

Test Report

Product	Telematics unit for mounting on forklifts		
Name and address of the applicant	Toyota Material Handling, Inc. 5559 Inwood Drive, Columbus IN 47201, USA		
Name and address of the manufacturer	Toyota Material Handling, Inc. 5559 Inwood Drive, Columbus IN 47201, USA		
Model	DHUnx		
Rating	External DC supply (12-48 V _{DC})		
Trademark	TOYOTA		
Serial number	202205REVBZ02404		
Additional information	WiFi, BT Classic, BLE, WCDMA, LTE		
Tested according to	Parts of FCC Part 15.407 Unlicensed National Information Infrastructure Devices (U-NII) Parts of Industry Canada RSS-247, Issue 2 Licence-Exempt Local Area Network (LE-LAN) Devices		
Order number	433049		
Tested in period	2022-05-23 to 2022-05-24		
Issue date	2022-06-08		
Name and address of the testing laboratory	<div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="text-align: center;">  Instituttveien 6 Kjeller, Norway www.nemko.com </div> <div style="text-align: center;"> CAB Number FCC: NO0001 ISED: NO0470 </div> <div style="text-align: center;">  NORWEGIAN ACCREDITATION TEST 033 </div> </div> <p style="text-align: center; color: red; font-weight: bold;">An accredited technical test executed under the Norwegian accreditation scheme</p>		
<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  Prepared by [Frode Sveinsen] </div> <div style="text-align: center;">  Approved by [G.Suhanthakumar] </div> </div>			
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Revision history

Revision	Date	Comment	Sign
00	2022-06-08	First edition	FS



THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.

Deviations from, additions to, or exclusions from the test specifications are described in "Summary of Test Data".

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1 INFORMATION

1.1 Test Item

Name	Toyota
Model	DHUnx
FCC ID	2A226-TELETMH01
ISED ID	27732-TELETMH01
Serial number	202205REVBZ02404
Hardware identity and/or version	BZ1
Software identity and/or version	dv_b1_2021-05-05
Frequency Ranges	U-NII 1 : 5180 – 5240 MHz: 4 channels U-NII 2A : 5260 – 5320 MHz: 4 channels U-NII 2C : 5500 – 5720 MHz: 12 channels U-NII 3 : 5745 – 5825 MHz: 5 channels
Operating Modes	802.11a 802.11n (20/40 MHz BW) 802.11ac (40/80 MHz BW)
Type of Modulation	Digital (OFDM - Orthogonal frequency-division multiplexing)
Conducted Output Power	5180 – 5240 MHz: 16.4 mW 5260 – 5320 MHz: 16.6 mW 5500 – 5720 MHz: 12.9 mW 5745 – 5825 MHz: 13.3 mW
Antenna Connector	Quad MiniFakra
Antenna Type	Molex Antenna, P/N: 2144500750 (P/N is for version with 750mm cable length, longer cables may also be used) Antenna element LTE1: Rx/Tx Antenna element LTE2: Rx Only Antenna element WiFi/BT: Rx/Tx 2.4GHz WiFi/BT/BLE and 5GHz WiFi Antenna element GNSS: Rx Only GNSS/GPS
Antenna Diversity Supported	Not for WiFi
Smart Antennas Supported	No
TPC Supported	Not implemented. Not required when EIRP is below 500 mW
DFS Supported	Client Device without Radar Detection
Ad-hoc Mode	EUT does not support Ad-hoc Mode in DFS bands
Hotspot Mode	EUT does not support Hotspot Mode in DFS bands
Power Source	External DC Supply (12-48V _{DC} , supplied through MX23 connector)
Interfaces	MX23 Connector HSD Connector (100TX Ethernet)

Description of Test Item

The EUT is a telematics unit with radio modules for BT/BLE/WiFi and Mobile (WCDMA and LTE). Both radio modules are certified radio modules. The EUT also contains a GPS receiver.

This test report covers tests to verify Output Power after change of WiFi Module from FC20-Q73 to FC20-Q93.

1.2 Normal test conditions

Temperature:	20 - 24 °C
Relative humidity:	20 - 50 %
Normal test voltage:	24V DC (2x 12V lead acid batteries, Fiamm FG20451)

The EUT was powered from two fully charged batteries during all tests.

The values are the limit registered during the test period.

1.3 Test Engineer

Frode Sveinsen

1.4 Antenna Requirement

Does the EUT have detachable antenna(s)?	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO
If detachable, is the antenna connector(s) non-standard?	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO
Antenna Connector: Quad MiniFakra		

Requirement: FCC 15.203, 15.204

1.5 Worst-Case Configuration

Radiated Emissions and Power Line Conducted Emissions were performed with the EUT set to transmit at the channel with the highest output power as worst-case scenario.

