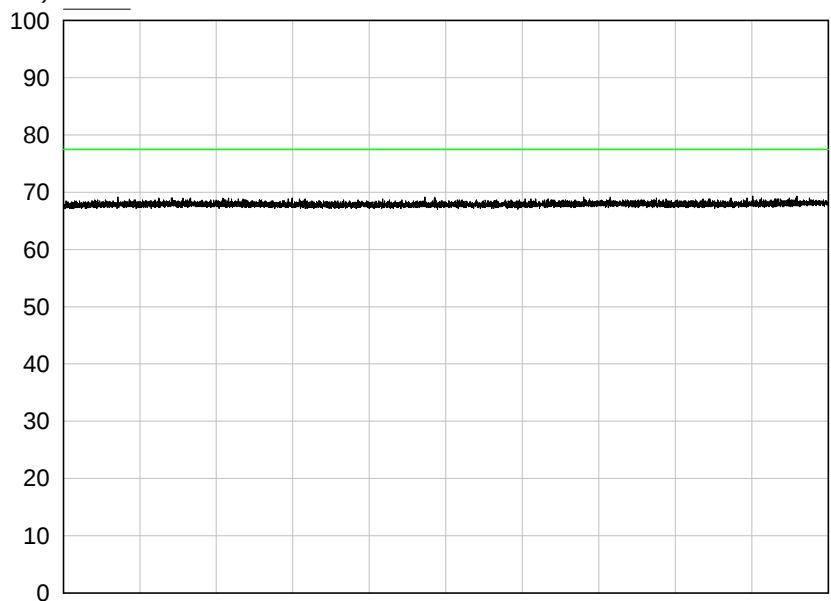
(uV/m) Trace A



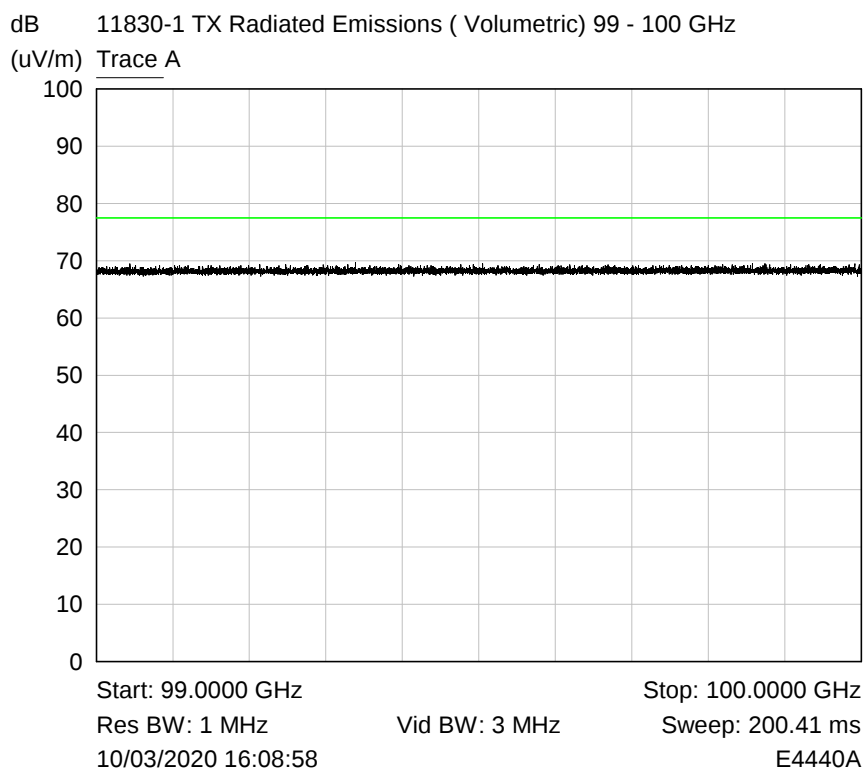
Start: 91.0000 GHz Stop: 95.0000 GHz
Res BW: 1 MHz Vid BW: 3 MHz Sweep: 200.41 ms
10/03/2020 16:07:28 E4440A

dB 11830-1 TX Radiated Emissions (Volumetric) 95 - 99 GHz

(uV/m) Trace A

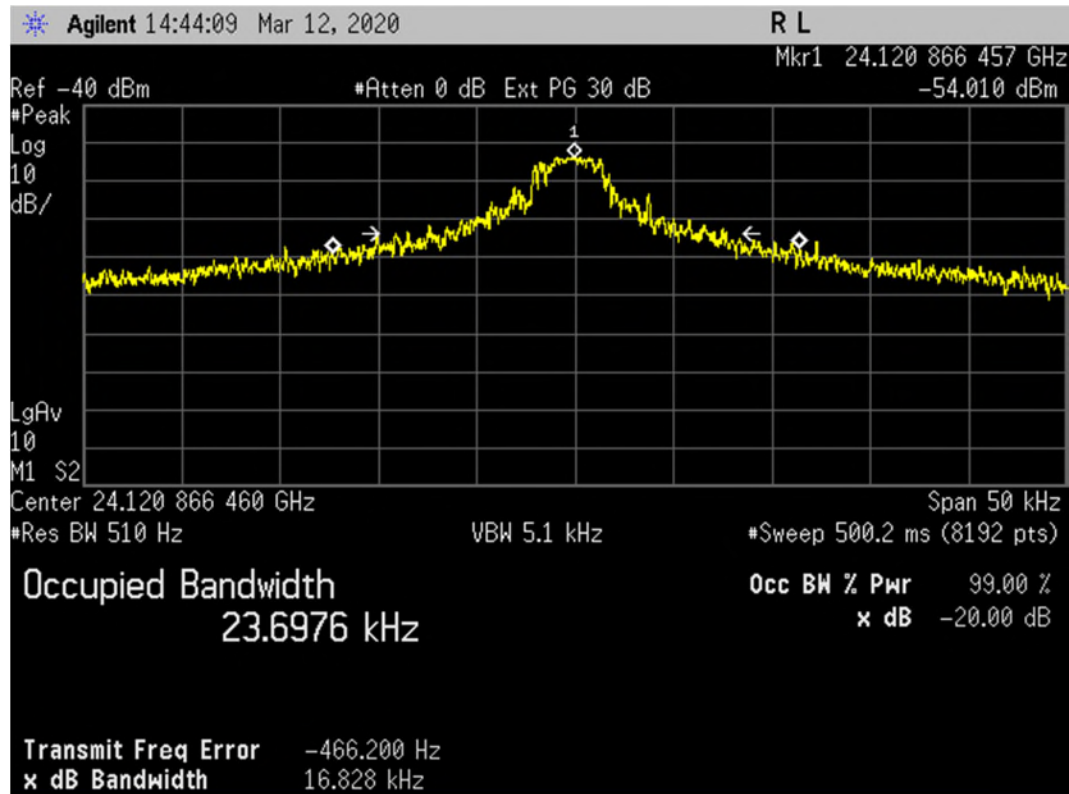


Start: 95.0000 GHz Stop: 99.0000 GHz
Res BW: 1 MHz Vid BW: 3 MHz Sweep: 200.41 ms
10/03/2020 16:08:15 E4440A



