TEST REPORT CONCERNING THE COMPLIANCE OF A SPREAD SPECTRUM TRANSMITTER, BRAND Nedap, HVIN/PMN UPASS TARGET REGION 2-3 WITH 47 CFR PART 15 (10-1-14 Edition), RSS-Gen (Issue 4, November 2014) and RSS-247 (Issue 1, May 2015).

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FCC listed : 90828
Industry Canada : 2932G-2
R&TTE and EMC Notified Body : 1856

TÜV Rheinland Nederland B.V.
Eiberkamp 10
9351 VT Leek
Telephone: +31 88 8887888
Telefax: +31 594 504804

E-mail: products@nl.tuv.com
Web: www.tuv.com\nl

MEASUREMENT/TECHNICAL REPORT

N.V. Nederlandsche Apparatenfabriek "Nedap"
HVIN/PMN: UPASS TARGET REGION 2-3

FCC ID: CGDUPASSTAR
IC: 1444A-UPASSTAR

This report concerns: Original grant/certification ~~Class 1 permissive change~~ ~~Verification~~ Equipment type: Spread Spectrum Transmitter (DSS)		
Report prepared by:	Name	: Richard van der Meer
	Company name	: TÜV Rheinland Nederland B.V.
	Address	: Eiberkamp 10
	Postal code/city	: 9351VT Leek
	Mailing address	: P.O. Box 37
	Postal code/city	: 9350 AA Leek
	Country	: The Netherlands
	Telephone number	: + 31 594 505 005
	Telefax number	: + 31 594 504 804
	E-mail	: products@nl.tuv.com

The data taken for this test and report herein was done in accordance with 47 CFR Part 15 (10-1-14 Edition) and the measurement procedures of ANSI C63.10-2013. TÜV Rheinland Nederland B.V. at Leek, The Netherlands, certifies that the data is accurate and contains a true representation of the emission profile of the Equipment Under Test (EUT) on the date of the test as noted in the test report. I have reviewed the test report and find it to be an accurate description of the test(s) performed and the EUT so tested.

Date: February 29, 2016

Signature:

P. de Beer
Technical Manager TÜV Rheinland Nederland B.V.

Test results summary

3 Conducted Measurements at Antenna Port
RESULT: PASS
4 Occupied bandwidth and 99% Bandwidth
RESULT: PASS
5 Hopping requirements
RESULT: PASS
6 Band Edge Conducted Emissions
RESULT: Pass
7 Conducted Spurious Emissions of Transmitter
RESULT: PASS
8 Radiated Spurious Emissions of Transmitter in restricted bands
RESULT: PASS
9 AC Power Line Conducted Emission of Transmitter
RESULT: Pass

Description of test item

Test item	:	Spread Spectrum Transmitter (DSS)
Manufacturer	:	N.V. Nederlandsche Apparatenfabriek "Nedap"
Brand	:	Nedap
HVIN/PMN	:	UPASS TARGET REGION 2-3
Serial number	:	4 and 18

Applicant information

Applicant's representative	:	Mr. J. Hulshof
Company	:	N.V. Nederlandsche Apparatenfabriek "Nedap"
Address	:	Parallelweg 2
Postal code	:	7141 DC
City	:	Groenlo
Country	:	The Netherlands
Telephone number	:	+31 544 471 162
Telefax number	:	+31 544 463 475

Test(s) performed

Location	:	Leek
Test(s) started	:	December 17, 2015
Test(s) completed	:	January 07, 2016
Purpose of test(s)	:	Equipment Authorization (Original grant/certification)
Test specification(s)	:	FCC 47 CFR Part 15, Subpart C, Section 15.247 (10-1-14 Edition) RSS-Gen (Issue 4, November 2014) an RSS-247 (Issue 1, May 2015) ANSI C63.10-2013
Test engineer(s)	:	R. van der Meer
Report written by	:	R. van der Meer
Report date	:	February 29, 2016

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The test results relate only to the item(s) tested.

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1 General information.

1.1 Product description.

1.1.1 Introduction.

The brand Nedap model UPASS TARGET REGION 2-3, hereafter referred to as EUT, is a Spread Spectrum Transmitter (DSS) and is a RFID reader. The EUT is factory configured for the 902-928 MHz band.

The device is operated by an external power supply or POE.

The content of this report and measurement results have not been changed other than the way of presenting the data. The Part 15B/Ices-003 is covered in a separate test report.

1.2 Related submittal(s) and/or Grant(s).

1.2.1 General.

This test report supports the original certification in equipment authorization files under:
FCC ID: CGDUPASSTAR and IC: 1444A-UPASSTAR.

1.3 Tested system details.

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

EUT	:	Spread Spectrum Transmitter (DSS)
Manufacturer	:	N.V. Nederlandsche Apparatenfabriek "Nedap"
Brand	:	Nedap
HVIN/PMN	:	UPASS TARGET REGION 2-3
Serial number	:	4 and 18
Hardware version	:	-
Firmware version	:	1.0
Region	:	US
Antenna	:	1 internal 6 dBi and 1 external 6 dBi
Operation frequency	:	902 – 928 MHz
Modulation	:	PR-ASK
Spreading technique	:	FHSS
Clock frequency	:	32.768 kHz, 12 MHz and 15.36 MHz
Remarks	:	operated on an external power supply or POE

AUX1	:	Mains Power Supply Adapter
Brand	:	Panasonic
Model	:	AFP0632 FP0PSA2
Serial number	:	--
Voltage input rating	:	100-240V, 50-60Hz
Voltage output rating	:	24Vdc 0.7A
Remark	:	power supply for EUT

AUX2	:	Laptop Computer
Brand	:	HP
Model	:	Compaq 610
Serial number	:	CNU94710WB
Remark	:	Contains software for programming the EUT

AUX3	:	POE
Brand	:	Black box
Model	:	LPJ000A-F
Serial number	:	--
Voltage input rating	:	100-240V-0.4A, 50-60Hz
Voltage output rating	:	48Vdc 0.32A
Remark	:	power supply for EUT

1.3.1 Description of input and output ports.

Number	Terminal	From	To	Remarks
1	Mains	AUX1	EUT Conn.5	--
2	Mains	Mains	AUX2	--
3	USB connection	AUX2	EUT Conn.1	shielded cable, for programming only

Table 1: Interconnection between EUT and auxiliary equipment

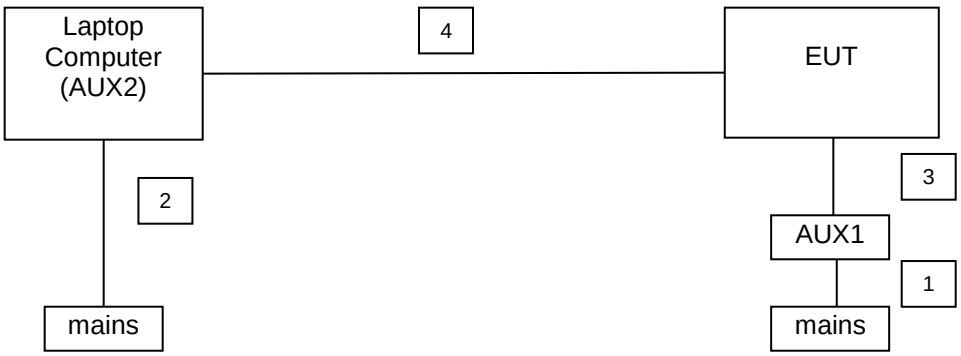


Figure 1. Blockdiagram of the basic test setup and connections

1.4 Test methodology.

The test methodology used is based on the requirements of 47 CFR Part 15 (10-1-14 Edition), sections 15.31, 15.209 and 15.247, RSS-Gen (Issue 4, November 2014) and RSS-247 (Issue 1, May 2015).

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.

1.5 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 registration number 90828. 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 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.

1.6 Test conditions.

Normal test conditions:

Temperature (*)	: +15°C to +35°C
Relative humidity(*)	: 20 % to 75 %
Supply voltage	: EUT is battery powered and batteries was fully charged for testing
Air pressure	: 950 – 1050 hPa

*When it was impracticable to carry out the tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests are stated separately.

2 System test configuration.

2.1 Justification.

The system was configured for testing in a typical fashion (as a customer would normally use it). Software was provided by the applicant to enable continues transmit mode or normal mode. Conducted measurements were performed on Ext. Ant. Output connector. The EUT switches to either Internal antenna or external antenna, and therefor never transmit on the antennas simultaneously. Both Internal- and External antenna are coupled to the same output port with only the switch in between.

The justification and manipulation of cables and equipment in order to simulate a worst-case behavior of the test setup has been carried out as prescribed in ANSI C63.10-2013.

2.2 EUT mode of operation.

The EUT has been tested in continuous transmit mode and in receive mode. Testing was performed at the lowest operating frequency (902.70 MHz), at the operating frequency in the middle of the specified frequency band (915.20 MHz) and at the highest operating frequency (927.20 MHz) and in normal operation mode (hopping on 50 channels).

2.3 Special accessories.

No special accessories are used and/or needed to achieve compliance.

2.4 Test software.

The EUT was provided by the manufacturer with suitable software to allow operation in all the required modes. Software used for testing: UHF Tool v3.01

This software was running on a laptop computer (AUX2). It was used to enable the test operation modes listed in section 2.2 as appropriate.

2.5 Equipment modifications.

No modifications have been made to the equipment in order to achieve compliance.

2.6 Product Labeling

The product labeling information is available in the technical documentation package.

2.7 Schematics of the EUT.

The schematics are available in the technical documentation package.

2.8 Part list of the EUT.

The part list is available in the technical documentation package.

3 Peak output power

Results: Pass

Date of testing: 2015-12-17

Requirements:

FCC 15.247(b)(2) and RSS-247 Section 5.4(1)

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:

ANSI C63.10-2013.

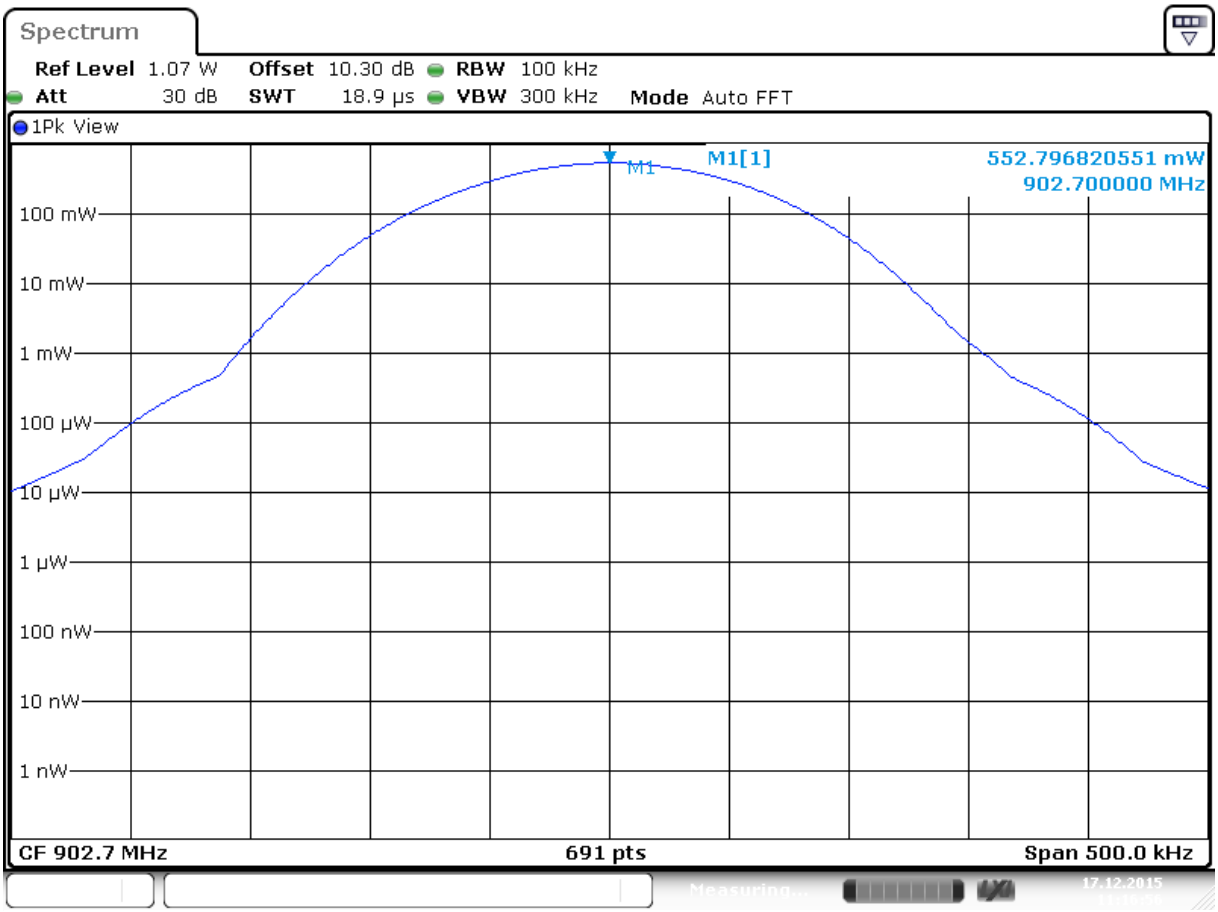
The test results are obtained by conducted measurements using a spectrum analyzer.
Test setup as per Photo 1 and Figure 1 was used. Tested on EUT Serial number: 4

Frequency (MHz)	Measured Peak Output Power (W)	Limit (W)
902.70	0.5528	1
915.20	0.5581	1
927.20	0.4779	1

Table 2 Peak output power

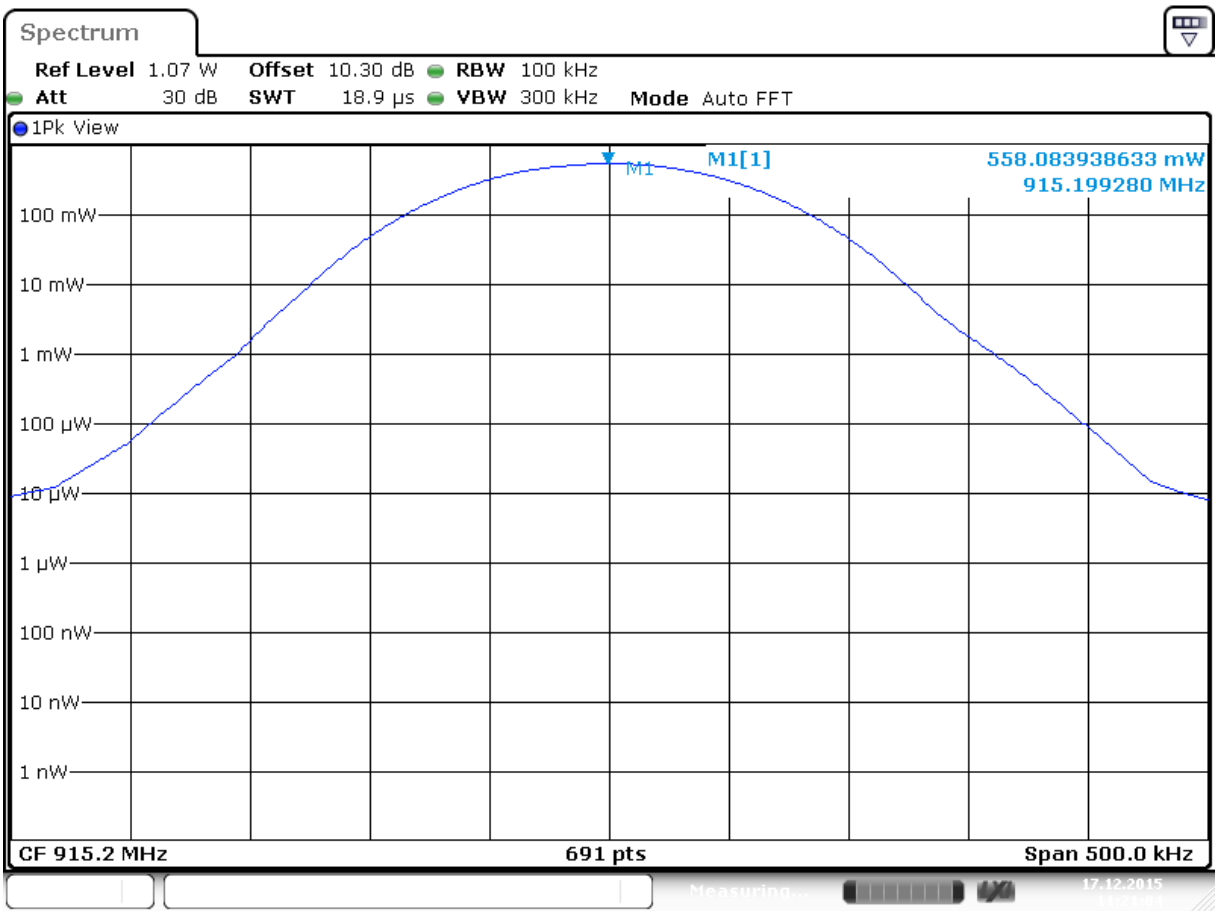
Notes:

1. Measured value includes correction factor for cable loss (0.3 dB) and external attenuator (10 dB).
2. Measurement uncertainty is ±2.5 dB.
3. See plots on the next pages.



