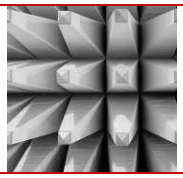




CETECOM™
CETECOM ICT Services
consulting - testing - certification

TEST REPORT

DAkkS Deutsche Akkreditierungsstelle D-PL-12075-01-01

Test report no.: 1-3646-01-03/11

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 test laboratory:
The test laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025
DAkkS registration number: D-PL-12076-01-01

Area of Testing: Radio/Satellite Communications

Applicant

ELMO COMPANY,LIMITED
6-14
Meizen-Cho, Mizuho-Ku, Nagoyai 467-8567 / Japan
Phone: +81-52-811-5136
Fax: +81-52-811-5179
Contact: Haruo Maeda
e-mail: maeda_haru@elmo.co.jp
Phone: +81-52-811-5136

Manufacturer

ELMO COMPANY,LIMITED
6-14
Meizen-cho Mizuho-ku Nagoya 467-8567 / Japan

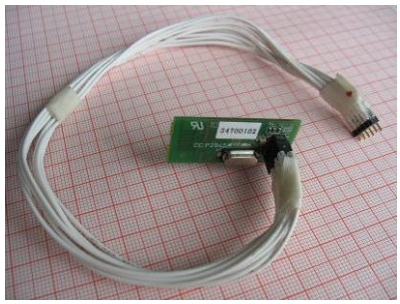
Test standard/s

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 Low-power Licence-exempt Radiocommunication Devices (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:	**2.4 GHz Transceiver Module**
Model name:	**WUSBMDL**
FCC ID:	**X3X-WUSBMDL**
IC:	**8804A-X3XWUSBMDL**
Frequency:	**2402 MHz – 2479 MHz**
Power supply:	**3.0 V**
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 performed:

cn=Stefan Boes, o=Cetecom ICT Services GmbH, ou=BOE-100817, email=Stefan.Boes@cetecom.com, c=DE
2011.09.07 16:26:08 +02'00'

Stefan Bös

Test report authorised:

cn=Andreas Keller, o=Cetecom ICT Services GmbH, ou=KLL-100830, email=Andreas.Keller@cetecom.com, c=DE
2011.09.08 07:46:57 +02'00'

Andreas Keller

1 Table of contents

2 General information

2.1 Notes

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 generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM ICT Services GmbH.
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.

2.2 Application details

Date of receipt of order:	2011-07-11
Date of receipt of test item:	2011-08-29
Start of test:	2011-08-29
End of test:	2011-09-07
Person(s) present during the test:	-/-

3 Test standard/s

Test standard	Date	Test standard description
47 CFR Part 15	2010-10	Title 47 of the Code of Federal Regulations; Chapter I Part 15 - Radio frequency devices
RSS - 210 Issue 8	2010-12	Spectrum Management and Telecommunications - Radio Standards Specification Low-power Licence-exempt Radiocommunication Devices (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}	-20 °C during low temperature tests
Relative humidity:		55 %
Air pressure:		not relevant for this kind of testing
Power supply:	V_{nom}	3.0 V DC
	V_{max}	V
	V_{min}	V

5 Test item

Kind of test item	:	**2.4 GHz Transceiver Module**
Type identification	:	**WUSBMDL**
S/N serial number	:	**Rad. 34700102** **Cond. 34700100**
HW hardware status	:	**No information provided**
SW software status	:	**No information provided**
Frequency band [MHz]	:	**2400MHz – 2483.5MHz** **(lowest channel 2402MHz, highest channel 2479MHz)**
Type of modulation	:	**GFSK (DSSS)**
Number of channels	:	**No information provided**
Antenna	:	**Integrated antenna (printed PCB antenna)**
Power supply	:	**3.0 V DC**
Temperature range	:	**-20°C to +55 °C**

6 Test laboratories sub-contracted

None

7 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	2011-09-07	-/-

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

Note: NA = Not Applicable; NP = Not Performed

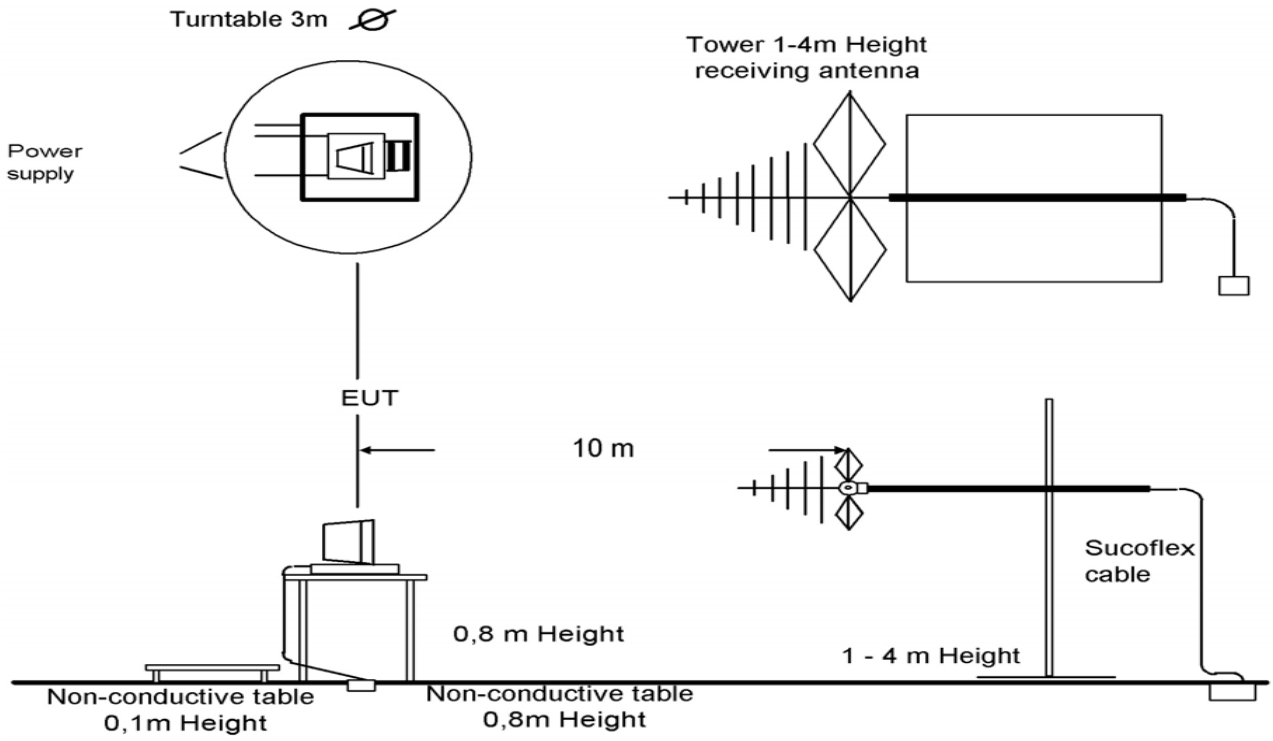
8 RF measurements

8.1 Description of test setup

8.1.1 Radiated measurements

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 25 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are confirmed with specifications ANSI C63.2-1996 clause 15 and ANSI C63.4-2009 clause 4.1.5. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63-4-2009 clause 4.2.
Antennas are confirmed with ANSI C63.2-1996 item 15.

Semi anechoic chamber



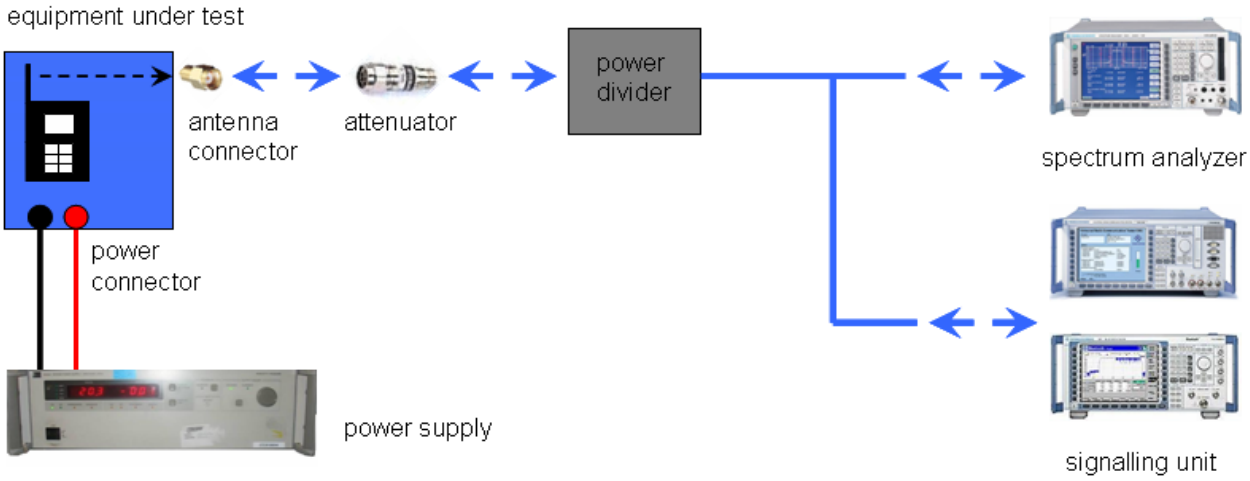
Picture 1: Diagram radiated measurements

9 kHz - 30 MHz:	active loop antenna
30 MHz – 1 GHz:	tri-log antenna
> 1 GHz:	horn antenna

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

8.1.2 Conducted measurements

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



Picture 2: Diagram conducted measurements

8.2 Additional comments

Reference documents: None

Special test descriptions: None

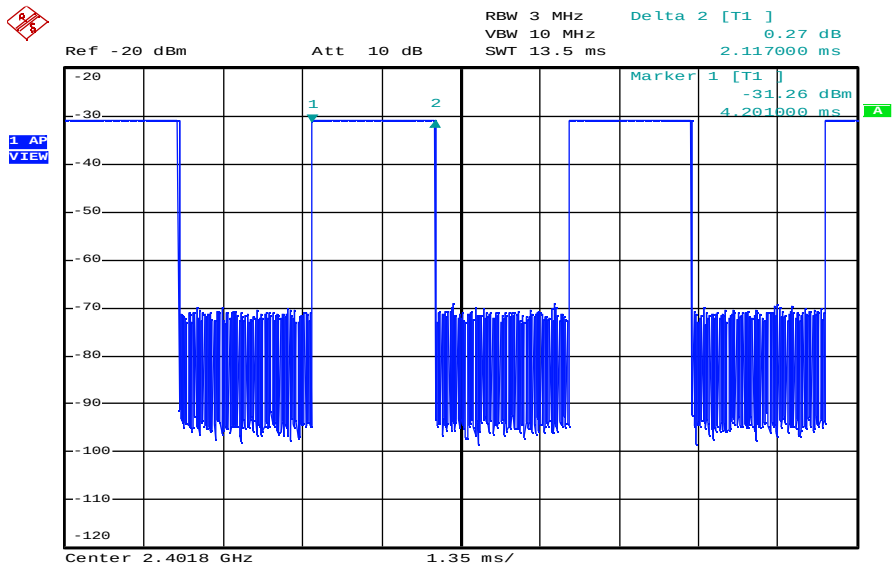
Configuration descriptions: This device operation battery powered only (2* 1.5V AAA-type).

Test mode:

☐ No test mode available.
Iperf was used to ping another device with the largest support packet size

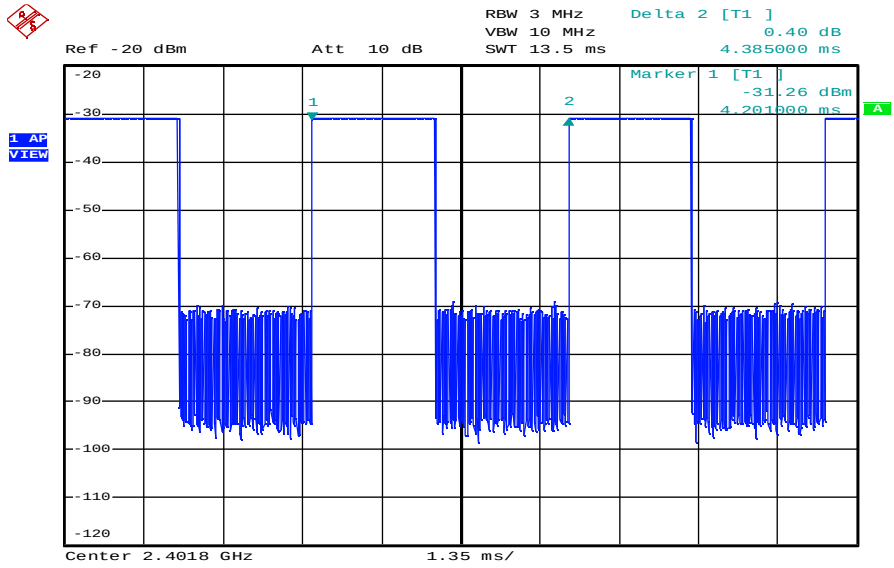
☒ Special software is used.
EUT is transmitting pseudo random data by itself

Plot 1: Duty cycle evaluation, t_on



Date: 29.AUG.2011 09:08:00

Plot 2: Duty cycle evaluation, t_tot



Date: 29.AUG.2011 09:08:18

8.3 RSP100 test report cover sheet / performance test data

Test report number	:	**1-3646-01-03/11**
Equipment model number	:	**WUSBMDL**
Certification number	:	**8804A-X3XWUSBMDL**
Manufacturer (complete address)	:	**ELMO COMPANY,LIMITED 6-14 Meizen-cho Mizuho-ku Nagoya 467-8567 / Japan**
Tested to radio standards specification no.	:	**RSS 210, Issue 8, Annex 8**
Open area test site IC No.	:	**IC 3462C-1**
Frequency range	:	**ISM band 2400 MHz to 2483.5 MHz (lowest channel 2412 MHz, highest channel 2462 MHz)**
RF-power [W] (max.)	:	**cond.: 0.6mW EIRP: 1.5mW**
Occupied bandwidth (99%-BW)	:	**1.64 MHz**
Type of modulation	:	**GFSK (DSSS)**
Emission designator (TRC-43)	:	**1M64G1D**
Antenna information	:	**Printed PCB antenna**
Transmitter spurious (worst case) [dBµV/m @ 3m]:		**46.9 @ 4806 MHz**
Receiver spurious (worst case) [dBµV/m @ 3m]:		**50 @ (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:

2011-09-07	Stefan Bös	cn=Stefan Boes, o=Cetecom ICT Services GmbH, ou=BOE-100817, email=Stefan.Boes@cetecom.com, c=DE 2011.09.07 16:25:38 +02'00'
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
Resolution bandwidth:	3 MHz
Video bandwidth:	3 MHz
Trace-Mode:	Max hold

Limits:

FCC	IC
CFR Part 15.247 (b)(4)	RSS 210, Issue 8, A 8.4(2)
Antenna Gain	
6 dBi	

Results:

T_{nom}	V_{nom}	lowest channel 2402 MHz	middle channel 2441 MHz	highest channel 2479 MHz
Conducted power [dBm]		-2.5	-3.0	-3.3
Radiated power [dBm]		1.6	1.0	0.6
Gain [dBi] Calculated		4.1	4.0	3.9
Measurement uncertainty		± 1.5 dB (cond.) / ± 3 dB (rad.)		

Result: **The measurement is passed.**

9.2 Maximum output power

Description:

Measurement of the maximum output power conducted and radiated.

Measurement:

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

Limits:

FCC	IC
CFR Part 15.247 (b)(3)	RSS 210, Issue 8, A 8.4(4)
Maximum Output Power	
Conducted: 1.0 W – Antenna Gain max. 6 dBi	

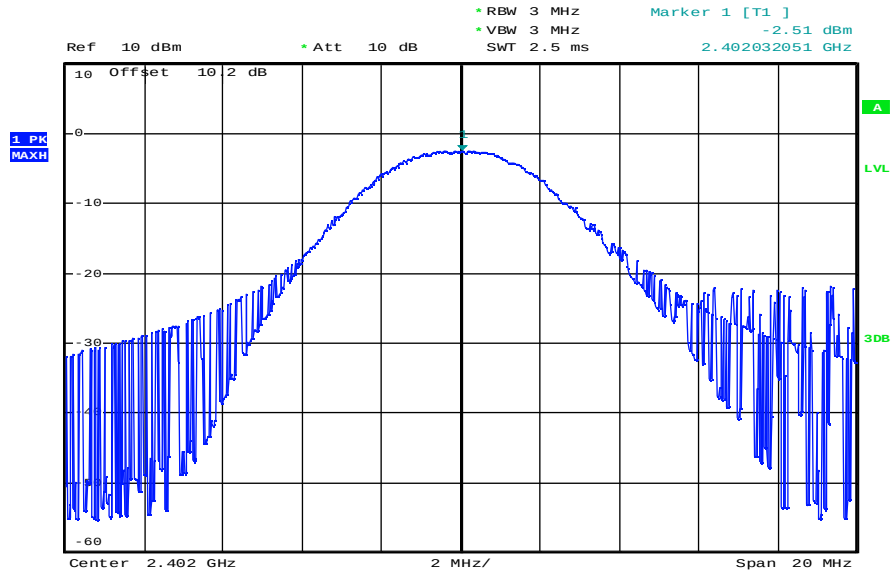
Results:

GFSK	Maximum Output Power [dBm]		
Frequency	2402 MHz	2441 MHz	2479 MHz
Peak Output Power Conducted	-2.5	-3.0	-3.3
Output Power Radiated – EIRP	1.6	1.0	0.6
Measurement uncertainty	± 1.5 dB (cond.) / ± 3 dB (rad.)		

Result: **The measurement is passed.**

Plots:

Plot 1: TX mode, conducted, lowest channel



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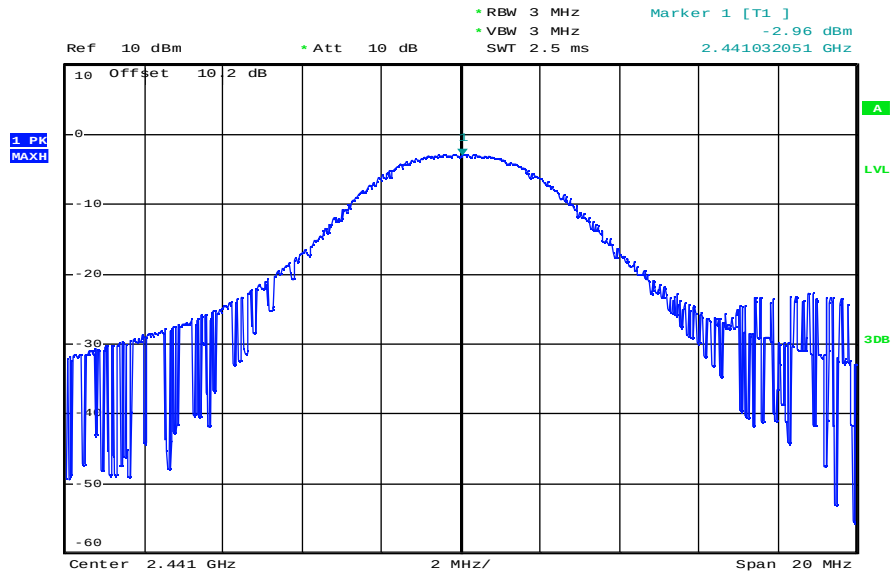
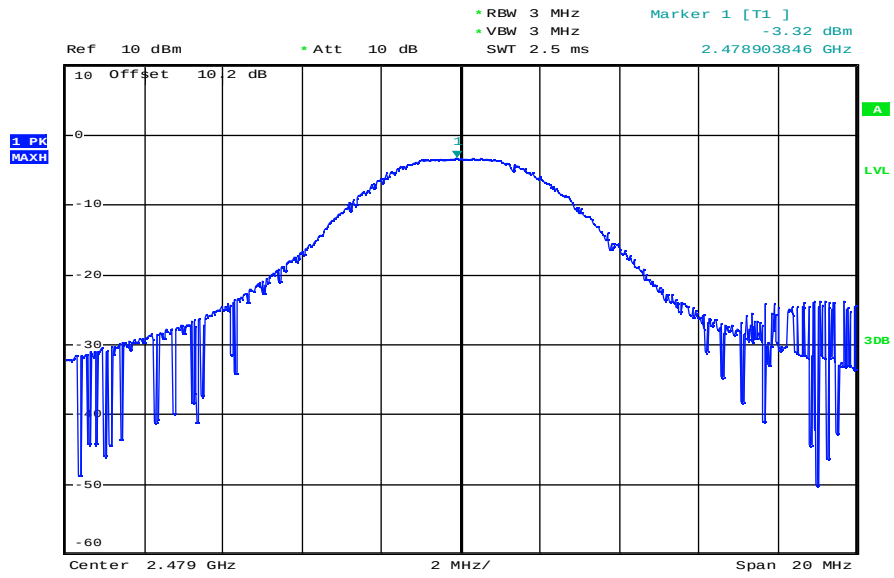
Plot 2: TX mode, conducted, middle channel



Date: 29.AUG.2011 12:56:42

Plot 3: TX mode, conducted, highest channel



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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:	500 s
Video bandwidth:	3 kHz
Resolution bandwidth:	3 kHz
Span:	1.5 MHz
Trace-Mode:	Max Hold

Limits:

FCC	IC
CFR Part 15.247 (e)	RSS 210, Issue 8, A 8.2(b)
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.	

