2360

Radio Test Report

Airspan Communications Ltd

AU545

47 CFR Part 27 Effective Date 1st October 2016

↳ 47CFR part 2J Effective Date 1st October 2016

TNB: Licensed Non-Broadcast station transmitter

Test Date: 1st November 2017

Report Number: 11-10222-1-17 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 10222-1

The equipment noted below has been partially tested by R.N. Electronics Limited and, where appropriate, conforms to the relevant subpart of 47CFR part 27. This is a certificate of test only and should not be confused with an equipment authorisation. Other standards may also apply.

Equipment:	AU545
Model Number:	AU545
Unique Serial Number:	D3BB113F45C2
Applicant:	Airspan Communications Ltd Capital Point, 33 Bath Road Slough, Berkshire, UK SL1 3UF
Proposed FCC ID	**PIDAU545ENB25**
Full measurement results are detailed in Report Number:	11-10222-1-17 Issue 01
Test Standards:	47 CFR Part 27 Effective Date 1st October 2016 ↳ 47CFR part 2J Effective Date 1st October 2016 TNB: Licensed Non-Broadcast station transmitter

NOTE:
The above list is incomplete as only partial tests conducted at request of the manufacturer. For details refer to section 3 of this report.

DEVIATIONS:
The following tests have not been performed at the request of Airspan Communications Ltd:- Spurious emissions at antenna terminals, RF Power Output, Frequency stability, Modulation characteristics, Occupied bandwidth.

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:	1st November 2017
Test Engineer:	Digitally signed by: Daniel Sims DN: CN = Daniel Sims C = GB O = RN Electronics Ltd Date: 2017.12.12 16:26:38 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: 2017.12.12 16:28:05 Z
Customer Representative:	

2360

File Name: Airspan Communications Ltd.10222-1 Issue 01

1 Contents

2 Equipment under test (EUT)

2.1 Equipment specification

Applicant	Airspan Communications Ltd Capital Point 33 Bath Road Slough Berkshire, UK SL1 3UF	
Manufacturer of EUT	Airspan Communications Ltd	
Full Name of EUT	AU545	
Model Number of EUT	AU545	
Serial Number of EUT	D3BB113F45C2	
Date Received	1st November 2017	
Date of Test:	1st November 2017	
Purpose of Test	To demonstrate design compliance to the relevant rules of Chapter 47 of the Code of Federal Regulations.	
Date Report Created	10th November 2017	
Main Function	Indoor LTE / Wi-Fi Access point.	
Information Specification	Height	250mm
	Width	350mm
	Depth	150mm
	Weight	<10kg
	Voltage	110-230 V AC 50/60 Hz
	Current	Not specified
EUT Supplied PSU	Manufacturer	Delta Electronics
	Model number	ADP-66CR B
	Serial number	-
	Input voltage	100-240V AC, 50/60 Hz
	Input current	2A
	Output	DC 12V, 5.5A

2.2 Configurations for testing

General Parameters	
EUT Normal use position	Table top / shelf top
Choice of model(s) for type tests	Production prototype
Antenna details	Each of the 4 transmitters has an integral antenna, UE Relay = 6dBi eNodeB = 10dBi 2.4 GHz Wi-Fi = 3 dBi 5 GHz Wi-Fi = Not specified
Antenna port	No
Baseband Data port (yes/no)?	No
Highest Signal generated in EUT	2649 MHz
Lowest Signal generated in EUT	Not specified
Hardware Version	Rev D0
Software Version	Rev 6.1.5.9
Firmware Version	Incorporated in software build
Type of Equipment	Fixed small cell Digital station
Technology Type	LTE and Wi-Fi
Geo-location (yes/no)	Not specified
TX Parameters	
Alignment range – transmitter	The EUT has 4 transmitters: eNodeB, UE Relay and Wi-Fi. eNodeB = 2506 – 2680 MHz UE Relay = 2506 – 2680 MHz Wi-Fi = 2.4 – 2.483.5 GHz Wi-Fi = 5.18 – 5.7 GHz
EUT Declared Modulation Parameters	LTE 64QAM & 802.11.g
EUT Declared Power level	eNodeB = 4400mW EIRP Sercom = 800mW EIRP Wi-Fi = <100mW EIRP 5G Wi-Fi = 600mW EIRP
EUT Declared Signal Bandwidths	eNodeB = 20 MHz Sercom = 20 MHz 2.4G Wi-Fi = 20MHz 5G Wi-Fi = 20/40/80MHz
EUT Declared Channel Spacing's	eNodeB = 20 MHz Sercom = 20 MHz 2.4G Wi-Fi = 20MHz 5G Wi-Fi = 20MHz
EUT Declared Duty Cycle	Not specified
Declared frequency stability	Not specified
RX Parameters	
Alignment range – receiver	Not specified
EUT Declared RX Signal Bandwidth	Not specified

2.3 Functional description

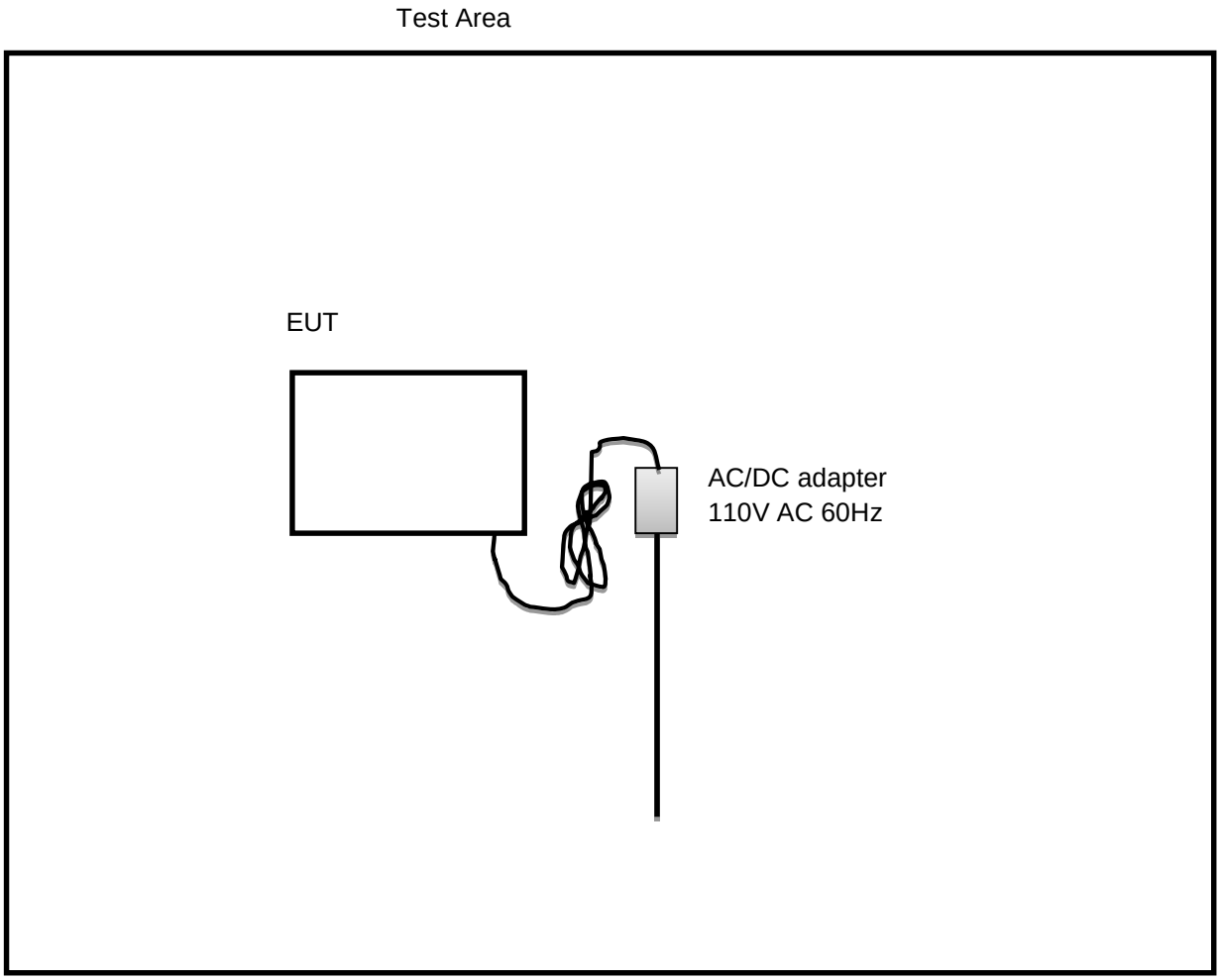
AirUnity: A best-in-class end user installed indoor LTE small cell with integrated LTE relay backhaul, designed specifically to solve the indoor mobile hotspot problem and dramatically improve network efficiency. Placing the small cell indoors right at the hotspots in enterprises and public access areas improves cellular signal quality and covering an area of around 30,000 square feet, and thus enables greater experience for indoor users. In addition AirUnity provides extended outdoor coverage of 100 metres. A free-standing unit with wireless backhaul which can be placed on window sills, tables and shelfs. It supports LTE-A (FDD or TDD) and an optional WiFi AP (802.11n concurrent with 802.11ac). AirUnity is composed of an eNB for access, and a standard high-performance UE relay for wireless backhaul.

2.4 Modes of operation

Mode Reference	Description	Used for testing
Mode 1	EUT eNodeB transmitting at 2550MHz, UE Relay transmitting on 2620 MHz, 2.4G Wi-Fi transmitting on 2412 MHz, and 5G Wi-Fi transmitting on 5200MHz	Yes

Note: No other modes / channels / Bandwidths or modulation schemes were assessed, at the client's request.

2.5 Emissions configuration



The unit was powered from the supplied AC/DC adapter. The unit was configured by the client to transmit on the channels listed below to allow intermodulation radiated emissions to be assessed. Please refer to section 2.4 of this report for the test mode. The eNodeB, UE Relay, 2.4G Wi-Fi and 5G Wi-Fi were configured to transmit using engineering programming commands. Pre scans were performed using a field strength method to determine any intermodulation emissions between the 4 transmitters, where signals were observed a substitution method was used for final results.

eNodeB Channel (2620 MHz)
UE Relay Channel (2550 MHz)
Wi-Fi Channel (2412 MHz)
5G Wi-Fi Channel 5200 MHz)

2.5.1 Signal leads

Port Name	Cable Type	Connected
Mains	AC/DC adapter to 2 core DC	Yes

3 Summary of test results

The AU545, was tested for compliance to the following standard(s) :

47 CFR Part 27 Effective Date 1st October 2016
↳ 47CFR part 2J Effective Date 1st October 2016

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. Spurious emissions at antenna terminals	47CFR part 2J Part 2.1051, 47CFR part 27 Part 27.53	NOT TESTED[1]
2. RF Power Output	47CFR part 2J Part 2.1046, 47CFR part 27 Part 27.50	NOT TESTED[1]
3. Frequency stability	47CFR part 2J Part 2.1055, 47CFR part 27 Part 27.54	NOT TESTED[1]
4. Occupied bandwidth	47CFR part 2J Part 2.1049, 47CFR part 27 Part 27.53	NOT TESTED[1]
5. Field strength of spurious radiations	47CFR part 2J Part 2.1053, 47CFR part 27 Part 27.53(m)(2)	PASSED
6. Band edge at antenna terminals	47CFR part 2J Part 2.1051, 47CFR part 27 Part 27.53(m)(4)	NOT TESTED[1]
7. Modulation characteristics	47CFR part 2J Part 2.1047,	NOT TESTED[1]

[1] Not tested at the request of applicant.