6.6 Occupied bandwidth

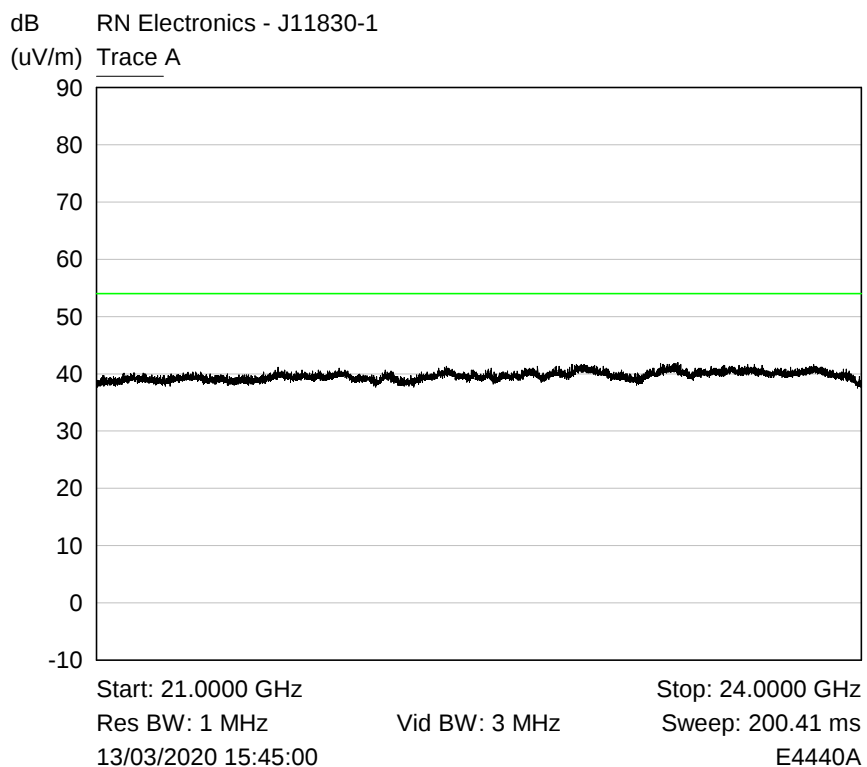
RF Parameters: Band 24075-24175 MHz, Power 20 dBm, Channel Spacing Single Channel,
Modulation CW, Channel 24125 MHz



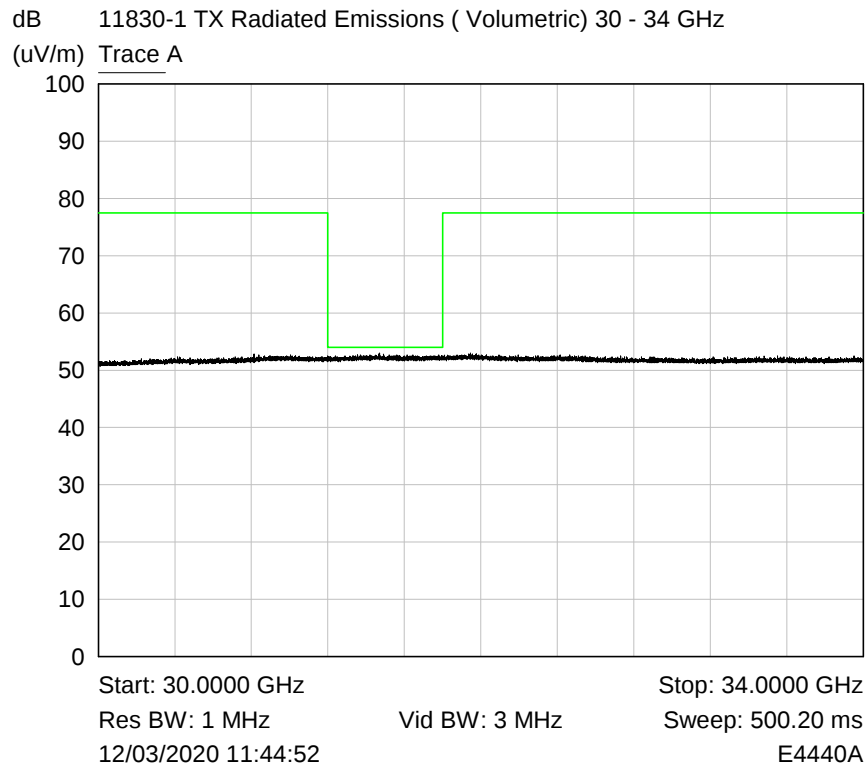
Plot for 20dB bandwidth

6.7 Band Edge Compliance

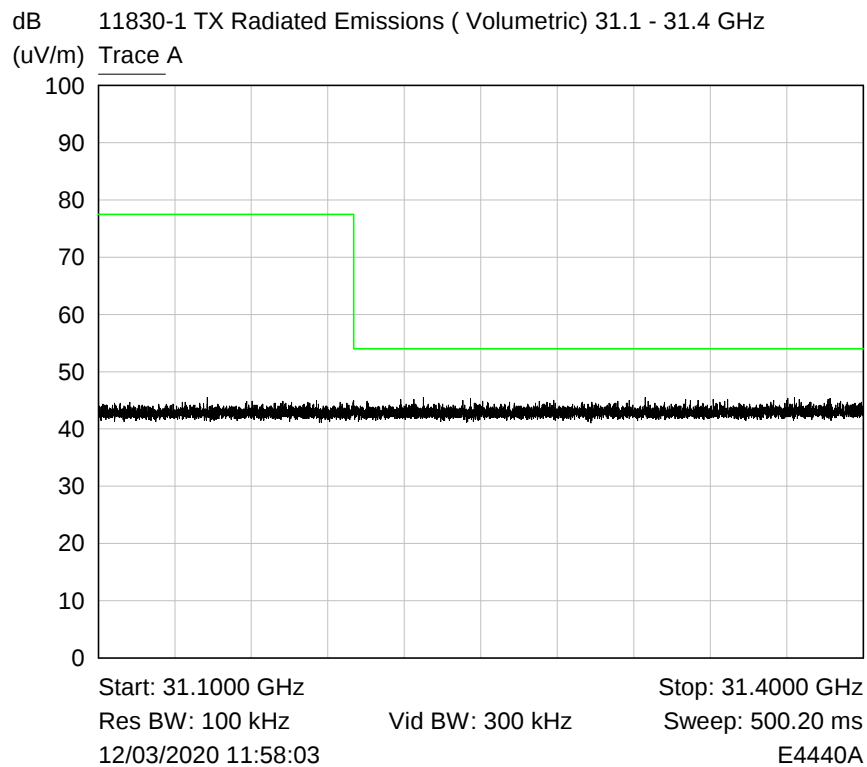
RF Parameters: Band 24075-24175 MHz, Power 20 dBm, Channel Spacing Single Channel,
Modulation CW, Channel 24125 MHz



