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STS 121

Ticket Vending Machine TVM Expert for New Jersey

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Test report reviewed by	Enrico Blondel
Owner of the test report	ACS Solutions Switzerland Ltd., Frankenstrasse 70, 3018 Bern
Customer	ACS Solutions Switzerland Ltd., Frankenstrasse 70, 3018 Bern
Test item	Ticket Vending Machine TVM Expert for New Jersey
Manufacturer	ACS Solutions Switzerland Ltd., Frankenstrasse 70, 3018 Bern
Field of test activity	EMC and Radio Spectrum Matters
Test Basis / Standard	47CRF15.207, 47CRF15.209, 47CRF15.225 a) - c), and ANSI C 63-4:2003
Range of Test	Complete
Test fulfilment	Pass
Remarks	None

Author (Visa)

Reviewer (Visa)

Head of test laboratory (Signature)

Without the written approval of the test laboratory, this test report shall not be reproduced, except in full. The test results relate only to the items tested and the specified configurations. The remarks are binding for correct interpretation of the test results.

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1 Abbreviations

EUT Equipment under Test (Prüfgegenstand)
TVM Ticket vending Machine

2 Test specifications

Test sample arrival date: January 15th, 2007
Date of test from: January 16th, 2007
to: January 16th, 2007
Customer representative during testing: Mr. A. Krebs; +41 31 999 62 14

3 Equipment under test

3.1 Short description (from customer)

The Expert ticket vending machine from ACS has the following features:

- Large 15.1" TFT display
- Touchscreen with "IR- Touchframe technology" behind safety glass
- Computer-controlled using Windows XP operating system
- Graphical user guidance even for the service functions
- Routine tasks are automated and user-guided wherever possible (replacement of paper and cashboxes)
- RS24.7 change money system with auxiliary coin storage units
- BNA 57 banknote processing
- Modern, monitored power supply system
- Online connection to the corresponding accounting, management and system servers
- Thermoprinter for Ultra light Tickets handles 7 paper rolls
- Thermoprinter for normal Paper based tickets and Receipt services
- Magnetic Card Reader and encrypting PIN Pad for EFT- POS payment systems
- Contactless Card Reader for cashless payment
- LED information display for passenger information
- Automatic temperature management

3.2 Identification

Test item: Ticket Vending Machine TVM Expert for New Jersey
 Type / Model: Expert 900
 Manufacturer: ACS Solutions Switzerland Ltd., Frankenstrasse 70, 3018 Bern
 Serial number: 30300240703S

Photos of the identification: See Annex 1 External Photos and Annex2 Internal Photos.

3.2.1 General

Dimensions (H*W*D) in mm: 2'017 * 912 * 534 (with pedestal and lightning top)
 Weight in kg: 350

3.2.2 Hardware identification

System: NJT 2006: Expert 900; 800.0001/04; Serial number 30300240703S

The EUT contains the following subsystems:

Description	Identification	Serial number
Central computer	849.2151/81	3030247414S
Display with IR Touchframe	701.0966/02	3030242631
Additional buttons	701.0966/10; 701.0966/20	3030242635; 3030242640
Coinsystem	560.0652	3807
“Banknotensystem”	Mars Electronics International Inc. BNA 57 ; 956.1022	Mars 177232/234/F
RFID Modul	ACS Solutions France SAS TLB A+B 701.1161/01 ; 701.1161/02/03	Controller 87728219V01AA Antenna 87728220V01AA
Modem	Multitech Systems MultiModem ZBA; 701.0843	Multitech 11047867
Power Supply	Chinfa DRA120; 701.1077/01 DRA240; 701.1070	R050787-960129060007 R050793-96010606060021
EMC Filter	Schaffner FN2060; 924.0295	0627R

3.2.3 Software identification

ACS test application 2006.1_alpha1

Hyperterminal 6.3

CSC test application

3.2.4 Additional equipment

Notebook containing a analogue modem

3.3 Tested configuration

Stand alone, applications for ticket vending, RFID-Module and modem connection running.

3.4 Active mode during all measurements and tests

The modem of the EUT was connected to an analogue telecom port. During the measurements a connection between the EUT and the notebook was established.

3.5 Modifications during the test

None.

4 Summary of test results and remarks

The measurements have been applied according to 47CFR15

Requirements / Test	Limit	Standard	Range	Test result	Chap.
Conducted disturbance	47CRF15.207	ANSI C 63-4:2003	0.15 – 30 MHz	pass	5.1
Radiated E-Field	47CRF15.209	ANSI C 63-4:2003	30 MHz – 12 GHz	pass	5.2
Radiated H-Field	47CRF15.209	ANSI C 63-4:2003	9 kHz – 30 MHz	pass	5.3
Additional Provisions	47CRF15.225 a) - c)	ANSI C 63-4:2003	13.11 – 14.01 MHz	pass	5.4
Stability of the carrier frequency while temperature and supply voltage variation	47CRF15.225 e)	ANSI C 63-4:2003	-20°C – 50°C and 97.5 V – 132.25 V	pass	5.5

5 Emission

5.1 Conducted disturbances 0.15 MHz - 30 MHz

ANSI C 63.4:2003

5.1.1 General

Date of test: January 16th, 2007

Tested by:

Marc Rubin

5.1.2 Limits

47CRF15.207:

Frequency Range [MHz]	Limit Quasi-Peak [μ V/m]	Limit Average [dB(μ V)/m]
0.15 – 0.5	66 to 56 (Log. Freq.)	56 to 46 (Log. Freq.)
0.5 – 5	56	46
5 – 30	60	50

5.1.3 Test set-up

Test equipment:

Equipment	Manufacturer	Type	Inventory No.
<input checked="" type="checkbox"/> Test receiver	Rohde & Schwarz	ESS	25201
<input checked="" type="checkbox"/> Relais-Matrix	Rohde & Schwarz	RSU	25202
<input type="checkbox"/> V-Artificial Mains Network	Rohde & Schwarz	ESH2-Z5	15840
<input checked="" type="checkbox"/> V- Artificial Mains Network	Rohde & Schwarz	ESH3-Z5	10540
<input type="checkbox"/> V- Artificial Mains Network	Rohde & Schwarz	ESH3-Z6	18078
<input type="checkbox"/> 200A – Artificial Mains Network	Rohde & Schwarz	ENV4200	168517
<input type="checkbox"/> T- Artificial Mains Network	Rohde & Schwarz	ESH3-Z4	25721
<input type="checkbox"/> TT- Artificial Mains Network	Rohde & Schwarz	EZ-10	16562
<input type="checkbox"/> 2*2-Wire Coupling Network	Rohde & Schwarz	ENY22	168515
<input type="checkbox"/> 4-Wire-Coupling Network	Rohde & Schwarz	ENY41	168516
<input type="checkbox"/> Coupling Network	Lüthi	CDN 801-S1	25786
<input type="checkbox"/> Coupling Network	Lüthi	CDN 801-S4	25717
<input type="checkbox"/> Coupling Network	Lüthi	CDN 801-S8	25715
<input type="checkbox"/> Coupling Network	Lüthi	CDN 801-S8	25716
<input type="checkbox"/> Current Clamp	Solar Electronic	6741-1	7525
<input checked="" type="checkbox"/> Power Source	Spitzenberger/Spiess	PHD 6750/B	17525
<input checked="" type="checkbox"/> Signal Generator	Spitzenberger/Spiess	Sycore	168592

Photos of the test set-up: See Annex 3, photos 1 & 2.

5.1.4 Test conditions

Operating mode: $U_{IN} = 115 V_{AC}$ 60 Hz; Active mode see chap. 3.3.

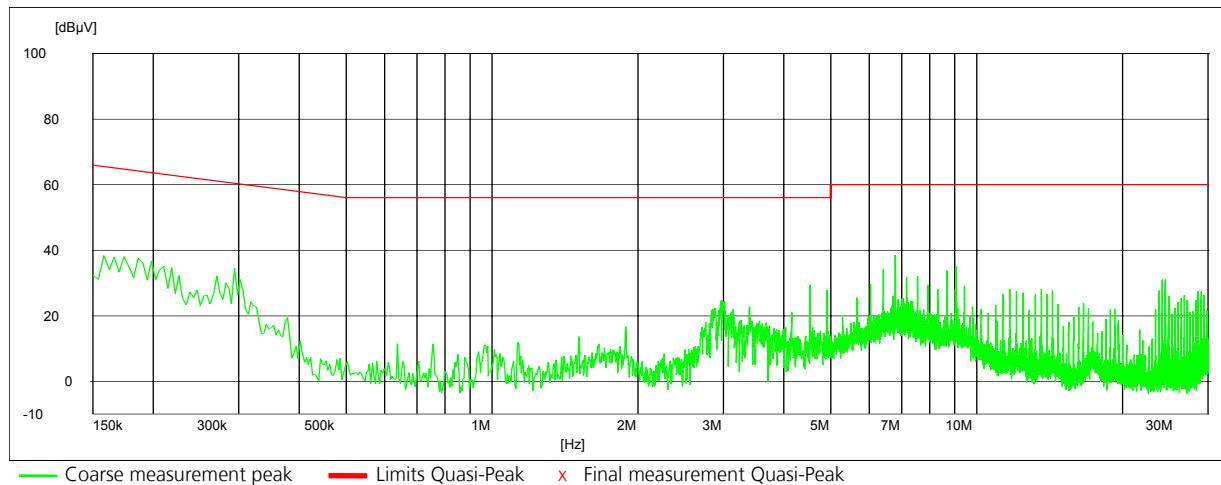
5.1.5 Mains input measurements

Measurement Procedure:

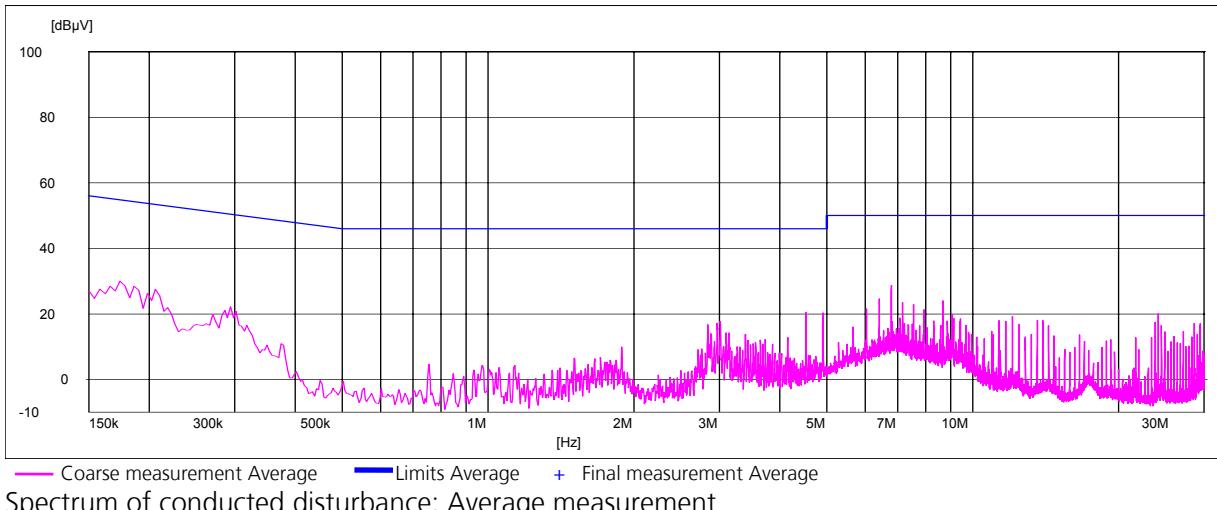
The coarse measurement is carried out with the Detectors Peak/Average (Fast Average) and the results of phase and neutral are plotted together. If the coarse measurement passes a margin of 10 dB to the limit a re-measurement with the appropriate detector will be carried out and the result will be listed on the table below the plots.

Settings

Start	Stop	Step	IFBW	Detector	Meastime	RF-ATTN	Preampl.
150.0 kHz	30.0 MHz	4.0 kHz	10 kHz	MaxPeak	1.0 ms	0 dB	Off
Average							



Spectrum of conducted disturbance: Peak measurement



Measurement with QP-detector

Frequency [MHz]	Level [dB(µV)]	Transd [dB]	Limit [dB(µV)]	Margin [dB]	Line	PE
--	--	--	--	--	--	--

Measurement with AV-detector

Frequency [MHz]	Level [dB(µV)]	Transd [dB]	Limit [dB(µV)]	Margin [dB]	Line	PE
--	--	--	--	--	--	--

5.1.6 Remarks

None.

5.2 Radiated disturbance 30 MHz up to 12 GHz

ANSI C 63.4:2003

5.2.1 General

Date of test: January 16th & May 16th, 2007 Tested by: Johannes Biner

5.2.2 Limits

47CRF15.209

Frequency Range [MHz]	Limit [μ V/m] @ 3 m	Limit [dB(μ V)/m] @ 3 m
30 – 88	100	40
88 – 216	150	43.5
216 – 960	200	46
Above 960	500	54

5.2.3 Test set-up

Test equipment:

Equipment	Manufacturer	Type	Inventory No.
<input checked="" type="checkbox"/> Test Receiver	Rohde & Schwarz	ESBI	25953
<input checked="" type="checkbox"/> Test Receiver	Rohde & Schwarz	ESBU	168593
<input checked="" type="checkbox"/> Preamplifier	Mini-Circuit	ZHL-1042J	168520
<input checked="" type="checkbox"/> Preamplifier	Miteq	AMF-5B-8018-20P	
<input checked="" type="checkbox"/> Antenna, biconical-logarithmical	Chase	CBL 6112A	26933
<input checked="" type="checkbox"/> Antenna, logarithmical	EMCO	3147	26021
<input checked="" type="checkbox"/> Antenna, logarithmical	Rohde & Schwarz	226/58	168591
<input checked="" type="checkbox"/> Power Source	Spitzenberger/Spiess	PHD 6750/B	17525
<input checked="" type="checkbox"/> Signal Generator	Spitzenberger/Spiess	Sycore	168592

Settings of the measurement equipment for the coarse measurement:

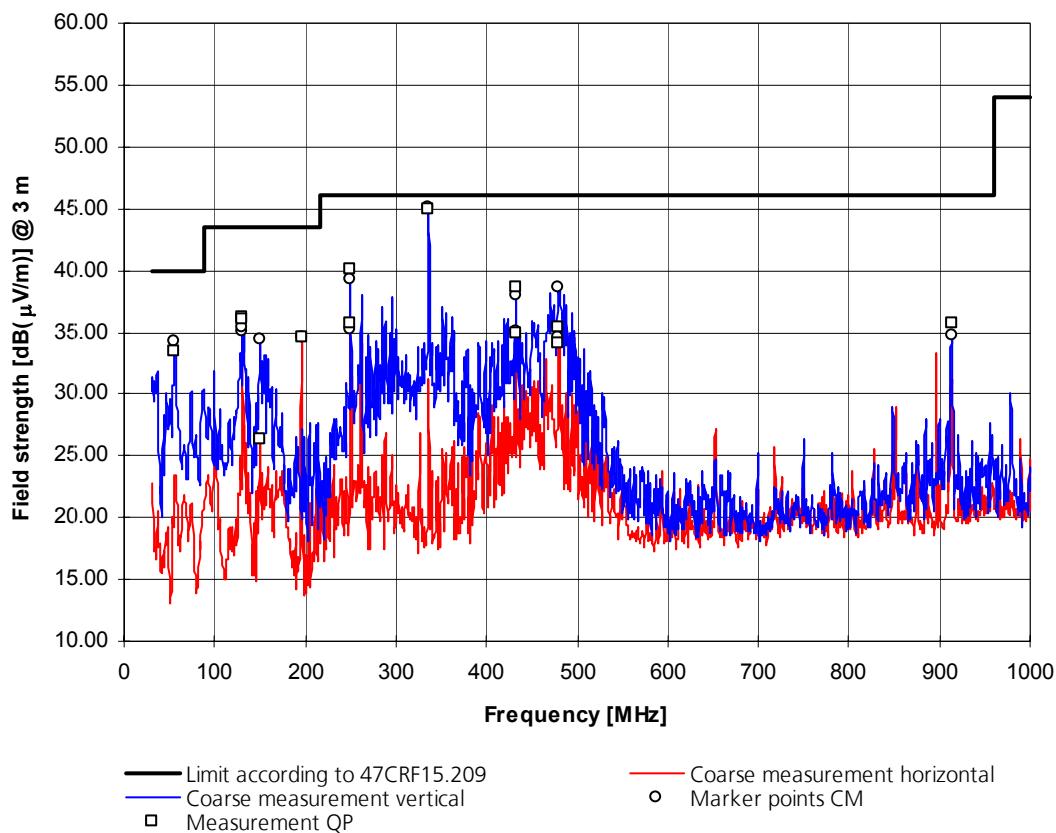
Frequency Range [MHz]	Resolution Bandwidth [kHz]	Video Bandwidth [MHz]	Sweep time	Measurement Procedure
30 – 1000	120	1	coupled	Coarse: Peak, Receiver: QP
1000 - 5000	1000	10	coupled	Coarse: Peak, Receiver: Average
5000 - 12000	1000	10	coupled	Peak and Average

Photo of the test set-up: See Annex 3, photo 3.

5.2.4 Test conditions

Operating mode: $U_{IN} = 115 V_{AC}$ 60 Hz; Active mode see chap. 3.3.

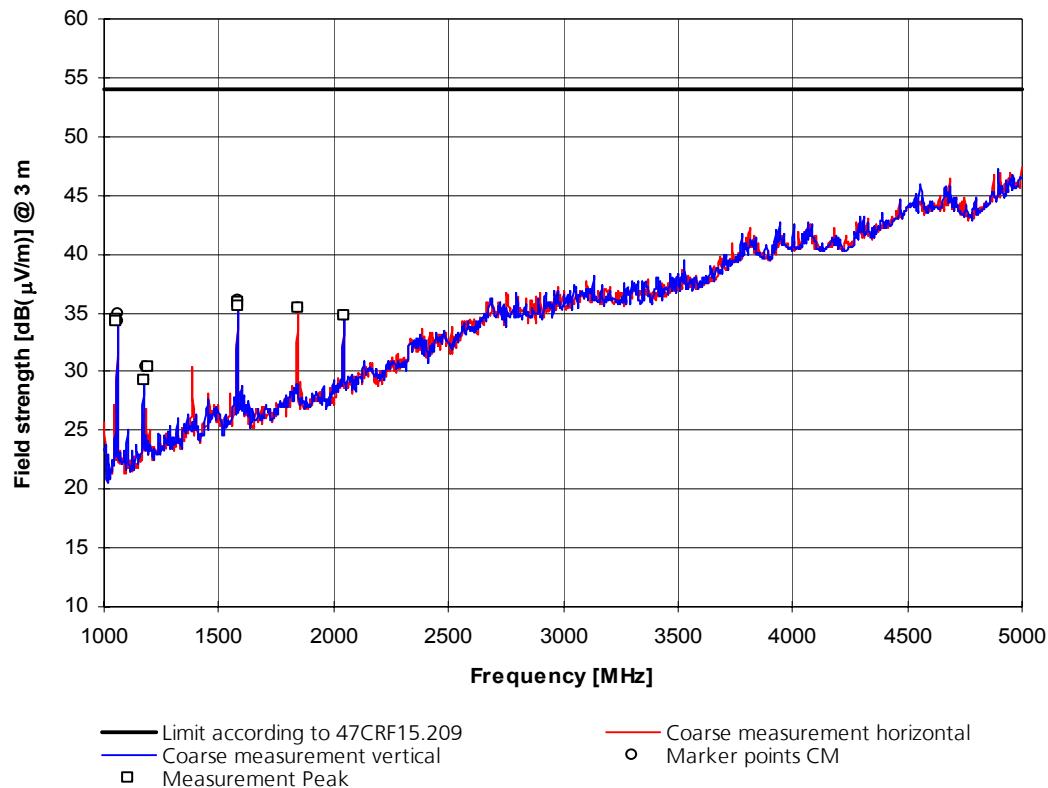
5.2.5 Measurements: 30 MHz up to 1 GHz



Field strength measurement in 3 m distance on a frequency range of 30 MHz up to 1000 MHz

