Prüfbericht - Nr.: *Test Report No.:*	**21138433_002**	**Seite 1 von 17** *Page 1 of 17*
Auftraggeber: *Client:*	**EpiSensor Limited** **Moylish Park, Limerick** **Irland**	
Gegenstand der Prüfung: *Test item:*	**ZigBee Modul**	
Bezeichnung: *Identification:*	**EpiLink Z31**	**Serien-Nr.:** *Serial No.:* ---
Wareneingangs-Nr.: *Receipt No.:*	80280	**Eingangsdatum:** *Date of receipt:* 2008-07-15
Prüfort: *Testing location:*	TÜV Rheinland Product Safety GmbH, Köln, Germany	
Prüfgrundlage: *Test specification:*	**FCC 47 CFR Ch.1 Part 15 2006-08-14 Emission** Section 15.107 (a), limits same as IEC/CISPR 22:1997 (EN 55022:1998) Class B Section 15.109 (a) Class B Section 15.109 (g), i.e. IEC/CISPR 22:1997 (EN 55022:1998) Class B Section 15.209 (Intentional radiator) Section 15.249 (Intentional radiator) Section 15.31 (e) and Section 15.215 (c)	
Prüfergebnis: *Test Result:*	**Der Prüfgegenstand entspricht oben genannten Prüfgrundlagen** *The test item passed the test specification(s)*	
Prüflaboratorium: *Testing Laboratory:*	TÜV Rheinland Product Safety GmbH, Köln, Germany	

geprüft / *tested by:*			**kontrolliert** / *reviewed by:*		
2009-01-12	O.Schaefer, SV		2009-01-12	K. Jauernik SV	
Datum *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*

Sonstiges / *Other Aspects:*
FCC Registration No. 91096, 2004-07-27
Anhang / *Annex:* **Messdiagramme** / *Measurement Diagrams*
Fotodokumentation / *Photo Documentation*

Abkürzungen:				*Abbreviations:*			
	P(ass)	=	entspricht Prüfgrundlage		*P(ass)*	=	*passed*
	F(ail)	=	entspricht nicht Prüfgrundlage		*F(ail)*	=	*failed*
	N/A	=	nicht anwendbar		*N/A*	=	*not applicable*
	N/T	=	nicht getestet		*N/T*	=	*not tested*

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Verwendete Messgeräte sind in der linken Spalte mit einem Kreuz **x** markiert
[used instruments are marked with an **x** in the left column]

	Störaussendung [emission] Test / Gerät [test / device]	Type	Hersteller [manufacturer]	Inv. – Nr. /Ser. - Nr.	kal. bis [cal. till]
	Elektr. Funkstörfeldstärke 2 [radiated disturbance SAC]				
	EMI Receiver 25-1000MHz	VUMA 1521 A	Schwarzbeck	14200621	2009-01
	EMI Receiver 25-1000MHz	VUMA 1524	Schwarzbeck	14200418	2009-03
	EMI Receiver < 2,75GHz	ESCS 30	Rohde & Schwarz	14201360	2010-01
	EMI Receiver < 26,5GHz	ESU 26	Rohde & Schwarz	30401912	2009-11
x	EMI Receiver < 26,5GHz	ESMI	Rohde & Schwarz	14200550	2010-10
x	BiConiLog-Ant 26-3000MHz	3142B	EMCO	14201363	2011-06
	Horn-Ant. 0,8-5GHz	BBHA 9120A	Schwarzbeck	30402211	2010-09
x	Horn-Ant 1-10GHz	BBHA 9120B 202	Schwarzbeck	14200694	2010-02
	Horn-Ant 1-10GHz	BBHA 9120B 204	Schwarzbeck	14200695	2009-10
	Horn-Ant 2-18GHz	BBHA 9120C 376	Schwarzbeck	30401857	2009-07
x	Horn-Ant 2-18GHz	BBHA 9120C 377	Schwarzbeck	30401858	2009-03
	Horn-Ant 15-26,5GHz	BBHA 9170 311	Schwarzbeck	30401855	2009-03
x	Horn-Ant 15-26,5GHz	BBHA 9170 312	Schwarzbeck	30401856	2009-03
x	Semi Anechoic Chamber SAC		ETS	14201372	2010-06

