Report on the FCC and IC Testing of the Guardhat Inc.
Guardhat with radio interfaces. Model: HF1
In accordance with FCC 47 CFR Part 15B and ICES-003

Product Service

Choose certainty.
Add value.

Prepared for: Guardhat Inc.
1520 Woodward Ave 3rd Floor
Detroit, MI 48226 - USA

FCC ID: Contains Transmit Module FCC ID: 2AR6OGHP2470
IC: Contains Transmit Module IC ID: 24751-GHP2470

COMMERCIAL-IN-CONFIDENCE

Date: 2019-04-17
Document Number: TR-03867-42960-05 | Issue: 01

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Matthias Stumpe	2019-04-17	
Authorised Signatory	Markus Biberger	2019-04-17	

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service document control rules.

ENGINEERING STATEMENT
The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15B and ICES-003. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Matthias Stumpe	2019-04-17	

Laboratory Accreditation	Laboratory recognition	Industry Canada test site registration
DAkkS Reg. No. D-PL-11321-11-02	Registration No. BNetzA-CAB-16/21-15	3050A-2

EXECUTIVE SUMMARY
A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15B and ICES-003:2017 and 2016.

Bundesnetzagentur
BNetzA-CAB-16/21-15

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Product Service

Contents

Product Service

1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	2019-04-10

Table 1

1.2 Introduction

Applicant	Guardhat Inc.
Manufacturer	Guardhat Inc.
Model Number(s)	HF1
Serial Number(s)	HF1-xxxxxxx-xx
Hardware Version(s)	NA
Software Version(s)	NA
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15B ICES-003:2017 and 2016
Test Plan/Issue/Date	NA
Order Number Date	NA 2018-09-05
Date of Receipt of EUT	2019-02-22
Start of Test	2019-02-22
Finish of Test	2019-02-22
Name of Engineer(s)	Matthias Stumpe
Related Document(s)	ANSI C63.4: 2014

Product Service

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15B and ICES-003 is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: Normal Operation				
2.1	15.109 and 6.2	Radiated Disturbance	Pass	ANSI C63.4: 2014

Table 2

Product Service

1.4 Product Information

1.4.1 EUT Port/Cable Identification

Port	Max Cable Length specified	Usage	Type	Screened

Table 3

1.4.2 Test Configuration

Configuration	Description
Normal Operation	EUT is normal Operation Mode with SOS function enabled

Table 4

1.4.3 Modes of Operation

Mode	Description
Normal Operation	EUT is normal Operation Mode with SOS function enabled

Table 5

1.5 Deviations from the Standard

None

1.6 EUT Modification Record

The table below details modifications made to the EUT during the test programme.
The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
0	As supplied by the customer	Not Applicable	Not Applicable

Table 6

Product Service

1.7 Test Location

TÜV SÜD Product Service conducted the following tests at our Straubing Test Laboratory.

Test Name	Name of Engineer(s)
Configuration and Mode: Normal Operation	
Radiated Disturbance	Matthias Stumpe

Table 7

Office Address:

Äußere Frühlingstraße 45
94315 Straubing
Germany

Product Service

2 Test Details

2.1 Radiated Disturbance

2.1.1 Specification Reference

FCC 47 CFR Part 15B and ICES-003, Clause 15.109 and 6.2

2.1.2 Equipment Under Test and Modification State

HF1, S/N: HF1-xxxxxxx-xx - Modification State 0

2.1.3 Date of Test

2019-02-22

2.1.4 Test Method

The EUT was set up in a semi-anechoic chamber on a remotely controlled turntable and placed on a non-conductive table 0.8m above a reference ground plane.
A pre-scan of the EUT emissions profile was made while varying the antenna-to-EUT azimuth and antenna-to-EUT polarisation using a peak detector; measurements were taken at a 3m distance. Using the pre-scan list of the highest emissions detected, their bearing and associated antenna polarisation, the EUT was then formally measured using a Quasi-Peak, Peak, Average detector as appropriate. The readings were maximised by adjusting the antenna height, polarisation and turntable azimuth, in accordance with the specification.

2.1.5 Environmental Conditions

Ambient Temperature	22,0 °C
Relative Humidity	33,0 %

2.1.6 Specification Limits

Required Specification Limits, Field Strength (Class B @ 3m)		
Frequency Range (MHz)	(µV/m)	(dBµV/m)
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54
Supplementary information: Quasi-peak detector to be used for measurements < 1GHz Average detector to be used for measurements > 1GHz		

Table 8

Product Service

2.1.7 Test Results

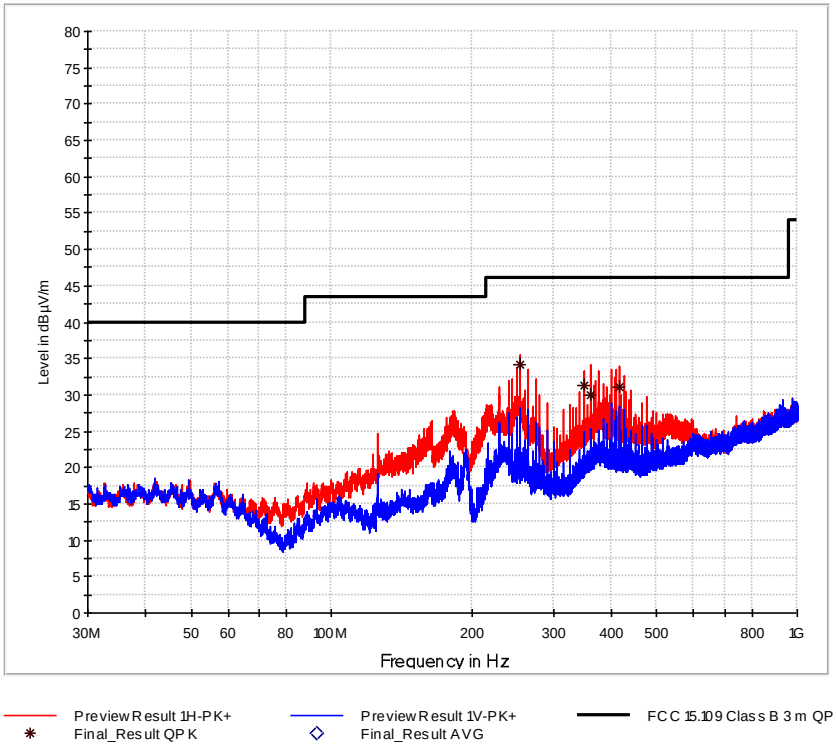
Results for Configuration and Mode : Normal Operation .

