

FCC Test Report

MiX Telematics International (Pty) Ltd
Telematics Unit, Model: MiX 6AMB-4G-B

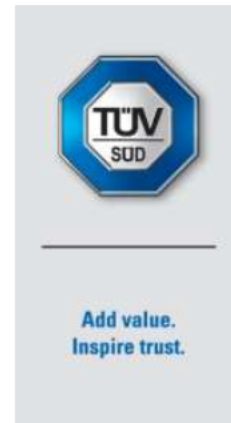
In accordance with FCC 47 CFR Part 15B

Prepared for: MiX Telematics International (Pty) Ltd
Blaauwklip Office Park 2
Cnr Strand & Webersvalley Roads
Stellenbosch
South Africa

FCC ID: 2AFMS-6AMB4G

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2 Test Details

2.1 Radiated Disturbance

2.1.1 Specification Reference

FCC 47 CFR Part 15B, Clause 15.109

2.1.2 Equipment Under Test and Modification State

MiX 6AMB-4G-B, S/N: 66000180 - Modification State 0

2.1.3 Date of Test

07-February-2021

2.1.4 Test Method

The EUT was set up on a non-conductive table 0.8 m above a reference ground plane within a semi-anechoic chamber on a remotely controlled turntable.

A pre-scan of the EUT emissions profile using a peak detector was made at a 3 m antenna distance whilst varying the antenna-to-EUT azimuth and polarisation.

For an EUT which could reasonably be used in multiple planes, pre-scans were performed with the EUT orientated in X, Y and Z planes with reference to the ground plane.

Using a list of the highest emissions detected during the pre-scan along with their bearing and associated antenna polarisation, the EUT was then formally measured using a Quasi-Peak, Peak or CISPR 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 Example Calculation

Below 1 GHz:

$$\begin{aligned} \text{Quasi-Peak level (dB}\mu\text{V/m)} &= \text{Receiver level (dB}\mu\text{V)} + \text{Correction Factor (dB/m)} \\ \text{Margin (dB)} &= \text{Quasi-Peak level (dB}\mu\text{V/m)} - \text{Limit (dB}\mu\text{V/m)} \end{aligned}$$

Above 1 GHz:

$$\begin{aligned} \text{CISPR Average level (dB}\mu\text{V/m)} &= \text{Receiver level (dB}\mu\text{V)} + \text{Correction Factor (dB/m)} \\ \text{Margin (dB)} &= \text{CISPR Average level (dB}\mu\text{V/m)} - \text{Limit (dB}\mu\text{V/m)} \end{aligned}$$

$$\begin{aligned} \text{Peak level (dB}\mu\text{V/m)} &= \text{Receiver level (dB}\mu\text{V)} + \text{Correction Factor (dB/m)} \\ \text{Margin (dB)} &= \text{Peak level (dB}\mu\text{V/m)} - \text{Limit (dB}\mu\text{V/m)} \end{aligned}$$



