TEST REPORT # EMCC-150524DBA, 2019-08-23

- This Test Report supersedes Test Report # EMCC-150524DB, 2019-07-18 -

EQUIPMENT UNDER TEST:

Trade Name:	KILN Data Transmitter
Type/Model:	MCT&WT-TX
Serial Number(s):	27002 27004
Application:	Measurement of wood moisture content and of wood temperature
FCC ID:	2AE3OTX-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 § 15.249

MEASUREMENT PROCEDURE: : ANSI C63.10-2013

TEST REPORT PREPARED BY:

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Tested:

Dominik Krüger

Checked:

Patrick Reusch
- Expert of Radio/EMC Test Dept. -

CONTENTS PAGE

0 REVISION HISTORY

Project number	Issue date	Chapter	Description
150524DB	2019-07-18	n.a.	Initial issue
150524DBA	2019-08-23	1.6	Date of Delivery and Test Date corrected
150524DBA	2019-08-23	1.8	Climatic Conditions for corrected test dates

1 GENERAL INFORMATION

1.1 Purpose

The purpose of this report is to show compliance with the 47 CFR §15.249 requirements applicable to intentional radiators (subpart C).

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
Phone:	+49 9194 7262-0
Fax:	+49 9194 7262-199
E-Mail:	info@emcc.de
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: 2019-05-13 to 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	--	--
2019-05-13	23	33	992	IV	Mr Glaeser
2019-05-14	22	30	987	IV	Mr Glaeser
2019-05-15	23	32	981	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:	MCT&WT-TX
Application:	Measurement of wood moisture content and of wood temperature
No of variants:	0
Serial No(s):	27002: Modified sample for continuous transmission without measurement 27004: Modified sample for measurement and data transmission with shortened time interval (every 1.5 s)
Firmware version:	7.0
Hardware version:	R7
FCC ID:	2AE3OTX-KILN-I
Highest internal frequency:	916.5 MHz
TX operating frequency range:	902 ... 928 MHz
TX operating frequency:	916.5 MHz
No of operating channels:	1
Used channels during test:	n/a
Power source:	Internal Battery (2.2 ... 3.6 V_{DC})
Voltage for testing:	Internal Battery (3.6 V_{DC})
Ports:	n/a
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 Transmitter”.

The Kiln Data Transmitter determines physical properties present in dry kilns for wood.
Several models are available of the device. They differ in the type and configuration of external sensors that are connected to it via short cables.

2.3 EUT Peripherals/Simulators

The EUT was connected to a wood test sample (see Annex 4).
A wood temperature sensor was connected externally (see Annex 2).

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: Continuous Transmission
By applying power to the EUT it enters its normal operation mode with a continuous transmission at its normal output power without measurements (moisture/temperature).

The EUT was powered by a 3.6 V_{DC} battery.

Mode: Active
By applying power to the EUT it enters its normal operation mode at its normal output power with a moisture and temperature measurement every 1.5 seconds.

The EUT was powered by a 3.6 V_{DC} battery.

2.5 Modifications required for compliance

Modification 1
An additional capacitor C22 of 18 pF was connected in parallel to L22.

2.6 Duty-Cycle Correction

The following calculation is based on customer’s information.

The measured readings of the EUT are transmitted automatically in regular time intervals of approx. 20 seconds. Each package consists of 6 Bytes with 14 Bits (1 Start, 1 Stop, 8 Data, 4 balance bits). With a data rate of 2400 baud, one pulse package length is equal to 35 ms.

The maximum duty cycle of the EUT referred to one pulse package is 67 % as declared by the manufacturer. It follows that the worst case ON-time in any 100 ms time window is
67 % x 35 ms = 23.5 ms.

For average correction purposes, a correction factor of (23.5 ms / 100 ms) * 100 = 23.5 % has to be used. Expressed in logarithmic terms, the correction factor is 20 x log (23.5 %) = -12.6 dB.

3 TEST RESULTS SUMMARY

Summary of test results for the following EUTs:

Manufacturer: Fidemco LLC
Type: MCT&WT-TX
Serial No.: 27002
27004

Requirement	47 CFR Section	Report Section	Tested EUT	Result
Antenna Requirement	§ 15.203	4.1	27004	Passed
Occupied Bandwidth	§ 15.215	4.2	27004	Passed
Radiated Field Strength of Fundamental	§ 15.249	4.3	27004	Passed
Radiated Emissions	§ 15.249, §15.209	4.4	27002	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 C63.10-2013 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: 2019-08-23

4 DETAILED TEST RESULTS

4.1 Antenna Requirement

4.1.1 Regulation

47 CFR § 15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

4.1.2 Test Result

Manufacturer:	Fidemco LLC
Type:	MCT&WT-TX
Serial No.:	27004
Test date:	2019-05-15
Test personnel:	Dominik Krüger

The EUT's antenna is directly soldered to the PCB and potted in the enclosure.

The EUT meets the requirements of this section.

4.2 Occupied Bandwidth

4.2.1 Regulation

47CFR § 15.215 Additional provisions to the general radiated emission limitations.

(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. In the case of intentional radiators operating under the provisions of subpart E, the emission bandwidth may span across multiple contiguous frequency bands identified in that subpart. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

47CFR §15.249 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHZ, and 24.0-24.25 GHz.

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

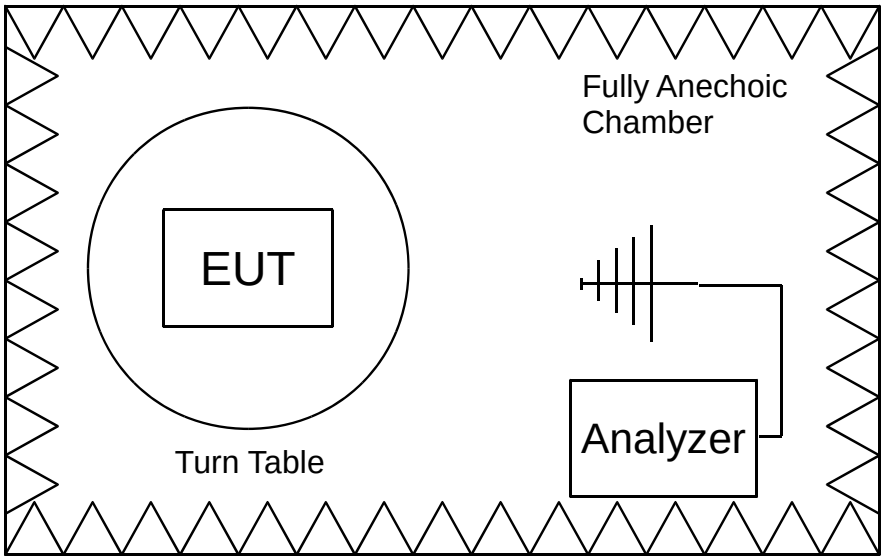
Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

4.2.2 Test Procedures

Testing is performed acc. to ANSI C63.10-2013.

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the EMI receiver or spectrum analyzer shall be between two times and five times the OBW.
b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW, unless otherwise specified by the applicable requirement.
c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2.
d) Steps a) through c) might require iteration to adjust within the specified tolerances.
e) The dynamic range of the instrument at the selected RBW shall be more than 10 dB below the target "–xx dB down" requirement; that is, if the requirement calls for measuring the –20 dB OBW, the instrument noise floor at the selected RBW shall be at least 30 dB below the reference value.
f) Set detection mode to peak and trace mode to max hold.
g) Determine the reference value: Set the EUT to transmit an unmodulated carrier or modulated signal, as applicable. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).
h) Determine the "–xx dB down amplitude" using [(reference value) – xx]. Alternatively, this calculation may be made by using the marker-delta function of the instrument.
i) If the reference value is determined by an unmodulated carrier, then turn the EUT modulation ON, and either clear the existing trace or start a new trace on the spectrum analyzer and allow the new trace to stabilize. Otherwise, the trace from step g) shall be used for step j).
j) Place two markers, one at the lowest frequency and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the "–xx dB down amplitude" determined in step h). If a marker is below this "–xx dB down amplitude" value, then it shall be as close as possible to this value. The occupied bandwidth is the frequency difference between the two markers. Alternatively, set a marker at the lowest frequency of the envelope of the spectral display, such that the marker is at or slightly below the "–xx dB down amplitude" determined in step h). Reset the marker-delta function and move the marker to the other side of the emission until the delta marker amplitude is at the same level as the reference marker amplitude. The marker-delta frequency reading at this point is the specified emission bandwidth.
k) The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

4.2.3 Test Setup

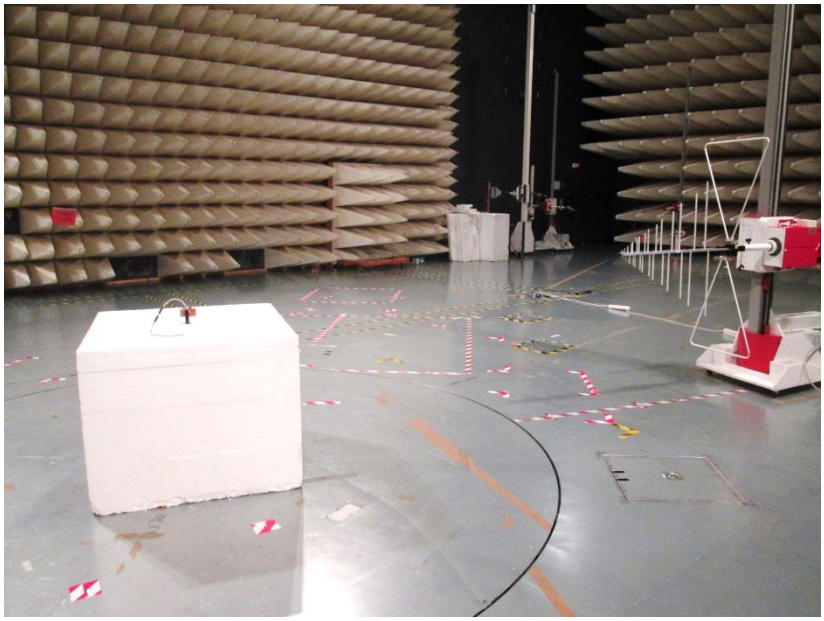


SCHEMATIC TEST SETUP

Requirement: 47 CFR, § 15.215
Procedure: ANSI C63.10-2013

Test Distance: 3 m

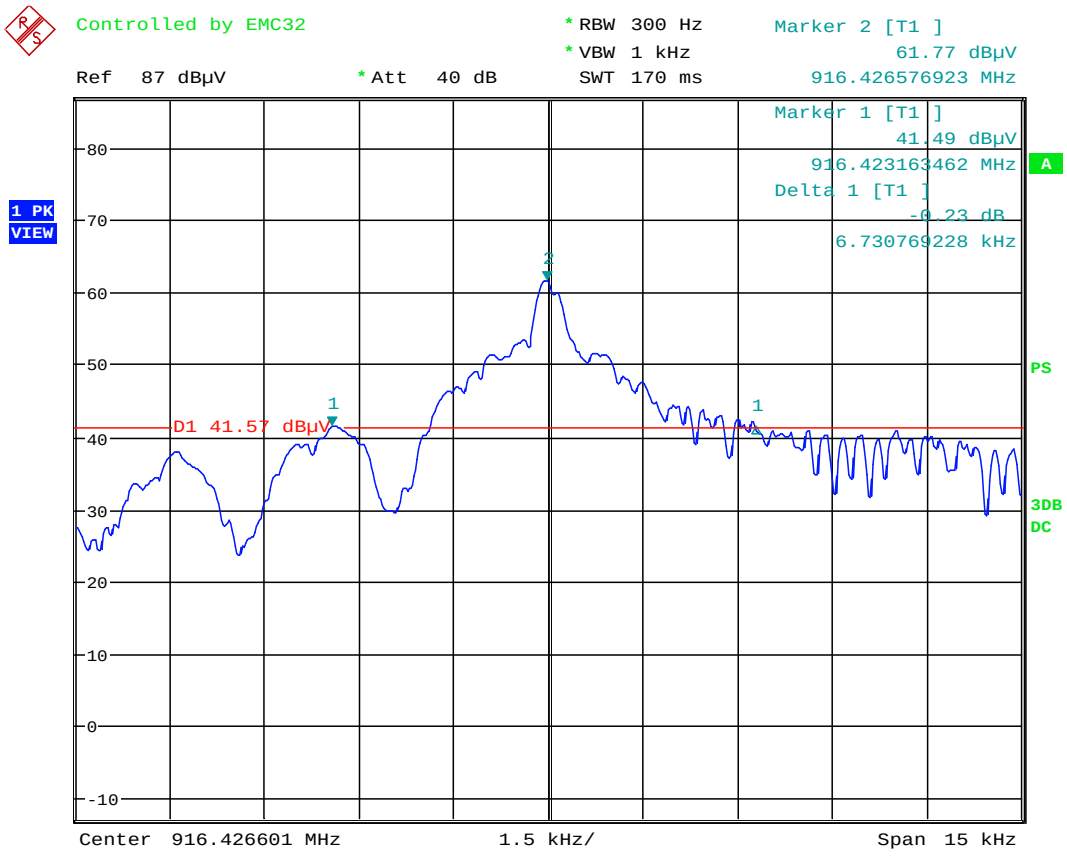
TEST EQUIPMENT USED:
Refer to chapter 5 of this document.
54, 1291, 1292, 1889, 2724, 3846, 4075, 4717, 5392, 6041



Sample photo of setup

4.2.4 Detailed Test Data

Manufacturer:	Fidemco LLC
Type:	MCT&WT-TX
Serial No:	27002



Final Result:

Center Frequency [MHz]	Lower 20 dB Freq. Edge [MHz]	Upper 20 dB Freq. Edge [MHz]	20 dB Bandwidth [kHz]	Limit ---
916.426576923	916.423163462	923.15393269	6.730769228	Within band 902 - 928 MHz

4.2.5 Test Result

Manufacturer:	Fidemco LLC
Type:	MCT&WT-TX
Serial No.:	27002
Test date:	2019-05-15
Test personnel:	Dominik Krüger

The EUT meets the requirements of this section.

4.3 Field Strength of Fundamental

4.3.1 Regulation

47CFR §15.249 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHZ, and 24.0-24.25 GHz.

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

(c) Field strength limits are specified at a distance of 3 meters.

4.3.2 Test Procedures

ANSI C63.10-2013, 6.6.4.1 General

Subclauses 6.6.4.2 and 6.6.4.3 describe the procedures that shall be used for making exploratory and final radiated emission tests for frequencies above 1 GHz. Measurements may be performed at a distance closer than that specified in the requirements; however, an attempt shall be made to avoid making measurements in the near field of both the measurement antenna and the EUT for final measurements.

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 does not provide a noise floor more than 6 dB below the limit, then low-noise preamplifiers, closer test distances, higher gain antennas, or narrower bandwidths might be required. If closer measurement distances are used, then the beamwidth of the measurement antenna versus the size of the EUT shall be taken into account. Also, measurement system overload protection shall be determined to be adequate when preamplifiers are used [see item b) of 4.1.3]. The effects of using bandwidths different from those specified shall also be determined (see also 6.3). Any changes from the specific measurement conditions shall be described in the report of the measurements (see also Annex E).

Install an appropriate filter at the input of the measurement system power amplifier. This filter shall attenuate the fundamental emission of the EUT and allow an accurate measurement of the associated harmonics and spurious emissions. The filter shall be characterized, and any attenuation/loss factors shall be accounted for in the measurement results.

Data shall be recorded in peak and average detection up to the highest measurement frequency required (unless stated otherwise in the applicable requirements).

ANSI C63.10-2013, 6.6.4.2 Exploratory radiated emissions measurements

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 and, if applicable, the EUT configuration that produces the maximum level of emissions. The frequencies of maximum emission may be determined by manually positioning the antenna close to the EUT, and then moving the antenna over all sides of the EUT while observing a spectral display. It is advantageous to have prior knowledge of the frequencies of emissions, although this may be determined from such a near-field scan. The near-field scan shall only be used to determine the frequency but not the amplitude of the emissions. Where exploratory measurements are not adequate to determine the worst-case operating modes and are used only to identify the frequencies of the highest emissions, additional preliminary tests can be required.

Preliminary tests shall be performed following the procedures in 6.3 on a site meeting the requirements of 5.2. For emissions from the EUT, the maximum level shall be determined by rotating the EUT and its antenna through 0° to 360°. For each mode of operation required to be tested, the frequency spectrum (based on findings from exploratory measurements) shall be monitored.
Broadband antennas and a spectrum analyzer or a radio-noise meter with a panoramic display are often useful in this type of test. If either antenna height or EUT azimuth are not fully measured during exploratory testing, then complete testing can be required at the OATS or semi-anechoic chamber when the final full spectrum testing is performed.

