

Prüfbericht-Nr:
Test report No: 20102801.r04

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Prüfbericht-Nr.: <i>Test Report No.:</i>	20102801.r04	Auftrags-Nr.: <i>Order No.:</i>	89004860
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	1018247	Auftragsdatum: <i>Order date:</i>	2020-11-18
Auftraggeber: <i>Client:</i>	TK Home Solutions B.V. Van Utrechtweg 99, 2921LN Krimpen ad IJssel Netherlands		
Prüfgegenstand: <i>Test item:</i>	remote control stairlift		
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	1131444		
Auftrags-Inhalt: <i>Order content:</i>	Compliance with standard		
Prüfgrundlage: <i>Test specification:</i>	FCC 47 CFR Part 15, Subpart C, Section 15.247 KDB 558074 D0115.247 Meas Guidance v05r02, April 2, 2019 RSS-Gen Issue 5, Amendment 2 February 2021 RSS-247 (Issue 2, February 2017) ANSI C63.10-2013		

Wareneingangsdatum: <i>Date of receipt:</i>	2021-02-10	
Prüfmuster-Nr.: <i>Test sample No.:</i>	S14463-C2A	
Prüfzeitraum: <i>Testing period:</i>	2021-03-10 – 2021-05-12	
Ort der Prüfung: <i>Place of testing:</i>	Leek	
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland Nederland B.V. Leek Laboratory	
Prüfergebnis*: <i>Test result*:</i>	PASS	

geprüft von / tested by: 			Kontrolliert von / reviewed by: 		
2021-07-13	Richard van der Meer, Expert		2021-07-13	Sajid Mohammed, Reviewer	
Datum Date	Name / Stellung Name / Position	Unterschrift Signature	Datum Date	Name / Stellung Name / Position	Unterschrift Signature
Sonstiges / Other: firmware version 9.14 ; hardware version: 05					
Zustand des Prüfgegenstandes be Anlieferung: Condition of the test item at delivery:2			Prüfmuster vollständig und unbeschädigt Test item complete and undamaged		
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet					
Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. Test specification(s) F(ail) a.m. test specification(s) N/A = not applicable N/T = not tested					
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. This test report only relates to the a.m. testsample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This report does not entitle to carry any test mark					
V04					

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If the place of testing differs from the location given on page 1 this is given under the respective test clause in the report. This test report consists of multiple pages, the number of pages can be seen in the header on the top right of each page. The report ends when the last page is reached.

For the influence of the measuring uncertainties on the results, reference is made to the validation of the respective methods.

The test results exclusively relate to the tested sample.

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No opinions or interpretation are included in this report.

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Statements

- This document does not represent type approval or certification of the product.
- The test results only relate to the behaviour of the test specimens of the examined product under the particular conditions of the test in laboratory conditions.
- The validity of this report will expire directly after alterations or modifications of the examined product (combination)(s) and/or the criteria.

All underlying Standards under the mentioned Main Standard on page 1 of this report are dated as given in the mentioned Main Standard.

Each test result below is marked with:

Under accreditation:	☒ Yes ☐ No
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To confirm tests carried out under ISO 17025: 2017 accreditation.

If not tested "Under Accreditation" "No" will be checked and "Yes" will be unchecked.

This report contains:

☒ No Subcontracting

☐ Subcontracting. Subcontracted measurements and results are marked with an "*" and subcontracted to qualified subcontractors and described under the respective test clause in the report.

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Revision Revision	Datum Date	Anmerkung Remark	Verfasser Author
00	2021.06.23	First Release	R. van der Meer
01	2021.07.13	Typos, corrected clause numbers	R. van der Meer

Note: Latest revision report will replace all previous reports

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Test Summary

The EUT was tested in accordance with the specifications given in the table below.

Test Standard		Description	Page	Pass / Fail
47 CFR Part 15	RSS-Gen Issue 5, Amendment 2 February 2021 RSS-247 Issue 2, February 2017			
15.207(a)	RSS-Gen(8.8)	AC power line conducted emissions	38 - 41	Pass
15.209 and 15.247(d)	RSS-Gen(8.9) and RSS-247 5.5	Radiated emissions	30 – 37	Pass
15.205	RSS-Gen(8.10)	Band edge emissions	24 - 26	Pass
15.247(a)(1)(i)	RSS-Gen(6.7) and RSS-247 5.1(c)	Bandwidth of the emission	15 - 19	Pass
15.247(b)(1)	RSS-247 5.4(a)	Peak output power	12 - 14	Pass
15.247(a)	RSS-247 5.1(c)	Hopping characteristics	20 – 23	Pass
15.247(d)	RSS-247 5.5	Conducted spurious emissions	27 - 29	Pass

Table : test specifications

1 General.

1.1 Applied standards.

The EUT, has been tested in conformity with the standards as stated on page 1.

1.2 Disclaimer, description of the EUT

EUT is a Remote control to move the stairlift while you are seated in the chair. EUT operates in the 902-928 MHz band. The EUT is equipped with an integrated battery.

Info as provided by the applicant.

1.3 System Details

Details (as provided by the applicant).and an overview of the system and all of its components, as it has been tested, may be found below.

EUT	
Voltage input rating	: 3.1 - 3.5 Vdc , battery operated
Antenna	: Internal, integrated on the PCB
Antenna Gain	: -2.62 dBi (including enclosure)
Operating frequencyband	: 902 MHz - 928 MHz.
Modulation	: 2FSK
Data-rate	: 20 kbps
Remarks	: n.a.

AUX Battery charger	
Brand	: XP power
Model	: VER05US050-UB
Output Voltage	: 5.0Vdc



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2 Test conditions.

2.1 Standard test conditions.

Environmental condition	Parameter	Range
Temperature	°C	+15 to +35
Relative humidity	%	20 – 75
Nominal supply voltage	Volts DC	3.3 V

EUT is battery powered and batteries were fully charged for testing , EUT is powered internally by a stabilized 3.3 V source.

2.2 Operation Modes

Testing was performed at the lowest operating frequency (902.3 MHz), at the operating frequency in the middle of the specified frequency band (915 MHz) and at the highest operating frequency (927.6 MHz). These operation modes were selected after review of the capabilities and characteristics of the EUT. The test software Putty enabled the settings of these modes.

The EUT has been tested in the modes as described in table below

Operation Mode	Channel	Frequency (MHz)	TX power control setting
Transmit (Tx)	2	902.3	80
Transmit (Tx)	129	915.0	80
Transmit (Tx)	253	927.6	80

2.3 Test methodology.

The test methodology used is based on the requirements of 47 CFR Part 15, sections 15.31, 15.209 and 15.247 and RSS-Gen (Issue 5, Amendment 2, February 2021) an RSS-247 (Issue 2, February 2017).

The test methods, which have been used, are based on ANSI C63.10-2013.
Radiated emission tests were performed at a measurement distance of 3 meters.

The receivers are switching automatically to the right bandwidth in accordance with CISPR 16. This is implemented in the receiver. The antenna factors are programmed in the test receiver. The receiver automatically calculates the appropriate correction factor for the utilized antenna and also the appropriate antenna factor for the cable loss. The total correction is automatically added to the measured value.

2.4 Test facility.

The Federal Communications Commission and Industry Canada has reviewed the technical characteristics of the test facilities at TÜV Rheinland Nederland B.V., located in Leek, 9351VT Eiberkamp 10, The Netherlands, and has found these test facilities to be in compliance with the requirements of 47 CFR Part 15, section 2.948.

The description of the test facilities has been filed at the Office of the Federal Communications Commission under Designation Number NL0005 (test site registration number: 786213). The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

The description of the test facilities has been filed to Industry Canada under CABID number NL0002 (test site registration number: 2932G-2). The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

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2.5 Measurement Uncertainty

Measurement Type	Frequency	Uncertainty
Antenna Port Conducted Emission (includes Peak Output power, Conducted spurious emissions)	< 1.3GHz	±1.7dB
	1.3 - 40GHz	±2.9 – 3.4dB
Radiated Emission	150kHz - 30MHz	±5.0dB
	30MHz - 1GHz	±5.22dB
	> 1GHz	±5.22dB
Bandwidth of the emission	< 1GHz	±56.3*10 ⁻⁹ Hz
AC Power Line Conducted Emissions	150kHz - 30MHz	±3.2dB

2.6 Test setup

2.6.1 Test setup for radiated measurements below 1 GHz

Description	Parameter
Antenna polarizations	Hor/Ver
Antenna to EUT distance	3 meter

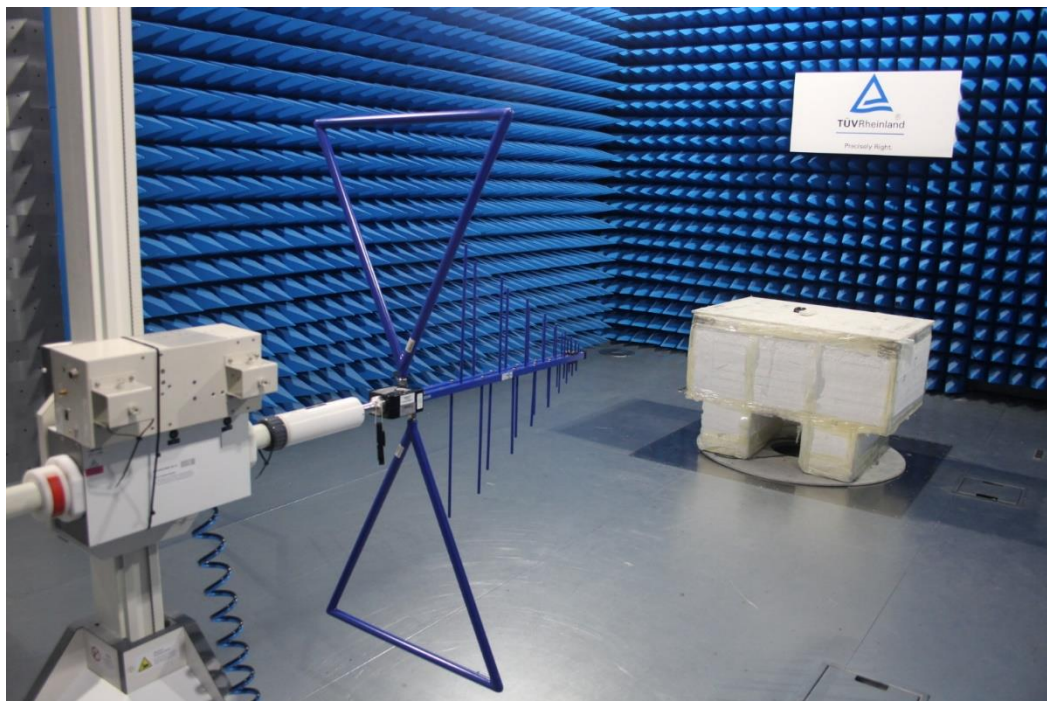
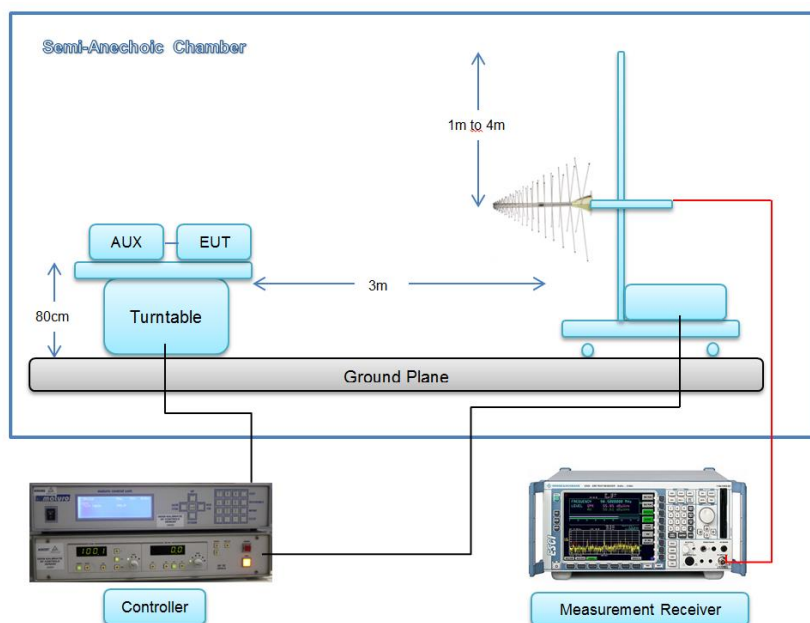


Figure 1: Test setup in the SAR below 1 GHz



Block diagram of the test setup

2.6.2 Test setup for radiated measurements above 1 GHz

Description	Parameter
Antenna polarizations	Hor/Ver
Antenna to EUT distance	3 meter
EUT height	1.5 meter

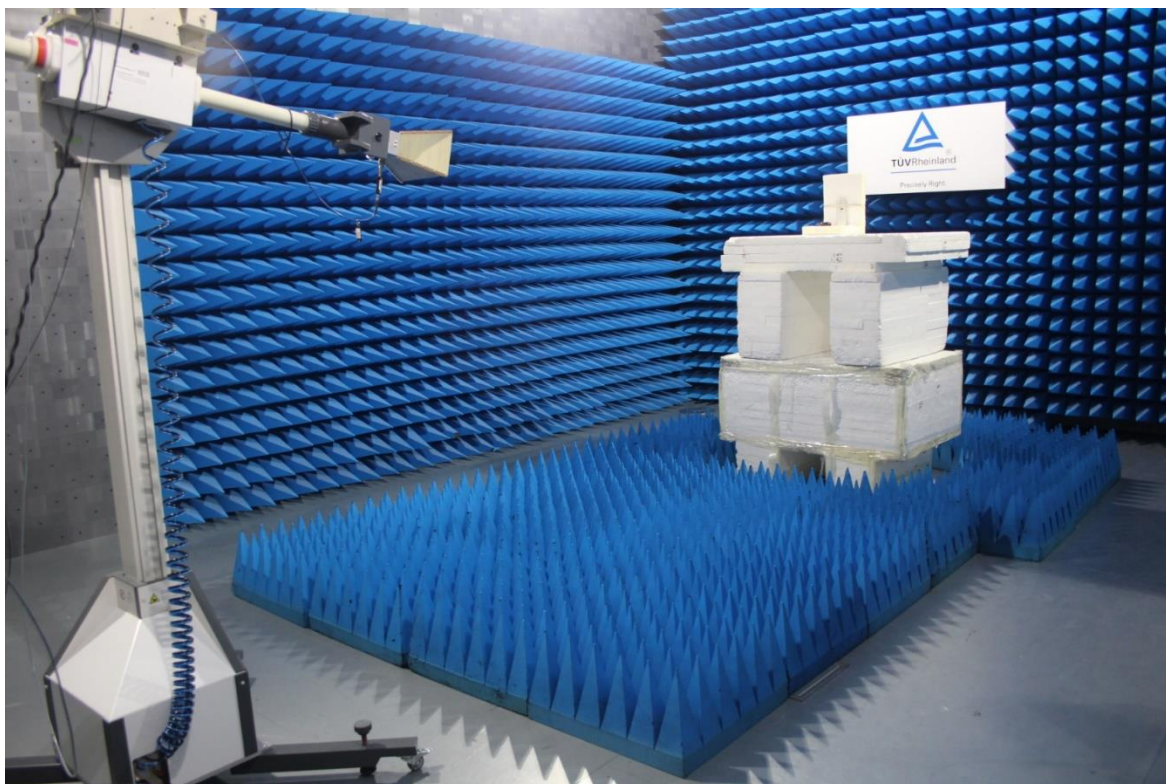
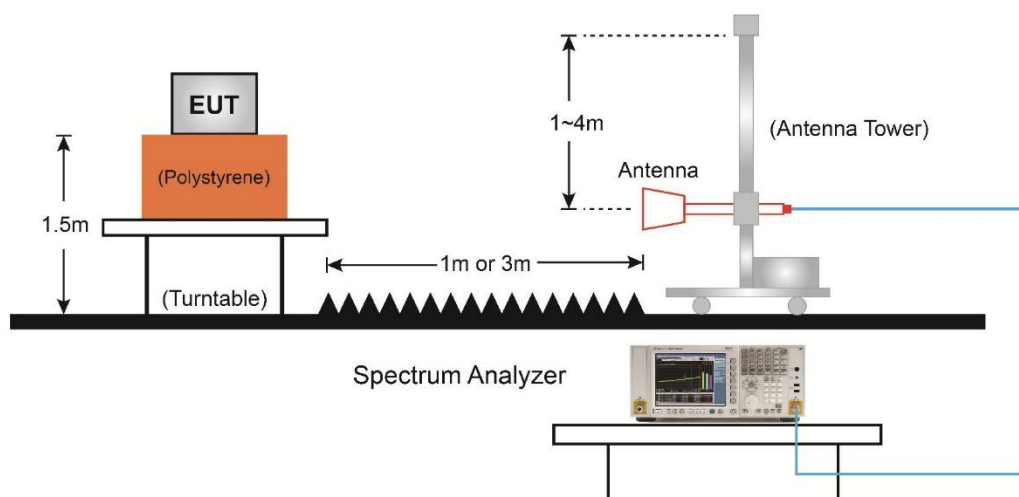