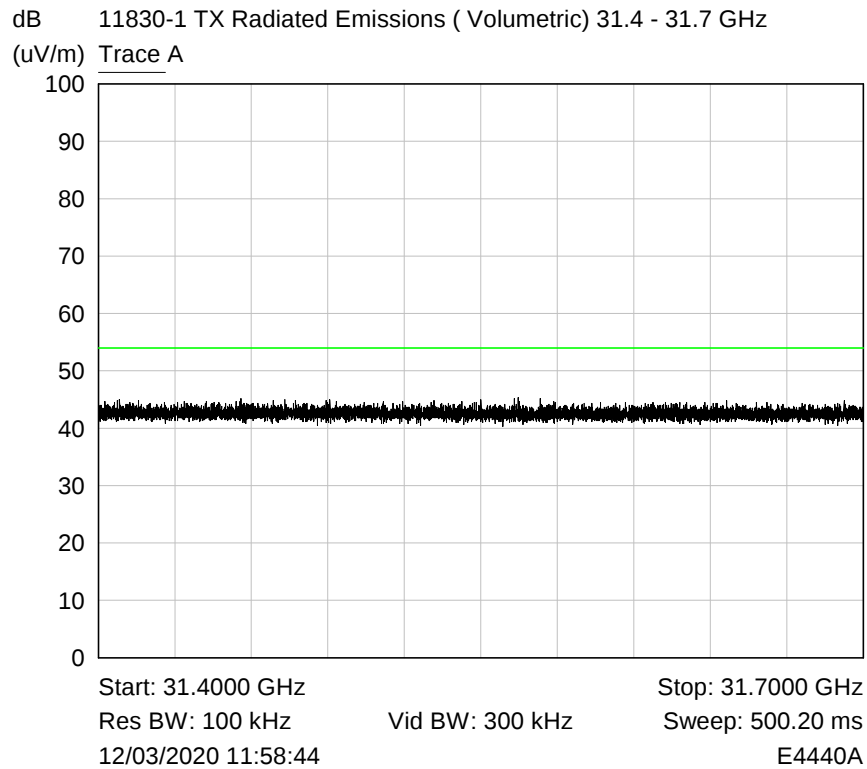
Lower restricted band edge plot



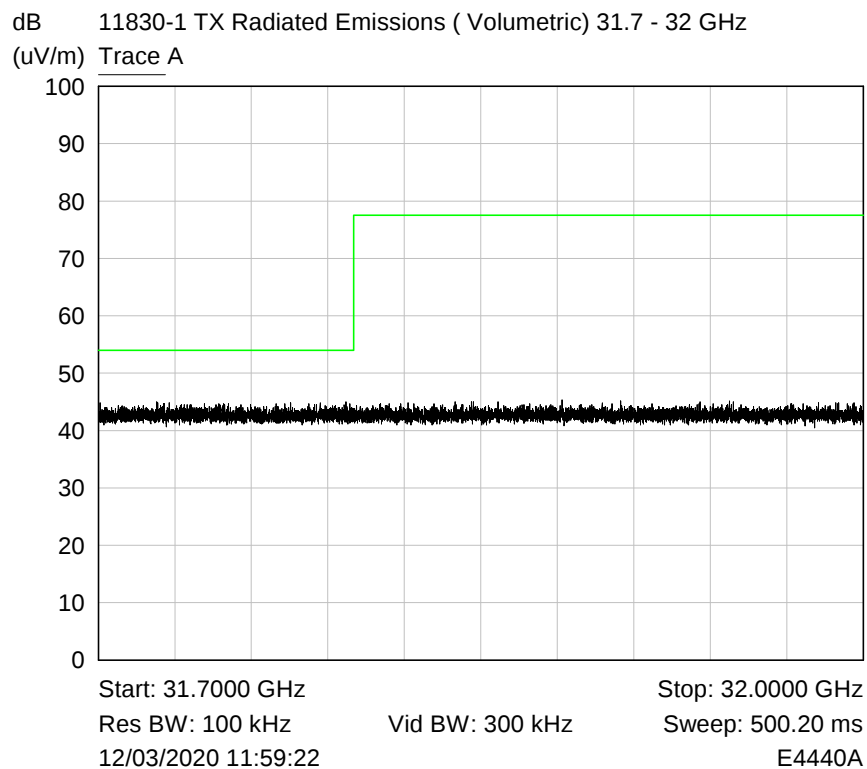
Upper restricted band edge plot



Upper restricted band edge plot

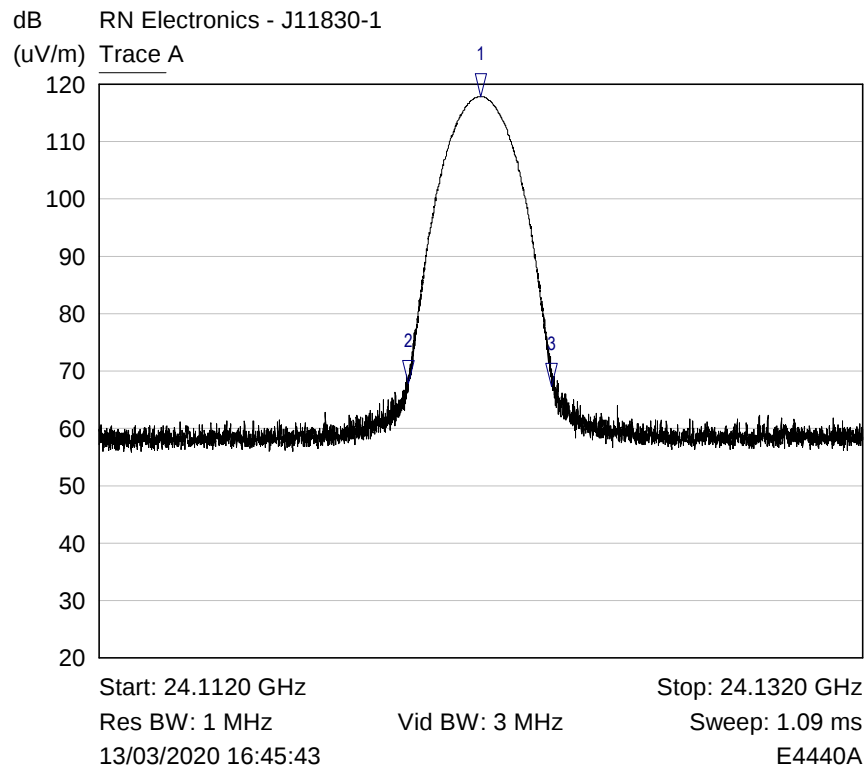


Upper restricted band edge plot



Upper restricted band edge plot

6.8 EIRP Field strength



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	24.1220 GHz	117.87 dB(uV/m)	
2 ▽	Trace A	24.1201 GHz	67.77 dB(uV/m)	
3 ▽	Trace A	24.1239 GHz	67.31 dB(uV/m)	

