Albis Technologies Ltd.
Certification Laboratory
CH-8047 Zürich
Tel. ++41 (0)58 252 4725
Fax ++41 (0)58 252 4961

STS 014

S Schweizerischer Prüfstellendienst
T Service Suisse d'essai
S Servizio di prova in Svizzera
Swiss testing service

FCC Registration Number: 477330

EMC Test Report

Number, Revision:	PB PST 2258, Revision 1
Date:	04 Septembert, 2009
Client:	Leica Geosystems AG, Heinrich-Wild-Strasse CH-9435 Heerbrugg
Equipment under Test:	CS10
Magnitude of Test:	EMC-Tests according to the 1999/5/EC harmonized standards: - ETSI EN 301 489-1 and ETSI EN 301 489-17, - EN 61000-6-3 (Emission) and EN 61000-6-2 (Immunity) and considering - Enhanced requirements by the client - Requirements according to FCC Part 15
Result of Test:	**The equipment under test (EUT) is in conformance to all requirements mentioned above.**
Author:	Daniel Rufer, Rudolf Hasler
Telephone:	++41(0)58 252 4352
Distribution List:	Client (Original), PST2, Archive

Function	Department	Name	Signature	Date
Test engineer	PST2	R. Hasler		
Technical Manager	PST2	U. von Känel		

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1 General

1.1 Test Laboratory

Albis Technologies Ltd - Certification Laboratory

Head of Certification Laboratory:	Mr. A. Gnehm
Technical Manager:	Mr. U. von Känel
Test site:	Certification Laboratory Albis Technologies Ltd. Albisriederstrasse 199 CH-8047 Zürich

1.2 Client

Address:	Leica Geosystems AG Heinrich-Wild-Strasse CH-9435 Heerbrugg
Contact Person:	Leica Geosystems AG Mr. Stefan Schnyder Heinrich-Wild-Strasse CH-9435 Heerbrugg Phone number ++41(0)582 52 4653

1.3 Equipment under test (EUT)

Supplier:	same address as client
Manufacturer:	same address as client

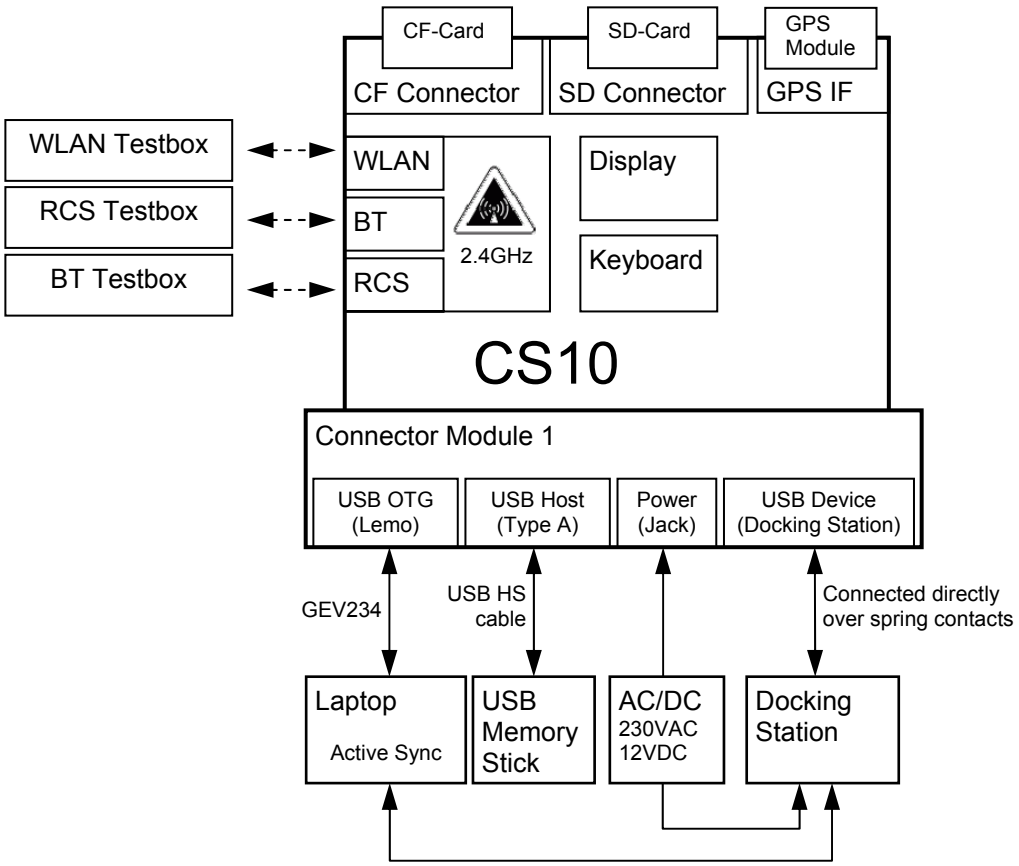
Identification:

Type:	CS10 (Note1)
Serial:	CS10-PT3/001 (Note2)
Docking Station:	Leica CCS01 Docking station for CS Controller
GPS Module	Leica GS05 GNSS cap
Power supply	GEV235
Lemo USB Cable	GEV234

Notes:

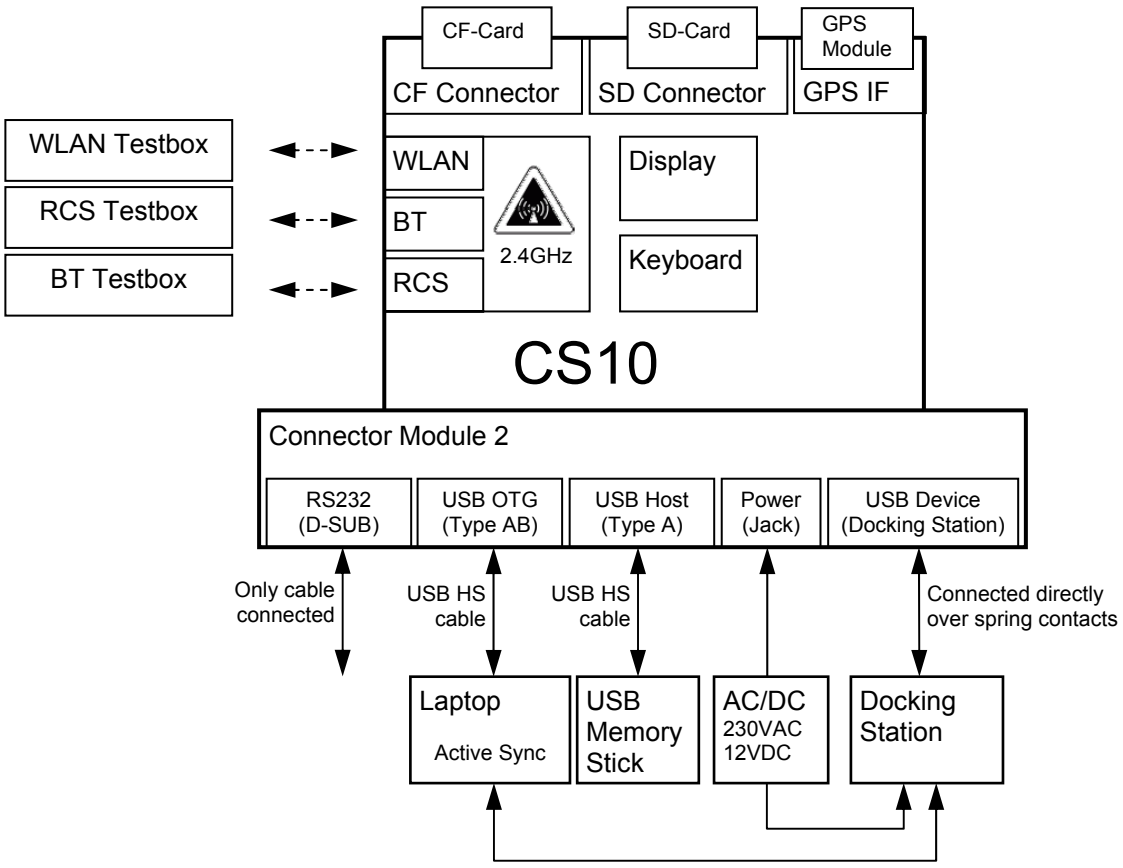
1) • CS10 (Basic) and CS10 with internal radio were tested within this test report. For the CS10 without internal radio (Basic), which is only a subset of the CS10 Radio, not all tests were performed.
   • Leica CCS01 Docking station for CS Controller was tested within this test report
   • Leica GS05 GNSS cap (GPS module) was tested within this test report for emission testings
2) Serial Number for CS10 Basic is CS10-PT3/002

1.4.2 Test configuration 1 (with connector module 1)



- *CS10 Basic* and *CS10 Radio* are tested with this configuration
- When *Docking Station* is tested, no other device is connected to the “connector module”

1.4.3 Test configuration 2 (with connector module 2)



- *CS10 Basic* and *CS10 Radio* are tested with this configuration
- When *Docking Staion* is tested, no other device is connected to the “connector module”

1.4.4 Interfaces and operating conditions

Port Type	Description
Power Jack	12V DC power in from AC/DC power adapter
USB-Host HS	Type A connector USB 2.0 (high speed) Connected to USB Memory stick
USB-OTG HS	Lemo connector (Configuration 1) or Type MiniAB connector (Configuration 2) USB 2.0 (high speed) Connected to PC over active sync Continuous copy files from laptop to CS10 and back
RS232	D-SUB connector Serial interface Cable attached but not connected RS232 with Connector Module 1 was not tested
Bluetooth (BT)	BT module is enabled and connected to a BT testbox (only for CS10 Radio)
RCS (2.4 GHz spread spectrum OEM module)	RCS module is enabled and connected to a RCS testbox (only for CS10 Radio)
Wireless LAN (WLAN)	WLAN module is enabled and connected to a WLAN testbox (only for CS10 Radio)
CF Card Interface	CF card inserted Test program checks read and write to CF card
SD Card Interface	SD card inserted Test program checks read and write to SD card
Enclosure	Plastic Housing

Power Consumption:

Mode	Definition	Power Consumption
On	The appliance is connected to a power source and fulfils a main function, including the provision of signals to supported devices	Normal operation: < 1A Battery charging: max. 1.3A

1.4.5 Operating conditions of the EUT for the tests (active condition)

- The EUT is performing continuous data communication consecutively over all three types of wireless interfaces, all external memory devices such as CF-, SD-card and USB Memory Stick, and over the USB OTG interface to the laptop.
- The EUT is playing continuously music over integrated loudspeaker.
- The EUT may be used in home or industrial environment, indoors or outdoors.
- The EUT is used in normal use, i.e. all parts are running; details see in the measurement results below.
- no adjustments are possible.

