
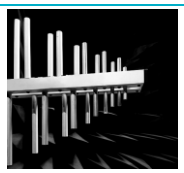
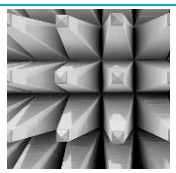

CTC advanced
member of RWTÜV group

Bundesnetzagentur

BNetzA-CAB-02/21-102

TEST REPORT

Test report no.: 1-3338/17-02-03-B

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
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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

Trackman A/S
Stubbeled 2
2950 Vedbæk / DENMARK
Phone: +45 4557 0850
Fax:
Contact: Fredrik Tuxen
e-mail: ft@trackman.com
Phone: -/-

Manufacturer

Trackman
Stubbeled 2
2950 Vedbæk / DENMARK

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

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

Test Item

Kind of test item:	**Radar Modul 10.5GHz**
Model name:	**RCM_V2**
FCC ID:	**SFX-40EU335001**
IC:	**10140A-40EU335001**
Frequency:	10.50 – 10.55 GHz
Antenna:	Integrated patch antenna (EU22 2010 / EU22 2001 / EU22 1001)
Power supply:	10 V to 24 V DC from power supply
Temperature range:	-10°C to +50°C

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.

Test report authorized:

Geraldy Karsten
cn=Karsten Geraldy, o=CTC advanced GmbH, ou=GER-2017-03-14, email=Karsten.Geraldy@ctcadvanced.com, c=DE
2018.04.06 11:18:54 +02'00'

Karsten Geraldy
Lab Manager
Radio Communications & EMC

Test performed:

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2018.04.03 20:58:58 +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.

This test report replaces the test report with the number 1-3338/17-02-03-A and dated 2018-02-05

2.2 Application details

Date of receipt of order:	2017-10-05
Date of receipt of test item:	2017-11-27
Start of test:	2017-12-04
End of test:	2018-01-24
Person(s) present during the test:	Mr. Stampe Thomsen

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	08-2016	Spectrum Management and Telecommunications Radio Standards Specification - Licence-Exempt Radio Apparatus: Category I Equipment

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} T_{max} T_{min}	+22 °C during room temperature tests +50 °C during high temperature tests -10 °C during low temperature tests
Relative humidity content	:		55 %
Power supply	:	V_{nom} V_{max} V_{min}	13.8 V DC from power supply 24.0 V 10.0 V

5 Test item

5.1 General description

Kind of test item	:	Radar Modul 10.5GHz
Type identification	:	RCM_V2
HMN	:	N/A
PMN	:	RCM V2
HVIN	:	40EU335001
FVIN	:	N/A
S/N serial number	:	17350029
HW hardware status	:	Rev.2 (Mounting version, C)
SW software status	:	1.15 (RCM2-MWCTRL)
Frequency band	:	10.50 – 10.55 GHz
Type of modulation	:	CW (each frequency consist of 3 simultaneous CW signals)
Number of channels	:	3
Antenna	:	Integrated patch antenna (EU22 2010 / EU22 2001 / EU22 1001)
Power supply	:	10 V to 24 V DC from power supply
Temperature range	:	-10°C to +50°C

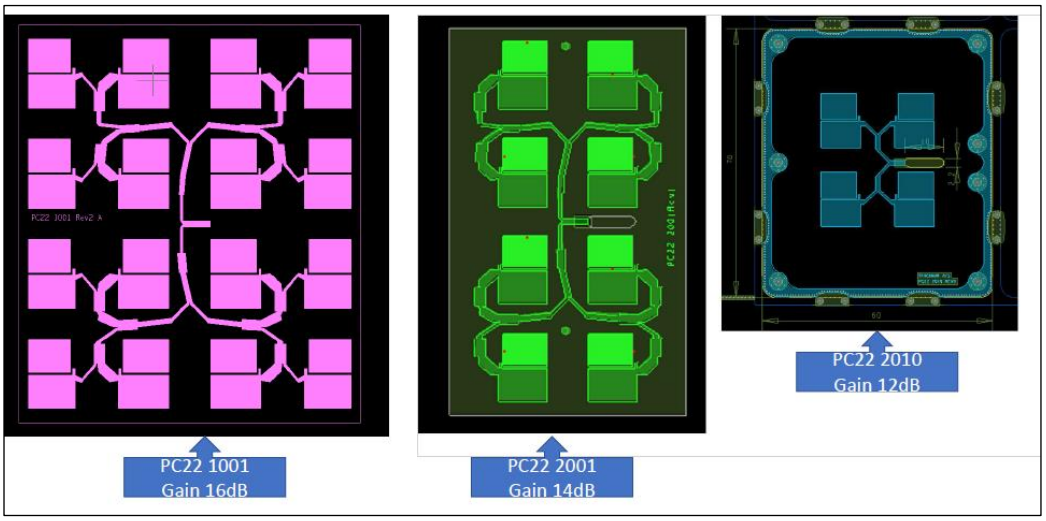
5.2 Additional information

Special test software was used to change from normal operation mode to test mode (low / middle / high) as required by CFR 47 Part 15.31(c). Each frequency consist of 3 simultaneous CW signals.

Low freq. will be F1=10.512 and F2=10.522 and F3=10.5235
Mid freq. will be F1 = 10.515 and F2 = 10.525 and F3 = 10.5265
High freq. will be F1=10.5265 and F2=10.5365 and F3=10.538

The tests were performed with 3 different Antennas (refer to customer documentations):

Antenna EU22 2010 @ 12 dBi Gain
Antenna EU22 2001 @ 14 dBi Gain
Antenna EU22 1001 @ 16 dBi Gain



The customer special software get some settings to have the same output power at antenna input terminal. Only the customer can change these settings.

The radiated spurious emissions were performed without the antenna but with a dummy load at the antenna connector.

Test setup- and EUT-photos are included in test report: 1-3338/17-02-01_AnnexA
1-3338/17-02-01_AnnexB
1-3338/17-02-01_AnnexC

6 Summary of measurements results

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

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	47 CFR Part 15 RSS-210, Issue 9, Annex F	Passed	2018-04-03	-/-

Test specification clause	Test case	Temperature conditions	Power supply	Pass	Fail	NA	NP	Results (max.)
§15.245(b) RSS-210 F1 RSS-Gen	**Field strength of emissions (wanted signal)**	Nominal	Nominal	☒	☐	☐	☐	126.3 dBµV/m
§2.1049	**Occupied bandwidth (99% bandwidth)**	Nominal	Nominal	☒	☐	☐	☐	14 MHz
§15.209(a) §15.245 (a) §15.245 (b)(3) RSS-210 F1 (a) RSS-210 F1 (e) RSS-Gen	**Field strength of emissions (band edge)**	Nominal	Nominal	☒	☐	☐	☐	Complies
§15.209(a) §15.245 (a) §15.245 (b)(3) RSS-210 F1 (a) RSS-210 F1 (e) RSS-Gen	**Field strength of emissions (spurious & harmonics)**	Nominal	Nominal	☒	☐	☐	☐	Complies

Note: NA = Not Applicable; NP = Not Performed

7 Description of the test setup

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

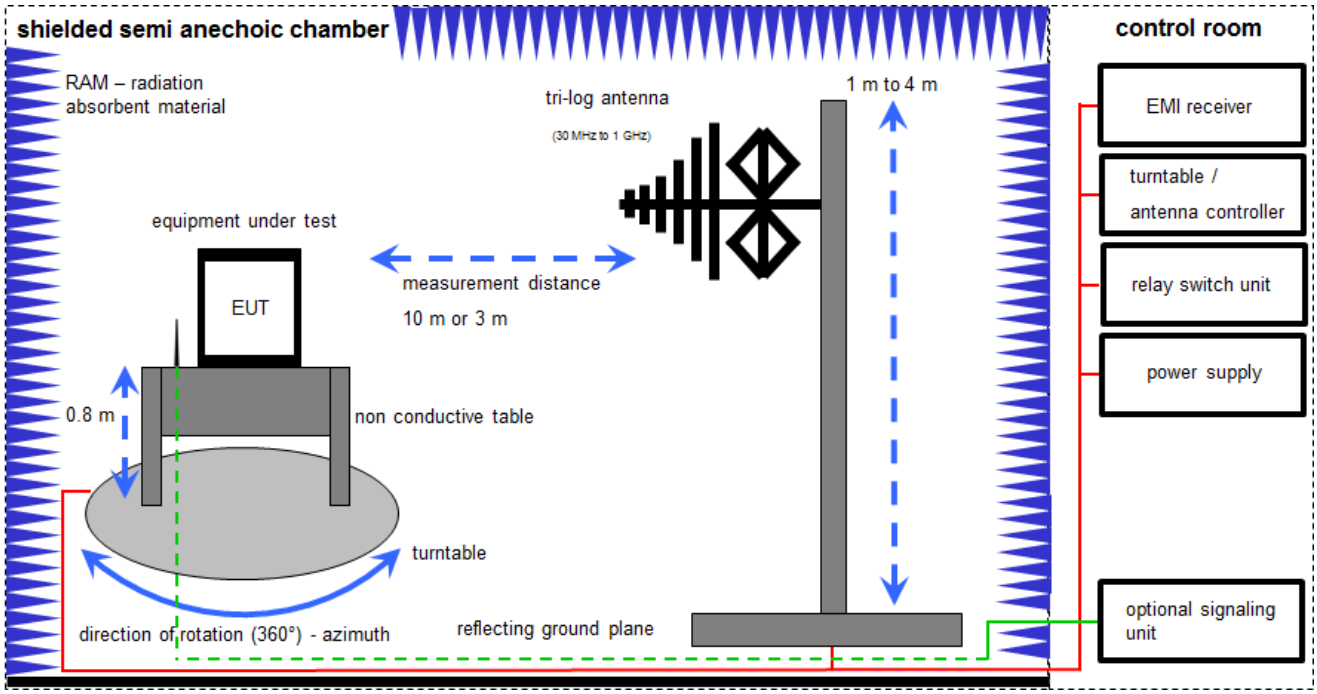
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

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

7.1 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 specification 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.



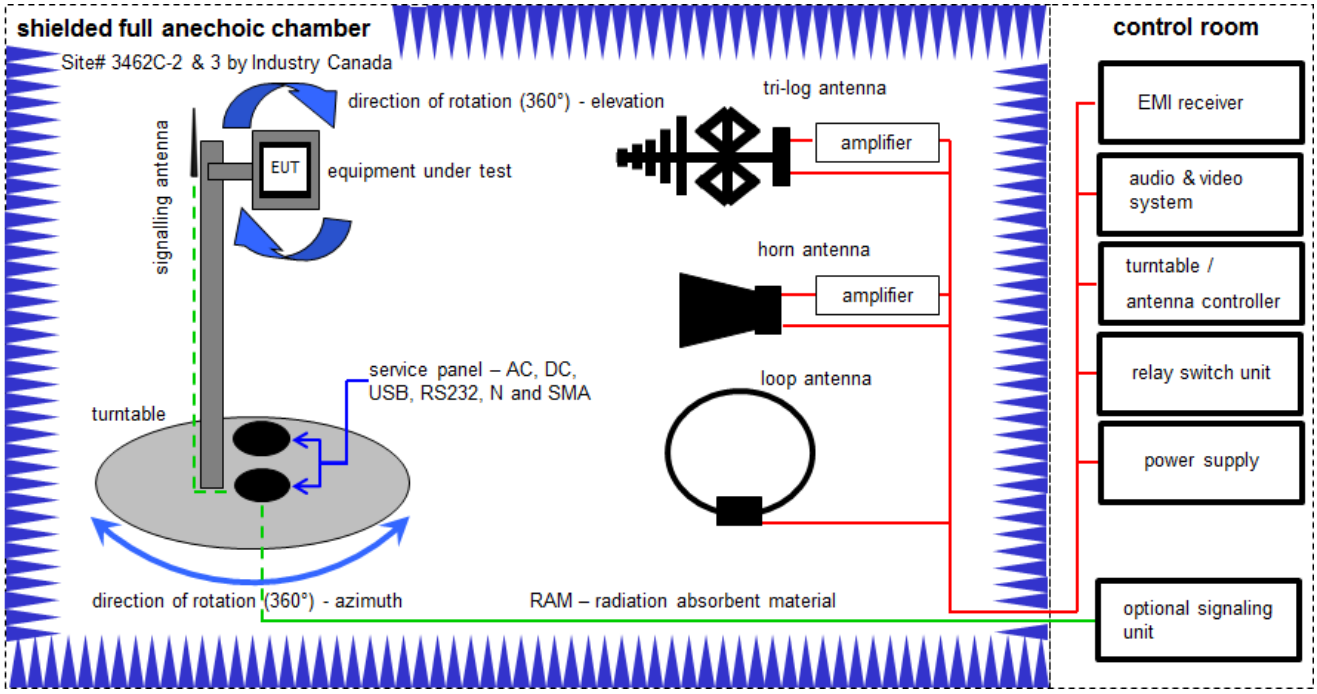
FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

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.	Equipment	Type	Manufacturer	Serial No.	INV. No CTC	Kind of Calibration	Last Calibration	Next Calibration
1	Switch-Unit	3488A	HP	2719A14505	300000368	ev		
2	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04466	300000580	ne		
3	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	15.12.2017	14.12.2018
4	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	Ve	02.02.2016	02.02.2018
5	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw		
6	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw		
7	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw		
8	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	25.04.2016	25.04.2018
9	Spectrum-Analyzer	FSU26	R&S	200809	300003874	k	24.01.2017	24.01.2018

7.2 Shielded fully anechoic chamber



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

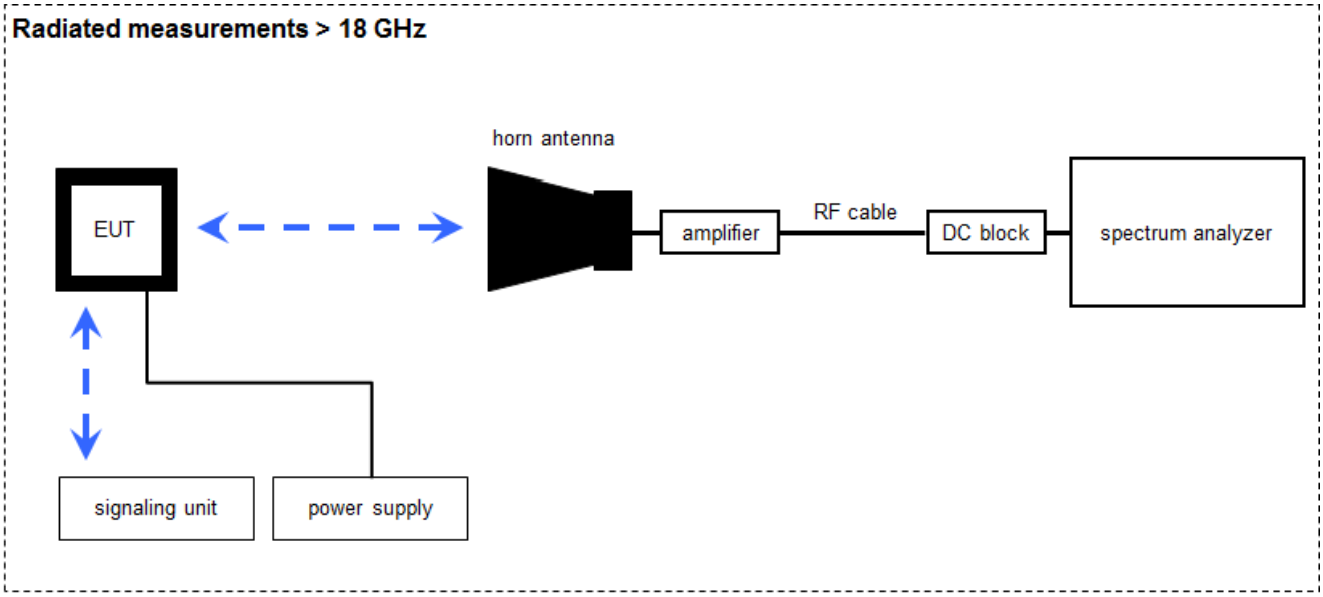
FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

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	n. a.	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2818A03450	300001040	Ve	20.01.2015	20.01.2018
2	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
3	n. a.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9107-3697	300001605	vIKI!	14.02.2017	13.02.2019
4	n. a.	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
5	n. a.	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	31.01.2017	30.01.2018
6	n. a.	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	19	300003790	ne	-/-	-/-
7	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854	vIKI!	-/-	-/-
8	n. a.	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22049	300004481	ev	-/-	-/-
9	n. a.	Broadband Amplifier 5-13 GHz	CBLU5135235	CERNEX	22010	300004491	ev	-/-	-/-
10	n. a.	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
11	n. a.	NEXIO EMV-Software	BAT EMC V3.16.0.49	EMCO		300004682	ne	-/-	-/-
12	n. a.	PC	ExOne	F+W		300004703	ne	-/-	-/-
13	n. a.	RF-Amplifier	AMF-6F06001800-30-10P-R	NARDA-MITEQ Inc	2011572	300005241	ev	-/-	-/-

7.3 Radiated measurements 18 GHz – 50 GHz



Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Std. Gain Horn Antenna 8.2-12.4 GHz	640	Narda		300000784	k	13.12.2017	12.12.2019
2	n. a.	Std. Gain Horn Antenna 18.0-26.5 GHz	638	Narda		300000486	k	13.12.2017	12.12.2019
3	n. a.	Std. Gain Horn Antenna 26.5-40.0 GHz	637	Narda	7911	300001751	ne	-/-	-/-
4	n. a.	Std. Gain Horn Antenna 39.3-59.7 GHz	2424-20	Flann	75	300001979	ne	-/-	-/-
5	n. a.	Std. Gain Horn Antenna 33.0-50.1 GHz	2324-20	Flann	57	400000683	ne	-/-	-/-
6	n. a.	Spectrum Analyzer 20 Hz - 50 GHz	FSU50	R&S	200012	300003443	k	28.10.2016	27.10.2018
7	n. a.	Broadband LNA 18-50 GHz	CBL18503070PN	CERNEX	25240	300004948	ev	-/-	-/-
8	n. a.	Signal generator 2.0 – 26.0 GHz	8673A	HP	2228A00139	30000513	k	13.12.2017	12.12.2019
9	n. a.	Synthesized Sweeper 10 MHz - 40 GHz	83640A	R&S	3119A00458	300002266	k	13.12.2017	12.12.2019

8 Measurement uncertainty

Measurement uncertainty	
Test case	**Uncertainty**
Field strength	± 3 dB
Occupied bandwidth	± span/1000
TX spurious emissions radiated below 30 MHz	± 3 dB
TX spurious emissions radiated 30 MHz to 1 GHz	± 3 dB
Spurious emissions radiated 1 GHz to 12.75 GHz	± 3.7 dB
Spurious emissions radiated above 12.75 GHz	± 4.5 dB

9 Sequence of testing

9.1 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.

