DEKRA Certification B.V.
Meander 1051, 6825 MJ Arnhem P.O. Box 5185, 6802 ED Arnhem, The Netherlands
T +31 88 96 83000 F +31 88 96 83100
www.dekra-certification.com Company registration 09085396

- The RvA is a signatory to the EA MLA.
- The RvA is a signatory to the ILAC MRA.
- The RvA is a signatory to the IAF MLA.

Assessment report No:
2251914.0501-RSM

ASSESSMENT REPORT
RF EXPOSURE - MPE

(*)	Identification of item to be assessed	Radar installation
(*)	Trademark	N/A
(*)	Model and /or type reference	SMART-L
(*)	Features, other identification of the product	PSR (L-band) and MSSR (Tx=1030 MHz)
(*)	Derived model(s)	N/A
(*)	Applicant´s name / address	Ministerie van Defensie Defensie Materieel Organisatie (DMO) Directie Projecten Kromhout Kazerne | Herculeslaan 1 – 3584 AB | Utrecht Gebouw K8 | Kamer 1.A080 Postbus 90125 | 3509BB | MPC55A | Utrecht
	Assessment method requested, standard	EN 62311:2020. Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz - 300GHz)
	Verdict Summary	IN COMPLIANCE
	Assessment / test performed by (name / position & signature)	Technical Professional EMC
	Approved by (name / position & signature)	Operational Manager EMC
	Date of issue	2021-06-07
	Report template No	TRF_RSM_EN62311 R1.0 (*) “Data provided by the applicant”

INDEX

page

COMPETENCES AND GUARANTEES

DEKRA is a testing laboratory competent to carry out the tests described in this report.

In order to assure the traceability to other national and international laboratories, DEKRA has a calibration and maintenance program for its measurement equipment.

DEKRA guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated in the report and it is based on the knowledge and technical facilities available at DEKRA at the time of performance of the test.

DEKRA is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

GENERAL CONDITIONS

1. This report is only referred to the item that has undergone the assessment.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or Competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA.
4. This assessment report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA.

POSSIBLE ASSESSMENT CASE VERDICTS

Assessment case does not apply to test object	N/A
Assessment object does meet requirement	P (Pass) / PASS
Assessment object does not meet requirement	F (Fail) / FAIL

DEFINITION OF SYMBOLS USED IN THIS ASSESSMENT REPORT

☒ Indicates that the listed condition, standard or equipment is applicable for this report/Assessment/EUT.				
☐ Indicates that the listed condition, standard or equipment is not applicable for this report/Assessment/EUT.				
Decimal separator used in this report	☐	Comma (,)	☒	Point (.)

DATA PROVIDED BY THE APPLICANT

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item to be assessed", "Trademark", "Model and/or type reference" and Features.

DEKRA Certification B.V. declines any responsibility with respect to the information provided by the applicant and that may affect the validity of results.

DOCUMENT HISTORY

Report nr.	Date	Description
2251914.0501-RSM	2021-06-07	First release.

CONCLUSION, REMARKS AND COMMENTS

This is an assessment report. The assessment was done according to the EN 62311 standard. Refer to these chapter for further details.

The equipment under assessment meets the requirements of the applicable standard and guidelines. The measured Electric field strengths at all frequencies and all measurement points/locations are well below the limit values for the general public as advised by the ICNIRP guidelines.

1. General

Between 15 December 2020 – 15 January 2021 and 18-20 May 2021 DEKRA Certification B.V. performed Electromagnetic Field measurements on the SMART-L Radar installation at Wier, province Friesland, The Netherlands. The measurements were performed according to the test plan (Measurementplan_RadHazWier_v4) provided by the applicant.

The objective of the assessment and measurements was to demonstrate the compliance of that SMART-L radar installation with the ICNIRP guidelines (ICNIRP1998 and ICNIRP2020).

1.1 Description of the equipment under assessment

1.1.1 MSSR

The transmit frequency is 1030 MHz, the polarization is vertical. The system operates in a so-called mixed-mode, the modes A, C, S and military modes are alternated. Pulse shapes are specified in the 'open literature,' an examples is provided in Figure 1. The instantaneous bandwidth is less than 12 MHz. The azimuth beamwidth is between 2 and 3 degrees, the antenna rotation rate is 5 s. If the SMART-L system operates with a non-rotating antenna, the MSSR is switched off.

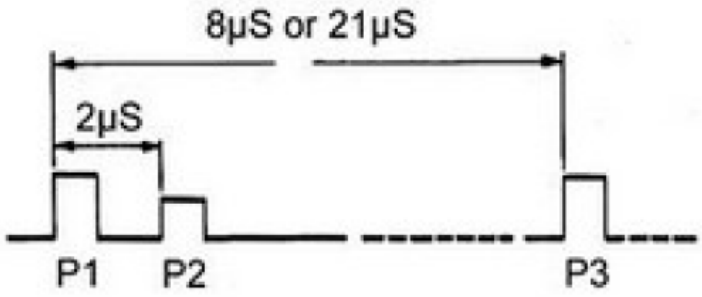


Figure 1: Transmit patterns for the modes A (requests squawk-code) and C (request barometric altitude).

1.1.2 PSR

The system operates in the L-band (coarsely: 1 – 1.5 GHz) and utilizes multiple frequencies in this band. The pulse duration is not constant but varies from burst-to-burst, a burst being a series of pulses. The mean duty cycle is more than 5%. The radar pulses are frequency modulated, the chirp being 2.5 MHz.

During the measurements the system was configured in a monochromatic (single frequency) mode, so that the measurement equipment can easily capture the transmitted pulses.

