
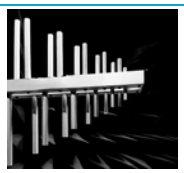
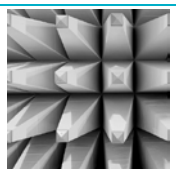

CTC advanced
member of RWTÜV group

TEST REPORT

Test report no.: 1-3635/17-02-02

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

Testing laboratory

CTC advanced GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
Phone: + 49 681 5 98 - 0
Fax: + 49 681 5 98 - 9075
Internet: http://www.ctcadvanced.com
e-mail: mail@ctcadvanced.com

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

Applicant

BERTHOLD TECHNOLOGIES GmbH & Co KG
Calmbacher Strasse 22
75323 Bad Wildbad / GERMANY
Phone: +49 7081 177 - 0
Fax: +49 7081 177-527
Contact: Rachid El Korch
e-mail: rachid.elkorch@Berthold.com
Phone: +49 7081 177-274

Manufacturer

BERTHOLD TECHNOLOGIES GmbH & Co KG
Calmbacher Strasse 22
75323 Bad Wildbad / GERMANY

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 9	Spectrum Management and Telecommunications Radio Standards Specification - Licence-Exempt Radio Apparatus: Category I Equipment
RSS – Gen Issue 4	Spectrum Management and Telecommunications Radio Standards Specifications - General Requirements and Information for the Certification of Radio Apparatus

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

Test Item

Kind of test item:	**Field disturbance sensor (2.4 GHz)**
Model name:	**MicroPolar (Brix) ++**
FCC ID:	**R9ZFCC01X12**
IC:	**4777A-IC01X12**
Frequency:	2.435 GHz – 2.465 GHz (2.441 GHz)
Antenna:	Tank sensor LB X65X-XX / Flow cell sensor LB 5660-XXX-XXX
Power supply:	100 - 240 V AC, 45 - 65 Hz 18 - 36 V DC (Nominal 24 V DC)
Temperature range:	-20°C to +60°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:

Geraldy Karsten

cn=Karsten Geraldy, o=CTC advanced GmbH, ou=GER-2017-03-14, email=Karsten.Geraldy@ctcadvanced.com, c=DE
2017.09.07 13:36:05 +02'00'

Karsten Geraldy
Lab Manager
Radio Communications & EMC

Test performed:

M. Walla

cn=Walla Meheza, o=ctcadvanced GmbH, ou=WAL-161220, email=meheza.walla@ctcadvanced.com, c=DE
2017.09.07 13:12:56 +02'00'

Meheza Walla
Lab Manager
Radio Communications & EMC

1 Table of contents

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. CTC advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.
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This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

2.2 Application details

Date of receipt of order:	2017-02-22
Date of receipt of test item:	2017-04-24
Start of test:	2017-04-26
End of test:	2017-05-05
Person(s) present during the test:	Mr. Ulrich Klute, Mr. El Korch Rachid

2.3 Test laboratories sub-contracted

None

3 Test standard/s and references

Test standard	Date	Description
47 CFR Part 15		Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 210 Issue 9	August 2016	Spectrum Management and Telecommunications Radio Standards Specification - Licence-Exempt Radio Apparatus: Category I Equipment
RSS - Gen Issue 4	November 2014	Spectrum Management and Telecommunications Radio Standards Specifications - General Requirements and Information for the Certification of Radio Apparatus

Guidance	Version	Description
ANSI C63.4-2014	-/-	American national standard for methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz
ANSI C63.10-2013	-/-	American national standard of procedures for compliance testing of unlicensed wireless devices

4 Test environment

Temperature	:	T_{nom}	+22 °C during room temperature tests
Relative humidity content	:		55 %
Barometric pressure	:		1021 hpa
Power supply	:	V_{nom}	24 V DC by lab power supply 115 V AC (45 Hz to 65 Hz)

5 Test item

5.1 General description

Kind of test item	:	Field disturbance sensor (2.4 GHz)
Type identification	:	MicroPolar (Brix) ++ AC Powered: LB 565-11 / LB 566-11 DC Powered: LB 565-12 / LB 566-12
S/N serial number	:	-/-
HW hardware status	:	-/-
SW software status	:	-/-
Frequency band	:	2.435 GHz – 2.465 GHz (2.441 GHz)
Type of modulation	:	unmodulated signal (N0N)
Number of channels	:	1
Antenna	:	Tank sensor LB X65X-XX / Flow cell sensor LB 5660-XXX-XXX
Power supply	:	100 - 240 V AC, 45 - 65 Hz 18 - 36 V DC (Nominal 24 V DC)
Temperature range	:	-20°C to +60°C

5.2 Additional information

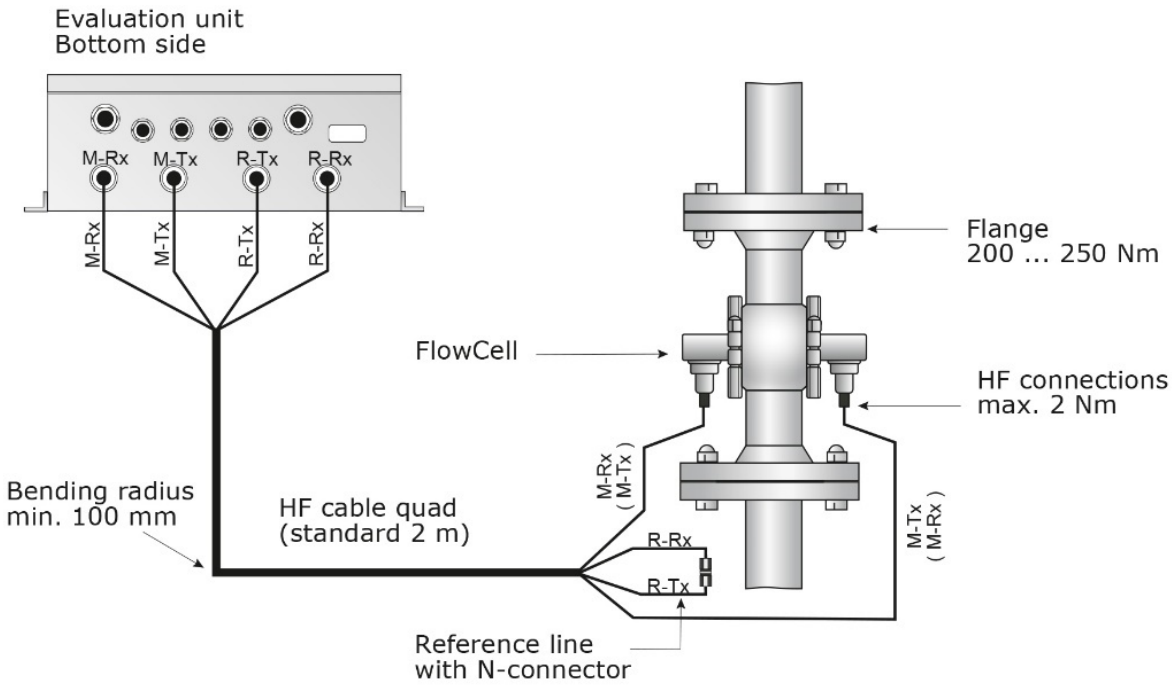
The tests were performed with: MicroPolar Brix ++ LB 565-11 (AC powered)
MicroPolar Brix ++ LB 565-12 (DC powered)

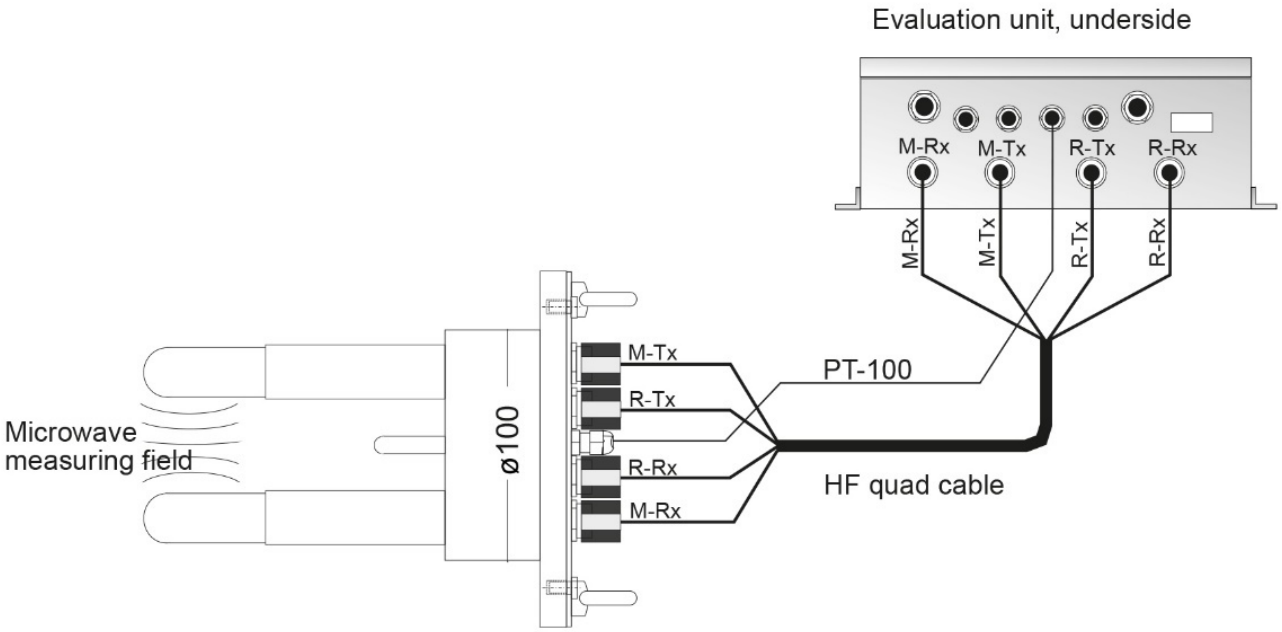
The test report also covers the model versions LB 566-11 and LB 566-12 which are equipped with different software for the data evaluation. This has no influence on the RF-parameters.

Every model mentioned above was tested with two antennas (a tank sensor and a flow cell sensor).

The HF cable must be at least 2 m long.

It was tested with a 2 m long HF cable quad with an attenuation of approx. 0.3 dB/m.





Transmitter frequency alignment range: 2.401 GHz – 2.491 GHz

Transmitter channel switching frequency range: Depending on regulations of the country
USA/Canada: One step by 2.441 GHz

Frequency bands of operation: selection by manufacturer or selected service personnel, protected by password.

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: 1-3635/17-02-01_AnnexA
1-3635/17-02-01_AnnexB
1-3635/17-02-01_AnnexC

6 Description of the test setup

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, 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).

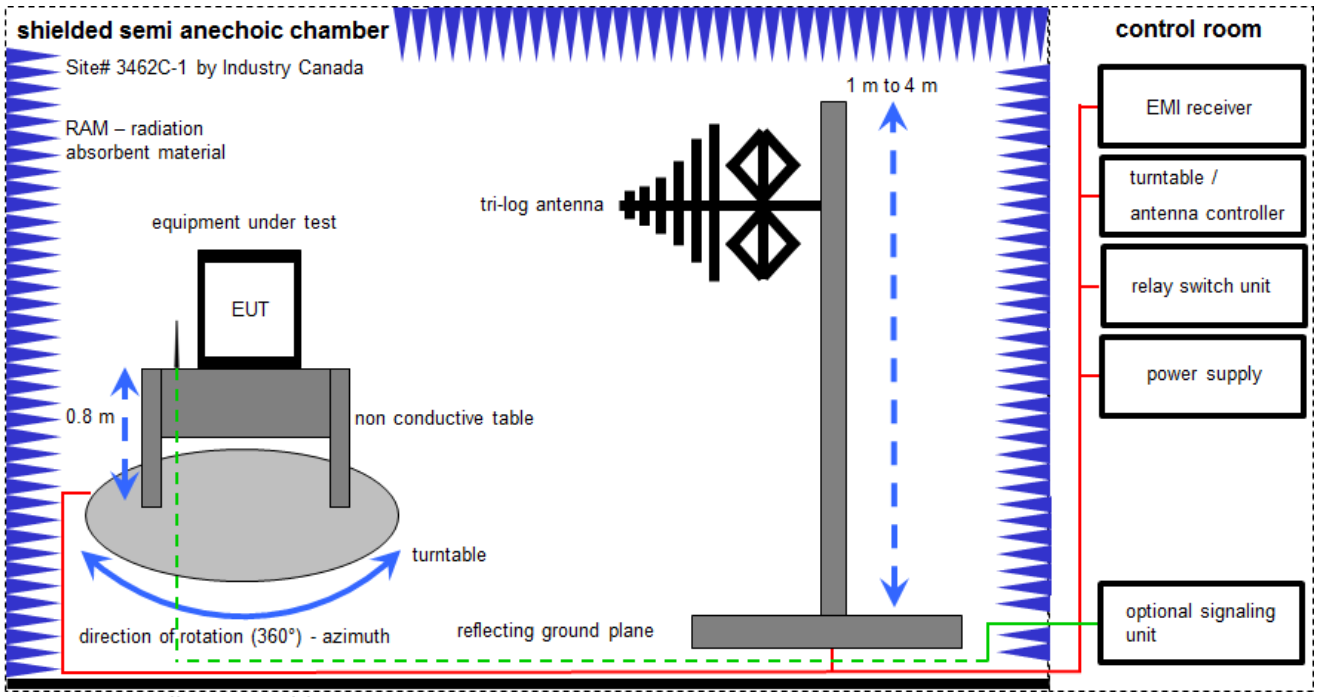
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

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

6.1 Shielded semi anechoic chamber

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 conform to specifications ANSI C63. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



Measurement distance: tri-log antenna 10 meter

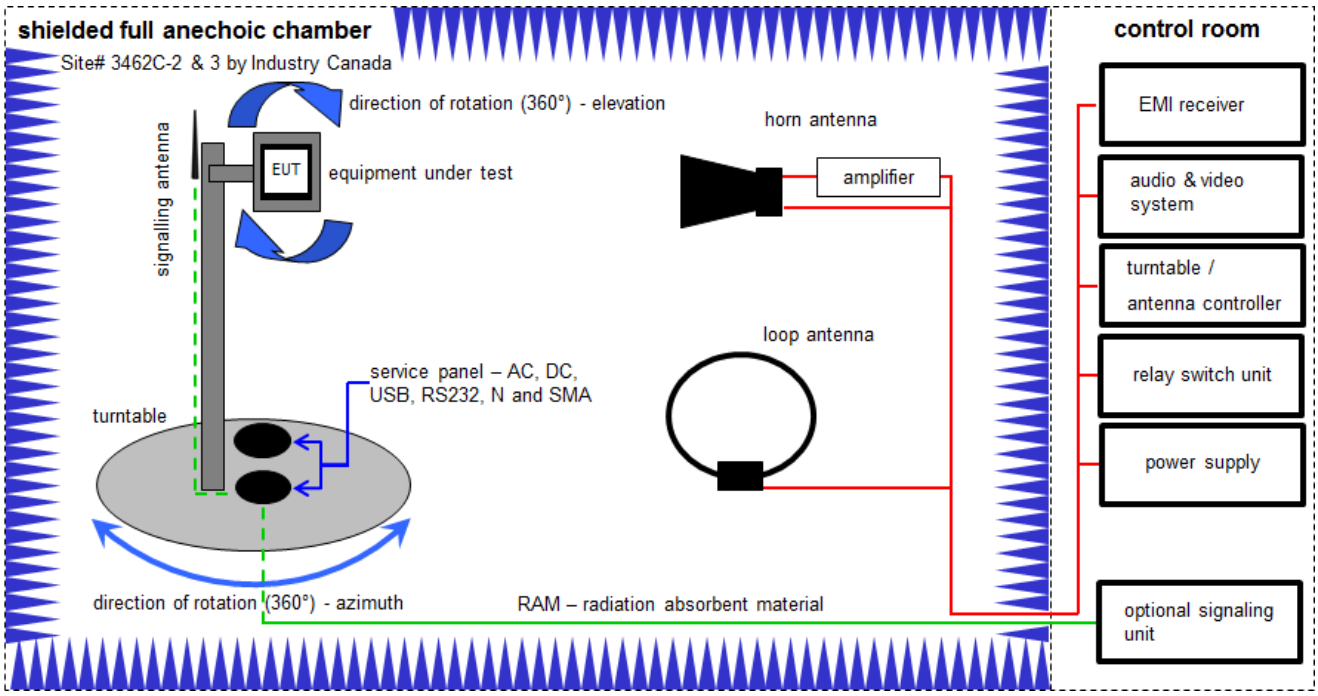
FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 12.35 [dBµV/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dBµV/m] (35.69 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Meßkabine 1	HF-Absorberhalle	MWB AG 300023		300000551	ne	-/-	-/-
2	A	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	01.02.2017	31.01.2018
3	A	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
4	A	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
5	A	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
6	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	25.04.2016	25.04.2018
7	A	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04466	300000580	ne	-/-	-/-

6.2 Shielded fully anechoic chamber



Measurement distance: horn antenna 3 meter / 1 meter; loop antenna 3 meter / 1 meter

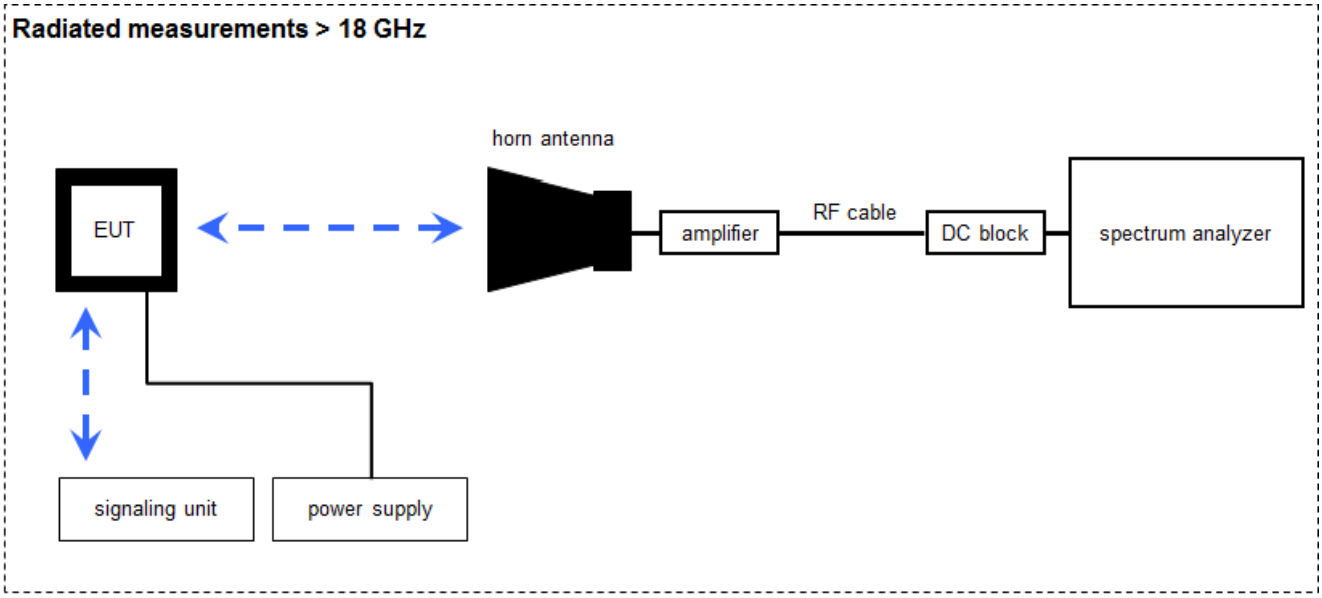
FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 40.0 [dBµV/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dBµV/m] (71.61 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9709-5290	300000212	k	13.08.2015	13.08.2017
2	A, B, C	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
3	A, B, C	Switch / Control Unit	3488A	HP	-/-	300000199	ne	-/-	-/-
4	C	Active Loop Antenna 10 kHz to 30 MHz	6502	EMCO/2	8905-2342	300000256	k	24.06.2015	24.06.2017
5	A	Band Reject filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	11	300003351	ev	-/-	-/-
6	A, B, C	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	31.01.2017	30.01.2018
7	A	Highpass Filter	WHK1.1/15G-10SS	Wainwright	3	300003255	ev	-/-	-/-
8	A	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	19	300003790	ne	-/-	-/-
9	A, B	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854	vlKl!	29.10.2014	29.10.2017
10	A	High Pass Filter	VHF-3500+	Mini Circuits	-/-	400000193	ne	-/-	-/-
11	A	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22049	300004481	ev	-/-	-/-
12	A, B, C	NEXIO EMV-Software	BAT EMC V3.16.0.49	EMCO	-/-	300004682	ne	-/-	-/-
13	A, B, C	PC	ExOne	F+W	-/-	300004703	ne	-/-	-/-
14	A, B, C	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2818A03450	300001040	Ve	20.01.2015	20.01.2018

6.3 Radiated measurements > 18 GHz



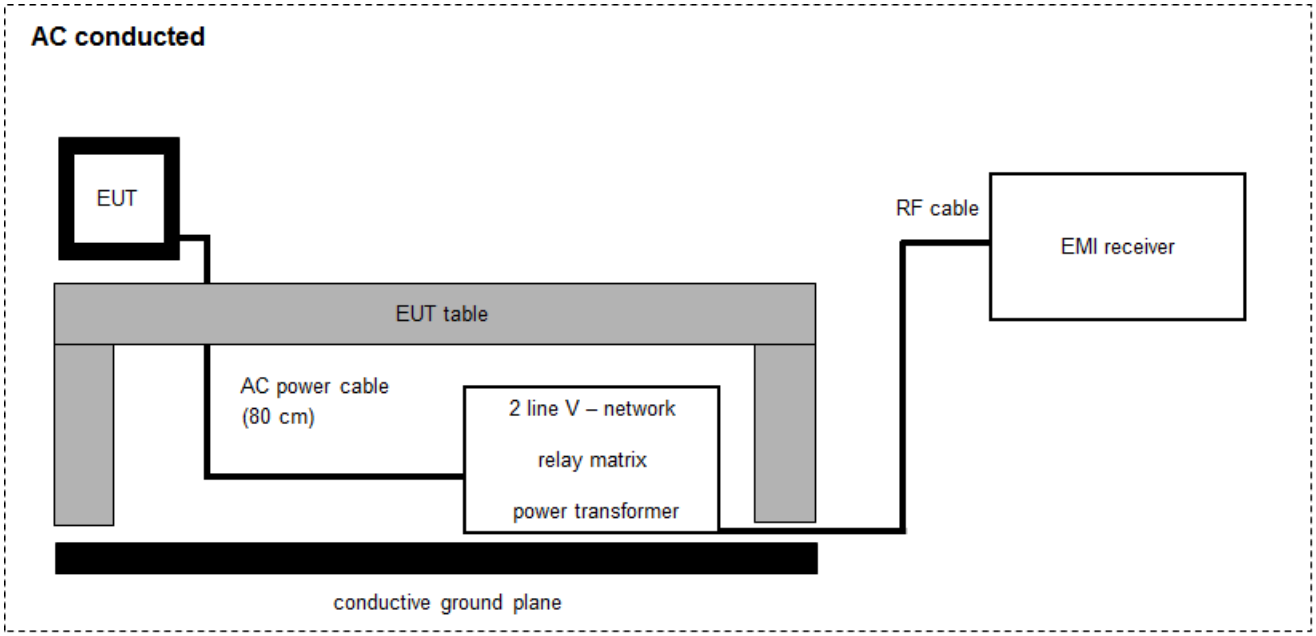
FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss signal path & distance correction; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 40.0 [dBµV/m] + (-60.1) [dB] + 36.74 [dB/m] = 16.64 [dBµV/m] (6.79 µV/m)

Equipment table (RF laboratory):

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	n.a.	Std. Gain Horn Antenna 12.4 to 18.0 GHz	639	Narda	8402	300000787	k	14.08.2015	14.08.2017
2	n.a.	Std. Gain Horn Antenna 18.0 to 26.5 GHz	638	Narda	8402	300000486	k	10.09.2015	10.09.2017
3	n.a.	Spectrum Analyzer 20 Hz - 50 GHz	FSU50	R&S	200012	300003443	Ve	28.10.2016	28.10.2018
4	n. a.	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22050	300004482	ev	-/-	-/-

6.4 AC conducted



FS = UR + CF + VC
(FS-field strength; UR-voltage at the receiver; CR-loss of the cable and filter; VC-correction factor of the ISN)

Example calculation:
FS [dBµV/m] = 37.62 [dBµV/m] + 9.90 [dB] + 0.23 [dB] = 47.75 [dBµV/m] (244.06 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Two-line V-Network (LISN) 9 kHz to 30 MHz	ESH3-Z5	R&S	892475/017	300002209	k	24.02.2017	23.02.2019
2	n. a.	MXE EMI Receiver 20 Hz to 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	16.08.2016	16.08.2017
3	n. a.	software	SPS_PHE 1.4f	Spitzenberger & Spiess	B5981; 5D1081;B5979	300000210	ne	-/-	-/-

7 Sequence of testing

7.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1.5 m.
- At each turntable position the analyzer sweeps with positive-peak detector to find the maximum of all emissions.