Figure 2: Test setup in the SAR above 1 GHz



Block diagram of the test setup

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2.6.3 Setup for conducted tests

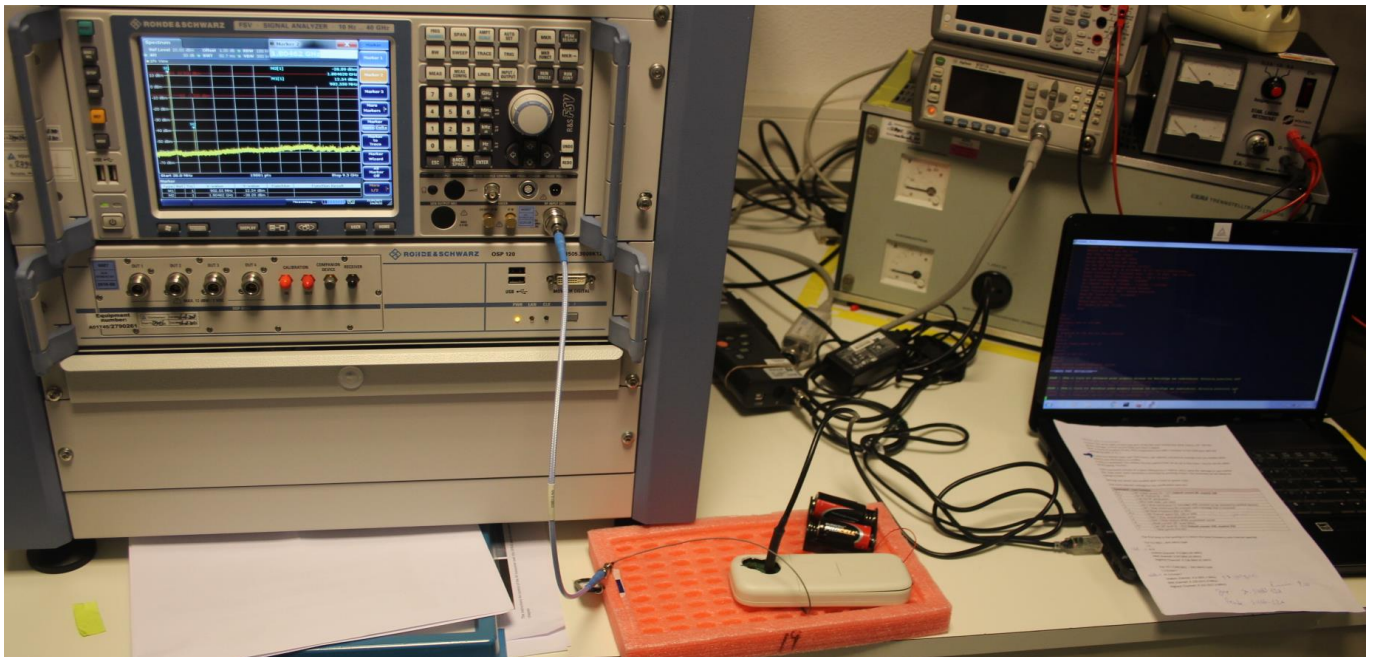


Figure 3: EUT



Figure 4. AC Power Line conducted emissions setup

2.7 Default EUT orientation(s)

To obtain the maximum emitted power level between the EUT and the measurement antenna, all radiated measurements are performed with the EUT either placed in horizontal(X), vertical(Y) or (Z) position. Figure 4 are photographs to demonstrate the orientation of the EUT in those positions. The EUT is rotated along the full 360 degrees on a turntable in the horizontal plane.

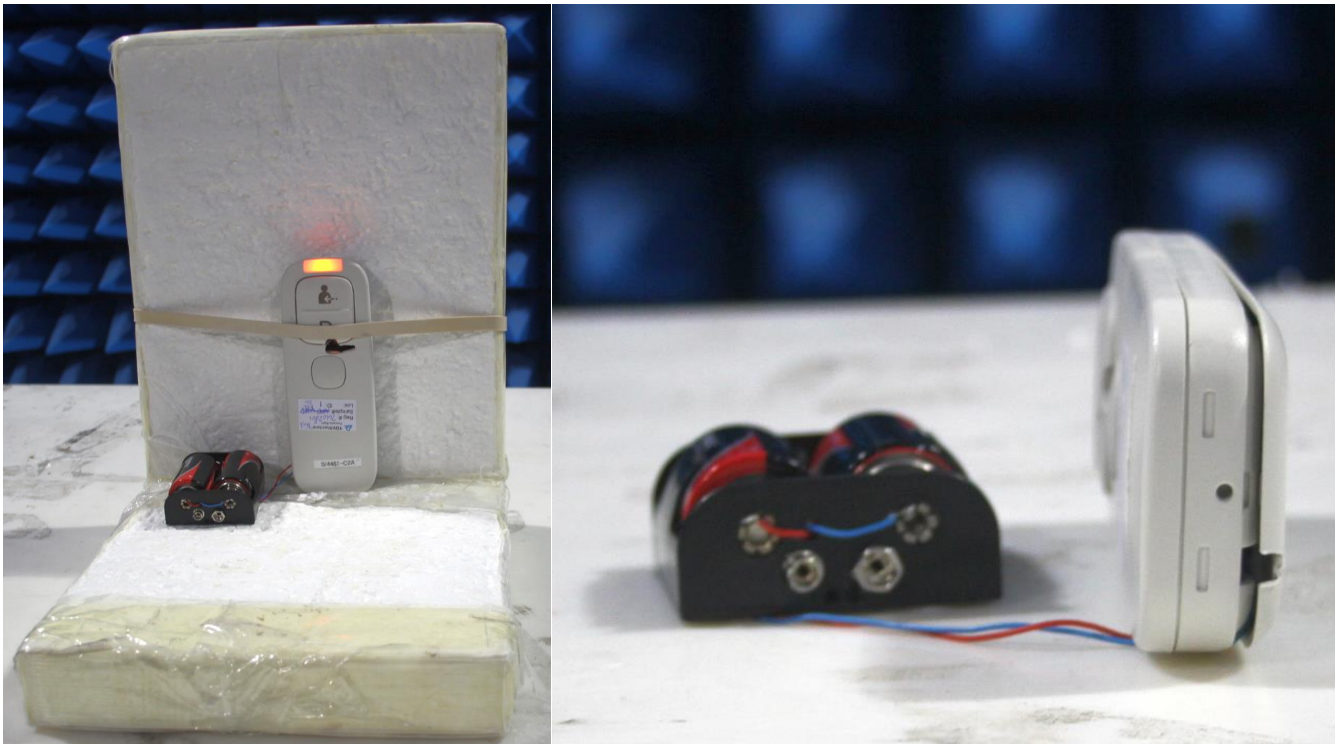


Figure 4: EUT in the vertical (Y) position (left) and Z position (right)



Figure 5: EUT in the horizontal (X) position

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3 Conducted Measurements at Antenna Port

3.1 Peak output power

RESULT: PASS

Date of testing: 2021-04-21

Requirements:

FCC 15.247(b)(2) and RSS-247 Section 5.4(a)

For systems using frequency hopping in the 902-928 MHz band, the maximum peak output power is 1W (+30dBm) for systems employing at least 50 hopping channels.

Test procedure:

The Peak Output Power was measured using the method according to section 7.8.5 in ANSI C63.10-2013.

The maximum peak output power (conducted) was measured at the antenna connector with a spectrum analyzer. The final measurement takes into account the loss generated by all the involved cables.

Measurement uncertainty is +/- 2.5 dB.

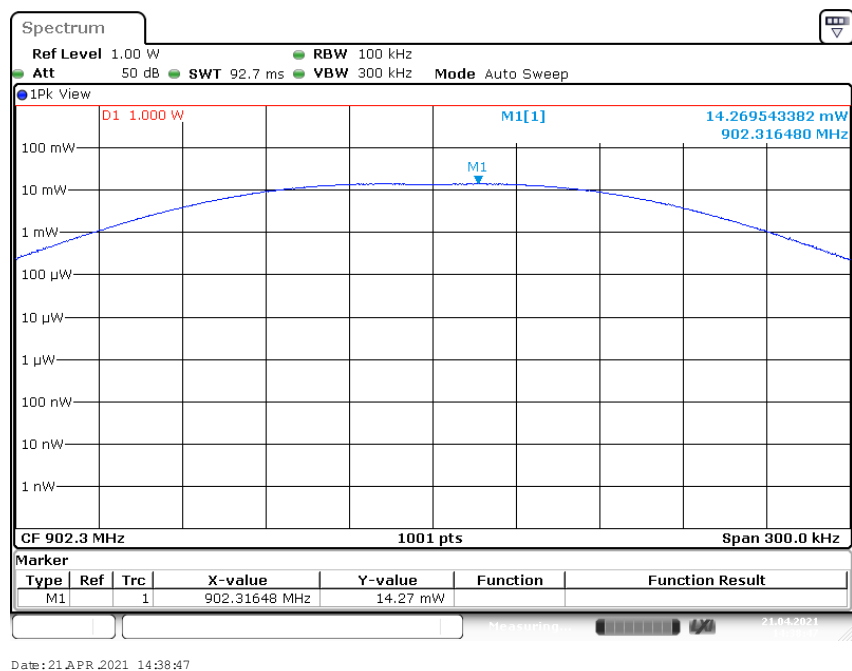
Notes: $mW = 10^{(dBm/10)}$
 $dBm = 10 \times \log(mW)$

Test results

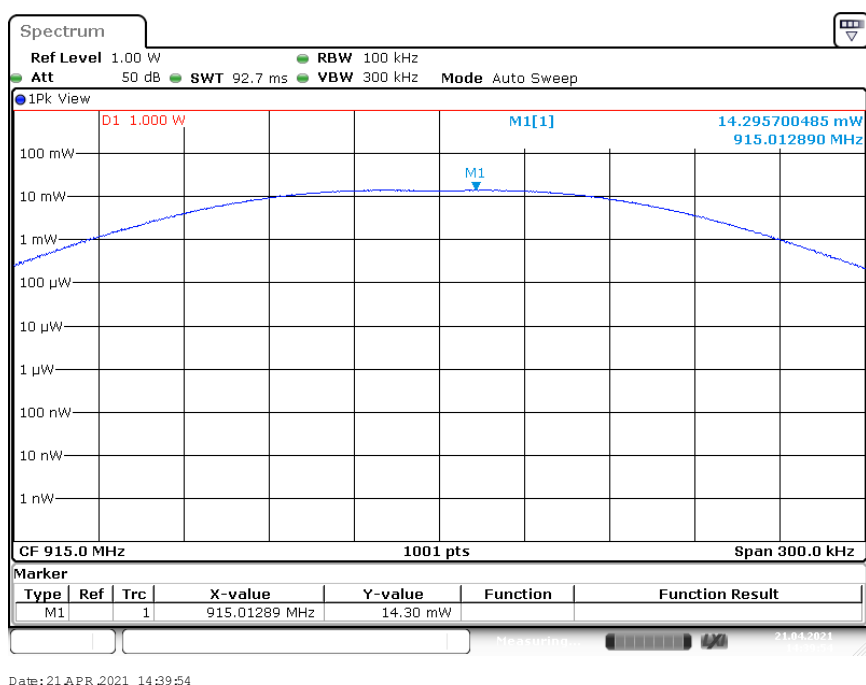
Frequency	Peak output power	Limit	Verdict	Plot number
[MHz]	[W]	[W]	[Pass/Fail]	
902.3	0.014	1	Pass	A
915.0	0.014	1	Pass	B
927.6	0.014	1	Pass	C

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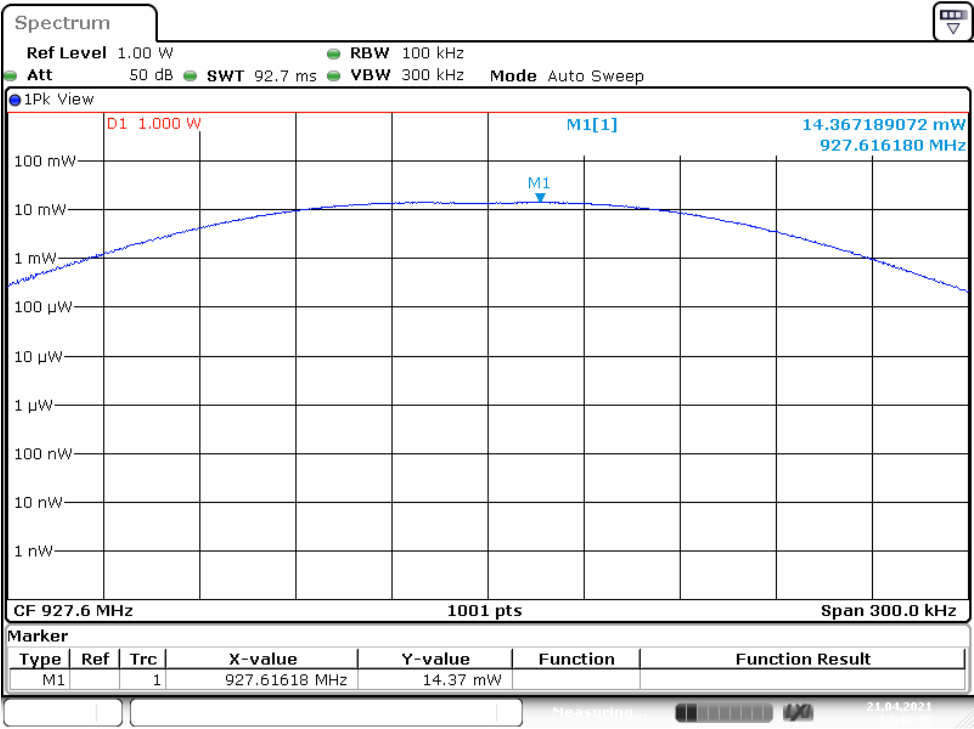
Plot A



Plot B

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Date: 21 APR 2021 14:40:45

Plot C

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3.2 Bandwidth of the emission

RESULT: PASS

Date of testing: 2021-04-21

Requirements:

FCC 15.247 (a)(1)(i) and RSS-247 5.1(c) the 20 dB bandwidth of the emission must be within the frequency band 902 – 928 MHz. The maximum bandwidth of the hopping channel shall be 500 kHz.

