TEST REPORT

Test Report No. : UL-RPT-RP-13935019-316-FCC

Applicant	:	EVBox North America Inc
Model No.	:	HMI Board G5P
FCC ID	:	2A3C7-HMIGP5
Technology	:	NFC 13.56 MHz
Test Standard(s)	:	FCC Parts 15.207, 15.209(a) & 15.225
		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: Sercan, Usta
Title: Laboratory Engineer
Date: 13 July 2022

Approved by: Ajit, Phadtare
Title: Lead Test Engineer
Date: 13 July 2022

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

1.1.Applicant Information

Company Name:	EVBox North America Inc
Company Address:	1930 Innovation Way, Suite 200, Illinois, Libertyville, 1014 BA, USA
Contact Person:	Susan Eckman
Contact E-Mail Address:	susan.eckman@evbox.com
Contact Phone No.:	+1 630 209 9060

1.2.Manufacturer Information

Company Name:	EVBox Intelligence BV
Company Address:	Kabelweg 47 1014 BA Amsterdam The Netherlands
Contact Person:	Marco Farina
Contact E-Mail Address:	marco.farina@evbox.com
Contact Phone No.:	+31620549130

2. Summary of Testing

2.1. General Information

Applied Standards

Specification Reference:	47CFR15.225
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Radio Frequency Devices) - Section 15.225
Specification Reference:	47CFR15.207 and 47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 15.209

Location

Location of Testing:	UL International Germany GmbH Hedelfinger Str. 61 70327 Stuttgart Germany
Test Firm Registration:	399704

Date information

Order Date:	22 July 2021
EUT arrived:	10 January 2022
Test Dates:	27 January 2022 to 22 February 2022
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 15.225(a)(b)(c)(d)	Transmitter Fundamental Field Strength & Spectrum Mask (continued)	☒	☐	☐	☐
Part 15.209(a)/ 15.225(d)	Transmitter Radiated Emissions	☒	☐	☐	☐
Part 15.225(e)	Transmitter Frequency Stability (Temperature & Voltage Variation)	☒	☐	☐	☐

Note(s):

2.3. Methods and Procedures

Reference:	ANSI C63.4-2014
Title:	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.
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 D01 Line Conducted FAQ v01r01 June 3, 2015
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:	EVBox
Model Name or Number:	HMI Board G5P
Serial Number:	JU10214700056 (Radiated Sample)
Hardware Version Number:	Rev D
Firmware Version Number:	Gear0_4Volt_readrange_8percent_less_08102021.bin EEPROM base address: 0x201200 Flash driver file: PN7xxxxx_EE_3_5k.cfx
FCC ID:	2A3C7-HMIGP5

Brand Name:	EVBox
Model Name or Number:	HMI Board G5P
Serial Number:	JU10214700099 (Conducted Sample)
Hardware Version Number:	Rev D
Firmware Version Number:	Gear0_4Volt_readrange_8percent_less_08102021.bin EEPROM base address: 0x201200 Flash driver file: PN7xxxxx_EE_3_5k.cfx
FCC ID:	2A3C7-HMIGP5

Brand Name:	EVBox
Model Name or Number:	HMI Board G5P
Serial Number:	JU10214700146 (Dummy Load Sample)
Hardware Version Number:	Rev D
Firmware Version Number:	Gear0_4Volt_readrange_8percent_less_08102021.bin EEPROM base address: 0x201200 Flash driver file: PN7xxxxx_EE_3_5k.cfx
FCC ID:	2A3C7-HMIGP5

3.2. Description of EUT

The equipment under test was an electronic car charger NFC module which supporting NFC 13.56 MHz technology.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Tested Technology:	NFC 13.56 MHz	
Category of Equipment:	Transceiver	
Channel Spacing:	Single channel device	
Transmit Frequency Range:	13.56 MHz	
Power supply Requirement(s):	12V DC via 85-264 V AC / <1A	
Tested Temperature Range:	Minimum	-20 °C
	Maximum	+50 °C
Modulation:	ASK	
Supported Data Rates	Signal Type	Bit Rate (kb/s)
	NFC-A	default
		106
		212
		424
		848
	NFC-B	default
		106
		212
		424
		848
	NFC-F	default
		212
		424
	ISO15693	default
		100ASK
		10ASK
	EPCV2	Default
		TARI 9 44
		TARI 18 88

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	Laptop PC with jdiag v1.6.0	HP	HP Probook 650 G1	5CG614419V

B. . Support Equipment (Manufacturer supplied)

Item	Description	Brand Name	Model Name or Number	Serial Number
1	Power and Control Unit	EVBox	US Powerboard PBA1061480	JU15211900219

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):
☒ Continuous transmitting NFC-A I 212 kb/s I ASK at maximum power in NFC-13.56 MHz test mode. *
*Multiple supported modulation schemes, nominal channel bandwidths were initially investigated to determine the above mentioned worst case data rates.

4.2.Configuration and Peripherals

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

- The customer supplied a document which name is “HMI testing - Board configuration and setting Quickguide rev28.12.21.pdf” Date:03.01.2022 containing the setup instructions was used.
- In accordance with FCC rule section(s) 15.212(a)(1)(v), the EUT being a modular transmitter was tested in a stand-alone configuration.
  - The EUT was not placed inside another device during testing for compliance requirements.
  - The EUT was mounted on Test Evaluation Board (a stand-alone PCB) with voltage supply & RF control settings connections made directly to the module.
  - The length of power voltage supply lines was at least 10 cm to insure that there is no coupling between the case of the EUT and Test Evaluation Board.

EUT Power supply:

- The EUT was powered via 12V DC with Power and Control Unit. Power and Control Unit was powered via 120 V AC 60 Hz power supply.

Test Mode Activations:

- The NFC 13.56 MHz test mode was activated by using a software which name is jdiag. Different modulations and data rates set accordingly.
- All possible data rates and modulation types checked with BW and HField measurements and the worst-case modulation found.
- NFC-A and 212 kb/s configuration settings were found to be the worst case therefore this report includes relevant results.
- Spurious emissions, Freq. stability & AC conducted line emissions measurements were performed with this worst case

Conducted Measurements:

- All conducted measurements were carried out by using conducted samples with SMA-MHF/UF.LP connector cable which supplied by the customer. The maximum attenuation of 0.50 dB at the tested frequencies was added to a reference level offset to each of the conducted plots.

Radiated Measurements:

- Before starting final radiated spurious emission measurements “worst case verification” with the EUT in Standing-position & Laying-position was performed by Lab.
- The EUT in Standing-position was found to be the worst case therefore this report includes relevant results.
- Radiated measurements below 30 MHz were performed with the EUT positioned on the turn table and rotating 360 degrees while the loop antenna height was set to 80 cm.
- Radiated measurements above 30 MHz were performed with the EUT positioned on the turn table and rotating 360 degrees while the antenna height varies from 1 to 4 m over the measurement frequency range.
- R&S®EMC32 Measurement Software V10.60.10 was used for the radiated spurious emission measurements.

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:**	18 February 2022
Test Sample Serial Number:	JU10214700146 (Dummy Load Sample)		
Test Site Identification	SR 7/8		

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

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	48

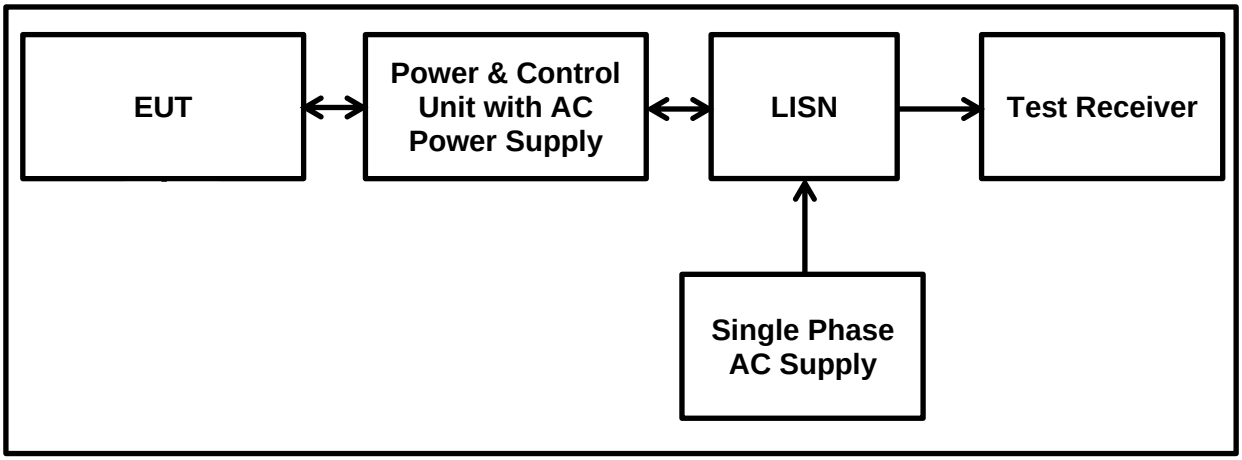
Settings of the Instrument

Detector	Quasi Peak/ Average Peak

Note(s):

1. The EUT was plugged into main power supply unit with 12V DC. Power supply unit connected an AC/DC Power supply. The Power supply was connected to 120 VAC / 60 Hz and 240 VAC / 50 Hz single phase supply via a LISN.
2. As a worst case the EUT was configured on NFC 13.56 MHz, NFC-A: 212 kb/s: ASK: Single Channel.
3. As mentioned in FCC KDB 174176 Q5 a suitable dummy load is a radio frequency termination used in place of the antenna, which has the same electrical properties as the intended antenna without radiated emissions.
4. Pre-scans were performed, and markers placed on the highest live and neutral measured levels. Final measurements were performed on the marker frequencies and the results entered into the tables below.
5. The final measured value, for the given emission, in the table below incorporates the cable loss.
6. All other emissions shown on the pre-scan plot were investigated. Only the highest 6 emissions have been reported in the tables below in accordance with ANSI C63.10 section 6.2.5.
7. 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.
8. Measurement software used: Toyo EMI Software; CE measurement software EP5/CE Ver 4.0.1.

