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TEST REPORT

Test report no.: 1-3012/16-01-04-A



Deutsche
Akkreditierungsstelle
D-PL-12076-01-01

Testing laboratory

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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

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Manufacturer

Wisycom SRL

Via Spin, 156

36060 Romano D' Ezzelino - Vicenza / ITALY

Test standard/s

47 CFR Part 74

Title 47 of the Code of Federal Regulations; Chapter I; Part 74 - Experimental radio, auxiliary, special broadcast and other program distributional services

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

Test Item

Kind of test item: VHF BASE TRANSMITTER

Model name: CST38

FCC ID: POU CST38

IC: 11967A-CST38

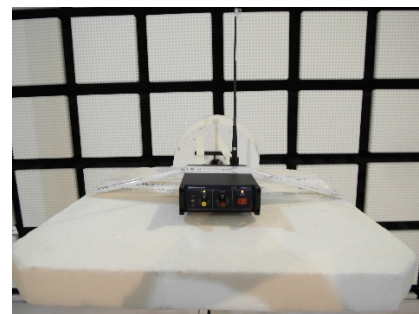
Frequency: 174 MHz to 216 MHz

Technology tested: Proprietary

Antenna: External $\frac{1}{4}$ λ antenna for portable equipment

Power supply: 10.5 V to 16.0 V DC by external power supply

Temperature range: -10°C to +55°C



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

Test report authorized:



Marco Bertolino
Lab Manager
Radio Communications & EMC

Test performed:



Christoph Schneider
Lab Manager
Radio Communications & EMC

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2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. 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 replaces the test report with the number 1-3012/16-01-04 and dated 2017-04-06.

2.2 Application details

Date of receipt of order:	2017-01-02
Date of receipt of test item:	2017-02-03
Start of test:	2017-02-07
End of test:	2017-04-03
Person(s) present during the test:	-/-

2.3 Test laboratories sub-contracted

None

3 Test standard/s and references

Test standard	Date	Description
47 CFR Part 74		Title 47 of the Code of Federal Regulations; Chapter I; Part 74 - Experimental radio, auxiliary, special broadcast and other program distributional services

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

4 Test environment

Temperature	:	T _{nom} T _{max} T _{min}	+22 °C during room temperature tests +55 °C during high temperature tests -10 °C during low temperature tests
Relative humidity content	:		44 %
Barometric pressure	:		Not relevant for this kind of testing
Power supply	:	V _{nom} V _{max} V _{min}	12.0 V DC by external power supply 16.0 V 10.5 V

5 Test item

5.1 General description

Kind of test item	:	VHF BASE TRANSMITTER
Type identification	:	CST38
FCC ID	:	POUCST38
Reg. Number IC	:	11967A-CST38
HMN	:	-/-
PMN	:	CST38-US
HVIN	:	CST38-US
FVIN	:	-/-
S/N serial number	:	-/-
HW hardware status	:	3
SW software status	:	-/-
Frequency band	:	174 MHz to 216 MHz Lowest carrier frequency: 210.000 MHz Highest carrier frequency: 215.425 MHz
Type of radio transmission	:	Modulated carrier
Use of frequency spectrum	:	
Type of modulation	:	FM
Number of channels	:	16
Channel spacing	:	25 kHz
Antenna	:	External $\frac{1}{4}$ λ antenna for portable equipment Name: AWN38-V11 Gain: 0 dB
Power supply	:	10.5 V to 16.0 V DC by external power supply
Temperature range	:	-10°C to +55°C

5.2 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: 1-3012/16-01-01_AnnexA
 1-3012/16-01-01_AnnexB
 1-3012/16-01-01_AnnexD

6 Description of the test setup

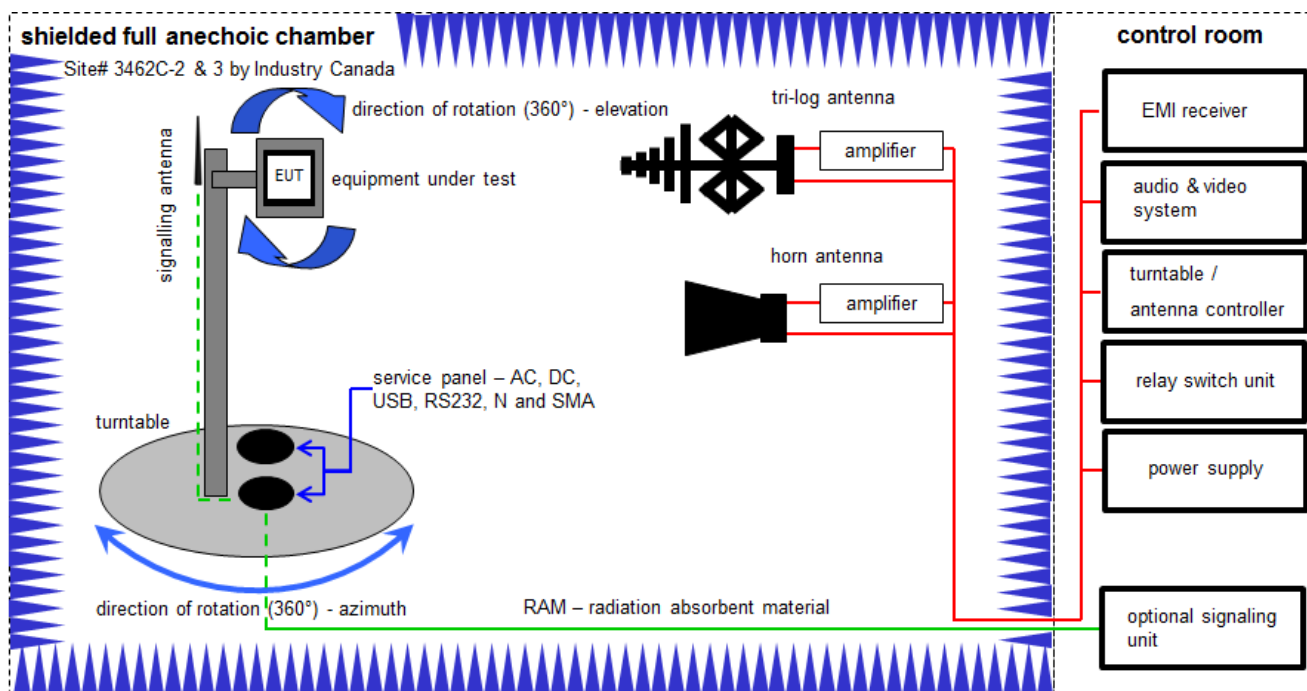
Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements 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
vlk!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress

6.1 Shielded fully anechoic chamber



Measurement distance: tri-log antenna and horn antenna 3 meter

$$OP = AV + D - G + CA$$

(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance;
 G-antenna gain+amplifier gain; CA-loss signal path)

Example calculation:

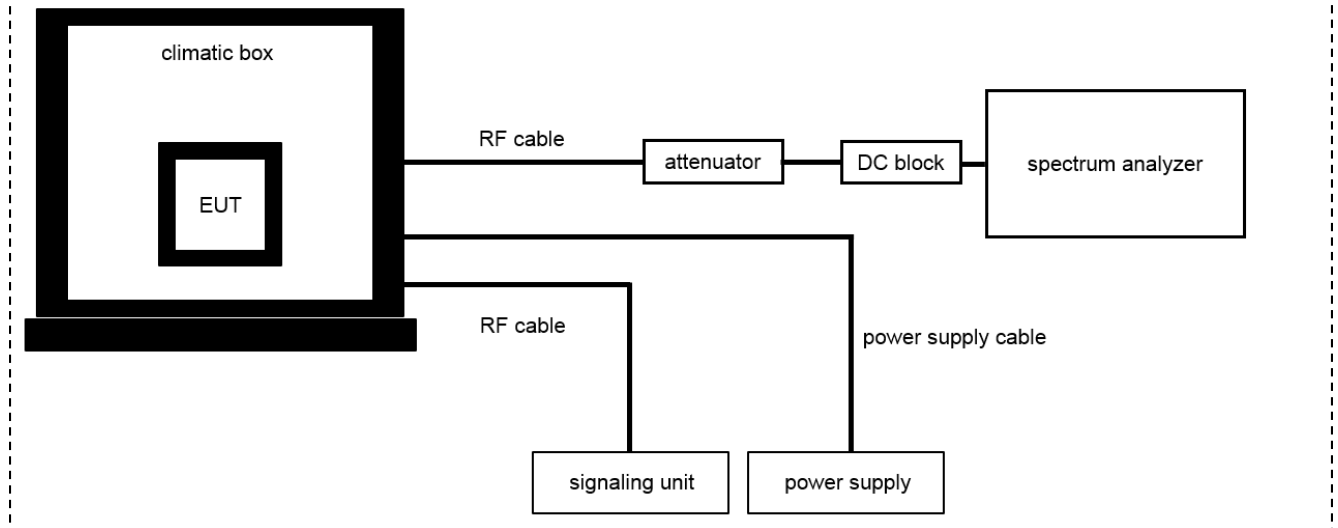
$$OP \text{ [dBm]} = -65.0 \text{ [dBm]} + 50 \text{ [dB]} - 20 \text{ [dBi]} + 5 \text{ [dB]} = -30 \text{ [dBm]} (1 \mu\text{W})$$

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	B	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vKII	20.05.2015	20.05.2017
2	A, B	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
3	A, B	Switch / Control Unit	3488A	HP	-/-	300000199	ne	-/-	-/-
4	A, B	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	31.01.2017	30.01.2018
5	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854	vKII	29.10.2014	29.10.2017
6	B	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22049	300004481	ev	-/-	-/-
7	A, B	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
8	B	High Pass Filter	VHF-3500+	Mini Circuits	-/-	400000193	ne	-/-	-/-

6.2 Conducted measurements normal and extreme conditions

Conducted measurements normal & extreme conditions



$$OP = AV + CA$$

(OP-output power; AV-analyzer value; CA-loss signal path)