1.4.6 Clock frequencies in the EUT

Component, Part	Frequency
SD-RAM clock	133 MHz
CPU main clock	26 MHz
Display clock	26.6 MHz
USB system clock	60 MHz

1.5 Test specifications and results

1.5.1 References

Standard	Description
ETSI EN 301 489-1: V1.8.1 (2008-04)	Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements
ETSI EN 301 489-17: V1.3.2 (2008-04)	Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for 2.4 GHz wideband transmission systems and 5 GHz high performance RLAN equipment
EN 61000-6-2: 2005	Electromagnetic compatibility (EMC) - Generic standards - Immunity for industrial environments
EN 61000-6-3: 2007	Electromagnetic compatibility (EMC) - Generic standards - Emission standard for residential, commercial and light-industrial environments
EN 55022: 2006	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement
EN 61000-3-2: 2006	Electromagnetic compatibility (EMC) - Limits - Limits for harmonic current emissions (equipment input current < 16 A per phase)
EN 61000-3-3: 1995 + A1:2001 + A2:2005	Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current < 16 A per phase and not subjected to conditional connection
EN 61000-4-2: 1995+ A1:1998 + A2:2001	Electromagnetic compatibility (EMC) - Testing and measurement techniques - Electrostatic discharge immunity test
EN 61000-4-3: 2006	Electromagnetic compatibility (EMC) - Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test
EN 61000-4-4: 2004	Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test
EN 61000-4-5: 2006	Electromagnetic Compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test
EN 61000-4-6: 1996 + A1:2001	Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques; Immunity to conducted disturbances, induced by radio-frequency fields
EN 61000-4-8: 2001	Electromagnetic compatibility (EMC) - Part 4-8: Testing and measurement techniques; Power frequency magnetic field immunity test
FCC Part 15:2008	Code of Federal Regulations – Title 47 – Part 15: Radio Frequency Devices Subpart B: Unintentional Radiators
ANSI C63.4:2003	American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz

1.5.2 Assembly of test specifications and results

Emission requirements according to 1999/5/EC harmonized standards ETSI EN 301 489-1 and -17, referring to EN 55022		
Test	**Standard / Limit**	**Result**
Stationary interference voltage on the operational voltage terminals V-Network 0.15 - 30 MHz ***AC230V-Mains*** (2.1.1 Measurement of the interference voltage on the 230VAC power supply module input)	EN 55022 Class B, Chap. 5.1, Tab. 2 CISPR 22 :2005	**PASS 2)**
Radiated E-Field, horizontal and vertical polarized E-Field-Antenna 30 - 6000 MHz (Note 1) ***EUT with all cables*** (2.1.2 Measurement of the electromagnetic field)	EN 55022 Class B, Chap. 6, Tab. 6	**PASS 3)**
Current harmonics on the operational voltage terminals ***AC230V-Mains*** (2.1.3 Current harmonics on the mains (EN 61000-3-2))	EN 61000-3-2	**PASS**
Voltage fluctuations and flicker on the operational voltage terminals ***AC230V-Mains*** (2.1.4 Voltage fluctuations and flicker on the AC voltage terminals (EN 61000-3-3))	EN 61000-3-3	**PASS**

Notes:
1) Enhanced by client requirements
2) equal requirements for FCC Part 15 for conducted emission
3) slightly different requirements for FCC; see measurements results below
   EUT complies with both standards

Immunity requirements according to 1999/5/EC harmonized standard ETSI EN 301 489-1 and -17, and EN 61000-6-2 3)			
Test	**Standard / Test level**	**Compliance Criteria**	**Result**
Electrostatic discharge (ESD) – indirect on coupling plane with contact discharge – direct on case with air and contact discharge ***EUT with all cables*** (2.2.1 Electrostatic discharge (ESD) (EN 61000-4-2))	EN 61000-4-2 **8 kV Cont. 15 kV Air** 1)	 **B**	 **PASS**
Radiated electromagnetic field 80 - 1000 MHz, 80% AM (1kHz) 900 MHz, 1min, PM 1Hz 50% duty cycle ***EUT with all cables*** (2.2.2 Radiated electromagnetic field (EN 61000-4-3))	EN 61000-4-3 **10 V/m (AM)** Note 1 **10 V/m (PM)** Note 1	 **A** **A**	 **PASS** **PASS**
Radiated electromagnetic field 1.0 – 2.7 GHz, 80% AM (1 kHz) 1.9 GHz, 1min, PM 1Hz 50% duty cycle ***EUT with all cables*** (2.2.2 Radiated electromagnetic field (EN 61000-4-3))	EN 61000-4-3 **10 V/m (AM)** Note 1 **10 V/m (PM)** Note 1	 **A** **A**	 **PASS** **PASS**
Fast Transients (Burst) Common Mode, 5/50ns, Repetition frequency 5kHz ***AC230V-Mains*** ***Signal Lines*** (2.2.3 Fast transients (Burst) (EN 61000-4-4))	EN 61000-4-4 **2 kV** **1 kV**	 **B** **B**	 **PASS** **PASS**
Conducted radio frequency 150 kHz - 80 MHz, 1kHz 80% AM, 150Ω source imp. ***Power supply AC 230V*** ***Signal lines (L > 3m)*** (2.2.4 Conducted radio frequency (EN 61000-4-6))	EN 61000-4-6 **10 V** **10 V**	 **A** **A**	 **PASS** **PASS**
Voltage dips and short interruptions ***AC230V-Mains*** (2.2.5 Voltage dips and interruptions on the AC power supply (EN 61000-4-11))	EN 61000-4-11 **0%, 10, 20ms/** **70%, 500ms/** **0%, 5s**	 **B** **C** **C**	 **PASS** **PASS** **PASS**
Slow transients (Surges) Pulse form 1.2/50 μs ***AC230V-Mains*** ***Signal Lines*** (2.2.6 Slow transients (Surge) on the AC power supply (EN 61000-4-5))	EN 61000-4-5 **1 kV (L→ N),** **2 kV (L, N →PE)** **1 kV (Screen → PE)**	 **B** **B** **B**	 **PASS** **PASS** **PASS**
Power frequency magnetic field immunity test ***EUT with all cables***	EN 61000-4-8 **30 A/m** **300 A/m** (Note 1)	 **A** **A**	 **PASS** **PASS** **2)**

Notes:
1) Enhanced by client requirements
2) Test were performed earlier with Prototype 2
3) no immunity requirements by FCC

1.5.3 Compliance criteria for immunity tests

Compliance criteria according to EN 61000-6-2	
A	The EUT shall continue to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the EUT is used as intended.
B	The EUT shall continue to operate as intended after the test. During the test, degradation of performance is however allowed.
C	Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

EUT specific compliance criteria	
A	The data communication over all interfaces including wireless is not stopped and without errors The EUT plays music continuously
B	After the test, the EUT shall operate as in normal mode
C	No specific requirement

In any case, the EUT should not be damaged by the tests!

1.5.4 Test environment

Variable	Requirement	Actual values during the test	Complied
Mains	207 – 253 VAC	220 – 240 VAC	Yes
Temperature	15 – 35°C	23°C	Yes
Relative humidity (RH)	25 – 75 %	25 – 75 %	Yes
Air pressure	860 – 1060 mbar	980 – 1035 mbar (QNH)	Yes

Remark: For ESD test see requirements and actual values in the test description.

1.6 Test report summary

- The EUT mentioned in chapter 1.3 with the modifications according to chapter 1.7 is in conformance with the EMC requirements indicated in the chapter 1.5.

1.7 Modifications

1.8 Comments

The test report applies exclusively to the EUT specified in chapter 1.3 of this document.

Test equipment

Device Type	Description	Brand	Type	ID
Cable LISN -> preamp	CE <1 GHz Receiver-Cabin-LISN H8002+H8003	Huber&Suhner	RG223/U	H8002+H8003
LISN	PE7627 V-LISN 1Ph+N 16A Rohde & Schwarz ESH3-Z5	Rohde & Schwarz	ESH3-Z5	PE7627
Spectrum analyzer	OA7712 HP 8542E 9k-50M	Hewlett Packard	8542E	OA7712

Comment to the following diagrams

The following diagrams show the result of the Peak measurement and the Quasi-Peak and Average limit. At the six highest disturbances, where the Peak value exceeds the 12 dB margin to one of the limits, a measurement with the Quasi-Peak and/or Average detector is carried out and the result is listed in the table below the diagram.

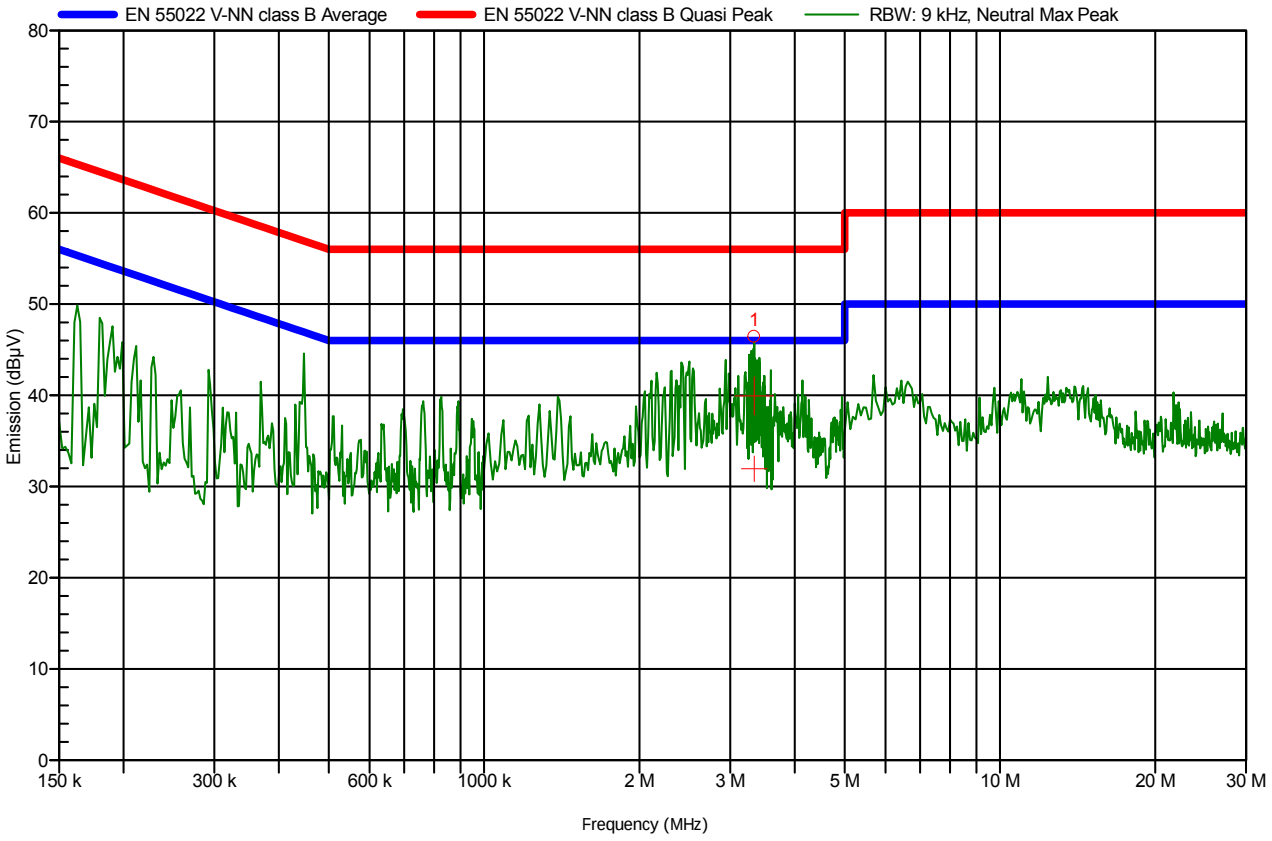
Result of the measurement

The EUT is **in conformance** with the specification.
Equal requirements in European and FCC standards.

