EUT: SIR-2010
FCC ID: WVUSIR-2010

Date of issue: 2011-08-08

Test Report acc. to FCC Title 47 CFR Part 15
relating to
Scemtec Transponder Technology GmbH
SIR-2010 with antennas
SAT-A40-LR-O-13MHz & SAT-A25/30-MR-P-13MHz

Title 47 - Telecommunication
Part 15 - Radio Frequency Devices
Subpart C – Intentional Radiators
Measurement Procedure:
ANSI C63.4-2009

dudde hochfrequenz-technik Rottland 5a D-51429 Bergisch Gladbach/ Germany Tel: +49 2207-96890 Fax +49 2207-968920

Manufacturer's details	
Manufacturer	Scemtec Transponder Technology GmbH
Manufacturer's grantee code	**WVU**
Manufacturer's address	Gewerbeparkstr.20
	51580 Reichshof Wehnrath
	Germany
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	Contact: Mr. Jürgen Kalbitzer
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Relevant standard used	47 CFR Part 15C - Intentional Radiators
	ANSI C63.4-2009

Test Report prepared by	
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Equipment **U**nder **T**est **(EUT)**	
Equipment category	Inductive application / RFID
Trade name	Scemtec
Type designation	SIR-2010
Serial no.	---
Variants	
Antennas	SAT-A40-LR-O-13MHz SAT-A25/30-MR-P-13MHz

1. Test results

Clause	Requirements headline	Test result			Report page number
8.1	Antenna Requirement	**Pass**	~~Fail~~	~~N.t.*~~	10
8.2	Restricted bands of operation	**Pass**	~~Fail~~	~~N.t.*~~	11 to 12
8.3	Conducted limits	**Pass**	~~Fail~~	~~N.t.*~~	13 to 17
8.4	Radiated emission limits	**Pass**	~~Fail~~	~~N.t.*~~	18 to 34
8.5	Frequency tolerance	**Pass**	~~Fail~~	~~N.t.*~~	35 to 37

* Not tested

The equipment meets the requirements	**Yes**	~~No~~

Signature: ..... (Technician)

Signature: ..... (Manager)

Datum: 2011.08.24 17:54:30 +02'00'

Table of contents

1. Test results 3
2. Introduction 5
3. Testing laboratory 5
4. Applicant 6
5. Product and product documentation 6
6. Conclusions, observations and comments 7
7. Operational description 8
8. Compliance assessment 9
8.1 Antenna requirement 9
8.1.1 Regulation 9
8.1.2 Result 9
8.2 Restricted bands of operation 10
8.2.1 Regulation 10
8.2.2 Result 11
8.3 Conducted limits 12
8.3.1 Regulation 12
8.3.2 Test equipment 13
8.3.3 Test procedures 13
8.3.4 Result 14
8.4 Radiated emission limits 17
8.4.1 Regulation 17
8.4.2 Test equipment 18
8.4.3 Test procedure 19
8.4.4 Calculation of the field strength 20
8.4.5 Result 21
8.5 Frequency tolerance 26
8.5.1 Regulation 26
8.5.2 Test equipment 26
11.5.3 Test procedures 26
8.5.4 Result 28
9. Additional information to the test report 29

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2. Introduction

This test report consists of:

- Test result summary
- List of contents
- Introduction and further information
- Performance assessment
- Detailed test information

All pages have been numbered consecutively and bear the m. dudde hochfrequenz-technik logo, the test report number, the date, the test specification in its current version as well as the type designation of the EUT. The total number of pages in this report is **30**.

The tests were carried out at:

- m. dudde hochfrequenz-technik, D-51429 Bergisch Gladbach

in a representative assembly and in accordance with the test methods and/or requirements stated in:

FCC Title 47 CFR Part 15 Subpart C & ANSI C63.4-2009

The sample of the product was received on:

- 2011-03-17

The tests were carried out in the following period of time:

- 2011-06-21 – 2011-08-04

3. Testing laboratory

m. dudde hochfrequenz-technik
Rottland 5a, 51429 Bergisch Gladbach, Germany

Phone: +49 - (0) 22 07 / 96 89-0
Fax: +49 - (0) 22 07 / 96 89-20

- FCC Registration Number: **699717**

Accredited by:

DAkkS Deutsche Akkreditierungsstelle GmbH
DAkkS accreditation number: D-PL-12053-01

4. Applicant

Company name	: Scemtec Transponder Technology GmbH
Address	: Gewerbeparkstrasse 20
	51580 Reischshof-Wehnrath
Country	: Germany
Telephone	: +49 (0) 2265 996 0
Fax	: +49 (0) 2265 996 699
Email	: j.kalbitzer@stt-rfid.de
Date of order	: 2011-04-08
References	: Mr. Jürgen Kalbitzer

5. Product and product documentation

Samples of the following apparatus were submitted for testing:

Manufacturer	: Scemtec Transponder Technology GmbH
Trademark	: Scemtec
Type designation	: **SIR-2010 with antennas**
	SAT-A40-LR-O-13MHz & SAT-A25/30-MR-P-13MHz
Hardware version	: SIR-2010 with antennas
	SAT-A40-LR-O-13MHz & SAT-A25/30-MR-P-13MHz
Serial number	: ---
Software release	: ---
Type of equipment	: RFID
Power used	: 6.0 V DC
Frequency used	: 13.560 MHz
Generated frequencies	: 13.560 MHz (Carrier), 18.432 MHz (Crystal),
ITU emission class	: 33K1A1D

dudde hochfrequenz-technik Rottland 5a D-51429 Bergisch Gladbach/ Germany Tel: +49 2207-96890 Fax +49 2207-968920

For issuing this report the following product documentation was used:

Description	**Date**	**Identifications**
External photographs of the **E**quipment **U**nder **T**est (EUT)	2011-08-09	Annex no. 1
Internal photographs of the **E**quipment **U**nder **T**est (EUT)	2011-08-09	Annex no. 2
Channel occupancy / bandwidth	2011-08-09	Annex no. 3
Label sample	2011-08-09	Annex no. 4
Functional description / User manual	2011-08-09	Annex no. 5
Test setup photos	2011-08-09	Annex no. 6
Block diagram	2011-08-09	Annex no. 7
Operational description	2011-08-09	Annex no. 8
Schematics	2011-08-09	Annex no. 9
Parts list & Layouts	2011-08-09	Annex no. 10
Periodic operation characteristics / Transmission times	– – –	Annex no. 11
Antenna description	2011-08-09	Annex no. 12

6. Conclusions, observations and comments

The test report will be filed at m. dudde hochfrequenz-technik for a period of 10 years following the issue of this report. It may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of m. dudde hochfrequenz-technik.

