

## TEST REPORT

Test report no.: 1-1894/21-01-08-A

BNetzA-CAB-02/21-102

### Testing laboratory

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#### Accredited Testing Laboratory:

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2018-03) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)  
The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate starting with the registration number: D-PL-12076-01.

### Applicant

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### Manufacturer

**Trackunit Aps**  
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9000 Aalborg / DENMARK

### Test standard/s

FCC - Title 47 CFR Part 22    FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 22 - Public mobile services  
FCC - Title 47 CFR Part 24    FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 24 - Personal communications services

For further applied test standards please refer to section 3 of this test report.

### Test Item

**Kind of test item:**            **Telemetric unit for Fleet management**  
**Model name:**                **TU600-15 (Family TU600A)**  
**FCC ID:**                        **ZMF-TU600A**  
**IC:**                                **9746A-TU600A**  
**Frequency:**                    GSM 850 & 1900  
**Technology tested:**        GSM  
**Antenna:**                        Integrated antenna  
**Power supply:**                12V-48V DC external power supply or 3.7V DC by internal backup battery  
**Temperature range:**        -30°C to +55°C (+60°C with internal battery power)

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

### Test report authorized:

Michael Dorongovski  
Lab Manager  
Radio Communications

### Test performed:

Andreas Luckenbill  
Head of Department  
Radio Communications

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## 2 General information

### 2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CTC advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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**This test report replaces the test report with the number 1-1894/21-01-08 and dated 2021-07-30.**

### 2.2 Application details

Date of receipt of order:	2021-03-04
Date of receipt of test item:	2021-03-08
Start of test:*	2021-03-08
End of test:*	2021-06-30
Person(s) present during the test:	-/-

\*Date of each measurement, if not shown in the plot, can be requested. Dates are stored in the measurement software.

### 2.3 Test laboratories sub-contracted

None

### 3 Test standard/s, references and accreditations

Test standard	Date	Description
FCC - Title 47 CFR Part 22		FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 22 - Public mobile services
FCC - Title 47 CFR Part 24		FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 24 - Personal communications services
RSS - 132 Issue 3	January 2013	Spectrum Management and Telecommunications Radio Standards Specification - Cellular Telephone Systems Operating in the Bands 824-849 MHz and 869-894 MHz
RSS - 133 Issue 6	January 2018	Spectrum Management and Telecommunications Policy - Radio Standards Specifications, 2 GHz Personal Communication Services

Guidance	Version	Description
ANSI C63.4-2014	-/-	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.26-2015	-/-	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
Power Meas License Systems: KDB 971168 D01	v03r01	Measurement Guidance for Certification of Licensed Digital Transmitters

Accreditation	Description
D-PL-12076-01-04	Telecommunication and EMC Canada <a href="https://www.dakks.de/as/ast/d/D-PL-12076-01-04e.pdf">https://www.dakks.de/as/ast/d/D-PL-12076-01-04e.pdf</a>
D-PL-12076-01-05	Telecommunication FCC requirements <a href="https://www.dakks.de/as/ast/d/D-PL-12076-01-05e.pdf">https://www.dakks.de/as/ast/d/D-PL-12076-01-05e.pdf</a>



Deutsche  
Akkreditierungsstelle  
D-PL-12076-01-04



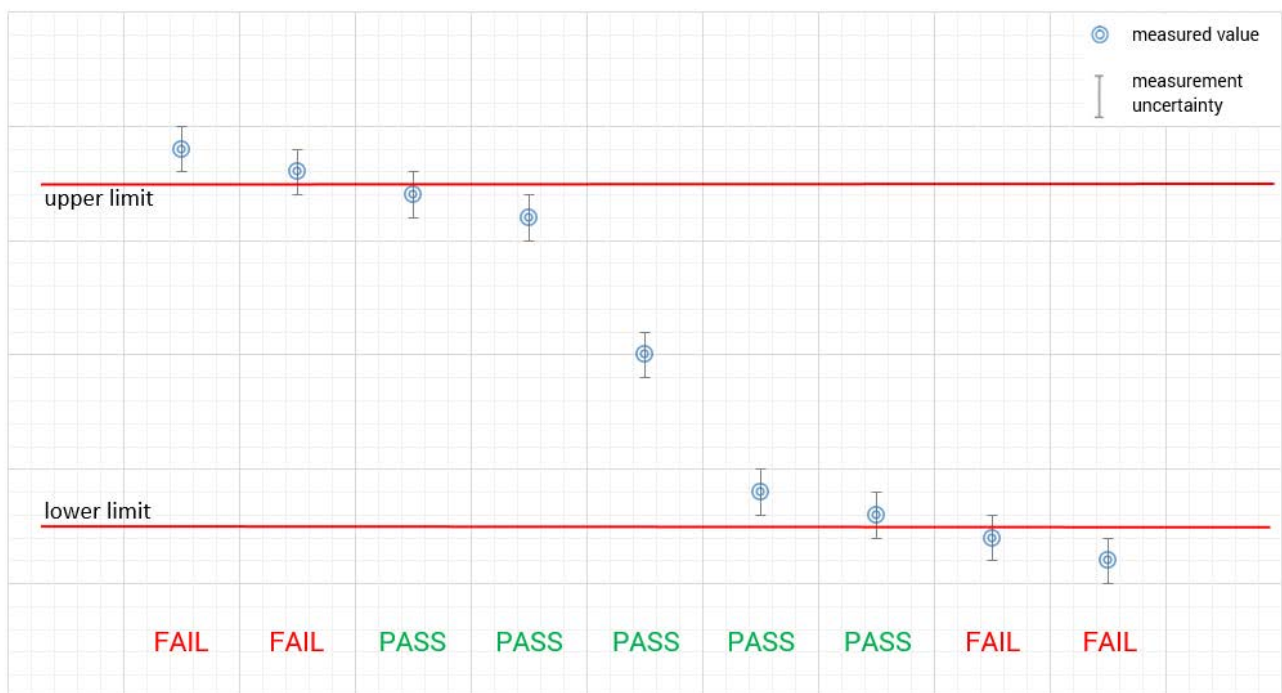
Deutsche  
Akkreditierungsstelle  
D-PL-12076-01-05

#### 4 Reporting statements of conformity – decision rule

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3.

