

CETECOM™

CETECOM ICT Services
consulting - testing - certification >>>

TEST REPORT

Test report no.: 1-1410/16-01-05



Deutsche
Akkreditierungsstelle
D-PL-12076-01-01

Testing laboratory

CETECOM ICT Services GmbH

Untertuerkheimer Strasse 6 – 10

66117 Saarbruecken / Germany

Phone: + 49 681 5 98 - 0

Fax: + 49 681 5 98 - 9075

Internet: <http://www.cetecom.com>

e-mail: ict@cetecom.com

Accredited Testing Laboratory:

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)

The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-01

Applicant

Sennheiser electronic GmbH & Co. KG

Am Labor 1

30900 Wedemark / GERMANY

Phone: +49 5130 600-0

Fax: +49 5130 600-574

Contact: Volker Bartsch

e-mail: volker.bartsch@sennheiser.com

Phone: +49 5130 600 1465

Manufacturer

Sennheiser electronic GmbH & Co. KG

Am Labor 1

30900 Wedemark / GERMANY

Test standard/s

47 CFR Part 74

Part 74 – Experimental radio, auxiliary, special broadcast and or other program distributional services

RSS - 210 Issue 8

Spectrum Management and Telecommunications Radio Standards Specification - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

RSS - 210 Issue 8
Amendment 1

RSS-210, Amendment 1 — Licence-Exempt, Low-Power Radio Apparatus
Operating in the Television Bands (February 2015)

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item: In-Ear Monitoring Stereo Transmitter

Model name: SR300-IEMG3

FCC ID: DMOG3SREKU

IC: 2099A-G3SREKU

Frequency band: 470 MHz to 608 MHz

Technology tested: Analog FM

Antenna: External dedicated dipole antenna

Power supply: 110 V AC by mains adapter FW7661/12

Temperature range: -10°C to +55°C



This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Test report authorized:

Andreas Luckenbill
Lab Manager
Radio Communications & EMC

Test performed:

Marco Bertolino
Lab Manager
Radio Communications & EMC

1 Table of contents

1 Table of contents2

2 General information3

 2.1 Notes and disclaimer3

 2.2 Application details.....3

3 Test standard/s and references4

4 Test environment.....5

5 Test item5

 5.1 General description5

 5.2 Additional information5

6 Test laboratories sub-contracted5

7 Description of the test setup6

 7.1 Shielded fully anechoic chamber7

 7.2 Conducted measurements normal and extreme conditions.....8

 7.3 AC conducted9

8 Sequence of testing10

 8.1 Sequence of testing radiated spurious 9 kHz to 12.75 GHz.....10

9 Measurement uncertainty11

10 Summary of measurement results.....12

11 Additional comments13

12 Measurement results14

 12.1 Transmitter output power14

 12.2 Occupied bandwidth.....18

 12.3 Transmitter frequency stability22

 12.4 Transmitter unwanted emissions (radiated)24

 12.5 Modulation characteristics37

 12.6 Necessary bandwidth (BN) for analogue systems38

 12.7 Frequency modulation41

 12.8 Spurious emissions conducted below 30 MHz (AC conducted).....44

13 Observations47

Annex A Document history47

Annex B Further information.....47

Annex C Accreditation Certificate48

2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM ICT Services GmbH.

The testing service provided by CETECOM ICT Services GmbH has been rendered under the current "General Terms and Conditions for CETECOM ICT Services GmbH".

CETECOM ICT Services GmbH will not be liable for any loss or damage resulting from false, inaccurate, inappropriate or incomplete product information provided by the customer.

Under no circumstances does the CETECOM ICT Services GmbH test report include any endorsement or warranty regarding the functionality, quality or performance of any other product or service provided.

Under no circumstances does the CETECOM ICT Services GmbH test report include or imply any product or service warranties from CETECOM ICT Services GmbH, including, without limitation, any implied warranties of merchantability, fitness for purpose, or non-infringement, all of which are expressly disclaimed by CETECOM ICT Services GmbH.

All rights and remedies regarding vendor's products and services for which CETECOM ICT Services GmbH has prepared this test report shall be provided by the party offering such products or services and not by CETECOM ICT Services GmbH.

In no case this test report can be considered as a Letter of Approval.

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

2.2 Application details

Date of receipt of order:	2016-03-18
Date of receipt of test item:	2016-03-30
Start of test:	2016-03-30
End of test:	2016-04-08
Person(s) present during the test:	-/-

3 Test standard/s and references

Test standard	Date	Description
47 CFR Part 74	-/-	Part 74 – Experimental radio, auxiliary, special broadcast and or other program distributional services
CFR 47 Part 2	-/-	Frequency allocations and radio treaty matters; general rules and regulations
CFR 47 Part 15	-/-	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 210 Issue 8	December 2010	Spectrum Management and Telecommunications Radio Standards Specification - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
RSS - 210 Issue 8 Amendment 1	February 2015	RSS-210, Amendment 1 — Licence-Exempt, Low-Power Radio Apparatus Operating in the Television Bands (February 2015)
RSS – Gen Issue 4	November 2014	General Requirements for Compliance of Radio Apparatus
ETSI EN 300 422-1 V1.4.2	2011-08	Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; Part 1: Technical characteristics and methods of measurement
ETSI EN 300 422-2 V1.3.1	2011-08	Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; Part 2: Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive
Guidance	Version	Description
ANSI C63.4-2014	-/-	American national standard for methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz

4 Test environment

Temperature	:	T_{nom} +20 °C during room temperature tests T_{max} +50 °C during high temperature tests T_{min} -30 °C during low temperature tests
Relative humidity content	:	55 %
Barometric pressure	:	not relevant for this kind of testing
Power supply	:	V_{nom} 110.0 V AC by mains adapter FW7661/12 V_{max} 126.5 V V_{min} 93.5 V

5 Test item

5.1 General description

Kind of test item	:	In-Ear Monitoring Stereo Transmitter
Type identification	:	SR300-IEMG3
HMN	:	-/-
PMN	:	SR 300 IEM
HVIN	:	SR300IEMG3A1
FVIN	:	1.7.8. DevId39, SWR26
S/N serial number	:	Radiated unit: 1036290308
Hardware status	:	No information available!
Software status	:	No information available!
Frequency band	:	470 MHz to 608 MHz (lowest channel 470.075 MHz, highest channel 516.000 MHz)
Type of radio transmission	:	Modulated carrier
Use of frequency spectrum	:	
Type of modulation	:	Analog FM
Antenna	:	External dedicated dipole antenna
Power supply	:	110 V AC by mains adapter FW7661/12
Temperature range	:	-10°C to +55°C

5.2 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup- and EUT-photos are included in test report: 1-1410/16-01-16_AnnexA
1-1410/16-01-16_AnnexB
1-1410/16-01-16_AnnexC

6 Test laboratories sub-contracted

None

7 Description of the test setup

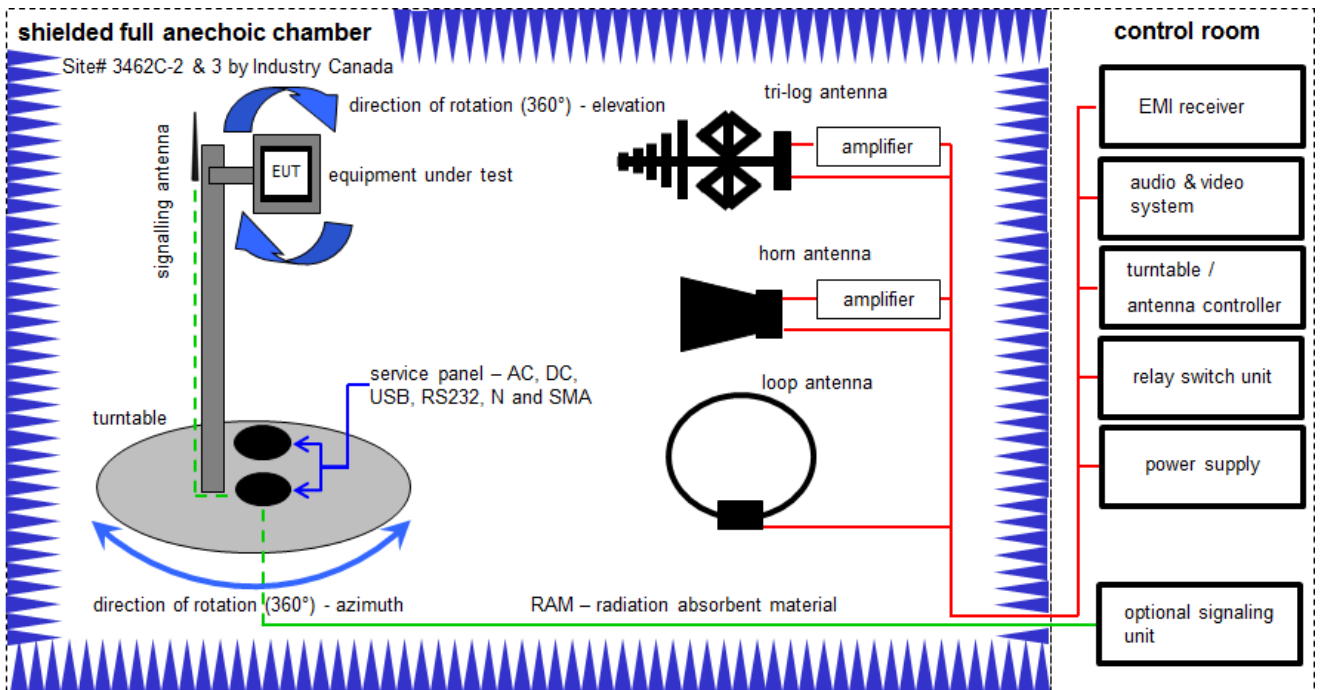
Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signaling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

Agenda: Kind of Calibration

k	calibration / calibrated	EK	limited calibration
ne	not required (k, ev, izw, zw not required)	zw	cyclical maintenance (external cyclical maintenance)
ev	periodic self verification	izw	internal cyclical maintenance
Ve	long-term stability recognized	g	blocked for accredited testing
v/k!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress

7.1 Shielded fully anechoic chamber



Measurement distance: tri-log antenna and horn antenna 3 meter; loop antenna 3 meter

$$FS = UR + CA + AF$$

(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

Example calculation:

$$FS [dB\mu V/m] = 40.0 [dB\mu V/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dB\mu V/m] (71.61 \mu V/m)$$

$$OP = AV + D - G + CA$$

(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain+amplifier gain; CA-loss signal path)

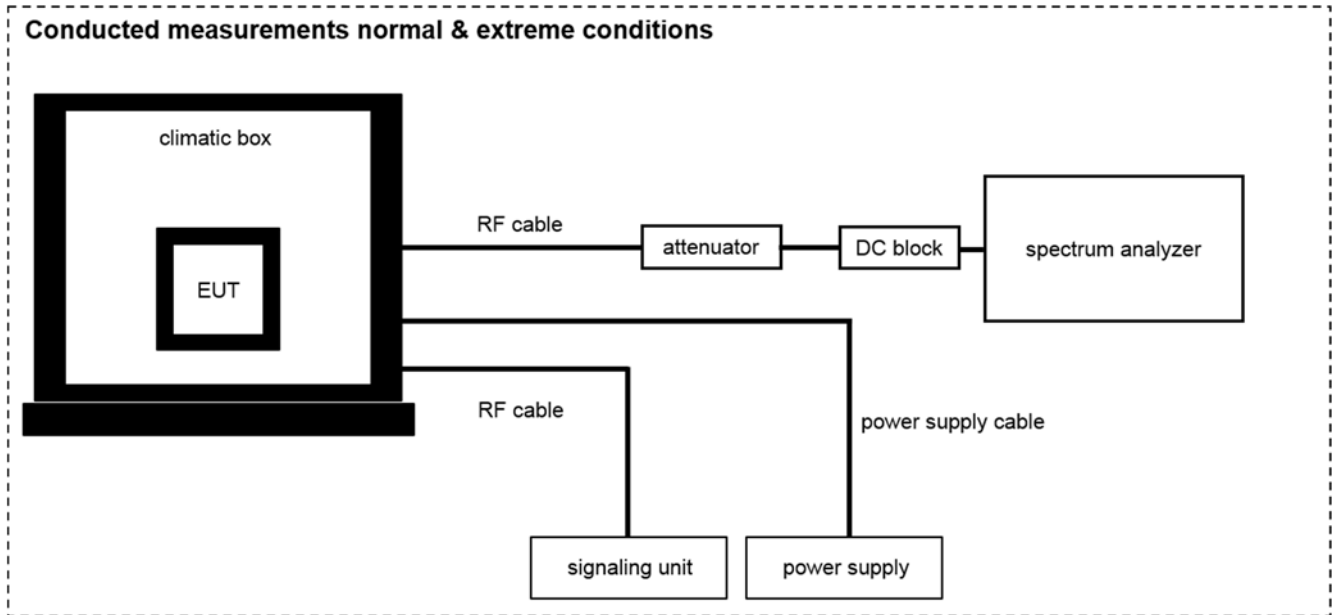
Example calculation:

$$OP [dBm] = -65.0 [dBm] + 50 [dB] - 20 [dBi] + 5 [dB] = -30 [dBm] (1 \mu W)$$

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9709-5290	300000212	k	13.08.2015	13.08.2017
2	A	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	02.02.2016	02.02.2017
3	A	Highpass Filter	WHK1.1/15G-10SS	Wainwright	37	400000148	ne	-/-	-/-
4	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	318	300003696	k	22.04.2014	22.04.2017
5	A	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000032	300004510	ne	-/-	-/-
6	A	Messrechner und Monitor	Intel Core i3 3220/3,3 GHz, Prozessor	Agilent Technologies	2V2403033A54 21	300004591	ne	-/-	-/-
7	A	NEXIO EMV-Software	BAT EMC	EMCO	2V2403033A54 21	300004682	ne	-/-	-/-
8	A	Active Loop Antenna 10 kHz to 30 MHz	6502	EMCO/2	8905-2342	300000256	k	24.06.2015	24.06.2017

7.2 Conducted measurements normal and extreme conditions



OP = AV + CA
 (OP-output power; AV-analyzer value; CA-loss signal path)

