Radio Test Report

Cambridge Communication Systems Ltd

MetNet 60G

G60UM050000

47 CFR Part 15.255 Effective Date 1st October 2019
DXX: Part 15 Low Power Communication Device Transmitter
Test Date: 30th April 2021 to 5th May 2021
Report Number: 05-11691-1-21 Issue 02
Supersedes Report Number: 05-11691-1-21 Issue 01

R.N. Electronics Ltd.
Arnolds Court
Arnolds Farm Lane
Mountnessing
Essex
CM13 1UT
U.K.

www.RNelectronics.com

Telephone: +44 (0) 1277 352219
Email: sales@RNelectronics.com

Arnolds Court, Arnolds Farm Lane, Mountnessing, Brentwood Essex, CM13 1UT

Certificate of Test 11691-1

The equipment noted below has been partially 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:	MetNet 60G
Model Number:	G60UM050000
Unique Serial Number:	ASY038902.000000869
Applicant:	Cambridge Communication Systems Ltd Victory House Chivers Way Histon Cambridge CB24 9ZR
Proposed FCC ID	2ACV4-M60G-xxx
Full measurement results are detailed in Report Number:	05-11691-1-21 Issue 02
Test Standards:	47 CFR Part 15.255 Effective Date 1st October 2019 DXX: Part 15 Low Power Communication Device Transmitter

NOTE:
The above list is incomplete as only partial tests conducted at request of the manufacturer. Certain tests were not performed based upon manufacturer's declarations. Certain other requirements are subject to manufacturer declaration only and have not been tested/verified. For details refer to section 3 of this report.

DEVIATIONS:
The following tests have had deviations applied: Radiated emissions above 1 GHz. The following tests have not been performed at the request of Cambridge Communication Systems Ltd:- Peak Conducted Power, Frequency stability, 6 dB Occupied bandwidth, Peak & Average EIRP

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:	30th April 2021 to 5th May 2021
Test Engineer:	Ian Rose Digitally signed by: Ian Rose DN: CN = Ian Rose email = Ian@RNElectronics.com C = GB O = Rn Electronics Date: 2021.07.14 08:15:46 Z
Approved By: Technical Manager	Steve Hull Digitally signed by: Steve Hull DN: CN = Steve Hull email = steve@rnelectronics.com C = GB O = RN Electronics Date: 2021.07.13 18:21:22 Z
Customer Representative:	

2360

0 Revision History

Issue Number	Revision History	Page Reference(s)
01	First Issue	-
02	Removed AC mains test from list of tests not performed Model number/HVIN reference table updated and models tested statement revised. Antenna Gain updated to 22dBi. Revised EIRP beam overlap text and included additional diagram demonstrating where beam overlap could occur between radios. Expanded and reordered notes explanation under summary table regarding partial testing. Expanded deviation explanation regarding partial testing, removed AC deviation. Added missing AC Conducted emissions section/results Expanded procedure with reason for not testing above 26.5GHz and referenced report with results in. Expanded notes explanation regarding partial testing. Added missing AC conducted emissions plots Updated section number. Added AC conducted emissions test set-up pictures Added missing AC Conducted emissions test equipment	2 5, 6 7 9, 10 12 13 13 14, 15, 16 21 24 25 – 28 29, 30, 32 50, 51 56

1 Contents

2 Equipment under test (EUT)

2.1 Equipment specification

Applicant	Cambridge Communication Systems Ltd (CCS) Victory House Chivers Way Histon Cambridge CB24 9ZR	
Manufacturer of EUT	Cambridge Communication Systems Ltd (CCS)	
Full Name of EUT	MetNet 60G	
Model Number of EUT	G60UM050000	
Serial Number of EUT	ASY038902.000000869	
Date Received	23rd April 2021	
Date of Test:	30th April 2021 to 5th May 2021	
Purpose of Test	To demonstrate design compliance to the relevant rules of Chapter 47 of the Code of Federal Regulations.	
Date Report Issued	12th July 2021	
Main Function	60GHz mmWave Fixed Wireless Access backhaul.	
Information Specification	Height	270 mm
	Width	140 mm
	Depth	105 mm
	Weight	4 kg
	Voltage	48-57 V DC
	Current	0.5 A
EUT Supplied PSU	Manufacturer	TT Electronics
	Model number	STD-48025
	Serial number	-
	Input voltage	100-240V
	Input current	1.6 A
	Output	1 x 48 V DC @ 2.5 A

The CCS 60GHz Metnet Mesh V2 Node has several variants dependent upon the options fitted; options are power supply type, fibre optic expansion ports and colour. All variants have the same digital board, modem, gps, radios and metalwork.

A power supply must be fitted, the options are:-
AC Mains
48V DC/PoE combined relay switched
48V DC only, No PoE input
PoE only, No 48V DC input

All variants have the same metalwork and construction, the only exception being the top cover which has two extra access holes in the top cover when a fibre board is fitted.
A node can come in different colours, this is purely a cosmetic change, and currently a node is only available in black or grey.

The following Models/HVIN's are available for this EUT:

G60UM00 AC mains PSU without fibre
G60UM04 AC mains PSU with fibre
G60UM01 48V DC/PoE PSU, No Fibre
G60UM02 48V DC PSU, No Fibre

G60UM03 PoE PSU, No Fibre
G60UM05 48V DC/PoE PSU, Fibre
G60UM06 48V DC PSU, Fibre
G60UM07 PoE PSU, Fibre

HVIN/Model cross reference to Product code and variants:

HVIN	Description	Colour	Power	Fibre	Product Code
G60UM00	Metnet 60G Mesh v2	Black	AC	N/A	G60UM000000
G60UM01	Metnet 60G Mesh v2	Black	48vdc or PoE	N/A	G60UM010000
G60UM02	Metnet 60G Mesh v2	Black	48vdc only	N/A	G60UM020000
G60UM03	Metnet 60G Mesh v2	Black	PoE only	N/A	G60UM030000
G60UM04	Metnet 60G Mesh v2	Black	AC	1G/10G	G60UM040000
G60UM05	**Metnet 60G Mesh v2**	**Black**	**48vdc or PoE**	**1G/10G**	**G60UM050000**
G60UM06	**Metnet 60G Mesh v2**	**Black**	**48vdc only**	**1G/10G**	**G60UM060000**
G60UM07	**Metnet 60G Mesh v2**	**Black**	**PoE only**	**1G/10G**	**G60UM070000**
G60UM00	Metnet 60G Mesh v2	Grey	AC	N/A	G60UM000088
G60UM01	Metnet 60G Mesh v2	Grey	48vdc or PoE	N/A	G60UM010088
G60UM02	Metnet 60G Mesh v2	Grey	48vdc only	N/A	G60UM020088
G60UM03	Metnet 60G Mesh v2	Grey	PoE only	N/A	G60UM030088
G60UM04	Metnet 60G Mesh v2	Grey	AC	1G/10G	G60UM040088
G60UM05	**Metnet 60G Mesh v2**	**Grey**	**48vdc or PoE**	**1G/10G**	**G60UM050088**
G60UM06	**Metnet 60G Mesh v2**	**Grey**	**48vdc only**	**1G/10G**	**G60UM060088**
G60UM07	**Metnet 60G Mesh v2**	**Grey**	**PoE only**	**1G/10G**	**G60UM070088**

Models listed in Green in the table above are covered by this test report. Namely G60UM05, G60UM06 and G60UM07.

Some tests have not been applied or only partial test ranges have been applied within this report, this is due to the following rationale:

All models contain identical radio configurations, have the same digital board, same modem, same gps, and utilise the same metalwork, only the method of powering changes along with the addition of a fibre port board. For this reason, only radiated emissions were performed up to 26.5GHz to encompass any differences in emissions between power supply methods and the fibre board.

2.2 Configurations for testing

General Parameters	
EUT Normal use position	Vertically mounted
Choice of model(s) for type tests	Production samples
Antenna details	Integral. Phase array beamforming. 22 dBi gain.
Antenna port	None
Baseband Data port (yes/no)?	No
Highest Signal generated in EUT	69.12 GHz
Lowest Signal generated in EUT	25 MHz
Hardware Version	V1.0
Software Version	radio-integration-unreleased-154
Firmware Version	Not applicable
Type of Equipment	60 GHz radio
Technology Type	IEEE 802.11 ad
Geo-location (yes/no)	Yes
TX Parameters	
Alignment range – transmitter	57-71 GHz
EUT Declared Modulation Parameters	DSSS, BPSK, QPSK, 16QAM
EUT Declared Power level	+40 dBm EIRP
EUT Declared Signal Bandwidths	2.16 GHz
EUT Declared Channel Spacing's	2.16 GHz
EUT Declared Duty Cycle	Not declared
Unmodulated carrier available?	Yes
Declared frequency stability	Not declared
RX Parameters	
Alignment range – receiver	57-71 GHz
EUT Declared RX Signal Bandwidth	2.16 GHz
Receiver Signal Level (RSL)	Not declared
Method of Monitoring Receiver BER	1 % PER
FCC Parameters	
FCC Transmitter Class	FCC: DXX Part 15 Low Power Communication Device Transmitter

2.3 Functional description

The product is a 60GHz 802.11 ad transceiver node capable of sustaining simultaneous links with multiple CPE providing and to provide wireless backhaul for access equipment such as cellular base stations.

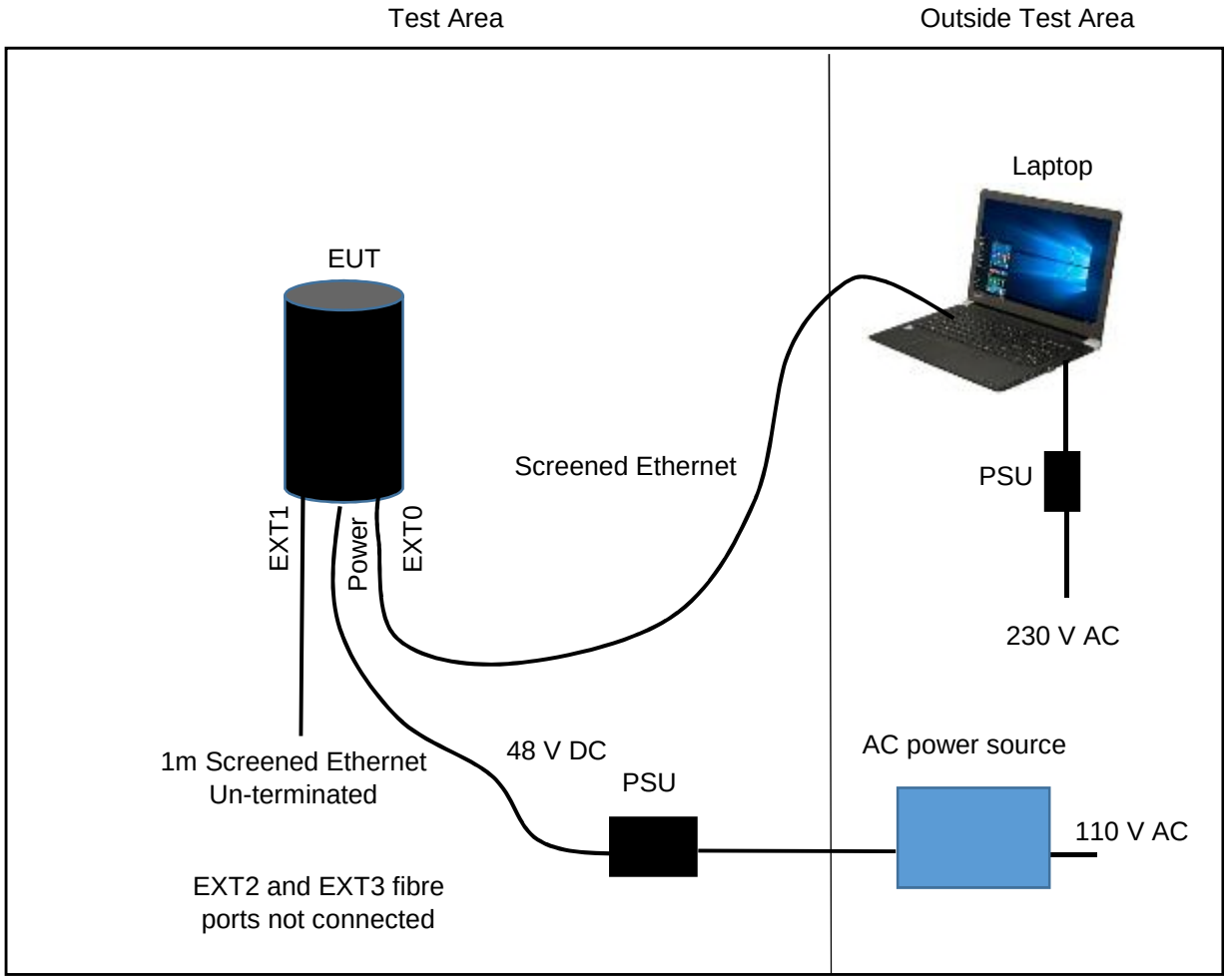
• Topologies
– MultiPoint-to-MultiPoint (MPtMP) mesh
– Point-to-MultiPoint (PtMP)
– Point-to-Point (PtP)

The product is designed to be mounted on street furniture such as a pole, lamppost or residential or commercial property.

2.4 Modes of operation

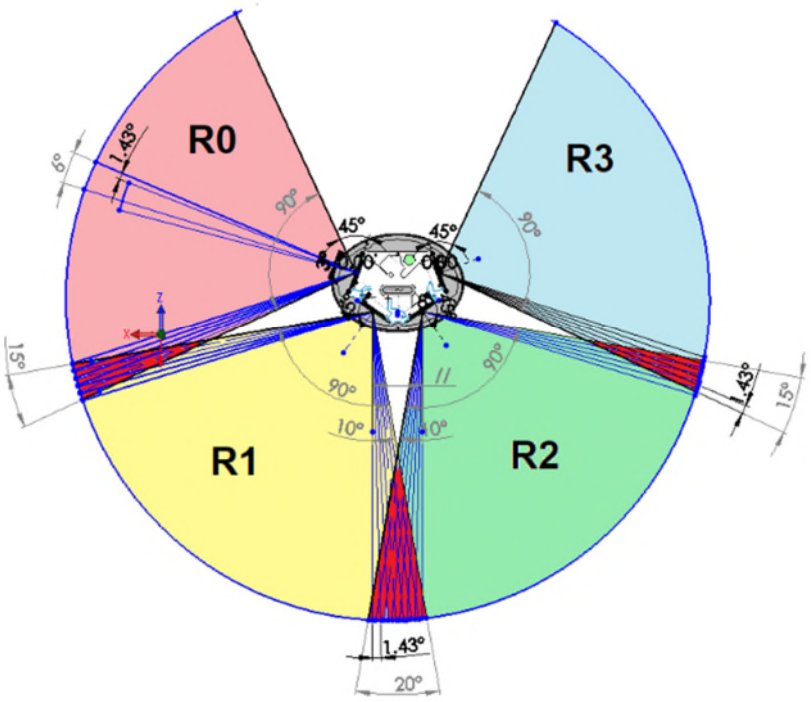
Mode Reference	Description	Used for testing
TX1	Transmitting 58.32 GHz 40 dBm mcs0	No
TX2	Transmitting 58.32 GHz 40 dBm mcs1	No
TX3	Transmitting 58.32 GHz 40 dBm mcs2	No
TX4	Transmitting 58.32 GHz 40 dBm mcs3	No
TX5	Transmitting 58.32 GHz 40 dBm mcs4	No
TX6	Transmitting 58.32 GHz 40 dBm mcs5	Yes
TX7	Transmitting 58.32 GHz 40 dBm mcs6	No
TX8	Transmitting 58.32 GHz 40 dBm mcs7	No
TX9	Transmitting 58.32 GHz 40 dBm mcs8	No
TX10	Transmitting 58.32 GHz 40 dBm mcs9	No
TX11	Transmitting 58.32 GHz 40 dBm mcs10	No
TX12	Transmitting 58.32 GHz 40 dBm mcs11	No
TX13	Transmitting 58.32 GHz 40 dBm mcs12	No
TX14	Transmitting 62.64 GHz 40 dBm mcs0	No
TX15	Transmitting 62.64 GHz 40 dBm mcs1	No
TX16	Transmitting 62.64 GHz 40 dBm mcs2	No
TX17	Transmitting 62.64 GHz 40 dBm mcs3	No
TX18	Transmitting 62.64 GHz 40 dBm mcs4	No
TX19	Transmitting 62.64 GHz 40 dBm mcs5	Yes
TX20	Transmitting 62.64 GHz 40 dBm mcs6	No
TX21	Transmitting 62.64 GHz 40 dBm mcs7	No
TX22	Transmitting 62.64 GHz 40 dBm mcs8	No
TX23	Transmitting 62.64 GHz 40 dBm mcs9	No
TX24	Transmitting 62.64 GHz 40 dBm mcs10	No
TX25	Transmitting 62.64 GHz 40 dBm mcs11	No
TX26	Transmitting 62.64 GHz 40 dBm mcs12	No
TX27	Transmitting 69.12 GHz 40 dBm mcs0	No
TX28	Transmitting 69.12 GHz 40 dBm mcs1	No
TX29	Transmitting 69.12 GHz 40 dBm mcs2	No
TX30	Transmitting 69.12 GHz 40 dBm mcs3	No
TX31	Transmitting 69.12 GHz 40 dBm mcs4	No
TX32	Transmitting 69.12 GHz 40 dBm mcs5	Yes
TX33	Transmitting 69.12 GHz 40 dBm mcs6	No
TX34	Transmitting 69.12 GHz 40 dBm mcs7	No
TX35	Transmitting 69.12 GHz 40 dBm mcs8	No
TX36	Transmitting 69.12 GHz 40 dBm mcs9	No
TX37	Transmitting 69.12 GHz 40 dBm mcs10	No
TX38	Transmitting 69.12 GHz 40 dBm mcs11	No
TX39	Transmitting 69.12 GHz 40 dBm mcs12	No
TX40	Transmitting CW 58.32 GHz 99.687 MHz tone	No
TX41	Transmitting CW 62.64 GHz 99.687 MHz tone	No

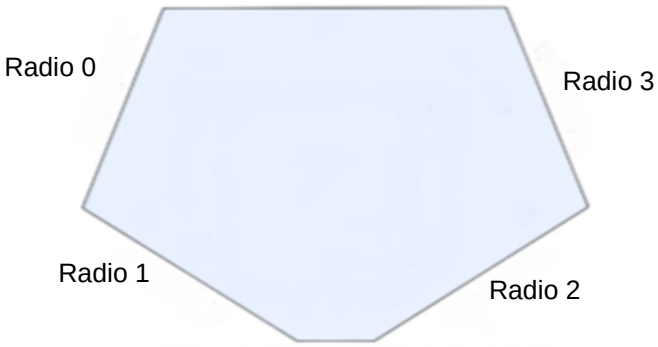
2.5 Emissions configuration



The unit was powered from 48 V DC via a power adaptor from 110 V AC mains. The unit was configured with engineering menus via a terminal program to allow permanent transmit modes of the device on the each of 4 radios, and on the channels and modulation schemes as stated within section 2.4 of this report. The applicant declares that each radio operates on a different channel and that they can transmit at the same time. In addition, each radio allows circular beam steering as defined in ANSI C63.10 section 13. The beam value is settable between 0 and 64, with 0 being omnidirectional and 1 to 63 being a sector angle. The applicant declares that it is possible for beam overlap from adjacent radios (but each radio is on a different channel). RN Electronics performed initial investigations in 0.5° steps on each of the radios through a 360° EUT rotation for all beam settings. The -3 dB beamwidth was found to be approximately ±4° and is steerable over roughly 95° thereby providing near 360° coverage with all four radios. It was found that individual antenna beamwidth increased slightly on antenna beams at each end of the antenna arrays, but EIRP from those same beam settings at the outer arrays was reduced. From this information it was possible to determine the effect of having adjacent radios with beam overlap and where maximum EIRP would occur. Highest EIRP was still measured when there was no beam overlap.

