

**CETECOM™****CETECOM ICT Services**
consulting - testing - certification >>>

TEST REPORT

Test report no.: 1-7276/13-01-03

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

Testing laboratory

CETECOM ICT Services GmbH
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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

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Av. de Longemalle 11
1020 Renens / SWITZERLAND
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Fax: + 41 21 637 26 81
Contact: Dieter Rauch
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Phone: + 41 21 637 26 72

Manufacturer

ELINCHROM S.A.
Av. de Longemalle 11
1020 Renens / SWITZERLAND

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:	EL-Skyport MK 2 Module
Model name:	ELS-Module-Mk2
FCC ID:	UV7-ELSMKM2
IC:	7126A-ELSMKM2
Frequency:	2.4 GHz DTS band (lowest channel 2404 MHz, highest channel 2478MHz)
Technology tested:	Proprietary
Antenna:	Integrated antenna
Power supply:	5.0 V DC USB powered
Temperature range:	-20°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:

p.o.

Marco Bertolino
Testing Manager

Test performed:

David Lang
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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2.2 Application details

Date of receipt of order:	2013-12-09
Date of receipt of test item:	2014-01-13
Start of test:	2014-01-14
End of test:	2014-01-16
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

3.1 Measurement guidance

DTS : KDB 558074	2013-04	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247
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4 Test environment

Temperature:	T_{nom}	+22 °C during room temperature tests
	T_{max}	+55 °C during high temperature tests
	T_{min}	-20 °C during low temperature tests
Relative humidity content:		55 %
Barometric pressure:		not relevant for this kind of testing
Power supply:	V_{nom}	5.0 V DC USB powered
	V_{max}	-/- V
	V_{min}	-/- V

5 Test item

Kind of test item :	EL-Skyport MK 2 Module
Type identification :	ELS-Module-Mk2
S/N serial number :	Rad. 100001995 Cond. 10000001
HW hardware status :	02
SW software status :	Not available!
Frequency band [MHz] :	2.4 GHz DTS band (lowest channel 2404 MHz, highest channel 2478MHz)
Type of radio transmission :	
Use of frequency spectrum :	Single carrier
Type of modulation :	GFSK
Number of channels :	1
Antenna :	Integrated antenna
Power supply :	5.0 V DC USB powered
Temperature range :	-20°C to +55 °C

5.1 Additional information

Test setup- and EUT-photos are included in test reports:

1-7276_13-01-01_AnnexA

1-7276_13-01-01_AnnexB

1-7276_13-01-01_AnnexC

To pass radiated band edge and power spectral density tests the output power was reduced by -6dB at the lowest and highest channel.

All other tests were performed with higher output power to show worst case scenario.

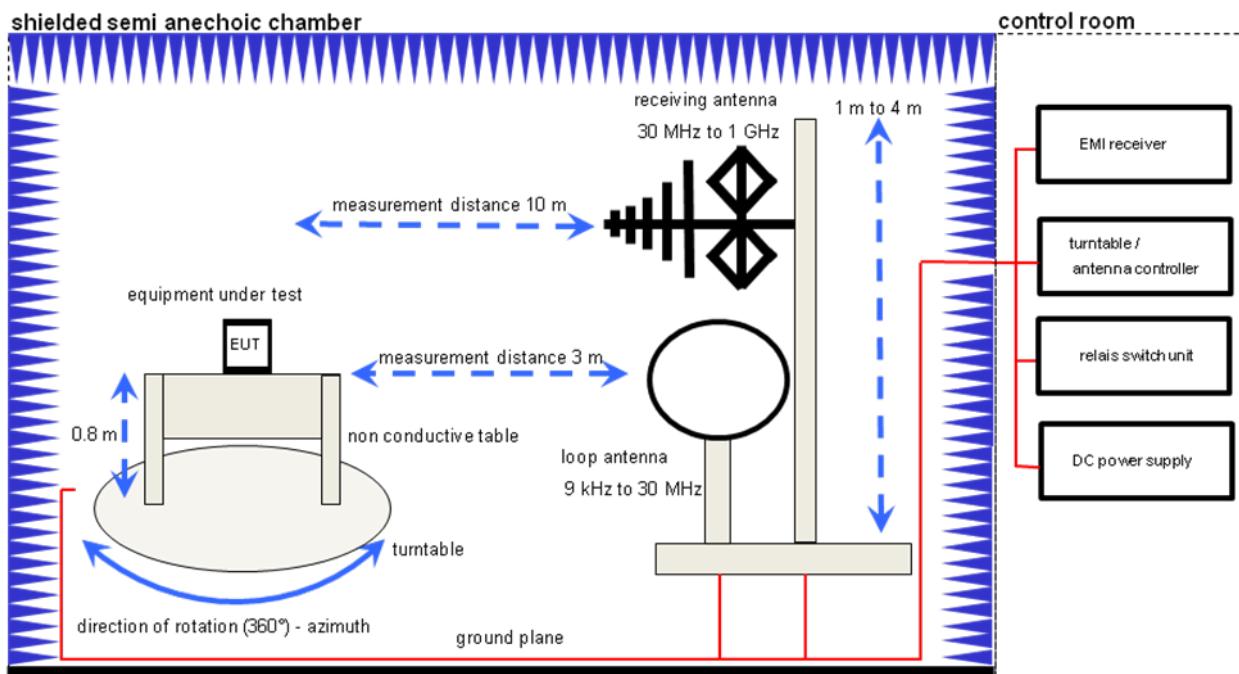
6 Test laboratories sub-contracted

None

7 Description of the test setup

7.1 Radiated measurements < 1GHz

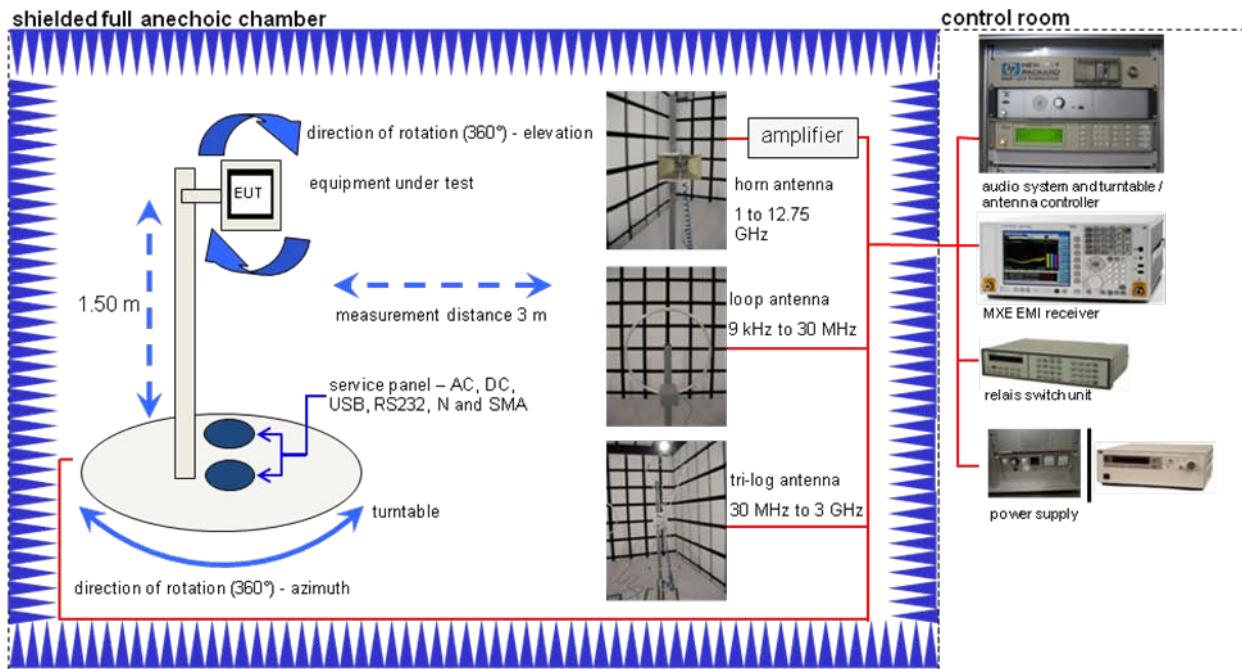
The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas 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
Test Receiver	ESH2	R&S	871921/095	300002505
Loop Antenna 9 KHz - 30 MHz	HFH2-Z2	R&S	872096/61	300001824
EMI Test Receiver 9 kHz - 3 GHz incl. Preselector	ESPI3	R&S	101713	300004059

7.2 Radiated measurements 1 – 12.75 GHz



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 Regeltravco	Erfi	91350	300001155
Three-Way Power Splitter, 50 Ohm	11850C	HP Meßtechnik		300000997
Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143

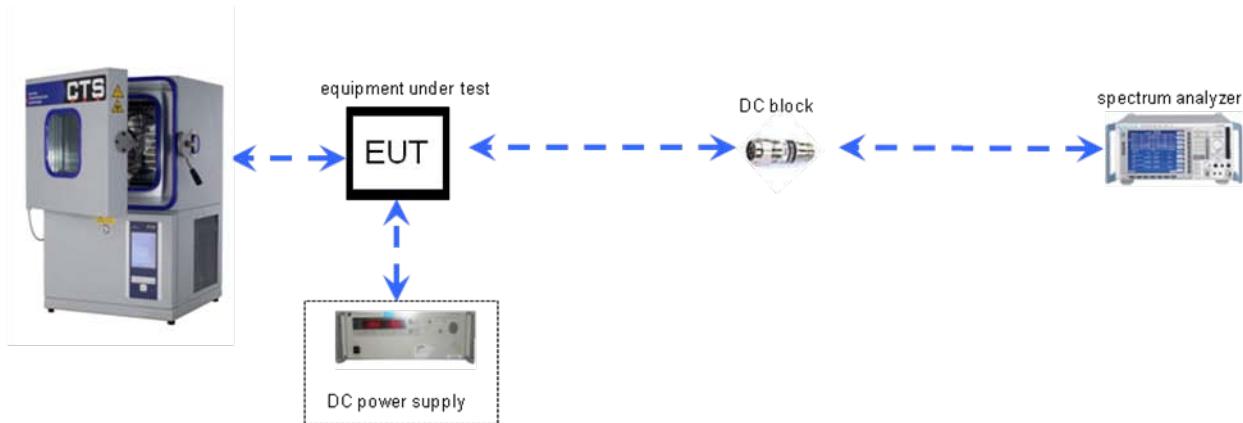
7.3 Radiated measurements 12.75 GHz to 25 GHz



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

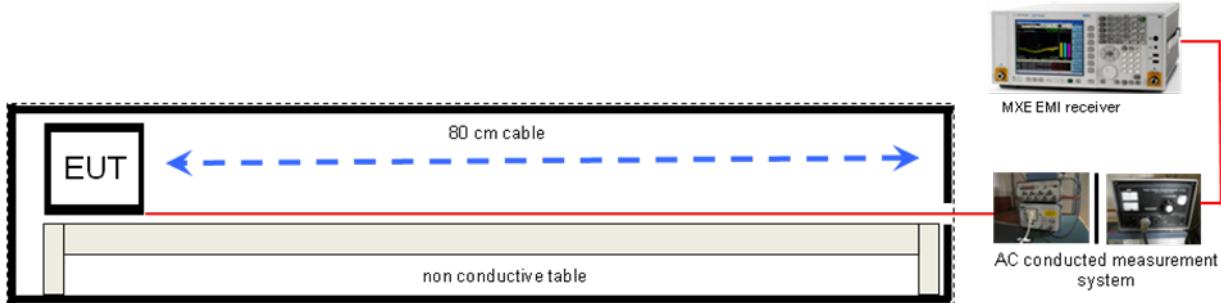
7.4 Conducted measurements



Equipment table:

Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom
DC Power Supply 0 – 32V	1108-32	Heiden	001802	300001383
Temperature Test Chamber	T-40/50	CTS GmbH	064023	300003540
Spectrum Analyzer 20 Hz - 50 GHz	FSU50	R&S	200012	300003443

7.5 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

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, Annex 8		Passed	2014-02-18		-/-

Test specification clause	Test case	Temperature conditions	Power source voltages	Pass	Fail	NA	NP	Remark
§15.247(b)(4) RSS 210 / A8.4(2)	Antenna gain	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.247(e) RSS 210 / A8.2(b)	Power spectral density	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.247(a)(2) RSS 210 / A8.2(a)	Spectrum bandwidth 6dB bandwidth	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.247(a)(2) RSS 210 / A8.2(a)	Spectrum bandwidth 20dB bandwidth	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.247(b)(3) RSS-210 / A8.4(4)	Maximum output power	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.247(d) RSS-210 / A8.5	Band edge compliance conducted	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.205 RSS-210 / A8.5	Band edge compliance radiated	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.247(d) RSS-210 / A8.5	TX spurious emissions conducted	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.247(d) RSS-210 / A8.5	TX spurious emissions radiated	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.109 RSS-Gen.	RX spurious emissions radiated	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.209(a) RSS-Gen	TX spurious emissions radiated < 30 MHz	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.107(a) §15.207	Conducted emissions < 30 MHz	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies

Note: NA = Not Applicable; NP = Not Performed

8.1 RSP100 test report cover sheet / performance test data

Test report number	:	1-7276/13-01-03
Equipment model number	:	ELS-Module-Mk2
Certification number	:	7126A-ELSMMK2
Manufacturer (complete address)	:	ELINCHROM S.A. Av. de Longemalle 11 1020 Renens / SWITZERLAND
Tested to radio standards specification no.	:	RSS 210, Issue 8, Annex 8
Open area test site IC No.	:	IC 3462C-1
Frequency range	:	Lowest channel 2404 MHz; highest channel 2478 MHz
RF-power [W] (max.)	:	cond.: 0.07 EIRP: 0.03
Occupied bandwidth (99%-BW) [kHz]	:	3790
Type of modulation	:	GFSK
Emission designator (TRC-43)	:	3M79F3D
Antenna information	:	Integrated antenna
Transmitter spurious (worst case)[dB μ V/m @ 3m]:		51.7 (@4.896GHz)

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	David Lang	
Date	Name	Signature

9 Measurement results

9.1 Antenna gain

Measurement:

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

Measurement parameters:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	3 MHz
Resolution bandwidth:	3 MHz
Span:	3 MHz
Trace-Mode:	Max hold

Limits:

FCC	IC
Antenna Gain	
6 dBi	

Results:

T_{nom}	V_{nom}	lowest channel	middle channel	highest channel
Conducted power [dBm] Measured		18.3	15.8	15.8
Radiated power [dBm] Measured		14.9	14.3	14.1
Gain [dBi] Calculated		-3.4	-1.5	-1.7

Result: **Passed**

9.2 Maximum output power

Description:

Measurement of the maximum output power conducted.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	1 MHz
Resolution bandwidth:	3 MHz
Span:	3 MHz
Trace-Mode:	Max Hold

Result:

Modulation Channel	Maximum output power conducted [dBm]		
	Lowest	Middle	Highest
	18.3	15.8	15.8
Measurement uncertainty	± 3 dB		

Result: **Passed**

9.3 Power spectral density

Description:

Measurement of the power spectral density of a digital modulated system. The measurement is repeated at the lowest, middle and highest channel.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	10 kHz
Resolution bandwidth:	3 kHz
Span:	2 MHz
Trace-Mode:	Max Hold

Limits:

FCC	IC
Power Spectral Density	
The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission or over 1.0 second if the transmission exceeds 1.0-second duration.	