1.6 EUT Operating Modes

Description of operating modes	Continuous TX, 5 GHz 20/40/80 MHz Mode
Additional information	EUT was controlled from a computer and programmed with the Qualcomm Test App.

1.7 Radio Modules

Data for radio modules			
Manufacturer	Model No	Identification	Technology
Quectel	FC20	FCC ID: XMR201703FC20 IC: 10224A-201703FC20 P/N: FC20-Q93	BT Classic BT Low Energy WiFi 2.4 GHz WiFi 5GHz
Quectel	EG25	FCC ID: XMR201903EG25G IC: 10224A-201903EG25G P/N: EG25GGB-256-SGNS	GSM WCDMA LTE

1.8 EUT Power Levels

The default values from the module manufacturer were used for all channels and modulations.

No power levels were modified for any of the tests.

1.9 Comments

The measurements were done with the EUT powered from fully charged batteries.

All ports were populated during spurious emission measurements.

This test report covers only selected tests for new antennas, all other tests are covered by the original Test Reports.

2 TEST REPORT SUMMARY

2.1 General

All measurements are traceable to national standards.

The tests were conducted for demonstrating compliance with FCC CFR 47 Part 15, paragraph 15.407 and ISSED RSS-247 Issue 2.

Tests were performed in accordance with ANSI C63.4-2014 and ANSI C63.10-2013.

Radiated tests were performed in a semi-anechoic chamber at measuring distances of 1m and 3m.

☐ New Submission

☒ Production Unit

☒ Class II Permissive Change

☐ Pre-production Unit

NII Equipment Code

☐ Family Listing

2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-247 Issue 2 RSS-GEN Issue 5 reference	Result
Maximum Output Power	15.407(a)	6.2	Complies

3 TEST RESULTS

3.1 Maximum Output Power, EIRP

FCC 15.407 (a)

ISED RSS-247, Issue 2, Clause 6.2

Measurement procedure: ANSI C63.10-2013 Clause 12.3, method SA-1

Test Results: Complies

Measurement Data:

Ch. No.	Nominal Frequency (MHz)	Maximum Field Strength (dBμV/m)				Maximum e.i.r.p. (dBm)			
		802.11a		802.11n HT20		802.11a		802.11n HT20	
		6M	54M	MCS0	MCS7	6M	54M	MCS0	MCS7
48	5240	93.5	89.4	91.4	88.3	-1.7	-5.8	-3.8	-6.9
116	5580	98.0	94.0	95.9	92.8	2.8	-1.3	0.6	-2.5

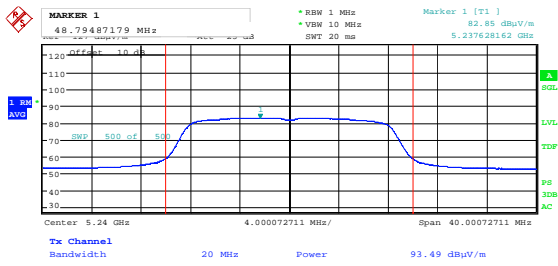
The EUT operates continuously; therefore, method SA-1 of ANSI C63.10-2013 clause 12.3 was used.

EIRP values were calculated from Field Strength values using the method described in KDB 412172 D01.

This is an indoor device with directional Antenna Gain less than 6 dBi.

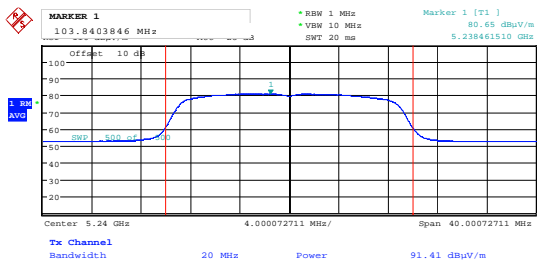
Limits for Indoor Device:

Frequency Band	FCC 15.407(a)	ISED RSS-247 Issue 2
5150 – 5250 MHz	Less than 250 mW (24 dBm) for client device Less than 1 W (30 dBm) for master device	Less than the lesser of 200 mW e.i.r.p. or $10 + 10 \log_{10} B$ dBm e.i.r.p.
5250 – 5350 MHz 5470 – 5725 MHz	Less than the lesser of 250 mW (24 dBm) or $11 + 10 \log_{10} B$ dBm	Less than the lesser of 250 mW or $11 + 10 \log_{10} B$ dBm, and Less than the lesser of 1 W e.i.r.p. or $17 + 10 \log_{10} B$ dBm e.i.r.p. Devices with e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W
5725 – 5825 MHz	Less than 1 Watt	Less than 1 Watt If Antenna Gain is more than 6 dBi the Power Limit is reduced by the amount exceeding 6 dBi
	If Antenna Gain is more than 6 dBi the Power Limit is reduced by the amount exceeding 6 dBi	
	B is the 26dB emission bandwidth in MHz	B is the 99% emission bandwidth in MHz



