

TEST REPORT

No.: 17-1-0078101T02a-C1

According to:
FCC Regulations
 Part 1.1310 , Part 2.1091

for
Gemalto M2M GmbH

EMS31-V

FCC-ID: QIPEMS31-V

Laboratory Accreditation and Listings			
 DAKKS Deutsche Akkreditierungsstelle D-PL-12047-01-01	 FEDERAL COMMUNICATIONS COMMISSION • USA • MRA US-EU 0003	 Industry Canada Reg. No.: 3462D-2 Reg. No.: 3462D-3	 Voluntary Controls for Electromagnetic Emissions Reg. No.: R-2666 C-2914, T-1967, G-301
 Wi-Fi ALLIANCE AUTHORIZED RF LABORATORY	 ctia Authorized TM Test Lab Lab Code: 20011130-00		
accredited according to DIN EN ISO/IEC 17025			
CETECOM GmbH Laboratory Radio Communications & Electromagnetic Compatibility Im Teelbruch 116 • 45219 Essen • Germany Registered in Essen, Germany, Reg. No.: HRB Essen 8984 Tel.: + 49 (0) 20 54 / 95 19-954 • Fax: + 49 (0) 20 54 / 95 19-964 E-mail: info@cetecom.com • Internet: www.cetecom.com			

Table of contents

1. SUMMARY OF TEST RESULTS.....	3
1.1 Summary of tests results.....	3
1.2 Summary of product description.....	4
1.3 Refer Rules	4
1.4 EUT Technologies	5
1.5 Antenna Information.....	7
1.6 Description of EUT.....	10
1.7 Auxiliary Equipment (AE).....	10
1.8 EUT Set-ups	10
1.9 EUT operating modes	10
1.10 Configuration of cables used for testing	11
2 ADMINISTRATIVE DATA	12
2.1 Identification of the testing laboratory.....	12
2.2 Test location	12
2.3 Organizational items	12
2.4 Applicant's details	12
2.5 Manufacturer's details	12
3 MEASUREMENTS	13
3.1. Test location	13
3.2 Evaluation Rules for FCC Standard.....	13
3.3 Limits for FCC Standard	13
3.5 MPE Calculation method.....	14
3.6 Conducted Output Power.....	14
3.7 Evaluation Method.....	15
3.8 Conclusion.....	16
4 MEASUREMENT UNCERTAINTIES.....	17
5 ABBREVIATIONS USED IN THIS REPORT	18
6 ACCREDITATION DETAILS OF CETECOM'S LABORATORIES AND TEST SITES	18
7 TEST REPORT VERSION.....	18

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.

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-Exposure Evaluation (separation distance user to RF-radiating element greater 20cm)						
Test cases	Port	References & Limits		EUT set-up	EUT op. mode	Result
		FCC Standard	Test Limit			
Radio frequency radiation exposure Requirements	Cabinet + Inter-Connecting Cables (conducted)	§2.1091 §2.1093	RF-Field Strength Limits: FCC: "general population/ uncontrolled" environment	1	1	Pass

The current version of the Test Report CETECOM-17-1-0078101T02a-C1 replaces the Test Report CETECOM-17-1-0078101T02a dated 2017-11-30. The replaced test report is herewith invalid.