Results:

GFSK Modulation Channel	Power Spectral density [dBm/3kHz]		
	Lowest	Middle	Highest
	6.52	6.31	3.00
Measurement uncertainty	± 1.5 dB		

Result: **Passed**

Plots: GFSK – mode 250 kbps**Plot 1: TX mode, lowest channel**

Date: 28.JAN.2014 08:34:35

Plot 2: TX mode, middle channel

Date: 14.JAN.2014 14:23:15

Plot 3: TX mode, highest channel

9.4 Spectrum bandwidth – 6 dB bandwidth

Description:

Measurement of the 6 dB bandwidth of the modulated signal.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	300 kHz
Resolution bandwidth:	100 kHz
Span:	See plots
Trace-Mode:	Max Hold

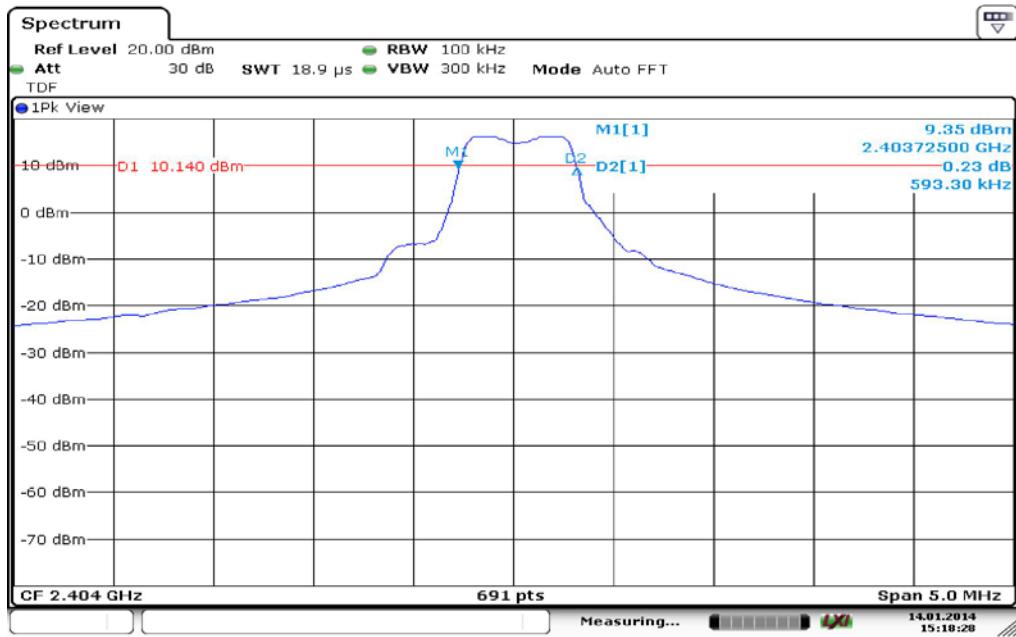
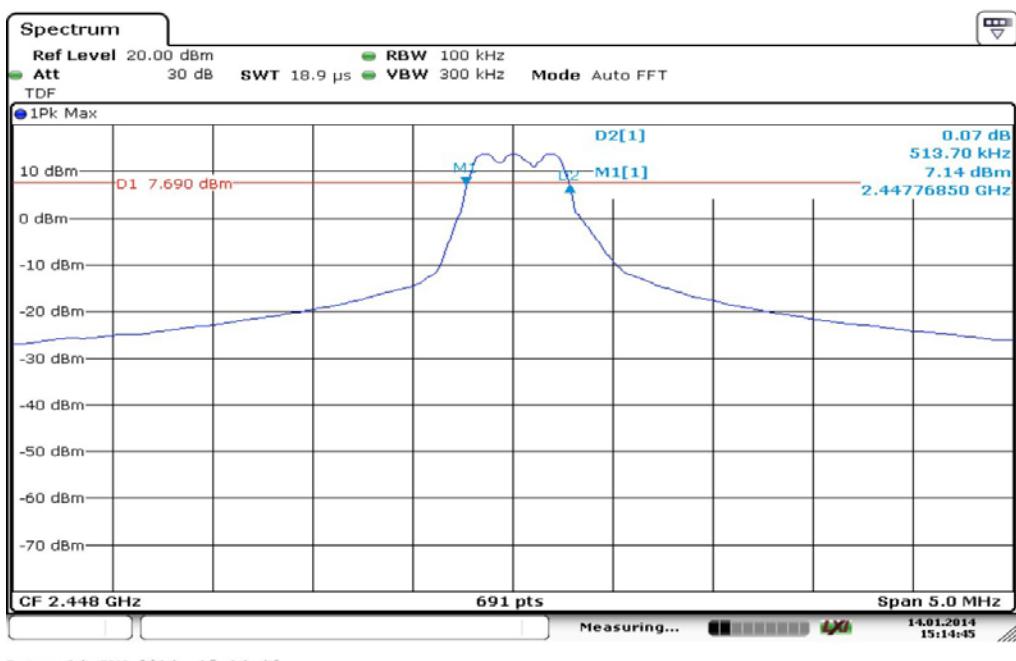
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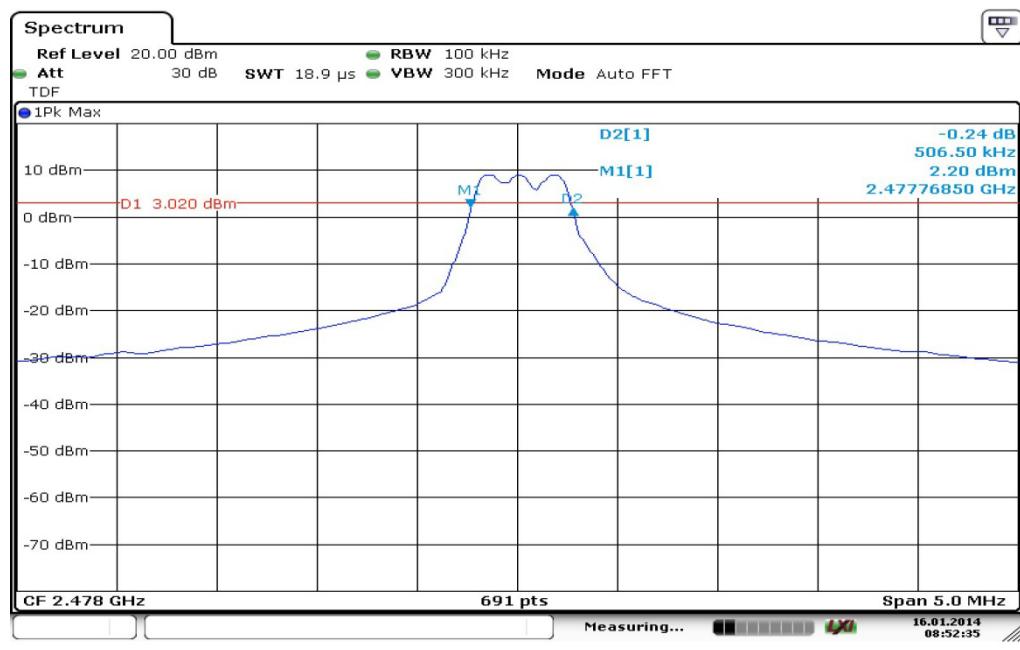
FCC	IC
Spectrum Bandwidth – 6 dB Bandwidth	
Systems using digital modulation techniques may operate in the 2400–2483.5 MHz band. The minimum 6 dB bandwidth shall be at least 500 kHz.	

Results:

GFSK Modulation	6 dB BANDWIDTH [MHz]		
	Lowest	Middle	Highest
	0.593	0.513	0.506
Measurement uncertainty	± 100 kHz		

Result: Passed

Plots: GFSK – mode 250kBps**Plot 1: TX mode, lowest channel****Plot 2: TX mode, middle channel**

Plot 3: TX mode, highest channel

9.5 Spectrum bandwidth – 20 dB bandwidth

Description:

Measurement of the 20 dB bandwidth of the modulated signal.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	3 MHz
Resolution bandwidth:	500 kHz
Span:	See plots!
Trace-Mode:	Max Hold

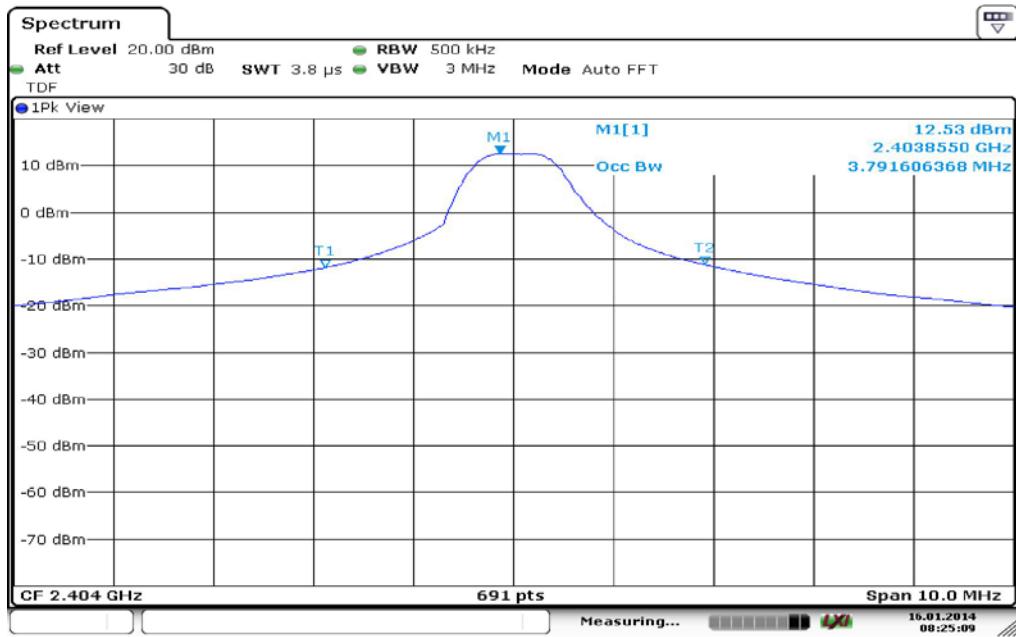
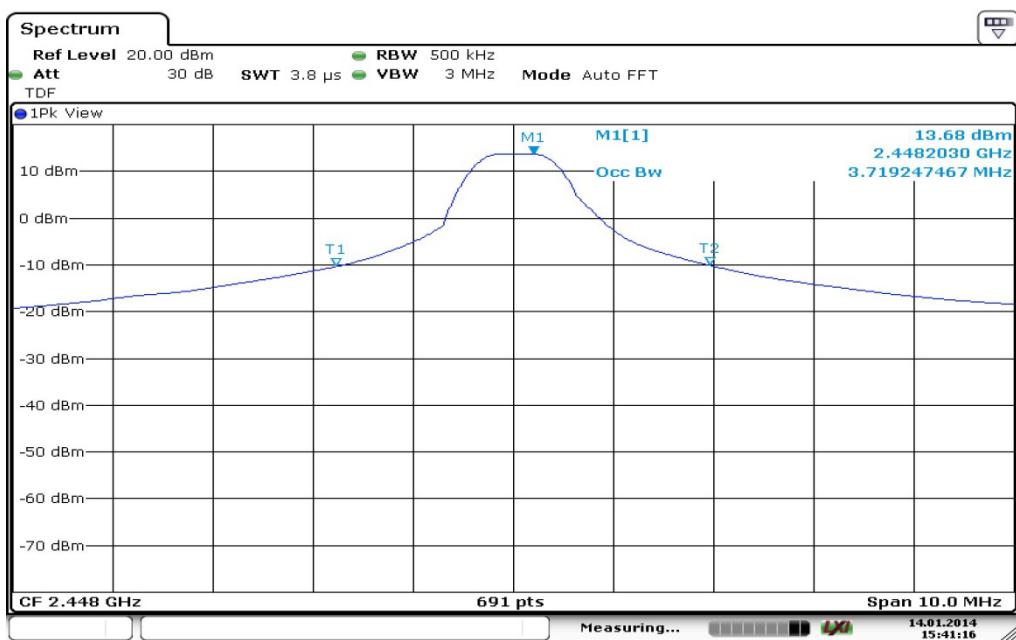
Limits:

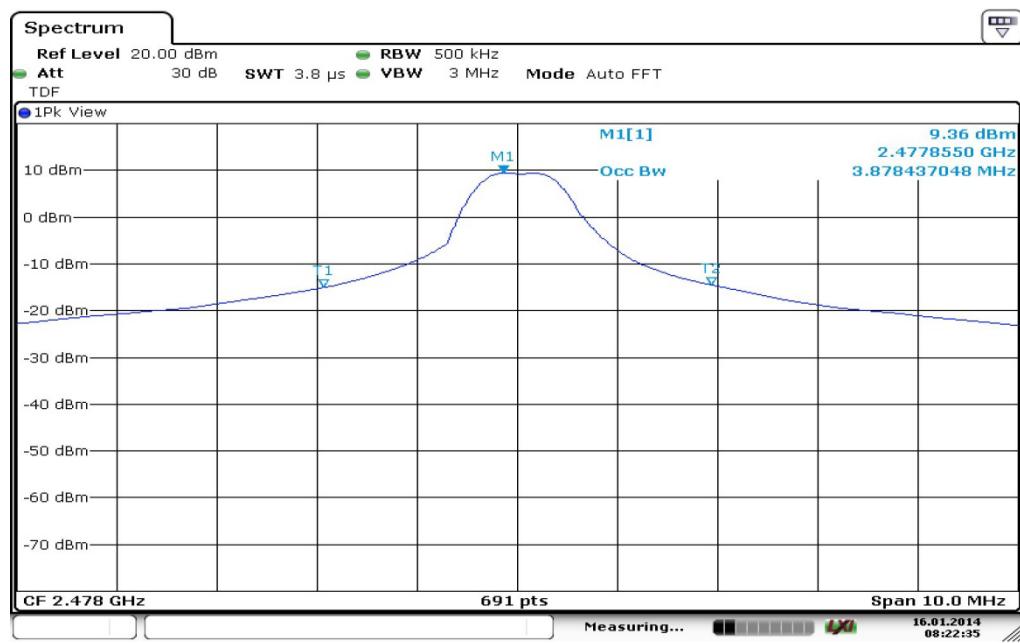
FCC	IC
Spectrum Bandwidth – 20 dB Bandwidth	

Results:

GFSK Modulation	20 dB BANDWIDTH [MHz]		
	Lowest	Middle	Highest
	3.79	3.72	3.78
Measurement uncertainty	± 100 kHz		

Result: Passed

Plots: GFSK – mode 250kBps**Plot 1: TX mode, lowest channel****Plot 2: TX mode, middle channel**

Plot 3: TX mode, highest channel

9.6 Band edge compliance conducted

Description:

Measurement of the conducted band edge compliance. EUT is measured at the lower and upper band edge.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	500 kHz
Resolution bandwidth:	100 kHz
Span:	See plots!
Trace-Mode:	Max Hold

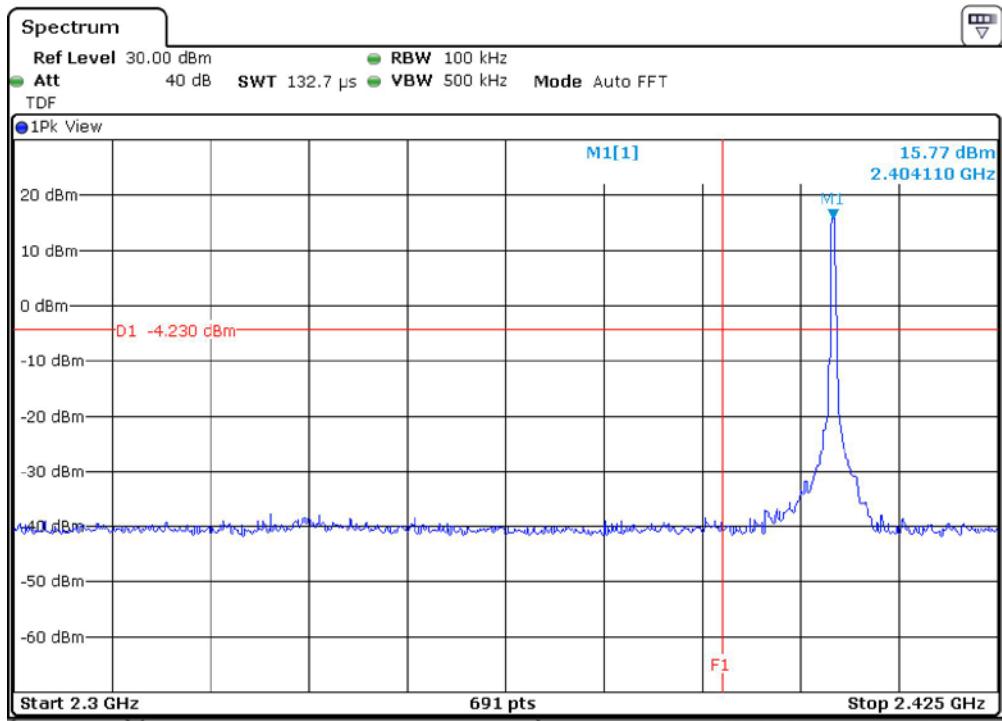
Limits:

FCC	IC
Band Edge Compliance Conducted	
<p>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.</p>	

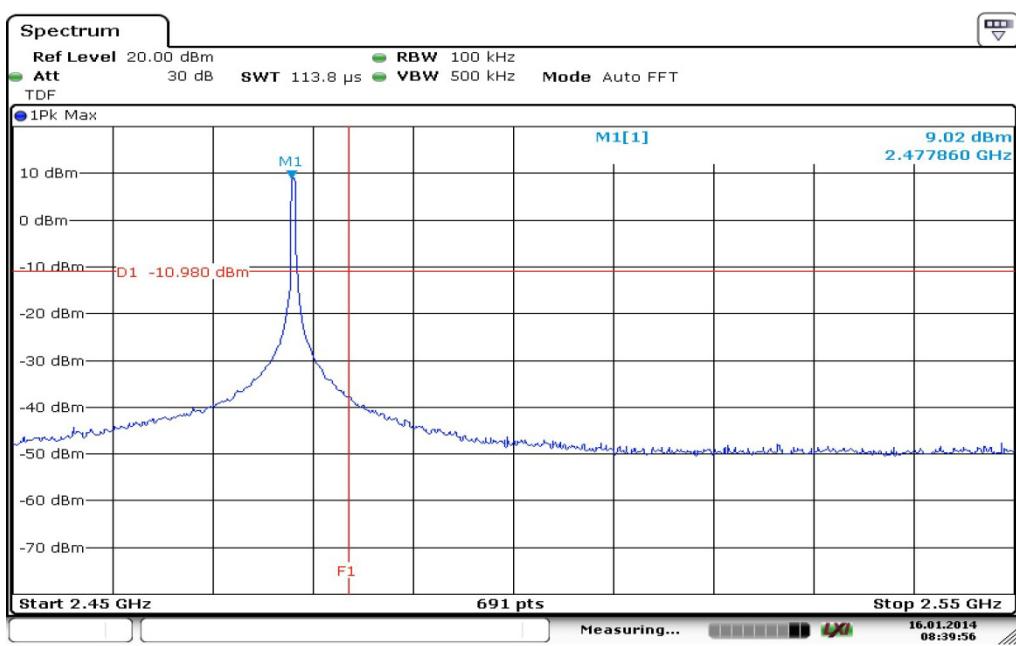
Result:

Scenario	Band Edge Compliance Conducted [dB]
Lower Band Edge	> 20 dB (see plot 1)
Upper Band Edge	> 20 dB (see plot 2)
Measurement uncertainty	± 1.5 dB

Result: The result of the measurement is passed.

Plots: GFSK – mode 250kBps**Plot 1: TX mode, lower band edge**

Date: 14.JAN.2014 16:32:26

Plot 2: TX mode, upper band edge

Date: 16.JAN.2014 08:39:56

9.7 Band edge compliance radiated

Description:

Measurement of the radiated band edge compliance. The EUT is turned in the position that results in the maximum level at the band edge. Then a sweep over the corresponding restricted band is performed. The EUT is set to the lowest channel for the lower restricted band and to the highest channel for the upper restricted band. Measurement distance is 3m.

Measurement:

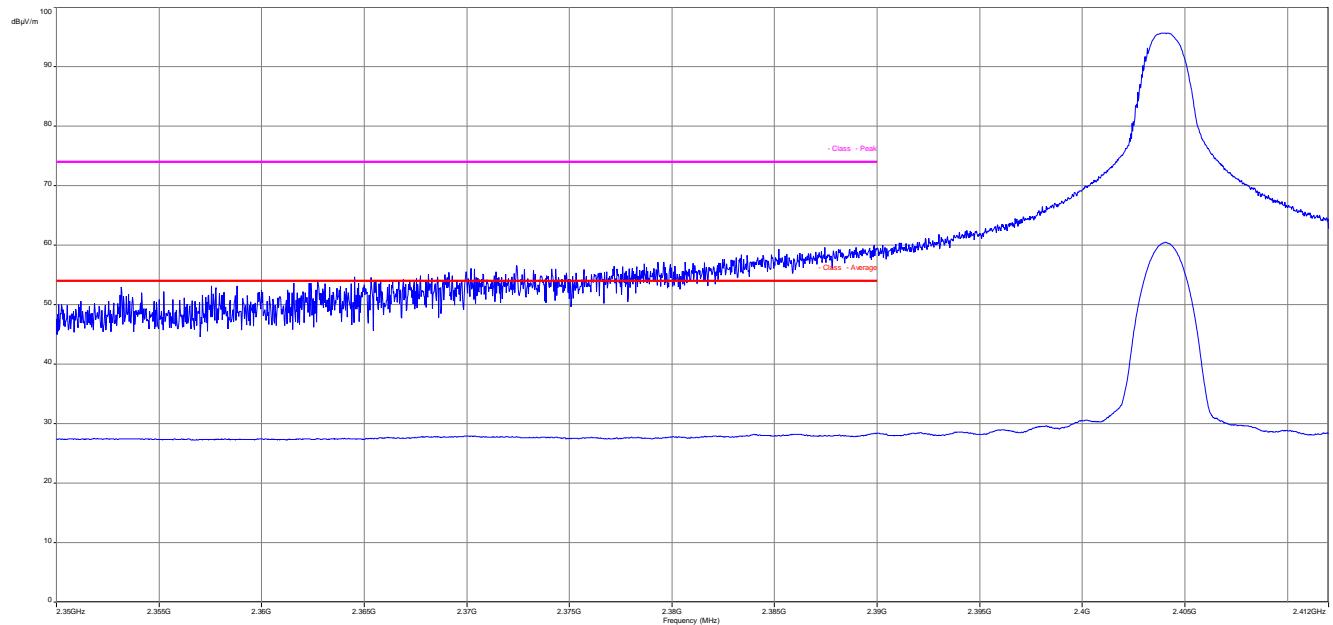
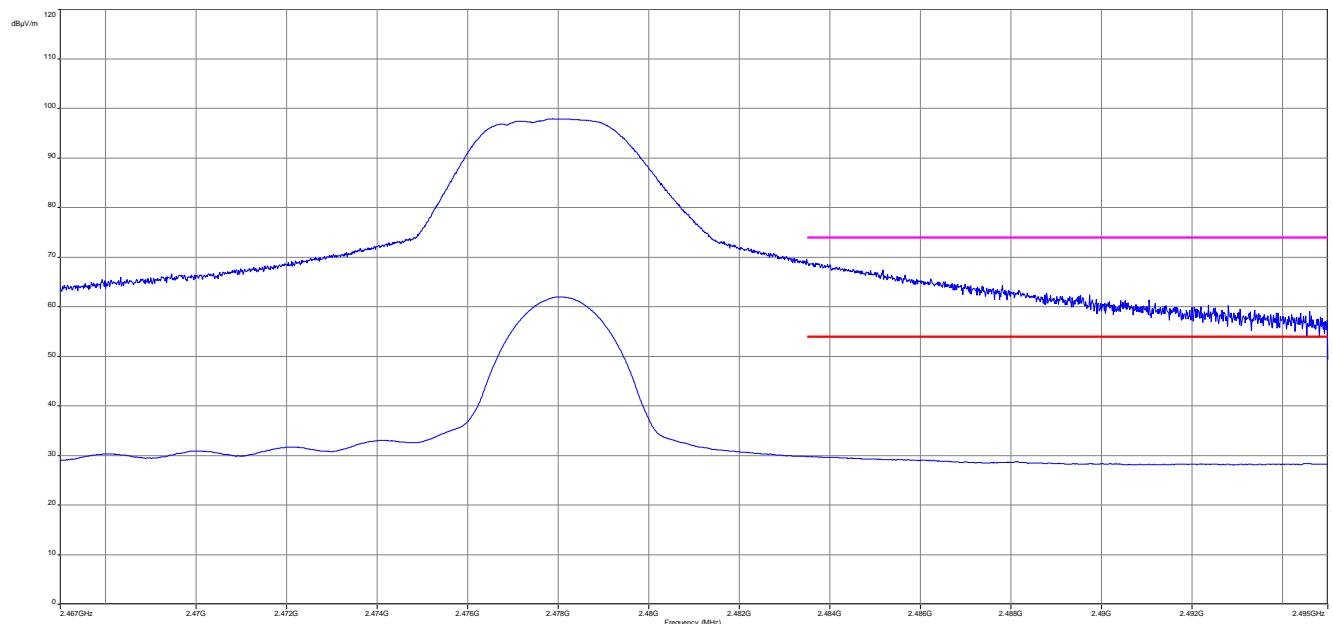
Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	10 Hz
Resolution bandwidth:	1 MHz
Span:	See plot!
Trace-Mode:	Max Hold

