

Test Report
Electromagnetic Compatibility

Test Report - Nr.: 07KFE008728-CFC-01

Date: 2008-06-03

Type:	CFC105
REF:	590087
Description:	RF-Module for PDA
Serial number:	001242000000E20

Manufacturer:	Biocomfort Diagnostics GmbH & Co. KG
Customer:	Biocomfort Diagnostics GmbH & Co. KG
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This test report consists of 16 pages. All measurement results exclusively refer to the equipment, which was tested.
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1. General description

1.1. Product description

The RF-Module CFC105 is plugged into a PDA and is part of the following system:

Excerpt of the manufacturers product description:

The high-performance measuring devices automatically transmits your values by radio to your PDA. Every time you open the Health Manager software on your PDA the values are amalgamated, put in a medically based, sensible context, and interpreted.

Blood pressure, which indicates a healthy cardiovascular system, blood sugar, the early warning system for health problems, HRV, the absolute parameter for assessing the heart's adaptability to stress and relaxation, body weight and fat as indicators of fitness and diet – these values are easily and quickly measured using Biocomfort's high-quality devices.

The technology used is 2.4 GHz IEEE 802.15.4 / Zigbee.

The operating frequency is 2.425 GHz. The CFC105 and the measuring devices are working as transceivers.

Antenna type : Internal, Integral

Duty cycle : the duty cycle was 100 ms (this is the shortest periodic transmission interval).

The PDA was supplied by an external power supply.

1.2. Related submittal(s) Grants

This is an application for the certification of the RF-Module CFC105.

1.3. Test Methodology

- The test setup and test in the frequency range of 30 MHz to 1 GHz was done according to: **CISPR 22: 1998 + Corrigendum: 2003 + A1: 2000 + A2: 2003 and ANSI C63.4: 2003**
- The test setup and test in the frequency range of 1 GHz to 25 GHz was done according to: **ANSI C63.4: 2003** American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz and **CFR 47, Part 15.249**.

The test results detailed in this report apply only to the RF-Module CFC105 with the test setup described. Any modification such as a change, addition to or inclusion of another device into this product will require an additional evaluation.

The support equipment listed as part of the emission tests is required to properly exercise and test the device under test.

1.4. Test Facility

The test site was the semi-anechoic chamber Intertek Germany (PM KF 1150). The measurement distance EUT – Antenna was $d = 3$ m and in the frequency range of 18 GHz to 25 GHz a measurement distance EUT – Antenna of $d = 1$ m was additionally used to find emissions easier.

1.5. List of exhibits

Following exhibits are delivered as separate pdf files. The name of each file corresponds to the description of the exhibit with the extension **.pdf**

EXHIBIT 1	Block Diagram
EXHIBIT 2	Confidentiality Request
EXHIBIT 3	External Photos
EXHIBIT 4	ID Label / Location Info
EXHIBIT 5	Internal Photos
EXHIBIT 6	Parts List / Tune Up Info
EXHIBIT 7	Schematics
EXHIBIT 8	Test Setup Photos
EXHIBIT 9	Users Manual

2. Measurements And Test Specifications

Emission - Requirements according to

- FCC, Part 15, Class A, verification
- FCC, Part 15, Class B, DoC
- FCC, Part 15, Class B, certification
- FCC, Part 15, intentional radiator, certification

3. Description Of EUT

3.1. Configuration / Operating Conditions

table-top EUT

floor-standing EUT

The RF-Module is powered by the PDA and it's external power supply.

The blood pressure measuring device, the blood sugar measuring device and the scale for body weight and fat were switched on and placed on the same table to transmit in a duty cycle of 100 ms.

The equipment under test (EUT) is placed on wooden table 0,8 m above ground plane.

The measurements in the frequency range of 30 MHz – 3 GHz were performed with the bilog antenna HL 562. At all interference frequencies the height of the antenna is scanned in the range 1 m to 4 m with horizontal and vertical polarization and the turntable is rotated in the range 0° to 360° to obtain the highest field strength.

The measurements in the frequency range of 3 GHz – 18 GHz were performed with the horn aerial HF 906 with a pre-amp. At all interference frequencies the height of the antenna is scanned in the range 1 m to 4 m with horizontal and vertical polarization and the turntable is rotated in the range 0° to 360° to obtain the highest field strength.

