PHOENIX TESTLAB

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Test Report

Report Number:

F191161E6

Equipment under Test (EUT):

omlox Satellite

Applicant:

TRUMPF Werkzeugmaschinen GmbH + Co. KG

Manufacturer:

TRUMPF Werkzeugmaschinen GmbH + Co. KG

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

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.

Tested and written by:	Bernward ROHDE	0.5.0.	07.09.2020
	Name	Signature	Date
Reviewed and approved by:	Bernd STEINER	12.02.2021 13:32	07.09.2020
	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.

Contents: Page

1 Identification

1.1 Applicant

Name:	TRUMPF Werkzeugmaschinen GmbH + Co. KG
Address:	Johann-Maus-Str. 2, 71254 Ditzingen
Country:	Germany
Name for contact purposes:	Mr. Guido Schönhardt
Phone:	07156-303-36117
Fax:	-
eMail Address:	Guido.schoenhardt@trumpf.com
Applicant represented during the test by the following person:	-

1.2 Manufacturer

Name:	TRUMPF Werkzeugmaschinen GmbH + Co. KG
Address:	Johann-Maus-Str. 2, 71254 Ditzingen
Country:	Germany
Name for contact purposes:	Mr. Guido Schönhardt
Phone:	07156-303-36117
Fax:	-
eMail Address:	Guido.schoenhardt@trumpf.com
Applicant represented during the test by the following person:	-

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-17186-01-05 and D-PL-17186-01-06, FCC Test Firm Accreditation designation number DE0004, FCC Test Firm Registration Number 469623, CAB Identifier DE0003 and ISED# 3469A.

1.4 EUT (Equipment under Test)

EUT	
Test object: *	Satellite for indoor localization
PMN / Model name: *	Omlox Satellite
FCC ID: *	2AVYV-2554432-01
Serial number: *	204744041
PCB identifier: *	1901154A00102B90
Hardware version: *	Rev D
Software version: *	3.0.6

* Declared by the applicant

Note: Phoenix Testlab GmbH does not take samples. The samples used for the tests are provided exclusively by the applicant.

1.5 Technical Data of Equipment

EUT data						
Power supply EUT: *	DC (by POE or USB)					
Supply voltage EUT POE: *	U_{nom}=	48.0 V_{DC}	U_{min}=	42.5 V_{DC}	U_{max}=	57.0 V_{DC}
Supply voltage EUT (USB): *	U_{nom}=	5.0 V_{DC}	U_{min}=	4.45 V_{DC}	U_{max}=	5.25 V_{DC}
Temperature range: *	-10 °C to +39 °C					
Lowest / highest internal clock frequency: *	32 kHz / 4500 MHz					

Ports / Connectors				
Identification	EUT	Ancillary	Length during test	Shielding (Yes / No)
Ethernet (with POE)	RJ45	RJ45	3m	Yes
USB	USB type C	USB type A	-	-

USB was not connected during testing

1.5.1 802.11 WLAN mode

IEEE 802.11 WLAN mode						
Fulfils radio specification: *	IEEE 802.11 WLAN b/g/n (HT20/HT40)					
Radio module: *	WL18MODGB, Texas Instruments					
FCC ID: *	2AVYV-2547263-01					
Antenna type: *	Inverted F PCB antenna					
Antenna name: *	ANT1					
Antenna gain: *	2 dBi					
Antenna connector: *	n/a					
Power supply EUT: *	DC (by POE or USB)					
Supply voltage EUT POE: *	U_{nom}=	48.0 V_{DC}	U_{min}=	42.5 V_{DC}	U_{max}=	57.0 V_{DC}
Supply voltage EUT (USB): *	U_{nom}=	5.0 V_{DC}	U_{min}=	4.45 V_{DC}	U_{max}=	5.25 V_{DC}
Conducted output power: *	IEEE 802.11 b	17.96 dBm (from original filing)				
	IEEE 802.11 g	20.59 dBm (from original filing)				
	IEEE 802.11 n20	20.56 dBm (from original filing)				
	IEEE 802.11 n40	20.22 dBm (from original filing)				
Type of modulation: *	IEEE 802.11 b	DSSS (DBPSK, DQPSK, CCK) (1/2/5.5/11 Mbit/s)				
	IEEE 802.11 g	OFDM (BPSK, QPSK, 16-QAM, 64-QAM) (6/9/12/18/24/36/48/54 Mbit/s)				
	IEEE 802.11 n20	OFDM (BPSK, QPSK, 16-QAM, 64-QAM) (up to 72.2 Mbit/s)				
	IEEE 802.11 n40	OFDM (BPSK, QPSK, 16-QAM, 64-QAM) (up to 150 Mbit/s)				
Operating frequency range: *	IEEE 802.11 b	2412 – 2462 MHz				
	IEEE 802.11 g	2412 – 2462 MHz				
	IEEE 802.11 n20	2412 – 2462 MHz				
	IEEE 802.11 n40	2422 – 2452 MHz				
Number of channels: *	IEEE 802.11 b	11 (5 MHz channel spacing)				
	IEEE 802.11 g	11 (5 MHz channel spacing)				
	IEEE 802.11 n20	11 (5 MHz channel spacing)				
	IEEE 802.11 n40	7 (5 MHz channel spacing)				