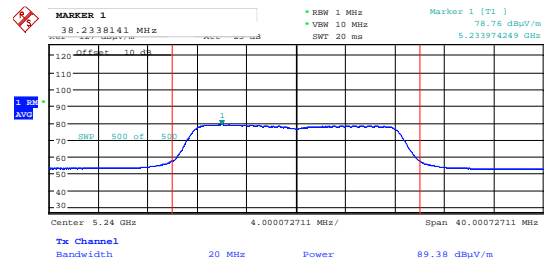
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Maximum EIRP, Ch048, 802.11a, 6M



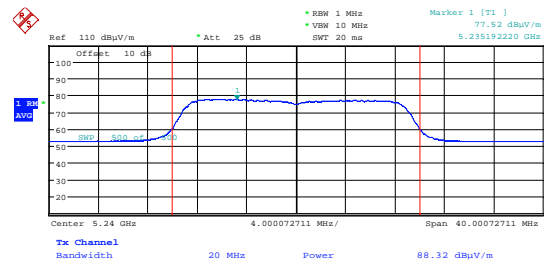
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Maximum EIRP, Ch048, 802.11n, HT20, MCS0



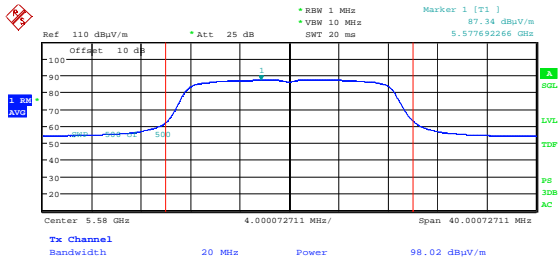
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Maximum EIRP, Ch048, 802.11a, 54M



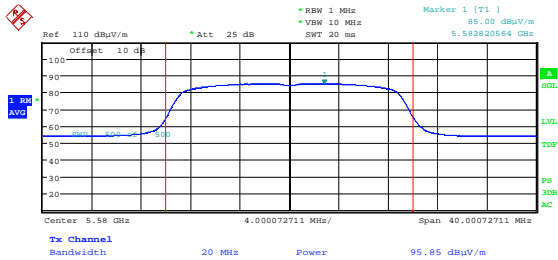
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Maximum EIRP, Ch048, 802.11n, HT20, MCS7



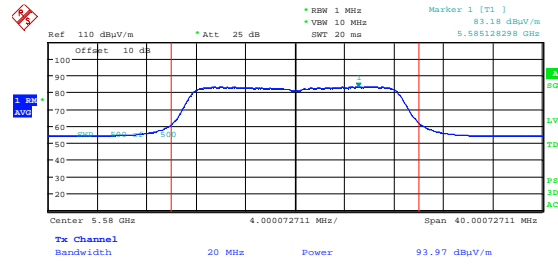
Date: 24.MAY.2022 10:21:37

Maximum EIRP, Ch116, 802.11a, 6M



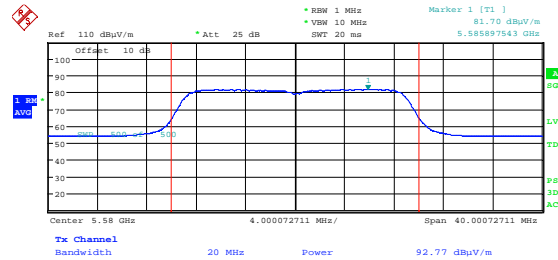
Date: 24.MAY.2022 10:19:07

Maximum EIRP, Ch116, 802.11n, HT20, MCS0



Date: 24.MAY.2022 10:22:36

Maximum EIRP, Ch116, 802.11a, 54M



Date: 24.MAY.2022 10:18:09

Maximum EIRP, Ch116, 802.11n, HT20, MCS7

4 Measurement Uncertainty

Measurement Uncertainty Values		
Test Item		Uncertainty
Output Power		±0.5 dB
Power Spectral Density		±0.5 dB
Out of Band Emissions, Conducted	< 3.6 GHz	±0.6 dB
	> 3.6 GHz	±0.9 dB
Spurious Emissions, Radiated	< 1 GHz	±2.5 dB
	> 1 GHz	±2.2 dB
Emission Bandwidth		±4 %
Power Line Conducted Emissions		+2.9 / -4.1 dB
Spectrum Mask Measurements	Frequency	±5 %
	Amplitude	±1.0 dB
Frequency Error		±0.6 ppm
Temperature Uncertainty		±1 °C