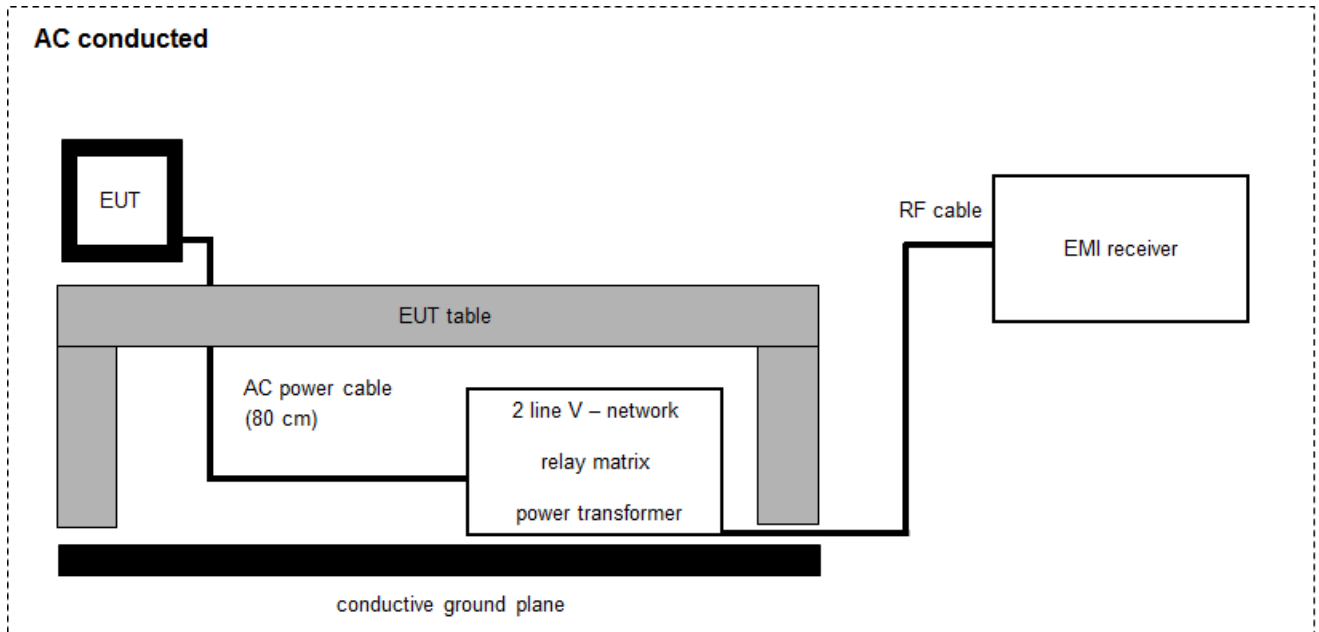
Example calculation:

OP [dBm] = 6.0 [dBm] + 11.7 [dB] = 17.7 [dBm] (58.88 mW)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A, B, C	DC Power Supply 0 - 32V	1108-32	Heiden Elektronik	001802	300001383	Ve	29.01.2014	29.01.2017
2	B	Temperature Test Chamber	VT 4002	Heraeus Voetsch	521/83761	300002326	ev	03.09.2015	03.09.2017
3	A, B, C	Spectrum Analyzer 9kHz to 30GHz - 140..+30dBm	FSP30	R&S	100886	300003575	k	27.01.2016	27.01.2018
4	A, B, C, D	RF-Cable	ST18/SMAm/SMAm/72	Huber & Suhner	Batch no. 699714	400001184	ev	-/-	-/-
5	A, B, C, D	DC-Blocker 0.1-40 GHz	8141A	Inmet	Batch no. 699714	400001185	ev	-/-	-/-
6	C	Radiocom. Analyzer Multifunction synthesizer DC-600 kHz	CMTA 84	R&S	894199/012	300001176	vIKI!	07.03.2016	07.03.2018
7	A, B, C, D	Audio Analyzer	8904A	HP	2822A01203	300001367	Ve	30.01.2014	30.01.2017
8	C	Signal Analyzer 40 GHz	UPA	R&S	841074/009	300001236	k	02.02.2016	02.02.2018
9	D		FSV40	R&S	101353	300004819	k	24.08.2015	24.08.2016

7.3 AC conducted



$$FS = UR + CF + VC$$

(FS-field strength; UR-voltage at the receiver; CR-loss of the cable and filter; VC-correction factor of the ISN)

Example calculation:

$$FS [dB\mu V/m] = 37.62 [dB\mu V/m] + 9.90 [dB] + 0.23 [dB] = 47.75 [dB\mu V/m] (244.06 \mu V/m)$$

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Netznachbildung	ESH3-Z5	R&S	892475/017	300002209	k	17.06.2014	17.06.2016
2	A	EMI-Receiver	8542E	HP	3617A00170	300000568	k	28.01.2016	28.01.2017
3	A.	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	Ve	28.01.2016	28.01.2017

8 Sequence of testing

8.1 Sequence of testing radiated spurious 9 kHz to 12.75 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 10 m or 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 m to 3 m.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position $\pm 45^\circ$ and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

9 Measurement uncertainty

Measurement uncertainty	
Test case	Uncertainty
Transmitter output power	± 3 dB
Occupied bandwidth	± 3 kHz to 10 kHz (depends on the used RBW)
Transmitter frequency stability	± 1 Hz to 1 kHz (depends on the used RBW)
Transmitter unwanted emissions (radiated or conducted)	Radiated: ± 3 dB Conducted: ± 0.5 dB
Modulation characteristics	-/-
Necessary bandwidth (BN) for analogue systems	± 1 kHz (depends on the used RBW)
Frequency modulation	± 3 kHz (depends on the used RBW)
Spurious emissions conducted below 30 MHz (AC conducted)	± 2.6 dB

10 Summary of measurement results

<input checked="" type="checkbox"/>	No deviations from the technical specifications were ascertained
<input type="checkbox"/>	There were deviations from the technical specifications ascertained
<input type="checkbox"/>	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	FCC Part 74 RSS - 210, Issue 8, Amendment 1 RSS-Gen Issue 4	See table!	2016-06-02	-/-

Test specification clause	Test case	Temperature conditions	Voltage conditions	C	NC	NA	NP	Remark
FCC Part 74.861 (e)(1)(ii) RSS-210 A1 – 5.1 & 5.3.2 RSS-Gen – 6.12	Transmitter output power	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
FCC Part 74.861 (e)(5) FCC Part 2.1049 RSS-210 A1 – 6.2 RSS-Gen – 6.6	Occupied bandwidth	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
FCC Part 74.861 (e)(4) FCC Part 2.1055 RSS-210 A1 – 6.3 RSS-Gen – 6.11	Transmitter frequency stability	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
		Extreme	Extreme	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
FCC Part 74.861 (e)(6) RSS-210 A1 – 6.4.1	Transmitter unwanted emissions (radiated or conducted)	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
FCC Part 2.1049	Modulation characteristics	Nominal	Nominal	-/-				-/-
FCC Part 74.861 (e)(7) ETSI EN 300 422-1 8.3.1	Necessary bandwidth (BN) for analogue systems	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
FCC Part 74.861 (e)(3) RSS-210 A1 – 6.6.2	Frequency modulation	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
RSS-210 A1 – 6.5 RSS-Gen	Receiver spurious emissions	Nominal	Nominal	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	No receiver integrated!
§15.107(a) §15.207	Conducted emissions < 30 MHz	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-

Note: C = Compliant; NC = Not compliant; NA = Not applicable; NP = Not performed

11 Additional comments

Reference documents: None

Special test descriptions: None

Configuration descriptions: EUT tested with a sensitivity setting of -30 dB – pre-setting from manufacturer.

Test mode:

- No test mode available.
Test signal is applied to the transmitter.
- Special software is used.
EUT is transmitting pseudo random data by itself

Antennas and transmit operating modes:

- Operating mode 1 (single antenna)
- *Equipment with 1 antenna,*
 - *Equipment with 2 diversity antennas operating in switched diversity mode by which at any moment in time only 1 antenna is used,*
 - *Smart antenna system with 2 or more transmit/receive chains, but operating in a mode where only 1 transmit/receive chain is used)*
- Operating mode 2 (multiple antennas, no beamforming)
- *Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously but without beamforming.*
- Operating mode 3 (multiple antennas, with beamforming)
- *Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously with beamforming. In addition to the antenna assembly gain (G), the beamforming gain (Y) may have to be taken into account when performing the measurements.*

12 Measurement results

12.1 Transmitter output power

Measurement:

Measurement parameter	
Detector:	Peak (worst case) / Average (RMS)
Sweep time:	Auto / 20s
Resolution bandwidth:	> emission bandwidth
Video bandwidth:	> resolution bandwidth
Span:	> 2 times emissions bandwidth
Trace mode:	Max. hold
EUT configuration:	Peak: Unmodulated carrier RMS: Modulate the transmitter with a 2.5 kHz tone at a level 16 dB higher than that required to produce a frequency deviation of ± 75 kHz, or to produce 50% of the manufacturer's rated deviation, whichever is less.
Test setup:	See sub clause 7.2 – A
Measurement uncertainty:	See sub clause 9

Limits:

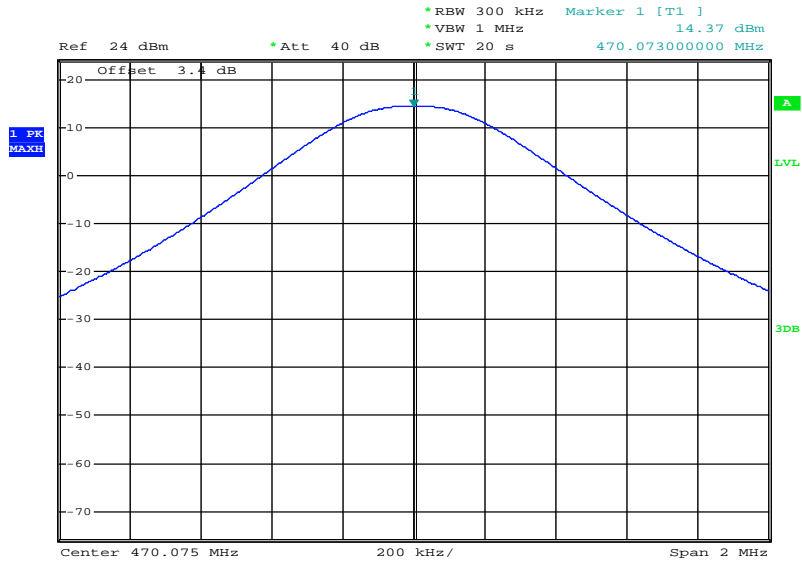
FCC & IC
470 MHz to 608 MHz 250 mW (average) / 24 dBm (average)

Result:

Frequency (MHz)	transmitter output power (dBm)	
	Peak	Average
470.075	14.37	14.23
493.000	14.85	14.74
516.000	14.95	14.82

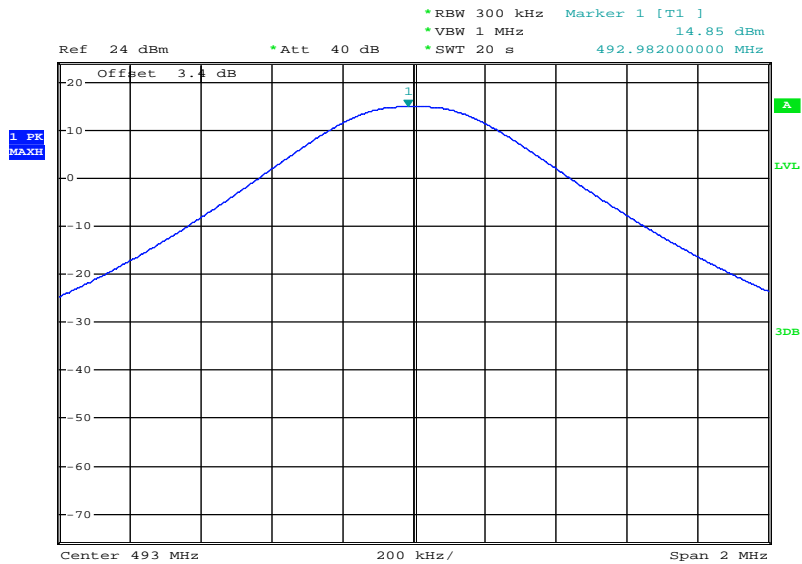
Plots:

Plot 1: lowest channel, conducted peak power



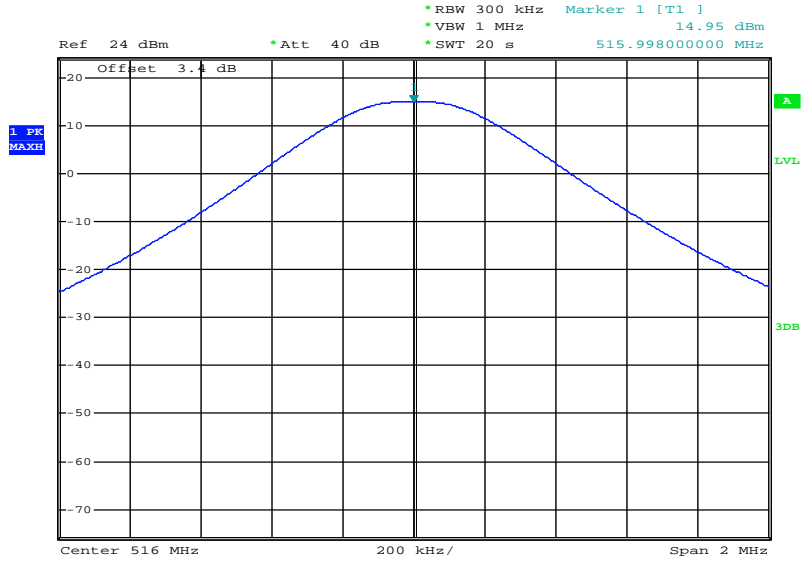
Date: 2.APR.2016 10:46:40

Plot 2: middle channel, conducted peak power



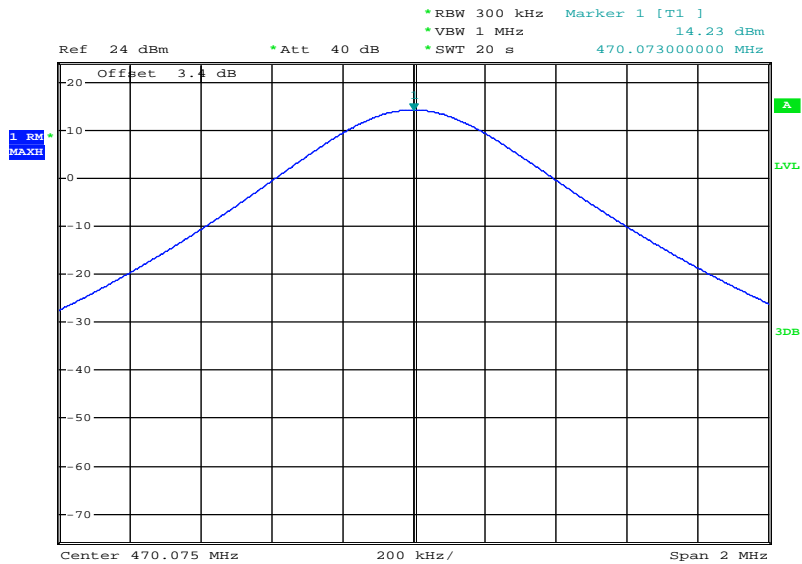
Date: 2.APR.2016 10:56:05

Plot 3: highest channel, conducted peak power



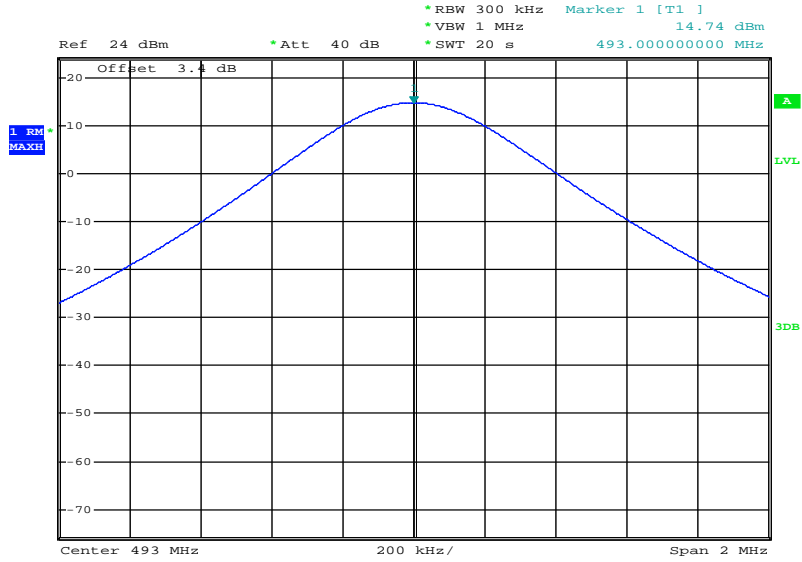
Date: 2.APR.2016 10:57:48

Plot 4: lowest channel, conducted average power



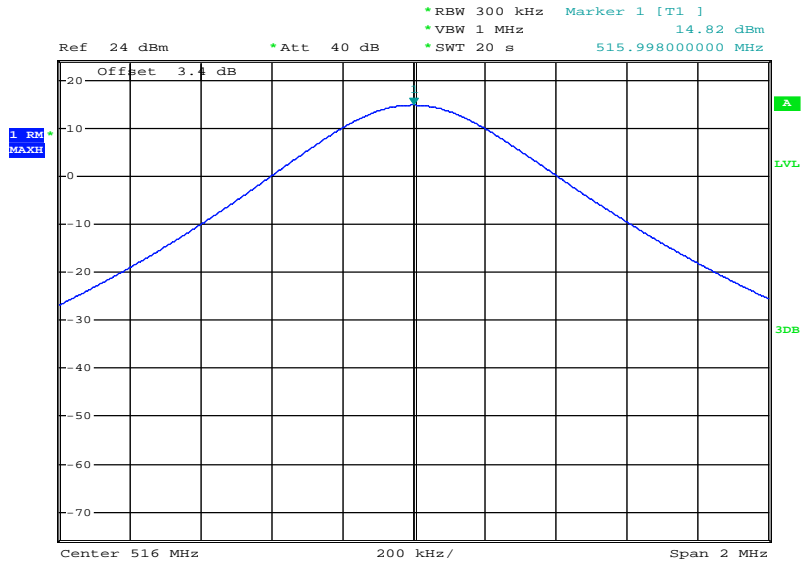
Date: 2.APR.2016 10:51:52

Plot 5: middle channel, conducted average power



Date: 2. APR. 2016 10:53:56

Plot 6: highest channel, conducted average power



Date: 2. APR. 2016 10:58:56

12.2 Occupied bandwidth

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1 % to 5 % of the occupied bandwidth
Video bandwidth:	3 x resolution bandwidth
Span:	2 x emission bandwidth
Trace mode:	Max. hold
Analyzer function:	99% power occupied bandwidth function
EUT:	Modulated signal with max. frequency deviation
Test setup:	See sub clause 7.2 - A
Measurement uncertainty:	See sub clause 9

Limits:

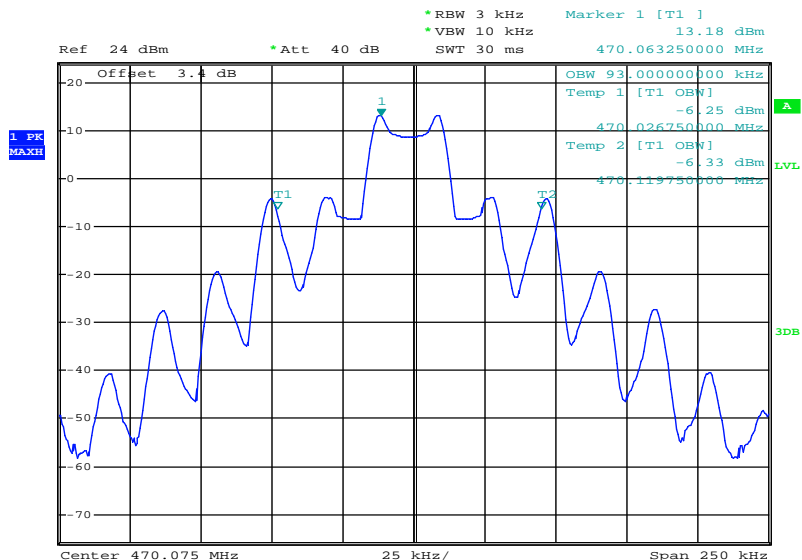
FCC & IC
470 MHz to 608 MHz 200 kHz
Occupied bandwidth 99%. Other than single sideband or independent sideband transmitters - when modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation. The input level shall be established at the frequency of maximum response of the audio modulating circuit.

Result:

Frequency (MHz)	occupied bandwidth (kHz)	
	1 kHz tone	2.5 kHz tone
470.075	93.0	105.0
493.000	92.3	104.3
516.000	92.5	104.8

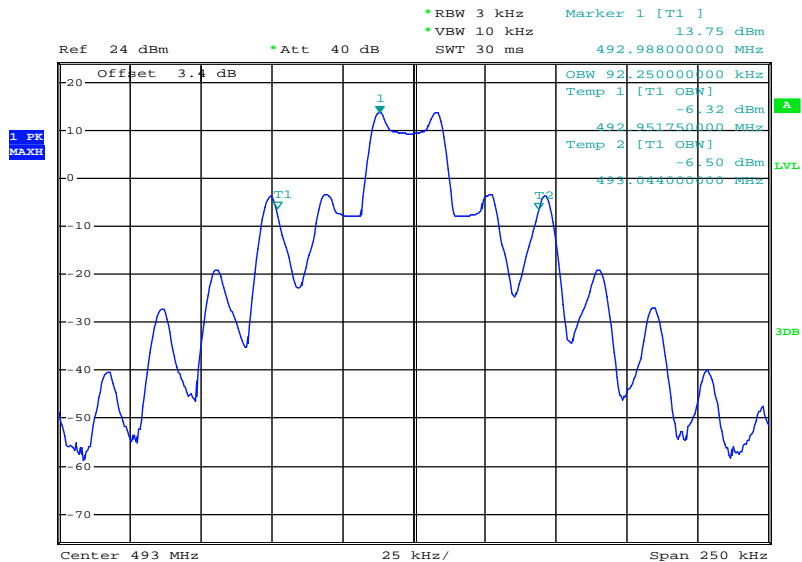
Plots:

Plot 1: lowest channel, 1 kHz tone



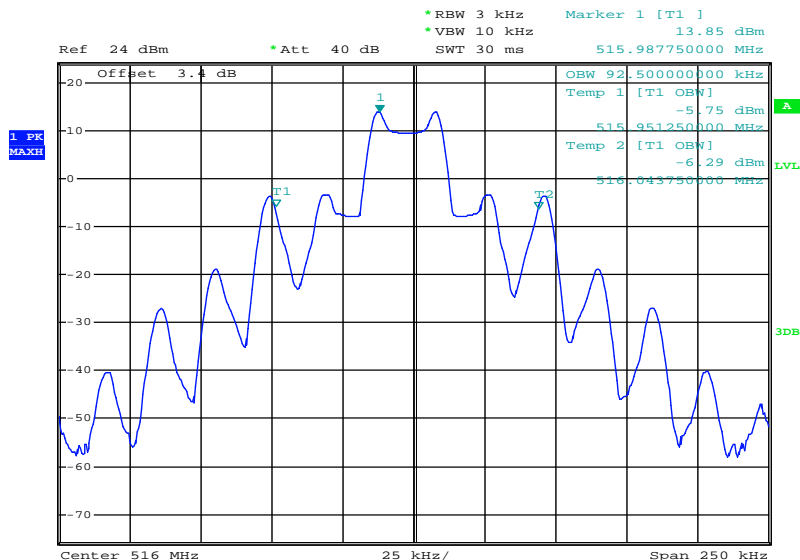
Date: 2.APR.2016 11:05:14

Plot 2: middle channel, 1 kHz tone



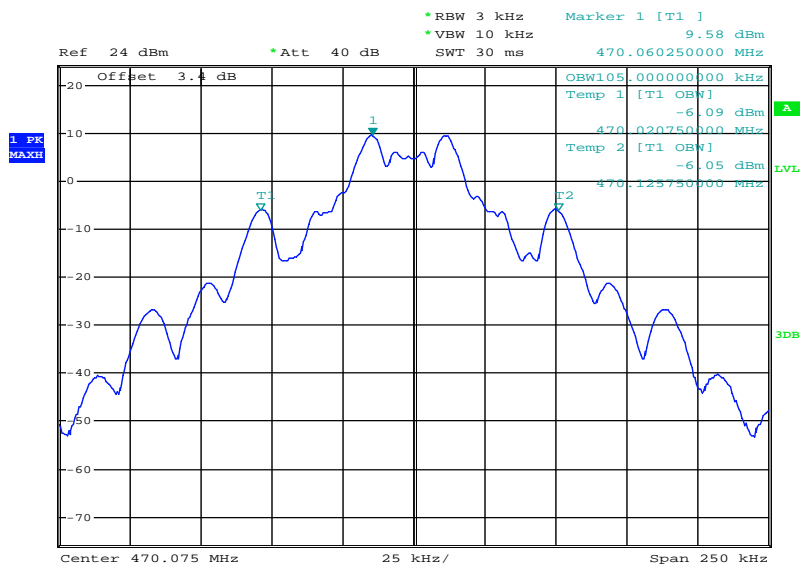
Date: 2.APR.2016 11:02:17

Plot 3: highest channel, 1 kHz tone



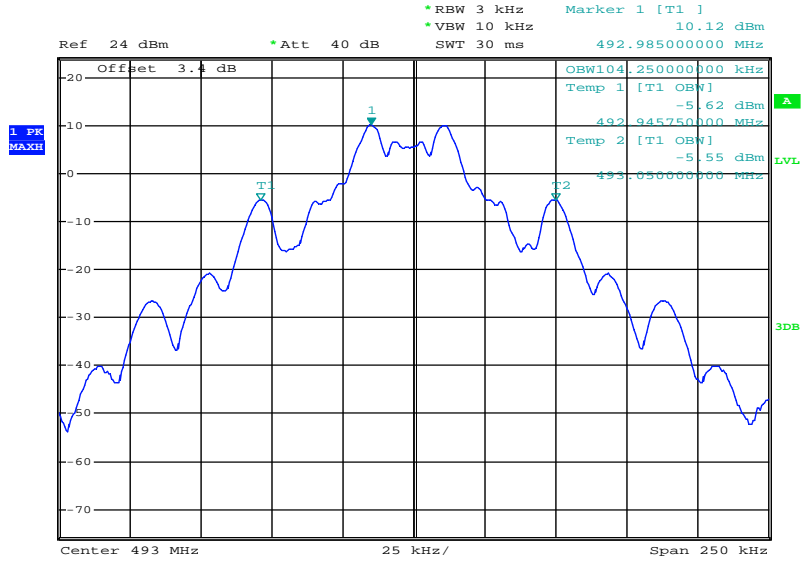
Date: 2.APR.2016 11:01:20

Plot 4: lowest channel, 2.5 kHz tone



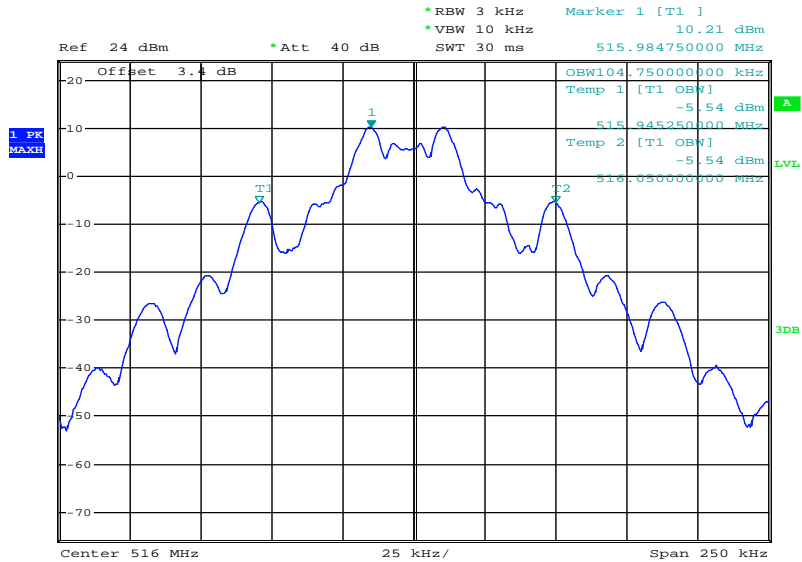
Date: 2.APR.2016 11:04:08

Plot 5: middle channel, 2.5 kHz tone



Date: 2.APR.2016 11:03:02

Plot 6: highest channel, 2.5 kHz tone



Date: 2.APR.2016 11:00:43

12.3 Transmitter frequency stability

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1 Hz / 10 Hz / 100 Hz
Video bandwidth:	3 x resolution bandwidth
Span:	wide enough to follow the frequency drift
Trace mode:	clear/write/view
EUT:	CW signal or MC with measurement method description
Test setup:	See sub clause 7.2 - B
Measurement uncertainty:	See sub clause 9

Limits:

FCC & IC
470 MHz to 608 MHz ± 50 ppm

Results: lowest channel

Temperature / Voltage	Frequency (MHz)	Deviation (kHz / ppm)
-30 °C / V_{nom}	470.0702	-4.8 / -10.2
-20 °C / V_{nom}	470.0719	-3.1 / -6.6
-10 °C / V_{nom}	470.0729	-2.1 / -4.5
0 °C / V_{nom}	470.0733	-1.7 / -3.6
+10 °C / V_{nom}	470.0732	-1.8 / -3.8
+20 °C / V_{nom}	470.0732	-1.8 / -3.8
+30 °C / V_{nom}	470.0731	-1.9 / -4.0
+40 °C / V_{nom}	470.0732	-1.8 / -3.8
+50 °C / V_{nom}	470.0733	-1.7 / -3.6
+55 °C / V_{nom} (not required)	470.0733	-1.7 / -3.6
+20 °C / $V_{nom} - 15\%$	470.0732	-1.8 / -3.8
+20 °C / V_{nom}	470.0732	-1.8 / -3.8
+20 °C / $V_{nom} + 15\%$	470.0732	-1.8 / -3.8

