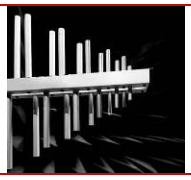
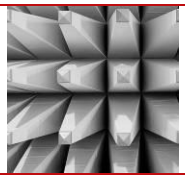

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consulting - testing - certification >>>

TEST REPORT

Test report no.: 1-7557/14-01-03

DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-01

Testing laboratory

CETECOM ICT Services GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
Phone: + 49 681 5 98 - 0
Fax: + 49 681 5 98 - 9075
Internet: http://www.cetecom.com
e-mail: ict@cetecom.com

Accredited Testing Laboratory:
The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)
The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-01
Area of Testing:
Radio Communications & EMC (RCE)

Applicant

RSI Video Technologies
Siège Social -Headquarters
25 rue Jacobi-Netter
67200 Strasbourg / FRANCE
Phone: +33 3 90 20 66 96
Fax: -/-
Contact: Geoffroy Eude
e-mail: geoffroy.eude@rsivideotech.com
Phone: +33 3 90 20 66 39

Manufacturer

RSI Video Technologies
Siège Social -Headquarters
25 rue Jacobi-Netter
67200 Strasbourg / FRANCE

Test standard/s

47 CFR Part 15	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 210 Issue 8	Spectrum Management and Telecommunications Radio Standards Specification - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item:	**Badge reader**
Model name:	**BR651**
FCC ID:	**X46BR51**
IC:	**8816A-BR51**
Frequency:	902 MHz – 928 MHz (Lowest channel 904.5 MHz; Highest channel 926.1 MHz)
Technology tested:	Proprietary system
Antenna:	Integrated antenna
Power supply:	3.6 V DC by Lithium battery
Temperature range:	-10°C to +55°C

This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Test report authorised:

cn=Marco Bertolino, o=CETECOM ICT Services GmbH, ou=BTL-100826, email=marco.bertolino@cetecom.com, c=DE
2014.02.18 15:47:33 +01'00'

Marco Bertolino
Testing Manager

Test performed:

cn=Stefan Boes, o=CETECOM ICT Services GmbH, ou=BOE-111011, email=Stefan.Boes@cetecom.com, c=DE
2014.02.18 15:53:19 +01'00'

Stefan Bös
Senior Testing Manager

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2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.
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In no case this test report can be considered as a Letter of Approval.

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

2.2 Application details

Date of receipt of order:	2014-01-24
Date of receipt of test item:	2014-02-11
Start of test:	2014-02-11
End of test:	2014-02-13
Person(s) present during the test:	-/-

3 Test standard/s

Test standard	Date	Test standard description
47 CFR Part 15	-/-	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 210 Issue 8	01.12.2010	Spectrum Management and Telecommunications Radio Standards Specification - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

4 Test environment

Temperature:	T_{nom}	+22 °C	during room temperature tests
	T_{max}	+55 °C	during high temperature tests
	T_{min}	-10 °C	during low temperature tests
Relative humidity content:		56 %	
Barometric pressure:		not relevant for this kind of testing	
Power supply:	V_{nom}	3.6 V	DC by Lithium battery
	V_{max}	4.2 V	
	V_{min}	3.3 V	

5 Test item

Kind of test item	**:**	**Badge reader**
Type identification	**:**	**BR651**
S/N serial number	**:**	**Cond.: 40400314820A0001** **Rad.: 40400314820A0002**
HW hardware status	**:**	**5CA1254B-0b**
SW software status	**:**	**05.40.95.61**
Frequency band [MHz]	**:**	**902 MHz – 928 MHz** **(Lowest channel 904.5 MHz; Highest channel 926.1 MHz)**
Type of radio transmission **Use of frequency spectrum**	**:** **:**	**FHSS**
Type of modulation	**:**	**FSK**
Number of channels	**:**	**25**
Antenna	**:**	**Integrated antenna**
Power supply	**:**	**3.6 V DC by Lithium battery**
Temperature range	**:**	**-10°C to +55 °C**

5.1 Additional information

Test setup- and EUT-photos are included in test report 1-7557_14-01-01_AnnexA
1-7557_14-01-01_AnnexB
1-7557_14-01-01_AnnexD

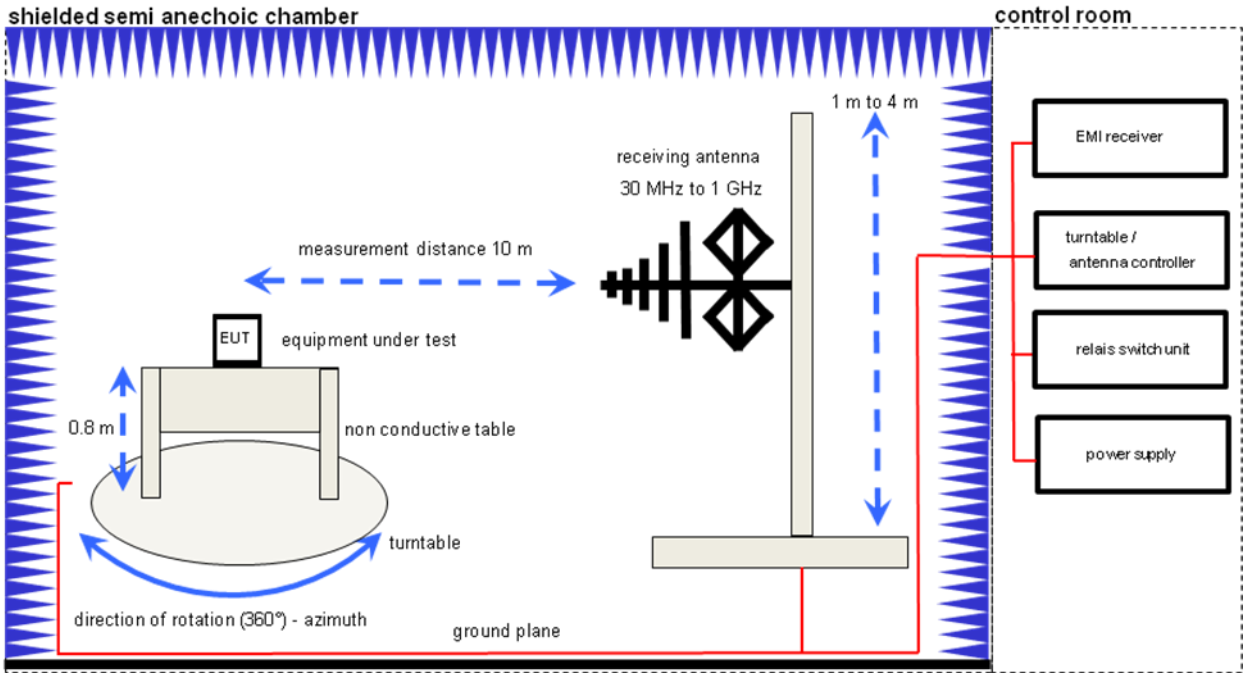
6 Test laboratories sub-contracted

None

7 Description of the test setup

7.1 Radiated measurements chamber F

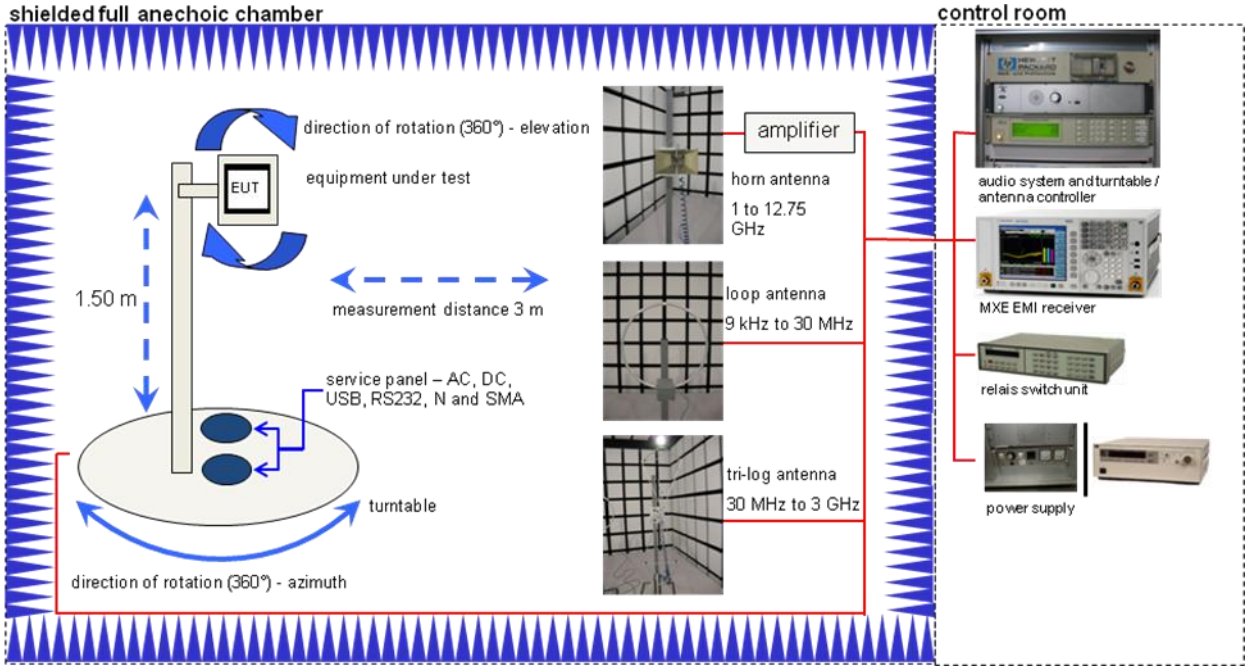
The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are confirmed with specifications ANSI C63. 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.



Equipment table:

Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom
Switch-Unit	3488A	HP Meßtechnik	2719A14505	300000368
DC power supply, 60Vdc, 50A, 1200 W	6032A	HP Meßtechnik	2920A04466	300000580
EMI Test Receiver	ESCI 3	R&S	100083	300003312
Amplifier	JS42-00502650-28-5A	MITEQ	1084532	300003379
Antenna Tower	Model 2175	ETS-LINDGREN	64762	300003745
Positioning Controller	Model 2090	ETS-LINDGREN	64672	300003746
Turntable Interface-Box	Model 105637	ETS-LINDGREN	44583	300003747
TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787

7.2 Radiated measurements chamber C



Equipment table:

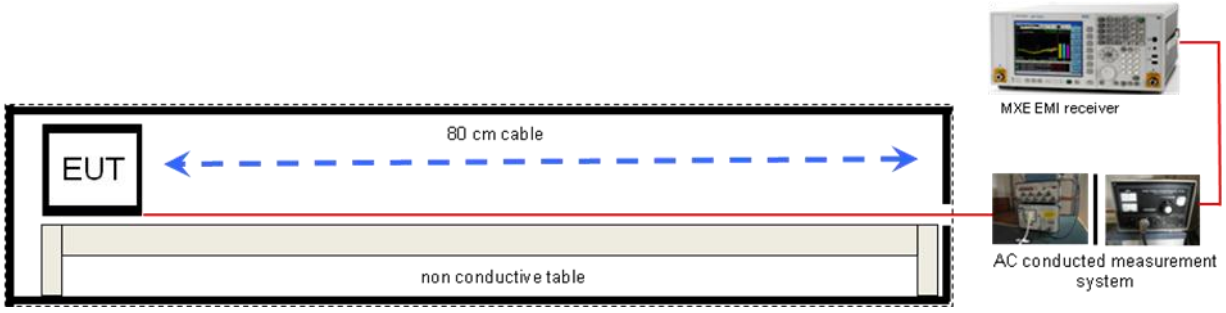
Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom
MXE EMI Receiver 20 Hz bis 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405
TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854
Band Reject filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	11	300003351
Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789
Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032
Active Loop Antenna	6502	EMCO	8905-2342	300000256
Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996
Switch / Control Unit	3488A	HP Meßtechnik	*	300000199
Switch / Control Unit	3488A	HP Meßtechnik	2719A15013	300001156
Isolating Transformer	MPL IEC625 Bus Regeltrenntravo	Erfi	91350	300001155
Three-Way Power Splitter, 50 Ohm	11850C	HP Meßtechnik		300000997
Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143

7.3 Radiated measurements 12.75 GHz to 25 GHz

Equipment table:

Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom
Std. Gain Horn Antenna 12.4 to 18.0 GHz	639	Narda	8402	300000787
Std. Gain Horn Antenna 18.0 to 26.5 GHz	638	Narda	8205	300002442
Microwave System Amplifier, 0.5-26.5 GHz	83017A	HP Meßtechnik	00419	300002268
Spectrum Analyzer 20 Hz - 50 GHz	FSU50	R&S	200012	300003443
Signal Analyzer 40 GHz	FSV40	R&S	101042	300004517

