PHOENIX TESTLAB
Königswinkel 10
32825 Blomberg, Germany
Phone: +49 (0) 52 35 / 95 00-0
Fax: +49 (0) 52 35 / 95 00-10
office@phoenix-testlab.de
www.phoenix-testlab.de

Test Report

Report Number:

F170754E3

Equipment under Test (EUT):

Control Panel for welding inverters

Einschub TPS/i Touch G2

Applicant:

Fronius International GmbH

Manufacturer:

Fronius International GmbH

ilac-MRA
DAkkS Deutsche Akkreditierungsstelle
D-PL-17186-01-01
D-PL-17186-01-02
D-PL-17186-01-03

References

[1] ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

[2] FCC CFR 47 Part 15 (June 2017), Radio Frequency Devices

[3] RSS-247 Issue 2 (February 2017), Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

[4] RSS-Gen Issue 4 (November 2014), General Requirements for Compliance of Radio Apparatus

[5] KDB 558074 D01 DTS Meas Guide v04 (April 2017), Guidance for Performing compliance measurements on digital transmission systems (DTS) operating under section 15.247

Test Result

The requirements of the tests performed as shown in the overview (clause 4) were fulfilled by the equipment under test.
The complete test results are presented in the following.

Test engineer:	Bernward ROHDE		20.08.2018
	Name	Signature	Date
Authorized reviewer:	Michael DINTER		20.08.2018
	Name	Signature	Date

This test report is only valid in its original form.

Any reproduction of its contents in extracts without written permission of the accredited test laboratory PHOENIX TESTLAB GmbH is prohibited.

The test results herein refer only to the tested sample. PHOENIX TESTLAB GmbH is not responsible for any generalizations or conclusions drawn from these test results concerning further samples. Any modification of the tested samples is prohibited and leads to the invalidity of this test report. Each page necessarily contains the PHOENIX TESTLAB Logo and the TEST REPORT NUMBER.

This test report is valid in hardcopy form as well as in electronic form.

Contents

Page

1 Identification 4
1.1 Applicant 4
1.2 Manufacturer 4
1.3 Test Laboratory 4
1.4 EUT (Equipment Under Test) 5
1.5 Technical Data of Equipment 6
1.6 Dates 7
2 Operational States 7
3 Additional Information 8
4 Overview 9
5 Results 10
5.1 Duty cycle 10
5.1.1 Test results 11
5.2 Maximum peak output power 12
5.3 DTS Bandwidth / 99% Bandwidth 14
5.3.1 Method of measurement 14
5.3.2 Test result 15
5.4 Peak Power Spectral Density 17
5.4.1 Method of measurement 17
5.4.2 Test result 18
5.5 Band-edge compliance 19
5.5.1 Method of measurement (band edges next to unrestricted bands (radiated)) 19
5.5.2 Test result (band edges next to unrestricted bands (radiated)) 20
5.5.3 Method of measurement (band edges next to restricted bands (radiated)) 21
5.5.4 Test result (band edges next to restricted bands (radiated)) 21
5.6 Maximum unwanted emissions 22
5.6.1 Method of measurement (radiated emissions) 22
5.6.2 Test results (radiated emissions) – Emissions from 9 kHz – 26.5 GHz 29
5.7 Conducted emissions on power supply lines (150 kHz to 30 MHz) 38
5.7.1 Mode: BLE and NFC active 38
6 Test equipment and ancillaries used for tests 40
7 Report History 41
8 List of Annexes 42

1 Identification

1.1 Applicant

Name:	Fronius International GmbH
Address:	Günter-Fronius-Straße 1, 4600 Wels
Country:	Austria
Name for contact purposes:	Mr. Jan HERNDLER
Phone:	+43-7242-241-2648
Fax:	+43-7242-241-0
email Address:	herndler.jan@fronius.com
Applicant partly represented during the test by the following person:	Mr. Jan HERNDLER, Franz NIEDEREDER

1.2 Manufacturer

Name:	Fronius International GmbH
Address:	Günter-Fronius-Straße 1, 4600 Wels
Country:	Austria
Name for contact purposes:	Mr. Jan HERNDLER
Phone:	+43-7242-241-2648
Fax:	+43-7242-241-0
email Address:	herndler.jan@fronius.com
Manufacturer partly represented during the test by the following person:	Mr. Jan HERNDLER, Franz NIEDEREDER

1.3 Test Laboratory

The tests were carried out by: **PHOENIX TESTLAB GmbH**
Königswinkel 10
32825 Blomberg
Germany

accredited by Deutsche Akkreditierungsstelle GmbH (DAkkS) in compliance with DIN EN ISO/IEC 17025 under Reg. No. D-PL-17186-01-02, FCC Test Firm Accreditation with the registration number 469623, designation number DE0004 and Industry Canada Test site registration SITE# IC3469A-1.

1.4 EUT (Equipment Under Test)

EUT	
Test object: *	**Control Panel for welding inverters**
Type / PMN: *	**Einschub TPS/i Touch G2**
FCC ID: *	QKWSPBMCU2
IC-Number: *	12270A-SPBMCU2
HVIN (Hardware Version Identification Number): *	Einschub TPS/i Touch G2
FVIN (Firmware Version Identification Number): *	V1.8 Beta
HMN (Host model name):*	N/A
Order number	43,0001,3547
Serial number: *	Engineering sample
PCB identifier: *	1614685

* As declared by the applicant

BLE frequencies:				
Channel 00	RX:	2402 MHz	TX:	2402 MHz
Channel 19	RX:	2440 MHz	TX:	2440 MHz
Channel 39	RX:	2480 MHz	TX:	2480 MHz

1.5 Technical Data of Equipment

EUT						
Fulfills Bluetooth specification:*	Bluetooth low energy only					
Antenna type:*	Dipole Antenna					
Antenna name:*	FXP832					
Antenna gain:*	3.66 dBi (on plastic according to the datasheet)					
Antenna connector:*	RP-SMA					
Power supply:*	DC					
Supply voltage EUT – Control Unit:*	U_{nom} =	24 V DC	U_{min} =	21.6 V DC	U_{max} =	26.4 V DC
Power supply:*	DC					
Supply voltage BTLE module:*	U_{nom} =	3.3 V DC	U_{min} =	2.5 V DC	U_{max} =	3.6 V DC
Type of modulation:*	GFSK					
Operating frequency range:*	2402 – 2480 MHz					
Number of channels:*	40 (2 MHz channel spacing)					
Temperature range:*	-10 °C to +60 °C					
Lowest / highest internal clock frequency:*	32.768 kHz (clock) / 2480 MHz					

* Declared by the applicant

Ancillary Equipment:	
Laptop PC:*	Fujitsu Lifebook S751 (PM No. 201036)
AC-Adaptor**	ITE Power supply Model number: UE36LCP1-240150SPA, 24 V d.c. / 1.5 A

*Provided by the laboratory
**Provided by the applicant

The following external I/O cables were used:

Identification	Connector		Length
	EUT	Ancillary	
Power (DC)*	2 x Measuring cables were used		~2 m
Ethernet*	HSD	RJ45	3 m
Power (AC-Adaptor)**	AC plug	CE	~2 m

* Length during the test if no other specified.
** Used for the “Conducted emissions on power supply lines”, delivered by the applicant

1.6 Dates

Date of receipt of test sample:	07.09.2017
Start of test:	08.09.2017
End of test:	12.04.2018

2 Operational States

The equipment under test (EUT) is the Bluetooth low energy -radio part of a control panel for welding units. During normal operation the EUT can be paired with an ancillary Smartphone/Laptop to configure the welding parameters via remote control.

Physical Boundaries of the EUT:

As declared by the applicant, only the 13.56.MHz RFID, Bluetooth low energy and WLAN (2.4 GHz) is to be used in the final application.

During the Bluetooth LE radio tests the RFID module was active and continuously transmitting.
So BLE and NFC were operating simultaneously. BT/BLE and WLAN share the same antenna and can't transmit simultaneously.

For the Bluetooth radio tests the "Dut labtool" as provided by the applicant was used to configure the rf-parameter of the EUT via the controlling laptop. A LAN connection was used to control the settings of the EUT.

For the tests the EUT was supplied with 24 V DC via laboratory power supply.

Operation mode	Description of the operation mode	mode	channel	Power-setting [dBm]	Data rate / Mbps
1	Continuous transmitting on 2402 MHz	BTLE	0	8	1 Mbps
2	Continuous transmitting on 2440 MHz	BTLE	19	8	1 Mbps
3	Continuous transmitting on 2480 MHz	BTLE	39	8	1 Mbps

This test-report incorporates the worst case results for Bluetooth low energy only.

All tests were done with an unmodified sample.

3 Additional Information

As declared by the applicant, the USB port of the EUT is only used for service purposes. Therefore no lines were connected to the USB port of the EUT during the tests.

This test-report covers the simultaneous transmission of the BTLE part and the 13.56 MHz NFC part, the NFC specific test-cases are documented in test-report 170754E1, the simultaneous transmission of the BTLE part and the 13.56 MHz NFC part specific test-cases are documented in test-report 170754E2.

4 Overview

Application	Frequency range [MHz]	FCC 47 CFR Part 15 section [2]	RSS-247 [3] or RSS-Gen, Issue 4 [4]	Status	Refer page
Maximum Peak Output Power	2400.0 - 2483.5	15.247 (b) (3), (4)	5.4 (d) [3]	Passed	10 et seq
DTS Bandwidth	2400.0 - 2483.5	15.247 (a) (2)	5.2 (a) [3]	Passed	14 et seq
Peak Power Spectral Density	2400.0 - 2483.5	15.247 (e)	5.2 (b) [3]	Passed	17 et seq
Band edge compliance	2400.0 - 2483.5	15.247 (d)	5.5 [3] 8.9 [4], 8.10 [4]	Passed	19 et seq.
Radiated emissions (transmitter)	0.009 – 26,500	15.247 (d) 15.205 (a) 15.209 (a)	5.5 [3] 8.9 [4], 8.10 [4]	Passed	22 et seq.
Conducted emissions on supply line	0.15 - 30	15.207 (a)	8.8 [4]	Passed	38 et seq.

5 Results

5.1 Duty cycle

For the peak power spectral density measurement, the EUT was measured radiated in the anechoic chamber.

The method described in chapter 11.6 b) of document [1] was used to perform the following test.

The following measurement technique was used:

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between two bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal.