The measurement uncertainty is mentioned in this test report, see chapter 9, but is not taken into account - neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong."

measured value, measurement uncertainty, verdict



## 5 Test environment

Temperature	:	$T_{nom}$ +22 °C during room temperature tests $T_{max}$ No tests under extreme environmental conditions performed. $T_{min}$ No tests under extreme environmental conditions performed.
Relative humidity content	:	55 %
Barometric pressure	:	1021 hpa
Power supply	:	$V_{nom}$ 12.0 V DC by external power supply $V_{max}$ No tests under extreme environmental conditions performed. $V_{min}$ No tests under extreme environmental conditions performed.

## 6 Test item

### 6.1 General description

Kind of test item	:	Telemetric unit for Fleet management
Model name	:	TU600-15 (Family TU600A)
HMN	:	-/-
PMN	:	Trackunit
HVIN	:	TU600-11 TU600-15
FVIN	:	-/-
S/N serial number	:	Rad. Sample 13
Hardware status	:	1.001
Software status	:	60.012
Firmware status	:	N/A
Frequency band	:	GSM 850 & 1900
Type of radio transmission	:	modulated carrier
Use of frequency spectrum	:	
Type of modulation	:	GMSK; 8PSK
Antenna	:	Integrated antenna
Power supply	:	12V-48V DC external power supply or 3.7V DC by internal backup battery
Temperature range	:	-30°C to +55°C (+60°C with internal battery power)

### 6.2 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup and EUT photos are included in test report:

- 1-1894/21-01-01\_AnnexA
- 1-1894/21-01-01\_AnnexB
- 1-1894/21-01-01\_AnnexD

## 7 Description of the test setup

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signaling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

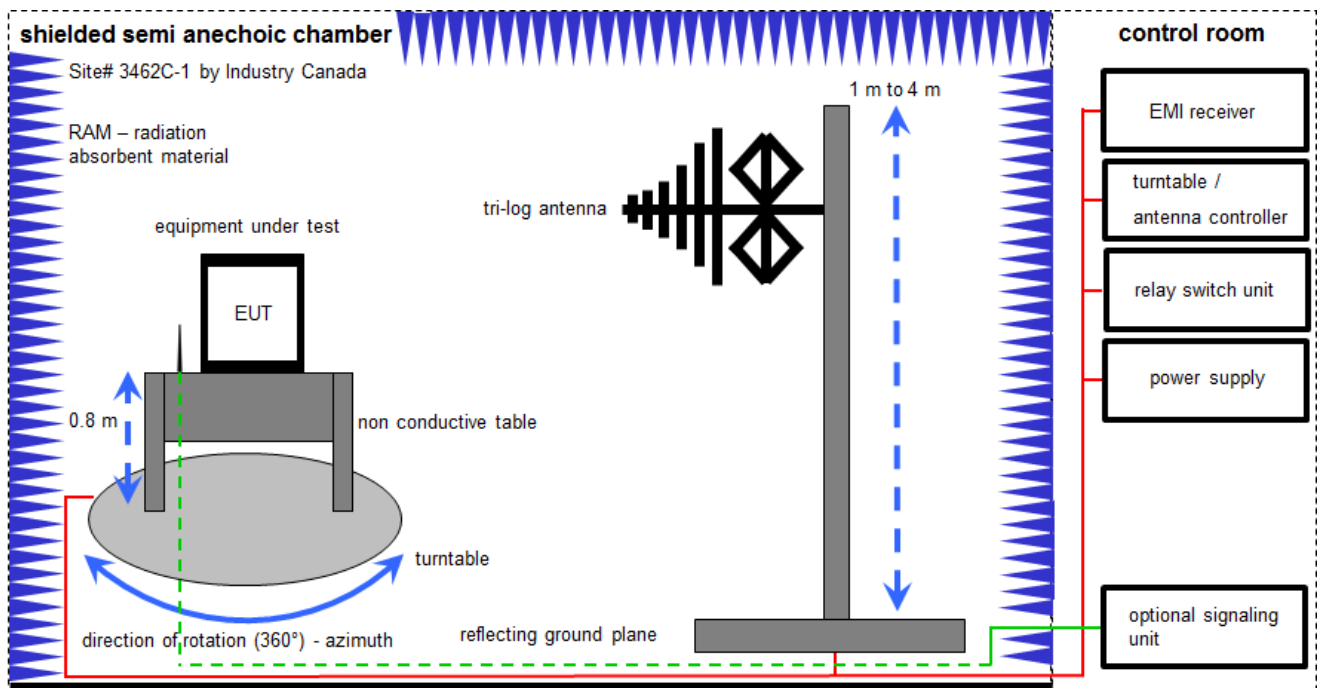
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

### **Agenda:** Kind of Calibration

k	calibration / calibrated	EK	limited calibration
ne	not required (k, ev, izw, zw not required)	zw	cyclical maintenance (external cyclical maintenance)
ev	periodic self verification	izw	internal cyclical maintenance
Ve	long-term stability recognized	g	blocked for accredited testing
vlk!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress

## 7.1 Shielded semi anechoic chamber

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 30 MHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are conform to specifications ANSI C63. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