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

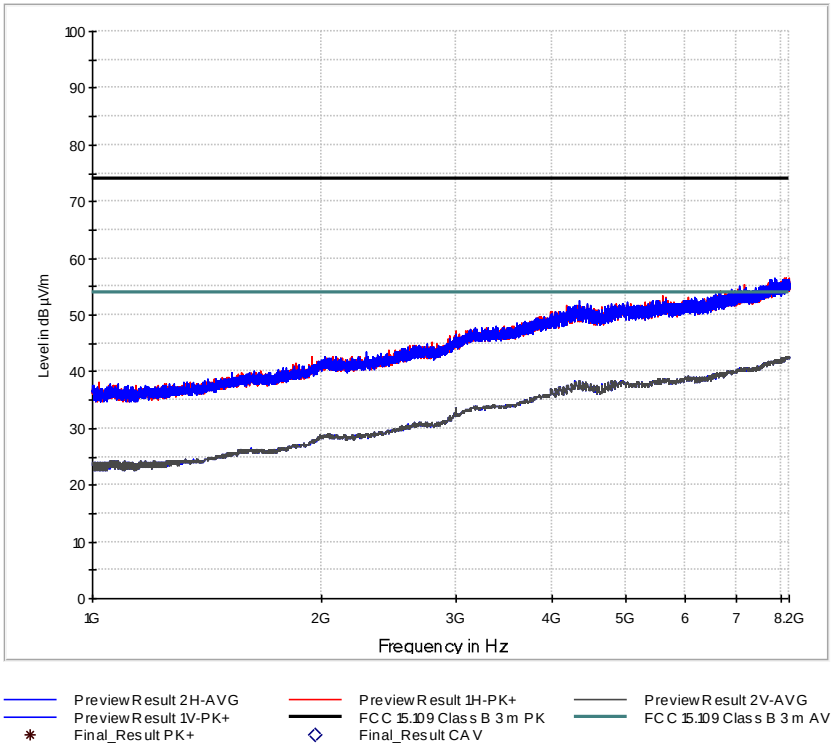
Highest frequency generated or used within the EUT: < 7 GHz
Which necessitates an upper frequency test limit of: 35 GHz

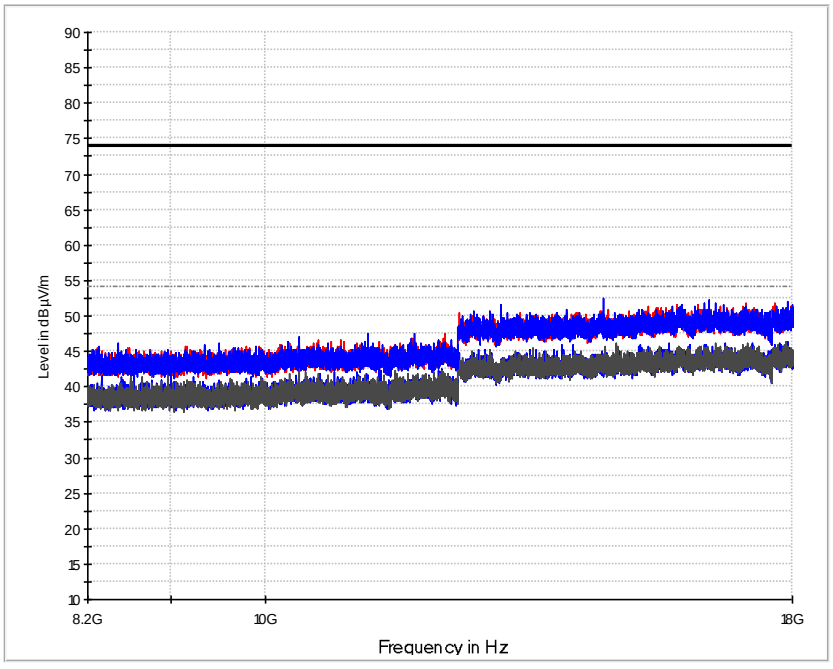
EUT in 1st of three orthogonal axis positions