- Set the center frequency of the instrument to the center frequency of the transmission.
- Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value.
- Set VBW ≥ RBW.
- Set detector = peak or average.
- The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

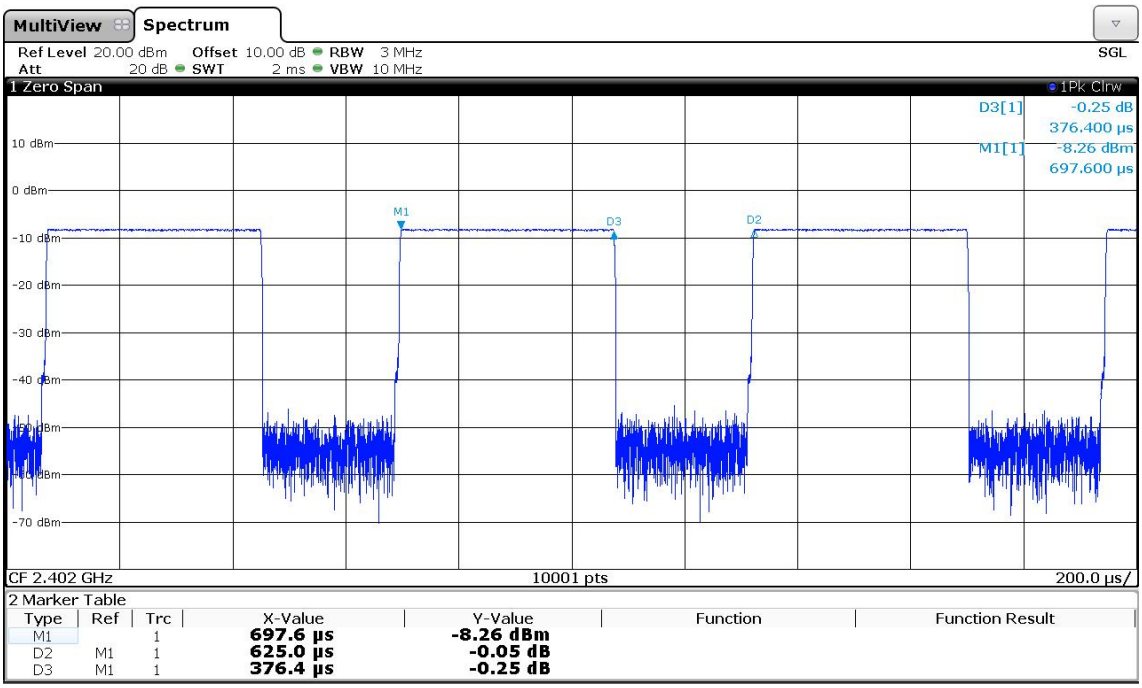
5.1.1 Test results

Ambient temperature	22 °C
Tested by	B. Rohde

Relative humidity	59 %
Date	08.09.2017

Since Bluetooth Low Energy only has one modulation, only one duty cycle plot is submitted below.

Duty cycle (operation mode 1):



Operation mode	TX_on [µs]	TX_ges [µs]	RBW [MHz]	50/T [kHz]	50/T < RBW?
1	376.4	625	3	133	Yes

Operation mode	Sweep points	Sweep time [µs]	Meas points	Meas points >100?	Duty cycle %	DCCF [dB]
1	10001	2000	3125	Yes	60.22	2.20

The DCCF (duty cycle correction factor) is calculated by:

$$DCCF = 10 * log_{10}\left(\frac{1}{Duty\ cycle}\right)$$

Therefore, for average measurements a correction factor of 2.20 dB is used for all tests.

TEST EQUIPMENT USED FOR THE TEST:

1 - 9

5.2 Maximum peak output power

The maximum peak output power was tested radiated in a fully anechoic room with the internal antenna.

Procedure 11.9.1.1 in [1] was used for the following test.

The following procedure shall be used when an instrument with a resolution bandwidth that is greater than the DTS bandwidth is available to perform the measurement:

a) Set the RBW ≥ DTS bandwidth.
b) Set VBW ≥ [3 × RBW].
c) Set span ≥ [3 × RBW].
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

The measurement was performed at the lower end of the assigned frequency band.

The measured Electric field strength was corrected with the following correction factor:

Antenna Factor [dB] + Cable Attenuation [dB] - Amplifier Gain[dB] = correction factor [dB]

The formula in 11.22.2.2 e) in [1] was used to calculate the EIRP power:

$E = EIRP - 20\log(d) + 104.8$
$EIRP = E - 95.3$

$MPOP = EIRP - G$

E is the electric field strength in dBµV/m
EIRP is the equivalent isotropically radiated power in dBm
d is the specified measurement distance in m
G is the antenna gain in dBi
MPOP is the maximum peak output power – measured antenna port conducted – in dBm

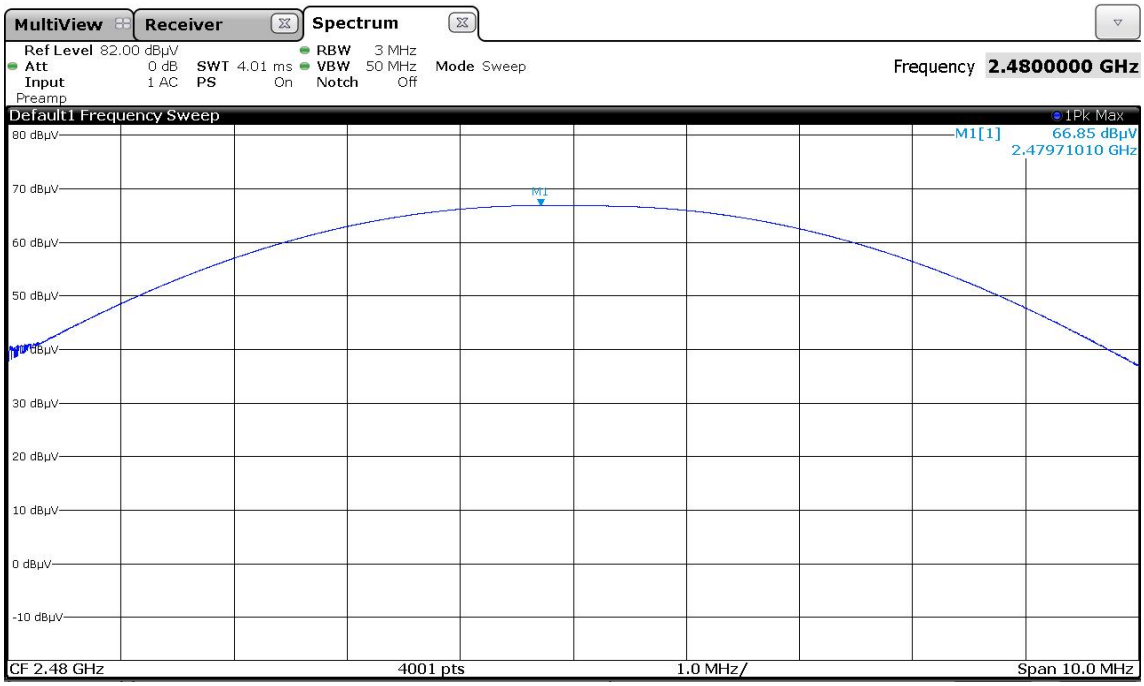
Result: radiated measurement on sample with integral antenna

Ambient temperature	22 °C
Tested by	B. Rohde

Relative humidity	59 %
Date	08.09.2017

Worst case plot only:

Maximum peak output power (operation mode 3):



Operation mode	Frequency [MHz]	Reading [dBmV]	Corr. Fact. [dB/m]	Field strength @ 3m [dBmV/m]	EIRP [dBm]	Maximum peak conducted output power [dBm]	Limit [dBm]
1	2402	60.4	34.0	94.4	-0.7	-4.4	30.00*
2	2440	65.6	34.2	99.8	4.7	1.0	30.00*
3	2480	66.9	34.1	101.0	5.8	2.1	30.00*
Measurement uncertainty				+/- 5.14 dB			

* Antenna gain below 6 dBi, therefore no power reduction was necessary.

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

1 - 9

5.3 DTS Bandwidth / 99% Bandwidth

5.3.1 Method of measurement

For the DTS bandwidth measurement, the EUT was measured radiated in the anechoic chamber using the procedures described in 5.6.1; respectively 8.1 option 1 of [5].

DTS bandwidth:

The measurement for the DTS bandwidth procedure refers to part 11.8.1 of document [1].

- Set RBW = 100 kHz.
- Set the video bandwidth (VBW) ≥ 3 x RBW.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

The following procedure was used for measuring the 99 % bandwidth:

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. The following procedure shall be used for measuring 99% power bandwidth:

- The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.
- The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be approximately three times the RBW, unless otherwise specified by the applicable requirement.
- Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2. [1]
- Step a) through step c) might require iteration to adjust within the specified range.
- e) Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
- f) Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.
- g) If the instrument does not have a 99% power bandwidth function, then the trace data points are recovered and directly summed in linear power terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% power bandwidth is the difference between these two frequencies.
- The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labelled. Tabular data maybe reported in addition to the plot(s).

Since this is only a relative measurement, no measurement level correction was performed.