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	47CFR part 27	2016	Part 27 – Miscellaneous Wireless Communications Services
4.1.2	47CFR part 2J	2016	Part 2 – Frequency Allocations and radio treaty matters; General rules and regulations
4.1.3	KDB 971168 D01 v02r02	2014	Measurement Guidance for Certification of Licensed Digital Transmitters
4.1.4	ITU-R SM.329-12	2012	Unwanted emissions in the spurious domain
4.1.5	TIA-603-E	2016	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards, Telecommunications Industry Association, March 2016

4.2 Deviations

The following tests have not been performed at the request of Airspan Communications Ltd:-
Spurious emissions at antenna terminals, RF Power Output, Frequency stability, Modulation characteristics, Occupied bandwidth.

5 Tests, methods and results

5.1 Spurious emissions at antenna terminals

NOT TESTED: Not tested at the request of applicant.

5.2 RF Power Output

NOT TESTED: Not tested at the request of applicant.

5.3 Frequency stability

NOT TESTED: Not tested at the request of applicant.

5.4 Occupied bandwidth

NOT TESTED: Not tested at the request of applicant

5.5 Field strength of spurious radiations

5.5.1 Test methods

Test Requirements:	47CFR part 2J Part 2.1053 [Reference 4.1.2 of this report], 47CFR part 27 part 27.53(m)(2) [Reference 4.1.1 of this report]
Test Method:	KDB 971168 D01 v02r02 [Reference 4.1.3 of this report], TIA-603-E [Reference 4.1.5 of this report]
Limits:	47CFR part 27 part 27.53(m)(2) [Reference 4.1.1 of this report]

5.5.2 Configuration of EUT

The EUT was tested in an ALSE and ambient conditions were monitored. The EUT was examined in its declared normal use position. The EUT was operated in Mode 1 for this test at the request of the client.

5.5.3 Test procedure

Tests were made in accordance with the Test Method noted above, using the measuring equipment listed in the 'Test Equipment' Section. Peak field strength from the EUT was maximised by rotating it 360 degrees. Appropriate band-pass filters were used to ensure the fundamentals did not distort the results. A peak detector and field strength measurement pre-scans were used to determine any signals for final measurements. Final measurements where required, were performed using an RMS detector using a substitution method of measurement.

30MHz - 1GHz.
The measuring antenna was scanned 1 - 4m in both Horizontal and Vertical polarisations. Substitution method was performed using tuned dipoles / a calibrated bi-conical antenna. Measurement distance of 3metres was used.

1GHz – 60 GHz.
The measuring antenna was used in both Horizontal and Vertical polarisations. Substitution method was performed using standard gain horn antennas. Measurement distances used were: 1 – 12 GHz at 3metres, 12 – 26.5 GHz at 1.2metres and 26.5 – 60 GHz at 0.3 metres.

The EUT was tested in Site M.

5.5.4 Test equipment

E136, E296-2, E296-4, E330, E410, E411, E412, E429, E547, E580, E624, TMS78, TMS79, TMS82, LPE364

See Section 9 for more details

5.5.5 Test results

Temperature of test environment	22°C
Humidity of test environment	63%
Pressure of test environment	102kPa

Setup Table

Band	2.495 - 2.690 GHz (LTE) 2.4 – 2.4835 GHz (2.4 Wi-Fi) 5.18 – 5.7 GHz (Wi-Fi)
Power Level	4400 mW
Channel Spacing	20
Mod Scheme	LTE & Wi-Fi
Test channels	EUT transmitters set to: eNodeB Channel (2620 MHz) UE Relay Channel (2550 MHz) 2.4G Wi-Fi Channel (2412 MHz) 5G Wi-Fi Channel (5200 MHz)

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
No spurious signals observed associated with the 4 transmitters within 20dB of limits.				

Note: Pre-scan field strength plots are shown for information in section 6 of this report. (Limit line is shown as a field strength limit at 3m, which is equivalent to -13dBm)

LIMITS:
Part 27.53(m)(2), -13dBm

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 - 1GHz ± 3.9 dB, 1 – 18 GHz ±3.5dB, 18 – 60 GHz ±3.9dB

5.6 Band edge antenna port emissions

NOT TESTED: Not tested at the request of applicant.

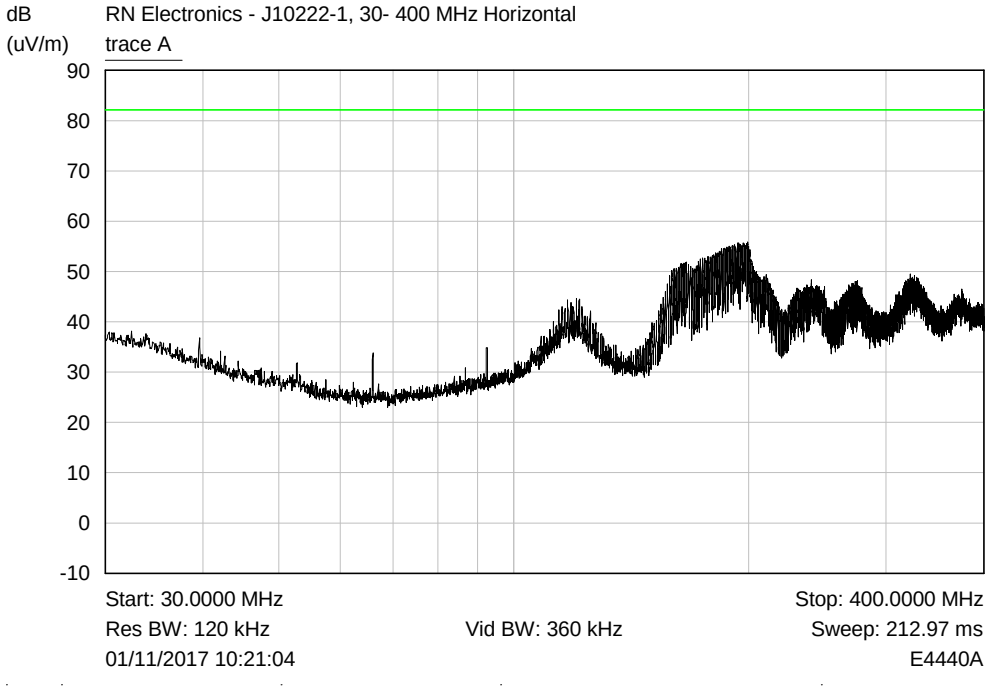
5.7 Modulation characteristics

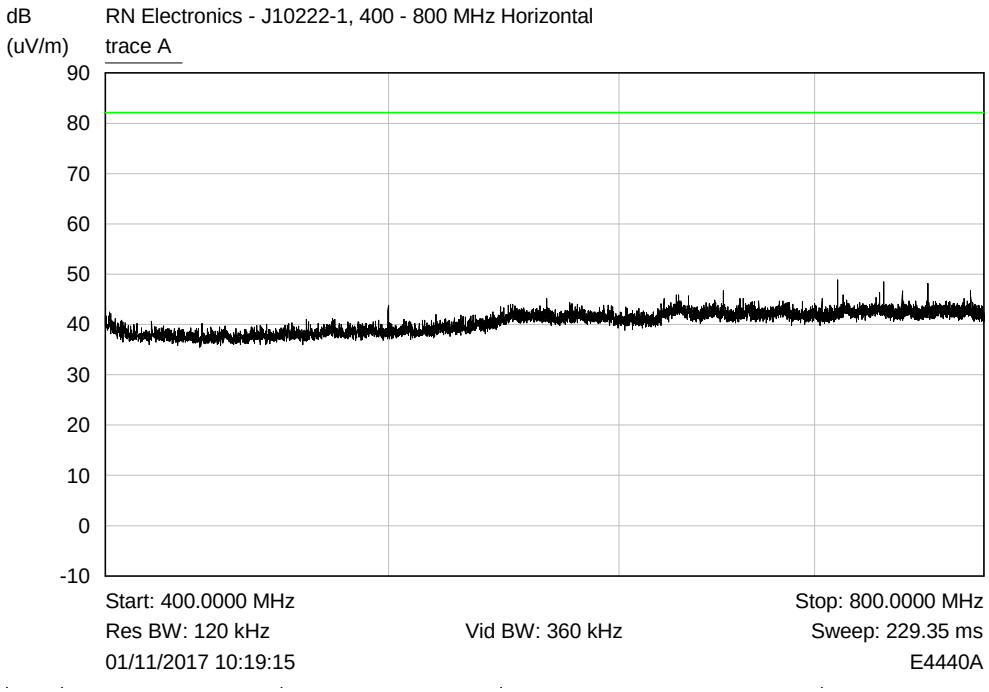
NOT TESTED: Not tested at the request of applicant.

