

EMI – TEST REPORT

- FCC 90.217 -

Type / Model Name : COR C-3-913-469

Product Description : Portable device for reading audio data from acoustical sensors and correlating these data

Applicant : Seba Dynatronic Mess- und Ortungstechnik GmbH

Address : Dr.-Herbert-lann-Str. 6
96148 BAUNACH, GERMANY

Manufacturer : Seba Dynatronic Mess- und Ortungstechnik GmbH

Address : Dr.-Herbert-lann-Str. 6
96148 BAUNACH, GERMANY

Licence holder : Seba Dynatronic Mess- und Ortungstechnik GmbH

Address : Dr.-Herbert-lann-Str. 6
96148 BAUNACH, GERMANY

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

POSITIVE

Test Report No. : **T40173-00-00KJ**

22. February 2016
Date of issue



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

The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

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Attachment A & B as separatly supplement

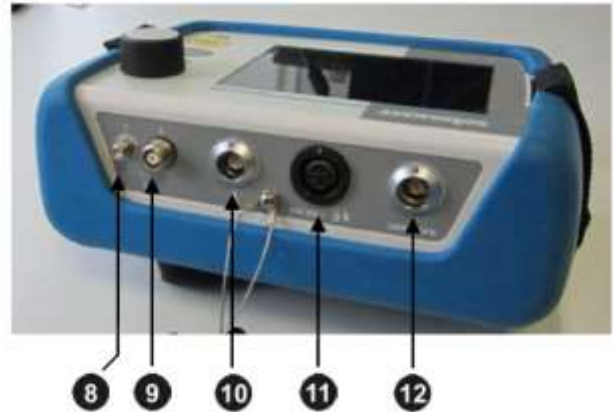
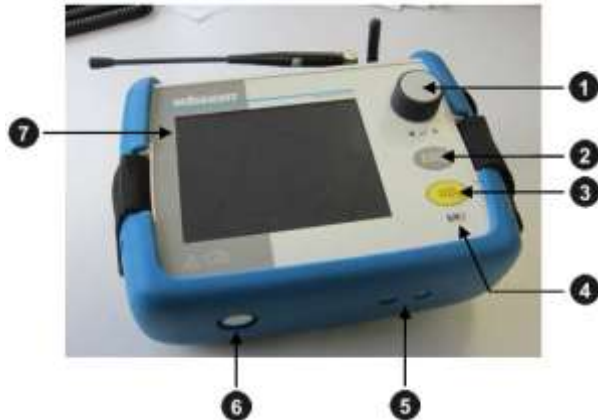
1 TEST STANDARDS

The tests were performed according to following standards:

FCC 47 CFR Part 2: 2015	Frequency allocations and radio treaty matters; General rules and regulations
FCC 47 CFR Part 15: 2015	Radio frequency devices
FCC 47 CFR Part 90: 2015	Private land mobile radio services
ANSI/TIA-603-C: 2004	Land Mobile FM or PM-Communications Equipment - Measurement and Performance Standards
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.
KDB 412172 D01: 2010	Determining ERP and EIRP

2 EQUIPMENT UNDER TEST

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



Item	Description
1	Rotary encoder Turning – Leads through the buttons and input fields displayed Pressing – Executes the selected button or enters the input field
2	ESC pushbutton exits the current menu and returns to the Start menu
3	I/O pushbutton Short – Switches the device on or activates the backlight Long – Switches the device off
4	Charging indicator light
5	Charging pins to charge the device wireless in the transport case
6	Ventilation / venting membrane

Item	Description
7	Touch screen (the Touch function can be enabled/disabled in the system settings)
8	Antenna 1 (digital radio) data transfer in Offline measurement mode
9	Antenna 2 (analogue radio) data transfer in Online measurement mode
10	Microphone connection socket for ground microphone
11	12V DC connection socket for headphone
12	USB / GPS combined connection socket for USB cable & GPS receiver

2.2 Short description of the equipment under test (EUT)

The COR C-3 is a portable device which is used to correlate audio data for leak detection in water pipes. The device communicates with the other devices of the Corrlux C-3 system. With the correlator it is possible to program/configure the Multisensors (COR MS-3) and receive the analog signal of the Power-Transmitters (COR PT-3).

The digital communication (programming/configuring) is done at a frequency of 913 MHz. The receiving of analog audio signals from the Power-Transmitter is done at a frequency of 469 MHz. The correlator has two external connectors to connect two different antennas - one for digital communication and one for long range analog communication.

2.3 Variants of the EUT

- There are no other variants.

2.4 Test Jig

- No test jig is used.

2.5 Technical description of the equipment under test (EUT)

Items	Description
Power supply - internal	7.4 V DC (Li-ion rechargeable battery)
Digital radio:	
Type of modulation	FSK
Operating frequency	913.02 MHz
Frequency band	902 MHz to 928 MHz
Data rate	9.6 kBd
Channel spacing	-
Number of channels	1
Antenna type	stub antenna, SMA right angle
Antenna connector	SMA
Antenna gain	0 dBi
Analog radio:	
Type of modulation	analog FM
Operating frequency digital radio	468,5 MHz / 469,6 MHz
Frequency band	468,5 - 496,6 MHz
Data rate	
Channel spacing	25 kHz
Number of channels	1 per Transmitter UNIT
Antenna type	Antenne lambda ½ 460MHz
Antenna connector	BNC
Antenna gain	7 dBi
Lowest internal frequency	32.768 kHz
Highest internal frequency	26.000 MHz
Serial number	0859000294
Firmware version	202.004
Number of tested samples	1

2.6 Test software

- A special test software was used, to performe the different radio tests.



2.7 Transmit operating modes

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

- cont. TX at 913.02 MHz (unmodulated)

- cont. TX at 913.02 MHz (modulated)

- cont. RX mode

2.8 Peripheral devices and interface cables

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

- | | |
|---------------------|----------------------------|
| - Headphone | Model : Sennheiser HD 215 |
| - Microphone | Model : sebaKMT PAM CORP-2 |
| - USB adapter cable | Model : Seba |
| - Laptop | Model : Toshiba Tecra |

2.9 Determination of worst case conditions for final measurement

Measurements have been made in all three orthogonal axes and the settings of the EUT were changed to locate at which position and at what setting of the EUT produce the maximum of the emissions.

For the further measurement, the EUT is set in horizontal position with TX antenna in vertical orientation.

3 Test result summary

FCC Rule Part	Test Procedure	Description	Result
15.107(a)	ANSI C63.4:2014	AC power line conducted emissions	passed
90.217	ANSI/TIA-603-C-2004	Maximum output power	passed
90.217(a)	ANSI/TIA-603-C-2004	Spurious emissions radiated	passed
90.217(a)	ANSI/TIA-603-C-2004	Modulation characteristics	passed
General	ANSI/TIA-603-C-2004	Occupied bandwidth	passed
90.213(a)(b)	ANSI/TIA-603-C-2004	Frequency stability	passed
15.109	ANSI C63.4:2014	Receiver spurious emissions	passed

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 : 14 September 2015

Testing concluded on : 09 February 2016

Checked by:

Tested by:

Thomas Weise
Laboratory Manager

Josef Knab
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.

5 TEST RESULTS

5.1 Conducted emissions

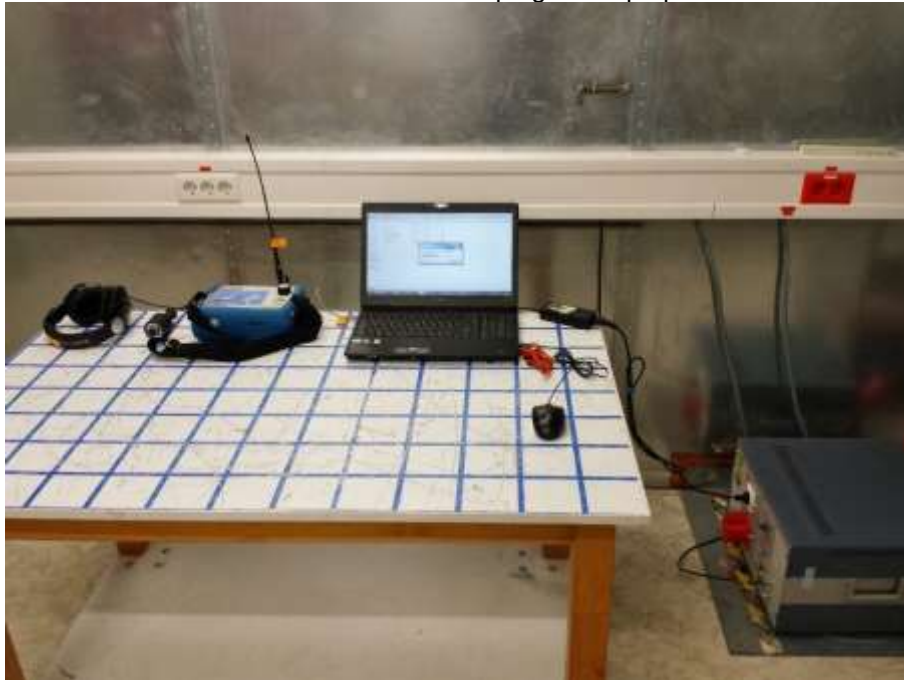
For test instruments and accessories used see section 6 Part A 4.

