EMI – TEST REPORT

- FCC Part 15B -

Type / Model Name	:	Active Cradle AC3
Product Description	:	Charging cradle with ZigBee
Applicant	:	Libify Technologies GmbH
Address	:	Rüdesheimer Straße 11
		80686 MÜNCHEN, GERMANY
Manufacturer	:	Libify Technologies GmbH
Address	:	Rüdesheimer Straße 11
		80686 MÜNCHEN, GERMANY

Test Result according to the standards listed in clause 1 test standards:	**POSITIVE**

Test Report No. : T40862-00-03KS	03. April 2018 Date of issue

Deutsche Akkreditierungsstelle
D-PL-12030-01-01
D-PL-12030-01-02

Contents

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15 Subpart A - General (September, 2016)

Part 15, Subpart A, Section 15.31	Measurement standards
Part 15, Subpart A, Section 15.33	Frequency range of radiated measurements
Part 15, Subpart A, Section 15.35	Measurement detector functions and bandwidths

FCC Rules and Regulations Part 15 Subpart B - Unintentional Radiators (September, 2016)

Part 15, Subpart B, Section 15.107	AC Line conducted emission ☐ Class A device ☒ Class B device
Part 15, Subpart B, Section 15.109	Radiated emission, general requirements
Part 15, Subpart B, Section 15.111	Antenna power conduction
ANSI C63.4: 2014	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
CISPR 16-4-2: 2011 EN 55016-4-2: 2011	Uncertainty in EMC measurement
CISPR 22: 2008 EN 55022: 2010	Information technology equipment

2 EQUIPMENT UNDER TEST

2.1 Photo documentation of the EUT – Detailed photos see ATTACHMENT A

2.2 Equipment category

ZigBee device

2.3 Short description of the equipment under test (EUT)

The EUT is a charging cradle AC3 for GeoCare GC5 and part of an emergency call system working in the 2.4 GHz ISM-Band. The EUT is compatible with the standard 802.15.4. A complete functional unit consists of a radio button, GEOCARE (GC5) and the EUT AC3. The EUT has only one integrated antenna, no temporary connector and no external antenna can be connected.

2.4 Variants of the EUT

None.

2.5 Antenna

The following antenna shall be used with the EUT:

Number	Type	Certification name	Plug	Frequency range (GHz)	Peak Gain (dBi)
1	Omni	SMD antenna	none	2.4	2.1

2.6 Transmit operating modes

The equipment under test was operated during the measurement under the following conditions:

- Active charging with GC5

- Standby mode without GC5

2.7 Power supply system utilised

Supply voltage, V_{nom}	:	115 V AC / 60 Hz (AC adaptor, USB connector)
Alternative voltage	:	5 V DC (USB powered by laptop computer or power adaptor) and internal power backup with 3.7 V accumulator pack.

2.8 Peripheral devices and interface cables

The following peripheral devices and interface cables are connected during the measurements:

- GeoCare GC5 Model : Supplied by manufacturer
- Laptop Model : Supplied by manufacturer
- _____ Model : _____

3 TEST RESULT SUMMARY

3.1 Final assessment

The equipment under test fulfills the EMI requirements cited in clause 1 test standards.

Date of receipt of test sample	:	acc. to storage records
Testing commenced on	:	23 January 2017
Testing concluded on	:	28 February 2017

Checked by:

Klaus Gegenfurtner
I confirm the correctness and integrity of this document.
2018.04.05 09:46:38 +02'00'

Klaus Gegenfurtner
Teamleader Radio

Tested by:

Kathrin Schiebl
I am the author of this document
2018.04.05 09:38:58 +02'00'

Kathrin Schiebl
Radio Team

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

CSA Group Bayern GmbH
Ohmstrasse 1-4
94342 STRASSKIRCHEN
GERMANY

4.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15-35 °C
Humidity:	30-60 %
Atmospheric pressure:	86-106 kPa

4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. It is noted that the expanded measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor k = 2. The true value is located in the corresponding interval with a probability of 95 % The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4-2 / 11.2003 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements“ and is documented in the quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, CSA Group Bayern GmbH, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Measurement Type	Range	Confidence Level	Calculated Uncertainty
AC power line conducted emissions	0.15 MHz to 30 MHz	95%	± 3.29 dB
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	± 3.71 dB
Radiated Spurious Emissions	1000 MHz to 10000 MHz	95%	± 2.34 dB

4.4 Measurement protocol for FCC

4.4.1 General information

4.4.1.1 Test methodology

Conducted and radiated disturbance testing is performed according to the procedures set out by the International Special Committee on Radio Interference (CISPR) Publication 22, European Standard EN 55022 as shown under section 1 of this report.

