







CETECOM ICT Services

consulting - testing - certification >>>

TEST REPORT

Test report no.: 1-9525/15-02-02



Testing laboratory

CETECOM ICT Services GmbH

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66117 Saarbruecken / Germany
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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-12076-01-00

Applicant

ABITRON Control Systems GmbH

Wiesnerstr. 20

4950 Altheim / AUSTRIA

Phone: +43 (0) 7723 44 860 700

Fax: -/-

Contact: Klaus Leuschner

e-mail: <u>klaus.leuschner@abitron.de</u> Phone: +49 (0) 9452 189 610

Manufacturer

Circuit Design INC

Azumino-city, Nagano, 399-8303

7557-1 Hotaka / Japan

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: Transmitter
Model name: 915FBTX-05

FCC ID: 2AC8P-915FBTX-05 IC: 12310A-915FBTX-05

Frequency: 915 MHz
Technology tested: Proprietary

Antenna: Integrated antenna

Power supply: 5 V DC by external power supply

Temperature range: -20°C to +65°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:	Test performed:		
Tobias Wittenmeier	Christoph Cohnoider		
Radio Communications & EMC	Christoph Schneider Radio Communications & EMC		



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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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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: 2015-04-16
Date of receipt of test item: 2015-04-22
Start of test: 2015-04-22
End of test: 2015-04-27

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

T_{nom} +22 °C during room temperature tests

Temperature: T_{max} +65 °C during high temperature tests

 T_{min} -20 °C during low temperature tests

Relative humidity content: 43 %

Barometric pressure: not relevant for this kind of testing

V_{nom} 5 V DC by external power supply

Power supply: V_{max} 12 V

 V_{min} 3.5 V

5 Test item

Kind of test item	:	Transmitter
PMN	PMN : 915FBTX-05	
Equivalent variants	:	Please take a look at the external customer declaration!
S/N serial number	:	-/-
HVIN	:	-/-
FVIN	:	-/-
Frequency band [MHz]	:	915 MHz
Type of modulation	:	FSK
Number of channels	:	3
Antenna	:	Integrated antenna
Power supply : 5 V DC by external power supply		5 V DC by external power supply
Temperature range	:	-20°C to +65°C

5.1 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup- and EUT-photos are included in test report: 1-9525/15-02-01_AnnexB

1-9525/15-02-01_AnnexC

6 Test laboratories sub-contracted

None



7 Description of the test setup

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, rfgenerating 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).

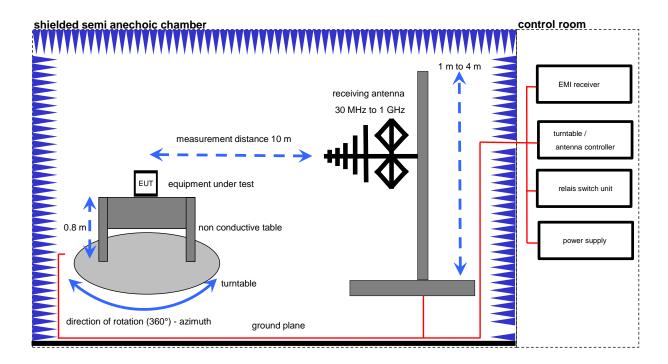
Agenda: Kind of Calibration

k ne	calibration / calibrated not required (k, ev, izw, zw not required)	EK zw	limited calibration 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



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.

