

Test Report

Report Number:

F231977E4

Equipment under Test (EUT):

NEARFI 2200 B

Applicant:

PHOENIX CONTACT Electronics GmbH

Manufacturer:

PHOENIX CONTACT GmbH & Co.KG



Deutsche
Akkreditierungsstelle
D-PL-17186-01-00

References

- [1] **FCC/OST MP-5 (1986)** FCC methods of measurement of radio noise emissions from industrial, scientific and medical equipment.
- [2] **FCC 47 CFR Part 2** General Rules and Regulations
- [3] **FCC 47 CFR Part 18** INDUSTRIAL, SCIENTIFIC, AND MEDICAL EQUIPMENT

Test Result

The requirements of the tests performed as shown in the overview (clause 4) were fulfilled by the equipment under test. The complete test results are presented in the following.

“Passed” indicates that the equipment under test conforms with the relevant limits of the testing standard without taking any measurement uncertainty into account. However, the measurement uncertainty is calculated and shown in this test report.

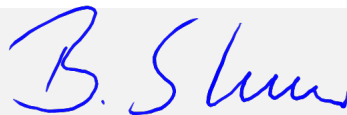
Tested and written
by:



Michael DINTER
20.11.2024

Signature

Reviewed and
approved by:



Bernd STEINER
20.11.2024

Signature

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1 Identification

1.1 Applicant

Name:	PHOENIX CONTACT Electronics GmbH
Address:	Dringenauer Straße 30, 31812 Bad Pyrmont
Country:	Germany
Name for contact purposes:	Mr. Maik STEMME
Phone:	+49 5281 946 3381
eMail address:	mstemme@phoenixcontact.com
Applicant represented during the test by the following person:	-

1.2 Manufacturer

Name:	PHOENIX CONTACT GmbH & Co.KG
Address:	Flachsmarktstr. 8, 32825 Blomberg
Country:	Germany
Name for contact purposes:	Mr. Maik STEMME
Phone:	+49 5281 946 3381
eMail address:	mstemme@phoenixcontact.com
Manufacturer represented during the test by the following person:	-

1.3 Test Laboratory

The tests were carried out by: **PHOENIX TESTLAB GmbH**
Königswinkel 10
32825 Blomberg
Germany

accredited by Deutsche Akkreditierungsstelle GmbH (DAkkS) according to DIN EN ISO/IEC 17025:2018. The accreditation is only valid for the scope of accreditation listed in the annex of the certificate D-PL-17186-01-00. FCC Test Firm Designation Number DE0004, FCC Test Firm Registration Number 469623, CAB Identifier DE0003 and ISED# 3469A.

1.4 EUT (Equipment under Test)

Test object: *	Energy coupler (Remote)
Model name: *	NEARFI 2200 B
Article number: *	1433050
FCC ID: *	YG32200B

	EUT number	
	1	2
Serial number: *	2023000002	-
PCB identifier: *	ADMV9613 (Radio module from Analog Devices); 30007761 (Interface- PCB); 30007707 (Power- PCB); 1184502 (Data-PCB)	-
Hardware version/ HVIN: *	10	-
Software version/ FVIN: *	100	-

* Declared by the applicant

1 set of EUT (primary and secondary part) were used for the tests. The overview (chapter 4) shows which EUT was used for each test case.

Note: PHOENIX TESTLAB GmbH does not take samples. The samples used for tests are provided exclusively by the applicant.

1.5 Technical Data of Equipment

General:			
Power supply EUT 1: *	DC		
Supply voltage EUT 1: *	$U_{nom} = 24 \text{ V}_{DC}$	$U_{min} = 19 \text{ V}_{DC}$	$U_{max} = 30 \text{ V}_{DC}$
Temperature range: *	-20 °C to +55 °C		
Max. Distance EUT 1 to EUT 2: *	10 mm		
Min. Distance EUT 1 to EUT 2: *	In touch		

* Declared by the applicant

Energy power part	
Frequency range: *	110 kHz – 148 kHz
Number of channels: *	-
Type of modulation: *	CW carrier only. No other data (information) is transmitted.
Data rate: *	-
Duty cycle: *	100 %
Antenna type: *	Internal coil
Antenna connector: *	None

* Declared by the applicant

Energy communication part	
Carrier frequency: *	10 MHz
Receiver bandwidth: *	2.1 MHz
Frequency range: *	8.95 MHz to 11.05 MHz
Type of modulation: *	OOK

* Declared by the applicant

Data transmission part:	
Frequency range: *	57 GHz to 64 GHz
Operation frequency: *	59.8500 GHz (NEARFI 2200 R, downlink) 63.2625 GHz (NEARFI 2200 B, uplink)
Rated output power: *	<1 dBm (e.i.r.p.)
Number of channels: *	1 (both units)
Channel spacing: *	N/A
Occupied bandwidth: *	app. 700 MHz
Antenna type: *	12 dBi gain and $\pm 20^\circ$ half power beamwidth typical
Antenna gain: *	Internal antenna only
Type of modulation: *	OOK
TX duty cycle: *	100 %

* Declared by the applicant

Ports/Connectors

Identification (NEARFI 2200 B and NEARFI 2200 R)	Connector		Length *
	EUT	Ancillary	
Power	4 pole M12 connector	4 mm laboratory plug	3.0 m
Ethernet	5 pole M12 connector	RJ45	Not used

* Provided by the applicant

Ancillary equipment		
Resistor* ²	12 Ohm resistive load	
Energy coupler (Remote) * ¹	Model name:	NEARFI 2200 R
	Article number	1433049
	Serial number:	2023000025
	Hardware version: *	10
	Software version: *	100
	FCC ID	YG32200R
-	-	

*¹ Provided by the applicant

*² Provided by the laboratory

1.6 Dates

Date of receipt of test sample:	22.11.2023
Start of test:	15.12.2023
End of test:	14.02.2024

2 Operational States

Description of function of the EUT:

The NEARFI couplers transmit power and real time Ethernet data contact-free over an air gap of a few centimetres. For contactless transmission at least two devices are needed: a base coupler and one or more remote couplers. The base coupler transfers the energy inductively to the remote coupler. The Ethernet transmission is bidirectional between base and remote.

A pre-test was performed with maximum and minimum distance between the two units, in order to find the worst case of emission. As maximum distance between NEARFI 2200 B (source) to the NEARFI 2200 R ENERGY COUPLER (REMOTE) (client) 10 mm were found, because with larger distances (up to 10 mm, as stated in the operational description) the maximum current of 2 A could not be transferred. For all tests cases this maximum distance (10 mm) between the two units causing higher emissions than the direct touch of the units. Therefore, the following states were defined as the operating conditions, which are documented in this test report:

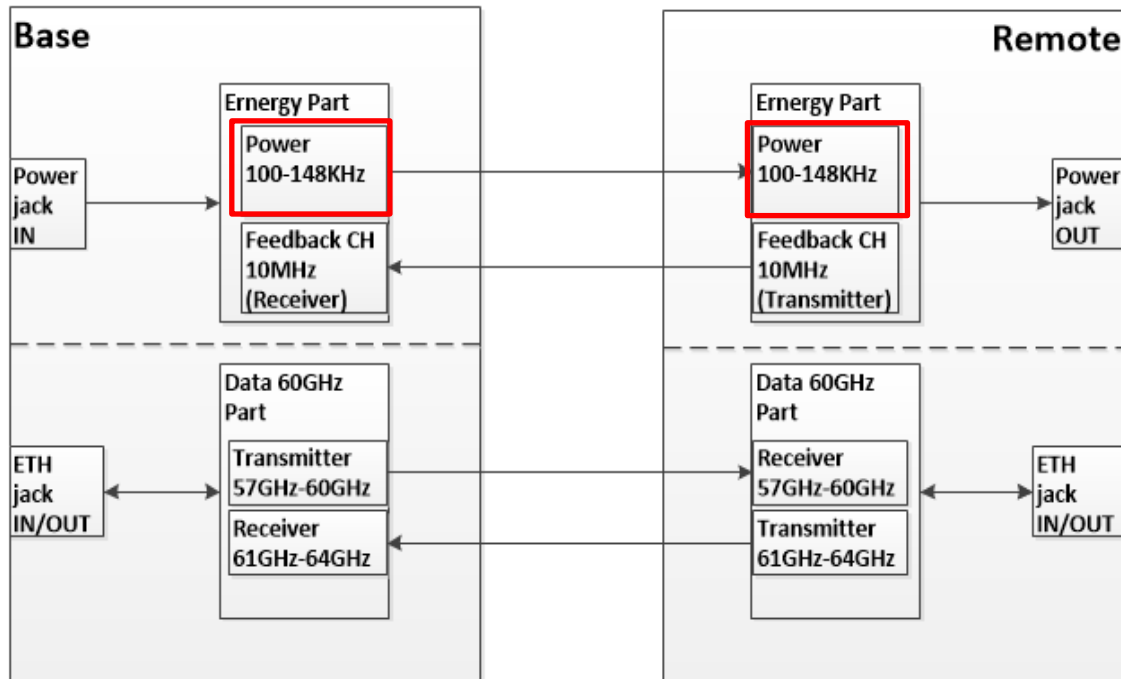
- NEARFI 2200 B (Energy coupler (Base) source) operates on a standalone base.
- Transfer Energy: NEARFI 2200 B (Energy coupler (Base) source) transfer energy to the NEARFI 2200 R (Energy coupler (Remote) client) in maximum distance (10 mm).

The following states were defined as the operating conditions:

Operational Mode	Set-up	Test	Remark
Communication 10 MHz and WPT energy	Worst case WPT highest current load	TX Base and RX Remote	Distance between EUT 1 and EUT 2: 10 mm And 2000 mA resistive load at NEARFI 2200 R
WPT energy	Only Base coupler standalone without transmit power	TX Base	Base coupler powered

Due to the fact that the transmitter for the feedback transmitter is only powered and operational if the base is present, the transmitter test could only be performed if the Base Unit is present.

The EUT was set up as follows:



3 Additional Information

The EUT was not labeled as required by FCC .

The maximum distance between EUT 1 and EUT 2 with a load current of 2000 mA was 10 mm. Therefore, this distance was chosen for the measurements.

The communication part is subject of separate test reports.

The results of the NEARFI 2200 R ENERGY COUPLER (REMOTE) (ancillary, client) were documented in another test report.

4 Overview

Conducted emissions FCC 47 CFR Part 18 section 18.307 (b) [3]					
Application	Frequency range	Limits	Reference standard	Remark	Status
AC supply line	0.15 to 0.5 MHz	66 to 56 dB(μV) (QP)*	FCC OST/MP-5 [1]	EUT 1 standalone and with ancillary client	Passed
	0.5 to 5 MHz	56 to 46 dB(μV) (AV)*			
		56 dB(μV) (QP)			
	5 to 30 MHz	46 dB(μV) (AV) 60 dB(μV) (QP) 50 dB(μV) (AV)			
Radiated emissions FCC 47 CFR Part 18 section 18.305 (b) [3]					
Application	Frequency range	Limits	Reference standard	Remark	Status
Radiated Emission	0.009 to 30 MHz 30 MHz to 1 GHz	15 μV/m (23.5 dB(μV)/m) at 300 m	FCC OST/MP-5 [1]	EUT 1 standalone and with ancillary client	Passed

*: Decreases with the logarithm of the frequency

5 Results

5.1 Test setups

5.1.1 Radiated: 9 kHz to 30 MHz

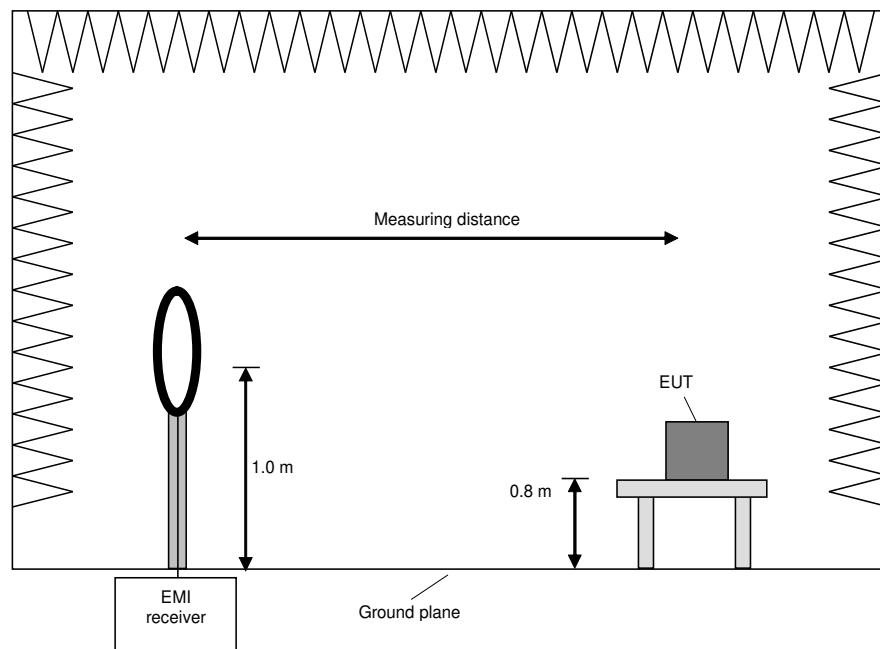
5.1.1.1 Preliminary measurement 9 kHz to 30 MHz

In the first stage a preliminary measurement is performed in a semi-anechoic chamber at a measuring distance of 3 meters. Table-top devices are set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices are placed directly on the turntable / ground plane. The setup of the equipment under test is in accordance with [1].

The frequency range 9 kHz to 30 MHz is monitored with an EMI receiver while the system and its cables are manipulated to find out the configuration with the maximum emission levels if applicable. The EMI receiver is set to MAX hold mode. The EUT and the measuring antenna are rotated around their vertical axis to find the maximum emission levels.

The resolution bandwidth of the EMI receiver is set to the following values:

Frequency range	Resolution bandwidth
9 kHz to 150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz



Procedure preliminary measurement:

Pre-scans are performed in the frequency range 9 kHz to 150 kHz and 150 kHz to 30 MHz.

The following procedure is used:

- 1) Monitor the frequency range with the measuring antenna facing the EUT and an EUT / turntable azimuth of 0 °.
- 2) Manipulate the system cables to produce the maximum levels of emissions.
- 3) Rotate the EUT by 360 ° to maximize the detected signals.
- 4) Measure the frequencies of the highest detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency values.
- 5) If the EUT is portable or ceiling mounted, repeat steps 1 to 4 with other orientations (x,y,z) of the EUT.
- 6) Rotate the measuring antenna and repeat steps 1 to 5.