In the rotating antenna mode, there are three different transmit antenna patterns, which are alternated. To prevent the recording of only the signal which is emitted with the highest antenna gain, the measurements were done for each transmit antenna pattern separately. Refer to the Operating modes chapter for further details about the operating modes used during the measurements.

In the mode with the non-rotating antenna, there are two different transmit patterns. Also, a different waveform is applied (compared to the rotating mode).

1.2 Measurement locations

The measurements were performed at five different locations and two antenna heights (which represents exposures of a (tall) person and a person on the first floor of a building). The detailed test plan is given below. At each location and antenna height the electromagnetic field strength levels were measured both using max-peak and RMS detectors.

The measurements were performed according to the following table which was prepared using the test plan provided by the applicant. All measurements were performed at Vertical antenna polarisation. During the measurements the radar system was controlled by the applicant.

		Measurement distances and Rx antenna heigths																			
		d=35 m.				d=150 m.				d=200 m.				d=300 m.				d=710 m.			
		Ah=2m.		Ah=4m.		Ah=2m.		Ah=4m.		Ah=2m.		Ah=4m.		Ah=2m.		Ah=4m.		Ah=2m.		Ah=4m.	
No	Measurement modes	PK	RMS	PK	RMS	PK	RMS	PK	RMS	PK	RMS	PK	RMS	PK	RMS	PK	RMS	PK	RMS	PK	RMS
1	Ambient noise (background) measurements	X	X	X	X													X	X	X	X
2	Rotating antenna, PSR beam 1 (antenna pattern 1)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	Rotating antenna, PSR beam 2 (antenna pattern 2)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	Rotating antenna, MSSR	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5	Non-rotating, PSR antenna pattern 1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6	Non-rotating, PSR antenna pattern 2 (see note)									X	X	X	X								
7	Rotating antenna, Operational combination of patterns OM#02 and OM#3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Note: The measurements at OM#06 were performed only at 200 m. (position C). Refer to further chapter for the rationale.

1.3 Other expected RF sources

At the measurement location an overview of the other expected RF sources as provided by the applicant are listed below. These RF sources were excluded from the assessment.

Frequency (MHz)	Source
1030	MSSR ATC radar, Leeuwarden airport
1090	Transponderreplies, ADS-B, FFM
2876	PSR ATC radar, Leeuwarden airport
5625	Weather radar Den Helder

1.4 Operating mode(s) used for tests

During the measurements the following operating modes have been used.

Operating mode	Operating mode description
1	Ambient noise (background) measurements
2	Rotating antenna, PSR beam 1 (antenna pattern 1)
3	Rotating antenna, PSR beam 2 (antenna pattern 2)
4	Rotating antenna, MSSR
5	Non-rotating, PSR antenna pattern 1
6	Non-rotating, PSR antenna pattern 2
7	Rotating antenna, Operational combination of patterns OM#02 and OM#3

1.5 Measurement method

The measurements were done using the setup given below. In order to measure the highest electric field strength radiated by the radar system, at all positions the measurement antenna was positioned (by tilting) in the direction of the radar system. In order to verify that the measurement antenna was in the maximum field location (pertaining to the non-rotating antenna), the handheld RF exposure meter has been used.

At the beginning of the measurements a preliminary measurement was performed to identify the exact frequency from the radar system and other electromagnetic sources in the environment. Refer to the annex 2 for the ambient noise graphics including other electromagnetic sources. At each measurement position preliminary (pre-scan) measurements were performed using MAX-HOLD function of the receiver. The preliminary measurements were repeated 15 times using dwell time (measurements for each frequency step) of 100 ms.. Multiple scans ensure correct measurements of signals with different characteristics including pulsed signals (see figure 1.5-2 given below for further details regarding multiple scans).

After identifying the frequencies of the radar system detailed measurements were performed on these specific frequencies using the following methods:

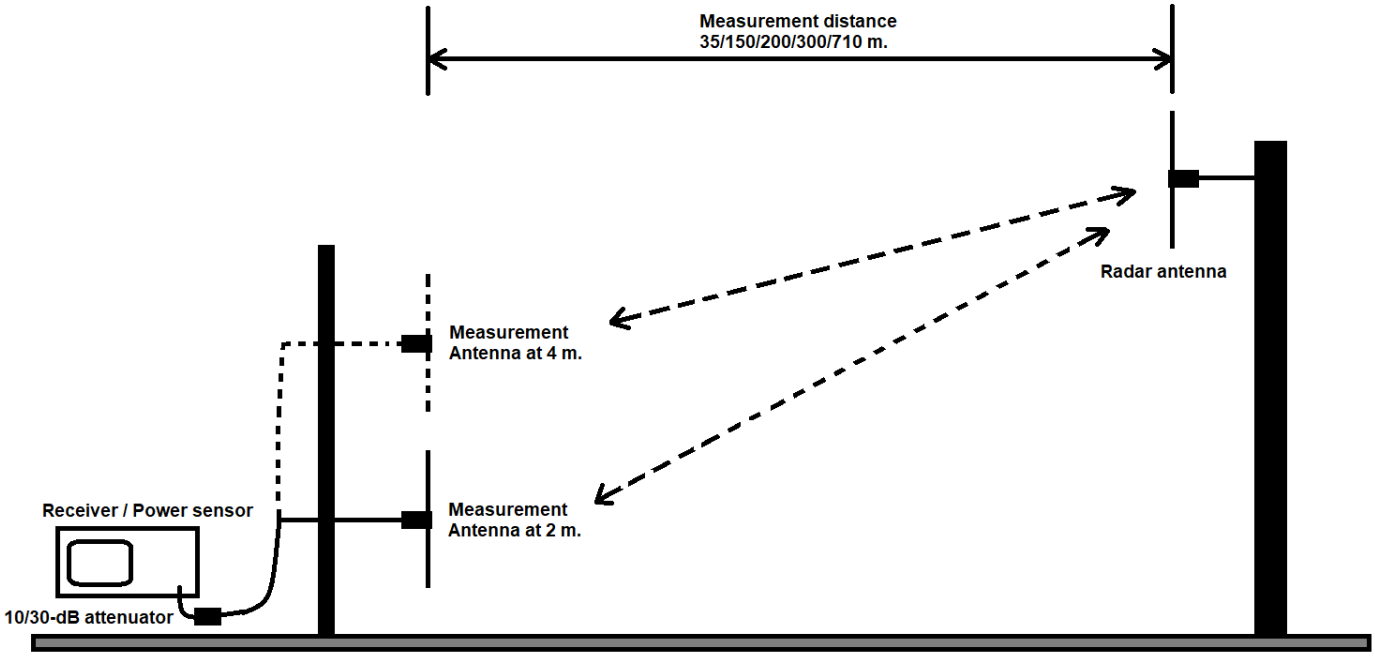
1. Electric field measurements using Spectrum analyser/Receiver (both with Peak and RMS detectors).
2. RF Power sensor. Both PK (peak) and RMS power values were measured.
3. Handheld RF exposure meter. Max electric field strength value was measured (only for 2m height).