Results: middle channel

Temperature / Voltage	Frequency (MHz)	Deviation (kHz / ppm)
-30 °C / V_{nom}	492.9947	-5.3 / -10.8
-20 °C / V_{nom}	492.9964	-3.6 / -7.3
-10 °C / V_{nom}	492.9975	-2.5 / -5.1
0 °C / V_{nom}	492.9980	-2.0 / -4.1
+10 °C / V_{nom}	492.9979	-2.1 / -4.3
+20 °C / V_{nom}	492.9978	-2.2 / -4.5
+30 °C / V_{nom}	492.9978	-2.2 / -4.5
+40 °C / V_{nom}	492.9979	-2.1 / -4.3
+50 °C / V_{nom}	492.9980	-2.0 / -4.1
+55 °C / V_{nom} (not required)	492.9980	-2.0 / -4.1
<hr/>		
+20 °C / V_{nom} - 15%	492.9978	-2.2 / -4.5
+20 °C / V_{nom}	492.9978	-2.2 / -4.5
+20 °C / V_{nom} + 15%	492.9978	-2.2 / -4.5

Results: highest channel

Temperature / Voltage	Frequency (MHz)	Deviation (kHz / ppm)
-30 °C / V_{nom}	515.9943	-5.7 / -11.0
-20 °C / V_{nom}	515.9960	-4.0 / -7.8
-10 °C / V_{nom}	515.9972	-2.8 / -5.4
0 °C / V_{nom}	515.9977	-2.3 / -4.5
+10 °C / V_{nom}	515.9976	-2.4 / -4.7
+20 °C / V_{nom}	515.9975	-2.5 / -4.8
+30 °C / V_{nom}	515.9975	-2.5 / -4.8
+40 °C / V_{nom}	515.9975	-2.5 / -4.8
+50 °C / V_{nom}	515.9978	-2.2 / -4.3
+55 °C / V_{nom} (not required)	515.9977	-2.3 / -4.5
<hr/>		
+20 °C / V_{nom} - 15%	515.9975	-2.5 / -4.8
+20 °C / V_{nom}	515.9975	-2.5 / -4.8
+20 °C / V_{nom} + 15%	515.9975	-2.5 / -4.8

12.4 Transmitter unwanted emissions (radiated)

Measurement:

Measurement parameter		
Detector:	Peak	
Sweep time:	Auto	
Resolution bandwidth:	25 dBc and 35 dBc-criteria:	1% of the authorized bandwidth
	$55+10\log_{10}(P_{MEAN}$ in Watts) dB - criteria	30 kHz
	$43+10\log_{10}(P_{MEAN}$ in Watts) dB - criteria	120 kHz / 1 MHz
Video bandwidth:	3 x resolution bandwidth	
Trace mode:	Max. hold	
EUT:	MC with max frequency deviation	
Test setup:	See sub clause 7.1 – A See sub clause 7.2 – A	
Measurement uncertainty:	See sub clause 9	

Limits:

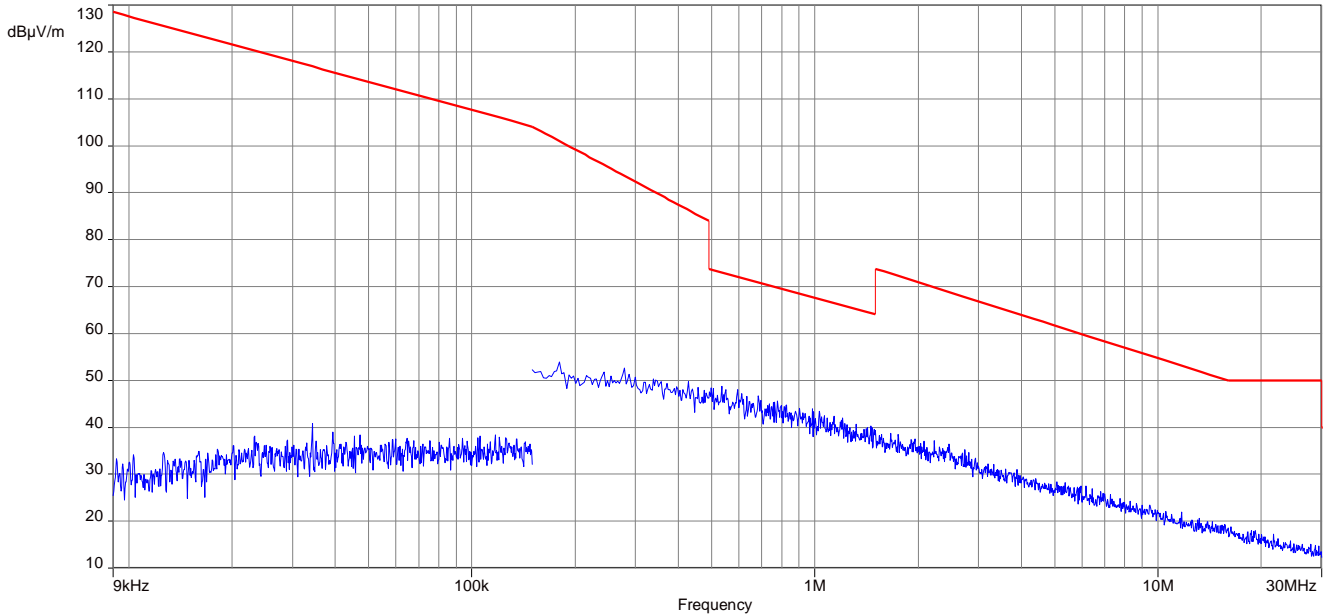
IC
<ul style="list-style-type: none"> at least 25 dB on any frequency that is removed from the operating frequency by more than 50%, up to and including 100% of the authorized bandwidth; and (FCC & IC) at least 35 dB on any frequency that is removed from the operating frequency by more than 100%, up to and including 250% of the authorized bandwidth. (FCC & IC) On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least $43 + 10 \cdot \log_{10}$ (mean output power in watts) dB. (FCC) at least $55 + 10 \cdot \log_{10}$ (P_{MEAN} in Watts) dB on any frequency removed from the operating frequency by more than 250% of the authorized bandwidth. (IC)

Results:

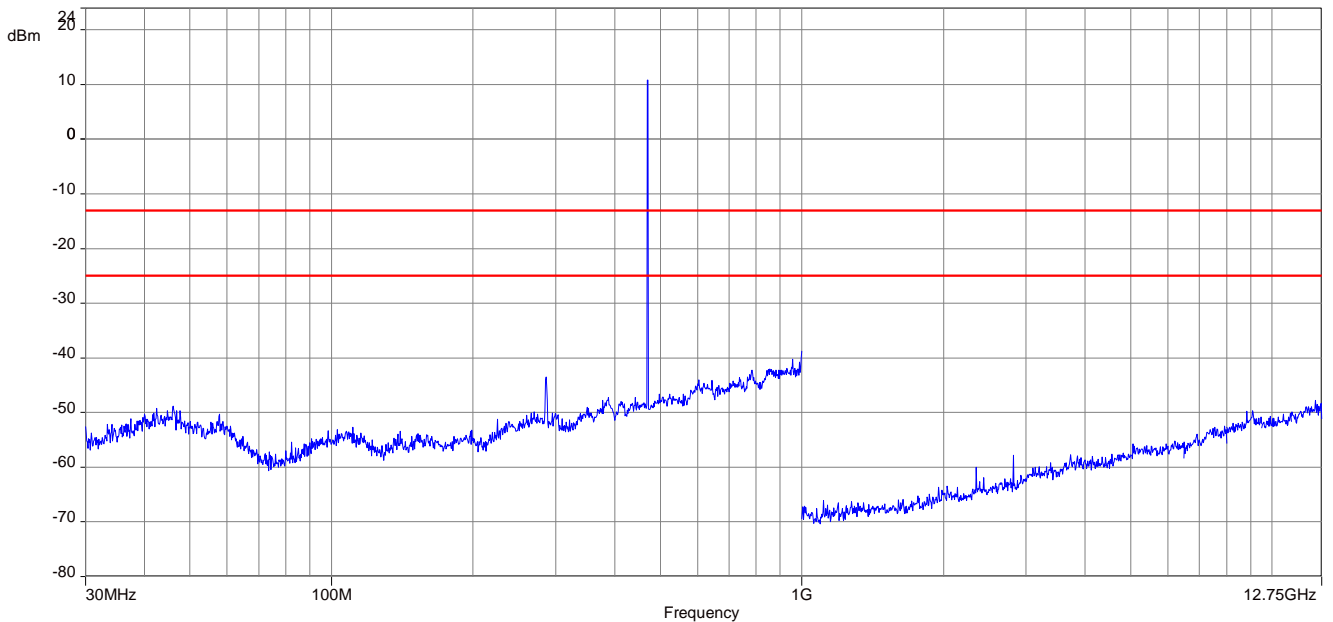
carrier frequency (MHz)	unwanted emission frequency (MHz)	Limit	level (dB) / (dBm) or remark
All detected emissions are more than 20 dB below the limit.			

Plots: radiated

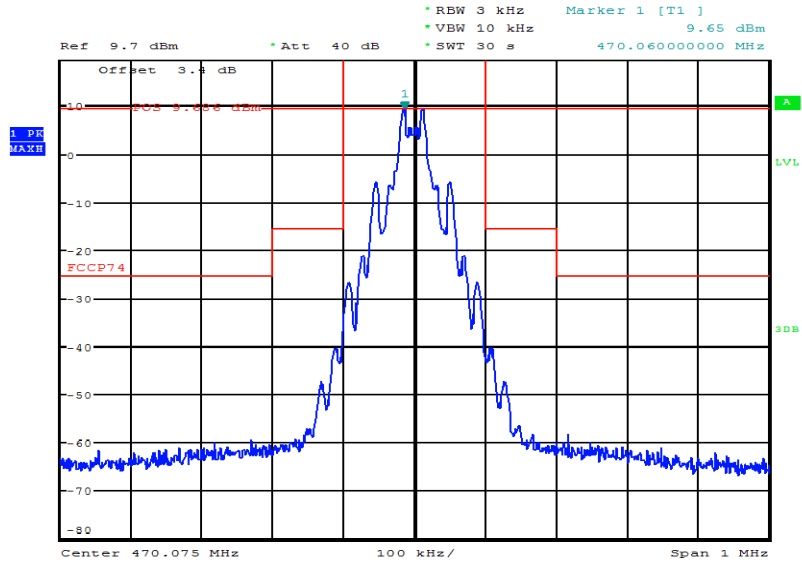
Plot 1: lowest channel, magnetic spurious emissions 9 kHz to 30 MHz



