

# TEST REPORT No.: 16-1-0130001T09a-C2

According to: FCC Regulations Part 1.1310 Part 2.1091

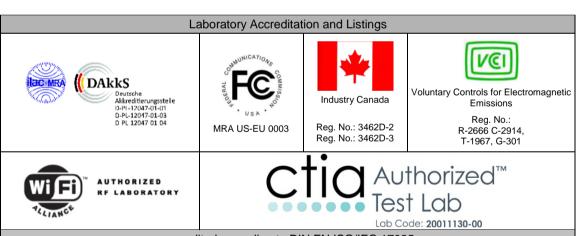
IC-Regulations RSS-102, Issue 5

for

# **Prodrive Technologies**

## **Carrier Controller Master**

FCC ID: Y2ICCMUL ISED: 9389A-CCMUL PMN: CCM-IO-ETH, UL HVIN: 64533



#### accredited according to DIN EN ISO/IEC 17025

#### **CETECOM GmbH**

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The listed attachments are an integral part of this report.



# 1. Summary of test results

The test results apply exclusively to the test samples as presented in this Report. The CETECOM GmbH does not assume responsibility for any conclusions and generalizations taken in conjunction with other specimens or samples of the type of the item presented to tests.

The presented Equipment Under Test (in this report, hereinafter referred as EUT) integrates a BT 2.4 GHz RF Transceiver. Other implemented wireless technologies were not considered within this test report.

Following tests have been performed to show compliance with applicable FCC Part 2.1091 and FCC Part 1.1310 of the FCC CFR 47 Rules.

#### 1.1. Summary of tests results

RF	RF-Exposure Evaluation (separation distance user to RF-radiating element greater 20cm)							
			References & Limits			EUT	EUT	
Test cases	Port	FCC	Test Limit	RSS	Test Limit	_	op.	Result
		Standard		Standard		set-up	mode	
Radio frequency radiation exposure Requirements	Cabinet	\$1.1310 \$2.1091 \$2.1093	RF-Field Strength Limits: FCC: "general population/ uncontrolled" environment	RSS- 102, Issue 5	Chapter 4 Table 4	1	1	Pass

**Remark:** Calculations based on Datasheet delivered by applicant

#### 1.2. Attestation:

I declare that all measurements were performed by me or under my supervision and that all measurements have been performed and are correct to my best knowledge and belief to Industry Canada standards. All requirements as shown in above table are met in accordance with enumerated standards.

The current version of the Test Report CETECOM\_TR161-0130001T09a-C2 replaces the Test Report CETECOM\_ TR16-1-0130001T09a-C1 dated 2019-01-16. The replaced test report is herewith invalid.

DiplIng. Niels Jeß	DiplIng. N. Perez
Responsible for test section	Responsible for test report



## 2. Administrative Data

## 2.1. Identification of the testing laboratory

Company name: CETECOM GmbH

Address: Im Teelbruch 116

45219 Essen - Kettwig

Germany

Responsible for testing laboratory: Dipl.-Ing. Niels Jeß

#### 2.2. Test location

#### 2.2.1. Test laboratory "CTC"

Company name: see chapter 2.1. Identification of the testing laboratory

## 2.3. Organizational items

Responsible for test report: Dipl.-Ing. N. Perez

Receipt of EUT: --Date(s) of test: ---

Date of report: 2019-01-25

## 2.4. Applicant's details

Applicant's name: Prodrive Technologies B.V.

Address: Science Park Eindhoven 5501

5692 EM Son Netherlands

Contact person: Mr. Pim Heemskerk

#### 2.5. Manufacturer's details

Manufacturer's name: please see applicant's details

Address: please see applicant's details



# 3. Equipment under test (EUT)

# 3.1. Summary of product description

FCC ID:	Y2ICCMUL		
Product name	Carrier Controller Master		
Exposure category	General population/uncontrolled environment		
Exposure category	Occupational exposure/controlled environment	nt	
	□ ERP		
Output power	□ EIRP		
	Peak		
	Source-based time-averaging		
Antenna gain	see Annex 1 & 2		
	_	☐ 2T2R	
	☐ MIMO	<u></u> 3T3R	
Technology		<u></u> 4T4R	
reemology	_		
	⊠ non-MIMO	☐ 1T2R	
		☐ 2T1R	
Evaluation type	Standalone		
Dvaraution type	Simultaneous transmission		
Evaluation distance	∑ 20 cm		
L'variation distance	XXX cm	declares by manufacturer	
	Production Unit		
EUT type	Pre-Production Unit		
	Engineering Unit		
Device type	Mobile device		
Device type	Fixed device		
	☐ CFR 47 FCC Part 2.1091		
Refer rules	☐ CFR 47 FCC Part 1.1310		
rector rules	XDB 447497 D01v06 October 23, 2015		
	XDB 865664 D01v01r02 October 23, 2015		