Plot of EIRP field strength including 50dBc points

7 Explanatory Notes

7.1 Explanation of Table of Signals Measured

Measurements are made as required by the standard. These measurements are made and recorded using detectors, either peak, quasi peak or average dependant on the test. A table of results has been given following the relevant plots. This table looks similar to the one illustrated below dependant on the measurements required by the test: -

Signal No.	Freq (MHz)	Peak Amp (dB μ V)	Pk – Lim 1 (dB)	QP Amp (dB μ V)	QP - Lim1 (dB)	Av Amp (dB μ V)	Av - Lim1 (dB)
1	12345	54.9	-10.5	48	-12.6	37.6	-14.4

Column One - Labelled Signal No. is an incremental number that the receiver has given to each signal that has been measured.

Column Two - Labelled Freq (MHz) is the approximate frequency of the signal received.

Column Three - Labelled Peak Amp (dB μ V) is the level of received signal that was measured in dB above 1 μ V using the peak detector.

Column Four - Labelled Pk - Lim1 (dB) is the difference in level from the peak signal given to the active limit line. If this column appears in the table the peak detector measurement is required by the standard for this test. The results entered in this column indicate the signal level relative to the compliance limit required. Negative numbers indicate that the product is compliant.

Column Five - Labelled QP Amp (dB μ V) is the level of received signal that was measured in dB above 1 μ V using the quasi-peak detector.

Column Six - Labelled QP - Lim1 (dB) is the difference in level from the quasi-peak signal given to the active limit line. If this column appears in the table the quasi-peak detector measurement is required by the standard for this test. The results entered in this column indicate the signal level relative to the compliance limit required. Negative numbers indicate that the product is compliant.

Column Seven - Labelled Av Amp (dB μ V) is the level of received signal that was measured in dB above 1 μ V using the average detector.

Column Eight - Labelled Av - Lim1 (dB) is the difference in level from the average signal given to the active limit line. If this column appears in the table the average detector measurement is required by the standard for this test. The results entered in this column indicate the signal level relative to the compliance limit required. Negative numbers indicate that the product is compliant.

Only signals highlighted in red are deemed to exceed the limit of the detector required.

7.2 Explanation of limit line calculations for radiated measurements

The limits given in the test standard are normally expressed as absolute values (e.g. in $\mu\text{V/m}$ at a specified distance), whereas the measured values are expressed as peak, quasi peak or average values in $\text{dB}\mu\text{V/m}$ referenced to the measuring instrument inputs. RN Electronics calibrate the test set-up to account for any path losses, antenna gains, etc. so that the value read at the receiver relates directly to the absolute value required, except that it is expressed in dB relative to one microVolt and may need to take account of any alternative measuring distance used. Examples:

(a) limit of $500 \mu\text{V/m}$ equates to $20.\log(500) = 54 \text{ dB } \mu\text{V/m}$.

(b) limit of $300 \mu\text{V/m}$ at 10m equates to $20.\log(300 \cdot 10/3) = 60 \text{ dB } \mu\text{V/m}$ at 3m

(c) limit of $30 \mu\text{V/m}$ at 30m, but below 30MHz, equates to $20.\log(30) + 40.\log(30/3) = 69.5 \text{ dB}\mu\text{V/m}$ at 3m, as extrapolation factor below 30MHz is 40dB/decade per $15.31(f)(2)$.

The measurement receiver used for emissions testing, performs the field strength (FS) calculations automatically. The receiver combines the signal amplitude (RA), Antenna Factor (AF) and Cable Loss (CL) factors for the frequency to be measured.

Example calculation: - FS = RA + AF + CL.

Receiver amplitude (RA)	Antenna factor (3m) (AF)	Cable loss (CL)	Field strength result (3m) (FS)
20dBuV	25 dB	3 dB	48dBuV/m

Additional calculation examples per ANSI C63.10 clause 9.4 – 9.6 equations 21, 22, 25 & 26:

Equation 21: $E_{\text{Linear}} = 10^{((E_{\text{Log}} - 120)/20)}$

And therefore equation 21 transposed is: $E_{\text{Log}} = 20 \times \log(E_{\text{Linear}}) + 120$

Where:

E_{Linear} is the field strength of the emission in V/m

E_{Log} is the field strength of the emissions in $\text{dB}\mu\text{V/m}$

Equation 22: $\text{EIRP} = E_{\text{Meas}} + 20\log(d_{\text{Meas}}) - 104.7$

Where:

EIRP is equivalent isotropically radiated power in dBm

E_{Meas} is the field strength of the emission at the measurement distance in $\text{dB}\mu\text{V/m}$

d_{Meas} is the measurement distance in metres

Equation 25: $\text{PD} = \text{EIRP}_{\text{Linear}} / 4\pi d^2$

And therefore equation 25 transposed is: $\text{EIRP}_{\text{Linear}} = \text{PD} \times 4\pi d^2$

Where:

PD is the power density at distance specified by the limit, in W/m^2

$\text{EIRP}_{\text{Linear}}$ is the equivalent isotropically radiated power in Watts

d is the distance at which the power density limit is specified in metres

Equation 26: $\text{PD} = E_{\text{Spec limit}}^2 / 377$

And therefore equation 26 transposed is: $E_{\text{Spec limit}} = \sqrt{(\text{PD} \times 377)}$

Where:

PD is the power density at distance specified by the limit, in W/m^2

$E_{\text{Spec limit}}$ is the field strength at the distance specified by the limit in V/m

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Example:

Radiated spurious emissions limit at 3metres of 90pW/cm².

$$90\text{pW/cm}^2 \times 100^2 = 0.9 \mu\text{W/m}^2 = (\text{EIRP Linear})$$

$$\text{Equation 25 transposed: } 0.9 \times 10^{-6} \times 4 \times \pi \times 3^2 = 0.0001017876 \text{ W}$$

And

$$\text{Equation 26 transposed: } E_{\text{Spec limit}} = \sqrt{(0.9 \times 10^{-6} \times 377)} = 0.01842 \text{ V/m.}$$

And

$$\text{Equation 21 transposed: } E_{\text{Log}} = 20\text{Log}(0.01842) + 120 = 85.3\text{dB}\mu\text{V/m @ 3m.}$$

8 Photographs

8.1 EUT Front View



8.2 EUT Reverse Angle



8.3 EUT Left side View



8.4 EUT Right side View



8.5 EUT Antenna

Picture not included due to confidentiality.