Measurement distance: tri-log antenna 10 meter; EMC32 software version: 10.30.0

$$FS = UR + CL + AF$$

(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

### Example calculation:

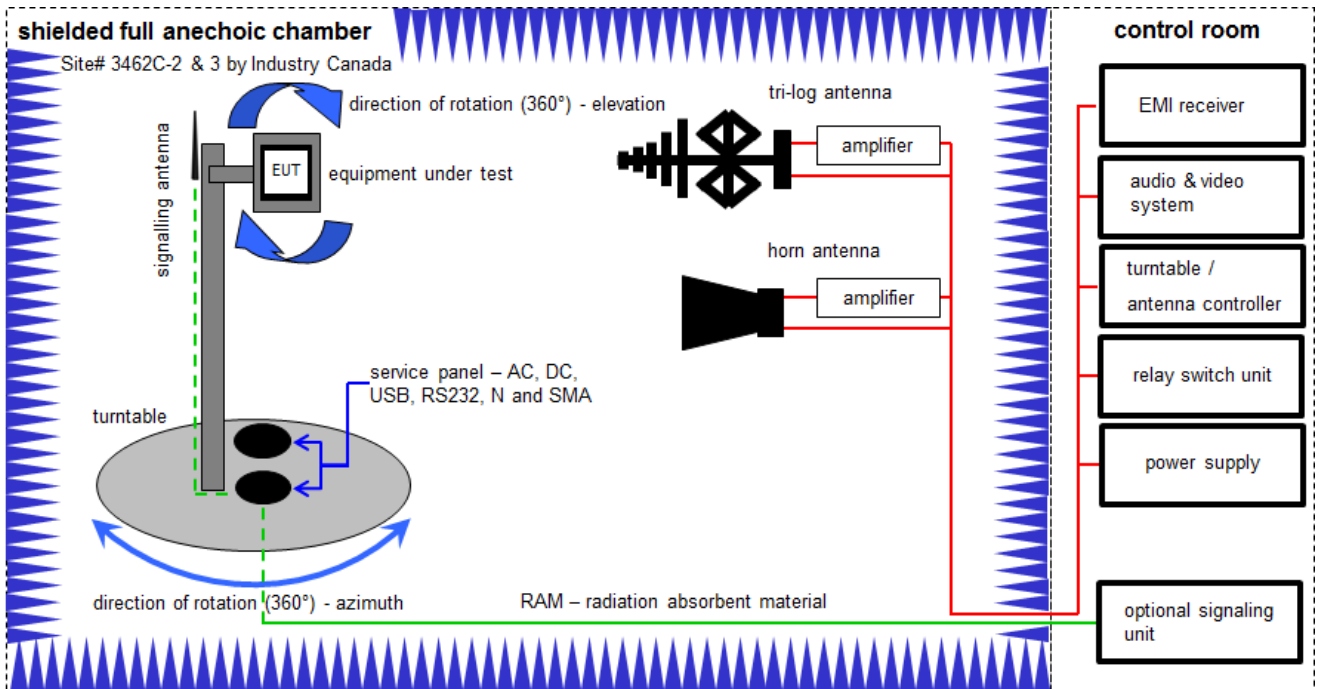
$$FS [dB\mu V/m] = 12.35 [dB\mu V/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dB\mu V/m] (35.69 \mu V/m)$$

### Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
2	A	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04466	300000580	ne	-/-	-/-
3	A	Semi anechoic chamber	3000023	MWB AG	-/-	300000551	ne	-/-	-/-
4	A	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
5	A	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
6	A	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
7	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	318	300003696	vKI!	04.09.2019	03.09.2021
8	A	EMI Test Receiver	ESR3	Rohde & Schwarz	102587	300005771	k	10.12.2020	09.06.2022
9	A	Turntable	2089-4.0	EMCO	-/-	300004394	ne	-/-	-/-
10	A	PC	TecLine	F+W	-/-	300004388	ne	-/-	-/-
11	A	Universal Radio Communication Tester	CMU200	R&S	103992	300003231	vKI!	10.12.2020	09.12.2022



## 7.2 Shielded fully anechoic chamber



Measurement distance: tri-log antenna and horn antenna 3 meter

$OP = AV + D - G + CA$

(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain+amplifier gain; CA-loss signal path)

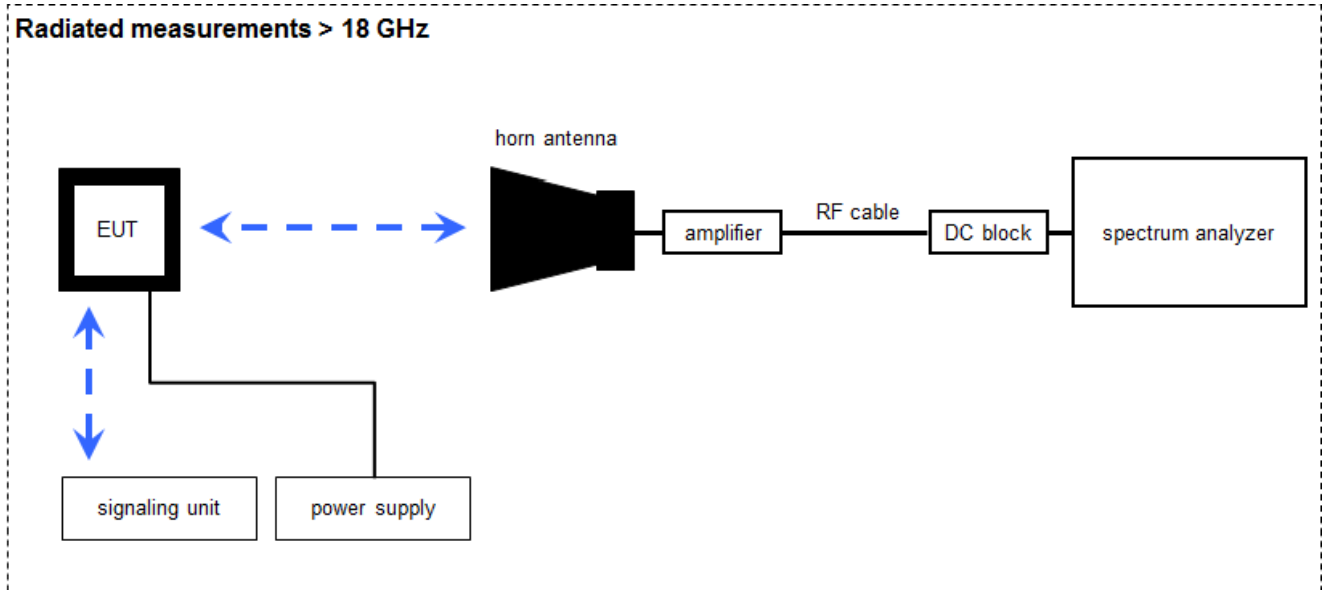
Example calculation:

$OP [dBm] = -65.0 [dBm] + 50 [dB] - 20 [dBi] + 5 [dB] = -30 [dBm] (1 \mu W)$

**Equipment table:**

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A, B, C	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2818A03450	300001040	vKI!	09.12.2020	08.12.2023
2	C	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	vKI!	13.06.2019	12.06.2022
3	A, B, C	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
4	A, B, C	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
5	A, B	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9709-5289	300000213	vKI!	14.07.2020	13.07.2022
6	B	Band Reject filter	WRCG1850/1910-1835/1925-40/8SS	Wainwright	7	300003350	ev	-/-	-/-
7	A, B, C	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	11.12.2020	10.12.2021
8	B	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	19	300003790	ne	-/-	-/-
9	B	High Pass Filter	VHF-3500+	Mini Circuits	-/-	400000193	ne	-/-	-/-
10	B	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22049	300004481	ev	-/-	-/-
11	A, B, C	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
12	A, B, C	NEXIO EMV-Software	BAT EMC V3.20.0.17	EMCO	-/-	300004682	ne	-/-	-/-
13	A, B, C	PC	ExOne	F+W	-/-	300004703	ne	-/-	-/-
14	A, B, C	Universal Radio Communication Tester	CMU200	R&S	103992	300003231	vKI!	10.12.2020	09.12.2022