# 3.2. EUT Technologies

Wireless Technologies	Frequency bands	Operation mode
⊠w-LAN	⊠5GHz	For WLAN 5 GHz 802.11a/n Modes tests are carried out with different Channels   Modulation   Data Rate   Bandwidth Combinations with help of WiFi Test Application.  The EUT was put to <b>Fixed Channel (Modulated) Continuous transmissions mode</b> with help of Terminal Software.
		*Other supported wireless technologies were put in idle mode using special test software

## 3.3. Antenna Information

Wireless Technologies	Frequency bands	Antenna type	Maximum antenna gain	
⊠W_LAN	⊠5GHz	☐Internal ⊠External	⊠Antenna 0	0 dBi gain max



# 3.4. EUT: Type, S/N etc. and short descriptions used in this test report

Short description*)	EUT	Туре	S/N serial number	HW hardware status	SW software status
EUT A	Carrier Controller Master	Master CCM-IO-ETH, UL 64533	ł	6752-1600- 1401	CPU: 6752- 1400-2608 uC: 6752-1400- 2912

<sup>\*)</sup> EUT short description is used to simplify the identification of the EUT in this test report.

# 3.5. Auxiliary Equipment (AE): Type, S/N etc. and short descriptions

AE short description *)	Auxiliary Equipment	Туре	S/N serial number	HW hardware status	SW software status
AE 1	Antenna	Slotted Wave Guide, SEW Eurodrive, Part Number Coupler R- SMA 5.0GHz			
AE 2	Antenna	Radiating Cable, Eupen, Part Number RMC 12-CH			

<sup>\*)</sup> AE short description is used to simplify the identification of the auxiliary equipment in this test report.

## 3.6. EUT set-ups

EUT set-up no.*)	Combination of EUT and AE	Remarks
set. 1	EUT A + AE 1	only theoretical calculation
set. 2	EUT A + AE 2	only theoretical calculation

<sup>\*)</sup> EUT set-up no. is used to simplify the identification of the EUT set-up in this test report.



# 3.7. EUT operating modes

EUT operating mode no.*)	Description of operating modes	Additional information
op. 1	WLAN 5 GHz 802.11a/n* TX-Fixed Channel (Modulated)	For WLAN 5 GHz 802.11a/n Modes tests are carried out with different Channels   Modulation   Data Rate   Bandwidth Combinations with help of WiFi Test Application.  The EUT was put to <b>Fixed Channel (Modulated) Continuous transmissions mode</b> with help of Terminal Software.  *Other supported wireless technologies were put in idle mode using special test software

<sup>\*)</sup> EUT operating mode no. is used to simplify the test report.



#### 4. Measurements

## 4.1. Radio Frequency Exposure Evaluation §2.1091

4.1.1. Test location and equipment (for reference numbers please see chapter 'List of test equipment')

test location	☑ CETECOM Essen (Chapter. 2.2.1)	☐ Please see Chapter. 2.2.2	☐ Please see Chapter. 2.2.3
	For Evaluation instruments are not needed	d. Results are determined by calculation ba	sed on applicants delivered Tune-Up
	procedure.		

4.1.2. Requirements

requirements	
FCC: §1.1310	The criteria used for the evaluation of human exposure to radio frequency radiation is table 1 according FCC §1.1310 and table chapter 4.2 of RSS-102 standard and it is subject for evaluation of the RF exposure prior to equipment authorization.  As the mobile equipment is authorized under Part 22 (Subpart H) and Part 24 of the FCC Rules, it is subject for evaluation of the RF exposure prior to equipment authorization.
FCC § 2.1091	Further information on evaluating compliance with these limits can be found in the FCC's OST/OET Bulletin Number 65, "Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radiofrequency Radiation."  For purposes of these requirements mobile devices are defined by the FCC as transmitters designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between radiating structures and the body of the user or nearby persons. These devices are normally evaluated for exposure potential with relation to the MPE limits given in Table 1 of Appendix A.