9.2 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.

9.3 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.

10 Measurement results

10.1 Field strength of emissions (wanted signal)

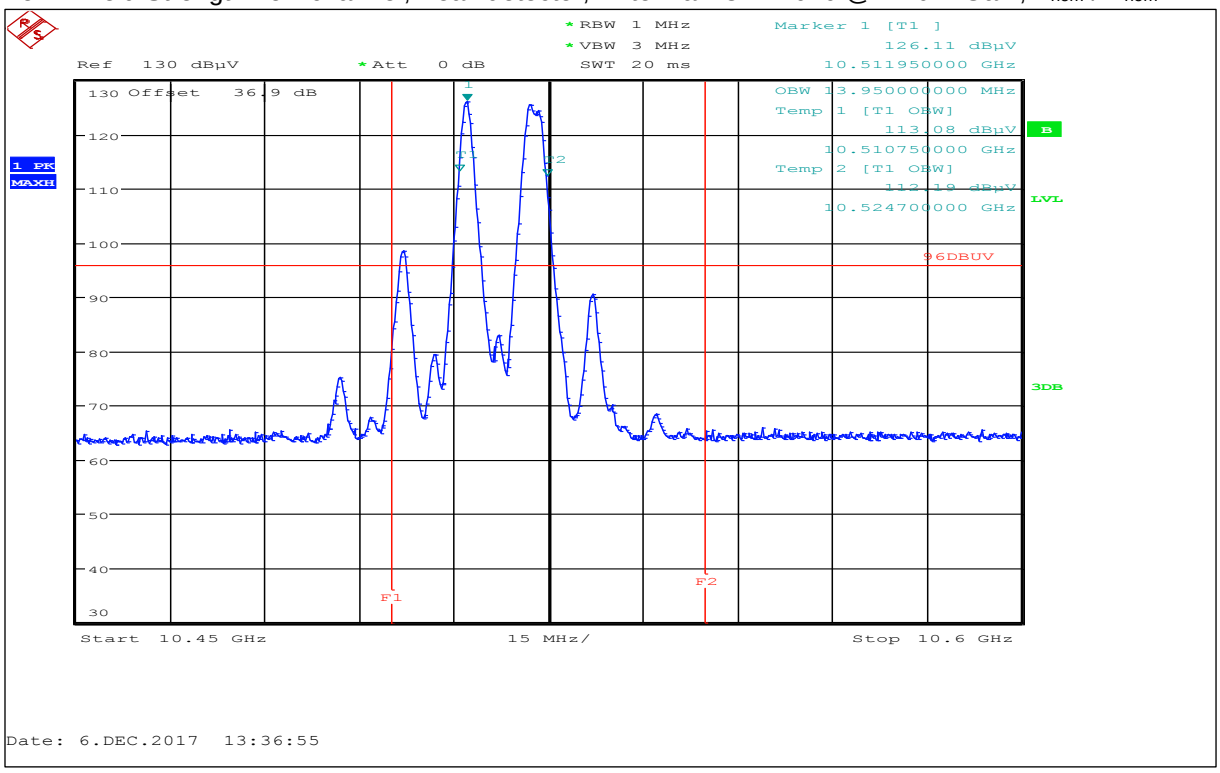
Description:

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

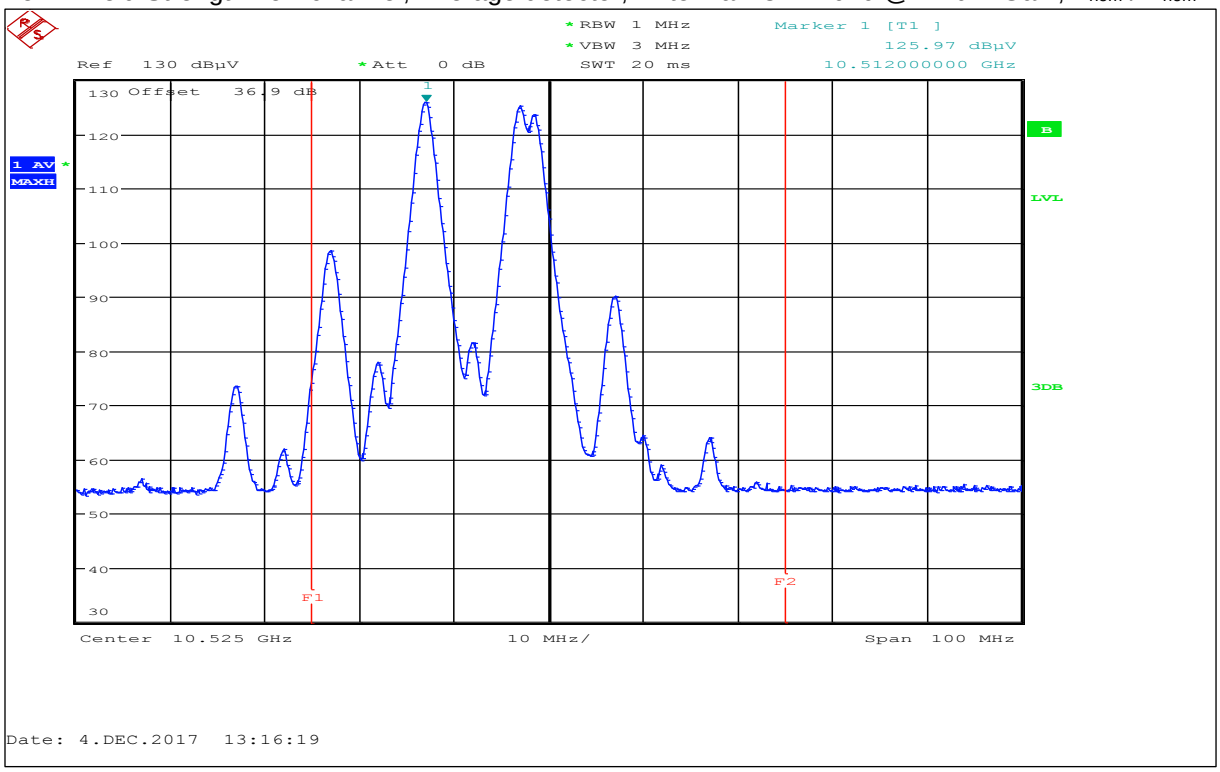
Measurement:

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

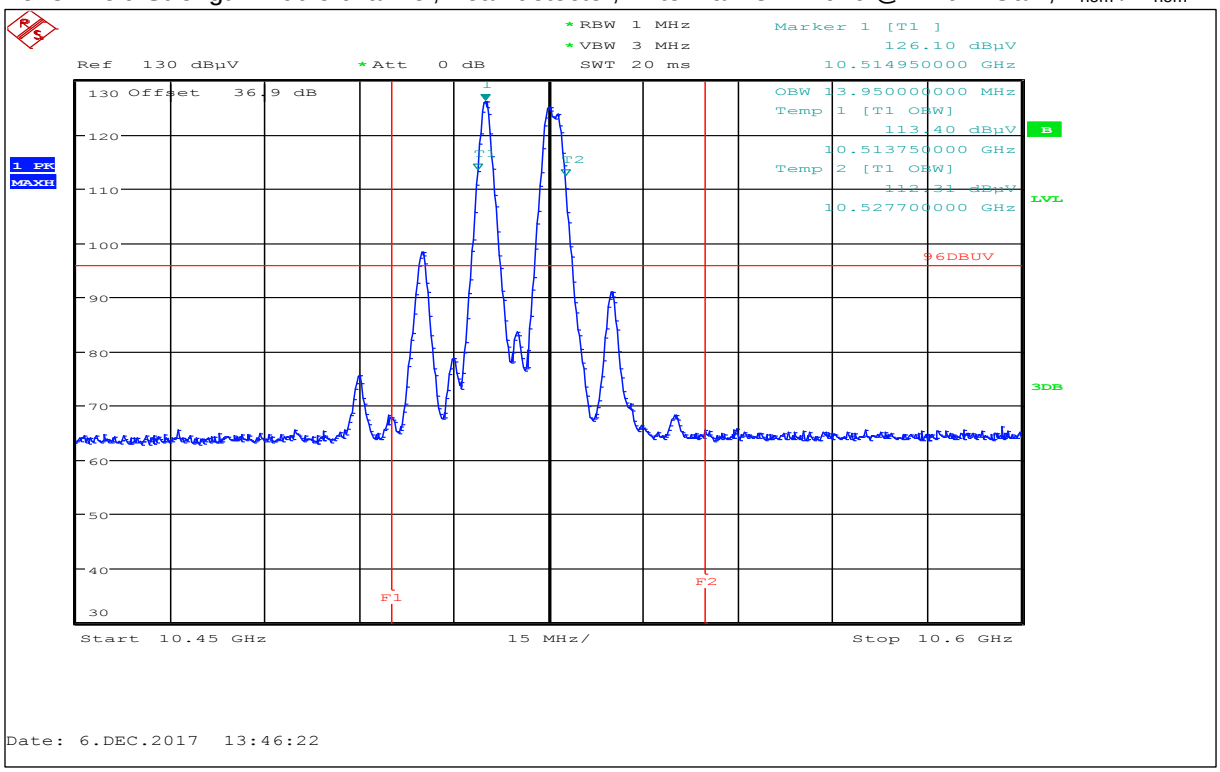
Plot No. 1: Field Strength Low channel, Peak detector, Antenna EU22 2010 @ 12 dBi Gain, T_{nom} / V_{nom}



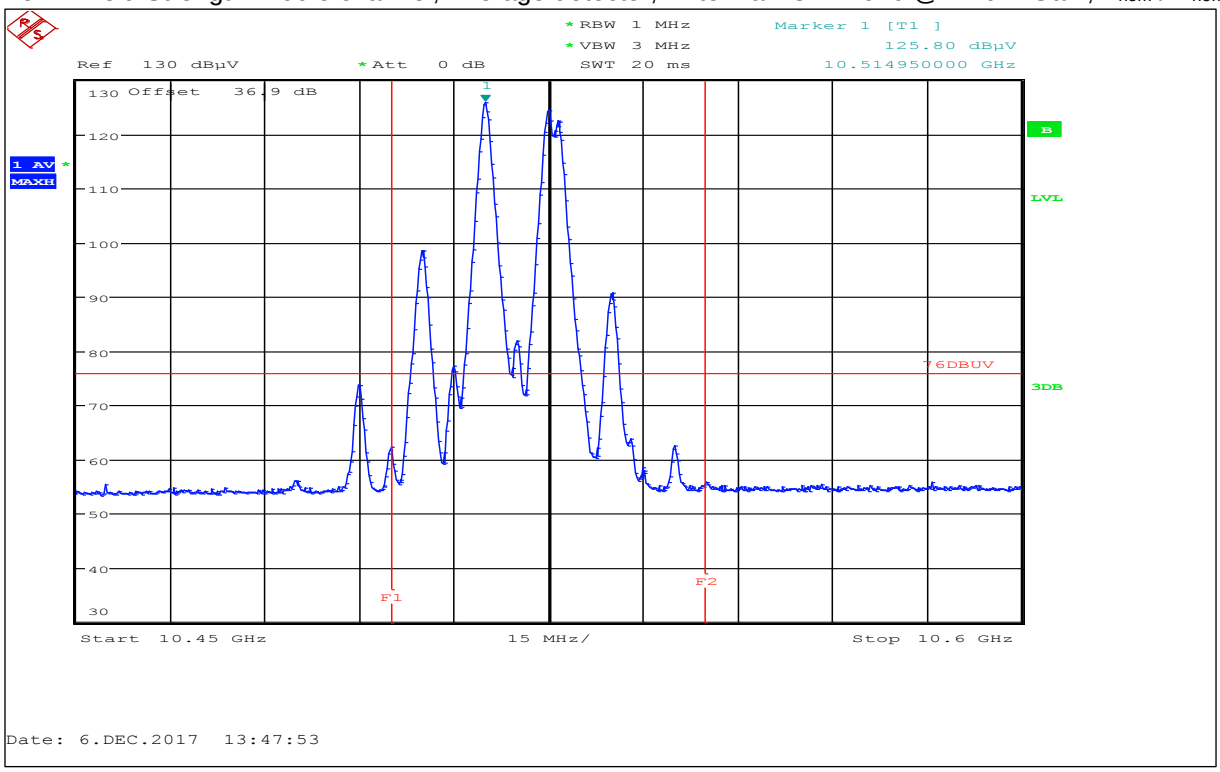
Plot No. 2: Field Strength Low channel, Average detector, Antenna EU22 2010 @ 12 dBi Gain, T_{nom} / V_{nom}



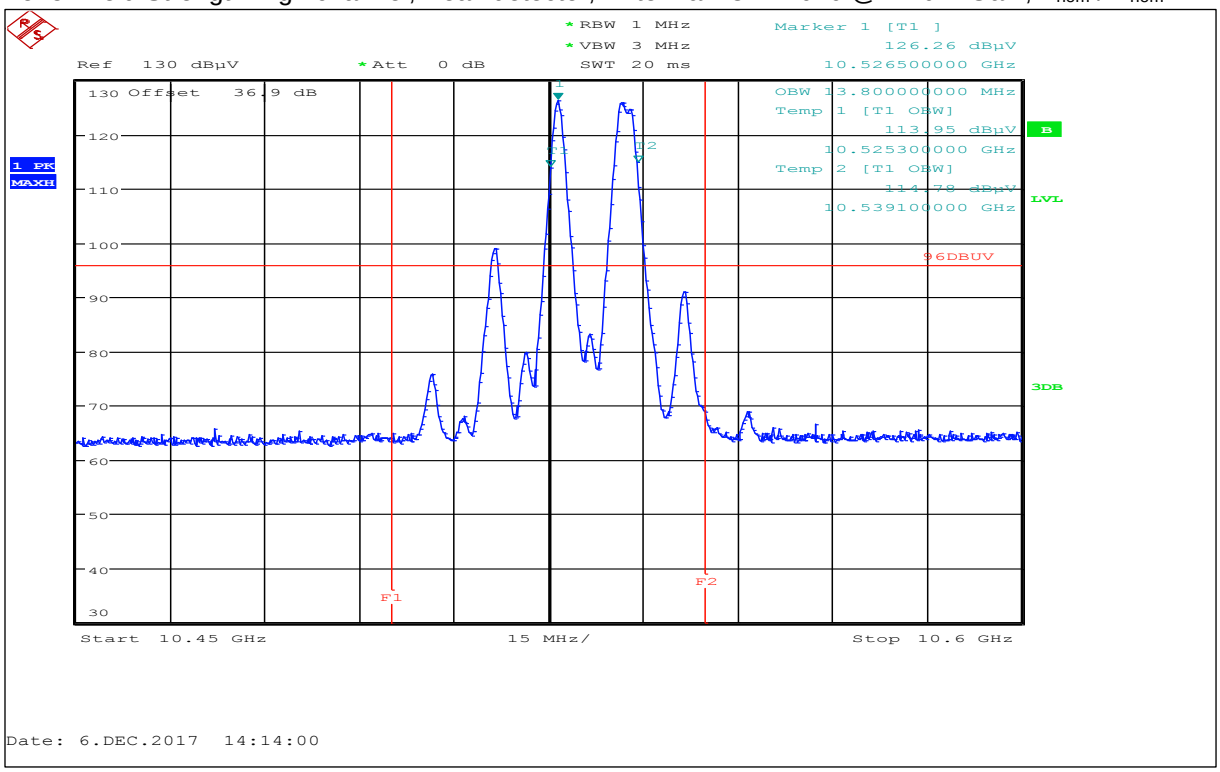
Plot No. 3: Field Strength Middle channel, Peak detector, Antenna EU22 2010 @ 12 dBi Gain, T_{nom} / V_{nom}



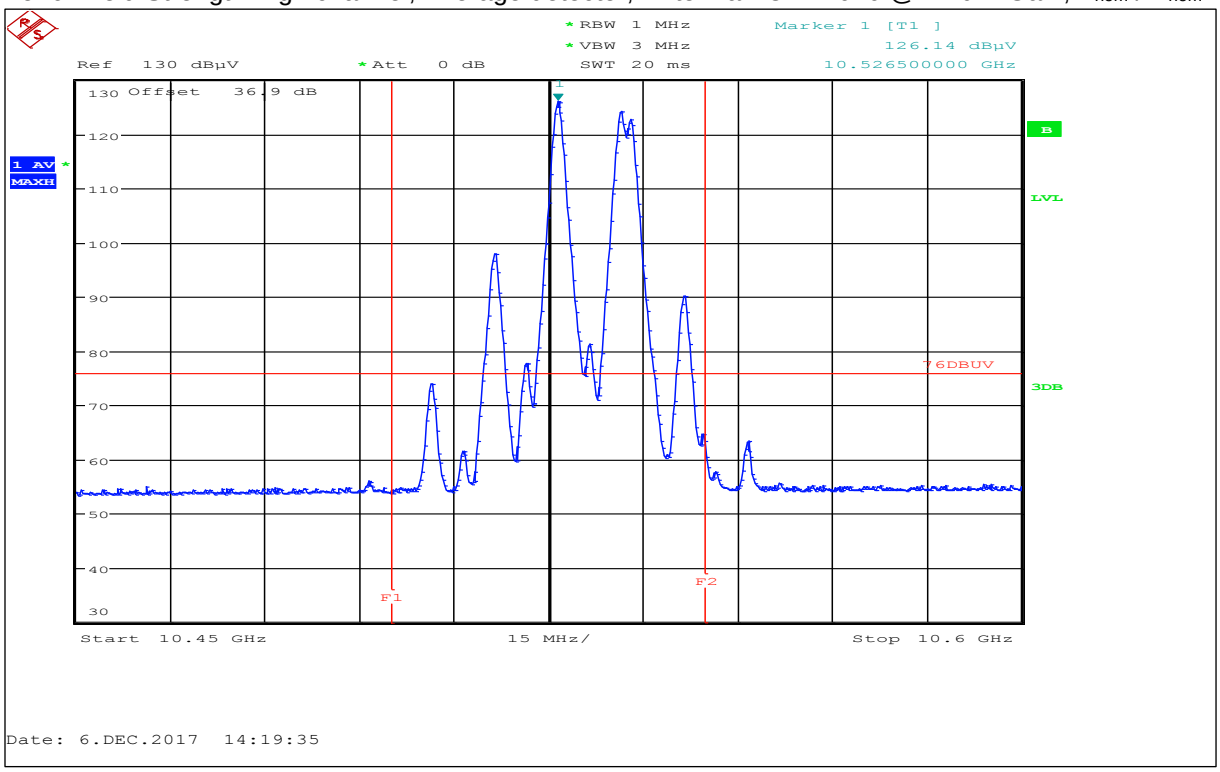
Plot No. 4: Field Strength Middle channel, Average detector, Antenna EU22 2010 @ 12 dBi Gain, T_{nom} / V_{nom}



