TEST REPORT # EMCC-150524DC, 2019-08-09

EQUIPMENT UNDER TEST:

Trade Name:	Kiln Data Collector
Type/Model:	RX-2T
Serial Number(s):	6626
Application:	Measurement of wood moisture, wood temperature, dry bulb temperature, wet bulb temperature
FCC ID:	2AE3ORX-KILN-I
Manufacturer:	Fidemco LLC
Address:	PO Box 20702 Portland, OR 97294 USA
Name:	Mr Martin Glaeser
Phone:	+1 (503) 830-5517
E-Mail:	martin@fidemco.com
RELEVANT STANDARD(S) :	47 CFR § 15.107 47 CFR § 15.109
MEASUREMENT PROCEDURE: :	ANSI C63.4-2014

TEST REPORT PREPARED BY:

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Tested:

Dominik Krüger

Checked:

Reinhard Sauerschell
- Head of Laboratory -

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0 REVISION HISTORY

Project number	Issue date	Chapter	Description
150524DC	2019-08-09	n.a.	Initial issue

1 GENERAL INFORMATION

1.1 Purpose

The purpose of this report is to show compliance with the 47 CFR § 15.107 and 47 CFR § 15.109 requirements applicable to unintentional radiators (subpart B).

1.2 Limits and Reservations

The test results in this report apply only to the particular equipment under test (EUT) as declared in this report. This test report shall not be reproduced except in full without the written permission of EMCCons DR. RAŠEK GmbH & Co. KG.

1.3 Test Laboratory

Test Laboratory:	EMCCons DR. RAŠEK GmbH & Co. KG
Accreditation No.:	D-PL-12067-01-04
Address of Labs I, II, III and Head Office:	EMCCons DR. RAŠEK GmbH & Co. KG Boelwiese 8 91320 Ebermannstadt GERMANY
Address of Labs IV and V:	EMCCons DR. RAŠEK GmbH & Co. KG Stoernhofer Berg 15 91364 Unterleinleiter GERMANY
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Web:	www.emcc.de

1.4 Customer

Company Name:	Fidemco LLC
Street:	PO Box 20702
City:	Portland, OR 97294
Country:	USA
Name:	Mr Martin Glaeser
Phone:	+1 (503) 830-5517
Fax:	n/a
E-Mail:	martin@fidemco.com

1.5 Manufacturer

Company Name:	Fidemco LLC
Street:	PO Box 20702
City:	Portland, OR 97294
Country:	USA
Phone:	+1 (503) 830-5517
E-Mail:	martin@fidemco.com

1.6 Dates and Test Location

Date of receipt of EUT: 2019-05-13
Test Date: 2019-05-14 and 2019-05-15
Test Location: Lab IV

1.7 Ordering Information

Purchase Order: PO 020619
Date: 2019-02-07
Vendor-Number: n/a

1.8 Climatic Conditions

Date	Temperature	Relative Humidity	Air Pressure	Lab	Customer attended tests
--	°C	%	hPa	--	--
2019-05-14	23	32	981	IV	Mr Glaeser
2019-05-15	23	36	973	IV	Mr Glaeser

2 PRODUCT DESCRIPTION

2.1 Equipment Under Test (EUT)

The following data is based on customer's information.

Manufacturer:	Fidemco LLC
Type:	RX-2T
Application:	Measurement of wood moisture, wood temperature, dry bulb temperature, wet bulb temperature
No of variants:	0
Serial No(s):	6626
Firmware version:	2.01-916 / 2.ce
Hardware version:	R10
FCC ID:	2AE3ORX-KILN-I
Highest internal frequency:	916.5 MHz
RX operating frequency range:	902 ... 928 MHz
RX frequency:	916.5 MHz
No of operating channels:	1
Power source:	DC Power Supply (9 ... 24 V_{DC})
Voltage for testing:	Laboratory Power Supply (20 V_{DC})
Ports:	RS485 signal line
Antenna:	Whip antenna
Max. antenna gain:	n/a
Remarks:	None

2.2 Intended Use

The following description was taken from product datasheet “Operational Description Kiln Data Collector”.

The Kiln Data Collector determines the electrical resistance of 2 sensors:
- Pt100 connected directly to circuitry
- (optional) Pt100 connected permanently via shielded cable (length 1m) to circuitry

The results are converted into temperature readings.
In addition, readings originating from Kiln Data Transmitters are received and stored.
Upon request from a host, all readings are downloaded to the host via a RS485-communication line.

2.3 EUT Peripherals/Simulators

None.

2.4 Mode of operation during testing and test setup

The equipment under test (EUT) was operated during the tests under the following conditions:

Mode: Active

The device is powered by an external 20 VDC supply.
The microcontroller is always running.

Every 6 sec the microcontroller controls the measuring circuitry and interprets the measuring signals to determine new temperature readings.

The microcontroller configures the receiver circuitry for 916.5MHz in on-off keyed modulation mode.
When data arrives from a Kiln Data Transmitter the signal is picked up by the receiver circuitry and serially sent to the microcontroller at 2400Bd.
A permanently attached ¼-wave length stub is used as antenna.
Whenever a request message arrives from the host at the serial port of the microcontroller all readings are sent to the host at 9600Bd via RS485.

2.5 Modifications required for compliance

None.

3 TEST RESULTS SUMMARY

Summary of test results for the following EUT:

Manufacturer: Fidemco LLC
Type: RX-2T
Serial No.: 6626

Requirement	47 CFR Section	Report Section	Tested EUT	Result
AC Power Line Conducted Emissions	§ 15.107	4.1	6626	Passed
Radiated Emissions	§15.109	4.2	6626	Passed

N.A. – not applicable; N.T. – Not tested acc. to applicant's order.

The client has made the determination that EUT Condition, Characterization, and Mode of Operation are representative of production units and meet the requirements of the specifications referenced herein.
Consistent with Industry practice, measurement and test equipment not directly involved in obtaining measurement results but having an impact on measurements (such as cable loss, antenna factors, etc.) are factored into the "Correction Factor" documented in certain test results. Instrumentation employed for testing meets tolerances consistent with known Industry Standards and Regulations.
The measurements contained in this report were made in accordance with the procedures described in ANSI C63.4-2014 and all applicable Public Notices received prior to the date of testing. All requirements were found to be within the limits outlined in this report.

The test results in this report apply only to the particular equipment under test (EUT) as declared in this report.

Test personnel: Dominik Krüger
Issuance date: 2019-08-09

4 DETAILED TEST RESULTS

4.1 AC Power Line Conducted Emissions

4.1.1 Regulation

47 CFR § 15.107 Conducted limits

(a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Frequency of emission [MHz]	Conducted limit [dBμV]	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

4.1.2 Test Procedures

ANSI C63.4-2014, 7.2 Measurement requirements
Measured levels of ac power-line conducted emission shall be the radio-noise voltage from the voltage probe, where permitted, or across the 50 Ω LISN port (to which the EUT is connected), as terminated into a 50 Ω EMI receiver or spectrum analyzer. All radio-noise voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord or calibrated extension cord by the use of mating plugs and receptacles on the EUT and LISN, if used. The manufacturer shall test equipment with power cords that are normally supplied or recommended by the manufacturer and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended. For measurements using a LISN, the 50 Ω measuring port is terminated into a 50 Ω EMI receiver or spectrum analyzer. All other ports are terminated into 50 Ω loads. Figure 7 through Figure 9 and Figure 14 show typical test setups for ac power-line conducted emissions testing.