Measurement – Interference voltage on the AC power supply

EUT	CS10 Radio
Test	CE_150k-30M_V-LISN_PE7627 ESH3-Z5 R&S_B
Modification	--
Cables, Notes	L1, Conf2 (see note below) all interfaces connected and running
Mode of operation	
Test date, time	4. Juni 2009
Interface / Line under test	power supply
Transducer	PE7627 V-LISN 1Ph+N 16A Rohde & Schwarz ESH3-Z5
Measurement settings	RBW: 9 kHz, VBW: Auto [30 kHz], Sweeptime: Auto [79.3 ms], Step freq: 120 kHz, Attenuator: 40 dB, Internal preamp: 0 dB, Measure time: Auto [120 ms], Measurement equipment: CE 9k-30M HP8542E V-LISN PE7627

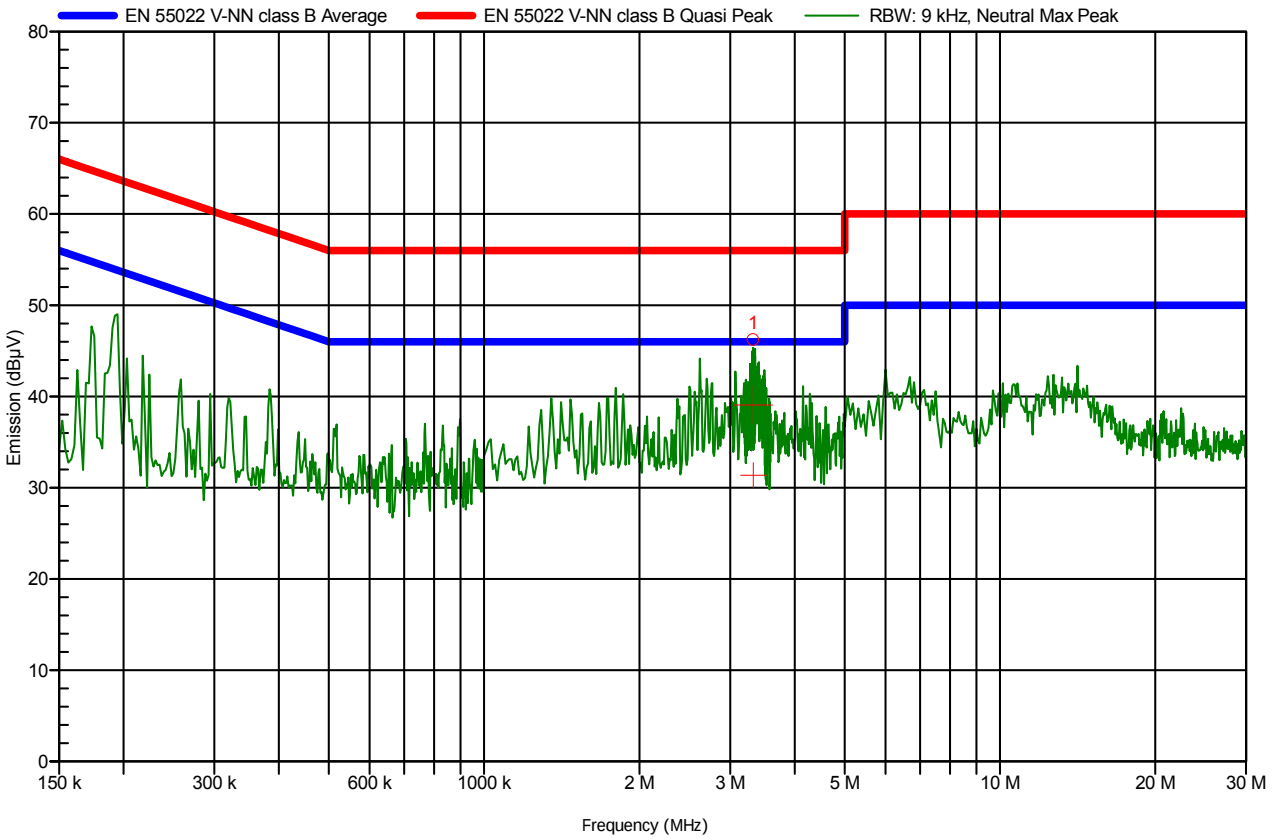
Note: this result is also valid for Conf1 as both versions use the same power supply interface



Peaks detected

Nr	Frequency	Peak identifier	Peak	Average	Average Limit	Average Diff.	Average Status	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Diff.	Quasi-Peak Status	Status
1	3.338 MHz	1	46.43 dBµV	31.94 dBµV	46 dBµV	-14.06 dB	Pass	39.93 dBµV	56 dBµV	-16.07 dB	Pass	Pass

EUT	CS10 Radio
Test	CE_150k-30M_V-LISN_PE7627 ESH3-Z5 R&S_B
Modification	--
Cables, Notes	N, Conf2, all interfaces connected and running
Mode of operation	
Test date, time	4. Juni 2009
Interface / Line under test	power supply
Transducer	PE7627 V-LISN 1Ph+N 16A Rohde & Schwarz ESH3-Z5
Measurement settings	RBW: 9 kHz, VBW: Auto [30 kHz], Sweeptime: Auto [79.3 ms], Step freq: 120 kHz, Attenuator: 40 dB, Internal preamp: 0 dB, Measure time: Auto [120 ms], Measurement equipment: CE 9k-30M HP8542E V-LISN PE7627



Peaks detected

Nr	Frequency	Peak identifier	Peak	Average	Average limit	Average Diff.	Average Status	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Diff.	Quasi-Peak Status	Status
1	3.326 MHz	1	46.19 dBµV	31.36 dBµV	46 dBµV	-14.64 dB	Pass	39.07 dBµV	56 dBµV	-16.93 dB	Pass	Pass

Uncertainty of Measurement

Estimated uncertainty of the measurement results: (normal distribution, k=2) ± 2.8 dB
Maximum uncertainty defined by the standard: ± 3.6 dB

The uncertainty does not affect the compliance to the specification limits.

Test equipment

Device Type	Description	Brand	Type	ID
Antenna	H9728 BiLog Chase CBL 6112B	Chase	CBL 6112B	H9728
Cable preamp -> analyser	RE <8 GHz Receiver---Ant H10010---H10013	Huber&Suhner	Coaxial Cable	H10010-H10011-H10012-H10013
Antenna tower	EMCO 1050	EMCO	1050	
EMI Test Receiver	20 Hz – 8 GHz	Rohde & Schwarz	ESU	OA10193
Turn table	Deisel HD 050	Deisel	HD 050	

Process of the measurement

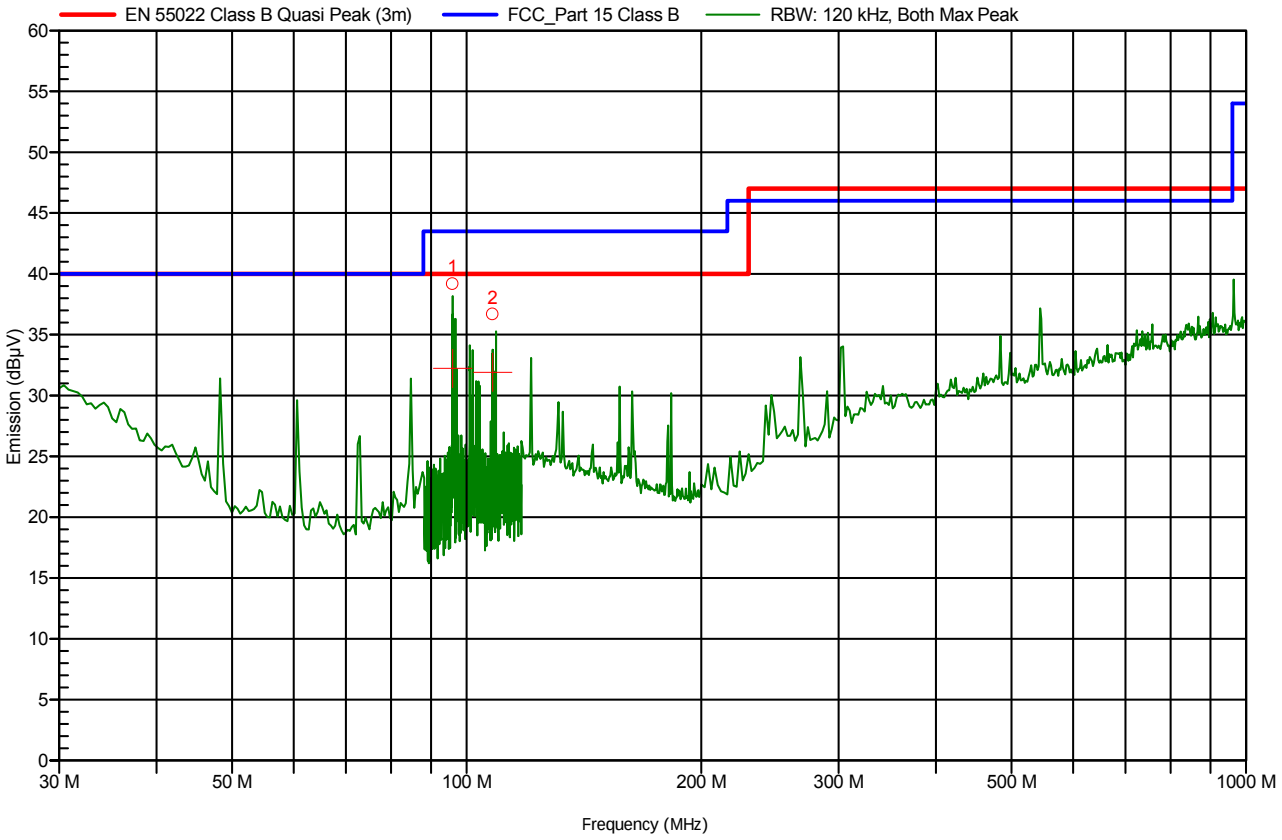
The radiated electromagnetic field is measured around the EUT at a height of 1 m to 4 m with the antenna on vertical and horizontal polarization.
The following diagrams show the result of the Peak measurement and the Quasi-Peak limit. At the six highest disturbances, where the Peak value exceeds the 12 dB margin to the Quasi-Peak limit, a measurement with the Quasi-Peak detector is carried out and the result is listed in the table below the diagram. Because of the shortened measurement distance (3 m instead of 10 m) the limit line is converted according to the actual distance of 3 m by adding 10 dB to the limit.

Result of the measurement

The EUT is **in conformance** with the specification according to European standards and to FCC standards

Measurements 30 MHz to 1000 MHz

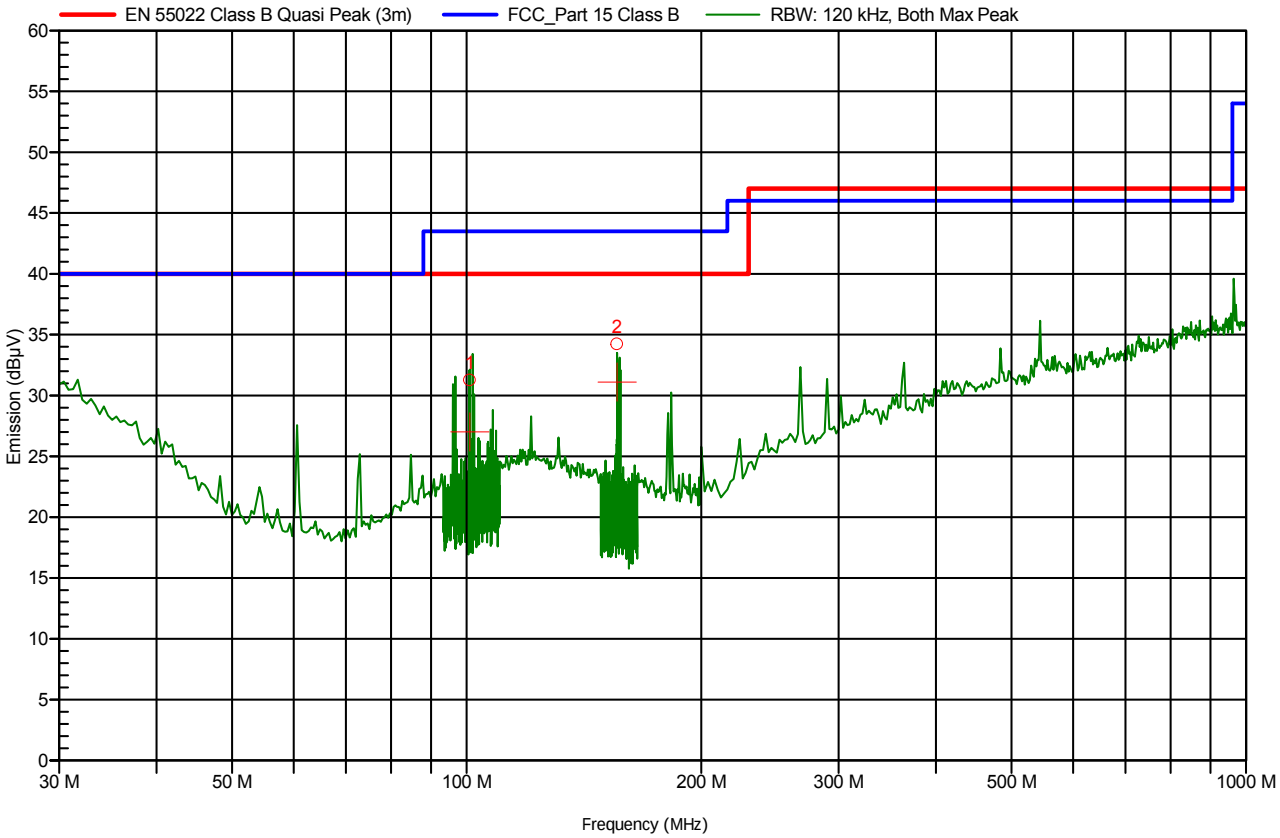
EUT	CS10 Basic		
Test	30M-1G EN 55022 Class B 3m Antenne 1-4m 0-360Grad		
Modification	None		
Cables, Notes	Conf1, Power supply in action, battery charge in progress, Active-sync running, copy file to devices		
Mode of operation			
Test date, time	2. Juni 2009		
Antenna height	100 cm - 4 m	**Antenna polarization**	Vertical/Horizontal
EUT position	0 Degree to 359 Degree (rotating)	**Antenna distance**	3 m
Measurement settings	RBW: 120 kHz, VBW: Auto [300 kHz], Sweep time: Auto [909.4 ms], Step freq: 120 kHz, Attenuator: Auto [10 dB], Internal preamp: 20 dB, Measure time: Auto [120 ms], Measurement equipment: RE 30M-1000M HP8546A Chase CBL6112B		