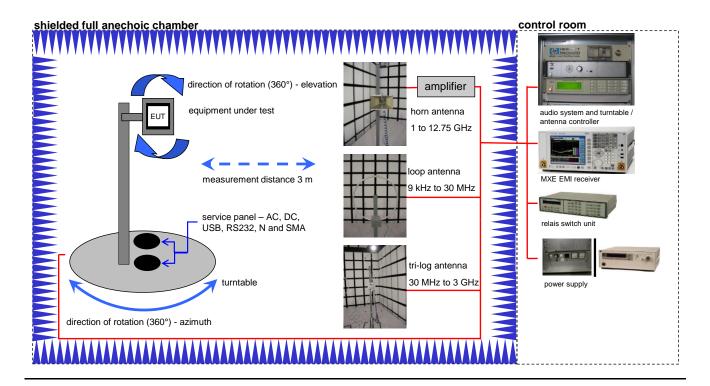


Equipment table:

No.	Lab / Item	Equipment	Туре	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	45	Switch-Unit	3488A	HP	2719A14505	300000368	g		
2	50	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04466	300000580	ne		
3	50	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	26.01.2015	26.01.2016
4	50	Analyzer-Reference- System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	Ve	11.02.2014	11.02.2016
5	50	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw		
6	50	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw		
7	50	Turntable Interface- Box	Model 105637	ETS-Lindgren	44583	300003747	izw		
8	50	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	22.04.2014	22.04.2016
9	50	Spectrum-Analyzer	FSU26	R&S	200809	300003874	k	26.01.2015	26.01.2016
10	6	20 MHz Pulse/Function Generator	8111A	НР	2215G00867	300001117	Ve	30.01.2014	30.01.2017



7.2 Radiated measurements chamber C

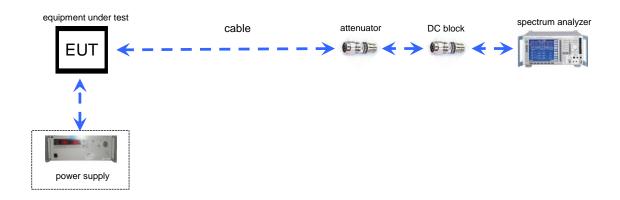


Equipment table:

No.	Lab / Item	Equipment	Туре	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	2818A03450	300001040	Ve	20.01.2015	20.01.2018
2	n. a.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vIKI!	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	*	300000199	ne		
5	90	Active Loop Antenna 10 kHz to 30 MHz	6502	Kontron Psychotech	8905-2342	300000256	k	13.06.2013	13.06.2015
6	90	Amplifier	js42-00502650-28- 5a	Parzich GMBH	928979	300003143	ne		
7	90	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne		
8	90	MXE EMI Receiver 20 Hz to 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	06.03.2015	06.03.2016
9	90	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne		
10	6	20 MHz Pulse/Function Generator	8111A	HP	2215G00867	300001117	Ve	30.01.2014	30.01.2017



7.3 Conducted measurements



Equipment table:

No.	Lab / Item	Equipment	Туре	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	6	20 MHz Pulse/Function Generator	8111A	HP	2215G00867	300001117	Ve	30.01.2014	30.01.2017
2	n. a.	EMI Test Receiver 9 kHz - 3 GHz incl. Preselector	ESPI3	R&S	101713	300004059	k	23.01.2015	23.01.2016
3	n. a.	DC Power Supply 0 - 32V	1108-32	Heiden Elektronik	001802	300001383	Ve	29.01.2014	29.01.2017



8 Summary of measurement results

No deviations from the technical specifications were ascertained
There were deviations from the technical specifications ascertained
This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	47 CFR Part 15	See table!	2015-04-29	-/-

Test specification clause	Test case	Temperature conditions	Power source voltages	Pass	Fail	NA	NP	Results
§15.249(a)	Field strength of emissions (wanted signal)	Nominal	Nominal	\boxtimes				complies
§2.1049	Occupied bandwidth (99% bandwidth)	Nominal	Nominal	\boxtimes				complies
§15.209(a) / §15.249(b)(1)(2)(3)	Field strength of emissions (spurious)	Nominal	Nominal	\boxtimes				complies
§15.207(a)	Conducted emissions < 30 MHz	Nominal	Nominal	\boxtimes				complies
§15.109	Field strength of emissions (spurious)	Nominal	Nominal	\boxtimes				complies