8.6 EUT Display & Controls

The EUT has no display or controls

8.7 EUT Internal photos

Pictures not included due to confidentiality.

8.8 EUT ID Label



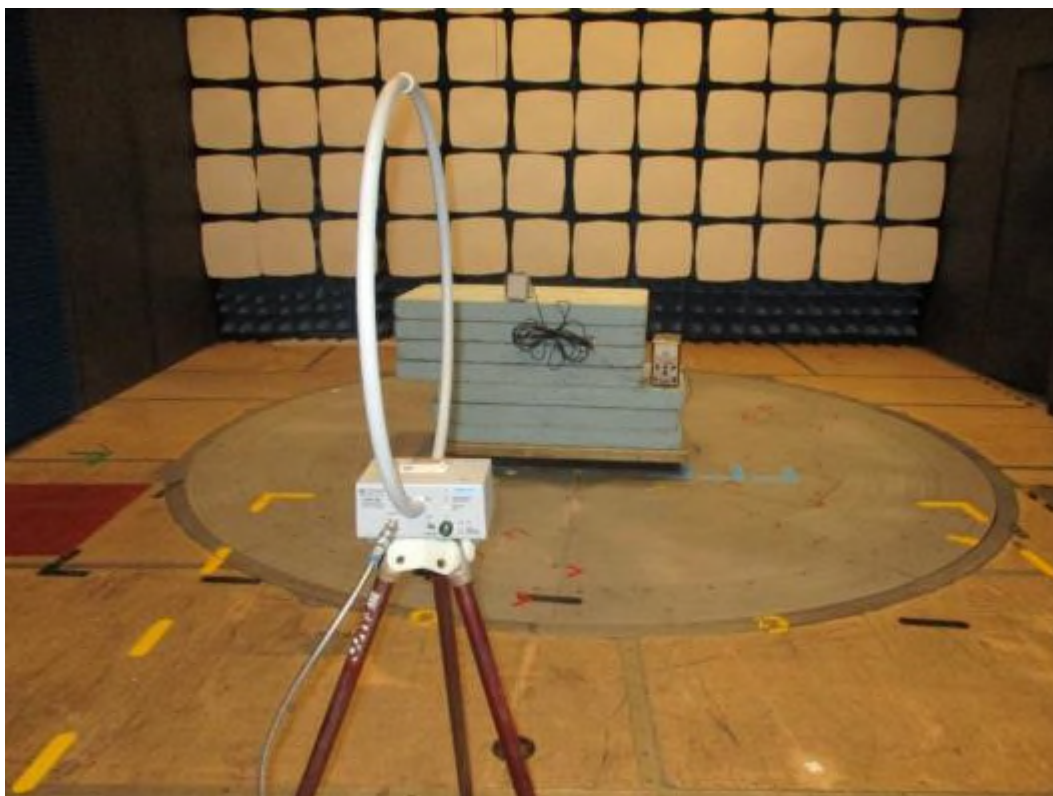
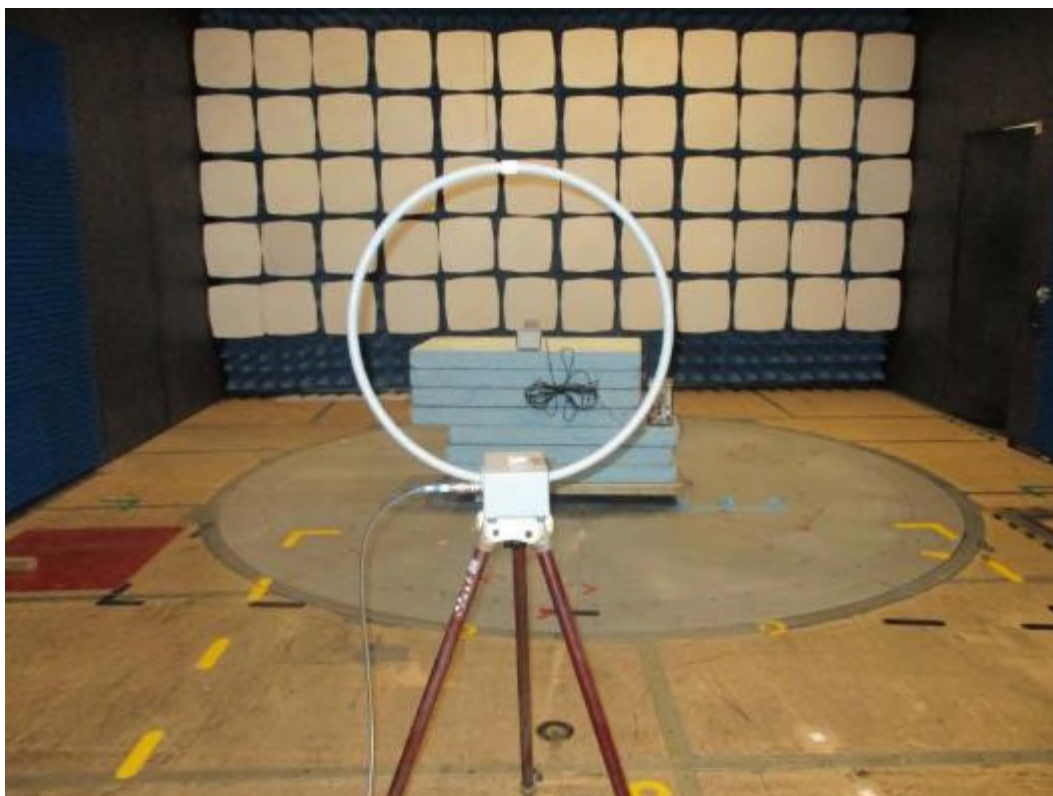
8.9 EUT Chassis