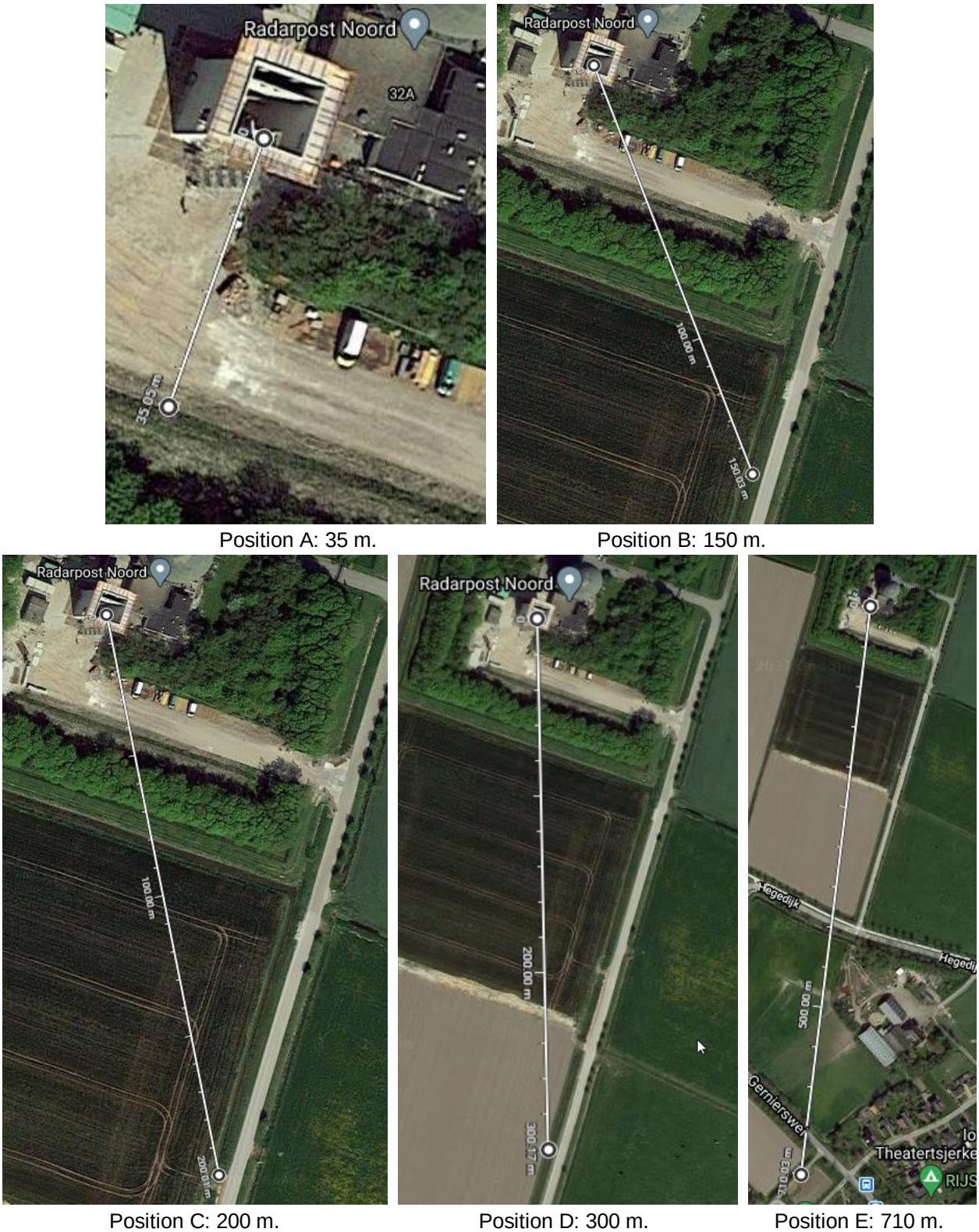
The measurements were done until reaching stable conditions (no significant change of the measurement results).

The measurements related to OM#04 (MSSR system) were performed using methods 2 and 3 due to wide bandwidth of the MSSR system.