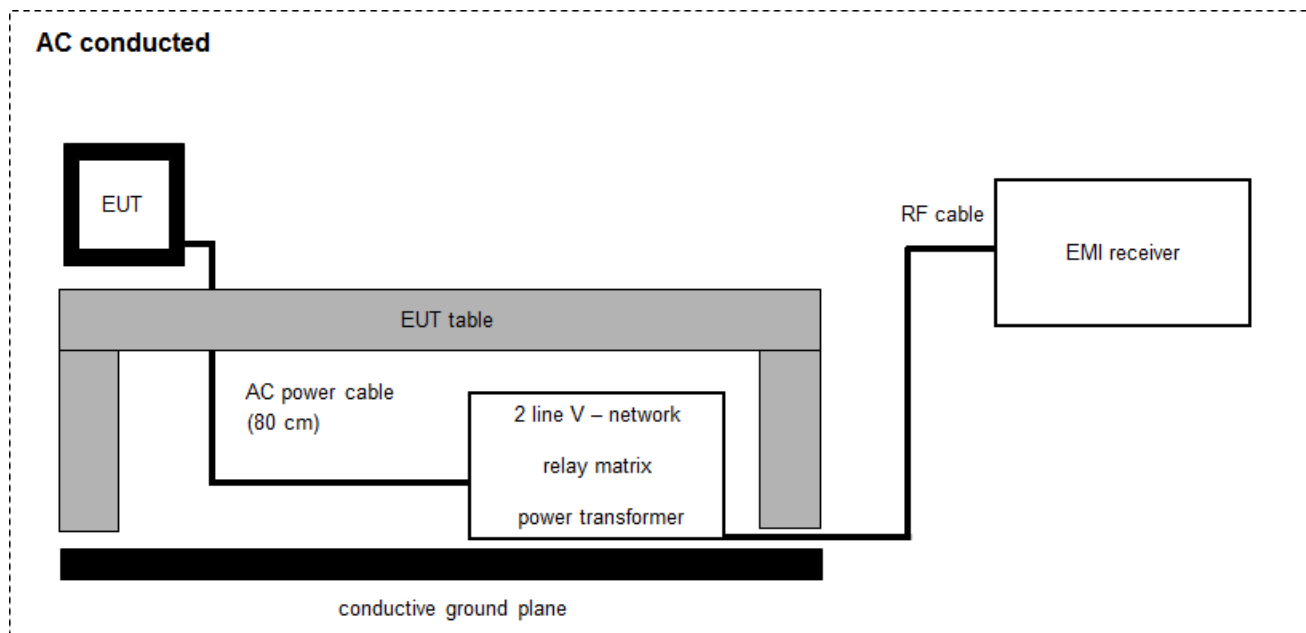
Example calculation:

$$OP \text{ [dBm]} = 6.0 \text{ [dBm]} + 11.7 \text{ [dB]} = 17.7 \text{ [dBm]} \text{ (58.88 mW)}$$

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	C	Audio Analyzer 2Hz - 300 kHz	UPD	R&S	841074/009	300001236	k	02.02.2016	02.02.2018
2	B	Temperature Test Chamber	T-40/50	CTS GmbH	064023	300003540	ev	03.09.2015	03.09.2017
3	A, B, C, D	Signal- and Spectrum Analyzer	FSW26	R&S	101455	300004528	k	14.03.2016	24.01.2018
4	A, B, C, D	DC Power Supply, 60V, 10A	6038A	HP	3122A11097	300001204	Ve	21.01.2015	21.01.2018
5	A, C	Radiocom. Analyzer Multifunction	CMTA 54	R&S	894043/010	300001175	NK!	06.06.2007	-/-
6	D	synthesizer DC-600 kHz	8904A	HP	2822A01203	300001367	√K!!	26.01.2017	25.01.2020

6.3 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:

$$FS [dB\mu V/m] = 37.62 [dB\mu V/m] + 9.90 [dB] + 0.23 [dB] = 47.75 [dB\mu V/m] \quad (244.06 \mu V/m)$$

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Two-line V-Network (LISN) 9 kHz to 30 MHz	ESH3-Z5	R&S	893045/004	300000584	k	31.01.2017	30.01.2018
2	A	RF-Filter-section	85420E	HP	3427A00162	300002214	k	27.11.2006	-/-
3	A	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	Ve	02.02.2016	02.02.2018
4	A	Hochpass 150 kHz	EZ-25	R&S	100010	300003798	ev	08.04.2008	-/-
5	A	MXE EMI Receiver 20 Hz to 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	16.08.2016	16.08.2017

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 $\pm 45^\circ$ 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 12.75 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.

8 Measurement uncertainty

Measurement uncertainty	
Test case	Uncertainty
Transmitter output power	± 3 dB
Occupied bandwidth	± 3 kHz to 10 kHz (depends on the used RBW)
Transmitter frequency stability	± 1 Hz to 1 kHz (depends on the used RBW)
Transmitter unwanted emissions (radiated or conducted)	Radiated: ± 3 dB Conducted: ± 0.5 dB
Modulation characteristics	-/-
Necessary bandwidth (BN) for analogue systems	± 1 kHz (depends on the used RBW)
Frequency modulation	± 3 kHz (depends on the used RBW)
Spurious emissions conducted below 30 MHz (AC conducted)	± 2.6 dB

9 Summary of measurement results

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

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	FCC Part 74	See table!	2017-06-26	-/-

Test specification clause	Test case	Temperature conditions	Voltage conditions	C	NC	NA	NP	Remark
FCC Part 74.861 (e)(1)(i)	Transmitter output power	Nominal	Nominal	☒	☐	☐	☐	-/-
FCC Part 74.861 (e)(5) FCC Part 2.1049	Occupied bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-
FCC Part 74.861 (e)(4) FCC Part 2.1055	Transmitter frequency stability	Nominal	Nominal	☒	☐	☐	☐	-/-
		Extreme	Extreme	☒	☐	☐	☐	
FCC Part 74.861 (e)(6)	Transmitter unwanted emissions (radiated or conducted)	Nominal	Nominal	☒	☐	☐	☐	-/-
FCC Part 74.861 (e)(7) ETSI EN 300 422-1 8.3.1	Necessary bandwidth (BN) for analogue systems	Nominal	Nominal	☒	☐	☐	☐	-/-
FCC Part 74.861 (e)(3)	Frequency modulation	Nominal	Nominal	☒	☐	☐	☐	-/-
§15.107(a) §15.207	Conducted emissions < 30 MHz	Nominal	Nominal	☒	☐	☐	☐	-/-

Note: C = Compliant; NC = Not compliant; NA = Not applicable; NP = Not performed

10 Additional comments

Reference documents: antenna datasheet: fsp-15-fme.de-DE.pdf

Special test descriptions: None

Configuration descriptions: None

Test mode: ☒ No test mode available.
Test signal is applied to the transmitter.

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

Antennas and transmit operating modes: ☒ Operating mode 1 (single antenna)

- Equipment with 1 antenna,
- Equipment with 2 diversity antennas operating in switched diversity mode by which at any moment in time only 1 antenna is used,
- Smart antenna system with 2 or more transmit/receive chains, but operating in a mode where only 1 transmit/receive chain is used)

☐ Operating mode 2 (multiple antennas, no beamforming)

- Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously but without beamforming.

☐ Operating mode 3 (multiple antennas, with beamforming)

- Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously with beamforming.
In addition to the antenna assembly gain (G), the beamforming gain (Y) may have to be taken into account when performing the measurements.

11 Measurement results

11.1 Transmitter output power

Measurement:

Measurement parameter	
Detector:	Peak (worst case) / Average (RMS)
Sweep time:	Auto / 20s
Resolution bandwidth:	> emission bandwidth
Video bandwidth:	> resolution bandwidth
Span:	> 2 times emissions bandwidth
Trace mode:	Max. hold
EUT configuration:	Peak: Unmodulated carrier RMS: Modulate the transmitter with a 2.5 kHz tone at a level 16 dB higher than that required to produce a frequency deviation of ± 75 kHz, or to produce 50% of the manufacturer's rated deviation, whichever is less.
Test setup:	See sub clause 6.1 A
Measurement uncertainty:	See sub clause 8

Limits:

FCC & IC
174 MHz to 216 MHz 50 mW (EIRP, average) / 17 dBm (EIRP, average)

Result:

Frequency (MHz)	transmitter output power EIRP (dBm)	
	Peak	Average
210.000	16.0	16.0
212.150	16.6	16.5
215.425	16.5	16.5

11.2 Occupied bandwidth

Measurement:

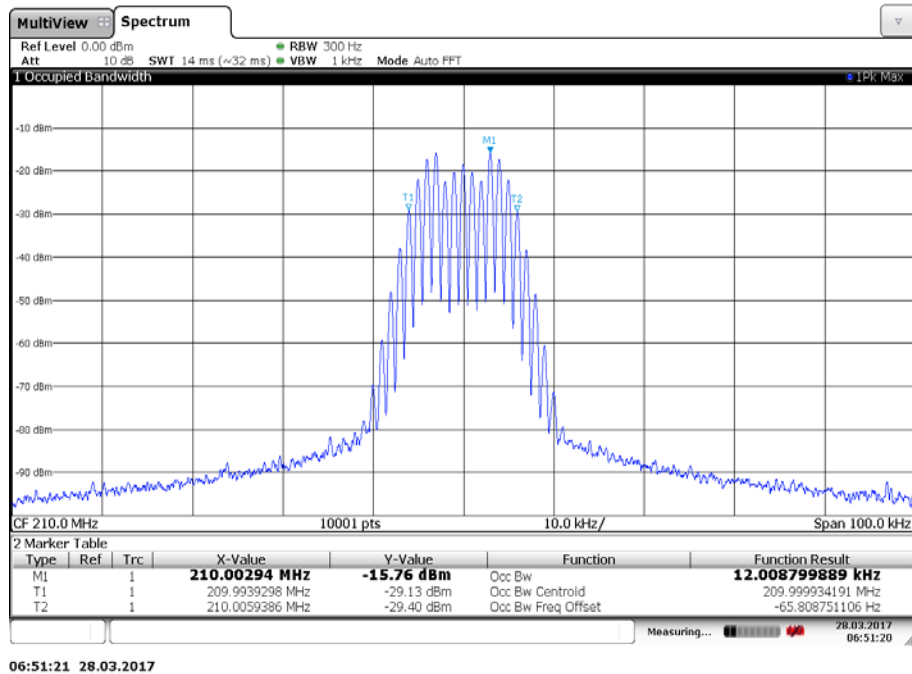
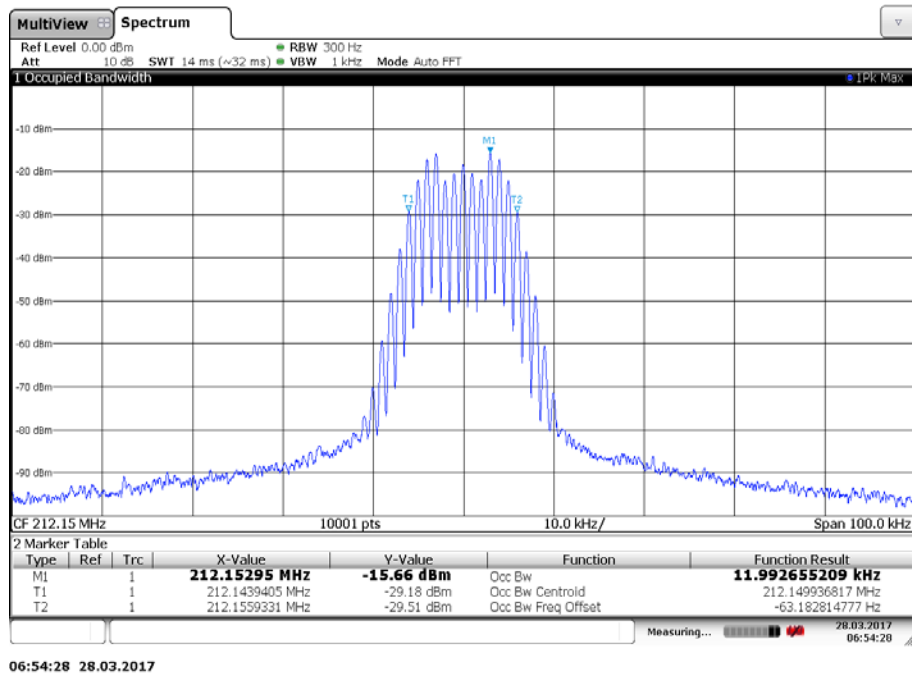
Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1 % to 5 % of the occupied bandwidth
Video bandwidth:	3 x resolution bandwidth
Span:	2 x emission bandwidth
Trace mode:	Max. hold
Analyzer function:	99% power occupied bandwidth function
EUT:	Modulated signal with max. frequency deviation
Test setup:	See sub clause 6.2 A
Measurement uncertainty:	See sub clause 8