For 99% Bandwidth: RSS-Gen Section 6.7: No requirement is given.

Test procedure 20dB bandwidth:

ANSI C63.10-2013 section 11.8.1 Option 1

For 99% Bandwidth: RSS-Gen.

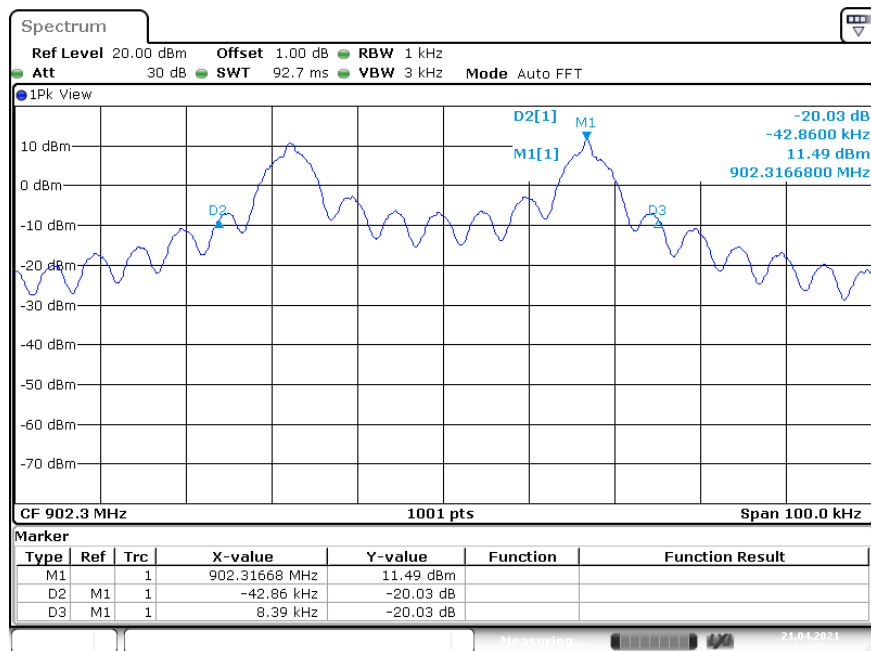
The transmitter was operated at its maximum carrier power measured under normal test conditions. A spectrum analyzer was connected to the antenna port of the EUT. The spectrum analyzer resolution bandwidth was set to 1% of the selected span, Video bandwidth was set to 3 times the resolution bandwidth. The span was set to capture the whole modulation process. The Spectrum analyzers automated function for 99% BW was used. Measurement uncertainty is $56,3 \cdot 10^{-9}$ Hz.

Plots A1,B1 and C1 shown on the next pages are of the 20 dB bandwidth.
Plots A2,B2 and C2 shown on the next pages are of the 99 % bandwidth

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Operating Frequency [MHz]	20dB Bandwidth [kHz]	Limit [kHz]	Verdict [Pass/Fail]	Plot number
902.3	51.25	≤ 500	Pass	A1
915.0	51.25	≤ 500	Pass	B1
927.6	51.25	≤ 500	Pass	C1

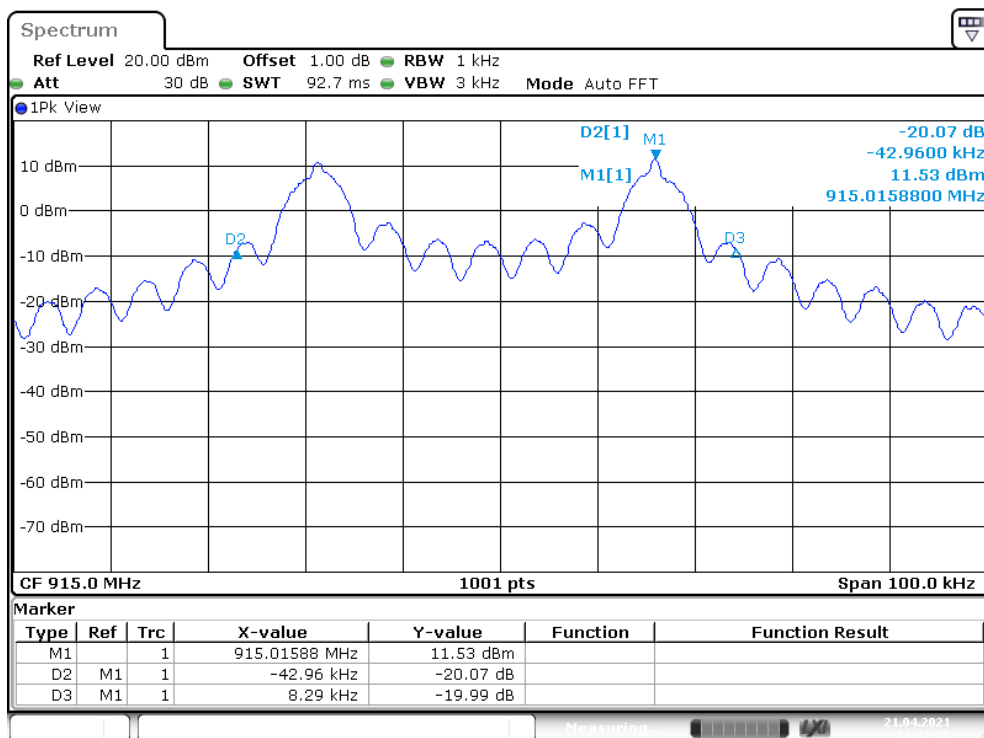


Date: 21 APR 2021 14:35:15

Plot A1

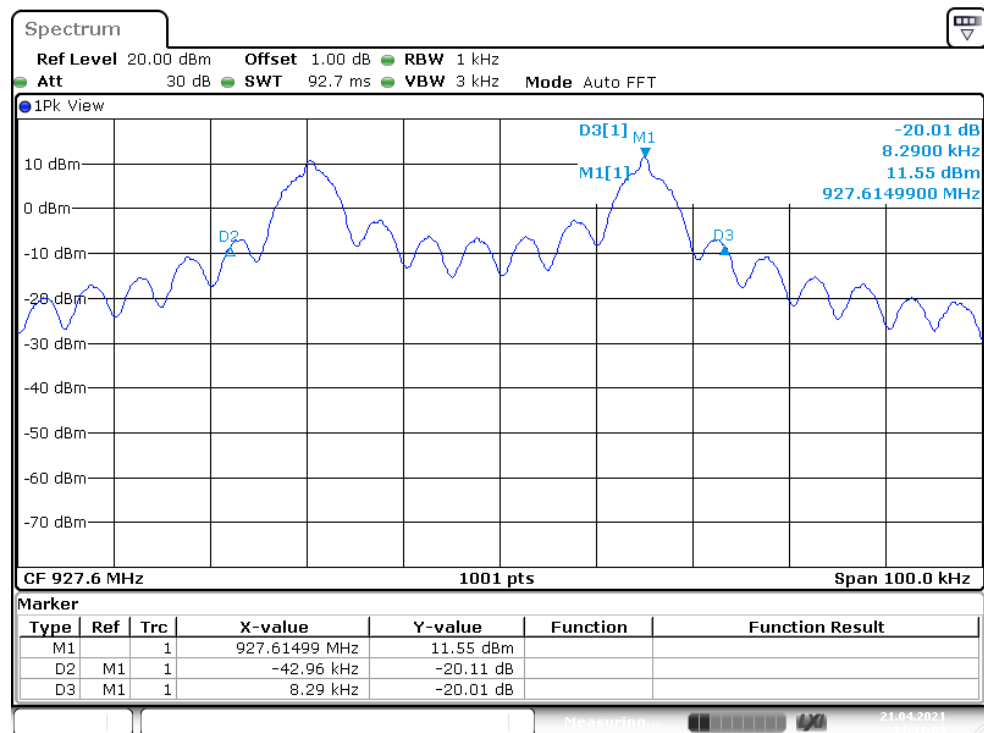
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Date: 21 APR 2021 14:32:35

Plot B1



Date: 21 APR 2021 14:31:08

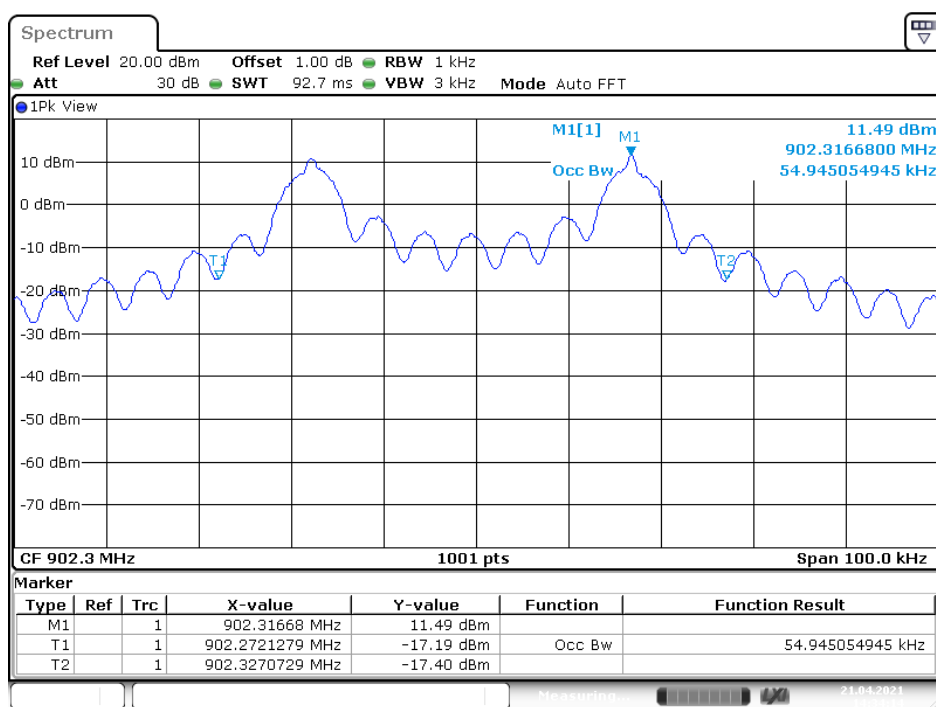
Plot C1

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Operating Frequency [MHz]	99% Bandwidth [kHz]	Limit [kHz]	Verdict [Pass/Fail]	Plot number
902.3	54.95	N/A	N/A	A2
915.0	54.55	N/A	N/A	B2
927.6	54.85	N/A	N/A	C2

N/A = Not applicable, for info only

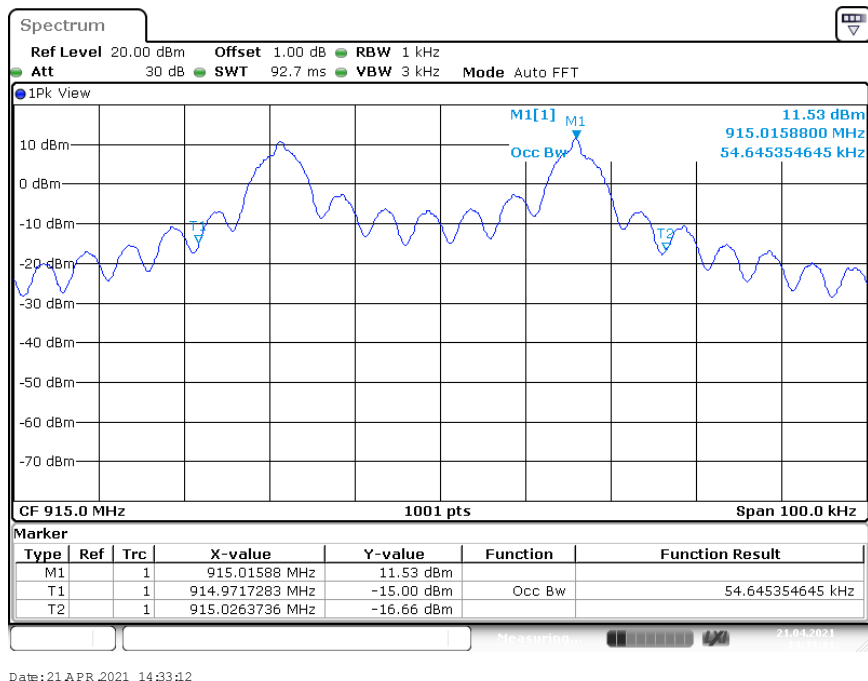


Date: 21.APR.2021 14:34:15

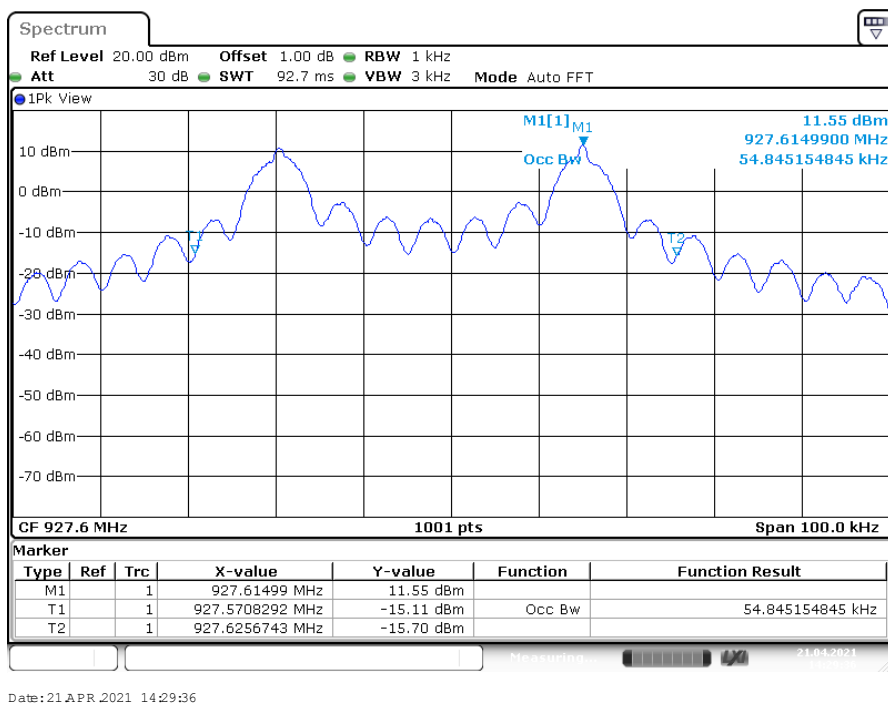
Plot A2

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Plot B2



Plot C2

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4 Hopping characteristics.