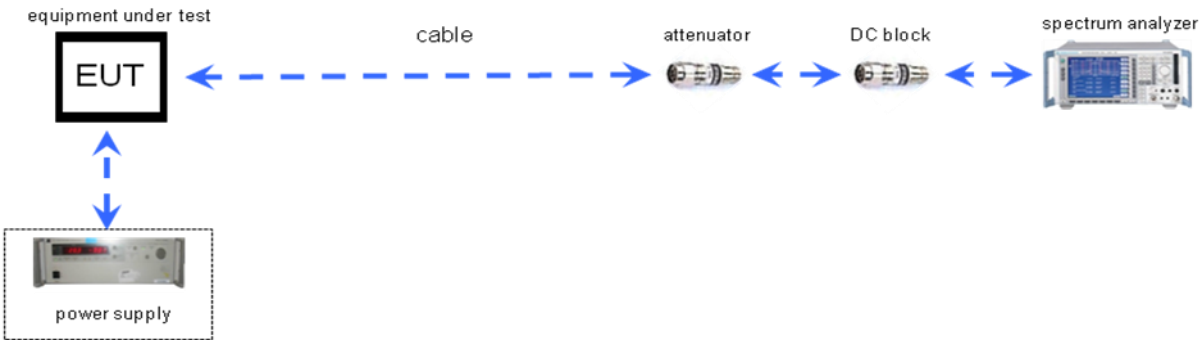
7.4 AC conducted



Equipment table:

Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom
MXE EMI Receiver 20 Hz bis 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405
Isolating Transformer	MPL IEC625 Bus Regeltrenntravo	Erfi	91350	300001155
Switch / Control Unit	3488A	HP Meßtechnik	*	300000199
Switch / Control Unit	3488A	HP Meßtechnik	2719A15013	300001168
Artificial Mains 9 kHz to 30 MHz	ESH3-Z5	R&S	828576/020	300001210

7.5 Conducted measurements



Equipment table:

Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom
Signal Analyzer 40 GHz	FSV40	R&S	101042	300004517

8 Summary of measurement results

☒	**No deviations from the technical specifications were ascertained**
☐	There were deviations from the technical specifications ascertained

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	CFR Part 15 RSS 210, Issue 8	Passed	2014-02-18	-/-

Test specification clause	Test case	Temperature conditions	Power source voltages	Mode	Pass	Fail	NA	NP	Results (max.)
§15.247(b)(4)	Antenna Gain	Nominal	Nominal	TX	☒	☐	☐	☐	complies
§15.247(a)(1) (i) RSS-210 A8.1 (b)	Carrier Frequency Separation	Nominal	Nominal	TX	☒	☐	☐	☐	complies
§15.247(a)(1)(i) RSS-210 A8.1 (c)	Number of Hopping channels	Nominal	Nominal	TX	☒	☐	☐	☐	complies
§15.247(a)(1)(i) RSS-210 A8.1 (c)	Average Time of Occupancy (Dwell Time)	Nominal	Nominal	TX	☒	☐	☐	☐	complies
§15.247(a)(1)(i) RSS-210 A8.1 (c)	20dB Bandwidth	Nominal	Nominal	TX	☒	☐	☐	☐	complies
§15.247(b)(2) RSS-210 A8.4 (1)	Maximum Output Power Radiated	Nominal	Nominal	TX	☒	☐	☐	☐	complies
§15.247(b)(4) RSS-210 A8.4 (1)	Maximum Output Power Conducted	Nominal	Nominal	TX	☒	☐	☐	☐	complies
§15.247(d) §15.205(a)	Band-edge Compliance	Nominal	Nominal	TX	☒	☐	☐	☐	complies
§15.247(d)	TX Spurious Emission Conducted	Nominal	Nominal	TX	☒	☐	☐	☐	complies
§15.209(a)	TX Spurious Emission Radiated < 30 MHz	Nominal	Nominal	TX	☒	☐	☐	☐	complies
§15.247(d) §15.209 A8.5	TX Spurious Emission Radiated > 30 MHz	Nominal	Nominal	TX	☒	☐	☐	☐	complies
§15.109 §15.207	RX Spurious Emissions Radiated	Nominal	Nominal	Idle	☒	☐	☐	☐	complies

Note: NA = Not Applicable; NP = Not Performed

9 RF measurements

9.1 Additional comments

Reference documents: None

Special test descriptions: None

Configuration descriptions: None

Test mode: ☒ Special software is used.
EUT is transmitting pseudo random data by itself

9.2 RSP100 test report cover sheet / performance test data

Test report number	**:**	**1-7557/14-01-03**
Equipment model number	**:**	**BR651**
Certification number	**:**	**8816A-BR51**
Manufacturer (complete address)	**:**	**RSI Video Technologies Siège Social -Headquarters 25 rue Jacobi-Netter 67200 Strasbourg / FRANCE**
Tested to radio standards specification no.	**:**	**RSS 210, Issue 8**
Open area test site IC No.	**:**	**IC 3462C-1**
Frequency range	**:**	**ISM band 902 MHz to 928 MHz (lowest channel 904.5 MHz, highest channel 926.1 MHz)**
RF-power [W] (max.)	**:**	**Cond.: 81.1 mW (FSK modulation) EIRP: 30.2 mW (FSK modulation)**
Occupied bandwidth (99%-BW) [kHz]	**:**	**302 (FSK modulation)**
Type of modulation	**:**	**FHSS technology with FSK modulation.**
Emission designator (TRC-43)	**:**	**302KFXD (FSK modulation)**
Antenna information	**:**	**Integrated wire antenna**
Transmitter spurious (worst case) [dBµV/m @ 3m]:		**40.6 @ 2778.1 MHz**
Receiver spurious (worst case) [dBµV/m @ 3m]:		**44 dBµV/m @ 12 GHz (noise floor)**

ATTESTATION:
DECLARATION OF COMPLIANCE:

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

Laboratory manager:

2014-02-18	Stefan Bös	cn=Stefan Boes, o=CETECOM ICT Services GmbH, ou=BOE-111011, email=Stefan.Boes@cetecom.com, c=DE 2014.02.18 15:52:58 +01'00'
Date	Name	Signature

10 Measurement results

10.1 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. The measurements were performed in single carrier mode unmodulated.

RBW / VBW = 3 MHz
Detector: Peak

	Low channel 904.5 MHz	Middle channel 915.3 MHz	High channel 926.1 MHz
Conducted power [dBm]	19.08	19.12	19.05
Radiated power [dBm]	14.84	14.14	13.97
Gain [dBi]	-4.24	-4.98	-5.08

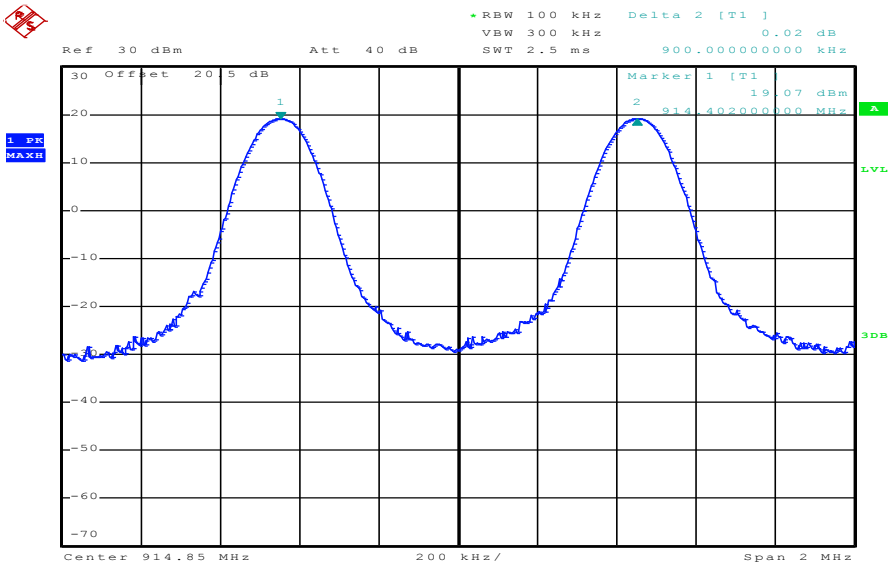
Limits:

FCC	IC
Antenna gain	
The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.	

Result: Passed

10.2 Carrier Frequency Separation

Plot 1:



Result: The channel separation is: 900 kHz

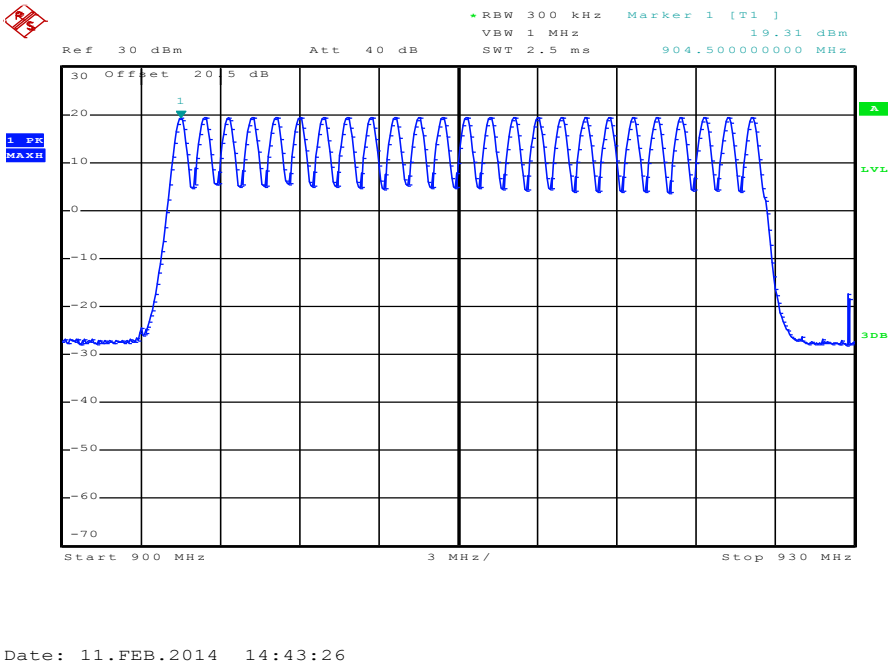
Limits:

FCC	IC
Carrier Frequency Separation	
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.	

Result: Passed

10.3 Number of Hopping Channels

Plot 1:



Result: The number of hopping channels is: 25

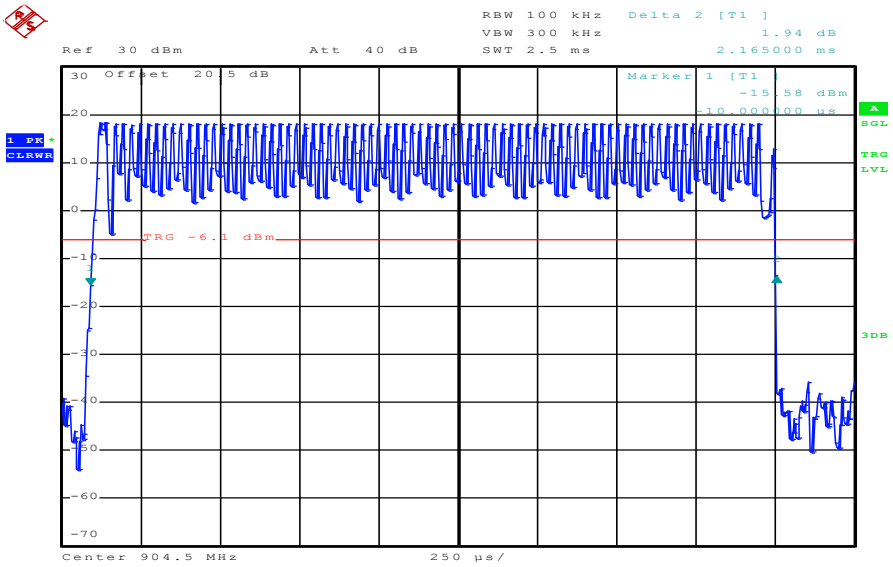
Limits:

FCC	IC
Number of Hopping Channels	
For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies.	