2.1.6 Example Test Setup Diagram

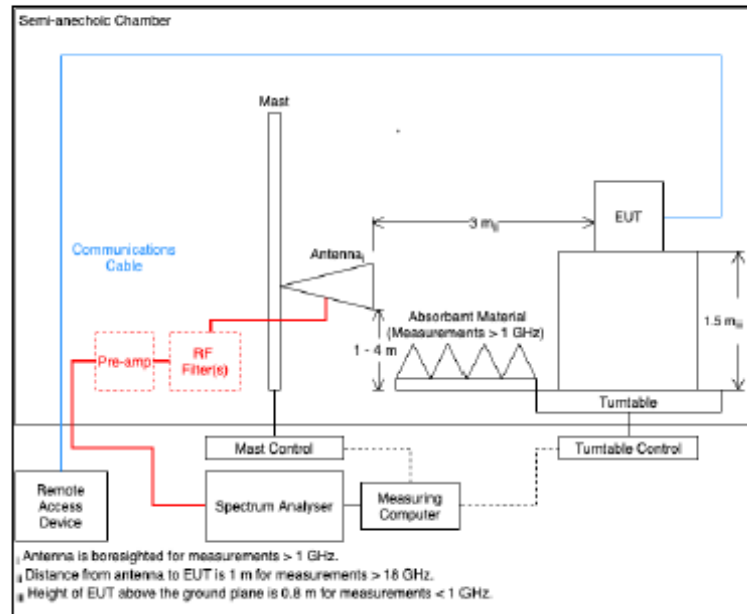


Figure 1

2.1.7 Environmental Conditions

Ambient Temperature 22.2 °C
Relative Humidity 26.9 %

2.1.8 Specification Limits

Required Specification Limits, Field Strength - Class B Test Limit at a 3 m Measurement Distance		
Frequency Range (MHz)	Test Limit (µV/m)	Test Limit (dBµV/m)
30 to 88	100	40.0
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

Supplementary information:
 Note 1. A Quasi-peak detector is to be used for measurements below 1 GHz.
 Note 2. A CISPR Average detector is to be used for measurements above 1 GHz.
 Note 3. The Peak test limit above 1 GHz is 20 dB higher than the CISPR Average test limit.

Table 21

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Figure 20 - Test Setup - 30 MHz to 1 GHz - X - Orientation

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Figure 21 - Test Setup - 30 MHz to 1 GHz - Y - Orientation

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Figure 22 - Test Setup - 30 MHz to 1 GHz - Z - Orientation

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Figure 23 - Test Setup - 1 GHz to 14 GHz - X - Orientation

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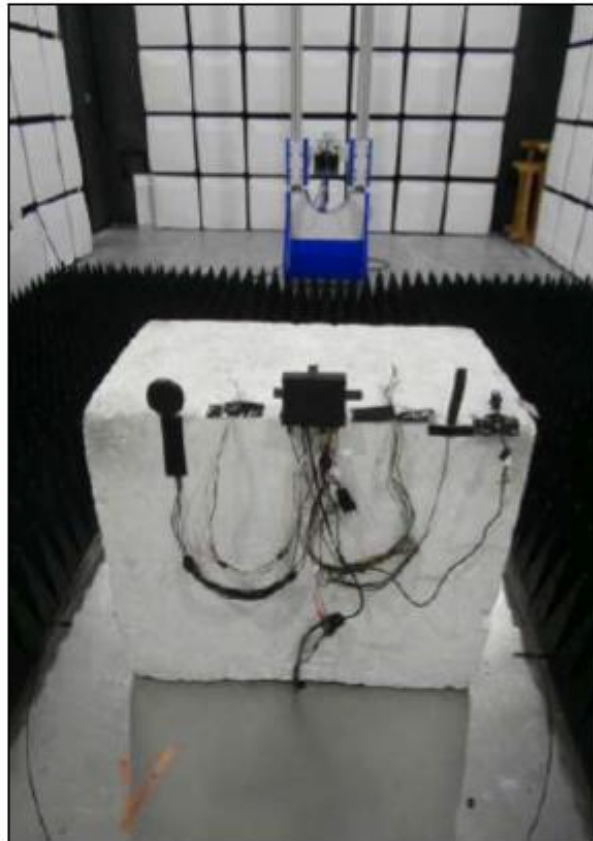