RESULT: PASS

Date of testing: 2021-04-29 / 2021-05-12

Requirements:

FCC 15.247(a)(1)(i) and RSS-247 Section 5.1(c).

For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz. Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Test procedure:

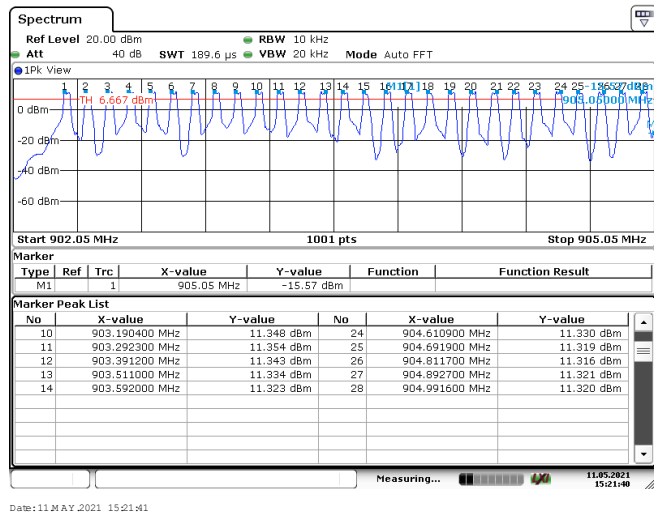
ANSI C63.10-2013

The tests were done with the conducted test setup. See plots on the next pages.

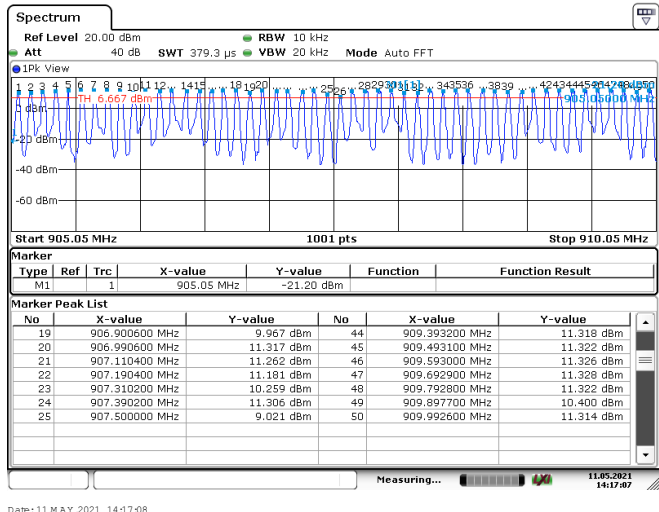
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Plot 7 (spread over 6 plots): more than 50 (actual = 254) hopping frequencies as required by section 15.247
(a)(1)(i), as measured on a spectrum analyzer



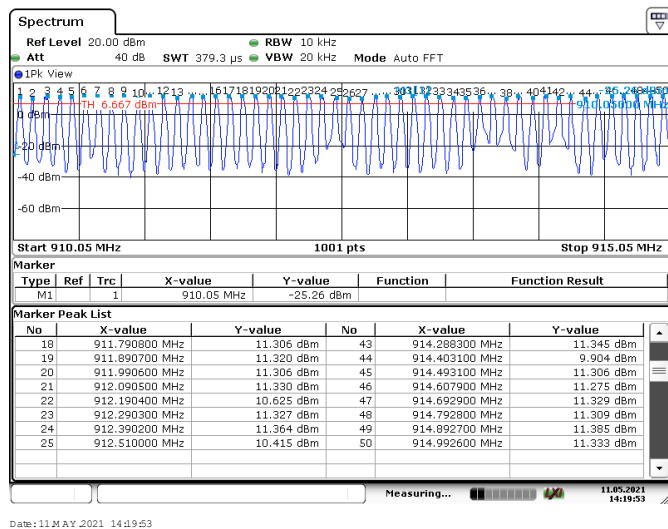
Date: 11 MAY 2021 15:21:41



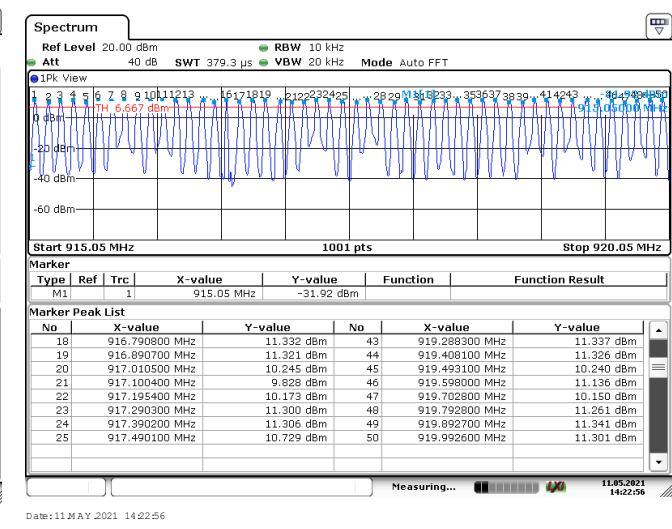
Date: 11 MAY 2021 14:17:08

Plot: 28 channels in the range 902-905 MHz

Plot: 50 channels in the range 905-910 MHz



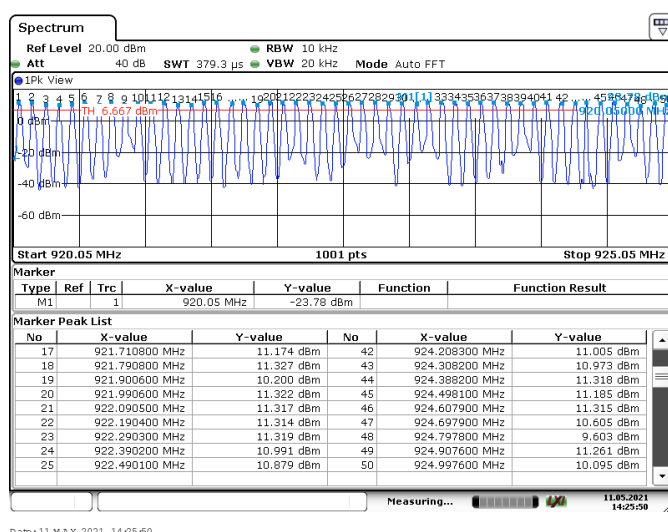
Date: 11 MAY 2021 14:19:53



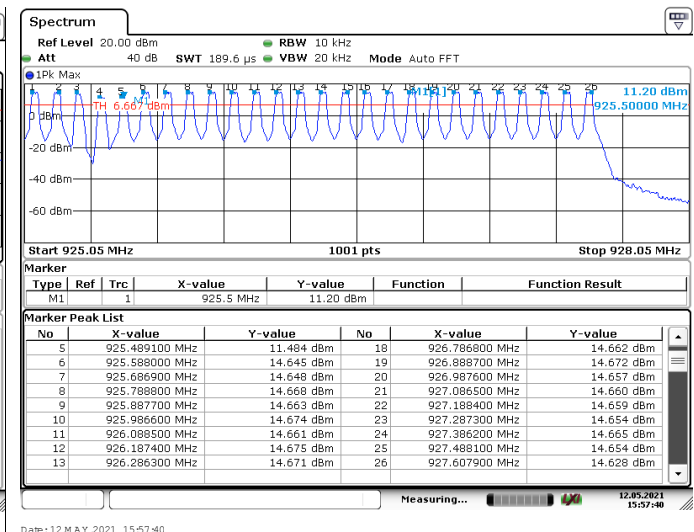
Date: 11 MAY 2021 14:22:56

Plot: 50 channels in the range 910-915 MHz

Plot: 50 channels in the range 915-920 MHz



Date: 11 MAY 2021 14:25:50



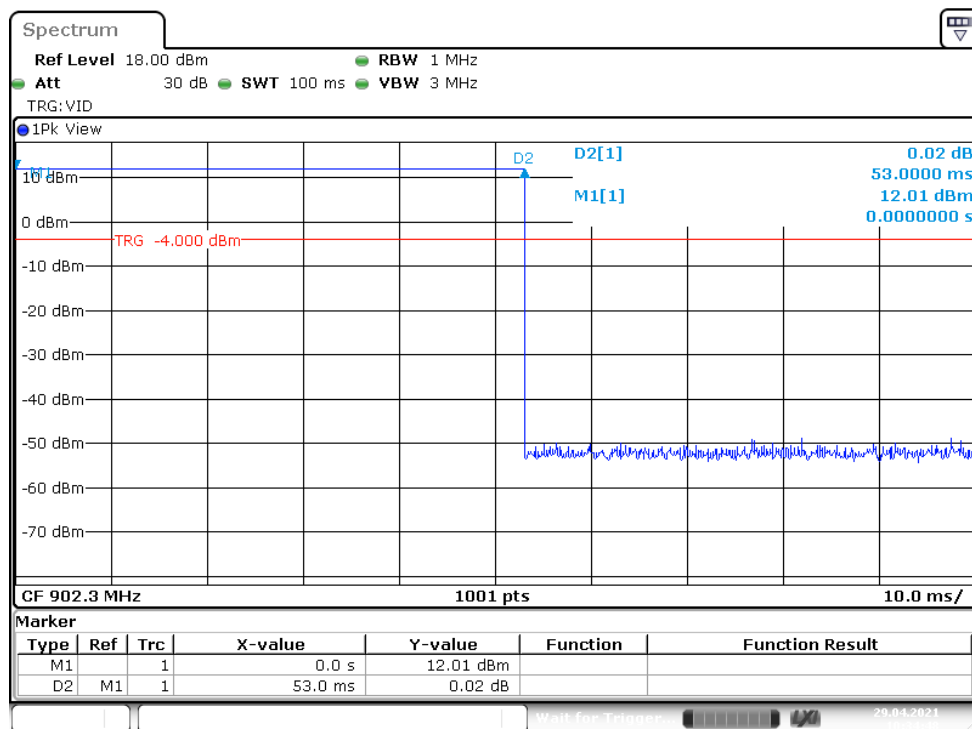
Date: 12 MAY 2021 15:57:40

Plot: 50 channels in the range 920-925 MHz

Plot: 26 channels in the range 925-928 MHz

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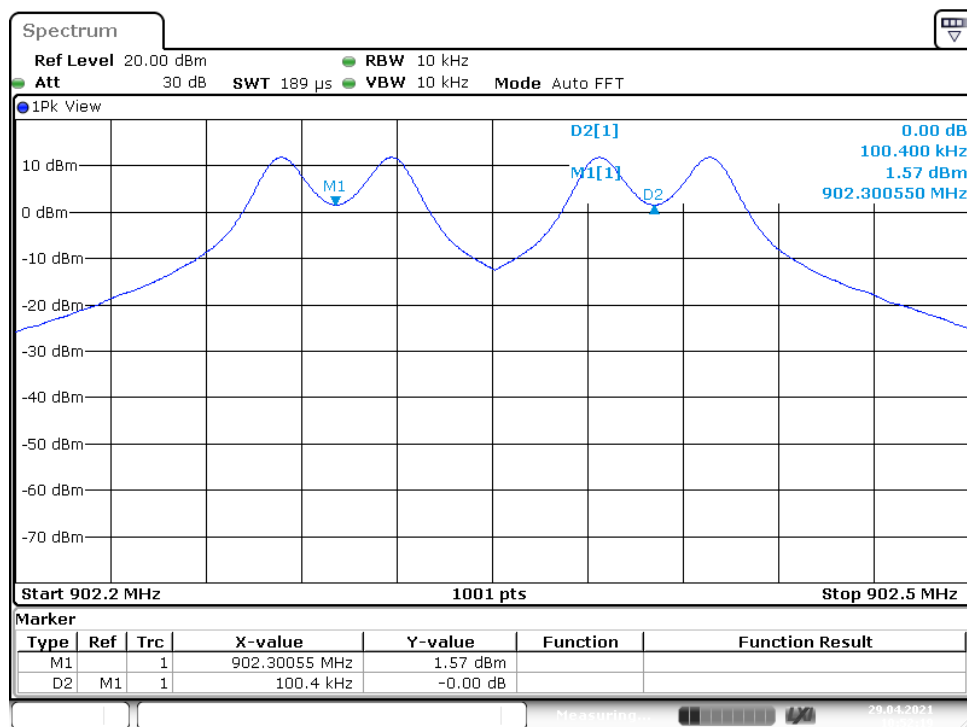
Date: 29 APR 2021 10:34:48

Plot 8: showing Average time of occupancy of 1 hop

Average time of occupancy (Dwell time) as measured on a spectrum analyzer. Plot 8 shows a hoplength of 53.0 ms for 1 channel. The EUT has 254 channels $254 \times 53.0 = 13462 \text{ ms}$. The channel may there for transmit $20/13.462 = 1.48$ times. The average time of occupancy would therefore be $1.48 \times 53.0 \text{ ms} = 78.4 \text{ ms}$, which is below the 400 ms limit.

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Plot 9: showing approximately 100 kHz spacing between channels as measured on a spectrum analyzer

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5 Band edge emissions

RESULT: Pass

Date of testing: 2021-04-19

Requirements:

FCC 15.205, FCC 15.209, FCC 15.247(d) and RSS-247 section 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Test procedure: ANSI C63.10-2013 Section 7.8.6 and 6.10

A RF conducted measurement was done using the marker-delta method, as described in ANSI C63.10.

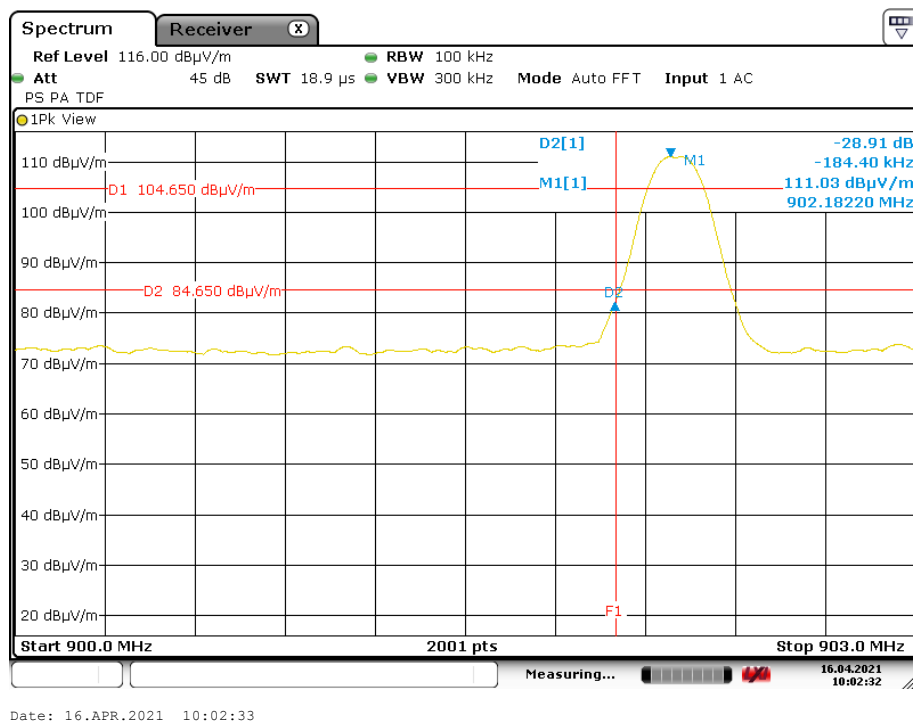
Measurements were performed using a spectrum analyzer with a suitable span to encompass the peak of the fundamental and using the following settings:
RBW = 100kHz, VBW = 300kHz.