Test setup:


EUT
Power & Control Unit with AC Power Supply
LISN
Test Receiver
Single Phase AC Supply

Transmitter AC Conducted Spurious Emissions (continued)

Results: Live / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.2141	Live	27.7	63.0	35.3	Complied
0.6411	Live	29.8	56.0	26.2	Complied
1.2117	Live	21.1	56.0	34.9	Complied
4.6565	Live	22.9	56.0	33.1	Complied
7.2994	Live	26.1	60.0	33.9	Complied
13.5608	Live	47.5	60.0	12.5	Complied

Results: Live / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.2141	Live	15.2	53.0	37.8	Complied
0.6411	Live	20.8	46.0	25.2	Complied
1.2117	Live	10.8	46.0	35.2	Complied
4.6565	Live	13.0	46.0	33.0	Complied
7.2994	Live	13.4	50.0	36.6	Complied
13.5608	Live	47.3	50.0	2.7	Complied

Results: Neutral / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.1962	Neutral	28.8	63.8	35.0	Complied
0.2454	Neutral	24.6	61.9	37.3	Complied
0.3965	Neutral	29.7	57.9	28.2	Complied
0.6211	Neutral	37.8	56.0	18.2	Complied
8.1672	Neutral	25.6	60.0	34.4	Complied
13.5602	Neutral	48.3	60.0	11.7	Complied

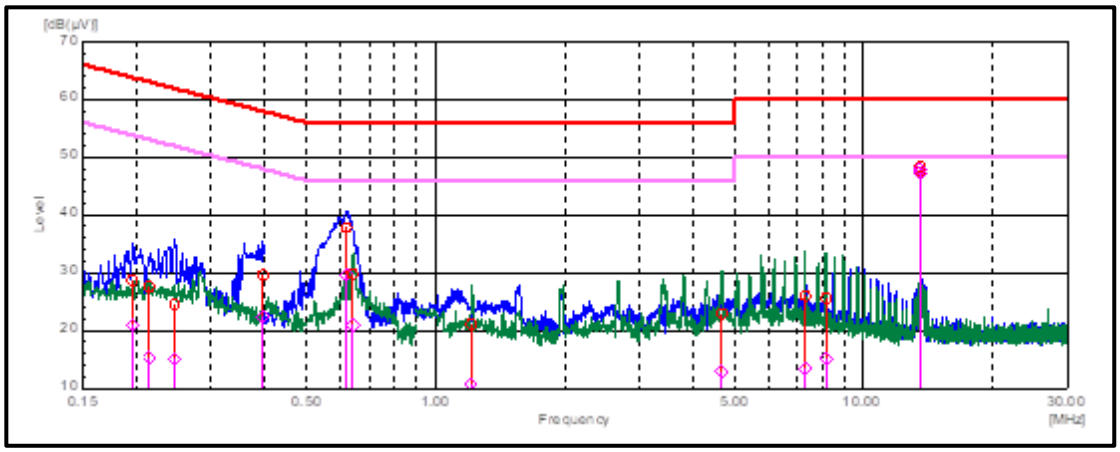
Results: Neutral / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.1962	Neutral	20.9	53.8	32.9	Complied
0.2454	Neutral	15.1	51.9	36.8	Complied
0.3965	Neutral	22.3	47.9	25.6	Complied
0.6211	Neutral	29.7	46.0	16.3	Complied
8.1672	Neutral	15.1	50.0	34.9	Complied
13.5602	Neutral	48.1	50.0	1.9	Complied

Result: Pass

Transmitter AC Conducted Spurious Emissions (continued)

Plot: Live and Neutral Line / 120 VAC 60 Hz



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

Transmitter AC Conducted Spurious Emissions (continued)

Results: Live / Quasi Peak / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.1637	Live	30.0	65.3	35.3	Complied
0.3566	Live	26.6	58.8	32.2	Complied
0.6139	Live	34.3	56.0	21.7	Complied
1.1481	Live	23.0	56.0	33.0	Complied
7.1072	Live	27.6	60.0	32.4	Complied
13.5604	Live	48.6	60.0	11.4	Complied

Results: Live / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.1637	Live	15.5	55.3	39.8	Complied
0.3566	Live	13.8	48.8	35.0	Complied
0.6139	Live	24.4	46.0	21.6	Complied
1.1481	Live	13.6	46.0	32.4	Complied
7.1072	Live	14.8	50.0	35.2	Complied
13.5604	Live	48.3	50.0	1.7	Complied

Results: Neutral / Quasi Peak / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.1612	Neutral	30.2	65.4	35.2	Complied
0.3562	Neutral	26.6	58.8	32.2	Complied
0.6366	Neutral	25.9	56.0	30.1	Complied
1.4281	Neutral	18.8	56.0	37.2	Complied
8.1394	Neutral	25.6	60.0	34.4	Complied
13.5608	Neutral	48.6	60.0	11.4	Complied

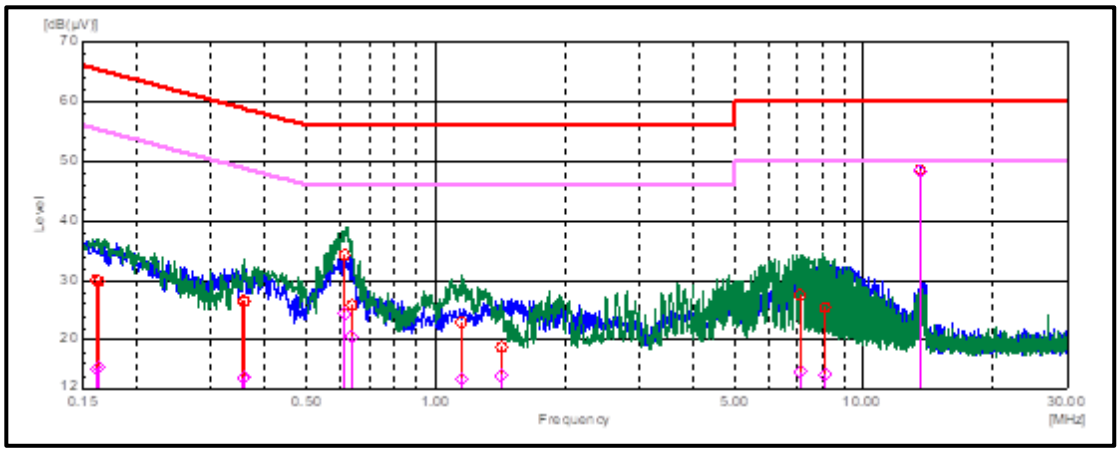
Results: Neutral / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.1612	Neutral	15.2	55.4	40.2	Complied
0.3562	Neutral	13.8	48.8	35.0	Complied
0.6366	Neutral	20.7	46.0	25.3	Complied
1.4281	Neutral	14.2	46.0	31.8	Complied
8.1394	Neutral	14.3	50.0	35.7	Complied
13.5608	Neutral	48.4	50.0	1.6	Complied

Result: Pass

Transmitter AC Conducted Spurious Emissions (continued)

Plot: Live and Neutral Line / 240 VAC 60 Hz



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

5.2.2. Transmitter 20 dB Bandwidth

Test Summary:

Test Engineer:	Sercan, Usta	**Test Dates:**	22 February 2022
Test Sample Serial Number:	JU10214700099 (Conducted Sample)		
Test Site Identification	SR 9		

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

Environmental Conditions:

Temperature (°C):	20.1
Relative Humidity (%):	34.2

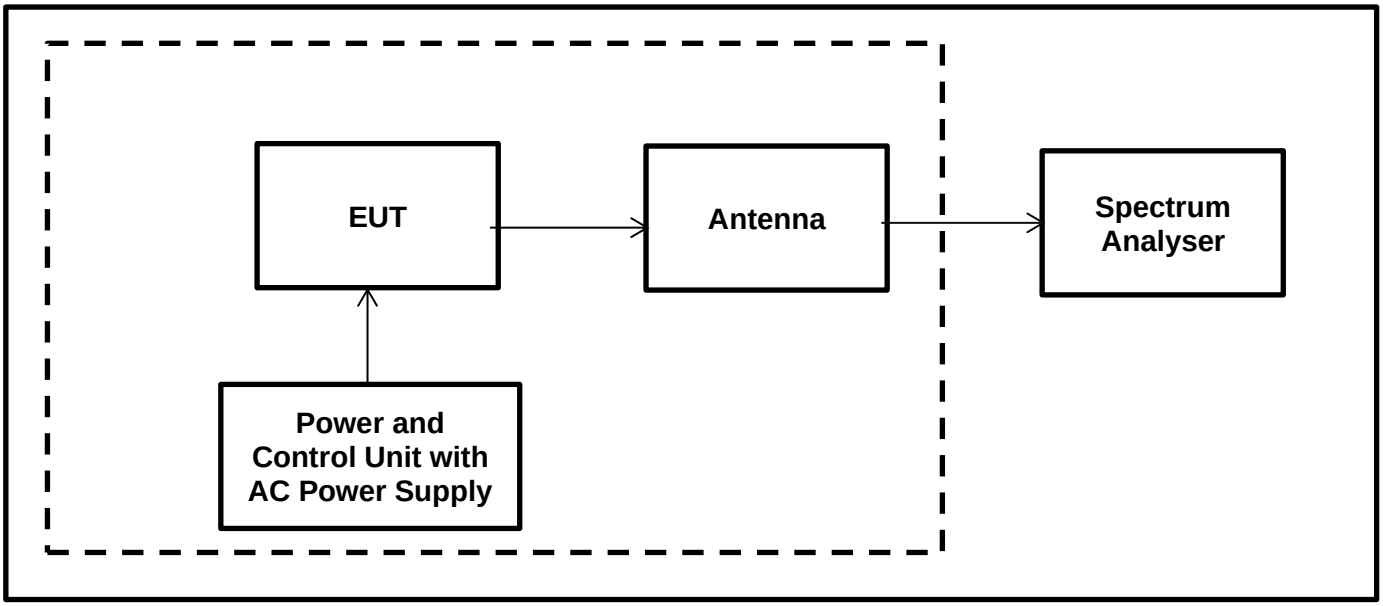
Settings of the Instrument:

RBW/VBW	30 kHz / 100 kHz
Span	3 MHz
Sweep time	Auto
Detector	MaxPeak

Notes:

1. The n dB down function of the spectrum analyzer was set to 20 dB.
2. As a worst case the EUT was configured on NFC-A I 212 kb/s I ASK: Single Channel.

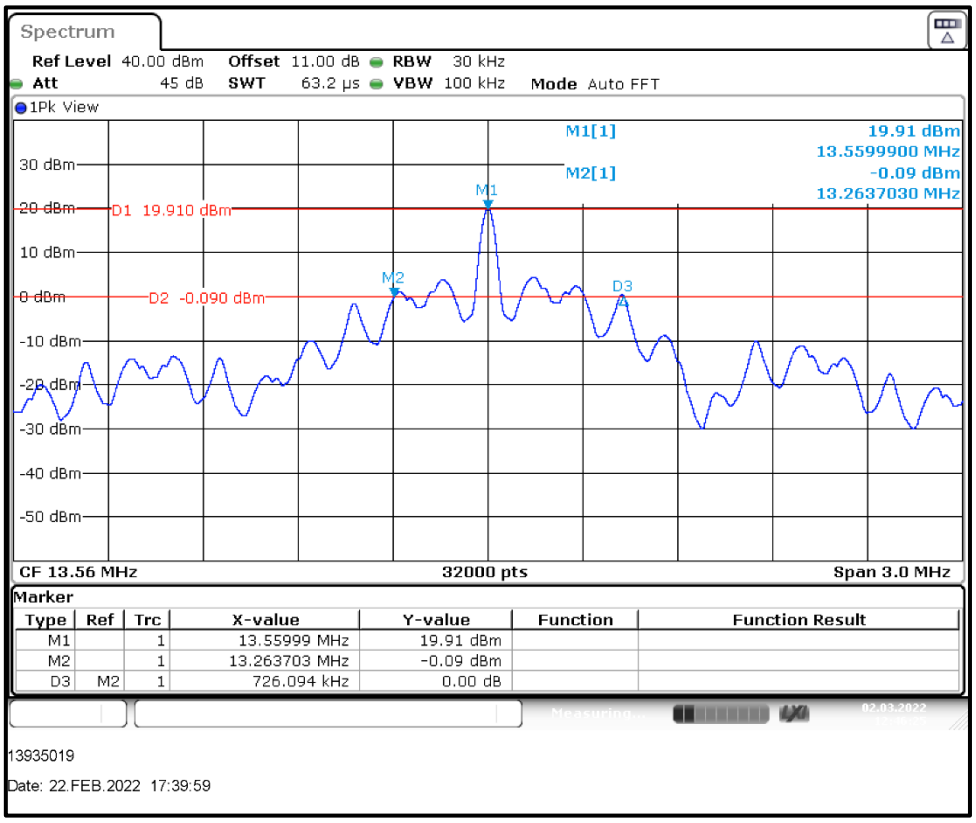
Test Setup:



Transmitter 20 dB Bandwidth (continued)

Results: AC Power Supply / NFC 13.56 MHz / NFC-A 212 kb/s

NFC Channel	20 dB Bandwidth (kHz)
13.56 MHz	726.09



NFC 13.56 MHz

Result: Pass

5.2.3. Transmitter Fundamental Field Strength & Spectrum Mask

Test Summary:

Test Engineer:	Sercan Usta	**Test Date:**	27 January 2022
Test Sample Serial Number:	JU10214700056 (Radiated Sample)		
Test Site Identification	SR 1/2		

FCC Reference:	Part 15.225(a)(b)(c)(d)
Test Method Used:	ANSI C63.10 Section 6.4

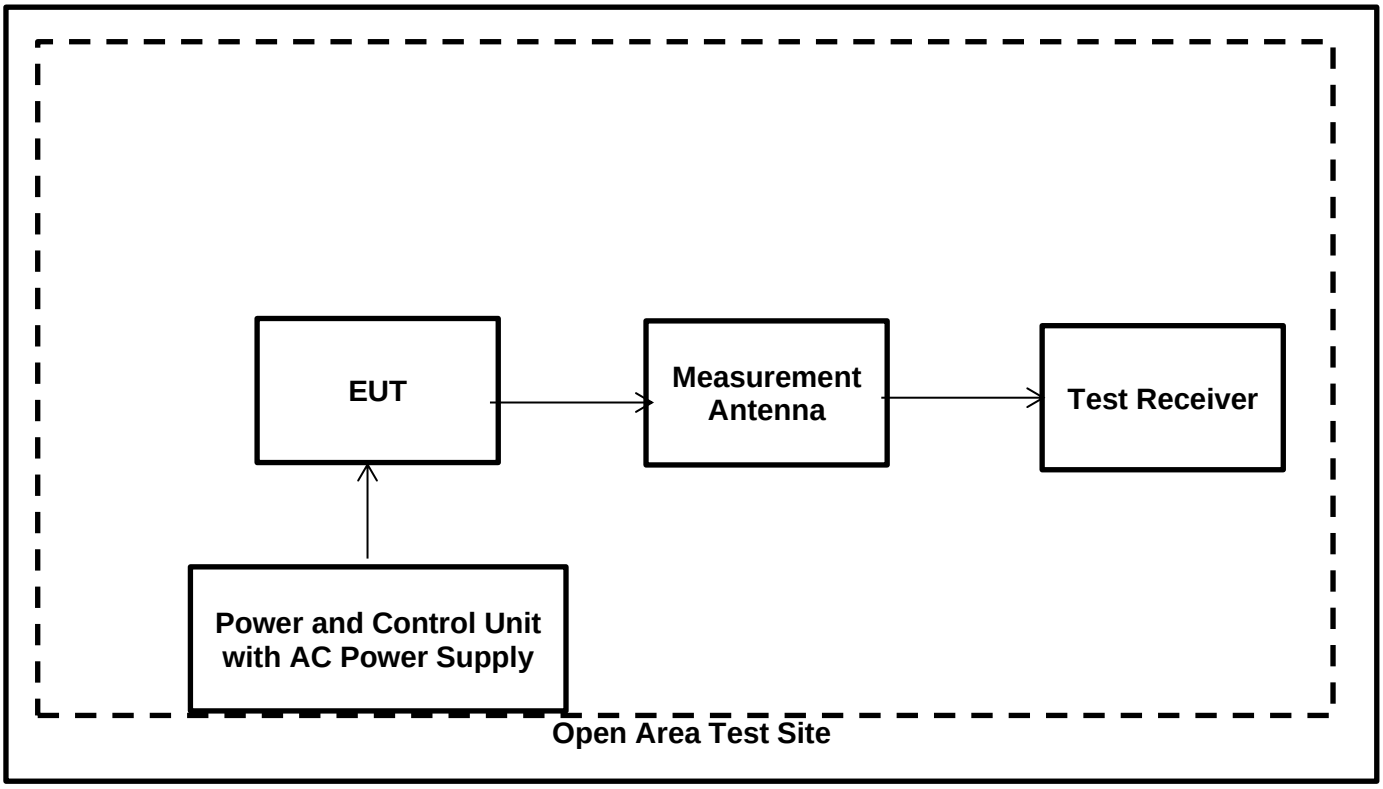
Environmental Conditions:

Temperature (°C):	20.1
Relative Humidity (%):	34.2

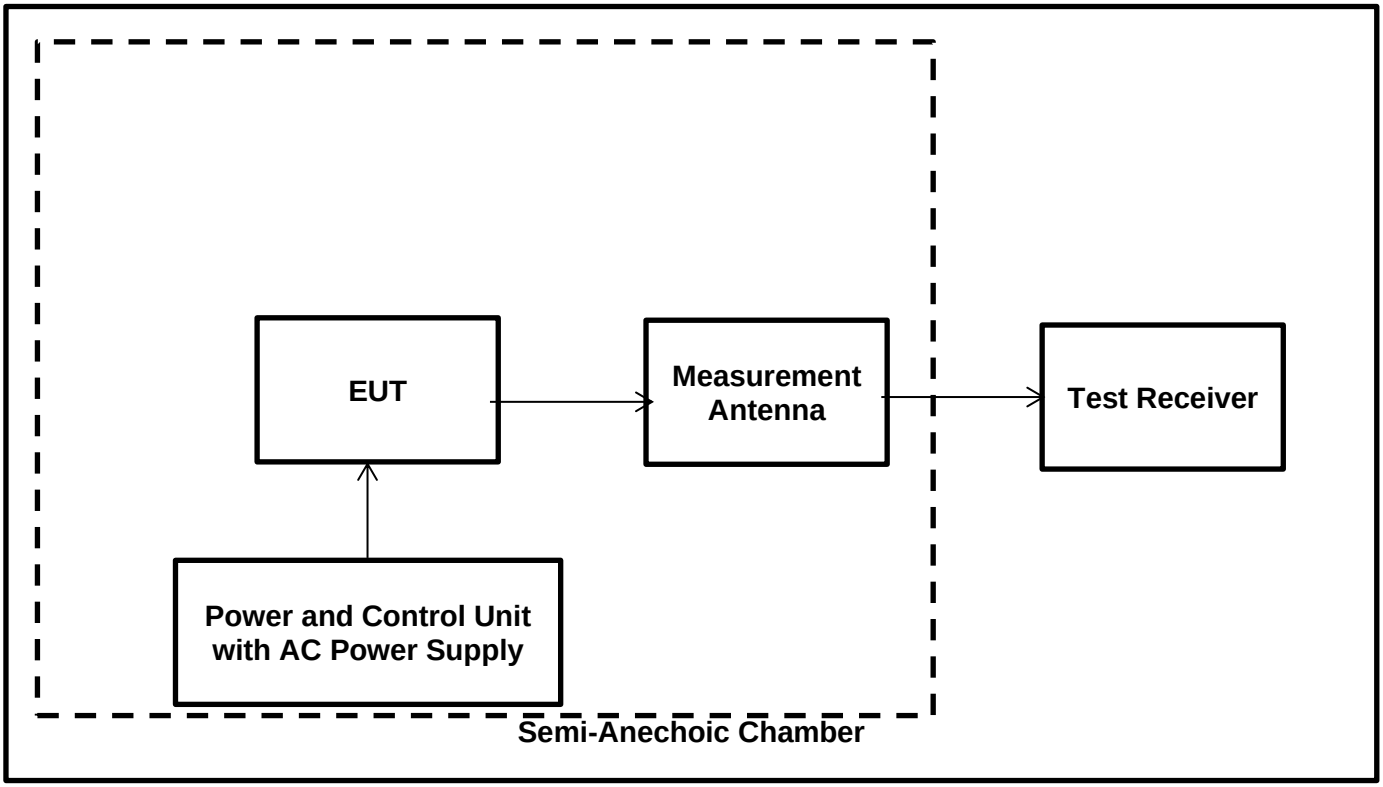
Note(s):

1. The limit is specified at a test distance of 30 metres. 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 (40 dB/decade).
2. In accordance with FCC KDB 414788 D01 Radiated Test Site v01 an alternative Test Site was used. Instead of an OATS a Semi Anechoic Chamber was used where evidence was shown that the behaviour is the same. A maximum deviation of 1.38 dB for 13.56 MHz could be determined. This deviation is also taken into account to the result.
3. Therefore, applicable limits were extrapolated from 30 m to 3 m using a distance extrapolation factor of 40 dB/decade. The transducer factor on the measuring instrument was used to extrapolate the measured values from 30 m to 3 m using a distance extrapolation factor of 40 dB/decade.
4. Pre-scan measurements were performed using a spectrum analyser with a peak detector and measurement bandwidth of 10 kHz. The fundamental field strength was maximized by rotating the measurement antenna and EUT. The spectrum analyser was then switched to test receiver mode and the final measurement on the maximized level was performed.
5. Compliance with the spectrum mask is shown by final measurements performed in a semi-anechoic chamber. For the field strength measurements in a semi-anechoic chamber, a transducer factor on the measuring instrument was used to extrapolate the results at 3 m to a distance of 30 m. A distance extrapolation factor of 40 dB was used.
6. 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.
7. For the emissions appearing within the 13.110-14.010 MHz band, compliance with the spectrum mask is shown in accordance with FCC Part 15.225(a)(b)(c)(d) limits.
8. The emissions shown at frequencies approximately at 13.56 MHz on the plot represent EUT's fundamental field strength for NFC 13.56 MHz.
9. For the emissions appearing outside of the 13.110-14.010 MHz band, compliance with the spectrum mask is shown in accordance with FCC Part 15.225(d) referencing FCC Part 15.209 general radiated emission limits.

Transmitter Fundamental Field Strength & Spectrum Mask(continued)
Open Area Test Site