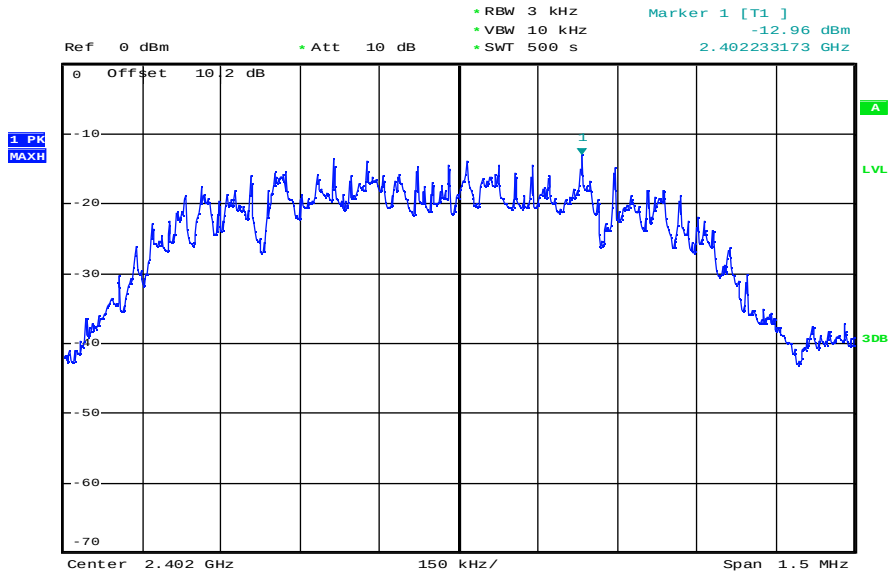
Results:

Modulation	Power Spectral density [dBm/3kHz]		
Frequency	2402 MHz	2441 MHz	2479 MHz
GFSK	-13.0	-13.9	-14.0
Measurement uncertainty	± 1.5 dB		

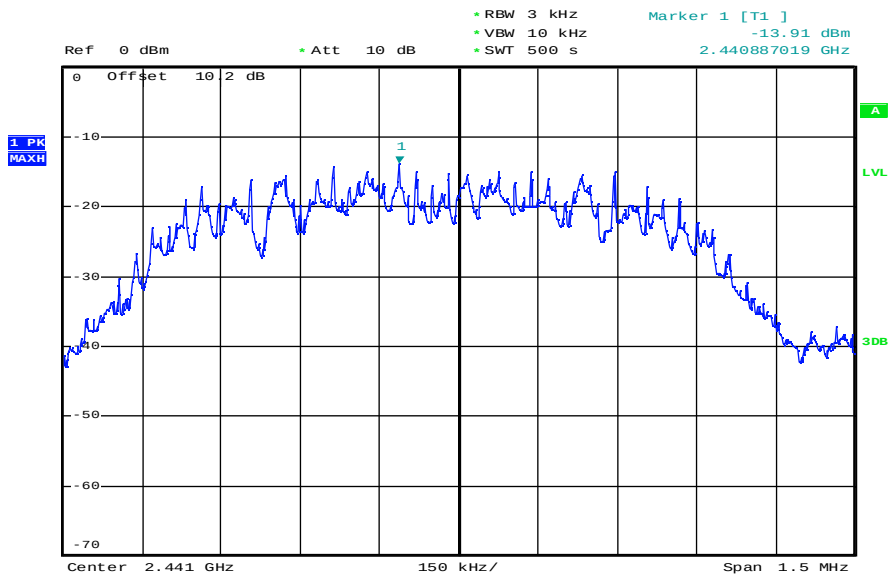
Result: **The measurement is passed.**

Plots:

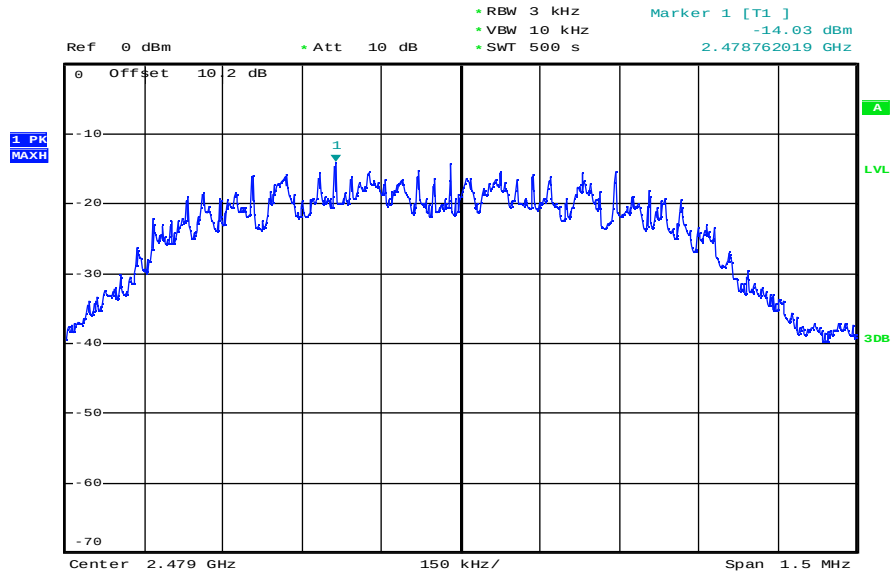
Plot 1: TX mode, lowest channel



Plot 2: TX mode, middle channel



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
Resolution bandwidth:	30 kHz
Video bandwidth:	100 kHz
Span:	3MHz
Trace-Mode:	Max Hold

Limits:

FCC	IC
CFR Part 15.247 (a)(2)	RSS 210, Issue 8, A 8.2(a)
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.	

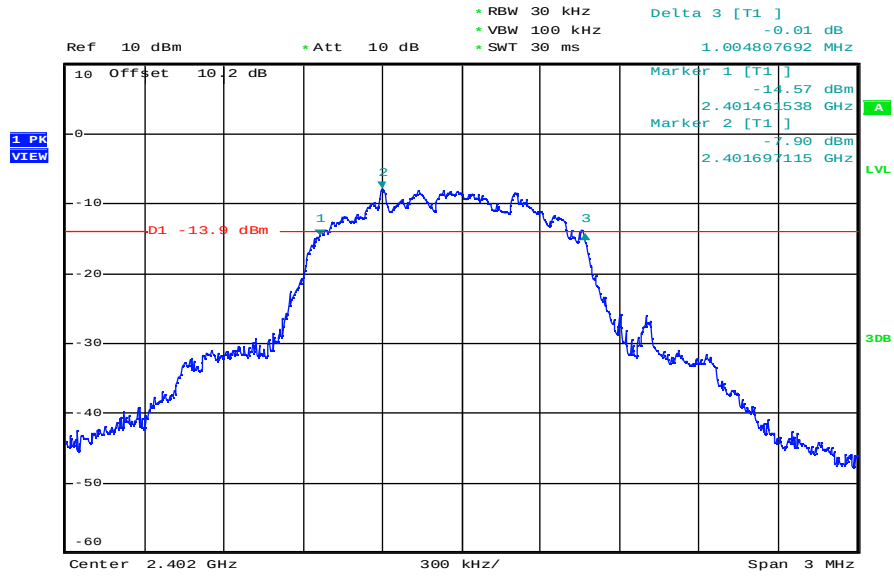
Results:

Modulation	6 dB BANDWIDTH [MHz]		
Frequency	2402 MHz	2441 MHz	2479 MHz
GFSK	1.00	0.97	0.96
Measurement uncertainty	± 30 kHz		

Result: **The measurement is passed.**

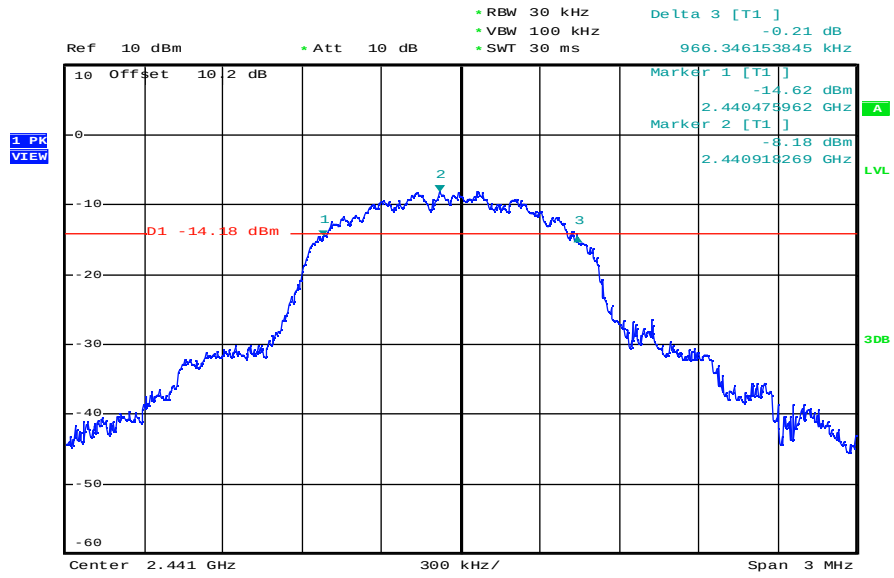
Plots:

Plot 1: TX mode, lowest channel, 6 dB bandwidth



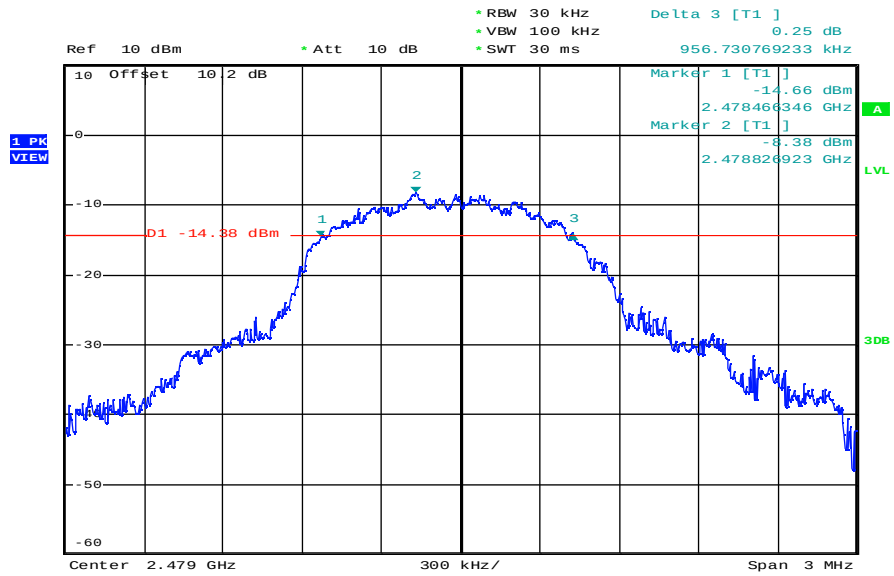
Date: 2.SEP.2011 08:58:18

Plot 2: TX mode, middle channel, 6 dB bandwidth



Date: 2.SEP.2011 09:03:23

Plot 3: TX mode, highest channel, 6 dB bandwidth



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
Resolution bandwidth:	30 kHz
Video bandwidth:	100 kHz
Span:	3MHz
Trace-Mode:	Max Hold

Limits:

FCC	IC
CFR Part 15.247 (a)(2)	RSS 210, Issue 8, A 8.2(a)
Spectrum Bandwidth – 20 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.	

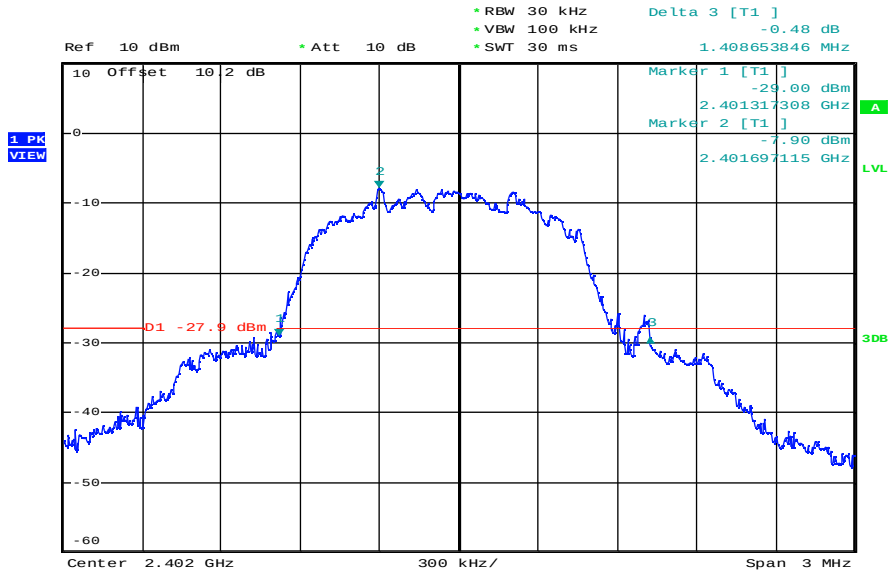
Results:

Modulation	20 dB BANDWIDTH [MHz]		
Frequency	2402 MHz	2441 MHz	2479 MHz
GFSK	1.41	1.42	1.64
Measurement uncertainty	± 30 kHz		

Result: **The measurement is passed.**

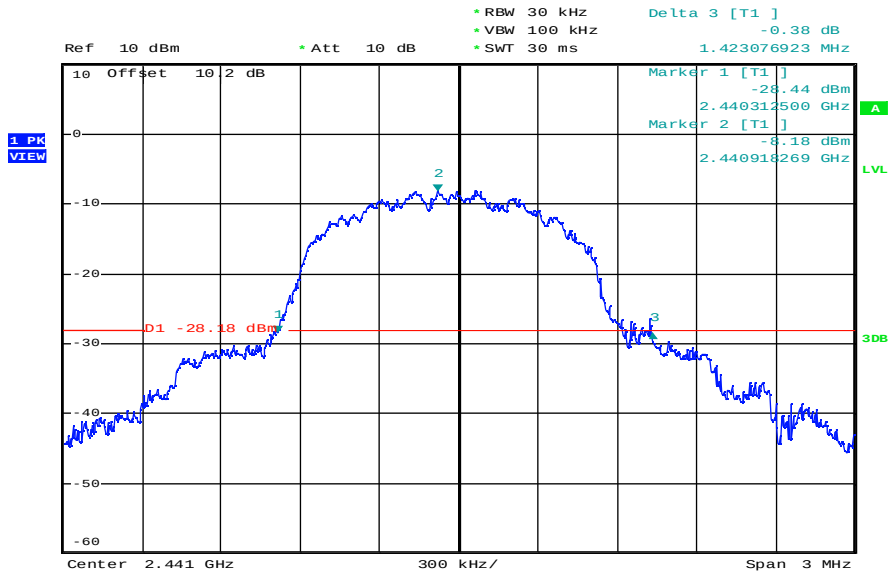
Plots:

Plot 1: TX mode, lowest channel, 20 dB bandwidth



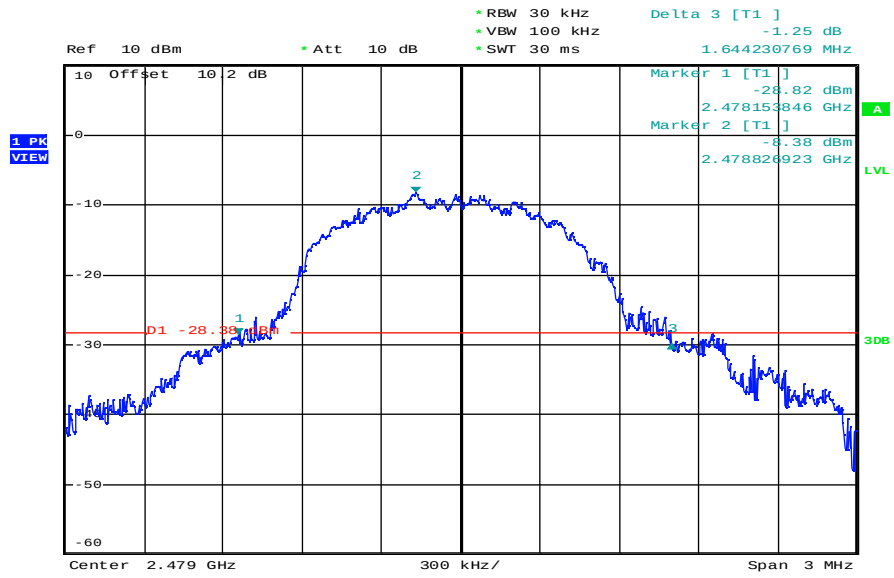
Date: 2.SEP.2011 09:00:01

Plot 2: TX mode, middle channel, 20 dB bandwidth



Date: 2.SEP.2011 09:06:14

Plot 3: TX mode, highest channel, 20 dB bandwidth



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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
Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Span:	Lower Band Edge: 2300 – 2425 MHz Upper Band Edge: 2450 – 2500 MHz
Trace-Mode:	Max Hold

Limits:

FCC	IC
CFR Part 15.247 (d)	RSS 210, Issue 8, A 8.5
Band Edge Compliance 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.	