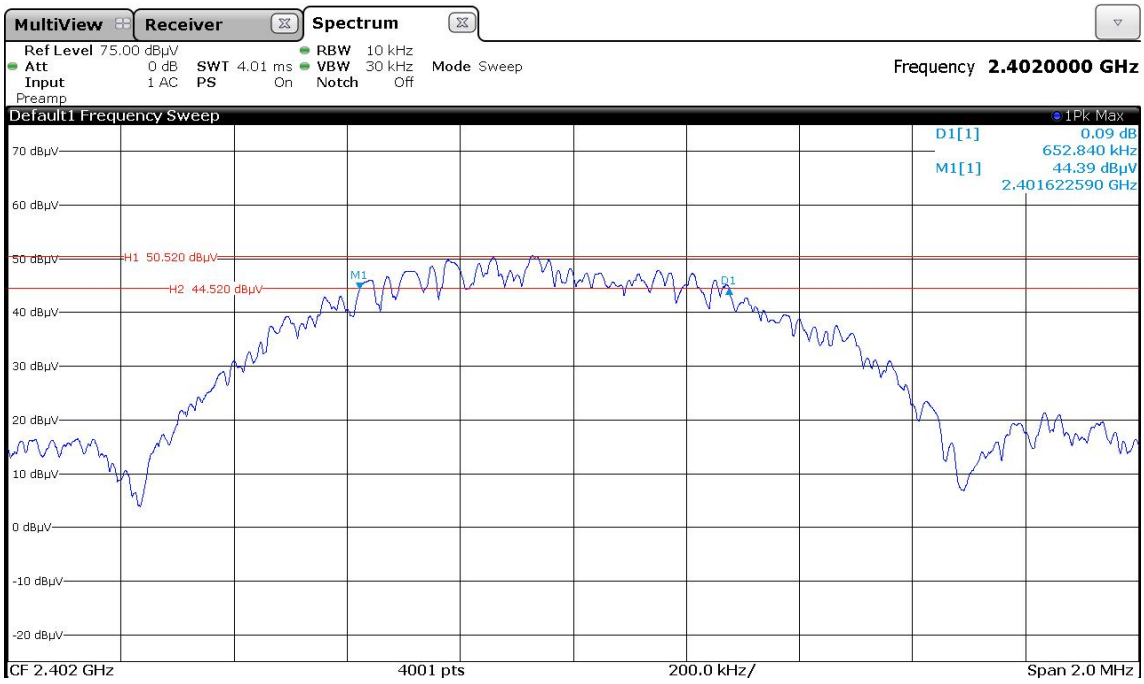
5.3.2 Test result

Ambient temperature	22 °C
Tested by	B. Rohde

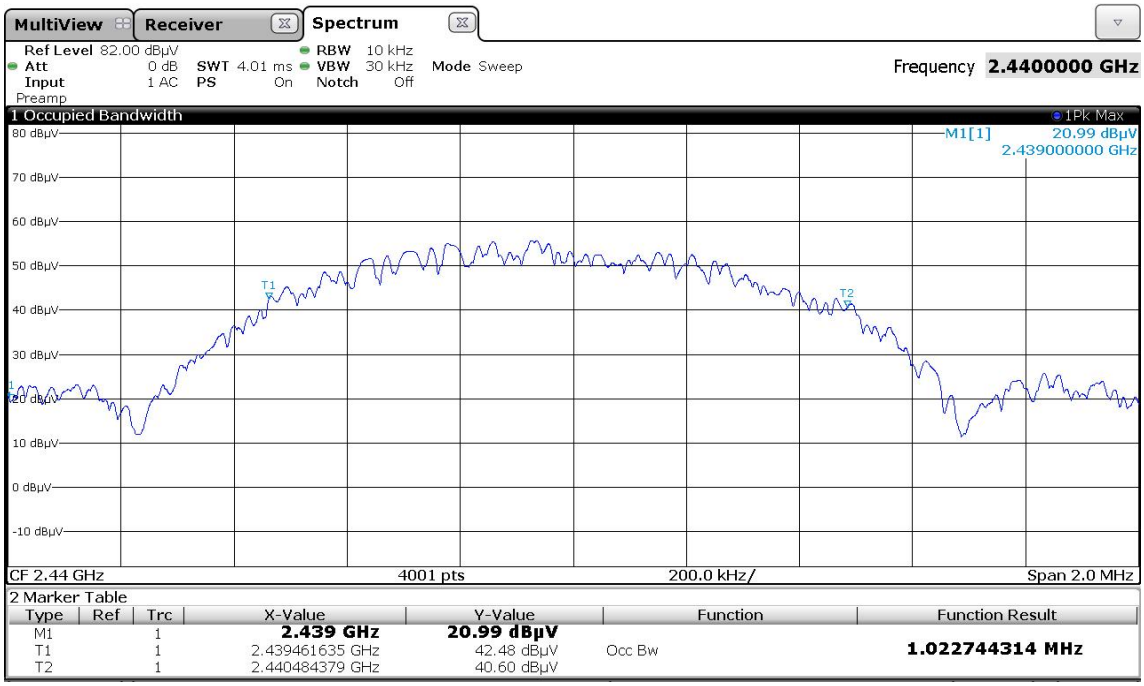
Relative humidity	59 %
Date	08.09.2017

Worst case plots only:

6-dB Bandwidth (operation mode 1):



99% Bandwidth (operation mode 2):



Operation Mode	Center Frequency [MHz]	Minimum 6-dB Bandwidth Limit [MHz]	6 dB Bandwidth [MHz]	99 % Bandwidth [MHz]	Result
1	2402	0.5	0.653	1.021	Passed
2	2440	0.5	0.655	1.023	Passed
3	2480	0.5	0.654	1.019	Passed

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

1 - 9

5.4 Peak Power Spectral Density

5.4.1 Method of measurement

For the peak power spectral density measurement, the EUT was measured radiated in the anechoic chamber.

The measurement procedure refers to part 11.10.2 of document [1] respectively 10.2 [5].

- Set analyzer center frequency to DTS channel center frequency
- Set the span to 1.5 times the DTS bandwidth.
- Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
- Set the VBW ≥ 3 x RBW.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level within the RBW.
- If measured value exceeds limit, reduce RBW (not less than 3 kHz) and repeat.

The measurement result in [dBmV/m] was calculated to [dBm] using the formula
in chapter 11.12.2.2 e) in [1].

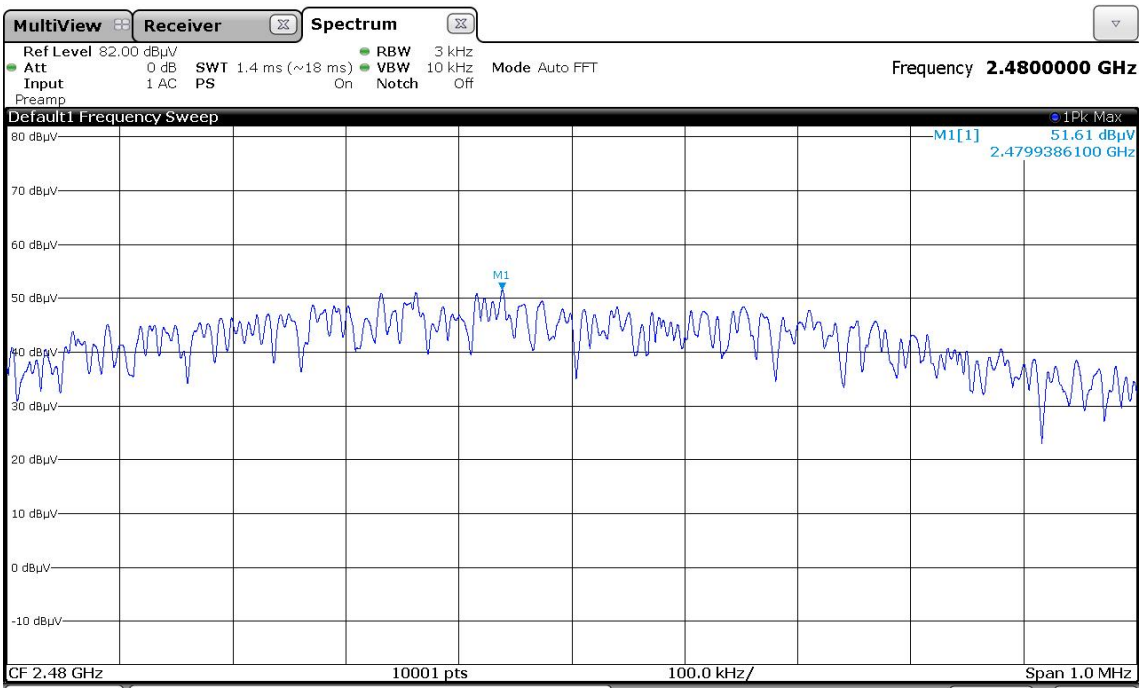
5.4.2 Test result

Ambient temperature	22 °C
Tested by	B. Rohde

Relative humidity	59 %
Date	08.09.2017

The plot shows an exemplary measurement result for the worst documented case.
The other results are listed in the following table.

Power Spectral Density (operation mode 3):



Operation Mode	Peak Frequency [MHz]	Power Spectral Density Limit [dBm/3kHz]	Power Spectral Density Reading [dBm / 3 kHz]	Result
1	2401.939	8	-16.0	Passed
2	2439.939	8	-10.5	Passed
3	2479.939	8	-9.4	Passed
Measurement uncertainty			+/- 5.14 dB	

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

1 - 9

5.5 Band-edge compliance

5.5.1 Method of measurement (band edges next to unrestricted bands (radiated))

The EUT was measured radiated in the anechoic chamber using the procedures described in 5.6.1, respectively see chapter 11.0 in [5].

Acceptable measurement configurations

The measurement procedure refers to part 11.11.2 and 11.11.3 of document [1].

Measurement Procedure Reference – Reference Level:

- Set the span to ≥ 1.5 times the DTS Bandwidth.
- RBW = 100 kHz.
- VBW ≥ 300 kHz.
- Detector = Peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level.

Measurement Procedure – Unwanted Emissions

- Set the center frequency and span to encompass the frequency range to be measured.
- RBW = 100 kHz.
- VBW ≥ 300 kHz.
- Detector = Peak.
- Ensure that the number of measurement points ≥ span/RBW.
- Sweep time = auto couple.
- Trace Mode = max hold.
- Allow the trace to stabilize.
- Use the peak marker function to determine the maximum amplitude level.

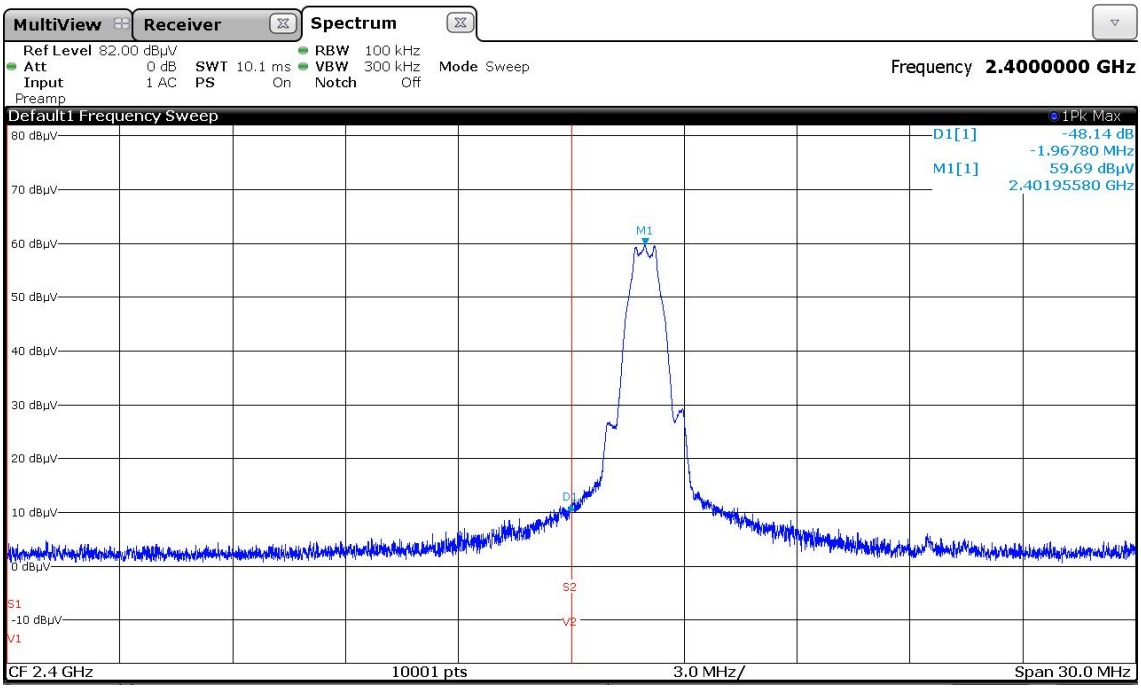
The measurements were performed at the lower end of the 2.4 GHz band.