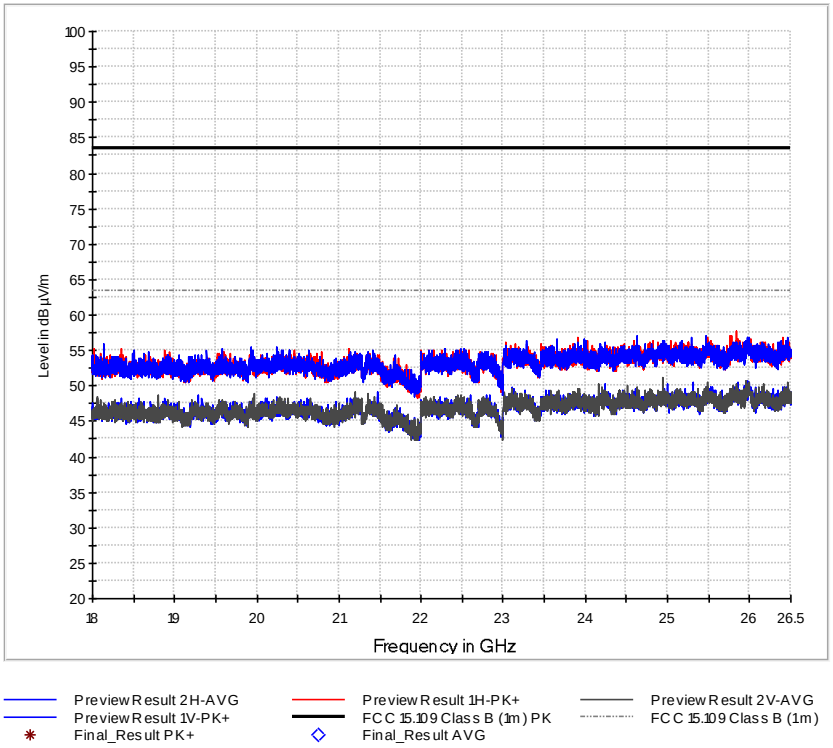


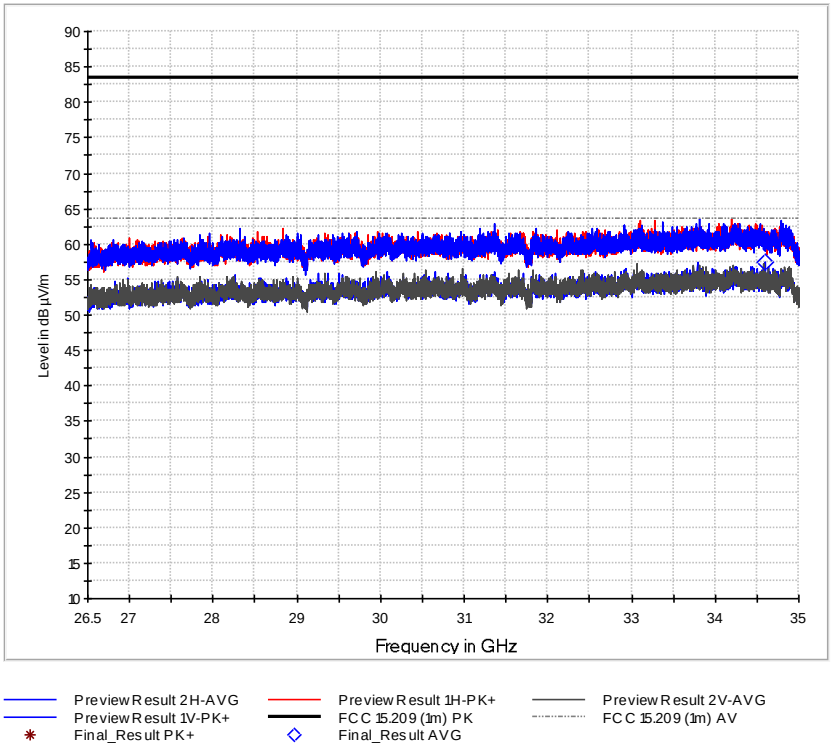
Final Result:

Frequency MHz	QuasiPeak dBµV/m	Average dBµV/m	Limit dBµV/m	Margin dB	Meas. Time ms	Bandwidth kHz	Height cm	Pol	Azimuth deg	Corr. dB
255.000000	34.05	0.00	46.00	11.95	1000.0	120.000	106.0	H	-90.0	14.3
350.010000	31.39	0.00	46.00	14.61	1000.0	120.000	107.0	H	-118.0	17.0
360.000000	30.06	0.00	46.00	15.94	1000.0	120.000	109.0	H	-90.0	16.6
414.990000	31.08	0.00	46.00	14.92	1000.0	120.000	230.0	H	-145.0	18.3


Level in dBµV/m
Frequency in Hz
1G
2G
3G
4G
5G
6
7
8.2G
Preview Result 2H-AVG
Preview Result 1V-PK+
Final_Result PK+
Preview Result 1H-PK+
FCC 15.109 Class B 3m PK
Final_Result CAV
Preview Result 2V-AVG
FCC 15.109 Class B 3m AV


Level in dBµV/m
Frequency in Hz
8.2G
10G
18G
Preview Result 2H-AVG
Preview Result 1V-PK+
Final_Result PK+
Preview Result 1H-PK+
FCC 15.109_3m_class B_Pk
Final_Result AVG
Preview Result 2V-AVG
FCC 15.109_3m_class B_AV


Level in dBµV/m
Frequency in GHz
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
18
19
20
21
22
23
24
25
26
26.5
Preview Result 2H-AVG
Preview Result 1V-PK+
Final_Result PK+
Preview Result 1H-PK+
FCC 15.109 Class B (1m) PK
Final_Result AVG
Preview Result 2V-AVG
FCC 15.109 Class B (1m)

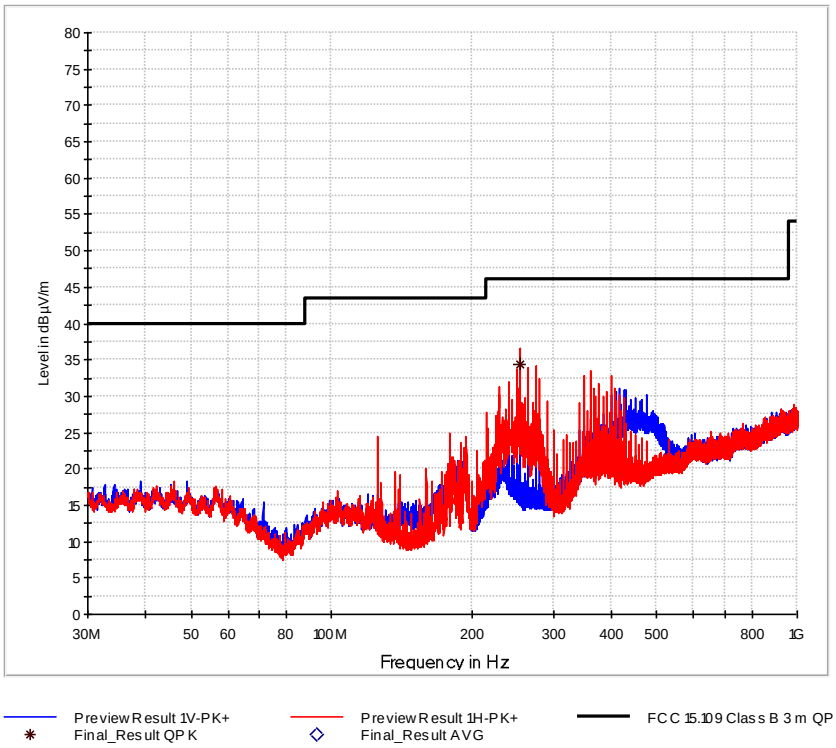


Final Results:

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*
34593.700000	0.00	57.52	63.50	5.98	5.0	1000.000	150.0	H	283.0	44