The EUT has no chassis

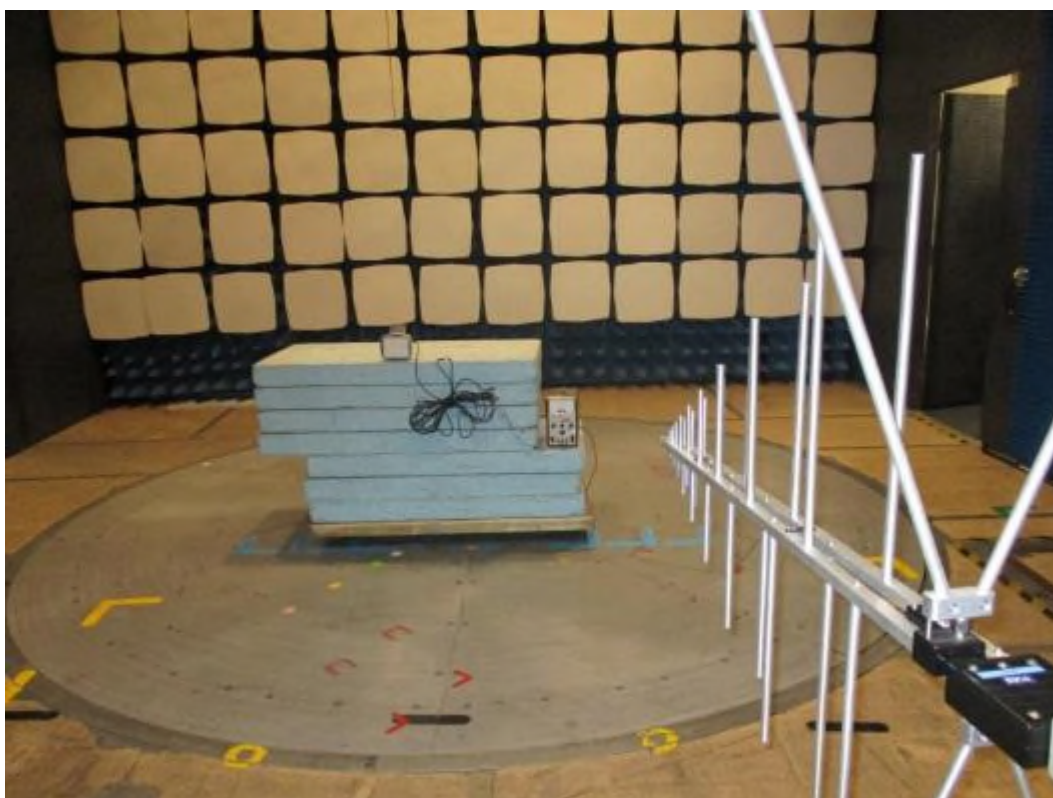
8.10 AC power line conducted emissions



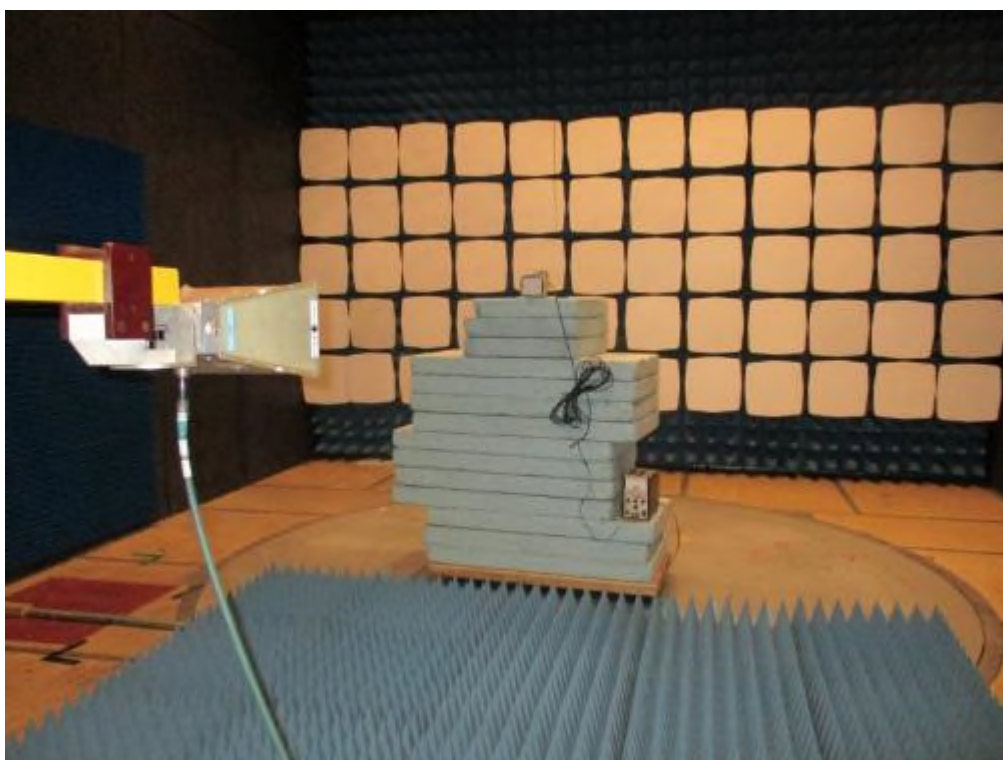
8.11 Radiated emissions 150 kHz - 30 MHz



