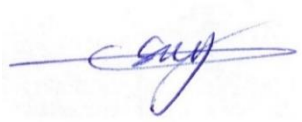
TEST REPORT

Test Report No. : UL-RPT-RP-12698311-1216-FCC

Applicant	:	Etatronix GmbH
Model No.	:	Consisting of transmitter (81909005) and receiver (81909004)
FCC ID	:	2AOR81909004
Technology	:	Wireless Power Transfer with associated 2 MHz Data Communication
Test Standard(s)	:	FCC Parts 15.205, 15.207, 15.209(a), 15.215
		For details of applied tests refer to test result summary

1. This test report shall not be reproduced in full or partial, without the written approval of UL International Germany GmbH.
2. The results in this report apply only to the sample tested.
3. The test results in this report are traceable to the national or international standards.
4. Test Report Version 1.0
5. Result of the tested sample: **PASS**



Prepared by: Abdoufataou, Salifou
Title: Laboratory Engineer
Date: 20 February.2020

Approved by: Ajit, Phadtare
Title: Lead Test Engineer
Date: 20 February.2020

DAkkS Deutsche Akkreditierungsstelle D-PL-19381-02-00

This laboratory is accredited by DAkkS.
The tests reported herein have been performed in accordance with its' terms of accreditation.

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1. Customer Information

Company Name:	Etatronix GmbH
Company Address:	Werschweilerstrasse 40, 66606 St Wendel
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2. Summary of Testing

2.1. General Information

Applied Standards

Specification Reference:	47CFR15.205, 47CFR15.207 and 47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.205 and 15.209
Specification Reference:	47CFR15.215
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.215
Test Firm Registration:	399704

Location

Location of Testing:	UL International Germany GmbH Hedelfinger Str. 61 70327 Stuttgart Germany

Date information

Order Date:	16 January 2019
EUT arrived:	12 February 2020
Test Dates:	19 & 20 February 2020
EUT returned:	-/-

2.2. Summary of Test Results

Clause	Measurement	Complied	Did not comply	Not performed	Not applicable
Part 15.207	Transmitter AC Conducted Emissions	☒	☐	☐	☐
Part 15.215(c)	Transmitter 20 dB Bandwidth	☒	☐	☐	☐
Part 15.209(a)	Transmitter Fundamental Field Strength	☒	☐	☐	☐
Part 15.209(a)(c)	Transmitter Radiated Emissions	☒	☐	☐	☐

2.3. Methods and Procedures

Reference:	ANSI C63.10-2013
Title:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
Reference:	KDB 414788 D01 Radiated Test Site v01r01
Title:	TEST SITES FOR RADIATED EMISSION MEASUREMENTS
Reference:	KDB 174176 Line Conducted FAQ v01r01
Title:	AC POWER-LINE CONDUCTED EMISSIONS FREQUENTLY ASKED QUESTIONS

2.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	Etatronix GmbH
Model Name:	Consisting of transmitter (81909005) and receiver (81909004)
WPT Source Test Sample Serial Number: **WPT Client Test Sample Serial Number:**	1933901004800071 1931001004900055
WPT Source / Client Test Sample Hardware Version Number:	0048 / 0042
WPT Source / Client Test Sample Firmware Version Number:	31909002Tx_00190034 / 31909002Rx_00080021
FCC ID:	2AOR81909004

Brand Name:	Etatronix GmbH
Model Name:	Consisting of transmitter (81909005) and receiver (81909004)
WPT Source Test Sample Serial Number: **WPT Client Test Sample Serial Number:**	1933901004800071 1931001004900069
WPT Source / Client Test Sample Hardware Version Number:	0048 / 0042
WPT Source / Client Test Sample Firmware Version Number:	31909002Tx_00190034 / 31909002Rx_00080021
FCC ID:	2AOR81909004

3.2. Description of EUT

The equipment under test was a 15 W Wireless Power Transfer (WPT) System operating at 111 kHz – 149 kHz, with associated 2 MHz Data communications.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Category of Equipment:	Short Range Device	
Type of Radio Device:	2 MHz Data Communication (associated with 111 kHz WPT)	
Power Supply Requirement(s):	Nominal	24 V DC (tested)
	Minimum	21.6 V DC (specified by customer but not tested)
	Maximum	26.4 V DC(specified by customer but not tested)
Temperature Requirement(s):	Nominal	20 – 25°C (tested)
	Minimum	10 °C (specified by customer but not tested)
	Maximum	45 °C (specified by customer but not tested)
Relative Humidity	30 - 36 %	
Transmit Frequency Range:	2 MHz	
Receive Frequency Range:	2 MHz	

Type of Device:	Miscellaneous (Any non ISM Freq)
Power Supply Requirement(s):	24 V DC
Lowest Frequency generated in the device:	2.5kHz (Modulation signal for data transmission)
Max Rated Power of the device (WPT source):	15W
Main Function:	Wireless Power System with 15 W USB-C Charger for tablets
WPT Source:	81909004 (Wireless module in Transmitting Mode)
WPT Client:	81909004 (Wireless module in Receiving Mode)
WPT Source to Client Separation Distance:	Minimum: 6mm | Maximum: 10mm
WPT Orientation:	WPT Client on WPT Source with center alignment
Type of Modulation:	On/Off Keying for Data Transmission, proprietary protocol
Maximum Data Rate:	2.5kbaud
WPT Operating Frequency Range:	111 kHz≤ f ≤ 149 kHz
Number of Channels:	1 Channel for WPT, 1 Channel for associated 2 MHz Data Communications
WPT Channel Frequencies:	111 kHz≤ f ≤ 149 kHz
WPT Source Coil Details:	Power coil and data coil are stacked together
WPT Source Coil Area:	3800mm² for the power coil
WPT Client Coil Details:	Power coil and data coil are stacked together
WPT Client Coil Area:	3800mm² for the power coil

3.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

A. Support Equipment (In-house)

Item	Description	Brand Name	Model Name or Number	Serial Number
1	Lab DC Power Supply	ELEKTRO-AUTOMATIK GmbH	PS 2342-10 B	2814040060
2	Power Supply(For AC CE)	GW	GPC-1850D	7662217

B. Support Equipment (Manufacturer supplied)

Item	Description	Brand Name	Model Name or Number	Serial Number
1	USB Type C 0.5 m cable	N/A	N/A	N/A
2	Power Bank	X LAYER	XL213266	N/A
3	Wireless charging receiver 2	Siemens Healthcare GmbH	11500613	4900069
4	Wireless charging receiver 2	Siemens Healthcare GmbH	11500613	4900055
5	USB Power Delivery Tester	Passmark Software	PM110	N/A

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):
☒ Modulated Carriers- continuous Wireless Power Transfer with full power & associated 2 MHz Data Link

4.2. Configuration and Peripherals

The EUT was tested in the following configuration(s):

- The customer supplied a document containing the setup instructions “AnleitungSiliconUL-01A.pdf".

  Testing with USB Power Delivery Tester:

  - The 2 MHz technology transmitter test mode and WPT were enabled through wireless charging of Silicon Rx Coil, the output of this coil was connected to the USB Type C port of the USB Power Delivery Tester.
  - This tester used as a load in this test.
  - The tests were carried out with the power levels 100 %.
- All tests were performed nominal supply voltage of 24V DC to EUT.
- Tests were performed with WPT Source to WPT Client minimum separation distance of 10 mm
- For radiated tests, the EUT in Z orientation was found to be the worst case therefore this report includes relevant results.
- Rohde & Schwarz EMC32 V10.1.0 Software was used for the Radiated spurious emission measurement.

5. Measurements, Examinations and Derived Results

5.1. General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to Section 6 *Measurement Uncertainty* for details.

In accordance with DAkkS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

5.2. Test Results

5.2.1. Transmitter AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	Asim Shahzad	**Test Date:**	20 February 2020
Test Sample Serial Number:	1933901004800071 / 1931001004900055		
Test Site Identification	SR 7/8		

Clause:	Part 15.207
Test Method:	ANSI C63.10 Section 6.2 / FCC KDB 174176 and notes below