	Weitere Messgeräte [other testequipment]	Type	Hersteller [manufacturer]	Inv. – Nr. /Ser. - Nr.	kal. bis [cal. till]
	Digital-Multimeter	Metra Hit 16	ABB	14200346	2010-06
x	Digital-Multimeter	Metra Hit 23S	Gossen	14200699	2009-09
	Oszilloskop [oscilloscope]	TDS 3052B	Tektronix	30401734	2010-02
x	Temperature / Humidity	615	testo	30401660	2009-08

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

All measurement equipment calibrations are traceable to DKD or where calibration is performed outside Germany, to equivalent nationally recognized standards organizations.

The measurement facilities for conducted and for radiated disturbances of TRPS GmbH in Cologne, Am Grauen Stein, has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules. Measurement data will be accepted in conjunction with applications for Certification under Parts 15 and 18 of the Commission´s Rules.

Registration-Number: 91096 Date of Listing: 2004-July-27

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Messunsicherheit [measurement uncertainty]

Where relevant, following measurement uncertainty levels have been estimated for tests performed on the apparatus.

	Expanded Uncertainty	
	U_{Lab}	U_{CISPR}
Conducted Emission 0,15 to 30 MHz, Power Line	2,70 dB	3,6 dB
Radiated Emission 9kHz to 30MHz, Magnetic Field 3m	4,16 dB	5,2 dB
Radiated Emission 30 to 300MHz, OATS 3m or 10m	5,11 dB	5,2 dB
Radiated Emission 300 to 1000MHz, OATS 3m	4,71 dB	5,2 dB
Radiated Emission 30 to 1000MHz, Semi Anechoic Chamber 3m	4,91 dB	5,2 dB
Radiated Emission 1000 to 2750MHz, Semi Anechoic Chamber 3m	4,89 dB	under consid.

Calculated in accordance with UKAS LAB 34
Uncertainty figures are valid to a confidence level of 95%

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1. Vereinbarungen [requirements and agreements]

Auftragsgemäß wurde an dem vorgestellten Prüfling eine EMV-Prüfung durchgeführt. Die Prüfung erfolgte nach den folgenden Grundlagen.
[The tested device got investigated by the following requirements and standards]

Störaussendung [Emission]
FCC 47 CFR Ch.1 Part 15

Section 15.107 (a) limits same as IEC/CISPR 22:1997 Class B (EN 55022:1998 Kl. B)	Störspannung, AC-Eingang [conducted noise, AC power input]
Section 15.109 (a) Class B	El. Störfeldstärke [radiated el. noise]
Section 15.209 Section 15.249	El. Störfeldstärke [radiated el. noise]
Section 15.31 (e) and Section 15.215 (c)	Voltage Variation Bandedge Compliance
ANSI C63.4:2003	Test Procedures

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1.1. Übersicht der Prüfergebnisse [Summary of test results]

Elektromagnetische Aussendung [Emission tests]	Ergebnis [result]
Funkstörspannung am Netzanschluss [Mains terminal disturbance voltage]	N/A
Funkstörspannung, Knackstörungen [Disturbance voltage, clicks]	N/A
Funkstörspannung/-strom [conducted cont. disturbance]	N/A
Funkstörleistung [Disturbance power]	N/A
Funkstörfeldstärke [Radiated disturbance] „Unintentional“	N/A
Funkstörfeldstärke [Radiated disturbance] „Intentional“	**Pass**
Oberschwingungsströme [Harmonic current emissions]	N/A
Spannungsschwankungen [Voltage fluctuations]	N/A

Elektromagnetische Beeinflussbarkeit [Immunity tests]	Ergebnis [result]
Leitungsgeführte Störgrößen, induziert durch HF-Felder [Conducted disturbances, induced by radio frequency fields]	N/A
Hochfrequente elektromagnetische Felder [Radiated, radio-frequency electromagnetic fields]	N/A
Schnelle transiente elektrische Störgrößen/Burst [Electrical fast transient/burst]	N/A
Spannungseinbrüche, Kurzzeitunterbrechungen und Spannungsschwankungen [Voltage dips, short interruptions and voltage variations]	N/A
Stoßspannungen [Surge]	N/A
Entladung statischer Elektrizität [Electrostatic discharge]	N/A
Magnetfelder mit energietechn. Freq. [Power frequent magnetic fields]	N/A