Final measurement

- Identified emissions during the premeasurement are maximized by the software by rotating the turntable from 0° to 360°. In case of the 2-axis positioner is used the elevation axis is also rotated from 0° to 360°.
- The final measurement is done in the position (turntable and elevation) causing the highest emissions with quasi-peak (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. A plot with the graph of the premeasurement and the limit is stored.

7.2 Sequence of testing radiated spurious 30 MHz to 1 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 10 m or 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 m to 3 m.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position ± 45° and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

7.3 Sequence of testing radiated spurious 1 GHz to 18 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height is 1.5 m.
- At each turntable position and antenna polarization the analyzer sweeps with positive peak detector to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximizes the peaks by rotating the turntable from 0° to 360°. This measurement is repeated for different EUT-table positions (0° to 150° in 30°-steps) and for both antenna polarizations.
- The final measurement is done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

7.4 Sequence of testing radiated spurious above 18 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet.
- The measurement distance is as appropriate (e.g. 0.5 m).
- The EUT is set into operation.

Premeasurement

- The test antenna is handheld and moved carefully over the EUT to cover the EUT's whole sphere and different polarizations of the antenna.

Final measurement

- The final measurement is performed at the position and antenna orientation causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement and the limit is stored.

8 Summary of measurement results

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

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	47 CFR Part 15 RSS 210, Issue 9, Annex F	Passed	2017-09-07	-/-

Test specification clause	Test case	Temperature conditions	Power source voltages	Pass	Fail	NA	NP	Results (max.)
§15.245(b) RSS 210 / F.1	Field strength of emissions (wanted signal)	Nominal	Nominal	☒	☐	☐	☐	68.9 dBµV/m
§2.1049	Occupied bandwidth (99% bandwidth)	Nominal	Nominal	☒	☐	☐	☐	80.3 kHz
§15.209(a) / §15.245(b)(1)(2)(3)(4) RSS 210 / F.2.1	Field strength of emissions (spurious)	Nominal	Nominal	☒	☐	☐	☐	complies

Note: NA = Not Applicable; NP = Not Performed

9 RF measurement testing

10 Measurement results

10.1 Field strength of emissions (wanted signal)

Description:

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

Measurement:

Measurement parameter	
Detector:	Pos-Peak
Sweep time:	Auto
Video bandwidth:	3 MHz
Resolution bandwidth:	1 MHz
Span:	50 MHz
Trace-Mode:	Max Hold

Limits:

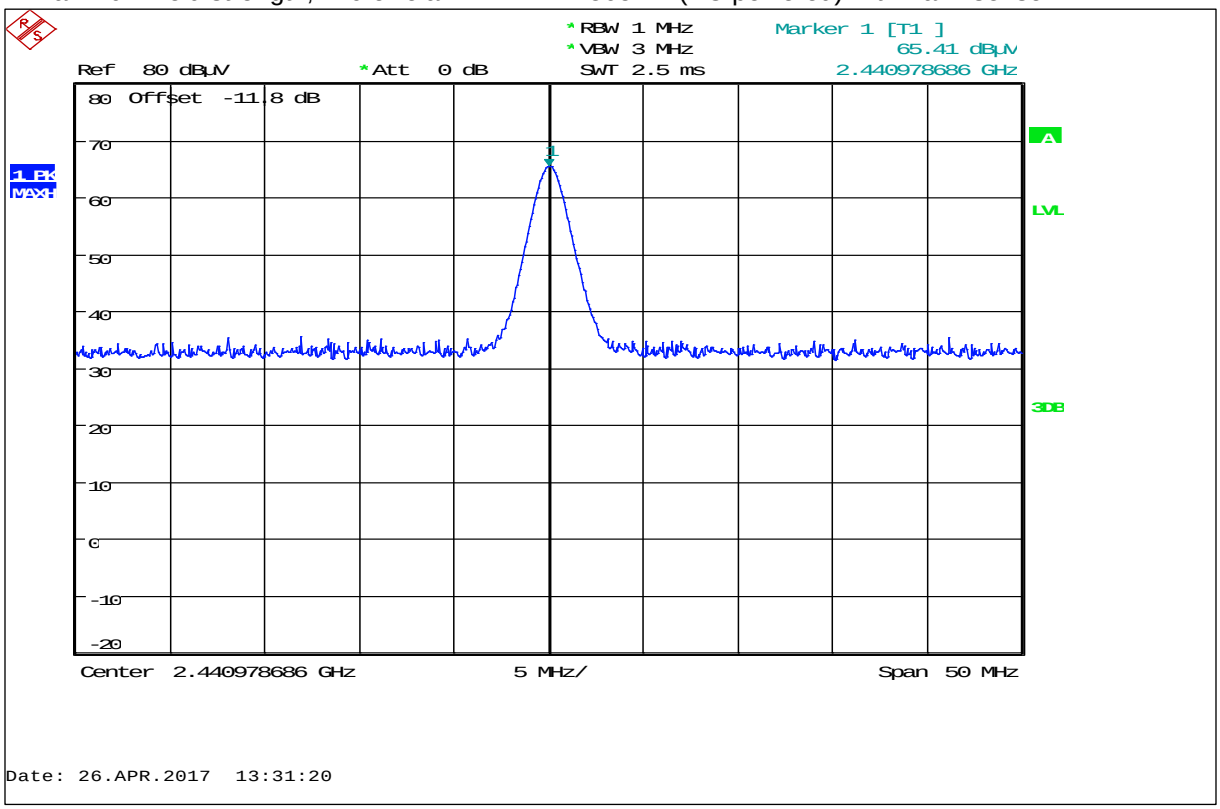
FCC		IC
CFR Part 15.245(b)		RSS - 210, F.1
Field strength of emissions		
The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:		
Frequency [GHz]	Field Strength [mV/m // dBµV/m]	Measurement distance
2.435 – 2.465	114	3m

Result:

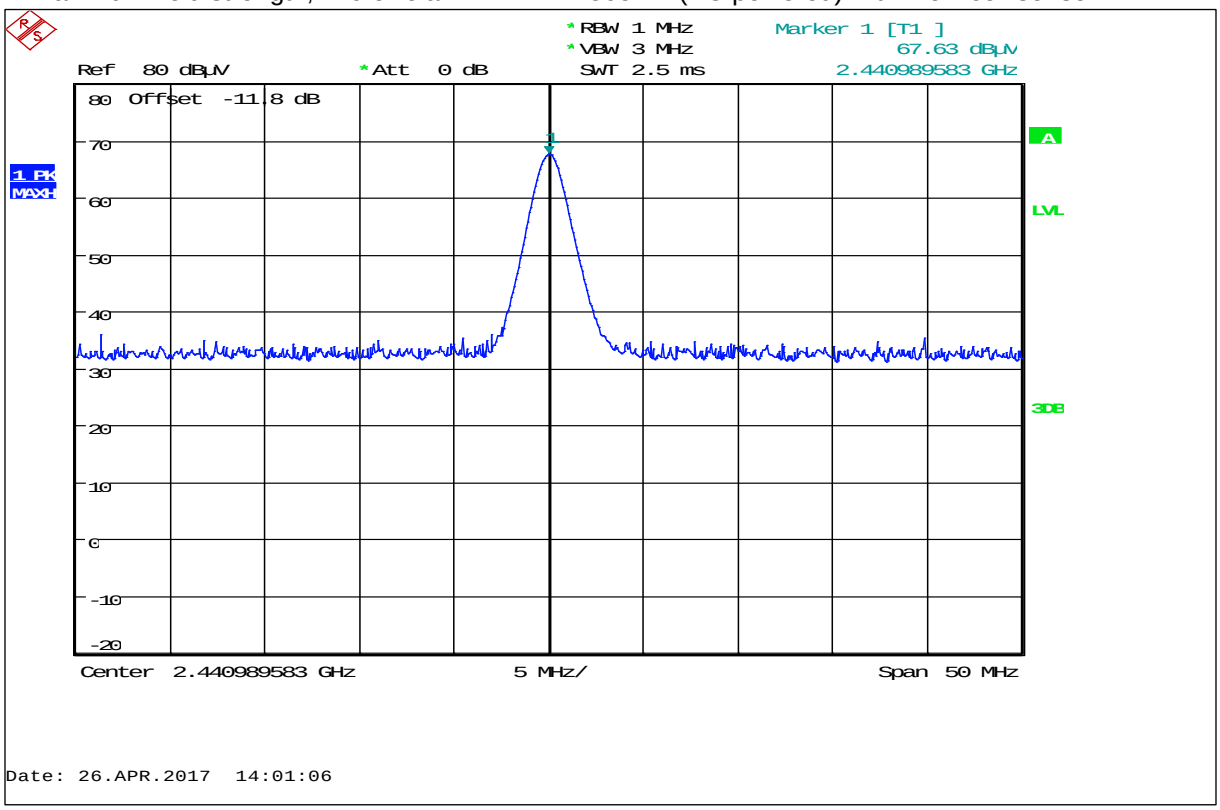
EUT	Maximum field strength [dBµV/m] @ 3 m	
	Tank sensor	Flow cell sensor
MicroPolar Brix ++ LB 565-11 (AC powered)	65.4	67.6
MicroPolar Brix ++ LB 565-12 (DC powered)	64.7	68.9
Measurement uncertainty	± 3 dB	

Result: The measurement is passed.

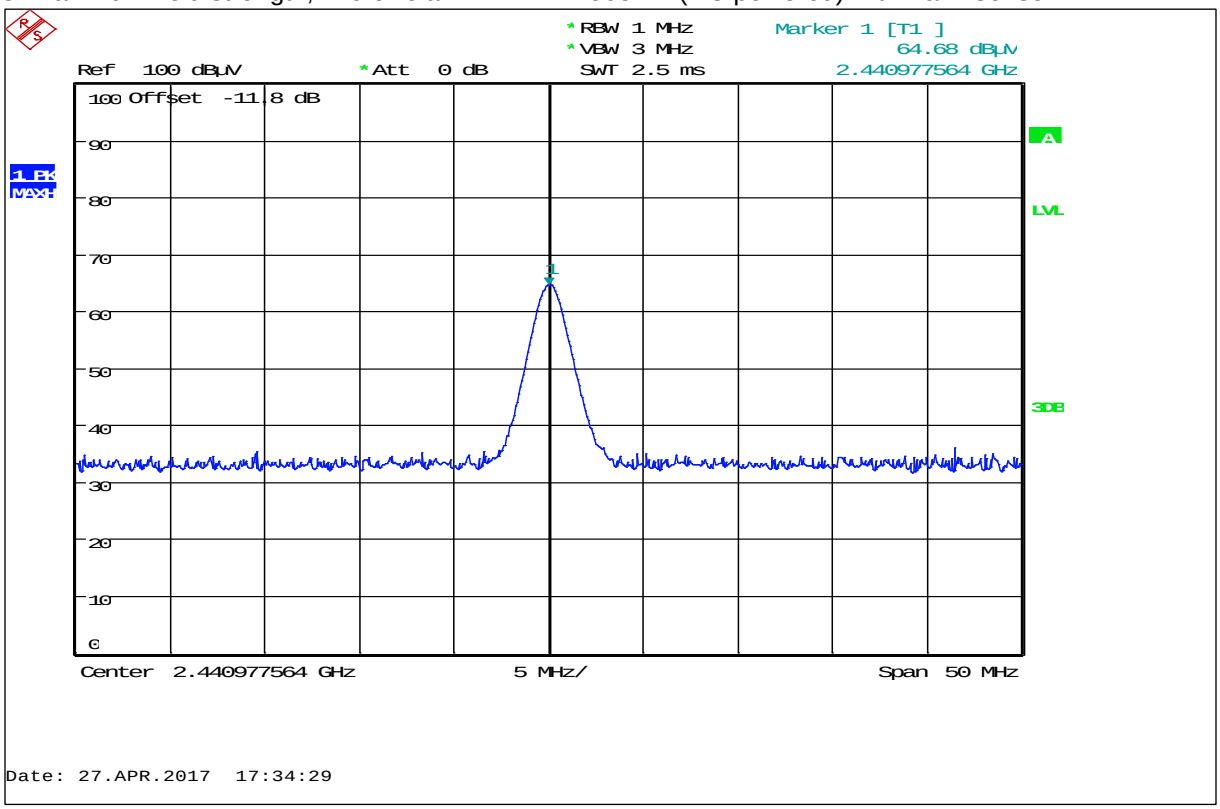
Plot 1: Maximum field strength, MicroPolar Brix ++ LB 565-11 (AC powered) with Tank sensor



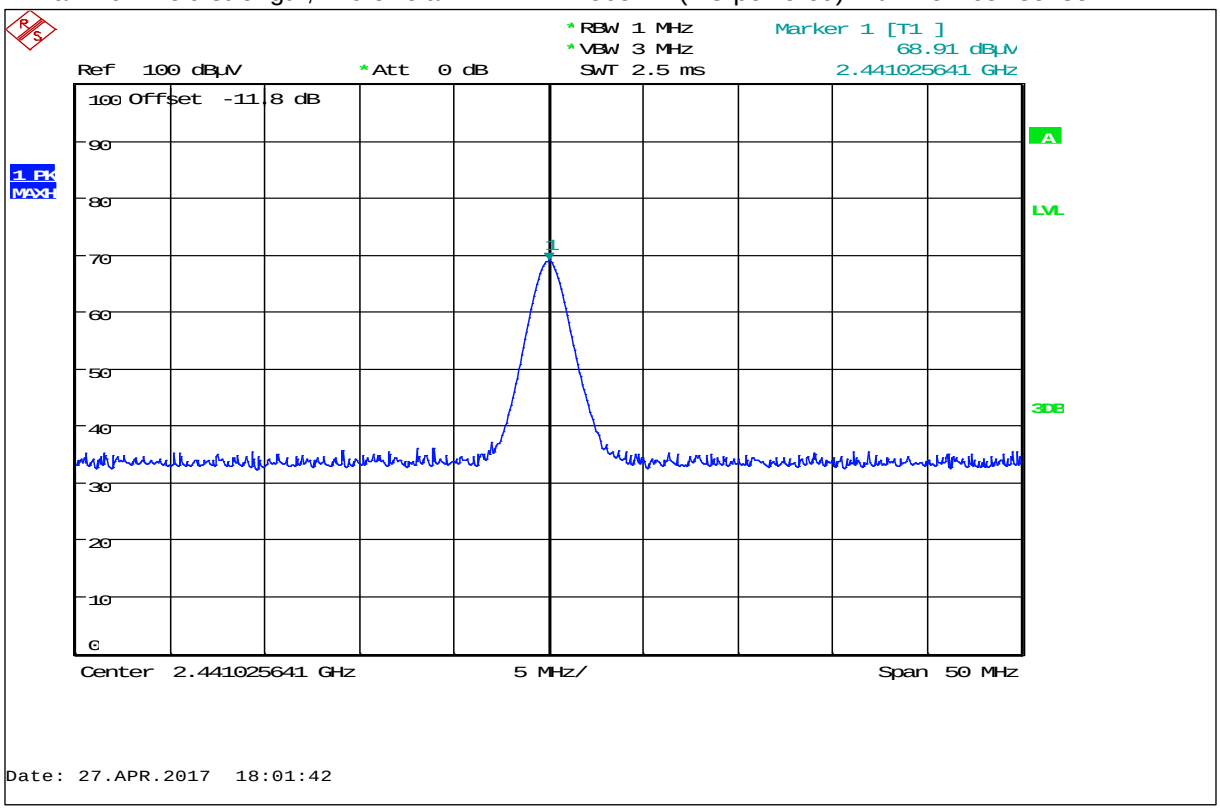
Plot 2: Maximum field strength, MicroPolar Brix ++ LB 565-11 (AC powered) with Flow cell sensor



Plot 3: Maximum field strength, MicroPolar Brix ++ LB 565-12 (DC powered) with Tank sensor



Plot 4: Maximum field strength, MicroPolar Brix ++ LB 565-12 (DC powered) with Flow cell sensor



10.2 Occupied bandwidth (99% bandwidth)

Description:

Measurement of the 99% bandwidth of the wanted signal.

Measurement:

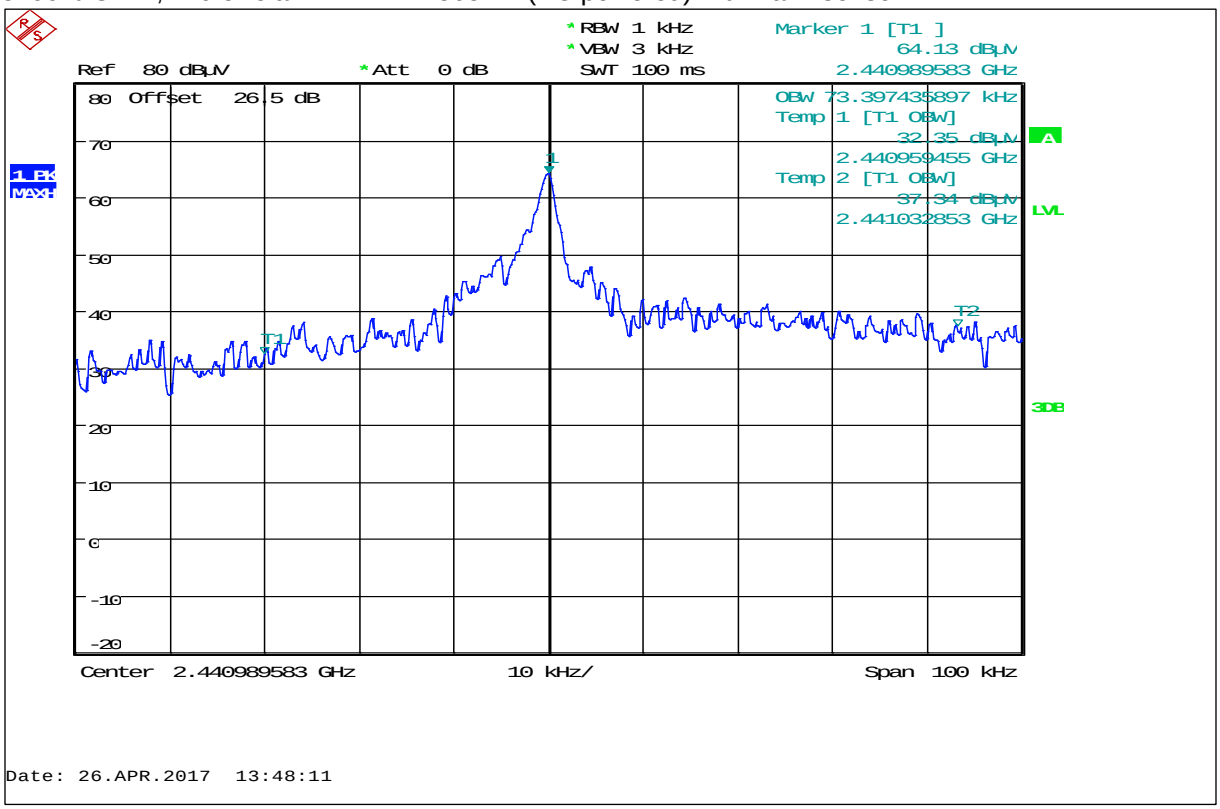
Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	1 kHz
Resolution bandwidth:	3 kHz
Span:	100 kHz
Trace-Mode:	Max Hold

Results:

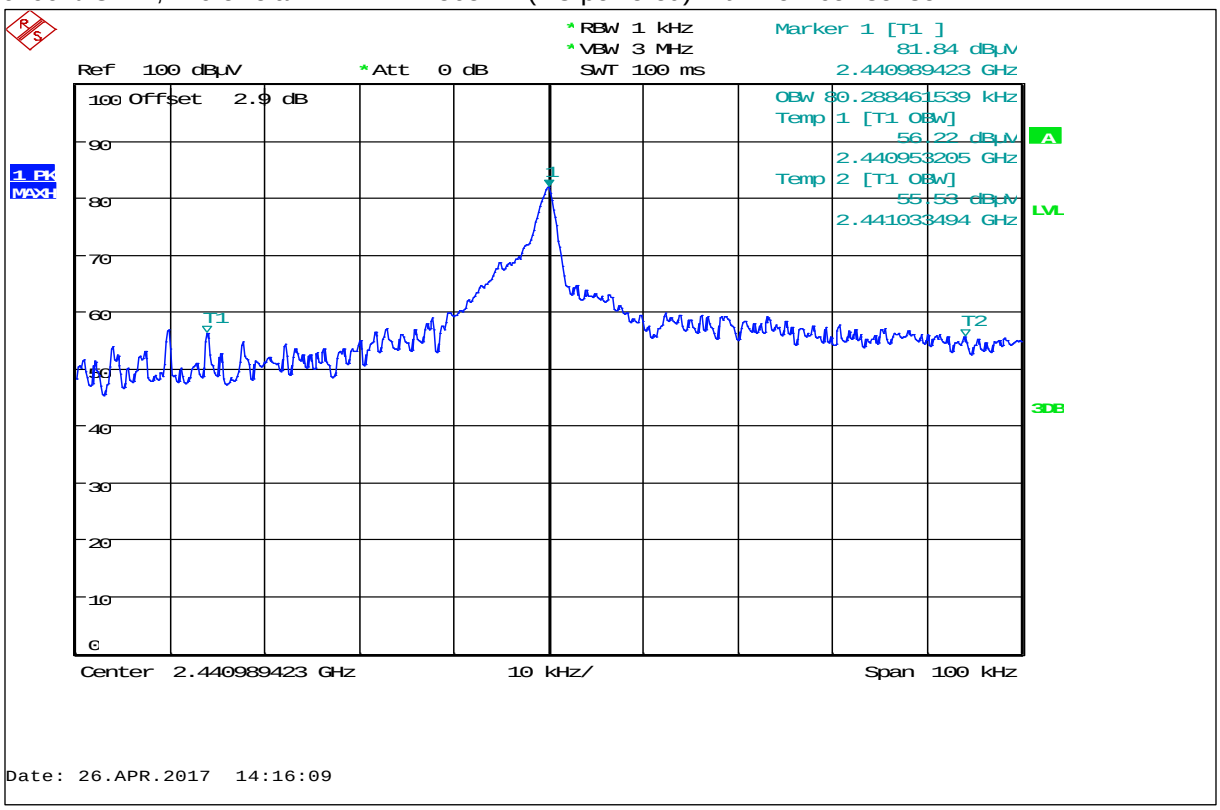
EUT	99% Occupied bandwidth [kHz]	
	Tank sensor	Flow cell sensor
MicroPolar Brix ++ LB 565-11 (AC powered)	73.4	80.3
MicroPolar Brix ++ LB 565-22 (DC powered)	72.0	20.2
Measurement uncertainty	± span/1000	

Result: The measurement is passed.