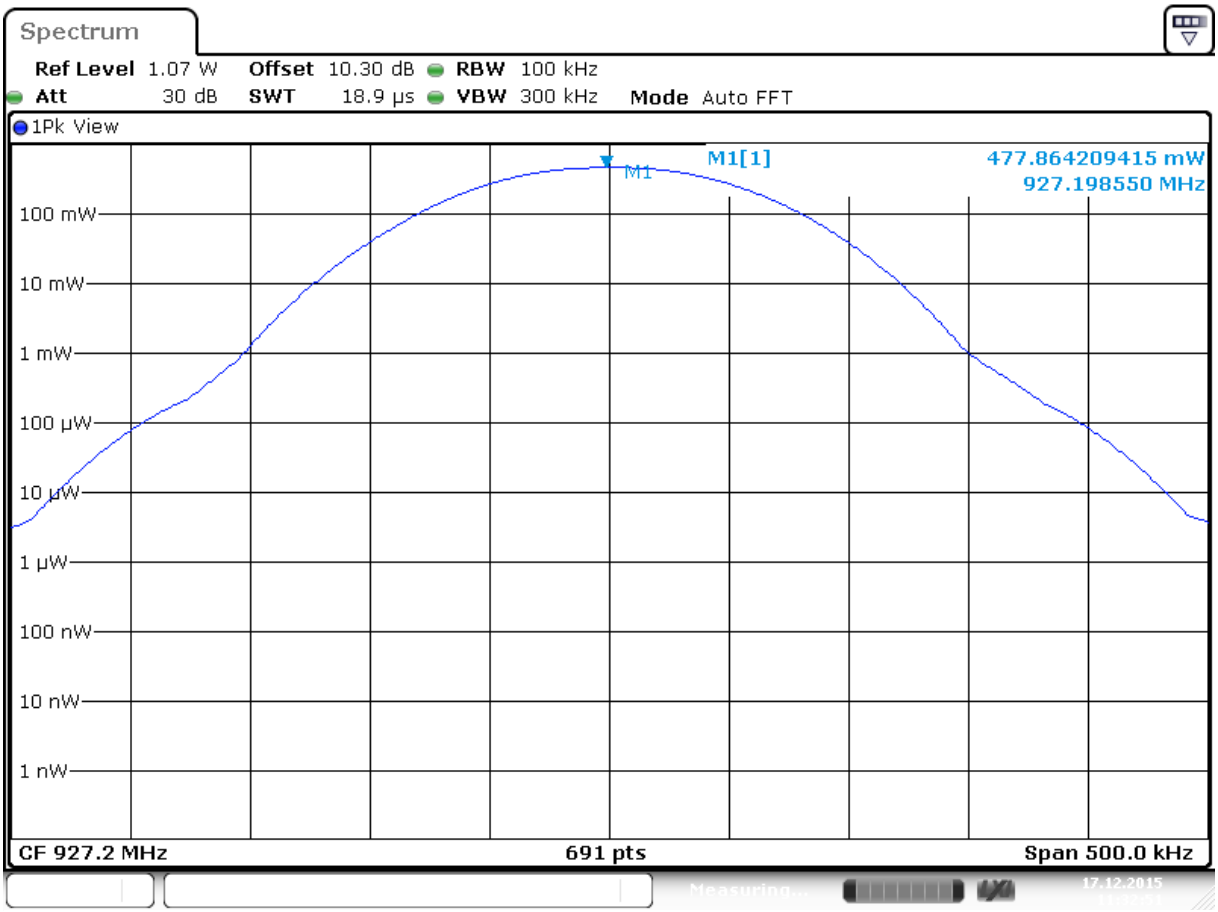
Date: 17.DEC.2015 11:16:56

Plot 1: Peak Output Power (902.70 MHz)



Date: 17.DEC.2015 11:21:04

Plot 2: Peak Output Power (915.20 MHz)



Date: 17.DEC.2015 11:32:51

Plot 3: Peak Output Power (927.20 MHz)

4 Occupied bandwidth and 99% bandwidth

Results: Pass

Date of testing: 2015-12-17

Requirements:

FCC 15.247(a)(1)(i) and RSS-247 Section 5.1(3).

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 have at least have 50 hopping channels and 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.

Test procedure:

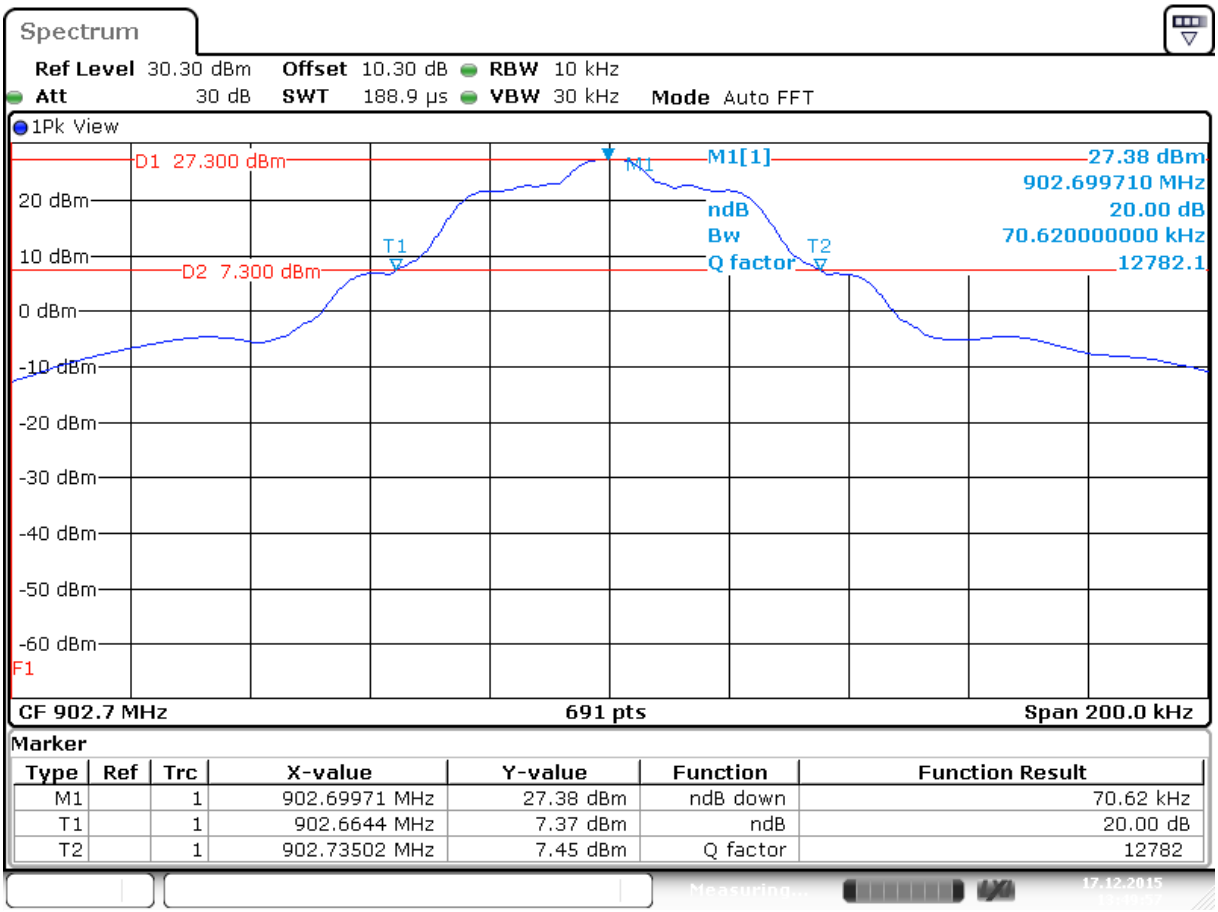
ANSI C63.10-2013

The Occupied bandwidth/99 % bandwidth was measured with the conducted test setup.
Test setup as per Photo 1 and Figure 1 was used. Tested on EUT Serial number: 4.

The spectrum analyzer resolution bandwidth was set to 10kHz and the span between 2 – 5 times the emission bandwidth.

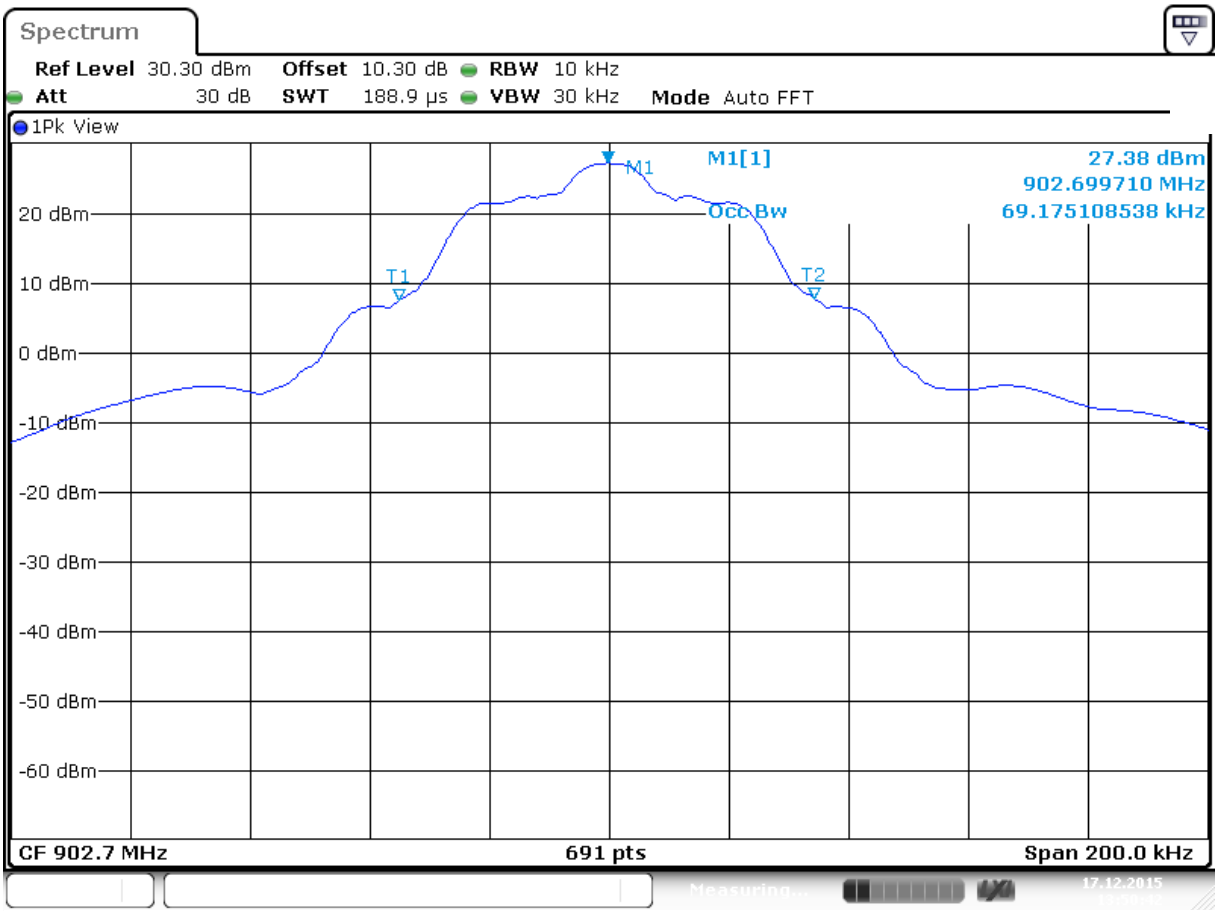
Measurement uncertainty is ±14.2%.

The EUT's 20 dB bandwidth was less than 250 kHz. See plots on the next pages.



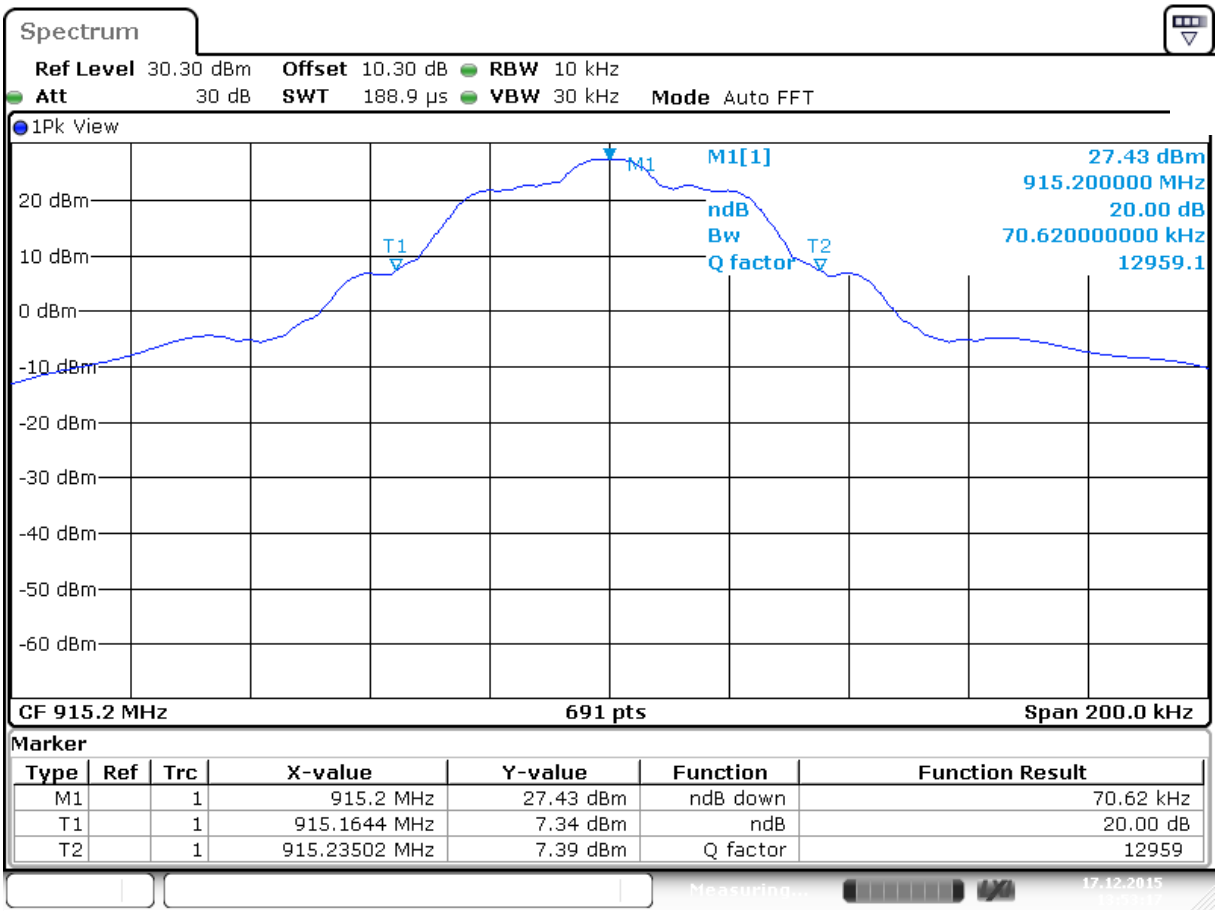
Date: 17.DEC.2015 13:49:57

Plot 4a: Occupied 20dB Bandwidth (= 70.62 kHz) of the EUT transmitting at 902.70 MHz