.....
Dipl.-Ing. Rachid Acharkaoui
Responsible for test section

.....
B.Eng. Martin Nunier
Responsible for test report

1.2 Summary of product description

FCC ID:	QIPEMS31-V	
Product name	EMS31-V	
Exposure category	☒ General population/uncontrolled environment ☐ Occupational exposure/controlled environment	
Output power	☒ Conducted ☐ ERP ☐ EIRP ☒ Peak ☒ Source-based time-averaging	
Antenna gain	none	
Technology	☐ MIMO	☐ 2T2R ☐ 3T3R ☐ 4T4R
	☒ non-MIMO	☒ 1T1R ☐ 1T2R ☐ 2T1R
Evaluation type	☒ Standalone ☐ Simultaneous transmission	
Evaluation distance	☒ 20 cm	
	☐ XXX cm	declares by manufacturer
EUT type	☒ Production Unit ☐ Engineering Unit	
Device type	☒ Mobile device ☐ Fixed device	
Refer rules	☒ CFR 47 FCC Part 2.1091 ☒ CFR 47 FCC Part 1.1310 ☒ KDB 447497 D01v06 October 23, 2015 ☒ KDB 865664 D01v01r04 August 7, 2015 ☒ KDB 865664 D02v01r02 October 23, 2015	

1.3 Refer Rules

ANSI C95.1-1999	IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.
KDB 447498 D01 v06 October 23, 2015	Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.
KDB 865664 D01v01r04 August 7, 2015	SAR measurement requirements for 100 MHz to 6 GHz
KDB 865664 D02v01r02 October 23, 2015	RF Exposure Compliance Reporting and Documentation Considerations.
CFR 47 FCC Part 2.1091	Radiofrequency radiation exposure evaluation: mobile devices.
CFR 47 FCC Part 1.1310	Radiofrequency radiation exposure limits.

1.4 EUT Technologies

Wireless Technologies	Frequency bands	Operation mode		Duty cycle	
☐ GSM	☐ 850 ☐ 1900	Voice (GMSK)	1 slot	☐ 12.5%	
☐ Support DTM (Dual Transfer Mode)					
☐ GPRS	☐ 850 ☐ 1900	GPRS (GMSK) Multi – Slot Class	☐ 8	1 slot (1 Up, 4 Down)	☐ 12.5%
			☐ 10	2 slots (2 Up, 4 Down)	☐ 12.5% ☐ 25%
			☐ 12	4 slots (4 Up, 4 Down)	☐ 12.5% ☐ 25% ☐ 37.5% ☐ 50%
☐ EDGE	☐ 850 ☐ 1900	EDGE (8-PSK) Multi – Slot Class	☐ 8	1 slot (1 Up, 4 Down)	☐ 12.5%
			☐ 10	2 slots (2 Up, 4 Down)	☐ 12.5% ☐ 25%
			☐ 12	4 slots (4 Up, 4 Down)	☐ 12.5% ☐ 25% ☐ 37.5% ☐ 50%
☐ WCDMA (UMTS)	☐ Band II ☐ Band IV ☐ Band V	☐ UMTS Rel.99 (Voice & Data) ☐ HSDPA(Rel.5) ☐ HSUPA(Rel.6) ☐ DC-HSDPA(Rel.8) ☐ HSPA+(Rel.7)		☐ 100%	
☐ CDMA (CDMA2000)	☐ BC0 ☐ BC1 ☐ BC10	☐ 1xRTT (Voice & Data) ☐ 1xEVDO Rel.0 ☐ 1xEVDO Rel.A ☐ 1xAdvanced		☐ 100%	
☐ Support SV-DO (1xRTT-1xEVDO)					
☒ LTE-FDD	☐ Band 2 ☐ Band 4 ☐ Band 5 ☐ Band 7 ☐ Band 12 ☒ Band 13 ☐ Band 17 ☐ Band 25 ☐ Band 26 ☐ Band 27 ☐ Band 30	☒ QPSK ☒ 16QAM		100%	
		☐ Rel.11 Carrier Aggregation	☐ 2 Uplinks 2 Downlinks ☐ 2 Uplinks 3 Downlinks ☐ 3 Uplinks 2 Downlinks ☐ 3 Uplinks 3 Downlinks		
☐ Supports SV-LTE (1xRTT-LTE)					
☐ LTE-TDD	☐ Band 38 ☐ Band 39 ☐ Band 40 ☐ Band 41 ☐ Band 42	☐ QPSK ☐ 16QAM		63.3% This device supports uplink –downlink configuration 0-6. The configuration with highest duty cycle was used (configuration. 0 at 63.3%)	
		☐ Rel.11 Carrier Aggregation	☐ 2 Uplinks 2 Downlinks ☐ 2 Uplinks 3 Downlinks ☐ 3 Uplinks 2 Downlinks ☐ 3 Uplinks 3 Downlinks		
☐ Supports SV-LTE (1xRTT-LTE)					
☐ Wi-Fi	☐ 2.4GHz	☐ IEEE 802.11b	☐ 2412 – 2462 MHz	☐ 100%	
		☐ IEEE 802.11g	☐ 2412 – 2462 MHz ☐ 2412 – 2472 MHz	☐ 100%	
		☐ IEEE 802.11n	☐ 2412 – 2462 MHz	☐ 100%	