ANSI C63.10-2013, 6.6.4.3 Final radiated emissions measurements
The final measurements are performed on a site meeting the requirements of 5.2. Using the orientation and equipment arrangement of the EUT based on the measurement results found during the preliminary (exploratory) measurements per 6.6.4.2, the EUT arrangement, appropriate modulation, and modes of operation that produce the emissions that have the highest amplitude relative to the limit shall be selected for the final measurement. The final measurement shall follow all the procedures in 6.3 with the EUT operating on frequencies per 5.6. For each mode selected, record the frequency and amplitude of the highest fundamental emission (if applicable), as well as the frequency and amplitude of the six highest spurious emissions relative to the limit. Emissions more than 20 dB below the limit do not need to be reported.
Measurements are performed with the EUT rotated from 0° to 360°; the antenna height scanned in accordance with 6.6.3.1, 6.6.3.2, or 6.6.3.3, as appropriate; and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Variations in cable or wire placement shall be explored to maximize the measured emissions.
The emission signal shall be kept within the illumination area of the 3 dB beamwidth of the antenna so that the maximum emission from the EUT is measured. This may be achieved by either pointing the antenna at an angle toward the source of the emission or by testing the EUT as described in 6.6.3.3. If the emission is pulsed, then refer to Annex C for guidelines on selecting bandwidth and determining pulse desensitization factors, as necessary.
As noted in 6.6.4.1, when 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, or narrower bandwidths may be used. If closer measurement distances or higher gain antennas are used, then the beamwidth of the measurement antenna versus the physical size of the EUT shall be taken into account, so that the physical sizes of the EUT dimensions are encompassed by the beamwidth of the measurement antenna. Also, measurement system overload protection shall be determined to be adequate when preamplifiers are used. The effects on the measured emission value using bandwidths different from those specified shall be determined if such bandwidth changes are made. Any changes from the specific measurement conditions shall be described in the report of the measurements.
Unless specified otherwise by the regulatory authority, the instrumentation, detector functions, and bandwidths specified in 4.1.4.2.1 and 4.1.4.2.2 shall be used. For pulsed emissions, the procedure in 4.1.4.2.4 shall be used.

Radiated Emissions Test Characteristics	
Frequency range	911.5 - 921.5 MHz
Test distance	3 m
Test instrumentation resolution bandwidth	120 kHz
Receive antenna height	1 m - 4 m
Receive antenna polarization	Vertical/Horizontal
Measurement chamber	Semi anechoic chamber (SAC)

4.3.3 Calculation of Field Strength Limits

E.g. radiated emissions field strength limits for the inside the band 902 ... 928 MHz:

50 mV/m (=50 000 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 50 000 µV/m corresponds with 94 dBµV/m.

4.3.4 Field Strength Calculation

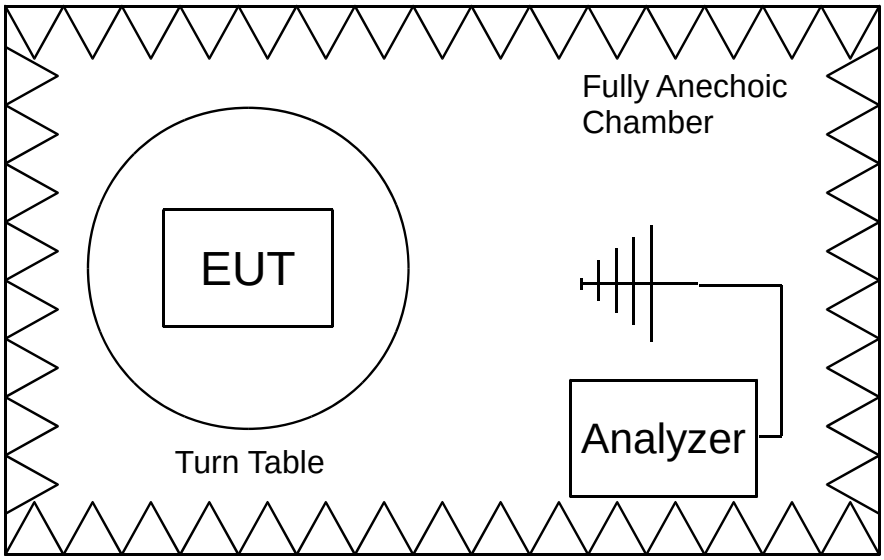
The field strength is calculated by adding the Antenna Factor and Cable Factor. The basic equation with a sample calculation is as follows:

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 76.2 dBµV is obtained. The Antenna Factor of 37.2 dB(1/m) and a Cable Factor of 2.7 dB are added, giving a field strength of 116.1 dBµV/m in the measurement distance. The field strength of 116.1 dBµV/m value can be mathematically converted to its corresponding level in µV/m.

FS = 76.2 + 37.2 + 2.7 = 116.1
Level (in µV/m) = Common Antilogarithm (116.1/20) = 638 263

4.3.5 Test Setup

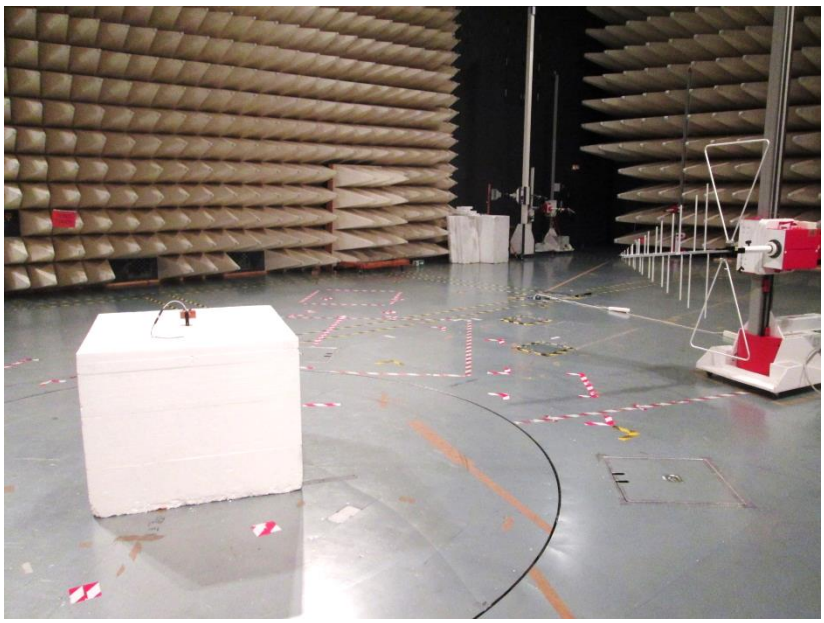


SCHEMATIC TEST SETUP

Requirement: 47 CFR, § 15.215
Procedure: ANSI C63.10-2013

Test Distance: 3 m

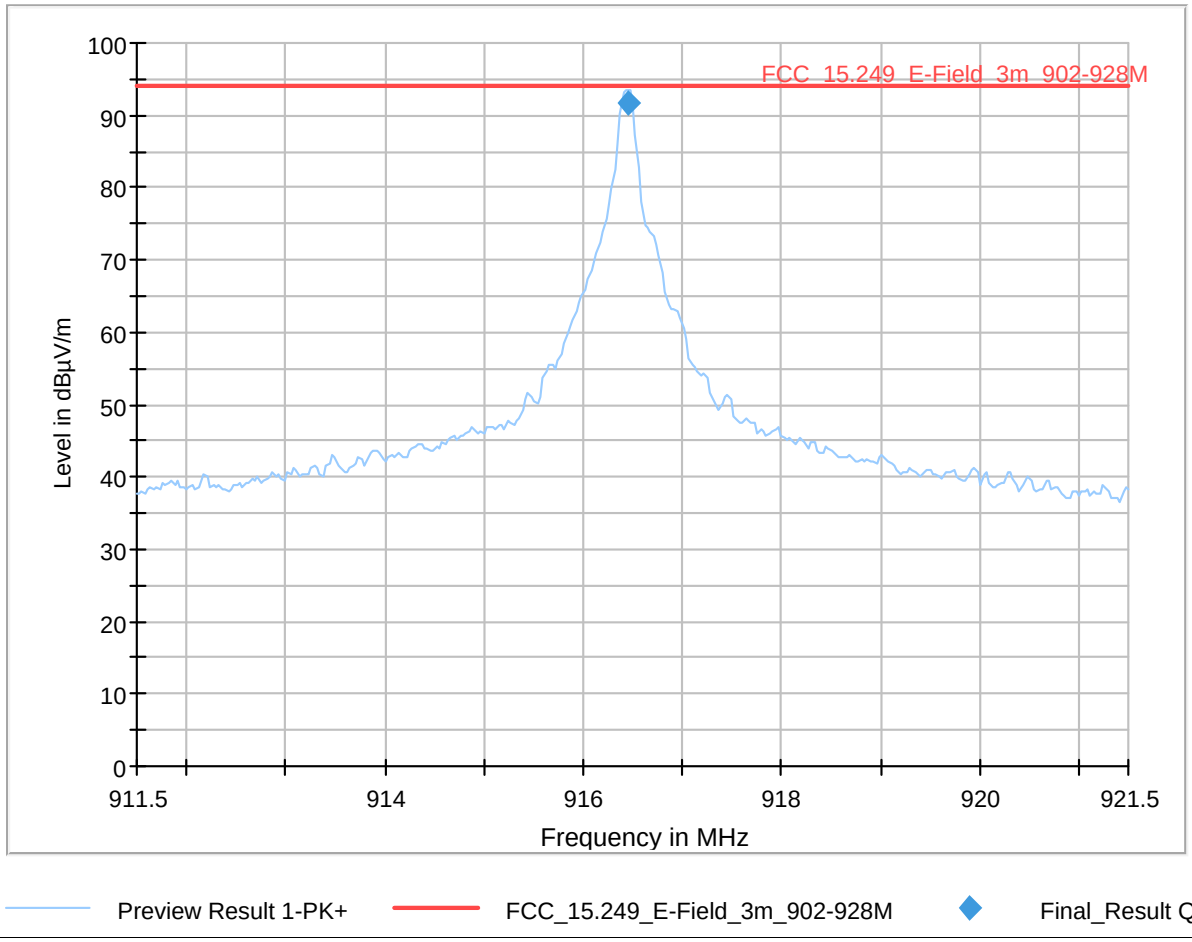
TEST EQUIPMENT USED:
Refer to chapter 5 of this document.
54, 1291, 1292, 1889, 2724, 3846, 4075, 4717, 5392, 6041



Sample photo of setup

4.3.6 Detailed Test Data

EUT Name:	KILN Data Transmitter MCT&WT-TX
Manufacturer:	Fidemco LLC
Serial Number:	27004
Orientation:	X (see Annex 1)
Mode:	Active
Modification:	Modification 1

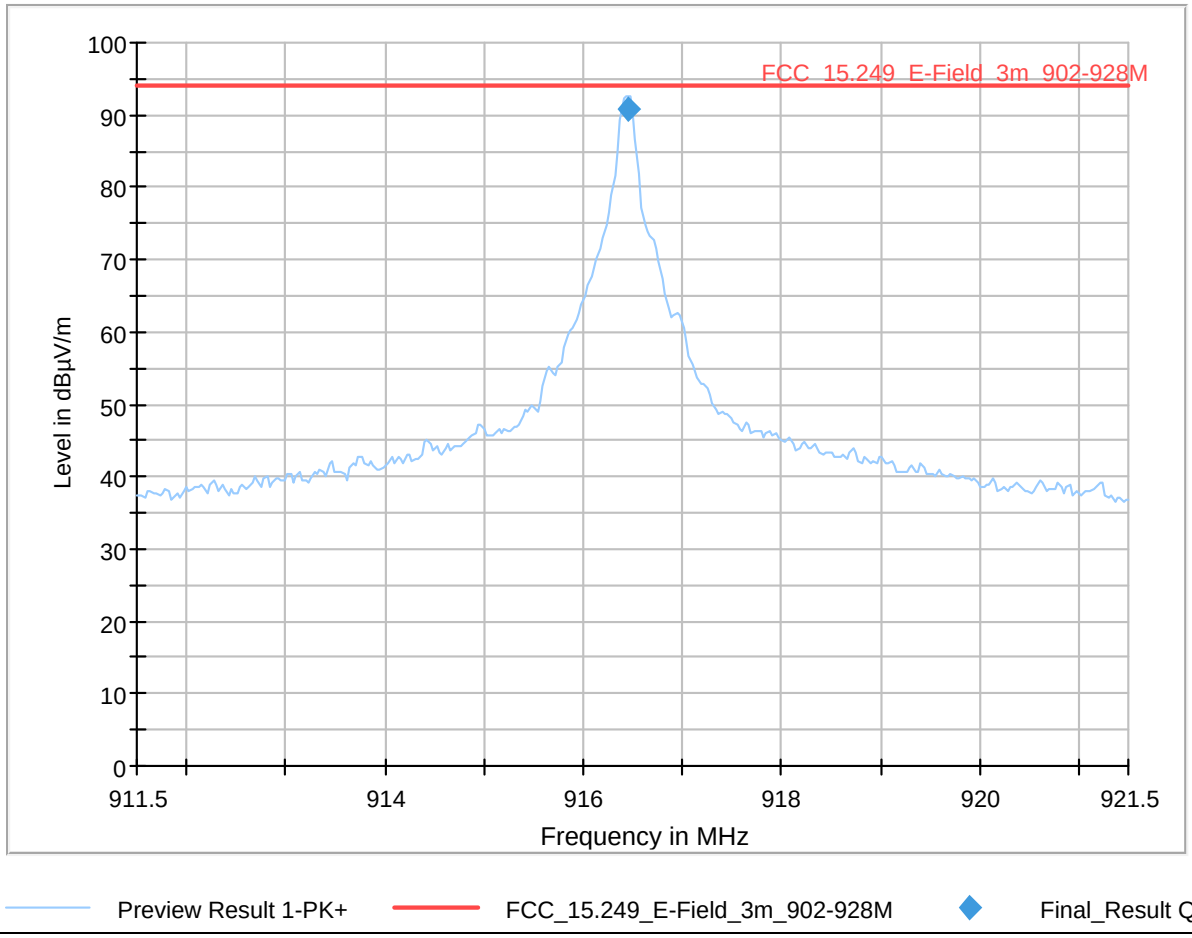


Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
916.45	91.6	94.0	2.4	1000	120.0	100.0	H	-162	29.9

Test on Fidemco LLC MCT&WT-TX to 47 CFR § 15.249

EUT Name:	KILN Data Transmitter MCT&WT-TX
Manufacturer:	Fidemco LLC
Serial Number:	27004
Orientation:	Y (see Annex 1)
Mode:	Active
Modification:	Modification 1

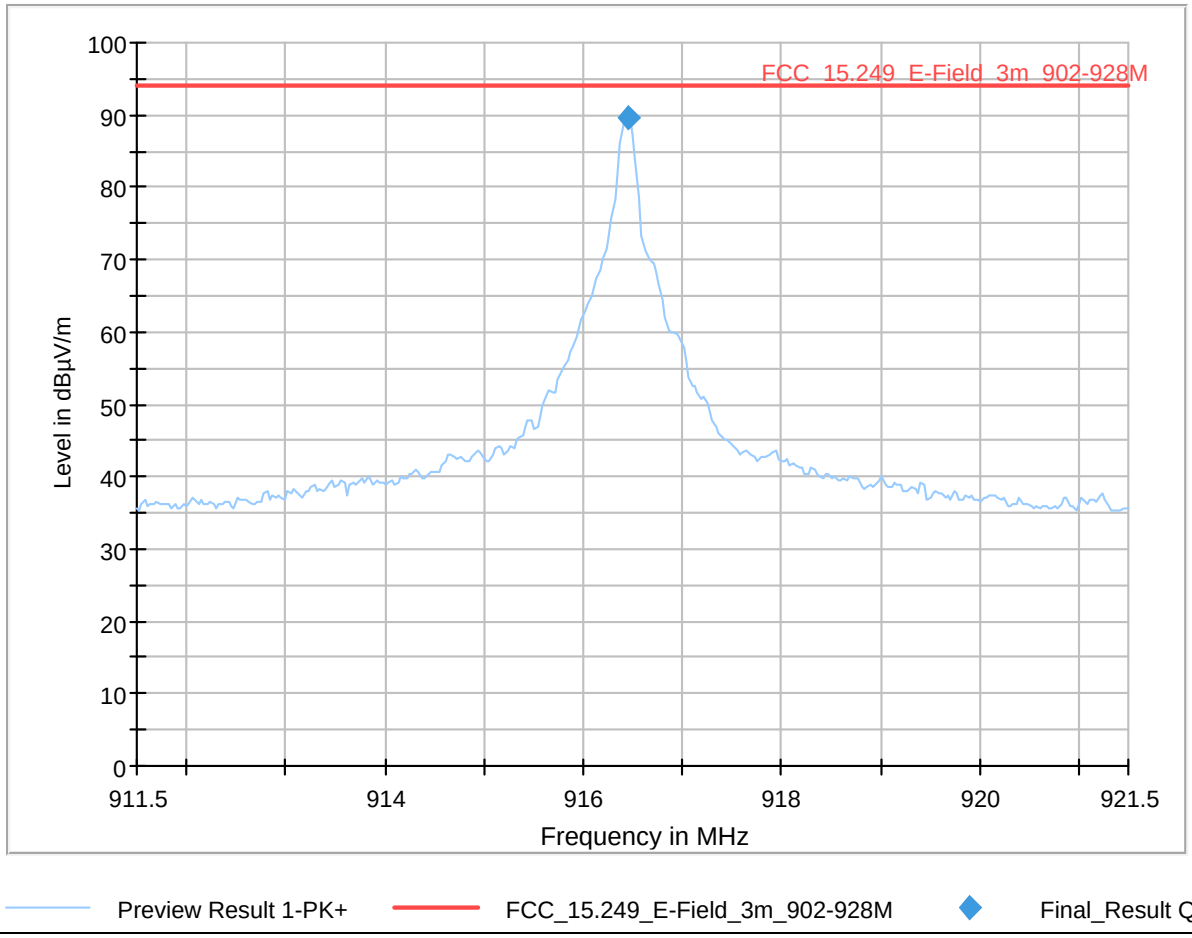


Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
916.45	90.7	94.0	3.3	1000	120.0	115.0	V	-149	29.9

Test on Fidemco LLC MCT&WT-TX to 47 CFR § 15.249

EUT Name:	KILN Data Transmitter MCT&WT-TX
Manufacturer:	Fidemco LLC
Serial Number:	27004
Orientation:	Z (see Annex 1)
Mode:	Active
Modification:	Modification 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)
916.45	89.6	94.0	4.4	1000	120.0	100.0	H	-38	29.9

4.3.7 Test Result

Manufacturer:	Fidemco LLC
Type:	MCT&WT-TX
Serial No.:	27004
Test date:	2019-05-13, 2019-05-14
Test personnel:	Dominik Krüger

The EUT meets the requirements of this section.