* Declared by the applicant

IEEE 802.11 b/g/n20 frequencies				
Channel 01	RX	2412 MHz	TX	2412 MHz
Channel 02	RX	2417 MHz	TX	2417 MHz
Channel 03	RX	2422 MHz	TX	2422 MHz
Channel 04	RX	2427 MHz	TX	2427 MHz
Channel 05	RX	2432 MHz	TX	2432 MHz
Channel 06	RX	2437 MHz	TX	2437 MHz
Channel 07	RX	2442 MHz	TX	2442 MHz
Channel 08	RX	2447 MHz	TX	2447 MHz
Channel 09	RX	2452 MHz	TX	2452 MHz
Channel 10	RX	2457 MHz	TX	2457 MHz
Channel 11	RX	2462 MHz	TX	2462 MHz

IEEE 802.11 n40 frequencies				
Channel 03	RX	2422 MHz	TX	2422 MHz
Channel 04	RX	2427 MHz	TX	2427 MHz
Channel 05	RX	2432 MHz	TX	2432 MHz
Channel 06	RX	2437 MHz	TX	2437 MHz
Channel 07	RX	2442 MHz	TX	2442 MHz
Channel 08	RX	2447 MHz	TX	2447 MHz
Channel 09	RX	2452 MHz	TX	2452 MHz

1.5.2 802.15.4 Radio mode

IEEE 802.15.4 radio mode		
Fulfils radio specification: *	IEEE 802.15.4	
Radio chip: *	Atmega256RFR2	
Antenna type: *	SMD Ceramic Chip antenna	
Antenna name: *	RFANT3216120A5T	
Antenna gain: *	2 dBi (Typical)	
Antenna connector: *	MM8030-2610RJ3	
Conducted output power: *	IEEE 802.15.4	-14.1 dBm (Peak)
		-14.3 dBm (Average)
Type of modulation: *	IEEE 802.15.4	O-QPSK (250 kbit/s)
Operating frequency range: *	IEEE 802.15.4	2405 – 2480 MHz
Number of channels: *	IEEE 802.15.4	16 (5 MHz channel spacing)

IEEE 802.15.4 frequencies				
Channel 11	RX	2405 MHz	TX	2405 MHz
Channel 12	RX	2410 MHz	TX	2410 MHz
Channel 13	RX	2415 MHz	TX	2415 MHz
Channel 14	RX	2420 MHz	TX	2420 MHz
Channel 15	RX	2425 MHz	TX	2425 MHz
Channel 16	RX	2430 MHz	TX	2430 MHz
Channel 17	RX	2435 MHz	TX	2435 MHz
Channel 18	RX	2440 MHz	TX	2440 MHz
Channel 19	RX	2445 MHz	TX	2445 MHz
Channel 20	RX	2450 MHz	TX	2450 MHz
Channel 21	RX	2455 MHz	TX	2455 MHz
Channel 22	RX	2460 MHz	TX	2460 MHz
Channel 23	RX	2465 MHz	TX	2465 MHz
Channel 24	RX	2470 MHz	TX	2470 MHz
Channel 25	RX	2475 MHz	TX	2475 MHz
Channel 26	RX	2480 MHz	TX	2480 MHz

1.5.3 BLE Radio mode

Bluetooth® Low Energy radio mode		
Fulfils radio specification: *	BLE 4.2 (1 Mbit/s only)	
Radio chip: *	nRF52840, Nordic Semiconductors	
Antenna type: *	Inverted F PCB antenna	
Antenna name: *	ANT2	
Antenna gain: *	2 dBi	
Antenna connector: *	n/a	
Conducted output power: *	BLE 1 Mbit/s	-1.3 dBm (Peak)
		-1.8 dBm (Average)
Type of modulation: *	BLE (1 Mbit/s, 2 Mbit/s)	GFSK (1 Mbit/s)
Operating frequency range: *	BLE (1 Mbit/s, 2 Mbit/s)	2402 – 2480 MHz
Number of channels: *	BLE (1 Mbit/s, 2 Mbit/s)	40 (2 MHz channel spacing)

Bluetooth® Low Energy frequencies				
Channel 0	RX	2402 MHz	TX	2402 MHz
Channel 1	RX	2404 MHz	TX	2404 MHz
…	…	…	…	…
Channel 19	RX	2440 MHz	TX	2440 MHz
…	…	…	…	…
Channel 38	RX	2478 MHz	TX	2478 MHz
Channel 39	RX	2480 MHz	TX	2480 MHz

1.5.4 UWB Radio mode

UWB radio mode	
Channel 1	f_C = 3.575 GHz, 500 MHz bandwidth
Channel 4	f_C = 4.000 GHz, 500 MHz bandwidth
Channel 3	f_C = 4.500 GHz, 500 MHz bandwidth
Channel 4	f_C = 4.000 GHz, 1000 MHz bandwidth

Rated rf-output power: *	-41.3 dBm (e.i.r.p.)
Antenna type: *	Internal PCB antenna only
Antenna gain: *	2 dBi
Antenna connector: *	None

* declared by the applicant.

1.5.5 Ancillary Equipment / Equipment used for testing

Equipment used for testing	
POE injector: *1	PowerSine 3001
Laptop for remote access: *2	Dell Inspiron 15 S/N: GB6H4P2

*1 Provided by the laboratory
*2 Provided by the applicant

1.6 Dates

Date of receipt of test sample:	07.05.2020
Start of test:	29.07.2020
End of test:	29.07.2020

2 Operational States

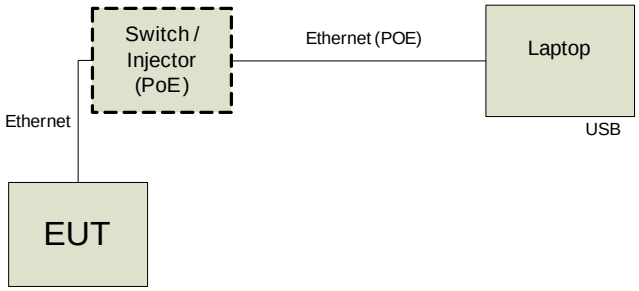
2.1 Description of function of the EUT

The EUT is intended to be used as transceiver for locating of machine tools inside a factory building. It will be fixed mounted inside the factory building. Therefore, it is defined as fixed indoor equipment.
All tests were carried out with an unmodified test sample powered with 48 V_{DC} via PoE from a PoE injector. Because the EUT also could be supplied with 5.0 VDC via USB, the conducted emission measurement on the power supply line was additionally carried out with this kind of power supply. The operation mode of the EUT could be chosen via the Ethernet link to a laptop PC with the help of a putty session.