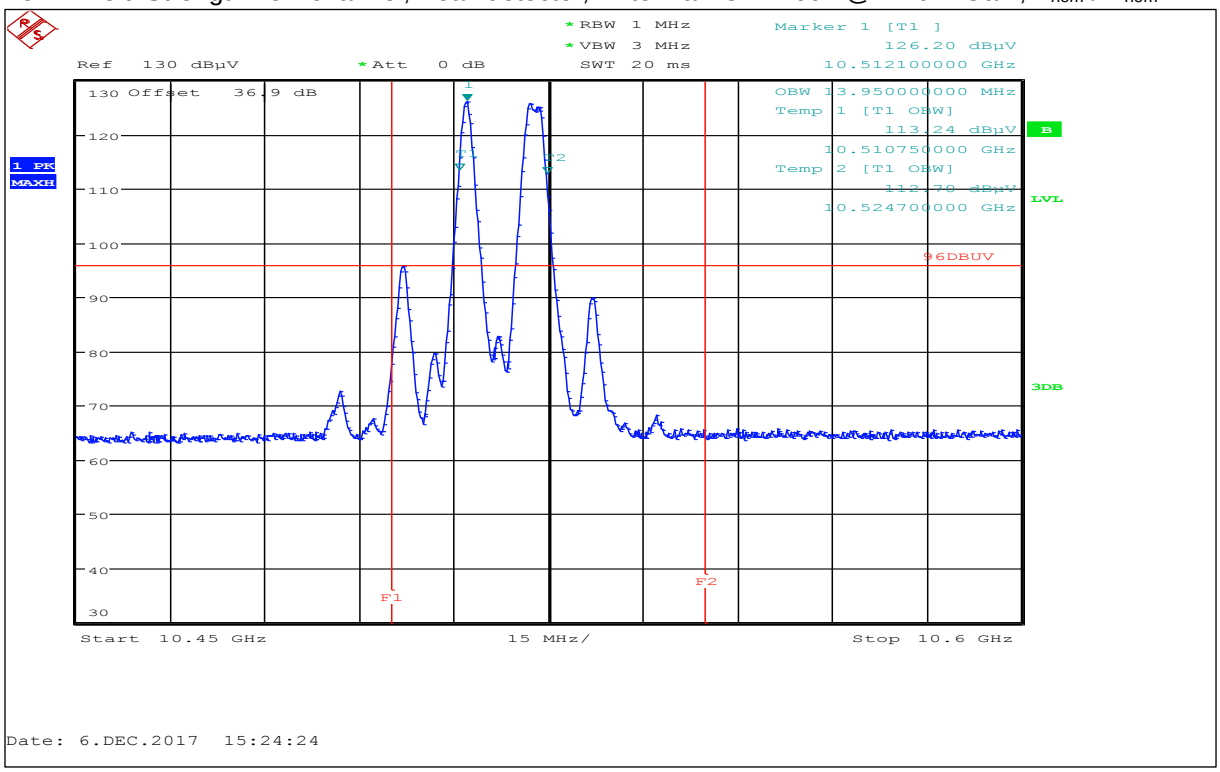
Plot No. 5: Field Strength High channel, Peak detector, Antenna EU22 2010 @ 12 dBi Gain, T_{nom} / V_{nom}



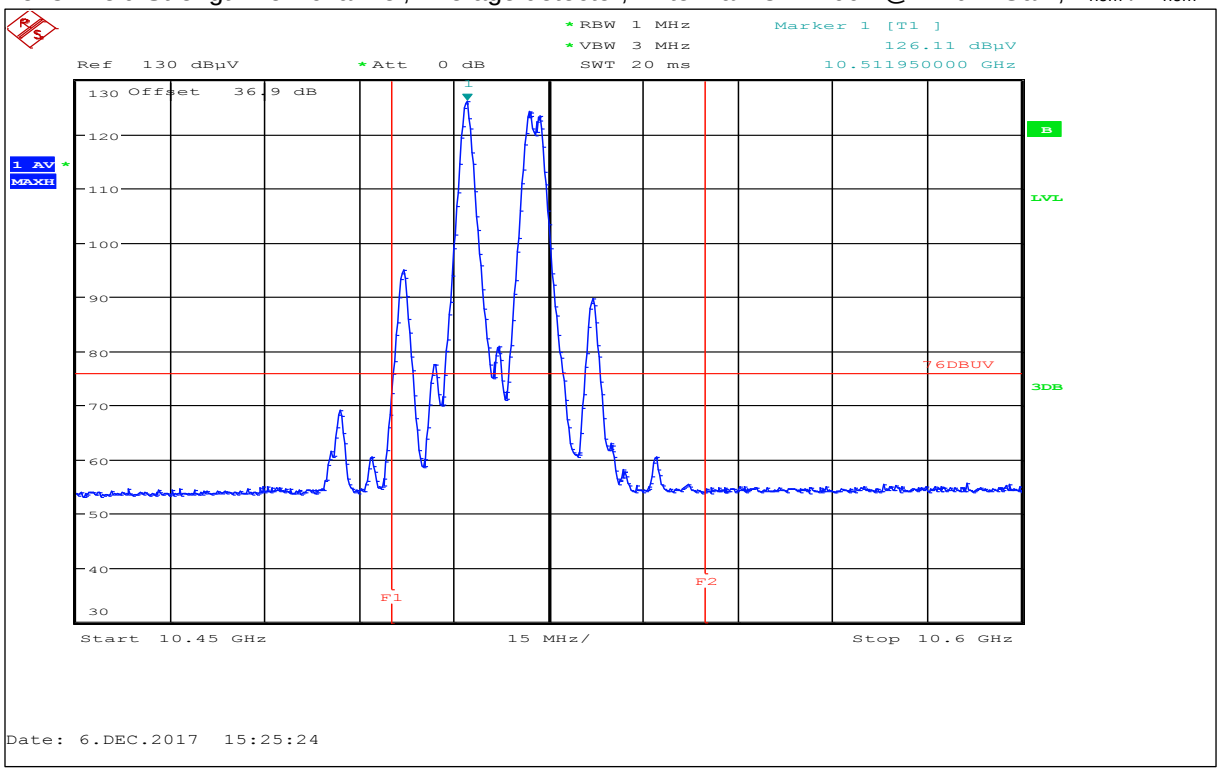
Plot No. 6: Field Strength High channel, Average detector, Antenna EU22 2010 @ 12 dBi Gain, T_{nom} / V_{nom}



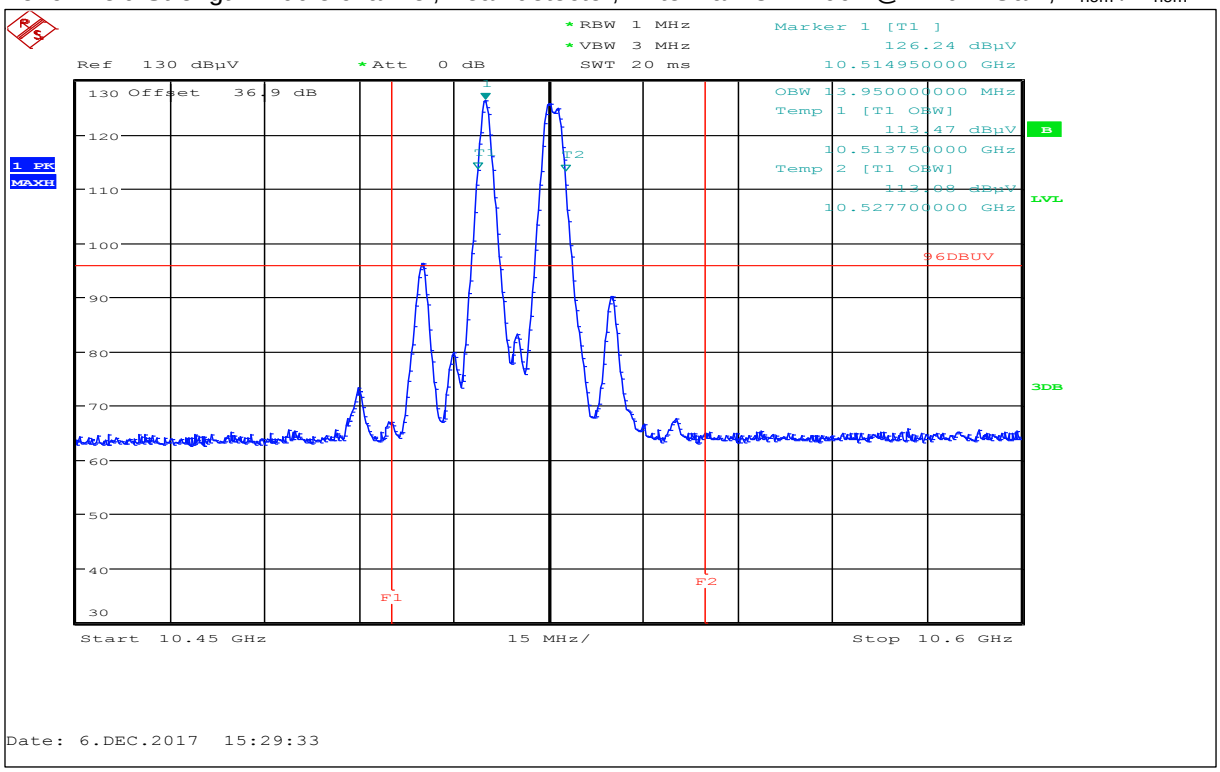
Plot No. 7: Field Strength Low channel, Peak detector, Antenna EU22 2001 @ 14 dBi Gain, T_{nom} / V_{nom}



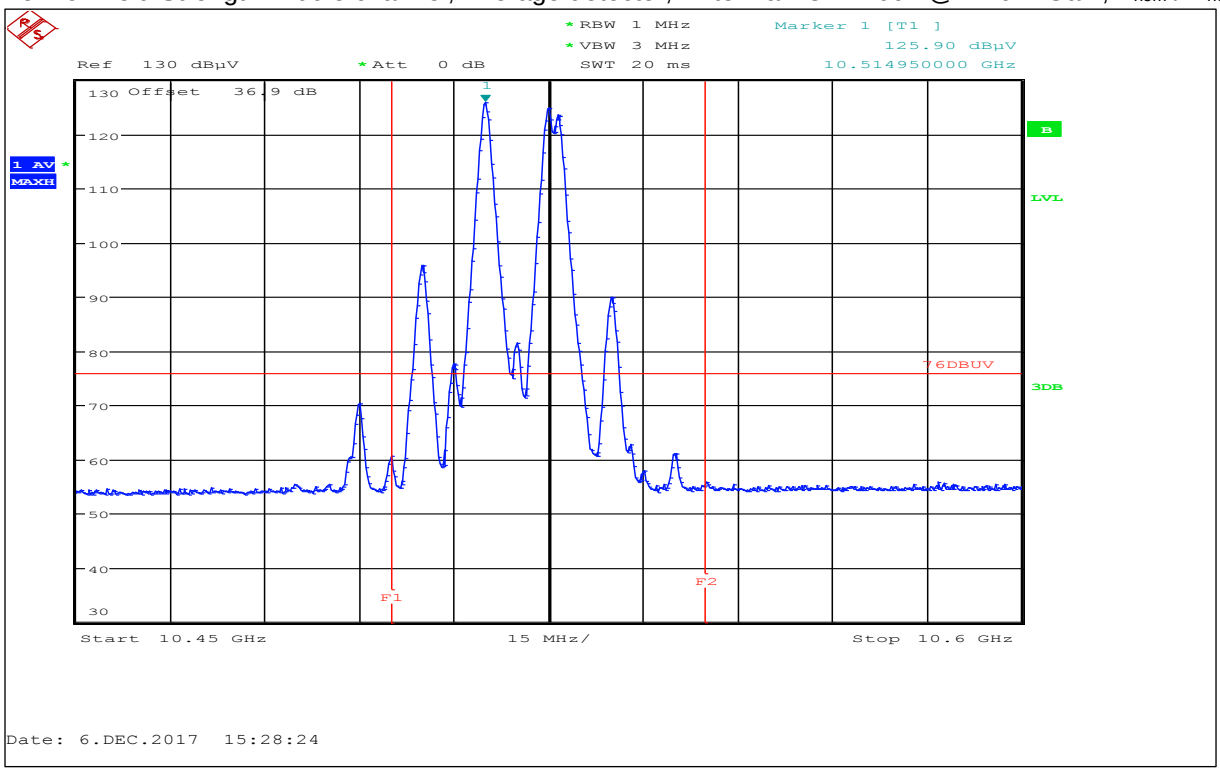
Plot No. 8: Field Strength Low channel, Average detector, Antenna EU22 2001 @ 14 dBi Gain, T_{nom} / V_{nom}



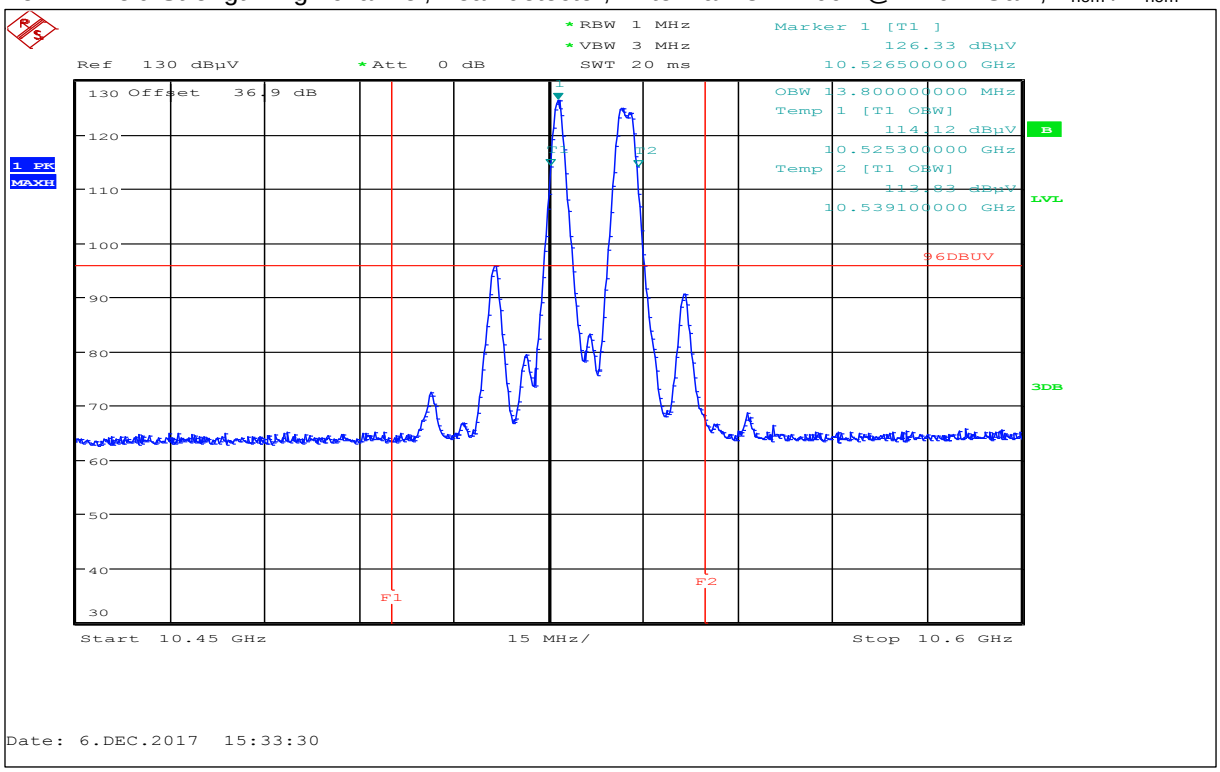
Plot No. 9: Field Strength Middle channel, Peak detector, Antenna EU22 2001 @ 14 dBi Gain, T_{nom} / V_{nom}



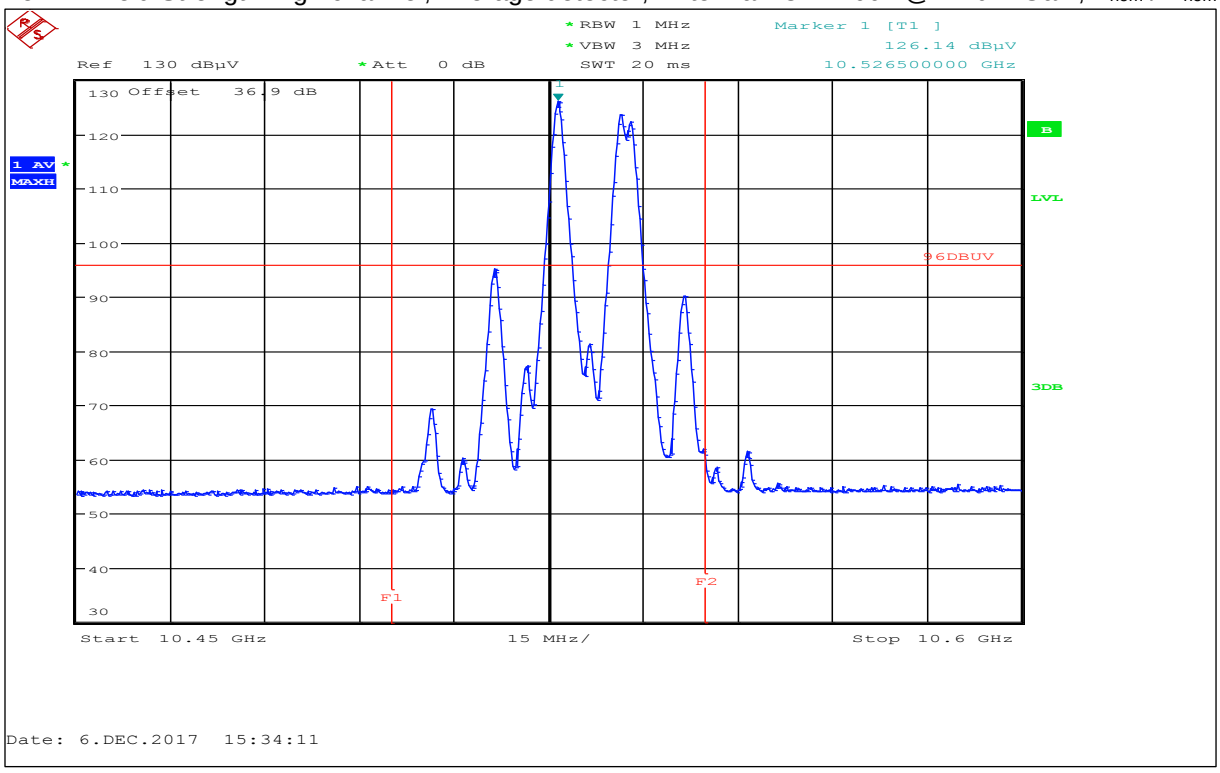
Plot No. 10: Field Strength Middle channel, Average detector, Antenna EU22 2001 @ 14 dBi Gain, T_{nom} / V_{nom}