Marker points from coarse measurement			Measurement with test receiver (Quasi-Peak Detector)						
Frequency [MHz]	Field strength (at 3m distance) [dBμV/m]	Polarisation	Frequency [MHz]	Field strength (at 3m distance) [dBμV/m]	Limit 47CFR15.209 [dBμV/m]	Margin [dB]	Antenna position [cm]	Turntable position [Degrees]	
55.87	34.25	Vertical	56.11	33.4	40	6.6	100	0	
130.23	35.08	Vertical	130.27	36.2	43	6.8	280	360	
131.31	35.46	Horizontal	130.62	36	43	7	160	0	
149.63	34.43	Vertical	150	26.4	43	16.6	100	360	
195.98	34.59	Horizontal	195.93	34.6	43	8.4	100	0	
249.87	35.22	Horizontal	250	35.8	46	10.2	100	280	
249.87	39.26	Vertical	250	40.1	46	5.9	280	0	
336.09	45.1	Vertical	336	44.9	46	1.1	100	0	
432.01	35.07	Horizontal	432.01	38.6	46	7.4	220	320	
432.01	37.99	Vertical	432.02	35	46	11	100	320	
478.36	38.61	Vertical	480	34.1	46	11.9	100	120	
479.43	34.61	Horizontal	480.01	35.4	46	10.6	280	40	
913.78	34.75	Vertical	913.93	35.7	46	10.3	100	0	

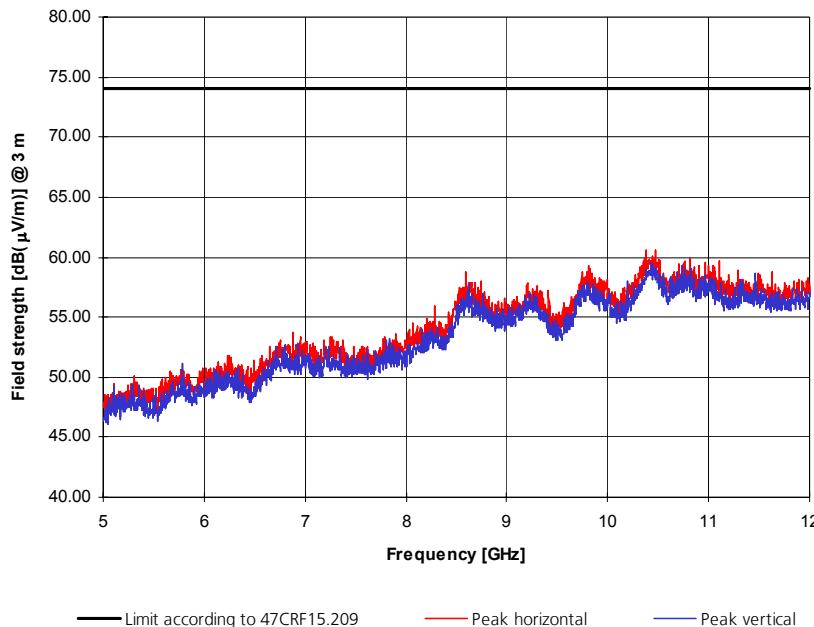
5.2.6 Measurements: 1 GHz up to 5 GHz



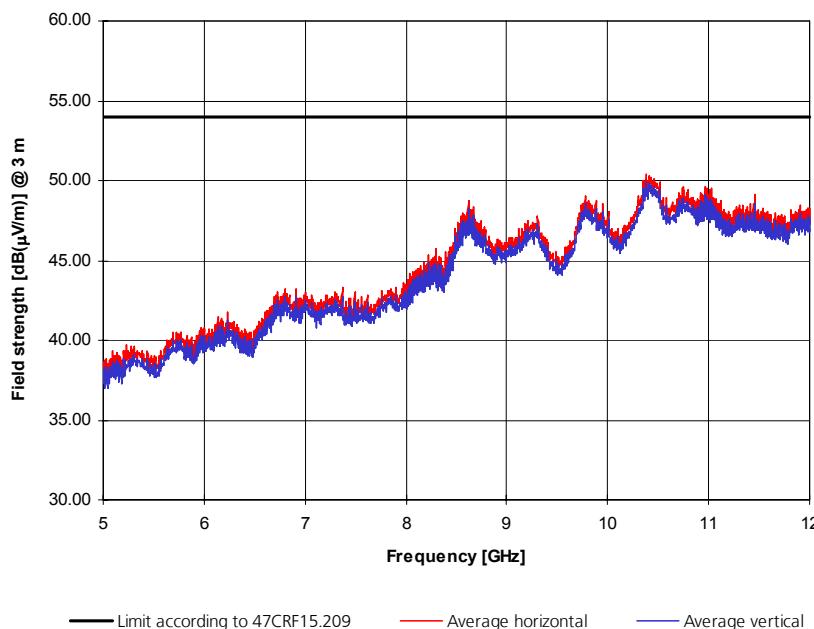
Field strength measurement in 3 m distance on a frequency range of 1 GHz up to 5 GHz

