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

## TEST REPORT

Test report no.: 1-2057/16-01-02

Deutsche  
Akkreditierungsstelle  
D-PL-12076-01-01

### Testing laboratory

**CETECOM ICT Services GmbH**

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Internet: <http://www.cetecom.com>e-mail: [ict@cetecom.com](mailto:ict@cetecom.com)**Accredited Testing Laboratory:**

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

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

### Applicant

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### Manufacturer

**ATMEL Automotive GmbH**

Theresienstrasse 2

74072 Heilbronn / GERMANY

### Test standard/s

47 CFR Part 15

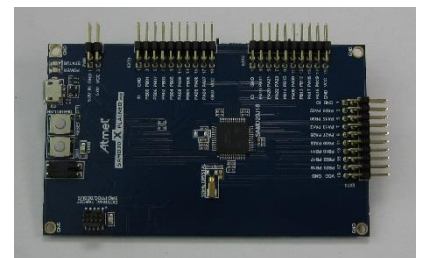
Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices

RSS - 247 Issue 1

Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence - Exempt Local Area Network (LE-LAN) Devices

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

### Test Item

**Kind of test item:** RF Transceiver Evaluation kit**Model name:** ATA8520-EB1-F**FCC ID:** 2AHW9-ATA8520EB1F**IC:** 7352A-ATA8520EB1F**Frequency:** 902.0-928.0 MHz  
Lowest channel: 902.114 MHz; Middle channel: 903.400 MHz; Highest channel: 904.686 MHz**Technology tested:** FHSS**Antenna:** external antenna**Power supply:** Controller Board: 4.5 V DC by external power supply  
Radio Board: 3.0 V DC by battery**Temperature range:** -20°C to +55°C

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

### Test report authorized:

Stefan Bös  
Lab Manager  
Radio Communications & EMC

### Test performed:

David Lang  
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. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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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:	2016-07-11
Date of receipt of test item:	2016-07-28
Start of test:	2016-07-28
End of test:	2016-07-29
Person(s) present during the test:	-/-

## 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 - 247 Issue 1	May 2015	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence - Exempt Local Area Network (LE-LAN) Devices
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 :	$T_{nom}$ $T_{max}$ $T_{min}$	+20 °C during room temperature tests +55 °C during high temperature tests -20 °C during low temperature tests
Relative humidity content :		55 %
Barometric pressure :		not relevant for this kind of testing
Power supply :	$V_{nom}$ $V_{max}$ $V_{min}$	Controller Board: 4.5 V DC by external power supply Radio Board: 3.0 V DC by battery -/- V (not relevant for testing) -/- V (not relevant for testing)

#### 5 Test item

##### 5.1 General description

Kind of test item :	RF Transceiver Evaluation kit
Type identification :	ATA8520-EB1-F
HMN :	-/-
PMN :	ATA8520-EK3-F
HVIN :	ATA8520-EB1-F
FVIN :	
S/N serial number :	Not available!
HW hardware status :	ATA8520-EB1-F
SW software status :	-/-
Frequency band :	902.0-928.0 MHz Tested frequencies: Lowest: 902.114 MHz Middle: 903.400 MHz Highest: 904.686 MHz
Type of radio transmission :	FHSS
Use of frequency spectrum :	
Type of modulation :	DBPSK
Number of channels :	54 (9 Macro channels x 6 Micro channels)
Antenna :	EUT will be sold with a dedicated external antenna with a peak gain of 1.2 dBi (see antenna specification as referenced in section 10.2).
Power supply :	Controller Board: 5.0 V DC by external power supply Radio Board: 3.0 V DC by battery
Temperature range :	-20°C to +55°C

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.

Reference documents:      Antennna specification: ANT-916-CW-HWR Data Sheet by Linx  
                                      (Revised 7/13/15).

Configuration descriptions:      None

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## 6 Test laboratories sub-contracted

None

## 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).

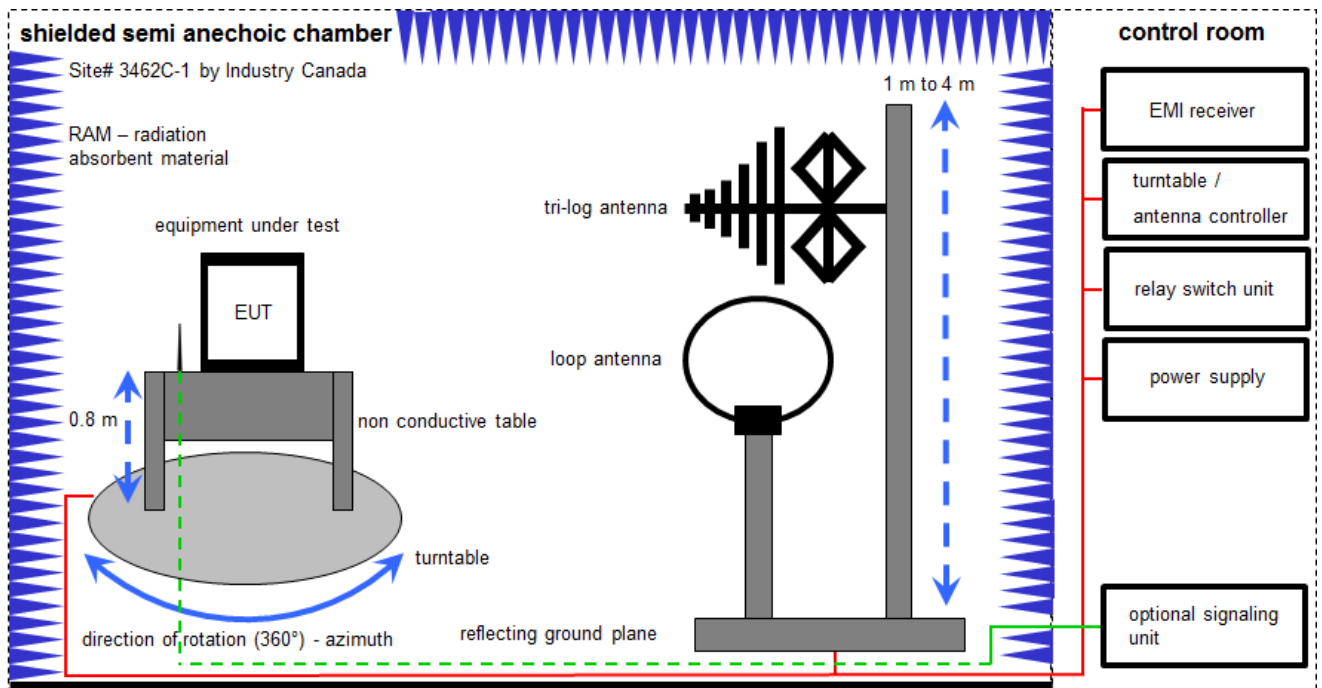
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

### 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
v/k!	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 confirmed with specifications ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



Measurement distance: tri-log antenna 10 meter; loop 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:

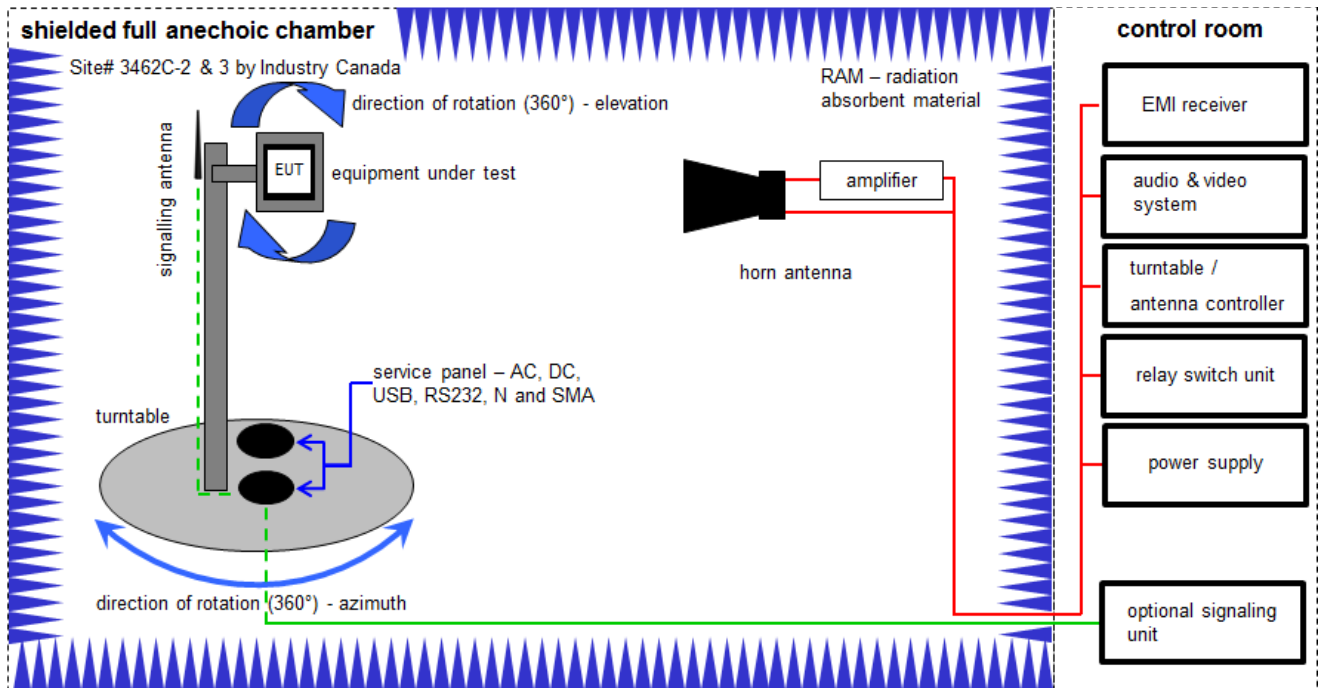
$$FS [dB\mu V/m] = 12.35 [dB\mu V/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dB\mu V/m] (35.69 \mu V/m)$$

### Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Active Loop Antenna 10 kHz to 30 MHz	6502	EMCO/2	8905-2342	300000256	k	24.06.2015	24.06.2017
2	A+B	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
3	A+B	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04466	300000580	ne	-/-	-/-
4	A+B	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	08.03.2016	08.03.2017
5	A+B	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
6	A+B	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
7	A+B	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
8	B	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	25.04.2016	25.04.2018



## 7.2 Shielded fully anechoic chamber



Measurement distance: horn antenna 3 meter

$$FS = UR + CA + AF$$

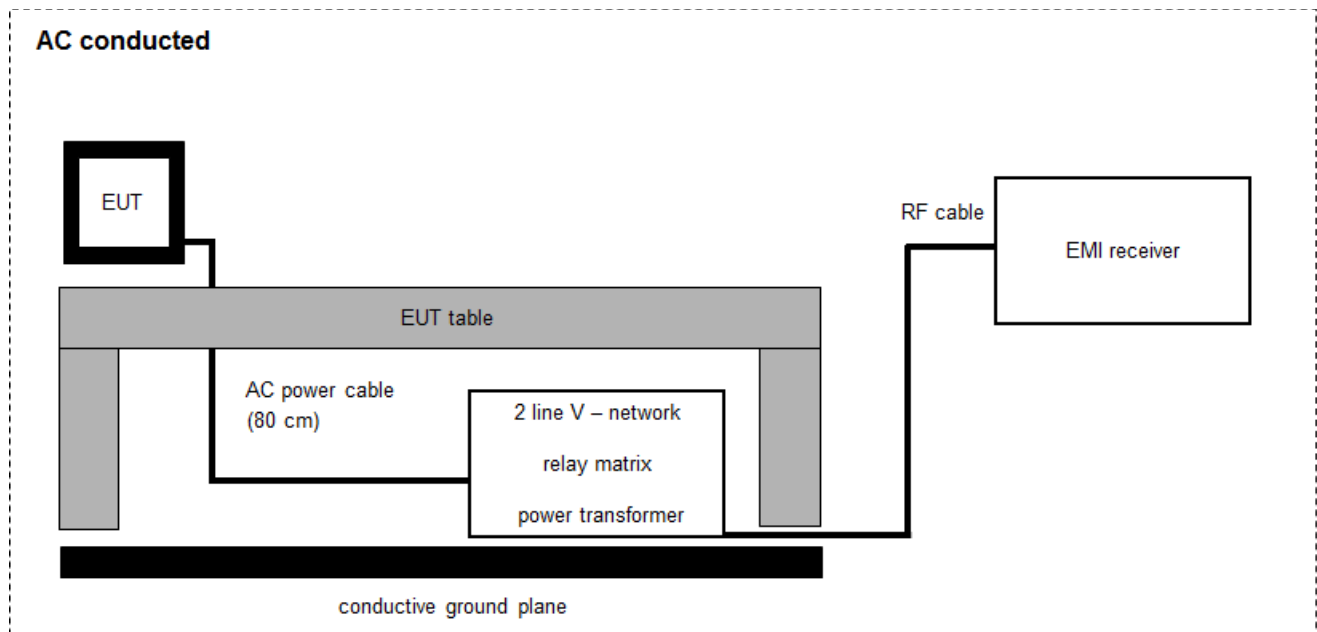
(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

Example calculation:

$$FS [dB\mu V/m] = 40.0 [dB\mu V/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dB\mu V/m] (71.61 \mu V/m)$$

### Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2818A03450	300001040	Ve	20.01.2015	20.01.2018
2	A	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vIKII	20.05.2015	20.05.2017
3	A	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
4	A	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
5	A	Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143	ne	-/-	-/-
6	A	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne	-/-	-/-
7	A	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-

**7.3 AC conducted****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:

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

**Equipment table:**

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	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	02.02.2016	02.02.2017
2	A	Power Supply	NGSM 32/10	R&S	3939	400000192	vIKII	22.01.2015	22.01.2017
3	A	MXE EMI Receiver 20 Hz to 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	04.02.2016	04.02.2017

## **8 Sequence of testing**

### **8.1 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.

## 8.2 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.

### 8.3 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.

## 9 Summary of measurement results

<input checked="" type="checkbox"/>	No deviations from the technical specifications were ascertained
<input type="checkbox"/>	There were deviations from the technical specifications ascertained
<input checked="" type="checkbox"/>	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	CFR Part 15 RSS 210, Issue 8	Passed	2016-08-02	Delta test plan for pre-certified radio (PC II)

Test specification clause	Test case	Temperature conditions	Power source voltages	Mode	Pass	Fail	NA	NP	Results (max.)
§15.247(b)(4)	Antenna Gain	Nominal	Nominal	TX	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	declared
§15.247(a)(1)(i) RSS-210 A8.1 (b)	Carrier Frequency Separation	Nominal	Nominal	TX	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	*1
§15.247(a)(1)(i) RSS-210 A8.1 (c)	Number of Hopping channels	Nominal	Nominal	TX	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	*1
§15.247(a)(1)(i) RSS-210 A8.1 (c)	Average Time of Occupancy (Dwell Time)	Nominal	Nominal	TX	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	*1
§15.247(a)(1)(i) RSS-210 A8.1 (c)	20dB Bandwidth	Nominal	Nominal	TX	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	*1
§15.247(b)(2) RSS-210 A8.4 (1)	Maximum Output Power Radiated	Nominal	Nominal	TX	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.247(b)(4) RSS-210 A8.4 (1)	Maximum Output Power Conducted	Nominal	Nominal	TX	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	*1
§15.247(d) §15.205(a)	Band-edge Compliance	Nominal	Nominal	TX	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	*1
§15.247(d)	TX Spurious Emission Conducted	Nominal	Nominal	TX	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	*1
§15.209(a)	TX Spurious Emission Radiated < 30 MHz	Nominal	Nominal	TX	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.247(d) §15.209 A8.5	TX Spurious Emission Radiated > 30 MHz	Nominal	Nominal	TX	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.109 §15.207	RX Spurious Emissions Radiated	Nominal	Nominal	Idle	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies

**Note:** NA = Not Applicable; NP = Not Performed; \*1 PC II test plan

## 10 RF measurements

## 11 Measurement results

### 11.1 Antenna gain

Declared antenna gain is 1.2 dBi.

## 11.2 Maximum Output Power Radiated

### Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Span:	5 MHz
Trace-Mode:	Max Hold
Test setup	See sub clause 7.1 B
Measurement uncertainty	See sub clause 9

### Limits:

FCC	IC
EIRP	
For frequency hopping systems operating in the 902–928 MHz band: 1 watt (30 dBm) for systems employing at least 50 hopping channels; and, 0.25 watts (24 dBm) for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.	