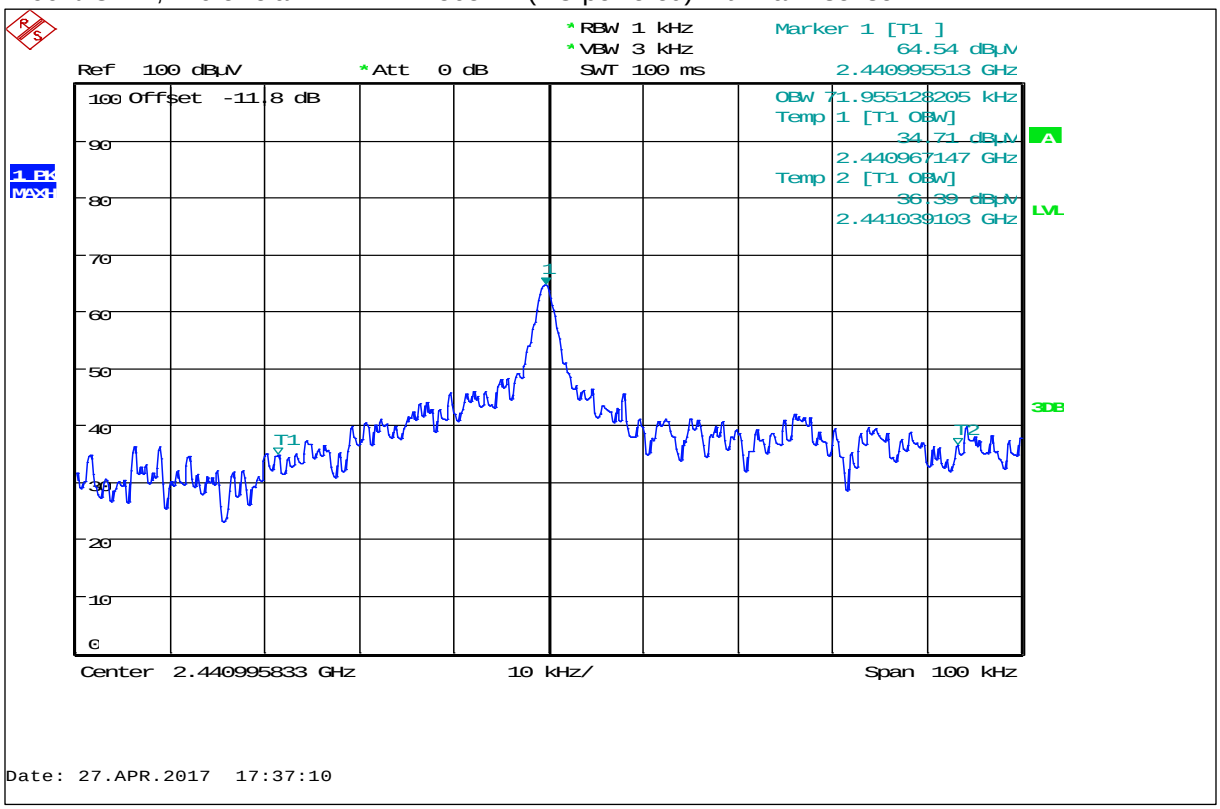
Plot 5: 99% OBW, MicroPolar Brix ++ LB 565-11 (AC powered) with Tank sensor



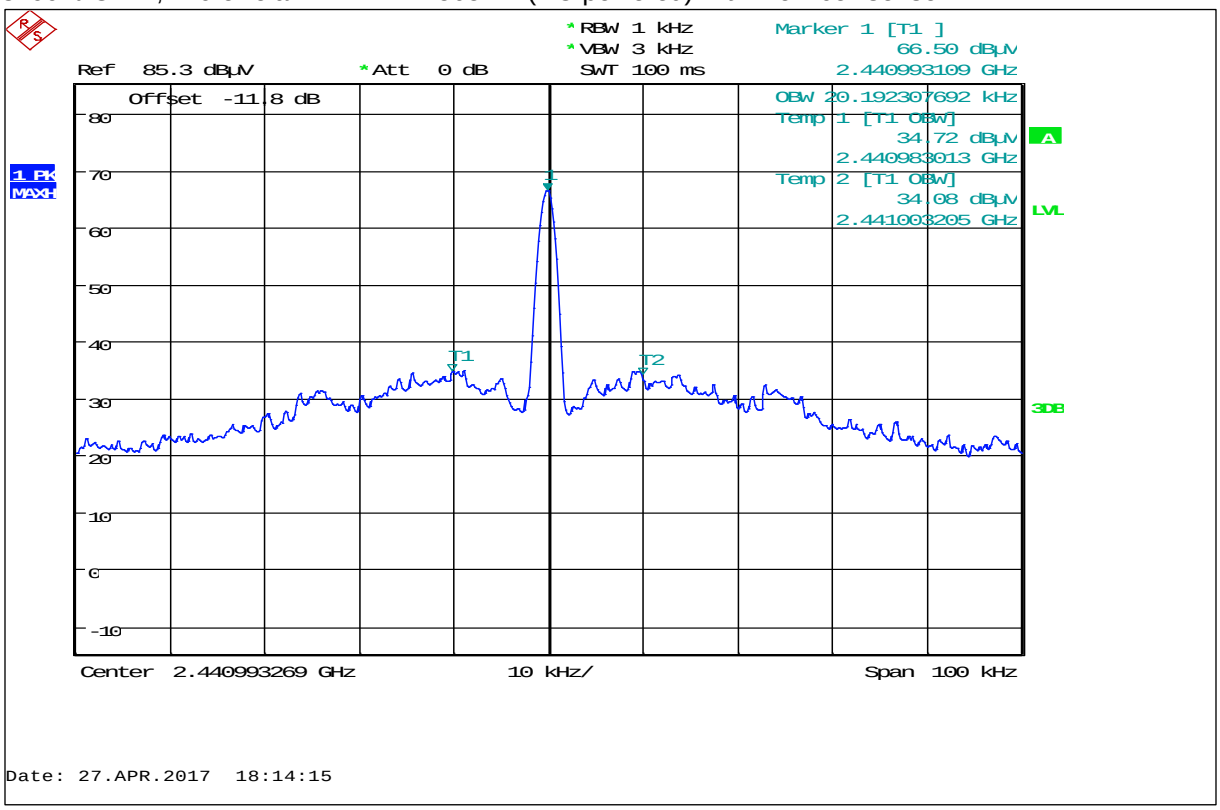
Plot 6: 99% OBW, MicroPolar Brix ++ LB 565-11 (AC powered) with Flow cell sensor



Plot 7: 99% OBW, MicroPolar Brix ++ LB 565-22 (DC powered) with Tank sensor



Plot 8: 99% OBW, MicroPolar Brix ++ LB 565-22 (DC powered) with Flow cell sensor



10.3 Field strength of emissions (radiated spurious)

Description:

Measurement of the radiated spurious emissions in transmit mode.

Measurement:

Measurement parameter	
Detector:	Peak / Quasi Peak
Sweep time:	Auto
Video bandwidth:	Auto
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz
Frequency range:	30 MHz to 100 GHz
Trace-Mode:	Max Hold

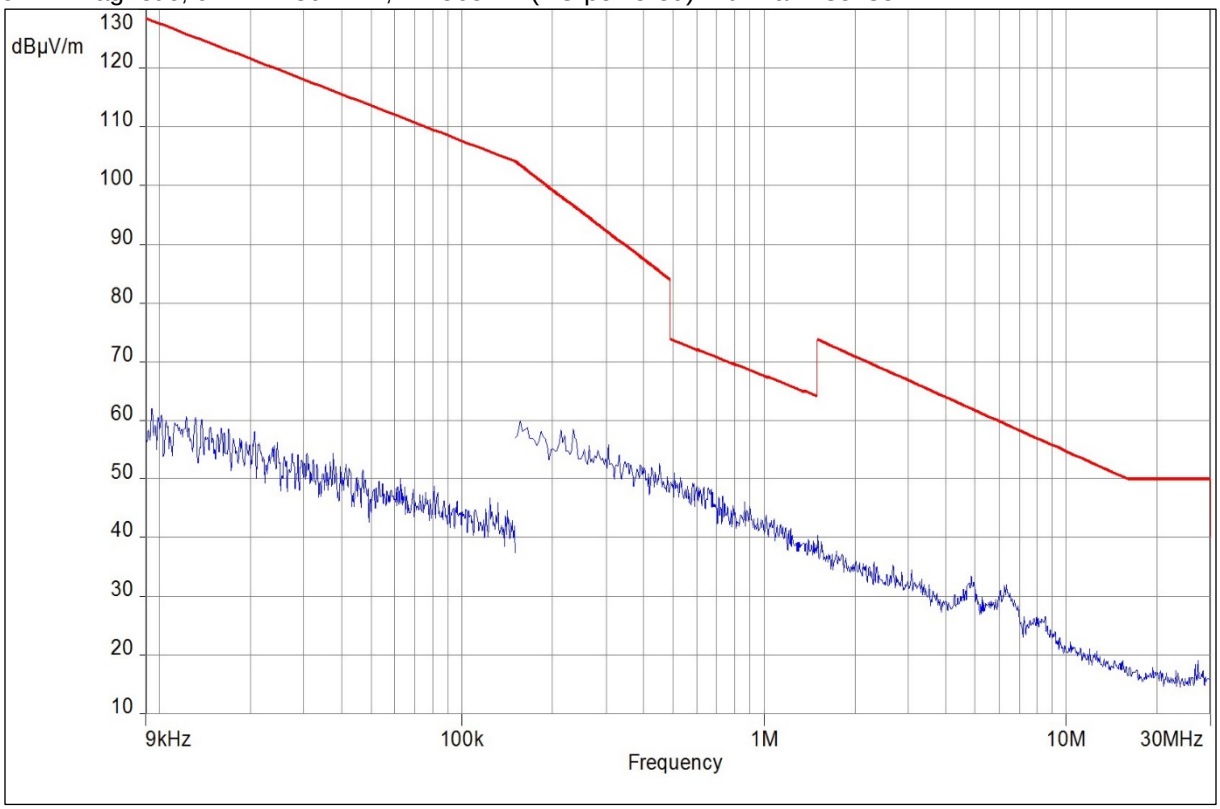
Limits:

FCC		IC
CFR Part 15.209(a)		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

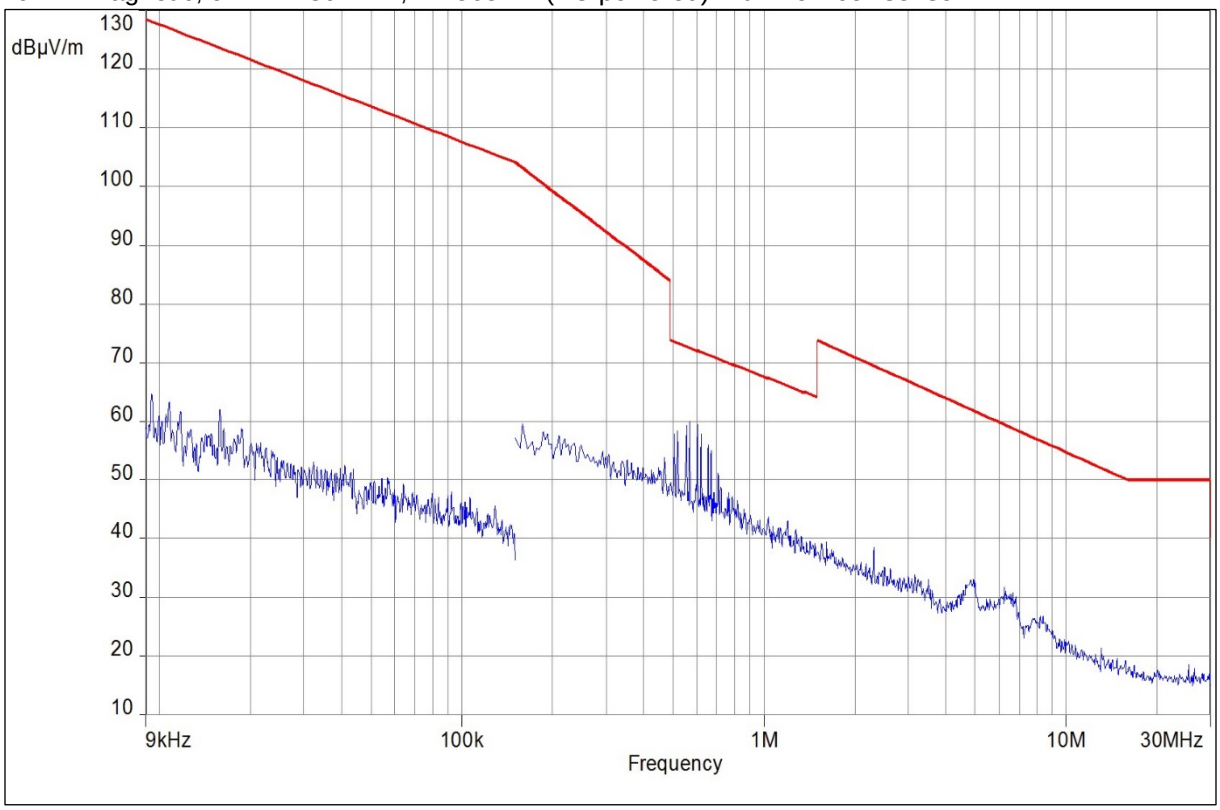
Results:

TX Spurious Emissions Radiated [dBµV/m]								
LB 565-11 (AC powered)			LB 565-12 (DC powered)			-/-		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
See Plots			See Plots			-/-		
Measurement uncertainty			± 3 dB					

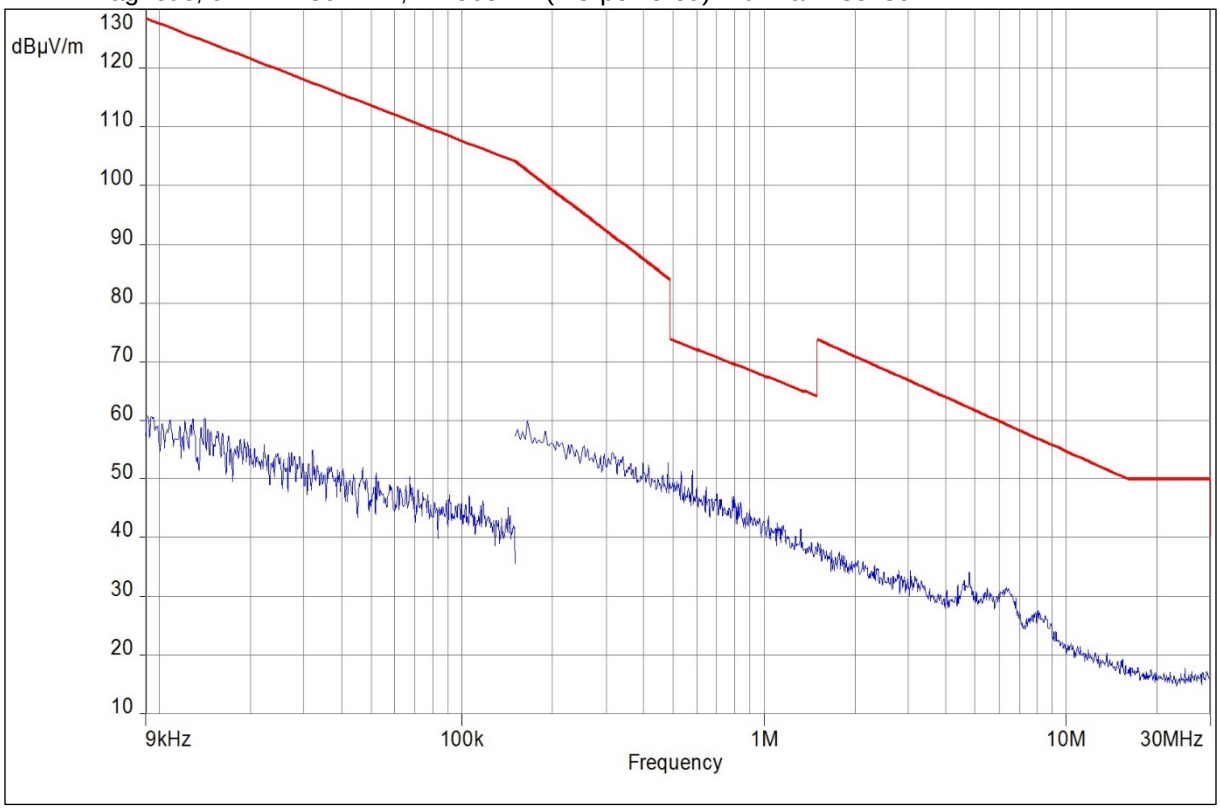
Plot 9: TX Magnetic, 9 kHz – 30 MHz, LB 565-11 (AC powered) with Tank sensor



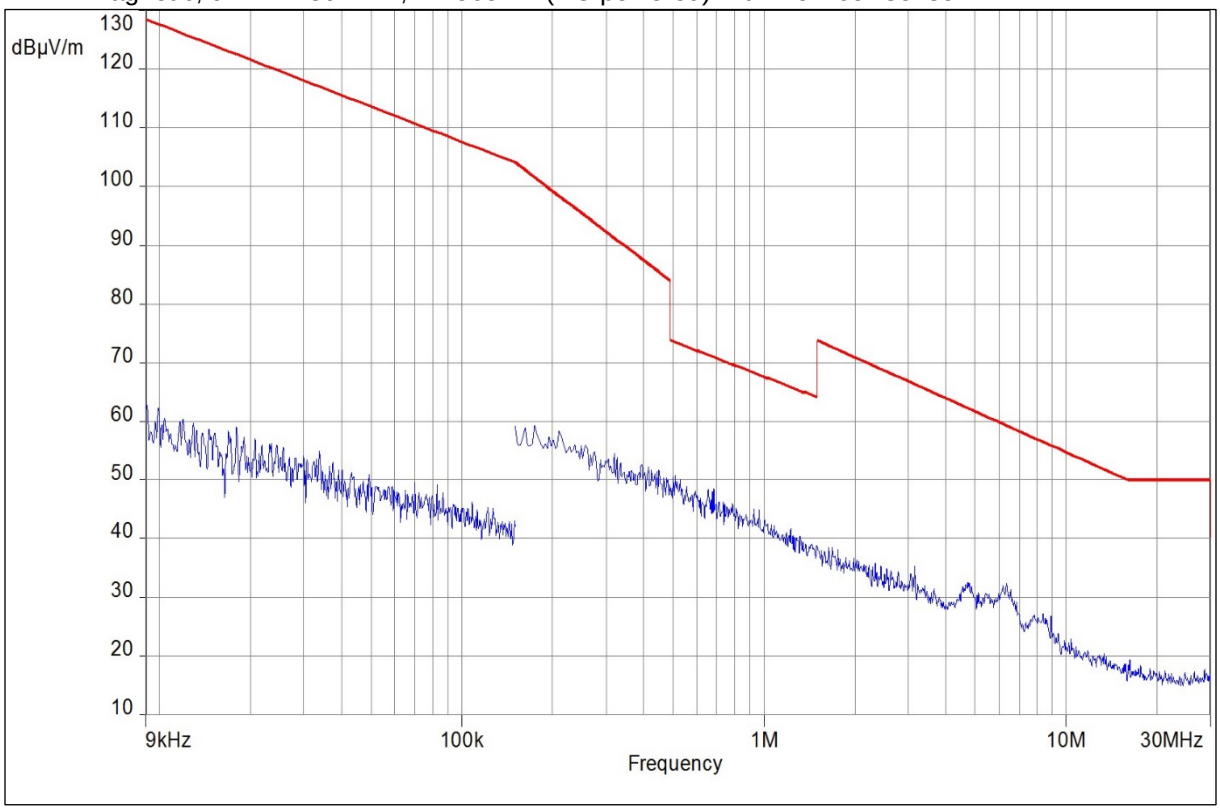
Plot 10: TX Magnetic, 9 kHz – 30 MHz, LB 565-11 (AC powered) with Flow cell sensor