All uncertainty values are expanded standard uncertainty to give a confidence level of 95%, based on coverage factor k=2

5 LIST OF TEST EQUIPMENT

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2022-01	2023-01
2	6810-17B	Attenuator	Suhner	LR 1669	2021-08	2022-08
3	3117-PA	Horn Antenna +PreAmp	EMCO	LR 1717	2021-08	2022-08

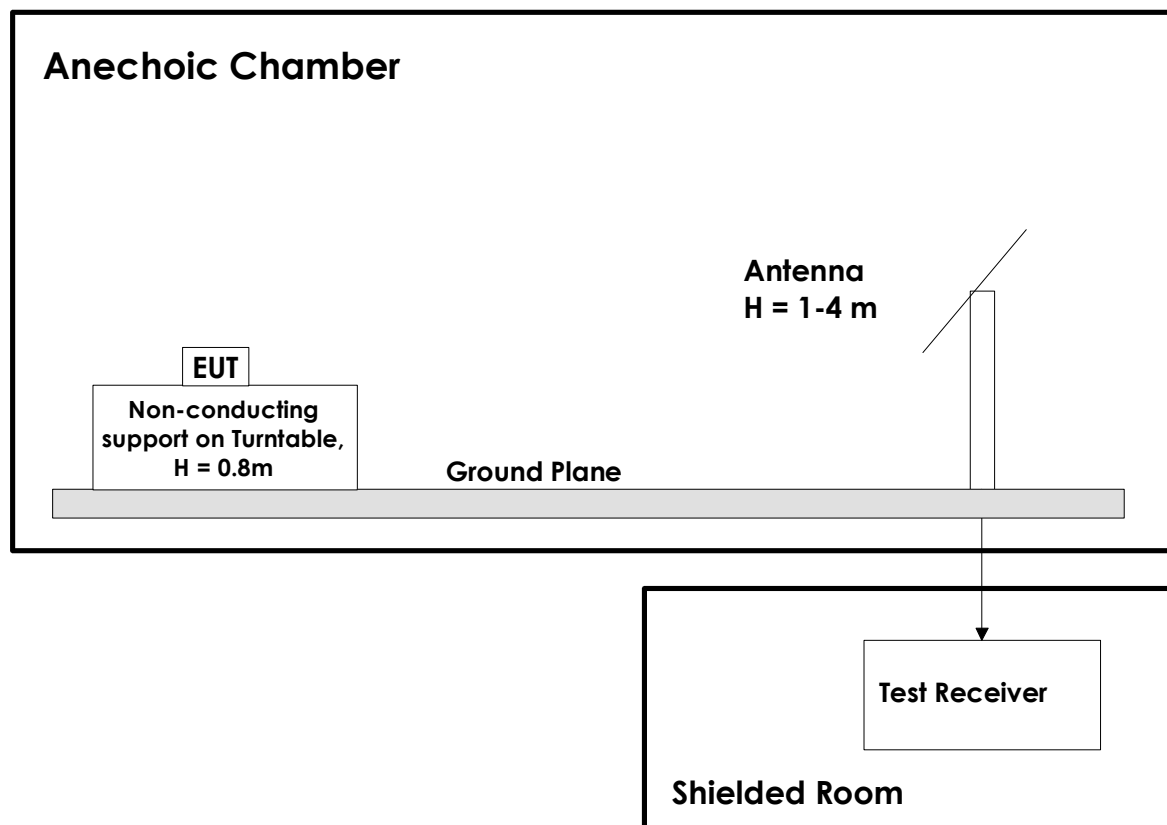
Note: COU – calibrate on use; N/A – Not Applicable

The software listed below has been used for one or more tests.

No.	Manufacturer	Name	Version	Comment
1	Nemko AS	RSPlot	1.0.8.0	Screenshots from R&S Spectrum Analyzers

6 BLOCK DIAGRAM

6.1 Test Site Radiated Emission



This test setup is used for all radiated emissions tests. Measuring distance is 3m for all frequencies.

Emissions above 1 GHz are measured with a Spectrum Analyzer and Horn Antenna.

All measurements at 1GHz and above were performed with turntable height 1.5m and with the ground plane covered by absorbers.

A pre-amplifier is used for all measurements, and High-Pass filter is used for all harmonics.