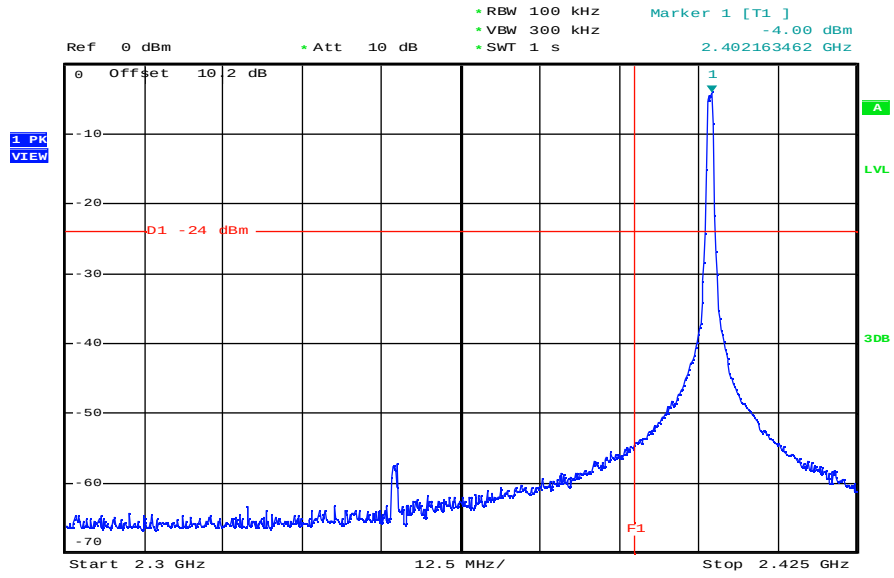
Results:

Scenario	Band Edge Compliance Conducted [dB]		
Modulation	GFSK	-/-	-/-
Lower Band Edge – lowest channel	> 20 dB (see plot 1)	-/-	-/-
Upper Band Edge – highest channel	> 20 dB (see plot 2)	-/-	-/-
Measurement uncertainty	± 1.5 dB		

Result: **The measurement is passed.**

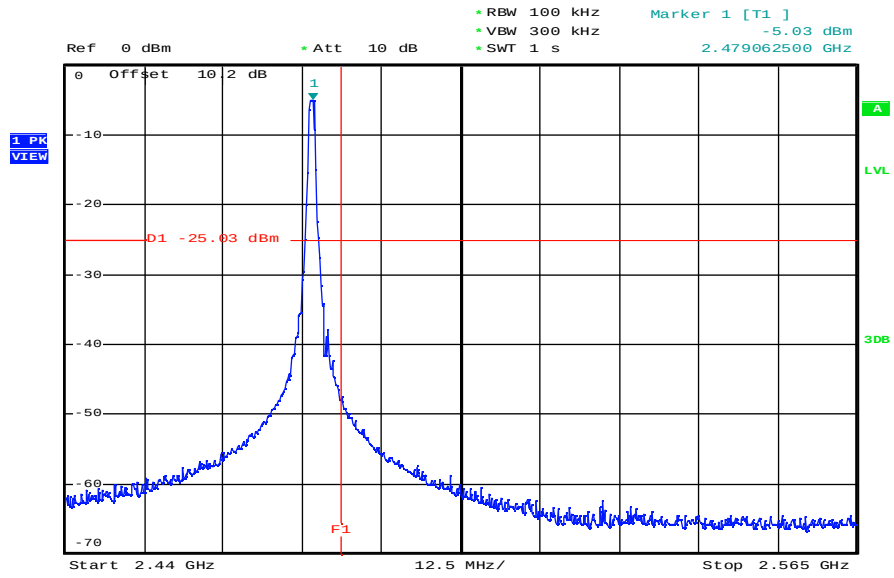
Plots:

Plot 1: TX mode, lower band edge



Date: 2.SEP.2011 10:36:13

Plot 2: TX mode, upper band edge



Date: 2.SEP.2011 10:39:41

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:	Lower Band: 2300 – 2400 MHz higher Band: 2480 – 2500 MHz
Trace-Mode:	Max Hold

Limits:

FCC	IC
CFR Part 15.205	RSS 210, Issue 8, A 8.5
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)).	
54 dBµV/m AVG	

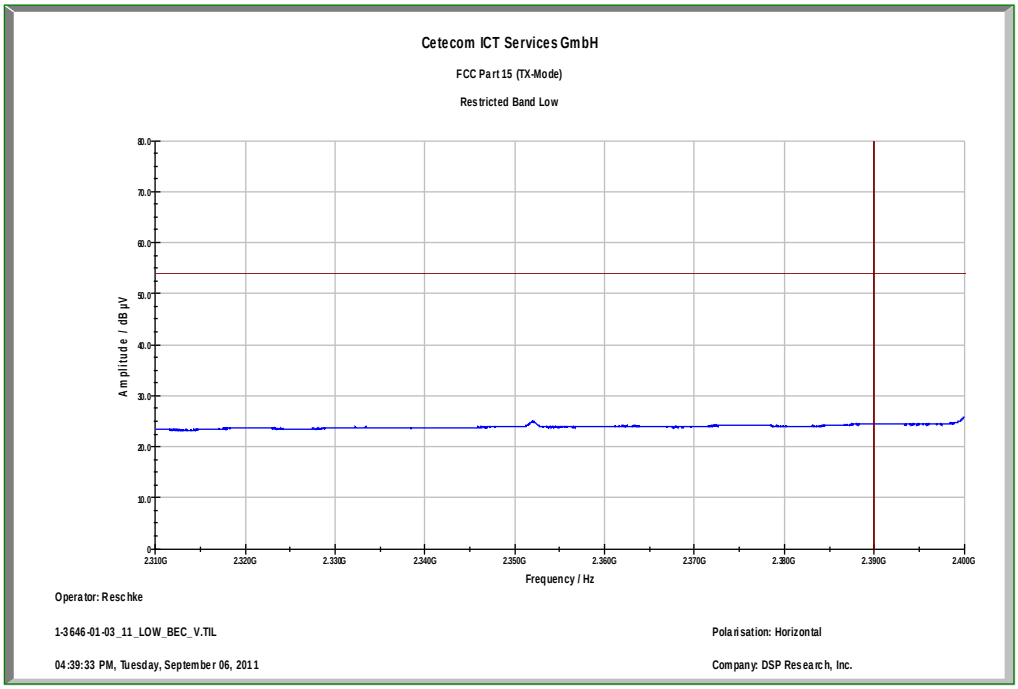
Results:

Szenario	Band Edge Compliance Conducted [dB]		
Modulation	GFSK	-/-	-/-
Lower Band Edge – lowest channel	> 20 dB	-/-	-/-
Upper Band Edge – highest channel	> 20 dB	-/-	-/-
Measurement uncertainty	± 3 dB		

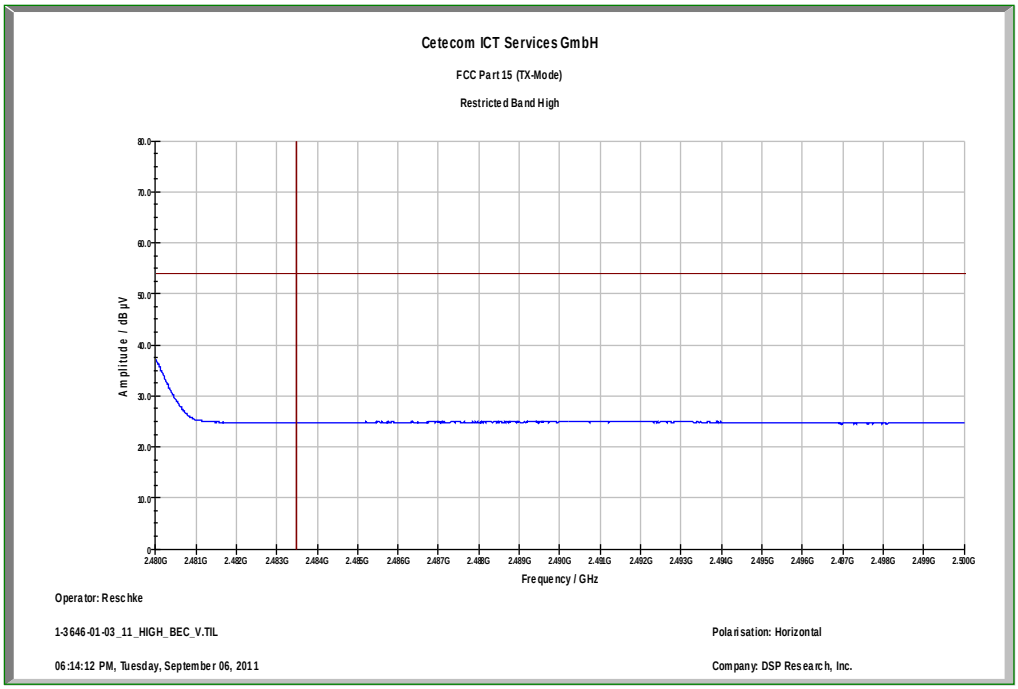
Result: **The measurement is passed.**

Plots:

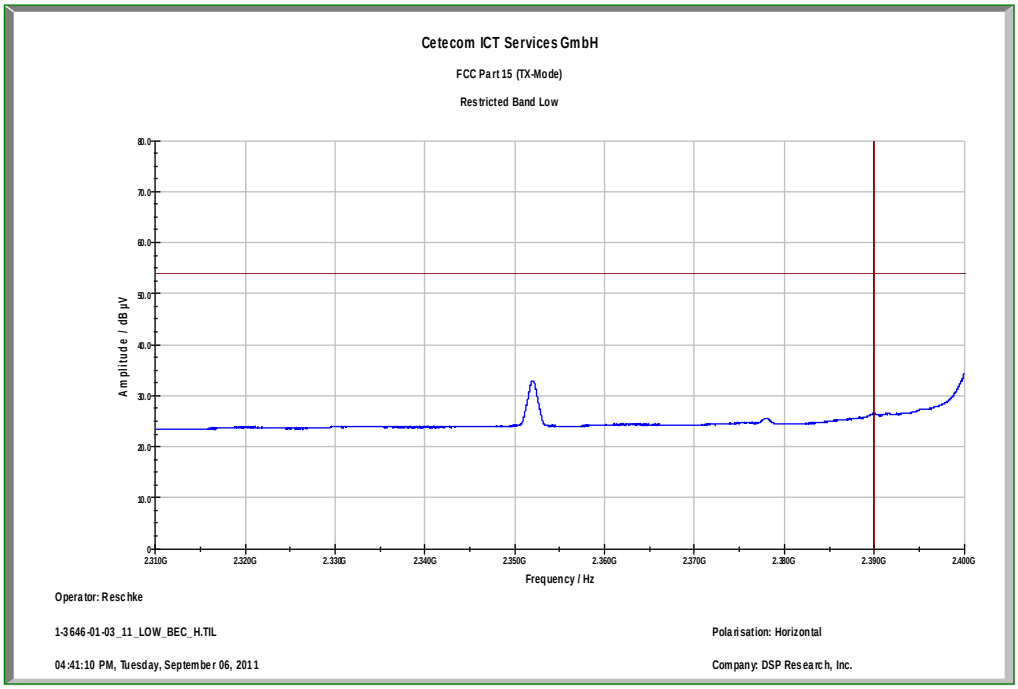
Plot 1: TX mode, lower band edge, vertical polarization



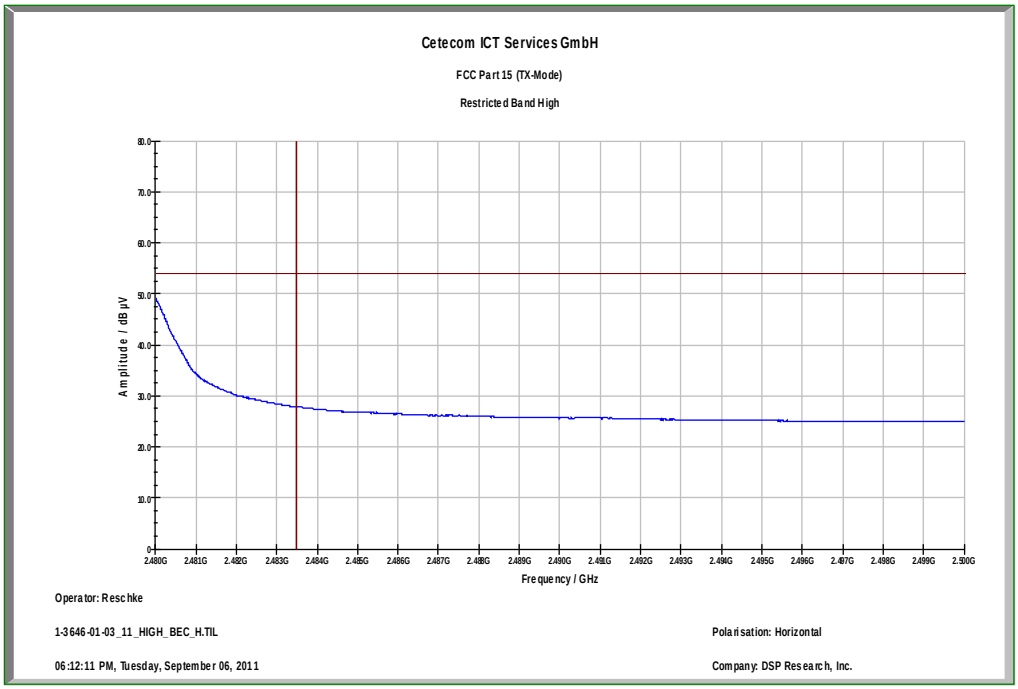
Plot 2: TX mode, upper band edge, vertical polarization



Plot 3: TX mode, lower band edge, horizontal polarization



Plot 4: TX mode, upper band edge, horizontal polarization



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
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 100 kHz
Video bandwidth:	F < 1 GHz: 300 kHz F > 1 GHz: 300 kHz
Span:	9 kHz to 25 GHz
Trace-Mode:	Max Hold

Limits:

FCC	IC
CFR Part 15.247(d)	RSS 210, Issue 8, A 8.5
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	

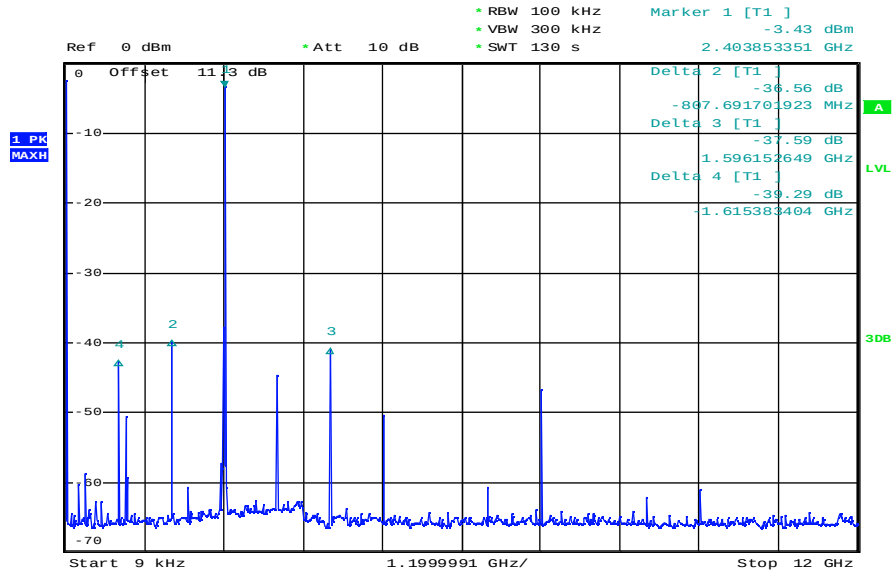
Results:

TX Spurious Emissions Conducted					
GFSK					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
2402		-3.4	30 dBm		Operating frequency
No critical peaks found			-20 dBc		complies
2441		-3.8	30 dBm		Operating frequency
No critical peaks found			-20 dBc		complies
2479		-3.8	30 dBm		Operating frequency
No critical peaks found			-20 dBc		complies
Measurement uncertainty		± 3 dB			

Result: **The measurement is passed.**

Plots:

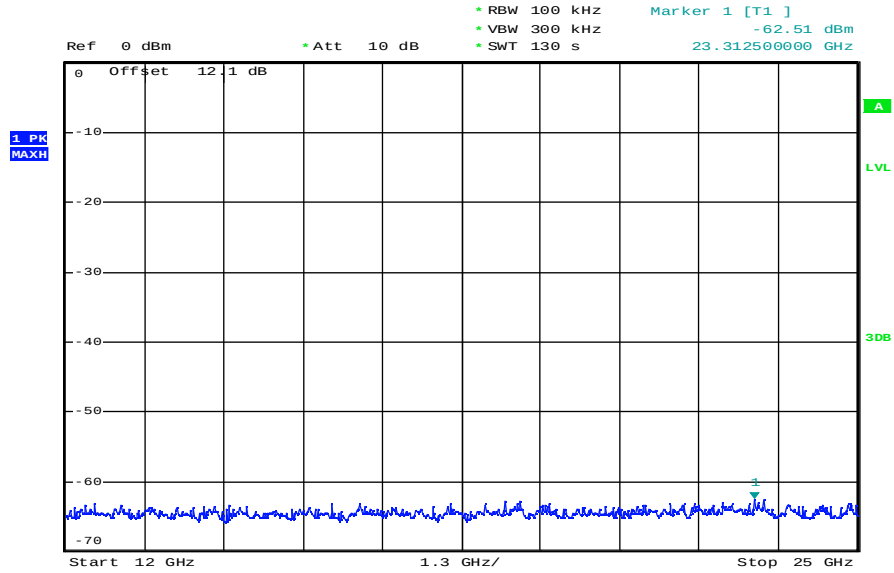
Plot 1: TX mode, lowest channel, up to 12 GHz



Date: 2.SEP.2011 09:54:38

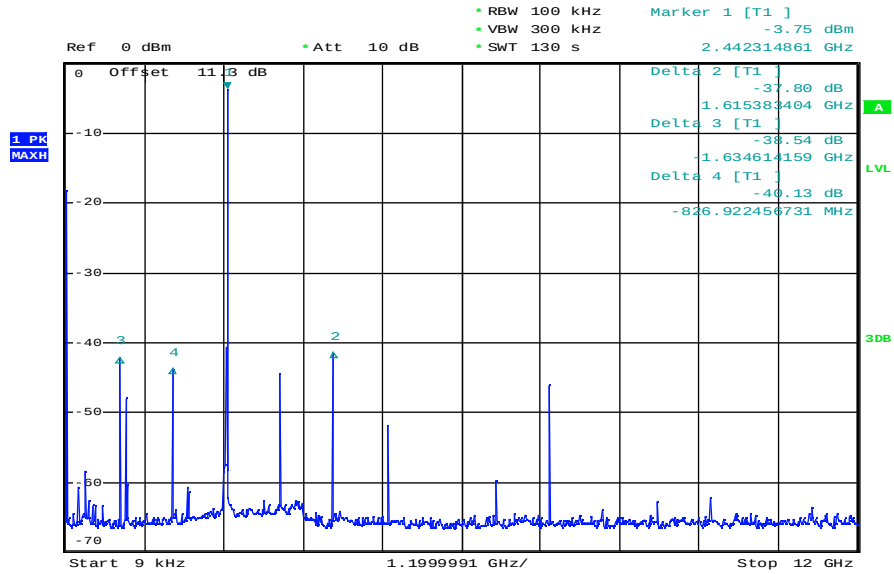
The peak at the beginning of the plot is the LO from the SA.

Plot 2: TX mode, lowest channel, 12 GHz to 25 GHz



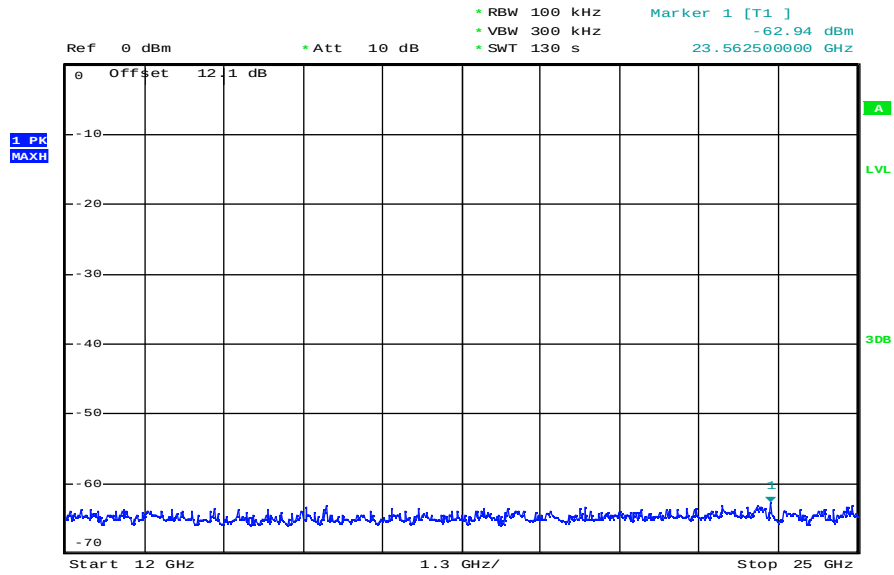
Date: 2.SEP.2011 10:24:32

Plot 3: TX mode, middle channel, up to 12 GHz

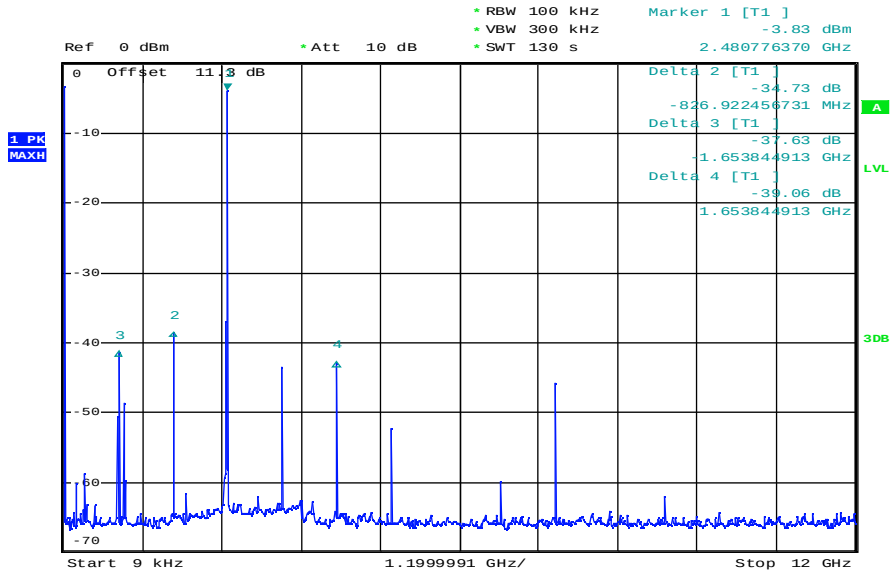


The peak at the beginning of the plot is the LO from the SA.