Plot 11: TX Magnetic, 9 kHz – 30 MHz, LB 565-12 (DC powered) with Tank sensor



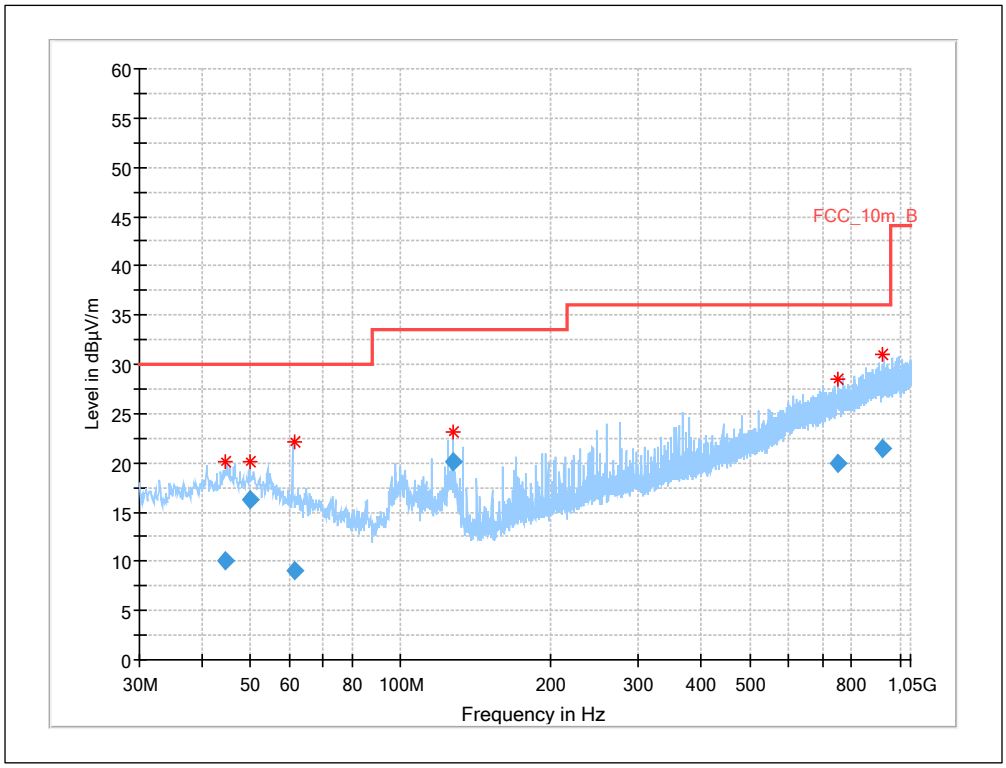
Plot 12: TX Magnetic, 9 kHz – 30 MHz, LB 565-12 (DC powered) with Flow cell sensor



Plot 13: 30 MHz to 1 GHz, LB 565-11 (AC powered) with Tank sensor, horizontal / vertical polarization

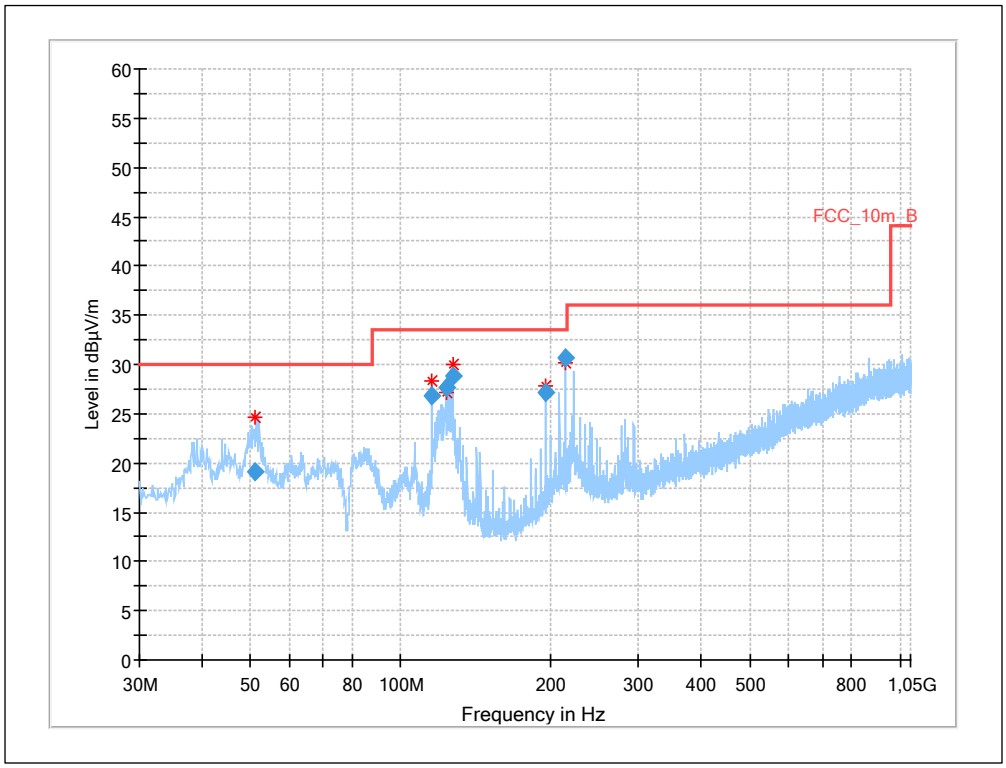
See plots below!

Plot 14: 30 MHz to 1 GHz, LB 565-11 (AC powered) with Flow cell sensor, horizontal / vertical polarization (115 V AC / 60 Hz; no further connections, grounded)



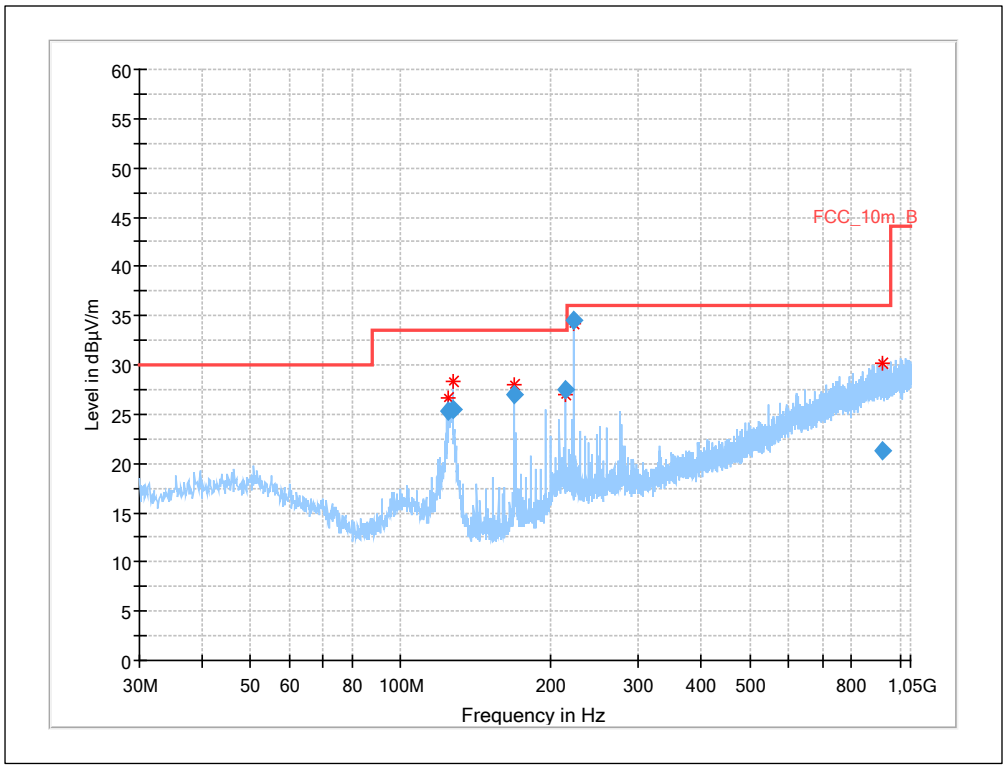
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
44.541900	10.08	30.00	19.92	1000.0	120.000	103.0	H	255.0	13.6
50.011650	16.28	30.00	13.72	1000.0	120.000	101.0	V	8.0	13.7
61.326000	9.09	30.00	20.91	1000.0	120.000	179.0	V	330.0	11.6
127.496100	20.14	33.50	13.36	1000.0	120.000	100.0	V	30.0	9.7
749.349900	19.90	36.00	16.10	1000.0	120.000	200.0	V	285.0	22.7
925.949250	21.37	36.00	14.63	1000.0	120.000	400.0	H	240.0	24.3

Plot 15: 30 MHz to 1 GHz, LB 565-12 (DC powered) with Tank sensor, horizontal / vertical polarization (24 V DC; Ferrite on TP100 cable)



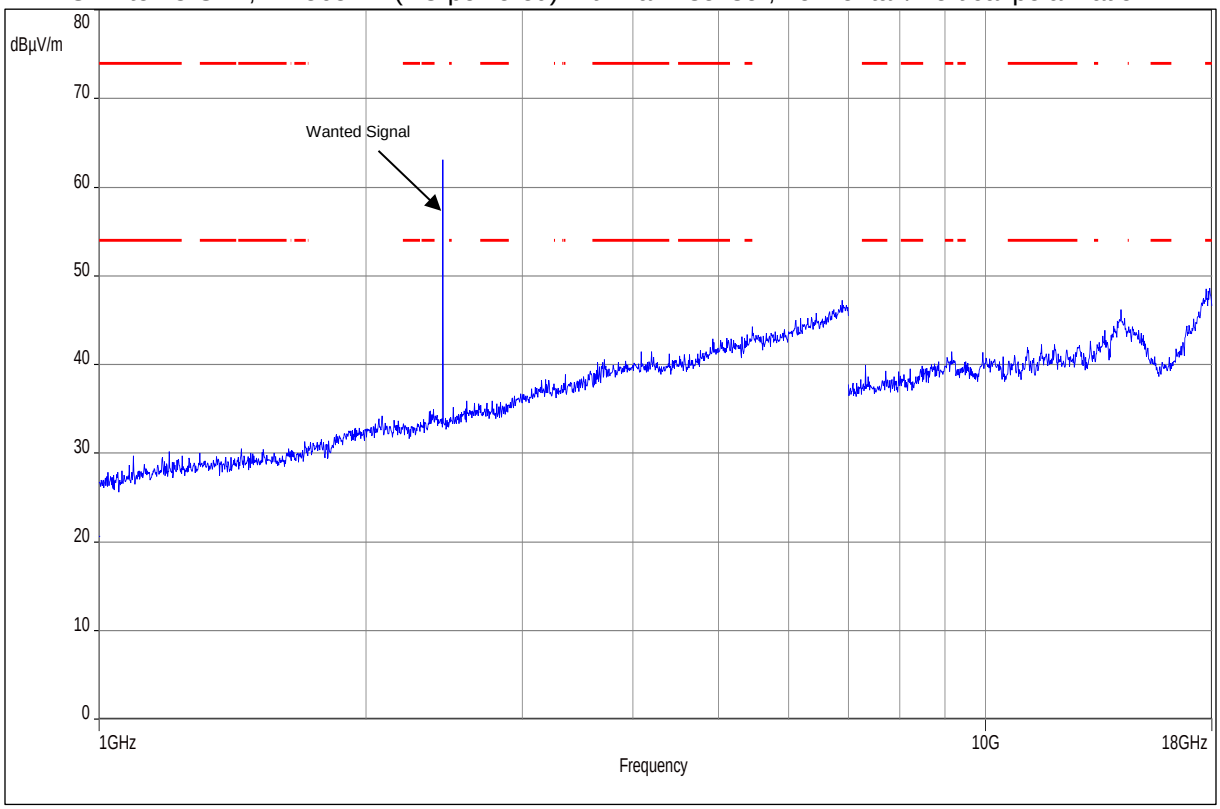
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
51.132300	19.16	30.00	10.84	1000.0	120.000	100.0	V	285.0	13.6
115.558050	26.89	33.50	6.61	1000.0	120.000	100.0	V	95.0	10.7
123.252150	27.73	33.50	5.77	1000.0	120.000	100.0	V	121.0	10.0
127.506900	28.81	33.50	4.69	1000.0	120.000	100.0	V	120.0	9.7
195.531900	27.22	33.50	6.28	1000.0	120.000	100.0	V	210.0	11.7
213.335550	30.68	33.50	2.82	1000.0	120.000	100.0	V	240.0	12.3

Plot 16: 30 MHz to 1 GHz, LB 565-12 (DC powered) with Flow cell sensor, horizontal / vertical polarization (24 V DC; no further connections, grounded)

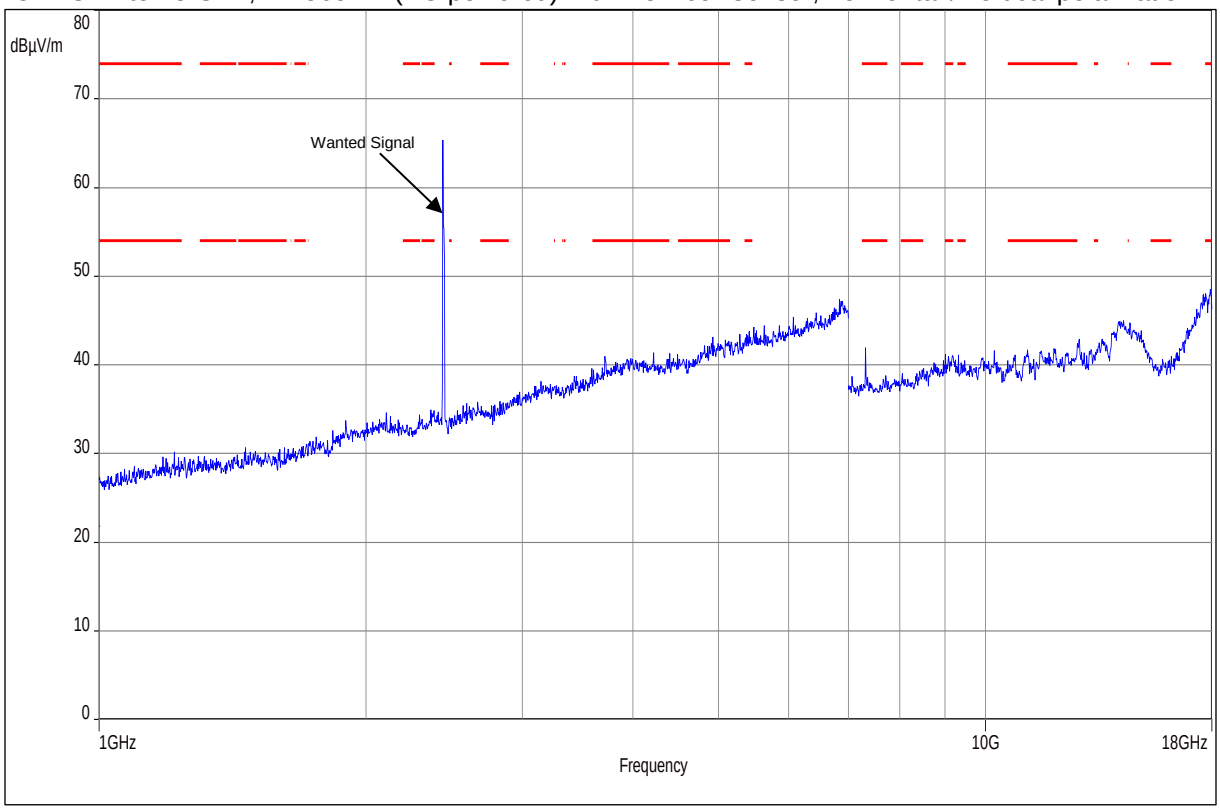


Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
124.439550	25.37	33.50	8.13	1000.0	120.000	103.0	V	195.0	9.9
127.499550	25.44	33.50	8.06	1000.0	120.000	98.0	V	225.0	9.7
168.889950	26.99	33.50	6.51	1000.0	120.000	98.0	V	-3.0	10.2
213.338250	27.54	33.50	5.96	1000.0	120.000	348.0	V	-3.0	12.3
222.228600	34.52	36.00	1.48	1000.0	120.000	349.0	V	-2.0	12.6
923.996550	21.26	36.00	14.74	1000.0	120.000	400.0	H	-50.0	24.3

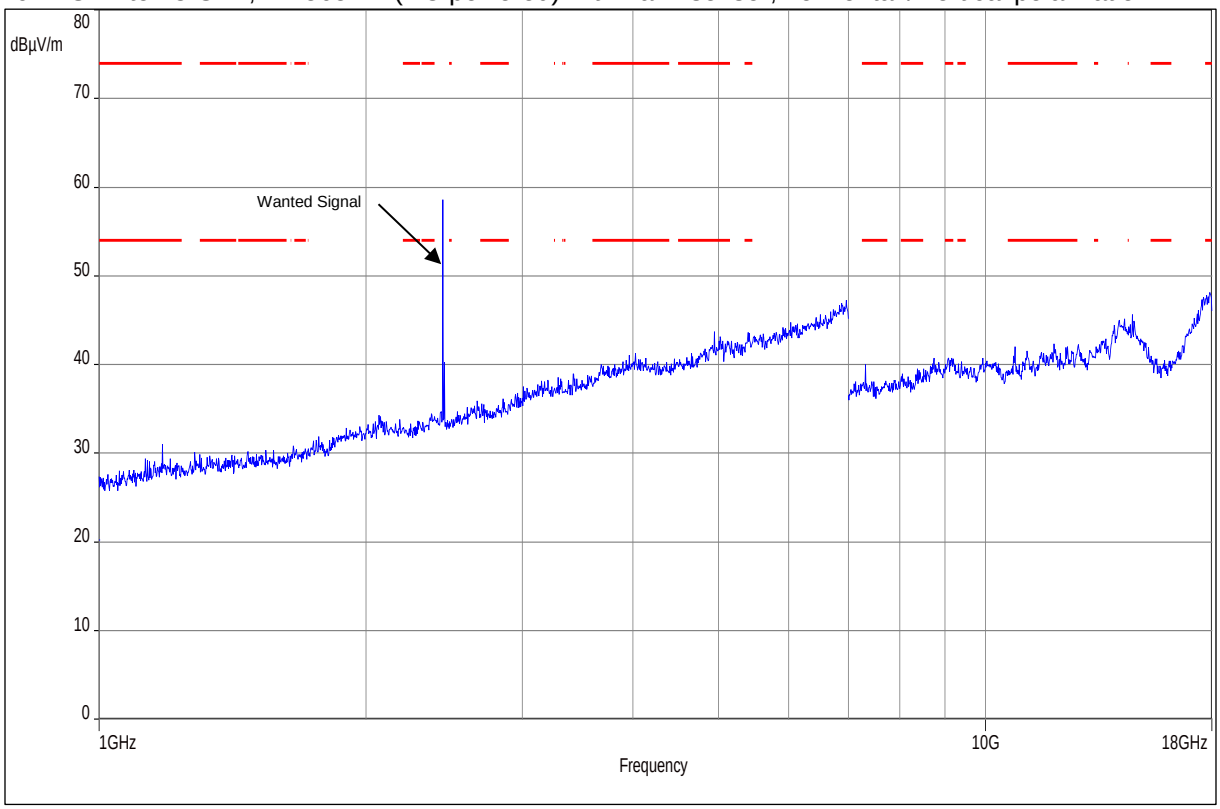
Plot 17: 1 GHz to 18 GHz, LB 565-11 (AC powered) with Tank sensor, horizontal / vertical polarization



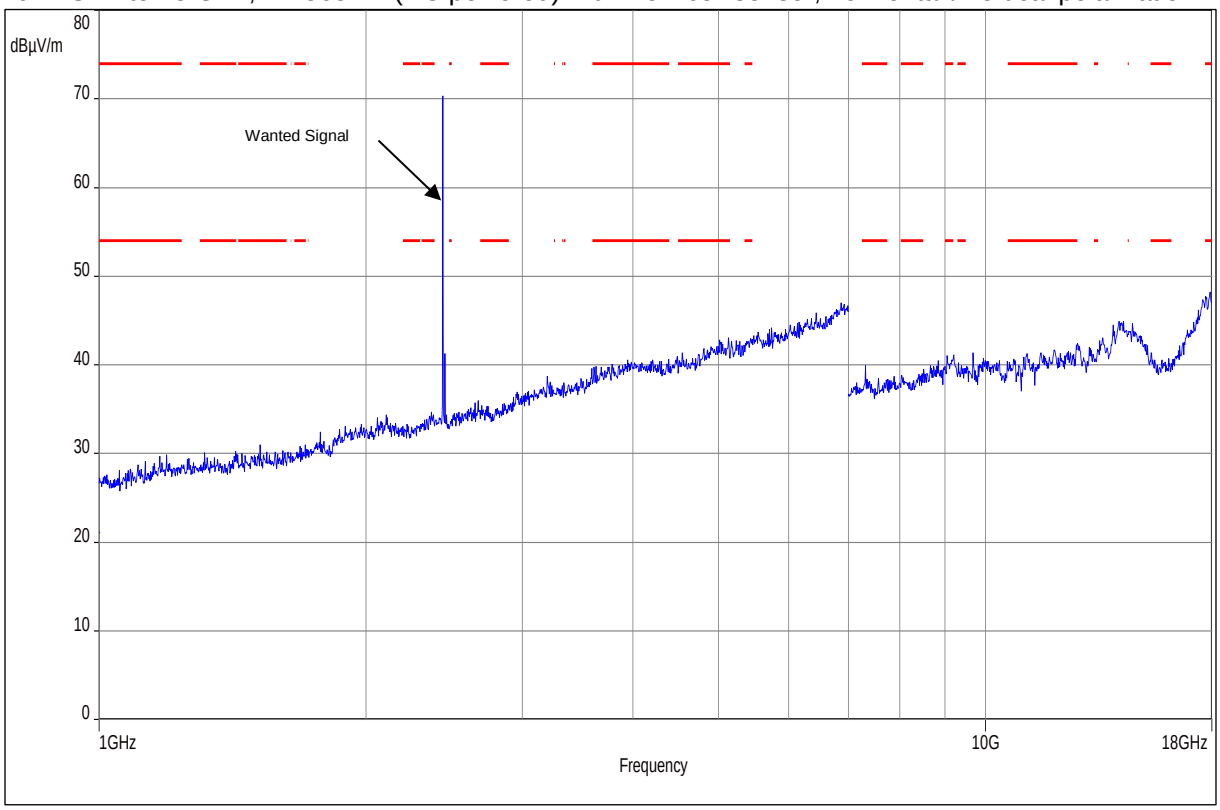
Plot 18: 1 GHz to 18 GHz, LB 565-11 (AC powered) with Flow cell sensor, horizontal / vertical polarization