In order to have the worst-case scenario related to the assessment of the radar system against the ICNIRP guidelines, at all other operating modes the highest measured values of the three measurements methods were reported.

The measurements at OM#06 were done only at one measurement position/location (position C) to compare with the results of the OM#05. Since the measured electric field levels at OM#06 were much lower than values measured at OM#05 the measurements were not done at other measurement positions. Compliance to ICNIRP guidelines of OM#05 yields compliance to ICNIRP of OM#06 as well.

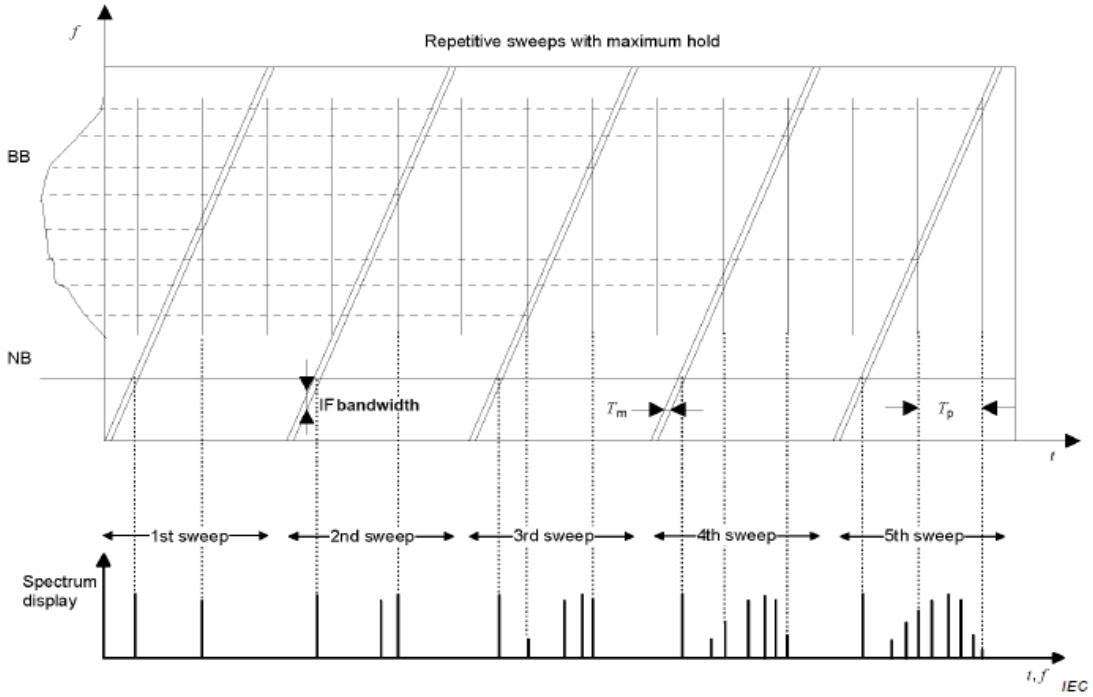

Measurement distance
35/150/200/300/710 m.
Radar antenna
Measurement
Antenna at 4 m.
Measurement
Antenna at 2 m.
Receiver / Power sensor
10/30-dB attenuator



Position A: 35 m. Position B: 150 m.

Position C: 200 m. Position D: 300 m. Position E: 710 m.

Figure 1.5-1: Test setup illustration and the measurement positions



Key:

T_o is the pulse-repetition interval of the impulsive signal. A pulse occurs at each vertical line of the spectrum versus time display (upper part of the figure).

Figure 1.5-2: Measurement of a combination of a CW signal (NB-narrowband) and an impulsive signal (BB-broadband) using multiple scans with maximum hold (CISPR 16-2-3:2016)

1.6 Settings of the measurement equipment (Receiver & Power sensor)

During the measurements the following receiver settings were used. The parameters were selected based on the requirements of the CISPR standards.

Receiver: Preliminary measurements to identify the radar frequencies		
Parameter	**Frequency range**	
	30 – 1000 MHz	**1000 – 6000 MHz**
Detectors	Peak (PK) and RMS at MaxHold	Peak (PK) and RMS at MaxHold
IF/RBW Bandwidth	100 kHz	1 MHz
Video bandwidth (VBW)	300 kHz	10 MHz
Dwell time (SCAN)	100 ms (15 repetition)	100 ms (15 repetition)
Dwell time (FINAL)	5 s.	5 s.

The following steps were taken to avoid the overload/saturation of the receiver /spectrum analyser:

- The spectrum analyser has preselection which means high dynamic range.
- During measurements no pre-amplifiers were used.
- The spectrum analyser was used in AUTO attenuation mode.
- Additional fixed attenuators of 10/30 dB was used at the RF input of the spectrum analyser.
- The spectrum analyser is equipped with overload indication.

Receiver: FINAL measurements at the identified radar frequencies	
Parameter	**Frequency range**
	1000 – 2000 MHz
Detectors	Peak (PK) and RMS
IF/RBW Bandwidth	10 MHz
Video bandwidth (VBW)	40 MHz
Sweet time	Continuous sweep until reaching steady state conditions

The following steps were taken to avoid the overload/saturation of the receiver /spectrum analyser:

- The spectrum analyser has preselection which means high dynamic range.
- During measurements no pre-amplifiers were used.
- The internal attenuator was set to 30 dB.
- Additional external fixed attenuator of 30 dB was used at the RF input of the spectrum analyser.
- The spectrum analyser is equipped with overload indication.

In addition to the Receiver all measurements were also performed using power sensor (see the equipment list).