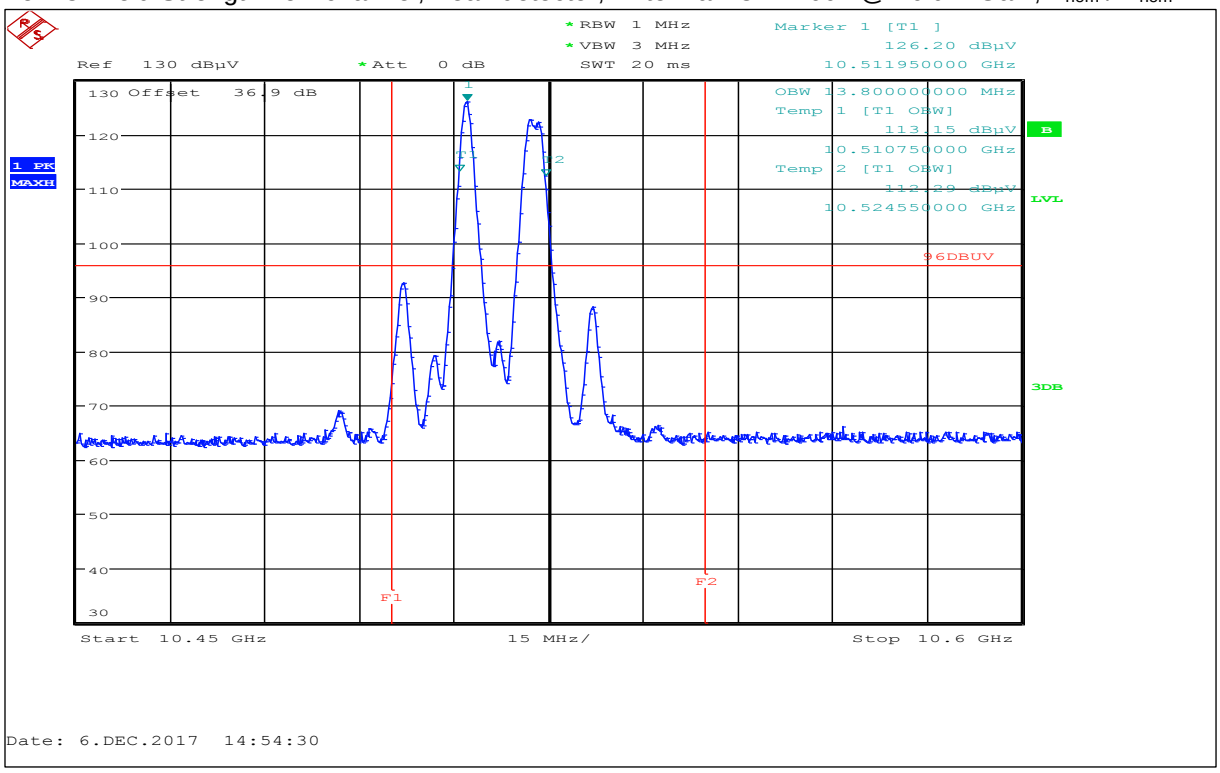
Plot No. 11: Field Strength High channel, Peak detector, Antenna EU22 2001 @ 14 dBi Gain, T_{nom} / V_{nom}



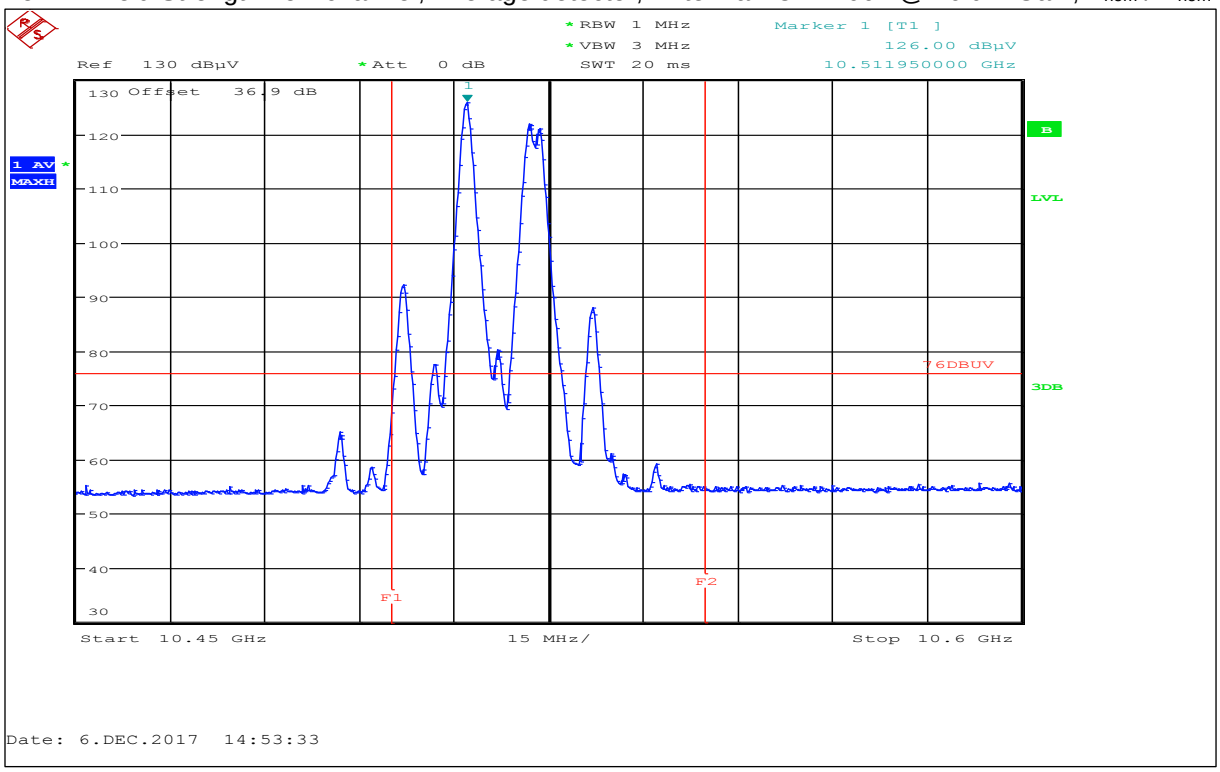
Plot No. 12: Field Strength High channel, Average detector, Antenna EU22 2001 @ 14 dBi Gain, T_{nom} / V_{nom}



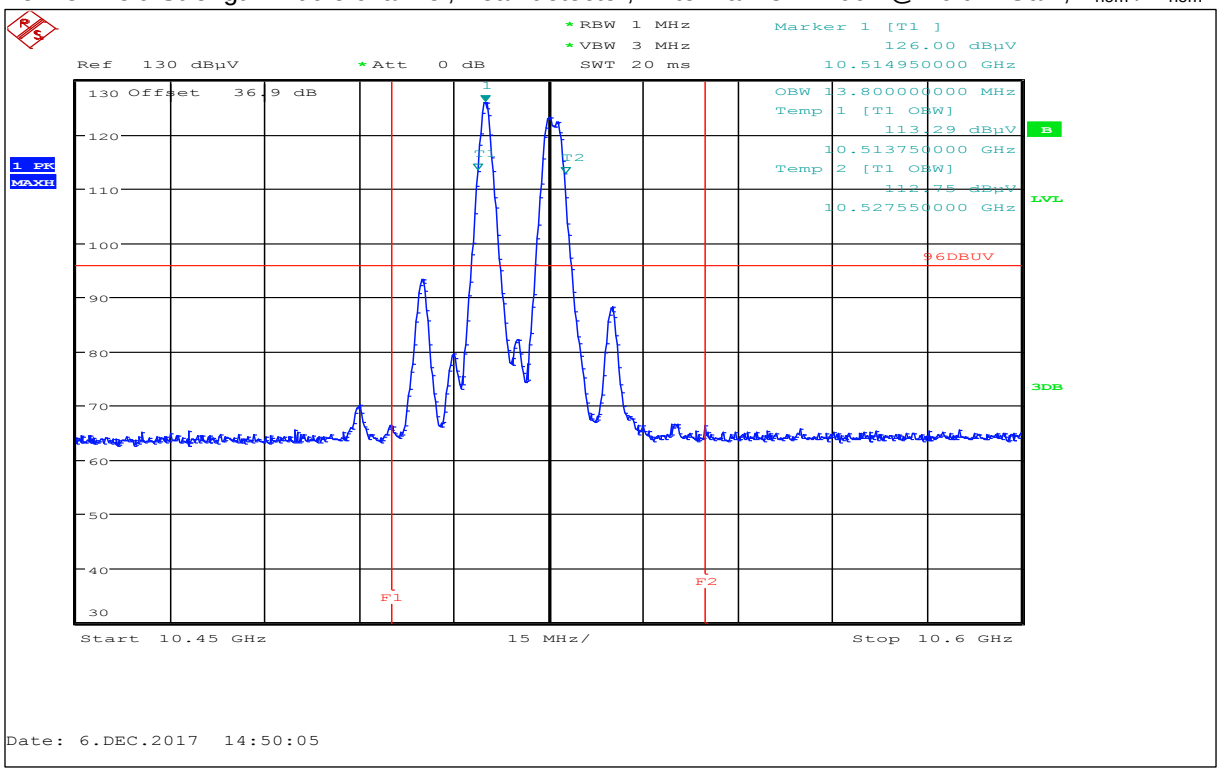
Plot No. 13: Field Strength Low channel, Peak detector, Antenna EU22 1001 @ 16 dBi Gain, T_{nom} / V_{nom}



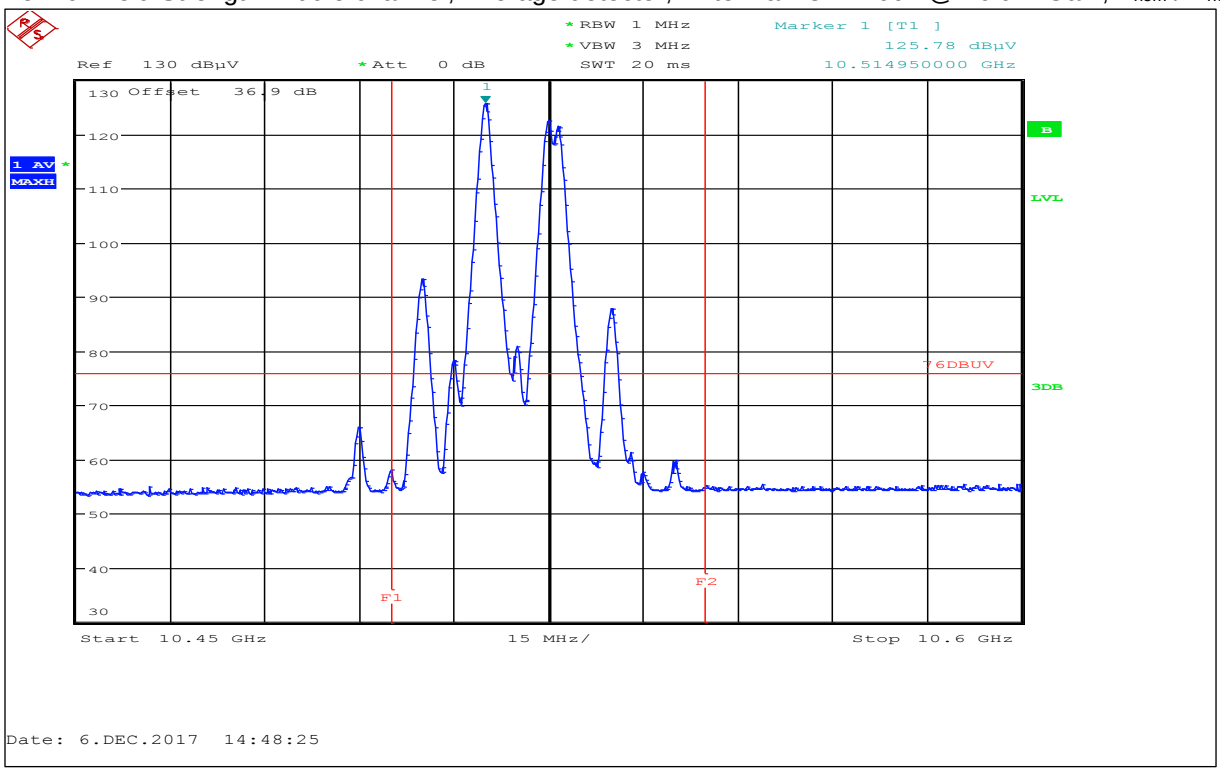
Plot No. 14: Field Strength Low channel, Average detector, Antenna EU22 1001 @ 16 dBi Gain, T_{nom} / V_{nom}



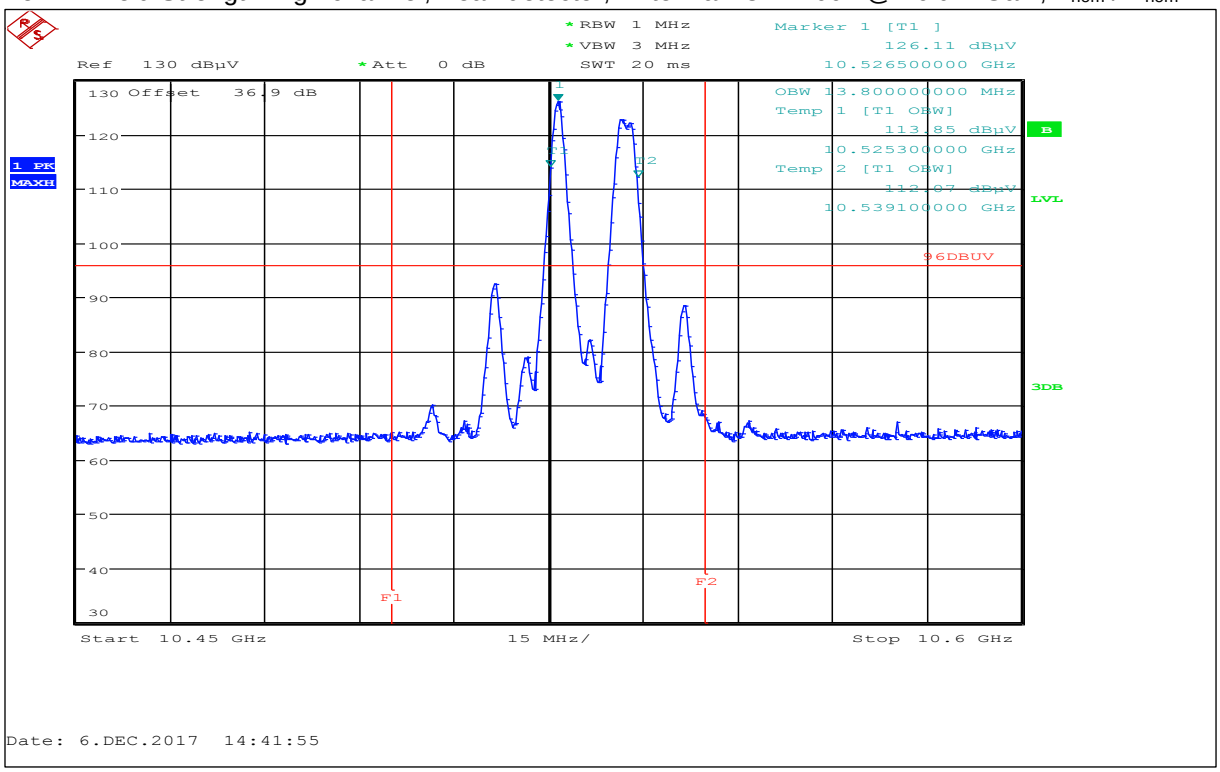
Plot No. 15: Field Strength Middle channel, Peak detector, Antenna EU22 1001 @ 16 dBi Gain, T_{nom} / V_{nom}



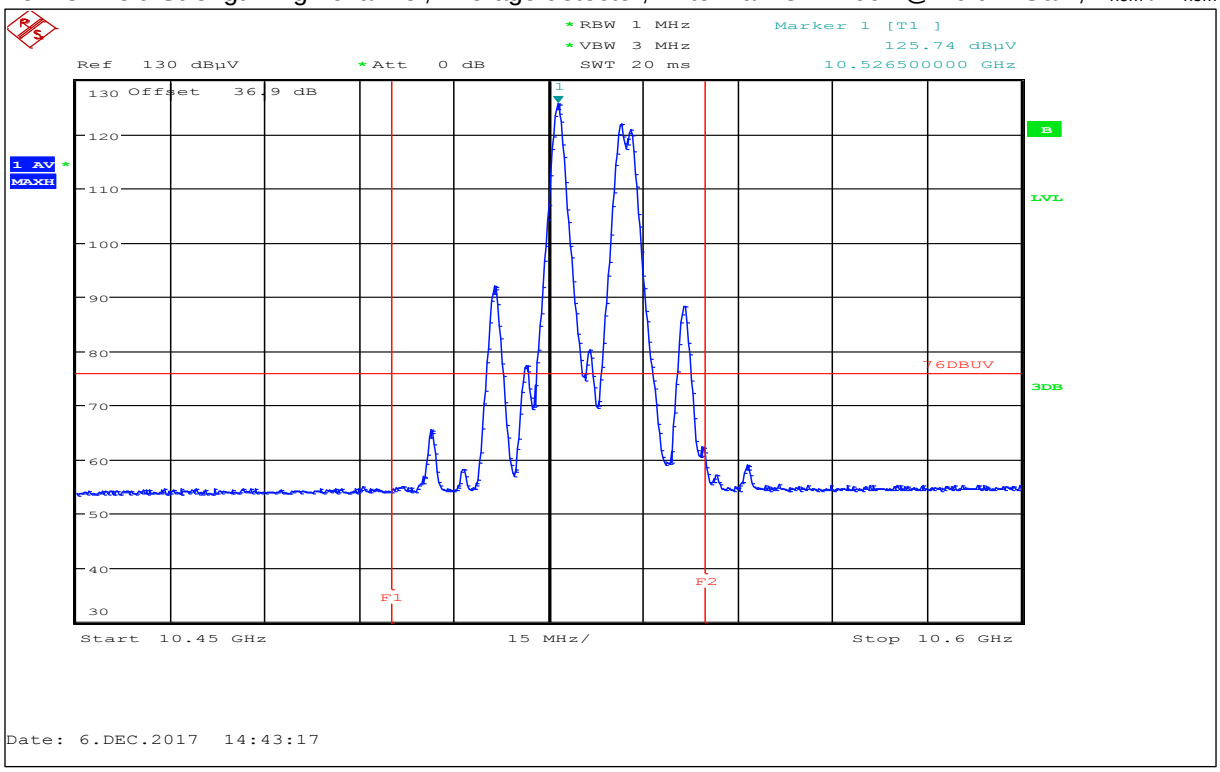
Plot No. 16: Field Strength Middle channel, Average detector, Antenna EU22 1001 @ 16 dBi Gain, T_{nom} / V_{nom}



Plot No. 17: Field Strength High channel, Peak detector, Antenna EU22 1001 @ 16 dBi Gain, T_{nom} / V_{nom}



Plot No. 18: Field Strength High channel, Average detector, Antenna EU22 1001 @ 16 dBi Gain, T_{nom} / V_{nom}



Result:

Test condition T_{nom} / V_{nom}	Maximum field strength [dBµV/m @ 3 m]
Low channel (EUT with EU22 2010 Antenna)	126.1 (Peak) / 125.9 (Average)
Middle Channel (EUT with EU22 2010 Antenna)	126.1 (Peak) / 125.8 (Average)
High channel (EUT with EU22 2010 Antenna)	126.3 (Peak) / 126.1 (Average)
Low channel (EUT with EU22 2001 Antenna)	126.2 (Peak) / 126.1 (Average)
Middle Channel (EUT with EU22 2001 Antenna)	126.2 (Peak) / 125.9 (Average)
High channel (EUT with EU22 2001 Antenna)	126.3 (Peak) / 126.1 (Average)
Low channel (EUT with EU22 1001 Antenna)	126.2 (Peak) / 126.0 (Average)
Middle Channel (EUT with EU22 1001 Antenna)	126.0 (Peak) / 125.8 (Average)
High channel (EUT with EU22 1001 Antenna)	126.1 (Peak) / 125.7 (Average)
Measurement uncertainty	± 3 dB

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 [dBµV/m]	Measurement distance [m]
10.500 – 10.550	128 (Average) 148 (Peak)	3

Verdict: **complies**

10.2 Occupied bandwidth (99% bandwidth)

Definition:

The occupied bandwidth is defined as the 99% bandwidth.

