



## Accredited testing-laboratory

**DAR registration number: DAT-P-176/94-D1**

**Federal Motor Transport Authority (KBA)**  
**DAR registration number: KBA-P 00070-97**

**Recognized by the Federal Communications Commission**

**Anechoic chamber registration no.: 90462 (FCC)**  
**Anechoic chamber registration no.: 3462C-1 (IC)**

**Certification ID: DE 0001**

**Accreditation ID: DE 0002**

**Accredited Bluetooth® Test Facility (BQTF)**

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**Test report no. : 1-1050-01-11/09**

**Type identification : DSpark – wireless base station**

**Applicant : Brähler ICS Konferenztechnik**

**FCC ID : XOCDSPARK**

**IC Certification No : 8548A-DSPLARK**

**Test standards : 47 CFR Part 15  
RSS - 210 Issue 7**

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## 1 General information

### 1.1 Notes

The test results of this test report relate exclusively to the test item specified in 3.1.1. The CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM ICT Services GmbH.

**Test laboratory manager:**

2009-09-02            Marco Bertolino  
Date                    Name



Signature

**Technical responsibility for area of testing:**

2009-09-02            Stefan Bös  
Date                    Name



Signature

## 1.2 Testing laboratory

**CETECOM ICT Services GmbH**

**Untertürkheimer Straße 6 - 10**

**66117 Saarbrücken**

**Germany**

**Phone:** + 49 681 5 98 - 0

**Fax:** + 49 681 5 98 - 9075

**e-mail:** info@ICT.cetecom.de

**Internet:** http://www.cetecom-ict.de

**State of accreditation:** The test laboratory (area of testing) is accredited according to  
DIN EN ISO/IEC 17025  
DAR registration number: DAT-P-176/94-D1

**Accredited by:** Federal Motor Transport Authority (KBA)  
DAR registration number: KBA-P 00070-97

**Testing location, if different from CETECOM ICT Services GmbH:**

**Name :**

**Street :**

**Town :**

**Country :**

**Phone :**

**Fax :**

## 1.3 Details of applicant

<b>Name:</b>	Brähler ICS Konferenztechnik International Congress Service AG
<b>Street:</b>	Wahlfelder Mühle 3
<b>Town:</b>	53639 Königswinter
<b>Country:</b>	GERMANY
<b>Telephone:</b>	+49 (0) 2244 930 0
<b>Fax:</b>	+49 (0) 244 930 440
<b>Contact:</b>	Frank Döhnhardt
<b>E-mail:</b>	fd@braehler.com
<b>Telephone:</b>	+49 (0) 244 930 149

## 1.4 Application details

<b>Date of receipt of order:</b>	2009-02-26
<b>Date of receipt of test item:</b>	2009-08-17
<b>Date of start test:</b>	2009-08-17
<b>Date of end test:</b>	2009-09-02
<b>Persons(s) who have been present during the test:</b>	Dipl.-Ing. Frank Döhnhardt Development engineer

## 2 Test standard/s

**47 CFR Part 15**

**Title 47 of the Code of Federal Regulations; Chapter I-  
Federal Communications Commission  
subchapter A - general, Part 15-Radio frequency devices**

**RSS - 210 Issue 7**

**Spectrum Management and Telecommunications - Radio  
Standards Specification  
Low-power Licence-exempt Radiocommunication Devices (All  
Frequency Bands): Category I Equipment**

### 3 Technical tests

#### 3.1 Details of manufacturer

Name:	<b>Brähler ICS Konferenztechnik International Congress Service AG</b>
Street:	<b>Wahlfelder Mühle 3</b>
Town:	<b>53639 Königswinter</b>
Country:	<b>GERMANY</b>

#### 3.1.1 Test item

Kind of test item :	<b>Conference System</b>
Type identification :	<b>DSpark – wireless base station</b>
S/N serial number :	<b>Base station 1: 00 10 00 01 Base station 2: 00 10 00 00</b>
HW hardware status :	<b>No information available!</b>
SW software status :	<b>Special test software – for testing only</b>
Frequency Band [MHz] :	<b>2403.328 MHz – 2479.104 MHz</b>
Type of Modulation :	<b>FHSS</b>
Number of channels :	<b>38</b>
Antenna :	<p><b><u>Antenna 1: TX antenna 1</u></b>            Name: SAA05-220680            Dual-band directional antenna for 2.4 / 5 GHz</p> <p><b><u>Antenna 2: TX antenna 2</u></b>            Name: SAA04-050360            Directional panel antenna for 2.4 GHz</p> <p><b><u>Antenna 3: RX antenna</u></b>            Name: SAA04-050350            Swivel access point omni antenna for 2.4 GHz</p> <p><b>For more information about the antennas – please take a look at the sub clause 5.2 - reference documents.</b></p>
Power Supply :	<b>115 V AC by power supply unit ETC45-48</b>
Temperature Range :	<b>-10 °C to +55 °C</b>

**Max. power radiated: 17.86 dBm                          Antenna 1**

**Max. power radiated: 17.98 dBm                          Antenna 2**

**Max. power conducted: 12.01 dBm**

**FCC ID:** XOCDSPARK  
**IC:** 8548A-DSPARK

### 3.1.2 Additional EUT information For IC Canada (appendix 2)

IC Registration Number:	<b>8548A-DSPARK</b>
Model Name:	<b>DSpark – wireless base station</b>
Manufacturer (complete Address):	<b>Brähler ICS Konferenztechnik Wahlfelder Mühle 3 53639 Königswinter GERMANY</b>
Tested to Radio Standards Specification (RSS) No.:	<b>RSS-210 Issue 7</b>
Open Area Test Site Industry Canada Number:	<b>IC 3462C-1</b>
Frequency Range (or fixed frequency) [MHz]:	<b>2403.328 MHz – 2479.104 MHz</b>
RF: Power [W] (max):	<b>Rad. EIRP: 61.09 mW Antenna 1 Rad. EIRP: 62.81 mW Antenna 2 Conducted : 15.89 mW</b>
Antenna Type:	<p><b>Antenna 1: TX antenna 1</b>  <b>Name: SAA05-220680</b>  <b>Dual-band directional antenna for 2.4 / 5 GHz</b></p> <p><b>Antenna 2: TX antenna 2</b>  <b>Name: SAA04-050360</b>  <b>Directional panel antenna for 2.4 GHz</b></p> <p><b>Antenna 3: RX antenna</b>  <b>Name: SAA04-050350</b>  <b>Swivel access point omni antenna for 2.4 GHz</b></p> <p><b>For more information about the antennas – please take a look at the sub clause 5.2 - reference documents.</b></p>
Occupied Bandwidth (99% BW) [MHz]:	<b>3.06</b>
Type of Modulation:	<b>GFSK</b>
Emission Designator (TRC-43):	<b>3M06FXD</b>
Transmitter Spurious (worst case) [dB $\mu$ V/m in 3m]:	<b>29.90 antenna 1 29.43 antenna 2</b>
Receiver Spurious (worst case) [dB $\mu$ V/m in 3m]:	<b>29.13 antenna 1 29.50 antenna 2</b>

#### ATTESTATION:

I attest that the testing was performed or supervised by me; that the test measurements were made in accordance with the above-mentioned departmental standard(s), and that the radio equipment identified in this application has been subject to all applicable test conditions specified in the departmental standards and all of the requirements of the standards have been met.

Signature:



Test engineer: Marco Bertolino    Date: 2009-09-02

### 3.1.3 RF Technical Brief Cover Sheet acc. To RSS-102

All Fields must be completed with the requested information or the following codes: N/A for Not Applicable, N/P for Not Performed or N/V for Not Available. Where applicable, check appropriate box.

1. COMPANY NUMBER: **8548A**

2. MODEL NUMBER: **DSpark – wireless base station**

3. MANUFACTURER: **Brähler ICS Konferenztechnik**

4. TYPE OF EVALUATION: **(c) RF Evaluation**

- Evaluated against exposure limits: General Public Use  Controlled Use
- Duty cycle used in evaluation: 100 %
- Standard used for evaluation: RSS-102 Issue 2 (2005-11)
- Measurement distance: 0.20 m
- RF value: 0.125 V/m  A/m  W/m<sup>2</sup>

Measured  Computed  Calculated

#### Declaration of RF Exposure Compliance

##### ATTESTATION:

I attest that the information provided in this test report are correct; that a Technical Brief was prepared and the information it contains is correct; that the device evaluation was performed or supervised by me; that applicable measurement methods and evaluation methodologies have been followed and that the device meets the SAR and/or RF exposure limits of RSS-102.

Name: Dipl.-Ing. (FH) Marco Bertolino  
Title: Engineer  
Company: Cetecom ICT Services GmbH

Signature:



Date: 2009-09-02

### 3.1.4 EUT operating modes

EUT operating mode no.*)	Description of operating modes	Additional information
Op. 0	normal mode	normal temperature and power source conditions
Op. 1		low temperature, low power source conditions
Op. 2		low temperature, high power source conditions
Op. 3		high temperature, low power source conditions
Op. 4		high temperature, high power source conditions

\*) EUT operating mode no. is used to simplify the test plan

### 3.1.5 Extreme conditions testing values

Description	Shortcut	Unit	Value
Nominal Temperature	T <sub>nom</sub>	°C	<b>20</b>
Nominal Humidity	H <sub>nom</sub>	%	<b>53</b>
Nominal Power Source	V <sub>nom</sub>	V	<b>115</b>

Type of power source: AC by power supply unit ETC45-48

Deviations from these values are reported in chapter 2

## 4 Summary of Measurement Results and list of all performed test cases

- No deviations from the technical specifications were ascertained  
 There were deviations from the technical specifications ascertained

TC identifier	Description	verdict	date	Remark
RF-Testing	FCC Part 15 §15.247 - CANADA RSS-210	Passed	2009-09-02	-/-

Test Specification Clause	Test Case	Pass	Fail	Not applicable	Not performed
None	Antenna Gain	Yes			
§15.247(a1)	Carrier frequency separation	Yes			
§15.247(a1)	Number of hopping channels	Yes			
§15.247(a)(1)(iii)	Time of occupancy (dwell time)	Yes			
§15.247(e)	Power Spectral density (Hybrid system in Inquiry mode/Page scan)			Yes	
§15.247(a)(1)	Spectrum Bandwidth of a FHSS System / 20dB Bandwith	Yes			
§ 15.247 (b)(1)	Maximum output power (conducted)	Yes			
§ 15.247 (b)(1)	Max. peak output power (radiated)	Yes			
§ 15.247 (d)	Band-edge compliance of conducted emissions	Yes			
§ 15.205	Band-edge compliance of radiated emissions	Yes			
§ 15.247 (d)	Spurious Emission - conducted (Transmitter)	Yes			
§ 15.247 (d)	Spurious Emission - radiated (Transmitter) >30 MHz	Yes			
§ 15.109	Spurious Emissions - radiated (Receiver)	Yes			
§ 15.209	Spurious Emissions - radiated (Transmitter) <30 MHz	Yes			
§ 15.107/207	Conducted Emissions <30 MHz	Yes			

## 5 RF measurement testing

### 5.1 Description of test set-up

#### 5.1.1 Radiated measurements

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 25 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are confirmed with specifications ANSI C63.2-1996 clause 15 and ANSI C63.4-2003 clause 4.1.5. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analysers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.4-2003 clause 4.2.

Antennas are confirmed with ANSI C63.2-1996 item 15.

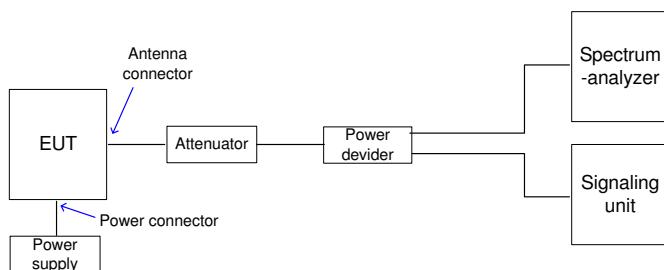
- 9 kHz - 150 kHz: Quasi Peak measurement, 200 Hz Bandwidth, passive loop antenna.
- 150 kHz - 30 MHz: Quasi Peak measurement, 9 kHz Bandwidth, passive loop antenna.
- 30 MHz - 200 MHz: Quasi Peak measurement, 120 kHz Bandwidth, bi-conical antenna
- 200MHz - 1GHz: Quasi Peak measurement, 120 kHz Bandwidth, log periodic antenna
- >1GHz: Average, RBW 1MHz, VBW 10 Hz, waveguide horn

All measurements are done in accordance with the Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems DA 00-705 and Appendix A "BLUETOOTH APPROVALS"

The EUT is powered by an external power supply with nominal voltage. The signalling is performed from outside the chamber with a signalling unit (CMU200 or other) by air link using signalling antenna.

#### 5.1.2 Conducted measurements

The EUT's RF signal is coupled out by the antenna connector which is supplied by the manufacturer. The signal is first 10dB attenuated before it is power divided (~6dB loss per branch). One of the signal paths is connected to the communication base Station (CMU200 or other), the other one is connected to the spectrum analyzer. The specific losses for both signal paths are first checked within a calibration. The measurement readings on the signalling unit/spectrum analyzer are corrected by the specific test set-up loss. The attenuator, power divider, signalling unit and the spectrum analyzer are impedance matched on 50 Ohm.



## 5.2 Referenced documents

### Antenna 1:

#### Dual-Band Directional Antenna for 2.4 / 5.0 / 5.2 / 5.6 / 5.8 GHz

Version 1

#### SAA05-220680

##### Electrical Specification

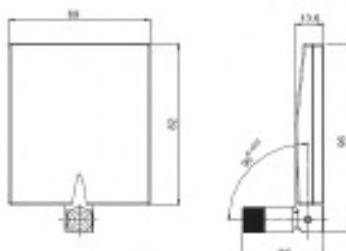
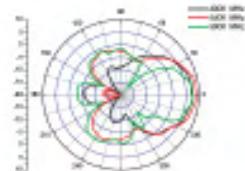
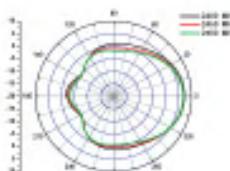
Frequency range	2400 MHz - 2500MHz	4900 MHz - 5875 MHz
Gain	6.0dBi	8.0 dBi
VSWR	2.0 : 1 Max.	2.0 : 1 Max.
Polarization	Linear, vertical	Linear, vertical
HPBW / horizontal	75°	50°
HPBW / vertical	70°	60°
Impedance	50 Ohms	50 Ohms
Connector	RP SMA Plug	



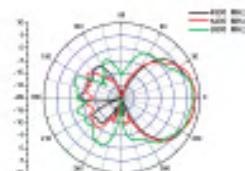
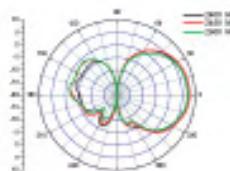
##### Environmental & Mechanical Characteristics

Temperature	-10°C to +65°C
Humidity	96% @ 55°C
Radome material	ABS, UV resistant
Weight	43.5 g
Dimension	96 x 69 x 39.5 mm

H-plane Co-polarization Pattern



V-plane Co-polarization Pattern



**Antenna 2:**
**Directional Panel Antenna  
for 2.4 GHz**
   

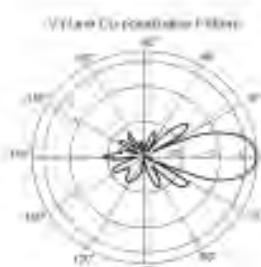
Version 2

**SAA04-050360****Electrical Specification**

Frequency range	2400 - 2500 MHz
Gain	12 dBi
VSWR	2.0 : 1 Max.
Polarization	Linear, vertical
HPBW / horizontal	84°
HPBW / vertical	23°
Front to back ratio	15 dB
Downtilt	0°
Power handling	10 W (cw)
Impedance	50 Ohms
Connector	SMA female

**Environmental & Mechanical Characteristics**

Survival wind speed	218 km/hr
Temperature	-40° C to +80° C
Humidity	95% @ 55° C
Lightning protection	DC ground
Radome color	Ivory
Radome material	ABS, UV resistant
Weight	0.2 kg
Dimensions	327 x 80 x 22 mm



**Antenna 3:** (only RX-antenna)

## Swivel Omni-Directional Antenna for 2.4 GHz

**SAA04-050350**

**Electrical Specification**

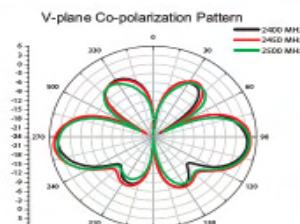
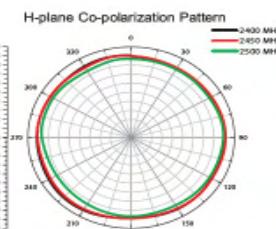
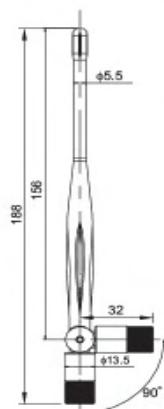
Frequency range	2400 MHz - 2500 MHz
Peak gain	4.5 dBi
VSWR	2.0 : 1 Max.
HPBW / horizontal	360°
HPBW / vertical	40°
Polarization	Linear, vertical
Impedance	50 Ohms
Power handling	2 W (cw)
Connector	RP SMA plug

Version 2



**Environmental & Mechanical Characteristics**

Temperature	- 10°C to +55°C
Humidity	95% @ 55°C
Radome color	Black
Radome material	ABS, UV resistant
Weight	20 g
Dimensions	Ø13.5 x 188 mm



### 5.3 Additional comments

The antenna gain for the antenna 2 included:

- the antenna gain for antenna 2
- and the attenuation for 6 m cable.

The antenna 2 is used with the 6 m cable only.

### 5.4 Antenna gain

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module.

#### Antenna 1:

TEST		lowest frequency	middle frequency	highest frequency
T <sub>nom</sub>	V <sub>nom</sub>			
Conducted power [dBm] Measured		11.36	<b>12.01</b>	11.34
Radiated power [dBm] Measured		17.41	17.78	<b>17.86</b>
Gain [dBi] Calculated		6.05	5.77	<b>6.52</b>

Measurement settings:

RBW	3 MHz
VBW	10 MHz
Detector	Positive Peak
Sweep time	Auto
Span	10 MHz

**Antenna 2:**

TEST				
T <sub>nom</sub>	V <sub>nom</sub>	lowest frequency	middle frequency	highest frequency
Conducted power [dBm] Measured		11.36	<b>12.01</b>	11.34
Radiated power [dBm] Measured		17.65	<b>17.98</b>	17.71
Gain [dBi] Calculated		6.29*	5.97*	<b>6.37*</b>

**\*Note:**

The antenna gain for the antenna 2 included:

- the antenna gain for antenna 2
- and the attenuation for 6 m cable.

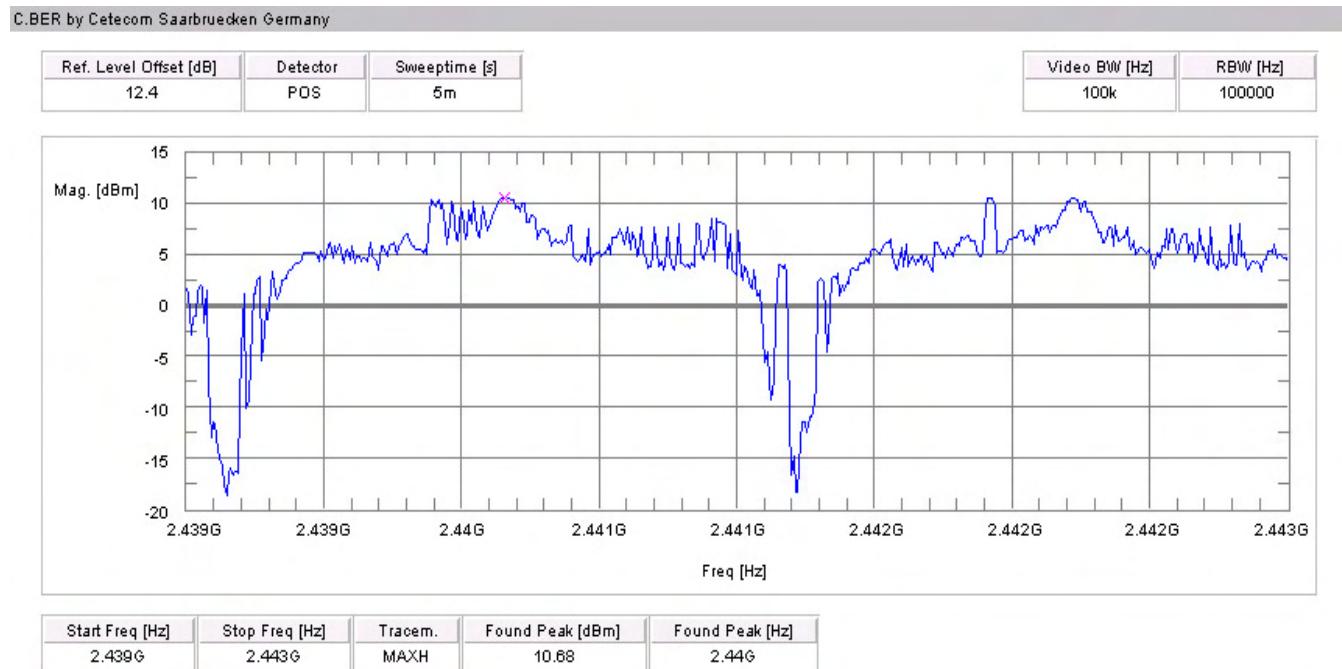
The antenna 2 is used with the 6 m cable only.

Measurement settings:

RBW	3 MHz
VBW	10 MHz
Detector	Positive Peak
Sweep time	Auto
Span	10 MHz

## 5.5 Carrier frequency separation §15.247(a)(1)

Plot 1 of 1:



Frequency range : 78.057 MHz

Number of hopping channels: 38

Calculated frequency separation: 2.054 MHz

Measured frequency separation: ~2 MHz → Passed

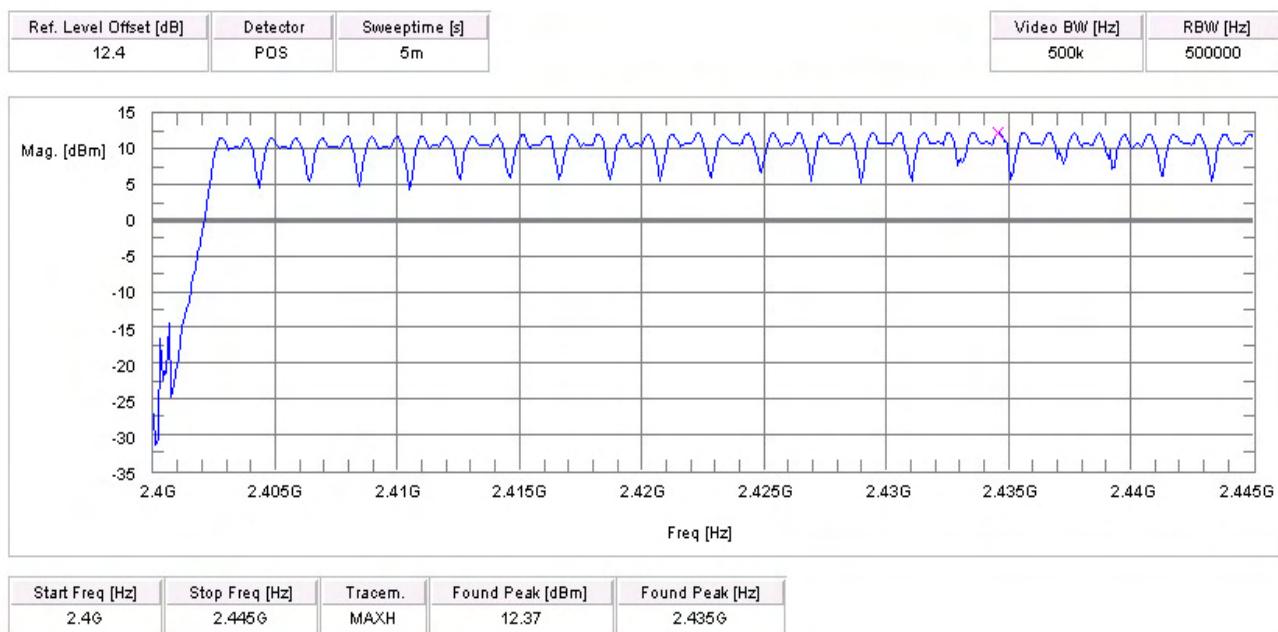
### Limits:

Under normal test conditions only	Minimum 25 kHz or two-thirds of the 20 dB bandwidth, whichever is greater
-----------------------------------	--

## 5.6 Number of hopping channels §15.247(a)(1)

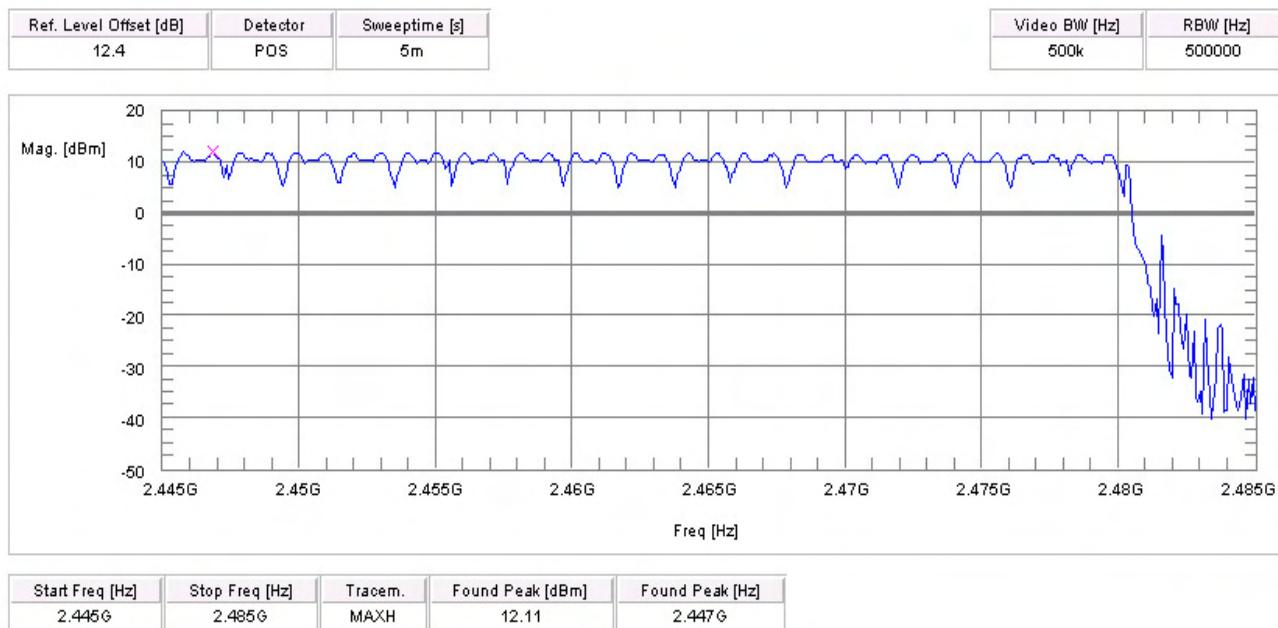
Plot 1 of 2:

C.BER by Cetecom Saarbruecken Germany



Plot 2 of 2:

C.BER by Cetecom Saarbruecken Germany



Result: The number of hopping channels is: 38

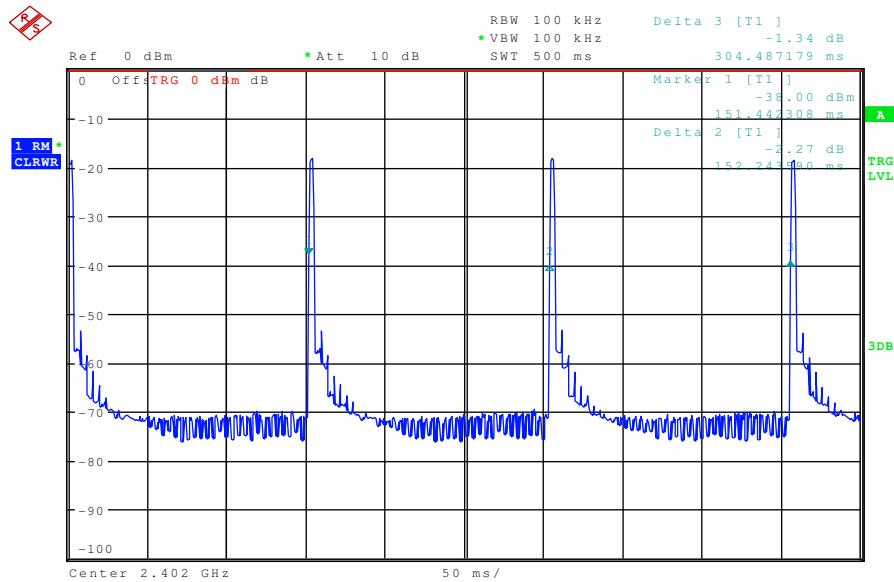
Limits:

Under normal test conditions only

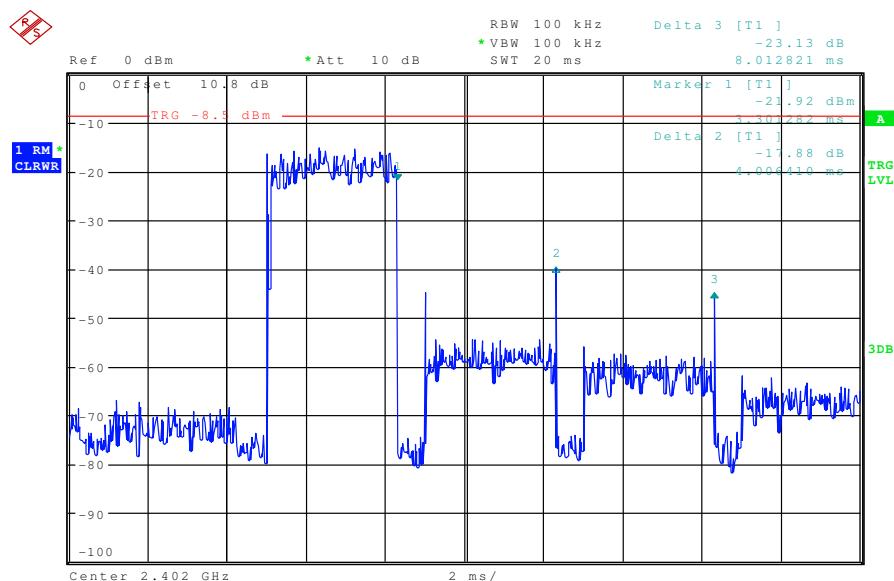
at least 15 non-overlapping channels

## 5.7 Time of occupancy (dwell time) §15.247(a)(1)(iii)

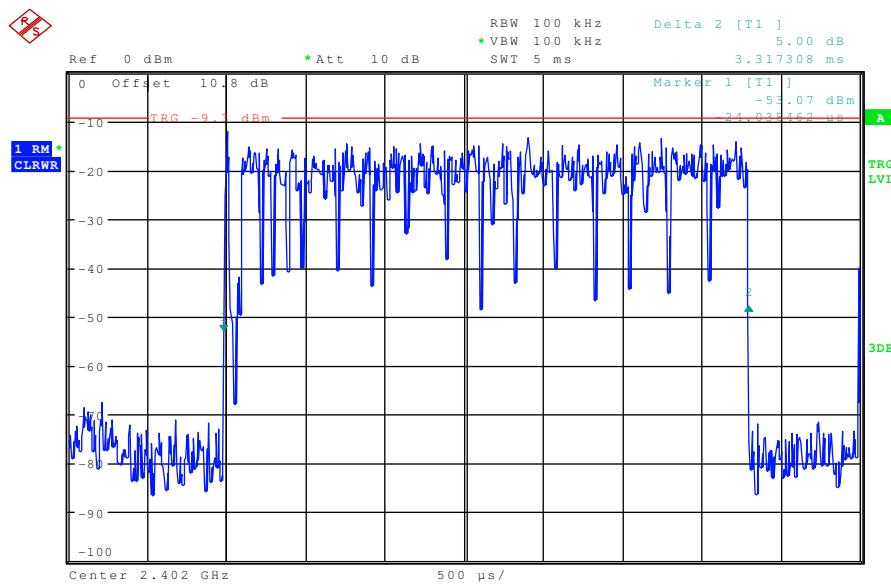
Plot 1:



Plot 2:



Plot 3:



Plot 1: Repetition rate = 153.34 ms

Plot 2: Staying time = 4.01 ms

Plot 3: Pulse time = 3.32 ms

**5.8 Power Spectral density (Hybrid system in Inquiry mode/Page scan)  
§ 15.247(e)**

**Not applicable – not for FHSS systems!**

Result: Power density: - dBm/Hz = - dBm / 3 kHz  
Correction factor from dBm/Hz to dBm / 3 kHz is +34,8 dB

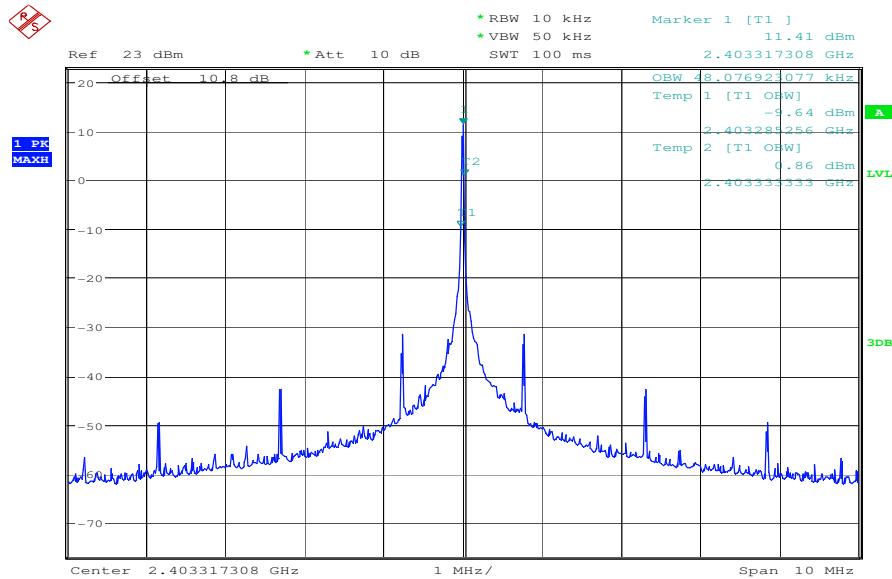
Limits:

Under normal test conditions only	For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission
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## 5.9 Spectrum Bandwidth of a FHSS System / 20dB Bandwidth §15.247(a)(1)

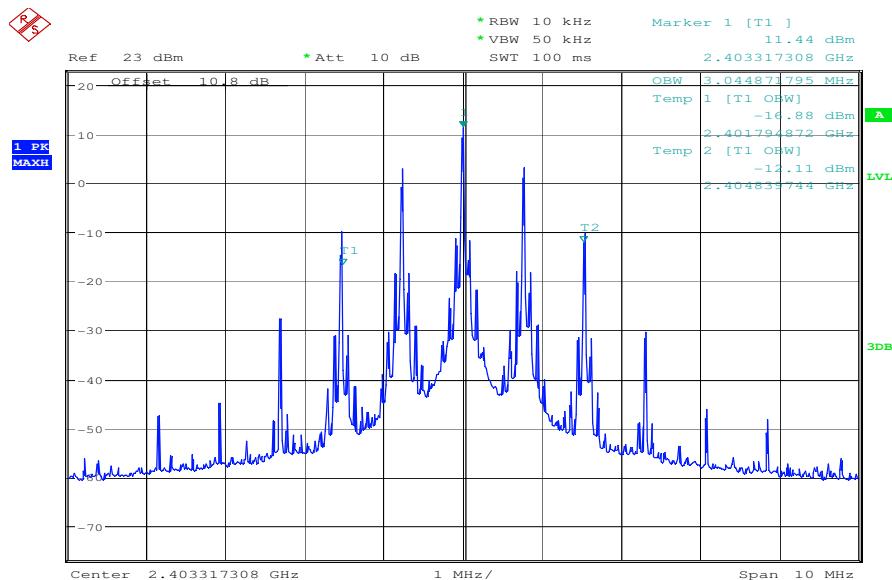
### Plots:

Plot 1 of 4: Un-modulated carrier, only for information



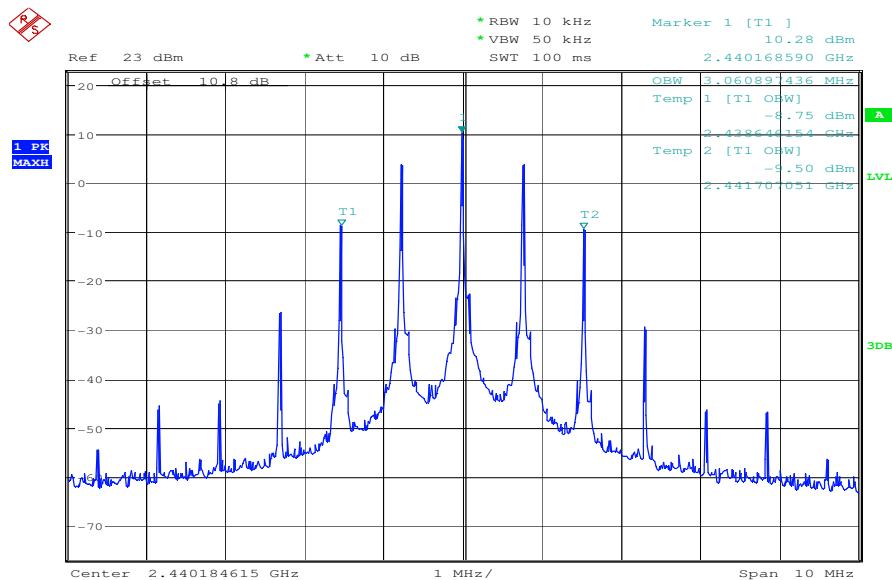
Date: 26.AUG.2009 14:45:01

Plot 2 of 4: lowest channel



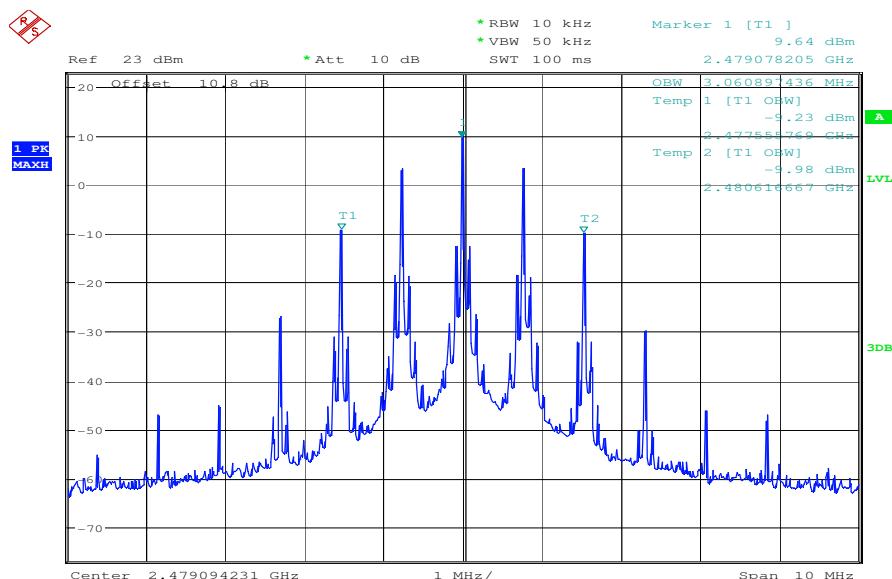
Date: 26.AUG.2009 14:54:18

Plot 3 of 4: mid channel



Date: 26.AUG.2009 14:54:57

Plot 4 of 4: highest channel



Date: 26.AUG.2009 14:55:32

Result:

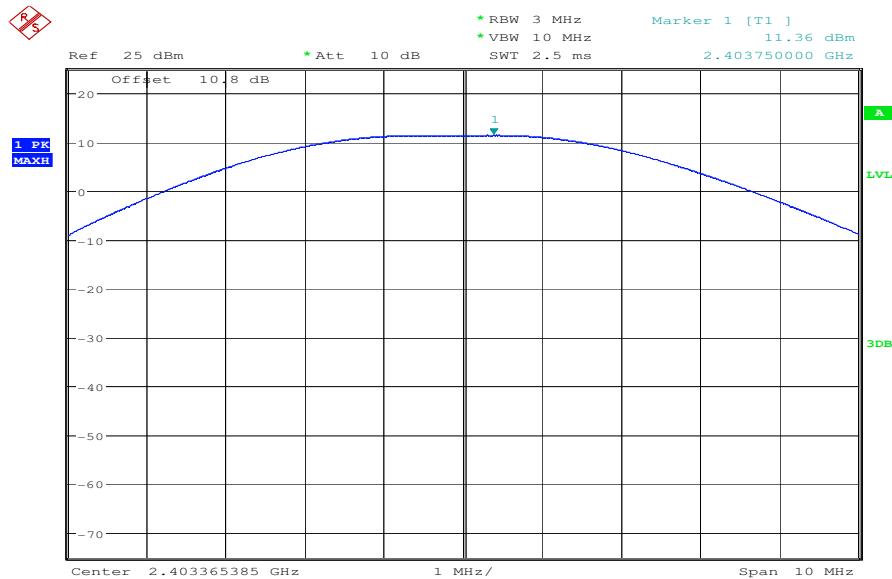
Test conditions		20 dB BANDWIDTH [kHz]		
Frequency [MHz]		lowest frequency	middle frequency	highest frequency
T <sub>nom</sub>	V <sub>nom</sub>	3.04	<b>3.06</b>	<b>3.06</b>
Measurement uncertainty		±1kHz		

RBW / VBW as provided in the „Measurement Guidelines“ (DA 00-705, March 30, 2000)

RBW: 10 kHz / VBW 50 kHz

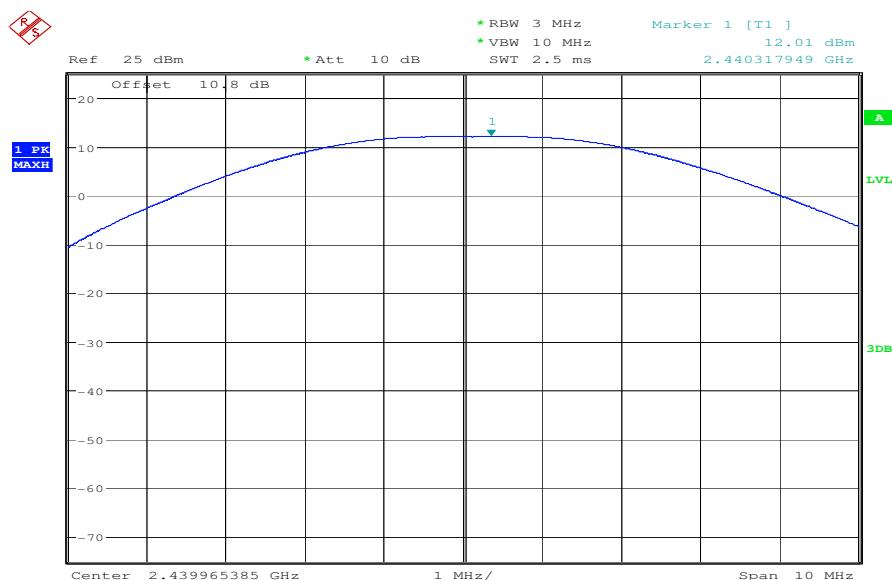
## 5.10 Maximum output power (conducted) § 15.247 (b)(1)

Plot 1 of 3



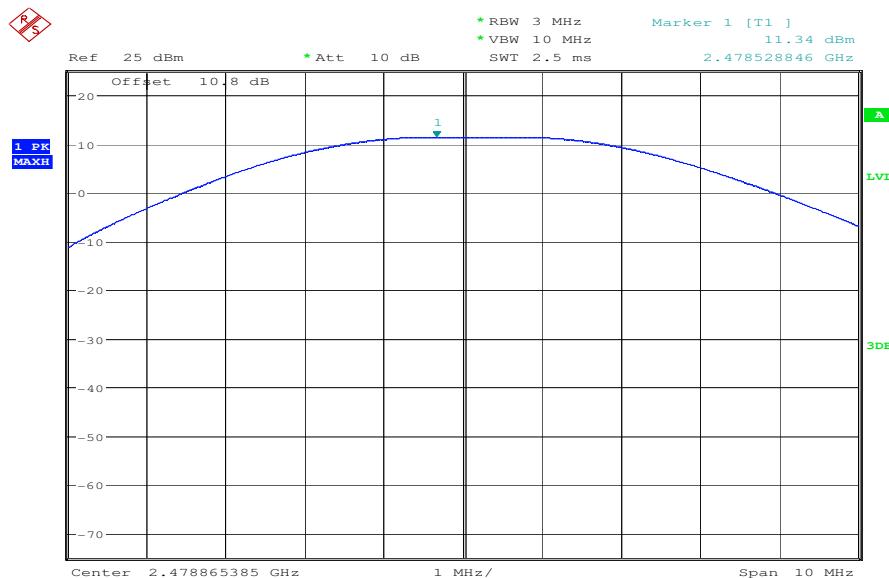
Date: 25.AUG.2009 06:30:25

Plot 2 of 3



Date: 25.AUG.2009 06:32:22

Plot 3 of 3



Date: 25.AUG.2009 06:33:23

Results:

Test conditions		Max. peak output power [dBm]				
Frequency [MHz]		lowest frequency		middle frequency		highest frequency
T <sub>nom</sub>	V <sub>nom</sub>	PK	11.36	PK	<b>12.01</b>	PK
Measurement uncertainty		±3dB				

Measurement settings:

RBW	3 MHz
VBW	10 MHz
Detector	Positive Peak
Sweep time	Auto
Span	10 MHz

Limits:

Under normal test conditions only, for frequency range 2400-2483.5 MHz	Max. 1.0 Watt
--	---------------

## 5.11 Max. peak output power (radiated) § 15.247 (b)(1)

Results: Antenna 1

Test conditions		Max. peak output power EIRP [dBm]		
Frequency [MHz]		lowest frequency	middle frequency	highest frequency
T <sub>nom</sub>	V <sub>nom</sub>	17.41	17.78	<b>17.86</b>
Measurement uncertainty		±3dB		

Measurement settings:

RBW	3 MHz
VBW	10 MHz
Detector	Positive Peak
Sweep time	Auto
Span	10 MHz

Results: Antenna 2

Test conditions		Max. peak output power EIRP [dBm]		
Frequency [MHz]		lowest frequency	middle frequency	highest frequency
T <sub>nom</sub>	V <sub>nom</sub>	17.65	<b>17.98</b>	17.71
Measurement uncertainty		±3dB		

Measurement settings:

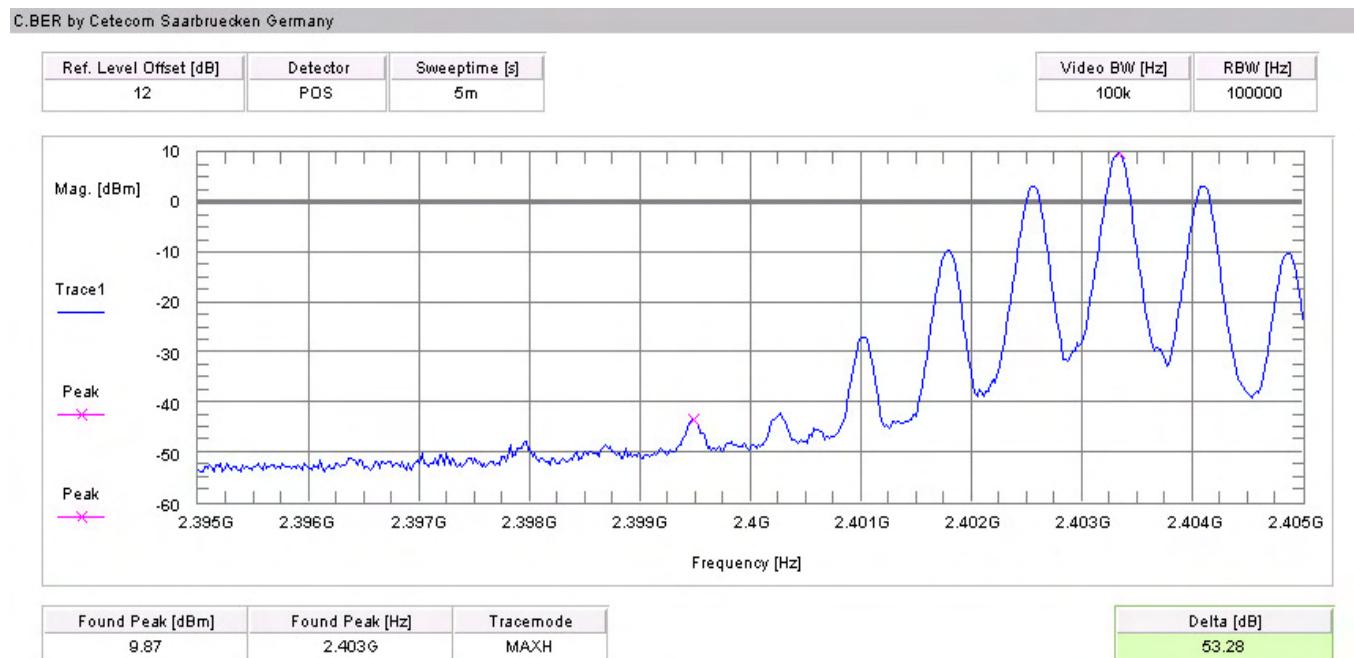
RBW	3 MHz
VBW	10 MHz
Detector	Positive Peak
Sweep time	Auto
Span	10 MHz

Limits:

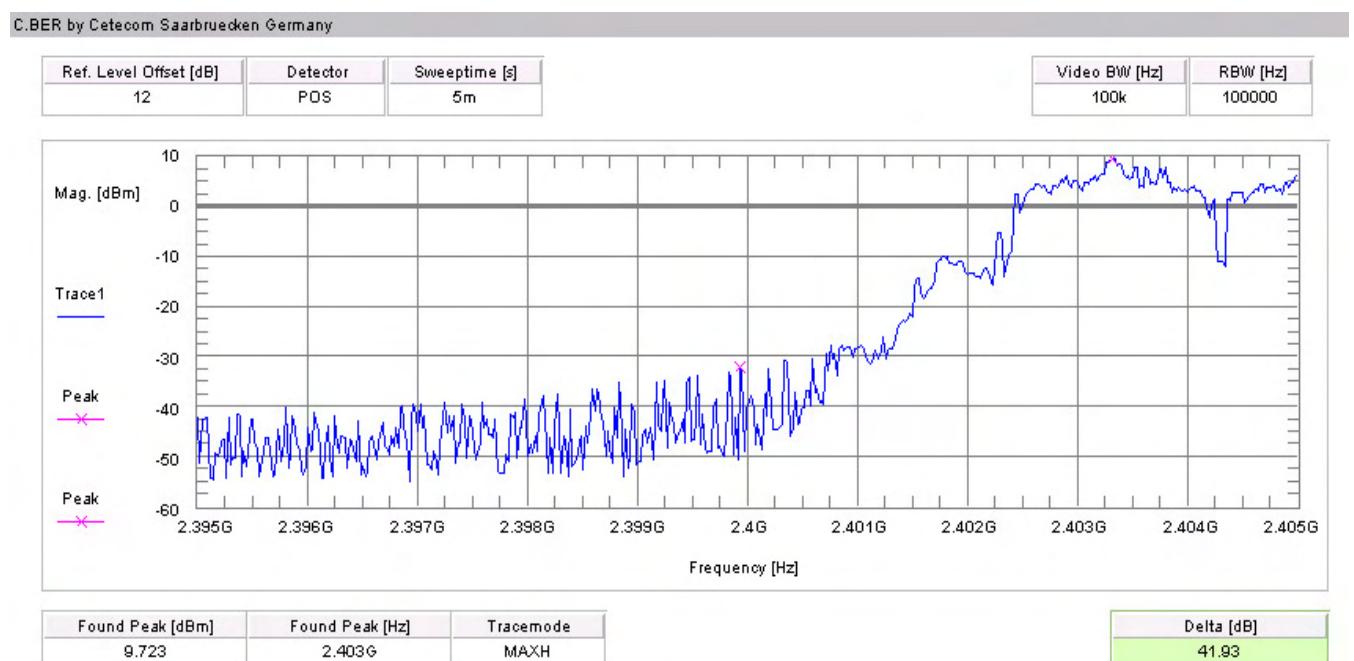
Under normal test conditions only, for frequency range 2400-2483.5 MHz	Max. 1.0 Watt
--	---------------

## 5.12 Band-edge compliance of conducted emissions §15.247 (d)

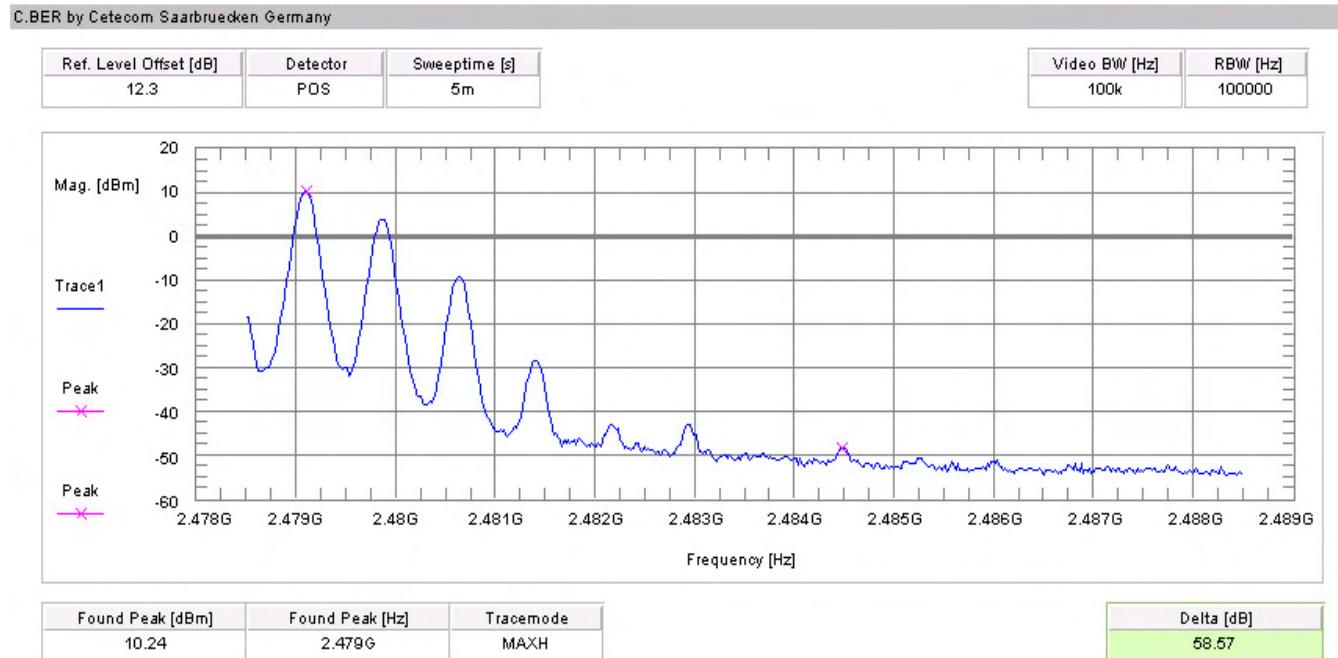
Plot 1 of 4 (hopping off, lowest frequency):



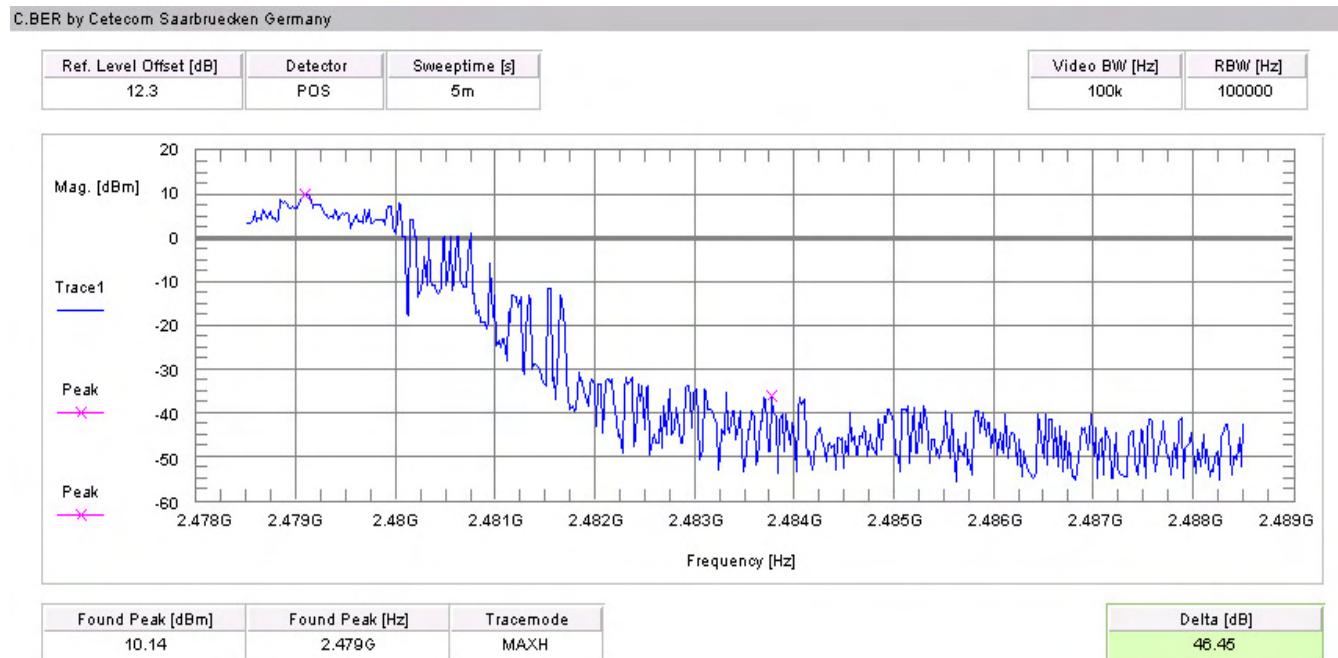
Plot 2 of 4 (hopping on, lowest frequency):



Plot 3 of 4 (hopping off, highest frequency):



Plot 4 of 4 (hopping on, highest frequency):



Results:

SZENARIO	DELTA VALUE [DB]
hopping off, lowest frequency	> 20 dB
hopping on, lowest frequency	> 20 dB
hopping off, highest frequency	> 20 dB
hopping on, highest frequency	> 20 dB
Measurement uncertainty	±1,5dB

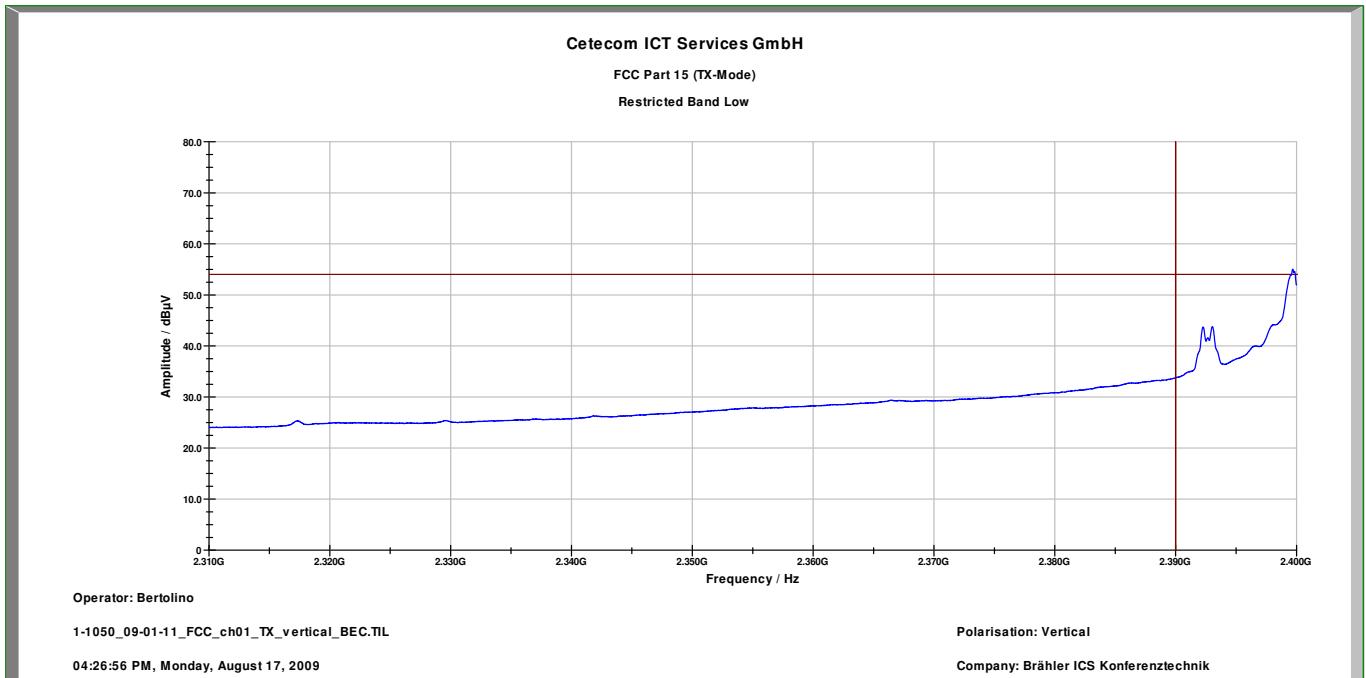
Limits:

Under normal test conditions only	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 5.205(c)).
-----------------------------------	--

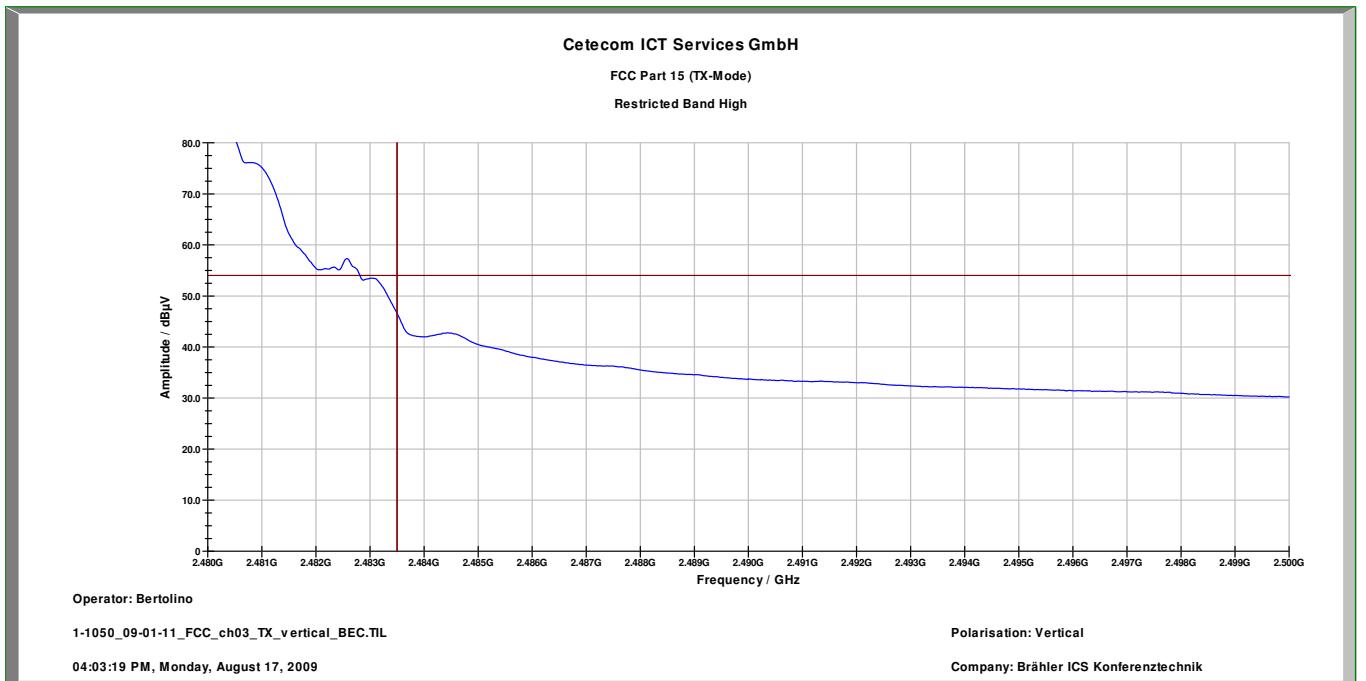
## 5.13 Band-edge compliance of radiated emissions §15.205

### Antenna 1: TX antenna 1

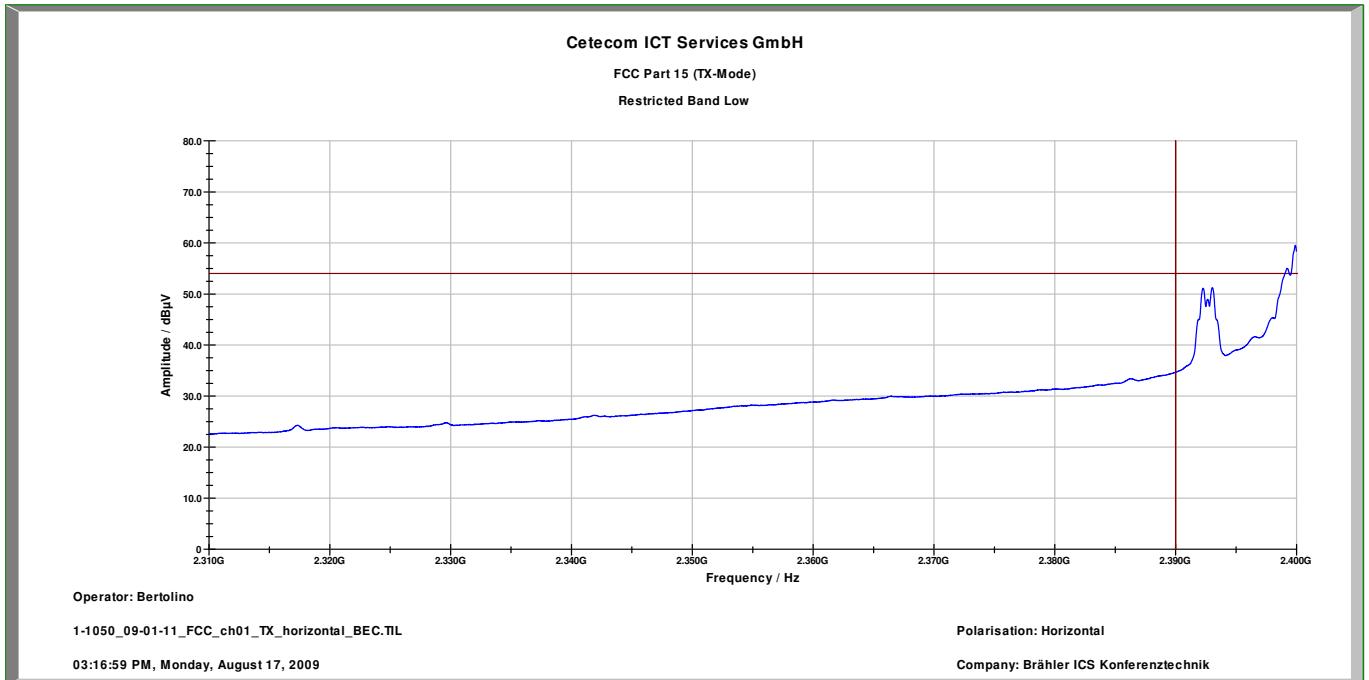
Plot 1: Restricted Bands low, vertical polarisation



