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Test Report

Report Number:

F170032E1

Equipment under Test (EUT):

EASYSCAN Link

Applicant:

Gutermann Technology GmbH

Manufacturer:

Gutermann Technology 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** 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

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:	Thomas KÜHN		05/08/2017
	Name	Signature	Date
Authorized reviewer:	Michael DINTER		05/08/2017
	Name	Signature	Date

This test report is only valid in its original form.

The test results herein refer only to the tested sample. PHOENIX TESTLAB GmbH is not responsible for any generalisations 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

1.1 Applicant

Name:	Gutermann Technology GmbH
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Country:	Germany
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Phone:	+49 751 35 90 16 - 83
Fax:	+49 751 35 90 16 - 99
eMail Address:	hermann.waibel@gutermann-water.com
Applicant represented during the test by the following person:	Mr. Hermann WAIBEL, Mr. Stefan LANG

1.2 Manufacturer

Name:	Gutermann Technology GmbH
Address:	Gottlieb Daimler Straße 10 88214 Ravensburg
Country:	Germany
Name for contact purposes:	Mr. Hermann WAIBEL
Phone:	+49 751 35 90 16 - 83
Fax:	+49 751 35 90 16 - 99
eMail Address:	hermann.waibel@gutermann-water.com
Manufacturer represented during the test by the following person:	Mr. Hermann WAIBEL, Mr. Stefan LANG

1.3 Test laboratory

The tests were carried out at:

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)

Test object: *	Wireless transceiver for data collection
(PMN): *	EASYSCAN Link
Modelname / HVIN: *	GELK501
FCC ID:*	ZSSESC915A
IC: *	9789A-ESC915A
Serial number: *	3500003
PCB identifier: *	EasyLink10A 0614-01, EasyLink_20B 0616-01
Hardware version: *	01
Software version: *	2.40
Lowest / highest internal frequency: *	32.768 kHz / 2.480 GHz

* declared by the applicant.

1.5 Technical data of equipment

Channel 0	RX:	904.000 MHz	TX:	904.000 MHz
Channel 24	RX:	911.200 MHz	TX:	911.200 MHz
Channel 49	RX:	918.700 MHz	TX:	918.700 MHz

Rated RF output power: *	16 dBm					
Antenna type: *	Integral					
Antenna gain: *	-0.7 dBi					
Antenna connector: *	No					
Adaptive frequency agility: *	No					
Modulation: *	FHSS (GFSK)					
Supply Voltage: *	U_{nom}=	3.3 V DC	U_{min}=	3.7 V DC	U_{max}=	4.1 V DC
Temperature range: *	0 °C to +50 °C					
Ancillary used for test:	External power supply type THX-050200KE for emission measurement on power supply lines.					

* declared by the applicant.

The following external I/O cables were used:

Identification	Connector		Length *
	EUT	Ancillary	
DC power	USB 2.0-micro-B plug	-	2 m
-	-	-	-
-	-	-	-
-	-	-	-

*: Length during the test if no other specified.

1.6 Dates

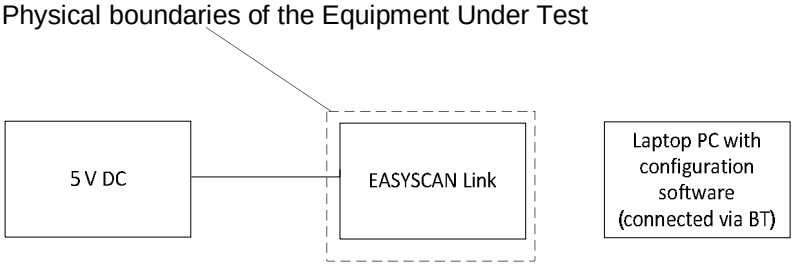
Date of receipt of test sample:	03/08/2017
Start of test:	03/08/2017
End of test:	03/10/2017

2 Operational states

The tested sample was unmodified and could be configured via Bluetooth with a test-software by the applicant. After adjusting the operation mode, the Bluetooth transceiver of the EUT is in receive mode.

All radiated measurements were carried out with a connection to an external 5 V DC power supply (buffering the internal battery), because preliminary measurements has shown, that the use of an external power supply causes higher emissions than the use of the internal battery without any connection to an external power supply.

Physical boundaries of the Equipment Under Test



The following test modes were adjusted during the tests:

Test items	Operation	Operation mode
20 dB bandwidth	Transmit with normal modulation on channel 0, 24 or 49	1, 2, 3
Carrier frequency separation	Transmit with normal modulation on channel 0, 24 or 49	1, 2, 3
Number of hopping channels	Transmit with normal modulation, hopping on all channels	4
Dwell time	Transmit with normal modulation on channel 0, 24 or 49	1, 2, 3
Maximum peak output power	Transmit with normal modulation on channel 0, 24 or 49	1, 2, 3
Radiated emissions (transmitter)	Transmit with normal modulation on channel 0, 24 or 49	1, 2, 3
Conducted emissions on supply line	Transmit with normal modulation, hopping on all channels	4

3 Additional information

During the tests the EUT was not labelled as required by FCC / IC.

The EUT contains also a Bluetooth module, which is already certified for FCC / IC (FCC ID: X3ZBTMOD5, IC 8828A-MOD5. Measurement results of the simultaneous transmission of both transmitters are documented in the test reports F170032E2. Object of this test report is the 915 MHz frequency hopper transceiver part of the EUT only.

4 Overview

Application	Frequency range [MHz]	FCC 47 CFR Part 15 section [2]	RSS 247, Issue 2 [3] or RSS-Gen, Issue 4 [4]	Status	Refer page
20 dB bandwidth	General	15.247 (a) (1) (i)	5.1 (a) [3]	Passed	8 et seq.
Carrier frequency separation	General	15.247 (a) (1) (i)	5.1 (c) [3]	Passed	11 et seq.
Number of hopping channels	902.0 – 928.0	15.247 (a) (1) (i)	5.1 (c) [3]	Passed	14 et seq.
Dwell time	902.0 – 928.0	15.247 (a) (1) (i)	5.1 (c) [3]	Passed	16 et seq.
Maximum peak output power	902.0 – 928.0	15.247 (b) (2)	5.4 (a) [3]	Passed	19 et seq.
Radiated emissions (transmitter)	0.009 - 10,000	15.247 (d) 15.205 (a) 15.209 (a)	5.5 [3] 8.9 [4]	Passed	20 et seq.
Conducted emissions on supply line	0.15 - 30	15.207 (a)	8.8 [4]	Passed	45 et seq.
Antenna requirement	-	15.203 [2]	-	Passed *	-

*: The EUT has an internal antenna only, so the requirement is regarded as fulfilled.

5 Test results

5.1 20 dB bandwidth

5.1.1 Method of measurement (20 dB bandwidth)

The calibration of the spectrum analyser has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyser via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed. The EUT has to be switched on and the hopping function has to be disenabled, the transmitter shall work with its maximum data rate.

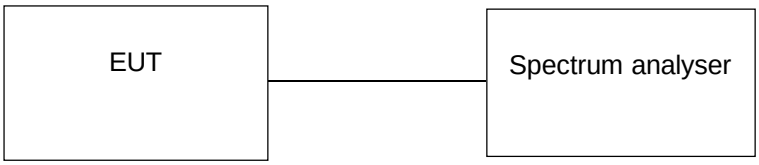
The following spectrum analyser settings according to [1] shall be used:

- Span: App. 2 to 5 times the 20 dB bandwidth, centred on the actual hopping channel.
- Resolution bandwidth: 1 % to 5 % of the 20 dB bandwidth.
- Video bandwidth: three times the resolution bandwidth.
- Set the reference level of the instrument either above the measured peak conducted output power level or 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.
- Sweep: Auto.
- Detector function: Peak.
- Trace mode: Max hold.

After trace stabilisation the marker shall be set on the signal peak. The first display line has to be set on this value. The second display line has to be set 20 dB below the first line (or the peak marker). The frequency lines shall be set on the intersection points between the second display line and the measured curve. Alternatively the 20 dB down function of the spectrum analyser could be used.

The measurement will be performed at the upper, the lower end and the middle of the assigned frequency band.

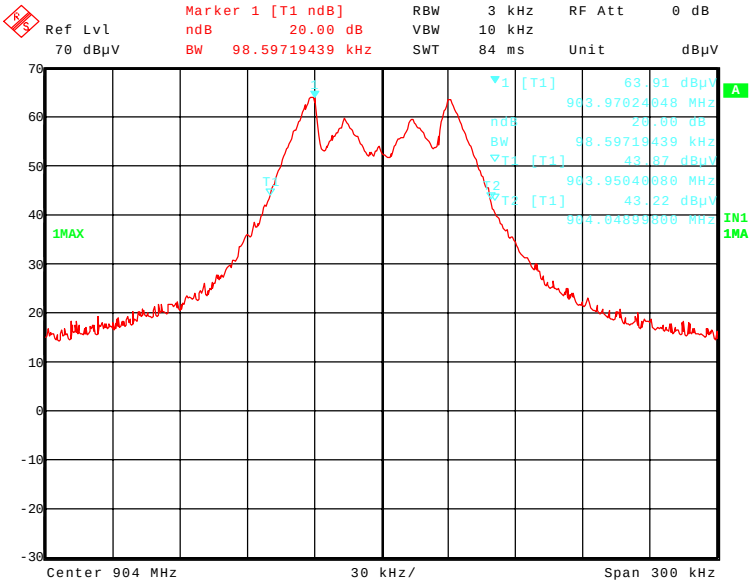
Test set-up:



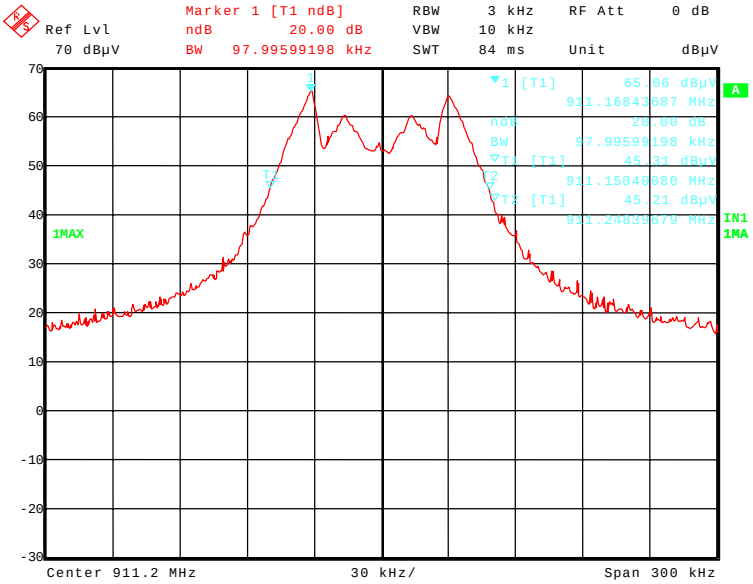
5.1.2 Test results (20 dB bandwidth)

Ambient temperature	22 °C	Relative humidity	30 %

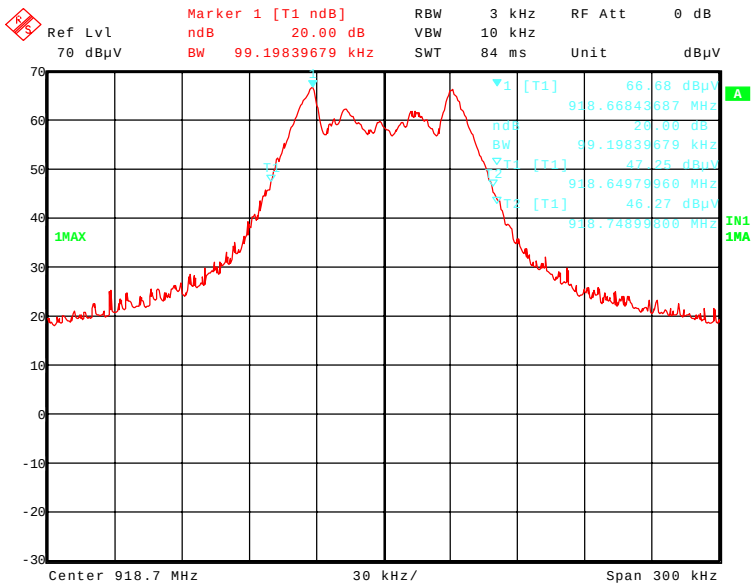
170032_11.wmf: 20 dB bandwidth at the lower end of the assigned frequency band:



170032_10.wmf: 20 dB bandwidth at the middle of the assigned frequency band:



170032_12.wmf: 20 dB bandwidth at the upper end of the assigned frequency band:



Channel number	Channel frequency [MHz]	20 dB bandwidth [kHz]
0	904.000	98.597
24	911.200	99.996
49	918.700	99.198
Measurement uncertainty		+0.66 dB / -0.72 dB

Test: Passed

Test equipment used (see chapter 6):

14, 16 - 20, 22, 26

5.2 Carrier frequency separation

5.2.1 Method of measurement (carrier frequency separation)

The calibration of the spectrum analyser has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyser via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed. The EUT has to be switched on and the hopping function has to be enabled.