		HT20	☐ 2412 – 2472 MHz	
		☐ IEEE 802.11n HT40	☐ 2422 – 2452 MHz	☐ 100%
	☐ 5GHz	☐ IEEE 802.11a	☐ 5180 – 5240 MHz ☐ 5260 – 5320 MHz ☐ 5500 – 5700 MHz ☐ 5745 – 5825 MHz	☐ 100%
		☐ IEEE 802.11n HT20	☐ 5180 – 5240 MHz ☐ 5260 – 5320 MHz ☐ 5500 – 5700 MHz ☐ 5745 – 5825 MHz	☐ 100%
		☐ IEEE 802.11n HT40	☐ 5190 – 5230 MHz ☐ 5270 – 5310 MHz ☐ 5510 – 5670 MHz ☐ 5755 – 5795 MHz	☐ 100%
		☐ IEEE 802.11ac VHT20	☐ 5180 – 5240 MHz ☐ 5260 – 5320 MHz ☐ 5500 – 5700 MHz ☐ 5745 – 5825 MHz	☐ 100%
		☐ IEEE 802.11ac VHT40	☐ 5190 – 5230 MHz ☐ 5270 – 5310 MHz ☐ 5510 – 5670 MHz ☐ 5755 – 5795 MHz	☐ 100%
		☐ IEEE 802.11ac VHT80	☐ 5210 – 5210 MHz ☐ 5290 – 5290 MHz ☐ 5530 – 5530 MHz ☐ 5775 – 5775 MHz	☐ 100%
		☐ Supports Band gap channels		
	☐ Others	☐ 2.4GHz	☐ 1 MHz Bandwidth ☐ 2402 – 2472 MHz	☐ 100%
	☐ Bluetooth	☐ 2.4GHz	☐ Version 2.1+EDR	☐ 77.5%
			☐ Version 3.0+HS	☐ 77.5%
			☐ Version 4.0	☐ 100%
			☐ Version 4.1+EDR	☐ 77.5%
			☐ Version 4.2+EDR	☐ 77.5%