4.4.1.2 Justification

The equipment under test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral using the appropriate impedance characteristic or left unterminated. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

4.4.2 Details of test procedures

4.4.2.1 General standard information

The test methods used comply with CISPR Publication 22, EN 55022 - " Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement" and with ANSI C63.4 - "Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". In compliance with 47 CFR Part 15 Subpart A, Section 15.38 testing for FCC compliance may be achieved by following the procedures set out in ANSI C63.4 and applying the CISPR 22 limits.

4.4.3 Conducted emission

4.4.3.1 Description of measurement

The final level, expressed in dBµV, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC limit or to the CISPR limit.

To convert between dBµV and µV, the following conversions apply:

$$dB\mu V = 20*\log(\mu V)$$
$$\mu V = 10^{(dB\mu V/20)}$$

Conducted emissions on the 50 Hz and/or 60 Hz power interface of the EUT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection and a Line Impedance Stabilization Network (LISN) with 50 Ω / 50 µH (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimetres above the floor and is positioned 40 centimetres from the vertical ground plane (wall) of the screen room. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emissions are re-measured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

4.4.4 Radiated emission (electrical field 30 MHz - 1 GHz)

4.4.4.1 Description of measurement

Spurious emission from the EUT is measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarised antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection. Table top equipment is placed on a 1.0 X 1.5 m non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is established in accordance with ANSI C63.4. The interface cables that are closer than 40 centimetres to the ground plane are bundled in the centre in a serpentine fashion so that they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the centre of the table and to a screened room located outside the test area. The antenna is positioned in horizontal polarisation and is repeated vertically. To locate maximum emission from the test sample the antenna is varied in height from 1 to 4 metres and the EUT is rotated 360 degrees.
The final level in dBµV/m is calculated by add the antenna correction factor and cable loss factor (dB) on the reading from the EMI receiver (dBµV). The FCC or CISPR limit is subtracted from this result in order to provide the delta to limit listed in the measurement protocol.

Example:

Frequency		Reading level		Correction Factor		Level		CISPR Limit		Delta
(MHz)		(dBµV)		(dB/m)		(dBµV/m)		(dBµV/m)		(dB)
719.0		75.0	+	32.6	=	107.6	-	110.0	=	-2.4

4.4.5 Radiated emission (electrical field 1 GHz - 40 GHz)

4.4.5.1 Description of measurement

Radiated emission from the EUT are measured in the frequency range 1 GHz up to the maximum frequency as specified in 47 CFR Part 15, Subpart A, Section 15.33, using a spectrum analyser and appropriate linearly polarized antennas. Table top equipment is placed on a 1.0 X 1.5 metre non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is following set out in ANSI C63.4. The interface cables that are closer than 40 centimetres to the ground plane are bundled in the centre in a serpentine fashion so they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the centre of the table and to a screened room located outside the test area. Measurements are made in both the horizontal and vertical polarization planes in a fully anechoic room using a spectrum analyser set to max peak detector function and a resolution 1 MHz and video bandwidth 3 MHz for peak and 10 Hz for average measurement. The conditions determined as worst case will then be used for the final measurements. When the EUT is larger than the beam width of the measuring antenna it will be moved over the surface for the four sides of the equipment. Where appropriate, the test distance may be reduced in order to detect emission under better uncertainty and is calculated to the specified test distance.