Measurement:

The EUT is powered on and set up to transmit its normal signal modulation sequence(s).
A spectrum analyzer with the following settings is used:

The test was performed under normal and extreme test conditions.

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

Limits:

10.500 GHz – 10.550 GHz	50 MHz

Results:

Test condition T_{nom} / V_{nom}	99% Occupied bandwidth [MHz]
Low channel (EUT with EU22 2010 Antenna)	13.95
Middle Channel (EUT with EU22 2010 Antenna)	13.95
High channel (EUT with EU22 2010 Antenna)	13.80
Low channel (EUT with EU22 2001 Antenna)	13.95
Middle Channel (EUT with EU22 2001 Antenna)	13.95
High channel (EUT with EU22 2001 Antenna)	13.80
Low channel (EUT with EU22 1001 Antenna)	13.80
Middle Channel (EUT with EU22 1001 Antenna)	13.80
High channel (EUT with EU22 1001 Antenna)	13.80
Measurement uncertainty	± span/1000

Verdict: complies

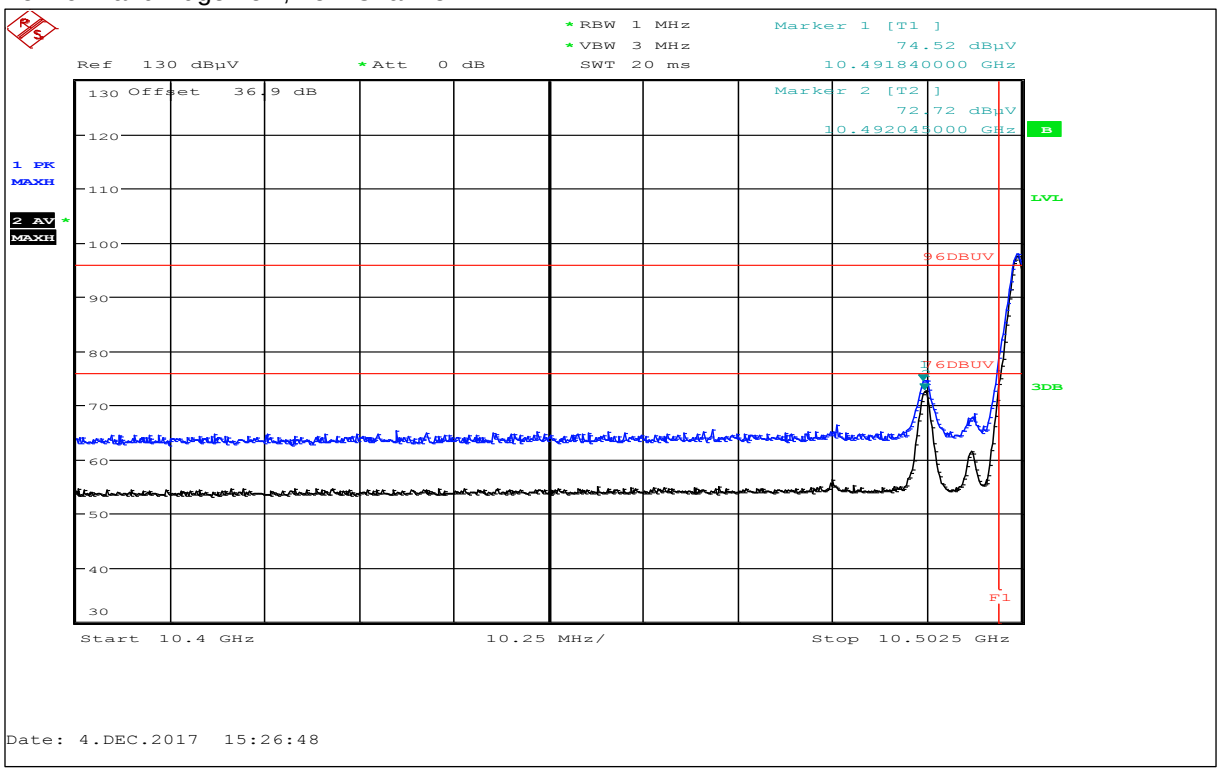
10.3 Field strength of emissions (band edge)

Limits: **FCC §15.245 (b) / RSS-210 F.1 (a)(e)**

Frequency range	f(lowest) > 10.500 GHz	f(highest) < 10.550 GHz

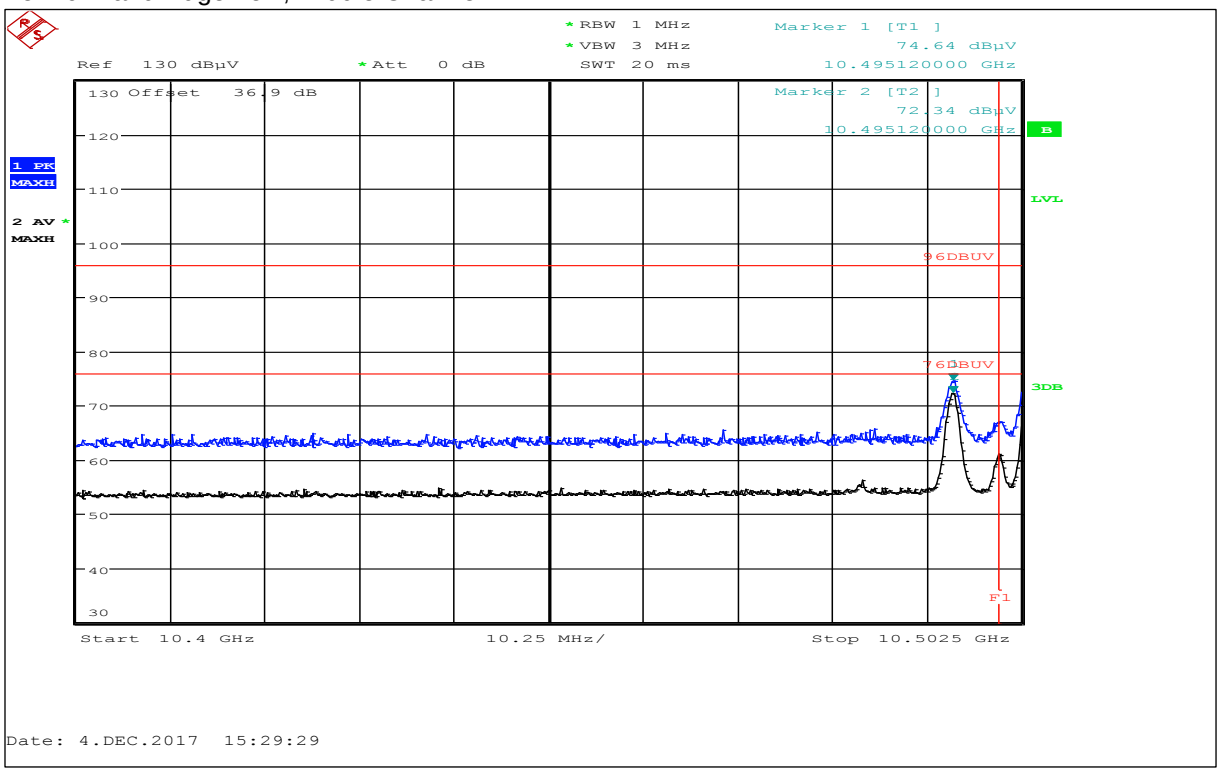
FCC	IC
CFR Part 15.245(b)(3)	RSS-210 F1 (a) (e)
Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209 or RSS-Gen, whichever is the lesser attenuation. PEAK→ 96 dBµV/m / Average → 76 dBµV/m	

Plot No. 19: Band Edge Low, Low Channel



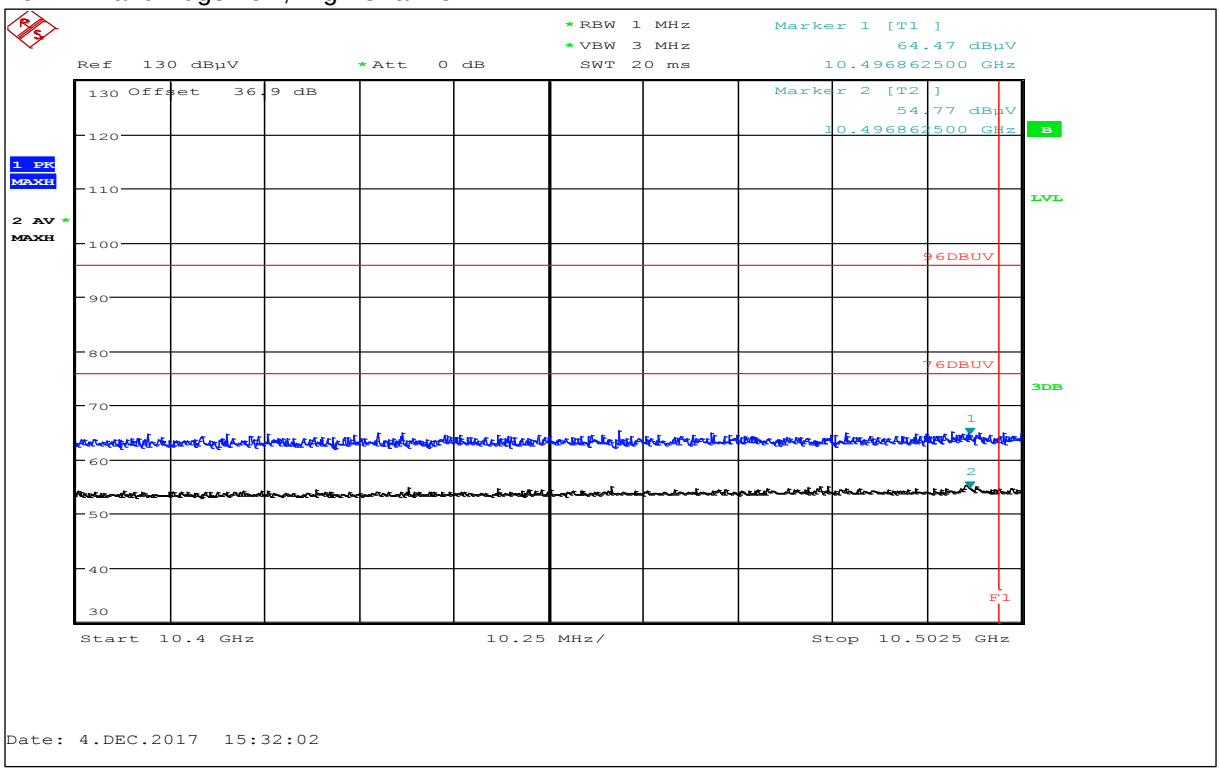
Peak Value: 74.52 dBµV/m (Limit 96 dBµV/m) / Average 72.72 dBµV/m (Limit 76 dBµV/m

Plot No. 20: Band Edge Low, Middle Channel

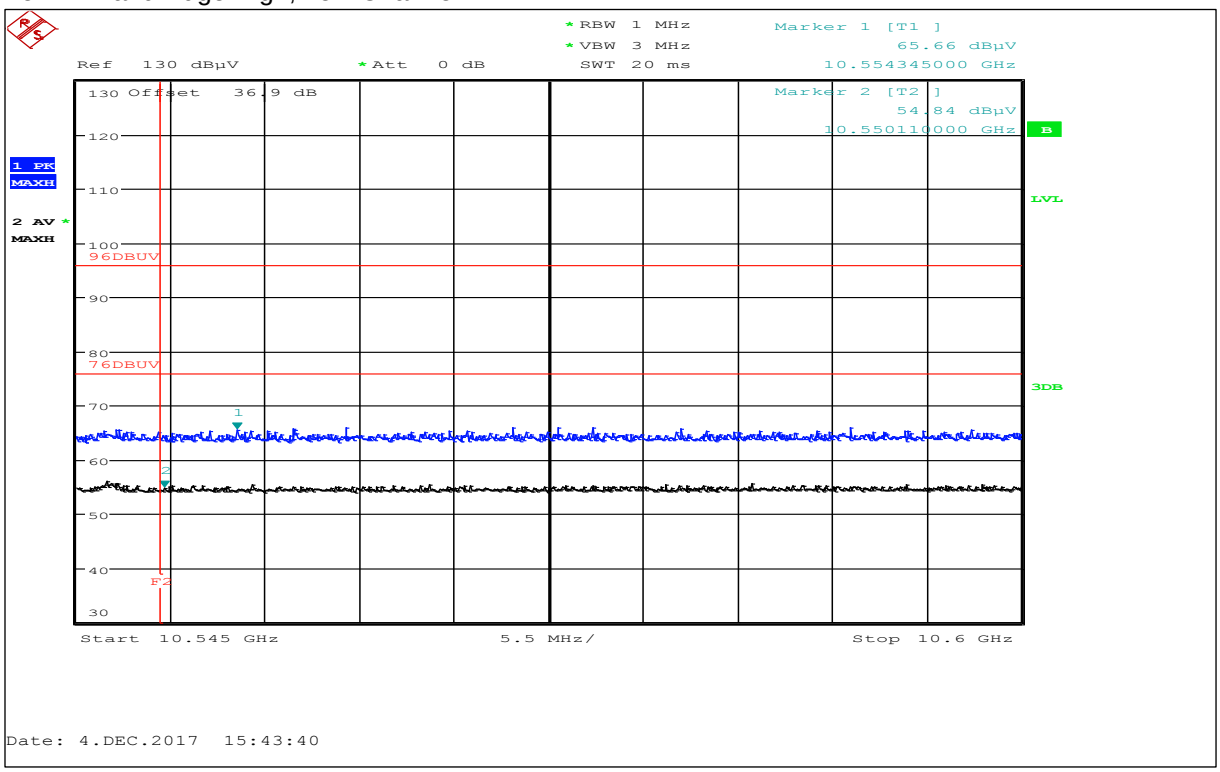


Peak Value: 74.64 dBµV/m (Limit 96 dBµV/m) / Average 72.34 dBµV/m (Limit 76 dBµV/m

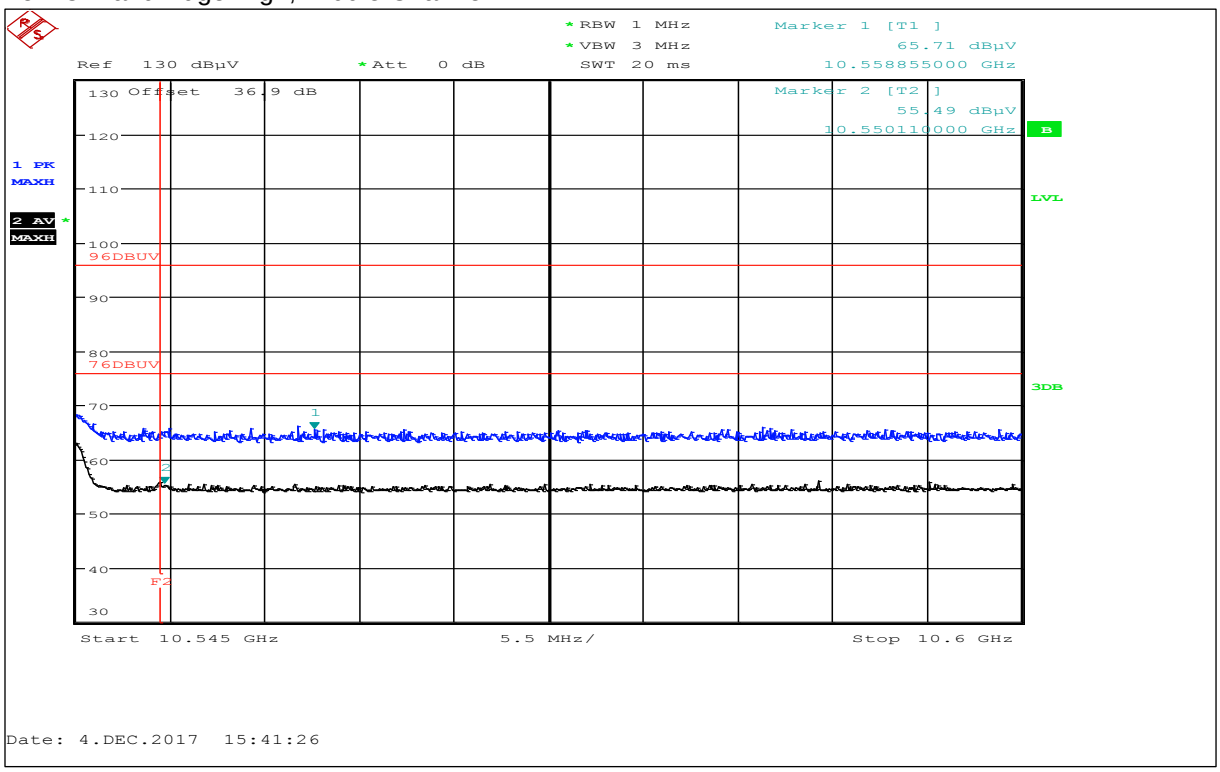
Plot No. 21: Band Edge Low, High Channel