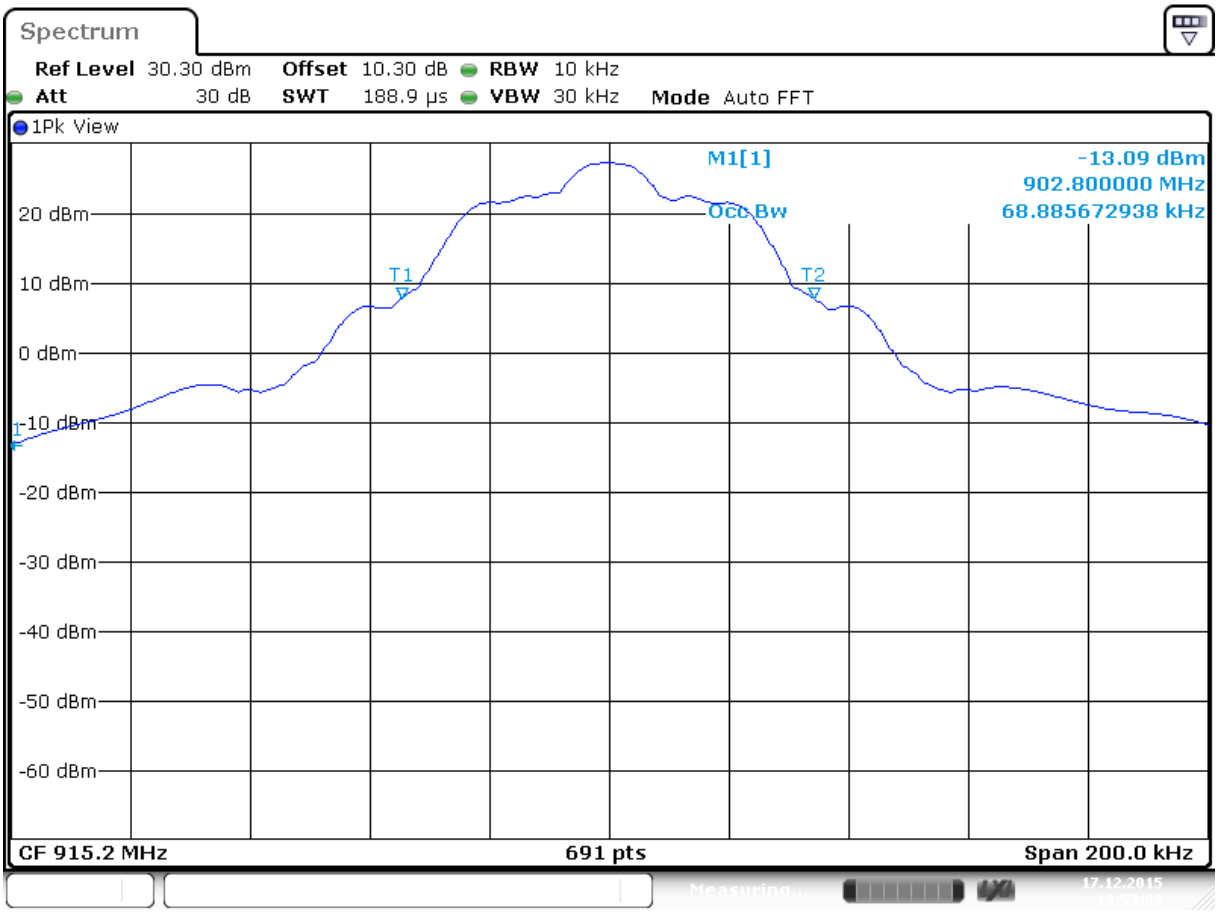
Date: 17.DEC.2015 13:50:42

Plot 4b: 99% Bandwidth (= 69.18 kHz) of the EUT transmitting at 902.70 MHz



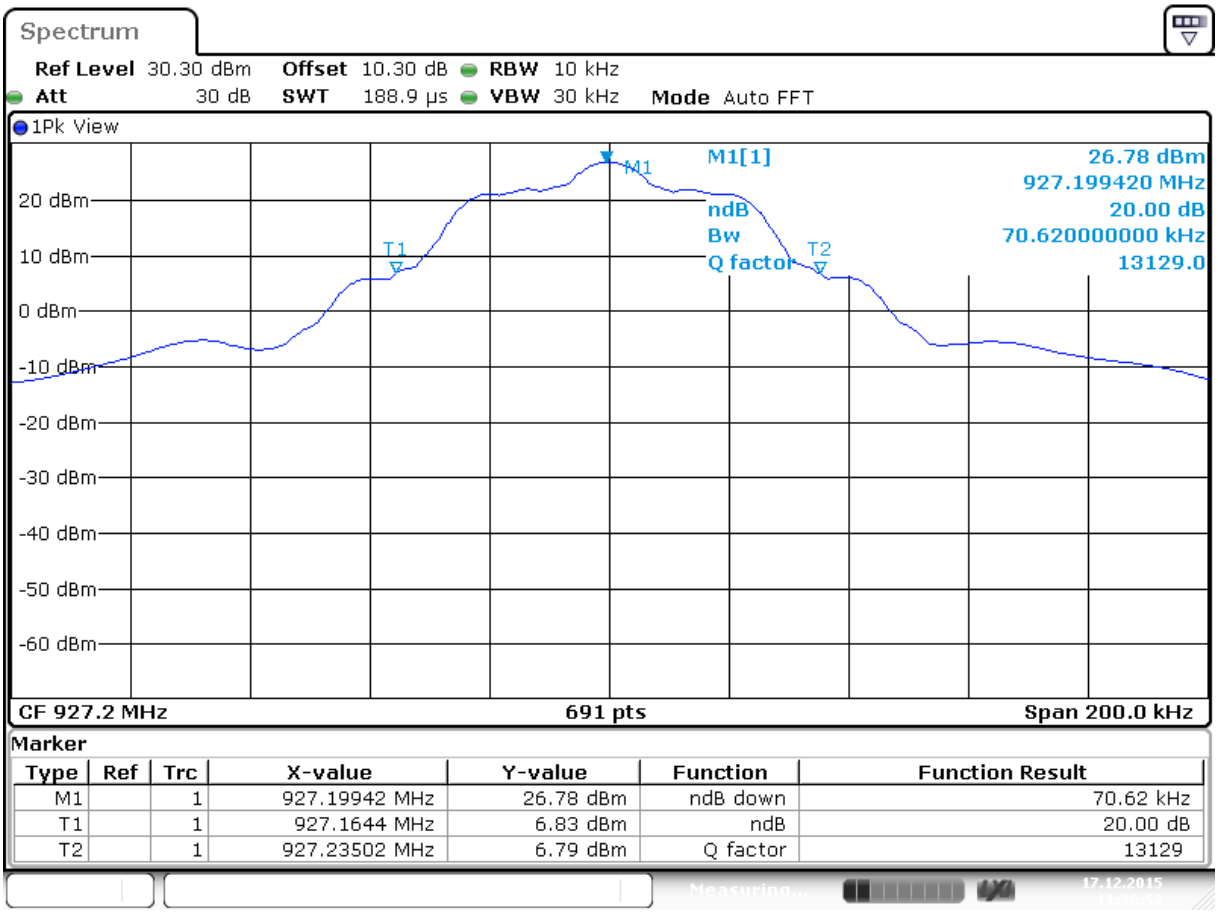
Date: 17.DEC.2015 13:53:17

Plot 5a: Occupied 20dB Bandwidth (= 70.62 kHz) of the EUT transmitting at 915.20 MHz



Date: 17.DEC.2015 13:54:08

Plot 5b: 99% Bandwidth (= 68.89 kHz) of the EUT transmitting at 915.20 MHz

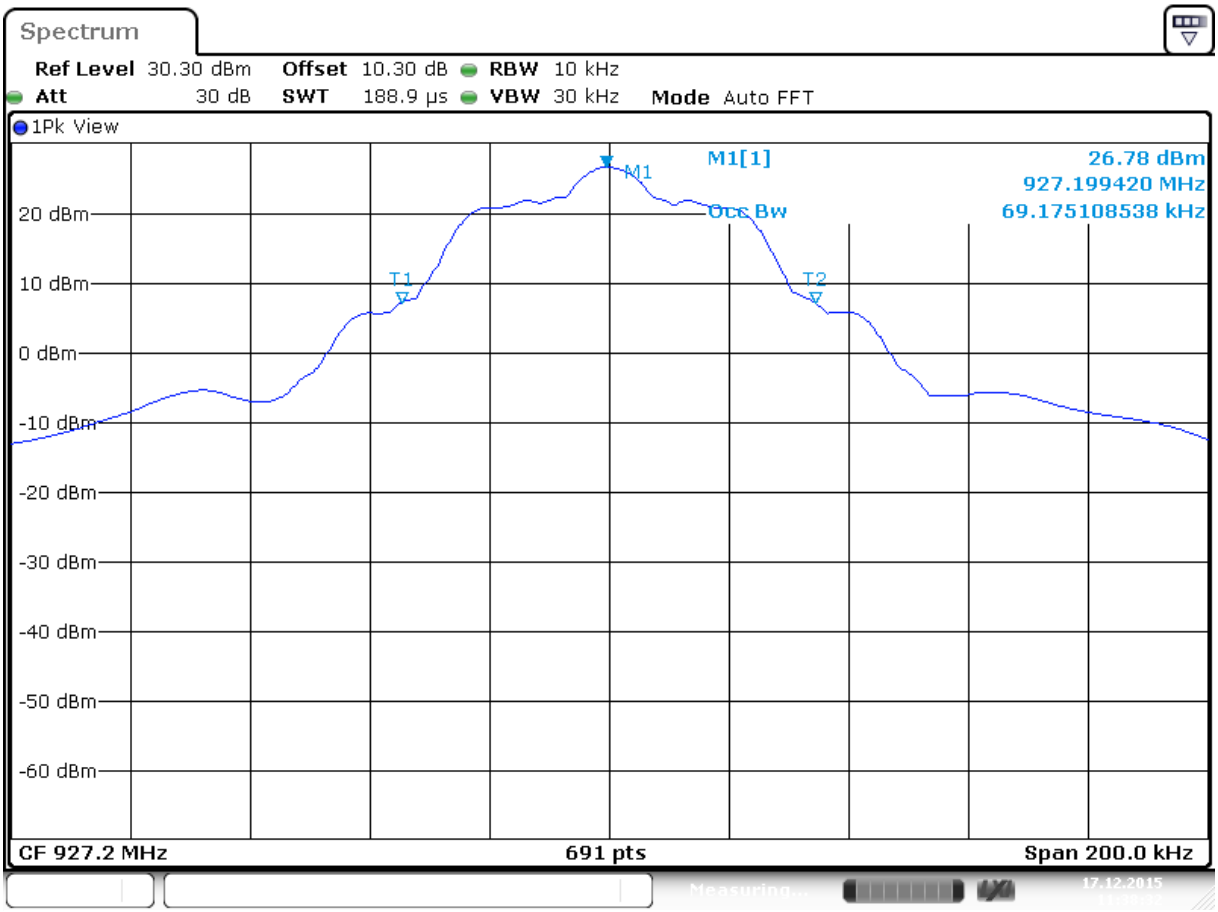


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	927.19942 MHz	26.78 dBm	ndB down	70.62 kHz
T1		1	927.1644 MHz	6.83 dBm	ndB	20.00 dB
T2		1	927.23502 MHz	6.79 dBm	Q factor	13129

Date: 17.DEC.2015 11:36:52

Plot 6a: Occupied 20dB Bandwidth (= 70.62 kHz) of the EUT transmitting at 927.20 MHz



Date: 17.DEC.2015 11:38:32

Plot 6b: 99% Bandwidth (= 69.18 kHz) of the EUT transmitting at 927.20 MHz

5 Hopping frequencies, Average time of occupancy and Channel spacing.

RESULT: PASS

Date of testing: 2015-12-17

Requirements:

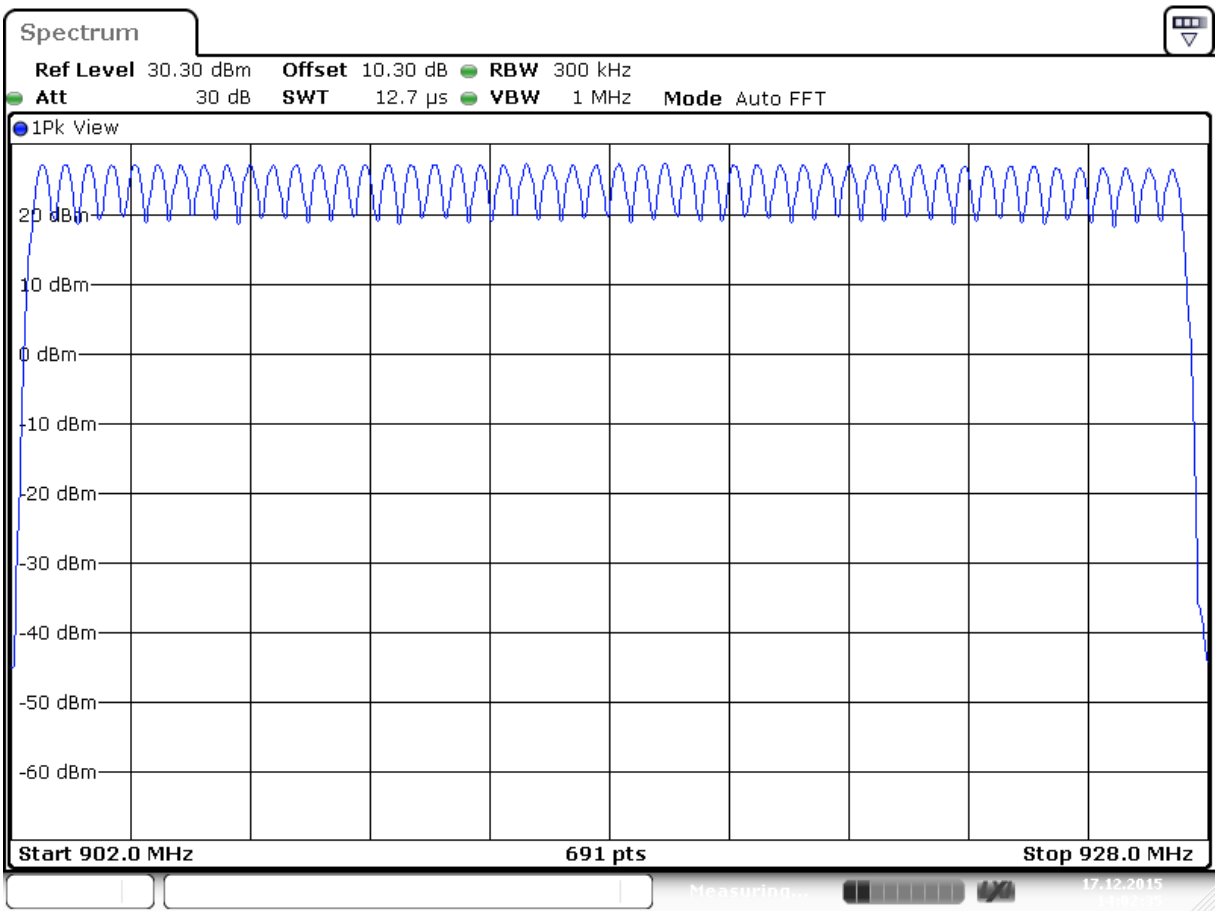
FCC 15.247(a)(1)(i) and RSS-247 Section 5.1(3) .

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:

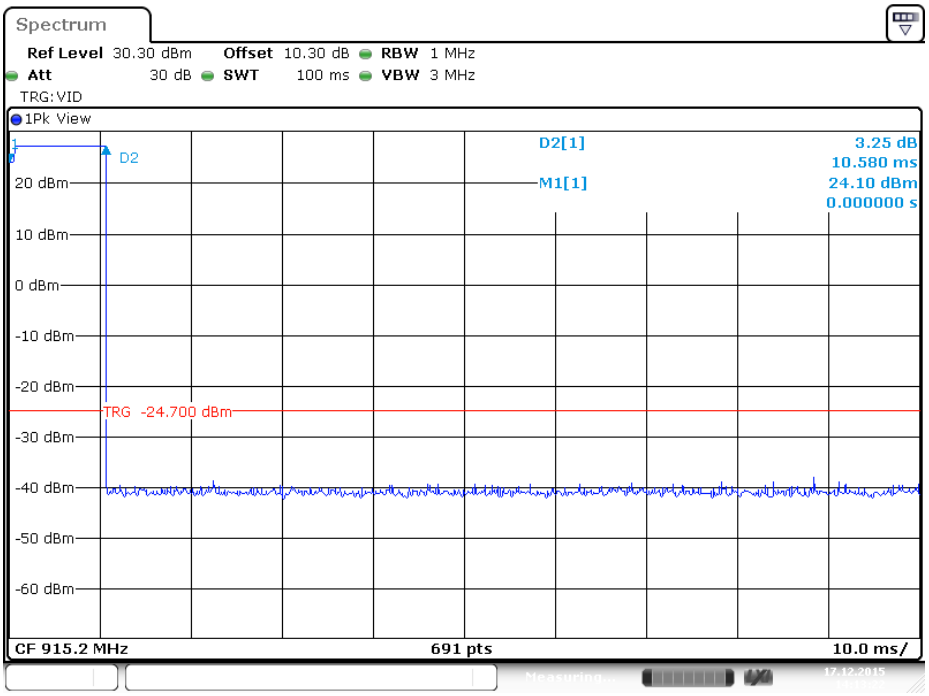
ANSI C63.10-2013

The tests were done with the conducted test setup (as per Photo 1 and Figure 1). Tested on EUT Serial number: 4. See plots on the next pages.