Result: Passed

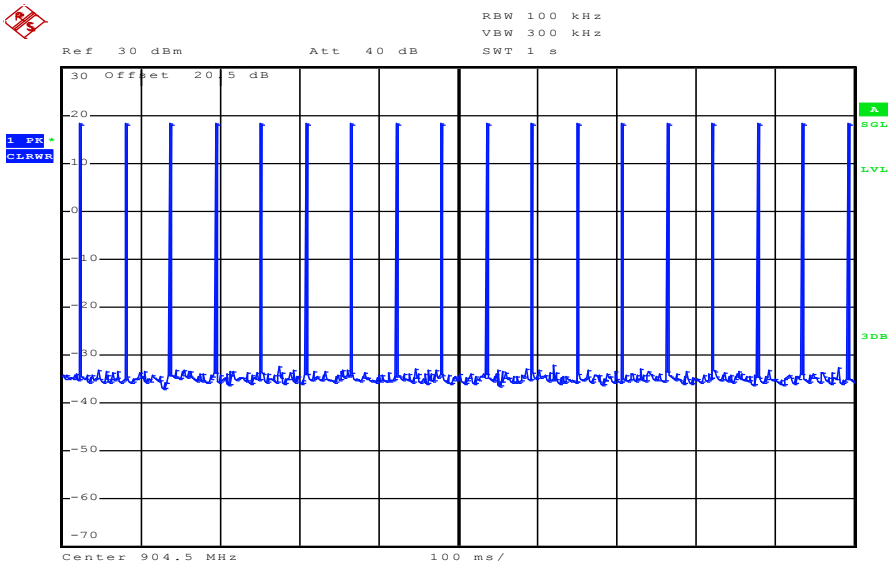
10.4 Average Time of Occupancy

Plot 1: Time slot length = 2.165 ms



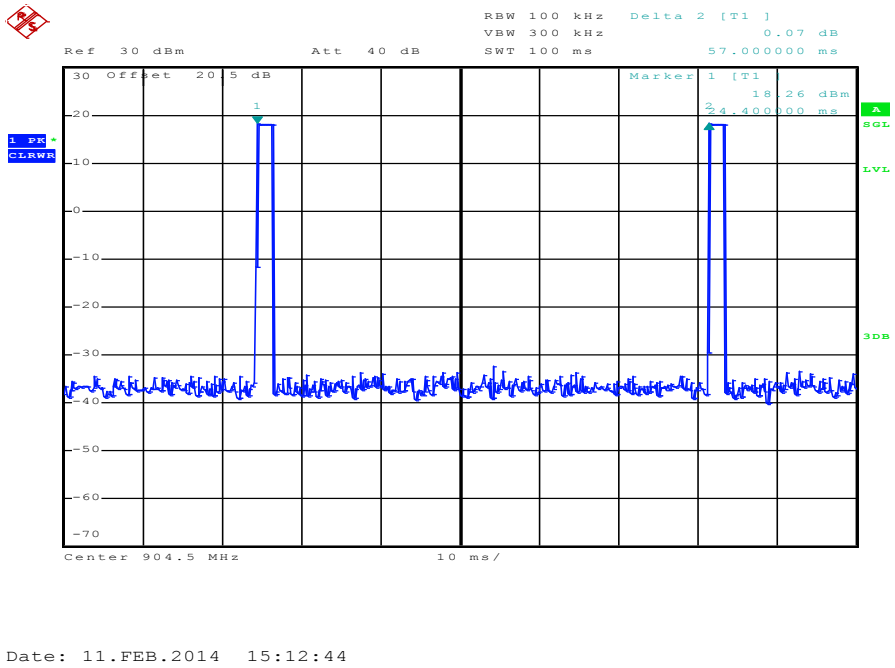
Date: 11.FEB.2014 15:15:26

Plot 2: hops / channel @ 1s = 18



Date: 11.FEB.2014 15:10:48

Plot 3: Zoom



Result: The time slot length is = 2.165 ms
Number of hops / channel @ 1s = 18

Within 10 s period, the average time of occupancy = 10 s * 18 * 2.165 ms

→ The average time of occupancy = 389.7 ms

Limits:

FCC	IC
Average time of occupancy	
For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within 10 second period.	

Result: Passed

10.5 20 dB Bandwidth

Description:

Measurement of the 20 dB bandwidth of the modulated signal.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	30 kHz
Resolution bandwidth:	10 kHz
Span:	1 MHz
Trace-Mode:	Max Hold

Result:

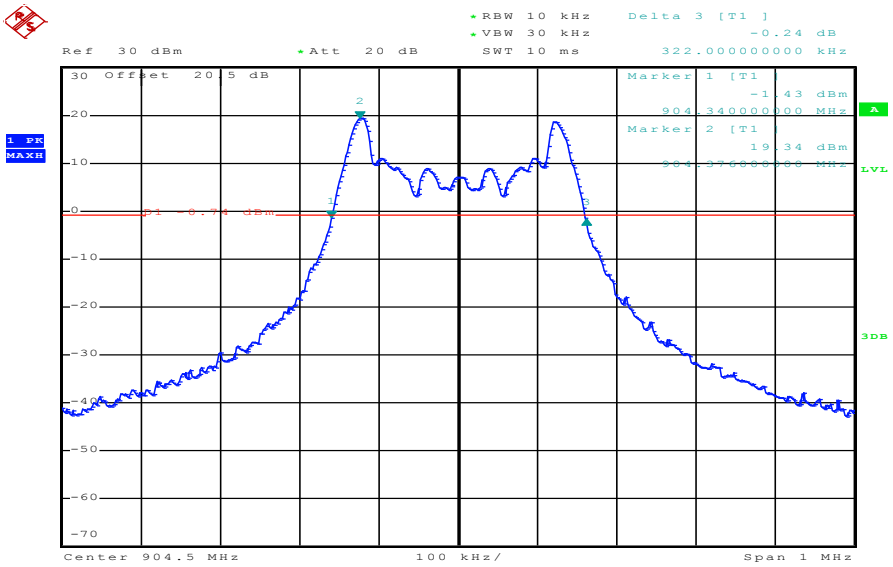
Test Conditions	20dB BANDWIDTH [kHz]		
	904.5 MHz	915.3 MHz	926.1 MHz
20 dB - Bandwidth	322	308	318
99% - Bandwidth	302	294	302
Measurement uncertainty	± 10 kHz		

Limits:

FCC	IC
20dB Bandwidth	
The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.	

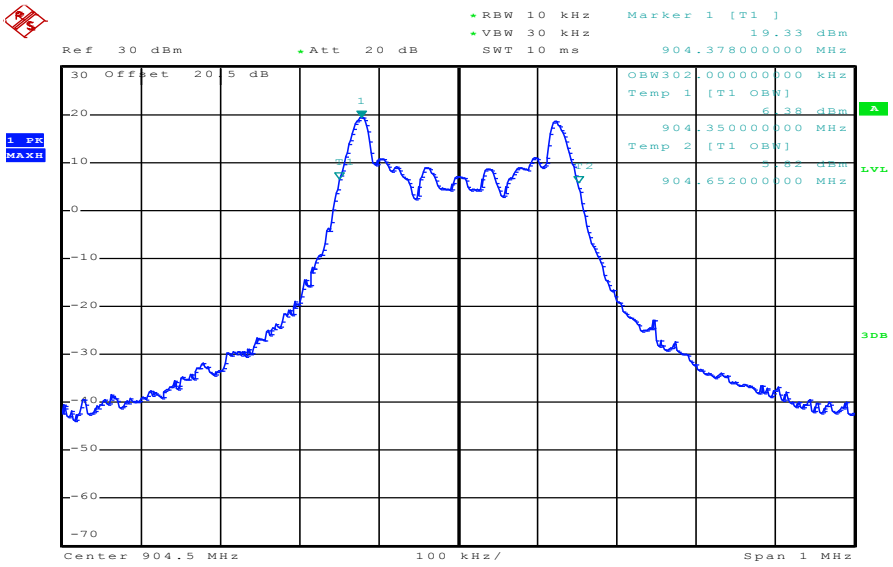
Result: Passed

Plot 1: Lowest Channel / 20 dB-Bandwidth



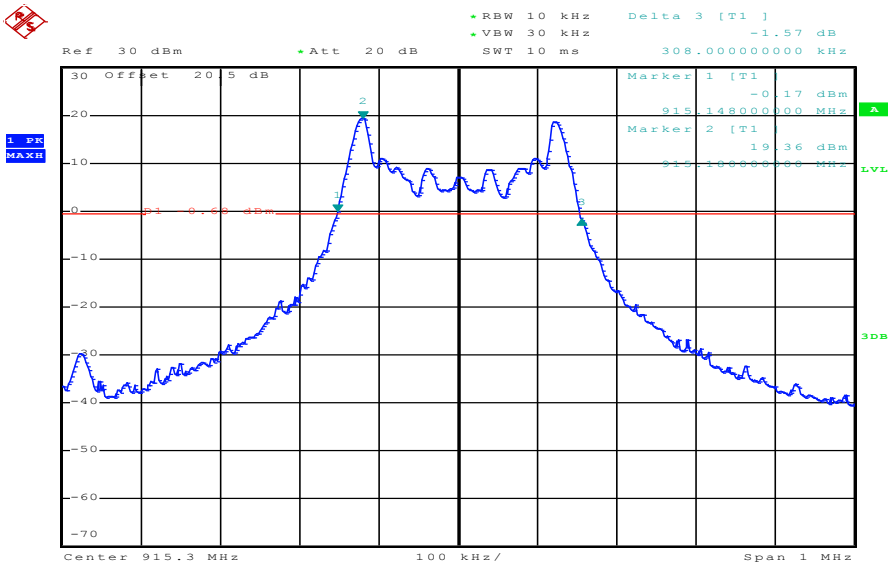
Date: 11.FEB.2014 15:31:53

Plot 2: Lowest Channel / 99%-Bandwidth



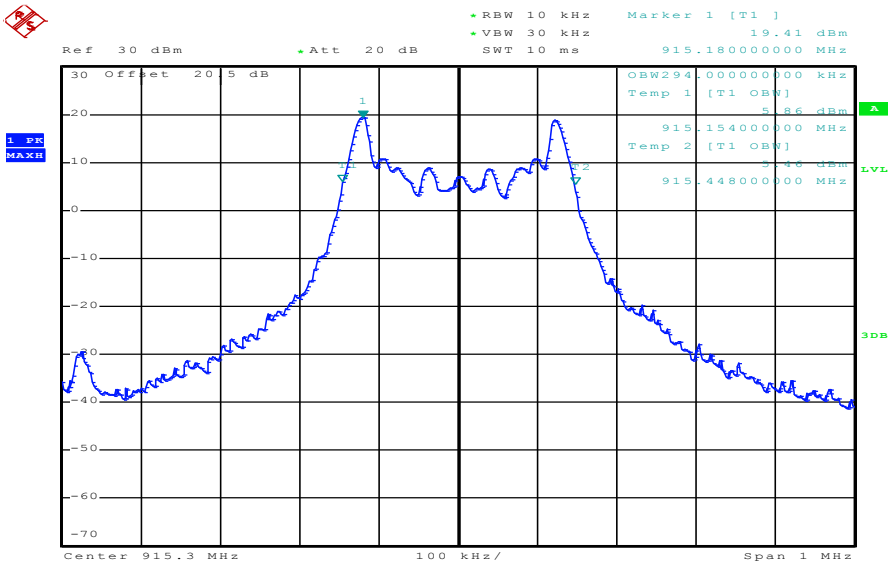
Date: 11.FEB.2014 15:30:50

Plot 3: Middle Channel / 20 dB-Bandwidth



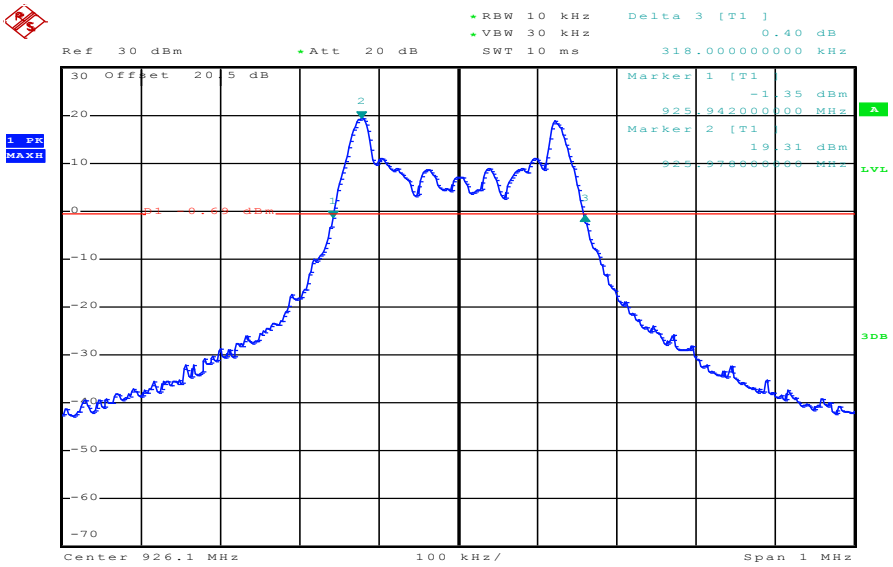
Date: 11.FEB.2014 15:33:18

Plot 4: Middle Channel / 99%-Bandwidth



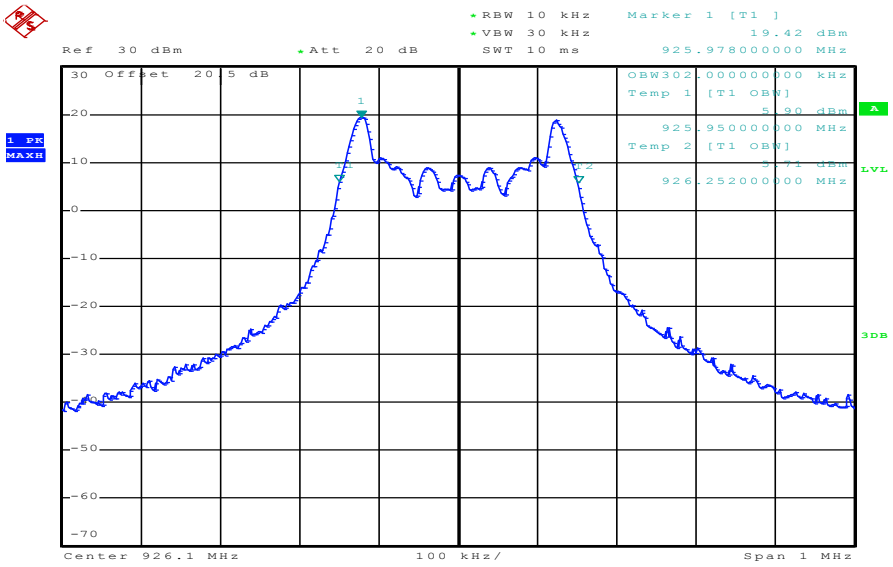
Date: 11.FEB.2014 15:29:52

Plot 5: Highest Channel / 20 dB-Bandwidth



Date: 11.FEB.2014 15:34:34

Plot 6: Highest Channel / 99%-Bandwidth



Date: 11.FEB.2014 15:28:08

10.6 Maximum Output Power Radiated

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1 MHz
Video bandwidth:	1 MHz
Span:	5 MHz
Trace-Mode:	Max Hold

Result:

Test Conditions		ERP [dBm]		
		904.5 MHz	915.3 MHz	926.1 MHz
T_{nom}	V_{nom}	14.80	14.11	13.94
Measurement uncertainty		± 3dB		

Limits:

FCC	IC
ERP	
For frequency hopping systems operating in the 902–928 MHz band: 1 watt (30 dBm) for systems employing at least 50 hopping channels; and, 0.25 watts (24 dBm) for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.	