5.1.1 Description of the test location

Test location: Shielded Room S2

5.1.2 Photo documentation of the test set-up

Connected over USB plug to a laptop



FCC ID: OV8-CORC3**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 described under item 4.4.3. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emissions are remeasured 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 (AC powered) 13.2 dB at 21.51 MHz

Min. limit margin (USB powered) 9.76 dB at 20.80 MHz

Limit according to FCC Part 15, Section 15.207(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

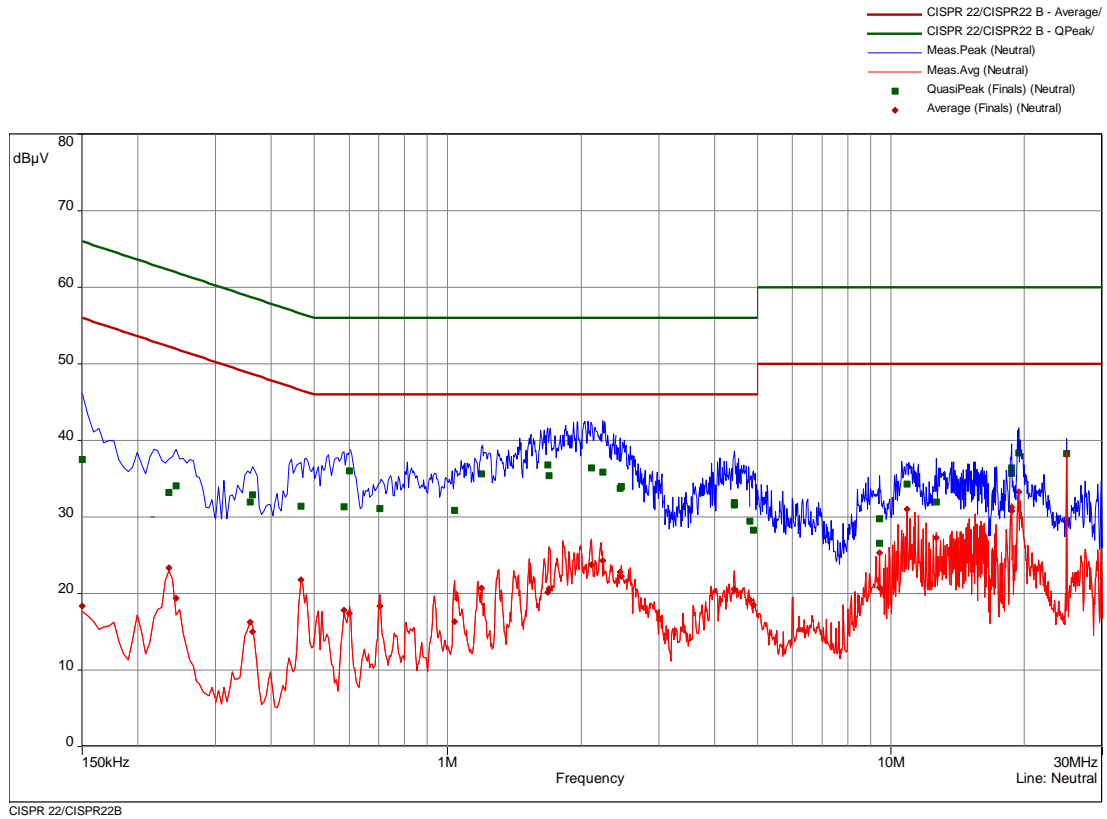
The requirements are **FULFILLED**.

Remarks: For detailed test results please see the following test protocols.

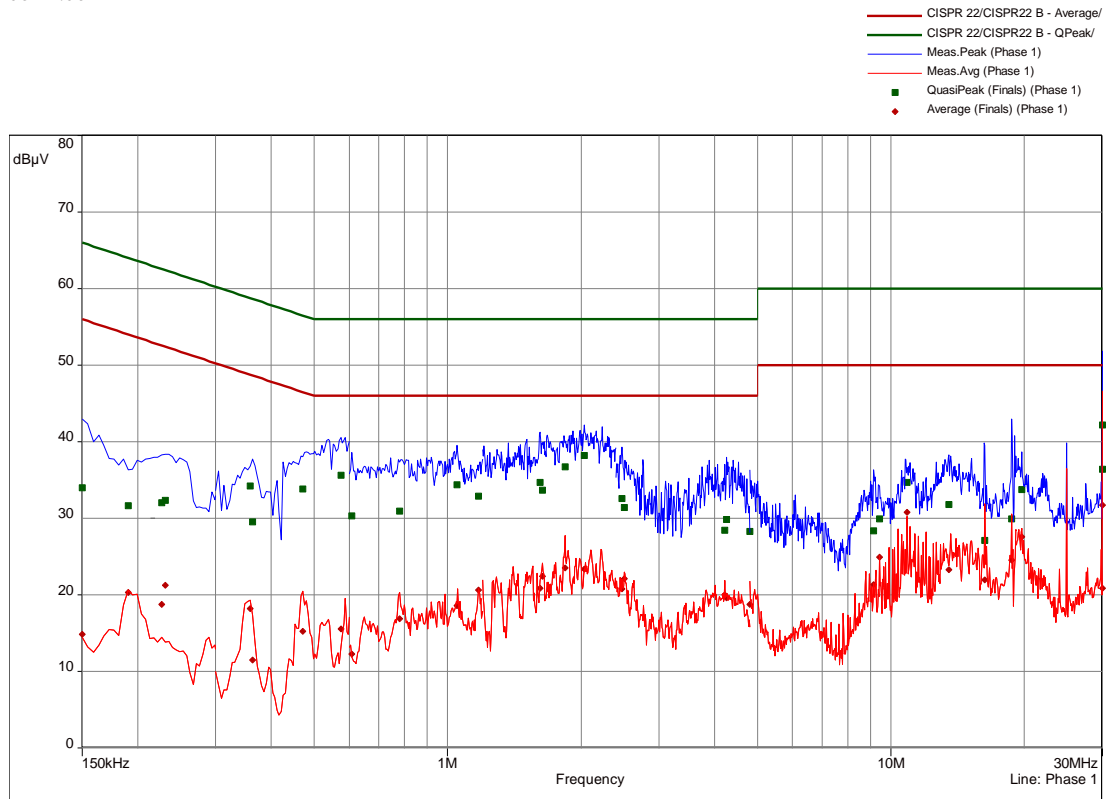
5.1.6 Test protocol

Test point N & L1 connected over laptop / USB
 Operation mode: RX continuous mode
 Remarks: None
 Date: 26. November 2015