#### 4.1.2.1. Valid for FCC

Table 1: LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)									
Frequency range	Electric field strength	Magnetic field strength	Power density	Averaging time					
[MHz)	[V/m]	[A/m]	[mW/cm <sup>2</sup> ]	[minutes]					
30 - 300	61.4	0.163	1.0	6					
300 - 1500	-		f/300	6					
1500 - 100,000	-		5	6					
	(B) Limits for	r General Population / Uncontrolle	ed Exposure						
0.3 - 1.34	614	1.63	*(100)	30					
1.34 – 30	824/f	2.19/f	*(180/f²)	30					
30 - 300	27.5	0.073	0.2	30					
300 - 1500	-	-	f/1500	30					
1500 – 100,0	-	-	1.0	30					

#### f=frequency in MHz

NOTE1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure. These limits apply to amateur station licensees and members of their immediate household as discussed in the text.

NOTE2: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure. As discussed in the text, these limits apply to neighbours living near amateur radio stations.

<sup>\*</sup>Plane-wave equivalent power density



## **4.1.3** General Limits:

FCC: §1.1307	Cellular Radiotelephone Service (subpart H of part 22) Non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m and total power of all channels > 1000 W ERP (1640 W EIRP)
FCC §1.1307	Personal Communications Services (part 24) Broadband PCS (subpart E): non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m and total power of all channels > 2000 W ERP (3280 W EIRP)
FCC §1.1310	LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE) Table 1(B) Limits for General Population/Uncontrolled Exposure 300–1500 MHz: f/1500 mW/cm² 1500–100,000 MHz: 1.0 mW/cm²
FCC §2.1091	Subject to routine evaluation is required when the device operate at frequencies of 1.5 GHz or below and their effective radiated power (ERP) is 1.5 watts or more, or if they operate at frequencies above 1.5 GHz and their ERP is 3 watts or more.
FCC §24.232	(a) Base stations are limited to 1640 watts peak equivalent isotropically radiated power (e.i.r.p.) with an antenna height up to 300 meters HAAT. b) Mobile/portable stations are limited to 2 watts e.i.r.p. peak power,
FCC §22.913	(a) Maximum ERP. The effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts. The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.
FCC §27.50 (C)(10)	(10) Portable stations (hand-held devices) are limited to 3 watts ERP; and
FCC §27.50(d)	(4) Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band are limited to 1 watt EIRP.
KDBs	No. 447498 D01 v06



## 4.2. Requirements and limits for RSS Standard

#### 2.5 Exemption Limits for Routine Evaluation

All transmitters are exempt from routine SAR and RF exposure evaluations provided that they comply with the requirements of sections 2.5.1 or 2.5.2. If the equipment under test (EUT) meets the requirements of sections 2.5.1 or 2.5.2, applicants are only required to submit a properly signed declaration of compliance (see <u>Annex C</u>). The information contained in the RF exposure technical brief may be limited to the value(s) of the maximum output power, the information that demonstrates how the maximum output power of the transmitter was derived and the rationale for the separation distances applied (see <u>Table 1</u>), which must be based on the most conservative exposure condition for the applicable module or host platform test procedure requirements.

#### 2.5.2 Exemption Limits for Routine Evaluation — RF Exposure Evaluation

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than  $4.49/f^{0.5}$  W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p.
  of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1.31 x  $10^{-2}$   $f^{0.6834}$  W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

#### 2.6 User Manual Requirements

The applicant is responsible for providing proper instructions to the user of the radio device, and any usage restrictions, including limits of exposure durations. The user manual shall provide installation and operation instructions, as well as any special usage conditions (e.g. proper accessory required, including the proper orientation of the device in the accessory, maximum antenna gain in the case of detachable antenna), in order to ensure compliance with SAR and/or RF field strength limits. For instance, compliance distance shall be clearly stated in the user manual.

The user manual of devices intended for controlled use shall also include information relating to the operating characteristics of the device; the operating instructions to ensure compliance with SAR and/or RF field strength limits; information on the installation and operation of accessories to ensure compliance with SAR and/or RF field strength limits; and contact information where the user can obtain Canadian information on RF exposure and compliance. Other related information may also be included.

