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

TEST REPORT

Test report no.: 1-8945/14-01-03-B

Deutsche
Akkreditierungsstelle
D-PL-12076-01-00

Testing laboratory

CETECOM ICT Services GmbH

Untertuerkheimer Strasse 6 – 10

66117 Saarbruecken / Germany

Phone: + 49 681 5 98 - 0

Fax: + 49 681 5 98 - 9075

Internet: <http://www.cetecom.com>e-mail: ict@cetecom.com**Accredited Testing Laboratory:**

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)

The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-00

Applicant

Valeo Schalter und Sensoren GmbH

Laiernstrasse 12

74321 Bietigheim-Bissingen / GERMANY

Phone: +49 7142 916-0

Fax: +49 7142 916-4195

Contact: Eric Amiot

e-mail: Eric.Amiot@valeo.com

Phone: +49 7142 916-1195

Manufacturer

Valeo Schalter und Sensoren GmbH

Laiernstrasse 12

74321 Bietigheim-Bissingen / GERMANY

Test standard/s

47 CFR 15

Subpart C - Intentional Radiators

RSS 310 - Issue 3

Licence-exempt Radio Apparatus (All Frequency Bands): Category II Equipment

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

Test Item

Kind of test item: 24 GHz Distance Radar**Model name:** MBHL2**FCC ID:** UR8307735**IC:** 3248C-307735

Frequency: 24.05-24.25 GHz

Antenna: Integrated patch antenna

Power supply: 9.0 - 16.0 V DC by Battery

Temperature range: -40°C to +85°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 authorized:

Meheza Walla
Lab Manager
Radio Communications & EMC

Test performed:

Karsten Gerald
Lab Manager
Radio Communications & EMC

1 Table of contents

1	Table of contents	2
2	General information	3
2.1	Notes and disclaimer	3
2.2	Application details	3
3	Test standard/s	3
4	Test environment	4
5	Test item	4
5.1	Additional information	4
6	Test laboratories sub-contracted	4
7	Summary of measurement results	5
8	Description of test setup	6
8.1	Radiated measurements	6
8.2	Shielded fully anechoic chamber	7
8.3	Radiated measurements > 12.75 GHz	8
8.4	Radiated measurements > 50 GHz	8
8.4.1	Additional comments	9
9	Measurement results	10
9.1	Antenna Requirement	10
9.2	Field strength of emissions (wanted signal)	11
9.3	Occupied bandwidth (99% bandwidth)	17
9.4	Field strength of emissions (radiated spurious)	26
10	Frequency stability	39
Annex A	Test equipment and ancillaries used for tests	40
Annex B	Document history	42
Annex C	Further information	42
Annex D	Accreditation Certificate	43

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.

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.

The testing service provided by CETECOM ICT Services GmbH has been rendered under the current "General Terms and Conditions for CETECOM ICT Services GmbH".

CETECOM ICT Services GmbH will not be liable for any loss or damage resulting from false, inaccurate, inappropriate or incomplete product information provided by the customer.

Under no circumstances does the CETECOM ICT Services GmbH test report include any endorsement or warranty regarding the functionality, quality or performance of any other product or service provided.

Under no circumstances does the CETECOM ICT Services GmbH test report include or imply any product or service warranties from CETECOM ICT Services GmbH, including, without limitation, any implied warranties of merchantability, fitness for purpose, or non-infringement, all of which are expressly disclaimed by CETECOM ICT Services GmbH.

All rights and remedies regarding vendor's products and services for which CETECOM ICT Services GmbH has prepared this test report shall be provided by the party offering such products or services and not by CETECOM ICT Services GmbH.

In no case this test report can be considered as a Letter of Approval.

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

2.2 Application details

Date of receipt of order:	2015-03-17
Date of receipt of test item:	2015-04-14
Start of test:	2015-04-14
End of test:	2015-06-12
Person(s) present during the test:	-/-

3 Test standard/s

Test standard	Date	Test standard description
47 CFR 15	2014/10	Subpart C - Intentional Radiators
RSS 310 - Issue 3	2010/12	Licence-exempt Radio Apparatus (All Frequency Bands): Category II Equipment

4 Test environment

Temperature:	T_{nom}	+22 °C during room temperature tests
	T_{max}	+85 °C during high temperature tests
	T_{min}	-40 °C during low temperature tests
Relative humidity content:		35 %
Barometric pressure:		not relevant for this kind of testing
Power supply:	V_{nom}	13.5 V DC by Battery
	V_{max}	16.0 V
	V_{min}	9.0 V

5 Test item

Kind of test item	:	24 GHz Distance Radar
Type identification	:	MBHL2
HMN	:	-/-
PMN	:	MBHL2
HVIN	:	MBHL2: 307735
FVIN	:	-/-
S/N serial number	:	MBL2 4301211 MBH2 na
HW hardware status	:	MBH2: DPS R04 Antenne R4.1 MBL2: DPS R04 Antenne R6
SW software status	:	MBH2: DSP 4.49.207 MCU 8.6.903 MBL2 DSP 10.15.16 MCU 10.6.2
Frequency band	:	24.05 - 24.25 GHz
Type of modulation	:	FMCW
Number of channels	:	1
Antenna	:	Integrated patch antenna
Power supply	:	9.0 - 16.0 V DC by Battery
Temperature range	:	-40°C to +85°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: 1-8945/14-01-03_AnnexA
1-8945/14-01-03_AnnexB
1-8945/14-01-03_AnnexD

6 Test laboratories sub-contracted

None

7 Summary of measurement results

<input checked="" type="checkbox"/>	No deviations from the technical specifications were ascertained
<input type="checkbox"/>	There were deviations from the technical specifications ascertained

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	FCC 47 CFR Part 15 / IC RSS-310	see below	2015-07-22	-/-

Test specification clause	Test case	Temperature conditions	Power supply	Pass	Fail	NA	NP	Results (max.)
§15.203 RSS-Gen 7.1.4	Antenna Requirement	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.249(a) / RSS-310, 3.10	Field strength of emissions (wanted signal)	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	PK: 112.3 dBµV/m RMS: 101.1 dBµV/m @ 3m
§2.1049	Occupied bandwidth (99% bandwidth)	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	192.8 MHz
§15.209(a) / §15.249(d) / RSS-310, 3.10	Field strength of emissions (spurious & harmonics)	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.249 (b) (2)	Frequency Stability	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies

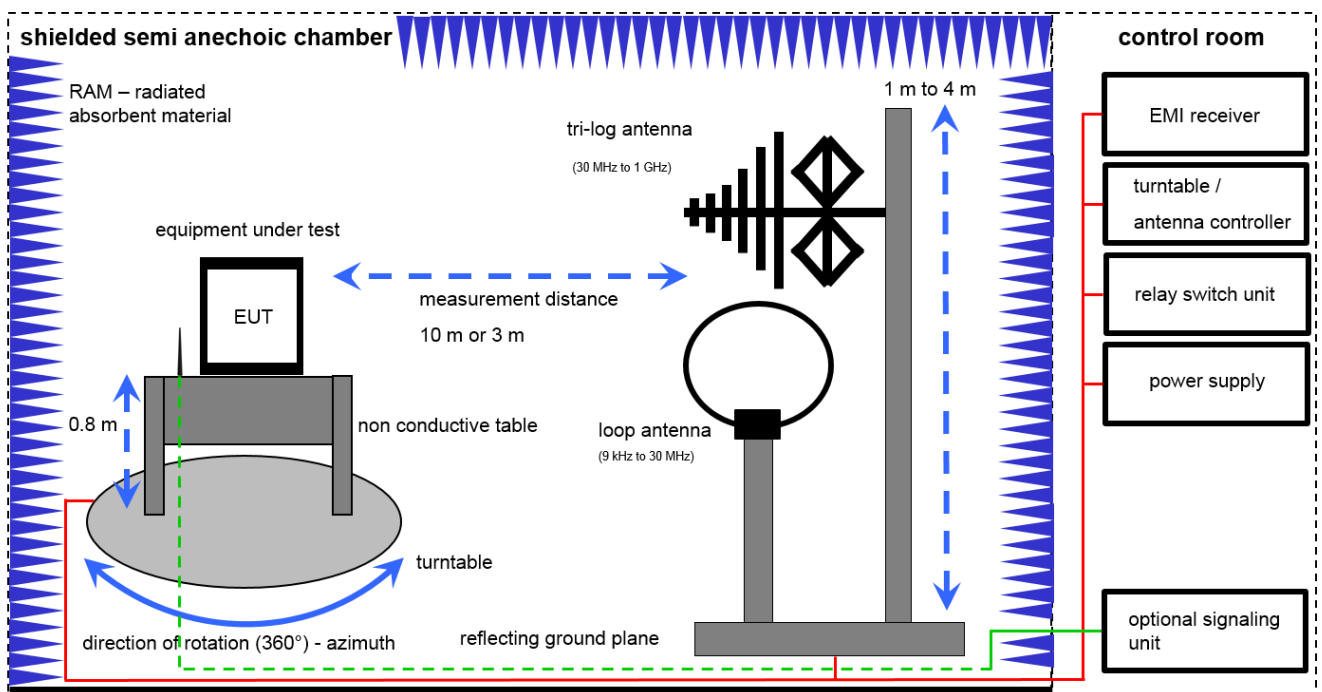
Note: NA = Not Applicable; NP = Not Performed

8 Description of test setup

8.1 Radiated measurements

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 C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices. 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.

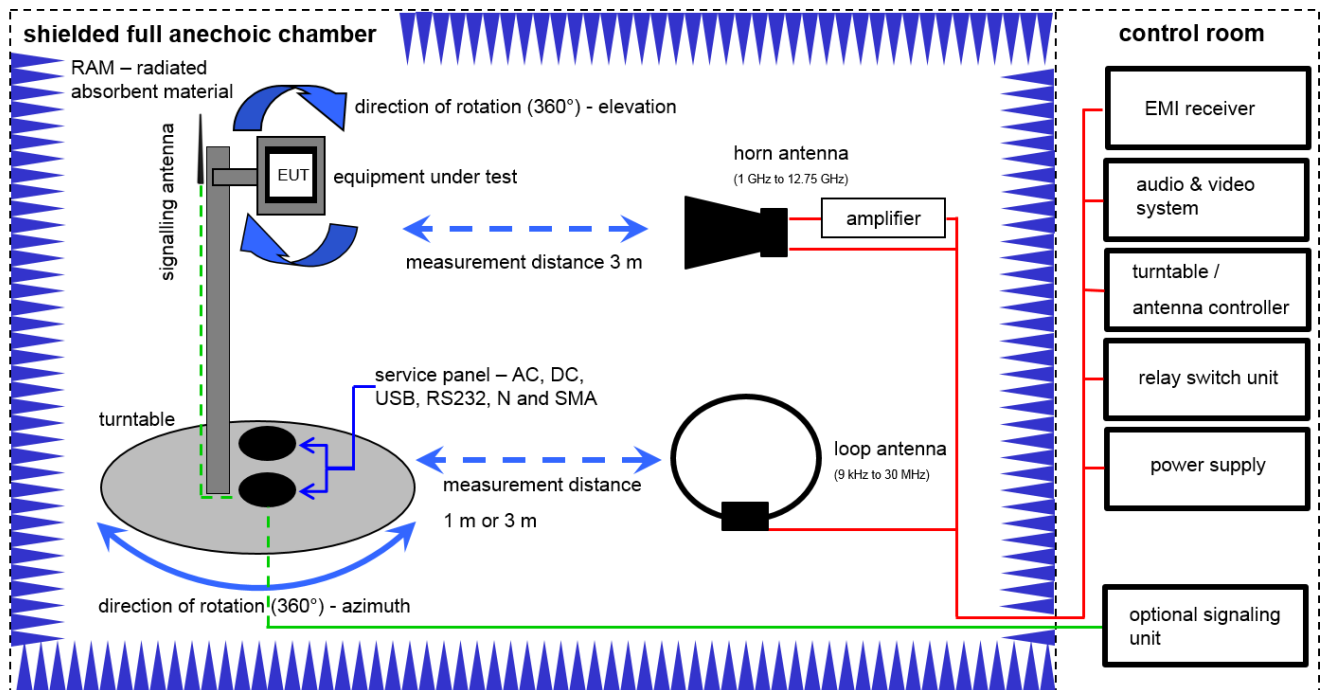
Semi anechoic chamber



Picture 1: Diagram radiated measurements

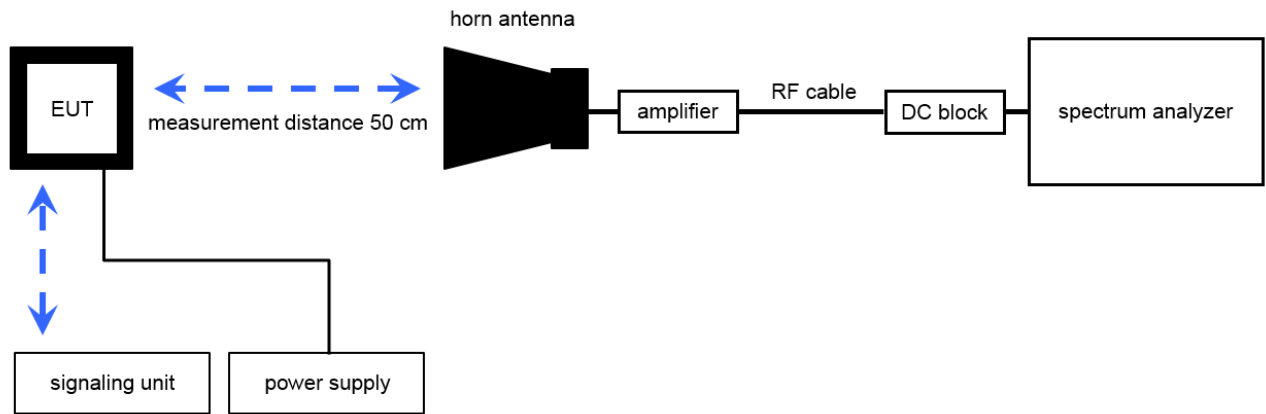
The EUT is powered by an external power supply with nominal voltage