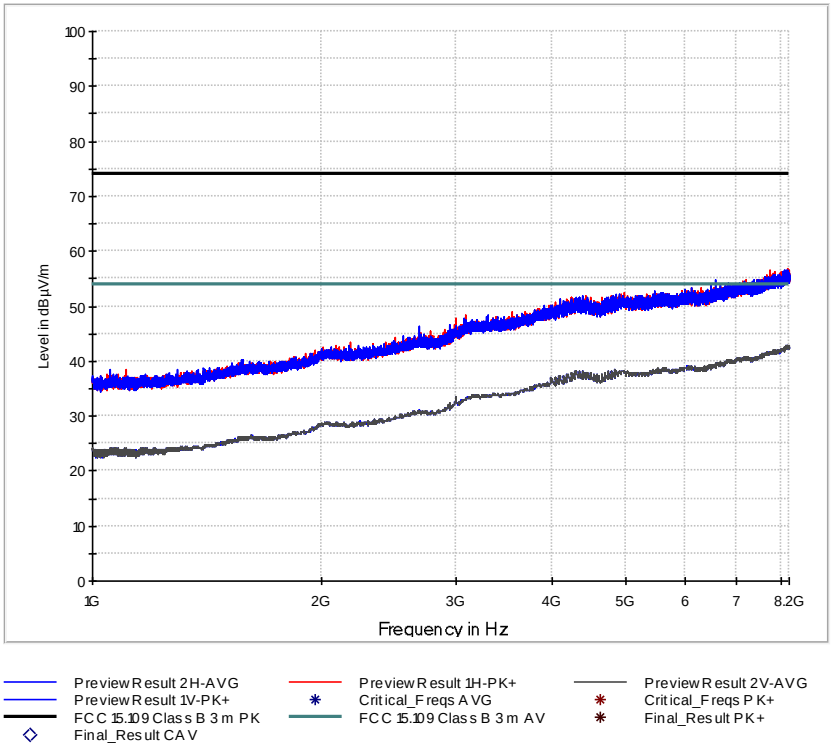
Product Service

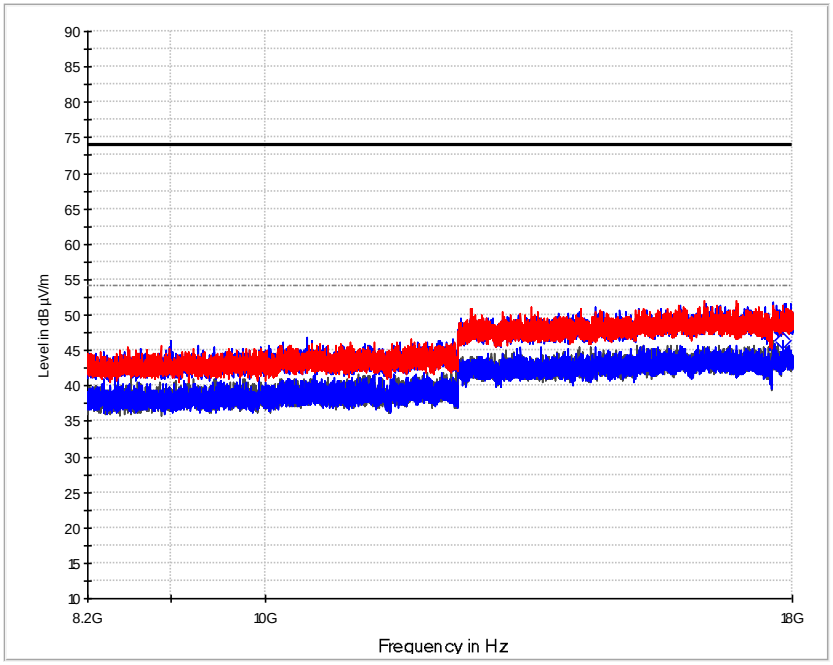
EUT in 2nd of three orthogonal axis positions



Final Results:

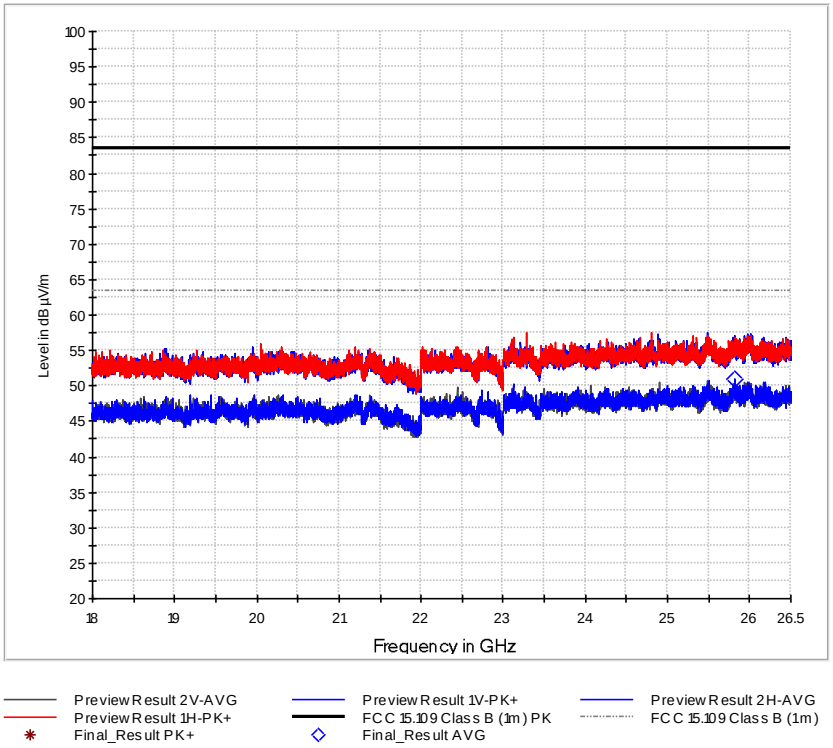
Frequency MHz	QuasiPeak dBµV/m	Average dBµV/m	Limit dBµV/m	Margin dB	Meas. Time ms	Bandwidth kHz	Height cm	Pol	Azimuth deg	Corr. dB
255.000000	34.34	0.00	46.00	11.66	1000.0	120.000	105.0	H	-119.0	14.3


100
90
80
70
60
50
40
30
20
10
0
Level in dBµV/m
1G
2G
3G
4G
5G
6
7
8.2G
Frequency in Hz
Preview Result 2H-AVG
Preview Result 1V-PK+
FCC 15.109 Class B 3m PK
Final_Result CAV
Preview Result 1H-PK+
Critical_Freqs AVG
FCC 15.109 Class B 3m AV
Preview Result 2V-AVG
Critical_Freqs PK+
Final_Result PK+