The following spectrum analyser settings according to [1] shall be used:

- Span: Wide enough to capture the peaks of two adjacent channels.
- Resolution bandwidth: Start with the Resolution bandwidth set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
- Video bandwidth ≥ Resolution bandwidth.
- Sweep: Auto.
- Detector function: Peak.
- Trace mode: Max hold.

After trace stabilisation the marker and the delta marker function will be used to determine the separation between the peaks of two adjacent channel signals.

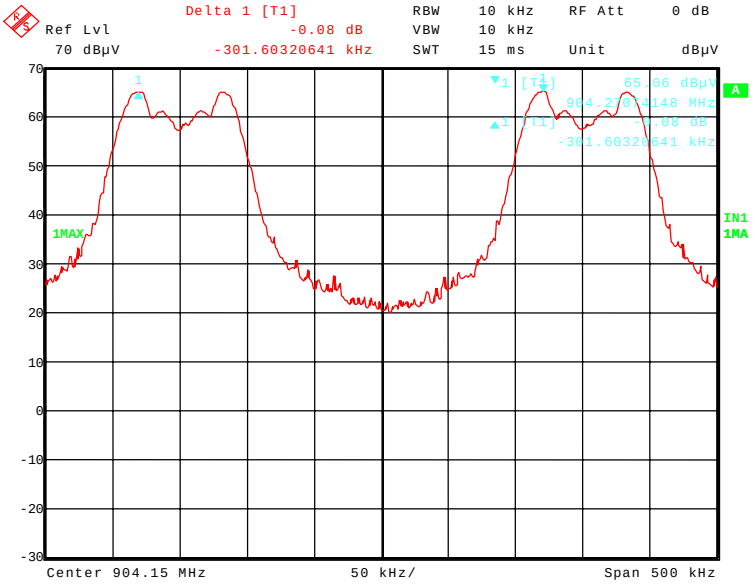
The measurement will be performed at the upper, the lower end and the middle of the assigned frequency band.

Test set-up:

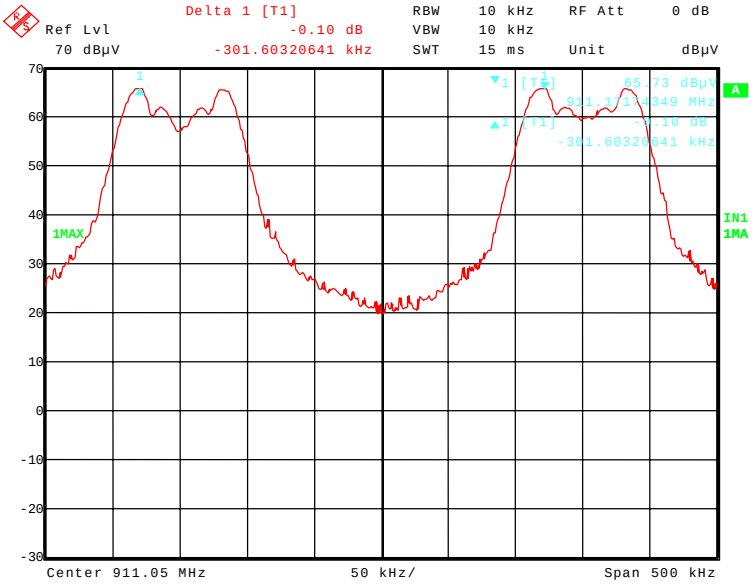
5.2.2 Test results (carrier frequency separation)

Ambient temperature	22 °C		Relative humidity	30 %

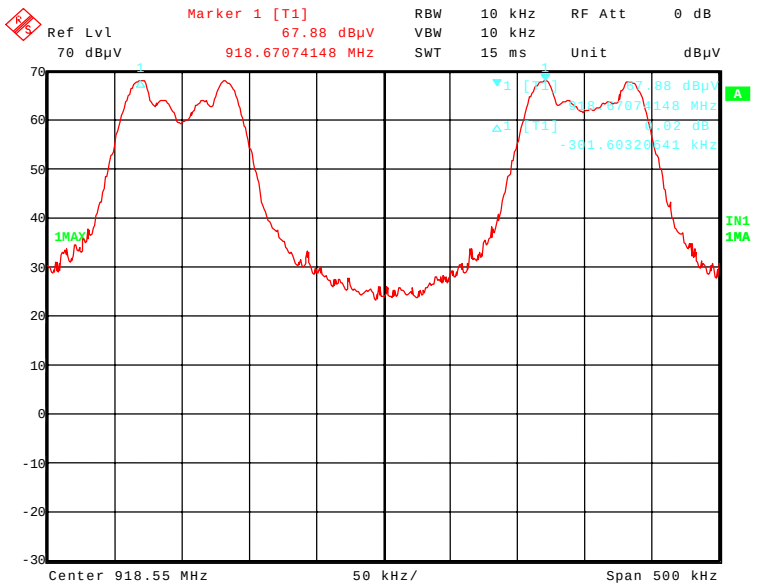
170032_15.wmf: Channel separation at the lower end of the assigned frequency band:



170032_14.wmf: Channel separation at the middle of the assigned frequency band:



170032_13.wmf: Channel separation at the upper end of the assigned frequency band:



Channel number	Channel frequency [MHz]	Channel separation [kHz]	Minimum limit [kHz]
0	904.000	301.603	98.597
24	911.200	301.603	99.996
49	918.700	301.603	99.198
Measurement uncertainty			$<10^{-7}$

Test: Passed

Test equipment used (see chapter 6):

14, 16 - 20, 22, 26

5.3 Number of hopping frequencies

5.3.1 Method of measurement (number of hopping frequencies)

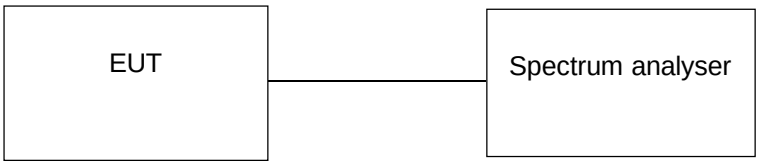
The calibration of the spectrum analyser has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyser via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed. The EUT has to be switched on and the hopping function has to be enabled.

The following spectrum analyser settings according to [1] shall be used:

- Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
- Resolution bandwidth: To identify clearly the individual channels, set the Resolution bandwidth to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
- Video bandwidth: ³ the resolution bandwidth.
- Sweep: Auto.
- Detector function: Peak.
- Trace mode: Max hold.

After trace stabilisation the number of hopping channels could be counted. It might be possible to divide the span into some sub ranges in order to clearly show all hopping frequencies.

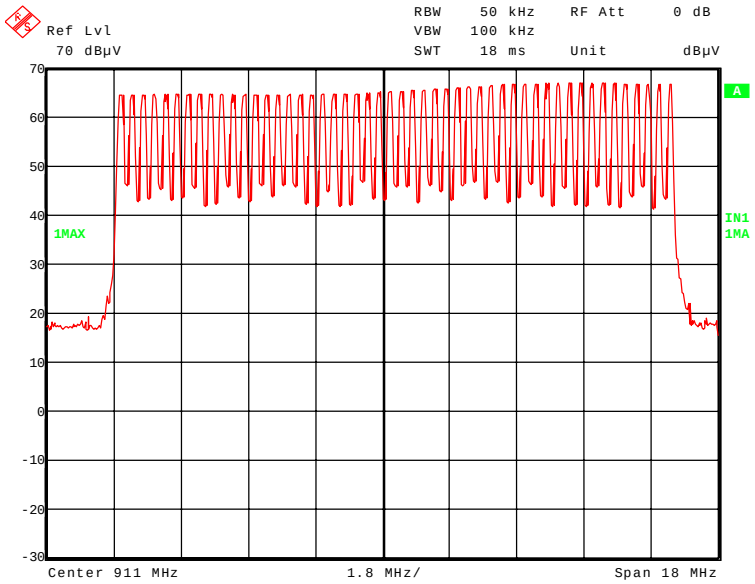
Test set-up:



5.3.2 Test results (number of hopping frequencies)

Ambient temperature	22 °C	Relative humidity	30 %

170032_16.wmf: Number of hopping channels:



Number of hopping channels	Limit
50	At least 50

Test: Passed

Test equipment used (see chapter 6):

14, 16 - 20, 22, 26

5.4 Dwell time

5.4.1 Method of measurement (dwell time)

The calibration of the spectrum analyser has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyser via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed. The EUT has to be switched on and the hopping function has to be enabled.

The following spectrum analyser settings according to [1] shall be used:

- Span: Zero, centred on a hopping channel.
- Resolution bandwidth shall be ≤ channel spacing and where possible Resolution bandwidth should be set >> 1 / *T*, where *T* is the expected dwell time per channel.
- Video bandwidth: ³ the resolution bandwidth.
- Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
- Detector function: peak.
- Trace mode: Max hold.

The marker and delta marker function of the spectrum analyser will be used to determine the dwell time.

The measurement will be performed at the middle of the assigned frequency band.

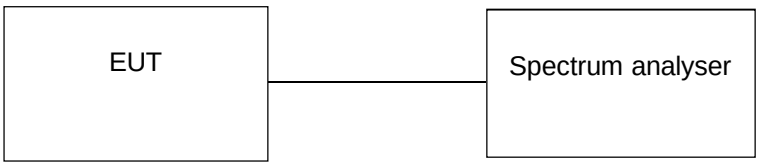
Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

(Number of hops in the period specified in the requirements) =
(number of hops on spectrum analyzer) × (period specified in the requirements / analyzer sweep time)

The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.

The measured transmit time and time between hops shall be consistent with the values described in the operational description for the EUT.

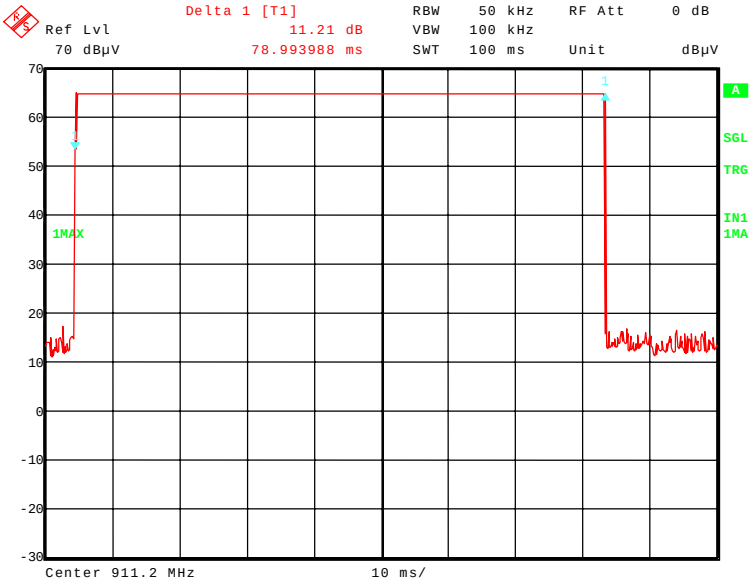
Test set-up:



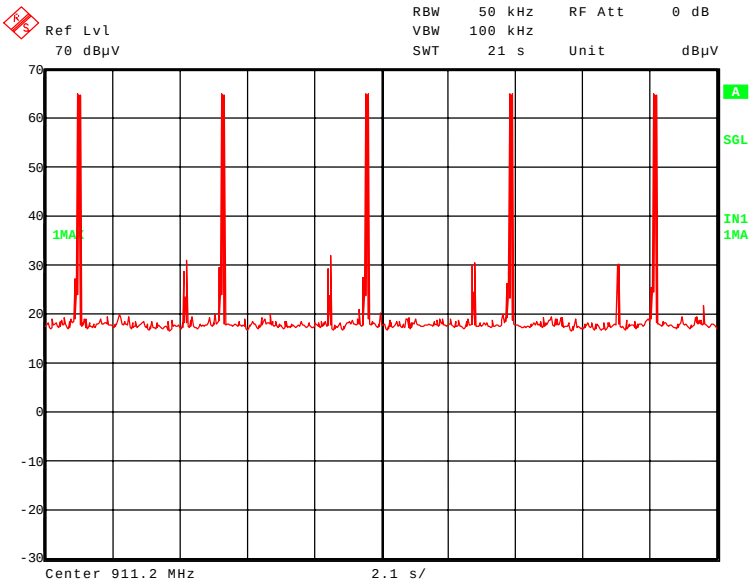
5.4.2 Test results (dwell time)

Ambient temperature	22 °C	Relative humidity	30 %

170032_17.wmf: Dwell time at the middle of the assigned frequency band (single hop):



170032_18.wmf: Dwell time at the middle of the assigned frequency band (21 s sweep):



Channel number	Channel frequency [MHz]	t_{pulse} [ms]	Number of pulses	Dwell time [ms]	Limit [ms]
24	911.200	78.994	5	394.970	400.000
Measurement uncertainty				$<10^{-7}$	

Test: Passed

Test equipment used (see chapter 6):

14, 16 - 20, 22, 26

5.5 Maximum peak output power

5.5.1 Method of measurement (maximum peak output power)

Because the EUT has no antenna connector, which presents the power delivered to the antenna, the average value of the field strength was measured. The method of measurement is described under clause 5.6.2.3 (final measurement (30 MHz to 1 GHz)) of this test report with the exception that an peak detector was used. According to [1] with this the field strength value the radiated peak power of the EUT was calculated. Together with the antenna gain of the EUTs antenna the conducted peak power was calculated.