5.5.2 Test result (band edges next to unrestricted bands (radiated))

Ambient temperature	22 °C
Tested by	B. Rohde

Relative humidity	59 %
Date	08.09.2017

Radiated band-edge compliance at an unrestricted band-edge (operation mode 1):



Operation Mode	Tx Frequency [MHz]	Emission Frequency [MHz]	Reference Level [dBµV/m]	Limit [dBµV/m]	Emission Level [dBµV/m]	Margin [dB]	Result
1	2412	2399.988	59.69	39.69	11.55	28.14	Passed
Measurement uncertainty			+/- 5.14 dB				

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

1- 9

5.5.3 Method of measurement (band edges next to restricted bands (radiated))

Ambient temperature	22 °C
Tested by	B. Rohde

Relative humidity	59 %
Date	08.09.2017

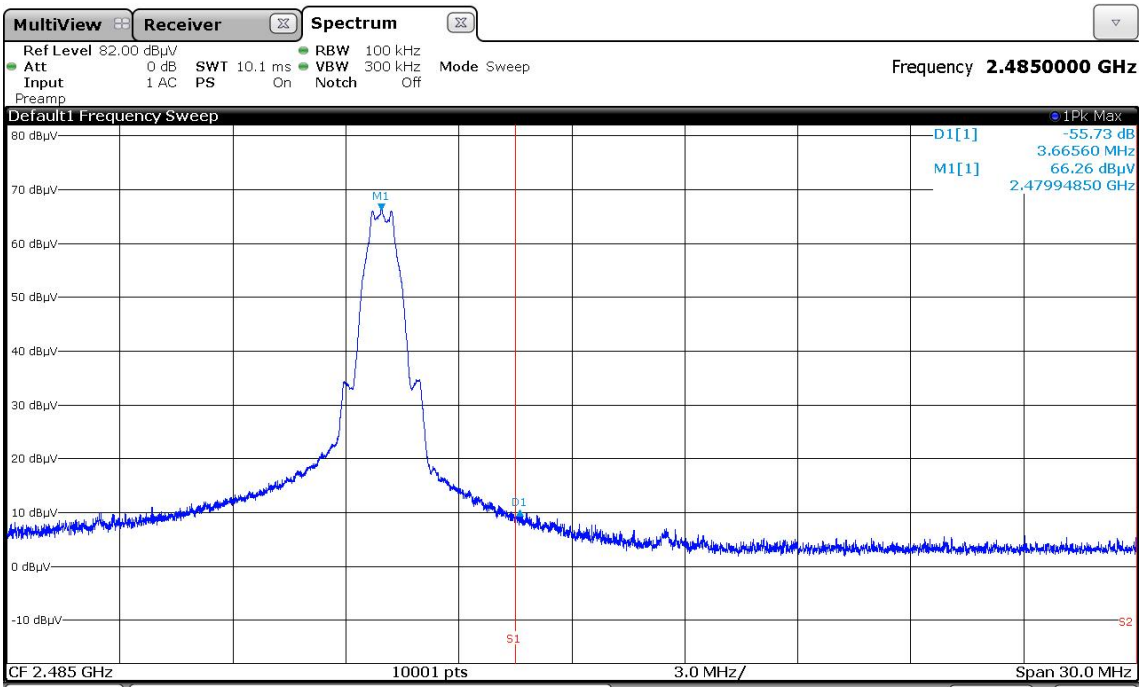
The EUT was measured radiated in the anechoic chamber using the procedures described in 5.6.1.

Acceptable measurement configurations

The same measurement configurations as described in 5.6.1. were used for the preview and final measurement.

5.5.4 Test result (band edges next to restricted bands (radiated))

Radiated band-edge compliance at a restricted band-edge (operation mode 3):



Band edge compliance			Upper band edge			Operation mode 3			
Frequency [MHz]	Max Peak [dBµV/m]	Average [dBµV/m]	Limit [dBµV/m]	Margin dB	Pol	Azimuth [°]	Elevation [°]	Correction [dB]	Result
-	-	-	-	-	-	-	-	-	-
No emission found									
Measurement uncertainty				+/- 5.14 dB					

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

1 - 9

5.6 Maximum unwanted emissions

5.6.1 Method of measurement (radiated emissions)

The radiated emission measurement is subdivided into five stages.

- A preliminary measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 9 kHz to 1 GHz.
- A final measurement carried out on an outdoor test side without reflecting ground plane and a fixed antenna height in the frequency range 9 kHz to 30 MHz.
- A final measurement carried out on an open area test side with reflecting ground plane and various antenna height in the frequency range 30 MHz to 1 GHz.
- A preliminary measurement carried out in a fully anechoic chamber with a variable antenna distance and height in the frequency range above 1 GHz.
- A final measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range above 1 GHz.

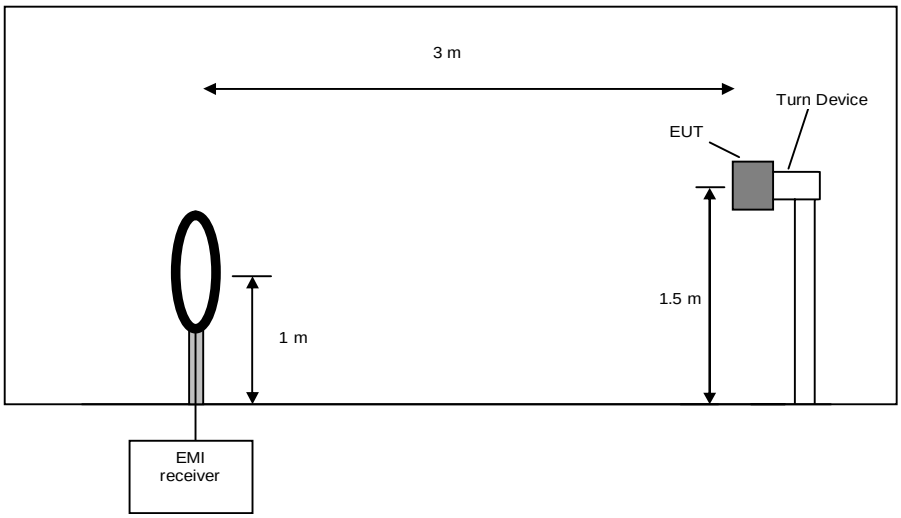
Preliminary measurement (9 kHz to 30 MHz):

In the first stage a preliminary measurement will be performed in a shielded room with a measuring distance of 3 meters. Table top devices will set up on a non-conducting turn device on the height of 1.5m. Floor-standing devices will be placed directly on the turntable/ground plane. The set-up of the Equipment under test will be in accordance to [1].

The frequency range 9 kHz to 30 MHz will be monitored with a spectrum analyzer while the system and its cables will be manipulated to find out the configuration with the maximum emission levels if applicable. The EMI Receiver will be set to MAX Hold mode. The EUT and the measuring antenna will be rotated around their vertical axis to found the maximum emissions.

The resolution bandwidth of the spectrum analyzer will be set to the following values:

Frequency range	Resolution bandwidth
9 kHz to 150 kHz	200 Hz
150 kHz to 30 MHz	10 kHz



Preliminary measurement procedure:

Pre-scans were performed in the frequency range 9 kHz to 150 kHz and 150 kHz to 30 MHz.

Pre-scans were performed in the frequency range 30 MHz to 230 MHz and 230 MHz to 1 GHz.
The following procedure will be used:

1. Monitor the frequency range at horizontal polarization and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Repeat 1) to 3) with the vertical polarization of the measuring antenna.
5. Make a hardcopy of the spectrum.
6. Repeat 1) to 5) with the EUT raised by an angle of 0° (45°, 90°) according to 6.6.5.4 in [1].
7. Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.

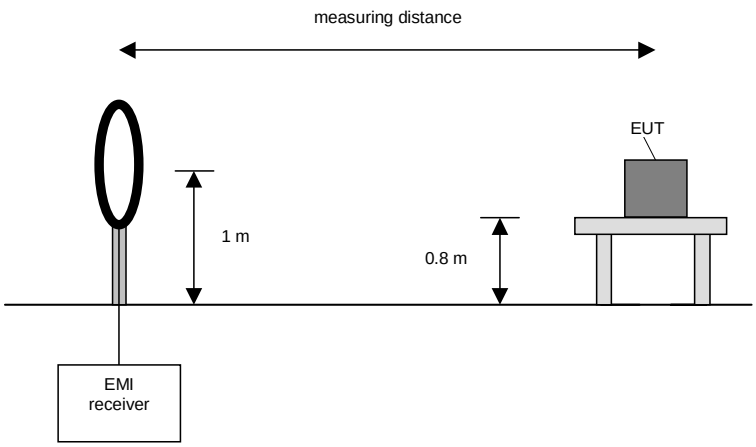
Final measurement (9 kHz to 30 MHz):

In the second stage a final measurement will be performed on an open area test site with no conducting ground plane in measuring distances of 3 m, 10 m and 30 m. In the case where larger measuring distances is required the results will be extrapolated based on the values measured on the closer distances according to Section 15.31 (f) (2) [2]. The final measurement will be performed with a EMI Receiver set to Quasi Peak detector except for the frequency bands 9 kHz to 90 kHz and 110 kHz to 490 kHz where an average detector will be used according Section 15.209 (d) [2].

On the frequencies, which were detected during the preliminary measurements, the final measurement will be performed while rotating the EUT and the measuring antenna in the range of 0 ° to 360 ° around their vertical axis until the maximum value is found.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
9 kHz to 150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz



Final measurement procedure:

The following procedure will be used:

1) Monitor the frequency range with the measuring antenna at vertical orientation parallel to the EUT at an azimuth of 0 °.
2) Rotate the EUT by 360 ° to maximize the detected signals and note the azimuth and orientation.
3) Rotate the measuring antenna to find the maximum and note the value.
4) Rotate the measuring antenna and repeat steps 1) to 3) until the maximum value is found.
5) Repeat steps 1) to 4) with the other orthogonal axes of the EUT (if the EUT is a module and might be used in a handheld equipment application).

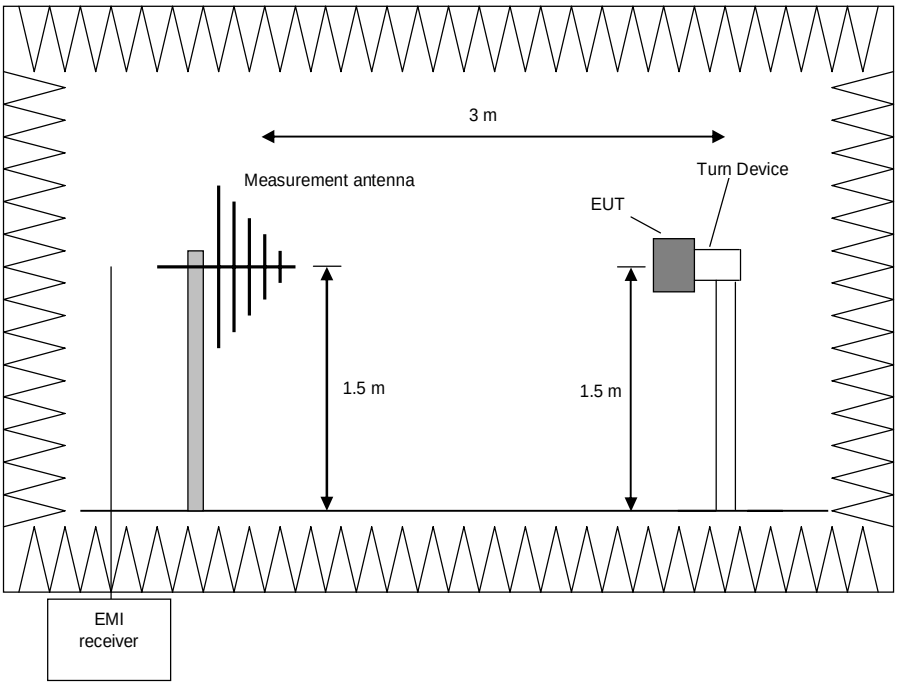
Preliminary measurement (30 MHz to 1 GHz)

In the first stage a preliminary measurement will be performed in a fully anechoic chamber with a measuring distance of 3 meter. Table top devices will set up on a non-conducting turn device on the height of 1.5m. Floor-standing devices will be placed directly on the turntable/ground plane. The setup of the Equipment under test will be in accordance to [1].