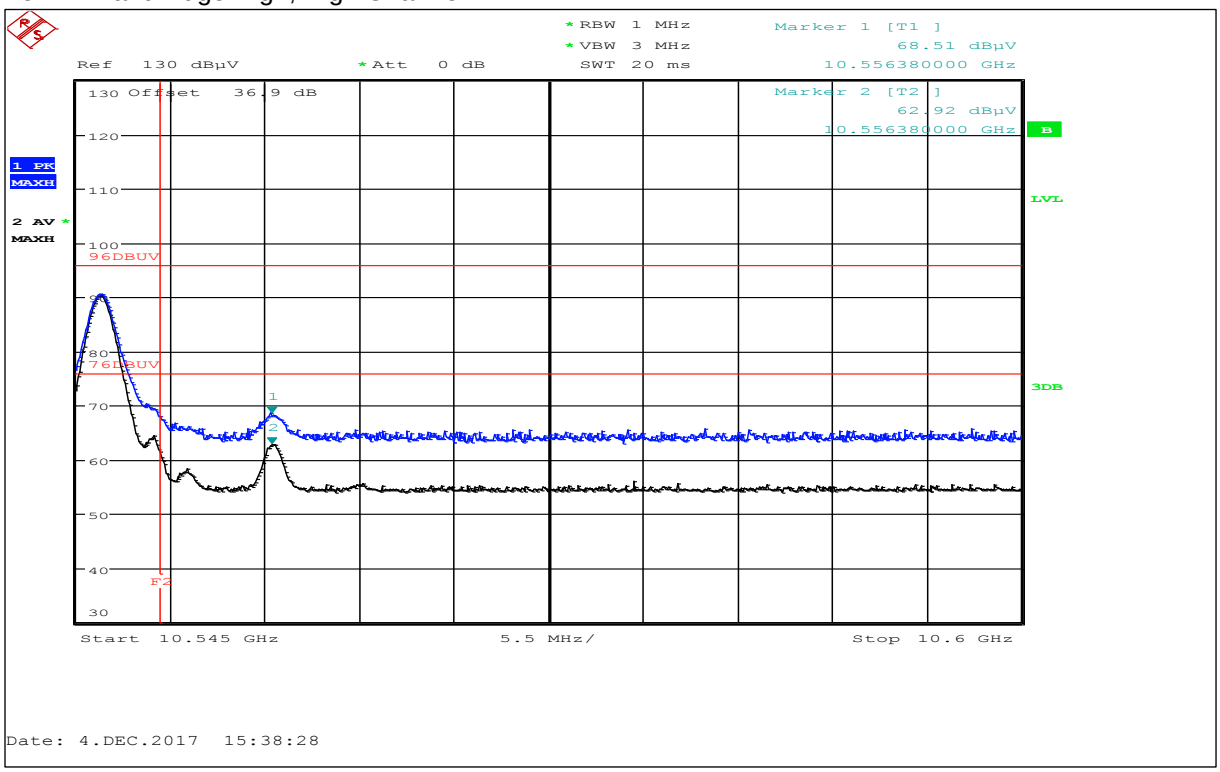
Plot No. 22: Band Edge High, Low Channel



Plot No. 23: Band Edge High, Middle Channel



Plot No. 24: Band Edge High, High Channel



Peak Value: 68.65 dBµV/m (Limit 96 dBµV/m) / Average 62.92 dBµV/m (Limit 76 dBµV/m

10.4 Field strength of emissions (radiated spurious)

Description:

Measurement of the radiated spurious emissions in transmit mode.

Measurement:

Measurement parameter	
Detector:	F < 1 GHz: Quasi-Peak F > 1 GHz: Average
Sweep time:	Auto
Video bandwidth:	Auto
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz
Frequency range:	30 MHz to 50 GHz
Trace-Mode:	Max-Hold

Limits:

FCC		IC
CFR Part 15.209(a)		RSS-210 F.1 (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

FCC	IC
CFR Part 15.245(b)(3)	RSS-210 F.1 (e)
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 or RSS-Gen, whichever is the lesser attenuation. PEAK→ 96 dBµV/m / Average → 76 dBµV/m	

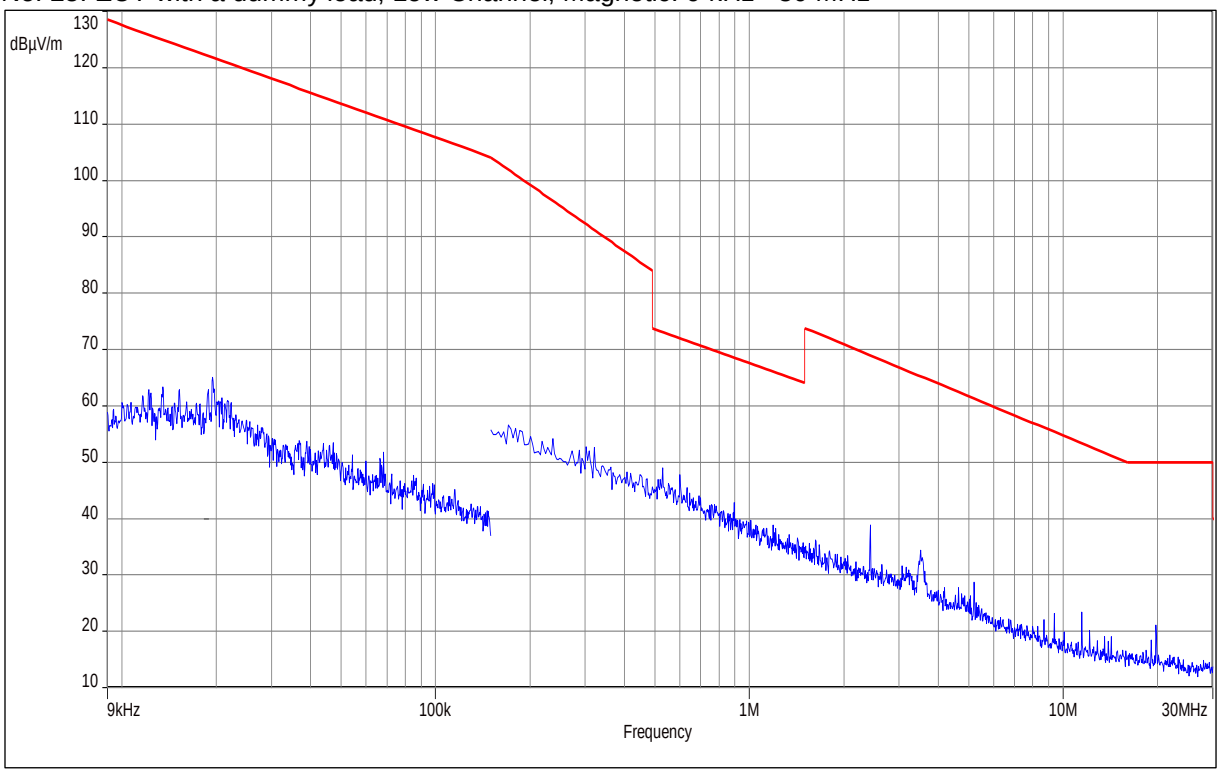
FCC	IC	
CFR Part 15.245(a)	RSS-GEN	
Field strength of harmonics		
The field strength of harmonics from intentional radiators shall comply with the following:		
Frequency [GHz]	Field Strength [mV/m // dBµV/m]	Measurement distance [m]
10.500 – 10.550	25 // 88	3

Results:

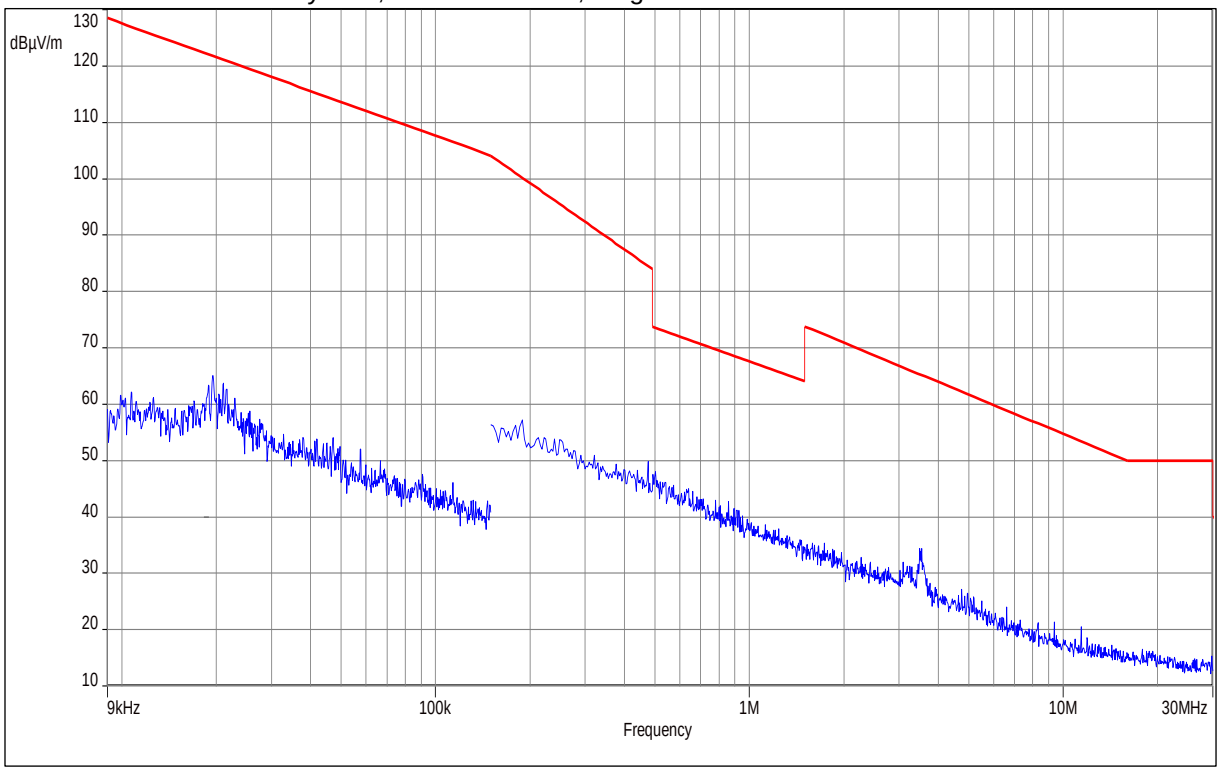
TX Spurious Emissions Radiated [dBµV/m]								
EUT			-/-			-/-		
Frequency [MHz]	Detector	Level [dBµV/m]	Frequency [GHz]	Detector	Level [dBµV/m]	Frequency [GHz]	Detector	Level [dBµV/m]
See plots								
Measurement uncertainty			± 3 dB					

Verdict: **complies**

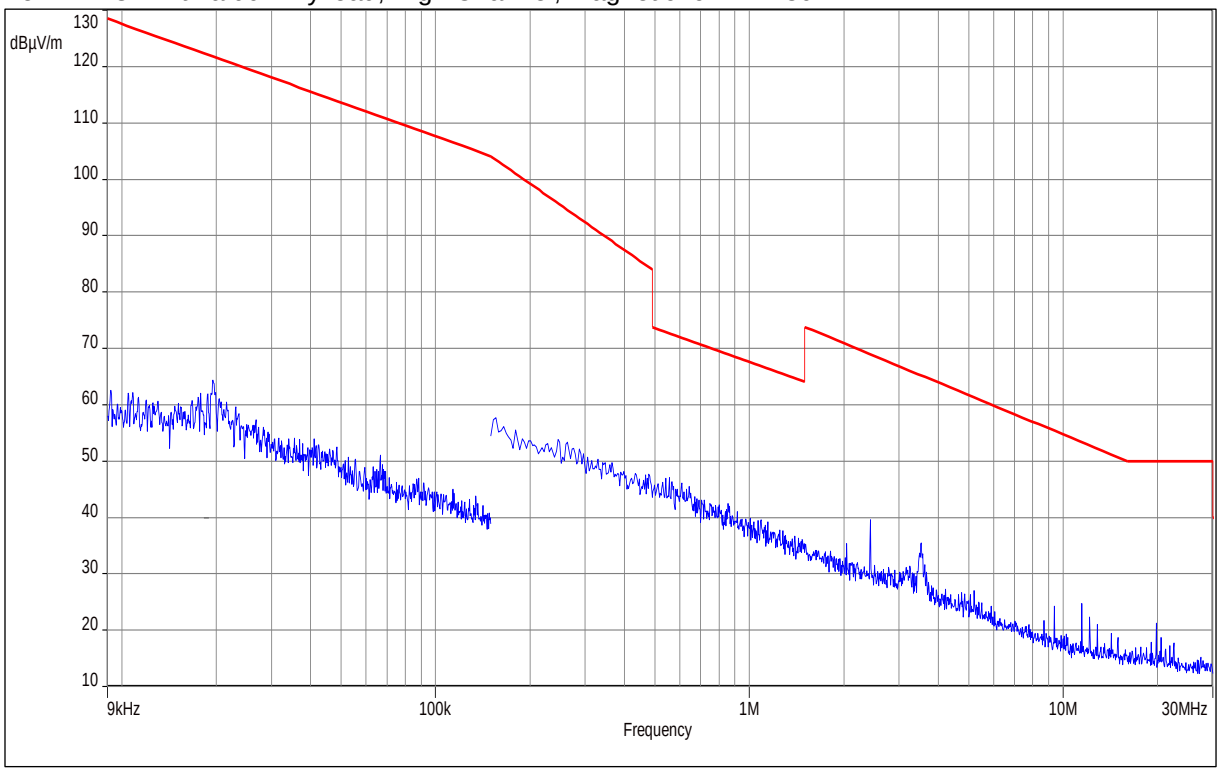
Plot No. 25: EUT with a dummy load, Low Channel, Magnetic: 9 kHz - 30 MHz



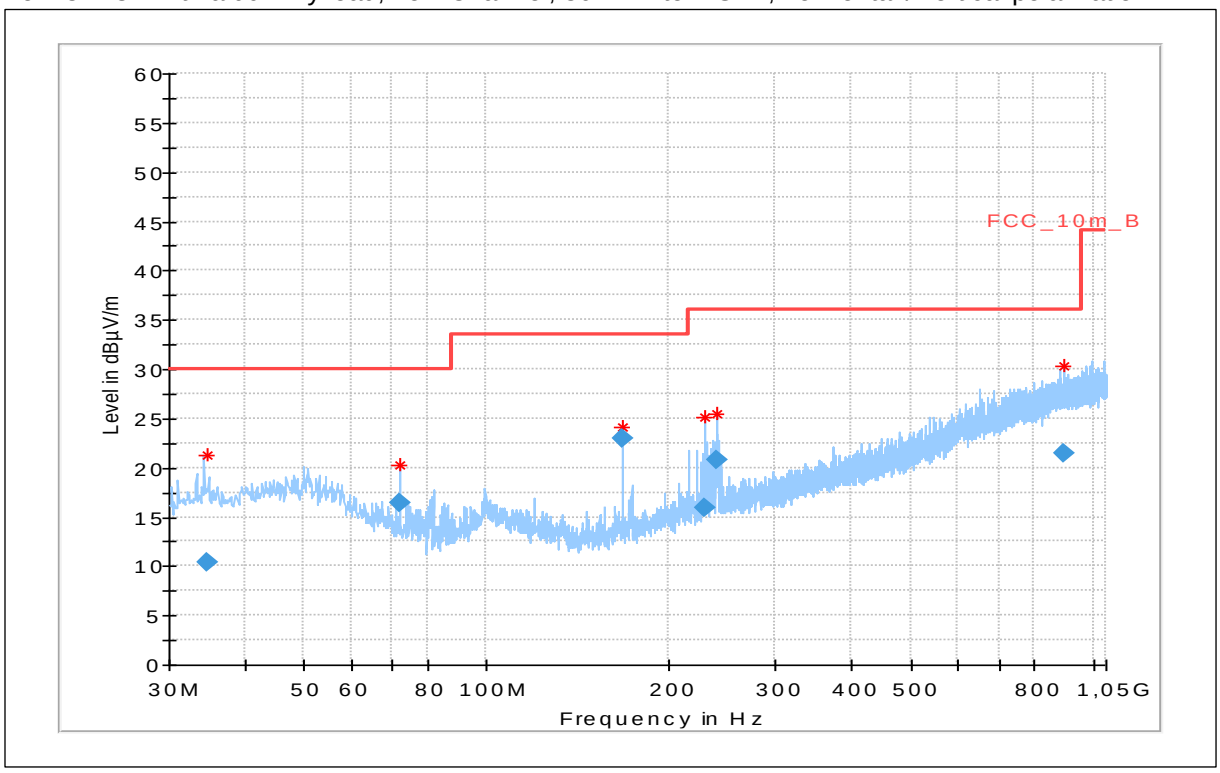
Plot No. 26: EUT with a dummy load, Middle Channel, Magnetic: 9 kHz - 30 MHz