Limits:

FCC	IC
Band Edge Compliance Radiated	
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)).	
74 dB μ V/m Peak	IC
54 dB μ V/m AVG	

Result:

Scenario	Band Edge Compliance Radiated [dB μ V/m]
Lower Band Edge	< 74 dB μ V/m (Peak) < 54 dB μ V/m (AVG)
Upper Band Edge	< 74 dB μ V/m (Peak) < 54 dB μ V/m (AVG)
Measurement uncertainty	± 3 dB

Plots: GFSK 250 kBps – mode peak / average**Plot 1:** TX mode, lower band edge, vertical & horizontal polarization**Plot 2:** TX mode, upper band edge, vertical & horizontal polarization**Result:** **Passed**

9.8 TX spurious emissions conducted

Description:

Measurement of the conducted spurious emissions in transmit mode. The measurement is performed at lowest, middle and highest channel.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	500 kHz
Resolution bandwidth:	100 kHz
Span:	9 kHz to 25 GHz
Trace-Mode:	Max Hold

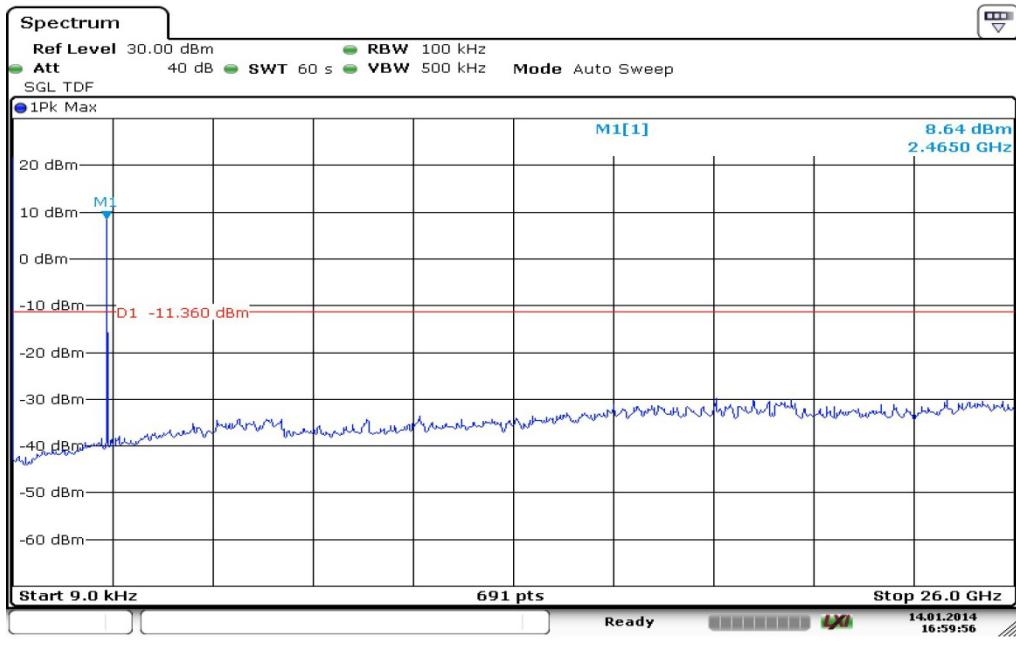
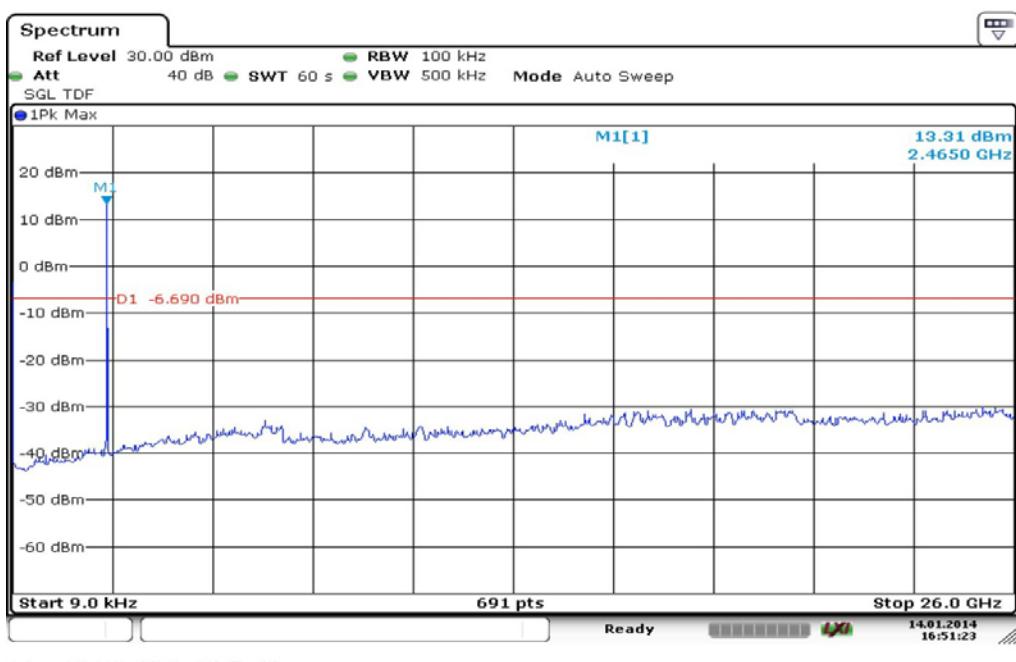
Limits:

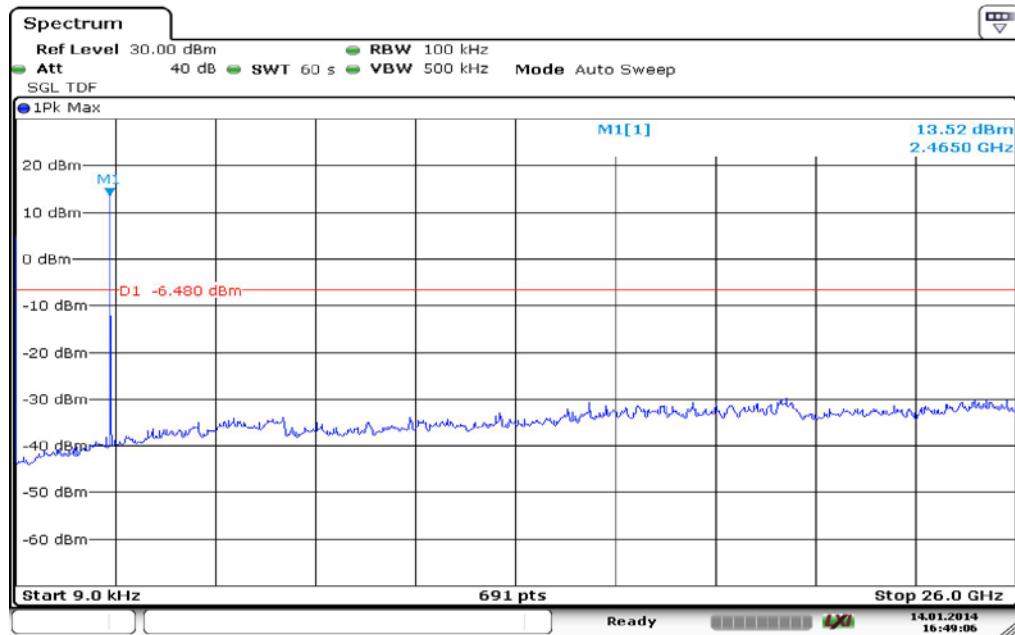
FCC	IC
TX Spurious Emissions Conducted	
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required	

Results:

TX Spurious Emissions Conducted					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
Low		8.64	30 dBm		Operating frequency complies
		<i>No peaks found</i>	-20 dBc		
Middle		13.31	30 dBm		Operating frequency complies
		<i>No peaks found</i>	-20 dBc		
High		13.52	30 dBm		Operating frequency complies
		<i>No peaks found</i>	-20 dBc		
Measurement uncertainty		± 3 dB			

Result: **Passed**

Plots: GFSK – mode 250kBps**Plot 1:** TX mode, lowest channel, up to 26 GHz**Plot 2:** TX mode, middle channel, up to 26 GHz

Plot 3: TX mode, highest channel, up to 26 GHz

Date: 14.JAN.2014 16:49:06

9.9 TX spurious emissions radiated

Description:

Measurement of the radiated spurious emissions in transmit mode. The measurement is performed at lowest, middle and highest channel.

Measurement:

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

Limits:

FCC	IC															
TX Spurious Emissions Radiated																
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 §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).																
§15.209																
<table border="1"> <thead> <tr> <th>Frequency (MHz)</th> <th>Field Strength (dBμV/m)</th> <th>Measurement distance</th> </tr> </thead> <tbody> <tr> <td>30 - 88</td> <td>30.0</td> <td>10</td> </tr> <tr> <td>88 - 216</td> <td>33.5</td> <td>10</td> </tr> <tr> <td>216 - 960</td> <td>36.0</td> <td>10</td> </tr> <tr> <td>Above 960</td> <td>54.0</td> <td>3</td> </tr> </tbody> </table>		Frequency (MHz)	Field Strength (dB μ V/m)	Measurement distance	30 - 88	30.0	10	88 - 216	33.5	10	216 - 960	36.0	10	Above 960	54.0	3
Frequency (MHz)	Field Strength (dB μ V/m)	Measurement distance														
30 - 88	30.0	10														
88 - 216	33.5	10														
216 - 960	36.0	10														
Above 960	54.0	3														

Results:

TX Spurious Emissions Radiated [dB μ V/m]								
Lowest			Middle			Highest		
F [MHz]	Detector	Level [dB μ V/m]	F [MHz]	Detector	Level [dB μ V/m]	F [MHz]	Detector	Level [dB μ V/m]
99.7	QP	25.7	99.7	QP	24.5	99.7	QP	24.5
1442.3	Peak	50.5	1468.9	Peak	45.6	1468.9	Peak	45.6
2749.9	Peak	42.7	2800.0	Peak	42.8	2834.2	Peak	42.6
4807.6	Peak	51.2	4896.8	Peak	51.7	4956.3	Peak	46.5
14423.4	Peak	50.48	14689.0	Peak	45.6	-/-	-/-	-/-
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)

Plots: GFSK – mode 250 kbps

Plot 1: Lowest channel, 30 MHz to 1 GHz, vertical & horizontal polarization

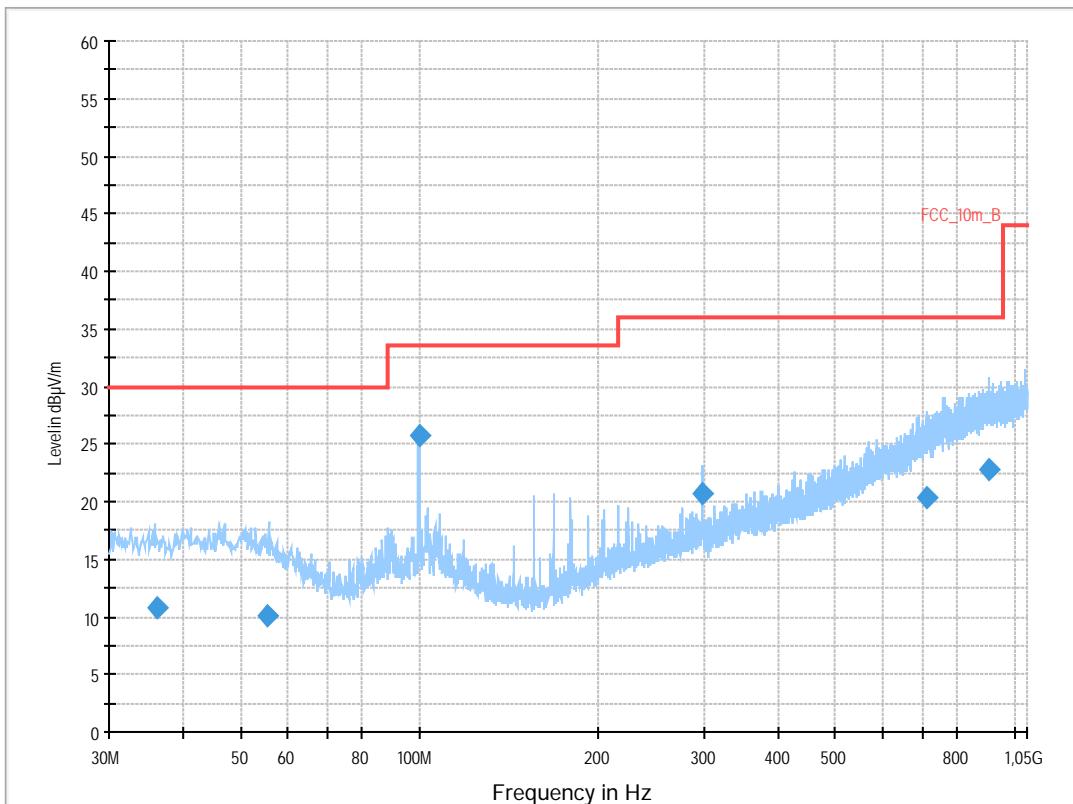
EUT: L-SKYPORT module MK2
 Serial Number: 100001994
 Test Description: FCC part 15 class B @ 10 m
 Operating Conditions: cont. TX 2404 MHz
 Operator Name: Hennemann
 Comment: powered by notebook (USB)

Hardware Setup: Electric Field (NOS)