Additional information provided by CCS Ltd confirmed where beam overlap could occur between specific radios:





View from above showing arrangement of radios

Channel 1 = 58.32 GHz, power level +40 dBm (all modulation schemes)
Channel 2 = 60.48 GHz, power level +40 dBm (all modulation schemes)
Channel 3 = 62.64 GHz, power level +40 dBm (all modulation schemes)
Channel 4 = 64.8 GHz, power level +40 dBm (all modulation schemes)
Channel 5 = 66.96 GHz, power level +40 dBm (all modulation schemes)
Channel 6 = 69.12 GHz, power level +40 dBm (all modulation schemes)

Modulation schemes available were DBPSK (MCS0), BPSK (MCS1 to MCS5), QPSK (MCS6 to MCS9) and 16QAM (MCS10 to MCS12).

Measured duty cycles for the schemes were as follows (MCS0 declared as not in use by applicant): -
MCS1 99.8 %
MCS2 99.5 %
MCS3 99.4 %
MCS4 99.3 %
MCS5 99.2 %

MCS6 99 %
MCS7 98.8 %
MCS8 98.6 %
MCS9 98.5 %
MCS10 98.1 %
MCS11 97.7 %
MCS12 97.3 %

2.5.1 Signal leads

Port Name	Cable Type	Connected
Power (AC)	Exterior grade cable. Commercial connector	Yes
EXT0	CAT5e screened. RJ45 connector	Yes
EXT1	CAT5e screened. RJ45 connector	Yes
EXT2	Optical fibre	No
EXT3	Optical fibre	No

3 Summary of test results

The MetNet 60G, G60UM050000 was tested for compliance to the following standard(s):

47 CFR Part 15.255 Effective Date 1st October 2019
DXX: Part 15 Low Power Communication Device Transmitter

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	NOT APPLICABLE[1]
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 15.255(d)(2)	PASSED
5. Radiated emissions above 1 GHz	47 CFR Part 15C Part 15.255(d)(2)/(3)/(4)	PASSED[2]
6. Frequency stability	47 CFR Part 15C Part 15.255(f)	NOT TESTED[3]
7. Peak & Average EIRP	47 CFR Part 15C Part 15.255(c)(1)(i)/(ii)	NOT TESTED[3]
8. Peak Conducted Power	47 CFR Part 15C Part 15.255(c)(3)/(4)	NOT TESTED[3]
9. 6dB Occupied bandwidth	47 CFR Part 15C Part 15.255(e)(1)	NOT TESTED[3]

[1] Spectrum below 30MHz started at a frequency of 150 kHz up to a frequency of 30MHz based on the lowest signal generated/used within the equipment of 25 MHz as declared by the applicant.
[2] Spectrum investigated up to 26.5 GHz at the request of the applicant, for results above 26.5GHz please refer to RN report 05-11387-1-21 as Radio configuration is identical between EUT models/HVIN's.
[3] Radio configuration is identical between EUT models/HVIN's, please refer to RN report 05-11387-1-21 for results of these tests.

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
4.1.4	KDB 842590 D01 v01	2019	Federal Communications Commission Office of Engineering and Technology Laboratory Division; Basic certification requirements and measurement procedures for Upper Microwave Flexible Use Service (UMFUS) devices

4.2 Deviations

Deviations have been applied on the following: Radiated emissions above 1 GHz : Frequency of investigation limited to 26.5 GHz at the request of the applicant, for results above 26.5GHz please refer to RN report 05-11387-1-21 as Radio configuration is identical between EUT models/HVIN's.

Peak Conducted Power, Frequency stability, 6 dB Occupied bandwidth, Peak & Average EIRP, These tests were not performed as Radio configuration is identical between EUT models/HVIN's, please refer to RN report 05-11387-1-21 for results of these tests.

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 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. During the initial scan, no discernible difference in emissions could be observed when operating on different channels or modulation schemes. For final test the EUT was operated with all four radios in mode TX6, both 48V DC powered configuration and PoE powered configuration were tested.

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

See Section 9 for more details

5.1.5 Test results

Temperature of test environment	12-15°C
Humidity of test environment	50-60%
Pressure of test environment	100kPa

Band	57-71 GHz
Power Level	40 dBm (EIRP)
Channel Spacing	2.16 GHz
Mod Scheme	mcs5
Single channel	62.64 GHz

Cond 1 AC - TX PoE PSU

Plot References
Peak emissions 150 kHz - 30 MHz on the live terminal against the average limit line.
Peak emissions 150 kHz - 30 MHz on the live terminal against the quasi-peak limit line.
Peak emissions 150 kHz - 30 MHz on the neutral terminal against the average limit line.
Peak emissions 150 kHz - 30 MHz on the neutral terminal against the quasi-peak limit line.

Cond 2 AC - TX Linear PSU

Plot References
Peak emissions 150 kHz - 30 MHz on the live terminal against the average limit line.
Peak emissions 150 kHz - 30 MHz on the live terminal against the quasi-peak limit line.
Peak emissions 150 kHz - 30 MHz on the neutral terminal against the average limit line.
Peak emissions 150 kHz - 30 MHz on the neutral terminal against the quasi-peak limit line.

Table of signals measured for Live 150k-30M TX PoE PSU

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP -Lim (dB)	AV Amp (dBuV)	AV -Lim (dB)
1	0.173	64.3	56.7	-8.1	27.4	-27.4
2	0.191	64.8	59.7	-4.3	43.1	-10.9
3	0.217	59.7	52.8	-10.1	24.0	-28.9
4	0.314	53.3	46.9	-13.0	27.3	-22.6
5	0.334	52.8	45.5	-13.9	25.5	-23.9
6	0.435	48.9	41.5	-15.7	24.5	-22.7
7	2.731	42.7	35.7	-20.3	20.2	-25.8
8	2.915	45.3	38.5	-17.5	22.7	-23.3
9	2.944	43.5	37.6	-18.4	22.1	-23.9
10	3.188	43.6	38.0	-18.0	24.4	-21.6
11	19.145	50.0	47.3	-12.7	42.2	-7.8
12	20.062	48.5	44.6	-15.4	37.8	-12.2

Table of signals measured for Neutral 150k-30M TX PoE PSU

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP -Lim (dB)	AV Amp (dBuV)	AV -Lim (dB)
1	0.159	65.0	58.5	-7.0	28.2	-27.3
2	0.192	65.0	60.7	-3.2	44.5	-9.4
3	0.253	59.2	53.1	-8.6	35.9	-15.8
4	0.430	47.2	41.6	-15.7	22.0	-25.3
5	0.505	45.4	39.7	-16.3	22.4	-23.6
6	0.542	45.0	39.5	-16.5	21.3	-24.7
7	2.742	40.6	36.1	-19.9	24.2	-21.8
8	2.884	41.4	36.8	-19.2	24.3	-21.7
9	3.184	41.5	36.9	-19.1	25.1	-20.9
10	18.425	46.3	43.2	-16.8	36.3	-13.7
11	19.570	50.3	46.6	-13.4	40.5	-9.5
12	21.103	46.4	42.6	-17.4	36.1	-13.9

Table of signals measured for Live 150k-30M TX Linear PSU

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP -Lim (dB)	AV Amp (dBuV)	AV -Lim (dB)
1	0.156	60.3	57.8	-7.9	46.9	-8.8
2	0.193	55.9	52.4	-11.5	41.6	-12.3
3	0.231	52.7	49.5	-12.9	37.3	-15.1
4	0.321	47.3	43.7	-16.0	27.1	-22.6
5	0.352	48.3	45.8	-13.1	32.3	-16.6
6	0.478	53.8	49.9	-6.5	32.6	-13.8
7	22.951	43.3	37.4	-22.6	25.2	-24.8
8	22.951	42.3	37.3	-22.7	25.2	-24.8
9	23.124	43.1	37.6	-22.4	25.8	-24.2
10	23.464	43.4	38.6	-21.4	26.6	-23.4
11	23.524	43.2	38.1	-21.9	26.7	-23.3
12	23.698	43.6	38.5	-21.5	26.9	-23.1

Table of signals measured for Neutral 150k-30M TX Linear PSU

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP -Lim (dB)	AV Amp (dBuV)	AV -Lim (dB)
1	0.196	58.0	52.3	-11.5	41.4	-12.4
2	0.230	52.9	50.0	-12.4	37.6	-14.8
3	0.478	54.2	50.6	-5.8	33.0	-13.4
4	0.493	52.7	48.3	-7.8	30.6	-15.5
5	0.493	52.7	48.5	-7.6	30.8	-15.3
6	0.532	47.3	43.4	-12.6	25.8	-20.2
7	23.085	43.7	38.2	-21.8	26.4	-23.6
8	23.124	44.7	38.5	-21.5	26.5	-23.5
9	23.252	44.4	38.8	-21.2	26.8	-23.2
10	23.471	43.7	38.8	-21.2	27.4	-22.6
11	23.871	45.4	39.0	-21.0	28.1	-21.9
12	23.925	42.2	39.1	-20.9	28.1	-21.9

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 ±3.6dB.

5.2 Radiated emissions 9 - 150 kHz

NOT APPLICABLE: Spectrum below 30MHz started at a frequency of 150 kHz based on the lowest declared signal generated within the equipment of 25 MHz.

5.3 Radiated emissions 150 kHz - 30 MHz

5.3.1 Test methods

Test Requirements:	47 CFR Part 15C Part 15.255(d)(2) [Reference 4.1.1 of this report]
Test Method:	ANSI C63.10 Clause 6.3 & 6.4 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15C Part 15.209/15.255(d)(2) [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 examined in its normal use position. During the initial scan worst case was seen when powered from 48 V DC rather than PoE. Radiated Emissions testing was performed with the EUT powered from 48 V DC. During the initial scan no discernible difference in emissions could be observed when operating on different channels or modulation schemes. The EUT was operated with all four radios in TX19 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 M.

5.3.4 Test equipment

TMS81, ZSW1, E624, E411

See Section 9 for more details

5.3.5 Test results

Temperature of test environment	18°C
Humidity of test environment	36%
Pressure of test environment	102kPa

Band	57-71 GHz
Power Level	40 dBm (EIRP)
Channel Spacing	2.16 GHz
Mod Scheme	mcs5
Single channel	62.64 GHz

Plot refs
11691-1 Rad 1 150k-30MHz Para
11691-1 Rad 1 150k-30MHz Perp

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.
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 ±3.9dB

5.4 Radiated emissions 30 MHz - 1 GHz

5.4.1 Test methods

Test Requirements:	47 CFR Part 15C Part 15.255(d)(2) [Reference 4.1.1 of this report]
Test Method:	ANSI C63.10 Clause 6.3 & 6.5 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15C Part 15.255(d)(2) [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 examined in its normal use position. During the initial scan worst case was seen when powered from 48 V DC rather than PoE. Radiated Emissions testing was performed with the EUT powered from 48 V DC. During the initial scan no discernible difference in emissions could be observed when operating on different channels or modulation schemes. The EUT was operated with all four radios in TX19 mode.

5.4.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment listed below. Measurements were made on a site listed with the FCC. 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 M.

5.4.4 Test equipment

LPE364, E743, NSA-M, ZSW1, E624, E411

See Section 9 for more details

5.4.5 Test results

Temperature of test environment	18°C
Humidity of test environment	36%
Pressure of test environment	102kPa

Band	57-71 GHz
Power Level	40 dBm (EIRP)
Channel Spacing	2.16 GHz
Mod Scheme	mcs5
Mid channel	62.64 GHz

Plot refs
11691-1 Rad 1 VHF Horiz
11691-1 Rad 1 VHF Vert
11691-1 Rad 1 UHF Horiz
11691-1 Rad 1 UHF Vert

Table of signals measured for Rad 1 Horizontal Sig List

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	QP Amp (dBuV/m)	QP -Lim (dB)
1	46.594	23.6	18.5	-21.5
2	49.028	22.1	16.3	-23.7
3	210.076	27.4	21.5	-22.0
4	218.929	26.3	20.6	-25.4
5	257.133	28.5	21.8	-24.2
6	552.303	34.8	29.1	-16.9
7	628.587	35.3	29.6	-16.4
8	806.495	35.4	29.1	-16.9

Table of signals measured for Rad 1 Vertical Sig List

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	QP Amp (dBuV/m)	QP -Lim (dB)
1	52.118	27.3	21.1	-18.9
2	56.923	24.5	20.3	-19.7
3	110.167	27.2	21.1	-22.4
4	256.822	27.1	21.1	-24.9
5	442.878	36.8	32.5	-13.5
6	491.860	38.9	33.6	-12.4
7	551.957	43.7	39.1	-6.9
8	565.007	43.5	39.8	-6.2
9	937.489	39.7	36.1	-9.9

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

Whilst Low, Mid and High channels were tested, plots are for illustrative purposes only and only Mid channel plots are shown in this report.

LIMITS:
15.209 limits are applicable in the restricted bands of 15.205 with the relevant detector.
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 ±6.1dB.

5.5 Radiated emissions above 1 GHz

5.5.1 Test methods

Test Requirements: 47 CFR Part 15C Part 15.255(d)(2)/(3)/(4) [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 6.3 & 6.6 & 9.8 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15C Part 15.255(d)(2)/(3)/(4) [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 listed in 5.5.3. The EUT was examined in its normal use position. During the initial scan worst case was seen when powered from 48 V DC rather than PoE. Radiated Emissions testing was performed with the EUT powered from 48 V DC. During the initial scan no modulation scheme was seen to be worst case so mcs5 was used. The EUT was operated with all four radios in TX6, TX19 and TX32 modes.

5.5.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment listed 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, 0.5m was used in the test range 18 – 26.5GHz. As Radio configuration is identical between EUT models/HVIN's, for results above 26.5GHz please refer to RN report 05-11387-1-21.
At least 6 signals within 20dB and all signals within 10dB of the limit were investigated.

Tests were performed using test Site M.

5.5.4 Test equipment

E136, E404, E411, E624, E743, LPE364, TMS78

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 102kPa

Setup Table

Band	57-71 GHz
Power Level	40 dBm (EIRP)
Channel Spacing	2.16 GHz
Mod Scheme	mcs5
Low channel	58.32 GHz

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
2474.999	42.2	-31.8	36.7	-17.3	Upright	Horizontal
2474.999	41.5	-32.5	36.4	-17.6	Upright	Vertical
2499.999	42.8	-31.2	36.6	-17.4	Upright	Horizontal
2499.999	42.4	-31.6	36.9	-17.1	Upright	Vertical
4999.975	44.7	-29.3	35.6	-18.4	Upright	Vertical
4999.999	48	-26	42.1	-11.9	Upright	Horizontal
9999.997	47.8	-26.2	44.2	-9.8	Upright	Vertical

Setup Table

Band	57-71 GHz
Power Level	40 dBm (EIRP)
Channel Spacing	2.16 GHz
Mod Scheme	mcs5
Mid channel	62.64 GHz

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
2474.999	42.2	-31.8	36.7	-17.3	Upright	Horizontal
2474.999	41.5	-32.5	36.4	-17.6	Upright	Vertical
2499.999	42.8	-31.2	36.6	-17.4	Upright	Horizontal
2499.999	42.4	-31.6	36.9	-17.1	Upright	Vertical
4999.975	44.7	-29.3	35.6	-18.4	Upright	Vertical
4999.999	48	-26	42.1	-11.9	Upright	Horizontal
9999.997	47.8	-26.2	44.2	-9.8	Upright	Vertical

Plots
11691-1 Rad 1 1-2GHz Horiz
11691-1 Rad 1 1-2GHz Vert
11691-1 Rad 1 2-5GHz Horiz
11691-1 Rad 1 2-5GHz Vert
11691-1 Rad 1 5-6GHz Horiz
11691-1 Rad 1 5-6GHz Vert
11691-1 Rad 1 6upto10GHz Horiz
11691-1 Rad 1 6upto10GHz Vert
11691-1 Rad 1 10upto12_5GHz Horiz
11691-1 Rad 1 10upto12_5GHz Vert
11691-1 12.5-15 Horiz
11691-1 12.5-15 Vert
11691-1 15-18 Horiz
11691-1 15-18 Vert
11691-1 Horiz 18-21GHz
11691-1 Vert 18-21GHz
11691-1 Horiz 21-23GHz
11691-1 Vert 21-23GHz
11691-1 Horiz 23-26.5GHz
11691-1 Vert 23-26.5GHz

Setup Table

Band	57-71 GHz
Power Level	40 dBm (EIRP)
Channel Spacing	2.16 GHz
Mod Scheme	mcs5
High channel	69.12 GHz

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
2474.999	42.2	-31.8	36.7	-17.3	Upright	Horizontal
2474.999	41.5	-32.5	36.4	-17.6	Upright	Vertical
2499.999	42.8	-31.2	36.6	-17.4	Upright	Horizontal
2499.999	42.4	-31.6	36.9	-17.1	Upright	Vertical
4999.975	44.7	-29.3	35.6	-18.4	Upright	Vertical
4999.999	48	-26	42.1	-11.9	Upright	Horizontal
9999.997	47.8	-26.2	44.2	-9.8	Upright	Vertical

Peak detector “Max held” Analyser plots against the average limit line can be found in Section 6 of this report.

Note: Whilst Low, Mid and High channels were tested, plots are for illustrative purposes only and only Mid channel plots are shown in this report.

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

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 ±3.5dB, 18 – 26.5 GHz ±3.9dB.

5.6 Frequency stability

NOT TESTED: Not tested at request of applicant as Radio configuration is identical between EUT models/HVIN's, please refer to RN report 05-11387-1-21 for results of these tests.

5.7 Peak & Average EIRP

NOT TESTED: Not tested at request of applicant as Radio configuration is identical between EUT models/HVIN's, please refer to RN report 05-11387-1-21 for results of these tests.

5.8 Peak Conducted Power

NOT TESTED: Not tested at request of applicant as Radio configuration is identical between EUT models/HVIN's, please refer to RN report 05-11387-1-21 for results of these tests.