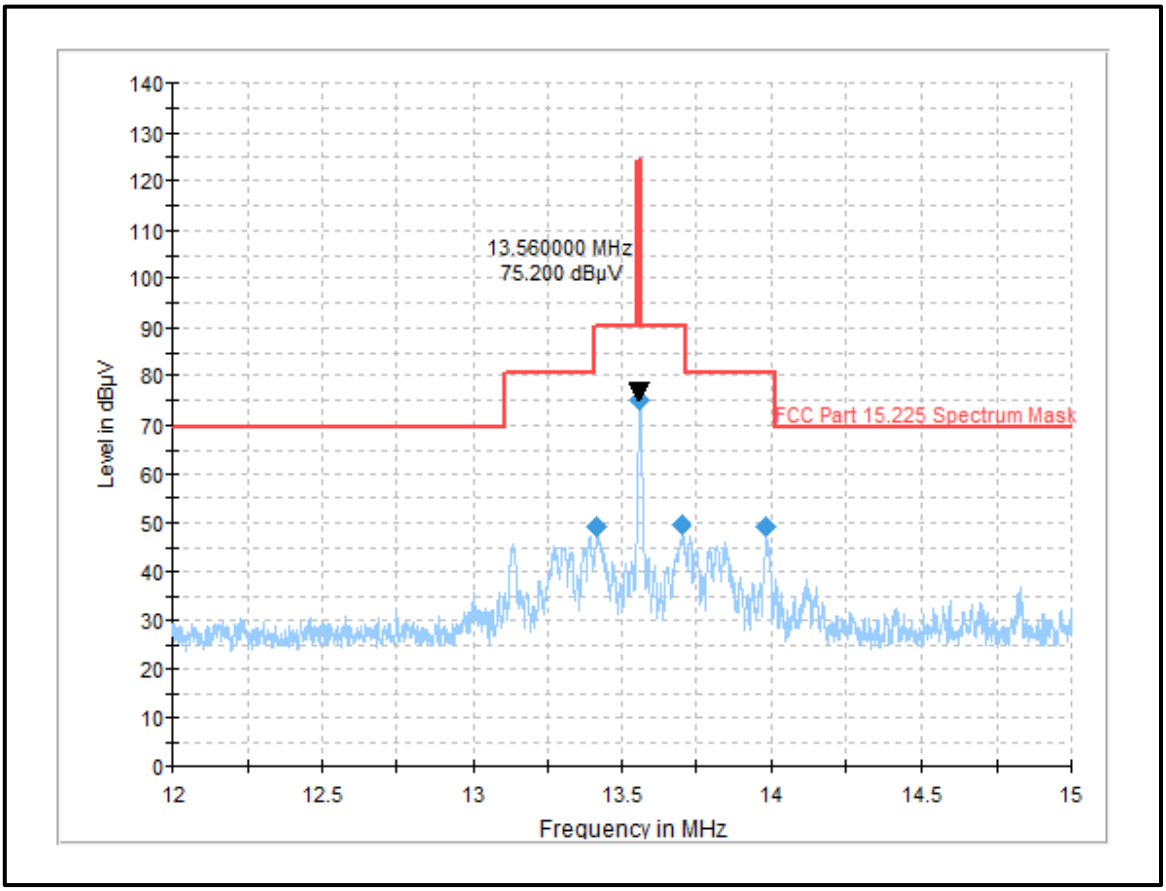
Semi Anechoic Chamber



Transmitter Fundamental Field Strength & Spectrum Mask (continued)
Results: AC Power supply / NFC 13.56 MHz / NFC-A 212 kb/s

Frequency Band (MHz)	Emission Frequency (MHz)	Loop Antenna Orientation	MaxPeak Emission Level at 3 m (dBµV/m) Note 3	Deviation from OATS to SAC) (dB)	Deviation Corrected Level at 3 m (dBµV/m)	Limit at 3 m (dBµV/m) Note 3	Margin (dB)	Result
12.000 to 13.110	All emissions were found to be below system noise floor							Complied
13.110 to 13.410	All emissions were found to be below system noise floor							Complied
13.410 to 13.553	13.42	90° to EUT	49.20	1.38	50.58	90.50	39.92	Complied
13.553 to 13.567	13.56	90° to EUT	75.20	1.38	76.58	124.0	47.42	Complied
13.567 to 13.710	13.70	90° to EUT	49.61	1.38	50.99	90.50	39.51	Complied
13.710 to 14.010	13.98	90° to EUT	49.29	1.07	50.36	80.50	30.14	Complied
14.010 to 15.000	All emissions were found to be below system noise floor							Complied

Transmitter Fundamental Field Strength & Spectrum Mask (continued)
Plot: AC Power supply / NFC 13.56 MHz / NFC-A 212 kb/s



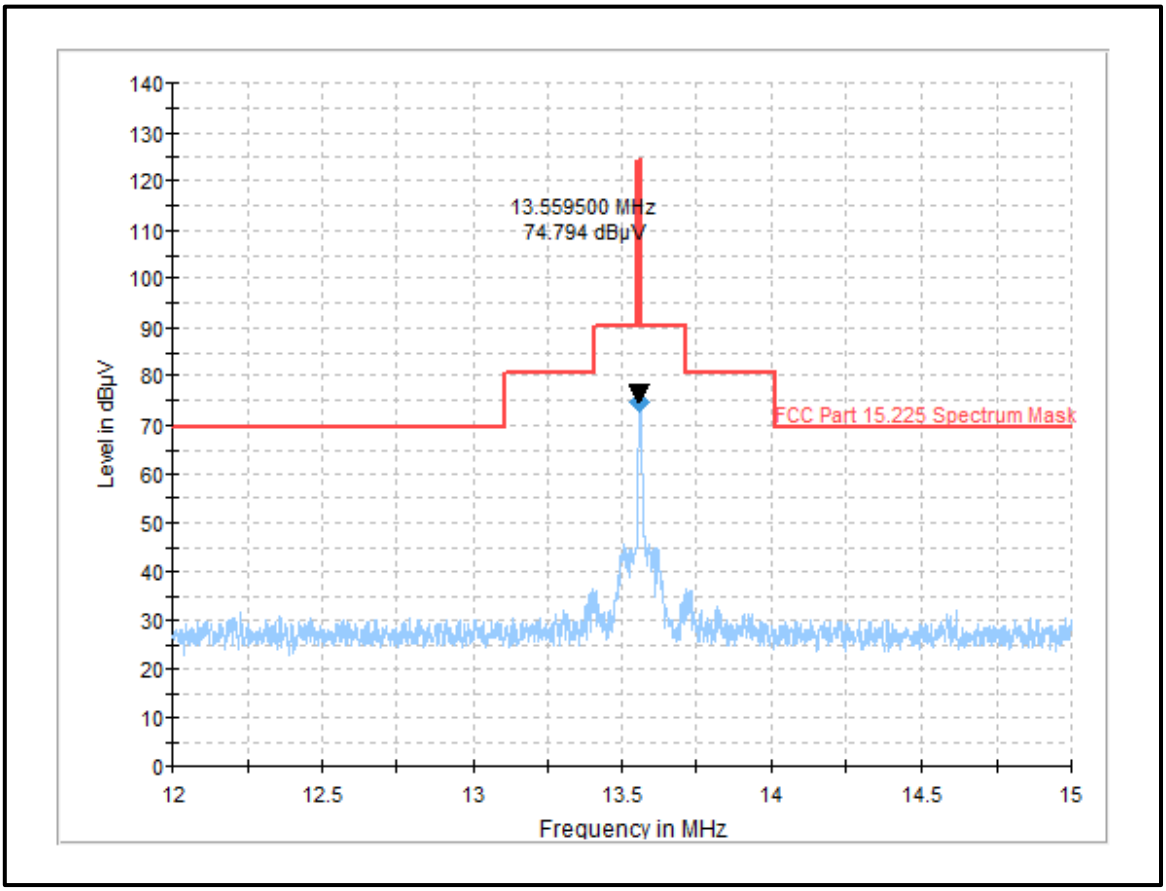
Fundamental field strength and spectrum mask / measured at 3 metres/ measured in a semi-anechoic chamber

Result: Pass

Transmitter Fundamental Field Strength & Spectrum Mask (continued)
Results: AC Power supply / NFC 13.56 MHz / NFC-B 106 kb/s

Frequency Band (MHz)	Emission Frequency (MHz)	Loop Antenna Orientation	MaxPeak Emission Level at 3 m (dBµV/m) Note 3	Deviation from OATS to SAC) (dB)	Deviation Corrected Level at 3 m (dBµV/m)	Limit at 3 m (dBµV/m) Note 3	Margin (dB)	Result
12.000 to 13.110	All emissions were found to be below system noise floor							Complied
13.110 to 13.410	All emissions were found to be below system noise floor							Complied
13.410 to 13.553	All emissions were found to be below system noise floor							Complied
13.553 to 13.567	13.56	90° to EUT	74.87	1.38	76.25	124.0	47.75	Complied
13.567 to 13.710	All emissions were found to be below system noise floor							Complied
13.710 to 14.010	All emissions were found to be below system noise floor							Complied
14.010 to 15.000	All emissions were found to be below system noise floor							Complied

Transmitter Fundamental Field Strength & Spectrum Mask (continued)
Plot: AC Power supply / NFC 13.56 MHz / NFC-B 106 kb/s



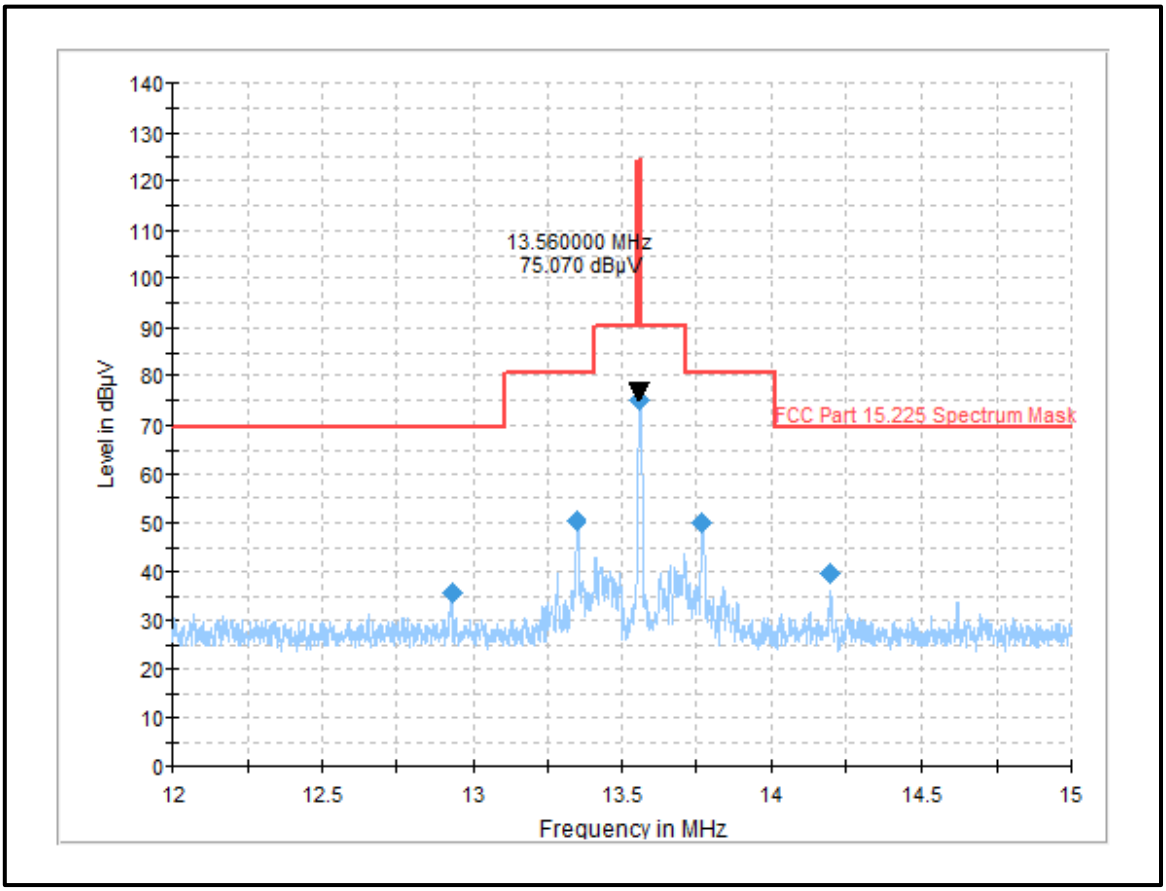
Fundamental field strength and spectrum mask / measured at 3 metres/ measured in a semi-anechoic chamber

Result: Pass

Transmitter Fundamental Field Strength & Spectrum Mask (continued)
Results: AC Power supply / NFC 13.56 MHz / NFC-F 212 kb/s