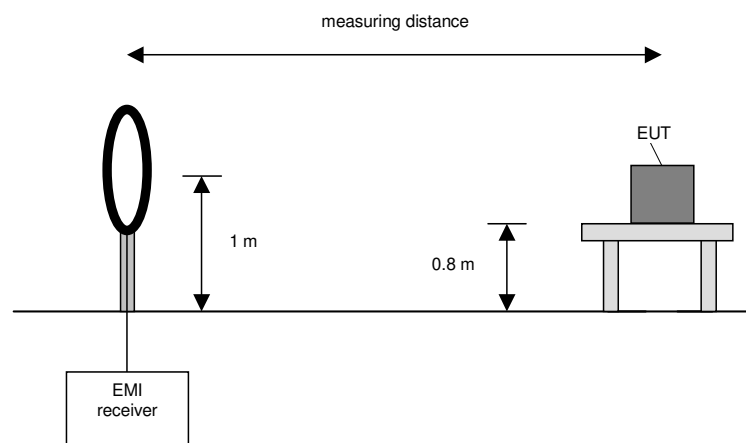
5.1.1.2 Final measurement 9 kHz to 30 MHz

In the second stage a final measurement is performed on an open area test site with no conducting ground plane at a measuring distance of 3 m, 10 m, 30 m or 300 m. If the standard requires larger measuring distances for a given frequency, the results are extrapolated with $1/d$, as stated in MP-5 [1]. The final measurement is performed with an EMI receiver set to average detector for FCC measurements and Quasi-Peak for RSS measurements.

At the frequencies, which were detected during the preliminary measurements, the final measurement is performed while rotating the EUT and the measuring antenna in the range of 0° to 360° around their vertical axis until the maximum level value is found.

The resolution bandwidth of the EMI receiver is set to the following values:

Frequency range	Resolution bandwidth	Measuring time
9 kHz to 150 kHz	200 Hz	1 s
150 kHz to 30 MHz	9 kHz	1 s



Procedure final measurement:

The following procedure is used:

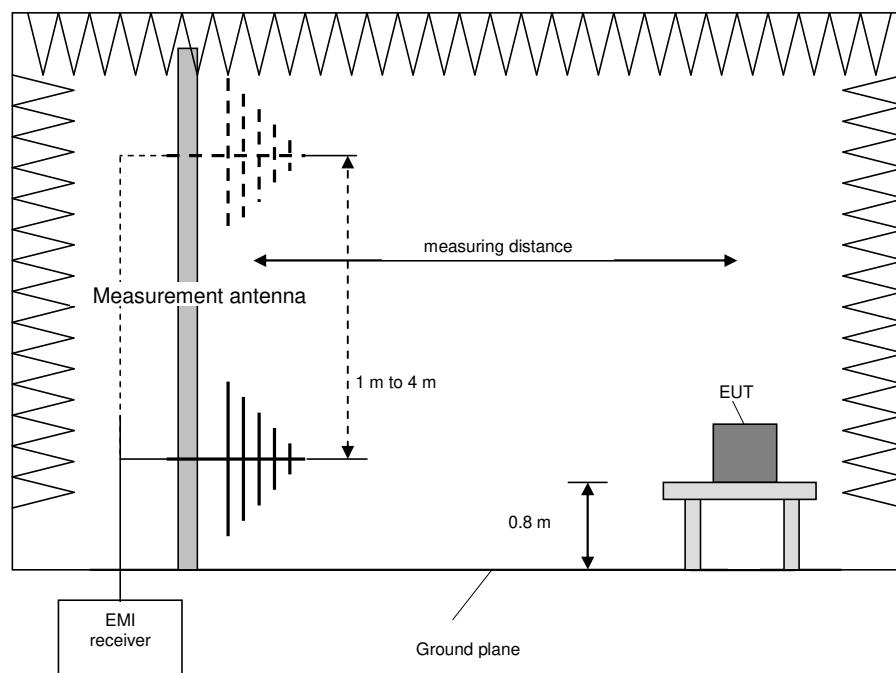
- 1) Monitor the selected frequencies from the preliminary measurement with the measuring antenna facing the EUT and an EUT azimuth of 0° .
- 2) Rotate the EUT by 360° to maximize the detected signals.
- 3) Rotate the measuring antenna and repeat steps 1 to 2 until the maximum value is found and note it.
- 4) If the EUT is portable or ceiling mounted, repeat steps 1 to 3 with other orientations (x,y,z) of the EUT.

5.1.2 Preliminary and final measurement (30 MHz to 1 GHz)

The preliminary and final measurements were conducted in a semi-anechoic chamber with a metal ground plane. During the test the EUT will be rotated in the range of 0 ° to 360 °, the measuring antenna will be set to horizontal and vertical polarization and raised and lowered in the range from 1 m to 4 m to find the maximum level of emissions.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Test	Frequency range	Resolution bandwidth
Preliminary measurement	30 MHz to 1 GHz	100 kHz
Frequency peak search	+ / - 1 MHz	10 kHz
Final measurement	30 MHz to 1 GHz	120 kHz



Procedure preliminary measurement:

The following procedure is used:

1. Set the measurement antenna to 1 m height.
2. Monitor the frequency range at vertical polarisation and a EUT azimuth of 0 °.
3. Rotate the EUT by 360° to maximize the detected signals.
4. Repeat 1) to 2) with the vertical polarisation of the measuring antenna.
5. Increase the height of the antenna for 0.5 m and repeat steps 2 – 4 until the final height of 4 m is reached.
6. The highest values for each frequency will be saved by the software, including the antenna height, measurement antenna polarization and turntable azimuth for that value.

Procedure final measurement:

The following procedure is used:

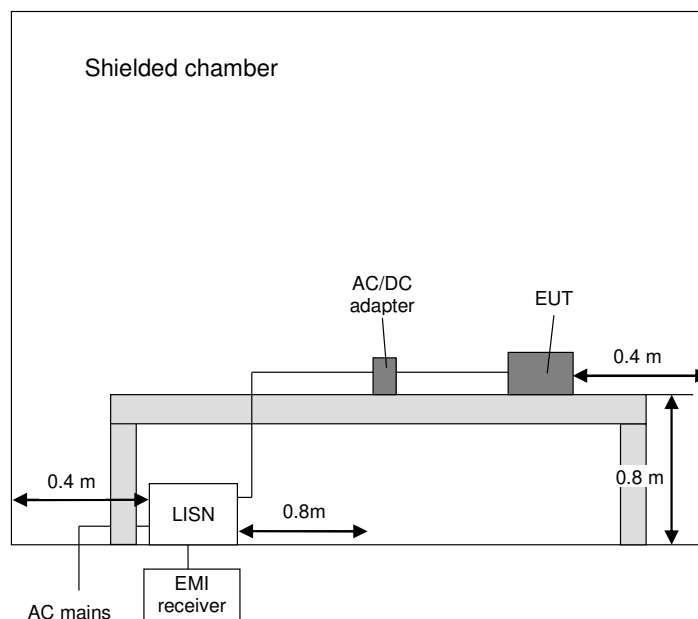
1. Select the highest frequency peaks to the limit for the final measurement.
2. The software will determine the exact peak frequencies by doing a partial scan with reduced RBW with +/- 10 times the RBW of the pre-scan of the selected peaks.
3. If the EUT is portable or ceiling mounted, find the worst case EUT position (x,y,z) for the final test.
4. The worst measurement antenna height is found by the measurement software by varying the measurement antenna height by +/- 0.5 m from the value obtained in the preliminary measurement, and to monitor the emission level.
5. The worst azimuth turntable position is found by varying the turntable azimuth by +/- 30° from the value obtained in the preliminary measurement, and to monitor the emission level.
6. The final measurement is performed at the worst case antenna height and the worst case turntable azimuth
7. Steps 2 – 6 will be repeated for each frequency peak selected in step 1.