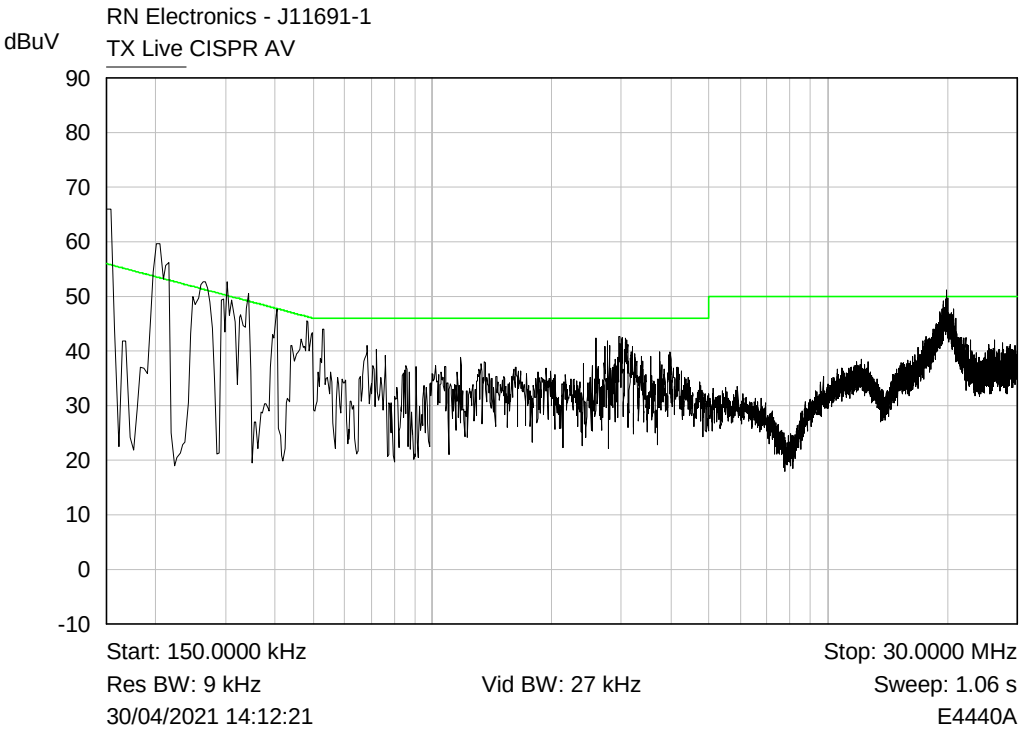
5.9 6 dB Occupied bandwidth

NOT TESTED: Not tested at request of applicant as Radio configuration is identical between EUT models/HVIN's, please refer to RN report 05-11387-1-21 for results of these tests.

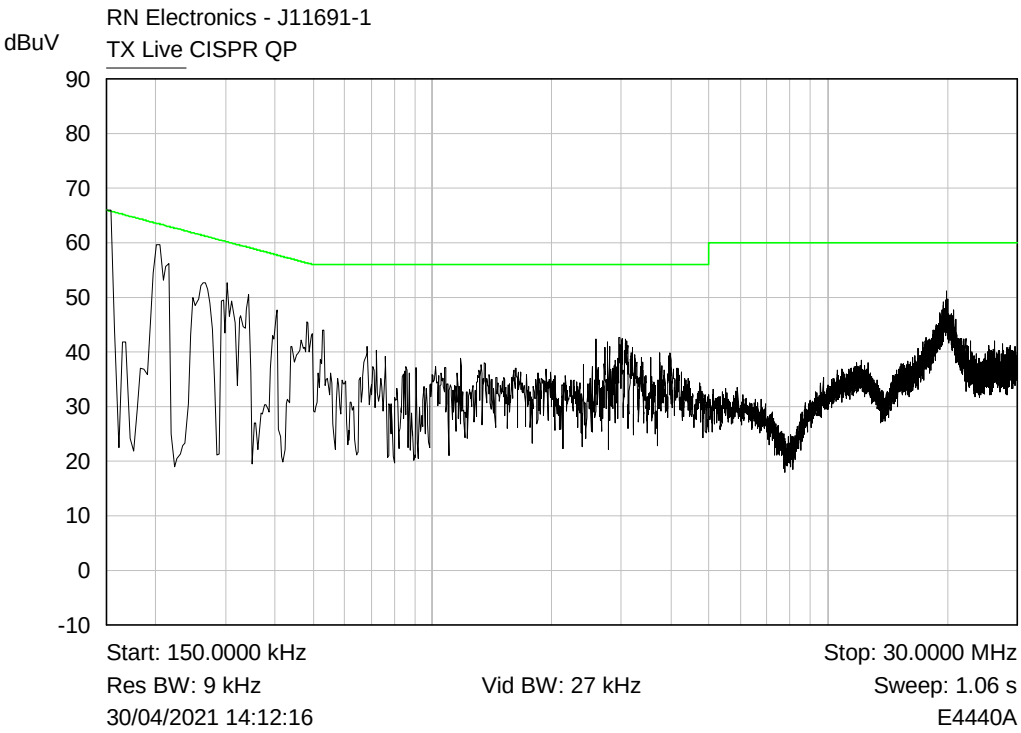
6 Plots/Graphical results

6.1 AC powerline conducted emission

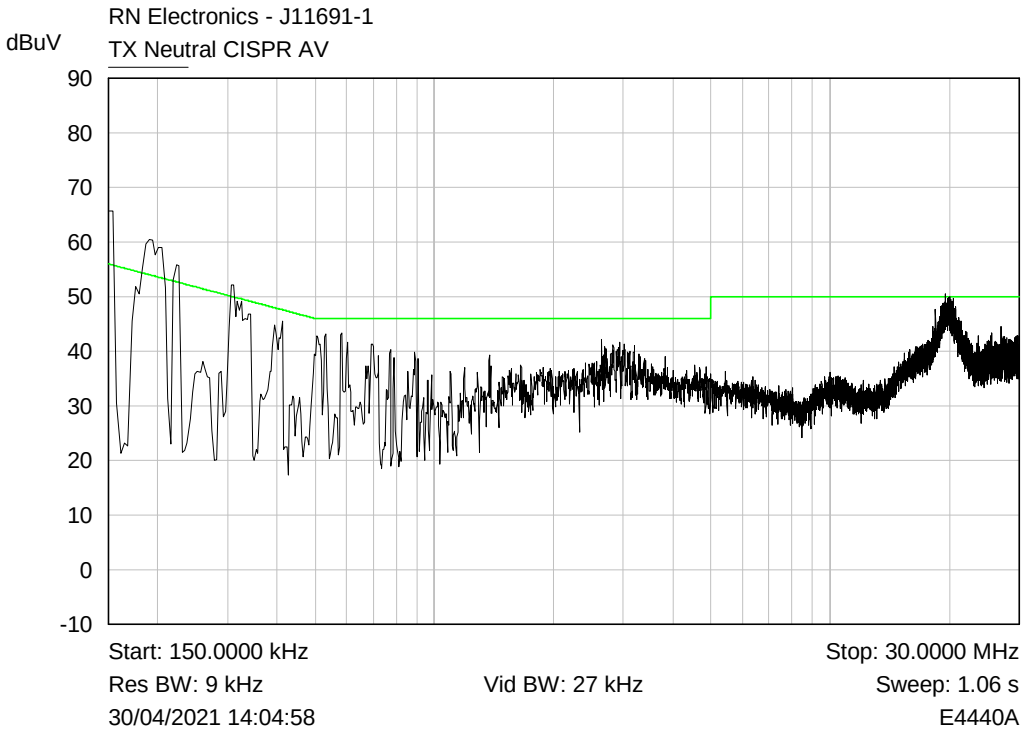
Cond 1 AC - TX PoE PSU



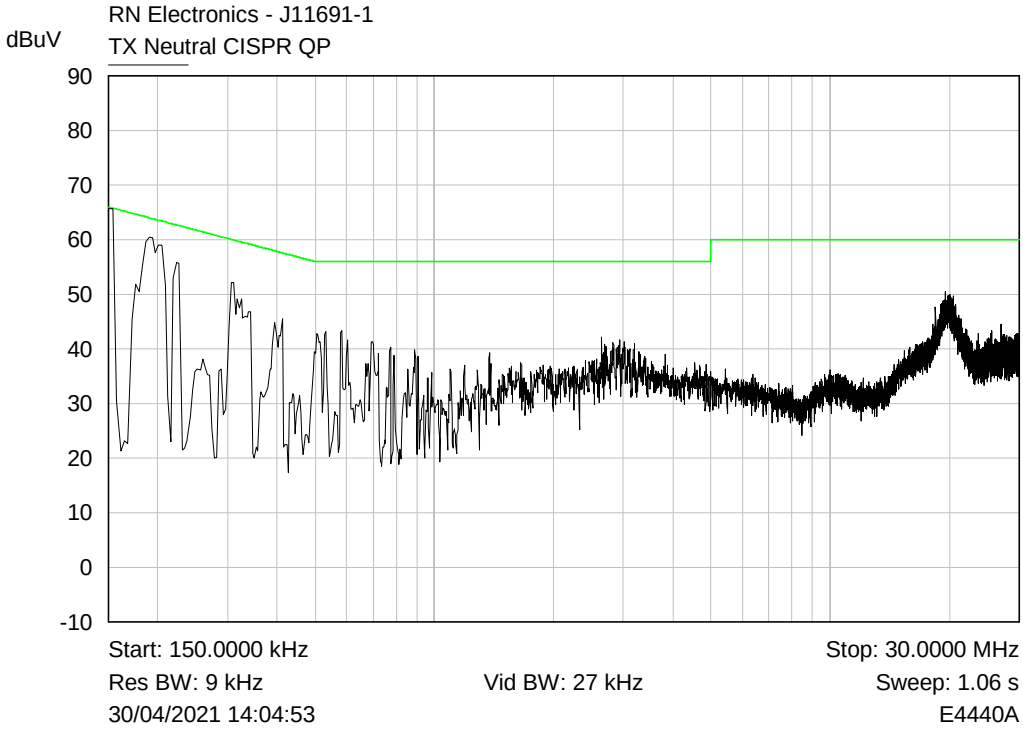
Peak emissions 150 kHz - 30 MHz on the live terminal against the average limit line.



Peak emissions 150 kHz - 30 MHz on the live terminal against the quasi-peak limit line.

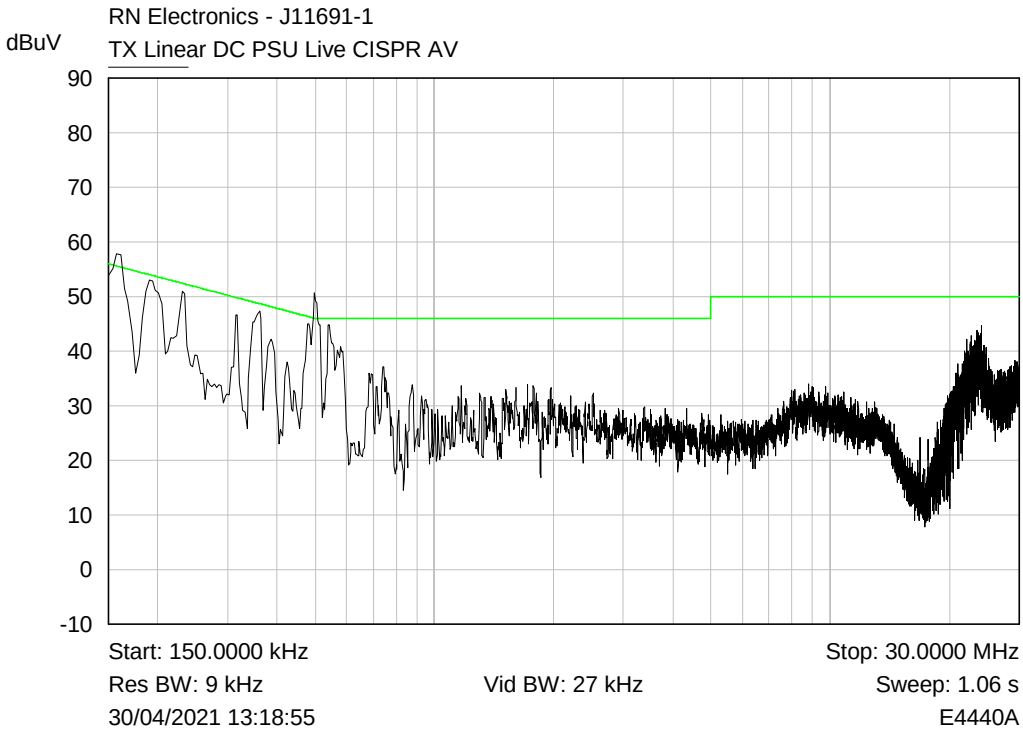


Peak emissions 150 kHz - 30 MHz on the neutral terminal against the average limit line.

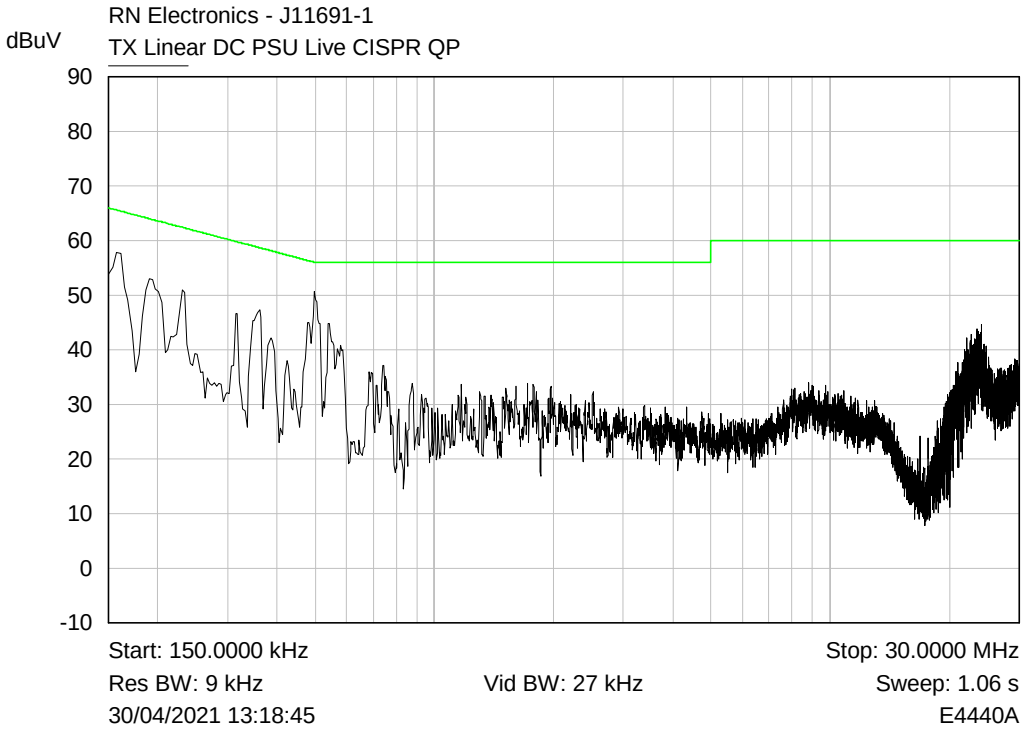


Peak emissions 150 kHz - 30 MHz on the neutral terminal against the quasi-peak limit line.

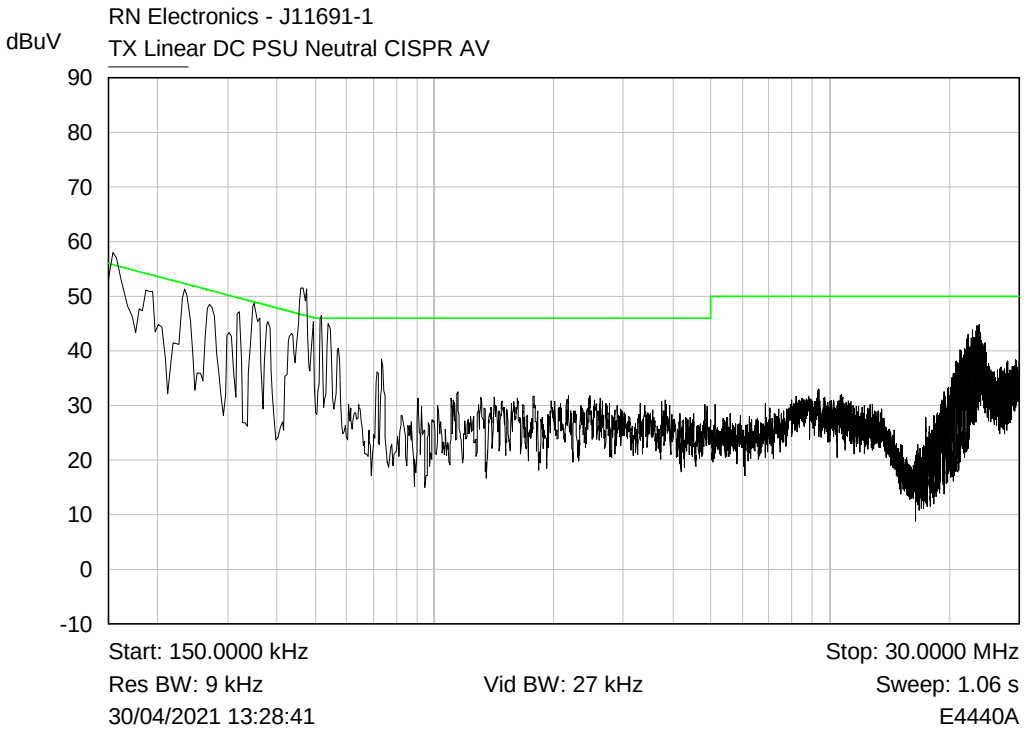
Cond 2 AC - TX Linear PSU



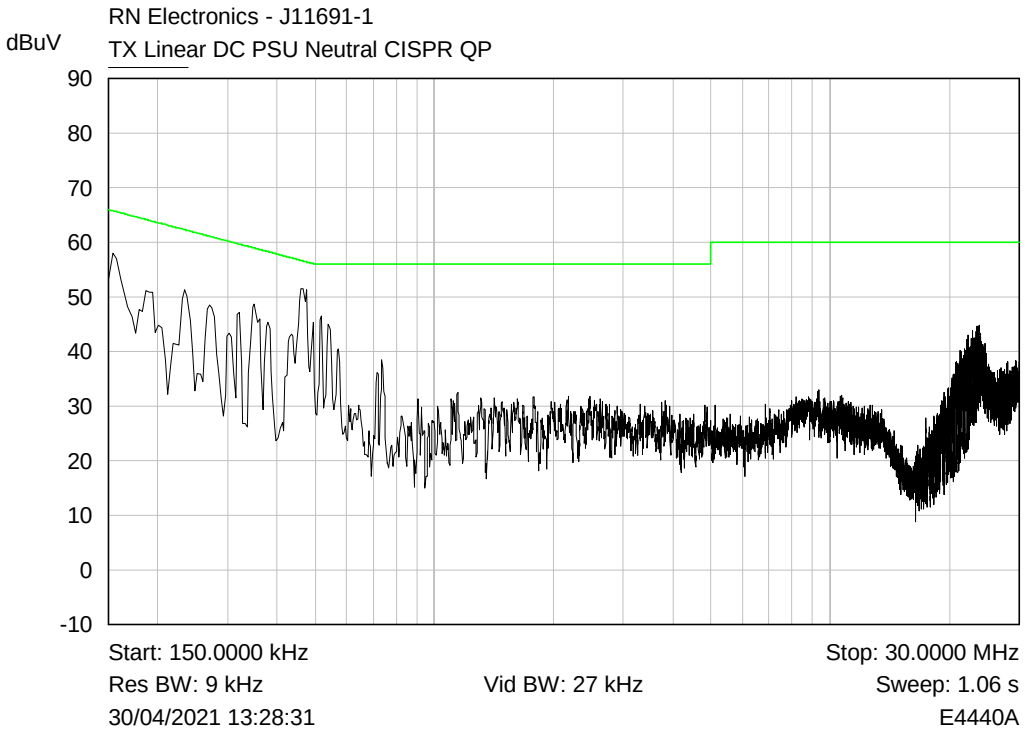
Peak emissions 150 kHz - 30 MHz on the live terminal against the average limit line.