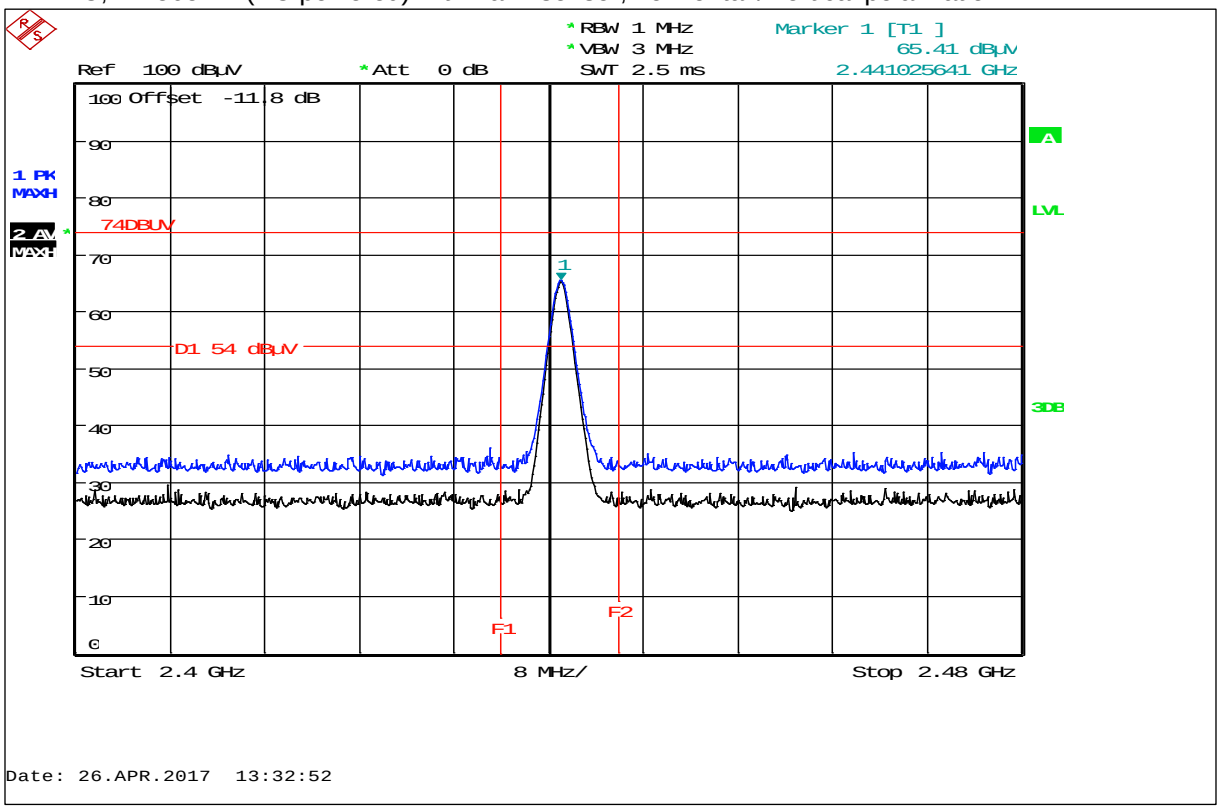
Plot 19: 1 GHz to 18 GHz, LB 565-12 (DC powered) with Tank sensor, horizontal / vertical polarization



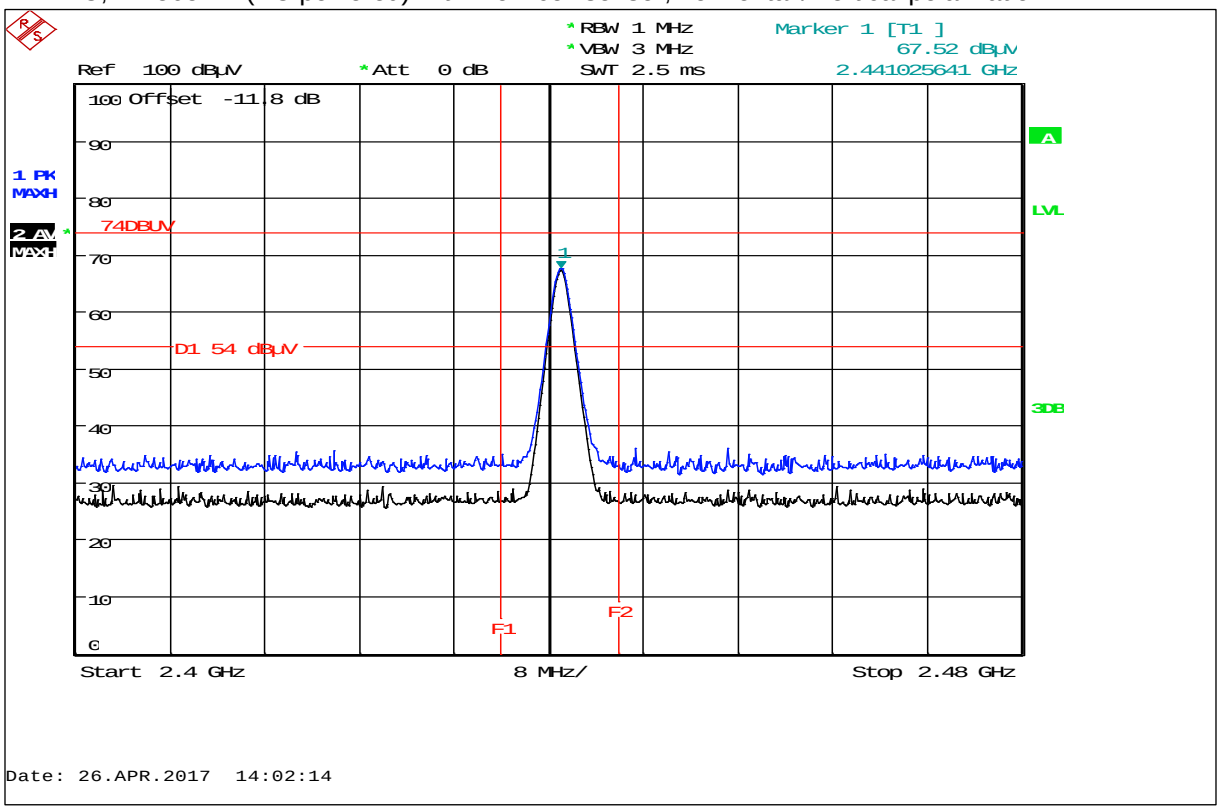
Plot 20: 1 GHz to 18 GHz, LB 565-22 (DC powered) with Flow cell sensor, horizontal / vertical polarization



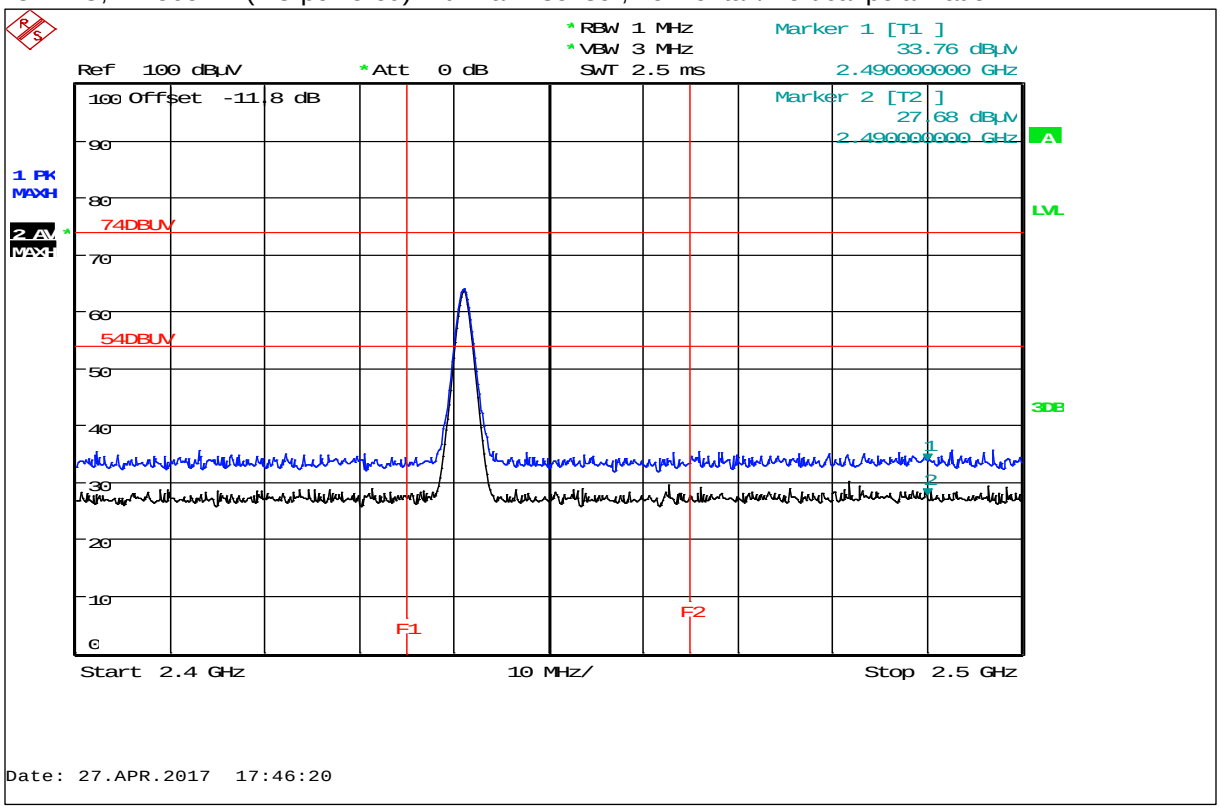
Plot 21: BEC, LB 565-11 (AC powered) with Tank sensor, horizontal / vertical polarization



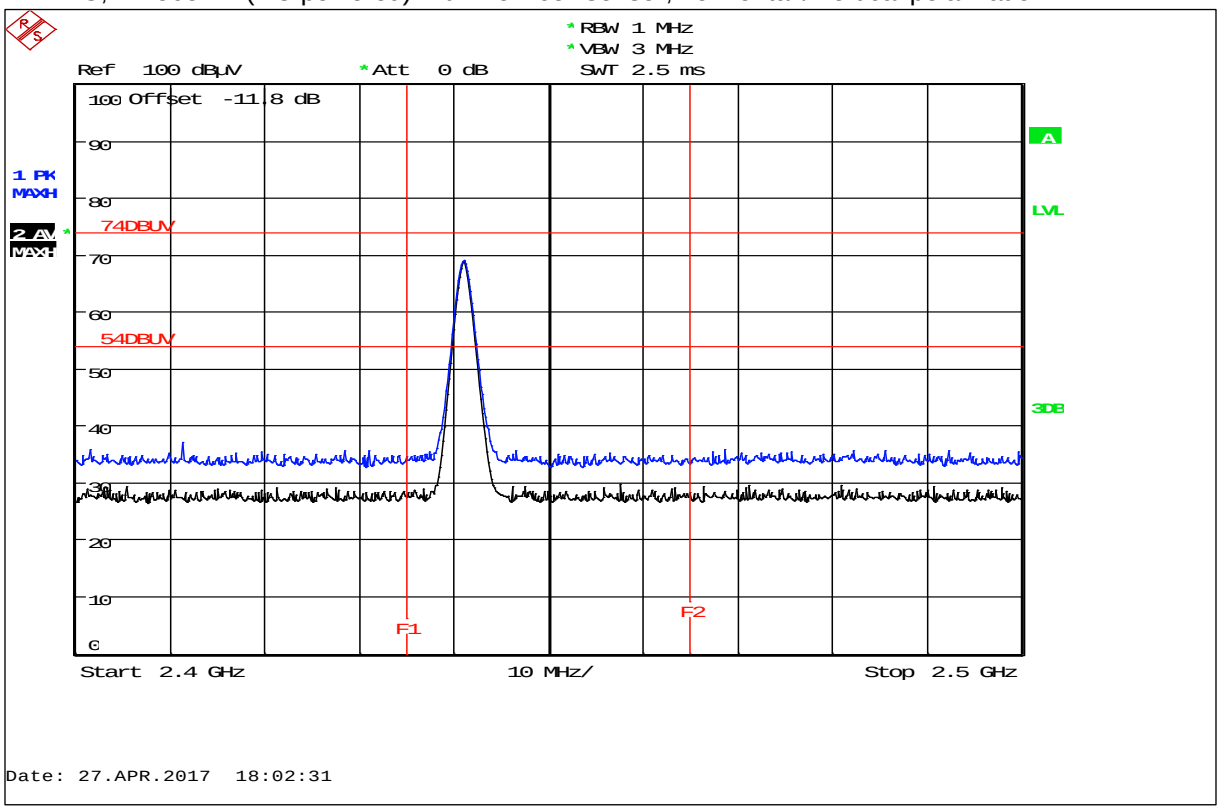
Plot 22: BEC, LB 565-11 (AC powered) with Flow cell sensor, horizontal / vertical polarization



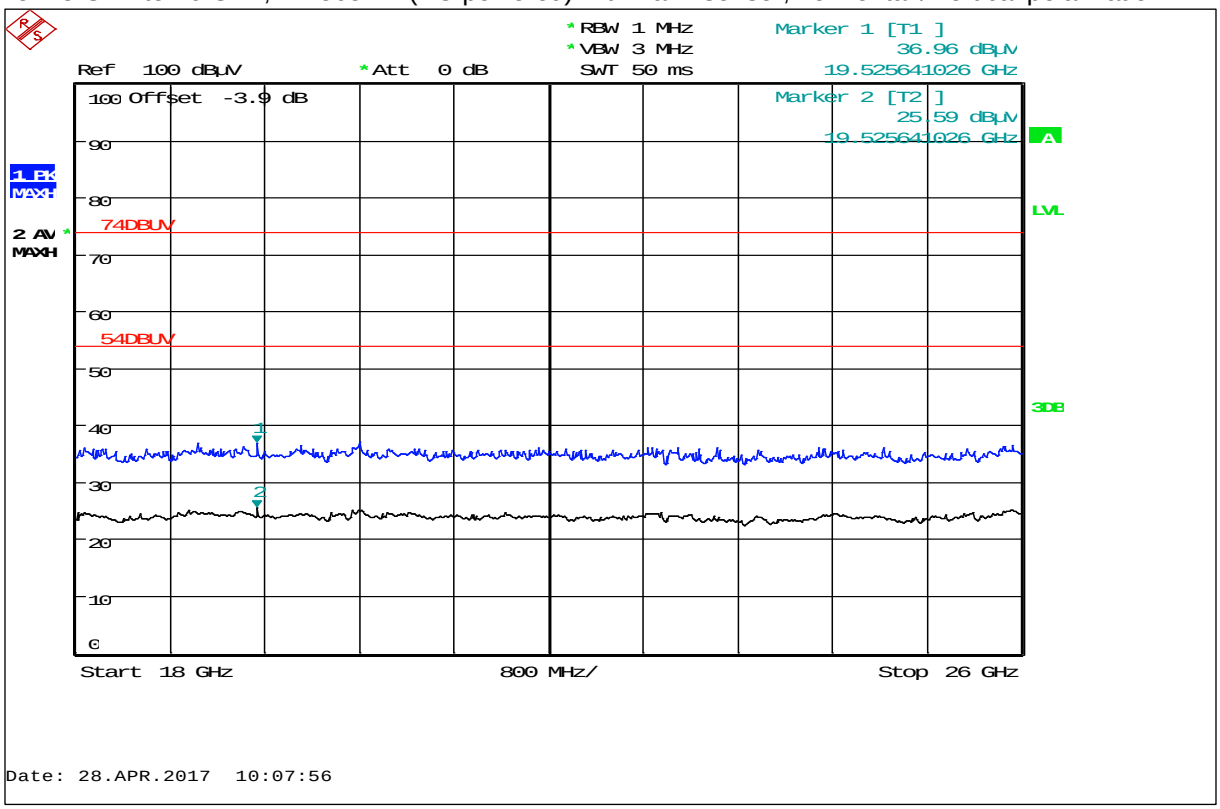
Plot 23: BEC, LB 565-12 (DC powered) with Tank sensor, horizontal / vertical polarization



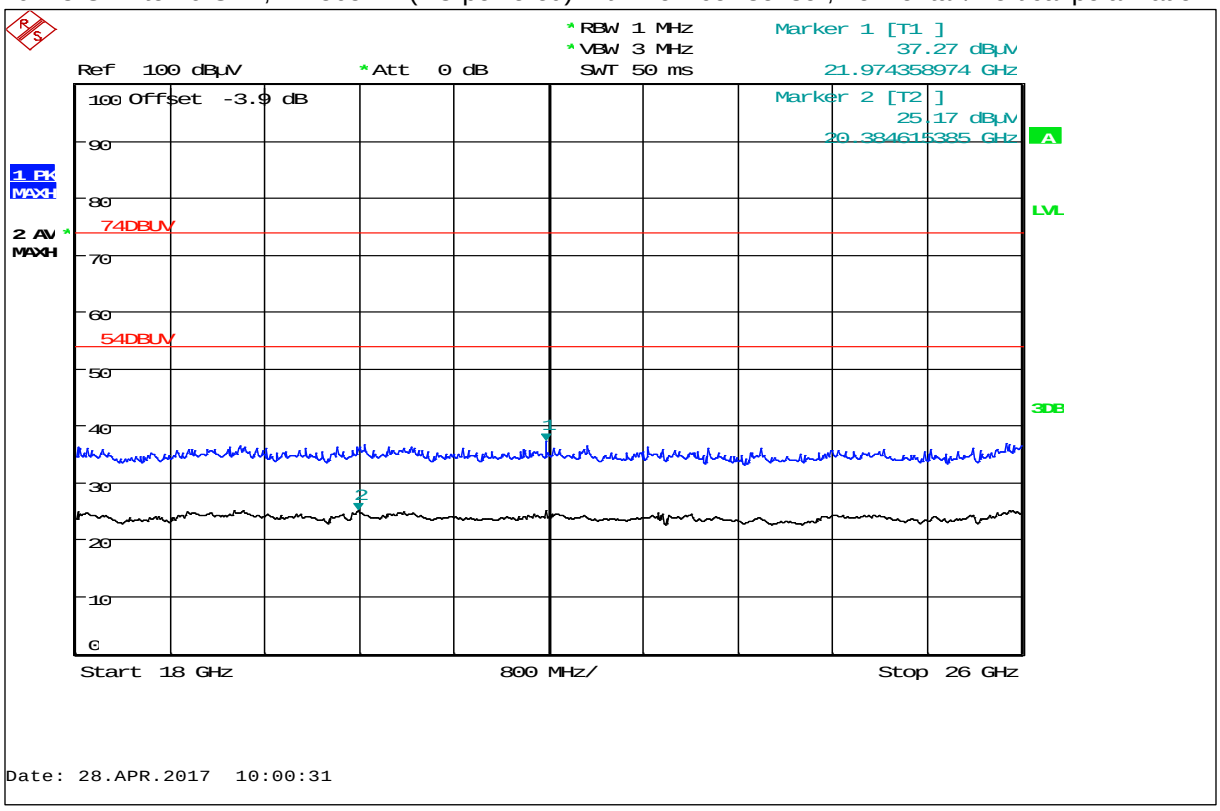
Plot 24: BEC, LB 565-12 (DC powered) with Flow cell sensor, horizontal / vertical polarization



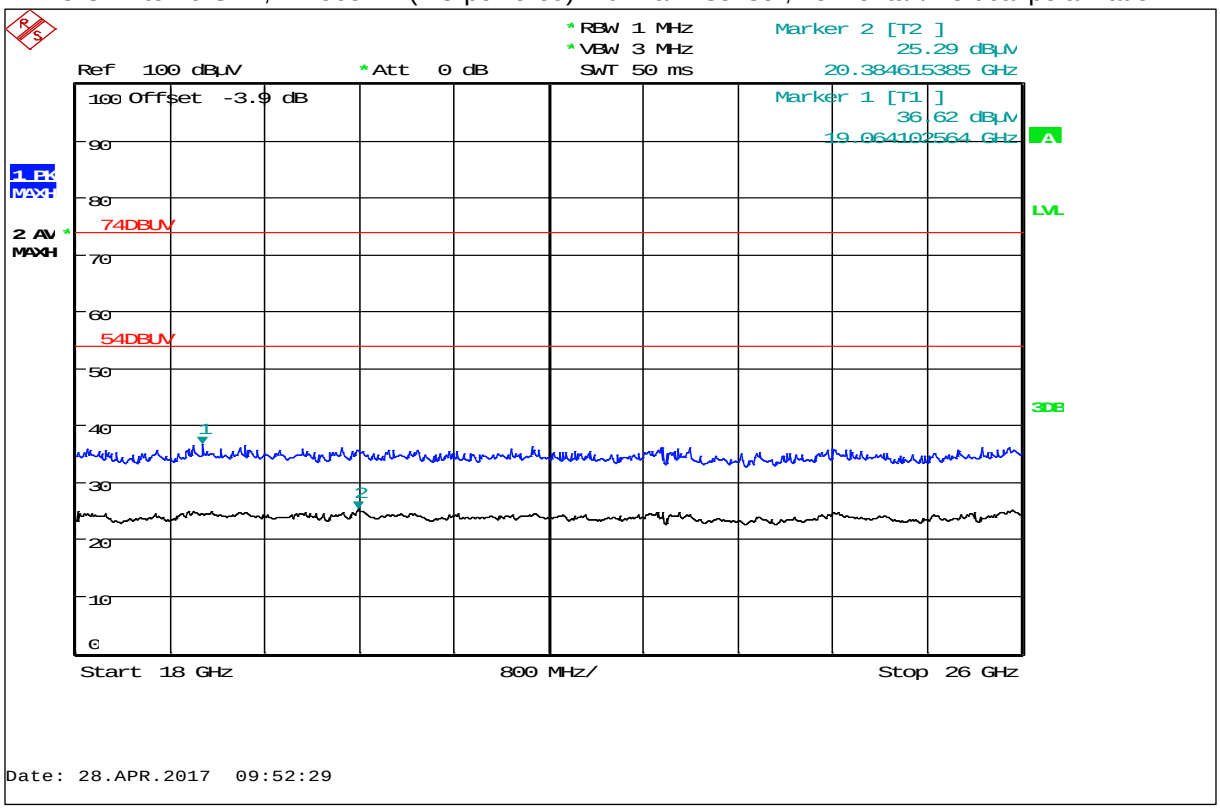
Plot 25: 18 GHz to 26 GHz, LB 565-11 (AC powered) with Tank sensor, horizontal / vertical polarization