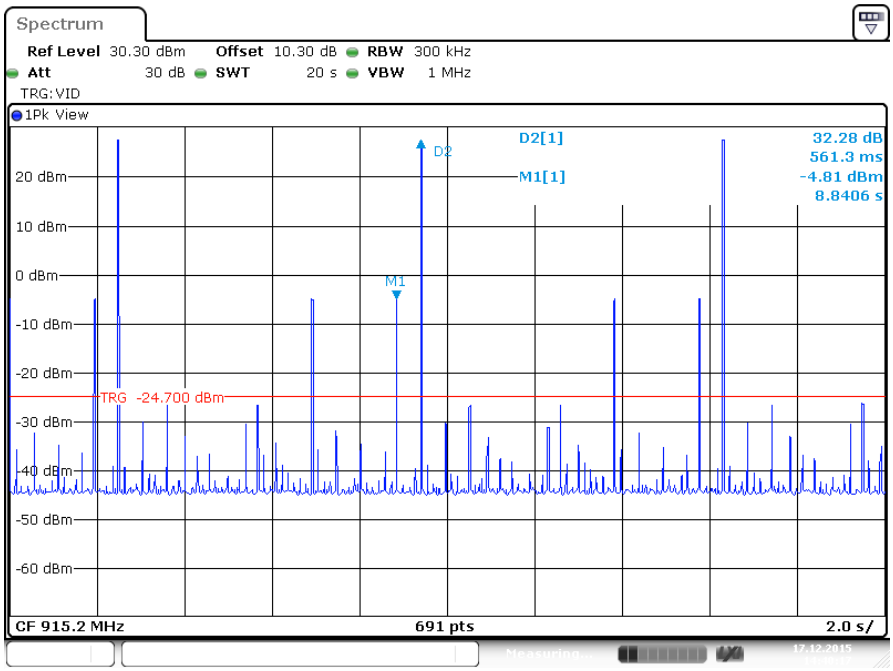
Date: 17.DEC.2015 14:02:36

Plot 7: at least 50 (actual = 50) hopping frequencies as required by section 15.247 (a)(1)(i) , as measured on a spectrum analyzer



Date: 17.DEC.2015 14:13:22

Plot 8a: showing Average time of occupancy of 1 hop



Date: 17.DEC.2015 14:40:17

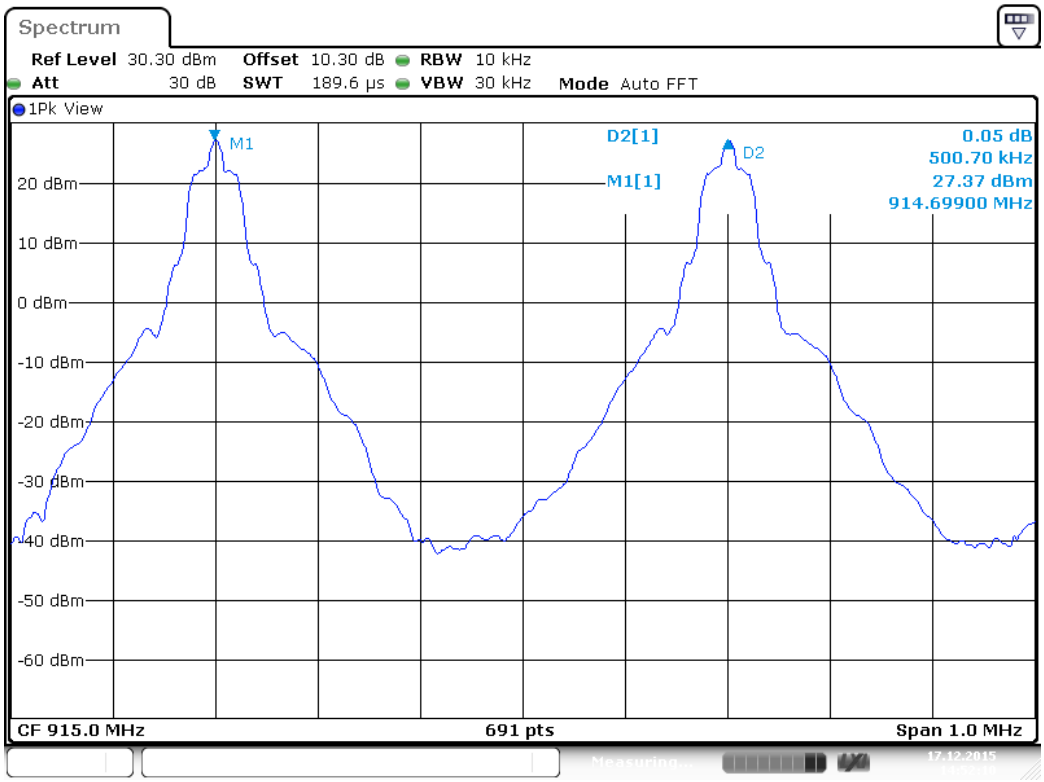
Plot 8b: showing time between occurrences is 561.3 ms in a 20s period.

Average time of occupancy (Dwell time) as measured on a spectrum analyzer.
Plot 8a shows a hoplenght of 10.58 ms for 1 channel.

In a 400ms period it is permitted to occur 37 times (txOn = 400ms/10.58ms = 37.8 times)
Time between transmissions is 561.3ms (see plot 8b).
In a period of 20 seconds it will occur 20sec/ 0.5613sec = 35.7 times

35.7 times the 10.58ms hoplenght is total On time of 377.706ms
which is below the 400 ms limit.

.



Date: 17.DEC.2015 14:52:09

Plot 9: showing approximately 500.7 kHz spacing between channels as measured on a spectrum analyzer

6 Band edge compliance

RESULT: Pass

Date of testing: 2015-12-17

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.

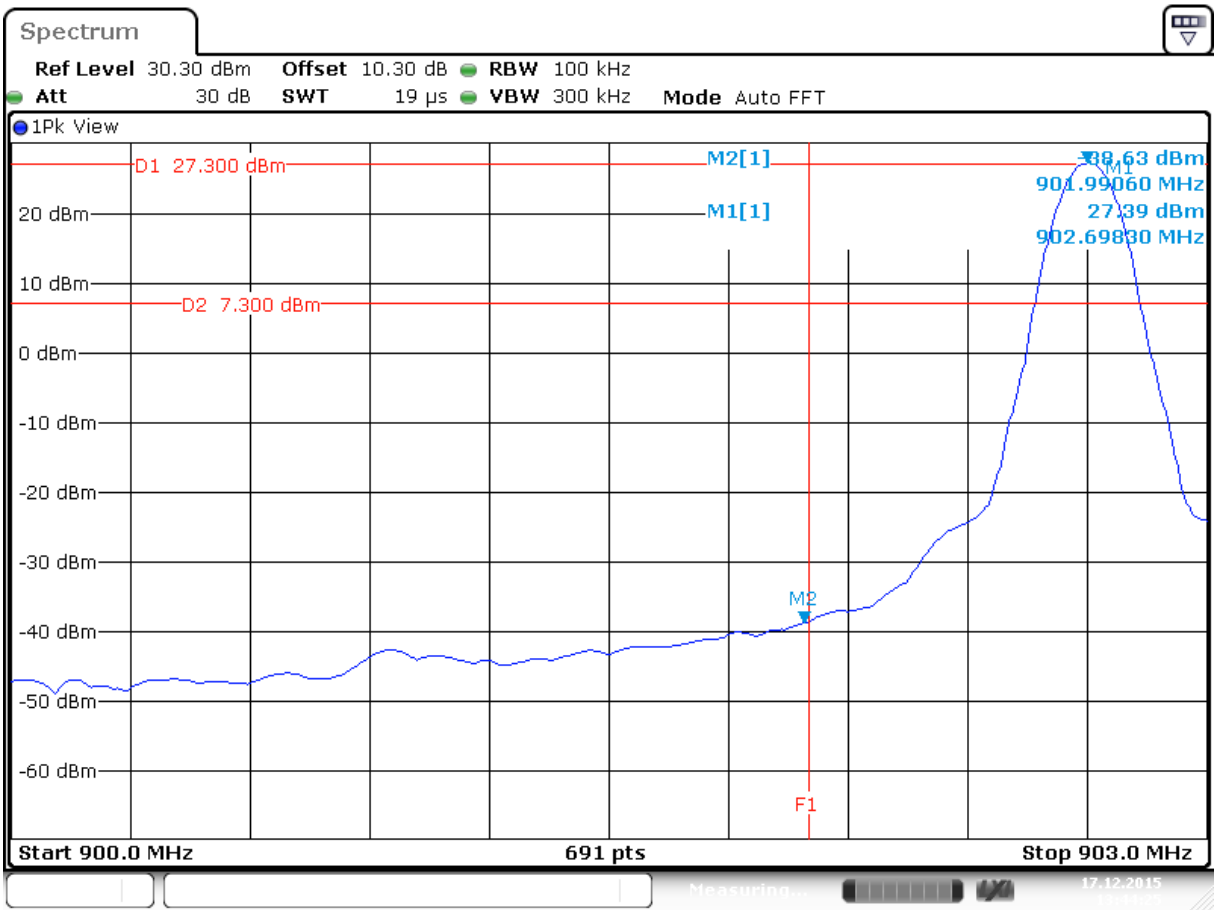
Test procedure:

ANSI C63.10-2013.

Measurements were performed with the conducted test setup (as per Photo 1 and Figure 1) using a spectrum analyzer with a suitable span to encompass the peak of the fundamental and using the following settings: RBW = 100kHz, VBW = 100kHz. Tested on EUT Serial number: 4.

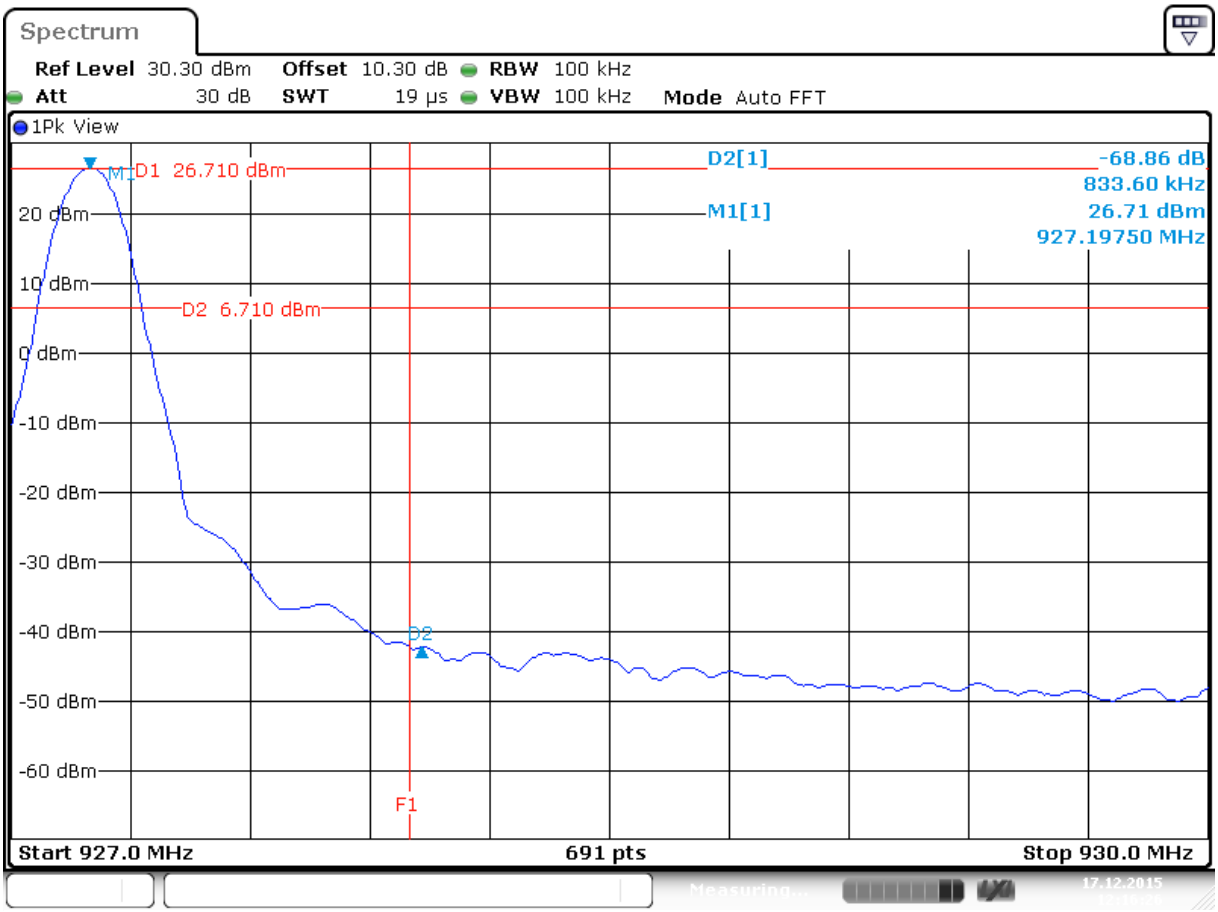
The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report. Measurement uncertainty is ±3.1 dB.

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



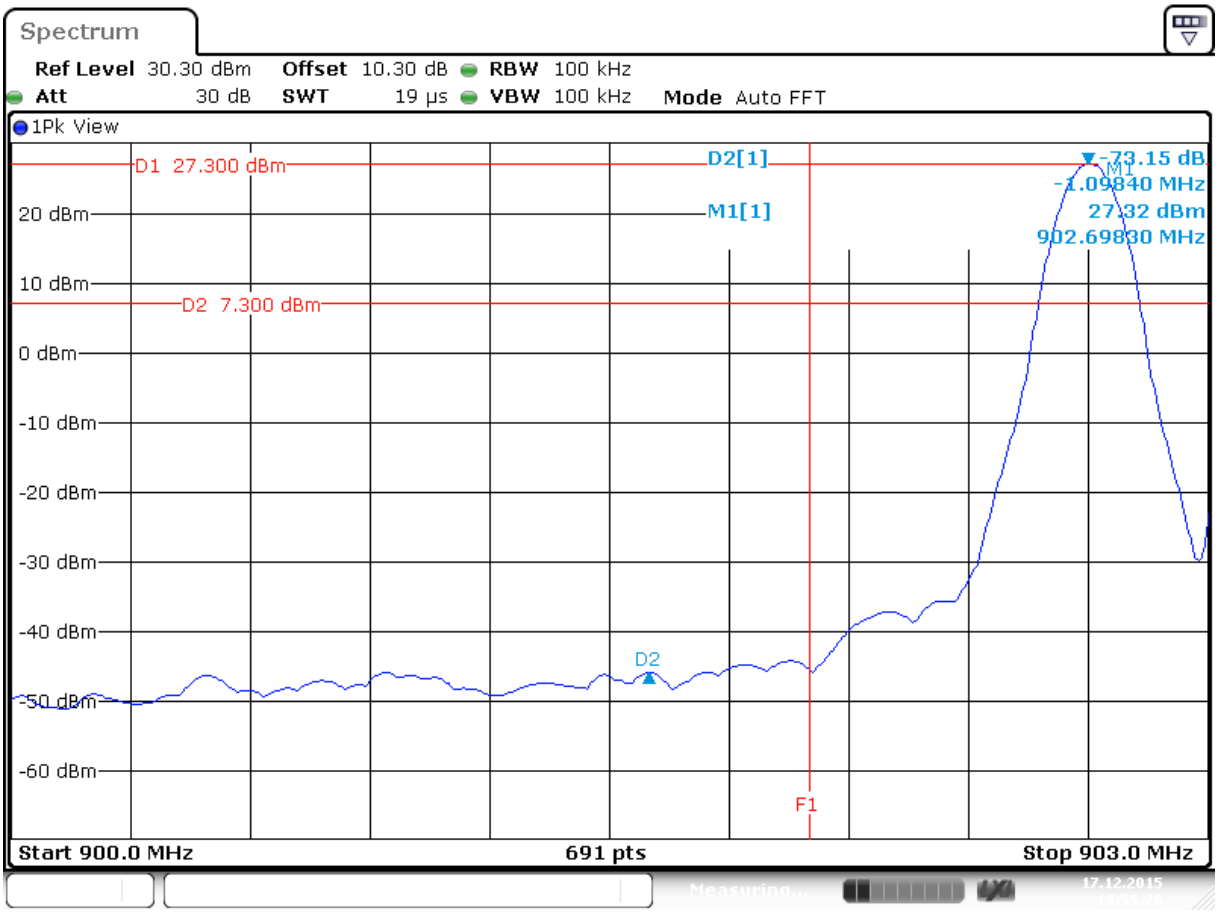
Date: 17.DEC.2015 13:44:25

Plot 10. showing more than 20 dB band edge attenuation, EUT continues modulated carrier at 902.70 MHz F1 shows the band edge frequency of 902 MHz.