Peak emissions 150 kHz - 30 MHz on the live terminal against the quasi-peak limit line.



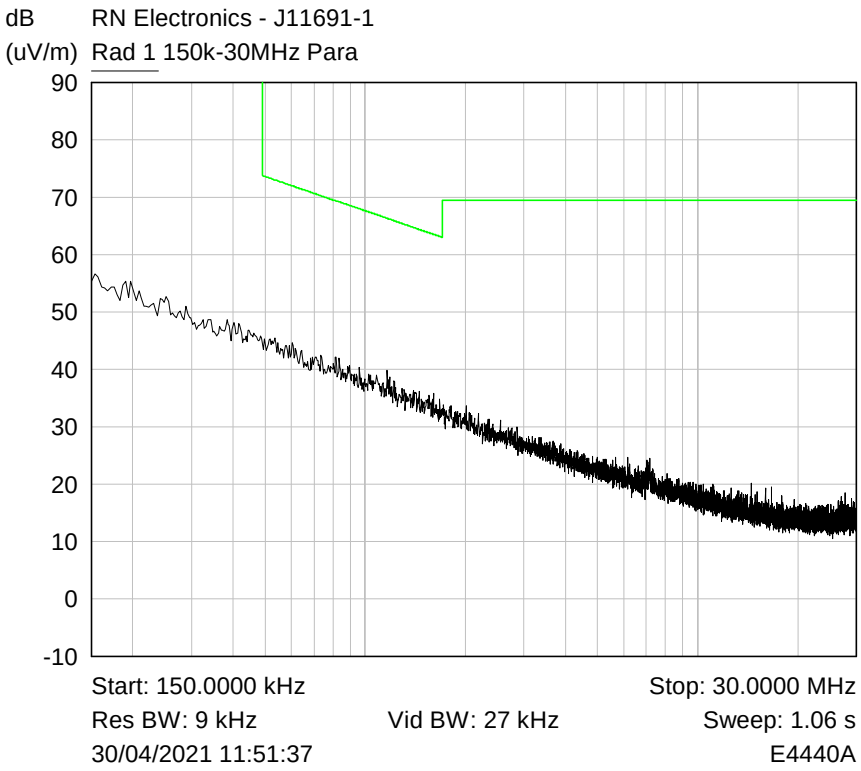
Peak emissions 150 kHz - 30 MHz on the neutral terminal against the average limit line.



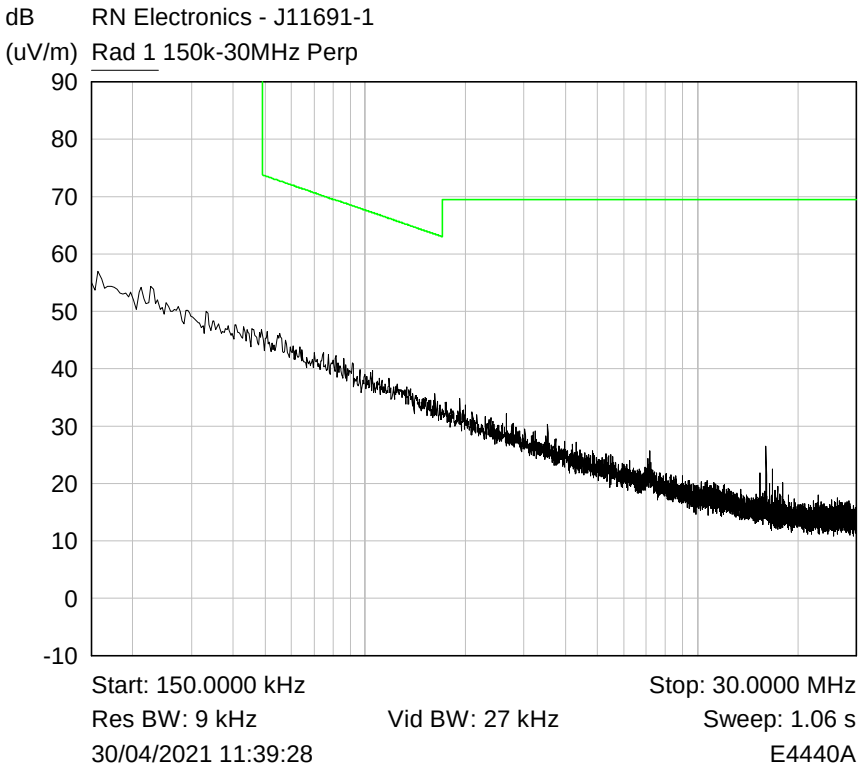
Peak emissions 150 kHz - 30 MHz on the neutral terminal against the quasi-peak limit line.

6.2 Radiated emissions 150 kHz - 30 MHz

RF Parameters: Band 57-71 GHz, Power 40 dBm (EIRP), Channel Spacing 2.16 GHz, Modulation mcs5, Channel 62.64 GHz



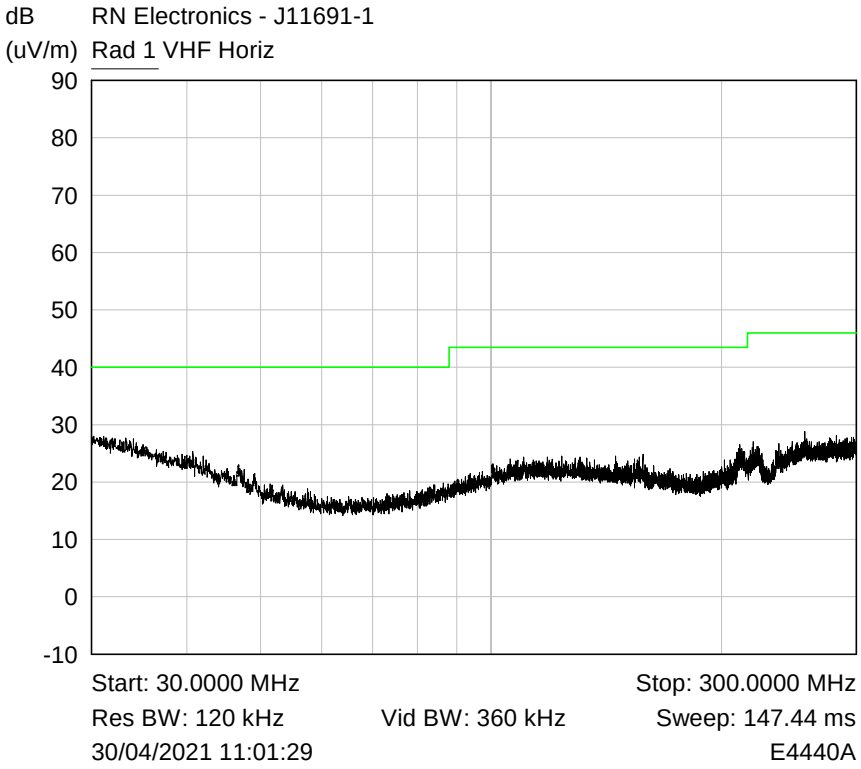
Plot of 150kHz-30MHz Parallel



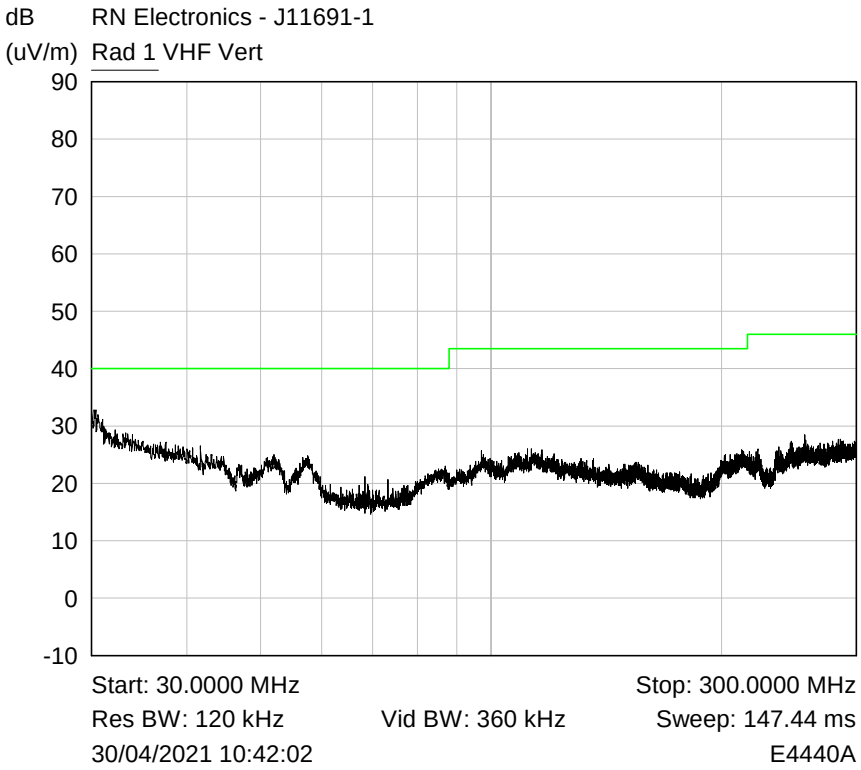
Plot of 150kHz-30MHz Perpendicular

6.3 Radiated emissions 30 MHz -1 GHz

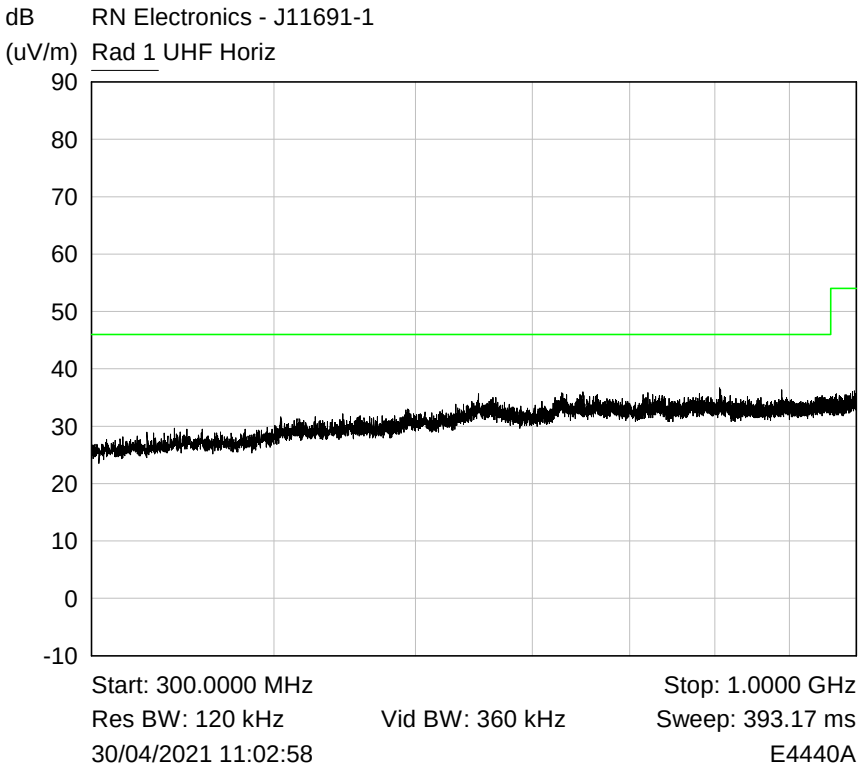
RF Parameters: Band 57-71 GHz, Power 40 dBm (EIRP), Channel Spacing 2.16 GHz, Modulation mcs5, Channel 62.64 GHz



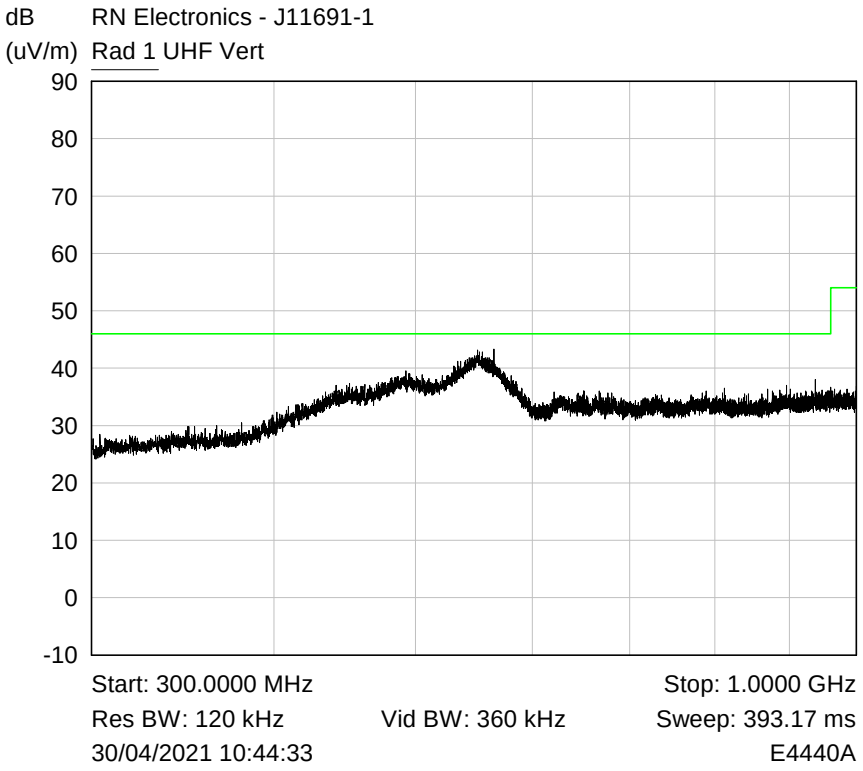
Plot of Peak emissions for VHF Horizontal against the QP limit line.



Plot of Peak emissions for VHF Vertical against the QP limit line.



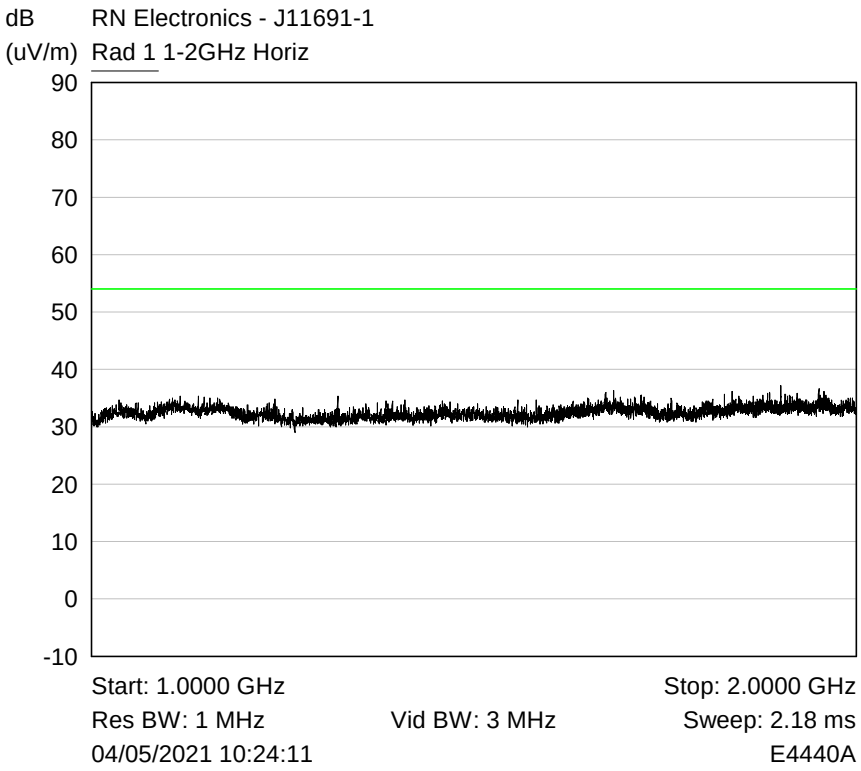
Plot of Peak emissions for UHF Horizontal against the QP limit line.

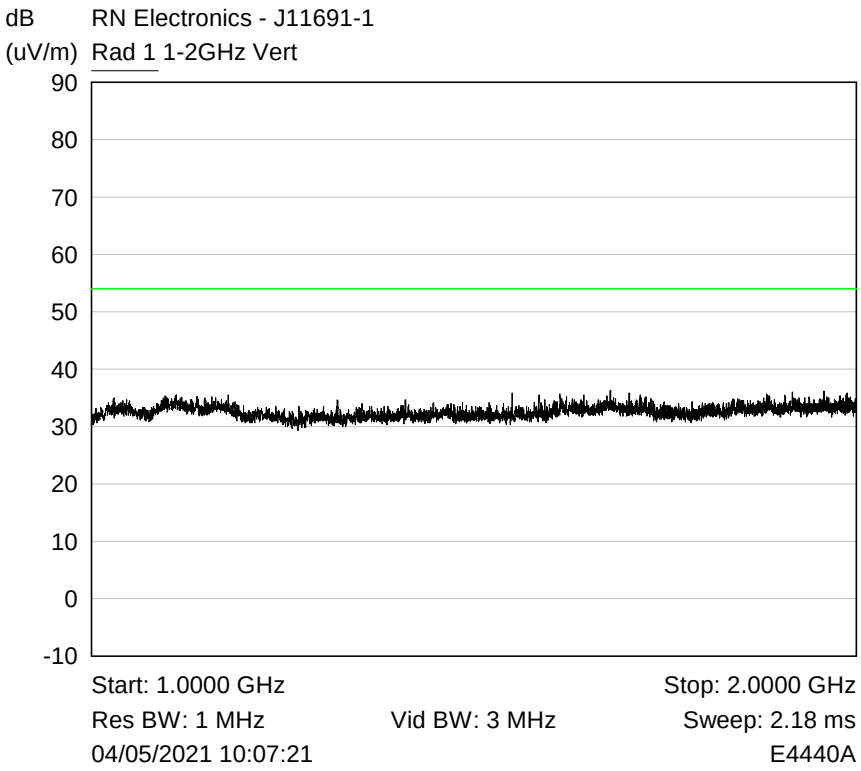


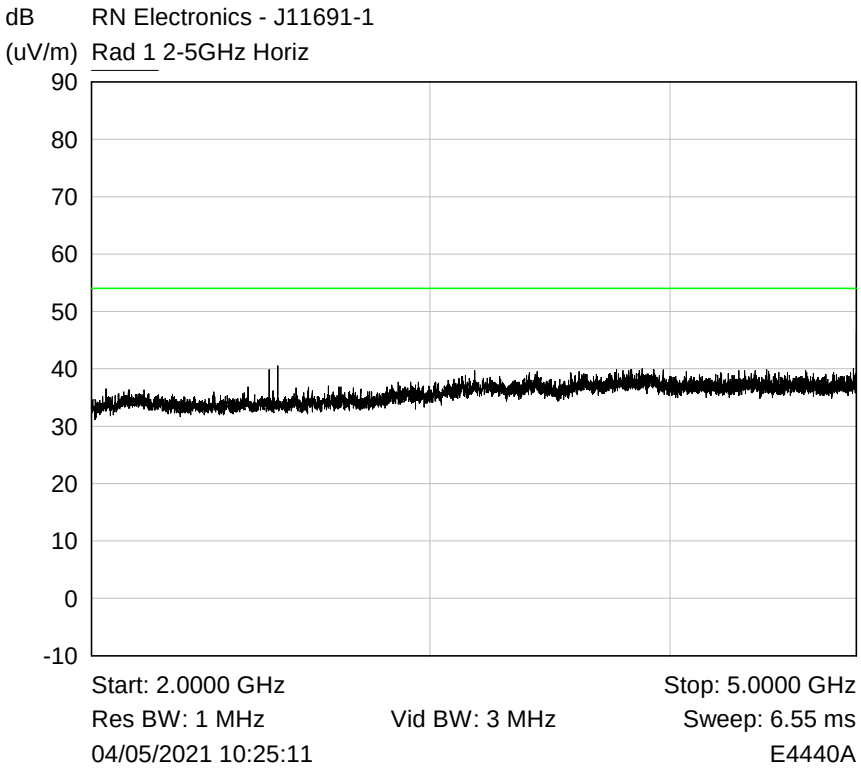
Plot of Peak emissions for UHF Vertical against the QP limit line.