5 TEST CONDITIONS AND RESULTS

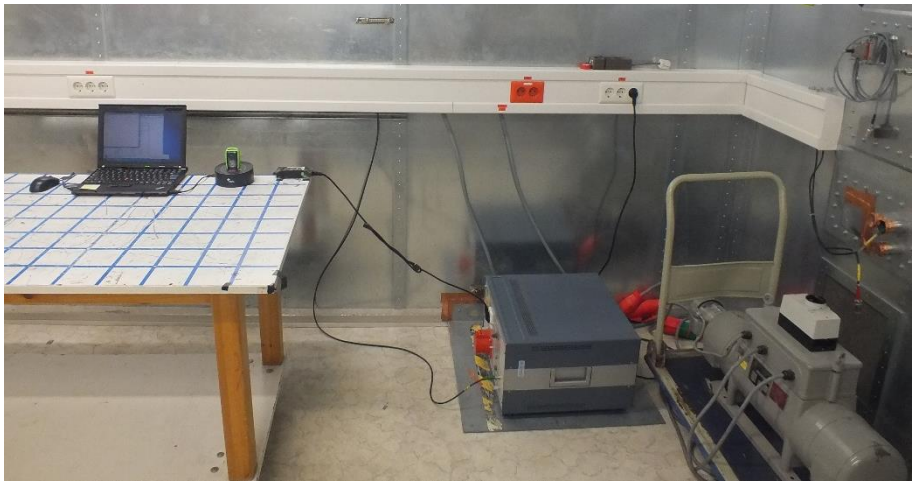
5.1 Conducted emission

For test instruments and accessories used see section 6 Part **A 4.**

5.1.1 Description of the test location

Test location: Shielded Room S2

5.1.2 Photo documentation of the test set-up



5.1.3 Applicable standard

According to FCC Part 15, Section 15.107(a):
Except for Class A devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the given limits.

5.1.4 Description of Measurement

The measurements are performed following the procedures set out in ANSI C63.4. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emissions are re-measured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

5.1.5 Test result

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin 13.18 dB at 0.471 MHz

Limit according to FCC Part 15, Section 15.107(a):

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

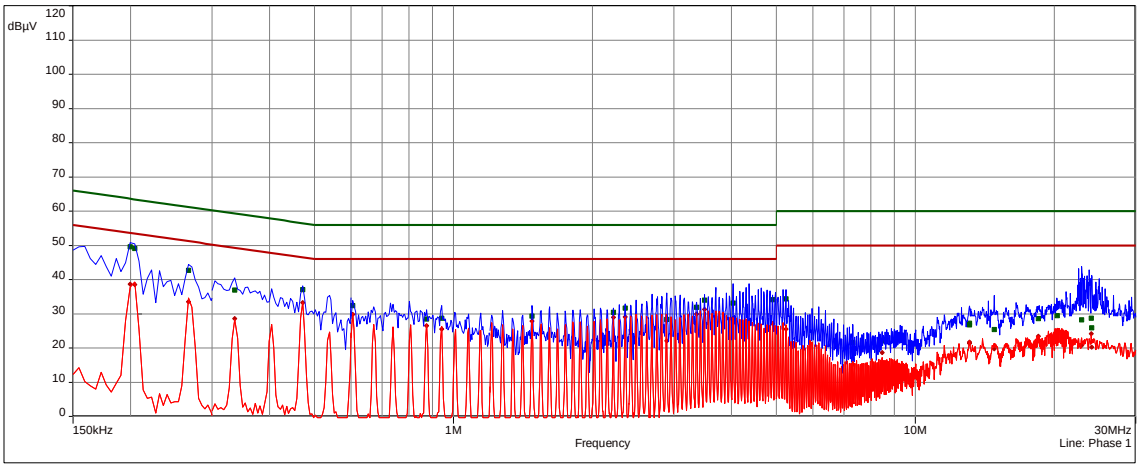
* Decreases with the logarithm of the frequency