For frequencies above 18 GHz the measurement was performed at a distance of d = 3 m with the horn aerial BBHA 9170. The measured values were below the noise level. Therefore the measurement was performed at a closer distance of d = 1 m.

The measured values were still below the noise level.

3.2. Peripheral Devices Used For Testing

Device	Manufacturer	Type	SN	FCC ID
PDA	HP	Hx2190b	2CK6420VJW	-/-
AC Adapter	Delta	EADP-10BB	592A601Z9S155G	-/-
Blood pressure measuring device	Biocomfort	gluco-comfort, BGM105	0206440120	-/-
Blood sugar measuring device	Biocomfort	tenso-comfort, BPM105	0206440120	-/-
Scale	Biocomfort	scaleo-comfort, BSC105	0407210123	-/-

3.3. Major Subassemblies Or Internal Peripherals

Device	Manufacturer	Type	SN	FCC ID
none				

3.4. Supply- And Interconnecting Cables

Line	Length	shielded	non shielded	Shield on GND / PE
DC- Cable to PDA	1,8 m	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

4. Test Results - Overview

Emission	required	passed	passed with modification	not passed
30 MHz - 25 GHz	FCC 15.249	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5. Measurement results detailed

5.1. Radiated Emission 30 MHz – 25 GHz

Data was measured for worst case configuration which resulted in highest emission levels. A sample calculation, configuration photographs and data tables of emissions are included.

The detector used was QP in the frequency range of 30 MHz – 1000 MHz. In the frequency range of 1 GHz – 25 GHz PK and AV were used.

The measurement time was 150 ms per step.

5.3.1. Field strength calculation

The field strength is calculated by adding the reading on the measuring receiver to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when the specified limit is related to average detector and measurements are made with peak detector).

A sample of calculation is included below :

$$E = RR + AF + CF - AG + PD + AV$$

Where

E	field strength in dB μ V/m
RR	receiver reading including preamplifier in dB μ V
CF	cable attenuation factor in dB
AF	antenna factor in dB/m
AG	amplifier gain in dB
PD	pulse desensitization in dB
AV	average factor in dB

Example : Assume that measured values and factors are as follows :

RR	= 60 dB μ V
CF	= 1.2 dB
AF	= 12.6 dB/m
AG	= 20 dB
PD	= 0 dB
AV	= -10 dB

$$\text{Then } E = 60 + 1.2 + 12.6 - 20 + 0 - 10 = 43.8 \text{ dB μ V/m}$$

The radiated emission tables which follow the graphical presentation of results were created by the EMC 32 software by Rohde-Schwarz. The data of field strength include the components given above with the exception of PD and AV.

5.3.2. Normative references

Limits equivalent:	FCC, Part 15.249
Methods of Measurement equivalent:	ANSI C63.4

Test requirement

Distance Antenna – EUT	3 m for $f < 18$ GHz; 1 m for $f > 18$ GHz
Frequency range	30 MHz - 25 GHz

Place of measurement

Semi anechoic chamber Intertek Germany PM KF 1150.
 Open Area Test Site

Measurement devices

Measurement device	Type	Manufacturer	SN	Asset No.	Last Calibr.ation	Inter-val
<input checked="" type="checkbox"/> Test receiver, 20Hz-26GHz	ESIB26	Rohde & Schwarz	100150	PM KF 0948	07-03	2
<input checked="" type="checkbox"/> Antenna, 30-3000 MHz	HL562	Rohde & Schwarz	100354	PM KF 1123	07-03	2
<input checked="" type="checkbox"/> Horn antenna, 1 GHz-18 GHz	Rohde & Schwarz	HF 906	100331	PM KF 1047	07-09	2
<input checked="" type="checkbox"/> Horn antenna preamp. 1 GHz-18GHz	Bonn	BLMA0118 -BT	76609	PM KF 1047	07-09	2
<input checked="" type="checkbox"/> Horn antenna, 14 GHz-40 GHz	Schwarzbeck	BBHA 9170	BBHA91703 61	PM KF 1204	07-10	2