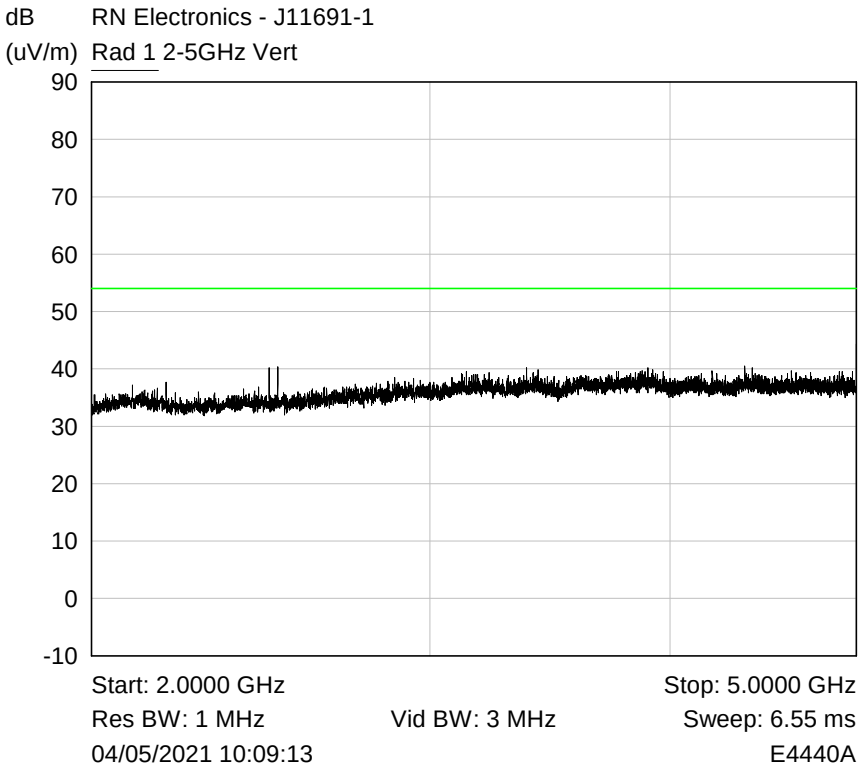
6.4 Radiated emissions above 1 GHz

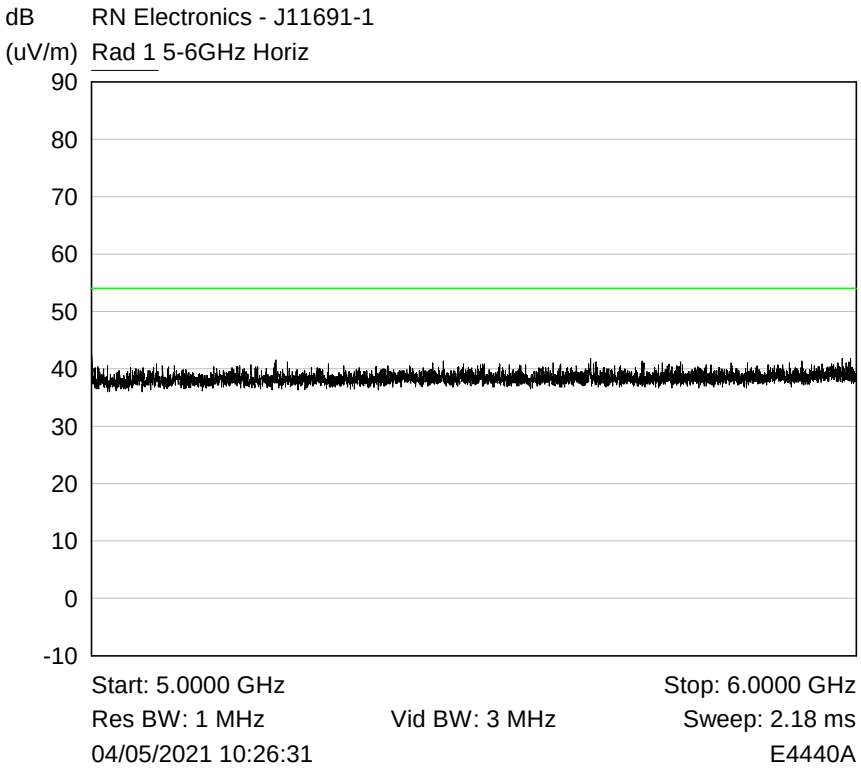
RF Parameters: Band 57-71 GHz, Power 40 dBm (EIRP), Channel Spacing 2.16 GHz, Modulation mcs5, Channel 62.64 GHz

