

TEST REPORT

No.: 17-1-0231001T19a-C2

According to:
FCC Regulations
Part 1.1310
Part 2.1091

for
IPETRONIK GmbH & Co. KG

μCROS SL
Datalogger

FCC ID: 2ARF8UCROS-SL

Laboratory Accreditation and Listings



Deutsche
Akkreditierungsstelle
D-PL-12047-01-01
D-PL-12047-01-03
D-PL-12047-01-04

accredited according to DIN EN ISO/IEC 17025

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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 GSM, WCDMA and WLAN 2.4GHz and 5GHz 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-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	§1.1310 §2.1091 §2.1093	RF-Field Strength Limits: FCC: "general population/ uncontrolled" environment	1	1-9	PASS

Remark: Calculations based on Datasheet delivered by applicant

The current version of the Test Report CETECOM_TR17-1-0231001T19a-C2 replaces the Test Report CETECOM_TR17-1-0231001T19a-C1 dated 2020-04-09. The replaced test report is herewith invalid.

.....
Volker Wittmann
Responsible for test section

.....
Ninovic Perez
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:	Volker Wittmann
Deputy:	Ninovic Perez

2.2. Test location

2.2.1. Test laboratory "CTC"

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

Responsible for test report:	Ninovic Perez
Receipt of EUT:	--
Date(s) of test:	--
Date of report:	2020-06-17

2.4. Applicant's details

Applicant's name:	IPETRONIK GmbH & Co. KG
Address:	Im Rollfeld 28 76532 Baden-Baden Germany
Contact person:	Peter Hütt

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:	2ARF8UCROS-SL		
Product name	μCROS SL		
Exposure category	☒ General population/uncontrolled environment ☐ Occupational exposure/controlled environment		
Output power	☐ Conducted ☐ ERP ☒ EIRP ☐ Peak ☒ Source-based time-averaging		
Antenna gain	details refer to: "MPE Information Requirements 1_1-korr3_For_FCC"		
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 ☒ Pre-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 D01v01r02 October 23, 2015		

3.2. EUT Technologies

Wireless Technologies	Frequency bands	Operation mode
☒ GSM	☒ GSM 850 ☒ PCS 1900	normal operation mode
☒ WCDMA	☒ FDD II ☒ FDD IV ☒ FDD V	normal operation mode
☒ WLAN	☒ 2.4GHz ☒ 5 GHz	normal operation mode

3.3. Antenna Information

Wireless Technologies	Frequency bands	Antenna type	Maximum antenna gain	
☒ GSM	☒ GSM 850 ☒ PCS 1900	☒ External	☒ MA962	see Annex 1
☒ WCDMA	☒ FDD II ☒ FDD IV ☒ FDD V	☒ External	☒ MA962	see Annex 1
☒ WLAN	☒ 2.4GHz ☒ 5 GHz	☒ External	☒ MA962	see Annex 1

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

Short description*)	EUT	Type	S/N serial number	HW hardware status	SW software status
EUT A	µCROS SL	Datalogger	00030	HW1.03	SW1.30

*) 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	Type	S/N serial number	HW hardware status	SW software status
AE 1	Antenna	MA962	6608015B00078	--	--

*) 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 + AE1	--

*) 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	GPRS 850	Only theoretical calculation
op. 2	E-GPRS 850	
op. 3	GPRS 1900	
op. 4	E-GPRS 1900	
op. 5	FDD Mode 2	Only theoretical calculation
op. 6	FDD Mode 4	
op. 7	FDD Mode 5	
op. 8	WLAN 2.4GHz	Only theoretical calculation
op. 9	WLAN 5GHz	

*) 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. Results are determined by calculation based on applicants delivered Tune-Up procedure.		