ANSI C63.4-2014, 6.3.2.2 Placement of tabletop EUTs
For tabletop systems, the EUT shall be centered laterally (left to right facing the tabletop) on the tabletop, and its rear shall be flush with the rear of the table. If the EUT is a stand-alone unit, its center shall be located over the center of the turntable.

ANSI C63.4-2014, 6.3.2.3 Placement of tabletop accessories/peripherals
a) Accessories/peripherals that are part of a system tested on a tabletop shall be placed in a test arrangement on one or both sides of the host with a 10 cm separation between the nearest points of the cabinets (see Figure 7). The rear of the host and accessories should be flush with the back of the supporting tabletop unless that would not be typical of normal use. If more than two accessories are present, then an equipment test arrangement should be chosen that maintains a spacing of 10 cm between cabinets unless the equipment is normally located closer together.
b) Multiple peripherals/accessories (more than two) may be distributed around the table as shown in Figure 7. If the EUT peripherals are designed to be stacked in typical use, then they shall be stacked for emission testing, occupying positions of peripheral 1 or peripheral 2. See Figure 7.
c) When there is only one peripheral, place the peripheral as shown in Figure 7 for peripheral 1.
d) Accessories that are typically table mounted because of cable length, such as ac power adapters providing dc power to the EUT, shall be mounted on the tabletop in a typical manner.

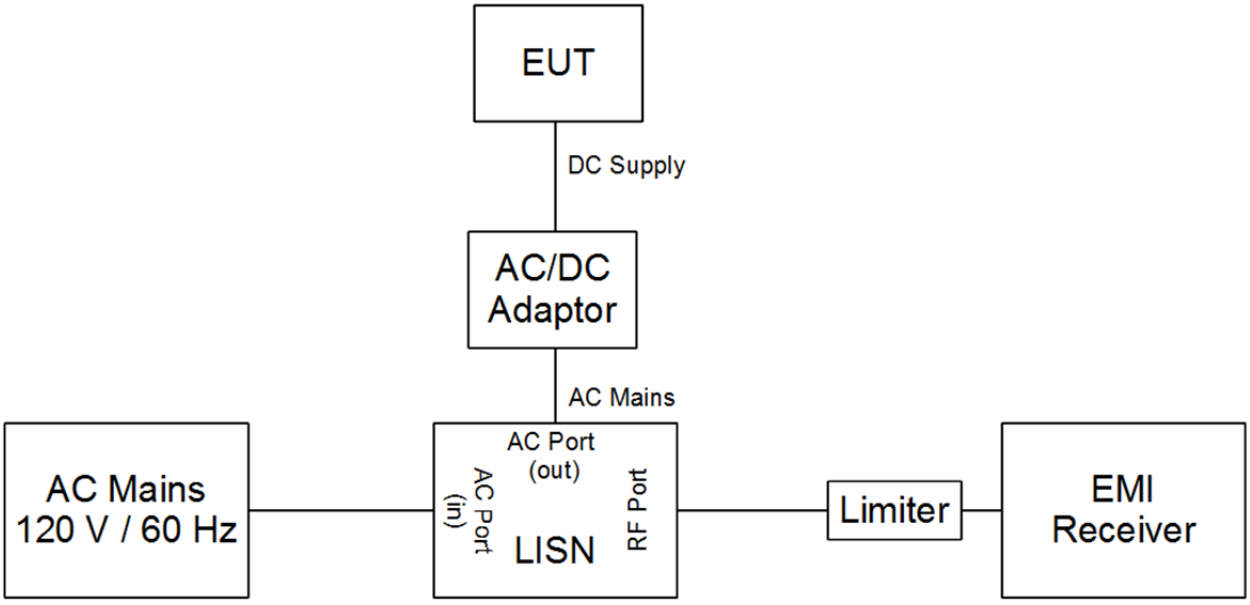
e) Accessories that are typically floor mounted shall occupy a floor position directly below the portion of the EUT to which they are typically connected. NOTE—The keyboard and mouse cables from the back of a personal computer (PC) should be routed along the side of the central processing unit (CPU) to gain maximum coupling between the CPU and the cables. f) Power accessories, such as ac power adapters that power other devices, shall be tested in the following manner:
1) Power accessories that are not the EUT: If the power accessory connects to a tabletop EUT having a power cord to the power accessory less than 80 cm in length, the power accessory is placed on the tabletop. If the EUT power cord to the power accessory is 80 cm or greater in length, then the power accessory is placed on the floor immediately under the EUT. If the power accessory plugs directly into the wall outlet, it shall be attached to the source of power on top of the ground plane and directly under the EUT with the EUT connected If the EUT power cord is less than 80 cm, then a nonconductive support for raising the power accessory is needed along with a short extension cord from the source of power to the raised power accessory.
[..]

Interconnecting cables that hang closer than 40 cm to the ground plane are folded back and forth in the center forming a bundle 30 cm to 40 cm long.

The EUT's DC port was connected to a laboratory DC power supply (EMCC-ID#4721), which was connected to a LISN.

The measurement receiver is connected to the 50 Ω RF port of the LISN.

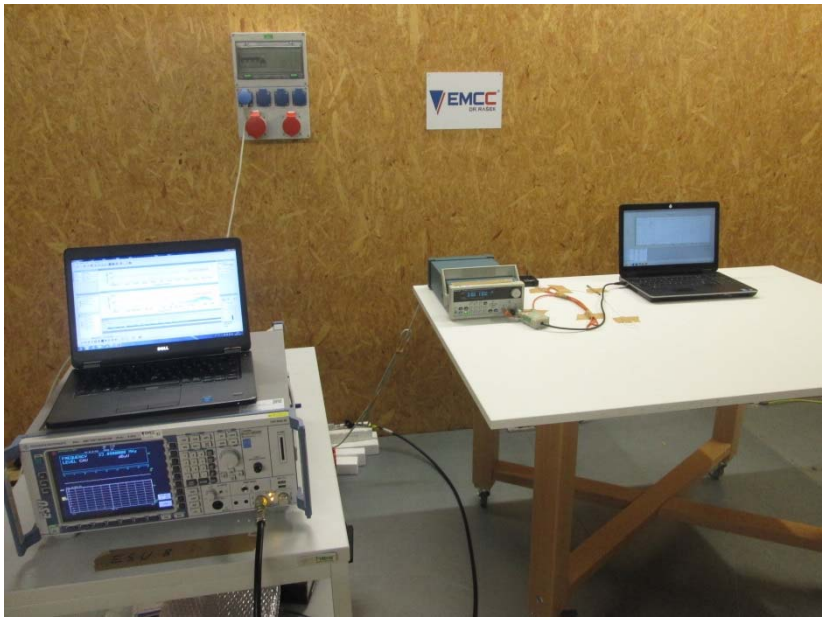
4.1.3 Test Setup



SCHEMATIC TEST SETUP

Requirement: 47 CFR, § 15.107
Procedure: ANSI C63.4-2014

TEST EQUIPMENT USED:
Refer to chapter 5 of this document.
1, 1901, 3184, 3846, 4717, 4721, 5392, 5404, 5551