1.5 Antenna Information

Wireless Technologies	Frequency bands	Antenna type	Maximum antenna gain	
☐ GSM	☐ 850	☐ PIFA ☐ PCB ☐	☐ Antenna 0	
		☐ PIFA ☐ PCB ☐	☐ Antenna 1	
		☐ PIFA ☐ PCB ☐	☐ Antenna 0	
☐ GSM	☐ 1900	☐ PIFA ☐ PCB ☐	☐ Antenna 0	
		☐ PIFA ☐ PCB ☐	☐ Antenna 1	
		☐ PIFA ☐ PCB ☐	☐ Antenna 0	
☐ WCDMA (UMTS)	☐ Band II	☐ PIFA ☐ PCB ☐	☐ Antenna 0	
		☐ PIFA ☐ PCB ☐	☐ Antenna 1	
		☐ PIFA ☐ PCB ☐	☐ Antenna 0	
	☐ Band IV	☐ PIFA ☐ PCB ☐	☐ Antenna 0	
		☐ PIFA ☐ PCB ☐	☐ Antenna 1	
		☐ PIFA ☐ PCB ☐	☐ Antenna 0	
☐ CDMA (CDMA2000)	☐ CDMA800	☐ PIFA ☐ PCB ☐	☐ Antenna 0	
		☐ PIFA ☐ PCB ☐	☐ Antenna 1	
		☐ PIFA ☐ PCB ☐	☐ Antenna 0	
	☐ CDMA1900	☐ PIFA ☐ PCB ☐	☐ Antenna 0	
		☐ PIFA ☐ PCB ☐	☐ Antenna 1	
		☐ PIFA ☐ PCB ☐	☐ Antenna 0	
☐ LTE-FDD	☐ Band 2	☐ PIFA ☐ PCB ☐	☐ Antenna 0	
		☐ PIFA ☐ PCB ☐	☐ Antenna 1	
		☐ PIFA ☐ PCB ☐	☐ Antenna 0	
	☐ Band 4	☐ PIFA ☐ PCB ☐	☐ Antenna 0	
		☐ PIFA ☐ PCB ☐	☐ Antenna 1	
		☐ PIFA ☐ PCB ☐	☐ Antenna 0	
☐ LTE-FDD	☐ Band 5	☐ PIFA ☐ PCB ☐	☐ Antenna 0	
		☐ PIFA ☐ PCB ☐	☐ Antenna 1	
		☐ PIFA ☐ PCB ☐	☐ Antenna 0	

		☐ PIFA ☐ PCB ☐	☐ Antenna 1	
	☐ Band 7	☐ PIFA ☐ PCB ☐	☐ Antenna 0	
		☐ PIFA ☐ PCB ☐	☐ Antenna 1	
	☐ Band 12	☐ PIFA ☐ PCB ☐	☐ Antenna 0	
		☐ PIFA ☐ PCB ☐	☐ Antenna 1	
	☐ Band 13	☐ PIFA ☐ PCB ☐	☐ Antenna 0	
		☐ PIFA ☐ PCB ☐	☐ Antenna 1	
	☐ Band 17	☐ PIFA ☐ PCB ☐	☐ Antenna 0	
		☐ PIFA ☐ PCB ☐	☐ Antenna 1	
	☐ Band 25	☐ PIFA ☐ PCB ☐	☐ Antenna 0	
		☐ PIFA ☐ PCB ☐	☐ Antenna 1	
	☐ Band 26	☐ PIFA ☐ PCB ☐	☐ Antenna 0	
		☐ PIFA ☐ PCB ☐	☐ Antenna 1	
☐ Band 27	☐ PIFA ☐ PCB ☐	☐ Antenna 0		
	☐ PIFA ☐ PCB ☐	☐ Antenna 1		
☐ LTE-TDD	☐ Band 38	☐ PIFA ☐ PCB ☐	☐ Antenna 0	
		☐ PIFA ☐ PCB ☐	☐ Antenna 1	
	☐ Band 39	☐ PIFA ☐ PCB ☐	☐ Antenna 0	
		☐ PIFA ☐ PCB ☐	☐ Antenna 1	
	☐ Band 40	☐ PIFA ☐ PCB ☐	☐ Antenna 0	
☐ PIFA		☐ Antenna 1		

		☐ PCB ☐		
	☐ Band 41	☐ PIFA ☐ PCB ☐	☐ Antenna 0	
		☐ PIFA ☐ PCB ☐	☐ Antenna 1	
	☐ Band 42	☐ PIFA ☐ PCB ☐	☐ Antenna 0	
		☐ PIFA ☐ PCB ☐	☐ Antenna 1	
☐ Wi-Fi	☐ 2.4GHz	☐ PIFA ☐ PCB ☐	☐ Antenna 0	
		☐ PIFA ☐ PCB ☐	☐ Antenna 1	
		☐ PIFA ☐ PCB ☐	☐ Antenna 2	
	☐ 5GHz	☐ PIFA ☐ PCB ☐	☐ Antenna 0	
		☐ PIFA ☐ PCB ☐	☐ Antenna 1	
		☐ PIFA ☐ PCB ☐	☐ Antenna 2	
☐ Others	☐ 2.4GHz	☐ PIFA ☐ PCB ☐ PRESTTA	☐ Antenna 0	
		☐ PIFA ☐ PCB ☐ Intel FA5 Port 1	☐ Antenna 1	
		☐ PIFA ☐ PCB ☐ Intel FA5 Port 5	☐ Antenna 2	
☐ Bluetooth	☐ 2.4GHz	☐ PIFA ☐ PCB ☐	☐ Antenna 0	