Plot 4: TX mode, middle channel, 12 GHz to 25 GHz

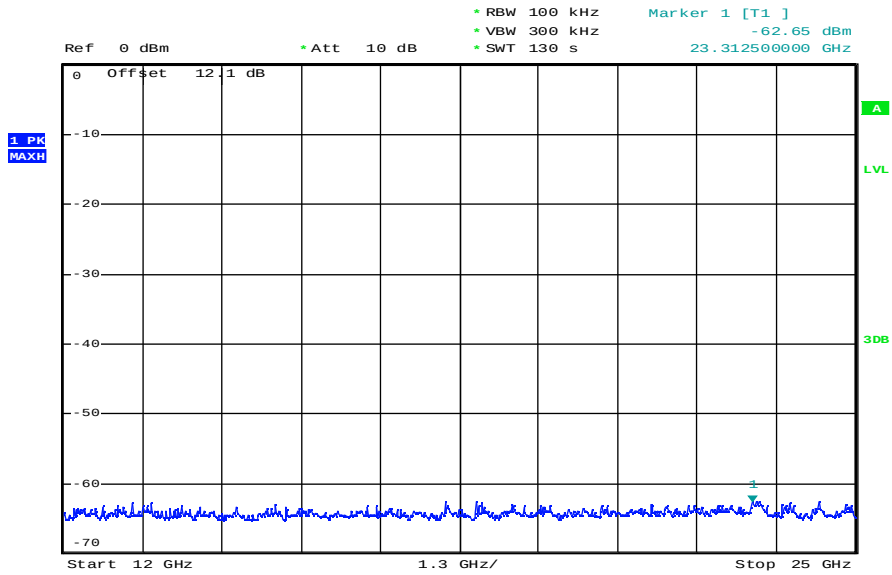


Plot 5: TX mode, highest channel, up to 12 GHz



The peak at the beginning of the plot is the LO from the SA.

Plot 6: TX mode, highest channel, 12 GHz to 25 GHz



9.9 TX spurious emissions radiated

Description:

Measurement of the radiated spurious emissions in transmit mode.

Measurement:

Measurement parameter	
Detector:	Peak / Quasi Peak
Sweep time:	Auto
Video bandwidth:	Sweep: 100 kHz Re measurement: 10 Hz
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz
Span:	30 MHz to 26 GHz
Trace-Mode:	Max Hold
Measured Modulation	GFSK

The modulation with the highest output power was used to perform the transmitter spurious emissions.

Limits:

FCC	IC	
CFR Part 15.247(d)	RSS 210, Issue 8, A 8.5	
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		
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

Results:

TX Spurious Emissions Radiated [dBµV/m]								
GFSK								
2402 MHz			2441 MHz			2479 MHz		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
4806	PK	46.9	4883	PK	42.2	4957	PK	44.3
Measurement uncertainty			± 3 dB					

Result: **The measurement is passed.**

Plots of measurements:

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

Common Information

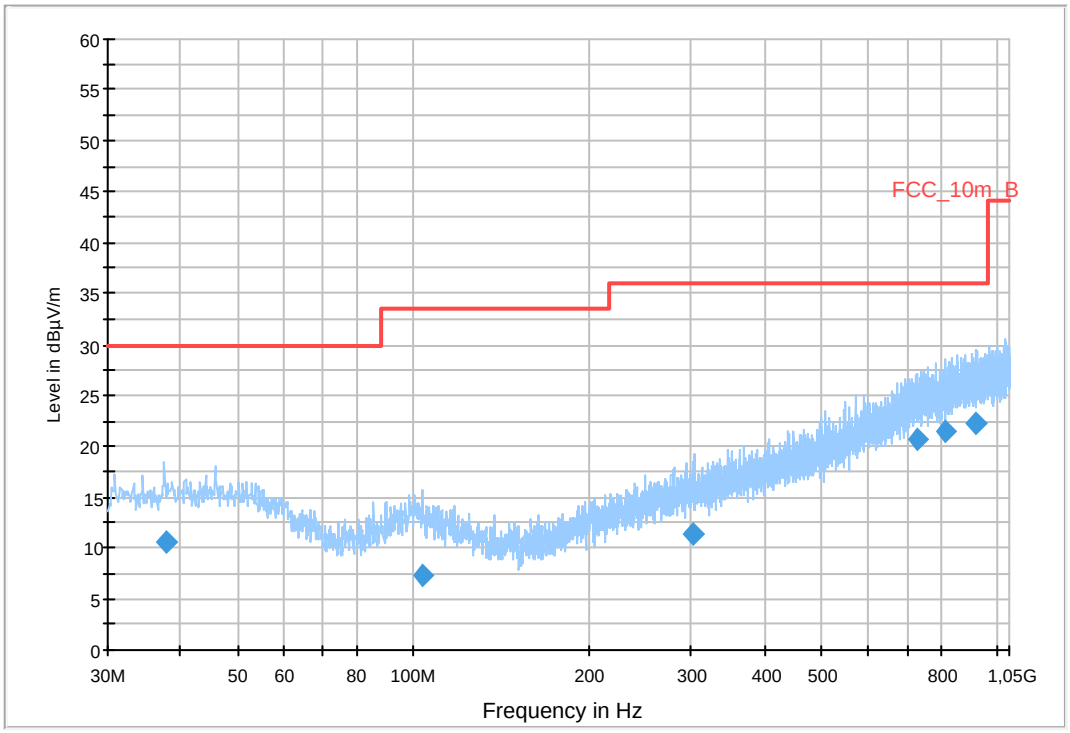
EUT:	WUSBMDL – RF module
Serial Number:	
Test Description:	FCC part 15 class B @ 10m
Operating Conditions:	tx @ 2.402GHz
Operator Name:	wld
Comment:	3V DC powered, by external power supply

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

FCC_10m(B)_3



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
37.873200	10.7	1000.0	120.000	120.0	H	82.0	13.3	19.3	30.0	
103.659300	7.3	1000.0	120.000	170.0	H	172.0	11.6	26.2	33.5	
302.278200	11.5	1000.0	120.000	170.0	V	102.0	14.6	24.5	36.0	
729.589950	20.6	1000.0	120.000	135.0	V	196.0	23.2	15.4	36.0	
815.732550	21.4	1000.0	120.000	98.0	V	284.0	24.0	14.6	36.0	
915.903600	22.1	1000.0	120.000	98.0	V	284.0	25.2	13.9	36.0	

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

Subrange 1

Frequency Range:	30 MHz - 2 GHz
Receiver:	Receiver [ESCI 3] @ GPIB0 (ADR 20), SN 100083/003, FW 4.42
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW --- Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table (vertical): Cable_EN_1GHz (1005) Correction Table (horizontal): Cable_EN_1GHz (1005)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

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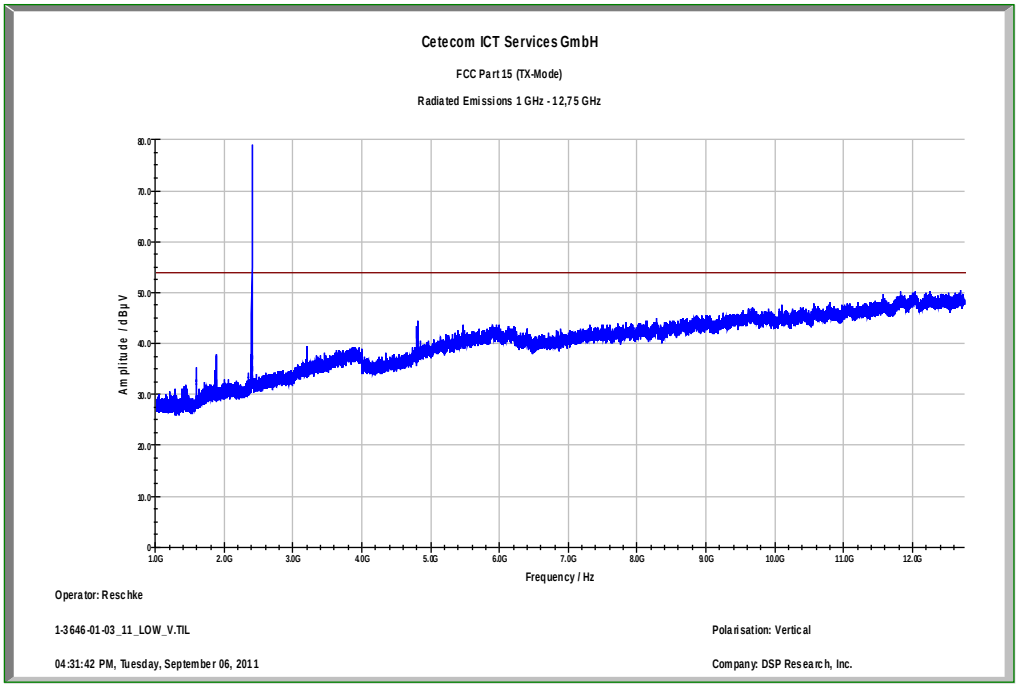
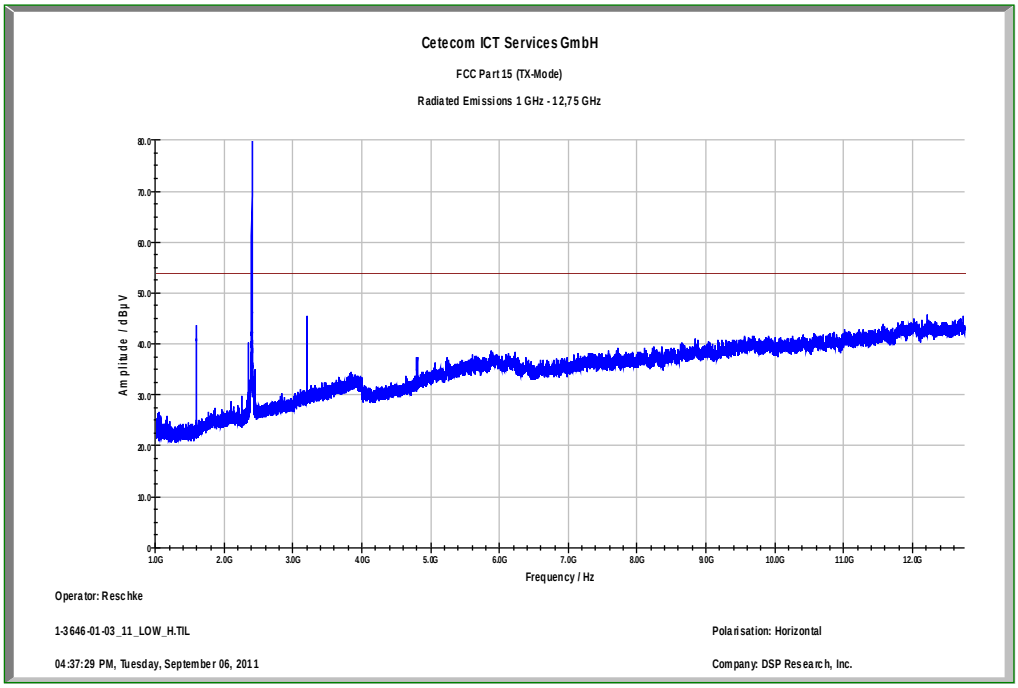
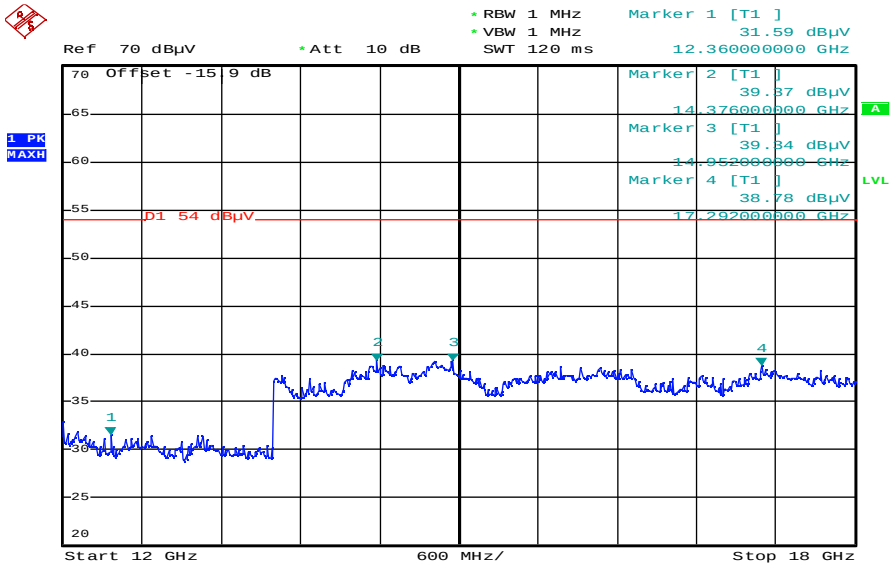
Plot 2: Lowest channel, 1 GHz to 12.75 GHz, vertical polarization



Plot 3: Lowest channel, 1 GHz to 12.75 GHz, horizontal polarization

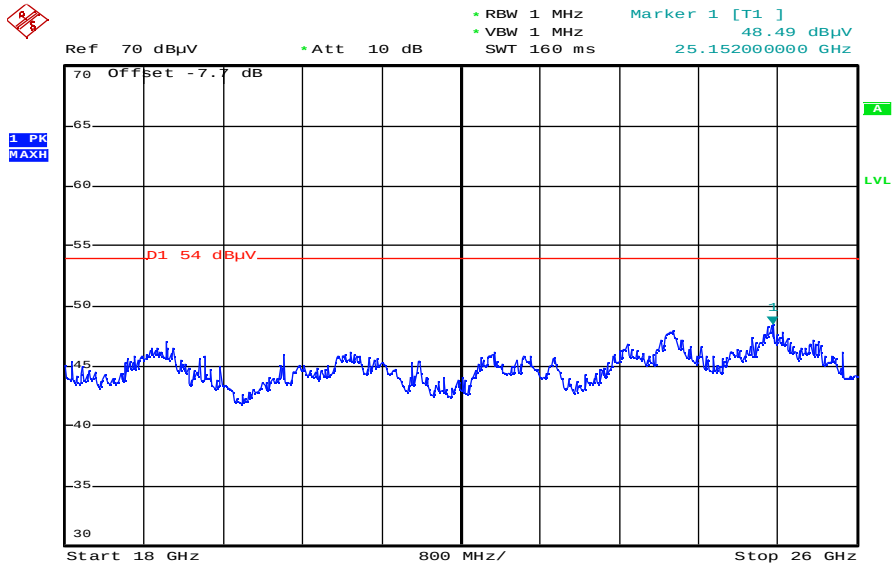


Plot 4: Lowest channel, 12 GHz to 18 GHz, vertical & horizontal polarization



Date: 7.SEP.2011 12:19:55

Plot 5: Lowest channel, 18 GHz to 26 GHz, vertical & horizontal polarization



Date: 7.SEP.2011 12:56:37

Plot 6: Middle channel, 30 MHz to 1 GHz, vertical & horizontal polarization

Common Information

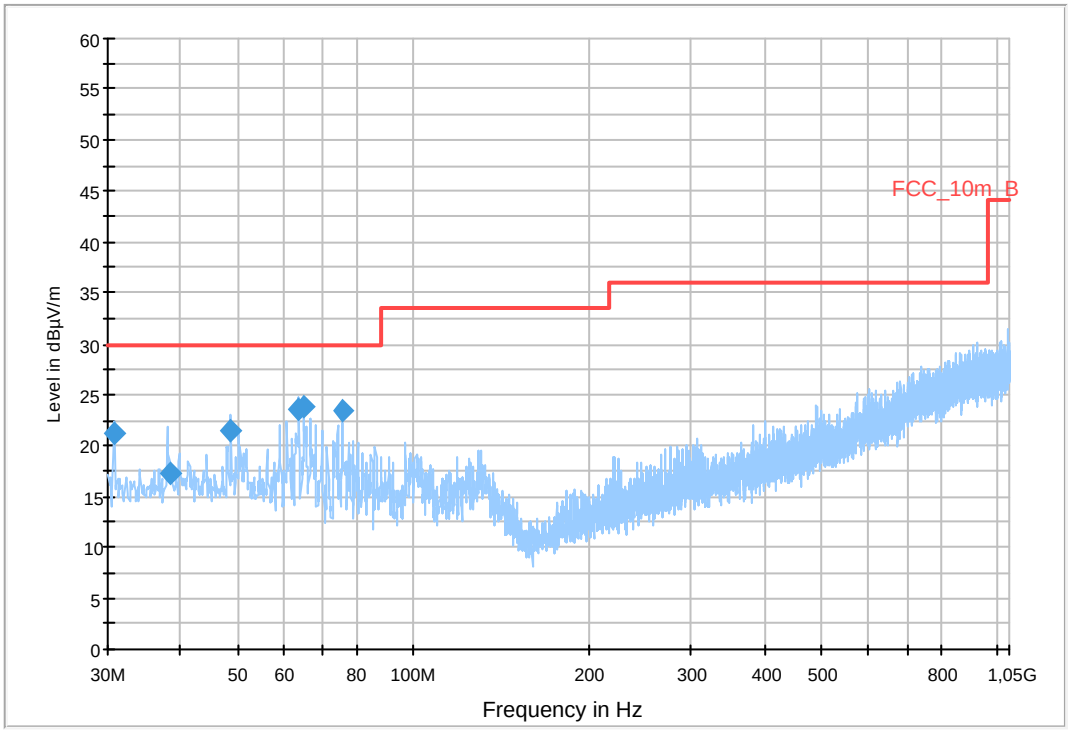
EUT:	WUSBMDL – RF module
Serial Number:	---
Test Description:	FCC part 15 class B @ 10 m
Operating Conditions:	tx @2.441GHz
Operator Name:	wld
Comment:	3V DC powered, by external power supply

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

FCC_10m(B)_3



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
30.760200	21.3	1000.0	120.000	148.0	V	284.0	12.6	8.7	30.0	
38.235750	17.4	1000.0	120.000	170.0	V	106.0	13.3	12.6	30.0	
48.747150	21.5	1000.0	120.000	98.0	V	106.0	13.3	8.5	30.0	
63.749550	23.6	1000.0	120.000	120.0	V	-6.0	10.7	6.4	30.0	
65.246850	23.8	1000.0	120.000	162.0	V	106.0	10.4	6.2	30.0	
75.747600	23.5	1000.0	120.000	170.0	V	184.0	9.2	6.5	30.0	

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

Subrange 1

Frequency Range:	30 MHz - 2 GHz
Receiver:	Receiver [ESCI 3] @ GPIB0 (ADR 20), SN 100083/003, FW 4.42
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW --- Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table (vertical): Cable_EN_1GHz (1005) Correction Table (horizontal): Cable_EN_1GHz (1005)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