2.2 The following states were defined as the operating conditions

2.2.1 Radio test

The system setup as follows:



2.2.2 Operation mode 1

Simultaneous transmission of all 4 radio technologies with the following settings:

Radio technology	Frequency [MHz]	Channel / Band	Modulation / Mode	Data rate	Power setting
UWB	4000	2	-	-	-4
WiFi	2437	6	b	1 Mbps	Not settable
BLE	2402 - 2480	Hopping on	GSFK	1 Mbps	Not settable
IEEE802.15.4	2480	26	O-QPSK	250 kbps	Not settable

Power settings were set by the applicant

3 Additional Information

The EUT contains a WiFi module, a Bluetooth Low Energy transceiver, a IEEE802.15.1 transceiver with two antennas and a UWB transceiver. The results of these technologies are documented in the test reports F191161E2 to F191161E5 separately. The emissions of the digital part of the EUT are documented in the test report F191161E1. Object of this test report is the simultaneous transmission of all radio parts of the EUT only.

The tested sample was not labeled as required by the FCC.

The tests were done with an unmodified sample.

4 Overview

Application	Frequency range [MHz]	FCC 47 CFR Part 15 section [2]	Status	Refer page
Maximum unwanted emissions	0.009 – 40,000	15.247 (d) 15.205 (a) 15.209 (a) 15.517 (c) 15.517 (d)	Passed	16

5 Results

5.1 Maximum unwanted emissions

5.1.1 Method of measurement (radiated)

The radiated emission measurement is subdivided into six stages.

- A preliminary measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 9 kHz to 30 MHz.
- 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 preliminary and final measurement carried out in a semi anechoic chamber with a varying antenna height in the frequency range 30 MHz to 1 GHz.
- A preliminary and final measurement carried out in a semi anechoic chamber with ground absorbers with a varying antenna height in the frequency range above 1 GHz.

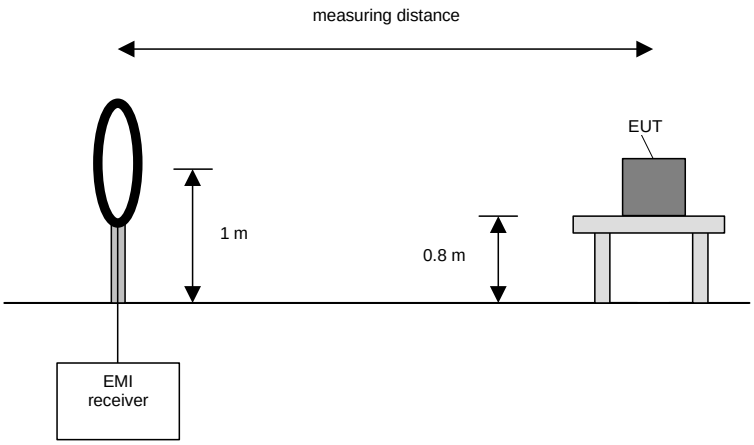
Preliminary measurement (9 kHz to 30 MHz):

In the first stage a preliminary measurement will be performed in a shielded room with a measuring distance of 3 meters. Tabletop devices will set up on a non-conducting turn device on the height of 0.8 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 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 find 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	9 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.

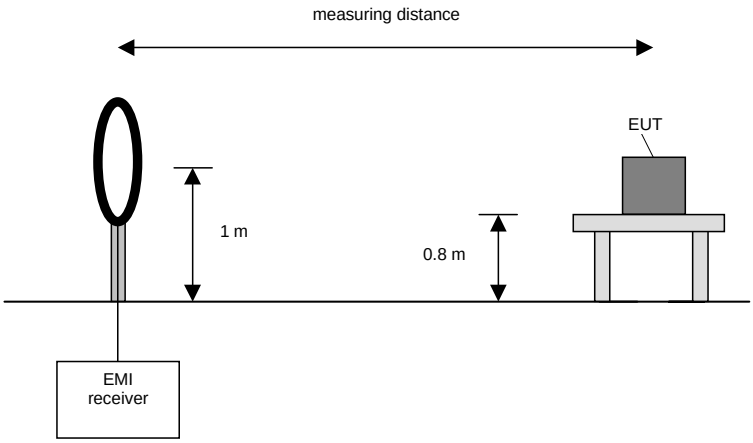
Final measurement (9 kHz to 30 MHz):

In the second stage a final measurement will be performed on an open area test site with no conducting ground plane in 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