1.6 Description of EUT

Short description*)	EUT	Type	S/N serial number	HW hardware status	SW software status
EUT A	EMS31-V	LTE modulexxx	E4000044191-03	B1.4	5.0.0.0a

*) EUT short description is used to simplify the identification of the EUT in this test report.

Remark: Tests only performed with EUT A

1.7 Auxiliary Equipment (AE)

AE short description *)	Auxiliary Equipment	Type	S/N serial number	HW hardware status	SW software status
AE 1	Cellular/4G LTE MAGNETIC ANTENNA	2J300M	--	--	--
AE 2	Development support board (Motherboard)	DSB75	W30880-Q9812-X-2	--	--
AE 3	RS232 cable	--	--	--	--

*) AE short description is used to simplify the identification of the auxiliary equipment in this test report.

1.8 EUT Set-ups

EUT set-up no. *)	Combination of EUT and AE	Remarks
set. 1	EUT A	Only for theoretically calculation based on tune-up information

*) EUT set-up no. is used to simplify the identification of the EUT set-up in this test report.

1.9 EUT operating modes

EUT operating mode no. *)	Description of operating modes	Additional information
1	LTE-Band 13 RMC Mode	A communication link is established between the mobile station (UE) and the test simulator. The transmitter is operated on its maximum rated output power class: 23dBm nominal. The input signal to the receiver is modulated with normal test modulation: QPSK or 16-QAM Modulation. The wanted RF input signal level to the receiver of the mobile station is set to a level to provide a stable communication link.

*) EUT operating mode no. is used to simplify the test report.

1.10 Configuration of cables used for testing

Cable number	Item	Type	S/N serial number	HW hardware status	Cable length
Cable 1	AC/DC cable	From AE1	--	--	1.90m

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. Rachid Acharkaoui
Deputy:	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 and project leader:	B.Eng. Martin Nunier
Receipt of EUT:	2017-05-16
Date(s) of test:	2017-05-16 to 2017-07-26
Date of report:	2017-12-08

Version of template: 13.02

Remark 1: based on applicants tune-up info

2.4 Applicant's details

Applicant's name:	Gemalto M2M GmbH
Address:	Werinherstrasse 81 81541 Munich Germany
Contact person:	Mr. Axel Heike

2.5 Manufacturer's details

Manufacturer's name:	please see Applicant's details
Address:	please see Applicant's details

3 Measurements

3.1. Test location

test location	☒ CETECOM Essen	☐	☐
	For Evaluation instruments are not needed. Results are determined by calculation based on applicants delivered Tune-Up procedure.		

3.2 Evaluation Rules for FCC Standard

Systems operating under the provisions of FCC 47 CFR section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as mobile device whereby a distance of 0.2m normally can be maintained between the user and the device, and below RF Permissible Exposure limit shall comply with.

In accordance with KDB447498D01 for Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modelled or measured field strengths or power density, is ≤ 1.0 . The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency. Either the maximum peak or spatially averaged results from measurements or numerical simulations may be used to determine the MPE ratios. Spatial averaging does not apply when MPE is estimated using simple calculations based on far-field plane-wave equivalent conditions. The antenna installation and operating requirements for the host device must meet the minimum test separation distances required by all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.