5.3.3. Emission Test results

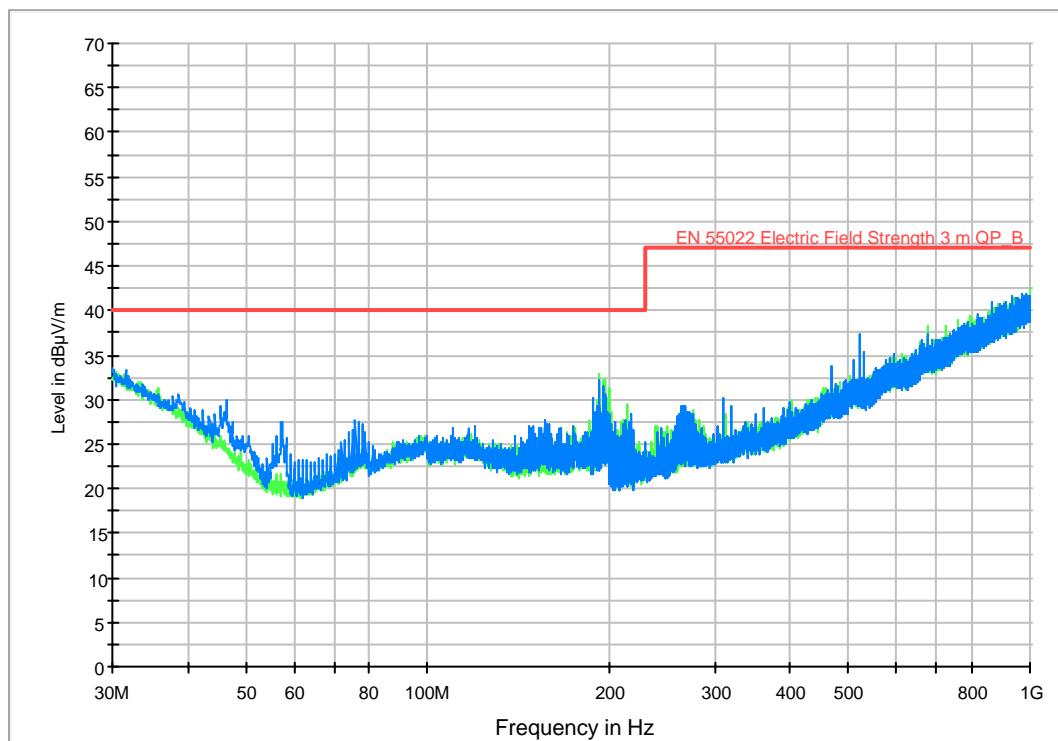
Test requirements **passed** **passed with modification** **not passed**

Comment:

The radiated emissions between 30 MHz and 25 GHz are under the limit specified in FCC 15.249.

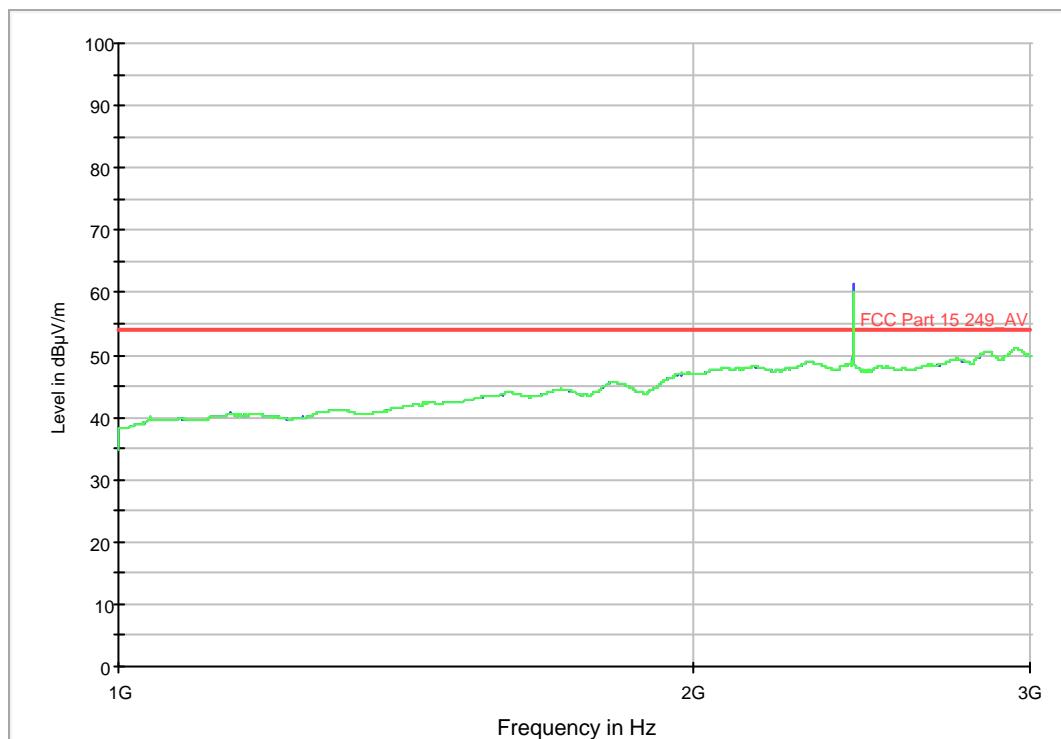
In the following diagrams the transmitter frequency at 2.425 GHz is visible.