Result: Passed

10.7 Maximum Output Power Conducted

Measurement: **(carrier modulated)**

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1 MHz
Video bandwidth:	1 MHz
Span:	5 MHz
Trace-Mode:	Max Hold

Result:

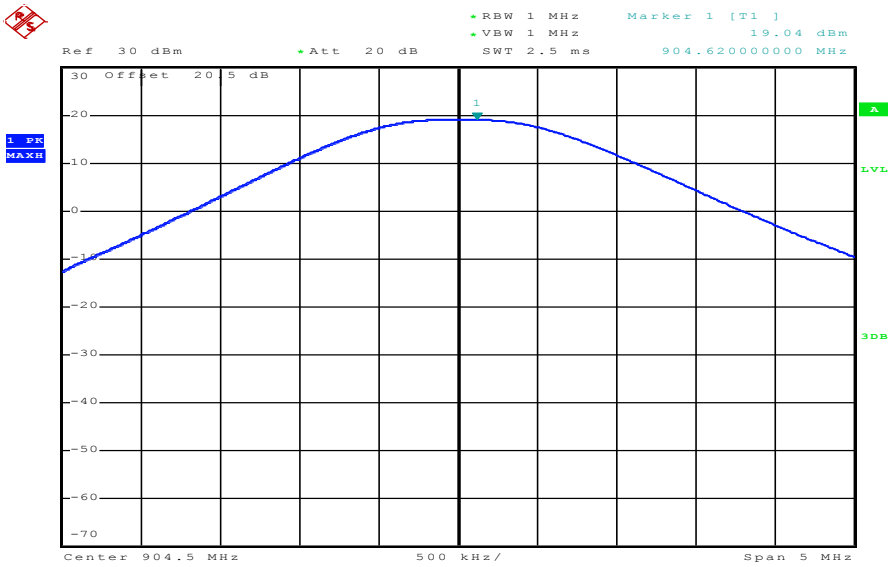
Test Conditions		Maximum Output Power Conducted [dBm]		
		904.5 MHz	915.3 MHz	926.1 MHz
T_{nom}	V_{nom}	19.04	19.09	19.02
Measurement uncertainty		± 3 dB		

Limits:

FCC	IC
Maximum Output Power Conducted	
For frequency hopping systems operating in the 902–928 MHz band: 1 watt (30 dBm) for systems employing at least 50 hopping channels; and, 0.25 watts (24 dBm) for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.	

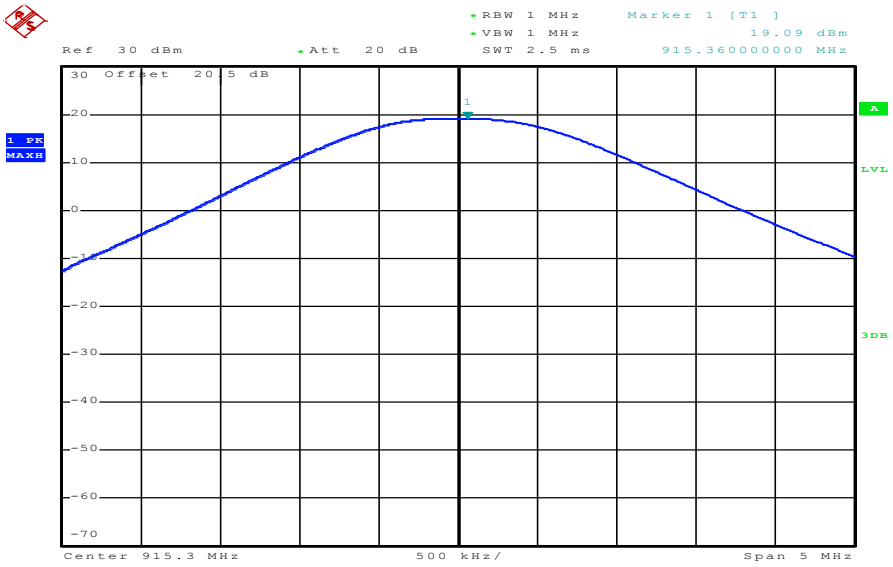
Result: **Passed**

Plot 1: Low Channel



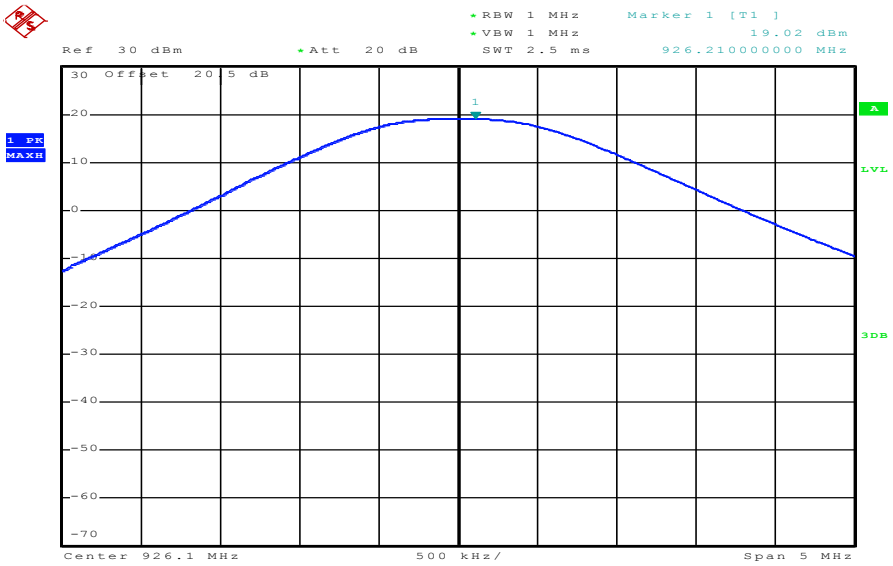
Date: 11.FEB.2014 15:37:36

Plot 2: Middle Channel



Date: 11.FEB.2014 15:36:57

Plot 3: High Channel



Date: 11.FEB.2014 15:36:14

10.8 Band-edge Compliance of conducted and radiated emissions

No restricted band in the range ± 2 channel bandwidths of the Band-edges of the specified emission band! (608 MHz – 614 MHz and 960 MHz – 1240 MHz).

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]0.495 - 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	([2])
13.36 - 13.41			

Limits:

FCC	IC
Band-edge Compliance of conducted and radiated emissions	
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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. 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)).	

Result: **See Results of spurious emissions conducted and radiated.**

Result: **Passed**

10.9 Spurious Emissions Conducted (Transmitter)

Description:

Measurement of the conducted spurious emissions in transmit mode. The measurement is performed at channel 00, 12 and 24.

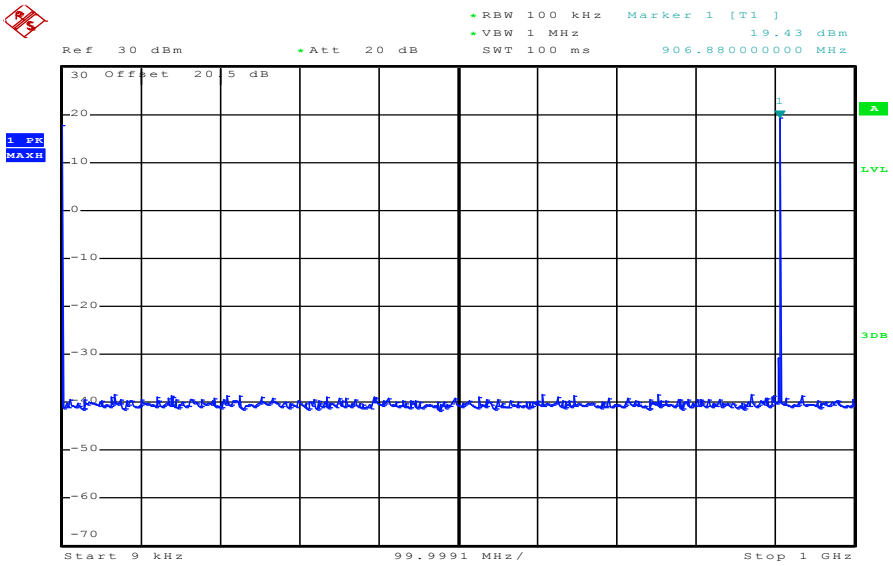
Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	F < 1 GHz: 1 MHz F > 1 GHz: 1 MHz
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 100 kHz
Span:	9 kHz to 12.75 GHz
Trace-Mode:	Max Hold

Limits:

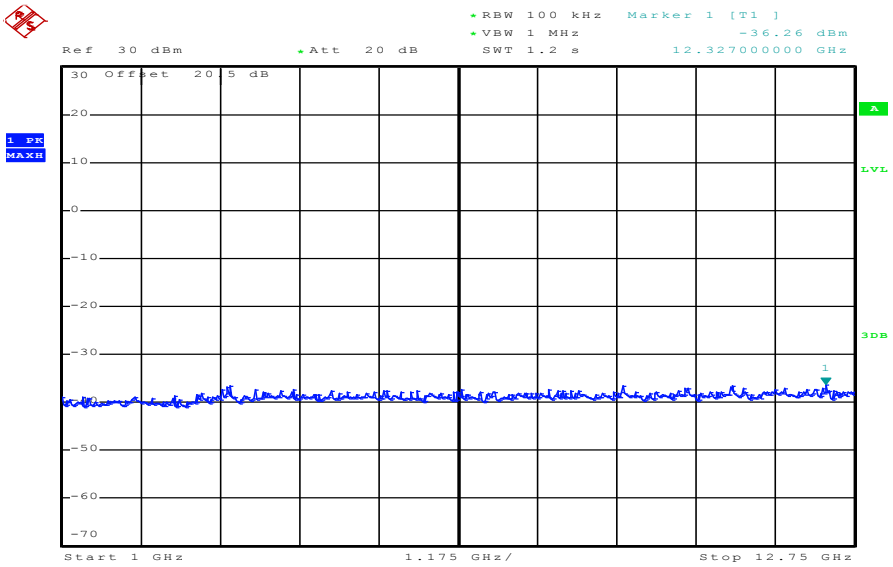
FCC	IC
Spurious emissions conducted	
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. 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)).	