### 7.3 Radiated measurements > 18 GHz



Measurement distance: horn antenna 50 cm

$$OP = AV + D - G + CA$$

(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain+amplifier gain; CA-loss signal path)

Example calculation:

$$OP \text{ [dBm]} = -65.0 \text{ [dBm]} + 50.0 \text{ [dB]} - 20.0 \text{ [dBi]} + 5.0 \text{ [dB]} = -30 \text{ [dBm]} \text{ (1 } \mu\text{W)}$$

**Equipment table:**

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Microwave System Amplifier, 0.5-26.5 GHz	83017A	HP	00419	300002268	ev	-/-	-/-
2	A	Std. Gain Horn Antenna 18.0-26.5 GHz	638	Narda	01096	300000486	vIKI!	21.01.2020	20.01.2022
3	A	Signal Analyzer 40 GHz	FSV40	Rohde & Schwarz	101042	300004517	k	07.12.2020	06.12.2021
4	A	RF-Cable	ST18/SMAm/SMAm /48	Huber & Suhner	Batch no. 600918	400001182	ev	-/-	-/-
5	A	RF-Cable	ST18/SMAm/SMAm /48	Huber & Suhner	Batch no. 127377	400001183	ev	-/-	-/-
6	A	DC-Blocker 0.1-40 GHz	8141A	Inmet	-/-	400001185	ev	-/-	-/-
7	A	Universal Radio Communication Tester	CMU200	R&S	103992	300003231	vIKI!	10.12.2020	09.12.2022

## 8 Sequence of testing

### 8.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

#### Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, it is placed on a table with 0.8 m height.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

#### Premeasurement\*

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1 m.
- At each turntable position the analyzer sweeps with positive-peak detector to find the maximum of all emissions.

#### Final measurement

- Identified emissions during the pre-measurement are maximized by the software by rotating the turntable from 0° to 360°.
- Loop antenna is rotated about its vertical axis for maximum response at each azimuth about the EUT. (For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT)
- The final measurement is done in the position (turntable and elevation) causing the highest emissions with quasi-peak (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. A plot with the graph of the premeasurement and the limit is stored.

\*Note: The sequence will be repeated three times with different EUT orientations.

## 8.2 Sequence of testing radiated spurious 30 MHz to 1 GHz

### Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 10 m or 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

### Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 m to 3 m.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

### Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position  $\pm 45^\circ$  and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

### 8.3 Sequence of testing radiated spurious 1 GHz to 18 GHz

#### Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

#### Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height is 1.5 m.
- At each turntable position and antenna polarization the analyzer sweeps with positive peak detector to find the maximum of all emissions.

#### Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximizes the peaks by rotating the turntable from 0° to 360°. This measurement is repeated for different EUT-table positions (0° to 150° in 30°-steps) and for both antenna polarizations.
- The final measurement is done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

## 8.4 Sequence of testing radiated spurious above 18 GHz

### Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet.
- The measurement distance is as appropriate (e.g. 0.5 m).
- The EUT is set into operation.

### Premeasurement

- The test antenna is handheld and moved carefully over the EUT to cover the EUT's whole sphere and different polarizations of the antenna.

### Final measurement

- The final measurement is performed at the position and antenna orientation causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement and the limit is stored.

**9 Measurement uncertainty**

Measurement uncertainty	
Test case	Uncertainty
RF output power conducted	$\pm 1$ dB
RF output power radiated	$\pm 3$ dB
Frequency stability	$\pm 20$ Hz
Spurious emissions radiated below 30 MHz	$\pm 3$ dB
Spurious emissions radiated 30 MHz to 1 GHz	$\pm 3$ dB
Spurious emissions radiated 1 GHz to 12.75 GHz	$\pm 3.7$ dB
Spurious emissions radiated above 12.75 GHz	$\pm 4.5$ dB
Spurious emissions conducted	$\pm 3$ dB
Block edge compliance	$\pm 3$ dB
Occupied bandwidth	$\pm$ RBW



## 10 Summary of measurement results

<input type="checkbox"/>	No deviations from the technical specifications were ascertained
<input type="checkbox"/>	There were deviations from the technical specifications ascertained
<input checked="" type="checkbox"/>	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC identifier	Description	verdict	date	Remark
RF-Testing	CFR Part 22, 24 RSS 132, 133,	See table!	2021-08-06	Tests according to customer demand

### 10.1 GSM 850

Test Case	temperature conditions	power source voltages	C	NC	NA	NP	Remark
RF Output Power	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
Frequency Stability	Nominal	Nominal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-/-
Spurious Emissions Radiated	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Only middle channel / GMSK
Spurious Emissions Conducted	Nominal	Nominal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-/-
Block Edge Compliance	Nominal	Nominal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-/-
Occupied Bandwidth	Nominal	Nominal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-/-

**Note:** C = Compliant; NC = Not compliant; NA = Not applicable; NP = Not performed

## 10.2 PCS 1900

Test Case	temperature conditions	power source voltages	C	NC	NA	NP	Remark
RF Output Power	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
Frequency Stability	Nominal	Nominal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-/-
Spurious Emissions Radiated	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Only middle channel / GMSK
Spurious Emissions Conducted	Nominal	Nominal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-/-
Block Edge Compliance	Nominal	Nominal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-/-
Occupied Bandwidth	Nominal	Nominal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-/-

**Note:** C = Compliant; NC = Not compliant; NA = Not applicable; NP = Not performed

## 11 Results GSM 850

All GSM-band measurements are done in GSM mode only (circuit switched). All relevant tests have been repeated using 8-PSK modulation if EDGE mode is supported. All tests were performed with one timeslot in uplink activated and one timeslot in downlink activated. For each mode the highest output power was determined and used.

### 11.1 RF output power

#### Description:

This paragraph contains average power, peak output power, PAPR and ERP measurements for the mobile station.

The plots in this test report represents only an example of the measurements. All plots of this chapter are available on request.

The red line in the measurements indicates the ideal Gaussian distribution for the measured amplitude range.

#### Measurement:

The mobile was set up for the maximum output power with pseudo random data modulation.

To determine the Peak-To-Average Power Ratio (PAPR) the measurement was performed with the Power Complementary Cumulative Distribution Function (CCDF).

Measurement parameters	
Detector:	Sample
AQT:	See plot
Resolution bandwidth:	1 MHz
Used equipment:	See chapter 7.1 A
Measurement uncertainty:	see chapter 9

#### Limits:

FCC	ISED
+38.45 dBm In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.	