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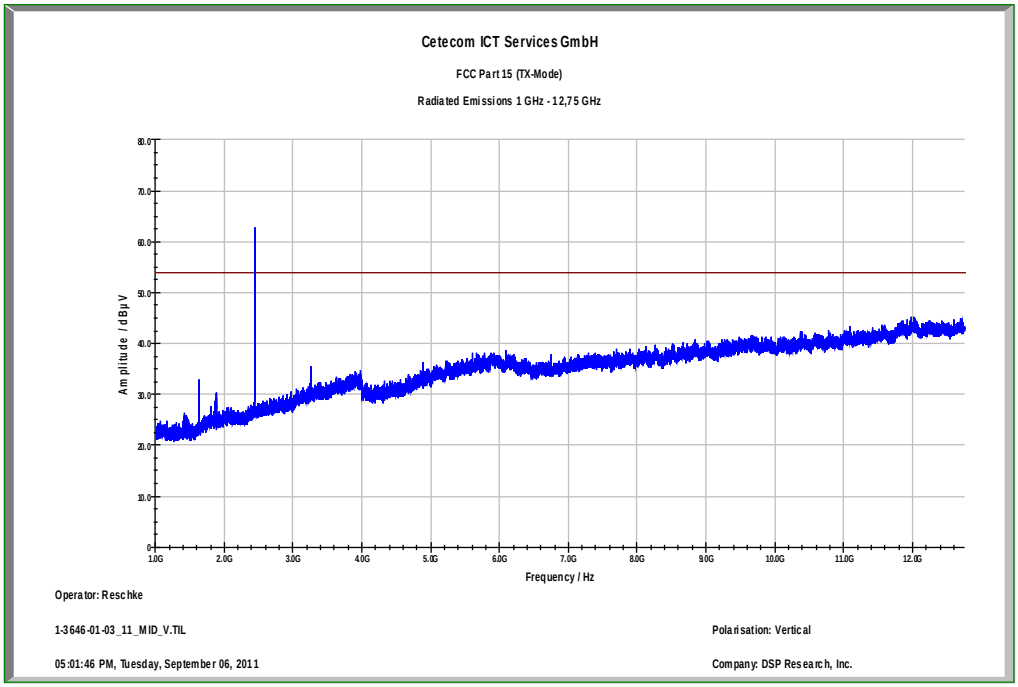
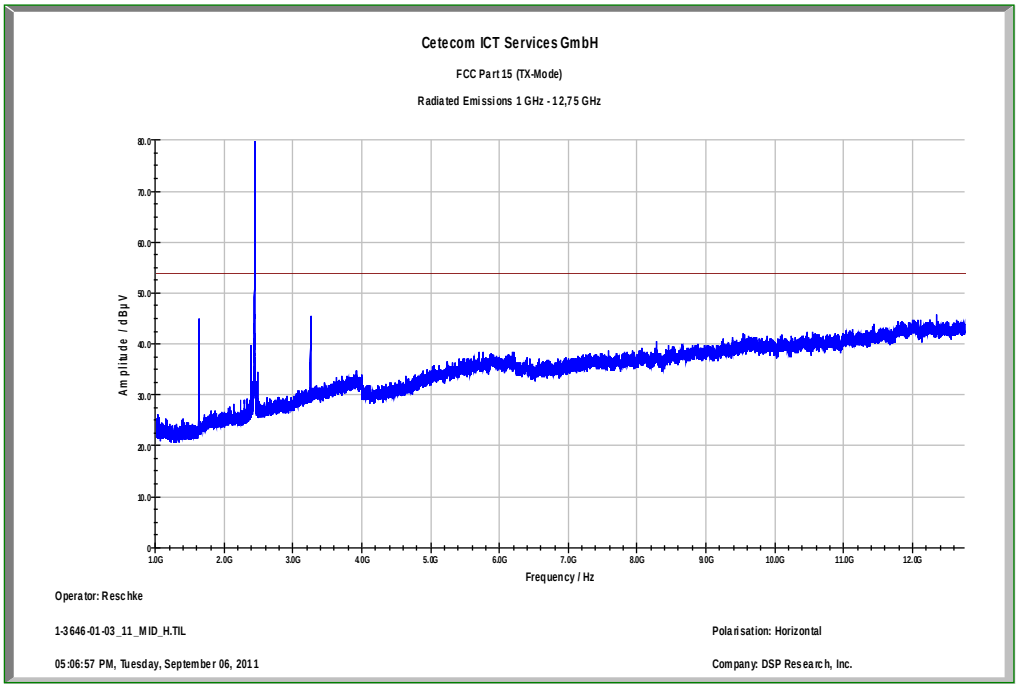
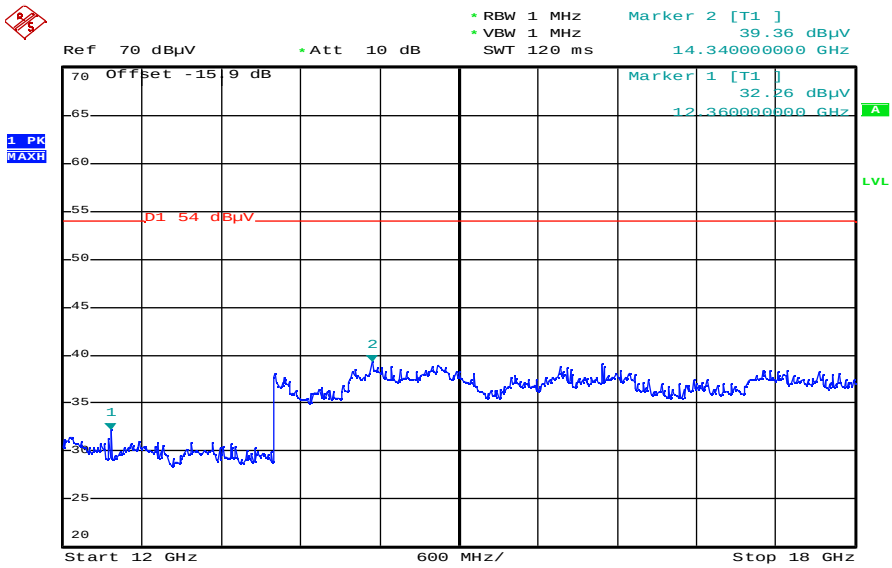
Plot 7: Middle channel, 1 GHz to 12.75 GHz, vertical polarization



Plot 8: Middle channel, 1 GHz to 12.75 GHz, horizontal polarization

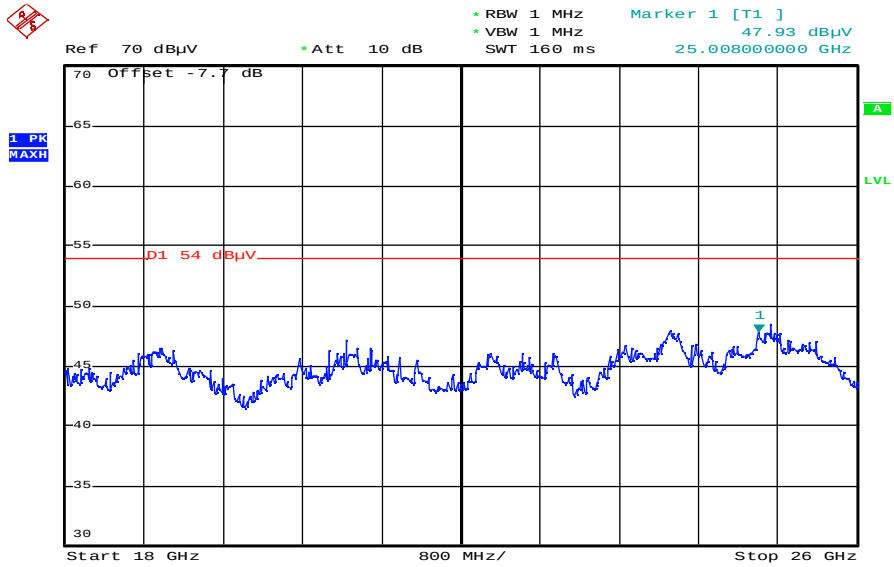


Plot 9: Middle channel, 12 GHz to 18 GHz, vertical & horizontal polarization



Date: 7.SEP.2011 12:22:18

Plot 10: Middle channel, 18 GHz to 26 GHz, vertical & horizontal polarization



Date: 7.SEP.2011 12:57:59

Plot 11: Highest channel, 30 MHz to 1 GHz, vertical & horizontal polarization

Common Information

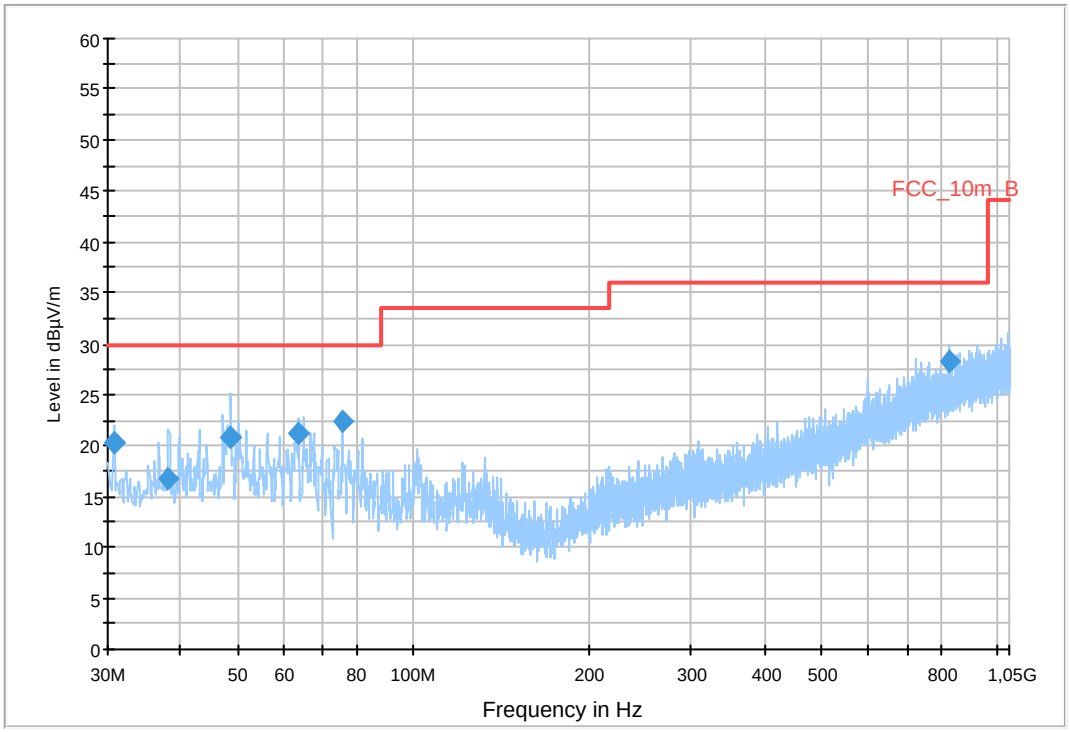
EUT:	WUSBMDL – RF module
Serial Number:	---
Test Description:	FCC part 15 class B @ 10 m
Operating Conditions:	tx @2.479GHz
Operator Name:	wld
Comment:	3V DC powered, by external power supply

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

FCC_10m(B)_3



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
30.741900	20.4	1000.0	120.000	170.0	V	10.0	12.6	9.6	30.0	
38.025900	16.8	1000.0	120.000	170.0	V	-6.0	13.3	13.2	30.0	
48.735300	20.9	1000.0	120.000	98.0	V	10.0	13.3	9.1	30.0	
63.340950	21.2	1000.0	120.000	170.0	V	274.0	10.8	8.8	30.0	
75.769350	22.5	1000.0	120.000	162.0	V	180.0	9.2	7.5	30.0	
826.268400	28.3	1000.0	120.000	98.0	H	196.0	24.2	7.7	36.0	

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

Subrange 1

Frequency Range:	30 MHz - 2 GHz
Receiver:	Receiver [ESCI 3] @ GPIB0 (ADR 20), SN 100083/003, FW 4.42
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW --- Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table (vertical): Cable_EN_1GHz (1005) Correction Table (horizontal): Cable_EN_1GHz (1005)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

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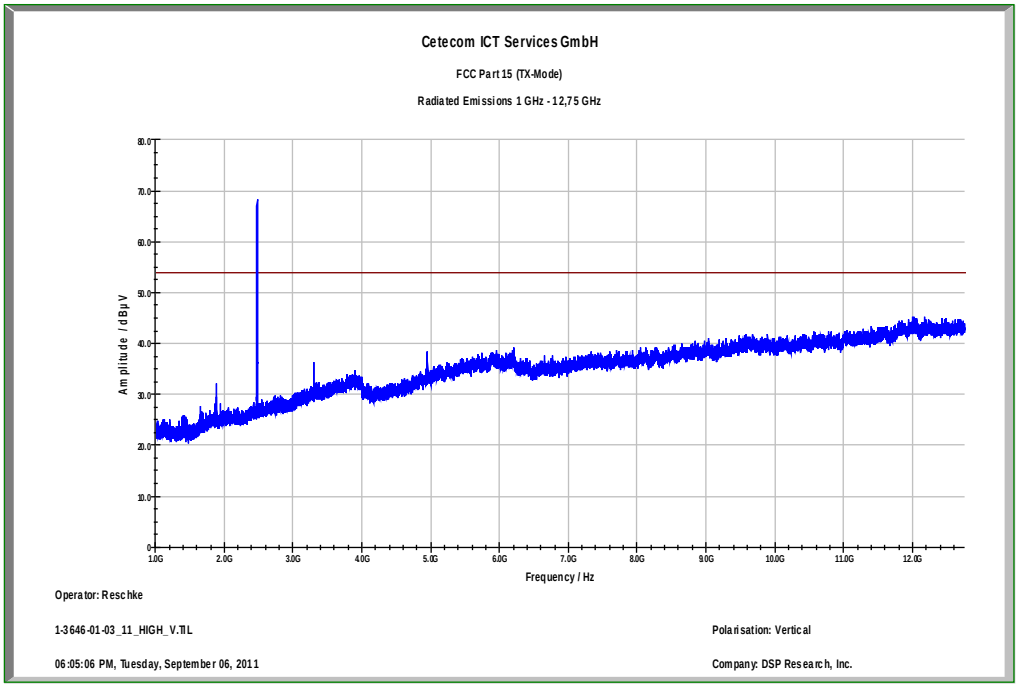
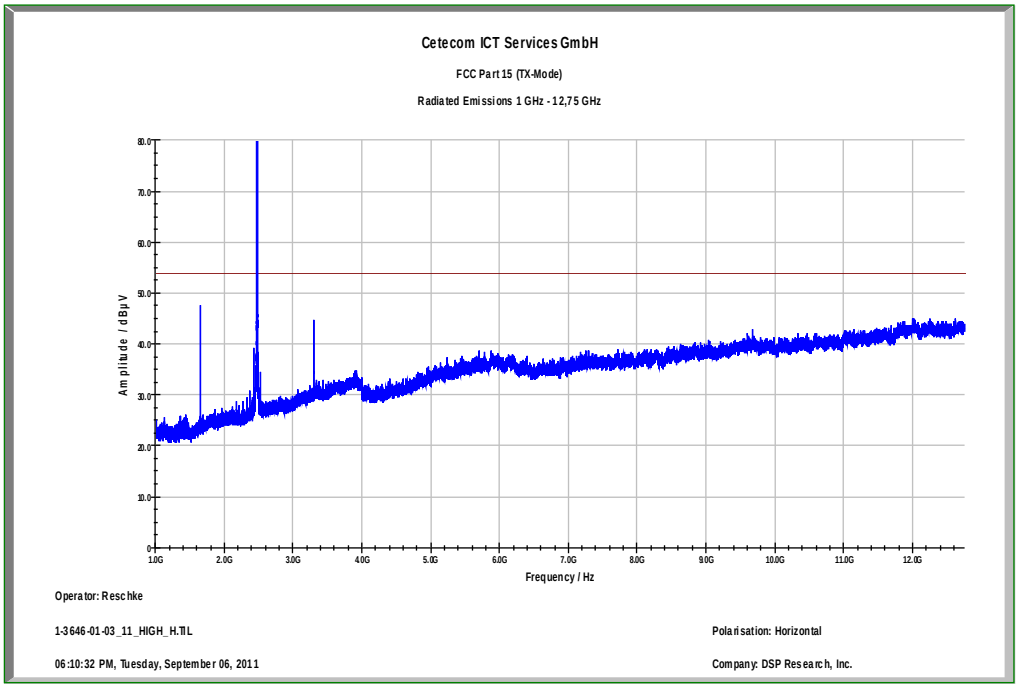
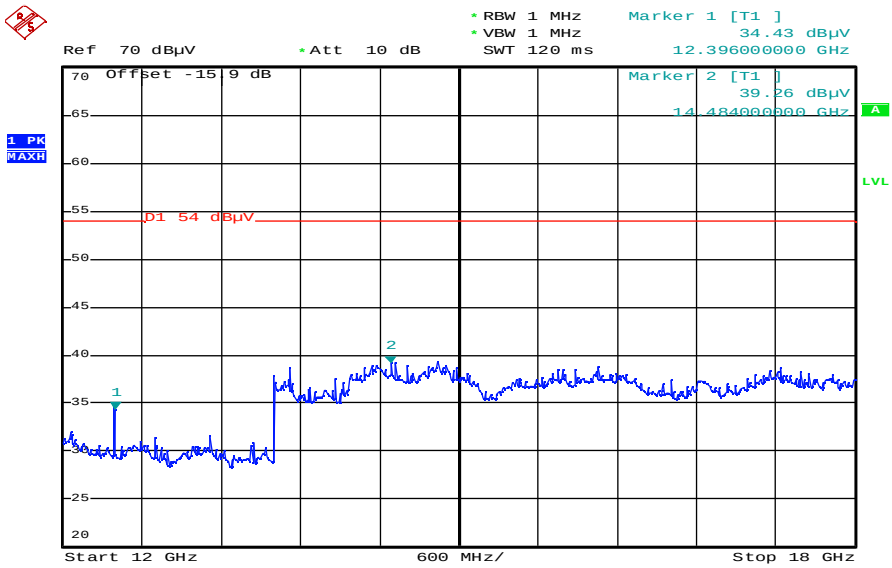
Plot 12: Highest channel, 1 GHz to 12.75 GHz, vertical polarization



Plot 13: Highest channel, 1 GHz to 12.75 GHz, horizontal polarization

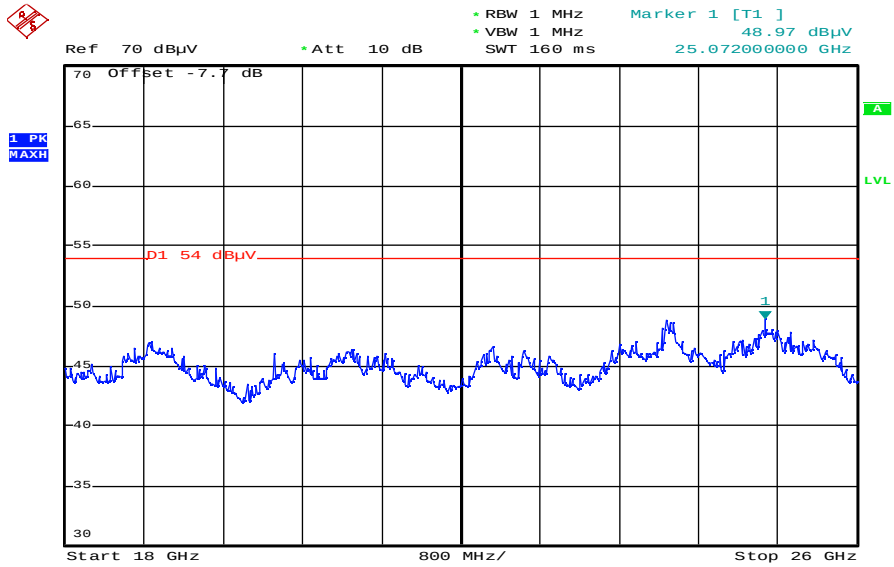


Plot 14: Highest channel, 12 GHz to 18 GHz, vertical & horizontal polarization



Date: 7.SEP.2011 12:24:07

Plot 15: Highest channel, 18 GHz to 26 GHz, vertical & horizontal polarization



Date: 7.SEP.2011 12:59:27

9.10 RX spurious emissions radiated

Description:

Measurement of the radiated spurious emissions in receive mode (middle channel).