Plot 1: Low channel



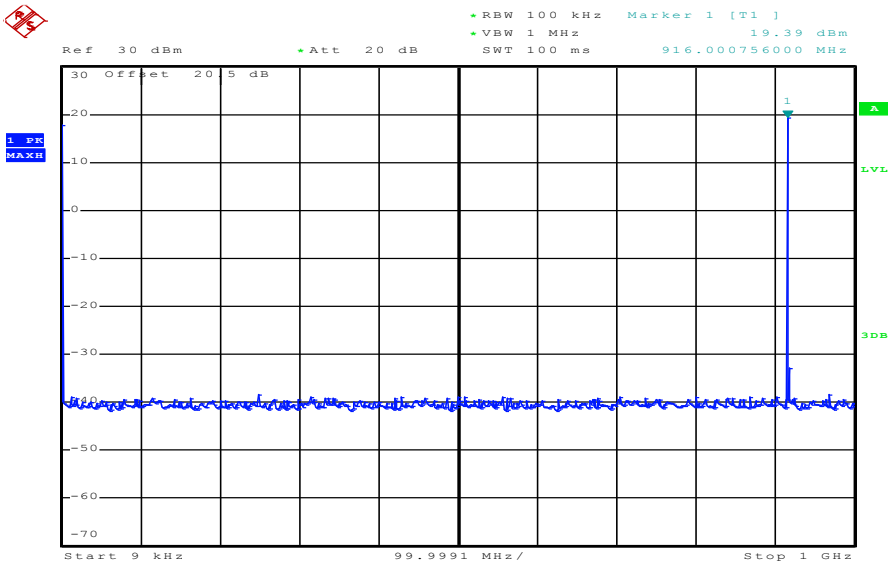
Date: 11.FEB.2014 15:40:58

Plot 2: Low channel



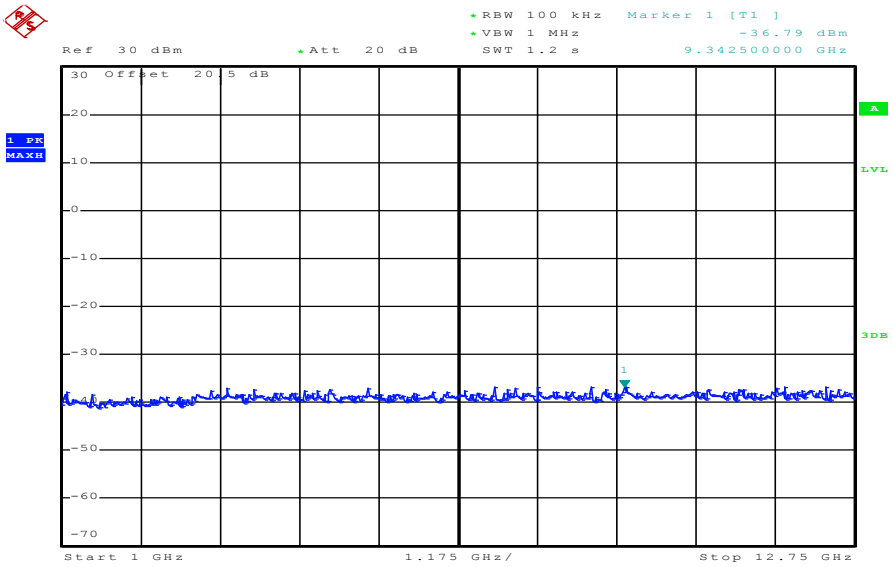
Date: 11.FEB.2014 15:41:48

Plot 3: Middle channel



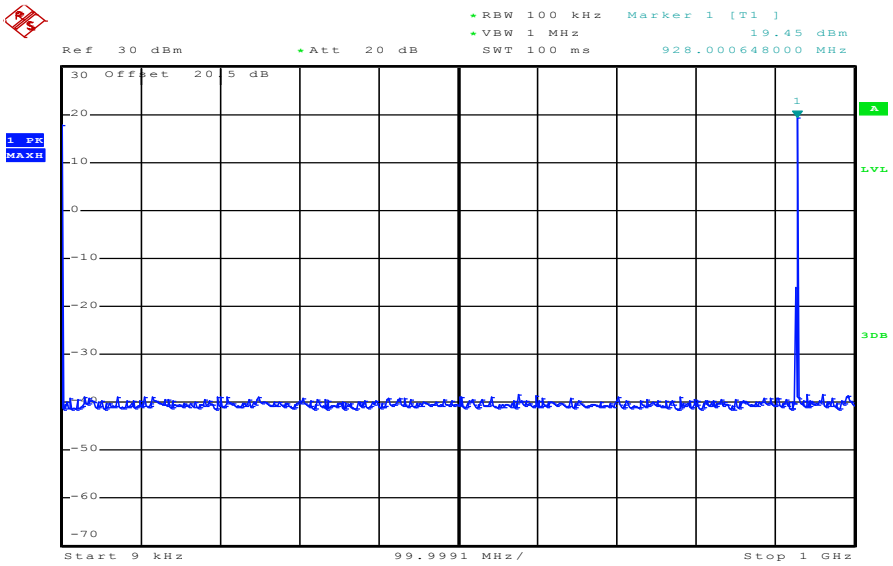
Date: 11.FEB.2014 15:43:01

Plot 4: Middle channel



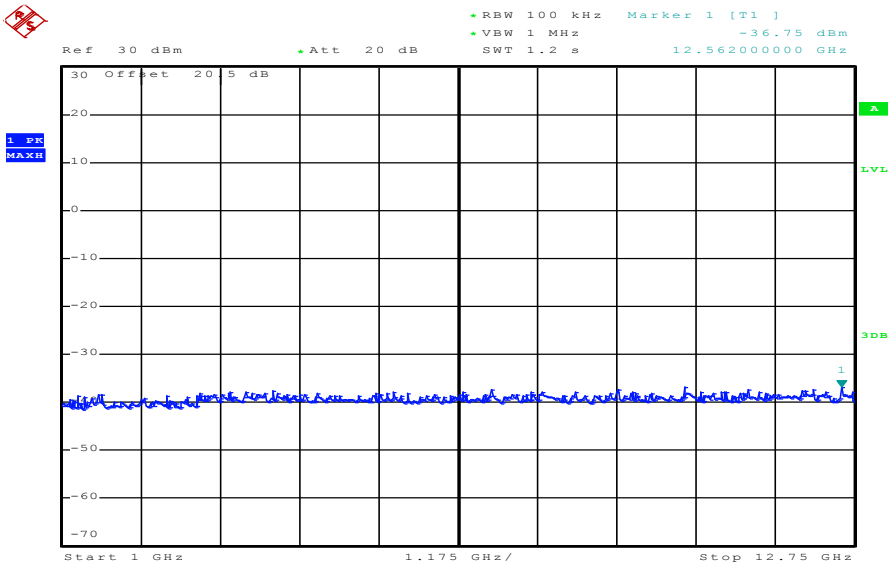
Date: 11.FEB.2014 15:42:38

Plot 5: High channel



Date: 11.FEB.2014 15:43:49

Plot 6: High channel



Date: 11.FEB.2014 15:44:19

Result:

Emission Limitation					
Frequency [MHz]		Amplitude of emission [dBm]	Limit max. allowed emission power	actual attenuation below frequency of operation [dB]	Results
904.5		19.43	24 dBm		Operating frequency
No peaks detected! All detected emissions are more than 20 dB below the limit!			-20 dBc		
915.3		19.39	24 dBm		Operating frequency
No peaks detected! All detected emissions are more than 20 dB below the limit!			-20 dBc		
926.1		19.45	24 dBm		Operating frequency
No peaks detected! All detected emissions are more than 20 dB below the limit!			-20 dBc		
Measurement uncertainty		± 3dB			

Limits:

FCC	IC
Spurious emissions conducted	
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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. 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)).	

Result: Passed

10.10 Spurious Emissions Radiated < 30 MHz

Description:

Measurement of the radiated spurious emissions in transmit mode below 30 MHz. The EUT is set to channel 12. This measurement is representative for all channels and modes. If any peaks are found channel 00 and channel 24 will be measured too. The limits are recalculated to a measurement distance of 3 m with 40 dB/decade according CFR Part 2.

Measurement:

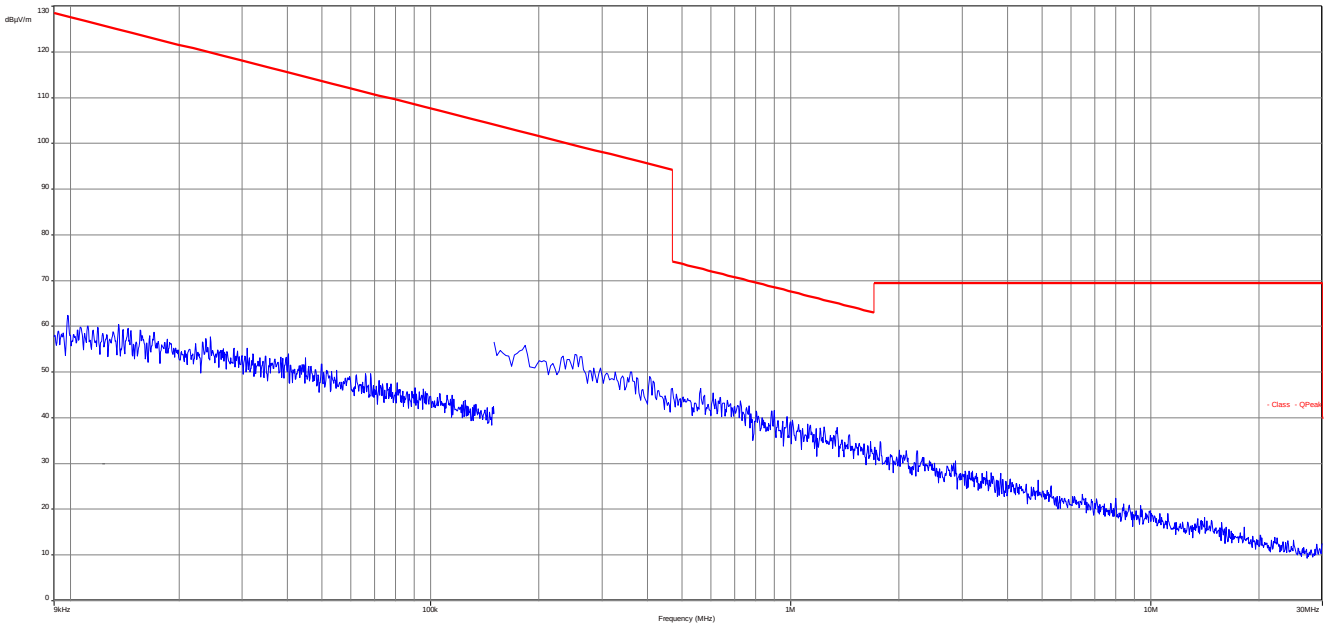
Measurement parameter	
Detector:	Peak / Quasi Peak
Sweep time:	Auto
Video bandwidth:	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Resolution bandwidth:	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span:	9 kHz to 30 MHz
Trace-Mode:	Max Hold

Limits:

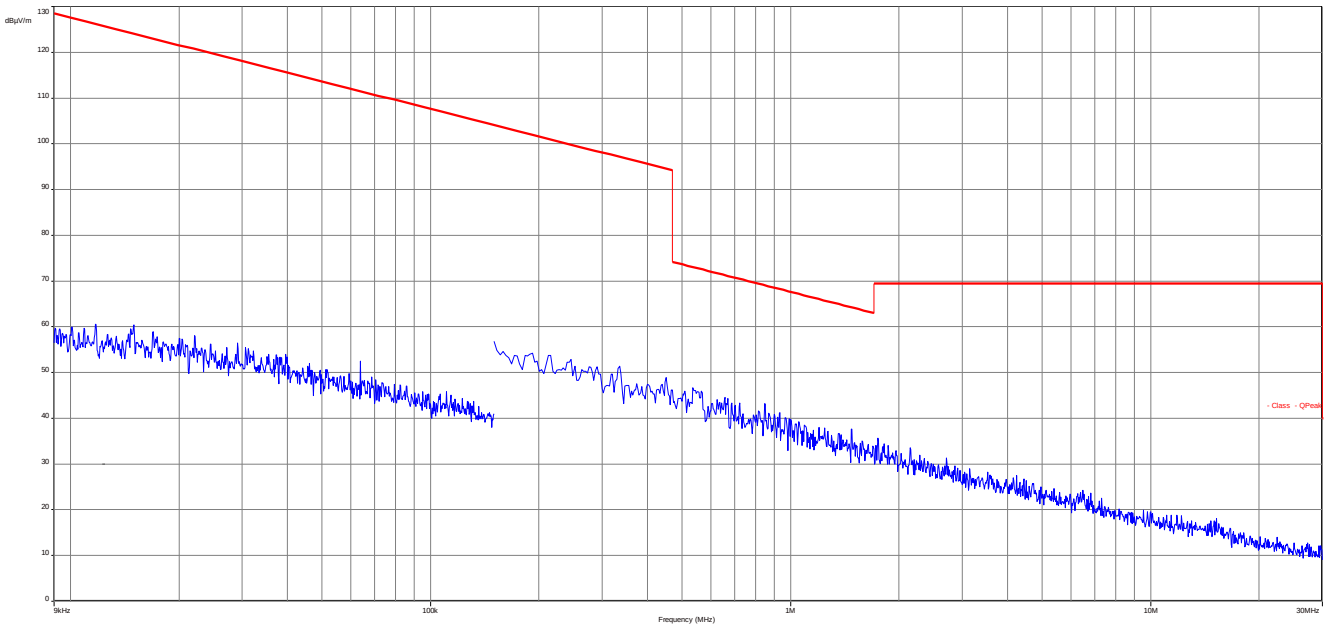
FCC		IC
Spurious Emissions Radiated < 30 MHz		
Frequency (MHz)	Field Strength (dBµV/m)	Measurement distance
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30

Result: Passed

Plot 1: TX-Mode



Plot 2: RX-Mode



10.11 Spurious Emissions Radiated (Transmitter) > 30 MHz

Description:

Measurement of the radiated spurious emissions in transmit mode. The measurement is performed at channel 00, 12 and 24.