4.1.2. Requirements

FCC: §1.1310	<i>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.</i>
FCC § 2.1091	<i>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.</i>

4.1.2.1. Valid for FCC

Table 1: LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)				
Frequency range [MHz]	Electric field strength [V/m]	Magnetic field strength [A/m]	Power density [mW/cm ²]	Averaging time [minutes]
30 - 300	61.4	0.163	1.0	6
300 - 1500	-	-	f/300	6
1500 - 100,000	-	-	5	6
(B) Limits for General Population / Uncontrolled Exposure				
0.3 – 1.34	614	1.63	*(100)	30
1.34 – 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 – 100,0	-	-	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.

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: $f/1500 \text{ mW/cm}^2$ 1500–100,000 MHz: 1.0 mW/cm^2
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

4.3. 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

4.4. Evaluation Method

4.4.1. Standalone

Valid for GSM/GPRS/EDGE mode:

- The power was tested on 3 frequencies (lowest/middle/highest) within each operable bands and the results compared to applicant's declared power values (tune-up info).
- Average burst power (slot power) and peak were measured (see separate report for GSM/GPRS/E-GPRS technology)
- Only one uplink slot (1 TX) was measured. 4 TX slots are maximum possible for this device and calculated as worst-case
- A duty-cycle correction factor of $10^{\log_{10}(\text{max. number of possible active slots} / 8 \text{ slots})}$ were applied

Valid for W-CDMA/LTE Mode:

- The power was checked on 3 frequencies (lowest/middle/highest) within each operable FDD-band (see separate report for W-CDMA technology) and the results compared to applicant's declared power values (tune-up info). A RMS detector was used.
- No duty-cycle correction factor is applicable

Valid for WLAN Mode:

- The peak power was checked on 3 frequencies (lowest/middle/highest) within the WLAN 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 values.

4.5. Results for fixed and mobile

4.5.1. Results for FCC Standard

4.5.1.1. Results for lower operational band: GSM850 and FDD Band 5

Operating Mode	Frequency on channel (MHz)	Declared maximum conducted output power (dBm)	Max. positive tolerance according manufacturer (dB)	Declared Antenna Gain (dBi)	Calculated maximum ERP (declared+ Tune-up+ antenna Gain) (dBm)	Duty cycle (%)	Calculated 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
GSM	824.2	32.5	0.5	2.9	35.9	50%	3.890	1945	0.5495	0.3870	0.1625	0.7043	0.7043
	837	32.5	0.5	2.9	35.9		3.890	1945	0.5580	0.3870	0.1710	0.6935	
	848.8	32.5	0.5	2.9	35.9		3.890	1945	0.5659	0.3870	0.1789	0.6839	
GPRS	824.2	30.5	0.5	2.9	33.9	50%	2.455	1227	0.5495	0.2442	0.3053	0.4444	0.4444
	837	30.5	0.5	2.9	33.9		2.455	1227	0.5580	0.2442	0.3138	0.4376	
	848.8	30.5	0.5	2.9	33.9		2.455	1227	0.5659	0.2442	0.3217	0.4315	
EDGE	824.2	25	0.5	2.9	28.4	50%	0.692	346	0.5495	0.0688	0.4806	0.1252	0.1252
	837	25	0.5	2.9	28.4		0.692	346	0.5590	0.0688	0.4892	0.1233	
	848.8	25	0.5	2.9	28.4		0.692	346	0.5659	0.0688	0.4970	0.1216	
WCDMA FDD Band 5 (RMS-Value)	826.4	23	0.5	2.9	26.4	100%	0.437	437	0.5509	0.0868	0.4641	0.1576	0.1576
	836.4	23	0.5	2.9	26.4		0.437	437	0.5576	0.0868	0.4708	0.1557	
	846.6	23	0.5	2.9	26.4		0.437	437	0.5644	0.0868	0.4776	0.1539	

Maximum calculated MPE value:		
Lowest MPE-Limit in Frequency-Band:	0.0688	[mW/cm ²]
Highest MPE value in frequency-band:	0.3870	[mW/cm ²]
Lowest margin to limit in frequency band:	0.1625	[mW/cm ²]