**Results:**

Output Power (radiated) GMSK mode	
Frequency (MHz)	Average Output Power (dBm) - ERP
824.2	31.1
836.4	31.0
848.8	31.0

Output Power (radiated) 8-PSK mode	
Frequency (MHz)	Average Output Power (dBm) - ERP
824.2	24.0
836.4	23.9
848.8	23.9

**NOTE:** The results are calculated with the conducted output power values from the module test reports and the measured antenna gain by CTC.

## 11.2 Spurious emissions radiated

### Description:

The following steps outline the procedure used to measure the radiated emissions from the mobile station. The site is constructed in accordance with ANSI C63.4:2014 requirements and is recognized by the FCC to be in compliance for a 3 and a 10 meter site. The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 848.8 MHz. Measurements made up to 12.75 GHz. The resolution bandwidth is set as outlined in Part 22.917. The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the GSM-850 band.

### Measurement:

Measurement parameters	
Detector:	Peak
Sweep time:	2 s
Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Span:	100 MHz Steps
Trace mode:	Max Hold
Used equipment:	See chapter 7.1 A & 7.2 B+C
Measurement uncertainty:	See chapter 9

### Limits:

FCC	ISED
Attenuation $\geq 43 + 10\log(P)$ (P, Power in Watts)	
-13 dBm	

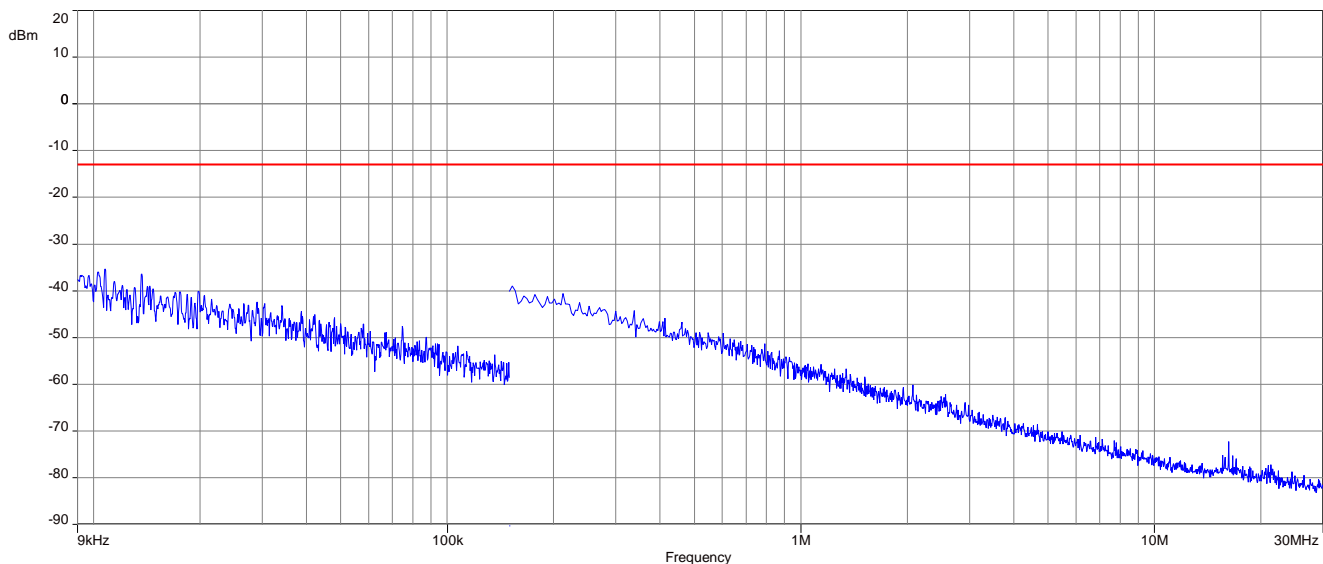
### Results GPRS & EGPRS:

Radiated emissions measurements were made only at the center carrier frequency of the GSM-850 band (836.4 MHz). The measurements shows the cabinet radiation in transmit mode. The antenna port can be terminated with 50  $\Omega$ .

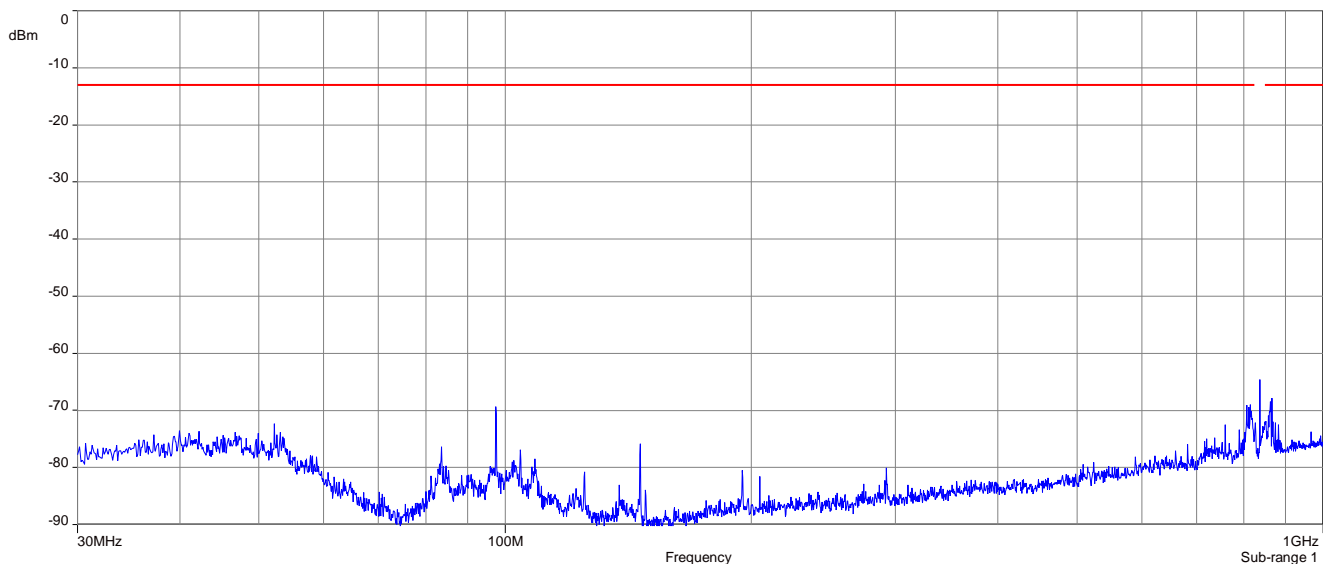
Spurious emission level (dBm)								
Harmonic	Ch. 128 Freq. (MHz)	Level [dBm]	Harmonic	Ch. 189 Freq. (MHz)	Level [dBm]	Harmonic	Ch. 251 Freq. (MHz)	Level [dBm]
2	1648.4	-	2	1672.8	-	2	1697.6	-
3	2472.6	-	3	2509.2	-	3	2546.4	-
4	3296.8	-	4	3345.6	-	4	3395.2	-
5	4121.0	-	5	4182.0	-	5	4244.0	-
6	4945.2	-	6	5018.4	-	6	5092.8	-
7	5769.4	-	7	5854.8	-	7	5941.6	-
8	6593.6	-	8	6691.2	-	8	6790.4	-
9	7417.8	-	9	7527.6	-	9	7639.2	-
10	8242.0	-	10	8364.0	-	10	8488.0	-