5.5.2 Test results (maximum peak output power)

Ambient temperature	22 °C	Relative humidity	30 %

Result measured with the peak detector:

Transmitter operates on the lower end of the assigned frequency band (operation mode 1)										
Frequency (MHz)	Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Restr. Band
904.00000	94.7	Carrier	-	1000.0	120.000	100.0	Hor.	2.0	34.6	-
Transmitter operates on the middle of the assigned frequency band (operation mode 2)										
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Restr. Band
911.20000	94.7	Carrier	-	1000.0	120.000	104.0	Hor.	204.0	34.8	-
Transmitter operates on the upper end of the assigned frequency band (operation mode 3)										
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Restr. Band
918.70000	97.3	Carrier	-	1000.0	120.000	100.0	Hor.	196.0	35.1	-
Measurement uncertainty				+2.2 dB / -3.6 dB						

The peak radiated output power was calculated with the following formula:

Calculated peak radiated output power [W] = (field strength [V/m] * measuring distance [m])^2 / 49.2

The maximum peak output power was calculated with the following formula:

Maximum peak output power [dBm] = Calculated peak radiated output power [dBm] – antenna gain [dB]

Frequency	Field strength		Peak radiated power		Antenna gain	Maximum peak output power	
(MHz)	(dBµV/m)	(V/m)	(W)	(dBm)	dB	(dBm)	(W)
904.000	94.7	0.054	0.010	10.0	-0.7	10.7	0.012
911.200	94.7	0.054	0.010	10.0	-0.7	10.7	0.012
918.700	97.3	0.073	0.013	11.3	-0.7	12.0	0.016

Test: Passed

Test equipment used (see chapter 6):

15, 31

5.6 Radiated 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 heights 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 1 GHz to 25 / 40 GHz.
- A final measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 40 GHz.

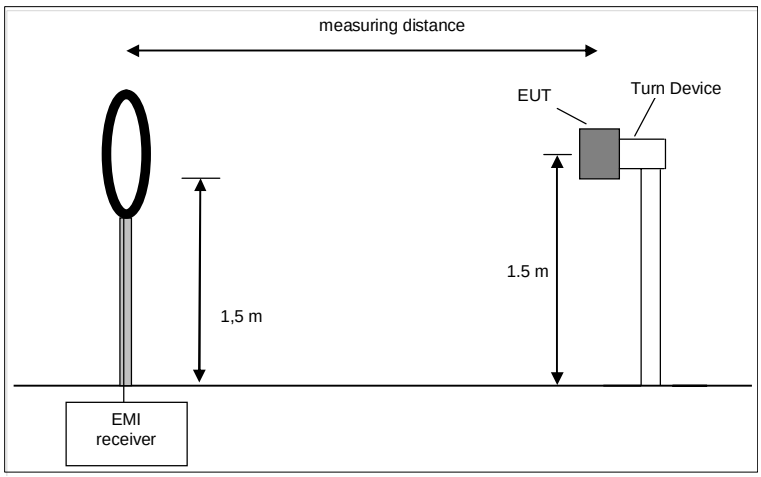
Preliminary measurement (9 kHz to 30 MHz):

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 support with a size of 1 m by 1.5 m and a height of 80 cm. 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 analyser 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 analyser 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:

Prescans were performed in the frequency range 9 kHz to 150 kHz and 150 kHz to 30 MHz.

The following procedure will be used:

1) Monitor the frequency range at horizontal polarisation 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) Make a hardcopy of the spectrum.
5) Measure the frequencies of highest detected emission with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
6) Repeat steps 1) to 5) with the other orthogonal axes of the EUT (because of EUT is a module and might be used in a handheld equipment application).
7) Rotate the measuring antenna and repeat steps 1) to 5).

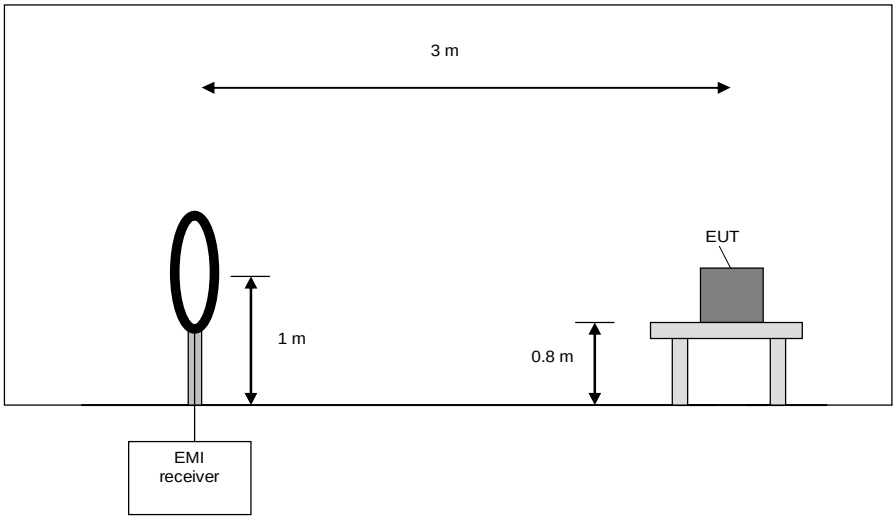
Final measurement (9 kHz to 30 MHz):

In the second stage a final measurement will be performed on an open area test site with no conducting ground plane in a measuring distances of 3 m, 10 m and 30 m. In the case where larger measuring distances are 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).

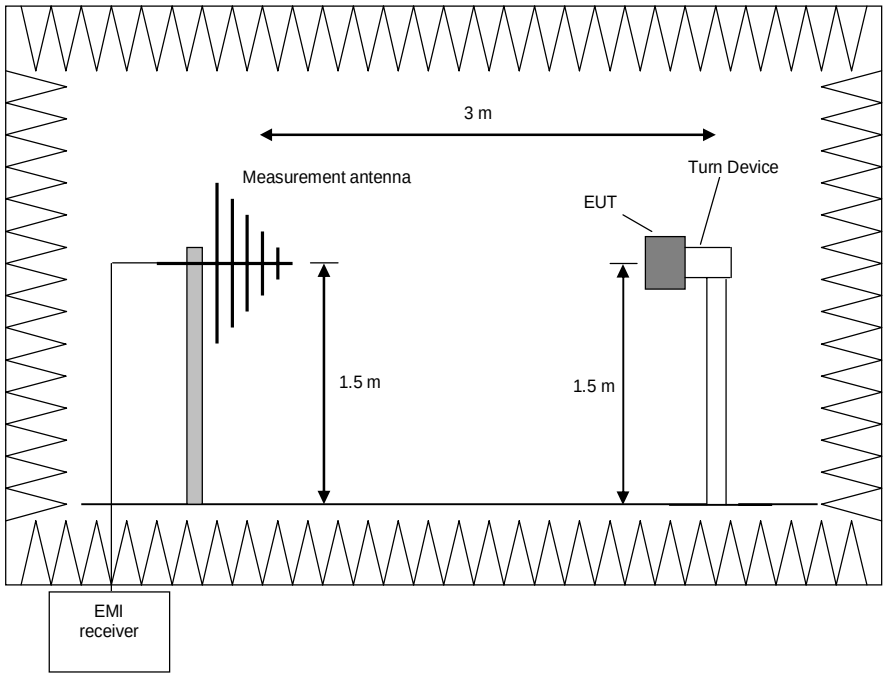
Preliminary measurement (30 MHz to 1 GHz)

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 1.5 m. 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 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 polarisation 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:

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

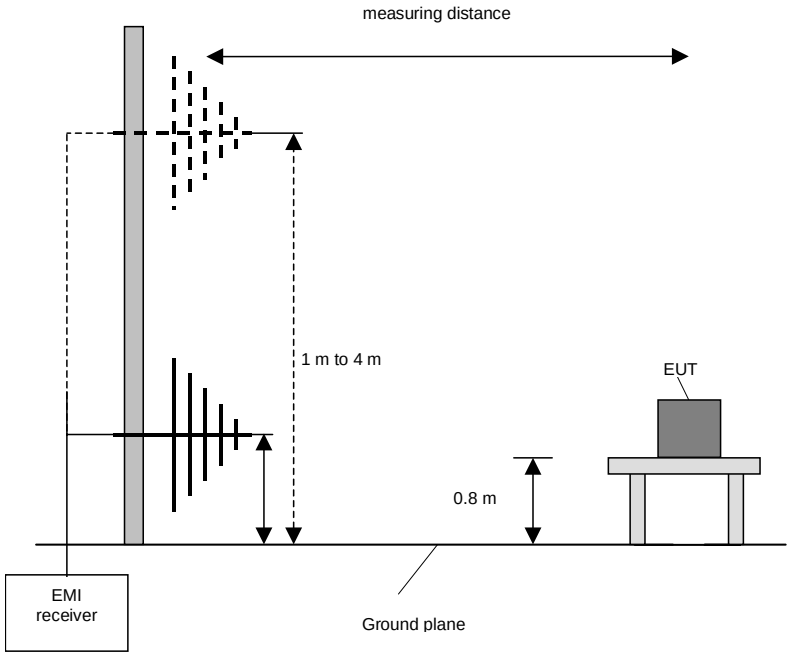
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Repeat 1) to 3) with the vertical polarisation of the measuring antenna.
5. Make a hardcopy of the spectrum.
6. Repeat 1) to 5) with the EUT raised by an angle of 30 ° (60 °, 90 °, 120 ° and 150 °) 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 (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 polarisation 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)

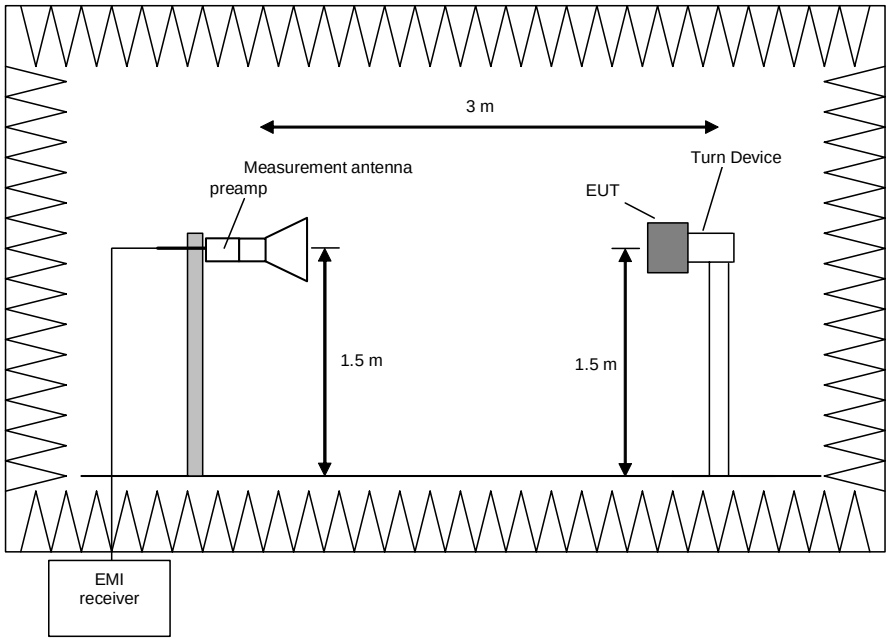
This measurement will be performed in a fully anechoic chamber. Table top devices will set up on a non-conducting turn device on the height of 1.5 m. The set-up of the Equipment under test will be in accordance to [1].

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 analyser set to MAX Hold mode and a resolution bandwidth of 100 kHz. The measurement will be performed in horizontal and vertical polarisation 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:

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

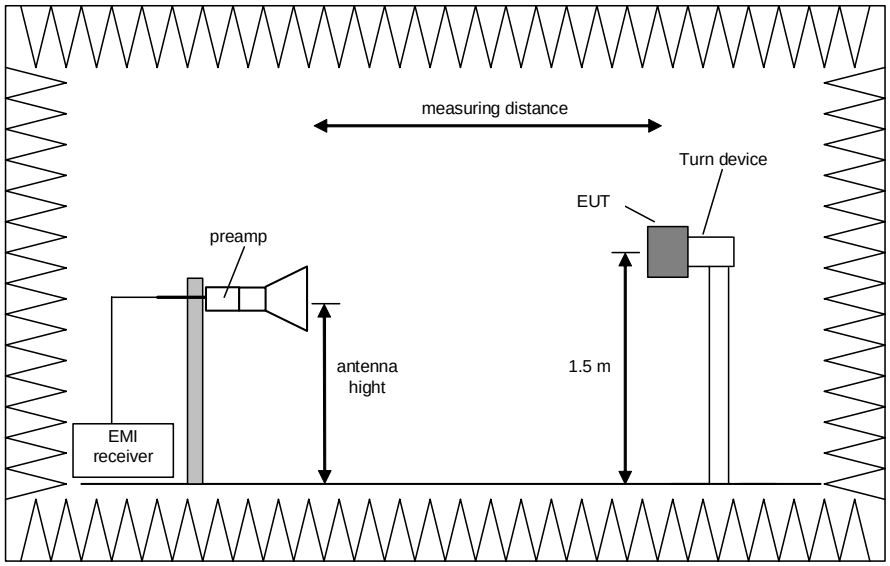
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Rotate the EUT by 360° to maximize the detected signals.
3. Repeat 1) to 2) with the vertical polarisation of the measuring antenna.
4. Make a hardcopy of the spectrum.
5. Repeat 1) to 4) with the EUT raised by an 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 polarisation, 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 polarisation to the orientation with the highest emission for the first frequency identified in the preliminary measurements.
3) Set the spectrum analyser to EMI mode with peak and average detector activated.
4) Rotate the turntable from 0° to 360° to find the EUT angle 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)

5.6.2.1 Preliminary radiated emission measurement

Ambient temperature	22 °C	Relative humidity	30 %

Position of EUT: The EUT was set-up on the positioner at 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 annex A of this test report.