4.5.1.2. Results for upper operational band: FDD Band 4

Operating Mode	Frequency on channel (MHz)	Declared maximum conducted output power (dBm)	Max. positive tolerance according manufacturer (dB)	Declared Antenna Gain (dBi)	Calculated maximum ERP (declared+ Tune-up+ antenna Gain) (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
W-CDMA Band 4 (RMS-Value)	1712.4	25.20	0.5	3.18	28.88	100%	0.7727	772.7	1.0000	0.1537	0.8463	0.153720	0.1537199
	1740.0	25.20	0.5	3.18	28.88		0.7727	772.7	1.0000	0.1537	0.8463	0.153720	
	1752.6	25.20	0.5	3.18	28.88		0.7727	772.7	1.0000	0.1537	0.8463	0.153720	

Maximum calculated MPE value:		
Lowest MPE-Limit in frequency-band:	1.0000	[mW/cm ²]
Highest MPE value in frequency-band:	0.1537	[mW/cm ²]
Lowest margin to limit in frequency-band:	0.85	[mW/cm ²]

4.5.1.3. Results for upper operational band: FDD Band 2 and GSM1900

Operation Mode	Frequency on channel	Declared maximum conducted output power	Max. positive tolerance according manufacturer	Antenna Gain	Declared maximum ERP (Measured+ Tune-up+ Antenna Gain)	Duty cycle	Declared Maximum ERP	Equivalent ERP (maximum ERP x duty cycle)	MPE Limit accord. Table 1	MPE-Value	Margin to limit:	Fraction for Co-Location calculations	Max. Fraction-Value within Frequency-Band
	(MHz)	(dBm)	(dB)	(dBi)	(dBm)	(%)	(W)	(mW)	(mW/cm ²)	(mW/cm ²)	(W/m ²)		
GSM	1850.2	30.0	0.50	2.98	33.48	50%	2.228	1114	1.0000	0.2217	0.7783	0.221667	0.2216665
	1880.0	30.0	0.50	2.98	33.48		2.228	1114	1.0000	0.2217	0.7783	0.221667	
	1909.8	30.0	0.50	2.98	33.48		2.228	1114	1.0000	0.2217	0.7783	0.221667	
GPRS	1850.2	28.0	0.50	2.98	31.48	50%	1.406	703	1.0000	0.1399	0.8601	0.139862	0.1398621
	1880.0	28.0	0.50	2.98	31.48		1.406	703	1.0000	0.1399	0.8601	0.139862	
	1909.8	28.0	0.50	2.98	31.48		1.406	703	1.0000	0.1399	0.8601	0.139862	
EDGE	1850.2	24.0	0.50	2.98	27.48	50%	0.560	280	1.0000	0.0557	0.9443	0.055680	0.0556801
	1880.0	24.0	0.50	2.98	27.48		0.560	280	1.0000	0.0557	0.9443	0.055680	
	1909.8	24.0	0.50	2.98	27.48		0.560	280	1.0000	0.0557	0.9443	0.055680	
W-CDMA FDD Band 2 (RMS-Value)	1852.4	23.5	0.50	2.98	26.98	100%	0.499	499	1.0000	0.0992	0.9008	0.099250	0.0992499
	1880.0	23.5	0.50	2.98	26.98		0.499	499	1.0000	0.0992	0.9008	0.099250	
	1907.6	23.5	0.50	2.98	26.98		0.499	499	1.0000	0.0992	0.9008	0.099250	

Maximum calculated MPE value:		
Lowest MPE-Limit in frequency-band:	1.0000	[mW/cm ²]
Highest MPE value in frequency-band:	0.1399	[mW/cm ²]
Margin to limit in frequency-band:	0.8601	[mW/cm ²]