Detected peaks

Nr	Frequency	Peak	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Status	Angle	Height	Polarization
1	95.957 MHz	39.16 dBµV	32.23 dBµV	40 dBµV	-7.77 dB	Pass	Pass	122 Degree	100 cm	Vertical
2	108.002 MHz	36.67 dBµV	31.91 dBµV	40 dBµV	-8.09 dB	Pass	Pass	286 Degree	100 cm	Vertical

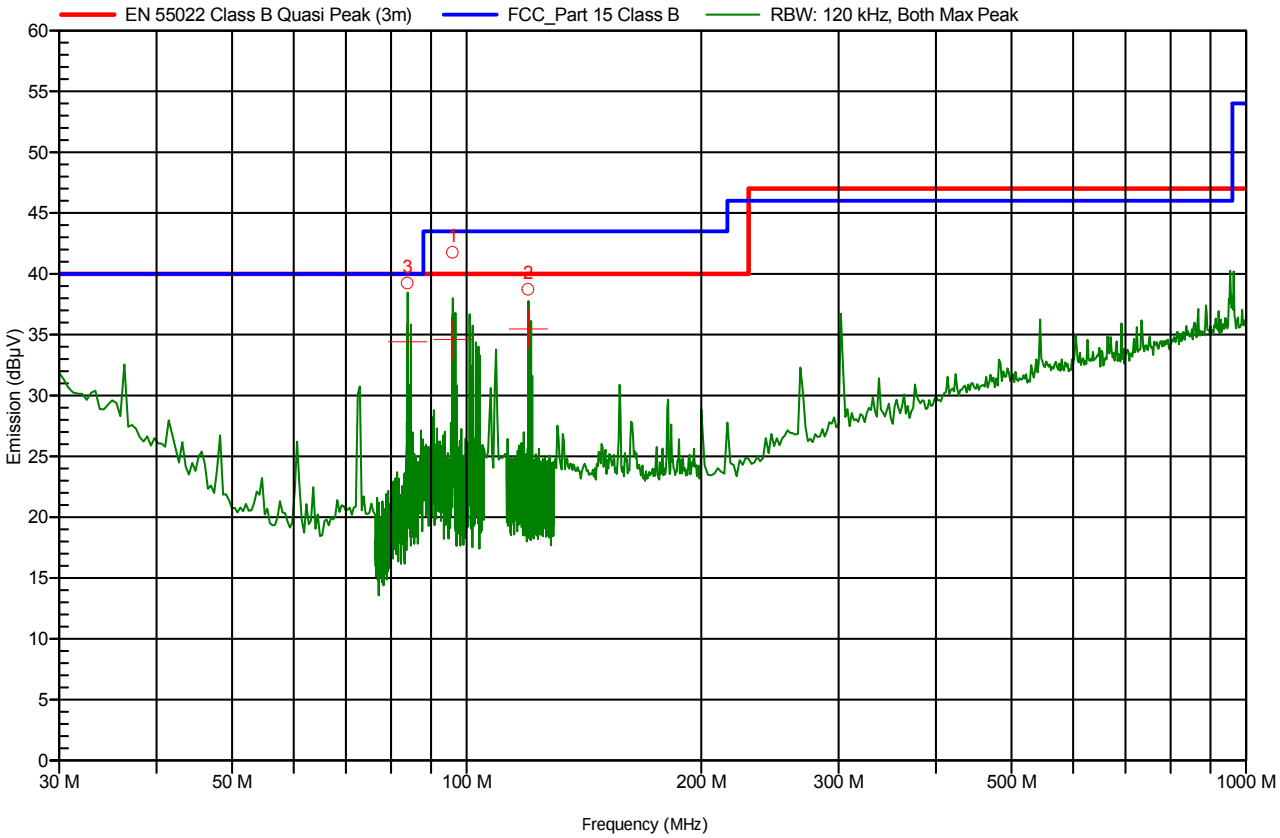
EUT	CS10 Basic		
Test	30M-1G EN 55022 Class B 3m Antenne 1-4m 0-360Grad		
Modification	None		
Cables, Notes	Conf2, Power supply in action, battery charge in progress, Active-sync running, copy file to devices		
Mode of operation			
Test date, time	2. Juni 2009		
Antenna height	100 cm - 4 m	**Antenna polarization**	Vertical/Horizontal
EUT position	0 Degree to 359 Degree (rotating)	**Antenna distance**	3 m
Measurement settings	RBW: 120 kHz, VBW: Auto [300 kHz], Sweep time: Auto [20 ms], Step freq: 120 kHz, Attenuator: Auto [10 dB], Internal preamp: 20 dB, Measure time: Auto [120 ms], Measurement equipment: RE 30M-1000M HP8546A Chase CBL6112B		



Detected peaks

Nr	Frequency	Peak	Quasi-Peak	Quasi-Peak Difference	Status	Angle	Height	Polarization
1	100.954 MHz	31.25 dBµV	27.01 dBµV	-12.99 dB	Pass	119 Degree	1.02 m	Vertical
2	155.981 MHz	34.21 dBµV	31.11 dBµV	-8.89 dB	Pass	347 Degree	93 cm	Vertical

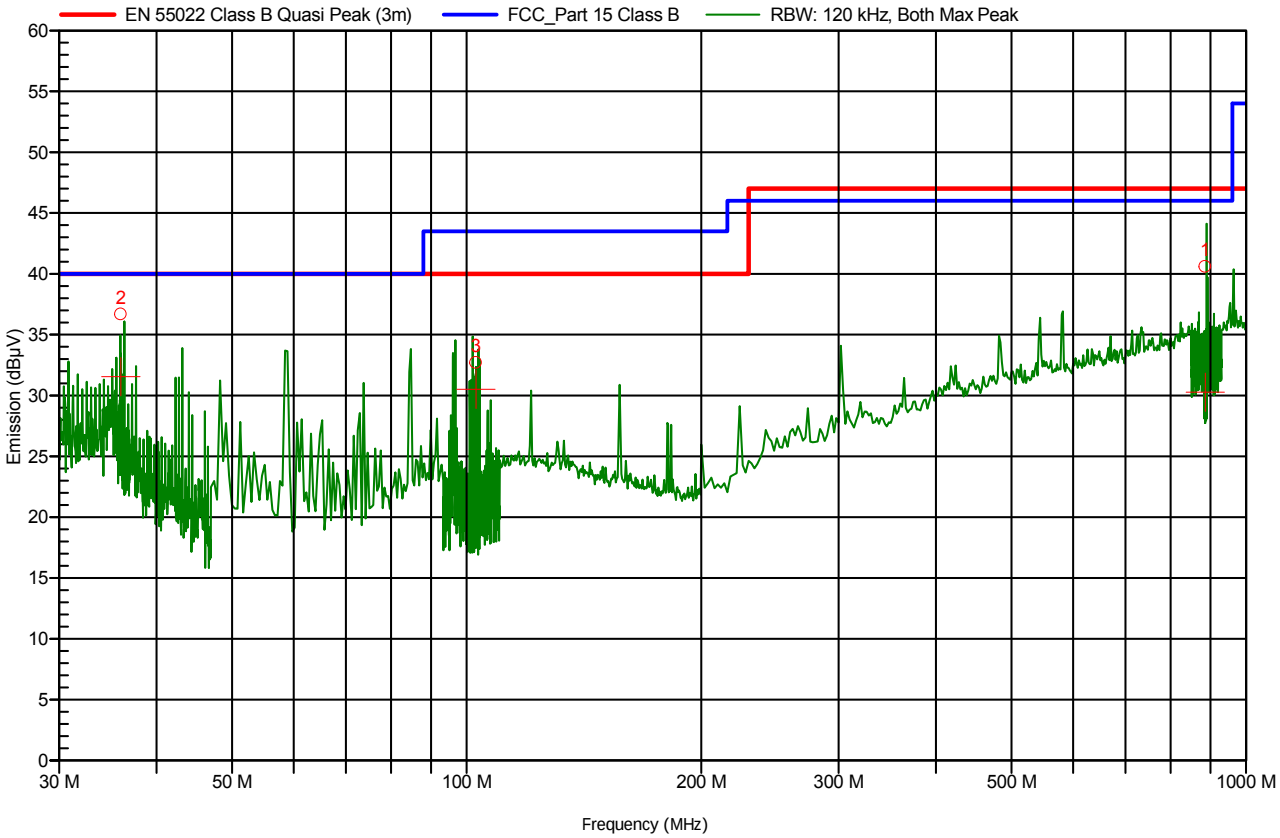
EUT	CS10 Radio		
Test	30M-1G EN 55022 Class B 3m Antenne 1-4m 0-360Grad		
Modification	None		
Cables, Notes	Conf1, Power supply in action, battery charge in progress, Active-sync running, copy file to devices		
Mode of operation			
Test date, time	2. Juni 2009		
Antenna height	100 cm - 4 m	**Antenna polarization**	Vertical/Horizontal
EUT position	0 Degree to 359 Degree (rotating)	**Antenna distance**	3 m
Measurement settings	RBW: 120 kHz, VBW: Auto [300 kHz], Sweep time: Auto [909.4 ms], Step freq: 120 kHz, Attenuator: Auto [10 dB], Internal preamp: 20 dB, Measure time: Auto [120 ms], Measurement equipment: RE 30M-1000M HP8546A Chase CBL6112B		



Detected peaks

Nr	Frequency	Peak	Quasi-Peak	Quasi-Peak Difference	Status	Angle	Height	Polarization
1	96.001 MHz	41.74 dBµV	34.6 dBµV	-5.4 dB	Pass	211 Degree	1.02 m	Vertical
2	119.995 MHz	38.69 dBµV	35.47 dBµV	-4.53 dB	Pass	119 Degree	1.03 m	Vertical
3	84.013 MHz	39.21 dBµV	34.43 dBµV	-5.57 dB	Pass	259 Degree	97 cm	Vertical