8.2 Shielded fully anechoic chamber



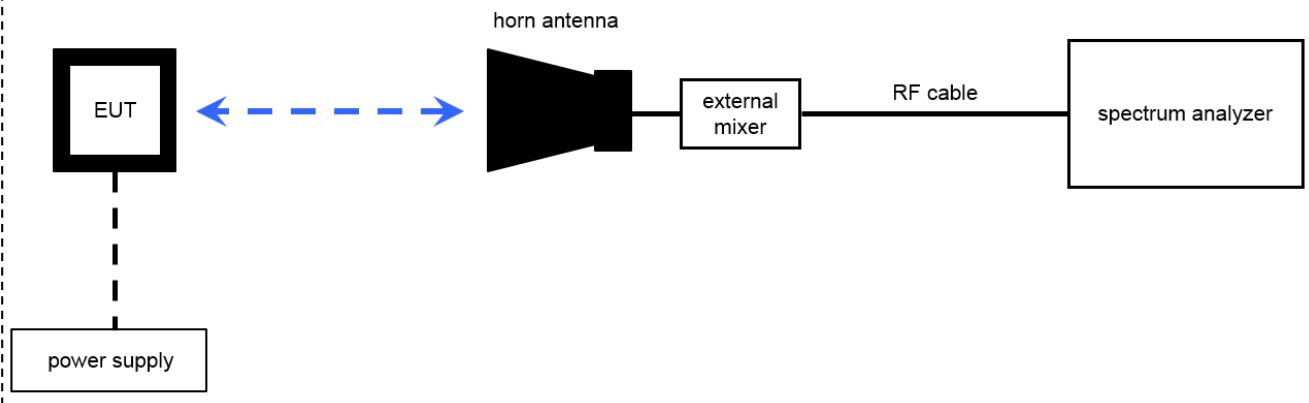
8.3 Radiated measurements > 12.75 GHz

Radiated measurements > 12.75 GHz



8.4 Radiated measurements > 50 GHz

Radiated measurements RF laboratory



8.4.1 Additional comments

Reference documents: None

Special test descriptions: None

Configuration descriptions: None

Test mode:

☐ Normal operation, no special test mode available.

☒ Special software is used to stop FMCW-sweep at low/mid/high frequency

9 Measurement results

9.1 Antenna Requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

Limits:

FCC / IC
47 CFR Part 15.203 / RSS-GEN 7.1.4

Result: The measurement is passed.

9.2 Field strength of emissions (wanted signal)**Description:**

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

Measurement:

Measurement parameter	
Detector:	Pos-Peak / RMS
Sweep time:	Auto
Resolution bandwidth:	1 MHz
Video bandwidth:	≥ RBW
Span:	200 MHz
Trace-Mode:	Max Hold

Limits:

FCC / IC		
47 CFR Part 15.249(a) / RSS-310, 3.10		
Field strength of emissions		
The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:		
Frequency [GHz]	Field Strength [dBμV/m]	Measurement distance
24.00 – 24.25	108	3

(e) As shown in § 15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

Measurement results:**Peak-Measurement:**

Test condition t = 22 °C	Frequency [GHz]		Maximum field strength (Peak) [dBμV/m] @ 3 m	
	MBH2	MBL2	MBH2	MBL2
normal operation mode U _{DC} = 12 V	24.05 – 24.25	24.05 – 24.25	112.3	112.3
stopped mode, low frequency U _{DC} = 12 V	24.057	24.052	111.5	112.2
stopped mode, mid frequency U _{DC} = 12 V	24.150	24.150	111.6	111.3
stopped mode, high frequency U _{DC} = 12 V	24.235	24.239	112.1	111.4
Measurement uncertainty	± 3 dB			

Average-Measurement:

Test condition t = 22 °C	Frequency [GHz]		Maximum field strength (Average) [dBμV/m] @ 3 m	
	MBH2	MBL2	MBH2	MBL2
normal operation mode U _{DC} = 12 V	24.05 – 24.25	24.05 – 24.25	94.02	101.1
stopped mode, low frequency U _{DC} = 12 V	24.056	24.09	111.2	110.5
stopped mode, mid frequency U _{DC} = 12 V	24.149	24.15	110.8	110.4
stopped mode, high frequency U _{DC} = 12 V	24.236	24.24	111.3	111.0
Measurement uncertainty	± 3 dB			

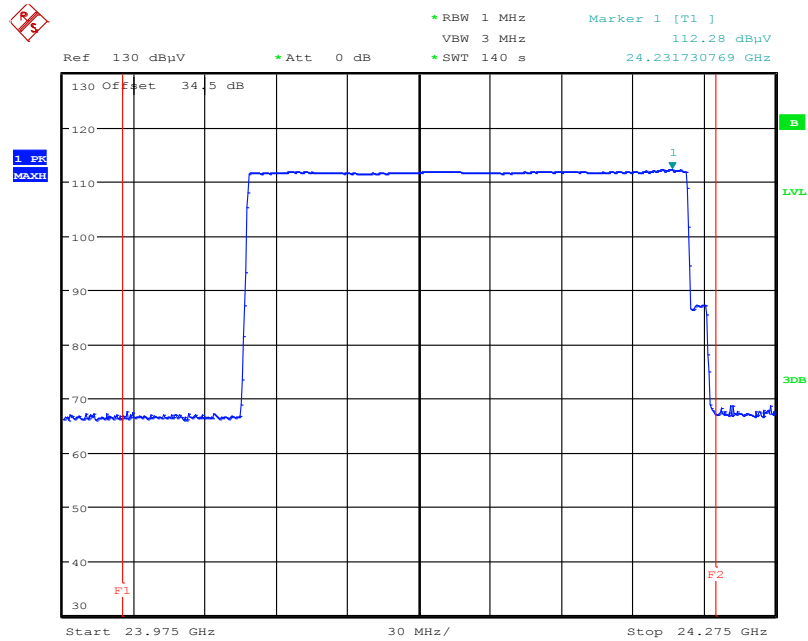
Note:

As the DUT generates a continuous CW carrier (not sweeping or bursting) in stopped mode, the measured average values have to be corrected by the minimum Peak-to-AVG-Ratio / Duty-Cycle Correction Factor of 12.2 dB during normal operation mode (112.3 dBμV - 101.1 dBμV = 12.2 dB). See also plot no. 5 and no. 6.

Result: The measurement is passed.

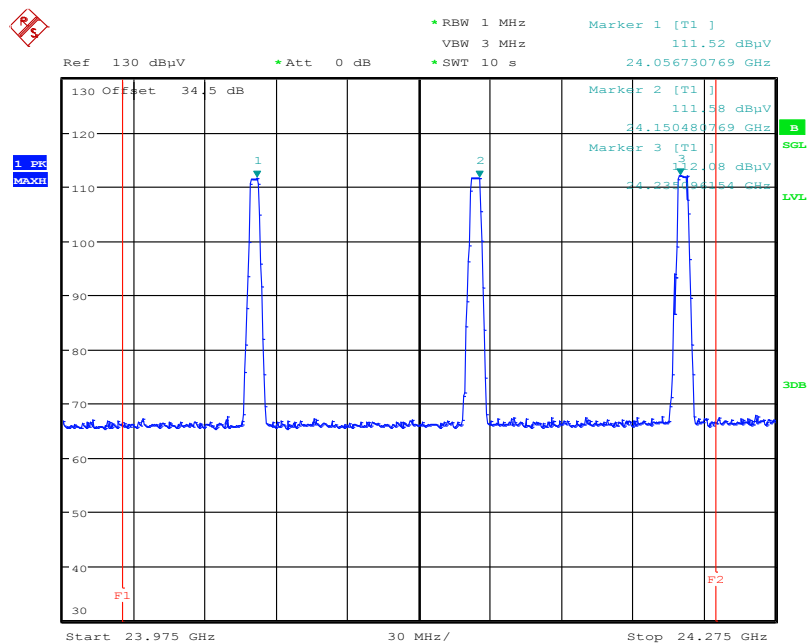
Plots:

Plot No. 1: MBH2, Peak measurement, normal operation mode



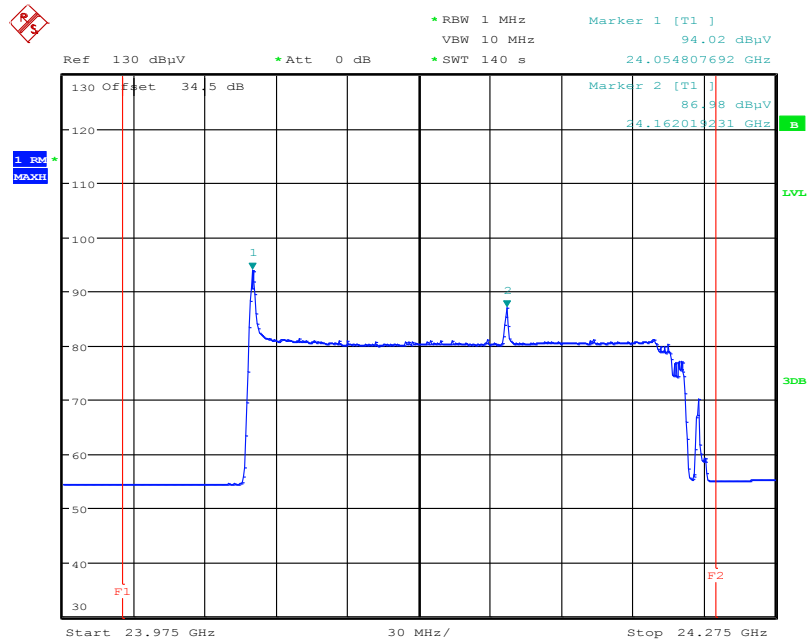
Date: 15.APR.2015 09:43:02

Plot No. 2: MBH2, Peak measurement, stopped mode



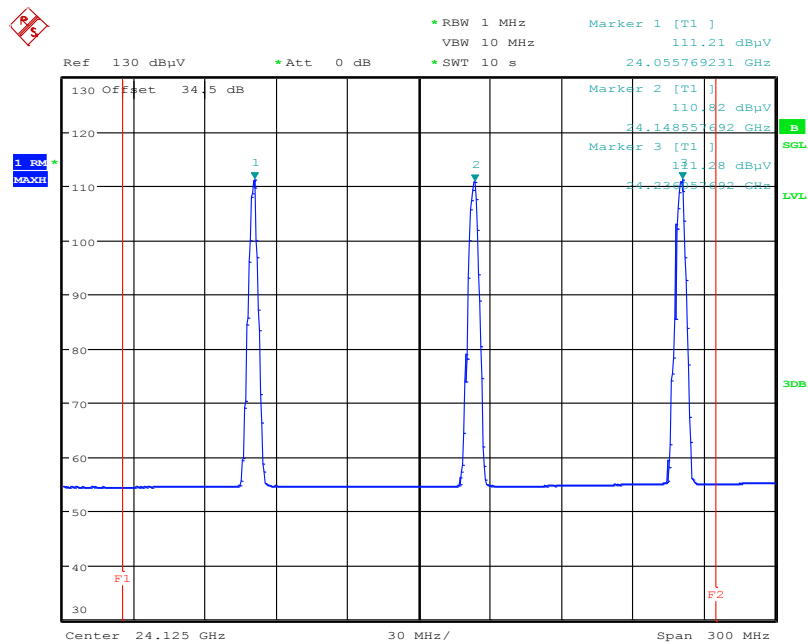
Date: 15.APR.2015 10:21:13

Plot No. 3: MBH2, Average measurement, normal operation mode



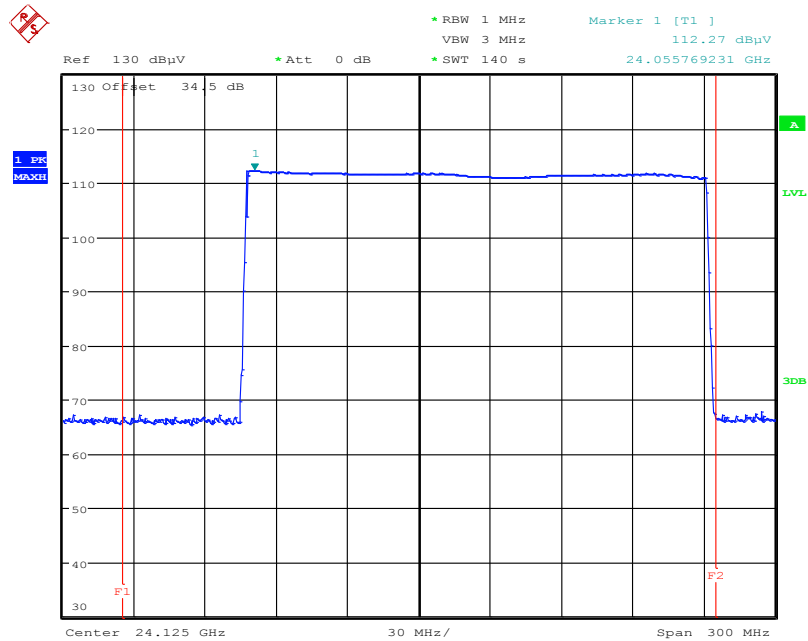
Date: 15.APR.2015 09:57:32

Plot No. 4: MBH2, Average measurement, stopped mode



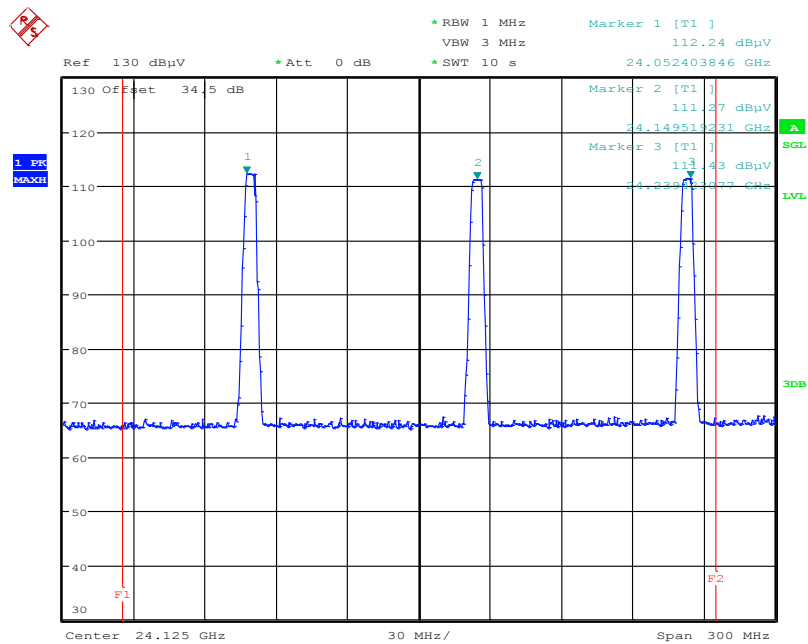
Date: 16.APR.2015 17:26:18

Plot No. 5: MBL2, Peak measurement, normal operation mode



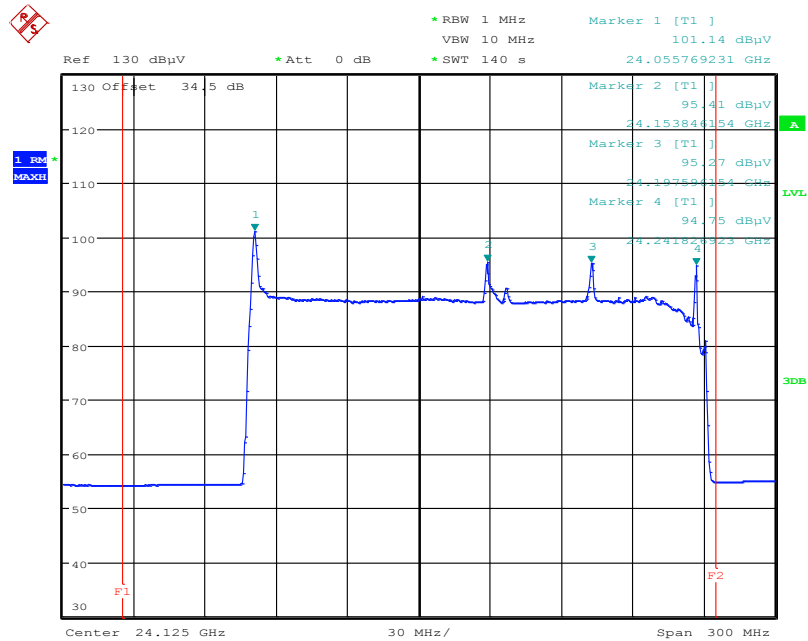
Date: 12.JUN.2015 12:00:20

Plot No. 6: MBL2, Peak measurement, stopped mode



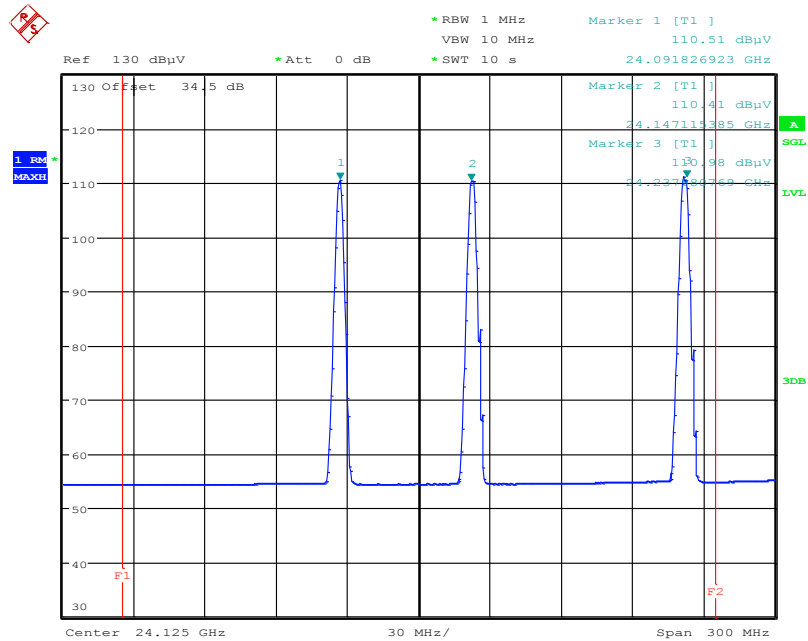
Date: 12.JUN.2015 15:47:49

Plot No. 7: MBL2, Average measurement, normal operation mode



Date: 12.JUN.2015 12:03:13

Plot No. 8: MBL2, Average measurement, stopped mode



Date: 8.JUL.2015 11:38:18

9.3 Occupied bandwidth (99% bandwidth)

Description:

Measurement of the 99% bandwidth of the wanted signal.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1 MHz / 3 MHz
Video bandwidth:	1 MHz / 3 MHz
Span:	20 MHz / 300 MHz
Trace-Mode:	Max Hold

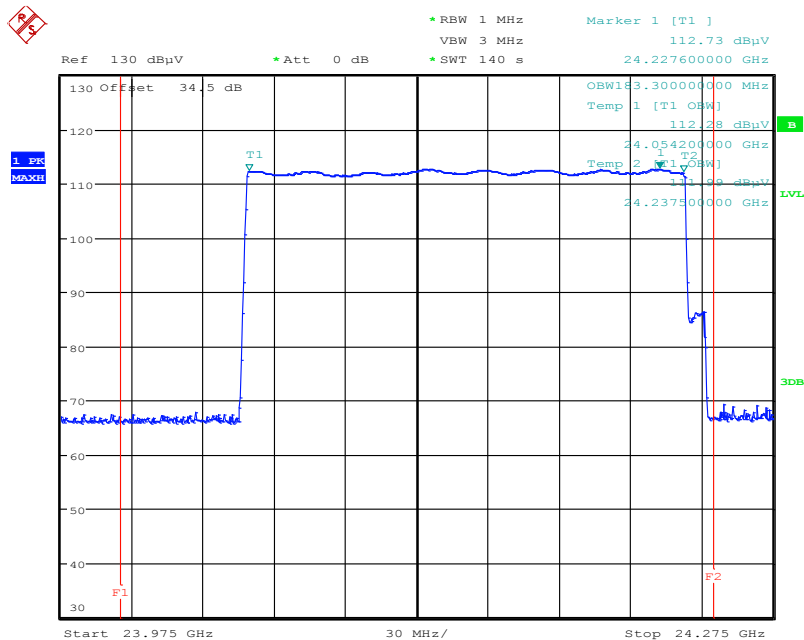
Measurement results:

Test condition	Occupied Bandwidth [MHz]			
	MBH2			MBL2
	T _{min}	T _{nom}	T _{max}	T _{nom}
normal operation mode U _{DC} = 12 V	183.3	183.6	183.7	192.8
stopped mode, low frequency U _{DC} = 12 V	5.0	5.4	6.2	5.8
stopped mode, mid frequency U _{DC} = 12 V	4.5	5.3	6.3	5.8
stopped mode, high frequency U _{DC} = 12 V	4.6	5.3	6.4	5.9
Measurement uncertainty	± span/1000			

Result: The measurement is passed.

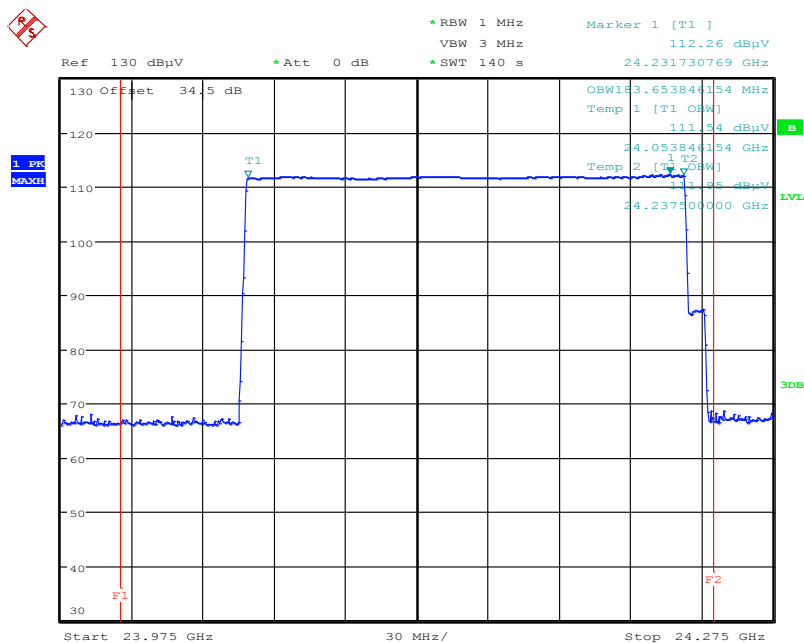
Plots:

Plot No. 9: MBH2, normal operation mode, T_{\min}



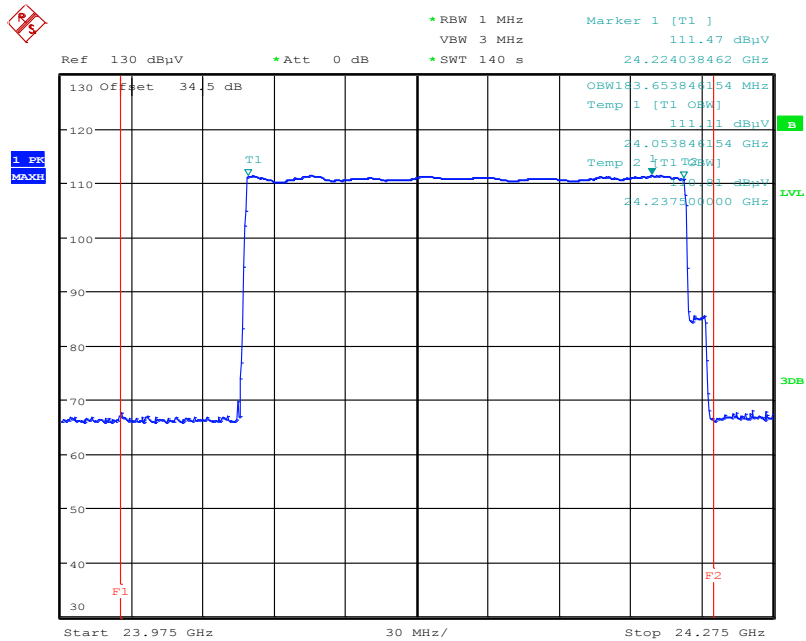
Date: 17.APR.2015 11:14:12

Plot No. 10: MBH2, normal operation mode, T_{nom}



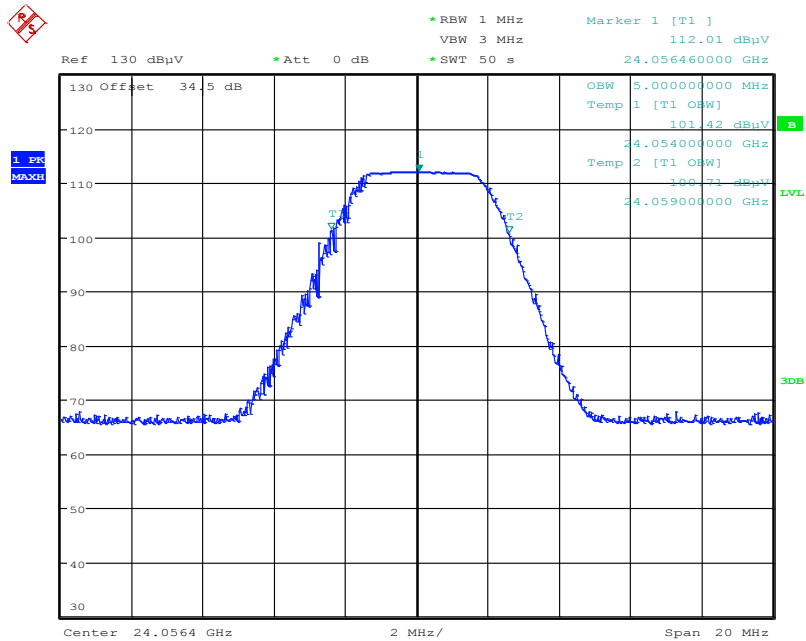
Date: 15.APR.2015 09:31:18

Plot No. 11: MBH2, normal operation mode, T_{\max}



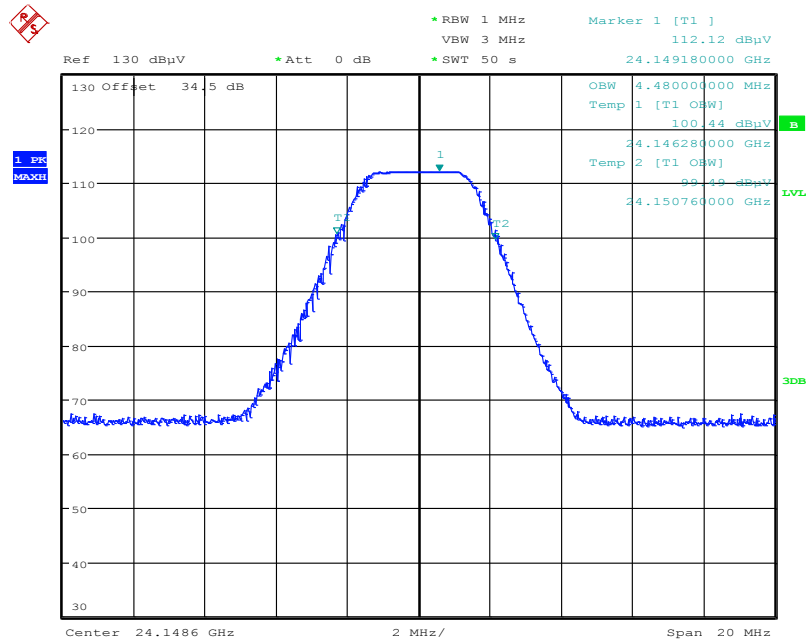
Date: 16.APR.2015 16:03:46

Plot No. 12: MBH2, stopped mode - low, T_{\min}



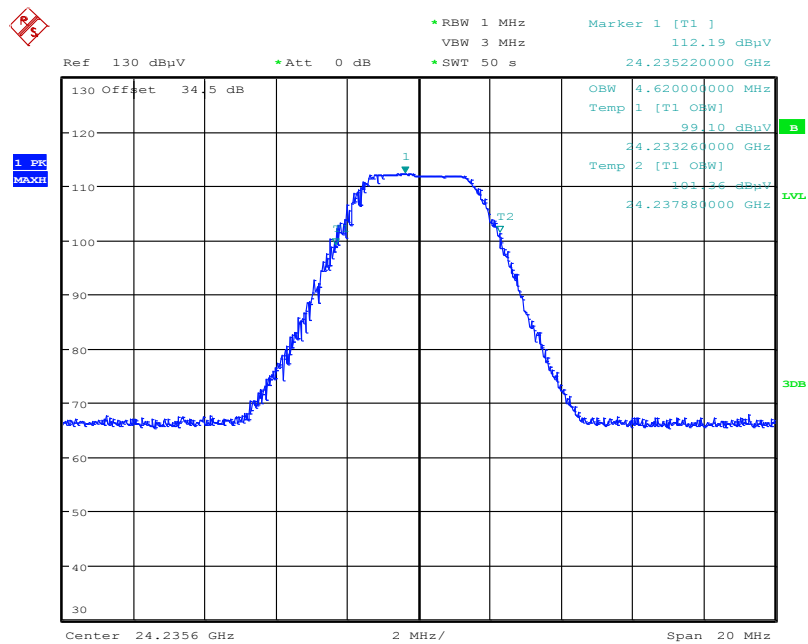
Date: 17.APR.2015 13:56:49

Plot No. 13: MBH2, stopped mode - mid, T_{\min}



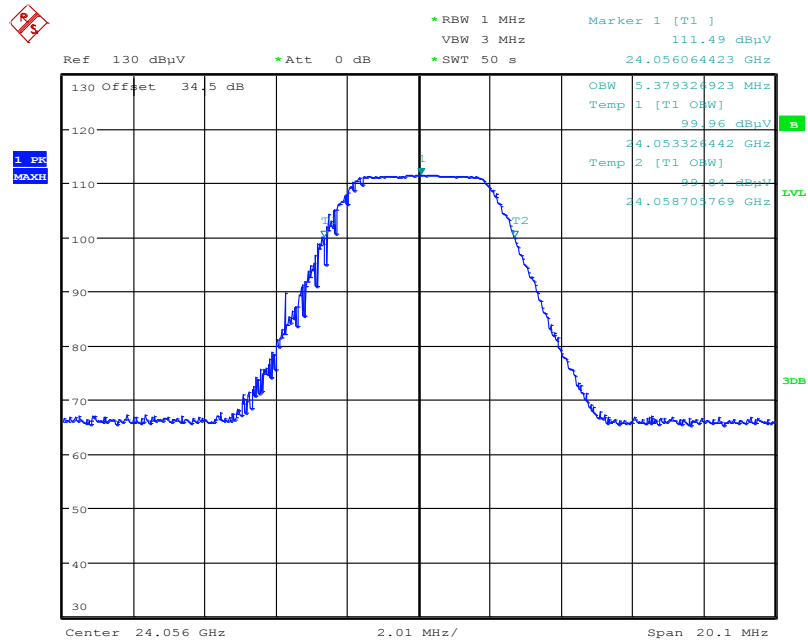
Date: 17.APR.2015 11:24:45

Plot No. 14: MBH2, stopped mode - high, T_{\min}



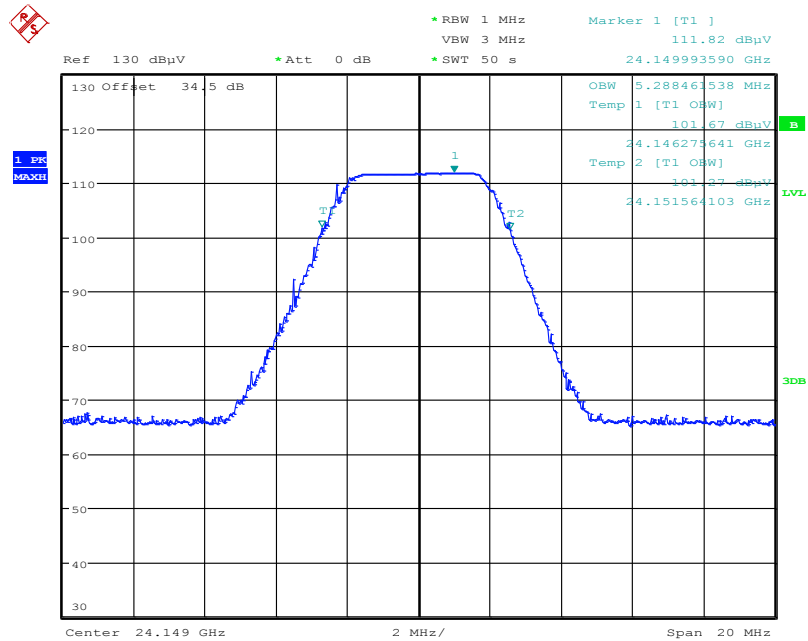
Date: 17.APR.2015 11:28:23

Plot No. 15: MBH2, stopped mode - low, T_{nom}



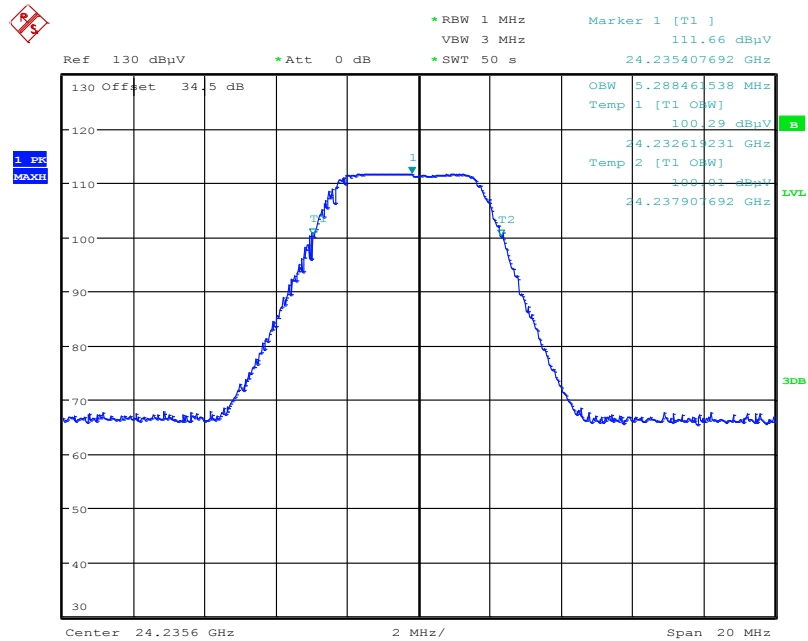
Date: 16.APR.2015 17:05:45

Plot No. 16: MBH2, stopped mode - mid, T_{nom}



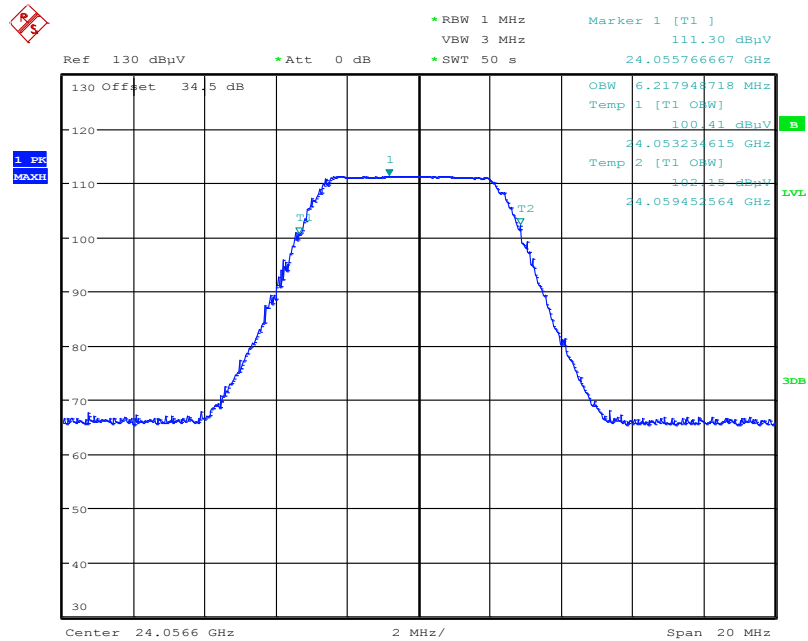
Date: 16.APR.2015 17:13:12

Plot No. 17: MBH2, stopped mode - high, T_{nom}



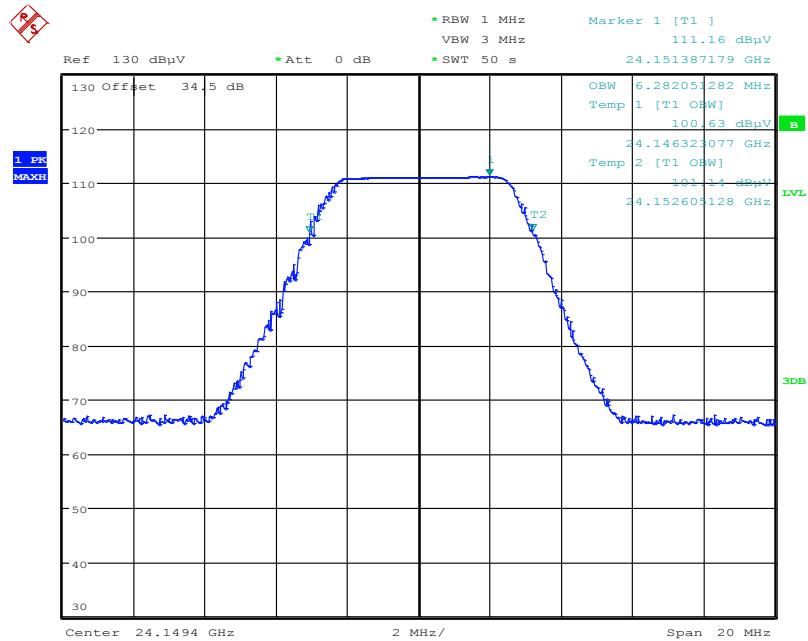
Date: 16.APR.2015 17:18:31

Plot No. 18: MBH2, stopped mode - low, T_{max}



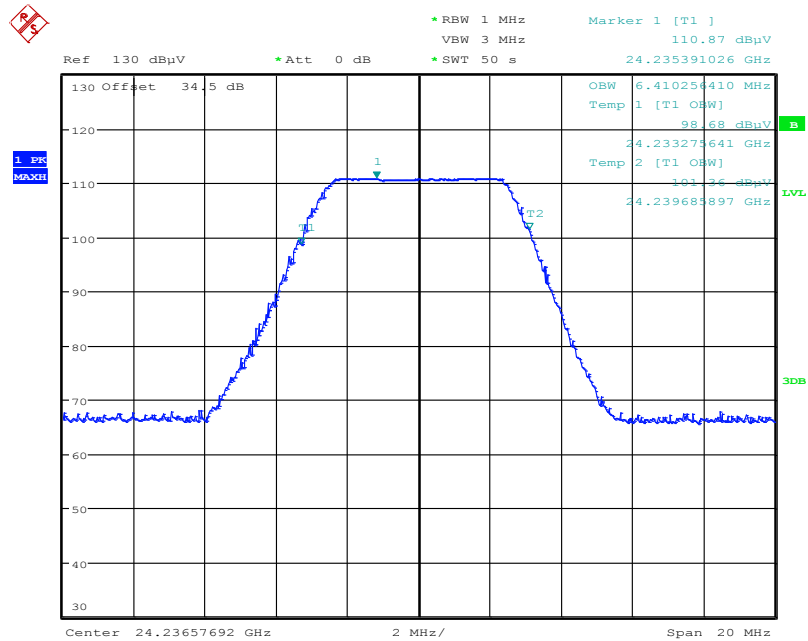
Date: 16.APR.2015 16:27:02

Plot No. 19: MBH2, stopped mode - mid, T_{\max}



Date: 16.APR.2015 16:22:49

Plot No. 20: MBH2, stopped mode - high, T_{\max}



Date: 16.APR.2015 16:20:51

Ref 130 dBmV *Att 0 dB *SWT 140 s 24.05365385 GHz

Marker 1 [T1]

