

TEST REPORT

Test report no.: 1-7049/13-01-02-A



Deutsche
Akkreditierungsstelle
D-PL-12076-01-01

Testing laboratory

CETECOM ICT Services GmbH

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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

Area of Testing:

Radio Communications & EMC (RCE)

Applicant

Swissphone Telecom AG

Fälmisstrasse 21

8833 Samstagern / SWITZERLAND

Phone: +41 44 786 77 70

Fax: +41 44 786 77 71

Contact: Patrick Nagele

e-mail: patrick.nagele@swissphone.com

Phone: +41 44 786 77 02

Manufacturer

Swissphone Telecom AG

Fälmisstrasse 21

8833 Samstagern / SWITZERLAND

Test standard/s

47 CFR Part 90

Title 47 of the Code of Federal Regulations; Chapter I

Part 90 - Land mobile services

RSS - 119 Issue 11

Radio Transmitters and Receivers Operating in the Land Mobile and Fixed Services
in the Frequency Range 27.41-960 MHz

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

Test Item

Kind of test item: VHF Data Transceiver

Model name: ITC 2100

FCC ID: L3M-ITC2100

IC: 4404A-ITC2100

Frequency: 150 MHz – 174 MHz band
(Lowest channel 150.995 MHz / highest channel 173.39625 MHz)

Technology tested: Proprietary

Antenna: External antenna connector (50 Ω)

Power supply: 115.0 V AC

Temperature range: -30°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 authorised:

Andreas Luckenbill
Expert

Test performed:

p.o.

Stefan Bös
Senior Testing Manager

1 Table of contents

1	Table of contents	2
2	General information	3
2.1	Notes and disclaimer	3
2.2	Application details.....	3
3	Test standard/s	3
4	Test environment.....	4
5	Test item	4
6	Test laboratories sub-contracted	4
7	Summary of measurement results	5
8	RF measurements	7
8.1	Description of test setup	7
8.2	Radiated measurements chamber F.....	7
8.3	Radiated measurements chamber C	8
8.4	AC conducted	9
8.5	Additional comments	9
8.6	RSP100 test report cover sheet / performance test data	10
9	Measurement results.....	11
9.1	Radiated output power.....	11
9.2	Audio frequency filter response	12
9.3	Transmitter modulation limiting.....	12
9.4	Spectrum efficiency	12
9.5	Occupied bandwidth	13
9.6	Transient frequency behaviour.....	52
9.7	Frequency stability	53
9.8	Transmitter spurious emissions conducted.....	54
9.9	Transmitter spurious emissions (radiated)	59
9.10	Spurious emissions radiated < 30 MHz	63
9.11	Receiver spurious emissions (radiated).....	65
9.12	Spurious emissions conducted < 30 MHz	69
10	Test equipment and ancillaries used for tests	73
11	Observations	74
Annex A	Photographs of the test setup	75
Annex B	External photographs of the EUT	78
Annex C	Internal photographs of the EUT	81
Annex D	Document history	87
Annex E	Further information.....	87
Annex F	Accreditation Certificate	88

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.

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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:	2013-11-28
Date of receipt of test item:	2014-02-26
Start of test:	2014-02-26
End of test:	2014-03-27
Person(s) present during the test:	-/-

3 Test standard/s

Test standard	Date	Test standard description
47 CFR Part 90	-/-	Title 47 of the Code of Federal Regulations; Chapter I Part 90 - Land mobile services
RSS - 119 Issue 11	June 2011	Radio Transmitters and Receivers Operating in the Land Mobile and Fixed Services in the Frequency Range 27.41-960 MHz

4 Test environment

Temperature:	T_{nom}	+22	°C during room temperature tests
	T_{max}	+55	°C during high temperature tests
	T_{min}	-30	°C during low temperature tests
Relative humidity content:		53 %	
Barometric pressure:		not relevant for this kind of testing	
Power supply:	V_{nom}	115.0	V AC
	V_{min}	97.8	V
	V_{max}	132.3	V

5 Test item

Kind of test item:	VHF Data Transceiver
Type identification :	ITC 2100
S/N serial number :	C201342 00170
HW hardware status :	No information available!
SW software status :	No information available!
Frequency band [MHz] :	150 MHz – 174 MHz band (Lowest channel 150.995 MHz / highest channel 173.39625 MHz)
Type of modulation :	FSK
Antenna :	External antenna connector (50 Ω)
Power supply :	115.0 V AC
Temperature range :	-30°C to +55°C

6 Test laboratories sub-contracted

None

7 Summary of measurement results

- ☒ No deviations from the technical specifications were ascertained
- ☐ There were deviations from the technical specifications ascertained

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	47 CFR Part 2 47 CFR Part 90 C RSS Gen Issue 2 RSS 119 Issue 11	Passed	2014-04-10	-/-

Test Specification Clause	Test Case	Temperature Conditions	Power Source Voltages	Pass	Fail	NA	NP	Remark
FCC 47 CFR § 2.1046 § 90.205 RSS 119 Issue 11 5.4	Transmitter output power	Nominal	Nominal	☒	☐	☐	☐	complies
FCC 47 CFR § 2.1047 § 90.211 (a) RSS 119 Issue 11 5.8.1	Audio frequency filter response	Nominal	Nominal	☐	☐	☒	☐	Only for analog modulated systems
FCC 47 CFR § 2.1047 (b) § 90.211 (a) RSS 119 Issue 11 5.8.1	Transmitter modulation limiting	Nominal	Nominal	☐	☐	☒	☐	Only for analog modulated systems
FCC 47 CFR § 90.20 (j)(3)	Spectrum efficiency	Nominal	Nominal	☒	☐	☐	☐	complies
FCC 47 CFR § 2.1049 (c) § 90.210 (d) RSS 119 Issue 11 5.8	Occupied bandwidth	Nominal	Nominal	☒	☐	☐	☐	complies
FCC 47 CFR § 90.214 RSS 119 Issue 11 5.9	Transient frequency behaviour	Nominal	Nominal	☒	☐	☐	☐	complies
FCC 47 CFR § 2.1055 (a)(1) § 90.213 RSS 119 Issue 11 5.3	Frequency stability	Nominal	Extreme	☒	☐	☐	☐	complies
		Extreme	Nominal	☒	☐	☐	☐	
FCC 47 CFR § 2.1051 § 90.210 RSS 119 Issue 11 5.8.9.2	Transmitter spurious emissions conducted	Nominal	Nominal	☒	☐	☐	☐	complies

FCC 47 CFR § 2.1051 § 90.210 RSS 119 Issue 11 5.8.9.2	Transmitter spurious emissions (radiated)	Nominal	Nominal	☒	☐	☐	☐	complies
FCC 47 CFR § 15.209 RSS Gen Issue 2 Section 6	Receiver spurious emissions (radiated)	Nominal	Nominal	☒	☐	☐	☐	complies
§15.107(a) §15.207	Conducted emissions < 30 MHz	Nominal	Nominal	☒	☐	☐	☐	complies

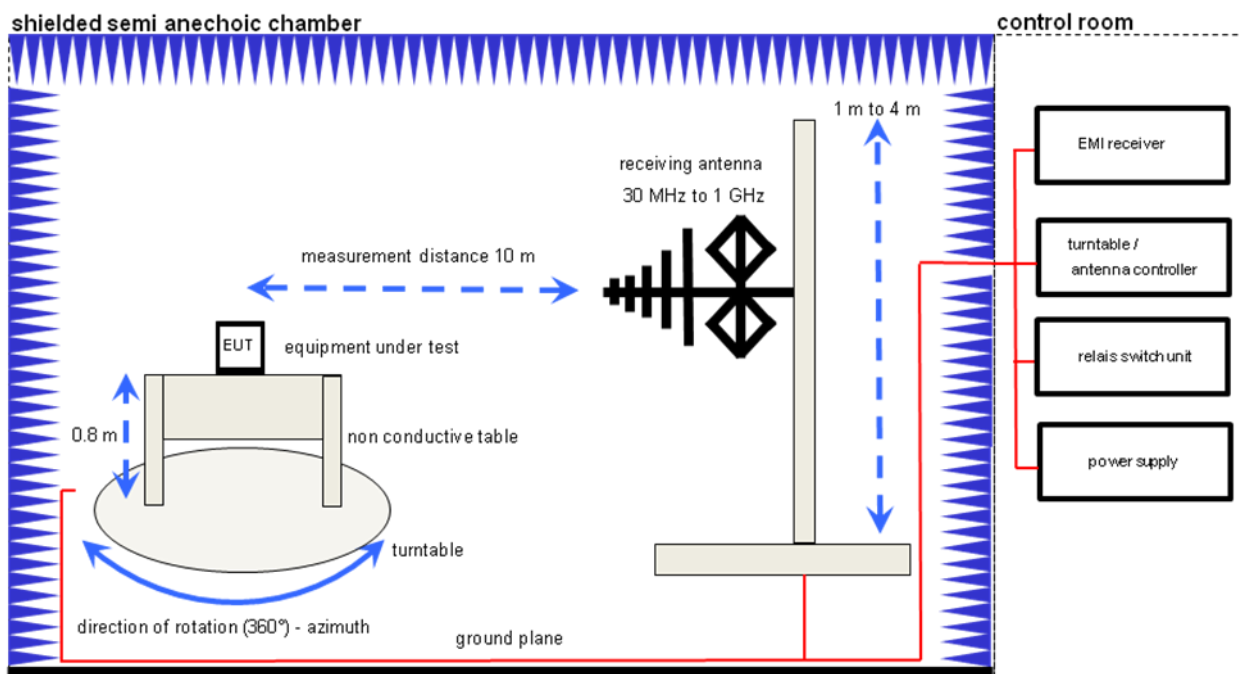
Note: NA = Not Applicable; NP = Not Performed

8 RF measurements

8.1 Description of test setup

8.2 Radiated measurements chamber F

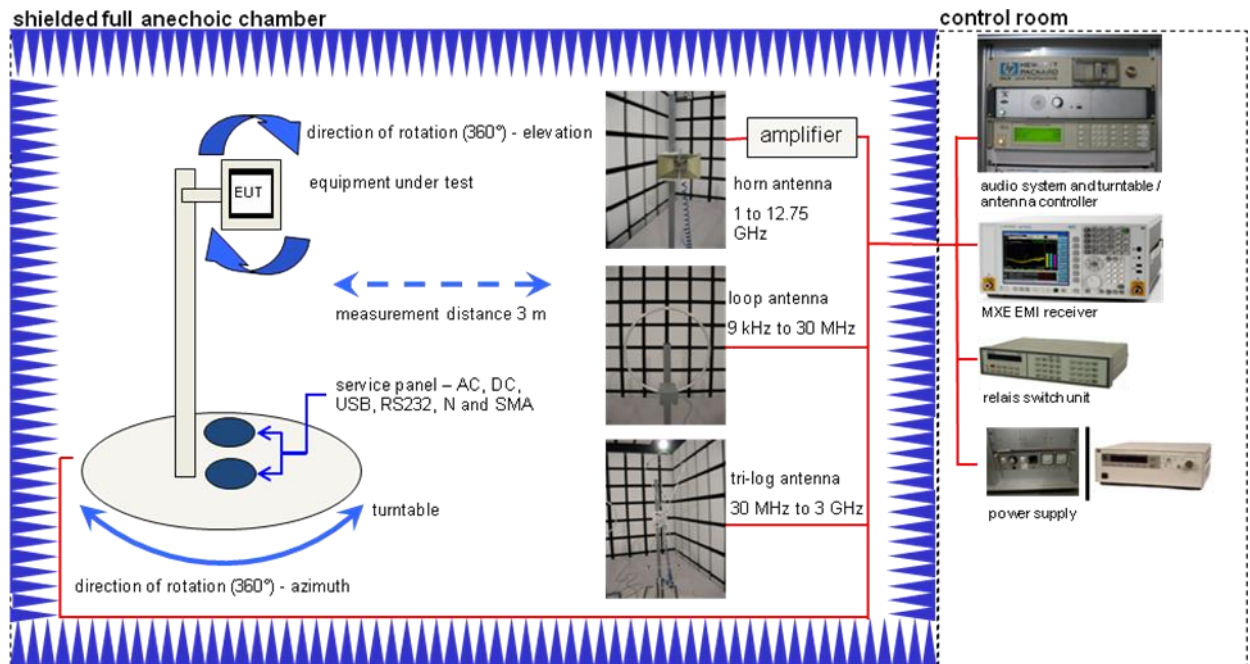
The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are confirmed with specifications ANSI C63. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analysers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



Equipment table:

Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom
Switch-Unit	3488A	HP Meßtechnik	2719A14505	300000368
DC power supply, 60Vdc, 50A, 1200 W	6032A	HP Meßtechnik	2920A04466	300000580
EMI Test Receiver	ESCI 3	R&S	100083	300003312
Amplifier	JS42-00502650-28-5A	MITEQ	1084532	300003379
Antenna Tower	Model 2175	ETS-LINDGREN	64762	300003745
Positioning Controller	Model 2090	ETS-LINDGREN	64672	300003746
Turntable Interface-Box	Model 105637	ETS-LINDGREN	44583	300003747
TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787

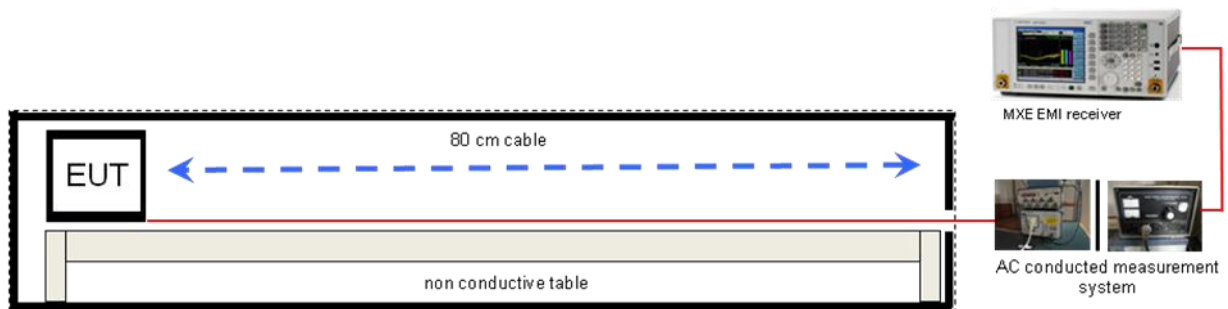
8.3 Radiated measurements chamber C



Equipment table:

Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom
MXE EMI Receiver 20 Hz bis 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405
TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854
Band Reject filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	11	300003351
Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789
Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032
Active Loop Antenna	6502	EMCO	8905-2342	300000256
Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996
Switch / Control Unit	3488A	HP Meßtechnik	*	300000199
Switch / Control Unit	3488A	HP Meßtechnik	2719A15013	300001156
Isolating Transformer	MPL IEC625 Bus Regeltrenntravo	ErFi	91350	300001155
Three-Way Power Splitter, 50 Ohm	11850C	HP Meßtechnik		300000997
Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143

8.4 AC conducted



Equipment table:

Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom
MXE EMI Receiver 20 Hz bis 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405
Isolating Transformer	MPL IEC625 Bus Regeltrenntravo	Erft	91350	300001155
Switch / Control Unit	3488A	HP Meßtechnik	*	300000199
Switch / Control Unit	3488A	HP Meßtechnik	2719A15013	300001168
Artificial Mains 9 kHz to 30 MHz	ESH3-Z5	R&S	828576/020	300001210

8.5 Additional comments

Reference documents: None

Special test descriptions: None

Configuration descriptions: None

8.6 RSP100 test report cover sheet / performance test data

Test Report Number	:	1-7049/13-01-02-A
Equipment Model Number	:	ITC 2100
Certification Number	:	4404A-ITC2100
Manufacturer (complete Address)	:	Swissphone Telecom AG Fälmissstrasse 21 8833 Samstagern / SWITZERLAND
Tested to radio standards specification no.	:	RSS 119, Issue 11
Open Area Test Site IC No.	:	IC 3462C-1
Frequency Range or fixed frequency	:	150 MHz – 174 MHz band (Lowest channel 150.995 MHz / highest channel 173.39625 MHz)
RF-power (max)	:	26.3 W
Occupied bandwidth (99%-BW) [kHz]	:	9.42 kHz
Type of modulation	:	FSK
Emission Designator (TRC-43)	:	9K42F1D
Antenna Information	:	External antenna connector (50Ω)
Transmitter Spurious (worst case) [dBm]	:	-23.2 dBm @ 348.1 MHz

ATTESTATION:

DECLARATION OF COMPLIANCE:

I attest that the testing was performed or supervised by me; that the test measurements were made in accordance with the above-mentioned Industry Canada standard(s); and that the equipment identified in this application has been subjected to all the applicable test conditions specified in the Industry Canada standards and all of the requirements of the standard have been met.

Laboratory Manager:

2014-04-10

Date

Stefan Bös

Name

p. o.

Signature

9 Measurement results

9.1 Radiated output power

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Span:	3 MHz
Trace-Mode:	Max. hold

Limits:

FCC	IC
CFR § 2.1046 CFR § 90.205	RSS 119 Issue 11 5.4
Maximum transmitter power shall be within ± 1.0 dB of the manufacturer's rated power	

Result:

Frequency (channel)	Radiated output power	
Rated output power by manufacturer	37 dBm / 5 W nominal	44 dBm / 25 W nominal
150.995 MHz	37.6 dBm / 5.754 W	44.2 dBm / 26.303 W
163.250 MHz	37.5 dBm / 5.623 W	44.2 dBm / 26.303 W
173.39625 MHz	37.4 dBm / 5.495 W	44.2 dBm / 26.303 W

Result: **Passed**

9.2 Audio frequency filter response

Not applicable!

9.3 Transmitter modulation limiting

Not applicable!

9.4 Spectrum efficiency

Limits:

FCC	IC
FCC 47 CFR § 90.20 (j)(3)	RSS 119 Issue 11
If the equipment is capable of transmitting data, has transmitter power greater than 500 mW, and has a channel bandwidth of more than 6.25 kHz, the equipment must be capable of supporting a minimum data rate of 4800 bits per second (bps) per 6.25 kHz of channel bandwidth.	

Result:

Supported channel bandwidth	Supported data rates
12.5 kHz	512, 1200, 2400, 4800 and 9600 bps

Result: **Passed**

9.5 Occupied bandwidth

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	300 Hz
Video bandwidth:	1 kHz
Span:	30 kHz
Trace-Mode:	Max. hold

Limits:

FCC	IC
FCC 47 CFR § 2.1049 (c) § 90.210 (d)	RSS 119 Issue 11 5.8
Occupied bandwidth 99%. Requirements of emission mask D	
Emission mask D: 12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows: (1) On any frequency from the center of the authorized bandwidth f0 to 5.625 kHz removed from f0: Zero dB. (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27(f_d - 2.88 kHz) dB. (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation. (4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two to three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emissions mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (m) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, then an alternate procedure may be used provided prior Commission approval is obtained.	

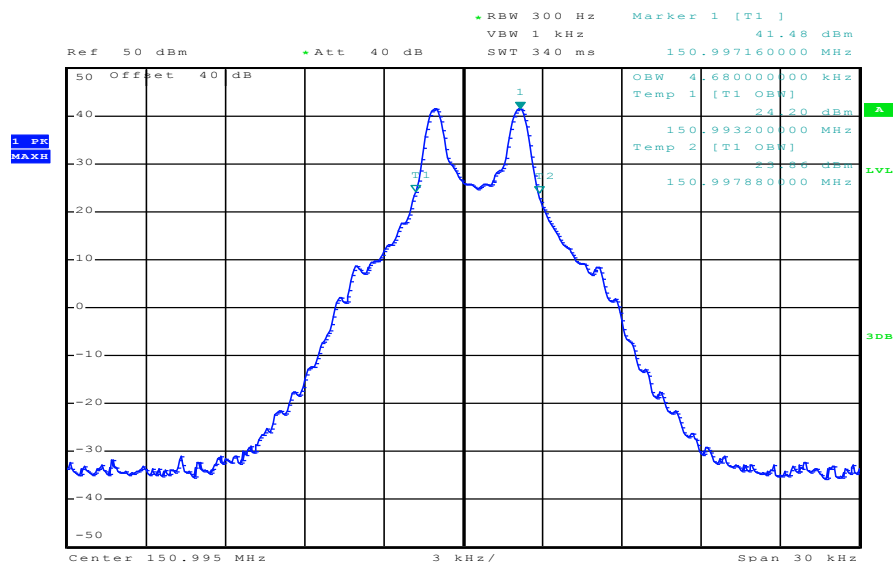
Result: 99%-bandwidth

	99%-bandwidth [kHz]				
Data rate [bits per second]	512	1200	2400	4800	9600
150.995 MHz	4.68	5.28	6.96	9.36	7.14
163.250 MHz	4.68	5.28	7.08	9.42	7.20
173.39625 MHz	4.68	5.22	7.08	9.42	7.20

Result: **Passed**

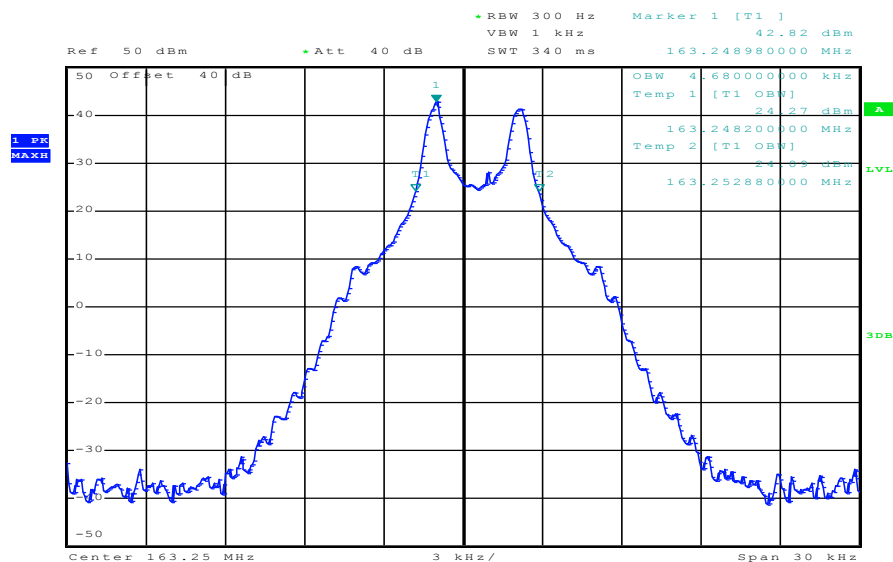
Plots of the measurements (99%-bandwidth)

Plot 1: Low channel / 512 bits per second



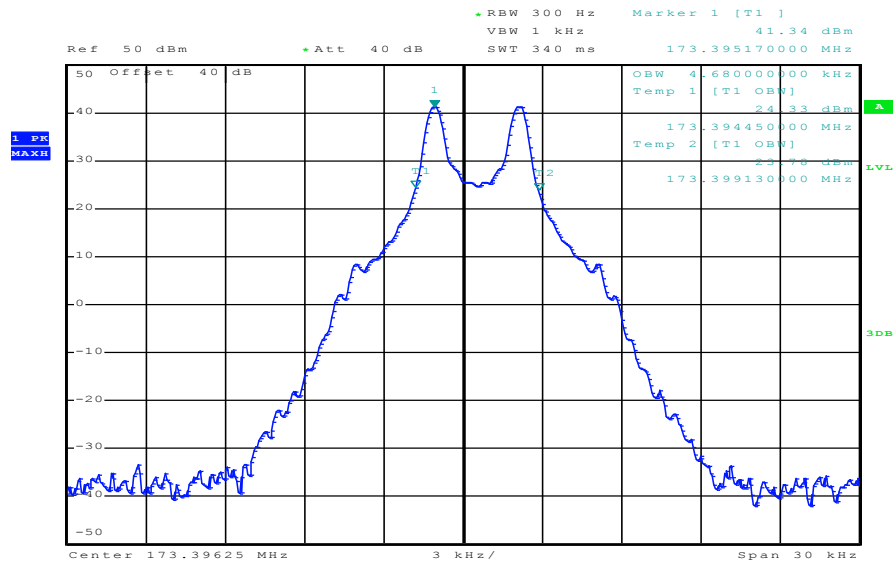
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Plot 2: Middle channel / 512 bits per second



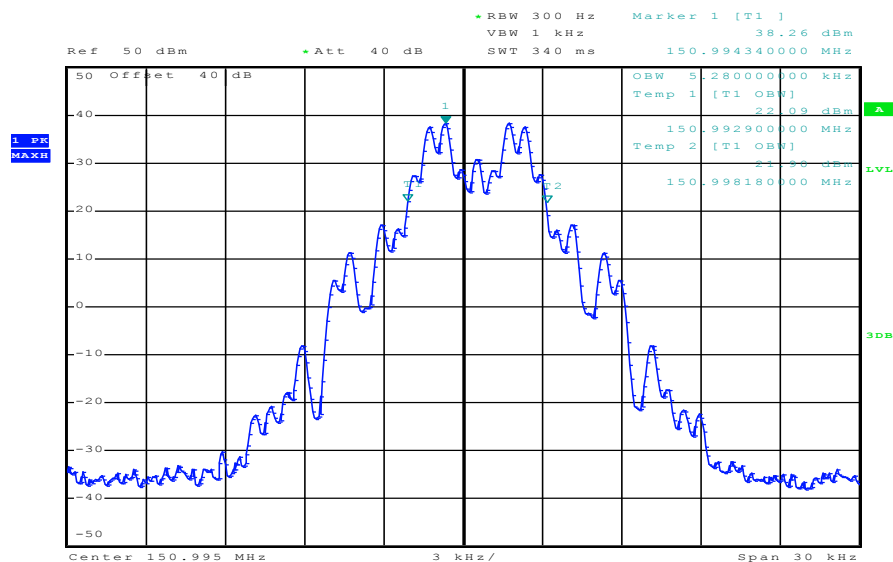
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Plot 3: High channel / 512 bits per second



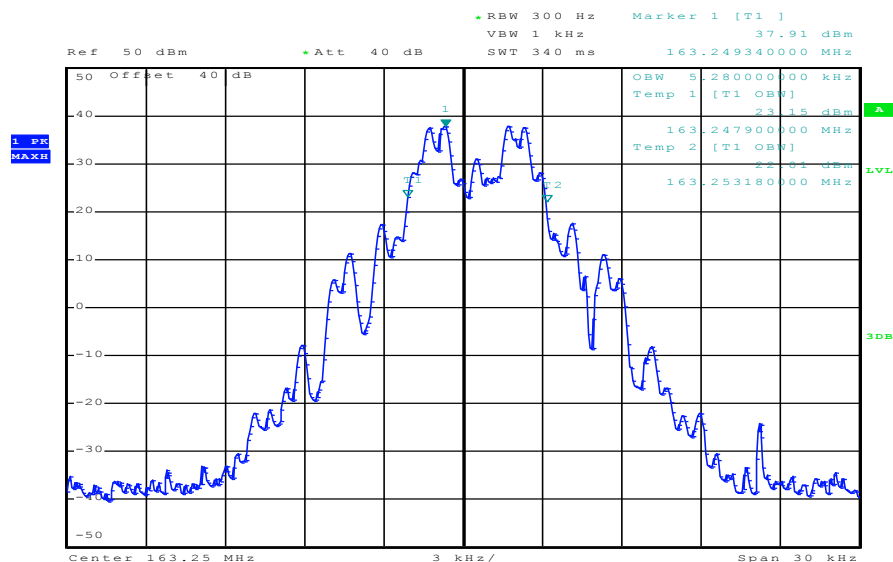
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Plot 4: Low channel / 1200 bits per second



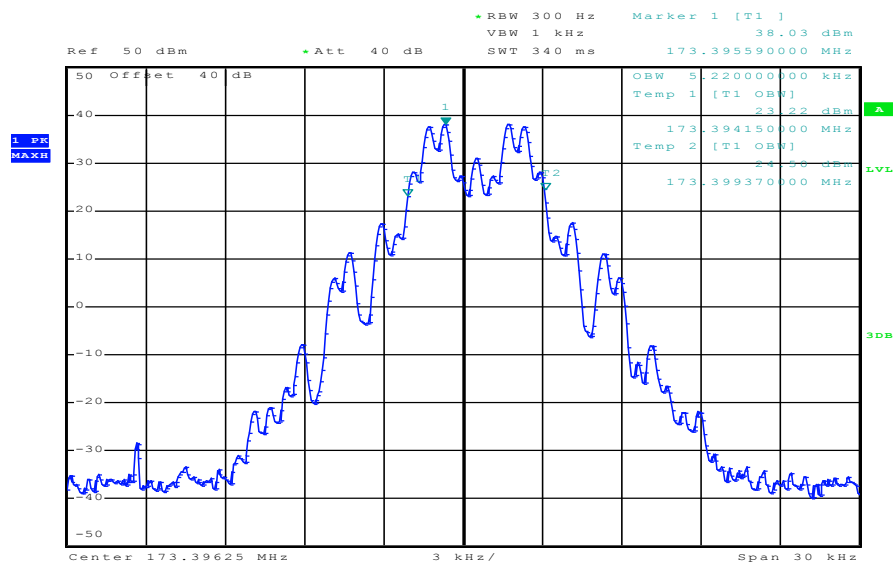
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Plot 5: Middle channel / 1200 bits per second



