
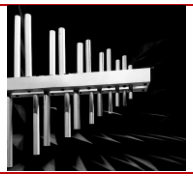
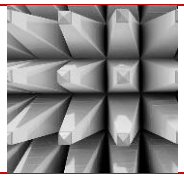

CETECOM™
CETECOM ICT Services
consulting - testing - certification

TEST REPORT

Test report no.: 1-9849/15-01-02-A

ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-00

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-12076-01-00

Applicant

Swissphone Wireless AG
Fälmisstrasse 21
8833 Samstagern / SWITZERLAND
Phone: +41 4 47 86 77 70
Fax: +41 4 47 86 77 71
Contact: Thomas Minder
e-mail: thomas.minder@swissphone.com
Phone: +41 4 47 86 77 42

Manufacturer

Swissphone Wireless AG
Fälmisstrasse 21
8833 Samstagern / SWITZERLAND

Test standard/s

CFR47 Part 90 Part 90 – Private land mobile radio services

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-NA 4B1**
FCC ID:	**L3M-ITC2100-4B1**
Frequency:	150 MHz – 174 MHz band Lowest channel 150.995 MHz – Highest channel 173.39625 MHz
Technology tested:	Proprietary
Output:	External antenna connector type N
Power supply:	115.0 V AC by main power supply
Temperature range:	-20°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:

cn=Stefan Boes, o=CETECOM ICT Services GmbH, ou=BOE-111011, email=Stefan.Boes@cetecom.com, c=DE
2015.10.27 15:43:51 +01'00'

Stefan Bös
Lab Manager
Radio Communications & EMC

Test performed:

cn=Mihail Dorongovskij, o=CETECOM ICT Services GmbH, ou=DOG-151008, email=Michael.Dorongovski@cetecom.com, c=DE
2015.10.27 15:39:43 +01'00'

Mihail Dorongovskij
Testing Manager
Radio Communications & EMC

1 Table of contents

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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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.

This test report replaces the test report with the number 1-9849/15-01-02 and dated 2015-09-08.

2.2 Application details

Date of receipt of order:	2015-06-30
Date of receipt of test item:	2015-07-06
Start of test:	2015-07-06
End of test:	2015-07-17
Person(s) present during the test:	-/-

3 Test standard/s

Test standard	Date	Test standard description
CFR47 Part 90	-/-	Part 90 – Private land mobile radio services

3.1 Measurement guidance

Guidance	Version	Description
KDB 971168 D01	v02r02	Measurement guidance for certification of licensed digital transmitters
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}	+22 °C	during room temperature tests
	T_{max}	+55 °C	during high temperature tests
	T_{min}	-20 °C	during low temperature tests
Relative humidity content:		56 %	
Barometric pressure:		not relevant for this kind of testing	
Power supply:	V_{nom}	115.0 V	AC by main power supply
	V_{max}	126.5 V	
	V_{min}	103.5 V	

5 Test item

Kind of test item	:	VHF Data Transceiver
Type identification	:	ITC 2100 NA-4B1
S/N serial number	:	C201515.00410 C201515.00409
HW hardware status	:	No information available
SW software status	:	No information available
Frequency band	:	150 MHz – 174 MHz band Lowest channel 150.995 MHz – Highest channel 173.39625 MHz
Type of modulation	:	FSK
Channel bandwidth	:	12.5 kHz
Output	:	External antenna connector type N
Power supply	:	115.0 V AC by main power supply
Temperature range	:	-20°C to +55°C

5.1 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: 1-9849/15-01-01_AnnexA
1-9849/15-01-01_AnnexB
1-9849/15-01-01_AnnexC

6 Test laboratories sub-contracted

None

7 Additional comments

Reference documents: Statement One Way Paging.pdf

Special test descriptions: None

Configuration descriptions: None

8 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 signalling equipment as well as measuring receivers and analysers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

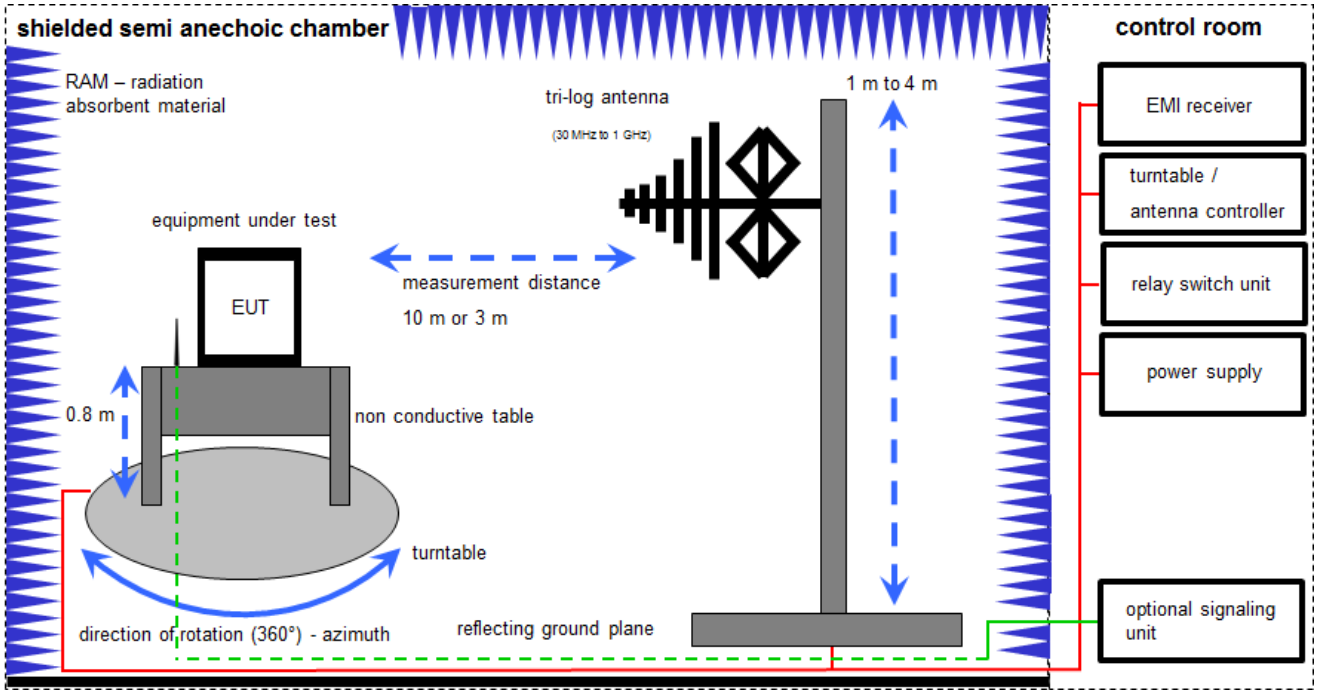
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

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

8.1 Shielded semi anechoic chamber

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 C63.4. 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 C63.4.



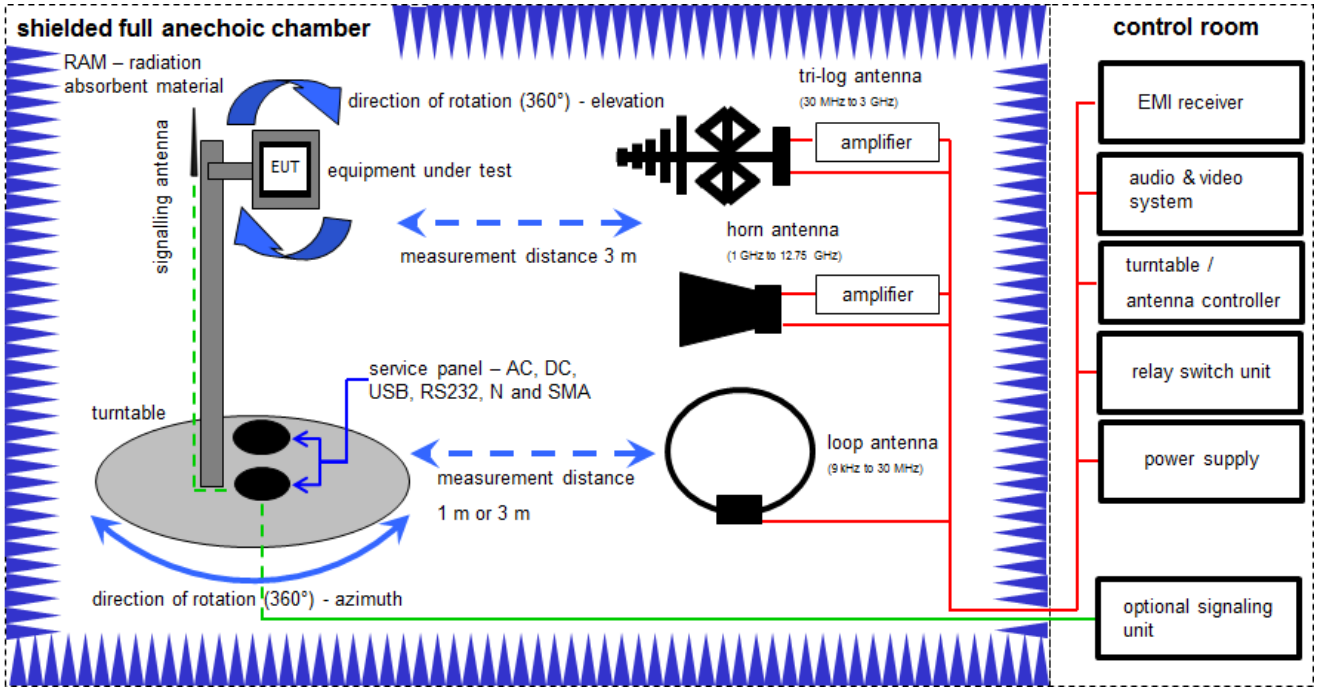
$SS = U_R + CL + AF$
(SS-signal strength; U_R-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

Example calculation:
SS [dBµV/m] = 12.35 [dBµV/m] + 1.90 [dB] + 16.80 [dBµV/m] = 31.05 [dBµV/m] (35.69 µV/m)

Used equipment:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Switch-Unit	3488A	HP	2719A14505	300000368	ev		
2	A	Isolating Transformer	MPL IEC625 Bus Regeltrenntravo	Erfi	91350	300001155	ne	-/-	-/-
3	A	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	26.01.2015	26.01.2016
4	A	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	30.01.2014	30.01.2016
5	A	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	29.01.2015	29.01.2017
6	A	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	26.08.2014	26.08.2016
7	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	22.04.2014	22.04.2016

8.2 Shielded fully anechoic chamber



Field strength measurements:
SS = U_R + CA + AF
(SS-signal strength; U_R-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

Example calculation:
SS [dBµV/m] = 40.0 [dBµV/m] + (-35.8) [dB] + 32.9 [dBµV/m] = 37.1 [dBµV/m] (71.61 µV/m)

Substitution measurements:
SP = P_R + CA
(SP-signal power; P_R-Power at the receiver; CA-loss of the signal path)

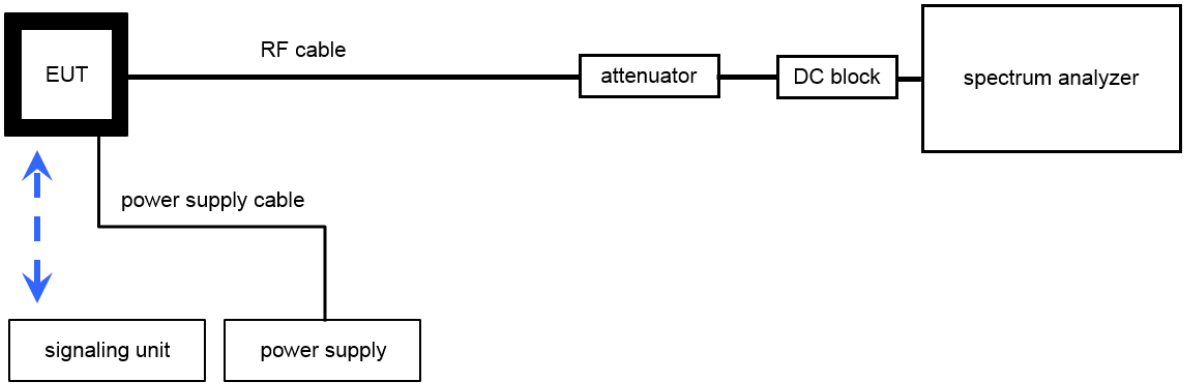
Example calculation:
SP [dBm] = -40.0 [dBµV/m] + (4.6) [dB] = -35.4 [dBm] (2.9 µW)

Used equipment:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vIKI!	20.05.2015	20.05.2017
2	A, B	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
3	A, B	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
4	B	Active Loop Antenna 10 kHz to 30 MHz	6502	Kontron Psychotech	8905-2342	300000256	k	24.06.2015	24.06.2017
5	A, B	Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143	ne	-/-	-/-
6	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854	vIKI!	29.10.2014	29.10.2017
7	A, B	MXE EMI Receiver 20 Hz to 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	06.03.2015	06.03.2016
8	A, B	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
9	A, B	Fixed Coaxial Attenuator, 40dB 100W DC-18GHz	WA91-20-43	Weinschel Ass	A514	300004824	ev	-/-	-/-

8.3 Conducted measurements

Conducted measurements normal conditions



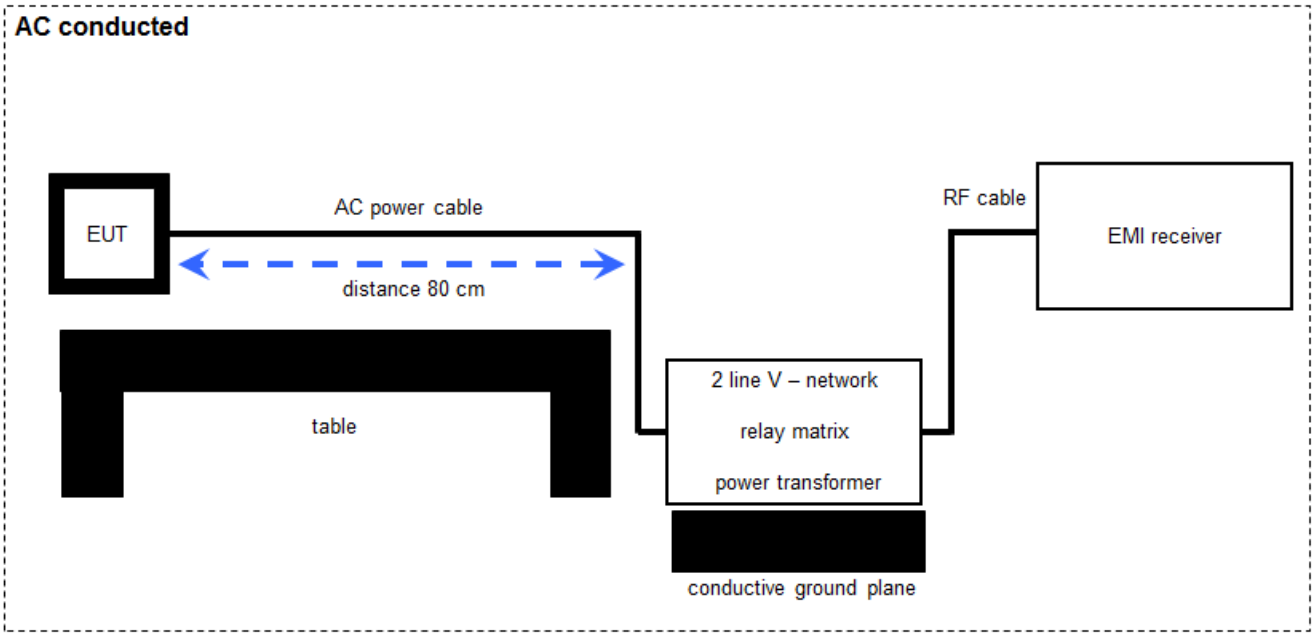
OP = AV + CA
(OP-output power; AV-analyzer value; CA-loss signal path)

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

Equipment table:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Signal- and Spectrum Analyzer	FSW26	R&S	101455	300004528	k	21.01.2015	21.01.2016
2	A, B	Fixed Coaxial Attenuator, 40dB 100W DC-18GHz	WA91-20-43	Weinschel Ass	A514	300004824	ev	-/-	-/-
3	A, B	RF-Cable	ST18/SMAm/SMAm/ 60	Huber & Suhner	Batch no. 606844	400001181	ev	-/-	-/-
4	A, B	DC-Blocker 0.1-40 GHz	8141A	Inmet	Batch no. 127377	400001185	ev	-/-	-/-
5	B	Spectrum Analyzer 9kHz to 30 GHz	FSP30	R&S	700886	300003575	k	26.08.2014	26.08.2016

8.4 AC conducted



SS = UR + CF + VC
(SS-signal strength; UR-voltage at the receiver; CR-loss of the cable and filter; VC-correction factor of the ISN)

Example calculation:
SS [dBµV/m] = 37.62 [dBµV/m] + 9.90 [dB] + 0.23 [dB] = 47.75 [dBµV/m] (244.06 µV/m)

Used equipment:

No.	Lab / Item	Equipment	Type	Manufact.	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	RF-Filter-section	85420E	HP	3427A00162	300002214	k	27.11.2006	
3	A	EMI-Receiver	8542E	HP	3617A00170	300000568	k	28.01.2015	28.01.2016
4	A	Fixed Coaxial Attenuator, 40dB 100W DC-18GHz	WA91-20-43	Weinschel Ass	A514	300004824	ev	-/-	-/-

9 Measurement uncertainty

Measurement uncertainty	
Maximum output power	± 1 dB
Audio frequency filter response	± 1 dB
Transmitter modulation limiting	± 2 dB
Spectrum efficiency	± 1 dB
Occupied bandwidth	± 21.5 kHz absolute; ± 15.0 kHz relative
Frequency stability	± 30 Hz
Spurious emissions conducted	± 3 dB
Spurious emissions radiated below 30 MHz	± 3 dB
Spurious emissions radiated 30 MHz to 1 GHz	± 3 dB
Spurious emissions radiated 1 GHz to 12.75 GHz	± 3 dB
Spurious emissions conducted below 30 MHz (AC conducted)	± 2.6 dB

10 Sequence of testing

10.1 Sequence of testing 9 kHz to 30 MHz

Setup

- The Equipment was setup to simulate a typical usage like descripted in the user manual / or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were 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.
- The measurement distance is 3 meter (see ANSI C 63.4) – see each test details
- The EUT was set into operation.

Pre measurement

- The turntable rotates from 0° to 315° with 45° steps.
- The antenna height is 1.5 meter.
- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement

- According to the maximum found antenna polarization and turntable position of the premeasurement the software maximizes the peaks by rotating the turntable position (0° to 360°).
- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with QPK (QPK / see ANSI C 63.4) detector
- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit, and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.
- The calculation of the results is appropriate to the descriptions in sub clause 10 using the appropriate correction factors for the measured frequency range.

10.2 Sequence of testing 30 MHz to 1 GHz

Setup

- The Equipment was setup to simulate a typical usage like descripted in the user manual / or described by 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 were 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.
- The measurement distance is 10 or 3 meter (see ANSI C 63.4) – see each test details
- The EUT was set into operation.

Pre measurement

- The turntable rotates from 0° to 315° with 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 to 3 meter.
- 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 will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter.
- The final measurement will be done with QP (Quasi-Peak / see ANSI C 63.4) detector
- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit, and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

10.3 Sequence of testing 1 GHz to 12.75 GHz

Setup

- The Equipment was setup to simulate a typical usage like descripted in the user manual / or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were 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.
- The measurement distance is 3 meter (see ANSI C 63.4) – see each test details
- The EUT was set into operation.

Pre measurement

- The turntable rotates from 0° to 315° with 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height is 1.5 meter.
- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement

- The final measurement will be performed with minimum the six highest peaks according the requirements of the ANSI C63.4.
- According to the maximum found antenna polarization and turntable position of the premeasurement the software maximizes the peaks by rotating the turntable position (0° to 360°). This measurement is repeated for different EUT-table positions (0° to 150° in 30°-steps). This procedure is repeated for both antenna polarizations.
- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with RMS (RMS / see ANSI C 63.4) detector
- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit, and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.
- The calculation of the results is appropriate to the descriptions in sub clause 10 using the appropriate correction factors for the measured frequency range.

11 Summary of measurement results

☒	No deviations from the technical specifications were ascertained
☐	There were deviations from the technical specifications ascertained
☐	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	47 CFR Part 2 47 CFR Part 90 C	See table	2015-10-27	-/-

Test Specification Clause	Test Case	Temperature Conditions	Power Source Voltages	C	NC	NA	NP	Remark
FCC 47 CFR § 2.1046 § 90.205	Transmitter output power	Nominal	Nominal	☒	☐	☐	☐	-/-
FCC 47 CFR § 90.203 (j)(3)/(7)	Spectrum efficiency	Nominal	Nominal	☐	☐	☒	☐	One way transmitter
FCC 47 CFR § 2.1049 (c) § 90.209 (b)(5) § 90.210 (d)	Occupied bandwidth / Spectrum Mask	Nominal	Nominal	☒	☐	☐	☐	-/-
FCC 47 CFR § 90.214	Transient frequency behaviour	Nominal	Nominal	☒	☐	☐	☐	-/-
FCC 47 CFR § 2.1055 (a)(1) § 90.213	Frequency stability	Nominal	Extreme	☒	☐	☐	☐	-/-
		Extreme	Nominal	☒	☐	☐	☐	
FCC 47 CFR § 2.1051 § 90.210	Transmitter spurious emissions conducted	Nominal	Nominal	☒	☐	☐	☐	-/-
FCC 47 CFR § 2.1051 § 90.210	Transmitter spurious emissions (radiated)	Nominal	Nominal	☒	☐	☐	☐	-/-
FCC 47 CFR § 15.209	Receiver spurious emissions (radiated)	Nominal	Nominal	☒	☐	☐	☐	-/-
§15.107(a) §15.207	Conducted emissions < 30 MHz	Nominal	Nominal	☒	☐	☐	☐	-/-

Note: C = Compliant; NC = Not Compliant; NA = Not Applicable; NP = Not Performed

12 Measurement results

12.1 Transmitter output power

Measurement:

Measurement parameter	
Measured according KDB 971168 D01 clause 5.1.1	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Span:	3 MHz
Trace mode:	Max. hold
Test setup:	See sub clause 8.3 A
Measurement uncertainty	See sub clause 9

Limits:

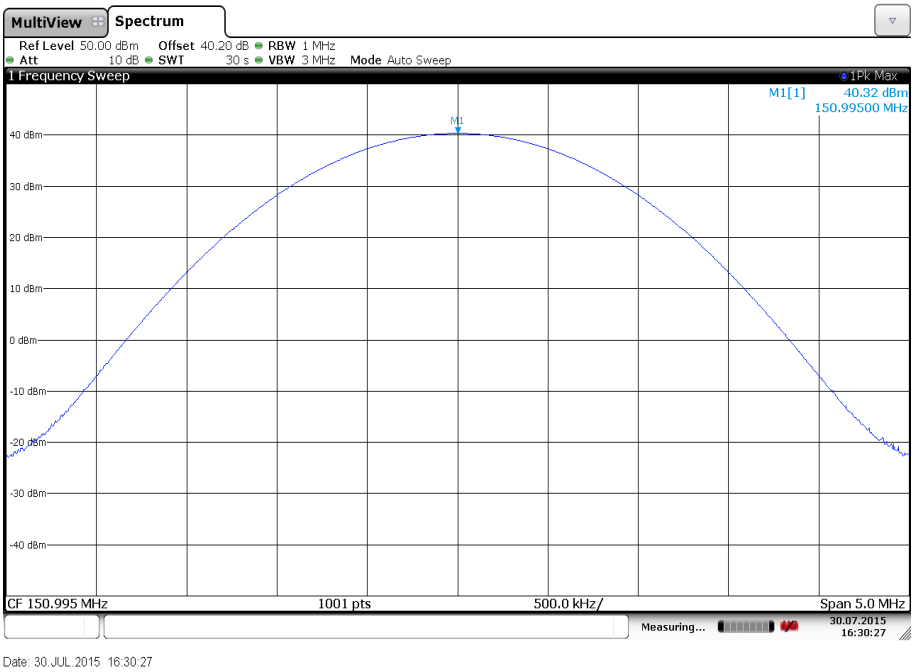
FCC
CFR § 2.1046 CFR § 90.205
Maximum transmitter power shall not exceed 120% of the manufacturer's rated power

Result:

Frequency (channel)	Transmitter output power	
Rated output power by manufacturer	40 dBm / 10 W nominal	47 dBm / 50 W nominal
150.995 MHz	40.32 dBm / 10.8 W	47.13 dBm / 51.6 W
163.250 MHz	40.48 dBm / 11.2 W	47.29 dBm / 53.6 W
173.39625 MHz	40.45 dBm / 11.1 W	47.47 dBm / 55.8 W

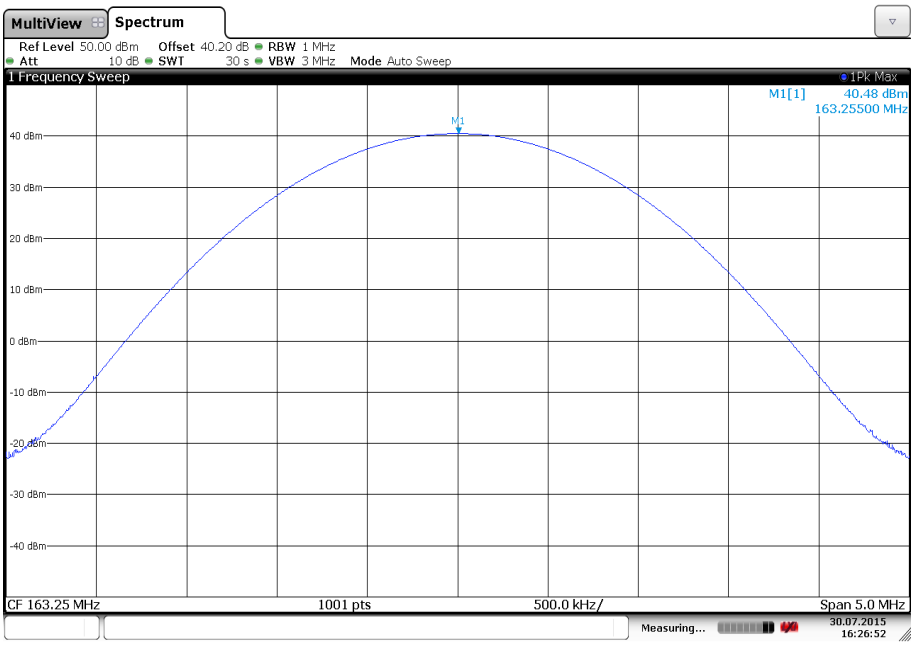
Plots of the measurements (Transmitter output power)

Plot 1: Lowest channel – Low power



Date: 30.JUL.2015 16:30:27

Plot 2: Middle channel – Low power



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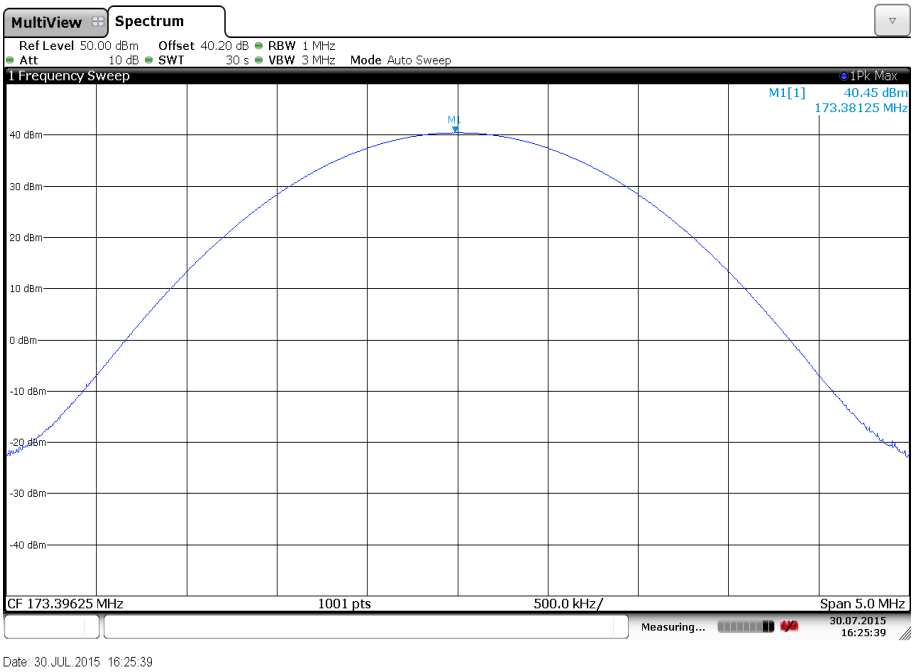
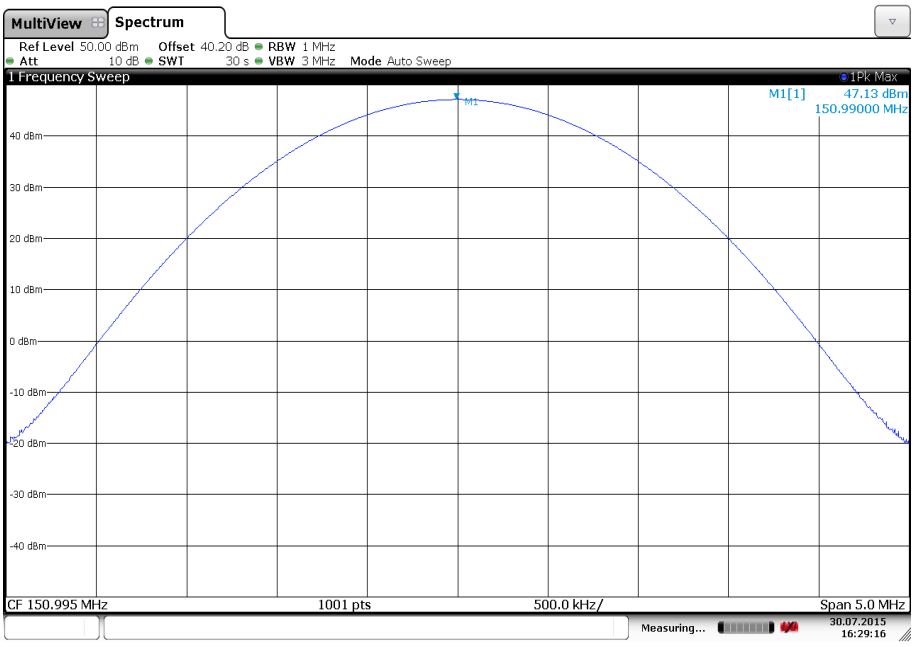
Plot 3: Highest channel – Low power



Date: 30.JUL.2015 16:25:39

Plot 4: Lowest channel – High power



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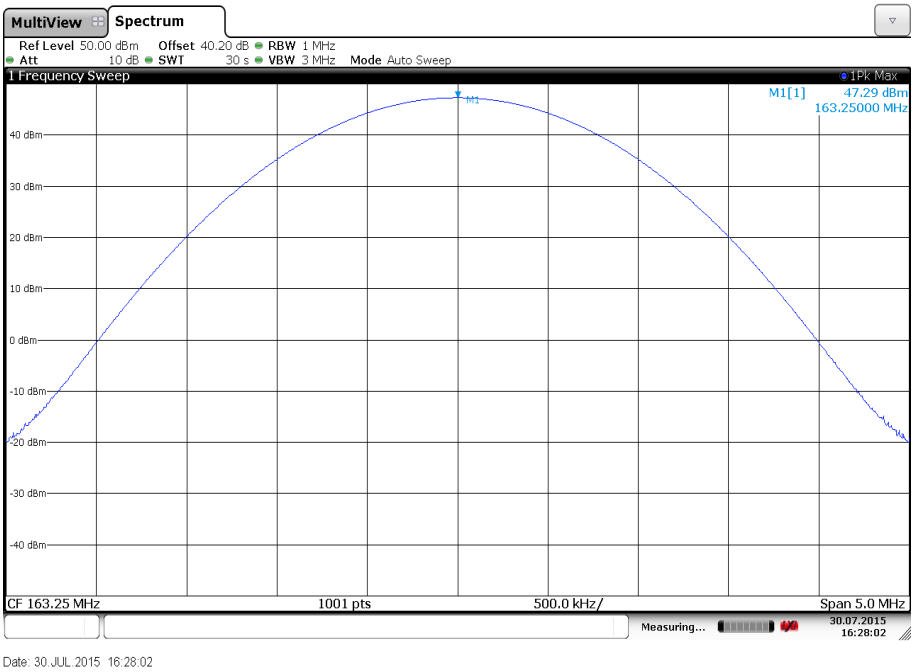
Plot 5: Middle channel – High power



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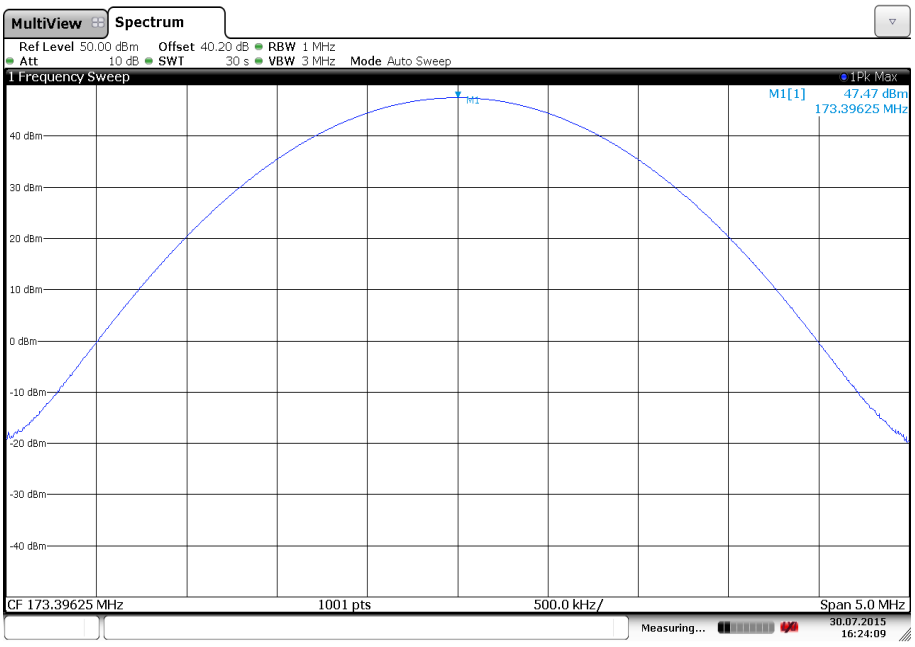
Plot 6: Highest channel – High power



Date: 30.JUL.2015 16:24:09

12.2 Spectrum efficiency

Limits:

FCC
FCC 47 CFR § 90.203 (j)(3)
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

According customer declaration (Statement One Way Paging.pdf) the EUT is a One Way Transmitter which is excluded from the spectrum efficiency requirements according FCC 47 CFR §90.203(j)(7).