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	38

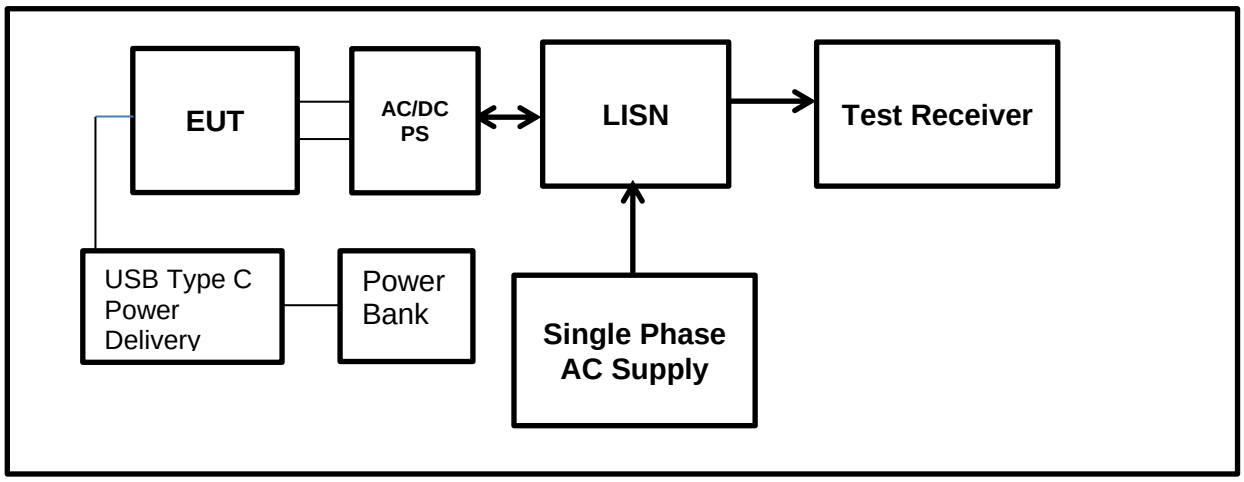
Settings of the Instrument

Detector	Quasi Peak/ Average Peak

Notes:

1. The EUT was plugged into a 120 -230 V AC / 50-60 Hz to 24 V DC Power Supply.
2. The Power Supply was connected to 120 VAC 60 Hz single phase supply via a LISN. The test was repeated with Power Supply connected to 240 VAC 60 Hz single phase supply via a LISN.
3. The final measured value, for the given emission, in the table below incorporates the cable loss.
4. All other emissions shown on the pre-scan plot were investigated and found to be ambient or >20 dB below the applicable limit or below the measurement system noise floor.
5. Measurements were performed in shielded room (SR7/ 8 Asset Number 1603671). The EUT was placed at a height of 80 cm above the reference ground plane and in a distance of 40 cm from the vertical ground plane at the edge of the table.
6. The tests were carried using USB Power delivery Tester as load (at 100% WPT capacity).
7. During the tests Wireless Power Transfer & associated 2 MHz Data Link modes were simultaneously active.

Test setup :



Results (tested with the USB Power Delivery Tester): Power level 100%

Results: Live / Quasi Peak (QP) Detector / 240 VAC 60 Hz

Frequency (MHz)	Line	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dB)	Result
0.39299	Live	41.9	58	16.1	Complied
0.63246	Live	39.5	56	16.5	Complied
0.84489	Live	23.5	56	32.5	Complied
1.32986	Live	22.4	56	33.6	Complied
6.10421	Live	38.3	60	21.7	Complied
21.77355	Live	43.9	60	16.1	Complied

Results: Live / Average (AV) Detector / 240 VAC 60 Hz

Frequency (MHz)	Line	AV Level (dBµV)	AV Limit (dBµV)	AV Margin (dB)	Result
0.39299	Live	15	48	33	Complied
0.63246	Live	10.5	46	35.5	Complied
0.84489	Live	5.3	46	40.7	Complied
1.32986	Live	4.3	46	41.7	Complied
6.10421	Live	31.8	50	18.2	Complied
21.77355	Live	41.3	50	8.7	Complied

Results: Neutral / Quasi Peak (QP) Detector / 240 VAC 60 Hz

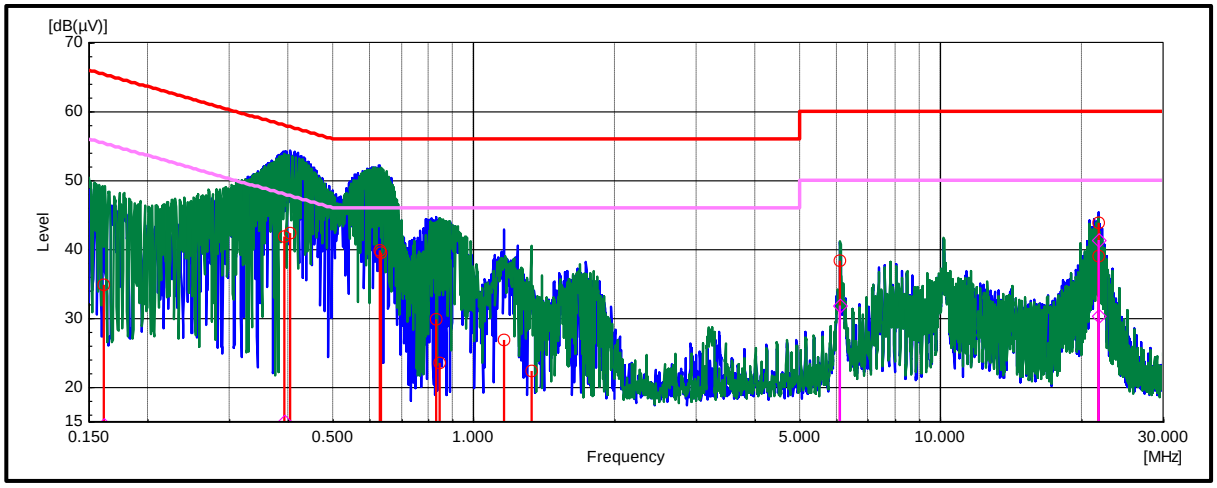
Frequency (MHz)	Line	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dB)	Result
0.16152	Neutral	34.9	65.4	30.5	Complied
0.40501	Neutral	42.4	57.8	15.4	Complied
0.62846	Neutral	39.8	56	16.2	Complied
0.83086	Neutral	29.9	56	26.1	Complied
1.16232	Neutral	26.9	56	29.1	Complied
21.78557	Neutral	39.1	60	20.9	Complied

Results: Neutral / Average (AV) Detector / 240 VAC 60 Hz

Frequency (MHz)	Line	AV Level (dBµV)	AV Limit (dBµV)	AV Margin (dB)	Result
0.16152	Neutral	14.4	55.4	41	Complied
0.40501	Neutral	14.2	47.8	33.6	Complied
0.62846	Neutral	11.3	46	34.7	Complied
0.83086	Neutral	6	46	40	Complied
1.16232	Neutral	5.9	46	40.1	Complied
21.78557	Neutral	30.4	50	19.6	Complied

Result: Pass

Plot: Live and Neutral Line / 240 VAC 60 Hz



Note: The plots show the max hold (peak detector) pre-scan results measured. Blue graph represents the result of the N-Line; green graph - the results for L1-Line. The bar graphs indicate the final measurement result applying the dedicated detector at selected frequencies for each limit line (red cycle for quasi peak limit; violet cycle for average limit).

Legend (Conducted Emissions)	
Items	Description
	Blue graph is the result of peak measurement phase L
	Green graph is the result of peak measurement phase N
	Limit line **Quasi-Peak**
	Limit line **Average**
	Final item **Quasi-Peak**
	Final item **Average**

Results (tested with the USB Power Delivery Tester): Power level 100%

Results: Live / Quasi Peak (QP) Detector / 120 VAC 60 Hz

Frequency (MHz)	Line	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dB)	Result
0.15852	Live	41	65.5	24.5	Complied
0.58737	Live	33.5	56	22.5	Complied
0.97275	Live	25.6	56	30.4	Complied
6.10421	Live	37.6	60	22.4	Complied
10.16032	Live	36.3	60	23.7	Complied
21.77355	Live	45	60	15	Complied

Results: Live / Average (AV) Detector / 120 VAC 60 Hz

Frequency (MHz)	Line	AV Level (dBµV)	AV Limit (dBµV)	AV Margin (dB)	Result
0.15852	Live	17.2	55.5	38.3	Complied
0.58737	Live	9.5	46	36.5	Complied
0.97275	Live	6	46	40	Complied
6.10421	Live	30.7	50	19.3	Complied
10.16032	Live	28.9	50	21.1	Complied
21.77355	Live	42	50	8	Complied