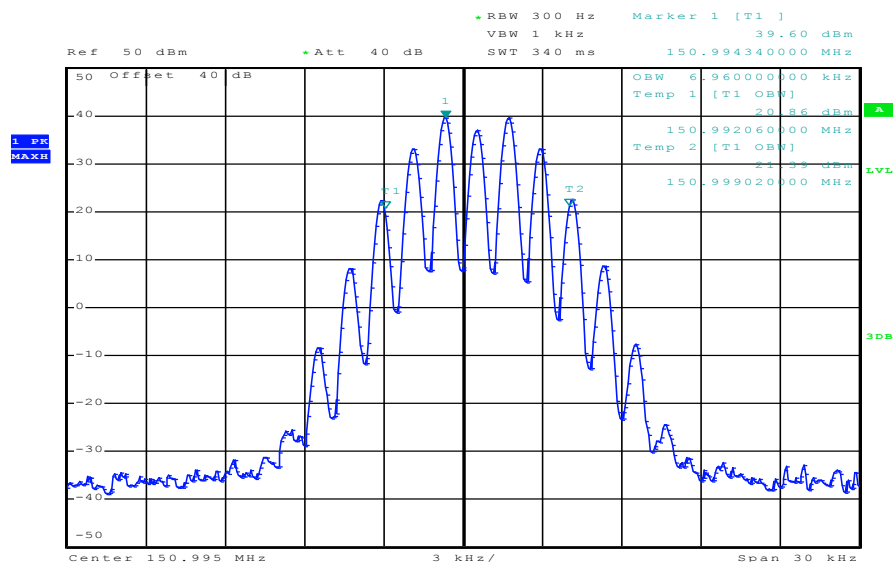
Date: 12.MAR.2014 07:36:54

Plot 6: High channel / 1200 bits per second



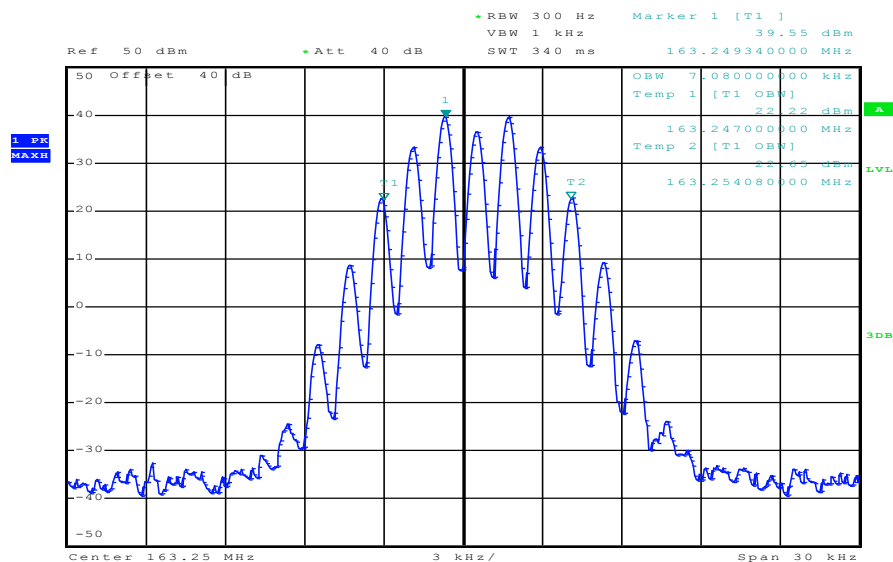
Date: 12.MAR.2014 07:40:23

Plot 7: Low channel / 2400 bits per second



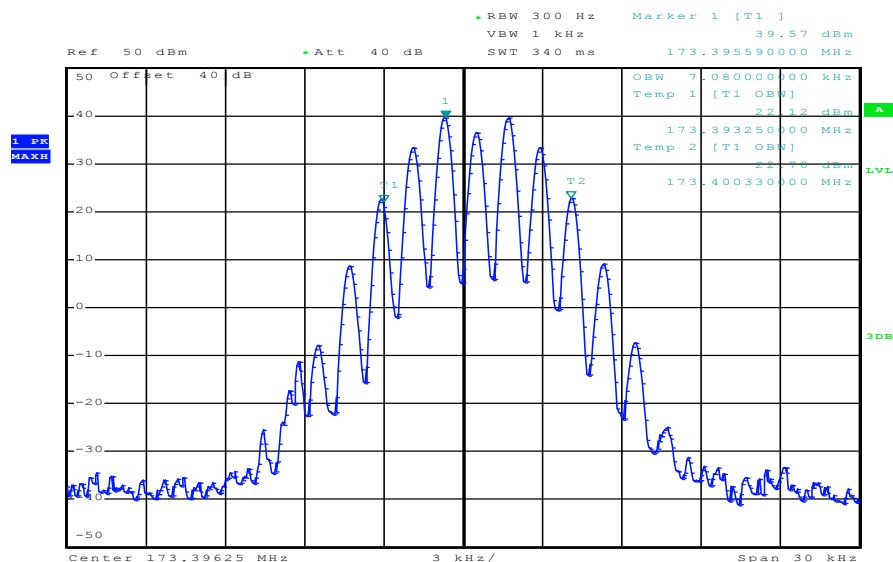
Date: 12.MAR.2014 07:29:14

Plot 8: Middle channel / 2400 b bits is per second



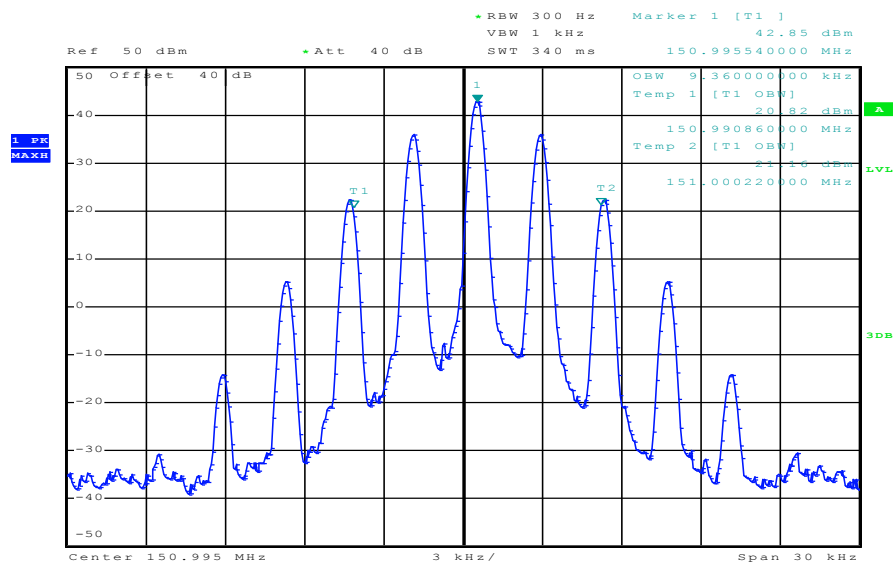
Date: 12.MAR.2014 07:36:05

Plot 9: High channel / 2400 bits per second



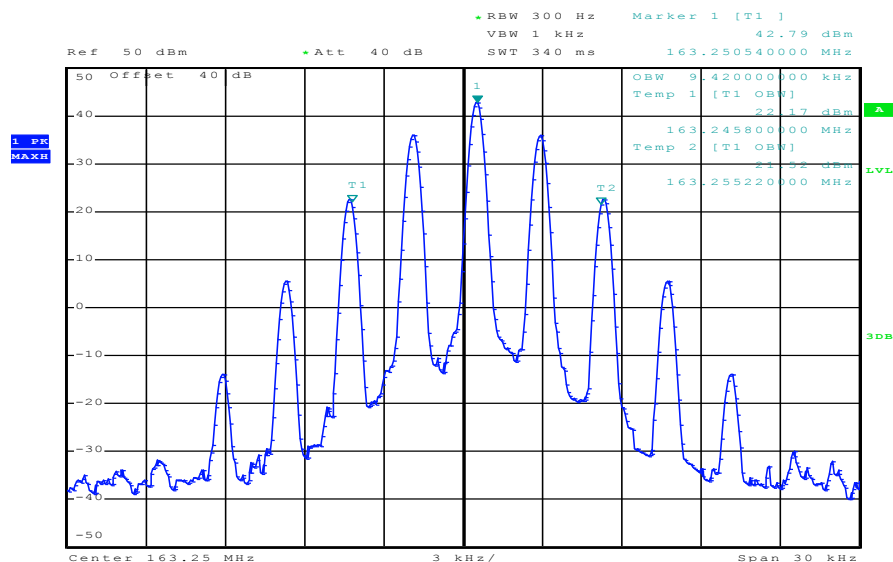
Date: 12.MAR.2014 07:41:11

Plot 10: Low channel / 4800 bits per second



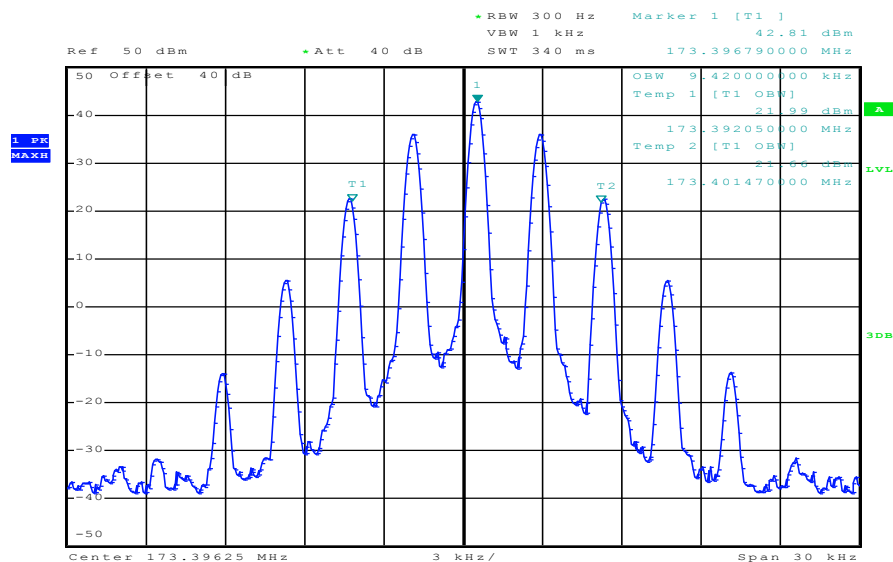
Date: 12.MAR.2014 07:30:06

Plot 11: Middle channel / 4800 bits per second



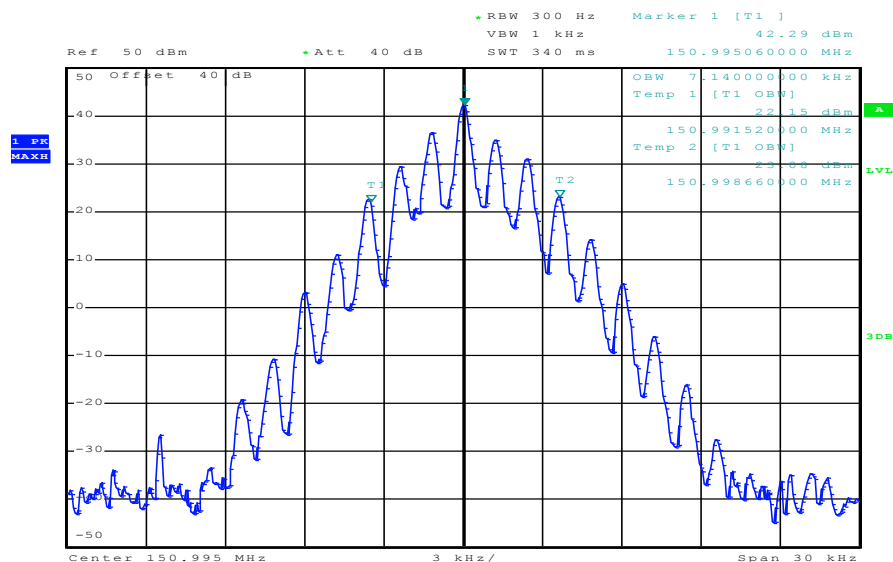
Date: 12.MAR.2014 07:35:20

Plot 12: High channel / 4800 bits per second



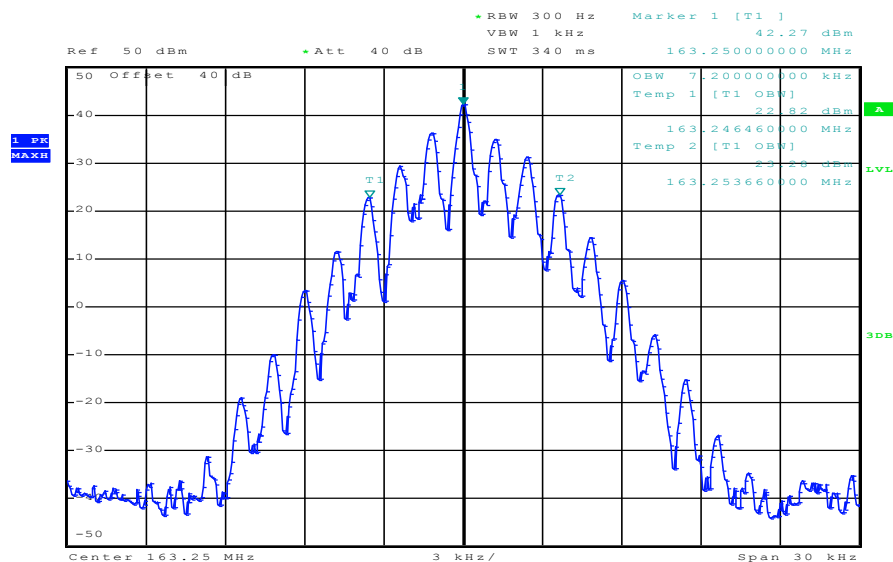
Date: 12.MAR.2014 07:42:11

Plot 13: Low channel / 9600 bits per second



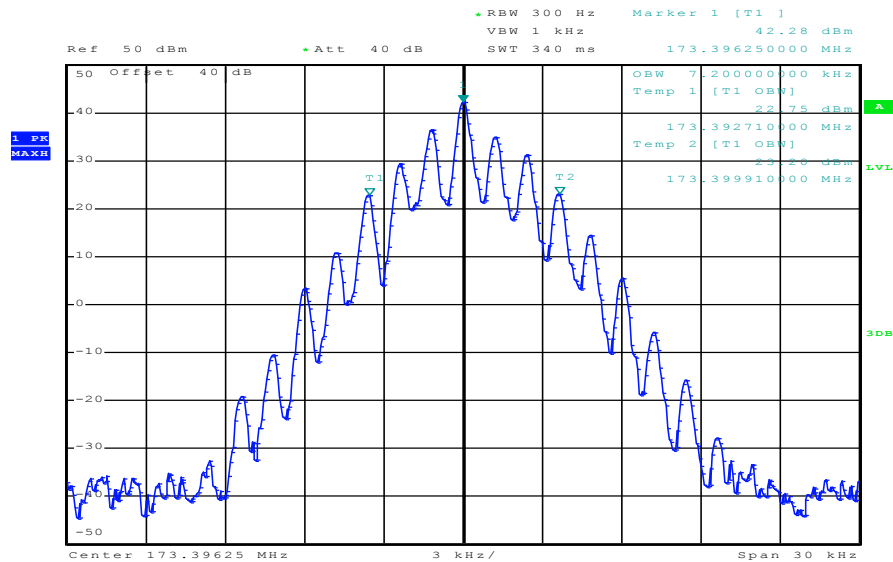
Date: 12.MAR.2014 07:32:12

Plot 14: Middle channel / 9600 bits per second



Date: 12.MAR.2014 07:34:29

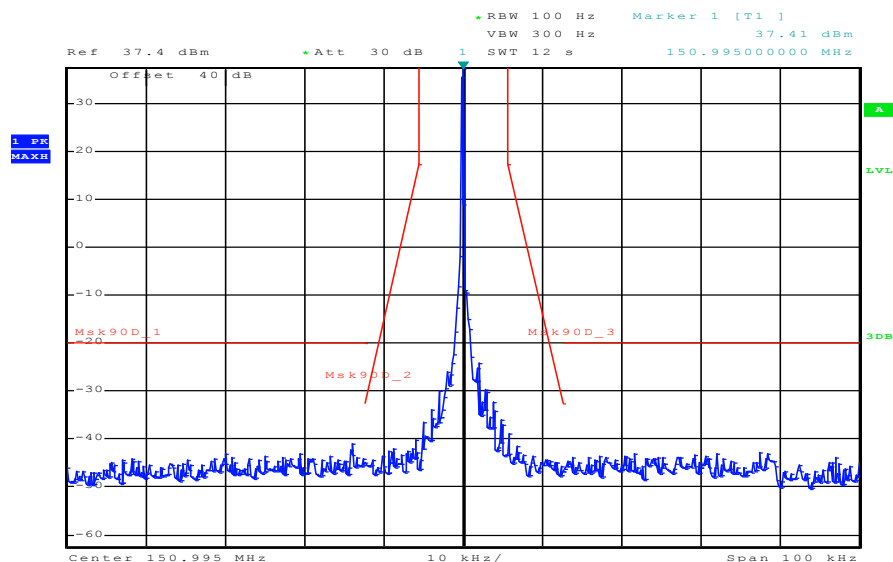
Plot 15: High channel / 9600 bits per second



Date: 12.MAR.2014 07:42:53

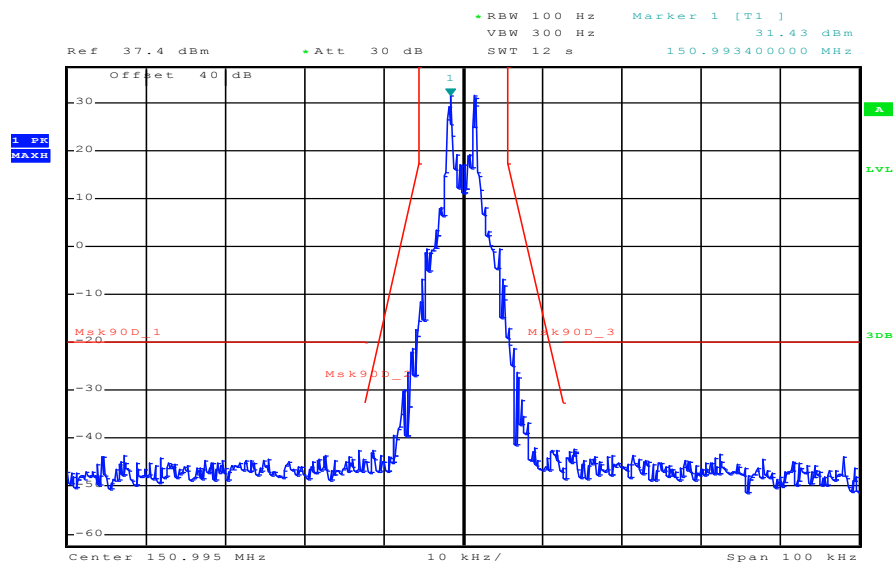
Plots of the measurements (Emission mask D)

Plot 1: Emission Mask D – Low channel – 512 bits per second – Low power – Carrier unmodulated



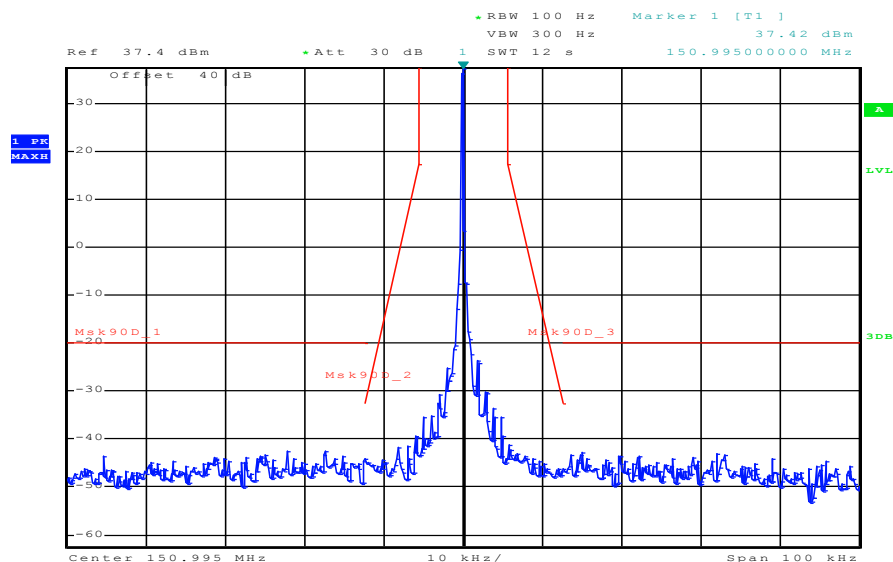
Date: 12.MAR.2014 08:22:13

Plot 2: Emission Mask D – Low channel – 512 bits per second – Low power – Carrier modulated



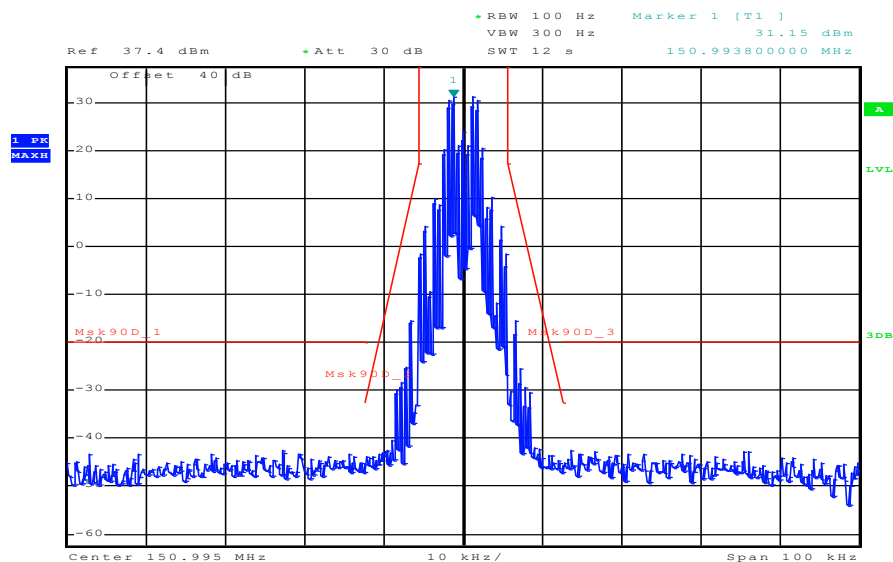
Date: 12.MAR.2014 08:23:37

Plot 3: Emission Mask D – Low channel – 1200 bits per second – Low power – Carrier unmodulated



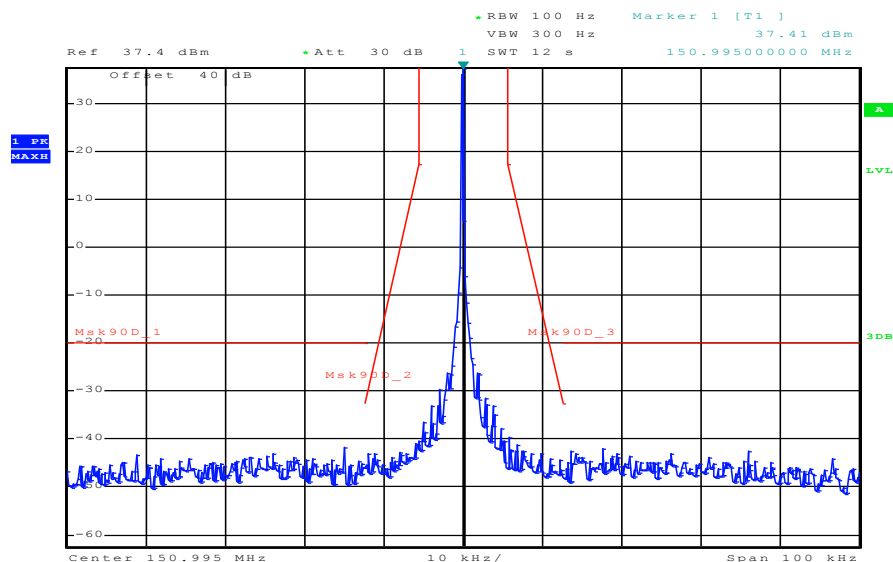
Date: 12.MAR.2014 08:17:49

Plot 4: Emission Mask D – Low channel – 1200 bits per second – Low power – Carrier modulated



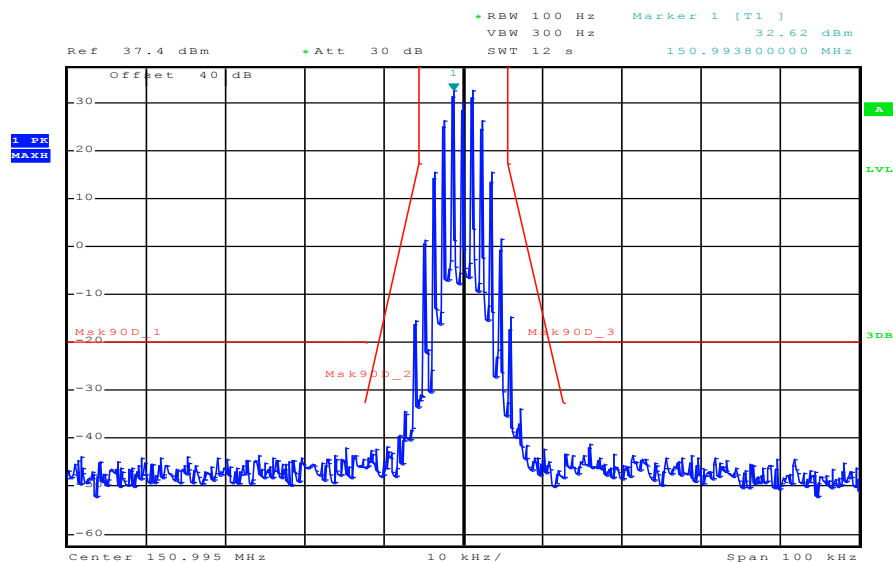
Date: 12.MAR.2014 08:19:07

Plot 5: Emission Mask D – Low channel – 2400 bits per second – Low power – Carrier unmodulated



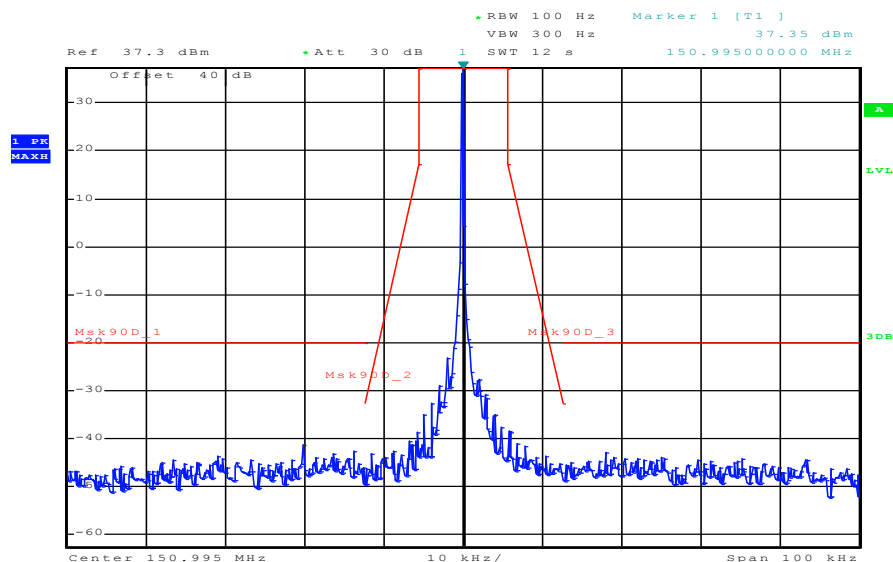
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Plot 6: Emission Mask D – Low channel – 2400 bits per second – Low power – Carrier modulated



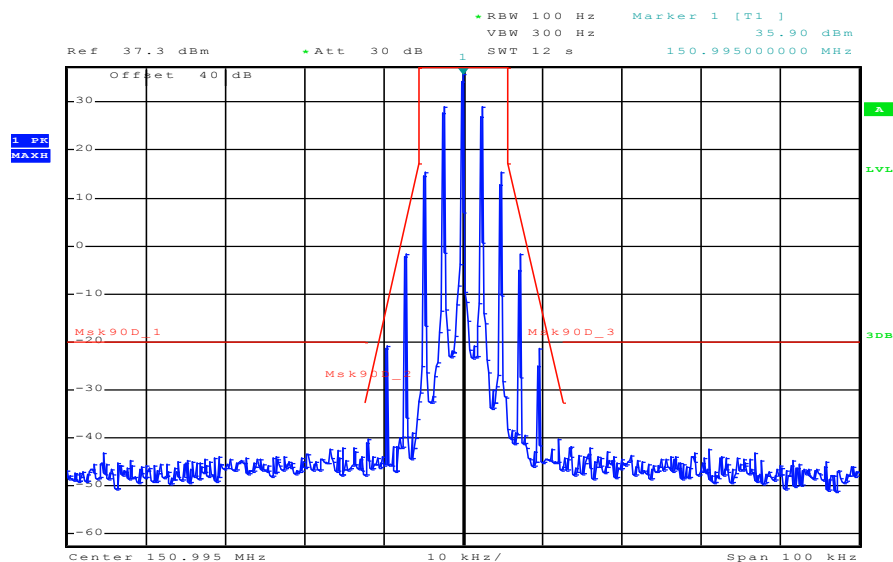
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Plot 7: Emission Mask D – Low channel – 4800 bits per second – Low power – Carrier unmodulated



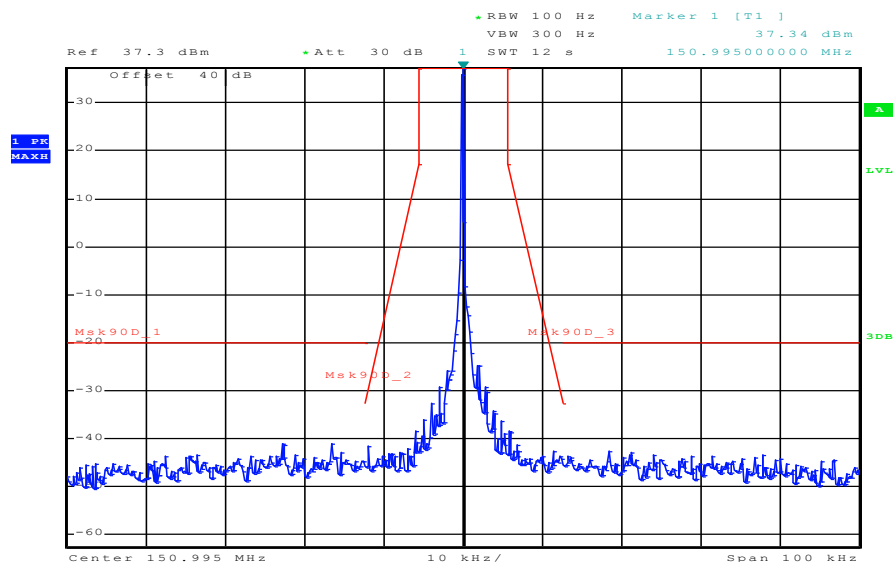
Date: 12.MAR.2014 08:11:21

Plot 8: Emission Mask D – Low channel – 4800 bits per second – Low power – Carrier modulated