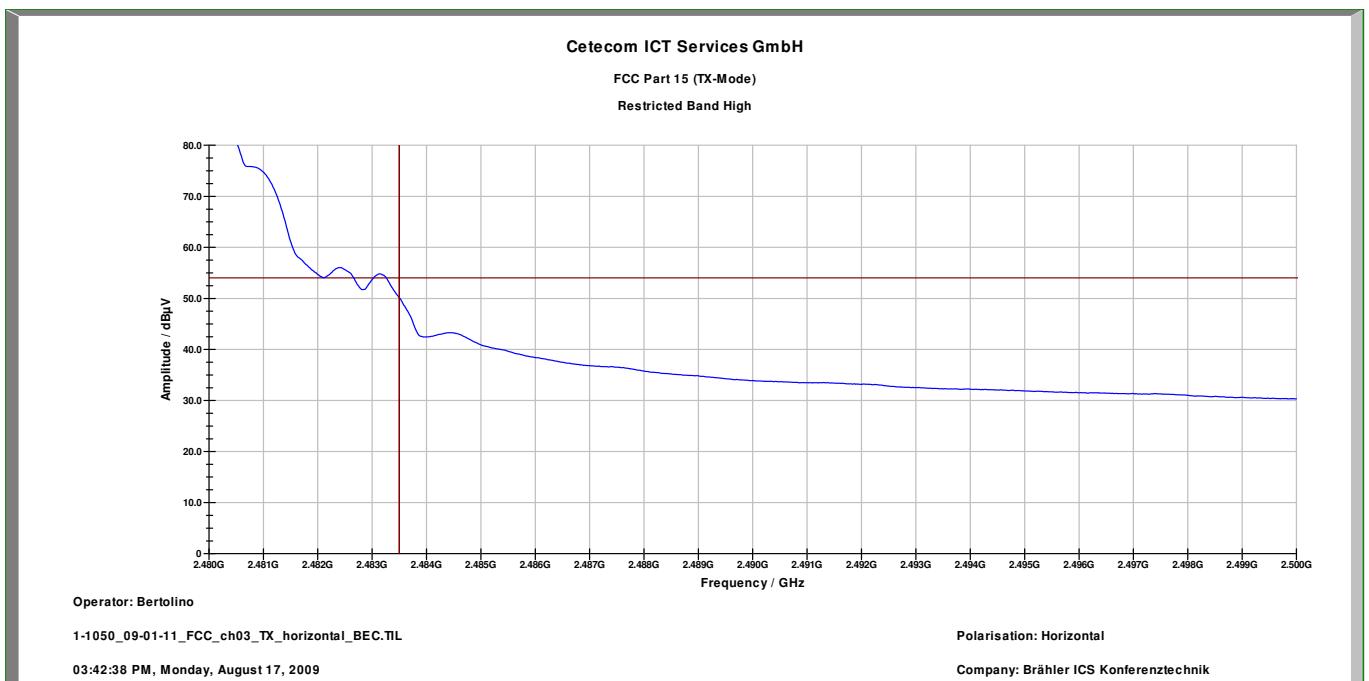
Plot 2: Restricted Bands high, vertical polarisation



Plot 3: Restricted Bands low, horizontal polarisation

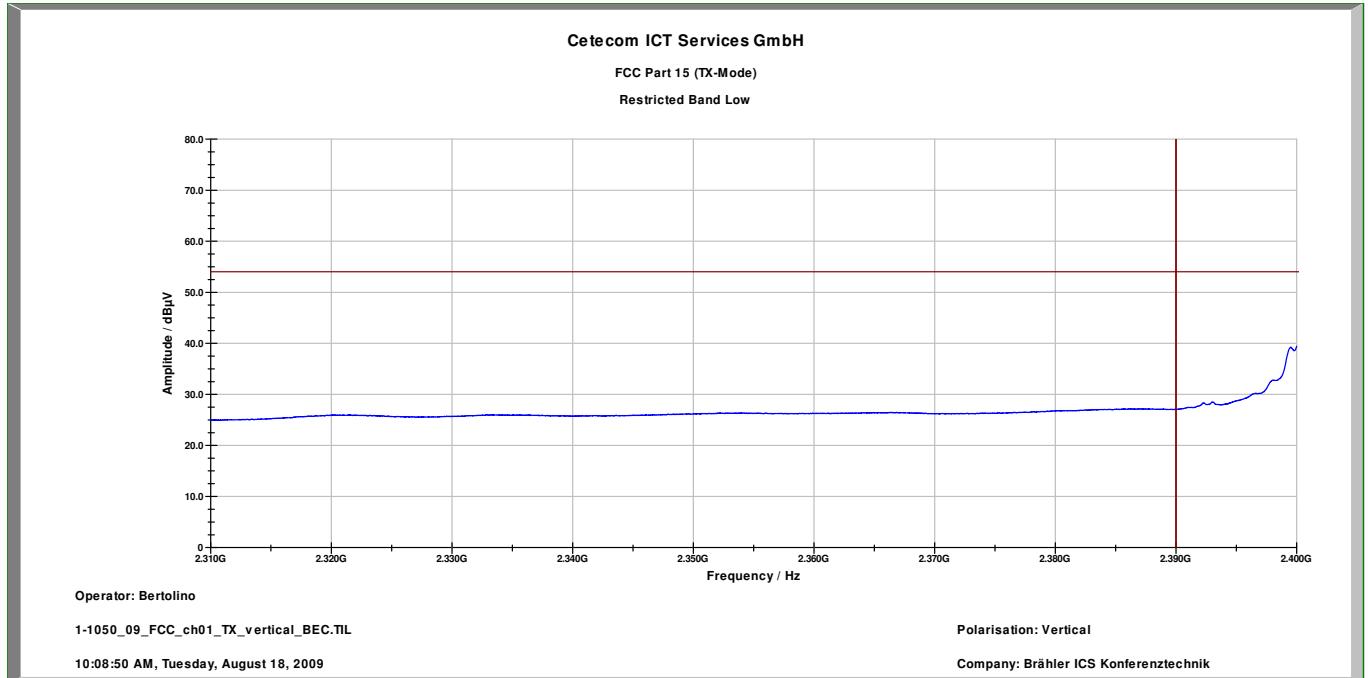


Plot 4: Restricted Bands high, horizontal polarisation

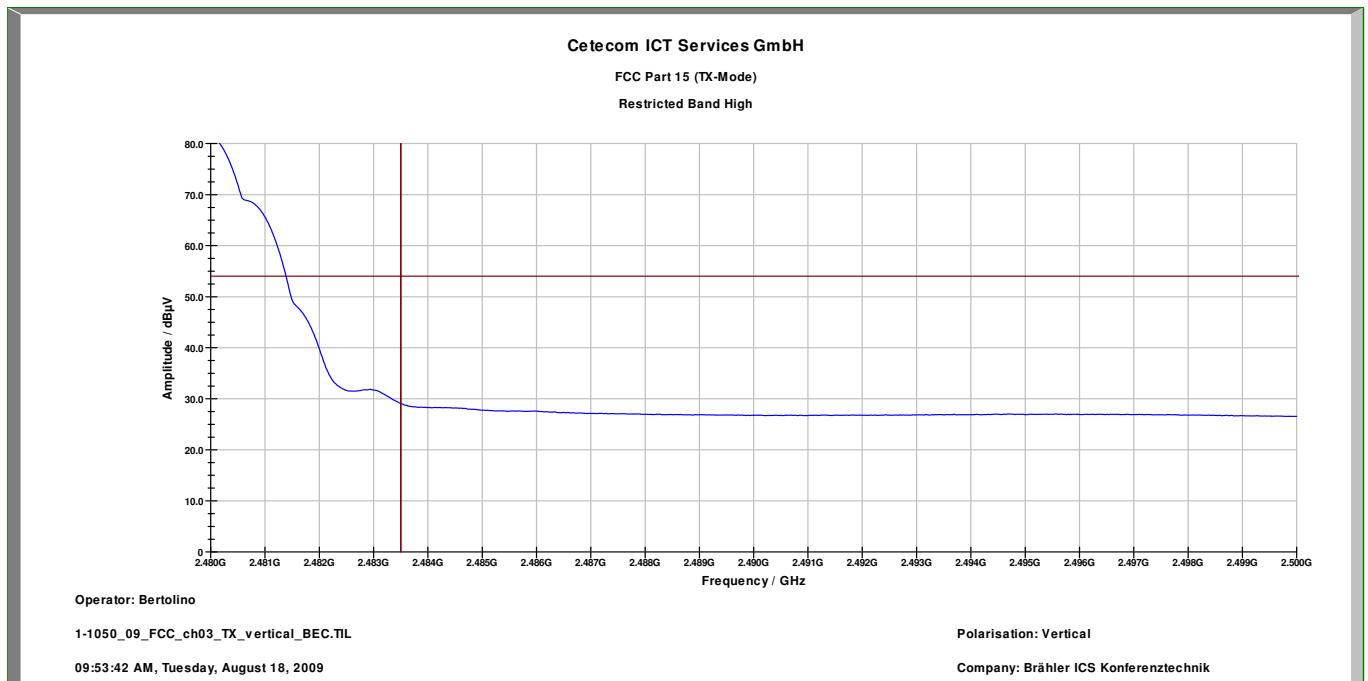


**Antenna 2: TX antenna 2**

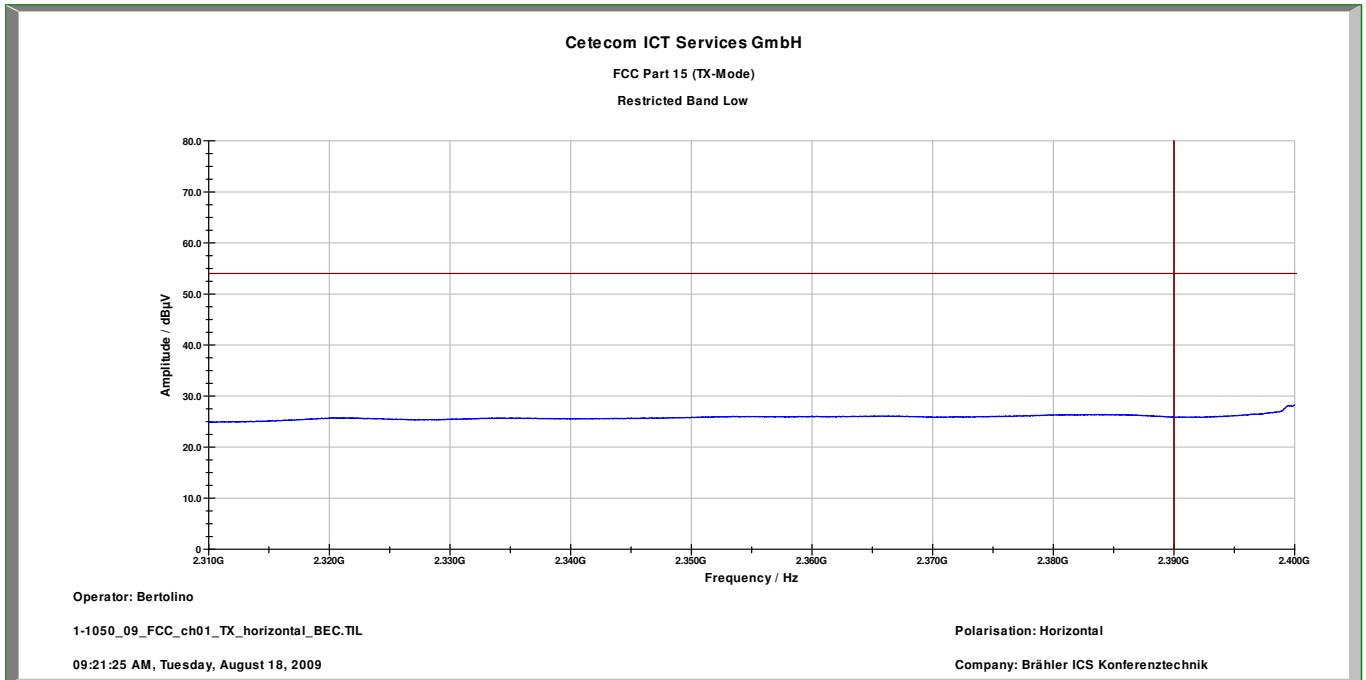
Plot 1: Restricted Bands low, vertical polarisation



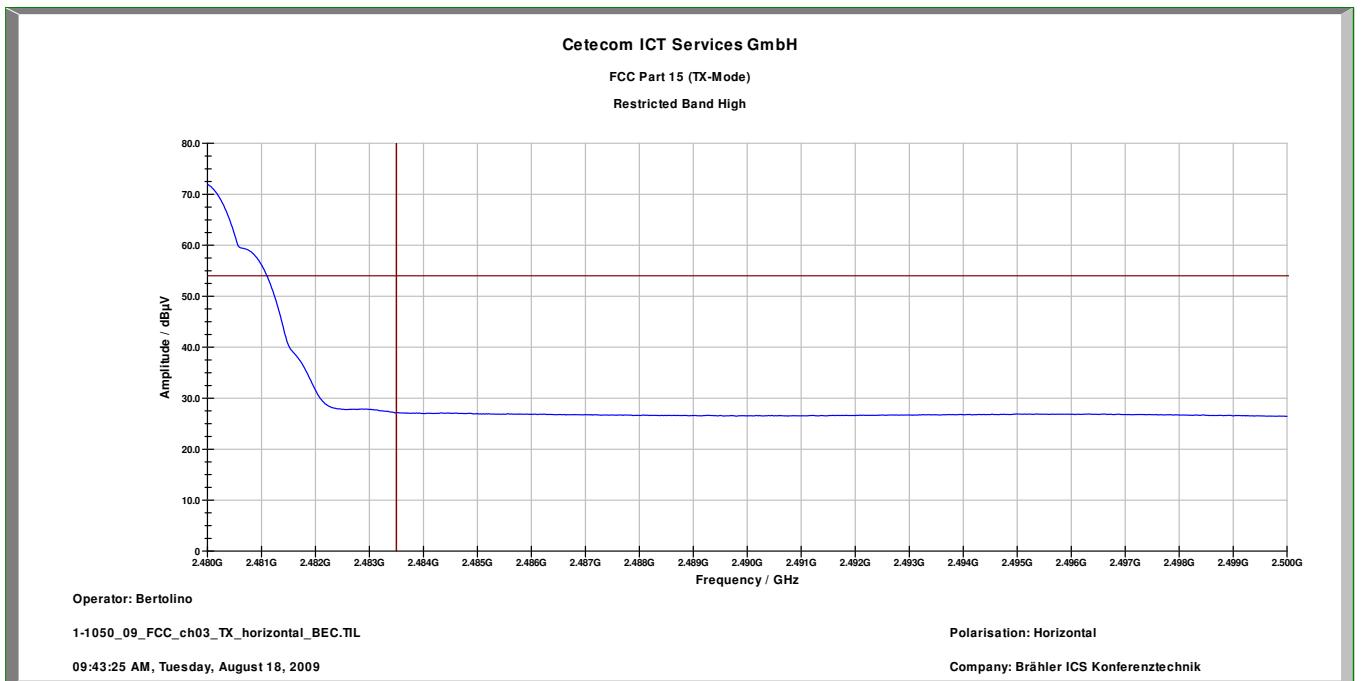
Plot 2: Restricted Bands high, vertical polarisation



Plot 3: Restricted Bands low, horizontal polarisation

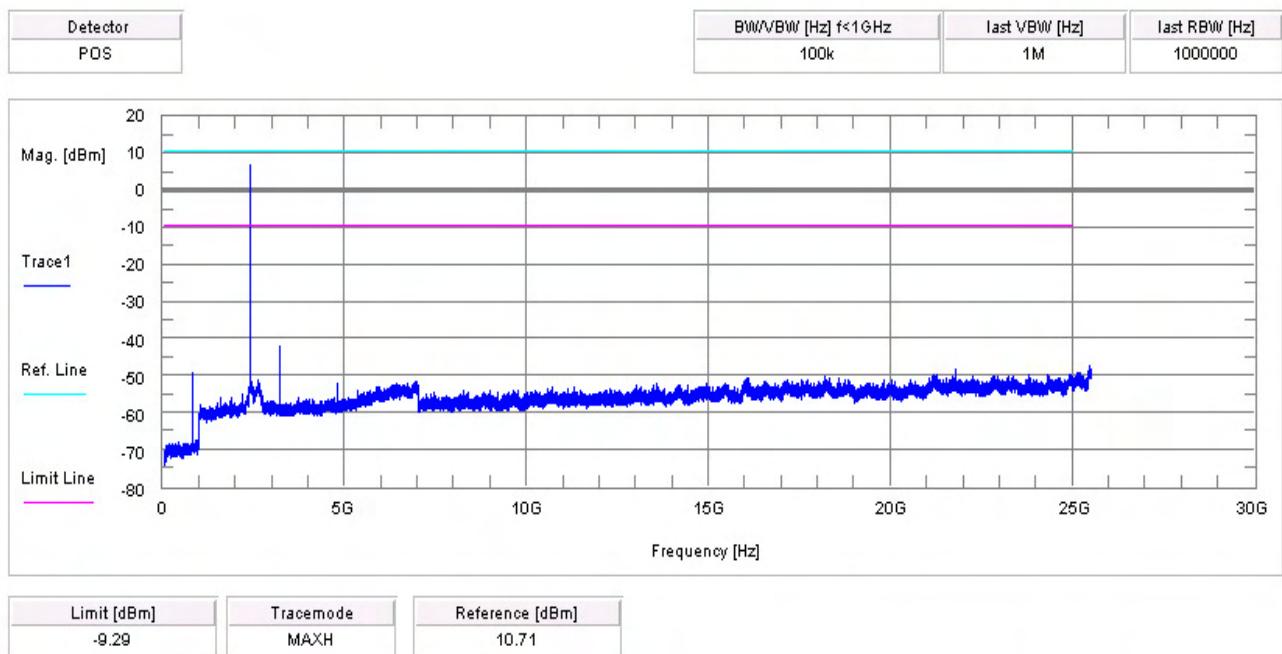


Plot 4: Restricted Bands high, horizontal polarisation

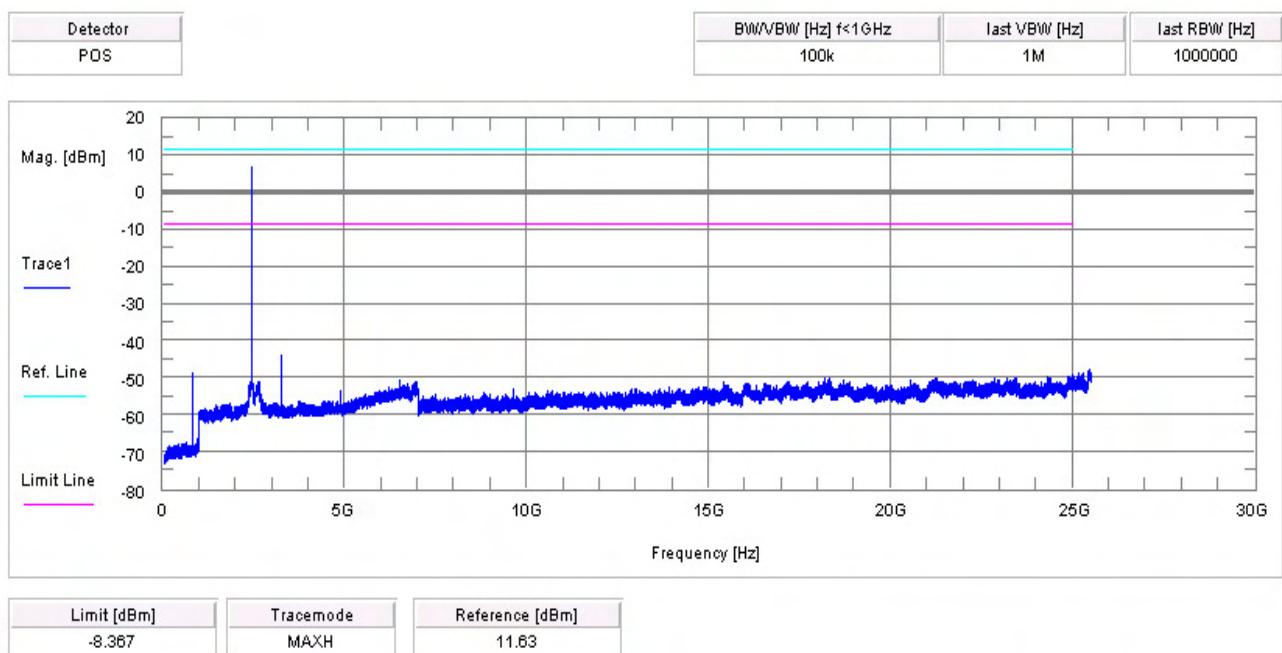


## 5.14 Spurious Emissions - conducted (Transmitter) § 15.247 (c)(1)

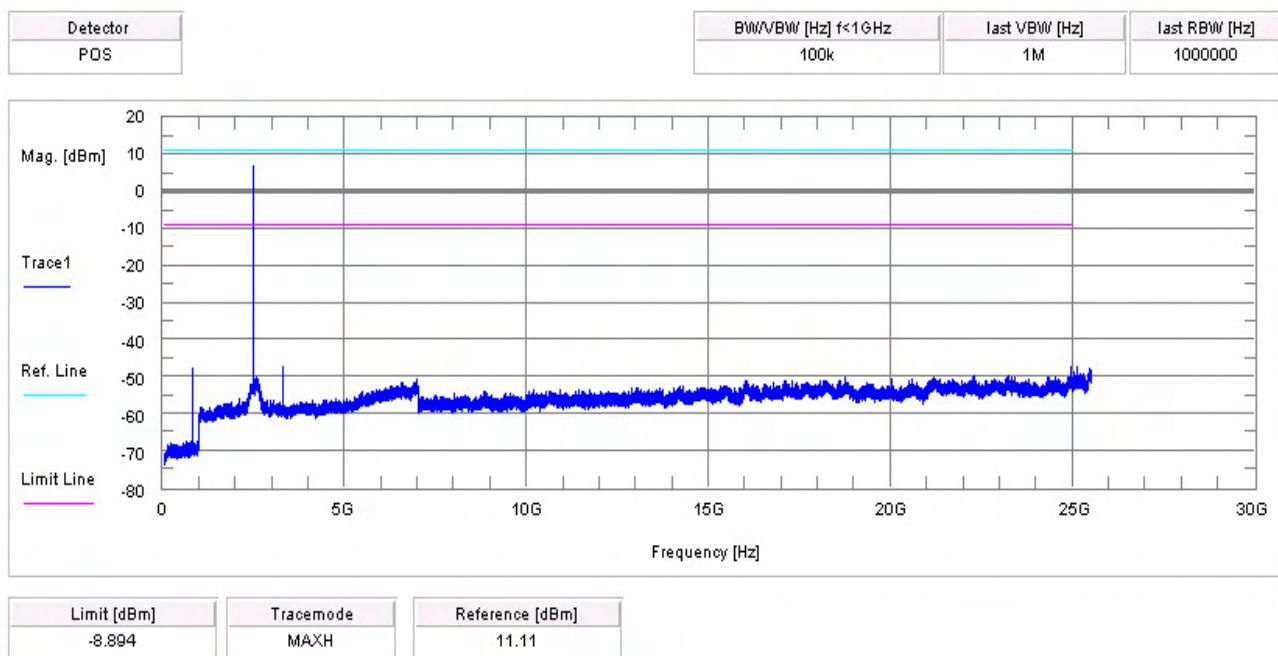
Plot 1 of 3: lowest channel



Plot 2 of 3: middle channel



Plot 3 of 3: highest channel



#### Result & Limits:

Emission Limitation						
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results	
lowest channel			30 dBm		Operating frequency	
No critical peaks detected.			-20 dBc		Complies	
middle channel			30 dBm		Operating frequency	
No critical peaks detected.			-20 dBc		Complies	
highest channel			30 dBm		Operating frequency	
No critical peaks detected.			-20 dBc		Complies	
Measurement uncertainty			$\pm 3\text{dB}$			

F < 1 GHz: RBW: 100 kHz VBW: 100 kHz  
 F > 1 GHz: RBW: 1 MHz VBW: 1 MHz

Under normal test conditions only	In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
-----------------------------------	--

Note: For emissions that fall into restricted bands you find the radiated emissions later in the report.

**5.15 Spurious Emissions > 30 MHz- radiated (Transmitter) § 15.247 (c)(1)**

**Antenna 1: TX antenna 1**

**Photo antenna 1:**



**Antenna 1-1 / EUT 1:**

P/N: SAA05-050690  
S/N: 8H100051

**Antenna 1-2 / EUT 2:**

P/N: SAA05-050690  
S/N: 8H100022

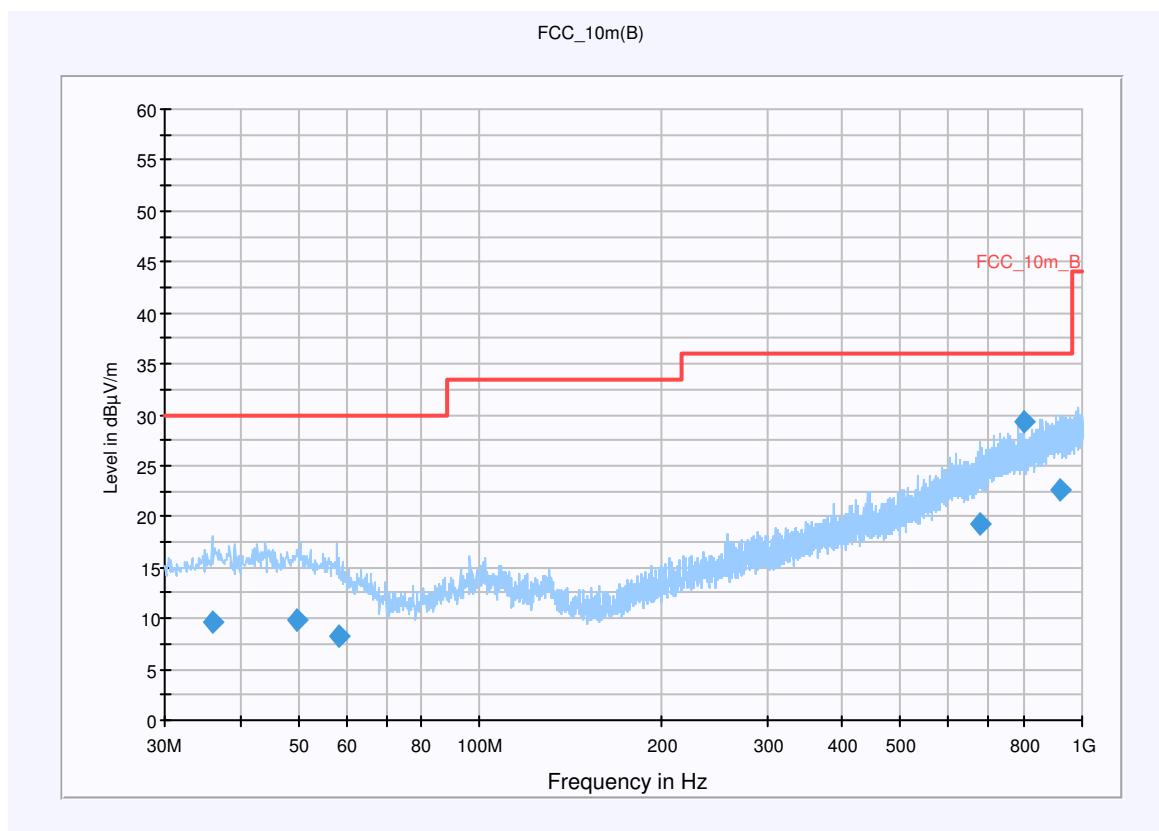
Plot 1: 0.03 - 1 GHz vertical & horizontal (lowest channel)

### Common Information

EUT: DIGIMIC  
 Serial Number: 00 10 00 00  
 Test Description: FCC class B @ 10 m  
 Operating Conditions: TX lowest channel  
 Operator Name: Hennemann  
 Comment: AC: 115 V / 60 Hz; Ant: SAA05-050690

### Scan Setup: STAN\_Fin [EMI radiated]

Hardware Setup:	Electric Field (NOS)		
Level Unit:	dB $\mu$ V/m		
<b>Subrange</b>	<b>Detectors</b>	<b>IF Bandwidth</b>	<b>Meas. Time</b>
30 MHz - 1 GHz	QuasiPeak	120 kHz	15 s
			<b>Receiver</b>



### Final Result 1

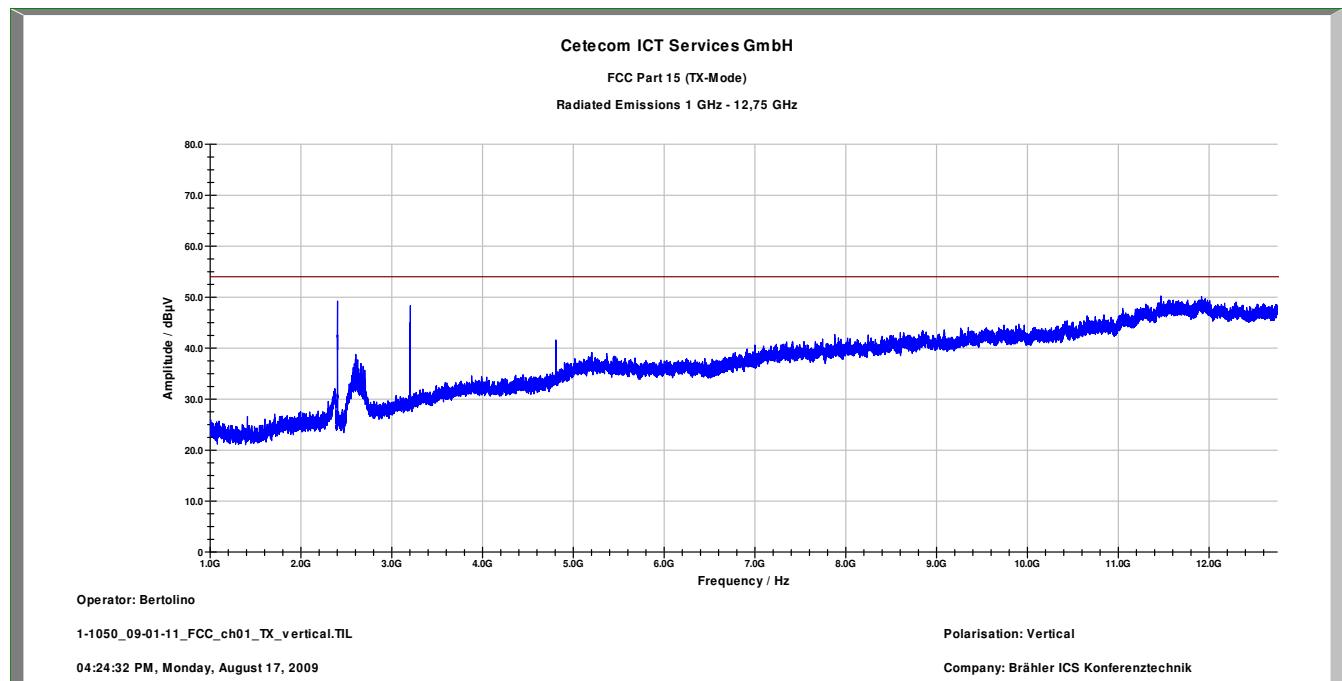
Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V/m)	Comment
35.959250	9.6	15000.000	120.000	400.0	H	173.0	13.2	20.4	30.0	
49.822200	9.8	15000.000	120.000	105.0	V	215.0	13.5	20.2	30.0	
58.224250	8.3	15000.000	120.000	200.0	H	277.0	12.3	21.7	30.0	
677.445500	19.3	15000.000	120.000	198.0	H	124.0	22.4	16.7	36.0	
801.118500	29.2	15000.000	120.000	98.0	H	318.0	24.3	6.8	36.0	
919.626500	22.7	15000.000	120.000	198.0	V	196.0	25.8	13.3	36.0	

**Hardware Setup: EMI radiated\Electric Field (NOS) - [EMI radiated]**

	Subrange 1
Frequency Range:	30 MHz - 2 GHz
Receiver:	Receiver [ESCI 3]
Signal Path:	@ GPIB0 (ADR 20), SN 100083/0033, FW 4.32 without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW --- Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table: Cable_EN_1GHz (0109)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

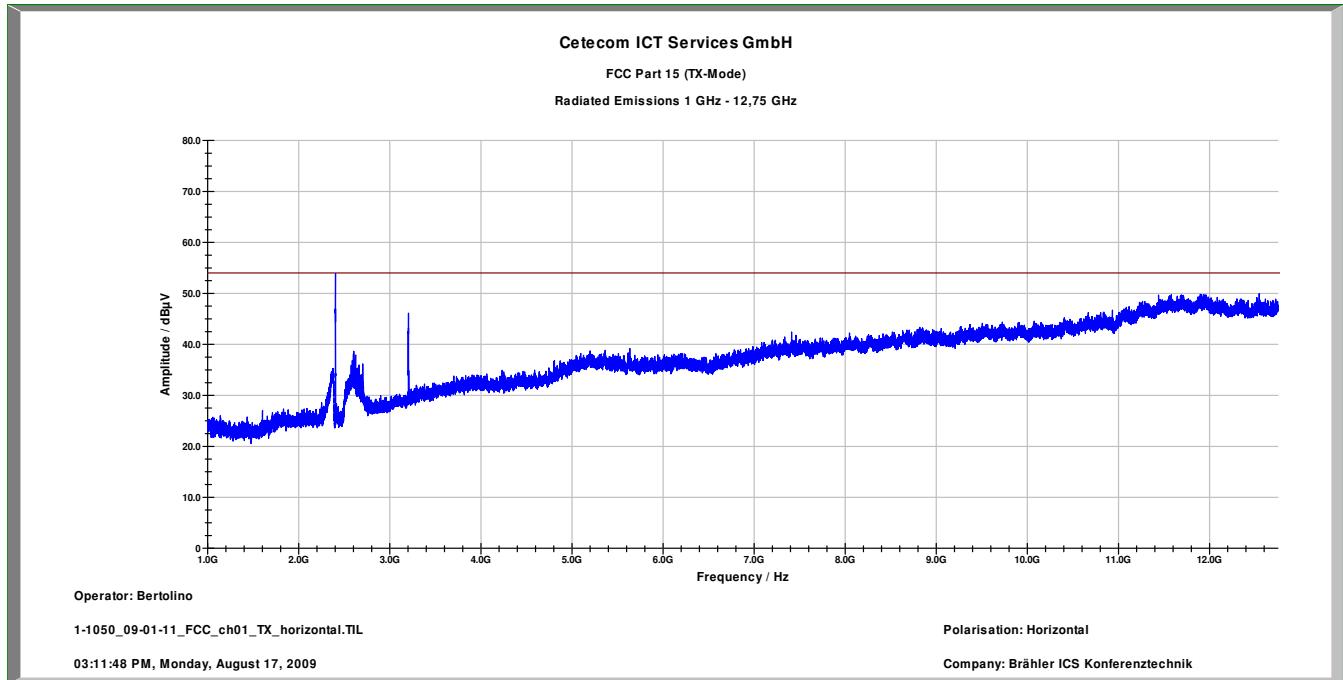
EMC 32 Version 8.10.00

Plot 2: 1 – 12.75 GHz vertical (lowest channel)