4.4 Radiated Emissions

4.4.1 Regulation

47CFR § 15.33 Frequency range of radiated measurements

(a) For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in this paragraph:
(1) If the intentional radiator operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
(2) If the intentional radiator operates at or above 10 GHz and below 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.
(3) If the intentional radiator operates at or above 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower, unless specified otherwise elsewhere in the rules.
(4) If the intentional radiator contains a digital device, regardless of whether this digital device controls the functions of the intentional radiator or the digital device is used for additional control or function purposes other than to enable the operation of the intentional radiator, the frequency range shall be investigated up to the range specified in paragraphs (a)(1) through (a)(3) of this section or the range applicable to the digital device, as shown in paragraph (b)(1) of this section, whichever is the higher frequency range of investigation.

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 § 15.209 Radiated emission limits; general requirements.

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

(e) The provisions in §§15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

47CFR §15.249 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHZ, and 24.0-24.25 GHz.

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

(c) Field strength limits are specified at a distance of 3 meters.
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.
(e) As shown in §15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.

4.4.2 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.

In case of testing being 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.

4.4.3 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

For average measurements, the measured peak field strength is corrected by an AV correction factor. Please refer to chapter 2.6 for details.

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.

4.4.4 Radiated Emissions 9 kHz – 30 MHz

4.4.4.1 Test Procedures

ANSI C63.10-2013, 6.4.3 Measuring antenna selection, location, and test distance
Radiated emission tests shall be performed in the frequency range of 9 kHz to 30 MHz, using a calibrated loop antenna as specified in 4.3.2, at a suitable site and measurement distance as specified in 5.3. This method is applicable for measuring radiated RF emissions from all units, cables, power cords, and interconnect cabling or wiring of the EUT, by applying the guidance provided in 5.10 along with guidance provided subsequently.

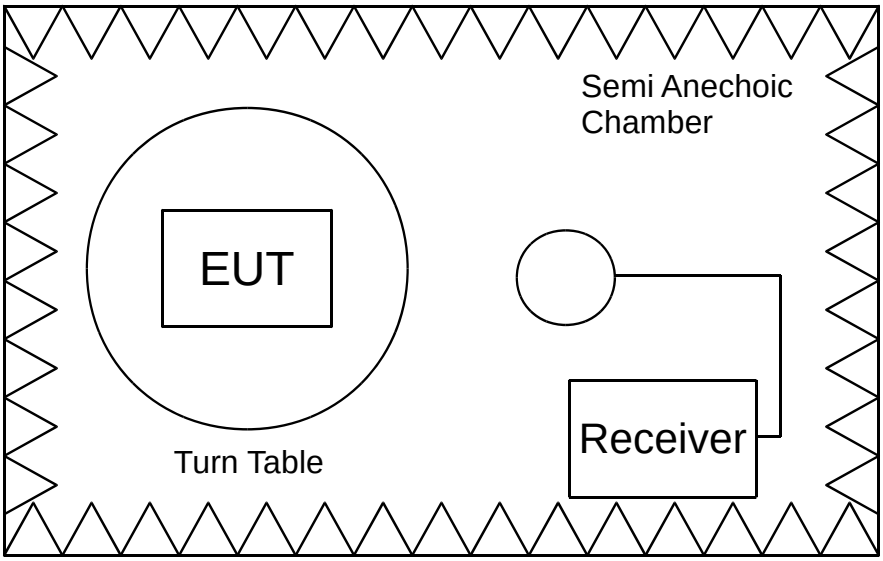
ANSI C63.10-2013, 6.4.6 Exploratory radiated emission tests
The tests shall be performed in the frequency range specified in 5.5 and 5.6, using the procedures in Clause 5, applying the appropriate modulating signal to the EUT, to determine cable or wire positions of the EUT system that produce the emission with the highest amplitude relative to the limit.
Exploratory measurements below 30 MHz are useful in determining the maximum level of emissions while manipulating and rotating the EUT; however, exploratory and final measurements may be made concurrently, provided care is taken to determine the maximum level of emissions for all configurations and orientations.
The test arrangement, measuring antenna guidelines and operational configurations in 6.3.1 and 6.3.2, shall be followed. The measurement antenna shall be positioned with its plane perpendicular to the ground at the specified distance. When perpendicular to the ground plane, the lowest height of the magnetic antenna shall be 1 m above the ground and shall be positioned at the specified distance from the EUT. When the EUT contains a loop antenna that can only be placed in a vertical axis, normal measurements shall be made aligning the measurement antenna along the site axis, and then orthogonal to the axis. For each measurement antenna alignment, the EUT shall be rotated through 0° to 360° on a turntable. When the EUT contains a loop antenna that can be placed in a horizontal or vertical axis, normal measurements shall be made aligning the measurement antenna along the site axis, orthogonal to the axis, and then with the measurement antenna horizontal. For each measurement antenna alignment, the EUT shall be rotated through 0° to 360° on a turntable. The report shall list the six emissions with the smallest margin relative to the limit, for each of the three antenna orientations (parallel, perpendicular, and ground-parallel) unless the margin is greater than 20 dB, then the following statement shall be made: “all emissions were greater than 20 dB below the limit.”

ANSI C63.10-2013, 6.4.7 Final radiated emission tests
Using the orientation and equipment arrangement of the EUT determined in 6.4.6, and applying the appropriate modulating signal to the EUT, perform final radiated emission measurements on the fundamental and highest spurious emissions.
Unless otherwise specified by the regulatory authority, the instrumentation, detector functions, and bandwidths specified in 4.1.4.2.1 shall be used. For pulsed emissions, the procedure in 4.1.4.2.4 shall be used.

Radiated Emissions Test Characteristics	
Frequency range	9 kHz – 30 MHz
Test distance	3 m
Test instrumentation resolution bandwidth	200 Hz (< 150 kHz) 9 kHz (≥ 150 kHz)
Receive antenna height	1 m
Receive antenna orientations	2
Measurement chamber	Semi anechoic chamber (SAC)

Following the test procedure described in KDB 414788, an open field measurement has to be performed in addition to the measurements performed in a semi anechoic chamber to evaluate a correction of the open field measurement to the semi-anechoic chamber measurement.
Hence laboratory experience has shown, that the correction factor is always negative, resulting in a lower level at the open field, these open field measurements are omitted, if there are all measurement emissions more than 20 dB below the limit.

4.4.4.2 Test Setup

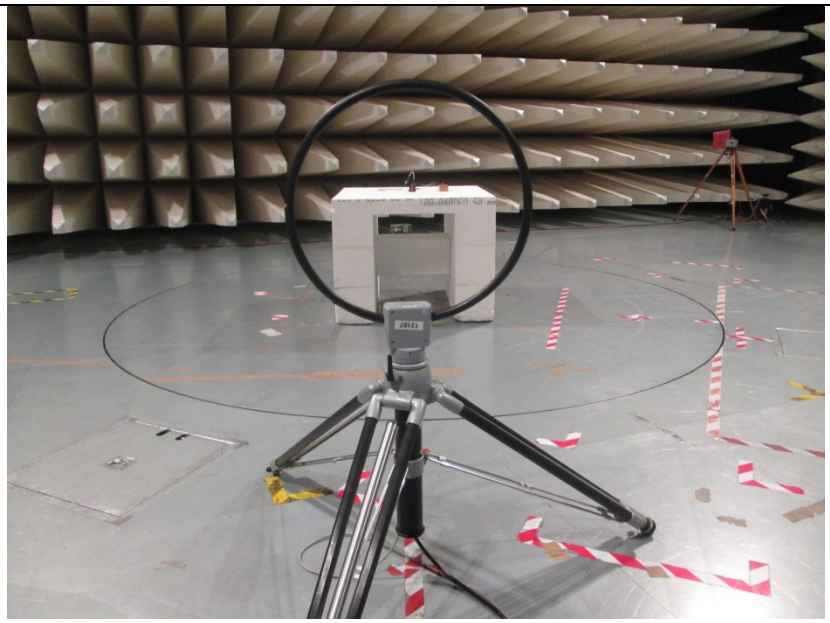


SCHEMATIC TEST SETUP

Requirement: 47 CFR, § 15.209
Procedure: ANSI C63.10-2013

Test distance: 3 m

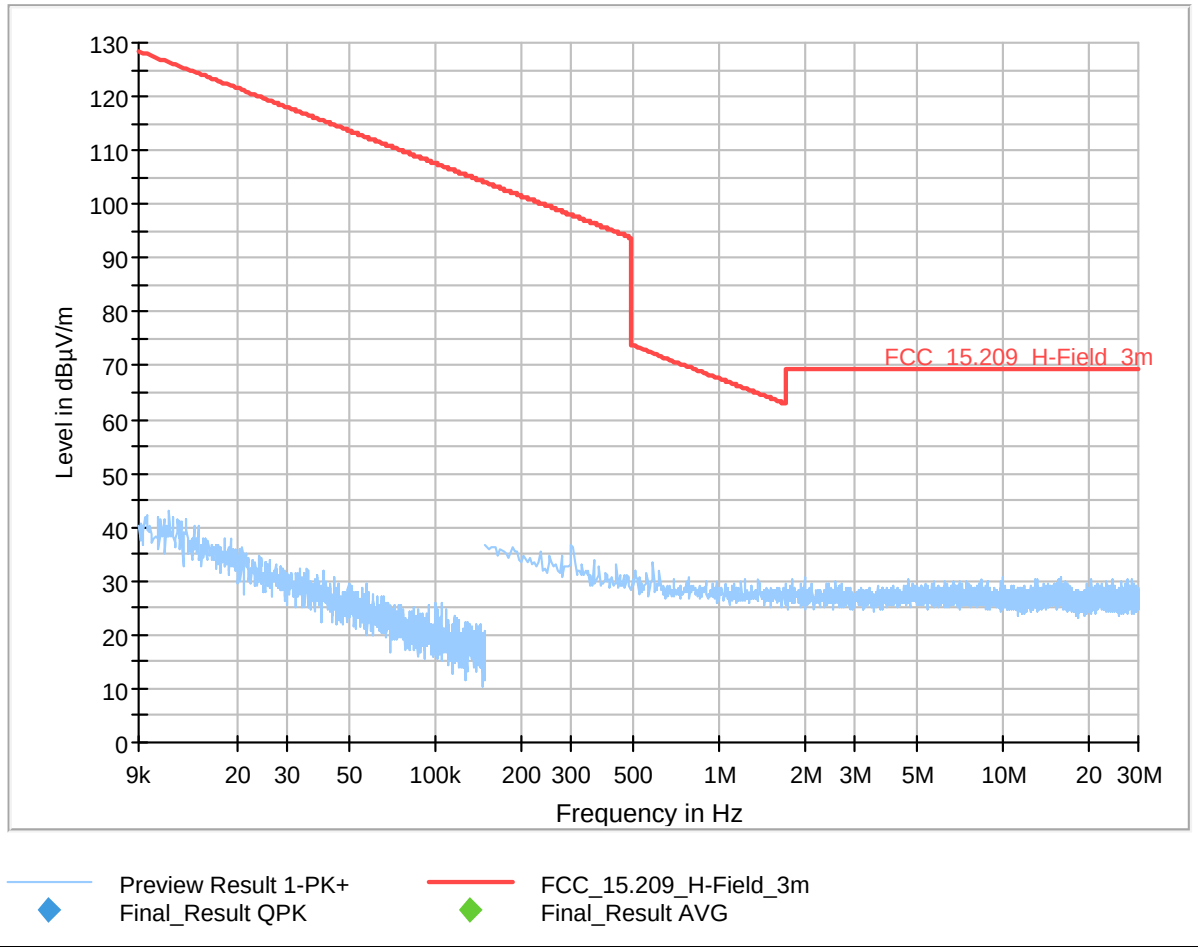
TEST EQUIPMENT USED:
Refer to chapter 5 of this document.
374, 1889, 1292, 3846, 4075, 4717, 5392



Sample photo of setup

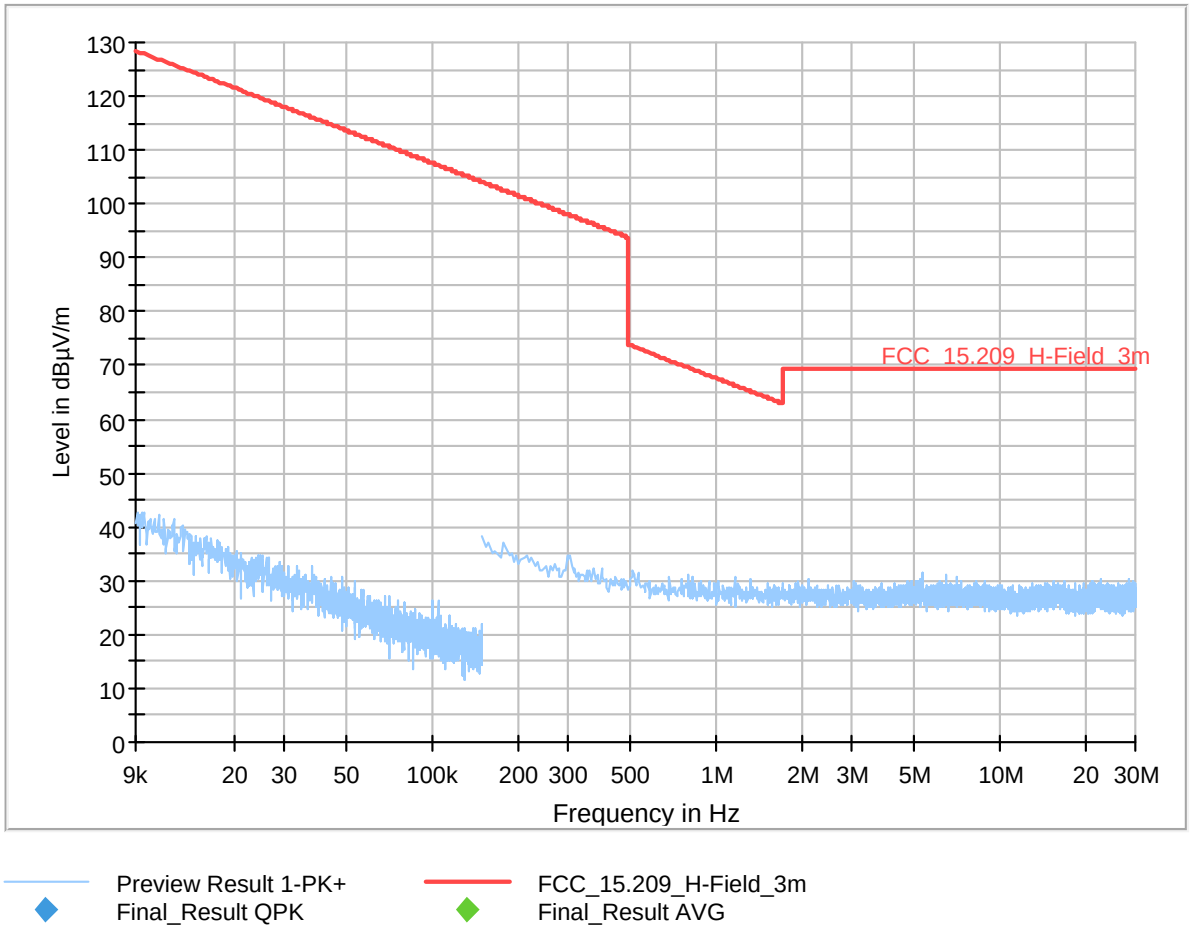
4.4.4.3 Detailed Test Data

Manufacturer:	Fidemco LLC
Type:	KILN Data Transmitter MCT&WT-TX
Serial No:	27002
EUT Orientation:	X (see Annex 1)
Mode:	Continuous Transmission
Modification:	none