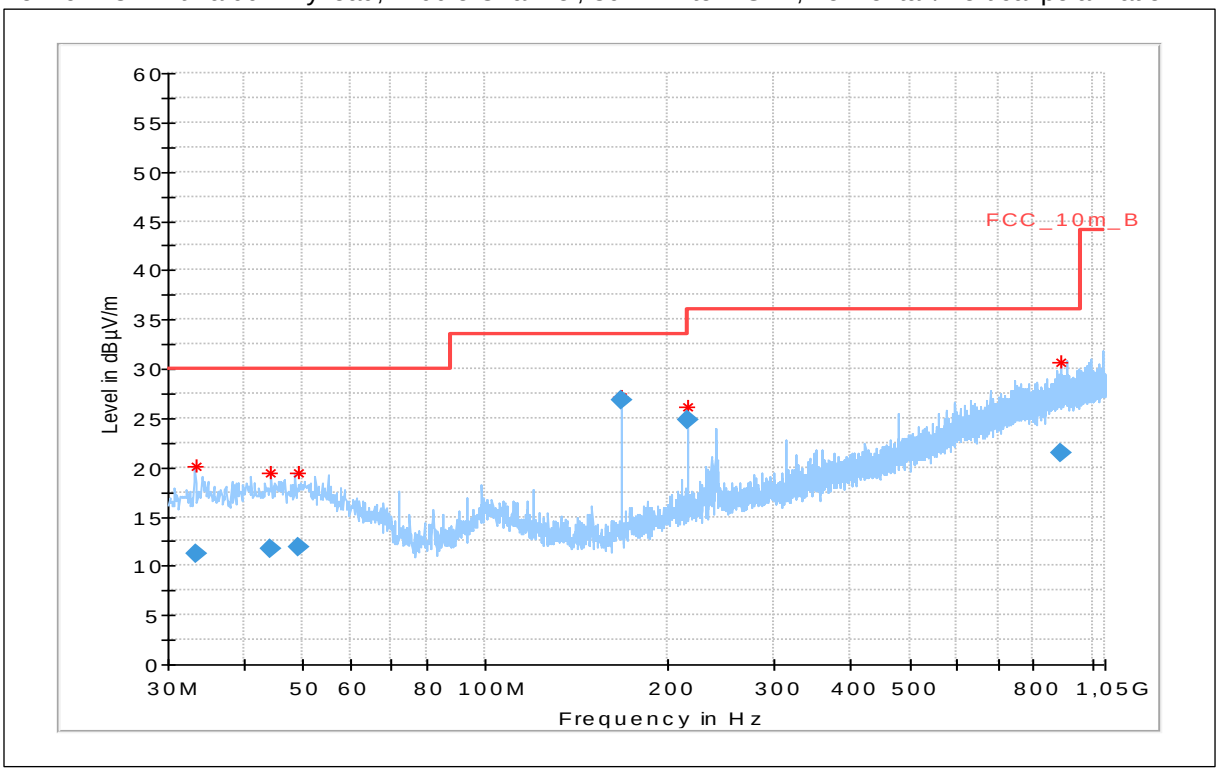
Plot No. 27: EUT with a dummy load, High Channel, Magnetic: 9 kHz - 30 MHz



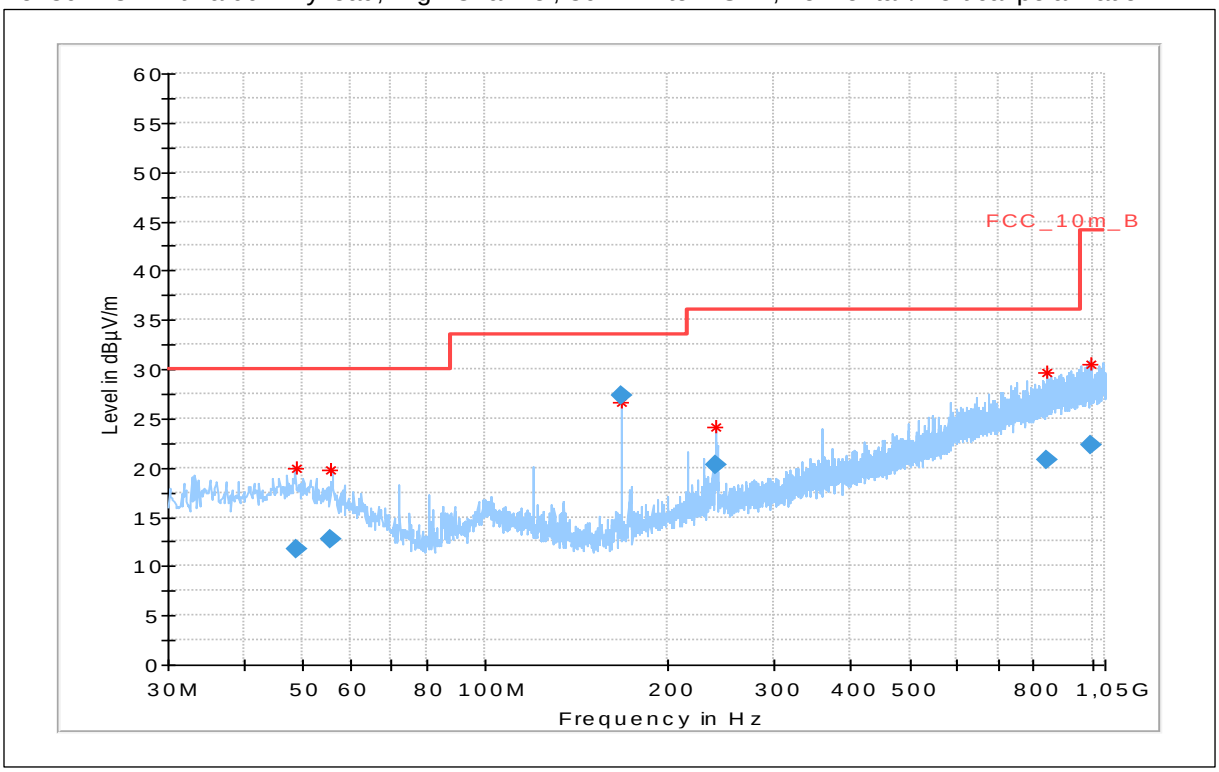
Plot No. 28: EUT with a dummy load, Low Channel, 30 MHz to 1 GHz, horizontal / vertical polarization



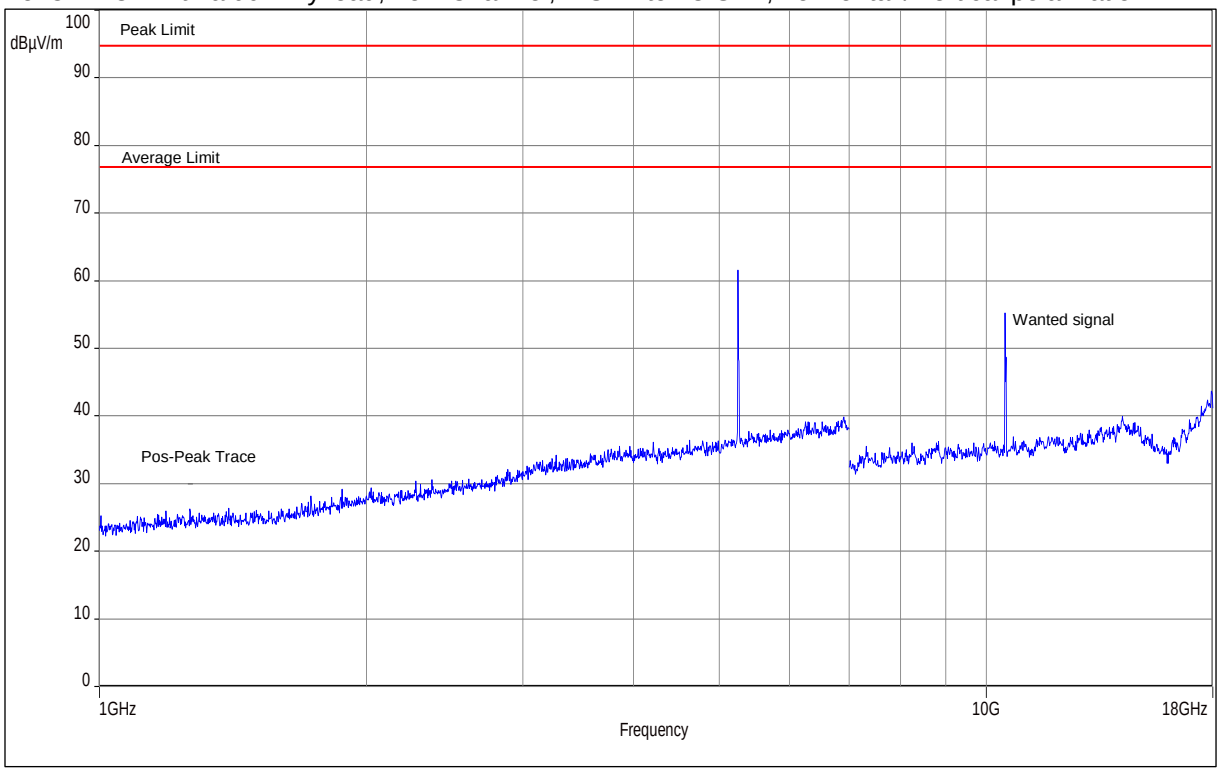
Plot No. 29: EUT with a dummy load, Middle Channel, 30 MHz to 1 GHz, horizontal / vertical polarization



Plot No. 30: EUT with a dummy load, High Channel, 30 MHz to 1 GHz, horizontal / vertical polarization

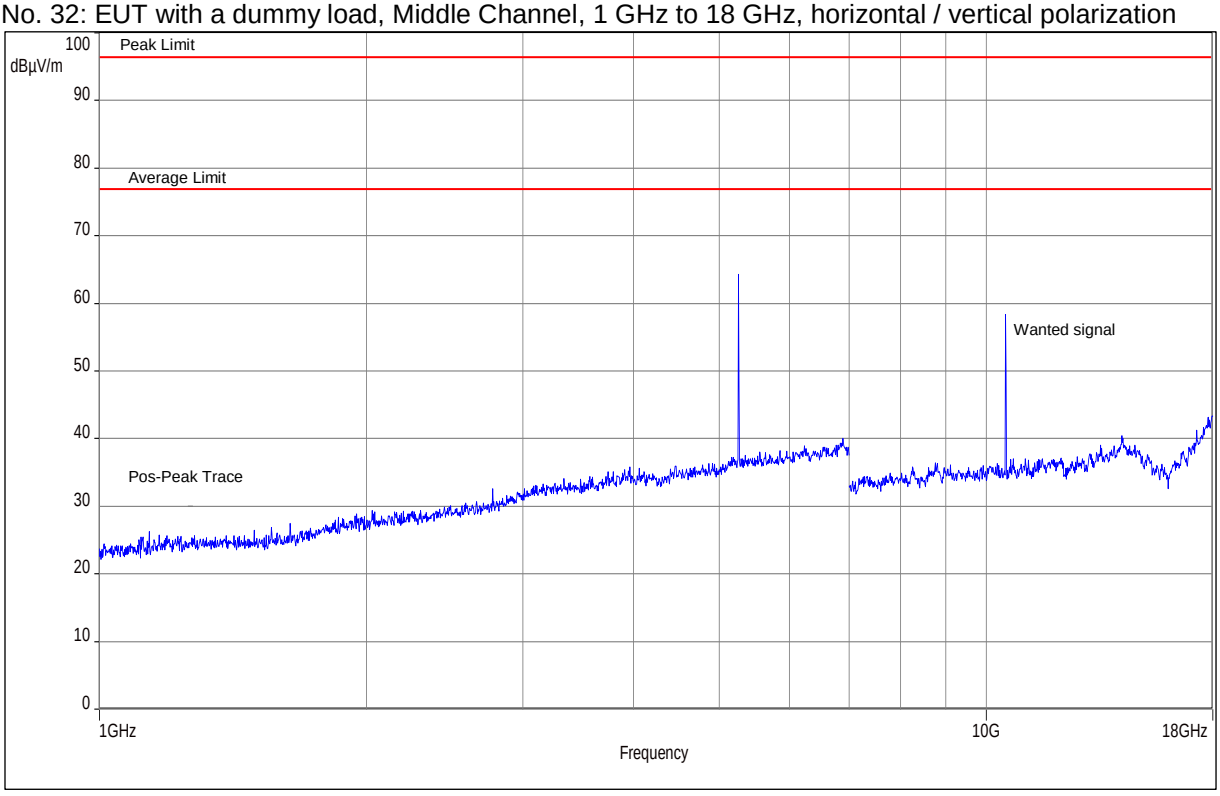


Plot No. 31: EUT with a dummy load, Low Channel, 1 GHz to 18 GHz, horizontal / vertical polarization



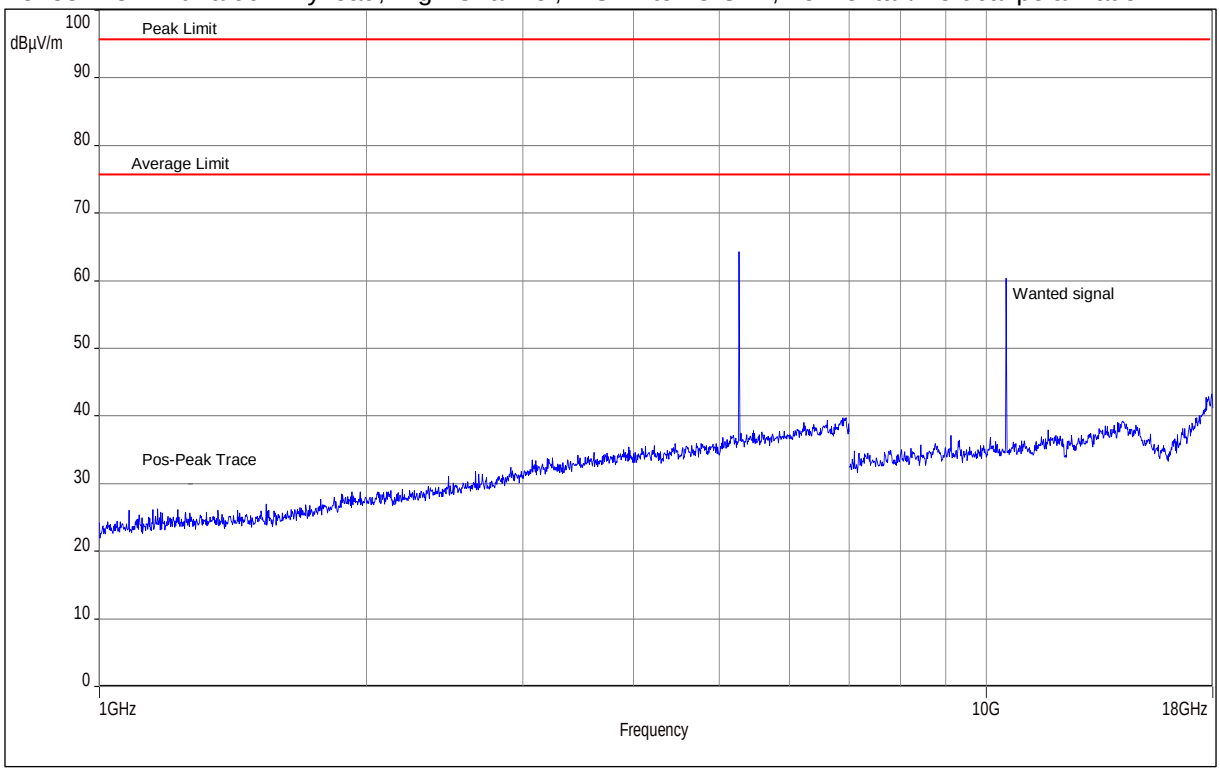
The spurious at 5.2 GHz is out of the restricted band

Plot No. 32: EUT with a dummy load, Middle Channel, 1 GHz to 18 GHz, horizontal / vertical polarization



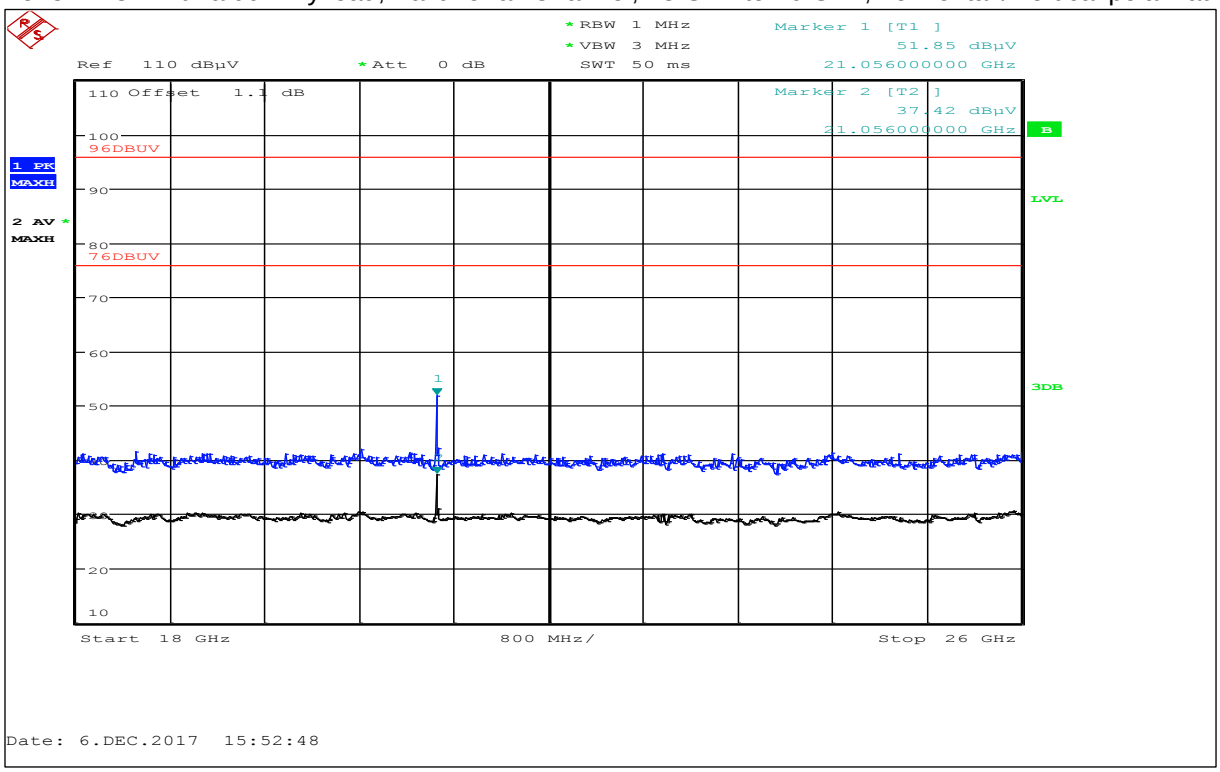
The spurious at 5.2 GHz is out of the restricted band

Plot No. 33: EUT with a dummy load, High Channel, 1 GHz to 18 GHz, horizontal / vertical polarization