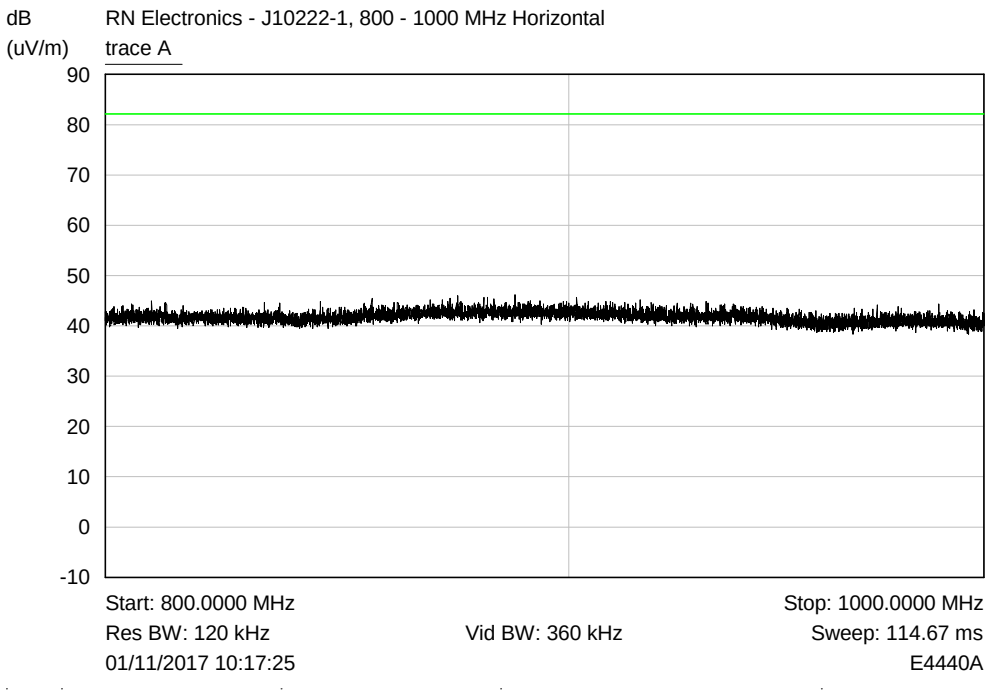
6 Plots/Graphical results

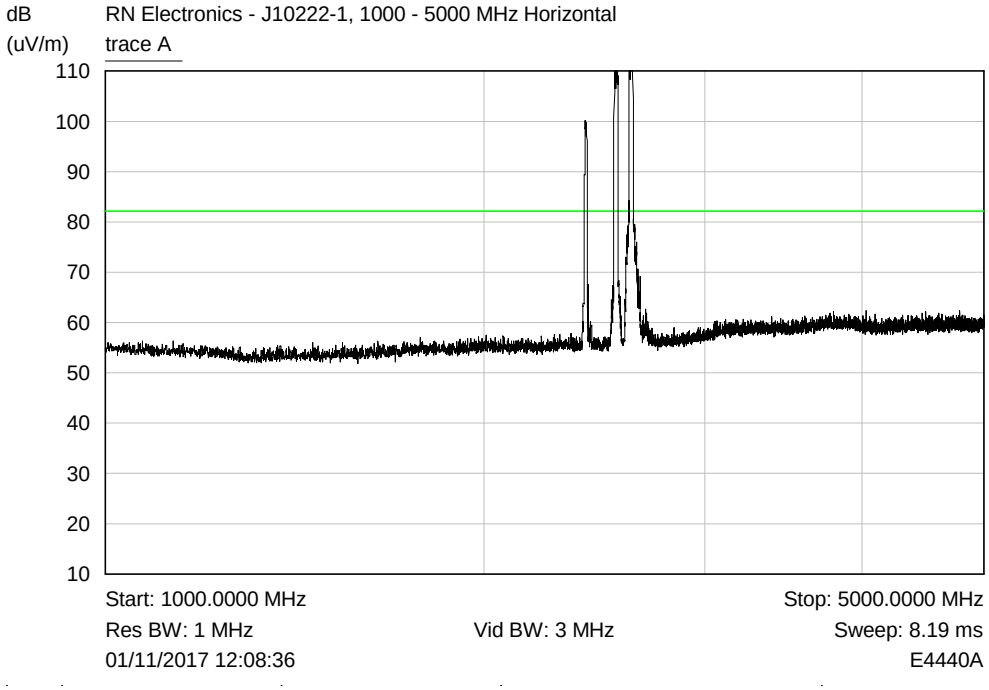
6.1 Pre-scan plots

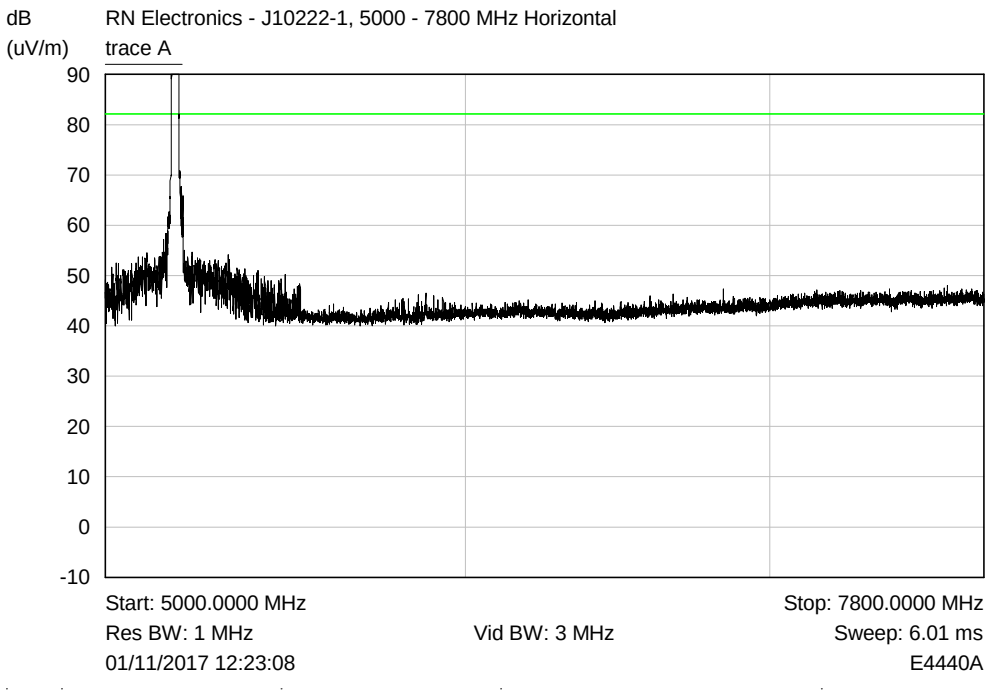
Horizontal plots

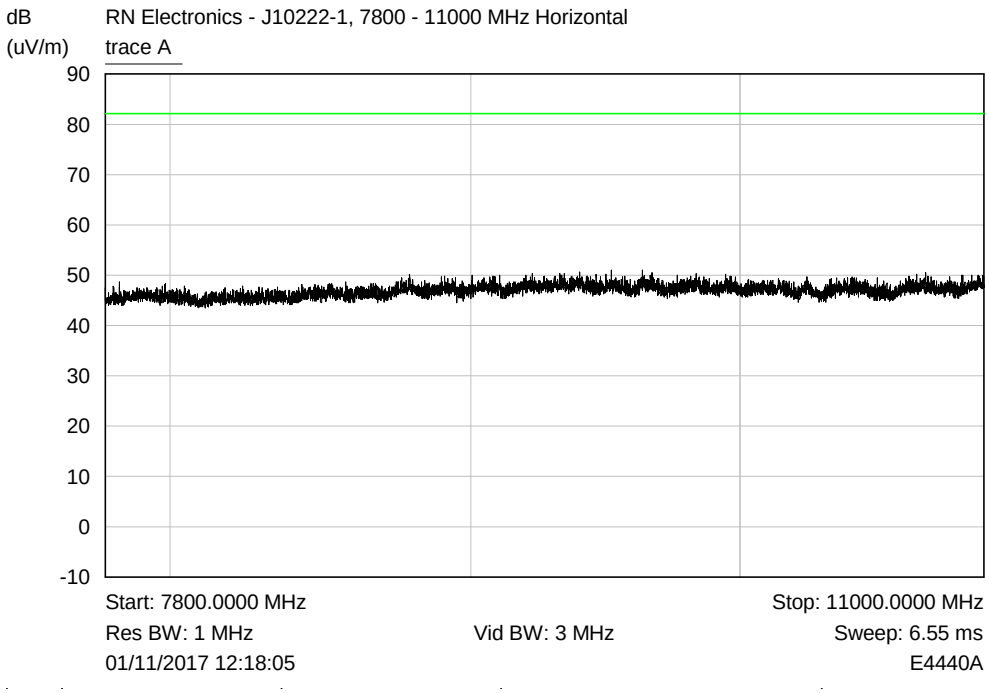


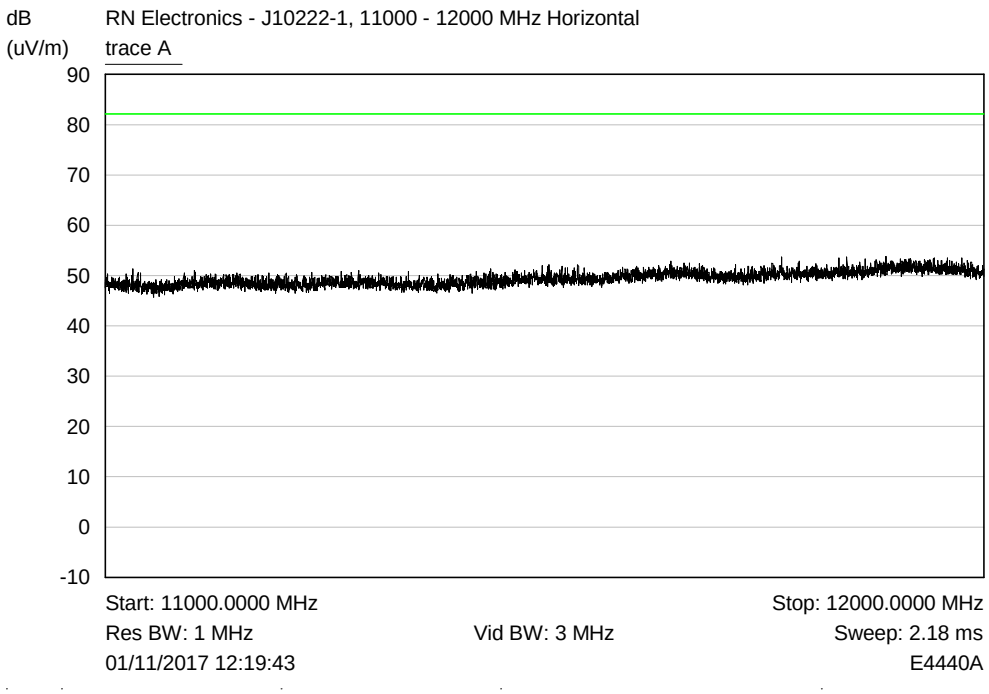