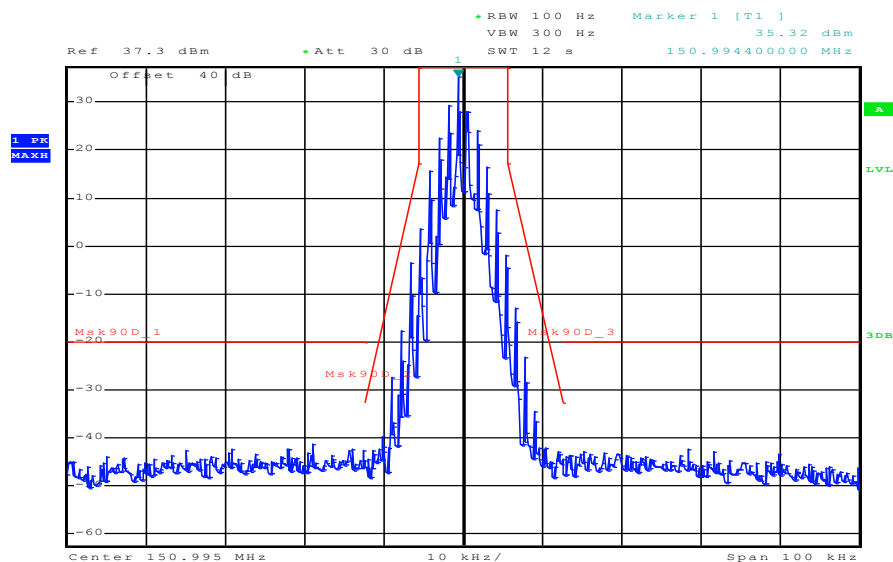
Date: 12.MAR.2014 08:14:09

Plot 9: Emission Mask D – Low channel – 9600 bits per second – Low power – Carrier unmodulated



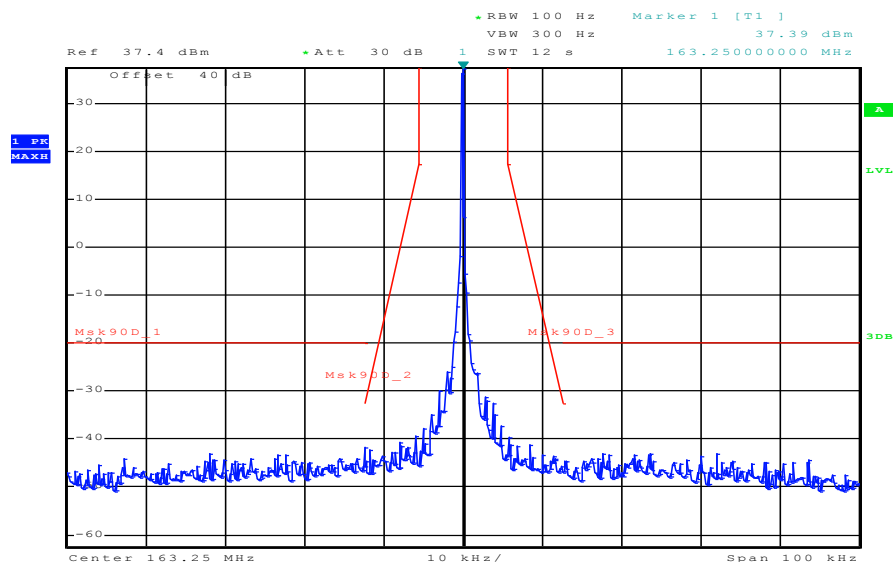
Date: 12.MAR.2014 08:10:37

Plot 10: Emission Mask D – Low channel – 9600 bits per second – Low power – Carrier modulated



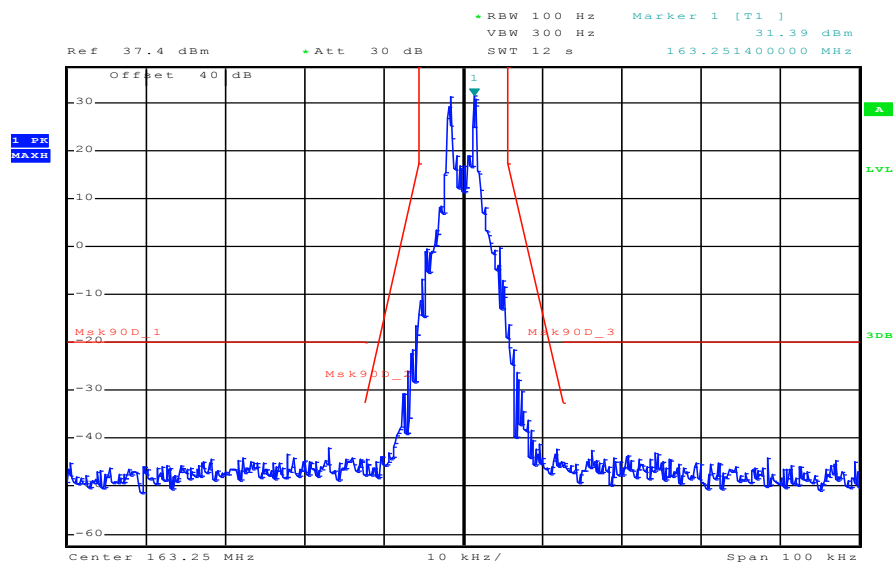
Date: 12.MAR.2014 08:12:51

Plot 11: Emission Mask D – Mid channel – 512 bits per second – Low power – Carrier unmodulated



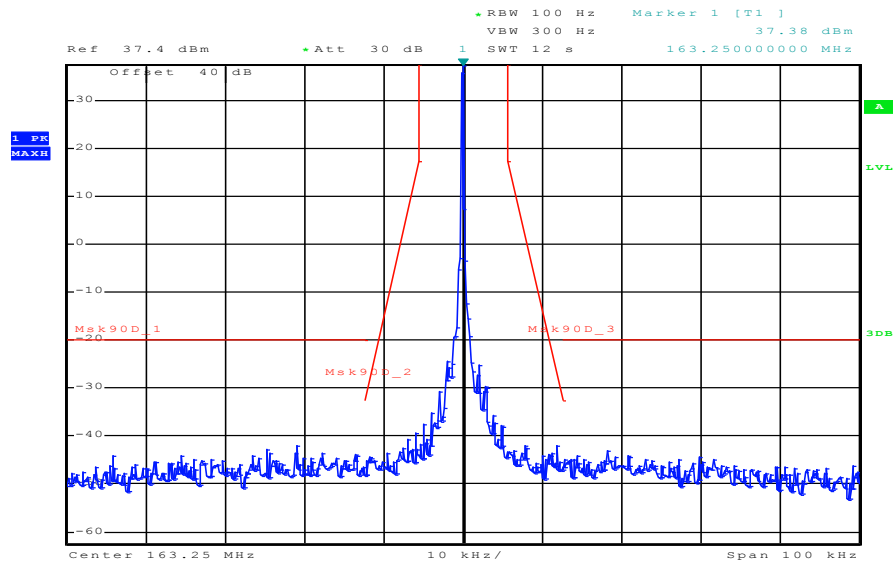
Date: 12.MAR.2014 08:25:31

Plot 12: Emission Mask D – Mid channel – 512 bits per second – Low power – Carrier modulated



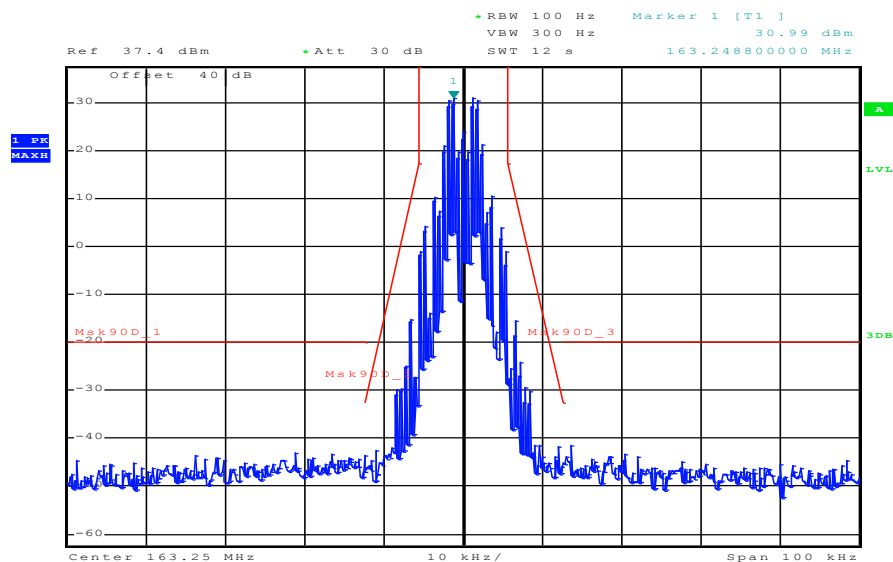
Date: 12.MAR.2014 08:26:51

Plot 13: Emission Mask D – Mid channel – 1200 bits per second – Low power – Carrier unmodulated



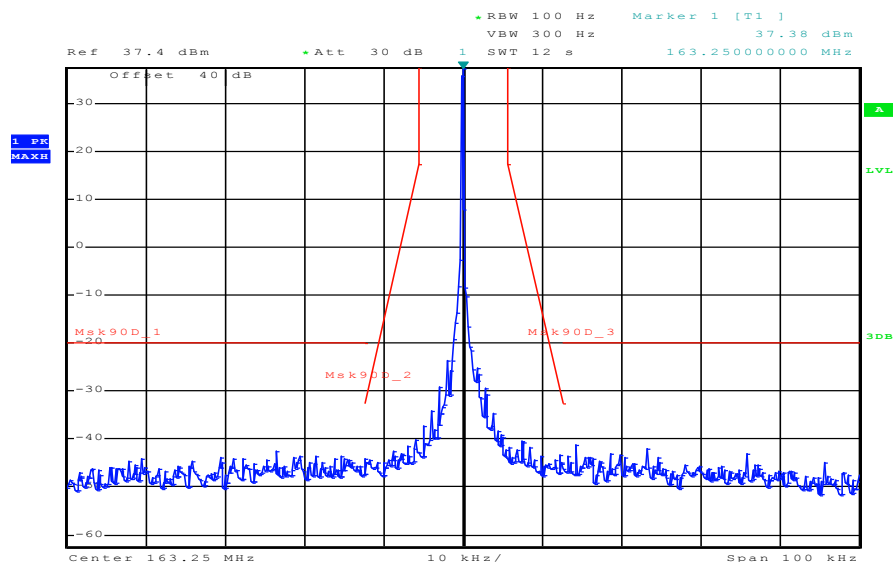
Date: 12.MAR.2014 08:28:17

Plot 14: Emission Mask D – Mid channel – 1200 bits per second – Low power – Carrier modulated



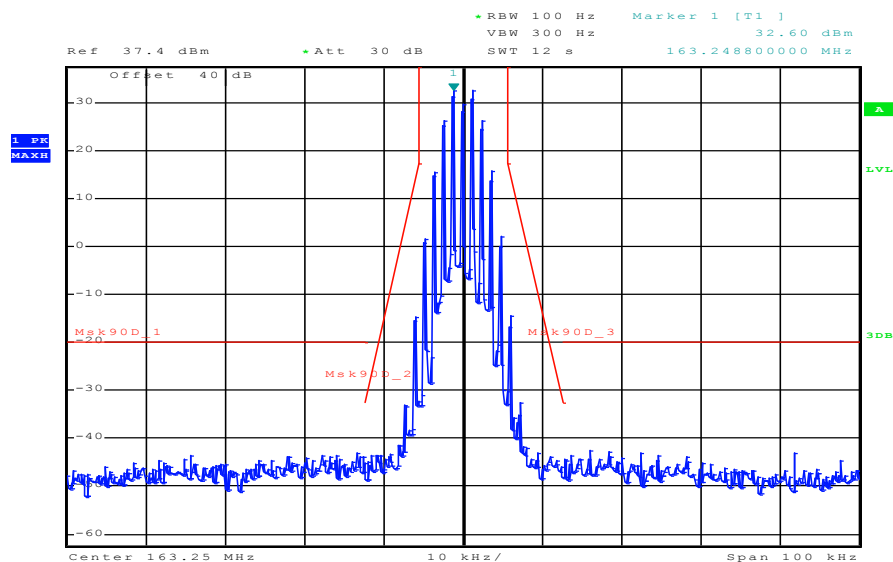
Date: 12.MAR.2014 08:29:16

Plot 15: Emission Mask D – Mid channel – 2400 bits per second – Low power – Carrier unmodulated



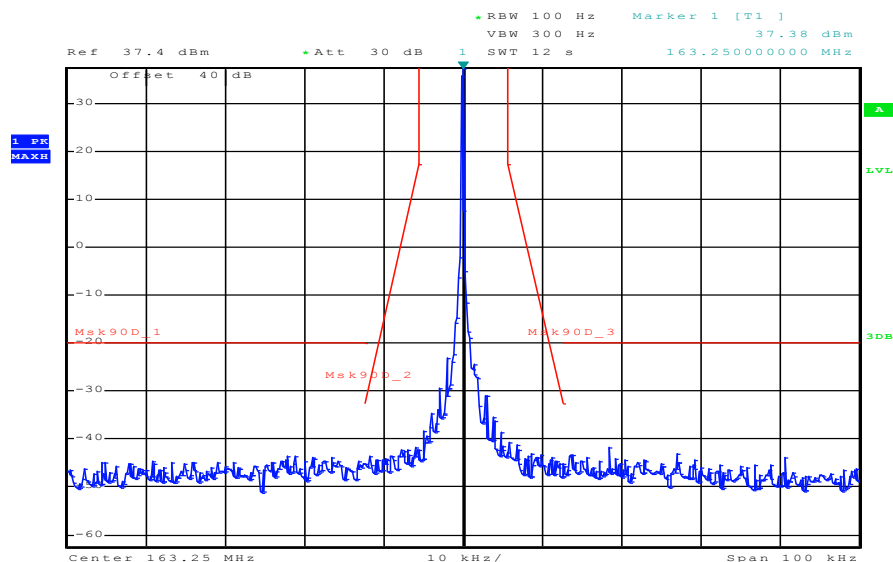
Date: 12.MAR.2014 08:30:44

Plot 16: Emission Mask D – Mid channel – 2400 bits per second – Low power – Carrier modulated



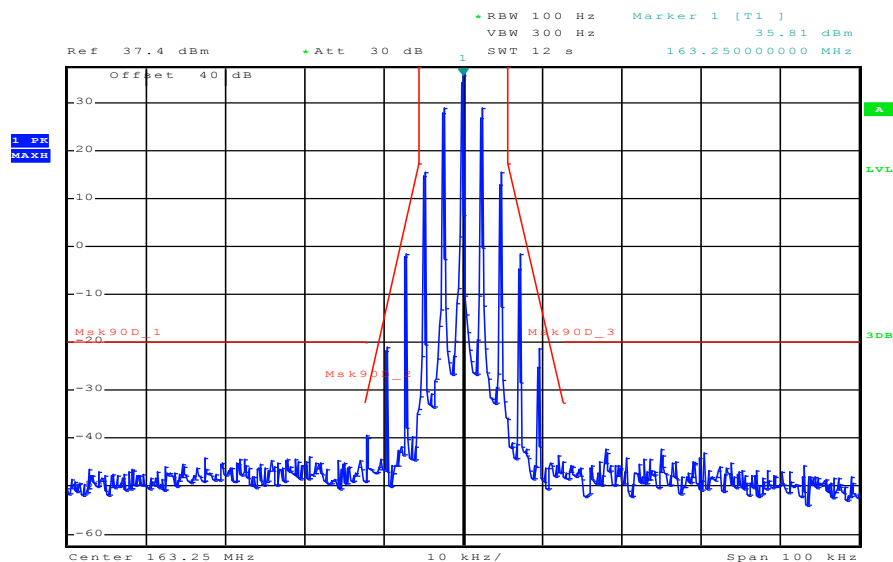
Date: 12.MAR.2014 08:31:50

Plot 17: Emission Mask D – Mid channel – 4800 bits per second – Low power – Carrier unmodulated



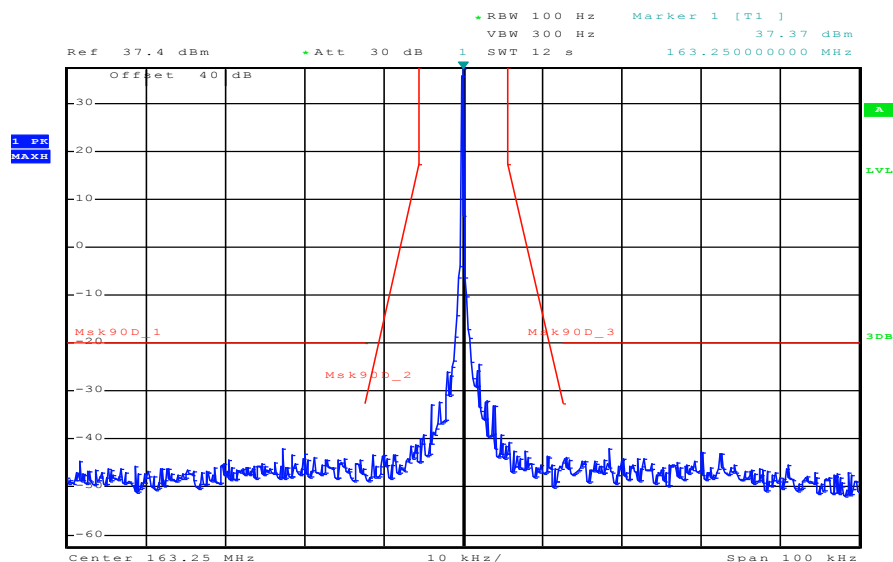
Date: 12.MAR.2014 08:33:16

Plot 18: Emission Mask D – Mid channel – 4800 bits per second – Low power – Carrier modulated



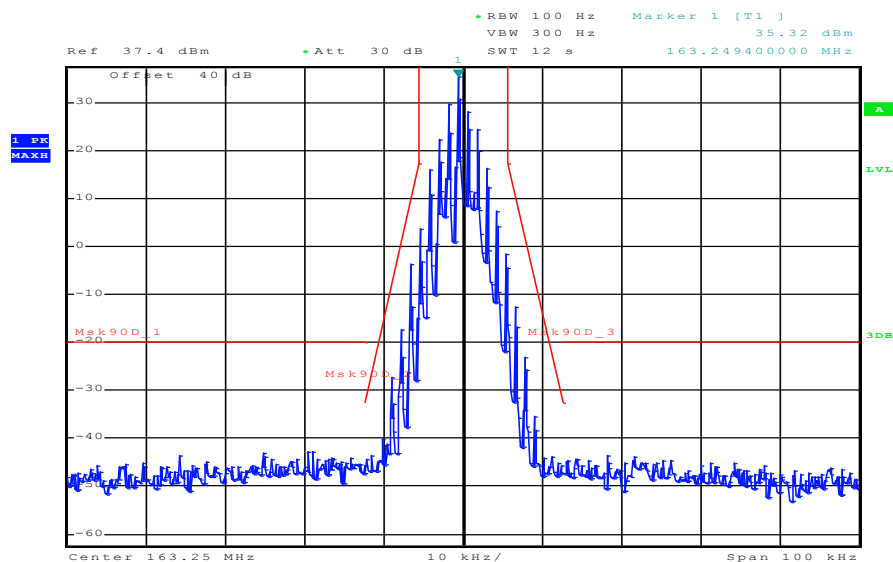
Date: 12.MAR.2014 08:34:23

Plot 19: Emission Mask D – Mid channel – 9600 bits per second – Low power – Carrier unmodulated



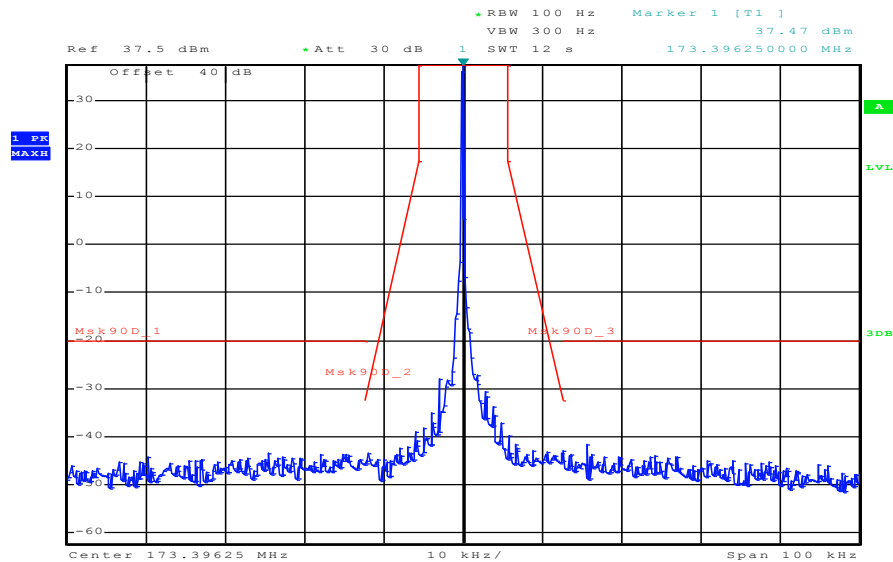
Date: 12.MAR.2014 08:35:39

Plot 20: Emission Mask D – Mid channel – 9600 bits per second – Low power – Carrier modulated



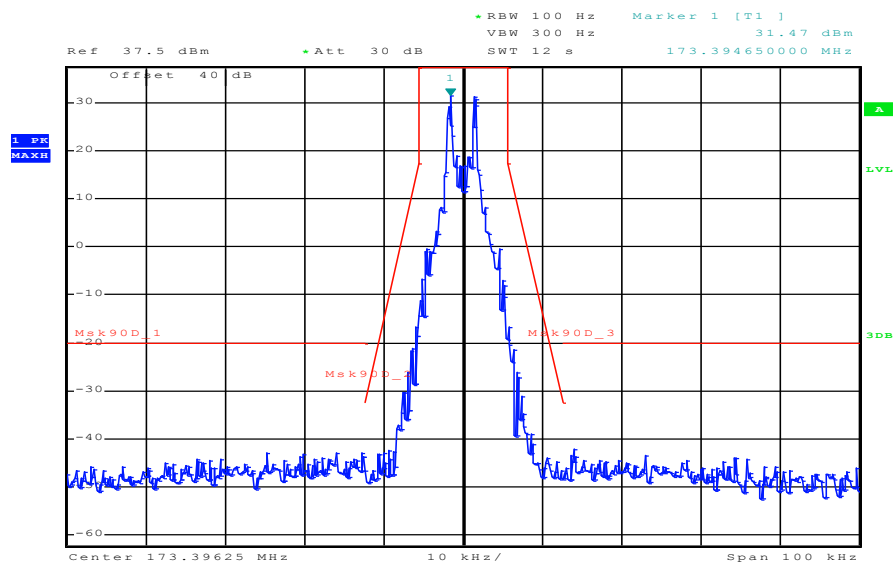
Date: 12.MAR.2014 08:36:27

Plot 21: Emission Mask D – High channel – 512 bits per second – Low power – Carrier unmodulated



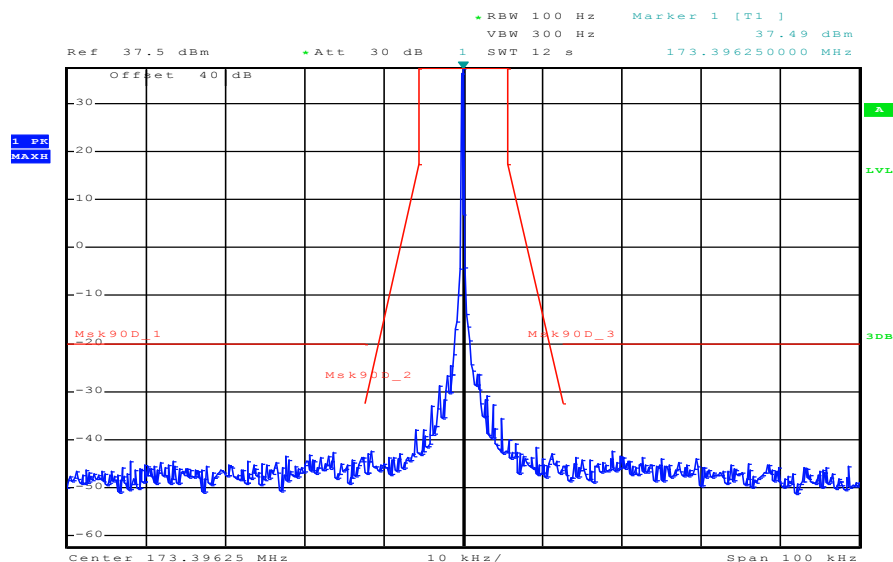
Date: 12.MAR.2014 10:21:06

Plot 22: Emission Mask D – High channel – 512 bits per second – Low power – Carrier modulated



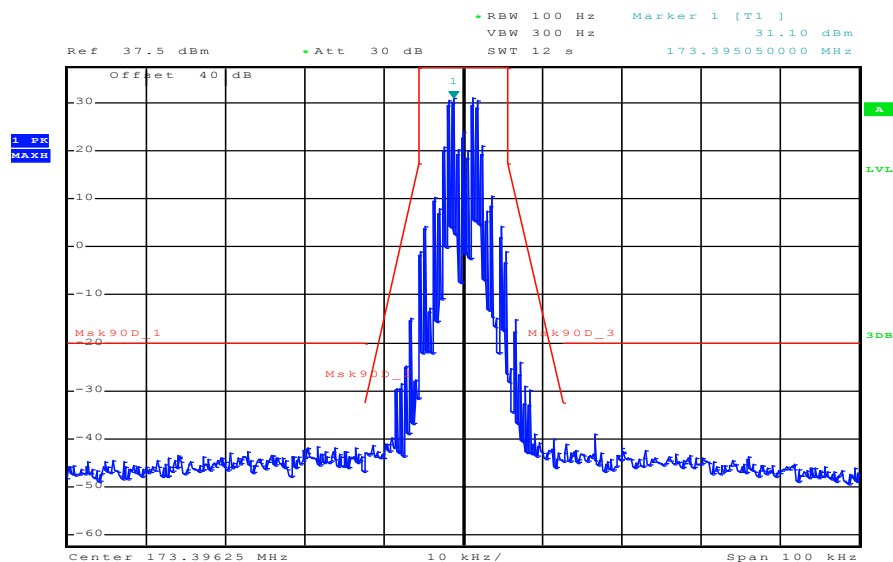
Date: 12.MAR.2014 10:22:12

Plot 23: Emission Mask D – High channel – 1200 bits per second – Low power – Carrier unmodulated



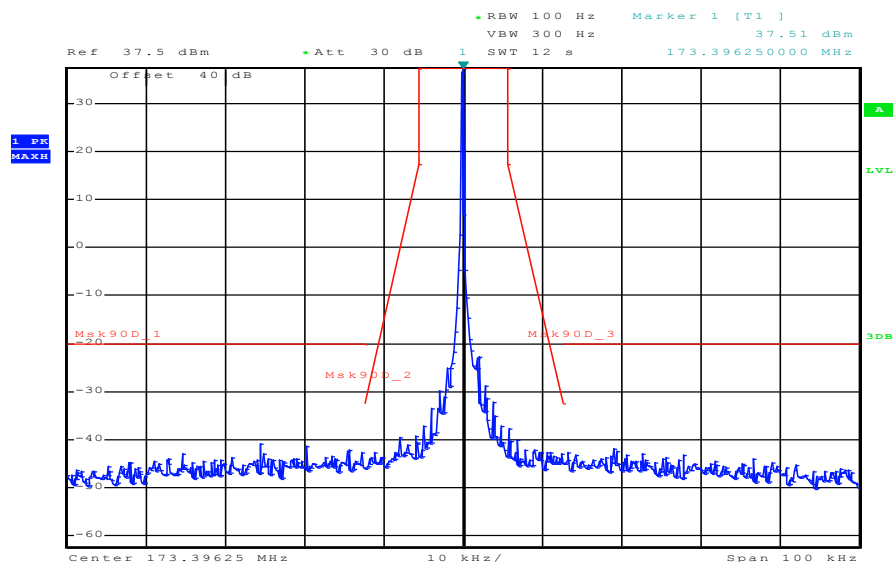
Date: 12.MAR.2014 10:16:02

Plot 24: Emission Mask D – High channel – 1200 bits per second – Low power – Carrier modulated



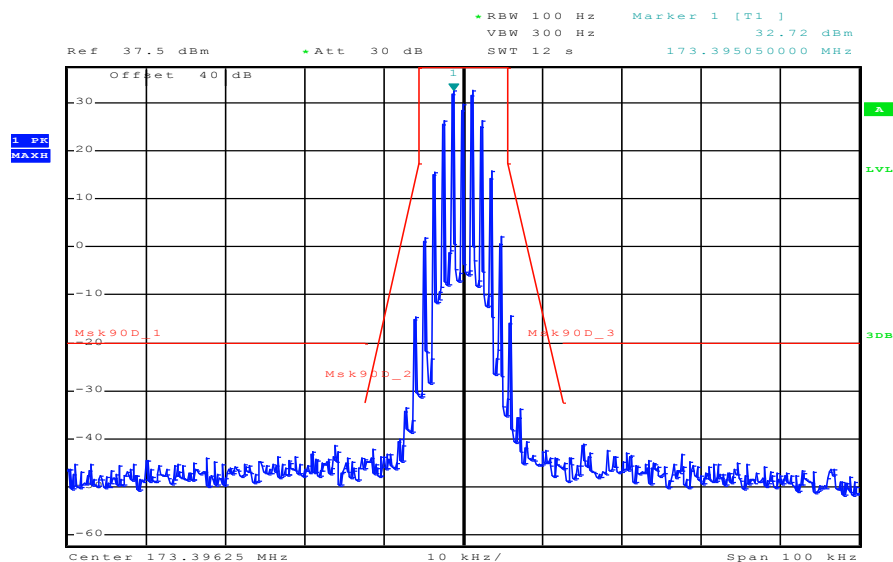
Date: 12.MAR.2014 10:19:44

Plot 25: Emission Mask D – High channel – 2400 bits per second – Low power – Carrier unmodulated