Results: Neutral / Quasi Peak (QP) Detector / 120 VAC 60 Hz

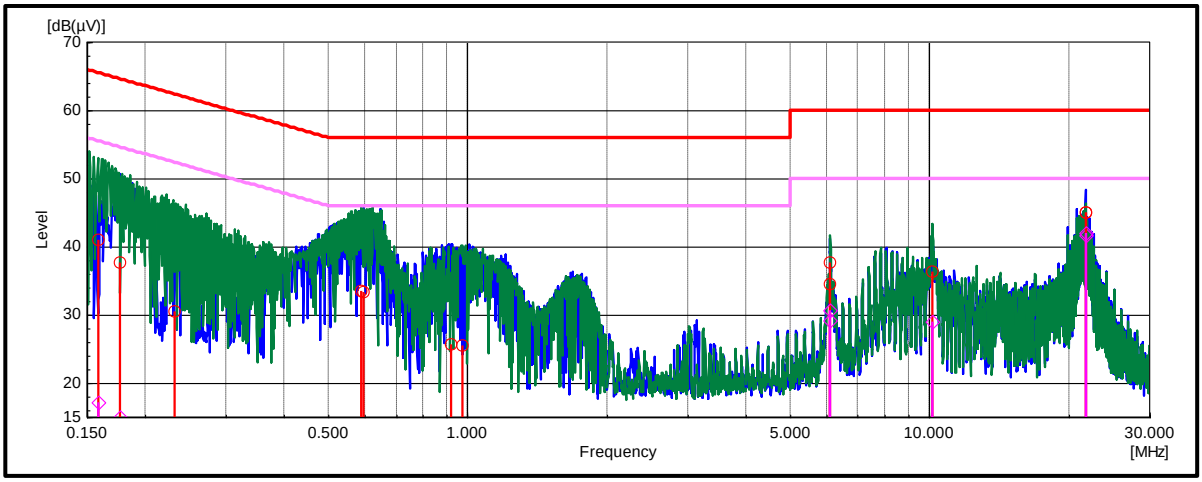
Frequency (MHz)	Line	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dB)	Result
0.17655	Neutral	37.7	64.6	26.9	Complied
0.23216	Neutral	30.5	62.4	31.9	Complied
0.59639	Neutral	33.3	56	22.7	Complied
0.91984	Neutral	25.7	56	30.3	Complied
6.09018	Neutral	34.5	60	25.5	Complied
21.77355	Neutral	45	60	15	Complied

Results: Neutral / Average (AV) Detector / 120 VAC 60 Hz

Frequency (MHz)	Line	AV Level (dBµV)	AV Limit (dBµV)	AV Margin (dB)	Result
0.17655	Neutral	15	54.6	39.6	Complied
0.23216	Neutral	13	52.4	39.4	Complied
0.59639	Neutral	8.5	46	37.5	Complied
0.91984	Neutral	6	46	40	Complied
6.09018	Neutral	29.2	50	20.8	Complied
21.77355	Neutral	41.7	50	8.3	Complied

Result: Pass

Plot: Live and Neutral Line / 120 VAC 60 Hz



Note: The plots show the max hold (peak detector) pre-scan results measured. Blue graph represents the result of the N-Line; green graph - the results for L1-Line. The bar graphs indicate the final measurement result applying the dedicated detector at selected frequencies for each limit line (red cycle for quasi peak limit; violet cycle for average limit).

Legend (Conducted Emissions)	
Items	Description
	Blue graph is the result of peak measurement phase L
	Green graph is the result of peak measurement phase N
	Limit line **Quasi-Peak**
	Limit line **Average**
	Final item **Quasi-Peak**
	Final item **Average**

5.2.2. Transmitter 20 dB Bandwidth

Test Summary:

Test Engineer:	Abdoufataou Salifou	**Test Dates:**	20 February 2020
Test Sample Serial Number:	1933901004800071 / 1931001004900055		
Test Site Identification	SR 1/2		

FCC Reference:	Part 15.215(c)
Test Method Used:	ANSI C63.10 Section 6.9.2

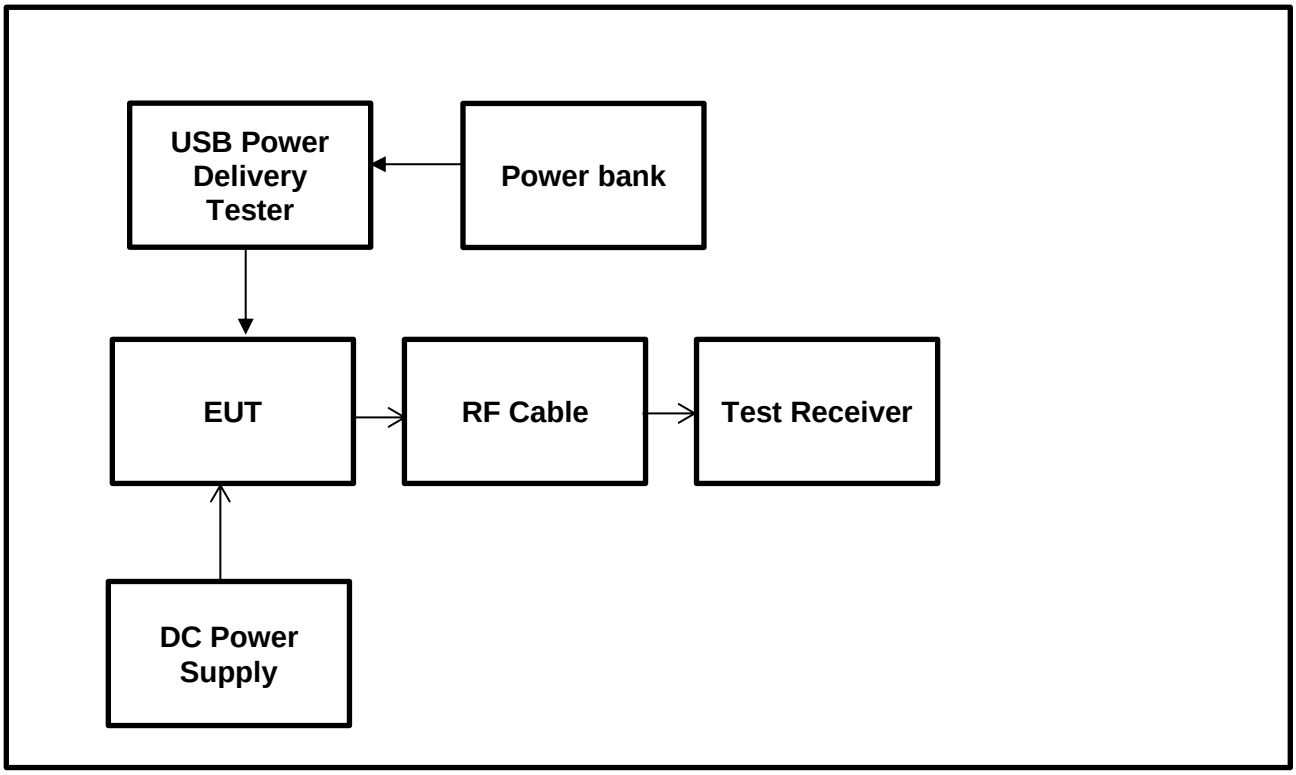
Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	36

Settings of the Instrument

Test Signal	2 MHz Data Link	Test Signal
RBW/VBW	10 kHz / 30 kHz	10 Hz / 30 Hz
Span	1 MHz	10 kHz
Sweep time	Auto	Auto
Detector	MaxPeak	MaxPeak

Test Setup:

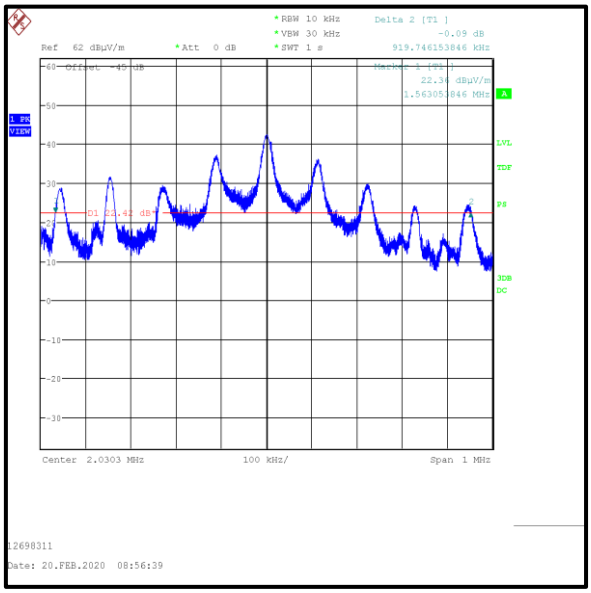


Transmitter 20 dB Bandwidth (continued)

Results for 2 MHz Data Communication (tested with the USB Power Delivery Tester):

Power level 100%

Data Link Channel	20 dB Bandwidth (kHz)
2.030 MHz	919.746



Single Channel

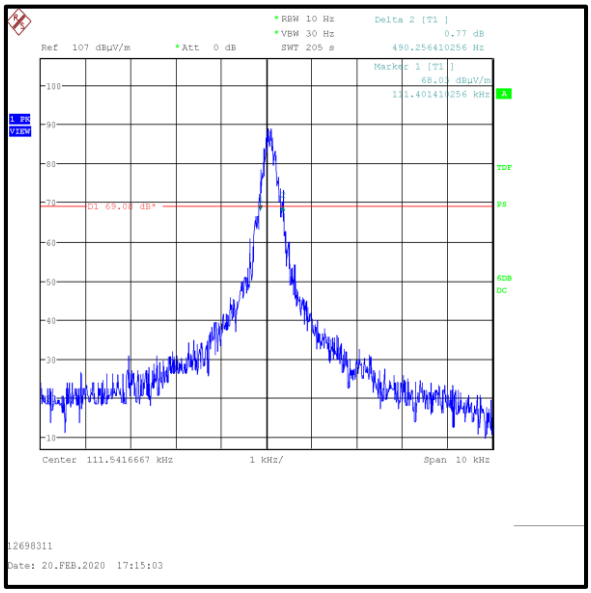
Result: Pass

Transmitter 20 dB Bandwidth (continued)