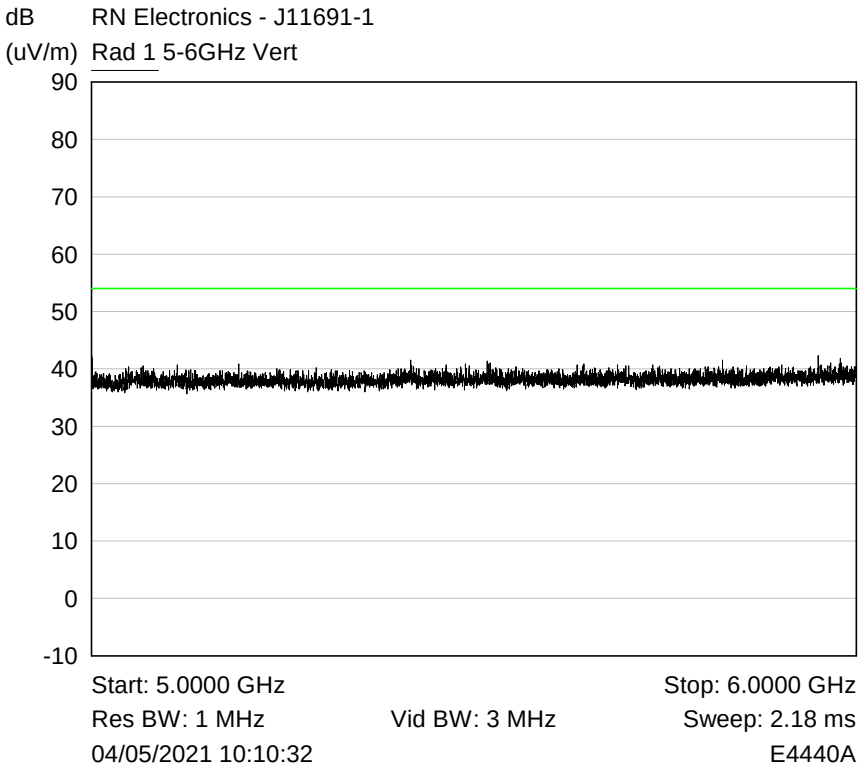


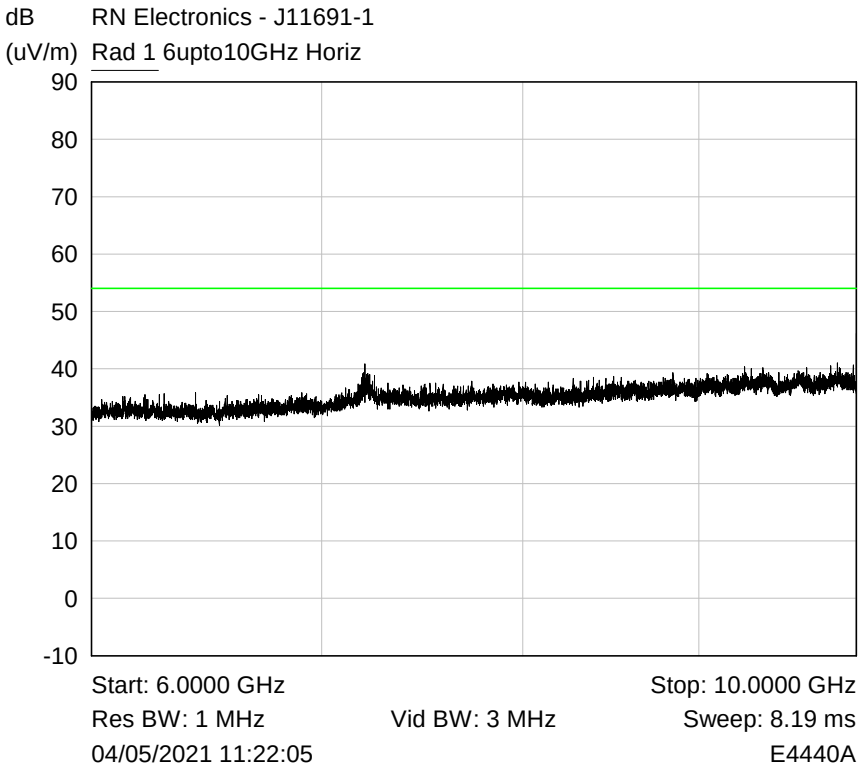


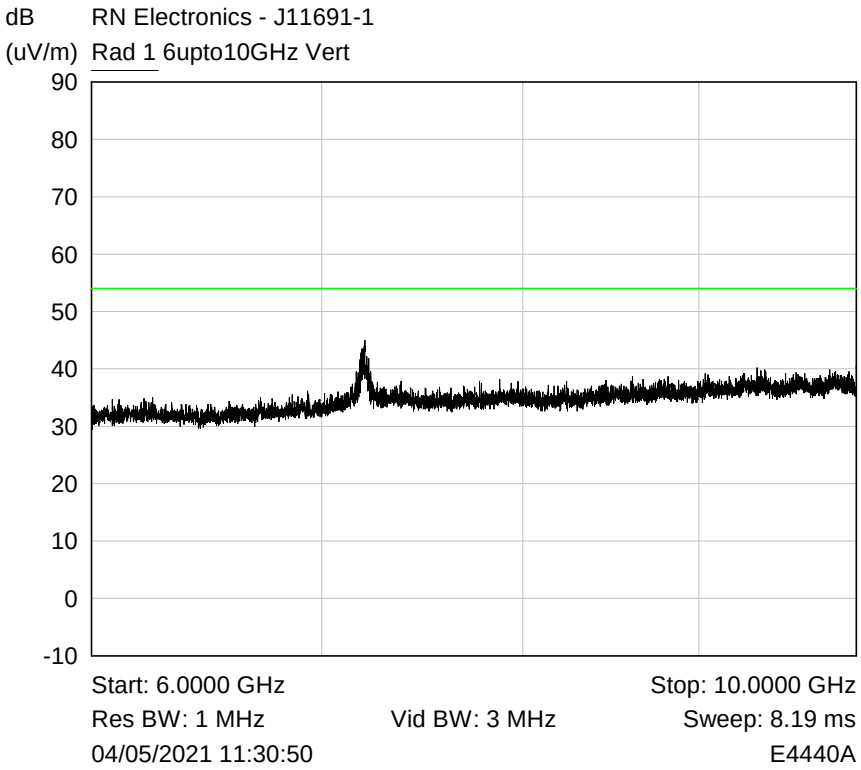


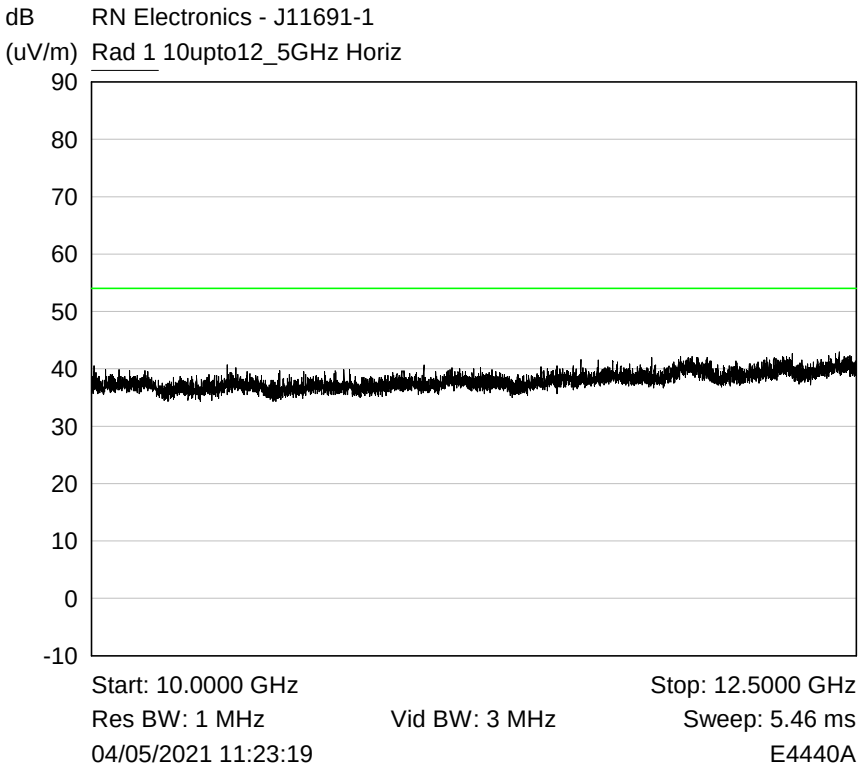


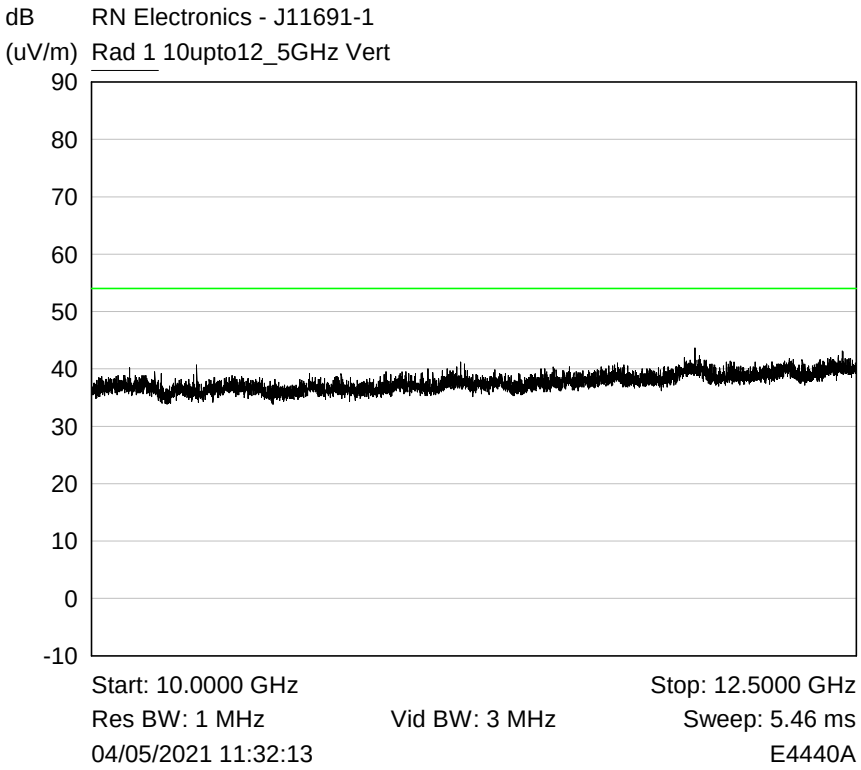


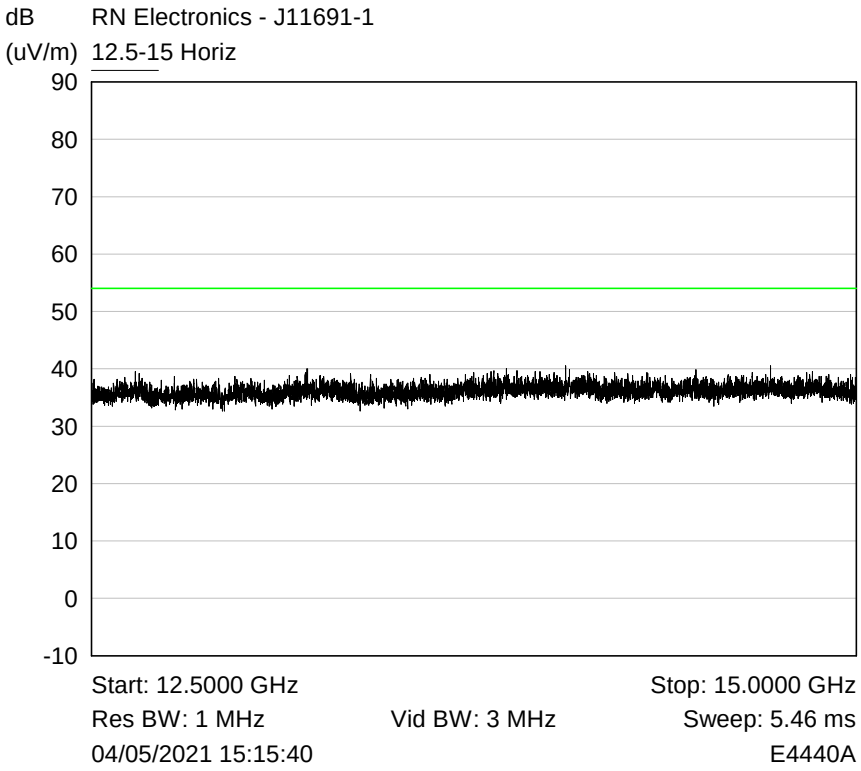


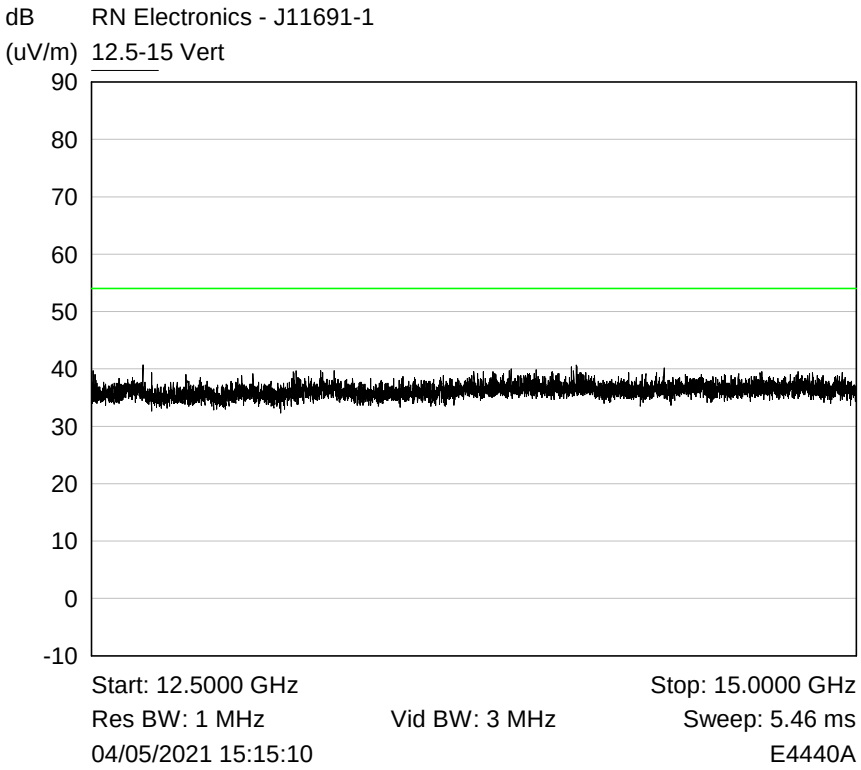


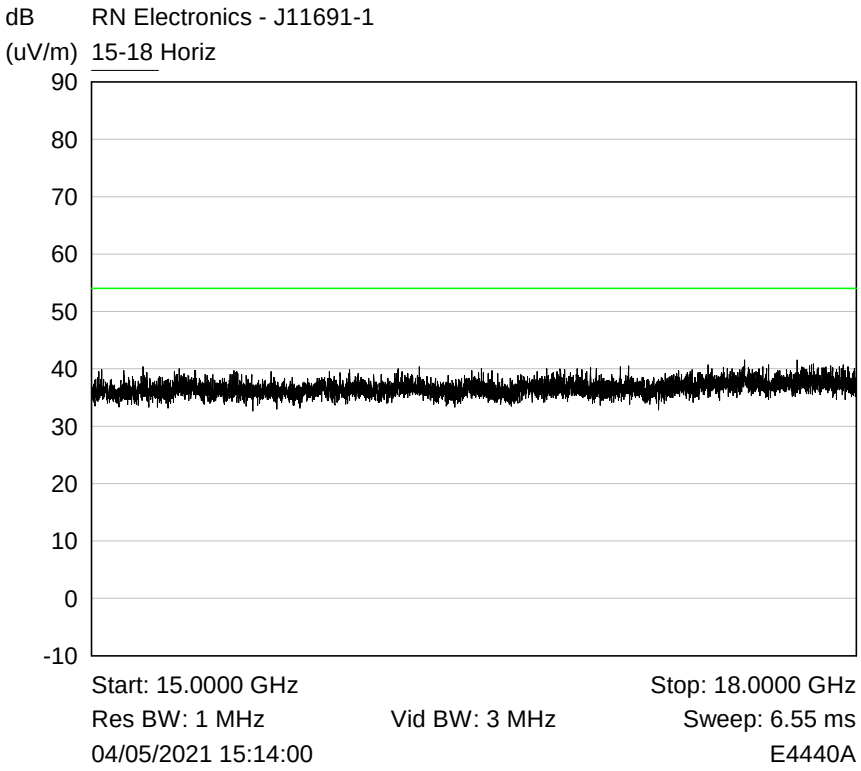


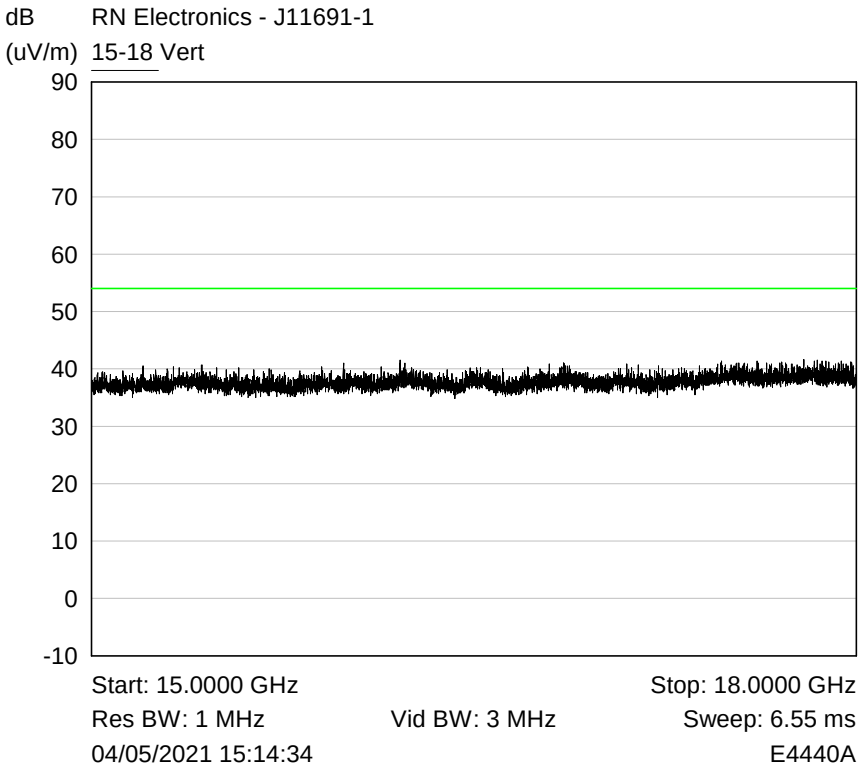


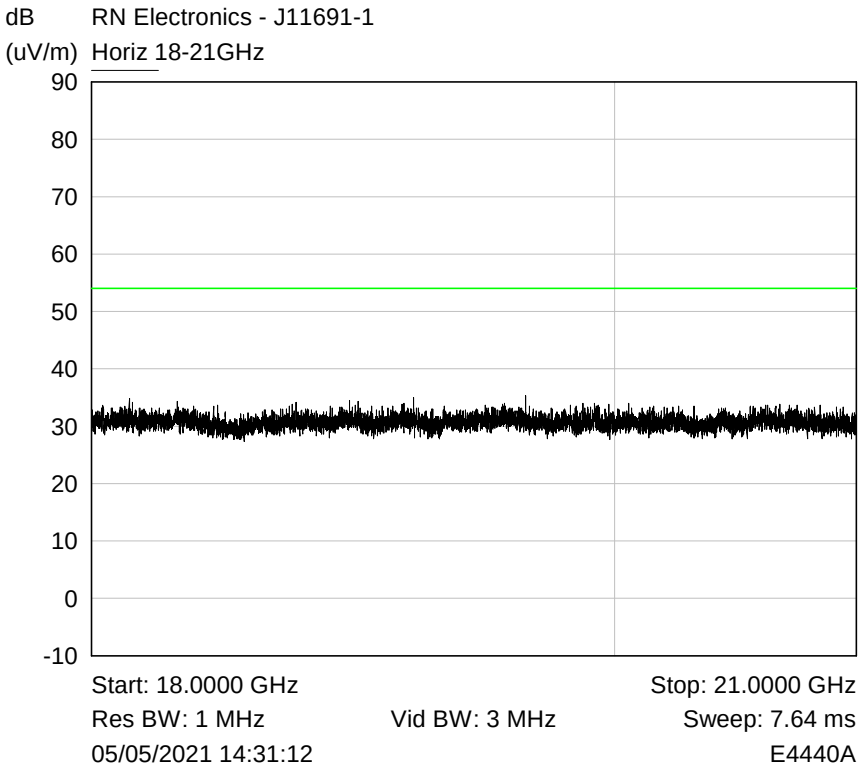


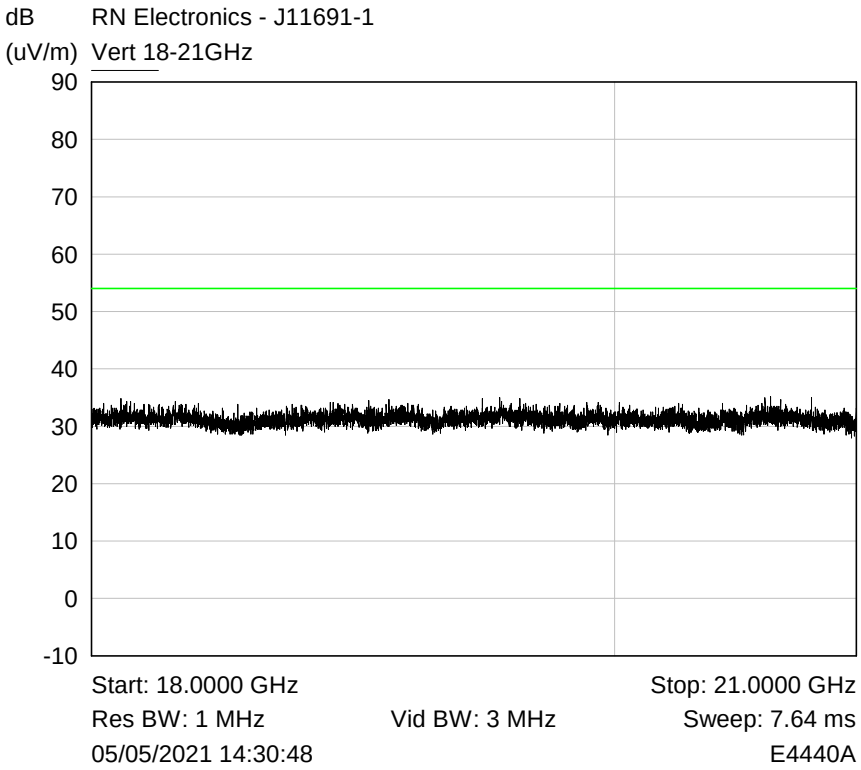


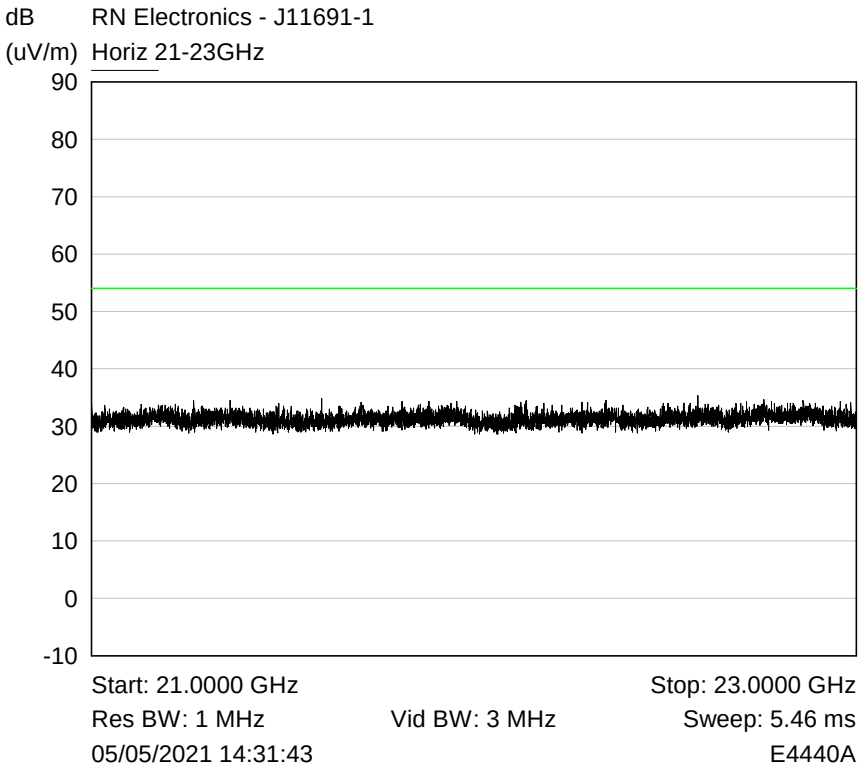


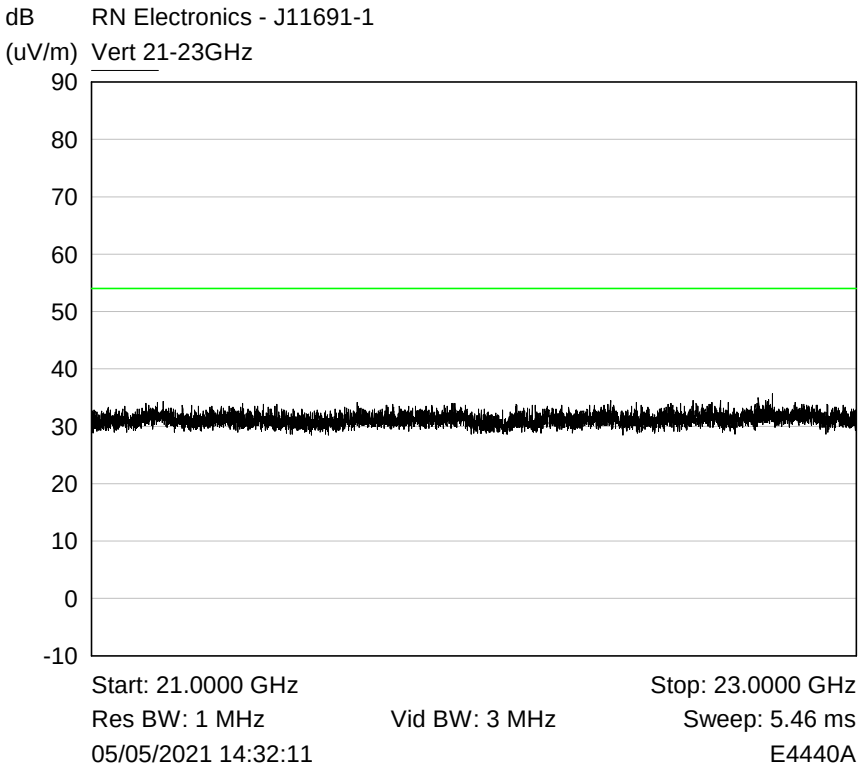


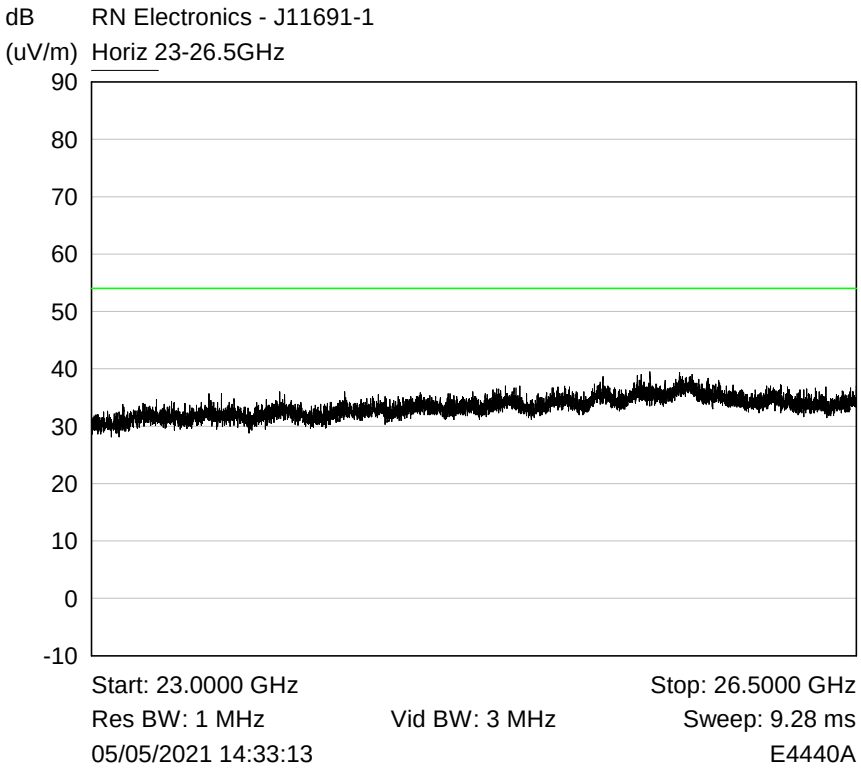


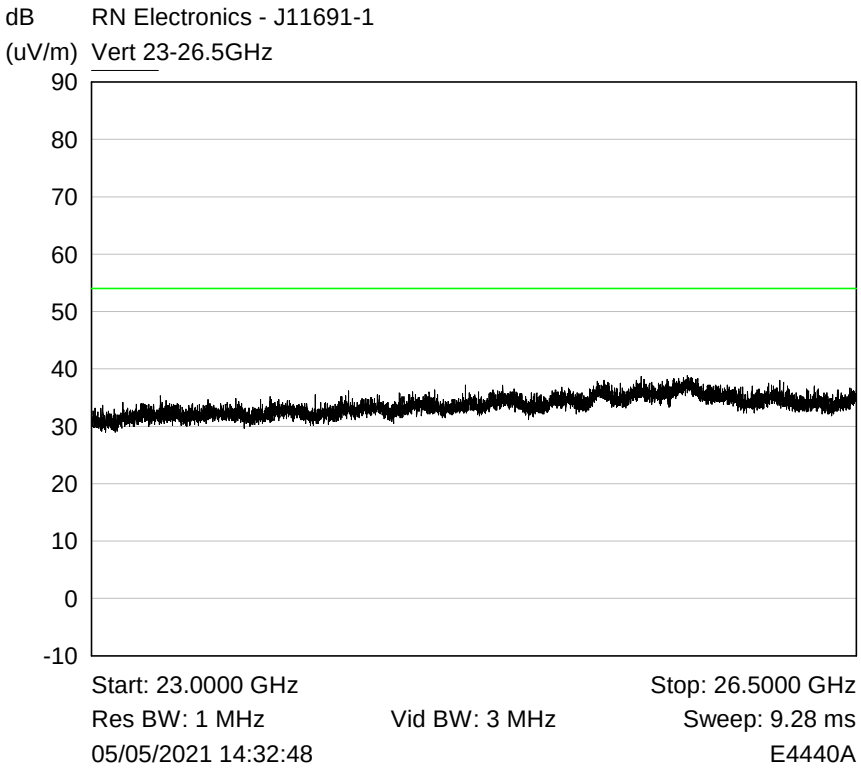












7 Explanatory Notes

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 (dBuV)	Pk – Lim 1 (dB)	QP Amp (dBuV)	QP - Lim1 (dB)	Av Amp (dBuV)	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 (dBμV) is the level of received signal that was measured in dB above 1μV 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 (dBμV) is the level of received signal that was measured in dB above 1μV 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 (dBμV) is the level of received signal that was measured in dB above 1μV 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 μV/m at a specified distance), whereas the measured values are expressed as peak, quasi peak or average values in dBμV/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 μV/m equates to 20.log (500) = 54 dB μV/m.