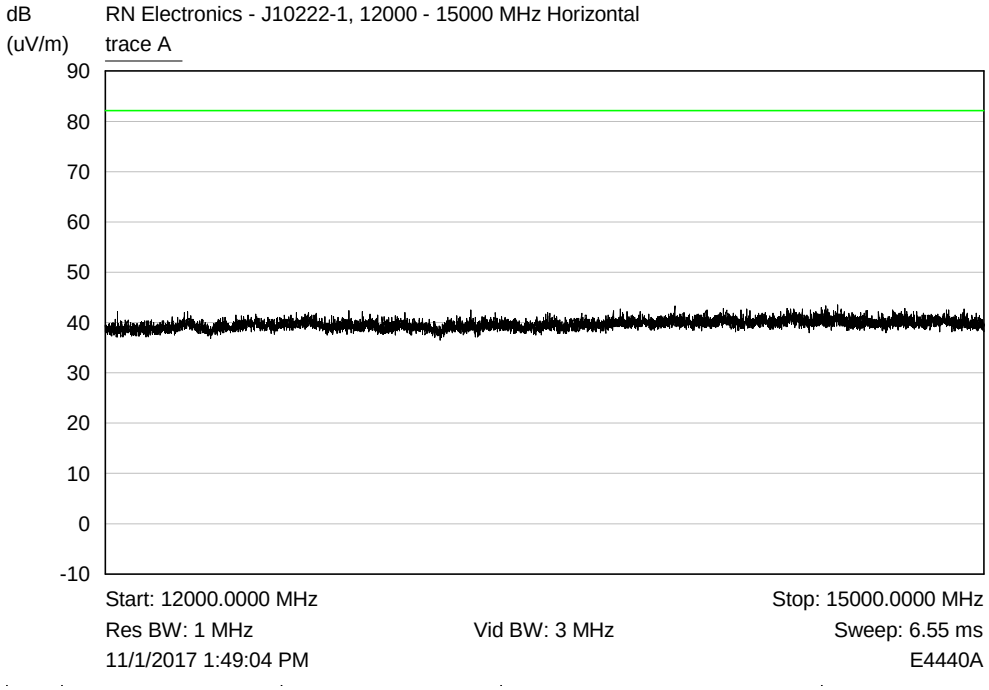


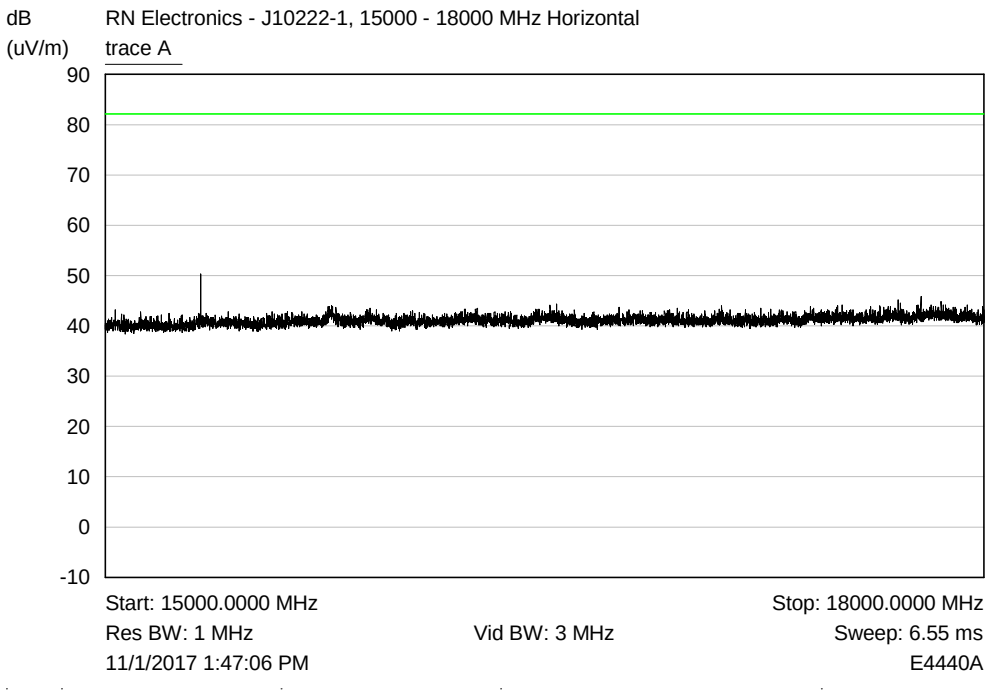


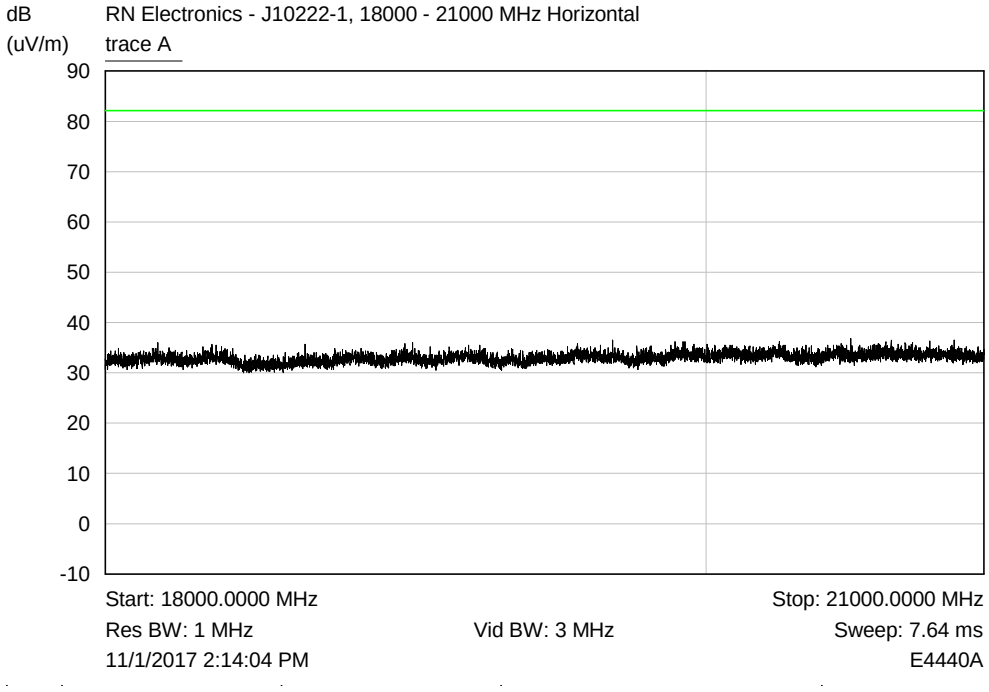


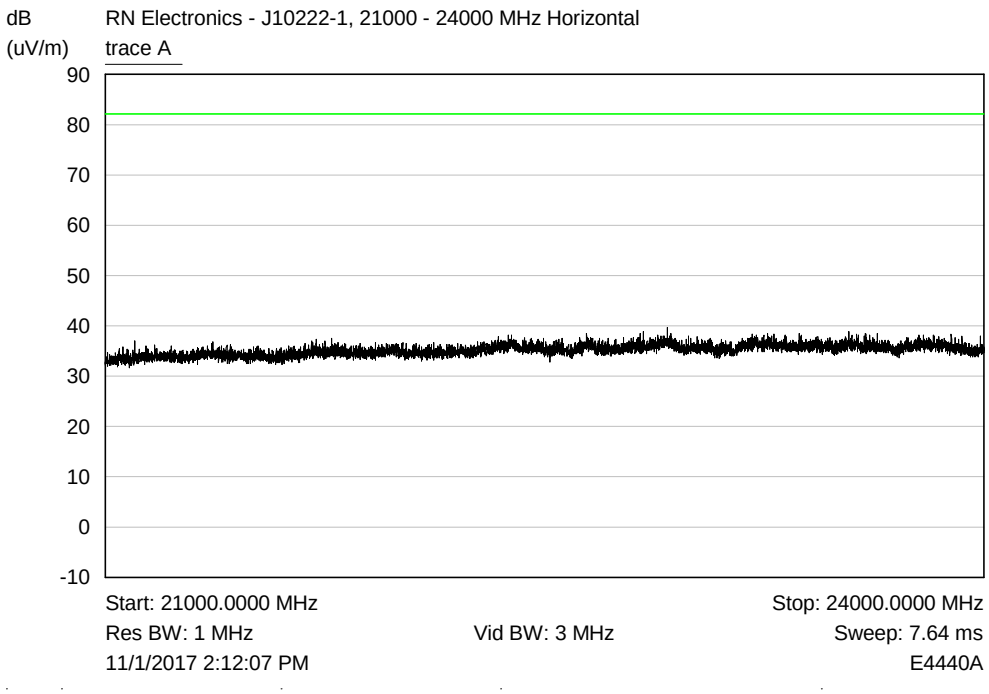


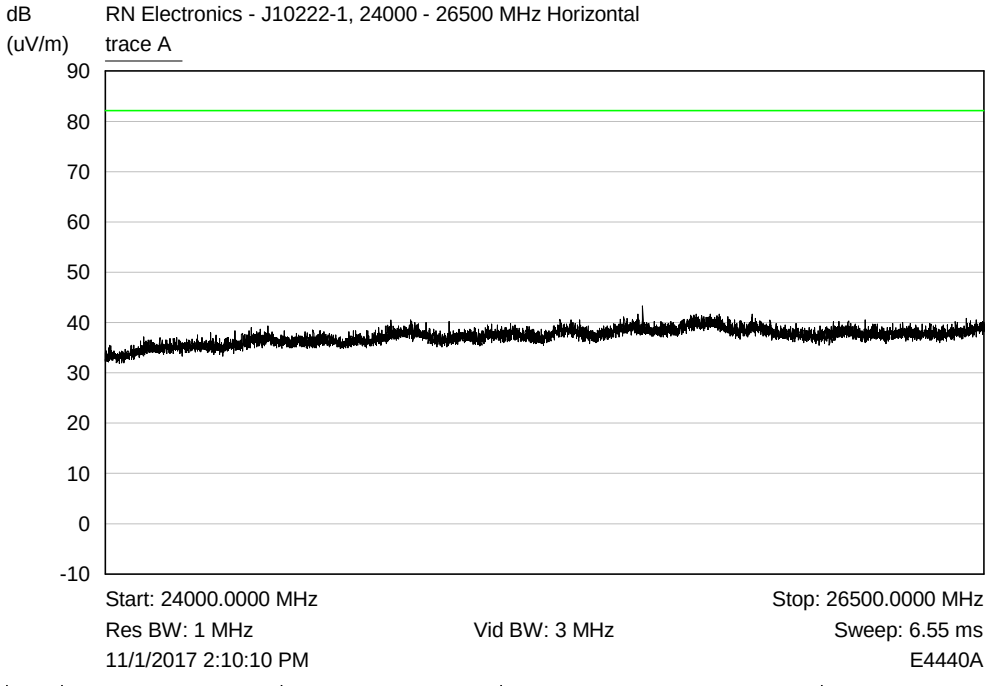




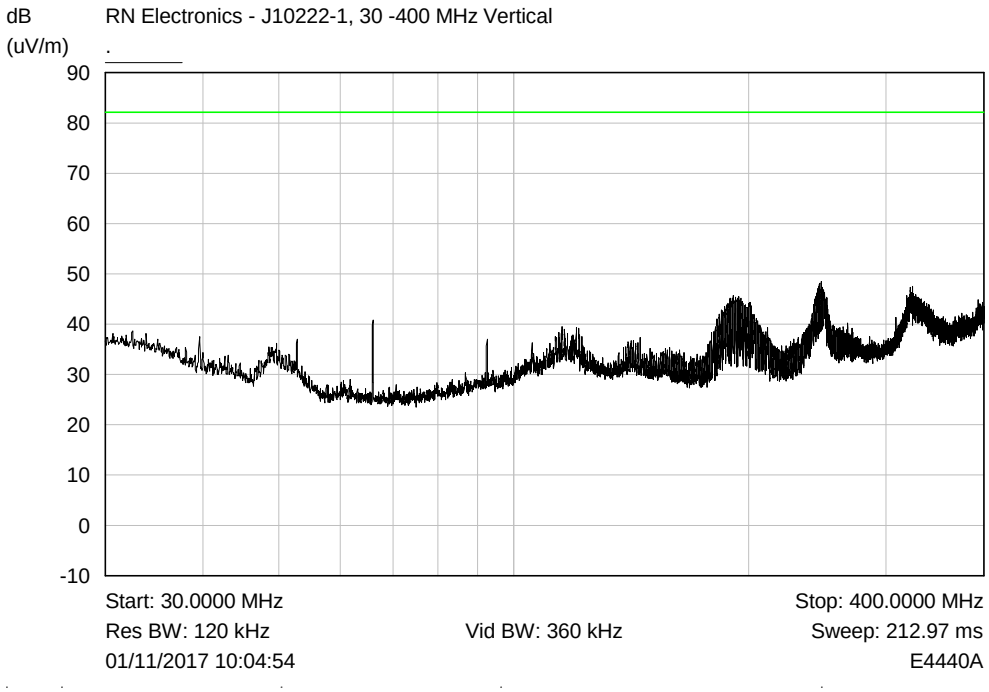