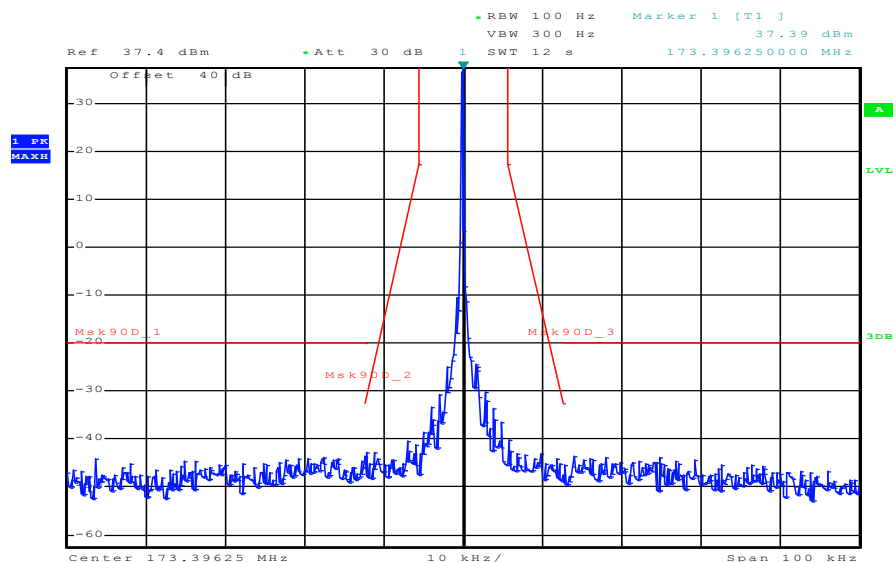
Date: 12.MAR.2014 10:13:32

Plot 26: Emission Mask D – High channel – 2400 bits per second – Low power – Carrier modulated



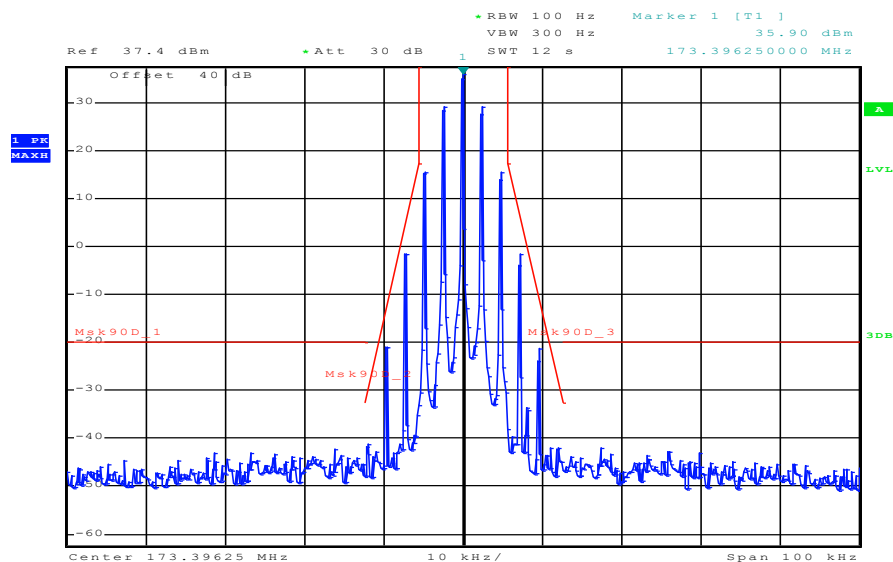
Date: 12.MAR.2014 10:14:35

Plot 27: Emission Mask D – High channel – 4800 bits per second – Low power – Carrier unmodulated



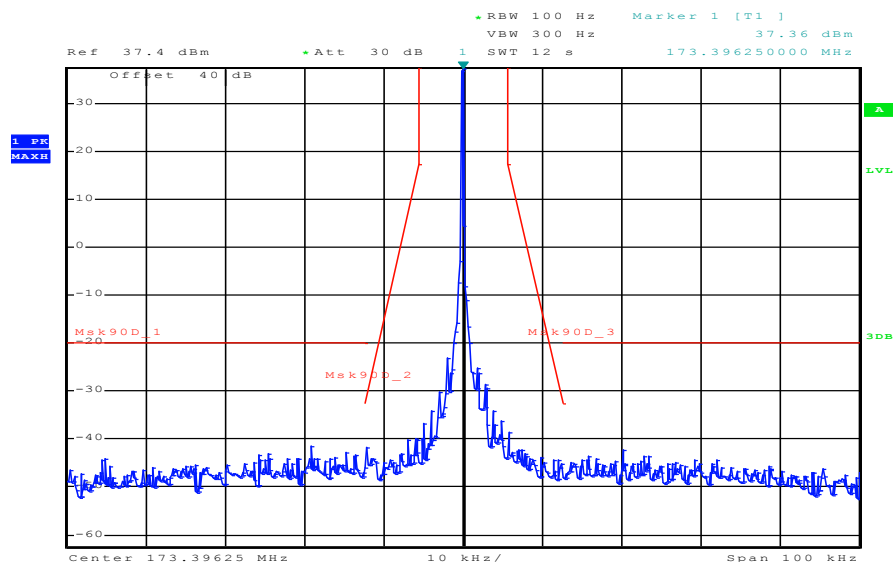
Date: 12.MAR.2014 09:51:02

Plot 28: Emission Mask D – High channel – 4800 bits per second – Low power – Carrier modulated



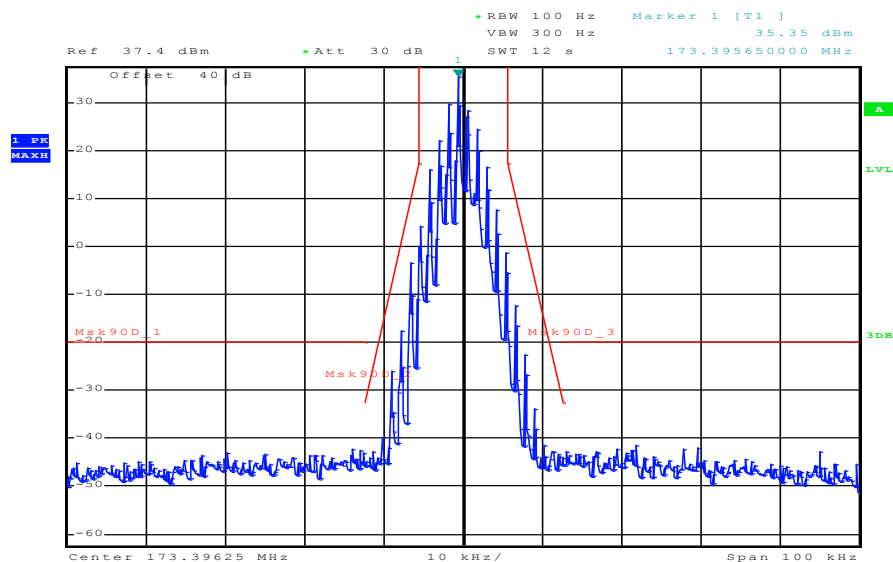
Date: 12.MAR.2014 09:52:53

Plot 29: Emission Mask D – High channel – 9600 bits per second – Low power – Carrier unmodulated



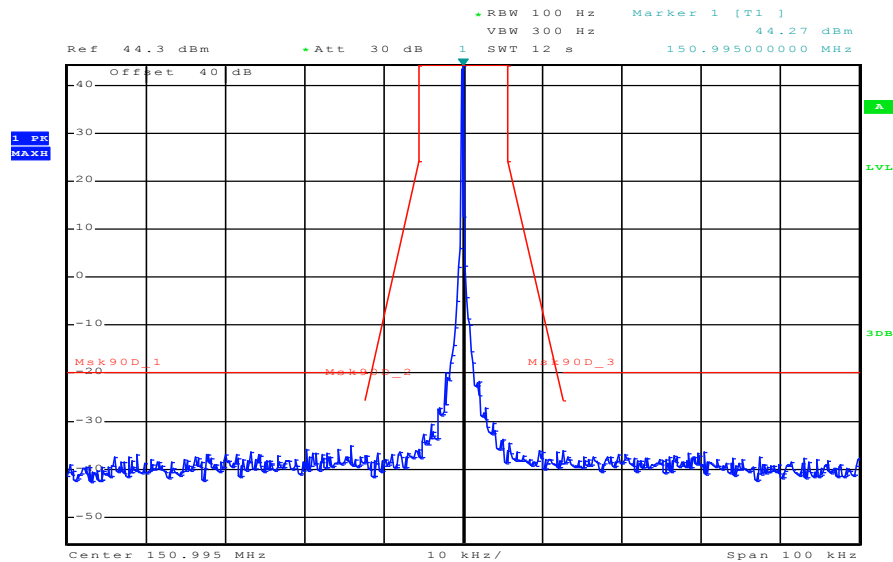
Date: 12.MAR.2014 09:50:07

Plot 30: Emission Mask D – High channel – 9600 bits per second – Low power – Carrier modulated



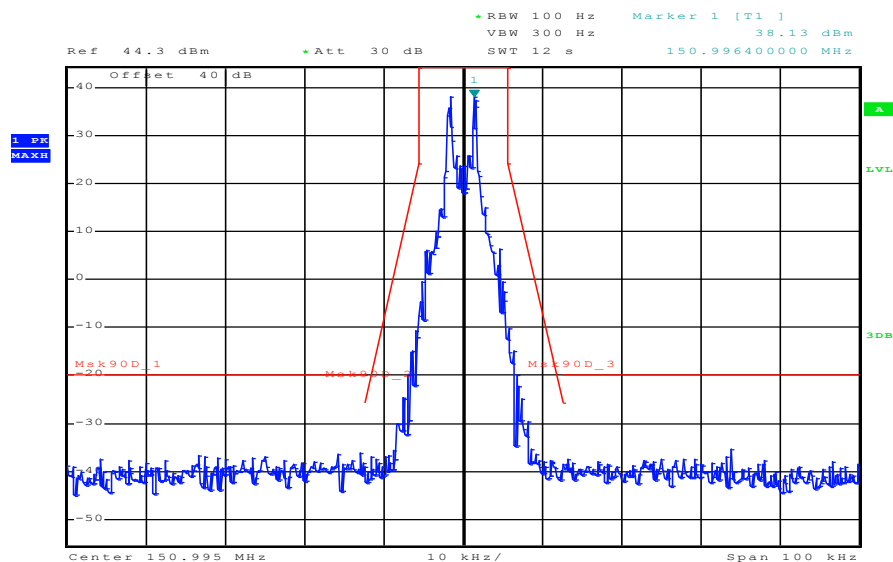
Date: 12.MAR.2014 09:54:58

Plot 31: Emission Mask D – Low channel – 512 bits per second – High power – Carrier unmodulated



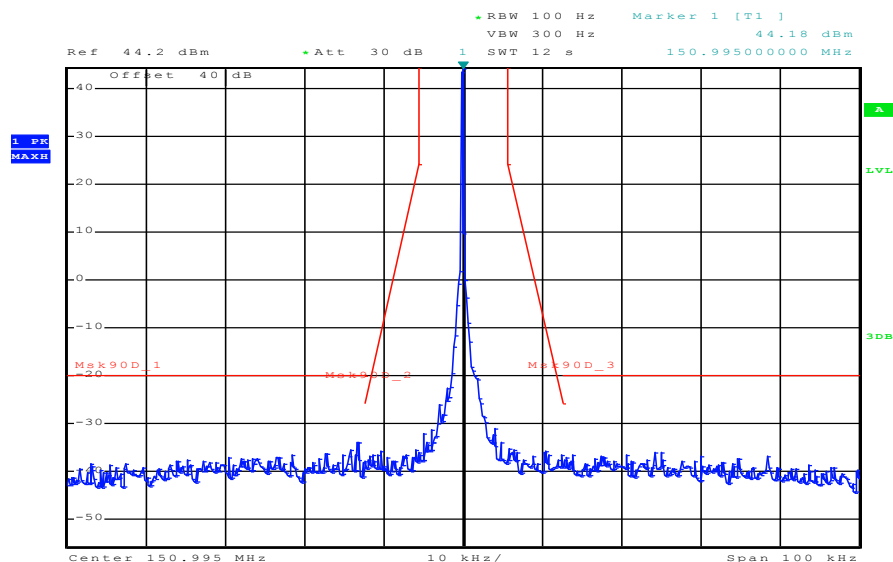
Date: 12.MAR.2014 07:57:59

Plot 32: Emission Mask D – Low channel – 512 bits per second – High power – Carrier modulated



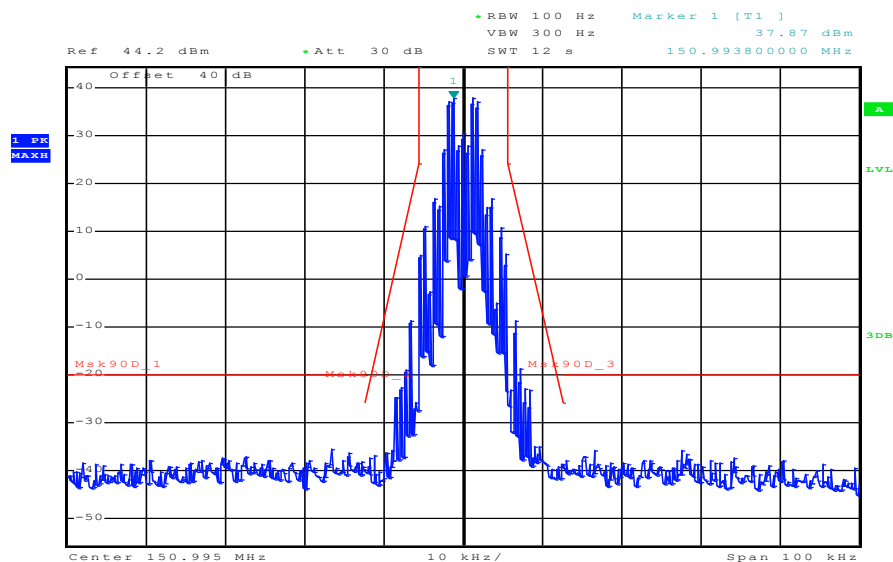
Date: 12.MAR.2014 07:59:01

Plot 33: Emission Mask D – Low channel – 1200 bits per second – High power – Carrier unmodulated



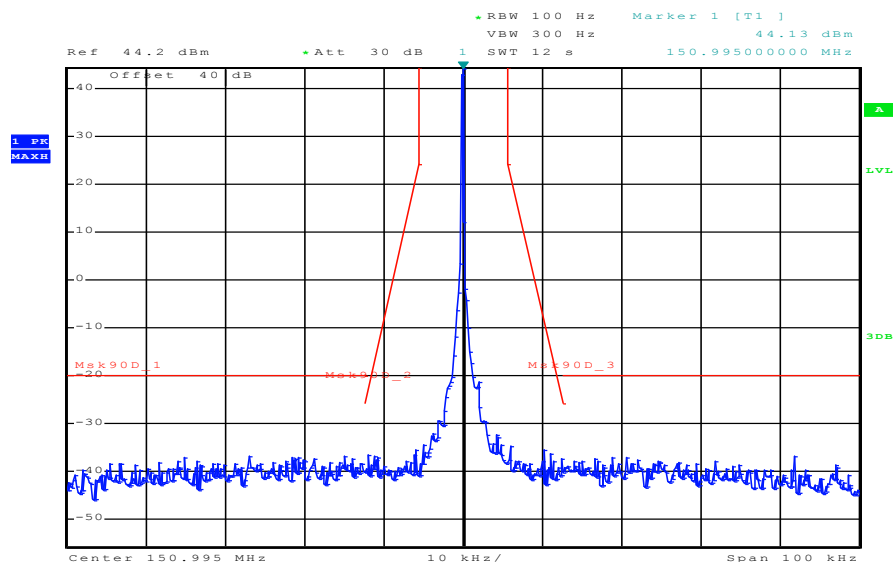
Date: 12.MAR.2014 08:00:52

Plot 34: Emission Mask D – Low channel – 1200 bits per second – High power – Carrier modulated



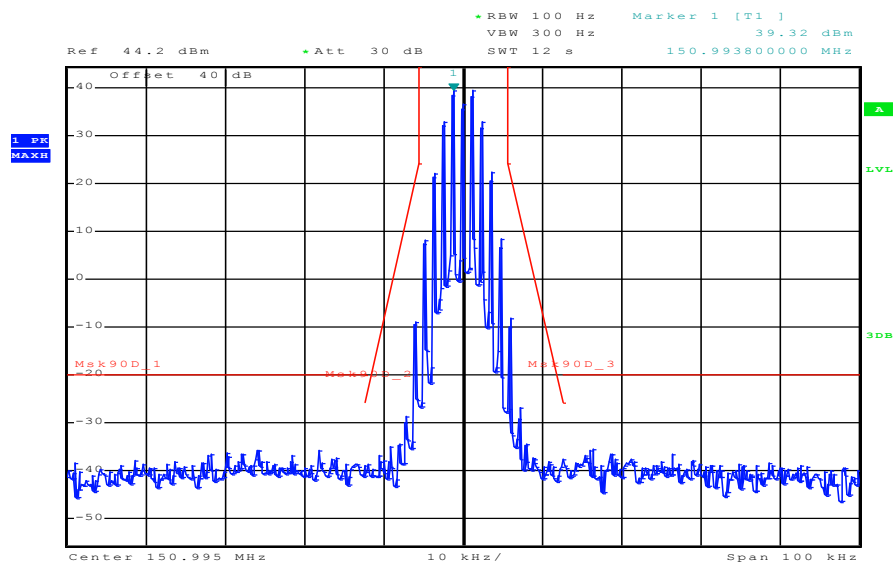
Date: 12.MAR.2014 08:01:47

Plot 35: Emission Mask D – Low channel – 2400 bits per second – High power – Carrier unmodulated



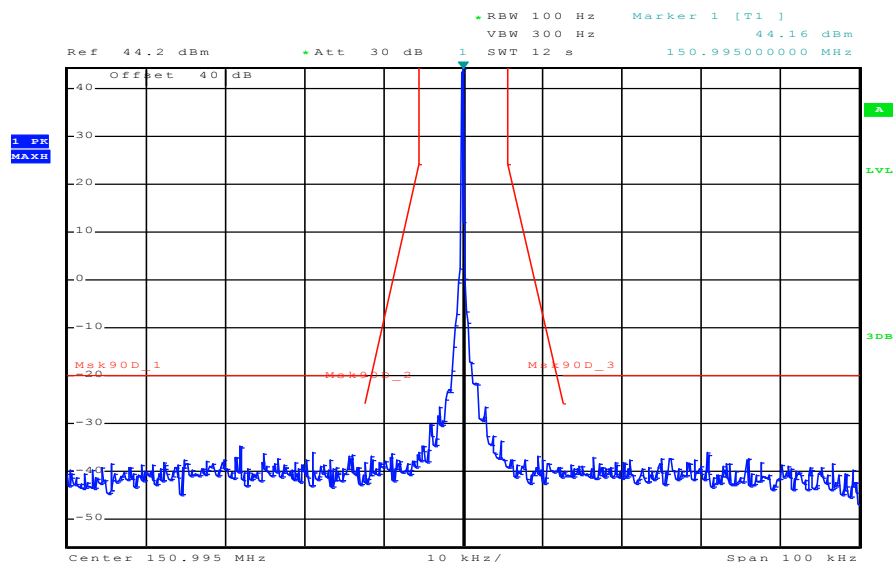
Date: 12.MAR.2014 08:02:56

Plot 36: Emission Mask D – Low channel – 2400 bits per second – High power – Carrier modulated



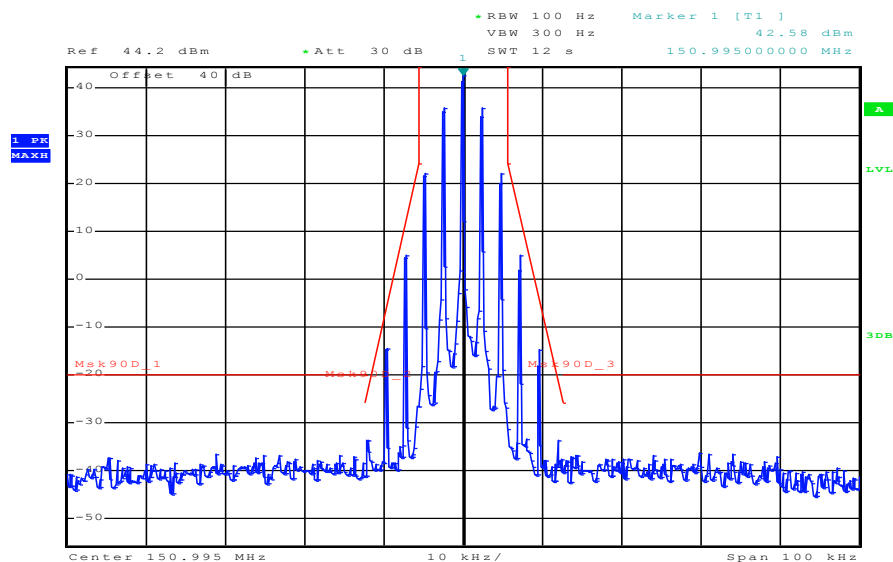
Date: 12.MAR.2014 08:03:54

Plot 37: Emission Mask D – Low channel – 4800 bits per second – High power – Carrier unmodulated



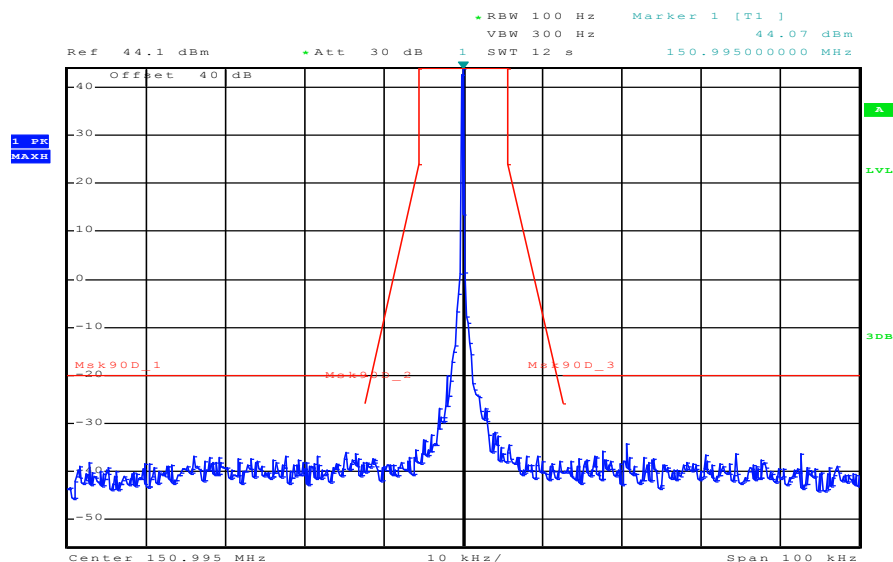
Date: 12.MAR.2014 08:05:04

Plot 38: Emission Mask D – Low channel – 4800 bits per second – High power – Carrier modulated



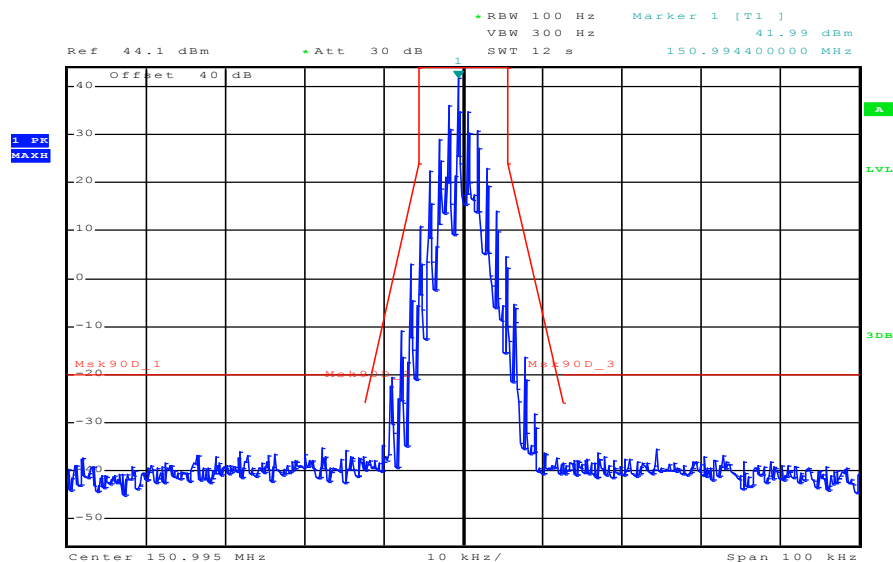
Date: 12.MAR.2014 08:06:08

Plot 39: Emission Mask D – Low channel – 9600 bits per second – High power – Carrier unmodulated



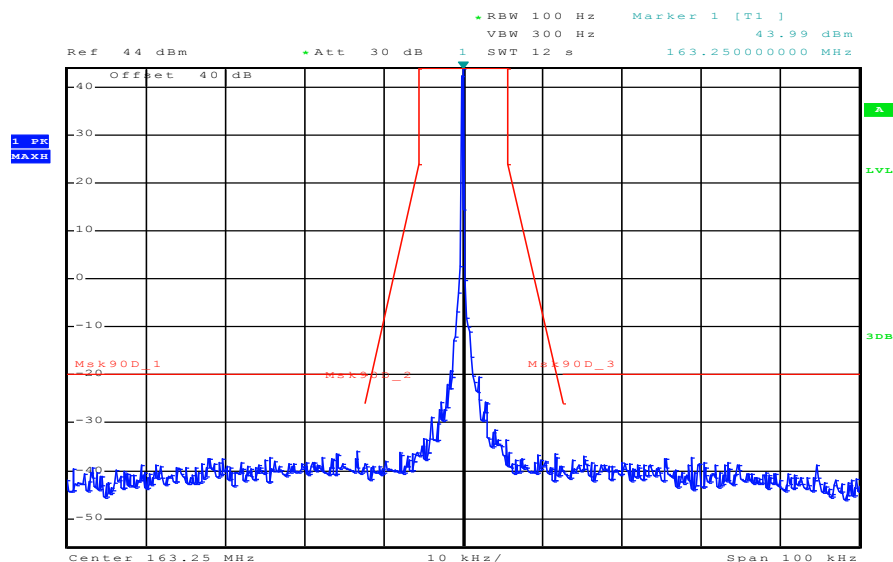
Date: 12.MAR.2014 08:07:34

Plot 40: Emission Mask D – Low channel – 9600 bits per second – High power – Carrier modulated



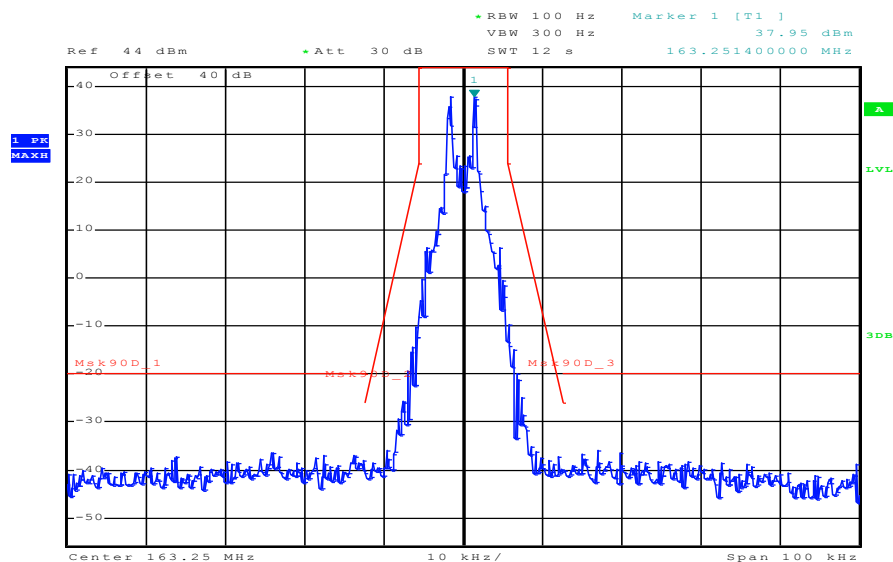
Date: 12.MAR.2014 08:08:38

Plot 41: Emission Mask D – Mid channel – 512 bits per second – High power – Carrier unmodulated



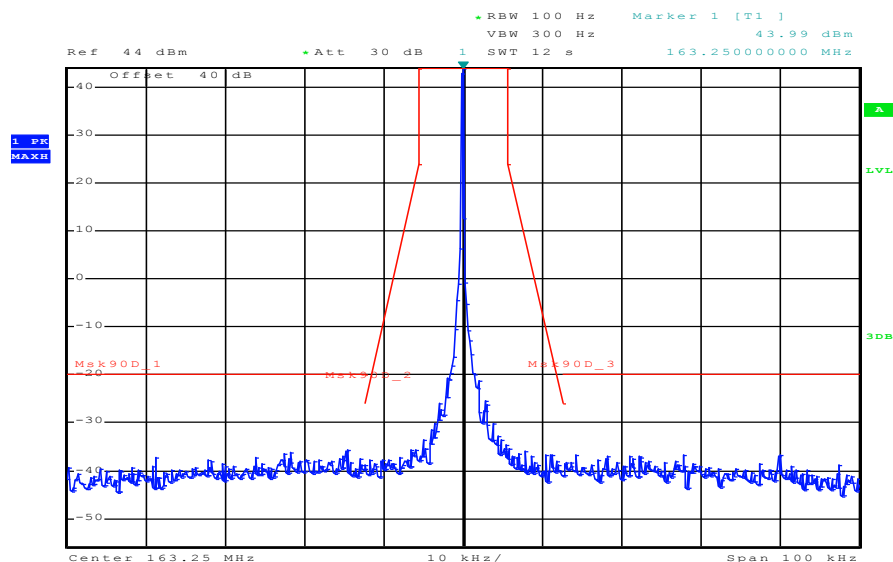
Date: 12.MAR.2014 09:23:31

Plot 42: Emission Mask D – Mid channel – 512 bits per second – High power – Carrier modulated