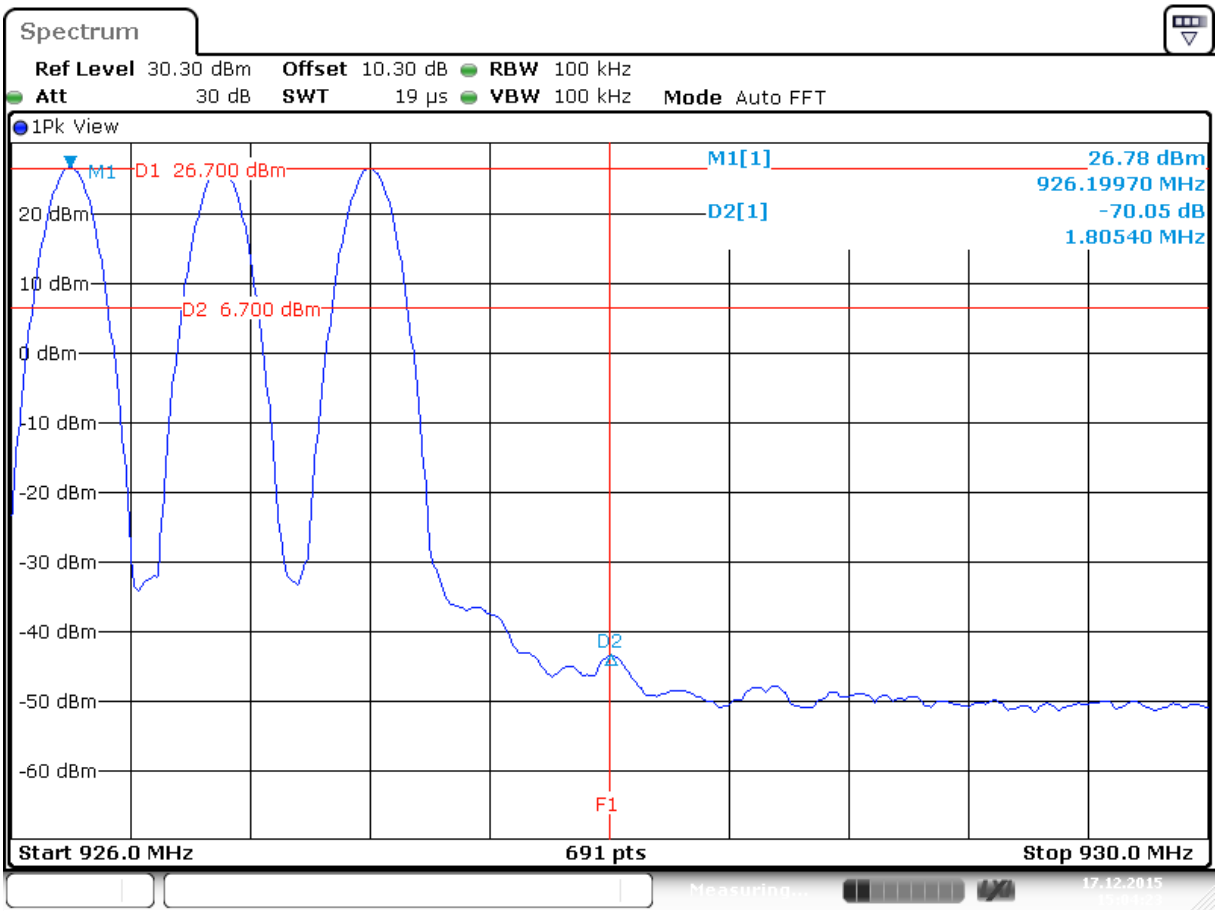
Date: 17.DEC.2015 12:16:26

Plot 11. showing more than 20 dB band edge attenuation, EUT continues modulated carrier at 927.20 MHz F1 shows the band edge frequency of 928 MHz.



Date: 17.DEC.2015 14:55:25

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



Date: 17.DEC.2015 15:04:23

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

7 Conducted Spurious Emissions of the Transmitter.

RESULT: PASS

Date of testing: 2015-12-17

Requirements:

FCC 15.247(d) and RSS-247 Section 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.

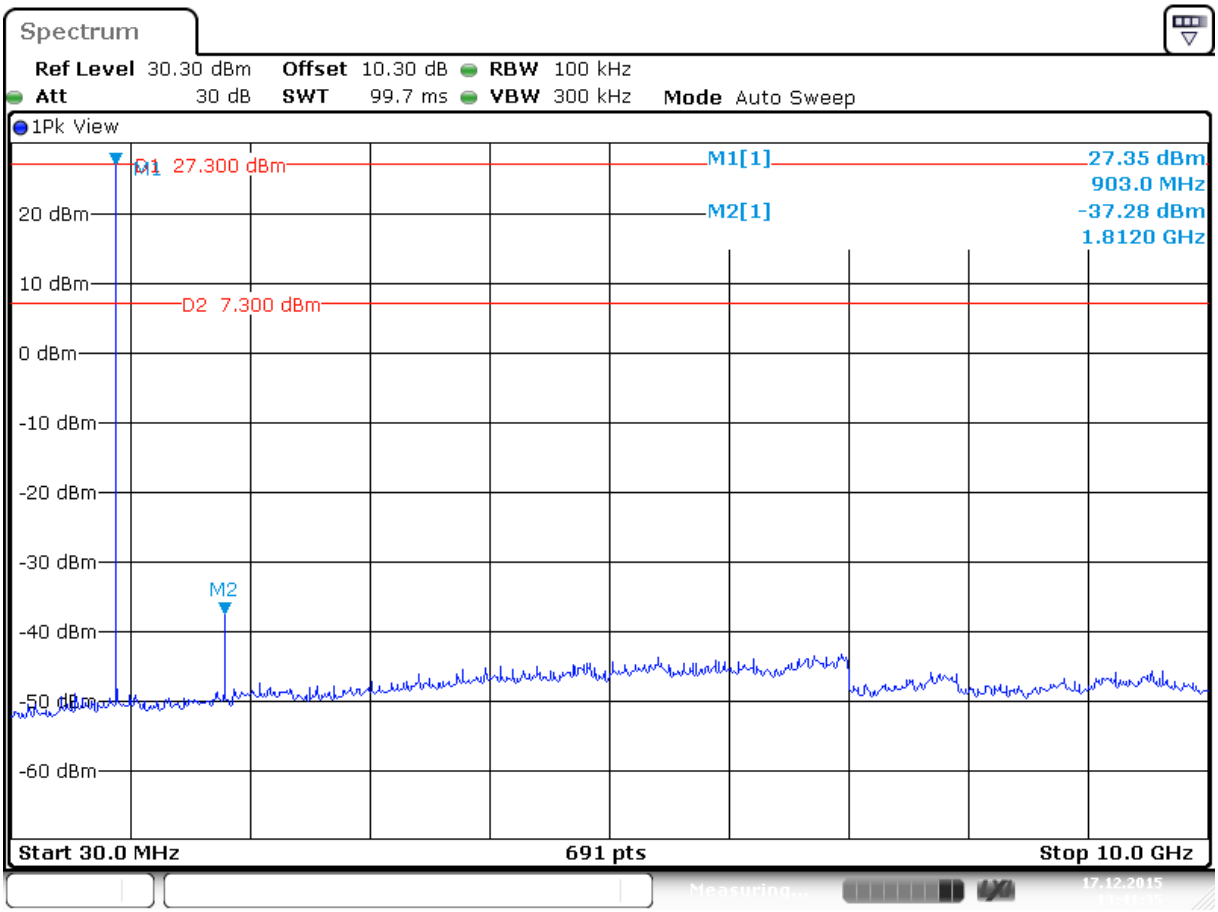
The tests were performed by RF conducted measurement by connecting a spectrum analyzer to the External RF Output connector (as per Photo 1 and Figure 1). Tested on EUT Serial number: 4.

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.

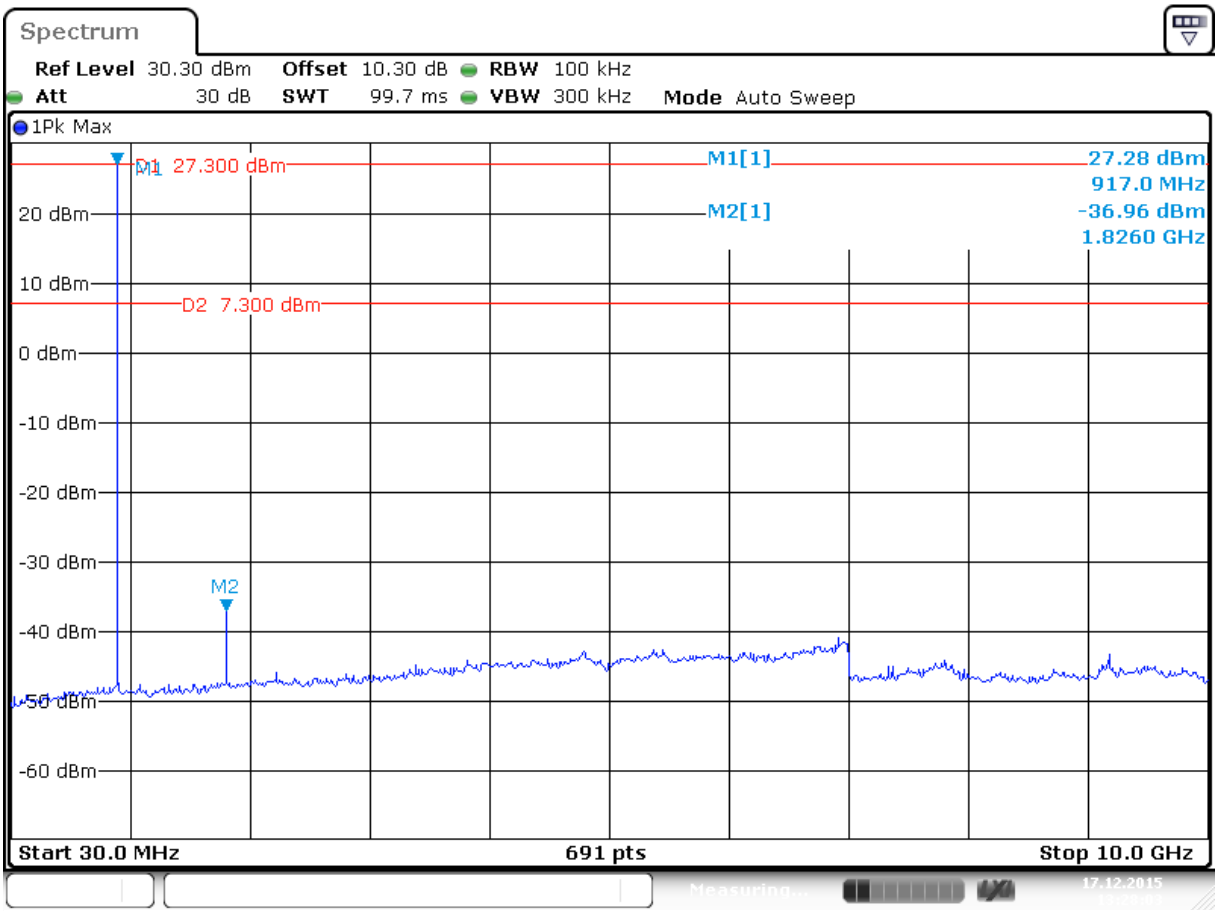
RBW = 100 kHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

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.
Measurement uncertainty is ±2.5 dB.



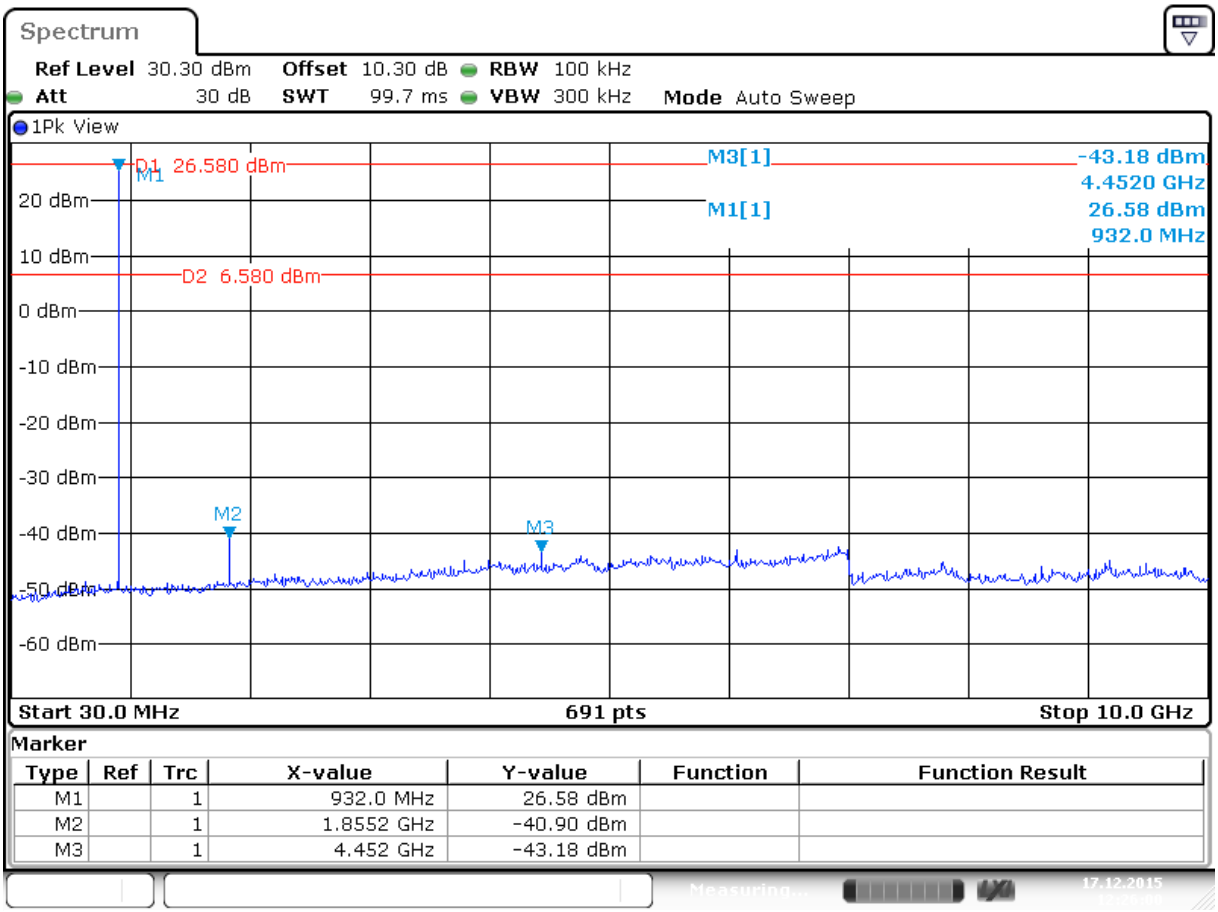
Date: 17.DEC.2015 13:41:35

Plot 14 of the conducted spurious emission, EUT frequency 902.70 MHz Constant modulated carrier.



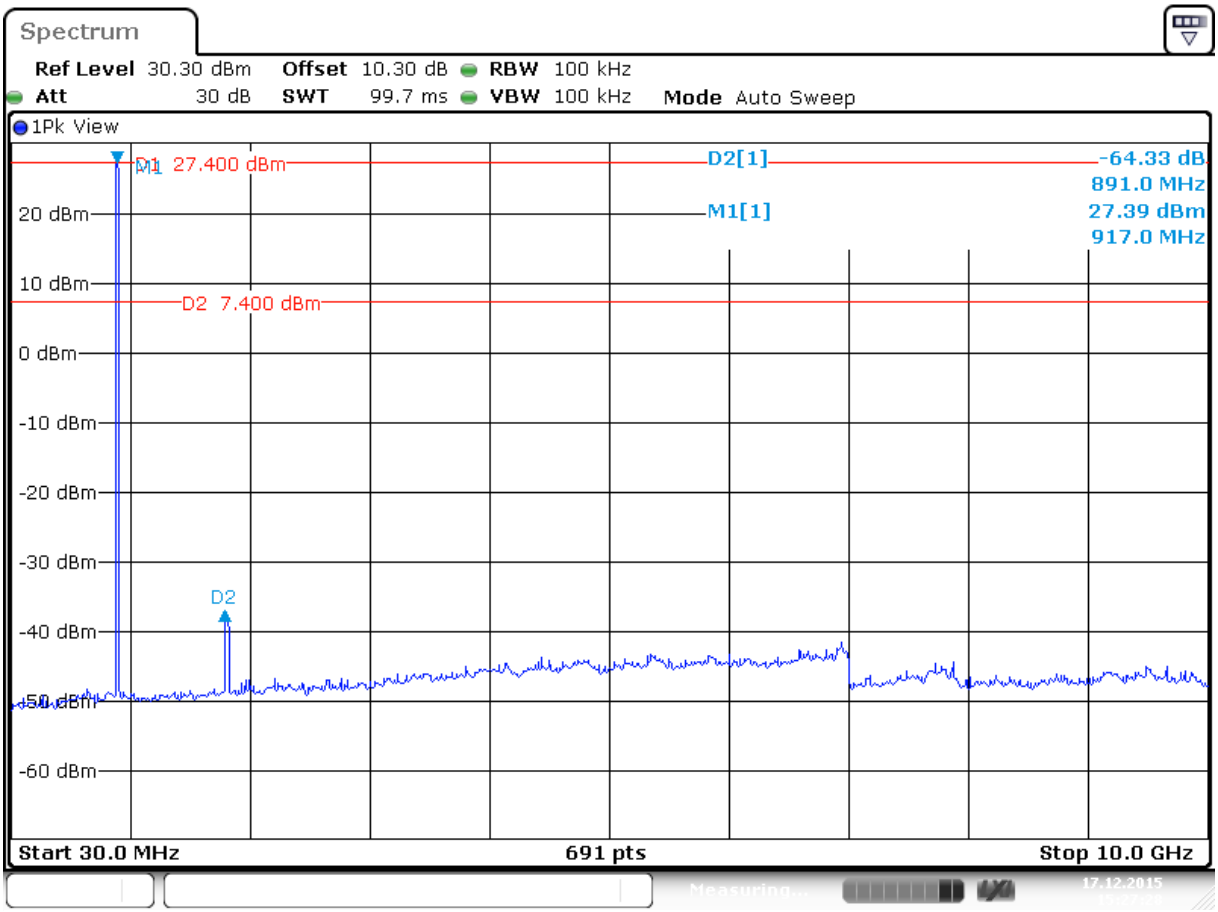
Date: 17.DEC.2015 13:28:03

Plot 15 of the conducted spurious emission, EUT frequency 915.20 MHz Constant modulated carrier.