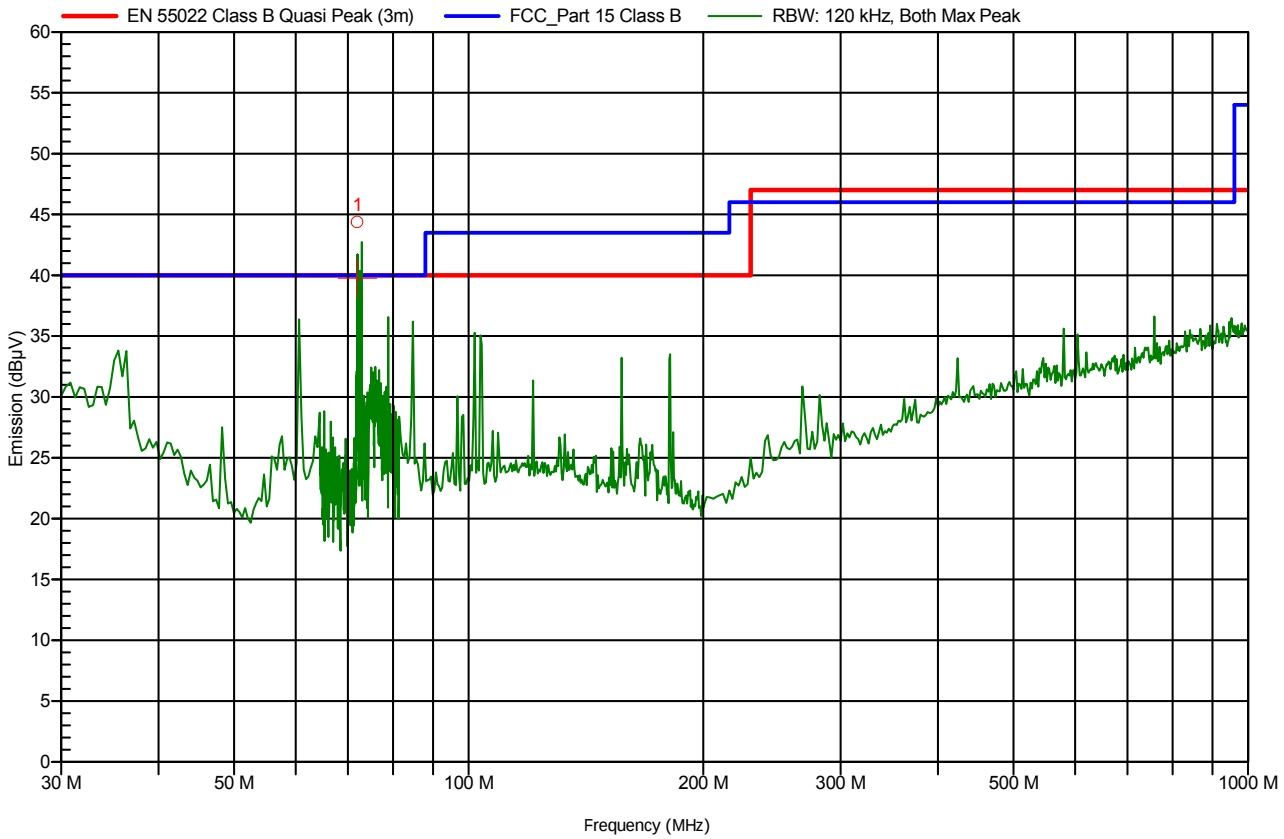
EUT	CS10 Radio		
Test	30M-1G EN 55022 Class B 3m Antenne 1-4m 0-360Grad		
Modification	None		
Cables, Notes	Conf2, Power supply in action, battery charge in progress, Active-sync running, copy file to devices		
Mode of operation			
Test date, time	2. Juni 2009		
Antenna height	100 cm - 4 m	**Antenna polarization**	Vertical/Horizontal
EUT position	0 Degree to 359 Degree (rotating)	**Antenna distance**	3 m
Measurement settings	RBW: 120 kHz, VBW: Auto [300 kHz], Sweep time: Auto [20 ms], Step freq: 120 kHz, Attenuator: Auto [10 dB], Internal preamp: 20 dB, Measure time: Auto [120 ms], Measurement equipment: RE 30M-1000M HP8546A Chase CBL6112B		



Detected peaks

Nr	Frequency	Peak	Quasi-Peak	Quasi-Peak Difference	Status	Angle	Height	Polarization
1	886.403 MHz	40.58 dBµV	30.27 dBµV	-16.73 dB	Pass	208 Degree	1.05 m	Vertical
2	36.007 MHz	36.67 dBµV	31.55 dBµV	-8.45 dB	Pass	103 Degree	1.02 m	Vertical
3	102.795 MHz	32.68 dBµV	30.5 dBµV	-9.5 dB	Pass	36 Degree	99 cm	Vertical

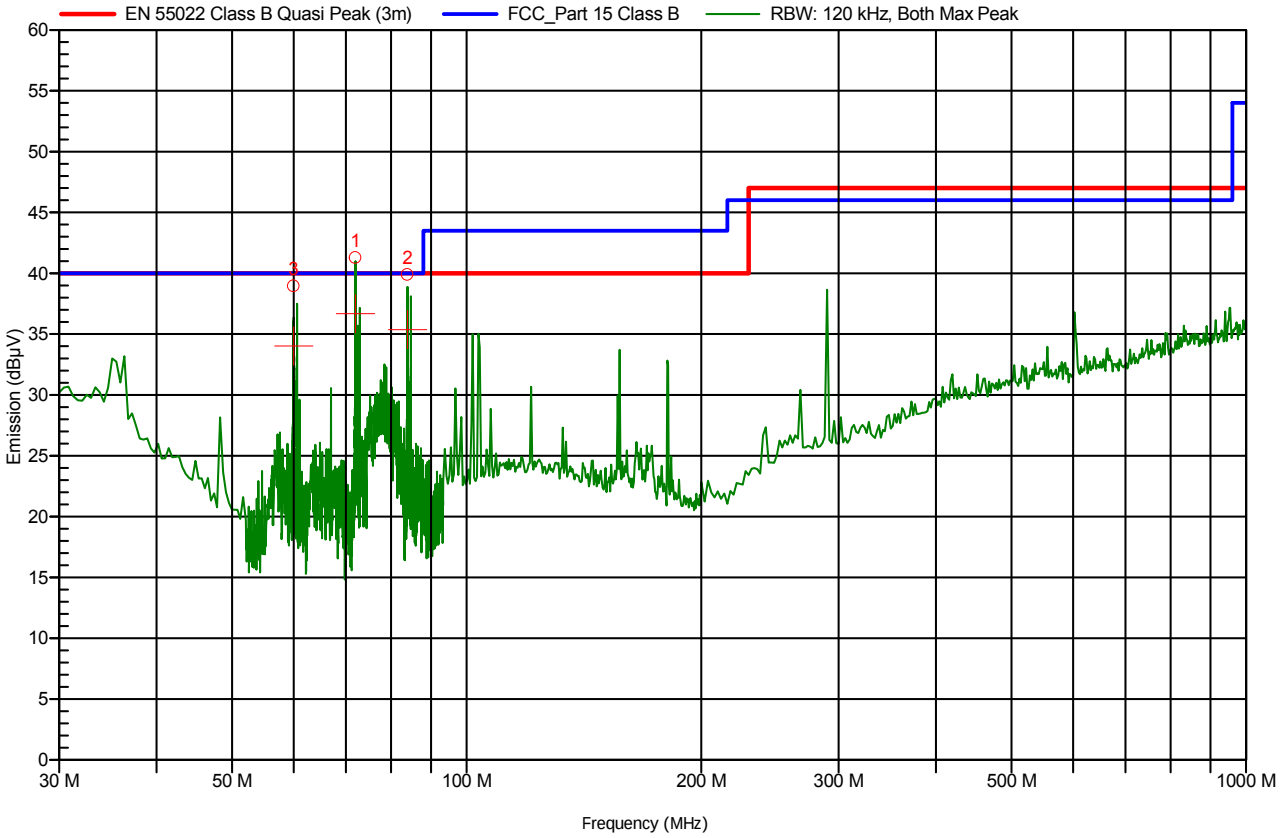
EUT	CS10 Radio		
Test	30M-1G EN 55022 Class B 3m Antenne 1m 0-360Grad		
Modification	None		
Cables, Notes	Conf1, Docking station Power supply in action, battery charge in progress, Active-sync running, copy file to devices		
Mode of operation			
Test date, time	2. Juni 2009		
Antenna height	100 cm - 100 cm	**Antenna polarization**	Vertical/Horizontal
EUT position	0 Degree to 359 Degree (rotating)	**Antenna distance**	3 m
Measurement settings	RBW: 120 kHz, VBW: Auto [300 kHz], Sweep time: Auto [909.4 ms], Step freq: 120 kHz, Attenuator: Auto [10 dB], Internal preamp: 20 dB, Measure time: Auto [120 ms], Measurement equipment: RE 30M-1000M HP8546A Chase CBL6112B		



Detected peaks

Nr	Frequency	Peak	Quasi-Peak	Quasi-Peak Diff.	Status	Angle	Height	Polarization
1	72.02 MHz	44.34 dBµV	39.76 dBµV	-0.24 dB	Pass	345 Degree	100 cm	Vertical

EUT	CS10 Radio		
Test	30M-1G EN 55022 Class B 3m Antenne 1m 0-360Grad		
Modification	None		
Cables, Notes	Conf2, Docking station, Power supply in action, battery charge in progress, Active-sync running, copy file to devices		
Mode of operation			
Test date, time	2. Juni 2009		
Antenna height	100 cm - 100 cm	**Antenna polarization**	Vertical/Horizontal
EUT position	0 Degree to 359 Degree (rotating)	**Antenna distance**	3 m
Measurement settings	RBW: 120 kHz, VBW: Auto [300 kHz], Sweep time: Auto [39.2 ms], Step freq: 120 kHz, Attenuator: Auto [10 dB], Internal preamp: 20 dB, Measure time: Auto [120 ms], Measurement equipment: RE 30M-1000M HP8546A Chase CBL6112B		

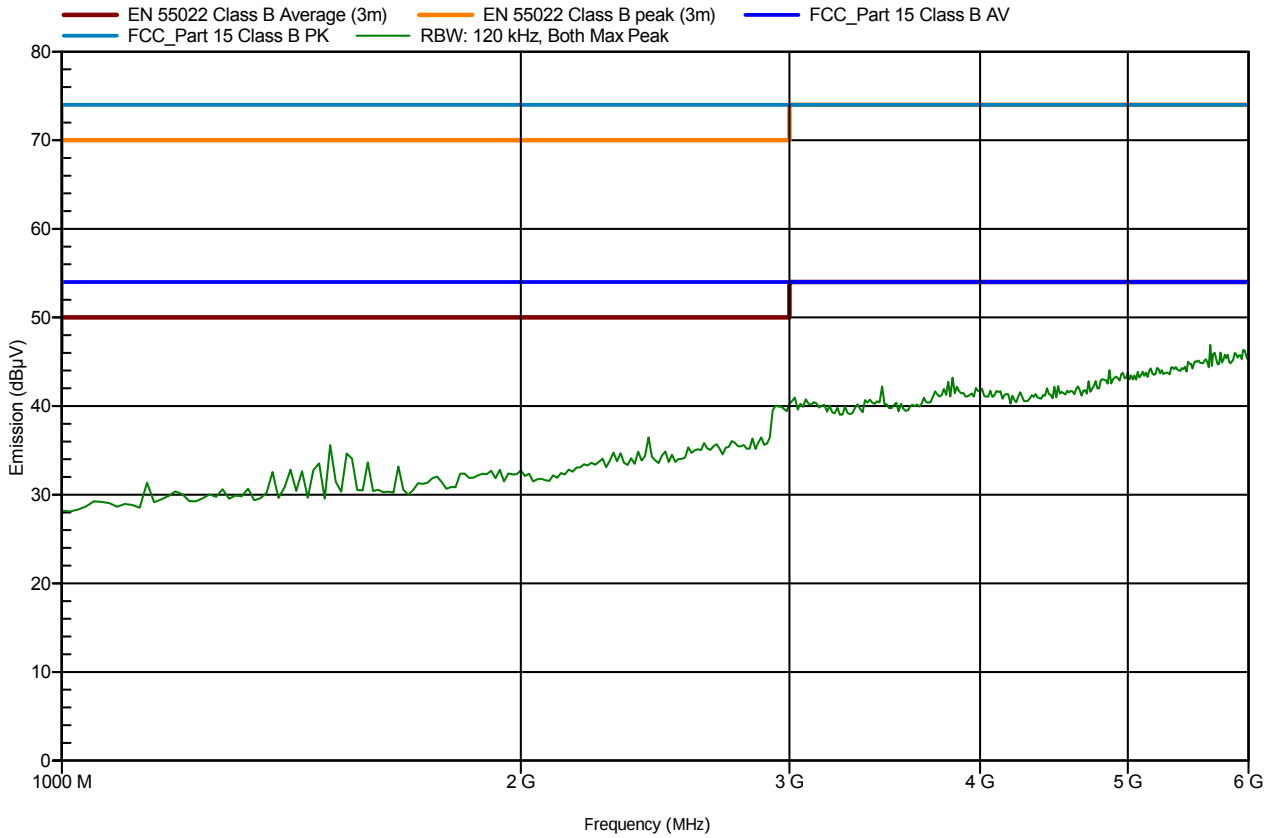


Detected peaks

Nr	Frequency	Peak	Quasi-Peak	Quasi-Peak Difference	Status	Angle	Height	Polarization
1	72.011 MHz	41.26 dBµV	36.67 dBµV	-3.33 dB	Pass	41 Degree	100 cm	Vertical
2	83.992 MHz	39.87 dBµV	35.37 dBµV	-4.63 dB	Pass	151 Degree	1.05 m	Vertical
3	60.015 MHz	38.93 dBµV	34.02 dBµV	-5.98 dB	Pass	300 Degree	1.02 m	Vertical