**Plots:** GMSK

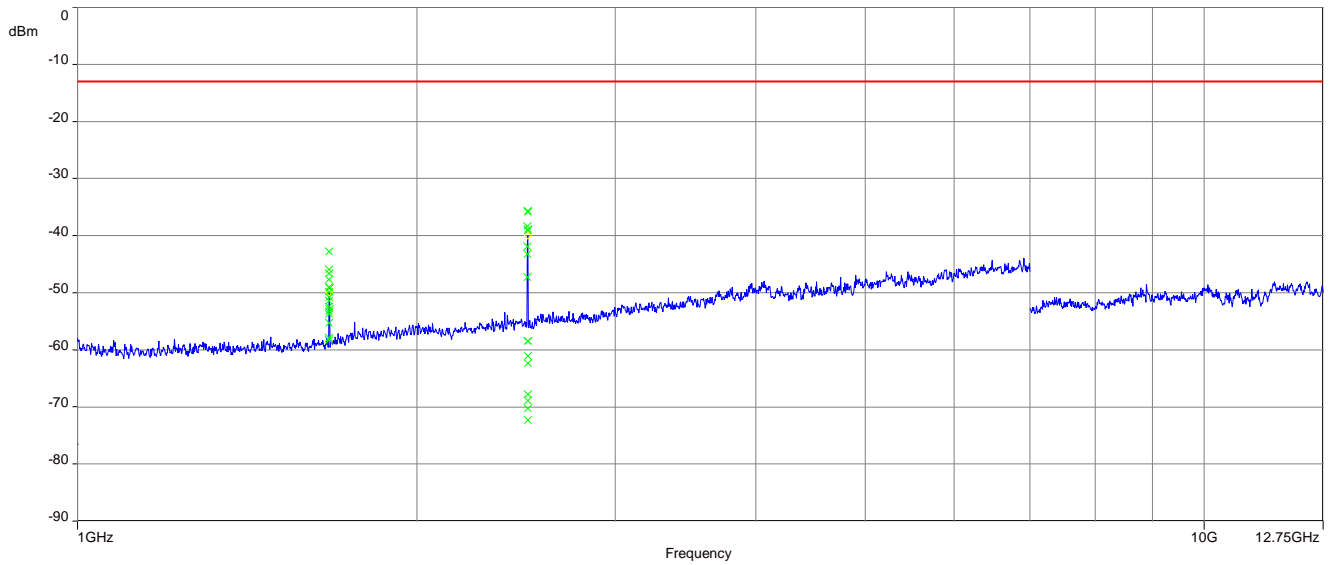
**Plot 1:** Channel 189 (Traffic mode up to 30 MHz)



**Plot 2:** Channel 189 (30 MHz – 1 GHz)



**Plot 3:** Channel 189 (1 GHz – 12.75 GHz)





## 12 Results PCS 1900

All GSM-band measurements are done in GSM mode only (circuit switched). All relevant tests have been repeated using 8-PSK modulation if EDGE mode is supported. All tests were performed with one timeslot in uplink activated and one timeslot in downlink activated. For each mode the highest output power was determined and used.

### 12.1 RF output power

#### Description:

This paragraph contains average power, peak output power, PAPR and ERP measurements for the mobile station.

The plots in this test report represents only an example of the measurements. All plots of this chapter are available on request.

The red line in the measurements indicates the ideal Gaussian distribution for the measured amplitude range.

#### Measurement:

The mobile was set up for the maximum output power with pseudo random data modulation.

To determine the Peak-To-Average Power Ratio (PAPR) the measurement was performed with the Power Complementary Cumulative Distribution Function (CCDF).

Measurement parameters	
Detector:	Sample
AQT:	See plot
Resolution bandwidth:	1 MHz
Used equipment:	See chapter 7.2 – A
Measurement uncertainty:	See chapter 9

#### Limits:

FCC	ISED
+33.00 dBm In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.	

**Results:**

Output Power (radiated) GMSK mode	
Frequency (MHz)	Average Output Power (dBm) - EIRP
1850.2	30.1
1880.0	30.0
1909.8	29.9

Output Power (radiated) 8-PSK mode	
Frequency (MHz)	Average Output Power (dBm) - EIRP
1850.2	25.5
1880.0	25.5
1909.8	25.1

**NOTE:** The results are calculated with the conducted output power values from the module test reports and the measured antenna gain by CTC.

## 12.2 Spurious emissions radiated

### Description:

The following steps outline the procedure used to measure the radiated emissions from the mobile station. The site is constructed in accordance with ANSI C63.4:2014 requirements and is recognized by the FCC to be in compliance for a 3 and a 10 meter site. The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 1910 MHz. Measurement made up to 25 GHz. The resolution bandwidth is set as outlined in Part 24.238. The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the PCS1900 band.