Verdict: **Not applicable**

12.3 Occupied bandwidth

Measurement:

Measurement parameter	
Measured according KDB 971168 D01 clause 4.2	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	100 Hz
Video bandwidth:	300 Hz
Span:	30 kHz
Trace mode:	Max. hold
Test setup:	See sub clause 8.3 A
Measurement uncertainty	See sub clause 9

Limits:

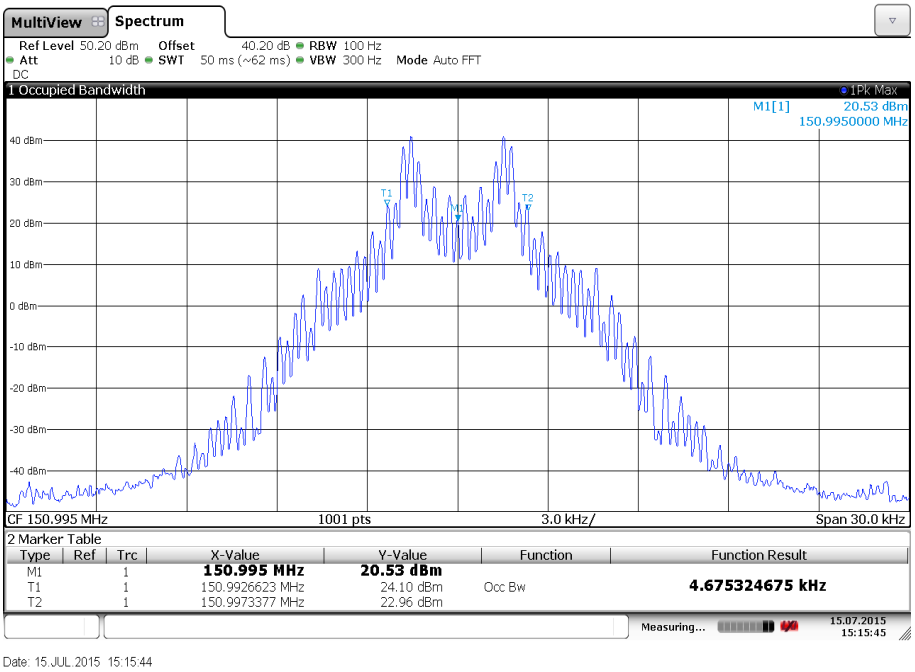
FCC
FCC 47 CFR § 2.1049 (c) § 90.209 (b)(5) § 90.210 (d)
Requirements of emission mask D
Authorized bandwidth for 12.5 kHz channel bandwidth: 11.25 kHz **Emission mask D:** *12.5 kHz channel bandwidth equipment.* For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must 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 f_0 to 5.625 kHz removed from f_0: Zero dB. (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d 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 (f_d 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
150.995 MHz	4.68	4.95	7.16	9.53
163.250 MHz	4.71	4.95	7.16	9.56
173.39625 MHz	4.65	4.95	7.10	9.50

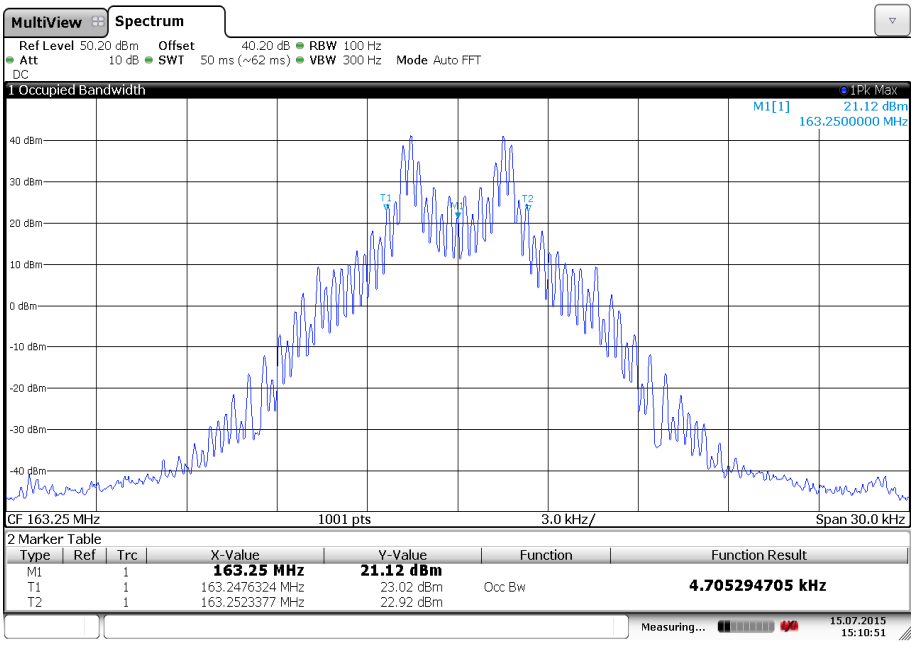
Plots of the measurements (99%-bandwidth)

Plot 1: Low channel / 512 bits per second



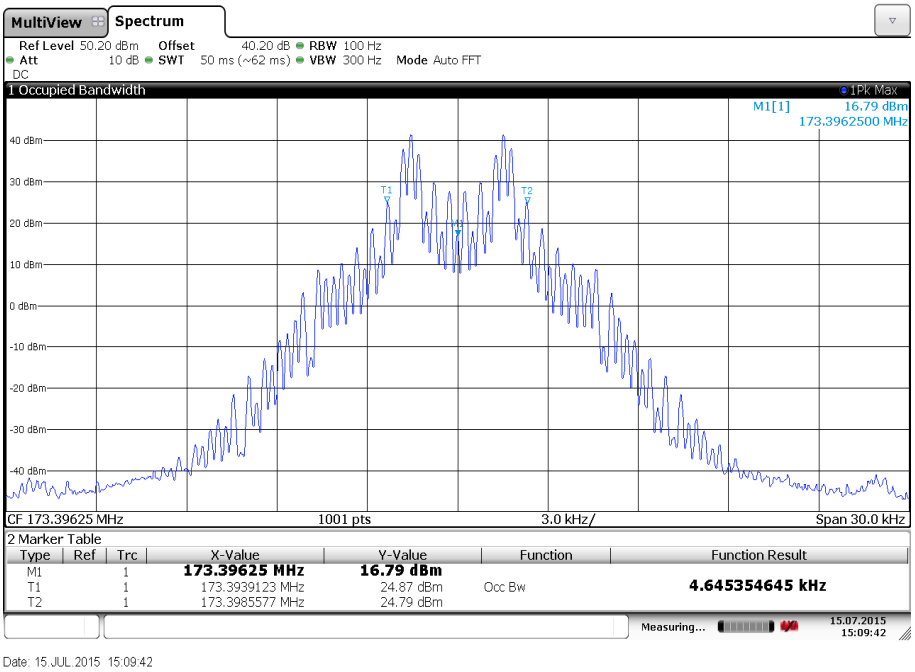
Date: 15.JUL.2015 15:15:44

Plot 2: Middle channel / 512 bits per second



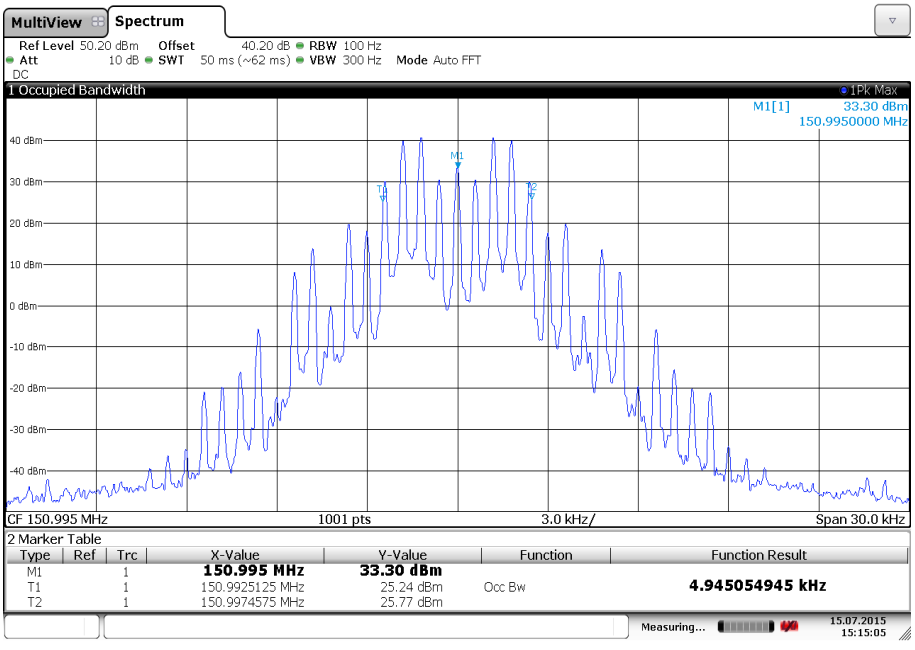
Date: 15.JUL.2015 15:10:51

Plot 3: High channel / 512 bits per second



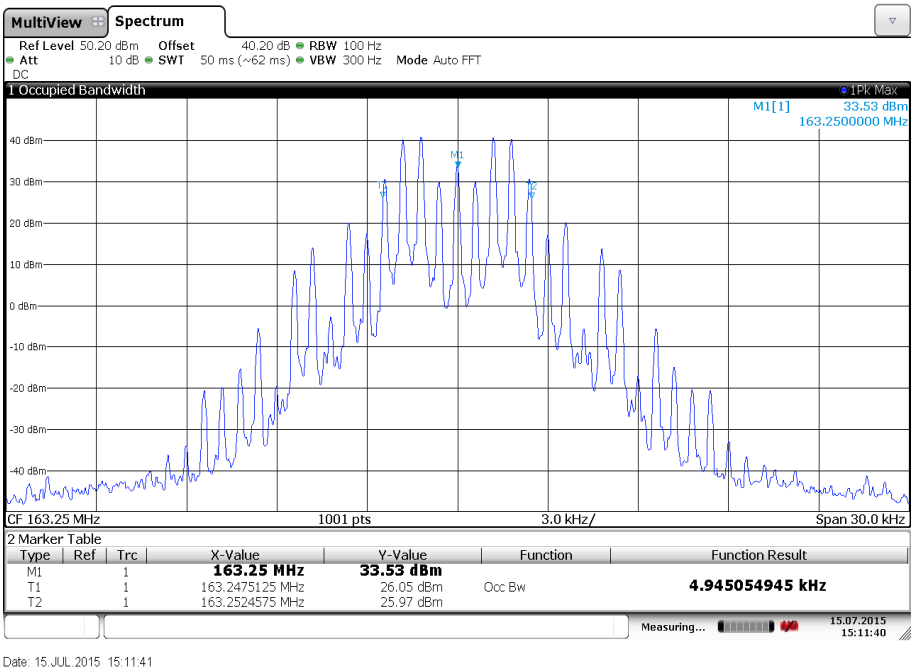
Date: 15.JUL.2015 15:09:42

Plot 4: Low channel / 1200 bits per second



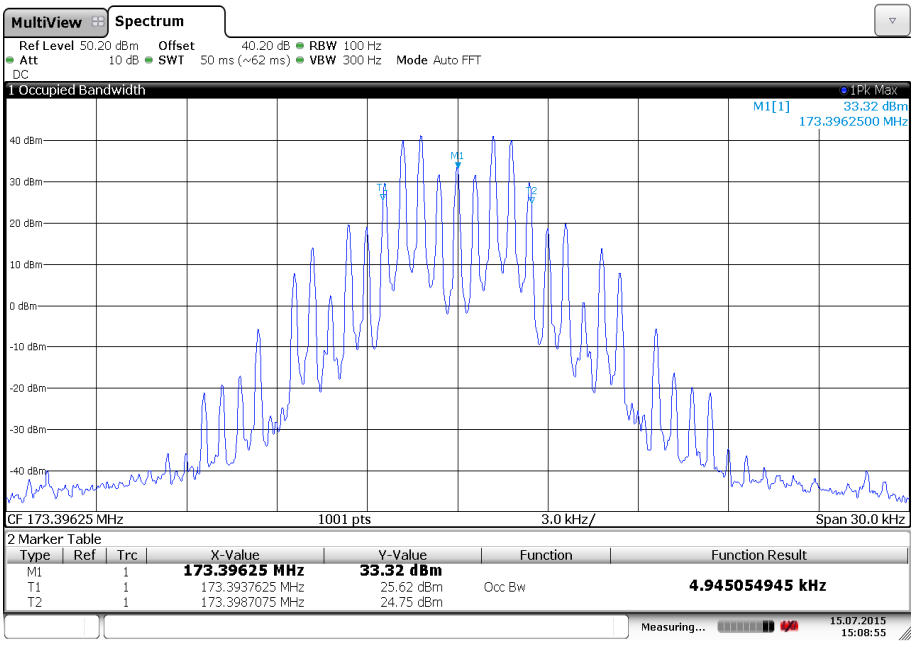
Date: 15.JUL.2015 15:15:06

Plot 5: Middle channel / 1200 bits per second



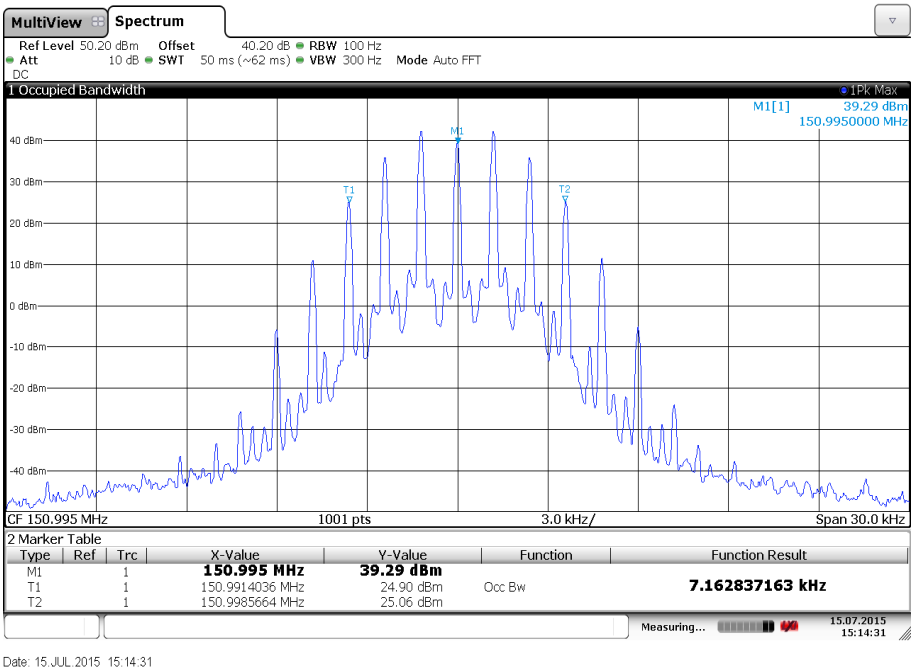
Date: 15.JUL.2015 15:11:41

Plot 6: High channel / 1200 bits per second



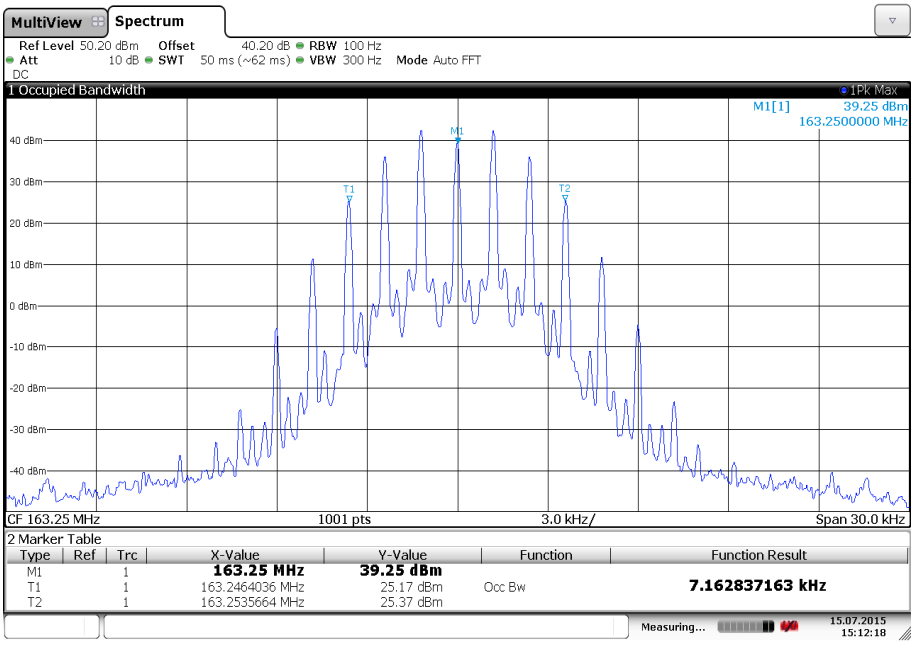
Date: 15.JUL.2015 15:08:55

Plot 7: Low channel / 2400 bits per second



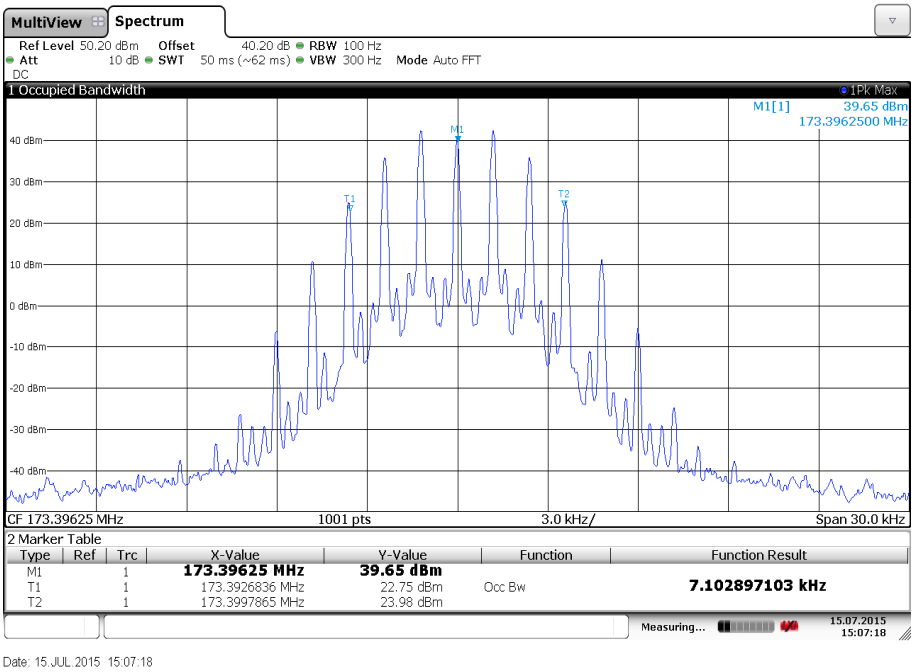
Date: 15.JUL.2015 15:14:31

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



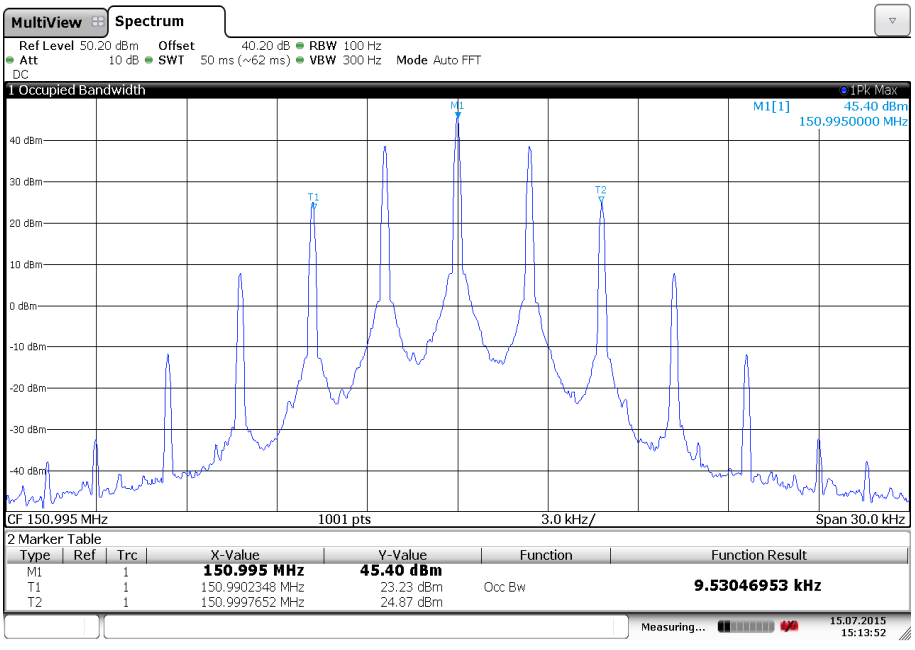
Date: 15.JUL.2015 15:12:18

Plot 9: High channel / 2400 bits per second



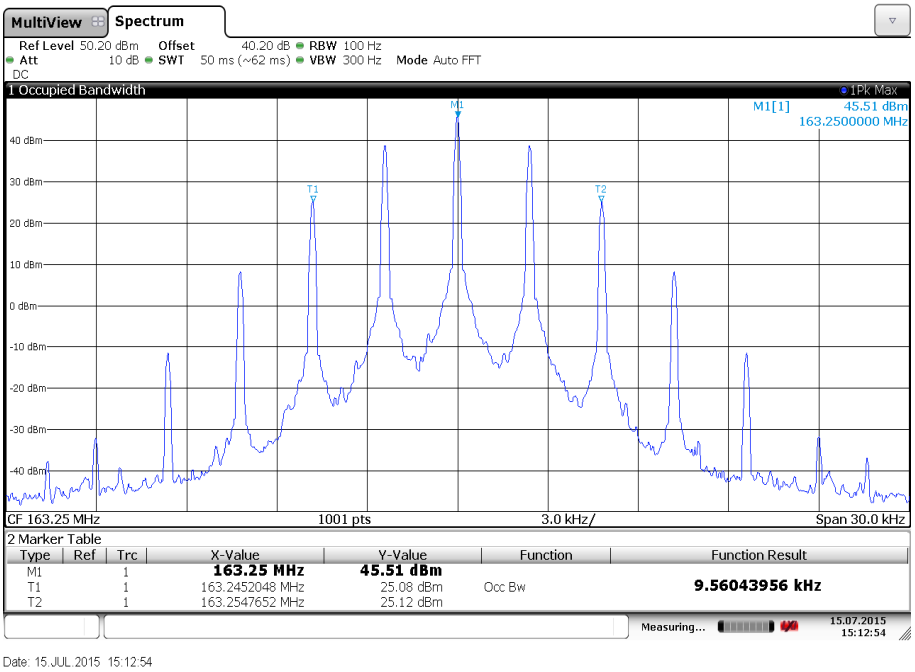
Date: 15.JUL.2015 15:07:18

Plot 10: Low channel / 4800 bits per second



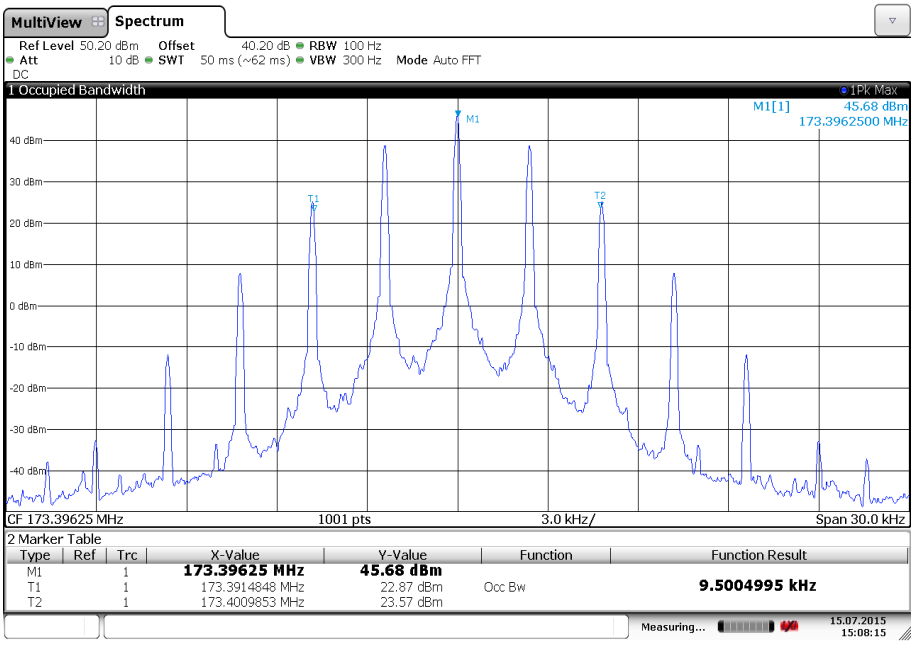
Date: 15.JUL.2015 15:13:52

Plot 11: Middle channel / 4800 bits per second



Date: 15.JUL.2015 15:12:54

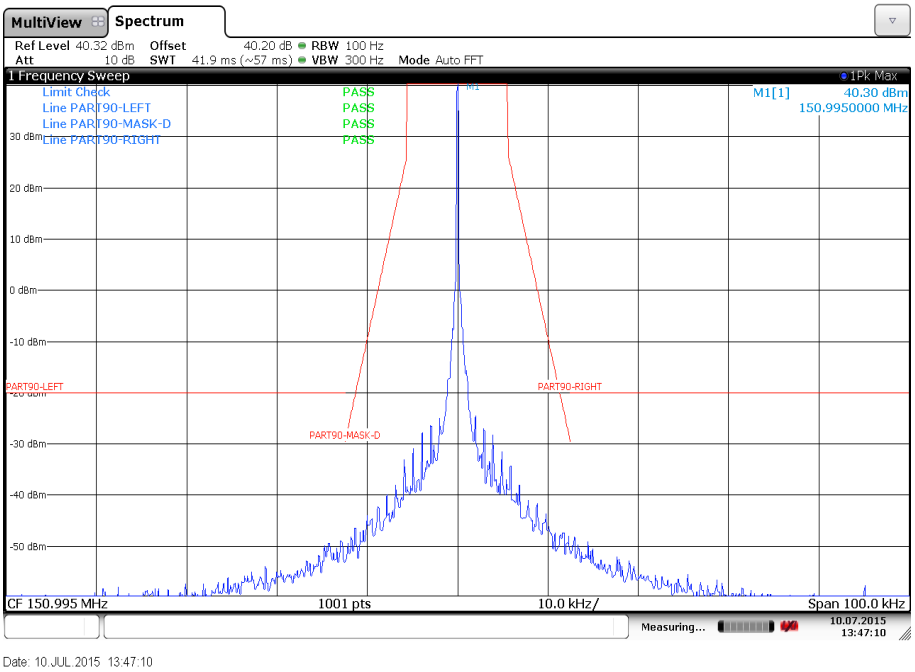
Plot 12: High channel / 4800 bits per second



Date: 15.JUL.2015 15:08:14

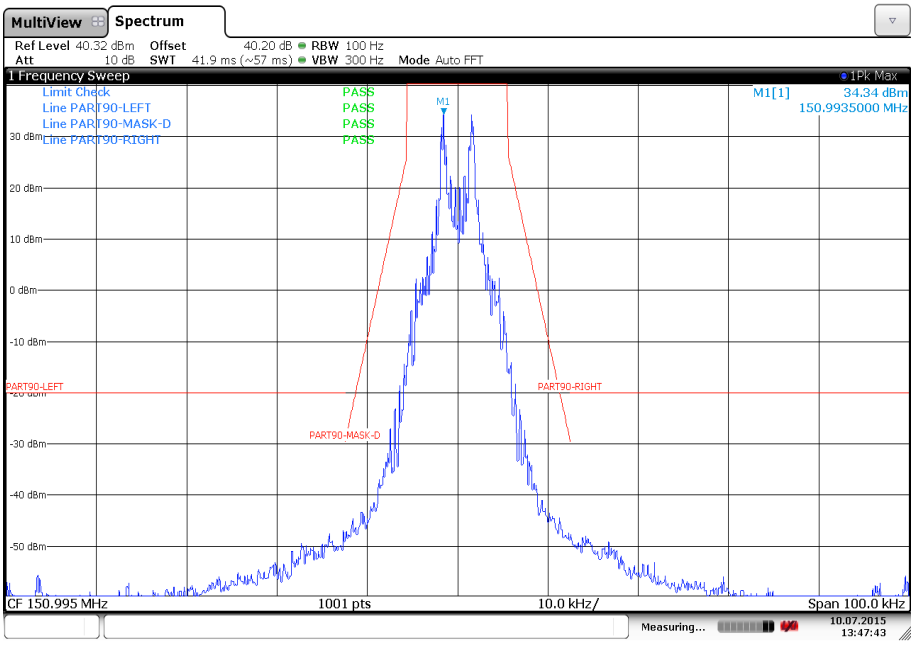
Plots of the measurements (Emission mask D)