The requirements are **FULFILLED.**

Remarks: For detailed test result please refer to following test protocols

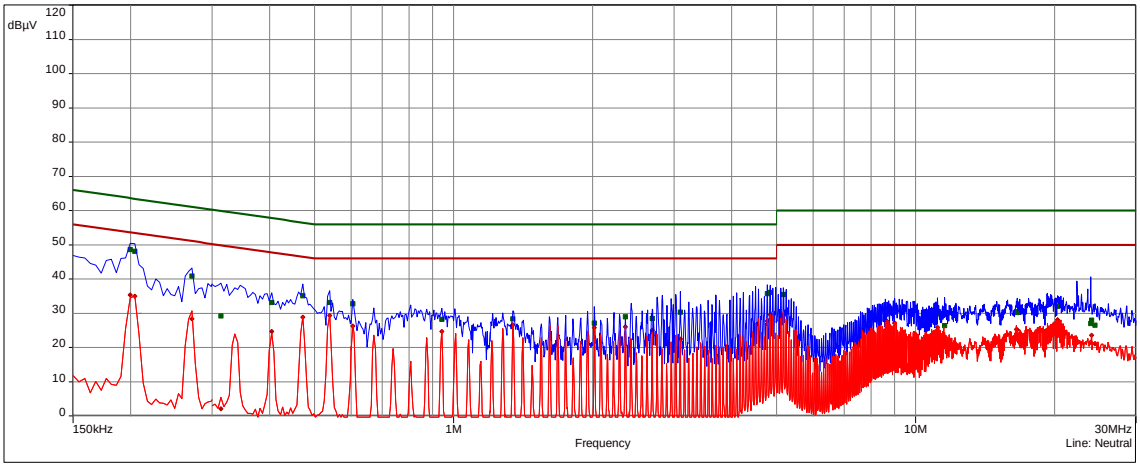
5.1.6 Test protocol

Test point L1 Result: positive
Operation mode: Active charging with GC5



Frequency (MHz)	QuasiPeak (dBµV)	QP Margin	QP Limit	Average (dBµV)	AV Margin	AV Limit	Line	Correction (dB)
0.1995	49.63	14.00	63.63	38.64	15.00	53.63	Phase 1	9.82
0.204	49.12	14.33	63.45	38.56	14.89	53.45	Phase 1	9.82
0.267	42.74	18.47	61.21	33.56	17.65	51.21	Phase 1	9.81
0.336	36.89	22.41	59.30	28.59	20.71	49.30	Phase 1	9.80
0.471	37.01	19.49	56.50	33.32	13.18	46.50	Phase 1	9.80
0.6045	32.44	23.56	56.00	29.81	16.19	46.00	Phase 1	9.80
0.8745	28.48	27.52	56.00	26.56	19.44	46.00	Phase 1	9.80
0.942	28.68	27.32	56.00	25.57	20.43	46.00	Phase 1	9.80
1.479	29.27	26.73	56.00	27.86	18.14	46.00	Phase 1	9.78
2.217	30.39	25.61	56.00	28.97	17.03	46.00	Phase 1	9.79
2.352	31.72	24.28	56.00	29.14	16.86	46.00	Phase 1	9.79
2.895	28.41	27.59	56.00	22.05	23.95	46.00	Phase 1	9.79
3.3585	31.88	24.12	56.00	29.93	16.07	46.00	Phase 1	9.81
3.4935	34.02	21.98	56.00	31.31	14.69	46.00	Phase 1	9.82
4.029	33.16	22.84	56.00	28.72	17.28	46.00	Phase 1	9.81
4.9035	34.07	21.93	56.00	27.16	18.84	46.00	Phase 1	9.82
5.241	34.42	25.58	60.00	25.55	24.45	50.00	Phase 1	9.83
7.3245	21.55	38.45	60.00	15.18	34.82	50.00	Phase 1	9.85
8.4675	22.04	37.96	60.00	18.61	31.39	50.00	Phase 1	9.86
13.083	26.76	33.24	60.00	21.39	28.61	50.00	Phase 1	10.03
13.0965	27.22	32.78	60.00	21.73	28.27	50.00	Phase 1	10.03
14.82	25.36	34.64	60.00	19.73	30.27	50.00	Phase 1	10.11
18.4785	28.54	31.46	60.00	23.47	26.53	50.00	Phase 1	10.27
20.289	29.40	30.60	60.00	24.06	25.94	50.00	Phase 1	10.34
22.8855	28.18	31.82	60.00	20.77	29.23	50.00	Phase 1	10.34
24.024	28.69	31.31	60.00	24.21	25.79	50.00	Phase 1	10.35
24.078	25.87	34.13	60.00	20.28	29.72	50.00	Phase 1	10.35