Limits:

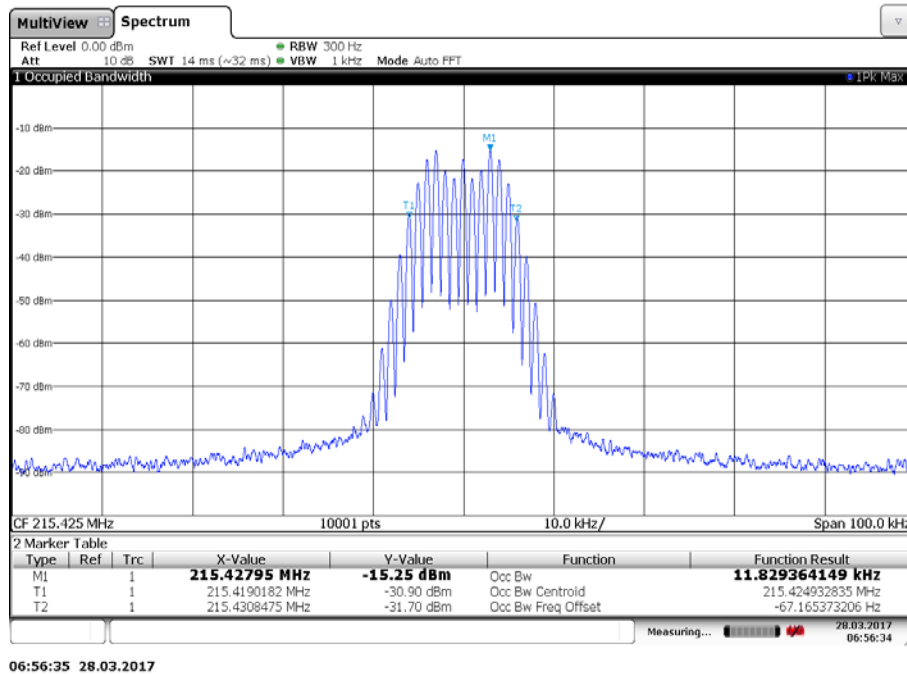
FCC & IC
174 MHz to 216 MHz 200 kHz
Occupied bandwidth 99%. Other than single sideband or independent sideband transmitters - when modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation. The input level shall be established at the frequency of maximum response of the audio modulating circuit.

Result:

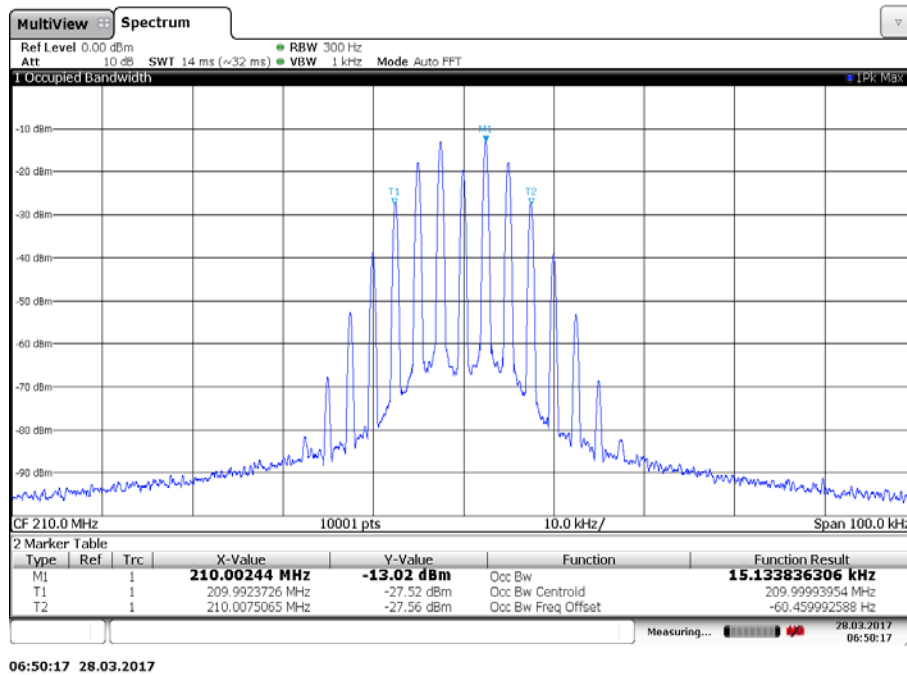
Frequency (MHz)	occupied bandwidth (kHz)	
	1 kHz tone	2.5 kHz tone
210.000	12.0	15.1
212.150	12.0	15.1
215.425	11.8	15.1

Plots:**Plot 1:** 210.000 MHz, 1 kHz tone**Plot 2:** 212.150 MHz, 1 kHz tone

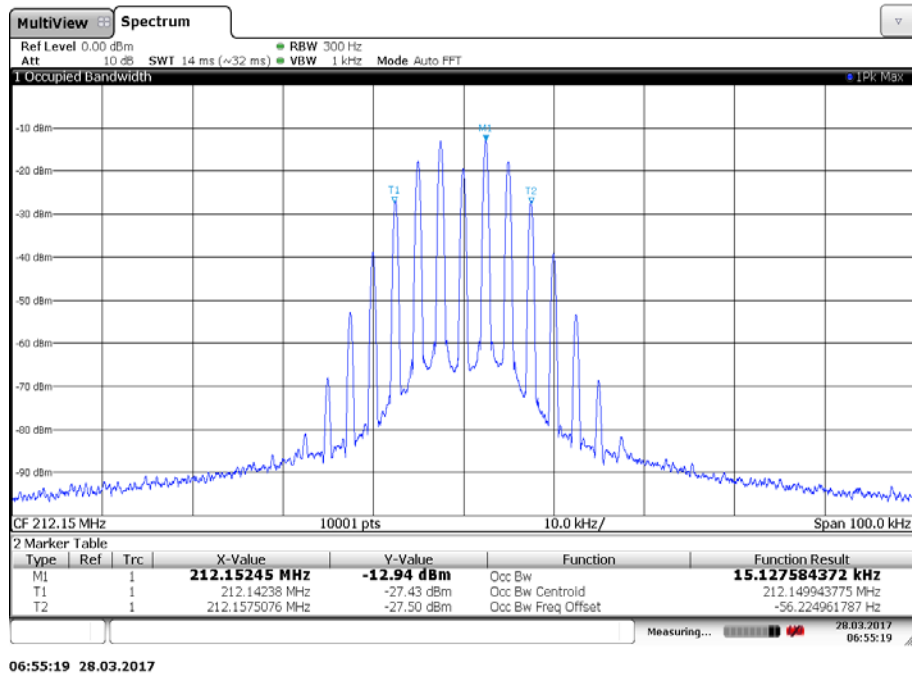
Plot 3: 215.425 MHz, 1 kHz tone



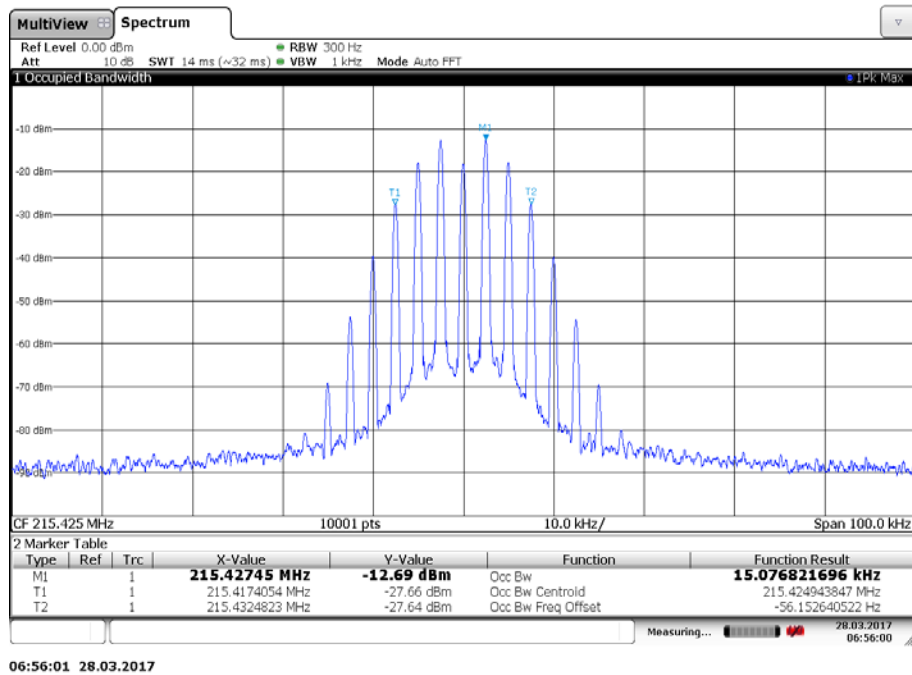
Plot 4: 210.000 MHz, 2.5 kHz tone



Plot 5: 212.150 MHz, 2.5 kHz tone



Plot 6: 215.425 MHz, 2.5 kHz tone



11.3 Transmitter frequency stability

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	100 Hz
Video bandwidth:	3 x resolution bandwidth
Span:	wide enough to follow the frequency drift
Trace mode:	clear/write/view
EUT:	CW signal or MC with measurement method description
Test setup:	See sub clause 6.2 B
Measurement uncertainty:	See sub clause 8