#### 4.3. MPE Calculation method

RSS-102, Issue 5

Predication of MPE limit at a given distance Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{EIRP}{4\pi R^2} = \frac{P * G}{4\pi R^2}$$

$$G_{NUMERIC} = \frac{S * 4\pi R^2}{P}$$

Where: S=power density P=power input to antenna

G=power gain of the antenna in the direction of interest relative to an isotropic radiator

R=distance to the centre of radiation of the antenna



#### 4.4. Evaluation Method

#### 4.4.1. Standalone

#### Valid for W-LAN Mode:

- The peak power was checked on 3 frequencies (lowest/middle/highest) within the W-LAN band and the results compared to applicant's declared power values (datasheet).
- No duty-cycle correction factor is applicable

Please find in the following tables the calculations based on applicants datasheet for the power and antenna gain values. Only the worst case antenna gain (0dBi for **AE2**) was considered.

#### 4.5. Results for fixed and mobile

#### 4.5.1. Results for FCC Standard

#### **4.5.1.1. MPE results**

Operation Mode		maximum conducted output power	Max. positive tolerance according manufacturer 's tune-up info	Antenna Gain	antenna connector according manufacturer		Duty cycle	Maxim um EIRP	Equivalent EIRP (EIRP x duty cycle)	MPE Limit accord. Table 1	MPE-Value		Fraction for Co-location calculations	Value within
	(MHz)	(dBm)	(dB)	(dBi)	(dB)	(dBm)	(%)	(W)	(mW)	(m W/cm ^2)	(m W/cm ^2)	(mW/cm^2)		band
	5170,0	15,50	0,50	0,00	0,00	16,00	100%	0,040	39,81	1,0000	0,00792	0,9921	0,0079	
W-LAN 5GHz (20MHZ BW)		15,50	0,50	0,00	0,00	16,00	100%	0,040	39,81	1,0000	0,00792	0,9921	0,0079	0,0079
(20.1 12 544)	5690,0	15,50	0,50	0,00	0,00	16,00	100%	0,040	39,81	1,0000	0,00792	0,9921	0,0079	

Maximum calculated MPE value:						
5GHz						
Lowest MPE- Limit:	1,0000	[W/m ^2]				
Highest MPE- value:	0,0079	[W/m ^2]				
Margin to limit	0,9921	[W/m ^2]				

## 4.5.2. Results for RSS Standard

## **4.5.2.1. MPE Results**

Operation Mode	Frequency on channel		Declared Antenna Gain (dBi)	EIRP	Duty cycle	Maximum ERP	Equivalent EIRP (EIRP x duty cycle)	MPE Limit accord. Table 4	MPE-Value		Fraction for Co-location calculations	Value within
	(MHz)			(dBm)	(%)	(W)	(mW)	(W/m ^2)	(W/m ^2)	(W/m ^2)		band
W. I. ANI 5011	5170,0	15,50	0,5	16,00	100%	0,040	39,81	9,0351	0,0792	8,9559	0,0088	
W-LAN 5GHz (20MHZ BW)	5540.0	15,50	0,5	16,00	100%	0,040	39,81	9,4722	0,0792	9,3930	0,0084	0,0088
(ZOIVII IZ DVV)	5690,0	15,50	0,5	16,00	100%	0,040	39,81	9,6467	0,0792	9,5675	0,0082	

Maximum calculated MPE value:						
5GHz						
Lowest MPE- Limit:	9,0351	[W/m ^2]				
Highest MPE- value:	0,0792	[W/m ^2]				
Margin to limit	8,9559	[W/m ^2]				



#### 4.6. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.

The measurement results comply with the RSS-102, Issue 5.

## 4.7. Measurement uncertainties

The reported uncertainties are calculated based on the standard uncertainty multiplied with the appropriate coverage factor **k**, such that a confidence level of approximately 95% is achieved.

For uncertainty determination, each component used in the concrete measurement set-up was taken in account and it's contribution to the overall uncertainty according it's statistical distribution calculated.

Following table shows expectable uncertainties for each measurement type performed.