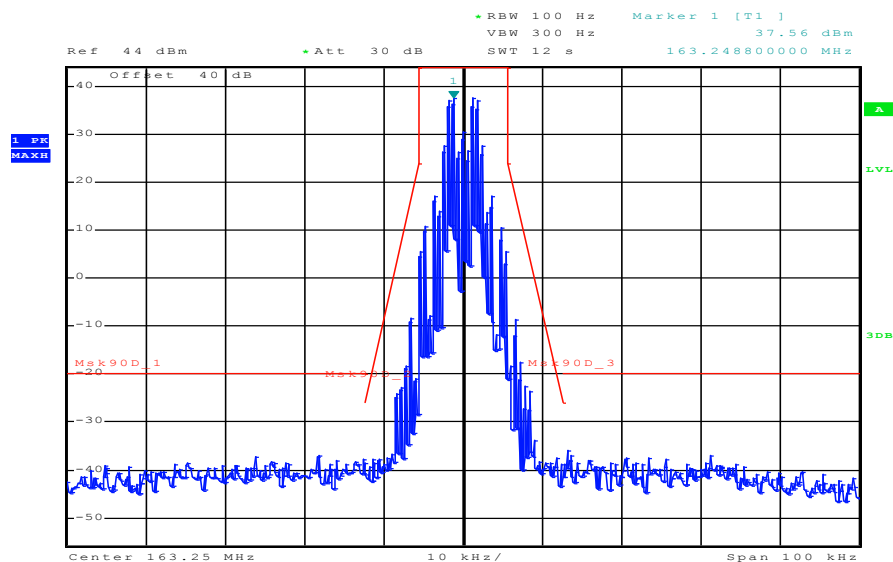
Date: 12.MAR.2014 09:24:25

Plot 43: Emission Mask D – Mid channel – 1200 bits per second – High power – Carrier unmodulated



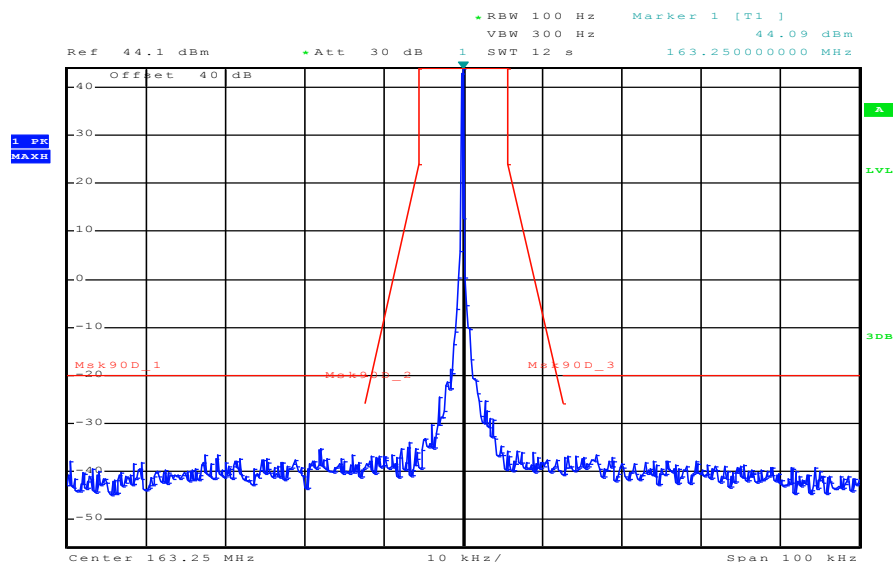
Date: 12.MAR.2014 09:21:06

Plot 44: Emission Mask D – Mid channel – 1200 bits per second – High power – Carrier modulated



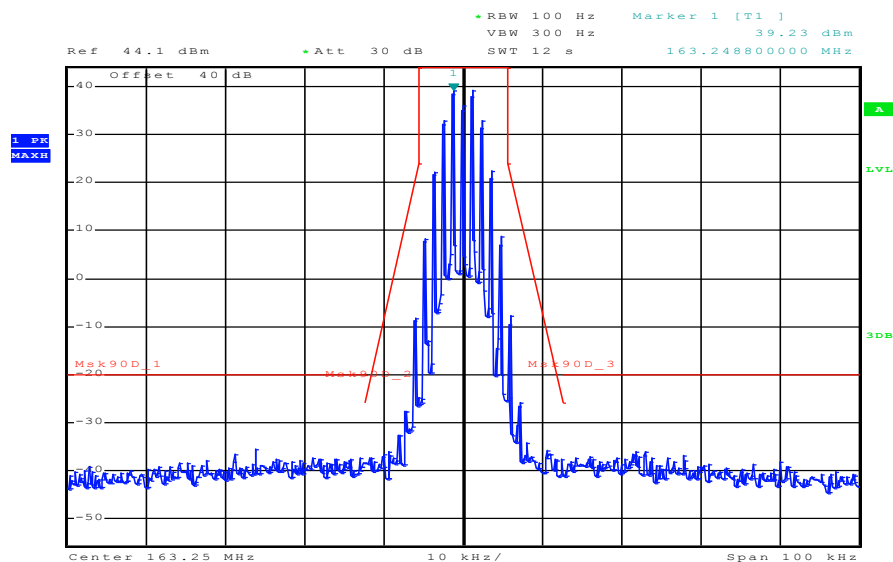
Date: 12.MAR.2014 09:22:03

Plot 45: Emission Mask D – Mid channel – 2400 bits per second – High power – Carrier unmodulated



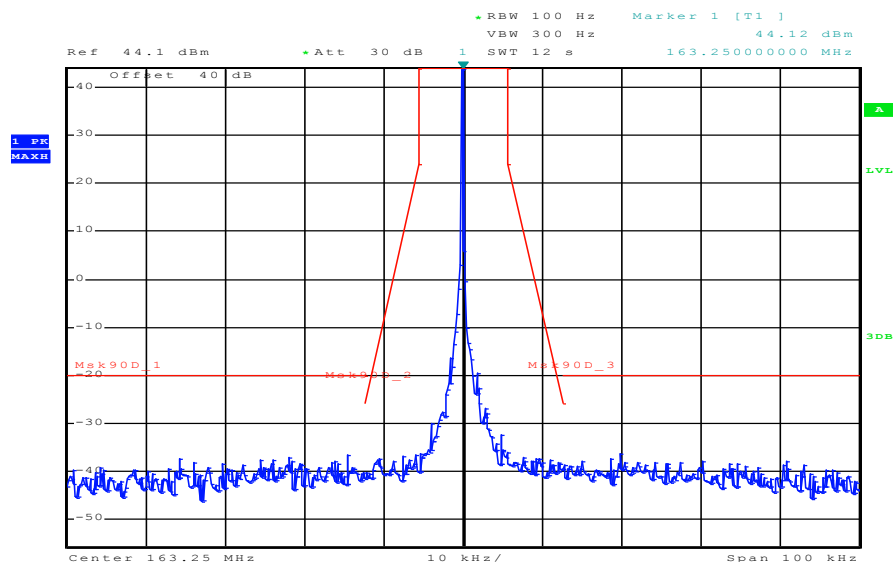
Date: 12.MAR.2014 09:17:38

Plot 46: Emission Mask D – Mid channel – 2400 bits per second – High power – Carrier modulated



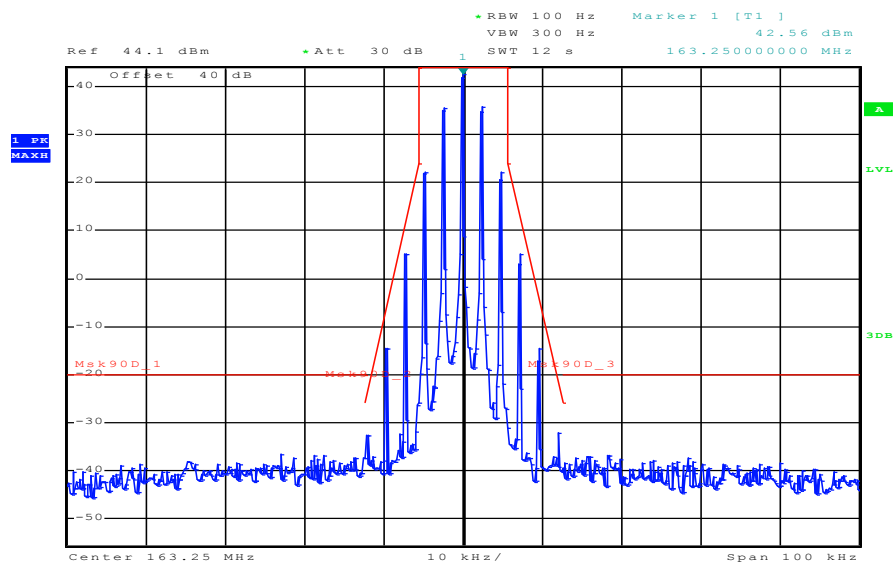
Date: 12.MAR.2014 09:19:16

Plot 47: Emission Mask D – Mid channel – 4800 bits per second – High power – Carrier unmodulated



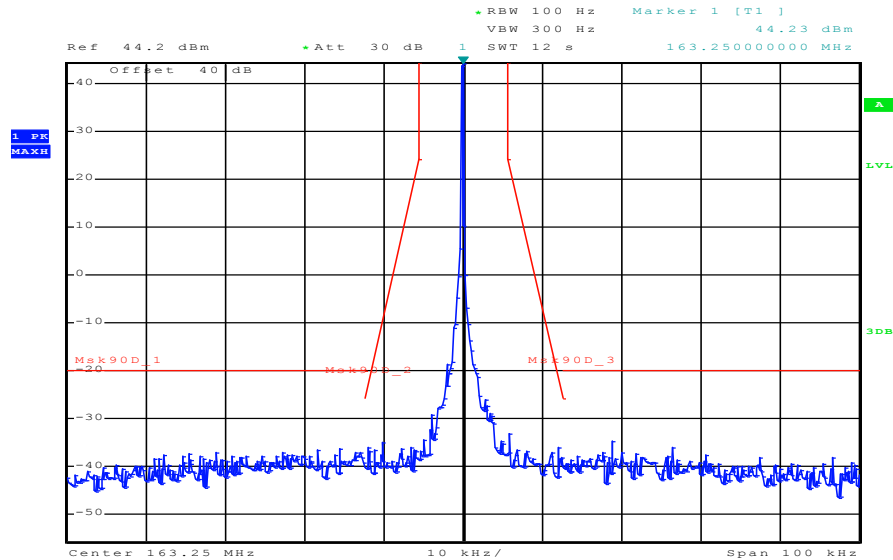
Date: 12.MAR.2014 09:13:29

Plot 48: Emission Mask D – Mid channel – 4800 bits per second – High power – Carrier modulated



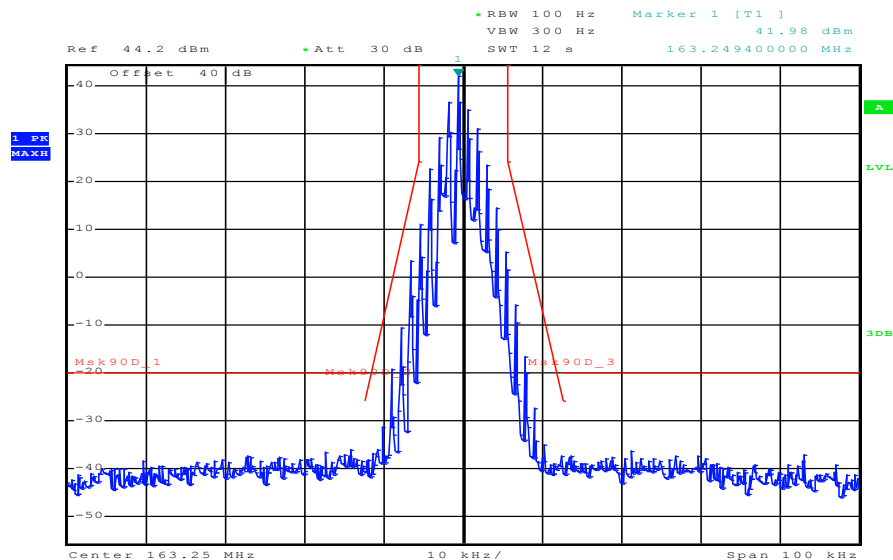
Date: 12.MAR.2014 09:14:41

Plot 49: Emission Mask D – Mid channel – 9600 bits per second – High power – Carrier unmodulated



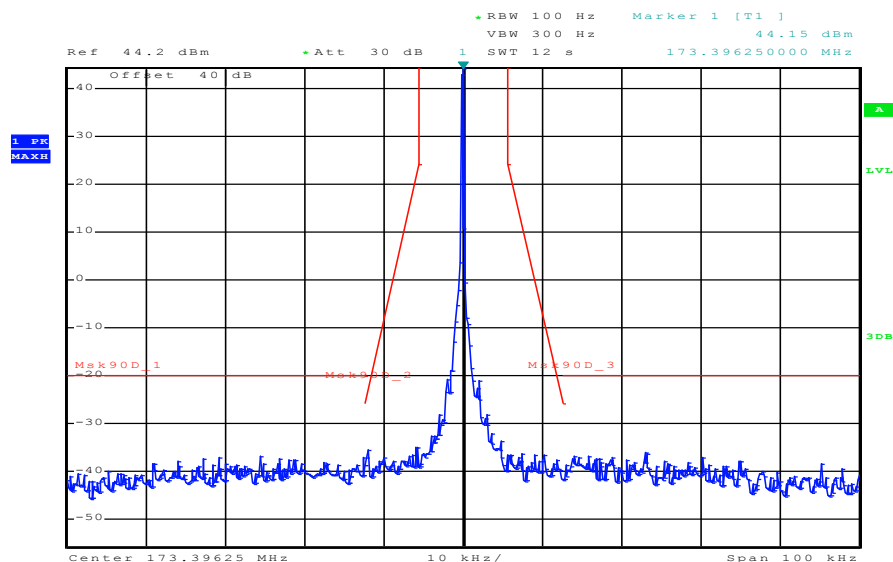
Date: 12.MAR.2014 09:12:33

Plot 50: Emission Mask D – Mid channel – 9600 bits per second – High power – Carrier modulated



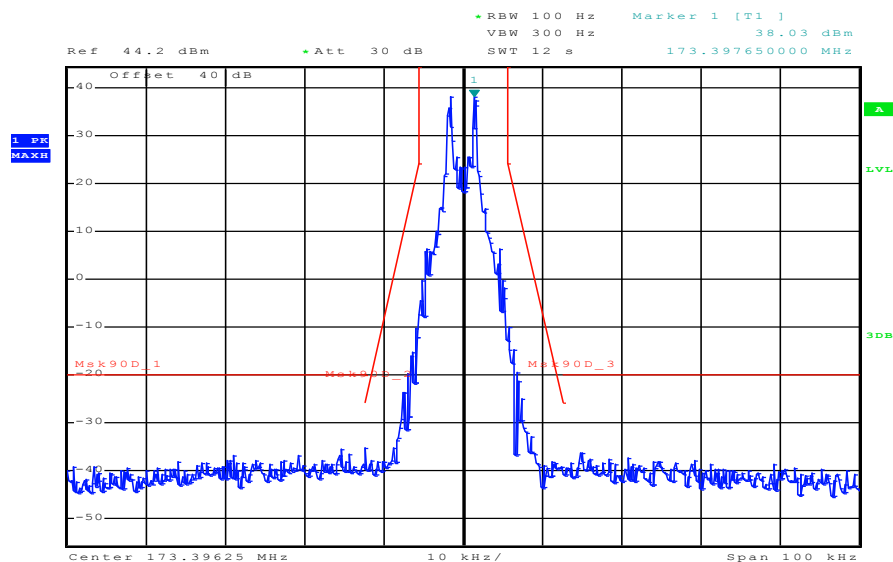
Date: 12.MAR.2014 09:15:50

Plot 51: Emission Mask D – High channel – 512 bits per second – High power – Carrier unmodulated



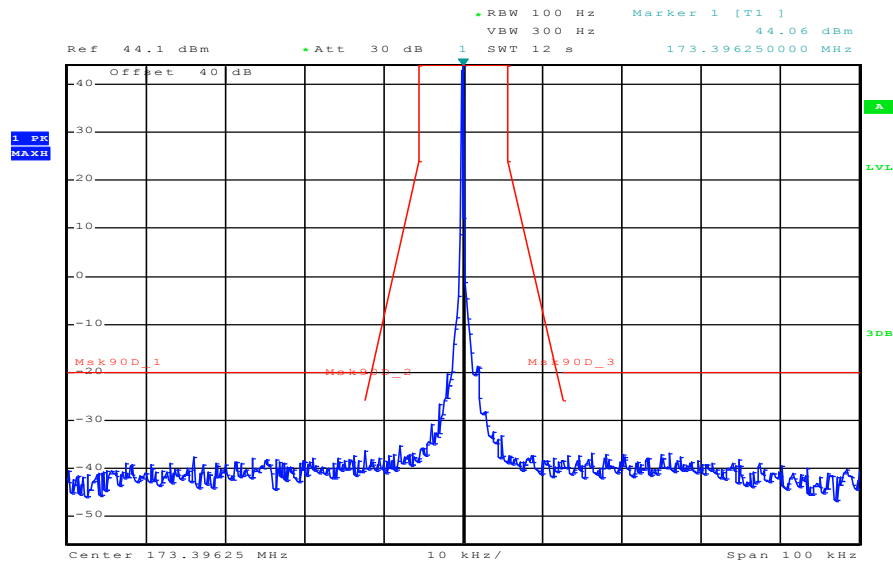
Date: 12.MAR.2014 09:31:10

Plot 52: Emission Mask D – High channel – 512 bits per second – High power – Carrier modulated



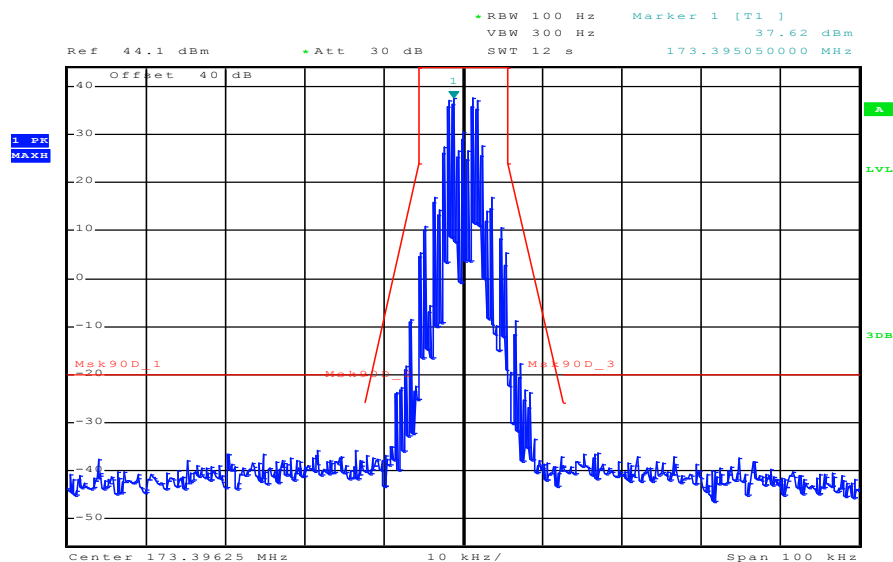
Date: 12.MAR.2014 09:32:20

Plot 53: Emission Mask D – High channel – 1200 bits per second – High power – Carrier unmodulated



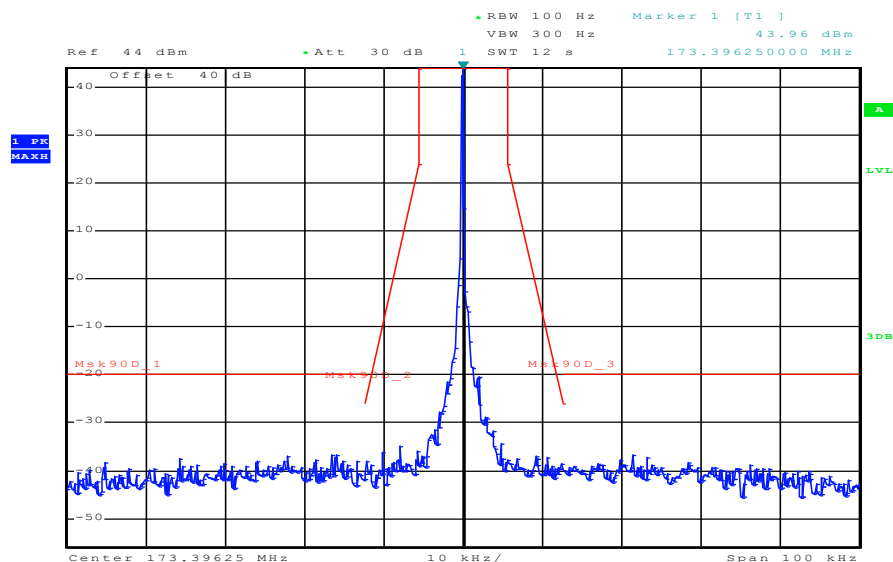
Date: 12.MAR.2014 09:33:52

Plot 54: Emission Mask D – High channel – 1200 bits per second – High power – Carrier modulated



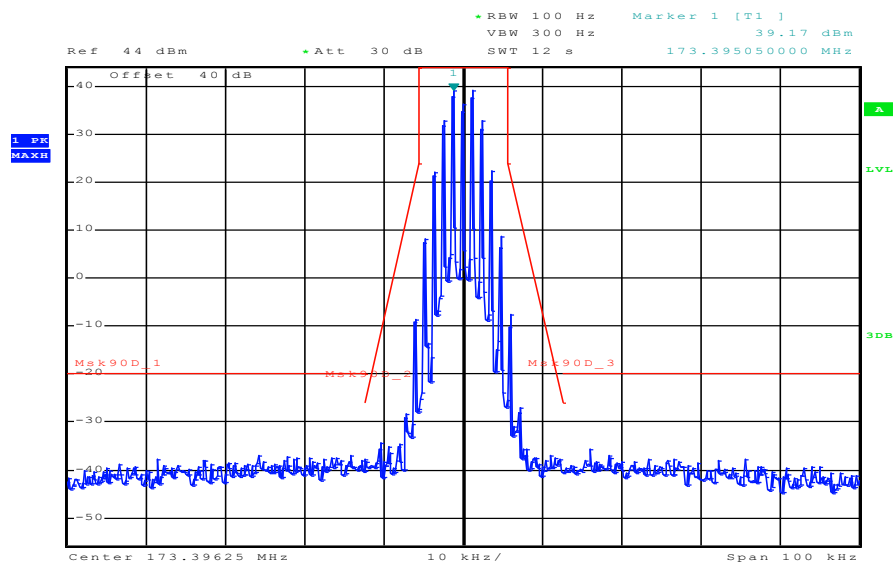
Date: 12.MAR.2014 09:34:58

Plot 55: Emission Mask D – High channel – 2400 bits per second – High power – Carrier unmodulated



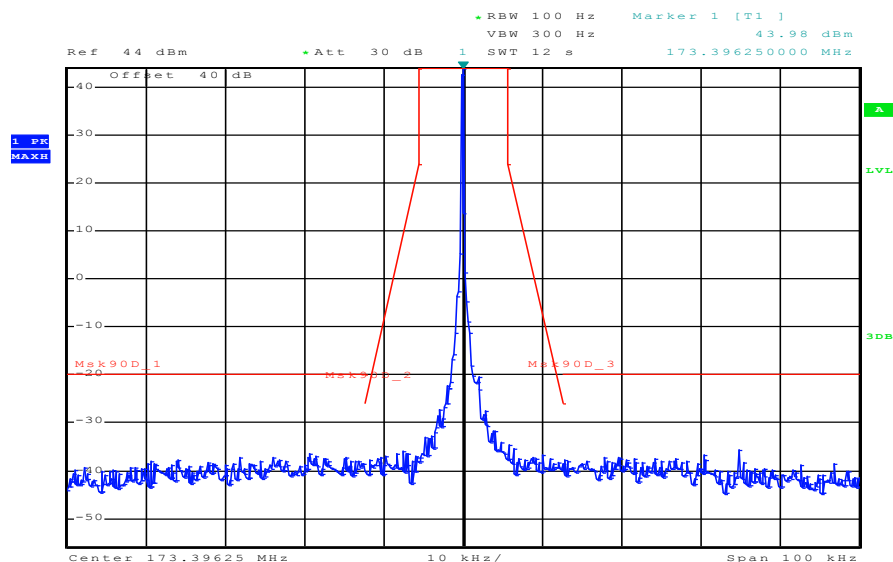
Date: 12.MAR.2014 09:37:45

Plot 56: Emission Mask D – High channel – 2400 bits per second – High power – Carrier modulated



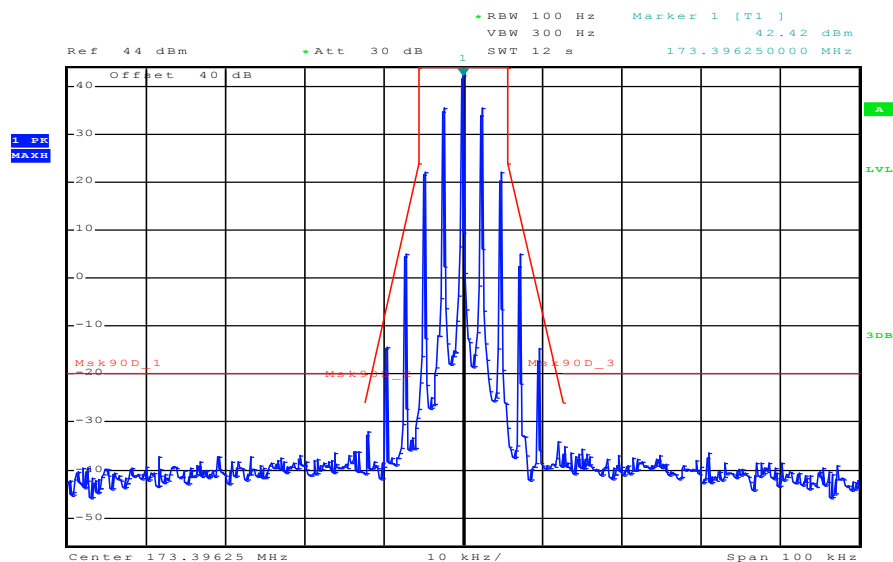
Date: 12.MAR.2014 09:39:18

Plot 57: Emission Mask D – High channel – 4800 bits per second – High power – Carrier unmodulated



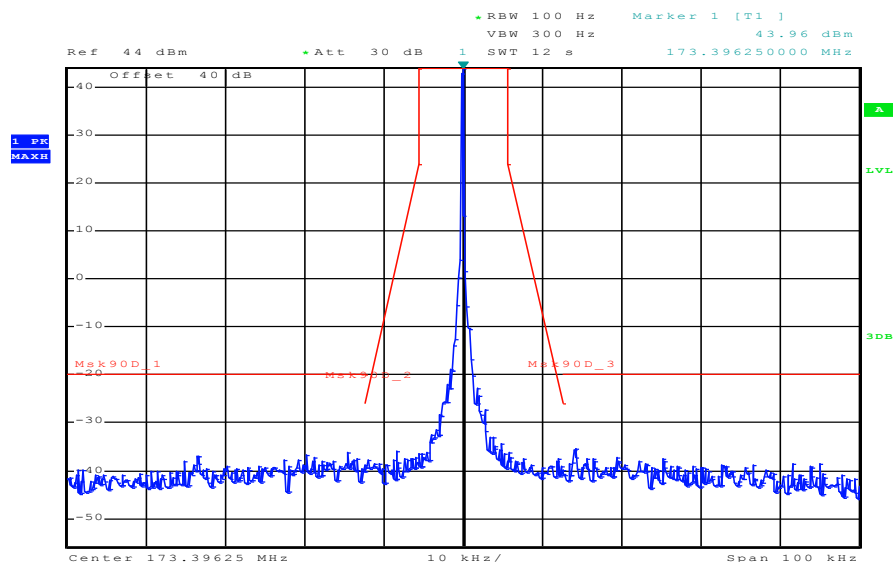
Date: 12.MAR.2014 09:41:11

Plot 58: Emission Mask D – High channel – 4800 bits per second – High power – Carrier modulated



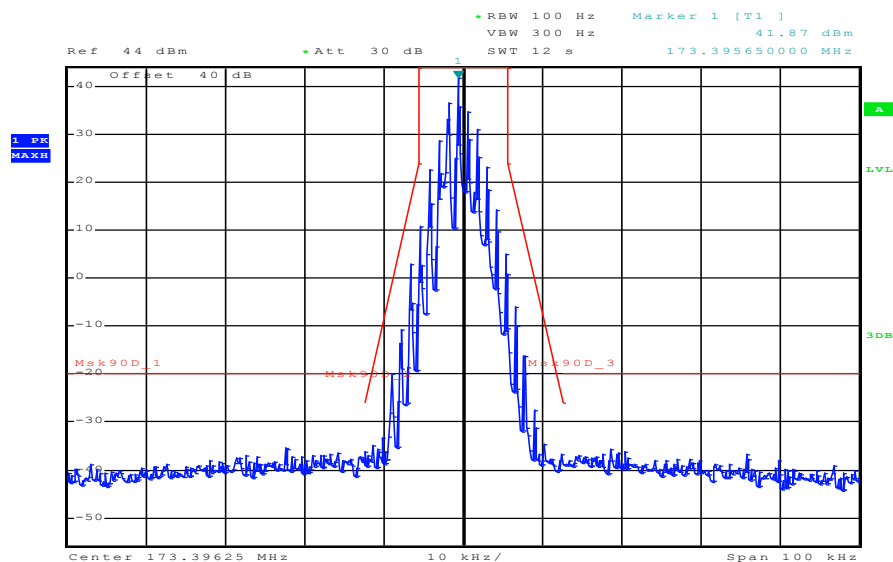
Date: 12.MAR.2014 09:43:37

Plot 59: Emission Mask D – High channel – 9600 bits per second – High power – Carrier unmodulated