Date: 17.DEC.2015 12:26:00

Plot 16 of the conducted spurious emission, EUT frequency 927.20 MHz Constant modulated carrier.



Date: 17.DEC.2015 15:27:28

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

8 Radiated Spurious Emissions of the Transmitter in restricted bands.

RESULT: PASS

Date of testing: 2016-01-04

Requirements:

Radiated emissions which fall in the restricted bands, as defined in FCC 15.205(a) and RSS-Gen Table 3, must comply with the radiated emission limits specified in FCC 15.209(a) and RSS-Gen Table 5.

Test procedure:

ANSI C63.10-2013.

Tested on EUT Serial number: 4.
This test is required for any spurious emission or modulation product that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

The EUT was placed on a nonconductive turntable 1.5m above the ground plane. 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 and the EUT orientation (X, Y, Z) 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 (10GHz). 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. The final measurement takes into account the loss generated by all the involved cables and filters.

Frequency [MHz]	Antenna Orientation	Detector	Level [dBµV/m]	Limit [dBµV/m]
96.9	Vertical	Qp	34.0	43.5
161.9	Vertical	Qp	26.7	43.5
255.04[R]	Vertical	Qp	30.5	46.0
Frequency [MHz]	**Antenna Orientation**	**Detector**	**Level [dBm]**	**Limit [dBm]**
1201[R]	Vertical	Pk	-65.2	-41.2 Av / -21.2 Pk
1801[H]	Vertical	Pk	-61.7	-41.2 Av / -21.2 Pk
2713[HR]	Horizontal	Pk	-54.5	-41.2 Av / -21.2 Pk
3611[HR]	Horizontal	Pk	-49.5	-41.2 Av / -21.2 Pk
4510[HR]	Horizontal	Pk	-36.2	-21.2 Pk
4510[HR]	Horizontal	Av	-63.6	-41.2 Av
5422[HR]	Horizontal	Pk	-46.9	-41.2 Av / -21.2 Pk

Table 3a Radiated spurious emissions of the EUT with External antenna at 902.70 MHz

Frequency [MHz]	Antenna Orientation	Detector	Level [dBµV/m]	Limit [dBµV/m]
96.6	Vertical	Qp	34.0	43.5
161.9	Vertical	Qp	26.0	43.5
255.04[R]	Vertical	Qp	30.0	46.0
Frequency [MHz]	**Antenna Orientation**	**Detector**	**Level [dBm]**	**Limit [dBm]**
1804[H]	Horizontal	Pk	-63.3	-41.2 Av / -21.2 Pk
2713[HR]	Horizontal	Pk	-54.7	-41.2 Av / -21.2 Pk
3611[HR]	Horizontal	Pk	-49.3	-41.2 Av / -21.2 Pk
4510[HR]	Horizontal	Pk	-35.8	-21.2 Pk
4510[HR]	Horizontal	Av	-63.2	-41.2 Av
5422[HR]	Horizontal	Pk	-46.2	-41.2 Av / -21.2 Pk

Table 3b Radiated spurious emissions of the EUT with External antenna at 915.20 MHz

Frequency [MHz]	Antenna Orientation	Detector	Level [dBµV/m]	Limit [dBµV/m]
96.6	Vertical	Qp	34.0	43.5
161.9	Vertical	Qp	26.0	43.5
255.04[R]	Vertical	Qp	30.0	46.0
Frequency [MHz]	**Antenna Orientation**	**Detector**	**Level [dBm]**	**Limit [dBm]**
1804[H]	Horizontal	Pk	-63.0	-41.2 Av / -21.2 Pk
2778[HR]	Horizontal	Pk	-71.5	-41.2 Av / -21.2 Pk
3703[HR]	Horizontal	Pk	-70.3	-41.2 Av / -21.2 Pk
4640[HR]	Horizontal	Pk	-57.2	-41.2 Av / -21.2 Pk

Table 3c Radiated spurious emissions of the EUT with External antenna at 927.20 MHz

Frequency [MHz]	Antenna Orientation	Detector	Level [dBµV/m]	Limit [dBµV/m]
96.6	Vertical	Qp	34.0	43.5
161.9	Vertical	Qp	26.4	43.5
255.04[R]	Vertical	Qp	30.4	46.0
Frequency [MHz]	**Antenna Orientation**	**Detector**	**Level [dBm]**	**Limit [dBm]**
1202[R]	Vertical	Pk	-64.6	-41.2 Av / -21.2 Pk
2192	Vertical	Pk	-63.3	-41.2 Av / -21.2 Pk
2765[HR]	Horizontal	Pk	-56.5	-41.2 Av / -21.2 Pk

Table 3d Radiated spurious emissions of the EUT with External antenna in normal mode (hopping)

Frequency [MHz]	Antenna Orientation	Detector	Level [dBµV/m]	Limit [dBµV/m]
96.11	Vertical	Qp	34.0	43.5
161.9	Vertical	Qp	26.6	43.5
255.04[R]	Vertical	Qp	30.2	46.0
Frequency [MHz]	**Antenna Orientation**	**Detector**	**Level [dBm]**	**Limit [dBm]**
2713[HR]	Vertical	Pk	-71.0	-41.2 Av / -21.2 Pk
3611[HR]	Vertical	Pk	-67.8	-41.2 Av / -21.2 Pk
4510[HR]	Horizontal	Pk	-56.5	-41.2 Av / -21.2 Pk
5422[HR]	Horizontal	Pk	-65.1	-41.2 Av / -21.2 Pk

Table 3e Radiated spurious emissions of the EUT with Internal antenna at 902.70 MHz

Frequency [MHz]	Antenna Orientation	Detector	Level [dBµV/m]	Limit [dBµV/m]
96.11	Vertical	Qp	34.0	43.5
161.9	Vertical	Qp	26.0	43.5
255.04[R]	Vertical	Qp	30.0	46.0
Frequency [MHz]	**Antenna Orientation**	**Detector**	**Level [dBm]**	**Limit [dBm]**
1827[H]	Horizontal	Pk	-74.0	-41.2 Av / -21.2 Pk
2752[HR]	Horizontal	Pk	-72.0	-41.2 Av / -21.2 Pk
3664[HR]	Horizontal	Pk	-64.1	-41.2 Av / -21.2 Pk
4575[HR]	Horizontal	Pk	-59.4	-41.2 Av / -21.2 Pk

Table 3f Radiated spurious emissions of the EUT with Internal antenna at 915.20 MHz

Frequency [MHz]	Antenna Orientation	Detector	Level [dBµV/m]	Limit [dBµV/m]
96.11	Vertical	Qp	34.0	43.5
161.9	Vertical	Qp	26.0	43.5
255.04[R]	Vertical	Qp	30.0	46.0
Frequency [MHz]	**Antenna Orientation**	**Detector**	**Level [dBm]**	**Limit [dBm]**
1853[H]	Horizontal	Pk	-75.7	-41.2 Av / -21.2 Pk
2778[HR]	Horizontal	Pk	-68.2	-41.2 Av / -21.2 Pk
3703[HR]	Horizontal	Pk	-67.5	-41.2 Av / -21.2 Pk
4640[HR]	Horizontal	Pk	-57.6	-41.2 Av / -21.2 Pk

Table 3g Radiated spurious emissions of the EUT with Internal antenna at 927.20 MHz

Frequency [MHz]	Antenna Orientation	Detector	Level [dBµV/m]	Limit [dBµV/m]
96.11	Vertical	Qp	34.0	43.5
161.92	Horizontal	Qp	26.3	43.5
225.94	Horizontal	Qp	33.0	46.0
255.04[R]	Horizontal	Qp	30.9	46.0
291.90	Horizontal	Qp	34.3	46.0
Frequency [MHz]	**Antenna Orientation**	**Detector**	**Level [dBm]**	**Limit [dBm]**
1827[H]	Horizontal	Pk	-74.0	-41.2 Av / -21.2 Pk
2778[HR]	Horizontal	Pk	-69.2	-41.2 Av / -21.2 Pk
3651[HR]	Horizontal	Pk	-64.1	-41.2 Av / -21.2 Pk
4523[HR]	Horizontal	Pk	-58.8	-41.2 Av / -21.2 Pk

Table 3h Radiated spurious emissions of the EUT with Internal antenna in normal mode (hopping)

The results of the radiated emission tests in the range 30 MHz – 10 GHz, with the system operating in transmit mode are depicted in Table 3a through 3h.

Notes:

1. Field strength values of radiated emissions at frequencies in the range 30 MHz – 10 GHz not listed in the table above are more than 20 dB below the applicable limit.
2. Measurement uncertainty is ±5.0dB
3. The reported field strength values are the worst case values at the indicated frequency. The receiving antenna was varied in horizontal and vertical orientations and also in height (between 1m and 4m).
4. From pretest it showed while scanning a card generated the highest emissions.
5. H refers to a harmonic frequency of the fundamental.
   R refers to an emission in a restricted frequency band.

9 AC Power Line Conducted Emission Data.

9.1 AC Power Line Conducted Emission data of the EUT

RESULT: Pass

Date of testing: 2016-01-06 and 07

Requirements:

Except when the requirements applicable to a given device state otherwise, for any license-exempt radio communication device equipped to operate from the public utility AC power supply, either directly or indirectly, the radio frequency voltage that is conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in the following table. The tighter limit applies at the frequency range boundaries.

Frequency of Emission (MHz)	Conducted Limit (dBµV) Quasi-Peak	Conducted Limit (dBµV) 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.

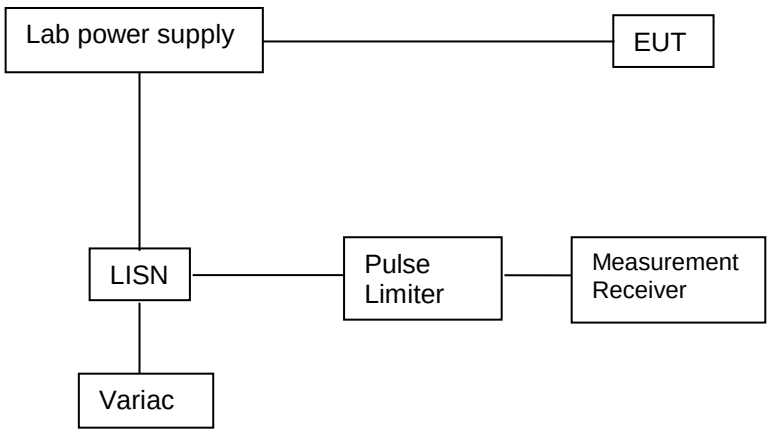
Test procedure:

ANSI C63.10-2013.

Tested on EUT Serial number: 18.
Each phase and neutral of the AC power line were measured with respect to ground. Measurements were performed using a 50 µH / 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.

9.1.1 Test results, EUT in combination with a lab power supply.

9.1.1.1 Test setup with lab power supply



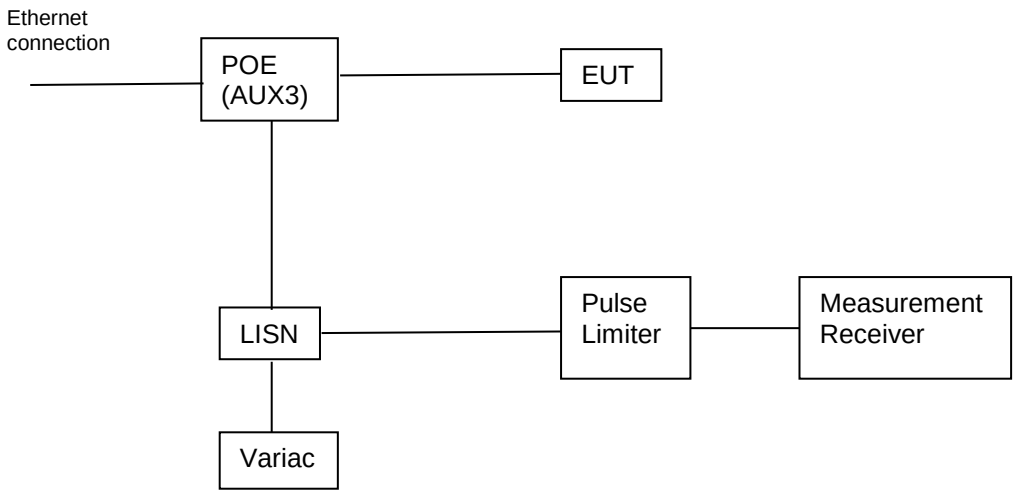
9.1.1.2 Testresults with lab power supply

Frequency (MHz)	Power supply voltage	Measurement results (dBµV) L1		Measurement results (dBµV) L2/Neutral		Limits (dBµV)		Verdict (Pass/Fail)
	(V)	QP	AV	QP	AV	QP	AV	
0.15000	12	29.1	Note 3	30.2	Note 3	66.0	56.0	Pass
0.15780	18	26.2	Note 3	29.8	Note 3	65.5	55.5	Pass
0.16172	24	30.5	Note 3	27.4	Note 3	65.5	55.5	Pass
15.54453	18	21.6	Note 3	24.4	Note 3	60.0	50.0	Pass
26.63828	24	22.2	Note 3	24.9	Note 3	60.0	50.0	Pass
26.82578	18	22.8	Note 3	25.5	Note 3	60.0	50.0	Pass

Table 4a AC Power Line Conducted Emissions of the EUT in combination with a power supply

9.1.2 Test results, EUT in combination with POE.

9.1.2.1 Test setup with POE



9.1.2.2 Test results with POE

Frequency (MHz)	Measurement results (dBµV) L1		Measurement results (dBµV) L2/Neutral		Limits (dBµV)		Verdict (Pass/Fail)
	QP	AV	QP	AV	QP	AV	
0.18516	46.5	Note 3	45.0	Note 3	64.5	54.5	Pass
0.18906	45.0	Note 3	46.0	Note 3	64.0	54.0	Pass
0.23203	40.5	Note 3	32.3	Note 3	62.4	52.4	Pass
0.26719	43.7	Note 3	43.6	Note 3	61.1	51.1	Pass
0.53281	43.2	Note 3	43.7	Note 3	56.0	46.0	Pass
1.06406	34.3	Note 3	35.8	Note 3	56.0	46.0	Pass
7.90781	30.5	Note 3	32.0	Note 3	60.0	50.0	Pass

Table 4b AC Power Line Conducted Emissions of the EUT in combination with POE (AUX3)

The results of the 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 EUT, are depicted in the Table 4a and 4b above.

Notes:

1. The resolution bandwidth used was 9 kHz.
2. Tested in the normal operation mode.
3. Table 4a Tested at 12V, 18V and 24V power supply voltage, worst case noted.
4. Qp values already within Av limits, therefor Av not tested.
5. Measurement uncertainty is ±3.5 dB.
6. Plots are provided on the next pages.