OBW1 2.788461538 MHz

Temp 1 [T1 OBW]

112.18 dBmV

24.052884615 GHz

Temp 2 [T1 OBW]

112.18 dBmV

24.245673077 GHz

130 Offset 34.5 dB

120

110

100

90

80

70

60

50

40

30

F1

F2

Center 24.125 GHz

Span 300 MHz

30 dB

1. PR
MDSCH

Ref 130 Offset 34.5 dB

*RBW 1 MHz
VBW 3 MHz
*Att 0 dB
*SWT 50 s

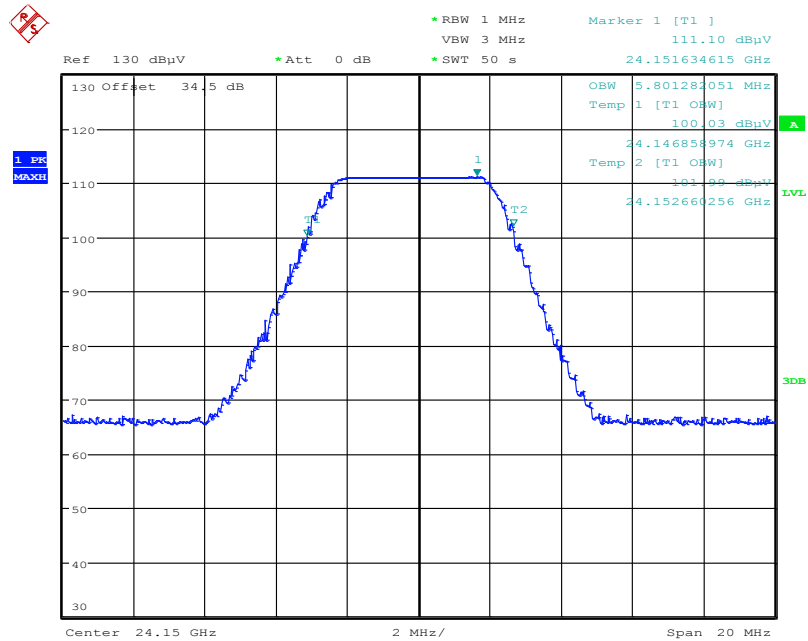
Marker 1 [T1]
112.18 dBuV
24.055724359 GHz

OBW 5.833333333 MHz
Temp 1 [T1 OBW]
100.58 dBuV
24.052166667 GHz
Temp 2 [T1 OBW]
101.91 dBuV
24.058000000 GHz

Center 24.05540385 GHz
2 MHz/
Span 20 MHz

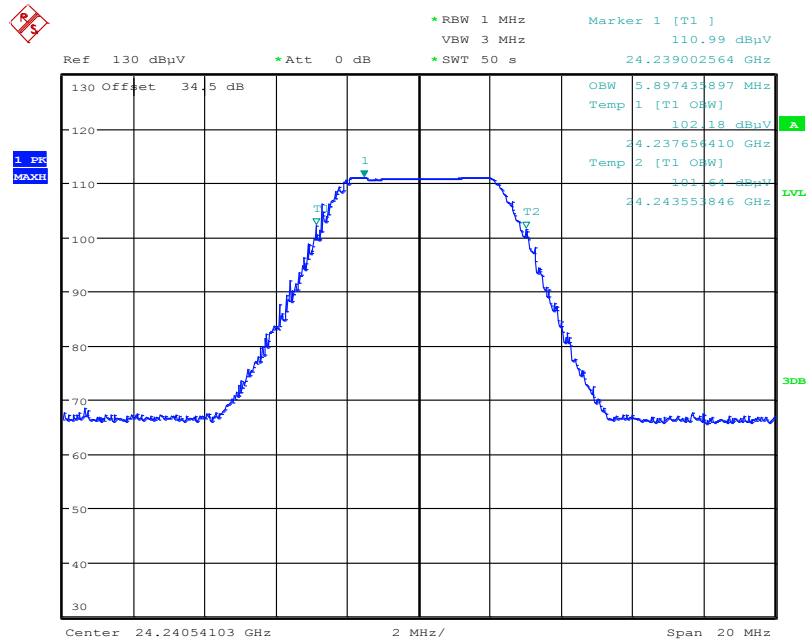
Page 24 of 43

Plot No. 23: MBL2, stopped mode - mid, T_{nom}



Date: 12.JUN.2015 15:55:18

Plot No. 24: MBL2, stopped mode - high, T_{nom}



Date: 12.JUN.2015 16:00:53

9.4 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
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz
Video bandwidth:	Auto
Frequency range:	30 MHz to 100 GHz
Trace-Mode:	Max Hold

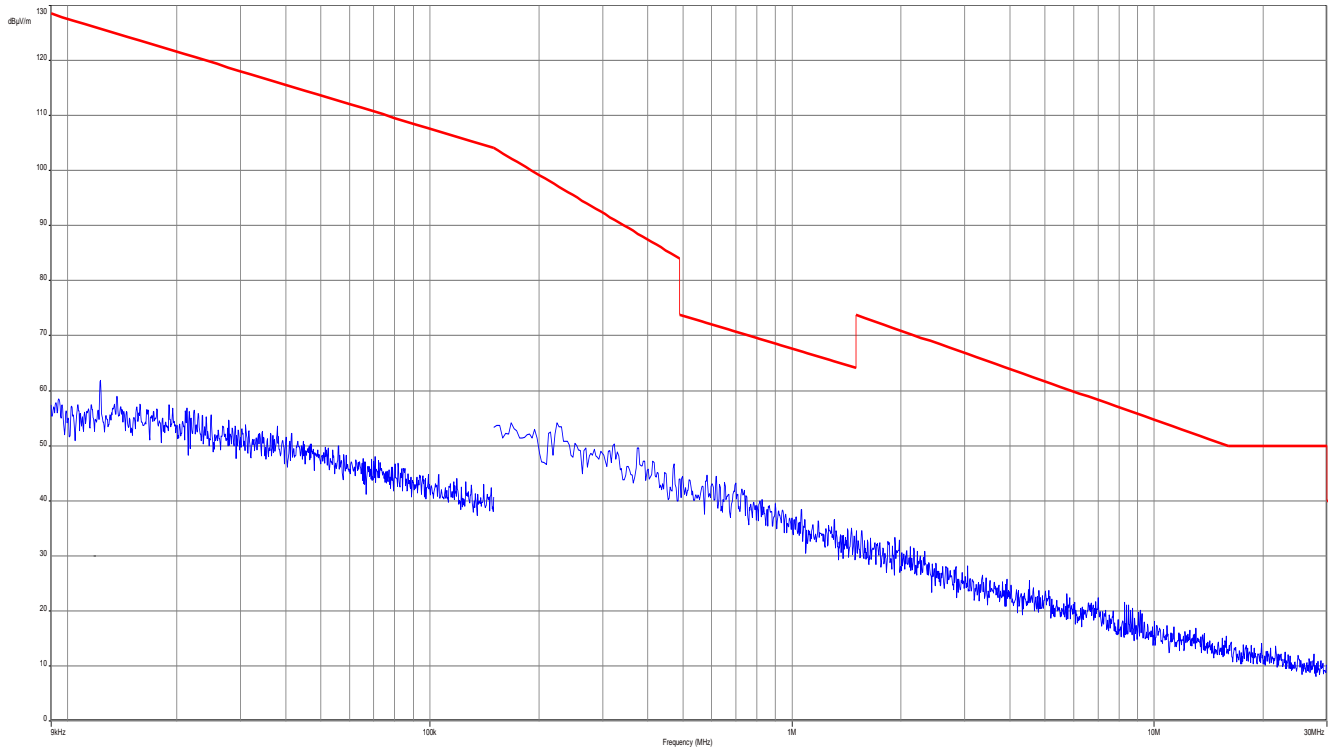
Limits:

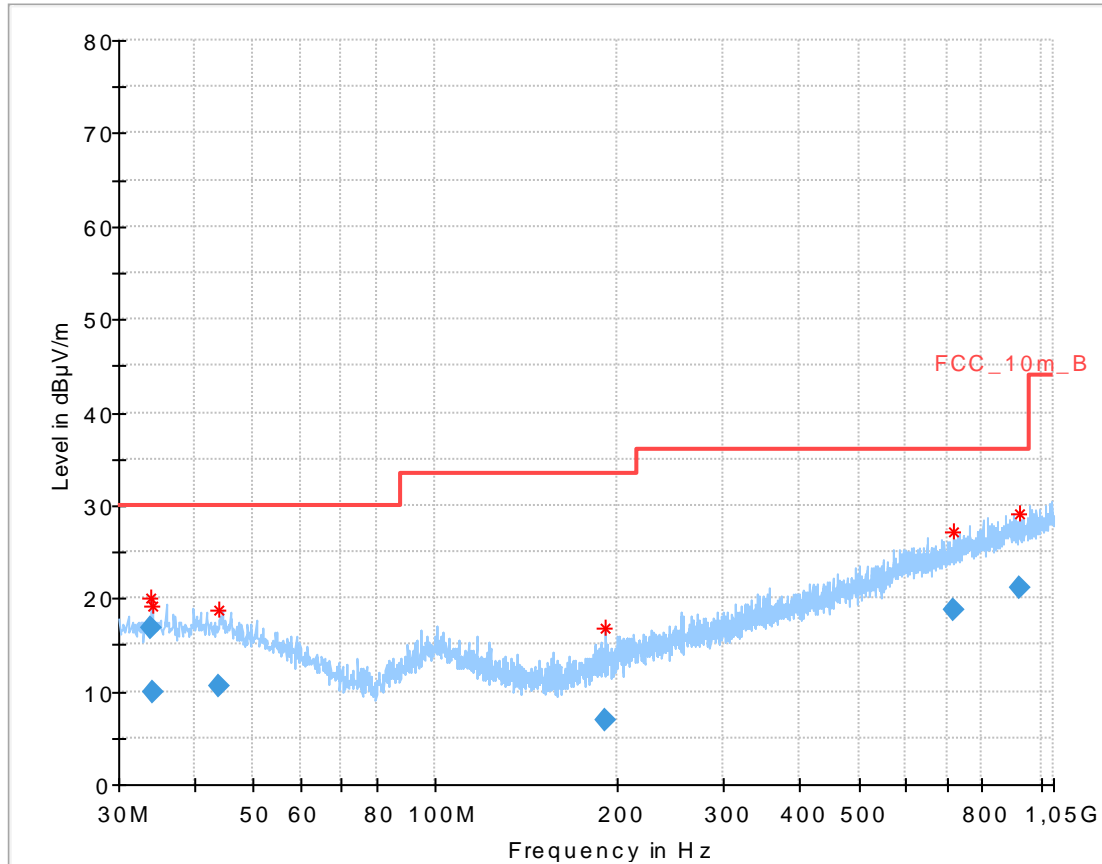
FCC / IC		
CFR Part 15.209(a) / RSS-310, 3.10 / RSS-Gen		
Radiated Spurious Emissions		
Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever 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

Measurement results:

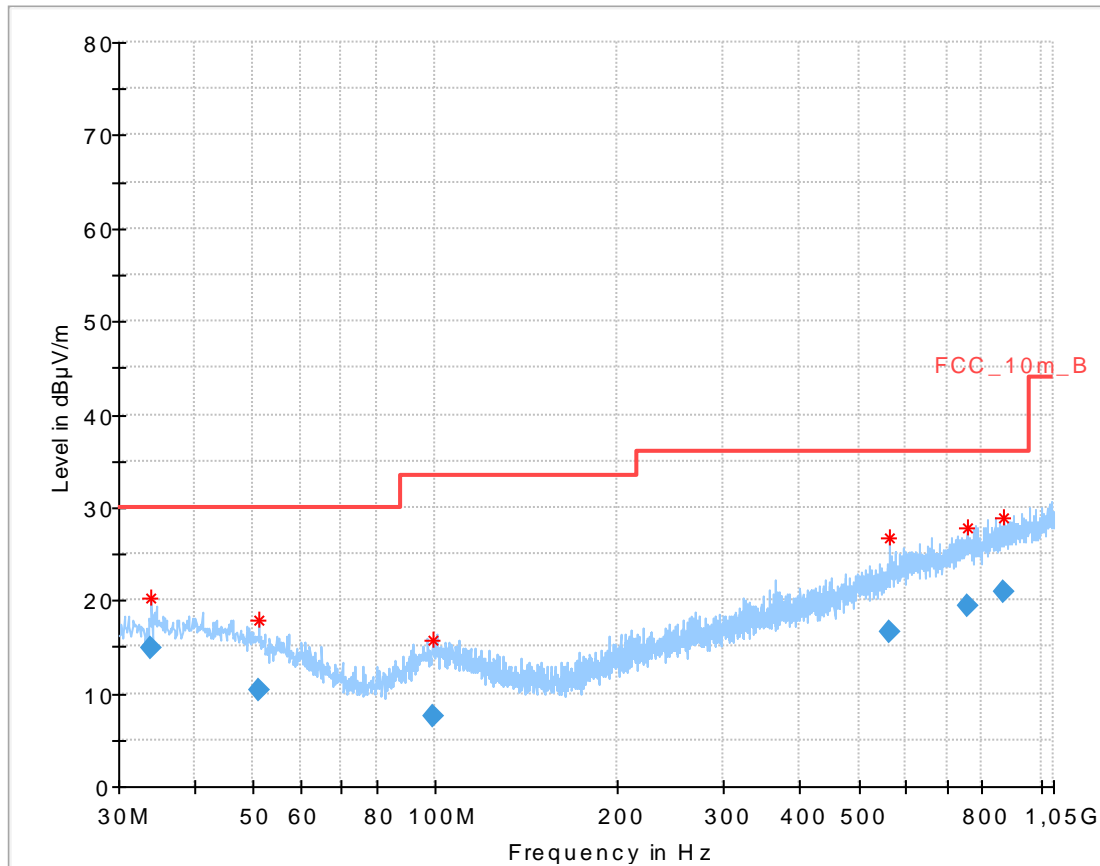
TX Spurious Emissions Radiated [dB μ V/m]								
Lowest			Middle			Highest		
F [GHz]	Detector	Level [dB μ V/m]	F [GHz]	Detector	Level [dB μ V/m]	F [GHz]	Detector	Level [dB μ V/m]
No critical peaks found			No critical peaks found			No critical peaks found		
Measurement uncertainty			± 3 dB					

Result: The measurement is passed.