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



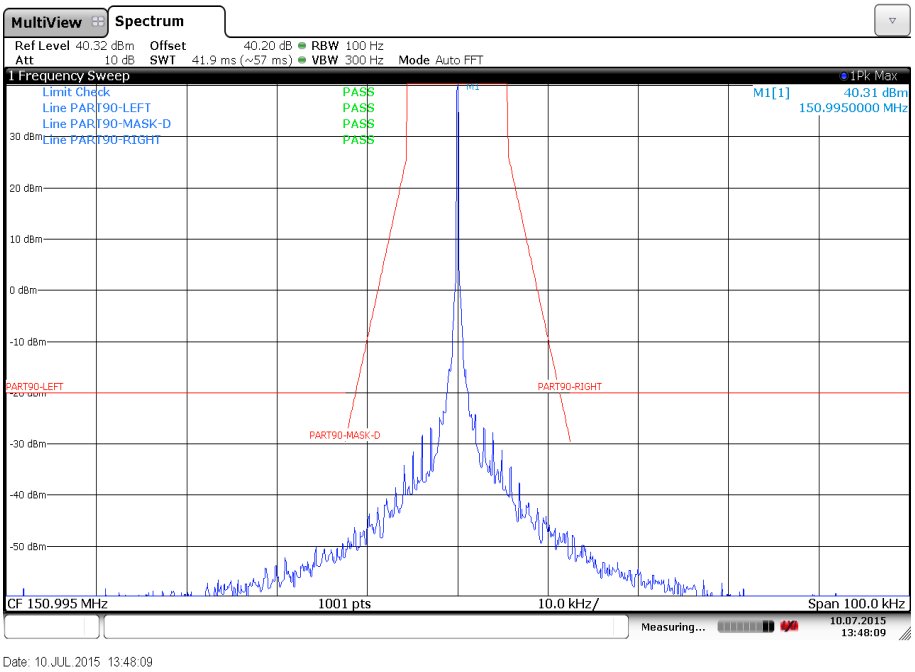
Date: 10.JUL.2015 13:47:10

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



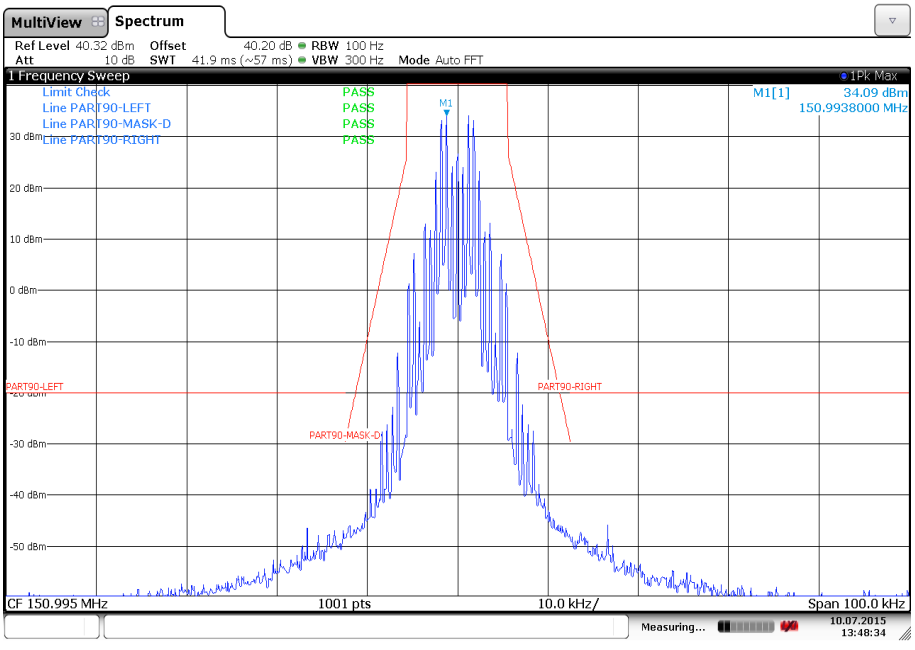
Date: 10.JUL.2015 13:47:42

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



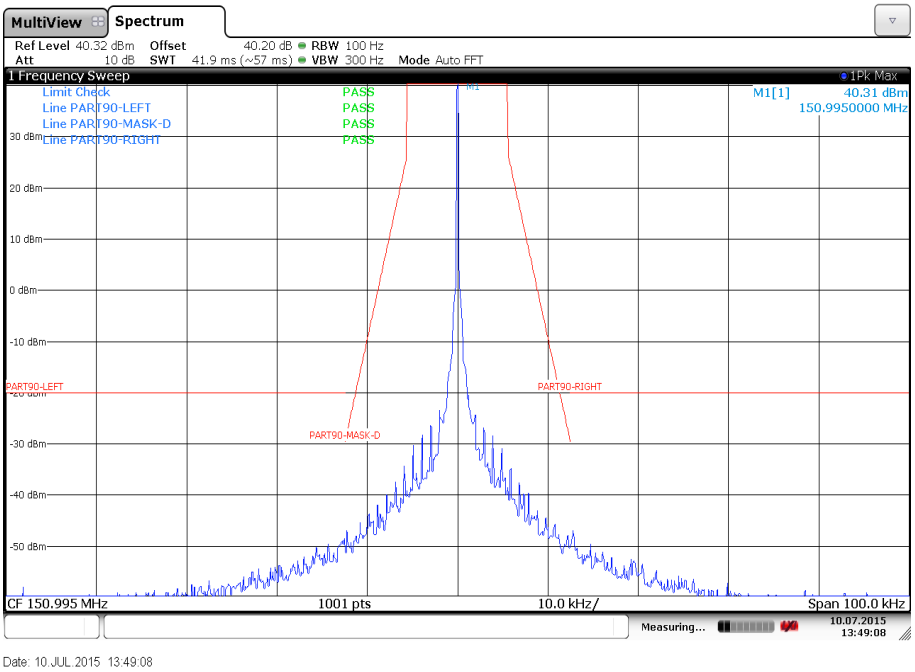
Date: 10.JUL.2015 13:48:09

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



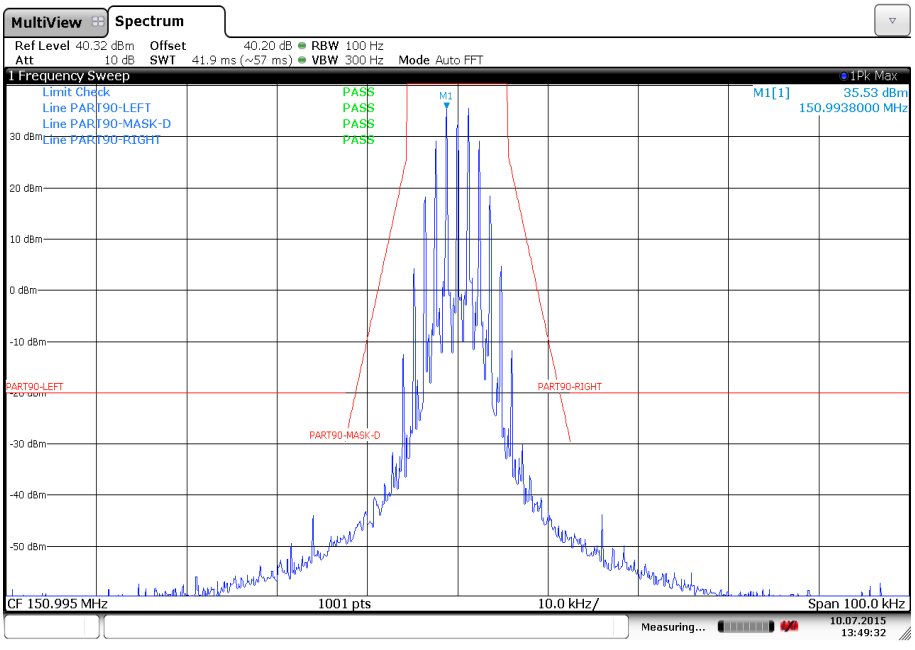
Date: 10.JUL.2015 13:48:34

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



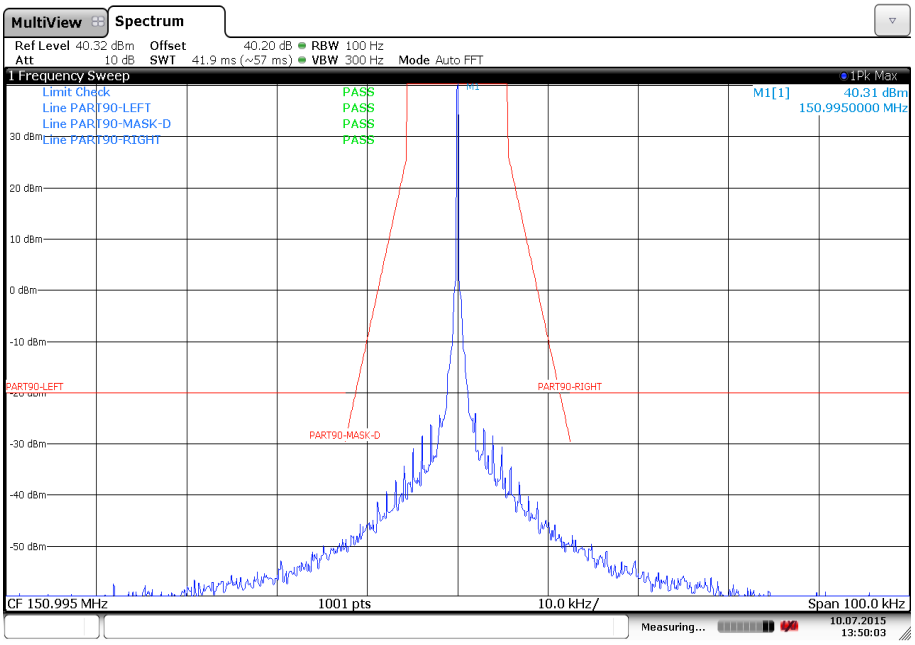
Date: 10.JUL.2015 13:49:08

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



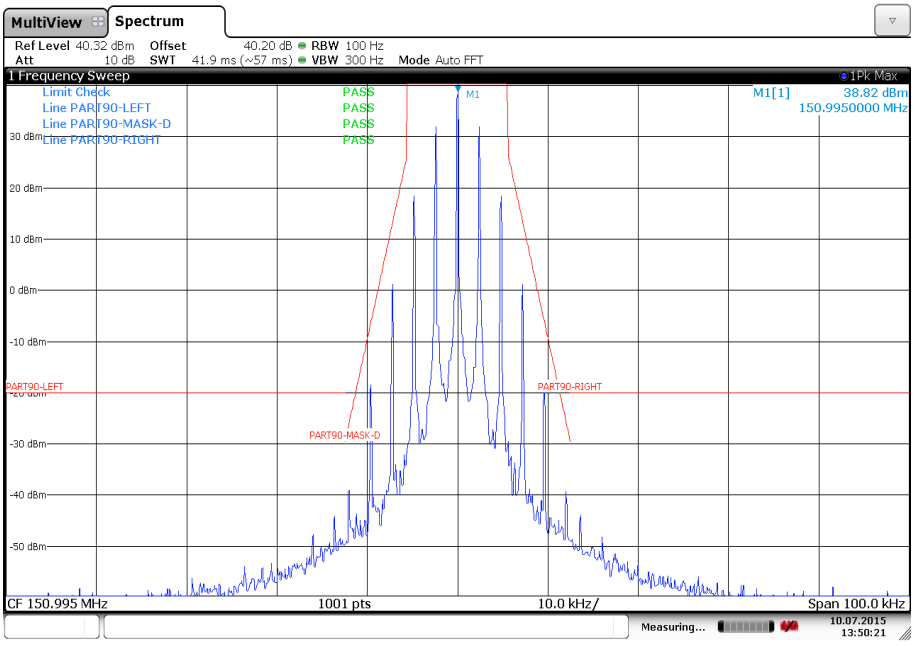
Date: 10.JUL.2015 13:49:32

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



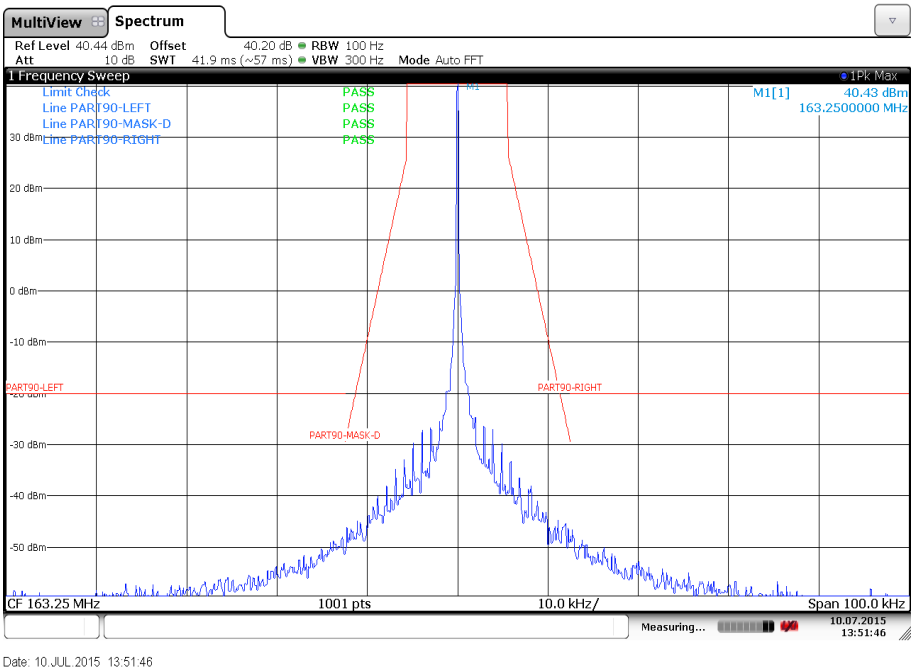
Date: 10.JUL.2015 13:50:03

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



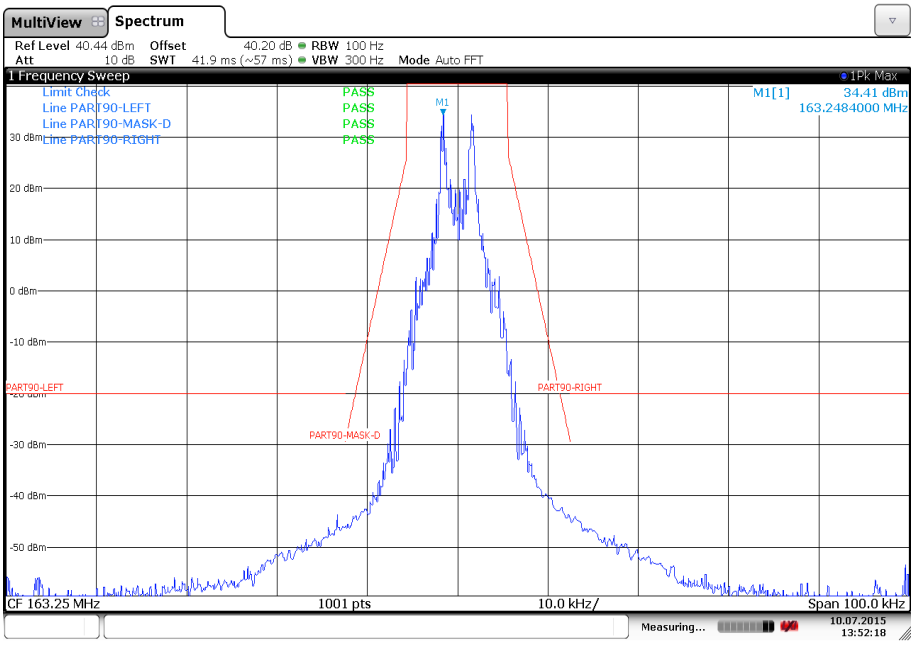
Date: 10.JUL.2015 13:50:21

Plot 9: Emission mask D – Mid channel – 512 bits per second – Low power – Carrier unmodulated



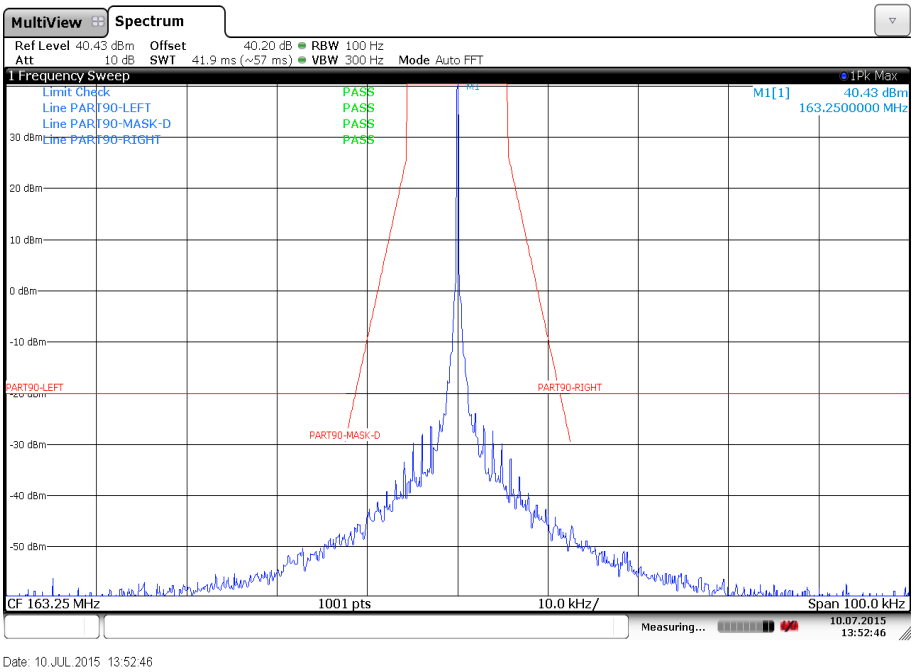
Date: 10.JUL.2015 13:51:46

Plot 10: Emission mask D – Mid channel – 512 bits per second – Low power – Carrier modulated



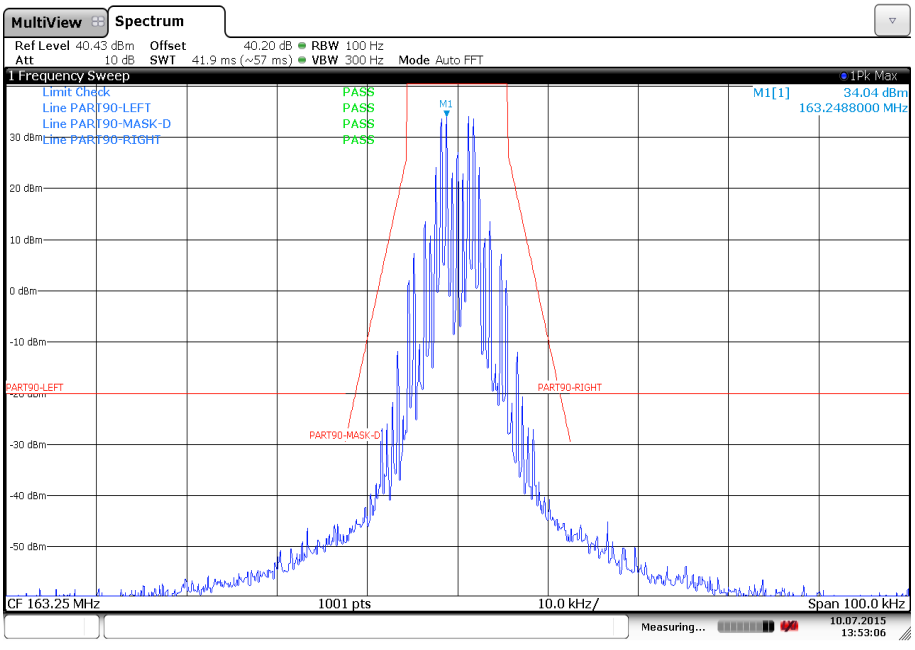
Date: 10.JUL.2015 13:52:19

Plot 11: Emission mask D – Mid channel – 1200 bits per second – Low power – Carrier unmodulated



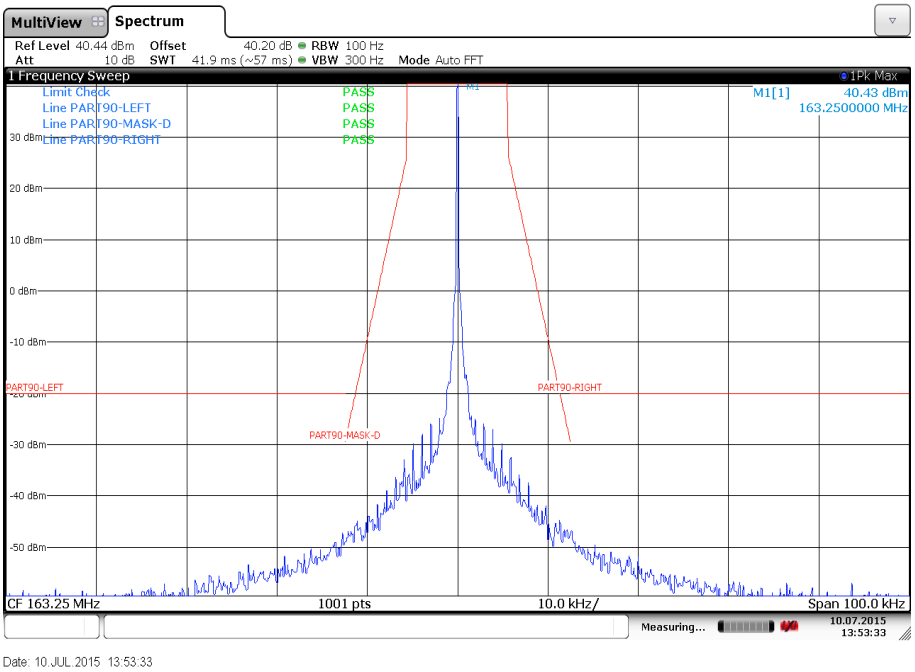
Date: 10.JUL.2015 13:52:46

Plot 12: Emission mask D – Mid channel – 1200 bits per second – Low power – Carrier modulated



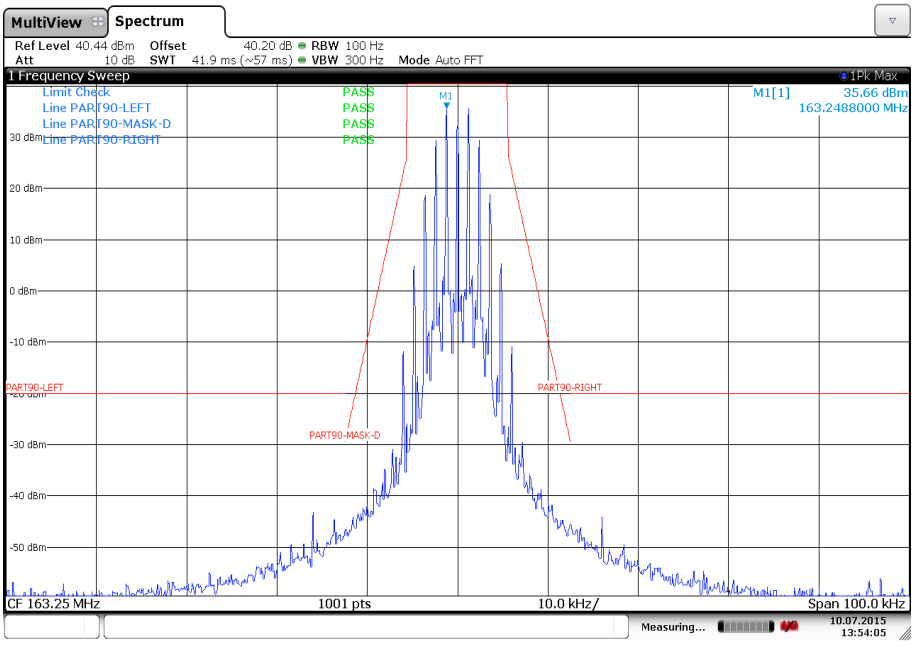
Date: 10.JUL.2015 13:53:06

Plot 13: Emission mask D – Mid channel – 2400 bits per second – Low power – Carrier unmodulated



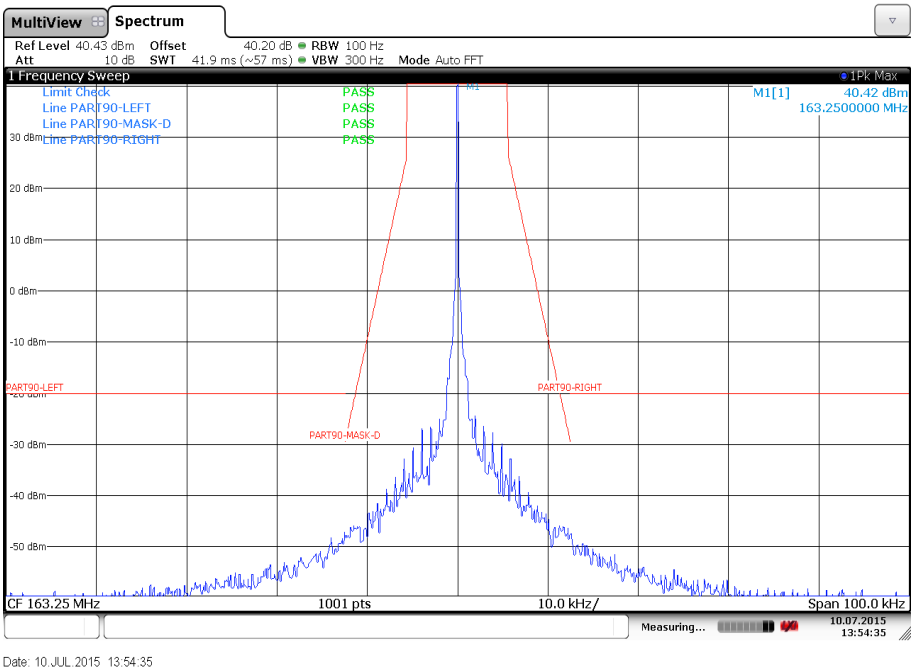
Date: 10.JUL.2015 13:53:33

Plot 14: Emission mask D – Mid channel – 2400 bits per second – Low power – Carrier modulated



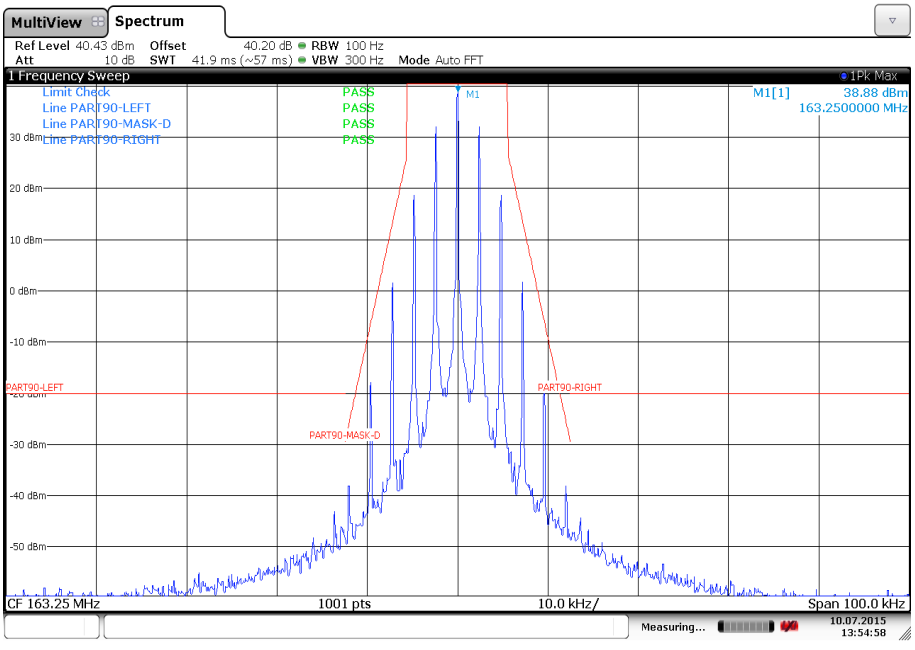
Date: 10.JUL.2015 13:54:05

Plot 15: Emission mask D – Mid channel – 4800 bits per second – Low power – Carrier unmodulated



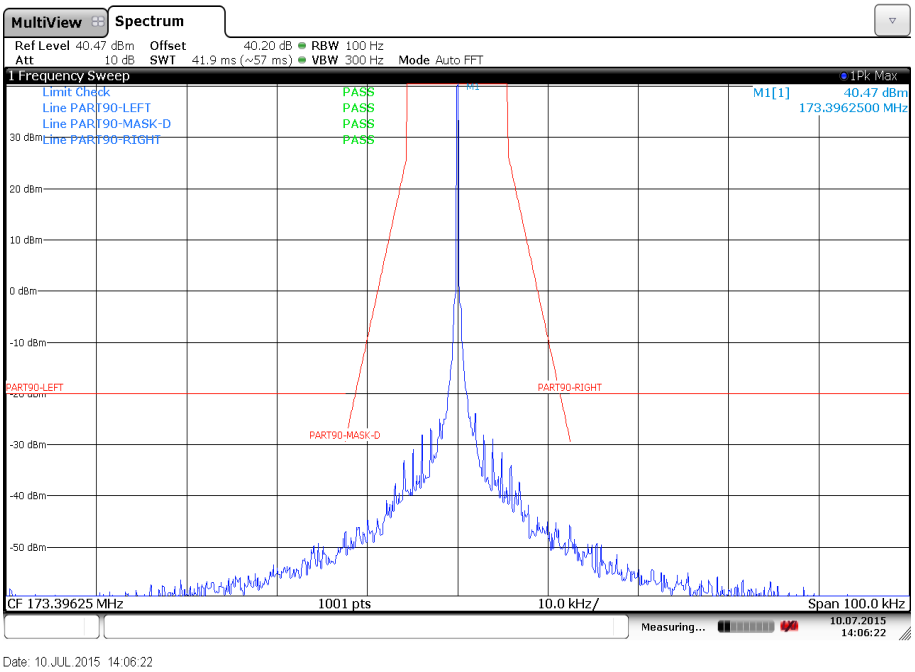
Date: 10.JUL.2015 13:54:35

Plot 16: Emission mask D – Mid channel – 4800 bits per second – Low power – Carrier modulated