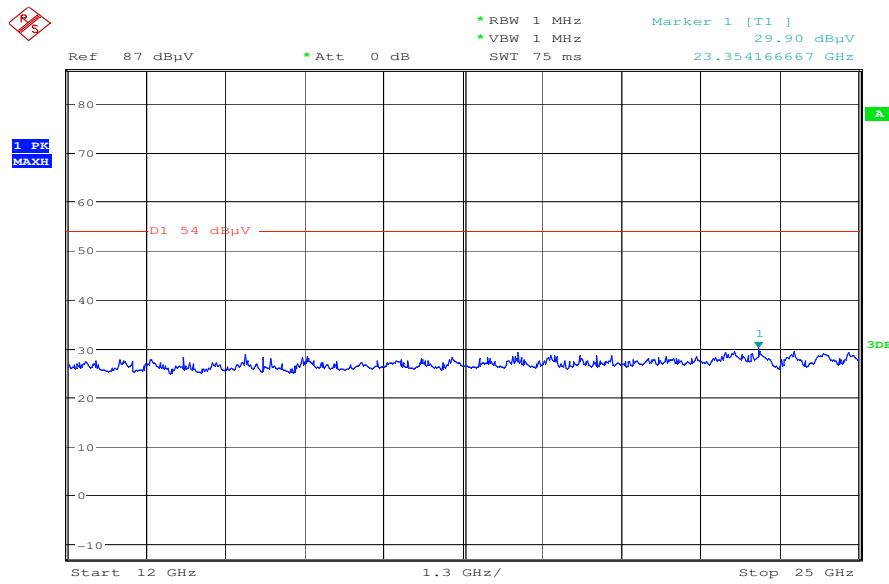
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 3: 1 – 12.75 GHz horizontal (lowest channel)



The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 4: 12 - 25 GHz vertical & horizontal (valid for all channels)



Date: 26.AUG.2009 15:07:57

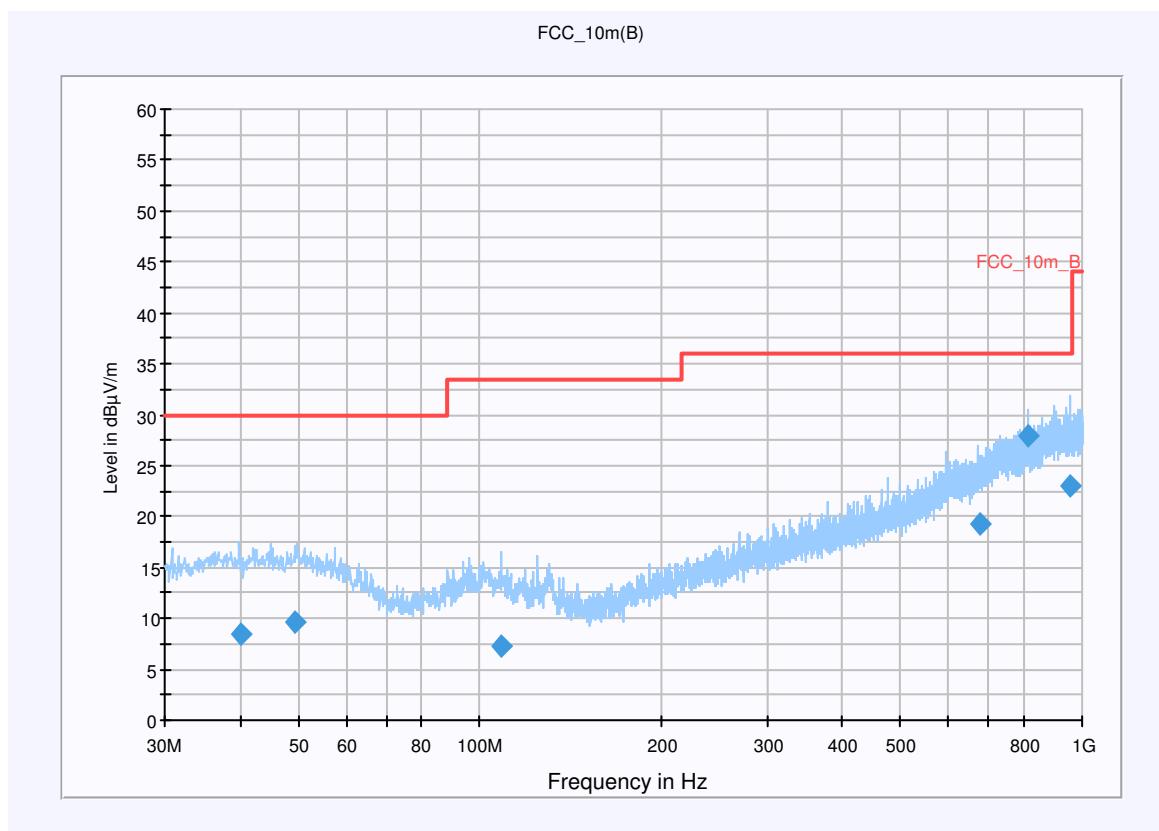
Plot 5: 0.03 - 1 GHz vertical & horizontal (middle channel)

### Common Information

EUT: DIGIMIC  
 Serial Number: 00 10 00 00  
 Test Description: FCC class B @ 10 m  
 Operating Conditions: TX mid channel  
 Operator Name: Hennemann  
 Comment: AC: 115 V / 60 Hz; Ant: SAA05-050690

### Scan Setup: STAN\_Fin [EMI radiated]

Hardware Setup:	Electric Field (NOS)		
Level Unit:	dB $\mu$ V/m		
<b>Subrange</b>	<b>Detectors</b>	<b>IF Bandwidth</b>	<b>Meas. Time</b>
30 MHz - 1 GHz	QuasiPeak	120 kHz	15 s
			<b>Receiver</b>



### Final Result 1

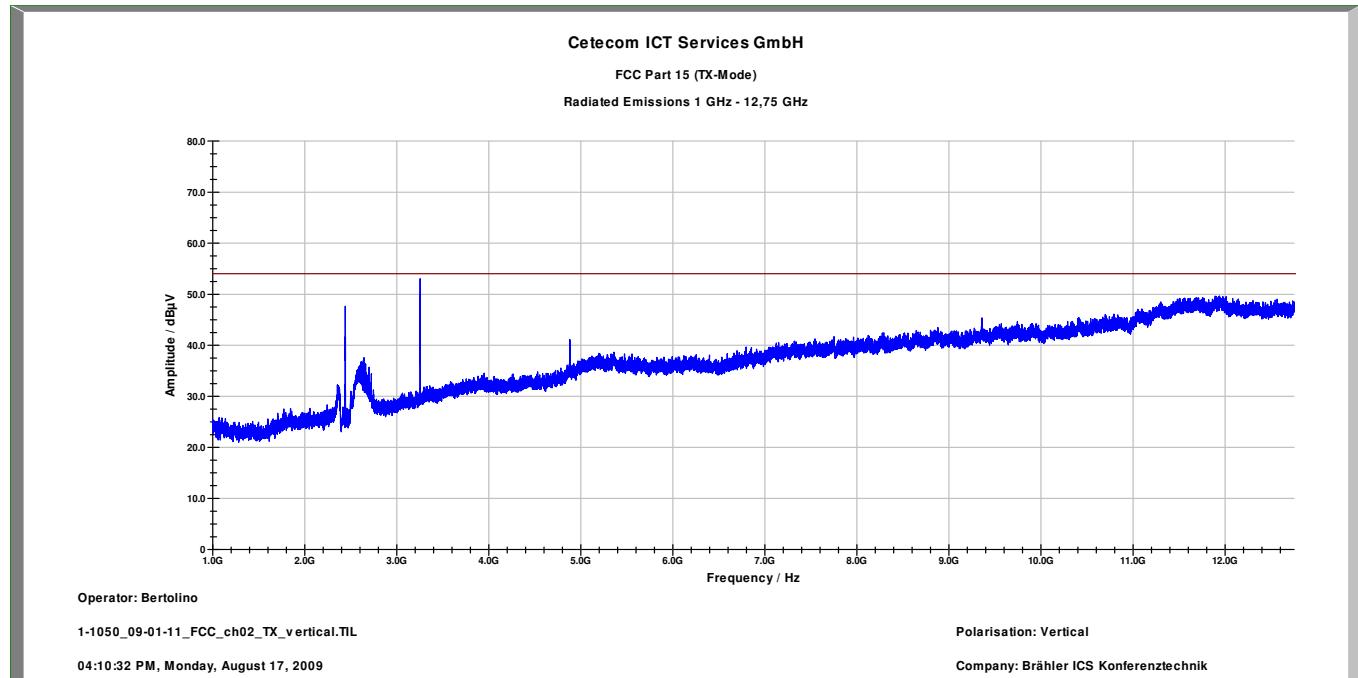
Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V/m)	Comment
40.027800	8.5	15000.000	120.000	400.0	V	79.0	13.6	21.5	30.0	
49.366400	9.7	15000.000	120.000	100.0	H	236.0	13.5	20.3	30.0	
108.811000	7.3	15000.000	120.000	142.0	H	236.0	11.5	26.2	33.5	
674.331800	19.2	15000.000	120.000	121.0	H	146.0	22.3	16.8	36.0	
813.370450	27.9	15000.000	120.000	252.0	H	299.0	24.5	8.1	36.0	
952.517450	23.1	15000.000	120.000	219.0	H	227.0	25.9	12.9	36.0	

**Hardware Setup: EMI radiated\Electric Field (NOS) - [EMI radiated]**

	Subrange 1 30 MHz - 2 GHz
Frequency Range:	
Receiver:	Receiver [ESCI 3] @ GPIB0 (ADR 20), SN 100083/0033, FW 4.32
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW --- Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table: Cable_EN_1GHz (0109)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

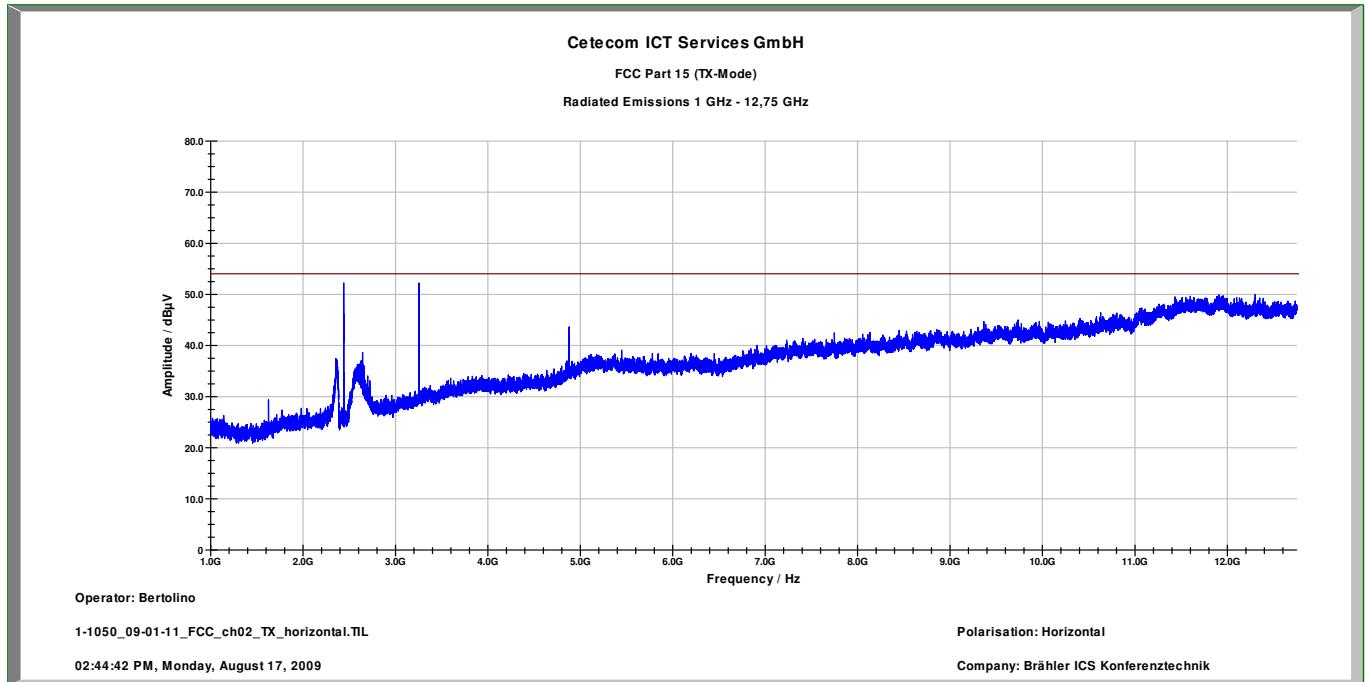
EMC 32 Version 8.10.00

Plot 6: 1 – 12.75 GHz vertical (middle channel)



The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 7: 1 – 12.75 GHz horizontal (middle channel)



The carrier signal is notched with a 2.4 GHz band rejection filter.

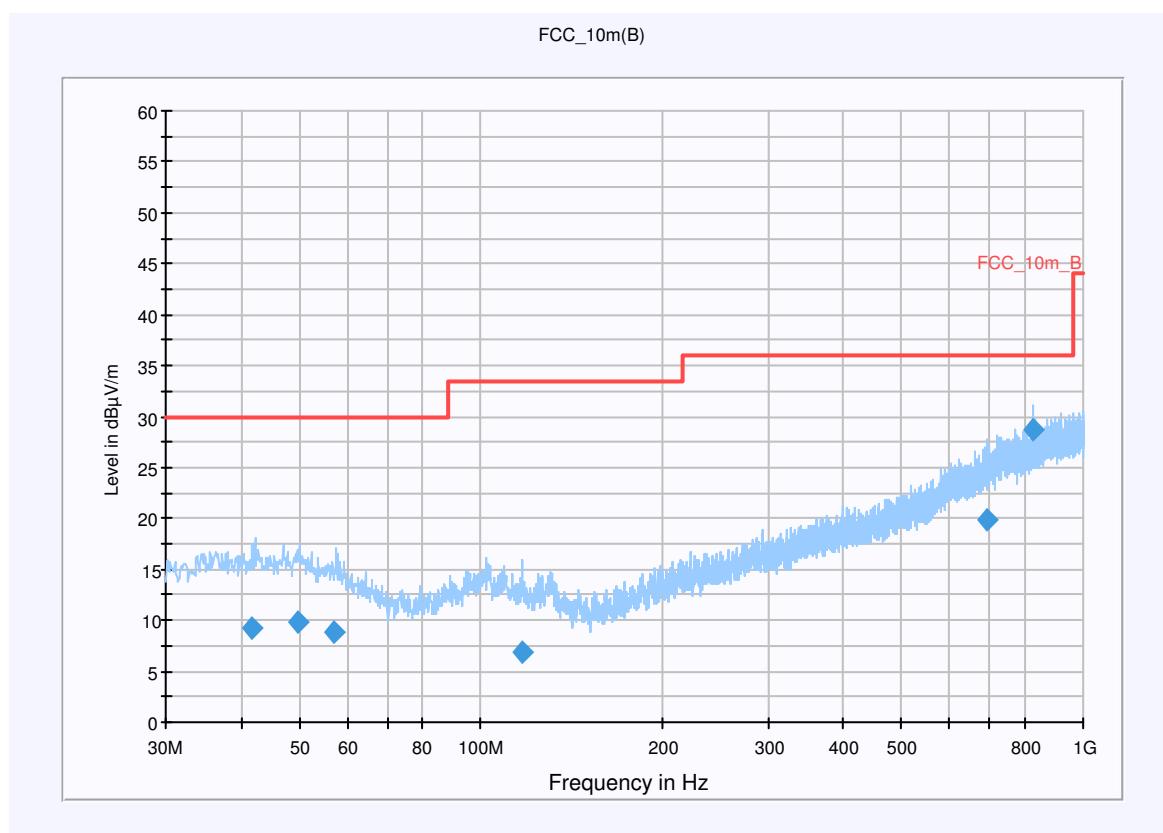
Plot 8: 0.03 - 1 GHz vertical & horizontal (highest channel)

### Common Information

EUT: DIGIMIC  
 Serial Number: 00 10 00 00  
 Test Description: FCC class B @ 10 m  
 Operating Conditions: TX highest channel  
 Operator Name: Hennemann  
 Comment: AC: 115 V / 60 Hz; Ant: SAA05-050690

### Scan Setup: STAN\_Fin [EMI radiated]

Hardware Setup:	Electric Field (NOS)		
Level Unit:	dB $\mu$ V/m		
Subrange	Detectors	IF Bandwidth	Meas. Time
30 MHz - 1 GHz	QuasiPeak	120 kHz	15 s
			Receiver



### Final Result 1

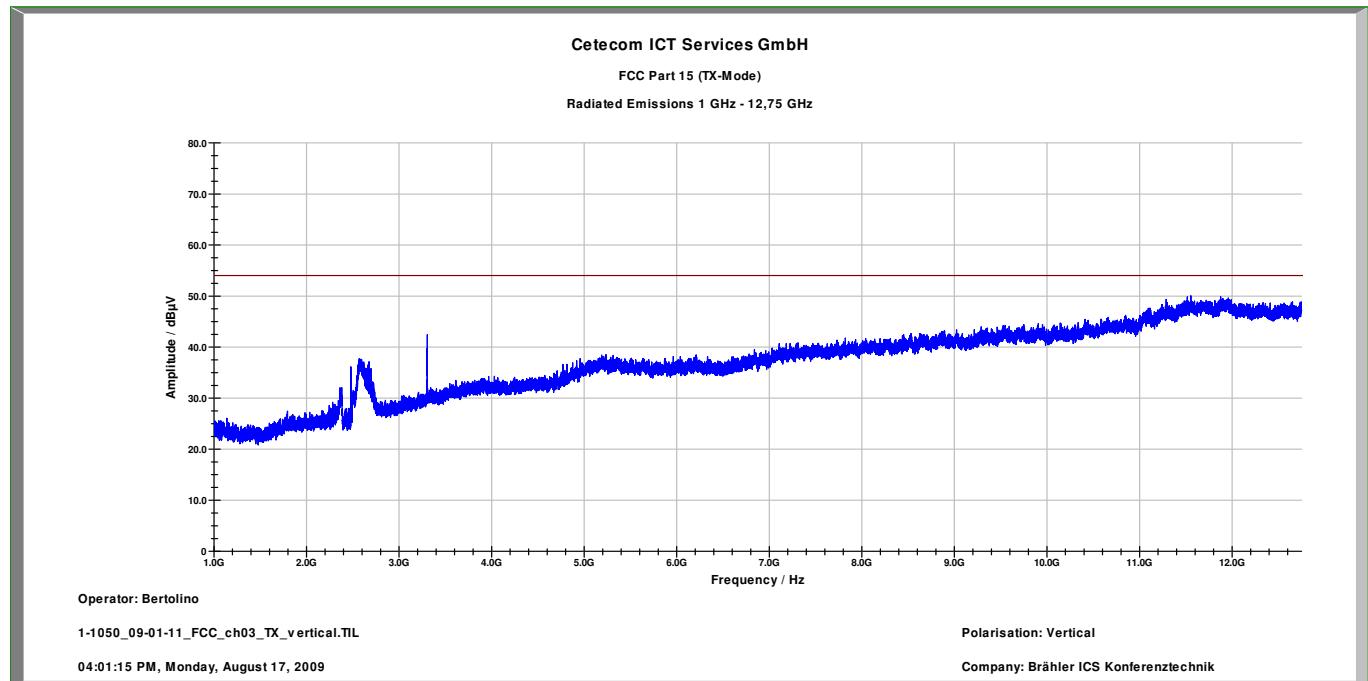
Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V/m)	Comment
41.746300	9.3	15000.000	120.000	100.0	V	56.0	13.5	20.7	30.0	
49.572750	9.7	15000.000	120.000	200.0	V	277.0	13.5	20.3	30.0	
57.142950	8.8	15000.000	120.000	200.0	H	145.0	12.5	21.2	30.0	
117.526850	6.8	15000.000	120.000	316.0	H	53.0	10.7	26.7	33.5	
694.499200	19.9	15000.000	120.000	186.0	V	199.0	22.9	16.1	36.0	
826.339100	28.7	15000.000	120.000	302.0	H	30.0	24.7	7.3	36.0	

**Hardware Setup: EMI radiated\Electric Field (NOS) - [EMI radiated]**

	Subrange 1 30 MHz - 2 GHz
Frequency Range:	
Receiver:	Receiver [ESCI 3] @ GPIB0 (ADR 20), SN 100083/0033, FW 4.32
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW --- Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table: Cable_EN_1GHz (0109)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

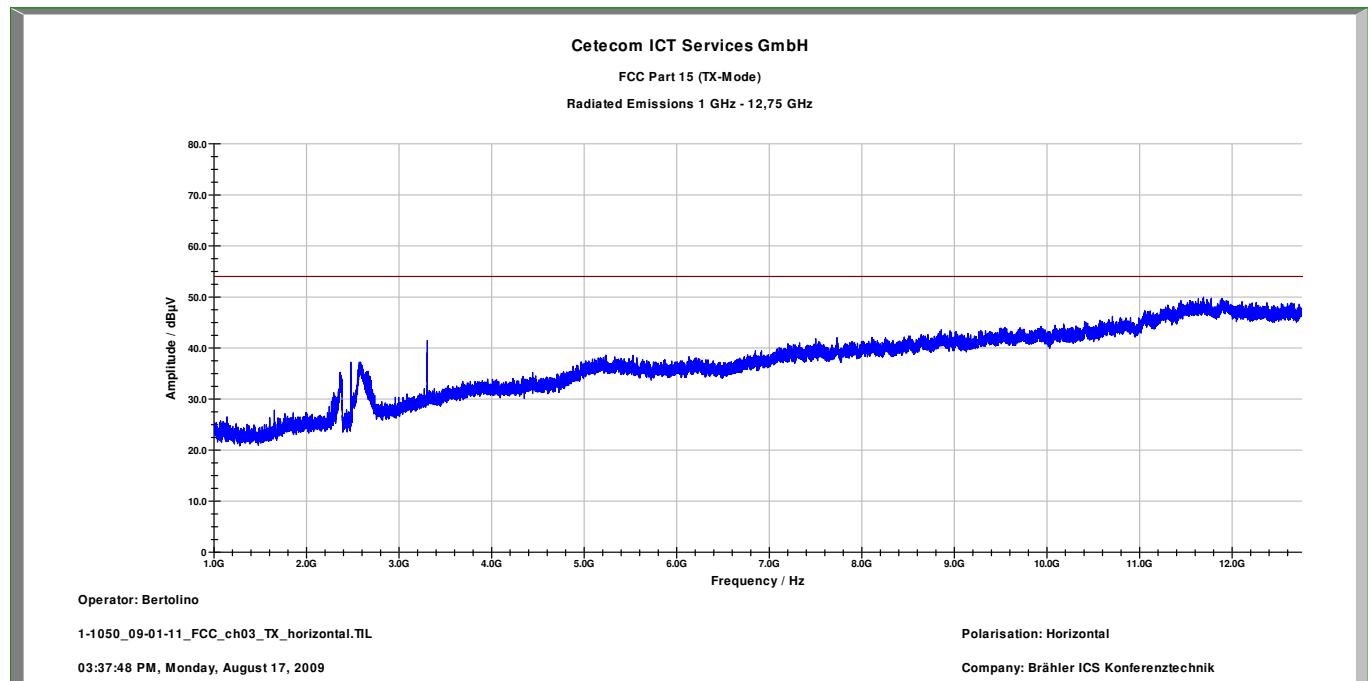
EMC 32 Version 8.10.00

Plot 9: 1 – 12.75 GHz vertical (highest channel)



The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 10: 1 – 12.75 GHz horizontal (highest channel)



The carrier signal is notched with a 2.4 GHz band rejection filter.

**Results:**

SPURIOUS EMISSIONS LEVEL (dBµV/m)								
Lowest frequency			Middle frequency			Highest frequency		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
No critical peaks detected.*			No critical peaks detected.*			No critical peaks detected.*		
Measurement uncertainty		±3 dB						

f &lt; 1 GHz : RBW/VBW: 100 kHz

f ≥ 1GHz : RBW/VBW: 1 MHz

**\*Note:**

- The detected spurious emissions / harmonics do not fall into the restricted bands listed in Section 15.205.  
Section 15.205 Restricted bands of operation.

(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
1.495 - 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	(*)
13.36 - 13.41			

## Measurement of Digital Transmission Systems Operating under Section 15.247

March 23, 2005

### Section 15.247(c) – Spurious emissions.

The following tests are required:

1. **RF antenna conducted test:** Set RBW = 100 kHz, Video bandwidth (VBW) > RBW, scan up through 10th harmonic. All harmonics/spurs must be at least 20 dB down from the highest emission level within the authorized band *as measured with a 100 kHz RBW*.  
*Note: If the device complies with the use of power option 2 the attenuation under this paragraph shall be 30 dB instead of 20 dB.*
2. **Radiated emission test:** Applies to harmonics/spurs that fall in the restricted bands listed in Section 15.205. The maximum permitted average field strength is listed in Section 15.209. A pre-amp (and possibly a high-pass filter) is necessary for this measurement. For measurements above 1 GHz, set RBW = 1MHz, VBW = 10 Hz, Sweep: Auto. If the emission is pulsed, modify the unit for continuous operation; use the settings shown above, then correct the reading by subtracting the peak-average correction factor, derived from the appropriate duty cycle calculation. See Section 15.35(b) and (c).

#### Limits: § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

#### Limits: § 15.209

Frequency [MHz]	Field strength [ $\mu$ V/m]	Measurement distance (m)
30 - 88	100 (40 dB $\mu$ V/m)	3
88 - 216	150 (43.5 dB $\mu$ V/m)	3
216 - 960	200 (46 dB $\mu$ V/m)	3
above 960	500 (54 dB $\mu$ V/m)	3

**Antenna 2: TX antenna 2**

**Photo antenna 2:**



**Antenna 2 / EUT 1:**

S/N: Not available!

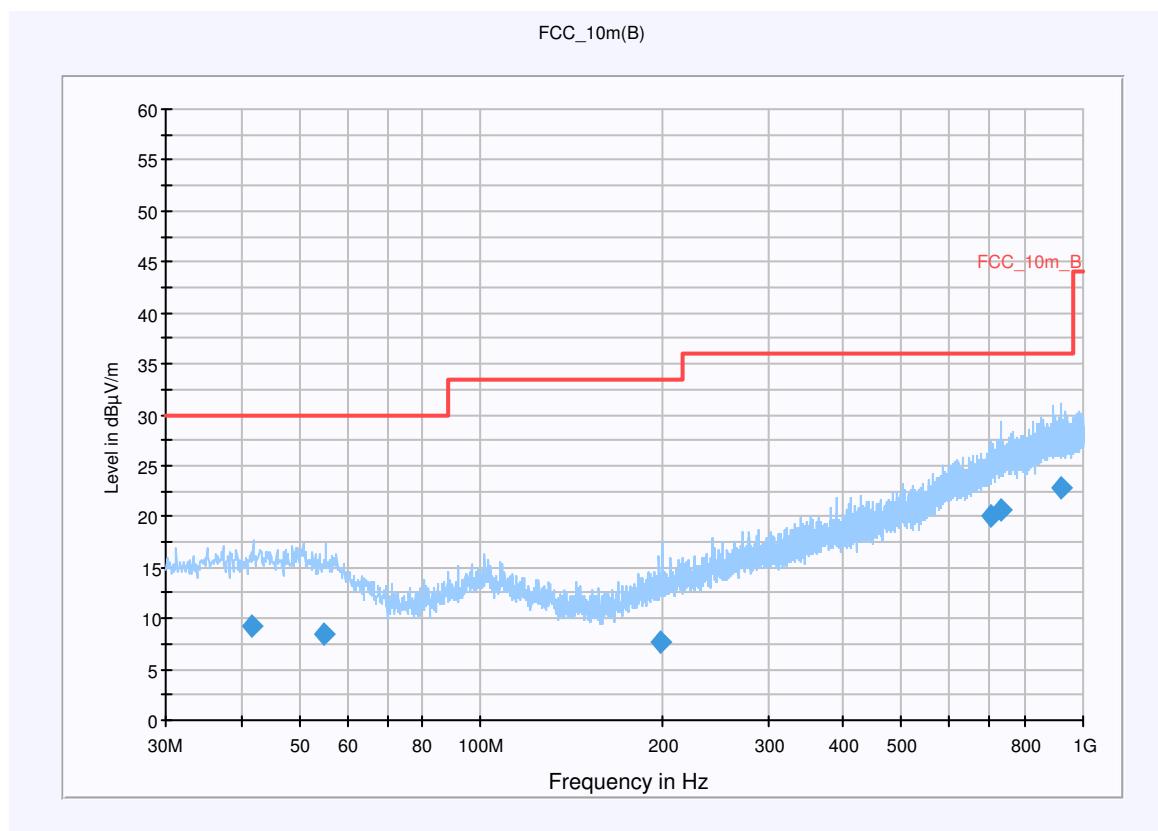
Plot 1: 0.03 - 1 GHz vertical & horizontal (lowest channel)

### Common Information

EUT: DIGIMIC  
 Serial Number: 00 10 00 00  
 Test Description: FCC class B @ 10 m  
 Operating Conditions: TX lowest channel  
 Operator Name: Hennemann  
 Comment: AC: 115 V / 60 Hz; Ant 2

### Scan Setup: STAN\_Fin [EMI radiated]

Hardware Setup:	Electric Field (NOS)		
Level Unit:	dB $\mu$ V/m		
Subrange	Detectors	IF Bandwidth	Meas. Time
30 MHz - 1 GHz	QuasiPeak	120 kHz	15 s
			Receiver



### Final Result 1

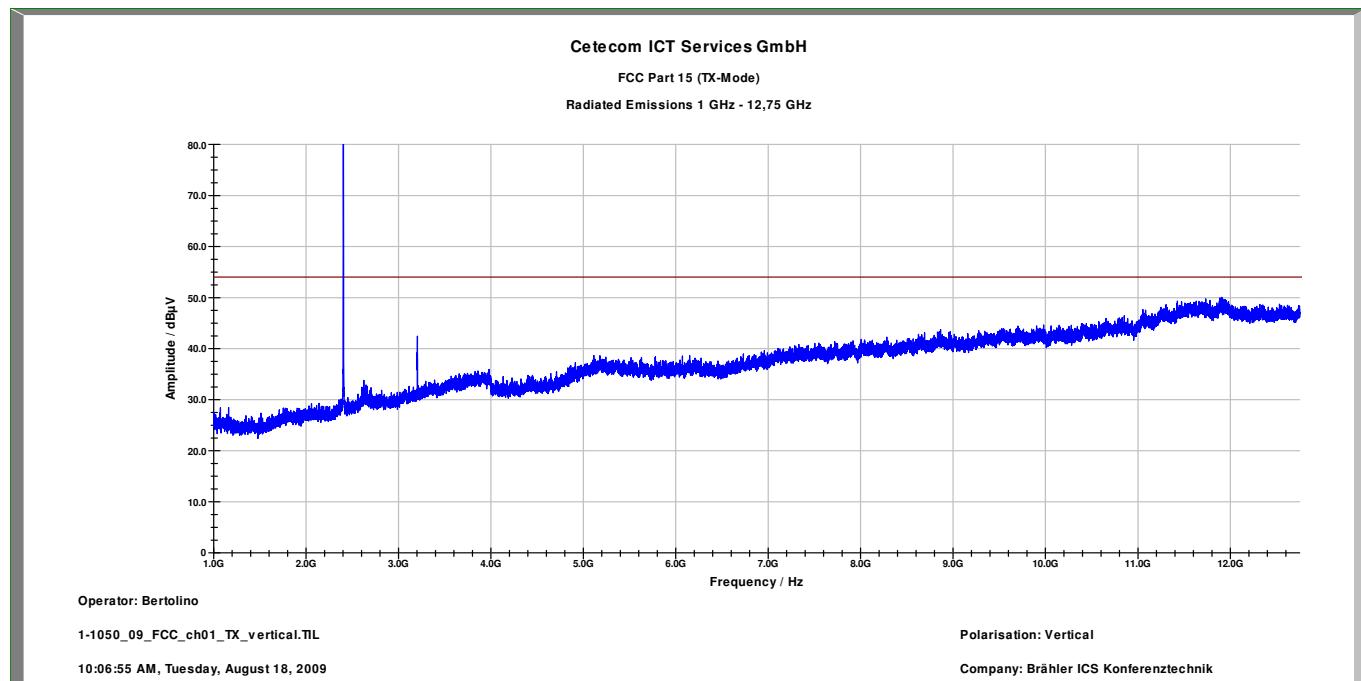
Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V/m)	Comment
41.824150	9.3	15000.000	120.000	100.0	V	341.0	13.5	20.7	30.0	
54.778150	8.5	15000.000	120.000	400.0	H	-5.0	13.1	21.5	30.0	
199.530050	7.8	15000.000	120.000	280.0	V	44.0	12.0	25.7	33.5	
703.092700	20.0	15000.000	120.000	218.0	V	134.0	23.1	16.0	36.0	
731.151400	20.7	15000.000	120.000	400.0	V	227.0	23.7	15.3	36.0	
916.838200	22.8	15000.000	120.000	100.0	V	7.0	25.8	13.2	36.0	

**Hardware Setup: EMI radiated\Electric Field (NOS) - [EMI radiated]**

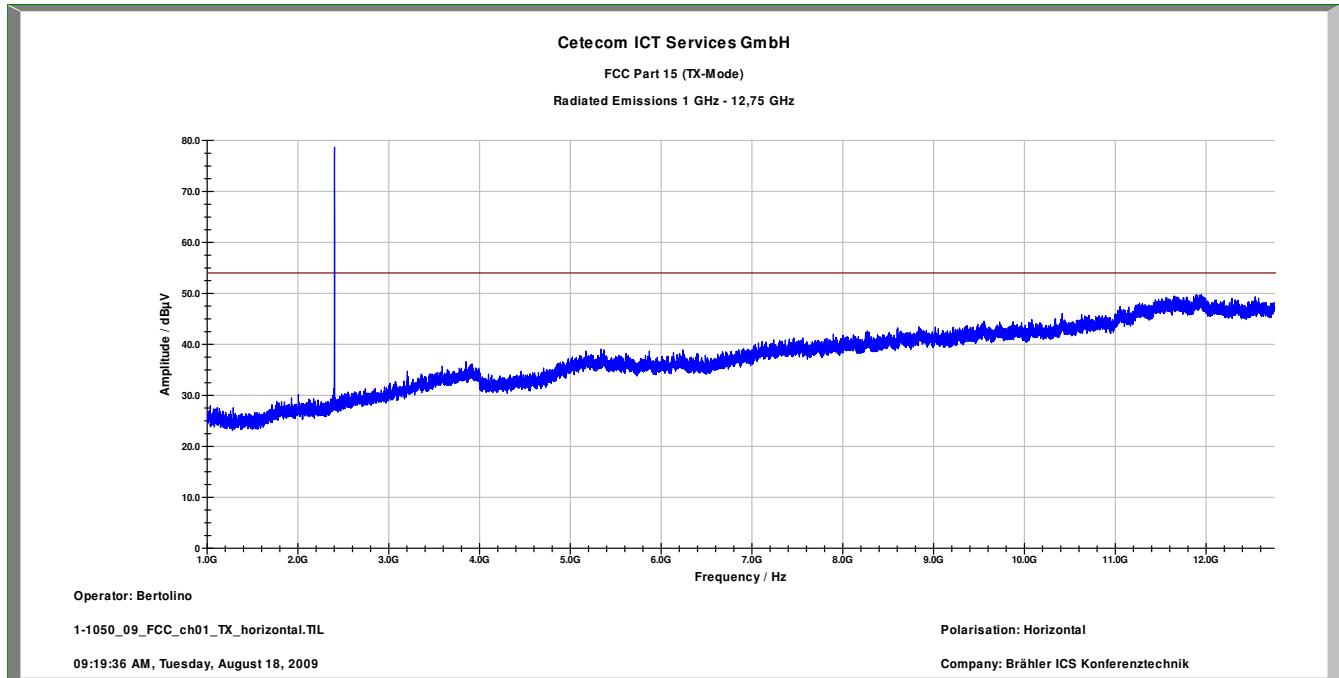
Frequency Range:	Subrange 1 30 MHz - 2 GHz
Receiver:	Receiver [ESCI 3] @ GPIB0 (ADR 20), SN 100083/0033, FW 4.32
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW --- Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table: Cable_EN_1GHz (0109)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