Date: 12.MAR.2014 09:42:07

Plot 60: Emission Mask D – High channel – 9600 bits per second – High power – Carrier modulated



Date: 12.MAR.2014 09:46:04

9.6 Transient frequency behaviour

Limits:

FCC		IC	
FCC 47 CFR § 90.214		RSS 119 Issue 11 5.9	
Transient frequency behaviour			
Transient periods	Frequency range 150 – 174 MHz	Frequency range 421 - 512 MHz	
t ₁ (ms)	5	10	
t ₂ (ms)	20	25	
t ₃ (ms)	5	10	

Result:

Confirm that during periods t_1 and t_3 the frequency difference does not exceed the value of one channel separation	Passed
Confirm that during period t_2 the frequency difference does not exceed half a channel separation	Passed
Confirm that during periods t_2 to t_3 the frequency difference does not exceed the frequency error limit	Passed

Result: **Passed**

9.7 Frequency stability

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	100 Hz
Video bandwidth:	100 Hz
Span:	1 kHz
Trace-Mode:	Max. hold

Limits:

FCC	IC
FCC 47 CFR § 2.1055 (a)(1) § 90.213	RSS 119 Issue 11 5.3
150–174 MHz band: 421–512 MHz band:	5 ppm for 12.5 kHz channel spacing 2.5 ppm for 12.5 kHz channel spacing

Results:

Temperature	Deviation (kHz)	Deviation (ppm)
-30 °C	-0.09	-0.52
-20 °C	-0.08	-0.46
-10 °C	-0.08	-0.46
0 °C	-0.07	-0.40
10 °C	-0.07	-0.40
20 °C (V nom)	-0.06	-0.35
30 °C	-0.06	-0.35
40 °C	-0.07	-0.40
50 °C	-0.07	-0.40
Voltage		
85 %	-0.06	-0.35
115 %	-0.06	-0.35

Result: **Passed**

9.8 Transmitter spurious emissions conducted

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	f < 1 GHz : 100 kHz f ≥ 1GHz : 1 MHz
Video bandwidth:	f < 1 GHz : 100 kHz f ≥ 1GHz : 1 MHz
Span:	See plots
Trace-Mode:	Max. hold

Limits:

FCC	IC
FCC 47 CFR § 2.1051 § 90.210	RSS 119 Issue 11 5.8.9.2
Emission Mask D 12.5 kHz channel spacing 50 m+ 10Log ₁₀ (P _{Watts})	

Results: Low Power

Spurious Emission Level (dBm)								
Harmonic	Ch. low Freq. (MHz)	Level [dBm]	Harmonic	Ch. mid Freq. (MHz)	Level [dBm]	Harmonic	Ch. high Freq. (MHz)	Level [dBm]
2	301.990	All detected spurious emissions are more than 10 dB below the limit.	2	326.500	All detected spurious emissions are more than 10 dB below the limit.	2	346.793	All detected spurious emissions are more than 10 dB below the limit.
3	452.985		3	489.750		3	520.189	
4	603.980		4	653.000		4	693.585	
5	754.975		5	816.250		5	866.981	
6	905.970		6	979.500		6	1040.378	
7	1056.965		7	1142.750		7	1213.774	
8	1207.960		8	1306.000		8	1387.170	
9	1358.955		9	1469.250		9	1560.566	
10	1509.950		10	1632.500		10	1733.963	
Measurement uncertainty				± 3dB				

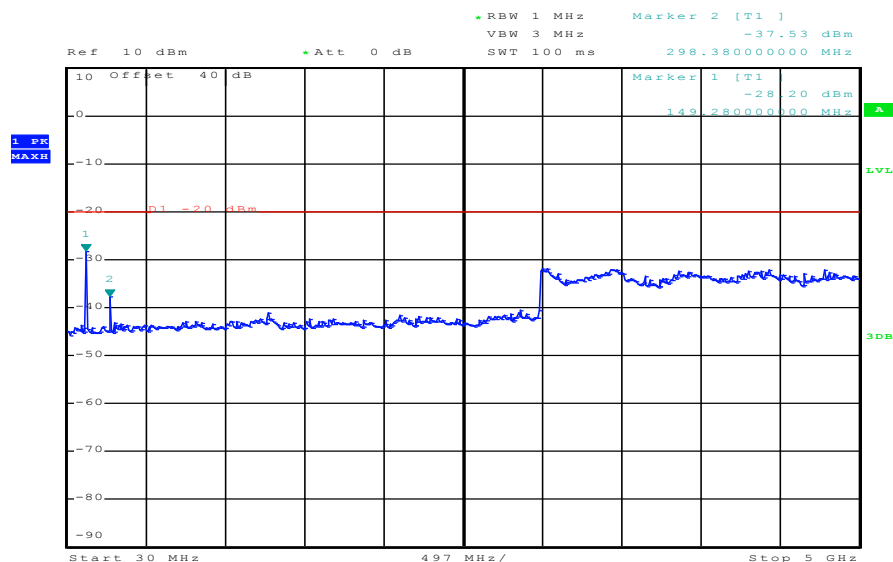
Results: High Power

Spurious Emission Level (dBm)								
Harmonic	Ch. low Freq. (MHz)	Level [dBm]	Harmonic	Ch. mid Freq. (MHz)	Level [dBm]	Harmonic	Ch. high Freq. (MHz)	Level [dBm]
2	301.990	-24.1	2	326.500	-24.0	2	346.793	-23.2
3	452.985	-34.5	3	489.750	-39.9	3	520.189	-37.9
4	603.980	-40.7	4	653.000	-40.2	4	693.585	-39.1
5	754.975	-/-	5	816.250	-/-	5	866.981	-/-
6	905.970	-/-	6	979.500	-/-	6	1040.378	-/-
7	1056.965	-/-	7	1142.750	-/-	7	1213.774	-/-
8	1207.960	-/-	8	1306.000	-/-	8	1387.170	-/-
9	1358.955	-/-	9	1469.250	-/-	9	1560.566	-/-
10	1509.950	-/-	10	1632.500	-/-	10	1733.963	-/-
Measurement uncertainty					± 3dB			

Result: Passed

Plots of the measurements

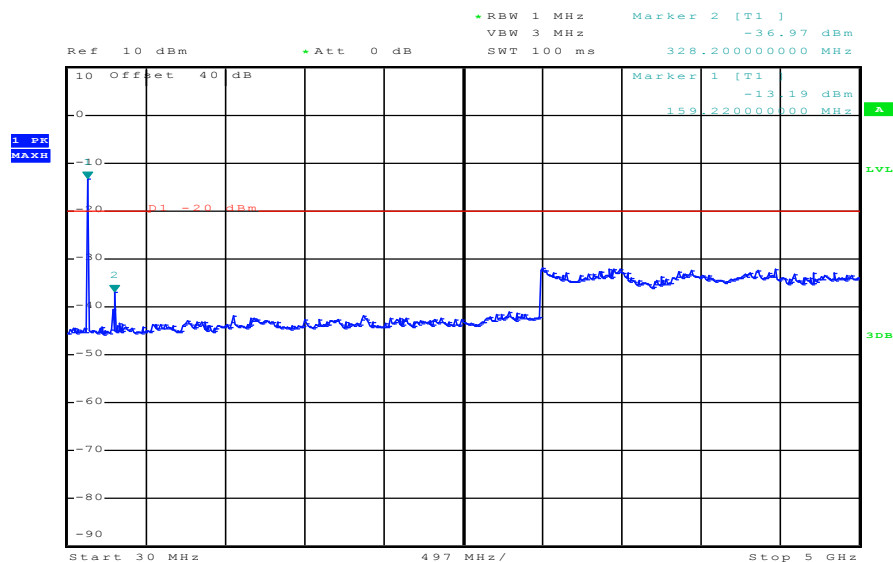
Plot 1: Low channel – Low power



Date: 12.MAR.2014 10:32:14

Carrier suppressed with a band rejection filter

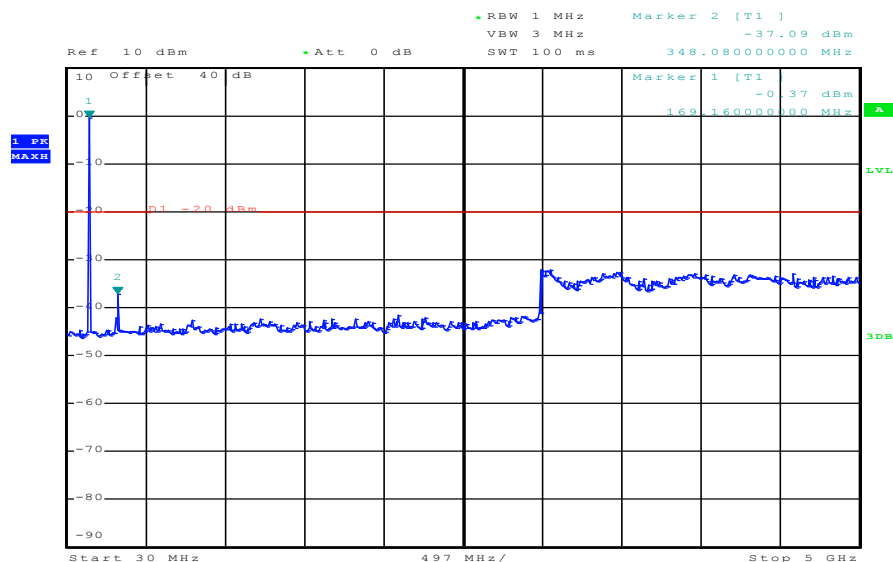
Plot 2: Middle channel – Low power



Date: 12.MAR.2014 10:30:55

Carrier suppressed with a band rejection filter

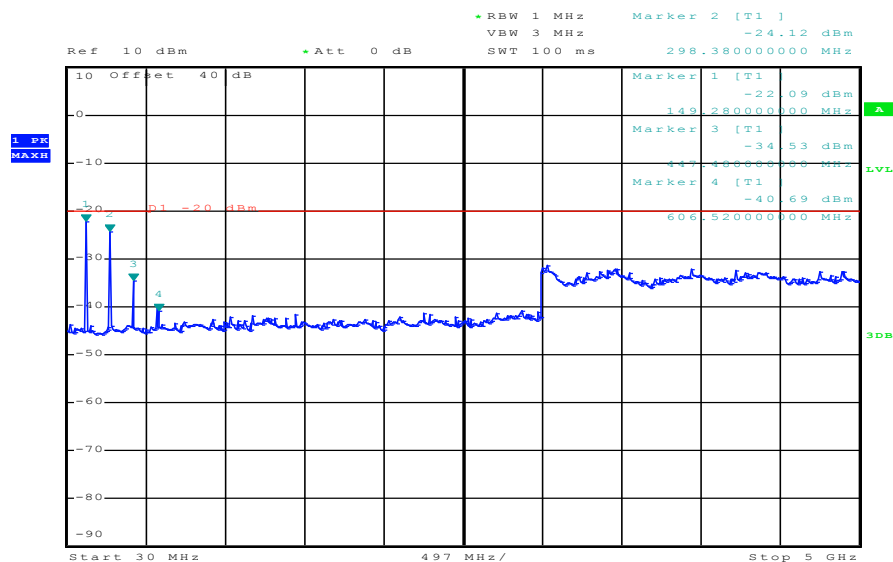
Plot 3: High channel – Low power



Date: 12.MAR.2014 10:33:33

Carrier suppressed with a band rejection filter

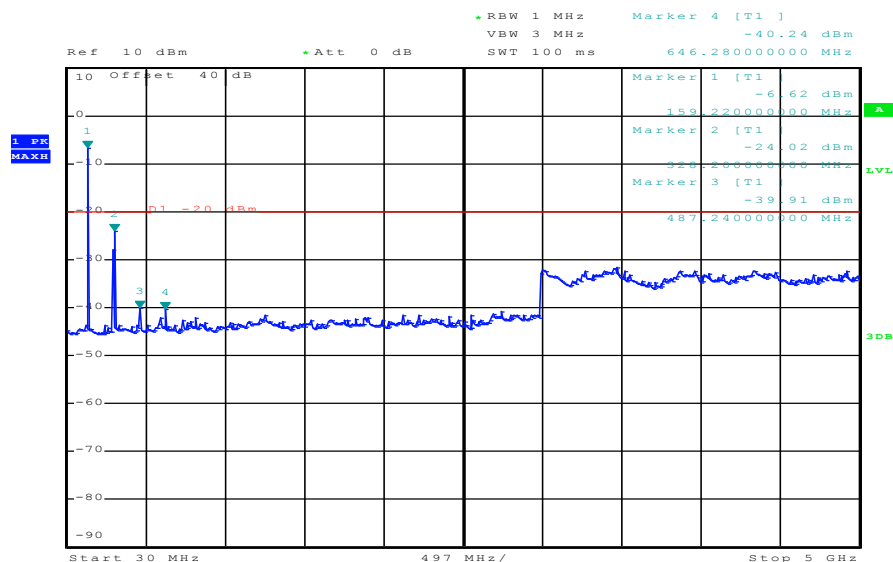
Plot 4: Low channel – High power



Date: 12.MAR.2014 10:37:39

Carrier suppressed with a band rejection filter

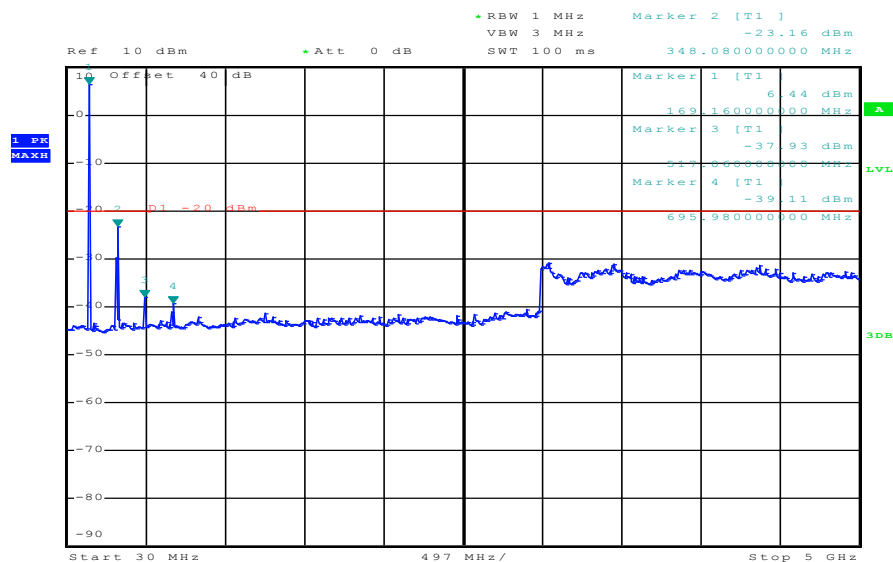
Plot 5: Middle channel – High power



Date: 12.MAR.2014 10:36:15

Carrier suppressed with a band rejection filter

Plot 6: High channel – High power



Date: 12.MAR.2014 10:34:57

Carrier suppressed with a band rejection filter

9.9 Transmitter spurious emissions (radiated)

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	f < 1 GHz : 100 kHz f ≥ 1GHz : 1 MHz
Video bandwidth:	f < 1 GHz : 100 kHz f ≥ 1GHz : 1 MHz
Span:	See plots
Trace-Mode:	Max. hold

Limits:

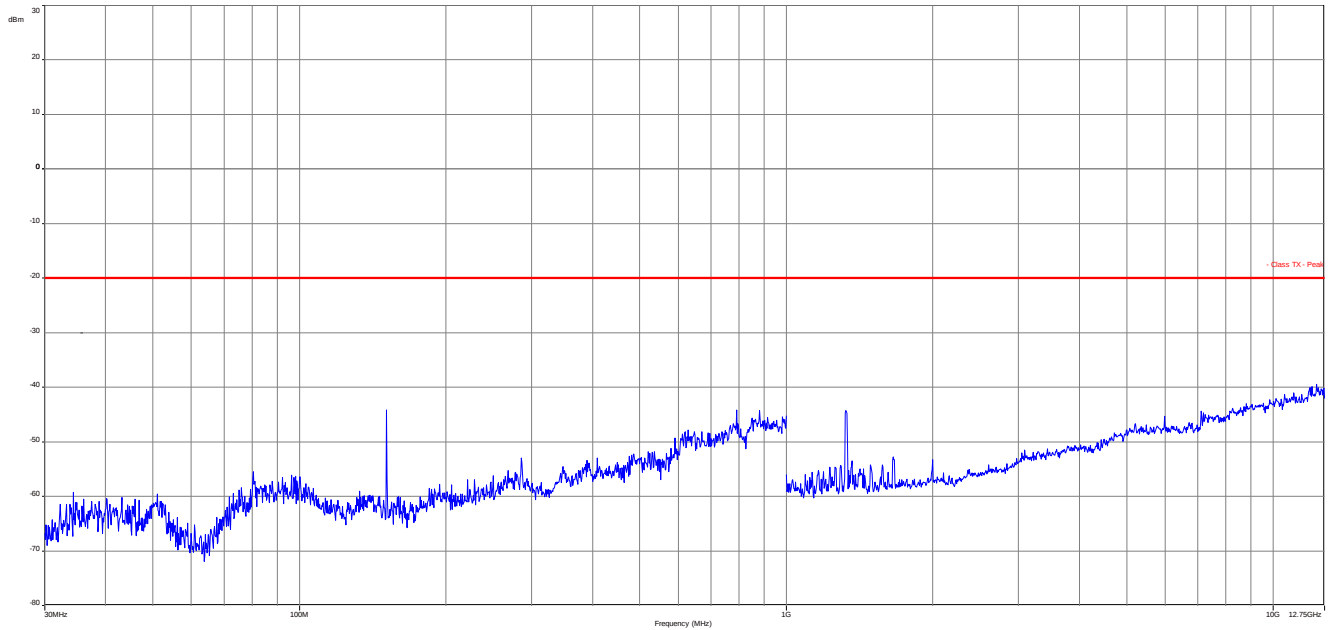
FCC	IC
FCC 47 CFR § 2.1051 § 90.210	RSS 119 Issue 11 5.8.9.2
Emission Mask D 12.5 kHz channel spacing $50 + 10\log_{10}(P_{\text{Watts}})$	

Transmitter spurious emissions (dBm)								
Lowest channel			Middle channel			Highest channel		
Frequency	Detector	Level	Frequency	Detector	Level	Frequency	Detector	Level
All detected spurious emissions are more than 10 dB below the limit.			All detected spurious emissions are more than 10 dB below the limit.			All detected spurious emissions are more than 10 dB below the limit.		
Measurement uncertainty ± 3 dB								

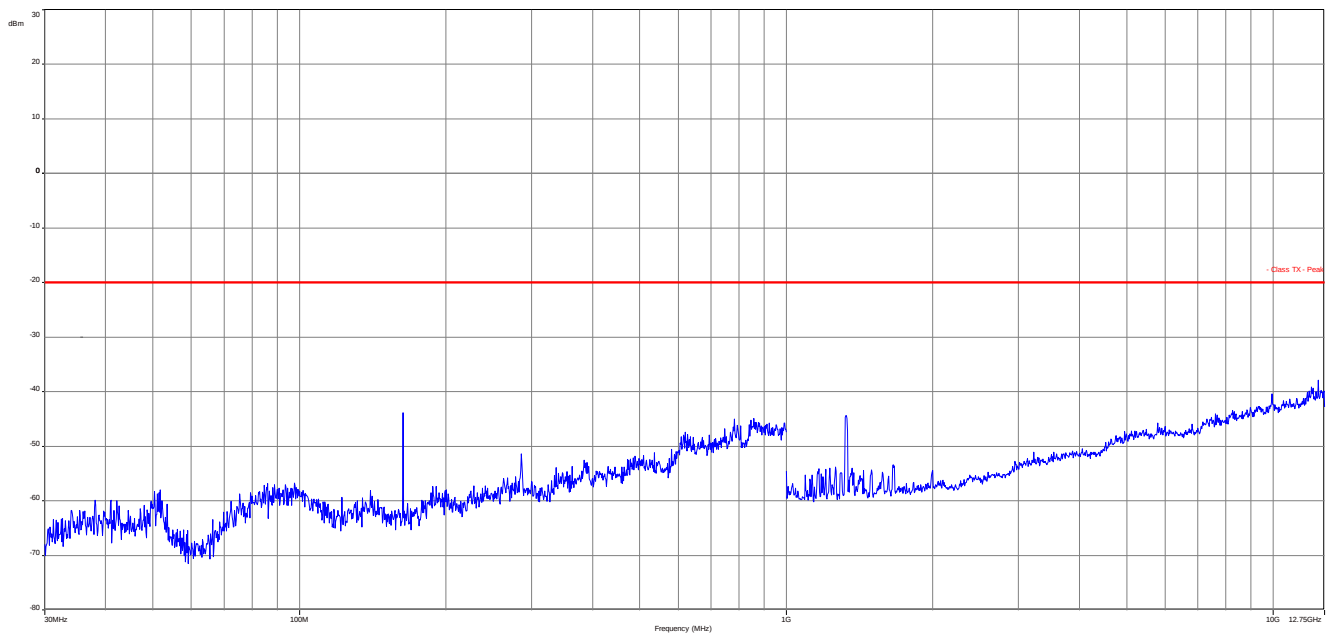
Result: Passed

Plots of the measurements (measured with dummy load)

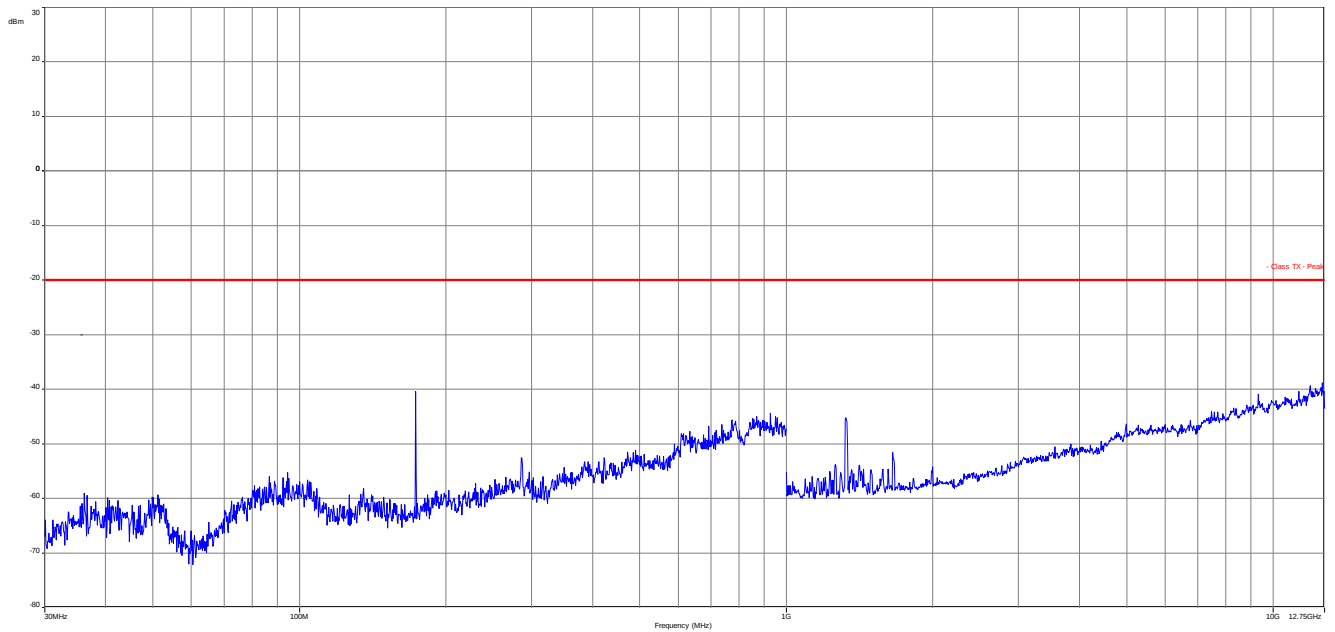
Plot 1: 30 MHz – 12.75 GHz, low channel, antenna vertical/horizontal, Low power



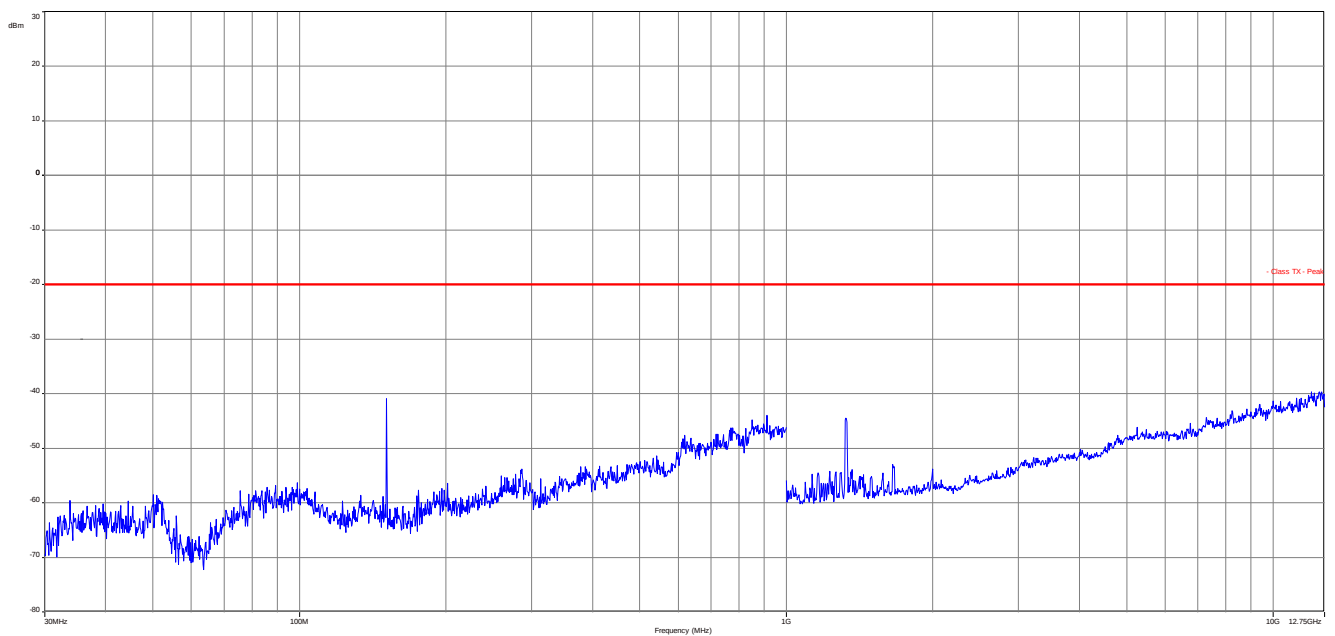
Plot 2: 30 MHz – 12.75 GHz, middle channel, antenna vertical/horizontal, Low power



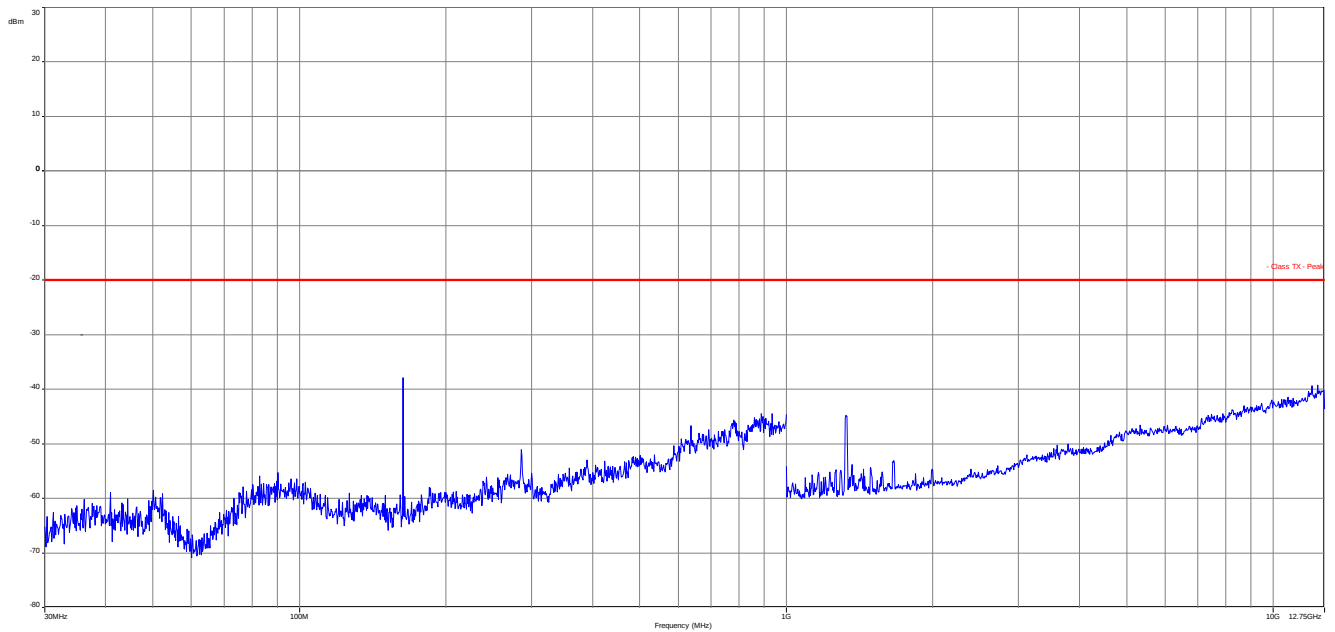
Plot 3: 30 MHz – 12.75 GHz, high channel, antenna vertical/horizontal, Low power



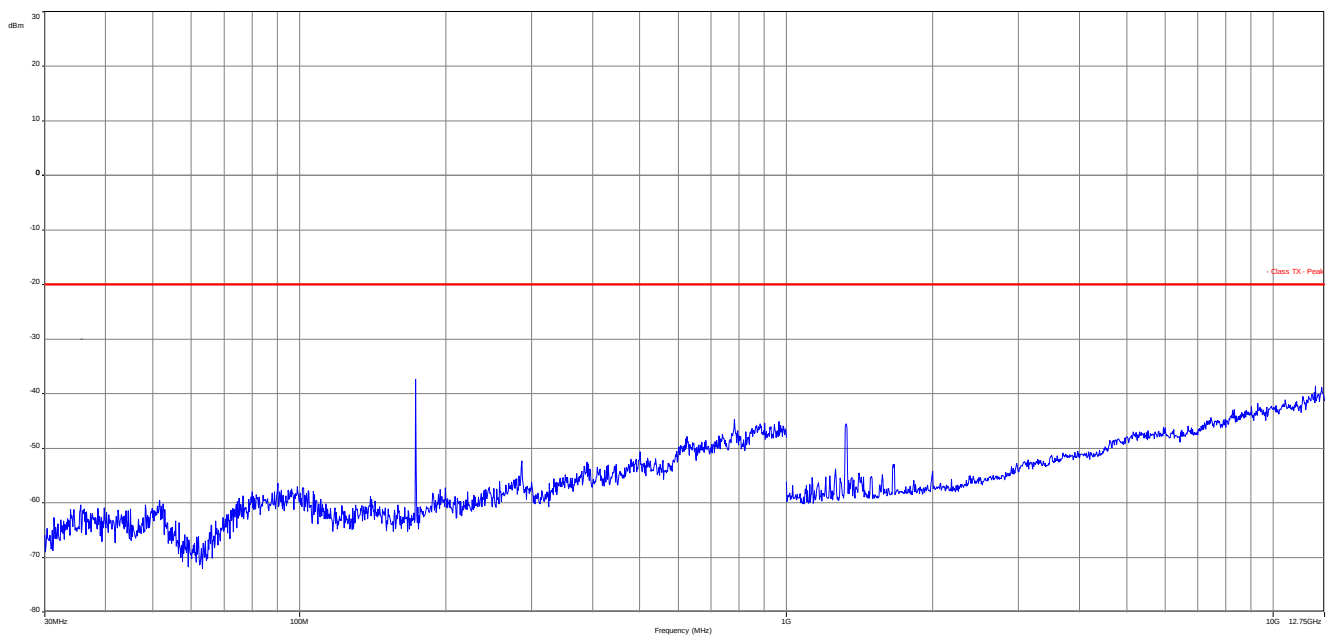
Plot 4: 30 MHz – 12.75 GHz, low channel, antenna vertical/horizontal, High power



Plot 5: 30 MHz – 12.75 GHz, middle channel, antenna vertical/horizontal, High power



Plot 6: 30 MHz – 12.75 GHz, high channel, antenna vertical/horizontal, High power



9.10 Spurious emissions radiated < 30 MHz

Description:

Measurement of the radiated spurious emissions in transmit mode below 30 MHz. The EUT is set to channel 6. This measurement is representative for all channels and modes. 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. The limits are recalculated to a measurement distance of 3 m with 40 dB/decade according CFR Part 2.