Result: passed



CISPR 22/CISPR22B



CISPR 22/CISPR22B

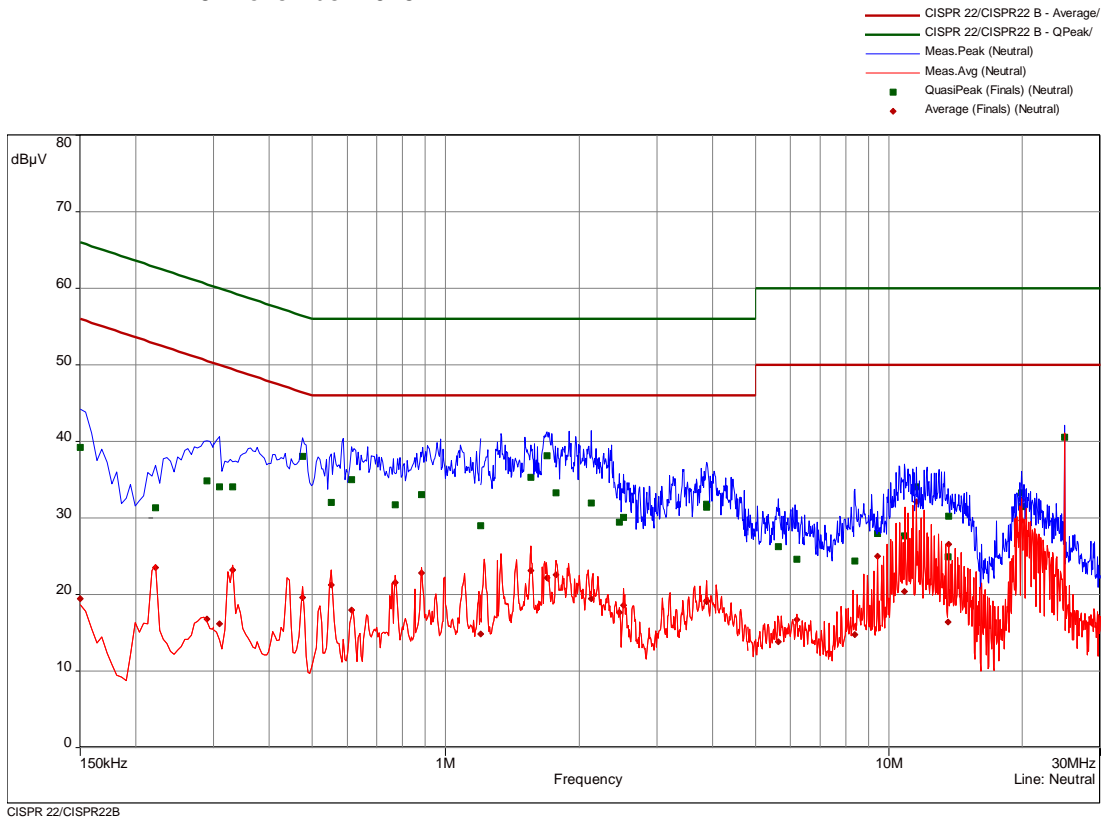
FCC ID: OV8-CORC3

freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(μV)	dB	dB	dB(μV)	dB	dB		dB
0.15	1	34.00	32.00	66.00	14.85	41.15	56.00	Phase 1	9.84
0.1905	1	31.68	32.33	64.01	20.30	33.71	54.01	Phase 1	9.83
0.2265	1	32.07	30.51	62.58	18.79	33.79	52.58	Phase 1	9.83
0.231	1	32.39	30.03	62.41	21.28	31.13	52.41	Phase 1	9.83
0.3585	2	34.24	24.53	58.76	18.19	30.57	48.76	Phase 1	9.81
0.363	2	29.53	29.13	58.66	11.52	37.14	48.66	Phase 1	9.81
0.471	2	33.81	22.69	56.50	15.27	31.23	46.50	Phase 1	9.82
0.5745	2	35.63	20.37	56.00	15.59	30.41	46.00	Phase 1	9.82
0.609	3	30.35	25.65	56.00	12.26	33.74	46.00	Phase 1	9.82
0.78	3	30.94	25.06	56.00	16.88	29.12	46.00	Phase 1	9.80
1.05	3	34.37	21.63	56.00	18.57	27.43	46.00	Phase 1	9.81
1.176	3	32.91	23.09	56.00	20.63	25.37	46.00	Phase 1	9.80
1.6185	4	34.70	21.30	56.00	20.89	25.11	46.00	Phase 1	9.79
1.6365	4	33.65	22.35	56.00	22.45	23.55	46.00	Phase 1	9.79
1.8435	4	36.71	19.29	56.00	23.54	22.46	46.00	Phase 1	9.80
2.037	4	38.19	17.81	56.00	23.35	22.65	46.00	Phase 1	9.81
2.4765	5	32.58	23.42	56.00	20.76	25.24	46.00	Phase 1	9.79
2.508	5	31.43	24.57	56.00	22.11	23.89	46.00	Phase 1	9.79
4.218	5	28.44	27.56	56.00	20.02	25.98	46.00	Phase 1	9.81
4.2585	5	29.87	26.13	56.00	19.62	26.38	46.00	Phase 1	9.81
4.8135	6	28.27	27.73	56.00	18.74	27.26	46.00	Phase 1	9.82
9.147	6	28.40	31.60	60.00	21.31	28.69	50.00	Phase 1	9.87
9.4305	6	29.89	30.11	60.00	24.94	25.06	50.00	Phase 1	9.88
10.86	7	34.69	25.31	60.00	30.75	19.25	50.00	Phase 1	9.93
13.5285	7	31.81	28.19	60.00	23.27	26.73	50.00	Phase 1	10.04
16.296	7	27.15	32.85	60.00	21.94	28.06	50.00	Phase 1	10.17
18.744	7	29.96	30.04	60.00	24.51	25.49	50.00	Phase 1	10.27
19.7175	8	33.73	26.27	60.00	27.59	22.41	50.00	Phase 1	10.33
29.9955	8	36.45	23.55	60.00	20.87	29.13	50.00	Phase 1	10.33
30	8	42.23	17.77	60.00	31.76	18.24	50.00	Phase 1	10.33
0.15	9	37.54	28.46	66.00	18.36	37.64	56.00	Neutral	9.84
0.2355	9	33.24	29.01	62.25	23.40	28.86	52.25	Neutral	9.84
0.2445	9	34.10	27.84	61.94	19.41	32.53	51.94	Neutral	9.84
0.3585	10	31.96	26.80	58.76	16.24	32.52	48.76	Neutral	9.81
0.363	10	32.89	25.77	58.66	14.99	33.67	48.66	Neutral	9.81
0.4665	10	31.45	25.13	56.58	21.81	24.77	46.58	Neutral	9.82
0.5835	10	31.34	24.66	56.00	17.83	28.17	46.00	Neutral	9.82
0.6	11	36.04	19.96	56.00	17.43	28.57	46.00	Neutral	9.82
0.7035	11	31.13	24.87	56.00	18.34	27.66	46.00	Neutral	9.81
1.0365	11	30.88	25.12	56.00	16.32	29.68	46.00	Neutral	9.81
1.194	11	35.63	20.37	56.00	20.74	25.26	46.00	Neutral	9.80
1.686	12	36.82	19.18	56.00	20.14	25.86	46.00	Neutral	9.79
1.695	12	35.41	20.59	56.00	20.61	25.39	46.00	Neutral	9.79
2.1135	12	36.42	19.58	56.00	23.73	22.27	46.00	Neutral	9.80
2.2395	12	35.89	20.11	56.00	24.28	21.72	46.00	Neutral	9.80
2.4495	13	33.79	22.21	56.00	22.79	23.21	46.00	Neutral	9.79
2.4675	13	33.97	22.03	56.00	22.24	23.76	46.00	Neutral	9.79
4.4295	13	31.60	24.40	56.00	20.56	25.44	46.00	Neutral	9.80
4.434	13	31.87	24.13	56.00	20.57	25.43	46.00	Neutral	9.80
4.8	14	29.44	26.56	56.00	19.16	26.84	46.00	Neutral	9.81
4.899	14	28.26	27.74	56.00	18.50	27.50	46.00	Neutral	9.81
9.426	14	26.53	33.47	60.00	20.79	29.21	50.00	Neutral	9.82
9.4305	14	29.79	30.21	60.00	25.33	24.67	50.00	Neutral	9.82
10.86	15	34.32	25.68	60.00	30.99	19.01	50.00	Neutral	9.84
12.669	15	31.93	28.07	60.00	27.27	22.73	50.00	Neutral	9.88
18.699	15	36.39	23.61	60.00	31.29	18.71	50.00	Neutral	10.07
18.7035	15	35.74	24.26	60.00	30.80	19.20	50.00	Neutral	10.07
19.407	16	38.36	21.64	60.00	33.28	16.72	50.00	Neutral	10.10
24.8925	16	38.26	21.74	60.00	38.10	11.90	50.00	Neutral	9.94

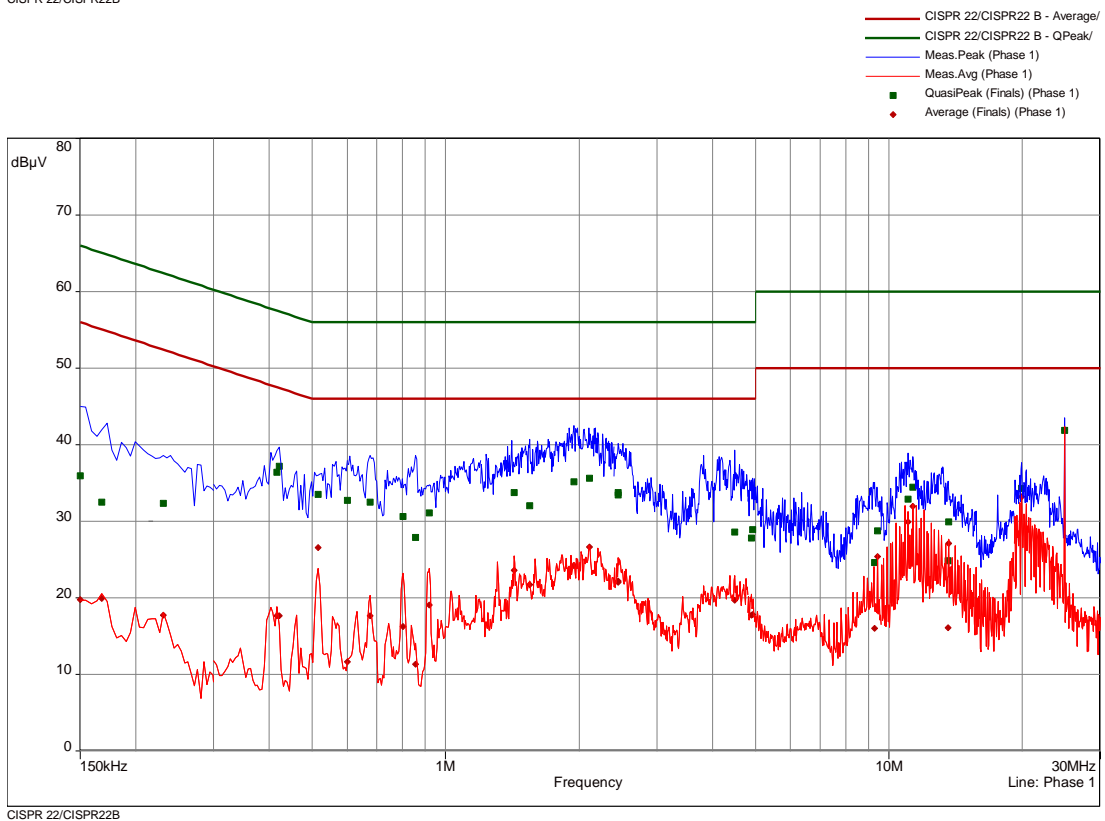
FCC ID: OV8-CORC3

Test point N & L1 connected over laptop / USB
 Operation mode: TX continuous mode
 Remarks: None
 Date: 26. November 2015