### Result:

Test Conditions		EIRP [dBm]		
		902.114 MHz	903.400 MHz	904.686 MHz
$T_{nom}$	$V_{nom}$	23.0	22.5	22.1
Measurement uncertainty		± 3dB		



### 11.3 Spurious Emissions Radiated < 30 MHz

#### Description:

Measurement of the radiated spurious emissions in transmit mode below 30 MHz. The EUT is set to channel 12. This measurement is representative for all channels and modes. If any peaks are found channel 00 and channel 24 will be measured too. The limits are recalculated to a measurement distance of 3 m with 40 dB/decade according CFR Part 2.

#### Measurement:

Measurement parameter	
Detector:	Peak / Quasi Peak
Sweep time:	Auto
Video bandwidth:	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Resolution bandwidth:	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span:	9 kHz to 30 MHz
Trace-Mode:	Max Hold
Test setup	See sub clause 7.1 A
Measurement uncertainty	See sub clause 9

#### Limits:

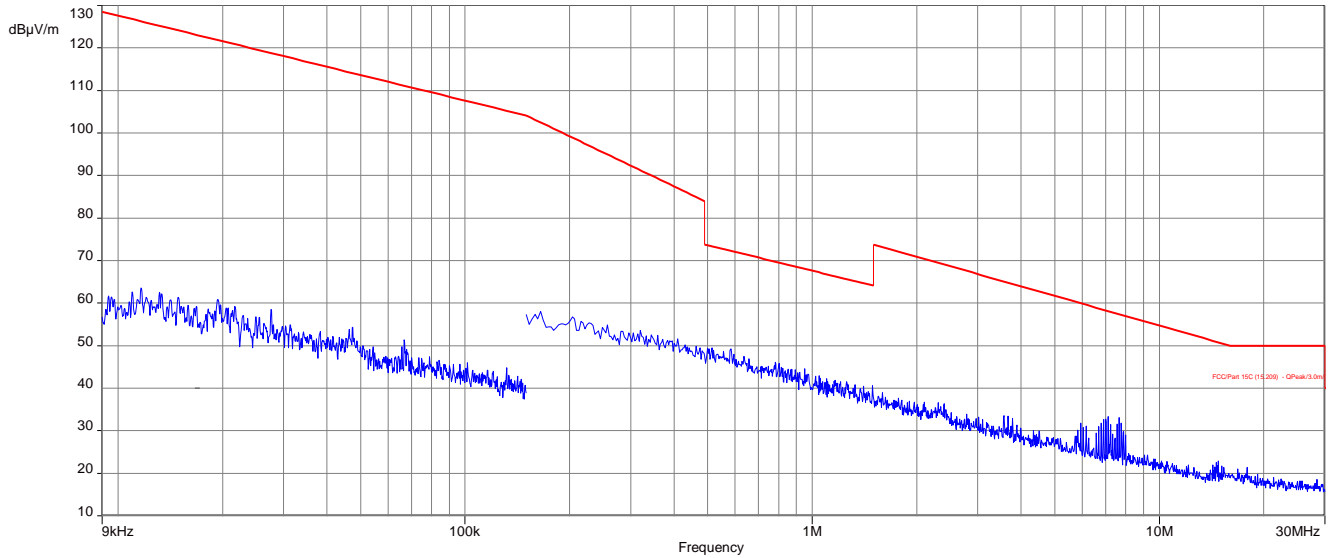
FCC		IC
TX spurious emissions radiated < 30 MHz		
Frequency (MHz)	Field strength (dB $\mu$ V/m)	Measurement distance
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30

#### Results:

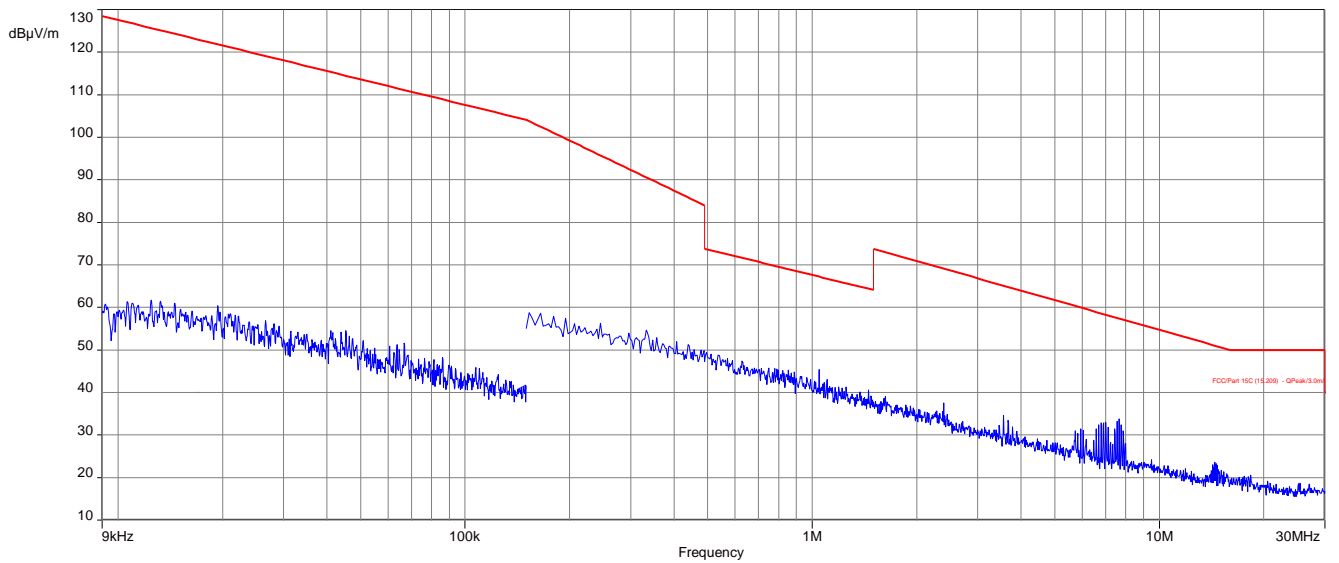
TX spurious emissions radiated below 30 MHz [dB $\mu$ V/m]		
F [MHz]	Detector	Level [dB $\mu$ V/m]
All detected emissions are more than 20 dB below the limit.		

**Plots:**

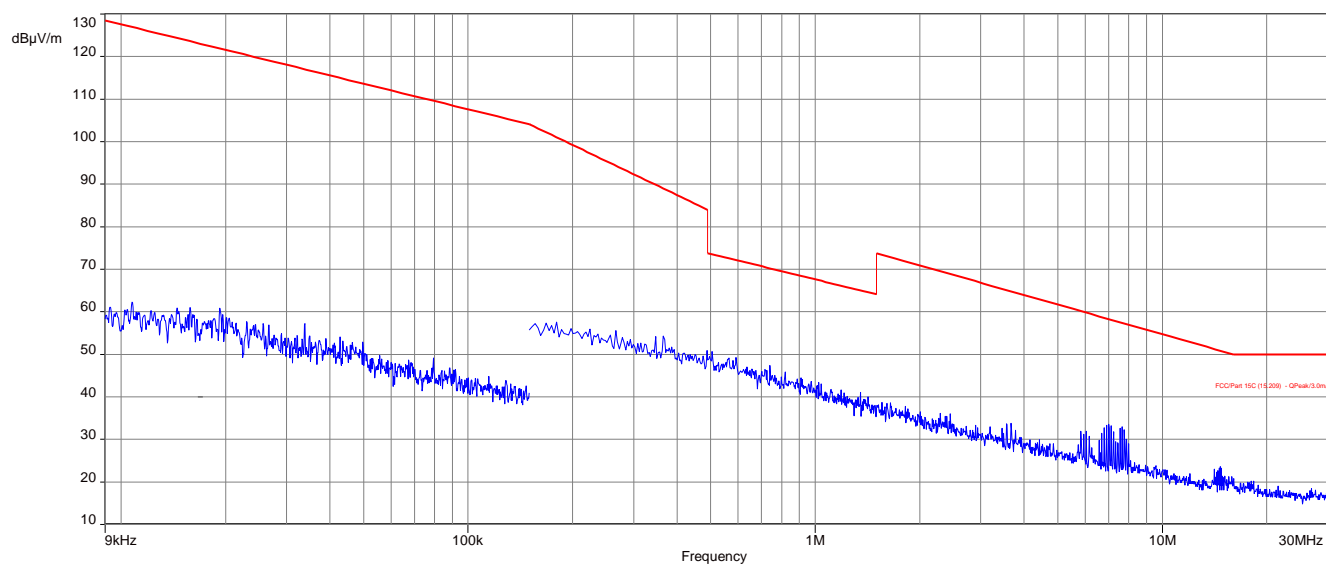
Plot 1: TX-Mode / 902.114 MHz



Plot 2: TX-Mode / 903.400 MHz



Plot 3: TX-Mode / 904.686 MHz



## 11.1 Spurious emissions radiated 30 MHz to 1 GHz

### Description:

Measurement of the radiated spurious emissions in transmit mode. The measurement is performed at lowest, middle and high channel.