Results for WPT (tested with the USB Power Delivery Tester):

Power level 100%

WPT Channel	20 dB Bandwidth (Hz)
111.542 kHz	490.256



Single Channel

Result: Pass

5.2.3. Transmitter Fundamental Field Strength

Test Summary:

Test Engineer:	Abdoufataou Salifou	**Test Dates:**	20 February 2020
Test Sample Serial Number:	1933901004800071 / 1931001004900069		
Test Site Identification	SR 1/2		

FCC Reference:	Part 15.209(a)
Test Method Used:	ANSI C63.10 Section 6.4, Section 6.3.2

Environmental Conditions:

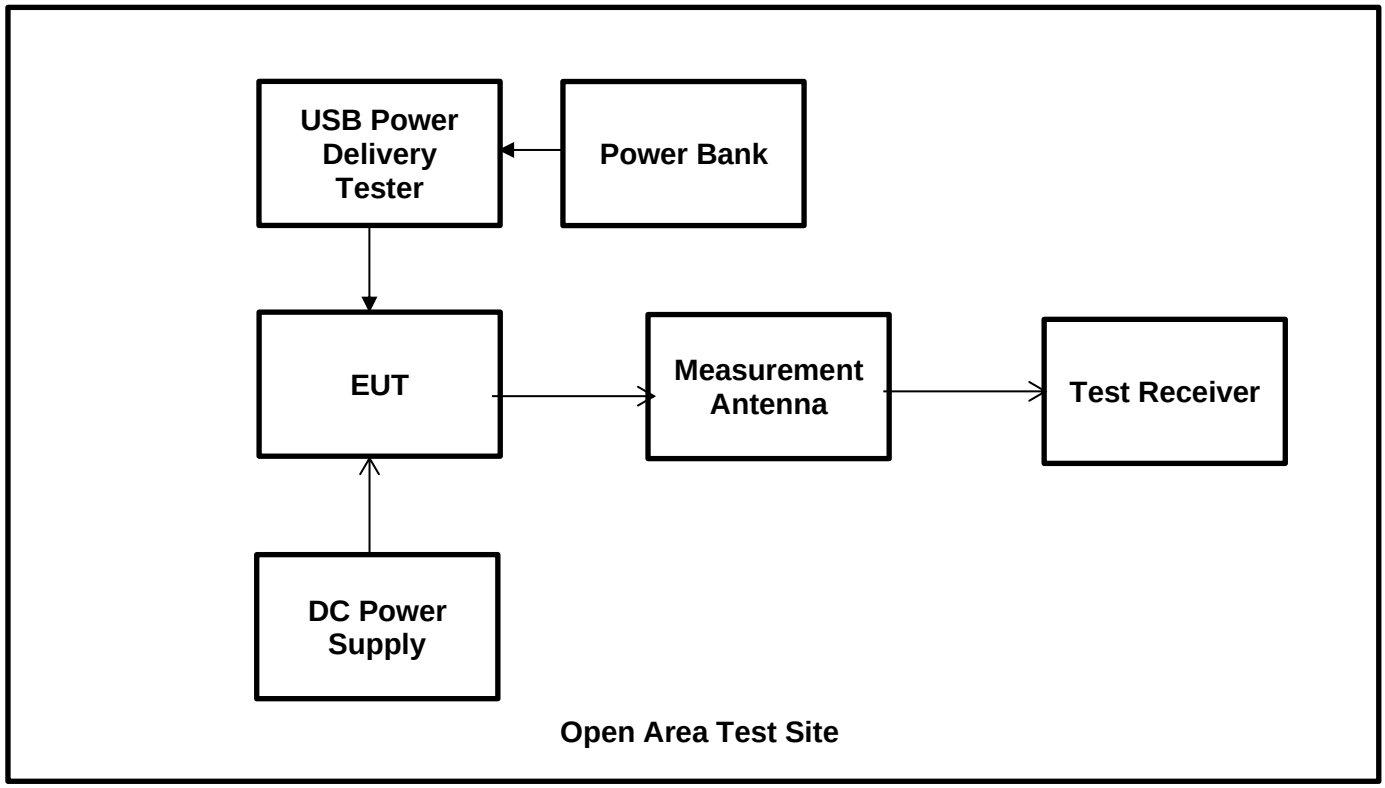
Temperature (°C):	24
Relative Humidity (%):	36

Notes:

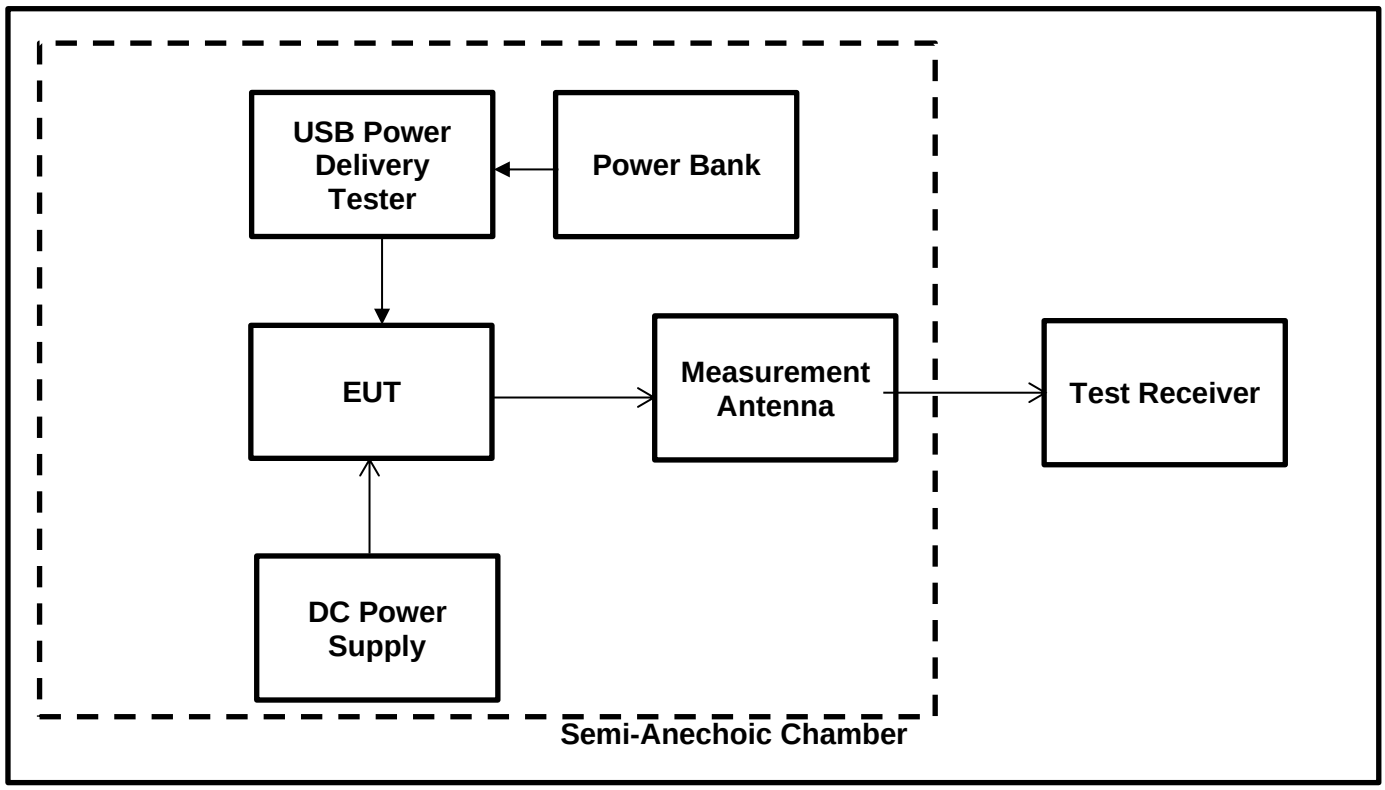
1. The limit is specified at a test distance of 300 m. However, as specified by FCC Section 15.31 (f)(2), measurements may be performed at a closer distance and the measured level corrected to the specified measurement distance by using the square of an inverse linear distance extrapolation factor (40dB/decade).
2. In accordance with 414788 D01. Instead of an OATS a Semi Anechoic Chamber was used where evidence was shown that the behaviour is the same. A maximum deviation of 0.31 dB for 2 MHz and -0.7 for 113 kHz was observed. This deviation is also taken into account to the result.
3. Pre-scan measurements were performed using a spectrum analyzer with a peak detector and measurement bandwidth of 9 kHz. The fundamental field strength was maximized by rotating the measurement antenna and EUT. The spectrum analyzer was then switched to test receiver mode and the final measurement on the maximized level was performed.
4. The measurement was performed at a measurement distance of 3 m where field strength of X dBµV/m was measured. This value was later extrapolated to a distance of 30 m by subtracting 40 dB from the result and to a distance of 300 m by subtracting 80 dB from the result.
5. A transducer factor was used on the spectrum analyser during measurement. This factor includes correction between the fixed gain of the magnetic loop antenna and the calibration values. It also includes the value of the RF cable used to connect the antenna to the spectrum analyser which was incorporated into the annual calibration of the magnetic loop antenna.
6. Since the field strength level is below the quasi peak limit, hence no quasi-peak detector measurement is required.