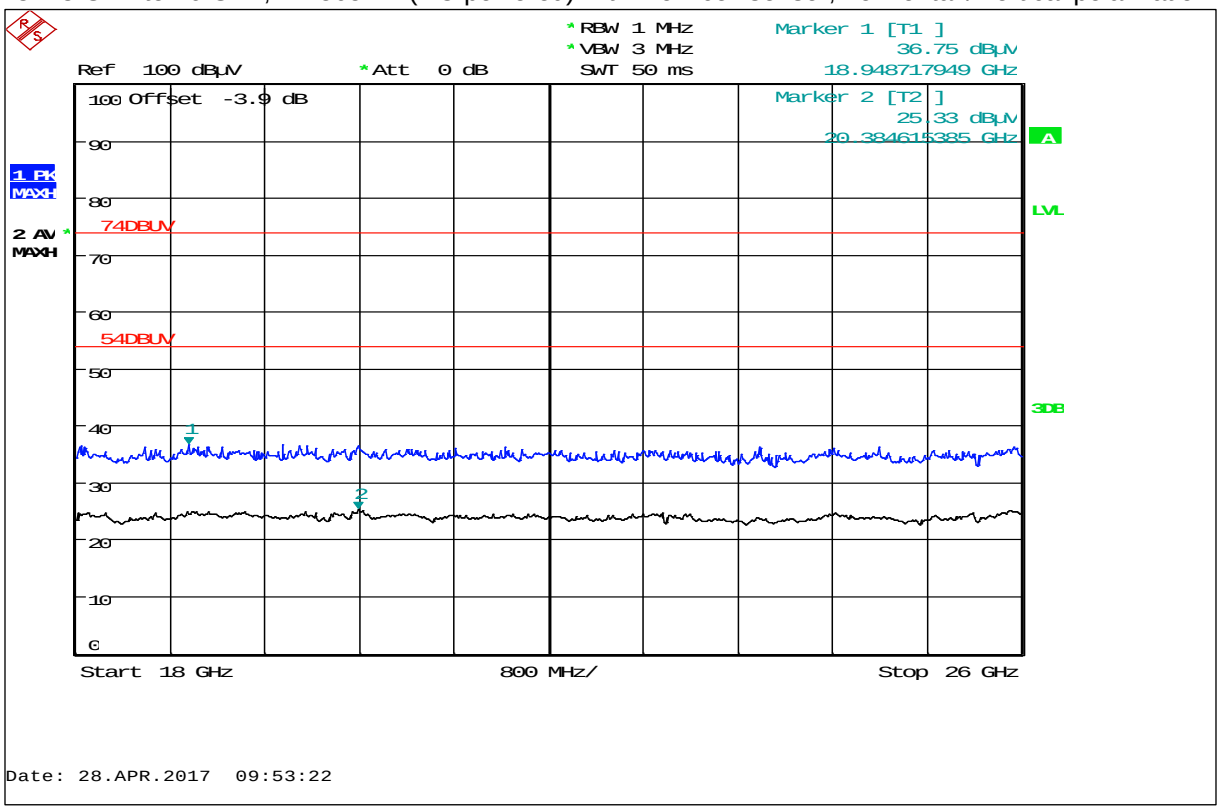
Plot 26: 18 GHz to 26 GHz, LB 565-11 (AC powered) with Flow cell sensor, horizontal / vertical polarization



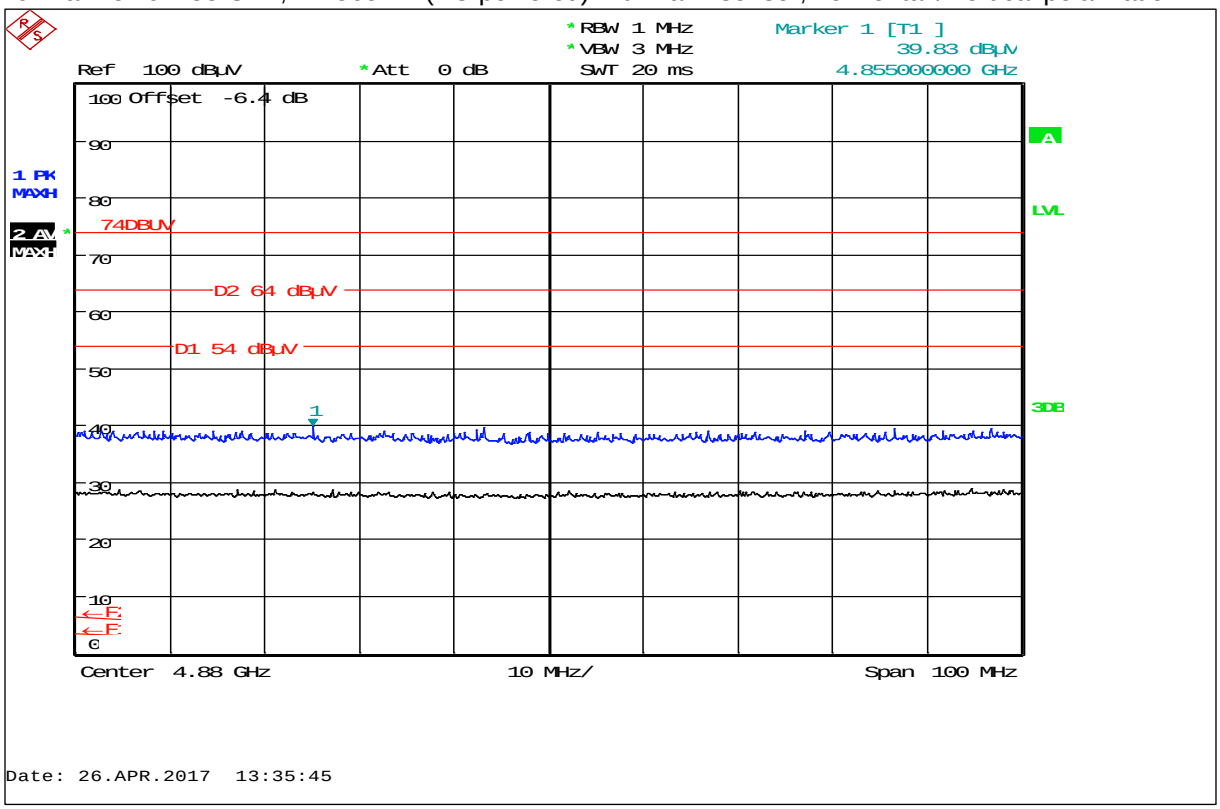
Plot 27: 18 GHz to 26 GHz, LB 565-12 (DC powered) with Tank sensor, horizontal / vertical polarization



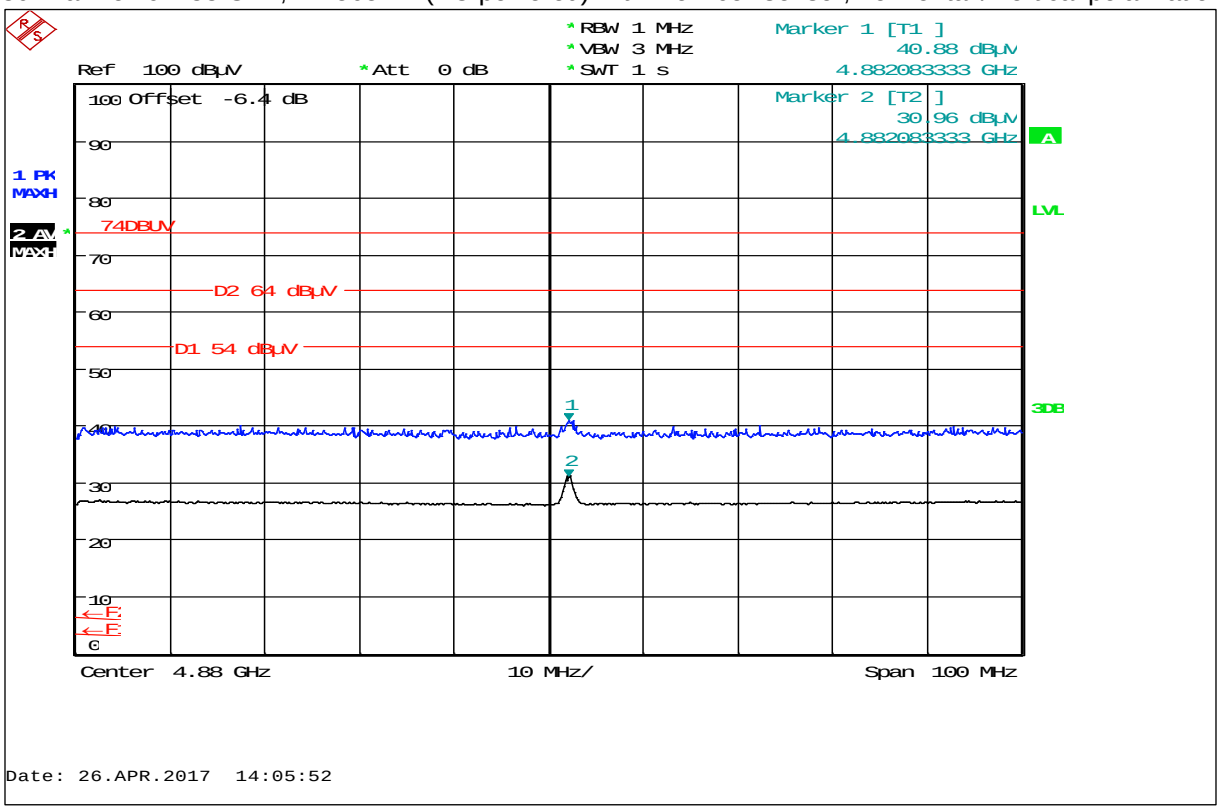
Plot 28: 18 GHz to 26 GHz, LB 565-12 (DC powered) with Flow cell sensor, horizontal / vertical polarization



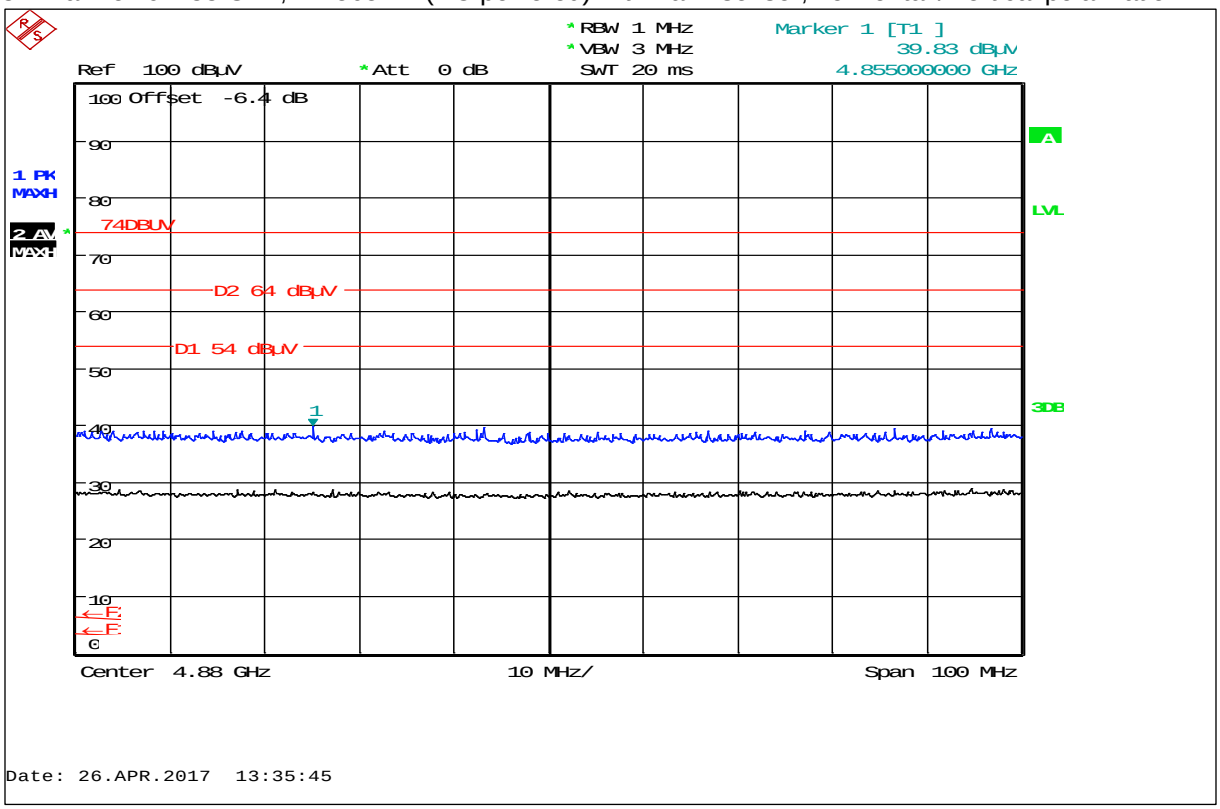
Plot 29: Harmonic 4.88 GHz, LB 565-11 (AC powered) with Tank sensor, horizontal / vertical polarization



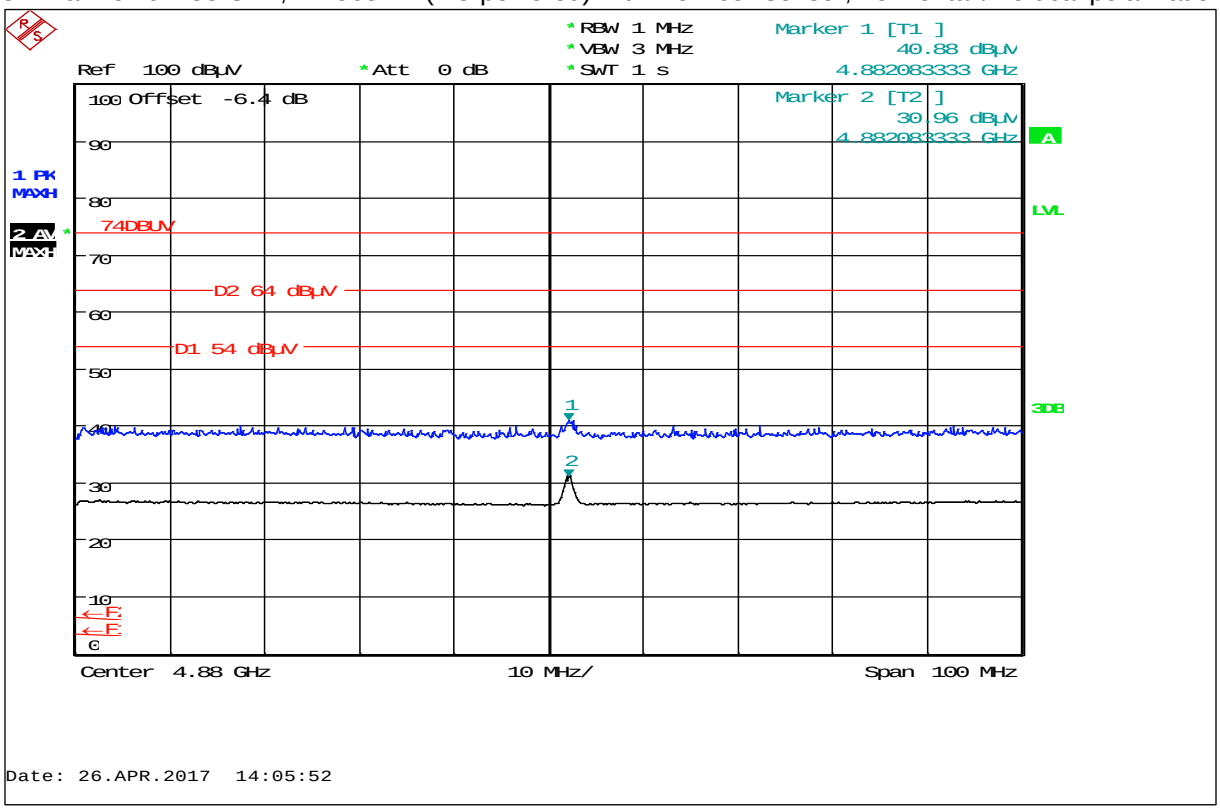
Plot 30: Harmonic 4.88 GHz, LB 565-11 (AC powered) with Flow cell sensor, horizontal / vertical polarization



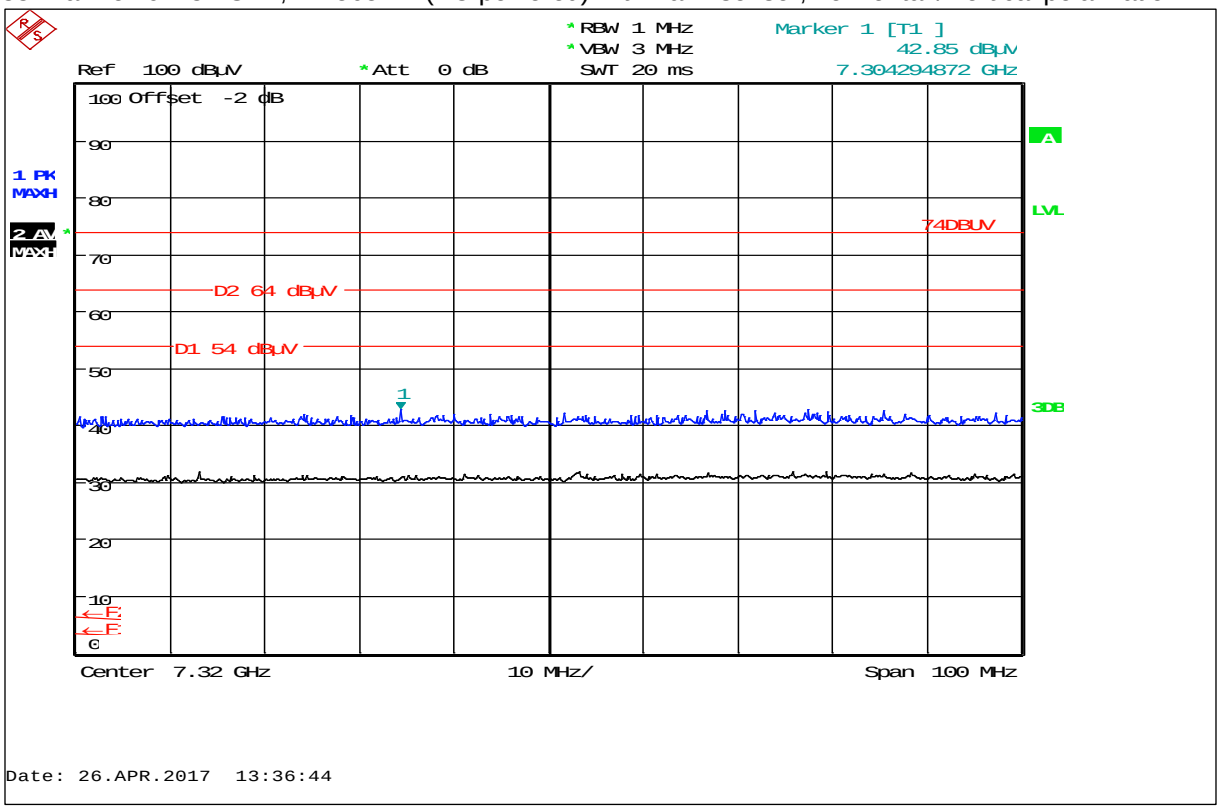
Plot 31: Harmonic 4.88 GHz, LB 565-12 (DC powered) with Tank sensor, horizontal / vertical polarization



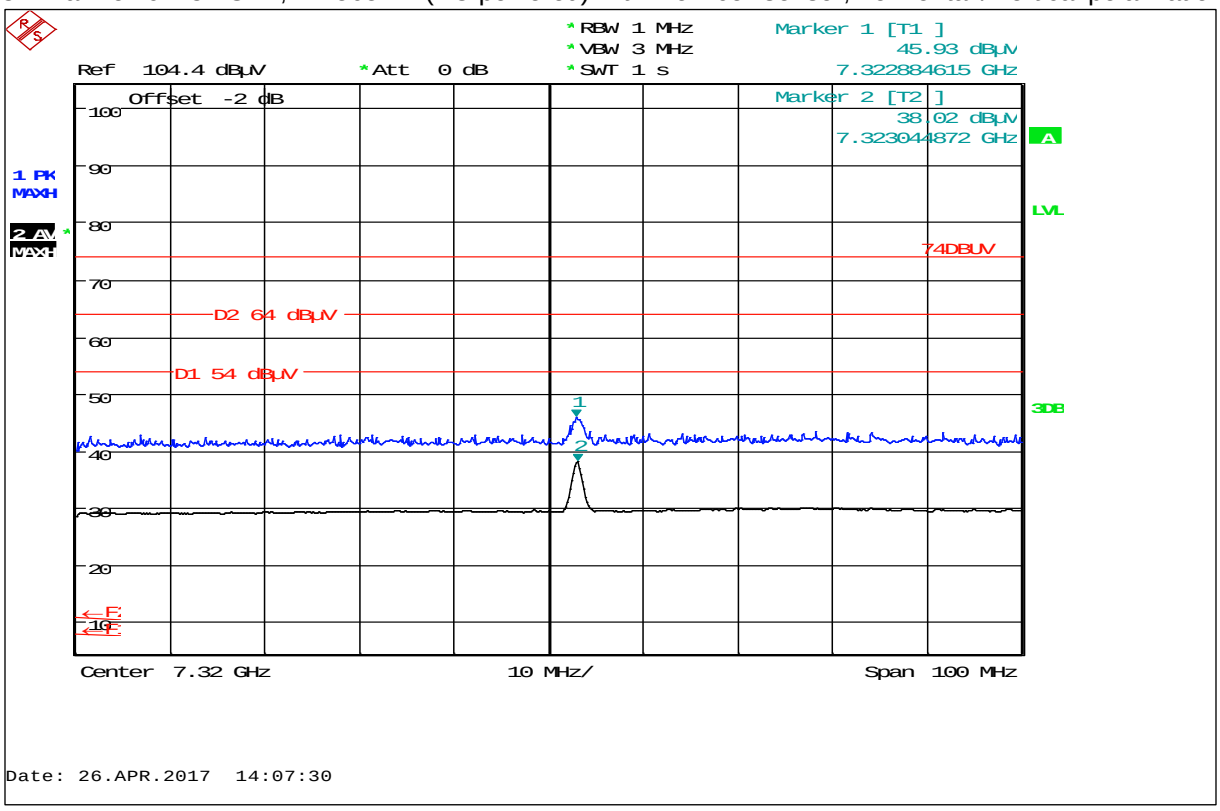
Plot 32: Harmonic 4.88 GHz, LB 565-12 (DC powered) with Flow cell sensor, horizontal / vertical polarization