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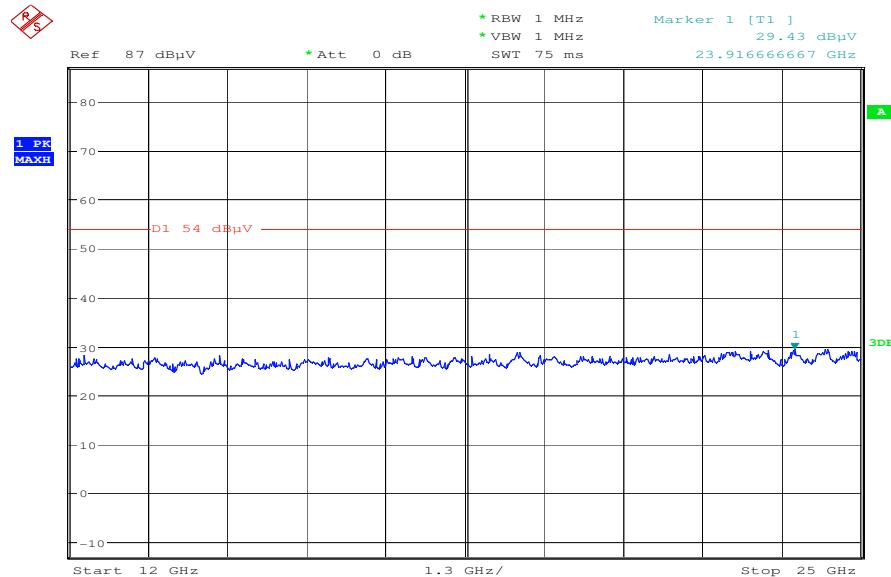
Plot 2: 1 – 12.75 GHz vertical (lowest channel)



Plot 3: 1 – 12.75 GHz horizontal (lowest channel)



Plot 4: 12 - 25 GHz vertical & horizontal (valid for all channels)



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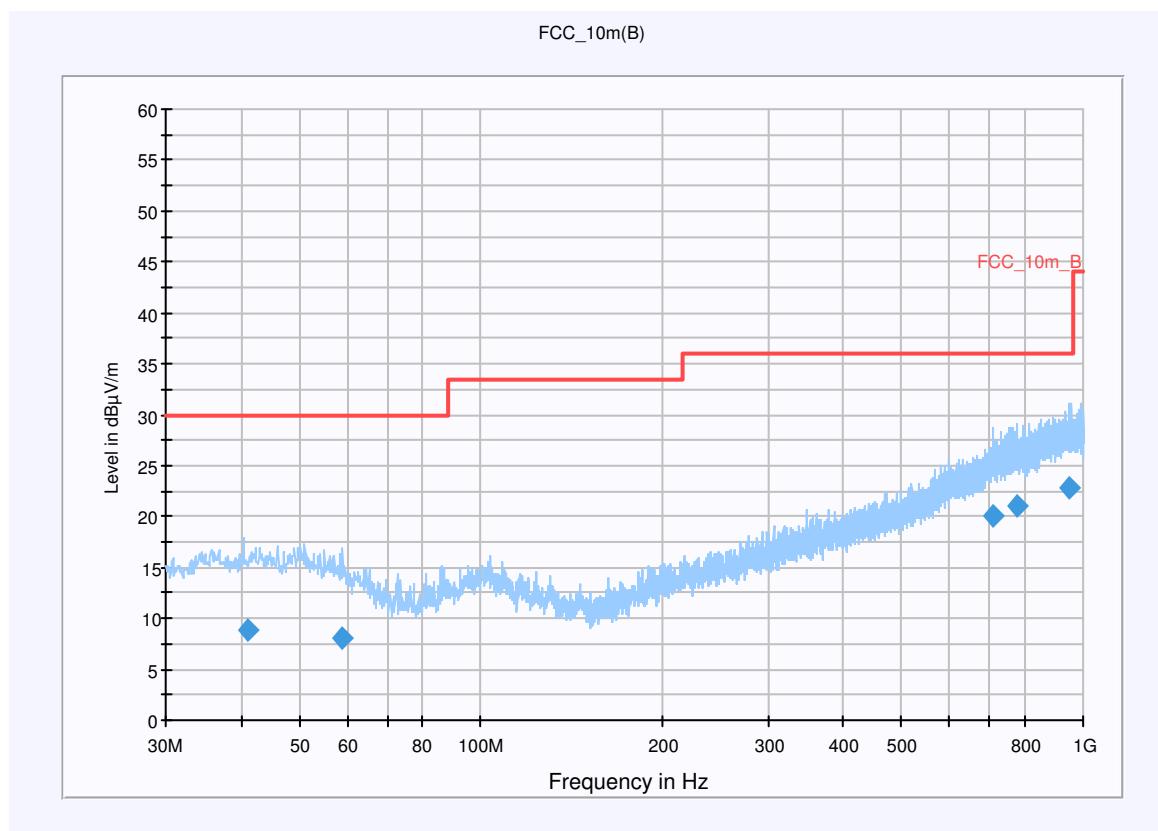
Plot 5: 0.03 - 1 GHz vertical & horizontal (middle channel)

### Common Information

EUT: DIGIMIC  
 Serial Number: 00 10 00 00  
 Test Description: FCC class B @ 10 m  
 Operating Conditions: TX mid channel  
 Operator Name: Hennemann  
 Comment: AC: 115 V / 60 Hz; Ant: 2

### Scan Setup: STAN\_Fin [EMI radiated]

Hardware Setup:	Electric Field (NOS)		
Level Unit:	dB $\mu$ V/m		
<b>Subrange</b>	<b>Detectors</b>	<b>IF Bandwidth</b>	<b>Meas. Time</b>
30 MHz - 1 GHz	QuasiPeak	120 kHz	15 s
			<b>Receiver</b>



### Final Result 1

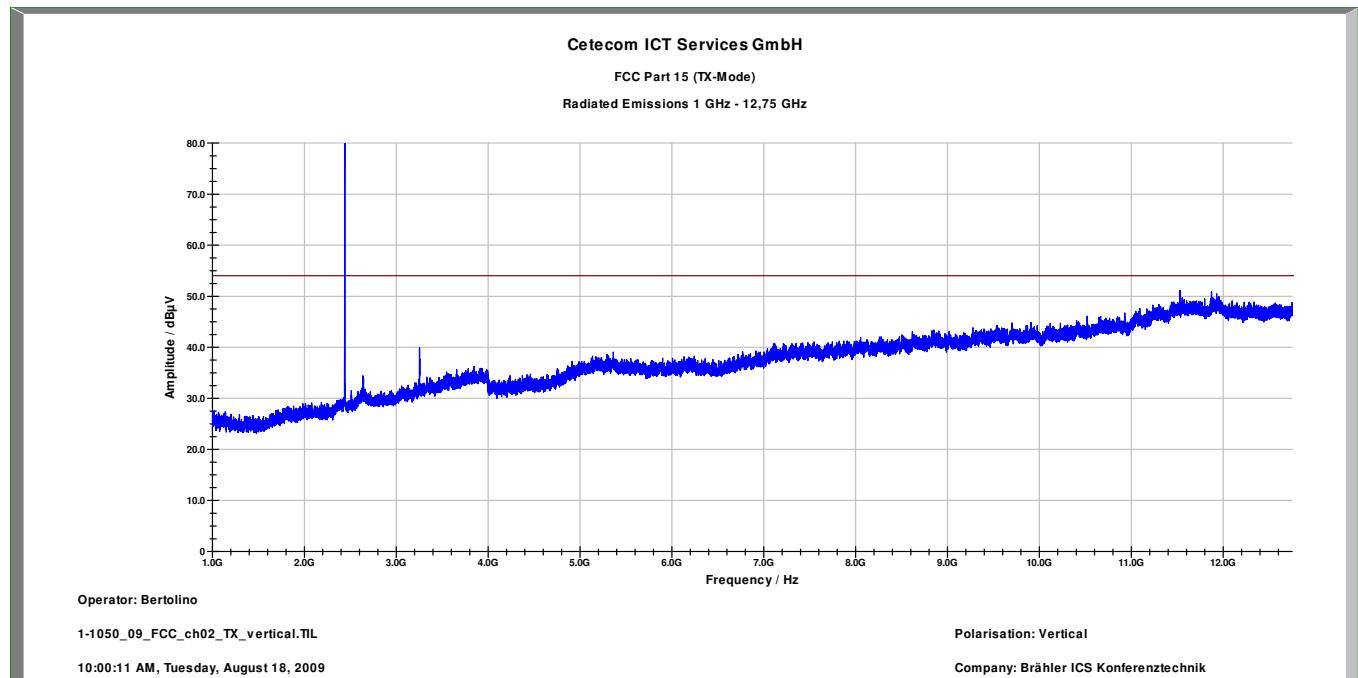
Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V/m)	Comment
40.960900	8.8	15000.000	120.000	198.0	V	283.0	13.5	21.2	30.0	
58.627900	8.1	15000.000	120.000	198.0	V	97.0	12.2	21.9	30.0	
710.085300	20.1	15000.000	120.000	400.0	V	37.0	23.2	15.9	36.0	
775.708800	21.1	15000.000	120.000	164.0	V	205.0	24.2	14.9	36.0	
947.422850	22.8	15000.000	120.000	394.0	V	42.0	25.8	13.2	36.0	

**Hardware Setup: EMI radiated\Electric Field (NOS) - [EMI radiated]**

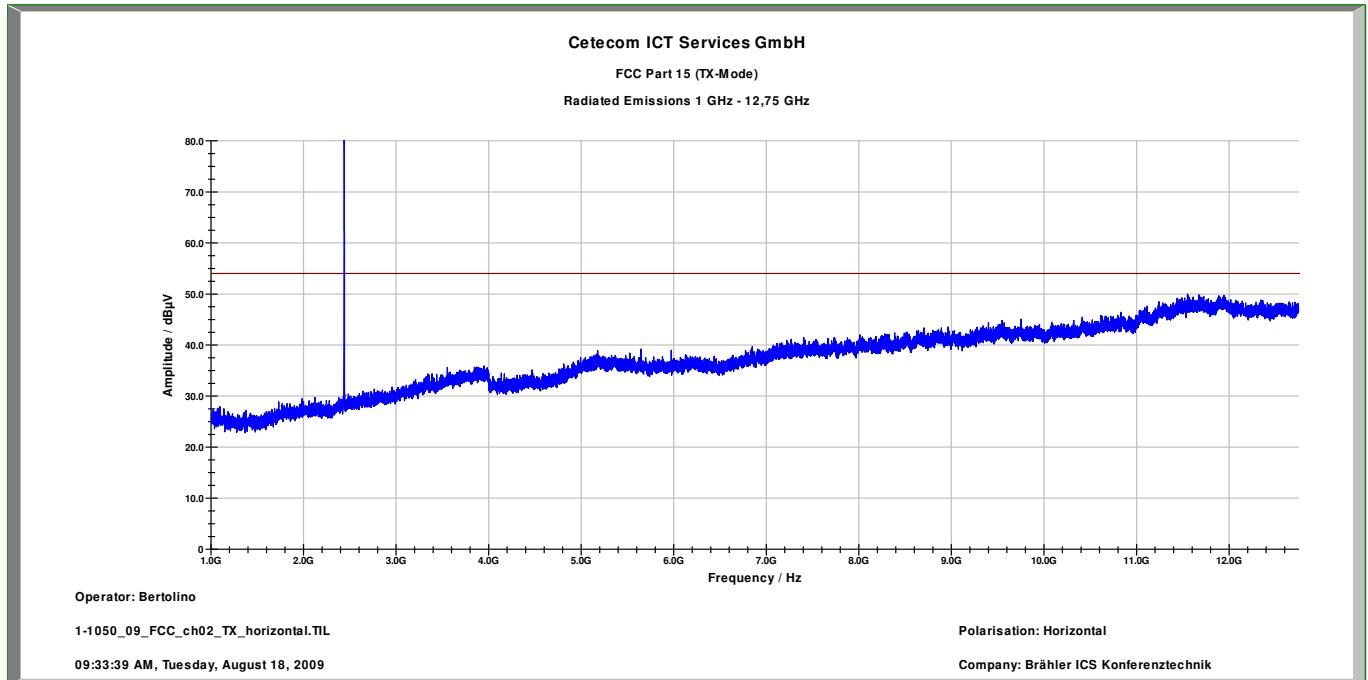
	Subrange 1
Frequency Range:	30 MHz - 2 GHz
Receiver:	Receiver [ESCI 3]
Signal Path:	@ GPIB0 (ADR 20), SN 100083/0033, FW 4.32 without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW --- Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table: Cable_EN_1GHz (0109)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

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Plot 6: 1 – 12.75 GHz vertical (middle channel)



Plot 7: 1 – 12.75 GHz horizontal (middle channel)



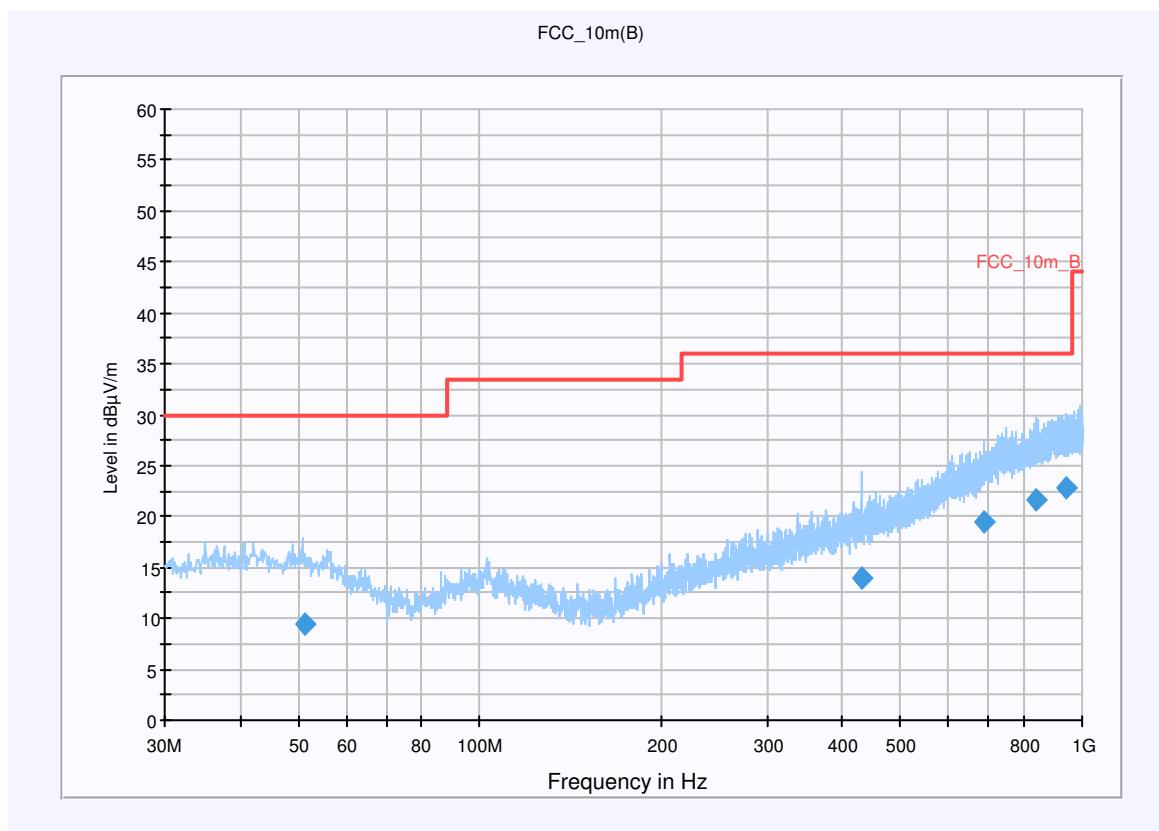
Plot 8: 0.03 - 1 GHz vertical/horizontal (highest channel)

### Common Information

EUT: DIGIMIC  
 Serial Number: 00 10 00 00  
 Test Description: FCC class B @ 10 m  
 Operating Conditions: TX highest channel  
 Operator Name: Hennemann  
 Comment: AC: 115 V / 60 Hz; Ant: 2

### Scan Setup: STAN\_Fin [EMI radiated]

Hardware Setup:	Electric Field (NOS) dB $\mu$ V/m				
Level Unit:	Subrange	Detectors	IF Bandwidth	Meas. Time	Receiver
	30 MHz - 1 GHz	QuasiPeak	120 kHz	15 s	Receiver



### Final Result 1

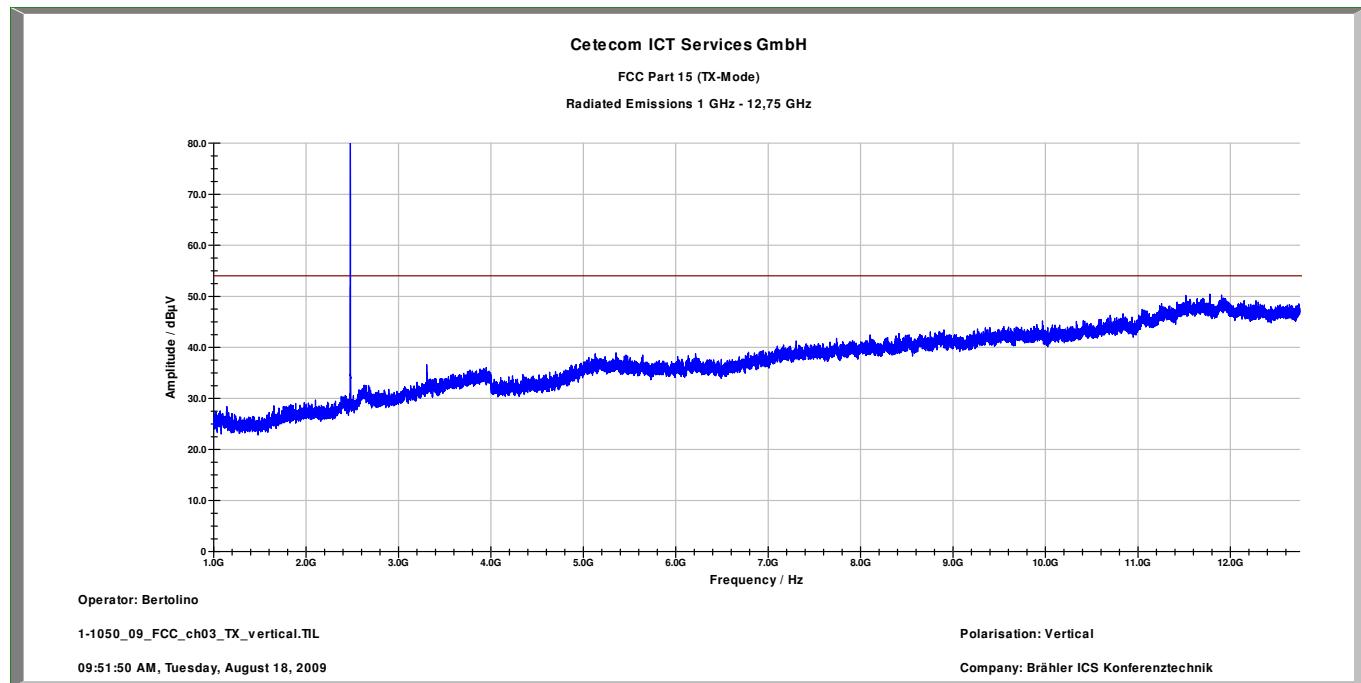
Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V/m)	Comment
51.114300	9.4	15000.000	120.000	261.0	H	269.0	13.4	20.6	30.0	
431.475800	13.9	15000.000	120.000	346.0	V	263.0	17.8	22.1	36.0	
688.175800	19.5	15000.000	120.000	160.0	H	327.0	22.7	16.5	36.0	
838.939100	21.6	15000.000	120.000	308.0	H	-7.0	24.9	14.4	36.0	
938.662500	22.9	15000.000	120.000	161.0	V	324.0	25.8	13.1	36.0	

**Hardware Setup: EMI radiated\Electric Field (NOS) - [EMI radiated]**

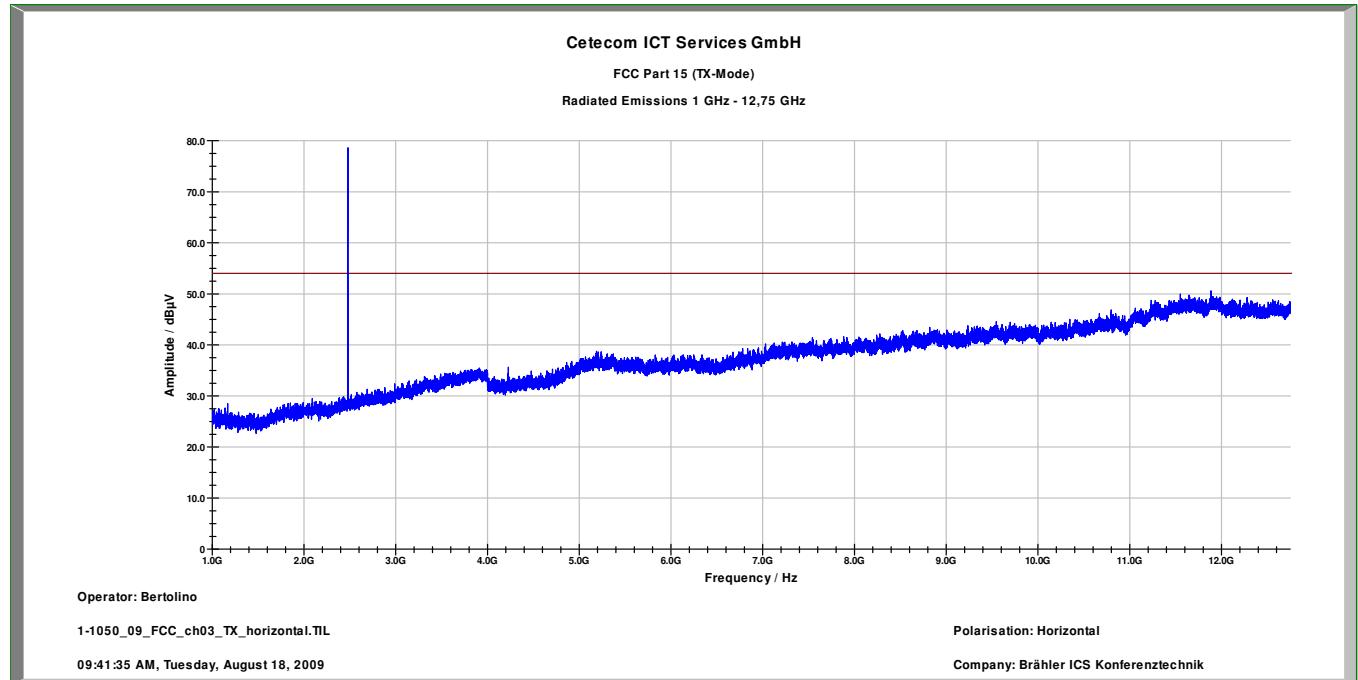
	Subrange 1
Frequency Range:	30 MHz - 2 GHz
Receiver:	Receiver [ESCI 3] @ GPIB0 (ADR 20), SN 100083/0033, FW 4.32
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW --- Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table: Cable_EN_1GHz (0109)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

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Plot 9: 1 – 12.75 GHz vertical/horizontal (highest channel)



Plot 10: 1 – 12.75 GHz vertical/horizontal (highest channel)



### Results:

SPURIOUS EMISSIONS LEVEL (dB $\mu$ V/m)										
Lowest frequency			Middle frequency			Highest frequency				
F [MHz]	Detector	Level [dB $\mu$ V/m]	F [MHz]	Detector	Level [dB $\mu$ V/m]	F [MHz]	Detector	Level [dB $\mu$ V/m]		
No critical peaks detected.*			No critical peaks detected.*			No critical peaks detected.*				
Measurement uncertainty			$\pm 3$ dB							

f < 1 GHz : RBW/VBW: 100 kHz

f  $\geq$  1GHz : RBW/VBW: 1 MHz

### \*Note:

- The detected spurious emissions / harmonics do not fall into the restricted bands listed in Section 15.205. Section 15.205 Restricted bands of operation.

(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
1.0495 - 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	( <sup>2</sup> )
13.36 - 13.41			

## Measurement of Digital Transmission Systems Operating under Section 15.247

March 23, 2005

### Section 15.247(c) – Spurious emissions.

The following tests are required:

1. **RF antenna conducted test:** Set RBW = 100 kHz, Video bandwidth (VBW) > RBW, scan up through 10th harmonic. All harmonics/spurs must be at least 20 dB down from the highest emission level within the authorized band *as measured with a 100 kHz RBW*.  
*Note: If the device complies with the use of power option 2 the attenuation under this paragraph shall be 30 dB instead of 20 dB.*
2. **Radiated emission test:** Applies to harmonics/spurs that fall in the restricted bands listed in Section 15.205. The maximum permitted average field strength is listed in Section 15.209. A pre-amp (and possibly a high-pass filter) is necessary for this measurement. For measurements above 1 GHz, set RBW = 1MHz, VBW = 10 Hz, Sweep: Auto. If the emission is pulsed, modify the unit for continuous operation; use the settings shown above, then correct the reading by subtracting the peak-average correction factor, derived from the appropriate duty cycle calculation. See Section 15.35(b) and (c).

#### Limits: § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

#### Limits: § 15.209

Frequency [MHz]	Field strength [ $\mu$ V/m]	Measurement distance (m)
30 - 88	100 (40 dB $\mu$ V/m)	3
88 - 216	150 (43.5 dB $\mu$ V/m)	3
216 - 960	200 (46 dB $\mu$ V/m)	3
above 960	500 (54 dB $\mu$ V/m)	3

## **5.16 Spurious Emissions - radiated (Receiver) § 15.109**

### **Antenna 1: TX antenna 1**

**Photo antenna 1:**



### **Antenna 1-1 / EUT 1:**

P/N: SAA05-050690

S/N: 8H100051

### **Antenna 1-2 / EUT 2:**

P/N: SAA05-050690

S/N: 8H100022

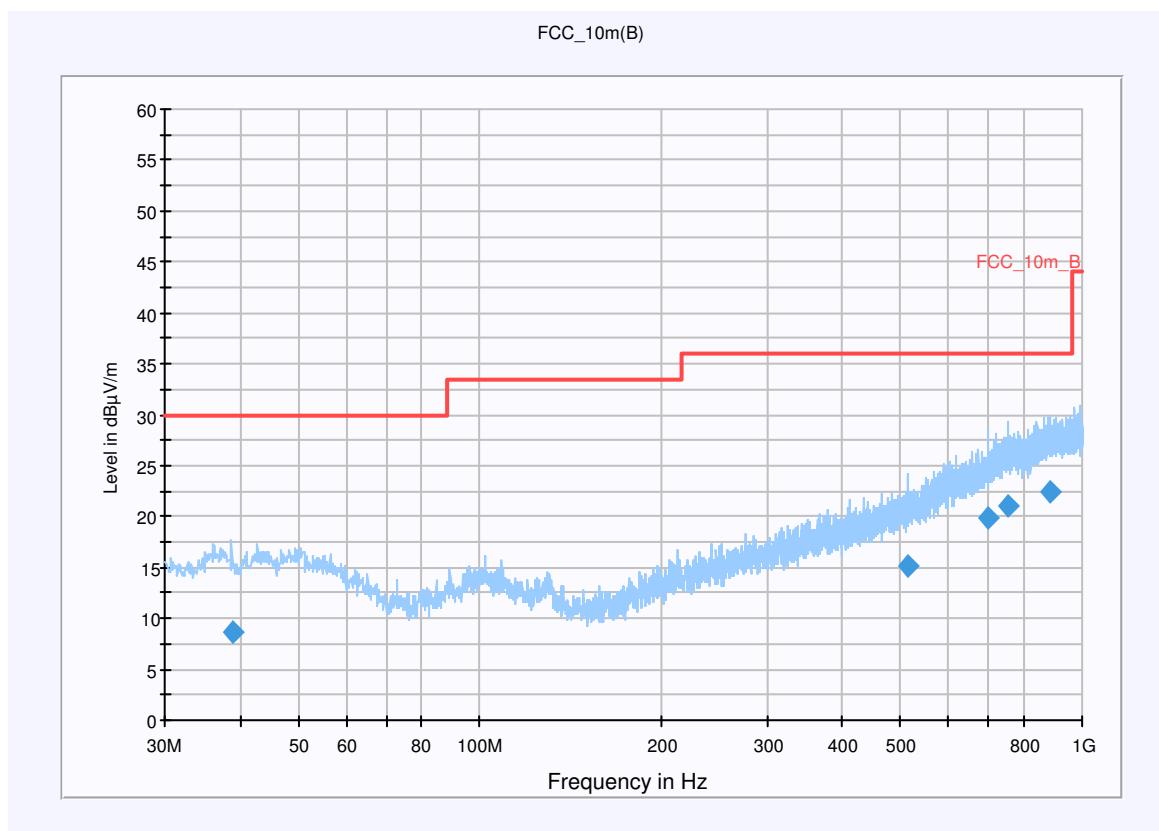
Plot 1: 0.03 - 1 GHz vertical & horizontal (receiver)

### Common Information

EUT: DIGIMIC  
 Serial Number: 00 10 00 00  
 Test Description: FCC class B @ 10 m  
 Operating Conditions: RX  
 Operator Name: Hennemann  
 Comment: AC: 115 V / 60 Hz; Ant: SAA05-050690 SN: 8H100051

### Scan Setup: STAN\_Fin [EMI radiated]

Hardware Setup:	Electric Field (NOS)		
Level Unit:	dB $\mu$ V/m		
<b>Subrange</b>	<b>Detectors</b>	<b>IF Bandwidth</b>	<b>Meas. Time</b>
30 MHz - 1 GHz	QuasiPeak	120 kHz	15 s
			<b>Receiver</b>



### Final Result 1

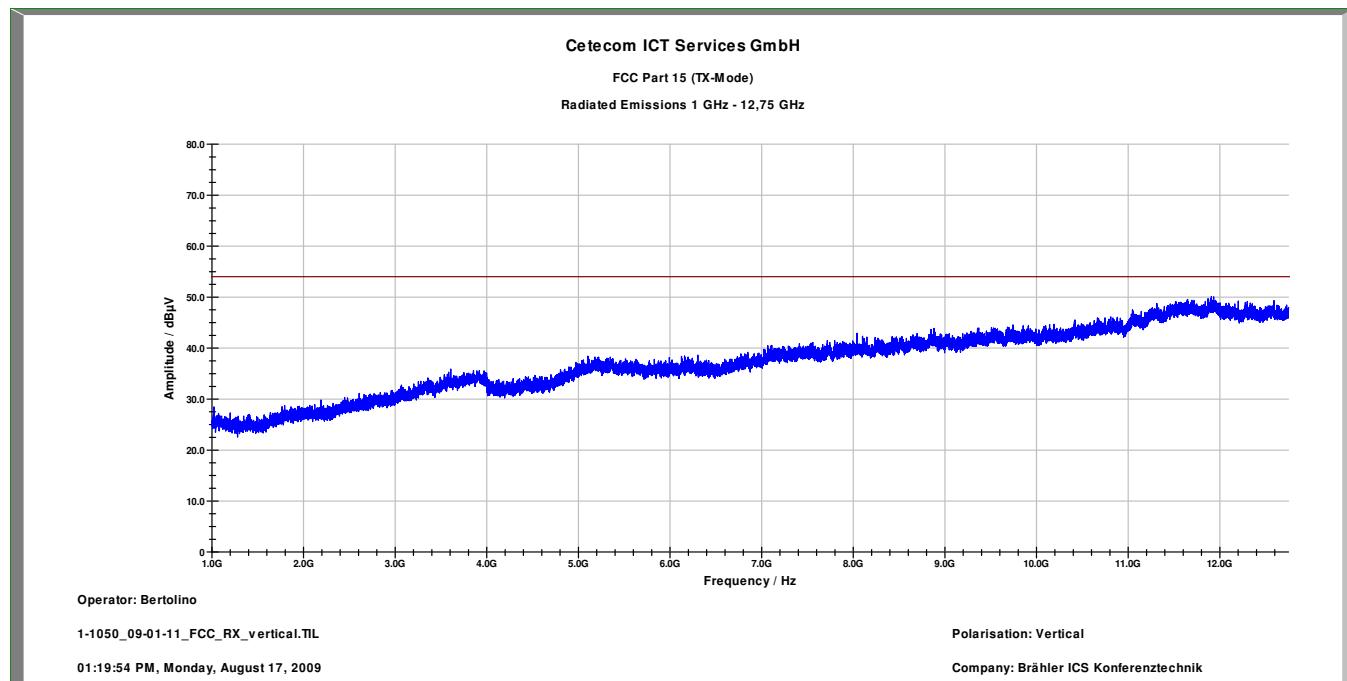
Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V/m)	Comment
38.996400	8.6	15000.000	120.000	387.0	H	138.0	13.5	21.4	30.0	
514.113250	15.2	15000.000	120.000	198.0	H	68.0	19.3	20.8	36.0	
699.897800	19.9	15000.000	120.000	129.0	V	164.0	23.0	16.1	36.0	
754.935350	21.0	15000.000	120.000	142.0	V	124.0	24.2	15.0	36.0	
882.517450	22.4	15000.000	120.000	198.0	V	182.0	25.5	13.6	36.0	