Limits:

FCC & IC
174 MHz to 216 MHz ± 50 ppm

Results: 210.000 MHz

Temperature / Voltage	Frequency (MHz)	Deviation (Hz / ppm)
-30 °C / V _{nom}	210.00	-92.30 / < -1 ppm
-20 °C / V _{nom}	210.00	-106.59 / < -1 ppm
-10 °C / V _{nom}	210.00	-71.09 / < -1 ppm
0 °C / V _{nom}	210.00	-37.52 / < -1 ppm
+10 °C / V _{nom}	210.00	-42.55 / < -1 ppm
+20 °C / V _{nom}	210.00	-64.02 / < -1 ppm
+30 °C / V _{nom}	210.00	-52.21 / < -1 ppm
+40 °C / V _{nom}	210.00	-75.02 / < -1 ppm
+50 °C / V _{nom}	210.00	-104.03 / < -1 ppm
+55 °C / V _{nom} (not required)	210.00	-124.14 / < -1 ppm
+20 °C / V _{nom} - 15%	210.00	-65.00 / < -1 ppm
+20 °C / V _{nom}	210.00	-64.02 / < -1 ppm
+20 °C / V _{nom} + 15%	210.00	-63.82 / < -1 ppm

Results: 212.150 MHz

Temperature / Voltage	Frequency (MHz)	Deviation (Hz / ppm)
-30 °C / V _{nom}	212.150	-96.14 / < -1 ppm
-20 °C / V _{nom}	212.150	-108.59 / < -1 ppm
-10 °C / V _{nom}	212.150	-76.43 / < -1 ppm
0 °C / V _{nom}	212.150	-37.50 / < -1 ppm
+10 °C / V _{nom}	212.150	-44.09 / < -1 ppm
+20 °C / V _{nom}	212.150	-65.04 / < -1 ppm
+30 °C / V _{nom}	212.150	-52.30 / < -1 ppm
+40 °C / V _{nom}	212.150	-75.56 / < -1 ppm
+50 °C / V _{nom}	212.150	-106.17 / < -1 ppm
+55 °C / V _{nom} (not required)	212.150	-123.87 / < -1 ppm
+20 °C / V _{nom} - 15%	212.150	-65.07 / < -1 ppm
+20 °C / V _{nom}	212.150	-65.04 / < -1 ppm
+20 °C / V _{nom} + 15%	212.150	-64.96 / < -1 ppm

Results: 215.425 MHz

Temperature / Voltage	Frequency (MHz)	Deviation (Hz / ppm)
-30 °C / V _{nom}	215.425	-110.27 / < -1 ppm
-20 °C / V _{nom}	215.425	-109.44 / < -1 ppm
-10 °C / V _{nom}	215.425	-80.57 / < -1 ppm
0 °C / V _{nom}	215.425	-36.77 / < -1 ppm
+10 °C / V _{nom}	215.425	-45.00 / < -1 ppm
+20 °C / V _{nom}	215.425	-67.54 / < -1 ppm
+30 °C / V _{nom}	215.425	-52.78 / < -1 ppm
+40 °C / V _{nom}	215.425	-76.39 / < -1 ppm
+50 °C / V _{nom}	215.425	-108.94 / < -1 ppm
+55 °C / V _{nom} (not required)	215.425	-124.12 / < -1 ppm
+20 °C / V _{nom} - 15%	215.425	-66.06 / < -1 ppm
+20 °C / V _{nom}	215.425	-67.54 / < -1 ppm
+20 °C / V _{nom} + 15%	215.425	-66.46 / < -1 ppm

11.4 Transmitter unwanted emissions (radiated)

Measurement:

Measurement parameter		
Detector:	Peak	
Sweep time:	Auto	
Resolution bandwidth:	25 dBc and 35 dBc-criteria:	1% of the authorized bandwidth
	$55 + 10 \log_{10}(P_{\text{MEAN}} \text{ in Watts}) \text{ dB} - \text{criteria}$	30 kHz
	$43 + 10 \log_{10}(P_{\text{MEAN}} \text{ in Watts}) \text{ dB} - \text{criteria}$	120 kHz / 1 MHz
Video bandwidth:	3 x resolution bandwidth	
Trace mode:	Max. hold	
EUT:	MC with max frequency deviation	
Test setup:	See sub clause 6.1 A & 6.1 B	
Measurement uncertainty:	See sub clause 8	

Limits:

FCC / IC
- at least 25 dB on any frequency that is removed from the operating frequency by more than 50%, up to and including 100% of the authorized bandwidth; and (FCC & IC) - at least 35 dB on any frequency that is removed from the operating frequency by more than 100%, up to and including 250% of the authorized bandwidth. (FCC & IC) - On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least $43 + 10 \cdot \log_{10}(\text{mean output power in watts}) \text{ dB}$. (FCC) - at least $55 + 10 \cdot \log_{10}(P_{\text{MEAN}} \text{ in Watts}) \text{ dB}$ on any frequency removed from the operating frequency by more than 250% of the authorized bandwidth. (IC)

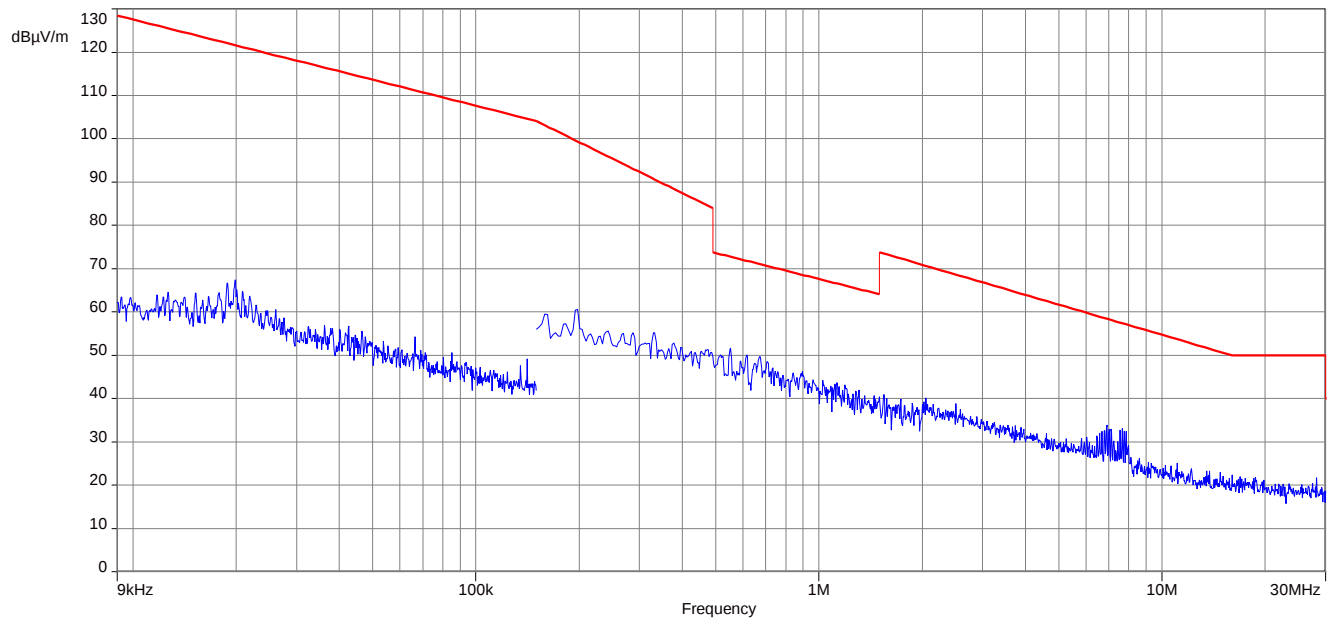
Results:

carrier frequency (MHz)	unwanted emission frequency (MHz)	Limit	level (dB) / (dBm) or remark
210.000	1889	-13.00	-29.53 (PP)
212.150	All detected emissions are more than 10 dB below the spurious limit		
215.425			