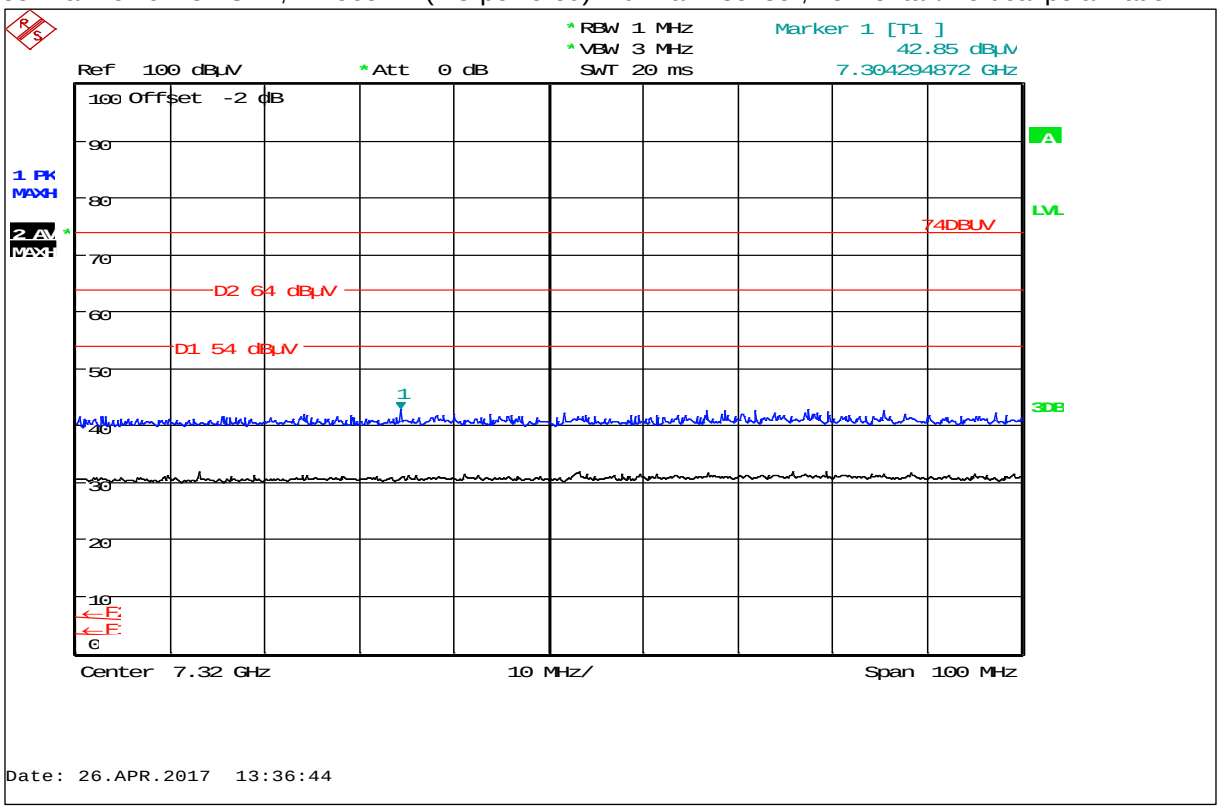
Plot 33: Harmonic 7.32 GHz, LB 565-11 (AC powered) with Tank sensor, horizontal / vertical polarization



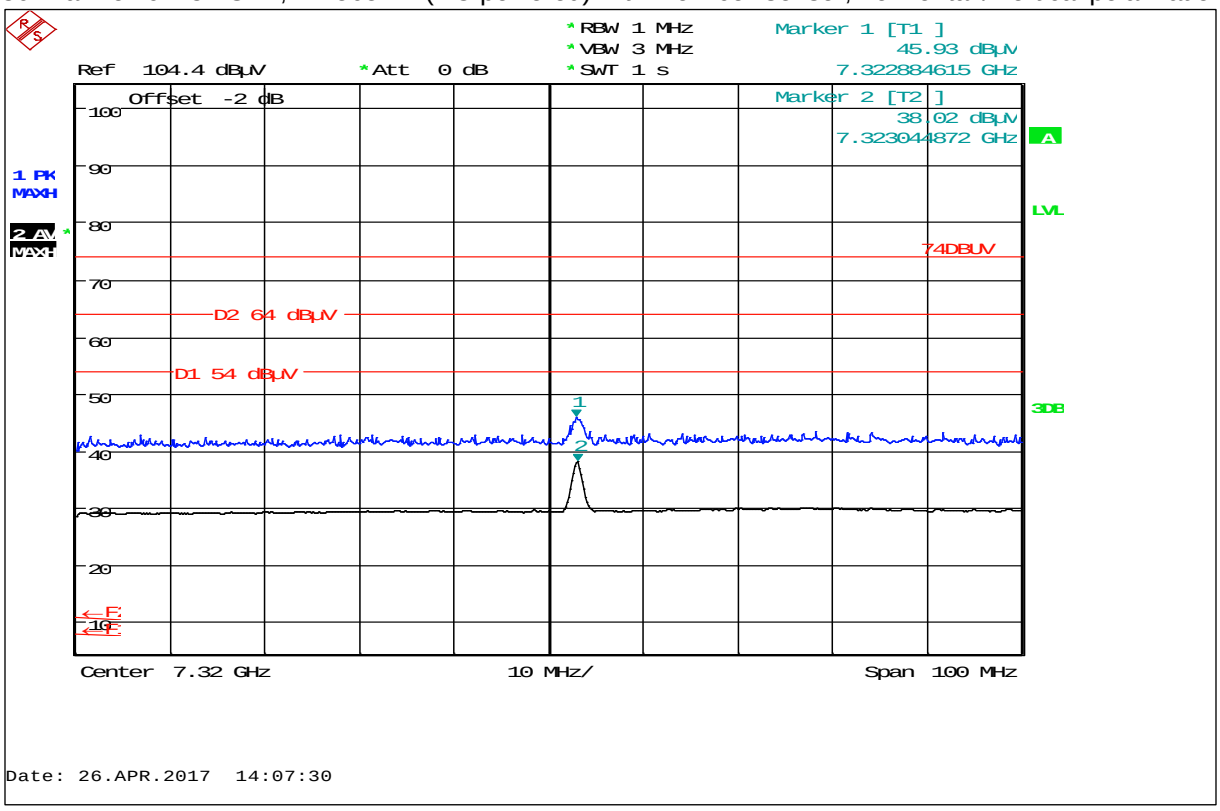
Plot 34: Harmonic 7.32 GHz, LB 565-11 (AC powered) with Flow cell sensor, horizontal / vertical polarization



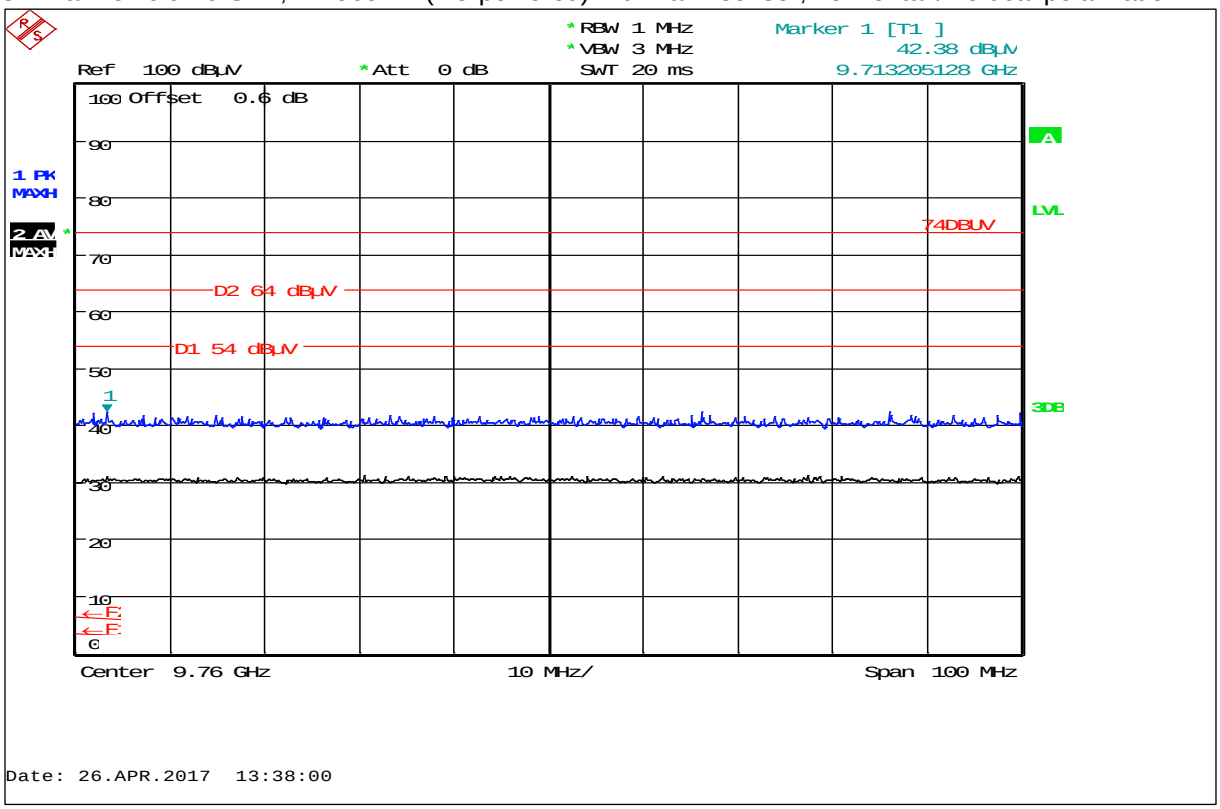
Plot 35: Harmonic 7.32 GHz, LB 565-12 (DC powered) with Tank sensor, horizontal / vertical polarization



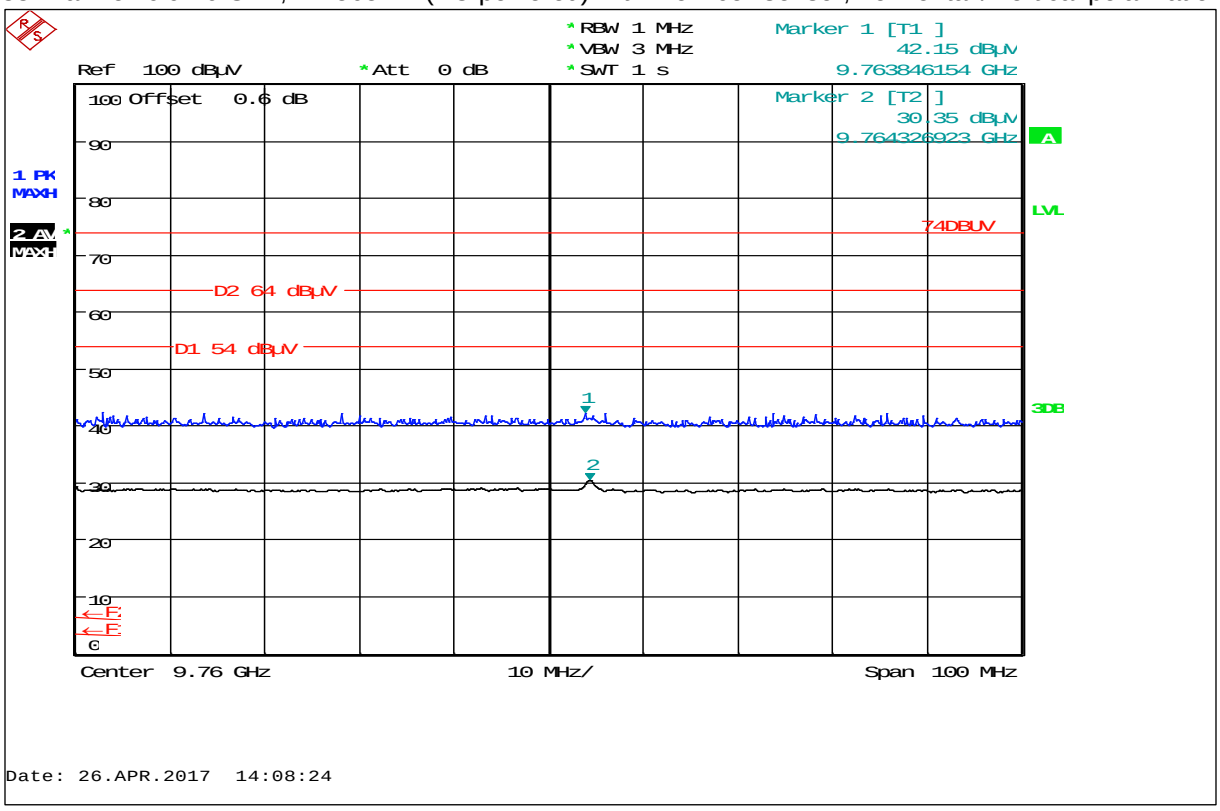
Plot 36: Harmonic 7.32 GHz, LB 565-12 (DC powered) with Flow cell sensor, horizontal / vertical polarization



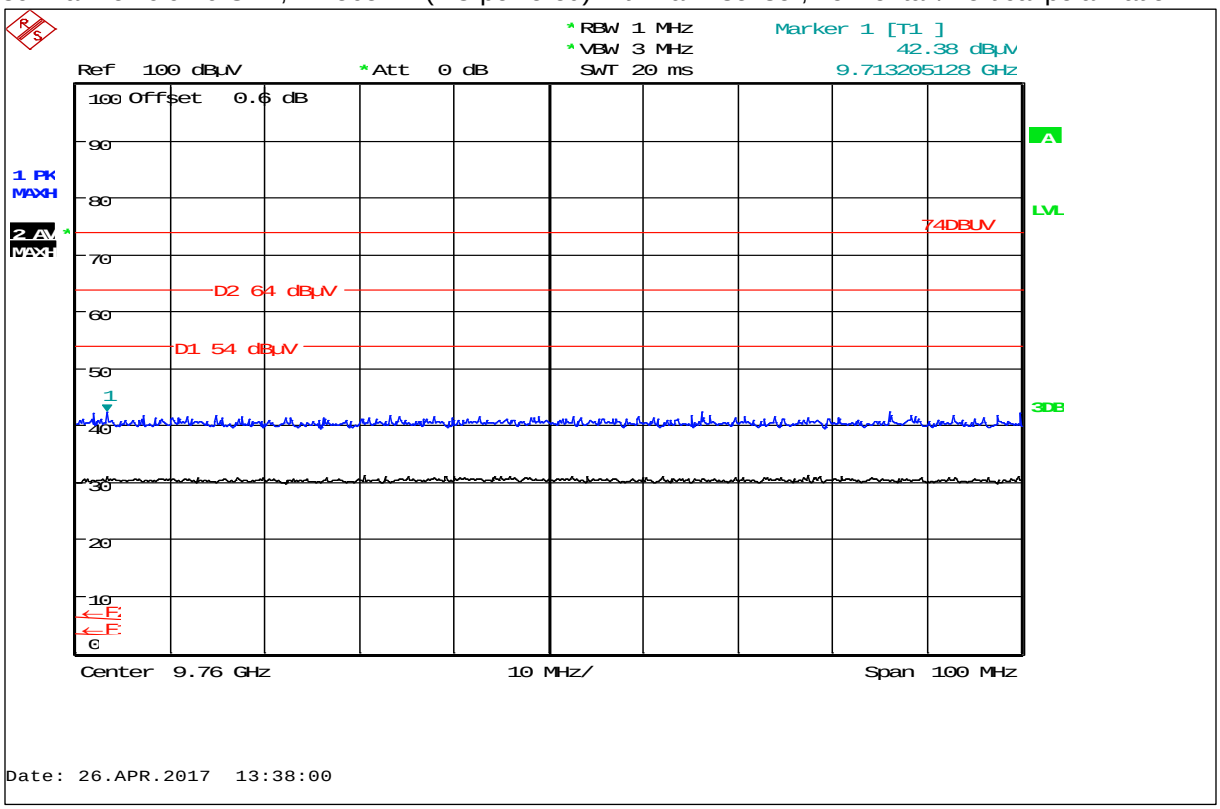
Plot 37: Harmonic 9.76 GHz, LB 565-11 (AC powered) with Tank sensor, horizontal / vertical polarization



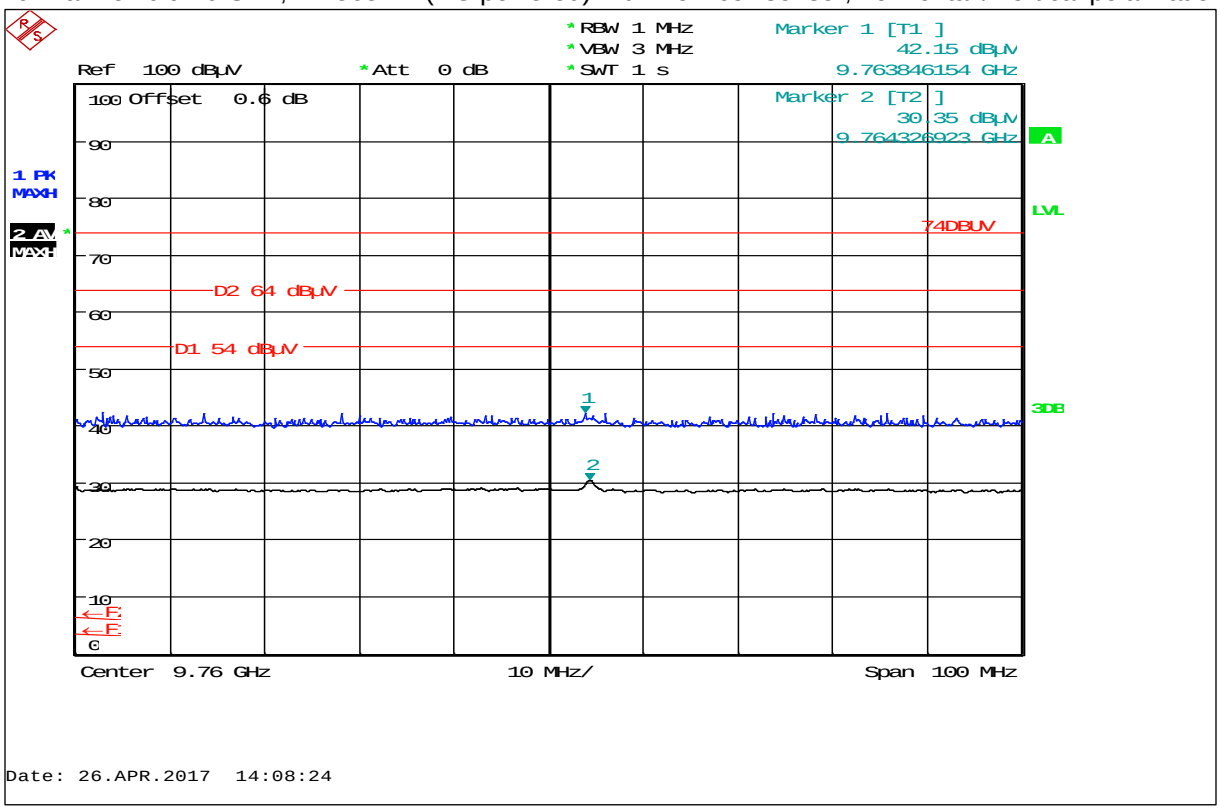
Plot 38: Harmonic 9.76 GHz, LB 565-11 (AC powered) with Flow cell sensor, horizontal / vertical polarization



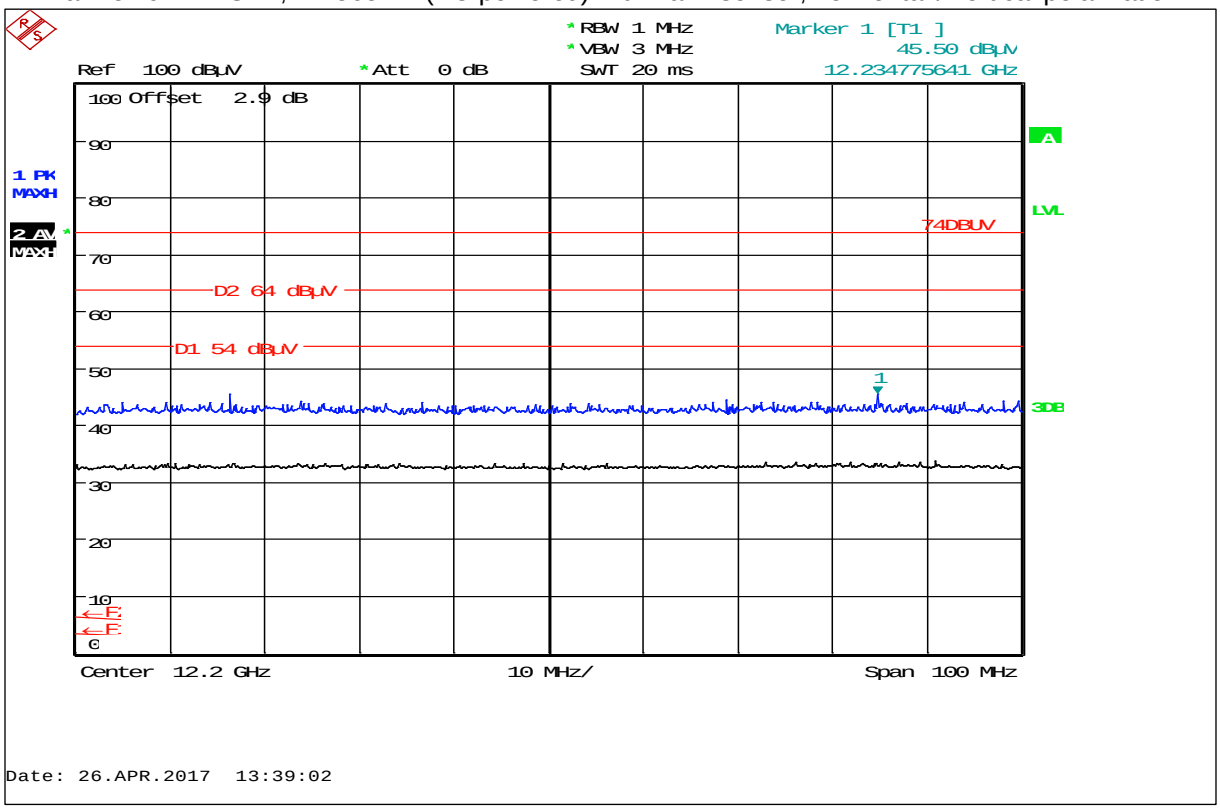
Plot 39: Harmonic 9.76 GHz, LB 565-12 (DC powered) with Tank sensor, horizontal / vertical polarization