The frequency range 30 MHz to 1 GHz will be measured with an EMI Receiver set to MAX Hold mode and a resolution bandwidth of 100 kHz. The measurement will be performed in horizontal and vertical polarization of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 °. This measurement is repeated after raising the EUT in 30° steps according 6.6.5.4 in [1].

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
30 MHz to 230 MHz	100 kHz
230 MHz to 1 GHz	100 kHz



Procedure preliminary measurement:

Pre-scans were performed in the frequency range 30 MHz to 230 MHz and 230 MHz to 1 GHz.
The following procedure will be used:

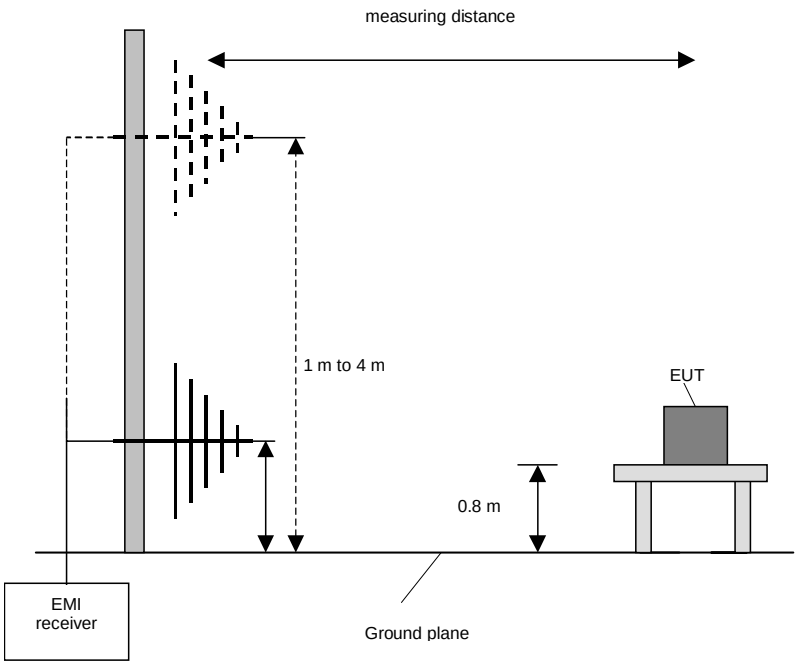
8. Monitor the frequency range at horizontal polarization and a EUT azimuth of 0 °.
9. Manipulate the system cables within the range to produce the maximum level of emission.
10. Rotate the EUT by 360 ° to maximize the detected signals.
11. Repeat 1) to 3) with the vertical polarization of the measuring antenna.
12. Make a hardcopy of the spectrum.
13. Repeat 1) to 5) with the EUT raised by an angle of 0° (45°, 90°) according to 6.6.5.4 in [1].
14. Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.

Final measurement (30 MHz to 1 GHz)

A final measurement on an open area test site will be performed on selected frequencies found in the preliminary measurement. During this test the EUT will be rotated in the range of
0 ° to 360 °, the measuring antenna will be set to horizontal and vertical polarization and raised and lowered in the range from 1 m to 4 m to find the maximum level of emissions.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
30 MHz to 1 GHz	120 kHz



Procedure final measurement:

The following procedure will be used:

1) Measure on the selected frequencies at an antenna height of 1 m and a EUT azimuth of 23 °.
2) Move the antenna from 1 m to 4 m and note the maximum value at each frequency.
3) Rotate the EUT by 45 ° and repeat 2) until an azimuth of 337 ° is reached.
4) Repeat 1) to 3) for the other orthogonal antenna polarization.
5) Move the antenna and the turntable to the position where the maximum value is detected.
6) Measure while moving the antenna slowly +/- 1 m.
7) Set the antenna to the position where the maximum value is found.
8) Measure while moving the turntable +/- 45 °.
9) Set the turntable to the azimuth where the maximum value is found.
10) Measure with Final detector (QP and AV) and note the value.
11) Repeat 5) to 10) for each frequency.
12) Repeat 1) to 11) for each orthogonal axes of the EUT (because of EUT is a module and might be used in a handheld equipment application).

Preliminary and final measurement (1 GHz to 40 GHz)

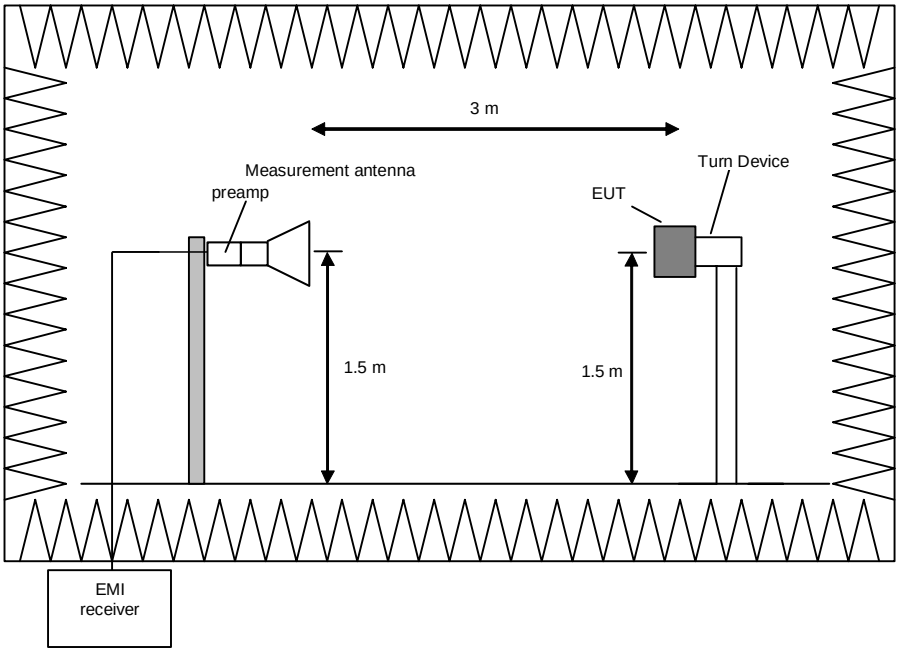
This measurement will be performed in a fully anechoic chamber. Table top devices will set up on a non-conducting turn device on the height of 1.5m. The set-up of the Equipment under test will be in accordance to [1].

Preliminary measurement (1 GHz to 40 GHz)

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The spectrum analyzer set to MAX Hold mode and a resolution bandwidth of 100 kHz. The measurement will be performed in horizontal and vertical polarization of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 °. This measurement is repeated after raising the EUT in 30° steps according 6.6.5.4 in [1].

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
1 GHz to 4 GHz	100 kHz
4 GHz to 12 GHz	100 kHz
12 GHz to 18 GHz	100 kHz
18 GHz to 25 / 26.5 GHz	100 kHz
26.5 GHz to 40 GHz	100 kHz



Procedure preliminary measurement:

Pre-scans were performed in the frequency range 1 to 40 GHz.
The following procedure will be used:

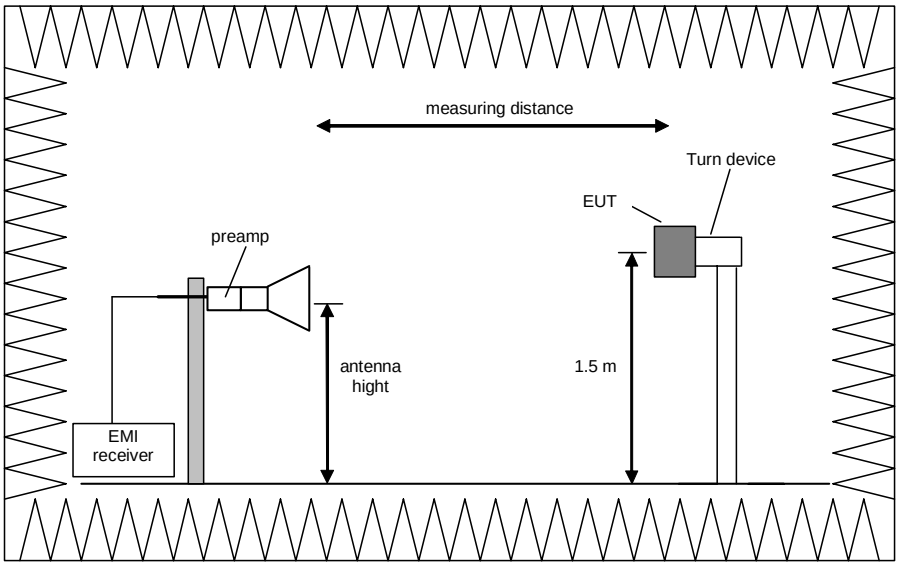
1. Monitor the frequency range at horizontal polarization and a EUT azimuth of 0 °.
2. Rotate the EUT by 360° to maximize the detected signals.
3. Repeat 1) to 2) with the vertical polarization of the measuring antenna.
4. Make a hardcopy of the spectrum.
5. Repeat 1) to 4) with the EUT raised by an angle of 30° (60°, 90°, 120° and 150°) according to 6.6.5.4 in [1].
6. Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
7. The measurement antenna polarization, with the according EUT position (Turntable and Turn device) which produces the highest emission for each frequency will be used for the final measurement. The six closest values to the applicable limit will be used for the final measurement.

Final measurement (1 GHz to 40 GHz)

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1 MHz. The measurement will be performed by rotating the turntable through 0 to 360° in the worst-case EUT orientation which was obtained during the preliminary measurements.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
1 GHz to 4 GHz	1 MHz
4 GHz to 12 GHz	1 MHz
12 GHz to 18 GHz	1 MHz
18 GHz to 25 / 26.5 GHz	1 MHz
26.5 GHz to 40 GHz	1 MHz



Procedure of measurement:

The measurements were performed in the frequency ranges 1 GHz to 4 GHz, 4 GHz to 12 GHz, 12 GHz to 18 GHz, 18 GHz to 25 /26.5 GHz and 26.5 GHz to 40 GHz.
The following procedure will be used:

1) Set the turntable and the turn device to obtain the worst-case emission for the first frequency identified in the preliminary measurements.
2) Set the measurement antenna polarization to the orientation with the highest emission for the first frequency identified in the preliminary measurements.
3) Set the spectrum analyzer to EMI mode with peak and average detector activated.
4) Rotate the turntable from 0° to 360° to find the TT Pos. that produces the highest emissions.
5) Note the highest displayed peak and average values
6) Repeat the steps 1) to 5) for each frequency detected during the preliminary measurements.

5.6.2 Test results (radiated emissions) – Emissions from 9 kHz – 26.5 GHz

Measurements were done with a sample with integral antenna.

5.6.2.1 Preliminary radiated emission measurement 9 kHz – 26.5 GHz

Ambient temperature	22 °C
Tested by	B. Rohde

Relative humidity	59 %
Date	08.09.2017 11.09.2017

Position of EUT: The EUT was set-up on a EUT turn device of a height of 1.5 m. The distance between EUT and antenna was 3 m.