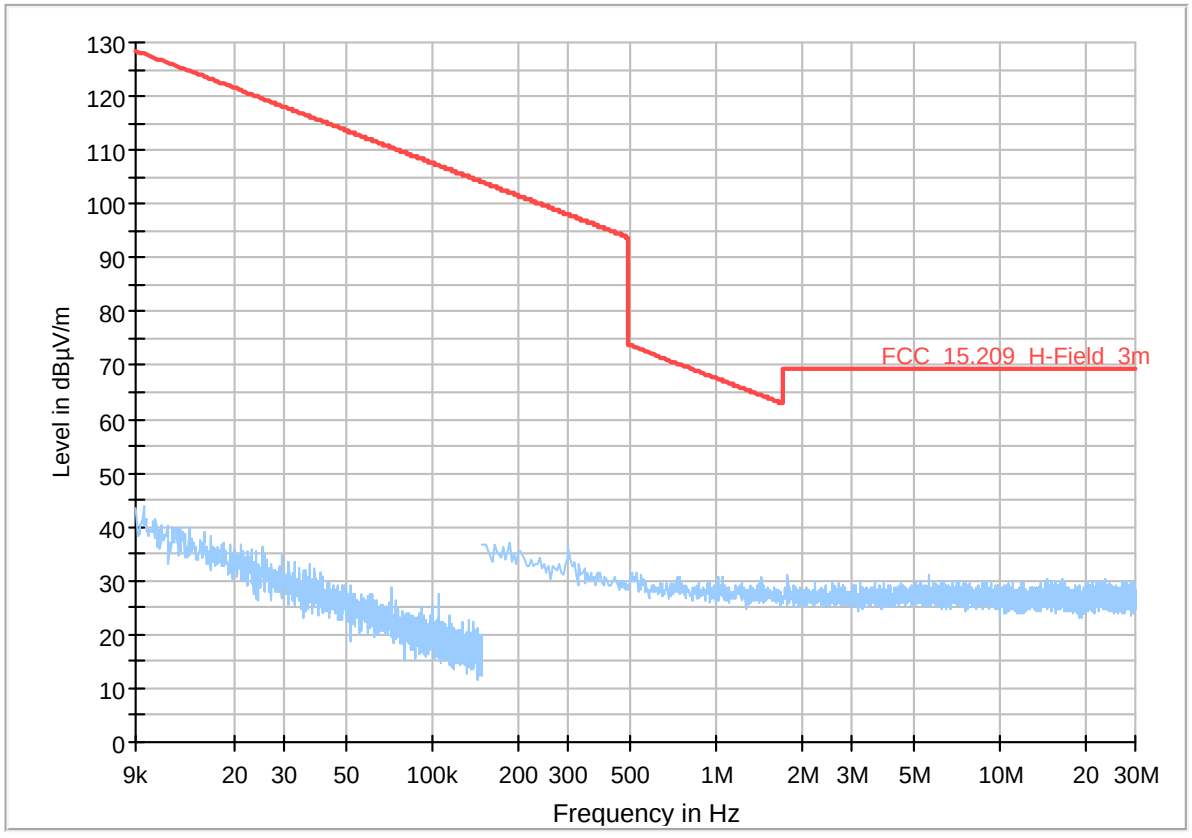
Test on Fidemco LLC MCT&WT-TX to 47 CFR § 15.249

Manufacturer:	Fidemco LLC
Type:	KILN Data Transmitter MCT&WT-TX
Serial No:	27002
EUT Orientation:	Y (see Annex 1)
Mode:	Continuous Transmission
Modification:	none



Test on Fidemco LLC MCT&WT-TX to 47 CFR § 15.249

Manufacturer:	Fidemco LLC
Type:	KILN Data Transmitter MCT&WT-TX
Serial No:	27002
EUT Orientation:	Z (see Annex 1)
Mode:	Continuous Transmission
Modification:	none



Final Result:

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

All emissions were greater than 20 dB below the limit.
Therefore, no final measurement performed.

All tests performed at the distance denoted in chapter 4.4.4.1. The limit was adjusted to correspond with the test distance.
The table above contains worst-case emissions, only. For further details refer to the pre-scan test plot above.

4.4.4.4 Test Result

Manufacturer:	Fidemco LLC
Type:	MCT&WT-TX
Serial No.:	27002
Test date:	2019-05-14
Test personnel:	Dominik Krüger

The EUT meets the requirements of this section.

4.4.5 Radiated Emissions 30 MHz – 1000 MHz

4.4.5.1 Test Procedures

ANSI C63.10-2013 6.5 Radiated emissions from unlicensed wireless devices in the frequency range of 30 MHz to 1000 MHz

This subclause specifies conditions for compliance testing in the frequency range above 30 MHz and below 1 GHz. The following subclauses describe the procedures that shall be used for making exploratory and final radiated emission tests for frequencies between 30 MHz and 1000 MHz. Measurements may be performed at a distance closer than that specified in the requirements, provided the measuring antenna is beyond its near-field range as determined by the Rayleigh criteria.

ANSI C63.10-2013, 6.5.3 Exploratory radiated emission tests

Exploratory measurements are used to identify the frequencies and amplitudes of the emissions while manipulating and rotating the EUT.

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. At near distances, for EUTs of comparably small size, it is relatively easy to determine the spectrum signature of the EUT and, if applicable, the EUT configuration that produces the maximum level of emissions. Exploratory measurements shall be made on a test site per 5.2. Shielded rooms, not treated with RF absorption material, shall not be used for exploratory measurements.

For each mode of operation required to be tested, the frequency spectrum shall be monitored. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations.

ANSI C63.10-2013, 6.5.4 Final radiated emission tests

Using the orientation and equipment arrangement of the EUT, and based on the measurement results found during the exploratory measurement in 6.5.3, the EUT arrangement, appropriate modulation, and modes of operation that produce the emissions that have the highest amplitude relative to the limit shall be selected for the final measurement. The final measurement shall follow all the procedures in 6.3 with the EUT operating on frequencies per 5.6. For each mode selected, record the frequency and amplitude of the highest fundamental emission (if applicable) and the frequency and amplitude of the six highest spurious emissions relative to the limit; emissions more than 20 dB below the limit do not need to be reported.

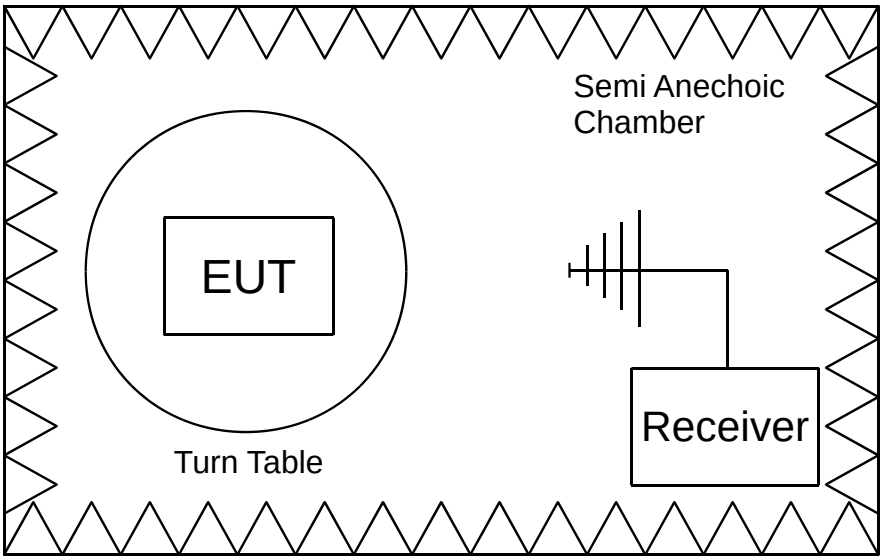
Measurements are performed with the EUT rotated from 0° to 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

Variations in cable or wire placement shall be explored to maximize the measured emissions.

Unless specified otherwise by the regulatory authority, the instrumentation, detector functions, and bandwidths specified in 4.1.4.2.1 and 4.1.4.2.2 shall be used. For pulsed emissions, the procedure in 4.1.4.2.4 shall be used.

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)

4.4.5.2 Test Setup

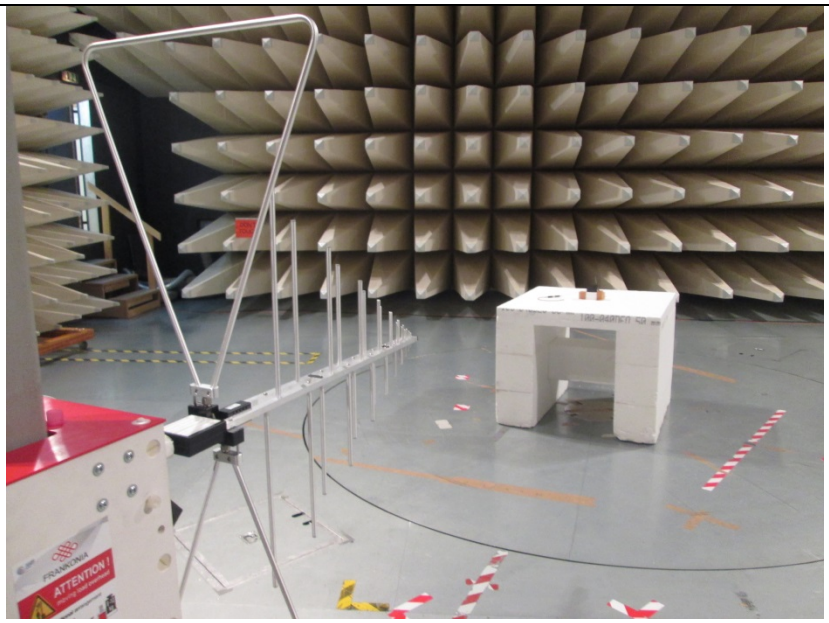


SCHEMATIC TEST SETUP

Requirement: 47 CFR, § 15.209
Procedure: ANSI C63.10-2013

Test distance: 3 m

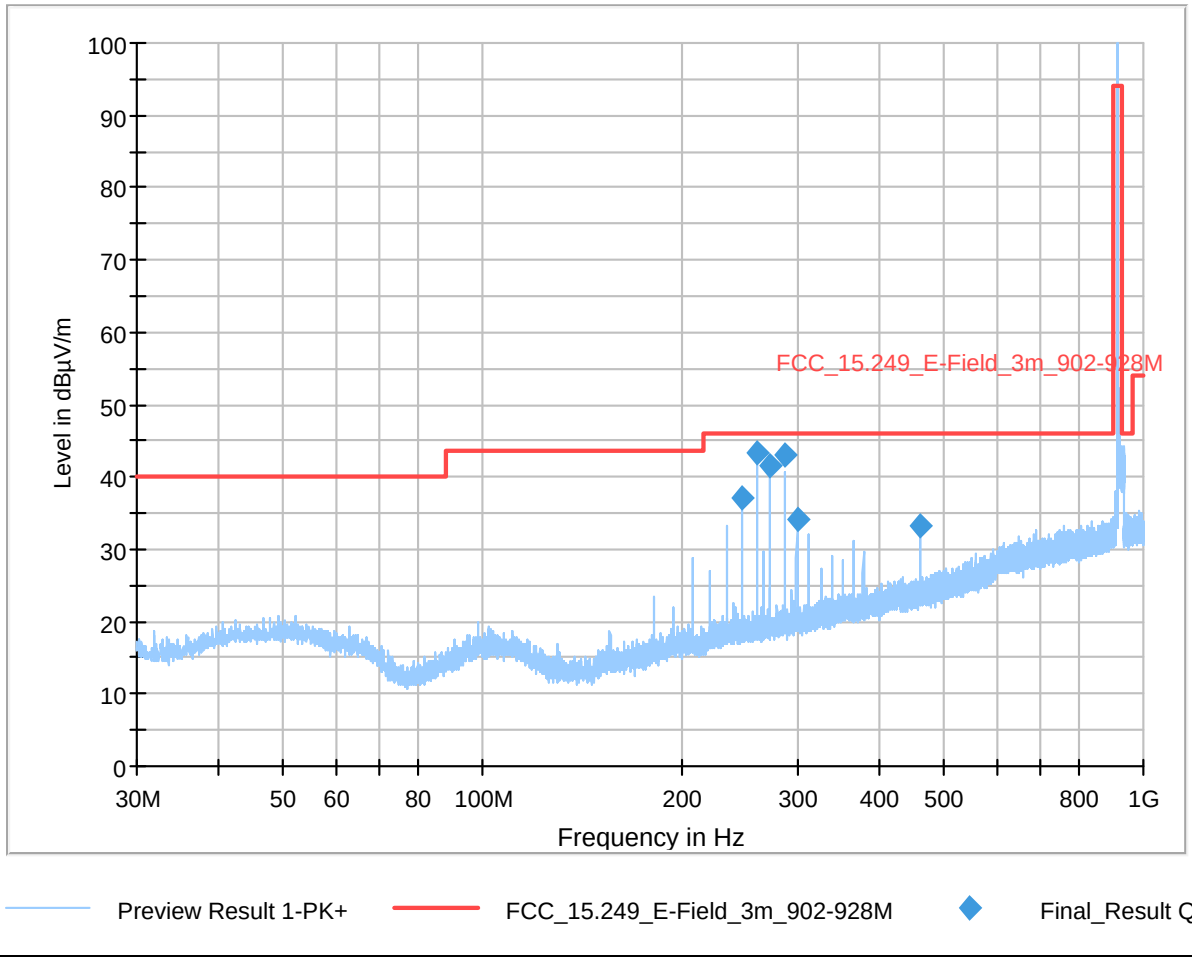
TEST EQUIPMENT USED:
Refer to chapter 5 of this document.
54, 1291, 1292, 1889, 2724, 3846, 4075, 4717, 5392, 6041



Sample photo of setup

4.4.5.3 Detailed Test Data

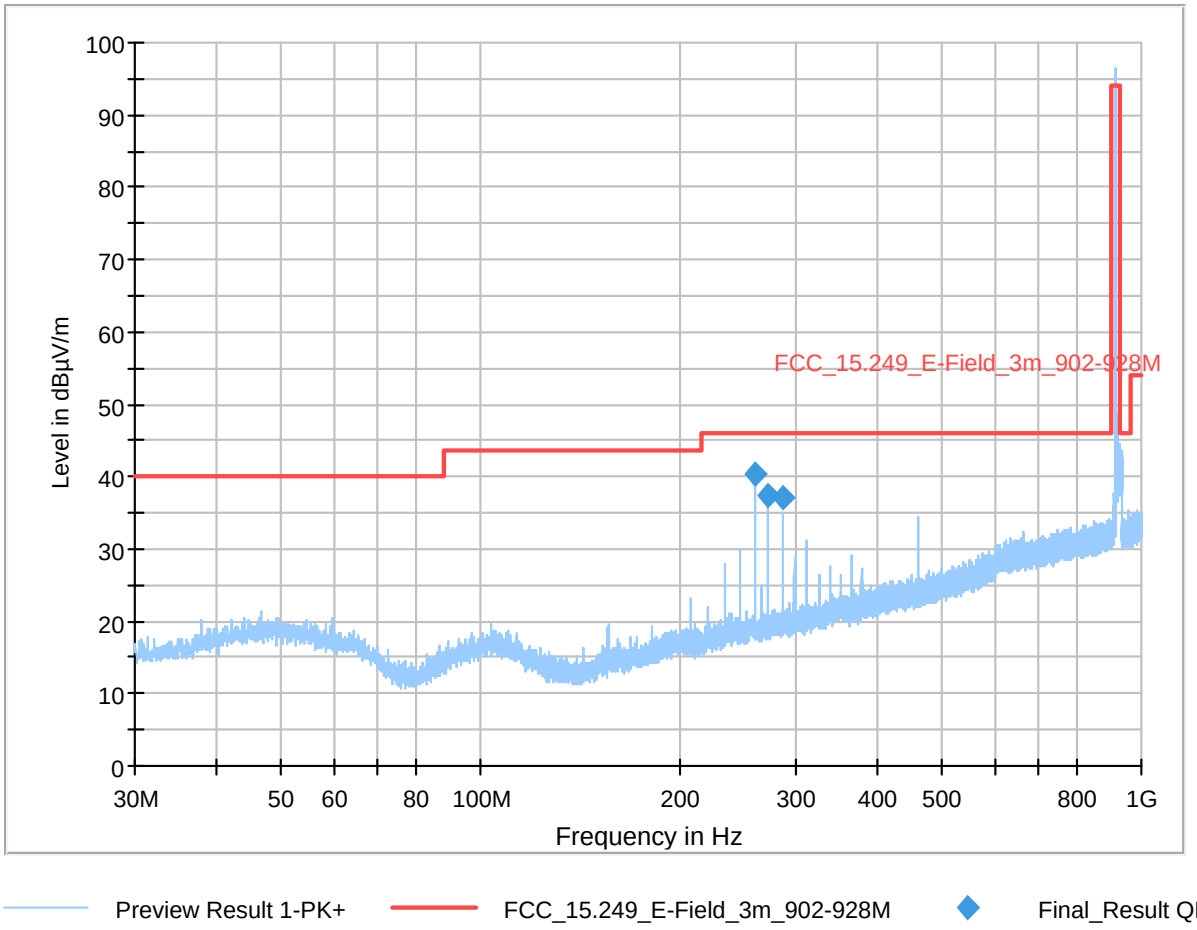
Manufacturer:	Fidemco LLC
Type:	KILN Data Transmitter MCT&WT-TX
Serial No:	27002
EUT Orientation:	X (see Annex 1)
Mode:	Continuous Transmission
Modification:	none



The carrier frequency was not taken into account in this plot and considered in chapter4.3.6.