Frequency Band (MHz)	Emission Frequency (MHz)	Loop Antenna Orientation	MaxPeak Emission Level at 3 m (dBµV/m) Note 3	Deviation from OATS to SAC) (dB)	Deviation Corrected Level at 3 m (dBµV/m)	Limit at 3 m (dBµV/m) Note 3	Margin (dB)	Result
12.000 to 13.110	12.93	90° to EUT	35.40	1.38	36.78	69.50	32.72	Complied
13.110 to 13.410	13.35	90° to EUT	50.34	1.38	51.72	80.50	28.78	Complied
13.410 to 13.553	All emissions were found to be below system noise floor							Complied
13.553 to 13.567	13.56	90° to EUT	75.07	1.38	76.45	124.0	47.55	Complied
13.567 to 13.710	All emissions were found to be below system noise floor							Complied
13.710 to 14.010	13.77	90° to EUT	50.17	1.07	50.24	80.50	30.26	Complied
14.010 to 15.000	14.20	90° to EUT	39.69	1.07	40.76	69.50	28.74	Complied

Transmitter Fundamental Field Strength & Spectrum Mask (continued)
Plot: AC Power supply / NFC 13.56 MHz / NFC-F 212 kb/s



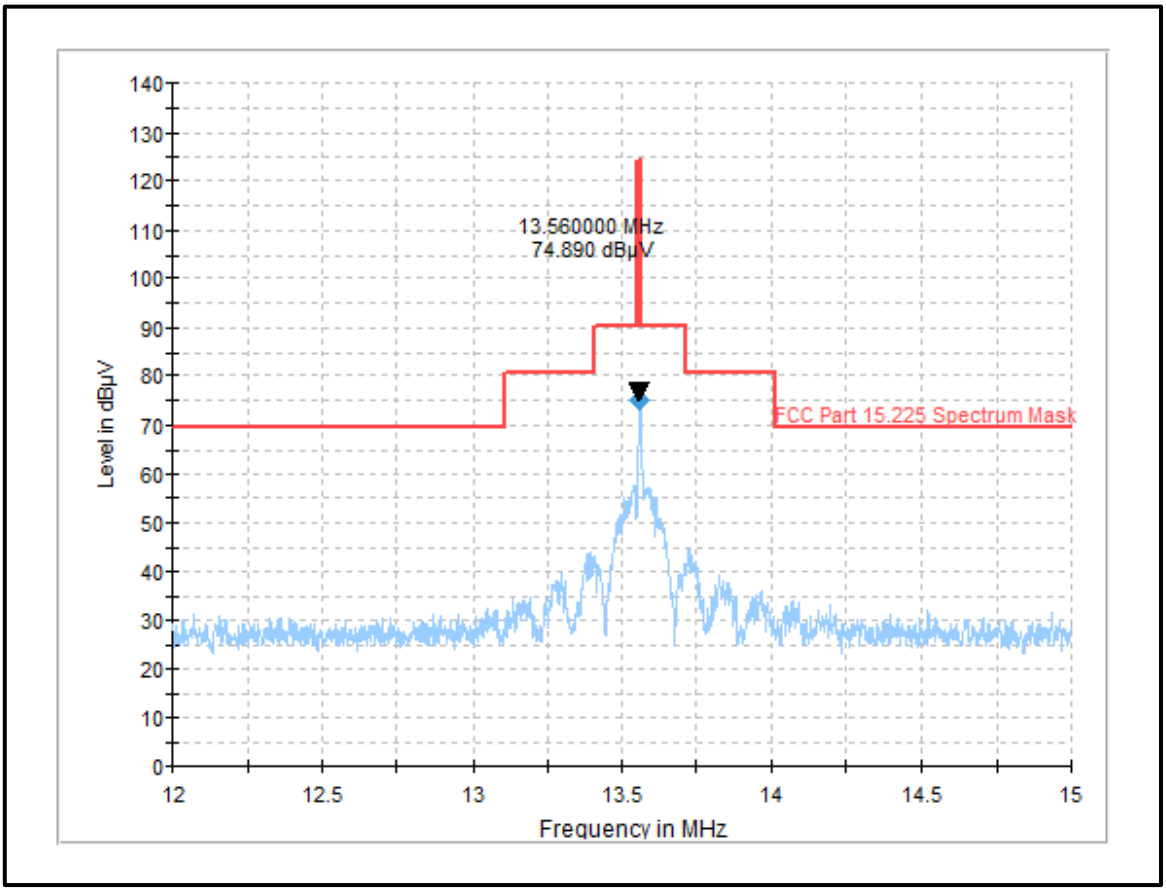
Fundamental field strength and spectrum mask / measured at 3 metres/ measured in a semi-anechoic chamber

Result: Pass

Transmitter Fundamental Field Strength & Spectrum Mask (continued)
Results: AC Power supply / MFC 13.56 MHz / ISO15693 100 ASK

Frequency Band (MHz)	Emission Frequency (MHz)	Loop Antenna Orientation	MaxPeak Emission Level at 3 m (dBµV/m) Note 3	Deviation from OATS to SAC) (dB)	Deviation Corrected Level at 3 m (dBµV/m)	Limit at 3 m (dBµV/m) Note 3	Margin (dB)	Result
12.000 to 13.110	All emissions were found to be below system noise floor							Complied
13.110 to 13.410	All emissions were found to be below system noise floor							Complied
13.410 to 13.553	All emissions were found to be below system noise floor							Complied
13.553 to 13.567	13.56	90° to EUT	74.89	1.38	76.27	124.0	47.73	Complied
13.567 to 13.710	All emissions were found to be below system noise floor							Complied
13.710 to 14.010	All emissions were found to be below system noise floor							Complied
14.010 to 15.000	All emissions were found to be below system noise floor							Complied

Transmitter Fundamental Field Strength & Spectrum Mask (continued)
Plot: AC Power supply / NFC 13.56 MHz / ISO15693 100 ASK



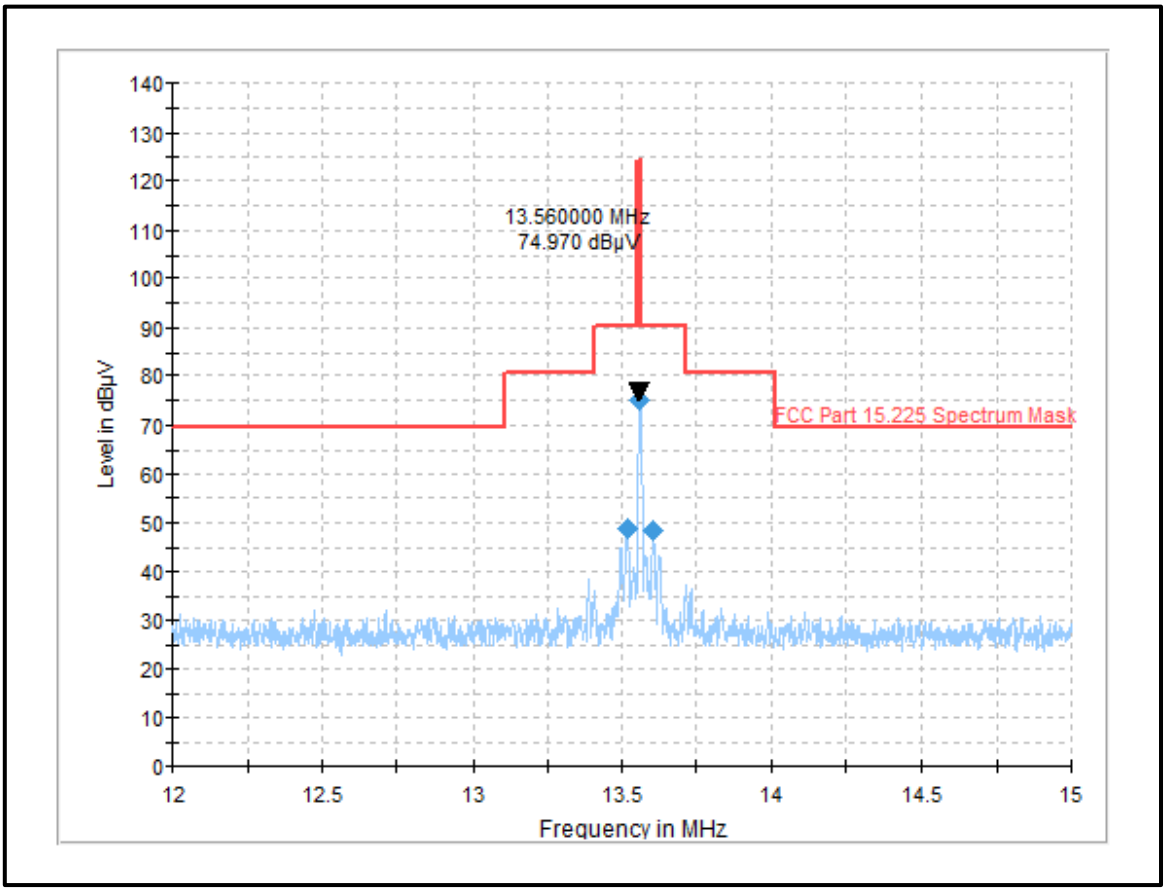
Fundamental field strength and spectrum mask / measured at 3 metres/ measured in a semi-anechoic chamber

Result: Pass

Transmitter Fundamental Field Strength & Spectrum Mask (continued)
Results: AC Power supply / NFC 13.56 MHz / EPCV2 TARI 18 88

Frequency Band (MHz)	Emission Frequency (MHz)	Loop Antenna Orientation	MaxPeak Emission Level at 3 m (dBµV/m) Note 3	Deviation from OATS to SAC) (dB)	Deviation Corrected Level at 3 m (dBµV/m)	Limit at 3 m (dBµV/m) Note 3	Margin (dB)	Result
12.000 to 13.110	All emissions were found to be below system noise floor							Complied
13.110 to 13.410	All emissions were found to be below system noise floor							Complied
13.410 to 13.553	13.42	90° to EUT	49.06	1.38	50.44	90.50	40.06	Complied
13.553 to 13.567	13.56	90° to EUT	74.97	1.38	76.35	124.0	47.65	Complied
13.567 to 13.710	13.70	90° to EUT	48.58	1.38	49.96	90.50	40.54	Complied
13.710 to 14.010	All emissions were found to be below system noise floor							Complied
14.010 to 15.000	All emissions were found to be below system noise floor							Complied

Transmitter Fundamental Field Strength & Spectrum Mask (continued)
Plot: AC Power supply / NFC 13.56 MHz / EPCV2 TARI 18 88



Fundamental field strength and spectrum mask / measured at 3 metres/ measured in a semi-anechoic chamber

Result: Pass

5.2.4. Transmitter Radiated Spurious Emissions

Test Summary:

Test Engineer:	Sercan Usta	**Test Date:**	27 January 2022
Test Sample Serial Number:	JU10214700056 (Radiated Sample)		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.225(d) & 15.209(a)
Test Method Used:	ANSI C63.10:2013 Sections 6.3 and 6.4
Frequency Range:	9 kHz to 30 MHz