3.3 Limits for FCC Standard

Table 1: LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

(A) Limits for Occupational/Controlled Exposure				
Frequency range [MHz]	Electric field strength [V/m]	Magnetic field strength [A/m]	Power density [mW/cm ²]	Averaging time [minutes]
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f ²)*	6
30-300	61.4	0.163	1.0	6
300-1500	--	--	--	6
1500-100,000	--	--	--	6
(B) Limits for General Population/Uncontrolled Exposure				
Frequency range [MHz]	Electric field strength [V/m]	Magnetic field strength [A/m]	Power density [mW/cm ²]	Averaging time [minutes]
0.3-3.0	614	1.63	*(100)	30
3.0-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	-	-	f/1500	30
1500-100,000	-	-	1.0	30

f=frequency in MHz

*Plane-wave equivalent power density

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.

3.5 MPE Calculation method

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

3.6 Conducted Output Power

LTE FDD Band 13						
Test case	Max Power value [dBm]					
	UARFCN no. 23205		UARFCN no. 23230		UARFCN no. 23255	
	PK	AV	PK	AV	PK	AV
QPSK	27.09	23.03	27.31	22.91	26.94	22.70
16-QAM	27.15	22.81	27.25	23.14	26.94	22.78

Regarding tune-up information maximum average output power is for QPSK 23dBm +2dB tolerance and for 16-QAM 22dBm +2dB tolerance. Applying customer's declared tolerance the results of conducted power verification are below the target output power.

3.7 Evaluation Method

3.7.1 Standalone

Valid for LTE Mode:

A RMS detector was used. No duty-cycle correction factor is applicable

Please find in the following tables the calculations based on applicants tune-up information for the power values.

Results for FCC Standard

Operating Mode	Frequency on channel (MHz)	Declared maximum conducted output power (dBm)	Duty cycle (%)	Declared Maximum ERP (W)	Equivalent ERP (maximum ERP x duty cycle) (mW)	MPE Limit accord. Table 1 (mW/cm ²)	MPE-Value (mW/cm ²)	Margin to limit: (mW/cm ²)	Fraction for Co-Location calculations	Max. Fraction-Value within Frequency-Band
LTE Band 13 QPSK	779,5	25,0	100%	0,316	316	0,5197	0,0629	0,4568	0,1211	0,1211
	782,0	25,0		0,316	316	0,5213	0,0629	0,4584	0,1207	
	784,5	25,0		0,316	316	0,5230	0,0629	0,4601	0,1203	
LTE Band 13 16-QAM	779,5	24,0	100%	0,251	251	0,5197	0,0500	0,4697	0,0962	0,0962
	782,0	24,0		0,251	251	0,5213	0,0500	0,4714	0,0959	
	784,5	24,0		0,251	251	0,5230	0,0500	0,4730	0,0955	

Maximum calculated MPE value:		
Lowest MPE-Limit in Frequency-Band:	0,5197	[mW/cm ²]
Highest MPE value in frequency-band:	0,0629	[mW/cm ²]
Lowest margin to limit in frequency band:	0,4568	[mW/cm ²]

Maximum antenna gain considerations for fixed/mobile operations for complying with limits:

P	Maximum power input to the antenna incl. Duty cycle [mW]: (Avg. Burst Power or RMS)	316
R	Distance [cm]:	20
S	MPE limit acc. §1.1310 for uncontrolled exposure [mW/cm ²]: (FCC use mW/cm ²)	0,52
G ₁	Maximum Antenna gain to comply with MPE limit [dBi]:	9,17

(For G₁ the lowest measured channel to reach minimum ant. Gain selected)

ERP power limit according to §2.1091 [W]: (Avg. Burst Power or RMS)		1,50
G ₂	Max. Antenna gain to comply with limit incl. Duty cycle [dBi]:	8,91

(For G₂ select the max. Avg. Burst Power or RMS value incl. Duty cycle)