Test point: N Result: positive
Operation mode: Standby without GC5



Frequency (MHz)	QuasiPeak (dBµV)	QP Margin	QP Limit	Average (dBµV)	AV Margin	AV Limit	Line	Correction (dB)
0.1995	48.57	15.06	63.63	35.35	18.28	53.63	Neutral	9.84
0.204	48.06	15.39	63.45	35.03	18.42	53.45	Neutral	9.83
0.2715	40.87	20.20	61.07	28.33	22.74	51.07	Neutral	9.81
0.3135	29.18	30.70	59.88	2.05	47.83	49.88	Neutral	9.80
0.4035	33.11	24.67	57.78	24.64	23.14	47.78	Neutral	9.80
0.471	35.08	21.42	56.50	28.85	17.65	46.50	Neutral	9.80
0.5385	33.18	22.82	56.00	29.39	16.61	46.00	Neutral	9.81
0.6045	32.76	23.24	56.00	26.25	19.75	46.00	Neutral	9.80
0.942	28.18	27.82	56.00	24.65	21.35	46.00	Neutral	9.80
1.344	28.36	27.64	56.00	26.68	19.32	46.00	Neutral	9.78
2.0145	27.16	28.84	56.00	25.81	20.19	46.00	Neutral	9.80
2.352	28.94	27.06	56.00	26.08	19.92	46.00	Neutral	9.79
2.688	28.52	27.48	56.00	25.02	20.98	46.00	Neutral	9.78
3.093	30.36	25.64	56.00	22.45	23.55	46.00	Neutral	9.79
4.7715	35.72	20.28	56.00	27.68	18.32	46.00	Neutral	9.81
4.8405	36.07	19.93	56.00	29.59	16.41	46.00	Neutral	9.81
5.1735	35.48	24.52	60.00	29.44	20.56	50.00	Neutral	9.82
8.67	31.47	28.53	60.00	27.66	22.34	50.00	Neutral	9.82
9.0075	30.77	29.23	60.00	27.15	22.85	50.00	Neutral	9.82
11.157	29.88	30.12	60.00	25.88	24.12	50.00	Neutral	9.85
11.5485	26.40	33.60	60.00	20.84	29.16	50.00	Neutral	9.85
16.5345	30.43	29.57	60.00	25.31	24.69	50.00	Neutral	9.99
16.602	30.15	29.85	60.00	25.11	24.89	50.00	Neutral	9.99
20.3025	32.09	27.91	60.00	28.10	21.90	50.00	Neutral	10.12
23.934	27.02	32.98	60.00	21.43	28.57	50.00	Neutral	9.97
24.024	28.02	31.98	60.00	23.55	26.45	50.00	Neutral	9.97
24.456	26.54	33.46	60.00	21.10	28.90	50.00	Neutral	9.96

5.2 Radiated emission

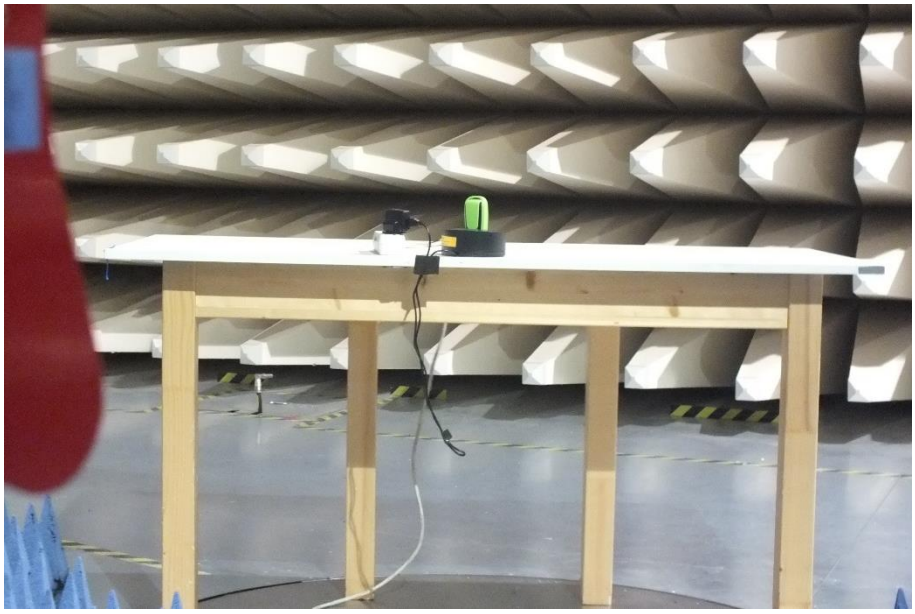
For test instruments and accessories used see section 6 Part **SER 2, SER 3**.

5.2.1 Description of the test location

Test location: OATS 1
Test distance: 10 m

Test location: Anechoic chamber 1
Test distance: 3 m

5.2.2 Photo documentation of the test setup



5.2.3 Applicable standard

According to FCC Part 15B, Section 15.109 (a):
Except for Class A digital devices, the field strength of radiated emission from unintentional radiators at a distance of 3 m shall not exceed the given limit.

5.2.4 Description of Measurement

The radiated emissions from the EUT are measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarized antennas. The setup of the EUT and the measurement procedure is in accordance to CISPR 22. In the frequency range above 1 GHz a spectrum analyser is used. If the emission level in peak mode complies with the average limit, testing is stopped and peak values will be reported, otherwise, the emission is measured in average mode again and both are reported. The EUT is measured in RX continuous mode under normal conditions.