The results of the tests as stated in this report are exclusively applicable to the EUT as identified in this report. m. dudde hochfrequenz-technik cannot be held liable for properties of the EUT that have not been observed during these tests.

m. dudde hochfrequenz-technik assumes the sample to comply with the requirements of FCC Title 47 CFR Part 15 for the respective test sector, if the test results turn out positive.

Comments:

Additional equipment for the tests to carry on the SIR-2010:

HP Notebook,
Type: Compaq nx6325
Serial No.: CNU64907PD

Sunny Power supply
Model: SYS1381-0606-W2E
Output: 6 V DC / 1.0A DC

Date	: 2011-08-08	Date	: 2011-08-08
Name	: Ralf Trepper	Name	: Manfried Dudde
Function	: Technician	Function	: Manager
Signature	:	Signature	: .....

7. Operational description

7.1 EUT details

RFID Reader System works at a frequency of 13.56 MHz. It comprises a reader, one antenna and transponder (for example: smart label) and is used for wireless identification of a variety of objects.

7.2 EUT configurations

The RFID Reader System will be set in continuous transmission mode via software and over an USB connected Laptop. After programming the EUT the Laptop are disconnected. No other changes will be done.

7.3 EUT measurement description

Radiated measurements

The ***SIR-2010*** was tested in a typical fashion with the combinations described in 7.2. During preliminary emission tests the ***SIR-2010*** was operated in the continuous transmitting mode for worst case emission mode investigation. Therefore, the final qualification testing was completed with ***SIR-2010*** operated in continuous modes.
All tests were performed with the applicant's declared maximum voltage: 6.0 V DC
In order to establish the maximum radiation, firstly, there have been viewed all orthogonal adjustments of the test samples, secondly the test ample have been rotated at all adjustments around the own axis between 0° and 360°, and thirdly, the antenna polarization between horizontal and vertical had been varied.

Conducted measurements

1.) The device was connected to the artificial mains network via an USB- connector to the USB- port of a HP Notebook and this to the artificial mains network. It has been tested in two runs: first, with inactive ***SIR-2010***, second with activated ***SIR-2010*** in read write mode to read user data and write user data into different tags.

2.) The device was connected to the artificial mains network via the external power supply ***SYS1381*** and this to the artificial mains network. It has been tested in two runs: first, with inactive ***SIR-2010,*** second with activated ***SIR-2010*** in read write mode to read user data and write user data into different tags.

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8. Compliance assessment

8.1 Antenna requirement

8.1.1 Regulation

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

8.1.2 Result

The equipment meets the requirements	**Yes**	~~No~~	~~N.t.~~

Further test results are attached	~~Yes~~	**No**	Page no.

Dedicated antennas limited to the following types:

SAT-A40-LR-O-13MHz
SAT-A25/30-MR-P-13MHz

Installation, operation, and maintenance procedures should only be carried out by qualified personnel!

N.t.* See page no. 29

8.2 Restricted bands of operation

8.2.1 Regulation

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz
[2] Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

(c) Except as provided in paragraphs (d) and (e), regardless of the field strength limits specified elsewhere in this Subpart, the provisions of this Section apply to emissions from any intentional radiator.

(d) The following devices are exempt from the requirements of this Section:

(1) Swept frequency field disturbance sensors operating between 1.705 and 37 MHz provided their emissions only sweep through the bands listed in paragraph (a), the sweep is never stopped with the fundamental emission within the bands listed in paragraph (a), and the fundamental emission is outside of the bands listed in paragraph (a) more than 99% of the time the device is actively transmitting, without compensation for duty cycle.

(2) Transmitters used to detect buried electronic markers at 101.4 kHz which are employed by telephone companies.

(3) Cable locating equipment operated pursuant to Section 15.213.

(4) Any equipment operated under the provisions of § 15.253, § 15.255 or § 15.257 of this part.

(5) Biomedical telemetry devices operating under the provisions of Section 15.242 of this part are not subject to the restricted band 608-614 MHz but are subject to compliance within the other restricted bands.

(6) Transmitters operating under the provisions of Subpart D or F of this part.

(7) Devices operated pursuant to § 15.225 are exempt from complying with this section for the 13.36-13.41 MHz band only.

(8) Devices operated in the 24.075-24.175 GHz band under § 15.245 are exempt from complying with the requirements of this section for the 48.15-48.35 GHz and 72.225-72.525 GHz bands only, and shall not exceed the limits specified in § 15.245(b).

(9) Devices operated in the 24.0-24.25 GHz band under § 15.249 are exempt from complying with the requirements of this section for the 48.0-48.5 GHz and 72.0-72.75 GHz bands only, and shall not exceed the limits specified in § 15.249(a).

(e) Harmonic emissions appearing in the restricted bands above 17.7 GHz from field disturbance sensors operating under the provisions of Section 15.245 shall not exceed the limits specified in Section 15.245(b).

8.2.2 Result

The equipment meets the requirements	**Yes**	~~No~~	~~N.t.~~

Further test results are attached	~~Yes~~	**No**	Page no.

N.t.* See page no. 29

8.3 Conducted limits

8.3.1 Regulation

(a) For an intentional radiator which 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 limits in the following table, as measured using a 50µH/50ohms line impedance stabilization network (LISN). Compliance with this provision of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.
The lower limit applies at the boundary between the frequency ranges.

Frequency of emission(MHz)	**Conducted limit (dBµV)**	
	Quasi-peak	**Average**
0.15-0.50	66 to 56*	56 to 46*
0.50-5.0	56	46
5.0-30.0	60	50

* Decreases with the logarithm of the frequency

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provision for, the use of battery chargers which permit operating while charging, AC adaptors or battery eliminators or connected to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

8.3.2 Test equipment

Type	Manufacturer/ Model no.	Serial no.	Last calibration	Next calibration	Remarks
Receiver (9 kHz - 30MHz)	Schwarzbeck FMLK 1518 (428)	1518294 9360	2010/08	2013/08	---
Panorama-Monitor FMLK / VUMA	PAZ1550 (429)				
Protector limiter 9 kHz - 30MHz 10 dB	Rhode & Schwarz ESH 3Z2 (272)	357,881052	2011/02	2014/02	---
V-LISN 50 ohms//(50 uH+5 ohms)	RFT NNB 11 (72)	13835240	2010/07	2013/07	---
V-LISN 50 ohms//(50 uH+5 ohms)	EMCO (49b)	9512-1227	2009/05	2012/05	---
RF-cable	Aircell 1.5m [BNC/N]	K30	2011/01	2012/01	---

8.3.3 Test procedures

The EUT and the additional equipment (if required) are connected to the main power through a line impedance stabilization network (LISN). The LISN must be appropriate to ANSI C63.4-2009 Section 7.
Additional equipment must also be connected to a second LISN with the same specifications described in the above sentence (if required).