8.12 Radiated emissions 30 MHz -1 GHz



8.13 Radiated emissions above 1 GHz



Site H

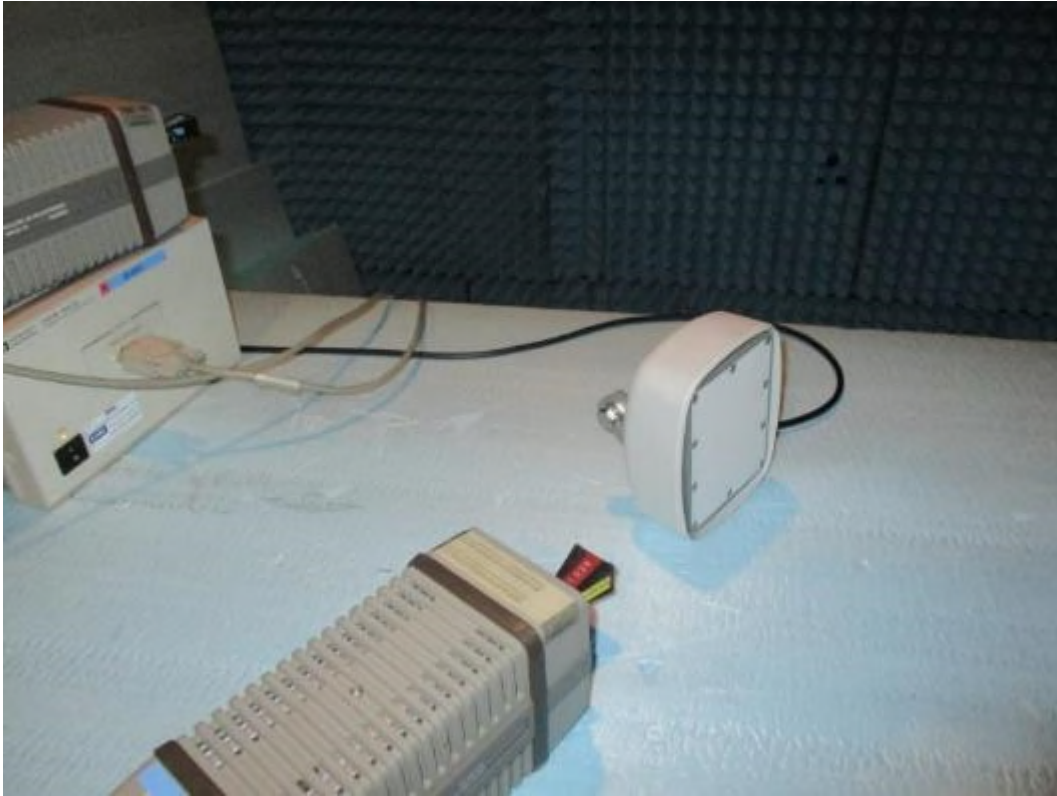




Site A



Site A



Site A

8.14 Radiated emission diagrams

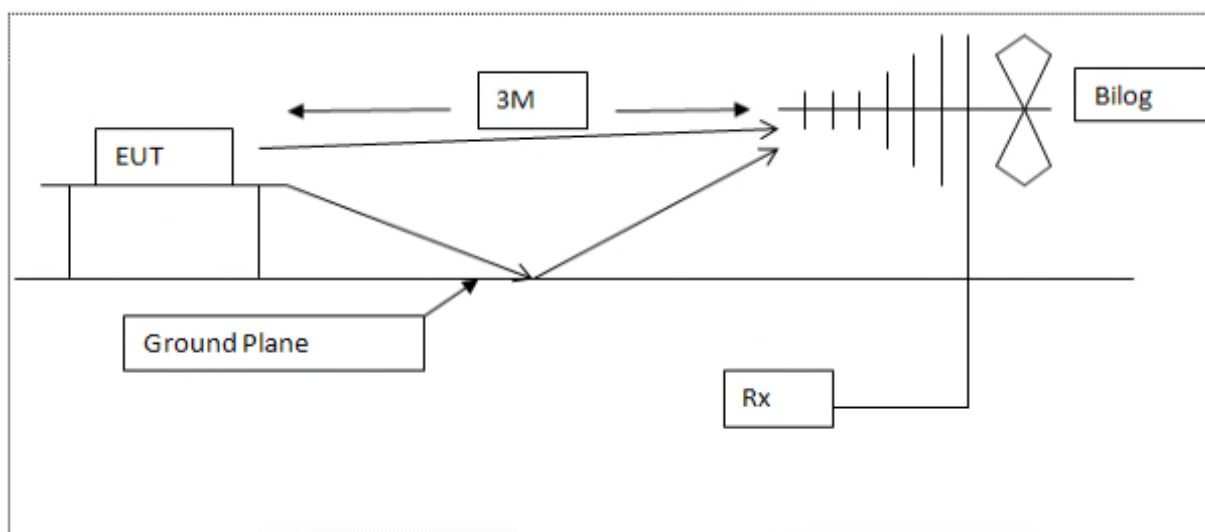


Diagram of the radiated emissions test setup 30 - 1000 MHz

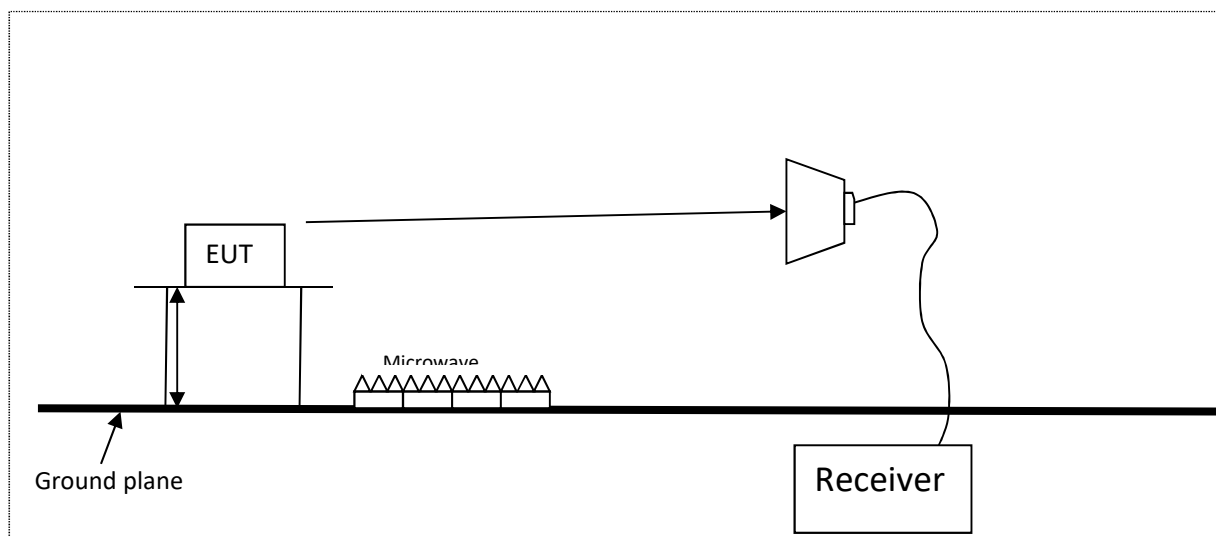


Diagram of the radiated emissions test setup above 1GHz

8.15 AC powerline conducted emission diagram

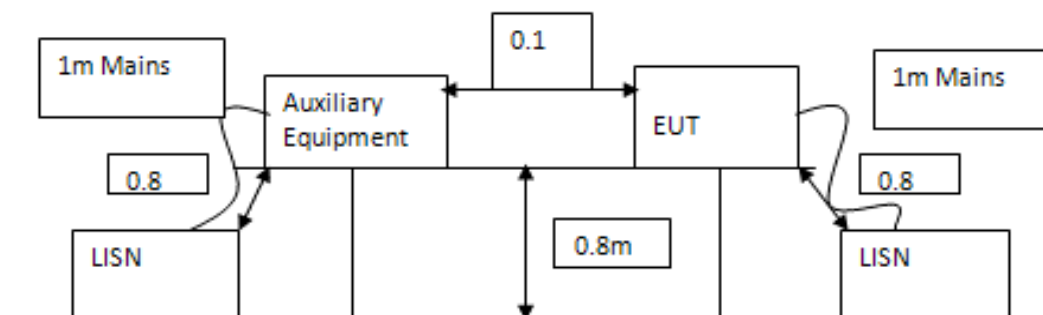


Diagram of the AC conducted emissions test setup

9 Test equipment calibration list

The following is a list of the test equipment used by R.N. Electronics Ltd to test the unit detailed within this report. In line with our procedures, the equipment was within calibration for the period during which testing was carried out.