4.5.1.4. Results for WLAN 2.4GHz

Operation Mode	Frequency on channel	Declared maximum conducted output power	Max. positive tolerance according manufacturer	Antenna Gain	Path Loss to ext. antenna connector according manufacturer	Declared maximum ERP (Measured+ Tune-up)	Duty cycle	Declared Maximum ERP	Equivalent ERP (maximum ERP x duty cycle)	MPE Limit accord. Table 1	MPE-Value	Margin to Limit:	Fraction for Co-Location calculations	Max. Fraction-Value within Frequency-Band
	(MHz)	(dBm)	(dB)	(dBi)	(dB)	(dBm)	(%)	(W)	(mW)	(mW/cm ²)	(mW/cm ²)	(mW/cm ²)		
WLAN 2.4GHz Main Ant	2412.0	15.0	0.0	3.15	1.15	17.0	100%	0.0501	50.1	1.0000	0.0100	0.9900	0.009971	0.0099708
	2442.0	15.0	0.0	3.15	1.15	17.0		0.0501	50.1	1.0000	0.0100	0.9900	0.009971	
	2472.0	15.0	0.0	3.15	1.15	17.0		0.0501	50.1	1.0000	0.0100	0.9900	0.009971	
WLAN 2.4GHz Back Ant	2412.0	15.0	0.0	1.74	1.15	15.6	100%	0.0362	36.2	1.0000	0.0072	0.9928	0.007207	0.0080859
	2442.0	15.5	0.0	1.74	1.15	16.1		0.0406	40.6	1.0000	0.0081	0.9919	0.008086	
	2472.0	15.0	0.0	1.74	1.15	15.59		0.0362	36.2	1.0000	0.0072	0.9928	0.007207	

Remark: no tolerance declared by applicant

Maximum calculated MPE value:		
Lowest MPE-Limit:	1.0000	[mW/cm ²]
Highest MPE value:	0.0100	[mW/cm ²]
Lowest Margin to limit:	0.9900	[mW/cm ²]

4.5.1.5. Results for WLAN 5GHz

Operation Mode	Frequency on channel	Declared maximum conducted output power	Max. positive tolerance according manufacturer's tune-up info	Declared Antenna Gain	Path Loss to ext. antenna connector according manufacturer	Declared maximum ERP (Measured+ Tune-up)	Duty cycle	Maximum ERP	Equivalent ERP (ERP x duty cycle)	MPE-Value	MPE-Value	Margin	Fraction for Co-location calculations	Maximum Fraction Value within Frequency band
	(MHz)	(dBm)	(dB)	(dBi)	(dB)	(dBm)	(%)	(W)	(mW)	(mW/cm ²)	(mW/cm ²)	(mW/cm ²)		
W-LAN 5GHz (20MHz BW) Main Ant	5180.0	13.50	0.00	3.14	1.60	15.04	100%	0.032	31.92	1.0000	0.00635	0.9937	0.0063	0.0063
	5200.0	13.50	0.00	3.14	1.60	15.04	100%	0.032	31.92	1.0000	0.00635	0.9937	0.0063	
	5240.0	13.50	0.00	3.14	1.60	15.04	100%	0.032	31.92	1.0000	0.00635	0.9937	0.0063	
W-LAN 5GHz (20MHz BW) Backup Ant	5180.0	13.50	0.00	3.90	1.60	15.80	100%	0.038	38.02	1.0000	0.00756	0.9924	0.0076	0.0076
	5200.0	13.50	0.00	3.90	1.60	15.80	100%	0.038	38.02	1.0000	0.00756	0.9924	0.0076	
	5240.0	13.50	0.00	3.90	1.60	15.80	100%	0.038	38.02	1.0000	0.00756	0.9924	0.0076	
W-LAN 5GHz (20MHz BW) Main Ant	5260.0	13.50	0.00	3.14	1.60	15.04	100%	0.032	31.92	1.0000	0.00635	0.9937	0.0063	0.0063
	5280.0	13.50	0.00	3.14	1.60	15.04	100%	0.032	31.92	1.0000	0.00635	0.9937	0.0063	
	5320.0	13.50	0.00	3.14	1.60	15.04	100%	0.032	31.92	1.0000	0.00635	0.9937	0.0063	
W-LAN 5GHz (20MHz BW) Backup Ant	5260.0	13.50	0.00	3.90	1.60	15.80	100%	0.038	38.02	1.0000	0.00756	0.9924	0.0076	0.0076
	5280.0	13.50	0.00	3.90	1.60	15.80	100%	0.038	38.02	1.0000	0.00756	0.9924	0.0076	
	5320.0	13.50	0.00	3.90	1.60	15.80	100%	0.038	38.02	1.0000	0.00756	0.9924	0.0076	
W-LAN 5GHz (20MHz BW) Main Ant	5500.0	13.50	0.00	3.14	1.70	14.94	100%	0.031	31.19	1.0000	0.00620	0.9938	0.0062	0.0062
	5580.0	13.50	0.00	3.14	1.70	14.94	100%	0.031	31.19	1.0000	0.00620	0.9938	0.0062	
	5700.0	13.50	0.00	3.14	1.70	14.94	100%	0.031	31.19	1.0000	0.00620	0.9938	0.0062	
W-LAN 5GHz (20MHz BW) Backup Ant	5500.0	13.50	0.00	3.90	1.70	15.70	100%	0.037	37.15	1.0000	0.00739	0.9926	0.0074	0.0074
	5580.0	13.50	0.00	3.90	1.70	15.70	100%	0.037	37.15	1.0000	0.00739	0.9926	0.0074	
	5700.0	13.50	0.00	3.90	1.70	15.70	100%	0.037	37.15	1.0000	0.00739	0.9926	0.0074	
W-LAN 5GHz (20MHz BW) Main Ant	5785.0	13.50	0.00	3.14	1.70	14.94	100%	0.031	31.19	1.0000	0.00620	0.9938	0.0062	0.0062
	5825.0	13.50	0.00	3.14	1.70	14.94	100%	0.031	31.19	1.0000	0.00620	0.9938	0.0062	
W-LAN 5GHz (20MHz BW) Backup Ant	5785.0	13.50	0.00	3.90	1.70	15.70	100%	0.037	37.15	1.0000	0.00739	0.9926	0.0074	0.0074
	5825.0	13.50	0.00	3.90	1.70	15.70	100%	0.037	37.15	1.0000	0.00739	0.9926	0.0074	