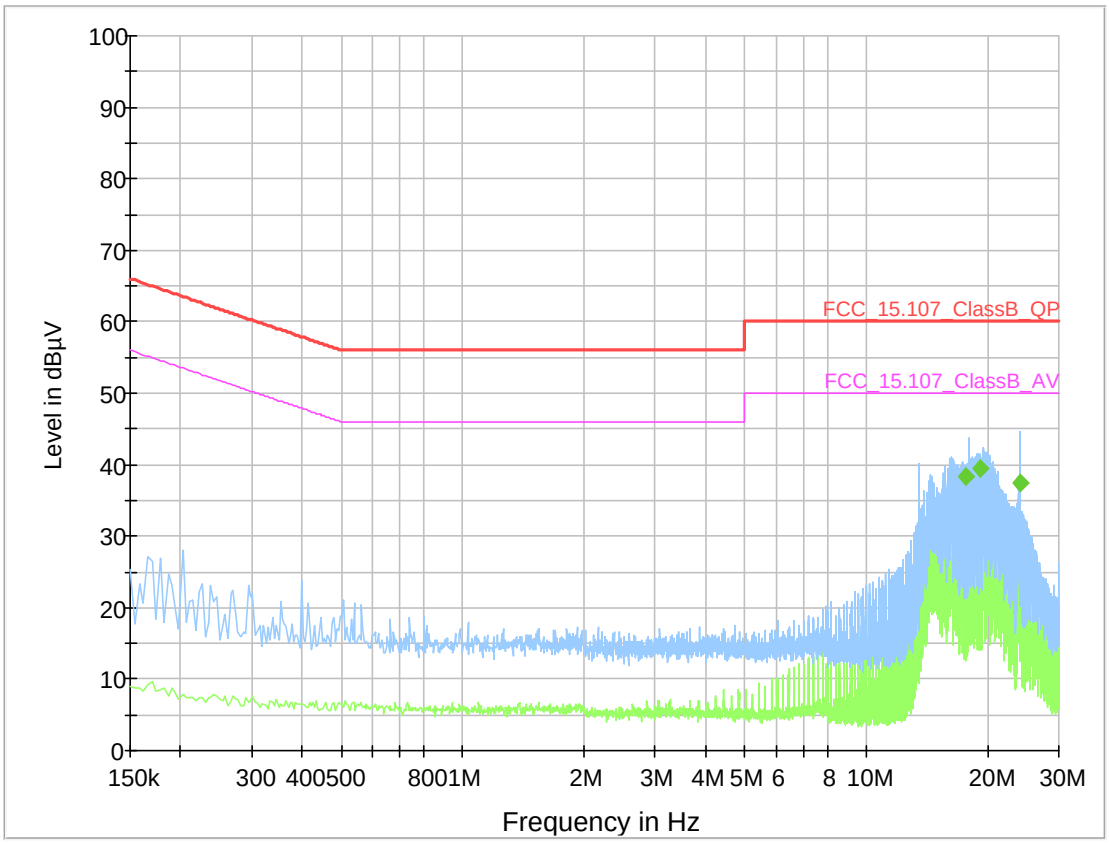


Sample photo of setup

4.1.4 Detailed Test Data

EUT Information

EUT Name:	KILN Data Collector RX-2T
Manufacturer:	Fidemco LLC
Serial Number:	6626
Lines:	L, N



Final Result

Frequency MHz	Detector	Result dBµV	Margin dB	Line
17.709500	AV	38.43	11.57	N
19.101500	AV	39.42	10.58	N
24.001500	AV	37.48	12.52	N

Worst case results listed, only.

Note: EUT was supplied by laboratory power supply (EMCC-ID #4721), because no power adaptor is being sold with these modules by the customer.

4.1.5 Test Result

Manufacturer:	Fidemco LLC
Type:	RX-2T
Serial No.:	6626
Test date:	2019-05-15
Test personnel:	Dominik Krüger

The EUT meets the requirements of this section.

4.2 Radiated Emissions

4.2.1 Regulation

47 CFR § 15.3 - Definitions.
(i) Class B digital device. A digital device that is marketed for use in a residential environment notwithstanding use in commercial, business and industrial environments. Examples of such devices include, but are not limited to, personal computers, calculators, and similar electronic devices that are marketed for use by the general public.

47 CFR § 15.33 - Frequency range of radiated measurements:
(b) For unintentional radiators:
(1) Except as otherwise indicated in paragraphs (b)(2) or (b)(3) of this section, for an unintentional radiator, including a digital device, the spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a radiated emission limit is specified, up to the frequency shown in the following table:
(3) Except for a CB receiver, a receiver employing superheterodyne techniques shall be investigated from 30 MHz up to at least the second harmonic of the highest local oscillator frequency generated in the device. If such receiver is controlled by a digital device, the frequency range shall be investigated up to the higher of the second harmonic of the highest local oscillator frequency generated in the device or the upper frequency of the measurement range specified for the digital device in paragraph (b)(1) of this section.

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30.
1.705-108	1000.
108-500	2000.
500-1000	5000.
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower.

47 CFR § 15.35 Measurement detector functions and bandwidths.
(a) On any frequency or frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified. The specifications for the measuring instrumentation using the CISPR quasi-peak detector can be found in ANSI C63.4-2014, clause 4 (incorporated by reference, see §15.38). As an alternative to CISPR quasi-peak measurements, the responsible party, at its option, may demonstrate compliance with the emission limits using measuring equipment employing a peak detector function as long at the same bandwidth as indicated for CISPR quasi-peak measurements are employed.

47 CFR § 15.109 Radiated emission limits; general requirements.

(a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

4.2.2 Calculation of Field Strength Limits

E.g. radiated emissions field strength limits for the frequency band 30 - 88 MHz:

100 µV/m at 3 meters

Using the equation:

$E_{dB\mu V/m} = 20 \log (E_{\mu V/m})$

where

$E_{dB\mu V/m}$ = Field Strength in logarithmic units (in dBµV/m)

$E_{\mu V/m}$ = Field Strength in linear units (in µV/m)

A field strength limit of 100 µV/m corresponds with 40.0 dBµV/m.

Distance correction (limit)
Remark: The preferred method is the correction of the measured field strength (refer to 4.2.3) instead of limit correction. Only one correction method shall be applied to a particular measurement.

If a measurement is performed in a distance other than specified, the limit may be adjusted by a Distance Extrapolation Factor DF of 20 dB per decade, which is calculated by the following equation:

$DF = 20 \log (D_{test}/D_{specification})$
where

DF = Distance Extrapolation Factor (in dB)

D_{test} = Distance, where measurement was performed (in m)

$D_{specification}$ = Distance acc. to specification (in m)

Example: Assume a limit specified in 3 m and a measurement performed at 1 m: The distance correction factor is 20 log (3 / 1) = 9.5. This factor is mathematically added to the limit by the following equation:
$E_{dB\mu V/m\_new} = E_{dB\mu V/m} + DF$
where

$E_{dB\mu V/m}$ = Field Strength limit in logarithmic units (in dBµV/m)

$E_{dB\mu V/m\_new}$ = Corrected Field Strength limit in logarithmic units (in dBµV/m)

DF = Distance Extrapolation Factor (in dB)

Example: Assume a limit of 40.0 dBµV/m specified in 3 m distance and the measurement performed at 3 m. The limit is adjusted by the distance correction factor of 9.5 dB to the new limit of 49.5 dBµV/m.

4.2.3 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF
where
FS = Field Strength (in dBµV/m)
RA = Receiver Amplitude (in dBµV)
AF = Antenna Factor (in dB (1/m))
CF = Cable Attenuation Factor (in dB)

Assume a receiver reading of 30 dBµV is obtained. The Antenna Factor of 10 dB(1/m) and a Cable Factor of 1.2 dB are added, giving a field strength of 41.2 dBµV/m in the measurement distance. The field strength of 41.2 dBµV/m value can be mathematically converted to its corresponding level in µV/m.