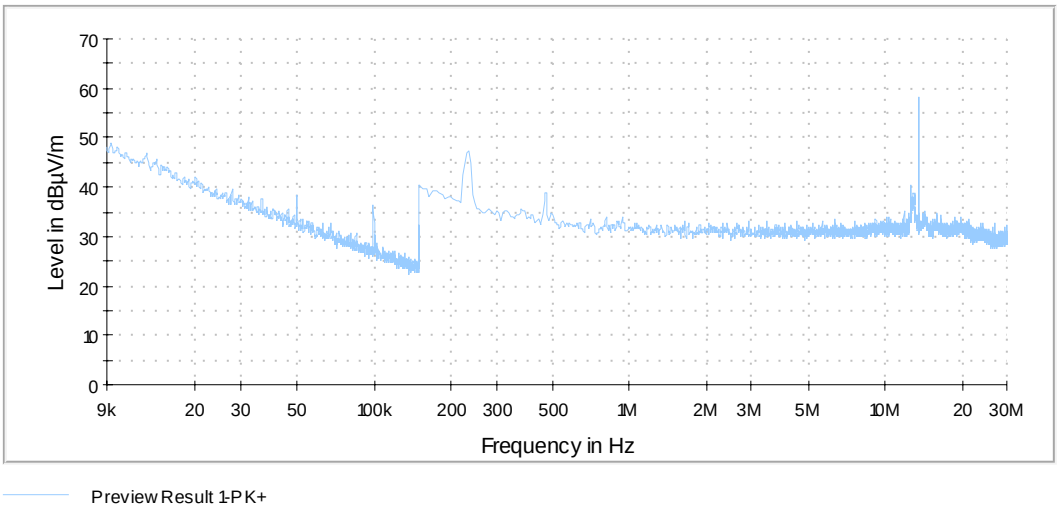
Cable guide: For detail information of test set-up and the cable guide refer to the pictures in the annex A in the test report.

Test record: Only the plot of the worst case emission is submitted below.

Supply voltage: During all measurements the EUT was powered with 24 V DC.
24 V were delivered by a laboratory power supply.

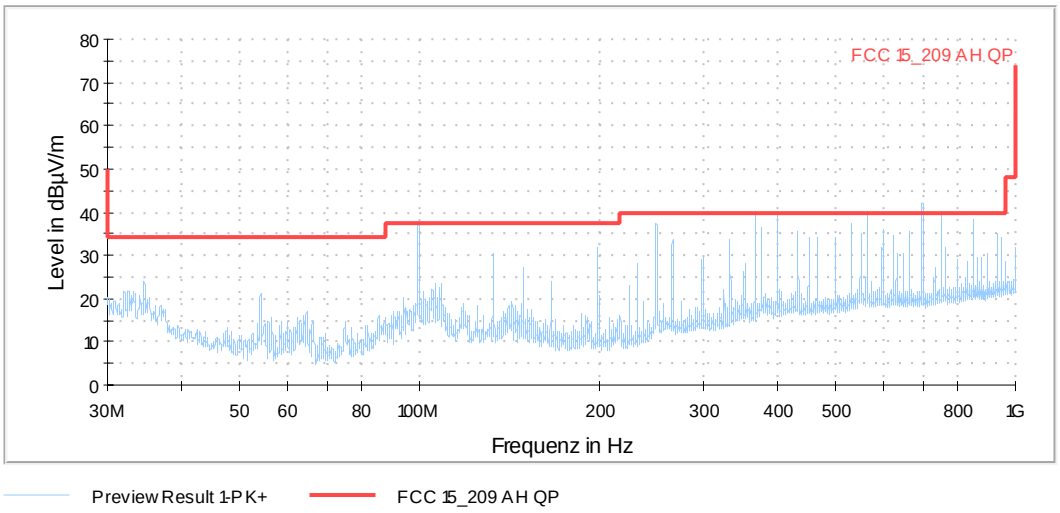
Remark: Since there were no differences in the spectrum for f < 1 GHz,
only one representative plot is submitted below 1 GHz.
For f > 1 GHz only the worst case plot is submitted for each frequency range.

Spurious emissions from 9 kHz to 30 MHz (operation mode 2):

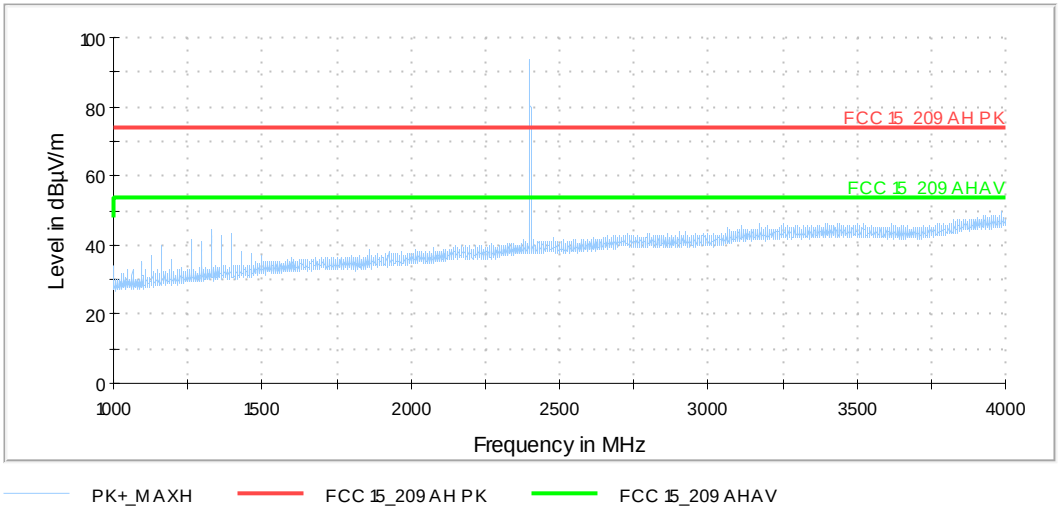


Remark: The peak at 13.56 MHz is a wanted signal of the EUT (NFC/RFID),
The 13.56 MHz signal is part of test report 170754E1.

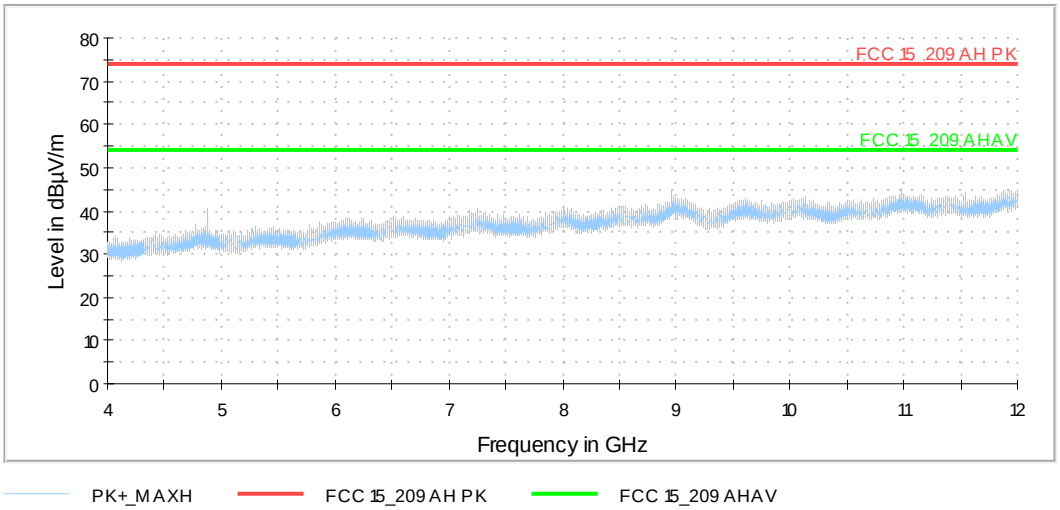
Spurious emissions from 30 MHz to 1 GHz (operation mode 2; preliminary plot):



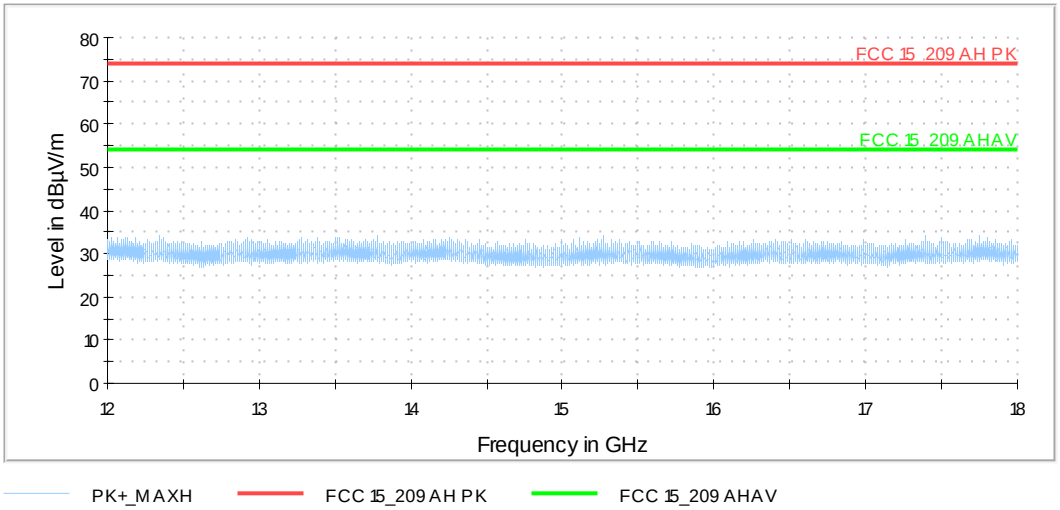
Spurious emissions from 1 GHz to 4 GHz (operation mode 1; preliminary and final plot):



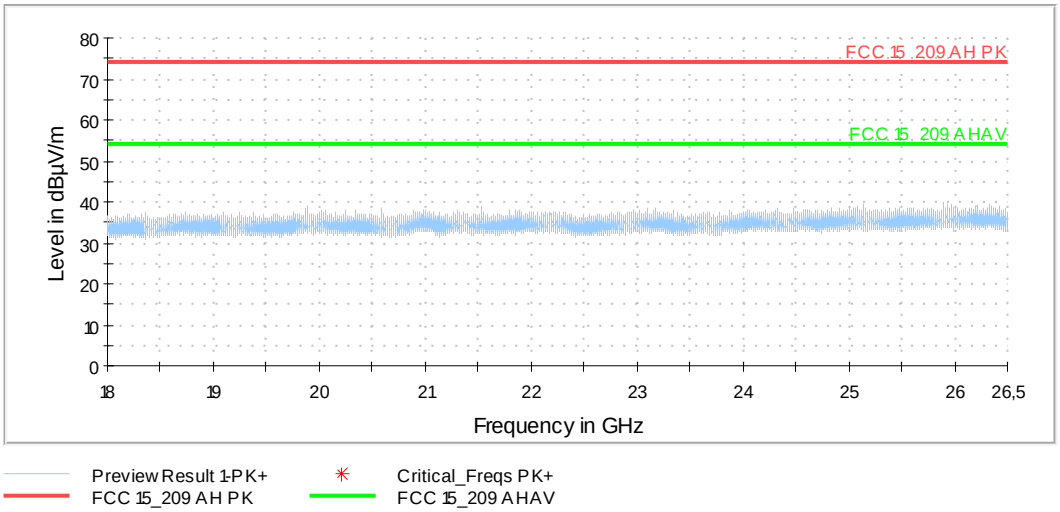
Spurious emissions from 4 GHz to 12 GHz (operation mode 2 preliminary and final plot):



Spurious emissions from 12 GHz to 18 GHz (operation mode 1; preliminary and final plot):



Spurious emissions from 18 GHz to 26.5 GHz (operation mode 3; preliminary and final plot):



TEST EQUIPMENT USED FOR THE TEST:

9 kHz - 30 MHz GHz preliminary	2, 4, 8 - 11
30 MHz – 1 GHz preliminary	1 - 2, 4, 8, 12 - 16
1 – 26.5 GHz preliminary	1 - 6, 8 - 9, 13, 16 - 23

5.6.2.2 Final radiated measurements

Ambient temperature	22 °C
Tested by	B. Rohde

Relative humidity	59 %
Date	14.09.2017[*1] 17.11.2017[*1] 08.09.2017[*3] 11.09.2017[*3]

[*1] Final radiated measurement 9 kHz – 30 MHz
[*2] Final radiated measurement 30 MHz – 1 GHz
[*3] Final radiated measurement 1 – 26.5 GHz

Position of EUT: For the final test on the open area test site the EUT was placed on a table with the height of 0.8 m. The distance between EUT and antenna was 3 m.