Maximum calculated MPE value:		
5GHz		
Lowest MPE Limit:	1.0000	[Wm ²]
Highest MPE value:	0.0076	[Wm ²]
Margin to limit	0.9924	[Wm ²]

4.5.1.3. Co-location assessment (scenario)

Following table shows calculations with GSM, WCDMA and WLAN (MIMO) technology active in the device.

Special limitations such as interactions between the transmitting RF-antennas due small physical distance between them, are not sufficient modeled by the far field formula for power density. For such cases a non-linear program electromagnetic software or MPE measurements should be performed.

		GSM 850	GPRS 850	EGPRS 850	W-CDMA FDD V	W-CDMA FDD IV	GSM 1900	GPRS 1900	EGPRS 1900	W-CDMA FDD II
	Ratio of MPE-Value/Limit	0.704301799	0.444384393	0.125244539	0.157627176	0.153719918	0.221666543	0.139862134	0.055680118	0.099249915
WLAN 2.4GHz Main Ant	0.009970803	0.714272602	0.454355196	0.135215342	0.167597979	0.163690721	0.231637347	0.149832937	0.065650921	0.109220718
WLAN 2.4GHz Backup Ant	0.008085933	0.712387732	0.452470326	0.133330472	0.165713109	0.161805851	0.229752476	0.147948067	0.063766051	0.107335848
WLAN 5GHz Main Ant	0.006349363	0.710651162	0.450733756	0.131593902	0.163976539	0.160069281	0.228015906	0.146211496	0.062029481	0.105599278
WLAN 5GHz Backup Ant	0.007563628	0.711865427	0.451948021	0.132808167	0.165190804	0.161283546	0.229230171	0.147425761	0.063243746	0.106813543
Maximum-Value		0.7142726								

4.6. Conclusion

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

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							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
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 D-PL-12047-01-03 D-PL-12047-01-04	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. Versions of test reports (change history)

Version	Applied changes	Date of release
--	Initial release	2019-03-28
C1	Tune-up information updated	2020-04-09
C2	Tune-up information updated	2020-06-17

END OF REPORT