Marker points from coarse measurement			Measurement with test receiver (Average Detector)						
Frequency [MHz]	Field strength (at 3m distance) [dB μ V/m]	Polarisation	Frequency [MHz]	Field strength (at 3m distance) [dB μ V/m]	Limits [dB μ V/m]	Margin [dB]	Antenna position [cm]	Turntable position [Degrees]	
1057.78	35	Horizontal	1055.9	34.5	50	15.5	200	320	
1057.78	34.22	Vertical	1056.2	34.22	50	21.4	100	0	
1173.33	29.3	Vertical	1174.87	29.3	50	20.7	100	0	
1186.67	30.4	Horizontal	1187.84	30.4	50	19.6	100	0	
1582.22	36	Horizontal	1583.83	35.9	50	14.1	100	40	
1582.22	36	Vertical	1583.88	35.5	50	14.5	100	80	
1844.44	35.4	Horizontal	1842.61	35.4	50	14.6	100	80	
2044.44	34.8	Vertical	2043.34	34.8	50	15.2	100	40	

5.2.7 Measurements: 5 GHz up to 12 GHz; Peak



5.2.8 Measurements: 5 GHz up to 12 GHz; Average



5.2.9 Remarks

None.

5.3 Spurious radiation H-Field 9 kHz - 30 MHz

ANSI C 63.4:2003

5.3.1 General

Date of test: January 16th, 2007 Tested by: Johannes Biner

5.3.2 Test requirements

47CRF15.209

Frequency Range [MHz]	Limit [μ V/m]	Measurment Distance
0.009 – 0.490	2400/F(kHz)	300
0.49 – 1.705	2400/F(kHz)	30
1.705 – 30.0	30	30

5.3.3 Result of the test

The EUT does fulfil the requirement.

5.3.4 Test set-up

Test equipment:

Equipment	Manufacturer	Type	Inventory No.
<input checked="" type="checkbox"/> Test Receiver	Rohde&Schwarz	ESBI	25953
<input checked="" type="checkbox"/> Preamplifier	Swisscom INO-EEC	4 kHz – 1.3 GHz	182188
<input checked="" type="checkbox"/> Antenna, loop	Rohde&Schwarz	HFH2-Z2	13765
<input checked="" type="checkbox"/> Power Source	Spitzenberger/Spiess	PHD 6750/B	17525
<input checked="" type="checkbox"/> Signal Generator	Spitzenberger/Spiess	Sycore	168592

Settings of the measurement equipment:

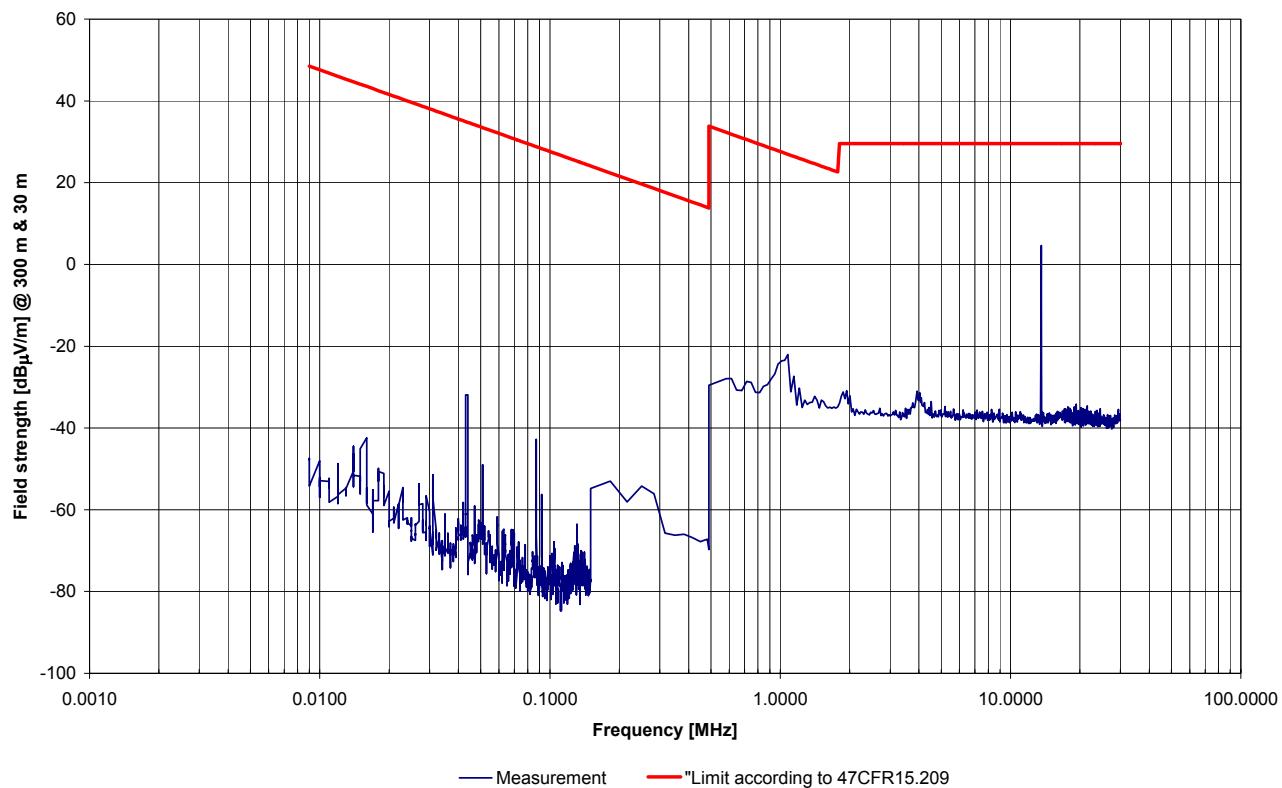
Frequency Range [MHz]	Resolution Bandwidth [kHz]	Video Bandwidth [kHz]	Sweep time
0.009 – 0.15	0.2	3	coupled
0.15 - 30	9	100	coupled