FS = 30 + 10 + 1.2 = 41.2
Level (in µV/m) = Common Antilogarithm (41.2/20) = 114.8

Distance correction (field strength)
Remark: The preferred method is the correction of the measured field strength instead of limit correction (refer to 4.2.2). Only one correction method shall be applied to a particular measurement..

If a measurement is performed at a different distance other than specified, the field strength at the specified distance can be obtained by the following equation:

$FS_{Dspecified} = FS_{Dtest} + 20 \log (D_{test}/D_{specified})$
where
$FS_{Dspecified}$ = Field Strength at specified distance $D_{specified}$ (in dBµV/m)
FS_{DTest} = Field Strength at specified distance D_{Test} (in dBµV/m)
D_{test} = Measurement distance where test was performed (in m)
$D_{specified}$ = Measurement distance as specified by the rules (in m)

Assuming a recorded field strength of 41.2 dBµV/m in a distance of 1 m. If the rules are specifying a limit in a distance of 3 m, the field strength recorded in 1 m is corrected by the distance. Therefore, the field strength $FS_{Dspecified}$ is 41.2 + 20 log (1 / 3) = 31.7 (in dBµV/m).
Remark: Using EMC32 software corrections are combined in the Corr. Factor as listed in the results' table.
"Result" represents the FS Result), "Corr." is the combined correction factor.

4.2.4 Radiated Emissions 30 MHz – 1000 MHz

4.2.4.1 Test Procedures

ANSI C63.4-2014, 8.2.3 Electric field radiated emissions (30 MHz to 1 GHz)

Electric field measurements are made in the frequency range of 30 MHz to 1000 MHz using a calibrated linearly polarized antenna as specified in 4.5.4, which shall be positioned at the specified distance from the periphery of the EUT. The specified distance is the distance between the horizontal projection onto the ground plane of the closest periphery of the EUT and the projection onto the ground plane of the center of the axis of the elements of the receiving antenna. However, if the receiving antenna is an LPDA antenna, the specified distance shall be the distance between the closest periphery of the EUT and the front-to-back center (midpoint along boom/feeder transmission line) of the array of elements.

Measurements shall be made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna shall be varied in height above the reference ground plane to obtain the maximum signal strength. Unless otherwise specified, the measurement distance shall be 3 m or 10 m. At either measurement distance, the antenna height shall be varied from 1 m to 4 m.

These height scans apply for both horizontal and vertical polarizations, except that for vertical polarization, the minimum height of the center of the antenna shall be increased so that the lowest point of the bottom of the lowest antenna element clears the site reference ground plane by at least 25 cm. For a tuned dipole, the minimum heights as measured from the center of the antenna are shown in Table D.3.

ANSI C63.4-2014, 8.3.1.1 Exploratory radiated emission measurements (9 kHz to 1 GHz)

a) Exploratory radiated measurements shall be performed at the measurement distance or at a closer distance than that specified for compliance to determine the emission characteristics of the EUT (see also 10.2.8 and Annex E) and recorded in tabular or graphical form. Significant emissions are identified using a remote-controlled turntable and antenna positioner and monitoring the spectrum while changing the EUT (turntable) azimuth, antenna polarity, and height. This spectrum exploratory monitoring can also be performed by manually moving the receiving antenna around the EUT to pick up significant emissions. A shielded room may be used for exploratory testing, but care must be taken to account for shielded room reflections that can lead to significant errors in amplitude measurements.

b) Broadband antennas and a spectrum analyzer or an EMI receiver with a panoramic display are most often used in this type of testing. It is recommended that either a headset or loudspeaker be connected as an aid in detecting ambient signals and finding frequencies of significant emission from the EUT when the exploratory and final testing is performed at an OATS with strong ambient signals. Caution should be taken if either antenna heights between 1 m and 4 m or EUT azimuth is not fully explored. Not fully exploring these parameters during exploratory testing may require complete testing at the OATS or semi-anechoic chamber when the final full spectrum testing is conducted.

c) The EUT should be set up in its typical configuration and arrangement and operated in its various modes. For tabletop systems, cables or wires not bundled in the initial setup shall be manipulated within the range of likely arrangements. For floor-standing equipment, the cables or wires should be located in the same manner as the user would install them and no further manipulation is made. For combination EUTs, the tabletop and floor-standing portions of the EUT shall follow the procedures for their respective setups and cable manipulation. If the manner of cable installation is not known, or if it changes with each installation, cables or wires for floor-standing equipment shall be manipulated to the extent possible to roduce the maximum level of emissions.

d) Exploratory radiated emissions testing of handheld and/or body-worn devices shall include rotation of the EUT through three orthogonal axes to determine the orientation (attitude) that maximizes the emissions. Subclause 6.3.6 applies for exploratory radiated emissions testing of ceiling-mounted devices. This equipment arrangement shall be used in the final measurements of radiated emission from the EUT.

e) For each mode of operation required to be tested, the frequency spectrum shall be monitored. Variations in antenna height between 1 m and 4 m, antenna polarization, EUT azimuth, and cable or wire placement (each variable within bounds specified elsewhere) shall be explored to produce the emission that has the highest amplitude relative to the limit. A suggested step-by-step technique for determining maximum radiated emission is given in Annex E.

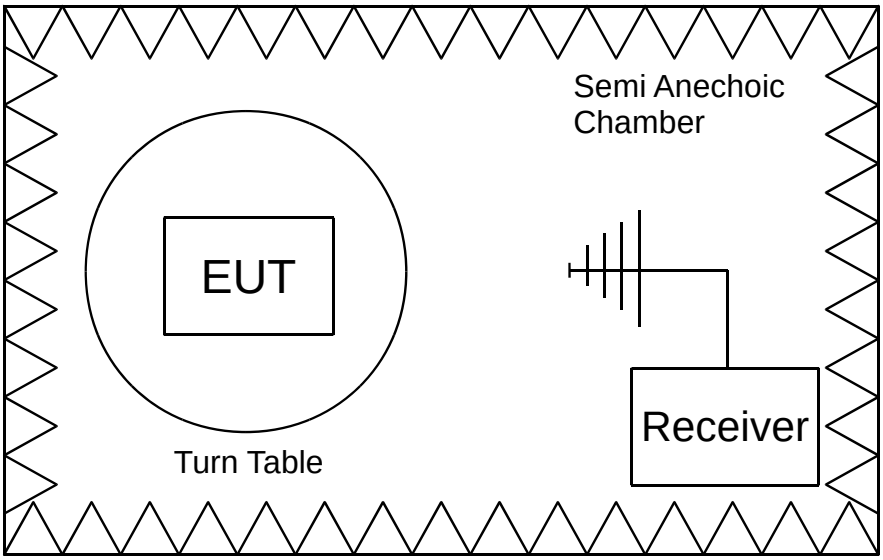
ANSI C63.4-2014, 8.3.2.1 Final radiated emission measurements (9 kHz to 1 GHz)

Based on the exploratory radiated emissions measurement results (i.e., see 8.3.1.1), the single EUT, cable and wire arrangement, and mode of operation that produces the emission that has the highest amplitude relative to the limit are selected for the final measurement. The final measurements are then performed on a site meeting the requirements of 5.3 or 5.4, as appropriate. If the EUT is relocated from an exploratory test site to a final test site, the highest emission relative to the limit shall be remaximized at the final test location before final radiated emissions measurements are

performed. However, antenna height and polarization and EUT azimuth are to be varied. In addition, the full frequency range to be checked for meeting compliance shall be investigated.
This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated by 90° relative to the ground plane to repeat the measurements for both the horizontal and vertical antenna polarizations. During the full frequency range investigation, particular focus should be made on the frequencies found in exploratory testing that were used to find the final test configuration, mode of operation, and arrangement (associated with achieving the least margin with respect to the limit). This full range test constitutes the compliance measurement.