Test on Fidemco LLC MCT&WT-TX to 47 CFR § 15.249

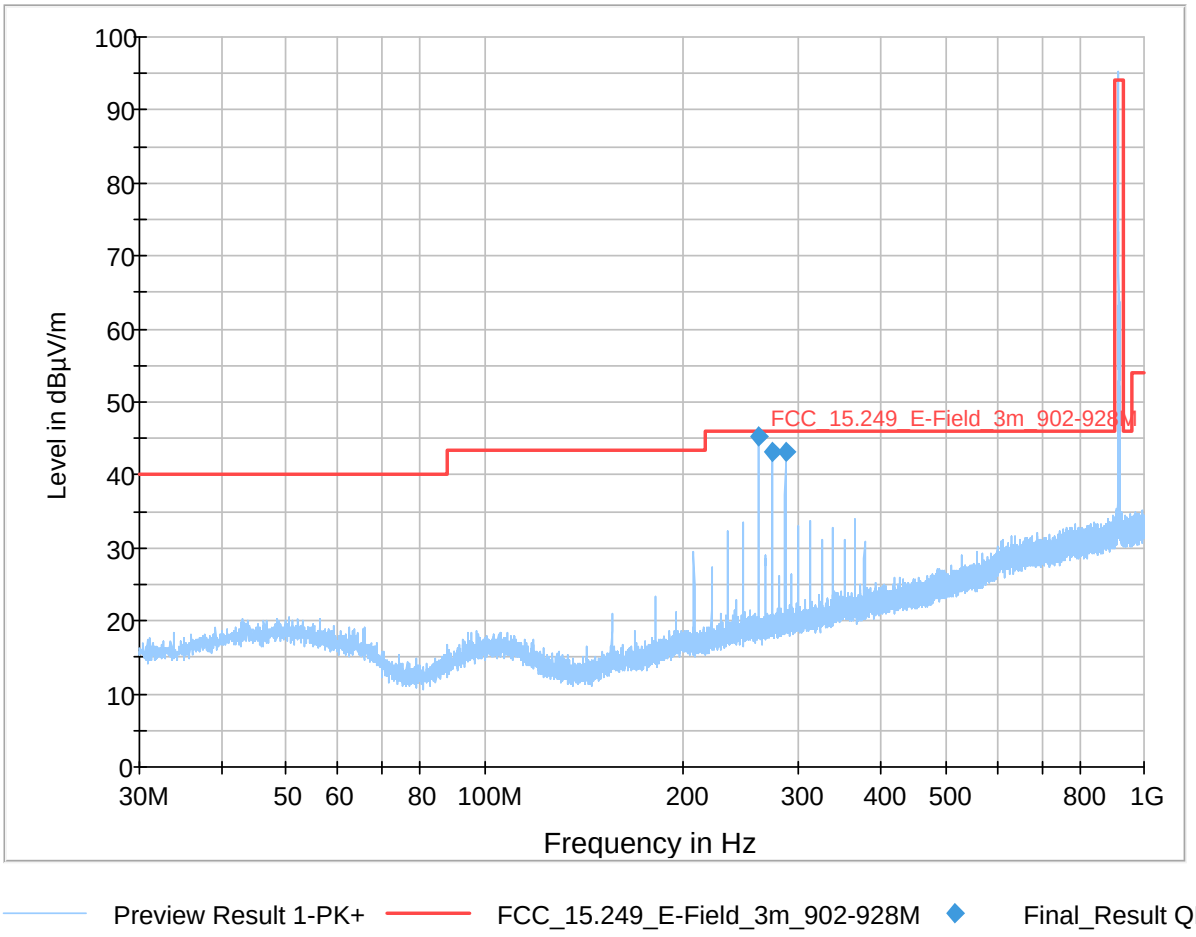
Manufacturer:	Fidemco LLC
Type:	KILN Data Transmitter MCT&WT-TX
Serial No:	27002
EUT Orientation:	Y (see Annex 1)
Mode:	Continuous Transmission
Modification:	none



The carrier frequency was not taken into account in this plot and considered in chapter4.3.6.

Test on Fidemco LLC MCT&WT-TX to 47 CFR § 15.249

Manufacturer:	Fidemco LLC
Type:	KILN Data Transmitter MCT&WT-TX
Serial No:	27002
EUT Orientation:	Z (see Annex 1)
Mode:	Continuous Transmission
Modification:	none



The carrier frequency was not taken into account in this plot and considered in chapter4.3.6.

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)
246.98	37.2	46.0	8.8	1000	120.0	123.0	H	71	18.8
259.98	45.3	46.0	0.7	1000	120.0	116.0	H	5	19.2
272.98	43.1	46.0	2.9	1000	120.0	117.0	H	9	19.4
285.98	43.1	46.0	2.9	1000	120.0	115.0	H	82	19.7
298.98	34.2	46.0	11.8	1000	120.0	102.0	H	73	20.0
458.22	33.4	46.0	12.6	1000	120.0	205.0	H	82	23.4

The table above contains worst-case emissions, only. For further details refer to the pre-scan test plot above.

4.4.5.4 Test Result

Manufacturer:	Fidemco LLC
Type:	MCT&WT-TX
Serial No.:	27002
Test date:	2019-05-13, 2019-05-14
Test personnel:	Dominik Krüger

The EUT meets the requirements of this section.

4.4.6 Radiated Emissions 1 – 6 GHz

4.4.6.1 Test Procedures

ANSI C63.10-2013, 6.6.4.1 General

Subclauses 6.6.4.2 and 6.6.4.3 describe the procedures that shall be used for making exploratory and final radiated emission tests for frequencies above 1 GHz. Measurements may be performed at a distance closer than that specified in the requirements; however, an attempt shall be made to avoid making measurements in the near field of both the measurement antenna and the EUT for final measurements.

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 does not provide a noise floor more than 6 dB below the limit, then low-noise preamplifiers, closer test distances, higher gain antennas, or narrower bandwidths might be required. If closer measurement distances are used, then the beamwidth of the measurement antenna versus the size of the EUT shall be taken into account. Also, measurement system overload protection shall be determined to be adequate when preamplifiers are used [see item b) of 4.1.3]. The effects of using bandwidths different from those specified shall also be determined (see also 6.3). Any changes from the specific measurement conditions shall be described in the report of the measurements (see also Annex E).

Install an appropriate filter at the input of the measurement system power amplifier. This filter shall attenuate the fundamental emission of the EUT and allow an accurate measurement of the associated harmonics and spurious emissions. The filter shall be characterized, and any attenuation/loss factors shall be accounted for in the measurement results.

Data shall be recorded in peak and average detection upto the highest measurement frequency required (unless stated otherwise in the applicable requirements).

ANSI C63.10-2013, 6.6.4.2 Exploratory radiated emissions measurements

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 and, if applicable, the EUT configuration that produces the maximum level of emissions. The frequencies of maximum emission may be determined by manually positioning the antenna close to the EUT, and then moving the antenna over all sides of the EUT while observing a spectral display. It is advantageous to have prior knowledge of the frequencies of emissions, although this may be determined from such a near-field scan. The near-field scan shall only be used to determine the frequency but not the amplitude of the emissions. Where exploratory measurements are not adequate to determine the worst-case operating modes and are used only to identify the frequencies of the highest emissions, additional preliminary tests can be required.

Preliminary tests shall be performed following the procedures in 6.3 on a site meeting the requirements of 5.2. For emissions from the EUT, the maximum level shall be determined by rotating the EUT and its antenna through 0° to 360°. For each mode of operation required to be tested, the frequency spectrum (based on findings from exploratory measurements) shall be monitored.

Broadband antennas and a spectrum analyzer or a radio-noise meter with a panoramic display are often useful in this type of test. If either antenna height or EUT azimuth are not fully measured during exploratory testing, then complete testing can be required at the OATS or semi-anechoic chamber when the final full spectrum testing is performed.

ANSI C63.10.2013, 6.6.4.3 Final radiated emissions measurements

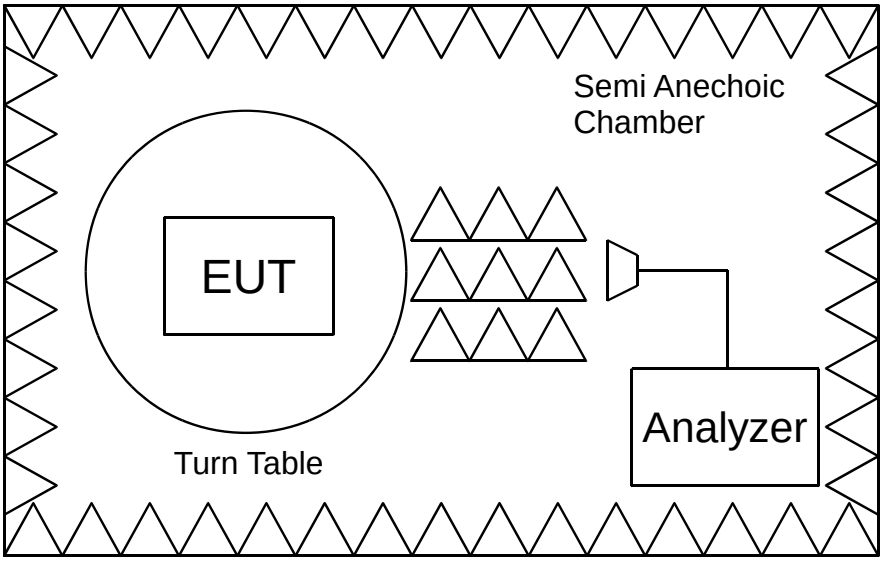
The final measurements are performed on a site meeting the requirements of 5.2. Using the orientation and equipment arrangement of the EUT based on the measurement results found during the preliminary (exploratory) measurements per 6.6.4.2, the EUT arrangement, appropriate modulation, and modes of operation that produce the emissions that have the highest amplitude relative to the limit shall be selected for the final measurement. The final measurement shall follow all the procedures in 6.3 with the EUT operating on frequencies per 5.6. For each mode selected, record the frequency and amplitude of the highest fundamental emission (if applicable), as well as the frequency and amplitude of the six highest spurious emissions relative to the limit. Emissions more than 20 dB below the limit do not need to be reported.

Measurements are performed with the EUT rotated from 0° to 360°; the antenna height scanned in accordance with 6.6.3.1, 6.6.3.2, or 6.6.3.3, as appropriate; and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Variations in cable or wire placement shall be explored to maximize the measured emissions.

The emission signal shall be kept within the illumination area of the 3 dB beamwidth of the antenna so that the maximum emission from the EUT is measured. This may be achieved by either pointing the antenna at an angle toward the source of the emission or by testing the EUT as described in 6.6.3.3.
If the emission is pulsed, then refer to Annex C for guidelines on selecting bandwidth and determining pulse desensitization factors, as necessary.
As noted in 6.6.4.1, when 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, or narrower bandwidths may be used. If closer measurement distances or higher gain antennas are used, then the beamwidth of the measurement antenna versus the physical size of the EUT shall be taken into account, so that the physical sizes of the EUT dimensions are encompassed by the beamwidth of the measurement antenna. Also, measurement system overload protection shall be determined to be adequate when preamplifiers are used. The effects on the measured emission value using bandwidths different from those specified shall be determined if such bandwidth changes are made. Any changes from the specific measurement conditions shall be described in the report of the measurements.
Unless specified otherwise by the regulatory authority, the instrumentation, detector functions, and bandwidths specified in 4.1.4.2.1 and 4.1.4.2.2 shall be used. For pulsed emissions, the procedure in 4.1.4.2.4 shall be used.

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

4.4.6.2 Test Setup

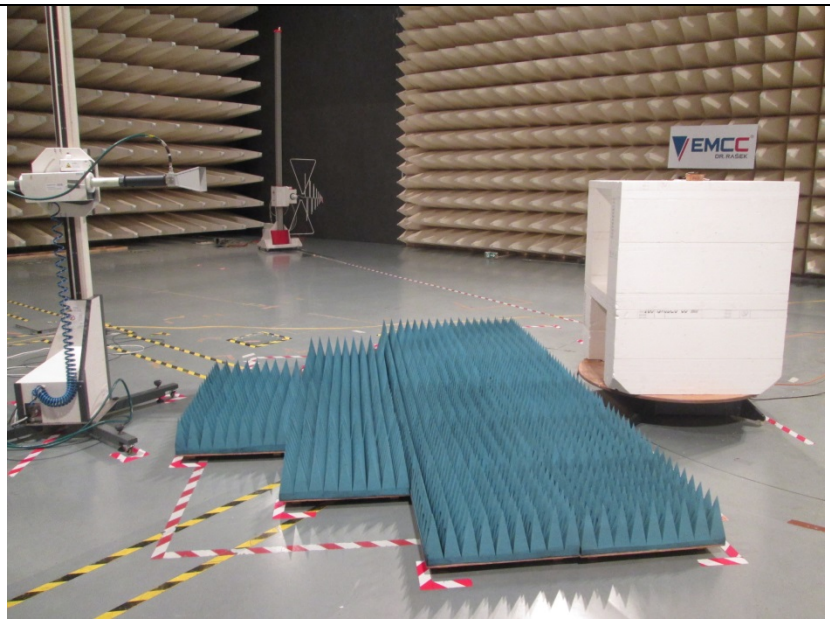


SCHEMATIC TEST SETUP

Requirement: 47 CFR, § 15.209
Procedure: ANSI C63.10-2013

Test distance: 3 m

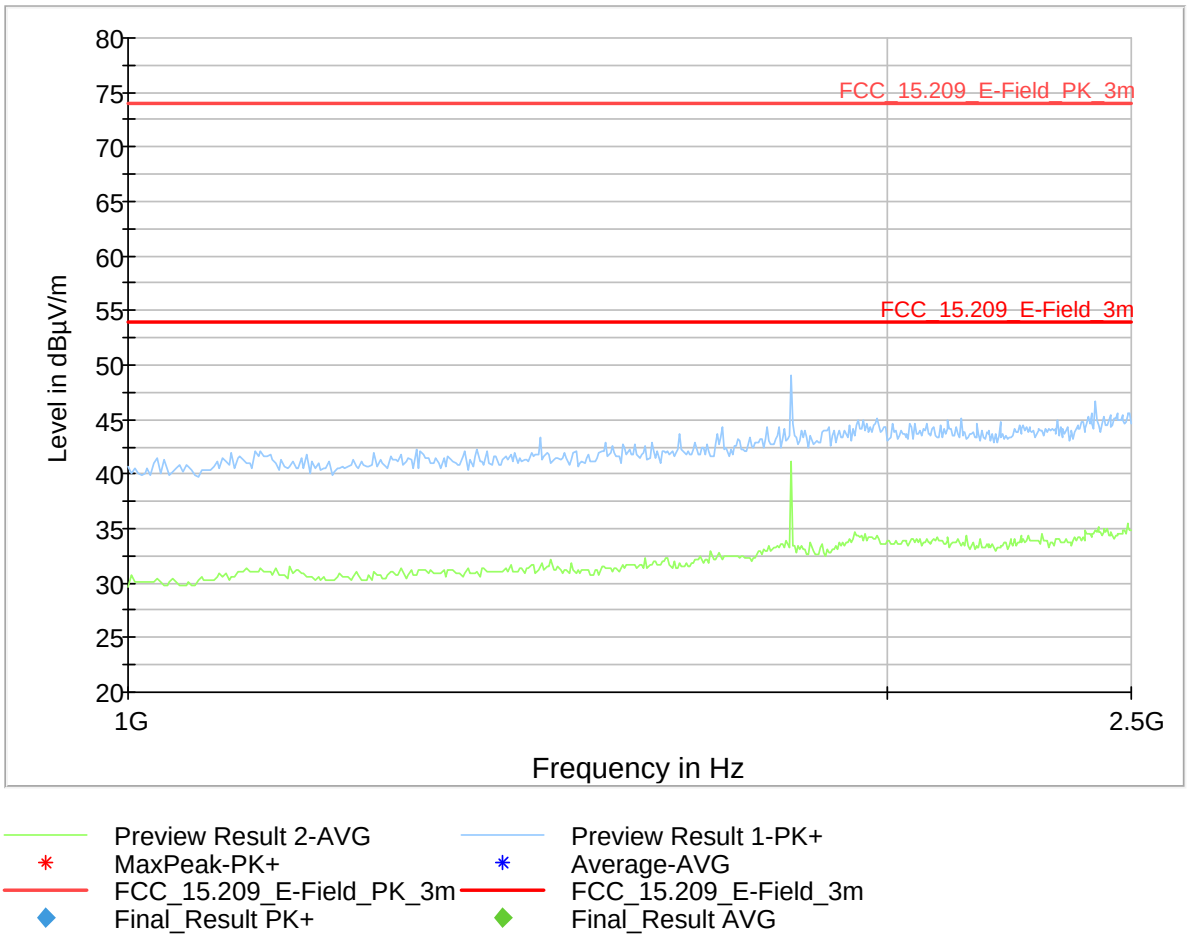
TEST EQUIPMENT USED:
Refer to chapter 5 of this document.
516, 1036, 1037, 1889, 3235, 4075, 4717, 5366, 5392, 5535, 5536, 5544, 5545, 5616