Abkürzungen [abbreviations]:

Pass	Anforderungen erfüllt	[requirements fulfilled or test passed]
Fail	Anforderungen nicht erfüllt	[requirements not fulfilled or test failed]
N/A	Nicht anwendbar/gefordert	[not applicable/requested]
A/nT	Anwendbar, nicht getestet	[applicable, not tested]

Begründung für anwendbare, jedoch nicht durchgeführte Prüfungen
[Reason for applicable but not executed tests]

Nr. [No.]	Begründung [Reason]
---	---

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1.2. **Einteilung des Prüflings** [classification of EUT]

Der Prüfling wird klassifiziert in Kategorie
[The EUT is classified into category]

FCC 47CFR Part 15 Subpart C Section 15.201
Intentional Radiator

Certification

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2. Informationen zum Prüfling [information about EUT]

Geräteart [kind of device]:	Siehe Seite 1 dieses Berichtes [refer to page 1 of this report]
Type:	Siehe Seite 1 dieses Berichtes [refer to page 1 of this report]
Ser. Nr.:	Siehe Seite 1 dieses Berichtes [refer to page 1 of this report]
Gerätevarianten [EUT variants]:	Keine [none]
Andere Bezeichnung [brandname]:	NN
Nennspannung [rated voltage]:	5 V DC (USB Connector)
Netzfrequenz [frequency]:	---
Nennstrom [rated current]:	---
Nennleistung [rated power]:	Keine spezif. Daten vorhanden [no specific data available]
Schutzklasse [protection class]:	---
Konstruktion/Aufbau: [constructional details] Abmessungen [dimensions]	Siehe Foto- bzw. System-Dokumentation [refer to photo and system documentation]
Schnittstellen [interfaces, ports] Eingang [input]:	---
Intern [internal]:	---
Ausgang [output]:	---
Ein/Ausgang [bidir. I/O]	---
EMV relevante Daten [EMC relevant data]	Weitere Daten siehe System-Dokumentation in Anhang 3 [for further information refer to appendix 3]
Systemfreq. [system freq.]:	2405 – 2480 MHz
Filter [filter]:	---
Erdung [grounding]:	---
Schirmung [shielding]:	Keine [None]
Besondere EMV-Massnahmen [special EMC measures]:	---
Sonstiges [other aspects]:	---

Betriebsart während der Prüfungen [EUT mode]:	1	Standby
	2	System in Funktion und interaktive Funktionstests [system operating and interactively functional tests]

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3. Prüfaufbau [EUT configuration]

Der Prüfaufbau erfolgte entsprechend den Angaben der genannten EMV-Normen.
Die Messungen und Tests wurden unter "worst case"-Bedingungen durchgeführt, d.h., es wurden typische Anordnungen und Betriebszustände gewählt bzw. angenommen und für maximale Störaussendung optimiert (sogenannte ”Ungünstigste Konfiguration”).
Die maximalen Störaussendungswerte wurden dokumentiert.
Einzelheiten sind (auch) der Fotodokumentation zu entnehmen, in der die Konfigurationen maximaler Störaussendung dargestellt sind.
Soweit nicht anders angegeben, gelten diese Angaben für alle nachfolgenden Messungen.

[The test setup was made in accordance with mentioned EMC standards.
Measurements and tests were executed under ”worst case” conditions. Typical EUT arrangements or operating modes were chosen or assumed and for maximum emission optimized (a so called ”unfavourable configuration”).
Maximum emissions are reported.
Details of test setup or adjustments are (also) shown inside the photo documentation, in which configurations of maximum emission are displayed.
As far as not mentioned otherwise these statements are valid for all following tests.]