Note: NA = Not Applicable; NP = Not Performed



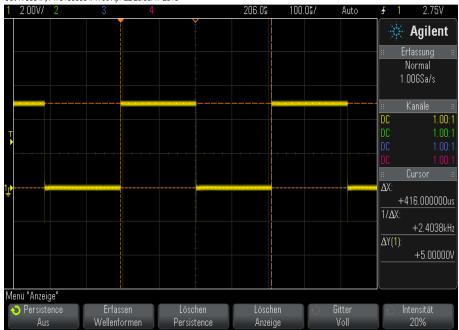
9 Additional comments

Reference documents: 20150414_TD_FBTX-05-V1_VTK_eng.pdf

Special test descriptions: None

Configuration descriptions: input signal at 'TTL' pin:





Test mode: Normal operation, no special test mode available.

Special software is used.



10 Measurement results

10.1 Field strength of emissions (wanted signal)

Description:

Measurement of the maximum radiated field strength of the wanted signal.

Measurement:

Measurement parameter					
Detector:	Pos-Peak				
Sweep time:	Auto				
Video bandwidth:	Auto				
Resolution bandwidth:	1 MHz				
Span:	max. 100 MHz				
Trace-Mode:	Max Hold				
Used test setup:	See chapter 7.2				

Limits:

FCC									
	Field strength of emissions								
The field strength of emissions from ir	ntentional radiators operated within these following:	requency bands shall comply with the							
Frequency [MHz]	Field Strength [dBµV/m]	Measurement distance							
902 – 928 MHz	94	3							

Result:

Test condition	Maximum field strength					
Test condition	Frequency [MHz]	Field strength [dBµV/m] @ 3 m				
	915.500 MHz	93.89				
Tnom / Vnom	915.700 MHz	93.52				
I nom / V nom	915.750 MHz	93.67				
	915.825 MHz	93.72				
Measurement uncertainty	± 3 dB					

Verdict: complies



10.2 Occupied bandwidth (99% bandwidth)

Description:

Measurement of the 99% bandwidth of the wanted signal.

Measurement:

Measurement parameter							
Detector:	Peak						
Sweep time:	Auto						
Video bandwidth:	1 kHz						
Resolution bandwidth:	3 kHz						
Span:	50 kHz						
Trace-Mode:	Max Hold						
Used test setup:	See chapter 7.3						

Results:

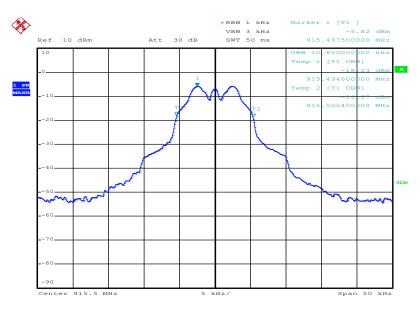
Took oon diking	Occupied bandwidth					
Test condition	Frequency [MHz]	Occupied bandwidth [kHz]				
	915.500 MHz	10.8				
Tnom / Vnom	915.700 MHz	10.8				
I nom / V nom	915.750 MHz	10.8				
	915.825 MHz	10.8				
Measurement uncertainty	± 3	dB				

Verdict: complies



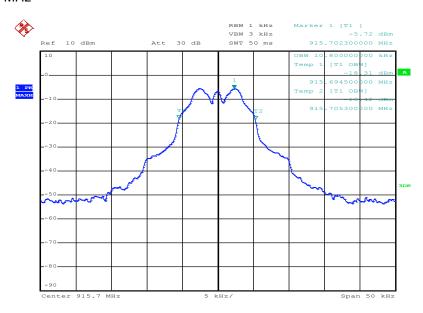
Plots:

Plot 1: 915.500 MHz



Date: 27.APR.2015 10:13:50

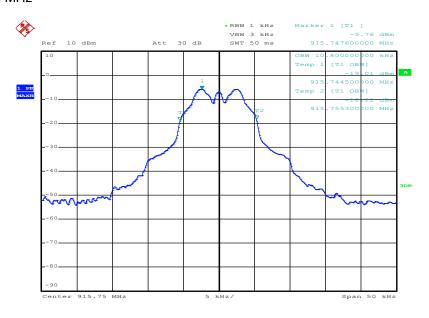
Plot 2: 915.700 MHz



Date: 27.APR.2015 10:03:32

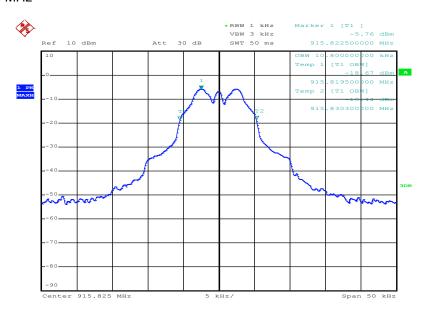


Plot 3: 915.750 MHz



Date: 27.APR.2015 10:11:23

Plot 4: 915.825 MHz



Date: 27.APR.2015 10:08:45



10.3 Field strength of emissions (radiated spurious)

Description:

Measurement of the radiated spurious emissions in transmit mode.

Measurement:

Measurement parameter									
Detector:	Peak / Quasi Peak								
Sweep time:	Auto								
Video bandwidth:	Auto								
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz								
Frequency range:	30 MHz to 100 GHz								
Trace-Mode:	Max Hold								
Used test setup:	9 kHZ – 30 MHz: See chapter 7.2 30 MHz – 1 GHz: See chapter 7.1 1 GHz – 12.75 GHz: See chapter 7.2								

Limits:

	FCC								
	Radiated Spurious Emissions								
Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.									
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							
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													
	915.500 MHz			915.700 MHz			915.750 MHz							
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]						
30.97	Quasi peak	29.37	30.87	30.87 Qua	Quasi peak	29.65	30.87	Quasi peak	29.56					
41.55	Quasi peak	25.60	41.40	Quasi peak	25.82 41.40	41.40	Quasi peak	25.93						
2746	Peak	50.40	2747	Peak	50.89	2747	Peak	50.61						
Meas	surement unce	rtainty			± 3	dB								

	TX Spurious Emissions Radiated											
	915.825 MHz			-/-			-/-					
F [MHz] Detector Level [dBµV/m]			F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]				
30.92	Quasi peak	27.65										
41.11	Quasi peak	24.42										
2748	Peak	50.45										
Measurement uncertainty					± 3	dB						

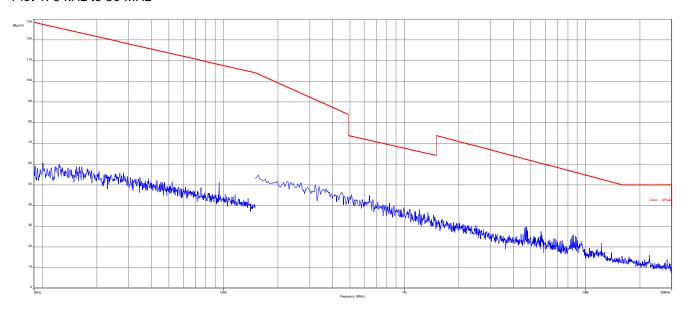
Verdict: complies

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)