**Hardware Setup: EMI radiated\Electric Field (NOS) - [EMI radiated]**

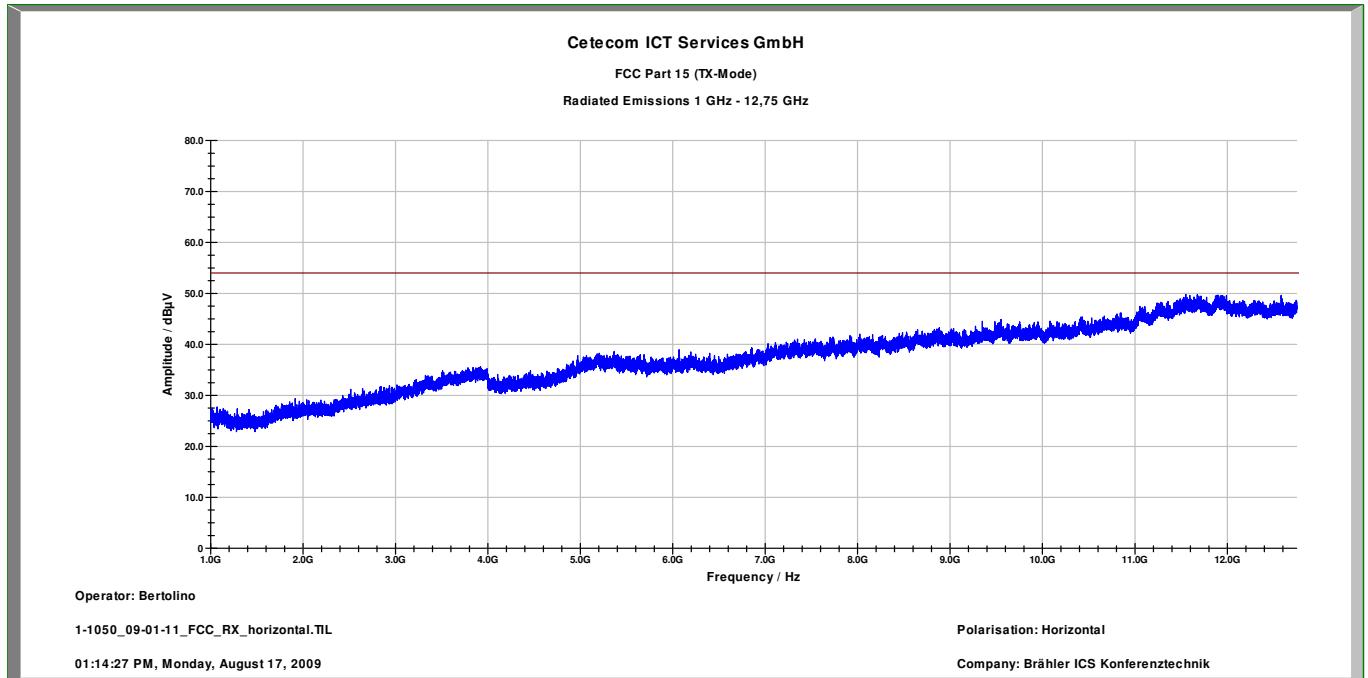
	Subrange 1
Frequency Range:	30 MHz - 2 GHz
Receiver:	Receiver [ESCI 3] @ GPIB0 (ADR 20), SN 100083/0033, FW 4.32
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW --- Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table: Cable_EN_1GHz (0109)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

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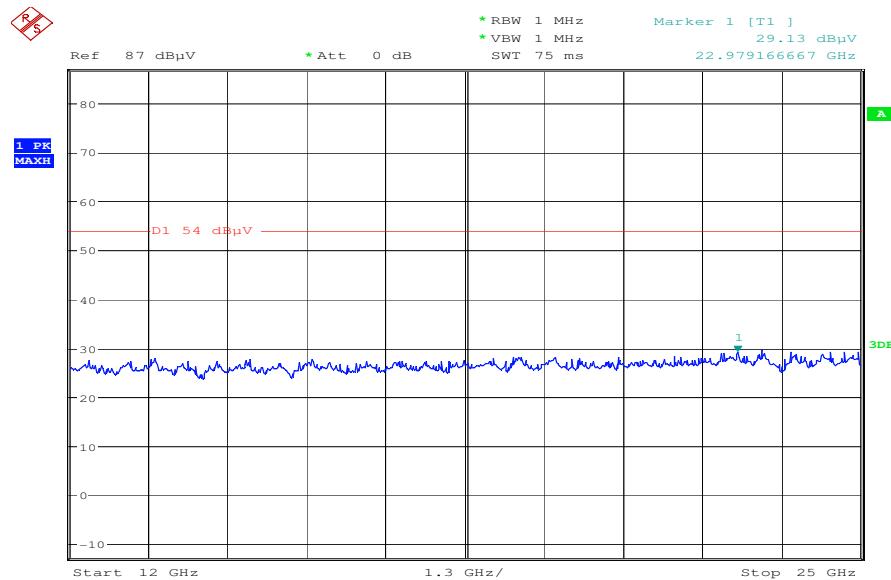
Plot 2:1 – 12.75 GHz vertical (receiver)



Plot 3: 1 – 12.75 GHz horizontal (receiver)



Plot 4: 12 - 25 GHz vertical & horizontal (receiver)



Date: 26.AUG.2009 15:08:17

Results:

Spurious Emissions level [dB $\mu$ V/m]		
f[MHz]	Detector	Level [dB $\mu$ V/m]
No critical peaks detected.		
Measurement uncertainty	$\pm 3$ dB	

f < 1 GHz: RBW/VBW: 100 kHz

f ≥ 1GHz : RBW/VBW: 1 MHz

See above plots

Measurement distance see table

Limits: § 15.109

Frequency (MHz)	Field strength ( $\mu$ V/m)	Measurement distance (m)
30 - 88	100 (40 dB $\mu$ V/m)	3
88 - 216	150 (43.5 dB $\mu$ V/m)	3
216 - 960	200 (46 dB $\mu$ V/m)	3
above 960	500 (54 dB $\mu$ V/m)	3

**Antenna 2: TX antenna 2**

**Photo antenna 2:**



**Antenna 2 / EUT 1:**

S/N: Not available!

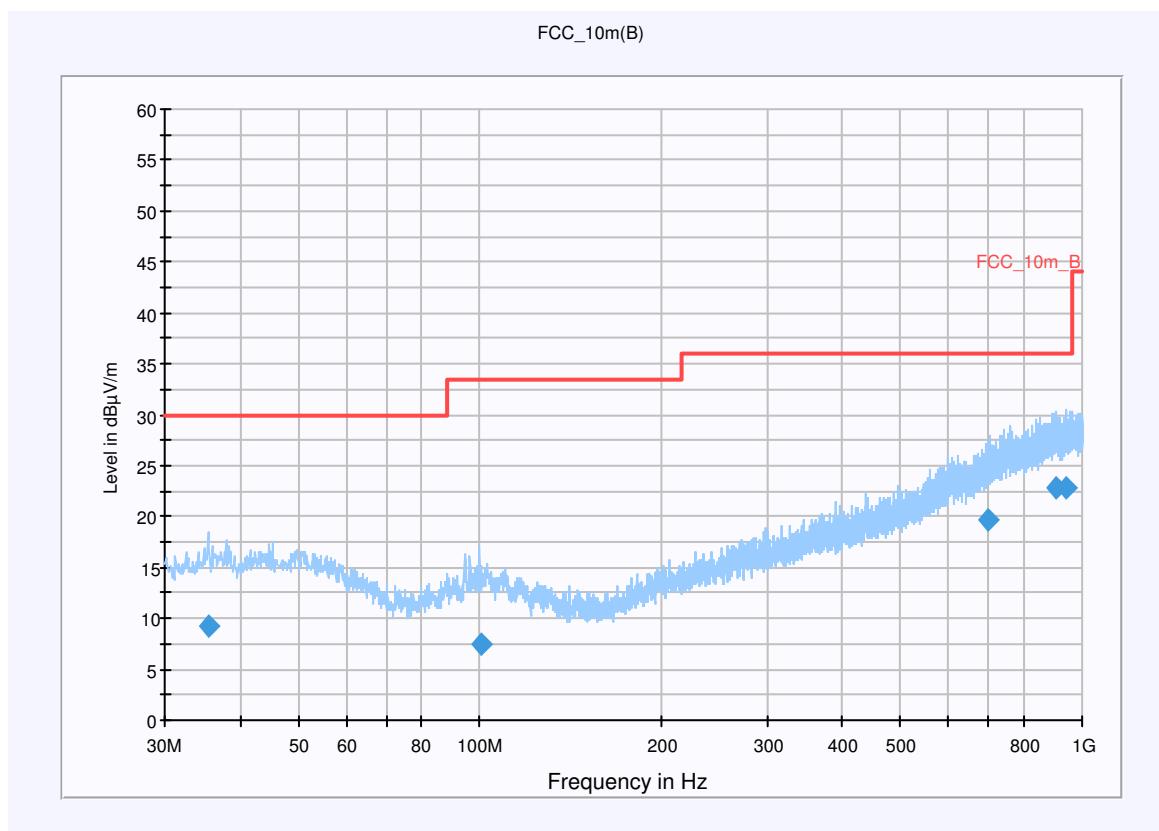
Plot 1: 0.03 - 1 GHz vertical & horizontal (receiver)

### Common Information

EUT: DIGIMIC  
 Serial Number: 00 10 00 00  
 Test Description: FCC class B @ 10 m  
 Operating Conditions: RX  
 Operator Name: Hennemann  
 Comment: AC: 115 V / 60 Hz; Ant: 2

### Scan Setup: STAN\_Fin [EMI radiated]

Hardware Setup:	Electric Field (NOS)			
Level Unit:	dB $\mu$ V/m			
<b>Subrange</b>	<b>Detectors</b>	<b>IF Bandwidth</b>	<b>Meas. Time</b>	<b>Receiver</b>
30 MHz - 1 GHz	QuasiPeak	120 kHz	15 s	Receiver



### Final Result 1

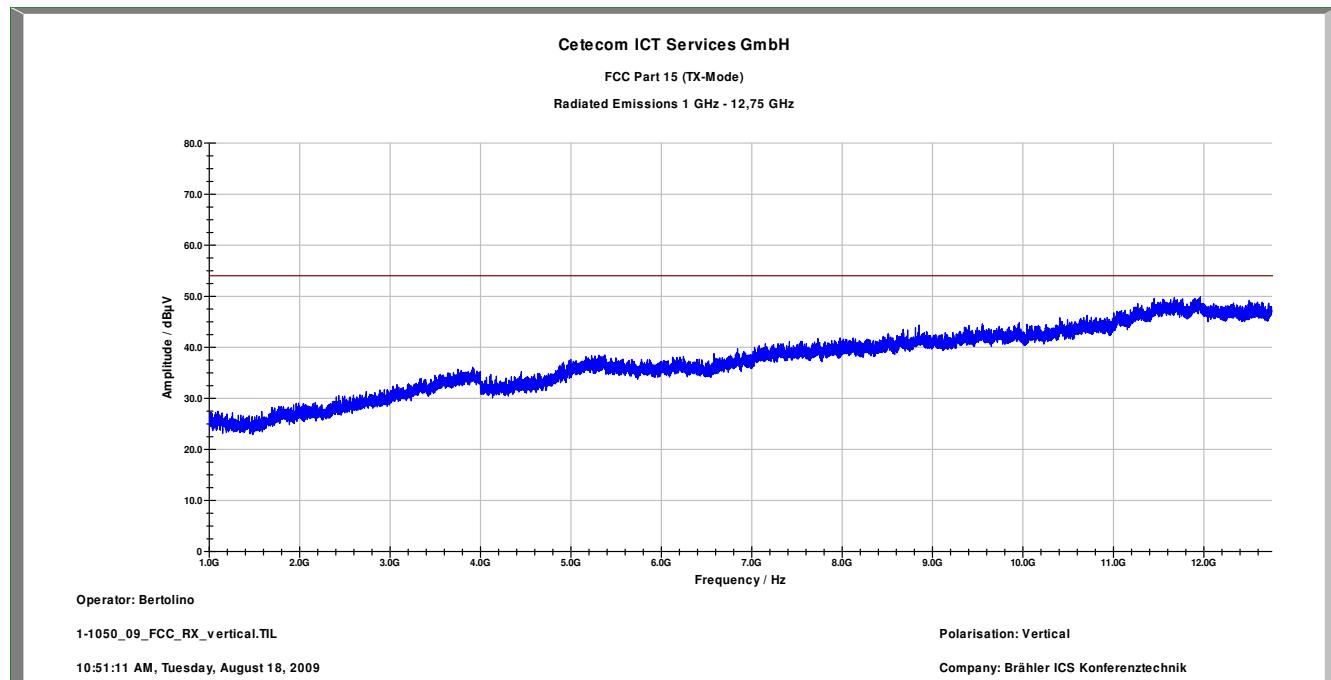
Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V/m)	Comment
35.377650	9.3	15000.000	120.000	400.0	H	349.0	13.2	20.7	30.0	
100.479500	7.4	15000.000	120.000	198.0	V	182.0	12.3	26.1	33.5	
695.849650	19.7	15000.000	120.000	198.0	H	94.0	22.9	16.3	36.0	
907.819200	22.8	15000.000	120.000	359.0	V	153.0	25.7	13.2	36.0	
938.920900	22.9	15000.000	120.000	400.0	V	172.0	25.8	13.1	36.0	

**Hardware Setup: EMI radiated\Electric Field (NOS) - [EMI radiated]**

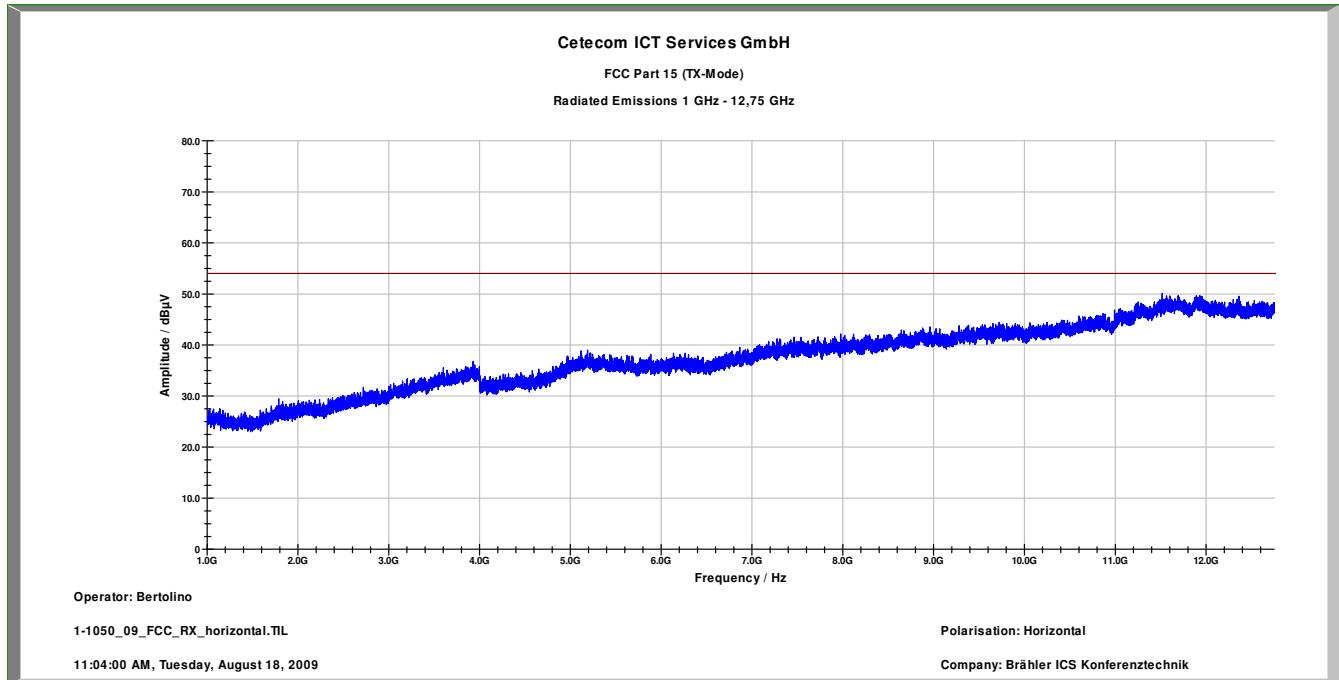
	Subrange 1
Frequency Range:	30 MHz - 2 GHz
Receiver:	Receiver [ESCI 3] @ GPIB0 (ADR 20), SN 100083/0033, FW 4.32
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW --- Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table: Cable_EN_1GHz (0109)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

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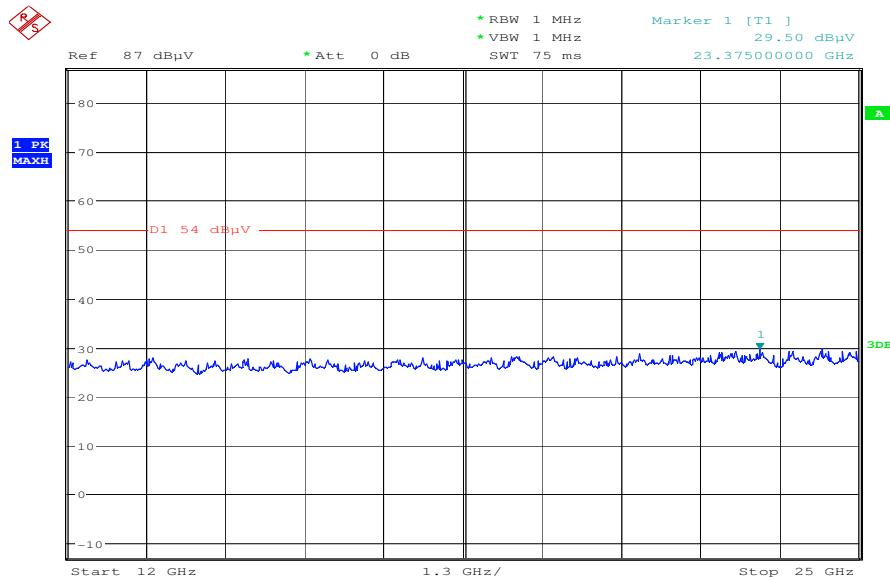
Plot 2:1 – 12.75 GHz vertical (receiver)



Plot 3: 1 – 12.75 GHz horizontal (receiver)



Plot 4: 12 - 25 GHz vertical & horizontal (receiver)



Date: 26.AUG.2009 15:08:31

Results:

Spurious Emissions level [dB $\mu$ V/m]		
f[MHz]	Detector	Level [dB $\mu$ V/m]
No critical peaks detected		
Measurement uncertainty	$\pm 3$ dB	

f < 1 GHz: RBW/VBW: 100 kHz

f ≥ 1GHz : RBW/VBW: 1 MHz

See above plots

Measurement distance see table

Limits: § 15.109

Frequency (MHz)	Field strength ( $\mu$ V/m)	Measurement distance (m)
30 - 88	100 (40 dB $\mu$ V/m)	3
88 - 216	150 (43.5 dB $\mu$ V/m)	3
216 - 960	200 (46 dB $\mu$ V/m)	3
above 960	500 (54 dB $\mu$ V/m)	3

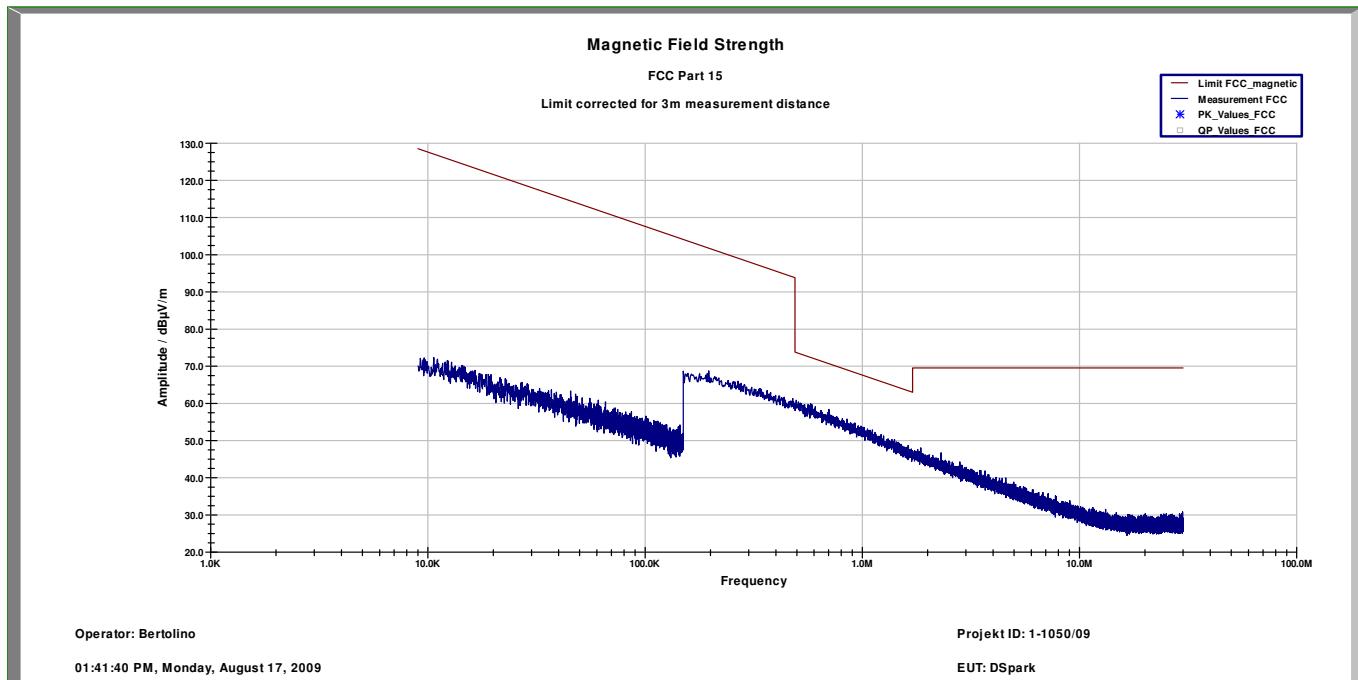
## 5.17 Spurious Emissions < 30 MHz - Transmitter radiated § 15.209

Measured at 10 m distance.

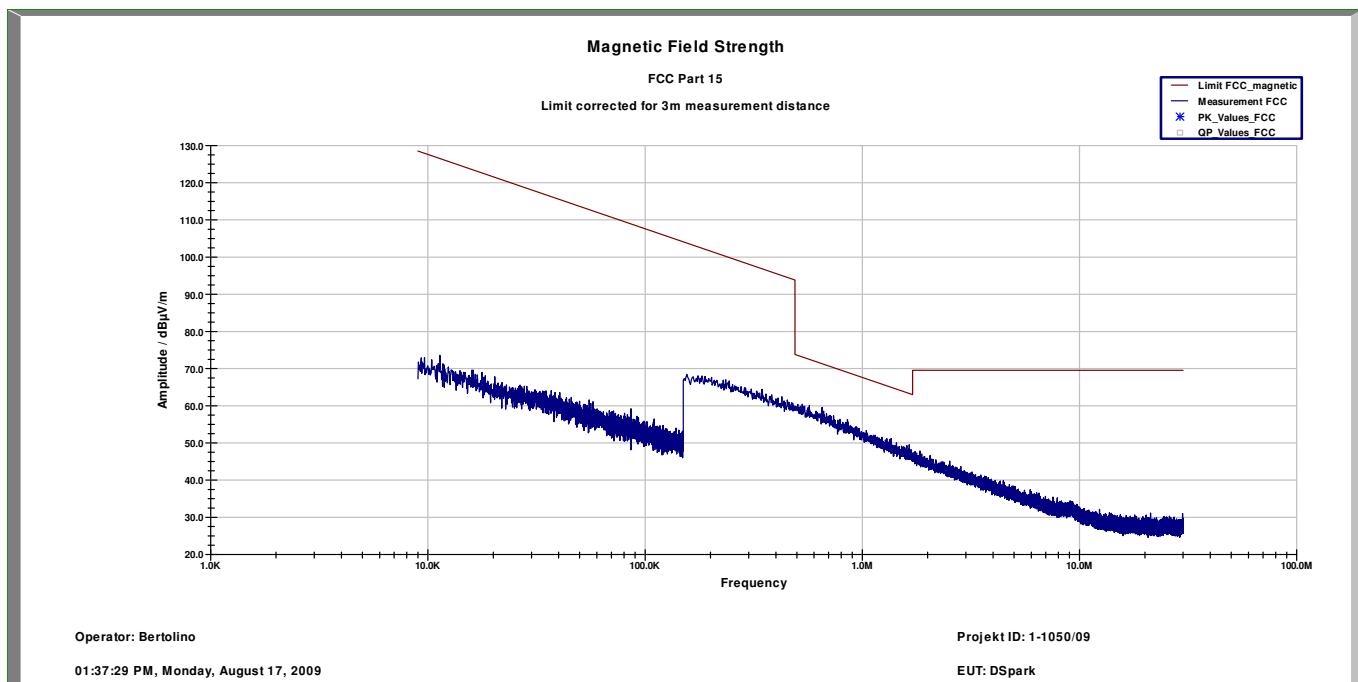
Values recalculated with 40 dB/decade according to FCC rules.

### Antenna 1: TX antenna 1

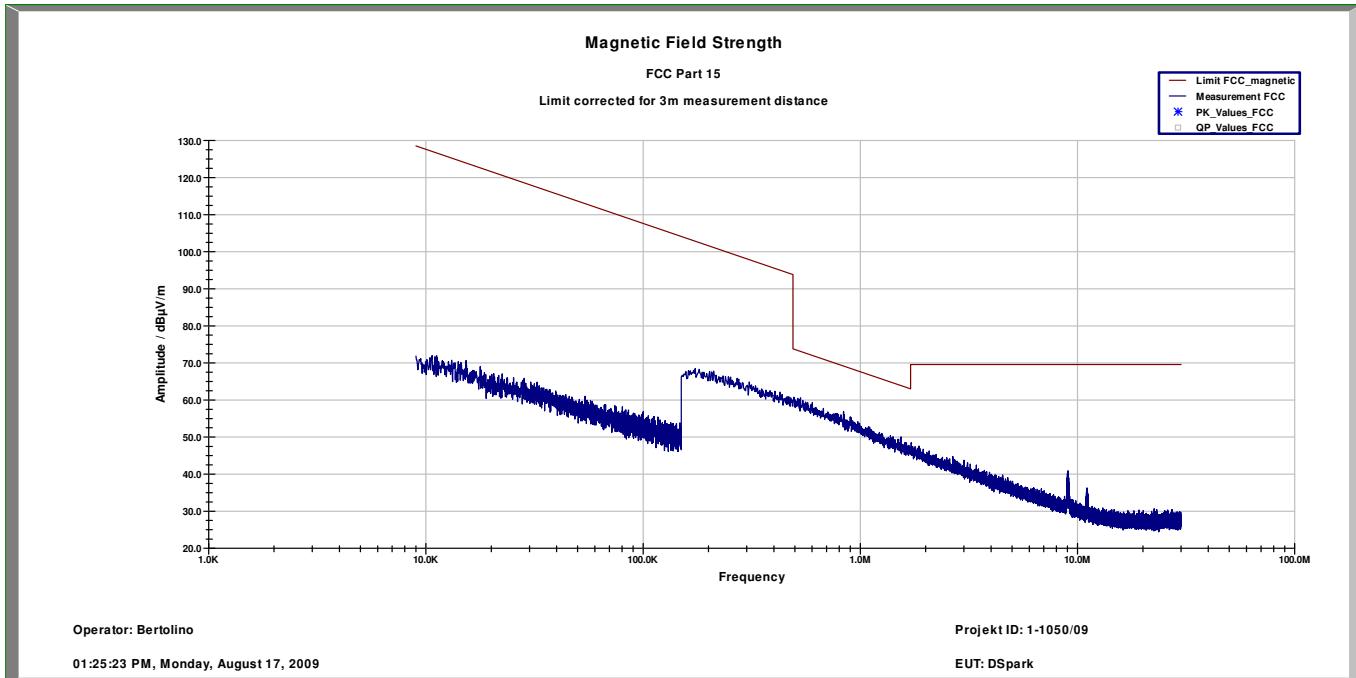
Plot 1: TX mode, EUT position 1



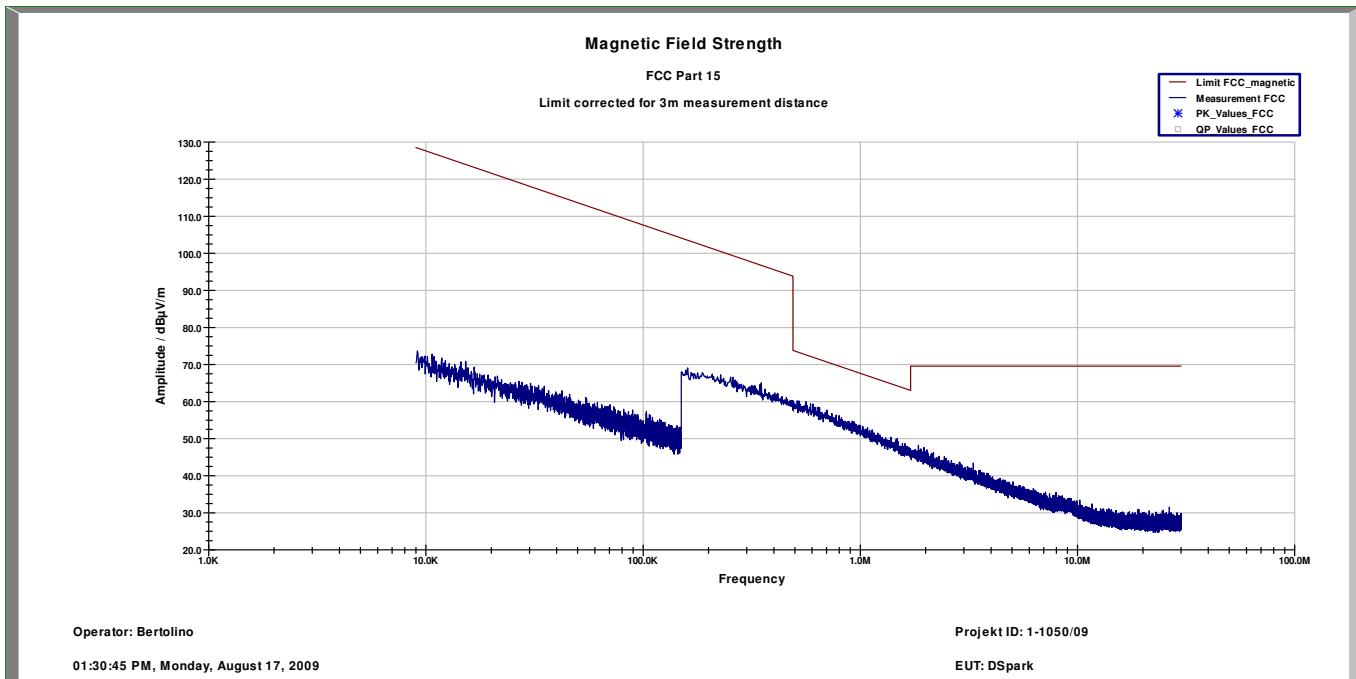
Plot 2: TX mode, EUT position 1



Plot 3: RX mode, EUT position 2



Plot 4: RX mode, EUT position 2

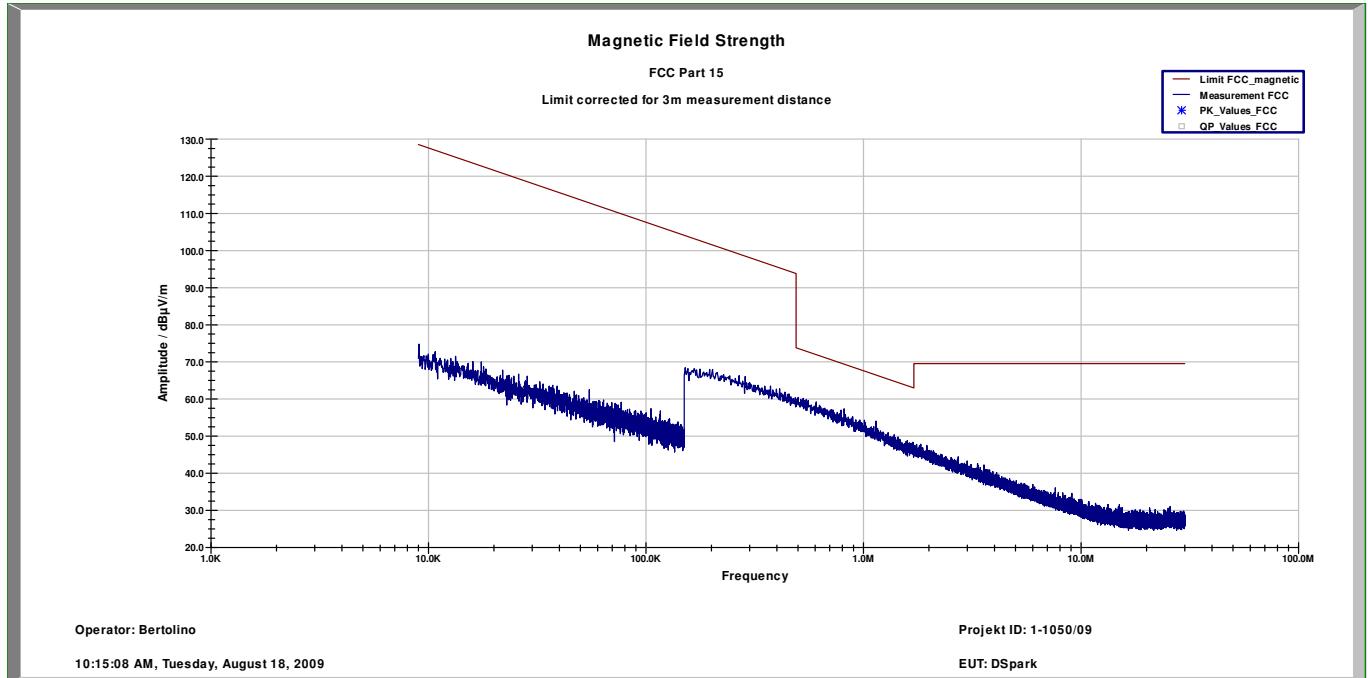


Limits:

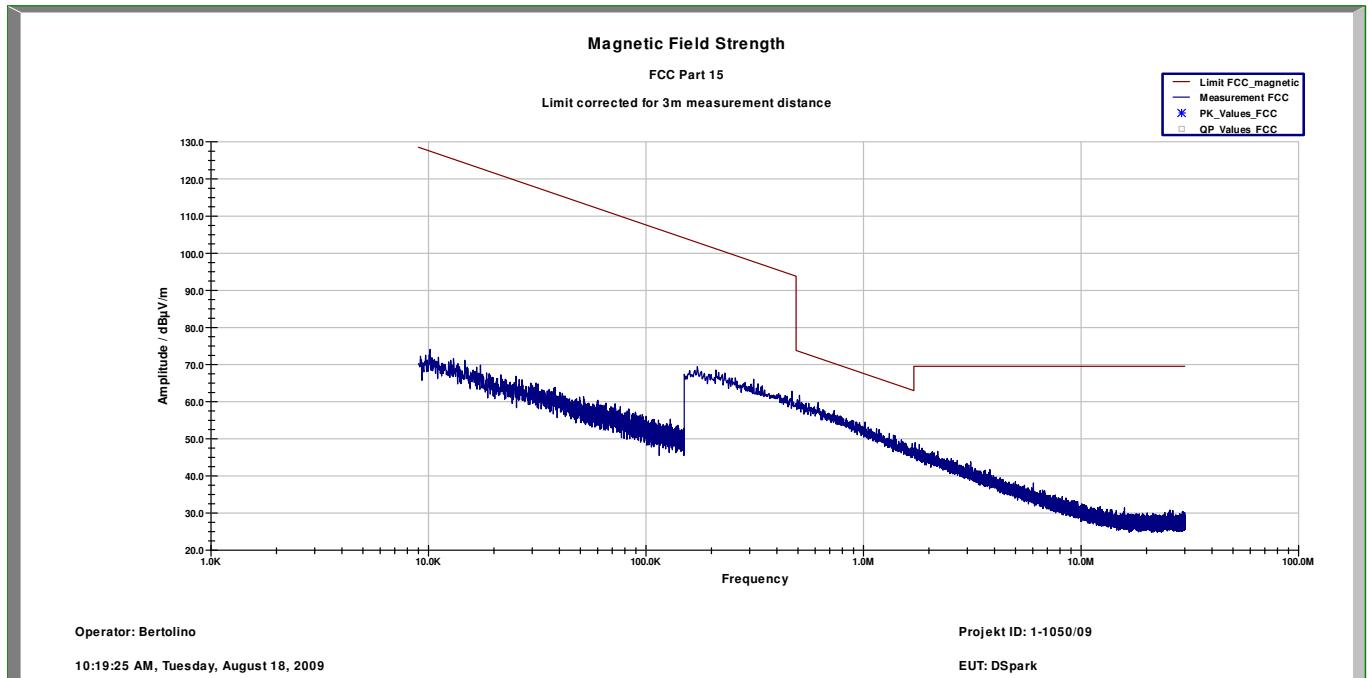
Frequency (MHz)	Field strength ( $\mu$ V/m)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30 / 29.5 dB $\mu$ V/m	30

**Antenna 2: TX antenna 2**

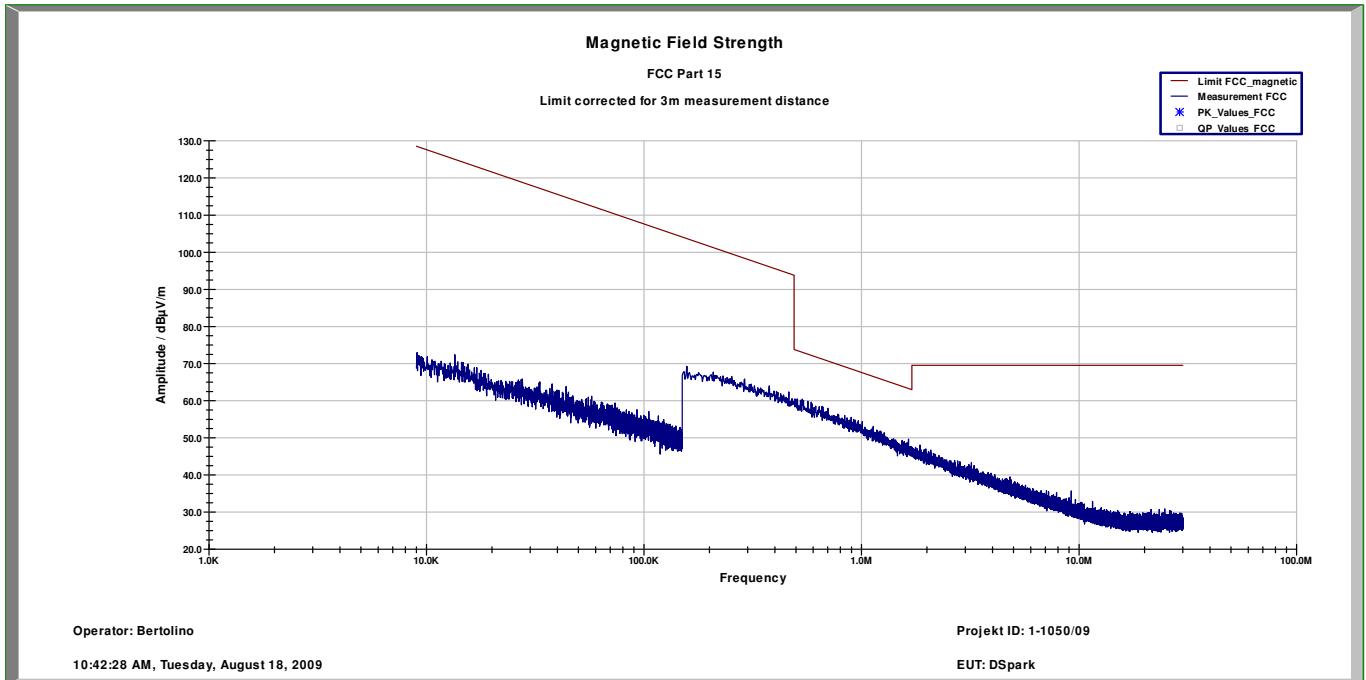
Plot 1: TX mode, EUT position 1



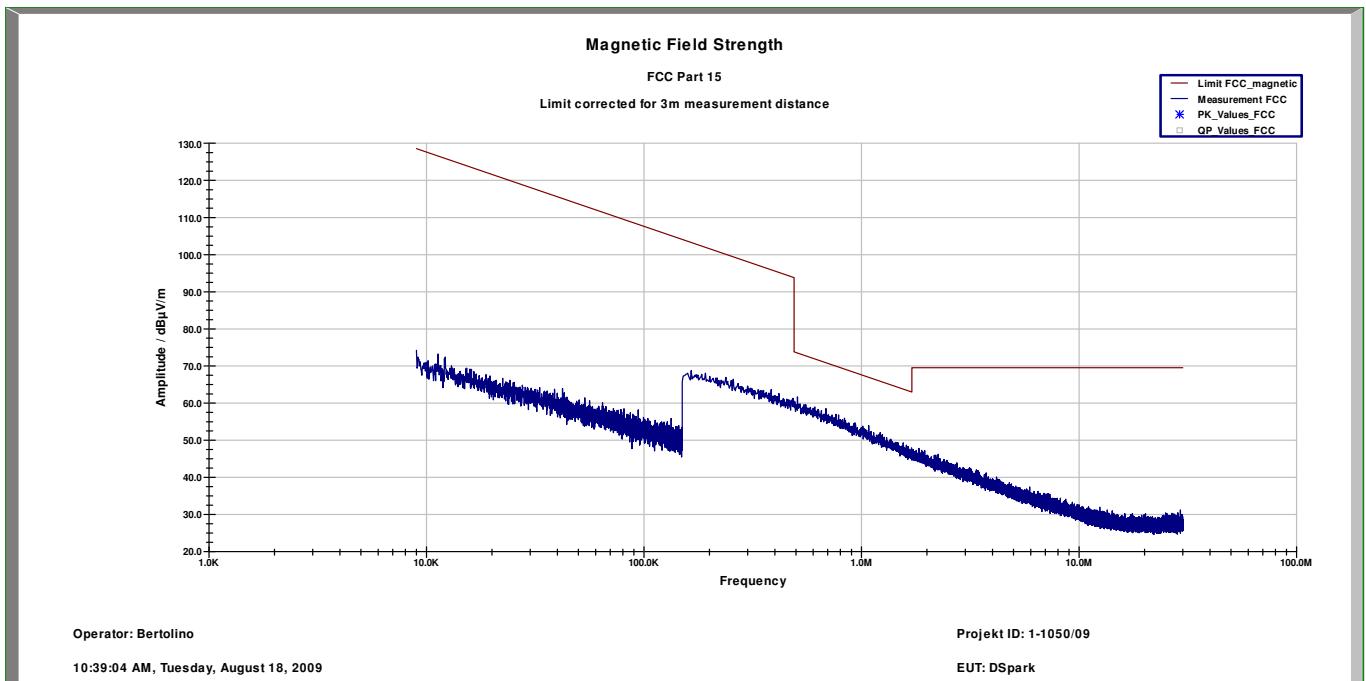
Plot 2: TX mode, EUT position 1



Plot 3: RX mode, EUT position 2



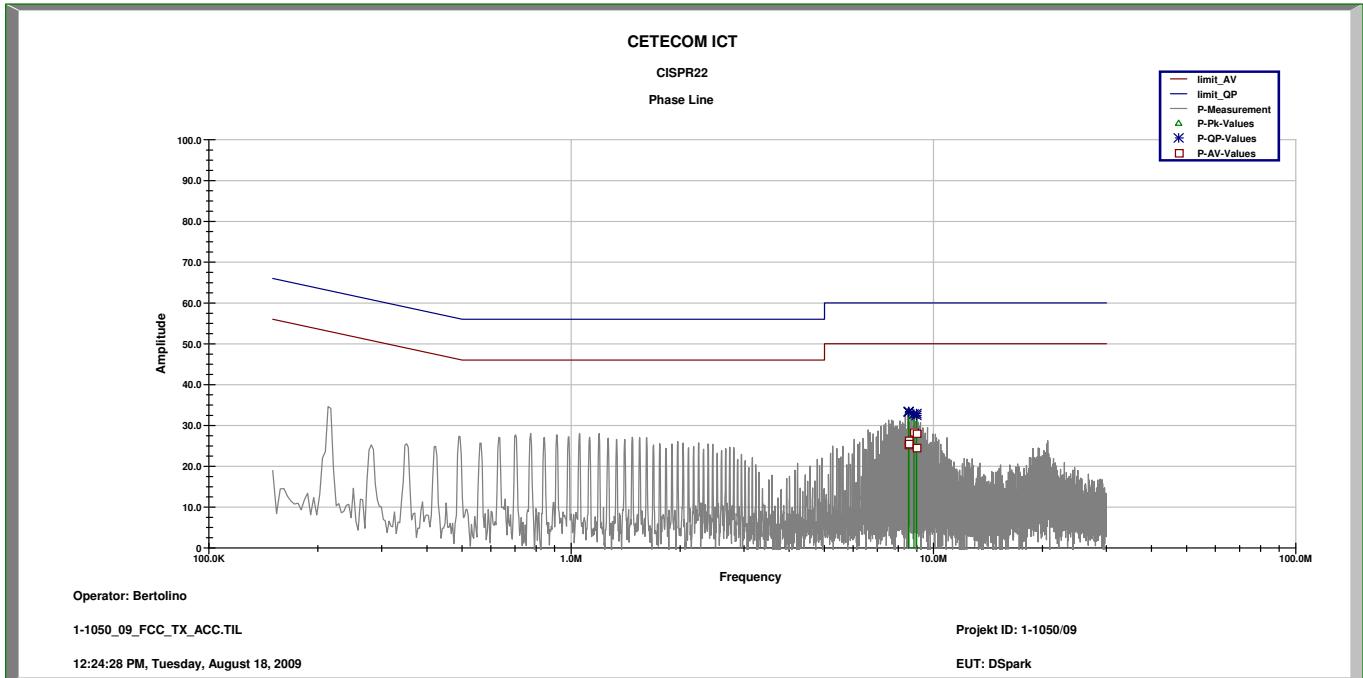
Plot 4: RX mode, EUT position 2

Limits:

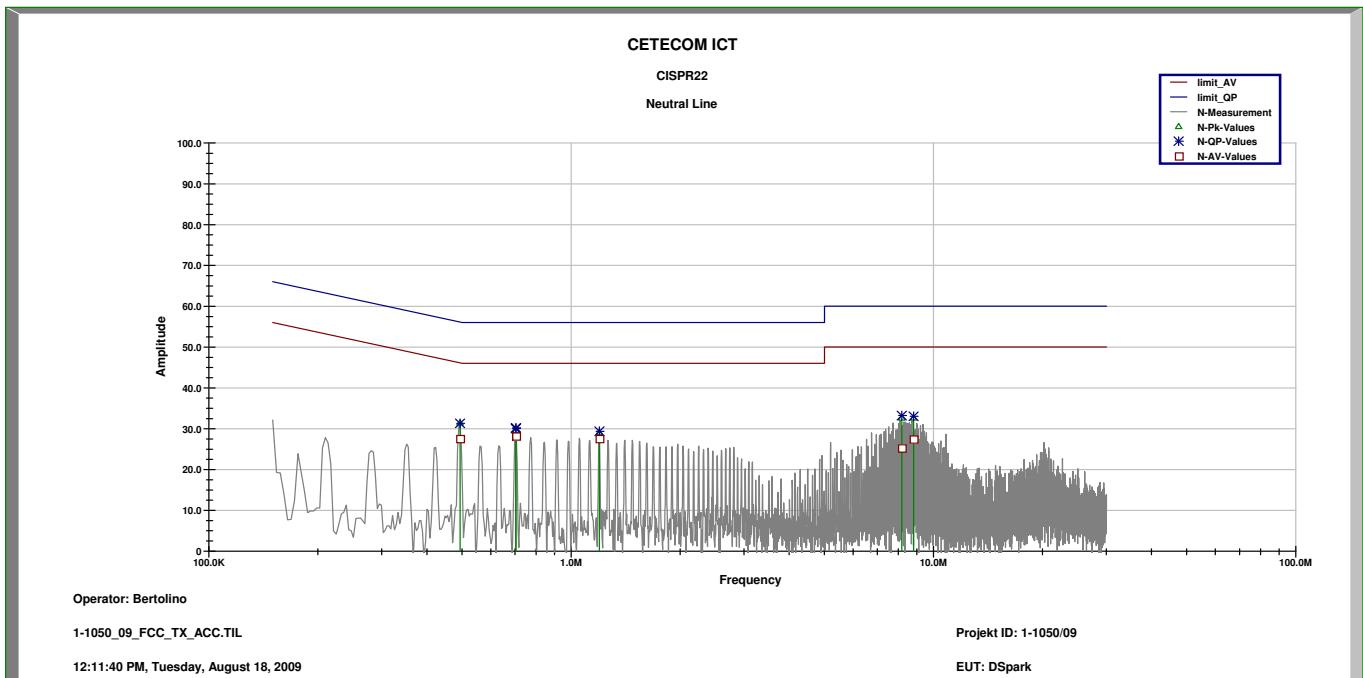
Frequency (MHz)	Field strength ( $\mu$ V/m)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30 / 29.5 dB $\mu$ V/m	30

**5.18 Conducted Emissions <30 MHz § 15.107/207**

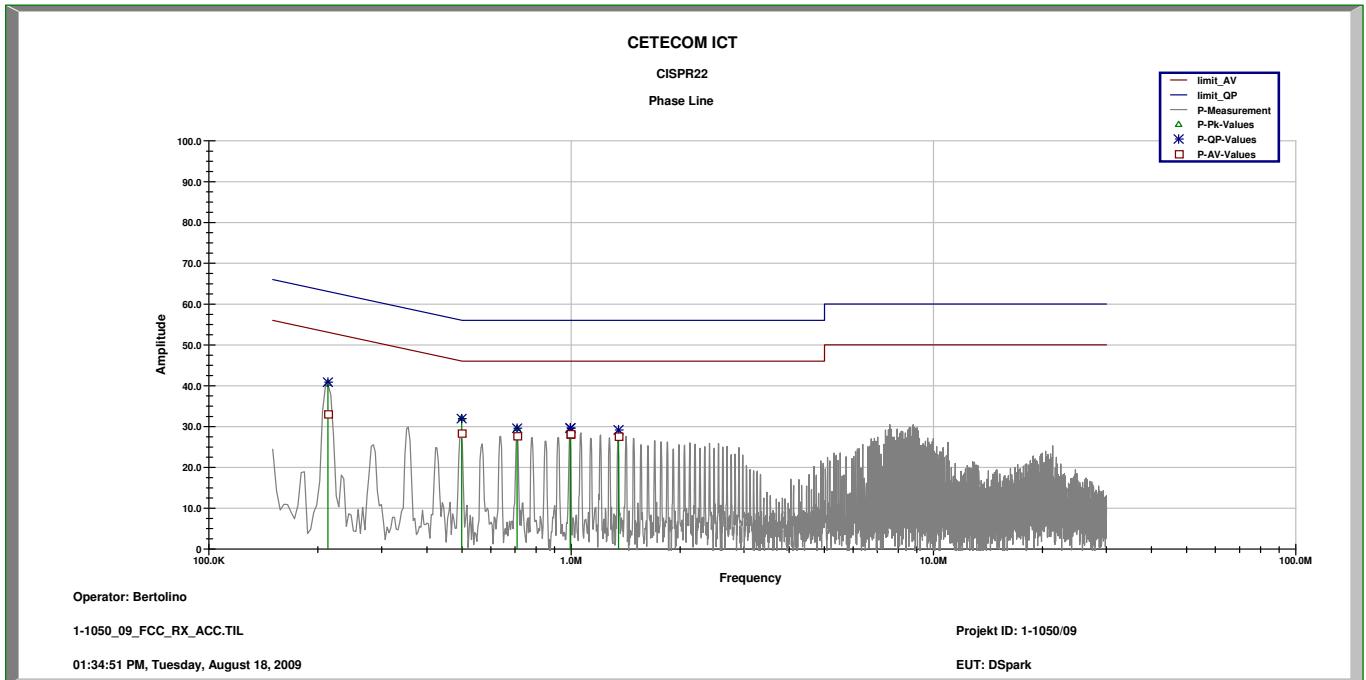
Plot 1: TX mode, Phase line



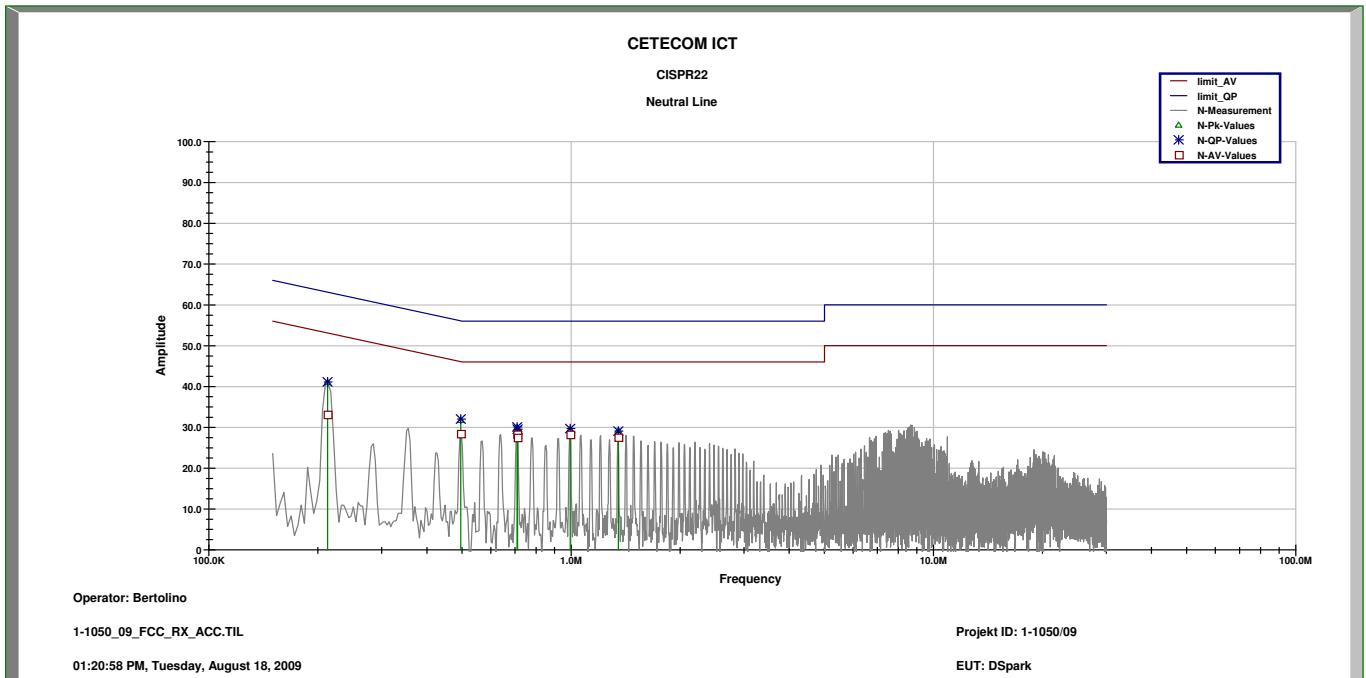
Plot 2: TX mode, Neutral line



Plot 3: RX mode, Phase line



Plot 4: RX mode, Neutral line



Limits:

Under normal test conditions only

See plots

## 6 Test equipment and ancillaries used for tests

To simplify the identification on each page of the test equipment used, on each page of the test report, each item of test equipment and ancillaries such as cables are identified (numbered) by the Test Laboratory, below.

All reported calibration intervals are calibrations according to the EN/ISO/IEC 17025 standard. These calibrations were performed from an accredited external calibration laboratory.

Additional to these calibrations the laboratory performed comparison measurements with other calibrated systems and performed a weekly chamber inspection.

All used devices are connected with a 10 MHz external reference.

According to the manufacturers' instruction is it possible to establish a calibration interval for the FSP unit of 24 month, if the device has an external 10 MHz reference.

### *Anechoic chamber C:*

No	Equipment/Type	Manuf.	Serial Nr.	Inv. No. Cetecom	Last Calibration	Frequency (months)	Next Calibration
1	Anechoic chamber	MWB	87400/02	300000996	Monthly verification		
2	System-Rack 85900	HP I.V.	*	300000222	n.a.		
3	Measurement System 1						
4	PSA-Spektrumanalysator 3 Hz - 26.5 GHz (E4440A)	Agilent	MY48250080	300003812	05.08.2008	24	05.08.2010
5	EMI Preselector 9 kHz - 1 GHz (N9039A)	Agilent	MY48260003	300003825	19.08.2008	24	19.08.2010
6	Microwave Analog Signal Generator (N5183A)	Agilent	MY47420220	300003813	06.08.2008	24	06.08.2010
7	PC	F+W			n.a.		
8	TILE	TILE			n.a.		
9	TRILOG Super Broadband Antenna (VULB9163)	Schwarzbeck	371	300003854	Monthly verification (System cal.)		
10	Double Ridged Antenna 3115	EMCO	3088	300001032	Monthly verification (System cal.)		
11	Active Loop Antenna 6502	EMCO	2210	300001015	Monthly verification (System cal.)		
12	Switch / Control Unit 3488A	HP	2719A15013	300001156	n.a.		
13	Power Supply 6032A	HP	2818A03450	300001040	08.01.2009	36	08.01.2012
14	Busisolator	Kontron		300001056	n.a.		
15	Leitungsteiler 11850C	HP		300000997	Monthly verification (System cal.)		
16	Power attenuator 8325	Byrd	1530	300001595	Monthly verification (System cal.)		
17	Band reject filter WRCG1855/1910	Wainwright	7	300003350	Monthly verification (System cal.)		
18	Band reject filter WRCG2400/2483	Wainwright	11	300003351	Monthly verification (System cal.)		
19	Hochpassfilter WHK1.1/15G-10SS	Wainwright	3	300003255	Monthly verification (System cal.)		
20	Hochpassfilter WHKX2.9/18G-12SS	Wainwright	1	300003492	Monthly verification (System cal.)		
21	Hochpassfilter WHKX7.0/18G-8SS	Wainwright	18	300003789	Monthly verification (System cal.)		
22	Switch / Control Unit 3488A	HP	2605e08770	300001443	n.a.		
23	Trenntrafo RT5A	Grundig	9242	300001263	n.a.		
24	Relais Matrix PSU	R&S	890167/024	300001168	n.a.		
25	Netznachbildung ESH3-Z5	R&S	828576/020	300001210	n.a.		

**System Rack Room 005:**

No	Equipment/Type	Manuf.	Serial Nr.	Inv. No. Cetecom	Last Calibration	Frequency (months)	Next Calibration
1	FSP 30	R&S	100886	300003575	25.08.2008	24	25.08.2010
2	CBT	R&S	100313	300003516	03.09.2008	24	03.09.2010
3	Switch Matrix	HP		300000929	n.a.		
4	Power Supply 6625A	HP	3041A00544	300002270	13.05.2007	36	13.05.2010
5	Signal Generator SMIQ03B	R&S	836206/0092	300002680	30.05.2007	36	30.05.2010

**Signalling Units:**

No	Equipment/Type	Manuf.	Serial Nr.	Inv. No. Cetecom	Last Calibration	Frequency (months)	Next Calibration
1	CBT	R&S	100313	300003516	03.09.2008	24	03.09.2010
2	CBT	R&S	100185	300003416	27.08.2008	24	27.08.2010
3	CMU-200	R&S	103992	300003231	04.06.2008	12	04.06.2009
4	CMU-200	R&S	106240	300003321	27.08.2008	24	27.08.2010
5	CMU-200	R&S	832221/0055	300002862	20.03.2008	24	20.03.2010

**Climatic Box:**

No	Equipment/Type	Manuf.	Serial Nr.	Inv. No. Cetecom	Last Calibration	Frequency (months)	Next Calibration
1	Climatic box VT 4002	Heraeus Vötsch	58566046820010	300003019	28.05.2009	24	28.05.2011
2	Climatic box CTS T-40/50	CTS	064023	300003540	04.06.2009	24	04.06.2011

**Test laboratory 011:**

No	Equipment/Type	Manuf.	Serial Nr.	Inv. No. Cetecom	Last Calibration	Frequency (months)	Next Calibration
1	Climatic box VUK 04/500	Heraeus Vötsch	32678	300000297	29.07.2008	24	27.07.2010
2	Spectrum Analyser 8565E	HP	3738A00773	300001665	08.01.2008	24	08.01.2010
3	Spectrum Analyser FSU 50	R&S	200012	300003443	05.06.2008	24	05.06.2010
4	SGH 12 ... 18 GHz	narda	01005	300000787	cyclic verification		
5	SGH 18 ... 27 GHz	narda	01005	300000487	cyclic verification		
6	SGH 27 ... 40 GHz	narda	82016	300000510	cyclic verification		
7	SGH 33 ... 50 GHz	Thomson		300000812	cyclic verification		
8	Adapter WG/SMA	narda	64088	-/-	cyclic verification		
9	Adapter WG/SMA	flann	213	-/-	cyclic verification		
10	Adapter WG/SMA	HP	00231	-/-	cyclic verification		
11	SGH 50 ... 75GHz	Thomson	-/-	300000813	cyclic verification		
12	Mixer 50 ... 75 GHz	11970V	HP	-/-	30000781i	07.08.2007	36
13	SGH 75 ... 110 GHz	Thomson	-/-	30000798b	cyclic verification		
14	Mixer 75 ... 110 GHz	11970W	HP	-/-	30000781e	07.08.2007	36
15	SGH 110 ... 170 GHz	Flann	-/-	300001999	cyclic verification		
16	Mixer 110 ... 170 GHz	Tektronix	B010186	300001685d	cyclic verification		
17	SGH 170 ... 325 GHz	Flann	-/-	300002000	cyclic verification		
18	Mixer 170 ... 325 GHz	Tektronix	B010241	300001685j	cyclic verification		

SRD Laboratory Room 005:

No	Equipment/Type	Manuf.	Serial Nr.	Inv. No. Cetecom	Last Calibration	Frequency (months)	Next Calibration
1	Spektrum Analyzer 8566B	HP	2747A05275	300000219	18.01.2008	24	18.01.2010
2	Spektrum Analyzer Display 85662A	HP	2816A16497	300001690	23.01.2008	24	23.01.2010
3	Quasi-Peak-Adapter 85650A	HP	2811A01135	300000216	23.01.2008	24	23.01.2010
4	Power Supply	Heiden	003202	300001187	12.05.2007	36	12.05.2010
5	Power Supply	Heiden	1701	300001392	12.05.2007	36	12.05.2010

*SRD Laboratory Room 011:*

No	Equipment/Type	Manuf.	Serial Nr.	Inv. No. Cetecom	Last Calibration	Frequency (months)	Next Calibration
1	NRP Power Meter	R&S	100212	300003780	27.02.2008	24	27.02.2010

*Anechoic chamber F:*

No	Equipment/Type	Manuf.	Serial Nr.	Inv. No. Cetecom	Last Calibration	Frequency (months)	Next Calibration
1	Control Computer	F+W	FW0502032	300003303	-/-	-/-	-/-
2	Trilog Antenna VULB 9163	Schwarzbeck	295	300003787	01.04.2008	24	01.04.2010
3	Amplifier - 0518C-138	Veritech Micro-wave Inc.	-/-	-/-	-/-	-/-	-/-
4	Switch - 3488A	HP		300000368	-/-	-/-	-/-
5	EMI Test receiver - ESCI	R&S	100083	300003312	31.01.2007	24	31.01.2009
6	Turntable Controller - 1061 3M	EMCO	1218	300000661	-/-	-/-	-/-
7	Tower Controller 1051 Controller	EMCO	1262	300000625	-/-	-/-	-/-
8	Tower - 1051	EMCO	1262	300000625	-/-	-/-	-/-
10	Ultra Notch-Filter Rejected band Ch. 62	WRCD	9	-/-	-/-	-/-	-/-

***C.BER Bluetooth Rack Room AC2:***

No	Equipment/Type	Manuf.	Inv. No. Cetecom	Last Calibration	Frequency (months)	Next Calibration
1	System Controller with XP Prof. & C.BER Control Software	F&W	300003580	na		
2	GPIB to USB Converter	Agilent	300003426	na		
3	Spectrum Analyser FSIQ26	R&S	300002681-005	10.01.2008	24	10.01.2010
	Sampling System FSIQ-B70	R&S	300002681-005	s.No.3		
	Tracking Generator FSIQ-B10 for FSIQ26	R&S	300002681-005	s.No.3		
4	RF-Generator SMIQ03 (Interferer Signal)	R&S	300002681-001	25.08.2008	36	25.08.2011
	Modulation Coder SMIQ-B20	R&S	300002681-001	s.No.4		
	Data Generator SMIQ-B11	R&S	300002681-001	s.No.4		
	RF Rear Connection SMIQ-B19	R&S	300002681-001	s.No.4		
	Fast CPU SM-B50	R&S	300002681-001	s.No.4		
	FM Modulator SM-B5	R&S	300002681-001	s.No.4		
5	Rubidium Standard RUB	R&S	300002681-009	27.08.2008	24	27.08.2010
6	Switching Unit 3488A including 2 44476A cards	HP	300000926	Verified with path compensation		
	44472A VHF switch	HP	300000926	Verified with path compensation		
7	Signalling Unit: CBT with EDR	R&S	300003416	27.08.2008	24	27.08.2010
8	RF-cable set	different	no	Verified with path compensation		
9	IEEE-cables	R&S	no	na		
10	NGPE programmable Power Supply for EUT	R&S	400000078	27.08.2008	24	27.08.2010
11	Coupling Unit 4324-2	Narda	no	Verified with path compensation		
12	Climatic Chamber VT4002	Voetch	300003019	28.05.2009	24	28.05.2011
13	6 dB Attenuator 1W	Narda	no	Verified with path compensation		
14	DCBlocker 30 MHz to 12.75 GHz 1W	Narda	no	Verified with path compensation		

## 7 Photographs of the Test Set-up

Photo documentation:

Photo No. 1:



Photo No. 2:



Photo No. 3:

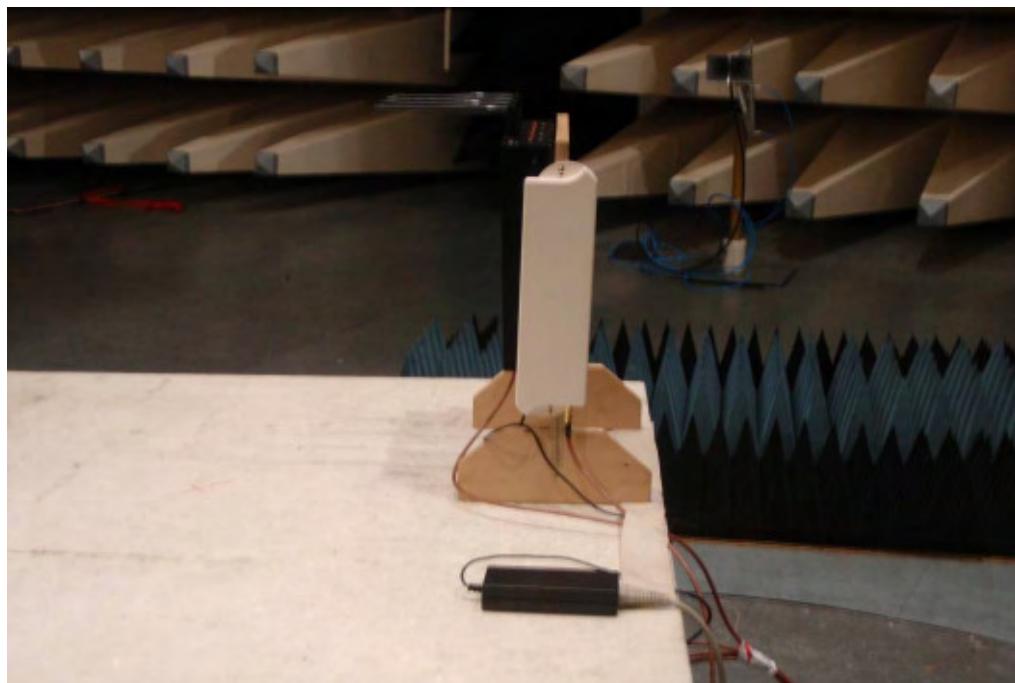


Photo No. 4:

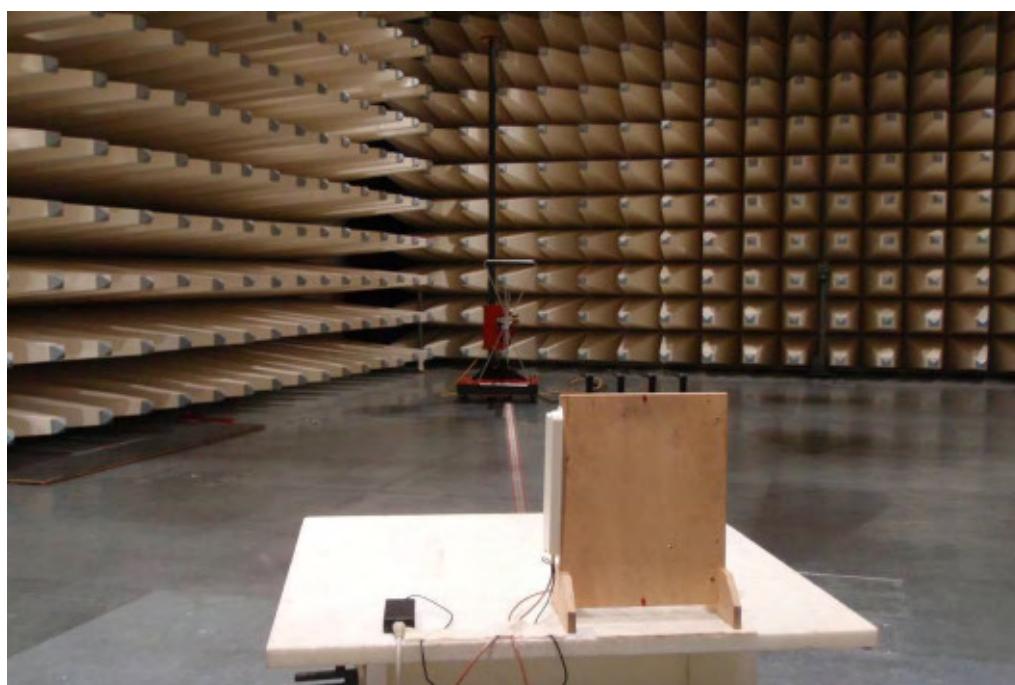


Photo No. 5:



## 8 Photographs of the EUT

Photo documentation:

Photo No. 1: DSpark

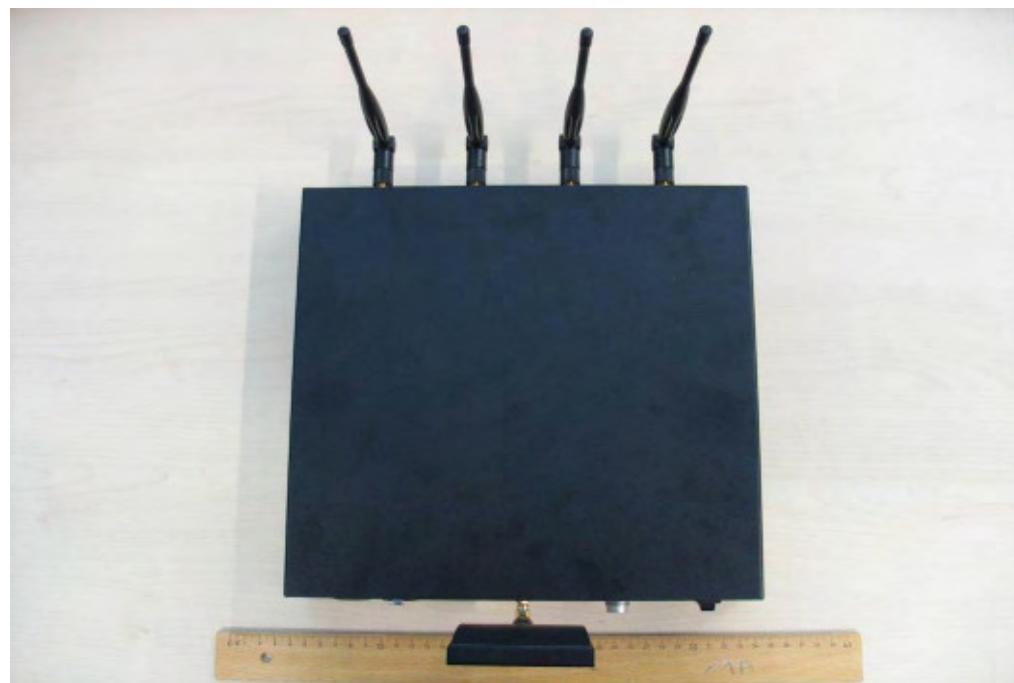


Photo No. 2: antenna 1

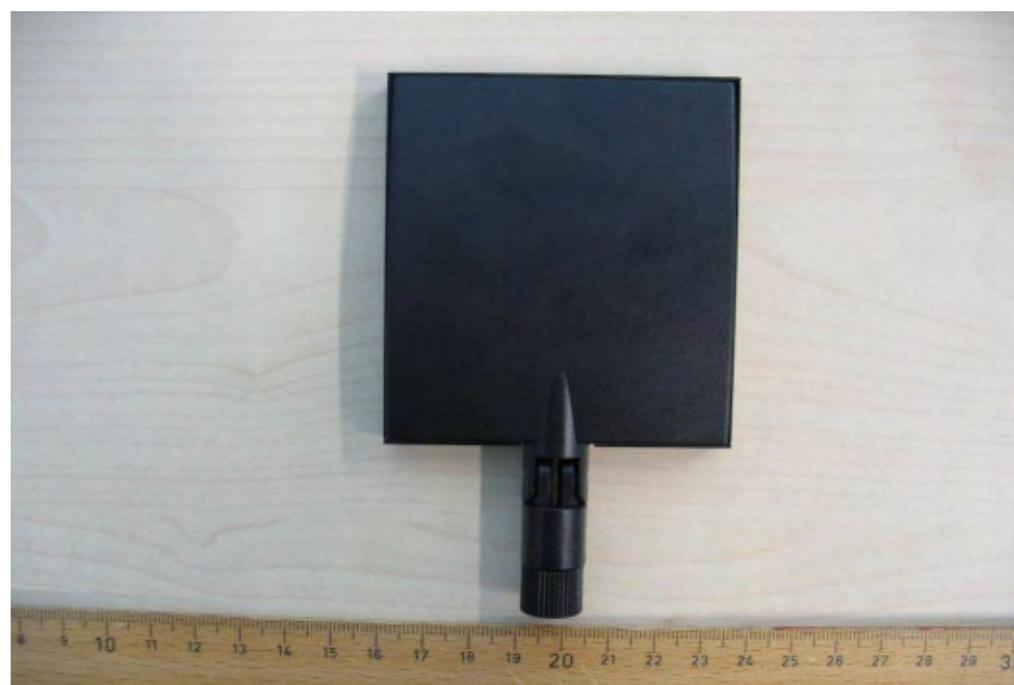


Photo No. 3: antenna 1



Photo No. 4: antenna 1



Photo No. 5: antenna 3



Photo No. 6: antenna 3



Photo No. 7: antenna 3



Photo No. 8: DSpark



Photo No. 9: DSpark



Photo No. 10: DSpark



Photo No. 11: DSpark



Photo No. 12: DSpark

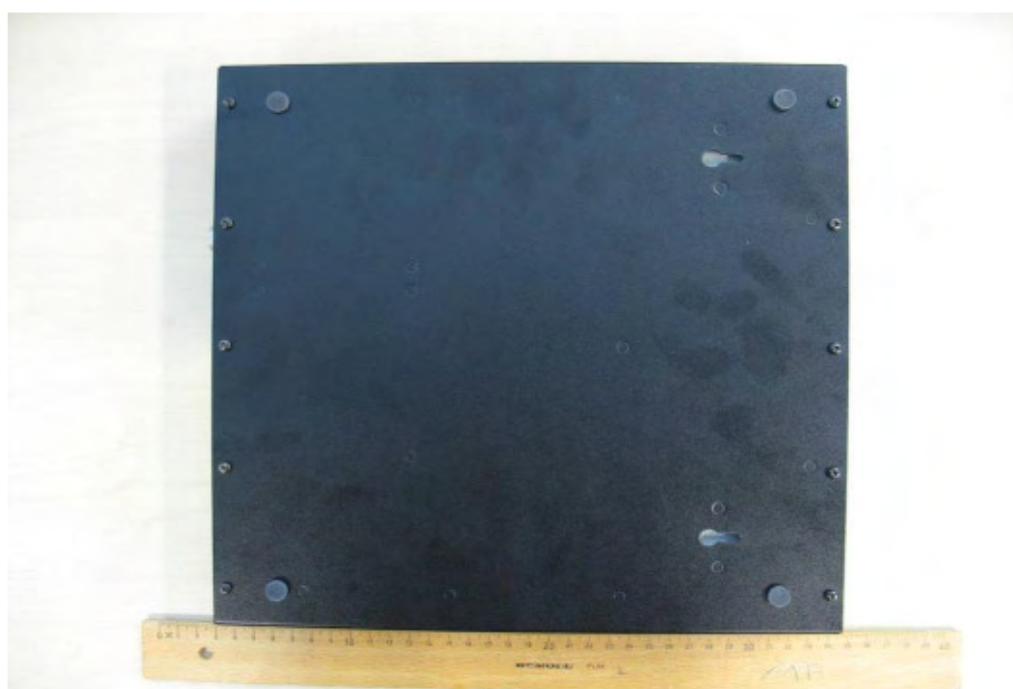


Photo No. 13: DSpark



Photo No. 14: DSpark

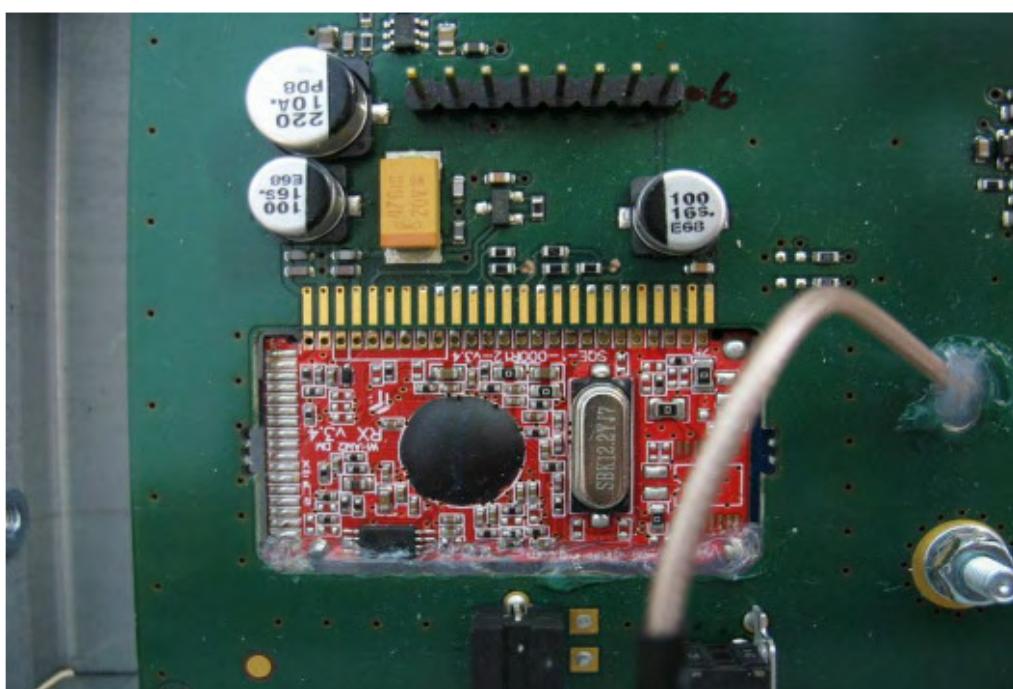


Photo No. 15: DSpark



Photo No. 16: DSpark

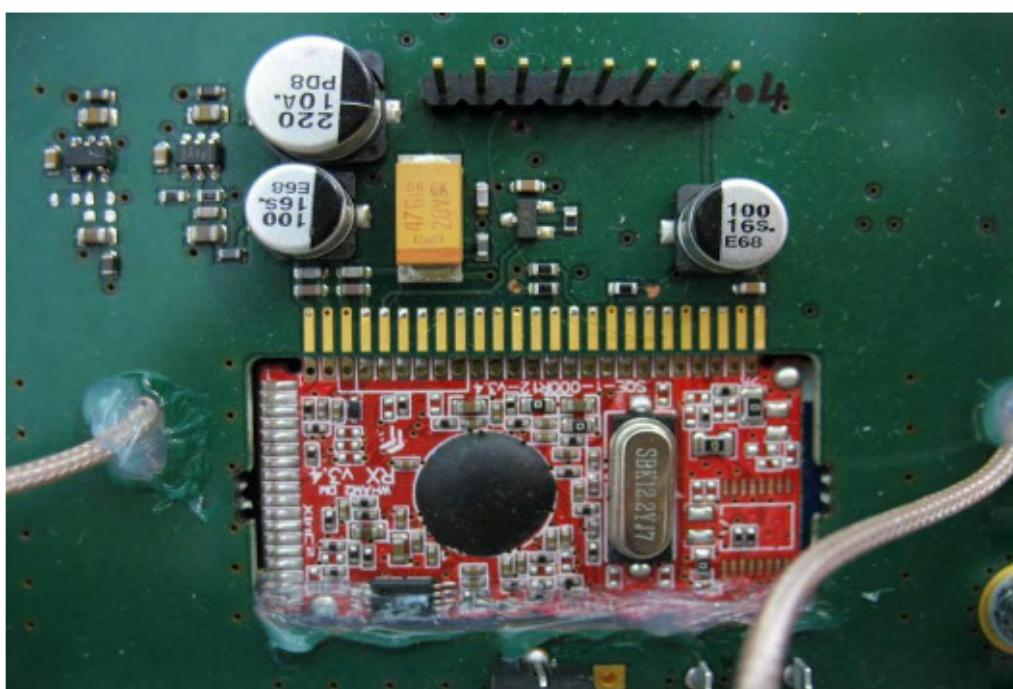


Photo No. 17: DSpark

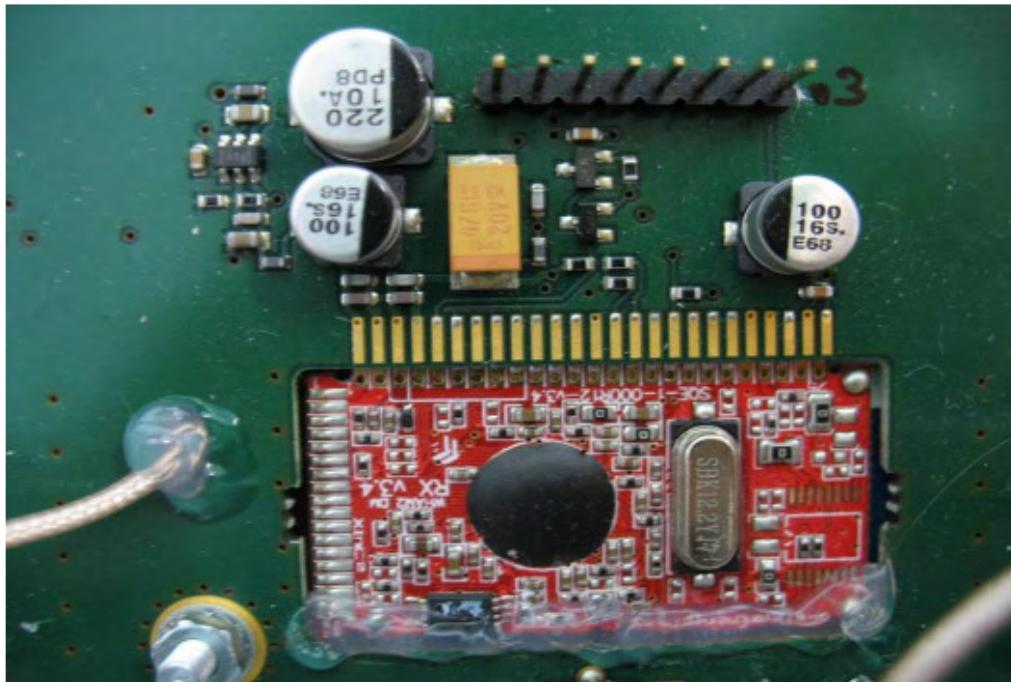


Photo No. 18: DSpark

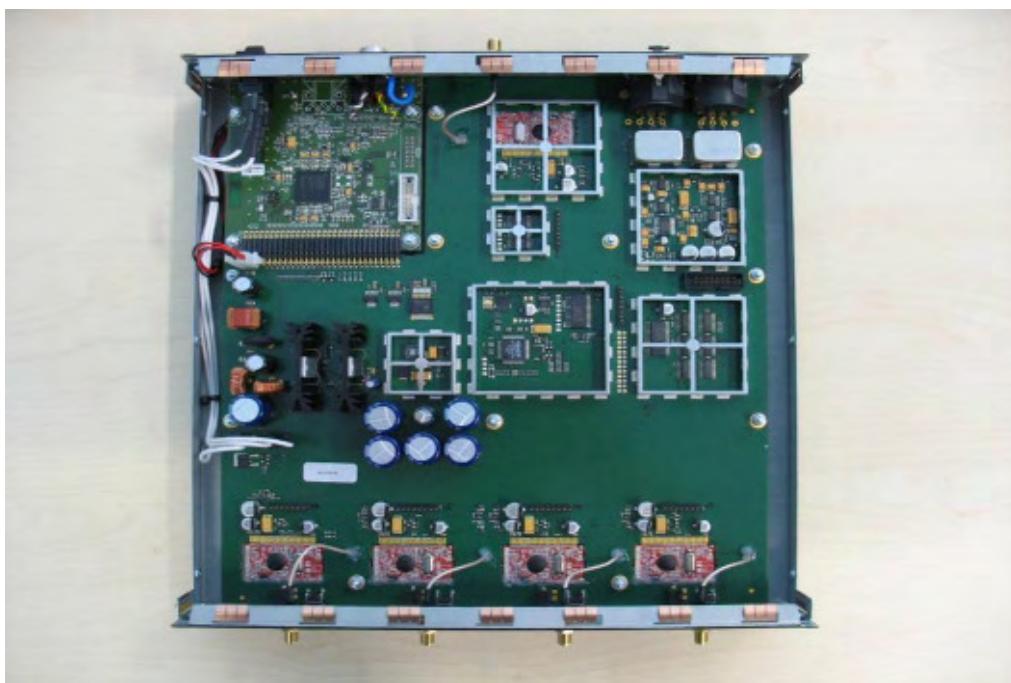


Photo No. 19: DSpark

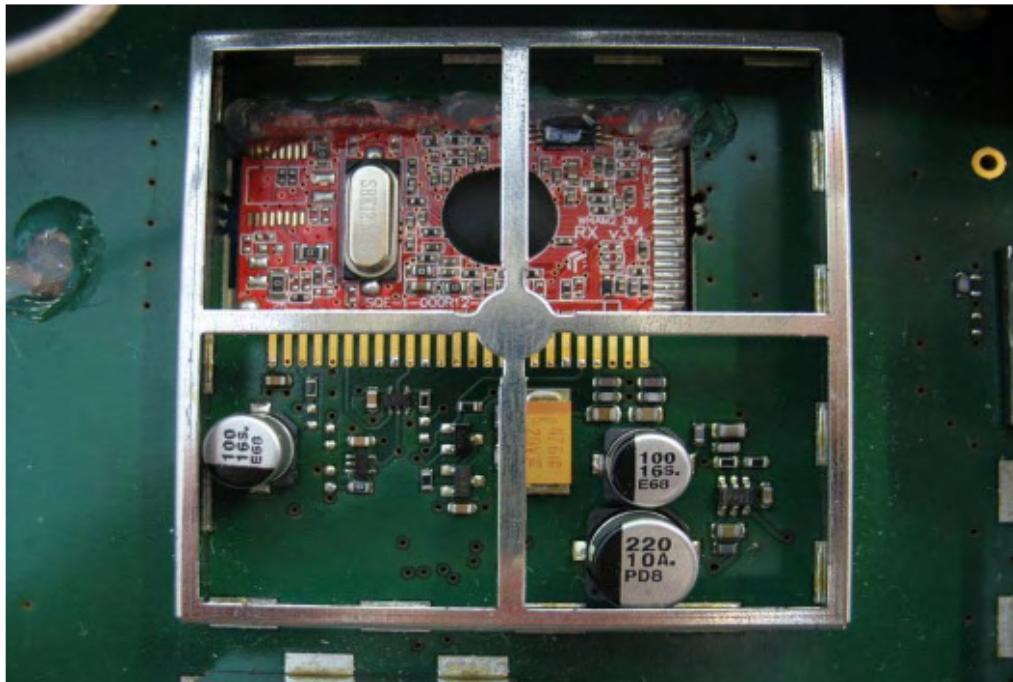


Photo No. 20: DSpark

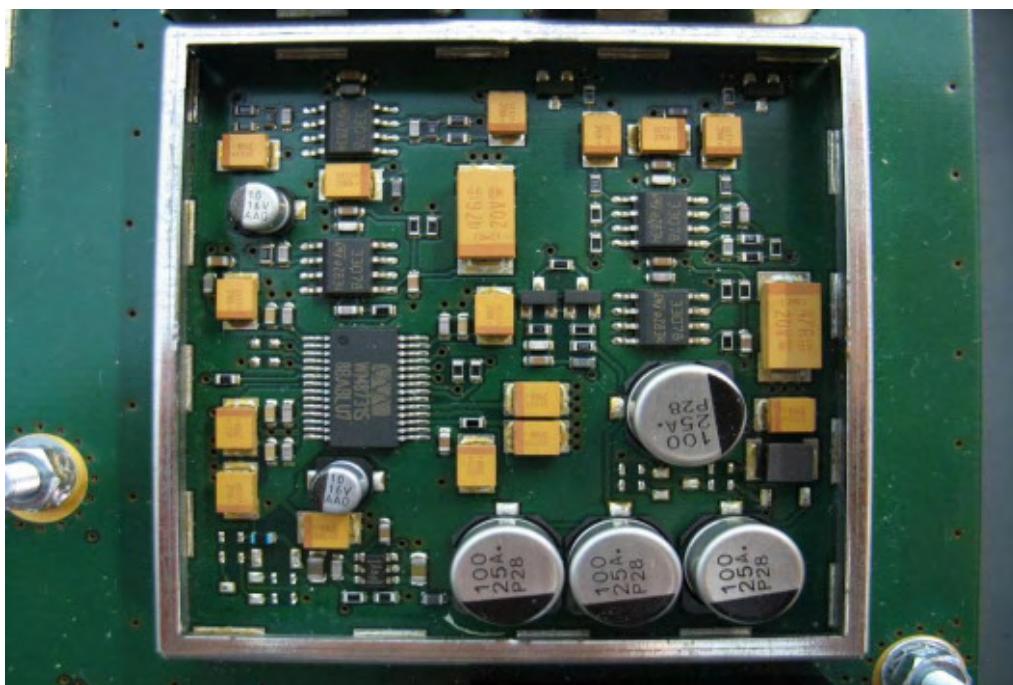


Photo No. 21: DSpark

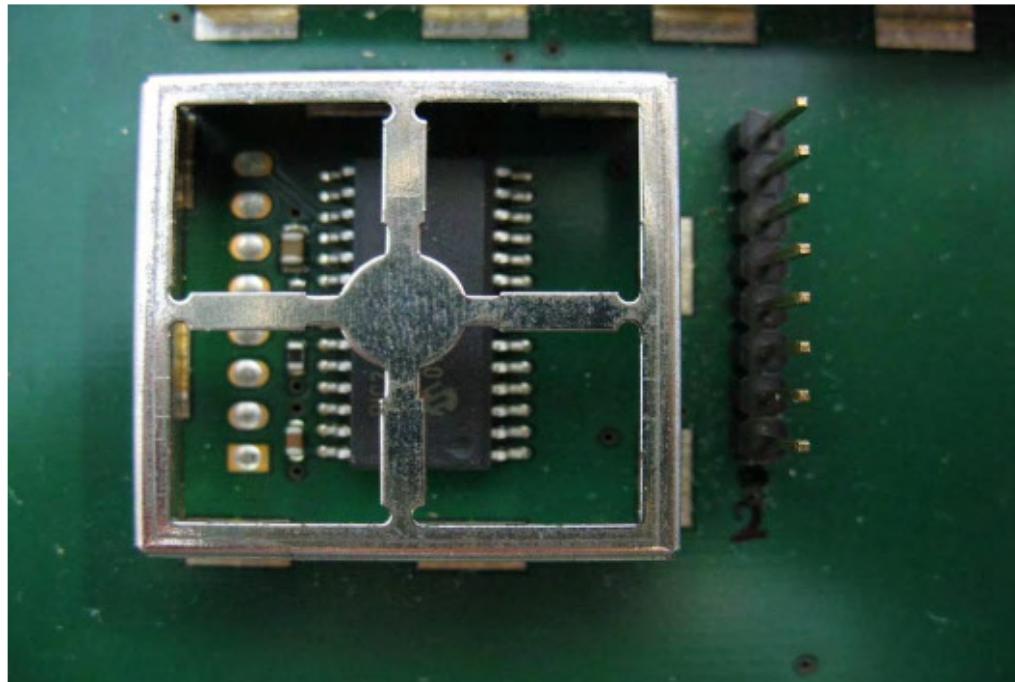


Photo No. 22: DSpark



Photo No. 23: DSpark

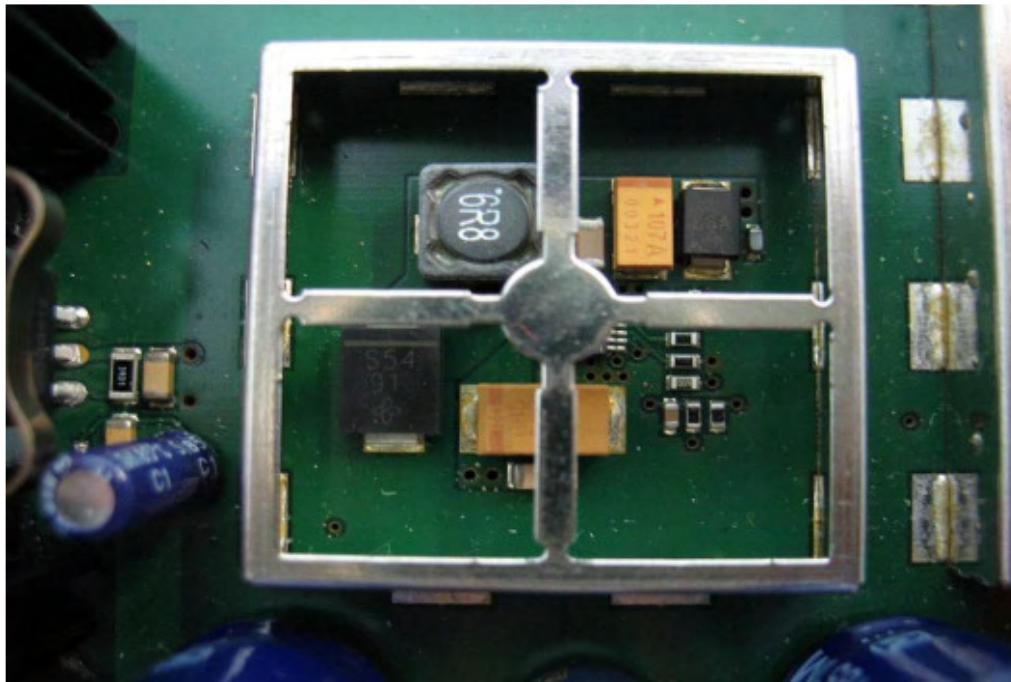


Photo No. 24: DSpark

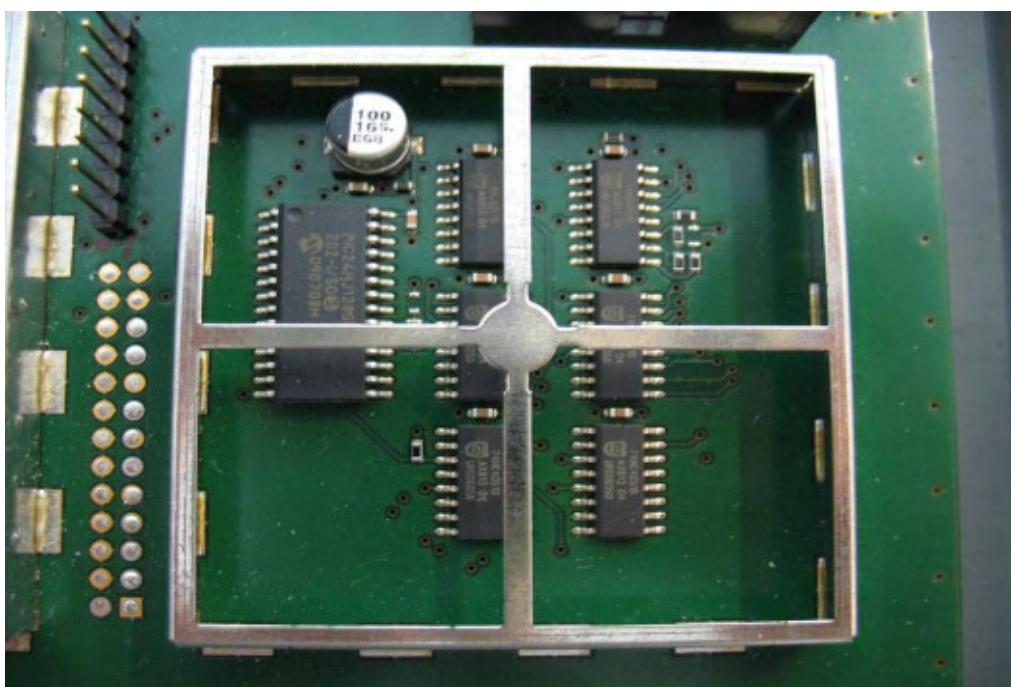


Photo No. 25: DSpark

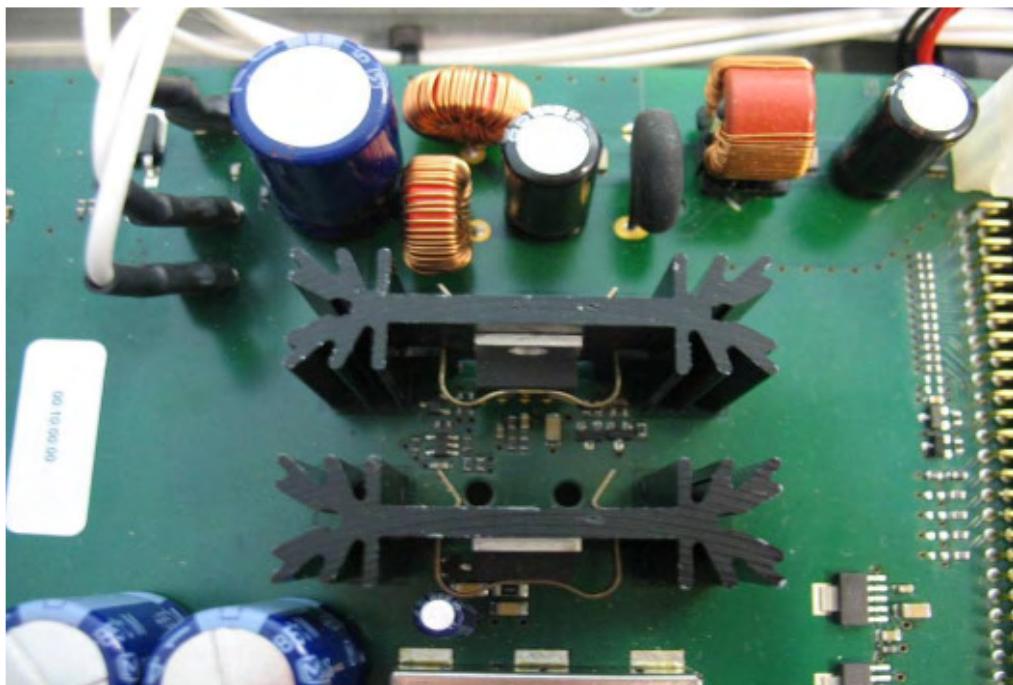


Photo No. 26: DSpark

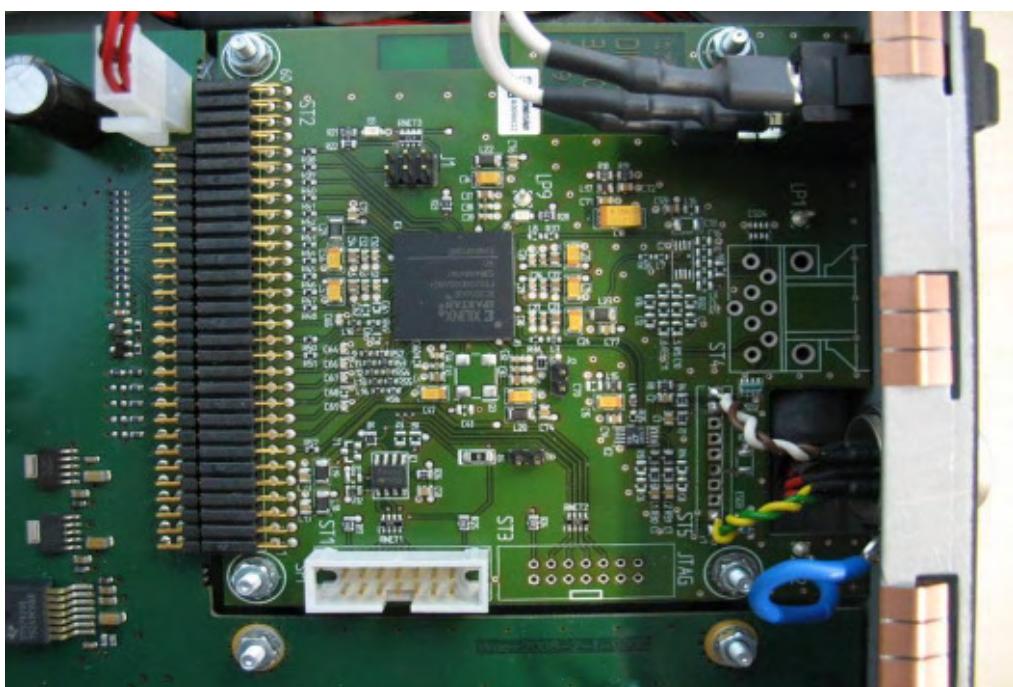


Photo No. 27: antenna 2



Photo No. 28: antenna 2



Photo No. 29: antenna 2