### Measurement:

Measurement parameter	
Detector:	Peak / Quasi Peak
Sweep time:	Auto
Video bandwidth:	3 x RBW Remeasurement: 10 Hz
Resolution bandwidth:	120 kHz
Trace-Mode:	Max Hold
Test setup	See sub clause 7.1 B
Measurement uncertainty	See sub clause 9

The modulation with the highest output power was used to perform the transmitter spurious emissions. If spurious were detected a re-measurement was performed on the detected frequency with each modulation.

### Limits:

FCC		IC
TX spurious emissions radiated		
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).		
§15.209		
Frequency (MHz)	Field strength (dBμV/m)	Measurement distance
30 - 88	30.0	10
88 – 216	33.5	10
216 – 960	36.0	10
Above 960	54.0	3

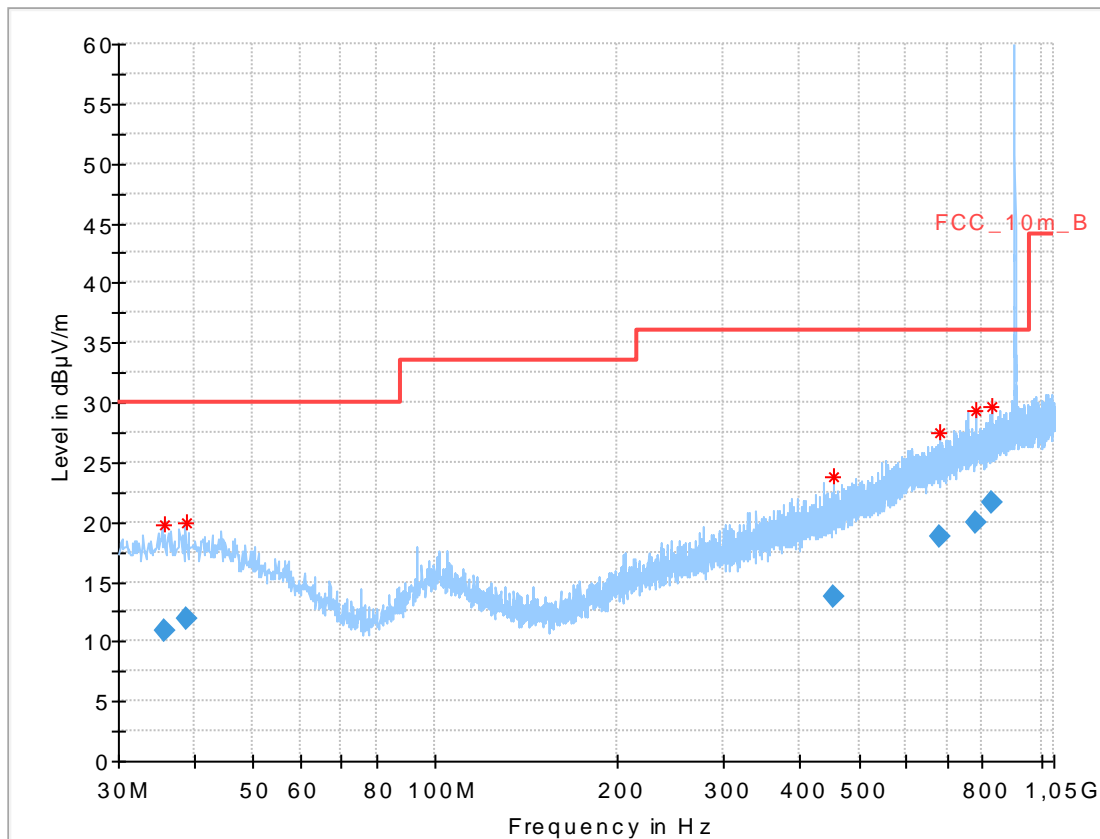
**Note:** The limit was recalculated with 20 dB / decade (Part 15.31) for all radiated spurious emissions 30 MHz to 1 GHz from 3 meter limit to a 10 meter distance. (40dB/decade for emissions < 30MHz)

**Results:**

TX and RX spurious emissions radiated 30 MHz to 1 GHz [dB $\mu$ V/m]		
F [MHz]	Detector	Level [dB $\mu$ V/m]
See result tables below plots.		

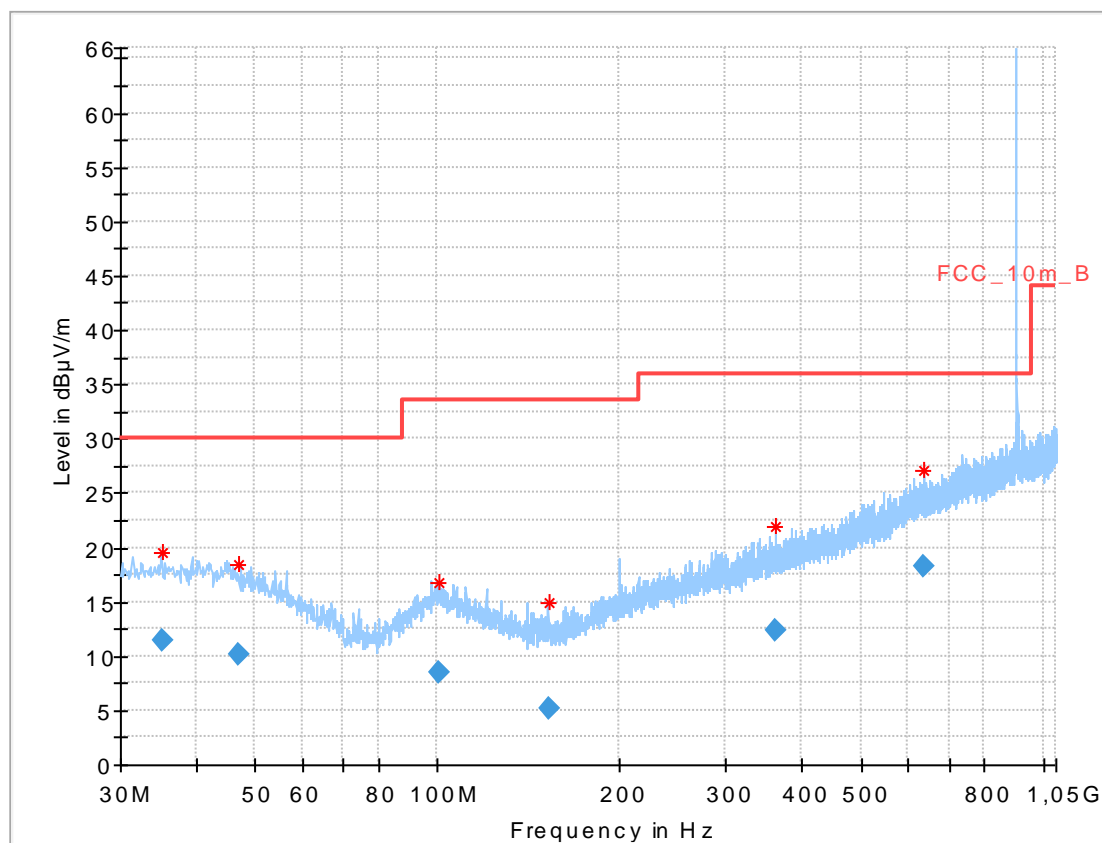
**Plots:**

Plot 1: 30 MHz – 1 GHz, horizontal &amp; vertical polarisation (lowest channel)