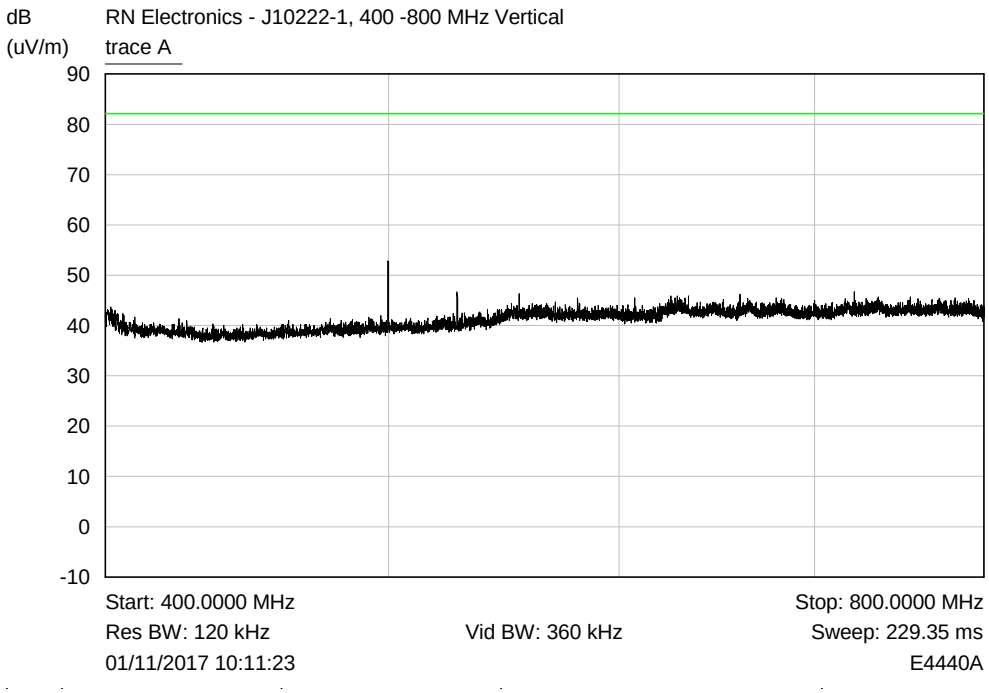


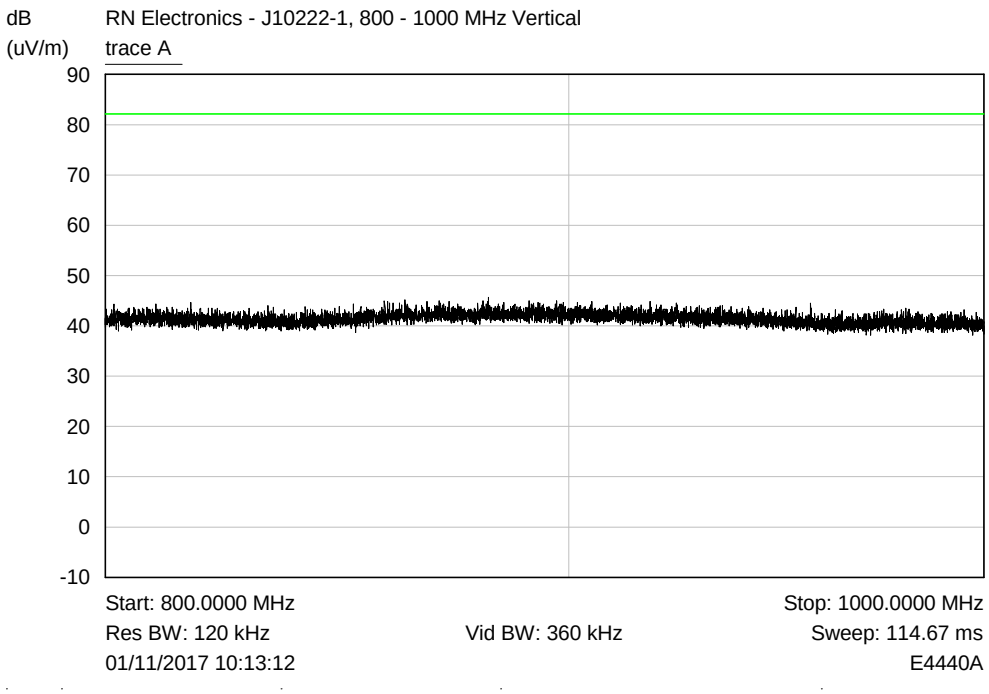


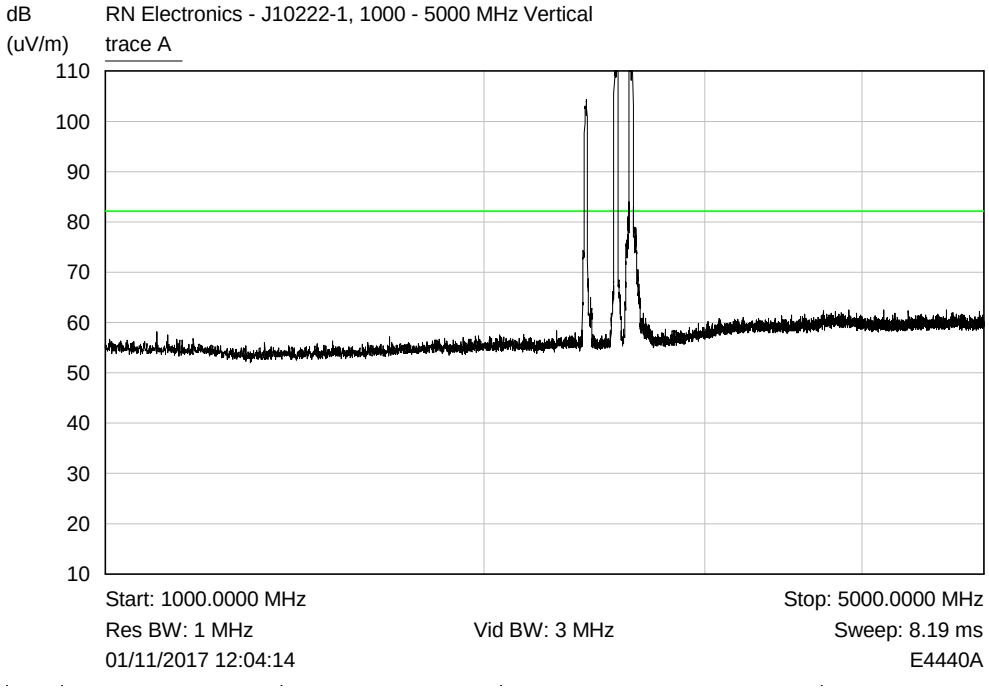


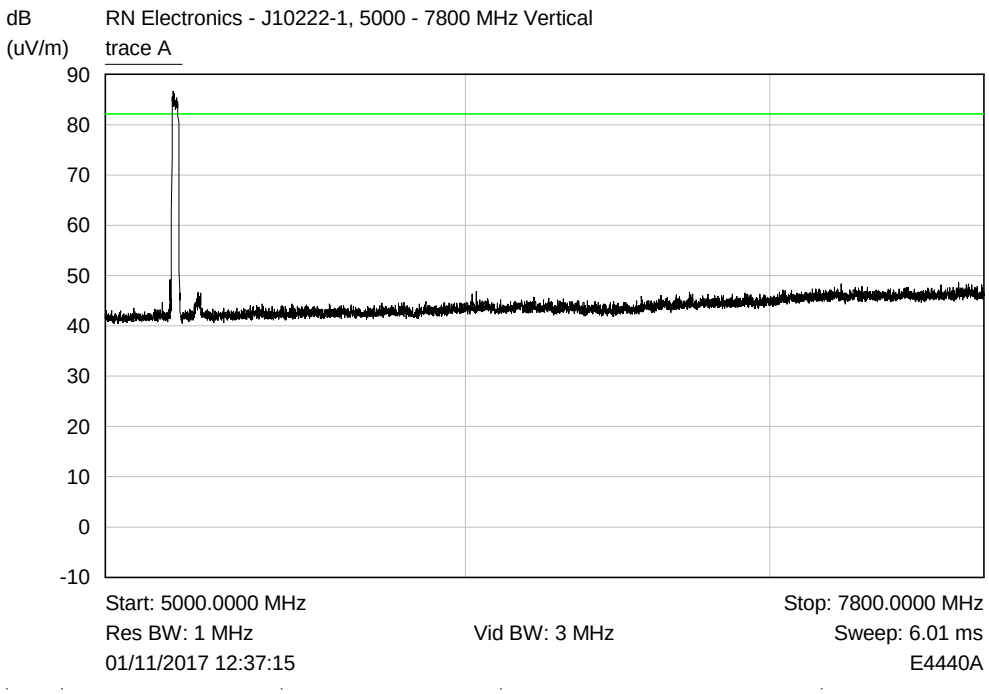
Vertical plots

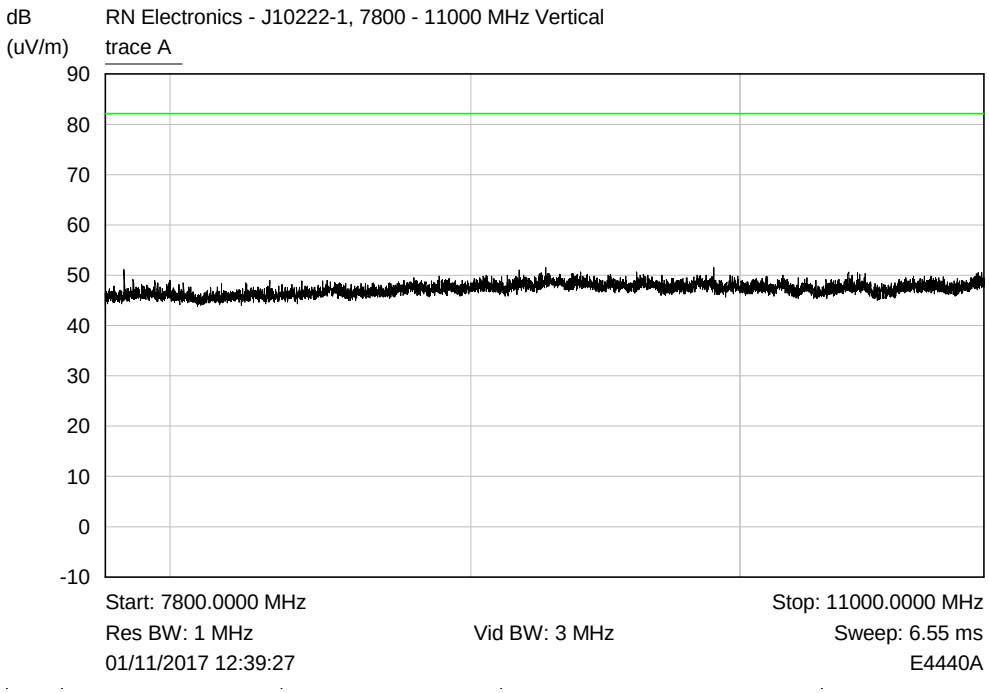