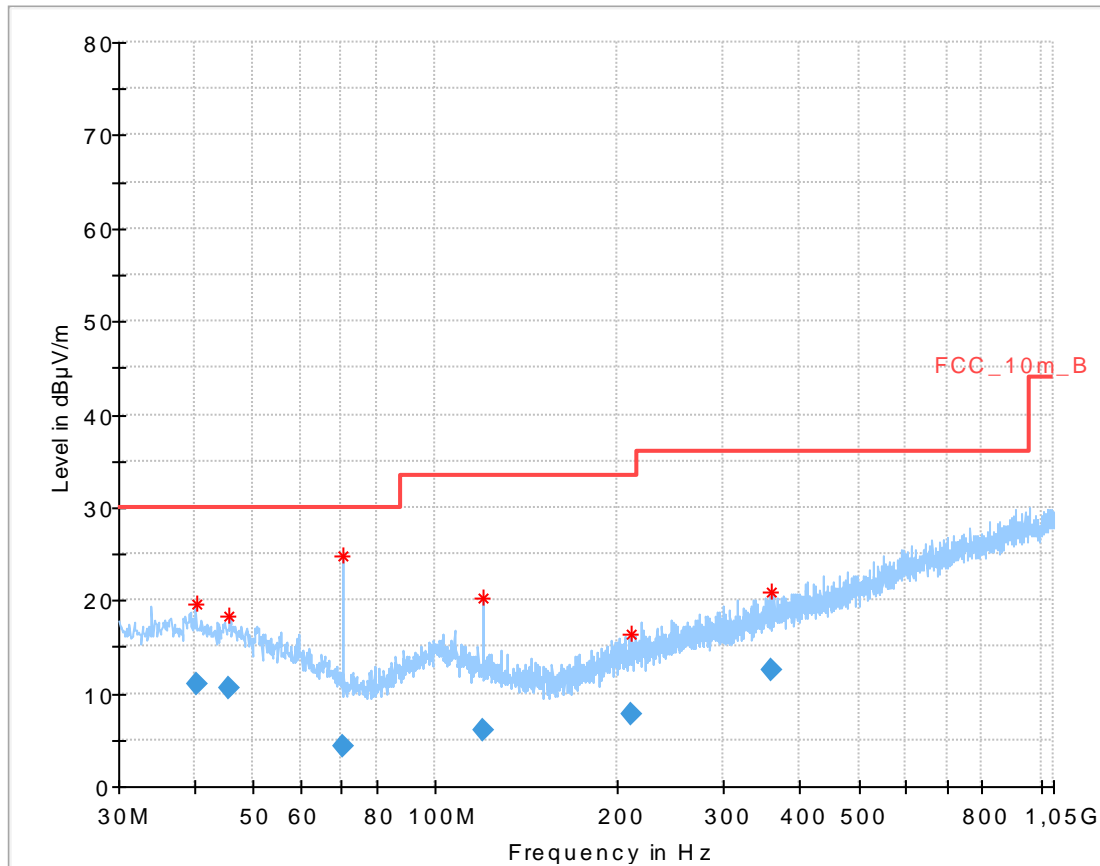
Plots:**Plot No. 25:** 9 kHz - 30 MHz, horizontal/vertical polarization, TX magnetic

Plot No. 26: 30 MHz to 1 GHz, horizontal/vertical polarization, low frequency

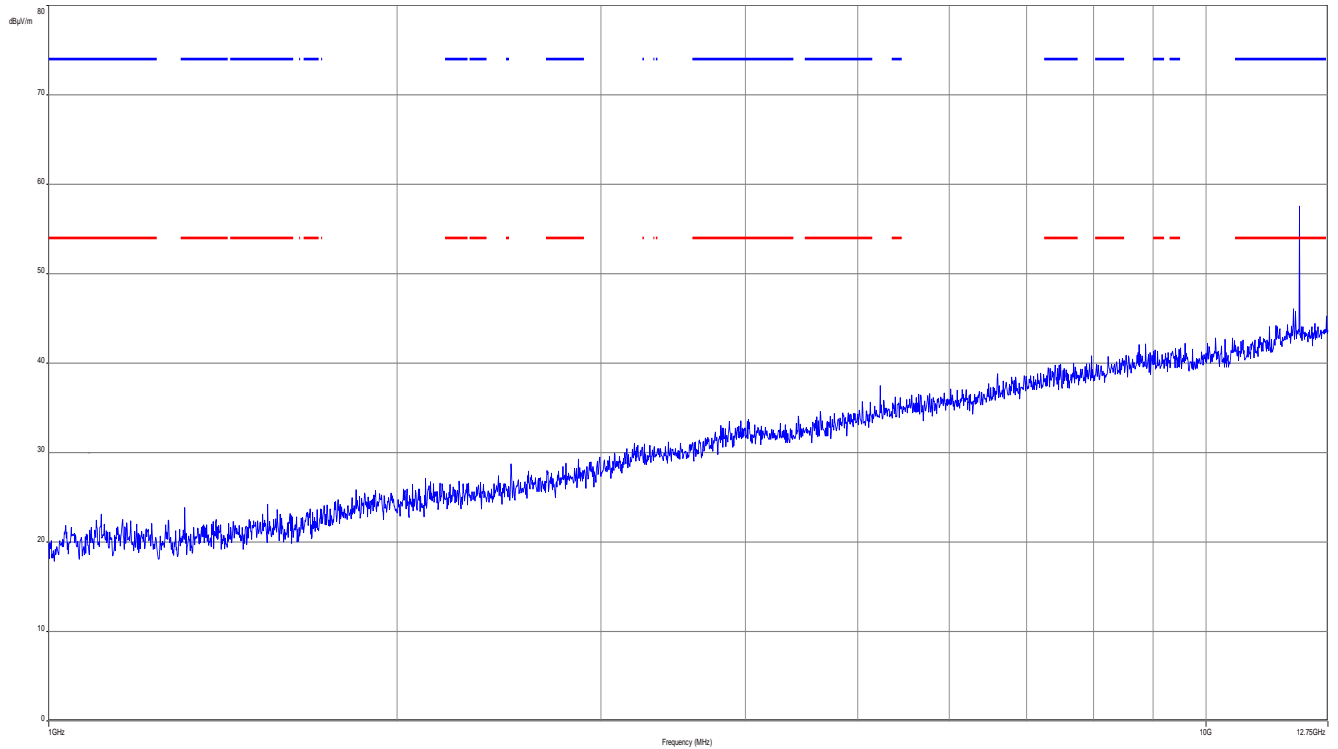
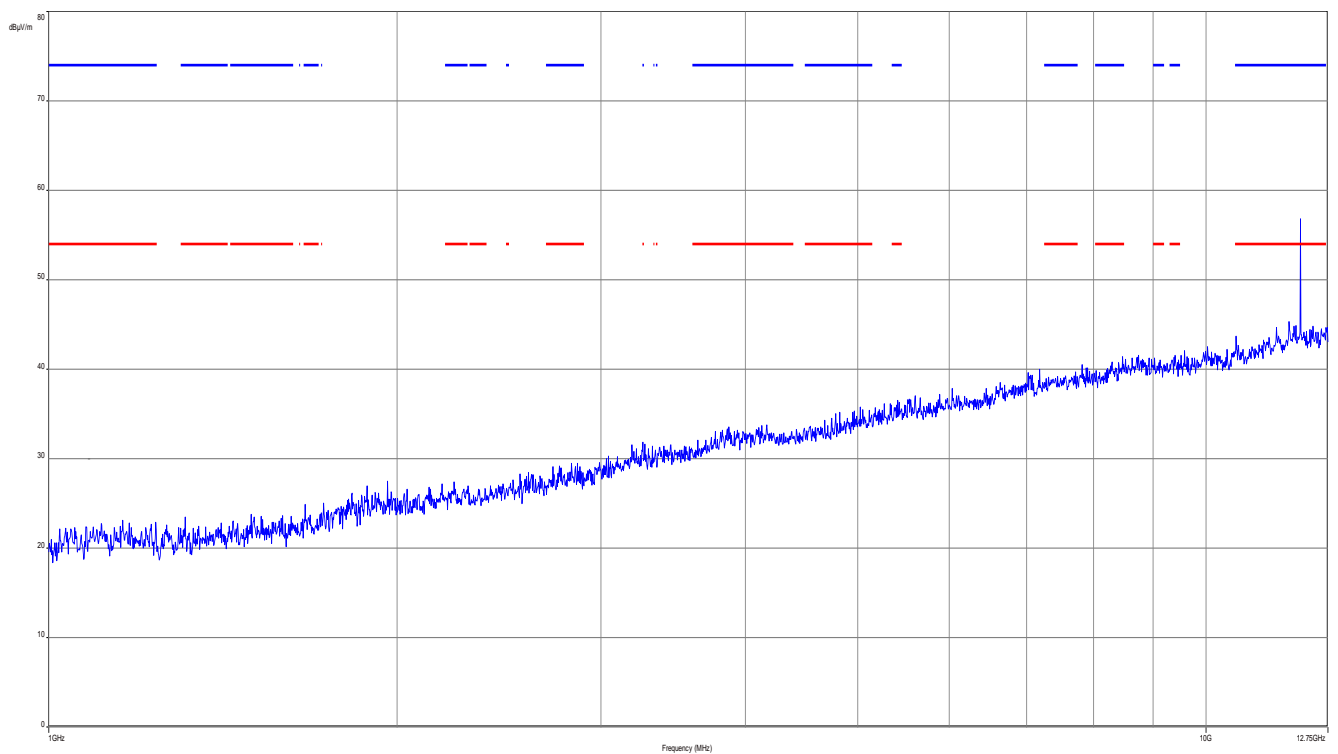
Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
33.990750	16.75	30.00	13.25	1000.0	120.000	101.0	V	190	13.7
34.257900	9.86	30.00	20.14	1000.0	120.000	170.0	H	190	13.7
43.821900	10.48	30.00	19.52	1000.0	120.000	101.0	V	280	13.9
190.442100	6.80	33.50	26.70	1000.0	120.000	170.0	V	100	11.1
717.780150	18.80	36.00	17.20	1000.0	120.000	170.0	H	280	21.9
923.522850	21.04	36.00	14.96	1000.0	120.000	98.0	V	260	24.2