Plot 2: lowest channel, spurious emissions, 30 MHz – 12.75 GHz

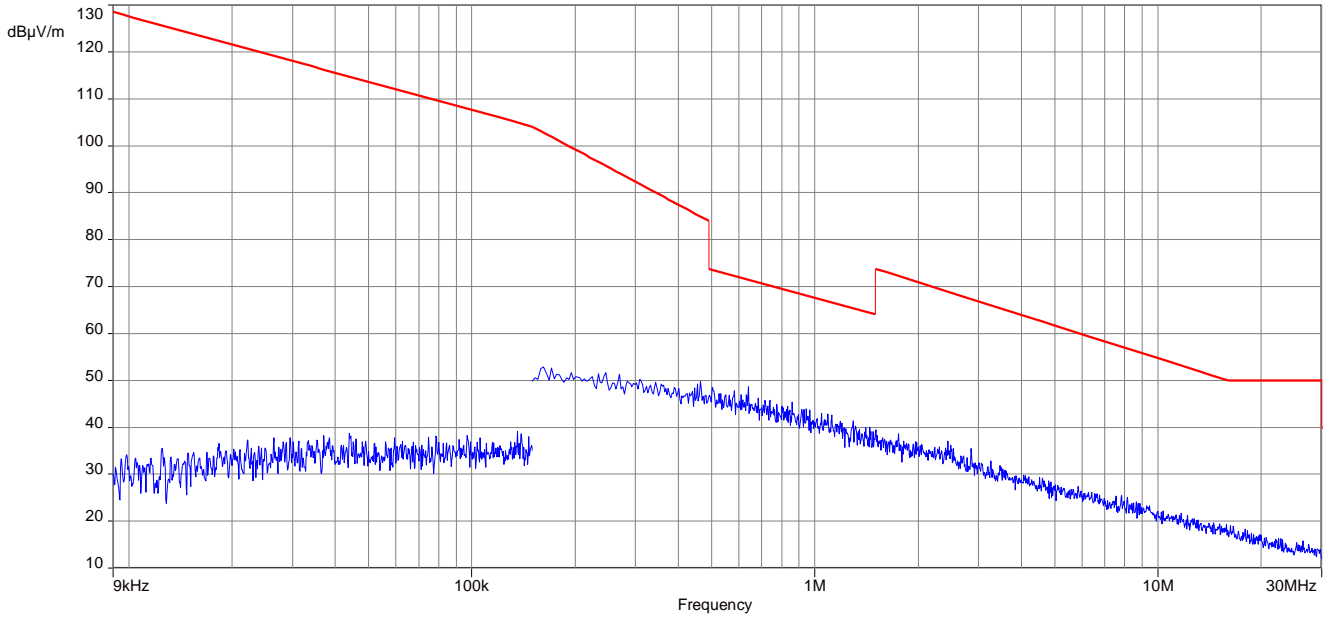


Plot 3: lowest channel, spectrum mask

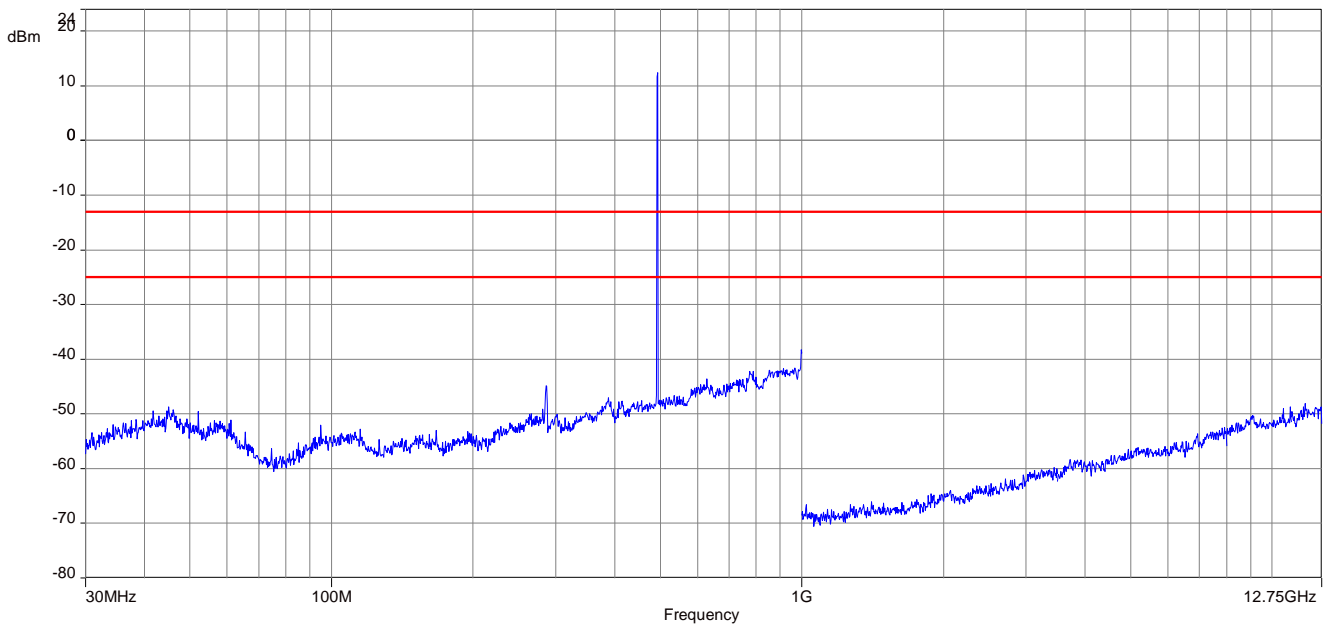


Date: 2.APR.2016 11:47:02

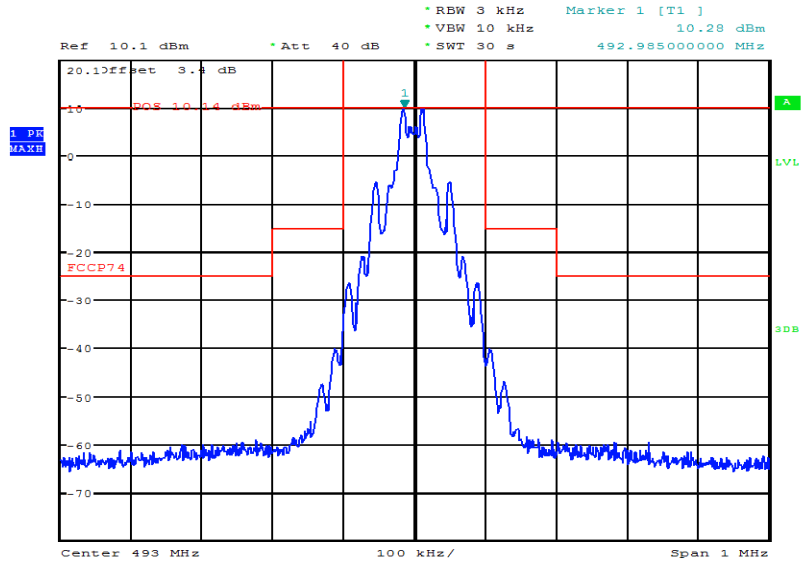
Plot 4: middle channel, magnetic spurious emissions 9 kHz to 30 MHz



Plot 5: middle channel, spurious emissions, 30 MHz – 12.75 GHz

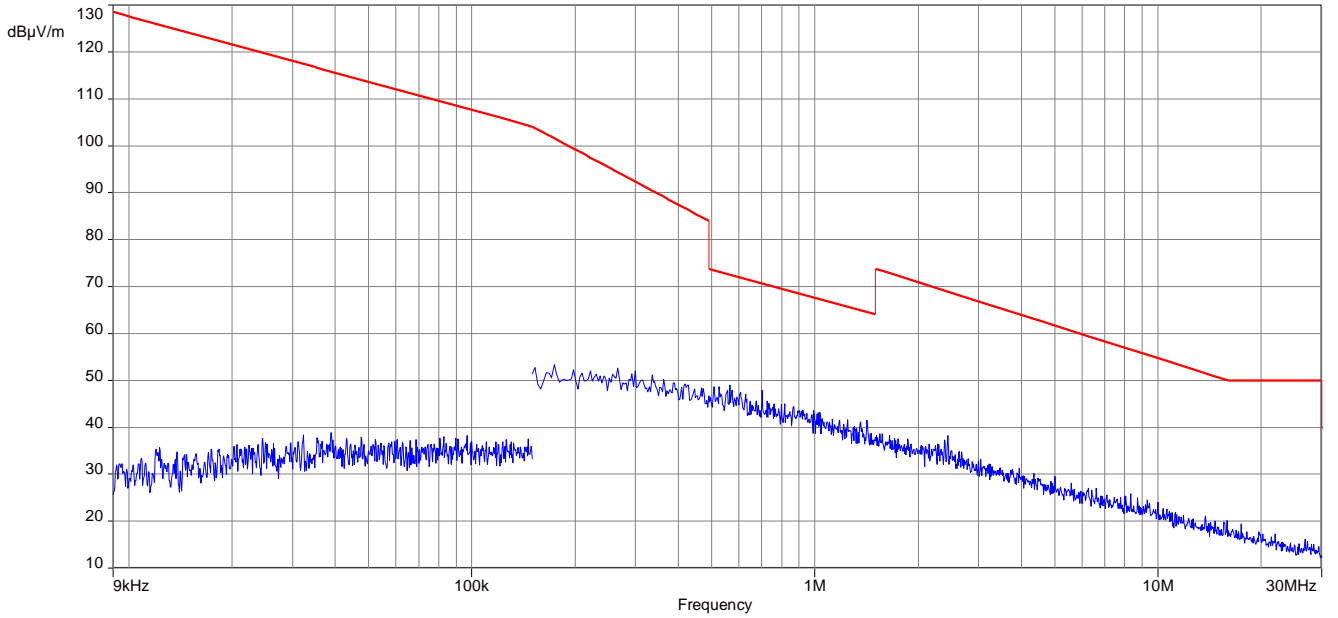


Plot 6: middle channel, spectrum mask

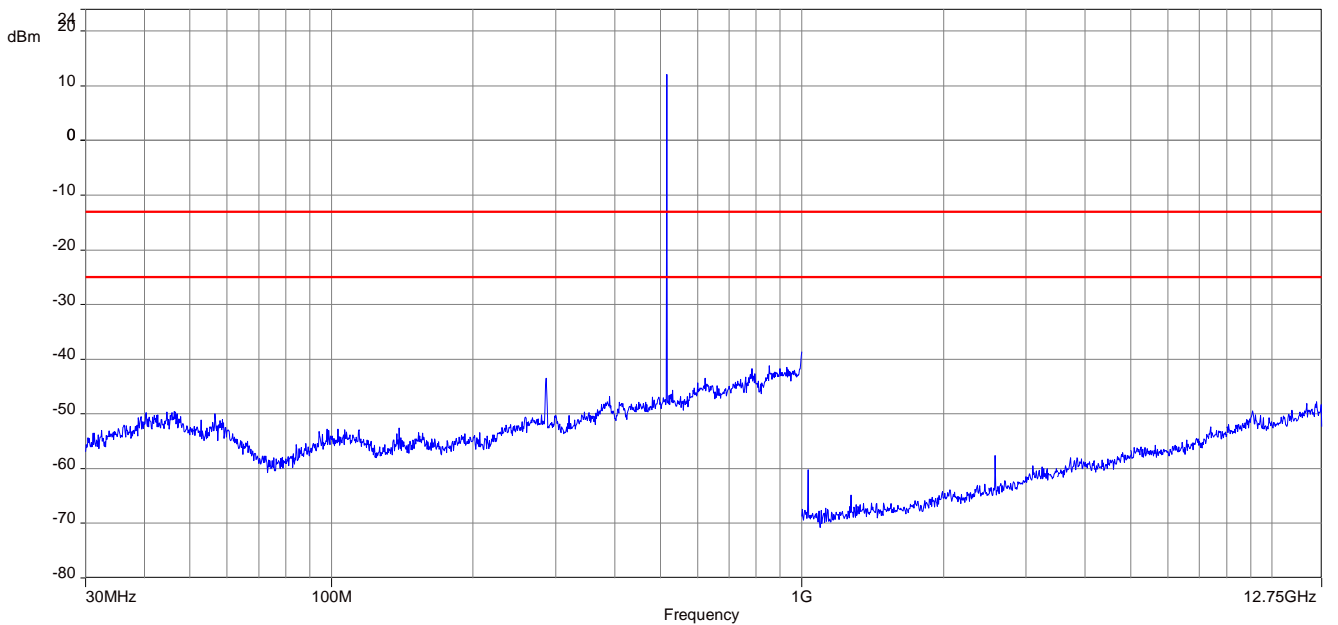


Date: 2.APR.2016 11:41:14

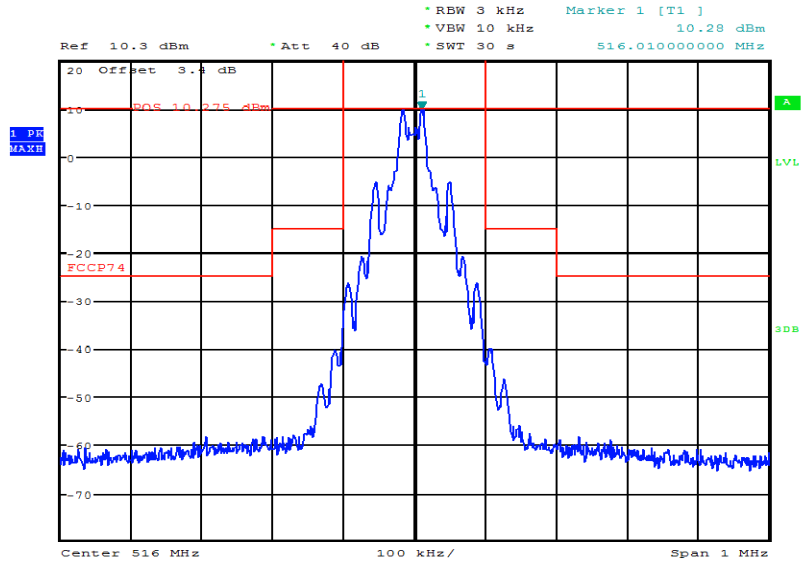
Plot 7: highest channel, magnetic spurious emissions 9 kHz to 30 MHz