8.3.4 Result

Tested with external AC/DC power supply (power supply Sonny SYS1381)

CONDUCTED EMISSIONS (Section 15.207)						
Tested line	Emission frequency [MHz]	Receiver bandwidth [kHz]	Result quasi-peak [dBµV]	Spec. limit (average) [dBµV]	Margin [dB]	Remarks
L1	0.177	9	-2	54.7	56.7	*[2]
N	0.177	9	-2	54.7	56.7	*[2]
L1	0.220	9	-2	52.7	54.7	*[2]
N	0.220	9	-2	52.7	54.7	*[2]
L1	**0.341**	9	**32.0**	**50.3**	**18.3**	*[2]
N	**0.341**	9	**32.0**	**50.3**	**18.3**	*[2]
L1	0.584	9	-2	46	48.0	*[2]
N	0.584	9	-2	46	48.0	*[2]
L1	0.600	9	-2	46	48.0	*[1]
N	0.600	9	-2	46	48.0	*[1]
L1	0.775	9	-2	46	48.0	*[1]
N	0.775	9	-2	46	48.0	*[1]
L1	0.850	9	-2	46	48.0	*[1]
N	0.850	9	-2	46	48.0	*[1]
L1	1.000	9	-2	46	48.0	*[1]
N	1.000	9	-2	46	48.0	*[1]
L1	1.250	9	-2	46	48,0	*[1]
N	1.250	9	-2	46	48,0	*[1]
L1	1.150	9	-2	46	48,0	*[2]
N	1.150	9	-2	46	48,0	*[2]
L1	4.000	9	-2	46	48.0	*[1]
N	4.000	9	-2	46	48.0	*[1]
L1	6.7644	9	-2	50	52.0	*[1]
N	6.7644	9	-2	50	52.0	*[1]
L1	**13.560**	9	**44.0**	50	**6.0**	*[1]
N	**13.560**	9	**44.0**	50	**6.0**	*[1]
L1	20.2931	9	-2	50	52.0	*[1]
N	20.2931	9	-2	50	52.0	*[1]
L1	**27.120**	9	**34.0**	50	**16.0**	*[2]
N	**27.120**	9	**34.0**	50	**16.0**	*[2]

Remark: *[1] Noise level of the measuring instrument ≤ -2dBµV (0.009 – 30MHz)
Remark: *[2] Quasi peak measurements lower than "Specified Average Limit"

The equipment meets the requirements	**Yes**	~~No~~	~~N.t.~~

Further test results are attached	~~Yes~~	**No**	Page no.

N.t.* See page no. 29

Tested with a Laptop over USB port (SIR-2010 not active)

CONDUCTED EMISSIONS (Section 15.207)						
Tested line	Emission frequency [MHz]	Receiver bandwidth [kHz]	Result quasi-peak [dBµV]	Spec. limit (average) [dBµV]	Margin [dB]	Remarks
L1	**0.197**	9	**48.0**	**55.3**	**7.3**	***[2]**
N	**0.197**	9	**48.0**	**55.3**	**7.3**	***[2]**
L1	0.301	9	-2	51.7	53.7	*[1]
N	0.301	9	-2	51.7	53.2	*[1]
L1	**0.507**	9	**41.0**	**47**	**6.0**	*[1]
N	**0.507**	9	**41.0**	**47**	**6.0**	*[1]
L1	0.600	9	-2	46	48.0	*[1]
N	0.600	9	-2	46	48.0	*[1]
L1	0.775	9	-2	46	48.0	***[2]**
N	0.775	9	-2	46	48.0	***[2]**
L1	0.850	9	-2	46	48.0	*[1]
N	0.850	9	-2	46	48.0	*[1]
L1	1.000	9	-2	46	48.0	*[1]
N	1.000	9	-2	46	48.0	*[1]
L1	**1.399**	9	**41.0**	**46**	**5.0**	***[2]**
N	**1.399**	9	**41.0**	**46**	**5.0**	***[2]**
L1	2.084	9	-2	46	48.0	***[2]**
N	2.084	9	-2	46	48.0	***[2]**
L1	2.423	9	-2	46	48.0	***[2]**
N	2.423	9	-2	46	48.0	***[2]**
L1	6.7644	9	-2	50	52.0	*[1]
N	6.7644	9	-2	50	52.0	*[1]
L1	13.5288	9	-2	50	52.0	*[1]
N	13.5288	9	-2	50	52.0	*[1]
L1	20.2931	9	-2	50	52.0	*[1]
N	20.2931	9	-2	50	52.0	*[1]
L1	27.0575	9	-2	50	52.0	*[1]
N	27.0575	9	-2	50	52.0	*[1]

Remark: *[1] Noise level of the measuring instrument ≤ -2dBµV (0.009 – 30MHz)
Remark: *[2] Quasi peak measurements lower than "Specified Average Limit"

The equipment meets the requirements	**Yes**	~~No~~	~~N.t.~~

Further test results are attached	~~Yes~~	**No**	Page no.

N.t.* See page no. 29

Tested with a Laptop over USB port (SIR-2010 active)

CONDUCTED EMISSIONS (Section 15.207)						
Tested line	Emission frequency [MHz]	Receiver bandwidth [kHz]	Result quasi-peak [dBµV]	Spec. limit (average) [dBµV]	Margin [dB]	Remarks
L1	0.1770	9	-2	55.4	57.4	*[2]
N	0.1770	9	-2	55.4	57.4	*[2]
L1	**0.197**	9	**52.0**	**55.3**	**3.3**	*[2]
N	**0.197**	9	**52.0**	**55.3**	**3.3**	*[2]
L1	0.301	9	-2	51.7	53.7	*[1]
N	0.301	9	-2	51.7	53.2	*[1]
L1	**0.507**	9	**41.0**	**47**	**6.0**	*[1]
N	**0.507**	9	**41.0**	**47**	**6.0**	*[1]
L1	0.600	9	-2	46	48.0	*[1]
N	0.600	9	-2	46	48.0	*[1]
L1	0.775	9	-2	46	48.0	*[2]
N	0.775	9	-2	46	48.0	*[2]
L1	0.850	9	-2	46	48.0	*[1]
N	0.850	9	-2	46	48.0	*[1]
L1	**1.399**	9	**41.0**	**46**	**5.0**	*[2]
N	**1.399**	9	**41.0**	**46**	**5.0**	*[2]
L1	1.787	9	-2	46	48.0	*[2]
N	1.787	9	-2	46	48.0	*[2]
L1	2.084	9	-2	46	48.0	*[2]
N	2.084	9	-2	46	48.0	*[2]
L1	2.423	9	-2	46	48.0	*[2]
N	2.423	9	-2	46	48.0	*[2]
L1	3.186	9	-2	46	48.0	*[2]
N	3.186	9	-2	46	48.0	*[2]
L1	6.7644	9	-2	50	52.0	*[1]
N	6.7644	9	-2	50	52.0	*[1]
L1	13.870	9	-2	50	52.0	*[2]
N	13.870	9	-2	50	52.0	*[2]
L1	20.2931	9	-2	50	52.0	*[1]
N	20.2931	9	-2	50	52.0	*[1]
L1	27.120	9	-2	50	52.0	*[2]
N	27.120	9	-2	50	52.0	*[2]