Plot No. 27: 30 MHz to 1 GHz, horizontal/vertical polarization, mid frequency

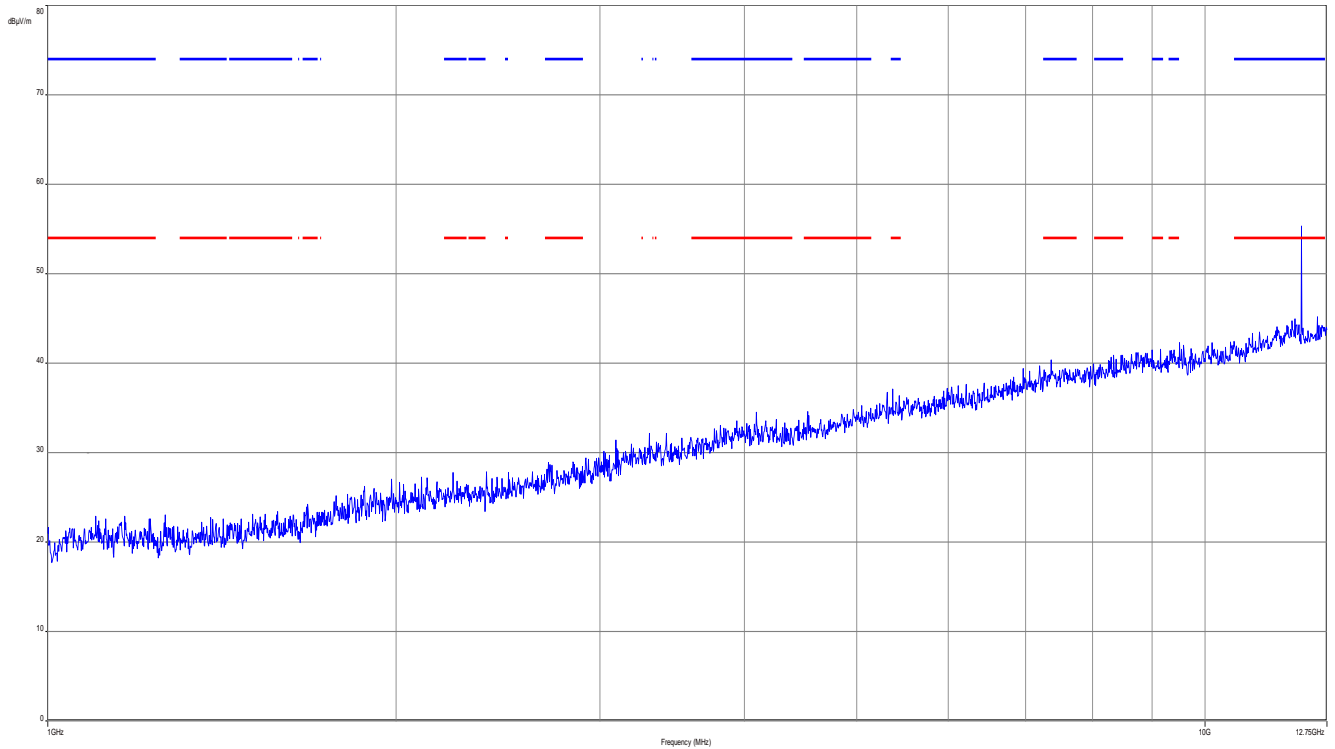
Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
33.983100	14.93	30.00	15.07	1000.0	120.000	170.0	V	10	13.7
51.034350	10.38	30.00	19.62	1000.0	120.000	170.0	V	280	12.5
99.332250	7.47	33.50	26.03	1000.0	120.000	101.0	H	10	12.1
563.080050	16.52	36.00	19.48	1000.0	120.000	101.0	H	-10	19.7
756.209700	19.42	36.00	16.58	1000.0	120.000	170.0	H	170	22.7
870.973350	20.86	36.00	15.14	1000.0	120.000	170.0	V	100	23.7

Plot No. 28: 30 MHz to 1 GHz, horizontal/vertical polarization, high frequency

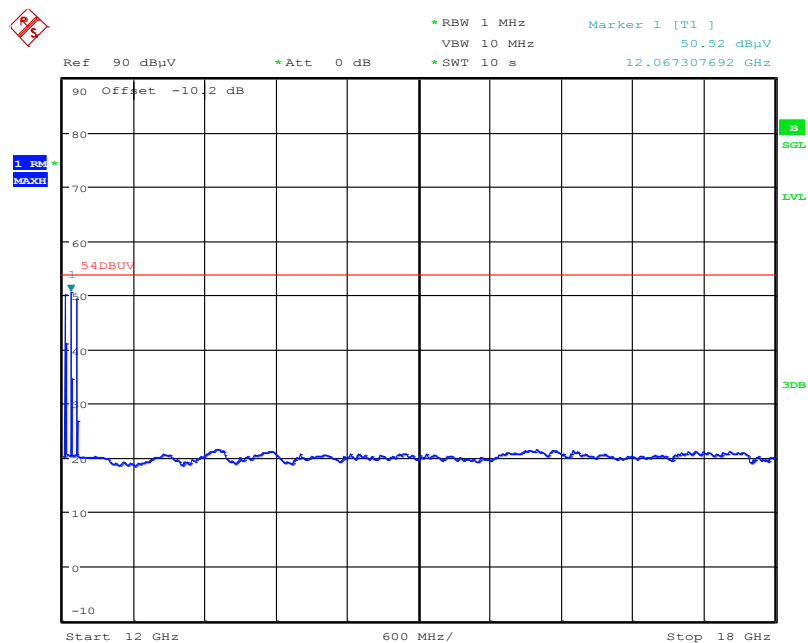
Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
40.388400	10.95	30.00	19.05	1000.0	120.000	170.0	V	10	14.0
45.582600	10.48	30.00	19.52	1000.0	120.000	98.0	V	80	13.7
70.541100	4.23	30.00	25.77	1000.0	120.000	101.0	H	10	8.4
120.049800	6.04	33.50	27.46	1000.0	120.000	101.0	H	190	10.2
211.395000	7.73	33.50	25.77	1000.0	120.000	170.0	V	280	12.1
359.691000	12.41	36.00	23.59	1000.0	120.000	170.0	H	81	16.2

Plot No. 29: 1 GHz to 12.75 GHz, horizontal/vertical polarization, low frequency**Plot No. 30:** 1 GHz to 12.75 GHz, horizontal/vertical polarization, mid frequency

Plot No. 31: 1 GHz to 12.75 GHz, vertical/horizontal polarization, high frequency



Plot No. 32: 12 GHz to 18 GHz, horizontal / vertical polarization, low/mid/high frequency



Date: 14.APR.2015 15:46:05

Ref 90 dBμV *Att 0 dB *RBW 1 MHz Marker 1 [T1] 32.30 dBμV
 VBW 10 MHz *SWT 10 s 21.87500000 GHz

90 Offset -2.2 dB

1.00 MHz Max

54 DBμV

1

FL

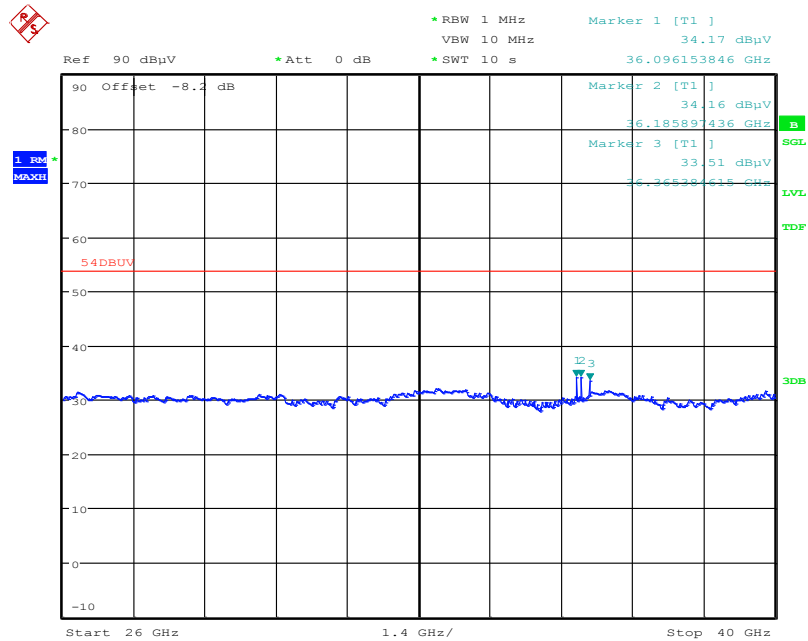
Start 18 GHz 600 MHz/ Stop 24 GHz

The screenshot shows a Spectrum Analyzer interface with the following details:

- Top Panel:**
 - Ref: 90 dBµV
 - *Att: 0 dB
 - *RBW: 1 MHz
 - VBW: 10 MHz
 - *SWT: 10 s
 - Marker 1 [T1]: 31.33 dBµV
 - 24.435096154 GHz
- Left Panel:**
 - 1 MHz
 - dBµV
- Plot Area:**
 - Y-axis: Power level in dBµV, ranging from -10 to 90.
 - X-axis: Frequency in GHz, ranging from 24.25 to 26.
 - Grid: A 10x10 grid is displayed.
 - Trace: A blue line representing the spectrum, showing a flat noise floor at approximately -30 dBµV.
 - Reference Line: A red horizontal line is drawn at 54 dBµV.
 - Marker: A green arrow points to the noise floor at 31.33 dBµV.
- Bottom Panel:**
 - Start: 24.25 GHz
 - 175 MHz/ (Sweep Rate)
 - Stop: 26 GHz

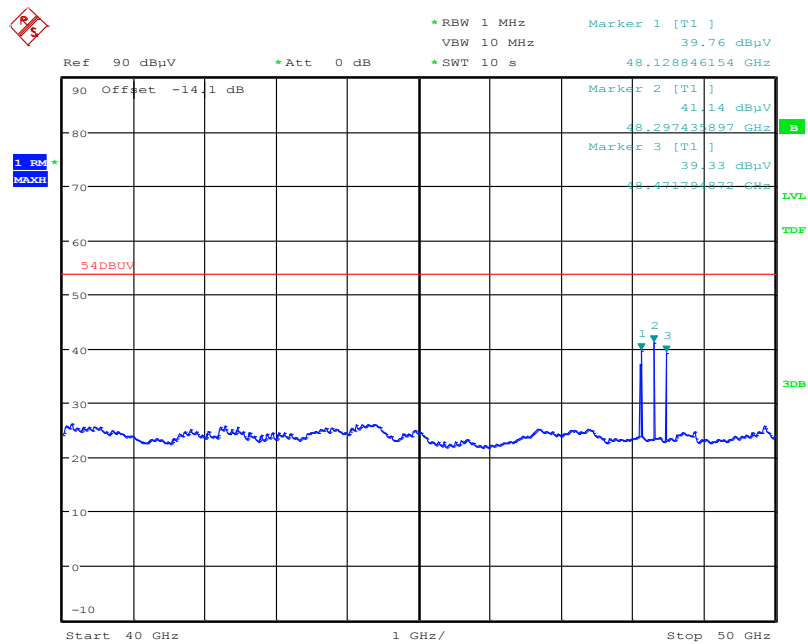
Page 34 of 43

Plot No. 35: 26 GHz to 40 GHz, horizontal / vertical polarization, low/mid/high frequency



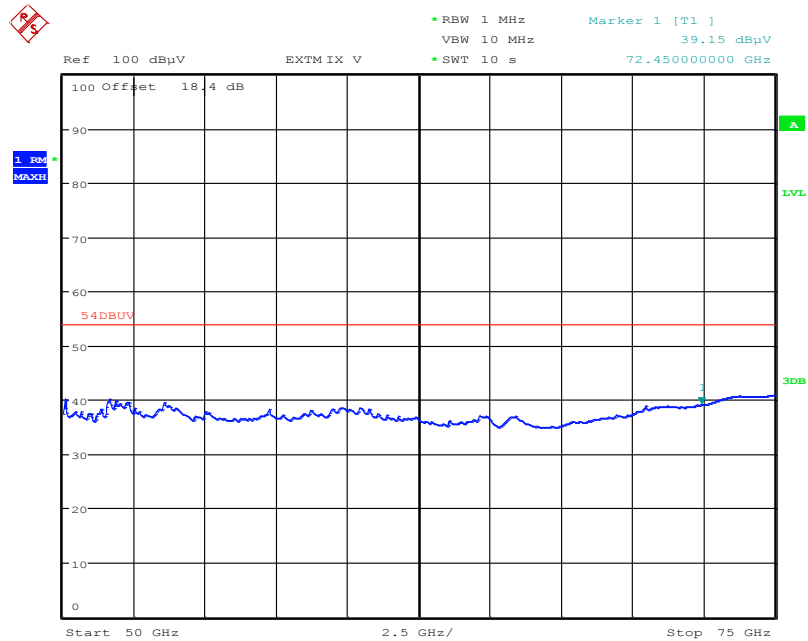
Date: 15.APR.2015 15:02:14

Plot No. 36: 40 GHz to 50 GHz, horizontal / vertical polarization, low/mid/high frequency



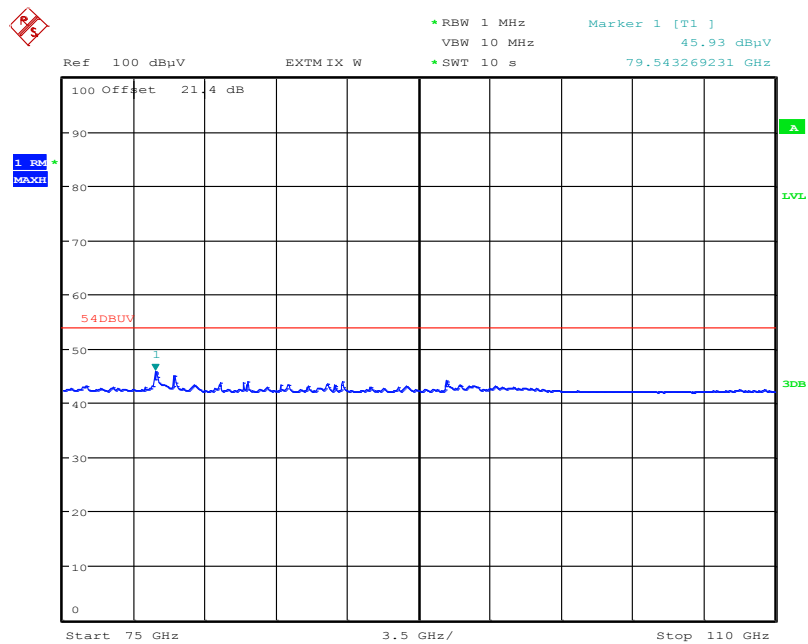
Date: 15.APR.2015 16:27:52

Plot No. 37: 50 GHz to 75 GHz, horizontal / vertical polarization, low/mid/high frequency