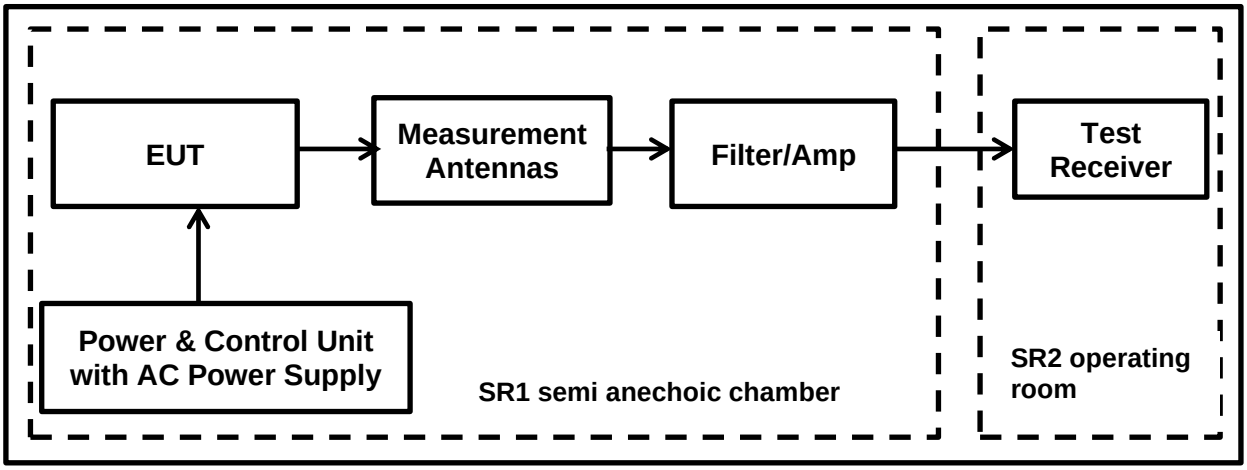
Environmental Conditions:

Temperature (°C):	20.1
Relative Humidity (%):	34.2

Note(s):

1. In accordance with FCC KDB 414788, an alternative test site may be used for the measurement below 30 MHz (The OATS / SAC comparison data is available upon request). Therefore the result from the semi-anechoic chamber tests is shown in this section of the test report.
2. The limits are specified at a test distance of 30 m & 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.
3. Therefore the limit values are extrapolated to a measurement distance of 3 m where field strength of X dBµV/m was measured.
   - 9 kHz- 490 kHz: limits extrapolated from 300 m to 3 m adding 80 dB at 40 dB /decade.
   - 490 kHz-1705 kHz: limits extrapolated from 30 m to 3 m by adding 40 dB at 40 dB /decade.
4. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
5. All emissions shown on the pre-scan plots were investigated and found to be ambient or > 20 dB below the appropriate limit.
6. Measurements below 30 MHz were performed in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) at a distance of 3 m. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. The measurement loop antenna height was 1 m.
7. Pre-scans were performed and markers placed on the highest measured levels. The test receiver was set to:
   - Frequency range: 9 kHz-150 kHz : RBW: 300 Hz /VBW: 1 kHz
   - Frequency range: 150 kHz – 30 MHz: RBW: 10 kHz /VBW: 30 kHz
   - Detector: Max-Peak detector
   - Trace Mode: Max Hold
8. All emissions shown on the pre-scan plots were investigated and found to be measurement system noise floor.
9. The emissions shown at frequencies approximately 13.56 MHz on the 9 kHz to 30 MHz plots are the EUT NFC 13.56 MHz fundamental for the tested channel.
10. As a worst case the EUT was configured on NFC 13.56 MHz, NFC-A: 212 kb/s: Single Channel.

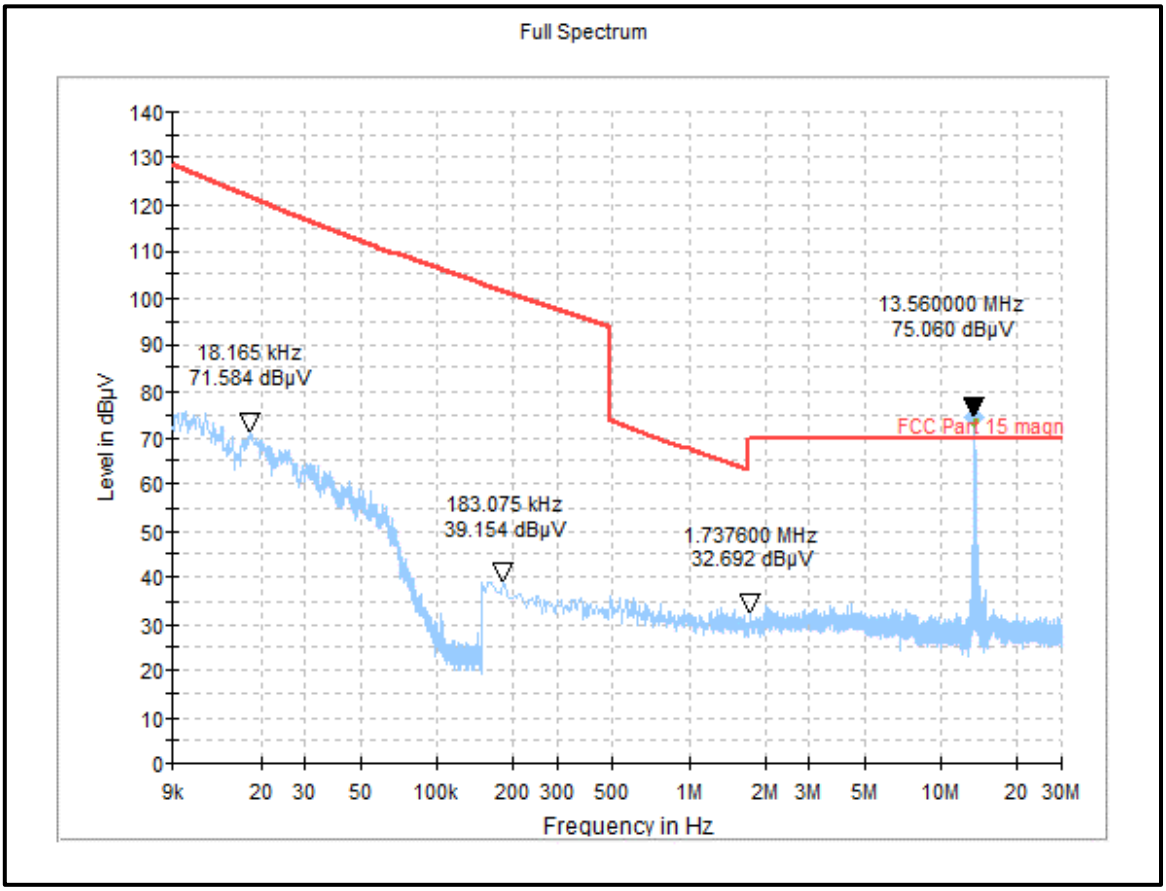
Transmitter Radiated Spurious Emission test setup
Test Setup:



Transmitter Radiated Emissions (continued)

Results: AC Power supply / NFC 13.56 MHz / NFC-A 212 kb/s

Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
No critical spurious emissions were found					



Result: Pass

Transmitter Radiated Emissions (continued)

Test Summary:

Test Engineer:	Sercan Usta	**Test Date:**	27 January 2022
Test Sample Serial Number:	JU10214700056 (Radiated Sample)		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.225(d) & 15.209(a)
Test Method Used:	ANSI C63.10:2013 Sections 6.3 and 6.5
Frequency Range:	30 MHz to 1000 MHz

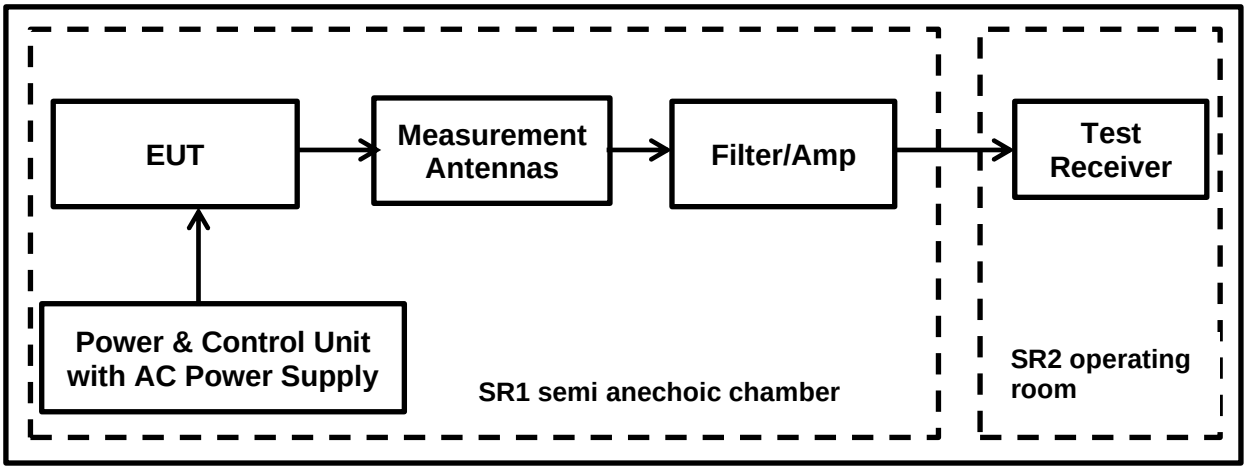
Environmental Conditions:

Temperature (°C):	20.1
Relative Humidity (%):	34.2

Note(s):

1. All emissions shown on the pre-scan plot were investigated and found to be ambient or >20 dB below the appropriate limit or below the measurement system noise floor.
2. Measurements below 1 GHz were performed in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) at a distance of 3 m. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 m to 4 m.
3. Pre-scans were performed and markers placed on the highest measured levels. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.
4. As a worst case the EUT was configured on NFC 13.56 MHz, NFC-A: 212 kb/s: Single Channel.

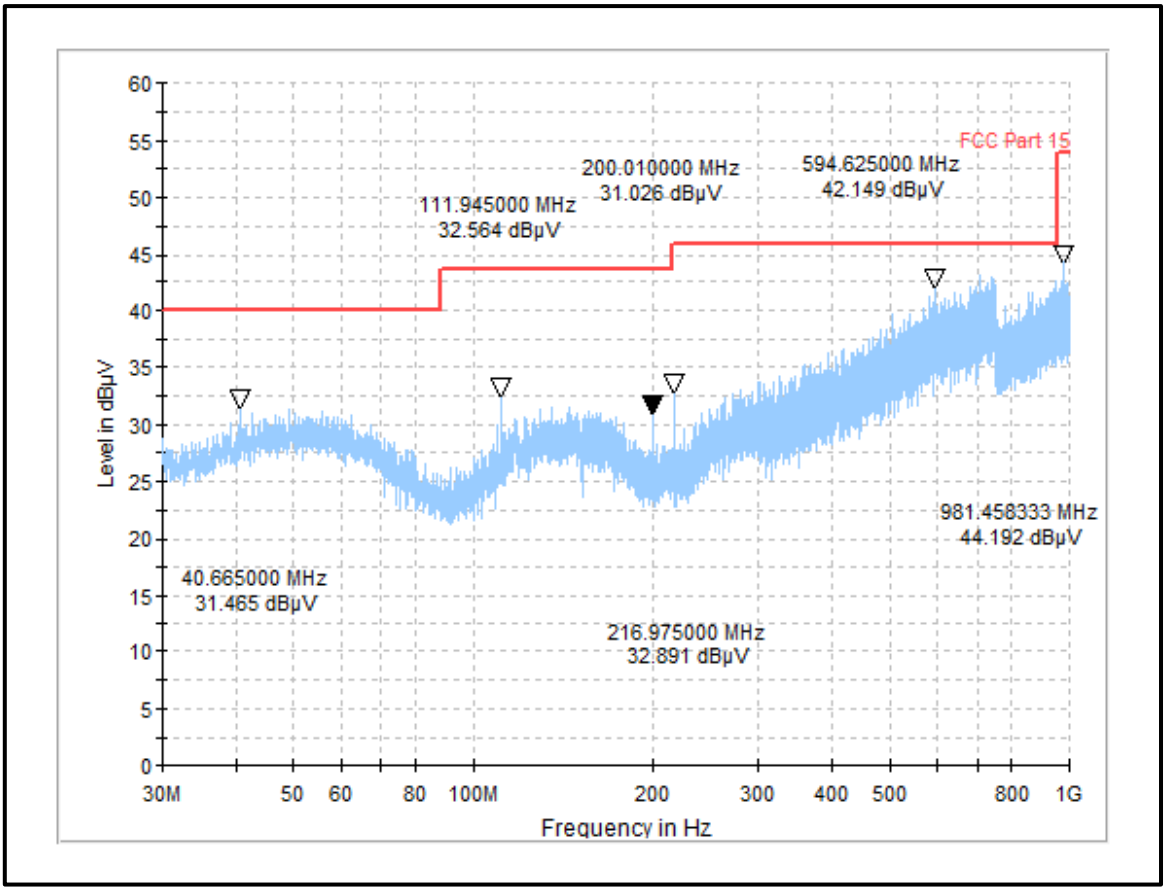
Test Setup:



Transmitter Radiated Emissions (continued)

Results: AC Power supply / NFC 13.56 MHz / NFC-A 212 kb/s

Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
No critical spurious emissions were found					



Result: Pass

5.2.5. Transmitter Frequency Stability (Temperature & Voltage Variation)

Test Summary:

Test Engineer:	Sercan Usta	**Test Dates:**	28 January 2022
Test Sample Serial Number:	JU10214700099 (Conducted Sample)		
Test Site Identification	SR 9		

FCC Reference:	Part 15.225(e)
Test Method Used:	ANSI C63.10 Sections 6.8.1 and 6.8.2

Environmental Conditions:

Ambient Temperature (°C):	27
Ambient Relative Humidity (%):	32

Settings of the Instrument

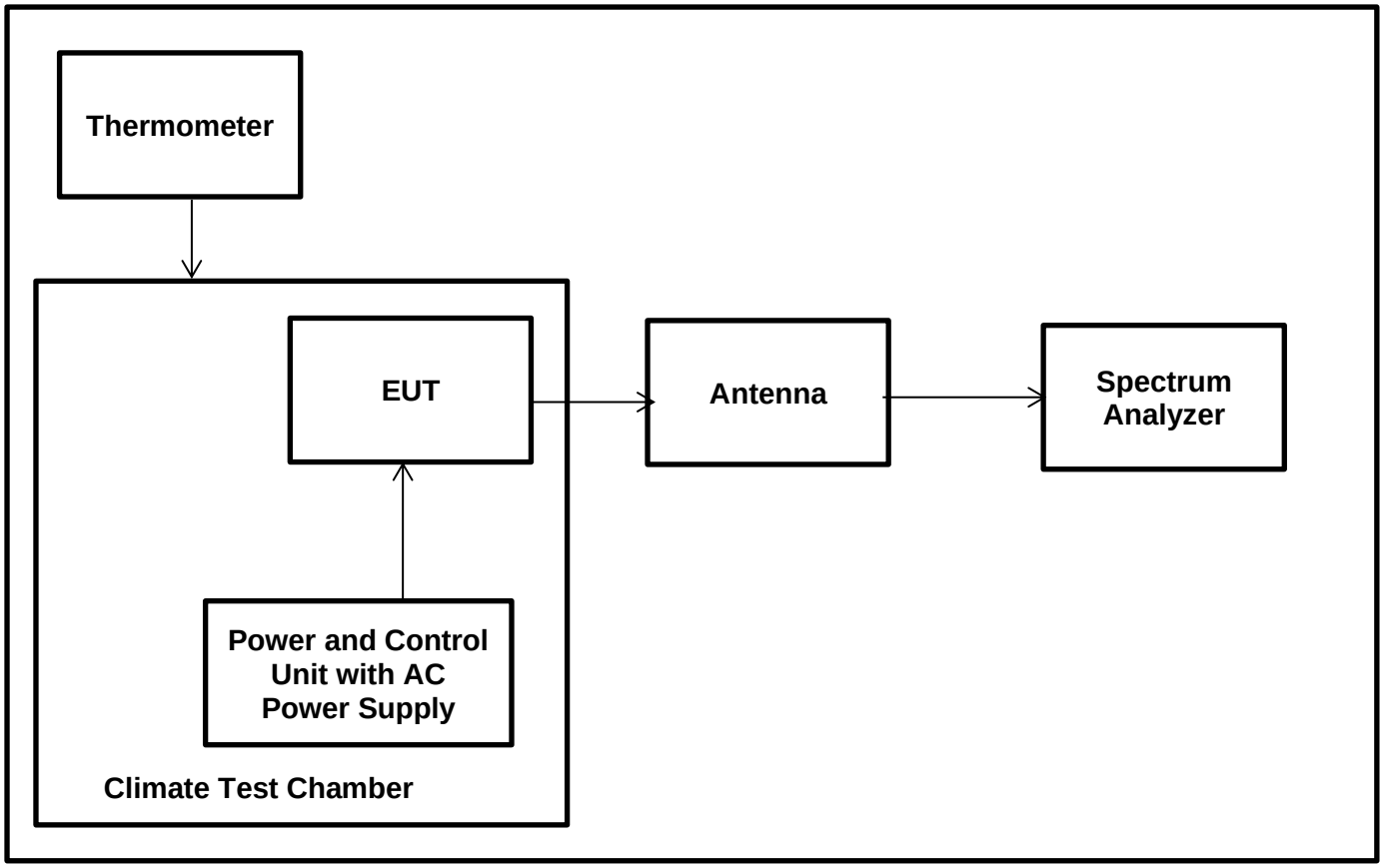
RBW/VBW	30 Hz/30 kHz
Span	4 kHz
Sweep Time	Auto
Sweep Mode	Single Sweep
Detector	Peak
Marker Function	Signal Count

Note(s):

1. The EUT was kept inside the environmental/climatic test chamber. The tests were performed with extreme temperature & extreme voltage variations.
2. The temperature variations were monitored throughout the tests using a calibrated digital thermometer. The voltage variations were monitored throughout the tests using a calibrated digital multimeter.
3. For accurate measurement of frequency deviations, Signal Count / frequency counter function was activated on the spectrum analyser.
4. The applicant's declared operating frequency 13.560 MHz was used as reference frequency.
5. The difference between operating /reference frequency & measured frequency was reported as a frequency error.
6. The frequency tolerance of the carrier signal shall be maintained within ±0.01% or 100 ppm of the operating frequency
7. As a worst case the EUT was configured on NFC 13.56 MHz, NFC-A: 212 kb/s: Single Channel.
8. As EUT can be operated either with AC/DC power adapter; the frequency stability measurements when varying supply voltage were performed with following supply voltages:
    - EUT powered via AC/DC power adapter:
        - with nominal AC voltage (120 VAC /60 Hz)
        - 85% of the nominal supply AC voltage (102 VAC /60 Hz)
        - 115% of the nominal supply AC voltage (138 VAC /60 Hz)

Transmitter Frequency Stability (Temperature & Voltage Variation) (continued)

Transmitter Frequency Stability Emissions test setup for temperature variations



Transmitter Frequency Stability (Temperature & Voltage Variation) (continued)

Results: AC Power supply / NFC 13.56 MHz / NFC-A 212 kb/s / Temperature Variations

Extreme Temperature (°C)	Time after EUT Power-up	Measured Frequency (MHz)	Frequency Error		Frequency Error Limits		Result
			%	ppm	%	ppm	
-20	at 0 minutes	13.559937526	-0.000460723	-4.61	± 0.01	± 100	Complied
	at 2 minutes	13.559937816	-0.000458584	-4.59	± 0.01	± 100	Complied
	at 5 minutes	13.559938036	-0.000456962	-4.57	± 0.01	± 100	Complied
	at 10 minutes	13.559939575	-0.000445612	-4.46	± 0.01	± 100	Complied
-10	at 0 minutes	13.559923570	-0.000563643	-5.64	± 0.01	± 100	Complied
	at 2 minutes	13.559928712	-0.000525723	-5.26	± 0.01	± 100	Complied
	at 5 minutes	13.559928039	-0.000530686	-5.31	± 0.01	± 100	Complied
	at 10 minutes	13.559927628	-0.000533717	-5.34	± 0.01	± 100	Complied
0	at 0 minutes	13.559885487	-0.000844491	-8.44	± 0.01	± 100	Complied
	at 2 minutes	13.559891819	-0.000797795	-7.98	± 0.01	± 100	Complied
	at 5 minutes	13.559892087	-0.000795819	-7.96	± 0.01	± 100	Complied
	at 10 minutes	13.559892465	-0.000793031	-7.93	± 0.01	± 100	Complied
+10	at 0 minutes	13.559850244	-0.001104395	-11.04	± 0.01	± 100	Complied
	at 2 minutes	13.559841834	-0.001166416	-11.66	± 0.01	± 100	Complied
	at 5 minutes	13.559843135	-0.001156822	-11.57	± 0.01	± 100	Complied
	at 10 minutes	13.559844887	-0.001143901	-11.44	± 0.01	± 100	Complied
+20	at 0 minutes	13.559783508	-0.001596549	-15.97	± 0.01	± 100	Complied
	at 2 minutes	13.559786031	-0.001577942	-15.78	± 0.01	± 100	Complied
	at 5 minutes	13.559787584	-0.001566490	-15.66	± 0.01	± 100	Complied
	at 10 minutes	13.559785488	-0.001581947	-15.82	± 0.01	± 100	Complied
+30	at 0 minutes	13.559746144	-0.001872094	-18.72	± 0.01	± 100	Complied
	at 2 minutes	13.559737329	-0.001937102	-19.37	± 0.01	± 100	Complied
	at 5 minutes	13.559732374	-0.001973643	-19.74	± 0.01	± 100	Complied
	at 10 minutes	13.559734626	-0.001957035	-19.57	± 0.01	± 100	Complied
+40	at 0 minutes	13.559700741	-0.002206925	-22.07	± 0.01	± 100	Complied
	at 2 minutes	13.559695972	-0.002242094	-22.42	± 0.01	± 100	Complied
	at 5 minutes	13.559693851	-0.002257736	-22.58	± 0.01	± 100	Complied
	at 10 minutes	13.559699413	-0.002216722	-22.17	± 0.01	± 100	Complied
+50	at 0 minutes	13.559676735	-0.002383960	-23.84	± 0.01	± 100	Complied
	at 2 minutes	13.559675680	-0.002391740	-23.92	± 0.01	± 100	Complied
	at 5 minutes	13.559675329	-0.002394329	-23.94	± 0.01	± 100	Complied
	at 10 minutes	13.559673955	-0.002404462	-24.04	± 0.01	± 100	Complied

Result: Pass

Transmitter Frequency Stability (Temperature & Voltage Variation) (continued)

Results: AC Power supply / NFC 13.56 MHz / NFC-A 212 kb/s / Voltage Variations

Extreme Voltage Conditions	Extreme AC Voltage (V)	Rated DC Voltage (V)	Measured Frequency (MHz)	Frequency Error		Frequency Error Limits		Result
				%	ppm	%	ppm	
85% of Rated Primary Supply Voltage	102	12	13.559761463	-0.0017591	-17.59	± 0.01	± 100	Complied
Rated Primary Supply Voltage	120	12	13.559711583	-0.0021270	-21.27	± 0.01	± 100	Complied
115% of Rated Primary Supply Voltage	138	12	13.559771066	-0.0016883	-16.88	± 0.01	± 100	Complied

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
AC Conducted Spurious Emissions	95%	±2.49 dB
20 dB Bandwidth	95%	±0.87 %
Fundamental Field Strength	95%	±3.10 dB
Radiated Spurious Emissions	95%	±3.10 dB
Frequency Stability	95%	±92 Hz