5.3.3.1 Radiated Emission 30 MHz – 1 GHz

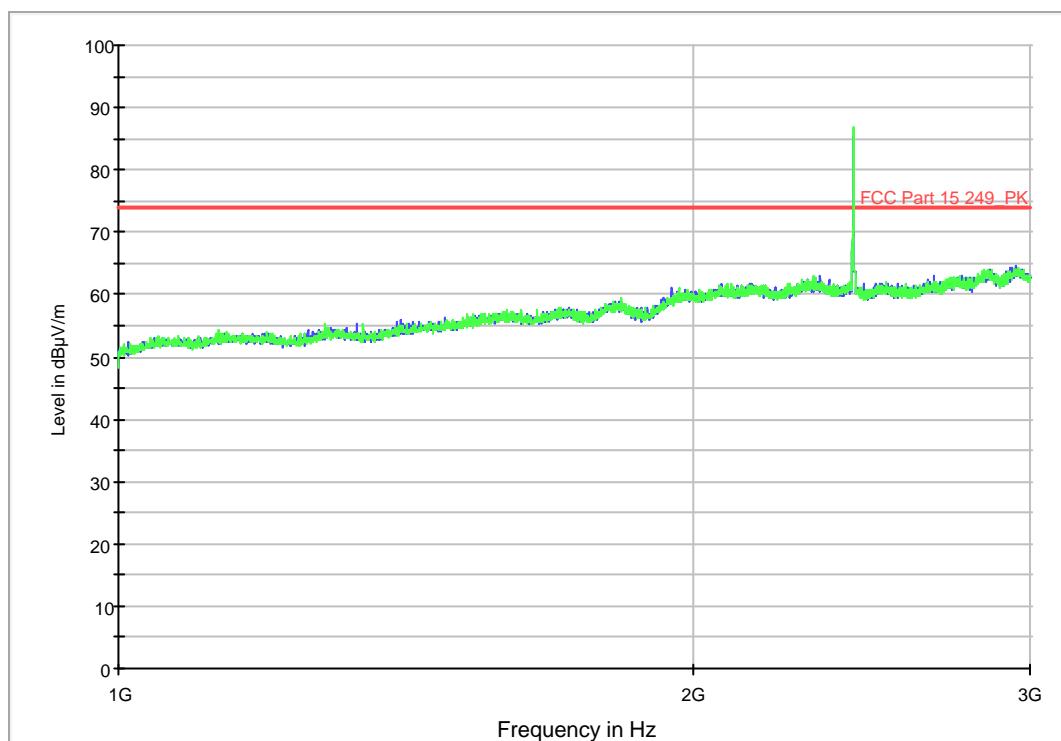


EMI-Scan_MaxPeak -1G

5.3.3.2 Radiated Emission 1 GHz – 3 GHz

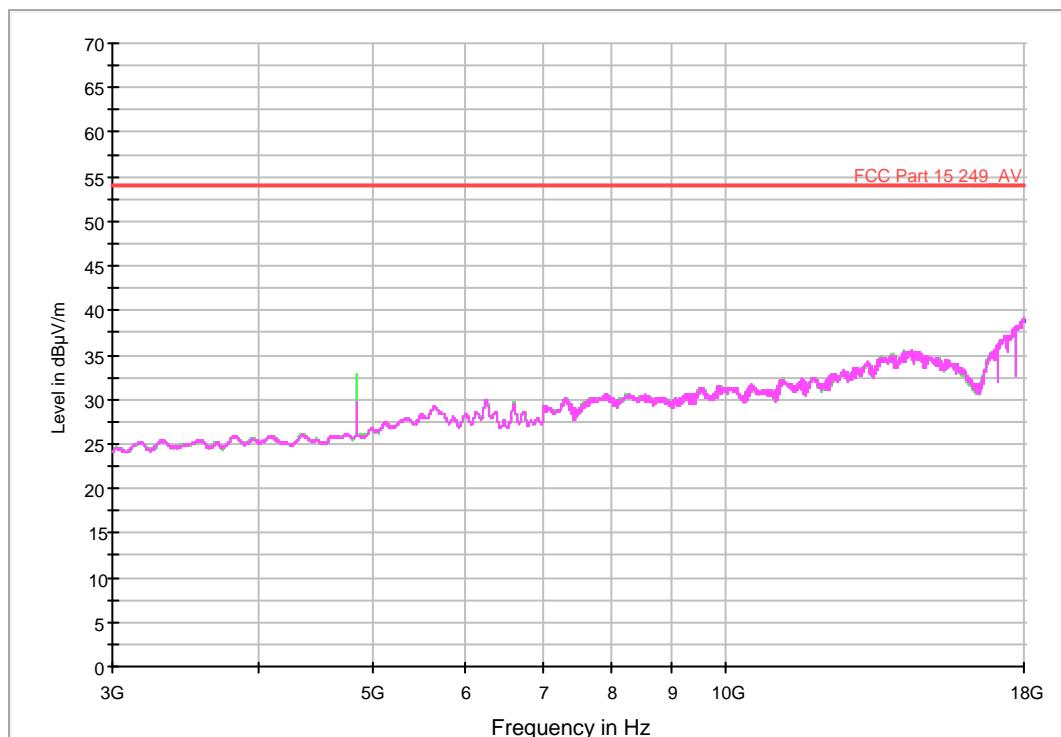


EMI-Scan_Average 1-3G

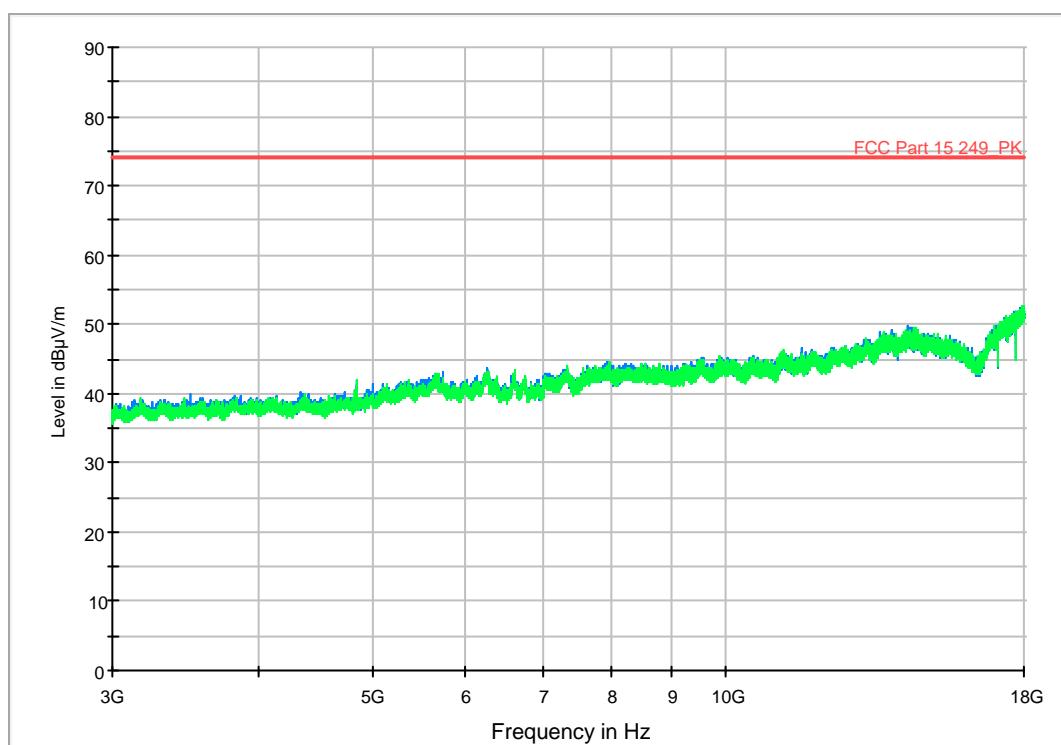


EMI-Scan_MaxPeak 1-3G

5.3.3.3 Radiated Emission 3 GHz – 18 GHz

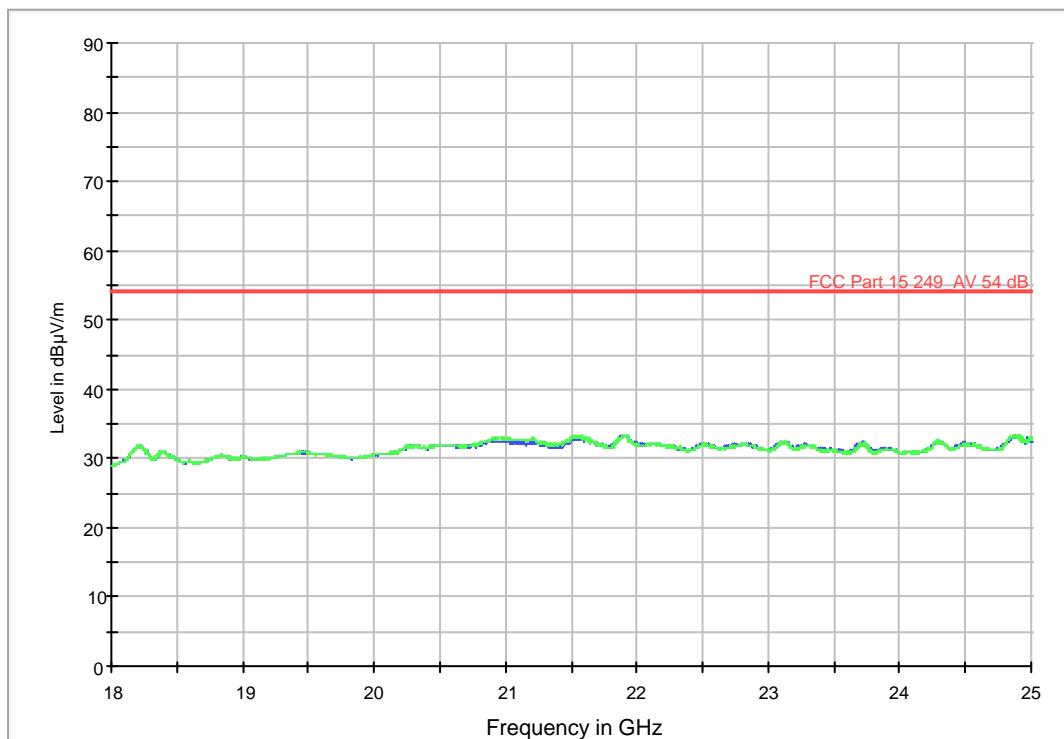


3_18G Scan_HF906_PreAmp AV

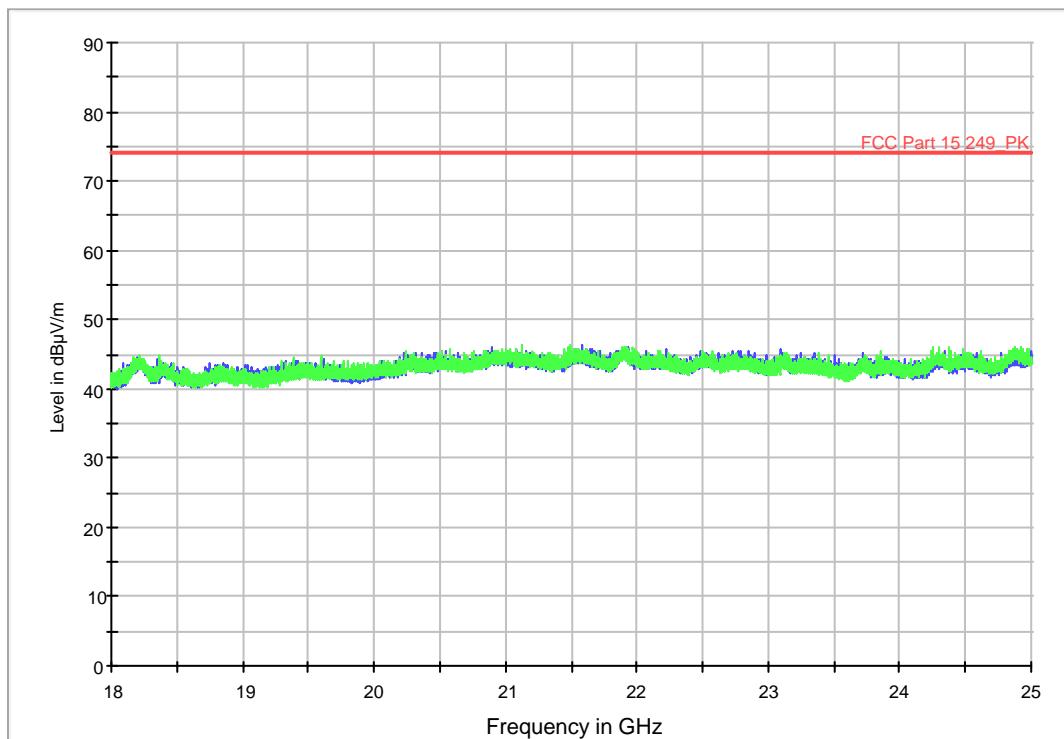