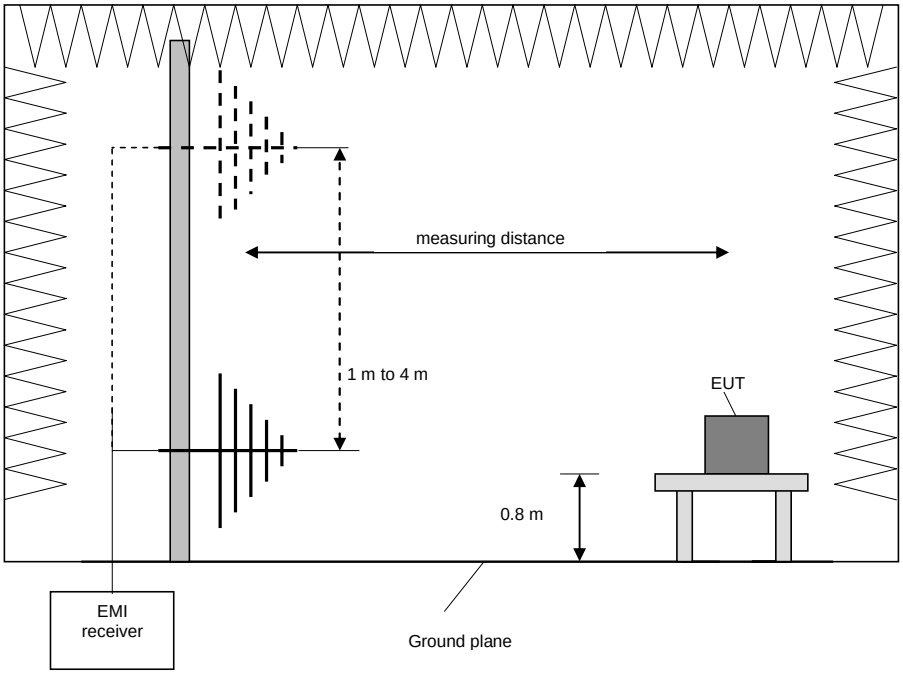


Preliminary and final measurement (30 MHz to 1 GHz)

The preliminary and final measurements were conducted in a semi-anechoic chamber with a metal ground plane. During the 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:

Test	Frequency range	Resolution bandwidth	Step size	Measurement time
Preliminary measurement	30 MHz to 1 GHz	120 kHz	40 kHz	100 ms
Frequency peak search	3 x RBW	120 kHz	10 kHz	1000 ms
Final measurement	30 MHz to 1 GHz	120 kHz	-	5 x 1000 ms



Procedure preliminary measurement:

The following procedure is used:

1. Set the measurement antenna to 1 m height.
2. Monitor the frequency range at vertical polarization and a EUT azimuth of 0 °.
3. Rotate the EUT by 360° to maximize the detected signals.
4. Repeat 1) to 2) with the vertical polarization of the measuring antenna.
5. Increase the height of the antenna for 0.5 m and repeat steps 2 – 4 until the final height of 4 m is reached.
6. The highest values for each frequency will be saved by the software, including the antenna height, measurement antenna polarization and turntable azimuth for the highest value.

Procedure final measurement:

The following procedure is used:

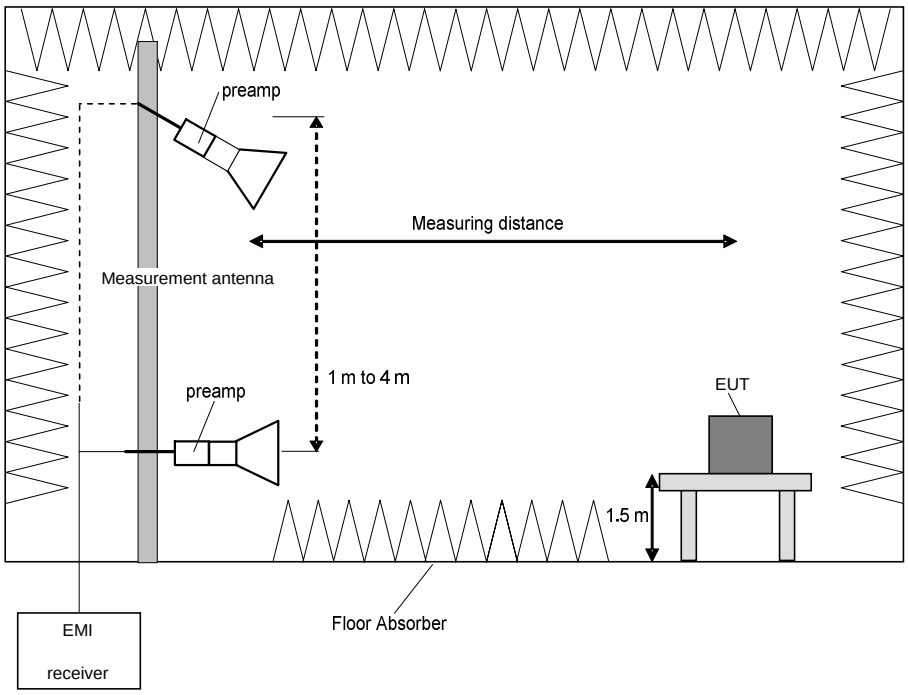
1. Select the highest frequency peaks to the limit for the final measurement.
2. The software will determine the exact peak frequencies by doing a partial scan with reduced step size with +/- 3 times the RBW of the pre-scan of the selected peaks.
3. If the EUT is portable or ceiling mounted, find the worst case EUT orientation (x,y,z) for the final test.
4. The worst measurement antenna height is found by the measurement software by varying the measurement antenna height by +/- 0.5 m from the worst-case value obtained in the preliminary measurement, and to monitor the emission level.
5. The worst azimuth turntable position is found by varying the turntable azimuth by +/- 30° from the worst-case value obtained in the preliminary measurement, and to monitor the emission level.
6. The final measurement is performed at the worst-case antenna height and the worst-case turntable azimuth.
7. Steps 2 – 6 will be repeated for each frequency peak selected in step 1.