- At all operating modes except OM#04 the coaxial cable coming from the measurement antenna connected to the power sensor via 10-dB fixed attenuator.
- For OM#04 no attenuator was used at the power sensor input.

The handheld RF exposure meter (see the equipment list) was only used for the measurements at 2 m. height. During the measurements the meter was set to MAX-HOLD mode and the maximum electric field strength was investigating around the measurement position/location (±20 meters).

2. RF Exposure Assessment result and verdict

Limits to comply with standard EN 62311:2020 are defined in "1999/519/EC Council Recommendation on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) for General Public":

Position: A (35 m.)

Operating mode	Measurement antenna height	Freq. [MHz]	Electric field (peak)			Electric field (rms)			VERDICT
			E-field strength (Peak) [V/m]	General Public Limit E-field strength [V/m]	[%] of the limit	E-field strength (rms) [V/m]	General Public Limit E-field strength [V/m]	[%] of the limit	
OM#02	2 m.	1350	47.15	1616.66	2.92	3.75	50.52	7.42	**PASS**
OM#03		1350	81.00	1616.66	5.01	7.63	50.52	15.10	**PASS**
OM#04		1030	6.56	1412.16	0.46	0.10	44.13	0.23	**PASS**
OM#05		1350	51.88	1616.66	3.21	13.02	50.52	25.77	**PASS**
OM#07		1350	61.73	1616.66	3.82	8.81	50.52	17.44	**PASS**
OM#02	4 m.	1350	28.71	1616.66	1.78	2.08	50.52	4.12	**PASS**
OM#03		1350	72.69	1616.66	4.50	6.64	50.52	13.14	**PASS**
OM#04		1030	6.85	1412.16	0.49	0.10	44.13	0.23	**PASS**
OM#05		1350	56.75	1616.66	3.51	12.20	50.52	24.15	**PASS**
OM#07		1350	75.95	1616.66	4.70	10.66	50.52	21.10	**PASS**

Position: B (150 m.)

Operating mode	Measurement antenna height	Freq. [MHz]	Electric field (peak)			Electric field (rms)			VERDICT
			E-field strength (Peak) [V/m]	General Public Limit E-field strength [V/m]	[%] of the limit	E-field strength (rms) [V/m]	General Public Limit E-field strength [V/m]	[%] of the limit	
OM#02	2 m.	1350	49.32	1616.66	3.05	3.46	50.52	6.85	**PASS**
OM#03		1350	75.68	1616.66	4.68	7.50	50.52	14.85	**PASS**
OM#04		1030	2.74	1412.16	0.19	0.04	44.13	0.09	**PASS**
OM#05		1350	54.45	1616.66	3.37	13.04	50.52	25.81	**PASS**
OM#07		1350	48.98	1616.66	3.03	8.00	50.52	15.84	**PASS**
OM#02	4 m.	1350	60.74	1616.66	3.76	4.86	50.52	9.62	**PASS**
OM#03		1350	121.90	1616.66	7.54	9.47	50.52	18.75	**PASS**
OM#04		1030	3.73	1412,16	0.26	0.05	44.13	0.11	**PASS**
OM#05		1350	88.10	1616.66	5.45	15.45	50.52	30.58	**PASS**
OM#07		1350	80.72	1616.66	4.99	11.99	50.52	23.73	**PASS**

Position: C (200 m.)									
			Electric field (peak)			Electric field (rms)			
Operating mode	**Measurement antenna height**	**Freq. [MHz]**	**E-field strength (Peak) [V/m]**	**General Public Limit E-field strength [V/m]**	**[%] of the limit**	**E-field strength (rms) [V/m]**	**General Public Limit E-field strength [V/m]**	**[%] of the limit**	**VERDICT**
OM#02	2 m.	1350	42.66	1616.66	2.64	3.67	50.52	7.26	**PASS**
OM#03		1350	155.24	1616.66	9.60	13.46	50.52	26.64	**PASS**
OM#04		1030	3.13	1412.16	0.22	0.04	44.13	0.09	**PASS**
OM#05		1350	122.04	1616.66	7.55	20.18	50.52	39.94	**PASS**
OM#06		1350	39.90	1616.66	2.47	6.27	50.52	12.41	**PASS**
OM#07		1350	162.55	1616.66	10.05	20.80	50.52	41.17	**PASS**
OM#02	4 m.	1350	31.26	1616.66	1.93	2.60	50.52	5.15	**PASS**
OM#03		1350	150.80	1616.66	9.33	12.88	50.52	25.49	**PASS**
OM#04		1030	2.93	1412.16	0.21	0.04	44.13	0.09	**PASS**
OM#05		1350	115.88	1616.66	7.17	19.25	50.52	38.10	**PASS**
OM#06		1350	37.33	1616.66	2.31	5.70	50.52	11.28	**PASS**
OM#07		1350	170.80	1616.66	10.56	21.48	50.52	42.52	**PASS**