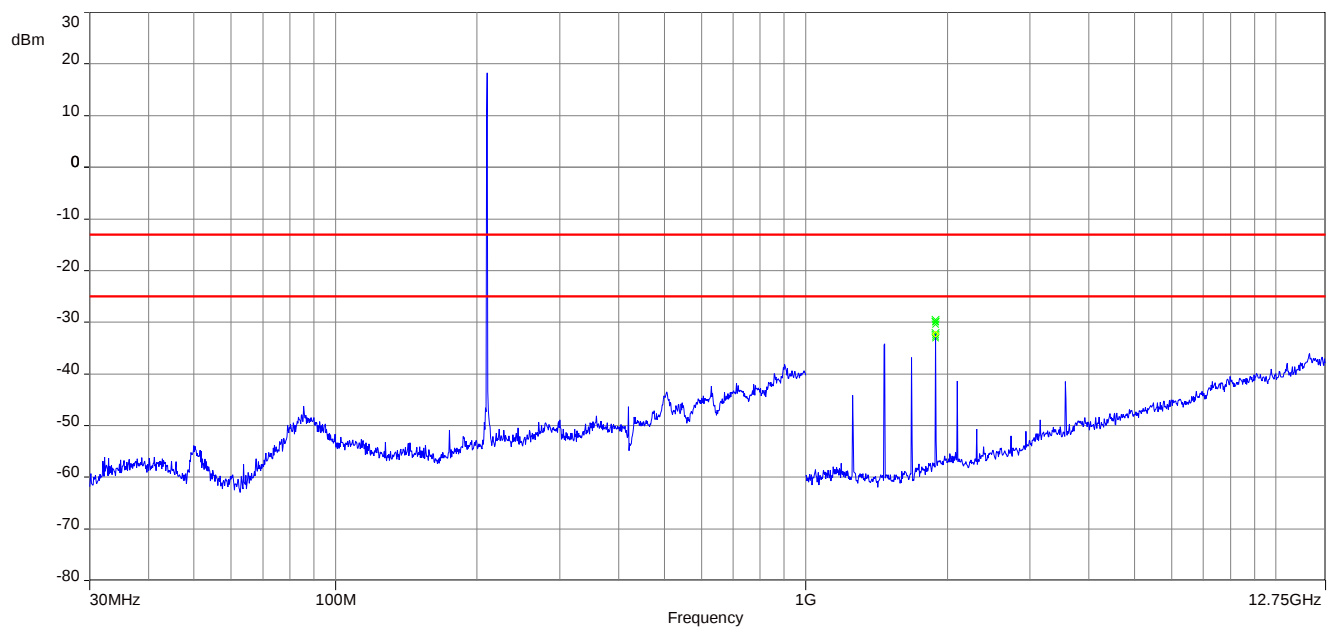
Where: PP: Positive peak detector

Plots: radiated

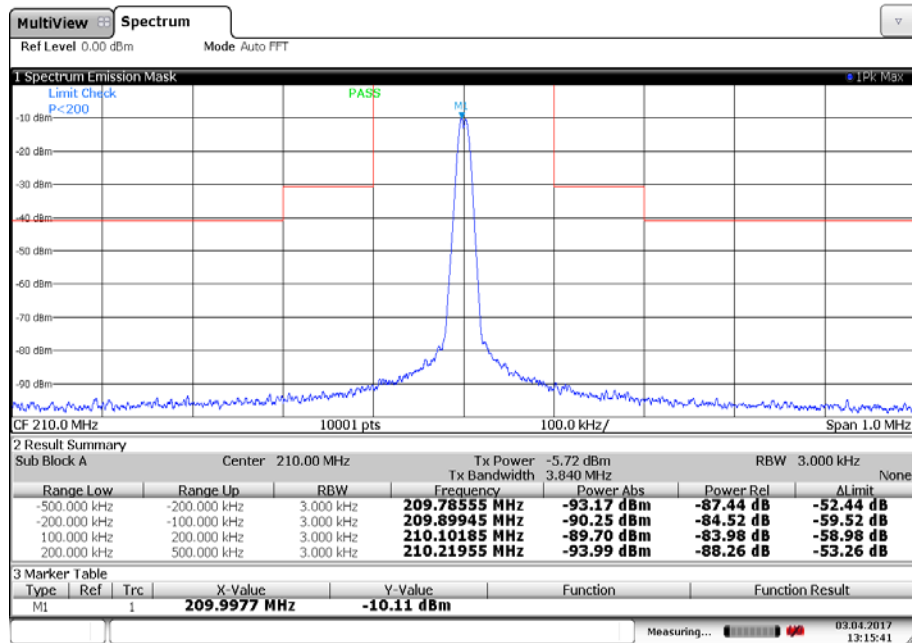
Plot 1: 210.000 MHz, magnetic spurious emissions 9 kHz to 30 MHz



Plot 2: 210.000 MHz, spurious emissions, 30 MHz – 12.75 GHz

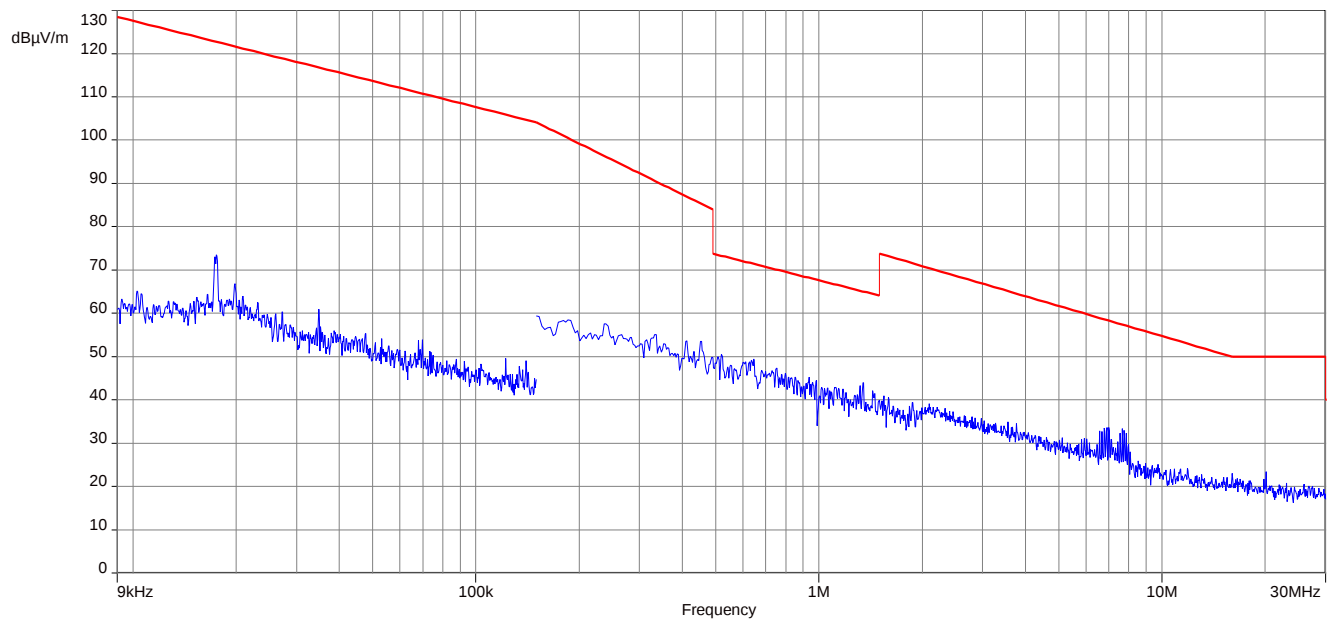


Plot 3: 210.000 MHz, spectrum mask

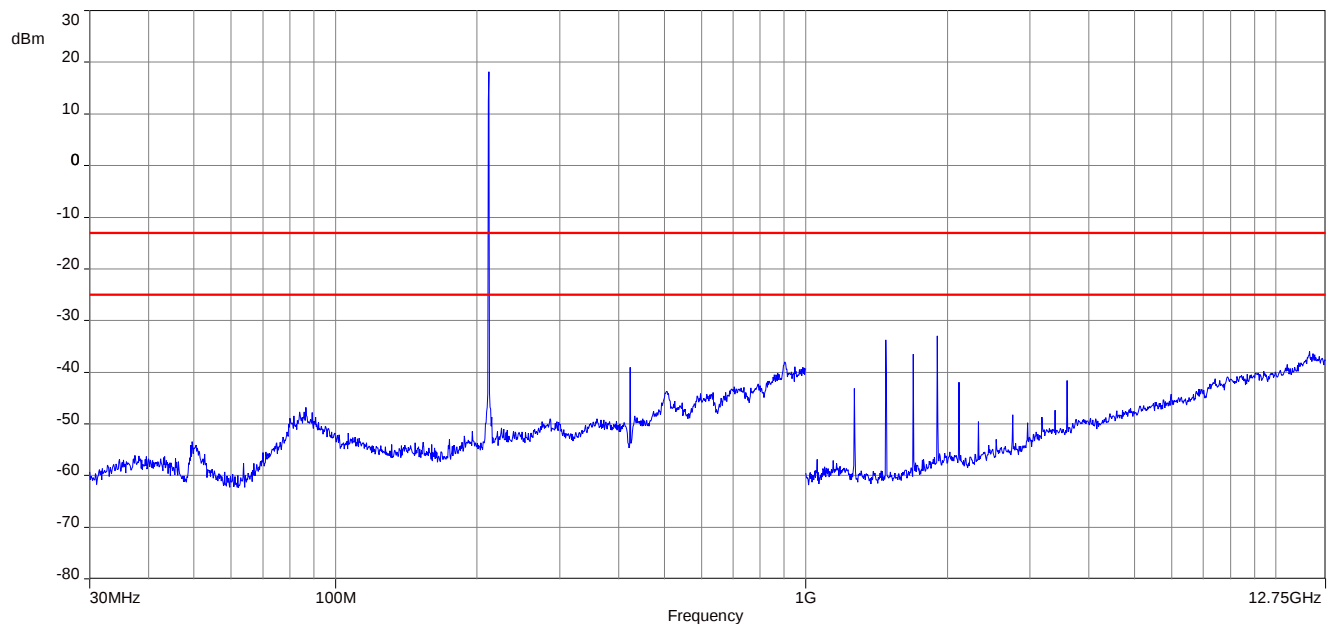


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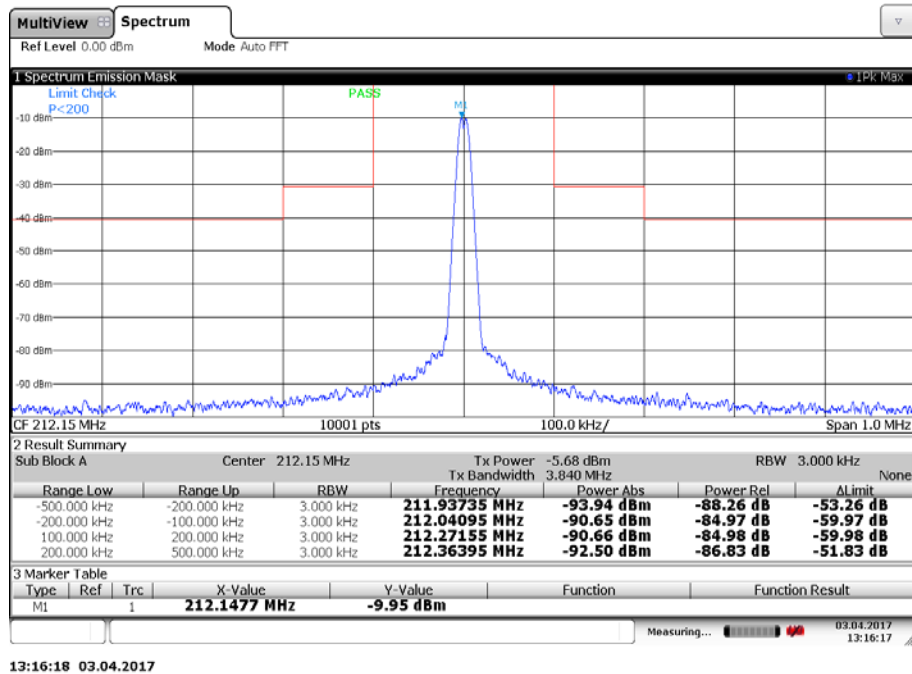
Plot 4: 212.150 MHz, magnetic spurious emissions 9 kHz to 30 MHz