The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.
Measurement uncertainty is +/- 2.5 dB.

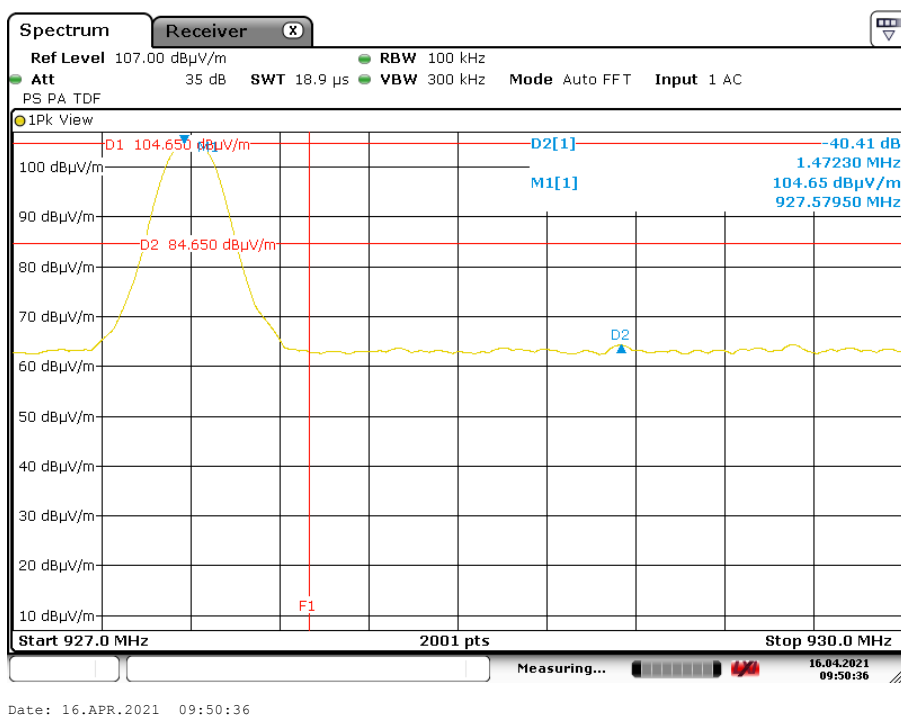
Results: All out of band spurious emissions are more than 20 dB below the fundamental.
See the figures on the following pages.

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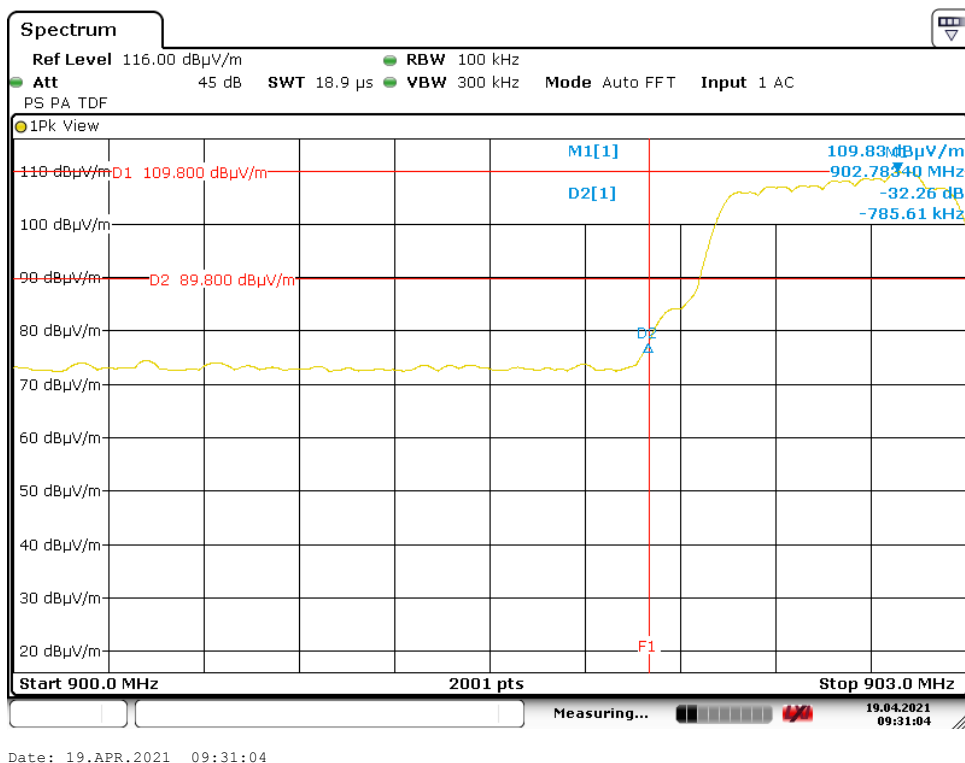
Plot: Band Edge Conducted Emission, Spectral Diagram, 902.3 MHz- EUT Y-Ant vertical (worst case situation).
Peak values, F1 shows the band edge frequency of 902 MHz.



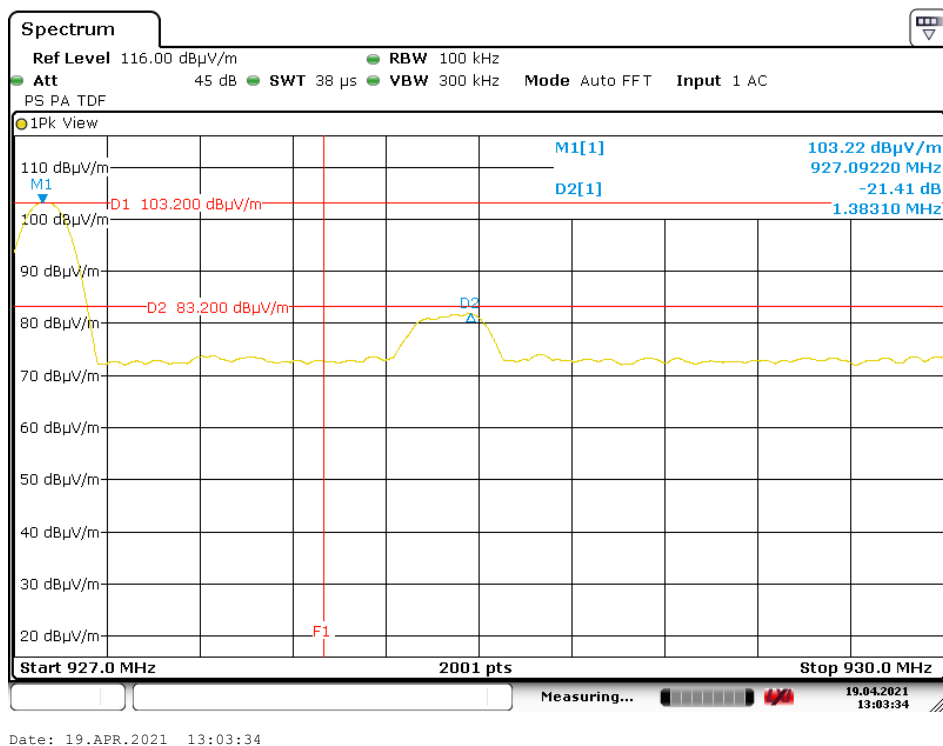
Plot: Band Edge Conducted Emission, Spectral Diagram, 927.6 MHz. Eut Y-Ant Vertical (worst case situation).
Peak values. F1 shows the band edge frequency of 928 MHz.

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Plot 12. showing more than 20 dB band edge attenuation, EUT in Hopping mode
F1 shows the band edge frequency of 902 MHz



Plot 13. showing more than 20 dB band edge attenuation, EUT in Hopping mode
F1 shows the band edge frequency of 928 MHz.

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6 Conducted spurious emissions.

RESULT: PASS

Date of testing: 2021-04-21

Requirements:

FCC 15.247(d) and RSS-247 Section 5.5.

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Test procedure:

ANSI C63.10-2013.

The tests were performed by RF conducted measurement by connecting a spectrum analyzer to the temporary SMA RF Output connector.

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

RBW = 100 kHz

VBW ≥ RBW

Sweep = auto

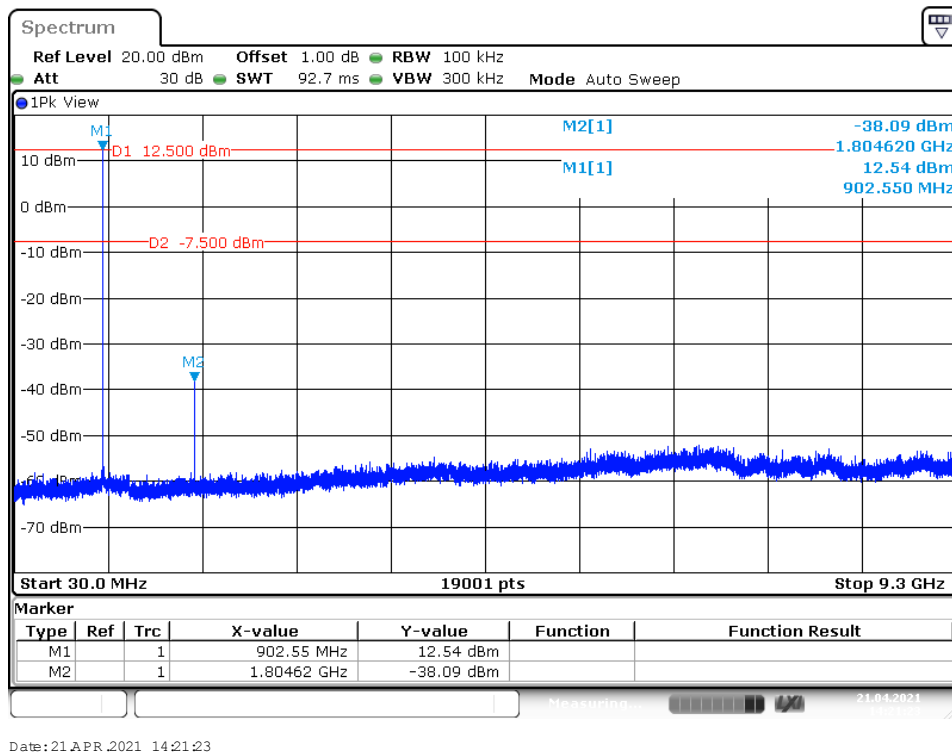
Detector function = peak

Trace = max hold

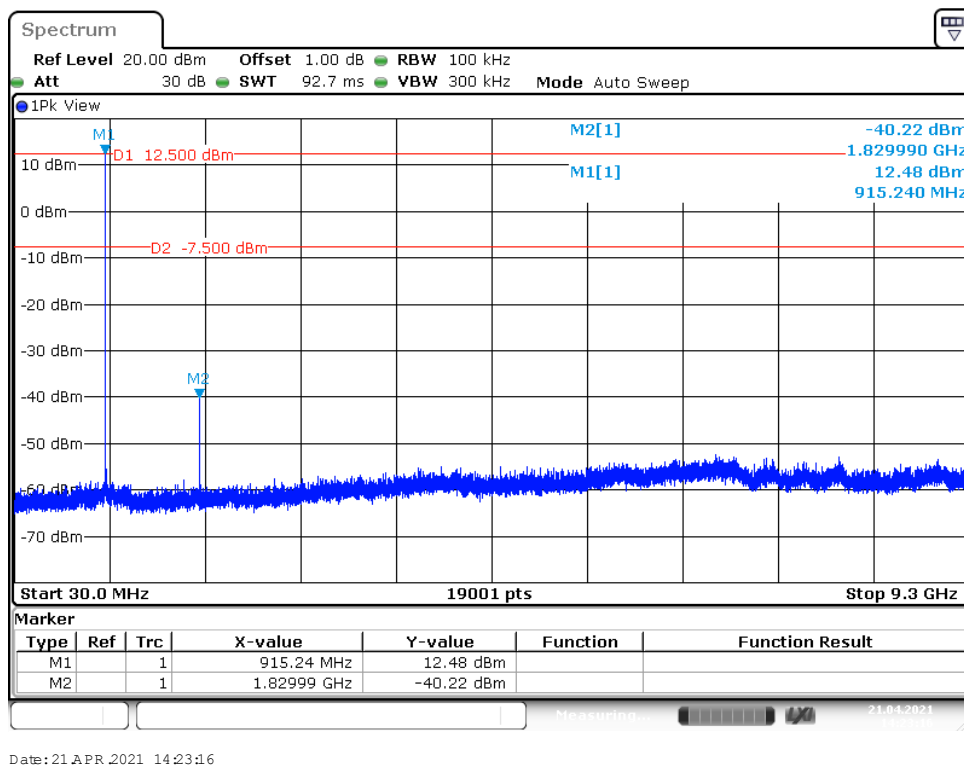
Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded. The level displayed must comply with the limit specified in this Section. See the plots on the next pages.

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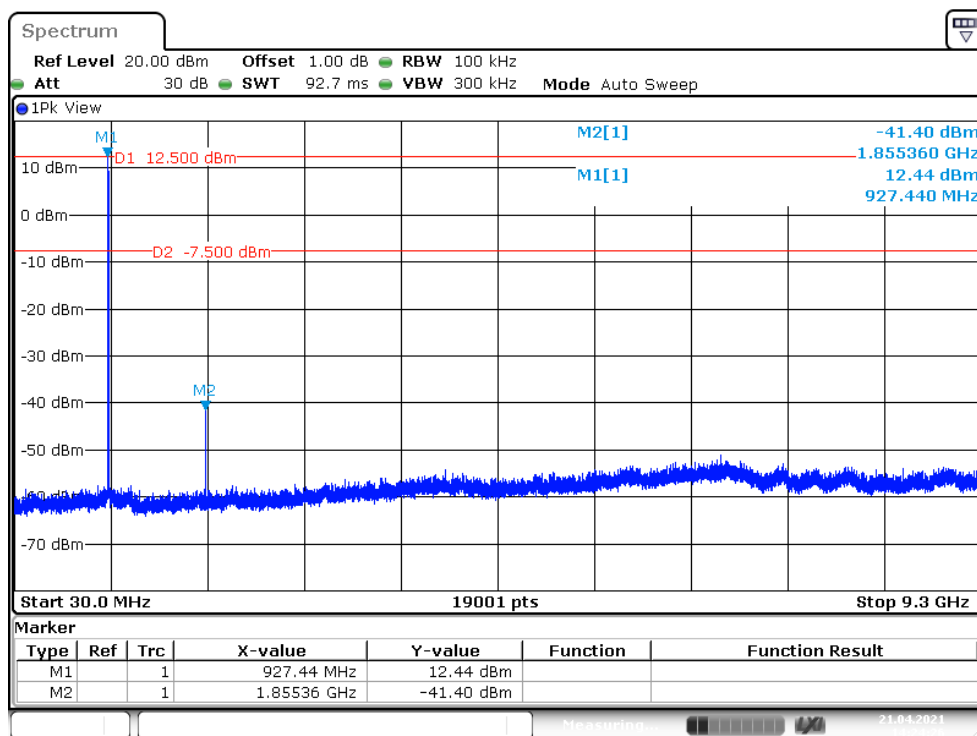
Plot 14 of the conducted spurious emission, EUT frequency 902.3 MHz Constant modulated carrier.