Figure 24 - Test Setup - 1 GHz to 14 GHz - Y - Orientation

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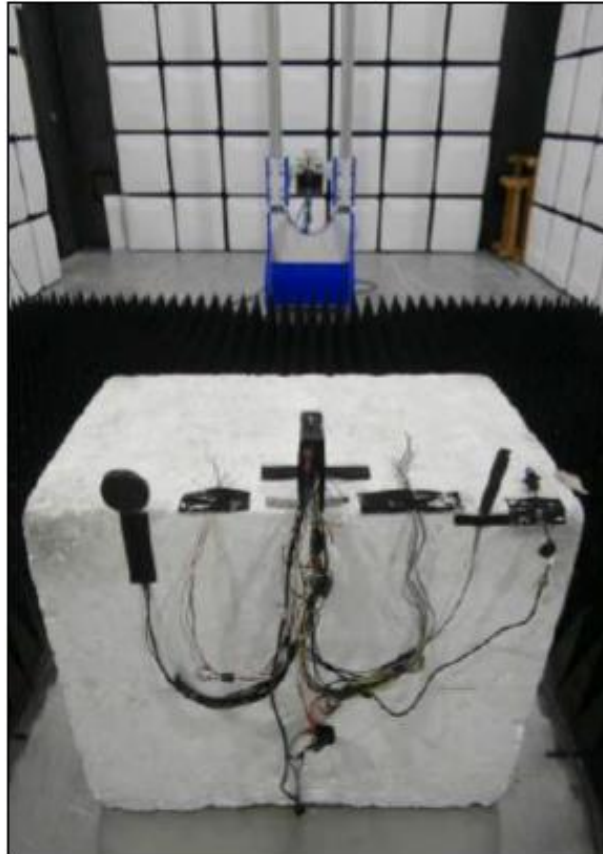


Figure 25 - Test Setup - 1 GHz to 14 GHz - Z - Orientation

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Telematics Unit, Model: MiX 6AMB-4G-B

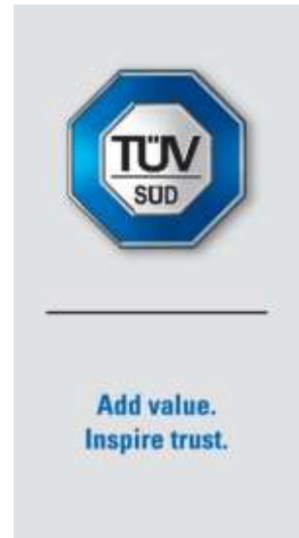
In accordance with FCC 47 CFR Part 15C
(915 MHz Transceiver)

Prepared for: MiX Telematics International (Pty) Ltd
Blaauwklip Office Park 2
Cnr Strand & Webersvalley Roads
Stellenbosch
South Africa

FCC ID: 2AFMS-6AMB4G

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2.3 Spurious Radiated Emissions

2.3.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (d) and 15.205

2.3.2 Equipment Under Test and Modification State

MiX 6AMB-4G-B, S/N: 66000181 - Modification State 0

2.3.3 Date of Test

24-January-2021 to 25-January-2021

2.3.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 6.3, 6.5 and 6.6.

The EUT was placed on the non-conducting platform in a manner typical of a normal installation. As the EUT could reasonable be used in multiple planes, pre-scans were performed with the EUT orientated in X, Y and Z planes with reference to the ground plane.

Ports on the EUT were terminated with loads as described in ANSI C63.4 clause 6.2.4. For multiple connectors of the same type, additional interconnecting cables were connected and pre-scans were performed to determine whether the level of the emissions were increased by >2 dB. For frequencies > 1 GHz, plots for average measurements were taken in accordance with ANSI C63.10 clause 4.1.4.2.5 to characterize the EUT.

This EUT employs pulsed operation. To determine the average value of pulsed emissions within restricted bands, testing was performed in accordance with ANSI C63.10, clause 7.5.

The Duty Cycle Correction Factor (DCCF) was calculated as:

$$20 \log (8.2\text{ms}/100\text{ms}) = 21.7\text{dB}$$

The plots shown are the characterization of the EUT. The limits on the plots represent the most stringent case for restricted bands, (74/54 dBuV/m) when compared to 20 dBc outside restricted bands. The limits shown have been used as a threshold to determine where further measurements are necessary. Where results are within 10 dB of the limits shown on the plots, further investigation was carried out and reported in results tables.

The following conversion can be applied to convert from dBuV/m to uV/m:
 $10^{(\text{Field Strength in dBuV}/m/20)}$.