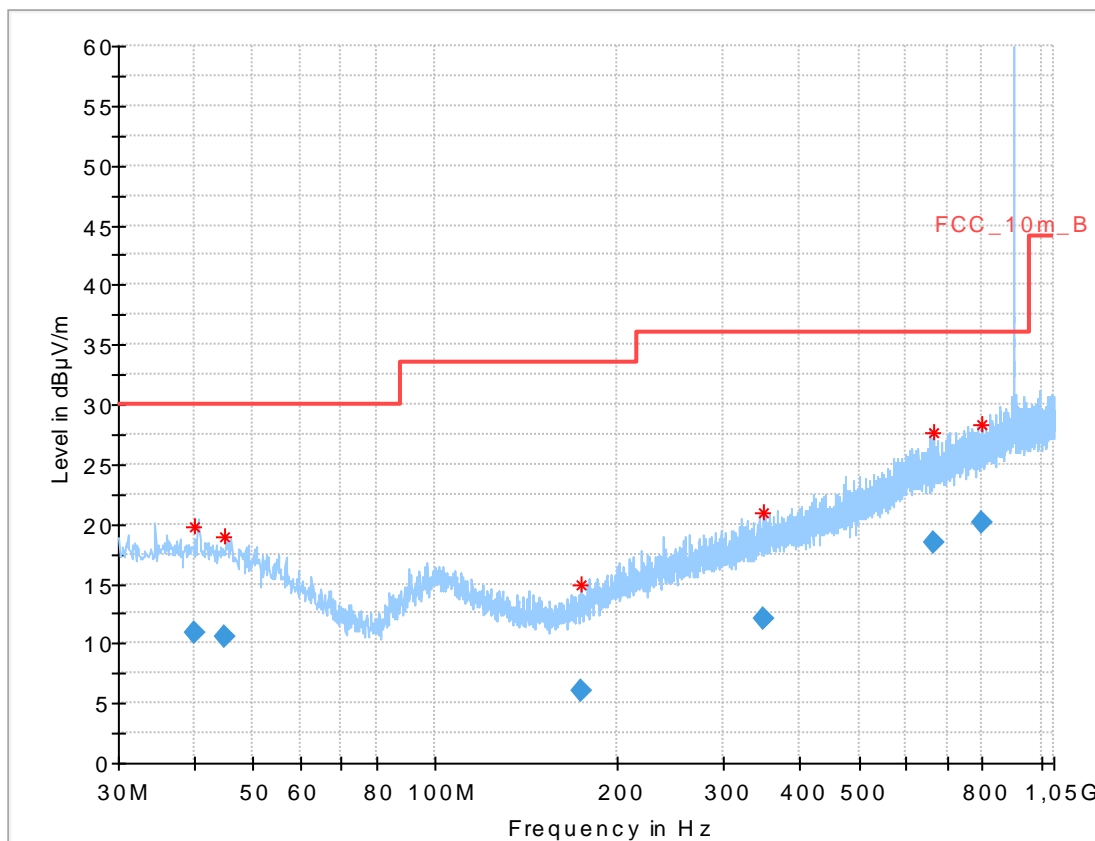
Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
35.607450	10.86	30.00	19.14	1000.0	120.000	273.0	H	142.0	13.8
38.723700	11.92	30.00	18.08	1000.0	120.000	103.0	V	117.0	14.0
455.191650	13.81	36.00	22.19	1000.0	120.000	200.0	H	122.0	17.7
678.603600	18.72	36.00	17.28	1000.0	120.000	200.0	H	141.0	21.3
781.106400	19.91	36.00	16.09	1000.0	120.000	279.0	V	-5.0	22.7
831.785550	21.68	36.00	14.32	1000.0	120.000	400.0	H	187.0	23.2

Plot 2: 30 MHz – 1 GHz, horizontal &amp; vertical polarisation (middle channel)



Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
35.189850	11.39	30.00	18.61	1000.0	120.000	274.0	H	5.0	13.8
46.985100	10.13	30.00	19.87	1000.0	120.000	275.0	V	275.0	13.4
100.568550	8.40	33.50	25.10	1000.0	120.000	351.0	V	142.0	12.1
152.459850	5.14	33.50	28.36	1000.0	120.000	200.0	H	-13.0	8.9
362.630550	12.26	36.00	23.74	1000.0	120.000	274.0	V	140.0	16.2
633.021450	18.19	36.00	17.81	1000.0	120.000	274.0	V	73.0	21.0

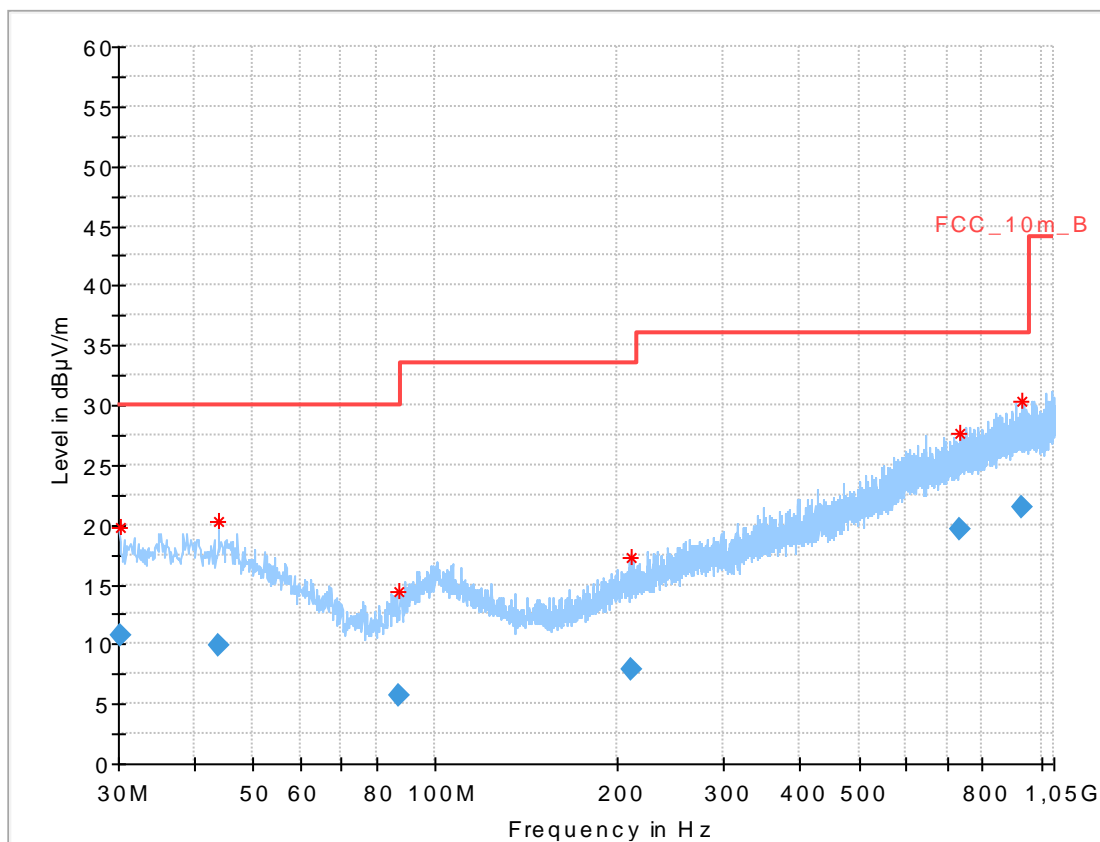
Plot 3: 30 MHz – 1 GHz, horizontal &amp; vertical polarisation (highest channel)



Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
40.110900	10.86	30.00	19.14	1000.0	120.000	103.0	V	2.0	14.0
45.045300	10.61	30.00	19.39	1000.0	120.000	272.0	V	253.0	13.8
174.132300	5.96	33.50	27.54	1000.0	120.000	277.0	H	275.0	10.0
347.203650	12.00	36.00	24.00	1000.0	120.000	200.0	H	320.0	15.9
664.723950	18.51	36.00	17.49	1000.0	120.000	400.0	H	187.0	21.2
799.042050	20.04	36.00	15.96	1000.0	120.000	400.0	H	252.0	22.7



Plot 4: 30 MHz – 1 GHz, horizontal &amp; vertical polarisation (Rx-Idle)



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.336825	10.77	30.00	19.23	1000.0	120.000	274.0	V	76.0	13.4
43.731600	9.92	30.00	20.08	1000.0	120.000	274.0	V	300.0	13.9
87.248700	5.68	30.00	24.32	1000.0	120.000	200.0	H	277.0	9.8
210.581700	7.87	33.50	25.63	1000.0	120.000	400.0	V	297.0	12.1
732.624300	19.56	36.00	16.44	1000.0	120.000	349.0	H	97.0	22.3
927.505350	21.45	36.00	14.55	1000.0	120.000	186.0	V	232.0	24.2

## 11.2 Spurious emissions radiated above 1 GHz

### Description:

Measurement of the radiated spurious emissions in transmit mode. The measurement is performed in the mode with the highest output power.