(b) limit of 300 μV/m at 10m equates to 20.log (300 . 10/3) = 60 dB μV/m at 3m

(c) limit of 30 μV/m at 30m, but below 30MHz, equates to 20.log(30) + 40.log(30/3) = 69.5 dBμV/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: $E_{Linear} = 10^{((E_{log}-120)/20)}$
And therefore equation 21 transposed is: $E_{Log} = 20xLog(E_{Linear}) +120$

Where:
E_{Linear} is the field strength of the emission in V/m
E_{Log} is the field strength of the emissions in dBµV/m

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

Where:
EIRP is equivalent isotropically radiated power in dBm
E_{Meas} is the field strength of the emission at the measurement distance in dBµV/m
d_{Meas} is the measurement distance in metres

Equation 25: $PD = EIRP_{Linear} / 4\pi d^2$
And therefore equation 25 transposed is: $EIRP_{Linear} = PD \times 4\pi d^2$

Where:
PD is the power density at distance specified by the limit, in W/m^2
$EIRP_{Linear}$ is the equivalent isotropically radiated power in Watts
d is the distance at which the power density limit is specified in metres

Equation 26: $PD = E^2_{Speclimit} / 377$
And therefore equation 26 transposed is: $E_{Spec\ limit} = \sqrt{(PD \times 377)}$

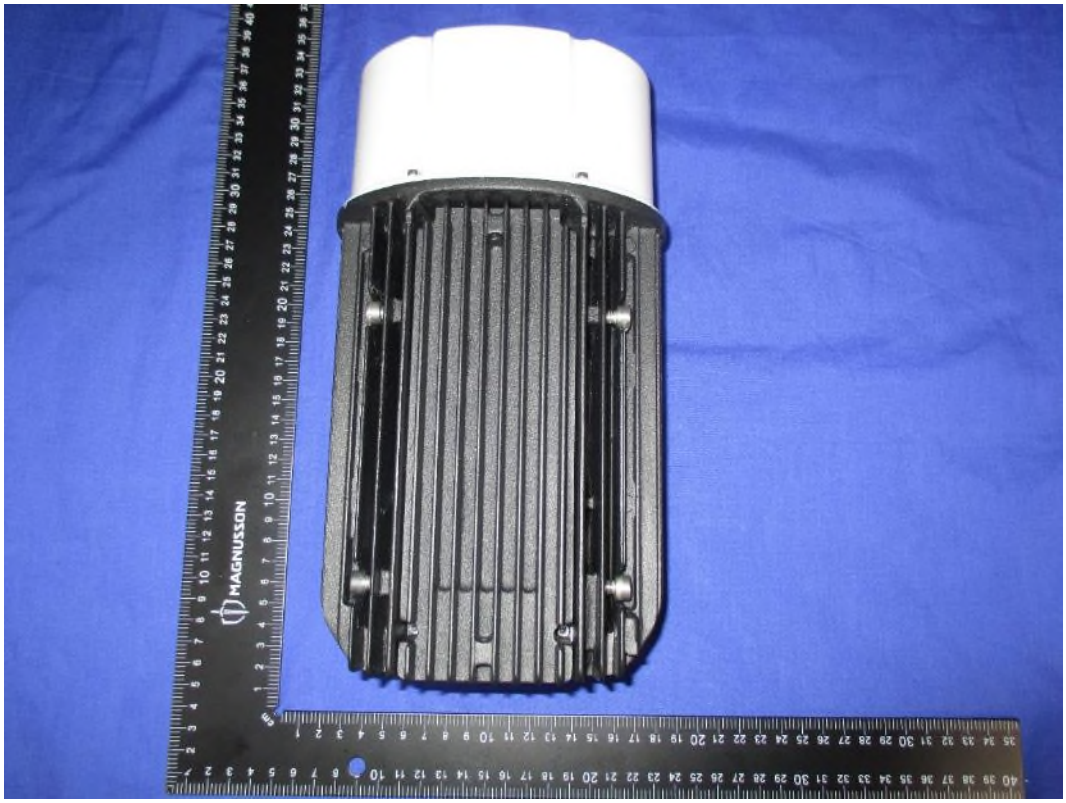
Where:
PD is the power density at distance specified by the limit, in W/m^2
$E_{spec\ limit}$ is the field strength at the distance specified by the limit in V/m

Example:
Radiated spurious emissions limit at 3metres of $90pW/cm^2$.
$90pW/cm^2 \times 100^2 = 0.9\ \mu W/m^2$ = (EIRP Linear)
Equation 25 transposed: $0.9 \times 10^{-6} \times 4 \times \pi \times 3^2 = 0.0001017876$ W
And
Equation 26 transposed: $E_{Spec\ limit} = \sqrt{(0.9x10^{-6} \times 377)} = 0.01842$ V/m.
And
Equation 21 transposed: $E_{Log} = 20Log(0.01842) +120 = 85.3dB\mu V/m$ @ 3m.