Result: passed



CISPR 22/CISPR22B



CISPR 22/CISPR22B

FCC ID: OV8-CORC3

freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(μV)	dB	dB	dB(μV)	dB	dB		dB
0.15	1	35.95	30.05	66.00	19.76	36.24	56.00	Phase 1	9.84
0.168	1	32.48	32.58	65.06	19.91	35.15	55.06	Phase 1	9.84
0.231	1	32.39	30.02	62.41	17.77	34.65	52.41	Phase 1	9.83
0.417	2	36.42	21.08	57.51	17.66	29.84	47.51	Phase 1	9.81
0.4215	2	37.20	20.21	57.42	17.66	29.76	47.42	Phase 1	9.81
0.516	2	33.54	22.46	56.00	26.55	19.45	46.00	Phase 1	9.82
0.6	2	32.72	23.28	56.00	11.67	34.33	46.00	Phase 1	9.82
0.6765	3	32.47	23.53	56.00	17.69	28.31	46.00	Phase 1	9.81
0.8025	3	30.63	25.37	56.00	16.29	29.71	46.00	Phase 1	9.81
0.8565	3	27.88	28.12	56.00	11.35	34.65	46.00	Phase 1	9.81
0.9195	3	31.12	24.88	56.00	19.10	26.90	46.00	Phase 1	9.82
1.4295	4	33.72	22.28	56.00	23.61	22.39	46.00	Phase 1	9.79
1.5465	4	32.02	23.98	56.00	21.72	24.28	46.00	Phase 1	9.78
1.947	4	35.15	20.85	56.00	24.22	21.78	46.00	Phase 1	9.81
2.109	4	35.61	20.39	56.00	26.63	19.37	46.00	Phase 1	9.80
2.4495	5	33.48	22.52	56.00	22.01	23.99	46.00	Phase 1	9.79
2.454	5	33.75	22.25	56.00	22.22	23.78	46.00	Phase 1	9.79
4.488	5	28.56	27.44	56.00	19.67	26.33	46.00	Phase 1	9.81
4.9035	6	27.85	28.15	56.00	17.77	28.23	46.00	Phase 1	9.82
4.926	6	28.91	27.09	56.00	17.82	28.18	46.00	Phase 1	9.82
9.2955	6	24.60	35.40	60.00	16.04	33.96	50.00	Phase 1	9.88
9.4305	6	28.73	31.27	60.00	25.39	24.61	50.00	Phase 1	9.88
11.0535	7	32.93	27.07	60.00	29.97	20.03	50.00	Phase 1	9.94
11.337	7	34.48	25.52	60.00	31.95	18.05	50.00	Phase 1	9.94
13.6095	7	24.82	35.18	60.00	16.10	33.90	50.00	Phase 1	10.04
13.623	7	29.94	30.06	60.00	27.10	22.90	50.00	Phase 1	10.05
19.911	8	34.34	25.66	60.00	33.20	16.80	50.00	Phase 1	10.34
24.8925	8	41.87	18.13	60.00	41.93	8.07	50.00	Phase 1	10.35
0.15	9	39.23	26.77	66.00	19.48	36.52	56.00	Neutral	9.84
0.222	9	31.35	31.40	62.74	23.53	29.21	52.74	Neutral	9.85
0.2895	9	34.82	25.72	60.54	16.79	33.75	50.54	Neutral	9.82
0.309	10	34.10	25.90	60.00	16.15	33.85	50.00	Neutral	9.82
0.3315	10	34.07	25.34	59.41	23.17	26.24	49.41	Neutral	9.81
0.4755	10	38.05	18.36	56.42	19.63	26.79	46.42	Neutral	9.82
0.552	10	32.05	23.95	56.00	21.28	24.72	46.00	Neutral	9.82
0.6135	11	35.00	21.00	56.00	17.95	28.05	46.00	Neutral	9.82
0.771	11	31.69	24.31	56.00	21.59	24.41	46.00	Neutral	9.80
0.8835	11	33.06	22.94	56.00	22.81	23.19	46.00	Neutral	9.81
1.2	11	29.02	26.98	56.00	14.83	31.17	46.00	Neutral	9.80
1.5555	12	35.33	20.67	56.00	23.16	22.84	46.00	Neutral	9.78
1.695	12	38.17	17.83	56.00	22.18	23.82	46.00	Neutral	9.79
1.776	12	33.29	22.71	56.00	22.55	23.45	46.00	Neutral	9.79
2.1315	12	31.94	24.06	56.00	19.48	26.52	46.00	Neutral	9.80
2.463	13	29.48	26.52	56.00	17.65	28.35	46.00	Neutral	9.79
2.5215	13	30.08	25.92	56.00	18.60	27.40	46.00	Neutral	9.79
3.8805	13	31.39	24.61	56.00	19.26	26.74	46.00	Neutral	9.81
3.885	13	31.83	24.17	56.00	19.06	26.94	46.00	Neutral	9.81
5.6235	14	26.29	33.71	60.00	13.86	36.14	50.00	Neutral	9.81
6.195	14	24.64	35.36	60.00	16.71	33.29	50.00	Neutral	9.81
8.3775	14	24.41	35.59	60.00	14.78	35.22	50.00	Neutral	9.81
9.4305	14	28.00	32.00	60.00	25.01	24.99	50.00	Neutral	9.82
10.8375	15	27.65	32.35	60.00	20.36	29.64	50.00	Neutral	9.84
11.526	15	34.05	25.95	60.00	32.13	17.87	50.00	Neutral	9.85
13.6005	15	24.91	35.09	60.00	16.39	33.61	50.00	Neutral	9.90
13.623	15	30.25	29.75	60.00	26.57	23.43	50.00	Neutral	9.90
19.911	16	33.25	26.75	60.00	32.35	17.65	50.00	Neutral	10.13
19.9425	16	31.48	28.52	60.00	29.72	20.28	50.00	Neutral	10.13
24.8925	16	40.57	19.43	60.00	40.65	9.35	50.00	Neutral	9.94

5.2 Maximum output power radiated

For test instruments and accessories used see section 6 Part CPR 2.

5.2.1 Description of the test location

Test location: OATS 1

Test distance: 10 m

5.2.2 Photo documentation of the test set-up



5.2.3 Applicable standard

According to FCC Part 90.217:

Except as noted herein, transmitters used at stations licensed below 800 MHz on any frequency listed in subparts B and C of this part or licensed on a business category channel above 800 MHz which have an output power not exceeding 120 mW are exempt from the technical requirements set out in this subpart, but must instead comply with the following:

(a) For equipment designed to operate with a 25 kHz channel bandwidth, the sum of the bandwidth occupied by the emitted signal plus the bandwidth required for frequency stability shall be adjusted so that any emission appearing on a frequency 40 kHz or more removed from the assigned frequency is attenuated at least 30 dB below the unmodulated carrier.

5.2.4 Description of Measurement

The maximum output power 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 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 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 10 metres horizontally from the EUT and is repeated vertically. To locate maximum emissions 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 dBm is calculated by taking the reading from the EMI receiver (Level dB μ V) and adding the correction factors (cable loss, antenna gain, free space attenuation). The FCC or CISPR limit is subtracted from this result in order to provide the limit margin listed in the measurement protocol.

The substitution antenna is used to replace the EUT for test the effective radiated. For measurements in the frequency band 30 MHz to 1 000 MHz, the substitution antenna is a $\frac{1}{2}$ wave dipole antenna. The centre of this antenna should coincide with either the phase centre or volume centre. A signal generator is connected to the dipole and its output is adjusted to match the level previously noted for each frequency. The output of the signal generator is recorded, and by factoring in the cable loss to the dipole antenna and its gain.

The radiated power of the fundamental emission from the EUT is measured in a test setup following the procedures set out in ANSI/TIA-603-C Section 2.2.17.

The resolution bandwidth during the measurement is as follows:

30 MHz – 1000 MHz: RBW: 120 kHz

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5.2.5 Test result

EuT in horizontal position – TX antenna vertical

Frequency (MHz)	Level PK (dBμV)	Bandwidth (kHz)	Correct. factor (dB)	Corrected power ERP (dBm)	Power limit (dBm)	Delta (dB)
913.02	60.2	120	-59.7	0.5	20.8	20.3

EuT in vertical position – TX antenna horizontal

Frequency (MHz)	Level PK (dBμV)	Bandwidth (kHz)	Correct. factor (dB)	Corrected power ERP (dBm)	Power limit (dBm)	Delta (dB)
913.02	59.5	120	-59.7	-0.2	20.8	21.0

Power limit according to FCC Part 90.217:

Frequency (MHz)	Radiated power limit	
	(dBm)	(mW)
>800	20.8	120

The requirements are **FULFILLED**.