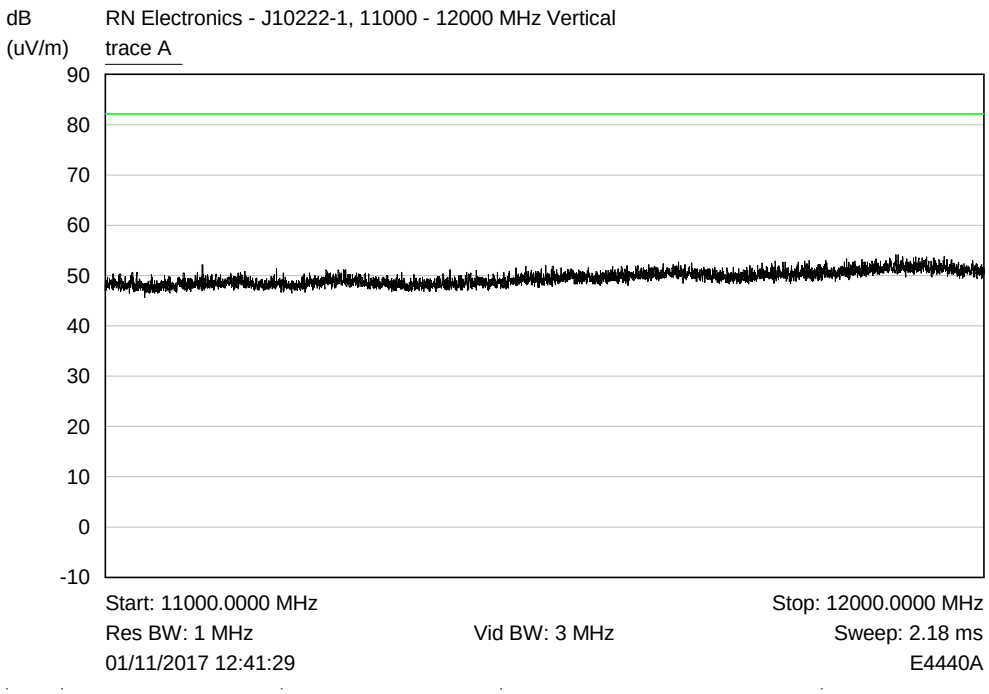


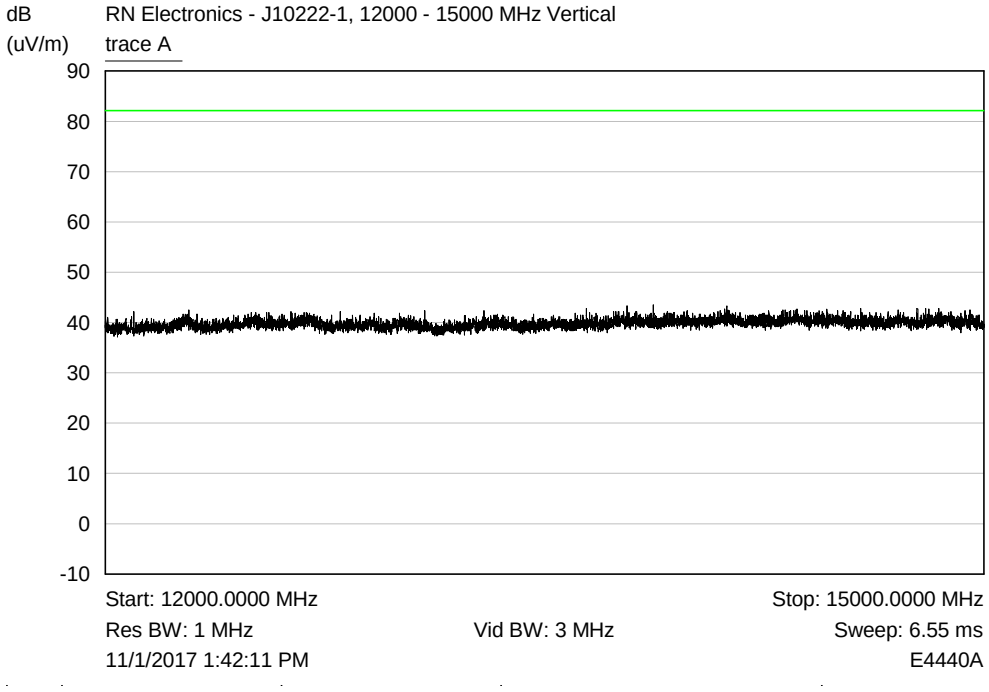


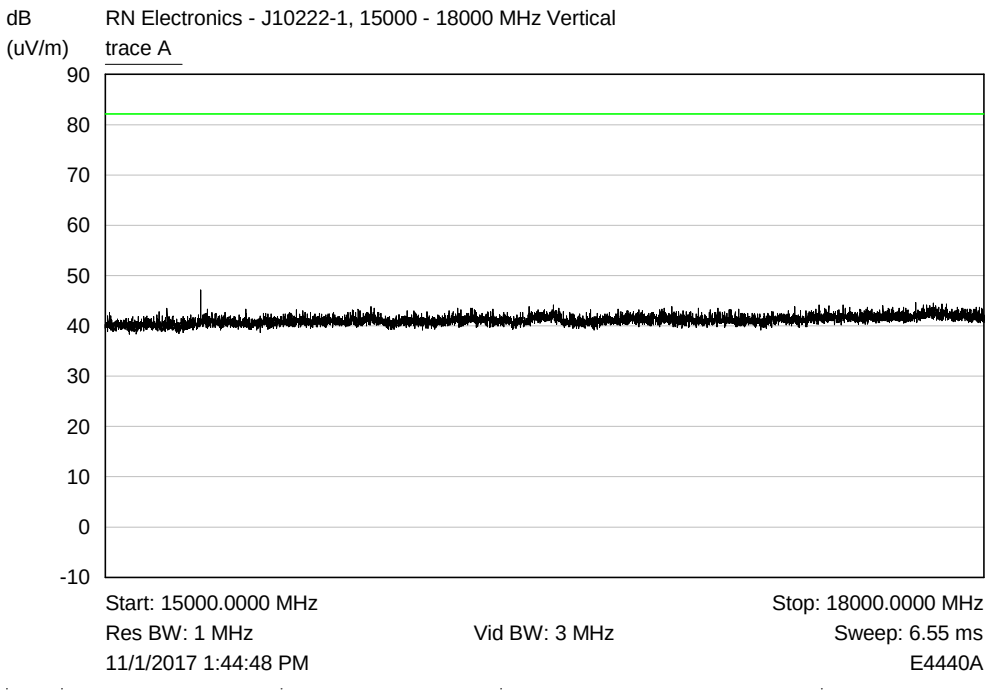


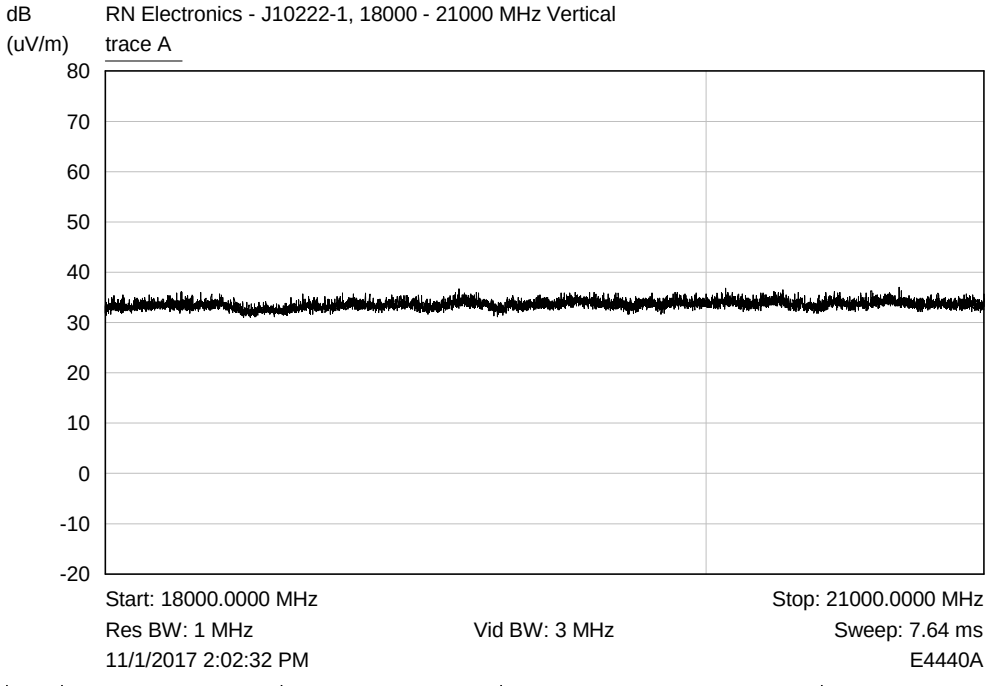


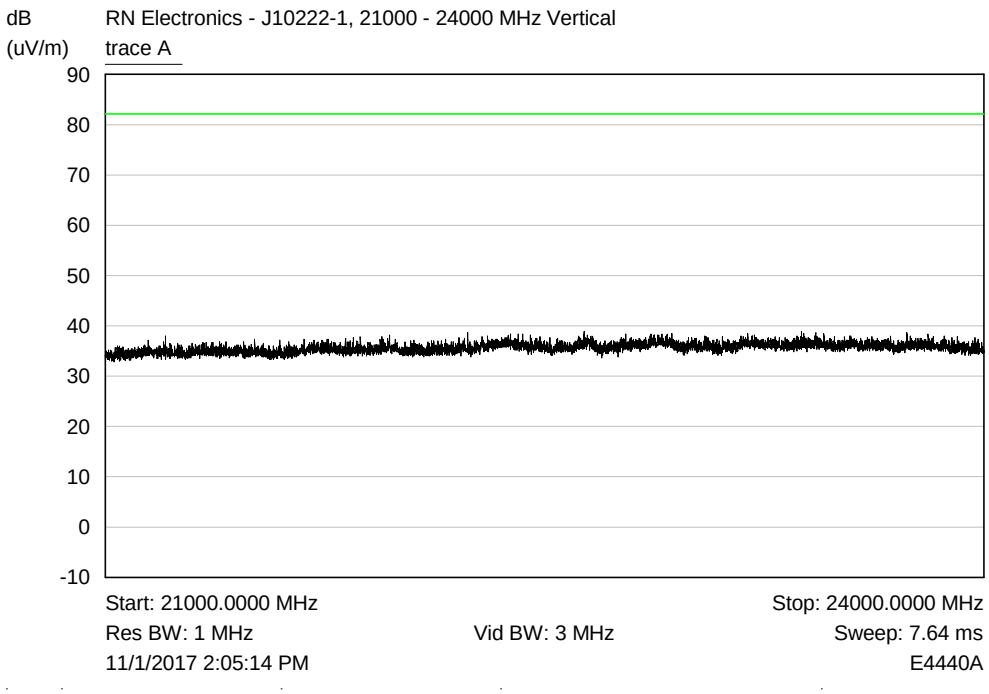


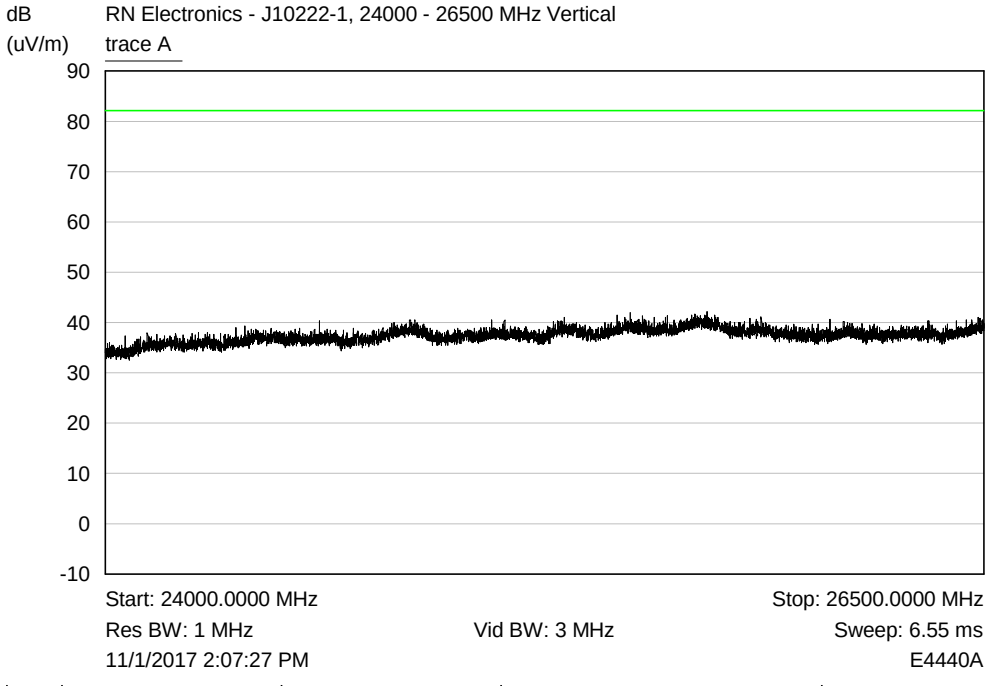