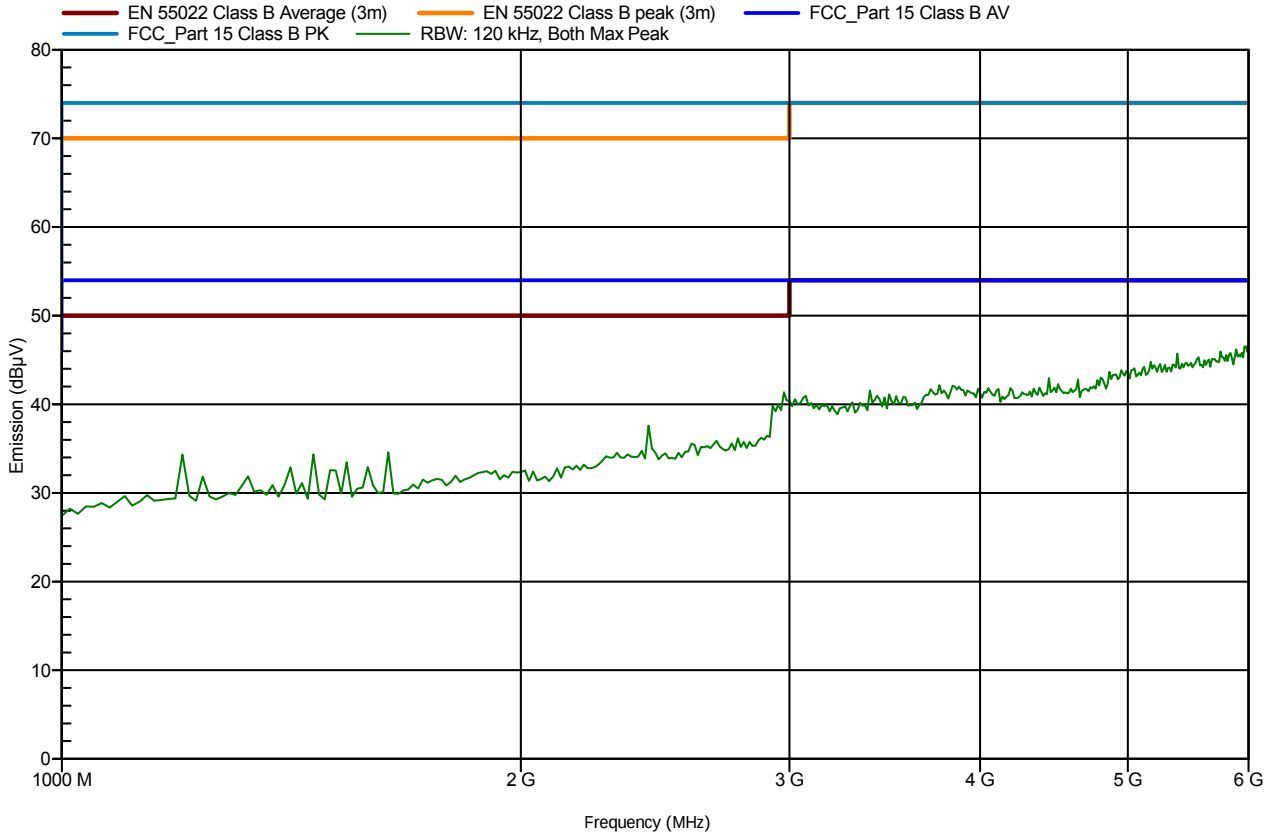
Measurements 1 GHz to 6 GHz:

EUT	CS10 Basic		
Test	1G-6G EN 55022 Class B 3m Antenne 1m 0-360Grad		
Modification	None		
Cables, Notes	Conf1, Power supply in action, battery charge in progress, Active-sync running, copy file to devices		
Mode of operation			
Test date, time	2. Juni 2009		
Antenna height	100 cm - 100 cm	**Antenna polarization**	Vertical/Horizontal
EUT position	0 Degree to 359 Degree (rotating)	**Antenna distance**	3 m
Measurement settings	RBW: 120 kHz, VBW: Auto [300 kHz], Sweep time: Auto [2.3 s], Step freq: 120 kHz, Attenuator: 0 dB, Internal preamp: 20 dB, Measure time: Auto [120 ms], Measurement equipment: RE 1-6GHz EMF		



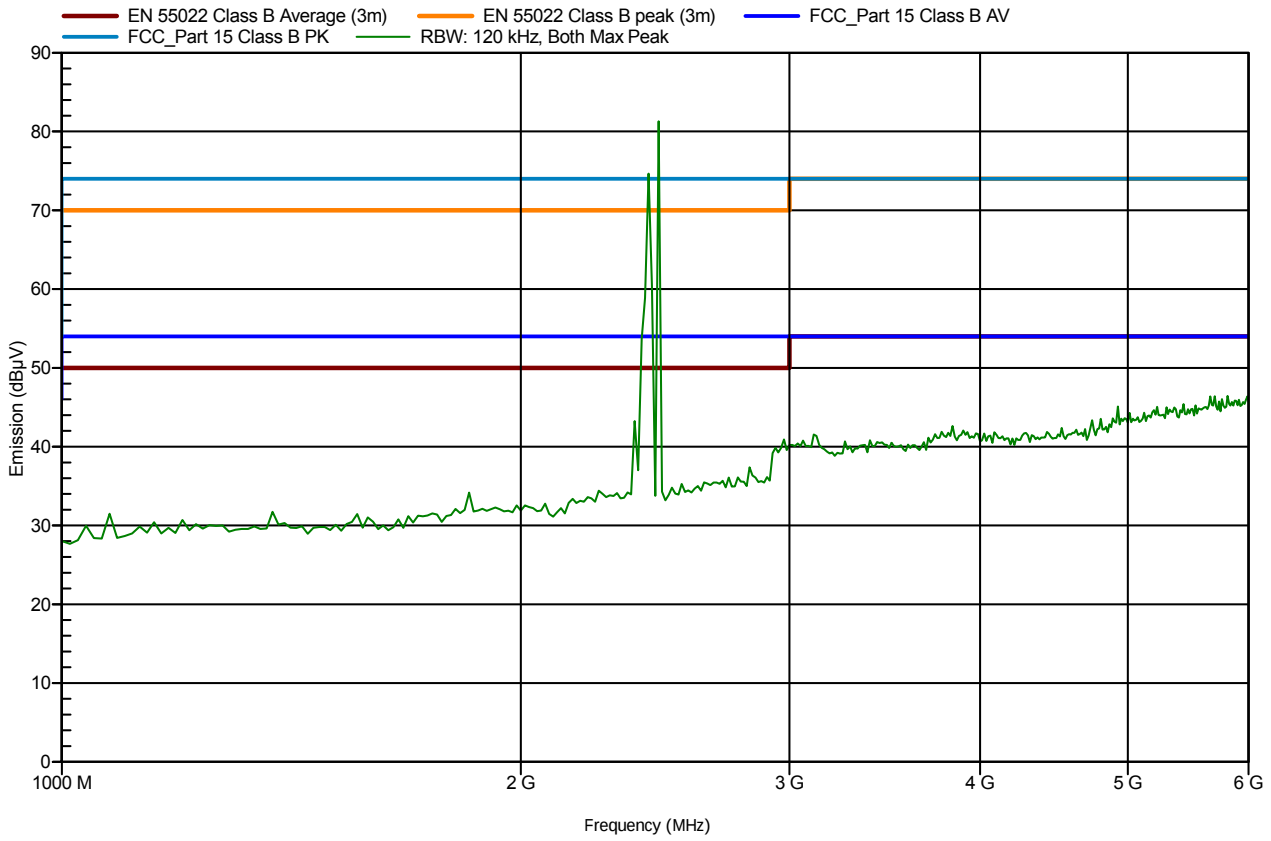
Detected peaks

EUT	CS10 Basic		
Test	1G-6G EN 55022 Class B 3m Antenne 1m 0-360Grad		
Modification	None		
Cables, Notes	Conf2, Power supply in action, battery charge in progress, Active-sync running, copy file to devices		
Mode of operation			
Test date, time	2. Juni 2009		
Antenna height	100 cm - 100 cm	**Antenna polarization**	Vertical/Horizontal
EUT position	0 Degree to 359 Degree (rotating)	**Antenna distance**	3 m
Measurement settings	RBW: 120 kHz, VBW: Auto [300 kHz], Sweep time: Auto [2.3 s], Step freq: 120 kHz, Attenuator: 0 dB, Internal preamp: 20 dB, Measure time: Auto [120 ms], Measurement equipment: RE 1-6GHz EMF		



Detected peaks

EUT	CS10 Radio		
Test	1G-6G EN 55022 Class B 3m Antenne 1m 0-360Grad		
Modification	None		
Cables, Notes	Conf1, Power supply in action, battery charge in progress, Active-sync running, copy file to devices		
Mode of operation			
Test date, time	2. Juni 2009		
Antenna height	100 cm - 100 cm	**Antenna polarization**	Vertical/Horizontal
EUT position	0 Degree to 359 Degree (rotating)	**Antenna distance**	3 m
Measurement settings	RBW: 120 kHz, VBW: Auto [300 kHz], Sweep time: Auto [2.3 s], Step freq: 120 kHz, Attenuator: 0 dB, Internal preamp: 20 dB, Measure time: Auto [120 ms], Measurement equipment: RE 1-6GHz EMF		



Detected peaks

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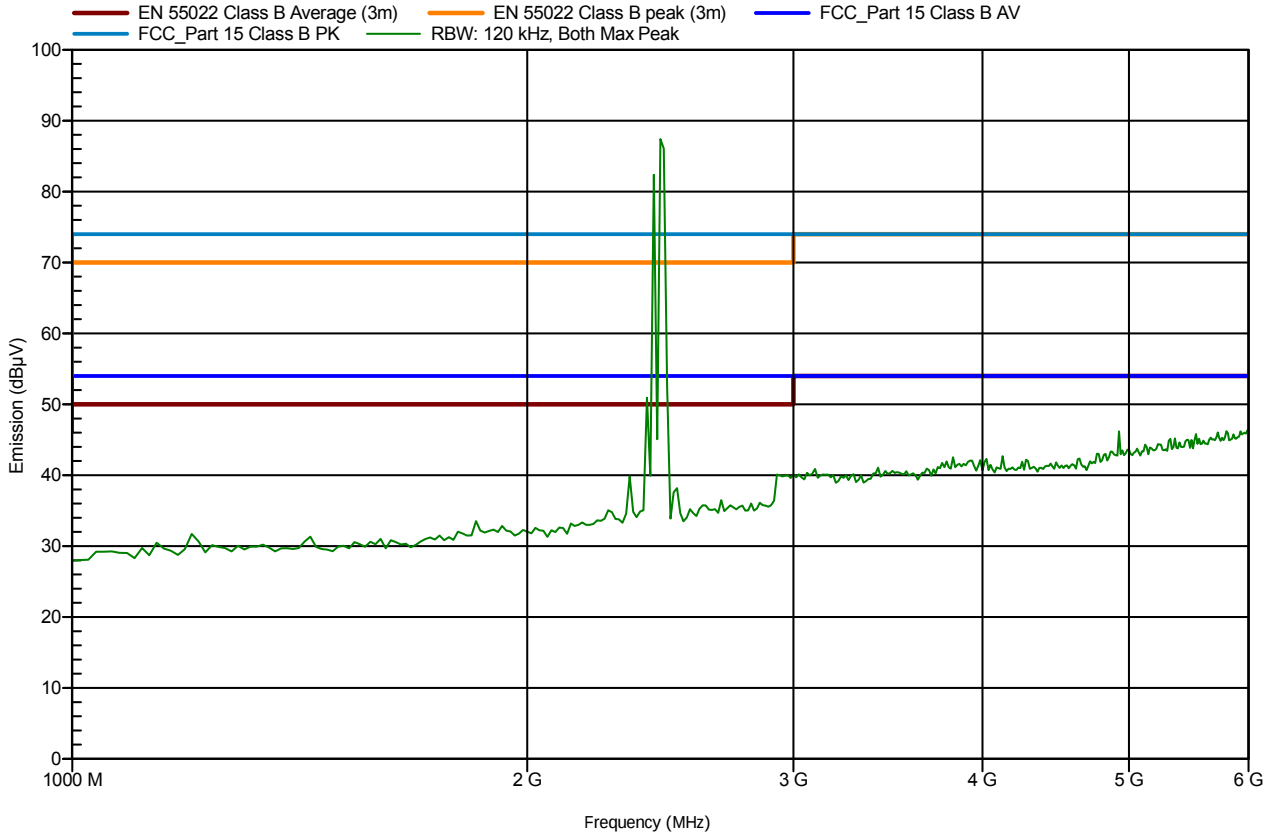
Note: Peaks within of the exclusion band 2280 MHz to 2607.675 MHz (see EN 301 489-17