Radiated Emissions Test Characteristics	
Frequency range	30 MHz – 1000 MHz
Test distance	3 m
Test instrumentation resolution bandwidth	120 kHz
Receive antenna height	1 m - 4 m
Receive antenna polarization	Vertical/Horizontal
Measurement location	Semi Anechoic Chamber (SAC)

4.2.4.2 Test Setup

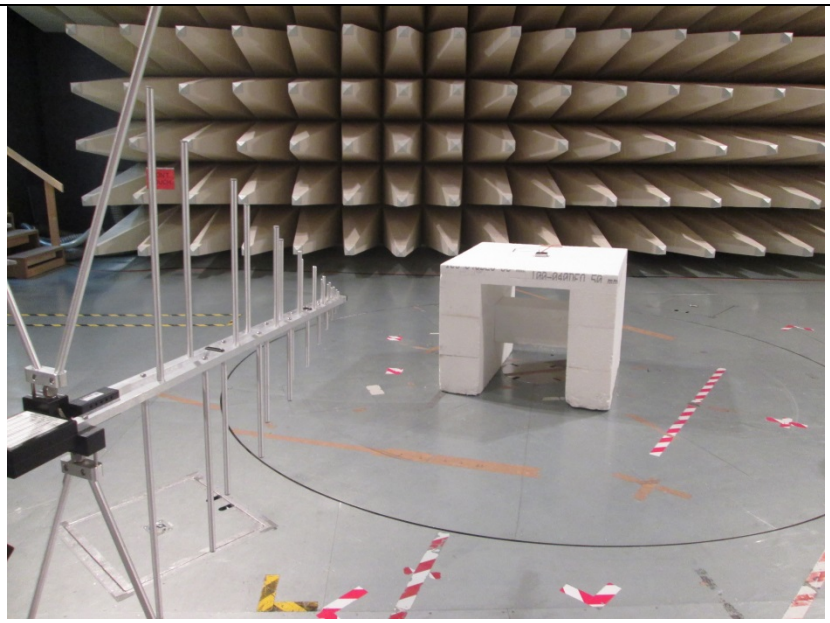


SCHEMATIC TEST SETUP

Requirement: 47 CFR, § 15.109
Procedure: ANSI C63.4-2014

Test distance: 3 m

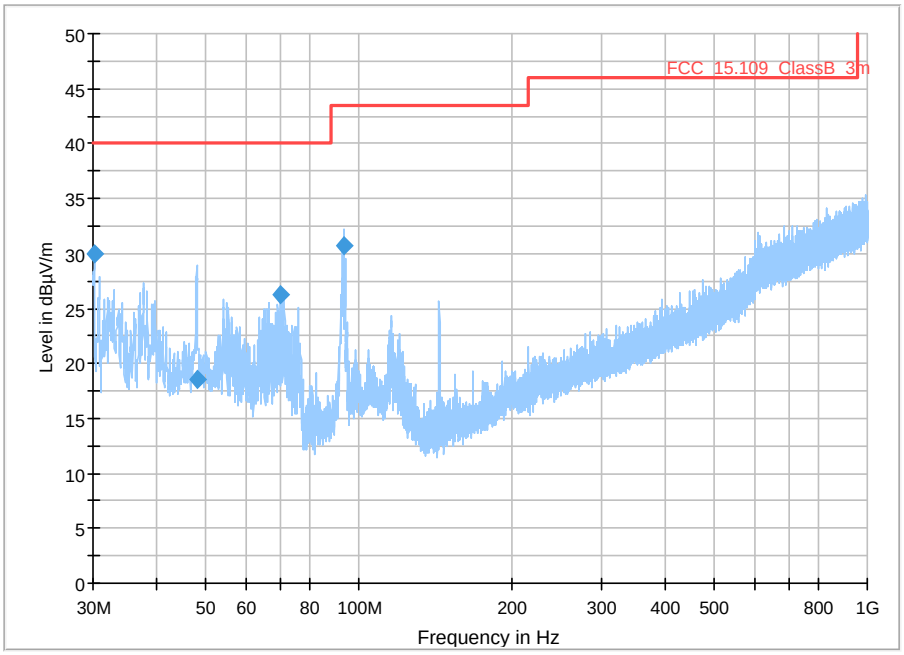
TEST EQUIPMENT USED:
Refer to chapter 5 of this document.
54, 1291, 1292, 1889, 2724, 3846, 4075, 4717, 5392, 6041



Sample photo of setup

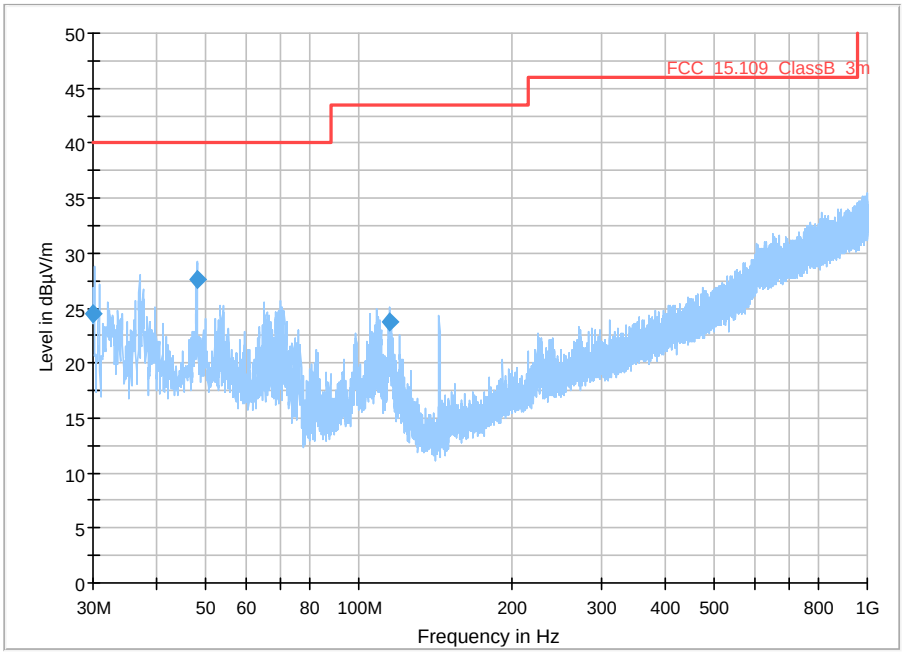
4.2.4.3 Detailed Test Data

Manufacturer:	Fidemco LLC
Type:	RX-2T
Serial No:	6626
EUT Orientation:	X (see Annex 1)