Testkonfiguration [tested configuration]
Prüfling EUT: ---
[Equipment Under Test EUT]

Verwendete Zusatzgeräte AE: ---
[Auxiliary Equipment AE]

Versorgung [supply]: Wie in Kap. 2 [same as in chapter 2]

Testsoftware [testsoftware]: ---

Überwachung während Prüfung: ---
[supervision during test]

Abkürzungen [abbreviations]	N/A	Nicht anwendbar [not applicable]
	NN	Nicht bekannt [not named]
	NC	Nicht bestückt [not connected]

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4. Prüfungen [EMC tests]

4.1. El. Funkstörfeldstärke,
[radiated disturbance, intentional radiator]

Prüfgrundlage [test bases]: FCC Part 15.209
FCC Part 15.249

Grenzwerte [limits]		L2	L3
FCC Part 15.209	0.009 – 0.490 MHz		2400/F(kHz) 300m !
	0.490 – 1.705 MHz		2400/F(kHz)
	1.705 - 30 MHz	70 dBµV/m	30 dBµV/m
Detektor [detector]		QP, 120 kHz	QP, 120 kHz
Messentfernung [distance]:		d2 = 3 m	d3 = 30 m
Entf.-Formel [distance formula] by FCC Part 15.31 (f) (2)		L2 = L3 + 40 dB/dec.	

Grenzwerte [limits]		L2	L1
FCC Part 15.209	30 - 88 MHz	40 dBµV/m	29,5 dBµV/m
	88 – 216 MHz	43,5 dBµV/m	33 dBµV/m
	216 – 960 MHz	46 dBµV/m	35,5 dBµV/m
	> 960 MHz	54 dBµV/m	43,5 dBµV/m
Detektor [detector]	< 1000 MHz	QP, 120 kHz	
	> 1000 MHz	Av, 1 MHz	
Messentfernung [distance]:		d2 = 3 m	d1 = 10 m
Entf.-Formel [distance formula] by FCC Part 15.31 (f) (1)	L2 = L1 + 20 dB/dec.		
by EN 55022 10.6	L2 = L1 * (d1/d2)	= L1 + 20 * lg d1/d2	= L1 + 10,46 dB

Grenzwerte [limits]

FCC Part 15.249 (b) (1)	902 – 928 MHz	N/A	
	2400 - 2483,5 MHz	50 mV/m	
	5725 – 5875 MHz	N/A	
	outside these bands	Limits as	FCC Part 15.209
Detektor [detector]		Pk	
Messentfernung [distance]:		d2 = 3 m	

Obere Messfrequenz [upper freq. of measurement] FCC Part 15 Section 15.33 (a)	from 30 MHz To 25 GHz

Messort [location]: Absorberkammer [semi anechoic chamber]

Prüftisch [turn table]
Dimension 1,5m, Höhe [height] 0,8m
Material Holz, nichtleitend [wood, non-conductive]
Messentfernung [distance]: 3 m

Messmethode [method] According ANSI C63.4:2003

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Betriebsart [EUT mode]:	siehe Kap. 2 und Anhang 1 [refer to chapter 2 and appendix 1]
Prüfaufbau [test setup]:	siehe Kap. 3 [refer to chapter 3]
Messergebnis [test data]:	siehe Anhang 1 [refer to appendix 1] Channel 11 = 22.38 mV Channel 26 = 19.95 mV **(Limit is 50 mV/m)**
Messunsicherheit [measurement uncertainty]	Erweiterte Messunsicherheit [expanded uncertainty) = 4,89 dB
Anmerkungen [comments]:	The transmitter was modulated. The center frequency for each channel can be calculated as, F_C = (2405 + (5 * ch)) MHz, where ch = 11, 12, ..., 26.
Prüfergebnis [test result]:	**X** Anforderungen erfüllt [Req. fulfilled, Passed] **---** Anforderungen nicht erfüllt [Req. not fulfilled, Failed] **---** Nicht anwendbar/gefordert [Not Applicable/Requested] **---** Nicht getestet [Not tested]
Field Strength Calculations:	The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured level. The basic equation with a sample calculation is as follows: Where: Field Strength = Measured Level + Antenna Factor + Cable Attenuation Factor – Amplifier Gain **Example:** FS = 30,0 + 7,4 + 1,1 - 0 = 38,5dBuV/m Level in uV/m = Common Antilogarithm [(38,5dBuV/m)/20] = 84,1uV/m

Max. Emission on Channal 11

Frequency / GHz	Peak	Average	Polarization
4.9022	362.66 µV	362.66 µV	Vertical
12.240	46.72 µV	46.72 µV	Vertical

X, Y and Z positions were tested and “X” position was found to be worst case.