Transmitter Fundamental Field strength test setup

Open Area Test Site (not tested in OATS – just for reference only)



Semi Anechoic Chamber

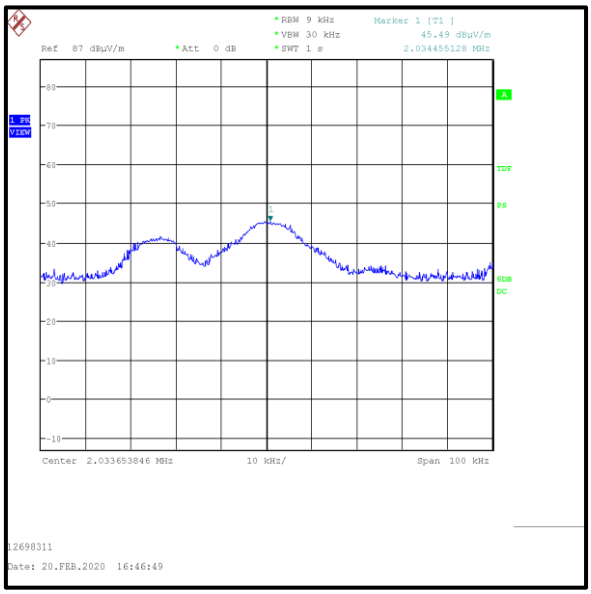


Transmitter Fundamental Field strength (continued)

Results for 2 MHz Data Communication (tested with the USB Power Delivery Tester): Peak Power level 100%

Frequency (MHz)	Measurement Antenna Orientation	Measured Level at 3 m (dBµV/m)	Extrapolated Level at 30 m (dBµV/m)	Deviation from OATS to SAC	Corrected Level at 30 m (dBµV/m) with deviation added	Limit at 30 m (dBµV/m)	Margin (dB)	Result
2.034	0° to EUT	45.49	5.49	0.31	5.80	29.54	23.74	Pass

Result: Pass



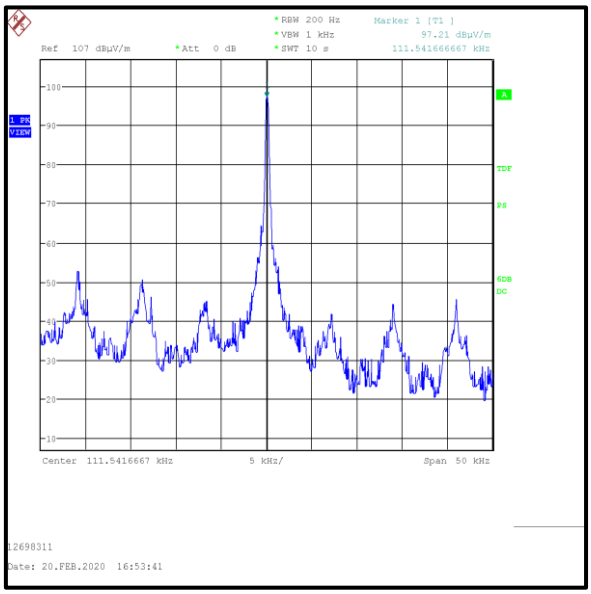
Transmitter Fundamental Field strength (continued)

Results for WPT (tested with the USB Power Delivery Tester): Peak

Power level 100%

Frequency (kHz)	Measurement Antenna Orientation	Measured Level at 3 m (dBµV/m)	Extrapolated Level at 300 m (dBµV/m)	Deviation from OATS to SAC	Corrected Level at 300 m (dBµV/m) with deviation added	Limit at 300 m (dBµV/m)	Margin (dB)	Result
111.542	0° to EUT	97.21	17.21	-0.70	16.40	26.65	10.25	Pass

Result: Pass



5.2.4. Transmitter Radiated Spurious Emissions

Test Summary:

Test Engineer:	Abdoufataou Salifou	**Test Dates:**	19 February 2020
Test Sample Serial Number:	1933901004800071 / 1931001004900069		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.209(a)
Test Method Used:	ANSI C63.10 Sections 6.3, 6.4 and 6.5
Frequency Range:	9 kHz to 1000 MHz

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	36

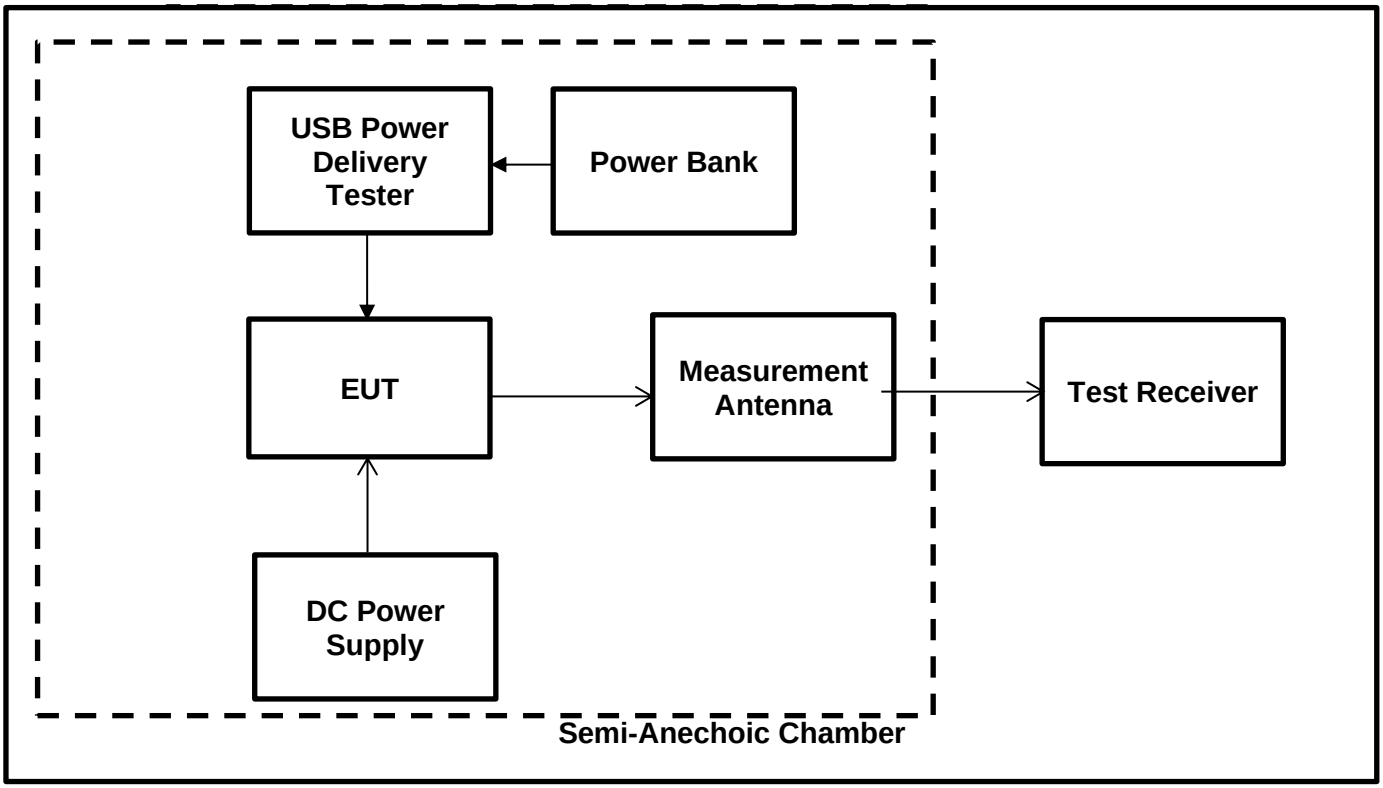
Settings of the Instrument

Frequency Range	RBW	VBW	Detector
9 kHz-150 kHz	300 Hz	1 kHz	Peak Detector
150 kHz-30 MHz	10 kHz	30 kHz	Peak Detector
30 MHz-1 GHz	100 kHz	300 kHz	Peak Detector