Remark: *[1] Noise level of the measuring instrument ≤ -2dBµV (0.009 – 30MHz)
Remark: *[2] Quasi peak measurements lower than "Specified Average Limit"

The equipment meets the requirements	**Yes**	~~No~~	~~N.t.~~

Further test results are attached	~~Yes~~	**No**	Page no.

N.t.* See page no. 29

8.4 Radiated emission limits

8.4.1 Regulation

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	**Field Strength (microvolts/meter)**	**Measurement distance (meters)**
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

(b) In the emission table above, the tighter limit applies at the band edges.

(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

(d) The emission limits shown in the above table are based on measurements employing a CISPR quasi peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

(e) The provisions in §§ 15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

(f) In accordance with Section 15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. lf measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in Section 15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in Section 15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit. Emissions which must be measured above the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator and which fall within the restricted bands shall comply with the general radiated emission limits in Section 15.109 that are applicable to the incorporated digital device.

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8.4.2 Test equipment

Type	Manufacturer/ Model no.	Serial no.	Last calibration	Next calibration
Receiver (9 kHz –18.0 GHz)	Rohde & Schwarz Spectrum Analyzer FSL 18 (171a)	100.117	2010/11	2012/11
Pre-amplifier (100kHz - 1.3GHz)	Hewlett Packard 8447 E (166a)	1726A00705	2010/02	2012/02
Pre-amplifier (1GHz - 18GHz)	Narda (345)	---	2010/02	2012/02
Magnetic loop antenna (9 kHz - 30 MHz)	Schwarzbeck FMZB 1516 (23)	---	2010/05	2013/05
Bilog antenna (30- 1000 MHz)	Schwarzbeck VULP 9168 (406)	---	2011/04	2014/04
Horn antenna (0.86-8.5 GHz)	Schwarzbeck BBHA 9120 A (284)	236	2008/01	2013/01
Horn antenna (2.0-14.0 GHz)	Schwarzbeck BBHA 9120 C (169)	305	2008/01	2013/01
RF- cable	Kabelmetal 18m [N]	K1	2011/01	2012/01
RF- cable	Aircell 0.5m [BNC]	K40	2011/01	2012/01
RF- cable	Aircell 1m [BNC/N]	K56	2011/01	2012/01
RF- cable	Sucoflex 106 Suhner 6,4m [N]	K74	2011/01	2012/01
RF- cable	Sucoflex 106 Suhner 6,4m [N]	K75	2011/01	2012/01

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8.4.3 Test procedure

The EUT and this peripheral (when additional equipment exists) are placed on a turn table which is 0.8 m above the ground. The turn table would be allowed to rotate 360 degrees to determine the position of the maximum emission level. The test distance between the EUT and the receiving antenna are 3m. To find the maximum emission, the polarization of the receiving antenna is changed in horizontal and vertical polarization; the position of the EUT was changed in different orthogonal determinations.

ANSI C63.4-2009 Section 8 “Radiated Emissions Testing”

Measurement procedures for electric field radiated emissions above 1 GHz are covered in Clause 8 of ANSI C63.4-2009. The ANSI C63.4-2009 measurement procedure consists of both an exploratory test and a final measurement. The exploratory test is critical to determine the frequency of all significant emissions. For each mode of operation required to be tested, the frequency spectrum is monitored. Variations in antenna height, antenna orientation, antenna polarization, EUT azimuth, and cable or wire placement is explored to produce the emission that has the highest amplitude relative to the limit.

The final measurements are made based on the findings in the exploratory testing. When making exploratory and final measurements it is necessary to maximize the measured radiated emission. Subclause 8.3.1.2 of ANSI C63.4-2009 states that the measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” We consider the “cone of radiation” to be the 3 dB beam width of the measurement antenna.

While the “bore-sighting” technique is not explicitly mentioned in ANSI C63.4-2009, it is a useful technique for measurements using a directional antenna, such as a double-ridged waveguide antenna. Several precautions must be observed, including: knowledge of the beam width of the antenna and the resulting illumination area relative to the size of the EUT, estimation for source of the emission and general location within larger EUTS, measuring system sensitivity, etc.

ANSI C63.4-2009 requires that the measurement antenna is kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. That means that if the directional radiation pattern of the EUT results in a maximum emission at an upwards angle from the EUT, when a directional antenna is used to make the measurement it will be necessary for it to be pointed towards the source of the emission within the EUT. This can be done by either pointing the antenna at an angle towards the source of the emission, or by rotating the EUT, in both height and polarization, to maximize the measured emission. The emission must be kept within the illumination area of the 3 dB beamwidth of the antenna so that the maximum emission from the EUT is measured.

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Radiated emissions test characteristics	
Frequency range	30 MHz - 4,000 MHz
Test distance	3 m*
Test instrumentation resolution bandwidth	120 kHz (30 MHz - 1,000 MHz)
	1 MHz (1000 MHz - 4,000 MHz)
Receive antenna scan height	1 m - 4 m
Receive antenna polarization	Vertical/horizontal

* According to Section 15.31 (f) (1): At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

8.4.4 Calculation of the field strength

The field strength is calculated by the following calculation:

Corrected Level = Receiver Level + Correction Factor (without the use of a pre-amplifier)

Corrected Level = Receiver Level + Correction Factor – Pre-amplifier (with the use of a pre-amplifier)

Receiver Level : Receiver reading without correction factors
Correction Factor : Antenna factor + cable loss

For example:
The receiver reading is 32.7 dBµV. The antenna factor for the measured frequency is +2.5 dB (1/m) and the cable factor for the measured frequency is 0.71 dB, giving a field strength of 35.91dBµV/m.
The 35.91dBµV/m value can be mathematically converted to its corresponding level in µV/m.