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4:2003.
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions. The Analyser was set to max. hold. All test was performed with Peak and Average detector. All values are the same. The Res.Bw and Vid.Bw for the above table is 1 MHz. The report shows the mas. value we found from both EUT’s.

After switch on GL-402 or RC-402 they try to connect each other. The transmitter switch on approximately all 250 msek. This will be done until you switch off the EUT. In this case we have a nearly continue transmission.

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Remote Control

Frequency error or frequency drift					
Measurement uncertainty: ±1x10^{-7} Limit: ±60ppm					
Tx Freq. (GHz)	**Temp. (°C)**	**Voltage (V)**	**Error (kHz)**	**Verdict**	**Remark**
Channel 11	23	3	0	Pass	---
	-20	3	0,661	Pass	
	50	3	1,110	Pass	

Base

Frequency error or frequency drift					
Measurement uncertainty: ±1x10^{-7} Limit: ±60ppm					
Tx Freq. (GHz)	**Temp. (°C)**	**Voltage (V)**	**Error (kHz)**	**Verdict**	**Remark**
Channel 26	23	4,6	0	Pass	---
	-20	4,6	0,673	Pass	
	50	4,6	0,992	Pass	

(2) The frequency tolerance of the carrier signal shall be maintained within + 0.001% of the operating frequency over a temperature variation of –20 degrees to +50 degrees 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 degrees C. **For battery operated equipment, the equipment tests shall be performed using a new battery.**

Bandedge	
Measurement uncertainty: ±1x10^{-7} Limit: ±60ppm	
Low frequency at 20 db bandwith (GHz)	**High frequency at 20 db bandwith (GHz)**
2,40183	2,40222

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Anhang 1
[Appendix 1]

Messdiagramme
[Test Data]

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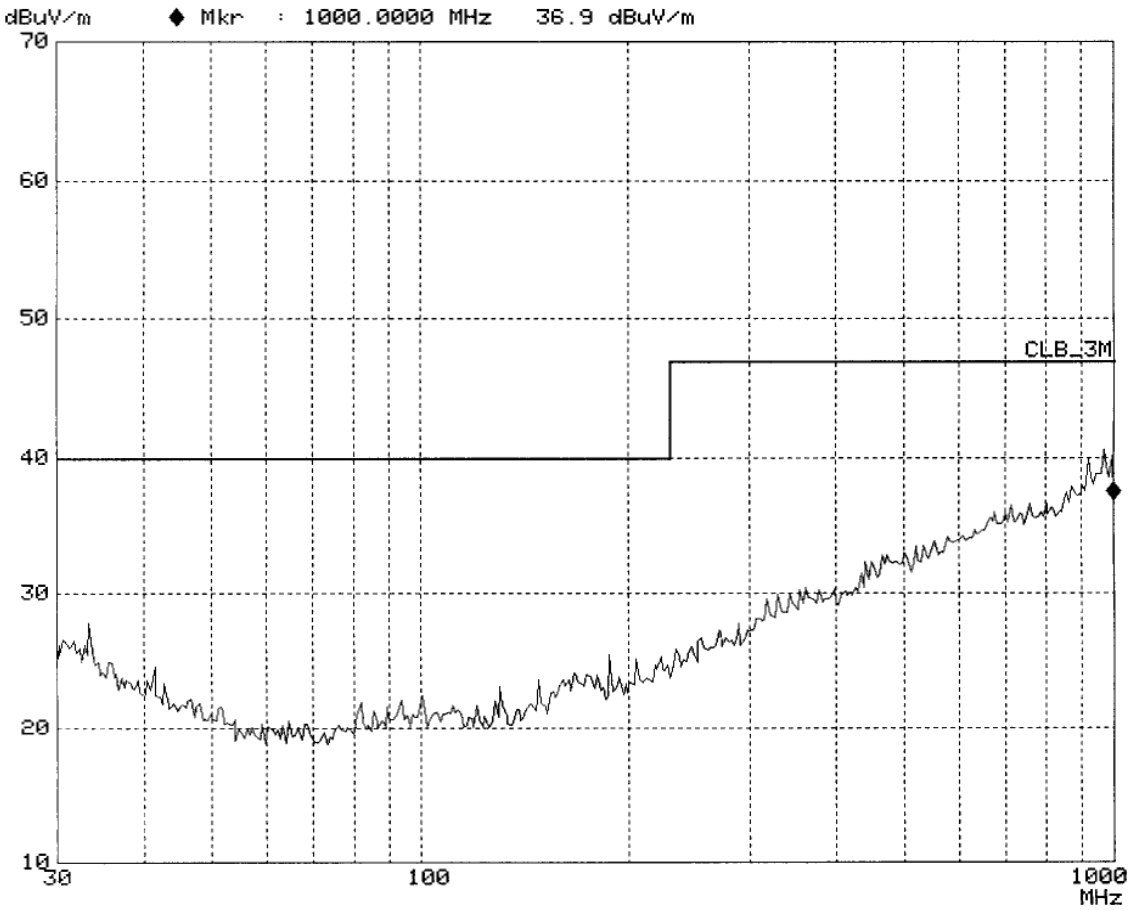
El. Funkstörfeldstärke,
[radiated disturbance, intentional radiator]