Measurement:

Measurement parameter	
Detector:	Peak / Quasi Peak
Sweep time:	Auto
Video bandwidth:	3 x RBW Remeasurement: 10 Hz
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz
Span:	30 MHz to 25 GHz
Trace-Mode:	Max Hold
Measured Modulation	FSK

Limits:

ANSI C63.10 – FCC Public Notice DA 00-705
The average emission shall be determined by using Video averaging (VBW = 10 Hz). If the dwell time of the hopping signal is less than 100 ms (per channel), the VBW=10 Hz reading may be adjusted by a factor: F = 20log (dwell time/100 ms)

FCC	IC	
Band-edge Compliance of conducted and radiated emissions		
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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. 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)).		
Frequency (MHz)	Field Strength (dBµV/m)	Measurement distance
30 - 88	30.0	10
88 – 216	33.5	10
216 – 960	36.0	10
Above 960	54.0	3

Note: The limit was recalculated with 20 dB / decade (Part 15.31) for all radiated spurious emissions 30 MHz to 1 GHz from 3 meter limit to a 10 meter distance. (40dB/decade for emissions < 30MHz)

Plot 1: 30 MHz – 1 GHz, horizontal & vertical polarisation (lowest channel)

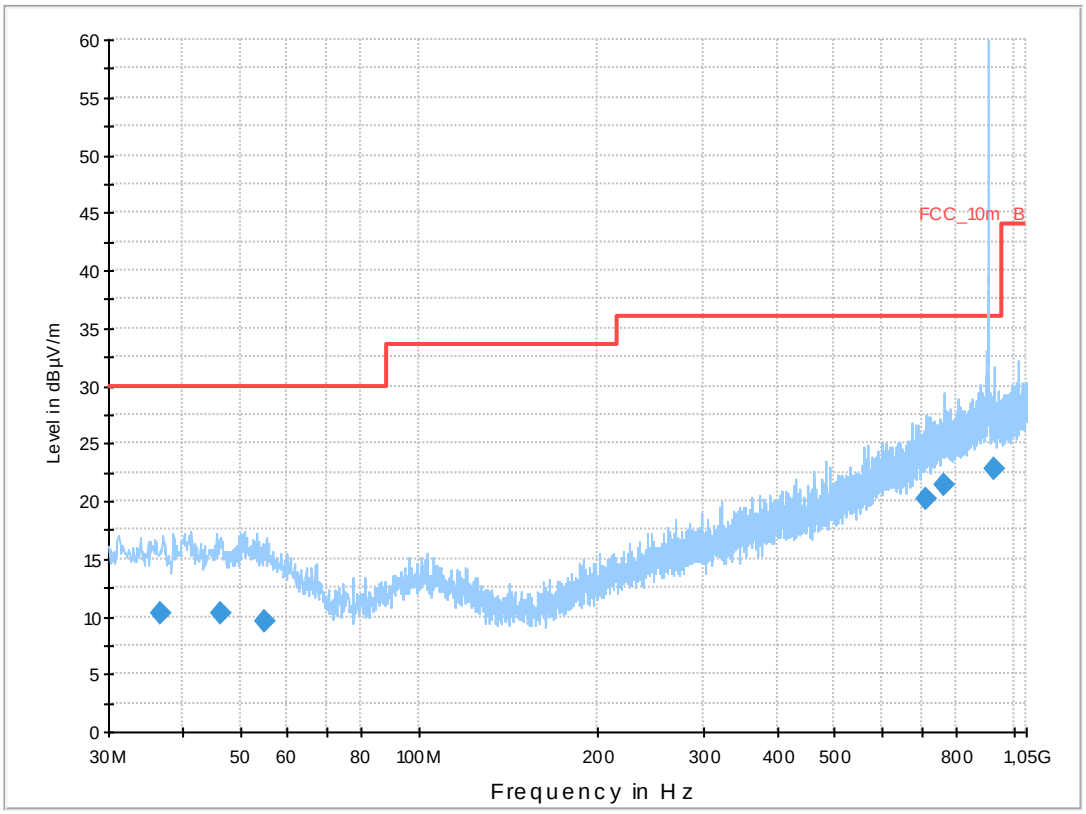
Common Information

EUT:	BR651
Serial Number:	40400314820A0002
Test Description:	FCC part 15 class B @ 10 m
Operating Conditions:	TX Ch. 0
Operator Name:	Hennemann
Comment:	battery powered

Scan Setup: STAN_Fin [EMI radiated]

Hardware Setup:	Electric Field (NOS)
Receiver:	[ESCI 3]
Level Unit:	dBµV/m

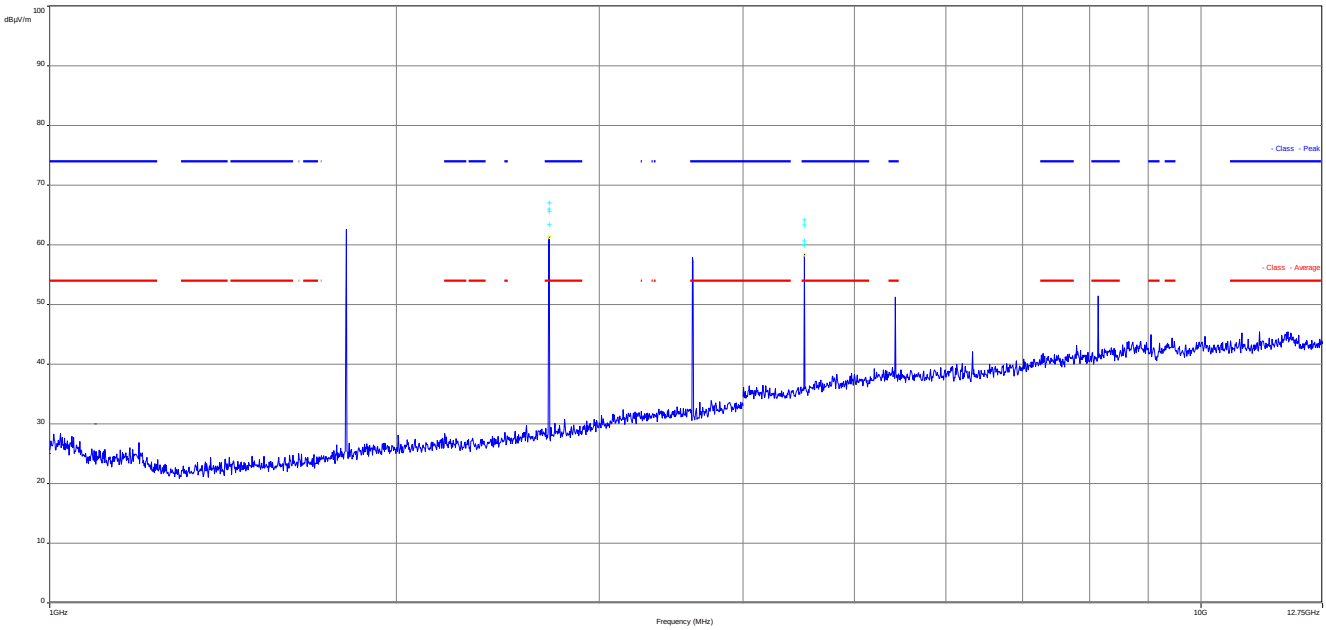
Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
30 MHz - 2 GHz	60 kHz	QPK	120 kHz	1 s	20 dB



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
36.824700	10.3	1000.0	120.000	98.0	V	180.0	13.2	19.7	30.0	
46.329600	10.3	1000.0	120.000	145.0	H	180.0	13.3	19.7	30.0	
54.994950	9.5	1000.0	120.000	98.0	V	270.0	12.9	20.5	30.0	
714.373500	20.1	1000.0	120.000	145.0	V	180.0	22.8	15.9	36.0	
761.974950	21.5	1000.0	120.000	145.0	H	180.0	23.7	14.5	36.0	
924.229650	22.8	1000.0	120.000	132.0	V	90.0	25.3	13.2	36.0	

Plot 2: 1 GHz – 12.75 GHz, horizontal & vertical polarisation (lowest channel)



Plot 3: 30 MHz – 1 GHz, horizontal & vertical polarisation (middle channel)

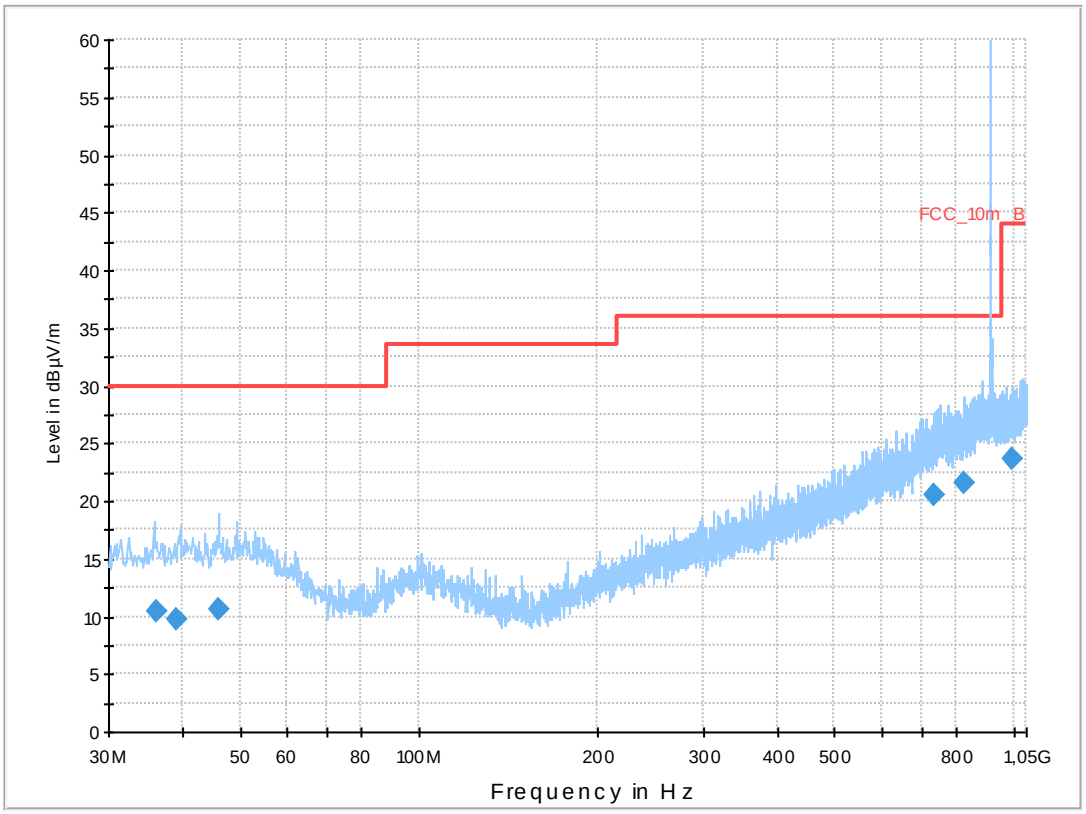
Common Information

EUT:	BR651
Serial Number:	40400314820A0002
Test Description:	FCC part 15 class B @ 10 m
Operating Conditions:	TX Ch. 12
Operator Name:	Hennemann
Comment:	battery powered

Scan Setup: STAN_Fin [EMI radiated]

Hardware Setup:	Electric Field (NOS)
Receiver:	[ESCI 3]
Level Unit:	dBµV/m

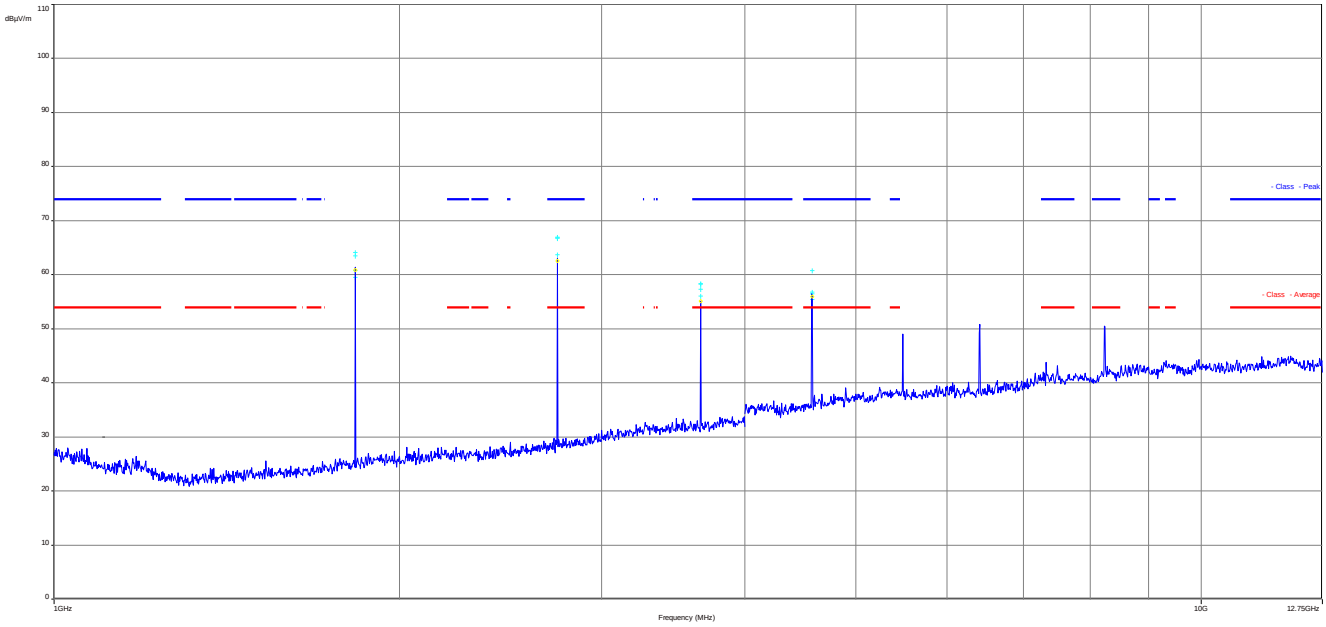
Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
30 MHz - 2 GHz	60 kHz	QPK	120 kHz	1 s	20 dB



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
36.152700	10.4	1000.0	120.000	145.0	V	0.0	13.1	19.6	30.0	
39.139200	9.7	1000.0	120.000	110.0	V	0.0	13.4	20.3	30.0	
45.934950	10.6	1000.0	120.000	98.0	V	270.0	13.3	19.4	30.0	
732.836700	20.6	1000.0	120.000	145.0	H	90.0	23.3	15.4	36.0	
823.719450	21.5	1000.0	120.000	145.0	V	270.0	24.2	14.5	36.0	
996.844350	23.7	1000.0	120.000	131.0	V	270.0	25.8	20.4	44.0	

Plot 4: 1 GHz – 12.75 GHz, horizontal & vertical polarisation (middle channel)



Plot 5: 30 MHz – 1 GHz, horizontal & vertical polarisation (highest channel)