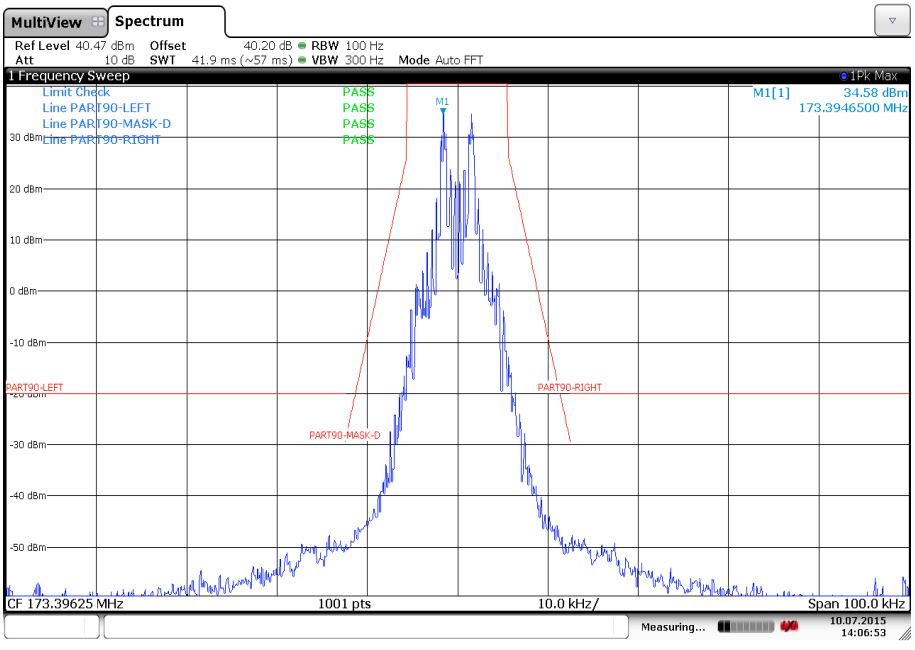
Date: 10.JUL.2015 13:54:58

Plot 17: Emission mask D – High channel – 512 bits per second – Low power – Carrier unmodulated



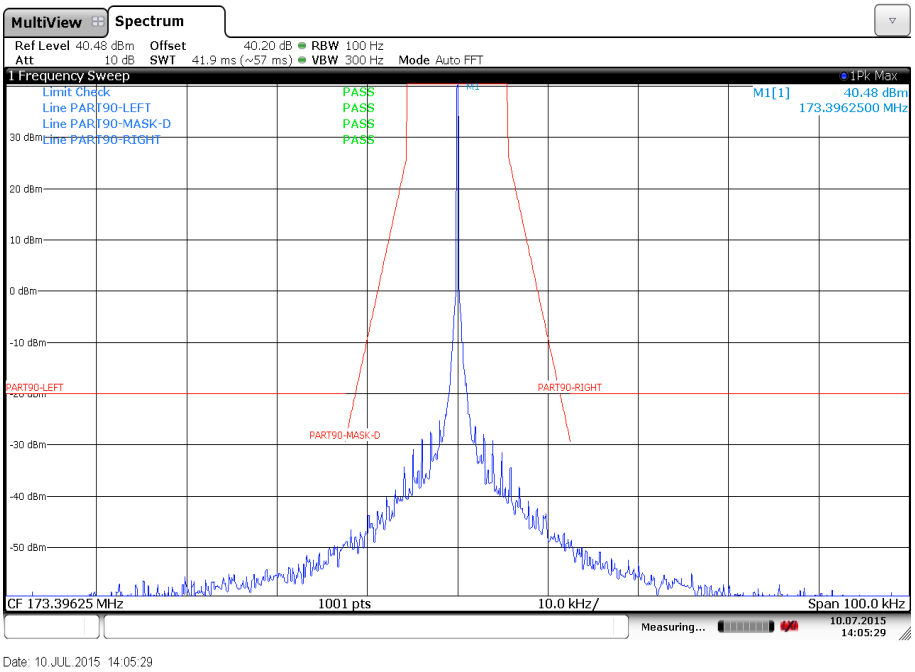
Date: 10.JUL.2015 14:06:22

Plot 18: Emission mask D – High channel – 512 bits per second – Low power – Carrier modulated



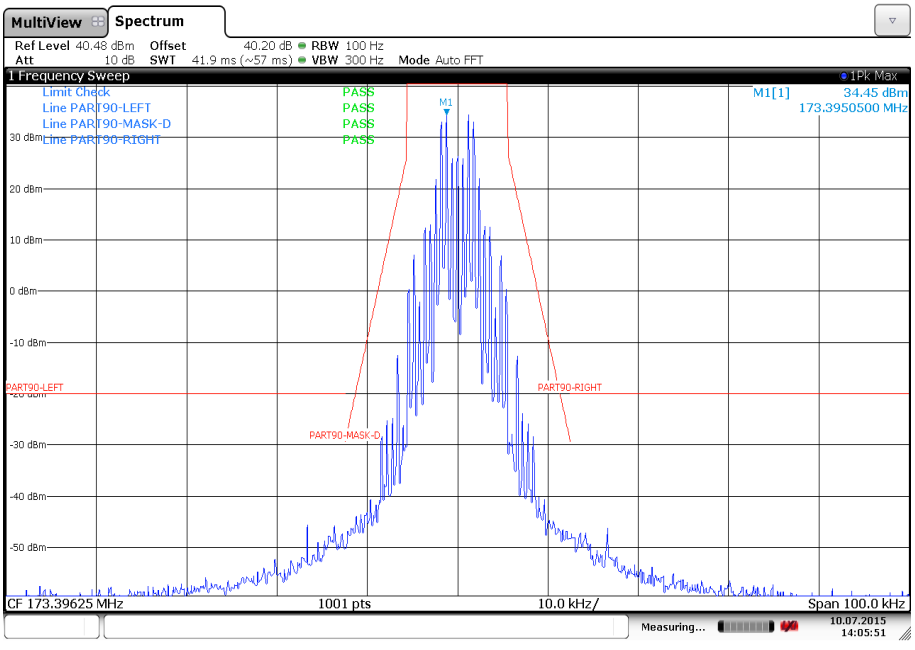
Date: 10.JUL.2015 14:06:52

Plot 19: Emission mask D – High channel – 1200 bits per second – Low power – Carrier unmodulated



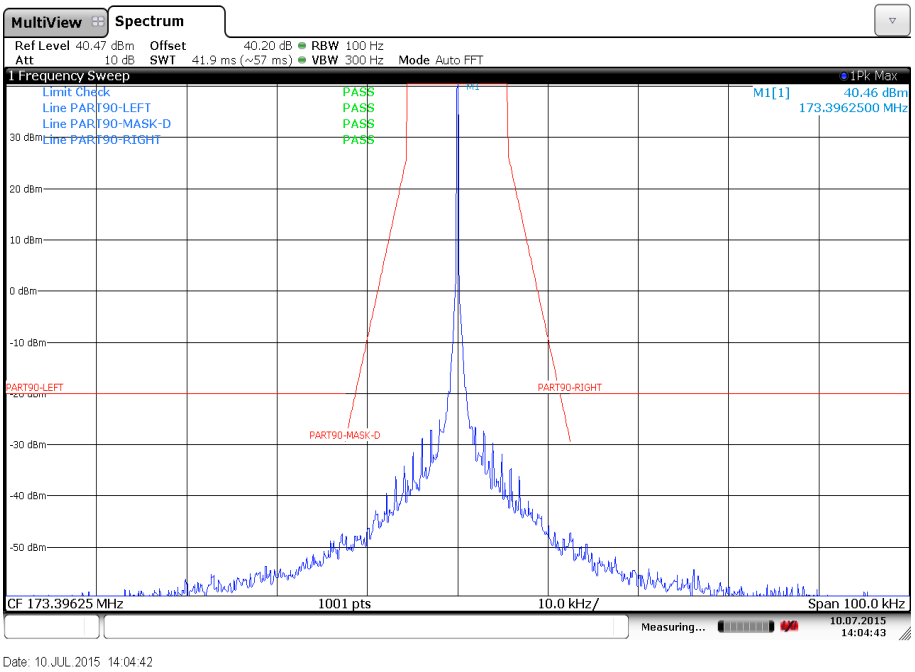
Date: 10.JUL.2015 14:05:29

Plot 20: Emission mask D – High channel – 1200 bits per second – Low power – Carrier modulated



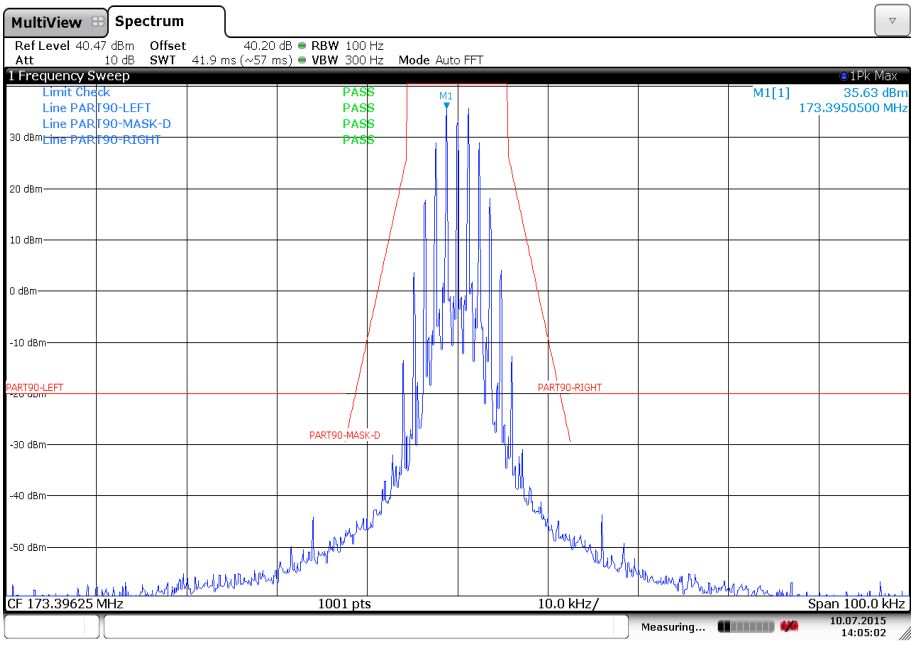
Date: 10.JUL.2015 14:05:51

Plot 21: Emission mask D – High channel – 2400 bits per second – Low power – Carrier unmodulated



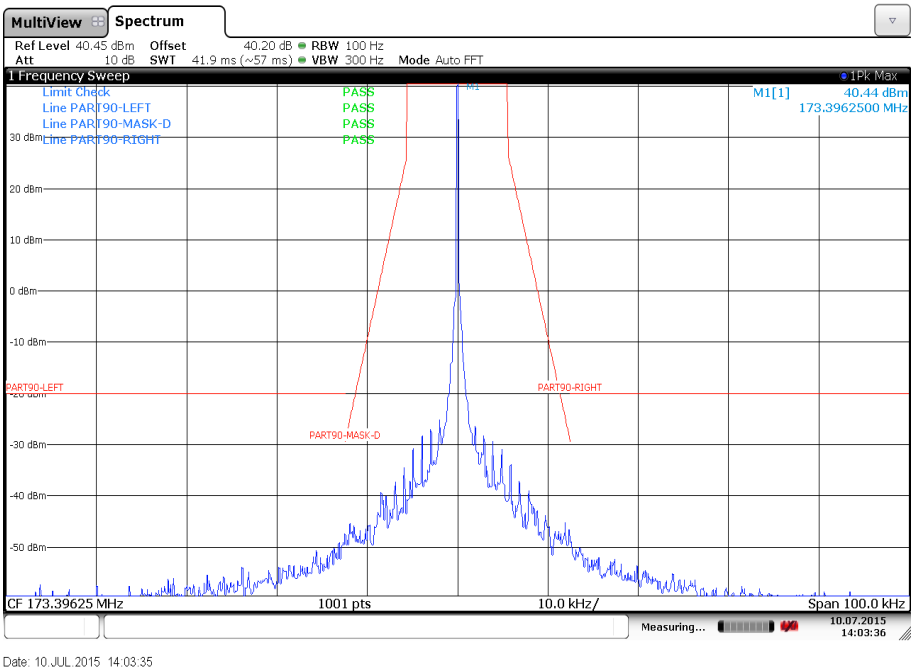
Date: 10.JUL.2015 14:04:42

Plot 22: Emission mask D – High channel – 2400 bits per second – Low power – Carrier modulated



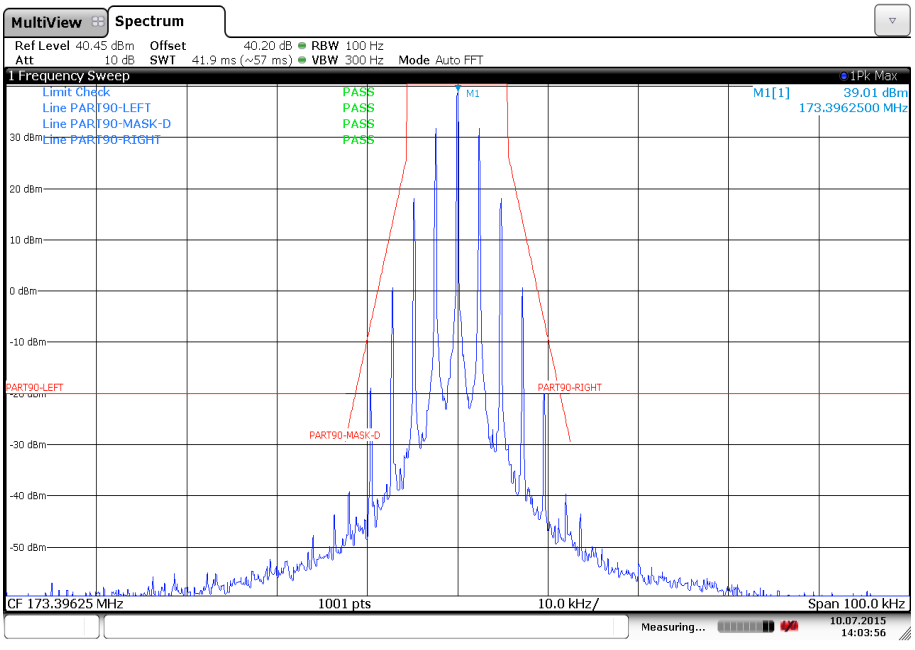
Date: 10.JUL.2015 14:05:02

Plot 23: Emission mask D – High channel – 4800 bits per second – Low power – Carrier unmodulated



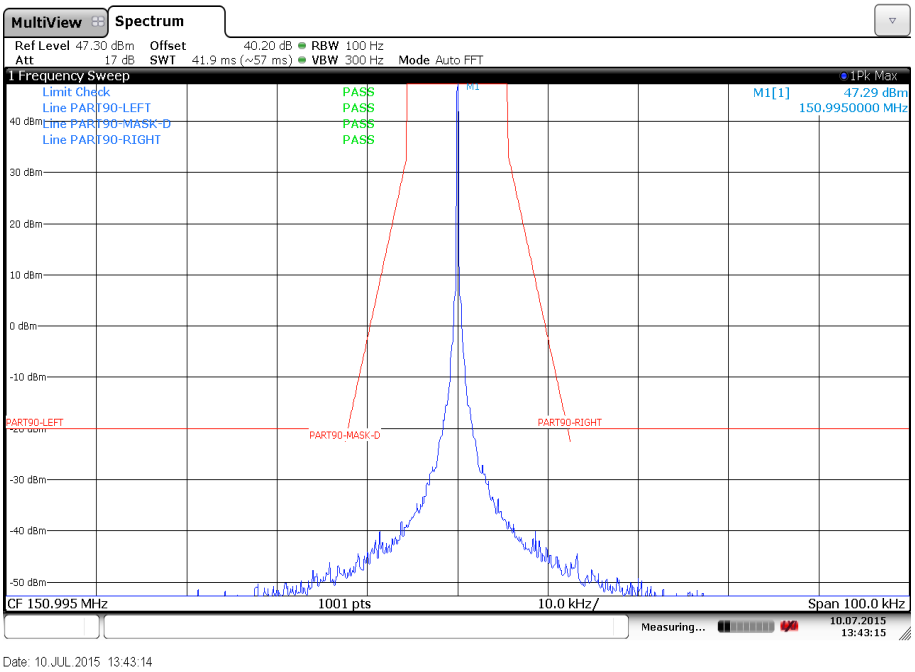
Date: 10.JUL.2015 14:03:35

Plot 24: Emission mask D – High channel – 4800 bits per second – Low power – Carrier modulated



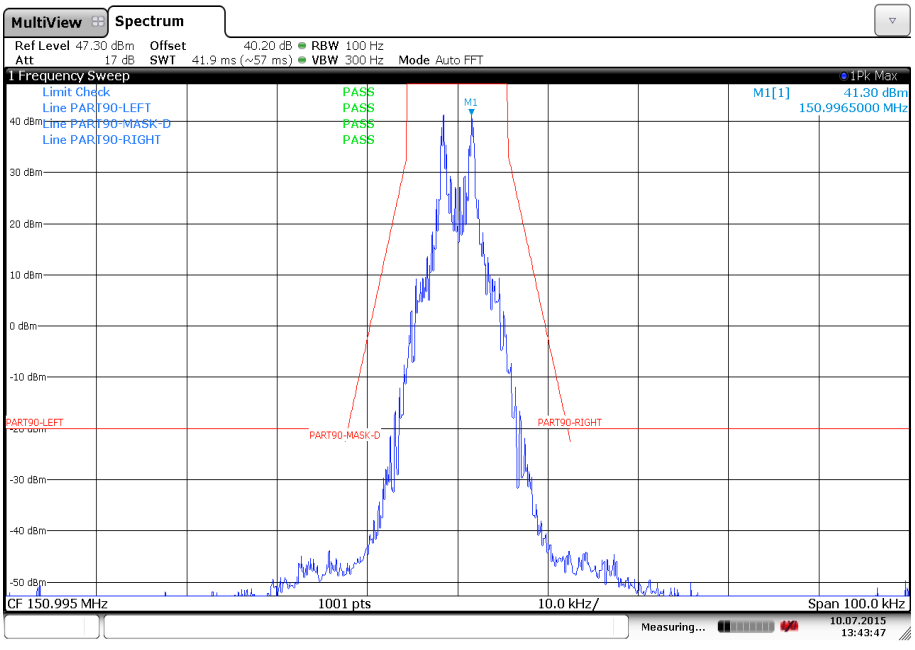
Date: 10.JUL.2015 14:03:56

Plot 25: Emission mask D – Low channel – 512 bits per second – High power – Carrier unmodulated



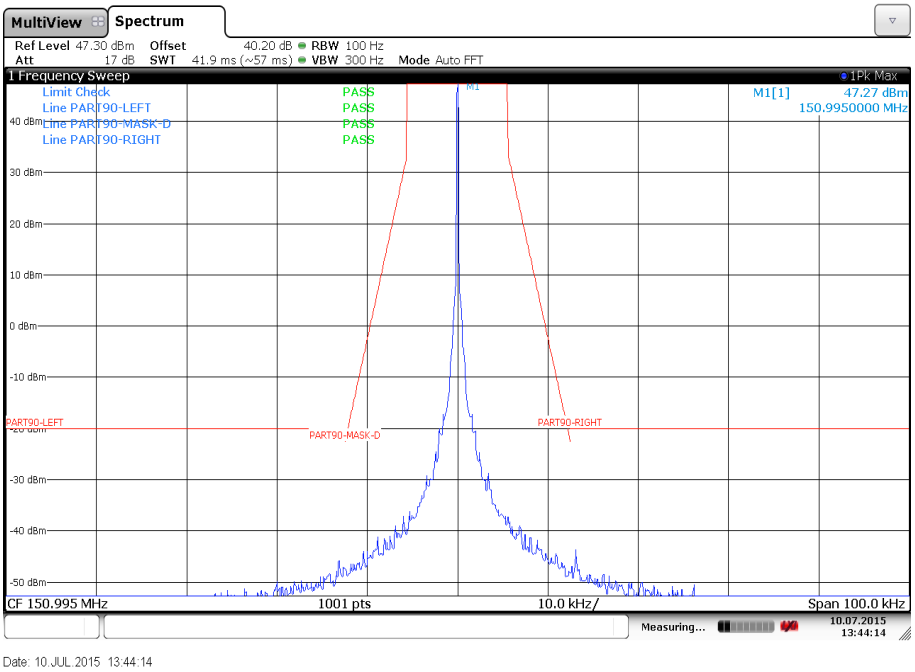
Date: 10.JUL.2015 13:43:14

Plot 26: Emission mask D – Low channel – 512 bits per second – High power – Carrier modulated

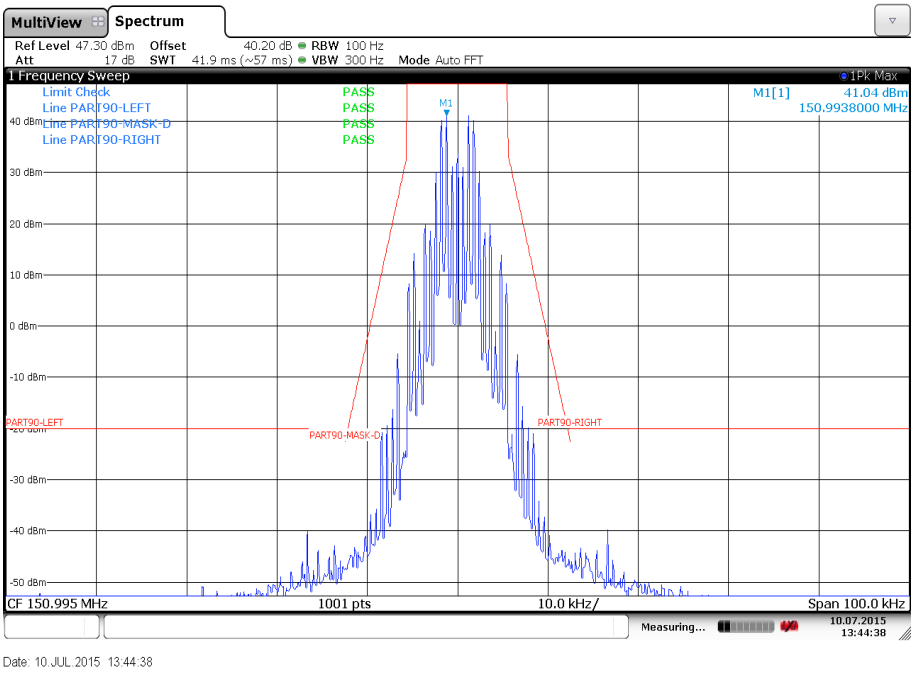


Date: 10.JUL.2015 13:43:47

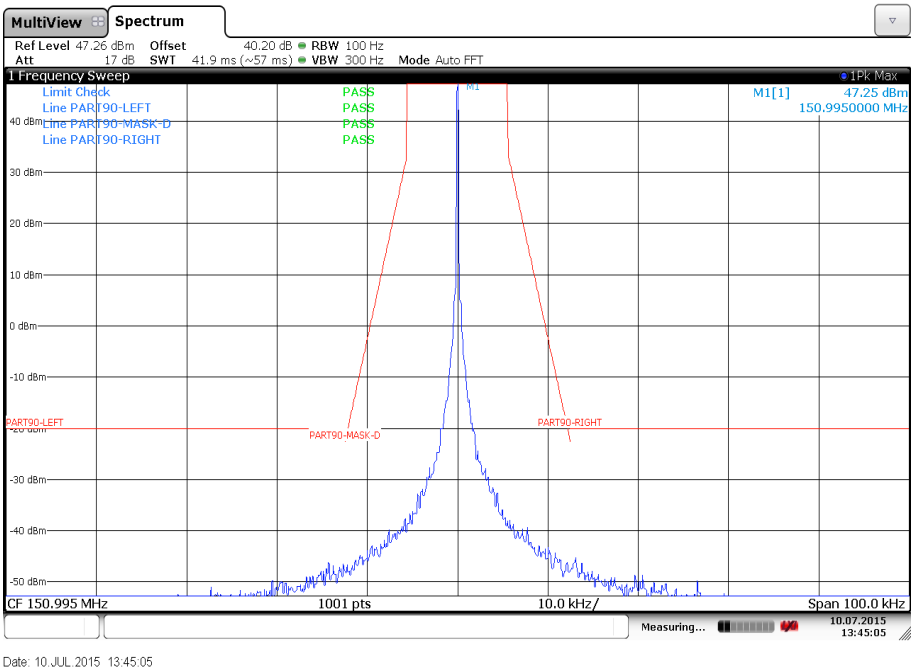
Plot 27: Emission mask D – Low channel – 1200 bits per second – High power – Carrier unmodulated



Plot 28: Emission mask D – Low channel – 1200 bits per second – High power – Carrier modulated

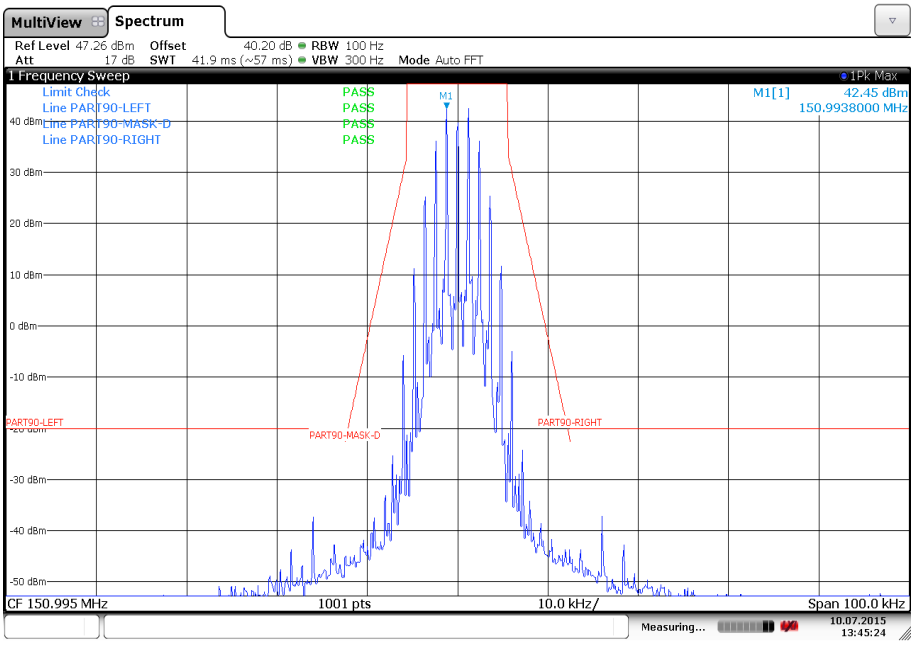


Plot 29: Emission mask D – Low channel – 2400 bits per second – High power – Carrier unmodulated



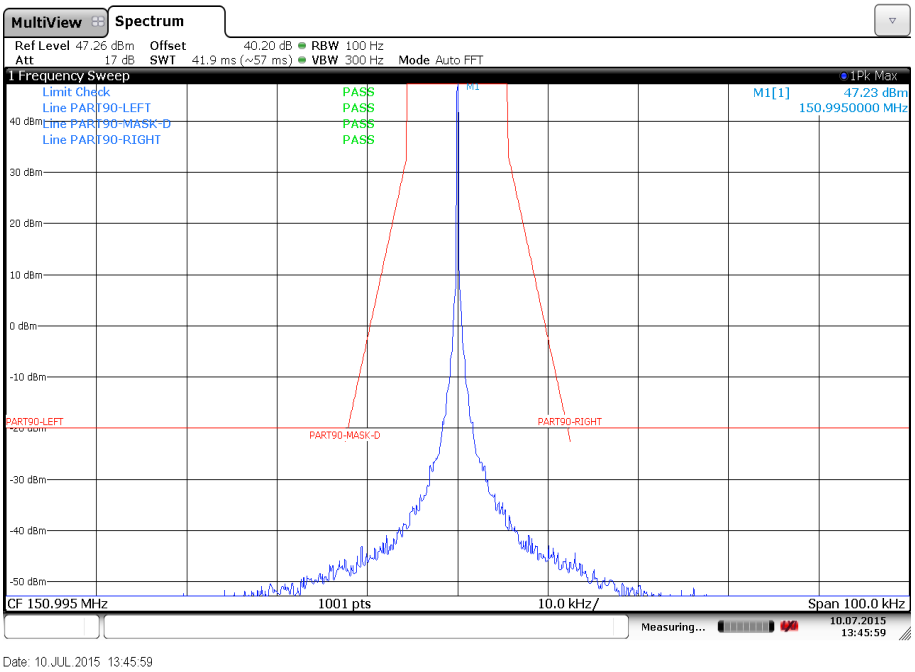
Date: 10.JUL.2015 13:45:05

Plot 30: Emission mask D – Low channel – 2400 bits per second – High power – Carrier modulated



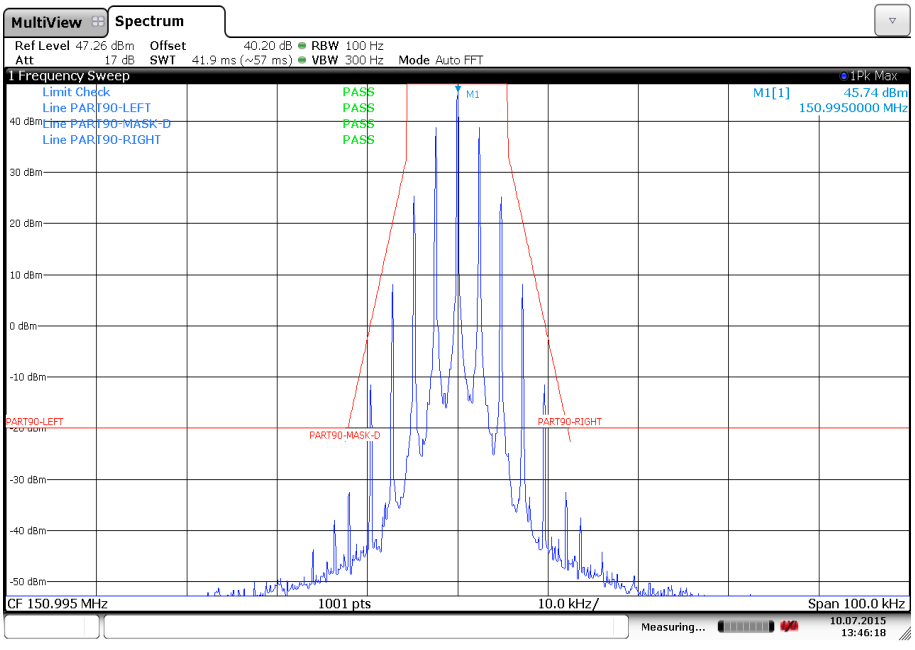
Date: 10.JUL.2015 13:45:23

Plot 31: Emission mask D – Low channel – 4800 bits per second – High power – Carrier unmodulated



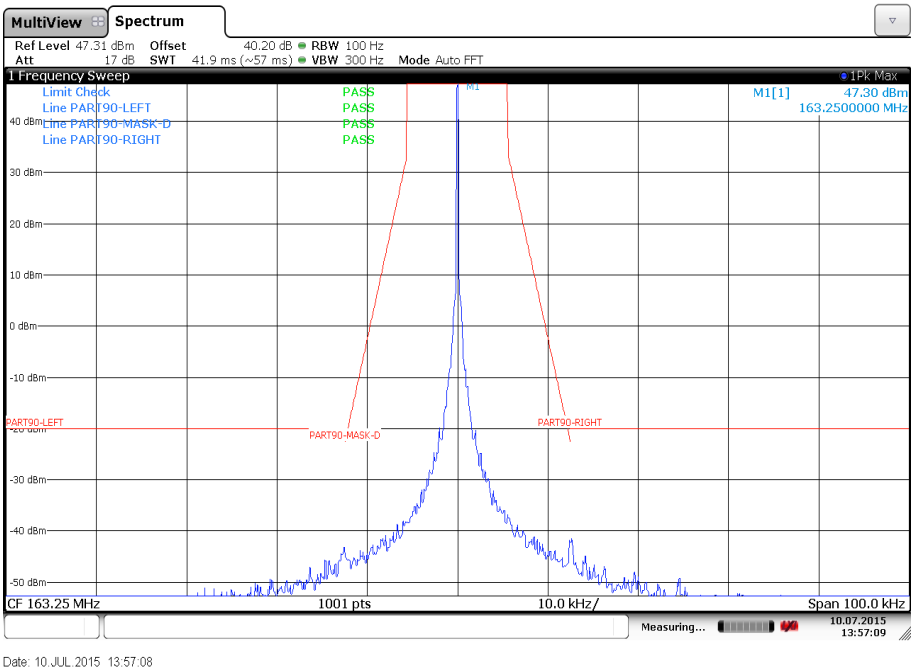
Date: 10.JUL.2015 13:45:59

Plot 32: Emission mask D – Low channel – 4800 bits per second – High power – Carrier modulated