Level in µV/m = Common Antilogarithm (35.91/20) = 39.8

For test distance other than what is specified, but fulfilling the requirements of Section 15.31 (f) (1) the field strength is calculated by adding additionally an extrapolation factor of 20 dB/decade (inverse linear distance for field strength measurements).

8.4.5 Result

SIR-2010in combination with SAT-A40-LR-O-13MHz

FUNDAMENTAL EMISSION & HARMONICS (Section 15.225)

f (MHz)	Bandwidth (kHz), Type of detector	Noted receiver level **dBµV**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	Level corrected **dBµV/m**	Limit **dBµV/m @ meter**	Margin **dB**	Polaris. EUT / antenna orientation	height/cm
13.560	QPK/9kHz	74.0	10	20.2	-19.1	75.1	84.0 @ 30	8.9	V / 90°	100
27.120	QPK/9kHz	20.0	10	20.2	-19.1	21.1	29.5 @ 30	8.4	V° / 90°	100
40.68	QPK/120kHz	34.0	3	-7.4	0	26.6	40.0 @ 3	13.4	V° / V 20°	100
54.24	QPK/120kHz	44.1	3	-8.1	0	36.0	40.0 @ 3	8.0	V° / V 20°	110
67.8	QPK/120kHz	45.7	3	-10.0	0	35.7	40.0 @ 3	4.3	V° / V 20°	108
81.36	QPK/120kHz	34.8	3	-11.4	0	23.4	40.0 @ 3	16.6	V° / V 20°	110
94.92	QPK/120kHz	41.2	3	-10.8	0	30.4	43.5 @ 3	10.1	V° / V 20°	105
108.48	QPK/120kHz	≤ 6.5	3	-9.7	0	-3.2	43.5 @ 3	46.7	V/H.0-360°	100-400
122.04	QPK/120kHz	≤ 6.5	3	-8.2	0	-1.7	43.5 @ 3	45.2	V/H.0-360°	100-400
135.6	QPK/120kHz	40.7	3	-7.4	0	33.3	43.5 @ 3	10.2	V° / V 20°	110
149.16	QPK/120kHz	34.4	3	-6.6	0	27.8	43.5 @ 3	15.7	V° / V 20°	115
162.72	QPK/120kHz	41.5	3	-6.6	0	34.9	43.5 @ 3	8.6	V° / V 20°	110
176.28	QPK/120kHz	46.2	3	-8.3	0	37.9	43.5 @ 3	5.6	V° / V 20°	110
189.84	QPK/120kHz	38.2	3	-10.0	0	28.2	43.5 @ 3	15.3	V° / V 20°	110
203.4	QPK/120kHz	42.8	3	-10.4	0	32.8	43.5 @ 3	10.7	V° / V 20°	103
216.96	QPK/120kHz	43.8	3	-9.4	0	34.4	46.0 @ 3	11.6	V° / V 30°	105
230.52	QPK/120kHz	44.0	3	-8.7	0	35.3	46.0 @ 3	10.7	V° / V 30°	105
244.08	QPK/120kHz	45.4	3	-8.4	0	37.0	46.0 @ 3	9.0	V° / V 30°	105
257.64	QPK/120kHz	44.4	3	-8.0	0	36.4	46.0 @ 3	9.4	V° / V 30°	110
271.2	QPK/120kHz	≤ 6.5	3	-7.4	0	-1.1	46.0 @ 3	47.1	V/H.0-360°	100-400
284.76	QPK/120kHz	36.5	3	-7.4	0	29.1	46.0 @ 3	16.9	V° / V 30°	154
298.32	QPK/120kHz	≤ 6.5	3	-6.4	0	0.1	46.0 @ 3	45.9	V/H.0-360°	100-400
311.88	QPK/120kHz	38.6	3	-6.2	0	32.4	46.0 @ 3	13.6	V° / V 30°	104
325.44	QPK/120kHz	≤ 6.5	3	-6.0	0	0.5	46.0 @ 3	45.5	V/H.0-360°	100-400
339	QPK/120kHz	≤ 6.5	3	-5.8	0	0.7	46.0 @ 3	45.3	V/H.0-360°	100-400
352.56	QPK/120kHz	≤ 6.5	3	-5.5	0	1.0	46.0 @ 3	45.0	V/H.0-360°	100-400
Measurement uncertainty			4 dB							

Blue marked: restricted bands
Bandwidth = the measuring receiver bandwidth

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FUNDAMENTAL EMISSION & HARMONICS (Section 15.225)

f (MHz)	Bandwidth (kHz), Type of detector	Noted receiver level dBµV	Test distance m	Correction factor dB	Distance extrapol. factor dB	Level corrected dBµV/m	Limit dBµV/m @ meter	Margin dBµV/m	Polaris. EUT / antenna orientation	height/cm
366.12	QPK/9kHz	45.1	3	-5.2	0	39.9	46.0 @ 3	6.1	V° / V 30°	105
379.68	QPK/9kHz	≤ 6.5	3	-4.9	0	1.5	46.0 @ 3	44.5	V/H.0-360°	100-400
393.24	QPK/120kHz	36.2	3	-4.5	0	31.7	46.0 @ 3	14.3	V° / V 30°	105
406.8	QPK/120kHz	≤ 6.5	3	-4.8	0	1.7	46.0 @ 3	44.3	V/H.0-360°	100-400
420.36	QPK/120kHz	37.9	3	-4.6	0	33.3	46.0 @ 3	12.7	V° / V 30°	109
433.92	QPK/120kHz	≤ 6.5	3	-4.4	0	2.1	46.0 @ 3	43.9	V/H.0-360°	100-400
447.48	QPK/120kHz	≤ 6.5	3	-4.0	0	2.5	46.0 @ 3	43.5	V/H.0-360°	100-400
461.04	QPK/120kHz	≤ 6.5	3	-3.9	0	2.6	46.0 @ 3	43.4	V/H.0-360°	100-400
474.6	QPK/120kHz	≤ 6.5	3	-3.8	0	2.7	46.0 @ 3	43.3	V/H.0-360°	100-400
488.16	QPK/120kHz	≤ 6.5	3	-3.8	0	2.7	46.0 @ 3	43.3	V/H.0-360°	100-400
501.72	QPK/120kHz	≤ 6.5	3	-3.4	0	3.1	46.0 @ 3	42.9	V/H.0-360°	100-400
528.84	QPK/120kHz	≤ 6.5	3	-2.8	0	3.7	46.0 @ 3	42.3	V/H.0-360°	100-400
542.4	QPK/120kHz	≤ 6.5	3	-2.6	0	3.9	46.0 @ 3	42.1	V/H.0-360°	100-400
555.96	QPK/120kHz	39.3	3	-2.4	0	36.9	46.0 @ 3	9.1	V° / V 30°	100
569.52	QPK/120kHz	≤ 6.5	3	-2.6	0	3.9	46.0 @ 3	42.1	V° / V 30°	100-400
Measurement uncertainty			4 dB							