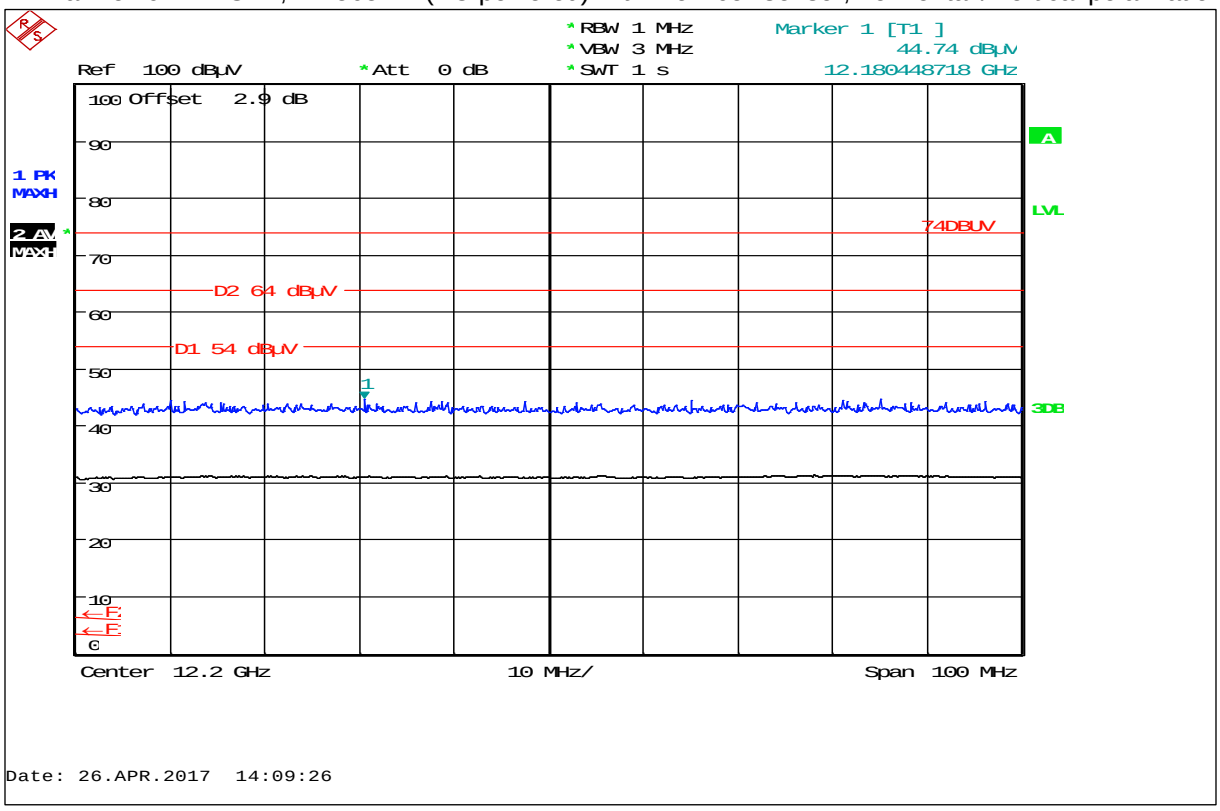
Plot 40: Harmonic 9.76 GHz, LB 565-12 (DC powered) with Flow cell sensor, horizontal / vertical polarization



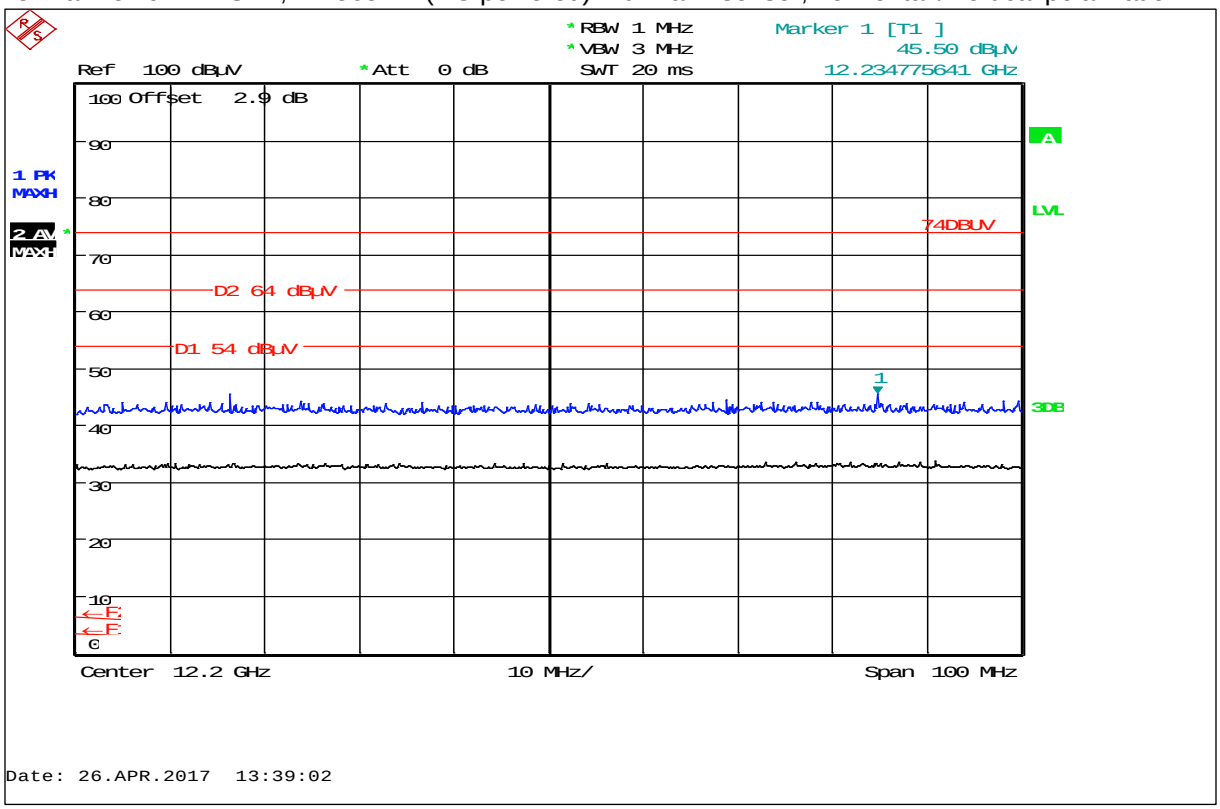
Plot 41: Harmonic 12.2 GHz, LB 565-11 (AC powered) with Tank sensor, horizontal / vertical polarization



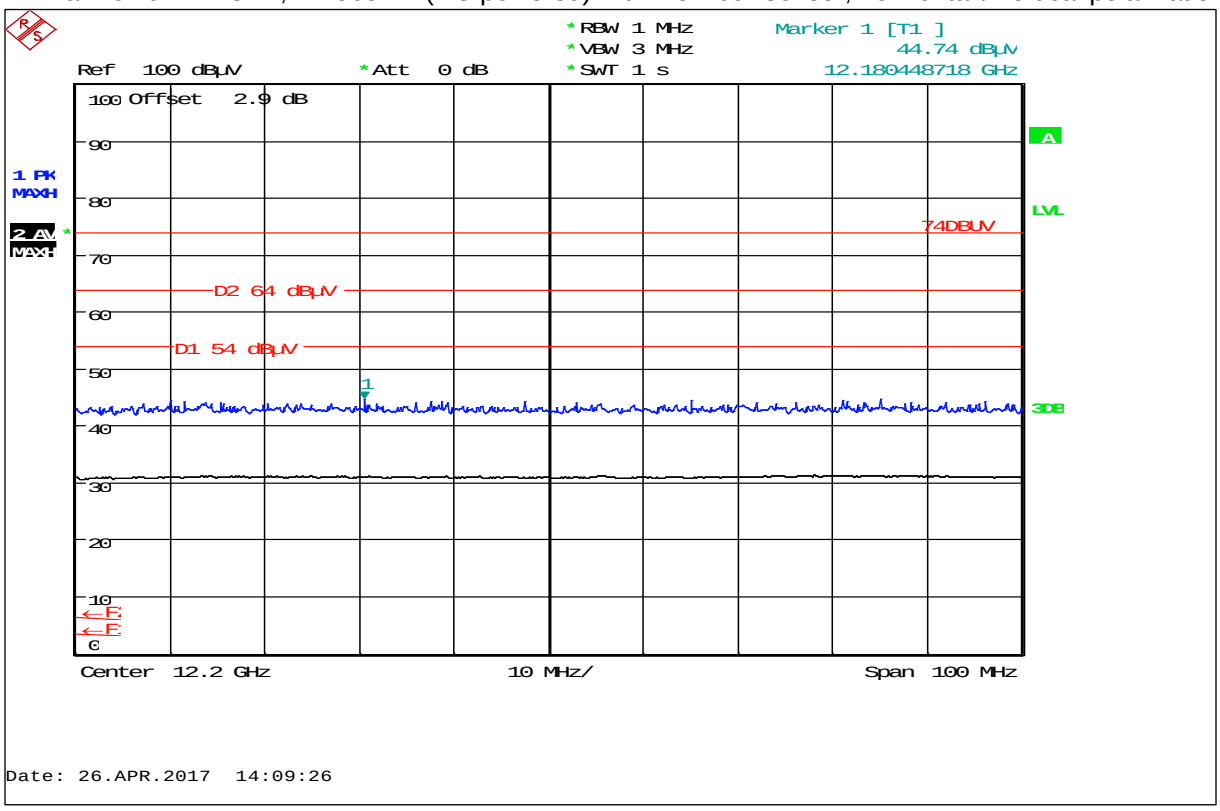
Plot 42: Harmonic 12.2 GHz, LB 565-11 (AC powered) with Flow cell sensor, horizontal / vertical polarization



Plot 43: Harmonic 12.2 GHz, LB 565-12 (DC powered) with Tank sensor, horizontal / vertical polarization



Plot 44: Harmonic 12.2 GHz, LB 565-12 (DC powered) with Flow cell sensor, horizontal / vertical polarization



10.4 Conducted spurious emissions < 30 MHz

Description:

Measurement of the conducted spurious emissions in transmit mode below 30 MHz. Both power lines, phase and neutral line, are measured. Found peaks are re-measured with average and quasi peak detection to show compliance to the limits.

Measurement:

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

Limits:

FCC		IC
CFR Part 15.207(a)		ICES-003, Issue 4
Conducted Spurious Emissions < 30 MHz		
Frequency (MHz)	Quasi-Peak (dBµV/m)	Average (dBµV/m)
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30.0	60	50

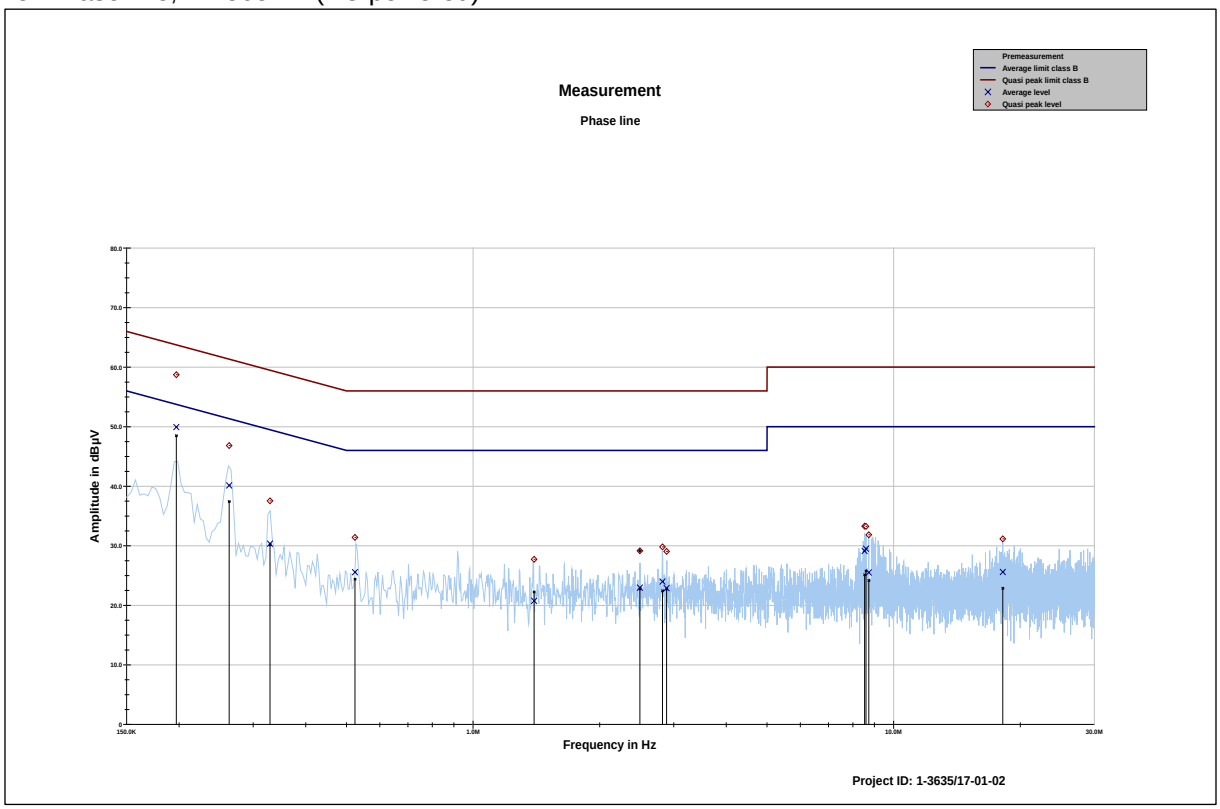
*Decreases with the logarithm of the frequency

Results:

Conducted Spurious Emissions < 30 MHz [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
See plots		
Measurement uncertainty	± 3 dB	

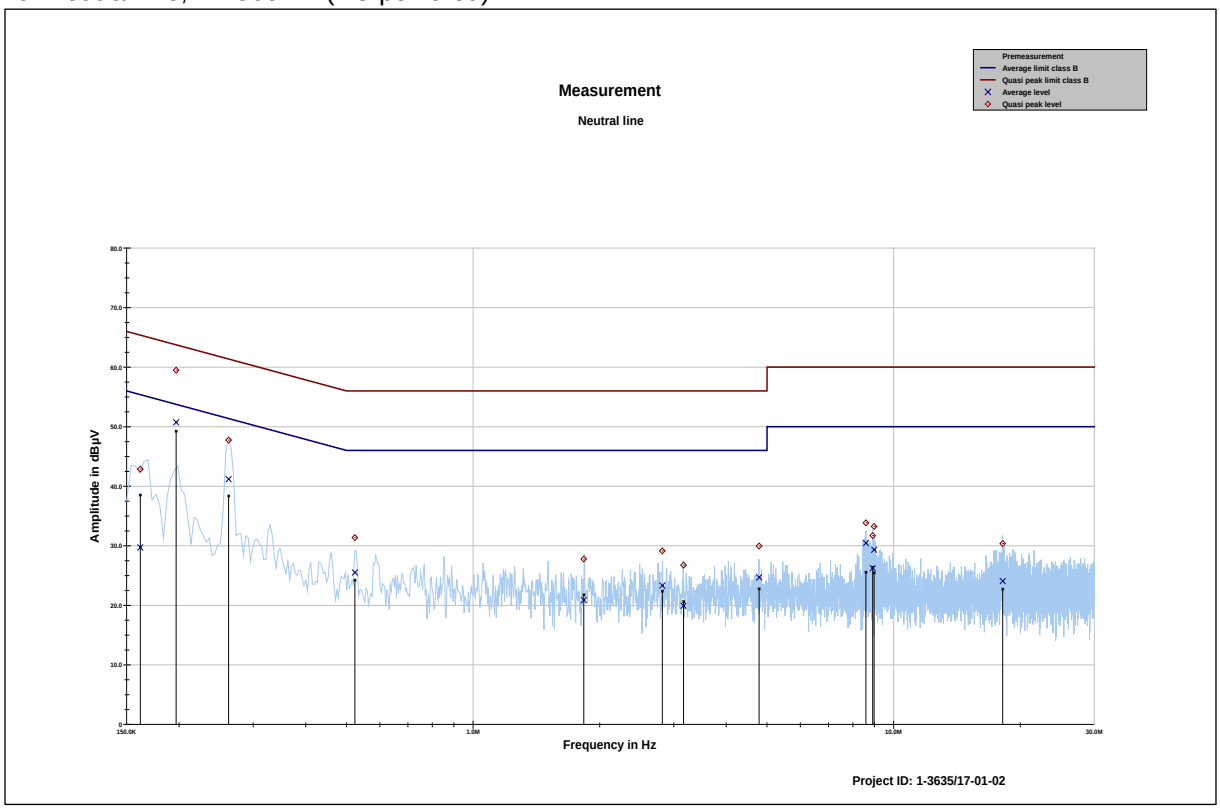
Result: **The measurement is passed.**

Plot 45: Phase line, LB 565-11 (AC powered)



Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.196934	58.72	5.02	63.739	49.93	4.73	54.659
0.262997	46.83	14.50	61.336	40.13	12.64	52.772
0.328917	37.55	21.93	59.479	30.35	20.54	50.888
0.523790	31.41	24.59	56.000	25.56	20.44	46.000
1.396635	27.72	28.28	56.000	20.76	25.24	46.000
2.491979	29.15	26.85	56.000	22.97	23.03	46.000
2.821331	29.81	26.19	56.000	23.98	22.02	46.000
2.884825	29.06	26.94	56.000	22.89	23.11	46.000
8.530750	33.29	26.71	60.000	29.11	20.89	50.000
8.595759	33.25	26.75	60.000	29.49	20.51	50.000
8.729800	31.84	28.16	60.000	25.50	24.50	50.000
18.180961	31.16	28.84	60.000	25.60	24.40	50.000

Plot 46: Neutral line, LB 565-11 (AC powered)



Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.161731	42.88	22.50	65.375	29.72	25.95	55.665
0.196720	59.49	4.26	63.748	50.73	3.93	54.665
0.262246	47.74	13.62	61.360	41.18	11.61	52.793
0.523620	31.37	24.63	56.000	25.51	20.49	46.000
1.832997	27.77	28.23	56.000	20.86	25.14	46.000
2.818268	29.14	26.86	56.000	23.31	22.69	46.000
3.164998	26.75	29.25	56.000	19.92	26.08	46.000
4.787597	29.95	26.05	56.000	24.68	21.32	46.000
8.593391	33.85	26.15	60.000	30.45	19.55	50.000
8.917039	31.72	28.28	60.000	26.22	23.78	50.000
8.986254	33.25	26.75	60.000	29.34	20.66	50.000
18.168518	30.38	29.62	60.000	24.07	25.93	50.000

Annex A Glossary

EUT	Equipment under test
DUT	Device under test
UUT	Unit under test
ETSI	European Telecommunications Standard Institute
EN	European Standard
FCC	Federal Communication Commission
FCC ID	Company Identifier at FCC
IC	Industry Canada
PMN	Product marketing name
HMN	Host marketing name
HVIN	Hardware version identification number
FVIN	Firmware version identification number
EMC	Electromagnetic Compatibility
HW	Hardware
SW	Software
Inv. No.	Inventory number
S/N or SN	Serial number
C	Compliant
NC	Not compliant
NA	Not applicable
NP	Not performed
PP	Positive peak
QP	Quasi peak
AVG	Average
OC	Operating channel
OCW	Operating channel bandwidth
OBW	Occupied bandwidth
OOB	Out of band
DFS	Dynamic frequency selection
CAC	Channel availability check
OP	Occupancy period
NOP	Non occupancy period
DC	Duty cycle
PER	Packet error rate
CW	Clean wave
MC	Modulated carrier
WLAN	Wireless local area network
RLAN	Radio local area network
DSSS	Dynamic sequence spread spectrum
OFDM	Orthogonal frequency division multiplexing
FHSS	Frequency hopping spread spectrum

Annex B Document history

Version	Applied changes	Date of release
-/-	DRAFT	2017-06-22
-/-	DRAFT2 (Model Name, Power Supply information's updated)	2017-08-01
-/-	DRAFT3 (Model Name updated)	2017-09-07
-/-	Initial release (Model Name updated)	2017-09-07

Annex C Accreditation Certificate

first page	last page

DAkkS Deutsche Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH

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

Akkreditierung

Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

CTC advanced GmbH
Untertürkheimer Straße 6-10, 66117 Saarbrücken

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

Funk
Mobilfunk (GSM / DCS) + OTA
Elektromagnetische Verträglichkeit (EMV)
Produktsicherheit
SAR / EMF
Umwelt
Smart Card Technology
Bluetooth®
Automotive
Wi-Fi-Services
Kanadische Anforderungen
US-Anforderungen
Akustik
Near Field Communication (NFC)

Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 25.11.2016 mit der Akkreditierungsnummer D-PL-12076-01 und ist gültig bis 17.01.2018. Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 63 Seiten.

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

Frankfurt, 25.11.2016

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

Siehe Hinweise auf der Rückseite

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38116 Braunschweig

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

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

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

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

Note: The current certificate including annex is published on the website (link see below) of the Accreditation Body DAkkS or may be received by CTC advanced GmbH on request

http://www.dakks.de/as/ast/d/D-PL-12076-01-01.pdf

http://www.dakks.de/as/ast/d/D-PL-12076-01-02.pdf