Including Antenna factor and cable lost



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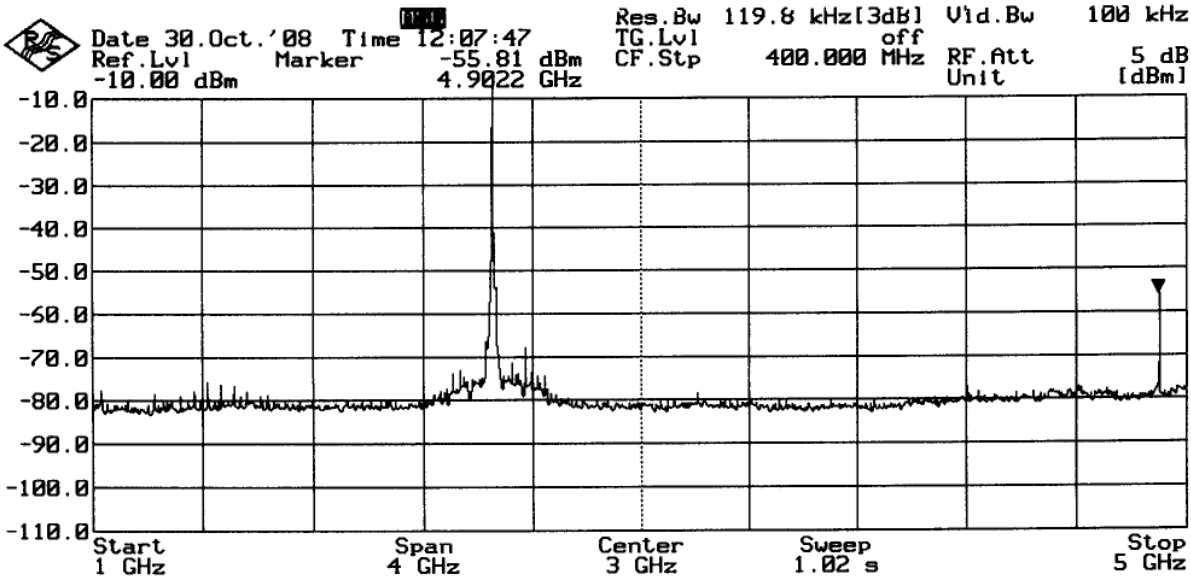
El. Funkstörfeldstärke,
[radiated disturbance, intentional radiator]