Test record: All results are shown in the following.

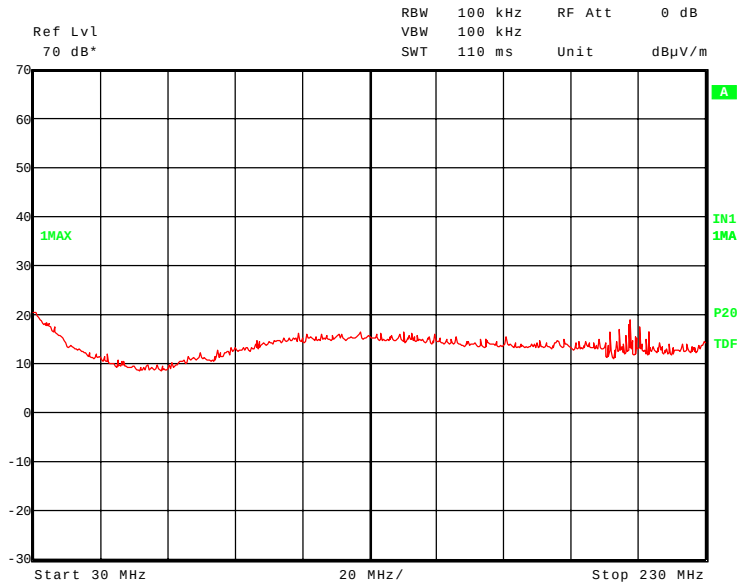
Supply voltage: During all measurements the EUT was supplied 3.3 V DC by the internal battery, which was buffered by an external power supply with 5 V DC.

Frequency range: The preliminary measurement was carried out in the frequency range 9 kHz to 25 GHz according to [2].

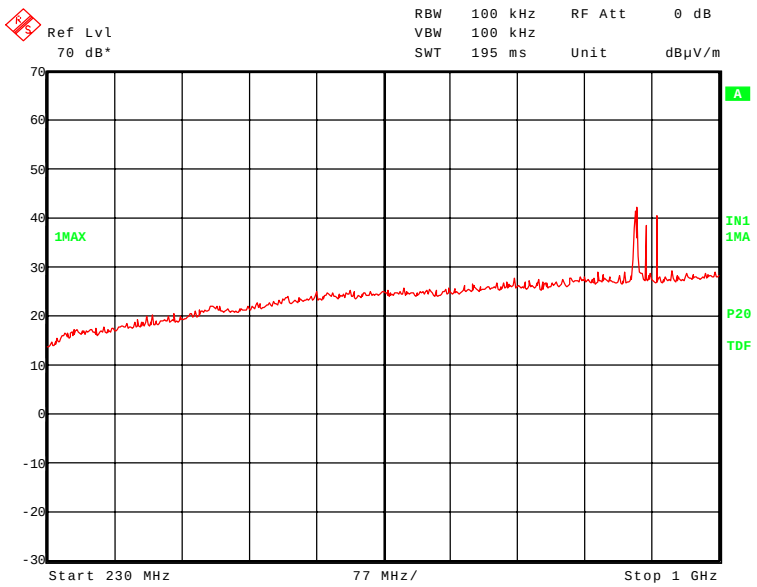
Remark: As pre-tests have shown, the emissions in the frequency range 9 kHz to 30 MHz are not depending on the transmitter operation mode. Therefore the emissions in this frequency range were measured only with the transmitter operates in operation mode 2.

Transmitter operates at the lower end of the assigned frequency band (operation mode 1)

170032_4.wmf: Spurious emissions from 30 MHz to 230 MHz (operation mode 1):



170032_3.wmf: Spurious emissions from 230 MHz to 1 GHz (operation mode 1, carrier notched):



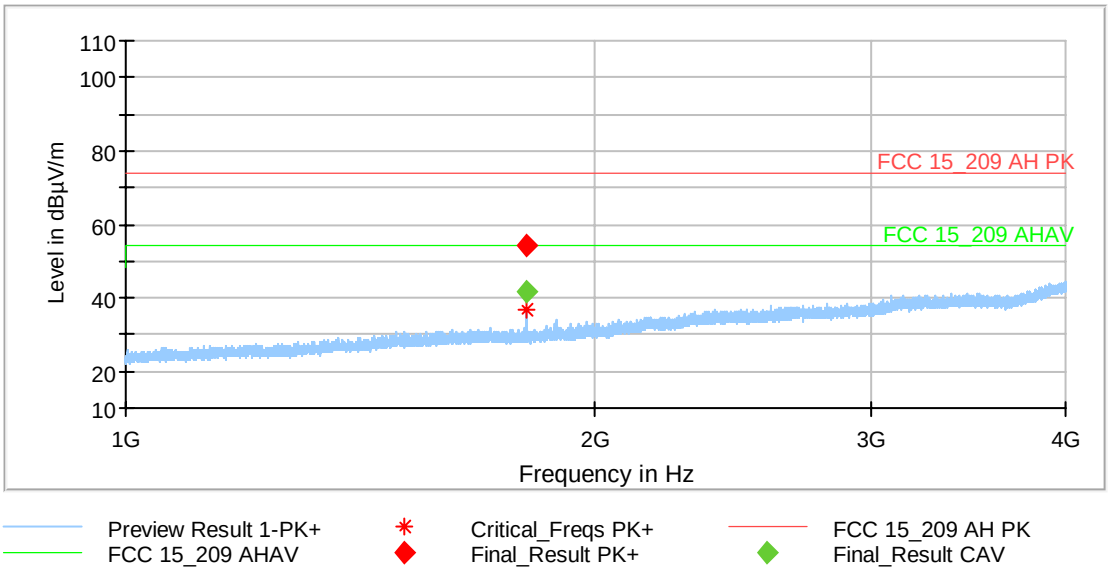
No emissions were found inside the restricted bands during the preliminary radiated emission test.

The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

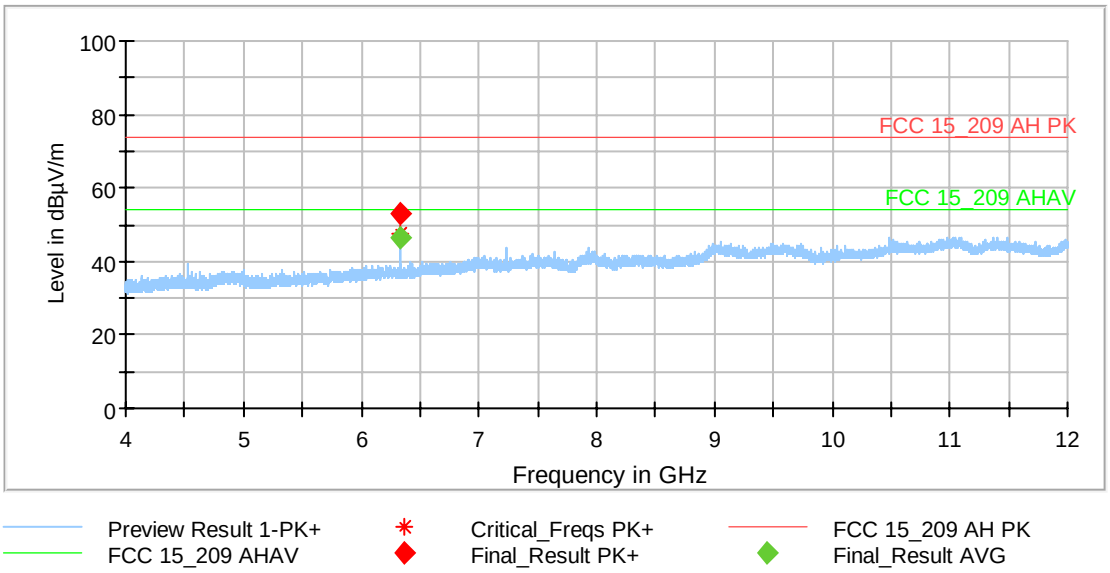
- 892.000 MHz, 904.000MHz, 916.000 MHz and 928.000 MHz.

These frequencies have to be measured on the open area test site. The result is presented in the following.

Spurious emissions from 1 GHz to 4 GHz (operation mode 1):

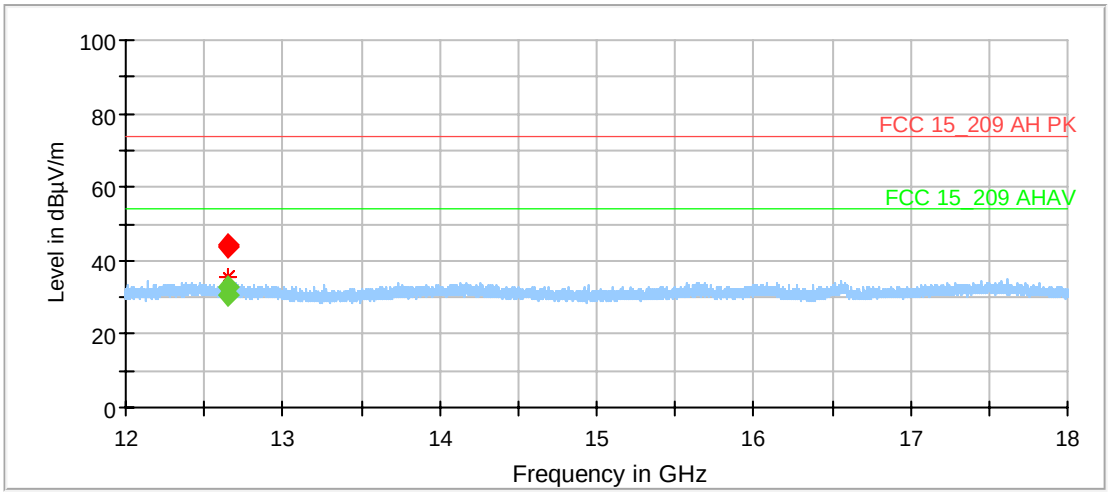


Spurious emissions from 4 GHz to 12 GHz (operation mode 1):



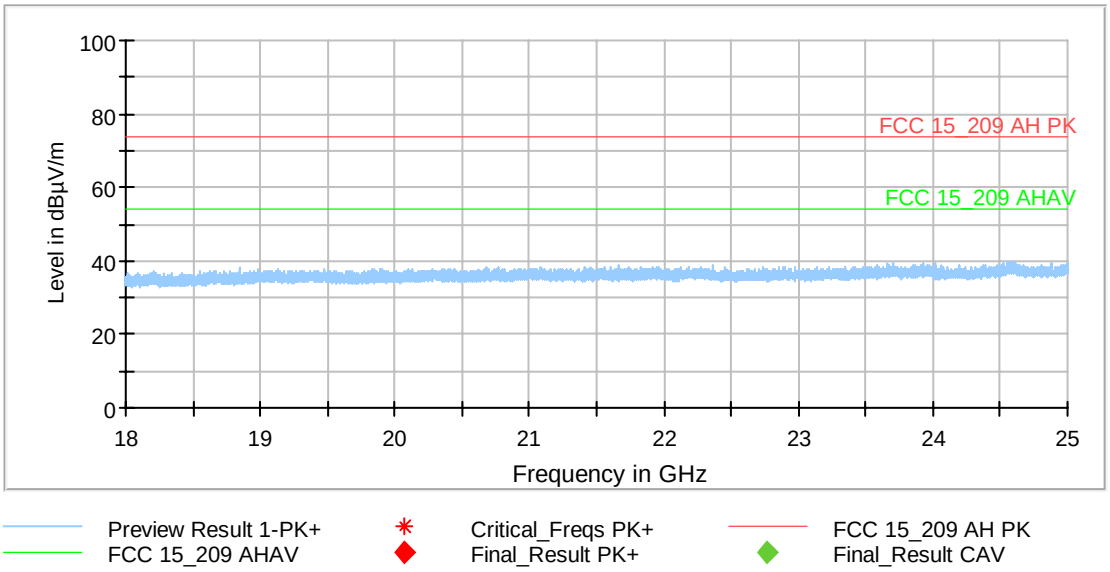
Preview Result 1-PK+ | Critical_Freqs PK+ | FCC 15_209 AH PK
FCC 15_209 AHAV | Final_Result PK+ | Final_Result AVG

Spurious emissions from 12 GHz to 18 GHz (operation mode 1):



Preview Result 1-PK+ | Critical_Freqs PK+ | FCC 15_209 AH PK
FCC 15_209 AHAV | Final_Result PK+ | Final_Result CAV

Spurious emissions from 18 GHz to 25 GHz (operation mode 1):



The following frequency was found inside the restricted bands during the preliminary radiated emission test:

- 12655.700 MHz.