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	10/07/2020	36
460	Deisl	Turntable	DT 4250 S	n/a	n/a	n/a
465	Schwarzbeck	Antenna, Trilog Broadband	VULB 9168	9168-240	02/09/2020	24
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	28/06/2021	12
608	Rohde & Schwarz	Switch Matrix	OSP 120	101227	lab verification	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
328	SPS	AC/DC power distribution system	PAS 5000	A2464 00/2 0200	lab verification	n/a
1603665	Siemens Matsushita Components	semi-anechoic chamber SR1/ 2	-/-	B83117-A1421-T161	n/a	n/a

Test site: SR 7/8

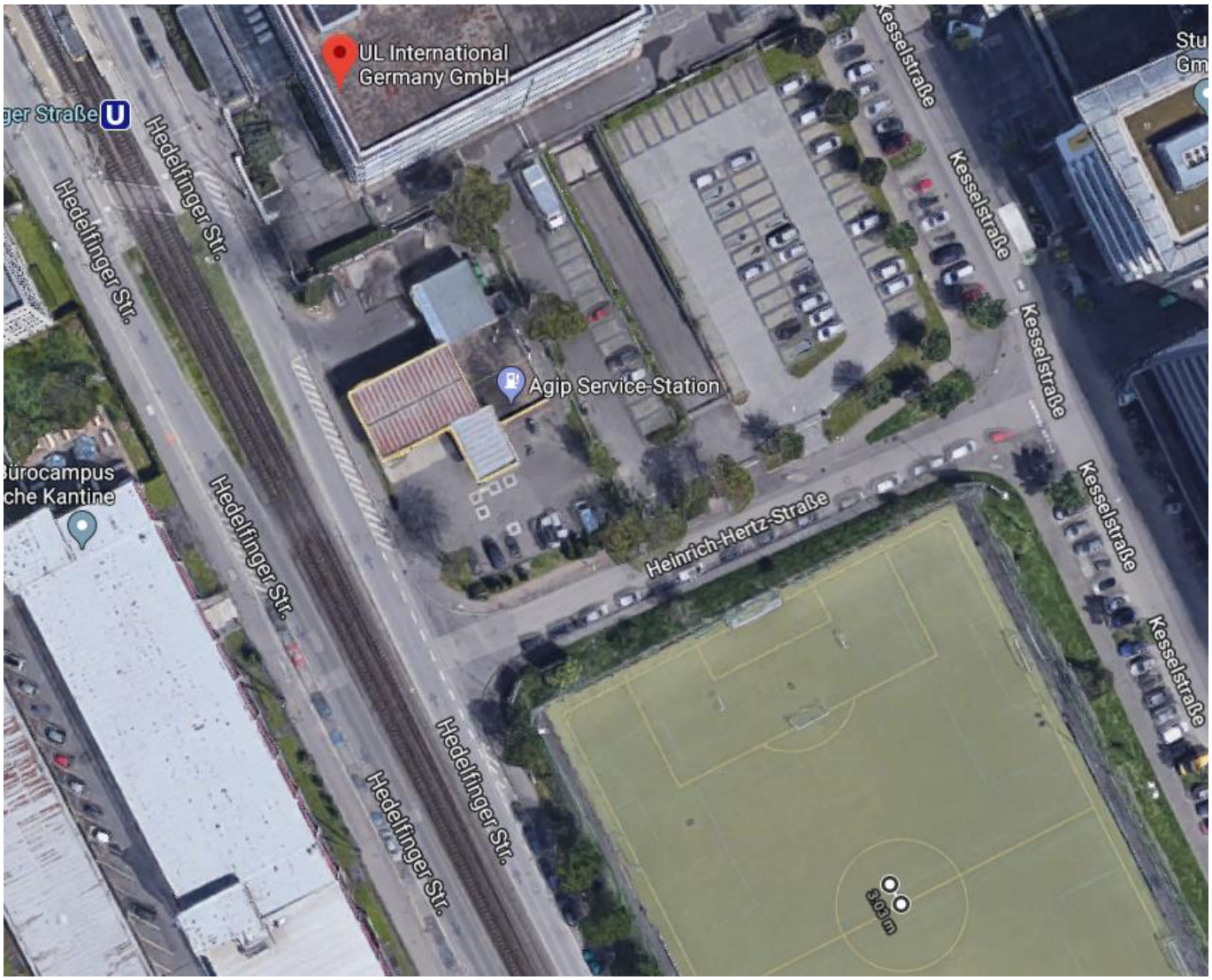
ID	Manufacturer	Type	Model	Serial	Calibration Date	Cal. Cycle (months)
23	Rohde & Schwarz	Artificial Mains	ESH3-Z5	831767/013	14/07/2021	12
28	Rohde & Schwarz	Passive Probe	ESH2-Z3	none	11/07/2019	36
349	Rohde & Schwarz	Receiver, EMI Test	ESIB7	836697/009	13/07/2021	12
351	Rohde & Schwarz	network, Artificial Mains	ESH3-Z5	862770/018	14/07/2021	12
564	Teseq	Impedance stabilisation network (ISN)	ISN T800	26076	14/07/2021	24
616	Rohde & Schwarz	ISN	ENY81-CA6	101656	07/07/2021	36
-/-	Testo	Thermo-Hygrometer	608-H1	08	lab verification	n/a
327	SPS	AC/DC power distribution system	PAS 5000	A2464 00/1 0200	lab verification	n/a

Test site: SR 9

ID	Manufacturer	Type	Model	Serial	Calibration Date	Cal. Cycle (months)
625	Schwarzbeck	Antenna, H-field	HFSL 7101	109	lab verification only relative measurements	n/a
637	Rohde & Schwarz	Spectrum Analyser	FSV40	101587	13/07/2021	12
-/-	Testo	Thermo-Hygrometer	608-H1	07	lab verification	n/a
645	Weiss Umwelttechnik	Climatic Chamber	LabEvent T/110/70/3	5822619794 0010	lab verification	n/a
327	SPS	AC/DC power distribution system	PAS 5000	A2464 00/1 0200	lab verification	n/a

8. Open-Area-Test Site comparison

GPS coordinates
Latitude: 48.765746, Longitude: 9.250684



Open-Area-Test Site comparison (continued)

The following listed equipment was used for the measurement:

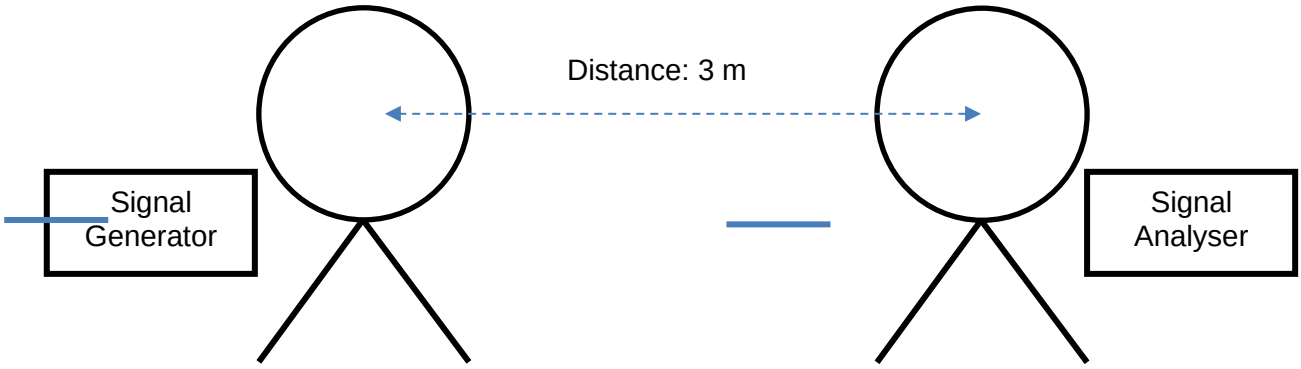
Manufacturer	Type	Model	Frequency Range
Rohde & Schwarz	Signal generator	SML03	9 kHz – 30 MHz
Rohde & Schwarz	Receiver, EMI Test	ESIB7	20 Hz – 7 GHz
Rohde & Schwarz	Antenna, Loop	HFH2-Z2	1 kHz – 30 MHz
ETS LINDGREN	Antenna, Loop	6512	1 kHz – 30 MHz
HUBER+SUHNER	RF Cable	-/-	-/-
Elspec	BNC Cable	-/-	-/-

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.



Open-Area-Test Site comparison (continued)

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

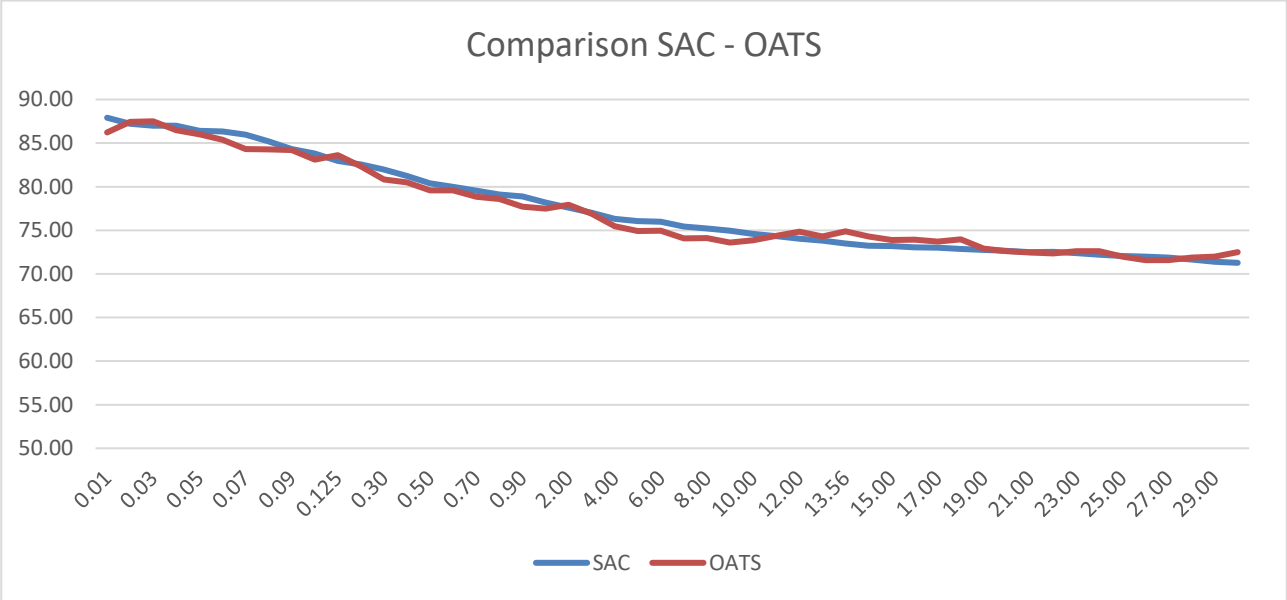
Frequency (MHz)	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	2.00	3.00	4.00	5.00
SR1 Measured power (dBµV)	81.98	81.23	80.39	80.00	79.53	79.10	78.87	78.20	77.60	77.01	76.32	76.04
OATS Measured power (dBµV)	80.84	80.49	79.58	79.58	78.85	78.59	77.69	77.50	77.91	76.90	75.45	74.90
Delta (dB)	-1.14	-0.74	-0.81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

Open-Area-Test Site comparison (continued)

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	48	-	Initial Version

END of Test Report