Remarks:

5.3 Spurious emissions radiated (electric field)

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

5.3.1 Description of the test location

Test location: OATS 1
Test distance: 10 m

Test location: Anechoic chamber 1
Test distance: 3 m

5.3.2 Photo documentation of the test set-up

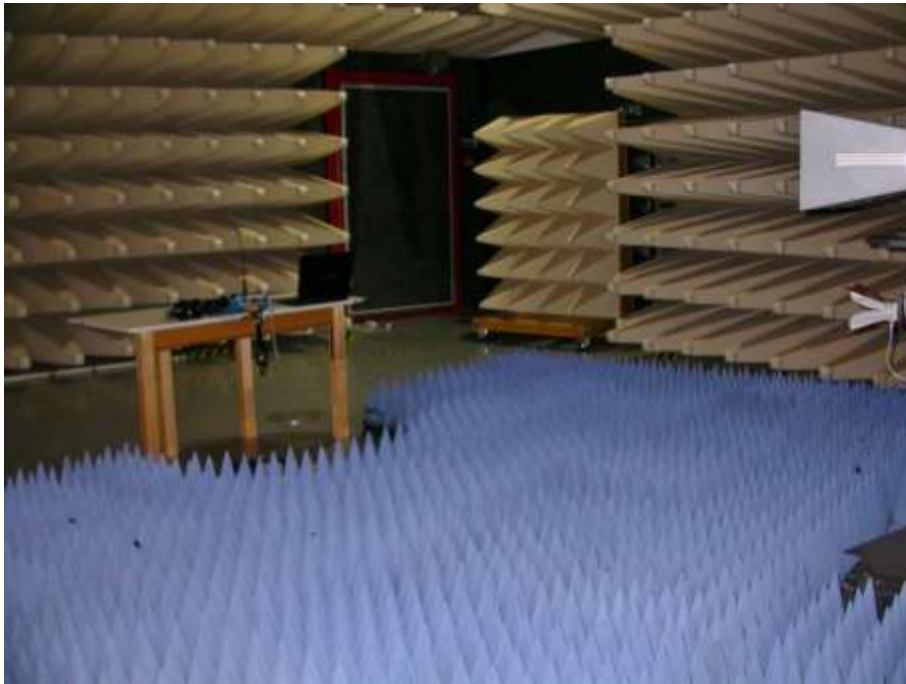


OATS1 – 10 m – 30 MHz to 1000 MHz



OATS1 – 10 m – 30 MHz to 1000 MHz

FCC ID: OV8-CORC3



A1 – 3 m – 1 GHz to 12.75 GHz



A1 – 3 m – 1 GHz to 12.75 GHz

5.3.3 Applicable standard

According to FCC Part 90.217(a):

(a) For equipment designed to operate with a 25 kHz channel bandwidth, the sum of the bandwidth occupied by the emitted signal plus the bandwidth required for frequency stability shall be adjusted so that any emission appearing on a frequency 40 kHz or more removed from the assigned frequency is attenuated at least 30 dB below the unmodulated carrier.

5.3.4 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 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 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 10 metres horizontally from the EUT and is repeated vertically. To locate maximum emissions 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 dBm is calculated by taking the reading from the EMI receiver (Level dB μ V) and adding the correction factors (cable loss, antenna gain, free space attenuation). The FCC or CISPR limit is subtracted from this result in order to provide the limit margin listed in the measurement protocol.

Spurious emission from the EUT are measured in the frequency range 1 GHz up to 12.75 GHz, 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 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 emissions under better uncertainty and are calculated at the specified test distance.

The final level in dBm is calculated by taking the reading from the spectrum analyser (Level dBm) and adding the correction factors (cable loss, antenna gain, free space attenuation). The FCC or CISPR limit is subtracted from this result in order to provide the limit margin listed in the measurement protocol.

The substitution antenna is used to replace the EUT for test the effective radiated power and spurious emissions. For measurements in the frequency band 30 MHz to 1 000 MHz, the substitution antenna is a $\frac{1}{2}$ wave dipole antenna. For measurements above 1000 MHz, a waveguide horn is taken. The centre of this antenna should coincide with either the phase centre or volume centre. A signal generator is connected to the dipole (horn antenna for frequencies above 1 GHz), and its output is adjusted to match the level previously noted for each frequency. The output of the signal generator is recorded, and by factoring in the cable loss to the dipole antenna and its gain; the power (dBm) into an ideal $\frac{1}{2}$ wave dipole antenna is determined for each radiated spurious emission.

The radiated power of the spurious emission from the EUT is measured in a test setup following the procedures set out in ANSI/TIA-603-C Section 2.2.12.

Instrument settings:

30 MHz – 1000 MHz:	RBW: 120 kHz
1000 MHz – 12750 MHz	RBW: 1 MHz

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5.3.5 Test result $f < 1$ GHz

Frequency (MHz)	Level PK (dB μ V)	Bandwidth (kHz)	Correct. factor (dB)	Corrected power ERP (dBm)	Power limit (dBm)	Delta (dB)
74.67	10.5	120	-76.7	-66.2	-29.5	-36.7
124.45	22.3	120	-77.5	-55.2	-29.5	-25.7
125.00	5.5	120	-79.5	-74.0	-29.5	-44.5
129.56	16.2	120	-77.3	-61.1	-29.5	-31.6
142.44	6.4	120	-76.7	-70.3	-29.5	-40.8
149.34	7.3	120	-76.1	-68.8	-29.5	-39.3
174.23	21.6	120	-76.4	-54.8	-29.5	-25.3
175.00	8.0	120	-76.9	-68.9	-29.5	-39.4
199.12	17.3	120	-78.0	-60.7	-29.5	-31.2
200.00	14.5	120	-78.0	-63.5	-29.5	-34.0
224.02	6.7	120	-76.6	-69.9	-29.5	-40.4
225.00	6.1	120	-76.5	-70.4	-29.5	-40.9
248.92	10.0	120	-71.6	-61.6	-29.5	-32.1
273.78	10.8	120	-67.9	-57.1	-29.5	-27.6
298.68	7.3	120	-76.1	-68.8	-29.5	-39.3
300.00	15.3	120	-75.4	-60.1	-29.5	-30.6
323.58	7.9	120	-73.8	-65.9	-29.5	-36.4
398.26	14.8	120	-75.8	-61.0	-29.5	-31.5
400.00	2.7	120	-72.6	-69.9	-29.5	-40.4
600.00	4.0	120	-69.3	-65.3	-29.5	-35.8

5.3.6 Test result $f > 1$ GHz:

Frequency (MHz)	Level PK (dBm)	Bandwidth (kHz)	Correct. factor (dB)	Corrected power ERP (dBm)	Power limit (dBm)	Delta (dB)
1825.75	-50.6	1000	-14.2	-64.8	-29.5	-35.3
2738.88	-52.3	1000	-10.7	-63.0	-29.5	-33.5
4533.75	-65.5	1000	4.9	-60.6	-29.5	-31.1

Spurious emission limit according to FCC Part 90.217:

Spurious emission limit (dBm)	
30 dB down	-29.5

The requirements are **FULFILLED**.

Remarks:

The measurement was performed up to the 10th harmonic.

For detailed test results please see the following test protocols.

No spurious emissions detected in the frequency range from 30 MHz to 1000 MHz.

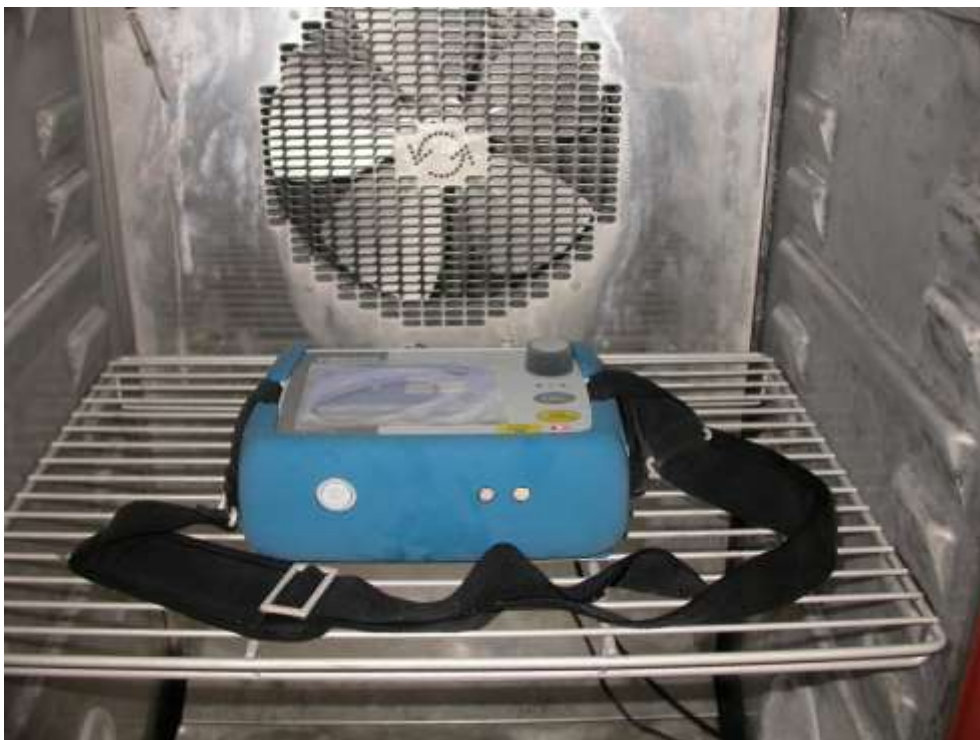
5.4 Modulation characteristics

For test instruments and accessories used see section 6 Part MB.