Plot 8: highest channel, spurious emissions, 30 MHz – 12.75 GHz



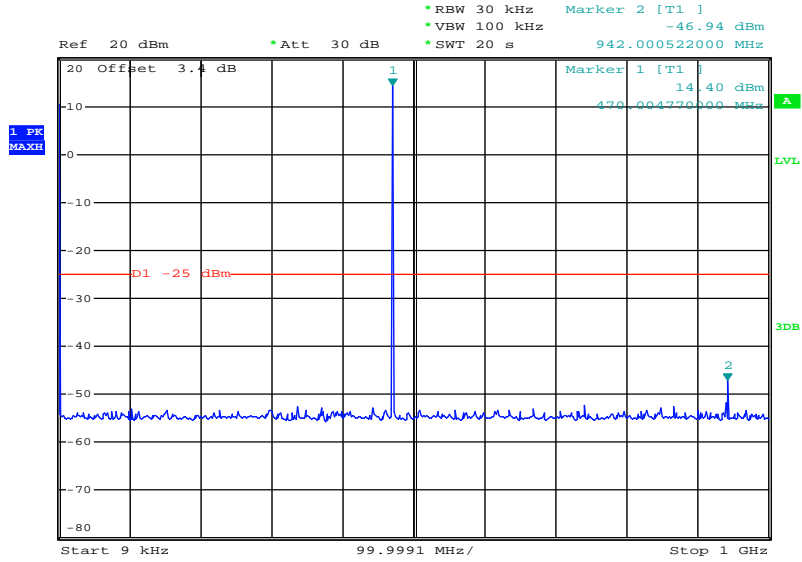
Plot 9: highest channel, spectrum mask



Date: 2.APR.2016 11:44:00

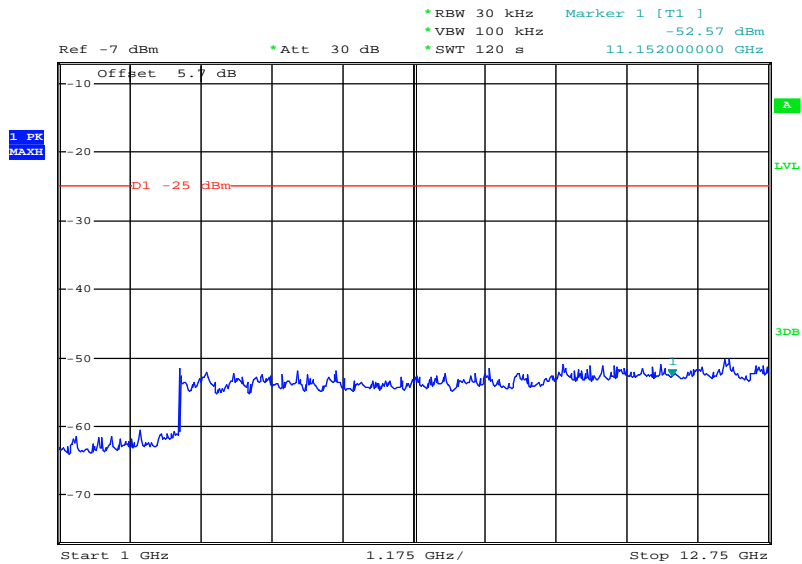
Plots: conducted

Plot 1: lowest channel, 9 kHz to 1 GHz, Canada requirement



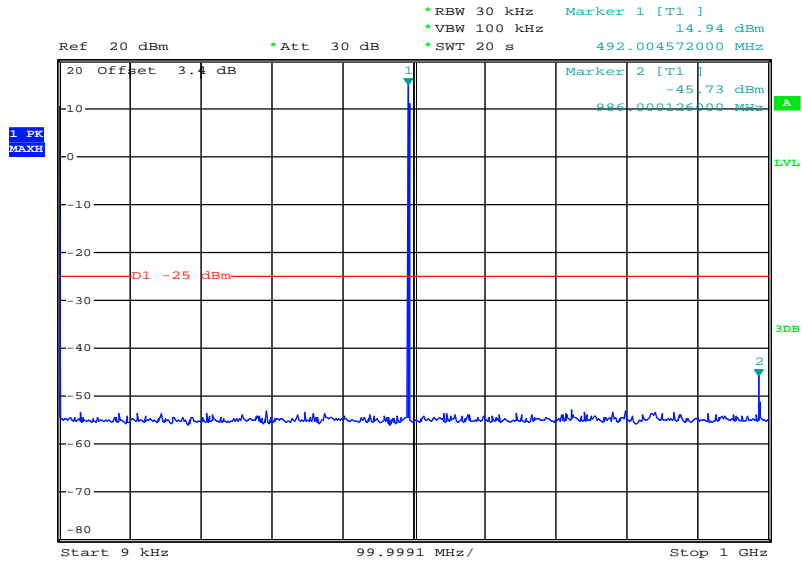
Date: 4.APR.2016 08:22:48

Plot 2: lowest channel, 1 GHz to 12.75 GHz, Canada requirement



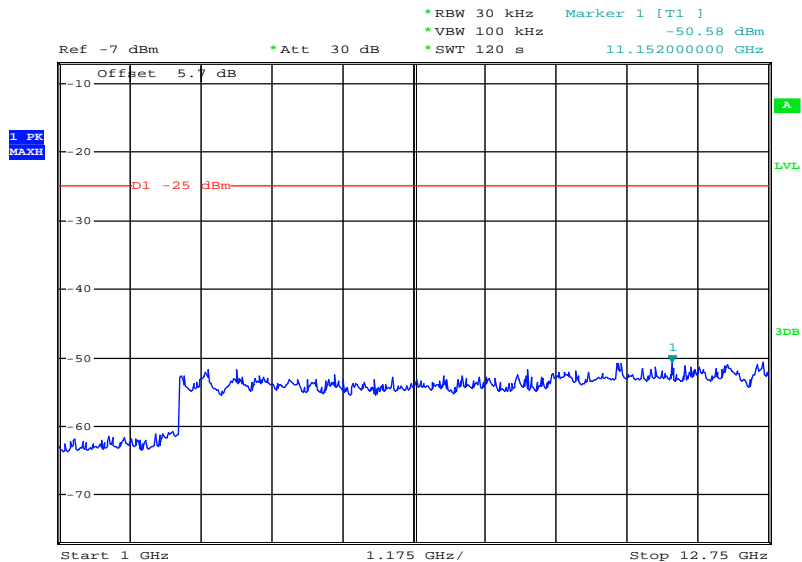
Date: 4.APR.2016 08:38:31

Plot 3: middle channel, 9 kHz to 1 GHz, Canada requirement



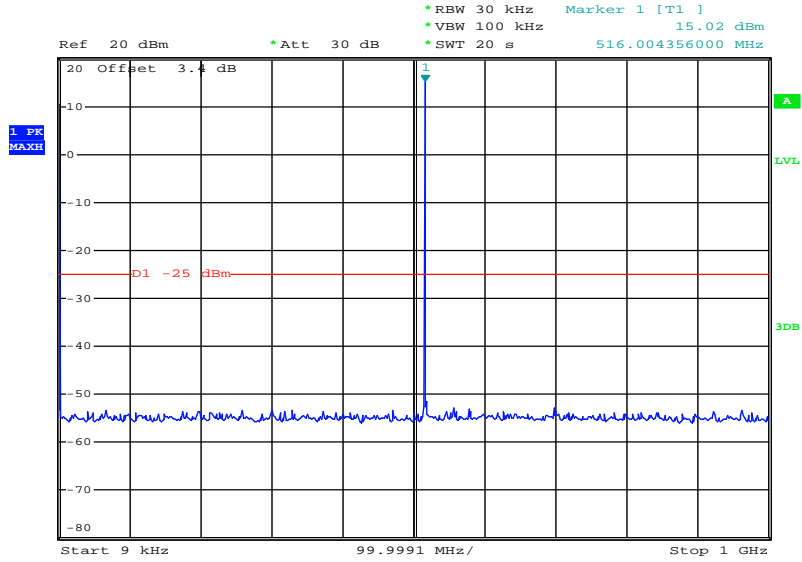
Date: 4. APR. 2016 08:24:27

Plot 4: middle channel, 1 GHz to 12.75 GHz, Canada requirement



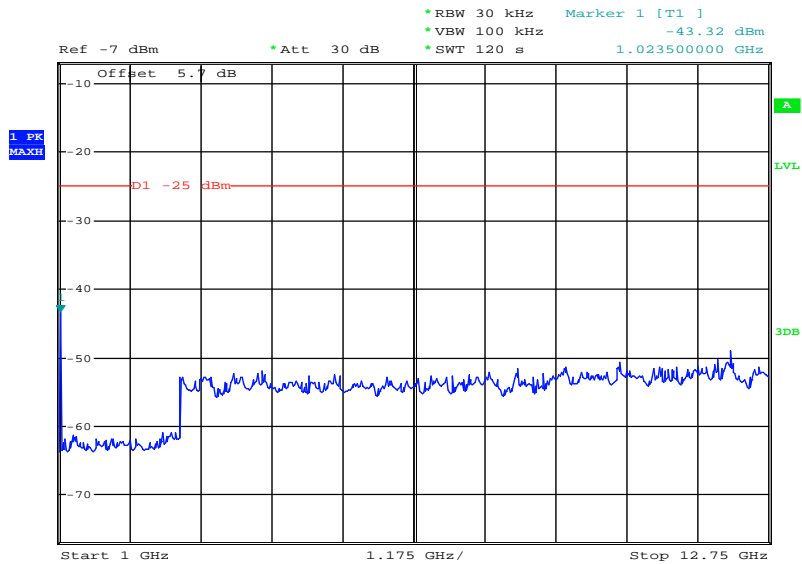
Date: 4. APR. 2016 08:34:05

Plot 5: highest channel, 9 kHz to 1 GHz, Canada requirement



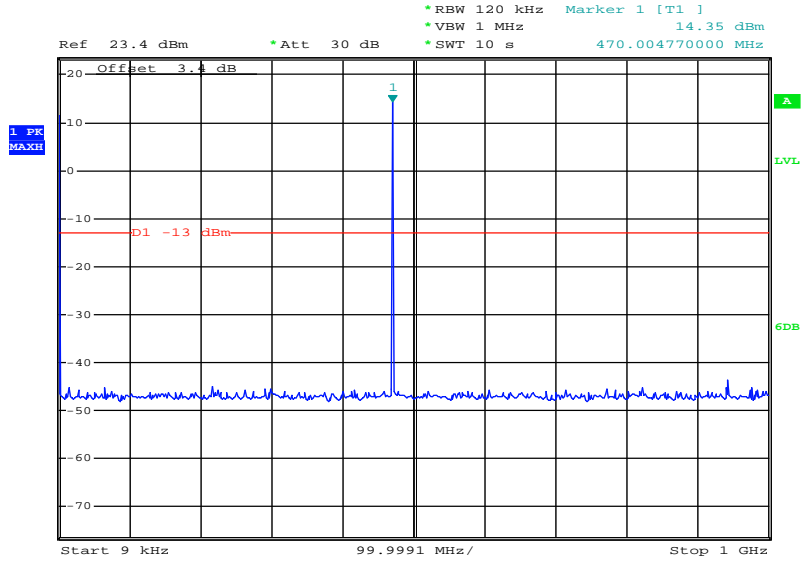
Date: 4.APR.2016 08:25:42

Plot 6: highest channel, 1 GHz to 12.75 GHz, Canada requirement



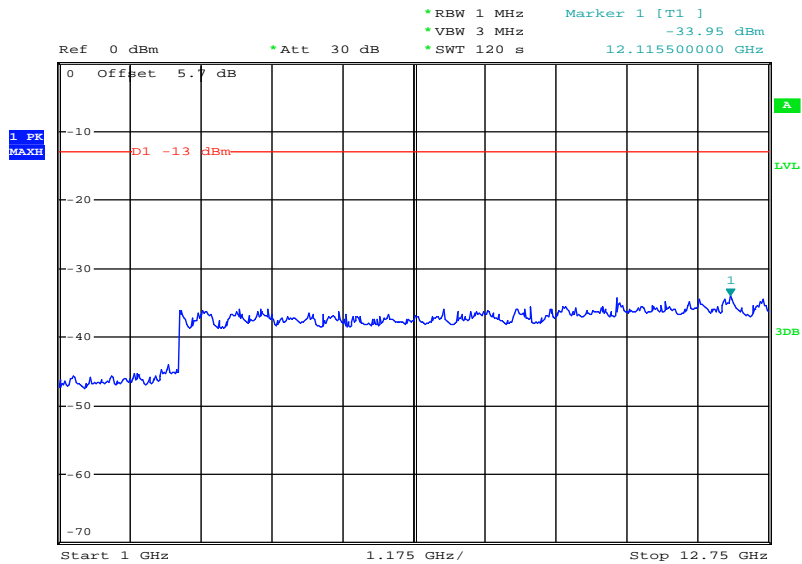
Date: 4.APR.2016 08:31:07

Plot 7: lowest channel, 9 kHz to 1 GHz, FCC requirement



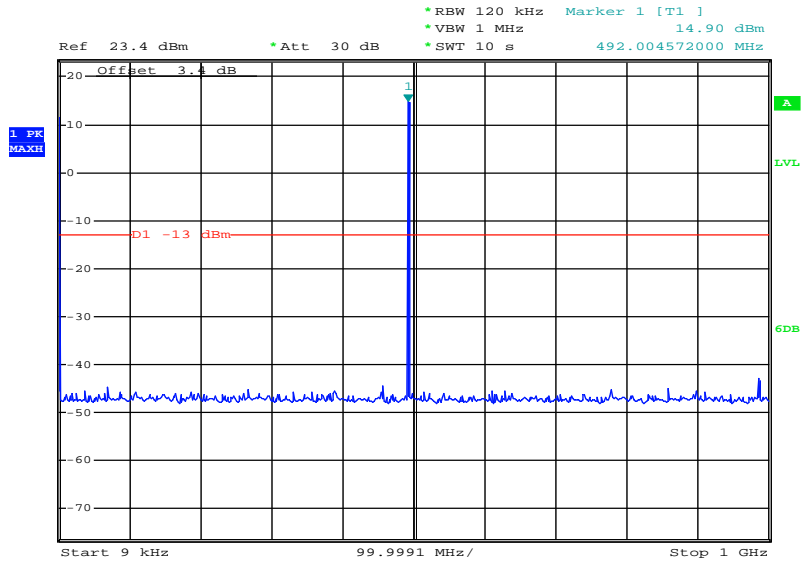
Date: 4.APR.2016 08:53:12

Plot 8: lowest channel, 1 GHz to 12.75 GHz, FCC requirement



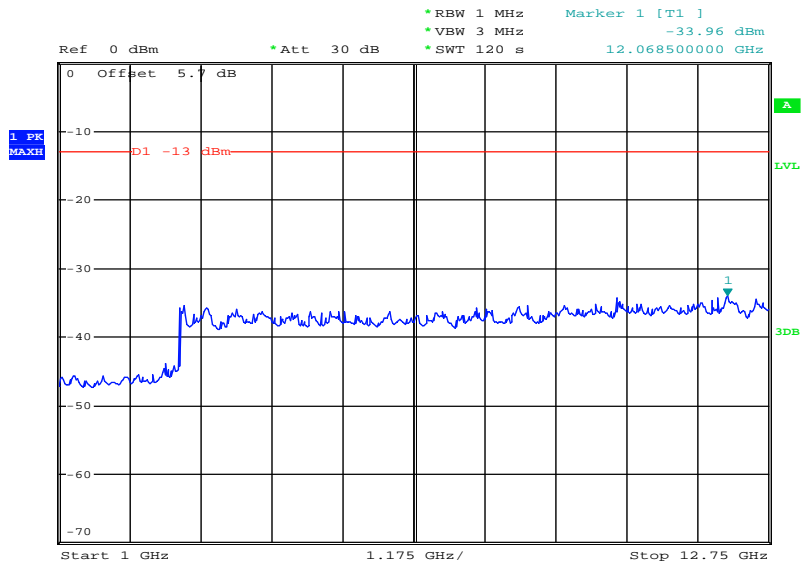
Date: 4.APR.2016 08:42:08

Plot 9: middle channel, 9 kHz to 1 GHz, FCC requirement



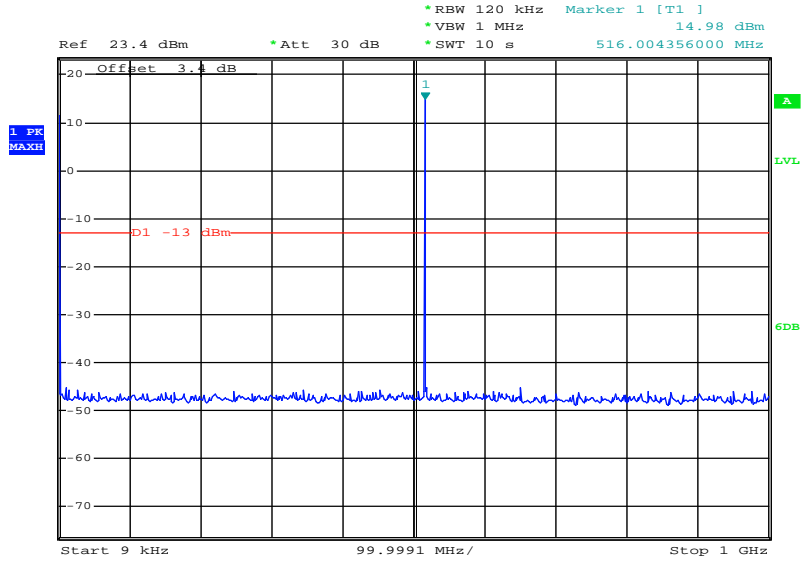
Date: 4.APR.2016 08:52:17

Plot 10: middle channel, 1 GHz to 12.75 GHz, FCC requirement



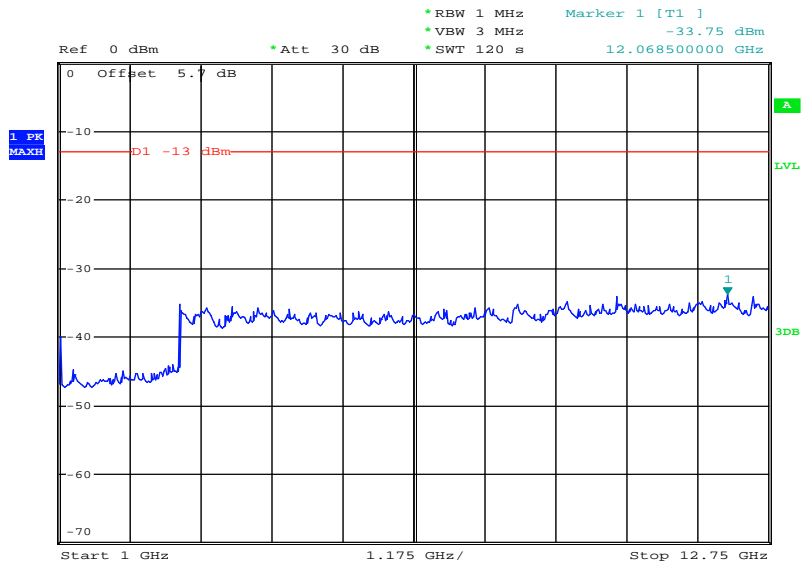
Date: 4.APR.2016 08:44:46

Plot 11: highest channel, 9 kHz to 1 GHz, FCC requirement



Date: 4.APR.2016 08:51:32

Plot 12: highest channel, 1 GHz to 12.75 GHz, FCC requirement



Date: 4.APR.2016 08:48:36