Measurement:

Measurement parameter	
Detector:	Peak / Quasi Peak
Sweep time:	Auto
Video bandwidth:	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Resolution bandwidth:	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span:	9 kHz to 30 MHz
Trace-Mode:	Max Hold

Limits:

FCC		IC
TX Spurious Emissions Radiated < 30 MHz		
Frequency (MHz)	Field Strength (dBμV/m)	Measurement distance
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30

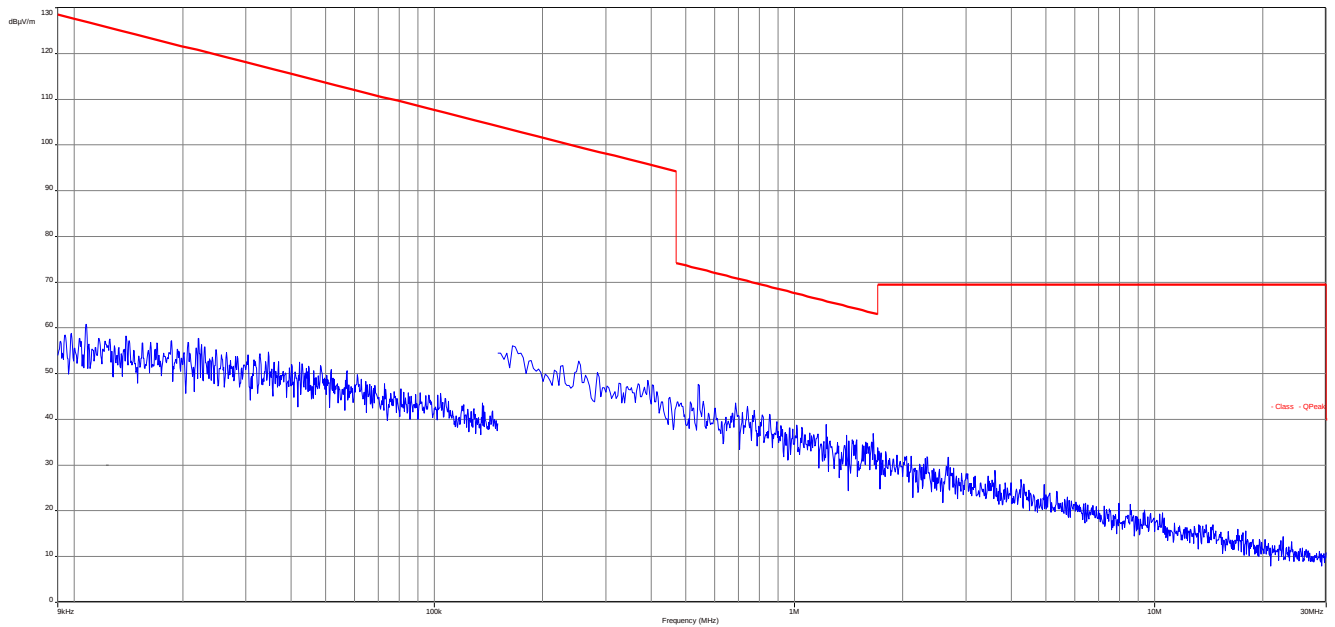
Results:

TX Spurious Emissions Radiated < 30 MHz [dBμV/m]		
F [MHz]	Detector	Level [dBμV/m]
No peaks detected.		
Measurement uncertainty	± 3 dB	

Result: Passed

Plots: TX mode

Plot 1: 9 kHz to 30 MHz



No EUT effected variation over all power settings and all used channels.

9.11 Receiver spurious emissions (radiated)

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	f < 1 GHz : 100 kHz f ≥ 1GHz : 1 MHz
Resolution bandwidth:	f < 1 GHz : 100 kHz f ≥ 1GHz : 1 MHz
Span:	See plots
Trace-Mode:	Max. hold

Limits:

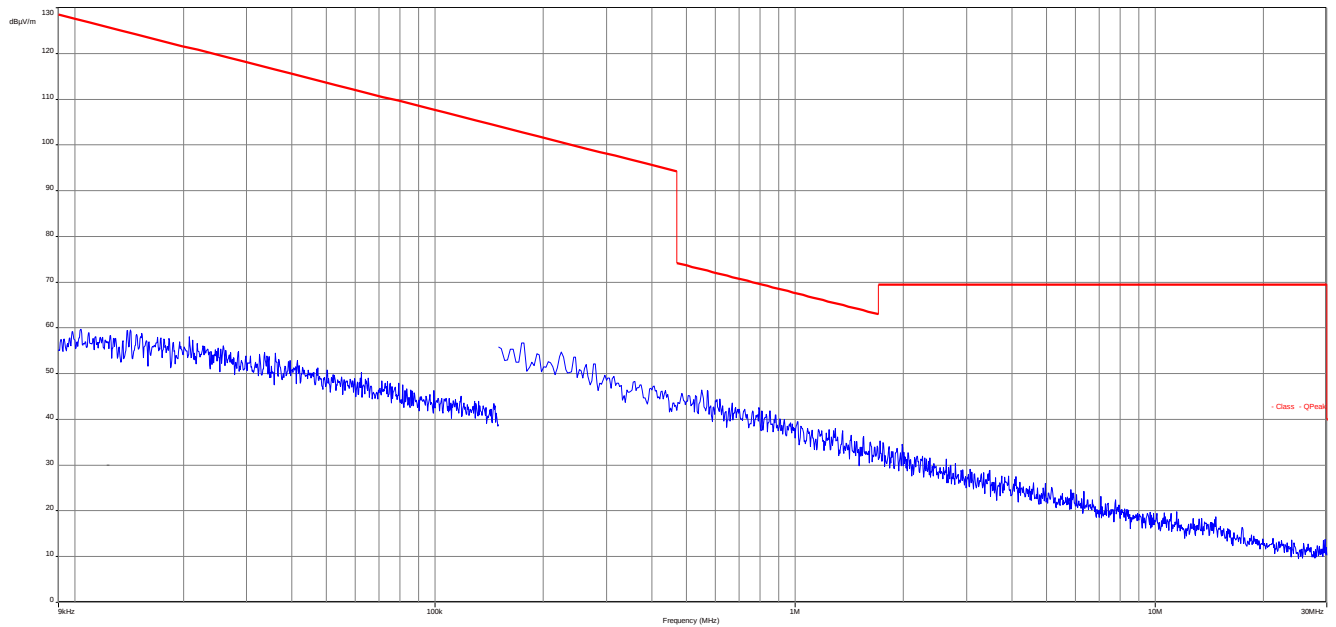
FCC		IC	
FCC 47 CFR § 15.209		RSS-GEN Issue 2 Section 6	
Receiver Spurious Emission (radiated)			
Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)	
30 - 88	100	3	
88 - 216	150	3	
216 - 960	200	3	
above 960	500	3	

Receiver spurious emissions (dBm)								
Lowest channel			Middle channel			Highest channel		
Frequency	Detector	Level	Frequency	Detector	Level	Frequency	Detector	Level
All detected spurious emissions are more than 10 dB below the limit.			All detected spurious emissions are more than 10 dB below the limit.			All detected spurious emissions are more than 10 dB below the limit.		
Measurement uncertainty ± 3 dB								

Result: Passed

Plots of the measurements

Plot 1: 9 kHz - 30 MHz



Plot 1: 30 MHz – 1 GHz

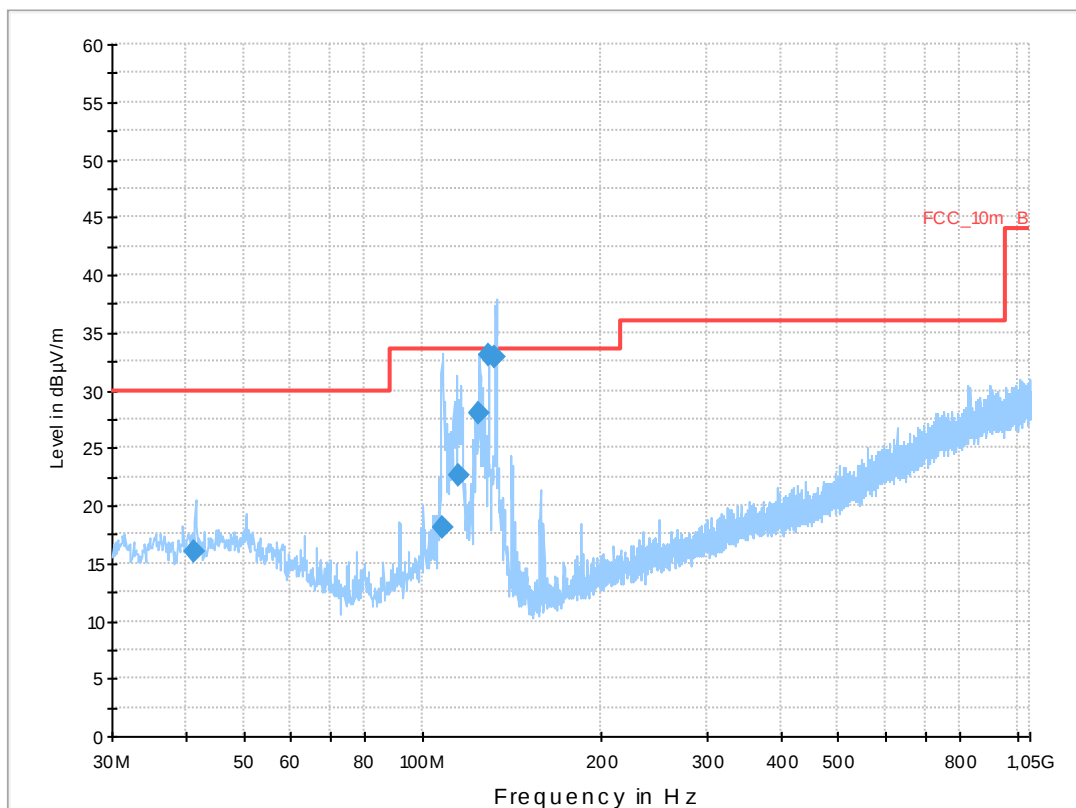
Common Information

EUT: ITC2100 BOS (VHF)
 Serial Number: C201342 00170
 Test Description: FCC part 15 class B
 Operating Conditions: Radio Idle / Data transfer via ETH / GPS idle
 Operator Name: Hennemann
 Comment: AC:115 V / 60 Hz; ETH-cable: Cat. 6

Scan Setup: STAN_Fin [EMI radiated]

Hardware Setup: Electric Field (NOS)
 Receiver: [ESC1 3]
 Level Unit: dB μ V/m

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
30 MHz - 1 GHz	60 kHz	QPK	120 kHz	1 s	20 dB



Final Result 1

Frequency (MHz)	QuasiPeak (dB μ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)	Comment
41.392650	16.0	1000.0	120.000	100.0	V	280.0	13.4	14.0	30.0	
108.205800	18.1	1000.0	120.000	144.0	V	17.0	11.2	15.4	33.5	
114.540450	22.6	1000.0	120.000	121.0	V	-43.0	10.7	10.9	33.5	
124.579200	28.0	1000.0	120.000	167.0	V	323.0	9.8	5.5	33.5	
128.864400	33.1	1000.0	120.000	100.0	V	317.0	9.5	0.4	33.5	
132.600300	32.9	1000.0	120.000	100.0	V	337.0	9.2	0.6	33.5	

Hardware Setup: EMI radiated\Electric Field (NOS) - [EMI radiated]

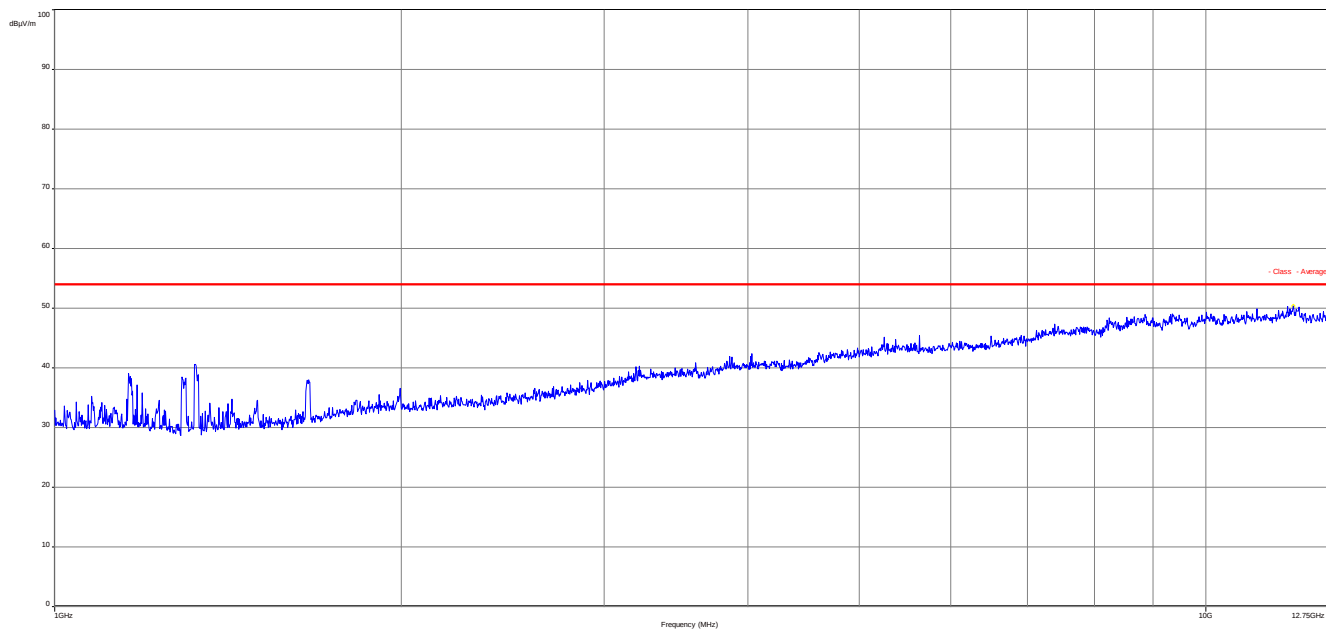
Subrange 1

Frequency Range: 30 MHz - 2 GHz

Receiver: Receiver [ESCI 3]
@ GPIB0 (ADR 20), SN 100083/003, FW 4.42Signal Path: without Notch
FW 1.0Antenna: VULB 9163
SN 9163-295, FW ---
Correction Table (vertical): VULP6113
Correction Table (horizontal): VULP6113
Correction Table (vertical): Cable_EN_1GHz (1005)
Correction Table (horizontal): Cable_EN_1GHz (1005)
Antenna Tower: Tower [EMCO 2090 Antenna Tower]
@ GPIB0 (ADR 8), FW REV 3.12Turntable: Turntable [EMCO Turntable]
@ GPIB0 (ADR 9), FW REV 3.12

EMC 32 Version 8.52

Plot 3: 1 GHz – 12.75 GHz, antenna vertical/horizontal



9.12 Spurious emissions conducted < 30 MHz

Description:

Measurement of the conducted spurious emissions in transmit mode below 30 MHz. 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 remeasured with average and quasi peak detection to show compliance to the limits.

Measurement:

Measurement parameter	
Detector:	Peak - Quasi Peak / Average
Sweep time:	Auto
Video bandwidth:	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Resolution bandwidth:	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span:	9 kHz to 30 MHz
Trace-Mode:	Max Hold

Limits:

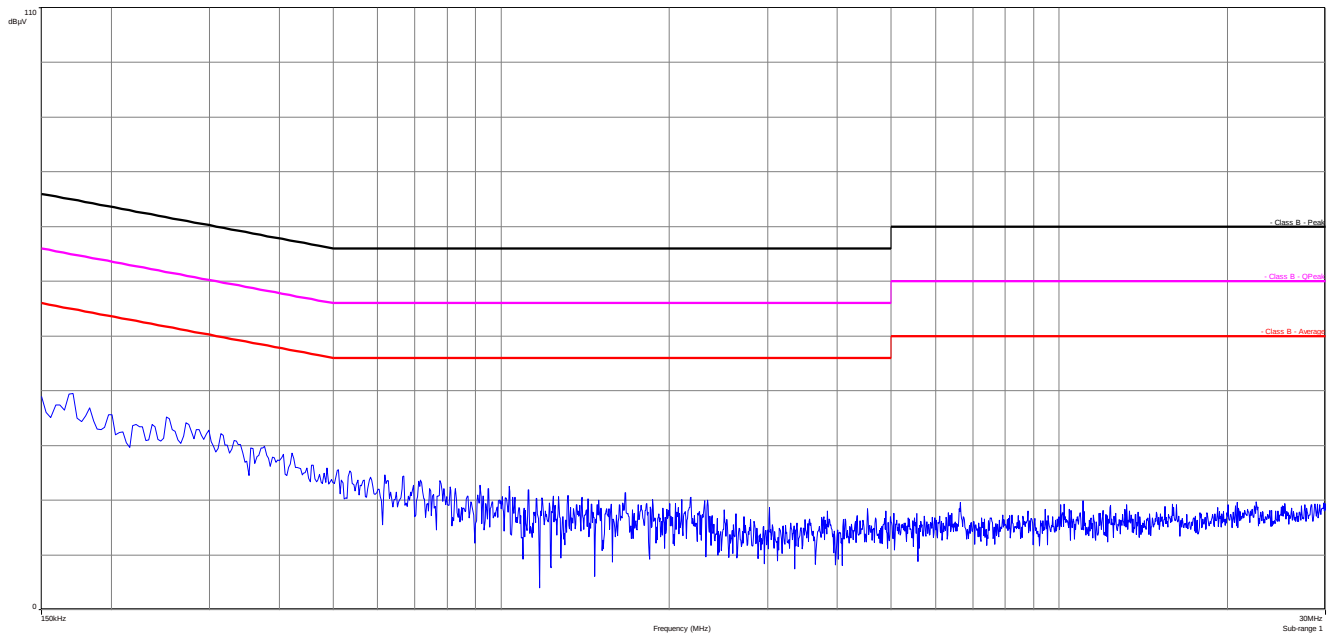
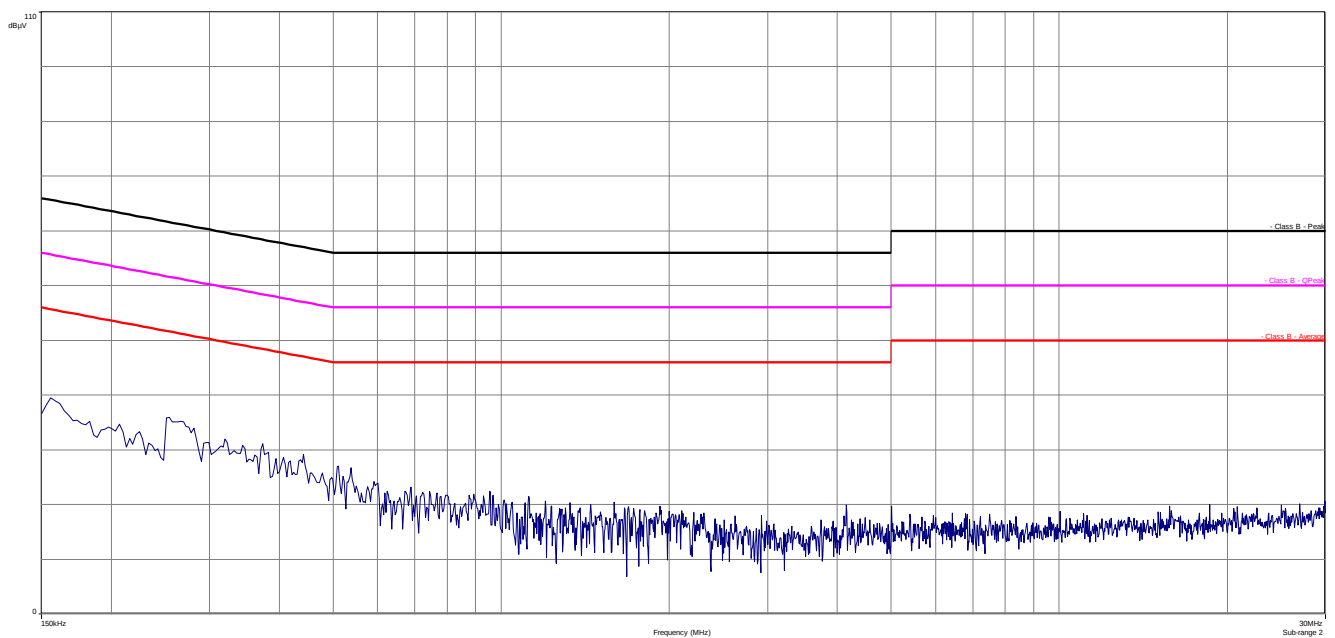
FCC		IC
TX Spurious Emissions Conducted < 30 MHz		
Frequency (MHz)	Quasi-Peak (dBμV/m)	Average (dBμV/m)
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30.0	60	50

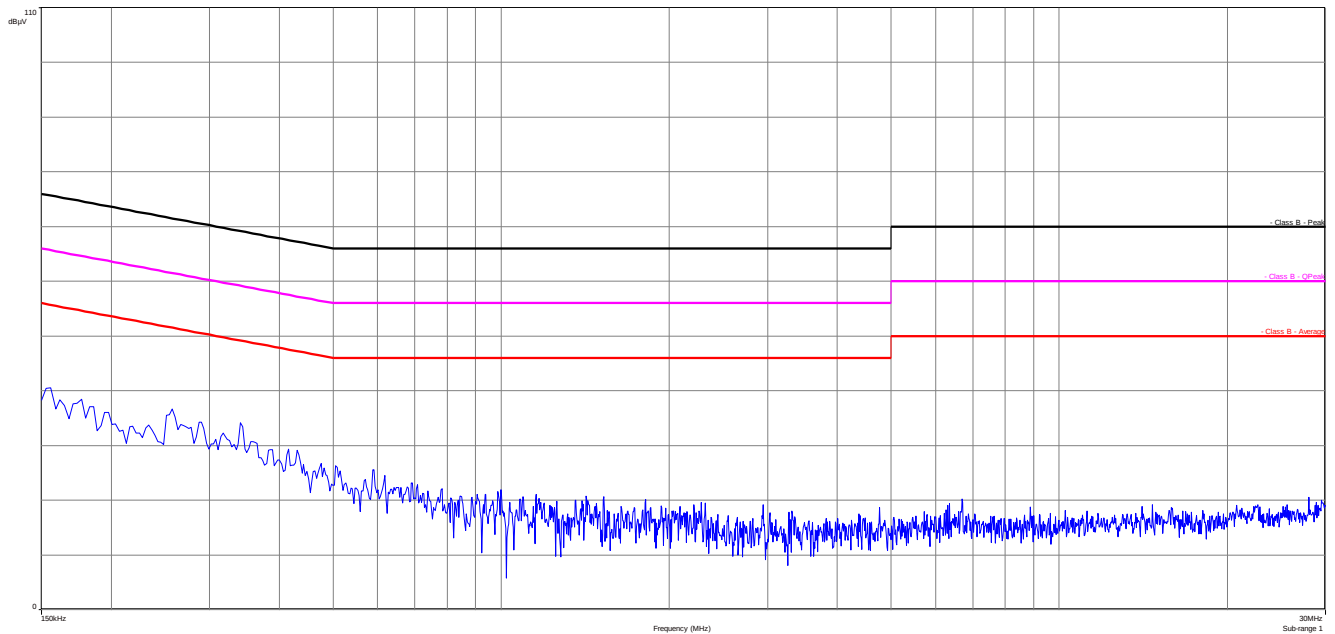
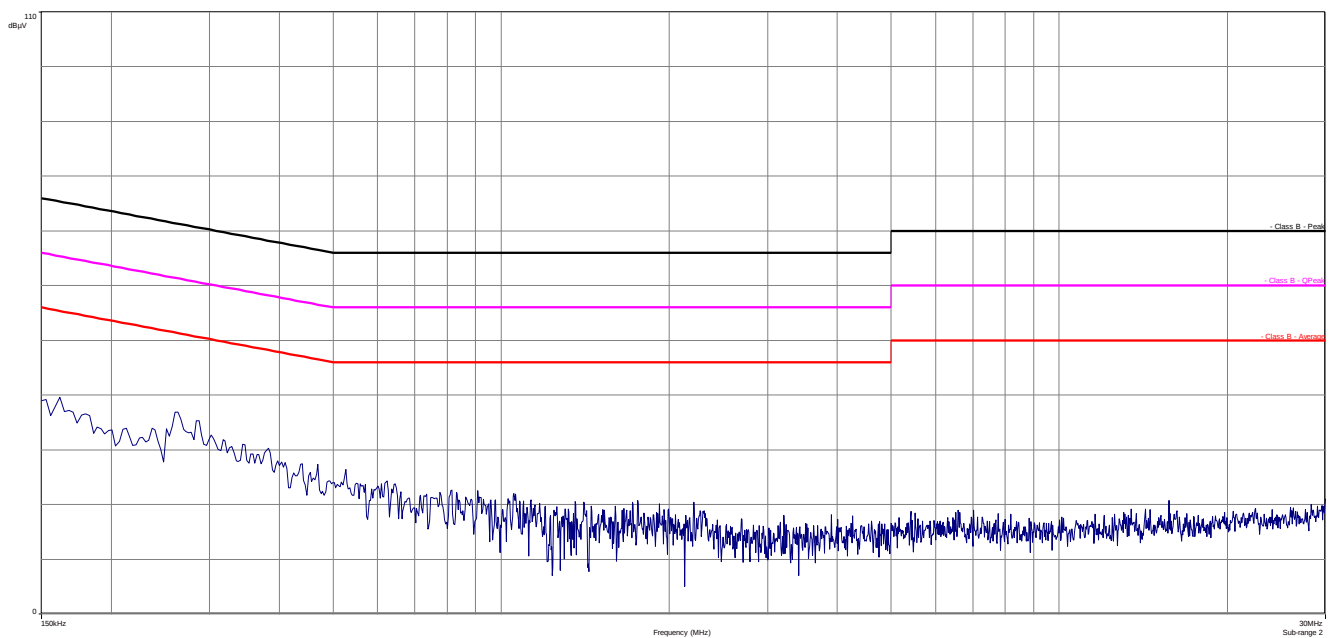
*Decreases with the logarithm of the frequency