5.4.1 Description of the test location

Test location: METROLOGY

5.4.2 Photo documentation of the test set-up



5.4.3 Applicable standard

According to FCC Part 90.217(a):

(a) For equipment designed to operate with a 25 kHz channel bandwidth, the sum of the bandwidth occupied by the emitted signal plus the bandwidth required for frequency stability shall be adjusted so that any emission appearing on a frequency 40 kHz or more removed from the assigned frequency is attenuated at least 30 dB below the unmodulated carrier.

5.4.4 Description of Measurement

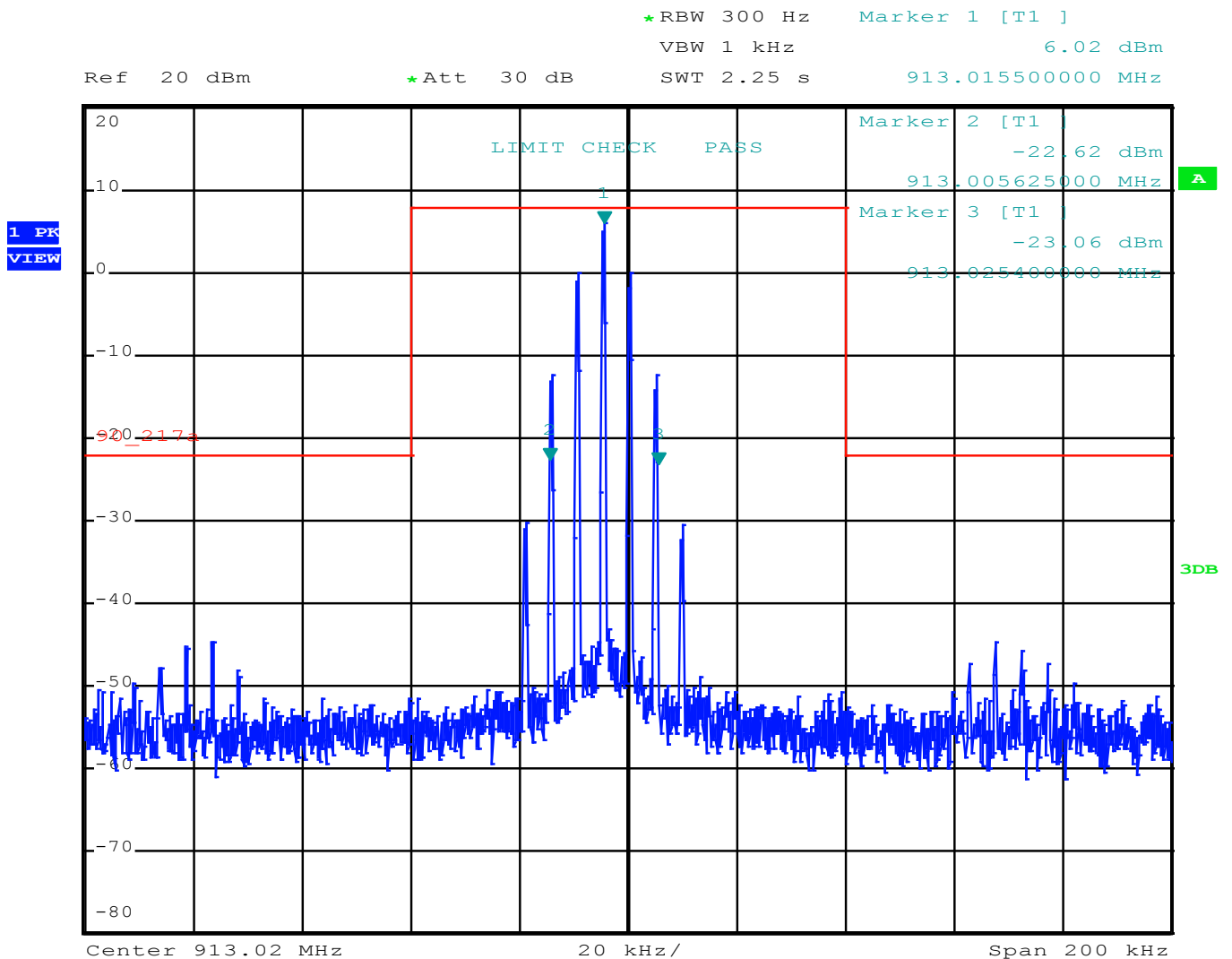
The measurement was performed conducted with intentional modulation on and off. The emission mask defined for 25 kHz channel bandwidth devices is shown on each plot. The 0 dB reference for the mask is the measured output power of the unmodulated carrier at that frequency.

Spectrum analyser settings:

RBW: 300 Hz, VBW: 1 kHz, Detector: PK sampling detector, Sweep time: auto

5.4.5 Test result

Cont. TX with modulation



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Peak power limit according to FCC Part 90.217(a):

Limit	Lower envelope point minimum frequency	Upper envelope point maximum frequency
30 dB down	912.98 MHz ($f_{e, \text{lower}} - 40 \text{ kHz}$)	913.06 MHz ($f_{e, \text{upper}} + 40 \text{ kHz}$)

The requirements are **FULFILLED**.

Remarks:

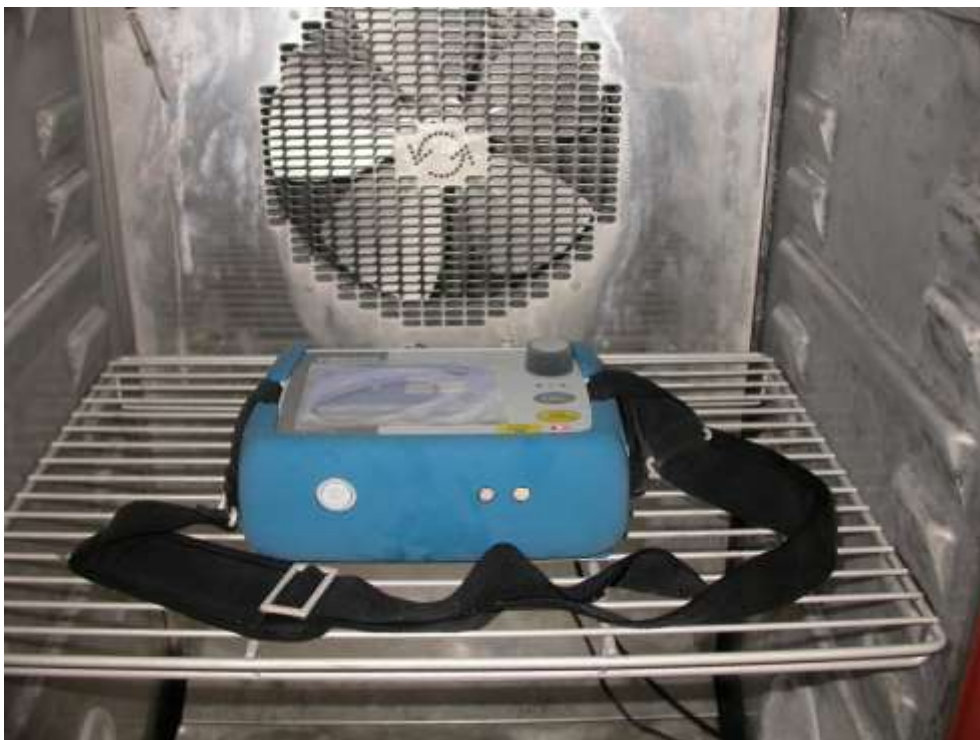
5.5 Occupied bandwidth

For test instruments and accessories used see section 6 Part MB.

5.5.1 Description of the test location

Test location: METROLOGY

5.5.2 Photo documentation of the test set-up



5.5.3 Applicable standard

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 per cent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable:

Transmitters in which the modulating baseband comprises not more than three independent channels—when modulated by the full complement of signals for which the transmitter is rated. The level of modulation for each channel should be set to that prescribed in rule parts applicable to the services for which the transmitter is intended. If specific modulation levels are not set forth in the rules, the tests should provide the manufacturer's maximum rated condition.

5.5.4 Description of Measurement

The bandwidth was measured conducted with the function “bandwidth measurement” of the spectrum analyser.