EUT	CS10 Radio		
Test	1G-6G EN 55022 Class B 3m Antenne 1m 0-360Grad		
Modification	None		
Cables, Notes	Conf2, Power supply in action, battery charge in progress, Active-sync running, copy file to devices		
Mode of operation			
Test date, time	2. Juni 2009		
Antenna height	100 cm - 100 cm	**Antenna polarization**	Vertical/Horizontal
EUT position	0 Degree to 359 Degree (rotating)	**Antenna distance**	3 m
Measurement settings	RBW: 120 kHz, VBW: Auto [300 kHz], Sweep time: Auto [2.3 s], Step freq: 120 kHz, Attenuator: 0 dB, Internal preamp: 20 dB, Measure time: Auto [120 ms], Measurement equipment: RE 1-6GHz EMF		



Detected peaks

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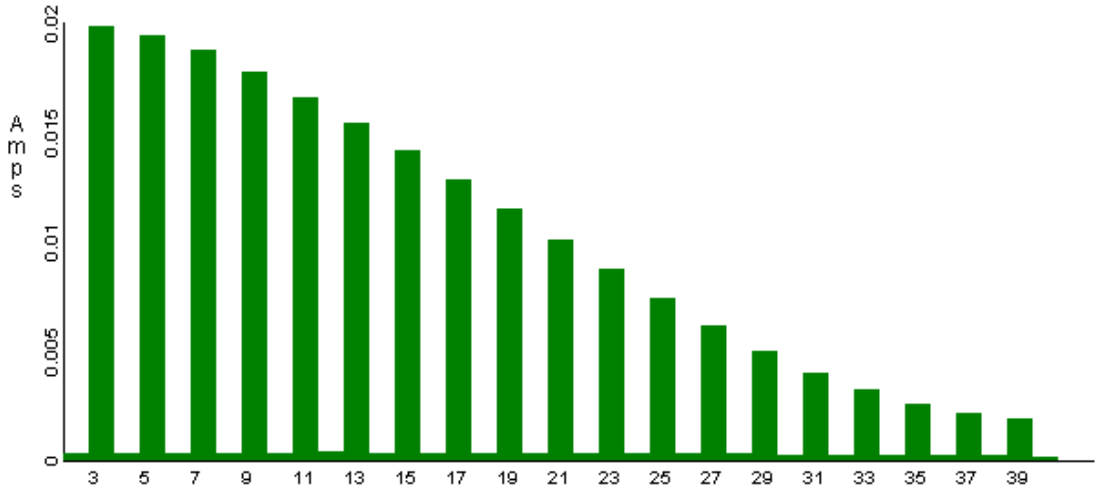
Note: Peaks within of the exclusion band 2280 MHz to 2607.675 MHz (see EN 301 489-17

Uncertainty of Measurement

Estimated uncertainty of the measurement results for 30 – 230MHz: (normal distribution, k=2)	± 3.4 dB
Estimated uncertainty of the measurement results for 230 – 1GHz:(normal distribution, k=2)	± 2.2 dB
Maximum uncertainty defined by the standard for 30 – 230MHz:	± 5,2 dB
Maximum uncertainty defined by the standard for 230 – 1GHz:	± 5,2 dB

The uncertainty does not affect the compliance to the specification limits.



Harmonic	Limit 1	Limit 2	Average Reading	<L1	<L2	Max Reading	<L2	Pass/FAIL
2	1.0800A	1.6200A	0.236mA	✓	✓	0.414mA	✓	N/A
3	2.3000A	3.4500A	18.89mA	✓	✓	19.89mA	✓	Pass
4	430.0mA	645.0mA	0.233mA	✓	✓	0.396mA	✓	N/A
5	1.1400A	1.7100A	18.52mA	✓	✓	19.48mA	✓	Pass
6	300.0mA	450.0mA	0.242mA	✓	✓	0.412mA	✓	N/A
7	770.0mA	1.1550A	17.88mA	✓	✓	18.78mA	✓	Pass
8	230.0mA	345.0mA	0.242mA	✓	✓	0.404mA	✓	N/A
9	400.0mA	600.0mA	16.96mA	✓	✓	17.79mA	✓	Pass
10	184.0mA	276.0mA	0.248mA	✓	✓	0.414mA	✓	N/A
11	330.0mA	495.0mA	15.94mA	✓	✓	16.66mA	✓	Pass
12	153.3mA	230.0mA	0.244mA	✓	✓	0.420mA	✓	N/A
13	210.0mA	315.0mA	14.80mA	✓	✓	15.44mA	✓	Pass
14	131.4mA	197.1mA	0.243mA	✓	✓	0.402mA	✓	N/A
15	150.0mA	225.0mA	13.62mA	✓	✓	14.16mA	✓	Pass
16	115.0mA	172.5mA	0.241mA	✓	✓	0.397mA	✓	N/A
17	132.3mA	198.5mA	12.38mA	✓	✓	12.85mA	✓	Pass
18	102.2mA	153.3mA	0.234mA	✓	✓	0.373mA	✓	N/A
19	118.4mA	177.6mA	11.18mA	✓	✓	11.56mA	✓	Pass
20	92.00mA	138.0mA	0.232mA	✓	✓	0.386mA	✓	N/A
21	107.1mA	160.7mA	9.869mA	✓	✓	10.16mA	✓	Pass
22	83.63mA	125.4mA	0.216mA	✓	✓	0.363mA	✓	N/A
23	97.82mA	146.7mA	8.586mA	✓	✓	8.780mA	✓	Pass
24	76.66mA	115.0mA	0.219mA	✓	✓	0.368mA	✓	N/A
25	90.00mA	135.0mA	7.371mA	✓	✓	7.497mA	✓	Pass
26	70.76mA	106.1mA	0.197mA	✓	✓	0.366mA	✓	N/A
27	83.33mA	125.0mA	6.149mA	✓	✓	6.215mA	✓	Pass
28	65.71mA	98.57mA	0.196mA	✓	✓	0.339mA	✓	N/A
29	77.58mA	116.3mA	5.033mA	✓	✓	5.083mA	✓	Pass
30	61.33mA	92.00mA	0.180mA	✓	✓	0.329mA	✓	N/A
31	72.58mA	108.8mA	4.029mA	✓	✓	4.082mA	✓	N/A
32	57.50mA	86.25mA	0.168mA	✓	✓	0.299mA	✓	N/A
33	68.18mA	102.2mA	3.257mA	✓	✓	3.318mA	✓	N/A
34	54.11mA	81.17mA	0.163mA	✓	✓	0.301mA	✓	N/A
35	64.28mA	96.42mA	2.537mA	✓	✓	2.616mA	✓	N/A
36	51.11mA	76.66mA	0.141mA	✓	✓	0.268mA	✓	N/A
37	60.81mA	91.21mA	2.102mA	✓	✓	2.202mA	✓	N/A
38	48.42mA	72.63mA	0.147mA	✓	✓	0.280mA	✓	N/A
39	57.69mA	86.53mA	1.795mA	✓	✓	1.927mA	✓	N/A
40	46.00mA	69.00mA	0.125mA	✓	✓	0.241mA	✓	N/A

Result of the measurement

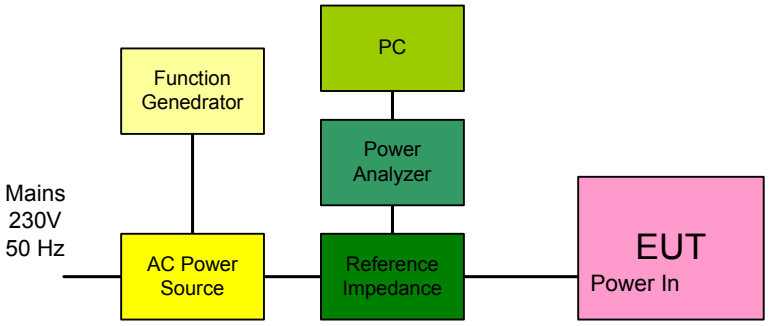
The EUT is **in conformance** with the specification.

Uncertainty of Measurement

Estimated uncertainty of the measurement of basic oscillation: (normal distribution, k=2)	± 0.2 % (rated current)
Estimated uncertainty of the measurement of harmonics: (normal distribution, k=2)	± 0.2 % (rated current)

2.1.4 Voltage fluctuations and flicker on the AC voltage terminals (EN 61000-3-3)

Measurement set-up



Picture of the test configuration: see 2.1.3 above

Test equipment

Device Type	Description	Brand	Type	ID
Generator	Function generator	Philips	PM 5193	GF5283
Source	AC Power Source	ELGAR	1001B	Q8311
Network	Reference impedance Network	Voltech	IEC 555	P8466
Analyzer	Universal Power Analyzer	Voltech	PM3000A	QA8465

Flicker on the mains (EN 61000-3-3)	
EUT:	CS10
Measured interface:	230 VAC
Mode of operation:	230 VAC, active condition, see chap. 1.4.5
Classification:	Class D

Result of the measurement

The EUT is **in conformance** with the specification.

Measurement protocol

PASS

	Pst	dc (%)	dmax (%)	d(t) > 3.3%(ms)
Limit	1.000	3.300	4.000	500
Reading 1	0.076	0.017	0.046	0

Uncertainty of Measurement

Estimated uncertainty of relative constant current deviation dC: (normal distribution, k=2) ± 5%
Estimated uncertainty of harmonics current dmax: (normal distribution, k=2) ± 5%
Estimated uncertainty of shot time flickers Pst: (normal distribution, k=2) ± 8%

Environment:

Variable	Requirement	Actual values during the test	Complied
Mains	--	--	--
Temperature	15 – 35° C	22 – 25° C	Yes
Relative humidity (RH)	30 – 60 %	35 – 40 %	Yes
Air pressure	860 – 1060 mbar	1010 mbar (QNH)	Yes

Test equipment

Device Type	Description	Brand	Type	ID
Generator	Generator for the simulation of electrostatic discharges	EM-Test	ESD 30N	PE10238, PE10238.1

Test requirements according to ETSI EN 301 489-1

Type of test	Voltage	EUT: Mode of operation	Compliance criterion
Indirect contact discharge	± 4 kV	Connected, normal operation	B
Contact discharge	± 4 kV		B
Air discharge	± 8 kV		B

Test requirements according to the requirement of the client

Type of test	Voltage	EUT: Mode of operation	Compliance criterion
Indirect contact discharge	± 8 kV	Connected, normal operation	B
Contact discharge	± 8 kV		B
Air discharge	± 15 kV	Enhanced requirement from client	B

Test plan and settings of the test equipment:

operating conditions of the EUT		The EUT was tested in the most critical version, namely Radio with configuration 1 and 2. Test program running, continuous operation; during the discharge
tested as table-top or floor-standing		table top
points of discharge:	contact indirect	ground plane
	contact direct	screws, sheath of the USB interface
	air discharge	enclosure, especially at the slots , cables, buttons, display
number of discharges applied		> 10

Protocol of the test

Type of test	Voltage	Behavior of the EUT
Indirect contact discharge	± 4 kV	No degradation noticed
	± 8 kV	No degradation noticed
Contact discharge	± 4 kV	No degradation noticed
	± 8 kV	No degradation noticed
Air discharge	± 4 kV	No degradation noticed
	± 8 kV	No degradation noticed
	± 10 kV	see note, EUT conforms to the compliance criteria B
	± 12 kV	see note, EUT conforms to the compliance criteria B
	± 15 kV	see note, EUT conforms to the compliance criteria B

Note: At voltages > 8kV, a reset in some parts of the software may appear.
But it was noticed, that the main part of the software is running, and the data communication is not corrupted.