Position: D (300 m.)									
			Electric field (peak)			Electric field (rms)			
Operating mode	**Measurement antenna height**	**Freq. [MHz]**	**E-field strength (Peak) [V/m]**	**General Public Limit E-field strength [V/m]**	**[%] of the limit**	**E-field strength (rms) [V/m]**	**General Public Limit E-field strength [V/m]**	**[%] of the limit**	**VERDICT**
OM#02	2 m.	1350	35.77	1616.66	2.21	3.05	50.52	6.04	**PASS**
OM#03		1350	107.28	1616.66	6.64	9.51	50.52	18.82	**PASS**
OM#04		1030	5.11	1412.16	0.36	0.06	44.13	0.14	**PASS**
OM#05		1350	29.14	1616.66	1.80	4.99	50.52	9.88	**PASS**
OM#07		1350	90.26	1616.66	5.58	12.97	50.52	25.67	**PASS**
OM#02	4 m.	1350	38.90	1616.66	2.41	3.72	50.52	7.36	**PASS**
OM#03		1350	39.63	1616.66	2.45	5.96	50.52	11.80	**PASS**
OM#04		1030	6.35	1412.16	0.45	0.07	44.13	0.16	**PASS**
OM#05		1350	36.73	1616.66	2.27	5.05	50.52	10.00	**PASS**
OM#07		1350	38.33	1616.66	2.37	5.54	50.52	10.97	**PASS**

Position: E (710 m.)									
Operating mode	**Measurement antenna height**	**Freq. [MHz]**	**Electric field (peak)**			**Electric field (rms)**			**VERDICT**
			E-field strength (Peak) [V/m]	**General Public Limit E-field strength [V/m]**	**[%] of the limit**	**E-field strength (rms) [V/m]**	**General Public Limit E-field strength [V/m]**	**[%] of the limit**	
OM#02	2 m.	1350	27.38	1616.66	1.69	2.59	50.52	5.13	**PASS**
OM#03		1350	42.95	1616.66	2.66	4.11	50.52	8.14	**PASS**
OM#04		1030	4.25	1412.16	0.30	0.05	44.13	0.11	**PASS**
OM#05		1350	15.38	1616.66	0.95	5.60	50.52	11.08	**PASS**
OM#07		1350	41.50	1616.66	2.57	6.88	50.52	13.62	**PASS**
OM#02	4 m.	1350	40.46	1616.66	2.50	3.90	50.52	7.72	**PASS**
OM#03		1350	61.80	1616.66	3.82	6.00	50.52	11.88	**PASS**
OM#04		1030	2.06	1412.16	0.15	0.05	44.13	0.11	**PASS**
OM#05		1350	19.54	1616.66	1.21	3.20	50.52	6.33	**PASS**
OM#07		1350	61.59	1616.66	3.81	8.77	50.52	17.36	**PASS**

The SMART-L system is the dominant contributor in the frequency bands. The objective of the assessment is to determine if the SMART-L complies to ICNIRP. Therefore, other users (sources; therefore frequencies other than listed in the tables given above) are not relevant for the assessment.

2.1 Equipment used during measurements

Equipment	Manufacturer	Model	Cal. date
EMI Test Receiver	Rohde & Schwarz	ESR 7	25-09-2020
Coax cable	Huber-Suhner	RG214	01-12-2020
Ultralog Antenna	Rohde & Schwarz	HL 562E	27-11-2020
Double Ridged Horn antenna	Rohde & Schwarz	HF906	04-03-2020
Power sensor	Rohde & Schwarz	NRP-Z81	22-10-2020
Antenna mast	Rohde & Schwarz	5 m.	N/A
Test Software	Rohde & Schwarz	EMC32 V.10.60.10	N/A
Test Software	Rohde & Schwarz	Power viewer	N/A
Hand held RF exposure meter	Wandel & Goltermann	EMR-20+E-field 8.3	1-11-2019

2.2 Measurement uncertainty

The table below shows the measurement uncertainty of the measurement. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

Test name	**Uncertainty**
Radiated electric field emissions; 30 MHz – 6000 MHz (Receiver)	2.19 dB
Radiated electric field emissions; 30 MHz – 6000 MHz (Power sensor)	1.70 dB
Radiated electric field emissions; 30 MHz – 3000 MHz (RF exposure meter)	1.76 dB

ANNEX 1 - EN RF Exposure Information

The device will be evaluated against basic restrictions or reference levels according to EN 62311:2020. If the reference levels are met, then the basic restrictions will also be met.

Reference levels are defined in the 1999/519/EC Council Recommendation on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz),See Table as under

Reference levels: ICNIRP1998

Table 7. Reference levels for general public exposure to time-varying electric and magnetic fields (unperturbed rms values).[a]

Frequency range	E-field strength ($V\ m^{-1}$)	H-field strength ($A\ m^{-1}$)	B-field (μT)	Equivalent plane wave power density S_{eq} ($W\ m^{-2}$)
up to 1 Hz	—	3.2×10^4	4×10^4	—
1–8 Hz	10,000	$3.2 \times 10^4/f^2$	$4 \times 10^4/f^2$	—
8–25 Hz	10,000	$4{,}000/f$	$5{,}000/f$	—
0.025–0.8 kHz	$250/f$	$4/f$	$5/f$	—
0.8–3 kHz	$250/f$	5	6.25	—
3–150 kHz	87	5	6.25	—
0.15–1 MHz	87	$0.73/f$	$0.92/f$	—
1–10 MHz	$87/f^{1/2}$	$0.73/f$	$0.92/f$	—
10–400 MHz	28	0.073	0.092	2
400–2,000 MHz	$1.375f^{1/2}$	$0.0037f^{1/2}$	$0.0046f^{1/2}$	$f/200$
2–300 GHz	61	0.16	0.20	10

[a] Note:
1. f as indicated in the frequency range column.
2. Provided that basic restrictions are met and adverse indirect effects can be excluded, field strength values can be exceeded.
3. For frequencies between 100 kHz and 10 GHz, S_{eq}, E^2, H^2, and B^2 are to averaged over any 6-min period.
4. For peak values at frequencies up to 100 kHz see Table 4, note 3.
5. For peak values at frequencies exceeding 100 kHz see Figs. 1 and 2. Between 100 kHz and 10 MHz, peak values for the field strengths are obtained by interpolation from the 1.5-fold peak at 100 kHz to the 32-fold peak at 10 MHz. For frequencies exceeding 10 MHz it is suggested that the peak equivalent plane wave power density, as averaged over the pulse width does not exceed 1,000 times the S_{eq} restrictions, or that the field strength does not exceed 32 times the field strength exposure levels given in the table.
6. For frequencies exceeding 10 GHz, S_{eq}, E^2, H^2, and B^2 are to be averaged over any $68/f^{1.05}$-min period (f in GHz).
7. No E-field value is provided for frequencies <1 Hz, which are effectively static electric fields. perception of surface electric charges will not occur at field strengths less than 25 kVm^{-1}. Spark discharges causing stress or annoyance should be avoided.