Including Antenna factor and cable lost



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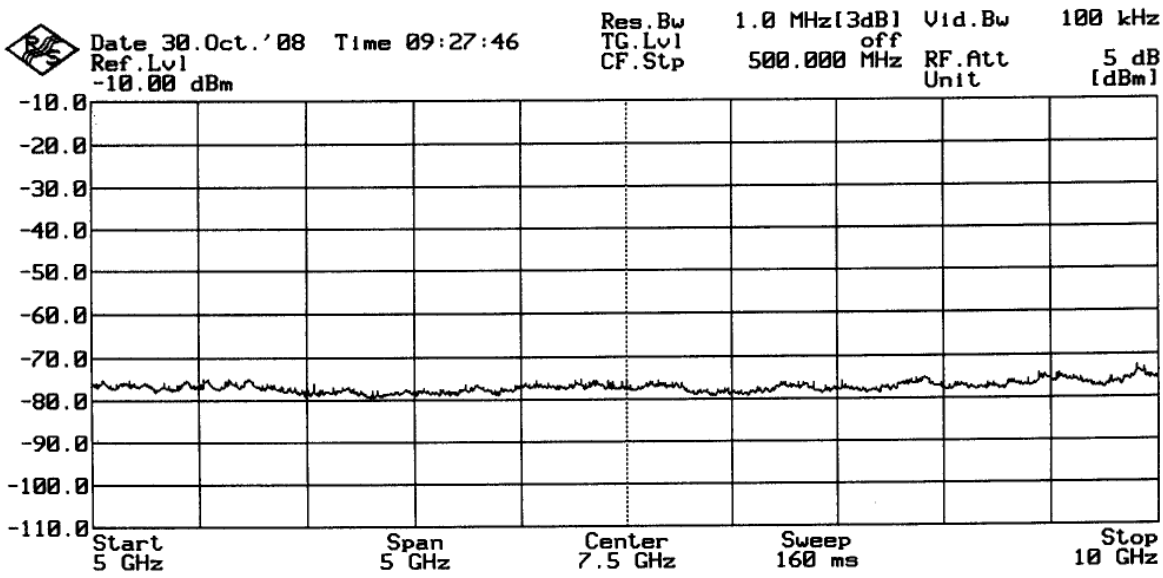
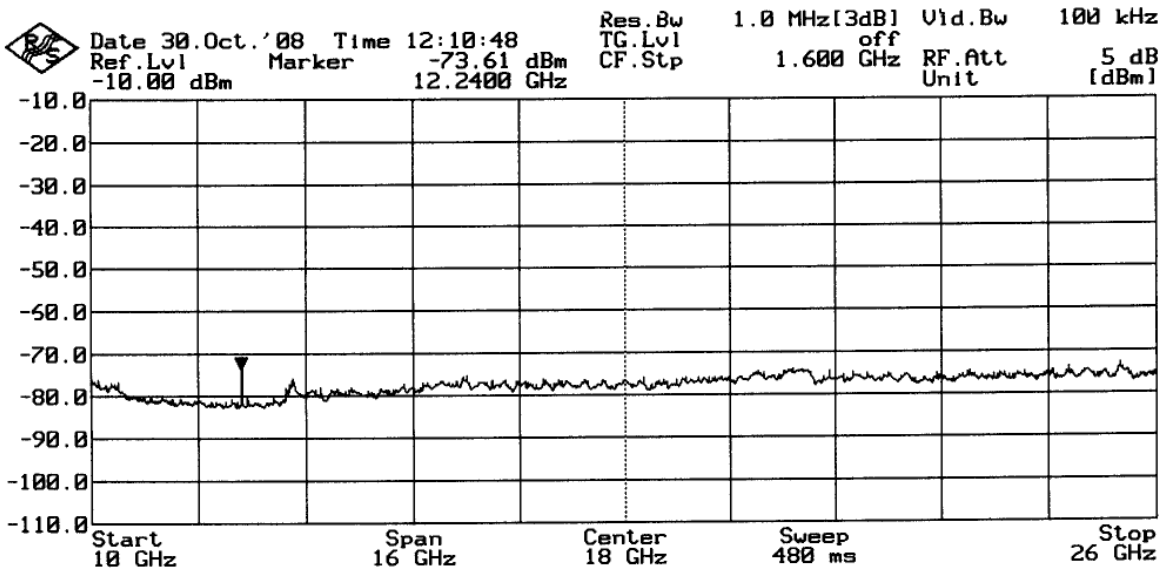
Including Antenna factor and cable lost



Including Antenna factor and cable lost



Including Antenna factor and cable lost

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Ende des Prüfberichtes / *End of Testreport*