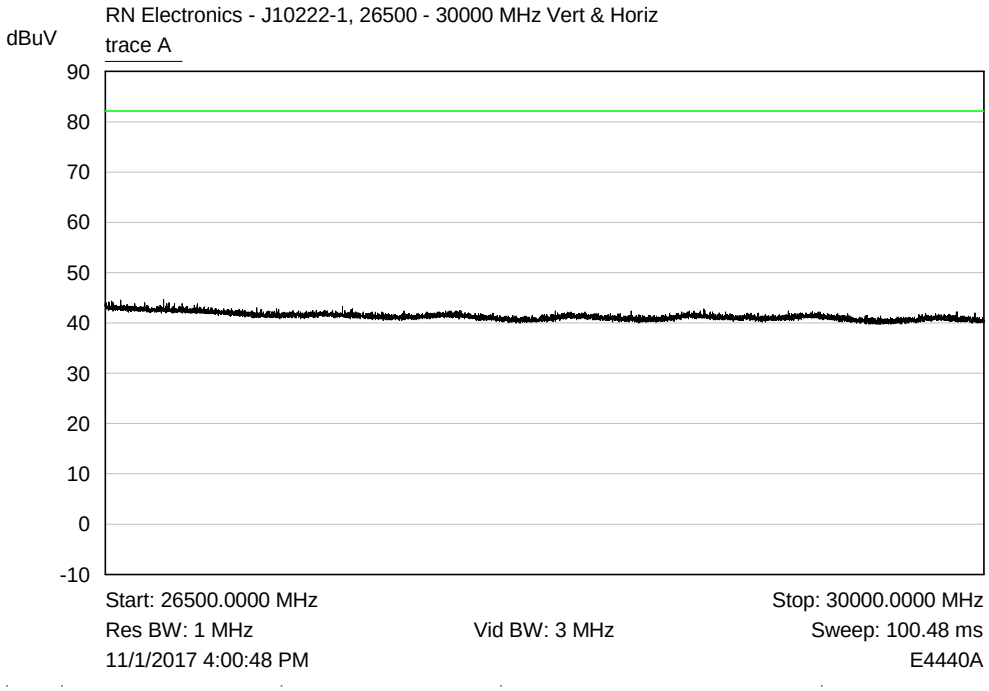


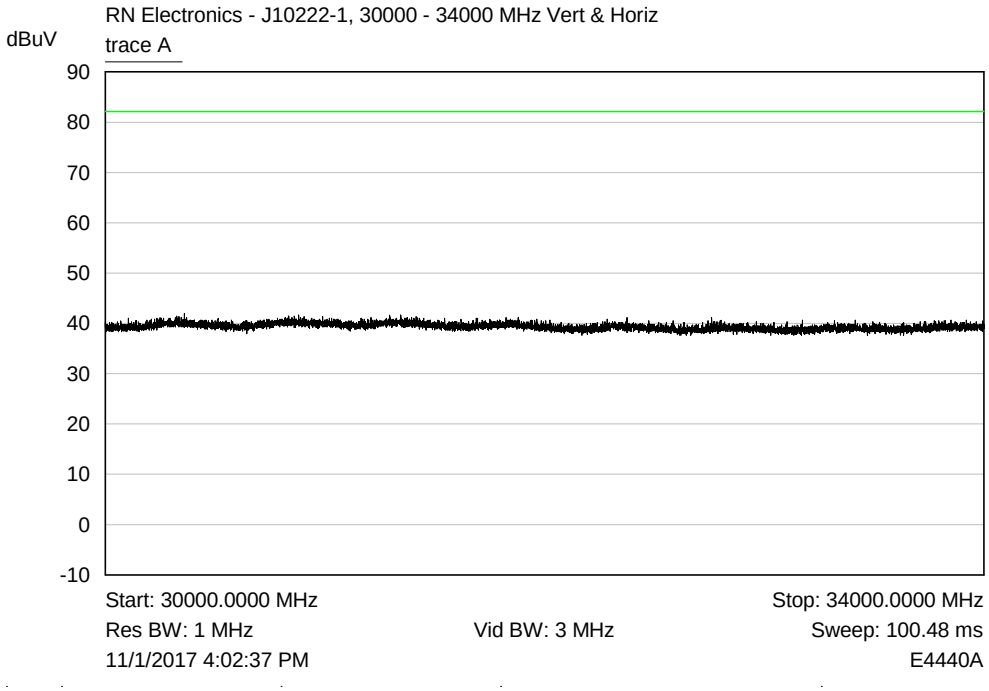


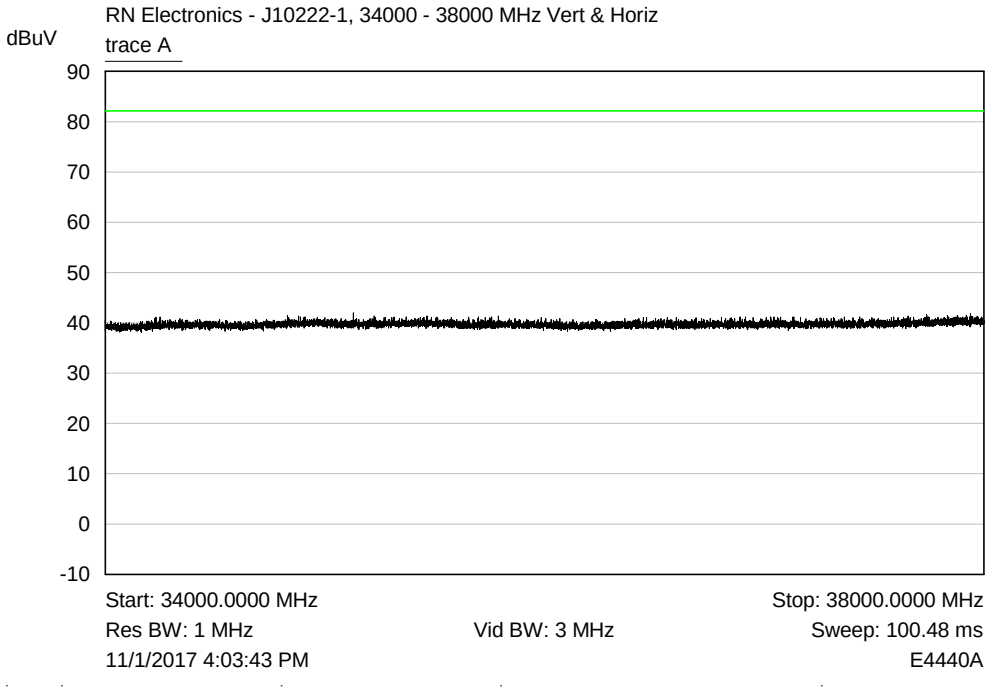


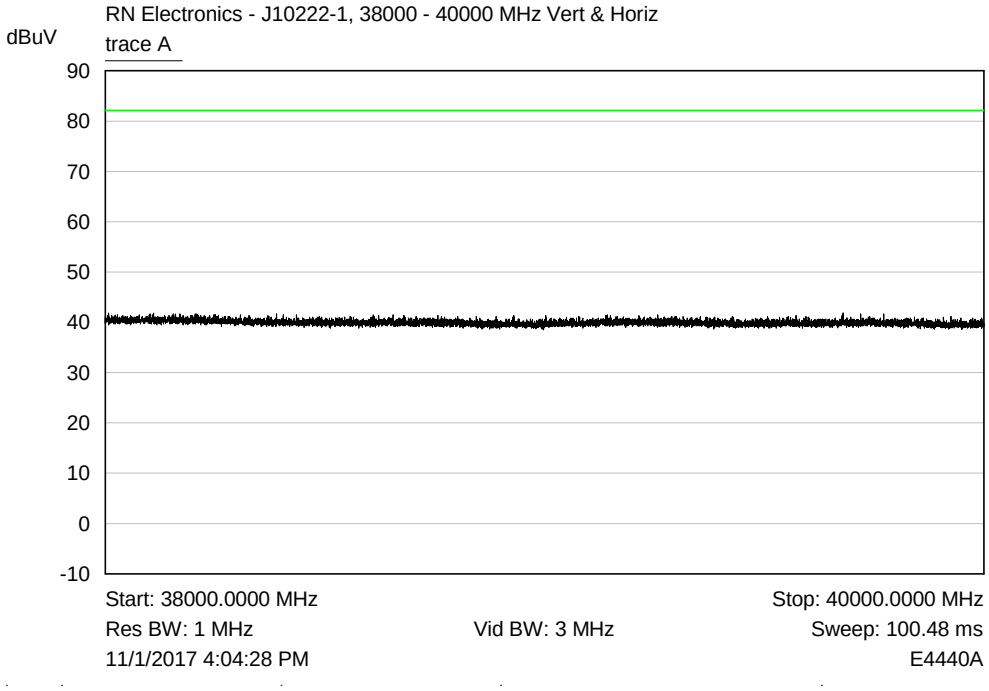


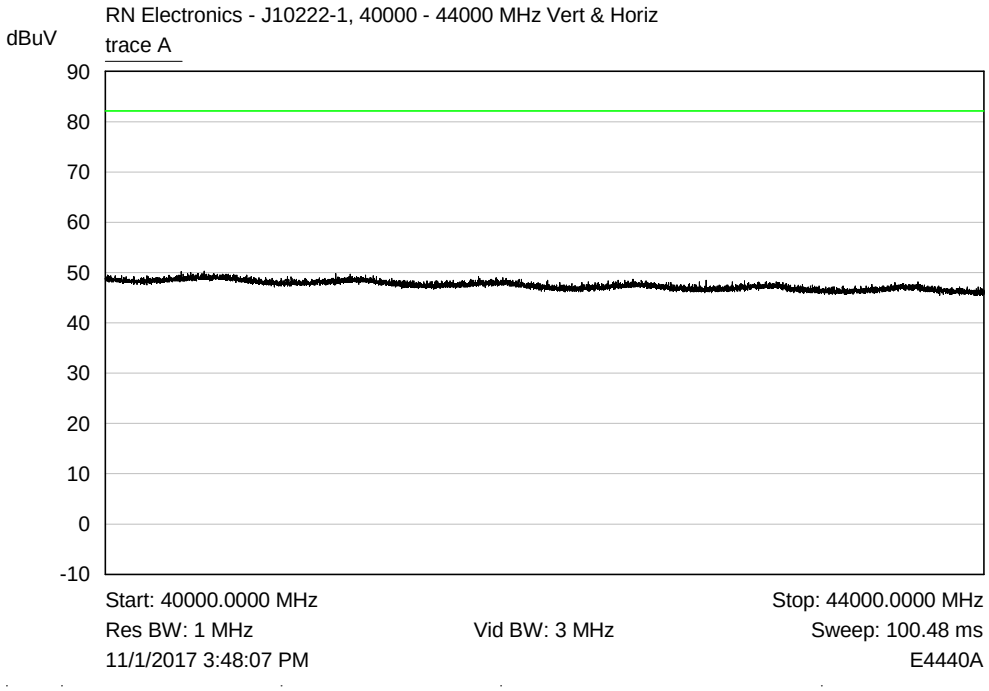
Combined Horizontal & Vertical plots 26.5 – 60 GHz