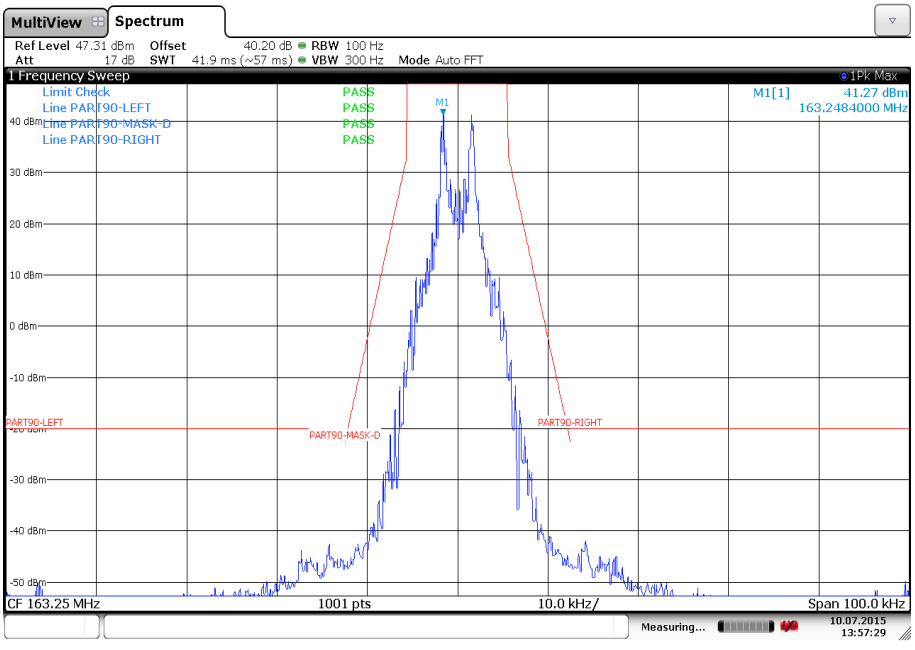
Date: 10.JUL.2015 13:46:17

Plot 33: Emission mask D – Mid channel – 512 bits per second – High power – Carrier unmodulated



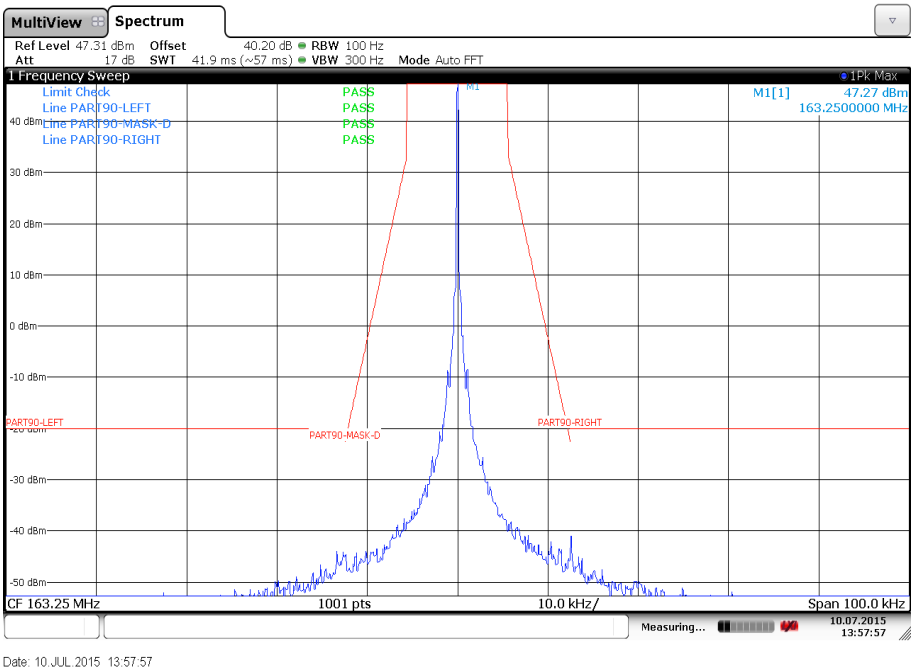
Date: 10.JUL.2015 13:57:08

Plot 34: Emission mask D – Mid channel – 512 bits per second – High power – Carrier modulated



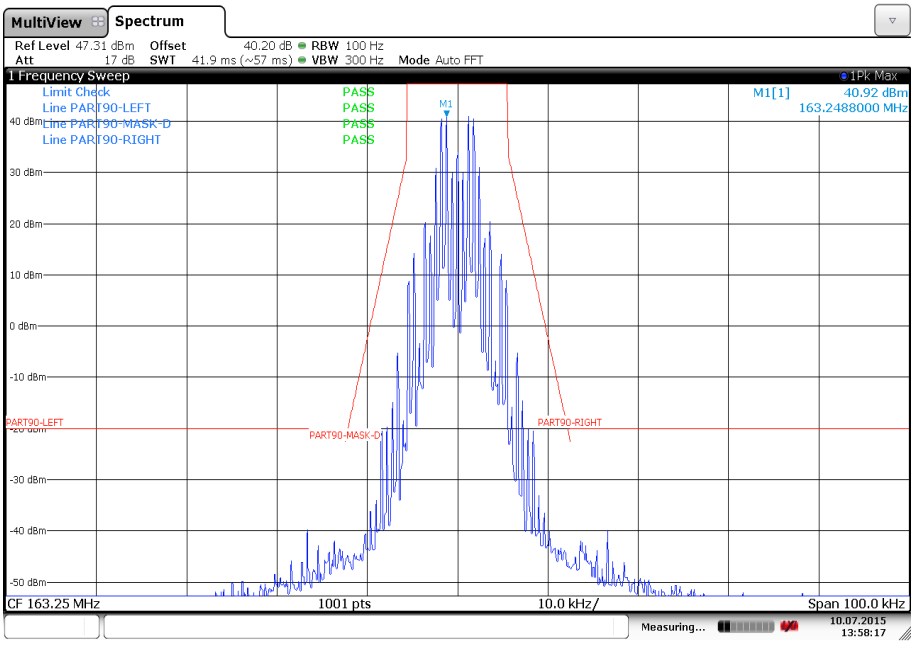
Date: 10.JUL.2015 13:57:29

Plot 35: Emission mask D – Mid channel – 1200 bits per second – High power – Carrier unmodulated



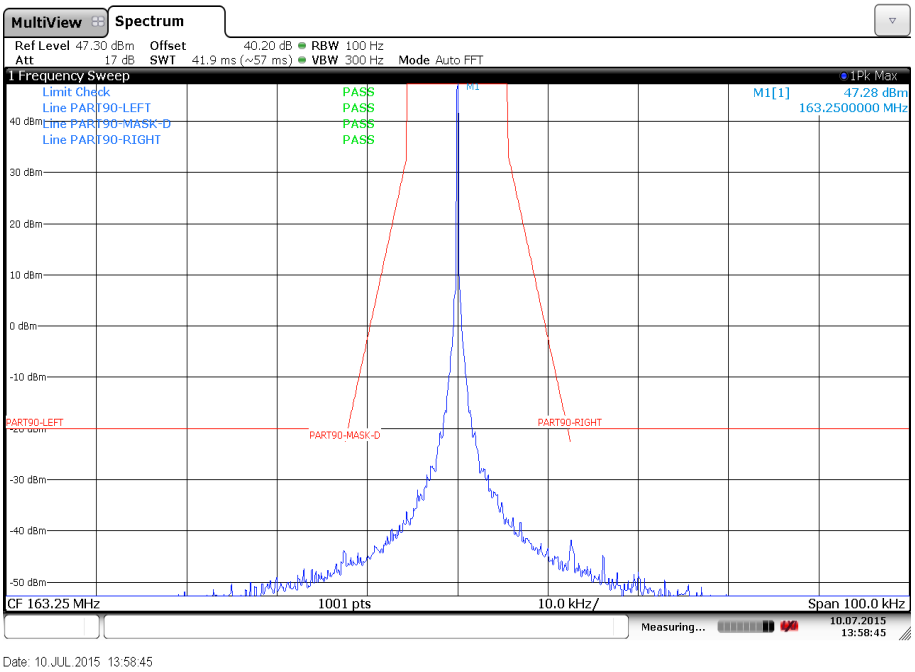
Date: 10.JUL.2015 13:57:57

Plot 36: Emission mask D – Mid channel – 1200 bits per second – High power – Carrier modulated



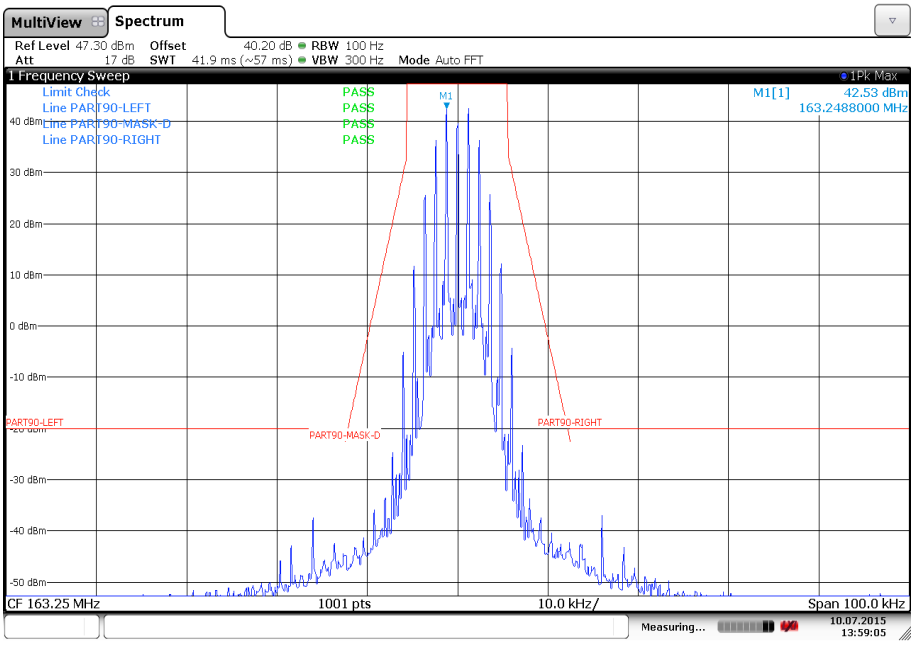
Date: 10.JUL.2015 13:58:17

Plot 37: Emission mask D – Mid channel – 2400 bits per second – High power – Carrier unmodulated



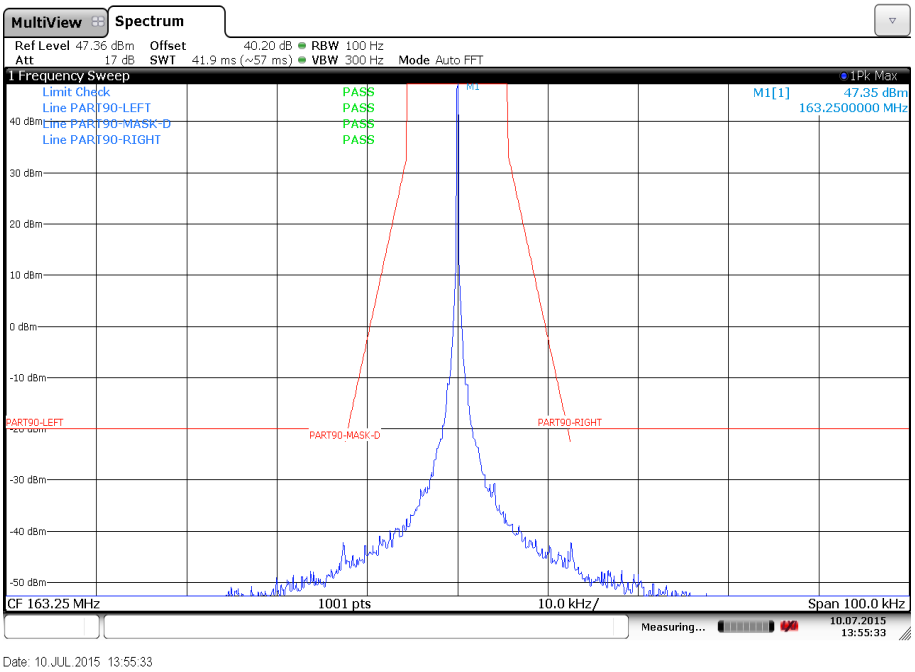
Date: 10.JUL.2015 13:58:45

Plot 38: Emission mask D – Mid channel – 2400 bits per second – High power – Carrier modulated



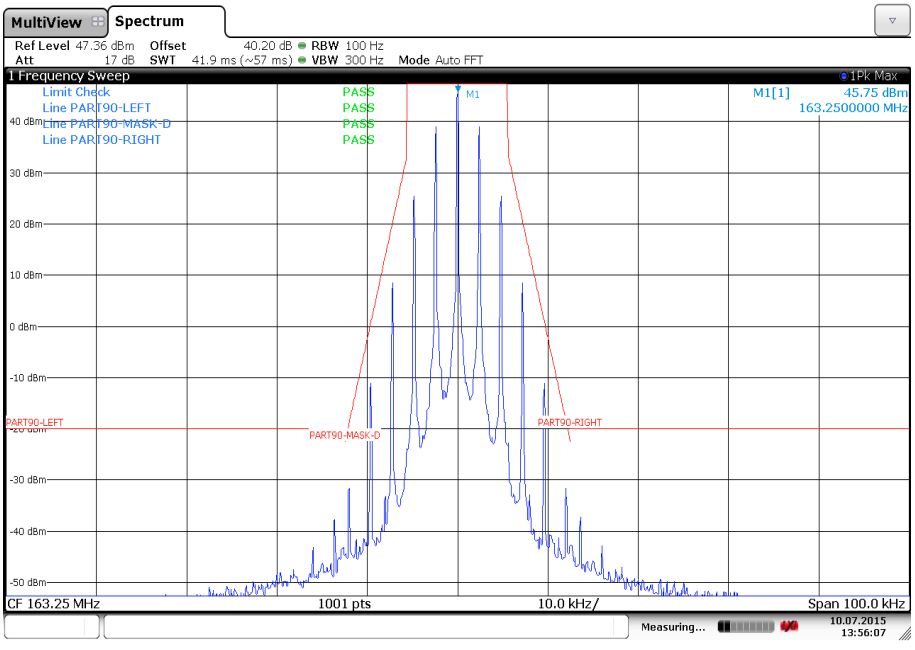
Date: 10.JUL.2015 13:59:05

Plot 39: Emission mask D – Mid channel – 4800 bits per second – High power – Carrier unmodulated



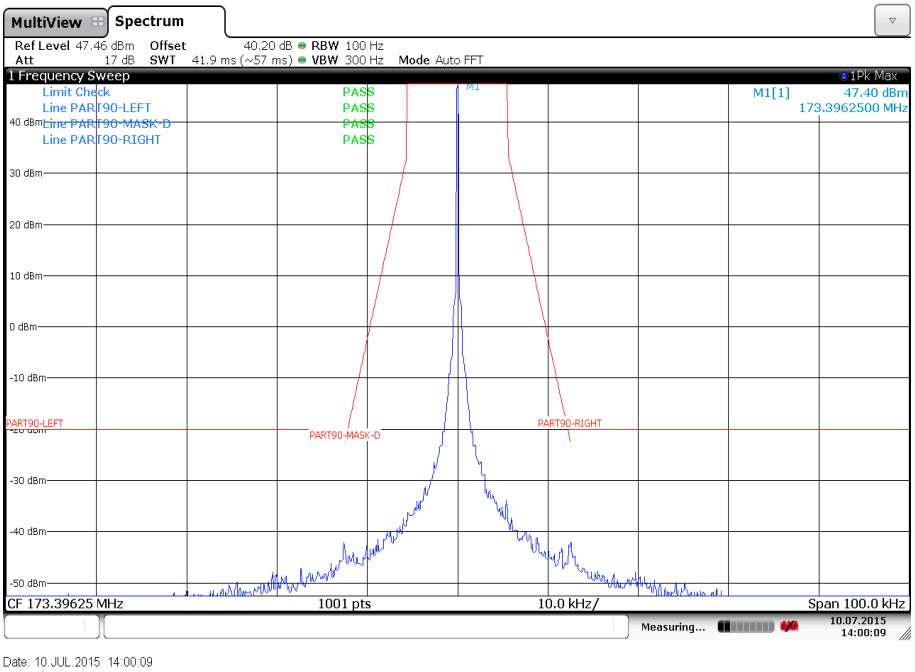
Date: 10.JUL.2015 13:55:33

Plot 40: Emission mask D – Mid channel – 4800 bits per second – High power – Carrier modulated



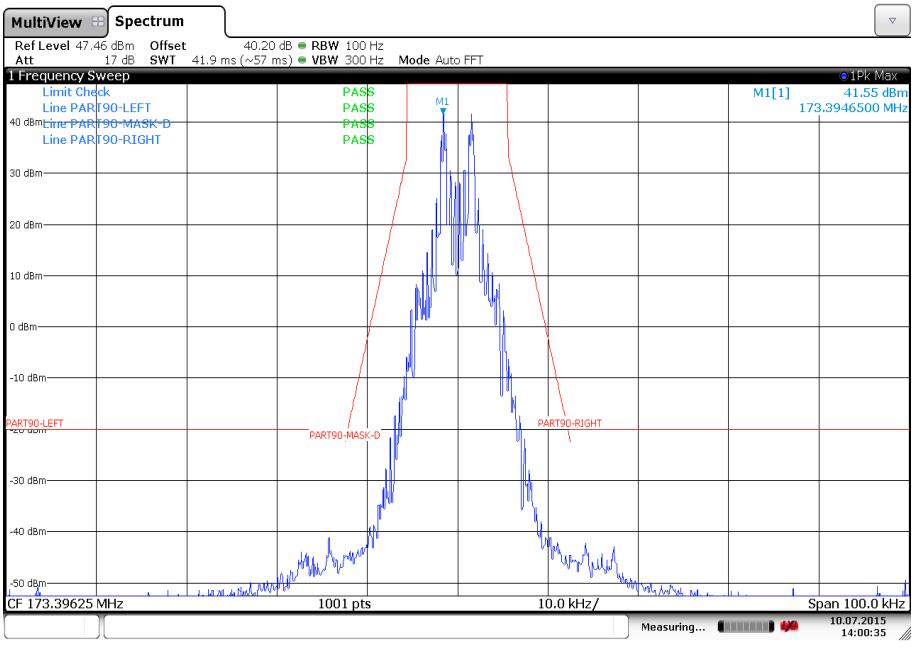
Date: 10.JUL.2015 13:56:07

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



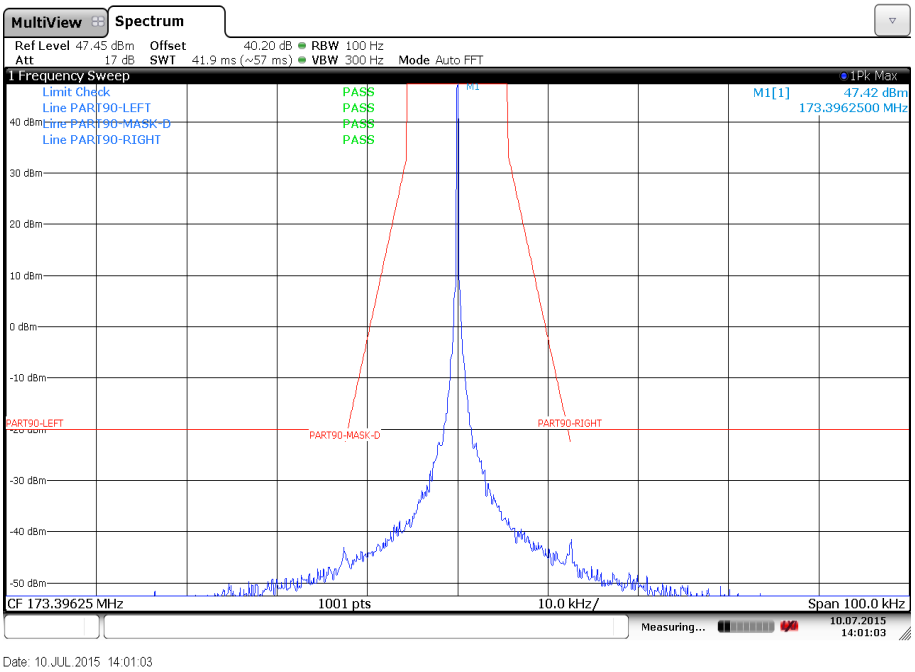
Date: 10.JUL.2015 14:00:09

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



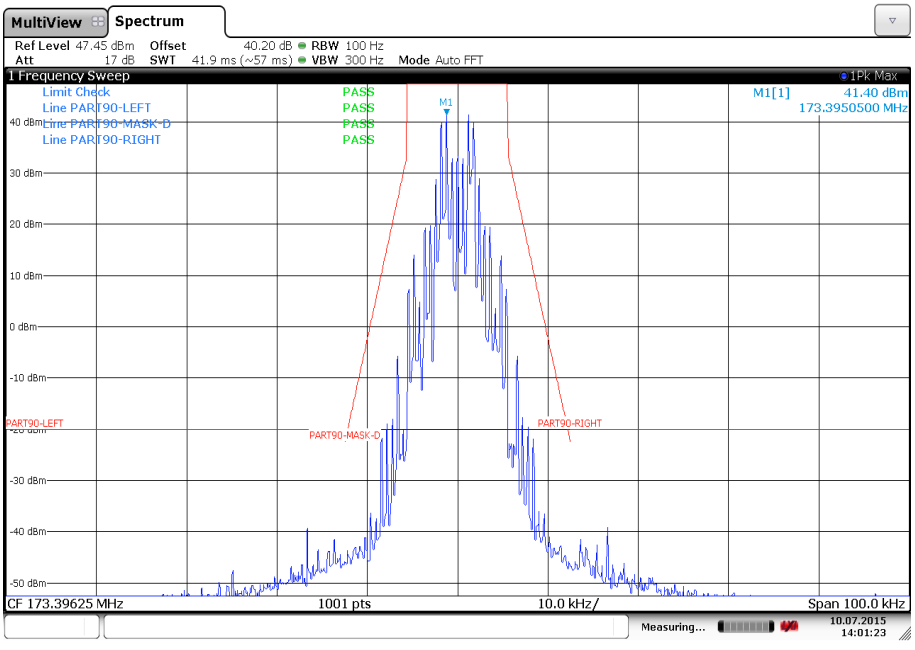
Date: 10.JUL.2015 14:00:35

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



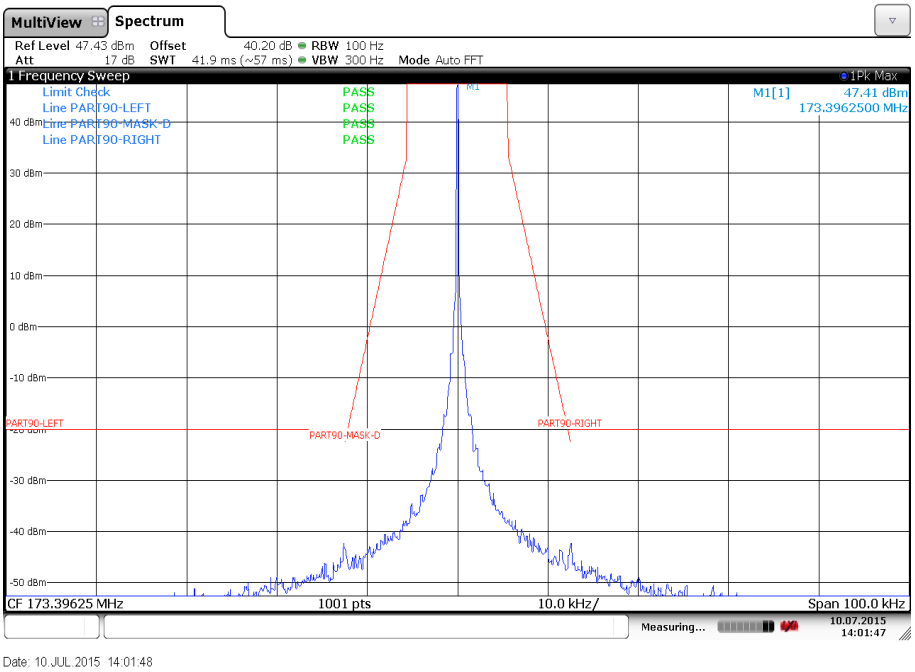
Date: 10.JUL.2015 14:01:03

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



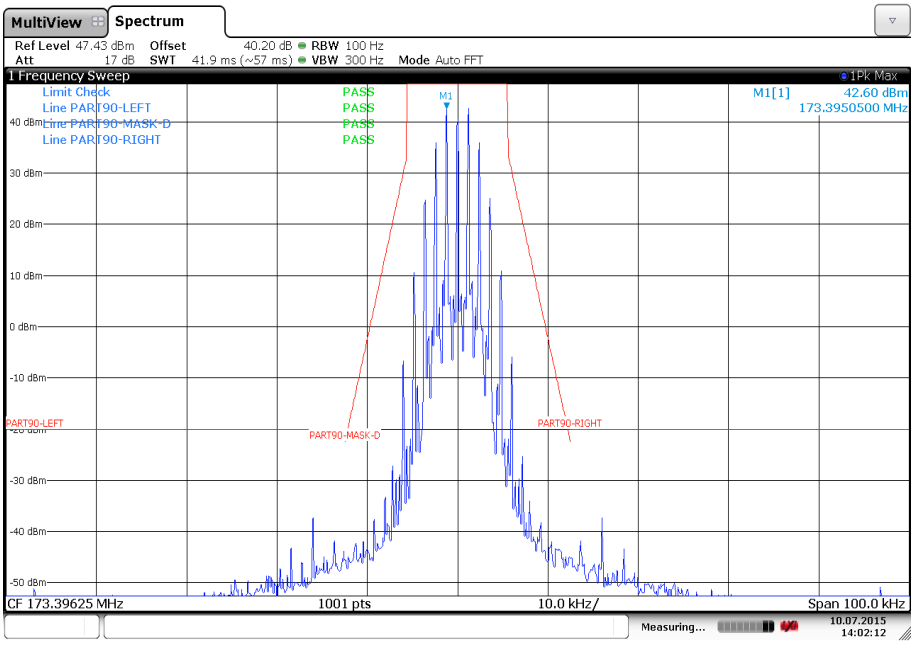
Date: 10.JUL.2015 14:01:23

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



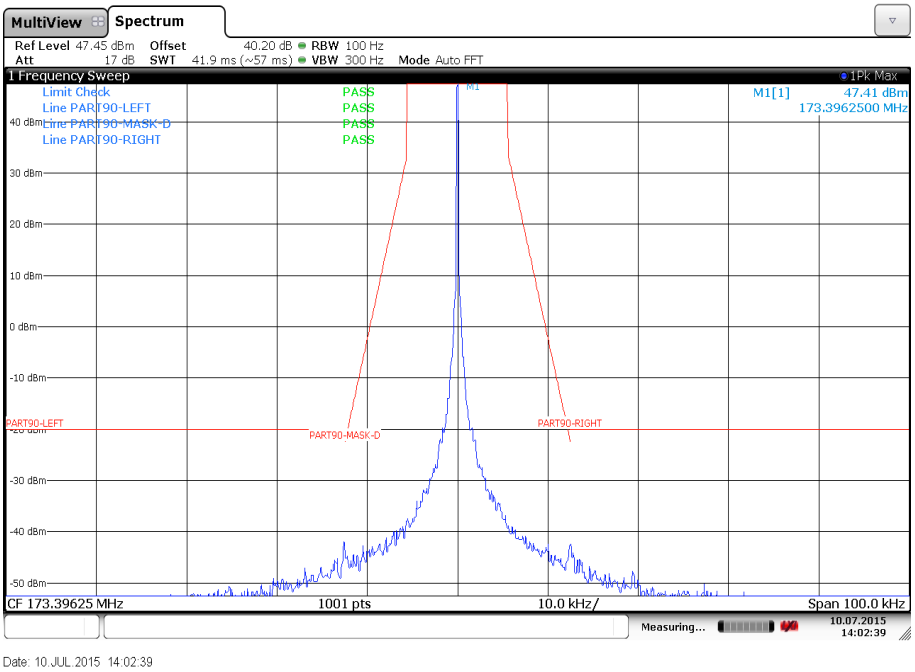
Date: 10.JUL.2015 14:01:48

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



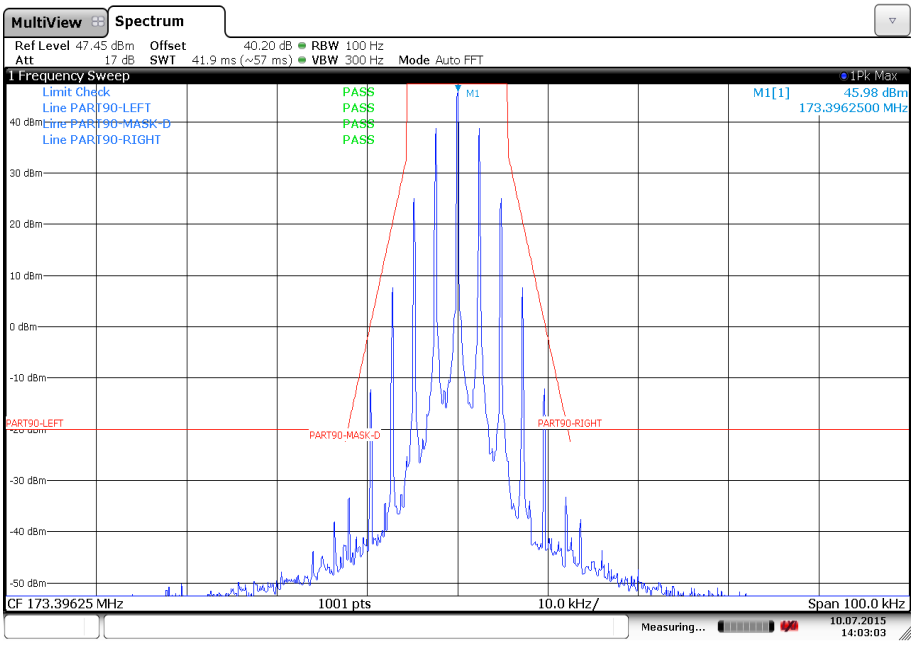
Date: 10.JUL.2015 14:02:12

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



Date: 10.JUL.2015 14:02:39

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



Date: 10.JUL.2015 14:03:04

12.4 Transient frequency behaviour

Measurement:

The first plot shows the measurement of the carrier signal to show that a clean carrier is transmitted which results in a measured bandwidth of nearly twice the used RBW.
The following plots show triggered measurements in the time domain with a RBW of 6.25 kHz (3-dB filter). A decrease of this power level of 3 dB can be correlated to a frequency error of a half RBW (3.125 kHz). Therefore the frequency error is less than ± 3.125 kHz as long as the power level is in the 3 dB range. This criteria was taken as worst case condition to show compliance.