Used test equipment and ancillaries:

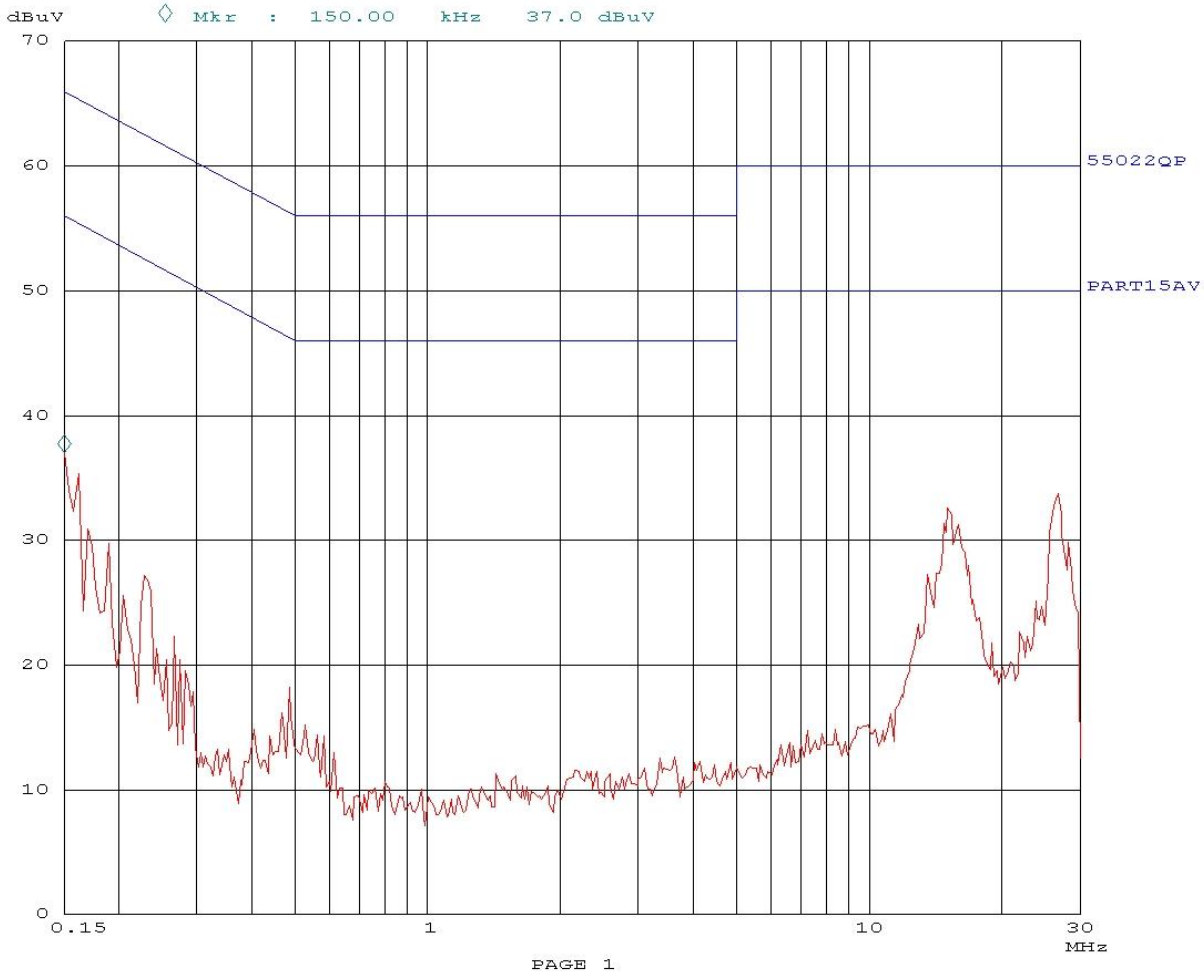
A00022	A00051	A00171	A00437	A00444	A00726	A01844
A00040						

06. Jan 16 12:59

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	0dBLN	OFF

Final Measurement: x QP
Meas Time: 1 s
Subranges: 25
Acc Margin: 6dB



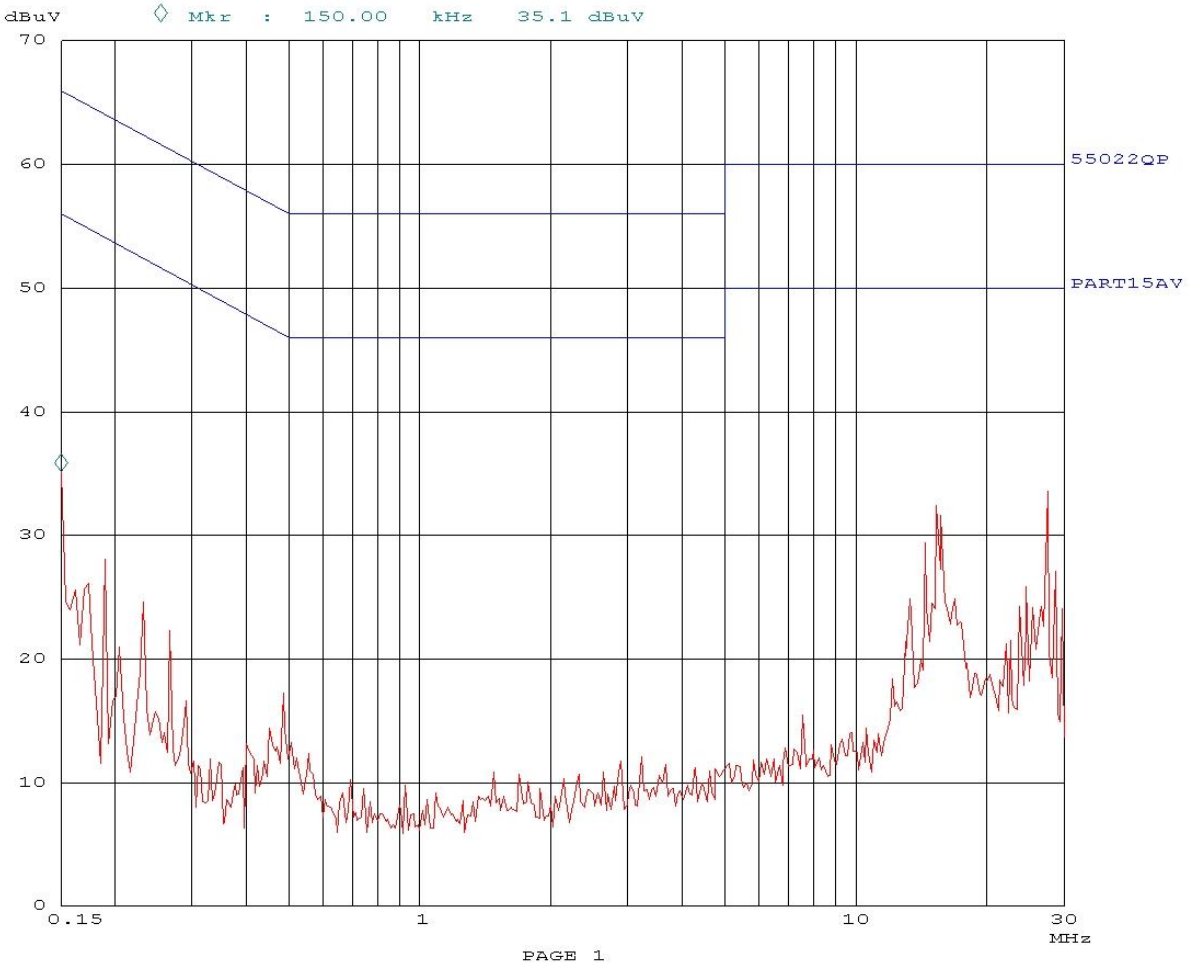
Plot 18 AC Power Line Conducted Emissions on L1, EUT in combination with Power supply at 12Vdc

06. Jan 16 13:08

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	0dBLN	OFF

Final Measurement: x QP
Meas Time: 1 s
Subranges: 25
Acc Margin: 6dB

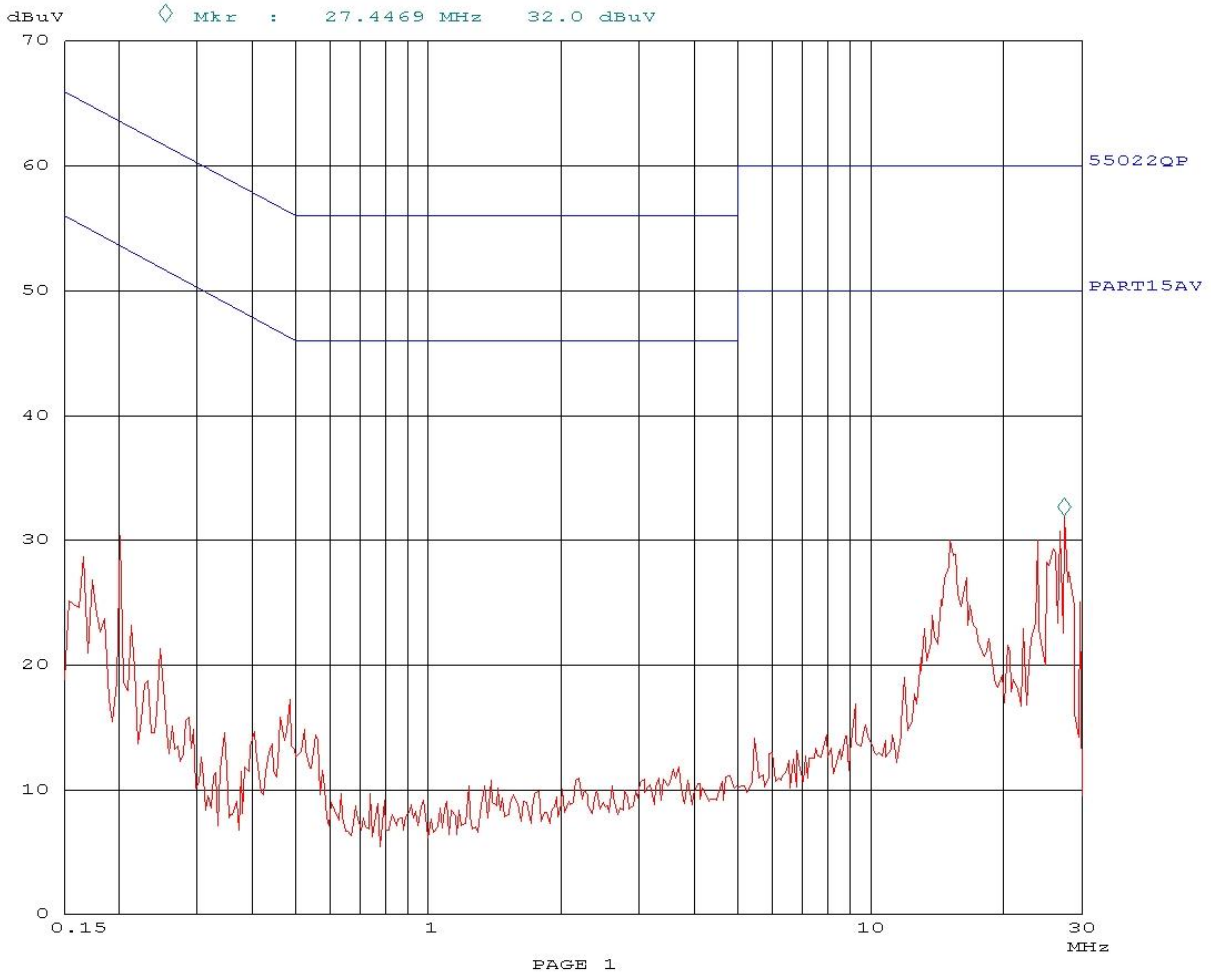


Plot 19 AC Power Line Conducted Emissions on L2, EUT in combination with Power supply at 12Vdc

06. Jan 16 13:15

```
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   0dBLN   OFF

Final Measurement: x QP
                   Meas Time:     1 s
                   Subranges:    25
                   Acc Margin:    6dB
```



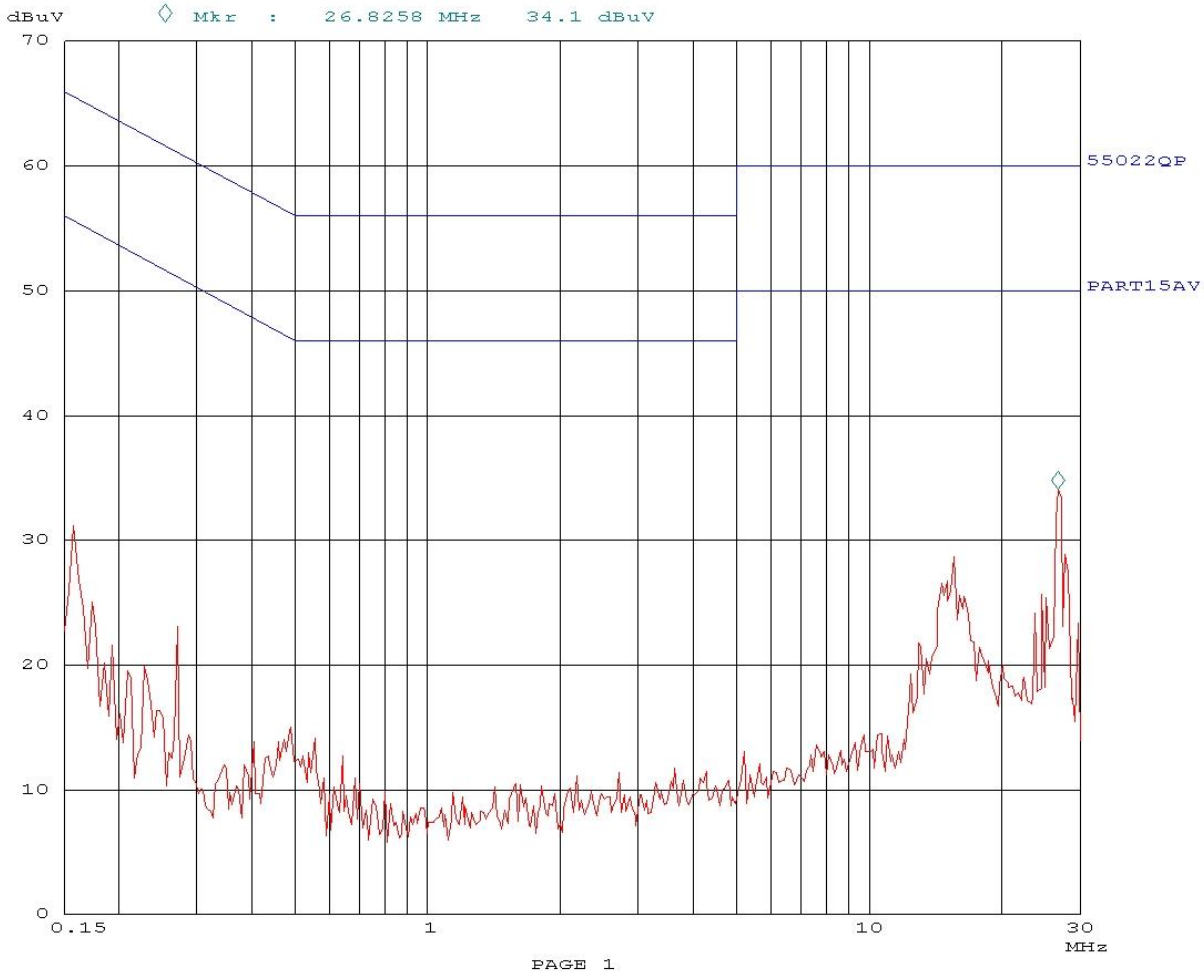
Plot 20 AC Power Line Conducted Emissions on L1, EUT in combination with Power supply at 18Vdc