Cable guide: For detail information of test set-up and the cable guide refer to the pictures in the annex A in the test report.

Test record: Only the plot of the worst case emission is submitted below.

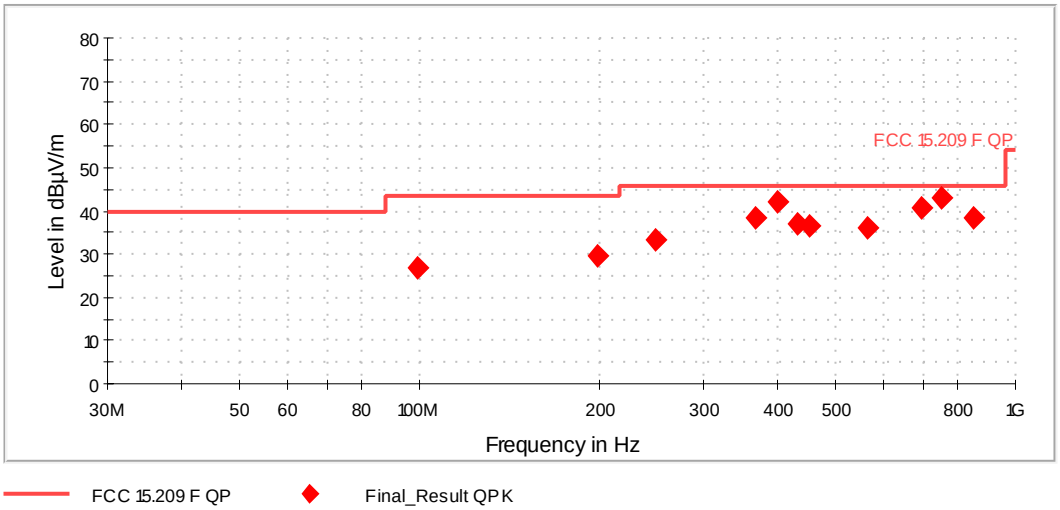
Supply voltage: During all measurements the EUT was powered with 24 V DC.
24 V were delivered by a laboratory power supply except during the measurement below 30 MHz where a battery pack was used.

5.6.2.2.1 Common Results (All operation modes)

Results 9kHz - 30 MHz									
No difference in this frequency range between the operation modes									
Frequency [MHz]	**Reading [dBµV]**	**Final Reading* [dBµV/m]**	**Limit acc. 15.209 [dBµV/m]**	**Margin [dB]**	**Detector (acc. to §15.209 (d)**	**Antenna factor [dB/m]**	**Measuring Distance [m]**	**Distance correction factor** [dB]**	**Result**
0.049890	23.9	-35.8 @ 300m	33.6	69.4	AV	20.3	3	80.0	Passed
0.099663	18.3	-41.5 @ 300m	27.6	69.1	QP	20.2	3	80.0	Passed
0.023458	33.2	-26.6 @ 300m	40.2	66.8	AV	20.2	3	80.0	Passed
0.468400	13.2	-46.6 @ 300m	14.2	60.8	AV	20.2	3	80.0	Passed
13.557625	36.6	16.9 @ 30m	29.5	12.6***	QP	20.3	3	40.0	Passed
Measurement uncertainty			+/- 4.78 dB						

Note: *Final Reading @ norm dist. = Reading + Antenna factor - Distance Extrapolation Factor
** 40dB/decade according Part §15.31 (f) (2)
***Wanted NFC signal

Spurious emissions from 30 MHz to 1 GHz (operation mode 2):



Radiated unwanted emissions 30 MHz - 1 GHz (all operation modes)								
Operation mode 2			No difference in this frequency range between the operation modes					
Frequency [MHz]	QuasiPeak [dBµV/m]	Limit [dBµV/m]	Margin dB	Pol	Azimuth [°]	Height [cm]	Correction [dB]	Result
99.694500	26.8	43.5	16.7	H	90	333	18.8	Passed
199.459000	29.7	43.5	13.8	V	342	102	18.0	Passed
249.947500	33.5	46	12.5	H	133	121	21.0	Passed
365.717000	38.5	46	7.5	H	352	100	24.1	Passed
398.988000	42.0	46	4.0	V	336	109	25.0	Passed
432.259000	37.1	46	8.9	V	112	120	26.0	Passed
450.010000	36.3	46	9.7	V	39	118	26.1	Passed
565.246000	36.2	46	9.8	V	340	138	29.5	Passed
698.233000	40.7	46	5.3	H	166	129	30.8	Passed
749.982500	43.2	46	2.8	H	315	110	32.6	Passed
849.989500	38.3	46	7.7	H	348	100	33.8	Passed
Measurement uncertainty			+/- 4.78 dB					

Radiated unwanted emissions 1 – 25 GHz (operation mode 1)									
Duty cycle correction factor of 2.2 dB was applied for the Average reading									
Frequency [MHz]	Max Peak [dBµV/m]	Average [dBµV/m]	Limit [dBµV/m]	Margin dB	Pol	Azimuth [°]	Elevation [°]	Correction [dB]	Result
1097.260000	42.8	---	74	31.2	H	126	29	25.3	Passed
1097.260000	---	35.6	54	18.4	H	126	29	27.5	Passed
1130.440000	42.1	---	74	31.9	H	126	29	25.8	Passed
1130.440000	---	36.0	54	18.0	H	126	29	28.0	Passed
1163.740000	45.1	---	74	28.9	V	113	150	26.2	Passed
1163.740000	---	40.1	54	13.9	V	113	150	28.4	Passed
1197.100000	41.0	---	74	33.0	H	121	90	26.5	Passed
1197.100000	---	33.8	54	20.2	H	121	90	28.7	Passed
1263.520000	46.1	---	74	27.9	H	126	29	26.8	Passed
1263.520000	---	40.9	54	13.1	H	126	29	29.0	Passed
1296.820000	---	44.1	54	9.9	H	125	60	29.2	Passed
1296.820000	50.6	---	74	23.4	H	125	60	27.0	Passed
1330.060000	---	43.5	54	10.5	H	117	60	29.7	Passed
1330.060000	49.3	---	74	24.7	H	117	60	27.5	Passed
1363.420000	---	42.3	54	11.7	H	120	60	30.0	Passed
1363.420000	49.3	---	74	24.7	H	120	60	27.8	Passed
1396.540000	---	39.2	54	14.8	H	179	60	30.0	Passed
1396.540000	48.6	---	74	25.4	H	179	60	27.8	Passed
1429.720000	41.9	---	74	32.1	H	190	120	28.1	Passed
1429.720000	---	34.6	54	19.4	H	190	120	30.3	Passed
1462.840000	45.2	---	74	28.8	V	174	0	28.5	Passed
1462.840000	---	32.0	54	22.0	V	174	0	30.7	Passed
1496.020000	---	36.3	54	17.7	H	182	120	31.2	Passed
1496.020000	45.8	---	74	28.2	H	182	120	29.0	Passed
4803.400000	---	38.6	54	15.4	H	114	60	1.2	Passed
4803.400000	47.9	---	74	26.1	H	114	60	-1.0	Passed
Measurement uncertainty				+/- 5.38 dB					

Radiated unwanted emissions 1 – 25 GHz (operation mode 2)									
Duty cycle correction factor of 2.2 dB was applied for the Average reading									
Frequency [MHz]	Max Peak [dBµV/m]	Average [dBµV/m]	Limit [dBµV/m]	Margin dB	Pol	Azimuth [°]	Elevation [°]	Correction [dB]	Result
1097.200000	---	33.1	54	20.9	V	121	0	27.5	Passed
1097.200000	40.7	---	74	33.3	V	121	0	25.3	Passed
1130.560000	---	37.5	54	16.5	H	124	60	28.0	Passed
1130.560000	43.1	---	74	30.9	H	124	60	25.8	Passed
1163.740000	---	40.7	54	13.3	V	141	0	28.4	Passed
1163.740000	46.7	---	74	27.3	V	141	0	26.2	Passed
1196.980000	41.3	---	74	32.7	H	113	90	26.5	Passed
1196.980000	---	33.8	54	20.2	H	113	90	28.7	Passed
1230.220000	---	35.0	54	19.0	H	124	60	28.9	Passed
1230.220000	43.9	---	74	30.1	H	124	60	26.7	Passed
1263.460000	49.3	---	74	24.7	H	136	150	26.8	Passed
1263.460000	---	42.1	54	11.9	H	136	150	29.0	Passed
1296.640000	51.1	---	74	22.9	H	127	60	27.0	Passed
1296.640000	---	43.9	54	10.1	H	127	60	29.2	Passed
1330.000000	---	42.7	54	11.3	V	214	0	29.7	Passed
1330.000000	48.6	---	74	25.4	V	214	0	27.5	Passed
1363.300000	---	42.3	54	11.7	H	191	60	30.0	Passed
1363.300000	48.5	---	74	25.5	H	191	60	27.8	Passed
1396.480000	50.0	---	74	24.0	H	183	90	27.8	Passed
1396.480000	---	40.6	54	13.4	H	183	90	30.0	Passed
1429.720000	---	38.2	54	15.8	H	144	150	30.3	Passed
1429.720000	45.1	---	74	28.9	H	144	150	28.1	Passed
4879.900000	---	38.6	54	15.4	H	35	60	1.4	Passed
4879.900000	46.9	---	74	27.1	H	35	60	-0.8	Passed
7256.450000	---	36.6	54	17.4	V	217	120	7.7	Passed
7256.450000	46.4	---	74	27.6	V	217	120	5.5	Passed
8960.650000	---	39.8	54	14.2	V	196	0	11.5	Passed
8960.650000	49.4	---	74	24.6	V	196	0	9.3	Passed
Measurement uncertainty				+/- 5.38 dB					