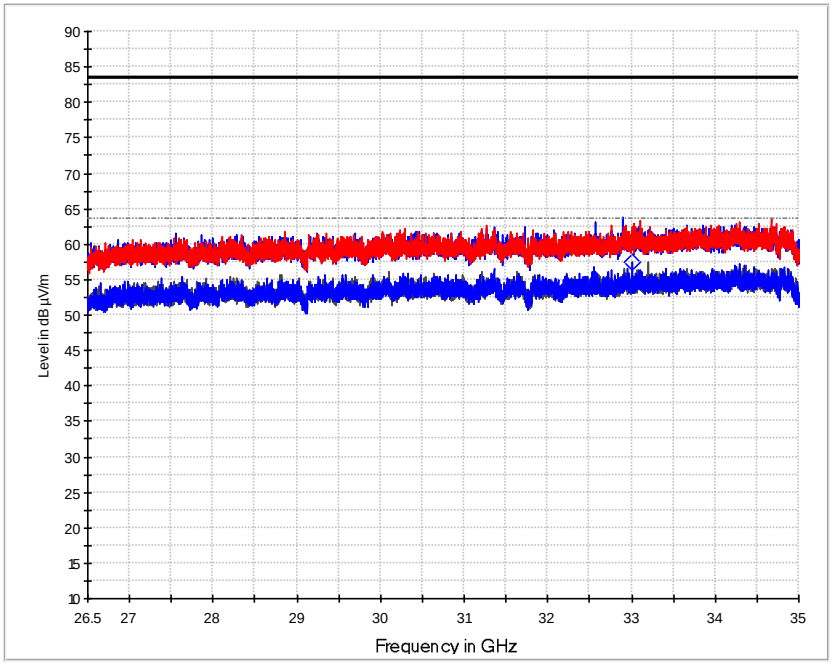
Final Results:

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*
17794.900000	0.00	46.47	54.00	7.53	5.0	1000.000	150.0	H	325.0	37.3



Final Results:

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*
25821.062500	0.00	50.90	63.50	12.60	5.0	1000.000	150.0	H	40.0	40.5

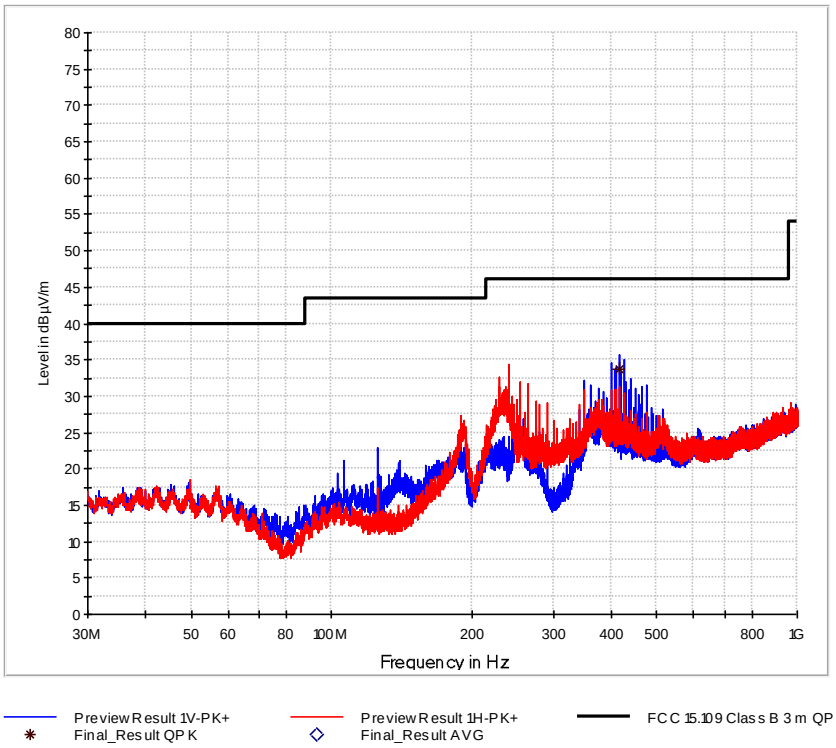


Final Results:

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*
33009.300000	0.00	57.54	63.50	5.96	5.0	1000.000	150.0	H	258.0	43.6