5.1.3 Conducted emission: AC power line

The test is carried out in a shielded chamber. Table-top devices are set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm above the ground plane. Floor-standing devices are placed directly on the ground plane. In case of DC powered equipment, which is not exclusively powered by a battery, it is connected to the LISN via a suitable AC/DC adaptor. The setup of the equipment under test is in accordance with [1].

The frequency range 150 kHz to 30 MHz is measured with an EMI receiver set to MAX hold mode with Peak and Average detectors and a resolution bandwidth of 9 kHz. A scan is carried out on the phase and neutral line of the AC mains network. If emissions less than 10 dB below the appropriate limit are detected, these emissions are measured with an Average and Quasi-peak detector on all lines.

Frequency range	Resolution bandwidth	Measuring time
150 kHz to 30 MHz	9 kHz	5 s



5.2 AC power line conducted emissions

5.2.1 Test setup (AC power line conducted emissions)

Test setup (Conducted emissions on power supply lines)			
Used	Setup	See sub-clause	Comment
☒	Conducted: AC power line	5.1.4	-
☐	Not applicable, because ...	-	-

5.2.2 Test method (AC power line conducted emissions)

Test setup (Conducted emissions on power supply lines)				
Used	Clause [1]	Name of method	Sub-clause	Comment
☒	6.2	Tabletop equipment testing	5.1.3	Provided AC switching power adaptor
☐	6.2	Floor-standing equipment testing	-	-

The AC power adaptor provided by the applicant was used for the tests:
HC24-2.4-AG from bel power solutions.

The power adaptor itself was supplied by 120 V_{AC} 60 Hz.

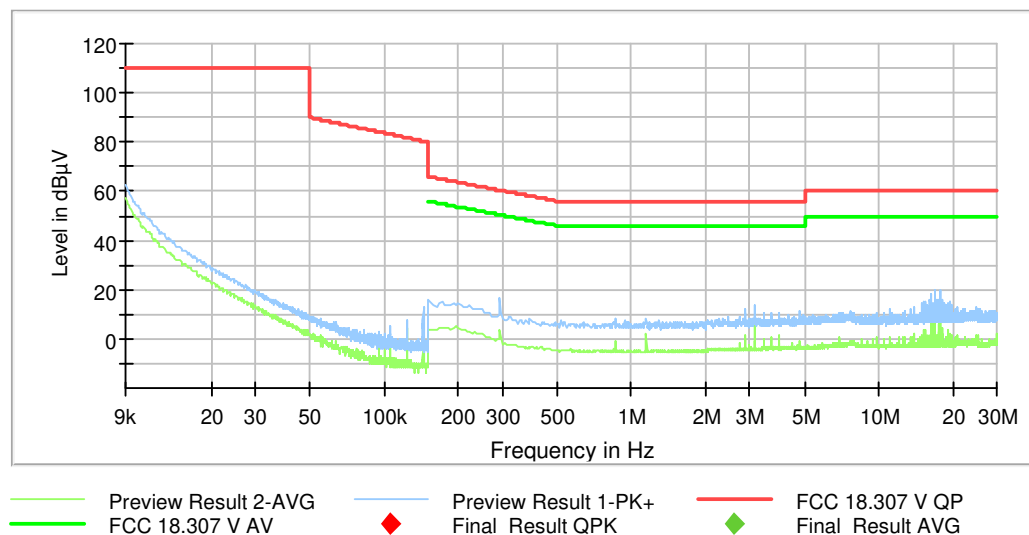
5.2.3 Results of conducted emission measurement on AC mains

Ambient temperature:	22 °C
Relative humidity:	37 %

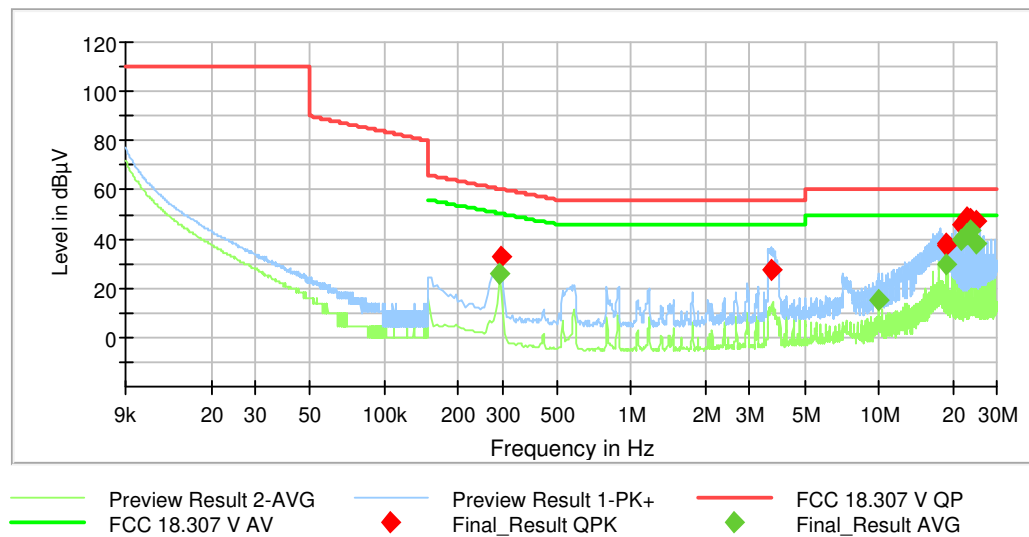
Date:	14.02.2024
Tested by:	Th. KÜHN

The curves in the diagrams below only represent for each frequency point the maximum measured value of all preliminary measurements which were made for each power supply line. The top measured curve represents the peak measurement and the bottom measured curve the average measurement. The Quasi-peak measured points are marked by ◆ and the average measured ▼.

NEARFI 2200 B Energy coupler (Base) without client:



NEARFI 2200 B Energy coupler (Base) and NEARFI 2200 R ENERGY COUPLER (REMOTE) (client, ancillary):



Frequency [MHz]	Result Quasi-peak [dB(μ V)]	Result average [dB(μ V)]	Limit [dB(μ V)]	Margin [dB]	Line	PE
0.294000	---	26.15	50.41	24.26	L1	GND
0.295800	33.02	---	60.36	27.34	L1	FLO
3.678000	27.67	---	56.00	28.33	L1	GND
10.020300	---	15.11	50.00	34.89	L1	FLO
18.569400	---	29.84	50.00	20.16	N	FLO
18.570300	38.26	---	60.00	21.74	N	FLO
18.573000	37.68	---	60.00	22.32	L1	FLO
21.586200	---	39.45	50.00	10.55	N	GND
21.594300	45.58	---	60.00	14.42	N	FLO
22.594200	49.12	---	60.00	10.88	N	GND
22.595100	---	41.74	50.00	8.26	N	FLO
23.599500	---	43.66	50.00	6.34	N	FLO
23.603100	47.82	---	60.00	12.18	N	FLO
24.591300	46.97	---	60.00	13.03	N	FLO
24.596700	---	38.23	50.00	11.77	L1	GND