The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

- 1808.000 MHz and 6327.700 MHz.

These frequencies have to be measured in a final measurement. The results were presented in the following.

Test equipment used (see chapter 6):

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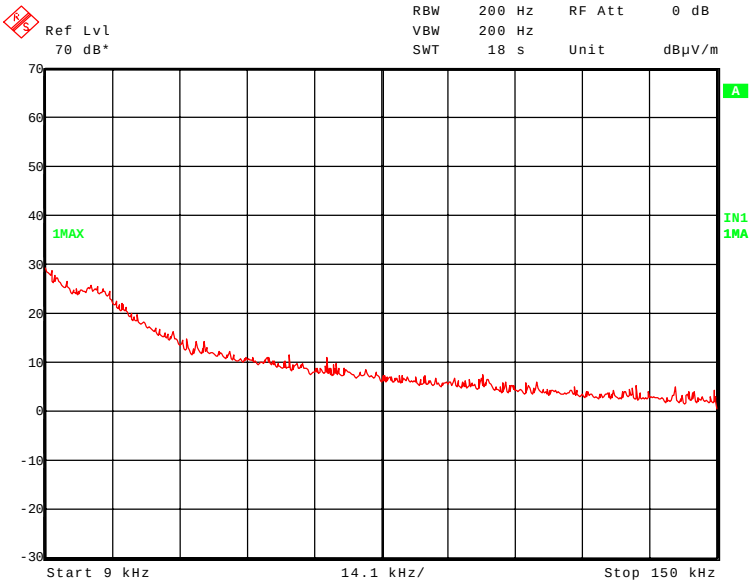
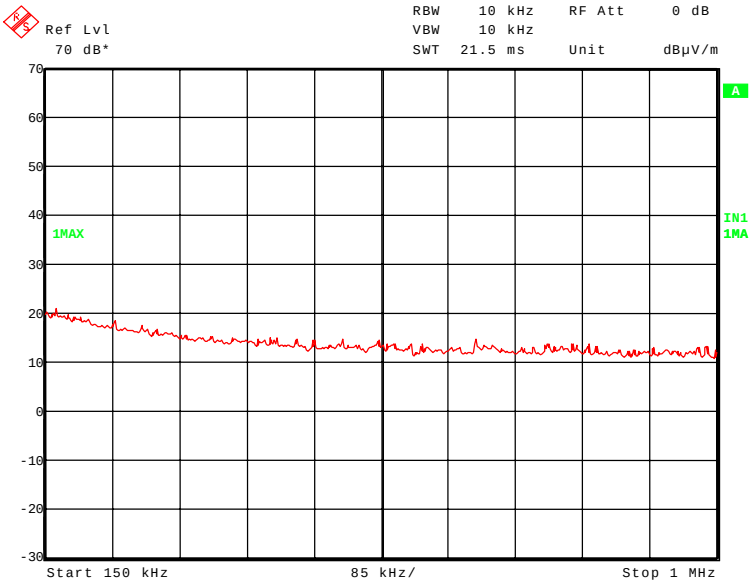
Transmitter operates on the middle of the assigned frequency band (operation mode 2)

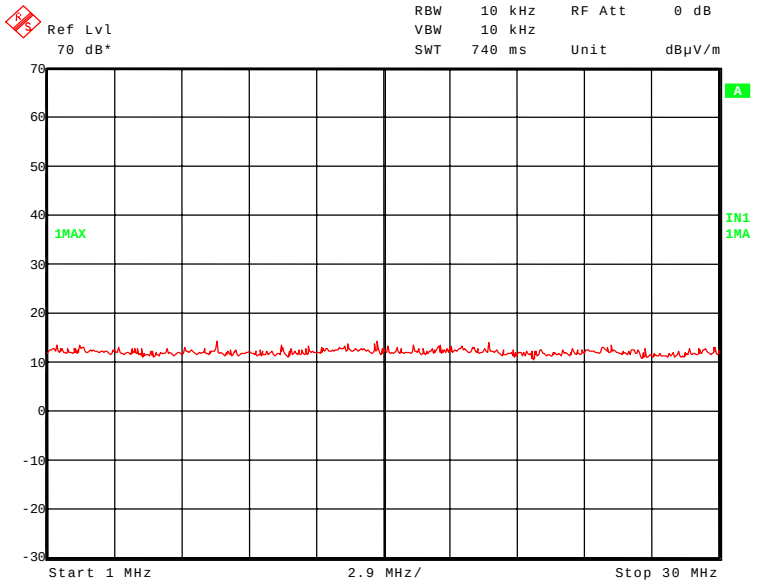
170032_7.wmf: Spurious emissions from 9 kHz to 150 kHz (operation mode 2):



170032_8.wmf: Spurious emissions from 150 kHz to 1 MHz (operation mode 2):

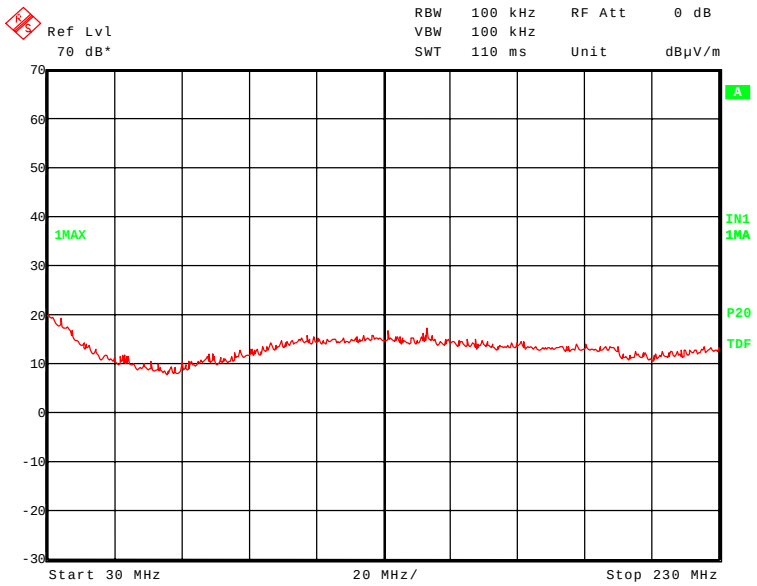


170032_9.wmf: Spurious emissions from 1 MHz to 30 MHz (operation mode 2):

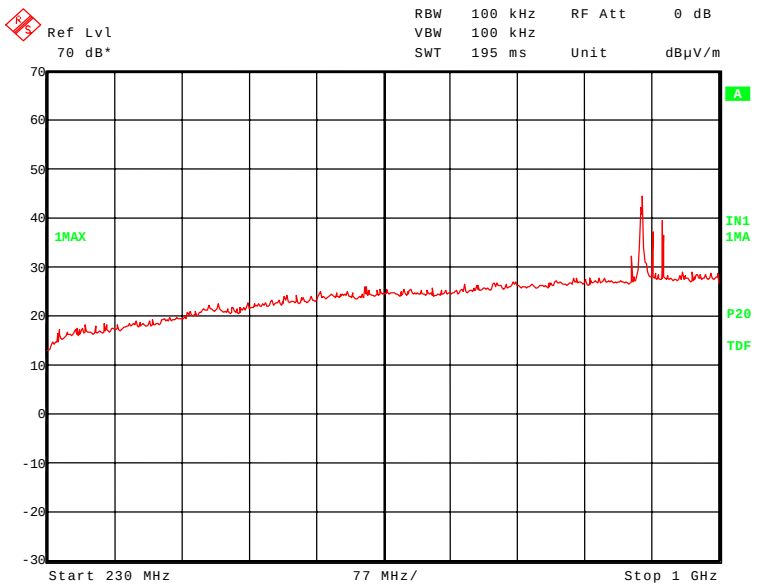


No significant frequencies above the noise floor of the system (max 30 dBµV/m (measured with peak detector) at 3 m distance) were found during the preliminary radiated emission test, so no measurements were carried out on the outdoor test site.

170032_2.wmf: Spurious emissions from 30 MHz to 230 MHz (operation mode 2):



170032_1.wmf: Spurious emissions from 230 MHz to 1 GHz (operation mode 2, carrier notched):



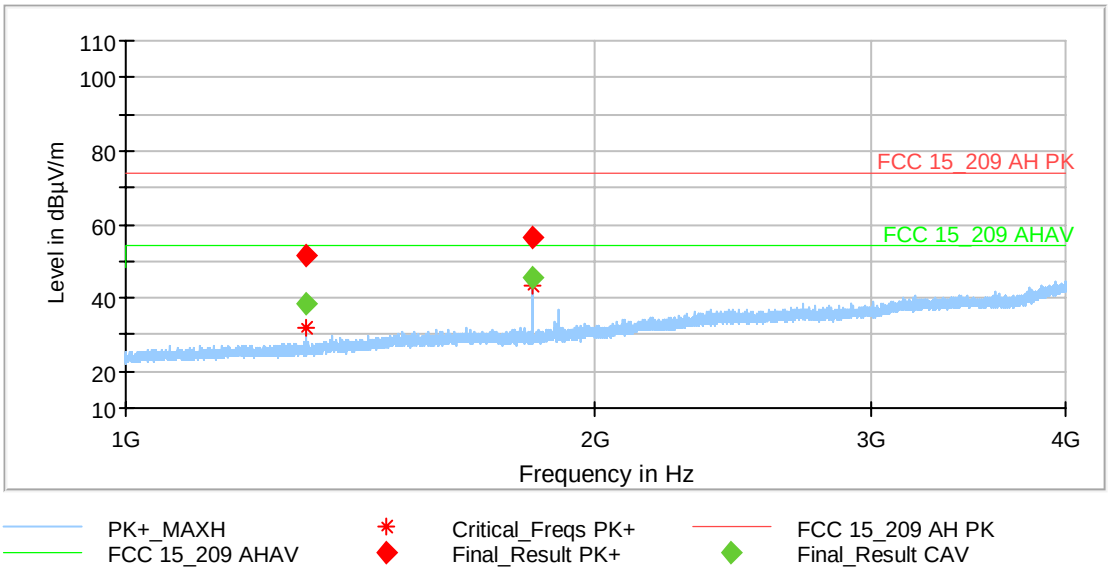
No emissions were found inside the restricted bands during the preliminary radiated emission test.

The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

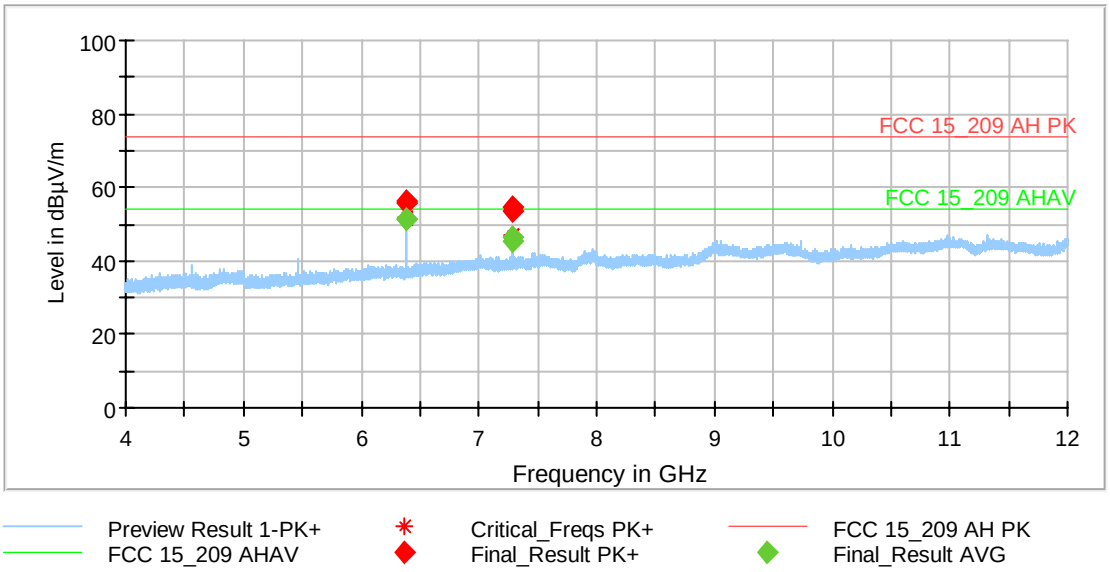
- 899.200 MHz, 911.200 MHz, 923.200 MHz, 935.200 MHz

These frequencies have to be measured on the open area test site. The result is presented in the following.