Limits:

FCC
FCC 47 CFR § 90.214
Transient frequency behaviour

For 12.5 kHz channels			
Transient periods	Maximum frequency difference	Frequency range 150 – 174 MHz	Frequency range 421 - 512 MHz
t_1 (ms)	±12.5 kHz	5.0 ms	10.0 ms
t_2 (ms)	± 6.5 kHz	20.0 ms	25.0 ms
t_3 (ms)	±12.5 kHz	5.0 ms	10.0 ms

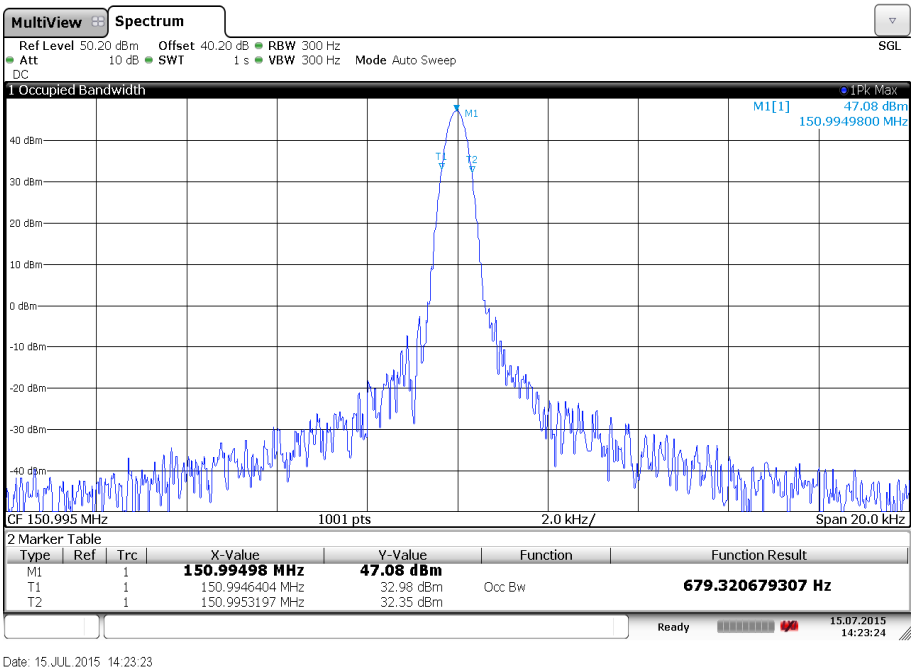
t_1 is the time period immediately following t_{on}.
t_2 is the time period immediately following t_1.
t_3 is the time period from the instant when the transmitter is turned off until t_{off}.

Result: (also see plots)

Test szenario	Lowest channel	Middle channel	Highest channel
The frequency stabilizes within the required frequency tolerance range after switching on the transmitter during period t_1 after:	1.4 ms	2.1 ms	2.1 ms
Maximum power deviation during t_2: (power deviation below 3 dB conforms a frequency deviation below ± 3.125 kHz)	-0.82 dB	-0.82 dB	-1.10 dB
Switch off time (t_3):	1.8 ms	1.5 ms	1.5 ms

Plots of the measurement:

Plot 1: Lowest channel - Carrier



Date: 15.JUL.2015 14:23:23

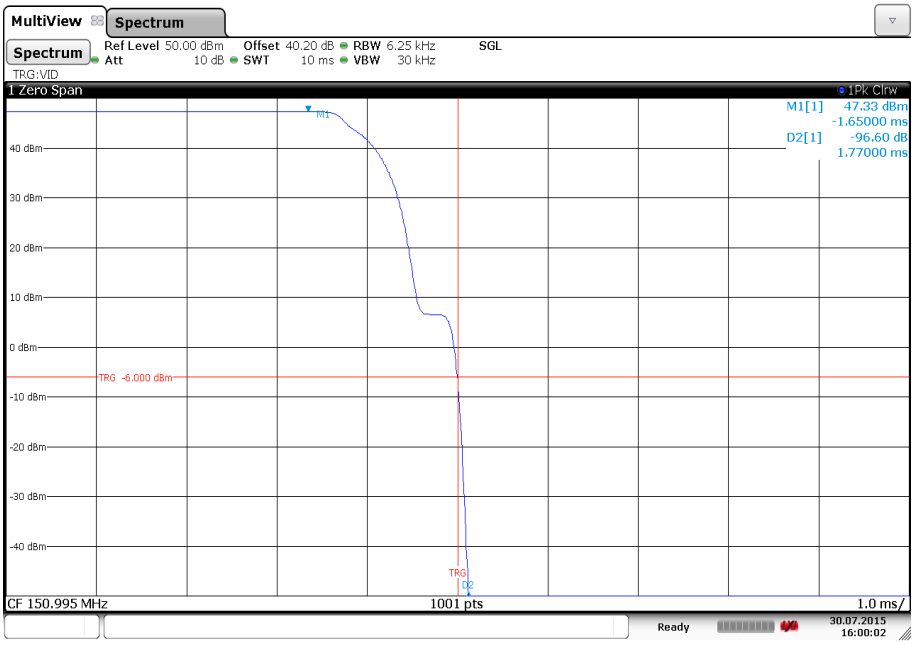
Plot 2: Lowest channel – Switch on (zoomed)

Date: 15.JUL.2015 14:57:04

Plot 3: Lowest channel – Operating

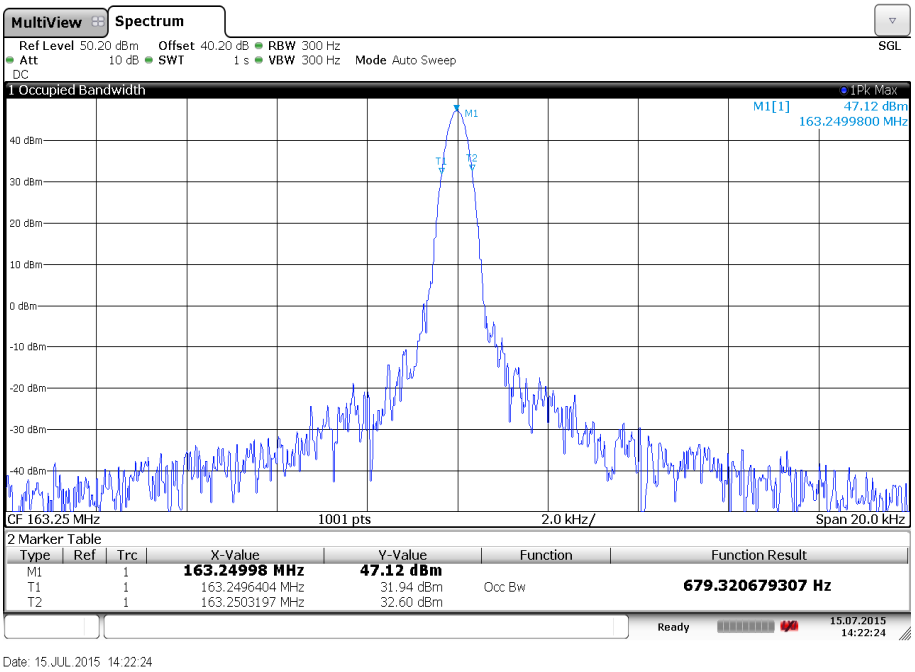
Date: 15.JUL.2015 14:56:23

Plot 4: Lowest channel – Switch off (zoomed)



Date: 30.JUL.2015 16:00:01

Plot 5: Middle channel - Carrier



Date: 15.JUL.2015 14:22:24

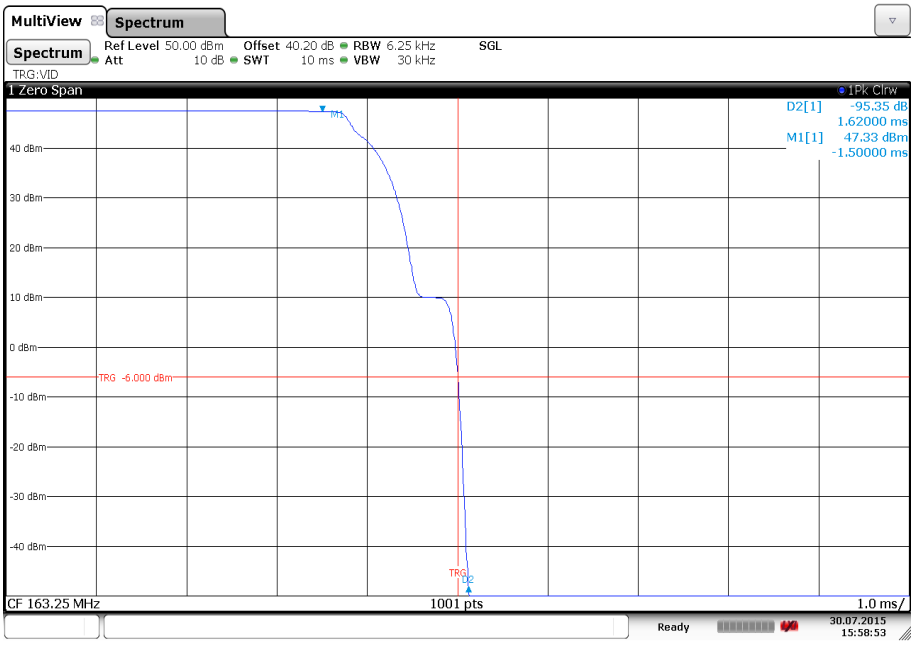
Plot 6: Middle channel – Switch on (zoomed)

Date: 15.JUL.2015 14:57:47

Plot 7: Middle channel – Operating

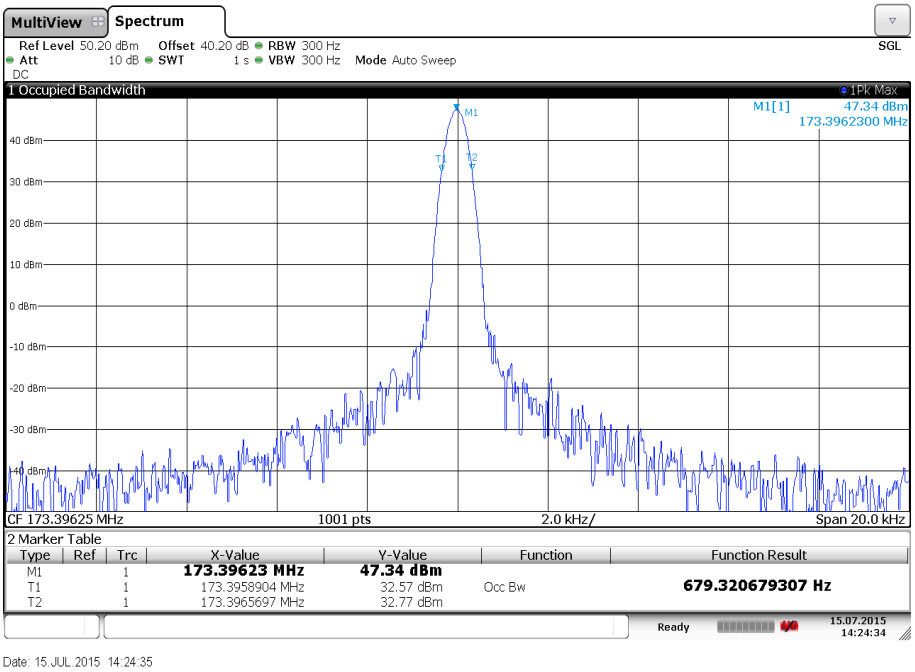
Date: 15.JUL.2015 14:54:56

Plot 8: Middle channel – Switch off (zoomed)



Date: 30.JUL.2015 15:58:53

Plot 9: Highest channel - Carrier

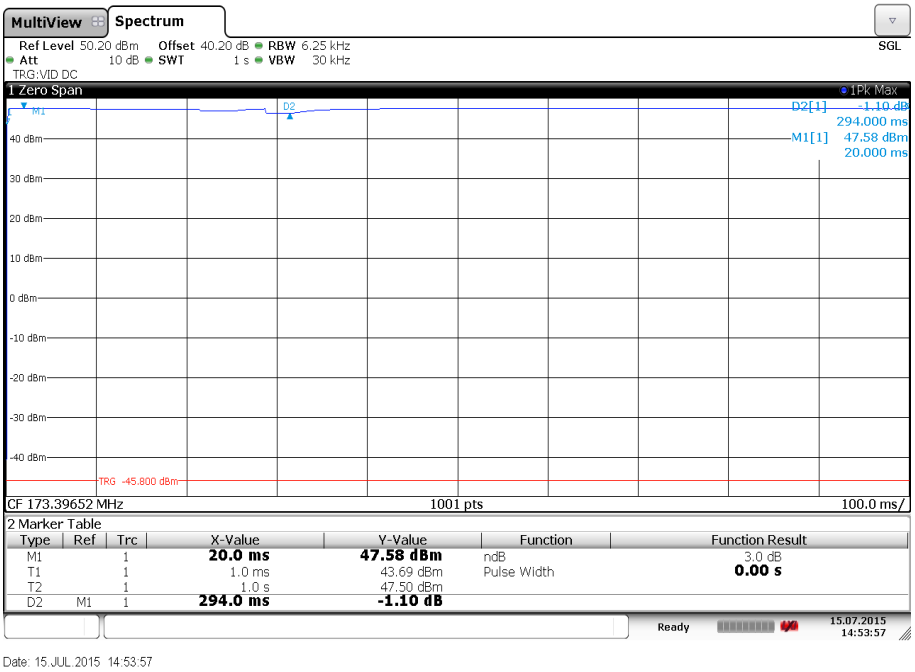


Date: 15.JUL.2015 14:24:35

Plot 10: Highest channel – Switch on (zoomed)

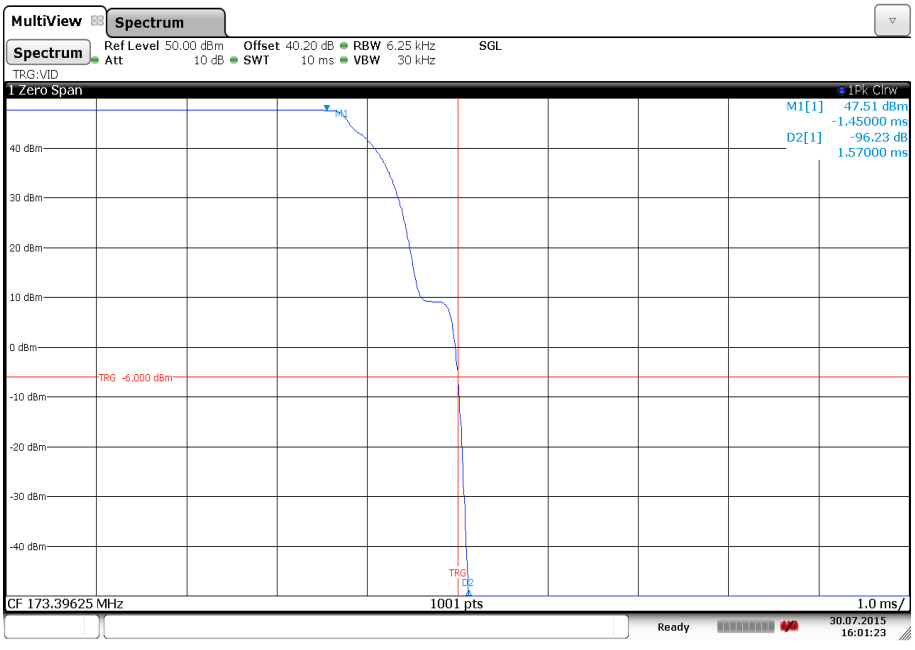
Date: 15.JUL.2015 14:58:36

Plot 11: Highest channel – Operating



Date: 15.JUL.2015 14:53:57

Plot 12: Highest channel – Switch off (zoomed)



Date: 30.JUL.2015 16:01:23

12.5 Frequency stability

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	30 Hz
Video bandwidth:	300 Hz
Span:	5 kHz
Trace mode:	Max. hold
Test setup:	See sub clause 8.3 B
Measurement uncertainty	See sub clause 9

Limits:

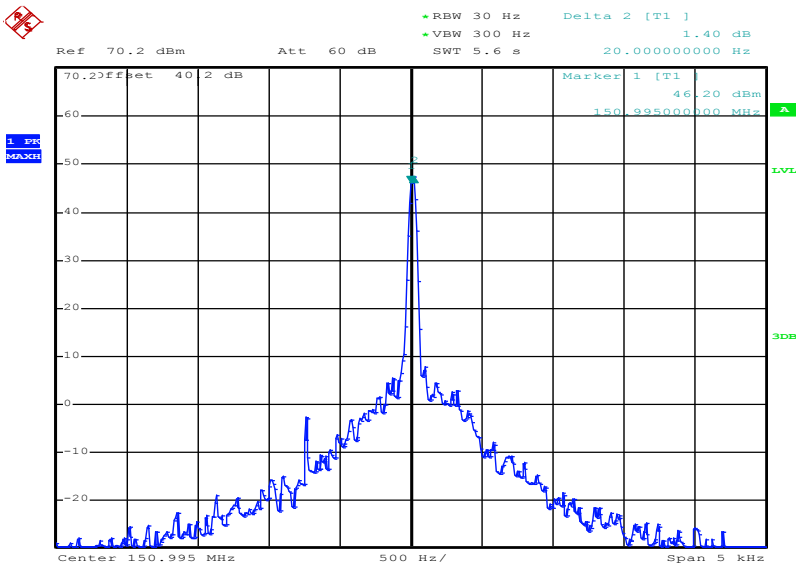
FCC
FCC 47 CFR § 2.1055 (a)(1) § 90.213
150–174 MHz band: 5 ppm for 12.5 kHz channel spacing 421–512 MHz band: 2.5 ppm for 12.5 kHz channel spacing

Results:

Temperature	Deviation (Hz)	Deviation (ppm)	Deviation (Hz)	Deviation (ppm)	Deviation (Hz)	Deviation (ppm)
	Low channel		Middle channel		High channel	
-20 °C	20	0.13	20	0.12	20	0.12
-10 °C	10	0.07	20	0.12	20	0.12
0 °C	0	0	10	0.06	10	0.06
10 °C	20	0.13	20	0.12	20	0.12
20 °C (V nom)	20	0.13	20	0.12	20	0.12
30 °C	0	0	10	0.06	10	0.06
40 °C	0	0	0	0	10	0.06
50 °C	0	0	20	0.12	10	0.06
Voltage	Deviation (Hz)	Deviation (ppm)	Deviation (Hz)	Deviation (ppm)	Deviation (Hz)	Deviation (ppm)
85 %	20	0.13	20	0.12	20	0.12
115 %	20	0.13	20	0.12	10	0.06