Spectrum analyser settings:
30 MHz – 1000 MHz: RBW: 120 kHz
1000 MHz – 12.75 GHz: RBW: 1 MHz, VBW: 3 MHz, Sweep: Auto, Detector function: Peak

5.2.5 Test result

f < 1 GHz

Frequency (MHz)	Reading Vert. (dBµV)	Reading Hor. (dBµV)	Correct. Vert. (dB/m)	Correct. Hor. (dB/m)	Level Vert. (dBµV/m)	Level Hor. (dBµV/m)	Limit (dBµV/m)	Dlimit (dB)
38.54	9.1	5.7	14.4	14.1	23.5	19.8	30.0	-6.5
47.76	9.1	8.1	15.3	14.9	24.4	23.0	30.0	-5.6
51.82	9.4	6.3	15.2	14.9	24.6	21.2	30.0	-5.4
57.82	12.9	6.2	14.7	14.6	27.6	20.8	30.0	-2.4
72.46	16.4	6.8	13.0	12.9	29.4	19.7	30.0	-0.6
116.08	10.0	6.2	13.2	12.8	23.2	19.0	30.0	-6.8
130.98	10.8	6.7	14.3	14.2	25.1	20.9	30.0	-4.9
157.70	13.5	6.4	15.6	15.6	29.1	22.0	30.0	-0.9
182.29	15.5	6.8	13.9	14.2	29.4	21.0	30.0	-0.6
194.75	16.2	9.3	12.2	13.2	28.4	22.5	30.0	-1.6
208.30	14.5	13.9	11.9	13.1	26.4	27.0	30.0	-3.0
236.81	11.5	9.0	13.5	14.3	25.0	23.3	37.0	-12.0
450.00	8.2	8.2	21.3	21.5	29.5	29.7	37.0	-7.3
549.93	7.7	7.6	24.1	24.1	31.8	31.7	37.0	-5.2
600.00	7.7	7.7	25.6	25.5	33.3	33.2	37.0	-3.7
700.00	7.5	7.5	26.9	27.0	34.4	34.5	37.0	-2.5

f > 1 GHz

Frequency (MHz)	Reading Vert. (dBµV)	Reading Hor. (dBµV)	Correct. Vert. (dB/m)	Correct. Hor. (dB/m)	Level Vert. (dBµV/m)	Level Hor. (dBµV/m)	Limit (dBµV/m)	Dlimit (dB)
2458.00		60.9		-14.2		46.7	50.0	-3.3
3876.25	52.4		-11.8		40.6		54.0	-13.4
5836.00		41.4		4.5		45.9	54.0	-8.1
5800.00	41.8		4.6		46.3		54.0	-7.7

Limit according to FCC Part 15B, Section 15.109(a):

Frequency (MHz)	Limit (µV/m)	Limit (dBµV/m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

The requirements are **FULFILLED.**

Remarks: The measurement is performed according to FCC Part 15A, Section 15.33(b), up to the 5th harmonic.

6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
A 4	ESCI	02-02/03-15-001	31/05/2018	31/05/2017		
	ESH 2 - Z 5	02-02/20-05-004	26/10/2017	26/10/2015	24/05/2017	24/11/2016
	6001.17.A	02-02/50-05-128				
	N-4000-BNC	02-02/50-05-138				
	N-1500-N	02-02/50-05-140				
	ESH 3 - Z 2	02-02/50-05-155	18/11/2019	18/11/2016	21/10/2017	21/04/2017
SER 2	ESVS 30	02-02/03-05-003	12/07/2018	12/07/2017		
	VULB 9168	02-02/24-05-005	12/04/2018	12/04/2017	12/10/2017	12/04/2017
	NW-2000-NB	02-02/50-05-113				
	6001.17.A	02-02/50-05-128				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
	KK-SD_7/8-2X21N-33,0M	02-02/50-15-028				
SER 3	FSP 30	02-02/11-05-001	06/10/2017	06/10/2016		
	AFS4-01000400-10-10P-4	02-02/17-13-002				
	AMF-4F-04001200-15-10P	02-02/17-13-003				
	BBHA 9120 E 251	02-02/24-05-006	27/04/2018	27/04/2017	27/10/2017	27/04/2017
	WBH2-18NHG	02-02/24-08-002	27/04/2018	27/04/2017	27/10/2017	27/04/2017
	Sucoflex N-2000-SMA	02-02/50-05-075				
	6001.17.A	02-02/50-05-128				
	SF104/11N/11N/1500MM	02-02/50-13-015				
	SF104/11SMA/11N/1500MM	02-02/50-13-016				
	SF104/11SMA/11N/1500MM	02-02/50-13-017				