RN No.	Model No.	Description	Manufacturer	Calibration date	Cal period
E035	11947A	Transient Limiter 9kHz - 200MHz	Hewlett Packard	16-Dec-2019	12 months
E150	MN2050	LISN 13A	Chase	18-Apr-2019	12 months
E296-2	11970A	Harmonic Mixer 26.5-40GHz	Hewlett Packard	02-Jan-2020	12 months
E296-4	11970U	Harmonic Mixer 40-60GHz	Hewlett Packard	04-Dec-2019	24 months
E296-5	11970V	Harmonic Mixer 50-75GHz	Hewlett Packard	25-Nov-2019	24 months
E296-6	11970W	Harmonic Mixer 75-110GHz WR10	Hewlett Packard	08-Dec-2017	36 months
E330	2224-20	Horn Antenna 26.5-40GHz	Flann (FMI)	24-Apr-2019	12 months
E411	N9039A	9 kHz - 1 GHz RF Filter Section	Agilent Technologies	11-Jul-2019	12 months
E412	E4440A	PSA 3 Hz - 26.5 GHz	Agilent Technologies	17-Jul-2018	24 months
E485	11974-60028	Preselector PSU	Agilent Technologies	#13-Mar-2020	12 months
E487	11974U	Preselect Mixer 40 - 60GHz	Agilent Technologies	12-Sep-2018	24 months
E534	E4440A	PSA 3 Hz - 26.5 GHz	Agilent Technologies	20-Jan-2020	24 months
E535	N9039A	9 kHz - 1 GHz RF Filter Section	Agilent Technologies	20-Jan-2020	12 months
E550	11974V	Preselected Mixer 50 - 75GHz	Hewlett Packard	21-Feb-2019	24 months
E580	24240	Horn Std Gain 40GHz - 60GHz	Flann (FMI)	23-Apr-2019	12 months
E624	E4440A	PSA 3 Hz - 26.5 GHz	Agilent Technologies	10-Jan-2020	24 months
E717		Horn Std Gain 50-75GHz		24-Apr-2019	12 months
E718		Horn Std Gain 75-110GHz		23-Apr-2019	12 months
E745	2017 4/2dB	Attenuator 4/2dB 30-1000MHz	RN Electronics	07-Feb-2020	12 months
E777	MG3695B	Signal Generator 8MHz - 50GHz	Anritsu	18-Jun-2019	12 months
E914	VULB 9163	Antenna BiLog 30MHz to 3GHz	Schwarzbeck	24-Apr-2019	12 months
F015	11974A	Preselect Mixer 26.5 - 40GHz	Hewlett Packard	02-Dec-2019	12 months
LPE333	8449B	Pre-Amplifier 1GHz - 26.5GHz	Hewlett Packard	05-Jun-2019	12 months
NSA-H	NSA - H	NSA - Site H	RN Electronics	11-Dec-2019	36 months
TMS78	3160-08	Horn Std Gain 12.4-18 GHz	ETS Systems	24-Jul-2019	12 months
TMS79	3160-09	Horn Std Gain 18-26.5 GHz	ETS Systems	26-Jul-2019	12 months
TMS81	6502	Antenna Active Loop	EMCO	24-Jun-2019	24 months
TMS937	CCN1000	Mains Flicker	Schaffner	08-Aug-2018	24 months
TMS938	NSG1007	AC Power Source 3kVA	Schaffner	08-Aug-2018	24 months
ZSW1	V2.4	Measurement Software Suite	RN Electronics	Not applicable	

Equipment was within calibration dates for tests and has been re-calibrated since/during date of tests.

10 Auxiliary and peripheral equipment

10.1 Customer supplied equipment

No customer equipment was supplied.

10.2 RN Electronics supplied equipment

RN No.	Model No.	Description	Manufacturer	Serial No
P281	L30-2	PSU 30V 2A	Farnell	3888

11 Condition of the equipment tested

In order for the EUT to produce the results shown within this report the following modifications, if any, were implemented.

11.1 Modifications before test

No modifications were made before test by RN Electronics Ltd.

11.2 Modifications during test

No modifications were made during test by RN Electronics Ltd.

12 Description of test sites

Site A	Radio Laboratory and Anechoic Chamber
Site B	Semi-Anechoic Chamber and Control Room FCC Registration No. 293246 IC Registration No. 5612A-4
Site C	Transient Laboratory
Site D	Screened Room (Conducted Immunity)
Site E	Screened Room (Control Room for Site D)
Site F	Screened Room (Conducted Emissions)
Site G	Screened Room (Control Room for Site H)
Site H	3m Semi-Anechoic Chamber (indoor OATS) FCC Registration No. 293246 IC Registration No. 5612A-2
Site J	Transient Laboratory
Site K	Screened Room (Control Room for Site M)
Site M	3m Semi-Anechoic Chamber (indoor OATS) FCC Registration No. 293246 IC Registration No. 5612A-3
Site N	Radio Laboratory
Site Q	Fully-Anechoic Chamber
Site OATS	3m and 10m Open Area Test Site FCC Registration No. 293246 IC Registration No. 5612A-1
Site R	Screened Room (Conducted Immunity)
Site S	Safety Laboratory
Site T	Transient Laboratory

13 Abbreviations and units

%	Percent	LBT	Listen Before Talk
µA/m	microAmps per metre	LO	Local Oscillator
µV	microVolts	mA	milliAmps
µW	microWatts	max	maximum
AC	Alternating Current	kPa	Kilopascal
ALSE	Absorber Lined Screened Enclosure	Mbit/s	MegaBits per second
AM	Amplitude Modulation	MHz	MegaHertz
Amb	Ambient	mic	Microphone
ATPC	Automatic Transmit Power Control	min	minimum
BER	Bit Error Rate	mm	milliMetres
°C	Degrees Celsius	ms	milliSeconds
C/I	Carrier / Interferer	mW	milliWatts
CEPT	European Conference of Postal and Telecommunications Administrations	NA	Not Applicable
COFDM	Coherent OFDM	nom	Nominal
CS	Channel Spacing	nW	nanoWatt
CW	Continuous Wave	OATS	Open Area Test Site
dB	decibel	OFDM	Orthogonal Frequency Division Multiplexing
dBµA/m	decibel relative to 1µA/m	ppm	Parts per million
dBµV	decibel relative to 1µV	PRBS	Pseudo Random Bit Sequence
dBc	decibel relative to Carrier	QAM	Quadrature Amplitude Modulation
dBm	decibel relative to 1mW	QPSK	Quadrature Phase Shift Keying
DC	Direct Current	R&TTE	Radio and Telecommunication Terminal Equipment
DTA	Digital Transmission Analyser	Ref	Reference
EIRP	Equivalent Isotropic Radiated Power	RF	Radio Frequency
ERP	Effective Radiated Power	RFC	Remote Frequency Control
EU	European Union	RSL	Received Signal Level
EUT	Equipment Under Test	RTP	Room Temperature and Pressure
FM	Frequency Modulation	RTPC	Remote Transmit Power Control
FSK	Frequency Shift Keying	Rx	Receiver
g	Grams	s	Seconds
GHz	GigaHertz	SINAD	Signal to Noise And Distortion
Hz	Hertz	Tx	Transmitter
IF	Intermediate Frequency	V	Volts
kHz	kiloHertz		