Spectrum analyser settings:

RBW: 300 Hz, VBW: 1 kHz, Detector: PK sampling detector, Sweep time: auto

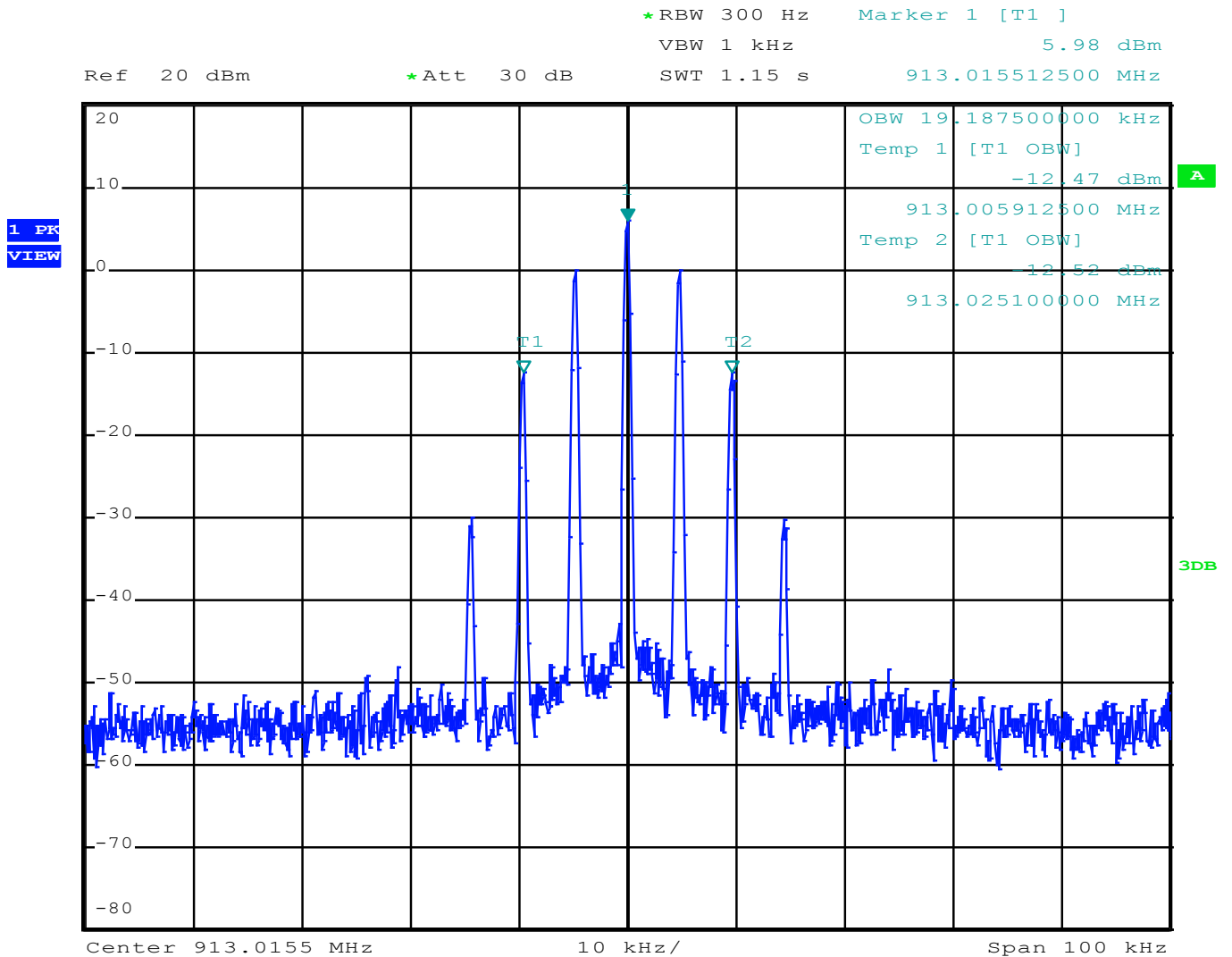
5.5.5 Test result

Channel number	Fundamental frequency (MHz)	99 % Bandwidth (kHz)
1	913.02	19.19

FCC ID: OV8-CORC3

5.5.6 Test protocol

99% Bandwidth measurement plots



The requirements are **FULFILLED**.

Remarks:

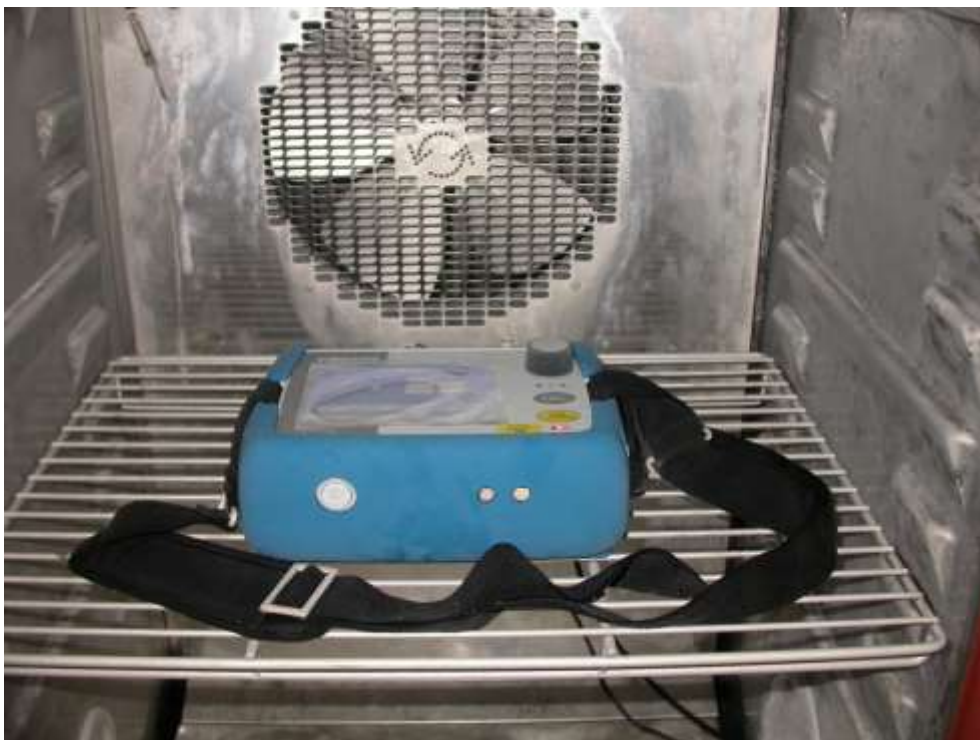
5.6 Frequency stability

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

5.6.1 Description of the test location

Test location: METROLOGY

5.6.2 Photo documentation of the test set-up



FCC ID: OV8-CORC3

5.6.3 Applicable standard

According to FCC Part 90.217(a):

(a) For equipment designed to operate with a 25 kHz channel bandwidth, the sum of the bandwidth occupied by the emitted signal plus the bandwidth required for frequency stability shall be adjusted so that any emission appearing on a frequency 40 kHz or more removed from the assigned frequency is attenuated at least 30 dB below the unmodulated carrier.

5.6.4 Description of Measurement

This test has been performed over variation in temperature. The temperature stability was measured with the EUT in a climatic chamber. During normal operation mode, the EUT has no external power supply connection. For this reason, the test was performed with full charges accus. The frequency stability of the transmitter was examined at over the temperature range of -30°C to +50°C. The carrier frequency was measured conducted with a spectrum analyser.

5.6.5 Test result

Test conditions		Test result	
		Frequency reading (MHz)	Frequency error (kHz)
T (50°C)	V _{min}	913.013168	-6.832
	V _{nom}	913.013170	-6.830
	V _{max}	913.013173	-6.827
T (40°C)	V _{min}	913.013200	-6.800
	V _{nom}	913.013206	-6.794
	V _{max}	913.013214	-6.786
T (30°C)	V _{min}	913.014111	-5.889
	V _{nom}	913.014121	-5.879
	V _{max}	913.014130	-5.870
T _{nom} (20°C)	V _{min}	913.015223	-4.777
	V _{nom}	913.015250	-4.750
	V _{max}	913.015269	-4.731
T (10°C)	V _{min}	913.016318	-3.682
	V _{nom}	913.016341	-3.659
	V _{max}	913.016367	-3.633
T (0°C)	V _{min}	913.017451	-2.549
	V _{nom}	913.017472	-2.528
	V _{max}	913.017494	-2.506
T (-10°C)	V _{min}	913.018264	-1.736
	V _{nom}	913.018276	-1.724
	V _{max}	913.018285	-1.715
T (-20°C)	V _{min}	913.018128	-1.872
	V _{nom}	913.018110	-1.890
	V _{max}	913.018091	-1.909
T (-30°C)	V _{min}	913.015659	-4.341
	V _{nom}	913.015641	-4.359
	V _{max}	913.015622	-4.378
Measurement uncertainty		± 500 Hz	

FCC ID: OV8-CORC3

Measured frequency 30 dB down nearest at the lower frequency (see page 22):

$$f_L + FE_{\min} = 913.0056 \text{ MHz} + -6.8 \text{ kHz} = \mathbf{912.9988 \text{ MHz}}$$

Measured frequency 30 dB down nearest at the higher frequency (see page 22):

$$f_H + FE_{\max} = 913.0254 \text{ MHz} + -1.7 \text{ kHz} = \mathbf{913.0186 \text{ MHz}}$$

Bandwidth limit according to FCC Part 90.217(a):

Limit	Lower envelope point minimum frequency	Upper envelope point maximum frequency
30 dB down	912.98 MHz ($f_{e, \text{lower}} - 40 \text{ kHz}$)	913.06 MHz ($f_{e, \text{upper}} + 40 \text{ kHz}$)

The requirements are **FULFILLED**.