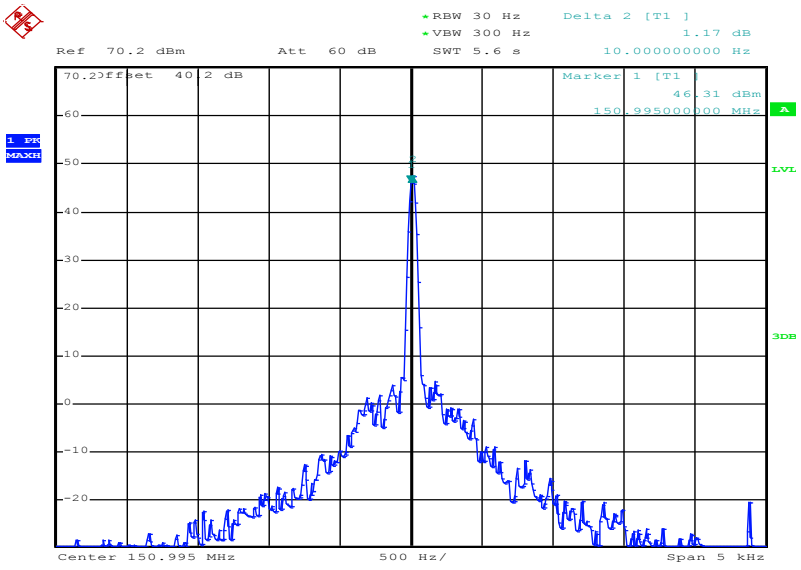
Plots of the measurements

Plot 1: Low channel – Temperature: -20°C



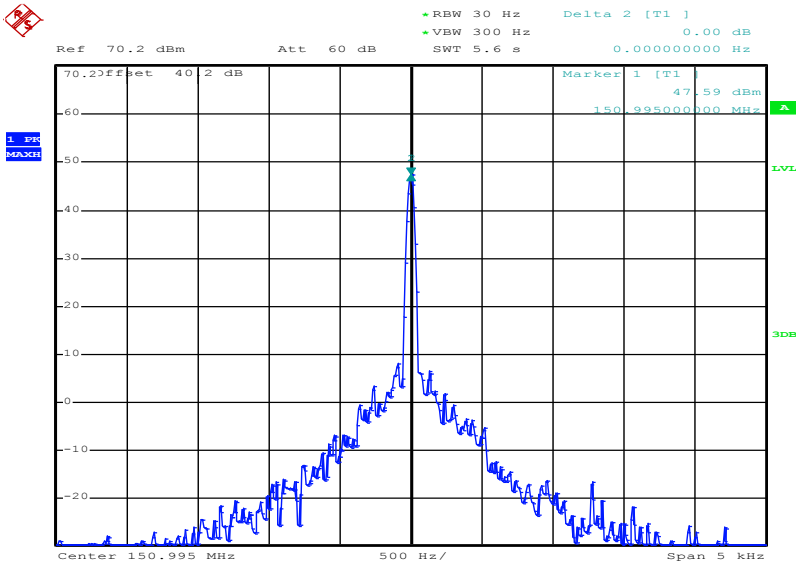
Date: 16.JUL.2015 14:54:47

Plot 2: Low channel – Temperature: -10°C



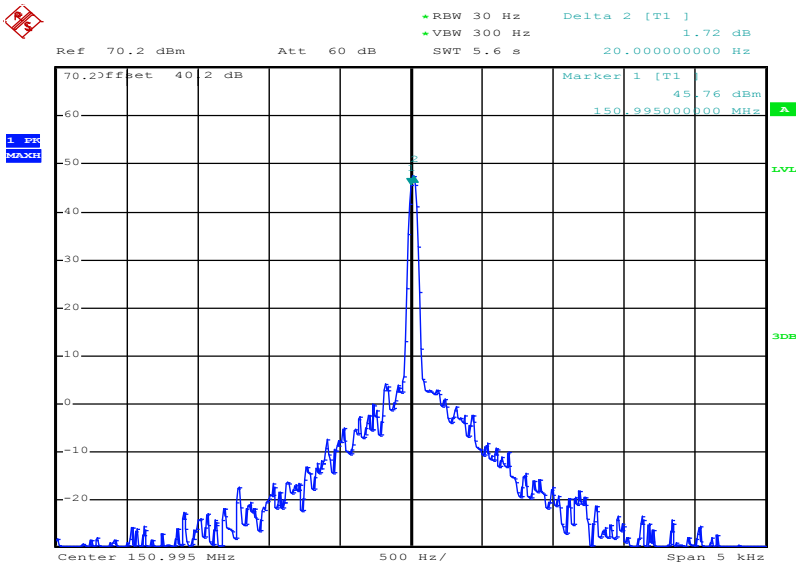
Date: 16.JUL.2015 15:08:34

Plot 3: Low channel – Temperature: 0°C



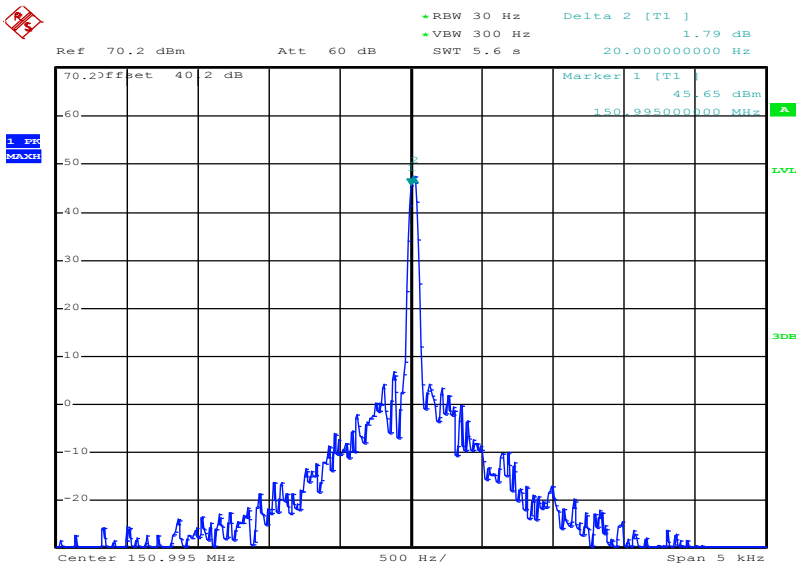
Date: 16.JUL.2015 15:23:19

Plot 4: Low channel – Temperature: 10°C



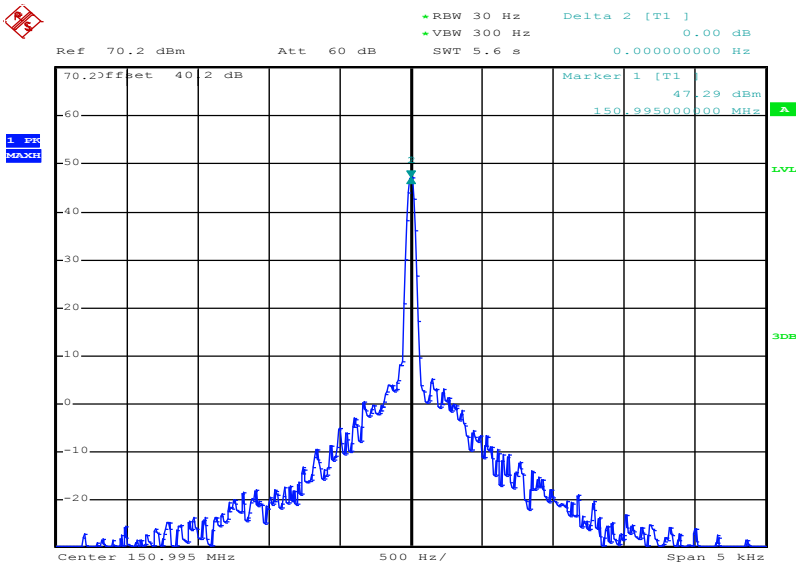
Date: 16.JUL.2015 15:39:43

Plot 5: Low channel – Temperature: 20°C



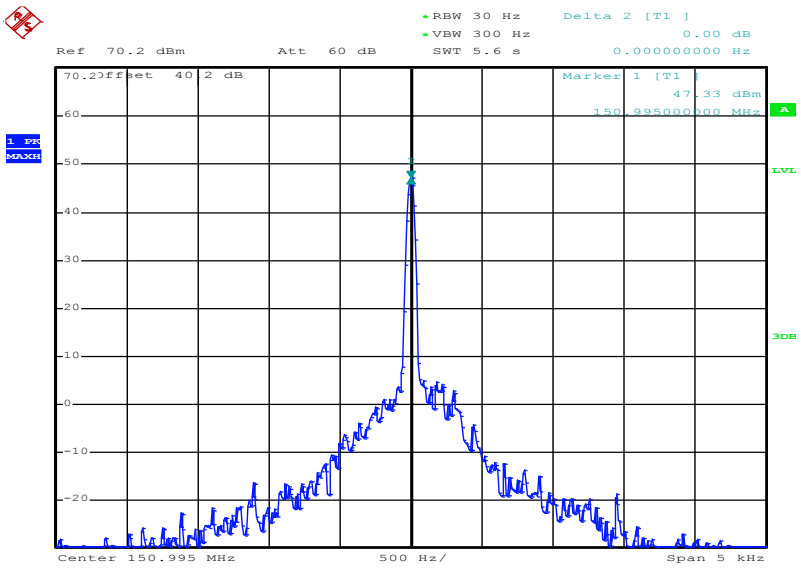
Date: 16.JUL.2015 15:45:22

Plot 6: Low channel – Temperature: 30°C



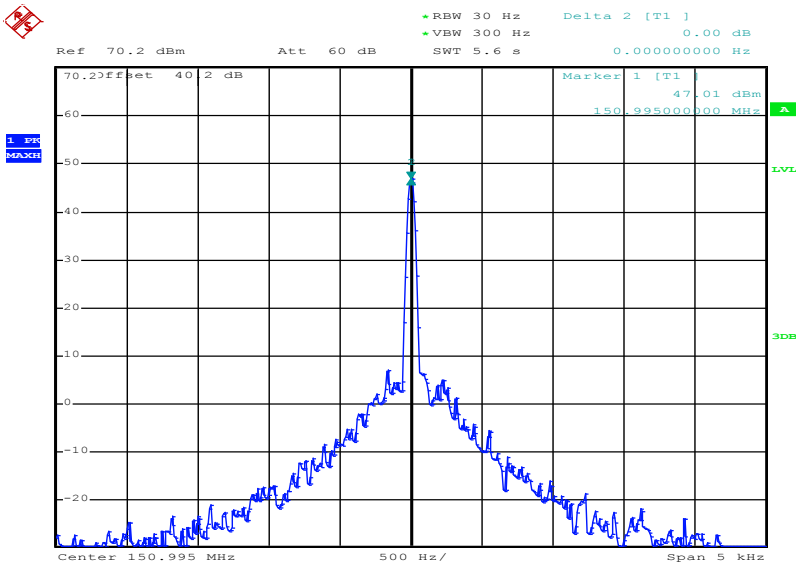
Date: 16.JUL.2015 16:00:31

Plot 7: Low channel – Temperature: 40°C



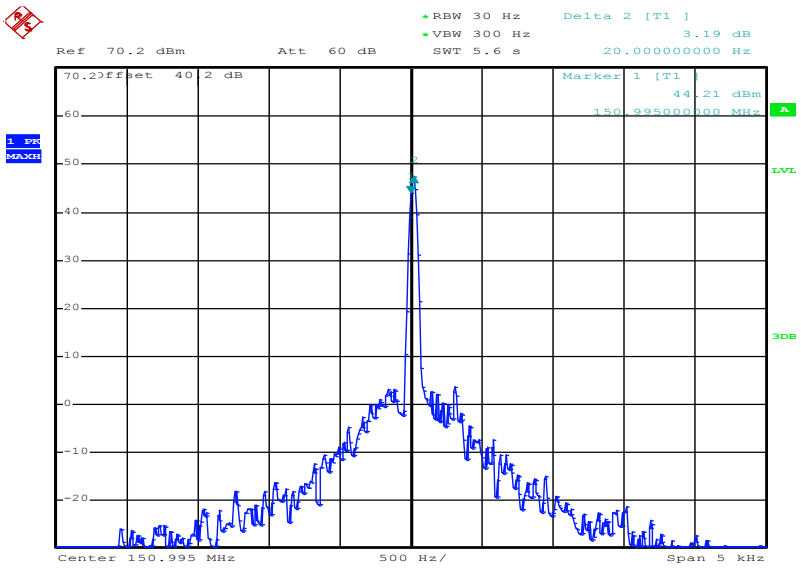
Date: 16.JUL.2015 16:11:07

Plot 8: Low channel – Temperature: 50°C



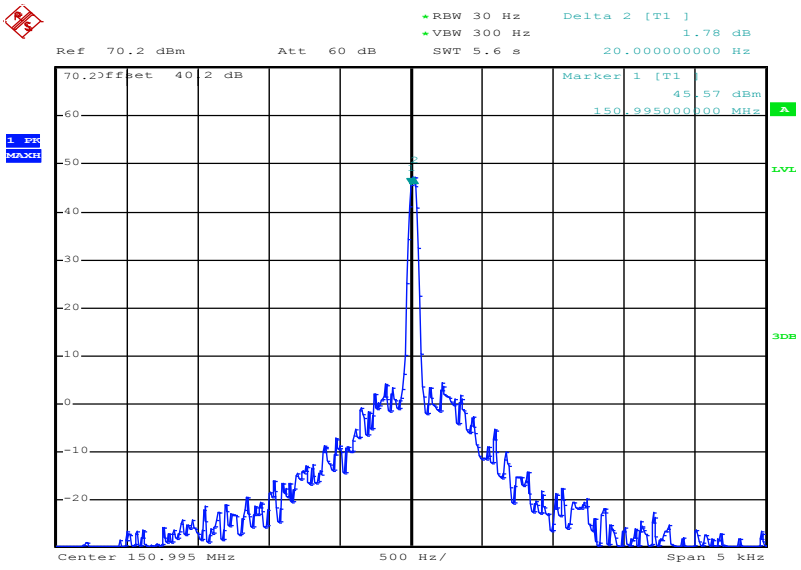
Date: 16.JUL.2015 16:25:47

Plot 9: Low channel – Temperature: 20°C – 85% Voltage



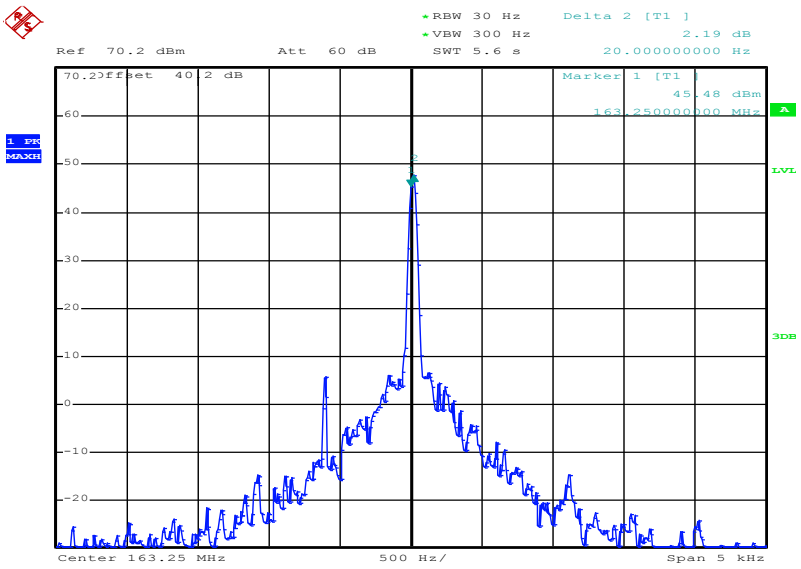
Date: 16.JUL.2015 15:45:46

Plot 10: Low channel – Temperature: 20°C – 115% Voltage



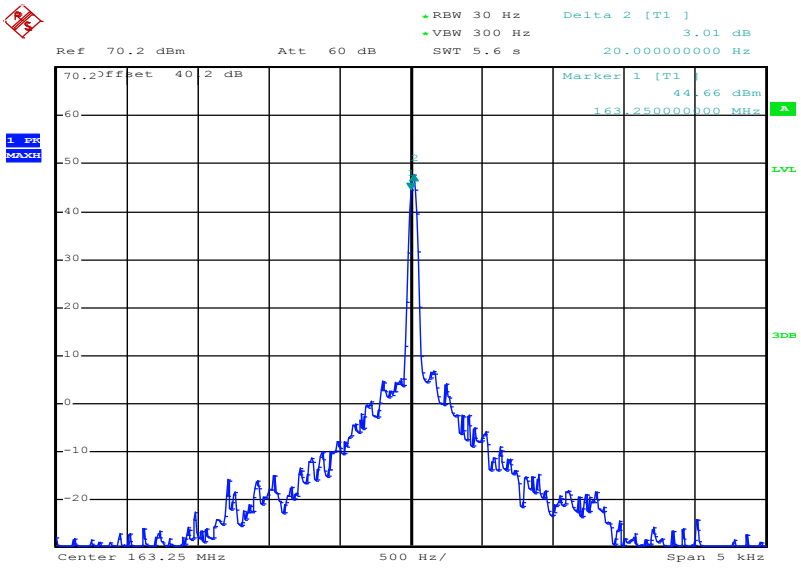
Date: 16.JUL.2015 15:46:13

Plot 11: Middle channel – Temperature: -20°C



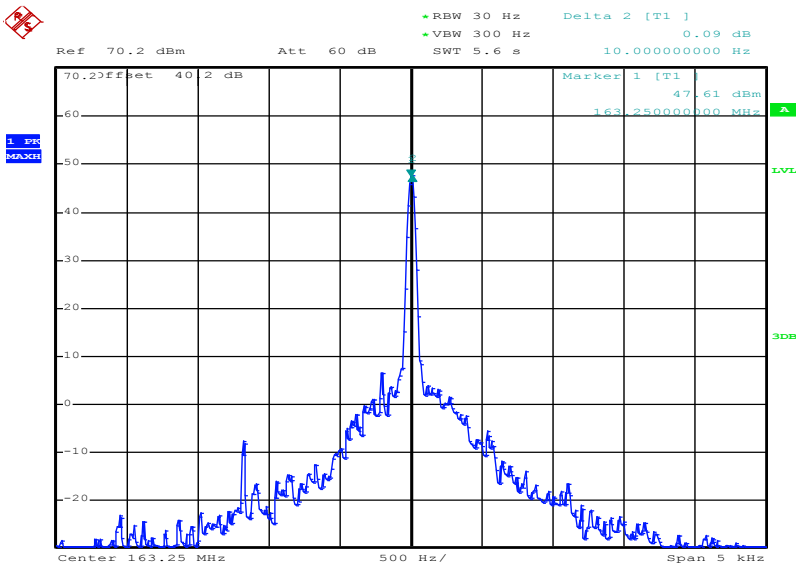
Date: 16.JUL.2015 14:56:15

Plot 12: Middle channel – Temperature: -10°C



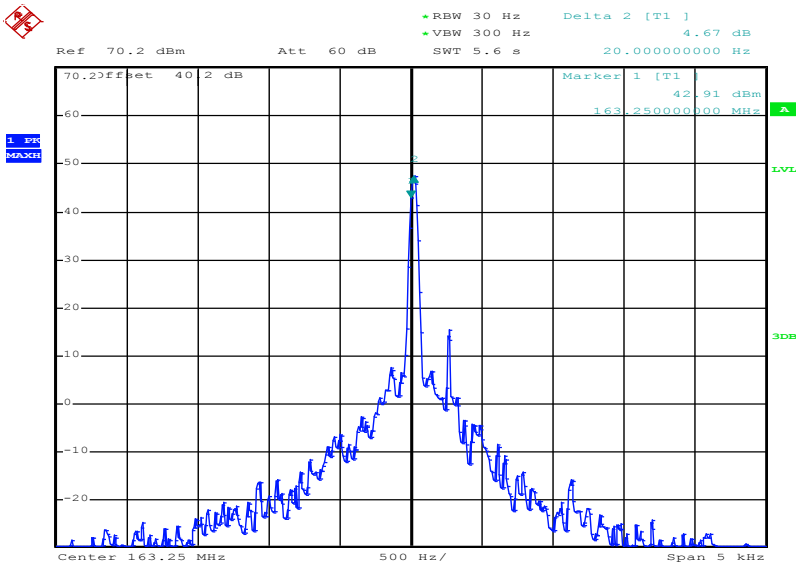
Date: 16.JUL.2015 15:07:21

Plot 13: Middle channel – Temperature: 0°C



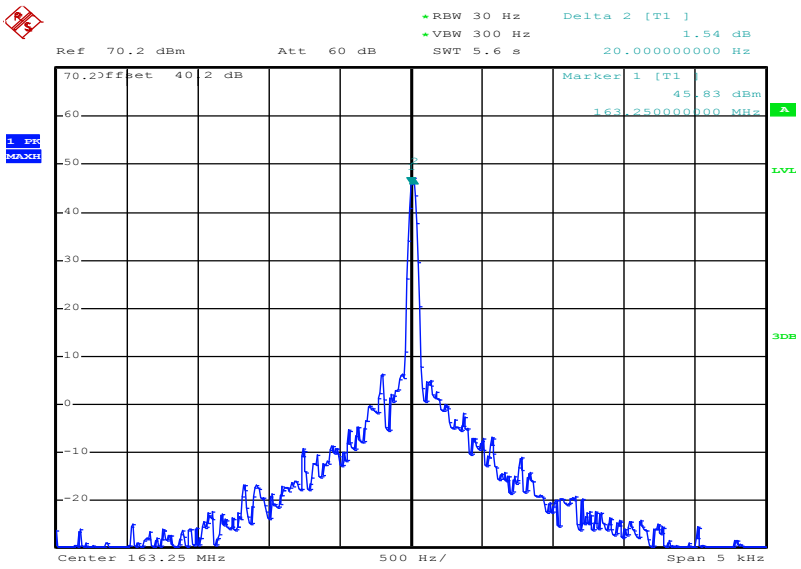
Date: 16.JUL.2015 15:24:33

Plot 14: Middle channel – Temperature: 10°C



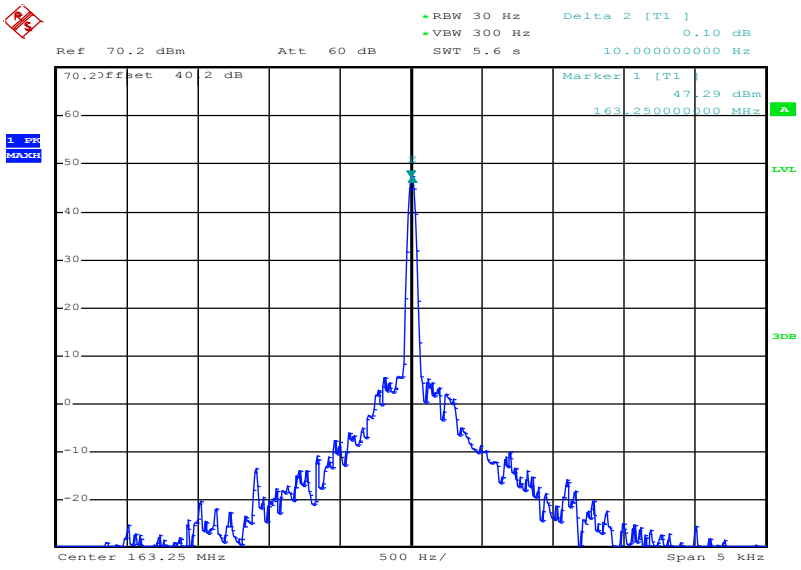
Date: 16.JUL.2015 15:38:45

Plot 15: Middle channel – Temperature: 20°C



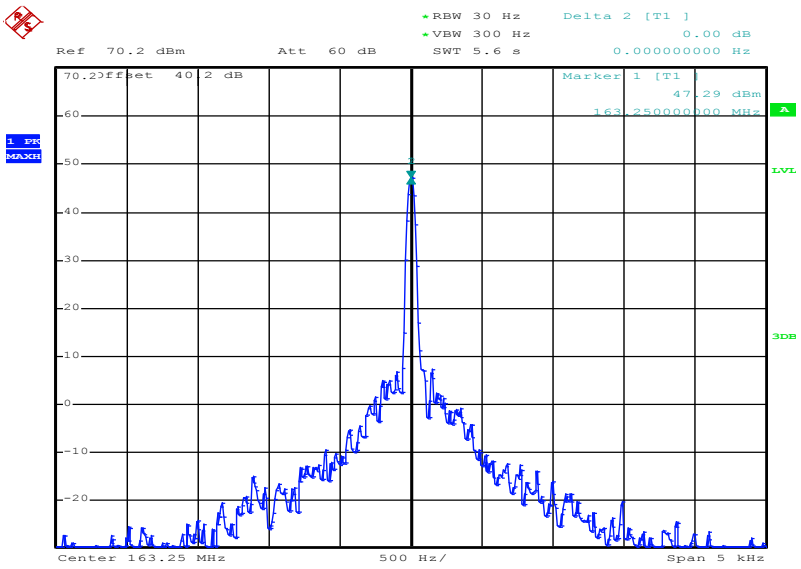
Date: 16.JUL.2015 15:48:27

Plot 16: Middle channel – Temperature: 30°C



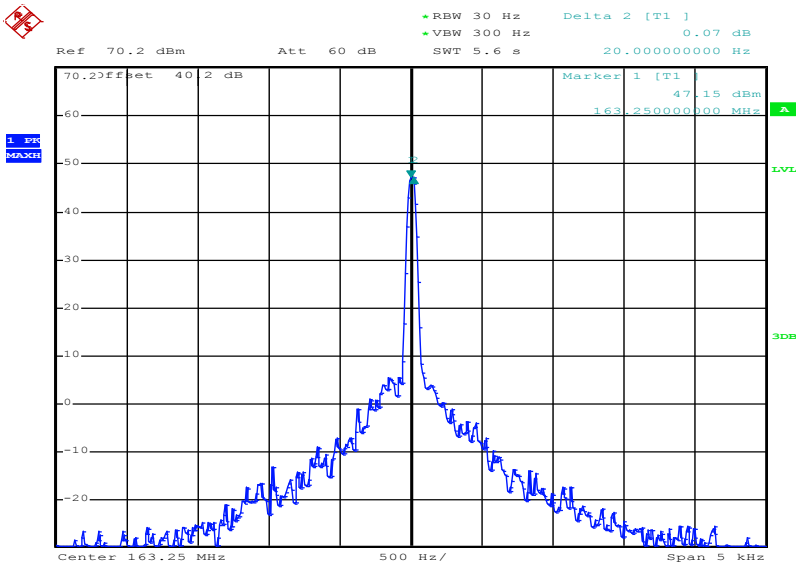
Date: 16.JUL.2015 15:59:34

Plot 17: Middle channel – Temperature: 40°C



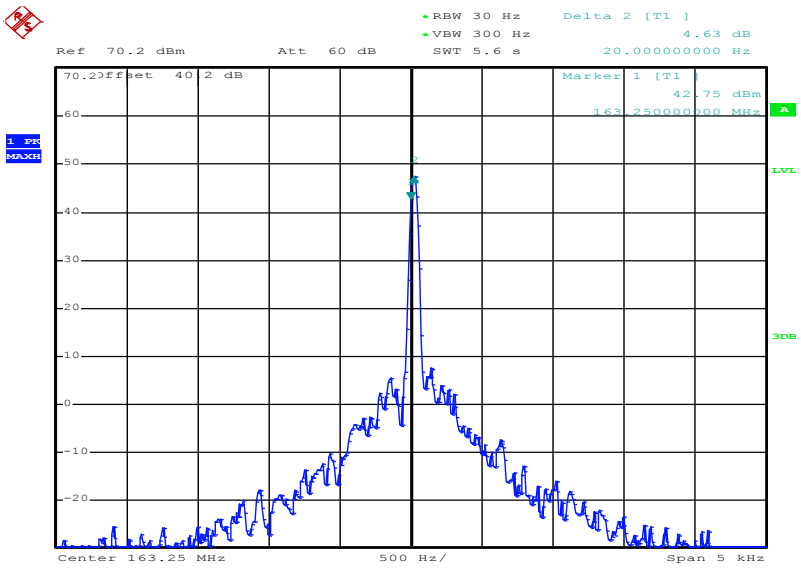
Date: 16.JUL.2015 16:12:18

Plot 18: Middle channel – Temperature: 50°C



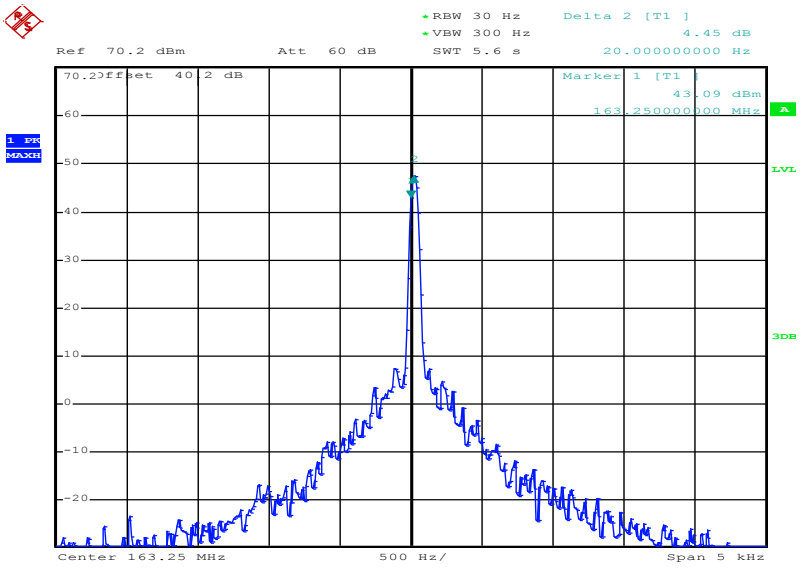
Date: 16.JUL.2015 16:24:35

Plot 19: Middle channel – Temperature: 20°C – 85% Voltage



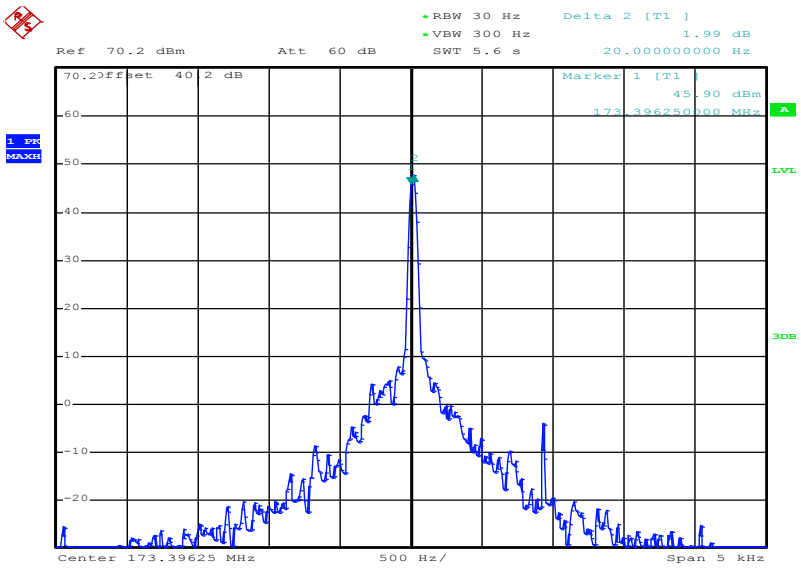
Date: 16.JUL.2015 15:47:50

Plot 20: Middle channel – Temperature: 20°C – 115% Voltage



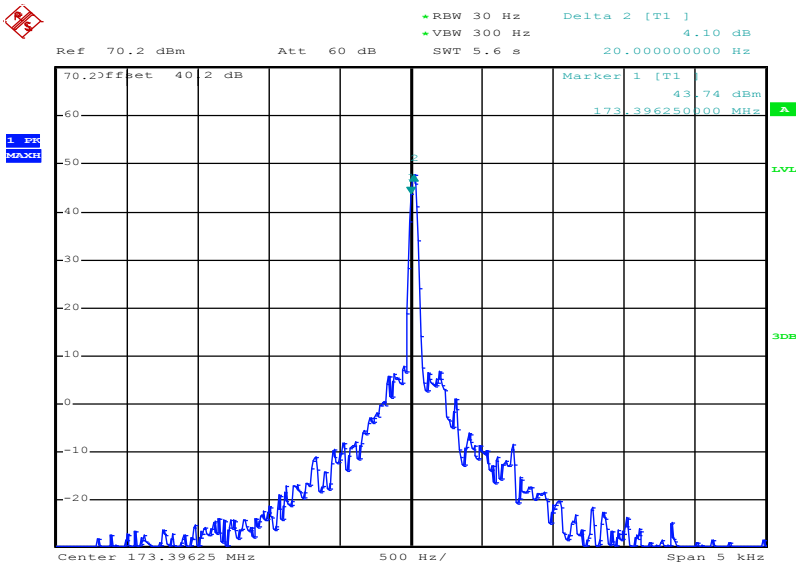
Date: 16.JUL.2015 15:47:21

Plot 21: High channel – Temperature: -20°C



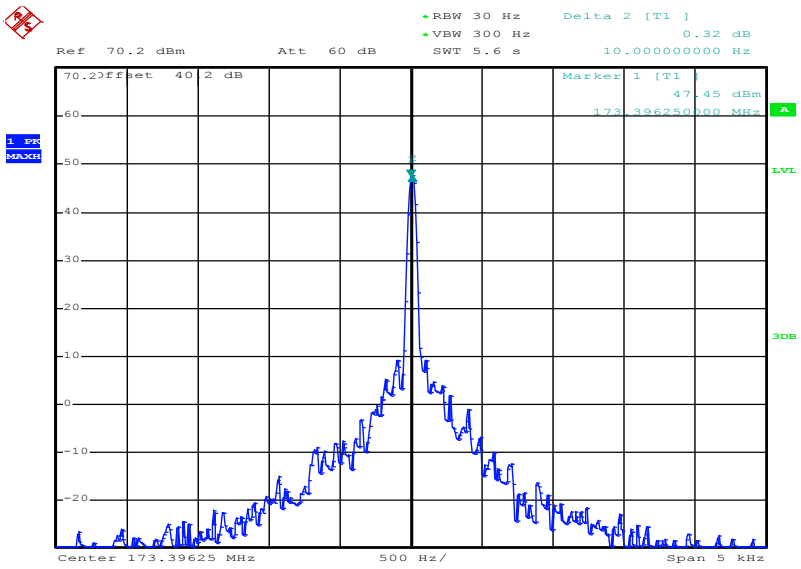
Date: 16.JUL.2015 14:57:28

Plot 22: High channel – Temperature: -10°C



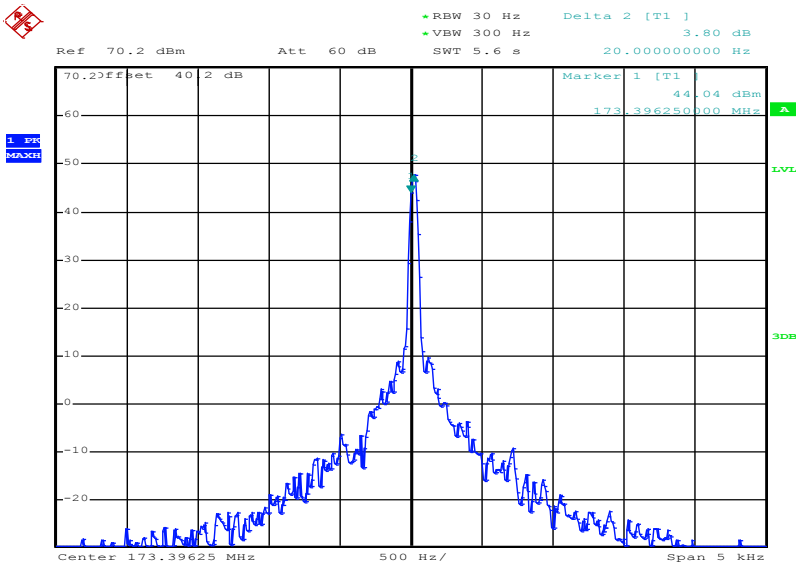
Date: 16.JUL.2015 15:06:21

Plot 23: High channel – Temperature: 0°C



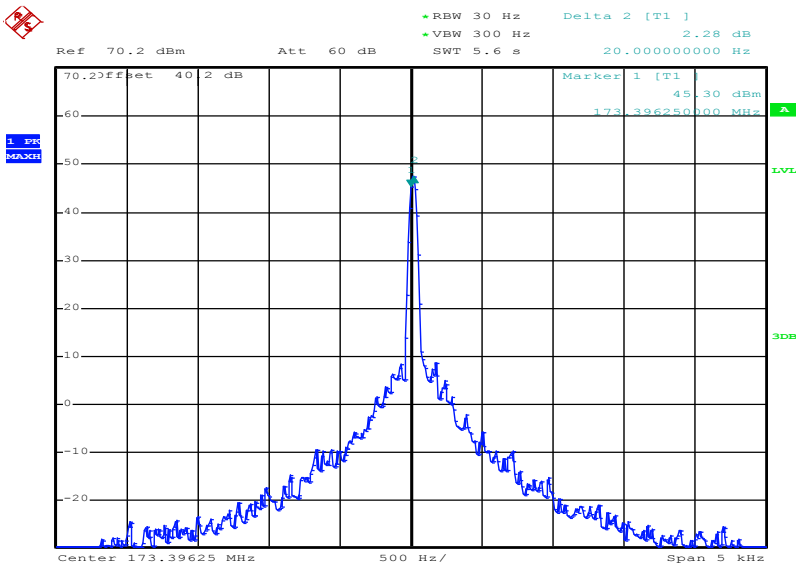
Date: 16.JUL.2015 15:25:53

Plot 24: High channel – Temperature: 10°C



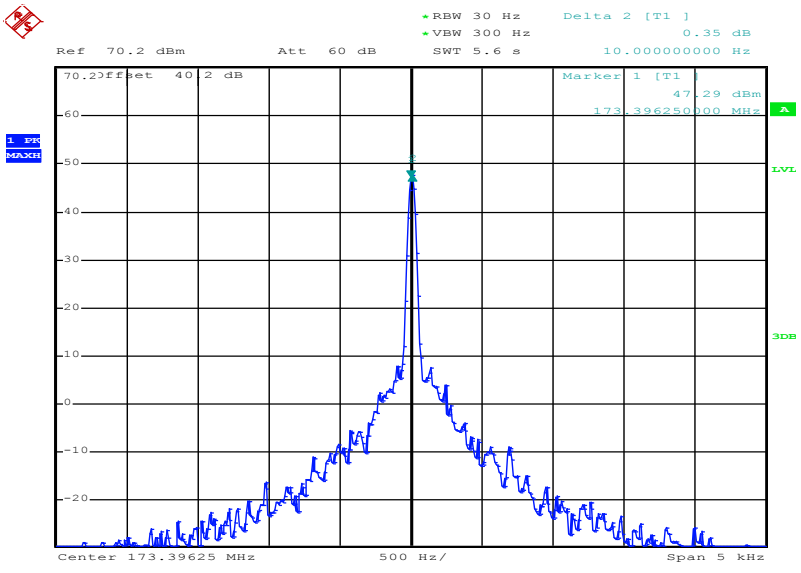
Date: 16.JUL.2015 15:37:21

Plot 25: High channel – Temperature: 20°C



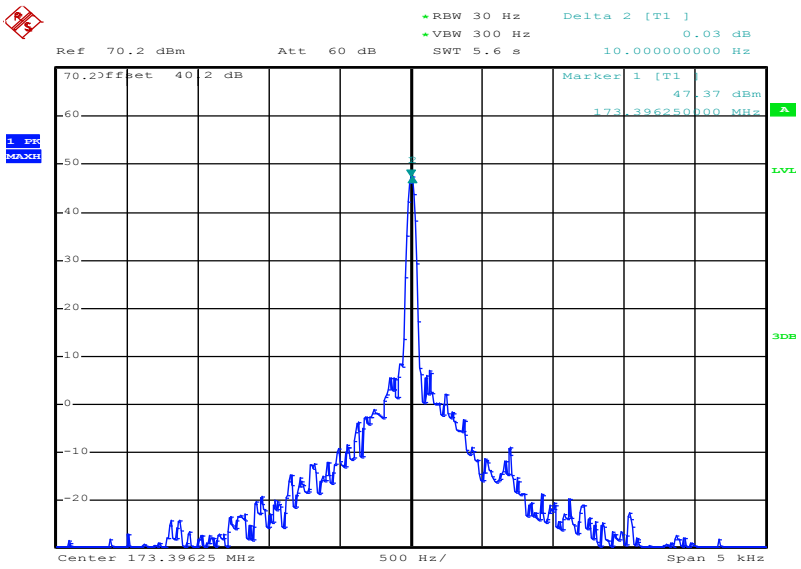
Date: 16.JUL.2015 15:50:43

Plot 26: High channel – Temperature: 30°C



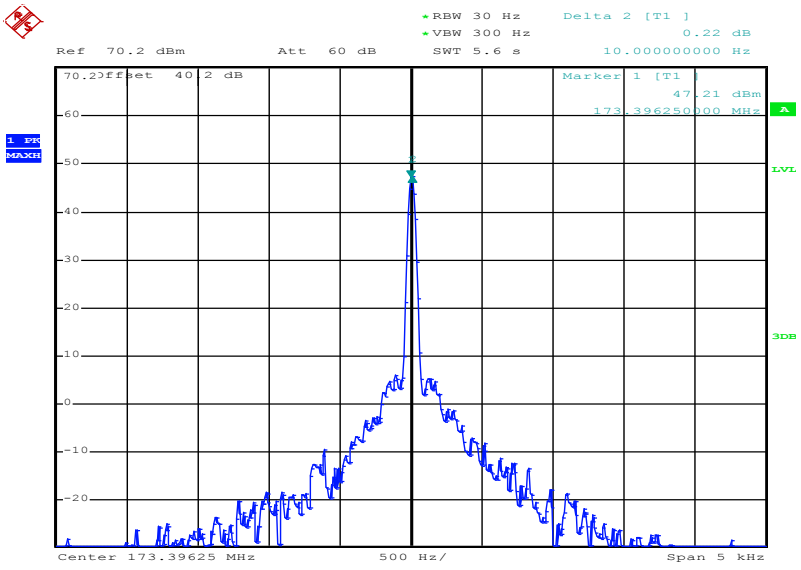
Date: 16.JUL.2015 15:58:46

Plot 27: High channel – Temperature: 40°C



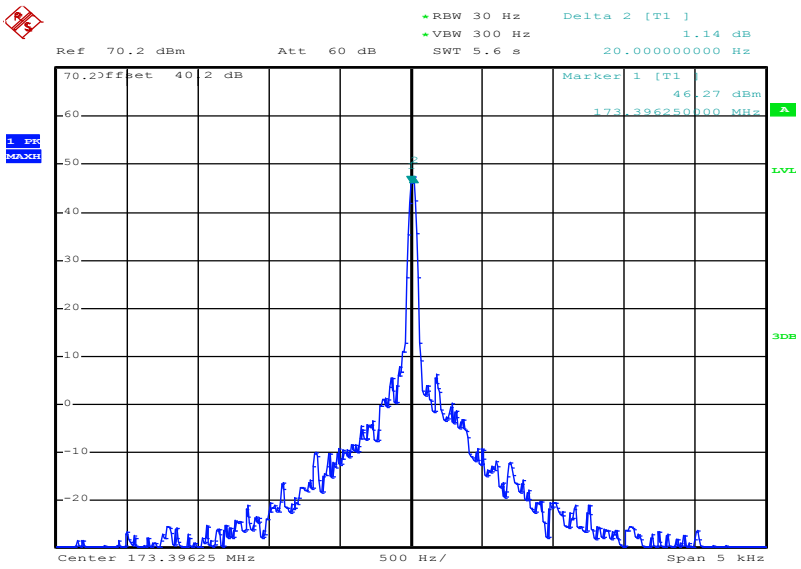
Date: 16.JUL.2015 16:14:29

Plot 28: High channel – Temperature: 50°C



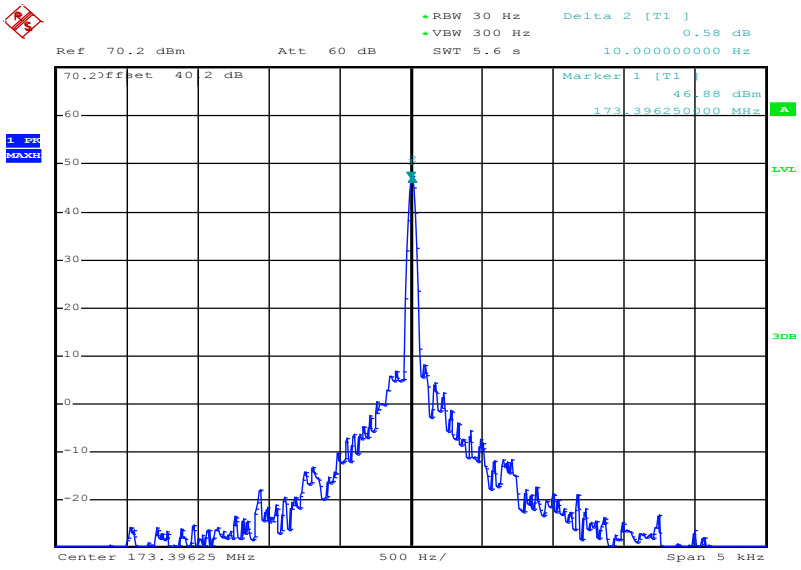
Date: 16.JUL.2015 16:23:22

Plot 29: High channel – Temperature: 20°C – 85% Voltage



Date: 16.JUL.2015 15:51:12

Plot 30: High channel – Temperature: 20°C - 115% Voltage



Date: 16.JUL.2015 15:51:44

12.6 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
Test setup:	See sub clause 8.3 A
Measurement uncertainty	See sub clause 9