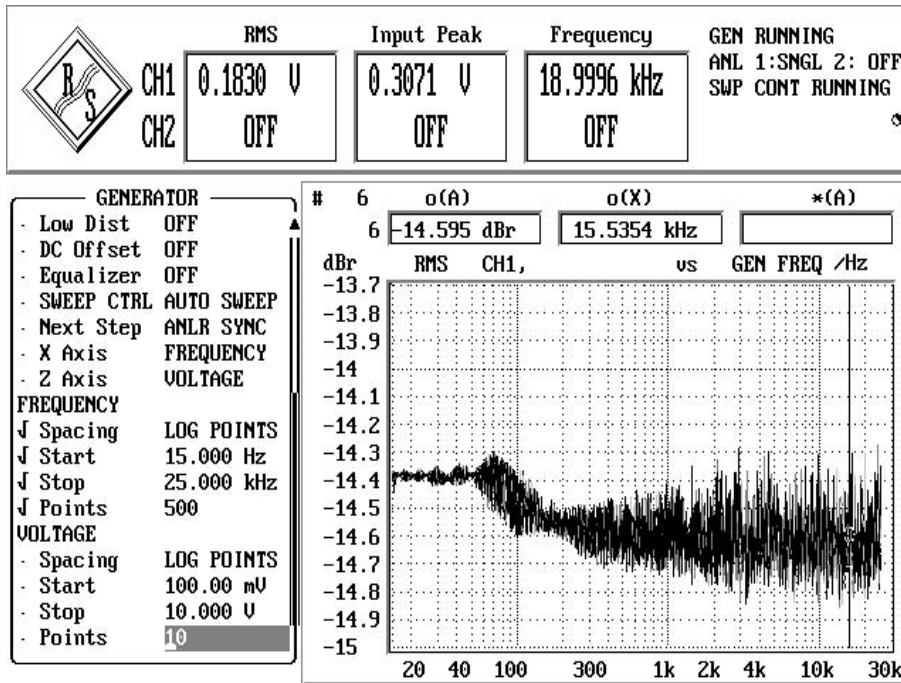
12.5 Modulation characteristics

Method of measurement:

The audio frequency response was measured in accordance with EIA/TIA 603. The plots shows 10 curves with different modulation levels, the test frequency is varied from 15 Hz to 20 kHz.

Plots:

Plot 1: 10 curves with voltage and frequency variation

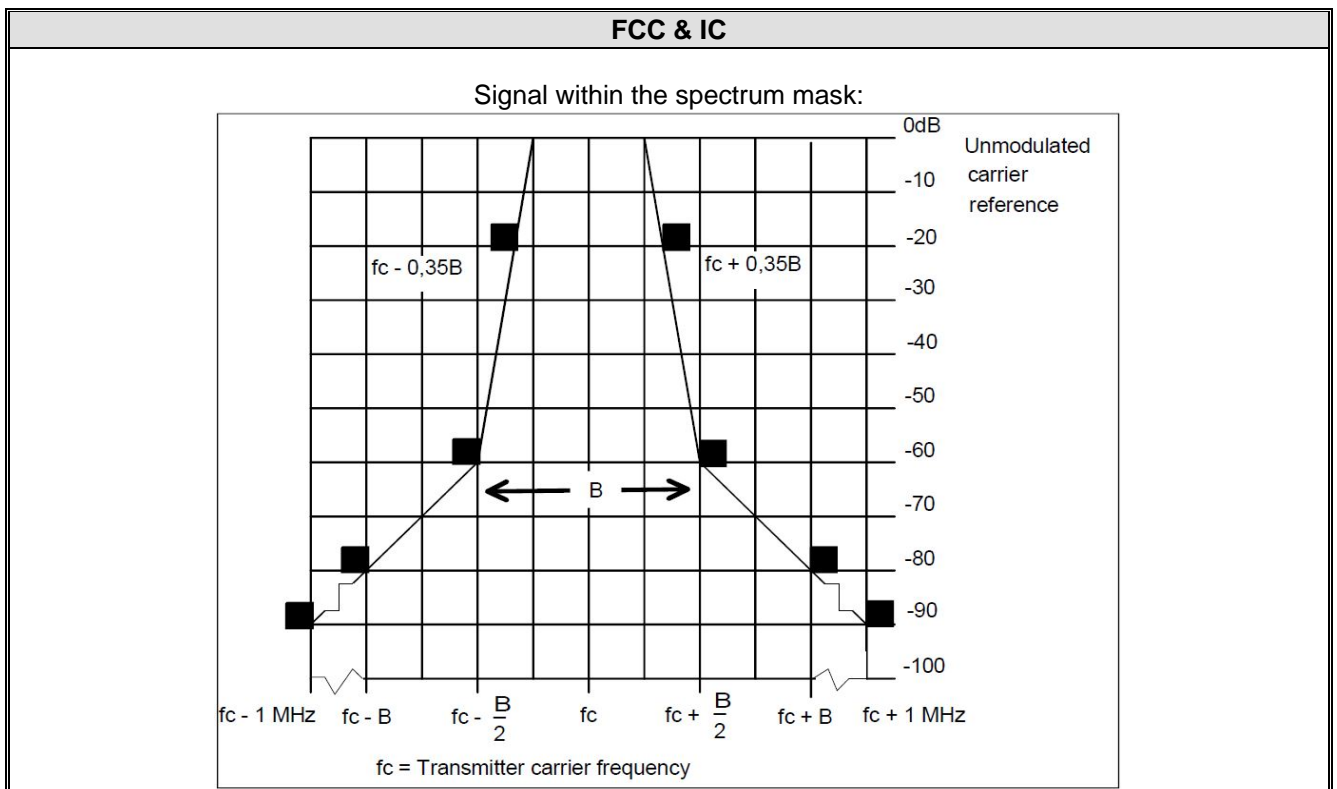


12.6 Necessary bandwidth (BN) for analogue systems

Measurement:

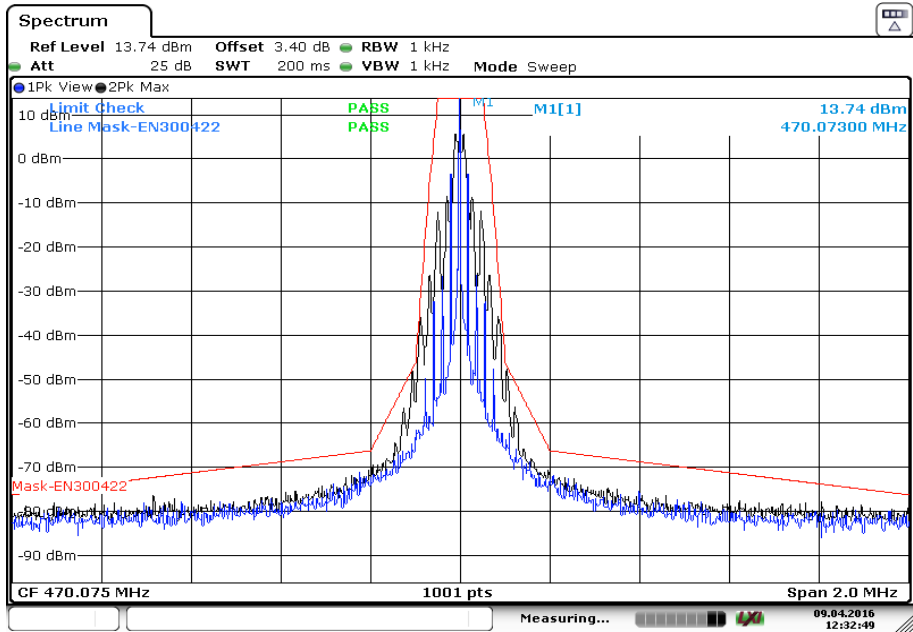
Measurement parameter	
Detector:	Peak / Average (-90 dBc point only)
Sweep time:	Auto
Resolution bandwidth:	1 kHz
Video bandwidth:	1 kHz
Span:	$f_c - 1 \text{ MHz}$ to $f_c + 1 \text{ MHz}$ (2 MHz)
Trace mode:	Max hold/view
EUT:	CW and MC
Test setup:	See sub clause 7.2 - D
Measurement uncertainty:	See sub clause 9

Limits:



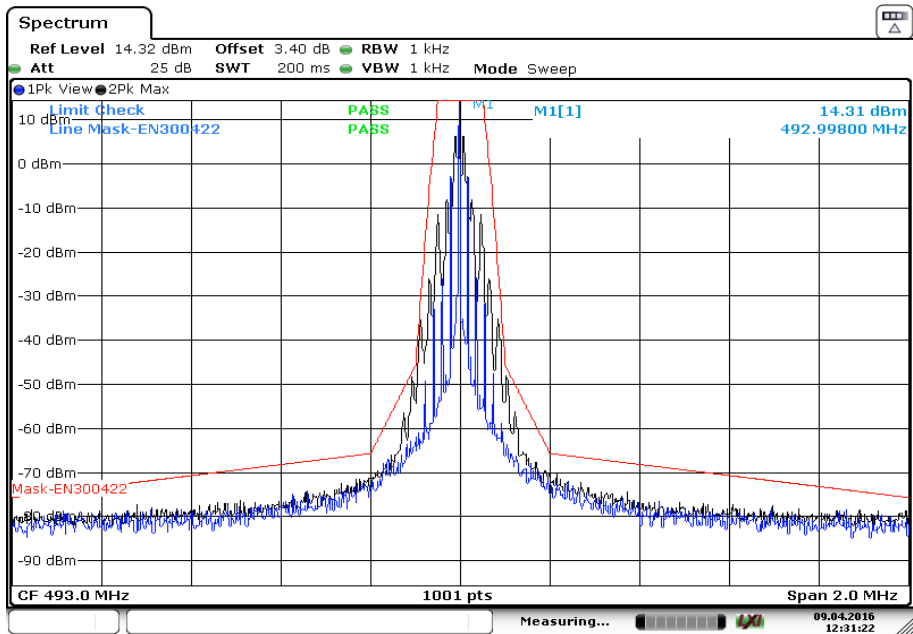
Plots:

Plot 1: lowest channel, unmodulated carrier for reference and modulated carrier



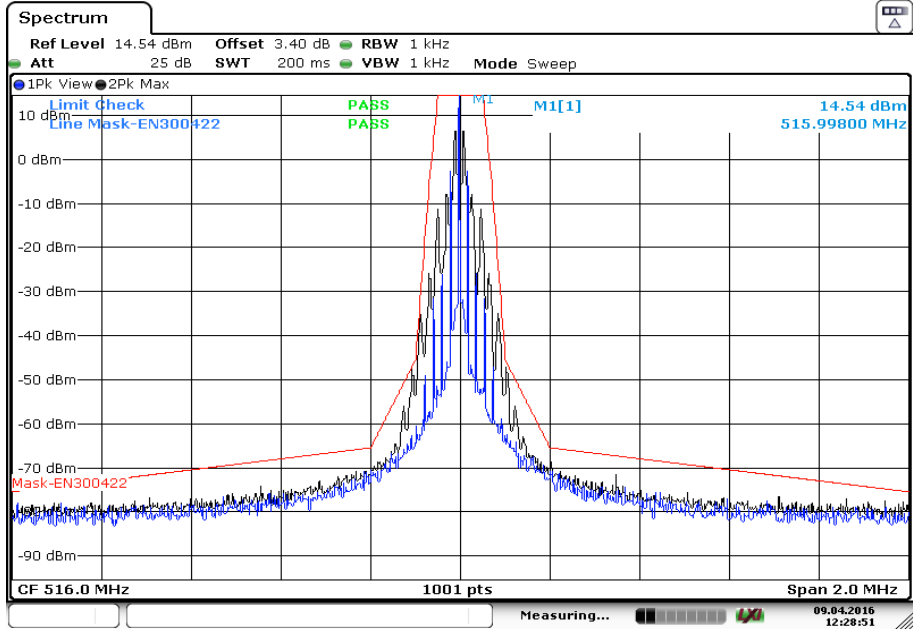
Date: 9 APR 2016 12:32:49

Plot 2: middle channel, unmodulated carrier for reference and modulated carrier



Date: 9 APR 2016 12:31:23

Plot 3: highest channel, unmodulated carrier for reference and modulated carrier



Date: 9 APR 2016 12:28:51

12.7 Frequency modulation**Measurement:**

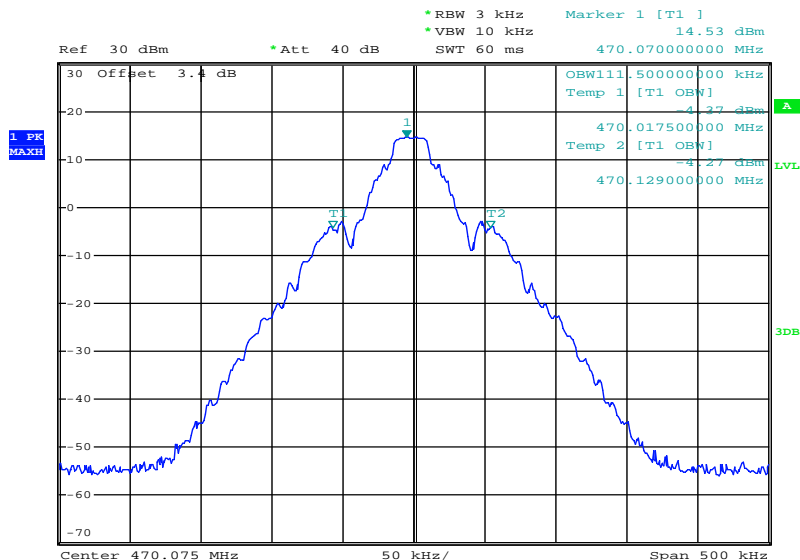
Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1 % to 5 % of the occupied bandwidth
Video bandwidth:	3 x resolution bandwidth
Span:	2 x emission bandwidth
Trace mode:	Max. hold
Analyzer function:	99% power occupied bandwidth function
EUT:	Modulated signal with frequency varied between 50 Hz and 15 kHz
Test setup:	See sub clause 7.2 - D
Measurement uncertainty:	See sub clause 9

Limits:

FCC & IC
Frequency deviation up to a maximum of ± 75 kHz

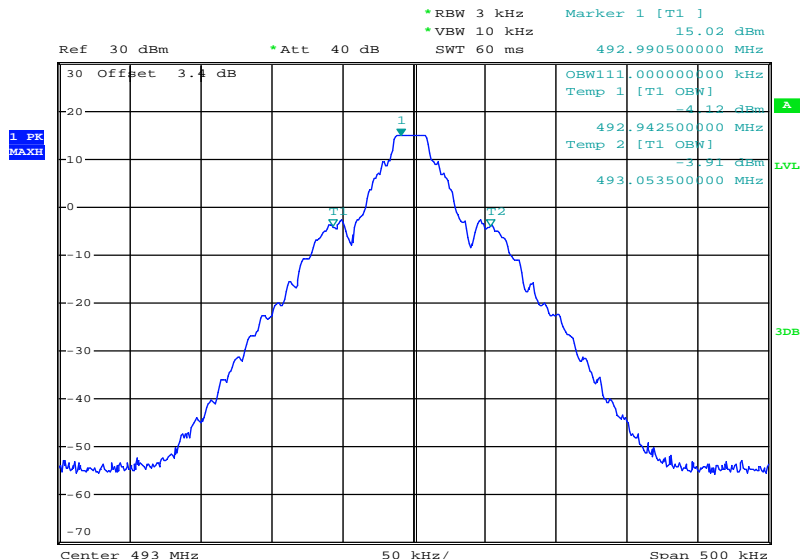
Plots:

Plot 1: lowest channel, max hold with frequency variation from 50 Hz to 15 kHz



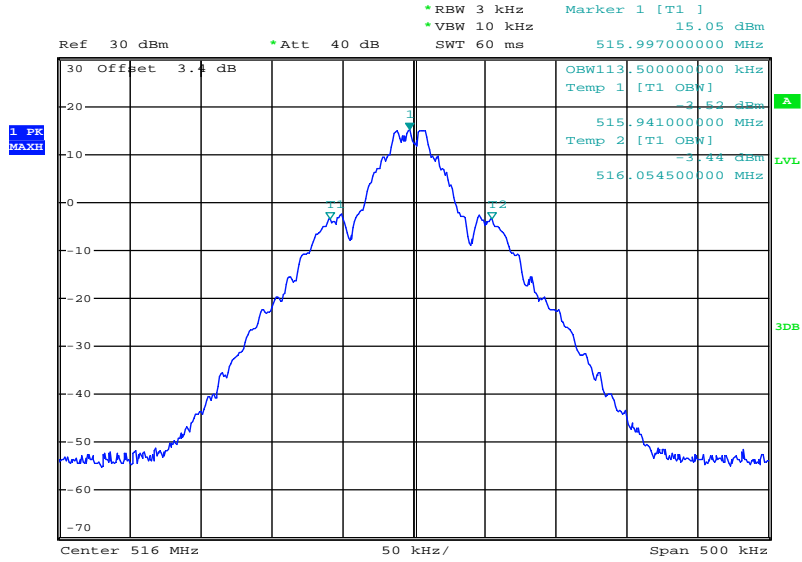
Date: 2.APR.2016 11:56:37

Plot 2: middle channel, max hold with frequency variation from 50 Hz to 15 kHz



Date: 2.APR.2016 12:00:30

Plot 3: highest channel, max hold with frequency variation from 50 Hz to 15 kHz



Date: 2.APR.2016 12:06:18

12.8 Spurious emissions conducted below 30 MHz (AC conducted)

Description:

Measurement of the conducted spurious emissions in transmit mode below 30 MHz. The EUT is set to channel 6. This measurement is repeated for DSSS and OFDM modulation. If peaks are found channel 1 and channel 11 will be measured too. The measurement is performed with the data rate producing the highest output power. Both power lines, phase and neutral line, are measured. Found peaks are re-measured with average and quasi peak detection to show compliance to the limits.

Measurement:

Measurement parameter	
Detector:	Peak - Quasi Peak / Average
Sweep time:	Auto
Resolution bandwidth:	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Video bandwidth:	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span:	9 kHz to 30 MHz
Trace mode:	Max Hold
Test setup:	See sub clause 7.3 – A
Measurement uncertainty:	See sub clause 9

Limits:

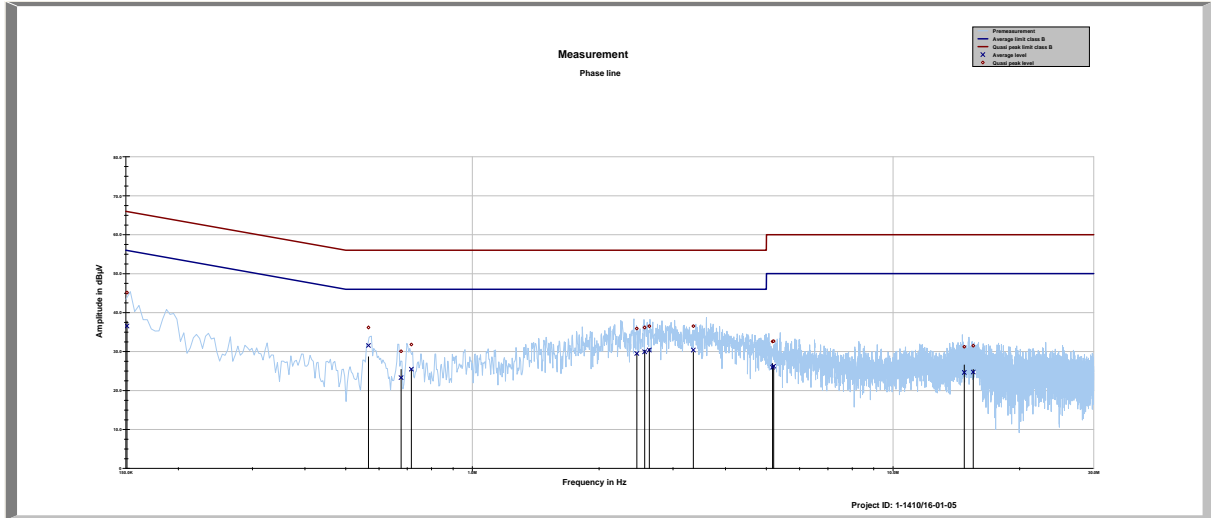
FCC & IC		
Frequency (MHz)	Quasi-Peak (dBµV/m)	Average (dBµV/m)
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30.0	60	50

Results:

TX Spurious Emissions Conducted < 30 MHz [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
See table below the plots!		

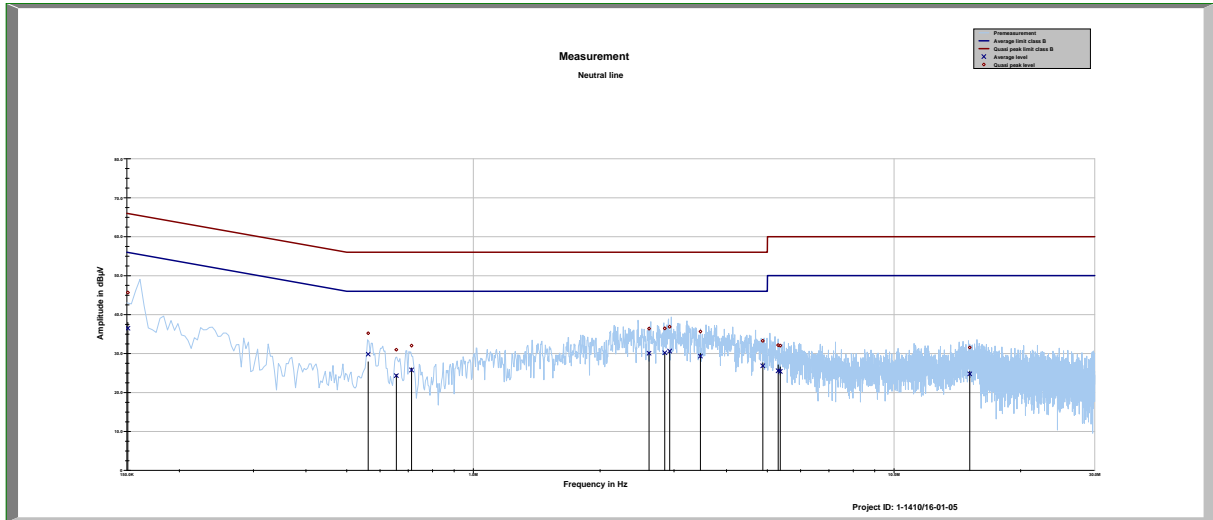
Plots:

Plot 1: 150 kHz to 30 MHz, phase line



Frequency MHz	Quasi peak level dBµV	Margin quasi peak dB	Limit QP dBµV	Average level dBµV	Margin average dB	Limit AV dBµV
0.150935	45.13	20.81	65.948	36.57	19.41	55.973
0.566363	36.19	19.81	56.000	31.57	14.43	46.000
0.676660	30.09	25.91	56.000	23.29	22.71	46.000
0.716208	31.80	24.20	56.000	25.47	20.53	46.000
2.459519	35.91	20.09	56.000	29.51	16.49	46.000
2.566602	36.18	19.82	56.000	29.93	16.07	46.000
2.632799	36.53	19.47	56.000	30.40	15.60	46.000
3.352141	36.54	19.46	56.000	30.39	15.61	46.000
5.172106	32.59	27.41	60.000	25.97	24.03	50.000
5.201814	32.67	27.33	60.000	26.26	23.74	50.000
14.770466	31.22	28.78	60.000	24.62	25.38	50.000
15.513503	31.50	28.50	60.000	24.76	25.24	50.000

Plot 2: 150 kHz to 30 MHz, neutral line



Frequency MHz	Quasi peak level dBµV	Margin quasi peak dB	Limit QP dBµV	Average level dBµV	Margin average dB	Limit AV dBµV
0.150860	45.67	20.28	65.953	36.48	19.50	55.975
0.562269	35.21	20.79	56.000	29.85	16.15	46.000
0.655685	31.00	25.00	56.000	24.31	21.69	46.000
0.712839	32.05	23.95	56.000	25.77	20.23	46.000
2.616347	36.38	19.62	56.000	30.09	15.91	46.000
2.850710	36.47	19.53	56.000	30.19	15.81	46.000
2.927740	36.88	19.12	56.000	30.64	15.36	46.000
3.464902	35.64	20.36	56.000	29.34	16.66	46.000
4.874611	33.26	22.74	56.000	26.85	19.15	46.000
5.301910	32.16	27.84	60.000	25.58	24.42	50.000
5.364251	32.05	27.95	60.000	25.41	24.59	50.000
15.138799	31.56	28.44	60.000	24.77	25.23	50.000

13 Observations

No observations except those reported with the single test cases have been made.

Annex A Document history

Version	Applied changes	Date of release
	Initial release	2016-06-02

Annex B Further information

Glossary

AVG	-	Average
DUT	-	Device under test
EMC	-	Electromagnetic Compatibility
EN	-	European Standard
EUT	-	Equipment under test
ETSI	-	European Telecommunications Standard Institute
FCC	-	Federal Communication Commission
FCC ID	-	Company Identifier at FCC
HW	-	Hardware
IC	-	Industry Canada
Inv. No.	-	Inventory number
N/A	-	Not applicable
PP	-	Positive peak
QP	-	Quasi peak
S/N	-	Serial number
SW	-	Software
PMN	-	Product marketing name
HMN	-	Host marketing name
HVIN	-	Hardware version identification number
FVIN	-	Firmware version identification number

Annex C Accreditation Certificate

Front side of certificate

Back side of certificate



Deutsche Akkreditierungsstelle GmbH

Beliehene gemäß § 8 Absatz 1 AkkStelleG i.V.m. § 1 Absatz 1 AkkStelleGBV
 Unterzeichnerin der Multilateralen Abkommen
 von EA, ILAC und IAF zur gegenseitigen Anerkennung

Akkreditierung

Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

CETECOM ICT Services GmbH
 Untertürkheimer Straße 6-10, 66117 Saarbrücken

die Kompetenz nach DIN EN ISO/IEC 17025:2005 besitzt, Prüfungen in folgenden Bereichen durchzuführen:

- Funk
- Mobilfunk (GSM / DCS) + OTA
- Elektromagnetische Verträglichkeit (EMV)
- Produktsicherheit
- SAR / EMF
- Umwelt
- Smart Card Technology
- Bluetooth®
- Automotive
- Wi-Fi-Services
- Kanadische Anforderungen
- US-Anforderungen
- Akustik
- Near Field Communication (NFC)

Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 04.05.2016 mit der Akkreditierungsnummer D-PL-12076-01 und ist gültig bis 17.01.2018. Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 63 Seiten.

Registrierungsnummer der Urkunde: D-PL-12076-01-01

Frankfurt, 04.05.2016

Im Auftrag Dir. Ing. (FH) Ralf Eigner
 Abteilungsleiter

Siehe Hinweise auf der Rückseite

Deutsche Akkreditierungsstelle GmbH

Standort Berlin
 Spittelmarkt 10
 10117 Berlin

Standort Frankfurt am Main
 Europa-Allee 52
 60327 Frankfurt am Main

Standort Braunschweig
 Bundesallee 100
 38116 Braunschweig

Die auszugsweise Veröffentlichung der Akkreditierungsurkunde bedarf der vorherigen schriftlichen Zustimmung der Deutsche Akkreditierungsstelle GmbH (DAkkS). Ausgenommen davon ist die separate Weiterverbreitung des Deckblatts durch die umseitig genannte Konformitätsbewertungsstelle in unveränderter Form.

Es darf nicht der Anschein erweckt werden, dass sich die Akkreditierung auch auf Bereiche erstreckt, die über den durch die DAkkS bestätigten Akkreditierungsbereich hinausgehen.

Die Akkreditierung erfolgte gemäß des Gesetzes über die Akkreditierungsstelle (AkkStelleG) vom 31. Juli 2009 (BGBl. I S. 2625) sowie der Verordnung (EG) Nr. 765/2008 des Europäischen Parlaments und des Rates vom 9. Juli 2008 über die Vorschriften für die Akkreditierung und Marktüberwachung im Zusammenhang mit der Vermarktung von Produkten (Abt. L 218 vom 9. Juli 2008, S. 30). Die DAkkS ist Unterzeichnerin der Multilateralen Abkommen zur gegenseitigen Anerkennung der European co-operation for Accreditation (EA), des International Accreditation Forum (IAF) und der International Laboratory Accreditation Cooperation (ILAC). Die Unterzeichner dieser Abkommen erkennen ihre Akkreditierungen gegenseitig an.

Der aktuelle Stand der Mitgliedschaft kann folgenden Webseiten entnommen werden:
 EA: www.european-accreditation.org
 ILAC: www.ilac.org
 IAF: www.iaf.nu

Note:
 The current certificate including annex can be received from CETECOM ICT Services GmbH on request.