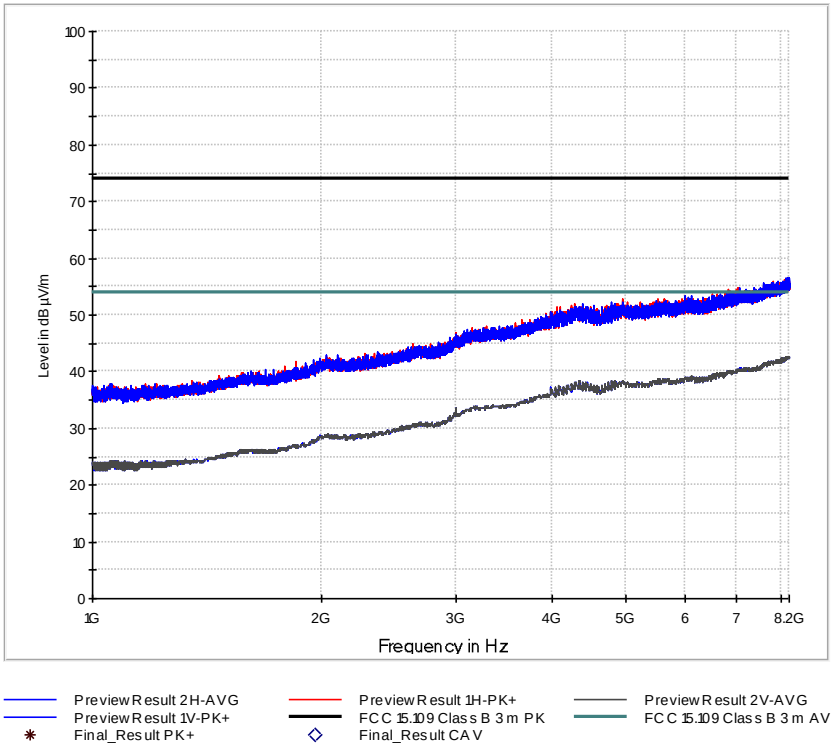
Product Service

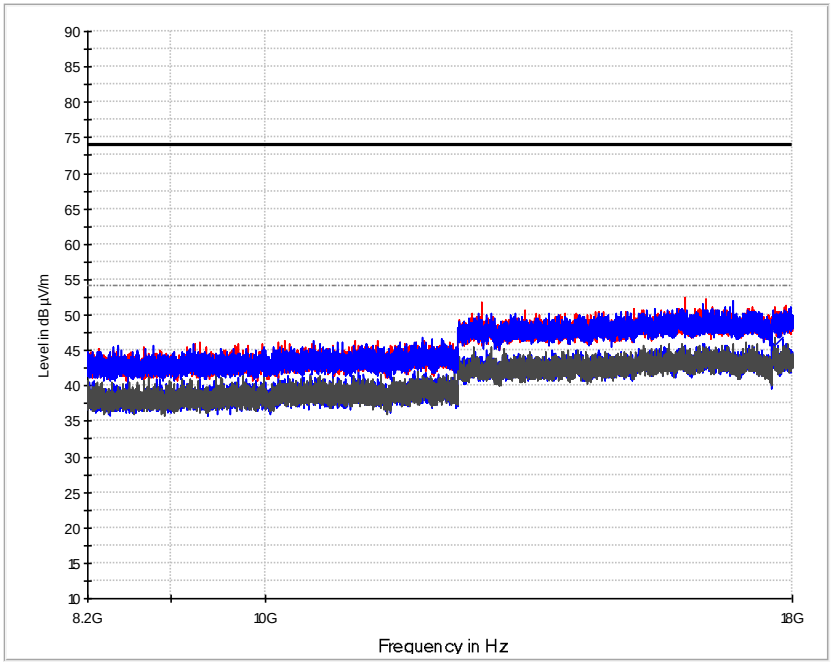
EUT in 3rd of three orthogonal axis positions



Final Results:

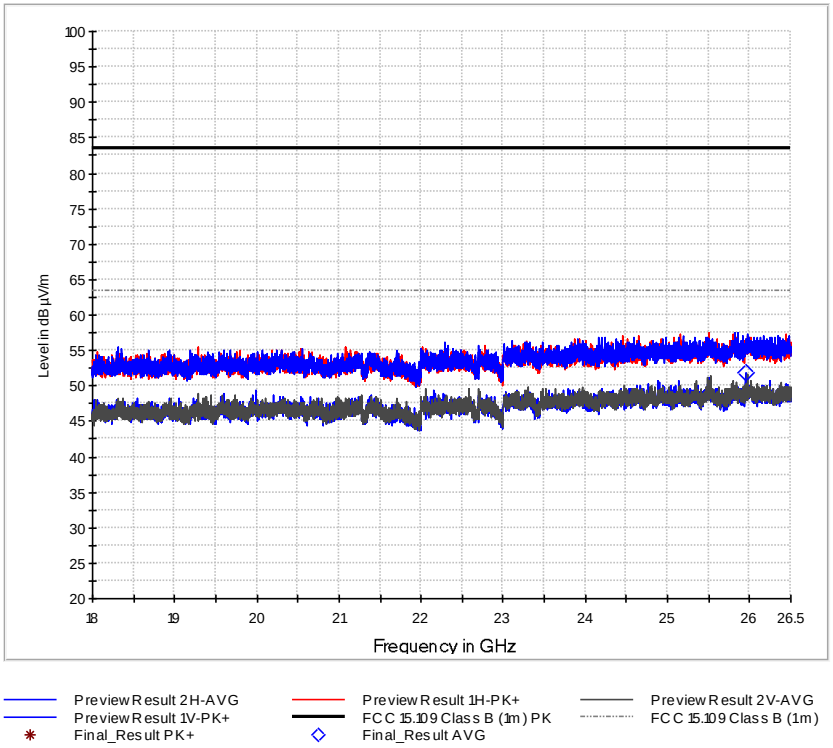
Frequency MHz	QuasiPeak dBµV/m	Average dBµV/m	Limit dBµV/m	Margin dB	Meas. Time ms	Bandwidth kHz	Height cm	Pol	Azimuth deg	Corr. dB
414.990000	33.63	0.00	46.00	12.37	1000.0	120.000	110.0	V	-113.0	18.3


100
90
80
70
60
50
40
30
20
10
0
Level in dBµV/m
1G
2G
3G
4G
5G
6
7
8.2G
Frequency in Hz
Preview Result 2H-AVG
Preview Result 1V-PK+
Final_Result PK+
Preview Result 1H-PK+
FCC 15.109 Class B 3m PK
Final_Result CAV
Preview Result 2V-AVG
FCC 15.109 Class B 3m AV



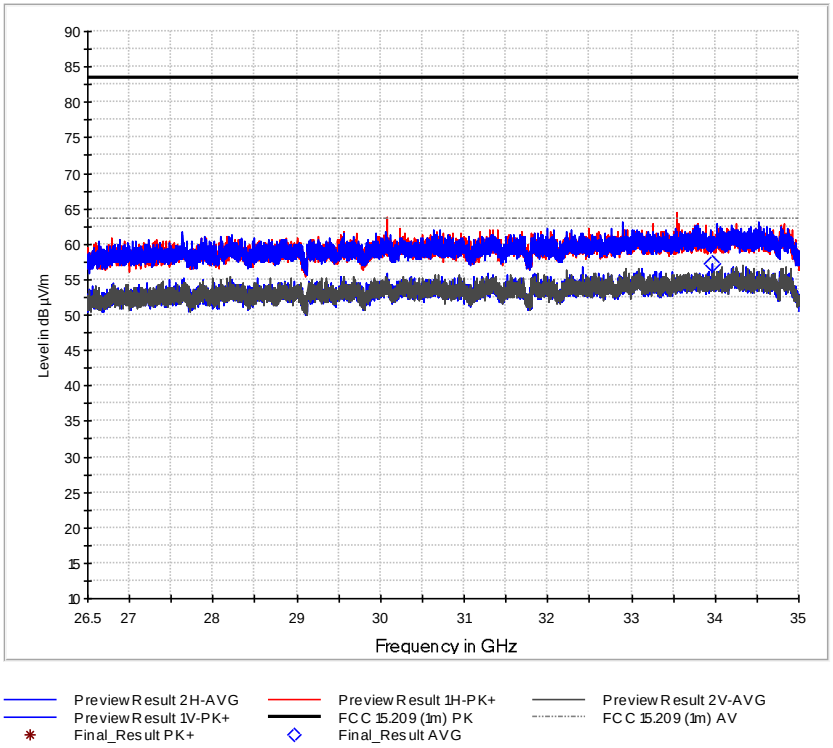
Final Results:

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*
17650.000000	0.00	46.75	54.00	7.25	5.0	1000.000	150.0	V	239.0	37.2



Final Results:

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*
25945,375000	0,00	51,92	63,50	11,58	5,0	1000,000	150,0	H	324,0	41



Final Results:

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*
33960,450000	0,00	57,20	63,50	6,30	5,0	1000,000	150,0	H	140,0	43,6