Radiated unwanted emissions 1 – 25 GHz (operation mode 3)									
Duty cycle correction factor of 2.2 dB was applied for the Average reading									
Frequency [MHz]	Max Peak [dBµV/m]	Average [dBµV/m]	Limit [dBµV/m]	Margin dB	Pol	Azimuth [°]	Elevation [°]	Correction [dB]	Result
1097.260000	42.8	---	74	31.2	H	126	29	25.3	Passed
1097.260000	---	35.6	54	18.4	H	126	29	27.5	Passed
1130.440000	42.1	---	74	31.9	H	126	29	25.8	Passed
1130.440000	---	36.0	54	18.0	H	126	29	28.0	Passed
1163.740000	45.1	---	74	28.9	V	113	150	26.2	Passed
1163.740000	---	40.1	54	13.9	V	113	150	28.4	Passed
1197.100000	41.0	---	74	33.0	H	121	90	26.5	Passed
1197.100000	---	33.8	54	20.2	H	121	90	28.7	Passed
1263.520000	46.1	---	74	27.9	H	126	29	26.8	Passed
1263.520000	---	40.9	54	13.1	H	126	29	29.0	Passed
1296.820000	---	44.1	54	9.9	H	125	60	29.2	Passed
1296.820000	50.6	---	74	23.4	H	125	60	27.0	Passed
1330.060000	---	43.5	54	10.5	H	117	60	29.7	Passed
1330.060000	49.3	---	74	24.7	H	117	60	27.5	Passed
1363.420000	---	42.3	54	11.7	H	120	60	30.0	Passed
1363.420000	49.3	---	74	24.7	H	120	60	27.8	Passed
1396.540000	---	39.2	54	14.8	H	179	60	30.0	Passed
1396.540000	48.6	---	74	25.4	H	179	60	27.8	Passed
1429.720000	41.9	---	74	32.1	H	190	120	28.1	Passed
1429.720000	---	34.6	54	19.4	H	190	120	30.3	Passed
1462.840000	45.2	---	74	28.8	V	174	0	28.5	Passed
1462.840000	---	32.0	54	22.0	V	174	0	30.7	Passed
1496.020000	---	36.3	54	17.7	H	182	120	31.2	Passed
1496.020000	45.8	---	74	28.2	H	182	120	29.0	Passed
4803.400000	---	38.6	54	15.4	H	114	60	1.2	Passed
4803.400000	47.9	---	74	26.1	H	114	60	-1.0	Passed
Measurement uncertainty				+/- 5.38 dB					

TEST EQUIPMENT USED FOR THE TEST:

9 kHz - 30 MHz GHz final	11, 24 - 25
30 MHz – 1 GHz final	26 - 32
1 – 26.5 GHz final	1 - 6, 8 - 9, 13, 16 - 23

5.7 Conducted emissions on power supply lines (150 kHz to 30 MHz)

5.7.1 Mode: BLE and NFC active

Ambient temperature	23 °C
Tested by	B. Rohde

Relative humidity	40 %
Date	12.04.2018

Position of EUT: For this test, the EUT was set to transmit at channel 0

Cable guide: For detail information of test set-up and the cable guide refer to the pictures in annex A of this test report.

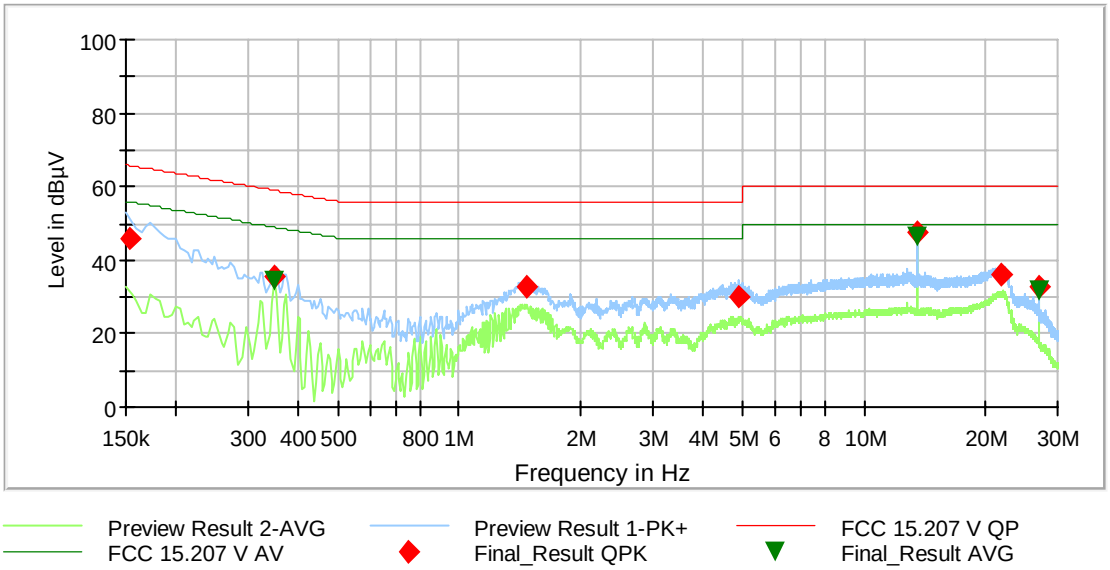
Test record: All results are shown in the following.

Supply voltage: Measurement performed with US 120V/60Hz. For the test a power supply type Model number: UE36LCP1-240150SPA as delivered by the applicant was used. The power supply provided 24 V DC up to 1.5A.

Remark: Worst case reported only.

The curves in the diagram only represent for each frequency point the maximum measured value of all preliminary measurements which were made for each power supply line. The top measured curve represents the peak measurement and the bottom measured curve the average measurement. The quasi-peak measured points are marked by "♦" and the average measured points by "▼".

Operation mode 1:



Results 150 kHz – 30 MHz (operation mode 1)									
Frequency [MHz]	QuasiPeak [dBµV]	Average [dBµV]	Limit [dBµV]	Margin [dB]	Meas. Time [ms]	Bandwidth (kHz)	Line	PE	Corr. (dB)
0.152700	46.00	---	65.85	19.85	5000.0	9.000	L1	FLO	9.8
0.348000	---	34.44	49.01	14.57	5000.0	9.000	L1	FLO	9.9
0.348900	35.30	---	58.99	23.69	5000.0	9.000	L1	FLO	9.9
1.471200	32.85	---	56.00	23.15	5000.0	9.000	N	FLO	9.9
4.906500	30.17	---	56.00	25.83	5000.0	9.000	L1	FLO	10.3
13.560000	47.35	---	60.00	12.65	5000.0	9.000	L1	FLO	10.7
13.560000	---	46.26	50.00	3.74	5000.0	9.000	L1	FLO	10.7
21.820200	35.97	---	60.00	24.03	5000.0	9.000	L1	FLO	10.9
27.118500	32.92	---	60.00	27.08	5000.0	9.000	L1	FLO	11.1
27.120300	---	31.49	50.00	18.51	5000.0	9.000	L1	FLO	11.1
Measurement uncertainty				+/- 3.80 dB					

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

30, 33 - 36

6 Test equipment and ancillaries used for tests

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal Due
1	Antenna mast	AS615P	Deisel	615/310	480187	Calibration not necessary	
2	Turntable	DS420 HE	Deisel	420/620/00	480315	Calibration not necessary	
3	RF-cable No.3	Sucoflex 106B	Suhner	0563/6B / Kabel 3	480670	Calibration not necessary	
4	Multiple Control Unit	MCU	Maturo GmbH	MCU/043/971107	480832	Calibration not necessary	
5	Antenna (Log.Per.)	HL050	Rohde & Schwarz	100438	481170	09.10.2017	10.2020
6	RF-Cable No. 40	Sucoflex 106B	Suhner	0708/6B / Kabel 40	481330	Calibration not necessary	
7	HF-Cable	Sucoflex 104	Huber+Suhner	517406	482391	Calibration not necessary	
8	EMI Receiver / Spectrum Analyser	ESW44	Rohde & Schwarz	101635	482467	22.06.2017	06.2019
9	Fully anechoic chamber M20	B83117-E2439-T232	Albatross Projects	103	480303	29.11.2016	11.2017
10	Antenna support	AS620P	Deisel	620/375	480325	Calibration not necessary	
11	loop antenna	HFH2-Z2	Rohde & Schwarz	100417	481912	20.10.2016	10.2017
12	Antenna (Bilog)	CBL6112B	Schaffner EMV GmbH (-Chase)	2688	480328	19.06.2017	06.2020
13	Software	WMS32	Rohde & Schwarz		481800	Calibration not necessary	
14	RF-cable No.36	Sucoflex 106B	Suhner	0587/6B / Kabel 36	480865	Calibration not necessary	
15	HF-Cable	Sucoflex 104	Huber+Suhner	517402	482392	Calibration not necessary	
16	Positioners	TDF 1.5- 10Kg	Maturo	15920215	482034	Calibration not necessary	
17	standard gain horn antenna	18240-20	Flann Microwave	483	480294	Calibration not necessary	
18	standard gain horn antenna	20240-20	Flann Microwave	411	480297	Calibration not necessary	
19	Microwave cable 2m	Insulated Wire Inc.	Insulated Wire	KPS-1533-800-KPS	480302	Calibration not necessary	
20	Preamplifier 100 MHz - 13 GHz	JS3-00101200-23-5A	MITEQ Hauppauge N.Y.	681851	480337	18.02.2016	02.2018
21	Preamplifier 18 GHz - 26 GHz	JS4-18002600-20-5A	MITEQ Hauppauge N.Y.	658697	480342	17.02.2016	02.2018
22	Preamplifier 12 GHz - 18 GHz	JS3-12001800-16-5A	MITEQ Hauppauge N.Y.	571667	480343	18.02.2016	02.2018
23	High pass filter	WHKX4.0/18G-8SS	Wainwright Instruments GmbH	1	480587	Calibration not necessary	
24	Outdoor test site	-	PHOENIX TESTLAB GmbH	-	480293	Calibration not necessary	
25	EMI Receiver / Spectrum Analyser	ESI 40	Rohde & Schwarz	100064/040	480355	15.02.2017	02.2018
26	Open area test site M6	Freifeld M6	Phoenix Contact	-	480085	Calibration not necessary	
27	Antenna mast	MA240-0	Inn-Co GmbH	MA240-0/030/6600603	480086	Calibration not necessary	
28	Turntable	DS412	Deisel	412/316	480087	Calibration not necessary	
29	Controller	HD100	Deisel	100/349	480139	Calibration not necessary	

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal Due
30	Software	EMC32	Rohde & Schwarz	100061	481022	Calibration not necessary	
31	Antenna (Bilog)	CBL6111D	Schaffner Elektrotest GmbH / Teseq GmbH	25761	480894	19.10.2017	10.2020
32	EMI Receiver / Spectrum Analyser	ESIB 26	Rohde & Schwarz	100292	481182	15.02.2016	02.2018
33	LISN	NSLK8128	Schwarzbeck	8128155	480058	14.03.2018	03.2020
34	Shielded chamber M4	B83117-S1-X158	Siemens	190075	480088	Calibration not necessary	
35	EMI Receiver / Spectrum Analyser	ESIB 26	Rohde & Schwarz	100292	481182	28.02.2018	02.2020
36	Transient Filter Limiter	CFL 9206A	Teseq GmbH	38268	481982	14.03.2018	03.2020

7 Report History

Report Number	Date	Comment
F170754E3	20.08.2018	Initial Test Report

8 List of Annexes

Annex A	Test Setup Photos	10 pages
Annex B	Internal Photos	9 pages
Annex C	External Photos	2 pages