Test result: Passed

Test equipment (please refer to chapter 7 for details)

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5.3 Radiated emissions

5.3.1 Test setup (Maximum unwanted emissions)

Test setup (Maximum unwanted emissions)			
Used	Setup	See sub-clause	Comment
☒	Radiated: 9 kHz to 30 MHz / 30 MHz to 1 GHz	5.1.2 / 5.1.3	-

5.3.2 Test method (Maximum unwanted emissions)

Used	Sub-Clause	Name of method	Applicability	Comment
☒	5.1.2 to 5.1.3	Unwanted radiated emissions	No limitations	-

5.3.3 Test results (Maximum unwanted emissions)

5.3.3.1 Test results preliminary measurement 9 kHz to 30 MHz

Ambient temperature:	23 °C
Relative humidity:	25 %

Date:	07.02.2024
Tested by:	M.DINTER

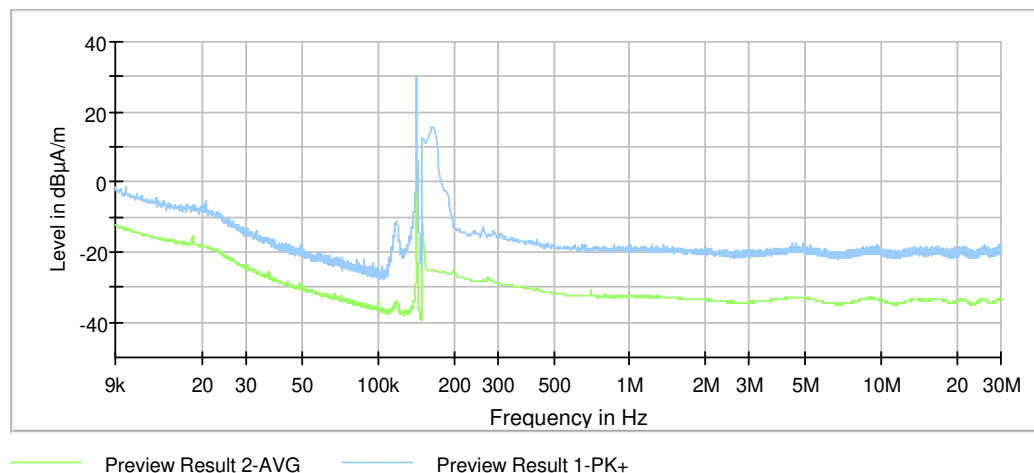
Position of EUT: For tests for f between 9 kHz to 30 MHz, the EUT was set-up on a table with a height of 80 cm. The distance between EUT and antenna was 3 m.

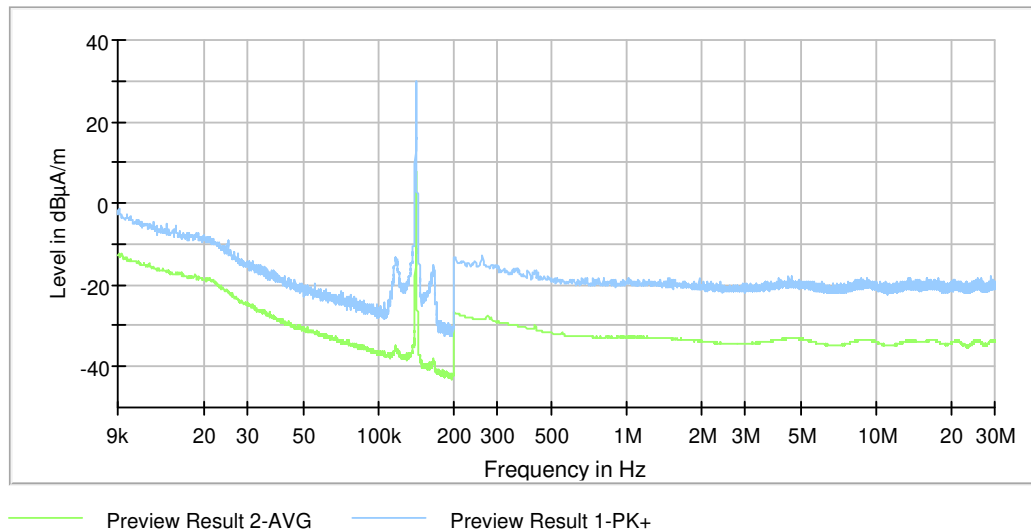
Cable guide: For detail information of test set-up and the cable guide refer to the pictures in the annex A in the test report.

Remark: All 3 orthogonal planes were tested separately, the plots below a showing the maximum of all positions.

Spurious emissions from 9 kHz to 30 MHz:

NEARFI 2200 B Energy coupler (Base) without client:





Remark: The peak at 150 kHz is caused by the switch of the resolution bandwidth from 200 Hz to 9 kHz which leads to the effect that the fundamental at 144 kHz is falling into the RBW filter at 150 kHz. A measurement with 200 Hz resolution bandwidth has shown that the emission at 150 kHz is nearby the noise floor of the system. Therefore, the shown peak in the preliminary measurement needn't be considered for the final measurement. The preliminary measurement results are shown in the unit dBμA/m. The conversion factor to dBμV/m is + 51.5 dB.

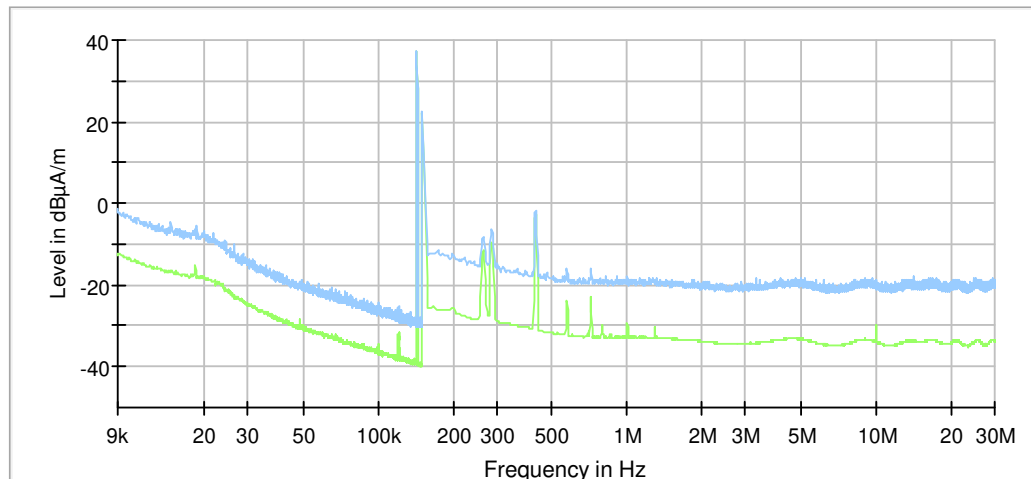
During the preliminary measurement, the following emissions were found:

142.7 kHz

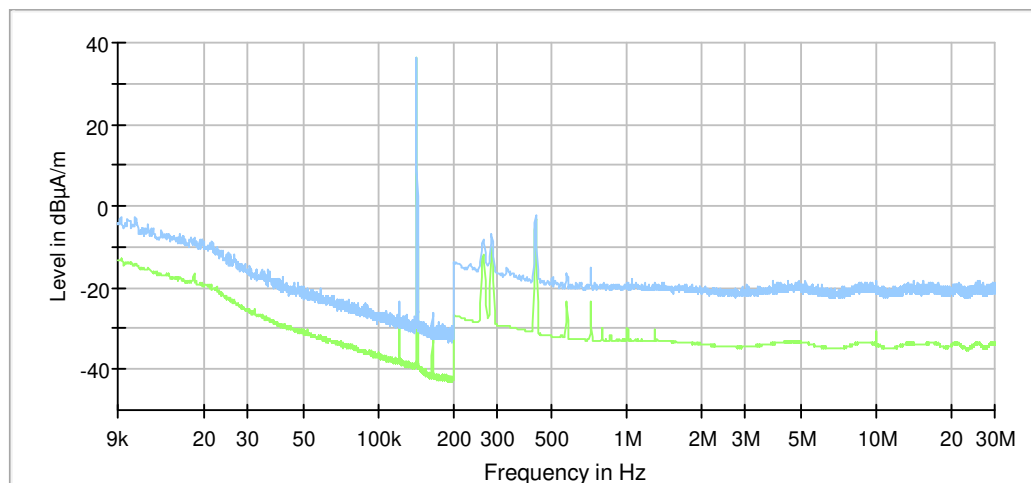
On these frequencies a final measurement on an outdoor test site has to be carried out. The results of this final measurement are presented in 5.3.3.2 of this test report.

NEARFI 2200 B Energy coupler (Base) and NEARFI 2200 R ENERGY COUPLER (REMOTE) (client, ancillary):

Separation distance of 10 mm between source and client and output current of 2 A at remote.
(Distance 10 mm, with 2 A load)



Preview Result 2-AVG Preview Result 1-PK+



Preview Result 2-AVG Preview Result 1-PK+

Remark:

The peak at 150 kHz is caused by the switch of the resolution bandwidth from 200 Hz to 9 kHz which leads to the effect that the fundamental at 145 kHz is falling in to the RBW filter at 150 kHz. A measurement with 200 Hz resolution bandwidth has shown that the emission at 150 kHz is nearby the noise floor of the system. Therefore, the shown peak in the preliminary measurement needn't be considered for the final measurement.
The preliminary measurement results are shown in the unit dBμA/m. The conversion factor to dBμV/m is + 51.5 dB.

During the preliminary measurement, the following emissions were found:

143.7 kHz, 265 kHz, 287 kHz and 431 kHz.

On these frequencies a final measurement on an outdoor test site has to be carried out. The results of this final measurement are presented in 5.3.3.2 of this test report.

Test equipment (please refer to chapter 7 for details)
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1 – 8, 27

5.3.3.2 Test results final measurement 9 kHz to 30 MHz

Ambient temperature:	2 °C
Relative humidity:	56 %

Date:	08.02.2024
Tested by:	M.DINTER

The results of the standard subsequent measurement at the outdoor test site are indicated in the tables below.

Calculations:

Result @ norm. dist. [dB(μV/m)] = Reading [dB(μV)] + AF [dB/m] + Distance corr. fact. (if applicable) [dB]

Result @ norm. dist. [dB(μA/m)] = Result @ norm. dist. [dB(μV/m)] – 20 x log₁₀ (377 Ω)

Margin [dB] = Limit [dB(μV/μA/m)] - Result [dB(μV/μA/m)]

NEARFI 2200 B Energy coupler (Base) without client according to [47 CFR 18.305 \(b\)](#):

The wanted signal was measured with two different measuring distances in order to calculate a distance correction factor. For all other distances a distance correction factor of 20 dB / decade (1/d) was used.

Frequency [MHz]	Level at 3 m distance (AV) [dB(μV)]	Level at 10 m distance (AV) [dB(μV)]	Difference from 3 to 10 m [dB]	Distance correction factor [dB/decade]
0.1427	73.8	45.2	28.6	57.2

The limits as well as the measured results (levels) refer to [47 CFR 18.305 \(b\)](#) while taking in account the specified requirements for a 3 | 300 m measuring distance.

Results 9 kHz - 30 MHz										
Frequency [MHz]	Reading @ measuring distance [dB(μV)]	Result @ norm. distance [dB(μV/m)]	Limit acc. 18.305 [dB(μV/m)]	Margin [dB]	Detector	Antenna factor [dB/m]	Measuring distance [m]	Normative distance [m]	Distance correction factor * [dB]	Position #
0.1427	53.5	-40.6	23.5	64.1	CAV	20.3	3	300	-114.4	1
		No further significant emission was found except the wanted fundamental signal, therefore, no final measurement was carried out.								

*: Distance correction according to ANSI C63.10 clause 6.4.4.2 [1].

NEARFI 2200 B Energy coupler (Base) and NEARFI 2200 R ENERGY COUPLER (REMOTE) (client, ancillary):

Separation distance of 10 mm between source and client and output current of 2 A at remote.

The wanted signal was measured with two different measuring distances in order to calculate a distance correction factor. For all other distances a distance correction factor of 20 dB / decade (1/d) was used.

Frequency [MHz]	Level at 3 m distance (AV) [dB(μV)]	Level at 10 m distance (AV) [dB(μV)]	Difference from 3 to 10 m [dB]	Distance correction factor [dB/decade]
0.1437	88.2	59.4	28.8	57.6

The limits as well as the measured results (levels) refer to [47 CFR 18.305 \(b\)](#) while taking into account the specified requirements for a 3 | 10 m measuring distance.

Results 9 kHz - 30 MHz										
Frequency [MHz]	Reading @ measuring distance [dB(μV)]	Result @ norm. distance [dB(μV/m)]	Limit acc. 18.305 [dB(μV/m)]	Margin [dB]	Detector	Antenna factor [dB/m]	Measuring distance [m]	Normative distance [m]	Distance correction factor * [dB]	Position #
0.1437	67.9	-27.0	23.5	50.5	CAV	20.3	3	300	-115.2	1
0.2650	23.3	3.5	23.5	20	CAV	20.2	3	300	-40.0	1
0.2880	23.5	3.7	23.5	18.5	CAV	20.2	3	300	-40.0	1
0.4310	27.8	8.0	23.5	15.1	CAV	20.2	3	300	-40.0	1

*: Distance correction according to ANSI C63.10 clause 6.4.4.2 [1].