Product Service

2.1.8 Test Location and Test Equipment Used

This test was carried out in Semi anechoic room - cabin no. 8.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
TRILOG Antenna (4dB)	Schwarzbeck	VULB 9162	20116	36	2022-01-31
Horn antenna	Rohde & Schwarz	HF907	19933	24	2019-06-30
EMI test receiver	Rohde & Schwarz	ESW26	28268	12	2019-05-31
EMC Measurement Software	Rohde&Schwarz	EMC32 V10.20.01	19719	N/A	N/A

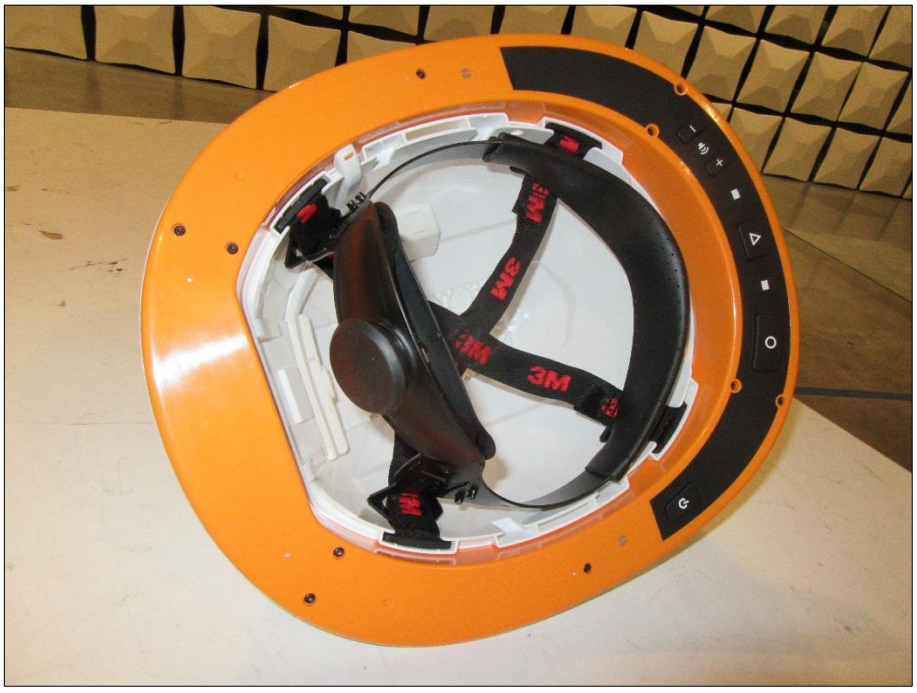
Table 9

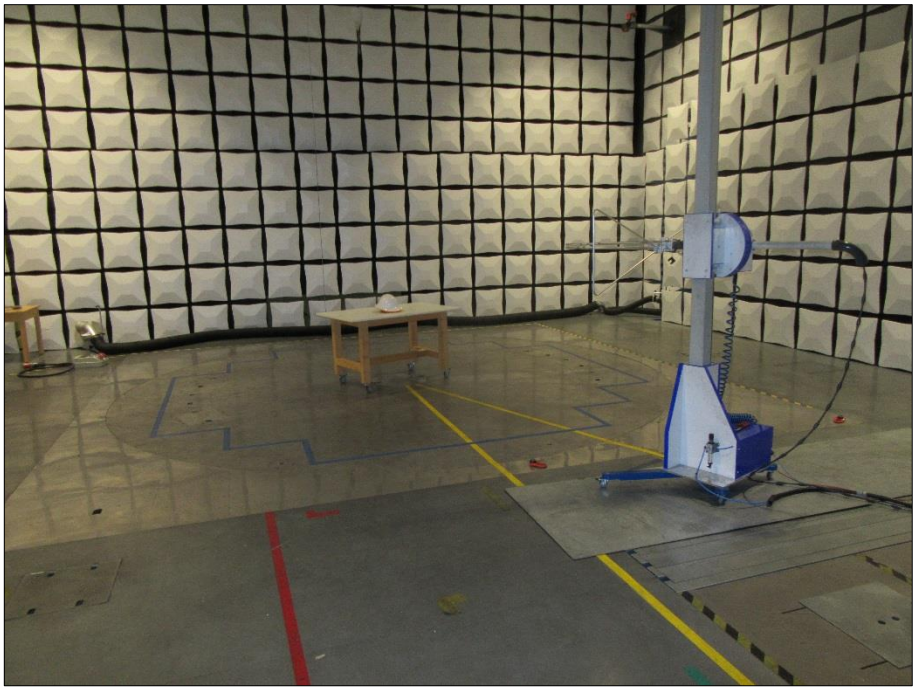
TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment
N/A - Not Applicable