Photo of the test set-up: See Annex 3, photo 4.

5.3.5 Test conditions

Operating conditions: $U_{IN} = 115 V_{AC}$ 60 Hz; Active mode, see chap. 3.3.

5.3.6 Measurement in the frequency range of 9 kHz up to 30 MHz



Radiated Field measured at a distance of 3 m and result converted to relevant distances

5.3.7 Remark

The carrier of the radio service at 13.56 MHz belongs to the exclusion band.

5.4 Radiated Emission Additional Provisions 13.110 MHz up to 14.010 MHz ANSI C 63.4:2003

5.4.1 General

Date of test: January 16th, 2007 Tested by: Johannes Biner

5.4.2 Test requirements

47CRF15.225 a) - c)

Paragraph	Frequency Range [MHz]	Limit [μ V/m] @ 30 m	Limit [dB μ V/m] @ 30 m
a)	13.553 – 13.567	15'848	84
b)	13.410 – 13.533 & 13.567 – 13.710	334	50.5
c)	13.110 – 13.410 & 13.710 – 14.010	106	40.5

5.4.3 Result of the test

The EUT does fulfil the requirement.

5.4.4 Test set-up

Test equipment:

Equipment	Manufacturer	Type	Inventory No.
Test Receiver	Rohde & Schwarz	ESBI	25953
Preamplifier	Swisscom INO-EEC	4 kHz – 1.3 GHz	182188
Antenna, loop	Rohde & Schwarz	HFH2-ZZ	168599
Power Source	Spitzenberger/Spiess	PHD 6750/B	17525
Signal Generator	Spitzenberger/Spiess	Sycore	168592

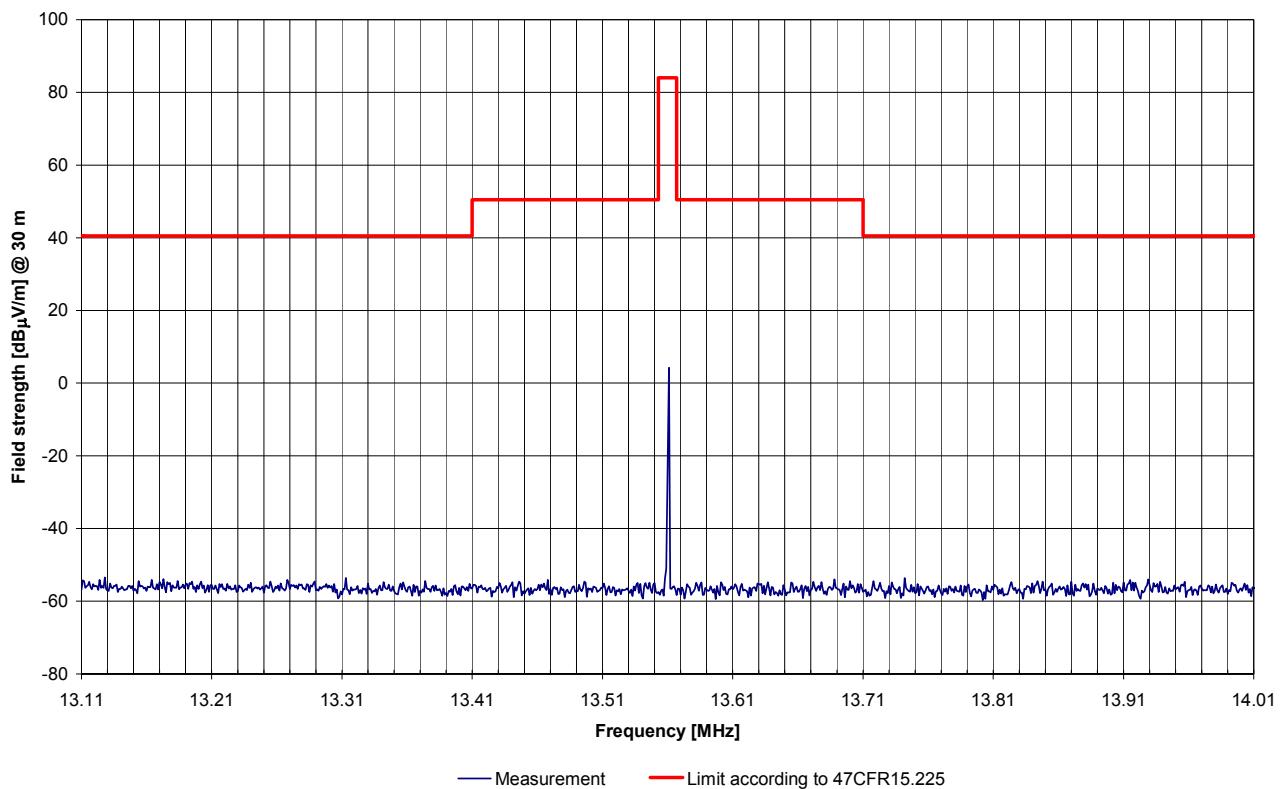
Settings of the measurement equipment:

Frequency Range [MHz]	Resolution Bandwidth [kHz]	Video Bandwidth [kHz]	Sweep time
13.110 – 14.011	0.2	3	coupled

Photo of the test set-up: See Annex 3, photo 4.

5.4.5 Test conditions

Operating conditions: $U_{IN} = 115 V_{AC}$ 60 Hz; Active mode, see chap. 3.3.

5.4.6 Measurement in the frequency range of 13.110 MHz up to 14.010 MHz

Radiated Field measured at a distance of 3 m and result converted to 30 m

5.4.7 Remark

None

5.5 Stability of the carrier frequency

ANSI C 63.4:2003

5.5.1 General

Date of test: April 27th until April 30th, 2007 Tested by: Johannes Biner

5.5.2 Test requirements

47CRF15.225 e)

What	Range or variation	Allowed variation
Supply voltage	97.75 V (85%) – 132.25 (115%)	0.01%
Temperature	-20° - 50° C	0.01%

5.5.3 Result of the test

The EUT does fulfil the requirement.

5.5.4 Test set-up

Test equipment:

Equipment	Manufacturer	Type	Inventory No.
Test Receiver	Rohde & Schwarz	ESU	168593
Preamplifier 30dB	Swisscom INO-EEC	3.5 kHz – 500 MHz	182187
Antenna, loop	Rohde & Schwarz	HFH2-Z4	13765
Power Source	Spitzenberger/Spiess	PHD 6750/B	17525
Signal Generator	Spitzenberger/Spiess	Sycore	168592
Climatic Chamber A	Weiss Technik		168543
Climatic Chamber C	Weiss Technik		168545
DVM	Fluke	8840A	105489
Relay Switching matrix	Swisscom		

Settings of the measurement equipment:

Center Frequency [MHz]	Span [kHz]	Resolution Bandwidth [kHz]	Video Bandwidth [kHz]	Sweep time
13.56	1.35	0.2	3	coupled

Photo of the test set-up: See Annex 3, photo 5, 6 & 7.

5.5.5 Test conditions

Operating conditions: $U_{IN} = 115 \text{ V}_{AC}$ 60 Hz; Active mode, see chap. 3.3.

5.5.6 Measurement of the carrier at supply voltage variation

Supply voltage [V]	Supply voltage [%]	Measurement [MHz]	Variation [Hz]	Limit [Hz]	Fulfilment
97.75	85	13.5605162	0.0	1356	PASS
115	100	13.5605162	--	--	--
132.25	115	13.5605162	0.0	1356	PASS

5.5.7 Measurement of the carrier at temperature variation

Temperature [° C]	Measurement [MHz]	Variation [Hz]	Limit [Hz]	Fulfilment
-20	13.5604955	-20.7	1356	PASS
-10	13.5604955	-20.7	1356	PASS
0	13.5604955	-20.7	1356	PASS
5	13.5604955	-20.7	1356	PASS
10	13.5605040	-12.2	1356	PASS
20	13.5605162	--	--	--
30	13.5605256	9.4	1356	PASS
40	13.5605336	17.4	1356	PASS
50	13.5607194	203.2	1356	PASS

5.5.8 Remark

The EUT contains a heating system which keeps the inside temperature at +5°C if the outside temperature decreases below this value.

5.6 Measurement Uncertainty

The uncertainty of the different measurement sections are listed in the following table:

Measurement section			Uncertainty [dB]		
Type	Coupling	Frequency range	U_{LAB}	U_{CISPR}	
Conducted disturbances	V-NNB	9 kHz - 150 kHz	2.8	-3.5	± 4.0
	V-NNB	150 kHz - 30 MHz	2.6	-2.9	± 3.6
	Current Probe	150 kHz - 30 MHz	3.1	-3.5	--
Radiated disturbances	Horizontal	30 MHz - 200 MHz	4.0	-4.7	± 5.0
	Vertical	30 MHz - 200 MHz	4.1	-4.7	± 5.1
	Horizontal	200 MHz - 1000 MHz	4.2	-5.1	± 5.2
	Vertical	200 MHz - 1000 MHz	4.2	-4.9	± 5.2

As U_{LAB} is less than or equal to U_{CISPR} (see table above), then:

- Compliance is deemed to occur if no measured disturbance exceeds the disturbance limit.
- Non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.