Preliminary and final measurement (above 1 GHz)

The preliminary and final measurements were conducted in a semi-anechoic chamber with floor absorbers between EUT and measurement antenna.
During the 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. For each height the angle of the antenna will be tilted so that the measurement antenna is always aiming at the EUT.

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

Test	Frequency range	Resolution bandwidth	Step size	Measurement time
Preliminary measurement	1 - 40 GHz	1 MHz	500 kHz	10 ms
Frequency peak search	+ / - 1 MHz	1 MHz	50 kHz	100 ms
Final measurement	1 - 40 GHz	1 MHz	-	10 x 100 ms



Procedure preliminary measurement:

The following procedure is used:

7. Set the measurement antenna to 1 m height.
8. Monitor the frequency range at vertical polarization and a EUT azimuth of 0 °.
9. Rotate the EUT by 360° to maximize the detected signals.
10. Repeat 1) to 2) with the vertical polarization of the measuring antenna.
11. Increase the height of the antenna for 0.5 m and repeat steps 2 – 4 until the final height of 4 m is reached.
12. The highest values for each frequency will be saved by the software, including the antenna height, measurement antenna polarization and turntable azimuth for the highest value.

Procedure final measurement:

The following procedure is used:

8. Select the highest frequency peaks to the limit for the final measurement.
9. The software will determine the exact peak frequencies by doing a partial scan with reduced step size with +/- 3 times the RBW of the pre-scan of the selected peaks.
10. If the EUT is portable or ceiling mounted, find the worst case EUT orientation (x,y,z) for the final test.
11. The worst measurement antenna height is found by the measurement software by varying the measurement antenna height by +/- 0.5 m from the worst-case value obtained in the preliminary measurement, and to monitor the emission level.
12. The worst azimuth turntable position is found by varying the turntable azimuth by +/- 30° from the worst-case value obtained in the preliminary measurement, and to monitor the emission level.
13. The final measurement is performed at the worst-case antenna height and the worst-case turntable azimuth.
14. Steps 2 – 6 will be repeated for each frequency peak selected in step 1.

5.1.2 Test results (radiated)

5.1.2.1 Test results (9 kHz – 30 MHz)

Ambient temperature	23 °C
Relative humidity	62 %

Date	29.07.2020
Tested by	B. ROHDE

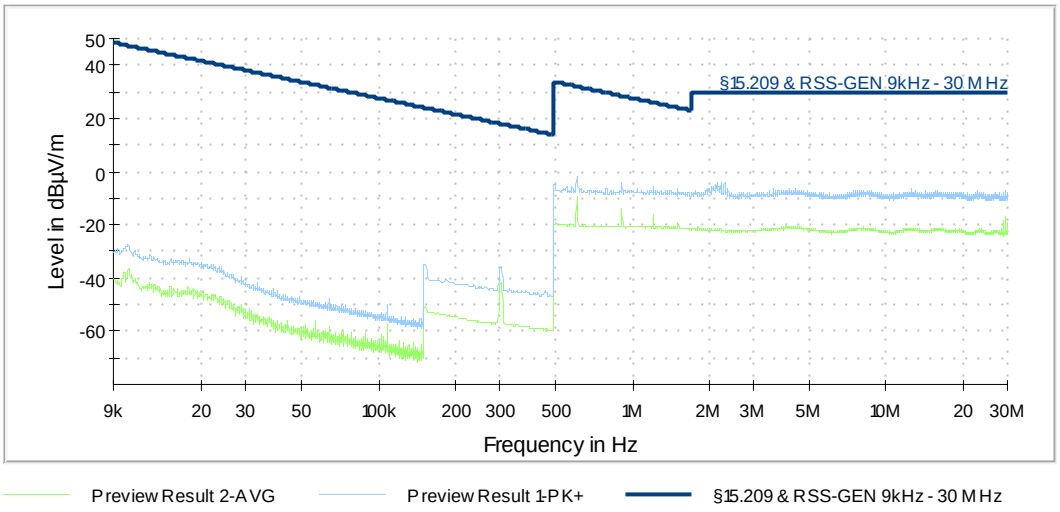
Position of EUT: For tests for f between 9 kHz and 30 MHz, the EUT was set-up on a table with a height of 80 cm. The distance between EUT and antenna was 3 m.

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: The measurement value was already corrected by 40 dB/decade as described in §15.31 (f) (2) regarding to the measurement distance as requested in §15.209

Plots of the worst-case transmitter spurious emissions

All_radios_on 16M-30M: Spurious emissions from 9kHz to 30 MHz (operation mode 1):



Remark: In the shown plot a distance correction factor was added to the measurement results to account for the different measuring distances according to standard (9 kHz to 490 kHz @ 300 m; 490 kHz to 30 MHz @ 30 m).

All emissions are more the 20 dB from the limit, so no final measurement was performed.