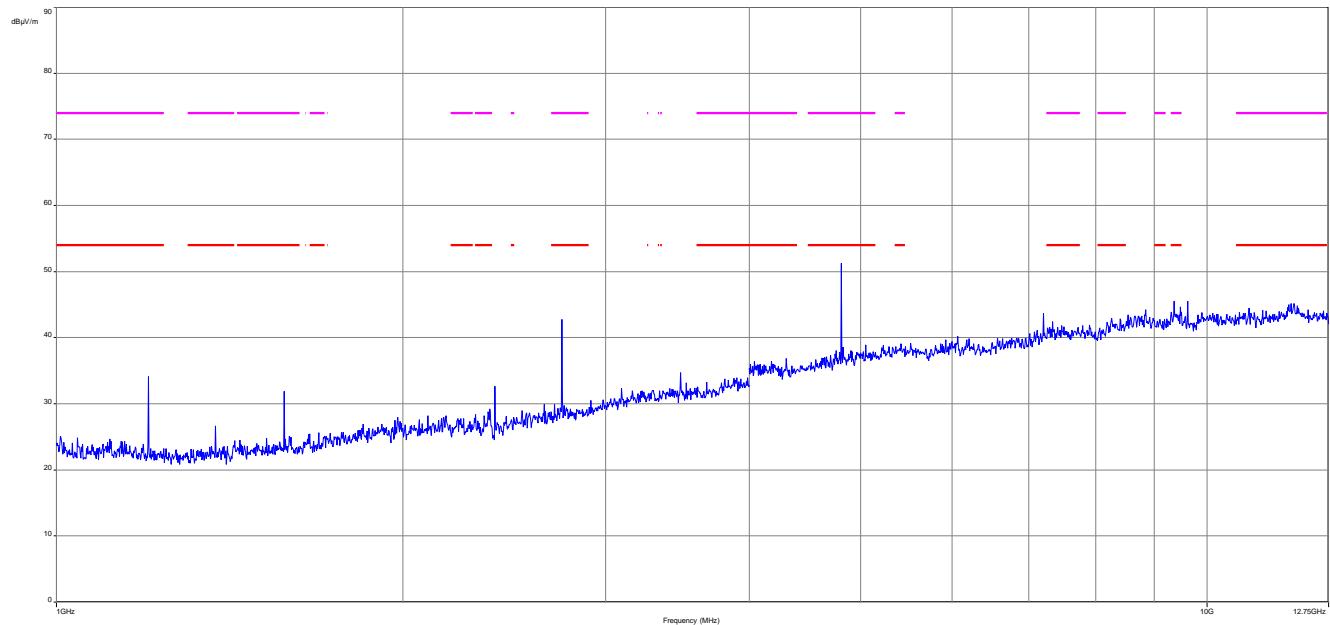
Receiver: [ESCI 3]

Level Unit: dB μ V/m

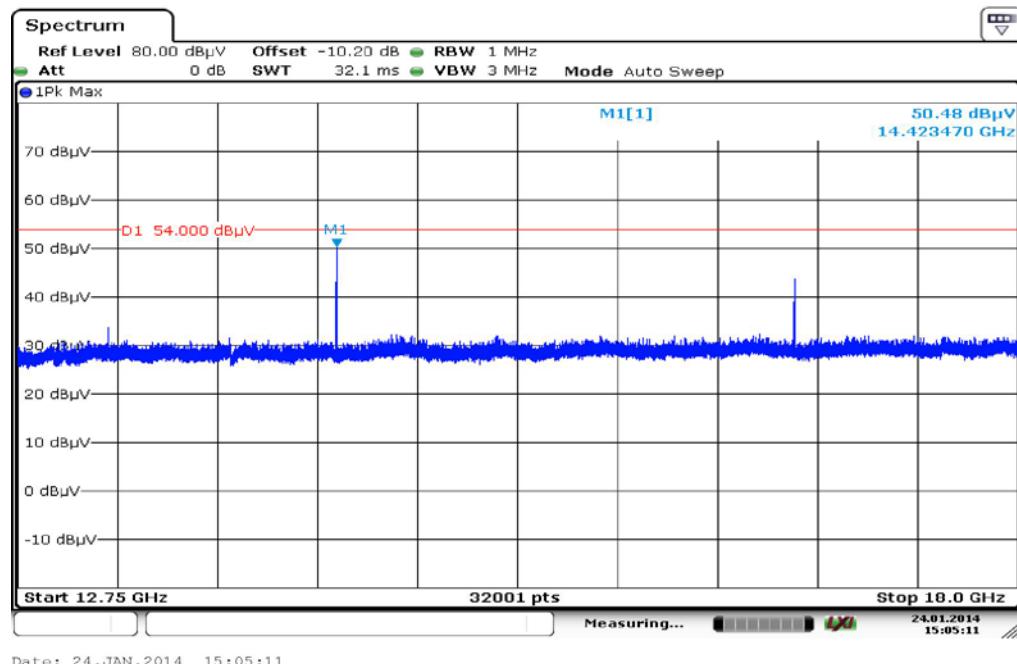
Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
30 MHz - 2 GHz	60 kHz	QPK	120 kHz	1 s	20 dB

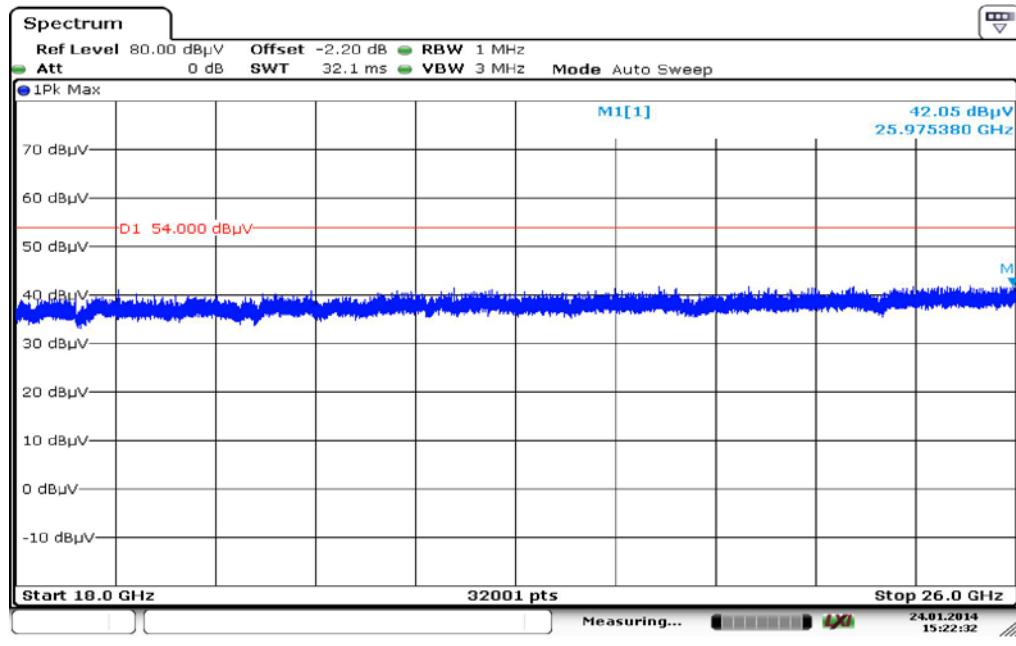


Frequency (MHz)	QuasiPeak (dB μ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimut h (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)	Comment
36.021150	10.8	1000.0	120.000	160.0	H	230.0	13.1	19.2	30.0	
55.558800	10.1	1000.0	120.000	222.0	V	314.0	12.7	19.9	30.0	
99.759450	25.7	1000.0	120.000	100.0	V	-1.0	11.9	7.8	33.5	
298.745850	20.7	1000.0	120.000	106.0	V	137.0	14.5	15.3	36.0	
713.162550	20.4	1000.0	120.000	223.0	H	202.0	22.8	15.6	36.0	
904.498650	22.7	1000.0	120.000	135.0	H	46.0	25.2	13.3	36.0	

Plot 2: Lowest channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization

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

Plot 3: Lowest channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization

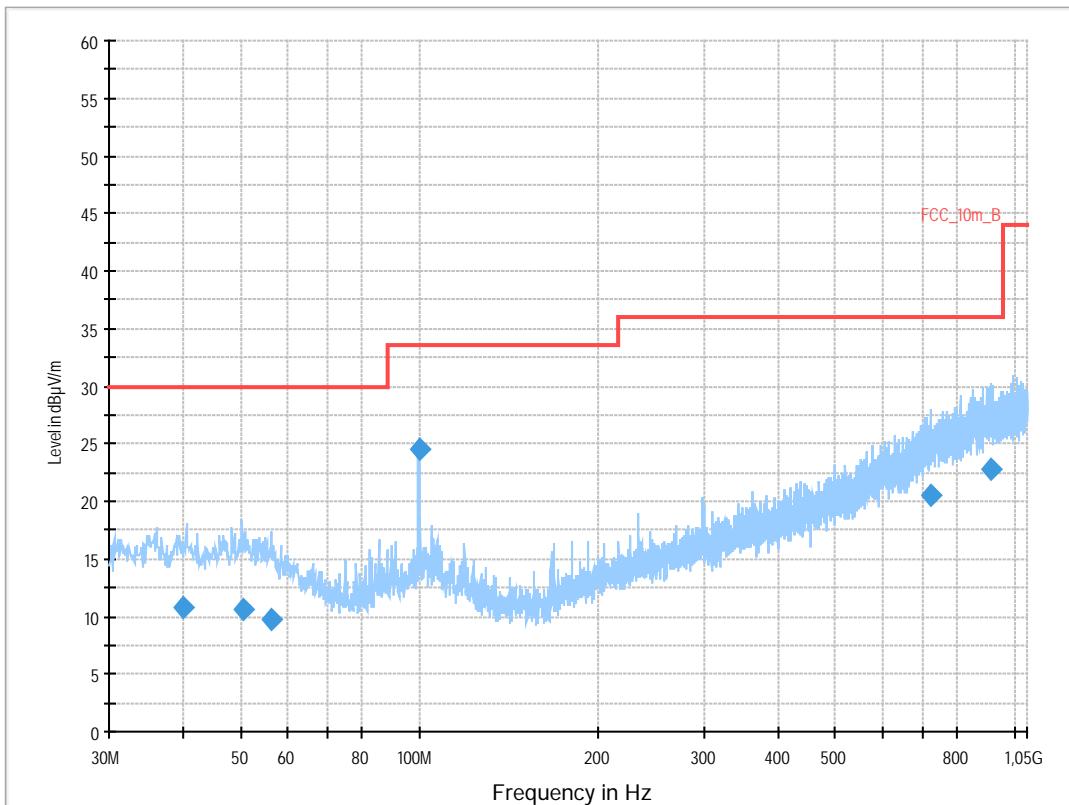
Plot 4: Lowest channel, 18 GHz to 26 GHz, vertical & horizontal polarization

Plot 5: Middle channel, 30 MHz to 1 GHz, vertical & horizontal polarization

EUT: L-SKYPORT module MK2
 Serial Number: 100001994
 Test Description: FCC part 15 class B @ 10 m
 Operating Conditions: cont. TX 2448 MHz
 Operator Name: Hennemann
 Comment: powered by notebook (USB)

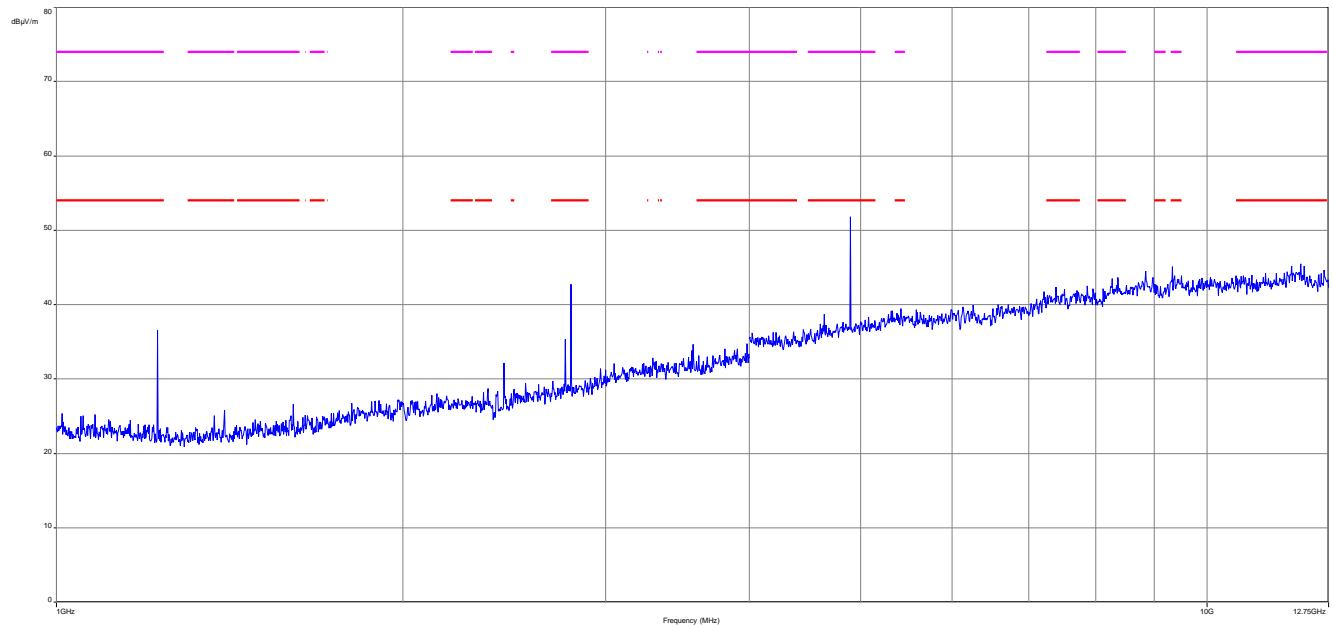
Hardware Setup: Electric Field (NOS)
 Receiver: [ESCI 3]
 Level Unit: dB μ V/m