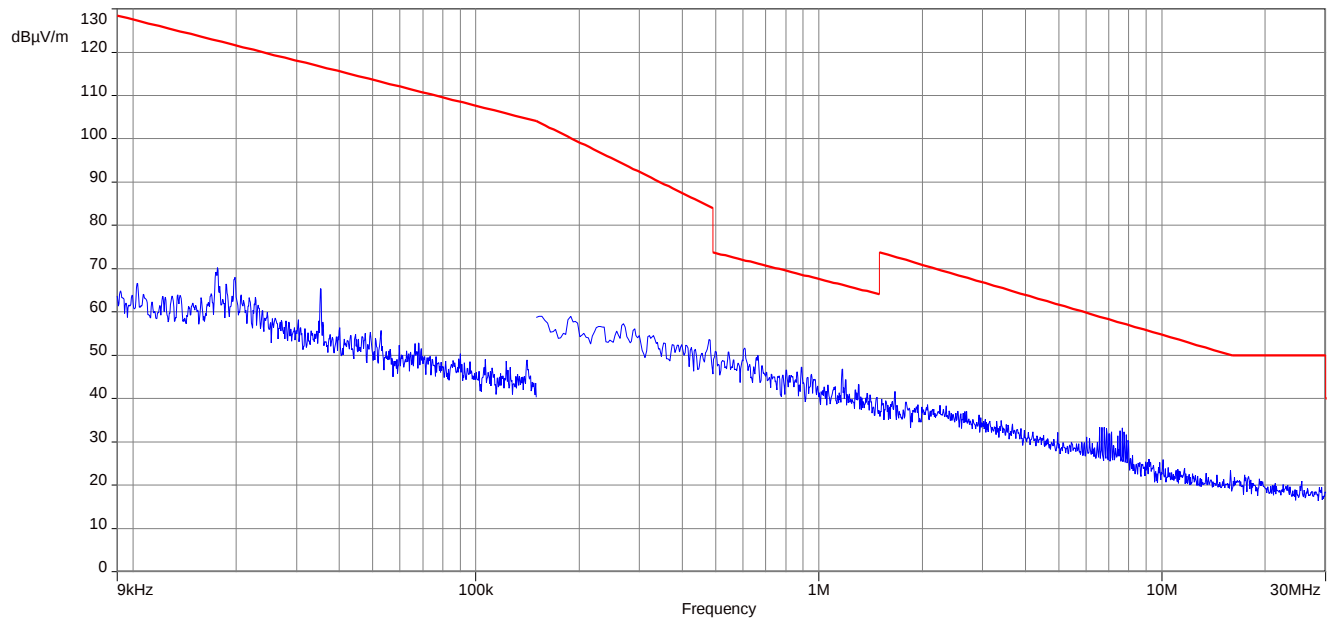
Plot 5: 212.150 MHz, spurious emissions, 30 MHz – 12.75 GHz



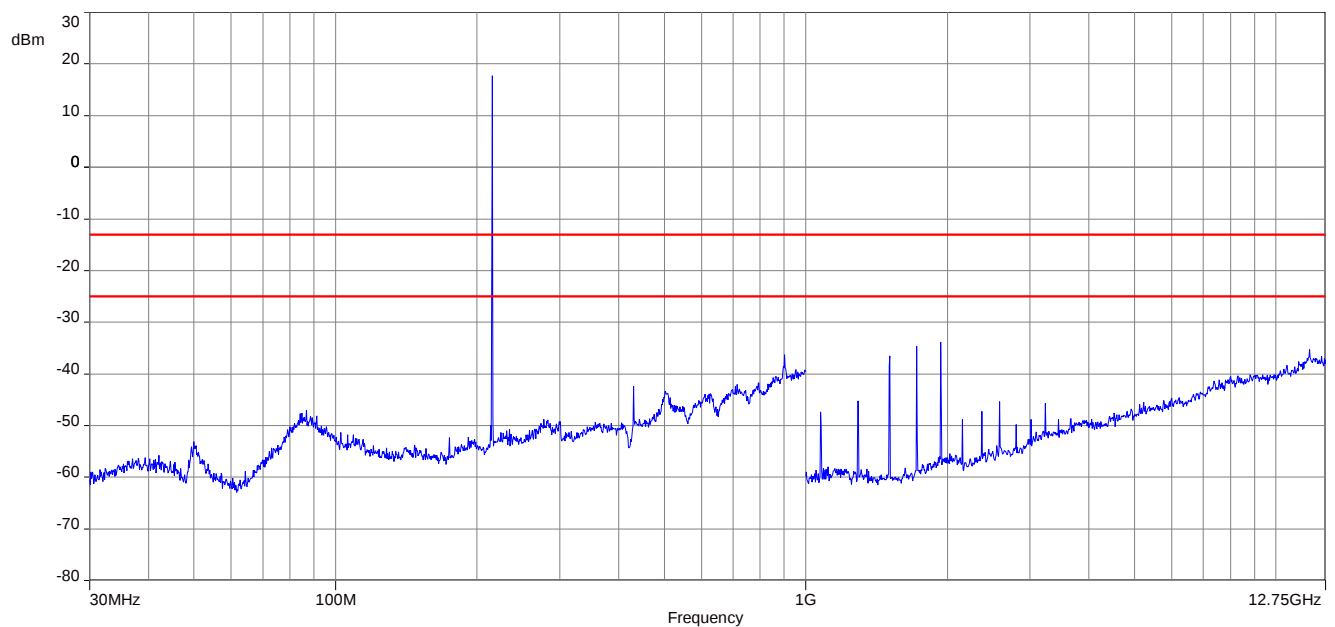
Plot 6: 212.150 MHz, spectrum mask



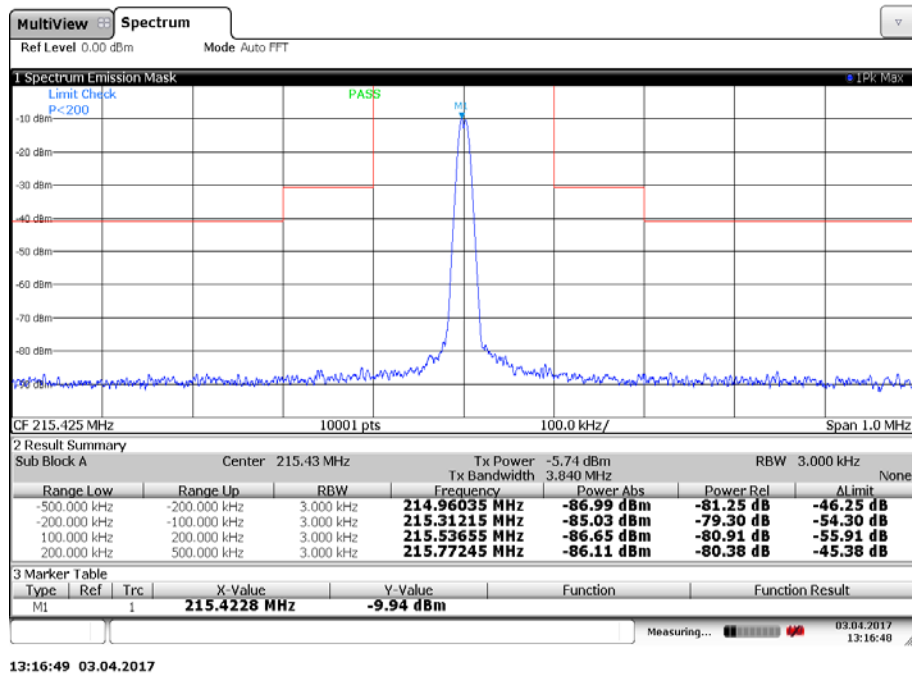
Plot 7: 215.425 MHz, magnetic spurious emissions 9 kHz to 30 MHz