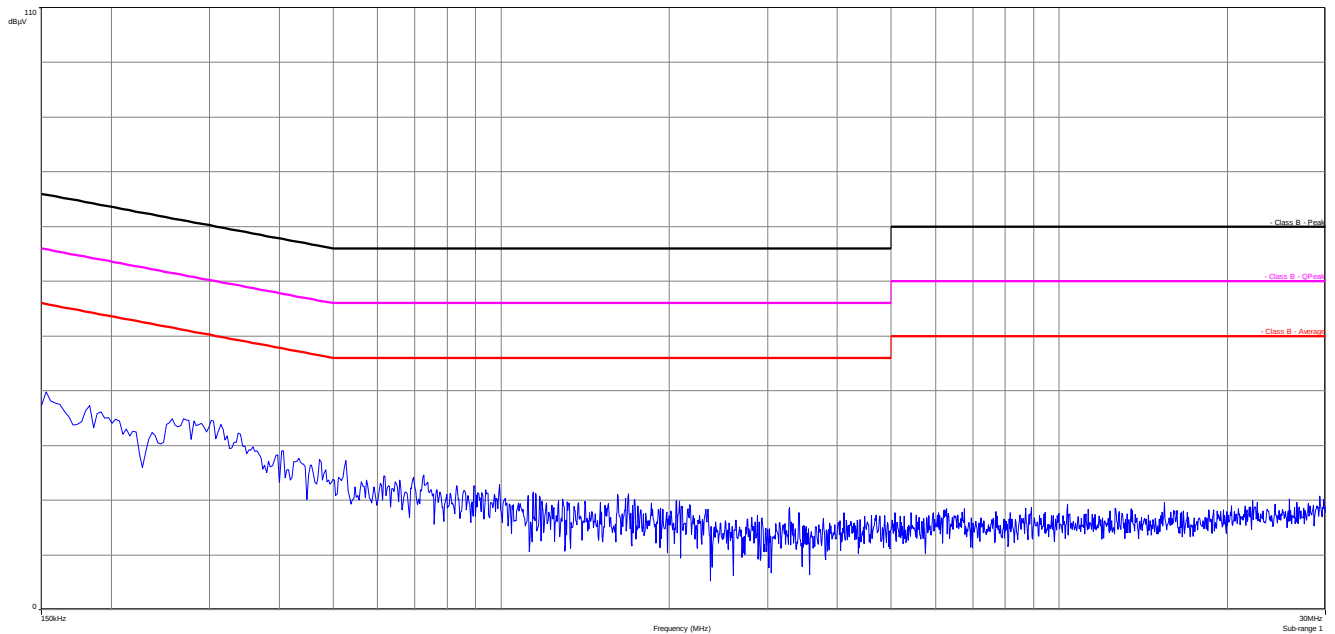
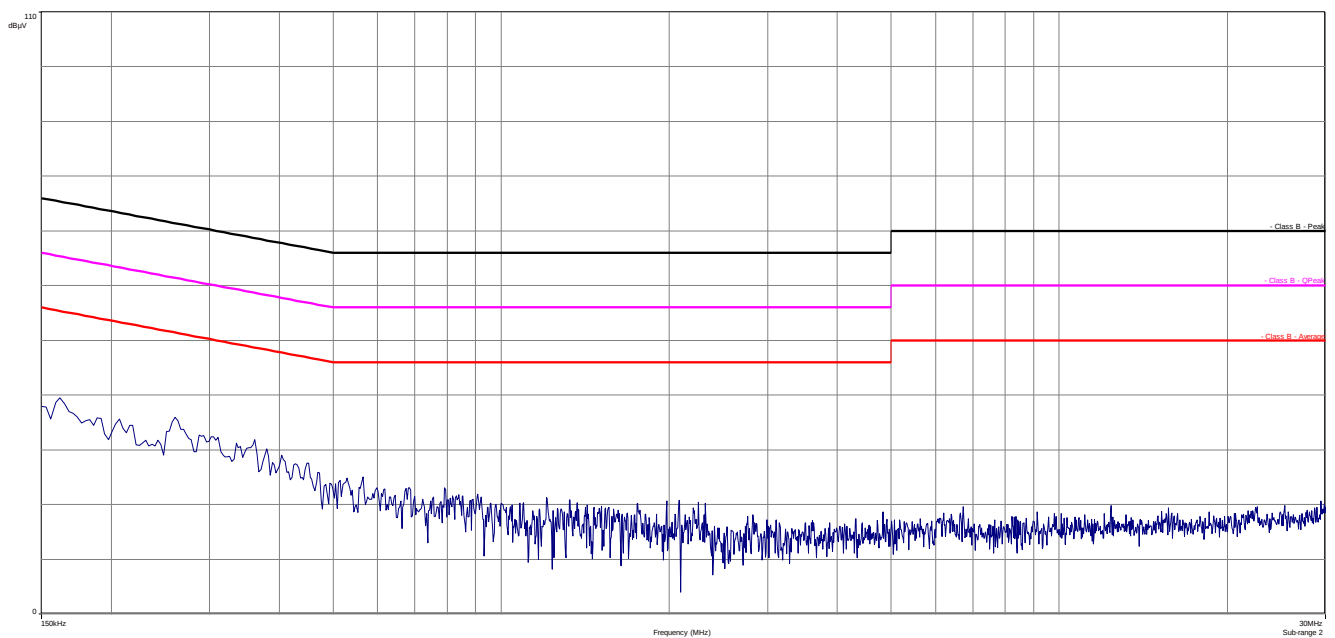
Results:

TX Spurious Emissions Conducted < 30 MHz [dBμV/m]		
F [MHz]	Detector	Level [dBμV/m]
No peaks detected.		
Measurement uncertainty	± 3 dB	

Result: Passed

Plots:**Plot 1:** TX mode, 150 kHz to 30 MHz, phase line, Low power**Plot 2:** TX mode, 150 kHz to 30 MHz, neutral line, Low power

Plot 3: TX mode, 150 kHz to 30 MHz, phase line, High power**Plot 4:** TX mode, 150 kHz to 30 MHz, neutral line, High power

Plot 5: Idle mode, 150 kHz to 30 MHz, phase line**Plot 6:** Idle mode, 150 kHz to 30 MHz, neutral line

10 Test equipment and ancillaries used for tests

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 signalling 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).

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP Meßtechnik	2818A03450	300001040	Ve	12.01.2012	12.01.2015
2	n. a.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vIKI!	08.05.2013	08.05.2015
3	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev		
4	n. a.	Switch / Control Unit	3488A	HP Meßtechnik	*	300000199	ne		
5	9	Artificial Mains 9 kHz to 30 MHz	ESH3-Z5	R&S	828576/020	300001210	Ve	30.01.2014	30.01.2016
6	n. a.	Switch / Control Unit	3488A	HP Meßtechnik	2719A15013	300001156	ne		
7	9	Isolating Transformer	MPL IEC625 Bus Regeltrennt ravo	Erfi	91350	300001155	ne		
8	n. a.	Three-Way Power Splitter, 50 Ohm	11850C	HP Meßtechnik		300000997	ne		
9	90	Active Loop Antenna 10 kHz to 30 MHz	6502	Kontron Psychotech	8905-2342	300000256	k	13.06.2013	13.06.2015
10	n. a.	Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143	ne		
11	n. a.	Band Reject filter	WRCG185 5/1910-1835/1925-40/8SS	Wainwright	7	300003350	ev		
12	n. a.	Band Reject filter	WRCG240 0/2483-2375/2505-50/10SS	Wainwright	11	300003351	ev		
13	n. a.	Highpass Filter	WHKX7.0/1 8G-8SS	Wainwright	18	300003789	ne		
14	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854	vIKI!	14.10.2011	14.10.2014
15	n. a.	MXE EMI Receiver 20 Hz bis 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	13.03.2014	13.03.2015
16	n. a.	Spectrum Analyzer 9kHz to 30GHz - 140...+30dBm	FSP30	R&S	100886	300003575	k	22.08.2012	22.08.2014
17	n. a.	Temperature Test Chamber	VT 4002	Heraeus Voetsch	521/84193	300003889	Ve	26.09.2013	26.09.2015

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
vlk!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress

11 Observations

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

Annex A Photographs of the test setup

Photo documentation:

Photo 1:



Photo 2:

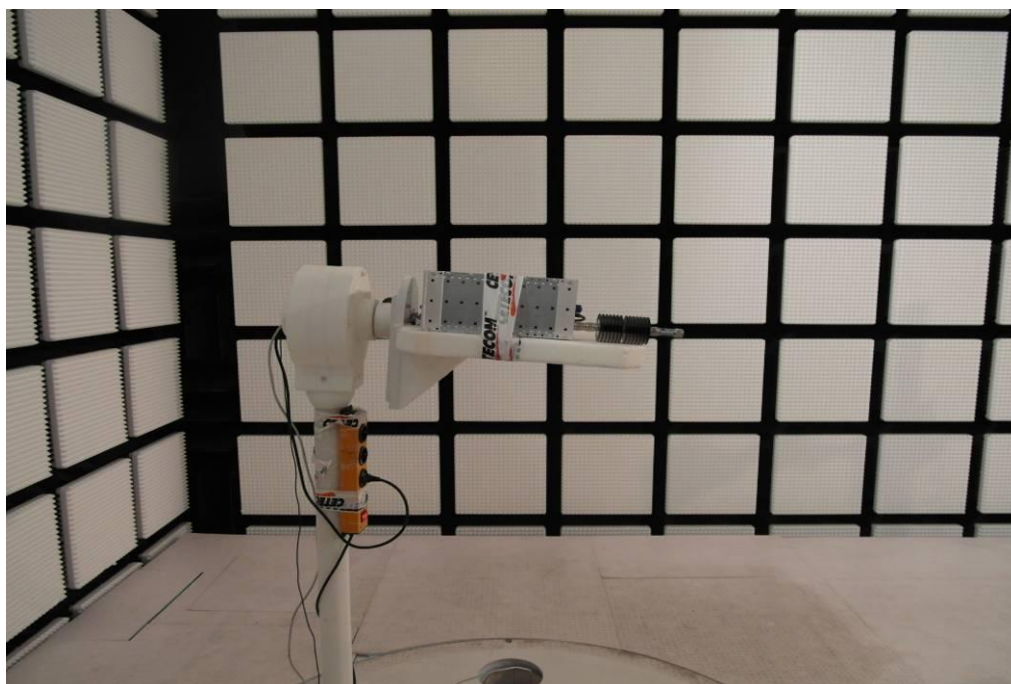


Photo 3:



Photo 4:



Photo 5:

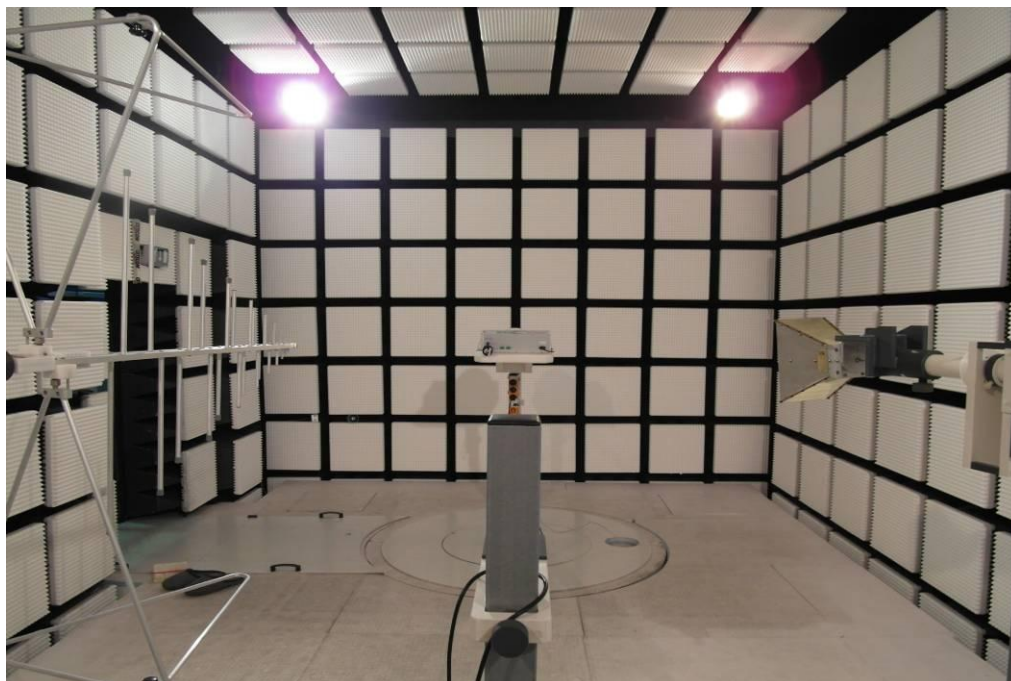


Photo 6:



Annex B External photographs of the EUT

Photo documentation:

Photo 1:



Photo 2:



Photo 3:

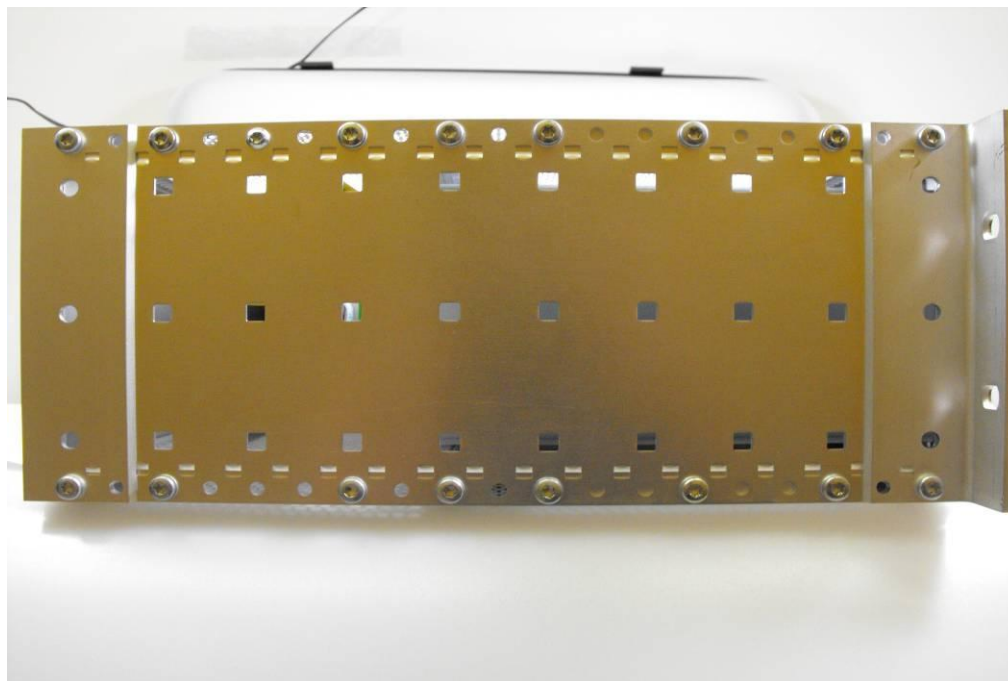


Photo 4:

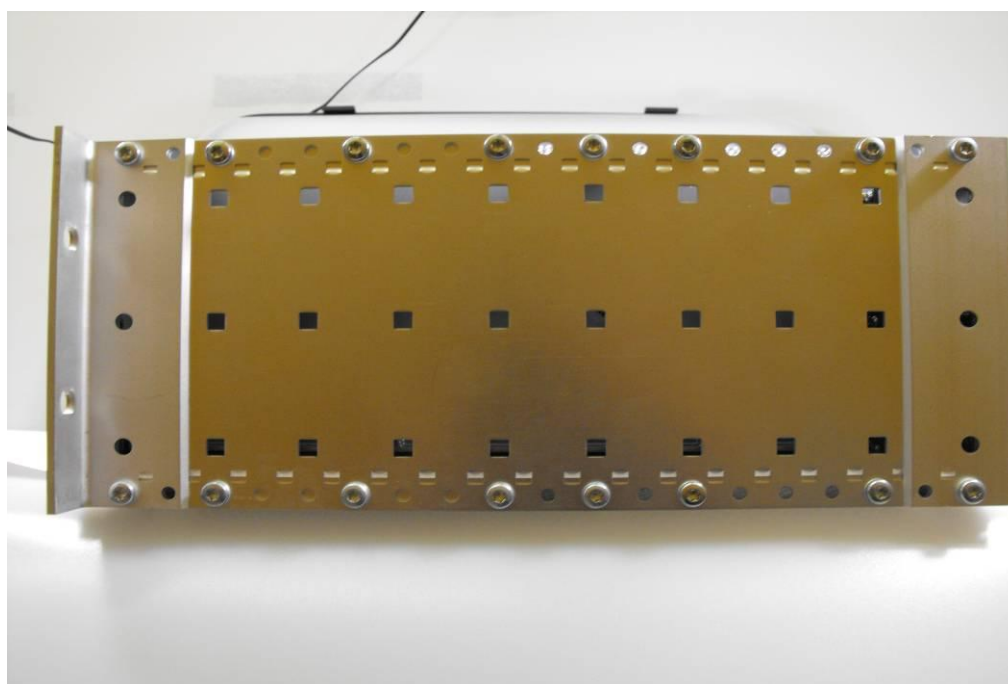


Photo 5:

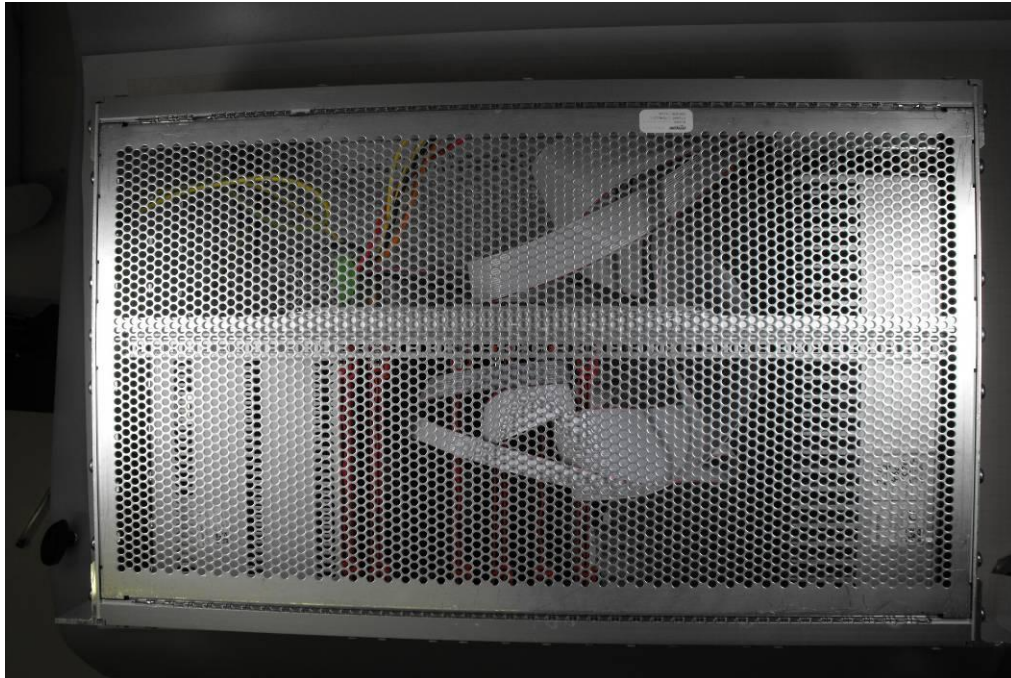


Photo 6:



Annex C Internal photographs of the EUT

Photo documentation:

Photo 1:



Photo 2:



Photo 3:



Photo 4:

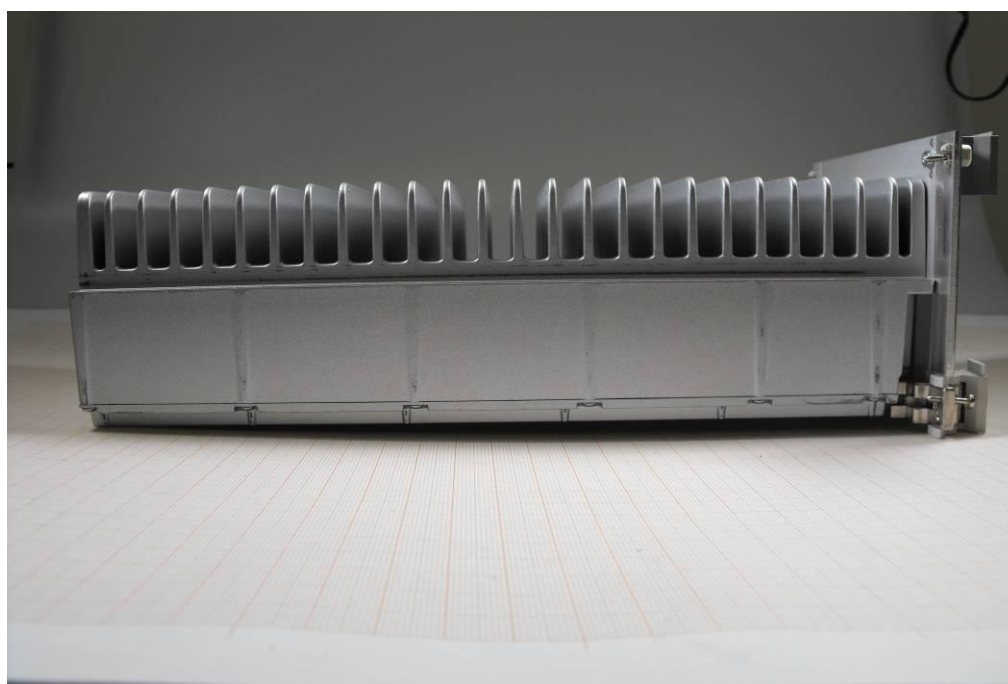


Photo 5:



Photo 6:



Photo 7:



Photo 8:

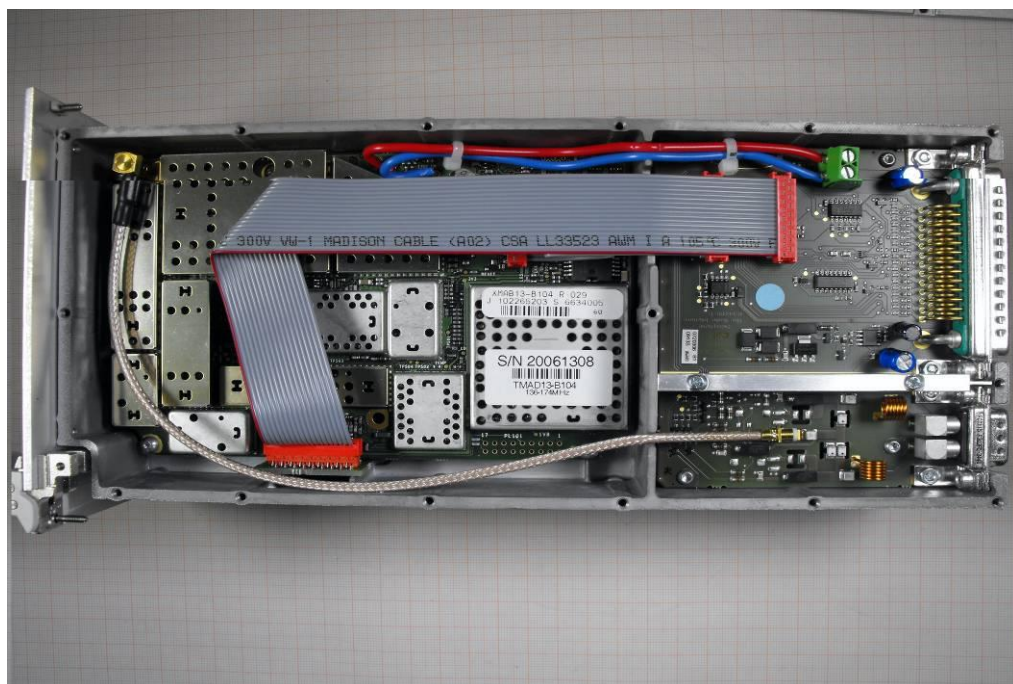


Photo 9:

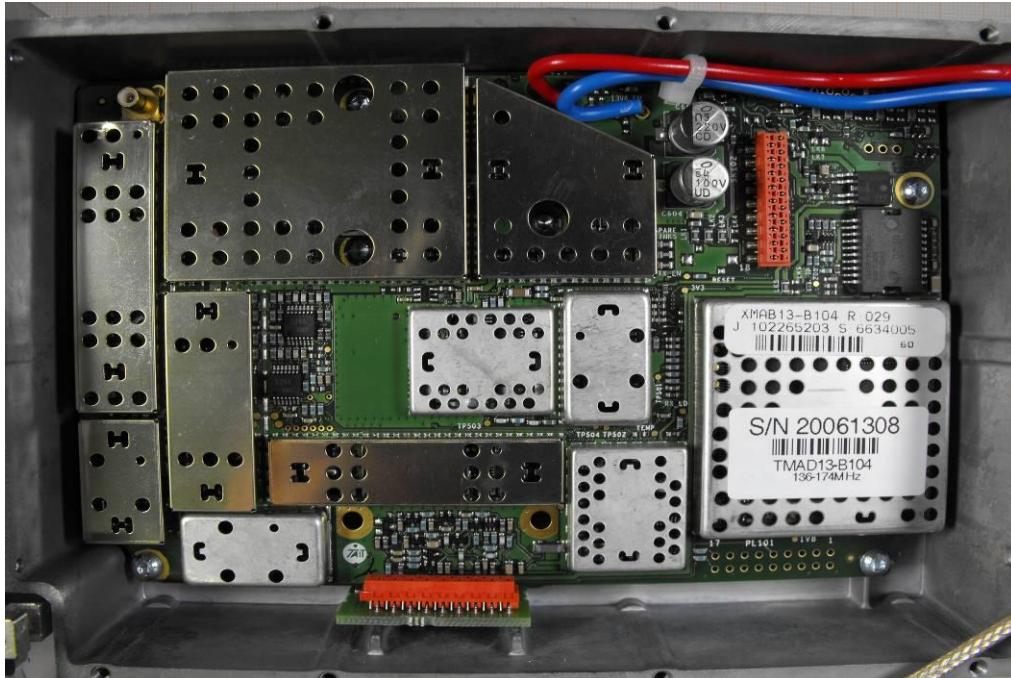


Photo 10:

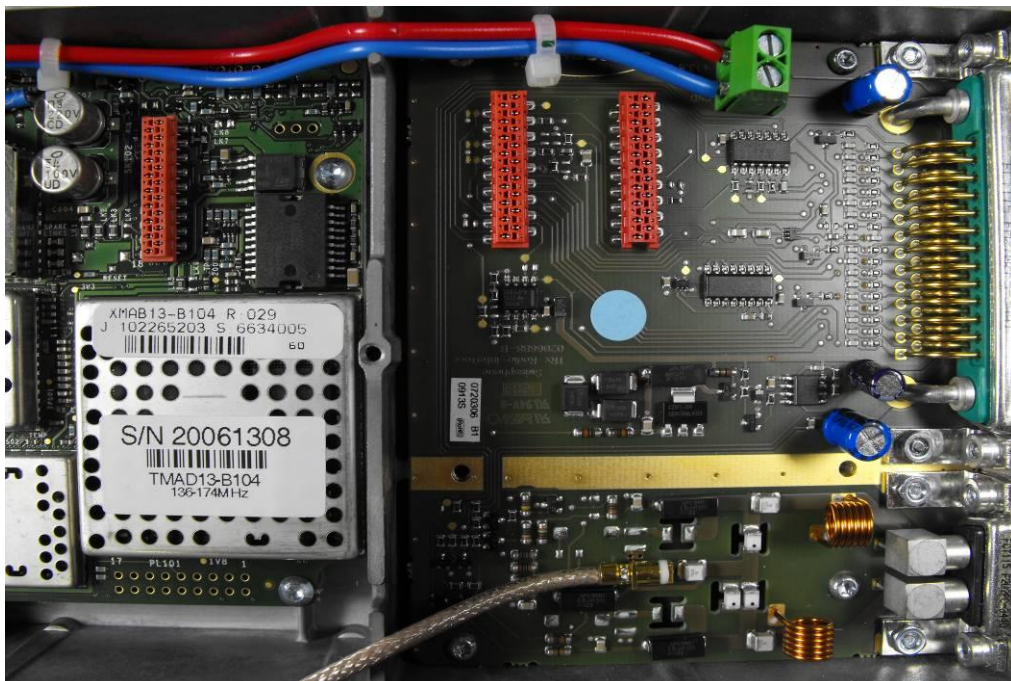


Photo 11:

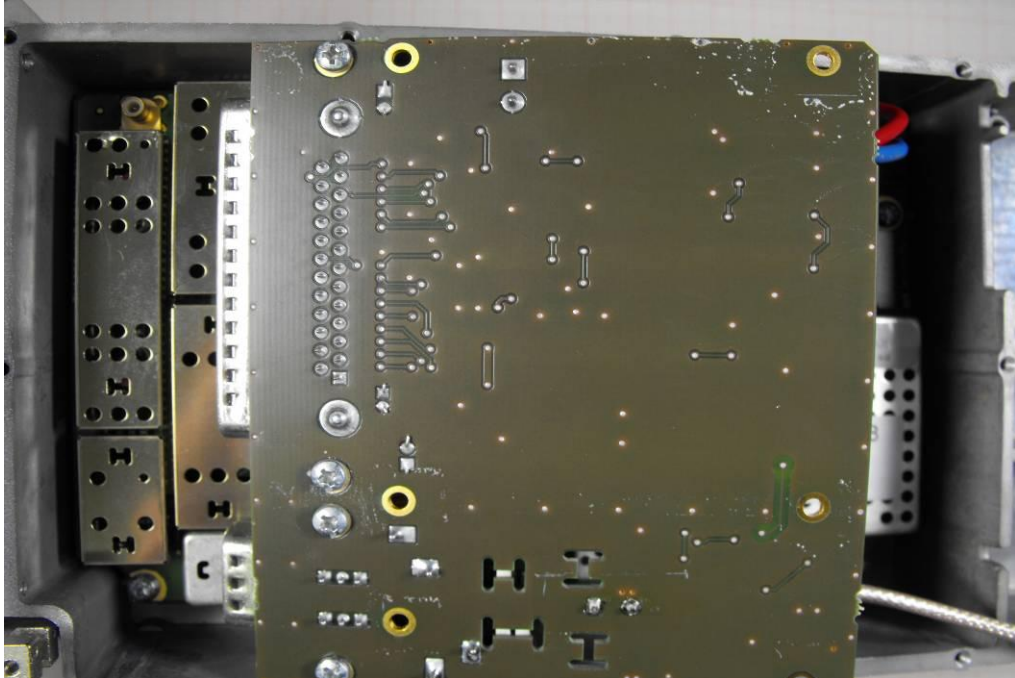


Photo 12:



Annex D Document history

Version	Applied changes	Date of release
	Initial release	2014-03-28
-A	Add radiated spurious emissions 9kHz to 30 MHz; changed modelname; changed FCC-ID; changed IC-ID	2014-04-10

Annex E 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

Front side of certificate Back side of certificate

Back side of certificate



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

Page 88 of 88