Test result: Passed

Test equipment (please refer to chapter 7 for details)
9 – 11, 27

5.3.3.3 Test results preliminary measurement 30 MHz to 1 GHz

Ambient temperature:	24 °C
Relative humidity:	25 %

Date:	07.02.2024
Tested by:	M.DINTER

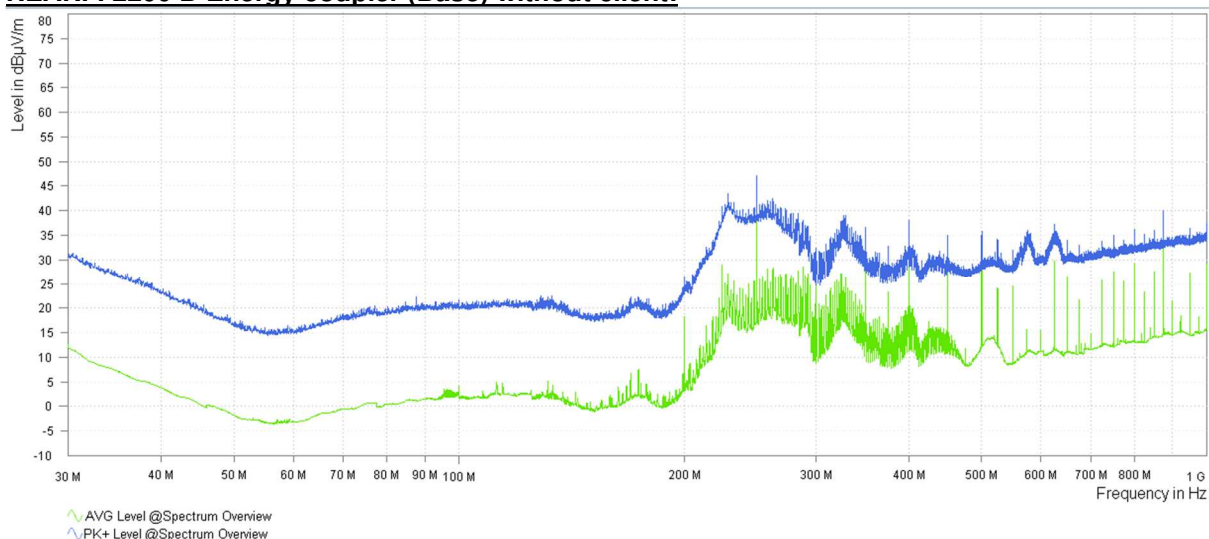
Position of EUT: For tests for f between 30 MHz to 1 GHz, the EUT was set-up on a table with a height of 80 cm. The distance between EUT and the antenna was 3 m.

Cable guide: For detail information of test set-up and the cable guide refer to the pictures in the annex A in the test report.

Test record: Plots for each frequency range are submitted below.

Remark: All 3 orthogonal planes were tested separately

NEARFI 2200 B Energy coupler (Base) without client:

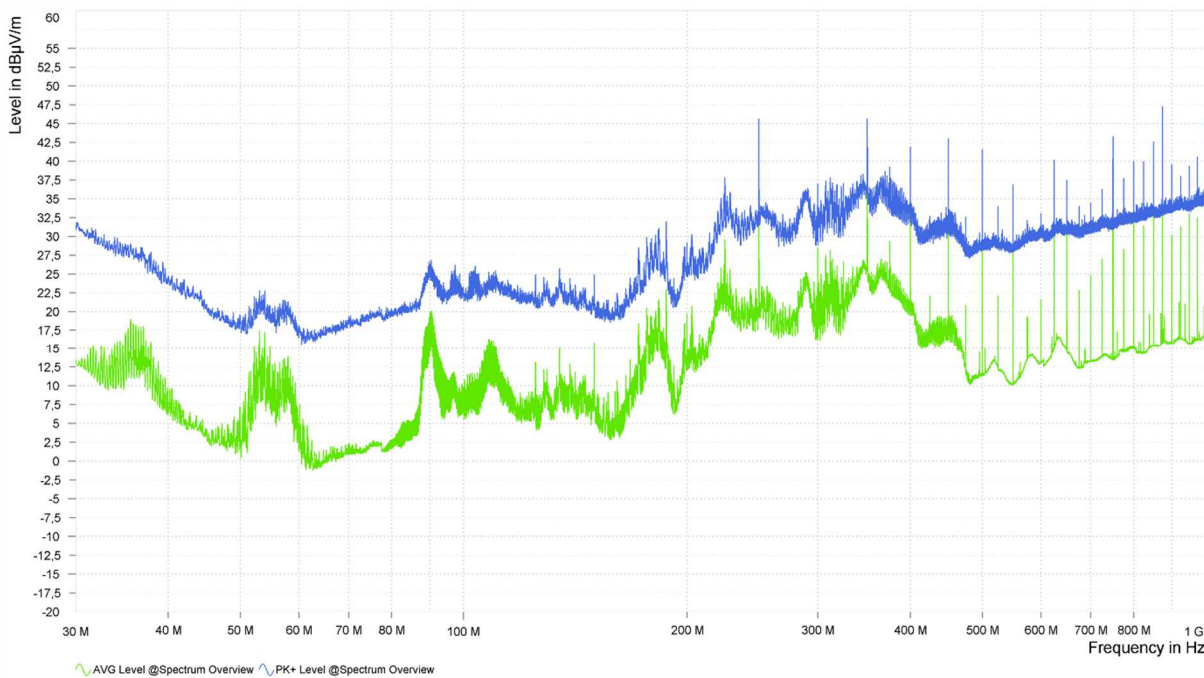


During the preliminary measurement, the following emissions were found:
228.94 MHz, 229.12 MHz, 250.00 MHz, 262.84 MHz, 349.99 MHz, 400.00 MHz 625.00 MHz and 874.99 MHz.

On these frequencies a final measurement has to be carried out. The results of this final measurement are presented in 5.3.3.4 of this test report.

NEARFI 2200 B Energy coupler (Base) and NEARFI 2200 R ENERGY COUPLER (REMOTE) (client, ancillary):

Separation distance of 10 mm between source and client and output current of 2 A at remote.



During the preliminary measurement, the following emissions were found:

225.00 MHz, 249.99 MHz, 350.01 MHz, 399.99 MHz, 450.00 MHz, 500.01 MHz 750.00MHz and 875.01MHz

On these frequencies a final measurement has to be carried out. The results of this final measurement are presented in 5.3.3.4 of this test report.

Test equipment (please refer to chapter 7 for details)

2, 13 - 21

5.3.3.4 Test results final measurement 30 MHz to 1 GHz

Ambient temperature:	24 °C
Relative humidity:	25 %

Date:	07.02.2024
Tested by:	M.DINTER

The results of the standard subsequent measurement inside the semi anechoic chamber are indicated in the tables below. The measurement was carried out with a 3 m measurement distance, measured with the Quasi-peak and average detector with a measuring time of 1 s. If applicable a distance correction factor of 20 dB / decade (1/d) was used.

Calculations:

Result [dB(μV/m)] = Reading [dB(μV)] + Correction [dB/m] + Distance corr. fact. (if applicable) [dB]
 Correction [dB] = AF [dB/m] + Cable attenuation [dB] + optional preamp gain [dB]
 Margin [dB] = Limit [dB(μV/m)] - Result [dB(μV/m)]

NEARFI 2200 B Energy coupler (Base) without client:

The limits as well as the measured results (levels) refer to [47 CFR 18.305 \(b\)](#) while taking into account the specified requirements for a 3 | 300 m measuring distance.

Results 30 MHz – 1 GHz											
Frequency	Reading @ measuring distance	Result (AV) @ norm. distance	Limit acc. 18.305	Margin	Correction	Normative distance	Distance correction factor *	Height	Azimuth	Pol.	Position
[MHz]	[dB(μV)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[dB/m]	[m]	[dB]	[m]	[deg]		#
228.94	-29.19	-12.76	23.5	36.26	16.43	300.0	-40.0	1.03	166	V	1
229.12	-28.76	-12.32	23.5	35.82	16.44	300.0	-40.0	1.03	148	H	1
250.00	-14.91	2.13	23.5	21.37	17.04	300.0	-40.0	1.05	202	H	1
262.84	-29.47	-11.75	23.5	35.25	17.72	300.0	-40.0	1.01	205	H	1
349.99	-29.15	-8.80	23.5	32.30	20.35	300.0	-40.0	1.00	88	V	1
400.00	-26.85	-5.18	23.5	28.68	21.67	300.0	-40.0	1.06	242	V	1
625.00	-36.03	-10.10	23.5	33.60	25.93	300.0	-40.0	1.05	314	H	1
874.99	-33.22	-4.17	23.5	27.67	29.05	300.0	-40.0	1.01	260	H	1

NEARFI 2200 B Energy coupler (Base) and NEARFI 2200 R ENERGY COUPLER (REMOTE) (client, ancillary):

Separation distance of 10 mm between source and client and output current of 2 A at remote.