Plot 8: 215.425 MHz, spurious emissions, 30 MHz – 12.75 GHz



Plot 9: 215.425 MHz, spectrum mask

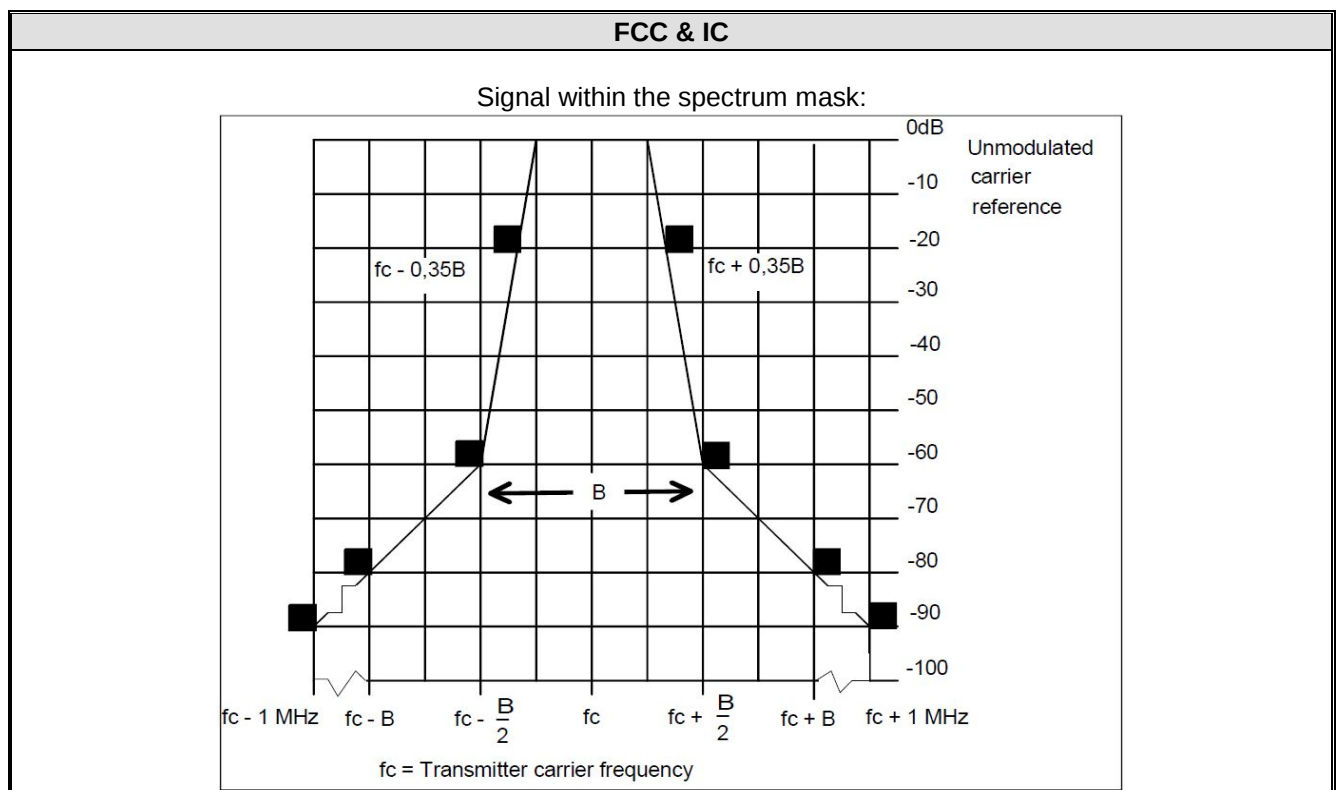


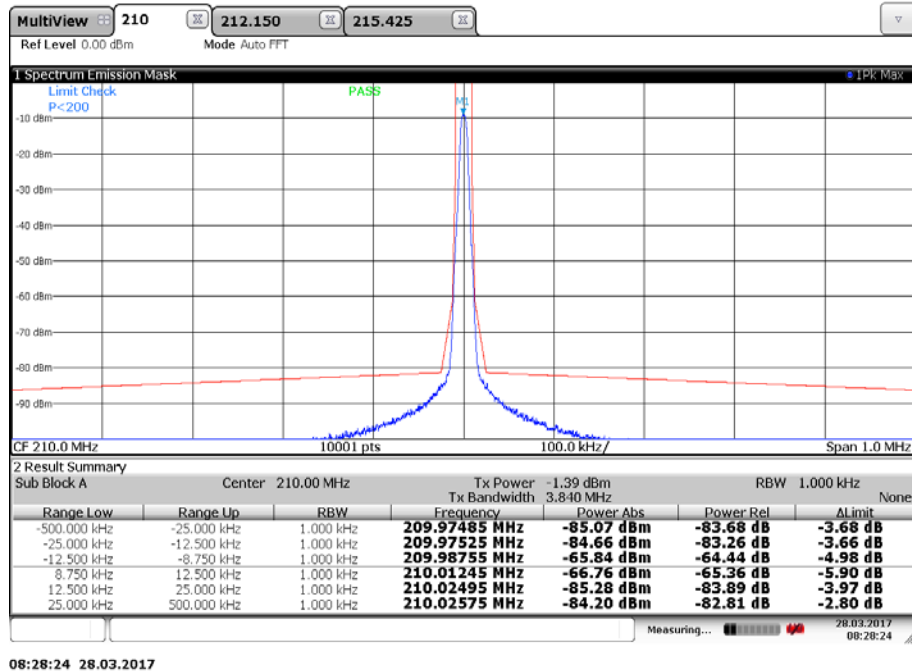
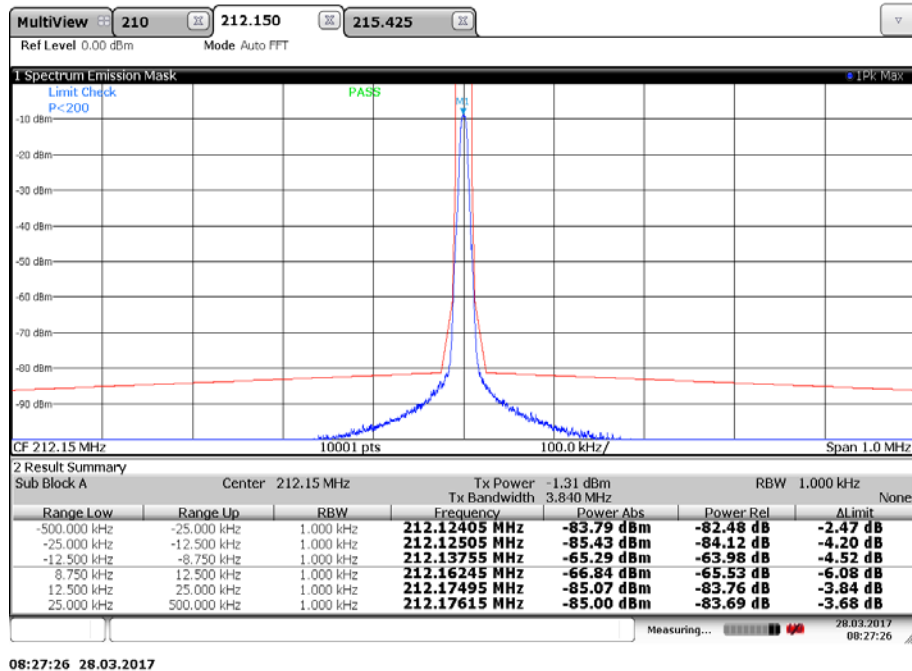
11.5 Necessary bandwidth (BN) for analogue systems

Measurement:

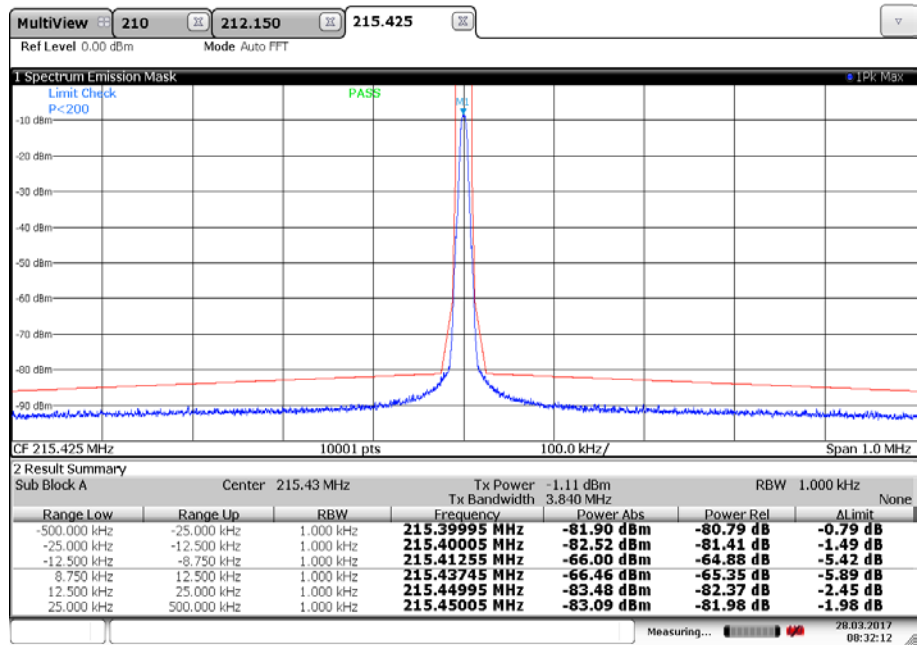
Measurement parameter	
Detector:	Peak / Average (-90 dBc point only)
Sweep time:	Auto
Resolution bandwidth:	1 kHz
Video bandwidth:	1 kHz
Span:	$f_c - 1 \text{ MHz}$ to $f_c + 1 \text{ MHz}$ (2 MHz)
Trace mode:	Max hold/view
EUT:	CW and MC
Test setup:	See sub clause 6.2 C
Measurement uncertainty:	See sub clause 8

Limits:



Plots:**Plot 1: 210.000 MHz****Plot 2: 212.150 MHz**

Plot 3: 215.425 MHz



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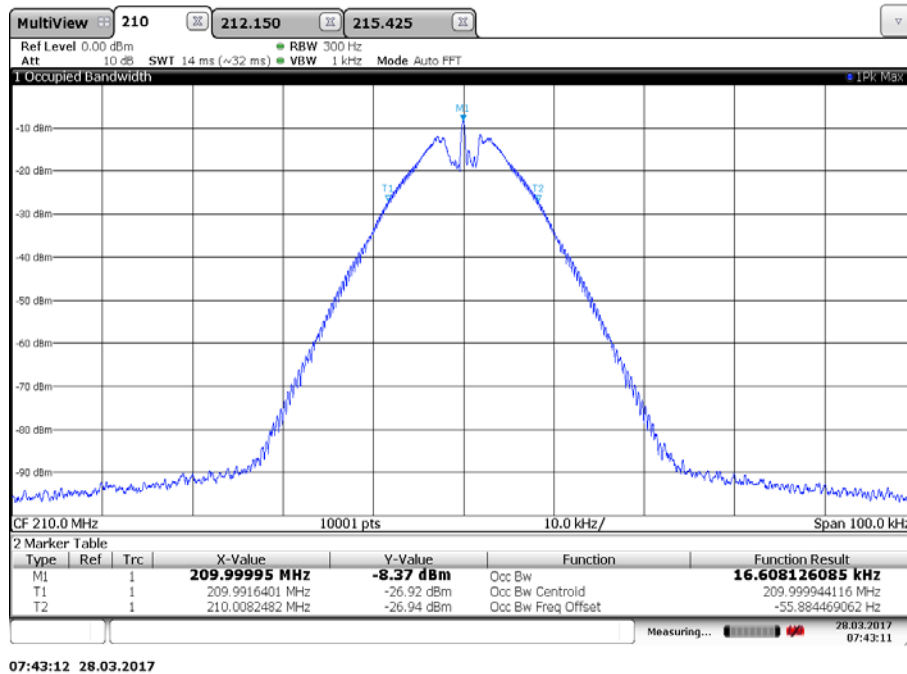
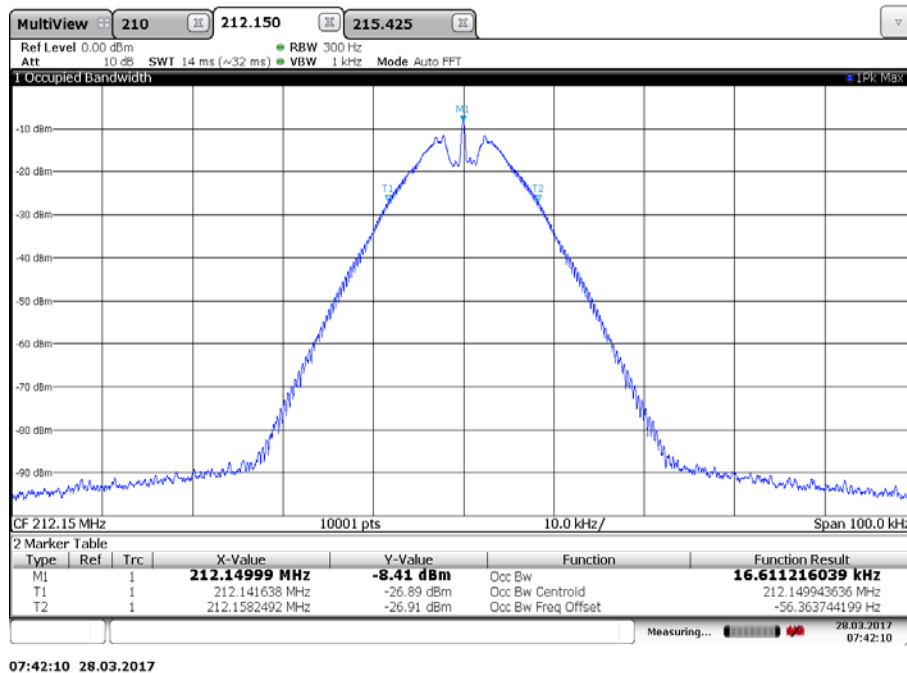
11.6 Frequency modulation

Measurement:

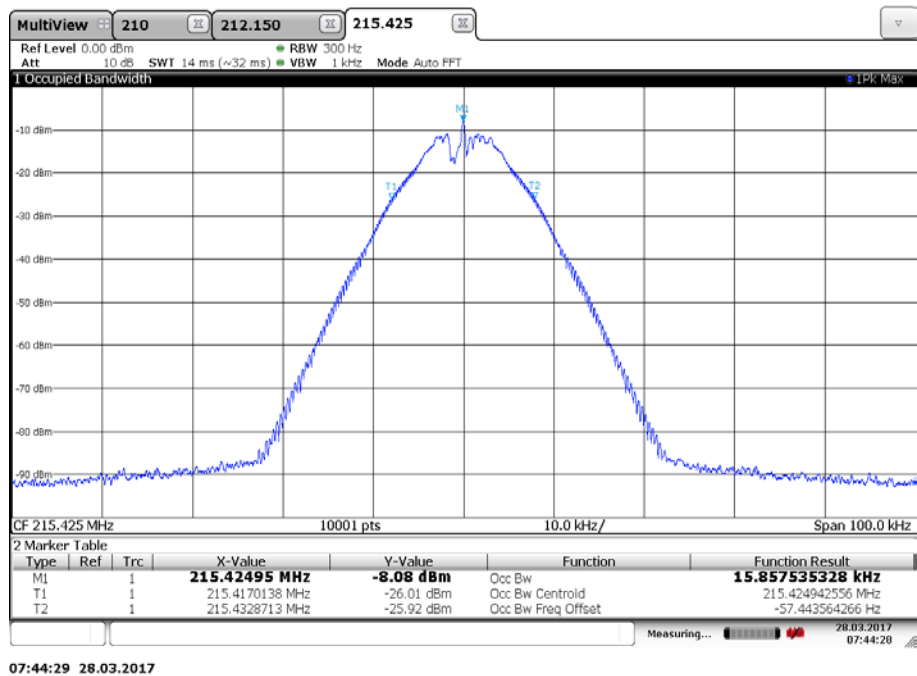
Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1 % to 5 % of the occupied bandwidth
Video bandwidth:	3 x resolution bandwidth
Span:	2 x emission bandwidth
Trace mode:	Max. hold
Analyzer function:	99% power occupied bandwidth function
EUT:	Modulated signal with frequency varied between 50 Hz and 15 kHz
Test setup:	See sub clause 6.2 D
Measurement uncertainty:	See sub clause 8

Limits:

FCC & IC
Frequency deviation up to a maximum of ± 75 kHz

Plots:**Plot 1:** 210.000 MHz, max hold with frequency variation from 50 Hz to 15 kHz**Plot 2:** 212.150 MHz, max hold with frequency variation from 50 Hz to 15 kHz

Plot 3: 215.425 MHz, max hold with frequency variation from 50 Hz to 15 kHz



11.7 Spurious emissions conducted below 30 MHz (AC conducted)

Description:

Measurement of the conducted spurious emissions in transmit mode below 30 MHz. The EUT is set to channel 6. This measurement is repeated for DSSS and OFDM modulation. If peaks are found channel 1 and channel 11 will be measured too. The measurement is performed with the data rate producing the highest output power. 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
Resolution bandwidth:	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Video bandwidth:	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span:	9 kHz to 30 MHz
Trace mode:	Max Hold
Test setup:	See sub clause 6.3 A
Measurement uncertainty:	See sub clause 8

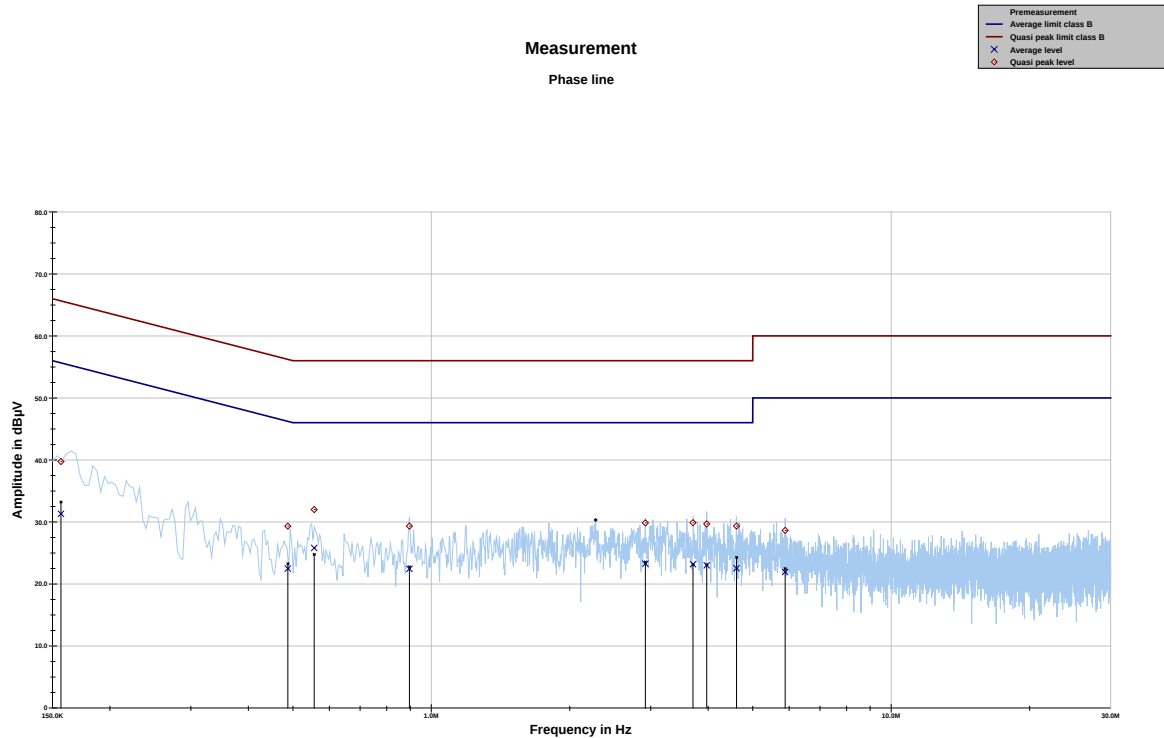
Limits:

FCC & IC		
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.

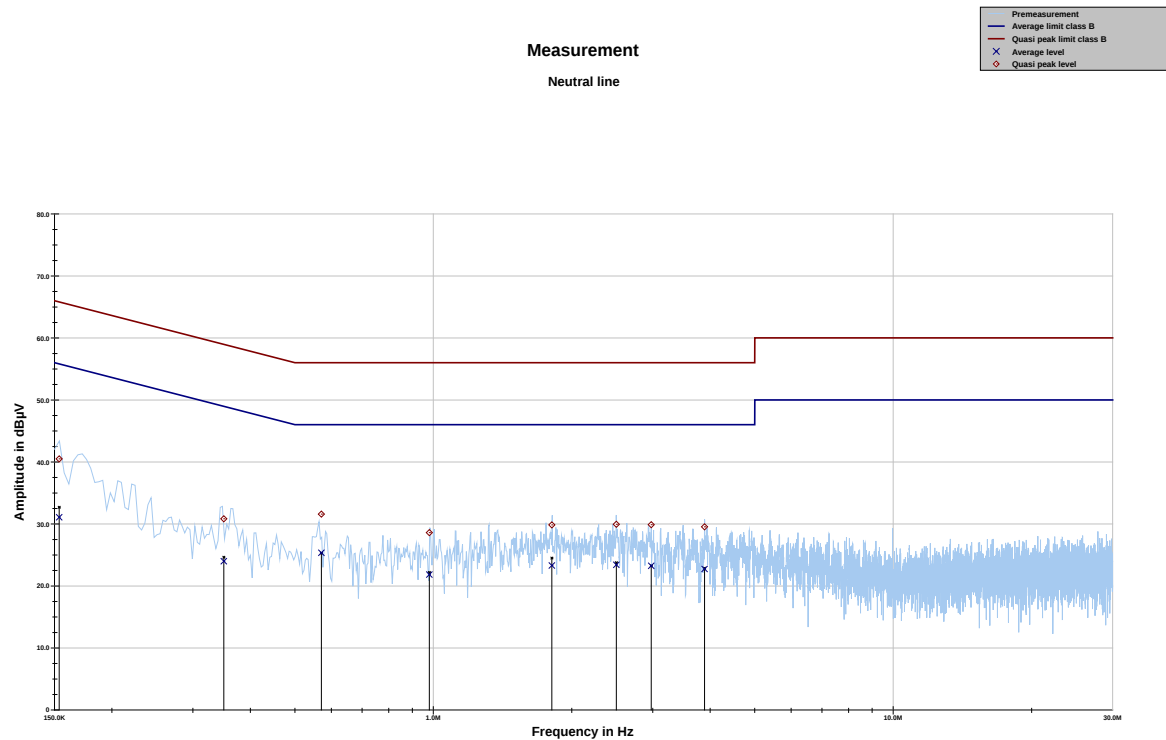
Results:

TX Spurious Emissions Conducted < 30 MHz [dBμV/m]		
F [MHz]	Detector	Level [dBμV/m]
All detected emissions are more than 20 dB below the spurious limit.		

Plots:**Plot 1:** 150 kHz to 30 MHz, phase line

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.156550	39.73	25.91	65.645	31.31	24.51	55.813
0.487384	29.31	26.90	56.212	22.48	23.88	46.360
0.556253	31.99	24.01	56.000	25.80	20.20	46.000
0.896119	29.33	26.67	56.000	22.42	23.58	46.000
2.920059	29.84	26.16	56.000	23.27	22.73	46.000
3.706434	29.88	26.12	56.000	23.18	22.82	46.000
3.970144	29.68	26.32	56.000	23.00	23.00	46.000
4.609612	29.33	26.67	56.000	22.52	23.48	46.000
5.881816	28.62	31.38	60.000	21.93	28.07	50.000

Plot 2: 150 kHz to 30 MHz, neutral line



Project ID: 1-3012/16-01-02

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.153561	40.49	25.31	65.805	31.08	24.82	55.898
0.350216	30.82	28.14	58.957	23.98	26.29	50.280
0.570932	31.58	24.42	56.000	25.34	20.66	46.000
0.980361	28.60	27.40	56.000	21.84	24.16	46.000
1.810121	29.84	26.16	56.000	23.30	22.70	46.000
2.500625	29.94	26.06	56.000	23.40	22.60	46.000
2.976775	29.88	26.12	56.000	23.24	22.76	46.000
3.888832	29.53	26.47	56.000	22.73	23.27	46.000

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
	Initial release	2017-04-06
A	Updated antenna information, measurements for IC canada removed	2017-06-26

Annex C Accreditation Certificate

first page	last page
 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	Deutsche Akkreditierungsstelle GmbH Standort Berlin Spittelmarkt 10 10117 Berlin Standort Frankfurt am Main Europa-Allee 52 60327 Frankfurt am Main Standort Braunschweig Bundesallee 100 38116 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 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 (Abi. 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>

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