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



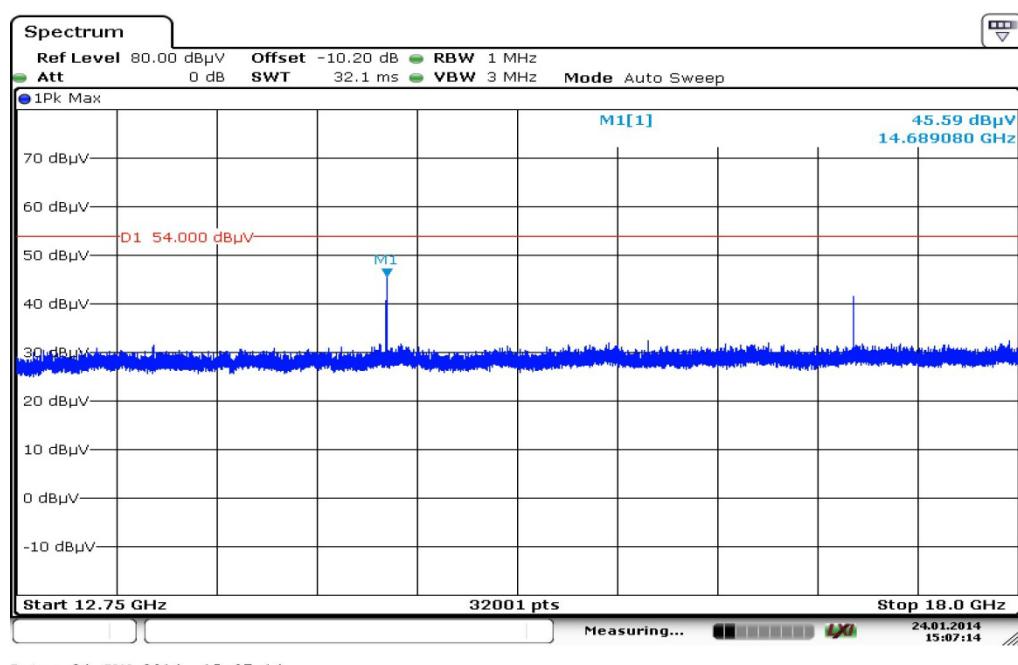
Frequency (MHz)	QuasiPeak (dB μ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)	Comment
40.091400	10.7	1000.0	120.000	170.0	H	-2.0	13.4	19.3	30.0	
50.640750	10.5	1000.0	120.000	170.0	V	100.0	13.3	19.5	30.0	
56.165700	9.8	1000.0	120.000	162.0	H	190.0	12.6	20.2	30.0	
99.723000	24.5	1000.0	120.000	105.0	V	10.0	11.9	9.0	33.5	
724.982100	20.6	1000.0	120.000	170.0	V	2.0	23.1	15.4	36.0	
914.143950	22.7	1000.0	120.000	170.0	V	175.0	25.2	13.3	36.0	

Plot 6: Middle channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization

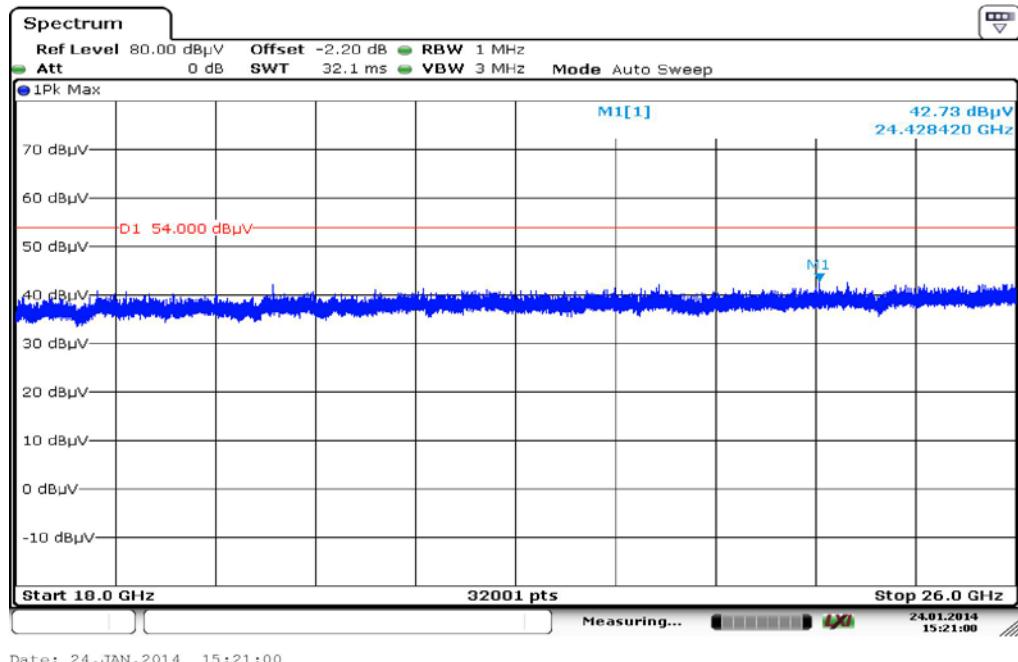


The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 7: Middle channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization



Date: 24.JAN.2014 15:07:14

Plot 8: Middle channel, 18 GHz to 26 GHz, vertical & horizontal polarization

Date: 24.JAN.2014 15:21:00

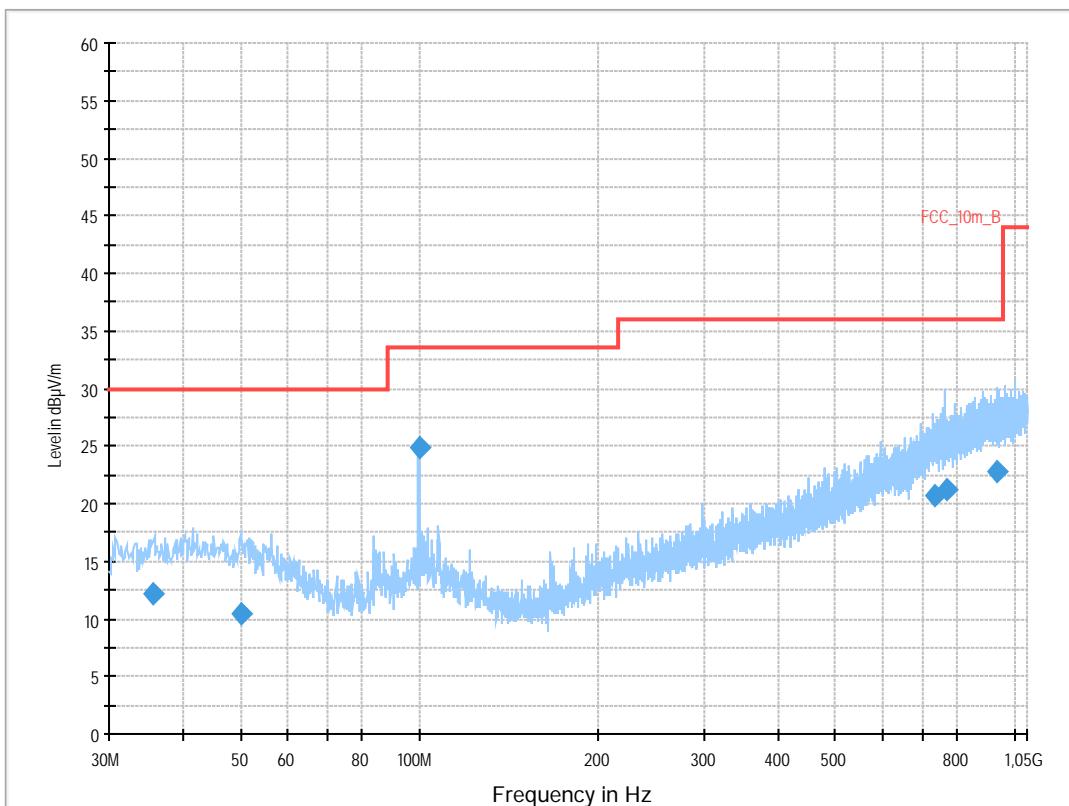
Plot 9: Highest channel, 30 MHz to 1 GHz, vertical & horizontal polarization

EUT: L-SKYPORT module MK2
 Serial Number: 100001994
 Test Description: FCC part 15 class B @ 10 m
 Operating Conditions: cont. TX 2478 MHz
 Operator Name: Hennemann
 Comment: powered by notebook (USB)

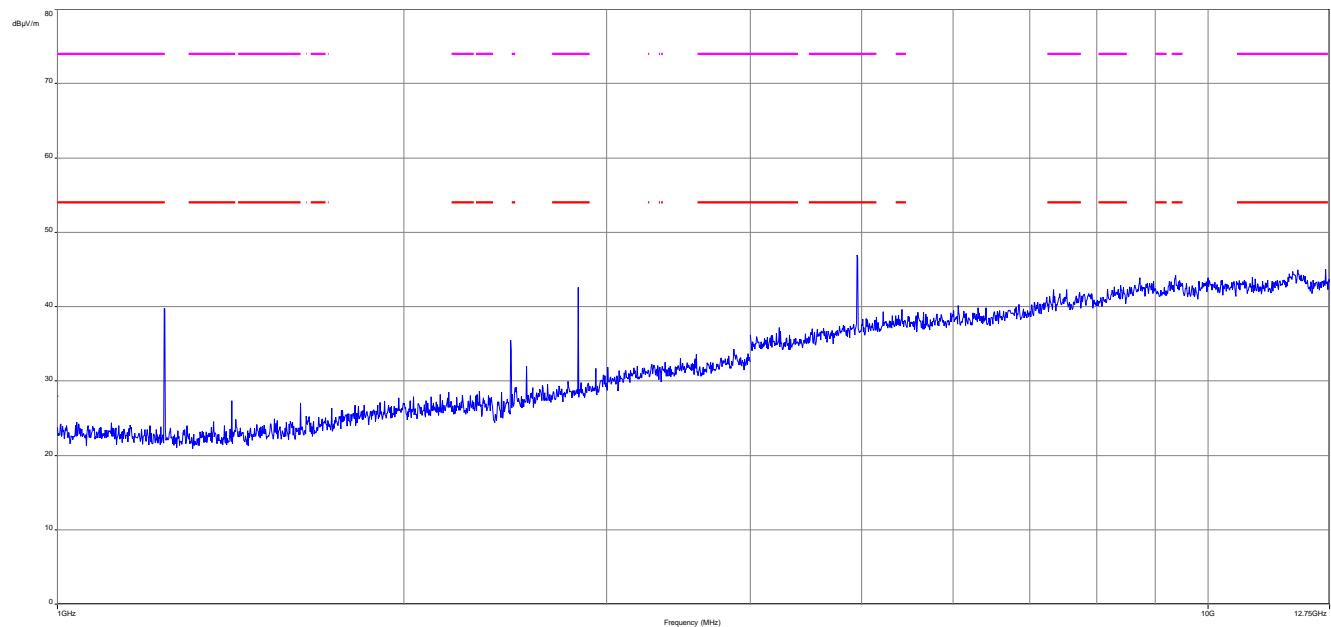
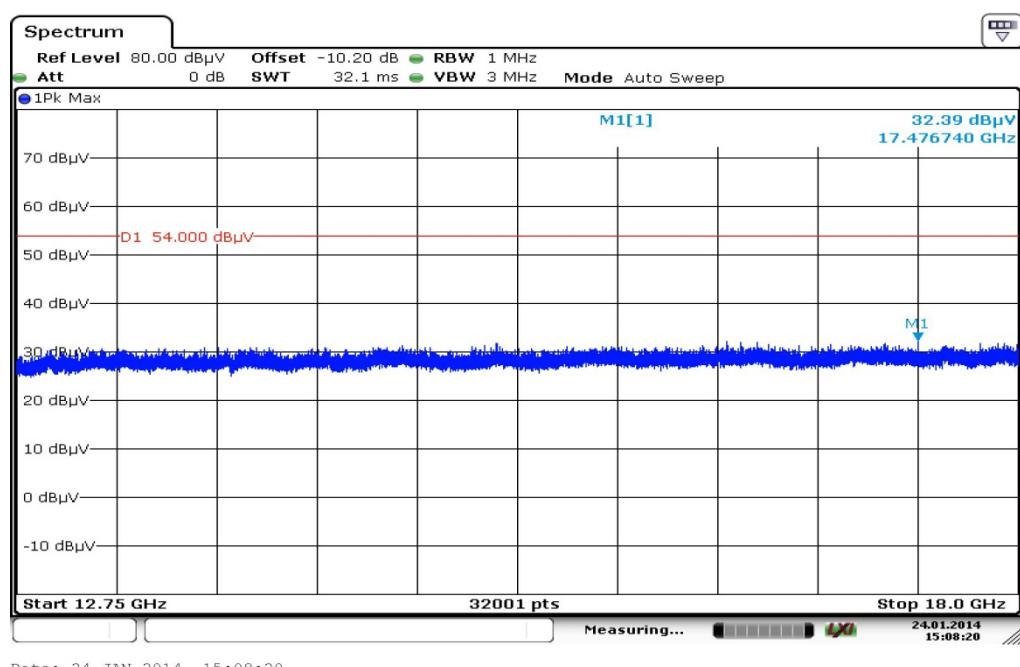
Hardware Setup: Electric Field (NOS)