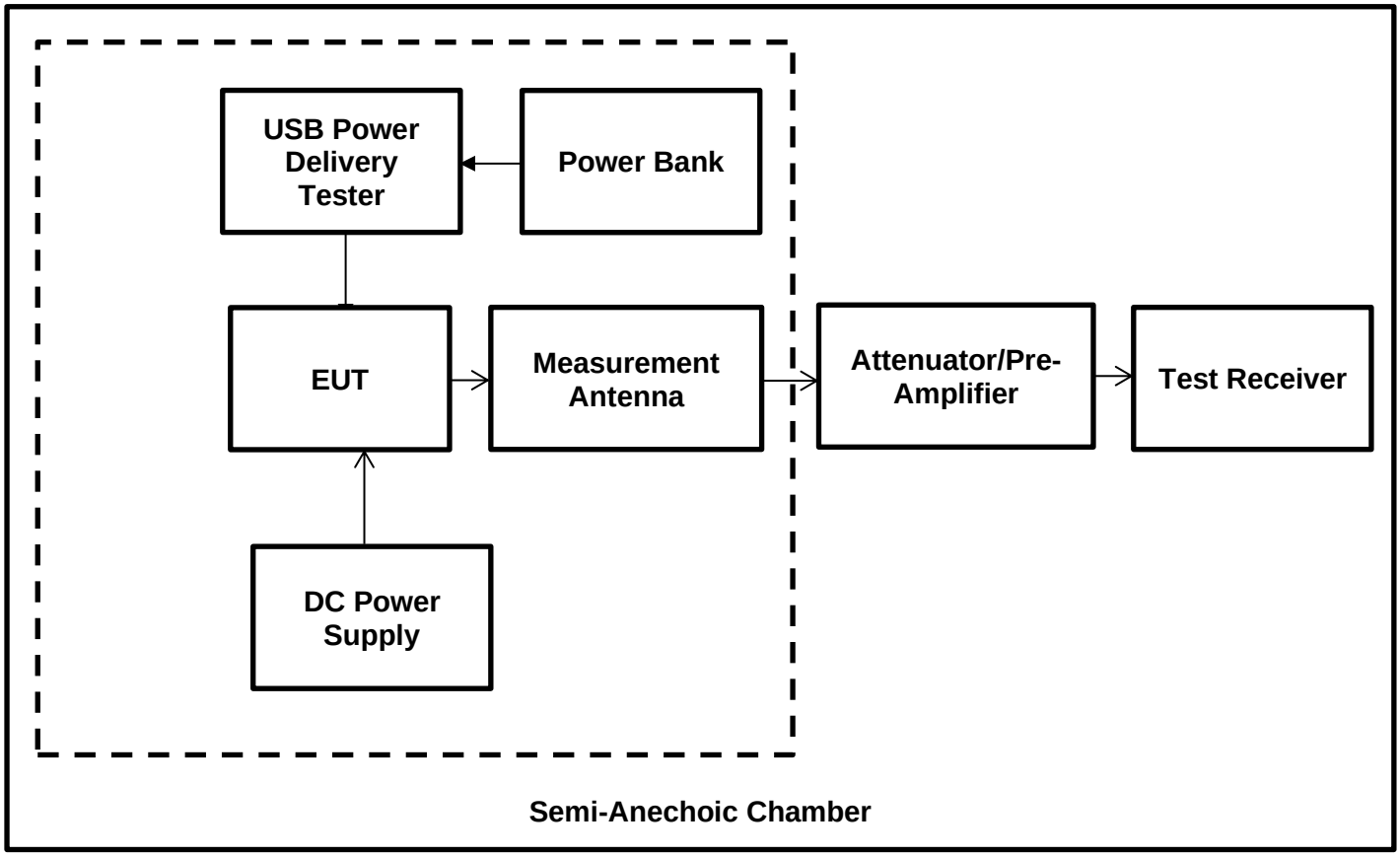
Notes:

1. In accordance with FCC KDB 414788, an alternative test site may be used for the measurement. Therefore the result from the semi-anechoic chamber tests is shown in this section of the test report.
2. The emissions from 9 kHz to 1 GHz were recorded. Markers were placed on the peaks of the pre-scan plots and the worst case emissions were noted.
3. All other emissions were greater than 20 dB below the applicable limit, below the noise floor of the measurement system or ambient.
4. Measurements were performed in a semi-anechoic chamber at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Between 30 MHz and 1 GHz, maximum emission levels were determined by height searching the measurement antenna over the range 1 meter to 4 meters.
5. A transducer factor was used on the spectrum analyser during open field tests. This factor includes correction between the fixed gain of the magnetic loop antenna and the calibration values. It also includes the value of the RF cable used to connect the antenna to the spectrum analyser which was incorporated into the annual calibration of the magnetic loop antenna.
6. The emissions shown at approximately 113 kHz and 2 MHz are the fundamental emission. The worst case emissions were presented in the result table.
7. Since the field strength level is below the quasi peak limit, hence no quasi-peak detector measurement is required.
8. The measurement was performed at a measurement distance of 3 m where field strength of X dBµV/m was measured.
    - 9 kHz- 490 kHz: measured level extrapolated to a distance of 300 m by subtracting 80 dB from the result.
    - 490 kHz-1705 kHz: measured level extrapolated to a distance of 30 m by subtracting 40 dB from the result.
    - 1.705 MHz-30 MHz: measured level extrapolated to a distance of 30 m by subtracting 40 dB from the result

Transmitter Radiated Spurious Emission test setup (Measurement below 30 MHz)



Transmitter Radiated Spurious Emission test setup (Measurement above 30 MHz)

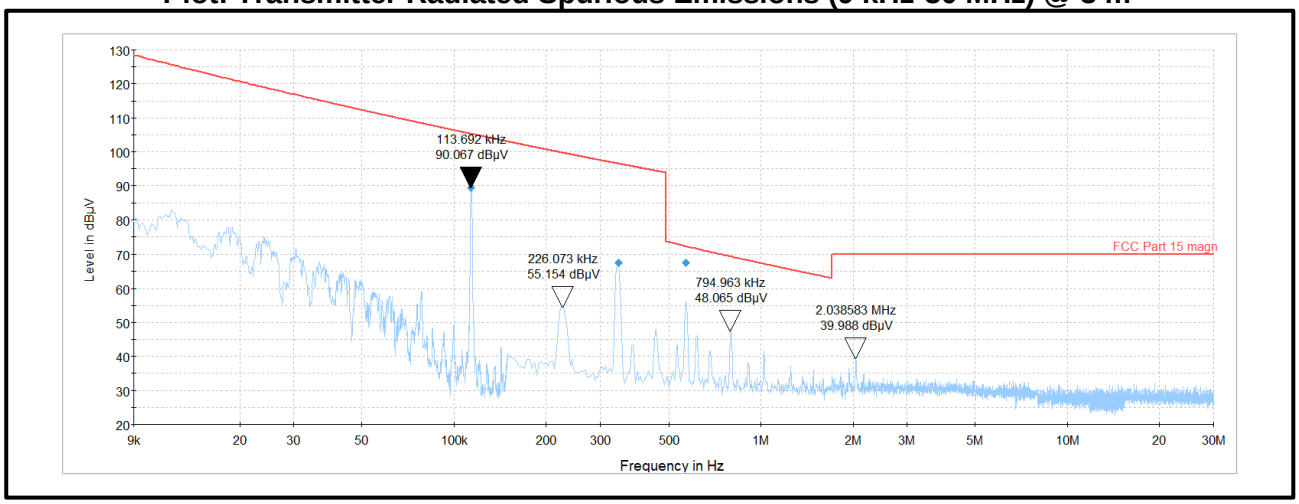


Transmitter Radiated Spurious Emissions (continued)

Results: Transmitter Radiated Spurious Emissions (tested with the USB Power Delivery Tester) / Peak Detector / Power level 100%

Frequency (MHz)	Transmitter Spurious Emissions Level at 3 m (dBµV/m)	Limit at 3 m (dBµV/m)	Margin (dB)	Antenna Polarization
0.113692	90.07	105.23	15.16	0° to EUT
0.226073	55.15	100.29	45.14	0° to EUT
0.341835	67.63	96.50	28.87	0° to EUT
0.566745	57.43	72.45	15.02	0° to EUT
0.794963	48.06	70.08	22.02	0° to EUT
2.038583	39.99	70.00	30.01	0° to EUT
WPT Channel Frequency = 113.7 kHz | Data Communication Channel Frequency = 2 MHz				

Plot: Transmitter Radiated Spurious Emissions (9 kHz-30 MHz) @ 3 m



Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying table.