Blue marked: restricted bands
Bandwidth = the measuring receiver bandwidth

Remark: *[1] noise floor noise level of the measuring instrument ≤ 4.0dBµV @ 10m distance (0.009 – 30 MHz)
Remark: *[2] noise floor noise level of the measuring instrument ≤ 6.5dBµV @ 3m distance (30 – 1,000 MHz)
Remark: *[3] noise floor noise level of the measuring instrument ≤ 10 dBµV @ 3m distance (1,000 – 2,000 MHz)
Remark: *[4] noise floor noise level of the measuring instrument ≤ 17 dBµV @ 3m distance (2,000 – 5,500 MHz)
Remark: *[5] for using a pre-amplifier in the range between 100 kHz and 1,000 MHz

The equipment meets the requirements	**Yes**	~~No~~	~~N.t.~~

Further test results are attached	~~Yes~~	**No**	Page no.

N.t.* See page no. 29

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SIR-2010in combination with SAT-A25/30-MR-P-13MHz

FUNDAMENTAL EMISSION & HARMONICS (Section 15.225)

f (MHz)	Bandwidth (kHz), Type of detector	Noted receiver level dBµV	Test distance m	Correction factor dB	Distance extrapol. factor dB	Level corrected dBµV/m	Limit dBµV/m @ meter	Margin dB	Polaris. EUT / antenna orientation	height/cm
13.560	QPK/9kHz	63.0	10	20.2	-19.1	64.1	84.0 @ 30	19.9	V / 90°	63.0
27.120	QPK/9kHz	18.5	10	20.2	-19.1	19.6	29.5 @ 30	9.9	V° / 90°	18.5
40.68	QPK/120kHz	33.0	3	-7.4	0	25.6	40.0 @ 3	14.4	V° / V 30°	100
54.24	QPK/120kHz	43.9	3	-8.1	0	35.8	40.0 @ 3	4.2	V° / V 30°	43.9
67.8	QPK/120kHz	45.9	3	-10.0	0	35.9	40.0 @ 3	4.1	V° / V 50°	45.9
81.36	QPK/120kHz	37.2	3	-11.4	0	25.8	40.0 @ 3	14.2	V° / V 50°	37.2
94.92	QPK/120kHz	44.6	3	-10.8	0	33.8	43.5 @ 3	9.7	V° / V 40°	44.6
108.48	QPK/120kHz	46.1	3	-9.7	0	36.4	43.5 @ 3	7.1	V° / V 60°	46.1
122.04	QPK/120kHz	36.5	3	-8.2	0	28.3	43.5 @ 3	15.2	V° / V 60°	36.5
135.6	QPK/120kHz	31.9	3	-7.4	0	24.5	43.5 @ 3	19.0	V° / V 60°	31.9
149.16	QPK/120kHz	34.5	3	-6.6	0	27.9	43.5 @ 3	15.6	V° / V 70°	34.5
162.72	QPK/120kHz	37.6	3	-6.6	0	31.0	43.5 @ 3	12.5	V° / V 50°	37.6
176.28	QPK/120kHz	51.0	3	-8.3	0	42.7	43.5 @ 3	0.8	V° / V 50°	51.0
189.84	QPK/120kHz	≤ 6.5	3	-10.0	0	-3.5	43.5 @ 3	46.5	V/H.0-360°	100-400
203.4	QPK/120kHz	41.3	3	-10.4	0	30.9	43.5 @ 3	12.6	V° / V 50°	140
216.96	QPK/120kHz	43.5	3	-9.4	0	34.1	46.0 @ 3	11.9	V° / V 40°	119
230.52	QPK/120kHz	43.8	3	-8.7	0	35.1	46.0 @ 3	10.9	V° / V 40°	---
244.08	QPK/120kHz	41.3	3	-8.4	0	32.9	46.0 @ 3	13.1	V° / V 40°	115
257.64	QPK/120kHz	43.1	3	-8.0	0	35.1	46.0 @ 3	10.9	V° / V 40°	120
271.2	QPK/120kHz	39.9	3	-7.4	0	32.5	46.0 @ 3	13.5	V° / V 40°	125
284.76	QPK/120kHz	44.6	3	-7.4	0	37.2	46.0 @ 3	8.8	V° / V 40°	100
298.32	QPK/120kHz	≤ 6.5	3	-6.4	0	0.1	46.0 @ 3	45.9	V/H.0-360°	100-400
311.88	QPK/120kHz	45.9	3	-6.2	0	39.7	46.0 @ 3	6.3	V° / V 40°	120
325.44	QPK/120kHz	≤ 6.5	3	-6.0	0	0.5	46.0 @ 3	45.5	V/H.0-360°	100-400
339	QPK/120kHz	44.8	3	-5.8	0	39.0	46.0 @ 3	7.0	V° / V 40°	100
352.56	QPK/120kHz	≤ 6.5	3	-5.5	0	1.0	46.0 @ 3	45.0	V/H.0-360°	100-400
Measurement uncertainty			4 dB							

Blue marked: restricted bands
Bandwidth = the measuring receiver bandwidth

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SIR-2010in combination with SAT-A25/30-MR-P-13MHz

FUNDAMENTAL EMISSION & HARMONICS (Section 15.225)