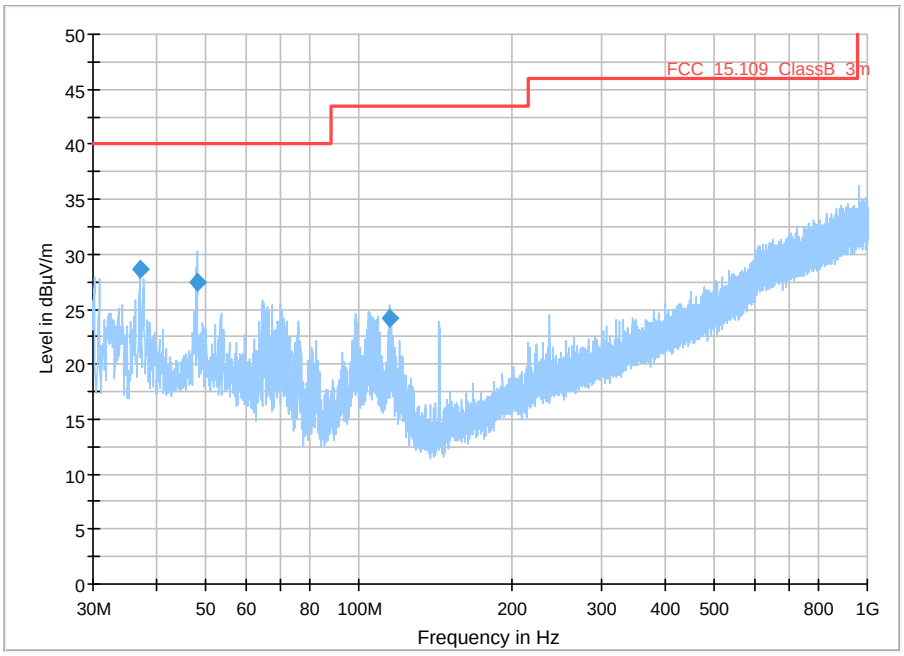


Test on Fidemco LLC RX-2T to 47 CFR § 15.107 and 47 CFR § 15.109

Manufacturer:	Fidemco LLC
Type:	RX-2T
Serial No:	6626
EUT Orientation:	Y (see Annex 1)



Manufacturer:	Fidemco LLC
Type:	RX-2T
Serial No:	6626
EUT Orientation:	Z (see Annex 1)



Final Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.20	29.9	40.0	10.1	1000	120.0	100.0	V	-78	16.6
37.06	28.7	40.0	11.3	1000	120.0	100.0	V	-23	17.8
48.06	27.7	40.0	12.4	1000	120.0	100.0	V	102	19.6
70.06	26.3	40.0	13.7	1000	120.0	100.0	V	-27	15.3
93.34	30.7	43.5	12.8	1000	120.0	110.0	V	146	16.5
115.30	24.2	43.5	19.3	1000	120.0	122.0	V	180	16.5

4.2.4.4 Test Result

Manufacturer:	Fidemco LLC
Type:	RX-2T
Serial No.:	6626
Test date:	2019-05-14
Test personnel:	Dominik Krüger

The EUT meets the requirements of this section.

4.2.5 Radiated Emissions 1 – 6 GHz

4.2.5.1 Test Procedures

ANSI C63.4-2014, 8.2.4 Electric field radiated emissions (1 GHz to 40 GHz)

Radiated emission measurements above 1 GHz are made using calibrated linearly polarized antennas as specified in 4.5.5, which may have a smaller beamwidth (main lobe) than do the antennas used for frequencies below 1 GHz. Because the source of emissions from the EUT is generally limited to relatively small-angle cones of radiation in any elevation above the ground plane including angles above the height of the EUT, the antenna beamwidth shall be known so that when EUT emissions are measured, the area of coverage of the EUT emissions can be determined. Moving the measurement antenna over the surfaces of the four sides of the EUT or another method of scanning of the EUT is required when the EUT is larger than the area covered by the beamwidth of the measuring antenna at the specified distance.

For any EUT, the frequencies of emission should first be detected. Then the amplitudes of the emissions are measured at the specified measurement distance using the required antenna height, polarization, and detector characteristics.

In performing these measurements, the sensitivity of the complete measurement system relative to the limit shall be determined before the test. If the overall measurement sensitivity is inadequate, then low-noise preamplifiers, closer measurement distances, higher gain antennas, and/or narrower bandwidths may be used. Also, measurement system overload levels shall be determined to be adequate when preamplifiers are used. The effects of using bandwidths different from those specified shall also be determined. Any changes from the specific measurement conditions shall be described in the report of the measurements. (See also 10.2.4 and 10.2.9.)

ANSI C63.4-2014, 8.3.1.2 Exploratory radiated emissions measurements (1 GHz to 40 GHz)

When measuring emissions above 1 GHz, the frequencies of maximum emission shall be determined by manually (or with an articulated antenna positioner) positioning the antenna close to the EUT and then moving the measurement antenna over the surfaces of the EUT while observing a spectral display. It will be advantageous to have prior knowledge of the frequencies of emissions above 1 GHz to help in the search for emissions at those frequencies.

ANSI C63.4-2014, 8.3.2.2 Final radiated emission measurements (1 GHz to 40 GHz)

The final measurements are performed on a site meeting the requirements of 5.5. For measurements above 1 GHz, use the cable, EUT arrangement, and mode of operation determined in the exploratory testing to produce the emission that has the highest amplitude relative to the limit. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. The data collected shall satisfy the report requirements of Clause 10.

Procedure:

The EUT was tested on a 1.5 meter high tabletop for a better antenna alignment.

In certain applications, a remotely located device may be connected to the EUT. In these cases, it is permissible for cabling from the remotely located device to the EUT or accessories to be placed directly on the reference groundplane or, if normally installed beneath the reference groundplane, beneath it. The remotely located device shall be located at a distance sufficient to ensure that it does not contribute to the measured level. This procedure evaluates the interference potential of the EUT, its accessories, and interconnecting cables or wires standing apart from the remotely located device, which in turn shall be evaluated separately, if required.

With the EUT operating in "worst case" mode, emissions from the unit are maximized by adjusting the polarization and height of the receive antenna and rotating the EUT on the turntable. Manipulating the system cables also maximizes EUT emissions. All tests performed with the EUT placed in both vertical and horizontal polarizations on the nonconductive table.

Test on Fidemco LLC RX-2T to 47 CFR § 15.107 and 47 CFR § 15.109

Measurement initially performed as a pre-scan in the full frequency range in order to find worst case emissions. Final measurement performed at worst-case emission frequencies in a FCC listed semi-anechoic room at the specified 3 m test distance. Worst case emissions are listed under chapter: test results.

Radiated Emissions Test Characteristics	
Frequency range	1 GHz – 6 GHz
Test distance	3 m
Test instrumentation resolution bandwidth	1 MHz
Receive antenna height	1 m – 4 m
Receive antenna polarization	Vertical/Horizontal
Measurement chamber	Semi anechoic chamber (SAC) with rf absorbers on the floor

4.2.6 Calculation of Field Strength Limits

E.g. radiated spurious emissions field strength limits for the band above 960 MHz:

500 µV/m at 3 meters

Using the equation:

$E_{dB\mu V/m} = 20 * \log (E_{\mu V/m})$

where

$E_{dB\mu V/m}$ = Field Strength in logarithmic units (dBµV/m)

$E_{\mu V/m}$ = Field Strength in linear units (µV/m)

A field strength limit of 500 µV/m corresponds with 46 dBµV/m.