Where formal measurements have been necessary, the results have been presented in the emissions table.



2.3.5 Example Test Setup Diagram

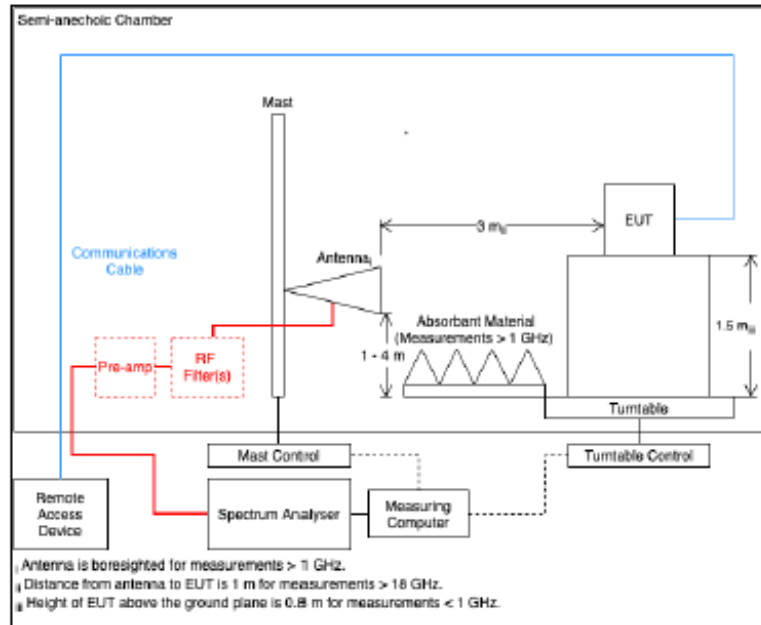


Figure 7

2.3.6 Environmental Conditions

Ambient Temperature 24.7 - 24.8 °C
 Relative Humidity 21.4 - 21.5 %

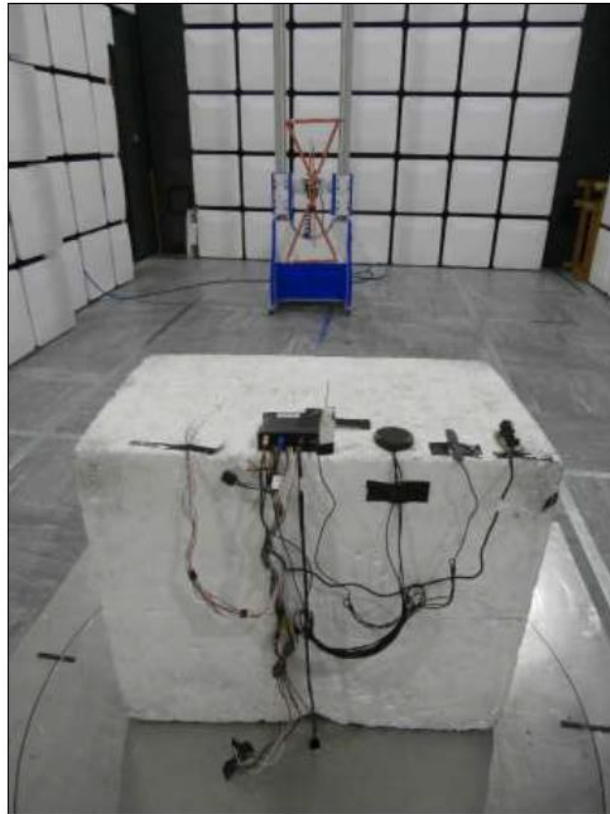


Figure 62 - Test Setup - 30 MHz to 1 GHz - X Orientation

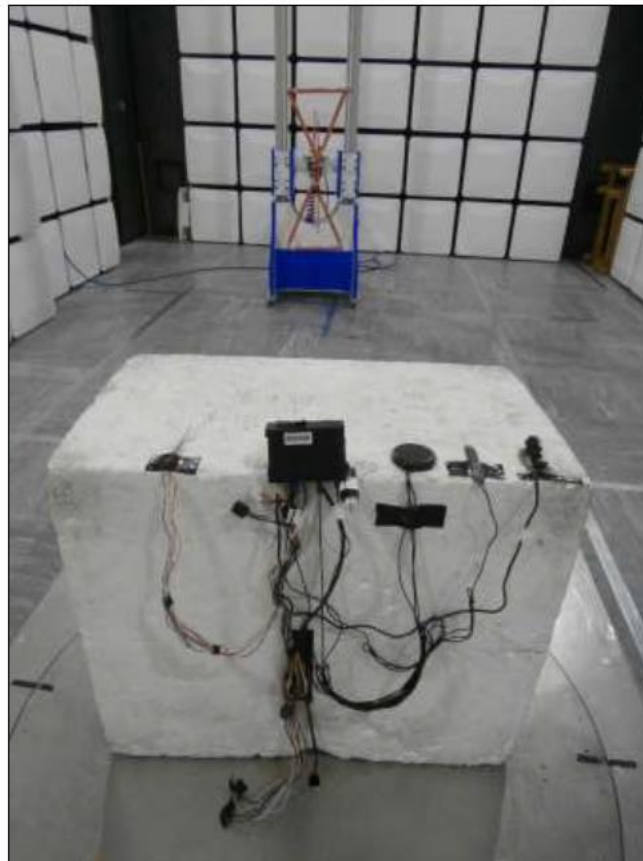


Figure 63 - Test Setup - 30 MHz to 1 GHz - Y Orientation

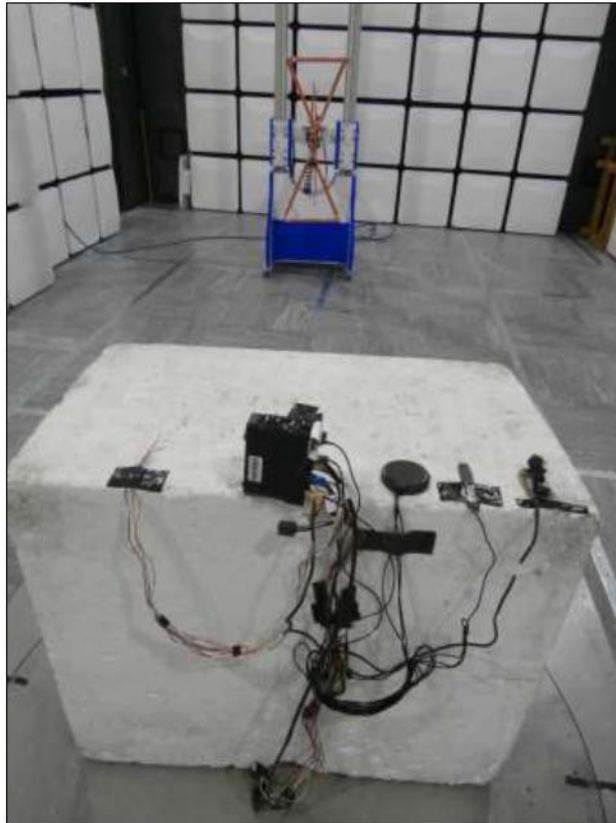