8 Photographs

8.1 EUT Front View

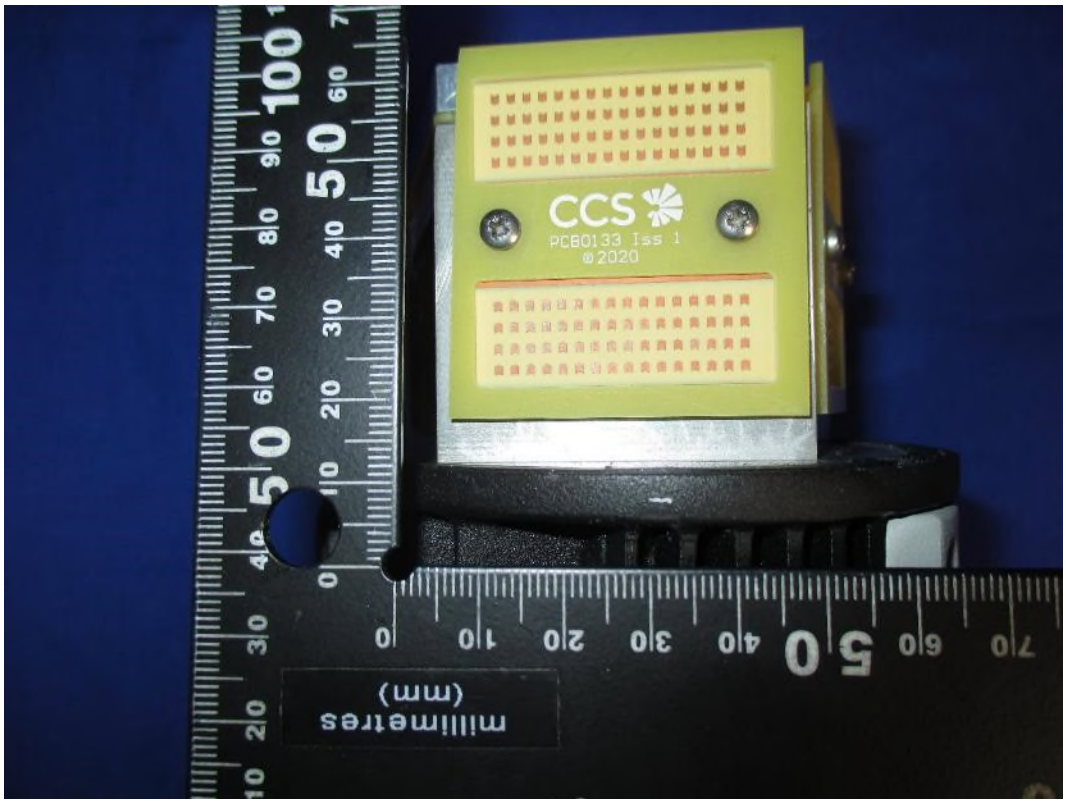
8.2 EUT Reverse Angle



8.3 EUT Left side View

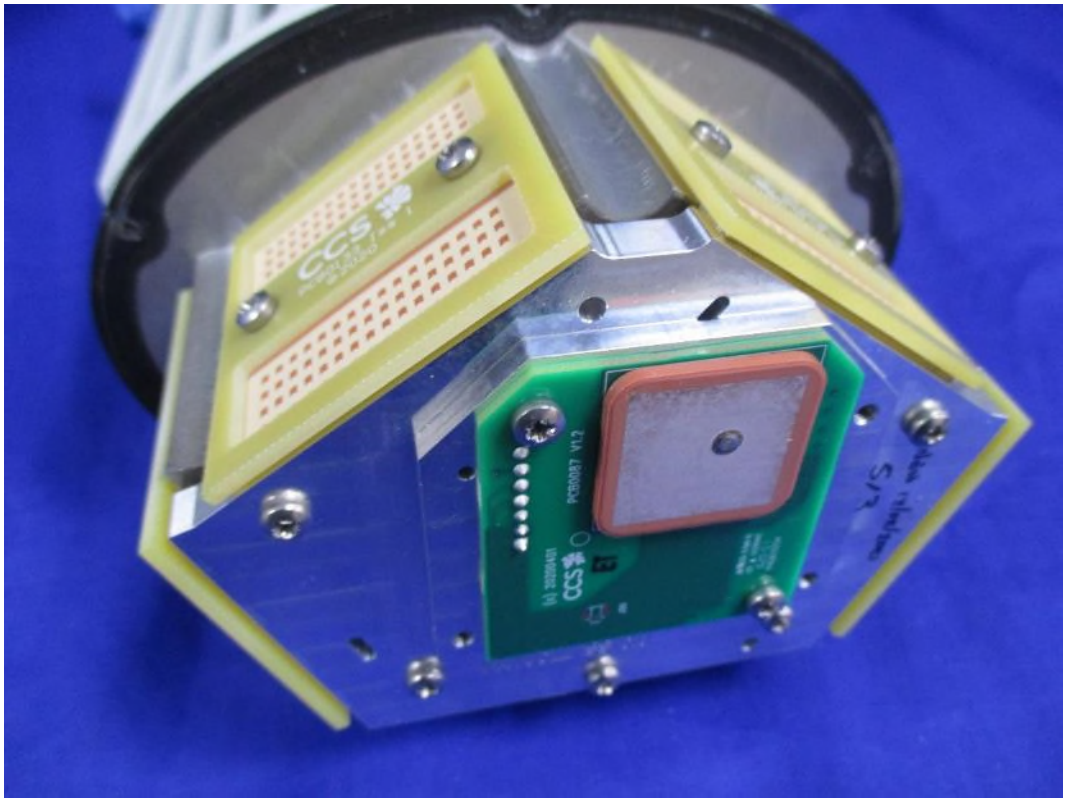
8.4 EUT Right side View

8.5 EUT Antenna Port

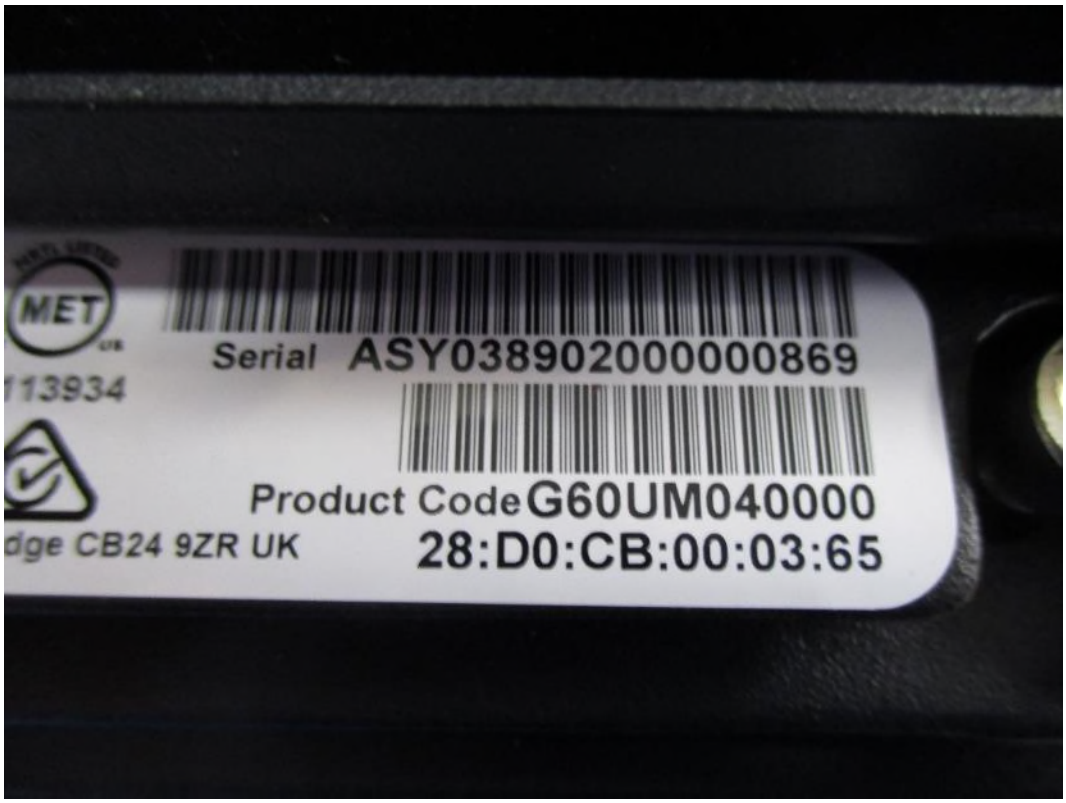


8.6 EUT Display & Controls

8.7 EUT Internal photos



8.8 EUT ID Label



Product Code on label is incorrect. Product Code = G60UM050000

8.9 AC powerline conducted emission

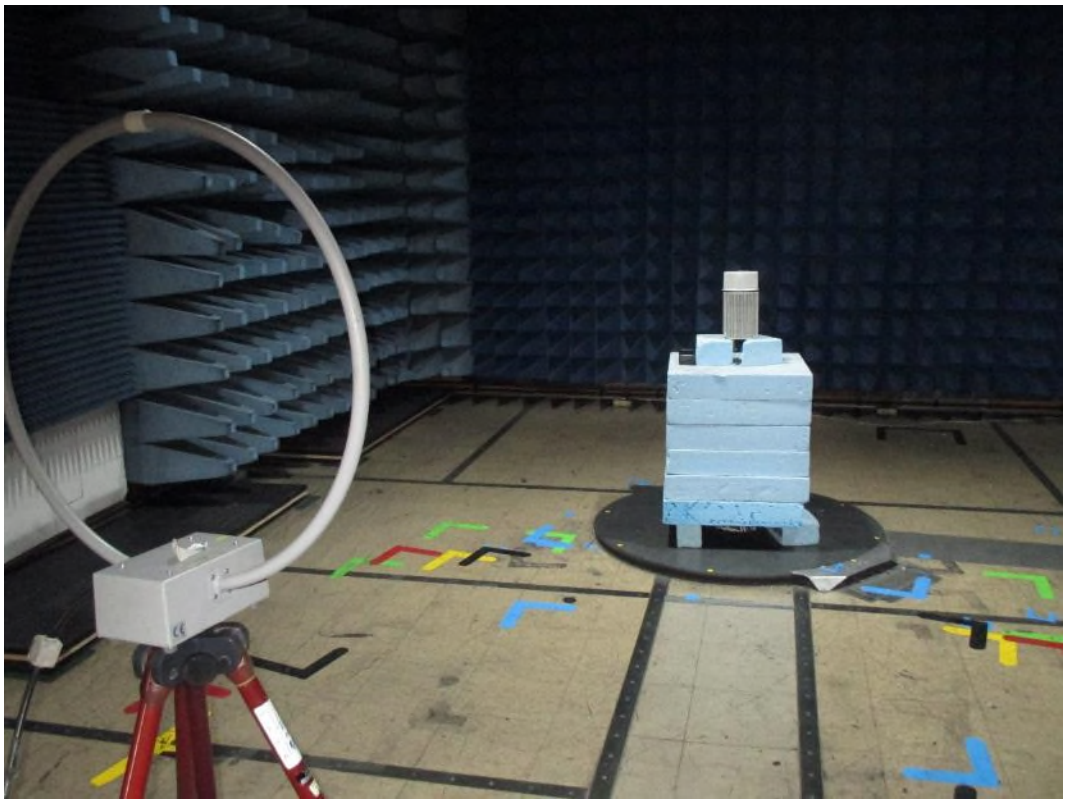
DC PSU

DC PSU

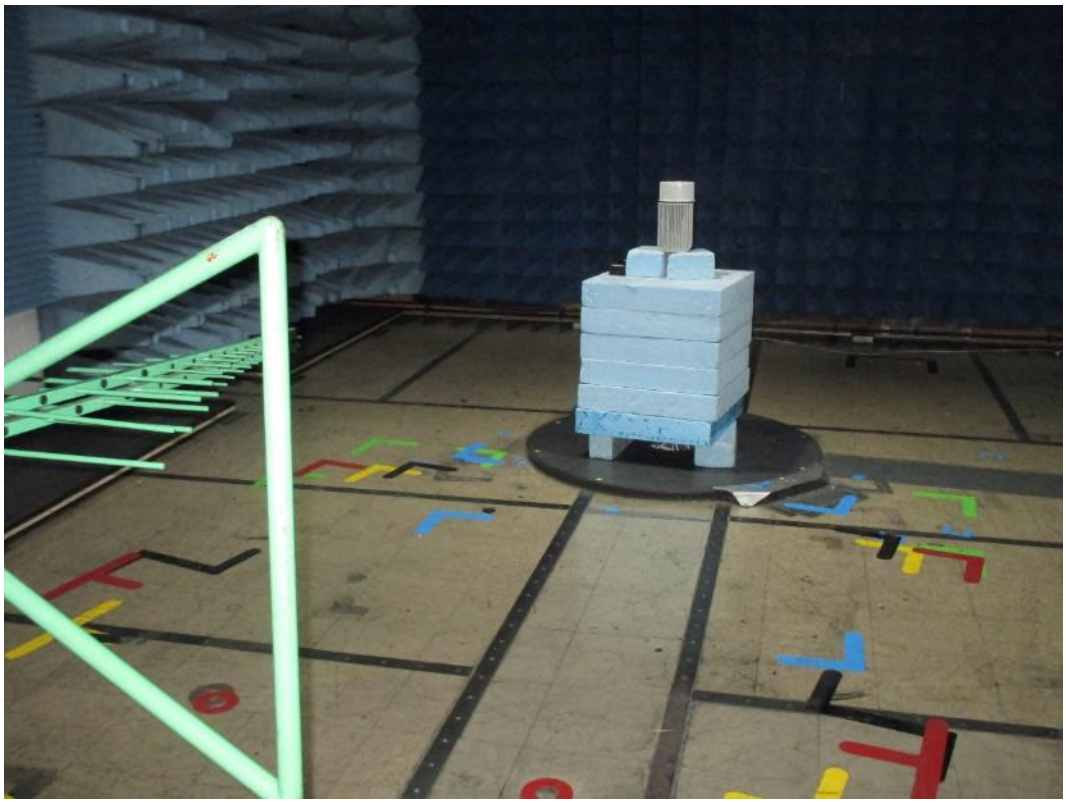
PoE PSU

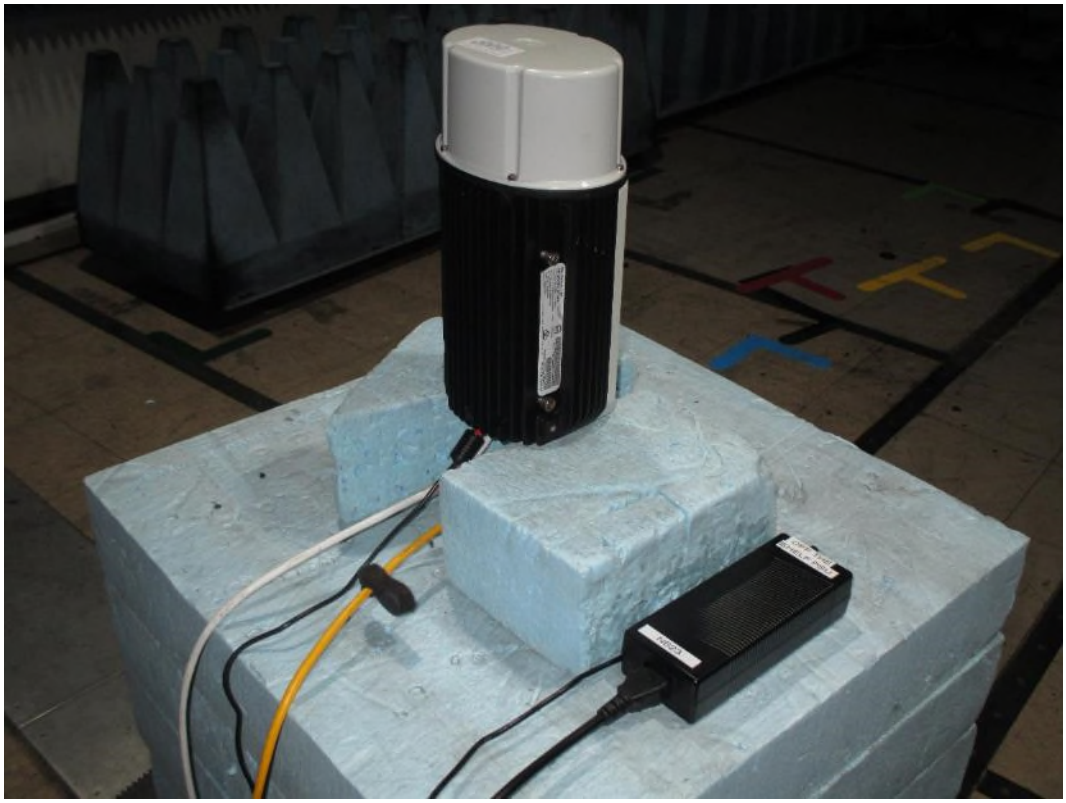
PoE PSU

8.10 Radiated emissions 150 kHz - 30 MHz



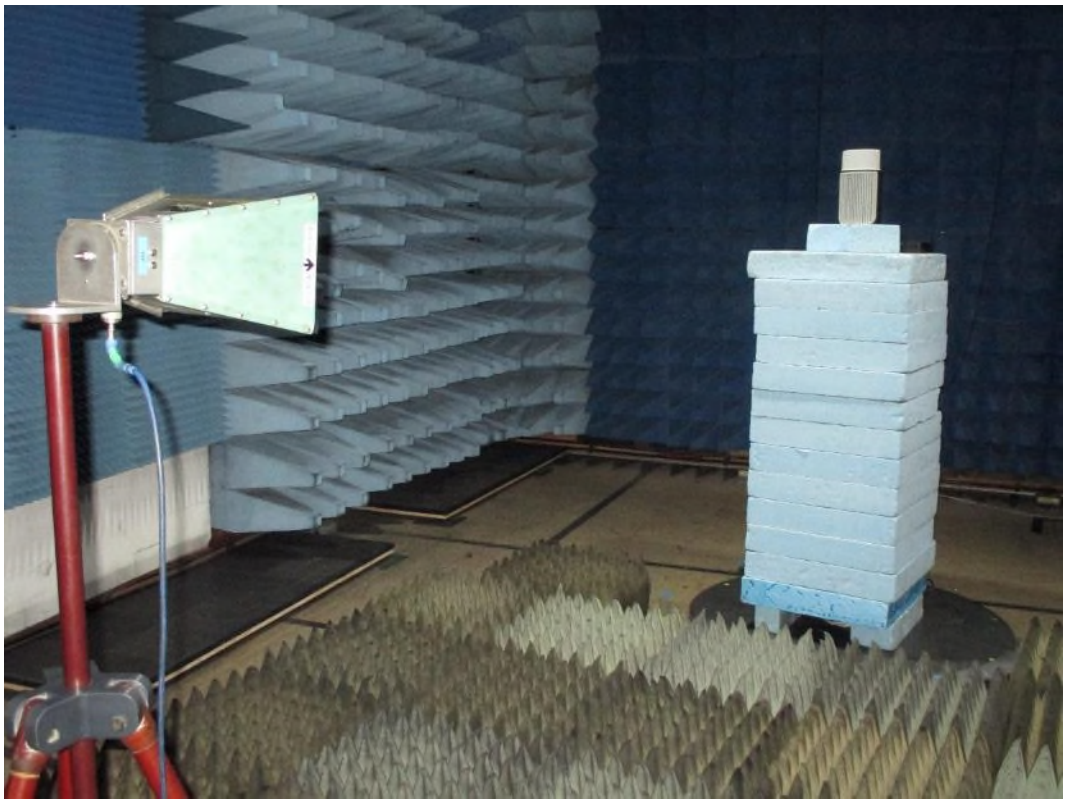
8.11 Radiated emissions 30 MHz -1 GHz

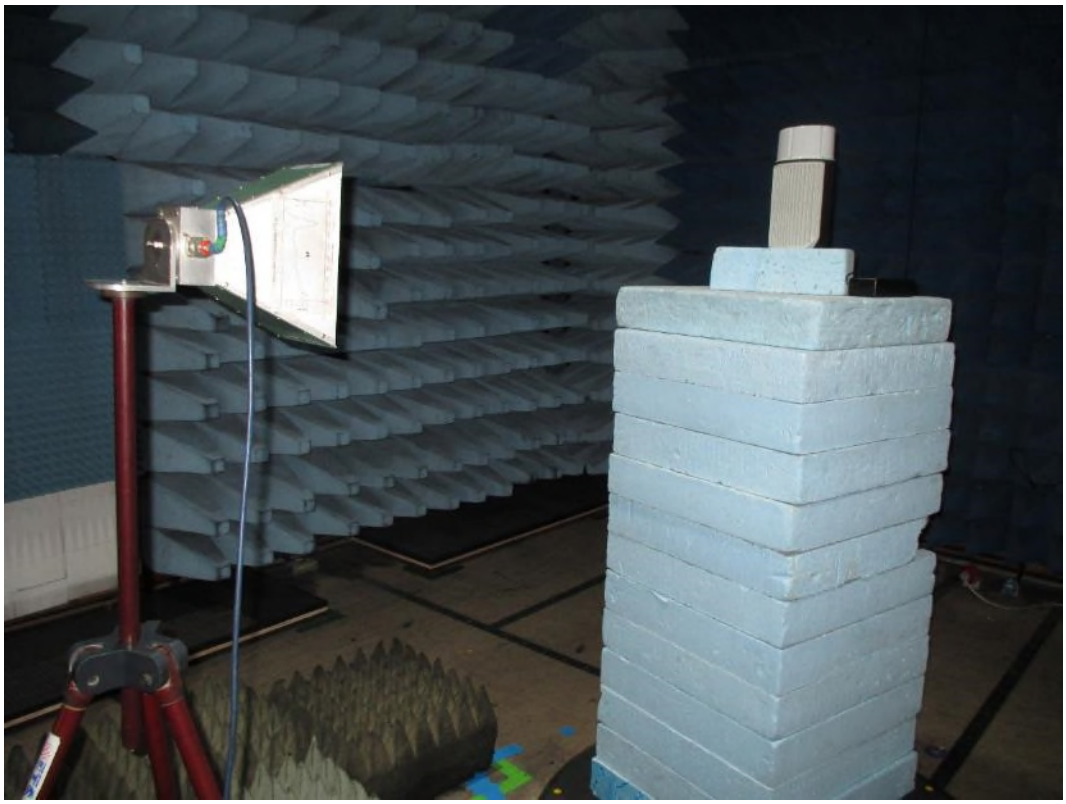


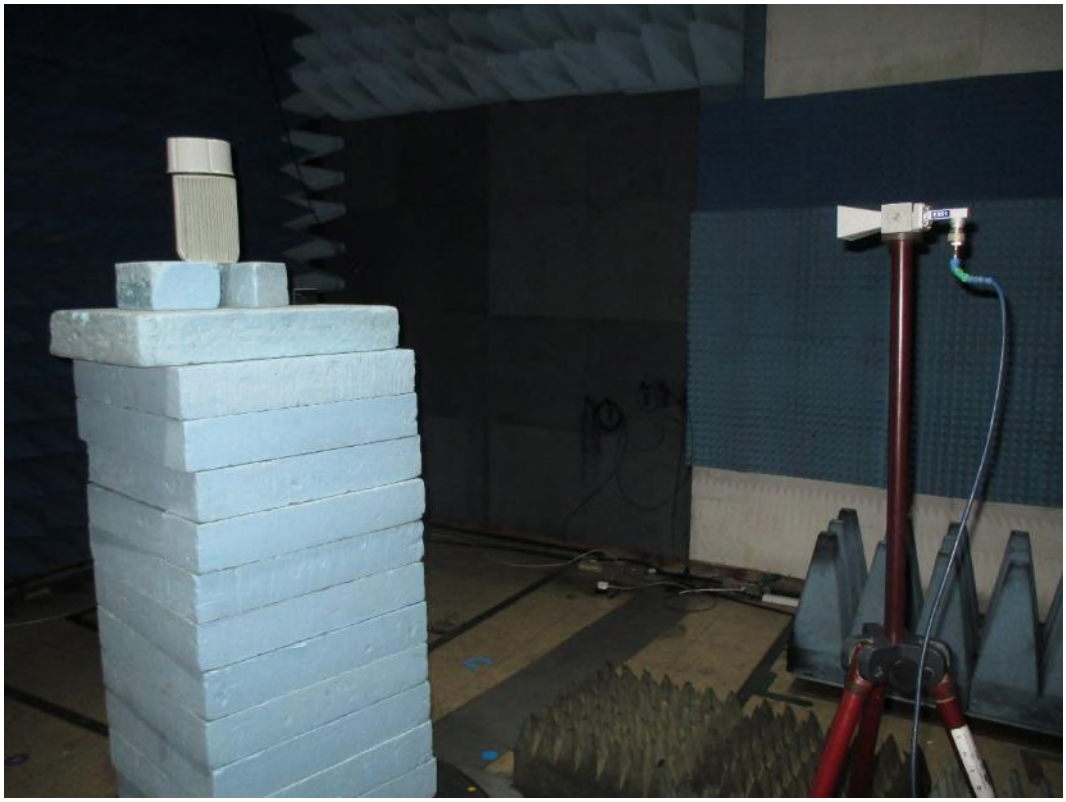



Electronics
AC ADAPTER 交換式電源供應器
PART NO : SW3634
Model : STD-48025
INPUT (輸入) : 100-240V ~ 47-63Hz 1.6A MAX.
OUTPUT (輸出) : 48V ⎓ 2.5A
FOR INDOOR USE ONLY
EFFICIENCY LEVEL VI
JET
I/P:100-240V AC 50-60Hz 135VA-145VA 1.6A
O/P:48V DC 2.5A
D/C:1947
MADE IN CHINA
ID NO . A

8.12 Radiated emissions above 1 GHz







8.13 Radiated emission diagrams

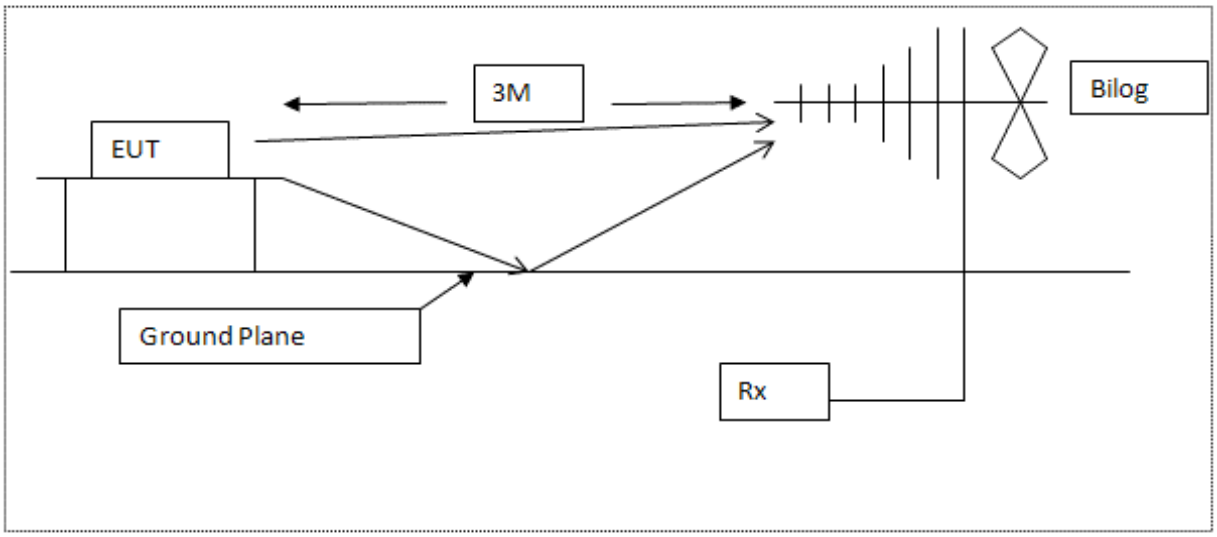


Diagram of the radiated emissions test setup 30 - 1000 MHz

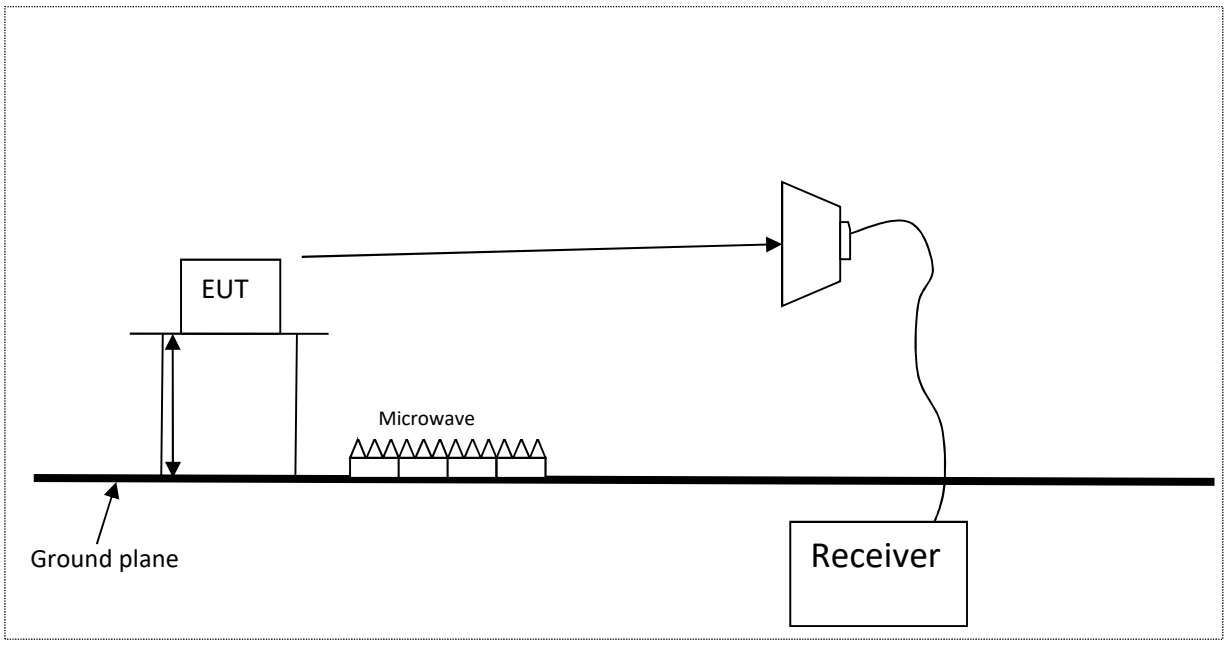


Diagram of the radiated emissions test setup above 1GHz

8.14 AC powerline conducted emission diagram

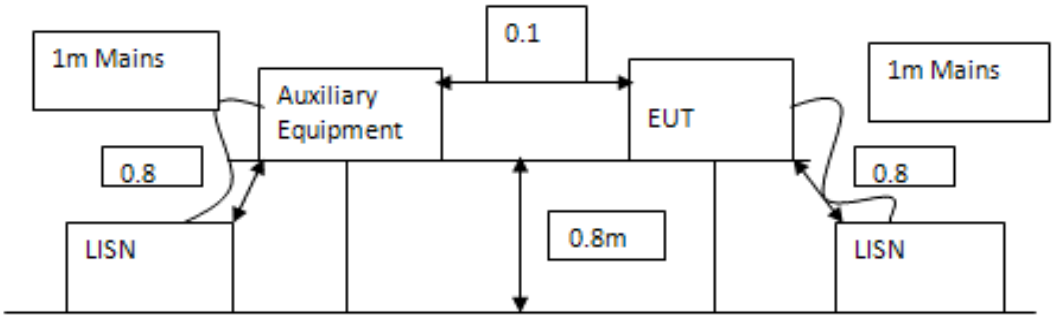


Diagram of the AC conducted emissions test setup

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	15-Dec-2020	12 months
E136	3105	Horn Antenna 1 - 12.5 GHz	EMCO	10-Apr-2021	12 months
E150	MN2050	LISN 13A	Chase	22-Apr-2021	12 months
E404	2024-20	Horn Std Gain 17.6-26.7GHz	Flann (FMI)	25-Aug-2020	12 months
E411	N9039A	9 kHz - 1 GHz RF Filter Section	Agilent Technologies	11-Jul-2020	12 months
E624	E4440A	PSA 3 Hz - 26.5 GHz	Agilent Technologies	11-Jul-2020	24 months
E743	2017 4/2dB	Attenuator 4/2dB 30-1000MHz	RN Electronics	06-Feb-2021	12 months
LPE364	CBL6112A	Antenna BiLog 30MHz - 2GHz	Chase Electronics Ltd	07-Mar-2020	24 months
NSA-M	NSA - M	NSA - Site M	RN Electronics	09-Jan-2019	36 months
TMS78	3160-08	Horn Std Gain 12.4-18 GHz	ETS Systems	25-Aug-2020	12 months
TMS81	6502	Antenna Active Loop	EMCO	24-Jun-2019	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

Item No.	Model No.	Description	Manufacturer	Serial No.
1	Latitude 5410	Laptop and power supply	Dell	CCSLT09-RFLab09

10.2 RN Electronics supplied equipment

RN No.	Model No.	Description	Manufacturer	Serial No
N623	STD-48025	PSU 48V 2.5A 120/240Vac	TT Electronics	-

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, ISED 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, ISED Registration No. 5612A-2, VCCI Registration No. 4065

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, ISED 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, ISED Registration No. 5612A-1

Site R Screened Room (Conducted Immunity)

Site S Safety Laboratory

Site T Transient Laboratory

RN Electronics CAB identifier as issued by Innovation, Science and Economic Development Canada is UK0002
RN Electronics CAB identifier as issued by FCC is UK0015

13 Abbreviations and units

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