06. Jan 16 13:11

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	0dBLN	OFF

Final Measurement: x QP
Meas Time: 1 s
Subranges: 25
Acc Margin: 6dB



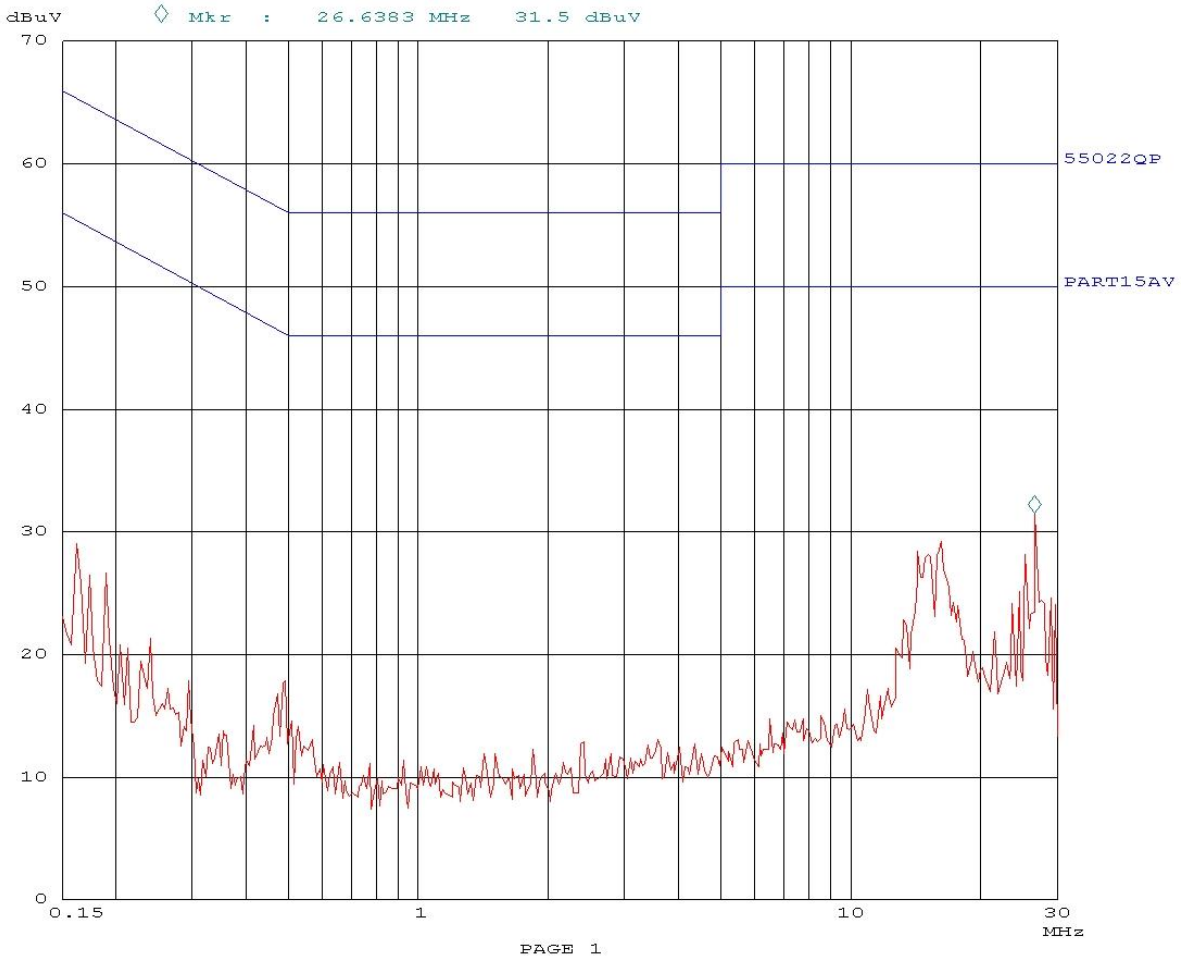
Plot 21 AC Power Line Conducted Emissions on L2, EUT in combination with Power supply at 18Vdc

06. Jan 16 15:24

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	0dBLN	OFF

Final Measurement: x QP
Meas Time: 1 s
Subranges: 25
Acc Margin: 6dB



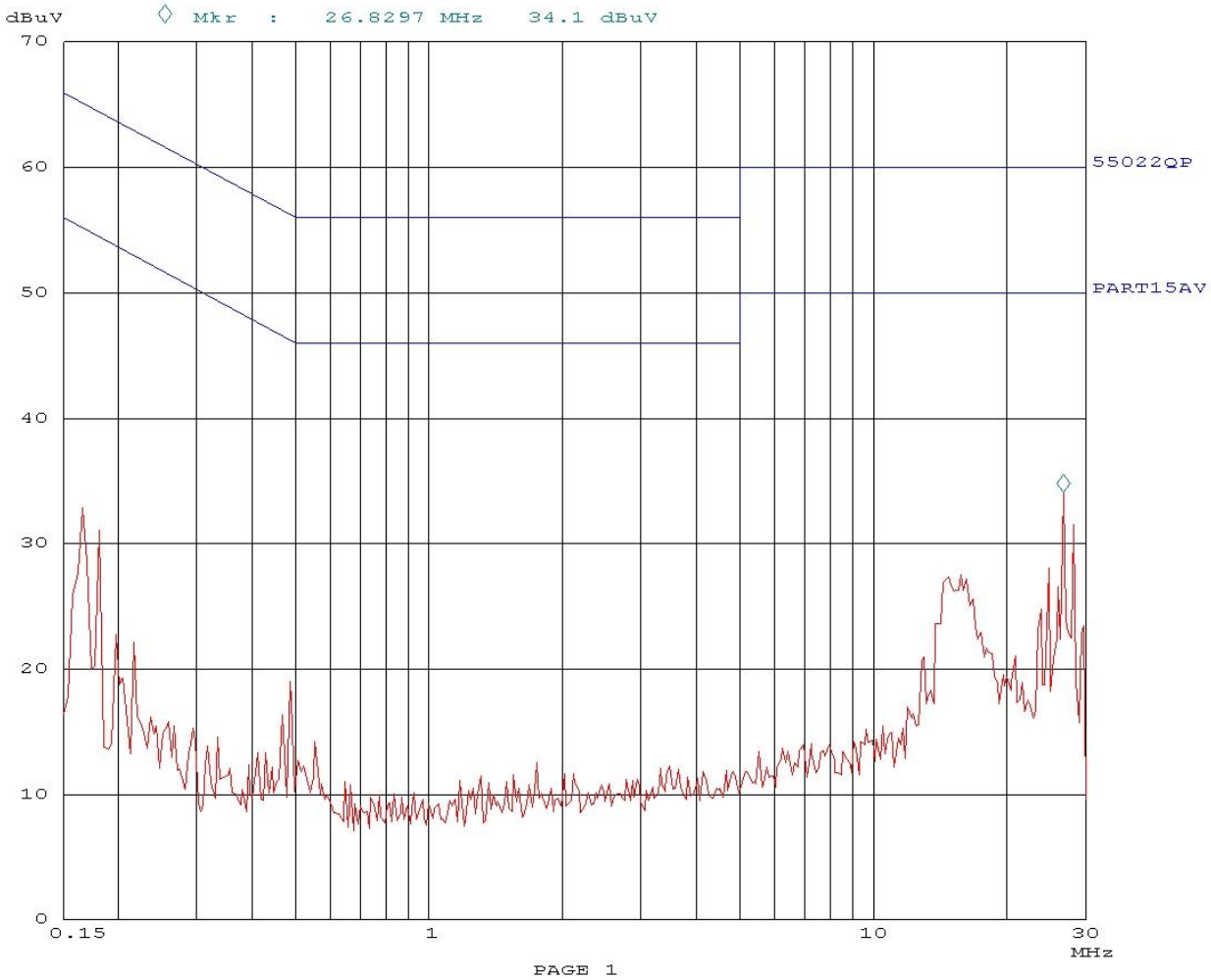
Plot 22 AC Power Line Conducted Emissions on L1, EUT in combination with Power supply at 24Vdc

06. Jan 16 15:28

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	0dBLN	OFF

Final Measurement: x QP
Meas Time: 1 s
Subranges: 25
Acc Margin: 6dB



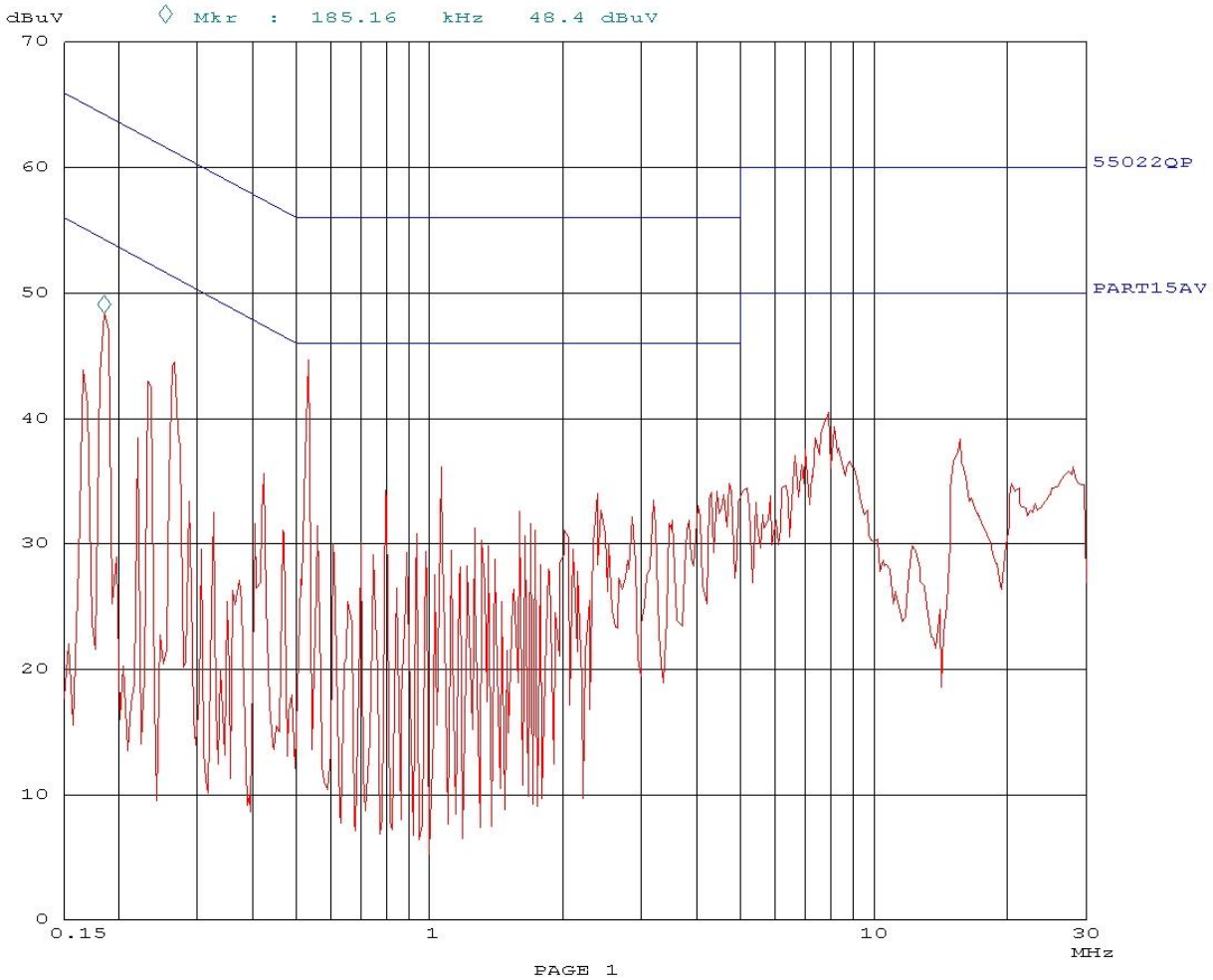
Plot 23 AC Power Line Conducted Emissions on L2, EUT in combination with Power supply at 24Vdc

07. Jan 16 10:22

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	0dBLN	OFF

Final Measurement: x QP
Meas Time: 1 s
Subranges: 25
Acc Margin: 6dB

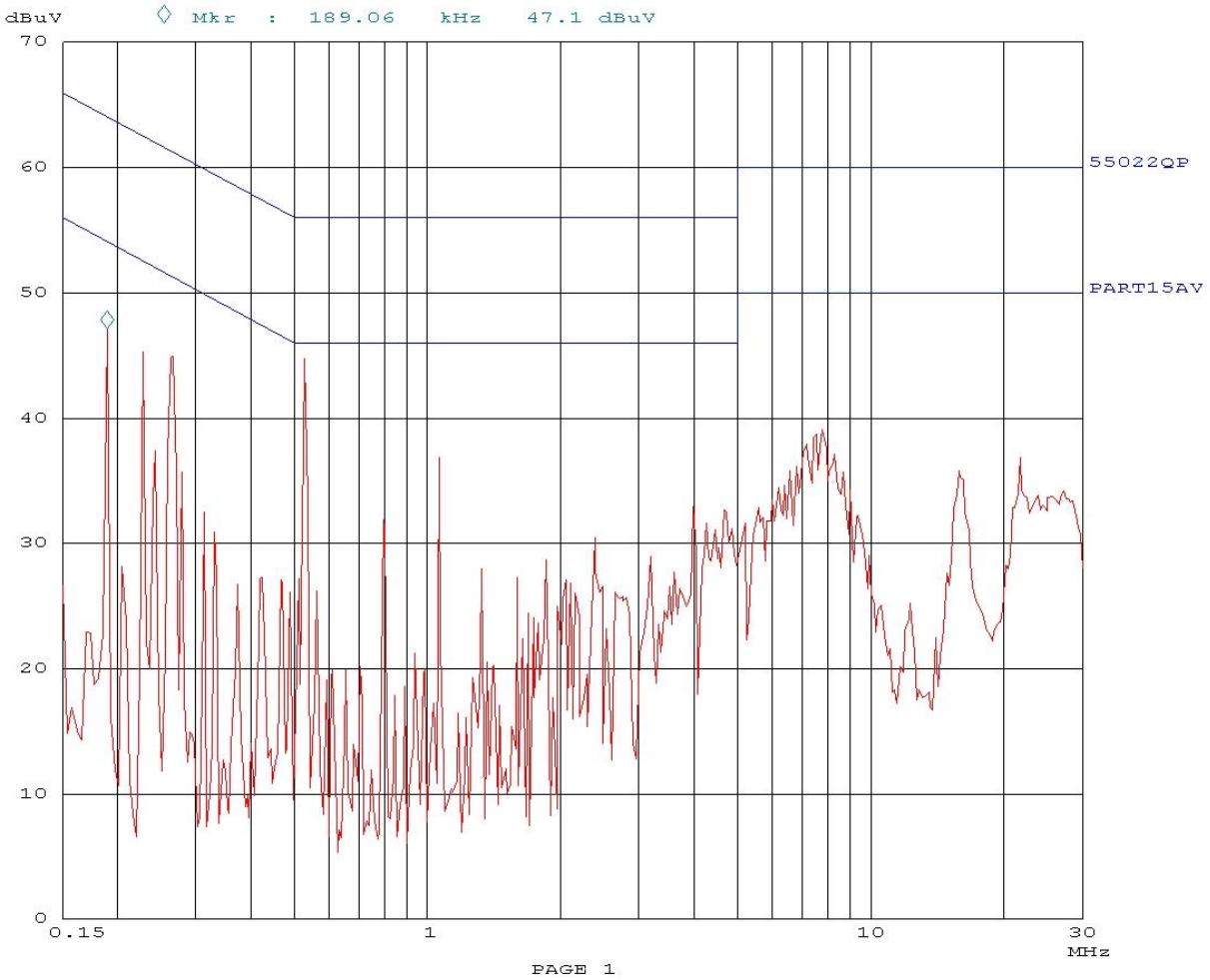


Plot 24 AC Power Line Conducted Emissions on L1, EUT in combination with POE (AUX3)

07. Jan 16 10:32

```
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   0dBLN   OFF

Final Measurement: x QP
                   Meas Time:     1 s
                   Subranges:    25
                   Acc Margin:    6dB
```



Plot 25 AC Power Line Conducted Emissions on L2, EUT in combination with POE (AUX3)

10 List of utilized test equipment.

Kind of Equipment	Manufacturer	Model Name	Inventory number	Calibration date (mm/yyyy)	Calibration due date (mm/yyyy)
For Antenna Port Conducted Emissions					
Temperature-Humidity meter	Extech	SD500	A00446	03/2015	03/2016
Spectrum Analyzer	Rohde & Schwarz	FSV	A00337	05/2015	05/2016
RF Cable	H+S	Secuflex	A00347	04/2015	04/2016
For Radiated Emissions					
Measurement Receiver	Rohde & Schwarz	ESCI	A00314	03/2015	03/2016
RF Cable S-AR	Gigalink	APG0500	A00447	01-30/2015	01-30/2016
Controller	Maturo	SCU/088/ 8090811	A00450	N/A	N/A
Controller	EMCS	DOC202	A00257	N/A	N/A
Test facility	Comtest	FCC listed: 90828 IC: 2932G-2	A00235	04/2014	04/2017
Spectrum Analyzer	Rohde & Schwarz	FSV	A00337	05/2015	05/2016
Antenna mast	EMCS	AP-4702C	A00258	N/A	N/A
Temperature-Humidity meter	Extech	SD500	A00444	03/2015	03/2016
Guidehorn 1-18 GHz	EMCO	3115	A00009	04/2015	04/2016
Biconilog Test antenna	Teseq	CBL 6111D	A00466	06/2015	06/2016
1GHz High pass filter	Wainwright Instr.	WHKX12-935-100C	A01750	N/A	N/A
Preamplifier 0.5 - 18 GHz	Miteq	AMF-5D-005180-28-13p	A00247	N/A	N/A
Filterbox	EMCS	RFS06S	A00255	11/2015	11/2016
For AC Power Line	**Conducted**	**Emissions**			
Pulse limiter	R&S	ESH3-Z2	A00051	01-05/2016	01-05/2017
Variac	RFT	LSS020	A00171	NA	NA
LISN	EMCO	3625/2	A00022	01-18/2014	01-18/2016
RF cable	-	-	A01844	NA	NA
DC Power supply	Delta Elektronica	SM6020	A00040	04/2015	04/2016
Measurement Receiver	Rohde & Schwarz	ESCS30	A00726	09/2015	09/2016
Shielded room for Conducted emissions	--	--	A00437	NA	NA
Temperature-Humiditymeter	Extech	SD500	A00444	03/2015	03/2016

NA= Not Applicable

Conformance of the used measurement and test equipment with the requirements of ISO/IEC 17025:2005 has been confirmed before testing.