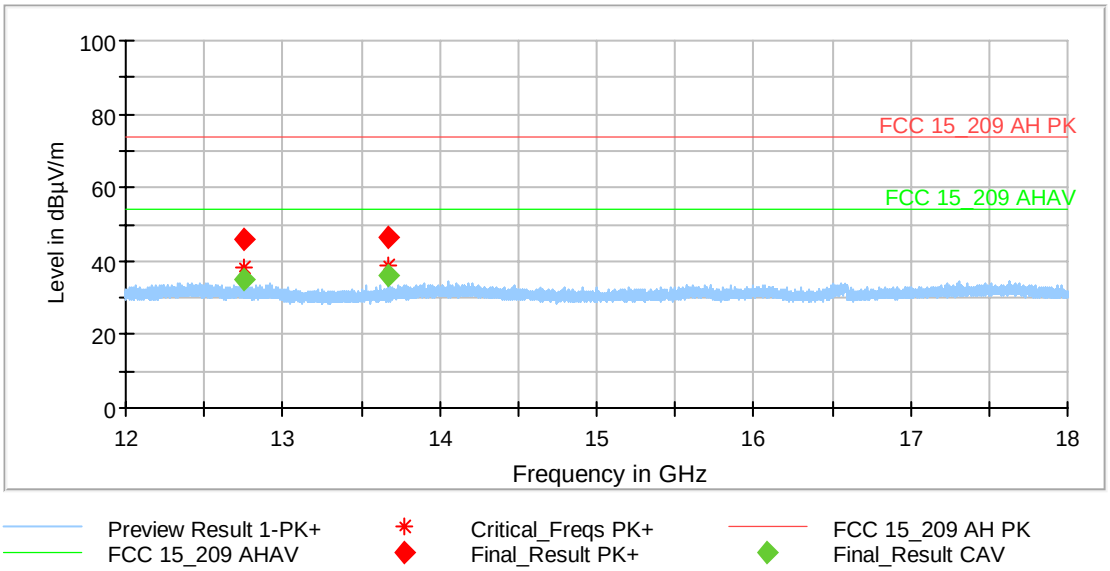
Spurious emissions from 1 GHz to 4 GHz (operation mode 2):



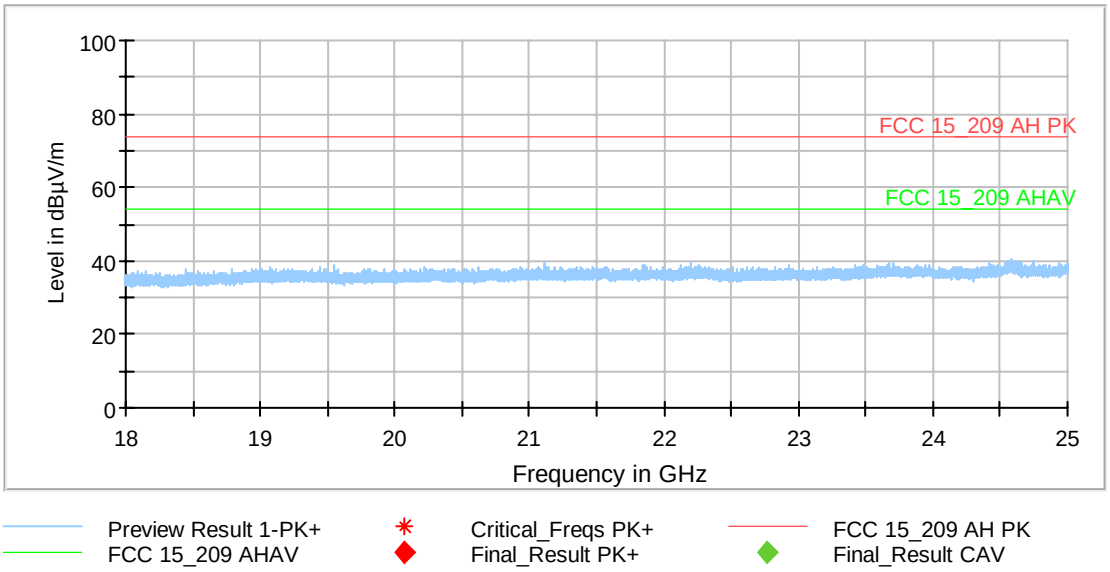
Spurious emissions from 4 GHz to 12 GHz (operation mode 2):



Spurious emissions from 12 GHz to 18 GHz (operation mode 2):



Spurious emissions from 18 GHz to 25 GHz (operation mode 2):



The following frequencies were found inside the restricted bands during the preliminary radiated emission test:

- 1305.100 MHz and 7289.800 MHz.

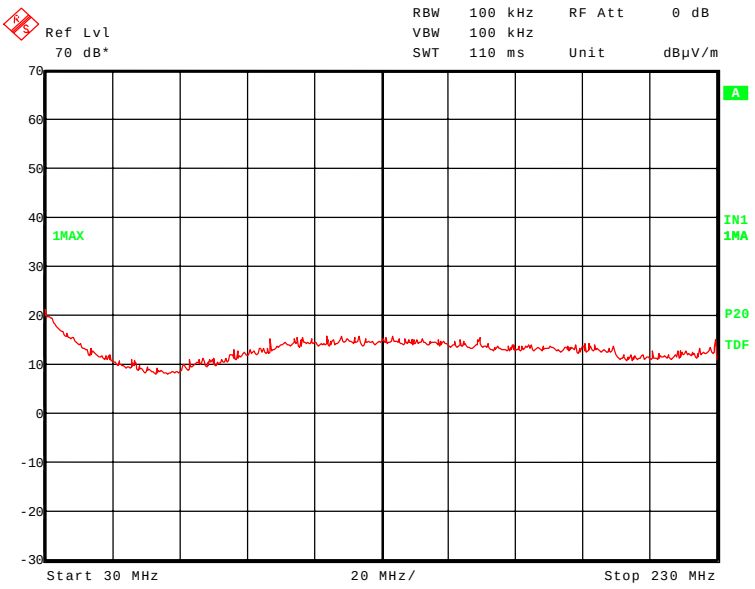
The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

- 1822.400 MHz, 6378.100 MHz, 12756.200 MHz and 13667.500 MHz.

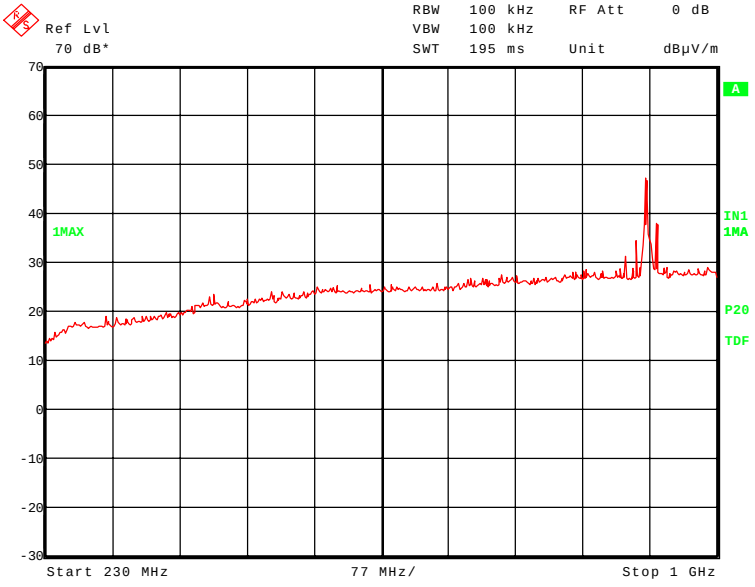
These frequencies have to be measured in a final measurement. The results were presented in the following.

Transmitter operates on the upper end of the assigned frequency (operation mode 3)

170032_6.wmf: Spurious emissions from 30 MHz to 230 MHz (operation mode 3):



170032_5.wmf: Spurious emissions from 230 MHz to 1 GHz (operation mode 3, carrier notched):



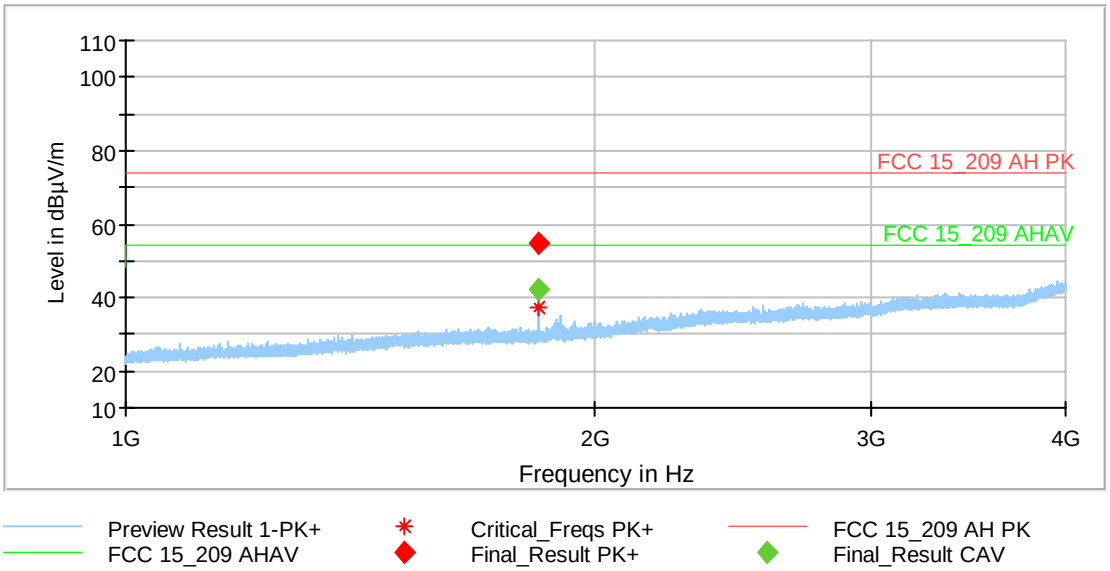
The following frequency was found inside the restricted bands during the preliminary radiated emission test.

The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

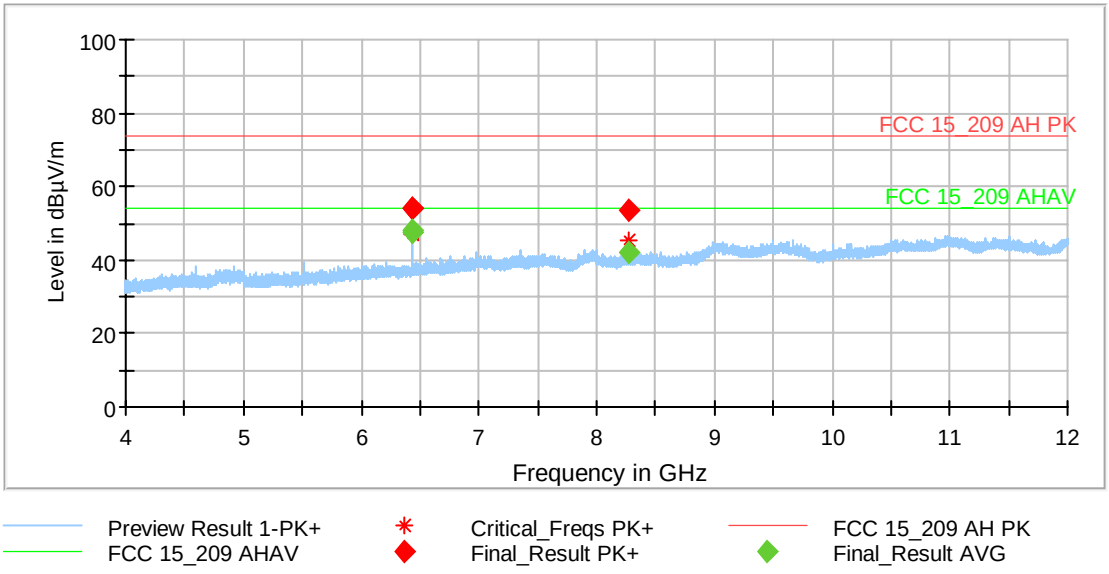
- 894.700 MHz, 906.700 MHz, 918.700 MHz and 930.700 MHz.

These frequencies have to be measured on the open area test site. The result is presented in the following.