Result: Pass

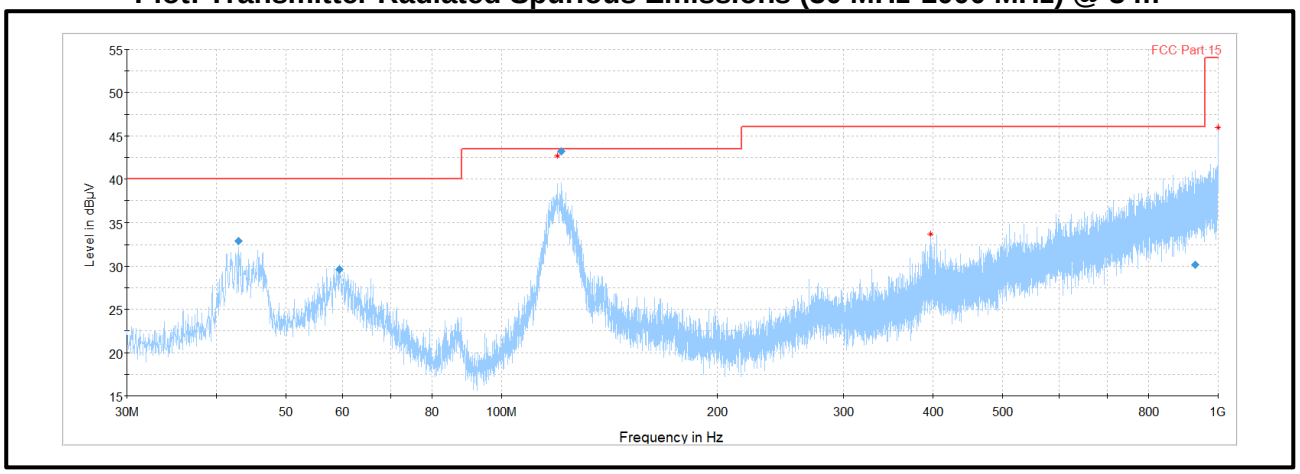
Transmitter Radiated Spurious Emissions (continued)

Results: Transmitter Radiated Spurious Emissions (tested with the USB Power Delivery Tester): Power level 100%

Frequency (MHz)	Transmitter Spurious Emissions Max Peak Level at 3m (dBµV/m)	Limit at 3 m (dBµV/m)	Margin (dB)	Antenna Polarization
42.915000	32.87	40.00	7.13	Vertical
59.475000	29.61	40.00	10.39	Vertical
121.395	43.18	43.50	0.32	Horizontal

Frequency (MHz)	Transmitter Spurious Emissions Quasi Peak Level at 3m (dBµV/m)	Limit at 3 m (dBµV/m)	Margin (dB)	Antenna Polarization
120.923	39.55	43.50	3.95	Horizontal

Plot: Transmitter Radiated Spurious Emissions (30 MHz-1000 MHz) @ 3 m



Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying table.

Result: Pass

6. Measurement Uncertainty

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Confidence Level (%)	Calculated Uncertainty
Transmitter Fundamental Field Strength	95%	±3.10 dB
Radiated Spurious Emissions	95%	±3.10 dB
20 dB Bandwidth	95%	±0.87 %
AC Conducted Emissions	95%	±2.49 dB

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

7. Used equipment

Test site: SR 1/2

ID	Manufacturer	Type	Model	Serial	Calibration Date	Cal. Cycle (months)
1	Rohde & Schwarz	Antenna, Loop	HFH2-Z2	831247/012	7/11/2019	36
377	BONN Elektronik	Amplifier, Low Noise Pre	BLMA 0118-1A	025294B	7/10/2019	12
423	Bonn Elektronik	Amplifier, Low Noise Pre	BLMA 1840-1A	55929	7/16/2019	12
460	Deisl	Turntable	DT 4250 S	n/a	n/a	n/a
465	Schwarzbeck	Antenna, Trilog Broadband	VULB 9168	9168-240	3/20/2019	24
496	Rohde & Schwarz	Antenna, log. - periodical	HL050	100297	2/19/2019	36
587	Maturo	antenna mast, tilting	TAM 4.0-E	011/7180311	n/a	n/a
588	Maturo	Controller	NCD	029/7180311	n/a	n/a
591	Rohde & Schwarz	Receiver	ESU 40	100244/040	7/9/2019	12
608	Rohde & Schwarz	Switch Matrix	OSP 120	101227	lab verification	n/a
625	Schwarzbeck	Antenna, H-field	HFSL 7101	109	Verification - only relative measurements	n/a
628	Maturo	Antenna mast	CAM 4.0-P	224/19590716	n/a	n/a
629	Maturo	Kippeinrichtung	KE 2.5-R-M	MAT002	n/a	n/a
-/-	Testo	Thermo-Hygrometer	608-H1	01	lab verification	n/a

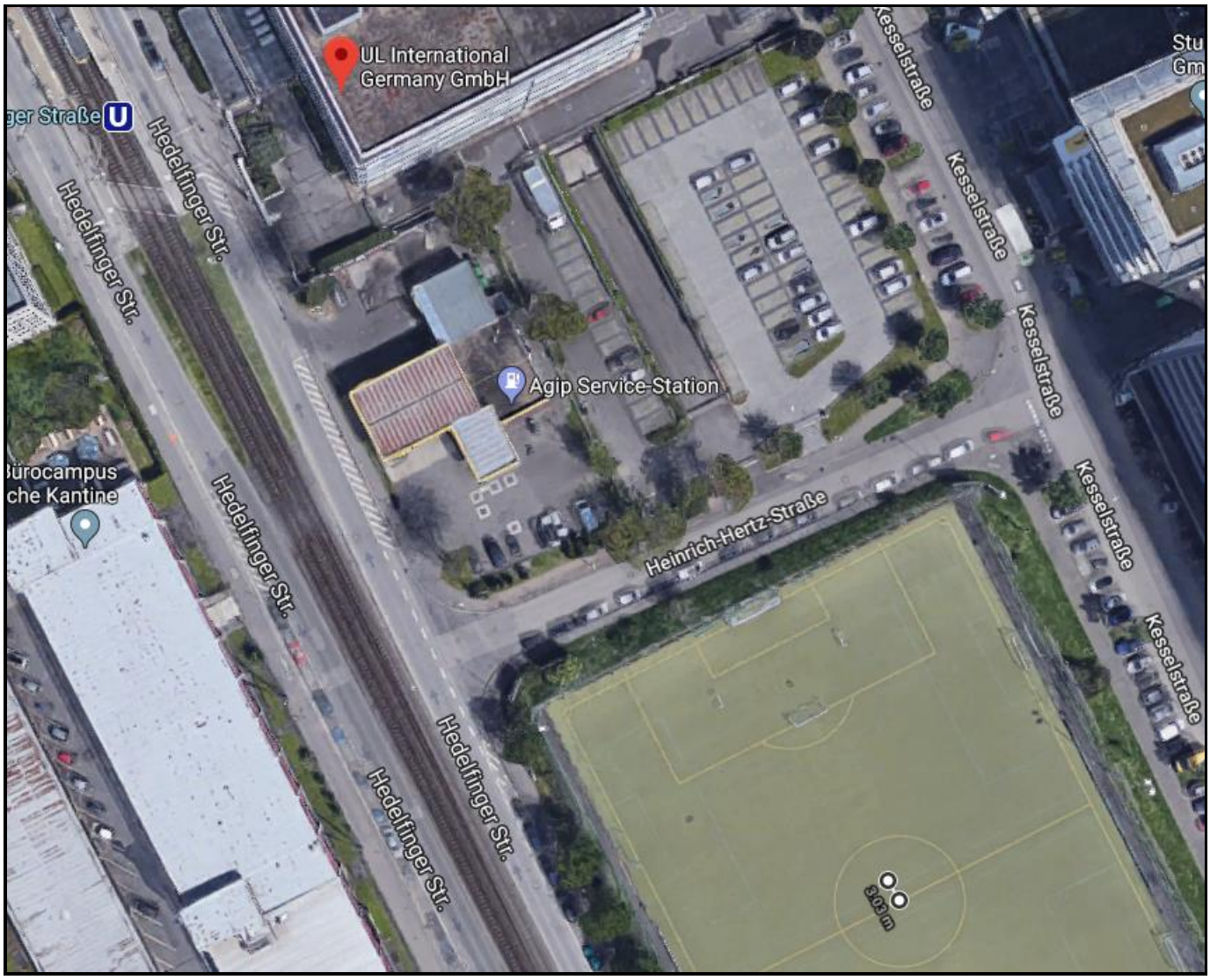
Test site: SR 7/8

ID	Manufacturer	Type	Model	Serial	Calibration Date	Cal. Cycle (months)
22	Rohde & Schwarz	Artificial Mains	ESH3-Z5	831767/014	9/7/2019	12
23	Rohde & Schwarz	Artificial Mains	ESH3-Z5	831767/013	9/7/2019	12
28	Rohde & Schwarz	Passive Probe	ESH2-Z3	none	11/7/2019	12
215	Rohde & Schwarz	Artificial Mains Network	ESH2-Z5	879675/002	5/7/2019	12
349	Rohde & Schwarz	Receiver, EMI Test	ESIB7	836697/009	10/7/2019	12
351	Rohde & Schwarz	network, Artificial Mains	ESH3-Z5	862770/018	8/7/2019	12
564	Teseq	Impedance stabilisation network (ISN)	ISN T800	26076	8/7/2019	24
616	Rohde & Schwarz	ISN	ENY81-CA6	101656	9/7/2019	12
-/-	Testo	Thermo-Hygrometer	608-H1	08	lab verification	n/a