4.2.7 Field Strength Calculation

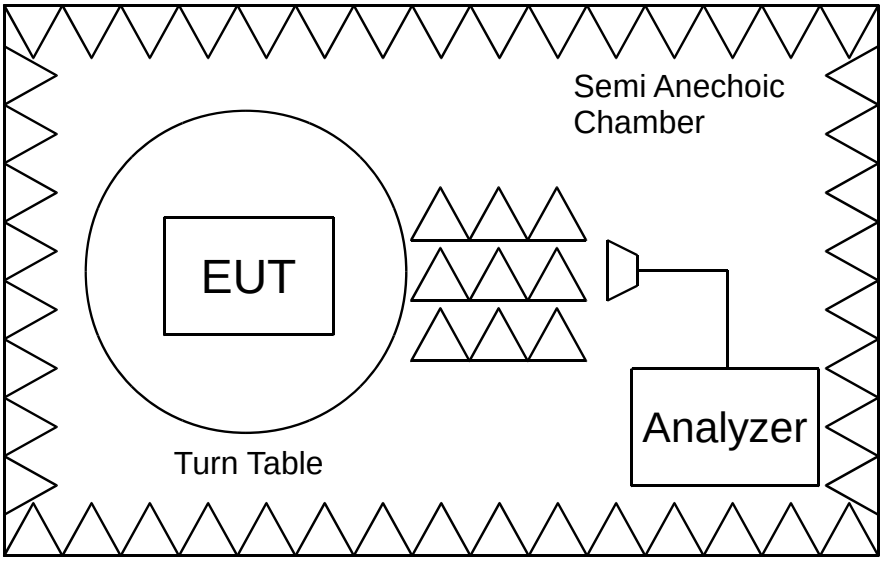
The field strength is calculated by adding the Antenna Factor and Cable Factor. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF
where
FS = Field Strength in dBµV/m
RA = Receiver Amplitude in dBµV
AF = Antenna Factor in dB(1/m)
CF = Cable Attenuation Factor in dB
Assume a receiver reading of 23.5 dBµV is obtained. The Antenna Factor of 7.4 dB(1/m) and a Cable Factor of 1.1 dB are added, giving a field strength of 32 dBµV/m. The 32 dBµV/m value can be mathematically converted to its corresponding level in µV/m.

FS = 23.5 + 7.4 + 1.1 = 32 [dBµV/m]

Level in µV/m = Common Antilogarithm (32/20) = 39.8

4.2.7.1 Test Setup

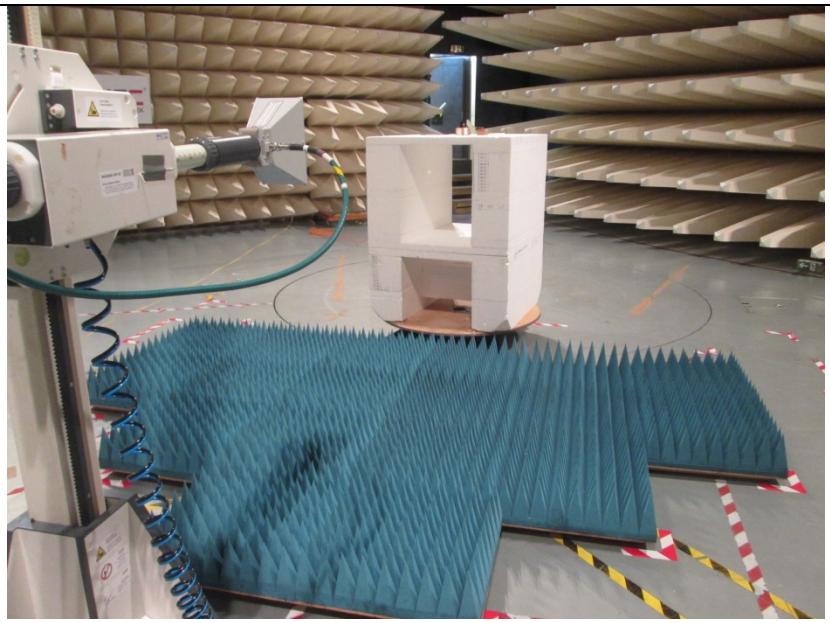


SCHEMATIC TEST SETUP

Requirement: 47 CFR, § 15.109
Procedure: ANSI C63.4-2014

Test distance: 3 m

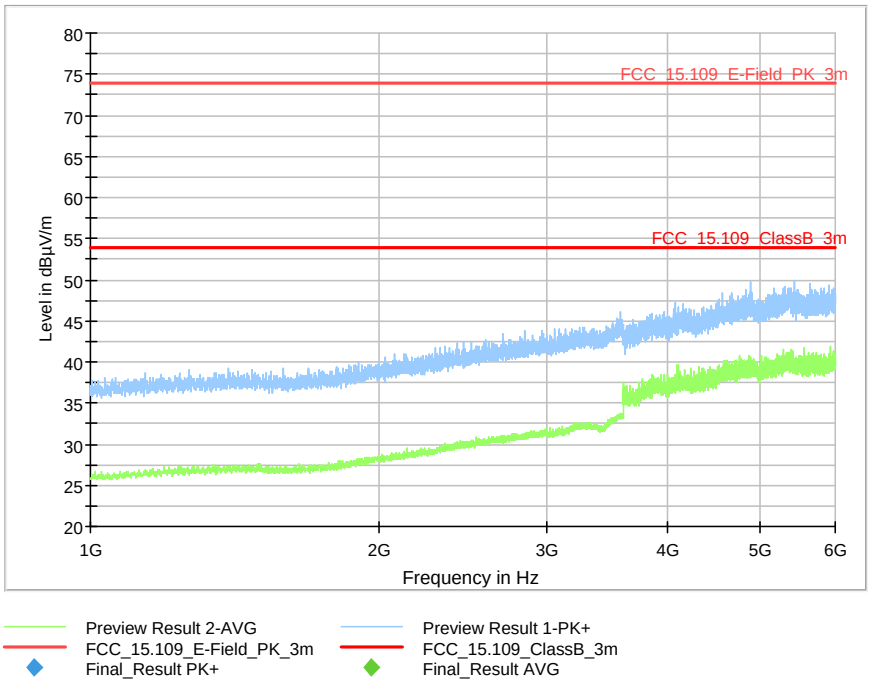
TEST EQUIPMENT USED:
Refer to chapter 5 of this document.
516, 1889, 3235, 4075, 4717, 5392, 5535, 5536, 5544, 5545, 5616