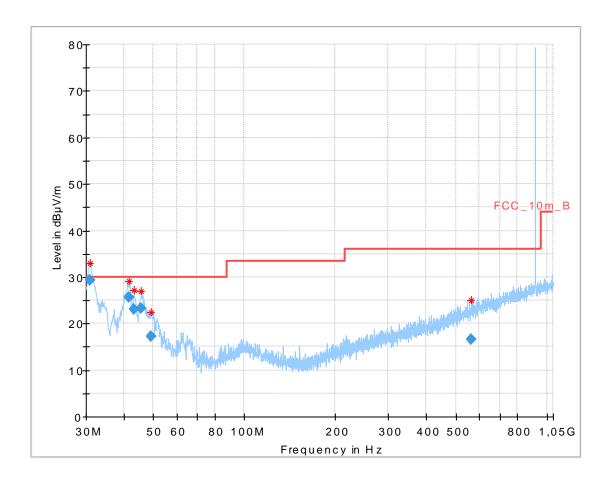
Plots 915.500 MHz:

Plot 1: 9 kHz to 30 MHz





Plot 2: 30 MHz to 1 GHz, horizontal / vertical polarization - max hold

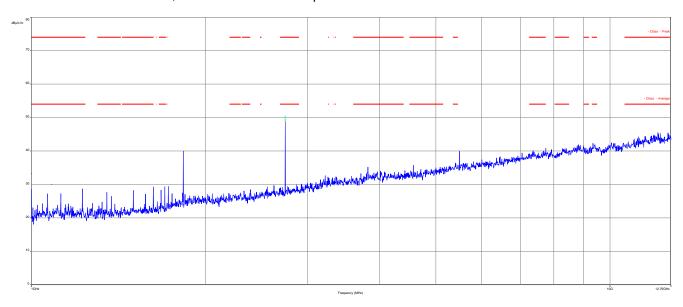


Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.974400	29.37	30.00	0.63	1000.0	120.000	101.0	٧	280	13.4
41.544600	25.60	30.00	4.40	1000.0	120.000	98.0	٧	100	14.0
43.205250	23.05	30.00	6.95	1000.0	120.000	98.0	٧	10	13.9
45.697500	23.19	30.00	6.81	1000.0	120.000	98.0	٧	10	13.7
49.293600	17.32	30.00	12.68	1000.0	120.000	101.0	٧	260	12.8
564.568650	16.51	36.00	19.49	1000.0	120.000	98.0	V	261	19.7



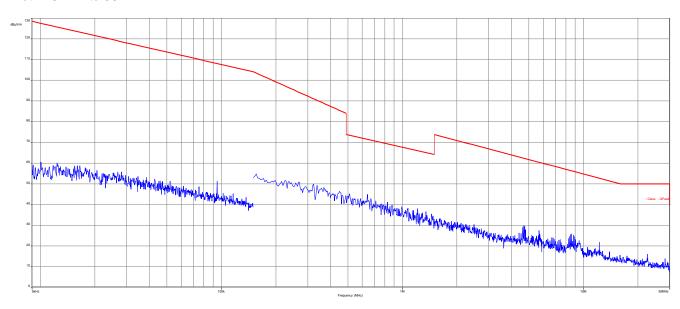
Plot 3: 1 GHz to 12.75 GHz, vertical and horizontal polarization





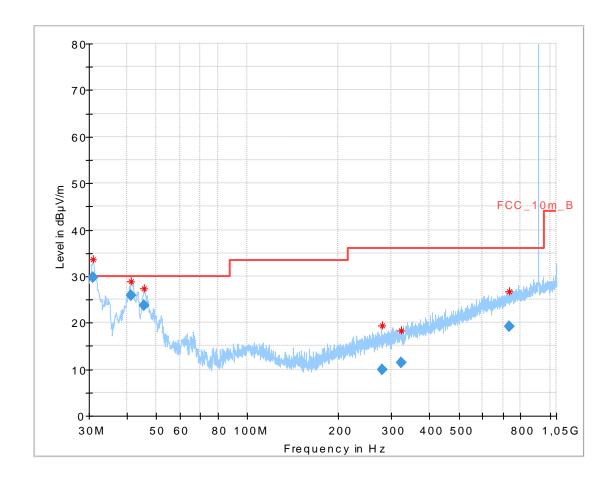
Plots 915.700 MHz:

Plot 1: 9 kHz to 30 MHz





Plot 2: 30 MHz to 1 GHz, horizontal / vertical polarization - max hold

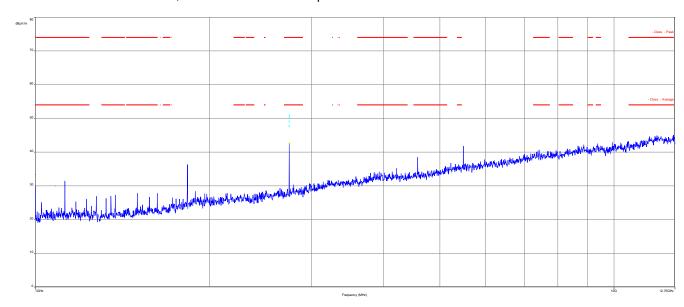


Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.871950	29.65	30.00	0.35	1000.0	120.000	101.0	٧	-10	13.4
41.398200	25.82	30.00	4.18	1000.0	120.000	98.0	٧	10	14.0
45.702450	23.77	30.00	6.23	1000.0	120.000	98.0	٧	100	13.7
278.167500	9.86	36.00	26.14	1000.0	120.000	98.0	٧	100	14.0
322.735050	11.37	36.00	24.63	1000.0	120.000	170.0	٧	190	15.2
734.897700	19.15	36.00	16.85	1000.0	120.000	170.0	٧	10	22.3



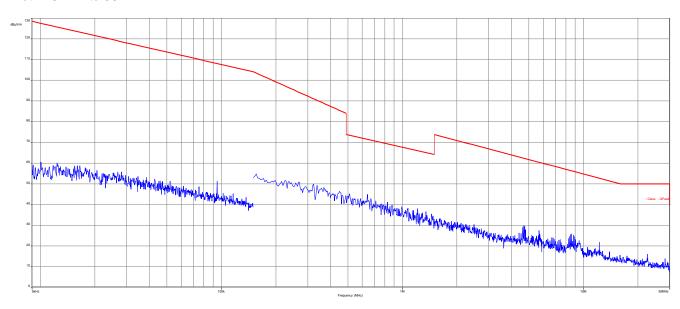
Plot 3: 1 GHz to 12.75 GHz, vertical and horizontal polarization





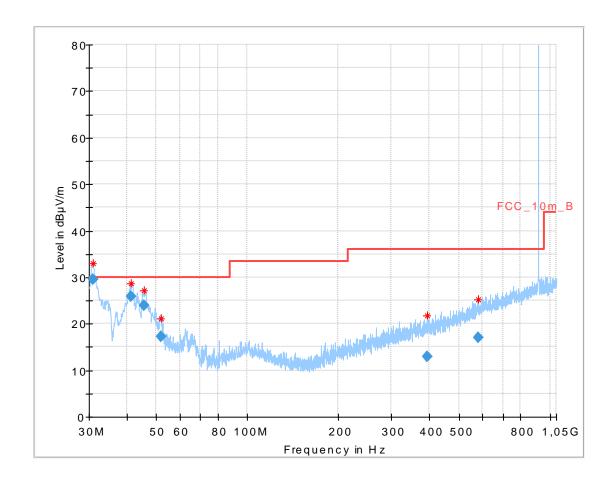
Plots 915.750 MHz:

Plot 1: 9 kHz to 30 MHz





Plot 2: 30 MHz to 1 GHz, horizontal / vertical polarization - max hold

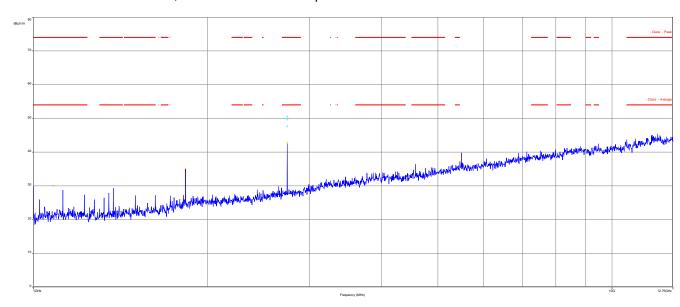


Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.871500	29.56	30.00	0.44	1000.0	120.000	101.0	٧	10	13.4
41.345700	25.93	30.00	4.07	1000.0	120.000	98.0	٧	10	14.0
45.747000	23.87	30.00	6.13	1000.0	120.000	98.0	٧	10	13.7
51.709050	17.28	30.00	12.72	1000.0	120.000	98.0	٧	190	12.4
392.245500	12.87	36.00	23.13	1000.0	120.000	101.0	٧	190	16.7
580.421400	16.94	36.00	19.06	1000.0	120.000	170.0	Н	80	20.2



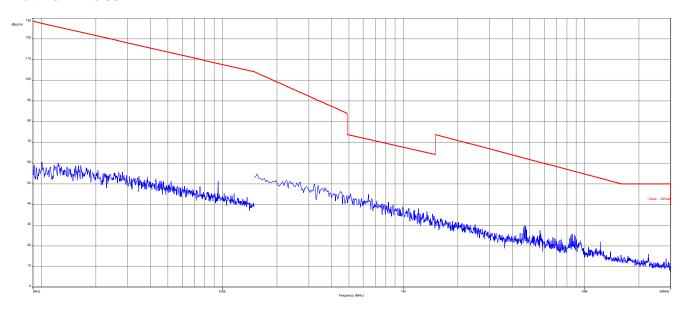
Plot 3: 1 GHz to 12.75 GHz, vertical and horizontal polarization





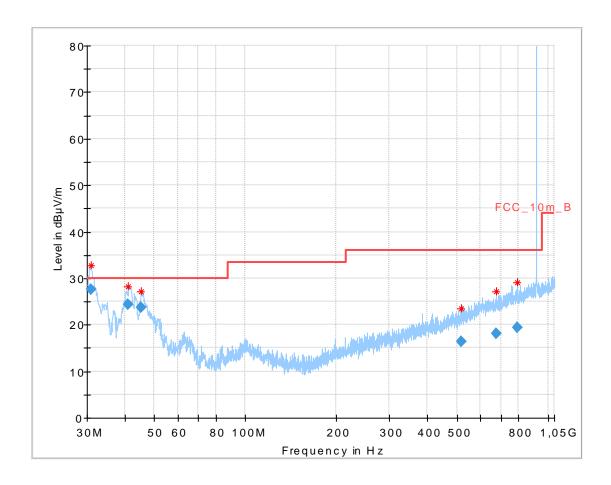
Plots 915.825 MHz:

Plot 1: 9 kHz to 30 MHz





Plot 2: 30 MHz to 1 GHz, horizontal / vertical polarization - max hold

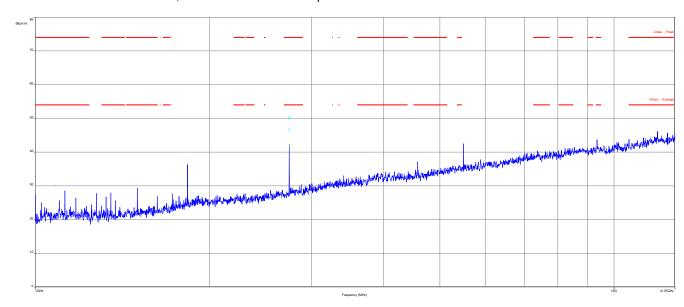


Final Result

i iiiai_i\csaii	•								
Frequency	QuasiPeak	Limit	Margin	Meas.	Bandwidth	Height	Pol	Azimuth	Corr.
(MHz)	(dBµV/m)	(dBµV/m)	(dB)	Time	(kHz)	(cm)		(deg)	(dB)
				(ms)					
30.920550	27.65	30.00	2.35	1000.0	120.000	170.0	٧	190	13.4
41.113200	24.42	30.00	5.58	1000.0	120.000	98.0	٧	170	14.0
45.420750	23.70	30.00	6.30	1000.0	120.000	98.0	٧	-9	13.8
515.363250	16.47	36.00	19.53	1000.0	120.000	170.0	٧	10	18.9
676.924950	18.12	36.00	17.88	1000.0	120.000	98.0	Н	190	21.3
791.232600	19.38	36.00	16.62	1000.0	120.000	98.0	٧	190	22.7



Plot 3: 1 GHz to 12.75 GHz, vertical and horizontal polarization





11 Observations

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



Annex A Document history

Version	Applied changes	Date of release
	Initial release	2015-04-29

Annex B Further information

Glossary

SW

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

Software



Accreditation Certificate Annex C

Front side of certificate

Back side of certificate

(DAkkS

Deutsche Akkreditierungsstelle GmbH

Bellehene gemäß § 8 Absatz 1 AkkStelleG i.V.m. § 1 Absatz 1 AkkStelleGBV Unterzeichnerin der Multilaleralen 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:

Orahsgebundene Kommunikation einschileßlich xDSL
VOIP und DECT
Akustik
Funk einschileßlich WLAN
Short Range Devices (SRD)
RFID
WIMax und Richtfunk
Mobilfunk (GSM / DCS, Over the Air (OTA) Performance)
Elektromagnetische Verträglichkeit (EMV) einschließlich Automotive
Yorduktsicherheit
SAR und Hearing Aid Compatibility (HAC)
Umweltsimulation

Umweltsimulation Smart Card Terminals Bluetooth Wi-Fi- Services

Die Akkreditierungsurkunde gill nur in Verbindung mit dem Bescheld vom 07.03 2014 mit der Akkreditierungsurmmer D-PI-17076-01 und ist gillig 17.01.2018. Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der fulgenden Anlage mit Insgesamt 77 Seiten.

Registrierungsnummer der Urkunde: D-PL-12076-01-00

Frankfurt am Main, 07.03.2014

Deutsche Akkreditierungsstelle GmbH

Standort Frankfurt am Main Gartenstra 3e 6 60594 Frankfurt am Main

Standort Braunschweig Bundesallee 100 38116 Braunschweig

Die auszugsweise Veröffentlichung der Akkreditierungsselunde bodanf der verherigen schriftlichen Zusämmung der Deutsche Akkreditierungsstelle GmbH (DAMS). Ausgenommen deven ist die sepanate Weber verenreitung des Deckle attes durch die umsoring genomme Konformitistakowertungsstelle in unweiß deterer Form.

Die Akkreditierung erfolgte gemäß des Graciters über din Akkreditierungsstells (AkkstelleC) vom 31. Juli 2009 (Boß). 1.5.2625) sowie der Verordrung (Foß) Nr. 765/2008 des Europäischen Parlament und des Rotts vom 9. Juli 2008 (Boß). 40. Europäischen Parlament und des Rotts vom 9. Juli 2008 (Boß). 30. Europäischen Vertraufstung von Produkten (Abl. 1.218 vom 9. Juli 2008, 3.30). Die DAkksit eiturer ichterin der Walthaltensten Aktemmen uns gegente Nigen Areitekenung der Europpion er operation for Autreditätien (Abl. des International Accorditation form (An) and der international Laberturer Accorditation Cooperation (BLAC). Die Unterzeichner eieser Abkommen erkonnen ihre Akknotl tierungen gegenstellig an.

Der aktue le Stund der Miglieukenaft kann folgenden Webseiten entnommen werden: FA: www.curopeum-accred tation.org IAAC www.cition.org IAAC www.cition.org

Note:

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

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