Result of the test

The EUT is **in conformance** with the standard.

Uncertainty of Measurement

Voltage level: (rectangular distribution)	1 digit
Imax first current peak: (rectangular distribution)	± 10 %
Rise time tr of the discharge current with discharge relay: (rectangular distribution)	± 17,6 %

The uncertainty does not affect the compliance to the specification.

Test equipment

Device Type	Description	Brand	Type	ID
Signal Generator:	9 kHz – 3.3 GHz	Rohde & Schwarz	SML 03	GF9921
Amplifier:	100 W, 25 – 1000 MHz	Amplifier Research	100W1000M5A	V8169
Amplifier:	50 W, 0.8 – 4.2 GHz	Amplifier Research	50S1G4A	V9671
Antenna:	80 – 6000 MHz, 6 dB, 50 Ω	Amplifier Research	AT 6080	H10192
Field Sensor 1:	0.3 – 300 V/m, 0.1 – 3000 MHz	PMM	OR03 + EP330	H9676

Test requirements according to enhanced requirement from client

Frequency	field strength	modulation	Compliance criterion
80 – 1000 MHz	10 V/m	1000Hz, 80%	A
1 – 2.7 GHz	10 V/m	1000Hz, 80%	A
900 MHz; 1min	10 V/m	PM, 1Hz, 50%	A
1.9 GHz; 1min	10 V/m	PM, 1Hz, 50%	A

ETSI EN 301 489-1 and 61000-6-2 are fulfilled

Test plan and settings of the test equipment:

operating conditions of the EUT	version: Radio 1 Test program running, continuous operation
supervision of the behaviour of the EUT	Control of the communication and the music
tested as table-top or floor-standing	table top
Modulation	80% AM, 1 kHz
step size	1%
Voltage	10 V/m
dwell time	1 sec
height of the antenna	167 cm (horizontal) / 149 cm (vertical)
Polarization	vertical / horizontal
Position	0°, 90°
test date	3.6.2009

Measurement 1: Test Configuration 1

Mode of operation:	Active condition, see chap. 1.4.5	
Frequency range:	**Test Voltage:**	**Performance of the EUT:**
80 – 1000 MHz	10 V/m	No degradation noticed
1.0 – 2.7 GHz	10 V/m	No degradation noticed

Note: not all positions of the EUT tested

Measurement 2: Test Configuration 2

Mode of operation:	Active condition, see chap. 1.4.5	
Frequency range:	**Test Voltage:**	**Performance of the EUT:**
80 – 1000 MHz	10 V/m	No degradation noticed
1.0 – 2.7 GHz	10 V/m	No degradation noticed

Result of the test

The EUT is **in conformance** with the specification.

Uncertainty of Measurement

The uncertainty of measurement is: (normal distribution, k=2) ± 26 %

The uncertainty does not affect the compliance to the specification.

Test equipment

Device Type	Description	Brand	Type	ID
Generator	Burst generator	EM-Test	EFT500M4S1	PE10105
Clamp	Capacitive coupling clamp	EM-Test	EM-Test HFK	H9360
Oscilloscope	Digital oscilloscope	Le Croy	Le Croy 9350M	OS7253
Probe	Voltage probe 100:1	PM 9100/001	PM 9100/001	
Ferrite	Ferrite tube green	Lüthi	FGZ 40X15E	

EUT:	CS10, Radio	
Connected:	All cables	
Operating mode:	Normal mode, see chapter 1.4.5	
Compliance criteria	**Test voltage:**	**Compliance Criterion:**
AC Mains:	± 2 kV	B
Signal Lines:	± 2 kV	B
Function surveillance:	Visual observation	

Settings of the test equipment			
Burst length:	15 ms	**Burst repetition**	3 Hz
Impulse form:	5/50 ns	**Impulse repetition:**	5 kHz

Measurement 1 – CS10-RADIO in configuration 1

Tested line:	**AC Mains**
Operating mode:	Normal mode, see chapter 1.4.5
Test voltage:	**Performance of the EUT:**
± 1.0 kV	No degradation noticed
± 2.0 kV	single spurious errors may be observed, complies to criteria B

Tested line:	**USB OTG (Lemo – Laptop)**
Operating mode:	Normal mode, see chapter 1.4.5
Test voltage:	**Performance of the EUT:**
± 1.0 kV	No degradation noticed

Tested line:	**USB Host (Memory Stick)**
Operating mode:	Normal mode, see chapter 1.4.5
Test voltage:	**Performance of the EUT:**
± 1.0 kV	No degradation noticed

Measurement 2 – CS10-RADIO in configuration 2:

Tested line:	**AC Mains**
Operating mode:	Normal mode, see chapter 1.4.5
Test voltage:	**Performance of the EUT:**
± 1.0 kV	No degradation noticed
± 2.0 kV	No degradation noticed

Tested line:	**USB OTG (MiniAB – Laptop)**
Operating mode:	Normal mode, see chapter 1.4.5
Test voltage:	**Performance of the EUT:**
± 1.0 kV	No degradation noticed

Tested line:	**USB Host (Memory Stick)**
Operating mode:	Normal mode, see chapter 1.4.5
Test voltage:	**Performance of the EUT:**
± 1.0 kV	No degradation noticed

Tested line:	**RS 232**
Operating mode:	Normal mode, see chapter 1.4.5
Test voltage:	**Performance of the EUT:**
± 1.0 kV	No degradation noticed

Measurement 3 – CS10-RADIO in docking station:

Tested line:	**AC Mains**
Operating mode:	Normal mode, see chapter 1.4.5
Test voltage:	**Performance of the EUT:**
± 1.0 kV	No degradation noticed
± 2.0 kV	No degradation noticed

Tested line:	**USB OTG (MiniAB – Laptop)**
Operating mode:	Normal mode, see chapter 1.4.5
Test voltage:	**Performance of the EUT:**
± 1.0 kV	No degradation noticed

Result of the test

EUT conforms to the compliance criteria B

Uncertainty of Measurement

The uncertainty of the open loop voltage is: (rectangular distribution) ± 10 %

The uncertainty does not affect the compliance to the specification.

Test equipment

Device Type	Description	Brand	Type	ID
Amplifier:	V6982 Amplifier Research 50A220	Amplifier Research	50A220	V6982
Signal generator:	GF7803 Marconi 2023	Marconi	2023	GF7803
Sensor power meter:	OL9501 Gigatronic 8541C+80301A Ch A	Gigatronic	8541 Channel A	OL9501
Injection device:	H4844 Lüthi EM 100 + FTC101	EM	FTC101	H4844
Injection device:	Lüthi CDN 801-S1	Lüthi	CDN 801-S1	H7679
Injection device:	Lüthi CDN M2/M3	Lüthi	CDN M2/M3	H10168
Injection device:	EM-Test CDN T4	EM-Test	CDN T4	H8451
Current sensor:	H5556 SOLAR 6741-1	SOLAR	6741-1	H5556
Cable SG -> amplifier:	CI <250 MHz Gen-CDN CI< 250 MHz	Huber&Suhner	Coaxial Cables	

EUT:	CS10	
Connected:	All cables	
Operating mode:	Normal mode, see chapter 1.4.5	
Compliance criteria (see chapter 1.5.3):	**Required Test voltage:**	**Compliance Criterion:**
	10 V	A
Function surveillance:	Visual observation	

Settings of the test equipment			
Frequency step:	1 %	**Dwell time:**	1 s
Frequency range:	0.15 – 80 MHz	**Amplitude modulation:**	80% with 1 kHz
Applied Test voltage:	10 V	**Coupling device**	See below

Protocol of the test:

Measurement 1 – CS10-RADIO in configuration 1

Tested line:	**AC Mains**
Operating mode:	Normal mode, see chapter 1.4.5
Test voltage:	**Performance of the EUT:**
10 V	No degradation noticed

Tested line:	**USB OTG (Lemo – Laptop)**
Operating mode:	Normal mode, see chapter 1.4.5
Test voltage:	**Performance of the EUT:**
10 V	No degradation noticed

Tested line:	**USB Host (Memory Stick)**
Operating mode:	Normal mode, see chapter 1.4.5
Test voltage:	**Performance of the EUT:**
10 V	No degradation noticed

Measurement 2 – CS10-RADIO in configuration 2:

Tested line:	**AC Mains**
Operating mode:	Normal mode, see chapter 1.4.5
Test voltage:	**Performance of the EUT:**
10 V	No degradation noticed

Tested line:	**USB OTG (MiniAB – Laptop)**
Operating mode:	Normal mode, see chapter 1.4.5
Test voltage:	**Performance of the EUT:**
10 V	No degradation noticed

Tested line:	**USB Host (Memory Stick)**
Operating mode:	Normal mode, see chapter 1.4.5
Test voltage:	**Performance of the EUT:**
10 V	No degradation noticed

Tested line:	**RS 232**
Operating mode:	Normal mode, see chapter 1.4.5
Test voltage:	**Performance of the EUT:**
10 V	No degradation noticed

Result of the test

EUT conforms to the compliance criteria A

Uncertainty of Measurement

The uncertainty of measurement is: (normal distribution, k=2) ± 19 %

The uncertainty does not affect the compliance to the specification.

Test requirements according to ETSI EN 301 489-1 and -17

EUT Mode of operation: normal operation

Test plan and general settings of the test equipment:

operating conditions of the EUT	Batteries removed; Interfaces connected; test program running, continuous operation
supervision of the behavior of the EUT	control of data communication and music
Voltage	0 V, 92 V, 161 V, 0V
Duration	as required (see above)
number of tests	10

Measurement and specific settings:

Nr	Voltage applied	Duration	Behavior of the EUT
1	161 V	500 msec	No degradation noticed
2	92 V	200 msec	No degradation noticed
3	0 V	20 msec	No degradation noticed
4	0 V	10 msec	No degradation noticed
5	0 V	5 sec	Manual Restart

Result of the test

The EUT is **in conformance** with the specification.

Uncertainty of Measurement

The uncertainty of measurement is: (normal distribution, k=2) ± 19 %

EUT:	CS10	
Connected:	All cables	
Operating mode:	Normal mode, see chapter 1.4.5	
Compliance criteria	**Test voltage:**	**Compliance Criterion:**
AC Mains L → N:	± 1 kV	B
AC Mains L → PE, N → PE	± 2 kV	B
Function surveillance:	Visual observation	

Settings of the test equipment			
Repetition frequency:	1 Surge / Minute	**Number of Surges:**	5 surges at each polarity
Coupling:	CDN of the generator	**Impulse shape:**	1,2 / 50 (8/20) µs

Measurement:

Tested line:	**AC Mains, L → N**
Operating mode:	Normal mode, see chapter 1.4.5
Test voltage:	**Performance of the EUT:**
± 1.0 kV	No degradation noticed

Tested line:	**AC Mains, L/N → PE**
Operating mode:	Normal mode, see chapter 1.4.5
Test voltage:	**Performance of the EUT:**
± 1.0 kV	No degradation noticed
± 2.0 kV	No degradation noticed

Result of the test

The EUT is **in conformance** with the specification.

Uncertainty of Measurement

The uncertainty of the open loop voltage is: (rectangular distribution) ± 10 %

The uncertainty does not affect the compliance to the specification.