3_18G Scan_HF906_PreAmp PK

5.3.3.4 Radiated Emission 18 GHz – 25 GHz



14_26G Scan_BBHA 9170 w Amplifier _AV



14_26G Scan_BBHA 9170 w Amplifier 70_PK

5.3.3.5 Radiated Emission : Table 30 MHz – 25 GHz

Measurements based on a measurement time of 1000 ms unless otherwise noted.
 Limits are valid for measuring distance d = 3m unless otherwise noted.

Frequency (MHz)	Average (dB μ V/m)	Peak (dB μ V/m)	Quasi Peak (dB μ V/m) d = 3 m	Antenna height (meter)	Polarisation	Turn-table (degree)	Margin (dB)	Limit (dB μ V/m)	BW (kHz)
46,44	-	-	29,50	1,0	v	0	10,50	40	120
57,24	-	-	28,30	1,0	v	0	11,70	40	120
76,02	-	-	28,30	1,0	v	250	11,70	40	120
192,35	-	-	26,50	1,0	v	0	13,50	40	120
192,40	-	-	22,40	1,0	h	0	17,60	40	120
197,10	-	-	22,00	1,0	h	170	18,00	40	120
197,35	-	-	24,50	1,0	v	0	15,50	40	120
199,95	-	-	22,20	1,0	h	150	17,80	40	120
266,50	-	-	28,60	1,0	v	35	18,40	47	120
520,10	-	-	31,10	1,0	v	0	15,90	47	120
2425,00	61,76	-	-	1,0	v	0	32,24	94	1000
2425,00	64,10	-	-	1,7	h	230	29,90	94	1000
4846,00	37,70	-	-	2,0	h	0	16,30	54	1000
4846,00	36,00	-	-	1,7	v	0	18,00	54	1000
2425,00	-	89,50	-	1,1	v	210	24,50	114	1000
2425,00	-	93,00	-	2,1	h	270	21,00	114	1000
4846,00	-	44,50	-	1,7	v	200	29,50	74	1000
4846,00	-	44,90	-	2,0	h	0	29,10	74	1000