Plot 15 of the conducted spurious emission, EUT frequency 915.0 MHz Constant modulated carrier.

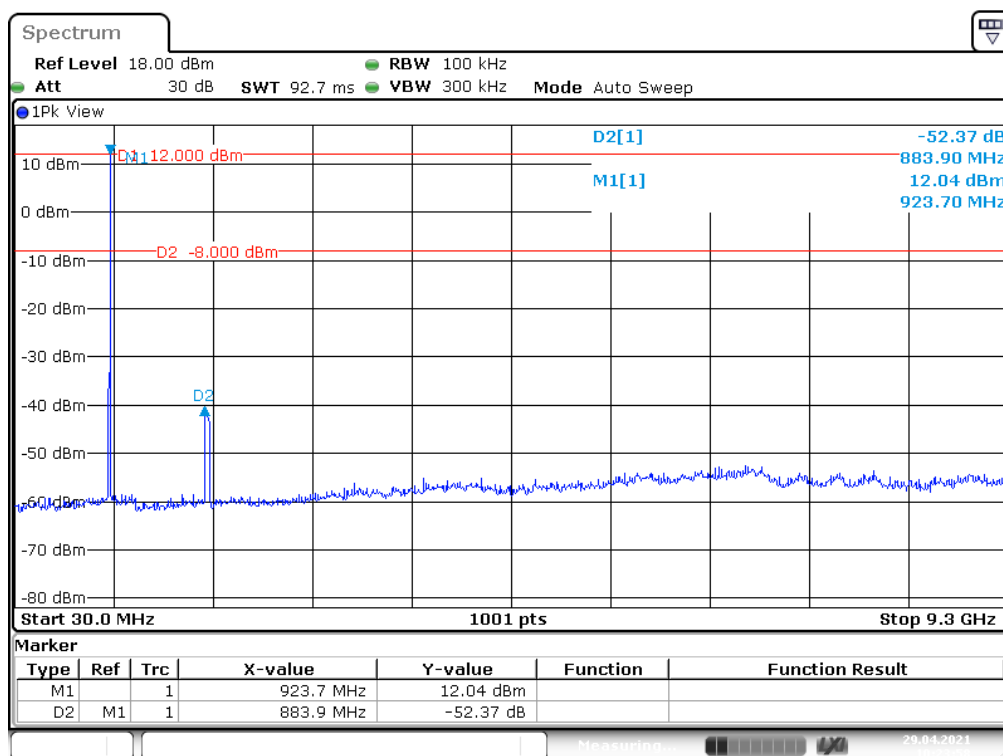
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Date: 21.04.2021 14:24:26

Plot 16 of the conducted spurious emission, EUT frequency 927.6 MHz Constant modulated carrier.



Date: 29.04.2021 10:23:59

Plot 17 of the conducted spurious emission, EUT in Hopping mode.

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7 Radiated spurious emissions

RESULT: PASS

Date of testing: 2021-04-16/19

Frequency range: 30MHz - 9.3GHz

Requirements:

FCC 15.209 and FCC 15.247(d) and RSS-Gen

Radiated emissions which fall outside the operation frequency band and outside restricted bands shall either meet the limit specified in FCC 15.209(a) or be attenuated at least 20dB below the power level in the 100kHz bandwidth within the band that contains the highest level of the desired power (the less severe limit applies).

Radiated emissions which fall in the restricted bands, as defined in FCC 15.205(a) and RSS-Gen Table 6, must comply with the radiated emission limits specified in FCC 15.209(a) and RSS-Gen Table 4.

Test procedure:

ANSI C63.10-2013.

The EUT was placed on the test site turntable. Before final measurements of radiated emissions were performed, the EUT was scanned to determine its emission spectrum profile. The physical arrangement of the test system, the associated cabling were varied in order to ensure that maximum emission amplitudes were attained.

The spectrum was examined from 30MHz to the 10th harmonic of the highest fundamental transmitter frequency. Final radiated emission measurements were made at 3m distance.

At each frequency where a spurious emission was found, the EUT was rotated 360° and the antenna was raised and lowered from 1 to 4m in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations.

The highest emission amplitudes relative to the appropriate limit were recorded in this report. Field strength values of radiated emissions at frequencies not listed in the tables are more than 20 dB below the applicable limit. Average values were calculated by subtracting the duty cycle value (see section 7) from the measured Peak (Pk) value.

$A_v = P_k - \text{Duty Cycle}$.

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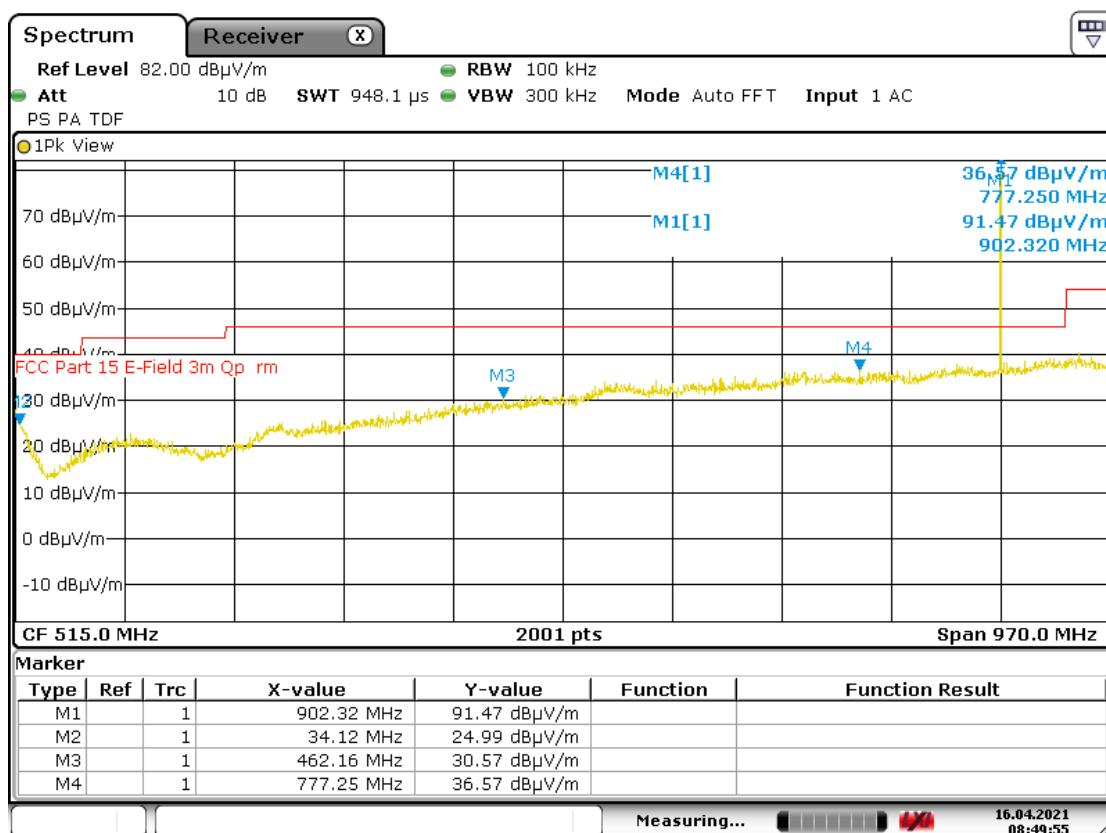
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Radiated Emissions, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations

Frequency [MHz]	EUT Orientation	Antenna Orientation	Level QP [dBµV/m]	Limit QP [dBµV/m]	Verdict [Pass/Fail]
32.2	Horizontal	Horizontal	26.4	40.0	Pass
257.1	Vertical	Horizontal	25.2	46.0	Pass
575.6	Vertical	Vertical	31.3	46.0	Pass
781.6	Vertical	Horizontal	35.1	46.0	Pass
792.8	Vertical	Horizontal	36.5	46.0	Pass
800-960 noise	-	Vertical	37.3	46.0	Pass

Notes:

- Tested in modes as described in section 4.2, the 6 highest values noted.
- Preliminary measurements indicated that the radiated emissions from EUT were not affected by the EUT's operating mode or frequency.
- *R refers to a frequency in a restricted band
- Quasi Peak detector used with a bandwidth of 120 kHz.
- Measurement uncertainty is +/- 5.22 dB.



Date: 16.APR.2021 08:49:56

Plot of the emissions (Peak detector values shown)

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Radiated Emissions, 1 – 9.3GHz, 902.3 MHz.

Frequency [MHz]	EUT Orientation	Antenna Orientation	Detector	Bandwidth (MHz)	Level [dBµV/m]	Limit [dBµV/m]	Result
1804.9 ^{*H}	X	Vertical	Pk	1	52.9 Pk/ 47.4 Av	74 (Pk) 54 (Av)	Pass
2706.9 ^{*H}	X	Vertical	Pk	1	51.9 Pk/ 46.4 Av	74 (Pk) 54 (Av)	Pass
3609.7 ^{*H}	X	Horizontal	Pk	1	48.8 Pk/ 43.3 Av	74 (Pk) 54 (Av)	Pass
4510.4 ^{*H*R}	Z	Horizontal	Pk	1	57.7 Pk 52.2 Av	74 (Pk) 54 (Av)	Pass
5412.0 ^{*H*R}	Z	Horizontal	Pk	1	51.3 Pk/ 45.8 Av	74 (Pk) 54 (Av)	Pass

Radiated Emissions, 1 – 9.3GHz, 915.0 MHz.

Frequency [MHz]	EUT Orientation	Antenna Orientation	Detector	Bandwidth (MHz)	Level [dBµV/m]	Limit [dBµV/m]	Result
1830.4 ^{*H}	X	Horizontal	Pk	1	53.4 Pk/ 47.9 Av	74 (Pk) 54 (Av)	Pass
2745.9 ^{*H}	Y	Horizontal	Pk	1	52.0 Pk/ 46.5 Av	74 (Pk) 54 (Av)	Pass
3659.9 ^{*H}	Y	Horizontal	Pk	1	53.9 Pk/ 48.4 Av	74 (Pk) 54 (Av)	Pass
4575.0 ^{*H*R}	Z	Horizontal	Pk	1	58.5 Pk 53.0 Av	74 (Pk) 54 (Av)	Pass
5435.5 ^{*H*R}	Z	Horizontal	Pk	1	49.1 Pk/ 43.6 Av	74 (Pk) 54 (Av)	Pass

Radiated Emissions, 1 – 9.3GHz, 927.6 MHz.

Frequency [MHz]	EUT Orientation	Antenna Orientation	Detector	Bandwidth (MHz)	Level [dBµV/m]	Limit [dBµV/m]	Result
1855.2 ^{*H}	X	Horizontal	Pk	1	52.0 Pk/ 46.5 Av	74 (Pk) 54 (Av)	Pass
2783.4 ^{*H}	Y	Horizontal	Pk	1	52.9 Pk/ 47.4 Av	74 (Pk) 54 (Av)	Pass
3710.9 ^{*H}	Y	Horizontal	Pk	1	58.6 Pk 53.1 Av	74 (Pk) 54 (Av)	Pass
4638.1 ^{*H*R}	Vertical	Horizontal	Pk	1	50.2 Pk/ 44.7 Av	74 (Pk) 54 (Av)	Pass
5565.5 ^{*H}	Vertical	Horizontal	Pk	1	50.5 Pk/ 45.0 Av	74 (Pk) 54 (Av)	Pass

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Radiated Emissions, 1 – 9.3GHz, Hopping mode.

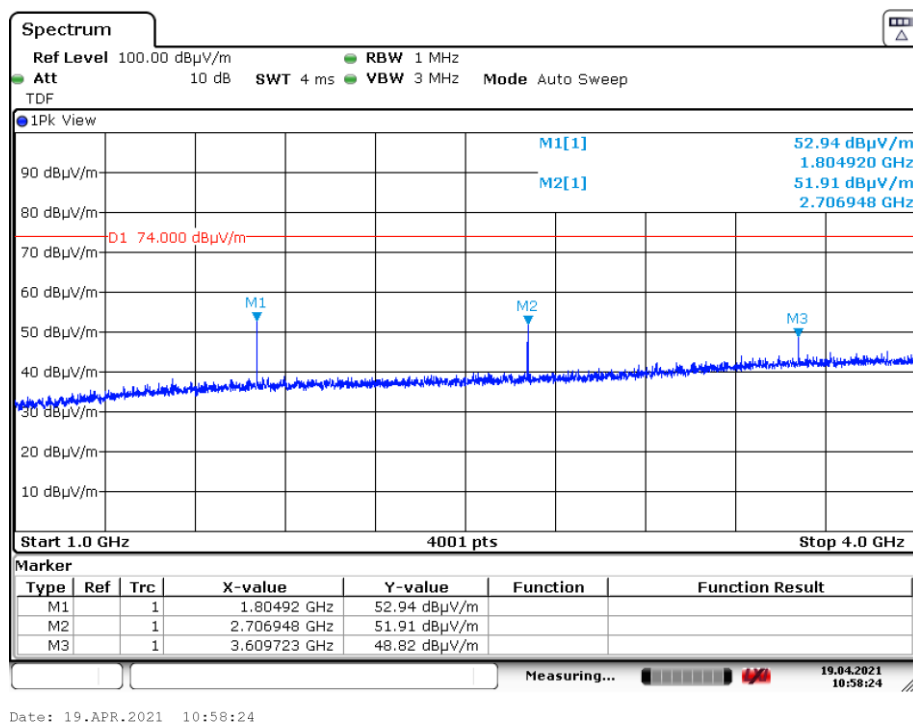
Frequency [MHz]	EUT Orientation	Antenna Orientation	Detector	Bandwidth (MHz)	Level [dBµV/m]	Limit [dBµV/m]	Result
1860 ^{*H}	X	Horizontal	Pk	1	52.0 Pk/ 46.5 Av	74 (Pk) 54 (Av)	Pass
2785 ^{*H}	Y	Horizontal	Pk	1	51.2 Pk/ 45.7 Av	74 (Pk) 54 (Av)	Pass
3712 ^{*H}	Y	Horizontal	Pk	1	53.2 Pk 47.7 Av	74 (Pk) 54 (Av)	Pass
4640 ^{*H*R}	Vertical	Horizontal	Pk	1	50.4 Pk/ 44.9 Av	74 (Pk) 54 (Av)	Pass
5560 ^{*H}	Vertical	Horizontal	Pk	1	50.5 Pk 45.0 Av	74 (Pk) 54 (Av)	Pass

- Notes:
- *R refers to a frequency in a restricted band,
 - *H refers to a frequency which is a harmonic of the fundamental.
 - Field strength values of radiated emissions not listed in the tables above are more than 20 dB below the applicable limit.
 - Measurement uncertainty is +/- 5.5 dB.
 - a selection of plots is provided on the next pages
 - Av values are calculated from the peak value, using the -5.5 dB duty cycle correction factor, see section 7 for Duty Cycle info.