Remarks:

5.7 Receiver spurious emissions, radiated

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

5.7.1 Description of the test location

Test location: OATS 1
Test distance: 3 m

Test location: Anechoic chamber 1
Test distance: 3 m

5.7.2 Photo documentation of the test set-up

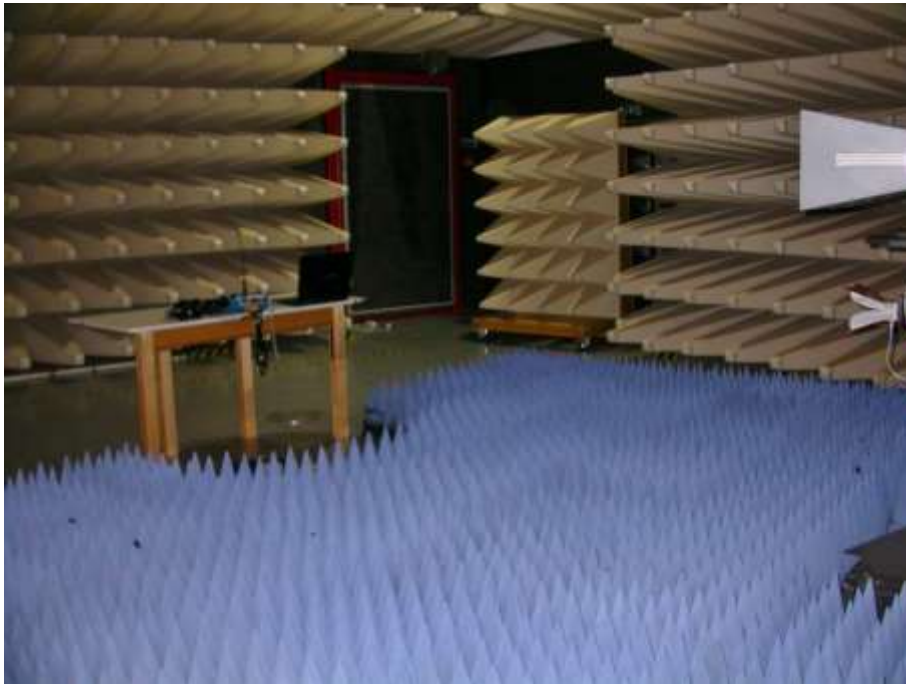


OATS1 – 10 m – 30 MHz to 1000 MHz



OATS1 – 10 m – 30 MHz to 1000 MHz

FCC ID: OV8-CORC3



A1 – 3 m – 1 GHz to 12.75 GHz



A1 – 3 m – 1 GHz to 12.75 GHz

5.7.3 Applicable standard

According to ANSI/TIA-603-C Section 3.1.1 and FCC Part 15B, Section 15.109 (a) and:

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.

5.7.4 Description of Measurement

Spurious emission from the EUT are 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 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 3 metres horizontally from the EUT and is repeated vertically. To locate maximum emissions 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 dB μ V/m is calculated by taking the reading from the EMI receiver (Level dB μ V) and adding the correction factors and cable loss factor (dB). The FCC or CISPR limit is subtracted from this result in order to provide the limit margin listed in the measurement protocol.

Spurious emission from the EUT are measured in the frequency range 1 GHz up to 12.75 GHz, 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 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 emissions under better uncertainty and are calculated at the specified test distance.

The radiated power of the spurious emission from the EUT is measured in a test setup following the procedures set out in ANSI C63.4. If the emission level of the EUT in peak mode complies with the average limit is 20 dB lower, then testing will be stopped and peak values of the EUT will be reported, otherwise the emission will be measured in average mode again and reported.

Instrument settings:

30 MHz – 1000 MHz:	RBW: 120 kHz
1000 MHz – 5000 MHz	RBW: 1 MHz

FCC ID: OV8-CORC3

5.7.5 Test result

Frequency (MHz)	Level QP (dBµV)	Level AV (dBµV)	Bandwidth (kHz)	Correct. factor (dB)	Level QP (dBµV/m)	Level AV (dBµV/m)	Limit (dBµV/m)	Delta (dB)
74.67	27.3	-	120	12.3	39.6	-	40.0	-0.4
124.45	30.2	-	120	12.6	42.8	-	43.5	-0.7
125.00	12.8	-	120	12.6	25.4	-	43.5	-18.1
129.56	21.7	-	120	12.8	34.5	-	43.5	-9.0
142.44	10.0	-	120	13.4	23.4	-	43.5	-20.1
149.34	22.7	-	120	14.5	37.2	-	43.5	-6.3
174.23	26.0	-	120	14.1	40.1	-	43.5	-3.4
175.00	14.1	-	120	14.1	28.2	-	43.5	-15.3
199.12	28.3	-	120	11.7	40.0	-	43.5	-3.5
200.00	23.4	-	120	11.6	35.0	-	43.5	-8.5
224.02	17.2	-	120	12.6	29.8	-	46.0	-16.2
225.00	14.0	-	120	12.6	26.6	-	46.0	-19.4
248.92	11.2	-	120	13.6	24.8	-	46.0	-21.2
273.78	13.7	-	120	14.9	28.6	-	46.0	-17.4
298.68	15.8	-	120	16.7	32.5	-	46.0	-13.5
298.68	17.0	-	120	16.7	33.7	-	46.0	-12.3
300.00	20.3	-	120	16.8	37.1	-	46.0	-8.9
323.58	17.9	-	120	17.4	35.3	-	46.0	-10.7
398.26	16.4	-	120	19.2	35.6	-	46.0	-10.4
400.00	6.3	-	120	19.2	25.5	-	46.0	-20.5
600.00	8.7	-	120	24.8	33.5	-	46.0	-12.5

Frequency (MHz)	Level PK (dBµV)	Level AV (dBµV)	Bandwidth (kHz)	Correct. factor (dB)	Level PK (dBµV/m)	Level AV (dBµV/m)	Limit AV (dBµV/m)	Delta (dB)
1028.13	58.6	-	1000	-20.8	37.8	-	54.0	-16.2
1095.25	61.5	-	1000	-20.8	40.7	-	54.0	-13.3
1168.75	56.6	-	1000	-19.8	36.8	-	54.0	-17.2
1560.25	56.9	-	1000	-20.8	36.1	-	54.0	-17.9
2651.13	54.1	-	1000	-13.0	41.1	-	54.0	-12.9
3580.75	53.9	-	1000	-13.0	40.9	-	54.0	-13.1
4245.00	43.3	-	1000	1.2	44.5	-	54.0	-9.5
5372.66	40.6	-	1000	3.8	44.4	-	54.0	-9.6
7449.69	40.1	-	1000	6.7	46.8	-	54.0	-7.2
8846.41	38.5	-	1000	7.7	46.2	-	54.0	-7.8

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

Frequency (MHz)	Limit (µV/m)	Limit (dBµV/m)
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

The requirements are **FULFILLED**.

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

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	ESHS 30	02-02/03-05-002	17/07/2016	17/07/2015		
	ESH 2 - Z 5	02-02/20-05-004	26/10/2016	26/10/2015	21/01/2016	21/07/2015
	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	06/11/2016	06/11/2015	06/05/2016	06/11/2015
CPR 2	ESVS 30	02-02/03-05-003	09/07/2016	09/07/2015		
	VULB 9168	02-02/24-05-005	17/04/2016	17/04/2015	29/02/2016	31/08/2015
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
	KK-SD_7/8-2X21N-33,0M	02-02/50-15-028				
MB	FSP 40	02-02/11-11-001	28/10/2016	28/10/2015		
	METRA HIT World	02-02/32-10-001	17/10/2016	17/10/2015		
	WK-180/40	02-02/45-08-001	08/07/2016	08/07/2015		
SER 2	ESVS 30	02-02/03-05-003	09/07/2016	09/07/2015		
	VULB 9168	02-02/24-05-005	17/04/2016	17/04/2015	29/02/2016	31/08/2015
	NW-2000-NB	02-02/50-05-113				
	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	01/10/2016	01/10/2015		
	AFS5-12001800-18-10P-6	02-02/17-06-002				
	AFS4-01000400-10-10P-4	02-02/17-13-002				
	AMF-4F-04001200-15-10P	02-02/17-13-003				
	3117	02-02/24-05-009	12/05/2016	12/05/2015		
	WHJS 1000-10EE	02-02/50-05-070				
	Sucoflex N-2000-SMA	02-02/50-05-075				
	WHK 3.0/18G-10EF	02-02/50-05-180				
	SF104/11N/11N/1500MM	02-02/50-13-015				