### Measurement:

Measurement parameters	
Detector:	Peak
Sweep time:	2 sec.
Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Span:	100 MHz Steps
Trace mode:	Max Hold
Used equipment:	See chapter 7.1 A & 7.2 B+C & 7.3 A
Measurement uncertainty:	See chapter 9

### Limits:

FCC	ISED
Attenuation $\geq 43 + 10\log(P)$ (P, Power in Watts)	
-13 dBm	

### Results GPRS & EGPRS:

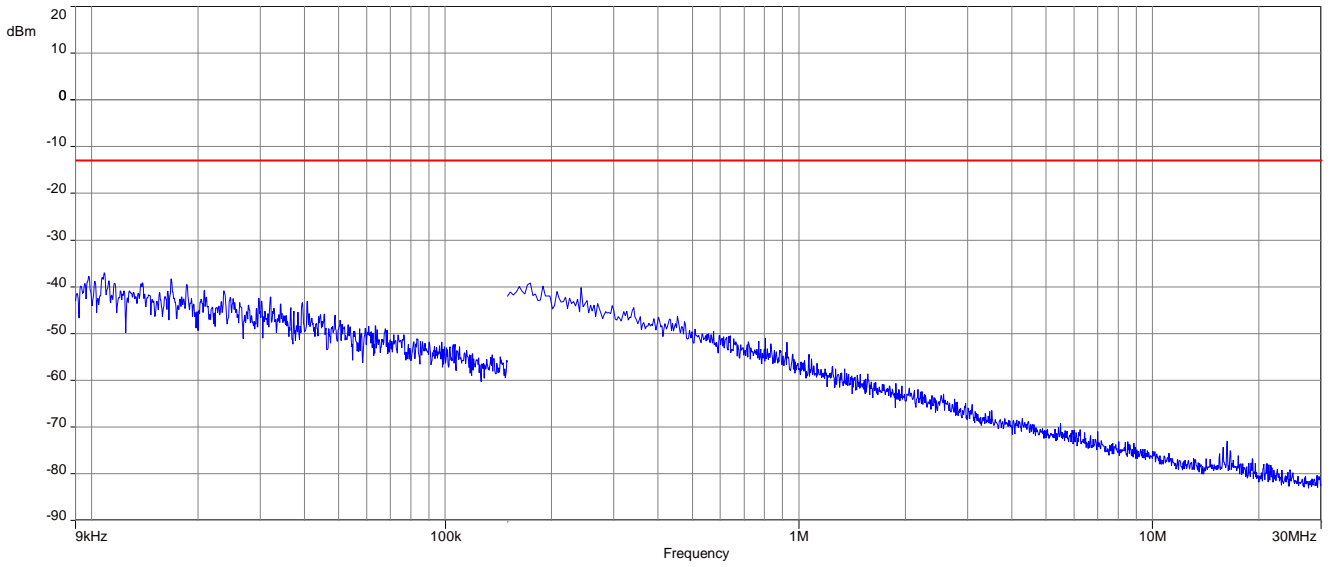
Radiated emissions measurements were made only at the center carrier frequencies of the PCS1900 band (1880.0 MHz) to show the compliance with cabinet radiation limits.

**Results:**

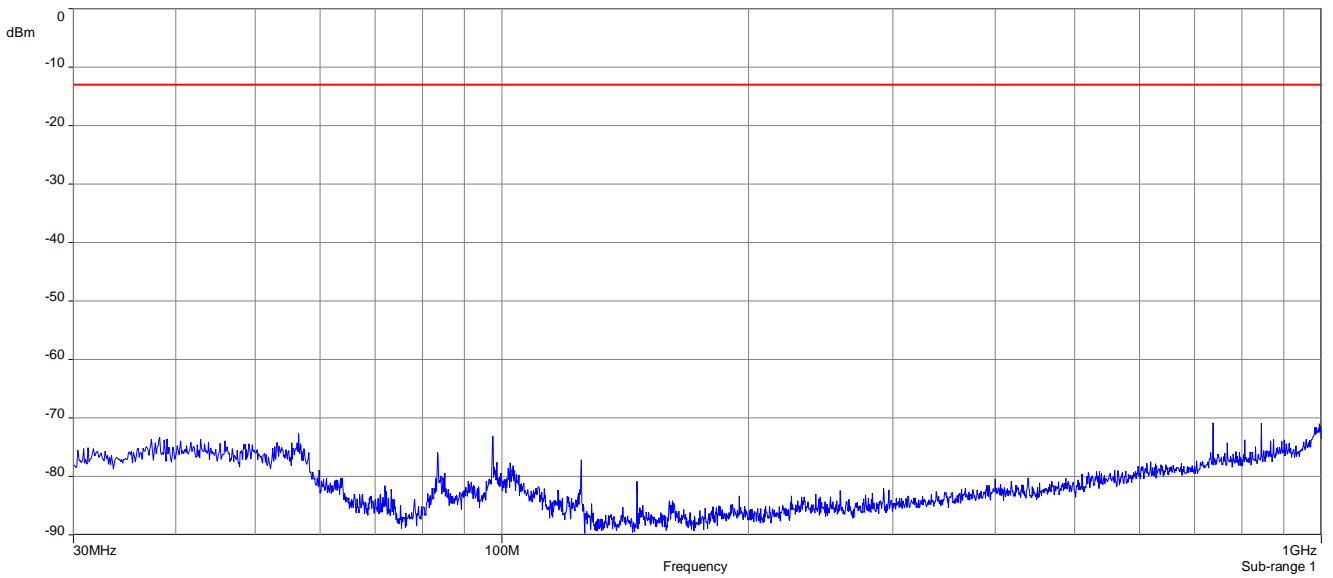
Spurious emission level (dBm)								
Harmonic	Ch. 512 Freq. (MHz)	Level [dBm]	Harmonic	Ch. 661 Freq. (MHz)	Level [dBm]	Harmonic	Ch. 810 Freq. (MHz)	Level [dBm]
2	3700.4	-	2	3760.0	-	2	3819.6	-
3	5550.6	-	3	5640.0	-	3	5729.4	-
4	7400.8	-	4	7520.0	-	4	7639.2	-
5	9251.0	-	5	9400.0	-	5	9549.0	-
6	11101.2	-	6	11280.0	-	6	11458.8	-
7	12951.4	-	7	13160.0	-	7	13368.6	-
8	14801.6	-	8	15040.0	-	8	15278.4	-
9	16651.8	-	9	16920.0	-	9	17188.2	-
10	18502.0	-	10	18800.0	-	10	19098.0	-