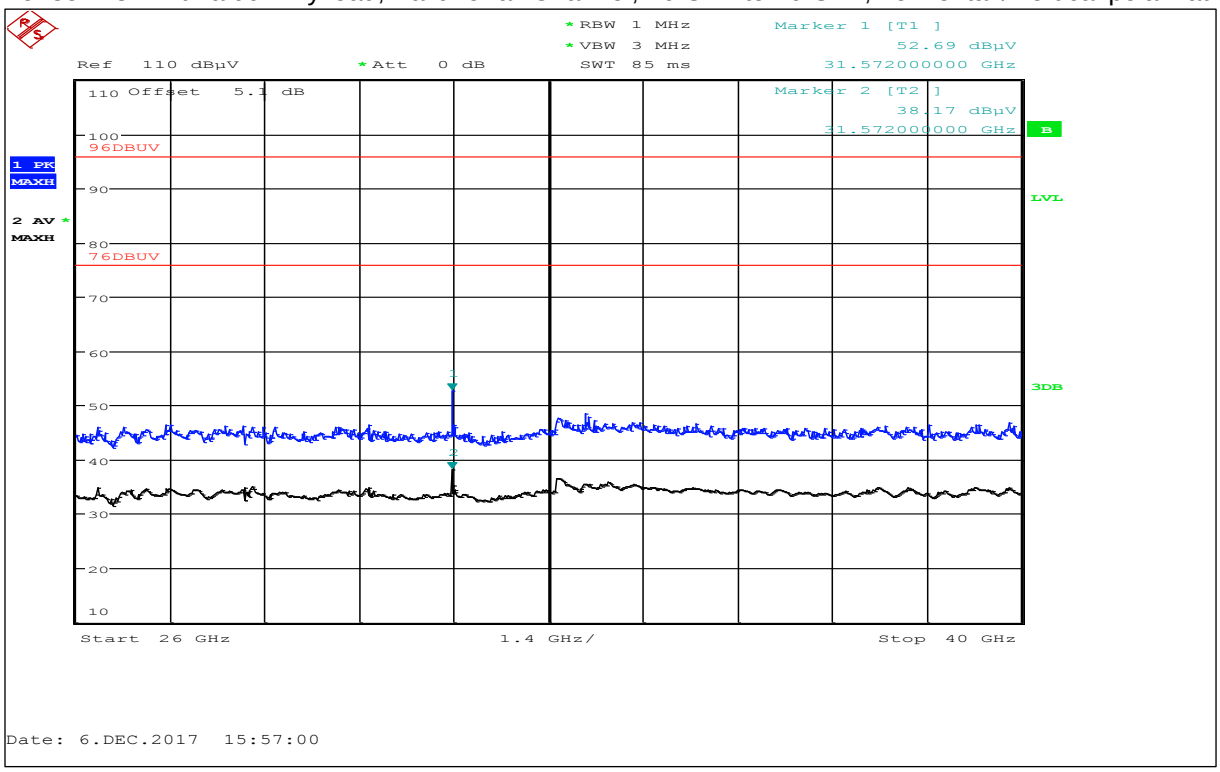


The spurious at 5.2 GHz is out of the restricted band

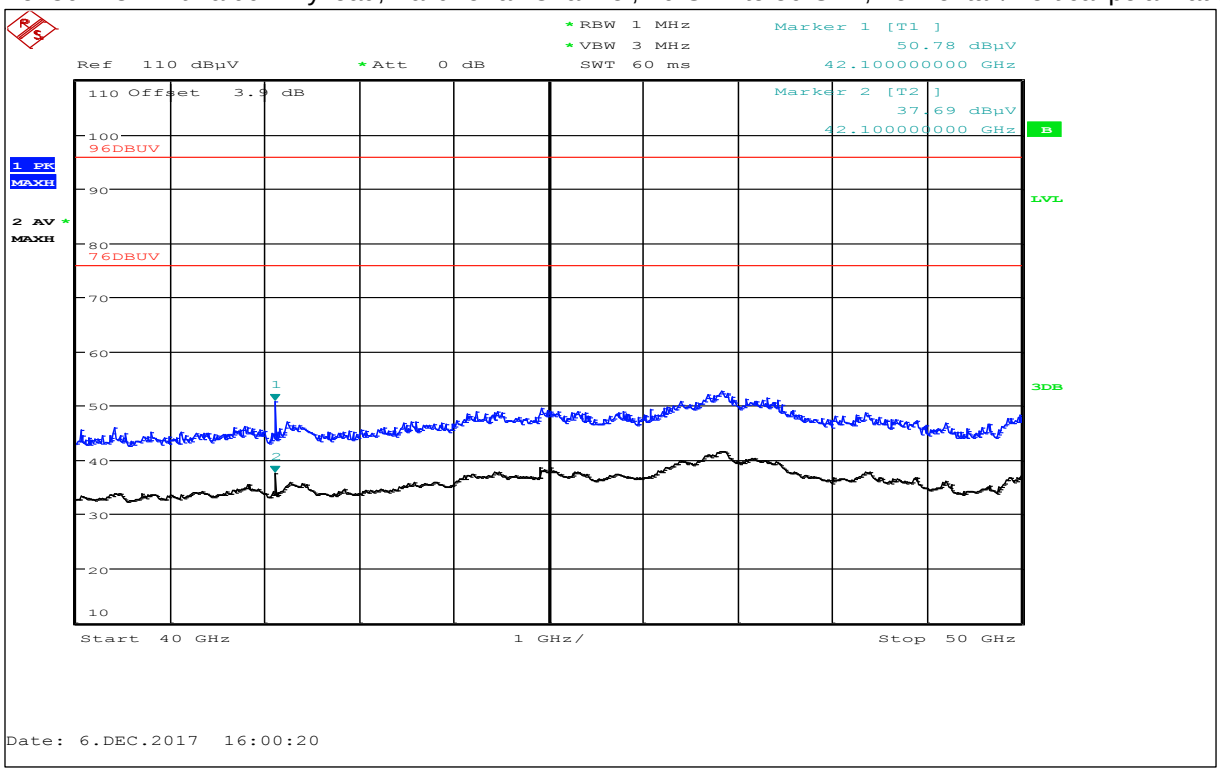
Plot No. 34: EUT with a dummy load, Valid for all Channel, 18 GHz to 26 GHz, horizontal / vertical polarization



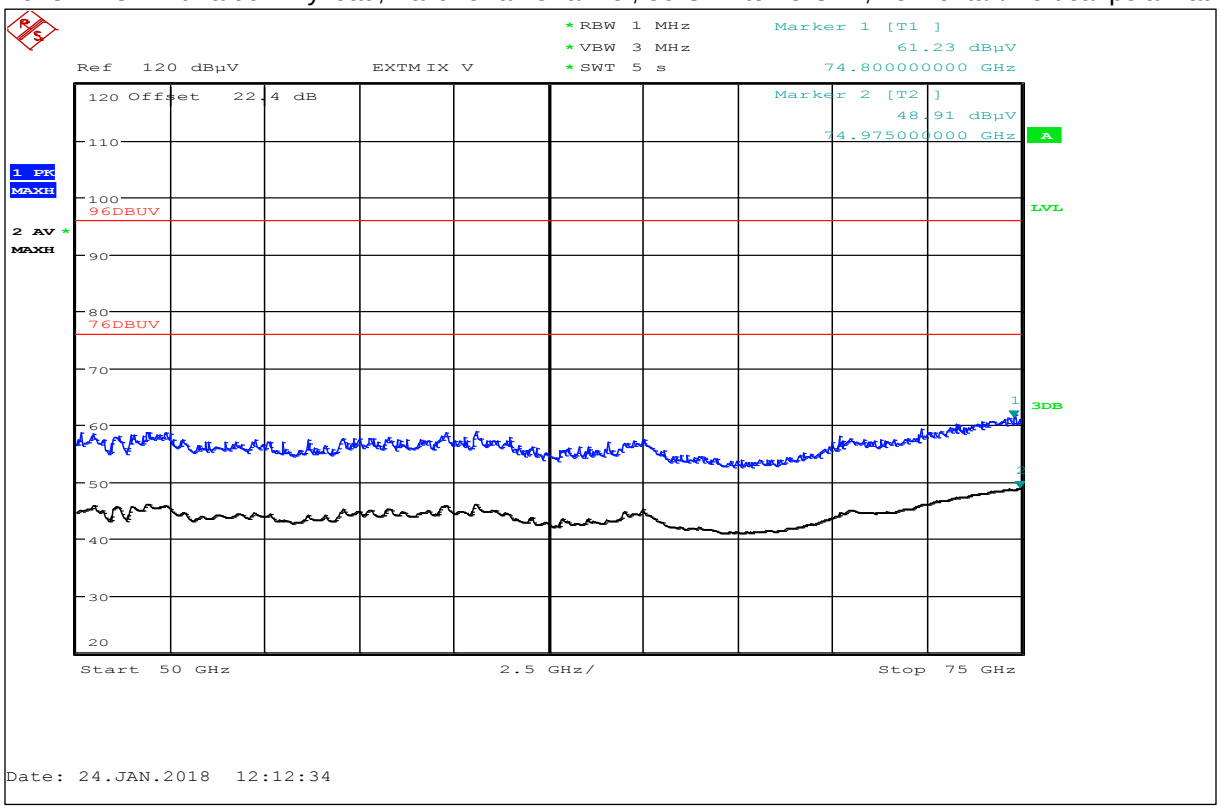
Plot No. 35: EUT with a dummy load, Valid for all Channel, 26 GHz to 40 GHz, horizontal / vertical polarization



Plot No. 36: EUT with a dummy load, Valid for all Channel, 40 GHz to 50 GHz, horizontal / vertical polarization



Plot No. 37: EUT with a dummy load, Valid for all Channel, 50 GHz to 75 GHz, horizontal / vertical polarization



10.5 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:

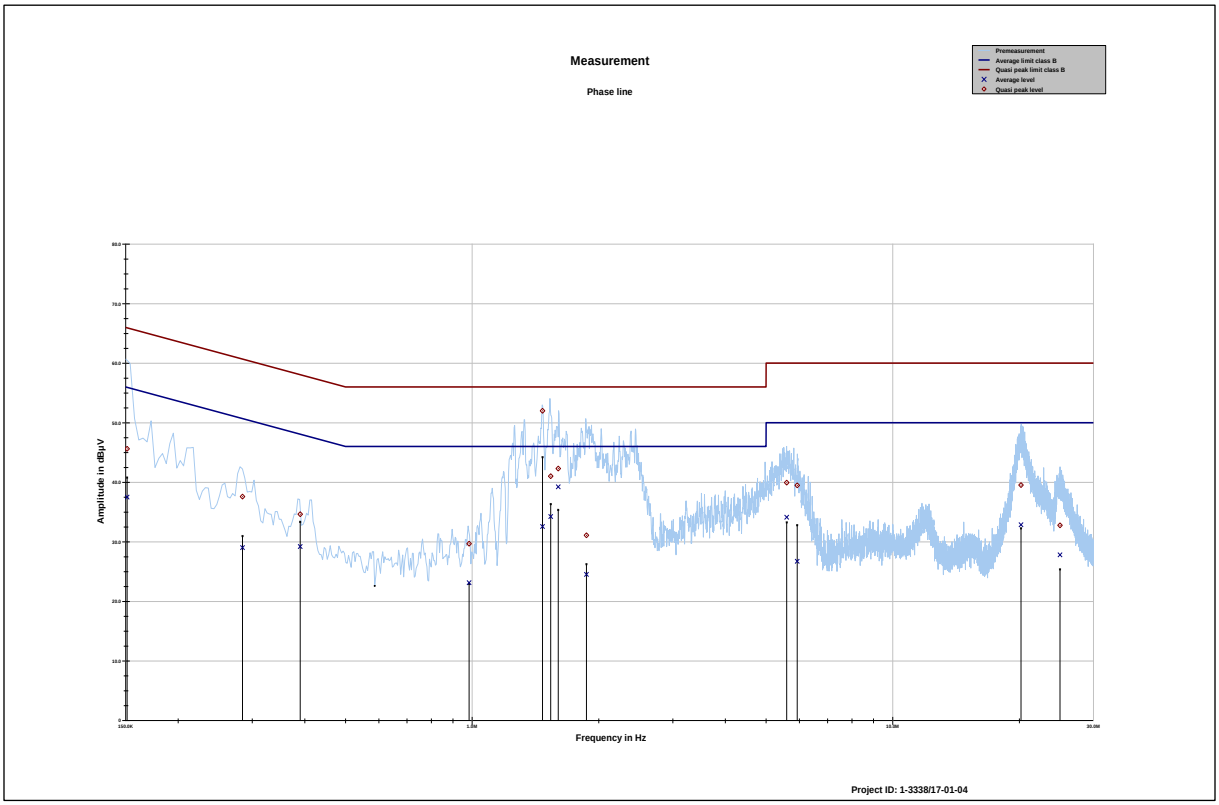
FCC		IC
CFR Part 15.207(a)		RSS-Gen 8.8
Conducted Spurious Emissions < 30 MHz		
Frequency (MHz)	Quasi-Peak (dBµV/m)	Average (dBµV/m)
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30.0	60	50

*Decreases with the logarithm of the frequency

Measurement results:

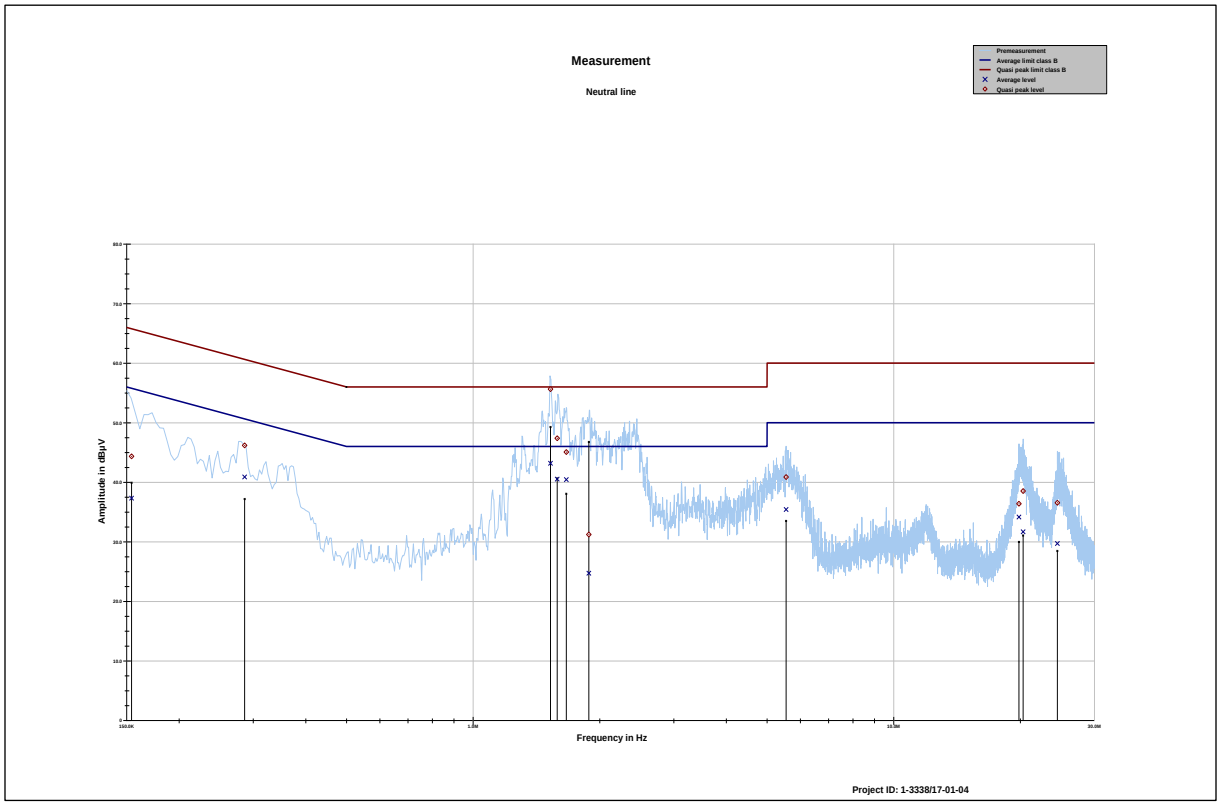
See plots below.

Plot No. 38: Phase line



Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.151265	45.62	20.31	65.930	37.51	18.45	55.964
0.284461	37.58	23.10	60.685	29.01	23.14	52.158
0.390215	34.63	23.43	58.059	29.20	19.93	49.137
0.983474	29.68	26.32	56.000	23.12	22.88	46.000
1.469963	52.00	4.00	56.000	32.57	13.43	46.000
1.537733	41.01	14.99	56.000	34.23	11.77	46.000
1.602554	42.30	13.70	56.000	39.23	6.77	46.000
1.870037	31.09	24.91	56.000	24.53	21.47	46.000
5.597297	39.93	20.07	60.000	34.12	15.88	50.000
5.928165	39.47	20.53	60.000	26.72	23.28	50.000
20.192235	39.53	20.47	60.000	32.87	17.13	50.000
24.991249	32.76	27.24	60.000	27.81	22.19	50.000

Plot No. 39: Neutral line



Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.154148	44.34	21.43	65.773	37.32	18.56	55.881
0.286307	46.18	14.45	60.631	40.89	11.22	52.106
1.527268	55.64	0.36	56.000	43.18	2.82	46.000
1.584877	47.38	8.62	56.000	40.52	5.48	46.000
1.665506	45.07	10.93	56.000	40.44	5.56	46.000
1.884662	31.22	24.78	56.000	24.72	21.28	46.000
5.549093	40.87	19.13	60.000	35.41	14.59	50.000
19.849185	36.39	23.61	60.000	34.16	15.84	50.000
20.310614	38.52	21.48	60.000	31.68	18.32	50.000
24.496630	36.55	23.45	60.000	29.71	20.29	50.000

11 Glossary

EUT	Equipment under test
DUT	Device under test
GUE	GNSS User Equipment
ETSI	European Telecommunications Standards Institute
EN	European Standard
FCC	Federal Communications 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
RLAN	Radio local area network
DSSS	Dynamic sequence spread spectrum
OFDM	Orthogonal frequency division multiplexing
FHSS	Frequency hopping spread spectrum
GNSS	Global Navigation Satellite System
C/N_0	Carrier to noise-density ratio, expressed in dB-Hz

12 Document history

Version	Applied changes	Date of release
-/-	DRAFT	2018-01-31
-/-	Minor editorial changes	2018-02-05
-A	Minor editorial changes	2018-03-16
-B	Minor editorial changes, AC conducted Plots, Field strength (Average)	2018-04-03

13 Accreditation Certificate

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Note: The current certificate 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-12076-01-03.pdf