Sample photo of setup

4.4.6.3 Detailed Test Data

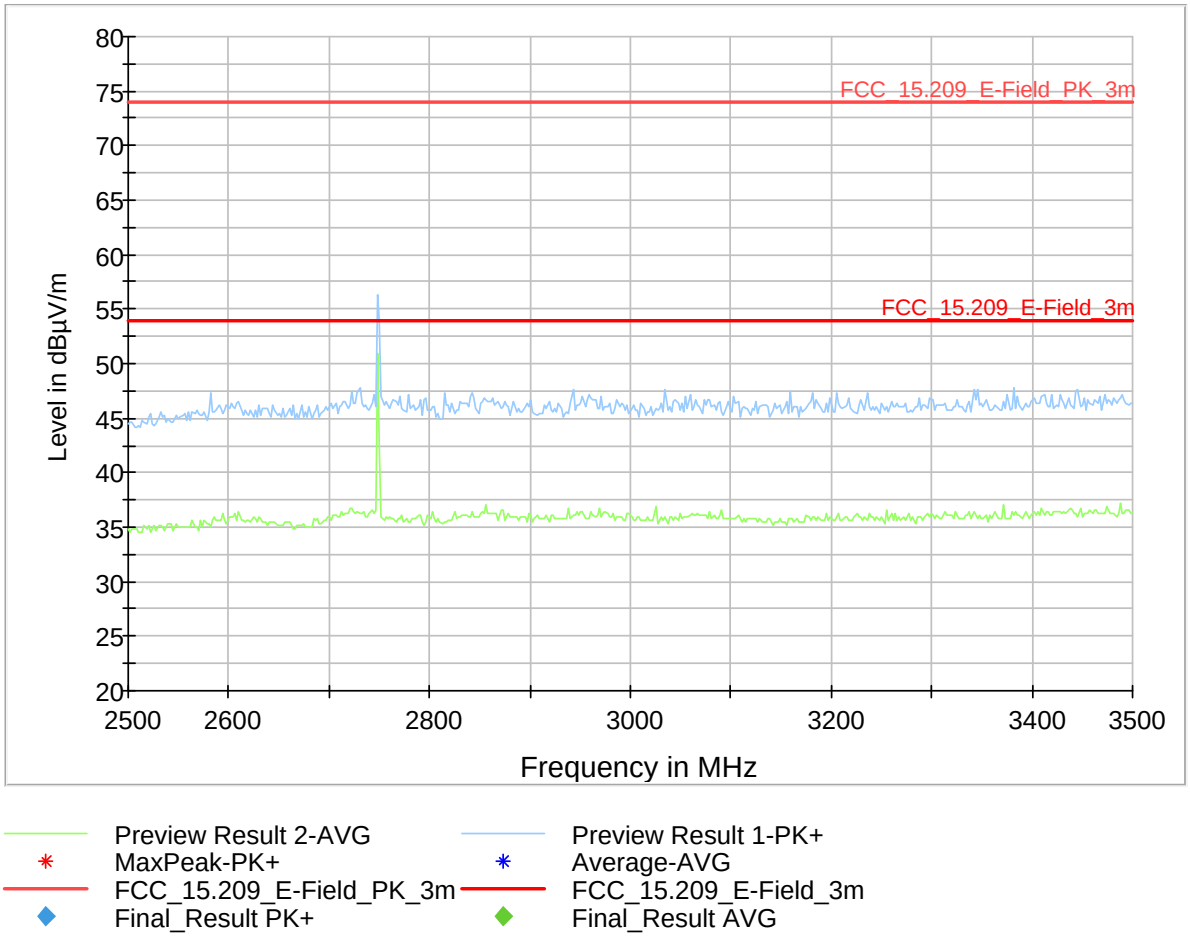
Manufacturer:	Fidemco LLC
Type:	KILN Data Transmitter MCT&WT-TX
Serial No:	27002
EUT Orientation:	X (see Annex 1)
Mode:	Continuous Transmission
Modification:	Modification 1



The average detector measurement of the harmonics was not taken into account due to the average correction factor based on the transmission time ratio of the EUT. For further details refer to chapter 2.6 of the report

Test on Fidemco LLC MCT&WT-TX to 47 CFR § 15.249

Manufacturer:	Fidemco LLC
Type:	KILN Data Transmitter MCT&WT-TX
Serial No:	27002
EUT Orientation:	X (see Annex 1)
Mode:	Continuous Transmission
Modification:	Modification 1



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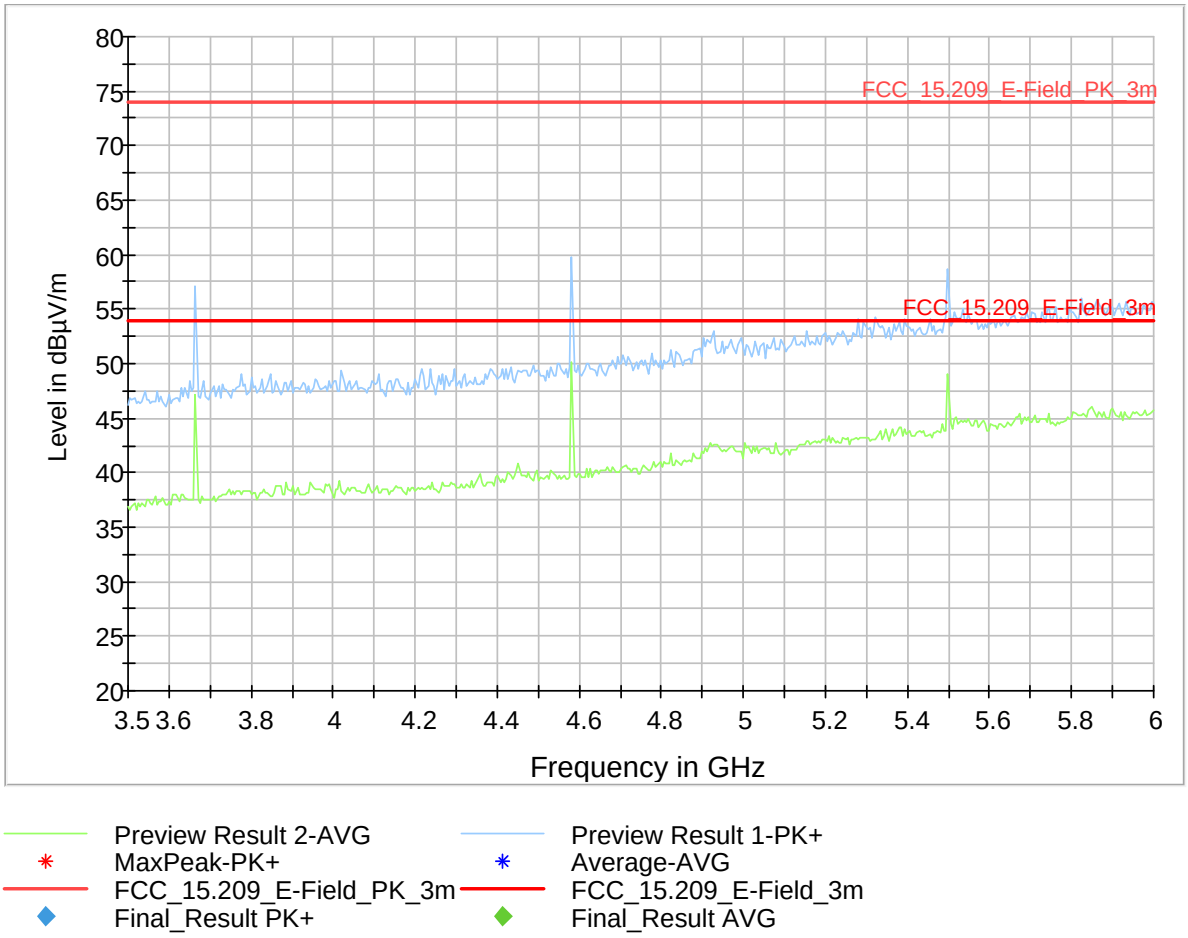
Manufacturer:	Fidemco LLC
Type:	KILN Data Transmitter MCT&WT-TX
Serial No:	27002
EUT Orientation:	X (see Annex 1)
Mode:	Continuous Transmission
Modification:	Modification 1



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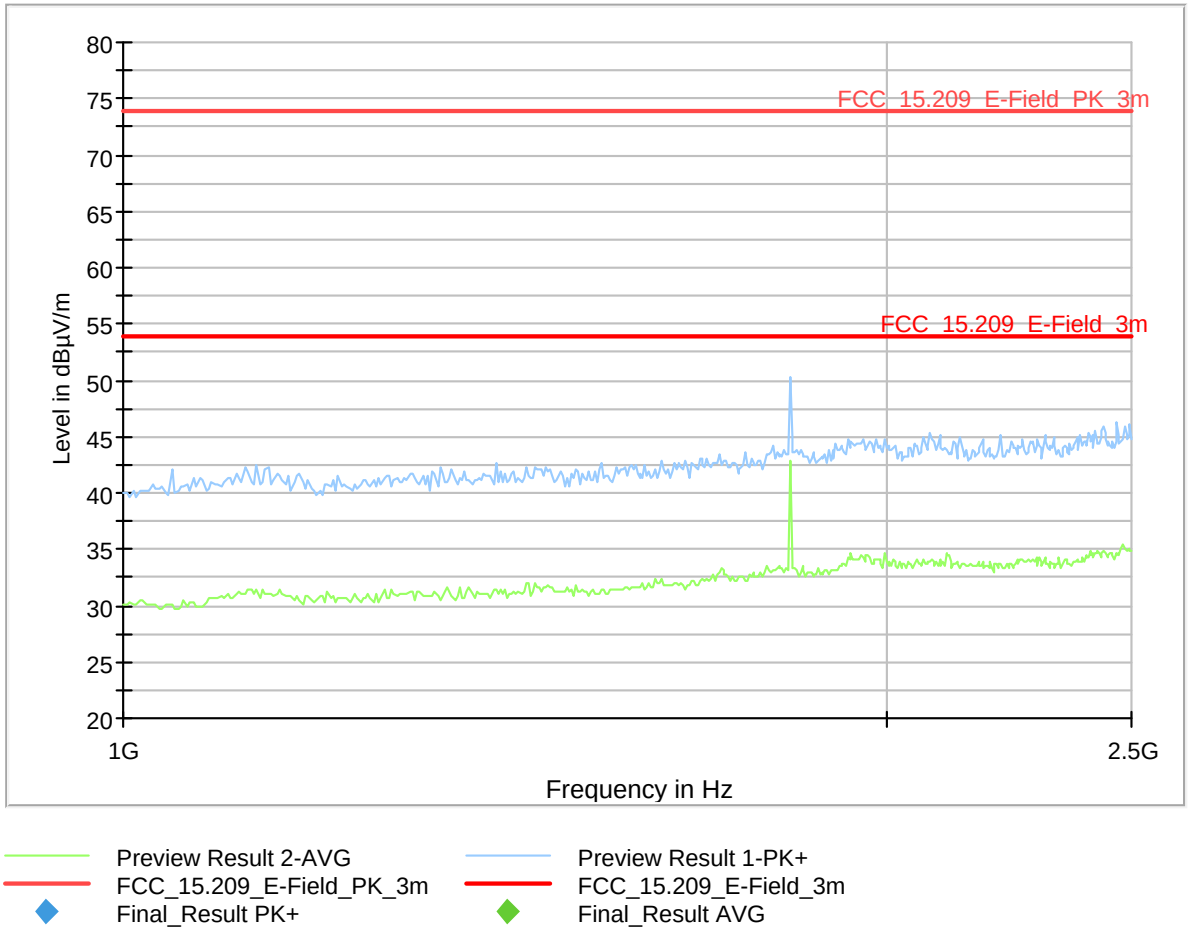
EUT Orientation:	Y (see Annex 1)
Mode:	Continuous Transmission
Modification:	Modification 1



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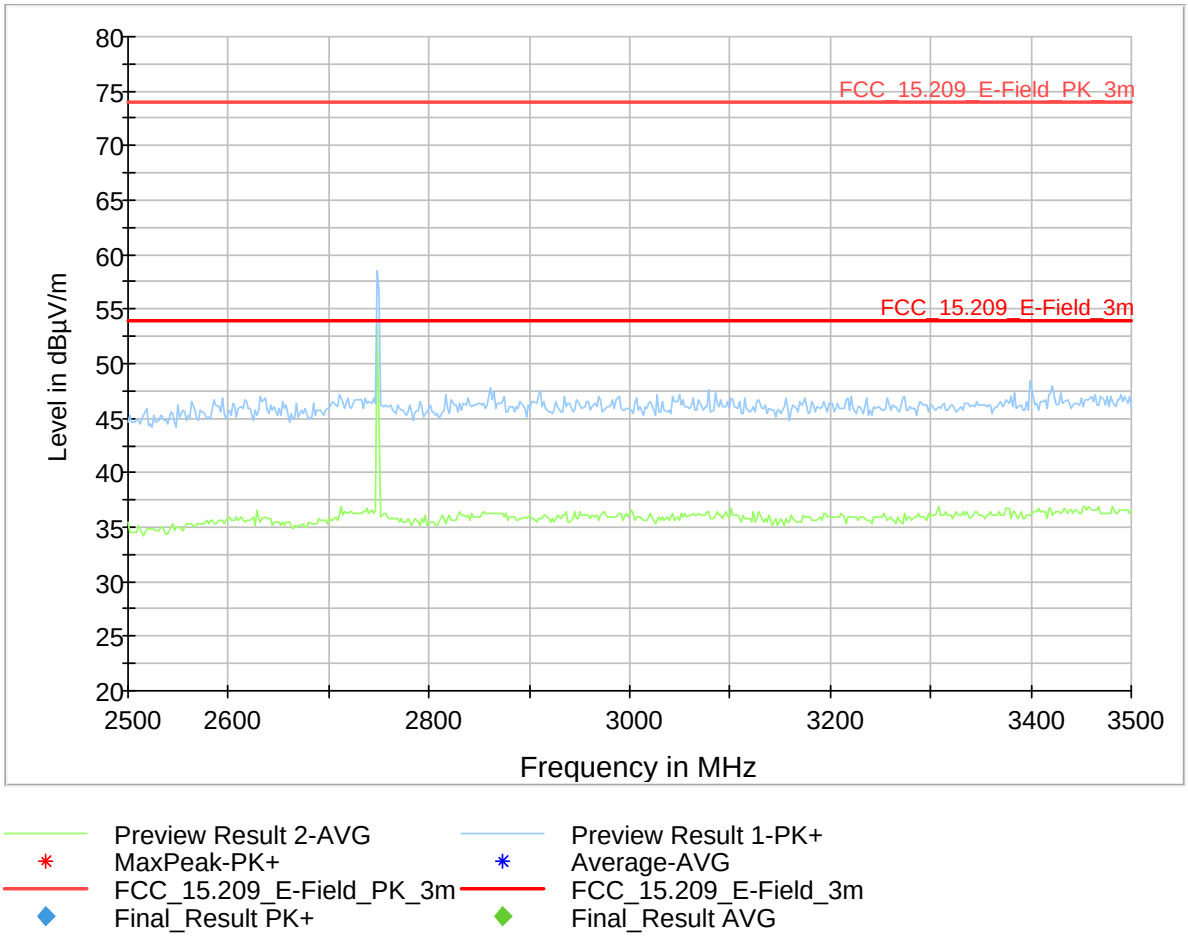

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Manufacturer:	Fidemco LLC
Type:	KILN Data Transmitter MCT&WT-TX
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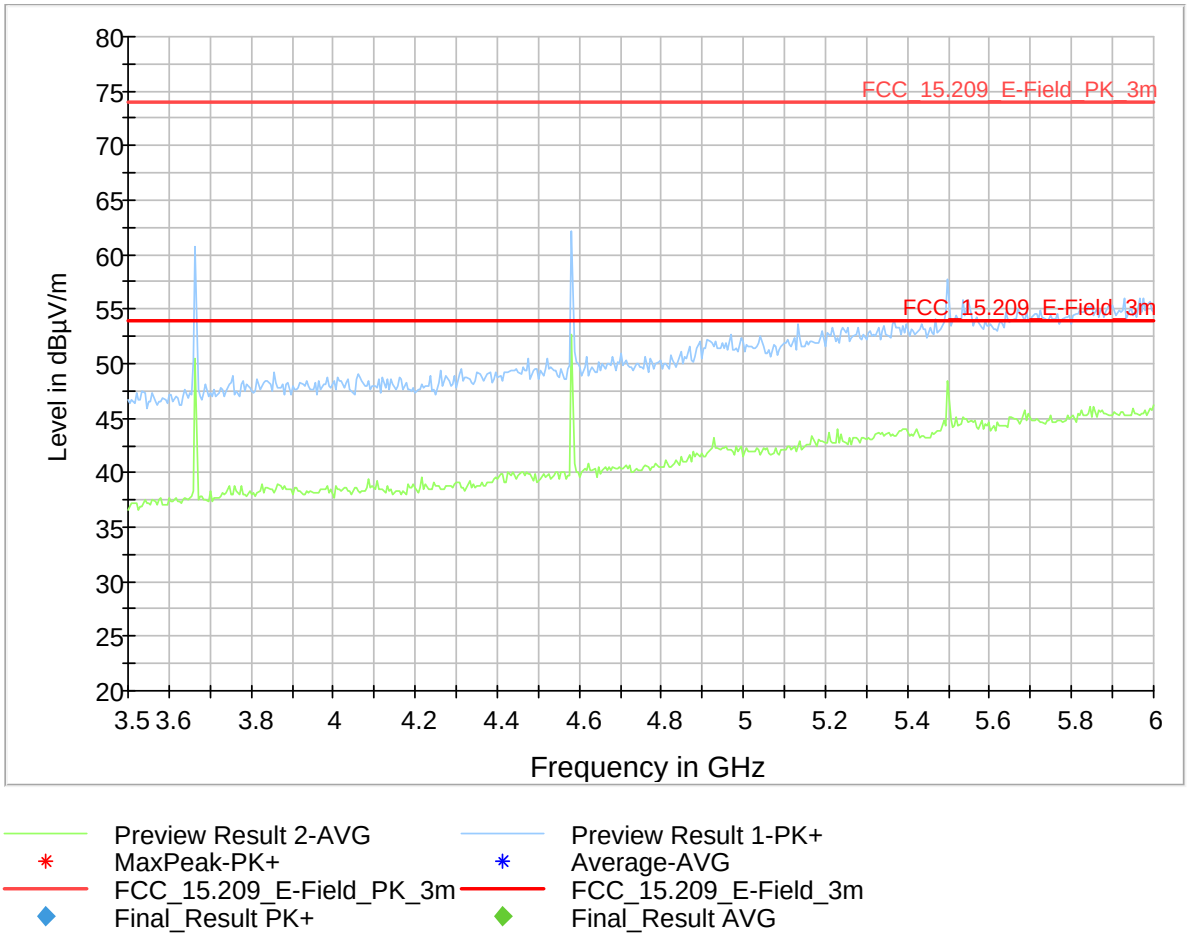
Modification:	Modification 1