Measurement:

Measurement parameter	
Detector:	Peak / Quasi Peak
Sweep time:	Auto
Video bandwidth:	Sweep: 100 kHz 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
CFR Part 15.109		RSS Gen, Issue 2, 4.10
RX Spurious Emissions Radiated		
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

Results:

RX Spurious Emissions Radiated [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
No critical peaks found		
Measurement uncertainty	± 3 dB	

Result: **The measurement is passed.**

Plots of measurements: RX – mode

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

Common Information

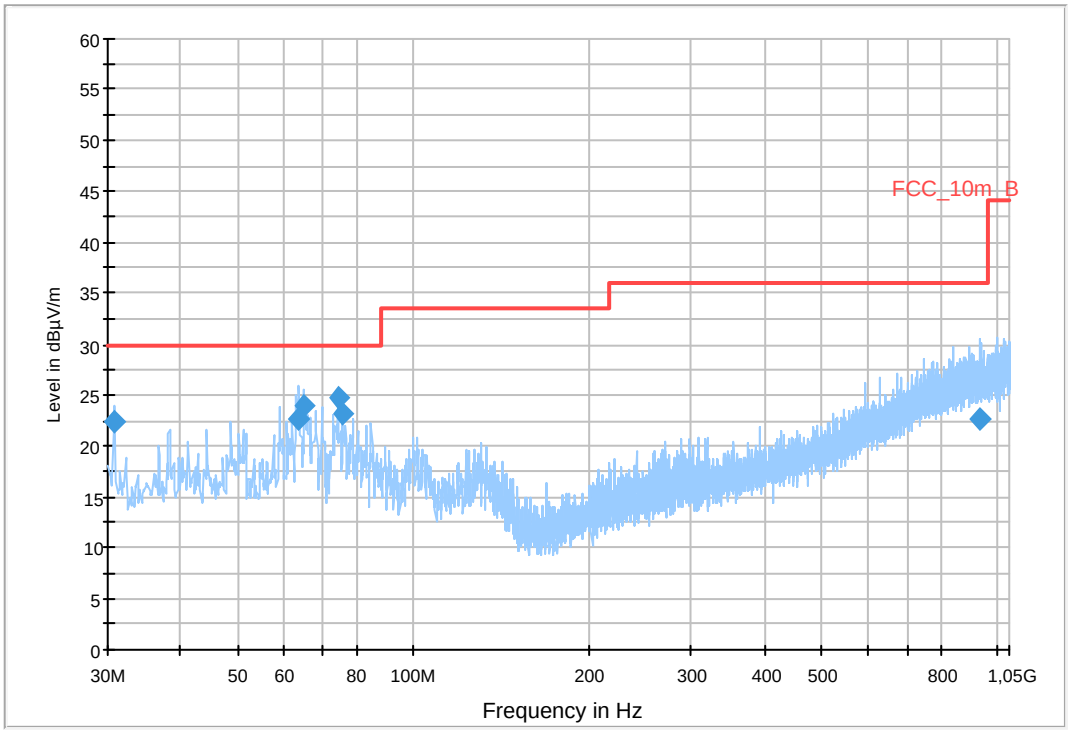
EUT:	WUSBMDL – RF module
Serial Number:	---
Test Description:	FCC part 15 class B @ 10 m
Operating Conditions:	rx
Operator Name:	wld
Comment:	3V DC powered, by external power supply

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

FCC_10m(B)_3



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
30.766200	22.4	1000.0	120.000	163.0	V	265.0	12.6	7.6	30.0	
63.689700	22.6	1000.0	120.000	98.0	V	-7.0	10.7	7.4	30.0	
65.245650	24.0	1000.0	120.000	143.0	V	106.0	10.4	6.0	30.0	
74.286000	24.8	1000.0	120.000	170.0	V	196.0	9.2	5.2	30.0	
75.733500	23.3	1000.0	120.000	170.0	V	-1.0	9.2	6.7	30.0	
930.085650	22.7	1000.0	120.000	170.0	H	267.0	25.3	13.3	36.0	

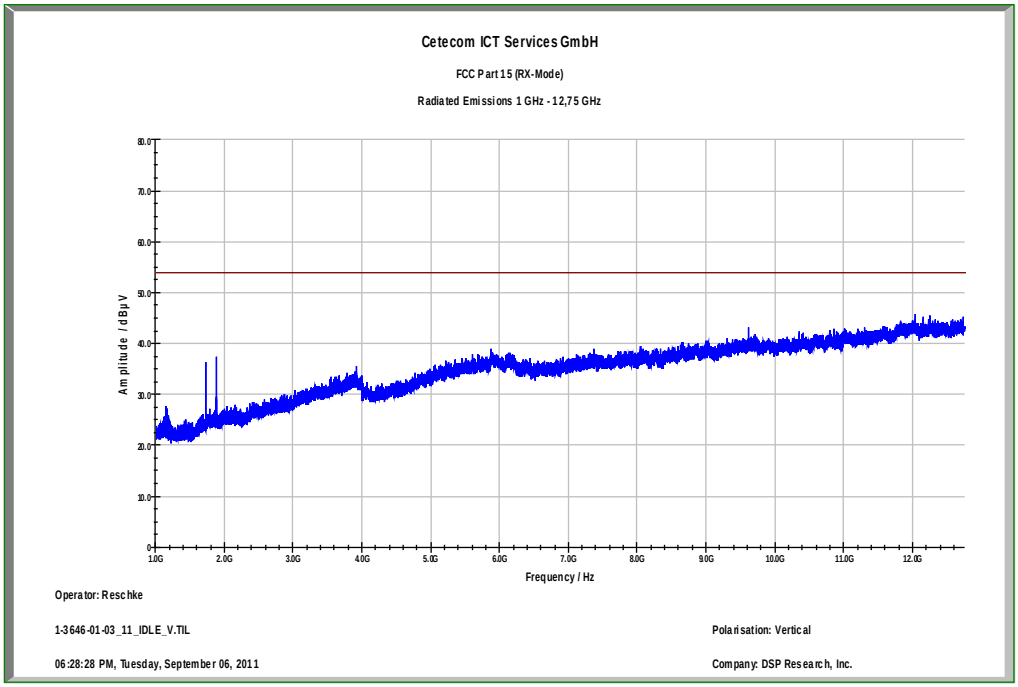
Hardware Setup: EMI radiated\Electric Field (NOS) - [EMI radiated]

Subrange 1

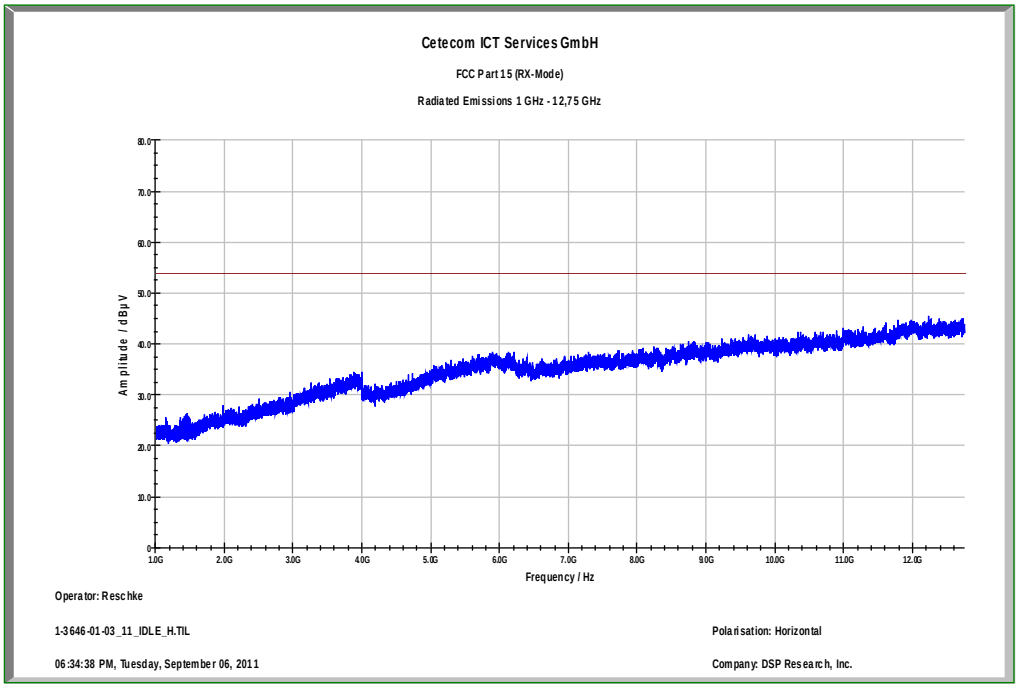
Frequency Range:	30 MHz - 2 GHz
Receiver:	Receiver [ESCI 3] @ GPIB0 (ADR 20), SN 100083/003, FW 4.42
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW --- Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table (vertical): Cable_EN_1GHz (1005) Correction Table (horizontal): Cable_EN_1GHz (1005)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

EMC 32 Version 8.10.00

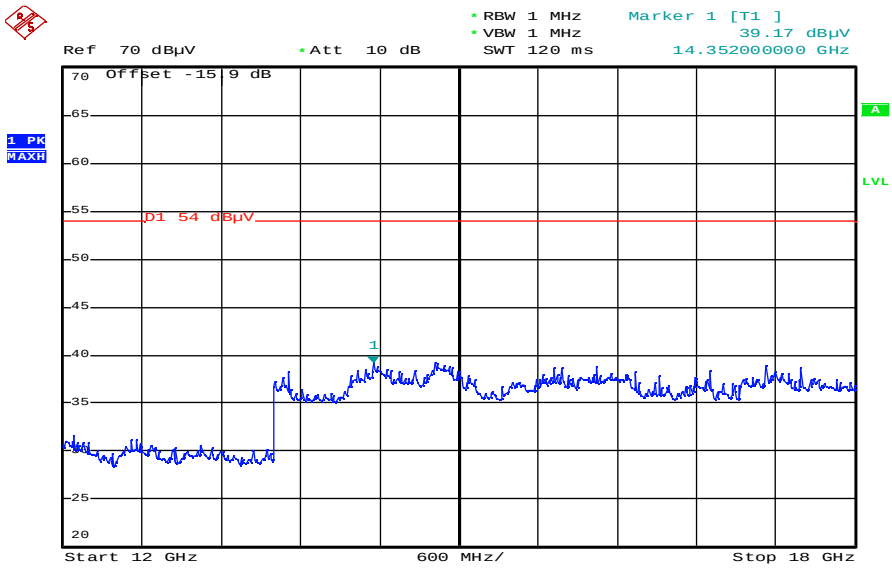
Plot 2: 1 GHz to 12.75 GHz, vertical polarization



Plot 3: 1 GHz to 12.75 GHz, horizontal polarization

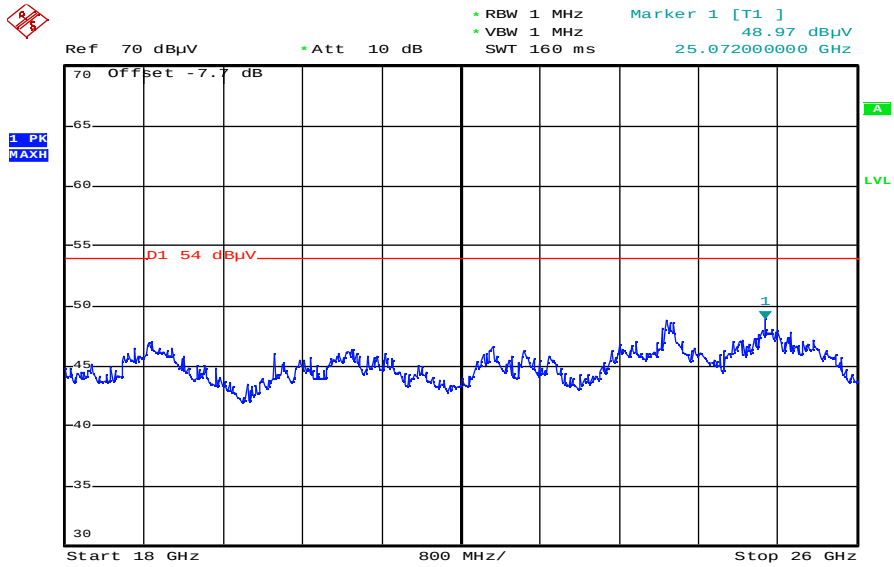


Plot 4: 12 GHz to 18 GHz, vertical & horizontal polarization



Date: 7.SEP.2011 12:26:04

Plot 5: 18 GHz to 26 GHz, vertical & horizontal polarization



Date: 7.SEP.2011 12:59:27

9.11 TX spurious emissions radiated < 30 MHz

Description:

Measurement of the radiated spurious emissions in transmit mode below 30 MHz. 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
CFR Part 15.209(a)		RSS –Gen
TX 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

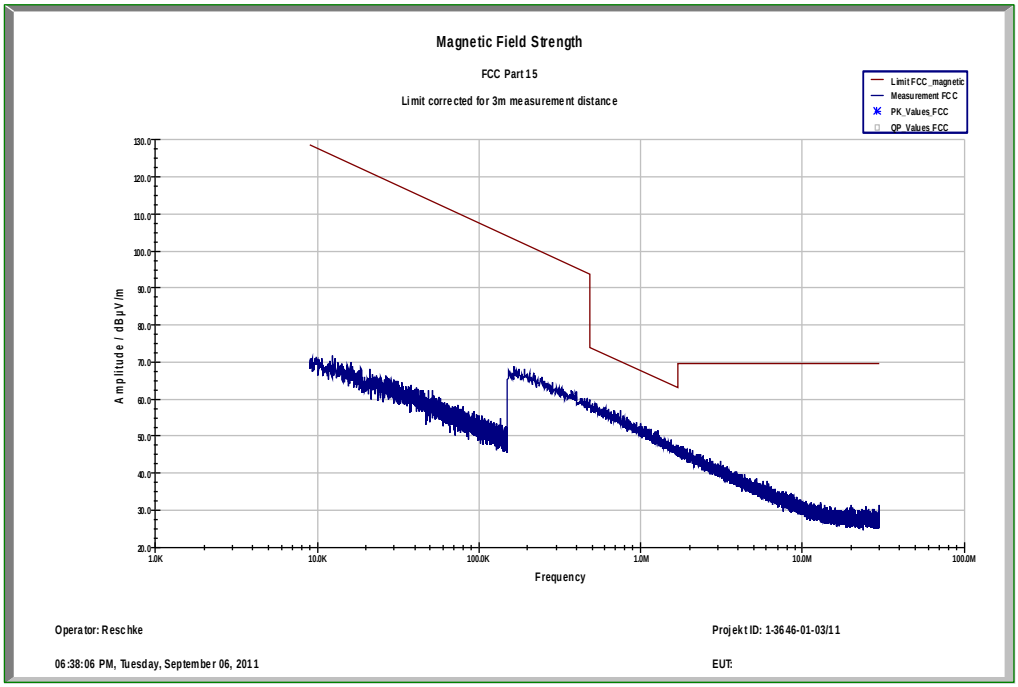
Results:

TX Spurious Emissions Radiated < 30 MHz [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
No critical peaks found		
Measurement uncertainty	± 3 dB	

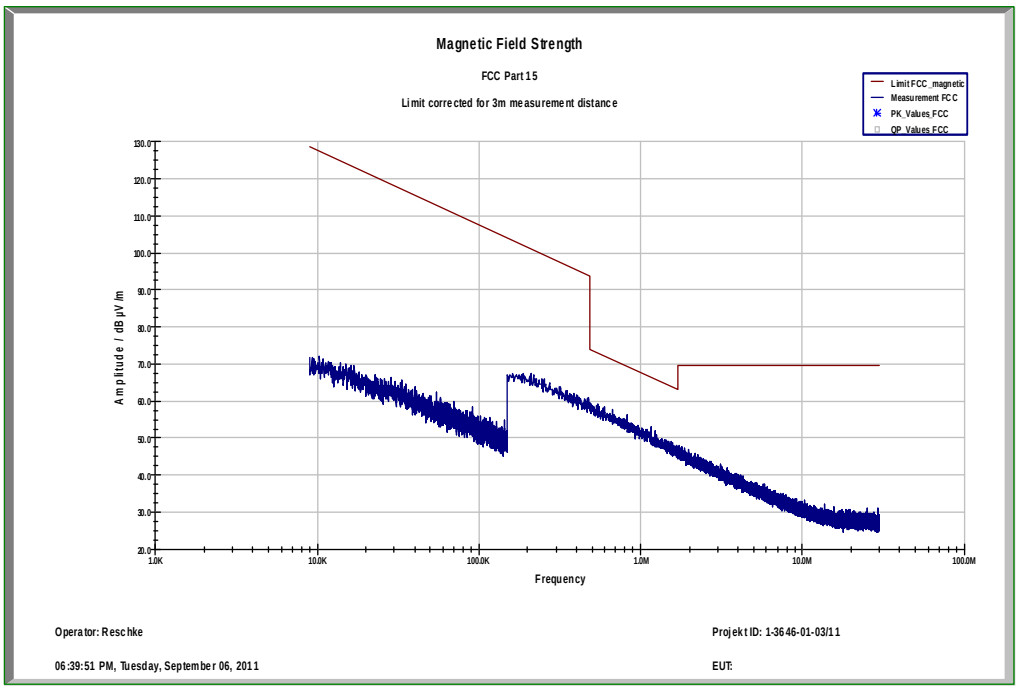
Result: **The measurement is passed.**

Plots of measurements:

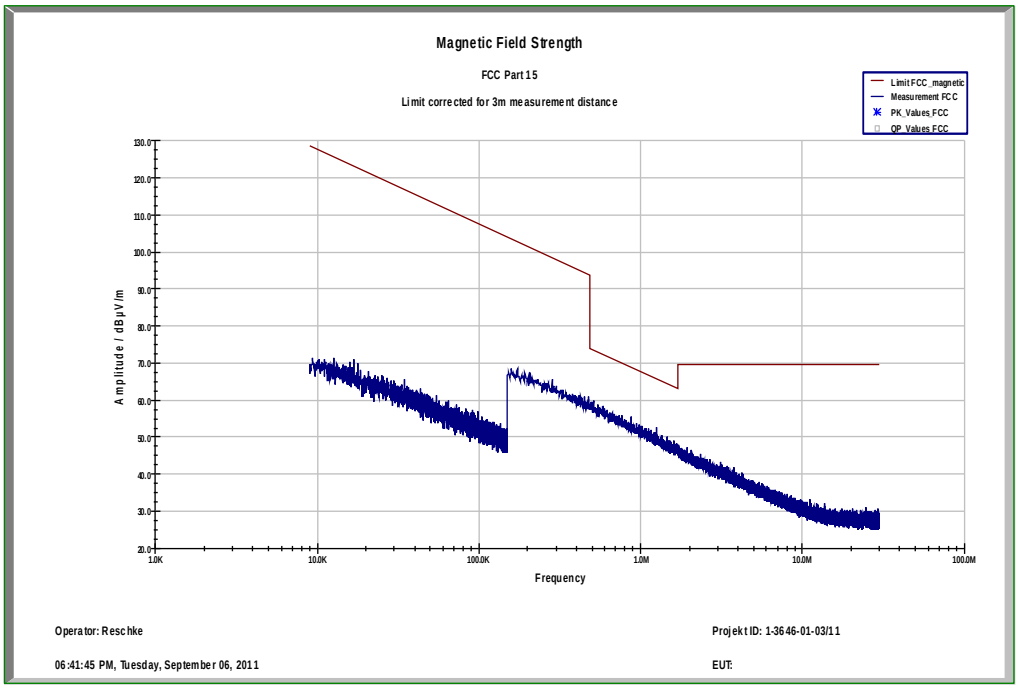
Plot 1: Lowest channel, 9 kHz to 30 MHz



Plot 2: Middle channel, 9 kHz to 30 MHz

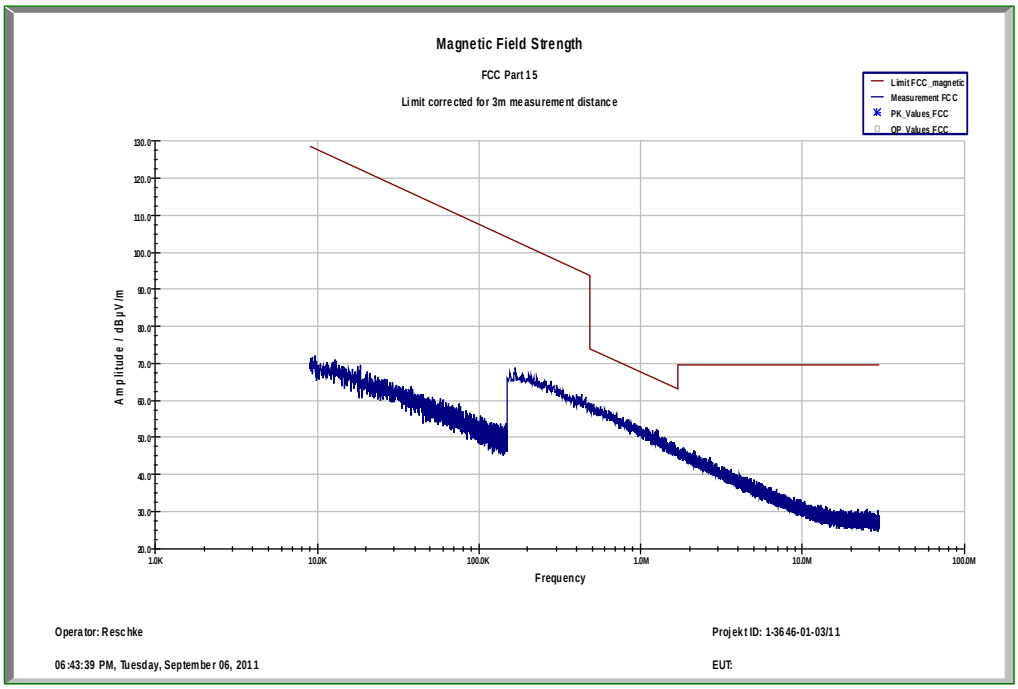


Plot 3: Highest channel, 9 kHz to 30 MHz



Plots of measurements: RX / Idle – mode

Plot 1: 9 kHz to 30 MHz



9.12 TX spurious emissions conducted < 30 MHz

Not applicable

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.	TILE-Software Emission	Quantum Change, Modell TILE-ICS/FULL	EMCO	none	300003451	ne		
2	n. a.	Highpass Filter	WHKX2.9/18G-12SS	Wainwright	1	300003492	ev		
3	n. a.	Highpass Filter	WHK1.1/15G-10SS	Wainwright	3	300003255	ev		
4	n. a.	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne		
5	n. a.	PSA Spectrum Analyzer 3 Hz - 26.5 GHz	E4440A	Agilent Technologies	MY48250080	300003812	k	08.09.2010	08.09.2012
6	n. a.	MXG Microwave Analog Signal Generator	N5183A	Agilent Technologies	MY47420220	300003813	k	13.09.2010	13.09.2012
7	n. a.	RF Filter Section 9kHz - 1GHz	N9039A	Agilent Technologies	MY48260003	300003825	vlKl!	08.09.2010	08.09.2012
8	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854	vlKl!	17.12.2008	17.12.2011
9	n. a.	EMI Test Receiver 9 kHz - 3 GHz incl. Preselector	ESPI3	R&S	101713	300004059	k	16.08.2011	16.08.2012
10	n. a.	Spectrum Analyzer 20 Hz - 50 GHz	FSU50	R&S	200012	300003443	ve	01.07.2010	01.07.2012
11	n. a.	Spectrum Analyzer 9kHz to 30GHz - 140..+30dBm	FSP30	R&S	100886	300003575	k	07.09.2010	07.09.2012
12	n. a.	DC Power Supply 0 – 32V	1108-32	Heiden	001802	300001383	Ve	23.06.2010	23.06.2013
13	n. a.	NRP Power meter Display and control unit AC sup	NRP + NRP-Z81	R&S	100212 + 100010	300003780	vlKl!	08.01.2010	08.01.2012
14	45	Switch-Unit	3488A	HP Meßtechnik	2719A14505	300000368	g		
15	50	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP Meßtechnik	2920A04466	300000580	ne		
16	n. a.	software	SPS_PHE 1.4f	Spitzberger & Spieß	B5981; 5D1081;B5979	300000210	ne		
17	n. a.	EMI Test Receiver	ESCI 1166.5950.03	R&S	100083	300003312	k	05.01.2011	05.01.2013
18	n. a.	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	k	14.07.2011	14.07.2013
19	n. a.	Amplifier	JS42-00502650-28-5A	MITEQ	1084532	300003379	ev		
20	n. a.	Antenna Tower	Model 2175	ETS-LINDGREN	64762	300003745	izw		
21	n. a.	Positioning Controller	Model 2090	ETS-LINDGREN	64672	300003746	izw		