RF-Measurement	Reference	Frequency range	Calculated uncertainty based on a confidence level of 95%			Remarks			
Conducted emissions (U CISPR)	CISPR 16-2-1	9 kHz - 150 kHz 150 kHz - 30 MHz	4.0 dB 3.6 dB						-
Radiated emissions Enclosure	CISPR 16-2-3	30 MHz - 1 GHz 1 GHz - 18 GHz	4.2 dB 5.1 dB	4.2 dB 5.1 dB					E-Field
Disturbance power	CISPR 16-2-2	30 MHz - 300 MHz	-						-
Power Output radiated	-	30 MHz - 4 GHz	3.17 dB					Substitution method	
Danier Outent and docted		Set-up No.	Cel- C1	Cel- C2	BT1	W1	W2		
Power Output conducted	-	9 kHz - 12.75 GHz	N/A	0.60					-
		12.75 - 26.5GHz	N/A	0.82					
Conducted emissions	-	9 kHz - 2.8 GHz	0.70	N/A					N/A - not
on RF-port		2.8 GHz - 12.75GHz	1.48	N/A					applicable
		12.75 GHz - 18GHz	1.81	N/A					
		18 GHz - 26.5GHz	1.83	N/A					
			0.1272	2 ppm (	Delta N	/arker)	)		Frequency
Occupied bandwidth	-	9 kHz - 4 GHz							error
			1.0 dB						Power
	-		0.1272	2 ppm (	Delta N	Aarker)	)		Frequency
Emission bandwidth		9 kHz - 4 GHz	G 1		70 ID				error
	-		See above: 0.70 dB				Power		
Frequency stability	-	9 kHz - 20 GHz	0.0636 ppm				-		
D 11 / 1 1 1		150 kHz - 30 MHz	5.0 dB		Magnetic				
Radiated emissions	-	30 MHz - 1 GHz	4.2 dB			field			
Enclosure		1 GHz - 20 GHz	3.17 d	В					E-field Substitution

Table: measurement uncertainties, valid for conducted/radiated measurements



# 5. Abbreviations used in this report

The abbreviation	The abbreviations					
ANSI	American National Standards Institute					
AV , AVG, CAV	Average detector					
EIRP	Equivalent isotropically radiated power, determined within a separate measurement					
EGPRS	Enhanced General Packet Radio Service					
EUT	Equipment Under Test					
FCC	Federal Communications Commission, USA					
IC	Industry Canada					
n.a.	not applicable					
Op-Mode	Operating mode of the equipment					
PK	Peak					
RBW	resolution bandwidth					
RF	Radio frequency					
RSS	Radio Standards Specification, Dokuments from Industry Canada					
Rx	Receiver					
TCH	Traffic channel					
Tx	Transmitter					
QP	Quasi peak detector					
VBW	Video bandwidth					
ERP	Effective radiated power					

# 6. Accreditation details of CETECOM's laboratories and test sites

Ref No.	Accreditation Certificate	Valid for laboratory area or test site	Accreditation Body
-	D-PL- 12047-01-01	All laboratories and test sites of CETECOM GmbH, Essen	DAkkS, Deutsche Akkreditierungsstelle GmbH
337 487 558 348 348	MRA US-EU 0003	Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS) Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements above 1 GHz, 3 m (FAR) Mains Ports Conducted Interference Measurements Telecommunication Ports Conducted Interference Measurem.	FCC, Federal Communications Commission Laboratory Division, USA
337 487 550	3462D-1 3462D-2 3462D-2	Radiated Measurements 30 MHz to 1 GHz, 3 m / 10 m (OATS) Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements 1 GHz to 6 GHz, 3 m (SAR)	IC, Industry Canada Certification and Engineering Bureau
558	3462D-3	Radiated Measurements above 1 GHz, 3 m (FAR)	and Engineering Edited
487 550 348 348	G-301 Radiated Measurements 1 GHz to 6 GHz, 3 m (SAR)  Kadiated Measurements 1 GHz to 6 GHz, 3 m (SAR)  Mains Ports Conducted Interference Measurements		VCCI, Voluntary Control Council for Interference by Information Technology Equipment, Japan
OATS	S = Open Area Te	est Site, SAR = Semi Anechoic Room, FAR = Fully Anechoic Room	



# 7. Photographs of the EUT's



Photograph 1: EUT A Top side



Photograph 2: AE 1 Slotted Wave Guide Antenna





Photograph 3: AE 2 Radiating Cable Antenna



# **8.** Versions of test reports (change history)

Version	Applied changes	Date of release
	Initial release	2018-09-10
C1	FCC-ID and ISED no, PMN and HVIN added	2019-01-16
C2	FCC-ID corrected, Antenna description changed	2019-01- 25

# END OF TEST REPORT