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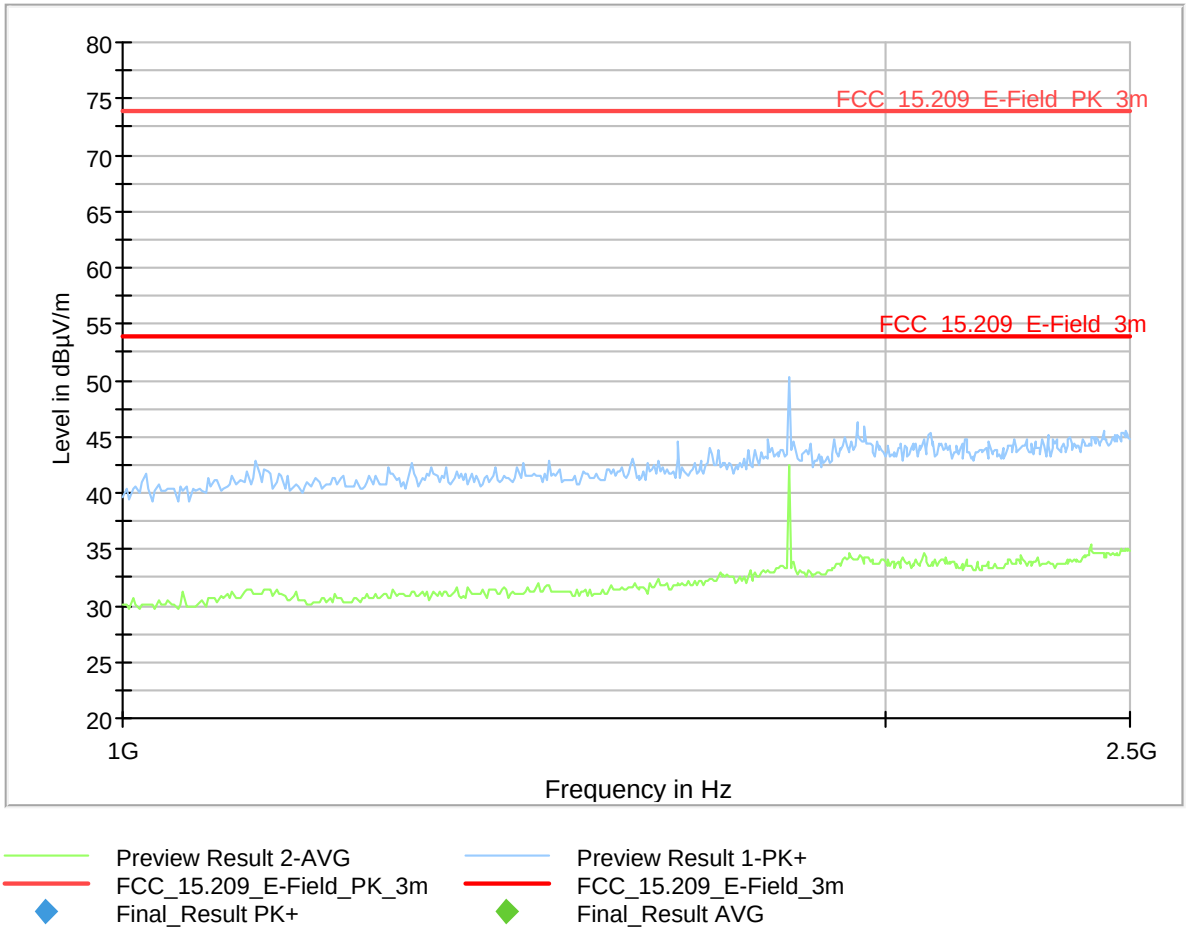
Test on Fidemco LLC MCT&WT-TX to 47 CFR § 15.249

Manufacturer:	Fidemco LLC
Type:	KILN Data Transmitter MCT&WT-TX
Serial No:	27002
EUT Orientation:	Z (see Annex 1)
Mode:	Continuous Transmission
Modification:	Modification 1



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Test on Fidemco LLC MCT&WT-TX to 47 CFR § 15.249

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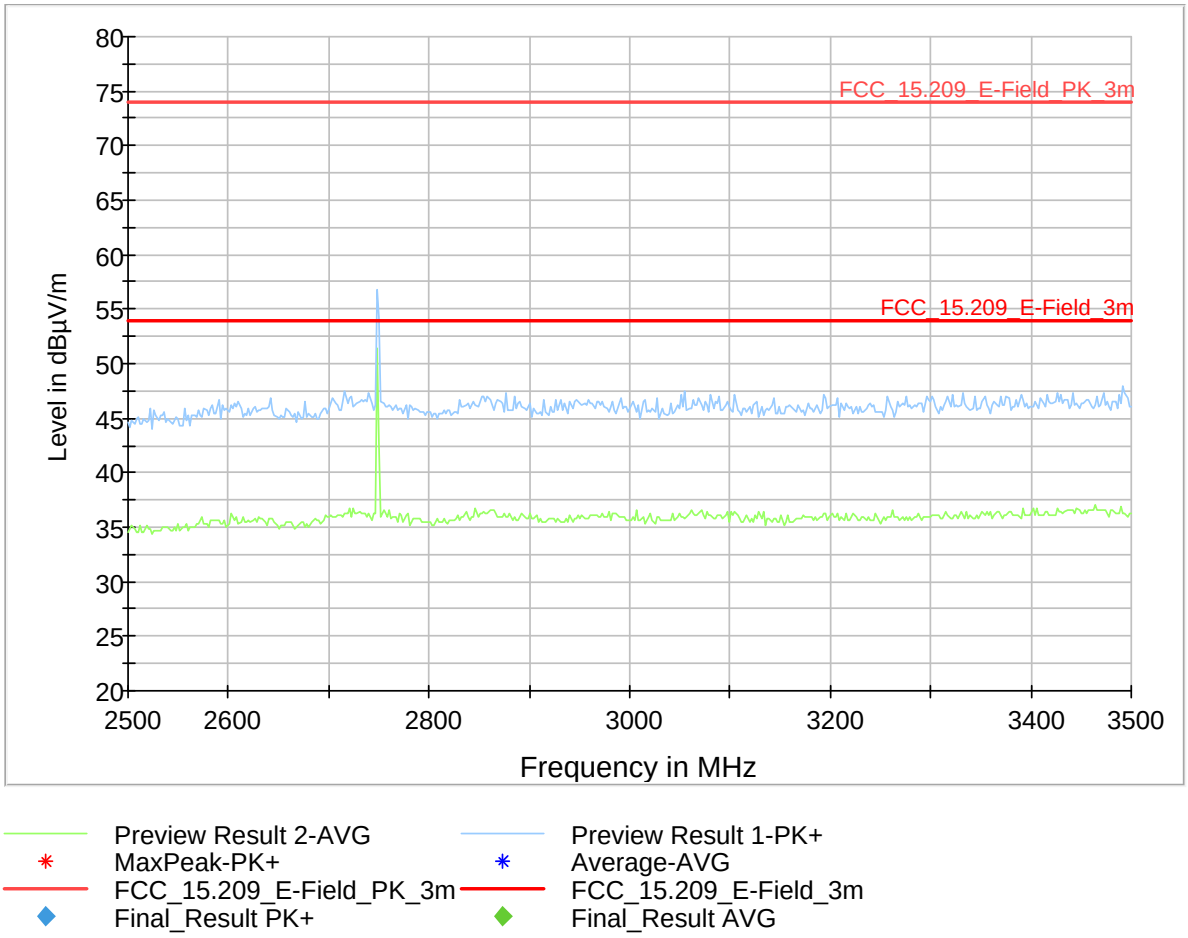
Type:	KILN Data Transmitter MCT&WT-TX
Serial No:	27002
EUT Orientation:	Z (see Annex 1)
Mode:	Continuous Transmission
Modification:	Modification 1



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Type:	KILN Data Transmitter MCT&WT-TX
Serial No:	27002
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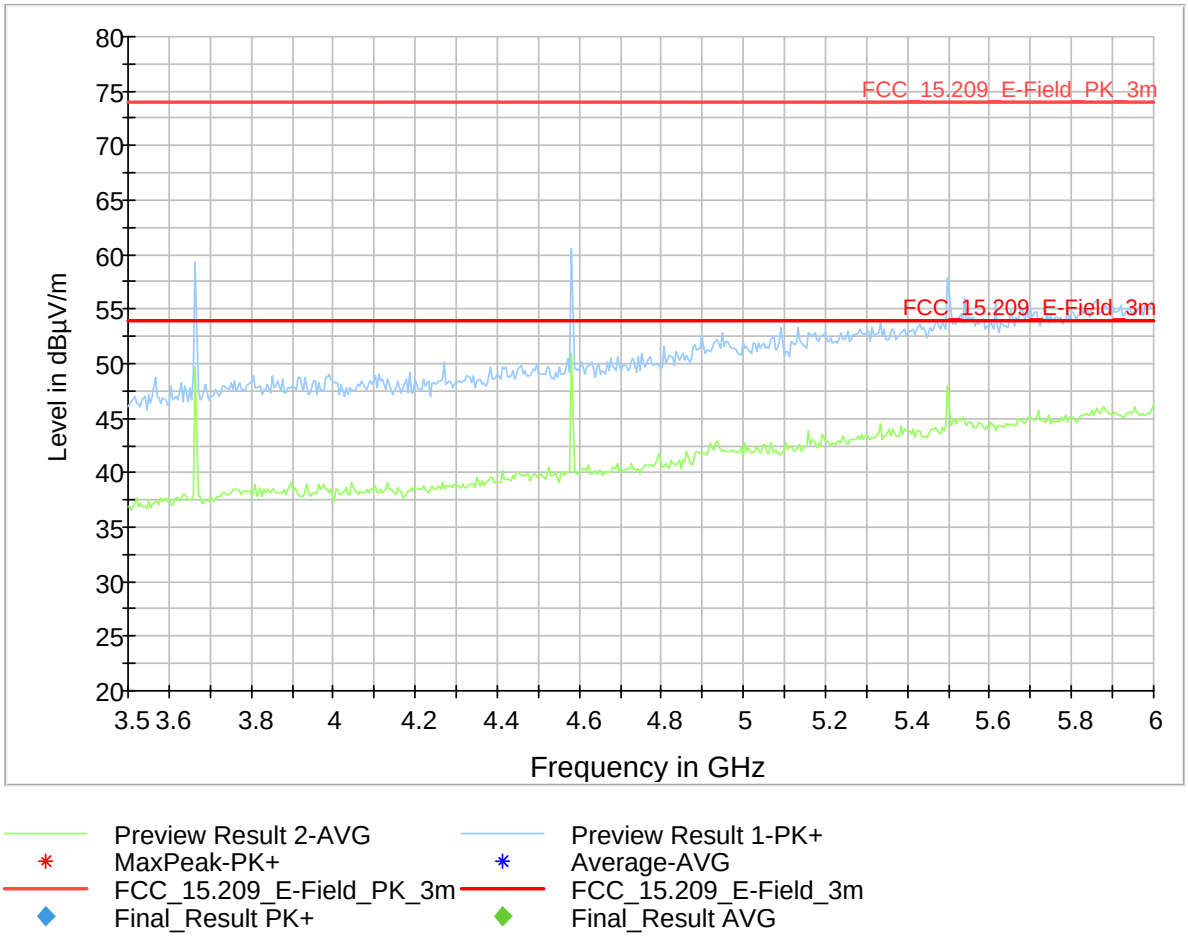
Modification:	Modification 1



The average detector measurement of the harmonics was not taken into account due to the average correction factor based on the transmission time ratio of the EUT. For further details refer to chapter 2.6 of the report.

Final Result

Frequency [MHz]	Peak Field Strength [dBµV/m]	AV Correction Factor [dB]	Result [dB(µV/m)]	Limit [dB(µV/m)]	Margin [dB]
1832.91	50.2	0	50.2	74	23.8
1832.91	50.2	-12.6	37.6	54	16.4
2748.50	58.6	0	58.6	74	15.4
2748.50	58.6	-12.6	46.0	54	8.0
3665.33	60.7	0	60.7	74	13.3
3665.33	60.7	-12.6	48.1	54	5.9
4582.16	62.1	0	62.1	74	11.9
4582.16	62.1	-12.6	49.5	54	4.5
5499.00	58.8	0	58.8	74	15.2
5499.00	58.8	-12.6	46.2	54	7.5

Note: average correction factor is based on the transmission time ratio of the EUT. For further details refer to chapter 2.6 of the report.

4.4.6.4 Test Result

Manufacturer:	Fidemco LLC
Type:	MCT&WT-TX
Serial No.:	27002
Test date:	2019-05-15
Test personnel:	Dominik Krüger

The EUT meets the requirements of this section.

4.4.7 Radiated Emissions 6 – 10 GHz

4.4.7.1 Test Procedures

ANSI C63.10-2013, 6.6.4.1 General

Subclauses 6.6.4.2 and 6.6.4.3 describe the procedures that shall be used for making exploratory and final radiated emission tests for frequencies above 1 GHz. Measurements may be performed at a distance closer than that specified in the requirements; however, an attempt shall be made to avoid making measurements in the near field of both the measurement antenna and the EUT for final measurements.

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 does not provide a noise floor more than 6 dB below the limit, then low-noise preamplifiers, closer test distances, higher gain antennas, or narrower bandwidths might be required. If closer measurement distances are used, then the beamwidth of the measurement antenna versus the size of the EUT shall be taken into account. Also, measurement system overload protection shall be determined to be adequate when preamplifiers are used [see item b) of 4.1.3]. The effects of using bandwidths different from those specified shall also be determined (see also 6.3). Any changes from the specific measurement conditions shall be described in the report of the measurements (see also Annex E).

Install an appropriate filter at the input of the measurement system power amplifier. This filter shall attenuate the fundamental emission of the EUT and allow an accurate measurement of the associated harmonics and spurious emissions. The filter shall be characterized, and any attenuation/loss factors shall be accounted for in the measurement results.

Data shall be recorded in peak and average detection upto the highest measurement frequency required (unless stated otherwise in the applicable requirements).

ANSI C63.10-2013, 6.6.4.2 Exploratory radiated emissions measurements

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 and, if applicable, the EUT configuration that produces the maximum level of emissions. The frequencies of maximum emission may be determined by manually positioning the antenna close to the EUT, and then moving the antenna over all sides of the EUT while observing a spectral display. It is advantageous to have prior knowledge of the frequencies of emissions, although this may be determined from such a near-field scan. The near-field scan shall only be used to determine the frequency but not the amplitude of the emissions. Where exploratory measurements are not adequate to determine the worst-case operating modes and are used only to identify the frequencies of the highest emissions, additional preliminary tests can be required.

Preliminary tests shall be performed following the procedures in 6.3 on a site meeting the requirements of 5.2. For emissions from the EUT, the maximum level shall be determined by rotating the EUT and its antenna through 0° to 360°. For each mode of operation required to be tested, the frequency spectrum (based on findings from exploratory measurements) shall be monitored.

Broadband antennas and a spectrum analyzer or a radio-noise meter with a panoramic display are often useful in this type of test. If either antenna height or EUT azimuth are not fully measured during exploratory testing, then complete testing can be required at the OATS or semi-anechoic chamber when the final full spectrum testing is performed.

ANSI C63.10.2013, 6.6.4.3 Final radiated emissions measurements

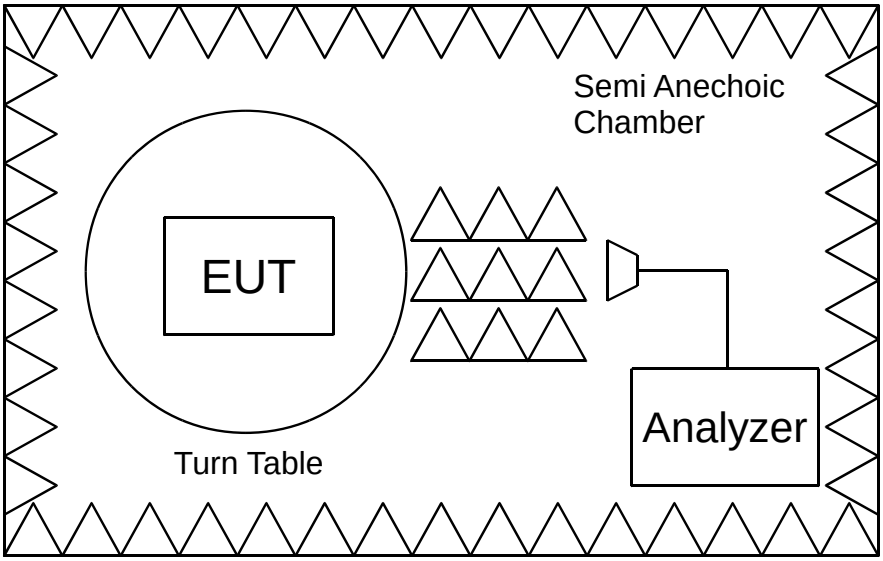
The final measurements are performed on a site meeting the requirements of 5.2. Using the orientation and equipment arrangement of the EUT based on the measurement results found during the preliminary (exploratory) measurements per 6.6.4.2, the EUT arrangement, appropriate modulation, and modes of operation that produce the emissions that have the highest amplitude relative to the limit shall be selected for the final measurement. The final measurement shall follow all the procedures in 6.3 with the EUT operating on frequencies per 5.6. For each mode selected, record the frequency and amplitude of the highest fundamental emission (if applicable), as well as the frequency and amplitude of the six highest spurious emissions relative to the limit. Emissions more than 20 dB below the limit do not need to be reported.