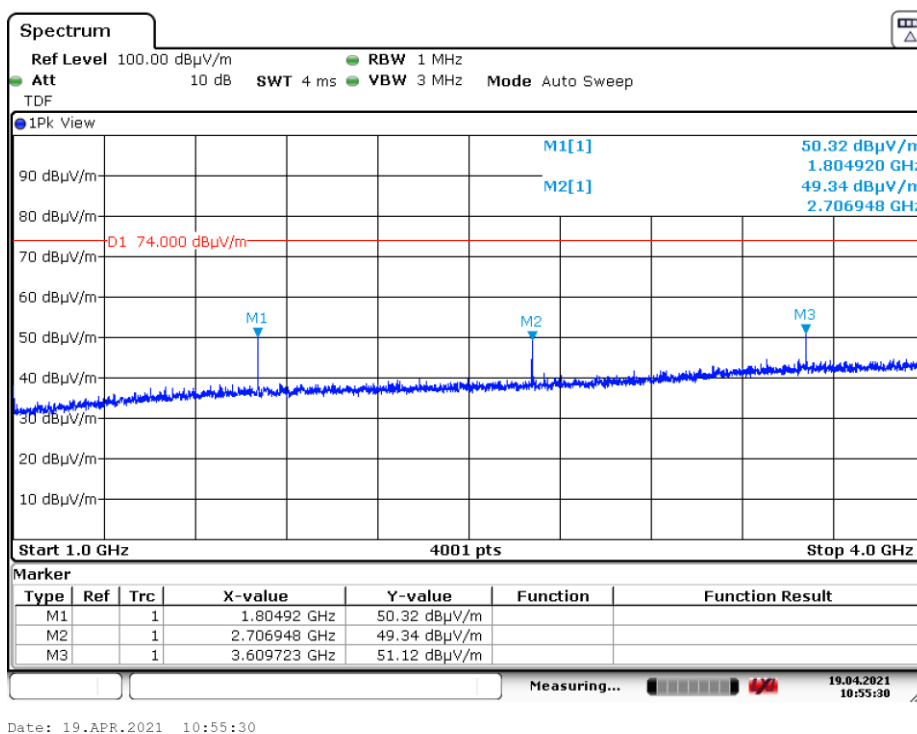
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Plots of the radiated emissions



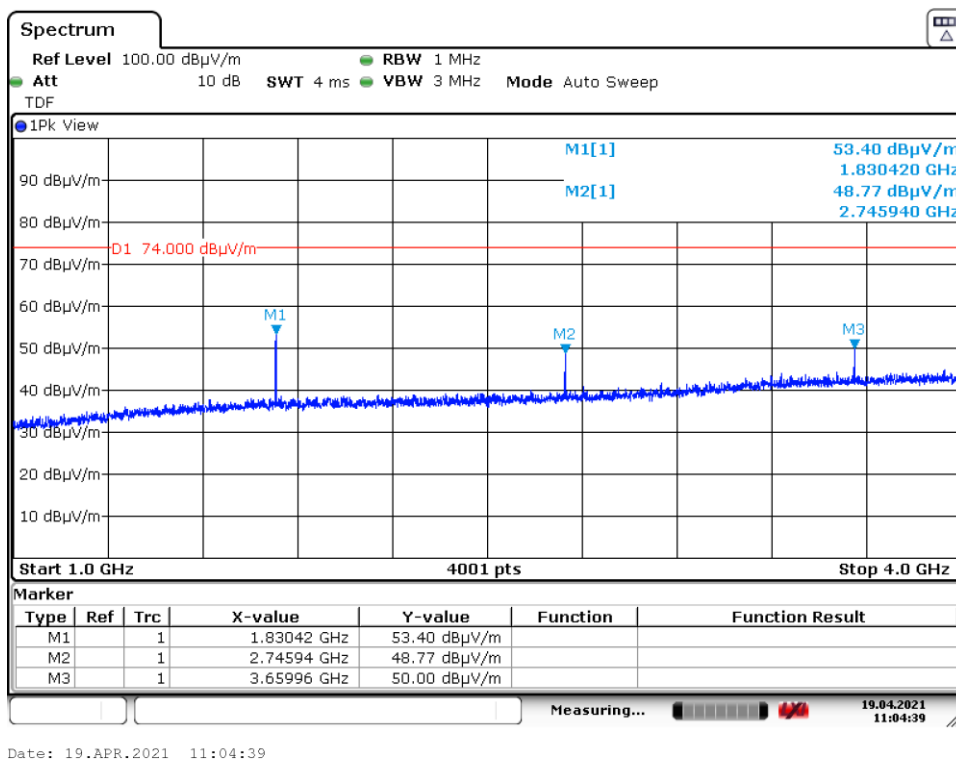
Plot of the emissions in the range 1 – 4 GHz at 902.3 MHz, EUT X - Horizontal polarization, Peak values shown



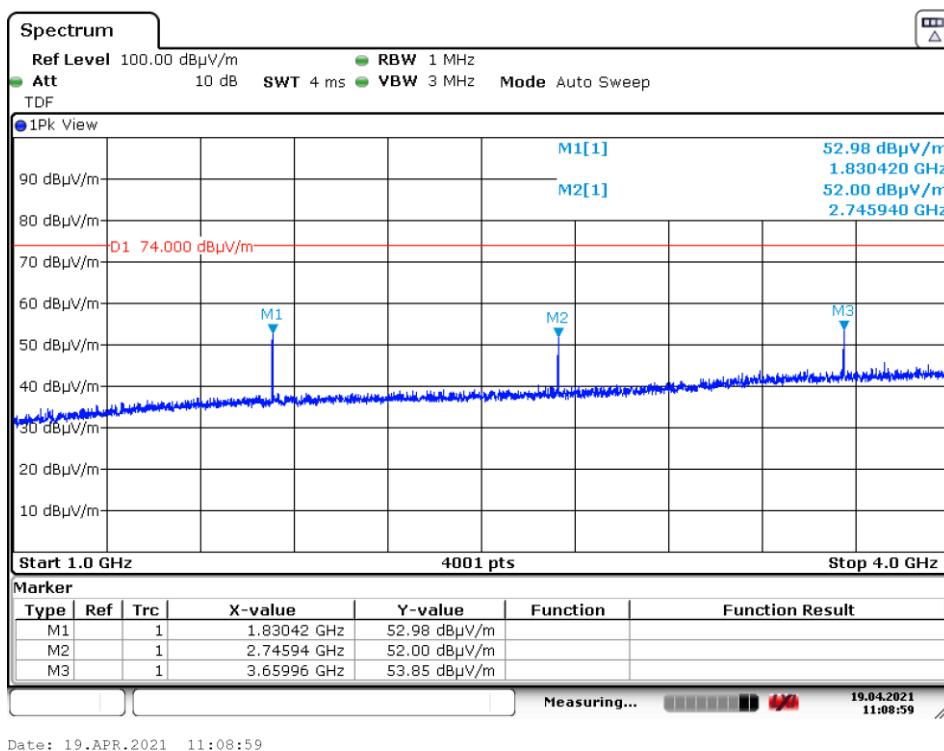
Plot of the emissions in the range 1 – 4 GHz at 902.3 MHz, EUT X - Vertical polarization, Peak values shown

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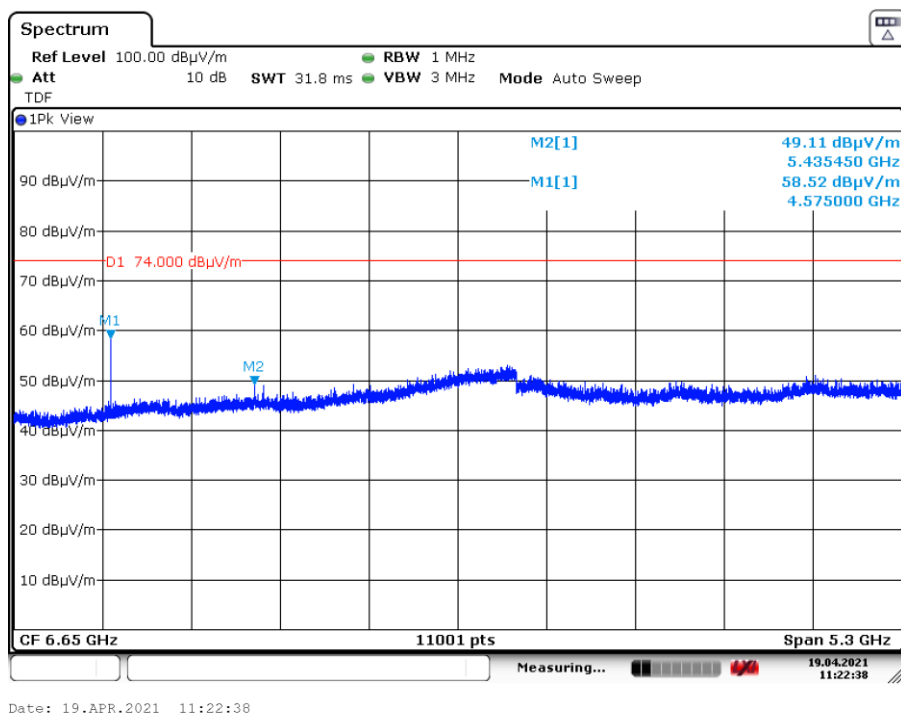
Plot of the emissions in the range 1 – 4 GHz at 915.0 MHz, EUT X-Horizontal polarization, Peak values shown



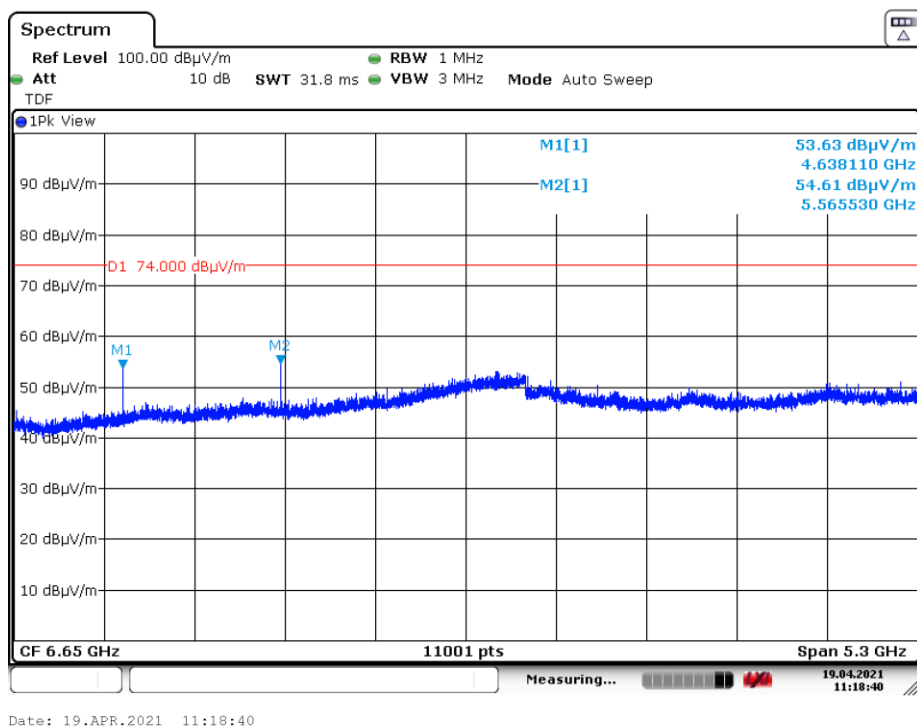
Plot of the emissions in the range 1 – 4 GHz at 915.0 MHz, EUT Y-Horizontal polarization, Peak values shown

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Plot of the emissions at 915.0 MHz, in the range 4 to 9.3 GHz, EUT Z-Horizontal polarization, Peak values shown



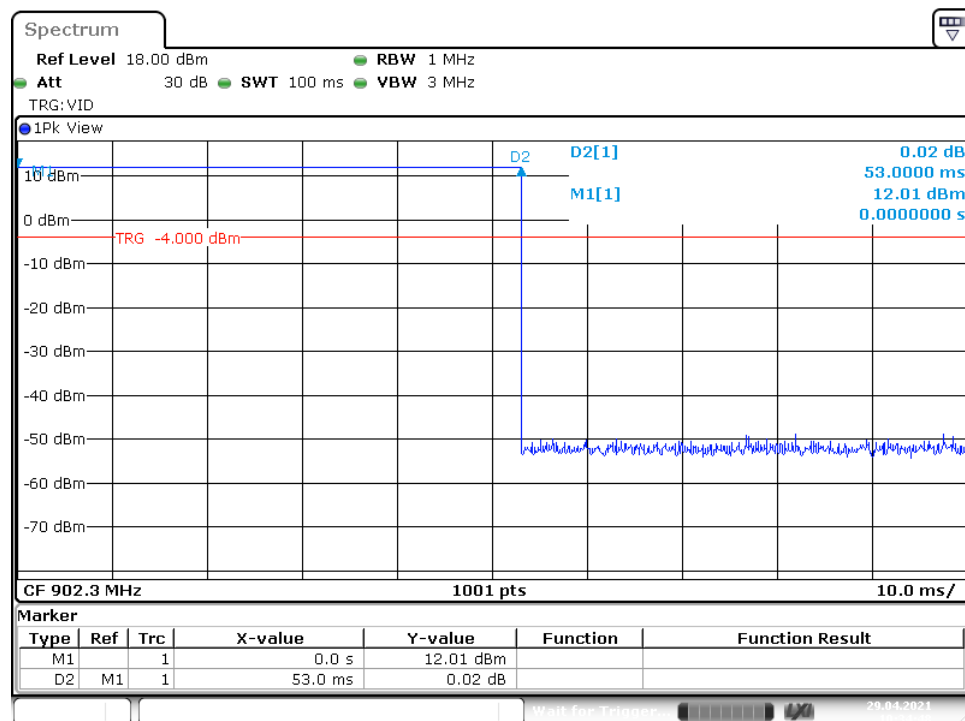
Plot of the emissions at 927.6 MHz, in the range 4 to 9.3 GHz, EUT Z-Horizontal polarization, Peak values shown

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7.1 Duty Cycle info

1 peak was observed in a 100 ms interval. The peak was measured to have a duration of 53.0 ms. Using the formula Average factor (dB) = $20 \cdot \log(53.0\text{ms} / 100\text{ms})$, the duty cycle average factor is therefore -5.5 dB.