**Plots:** GMSK

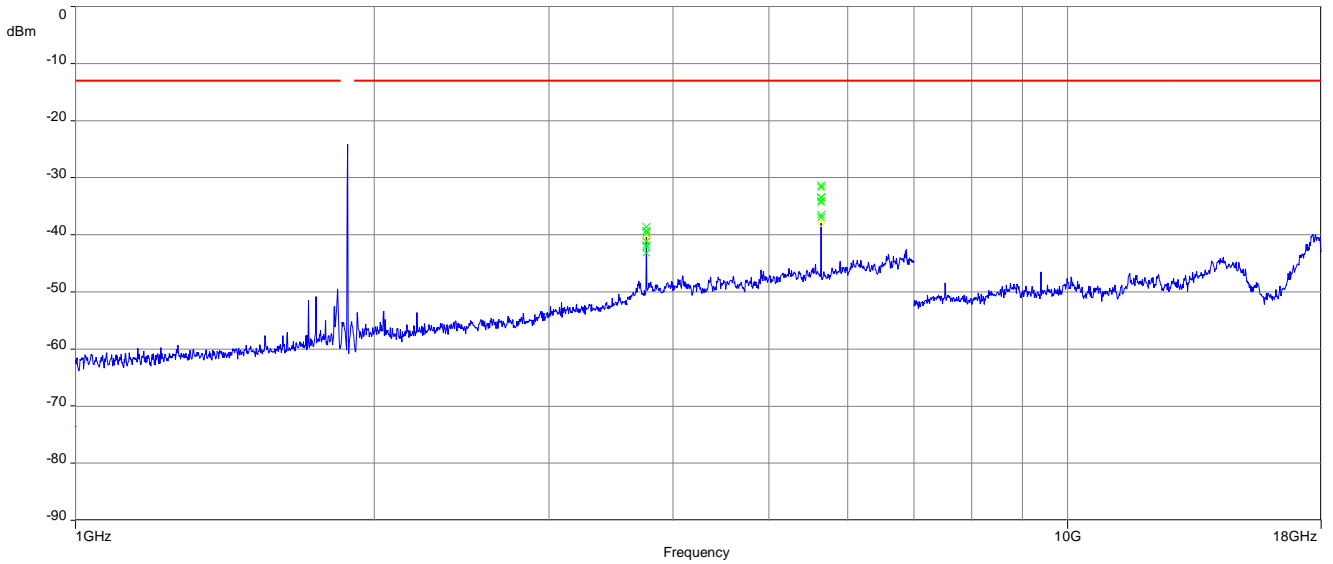
**Plot 1:** Channel 661 (Traffic mode up to 30 MHz)



**Plot 2:** Channel 661 (30 MHz – 1 GHz)

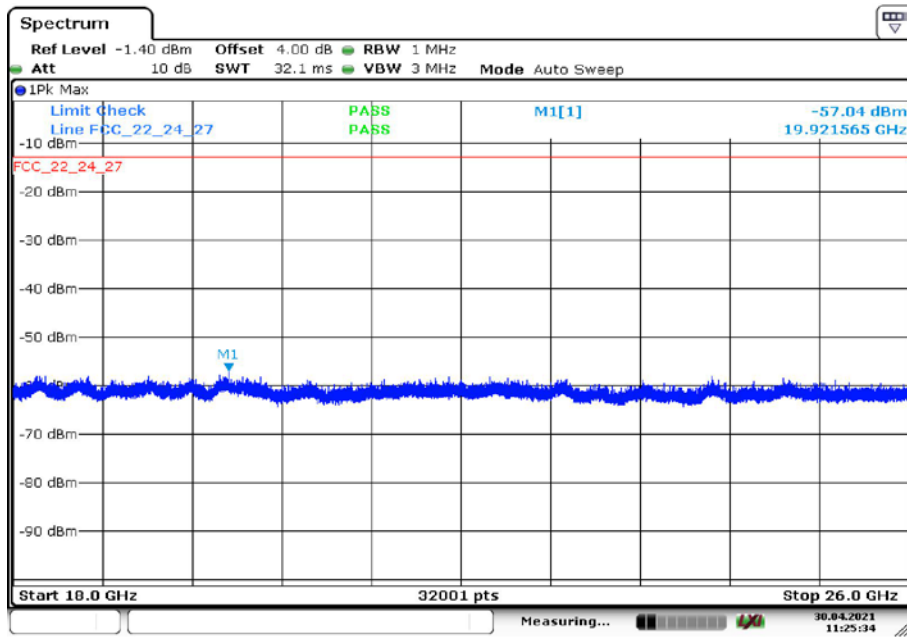


**Plot 3: Channel 661 (1 GHz – 18 GHz)**



*Carrier notched with 1.9 GHz rejection filter*

**Plot 3: Channel 661 (18 GHz - 26 GHz)**



Date: 30.APR.2021 11:25:34

## 13 Glossary

<b>EUT</b>	Equipment under test
<b>DUT</b>	Device under test
<b>UUT</b>	Unit under test
<b>GUE</b>	GNSS User Equipment
<b>ETSI</b>	European Telecommunications Standards Institute
<b>EN</b>	European Standard
<b>FCC</b>	Federal Communications Commission
<b>FCC ID</b>	Company Identifier at FCC
<b>IC</b>	Industry Canada
<b>PMN</b>	Product marketing name
<b>HMN</b>	Host marketing name
<b>HVIN</b>	Hardware version identification number
<b>FVIN</b>	Firmware version identification number
<b>EMC</b>	Electromagnetic Compatibility
<b>HW</b>	Hardware
<b>SW</b>	Software
<b>Inv. No.</b>	Inventory number
<b>S/N or SN</b>	Serial number
<b>C</b>	Compliant
<b>NC</b>	Not compliant
<b>NA</b>	Not applicable
<b>NP</b>	Not performed
<b>PP</b>	Positive peak
<b>QP</b>	Quasi peak
<b>AVG</b>	Average
<b>OC</b>	Operating channel
<b>OCW</b>	Operating channel bandwidth
<b>OBW</b>	Occupied bandwidth
<b>OOB</b>	Out of band
<b>DFS</b>	Dynamic frequency selection
<b>CAC</b>	Channel availability check
<b>OP</b>	Occupancy period
<b>NOP</b>	Non occupancy period
<b>DC</b>	Duty cycle
<b>PER</b>	Packet error rate
<b>CW</b>	Clean wave
<b>MC</b>	Modulated carrier
<b>WLAN</b>	Wireless local area network
<b>RLAN</b>	Radio local area network
<b>DSSS</b>	Dynamic sequence spread spectrum
<b>OFDM</b>	Orthogonal frequency division multiplexing
<b>FHSS</b>	Frequency hopping spread spectrum
<b>GNSS</b>	Global Navigation Satellite System
<b>C/N<sub>0</sub></b>	Carrier to noise-density ratio, expressed in dB-Hz

## 14 Document history

Version	Applied changes	Date of release
-/-	Initial release	2021-07-30
A	Editorial changes (Applicant/Manufacturer, additional temperature range with battery added)	2021-08-06

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