Test equipment (please refer to chapter 6 for details)
1 – 20, 27

5.1.2.2 Test results (30 MHz – 1 GHz)

Ambient temperature	23 °C
Relative humidity	62 %

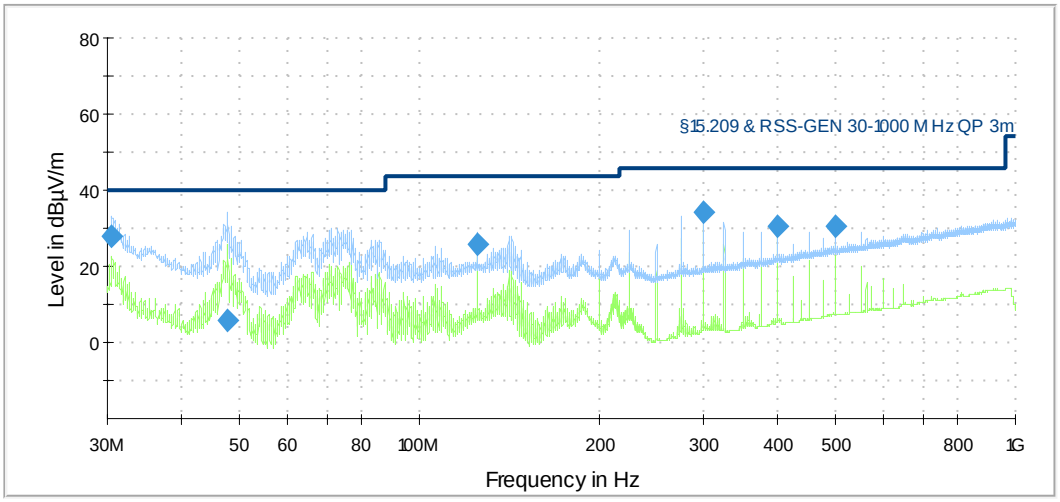
Date	29.07.2020
Tested by	B. ROHDE

Position of EUT: For tests between 30 MHz and the 1 GHz, the EUT was set-up on a table with a height of 80 cm. 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 worst-case plot for each frequency range/modulation is submitted below.

All_radios_on 30M-1G: Spurious emissions from 30 MHz to 1 GHz (operation mode 1):



Operation mode 1:

Frequency [MHz]	Result [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Readings [dBµV]	Correction [dB/m]	Height [cm]	Azimuth [deg]	Pol.	Result
30.540000	27.9	40	12.1	2.8	25.1	122	314	V	Passed
47.810000	5.7	40	34.3	-9.2	14.9	134	103	V	Passed
124.990000	25.8	43.52	17.7	8.4	17.3	150	98	H	Passed
300.000000	34.4	46.02	11.6	15.1	19.3	106	128	H	Passed
400.000000	30.6	46.02	15.4	8.5	22.1	126	183	V	Passed
500.000000	30.8	46.02	15.2	6.2	24.6	112	253	V	Passed
Measurement uncertainty				±5.5 dB					

Test equipment (please refer to chapter 6 for details)
1 – 20, 27

5.1.2.3 Test results (above 1 GHz)

Ambient temperature	23 °C
Relative humidity	62 %

Date	29.07.2020
Tested by	B. ROHDE

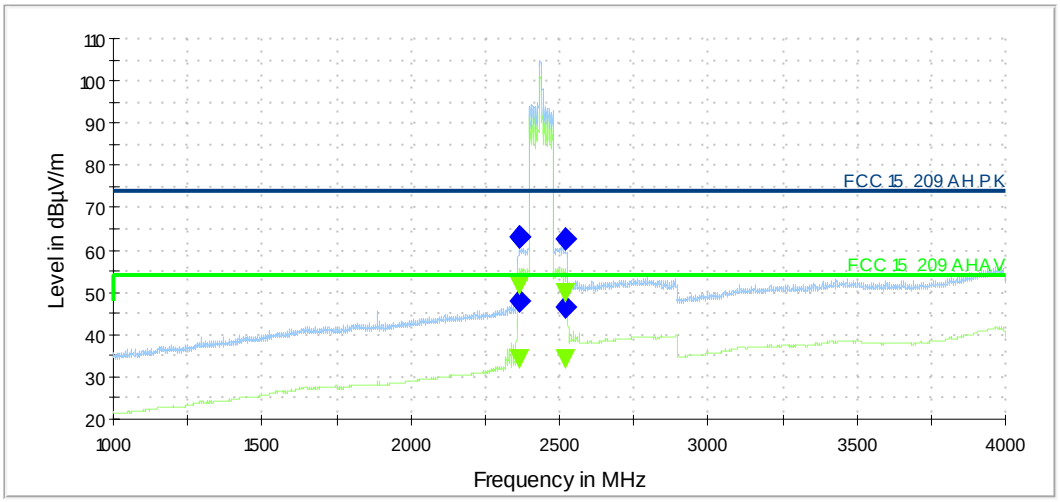
Position of EUT: For tests for f between 1 GHz and the 10th harmonic, the EUT was set-up on a table with a height of 150 cm. The distance between EUT and antenna was 3 m.

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.

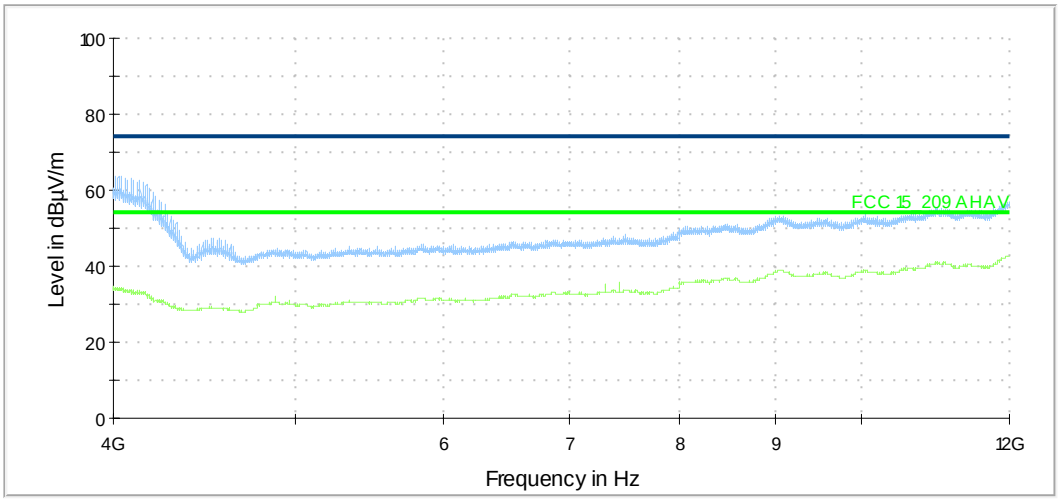
Test record: One plot for each frequency range is submitted below.