The limits as well as the measured results (levels) refer to [47 CFR 18.305 \(b\)](#) while taking into account the specified requirements for a 3 | 300 m measuring distance.

Results 30 MHz – 1 GHz											
Frequency	Reading @ measuring distance	Result (AV) @ norm. distance	Limit acc. 18.305	Margin	Correction	Normative distance	Distance correction factor *	Height	Azimuth	Pol.	Position
[MHz]	[dB(μV)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[dB/m]	[m]	[dB]	[m]	[deg]		#
225.00	-26.69	-10.62	23.5	34.12	16.07	300	-40.0	1.03	166	V	1
249.99	-19.69	-2.65	23.5	26.15	17.04	300	-40.0	1.03	148	H	1
350.01	-23.66	-3.31	23.5	26.81	20.35	300	-40.0	1.05	202	H	1
399.99	-28.46	-6.79	23.5	30.29	21.67	300	-40.0	1.01	205	H	1
450.00	-25.83	-3.12	23.5	26.62	22.71	300	-40.0	1.00	88	V	1
500.01	-36.09	-11.93	23.5	35.43	24.16	300	-40.0	1.06	242	V	1
750.00	-34.5	-6.96	23.5	30.46	27.54	300	-40.0	1.05	314	H	1
875.01	-29.22	-0.17	23.5	23.67	29.05	300	-40.0	1.01	260	H	1

Test result: Passed

Test equipment (please refer to chapter 7 for details)
12 – 20, 27

6 Measurement Uncertainties

Conducted measurements		
Measurement method	Standard used for calculating measurement uncertainty	Expanded measurement uncertainty (95 %) U_{lab}
Bandwidth measurements	-	9.0×10^{-8}
Conducted emissions from 9 kHz to 150 MHz with LISN	CISPR 16-4-2	3.8 dB
Conducted emissions from 150 kHz to 30 MHz with LISN	CISPR 16-4-2	2.8 dB

Radiated measurements		
Bandwidth measurements		
(Semi-) Anechoic chamber	-	9.0×10^{-8}
OATS	-	9.0×10^{-8}
Test fixture	-	9.1×10^{-8}
Radiated field strength M276		
R&S HL562E @ 3 m 30 MHz – 1 GHz	CISPR 16-4-2	4.8 dB
OATS		
Field strength measurements below 30 MHz on OATS without ground plane	-	4.4 dB

7 Test Equipment used for Tests

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal Due
1	Semi anechoic chamber	SAC-5	Albatross Projects		482784	Calibration not necessary	
2	RF Switch Matrix	OSP 220	Rohde & Schwarz	101376	483141	Calibration not necessary	
3	RF Switch Matrix	OSP 220	Rohde & Schwarz	101367	483142	Calibration not necessary	
4	RF Switch Matrix	OSP 220	Rohde & Schwarz	101423	483143	Calibration not necessary	
5	Software	EMC32 Ver. 10.60.15	Rohde & Schwarz	100622	483150	Calibration not necessary	
6	Antenna Mast	BAM 4.0P	Maturo	-	483222	Calibration not necessary	
7	Loop antenna	HFH2-Z2	Rohde & Schwarz	832609/014	480059	22.02.2022 + 21.02.2024	02.2024 + 02.2026
8	EMI Receiver / Spectrum Analyser	ESR7	Rohde & Schwarz	101252	481734	15.02.2022 + 22.02.2024	02.2024 + 02.2026
9	Loop antenna	HFH2-Z2	Rohde & Schwarz	100417	481912	22.02.2022 + 21.02.2024	02.2024 + 02.2026
10	Outdoor test site	-	PHOENIX TESTLAB GmbH	-	480293	Calibration not necessary	
11	EMI Receiver / Spectrum Analyser	ESI 40	Rohde & Schwarz	100064/040	480355	18.02.2022 + 20.02.2024	02.2024 + 02.2026
12	Attenuator 6 dB	WA2-6	Weinschel	8254	410119	Calibration not necessary	
13	Ultralog Antenna	HL562E	Rohde & Schwarz	101079	482978	18.03.2021 + 24.04.2024	03.2024 + 04.2027
14	EMC test software	Elektra V5.05.00	Rohde&Schwarz		483755	Calibration not necessary	
15	RF Switch Matrix	OSP220	Rohde & Schwarz	101391	482976	Calibration not necessary	
16	Turntable	TT3.0-3t	Maturo	825/2612/.01	483224	Calibration not necessary	
17	Antennasupport	BAM 4.5-P-10kg	Maturo	222/2612.01	483225	Calibration not necessary	
18	Controller	NCD	Maturo	474/2612.01	483226	Calibration not necessary	
19	Semi Anechoic Chamber M276	SAC5-2	Albatross Projects	C62128-A540-A138-10-0006	483227	Calibration not necessary	
20	EMI Testreceiver	ESW44	Rohde & Schwarz	101828	482979	08.12.2023 + 21.02.2024	02.2024 + 02.2026
21	LISN	NSLK8128	Schwarzbeck	8128161	480138	15.02.2022 + 28.02.2024	02.2024 + 02.2026
22	AC power supply	AC6803A AC Quelle 2000VA	Keysight	JPVJ002509	482350	Calibration not necessary	
23	Software	EMC32	Rohde & Schwarz	100061	481022	Calibration not necessary	
24	Shielded chamber M4	B83117-S1-X158	Siemens	190075	480088	Calibration not necessary	
25	EMI Receiver / Spectrum Analyser	ESIB 26	Rohde & Schwarz	100292	481182	16.02.2022 + 22.02.2024	02.2024 + 02.2026
26	Transient Filter Limiter	CFL 9206A	Teseq GmbH	38268	481982	15.02.2022 + 28.03.2024	02.2024 + 03.2026
27	Power Supply	TOE8852 (DC)	Toellner Electronic Inst.	51712	480233	Calibration not necessary	

8 Test site Verification

Test equipment	PM. No.	Frequency range	Type of validation	According to	Val. Date	Val Due
Shielded chamber M4	480088	9 kHz – 30 MHz	GND-Plane	ANSI C63.4-2014	08.11.2022	07.11.2025
OATS Outdoor	480293	9 kHz – 30 MHz	-	ANSI C63.4-2014	-	-
Semi anechoic chamber M276	483227	30 – 1000 MHz	NSA	ANSI C63.4-2014 ANSI C63.4a-2017	01.03.2023	28.02.2026
Semi anechoic chamber M276	483227	1 -18 GHz	SVSWR	CISPR 16-1-4 + Cor1:2010 + A1:2012 +A2:2017	28.02.2023	27.02.2026

9 Report History

Report Number	Date	Comment
F231977E4	20.11.2024	Initial Test Report
-	-	-
-	-	-

10 List of Annexes

Annex A Test Setup Photos

6 pages

----- end of test report -----