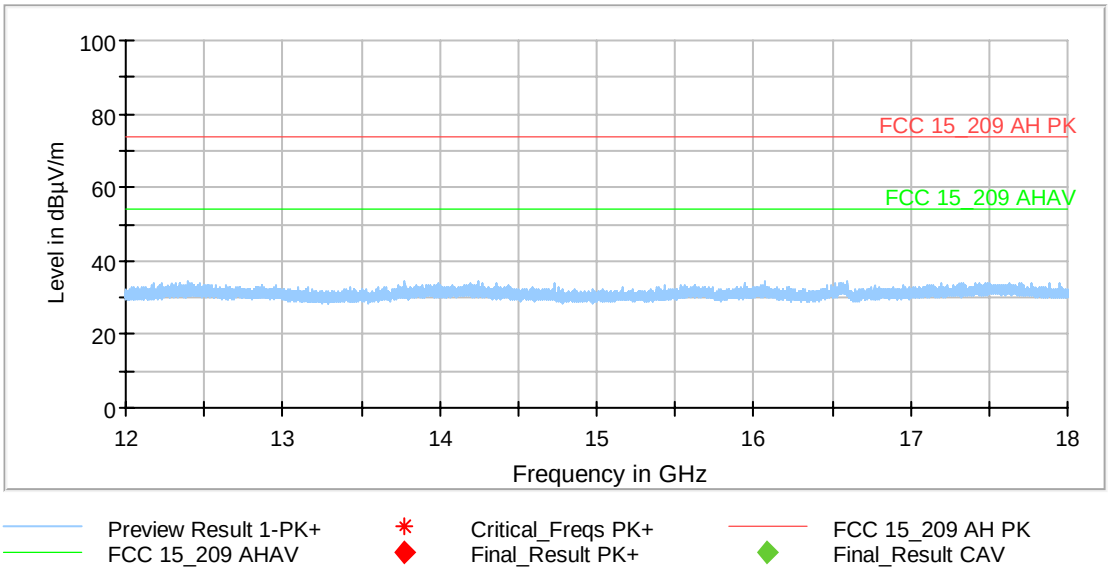
Spurious emissions from 1 GHz to 4 GHz (operation mode 3):



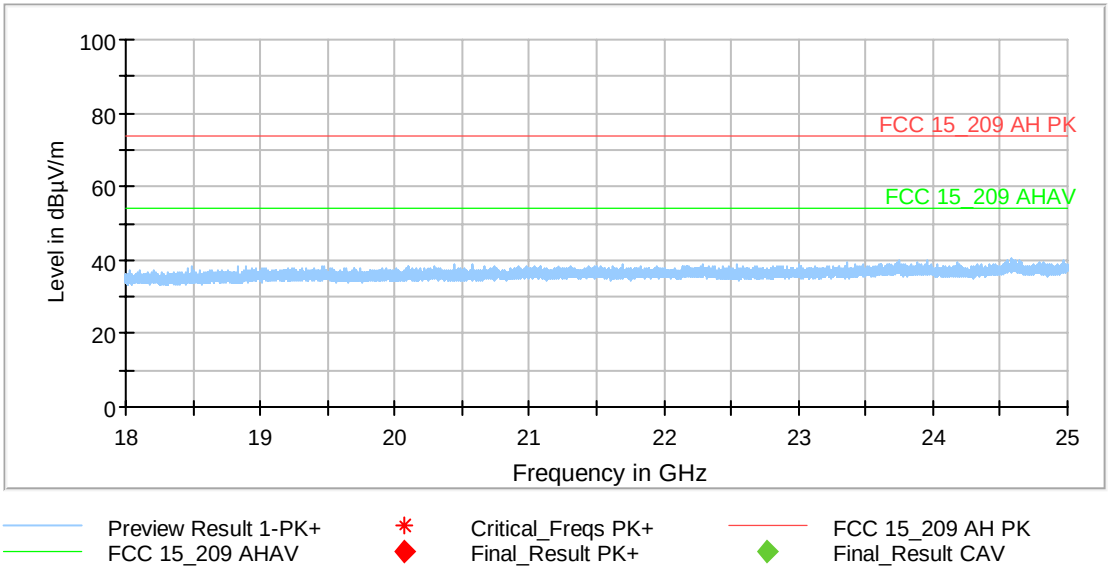
Spurious emissions from 4 GHz to 12 GHz (operation mode 3):



Spurious emissions from 12 GHz to 18 GHz (operation mode 3):



Spurious emissions from 18 GHz to 25 GHz (operation mode 3):



The following frequency was found inside the restricted bands during the preliminary radiated emission test.

- 8267.900 MHz

The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

- 1837.400 MHz and 6431.000 MHz.

These frequencies have to be measured in a final measurement. The results were presented in the following.

5.6.2.2 Final radiated emission measurement (9 kHz to 30 MHz)

No significant frequencies above the noise floor of the system (max. 30 dBµV/m (measured with peak detector) at 3 m distance) were found during the preliminary radiated emission test, so no measurements were carried out on the outdoor test site.

5.6.2.3 Final radiated emission measurement (30 MHz to 1 GHz)

Ambient temperature	21 °C	Relative humidity	31 %

Position of EUT: The EUT was set-up on a non-conducting table of a 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 annex A of this test report.

Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied 3.3 V DC by the internal battery, which was buffered by an external power supply with 5 V DC.

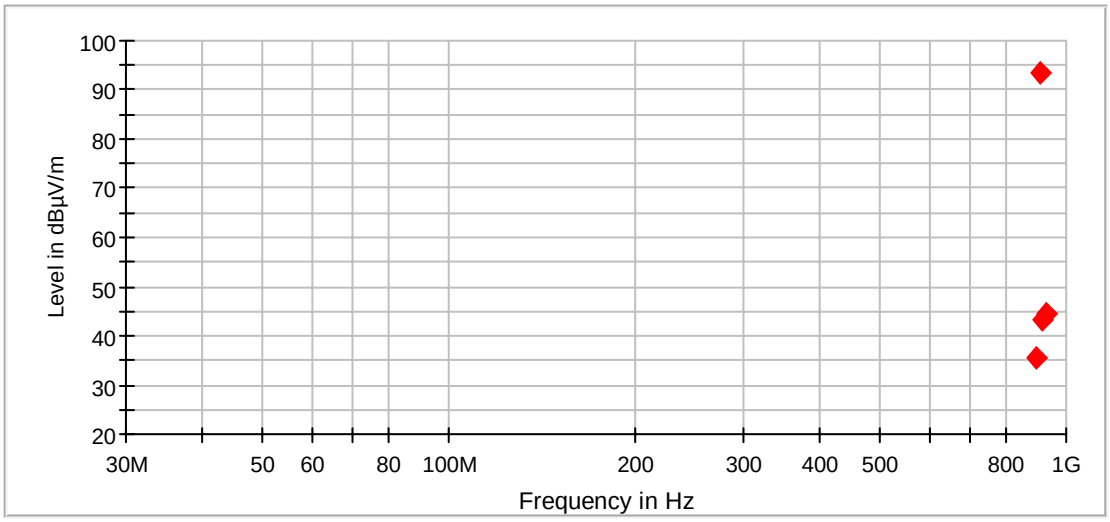
Test results: The test results were calculated with the following formula:

Result [dBµV/m] = reading [dBµV] + cable loss [dB] + antenna factor [dB/m] + 6 dB

The measured points and the limit line in the following diagrams refer to the standard measurement of the emitted interference in compliance with the above-mentioned standard. The measured points marked with a red diamond are the measured results of the standard final measurement on the open area test site.
The results of the standard subsequent measurement on the open area test site are indicated in the table below. The limits as well as the measured results (levels) refer to the above mentioned standard while taking account of the specified requirements for a 3 m measuring distance.

The measurement time with the quasi-peak measuring detector is 1 second.

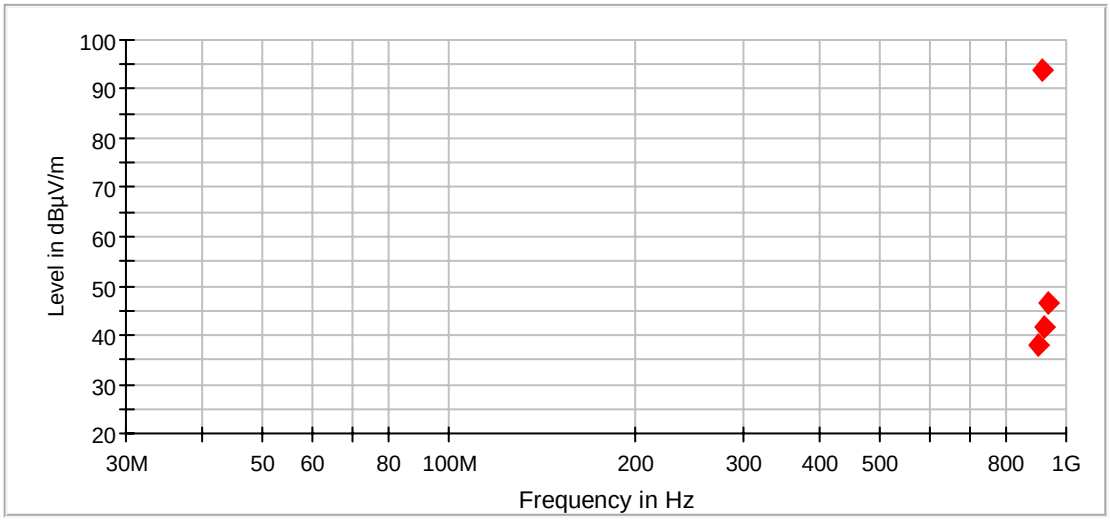
Transmitter operates on the lower end of the assigned frequency (operation mode 1)



Final_Result QPK

Data record name: 170032_ff_low

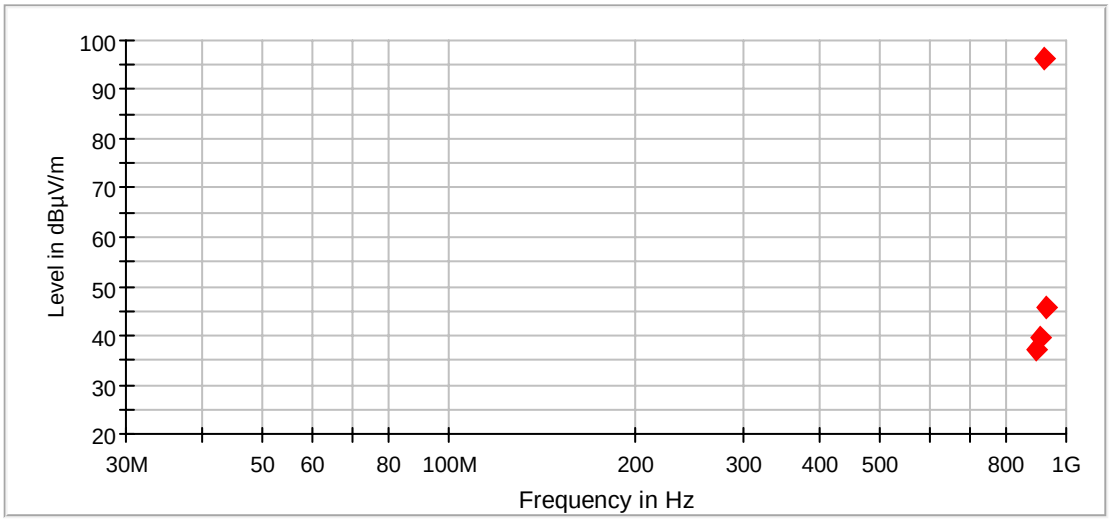
Transmitter operates on the middle of the assigned frequency (operation mode 2)



Final_Result QPK

Data record name: 170032_ff_mid

Transmitter operates on the upper end of the assigned frequency (operation mode 3)



◆ Final_Result QPK

Data record name: 170032_ff_high

Result measured with the quasi-peak detector:
(These values were marked in the diagrams by an ◆)

Transmitter operates on the lower end of the assigned frequency band (operation mode 1)										
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Restr. Band
892.00000	35.3	73.6	38.3	1000.0	120.000	104.0	Hor.	202.0	34.2	No
904.00000	93.6	Carrier	-	1000.0	120.000	100.0	Hor.	2.0	34.6	-
916.00000	43.4	73.6	30.2	1000.0	120.000	103.0	Hor.	199.0	35.0	No
928.00000	44.7	73.6	28.9	1000.0	120.000	105.0	Hor.	9.0	35.7	N
Transmitter operates on the middle of the assigned frequency band (operation mode 2)										
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Restr. Band
899.20000	37.8	73.7	35.9	1000.0	120.000	104.0	Hor.	210.0	34.4	No
911.20000	93.7	Carrier	-	1000.0	120.000	104.0	Hor.	204.0	34.8	-
923.20000	41.4	73.7	32.3	1000.0	120.000	104.0	Hor.	2.0	35.4	No
935.20000	46.6	73.7	27.1	1000.0	120.000	262.0	Vert.	342.0	35.9	No
Transmitter operates on the upper end of the assigned frequency band (operation mode 3)										
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Restr. Band
894.70000	37.0	76.5	39.5	1000.0	120.000	107.0	Hor.	209.0	34.3	No
906.70000	39.6	76.5	36.9	1000.0	120.000	103.0	Hor.	2.0	34.7	No
918.70000	96.5	Carrier	-	1000.0	120.000	100.0	Hor.	196.0	35.1	-
930.70000	45.7	76.5	30.8	1000.0	120.000	372.0	Vert.	81.0	35.8	No
Measurement uncertainty				±4.78 dB						

Test: Passed

Test equipment used (see chapter 6):

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5.6.2.4 Final radiated emission measurement (1 GHz to 25 GHz)

Ambient temperature	22 °C	Relative humidity	30 %

Position of EUT: The EUT was set-up on the positioner at 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 annex A of this test report.

Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied 3.3 V DC by the internal battery, which was buffered by an external power supply with 5 V DC.

Resolution bandwidth: For all measurements a resolution bandwidth of 1 MHz was used.