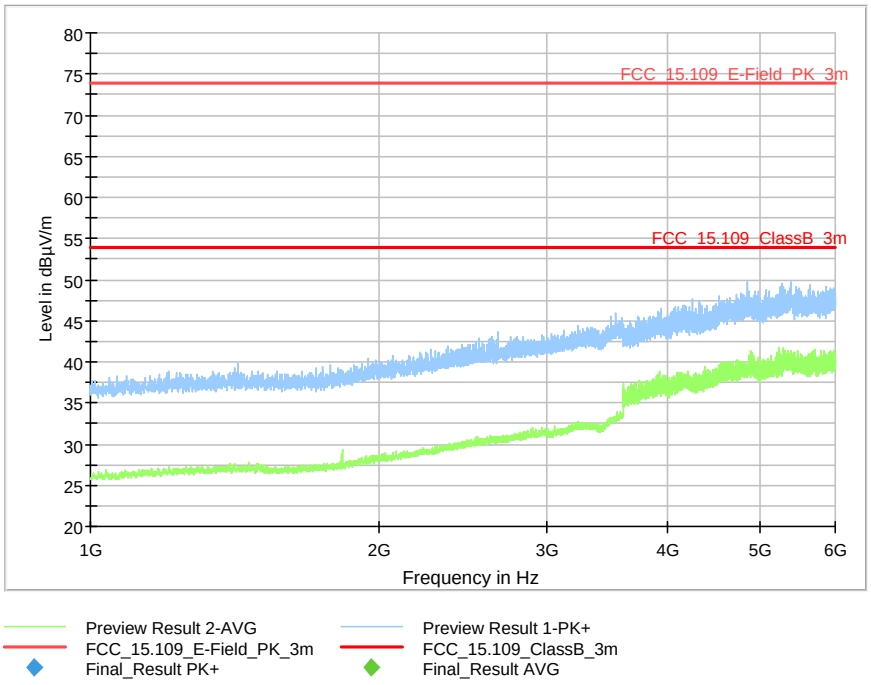
Sample photo of setup

4.2.7.2 Detailed Test Data

Manufacturer:	Fidemco LLC
Type:	RX-2T
Serial No:	6626
EUT Orientation:	X (see Annex 1)

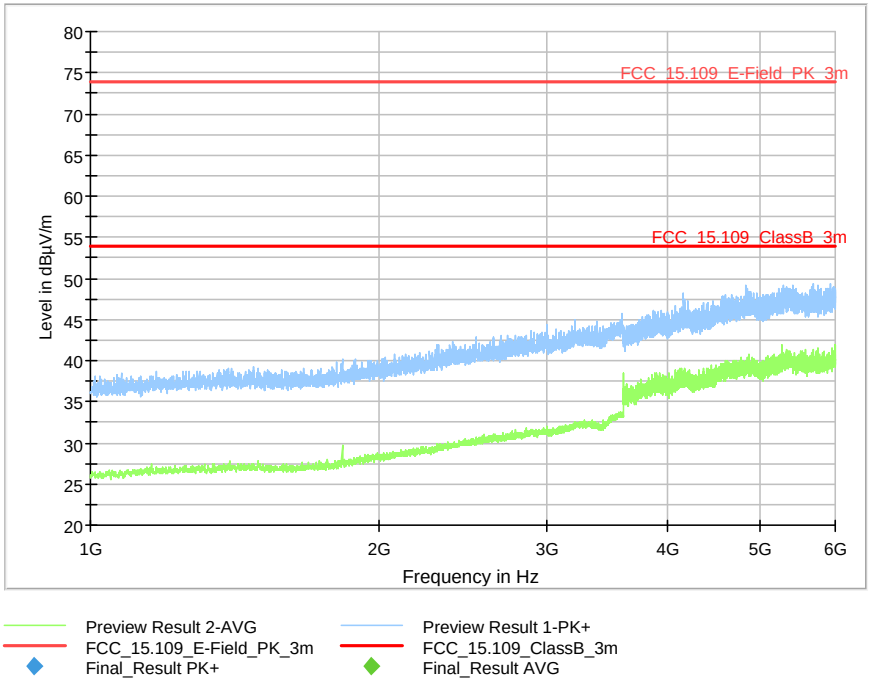


Manufacturer:	Fidemco LLC
Type:	RX-2T
Serial No:	6626
EUT Orientation:	Y (see Annex 1)



Test on Fidemco LLC RX-2T to 47 CFR § 15.107 and 47 CFR § 15.109

Manufacturer:	Fidemco LLC
Type:	RX-2T
Serial No:	6626
EUT Orientation:	Z (see Annex 1)



Final Result:

Frequency MHz	MaxPeak dBµV/m	Average dBµV/m	Limit dBµV/m	Margin dB	Meas. Time ms	Bandwidth kHz	Height cm	Pol --	Azimuth deg	Corr. dB/m

All peak emissions were below the average limit.
Therefore, no final measurement performed.

4.2.7.3 Test Result

Manufacturer:	Fidemco LLC
Type:	RX-2T
Serial No.:	6626
Test date:	2019-05-14
Test personnel:	Dominik Krüger

The EUT meets the requirements of this section.

5 TEST INSTRUMENTS

EMCC ID #	Instrument	Manufacturer	Model No.	Last Calibration	Calibration valid until
1	60-Hz-Converter	AEG	DAMK4/DAGK4	n/a	n/a
54	N-Cable N/50	Rohde & Schwarz	HFU2-Z5	2018-12	2019-12
516	EMI Test Receiver	Rohde & Schwarz	ESIB40	2019-04	2020-04
1291	Antenna Mast	Frankonia	FAM4	n/a	n/a
1292	Multi Device Controller	Frankonia	FC02	n/a	n/a
1889	SR-ULL-01, Semi-Anechoic Chamber (SAC)	EMCC/FRANK.	SAC-10	n/a	n/a
1901	V-LISN 50 ohms//(50 uH + 5 ohms)	Rohde & Schwarz	ESH2-Z5	2018-11	2019-11
2724	5 W Attenuator 6dB	Weinschel	2	2017-06	2019-06
3184	Pulse Limiter	MTS	MTA-IMP-136	2017-07	2019-07
3235	Double Ridged Guide Antenna	Schwarzbeck	BBHA 9120D	2019-01	2021-01
3846	EMI Test Receiver	Rohde & Schwarz	ESU8	2019-02	2020-02
4075	Workstation	Dell	Optiplex 7010	n/a	n/a
4717	Web-Thermo-Hygrobarograph	Wiesemann & Theis GmbH WUT	57613 Web-T/Rh/P	2018-01	2020-01
4721	DC Power Supply	Tektronix	PWS4205	n/a	n/a
5392	EMC Measurement Software (V 10.35.02)	Rohde & Schwarz	EMC32	n/a	n/a
5404	Notebook	DELL	Latitude E5450	n/a	n/a
5535	Positioning controller	Rohde & Schwarz	HCC	n/a	n/a
5536	Rotary table	Rohde & Schwarz	HCT12	n/a	n/a
5544	Antenna Mast	innco systems GmbH	MA 5000-XPET	n/a	n/a
5545	Antenna Mast Controller	innco systems GmbH	CO 3000-1D	n/a	n/a
5551	BNC cable	EMCC	BNC003m0	n/a	n/a
5616	RF cable assembly	Rosenberger	LA2-025-7000	2018-07	2019-07
6041	TRILOG Broadband Antenna	Schwarzbeck	VULB 9163	2017-09	2019-09

6 MEASUREMENT UNCERTAINTY

Measurement	Measurement Uncertainty
Conducted Emissions, AC mains (150 kHz – 30 MHz)	±3.5 dB
Radiated Emissions below 1000 MHz	±5.6 dB
Radiated Emissions above 1000 MHz	±4.6 dB

The reported uncertainty values are based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of 95%.

The given values have been calculated on the basis of the following documents:

CISPR 16-4-2:2011+A1:2014, Specification for radio disturbance and immunity measuring apparatus and methods - Part 4-2: Uncertainties, statistics and limit modelling - Measurement instrumentation uncertainty.

JCGM 100:2008, Evaluation of measurement data - Guide to the expression of uncertainty in measurement.

7 LIST OF ANNEXES

The following annexes are separated parts from this test report.

Description	Pages
Annex 1: Photographs of test setup	4
Annex 2: External photographs of equipment under test	2
Annex 3: Internal photographs of equipment under test	2
Annex 4: Photographs of ancillary equipment	2