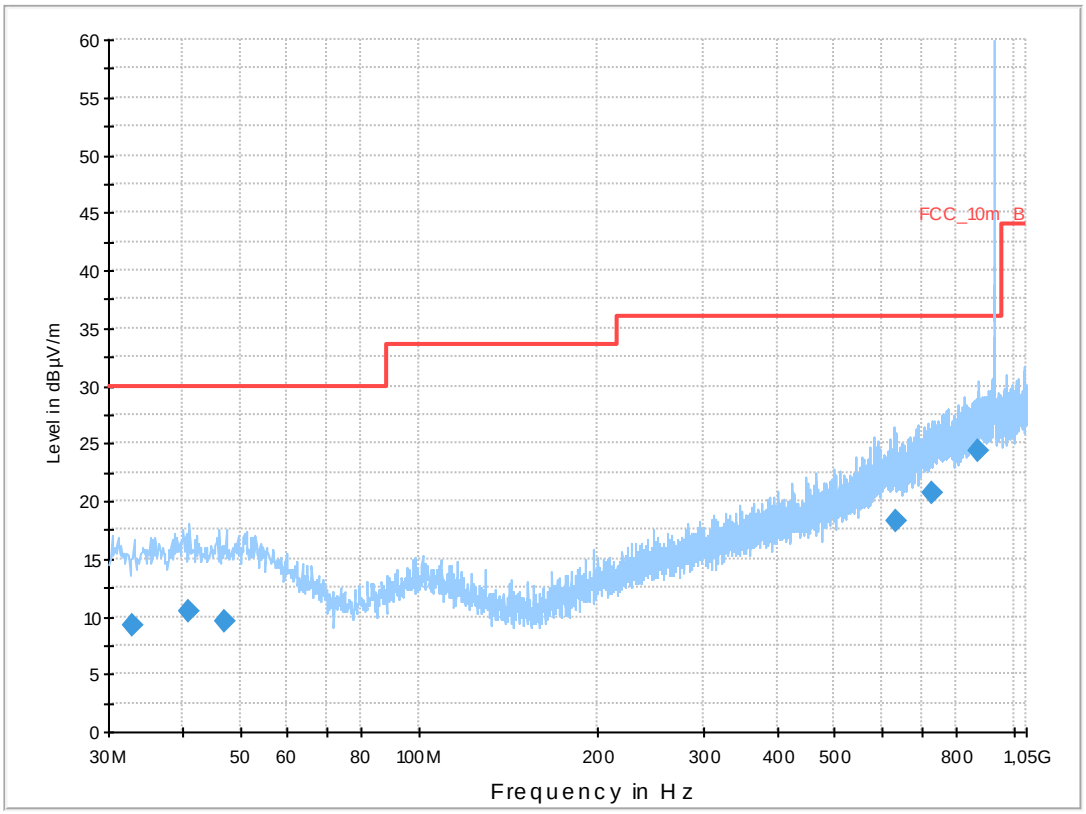
Common Information

EUT:	BR651
Serial Number:	40400314820A0002
Test Description:	FCC part 15 class B @ 10 m
Operating Conditions:	TX Ch. 24
Operator Name:	Hennemann
Comment:	battery powered

Scan Setup: STAN_Fin [EMI radiated]

Hardware Setup:	Electric Field (NOS)
Receiver:	[ESCI 3]
Level Unit:	dBµV/m

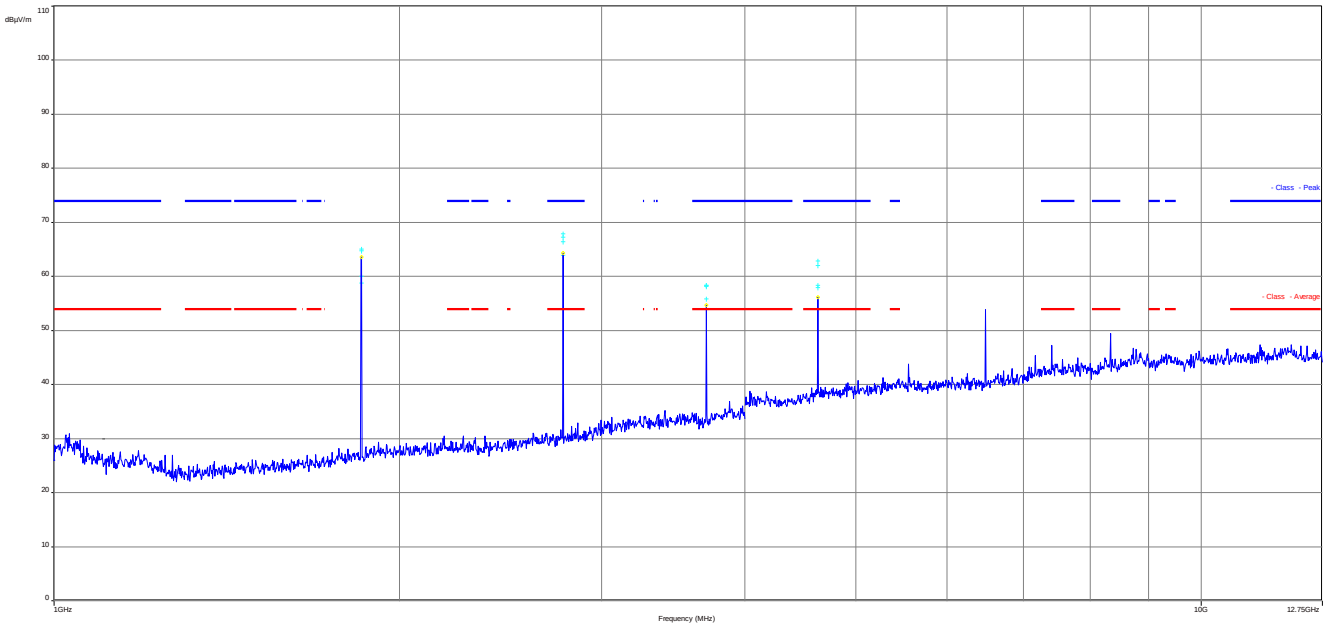
Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
30 MHz - 2 GHz	60 kHz	QPK	120 kHz	1 s	20 dB



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
32.962350	9.3	1000.0	120.000	131.0	V	180.0	12.8	20.7	30.0	
41.023800	10.5	1000.0	120.000	130.0	H	180.0	13.4	19.5	30.0	
47.189850	9.6	1000.0	120.000	145.0	H	180.0	13.3	20.4	30.0	
635.513100	18.3	1000.0	120.000	130.0	H	270.0	21.0	17.7	36.0	
729.689100	20.6	1000.0	120.000	120.0	H	0.0	23.2	15.4	36.0	
874.704300	24.4	1000.0	120.000	113.0	H	180.0	24.9	11.6	36.0	

Plot 6: 1 GHz – 12.75 GHz, horizontal & vertical polarisation (highest channel)



Result:

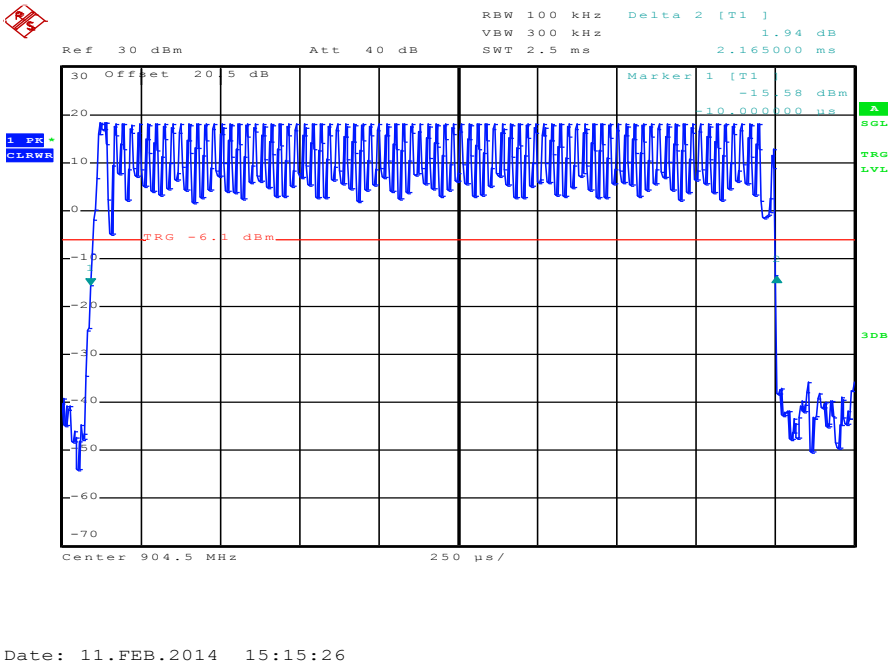
For radiated spurious emission the limits of 15.209 applies for all frequencies mentioned in 15.205. According to FCC Public Notice DA 00-705 (ANSI C63.10) the average emission shall be determined by using Video averaging (VBW = 10 Hz). If the dwell time of the hopping signal is less than 100 ms (per channel), the VBW=10 Hz reading may be adjusted by a factor:

F = 20*log (dwell time/100 ms)

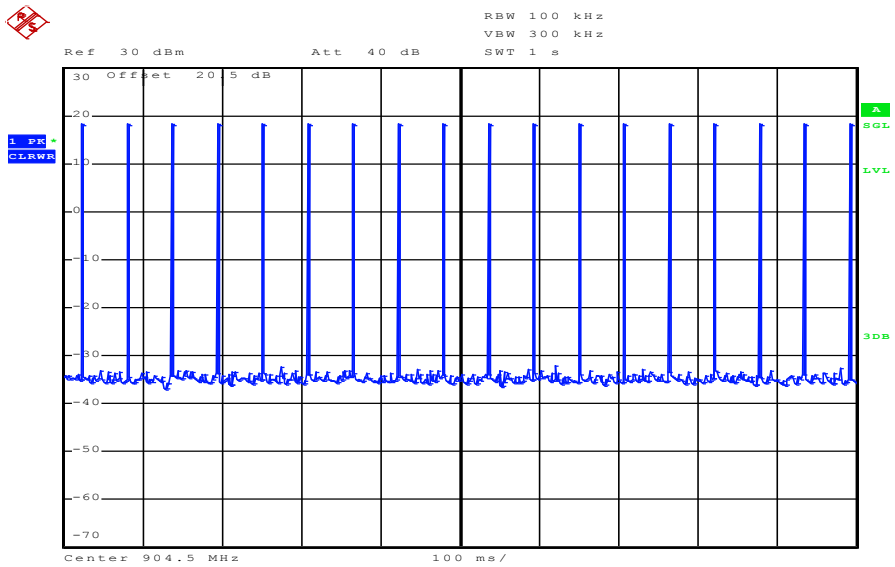
In a period of 100 ms, we have a maximum of 2 transmissions and that gives the correction factor for spurious measurement.

F = 20*log (2*2.165/100) = -27.3 dB

Plot 7: Time slot length = 2.165 ms



Plot 8: Number of hopping channels in 1s = 18



SPURIOUS EMISSIONS LEVEL [dBµV/m]								
904.5 MHz			915.3 MHz			926.1 MHz		
Frequency [MHz]	Detector	Level [dBµV/m]	Frequency [MHz]	Detector	Level [dBµV/m]	Frequency [MHz]	Detector	Level [dBµV/m]
2713.9	Peak	67.1	2745.4	Peak	67.0	2778.1	Peak	67.9
2713.9	AVG	39.8	2745.4	AVG	39.7	2778.1	AVG	40.6
3617.5	Peak	59.1	3661.6	Peak	58.4	3703.9	Peak	58.7
3617.5	AVG	31.8	3661.6	AVG	31.1	3703.9	AVG	31.4
4521.5	Peak	64.2	4577.5	Peak	60.7	4630.9	Peak	62.9
4521.5	AVG	36.9	4577.5	AVG	33.4	4630.9	AVG	35.6
Measurement uncertainty			±3 dB					

***AVG:** Detector Average corrected with the correction factor F = -27.3 dB

Result: Passed

10.12 RX spurious emissions radiated

Description:

Measurement of the radiated spurious emissions in idle/receive mode.