f (MHz)	Bandwidth (kHz), Type of detector	Noted receiver level dBµV	Test distance m	Correction factor dB	Distance extrapol. factor dB	Level corrected dBµV/m	Limit dBµV/m @ meter	Margin dBµV/m	Polaris. EUT / antenna orientation	height/cm
366.12	QPK/9kHz	43.4	3	-5.2	0	38.2	46.0 @ 3	7.8	V° / V 40°	100
379.68	QPK/9kHz	36.7	3	-5.0	0	31.7	46.0 @ 3	14.3	V° / V 40°	100
393.24	QPK/120kHz	36.8	3	-4.5	0	32.3	46.0 @ 3	13.7	V° / V 30°	110
406.8	QPK/120kHz	≤ 6.5	3	-4.5	0	2.0	46.0 @ 3	44.0	V/H.0-360°	100-400
420.36	QPK/120kHz	39.4	3	-4.6	0	34.8	46.0 @ 3	9.2	V° / V 30°	105
433.92	QPK/120kHz	≤ 6.5	3	-4.4	0	2.1	46.0 @ 3	43.9	V/H.0-360°	100-400
447.48	QPK/120kHz	≤ 6.5	3	-4	0	2.5	46.0 @ 3	43.5	V/H.0-360°	100-400
461.04	QPK/120kHz	≤ 6.5	3	-3.9	0	2.6	46.0 @ 3	43.4	V/H.0-360°	100-400
474.6	QPK/120kHz	≤ 6.5	3	-3.8	0	2.7	46.0 @ 3	43.3	V/H.0-360°	100-400
488.16	QPK/120kHz	37.2	3	-3.7	0	33.5	46.0 @ 3	12.5	V° / V 30°	112
501.72	QPK/120kHz	≤ 6.5	3	-3.4	0	3.1	46.0 @ 3	42.9	V/H.0-360°	100-400
528.84	QPK/120kHz	≤ 6.5	3	-2.8	0	3.7	46.0 @ 3	42.3	V/H.0-360°	100-400
542.4	QPK/120kHz	≤ 6.5	3	-2.6	0	3.9	46.0 @ 3	42.1	V/H.0-360°	100-400
555.96	QPK/120kHz	36.6	3	-2.4	0	34.2	46.0 @ 3	11.8	V° / V 30°	100
569.52	QPK/120kHz	≤ 6.5	3	-2.6	0	3.9	46.0 @ 3	42.1	V/H.0-360°	100-400
Measurement uncertainty			4 dB							

Blue marked: restricted bands
Bandwidth = the measuring receiver bandwidth

Remark: *[1] noise floor noise level of the measuring instrument ≤ 4.0dBµV @ 10m distance (0.009 – 30 MHz)
Remark: *[2] noise floor noise level of the measuring instrument ≤ 6.5dBµV @ 3m distance (30 – 1,000 MHz)
Remark: *[3] noise floor noise level of the measuring instrument ≤ 10 dBµV @ 3m distance (1,000 – 2,000 MHz)
Remark: *[4] noise floor noise level of the measuring instrument ≤ 17 dBµV @ 3m distance (2,000 – 5,500 MHz)
Remark: *[5] for using a pre-amplifier in the range between 100 kHz and 1,000 MHz

The equipment meets the requirements	**Yes**	~~No~~	~~N.t.~~

Further test results are attached	~~Yes~~	**No**	Page no.

N.t.* See page no. 29

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SPURIOUS RADIATION (Section 15.209)									
f (MHz)	Bandwidth (kHz) Type of detector	Noted receiver level **dBµV**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	Level corrected **dBµV/m**	Limit **dBµV/m**	Margin **dBµV/m**	Polarisation EUT / antenna orientation
0.1200	0.2, PK	< 4.0	10	20.2	-59.1	-34.9	46.0- @ 300 m	80.90	V, H/0-360°
	0.2, AV	< 4.0	10	20.2	-59.1	-34.9	26.0 @ 300 m	80.90	V, H/0-360°
0.5000	0.2, AV	< 4.0	10	20.2	-19.1	5.1	33.6 @ 30 m	28.5	V, H/0-360°
1.5000	0.2, AV	< 4.0	10	20.2	-19.1	5.1	24.1 @ 30 m	19.00	V, H/0-360°
3.0000	9, AV	< 4.0	10	20.2	-19.1	5.1	29.5 @ 30 m	24.4	V, H/0-360°
5.0000	9, AV	< 4.0	10	20.2	-19.1	5.1	29.5 @ 30 m	24.4	V, H/0-360°
8.0000	9, AV	< 4.0	10	20.2	-19.1	5.1	29.5 @ 30 m	24.4	V, H/0-360°
10.0000	9, AV	< 4.0	10	20.2	-19.1	5.1	29.5 @ 30 m	24.4	V, H/0-360°
20.0000	9, AV	< 4.0	10	20.2	-19.1	5.1	29.5 @ 30 m	24.4	V, H/0-360°
30.0000	9, AV	< 4.0	10	20.2	-19.1	5.1	29.5 @ 30 m	24.4	V, H/0-360°
35.0000	100, AV	≤ 3.5	3	-3.1*[6]	0	0	0.4	40.0	H,V/H,V
88.0000	100, AV	≤ 3.5	3	-10.8*[6]	0	-7.3	40.0	47.3	H,V/H,V
216.0000	100, AV	≤ 3.5	3	-10.3*[6]	0	-6.8	43.5	50.3	H,V/H,V
960.0000	100, AV	≤ 3.5	3	8.5*[6]	0	12.0	43.5	31.5	H,V/H,V
1700.0000	1000, AV	≤ 4.5	3	3.8*[7]	0	8.3	54.0	45.7	H,V/H,V
2250.0000	1000, AV	≤ 10	3	8.0*[7]	0	18.0	54.0	36.0	H,V/H,V
4000.0000	1000, AV	≤ 10	3	8.4*[7]	0	18.4	54.0	35.6	H,V/H,V
5000.0000	1000, AV	≤ 10	3	9.1*[7]	0	19.4	54.0	34.6	H,V/H,V
7500.0000	1000, AV	≤ 14	3	12.9*[7]	0	26.9	54.0	27.1	H,V/H,V
8300.0000	1000, AV	≤ 14	3	14.0*[7]	0	28.8	54.0	25.2	H,V/H,V
9400.0000	1000, AV	≤ 14	3	16.0*[7]	0	30.0	54.0	24.0	H,V/H,V
11000.0000	1000, AV	≤ 14	3	18.3*[7]	0	32.3	54.0	21.7	H,V/H,V
All other emissions than harmonics in the restricted bands are lower than the noise level of the measuring equipment!									
Measurement uncertainty		4 dB							

Blue marked: restricted bands

Bandwidth = the measuring receiver bandwidth

Remark: *[1] noise floor noise level of the measuring instrument ≤ 4.0dBµV @ 10m distance (0.009 MHz –30 MHz)
Remark: *[2] noise floor noise level of the measuring instrument ≤ 3.5dBµV @ 3m distance (30 – 1,000 MHz)
Remark: *[3] noise floor noise level of the measuring instrument ≤ 4.5dBµV @ 3m distance (1,000 – 2,000 MHz)
Remark: *[4] noise floor noise level of the measuring instrument ≤ 10dBµV @ 3m distance (2,000 – 5,500 MHz)
Remark: *[5] noise floor noise level of the measuring instrument ≤ 14dBµV @ 3m distance (5,500 – 14,500 MHz)
Remark: *[6] for using a pre-amplifier in the range between 100 kHz and 1,000 MHz
Remark: *[7] for using a pre-amplifier in the range between 1.0 GHz and 18.0 GHz

The equipment meets the requirements	**Yes**	~~No~~	~~N.t.~~

Further test results are attached	**Yes**	~~No~~	**Annex no. 3**

N.t.* See page no. 29

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8.5 Frequency tolerance

8.5.1 Regulation

(e) The frequency tolerance of the carrier signal shall be maintained within ± 0.01 % of the operating frequency over a temperature variation of -20 °C to +55 °C at normal supply voltage, and for a variation in the primary supply voltage from 85 % to 115 % of the rated supply voltage at a temperature of 20 °C.