Reference levels: ICNIRP2020

Table 5. Reference levels for exposure, averaged over 30 min and the whole body, to electromagnetic fields from 100 kHz to 300 GHz (unperturbed rms values).[a]

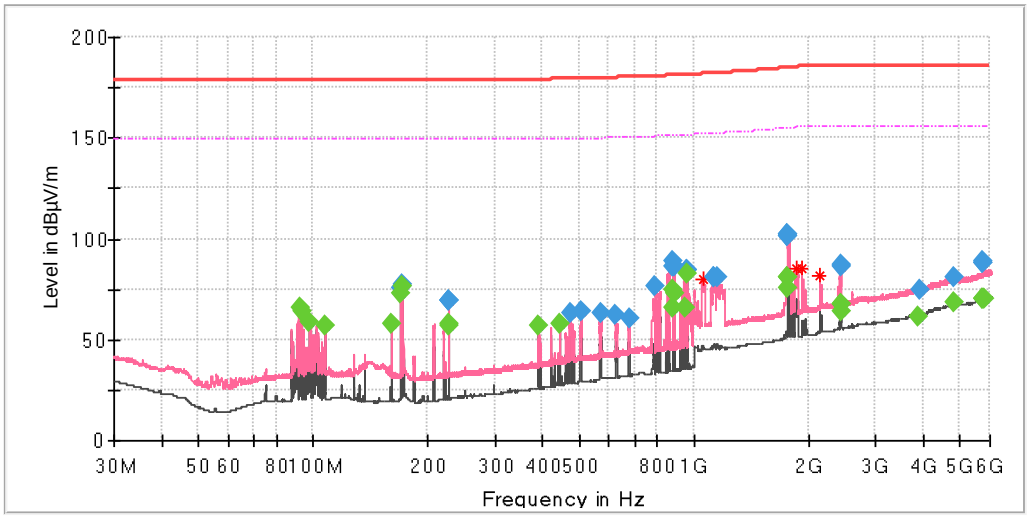
Exposure scenario	Frequency range	Incident E-field strength; E_{inc} (V m^{-1})	Incident H-field strength; H_{inc} (A m^{-1})	Incident power density; S_{inc} (W m^{-2})
Occupational	0.1 – 30 MHz	$660/f_M^{0.7}$	$4.9/f_M$	NA
	>30 – 400 MHz	61	0.16	10
	>400 – 2000 MHz	$3f_M^{0.5}$	$0.008f_M^{0.5}$	$f_M/40$
	>2 – 300 GHz	NA	NA	50
General public	0.1 – 30 MHz	$300/f_M^{0.7}$	$2.2/f_M$	NA
	>30 – 400 MHz	27.7	0.073	2
	>400 – 2000 MHz	$1.375f_M^{0.5}$	$0.0037f_M^{0.5}$	$f_M/200$
	>2 – 300 GHz	NA	NA	10

[a]Note:

1. "NA" signifies "not applicable" and does not need to be taken into account when determining compliance.
2. f_M is frequency in MHz.
3. S_{inc}, E_{inc}, and H_{inc} are to be averaged over 30 min, over the whole body space. Temporal and spatial averaging of each of E_{inc} and H_{inc} must be conducted by averaging over the relevant square values (see eqn 8 in Appendix A for details).
4. For frequencies of 100 kHz to 30 MHz, regardless of the far-field/near-field zone distinctions, compliance is demonstrated if neither E_{inc} or H_{inc} exceeds the above reference level values.
5. For frequencies of >30 MHz to 2 GHz: (a) within the far-field zone: compliance is demonstrated if either S_{inc}, E_{inc} or H_{inc}, does not exceed the above reference level values (only one is required); S_{eq} may be substituted for S_{inc}; (b) within the radiative near-field zone, compliance is demonstrated if either S_{inc}, or both E_{inc} and H_{inc}, does not exceed the above reference level values; and (c) within the reactive near-field zone: compliance is demonstrated if both E_{inc} and H_{inc} do not exceed the above reference level values; S_{inc} cannot be used to demonstrate compliance, and so basic restrictions must be assessed.
6. For frequencies of >2 GHz to 300 GHz: (a) within the far-field zone: compliance is demonstrated if S_{inc} does not exceed the above reference level values; S_{eq} may be substituted for S_{inc}; (b) within the radiative near-field zone, compliance is demonstrated if S_{inc} does not exceed the above reference level values; and (c) within the reactive near-field zone, reference levels cannot be used to determine compliance, and so basic restrictions must be assessed.