Figure 64 - Test Setup - 30 MHz to 1 GHz - Z Orientation

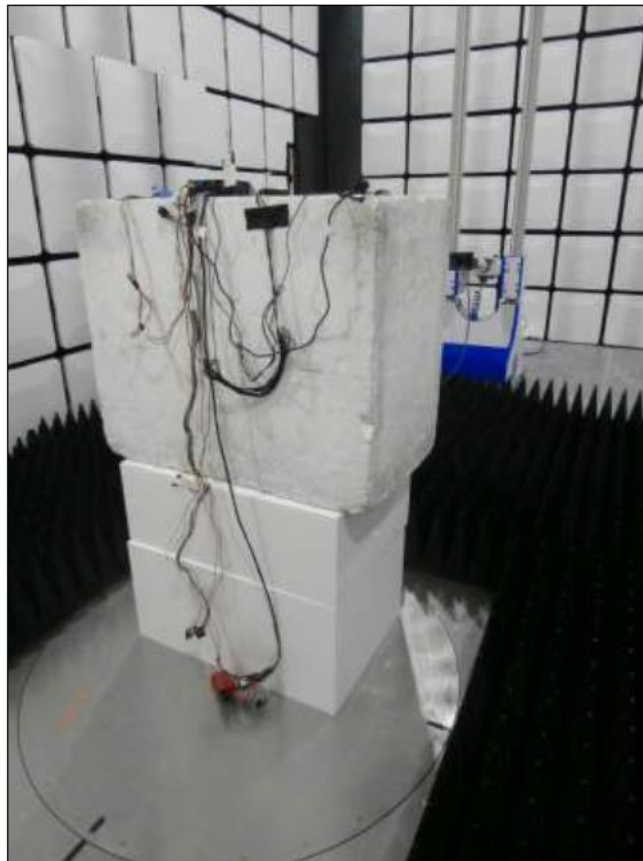


Figure 65 - Test Setup - 1 GHz to 10 GHz - X Orientation

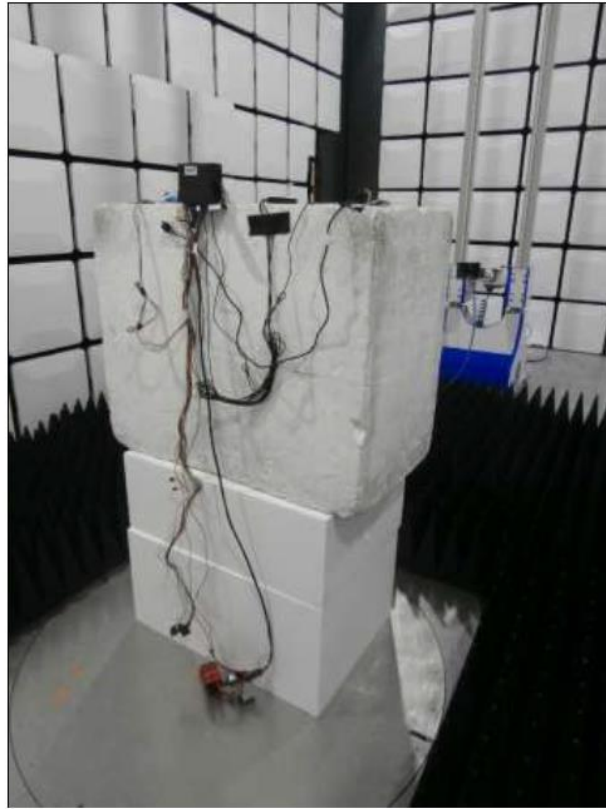


Figure 66 - Test Setup - 1 GHz to 10 GHz - Y Orientation



Figure 67 - Test Setup - 1 GHz to 10 GHz - Z Orientation

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Telematics Unit, Model: MiX 6AMB-4G-B

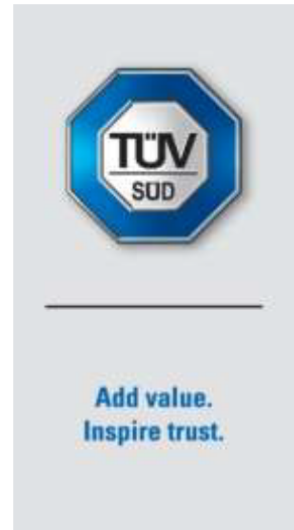
In accordance with FCC 47 CFR Part 15C
(2.4 GHz Bluetooth Low Energy)

Prepared for: MiX Telematics International (Pty) Ltd
Blaauwklip Office Park 2
Cnr Strand & Webersvalley Roads
Stellenbosch
South Africa

FCC ID: 2AFMS-6AMB4G

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2 Test Details

2.1 Restricted Band Edges

2.1.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.205

2.1.2 Equipment Under Test and Modification State

MiX 6AMB-4G-B, S/N: 66000181 - Modification State 0

2.1.3 Date of Test

27-January-2021

2.1.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 6.10.5 and 11.12.1.