Measurement parameters	
Detector	Peak / RMS
Sweep time	Auto
Resolution bandwidth	1 MHz
Video bandwidth	3 x RBW
Span	1 GHz to 26 GHz
Trace mode	Max hold
Measured modulation	DBPSK
Test setup	See sub clause 7.2 A (1 GHz - 10 GHz)
Measurement uncertainty	See sub clause 9

The modulation with the highest output power was used to perform the transmitter spurious emissions. If spurious were detected a re-measurement was performed on the detected frequency with each modulation.

### Limits:

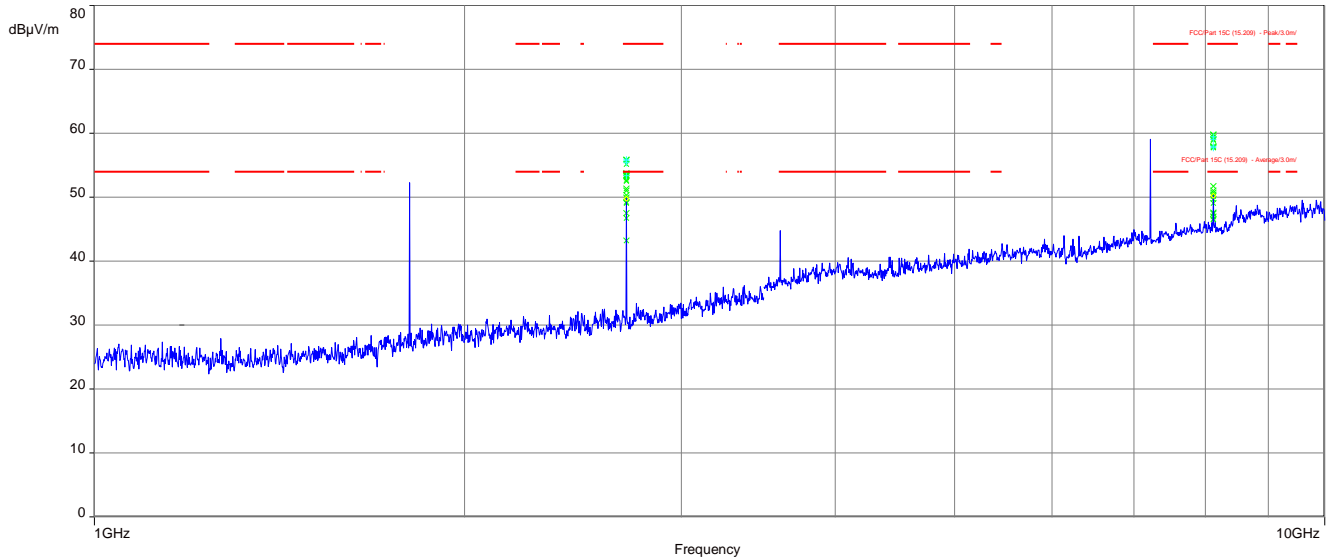
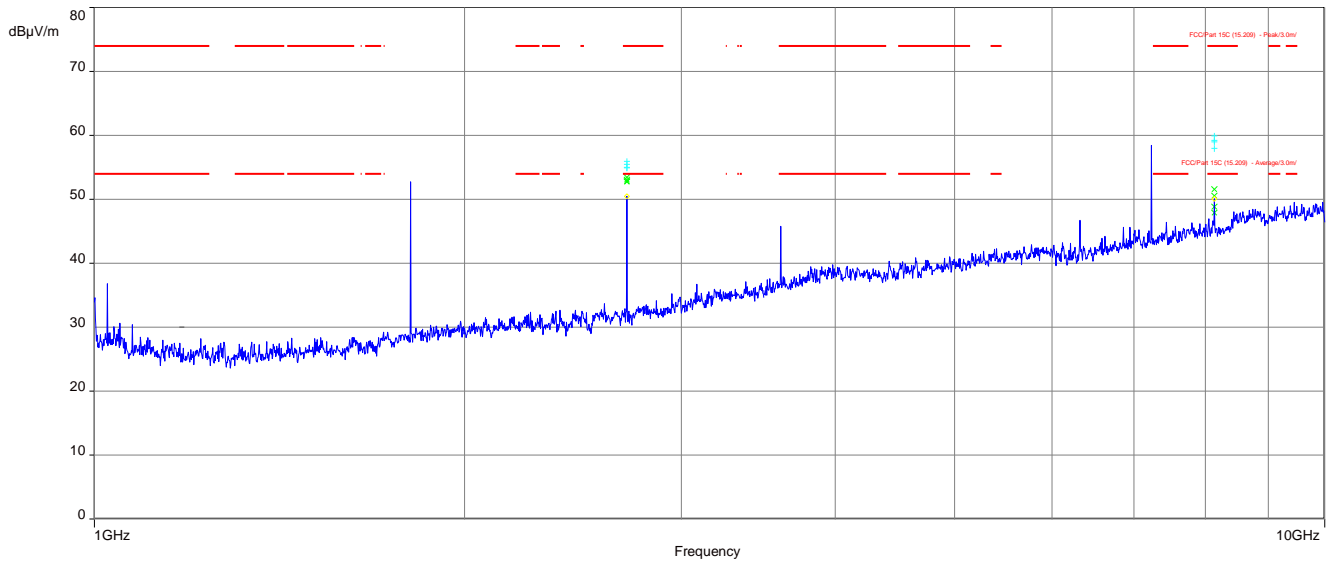
FCC		IC
TX spurious emissions radiated		
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).		
§15.209		
Frequency (MHz)	Field strength (dBμV/m)	Measurement distance
Above 960	54.0	3

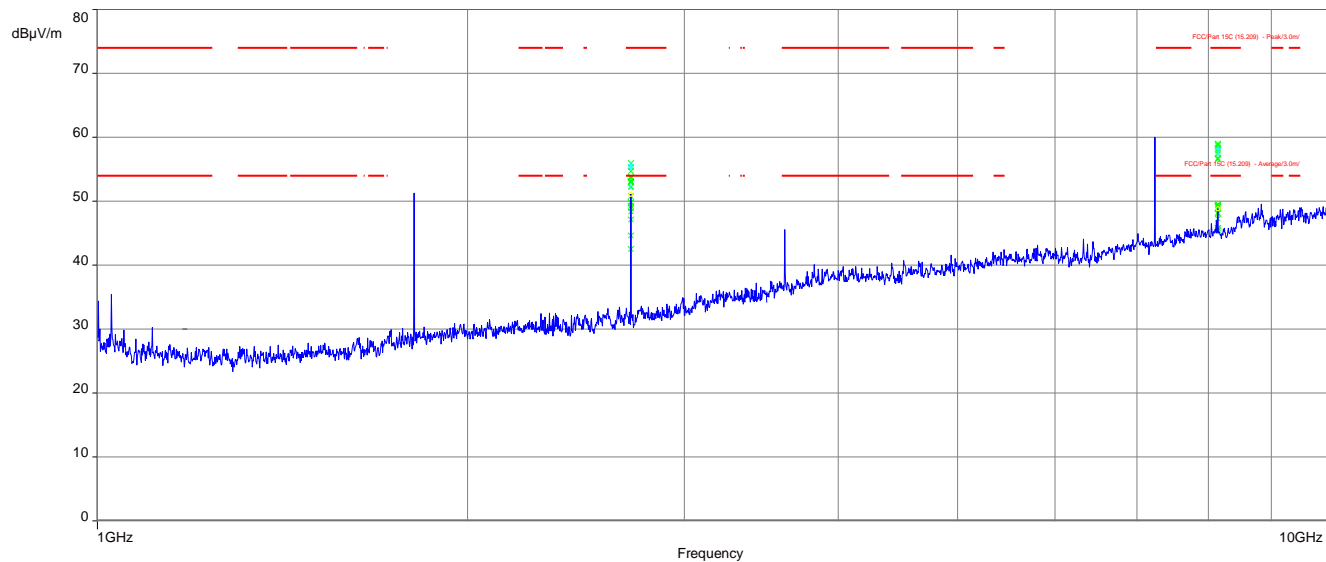
**Results:** Transmitter mode

TX spurious emissions radiated [dB $\mu$ V/m]								
902.1375 MHz			903.3875 MHz			904.6625 MHz		
F [MHz]	Detector	Level [dB $\mu$ V/m]	F [MHz]	Detector	Level [dB $\mu$ V/m]	F [MHz]	Detector	Level [dB $\mu$ V/m]
2710.2	Peak	55.9	2710.25	Peak	55.9	2714.1	Peak	55.9
	AVG	53.8		AVG	53.5		AVG	53.8
8119.1	Peak	59.8	8130.6	Peak	59.9	8142.3	Peak	59.0
	AVG	51.7		AVG	51.6		AVG	49.1
-/-	Peak	-/-	-/-	Peak	-/-	-/-	Peak	-/-
	AVG	-/-		AVG	-/-		AVG	-/-