22	n. a.	Turntable Interface-Box	Model 105637	ETS-LINDGREN	44583	300003747	izw		
23	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	01.04.2010	01.04.2012
24	n. a.	Spectrum-Analyzer	FSU26	R&S	200809	300003874	k	10.01.2011	10.01.2013
25	n. a.	Isolating Transformer	RT5A	Grundig	8041	300001626	g		
26	n. a.	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP Meßtechnik	2818A03450	300001040	Ve	08.01.2009	08.01.2012
27	n. a.	Coaxial Attenuator 30dB/500W	8325	Bird	1530	300001595	ev		
28	n. a.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vlKl!	11.05.2011	11.05.2013
29	n. a.	Active Loop Antenna	6502	EMCO	2210	300001015	ne		
30	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996		23.03.2009	
31	Spec.A. 2_2e	System rack for EMI measurement solution	85900	HP I.V.	*	300000222	ne		
32	9	Artificial Mains 9 kHz to 30 MHz	ESH3-Z5	R&S	828576/020	300001210	Ve	06.01.2010	06.01.2012
33	n. a.	Relais Matrix	3488A	HP Meßtechnik	2719A15013	300001156	ne		
34	n. a.	Relais Matrix	PSU	R&S	890167/024	300001168	ne		
35	n. a.	Isolating Transformer	RT5A	Grundig	9242	300001263	ne		
36	n. a.	Three-Way Power Splitter, 50 Ohm	11850C	HP Meßtechnik		300000997	ne		
37	n. a.	Switch / Control Unit	3488A	HP	2605e08770	300001443	ne		
38	n. a.	Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143	ne		
39	n. a.	Band Reject filter	WRCG1855/1910-1835/1925-40/8SS	Wainwright	7	300003350	ev		
40	n. a.	Band Reject filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	11	300003351	ev		
41									

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

Annex A Photographs of the test setup

Photo documentation:

Photo 1:

Photo 2:

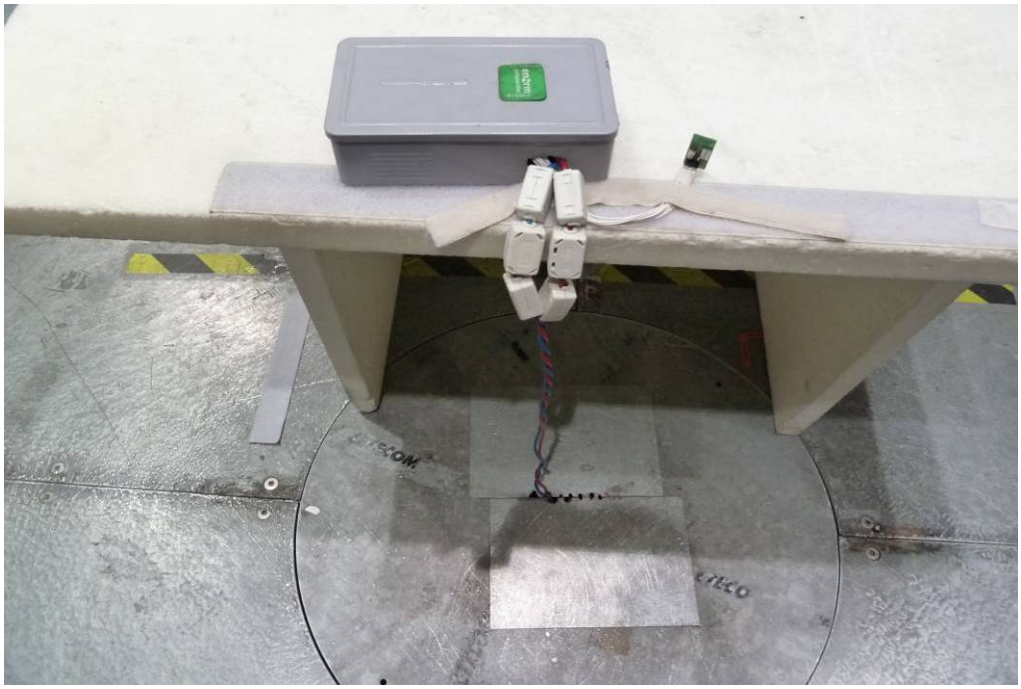


Photo 3:

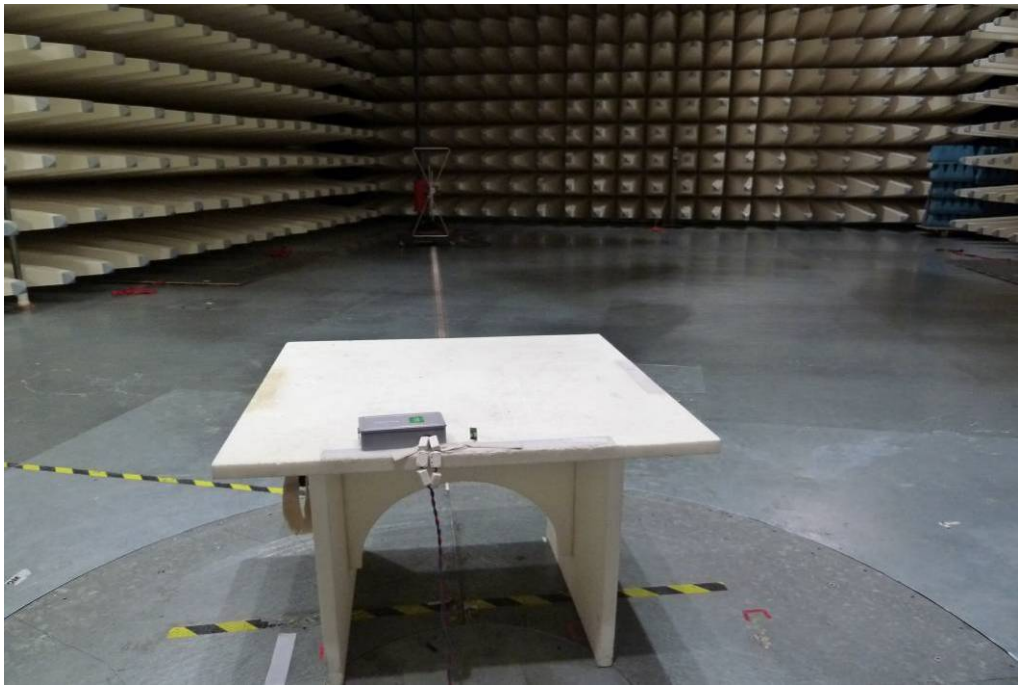


Photo 4:

Photo 5: Measurements > 1GHz

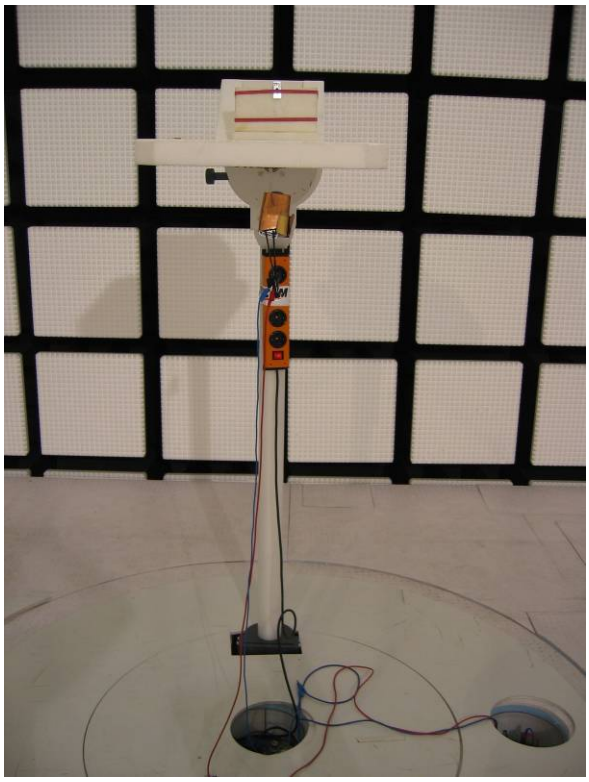


Photo 6: Measurements > 1GHz

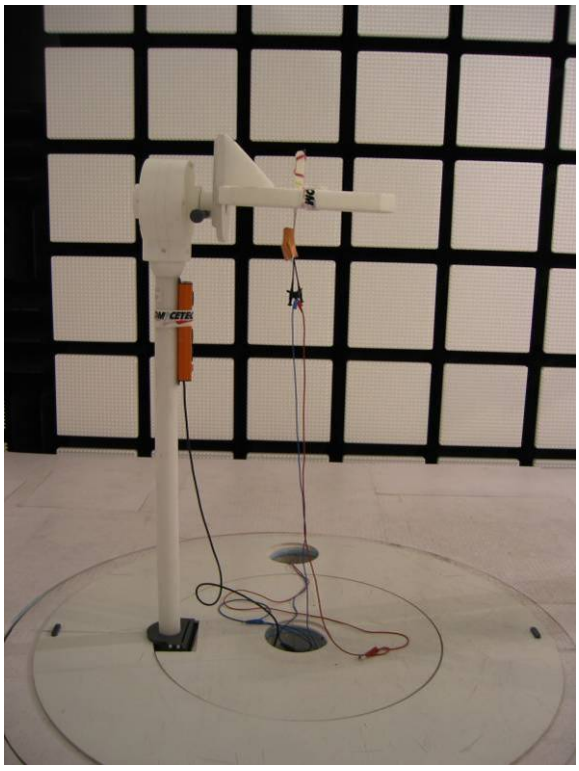


Photo 7: Measurements > 1GHz

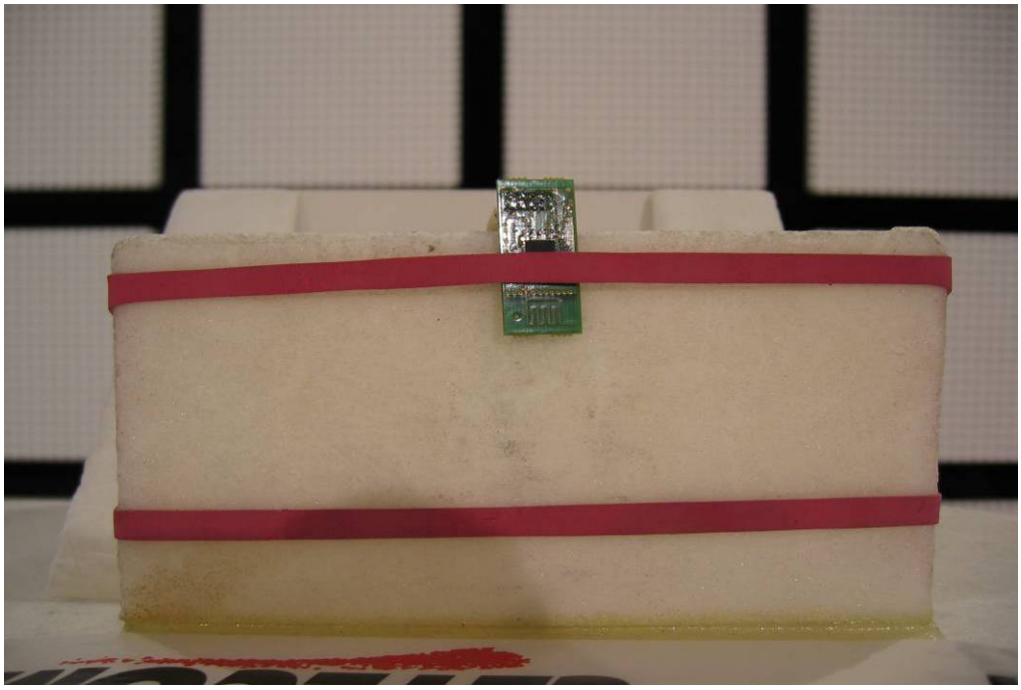
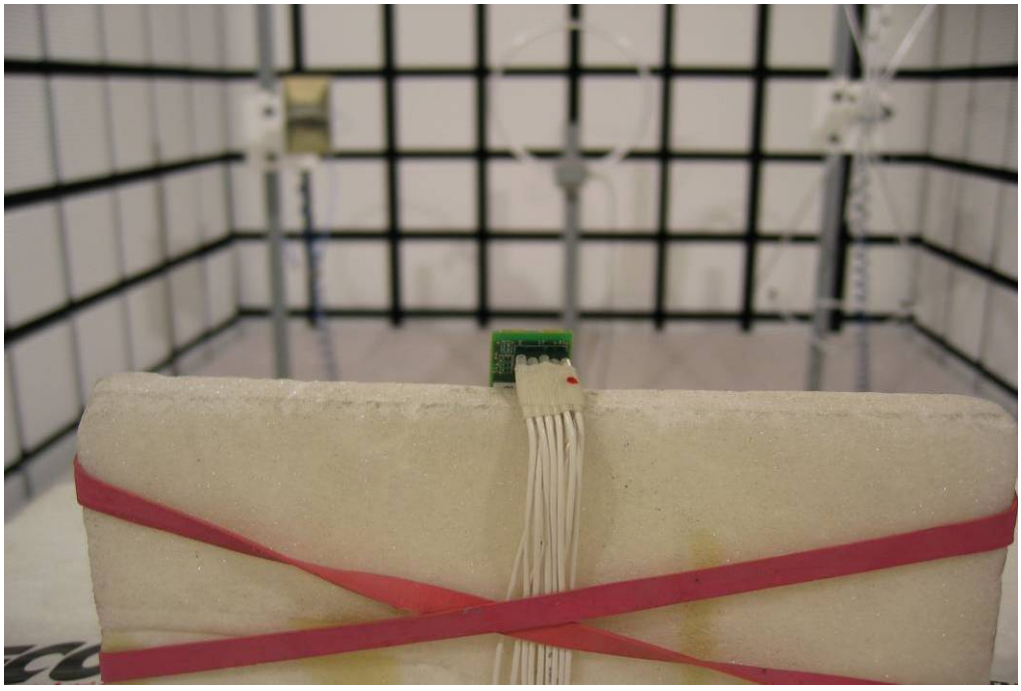


Photo 8: Measurements > 1GHz



Annex B Photographs of the EUT

Photo documentation:

Photo 1: Sample for conducted measurements

Photo 2: Sample for conducted measurements

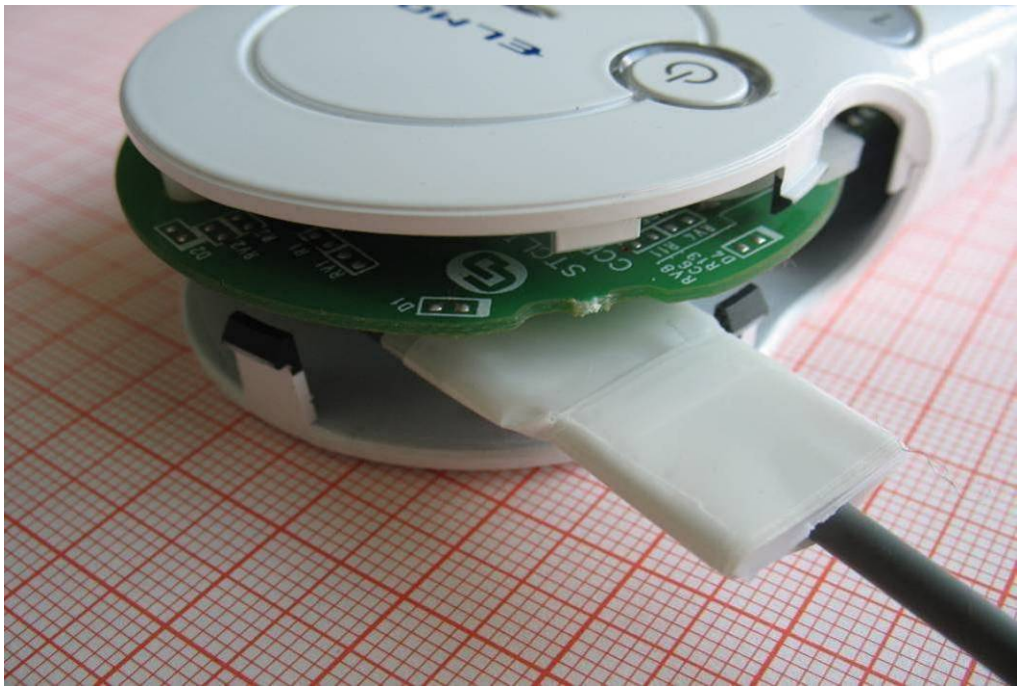


Photo 3: Sample for conducted measurements

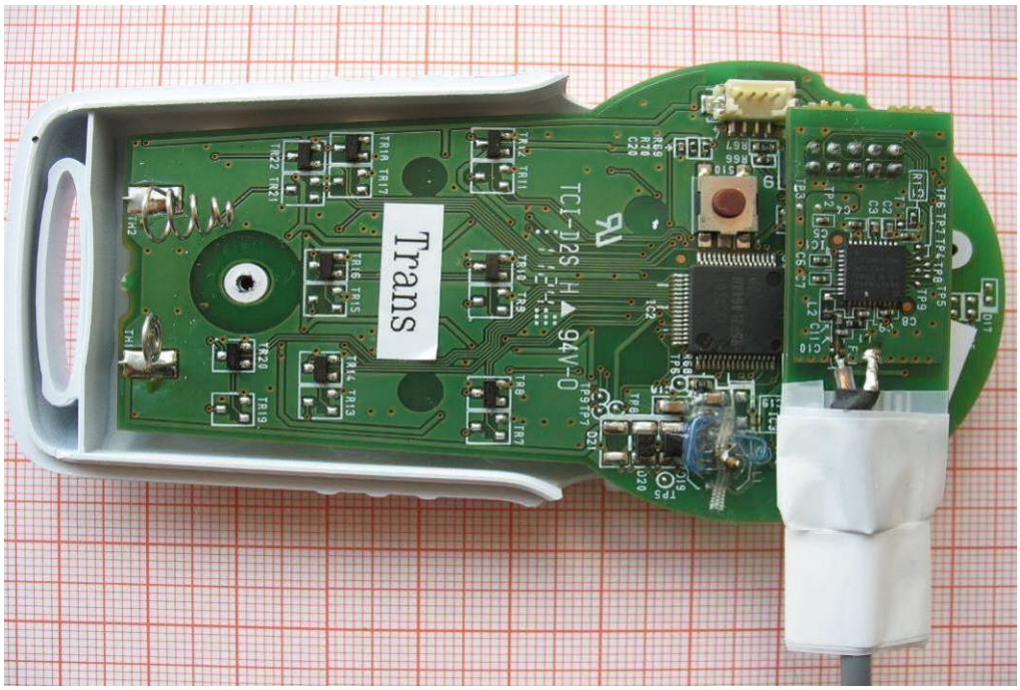


Photo 4: Sample for conducted measurements

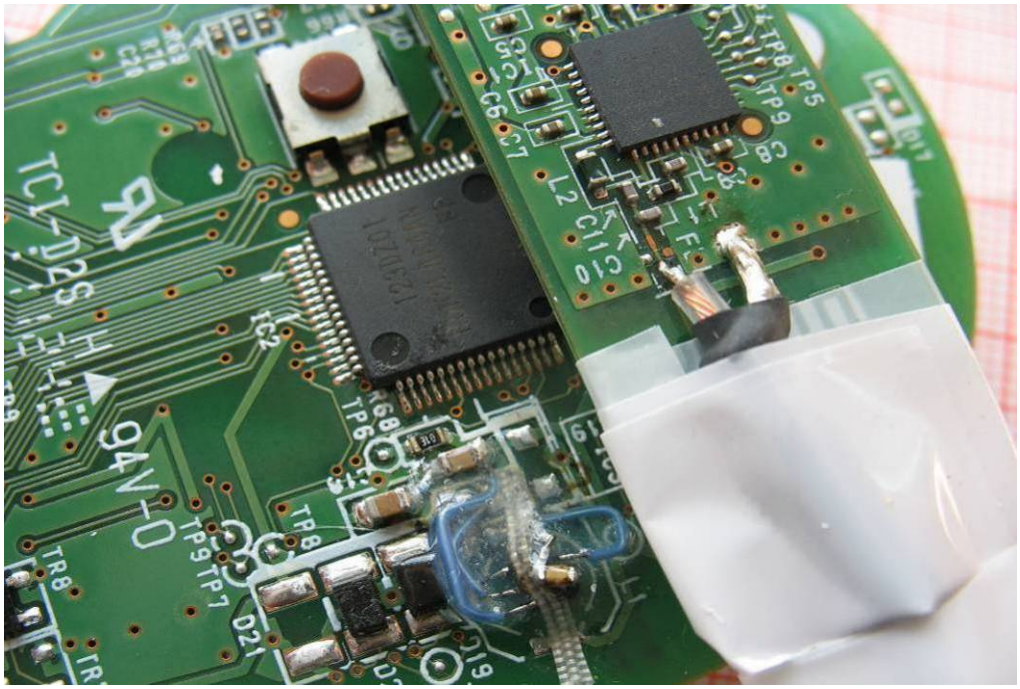


Photo 5: Configuration for radiated module measurements

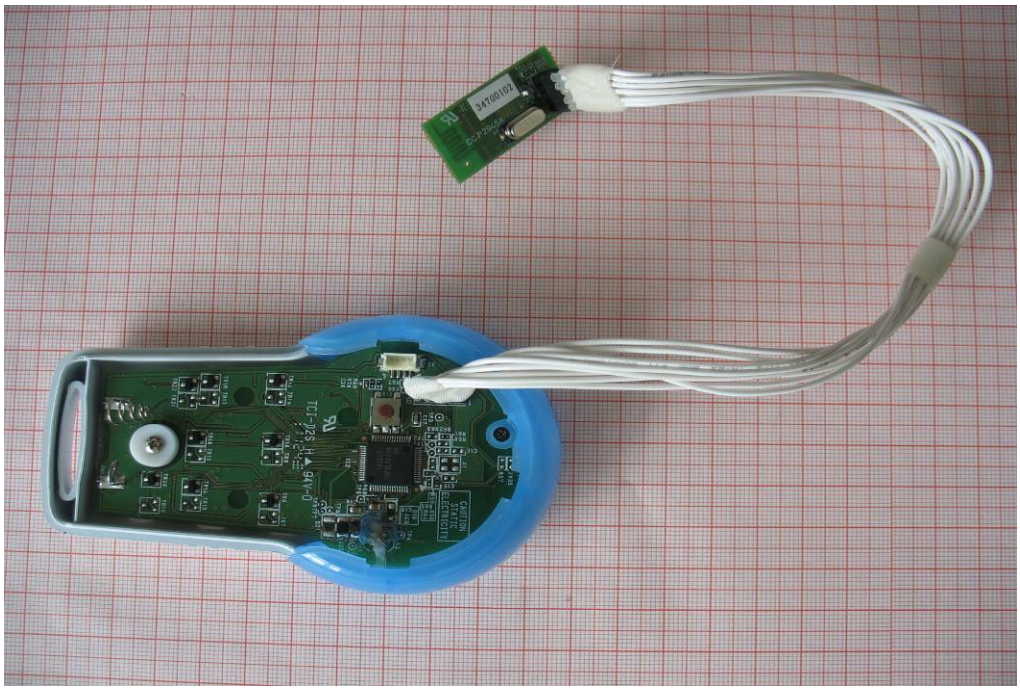


Photo 6: Module for radiated measurements

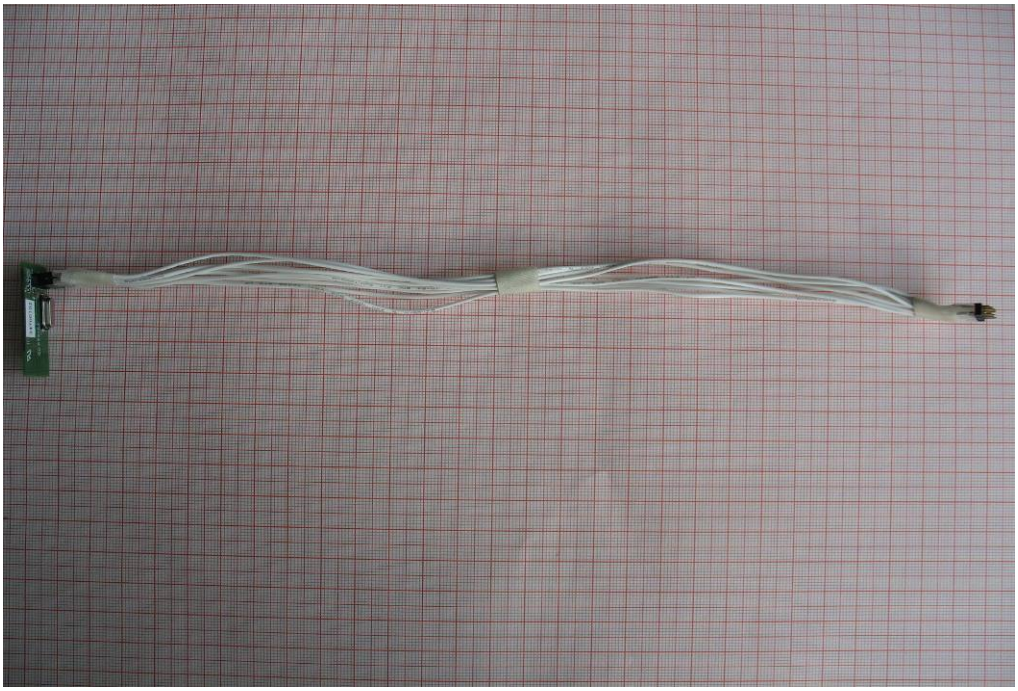


Photo 7: Module for radiated measurements

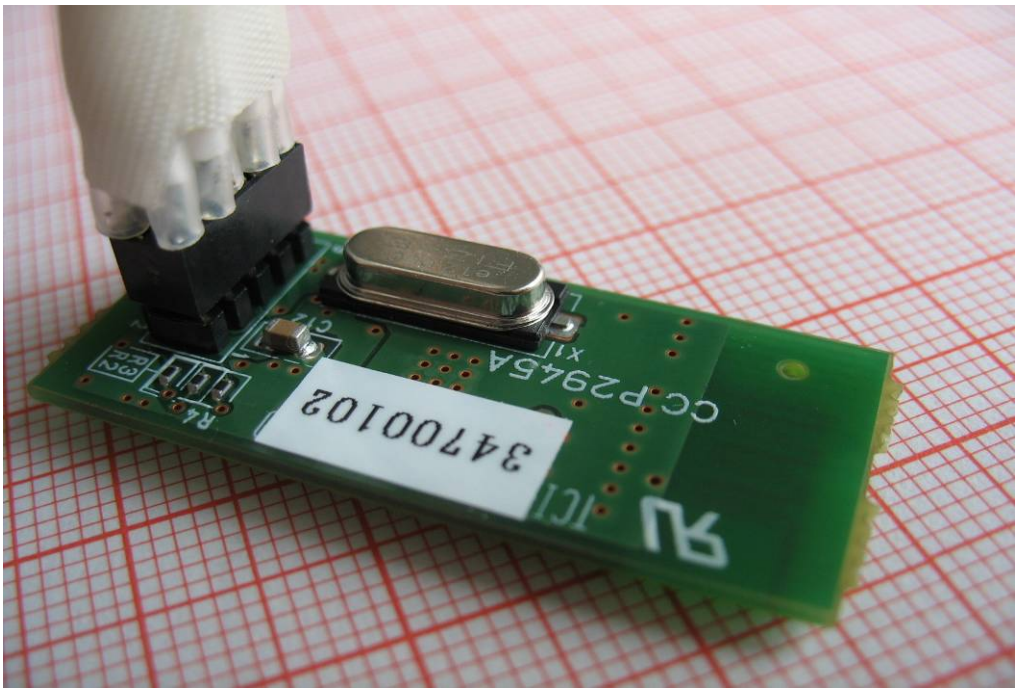


Photo 8: Module for radiated measurements

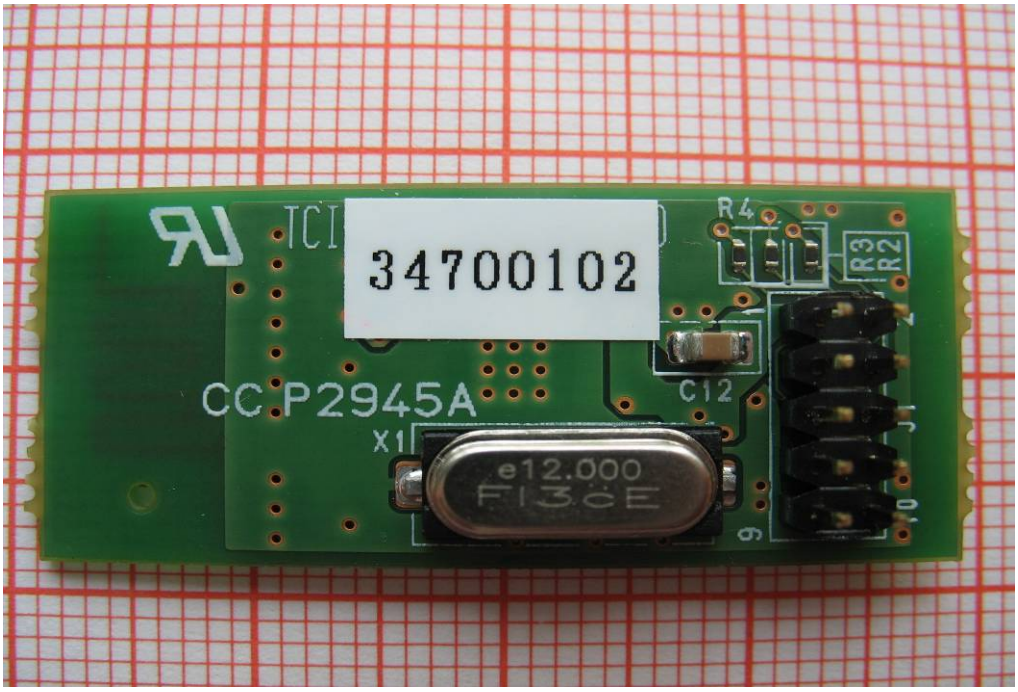


Photo 9: Module for radiated measurements

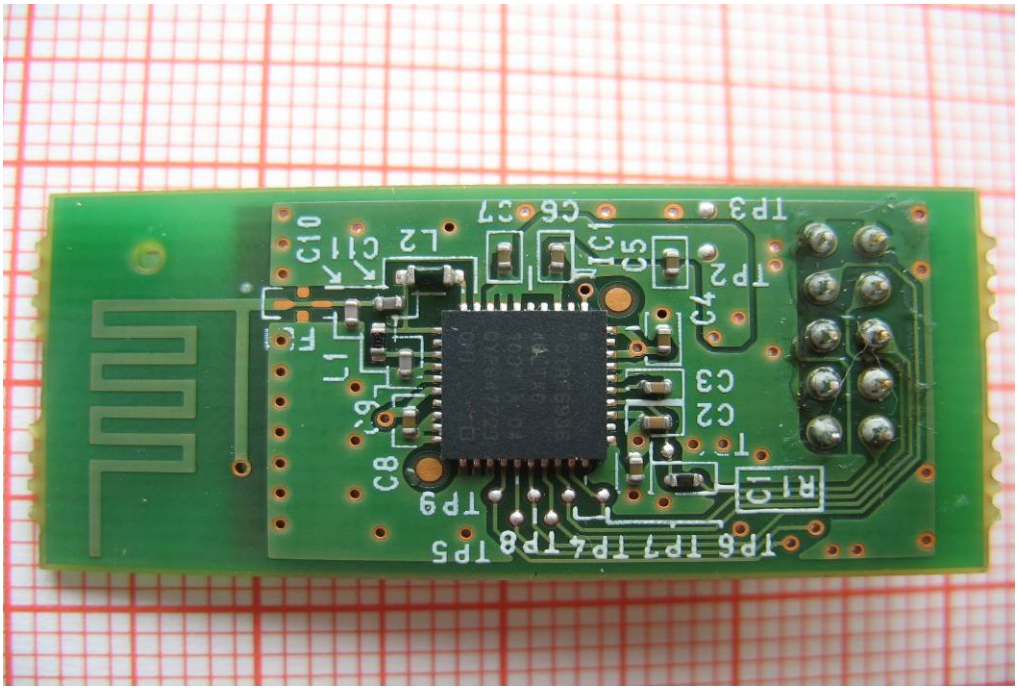


Photo 10: Main board for module (radiated measurements)

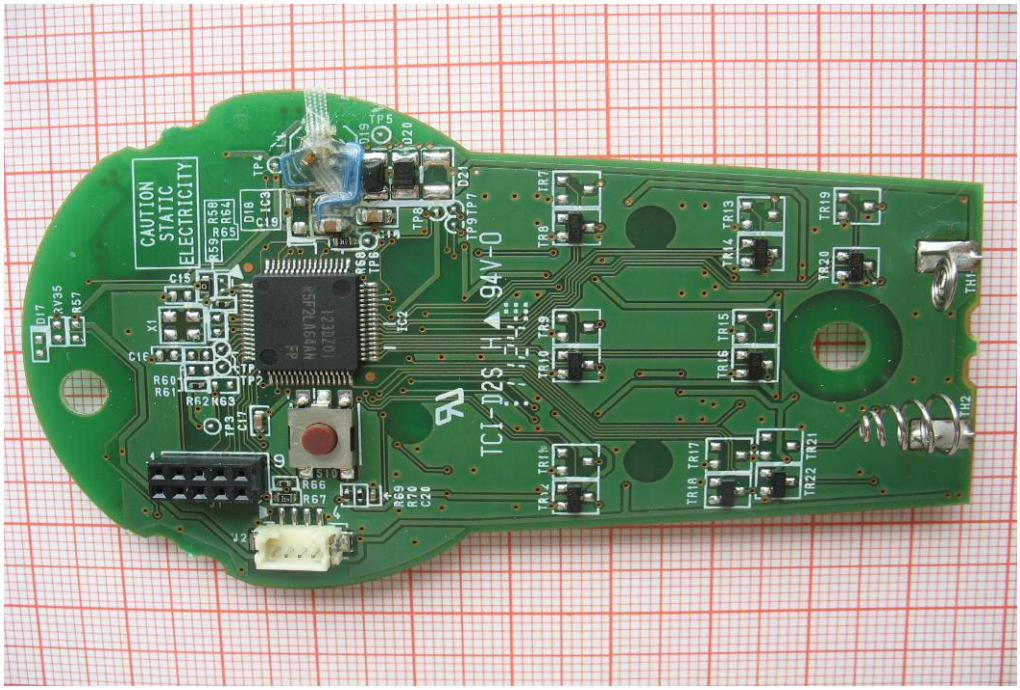


Photo 11: Main board for module (radiated measurements)

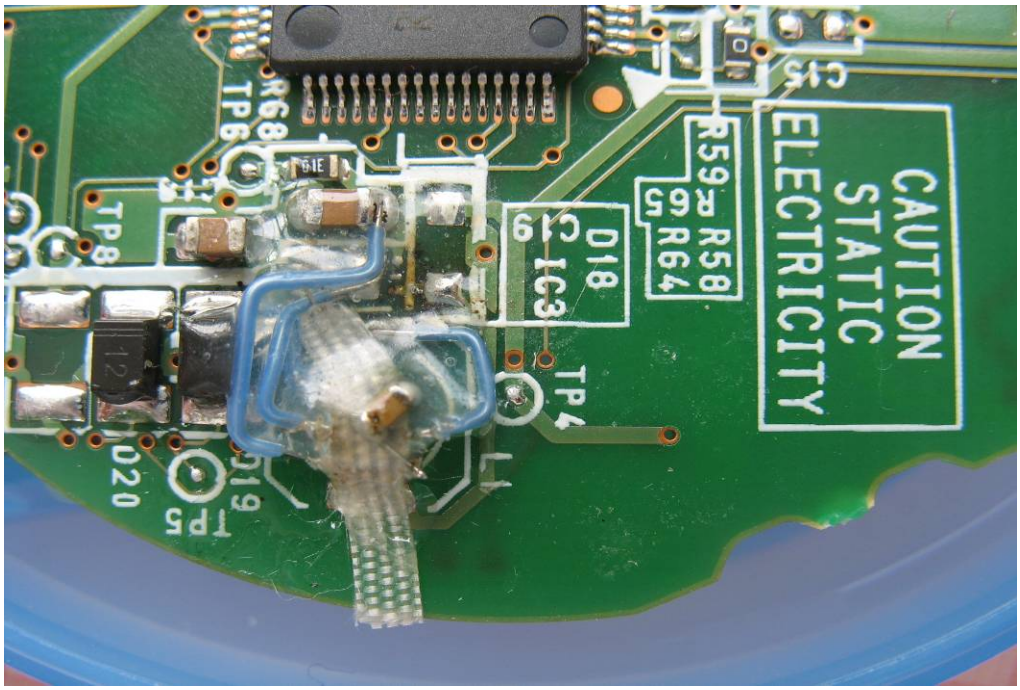
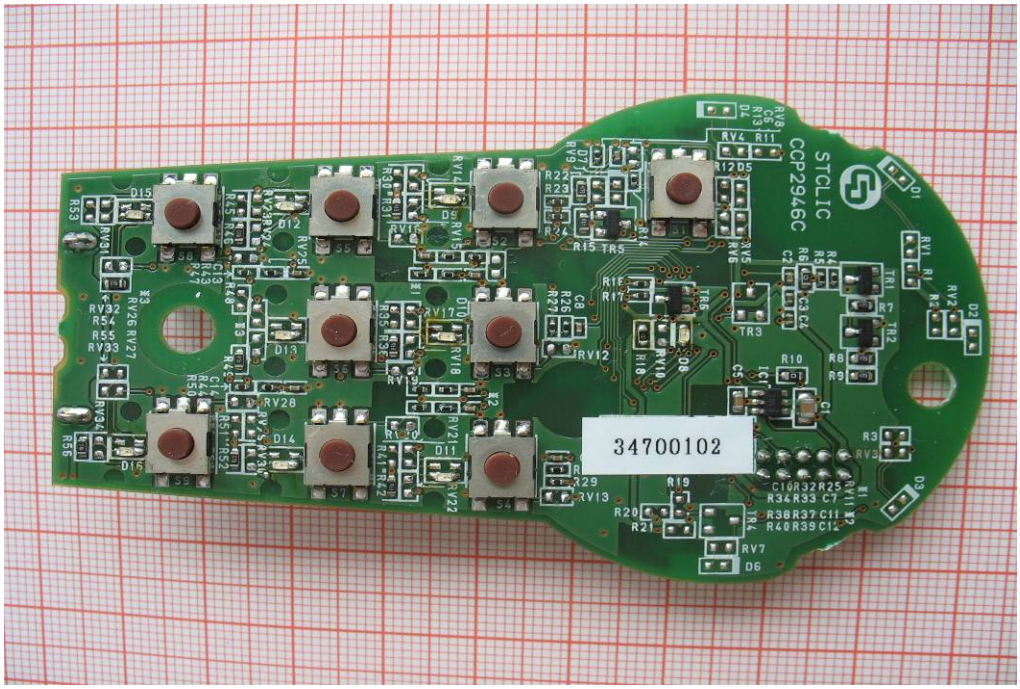


Photo 11: Main board for module (radiated measurements)



Annex C Document history

Version	Applied changes	Date of release
1.0	Initial release	2011-09-07

Annex D 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