Date: 29 APR 2021 10:34:48

Plot shows the RF On/Off characteristics of the EUT's emissions. From these characteristics a correction factor is calculated that is required to derive Average values from the measured peak values of the emissions.

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8 AC power line conducted emissions

RESULT: PASS.

Date of testing: 2021-04-30

Requirements: for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

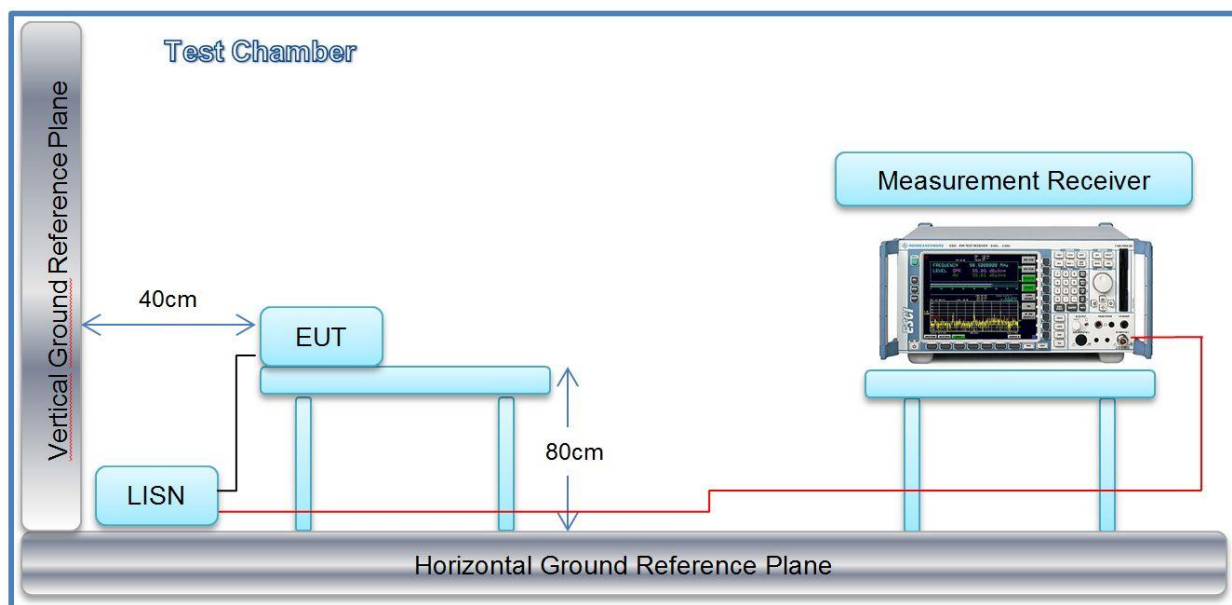
Frequency of Emission (MHz)	Conducted Limit (dB μ V) Quasi-Peak	Conducted Limit (dB μ V) Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 - 30	46	50

*Decreases with the logarithm of the frequency.

Test procedure:

ANSI C63.10-2013.

Each phase and neutral of the AC power line were measured with respect to ground. Measurements were performed using a 50 μ H / 50 Ω LISN. The frequency range from 150kHz to 30MHz was searched. The six highest EUT emissions relative to the limit were noted. The EUT was positioned at least 80cm from the LISN. The power cable was routed over the non-conductive plate to the LISN.



Block diagram of the test setup

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8.1 AC power line conducted emissions

EUT is battery operated and the batteries can be charged by use of AUX. The test results in charging mode are provided below.

Frequency (MHz)	Measurement results (dBµV) L1		Measurement results (dBµV) L2/Neutral		Limits (dBµV)		Verdict (Pass/Fail)
	QP	AV	QP	AV	QP	AV	
0.1696	25.2	*	24.9	*	65.0	55.5	Pass
0.3375	25.0	*	28.8	*	59.5	49.5	Pass
0.3492	26.1	*	18.8	*	59.0	49.0	Pass
0.5758	22.2	*	20.0	*	56.0	46.0	Pass
8.5016	20.2	*	20.0	*	60.0	50.0	Pass
22.450	20.0	*	21.0	*	60.0	50.0	Pass

The results of the AC power line conducted emission tests, carried out in accordance with 47 CFR Part 15 section 15.207(a) and RSS-Gen section 8.8, at the 120 Volts/ 60 Hz AC mains connection terminals of the AUX that connects to the EUT, are depicted in the table above.

Notes:

1. The resolution bandwidth used was 9 kHz.
2. * Qp values already within Av limits, therefor Av not tested. Worst case values noted
3. Measurement uncertainty is +/- 3.2 dB.
4. Plots are provided on the next pages.

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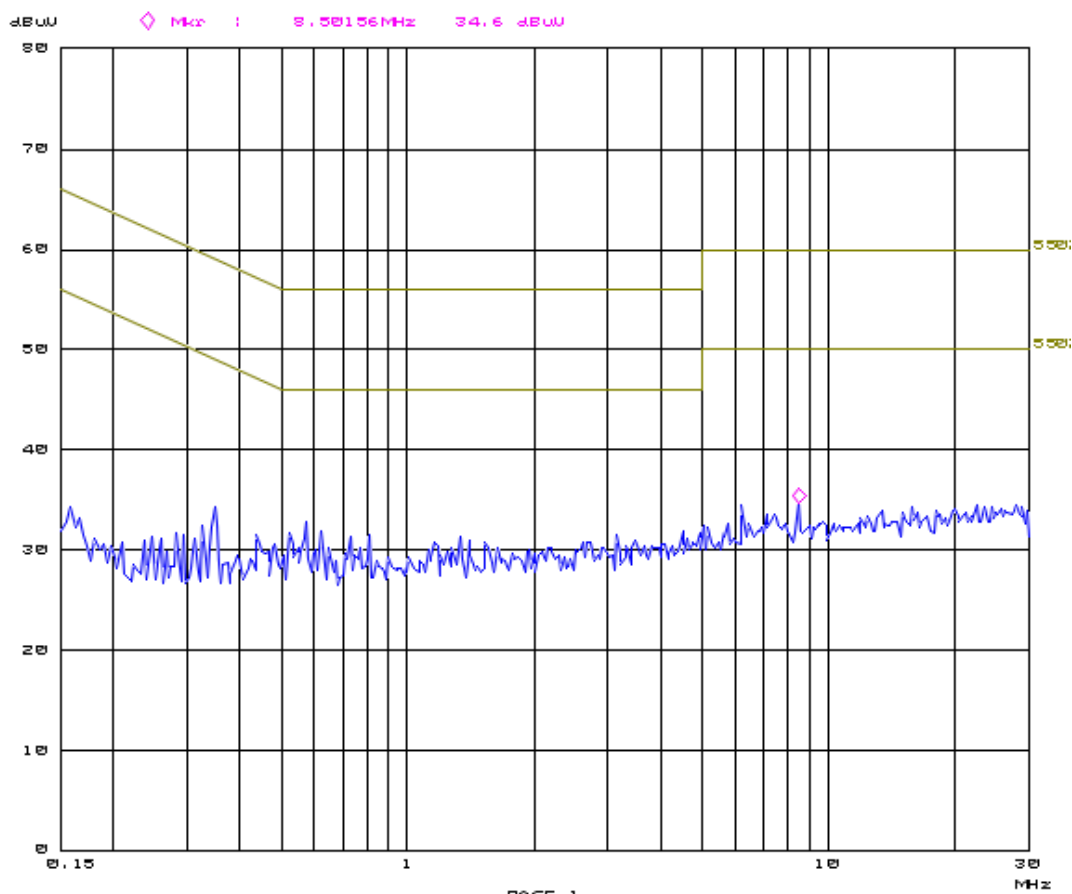
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8.1.1 Plots of the AC power line conducted emissions

30. Apr 21 13:52

Overview Scan Settings (1 Range)

Frequencies			Receiver Settings				
Start	Stop	Stop	IF BW	Detector	M-Time	Atten	Preamp
150k	30M	3.9k	9k	PK	0.10ms	20dB LN	OFF



Plot of the AC power line conducted emissions on L1

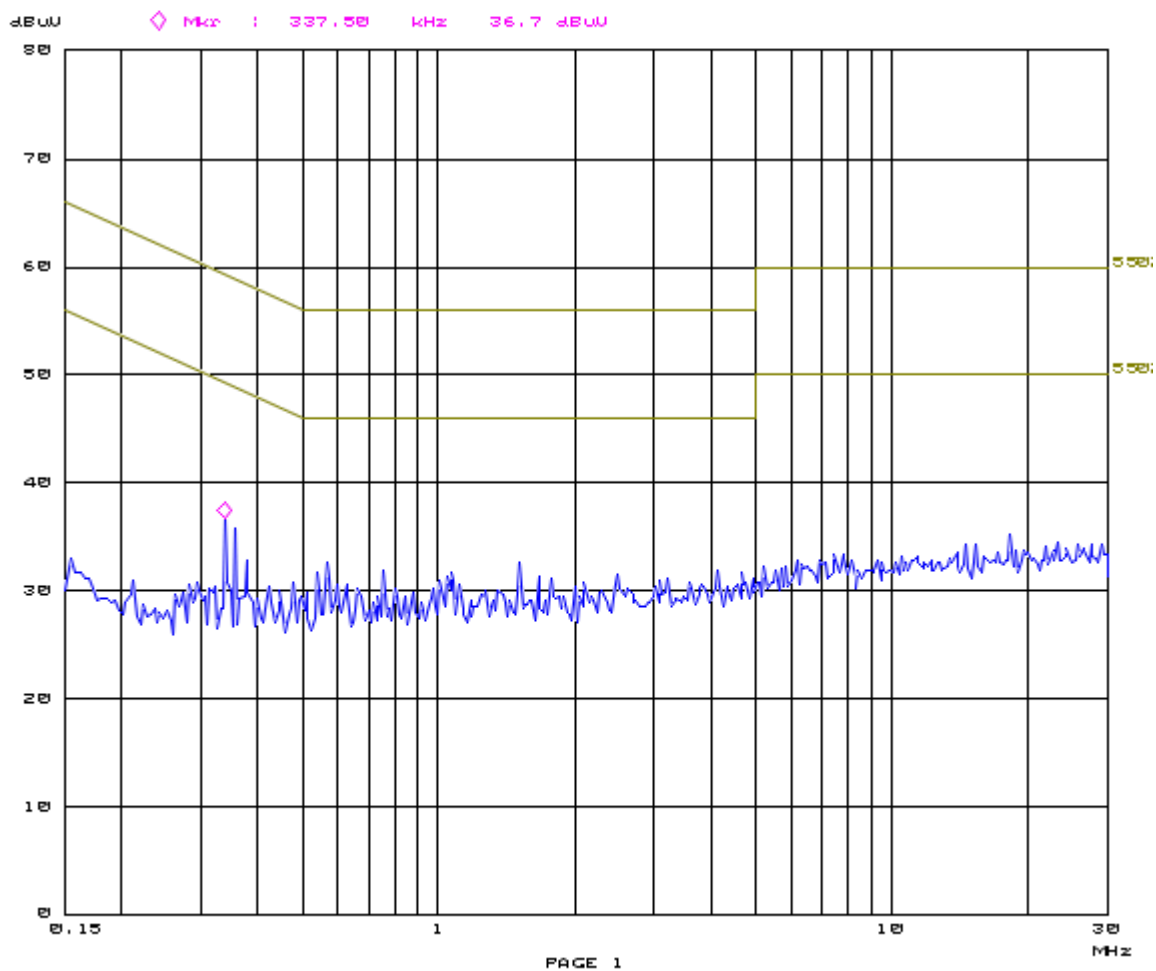
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30. Apr 21 14:07

Overview Scan Settings (1 Range)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	30M	3.9k	9k	PK	0.10ms	20dB LN	OFF



Plot of the AC power line conducted emissions on N

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9 Test equipment and ancillaries used for tests.

To facilitate inclusion of the test equipment, used for performing the tests, on each page of this test report, each item of test equipment and ancillaries, such as cables, must be identified (numbered) by the test laboratory.

Kind of Equipment	Manufacturer	Model Name	Inventory number	Calibration date (dd/mm/yyyy)	Calibration due date (dd/mm/yyyy)
Guide ant. 1-18GHz	Emco	3115	2789777	02/2021	02/2022
1 GHz HPF	Wainwright	WHKX12-	2790266	06/2020	06/2021
Measurement Receiver	Rohde & Schwarz	ESR7	2790499	18/09/2020	18/09/2021
RF Cable S-AR	Gigalink	APG0500	2789217	12/03/2021	12/03/2022
Controller	Maturo	SCU/088/ 8090811	2789220	N/A	N/A
Antenna mast+control	Innco Systems	MA4640-XP-ET- 0800-com	9002463	N/A	N/A
S-AR Setup Radiated Emission	EMCS	RFS06S	2789029	11/2020	11/2021
Test facility	Comtest	FCC listed: 786213 IC: 2932G-2	2789009	08/03/2020	08/03/2022
Spectrum Analyzer	Rohde & Schwarz	FSV	2789106	31/08/2020	31/08/2021
Temperature-Humiditymeter	Extech	SD500	2789214	03/07/2020	03/07/2021
Biconilog Testantenna	Teseq	CBL 6111D	2789237	04/08/2020	04/08/2021

For antenna port conducted tests

Kind of Equipment	Manufacturer	Model Name	Inventory number	Calibration date (dd/mm/yyyy)	Calibration due date (dd/mm/yyyy)
Spectrum Analyzer	Rohde & Schwarz	FSV	2789290	31/08/2020	31/08/2021
T/ Rh meter	Extech	SD500	2789214	03/07/2020	03/07/2021
Cable RF	Huber + Suhner	Sucotest 18/ Sucoflex 102	2789116	30/06/2020	30/06/2021

Kind of Equipment	Manufacturer	Model Name	Inventory number	Calibration date (dd/mm/yyyy)	Calibration due date (dd/mm/yyyy)
For AC Powerline Conducted Emissions					
Pulse limiter	R&S	ESH3-Z2	2788823	24/09/2020	24/09/2021
LISN	Rohde & Schwarz	ESH2-Z5	2788791	21/07/2020	21/07/2021
Measurement Receiver	Rohde & Schwarz	ESCS30	2789421	12/11/2020	12/11/2021
Shielded room for Conducted emissions	--	--	2789207	NA	NA
Temperature-Humiditymeter	Extech	SD500	2789211	03/07/2020	03/07/2021
Power supply for EUT	Delta Elektronika	SM6020	2788812	22/02/2021	22/02/2022
120Vac source	EMtest	DPA500N	2789197	22/11/2019	22/11/2021

Conformance of the used measurement and test equipment with the requirements of ISO/IEC 17025:2017 has been confirmed before testing. NA= Not Applicable

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Accreditation

The reported tests were performed under ISO17025:2017 accreditation, unless otherwise specified as 'not under Accreditation'

An overview of all TÜV Rheinland Nederland B.V. accreditations, notifications and designations, please visit our website www.tuv.com/nl. You can find the relevant declarations under the download link

- END OF TEST REPORT -