Plots of the transmitter spurious emissions

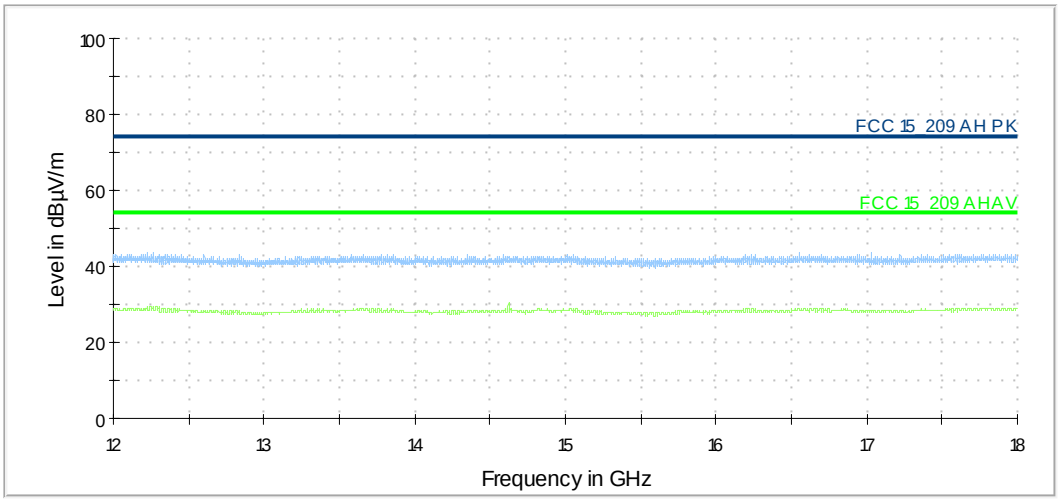
All_radios_on: Spurious emissions from 1 GHz to 4 GHz (operation mode 1):



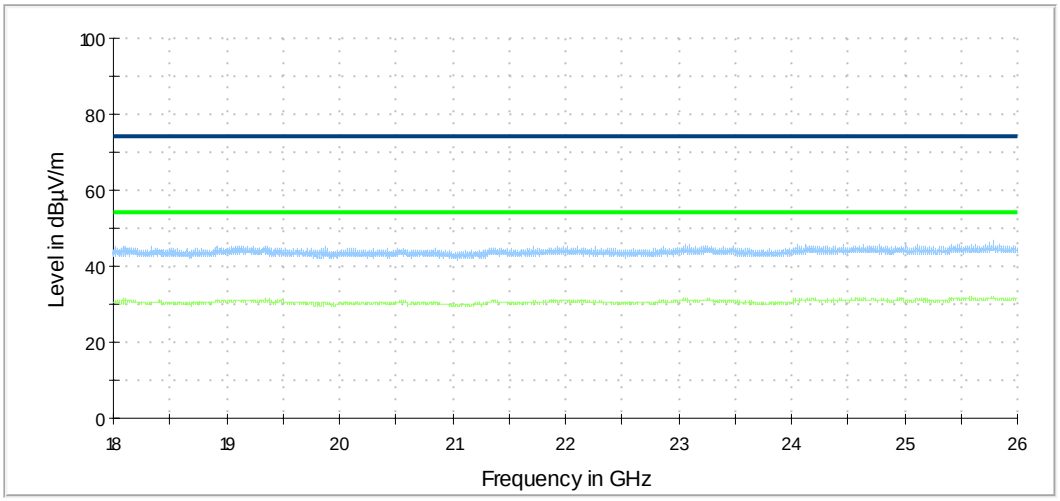
All_radios_on: Spurious emissions from 4 GHz to 12 GHz (operation mode 1):



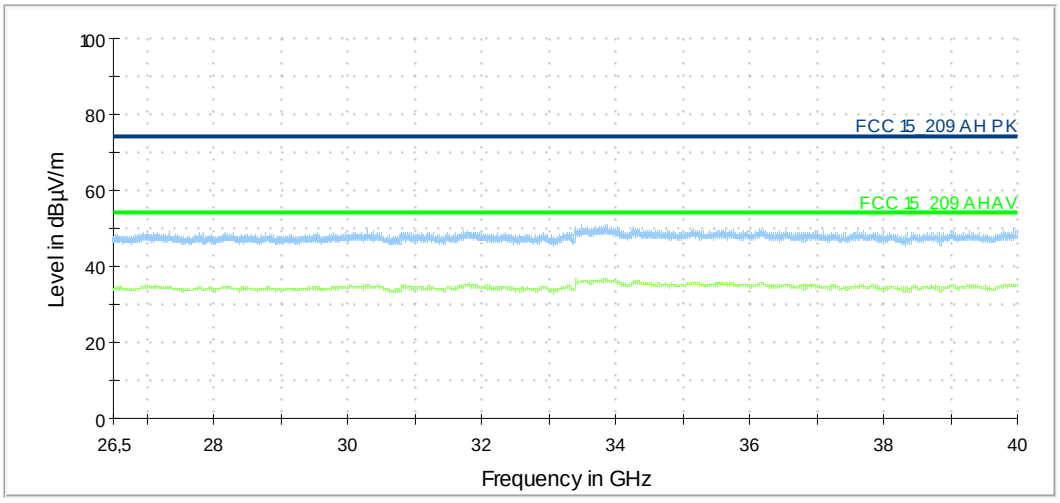
All_radios_on: Spurious emissions from 12 GHz to 18 GHz (operation mode 1):