ERP power limit according to §27.50b(10) [W ERP]:		3,00
G ₃	Max. Antenna gain to comply with limit [dBd]:	11,92

(For G₃ select the max. Average burst power value excluding Duty cycle)

G _{850 MHz band}	Min (G ₁ , G ₂ , G ₃) [dBi]	8,91
---------------------------	---	------

Summarized results:	The max. ant. gain for mobile operation at 700MHz band to comply with MPE and ERP limits incl. path loss shall not exceed [dBi]:	8,91	dBi
---------------------	--	------	-----

Remark:

1. Output power (Average) including tune-up tolerance;
2. Output power was adjust to duty cycle at 100% if measured duty cycle less than 98%;
3. MPE evaluate distance is 20cm from user manual provide by manufacturer;
4. Depending on output power and antenna gain only the worst case is reported;

3.7.3 Simultaneous Transmission MPE

According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;
 $\sum$ of MPE ratios ≤ 1.0

Wireless Module EMS31-V use only one transmitter antenna, no need consider simultaneous transmission.

3.8 Conclusion

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

4 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 to its 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							E-Field
Disturbance power	CISPR 16-2-2	30 MHz - 300 MHz	-							-
Power Output radiated	-	30 MHz - 4 GHz	3.17 dB							Substitution method
Power Output conducted	-	Set-up No.	Cel-C1	Cel-C2	BT1	W1	W2		-	
		9 kHz - 12.75 GHz	N/A	0.60	--	--	--			
		12.75 - 26.5GHz	N/A	0.82	--	--	--			
Conducted emissions on RF-port	-	9 kHz - 2.8 GHz	0.70	N/A	--	--	--		N/A - not applicable	
		2.8 GHz - 12.75GHz	1.48	N/A	--	--	--			
		12.75 GHz - 18GHz	1.81	N/A	--	--	--			
		18 GHz - 26.5GHz	1.83	N/A	--	--	--			
Occupied bandwidth	-	9 kHz - 4 GHz	0.1272 ppm (Delta Marker)							Frequency error
			1.0 dB							Power
Emission bandwidth	-	9 kHz - 4 GHz	0.1272 ppm (Delta Marker)							Frequency error
	-		See above: 0.70 dB							Power
Frequency stability	-	9 kHz - 20 GHz	0.0636 ppm							-
Radiated emissions Enclosure	-	150 kHz - 30 MHz	5.0 dB							Magnetic field E-field Substitution
		30 MHz - 1 GHz	4.2 dB							
		1 GHz - 20 GHz	3.17 dB							

Table: measurement uncertainties, valid for conducted/radiated measurements

5 Abbreviations used in this report

The abbreviations	
ANSI	American National Standards Institute
AV, AVG, CAV	Average detector
EIRP	Equivalent isotropically radiated power, determined within a separate measurement
EUT	Equipment Under Test
FCC	Federal Communications Commission, USA
n.a.	not applicable
Op-Mode	Operating mode of the equipment
PK	Peak
RBW	resolution bandwidth
RF	Radio frequency
RSS	Radio Standards Specification, Documents 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
337 487 550 558	3462D-1 3462D-2 3462D-2 3462D-3	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) Radiated Measurements above 1 GHz, 3 m (FAR)	IC, Industry Canada Certification and Engineering Bureau
487 550 348 348	R-2666 G-301 C-2914 T-1967	Radiated Measurements 30 MHz to 1 GHz, 3 m (SAR) Radiated Measurements 1 GHz to 6 GHz, 3 m (SAR) Mains Ports Conducted Interference Measurements Telecommunication Ports Conducted Interference Measurem.	VCCI, Voluntary Control Council for Interference by Information Technology Equipment, Japan
OATS = Open Area Test Site, SAR = Semi Anechoic Room, FAR = Fully Anechoic Room			

7 Test report version

Version	Applied changes	Date of release
--	Initial release	2017-11-30
C1	Contact person changed	2017-12-08