8. Open-Area-Test Site comparison

GPS coordinates

48.765746, 9.250684



Test Setup

The following listed equipment was used for the measurement:

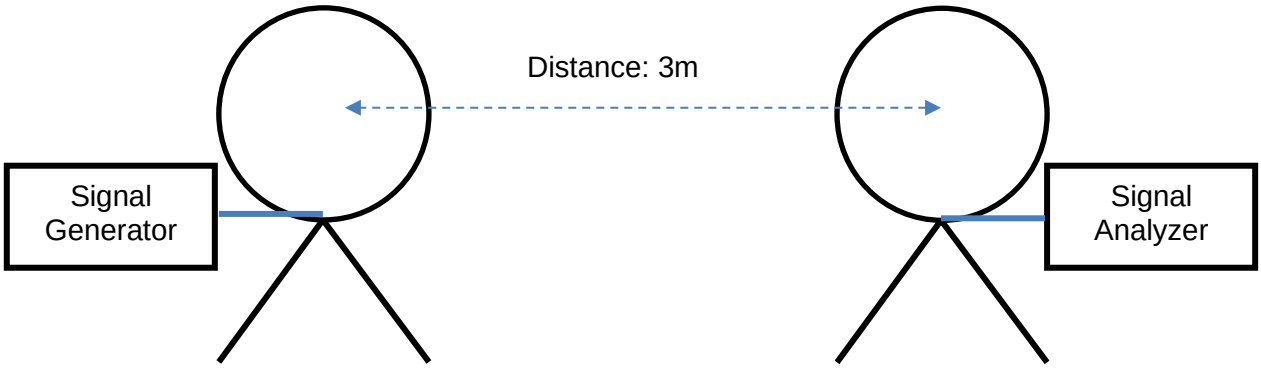
Manufacturer	Type	Model	Frequency Range
Rohde & Schwarz	Receiver, EMI Test	SML03	9 kHz – 30 MHz
Rohde & Schwarz	Receiver, EMI Test	ESIB7	20 Hz – 7 GHz
Rohde & Schwarz	Antenna, Loop	HFH2-Z2	1 kHz – 30 MHz
ETS LINDGREN	Antenna, Loop	6512	1 kHz – 30 MHz
Huber and Suhner	RF Cable	-	-
Elspec	BNC Cable	-	-

The transmit signal to the ETS Lindgren loop antenna is supplied by the SML signal generator.

The distance of the transmit and receive Antenna was 3 m. No other distances can be achieved in SR1 so 10 m and 30 m distances are not possible. Due to this no comparison is possible.

The Results are valid for equipment which is not larger as the loop antenna which represents in the comparison the EUT.
If an EUT is bigger measurements on an OATS are needed.

The measurement was performed on the lowest frequency 9 kHz and was increased by 10 kHz Steps up to 100 kHz. Then the step size was 100 kHz up to 1000 kHz. From 1 MHz up to the last frequency of 30 MHz the step size was 1 MHz. The HFH2-Z2 loop antenna placed at 80 cm height was used as the receive antenna. The intercepted RF signal from this antenna was measured with the ESIB7 Test Receiver and the values were recorded accordingly.



Numeric values

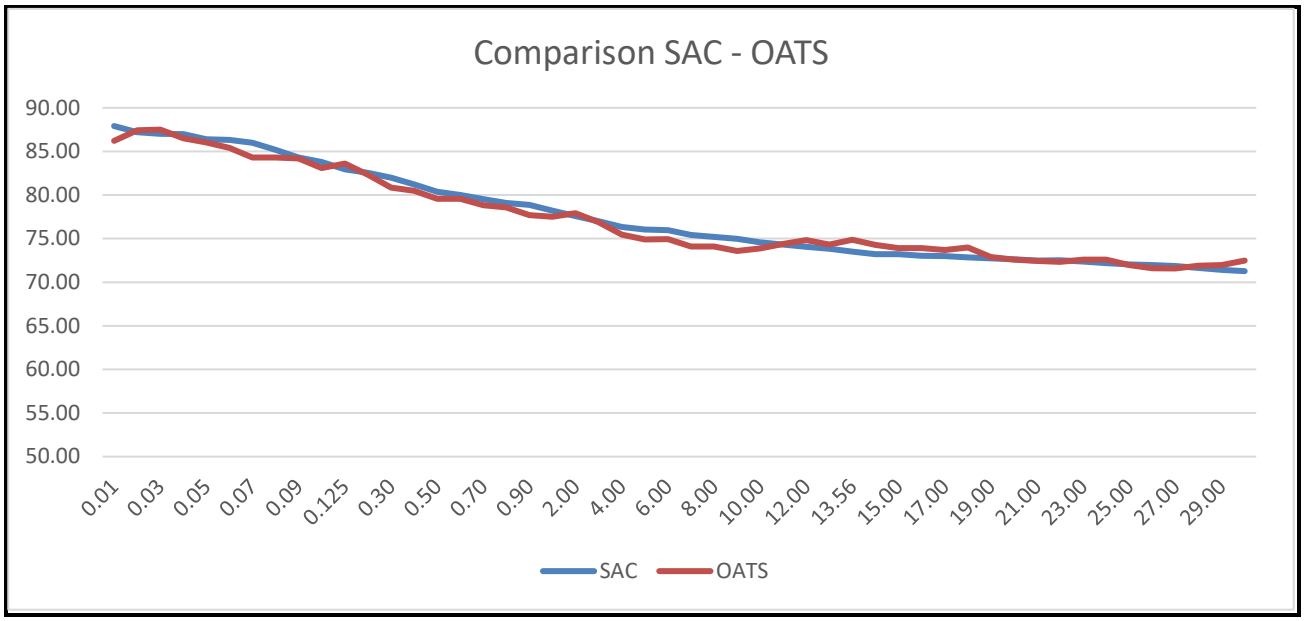
Frequency (MHz)	**0.01**	**0.02**	**0.03**	**0.04**	**0.05**	**0.06**	**0.07**	**0.08**	**0.09**	**0.10**	**0.125**	**0.20**
SR1 Measured power (dBµV)	87.91	87.22	87.01	86.98	86.40	86.32	85.98	85.20	84.30	83.80	82.96	82.55
OATS Measured power (dBµV)	86.22	87.42	87.50	86.49	86.01	85.39	84.32	84.29	84.20	83.10	83.60	82.32
Delta (dB)	-1.69	0.20	0.49	-0.49	-0.39	-0.93	-1.66	-0.91	-0.10	-0.70	0.64	-0.23

Frequency (MHz)	**0.30**	**0.40**	**0.50**	**0.60**	**0.70**	**0.80**	**0.90**	**1.00**	**2.00**	**3.00**	**4.00**	**5.00**
SR1 Measured power (dBµV)	81.98	81.23	80.39	80.00	79.53	79.10	78.87	78.20	77.60	77.01	76.32	76.04
OATS Measured power (dBµV)	80.84	80.49	79.58	79.58	78.85	78.59	77.69	77.50	77.91	76.90	75.45	74.90
Delta (dB)	-1.14	-0.74	-0.81	-0.42	-0.68	-0.51	-1.18	-0.70	0.31	-0.11	-0.87	-1.14

Frequency (MHz)	**6.00**	**7.00**	**8.00**	**9.00**	**10.00**	**11.00**	**12.00**	**13.00**	**13.56**	**14.00**	**15.00**	**16.00**
SR1 Measured power (dBµV)	75.98	75.43	75.20	74.97	74.59	74.32	74.05	73.83	73.50	73.22	73.20	73.05
OATS Measured power (dBµV)	74.94	74.09	74.11	73.58	73.87	74.38	74.84	74.31	74.88	74.29	73.90	73.93
Delta (dB)	-1.04	-1.34	-1.09	-1.39	-0.72	0.06	0.79	0.48	1.38	1.07	0.70	0.88

Frequency (MHz)	**17.00**	**18.00**	**19.00**	**20.00**	**21.00**	**22.00**	**23.00**	**24.00**	**25.00**	**26.00**	**27.00**	**28.00**	**29.00**	**30.00**
SR1 Measured power (dBµV)	73.00	72.86	72.74	72.64	72.50	72.52	72.39	72.20	72.04	71.97	71.86	71.64	71.41	71.27
OATS Measured power (dBµV)	73.70	73.98	72.90	72.60	72.45	72.34	72.59	72.59	71.97	71.59	71.58	71.88	71.98	72.49
Delta (dB)	0.70	1.12	0.16	-0.04	-0.05	-0.18	0.20	0.39	-0.07	-0.38	-0.28	0.24	0.57	1.22

Graph



Conclusion: Maximum difference is 1.69 dB @ 9 kHz

9. Report Revision History

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	35	-	Initial Version

END OF REPORT