Test results: The test results were calculated with the following formula:

Result [dBµV/m] = reading [dBµV] + cable loss [dB] + antenna factor [dB/m] – preamp [dB]

Transmitter operates at the lower end of the assigned frequency band (operation mode 2)

Result measured with the peak detector:

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1808.000	54.3	74.0	19.7	51.2	26.5	25.9	2.5	150	Hor.	No
6327.700	52.8	74.0	21.2	34.5	37.7	24.5	5.1	150	Vert.	No
12655.400	44.1	74.0	29.9	34.1	33.7	26.8	3.1	150	Vert.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Result measured with the average detector:

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1808.000	41.4	73.6	32.2	38.3	26.5	25.9	2.5	150	Hor.	No
6327.700	46.4	73.6	27.2	28.1	37.7	24.5	5.1	150	Vert.	No
12655.400	32.6	54.0	21.4	22.6	33.7	26.8	3.1	150	Vert.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Transmitter operates at the middle of the assigned frequency band (operation mode 2)

Result measured with the peak detector:

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1305.100	51.5	74.0	22.5	50.3	25.0	25.9	2.1	150	Hor.	Yes
1822.400	56.3	74.0	17.7	53.1	26.7	26.1	2.6	150	Hor.	No
6378.100	56.0	74.0	18.0	37.2	37.8	24.2	5.2	150	Vert.	No
7289.800	54.8	74.0	19.2	34.4	39.2	24.3	5.5	150	Hor.	Yes
12756.200	45.8	74.0	28.2	38.6	33.6	26.4	3.2	150	Hor.	No
13667.500	46.5	74.0	27.5	39.4	33.6	26.5	3.4	150	Hor.	No
Measurement uncertainty							+2.2 dB / -3.6 dB			

Result measured with the average detector:

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1305.100	38.6	54.0	15.4	37.4	25.0	25.9	2.1	150	Hor.	Yes
1822.400	45.4	73.7	28.3	42.2	26.7	26.1	2.6	150	Hor.	No
6378.100	51.5	73.7	22.2	32.7	37.8	24.2	5.2	150	Vert.	No
7289.800	46.6	54.0	7.4	26.2	39.2	24.3	5.5	150	Hor.	Yes
12756.200	34.8	73.7	38.9	27.6	33.6	26.4	3.2	150	Hor.	No
13667.500	36.1	73.7	37.6	29	33.6	26.5	3.4	150	Hor.	No
Measurement uncertainty							+2.2 dB / -3.6 dB			

Transmitter operates at the upper end of the assigned frequency band (operation mode 3)

Result measured with the peak detector:

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1837.400	54.9	76.5	21.6	51.4	26.8	26.0	2.7	150	Hor.	No
6431.000	54.1	76.5	22.4	35.4	38.0	24.4	5.1	150	Vert.	No
8267.900	53.5	74.0	20.5	31.4	40.0	23.8	5.9	150	Vert.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Result measured with the average detector:

Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1837.400	42.3	76.5	34.2	38.8	26.8	26.0	2.7	150	Hor.	No
6431.000	47.9	76.5	28.6	29.2	38.0	24.4	5.1	150	Vert.	No
8267.900	42.2	54.0	11.8	20.1	40.0	23.8	5.9	150	Vert.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Test: Passed

Test equipment used (see chapter 6):

14, 15, 17 - 19, 21, 23 - 26, 29, 31, 34, 35

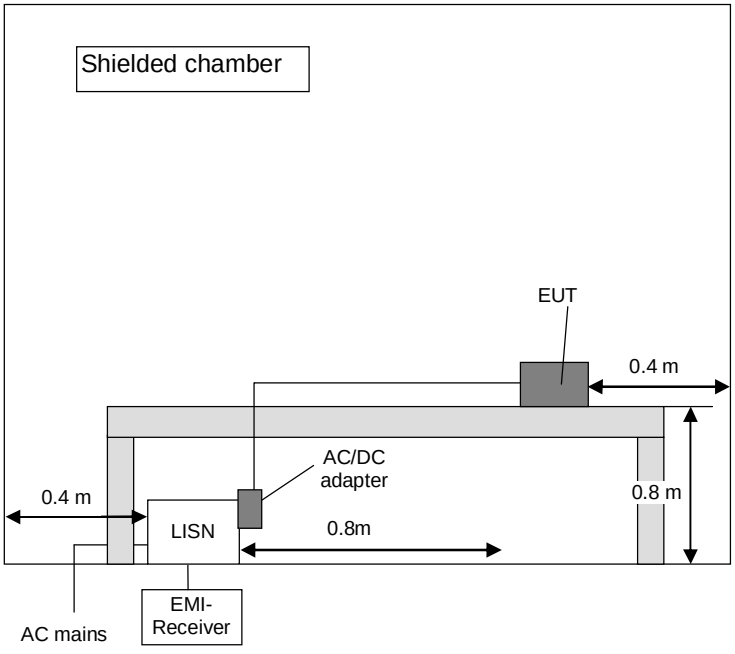
5.7 Conducted emissions on power supply lines (150 kHz to 30 MHz)

5.7.1 Method of measurement

This test will be carried out in a shielded chamber. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm above the ground plane. Floor-standing devices will be placed directly on the ground plane. The setup of the Equipment under test will be in accordance to [1].

The frequency range 150 kHz to 30 MHz will be measured with an EMI Receiver set to MAX Hold mode with peak and average detector and a resolution bandwidth of 9 kHz. A scan will be carried out on the phase (or plus pole in case of DC powered devices) of the AC mains network. If levels detected 10 dB below the appropriable limit, this emission will be measured with the average and quasi-peak detector on all lines.

Frequency range	Resolution bandwidth
150 kHz to 30 MHz	9 kHz



5.7.2 Test results (conducted emissions on power supply lines)

Ambient temperature	22 °C	Relative humidity	32 %

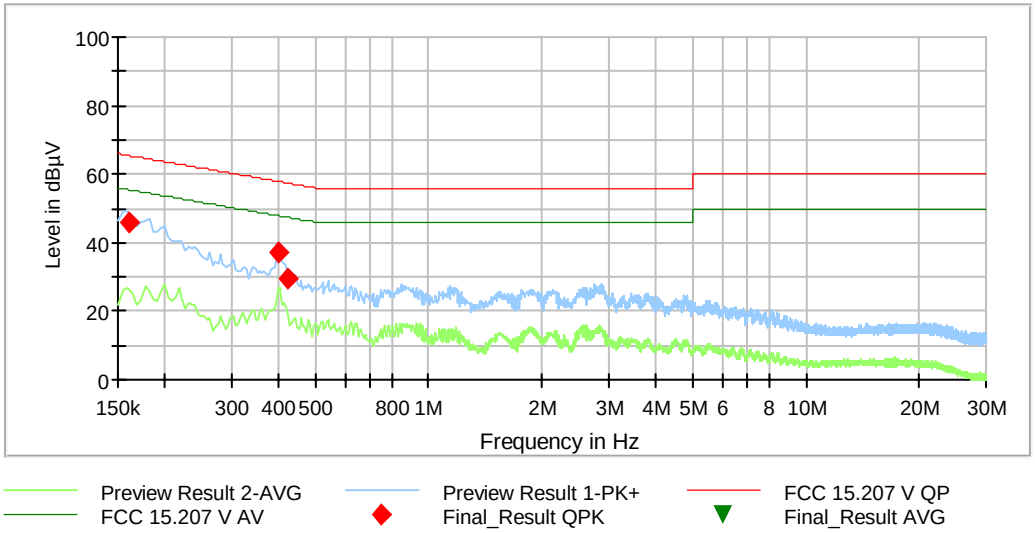
Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m.

Cable guide: The cables of the EUT were fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.

Test record: The test was carried out in operation mode 1 of the EUT (refer also clause 2 of this test report). All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied 3.3 V DC by the internal battery, which was buffered by an external power supply type THX-050200KE with 5 V DC.

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 ▼.



Data record name: 170032_AC

Remark: The limits of FCC 15.207 are identical to [3]

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Transducer (dB)
0.159900	46.1	---	65.5	19.4	5000.0	9.000	N	GND	9.8
0.401100	37.0	---	57.8	20.8	5000.0	9.000	N	FLO	9.9
0.420900	29.4	---	57.4	28.0	5000.0	9.000	N	GND	9.9
Measurement uncertainty			±2.76 dB						

Test: Passed

Test equipment used (see chapter 6):

1 - 5

6 Test equipment and ancillaries used for tests

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal. due
1	Shielded chamber M4	-	Siemens	B83117-S1-X158-	480088	Weekly verification (system cal.)	
2	EMI Receiver	ESIB 26	Rohde & Schwarz	1088.7490	481182	02/15/2016	02/2018
3	LISN	NSLK8128	Schwarzbeck	8128161	480138	02/16/2016	02/2018
4	Transient Filter Limiter	CFL 9206A	Teseq GmbH	38268	481982	Weekly verification (system cal.)	
5	EMI Software	EMC 32	Rohde & Schwarz	100061	481022	-	-
6	Open area test site	-	Phoenix Test-Lab	-	480085	Weekly verification (system cal.)	
7	Measuring receiver	ESIB7	Rohde & Schwarz	100304	480521	02/18/2016	02/2018
8	Controller	HD100	Deisel	100/670	480139	-	-
9	Turntable	DS420HE	Deisel	420/620/80	480087	-	-
10	Antenna support	AS615P	Deisel	615/310	480086	-	-
11	Antenna	CBL6111 D	Chase	25761	480894	09/18/2014	09/2017
12	EMI Software	EMC 32	Rohde & Schwarz	100061	481022	-	-
13	6 dB attenuator	WA2-6	Weinschel	8254	410119	Weekly verification (system cal.)	
14	Fully anechoic chamber M20	-	Albatross Projects	B83107-E2439-T232	480303	Weekly verification (system cal.)	
15	Spectrum analyser	FSW	Rohde & Schwarz	100586	481720	02/24/2016	02/2018
16	Measuring receiver	ESI 40	Rohde & Schwarz	100064	480355	02/17/2017	02/2018
17	Controller	MCU	Maturo	MCU/043/971107	480832	-	-
18	Turntable	DS420HE	Deisel	420/620/80	480315	-	-
19	Antenna support	AS615P	Deisel	615/310	480187	-	-
20	Antenna	CBL6112 B	Chase	2688	480328	04/14/2014	04/2017
21	Antenna	HL50	Rohde & Schwarz	100438	481170	08/27/2014	08/2017
22	RF-cable No. 36	Sucoflex 106B	Suhner	0587/6B	480865	Weekly verification (system cal.)	
23	RF-cable No. 3	Sucoflex 106B	Suhner	0563/6B	480670	Weekly verification (system cal.)	
24	RF-cable No. 40	Sucoflex 106B	Suhner	0708/6B	481330	Weekly verification (system cal.)	
25	Preamplifier	JS3-00101200-23-5A	Miteq	681851	480337	Six month verification (system cal.)	
26	Turn device	TDF 1.5- 10Kg	Maturo	15920215	482034	-	-
27	Loop antenna	HFH2-Z2	Rohde & Schwarz	100417	481912	10/20/2016	10/2017
28	High Pass Filter	WHJS1000C11 /60EF	Wainwright Instruments GmbH	1	480413	Weekly verification (system cal.)	
29	High Pass Filter	WHKX4.0/18G-8SS	Wainwright Instruments GmbH	1	480587	Weekly verification (system cal.)	
30	Tuneable Notch Filter	WRCA800/900-0.2/40-6EEK	Wainwright Instruments GmbH	15	480414	Weekly verification (system cal.)	

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal. due
31	Standard gain horn antenna	18240-20	Flann Microwave	483	480294	Calibration not necessary	
32	Standard gain horn antenna	20240-20	Flann Microwave	411	480297	Calibration not necessary	
33	Preamplifier 18 GHz - 26 GHz	JS4-18002600-20-5A	MITEQ Hauppauge N.Y.	658697	480342	02/17/2016	02/2018
34	Preamplifier 12 GHz - 18 GHz	JS3-12001800-16-5A	MITEQ Hauppauge N.Y.	571667	480343	02/18/2016	02/2018
35	RF-cable 2m	Insulated Wire Inc.	Insulated Wire	KPS-1533-800-KPS	480302	Calibration not necessary	

7 Report history

Report Number	Date	Comment
F170032E1	05/08/2017	Document created
-	-	-
-	-	-

8 List of annexes

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170032_c.JPG: EASYSCAN Link, test setup fully anechoic chamber
170032_b.JPG: EASYSCAN Link, test setup fully anechoic chamber
170032_d.JPG: EASYSCAN Link, test setup fully anechoic chamber
170032_e.JPG: EASYSCAN Link, test setup fully anechoic chamber
170032_g.JPG: EASYSCAN Link, test setup open area test site
170032_f.JPG: EASYSCAN Link, test setup shielded chamber

Annex B External photos 3 pages
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170032_3.JPG: EASYSCAN Link, detail view to type plate

Annex C Internal photos 10 pages
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170032_13.JPG: EASYSCAN Link, PCB 2, top view, shielding removed
170032_11.JPG: EASYSCAN Link, PCB 2, bottom view
170032_14.JPG: EASYSCAN Link, isolating PCB