Measurements are performed with the EUT rotated from 0° to 360°; the antenna height scanned in accordance with 6.6.3.1, 6.6.3.2, or 6.6.3.3, as appropriate; and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Variations in cable or wire placement shall be explored to maximize the measured emissions.

The emission signal shall be kept within the illumination area of the 3 dB beamwidth of the antenna so that the maximum emission from the EUT is measured. This may be achieved by either pointing the antenna at an angle toward the source of the emission or by testing the EUT as described in 6.6.3.3.
If the emission is pulsed, then refer to Annex C for guidelines on selecting bandwidth and determining pulse desensitization factors, as necessary.
As noted in 6.6.4.1, when 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, or narrower bandwidths may be used. If closer measurement distances or higher gain antennas are used, then the beamwidth of the measurement antenna versus the physical size of the EUT shall be taken into account, so that the physical sizes of the EUT dimensions are encompassed by the beamwidth of the measurement antenna. Also, measurement system overload protection shall be determined to be adequate when preamplifiers are used. The effects on the measured emission value using bandwidths different from those specified shall be determined if such bandwidth changes are made. Any changes from the specific measurement conditions shall be described in the report of the measurements.
Unless specified otherwise by the regulatory authority, the instrumentation, detector functions, and bandwidths specified in 4.1.4.2.1 and 4.1.4.2.2 shall be used. For pulsed emissions, the procedure in 4.1.4.2.4 shall be used.

Radiated Emissions Test Characteristics	
Frequency range	6 GHz – 10 GHz
Test distance	1 m
Test instrumentation resolution bandwidth	1 MHz
Receive antenna height	1.5 m – 2 m
Receive antenna polarization	Vertical/Horizontal
Measurement chamber	Semi anechoic chamber (SAC) with rf absorbers on the floor

4.4.7.2 Test Setup

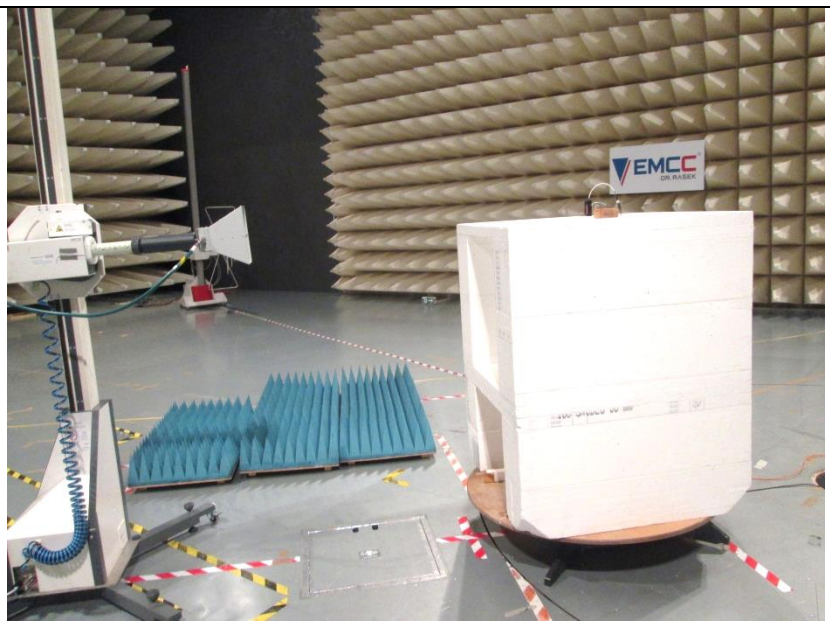


SCHEMATIC TEST SETUP

Requirement: 47 CFR, § 15.209
Procedure: ANSI C63.10-2013

Test distance: 1 m

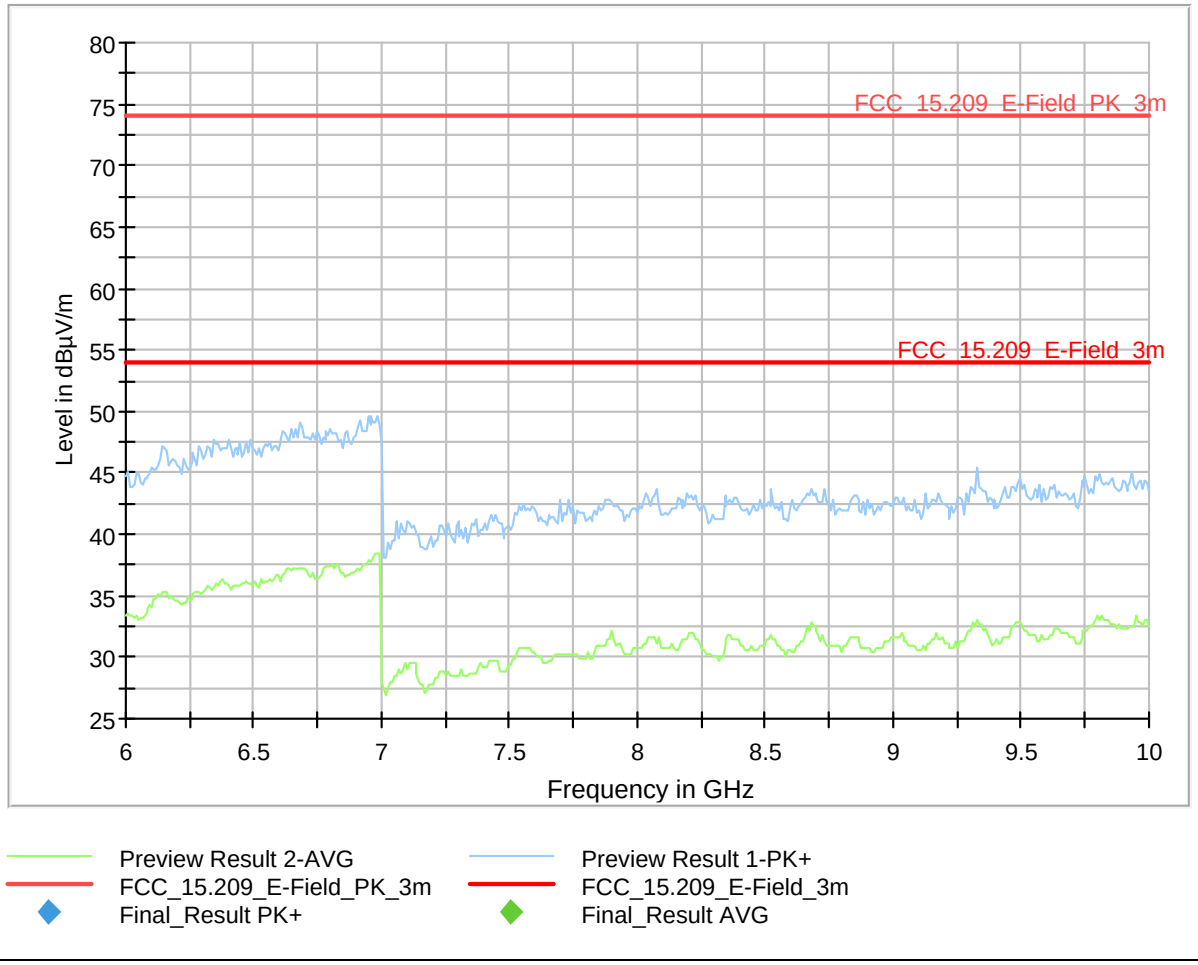
TEST EQUIPMENT USED:
Refer to chapter 5 of this document.
516, 1036, 1037, 1889, 3235, 4075, 4717, 5366, 5392, 5535, 5536, 5544, 5545, 5616



Sample photo of setup

4.4.7.3 Detailed Test Data

Manufacturer:	Fidemco LLC
Type:	KILN Data Transmitter MCT&WT-TX
Serial No:	27002
EUT Orientation:	X (see Annex 1)
Mode:	Continuous Transmission
Modification:	Modification 1



Test on Fidemco LLC MCT&WT-TX to 47 CFR § 15.249

Manufacturer:	Fidemco LLC
Type:	KILN Data Transmitter MCT&WT-TX
Serial No:	27002
EUT Orientation:	Y (see Annex 1)
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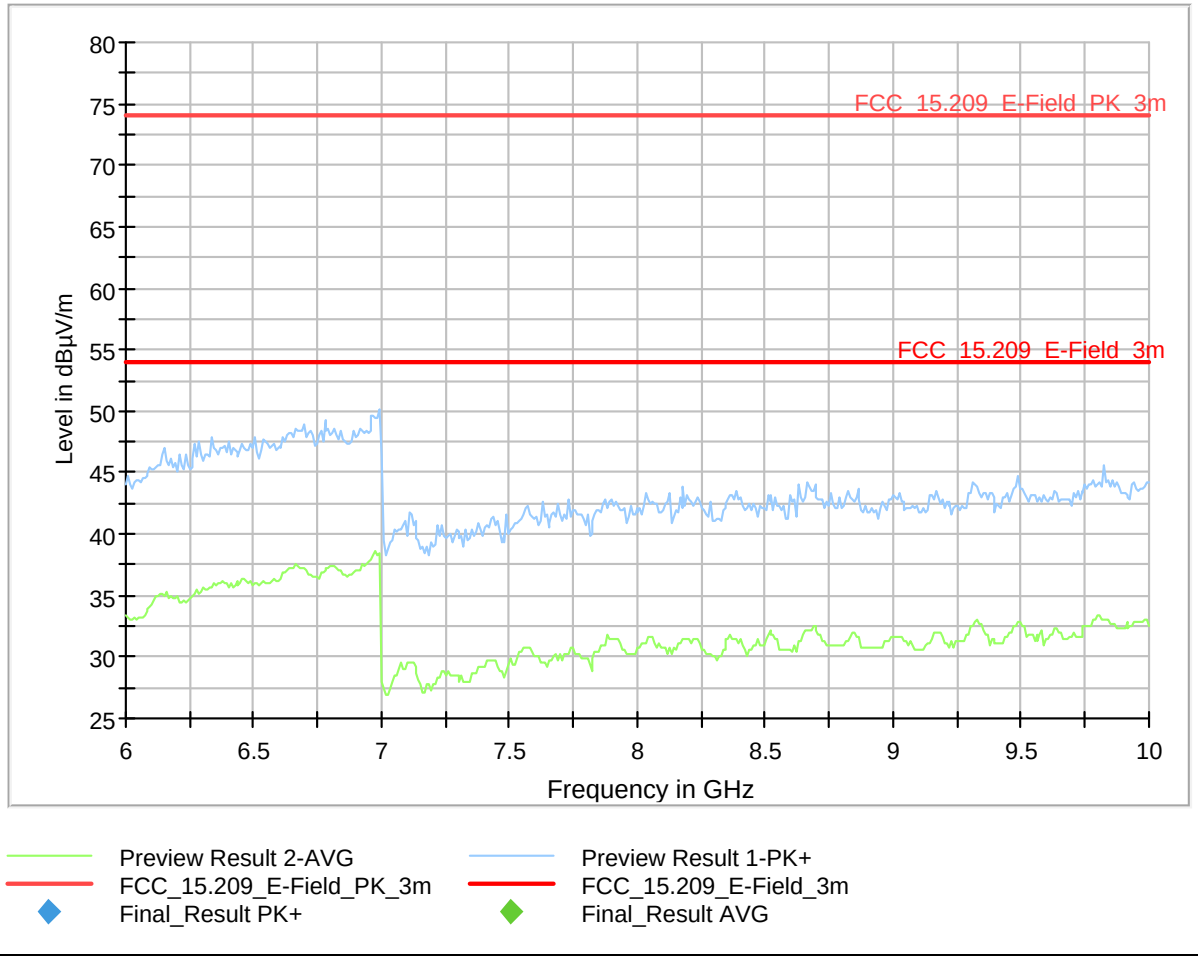
Modification:	Modification 1



Test on Fidemco LLC MCT&WT-TX to 47 CFR § 15.249

Manufacturer:	Fidemco LLC
Type:	KILN Data Transmitter MCT&WT-TX
Serial No:	27002
EUT Orientation:	Z (see Annex 1)
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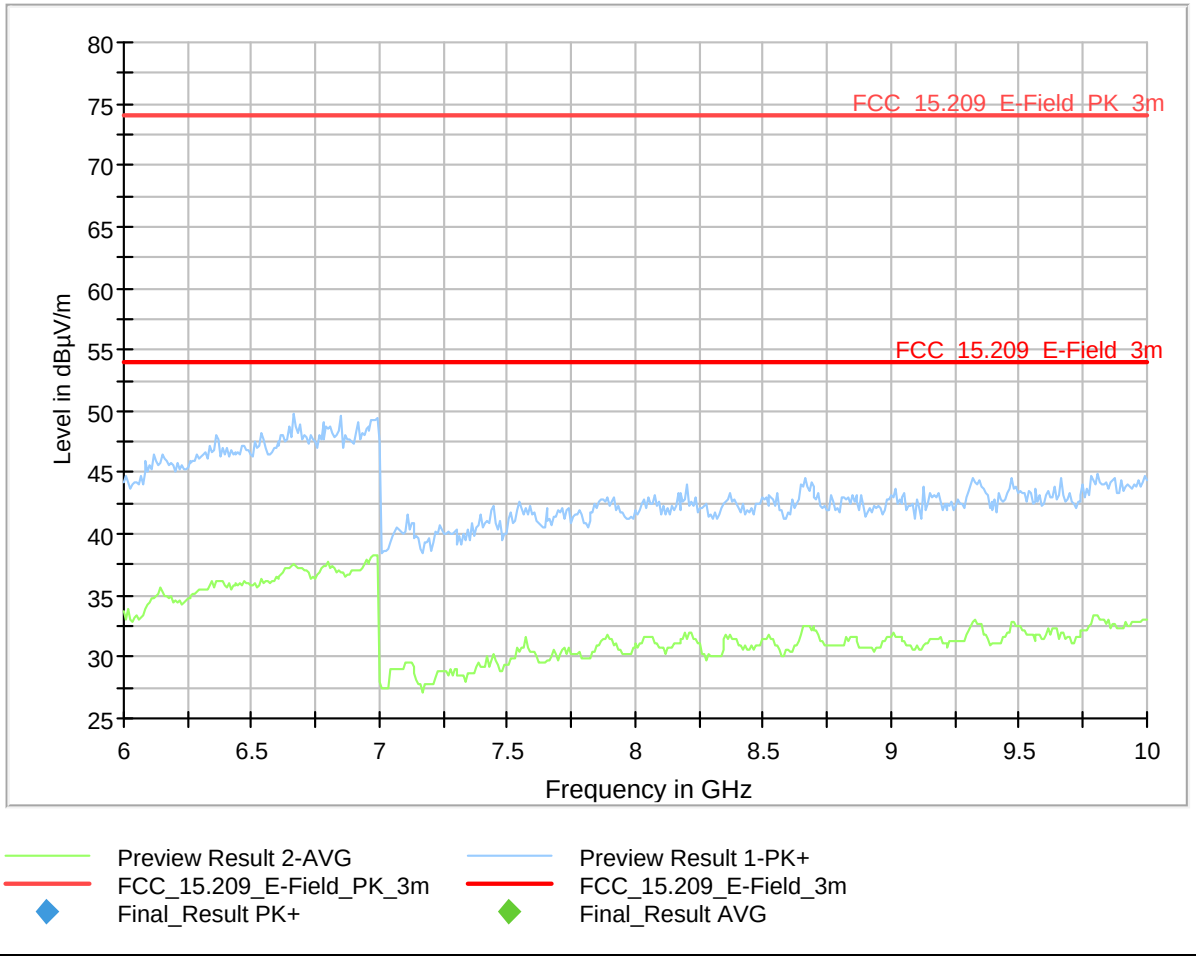
Modification:	Modification 1



Final Result

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

All emissions were greater than 20 dB below the limit.
Therefore, no final measurement performed.

All tests performed at the distance denoted in chapter 4.4.7.1. The measurement value was adjusted to correspond with the test distance. .The table above contains worst-case emissions, only. For further details refer to the pre-scan test plot above.

4.4.7.4 Test Result

Manufacturer:	Fidemco LLC
Type:	MCT&WT-TX
Serial No.:	27002
Test date:	2019-05-15
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
54	N-Cable N/50	Rohde & Schwarz	HFU2-Z5	2018-12	2019-12
374	Loop Antenna	Rohde & Schwarz	HFH 2-Z2	2018-11	2021-02
516	EMI Test Receiver	Rohde & Schwarz	ESIB40	2019-04	2020-04
1036	Octave Bandpass Filter	Microphase	K0916	n/a	n/a
1037	Octave Bandpass Filter	Microphase	K0917	n/a	n/a
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
2724	5 W Attenuator 6dB	Weinschel	2	2017-06	2019-06
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
5366	High Pass Filter	dBd communications	DBD-FTR-15SH-U3500-O/O	2018-02	2020-02
5392	EMC Measurement Software (V 10.35.02)	Rohde & Schwarz	EMC32	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
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
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	5
Annex 2: External photographs of equipment under test	3
Annex 3: Internal photographs of equipment under test	2
Annex 4: Photographs of ancillary equipment	2