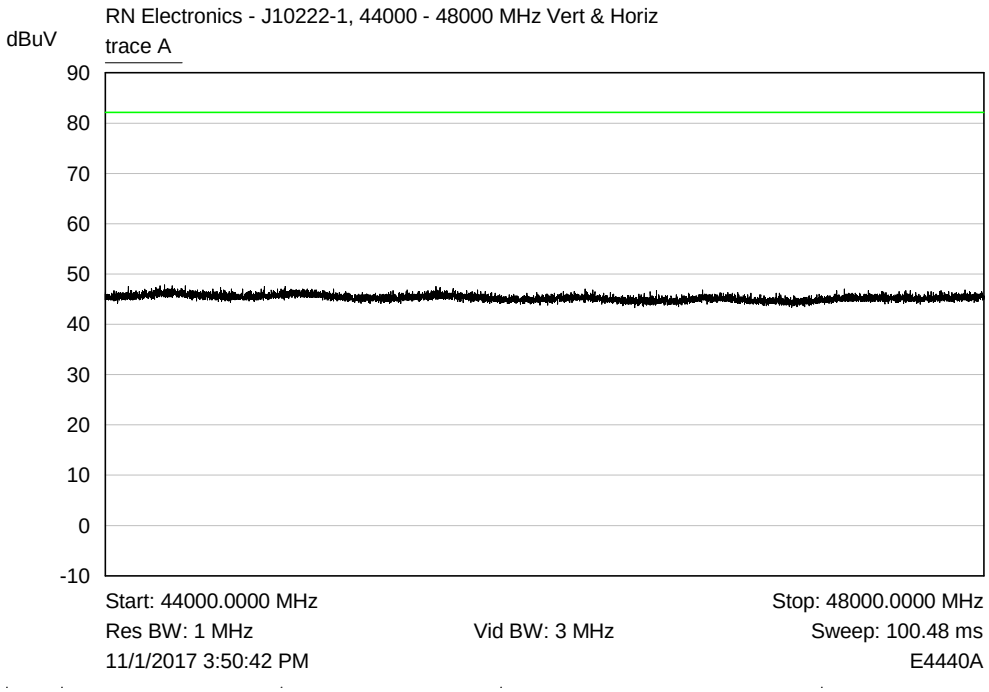


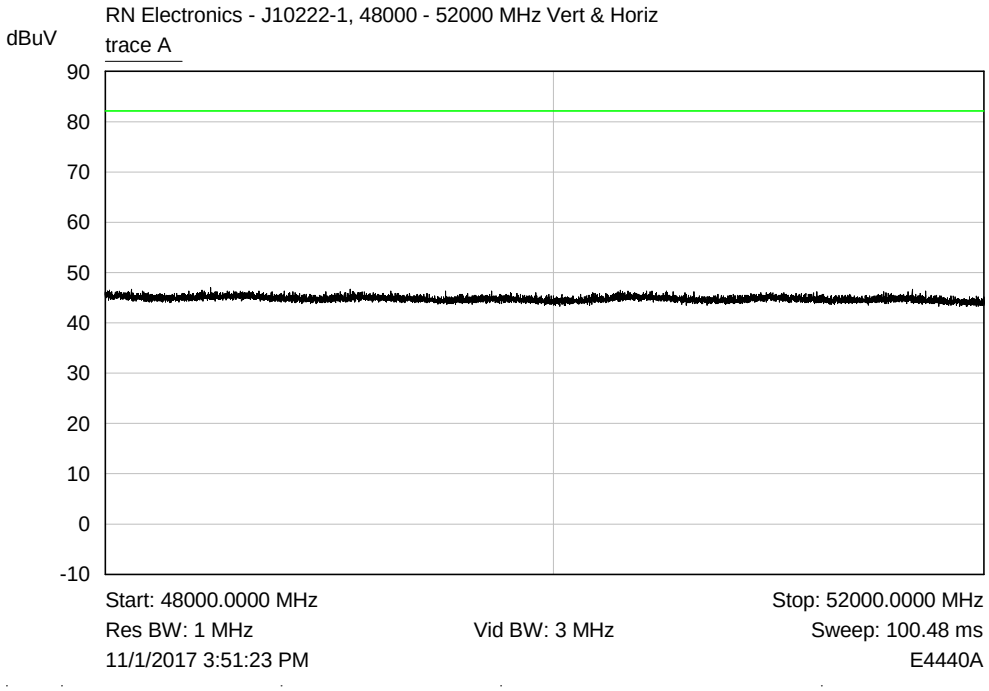


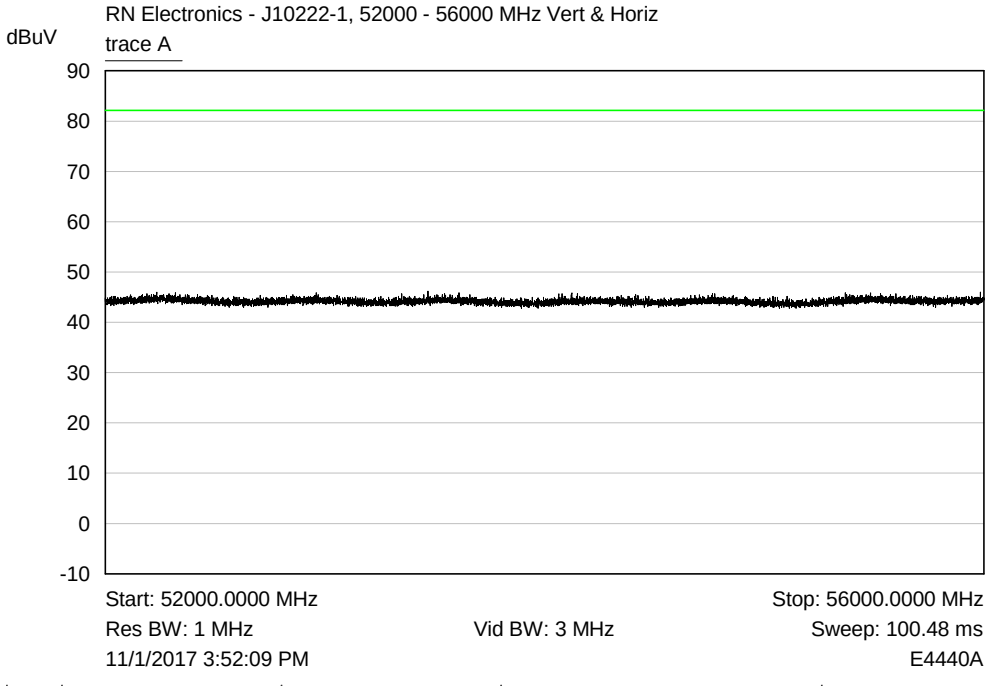


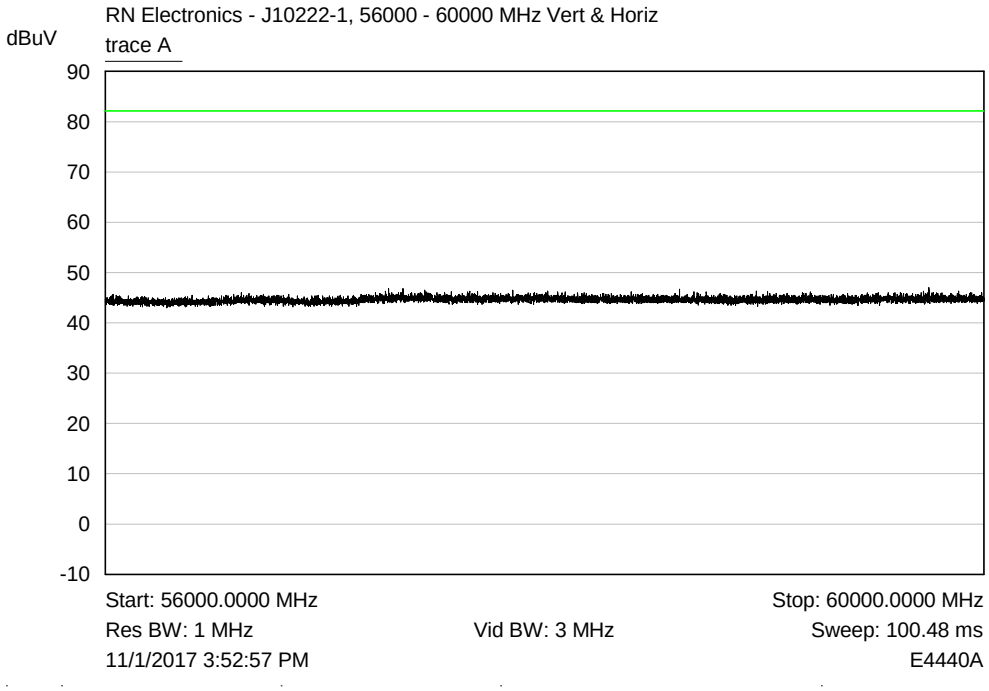












7 Explanatory Notes

Not required.

8 Photographs

No photographs have been included in this test report at the request of Airspan Communications Ltd.

8.1 Radiated emission diagram

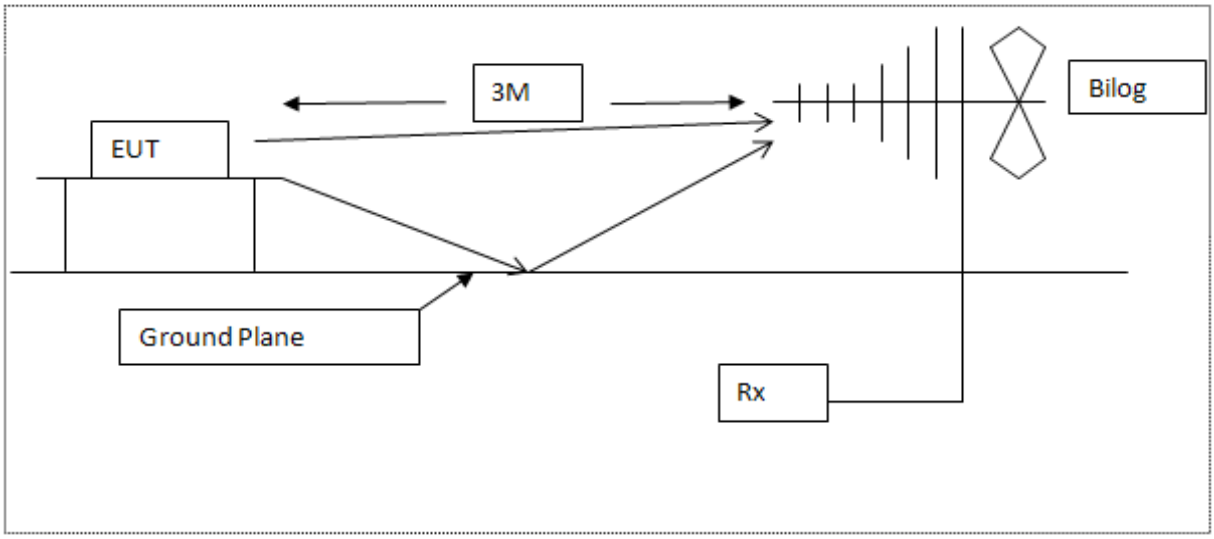


Diagram of the radiated emissions test setup 30 - 1000 MHz

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
E136	3105	Horn Antenna 12.5GHz	EMCO	03-Apr-2017	12 months
E296-2	11970A	Harmonic Mixer 26.5-40 GHz	Hewlett Packard	06-Sep-2017	12 months
E296-4	11970U	Harmonic Mixer 40-60 GHz	Hewlett Packard	*04-Dec-2017	24 months
E330	2224-20	Flann Horn 26.5-40 GHz	FMI	25-Apr-2017	12 months
E410	N5181A	Signal Generator 3 GHz MXG	Agilent Technologies	30-Apr-2015	36 months
E411	N9039A	9 kHz - 1 GHz RF Filter Section	Agilent Technologies	11-Jul-2017	12 months
E412	E4440A	PSA 3 Hz - 26.5 GHz	Agilent Technologies	10-Jul-2017	24 months
E429	-	Switched filter box 0.91 – 16.3 GHz	RN Electronics Ltd	29-Aug-2017	12 months
E547	8493A	Attenuator 20dB 12.4GHz	Hewlett Packard	02-Dec-2016	12 months
E580	24240	Standard Gain Horn 40GHz - 60GHz	FMI Ltd	25-Apr-2017	12 months
E624	E4440A	PSA 3 Hz - 26.5 GHz	Agilent Technologies	22-Dec-2015	24 months
LPE364	CBL6112A	Antenna Bilog 30MHz - 2GHz	Chase Electronics Ltd	22-Jan-2016	24 months
TMS78	3160-08	Std Gain Horn Antenna 12.4-18 GHz	ETS Systems	25-Jul-2017	12 months
TMS79	3160-09	Std Gain Horn Antenna 18-26.5 GHz	ETS Systems	25-Jul-2017	12 months
TMS82	8449B	Pre Amplifier 1 - 26 GHz	Agilent Technologies	19-Dec-2016	12 months

* Equipment was in calibration dates for tests or has since been re-calibrated to maintain calibration.

10 Auxiliary and peripheral equipment

10.1 Customer supplied equipment

No Customer supplied equipment was used.

10.2 RN Electronics supplied equipment

No RN Electronics Ltd supplied equipment was used.

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 / Calibration Laboratory and anechoic chamber

Site B Semi-anechoic chamber
FCC Registration No. 293246
IC Registration No. 5612A-4

Site B1 Control Room for Site B

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 Screened Room

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 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
ºC	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	deciBels	OFDM	Orthogonal Frequency Division Multiplexing
dBµA/m	deciBels relative to 1µA/m	ppm	Parts per million
dBµV	deciBels relative to 1µV	PRBS	Pseudo Random Bit Sequence
dBc	deciBels relative to Carrier	QAM	Quadrature Amplitude Modulation
dBm	deciBels 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		