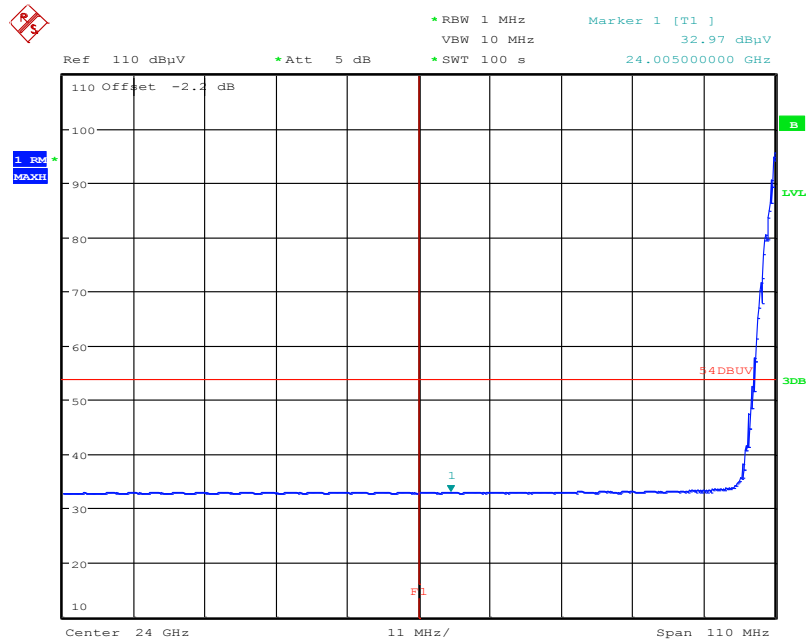
Date: 16.APR.2015 11:10:50

Plot No. 38: 75 GHz to 110 GHz, horizontal / vertical polarization, low/mid/high frequency



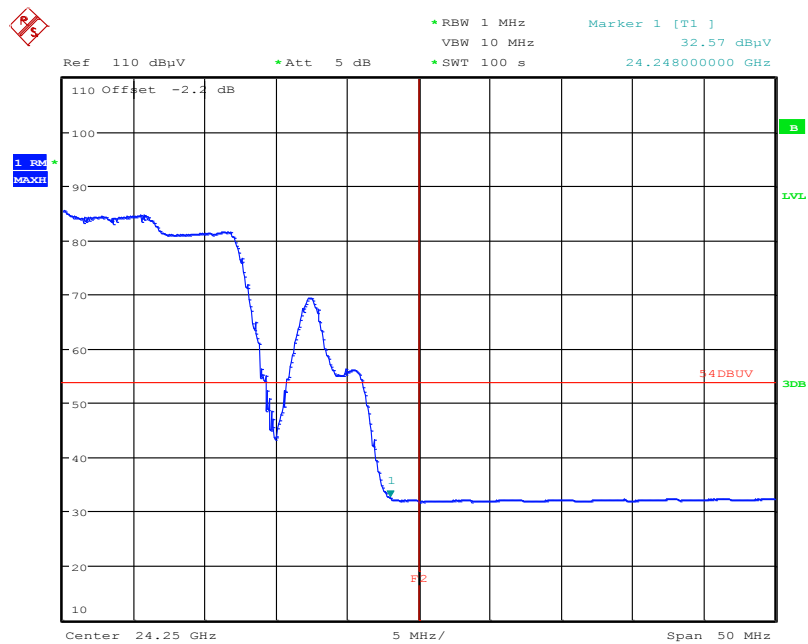
Date: 16.APR.2015 11:17:48

Plot No. 39: Band-Edge-Compliance, lower band-edge, normal operation mode



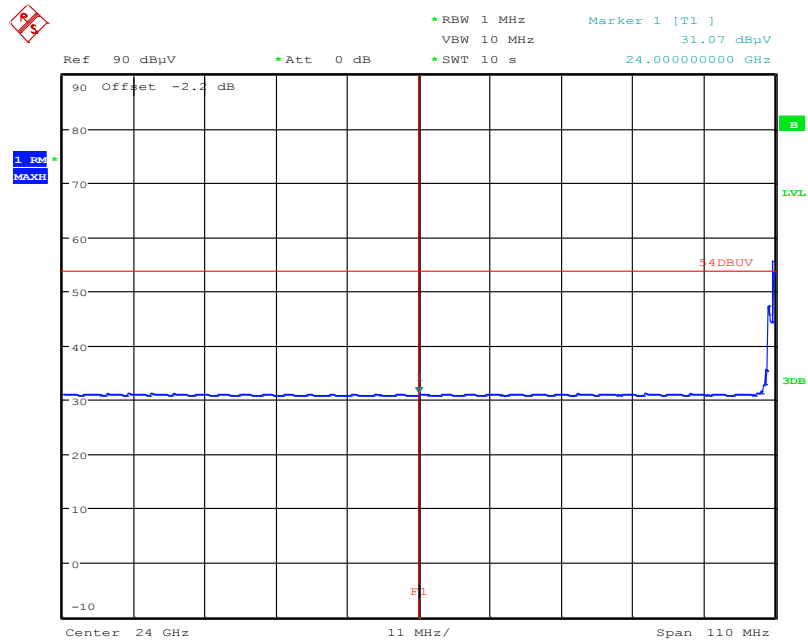
Date: 17.APR.2015 16:19:17

Plot No. 40: Band-Edge-Compliance, upper band-edge, normal operation mode



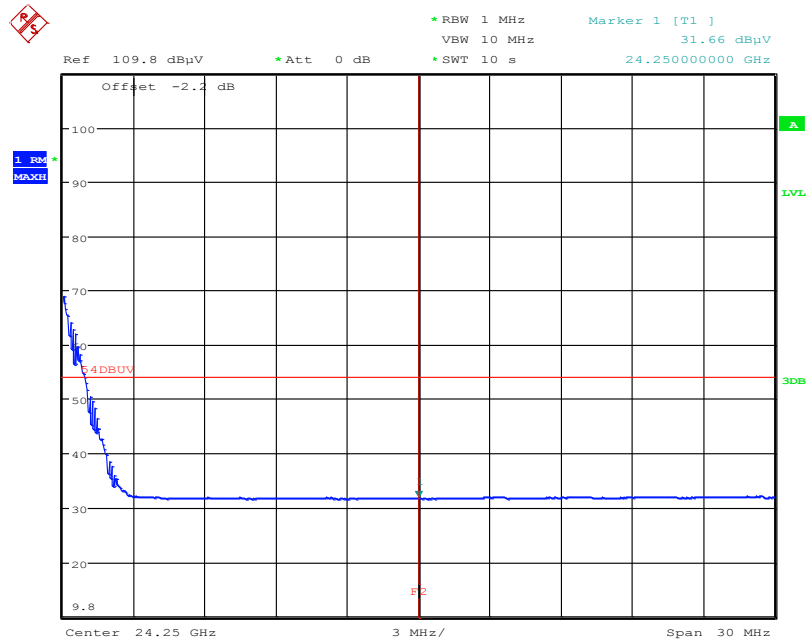
Date: 17.APR.2015 16:40:37

Plot No. 41: Band-Edge-Compliance, lower band-edge, stopped mode, low frequency



Date: 15.APR.2015 10:56:46

Plot No. 42: Band-Edge-Compliance, upper band-edge, stopped mode, high frequency



Date: 8.JUL.2015 11:19:47

10 Frequency stability

- Low frequency

TEST CONDITIONS	Carrier Frequency
T_{nom} / V_{nom}	24.0561 GHz
$T_{min} / V_{min-max}$	24.0564 GHz
$T_{max} / V_{min-max}$	24.0560 GHz

- Mid frequency

TEST CONDITIONS	Carrier Frequency
T_{nom} / V_{nom}	24.1490 GHz
$T_{min} / V_{min-max}$	24.1495 GHz
$T_{max} / V_{min-max}$	24.1486 GHz

- High frequency

TEST CONDITIONS	Carrier Frequency
T_{nom} / V_{nom}	24.2354 GHz
$T_{min} / V_{min-max}$	24.2365 GHz
$T_{max} / V_{min-max}$	24.2356 GHz

Limits:

FCC §15.249 (b) (2)

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.001\%$ of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

Result: The measurement is passed.

Annex A 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 signaling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

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

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	45	Switch-Unit	3488A	HP	2719A14505	300000368	ev		
2	50	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04466	300000580	ne		
3	50	software	SPS_PHE 1.4f	Spitzenberger & Spiess	B5981; 5D1081; B5979	300000210	ne		
4	50	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	26.01.2015	26.01.2016
5	50	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	Ve	11.02.2014	11.02.2016
6	50	Amplifier	JS42-00502650-28-5A	MITEQ	1084532	300003379	ev		
7	50	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw		
8	50	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw		
9	50	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw		
10	50	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	22.04.2014	22.04.2016
11	50	Spectrum-Analyzer	FSU26	R&S	200809	300003874	k	26.01.2015	26.01.2016
12	n. a.	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2818A03450	300001040	Ve	20.01.2015	20.01.2018
13	n. a.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vIKI!	20.05.2015	20.05.2017
14	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev		
15	n. a.	Switch / Control Unit	3488A	HP	*	300000199	ne		
16	9	Artificial Mains 9 kHz to 30 MHz	ESH3-Z5	R&S	828576/020	300001210	Ve	30.01.2014	30.01.2016
17	9	Isolating Transformer	MPL IEC625 Bus Regeltrenntravo	Erfi	91350	300001155	ne		
18	90	Active Loop Antenna 10 kHz to 30 MHz	6502	Kontron Psychotech	8905-2342	300000256	k	24.06.2015	24.06.2017
19	90	Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143	ne		
20	90	Band Reject filter	WRCG1855/1910-1835/1925-40/8SS	Wainwright	7	300003350	ev		
21	90	Band Reject filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	11	300003351	ev		
22	90	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne		
23	90	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854	vIKI!	29.10.2014	29.10.2017
24	90	MXE EMI Receiver 20 Hz to 26.5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	06.03.2015	06.03.2016
25	90	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne		
26	CR 79	Std. Gain Horn Antenna 26.5-40.0 GHz	V637	Narda	7911	300001751	ne		
27	11b	Microwave System Amplifier, 0.5-26.5 GHz	83017A	HP	00419	300002268	ev		
28	A025	Std. Gain Horn Antenna 49.9-75.8 GHz	2524-20	Flann	*	300001983	ne		
29	A028	Std. Gain Horn Antenna 73.8-112 GHz	2724-20	Flann	*	300001991	ne		

30	A026	Std. Gain Horn Antenna 12.4 to 18.0 GHz	639	Narda	8402	300000787	k	22.07.2013	22.07.2015
31	A029	Std. Gain Horn Antenna 18.0 to 26.5 GHz	638	Narda	8205	300002442	k	19.07.2013	19.07.2015
32	A029	Power Supply	LA30/5GA	Zentro	2046	300000711	NK!		
33	A029	Spectrum Analyzer 20 Hz - 50 GHz	FSU50	R&S	200012	300003443	Ve	02.10.2014	02.10.2016
34	A029	Harmonic mixer 50 - 75 GHz for spectrum analyzers	FS-Z75	R&S	100099	300003949	k	06.03.2015	06.03.2016
35	A029	Spectrum Analyzer Mixer 2-Port, 75-110 GHz	SAM-110-7	Radiometer Physics GmbH	002	300004155	k	31.01.2014	31.01.2016
36	A029	Broadband Low Noise Amplifier 18- 50 GHz	CBL18503070-XX	CERNEX	19338	300004273	ne		
37	A029	Std. Gain Horn Antenna 33.0-50.1 GHz	2324-20	Flann	57	400000683	ne		

Agenda: Kind of Calibration

k calibration / calibrated
 ne not required (k, ev, izw, zw not required)
 ev periodic self verification
 Ve long-term stability recognized
 vlkl! Attention: extended calibration interval
 NK! Attention: not calibrated

EK limited calibration
 zw cyclical maintenance (external cyclical
 maintenance)
 izw internal cyclical maintenance
 g blocked for accredited testing
 *) next calibration ordered / currently in progress

Annex B Document history

Version	Applied changes	Date of release
DRAFT	Initial release - DRAFT	2015-07-08
	minor changes based on manufacturer's information	2015-07-10
-A	Temperature range corrected	2015-07-22

Annex C 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
PMN		Product marketing name
HMN		Host marketing name
HVIN		Hardware version identification number
FVIN		Firmware version identification number

Annex D Accreditation Certificate

Front side of certificate



Deutsche Akkreditierungsstelle GmbH

Befähigung 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 / GPRS / UMTS / LTE) Performance
Elektromagnetische Verträglichkeit (EMV) einschließlich Automotive
Produktsicherheit
SAR und Hearing Aid Compatibility (HAC)
Umweltsimulation
Smart Card Terminals
Bluetooth
Wi-Fi Services

Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 07.03.2014 mit der Akkreditierungsnummer D-PL-12076-01 und ist gültig bis 17.03.2018. Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 77 Seiten.

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

Frankfurt am Main, 07.03.2014

Geführtes Dokument

Dr. Ingrid Dittmann
Abteilungsleiterin

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
38115 Braunschweig

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

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

Die Akkreditierung erfolgte gemäß des Gesetzes über die Akkreditierungsstelle (AkkStelleG) vom 31. Juli 2009 (BGBl. I S. 2625) sowie der Verordnung (EG) Nr. 765/2008 des Europäischen Parlaments und des Rates vom 9. Juli 2008 über die Vorschriften für die Akkreditierung und Marktüberwachung im Zusammenhang mit der Vermarktung von Produkten (Abt. L 218 vom 9. Juli 2008, S. 30). Die DAkkS ist Unterzeichnerin der Multilateralen Abkommen zur gegenseitigen Anerkennung der Europäischen Organisation für Akkreditierung (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-accordation.org
IAF: www.iaf.or.jp
ILAC: www.ilac.or.jp

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>