Measurement:

Measurement parameter	
Detector:	Peak / Quasi Peak
Sweep time:	Auto
Video bandwidth:	3 x RBW Remeasurement: 10 Hz
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz
Span:	30 MHz to 26 GHz
Trace-Mode:	Max Hold

Limits:

FCC		IC
Frequency (MHz)	Field Strength (dBµV/m)	Measurement distance
30 - 88	40	3
88 – 216	43.5	3
216 – 960	46.0	3
Above 960	54.0	3

Result:

SPURIOUS EMISSIONS LEVEL [dBµV/m]								
RX			-/-			-/-		
Frequency [MHz]	Detector	Level [dBµV/m]	Frequency [MHz]	Detector	Level [dBµV/m]	Frequency [MHz]	Detector	Level [dBµV/m]
No peaks found								
Measurement uncertainty			±3 dB					

Result: **Passed**

Note: The limit was recalculated with 20 dB / decade (Part 15.31) for all radiated spurious emissions 30 MHz to 1 GHz from 3 meter limit to a 10 meter distance. (40dB/decade for emissions < 30MHz)

Plot 1: 30 MHz – 1 GHz, RX-Mode, horizontal & vertical polarisation

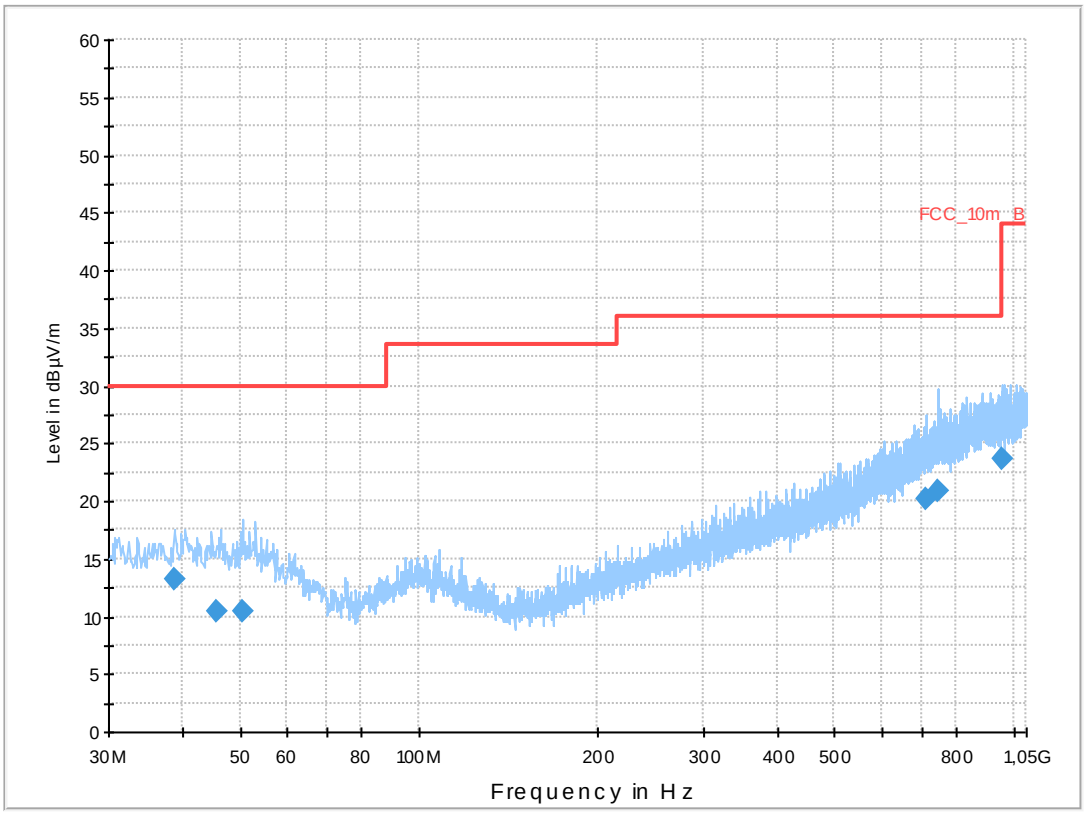
Common Information

EUT:	BR651
Serial Number:	40400314820A0002
Test Description:	FCC part 15 class B @ 10 m
Operating Conditions:	RX
Operator Name:	Hennemann
Comment:	battery powered

Scan Setup: STAN_Fin [EMI radiated]

Hardware Setup:	Electric Field (NOS)
Receiver:	[ESCI 3]
Level Unit:	dBµV/m

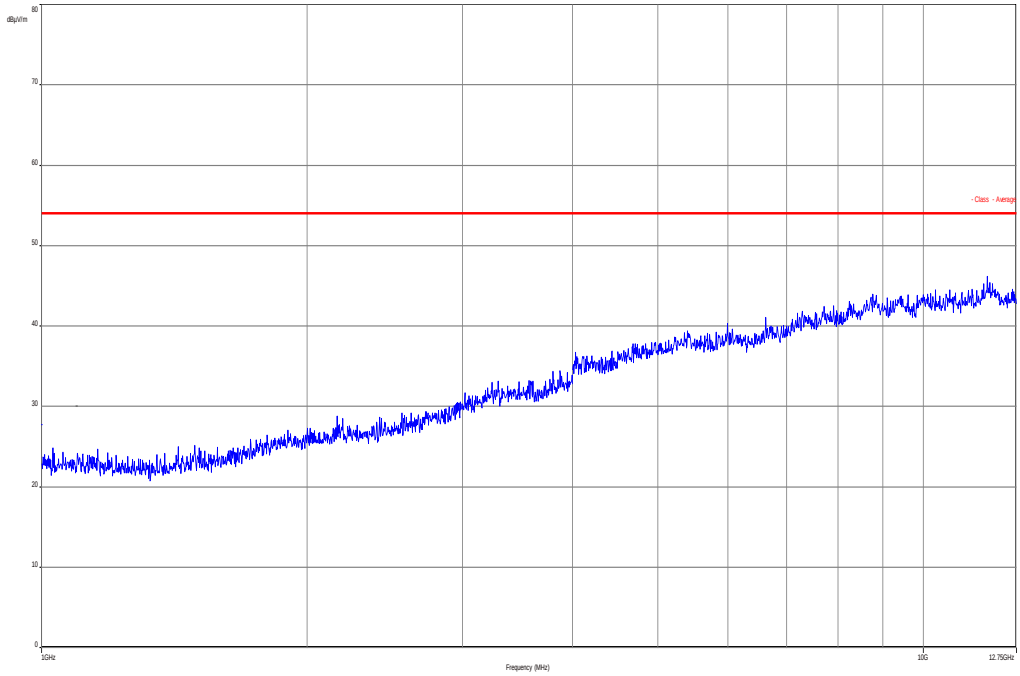
Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
30 MHz - 2 GHz	60 kHz	QPK	120 kHz	1 s	20 dB



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
38.702250	13.3	1000.0	120.000	113.0	V	0.0	13.3	16.7	30.0	
45.458550	10.4	1000.0	120.000	145.0	V	270.0	13.3	19.6	30.0	
50.625000	10.4	1000.0	120.000	145.0	V	270.0	13.3	19.6	30.0	
714.878850	20.1	1000.0	120.000	98.0	H	0.0	22.9	15.9	36.0	
747.867150	20.8	1000.0	120.000	145.0	V	90.0	23.6	15.2	36.0	
959.998650	23.6	1000.0	120.000	145.0	H	270.0	25.4	12.4	36.0	

Plot 2: 1GHz – 12.75 GHz, RX-Mode, horizontal & vertical polarisation



11 Test equipment and ancillaries used for tests

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, rf-generating and signalling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP Meßtechnik	2818A03450	300001040	Ve	12.01.2012	12.01.2015
2	n. a.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vlKl!	08.05.2013	08.05.2015
3	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev		
4	n. a.	Switch / Control Unit	3488A	HP Meßtechnik	*	300000199	ne		
5	9	Artificial Mains 9 kHz to 30 MHz	ESH3-Z5	R&S	828576/020	300001210	Ve	30.01.2014	30.01.2016
6	n. a.	Switch / Control Unit	3488A	HP Meßtechnik	2719A15013	300001156	ne		
7	9	Isolating Transformer	MPL IEC625 Bus Regeltrennt ravo	Erfi	91350	300001155	ne		
8	n. a.	Three-Way Power Splitter, 50 Ohm	11850C	HP Meßtechnik		300000997	ne		
9	90	Active Loop Antenna 10 kHz to 30 MHz	6502	Kontron Psychotech	8905-2342	300000256	k	13.06.2013	13.06.2015
10	n. a.	Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143	ne		
11	n. a.	Band Reject filter	WRCG1855/1910-1835/1925-40/8SS	Wainwright	7	300003350	ev		
12	n. a.	Band Reject filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	11	300003351	ev		
13	n. a.	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne		
14	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854	vlKl!	14.10.2011	14.10.2014
15	n. a.	MXE EMI Receiver 20 Hz bis 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	21.02.2013	21.02.2014
16	n. a.	Spectrum Analyzer 9kHz to 30GHz - 140..+30dBm	FSP30	R&S	100886	300003575	k	22.08.2012	22.08.2014
17	45	Switch-Unit	3488A	HP Meßtechnik	2719A14505	300000368	g		
18	50	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP Meßtechnik	2920A04466	300000580	ne		
19	n. a.	software	SPS_PHE 1.4f	Spitzberger & Spieß	B5981; 5D1081;B5979	300000210	ne		
20	n. a.	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	27.01.2014	27.01.2015
21	n. a.	Amplifier	JS42-00502650-	MITEQ	1084532	300003379	ev		

			28-5A						
22	n. a.	Antenna Tower	Model 2175	ETS-LINDGREN	64762	300003745	izw		
23	n. a.	Positioning Controller	Model 2090	ETS-LINDGREN	64672	300003746	izw		
24	n. a.	Turntable Interface-Box	Model 105637	ETS-LINDGREN	44583	300003747	izw		
25	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	12.04.2012	12.04.2014
26	n. a.	Spectrum-Analyzer	FSU26	R&S	200809	300003874	k	22.01.2014	22.01.2015

Agenda: Kind of Calibration

k	calibration / calibrated	EK	limited calibration
ne	not required (k, ev, izw, zw not required)	zw	cyclical maintenance (external cyclical maintenance)
ev	periodic self verification	izw	internal cyclical maintenance
Ve	long-term stability recognized	g	blocked for accredited testing
vlkl!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress

12 Observations

No observations exceeding those reported with the single test cases have been made.

Annex A Document history

Version	Applied changes	Date of release
	Initial release	2014-02-18

Annex B Further information

Glossary

AVG - Average
DUT - Device under test
EMC - Electromagnetic Compatibility
EN - European Standard
EUT - Equipment under test
ETSI - European Telecommunications Standard Institute
FCC - Federal Communication Commission
FCC ID - Company Identifier at FCC
HW - Hardware
IC - Industry Canada
Inv. No. - Inventory number
N/A - Not applicable
PP - Positive peak
QP - Quasi peak
S/N - Serial number
SW - Software

Annex C Accreditation Certificate

Front side of certificate

DAkkS Deutsche Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH

Beliehene gemäß § 8 Absatz 1 AkkStelleG i.V.m. § 1 Absatz 1 AkkStelleGBV
Unterzeichnerin der Multilateralen Abkommen
von EA, ILAC und IAF zur gegenseitigen Anerkennung

Akkreditierung

Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

CETECOM ICT Services GmbH
Untertürkheimer Straße 6-10, 66117 Saarbrücken

die Kompetenz nach DIN EN ISO/IEC 17025:2005 besitzt, Prüfungen in folgenden Bereichen durchzuführen:

Drahtgebundene Kommunikation einschließlich xDSL
VoIP und DECT
Akustik
Funk einschließlich WLAN
Short Range Devices (SRD)
RFID
WiMax und Richtfunk
Mobilfunk (GSM / DCS, Over the Air (OTA) Performance)
Elektromagnetische Verträglichkeit (EMV) einschließlich Automotive
Produktsicherheit
SAR und Hearing Aid Compatibility (HAC)
Umweltsimulation
Smart Card Terminals
Bluetooth
Wi-Fi- Services

Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 18.01.2013 mit der Akkreditierungsnummer D-PL-12076-01 und ist gültig 17.01.2018. Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 80 Seiten.

Registrierungsnummer der Urkunde: **D-PL-12076-01-01**

Frankfurt am Main, 18.01.2013

Siehe Hinweise auf der Rückseite

Im Auftrag
Dipl.-Ing. (FH) Axel Egner
Abteilungsleiter

Back side of certificate

Deutsche Akkreditierungsstelle GmbH

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Spittelmarkt 10
10117 Berlin

Standort Frankfurt am Main
Gartenstraße 6
60594 Frankfurt am Main

Standort Braunschweig
Rundesallee 100
38116 Braunschweig

Die auszugsweise Veröffentlichung der Akkreditierungsurkunde bedarf der vorherigen schriftlichen Zustimmung der Deutsche Akkreditierungsstelle GmbH (DAkkS). Ausgenommen davon ist die separate Weiterverbreitung des Deckblattes durch die umseitig genannte Konformitätsbewertungsstelle in unveränderter Form.

Es darf nicht der Anschein erweckt werden, dass sich die Akkreditierung auch auf Bereiche erstreckt, die über den durch die DAkkS bestätigten Akkreditierungsbereich hinausgehen.

Die Akkreditierung erfolgte gemäß des Gesetzes über die Akkreditierungsstelle (AkkStelleG) vom 31. Juli 2009 (BGBl. I S. 2625) sowie der Verordnung (EG) Nr. 765/2008 des Europäischen Parlaments und des Rates vom 9. Juli 2008 über die Vorschriften für die Akkreditierung und Marktüberwachung im Zusammenhang mit der Vermarktung von Produkten (Abl. L 218 vom 9. Juli 2008, S. 30).
Die DAkkS ist Unterzeichnerin der Multilateralen Abkommen zur gegenseitigen Anerkennung der European co-operation for Accreditation (EA), des International Accreditation Forum (IAF) und der International Laboratory Accreditation Cooperation (ILAC). Die Unterzeichner dieser Abkommen erkennen ihre Akkreditierungen gegenseitig an.

Der aktuelle Stand der Mitgliedschaft kann folgenden Webseiten entnommen werden:
EA: www.european-accreditation.org
ILAC: www.ilac.org
IAF: www.iaf.nu

Note:

The current certificate including annex is published on our website (see link below) or may be received from CETECOM ICT Services on request.

http://www.cetecom.com/eu/de/cetecom-group/europa/deutschland-saarbruecken/akkreditierungen.html