Plots for average measurements were taken in accordance with ANSI C63.10, clause 4.1.4.2.5. These are shown for information purposes and were used to determine the worst case measurement point. Final average measurements were then taken in accordance with ANSI C63.10, clause 11.12.2.5.2. to obtain the measurement result recorded in the test results tables.

The following conversion can be applied to convert from dB μ V/m to μ V/m:

$10^{(\text{Field Strength in dB}\mu\text{V}/\text{m}/20)}$.

2.1.5 Environmental Conditions

Ambient Temperature	23.7 °C
Relative Humidity	38.2 %

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MiX Telematics International (Pty) Ltd
Telematics Unit, Model: MiX 6AMB-4G-B

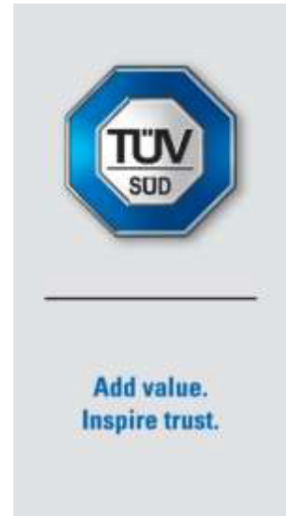
In accordance with FCC 47 CFR Part 15C
(2.4 GHz Bluetooth)

Prepared for: MiX Telematics International (Pty) Ltd
Blaauwklip Office Park 2
Cnr Strand & Webersvalley Roads
Stellenbosch
South Africa

FCC ID: 2AFMS-6AMB4G

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2 Test Details

2.1 Restricted Band Edges

2.1.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.205

2.1.2 Equipment Under Test and Modification State

MiX 6AMB-4G-B, S/N: 66000181 - Modification State 0

2.1.3 Date of Test

28-January-2021

2.1.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 6.10.5.

Plots for average measurements were taken in accordance with ANSI C63.10, clause 4.1.4.2.5. These are shown for information purposes and were used to determine the worst case measurement point. Final average measurements were then taken in accordance with ANSI C63.10, clause 4.1.4.2.2. to obtain the measurement result recorded in the test results tables.

The following conversion can be applied to convert from dB μ V/m to μ V/m:

$10^{(\text{Field Strength in dB}\mu\text{V/m}/20)}$.

2.1.5 Environmental Conditions

Ambient Temperature 25.5 °C
Relative Humidity 35.8 %

2.1.6 Test Results

2.4 GHz Bluetooth

Mode	Modulation	Packet Type	Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dB μ V/m)	Average Level (dB μ V/m)
Static	GFSK	DH5	2402	2390.0	51.04	36.98
Static	$\pi/4$ DQPSK	2DH5	2402	2390.0	51.22	36.92
Static	8-DPSK	3DH5	2402	2390.0	51.01	36.97
Static	GFSK	DH5	2480	2483.5	51.74	37.97
Static	$\pi/4$ DQPSK	2DH5	2480	2483.5	51.77	37.90
Static	8-DPSK	3DH5	2480	2483.5	51.65	37.94