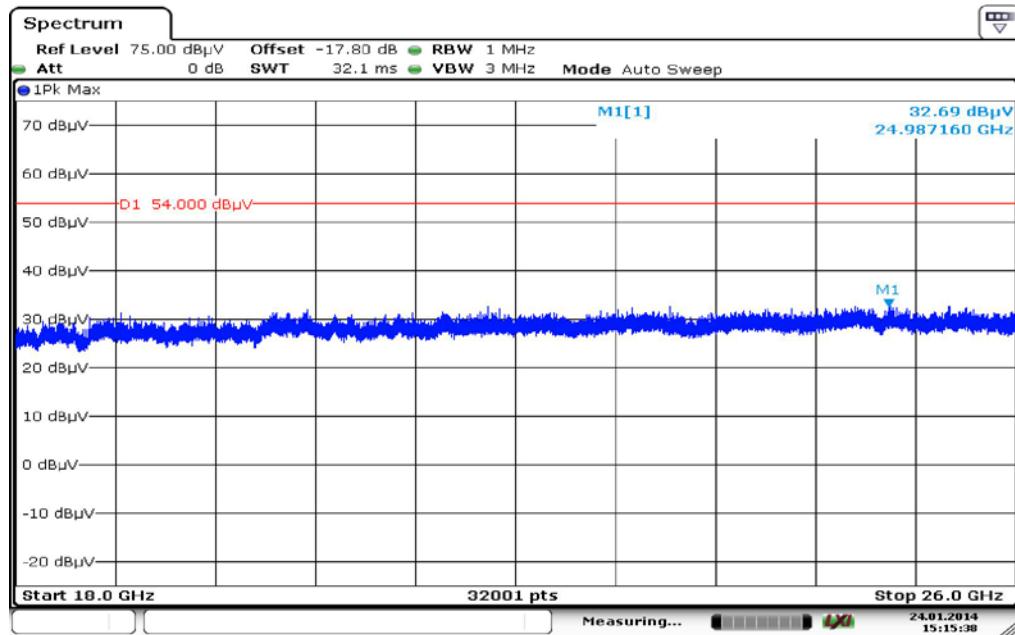
Receiver: [ESCI 3]
Level Unit: dB μ V/m

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



Frequency (MHz)	QuasiPeak (dB μ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimut h (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)	Comment
35.455350	12.2	1000.0	120.000	144.0	V	268.0	13.1	17.8	30.0	
50.214450	10.4	1000.0	120.000	155.0	H	190.0	13.4	19.6	30.0	
99.612300	24.9	1000.0	120.000	153.0	V	-2.0	11.8	8.6	33.5	
731.951850	20.8	1000.0	120.000	157.0	V	190.0	23.2	15.2	36.0	
766.832400	21.2	1000.0	120.000	170.0	V	100.0	23.7	14.8	36.0	
936.609300	22.8	1000.0	120.000	162.0	V	81.0	25.3	13.2	36.0	

Plot 10: Highest channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization**Plot 11:** Highest channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization

Plot 12: Highest channel, 18 GHz to 26 GHz, vertical & horizontal polarization

Date: 24.JAN.2014 15:15:38

9.10 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
Resolution bandwidth:	F > 1 GHz: 1 MHz F < 1 GHz: 100 kHz
Video bandwidth:	3 x RBW Remeasurement: 10 Hz / 3 MHz
Span:	30 MHz to 25 GHz
Trace-Mode:	Max Hold

Limits:

FCC	IC	
RX Spurious Emissions Radiated		
Frequency (MHz)	Field Strength (dB μ V/m)	Measurement distance
30 - 88	30.0	10
88 – 216	33.5	10
216 – 960	36.0	10
Above 960	54.0	3

Results:

RX Spurious Emissions Radiated [dB μ V/m]		
F [MHz]	Detector	Level [dB μ V/m]
99.7	QP	25.1
20984.2	Peak	43.2
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)

Plots: RX / Idle – mode**Plot 1: 30 MHz to 1 GHz, vertical & horizontal polarization**

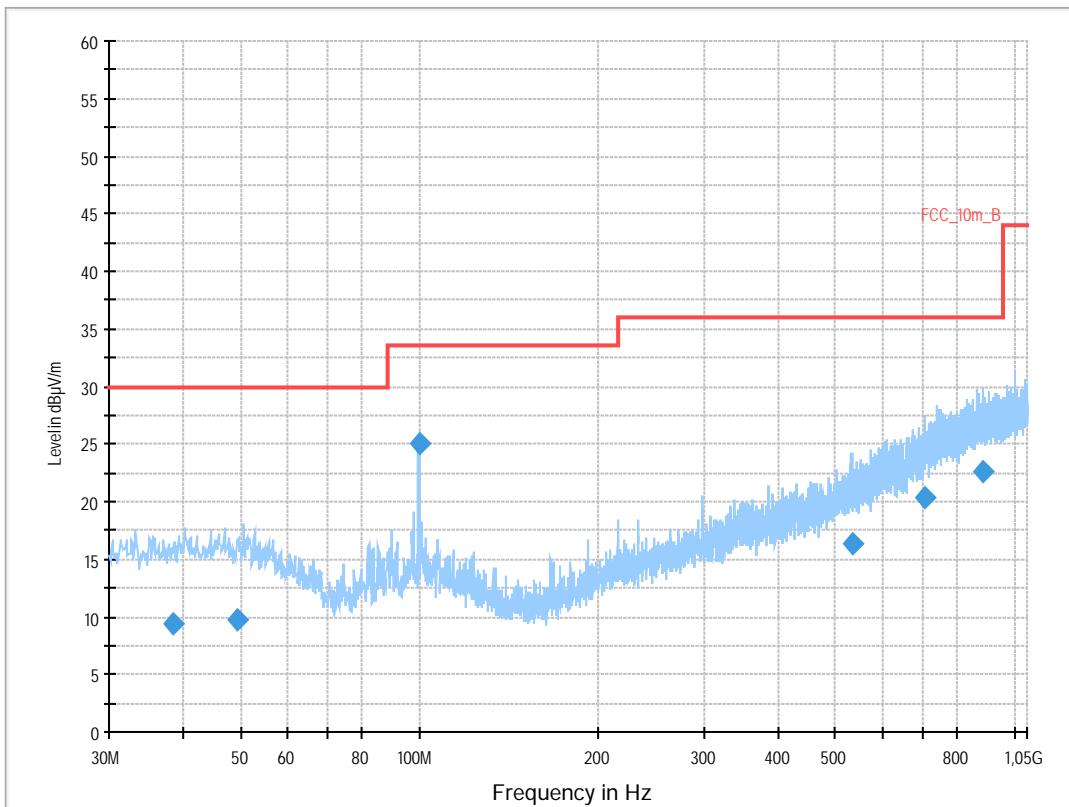
EUT: L-SKYPORT module MK2
 Serial Number: 100001994
 Test Description: FCC part 15 class B @ 10 m
 Operating Conditions: RX
 Operator Name: Hennemann
 Comment: powered by notebook (USB)

Hardware Setup: Electric Field (NOS)

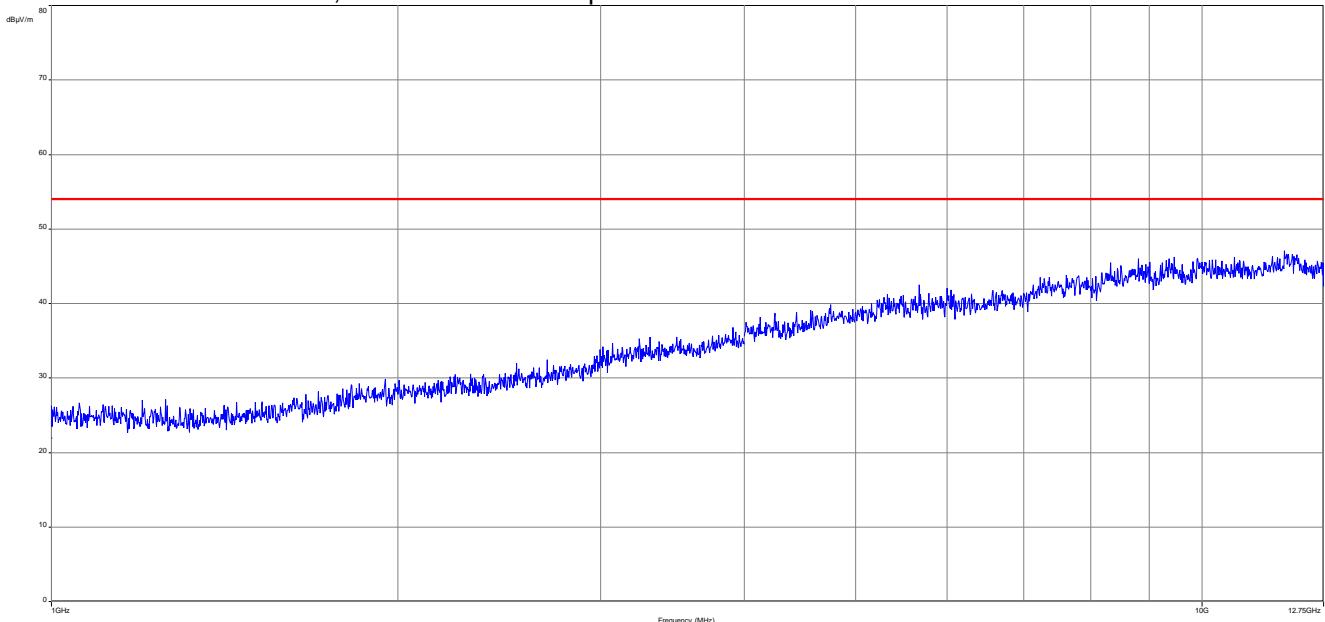
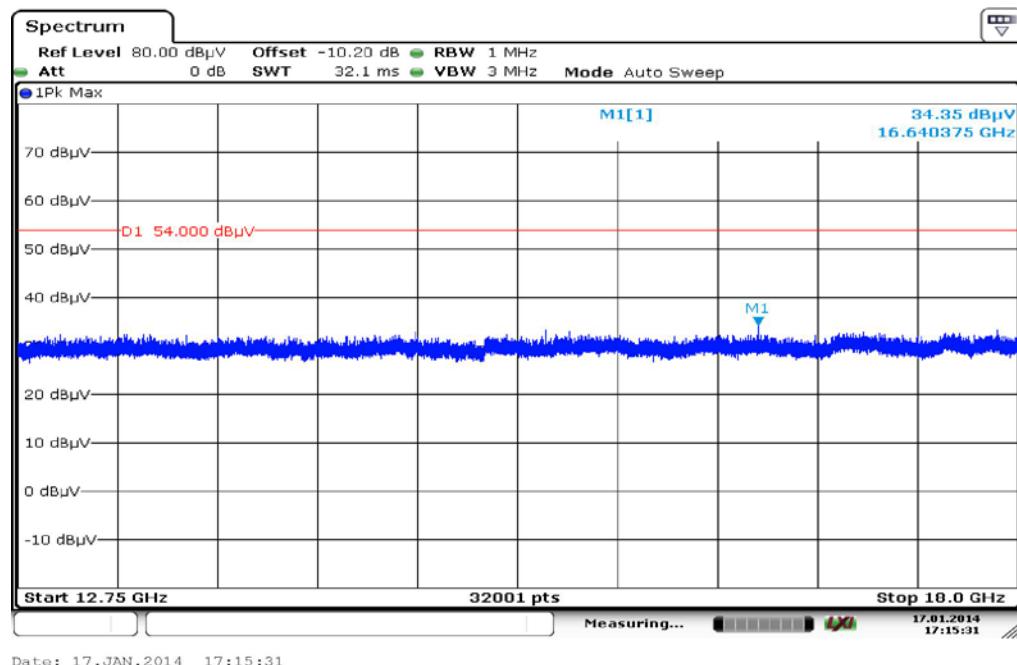
Receiver: [ESCI 3]

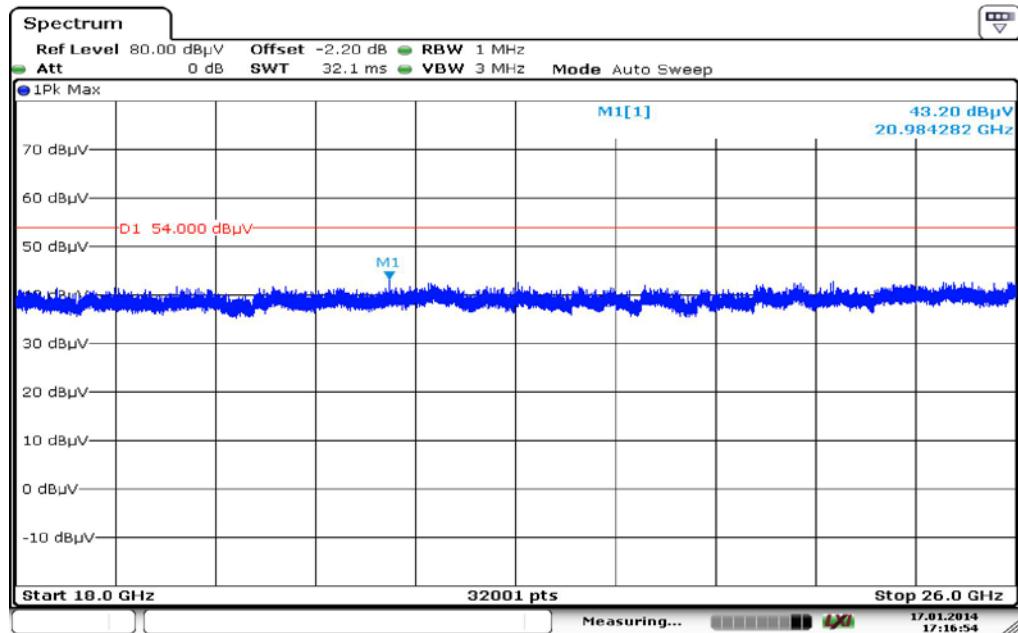
Level Unit: dB μ V/m

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



Frequency (MHz)	QuasiPeak (dB μ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimut h (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)	Comment
38.373450	9.5	1000.0	120.000	170.0	V	190.0	13.3	20.5	30.0	
49.399500	9.8	1000.0	120.000	156.0	H	-9.0	13.4	20.2	30.0	
99.774150	25.1	1000.0	120.000	170.0	V	10.0	11.9	8.4	33.5	
532.667400	16.4	1000.0	120.000	98.0	H	170.0	19.1	19.6	36.0	
709.011150	20.3	1000.0	120.000	170.0	V	10.0	22.7	15.7	36.0	
886.768050	22.6	1000.0	120.000	170.0	H	10.0	25.0	13.4	36.0	