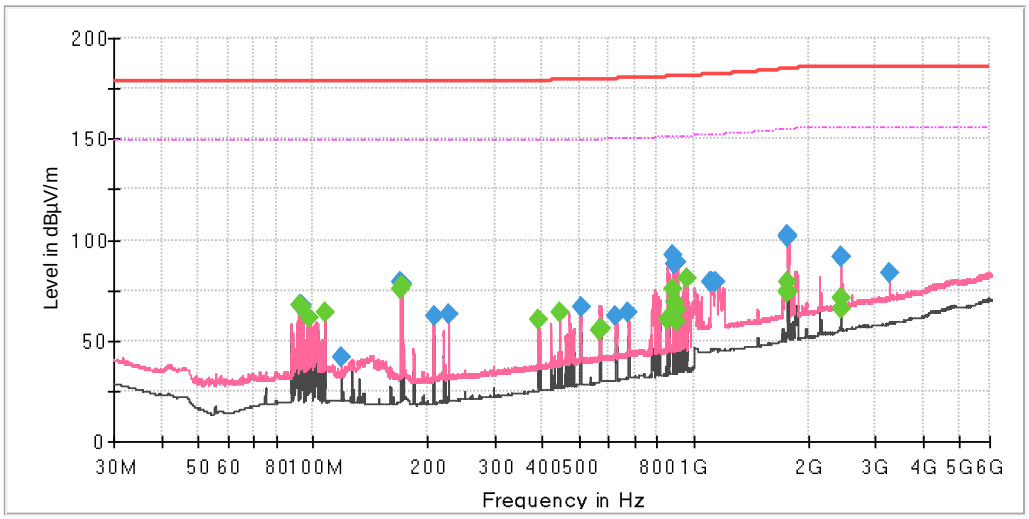
ANNEX 2 – Measurement data – Ambient background

Operating mode : Background / Position A (35 m.)
Antenna height : 2 m.



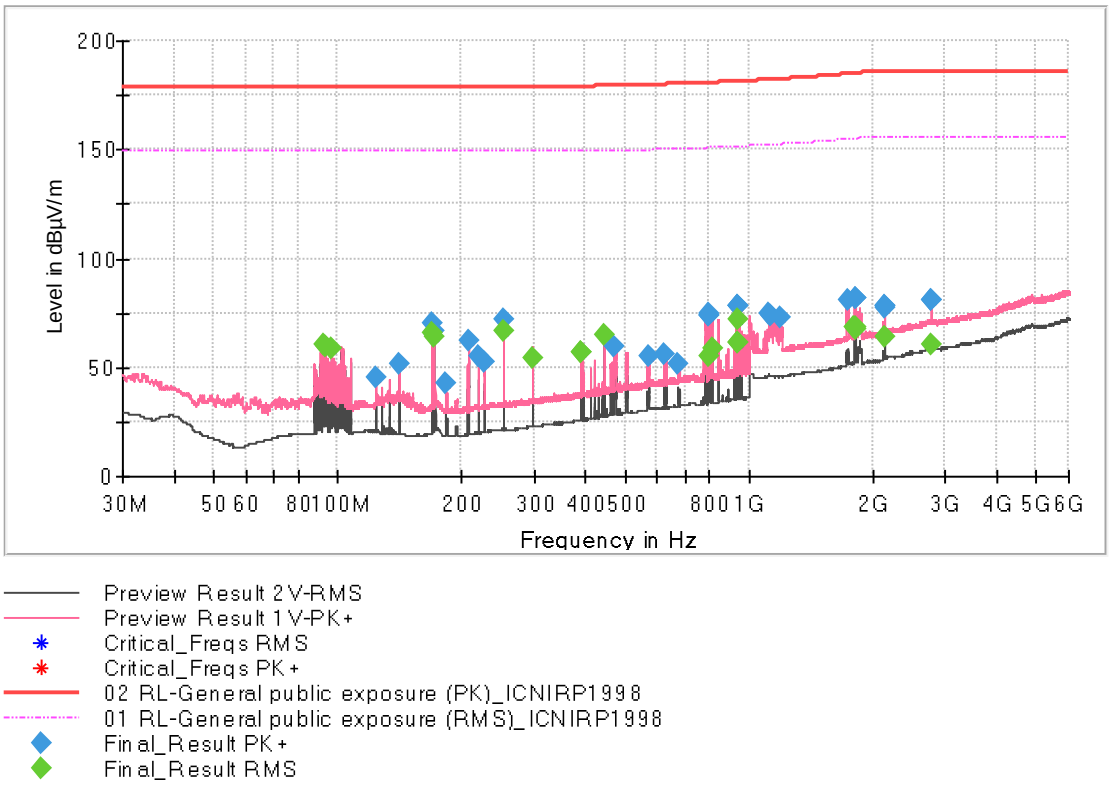
Preview Result 2V-RMS
Preview Result 1V-PK+
Critical_Freqs RMS
Critical_Freqs PK+
02 RL-General public exposure (PK)_ICNIRP1998
01 RL-General public exposure (RMS)_ICNIRP1998
Final_Result PK+
Final_Result RMS

Operating mode : Background / Position A (35 m.)
Antenna height : 4 m.



Preview Result 2V-RMS
Preview Result 1V-PK+
Critical_Freqs RMS
Critical_Freqs PK+
02 RL-General public exposure (PK)_ICNIRP1998
01 RL-General public exposure (RMS)_ICNIRP1998
Final_Result PK+
Final_Result RMS

Operating mode : Background / Position E (710 m)
Antenna height : 2 m.



Preview Result 2V-RMS
Preview Result 1V-PK+
Critical_Freqs RMS
Critical_Freqs PK+
02 RL-General public exposure (PK)_ICNIRP1998
01 RL-General public exposure (RMS)_ICNIRP1998
Final_Result PK+
Final_Result RMS

End of the Report