8.5.2 Test equipment

Type	**Manufacturer/ Model no.**	**Serial no.**	**Last calibration**	**Next calibration**
Receiver (9 kHz –18.0 GHz)	Rohde & Schwarz Spectrum Analyzer FSL 18 (171a)	100.117	2010/11	2012/11
Low noise signal generator (10kHz – 5.4GHz)	Marconi Instruments 2042 (6)	119347/003	2010/01	2012/01
Temperature chamber	Brabender TTE 32/40 H (87)	---	2010/03	2013/03
RF- cable	RG58 2.5m [BNC]	K21	2011/01	2012/01

11.5.3 Test procedures

Stability with respect to ambient temperature:

Supply the EUT with nominal ac voltage, or install a new or fully charged battery in the EUT. If possible, a dummy load should be connected to the EUT, because an antenna near the metallic walls of an environmental test chamber could affect the output frequency of the EUT. If the EUT is equipped with a permanently attached, adjustable-length antenna, the EUT should be placed in the center of the chamber with the antenna adjusted to the shortest length possible. Turn the EUT on, and tune it to one of the number of frequencies required

Couple the intentional radiator output to the measuring instrument by connecting an antenna to the measurement instrument with a suitable length of coaxial cable and placing the measurement antenna near the EUT (e.g., 15 cm away) or by connecting a dummy load to the measuring instrument through an attenuator, if necessary.

Supply the EUT with nominal ac voltage, or install a new or fully charged battery in the EUT. Turn the EUT on, and couple its output to the measuring instrument by connecting an antenna to the measurement instrument with a suitable length of coaxial cable.

Adjust the location of the measurement antenna and the controls on the measuring instrument to obtain a suitable signal level (i.e., a level that will not overload the measuring instrument, but is strong enough to allow measurement of the operating or fundamental frequency of the EUT).

Tune the EUT to any one of the number of frequencies specified. Turn the EUT off, and place it inside an environmental chamber if appropriate. Allow the chamber to stabilize at +20 °C before proceeding. Turn on the EUT, and record the operating frequency of the intentional radiator at start up and two, five, and ten minutes after start up. Turn the EUT off and allow it to cool to the ambient temperature, and then repeat this procedure for the number of the frequencies specified. Four measurements are made at each operating frequency.

Stability with respect to input voltage:

Supply the EUT with nominal ac voltage, or install a new or fully charged battery in the EUT. If possible, a dummy load should be connected to the EUT, because an antenna near the metallic walls of an environmental test chamber could affect the output frequency of the EUT. If the EUT is equipped with a permanently attached, adjustable-length antenna, the EUT should be placed in the center of the chamber with the antenna adjusted to the shortest length possible. Turn the EUT on, and tune it to one of the number of frequencies required.

Couple the intentional radiator output to the measuring instrument by connecting an antenna to the measurement instrument with a suitable length of coaxial cable and placing the measurement antenna near the EUT (e.g., 15 cm away) or by connecting a dummy load to the measuring instrument through an attenuator, if necessary.

Adjust the location of the measurement antenna and the controls on the measuring instrument to obtain a suitable signal level (i.e., a level that will not overload the measuring instrument, but is strong enough to allow measurement of the operating or fundamental frequency of the EUT). Turn the EUT off, and place it inside an environmental temperature chamber. For devices that are normally operated continuously, the EUT may be energized while inside the test chamber. For devices that have oscillator heaters, energize only the heater circuit while the EUT is inside the chamber.

Set the temperature control on the chamber to the highest specified EUT operating temperature, and allow the temperature inside the chamber to stabilize at the set temperature before starting frequency measurements.

While maintaining a constant temperature inside the environmental chamber, turn the EUT on and record the operating frequency at start up and two, five, and ten minutes after the EUT is energized. Four measurements in total are made.

Repeat the above procedure until the number of frequencies specified has been measured. After all measurements have been made at the highest specified temperature, turn the EUT off. Repeat the above measurement process for the EUT with the test chamber set at the lowest temperature specified by the regulatory or procuring agency. Measurements shall be made at the number of frequencies specified.

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8.5.4 Result

Frequency tolerance (Section 15.225(e))			
Test conditions	**Frequency Measured (MHz)**	**Frequency Error**	
T_{nom} = +20° C		**(kHz)**	**ppm**
V_{min} = 5.1 V DC	**13.559191**	**-0.809**	**59.7**
V_{nom} = 6.0 V DC	**13.559182**	**-0.818**	**60.3**
V_{max} = 6.9 V DC	**13.559186**	**-0.814**	**60.0**
Maximum Frequency error (MHz)		**0.818**	**60.3**
Measurement uncertainty	± $5*10^{8}$		

Frequency tolerance (Section 15.225(e))			
Test conditions	**Frequency Measured (MHz)**	**Frequency Error**	
V_{nom} = 6.0 V DC		**(kHz)**	**(kHz)**
T_{min} -20 °C	**13.559405**	**-0.595**	**43.9**
T_{min} -10 °C	**13.559376**	**-0.624**	**46.0**
T_{min} 0 °C	**13.559326**	**-0.674**	**49.7**
T_{min} +10 °C	**13.559196**	**-0.804**	**59.3**
T_{min} +20 °C	**13.559182**	**-0.818**	**60.3**
T_{min} +30 °C	**13.559111**	**-0.889**	**65.6**
T_{min} +40 °C	**13.559101**	**-0.899**	**66.3**
T_{min} +50 °C	**13.559086**	**-0.914**	**67.3**
Maximum frequency error (kHz)		**0.914**	**67.4**
Measurement uncertainty	±5 * 10^{-8}		

The equipment meets the requirements	**Yes**	~~No~~	~~N.t.~~

Further test results are attached	~~Yes~~	**No**	Page no.

N.t.* See page no. 29

9. Additional information to the test report

Remarks

N.t.[1]	Not tested, because the antenna is part of the PCB
N.t.[2]	Not tested, because the EUT is directly battery powered
N.t.[3]	Not tested, because not applicable to the EUT
N.t.[4]	Not tested, because not ordered

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End of test report

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