All_radios_on: Spurious emissions from 18 GHz to 26 GHz (operation mode 1):



All_radios_on: Spurious emissions from 26 GHz to 40 GHz (operation mode 1):



(Operation mode 1)

Frequency [MHz]	Result (Pk) [dBµV/m]	Result (Av) [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Readings [dBµV]	Correction [dB]	Height [cm]	Azimuth [deg]	Pol.	Result
2367.850000	47.9	---	74	26.1	13.6	34.3	284	241	V	Passed
2367.850000	---	34.2	54	19.8	-0.1	34.3	284	241	V	Passed
2520.650000	46.4	---	74	27.6	11.7	34.7	256	242	V	Passed
2520.650000	---	34.1	54	19.9	-0.6	34.7	256	242	V	Passed
2367.850000	62.9	---	74	11.1	28.60	34.3	284	241	V	Passed
2367.850000	---	51.9	54	2.1	17.60	34.3	284	241	V	Passed
2367.850000	63.1	---	74	10.9	28.80	34.3	284	241	V	Passed
2367.850000	---	51.9	54	2.1	17.60	34.3	284	241	V	Passed
2520.650000	62.9	---	74	11.1	28.20	34.7	256	241	V	Passed
2520.650000	---	50.1	54	3.9	15.40	34.7	256	241	V	Passed
Measurement uncertainty					±5.5 dB					

The measured emissions were a mix product of BLE and WiFi, with a transient behavior, for the worst case the final measurement procedure was repeated 10 time, the worst case was reported above.

Test equipment (please refer to chapter 6 for details)
1 – 20, 27

6 Test Equipment used for Tests

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal Due
1	Low Noise Amplifier 100 MHz - 18 GHz	LNA-30-00101800-25-10P	Narda-Miteq	2110917	482967	18.02.2020	02.2022
2	Log Per Antenna	HL050	Rohde & Schwarz	4062.4063.02-100908	482977	13.08.2019	08.2022
3	Standard Gain Horn 20 dB, 12 GHz-18 GHz	18240-20	Flann	267220	483025	Calibration not necessary	
4	Low Noise Amplifier 18 GHz - 26.5 GHz	LNA-30-18002650-20-10P	Narda-Miteq	2110911	482969	17.02.2020	02.2022
5	Standard Gain Horn 20 dB, 18 GHz -26 GHz	20240-20	Flann	266399	483026	Calibration not necessary	
6	Low Noise Amplifier 26 MHz - 40 GHz	LNA-30-26004000-27-10P	Narda-Miteq	2110293	482970	17.02.2020	02.2022
7	Standard Gain Horn 20 dB, 26 GHz - 40 GHz	22240-20	Flann	266405	483027	Calibration not necessary	
8	Loop antenna	HFH2-Z2	Rohde & Schwarz	832609/014	480059	14.02.2020	02.2022
9	RF Switch Matrix	OSP220	Rohde & Schwarz		482976	Calibration not necessary	
10	Turntable	TT3.0-3t	Maturo	825/2612/.01	483224	Calibration not necessary	
11	Antennasupport	BAM 4.5-P-10kg	Maturo	222/2612.01	483225	Calibration not necessary	
12	Controller	NCD	Maturo	474/2612.01	483226	Calibration not necessary	
13	Semi Anechoic Chamber M276	SAC5-2	Albatross Projects	C62128-A540-A138-10-0006	483227	Calibration not necessary	
14	Measurment software EMC32 M276	EMC32	Rohde & Schwarz	100970	482972	Calibration not necessary	
15	EMI Testreceiver	ESW44	Rohde & Schwarz	101828	482979	14.11.2019	11.2021
16	Preamplifier 12 GHz - 18 GHz	JS3-12001800-16-5A	MITEQ Hauppauge N.Y.	571667	480343	13.02.2020	02.2022
17	Antenna (Bilog)	CBL6111D	Schaffner Elektrotest GmbH / Teseq GmbH	25761	480894	19.10.2017	10.2020
18	Low Noise Amplifier 12 GHz - 18 GHz	LNA-30-12001800-13-10P	Narda-Miteq	2089798	482968	17.02.2020	02.2022
20	Loop antenna	HFH2-Z2	Rohde & Schwarz	100417	481912	05.02.2020	02.2021
27	Attenuator 6 dB	WA2-6	Weinschel	-	482794	Calibration not necessary	

7 Test site Validation

Test equipment	PM. No.	Frequency range	Type of validation	According to	Val. Date	Val Due
Semi anechoic chamber M276	483227	30 – 1000 MHz	NSA	ANSI C63.4-2017	19.09.2019	18.09.2021
Semi anechoic chamber M276	483227	1 -18 GHz	SVSWR	CISPR 16-1-4 + Cor1:2010 + A1:2012 +A2:2017	19.09.2019	18.09.2021

8 Report History

Report Number	Date	Comment
F191161E6	04.08.2020	Initial Test Report
-	-	-
-	-	-

9 List of Annexes

Annex A	Test Setup Photos	6 pages