Plot 2: 1 GHz to 12.75 GHz, vertical & horizontal polarization**Plot 3: 12.75 GHz to 18 GHz, vertical & horizontal polarization**

Plot 4: 18 GHz to 26 GHz, vertical & horizontal polarization

9.11 TX spurious emissions radiated < 30 MHz

Description:

Measurement of the radiated spurious emissions in transmit mode below 30 MHz. The EUT is set to channel 39. This measurement is representative for all channels and modes. If critical peaks are found channel 00 and channel 78 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	
TX Spurious Emissions Radiated < 30 MHz		
Frequency (MHz)	Field Strength (dB μ V/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

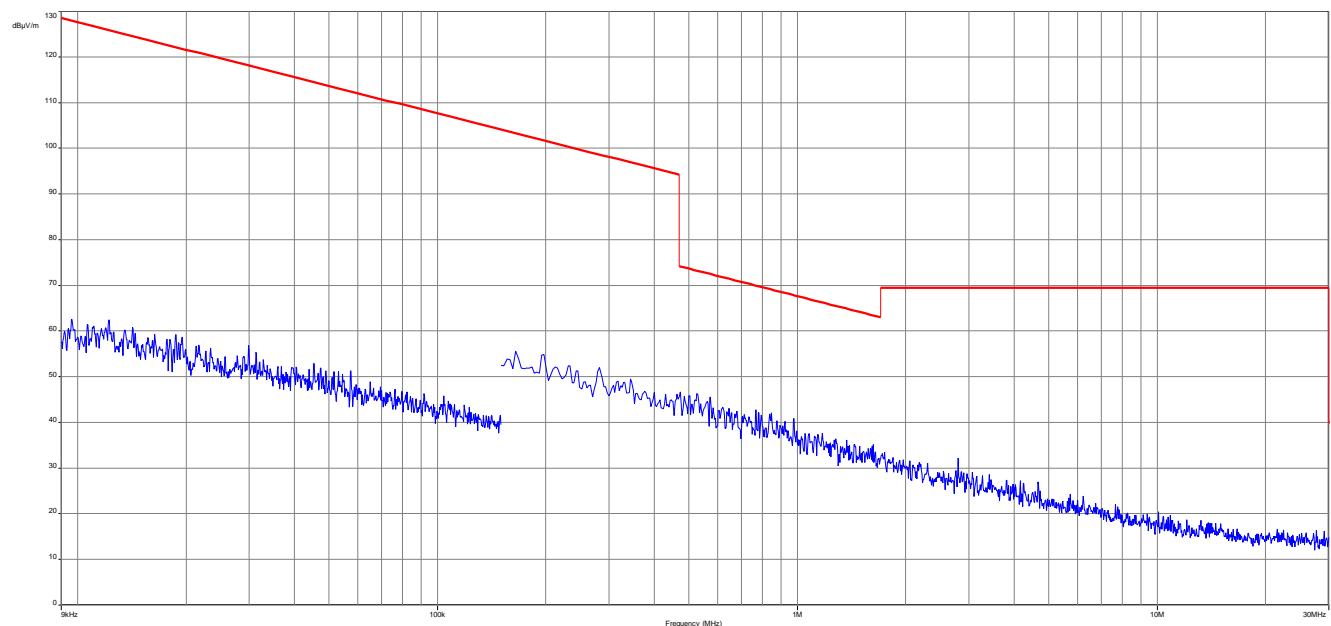
Results:

TX Spurious Emissions Radiated < 30 MHz [dB μ V/m]		
F [MHz]	Detector	Level [dB μ V/m]
No peaks detected!		
Measurement uncertainty		± 3 dB

Result: Passed

Plot:

Plot 1: 9 kHz to 30 MHz / 2448 MHz (valid for all channels)



9.12 TX spurious emissions conducted < 30 MHz

Description:

Measurement of the conducted spurious emissions in transmit mode below 30 MHz. The EUT is set to channel 39. If critical peaks are found channel 00 and channel 78 will be measured too. Both power lines, phase and neutral line, are measured. Found peaks are remeasured with average and quasi peak detection to show compliance to the limits.

Measurement:

Measurement parameter	
Detector:	Peak - Quasi Peak / Average
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:

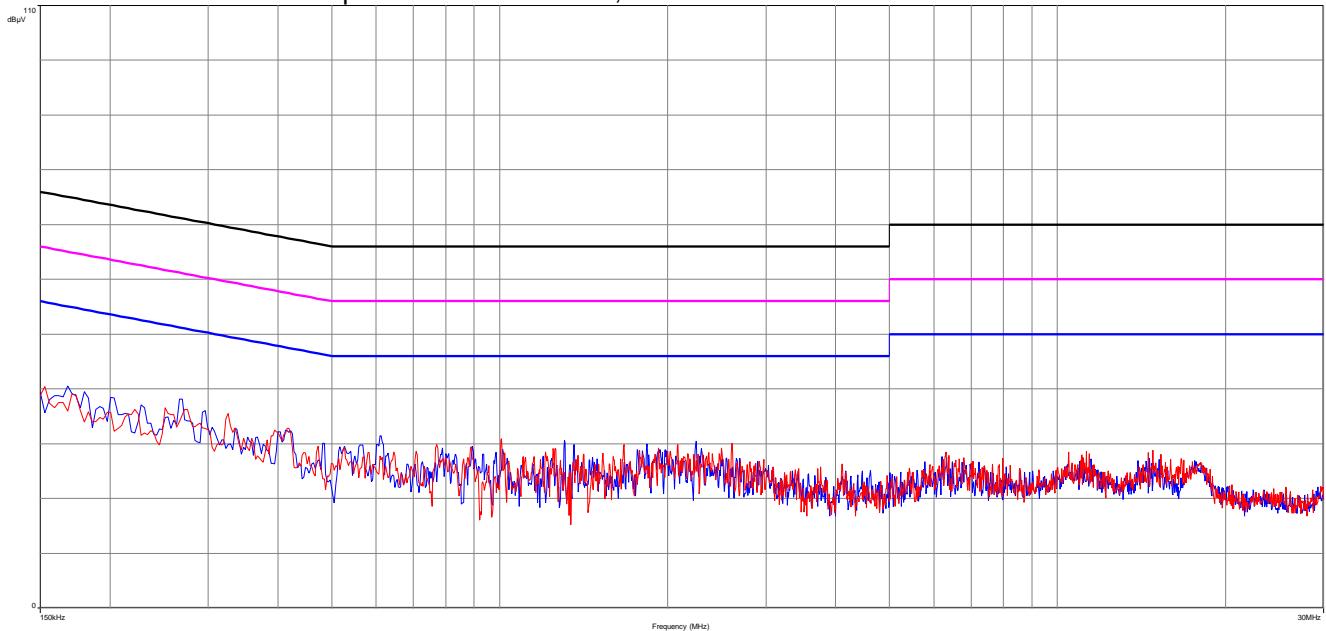
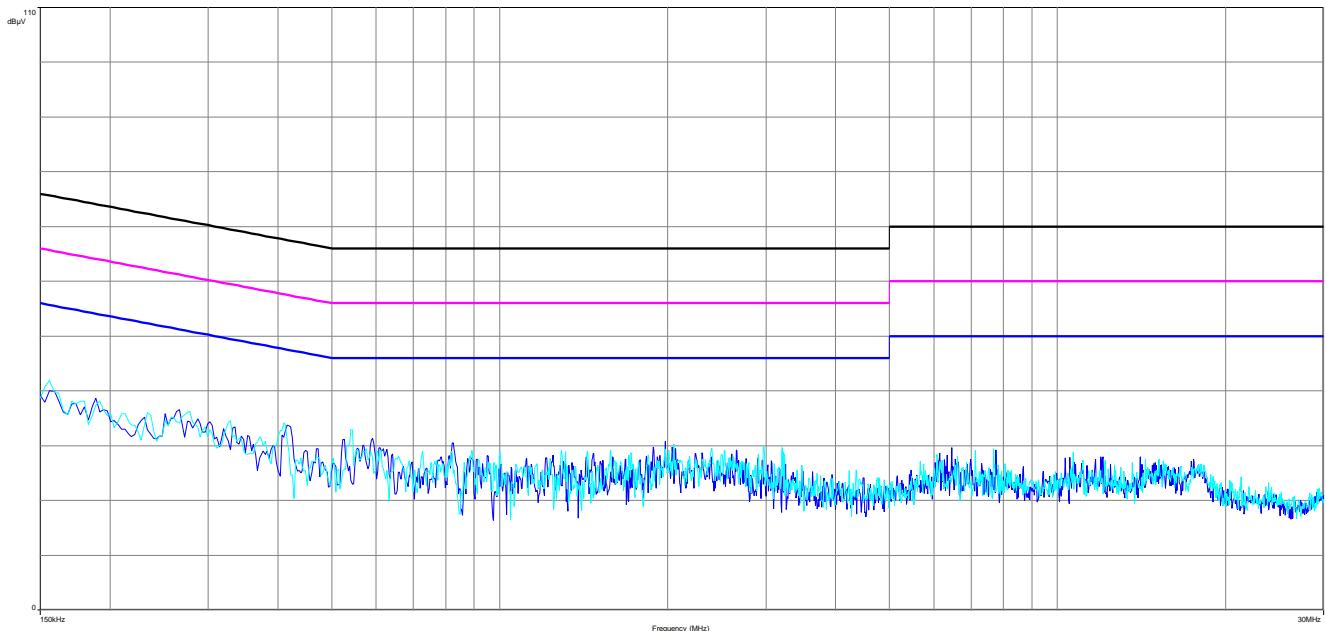
FCC		IC
TX Spurious Emissions Conducted < 30 MHz		
Frequency (MHz)	Quasi-Peak (dB μ V/m)	Average (dB μ V/m)
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30.0	60	50

*Decreases with the logarithm of the frequency

Results:

TX Spurious Emissions Conducted < 30 MHz [dB μ V/m]		
F [MHz]	Detector	Level [dB μ V/m]
No peaks found		
Measurement uncertainty		± 3 dB

Result: Passed

Plots:**Plot 1: 150 kHz to 30 MHz / phase Line and neutral, TX mode****Plot 2: 150 kHz to 30 MHz / phase Line and neutral, TX mode**

10 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 (Labor/Item).

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Signal Analyzer 40 GHz	FSV40	R&S	101042	300004517	k	22.10.2012	22.01.2014
2	n. a.	Power Supply 0-20V, 0-5A	6632B	Agilent Technologies	GB42110541	400000562	vlKI!	10.01.2013	10.01.2016
3	n. a.	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP Meßtechnik	2818A03450	300001040	Ve	12.01.2012	12.01.2015
4	n. a.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vlKI!	08.05.2013	08.05.2015
5	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev		
6	n. a.	Switch / Control Unit	3488A	HP Meßtechnik	*	300000199	ne		
7	9	Artificial Mains 9 kHz to 30 MHz	ESH3-Z5	R&S	828576/020	300001210	Ve	06.01.2012	
8	n. a.	Switch / Control Unit	3488A	HP Meßtechnik	2719A15013	300001156	ne		
9	9	Isolating Transformer	MPL IEC625 Bus Regeltrenntravo	Erfi	91350	300001155	ne		
10	n. a.	Three-Way Power Splitter, 50 Ohm	11850C	HP Meßtechnik		300000997	ne		
11	90	Active Loop Antenna 10 kHz to 30 MHz	6502	Kontron Psychotech	8905-2342	300000256	k	13.06.2013	13.06.2015
12	n. a.	Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143	ne		
13	n. a.	Band Reject filter	WRCG185 5/1910-1835/1925-40/8SS	Wainwright	7	300003350	ev		
14	n. a.	Band Reject filter	WRCG240 0/2483-2375/2505-50/10SS	Wainwright	11	300003351	ev		
15	n. a.	Highpass Filter	WPKX7.0/1 8G-8SS	Wainwright	18	300003789	ne		
16	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854	vlKI!	14.10.2011	14.10.2014
17	n. a.	MXE EMI Receiver 20 Hz bis 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	21.02.2013	21.02.2014
18	11b	Microwave System Amplifier, 0.5-26.5 GHz	83017A	HP Meßtechnik	00419	300002268	ev		
19	A026	Std. Gain Horn Antenna 12.4 to 18.0 GHz	639	Narda	8402	300000787	k	22.07.2013	22.07.2015
20	A029	Std. Gain Horn Antenna 18.0 to 26.5 GHz	638	Narda	8205	300002442	k	19.07.2013	19.07.2015
21	n. a.	Broadband Low Noise Amplifier 18-50 GHz	CBL18503 070-XX	CERNEX	19338	300004273	ne		

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

11 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



Deutsche Akkreditierungsstelle GmbH

Bescheinigt 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)
Umweltstation
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
Seite hinzugetragen auf der Rückseite

Im Auftrag
Dr. Wolfgang Eigner
Abteilungsleiter

Back side of certificate

Deutsche Akkreditierungsstelle GmbH

Standort Berlin
Spittelmarkt 10
10117 Berlin

Standort Frankfurt am Main
Gartenstraße 6
60594 Frankfurt am Main

Standort Braunschweig
Bundesallee 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 umsichtig 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 Akkreditierungsstellen (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>