Product Service

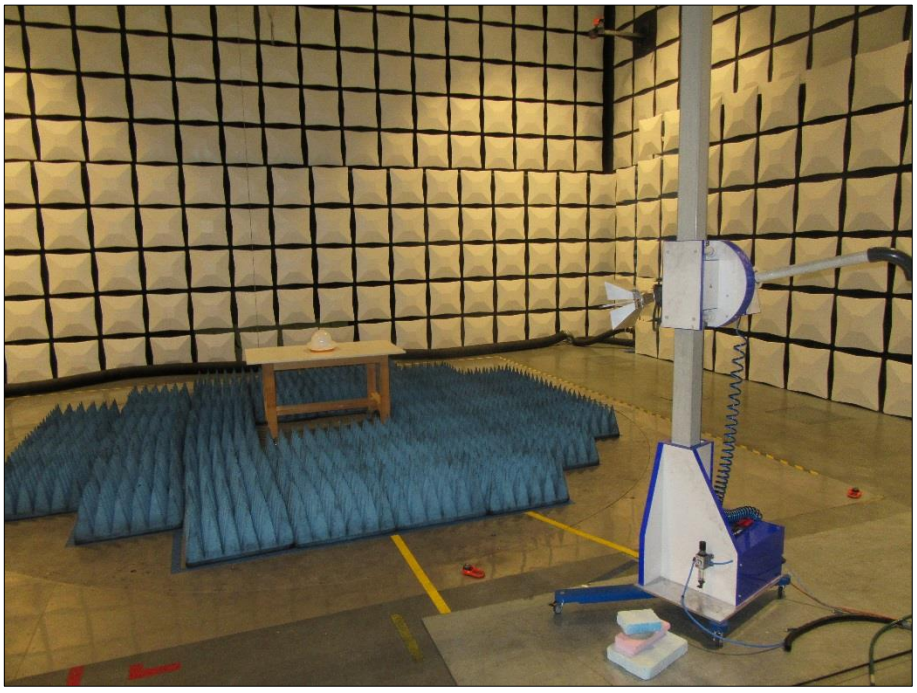
3 Test Setup Photos

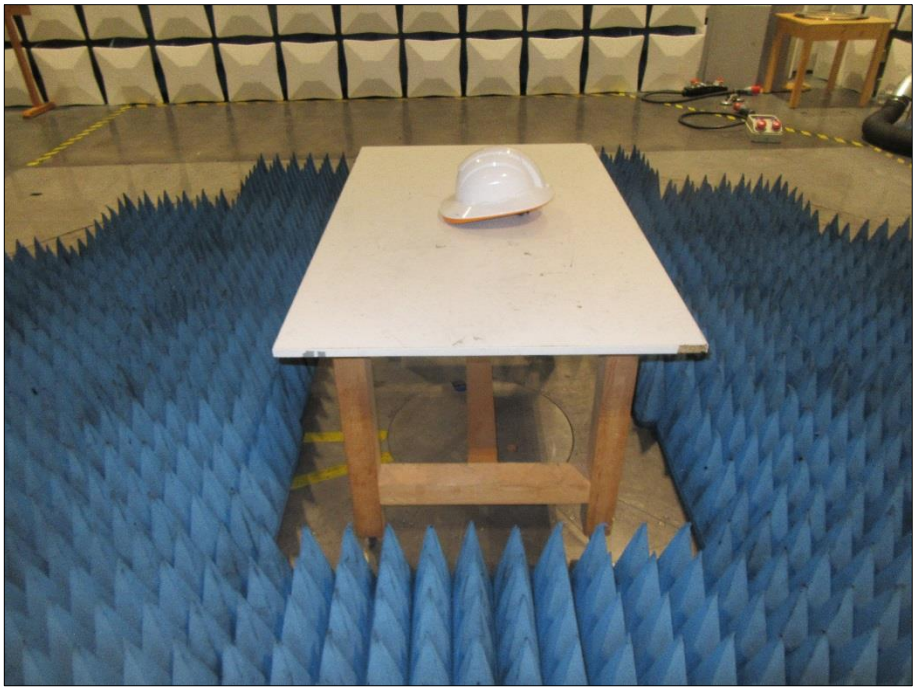
Product Service



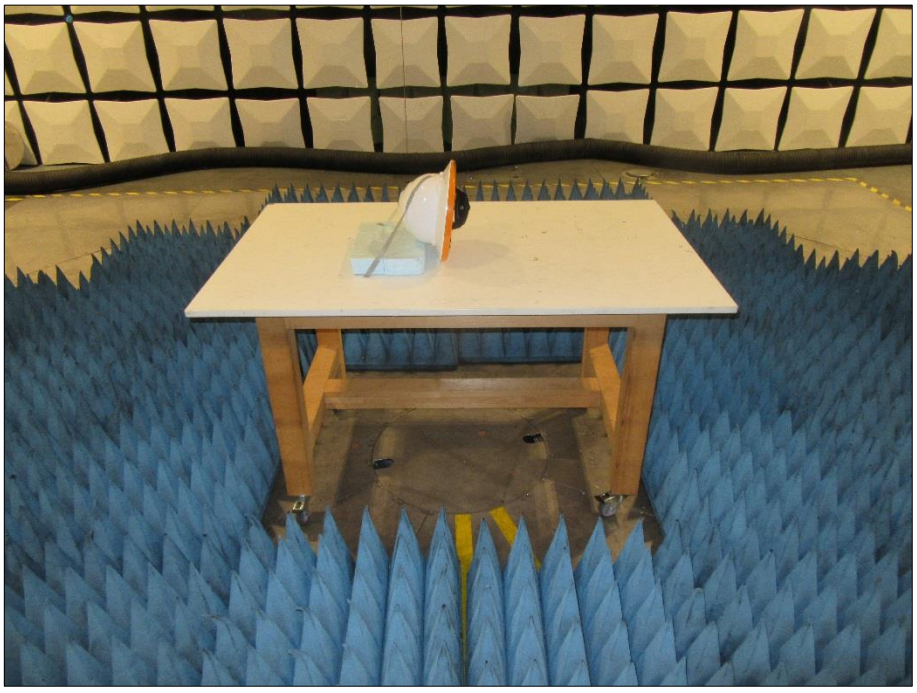


Product Service





Product Service



Product Service

4 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Radio Interference Emission Testing			
Test Name	kp	Expanded Uncertainty	Note
Conducted Voltage Emission			
9 kHz to 150 kHz (50Ω/50µH AMN)	2	± 3.8 dB	1
150 kHz to 30 MHz (50Ω/50µH AMN)	2	± 3.4 dB	1
100 kHz to 200 MHz (50Ω/5µH AMN)	2	± 3.6 dB	1
Discontinuous Conducted Emission			
9 kHz to 150 kHz (50Ω/50µH AMN)	2	± 3.8 dB	1
150 kHz to 30 MHz (50Ω/50µH AMN)	2	± 3.4 dB	1
Conducted Current Emission			
9 kHz to 200 MHz	2	± 3.5 dB	1
Magnetic Fieldstrength			
9 kHz to 30 MHz (with loop antenna)	2	± 3.9 dB	1
9 kHz to 30 MHz (large-loop antenna 2 m)	2	± 3.5 dB	1
Radiated Emission			
Test distance 1 m (ALSE)			
9 kHz to 150 kHz	2	± 4.6 dB	1
150 kHz to 30 MHz	2	± 4.1 dB	1
30 MHz to 200 MHz	2	± 5.2 dB	1
200 MHz to 2 GHz	2	± 4.4 dB	1
2 GHz to 3 GHz	2	± 4.6 dB	1
Test distance 3 m			
30 MHz to 300 MHz	2	± 4.9 dB	1
300 MHz to 1 GHz	2	± 5.0 dB	1
1 GHz to 6 GHz	2	± 4.6 dB	1
Test distance 10 m			
30 MHz to 300 MHz	2	± 4.9 dB	1
300 MHz to 1 GHz	2	± 4.9 dB	1
Radio Interference Power			
30 MHz to 300 MHz	2	± 3.5 dB	1

Table 10

Note 1:
The expanded uncertainty reported according to CISPR 16-4-2:2003-11 is based on a standard uncertainty multiplied by a coverage factor of kp = 2, providing a level of confidence of p = 95.45%

Product Service