**Results:** Receiver mode

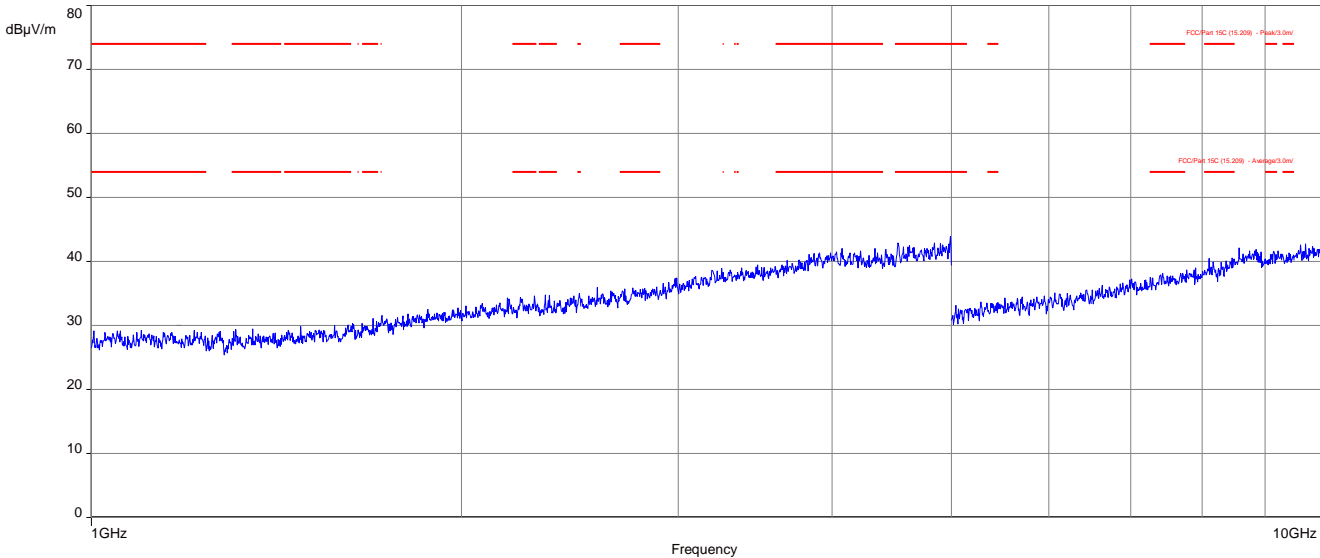
RX spurious emissions radiated [dB $\mu$ V/m]		
F [MHz]	Detector	Level [dB $\mu$ V/m]
All detected emissions are more than 20 dB below the limit.		
-/-	Peak	-/-
	AVG	-/-

**Plots:** Transmitter mode**Plot 1:** 1 GHz to 10 GHz, - lowest channel – DBPSK modulation**Plot 2:** 1 GHz to 10 GHz, - middle channel – DBPSK modulation

**Plot 3:** 1 GHz to 10 GHz, - highest channel – DBPSK modulation

**Plots:** Receiver mode

**Plot 1:** 1 GHz to 10 GHz, RX / idle-mode



**11.3 Spurious emissions conducted below 30 MHz (AC conducted)****Description:**

Measurement of the conducted spurious emissions in transmit mode below 30 MHz. The measurement is performed in the mode with the highest output power. Both power lines, phase and neutral line, are measured. Found peaks are remeasured with average and quasi peak detection to show compliance to the limits.

Measurement parameters	
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 7.3. A
Measurement uncertainty	See sub clause 9

**Limits:**

FCC		IC
TX an RX spurious emissions conducted < 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

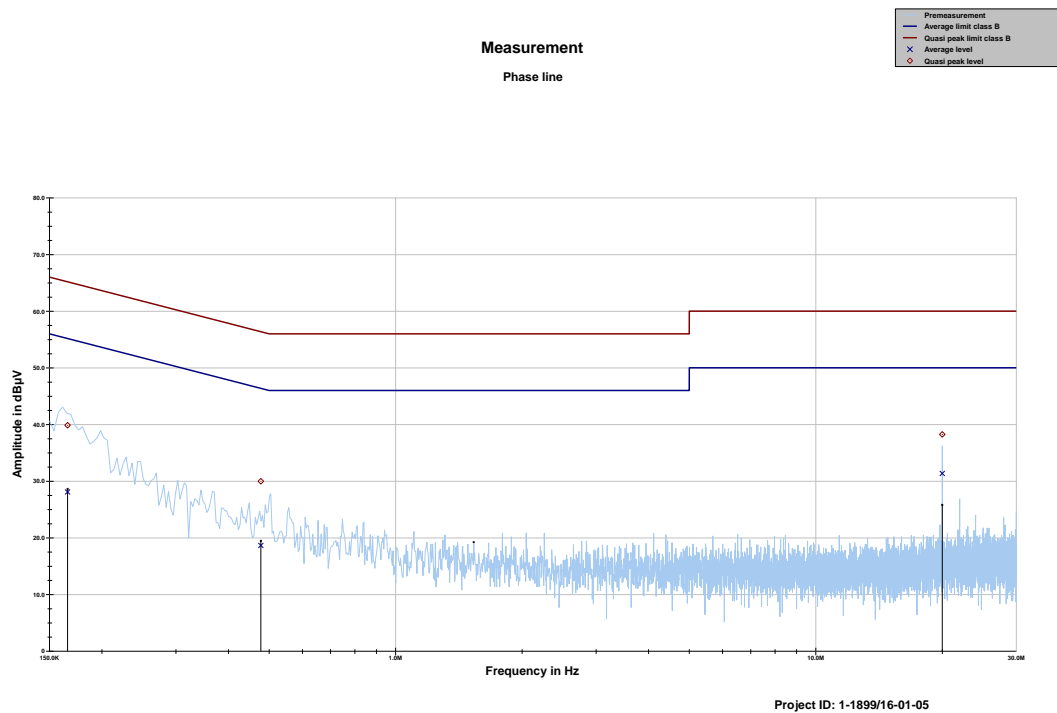
**Results:**

Spurious emissions conducted < 30 MHz [dBμV/m]		
F [MHz]	Detector	Level [dBμV/m]
See tables below plots!		
Measurement uncertainty	± 3 dB	

Note: Tests performed with a lab power supply.

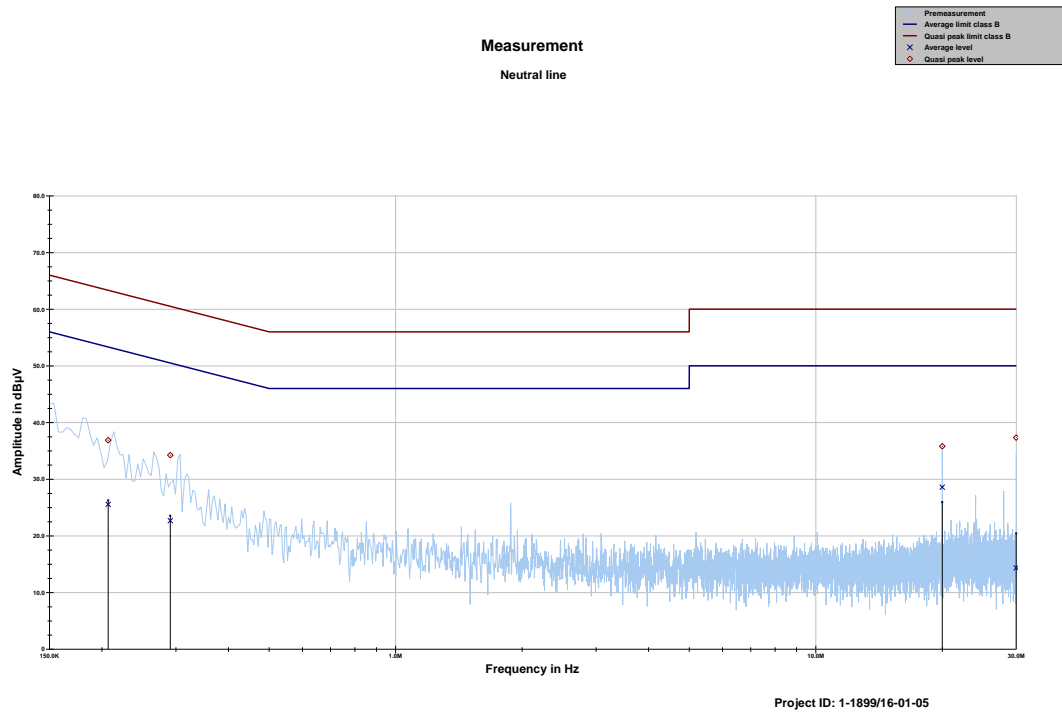
### Plots:

**Plot 1:** 150 kHz to 30 MHz, phase line – middle channel (Controller Board powered by lab power supply (4.5V))



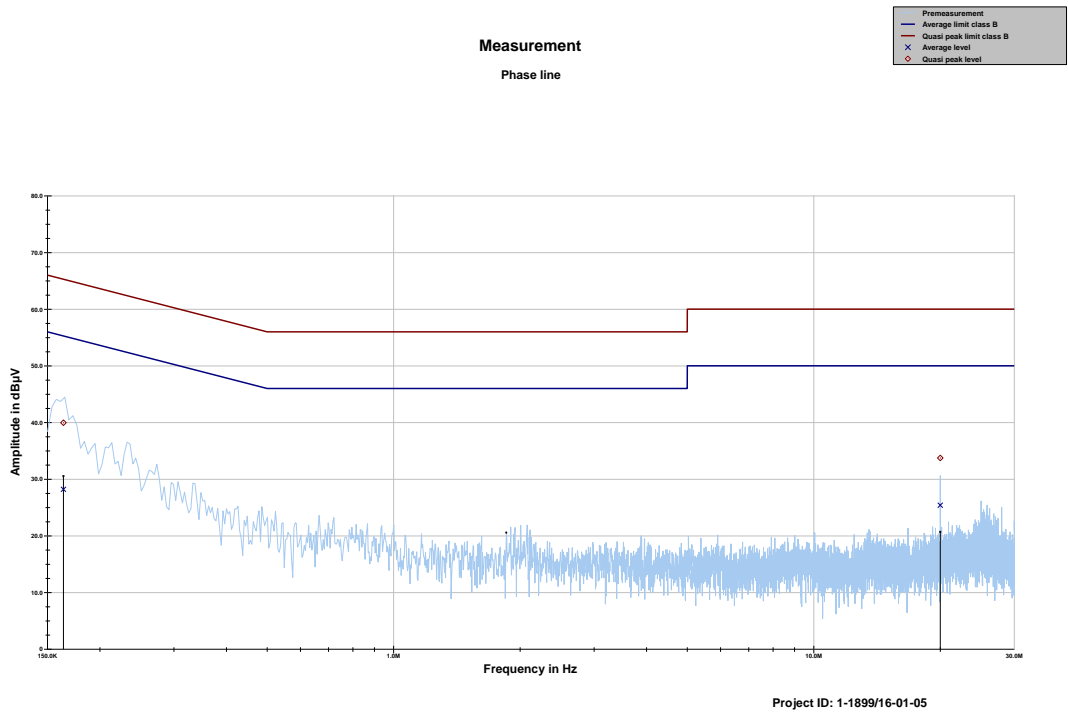
Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBμV	dB	dBμV	dBμV	dB	dBμV
0.165710	39.86	25.31	65.173	28.09	27.47	55.551
0.477789	29.98	26.39	56.377	18.66	27.97	46.635
19.999050	38.25	21.75	60.000	31.36	18.64	50.000



**Plot 2:** 150 kHz to 30 MHz, neutral line – middle channel (Controller Board powered by lab power supply (4.5V))


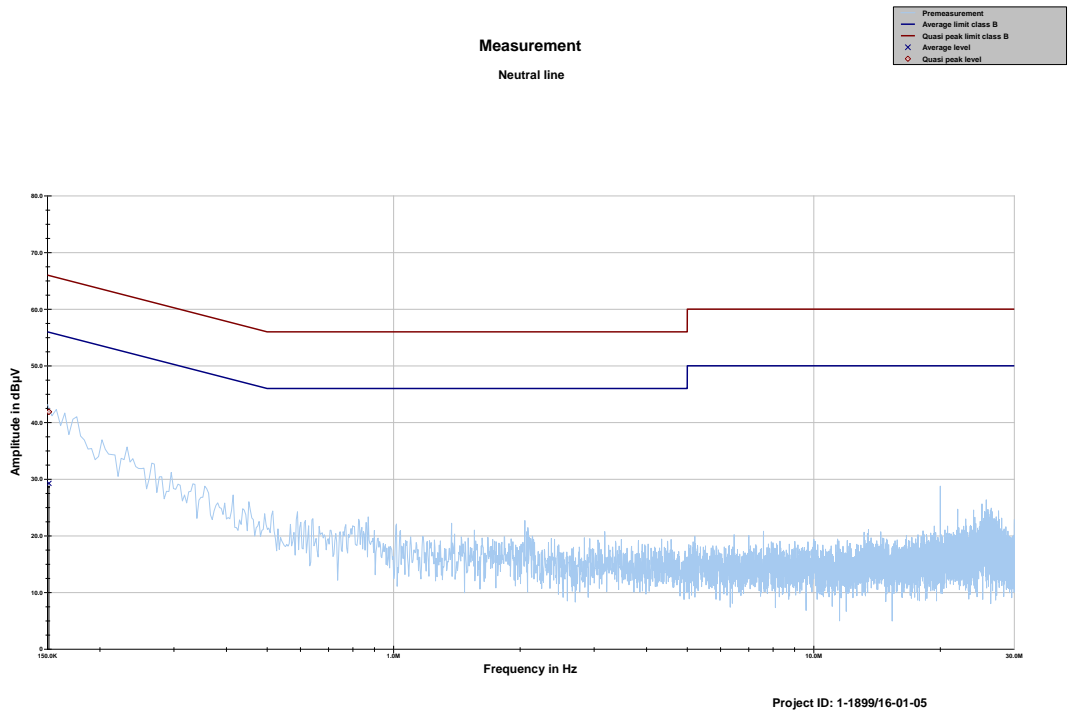
Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.144902	41.07			29.60		
0.207069	36.87	26.45	63.322	25.55	28.82	54.369
0.290921	34.24	26.26	60.498	22.68	29.29	51.974
20.004650	35.80	24.20	60.000	28.59	21.41	50.000
29.999850	37.34	22.66	60.000	14.33	35.67	50.000

Plot 2: 150 kHz to 30 MHz, phase line – middle channel (Radio Board powered by lab power supply (3.0V))



Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.163774	39.96	25.31	65.270	28.21	27.40	55.606
20.000245	33.73	26.27	60.000	25.41	24.59	50.000

Plot 2: 150 kHz to 30 MHz, neutral line – middle channel (Radio Board powered by lab power supply (3.0V))



Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.151260	41.88	24.05	65.931	29.25	26.71	55.964

## 12 Observations

No observations except those reported with the single test cases have been made.

**Annex A Document history**

Version	Applied changes	Date of release
	Initial release	2016-08-02

**Annex B Further information****Glossary**

AVG	-	Average
DUT	-	Device under test
EMC	-	Electromagnetic Compatibility
EN	-	European Standard
EUT	-	Equipment under test
ETSI	-	European Telecommunications Standard Institute
FCC	-	Federal Communication Commission
FCC ID	-	Company Identifier at FCC
HW	-	Hardware
IC	-	Industry Canada
Inv. No.	-	Inventory number
N/A	-	Not applicable
PP	-	Positive peak
QP	-	Quasi peak
S/N	-	Serial number
SW	-	Software
PMN	-	Product marketing name
HMN	-	Host marketing name
HVIN	-	Hardware version identification number
FVIN	-	Firmware version identification number

## Annex C Accreditation Certificate

Front side of certificate



Deutsche Akkreditierungsstelle GmbH

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

### Akkreditierung



Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

**CETECOM ICT Services GmbH**  
Untertürkheimer Straße 6-10, 66117 Saarbrücken

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

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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 04.05.2016 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, 04.05.2016

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

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Spittelmarkt 10  
10117 Berlin

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60327 Frankfurt am Main

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