Table 5 - Restricted Band Edge Results

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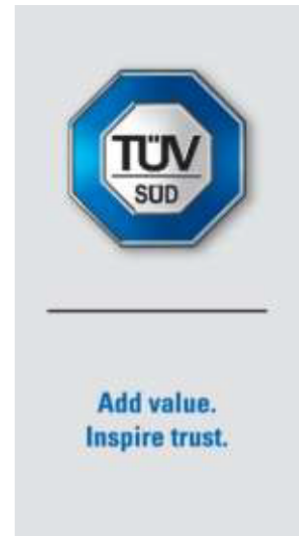
In accordance with FCC 47 CFR Part 15C,
FCC 47 CFR Part 22, FCC 47 CFR Part 24 and
FCC 47 CFR Part 27 (Simultaneous Transmission)

Prepared for: MiX Telematics International (Pty) Ltd
Blaauwklip Office Park 2
Cnr Strand & Webersvalley Roads
Stellenbosch
South Africa

FCC ID: 2AFMS-6AMB4G

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2 Test Details

2.1 Radiated Spurious Emissions (Simultaneous Transmission)

2.1.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (d) and 15.205
FCC 47 CFR Part 22, Clause 22.917 (a)
FCC 47 CFR Part 24, Clause 24.238 (a)
FCC 47 CFR Part 27, Clause 27.53(g)

2.1.2 Equipment Under Test and Modification State

MiX 6AMB-4G-B, S/N: 66000181 - Modification State 0

2.1.3 Date of Test

26-January-2021 to 31-January-2021

2.1.4 Test Method

Testing was performed in accordance with ANSI C63.26, clause 5.5.

Prescans were performed using the direct field strength method. Any emissions found within 10 dB of the specification limit were formally measured using the substitution method.

The limit line on the prescan plots was calculated from equation c) in clause 5.2.7.

To determine the emission characteristic of the EUT above 18 GHz, the test antenna was swept over all faces of the EUT whilst observing a spectral display. The frequency of any emissions of interest was noted for formal measurement at the correct measurement distance of 3m. This procedure was repeated for all relevant transmit operating channels.

The EUT was placed on a non-conducting platform in a manner typical of a normal installation. The EUT could be fitted in multiple planes, therefore, pre-scans were performed with the EUT orientated in X, Y and Z planes with reference to the ground plane.

Ports on the EUT were terminated with loads as described in ANSI C63.4 clause 6.2.4

A plot has been presented in the plots section to show measurement system sensitivity for the X – plane only over the frequency range from 18 GHz to 25 GHz.



2.1.5 Test Setup Diagram(s)

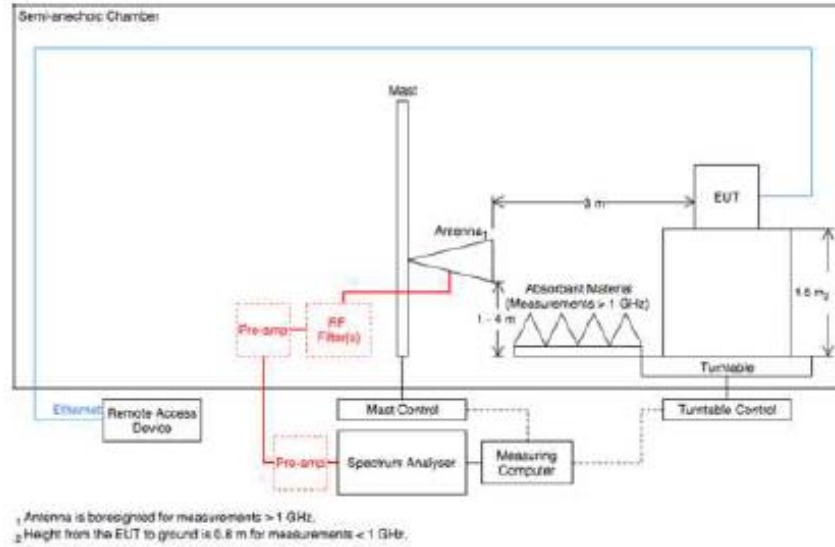


Table 5

2.1.6 Environmental Conditions

Ambient Temperature	24.1 - 25.5 °C
Relative Humidity	24.9 - 38.1 %