Limits:

FCC
FCC 47 CFR § 2.1051 § 90.210
Emission mask D 12.5 kHz channel spacing On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

Results: Low power

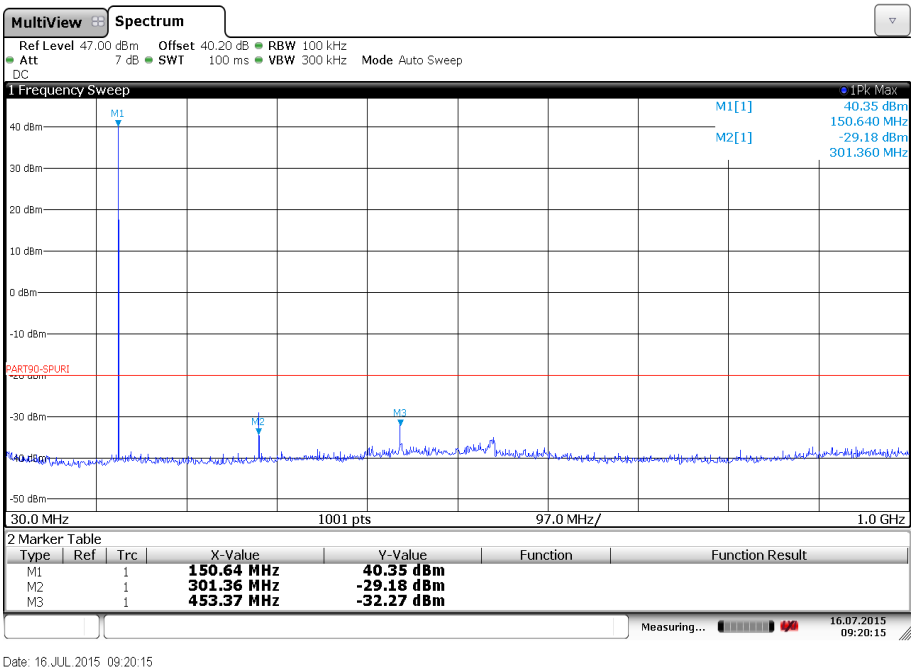
Spurious emission level (dBm)								
Harmonic	Ch. low Freq. (MHz)	Level [dBm]	Harmonic	Ch. mid Freq. (MHz)	Level [dBm]	Harmonic	Ch. high Freq. (MHz)	Level [dBm]
2	301.990	-29.2	2	326.500	-32.0	2	346.793	-31.6
3	452.985	-32.3	3	489.750	-30.8	3	520.189	-34.8
4	603.980	-/-	4	653.000	-/-	4	693.585	-/-
5	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	-/-

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	-27.6	2	326.500	-29.3	2	346.793	-28.1
3	452.985	-22.3	3	489.750	-21.0	3	520.189	-22.2
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	-/-

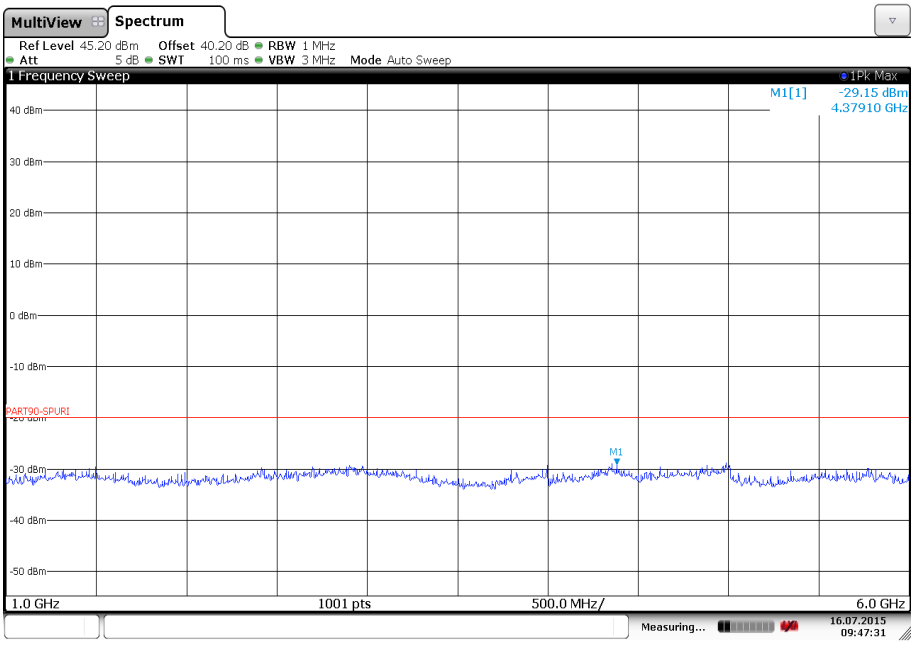
Plots of the measurements

Plot 1: Low channel – Low power - 30 MHz to 1 GHz



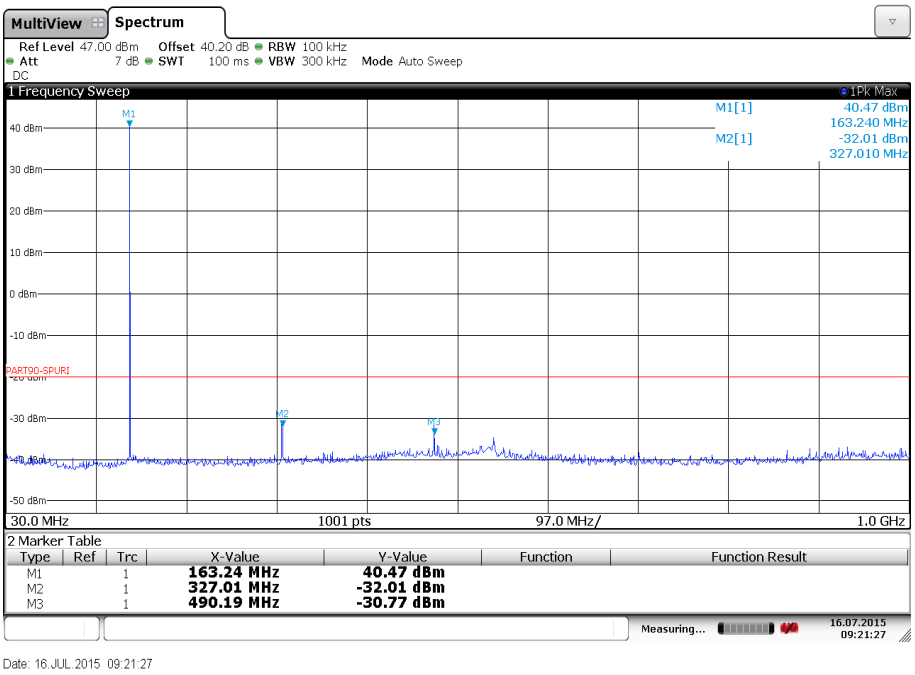
Date: 16.JUL.2015 09:20:15

Plot 2: Low channel – Low power – 1 GHz to 6 GHz



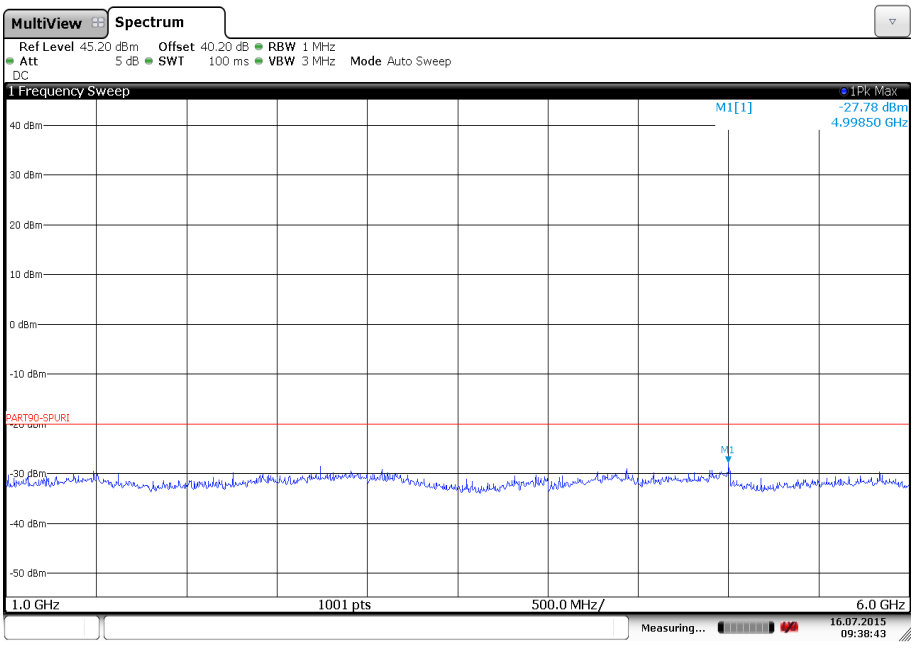
Date: 16.JUL.2015 09:47:30

Plot 3: Middle channel – Low power - 30 MHz to 1 GHz



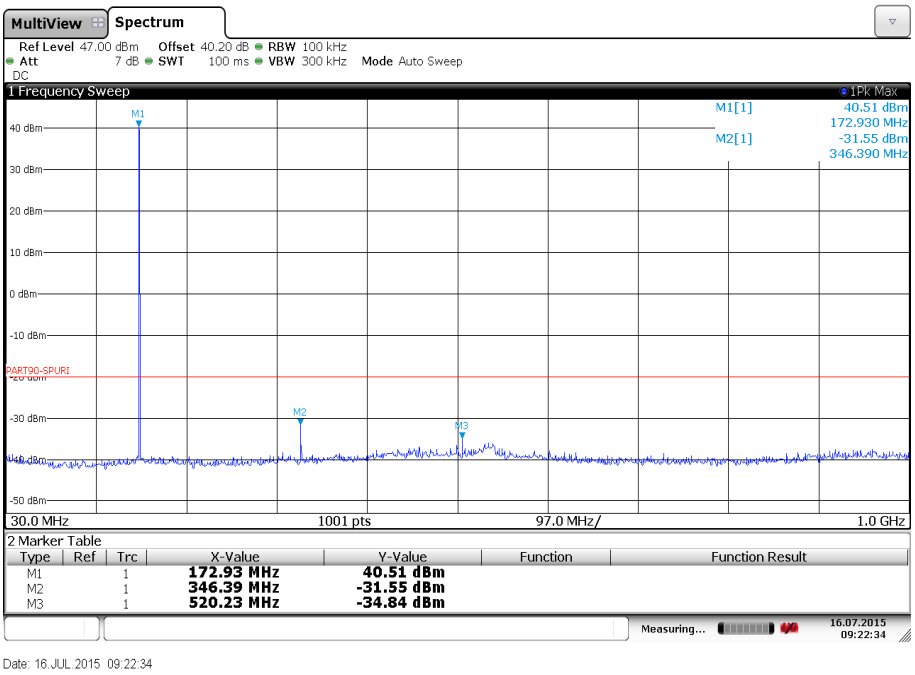
Date: 16.JUL.2015 09:21:27

Plot 4: Middle channel – Low power – 1 GHz to 6 GHz



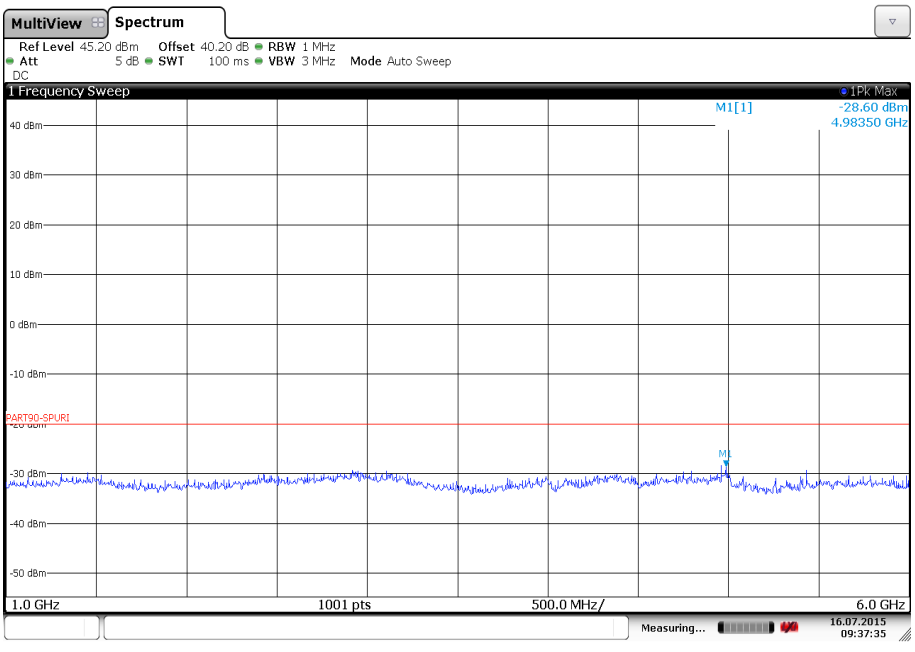
Date: 16.JUL.2015 09:38:43

Plot 5: High channel – Low power - 30 MHz to 1 GHz



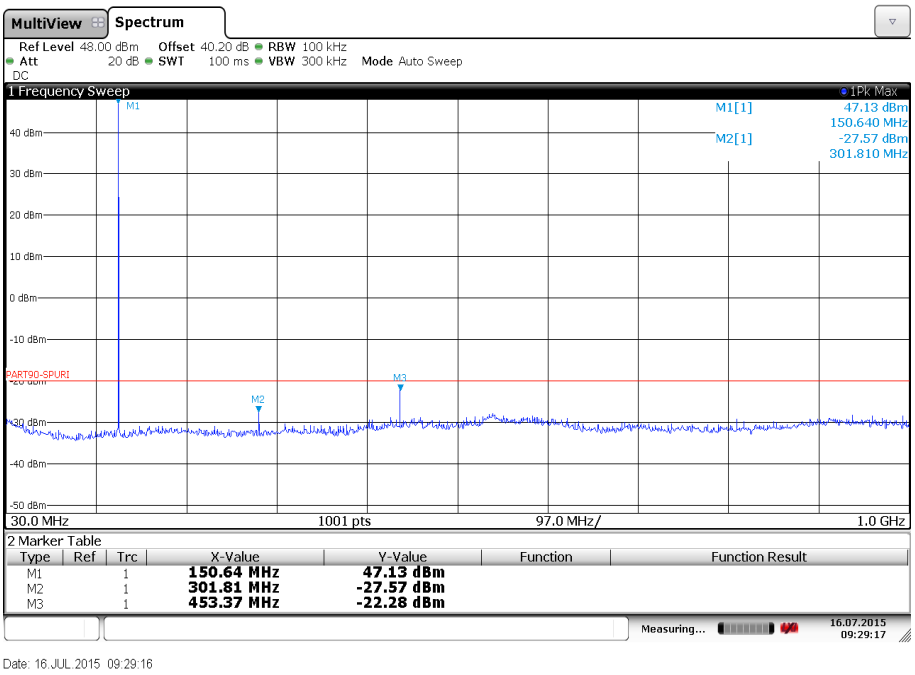
Date: 16.JUL.2015 09:22:34

Plot 6: High channel – Low power – 1 GHz to 6 GHz



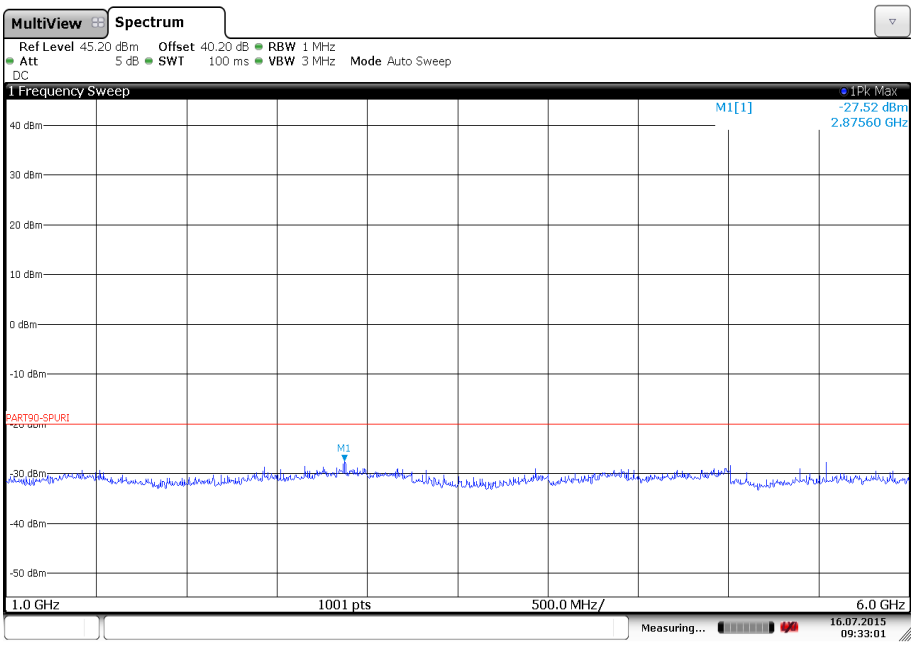
Date: 16.JUL.2015 09:37:35

Plot 7: Low channel – High power - 30 MHz to 1 GHz



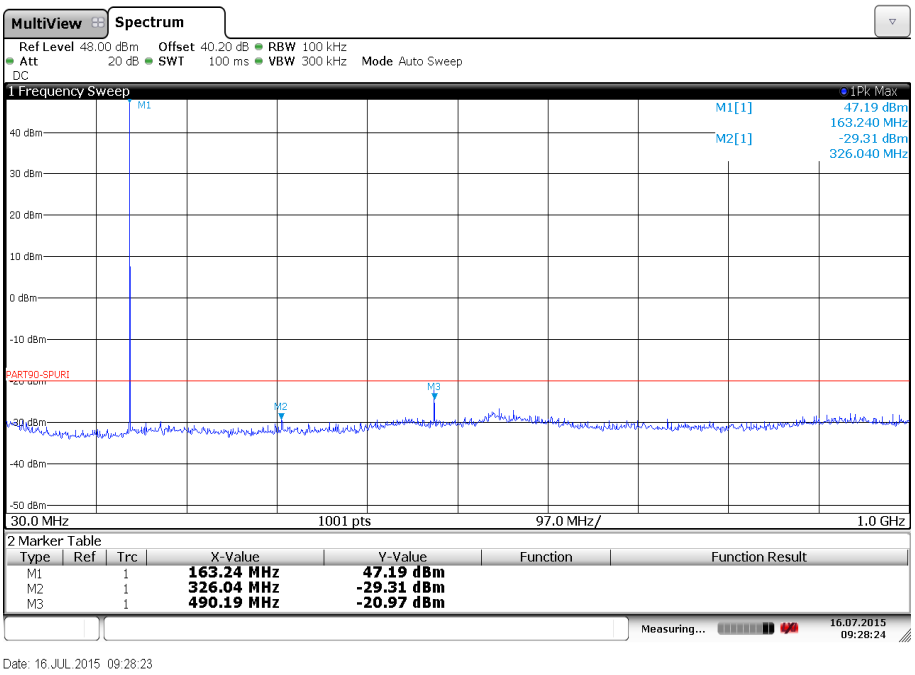
Date: 16.JUL.2015 09:29:16

Plot 8: Low channel – High power – 1 GHz to 6 GHz



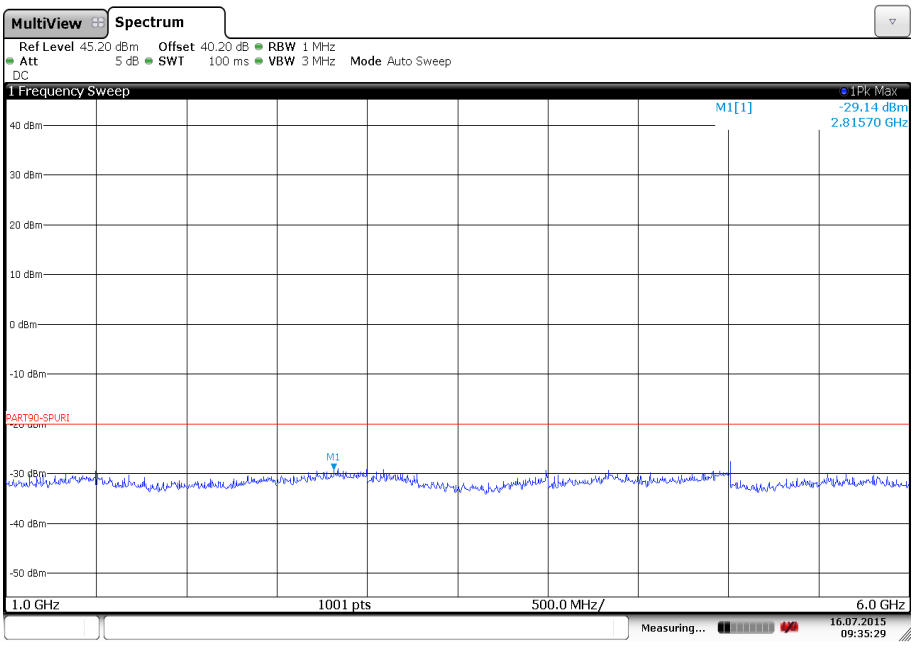
Date: 16.JUL.2015 09:33:01

Plot 9: Middle channel – High power - 30 MHz to 1 GHz



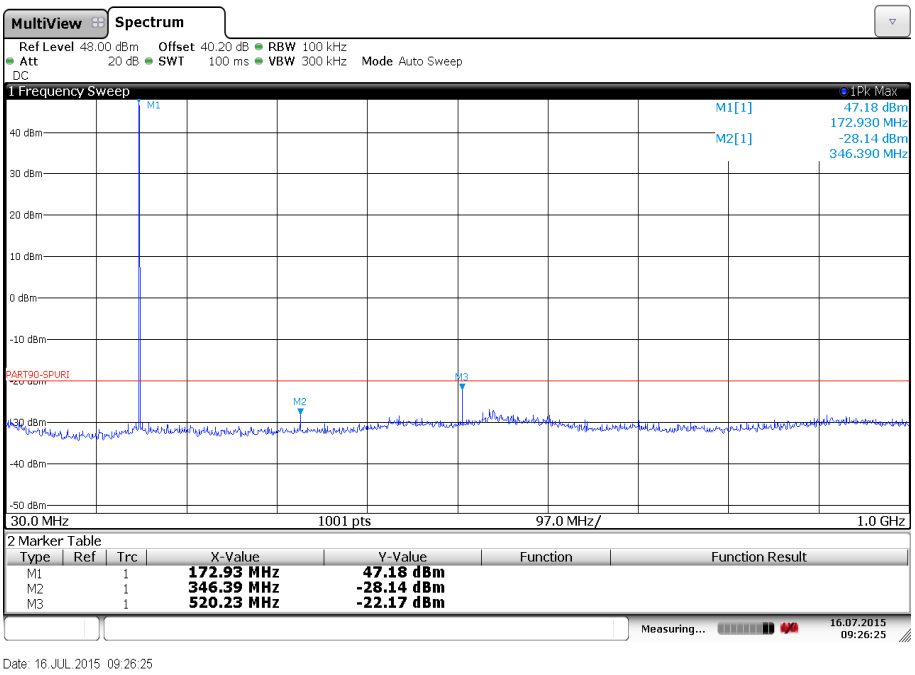
Date: 16.JUL.2015 09:28:23

Plot 10: Middle channel – High power – 1 GHz to 6 GHz



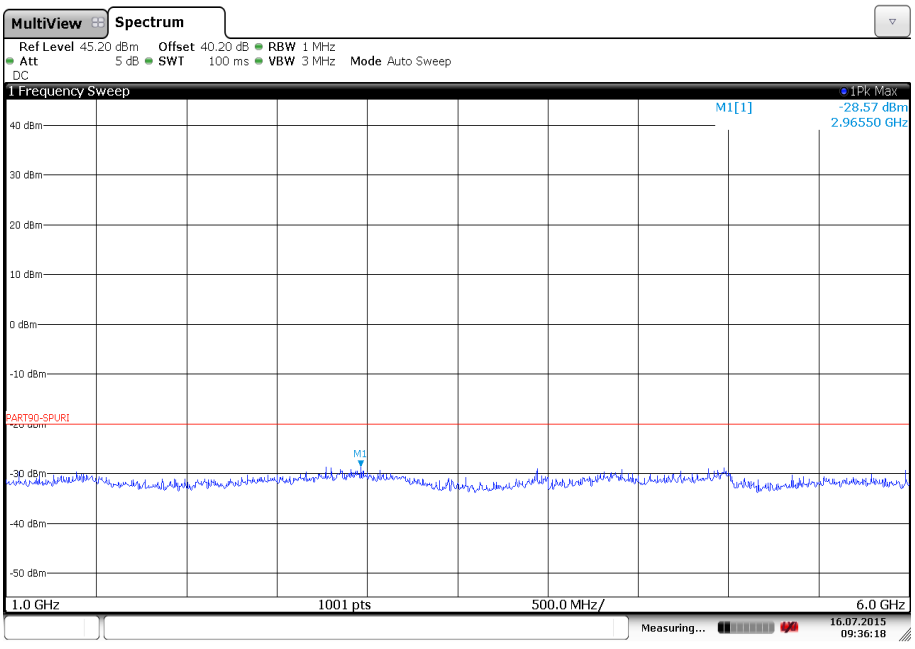
Date: 16.JUL.2015 09:35:28

Plot 11: High channel – High power - 30 MHz to 1 GHz



Date: 16.JUL.2015 09:26:25

Plot 12: High channel – High power – 1 GHz to 6 GHz



Date: 16.JUL.2015 09:36:18

12.7 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
Test setup:	See sub clause 8.2 A
Measurement uncertainty	See sub clause 9

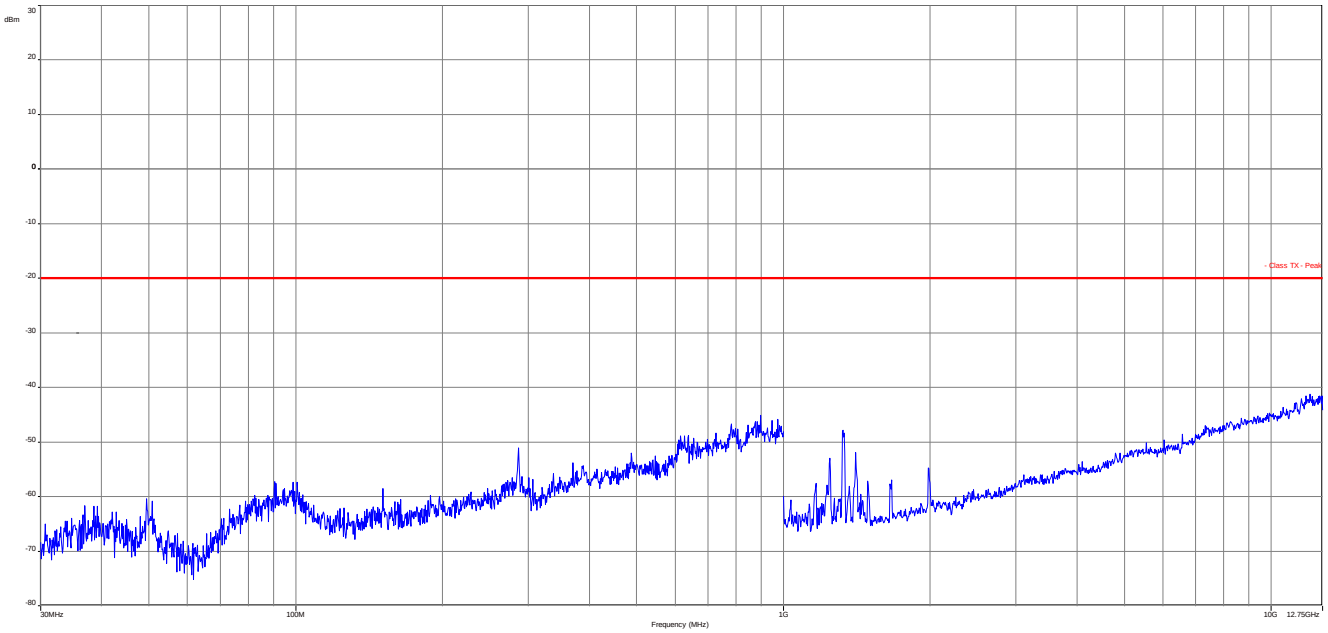
Limits:

FCC
FCC 47 CFR § 2.1051 § 90.210
Emission mask D 12.5 kHz channel spacing On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

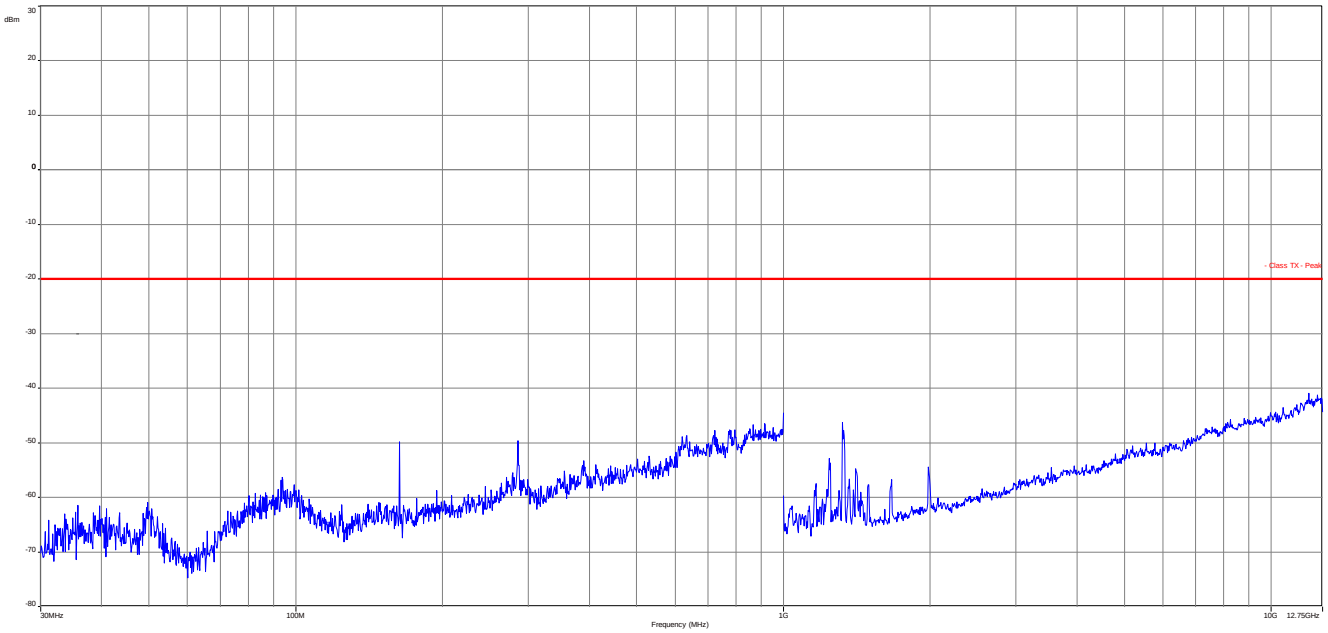
Transmitter spurious emissions (dBm)								
Lowest channel			Middle channel			Highest channel		
Frequency	Detector	Level	Frequency	Detector	Level	Frequency	Detector	Level
All detected spurious emissions are more than 10 dB below the limit.			All detected spurious emissions are more than 10 dB below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

Plots of the measurements (measured with dummy load)

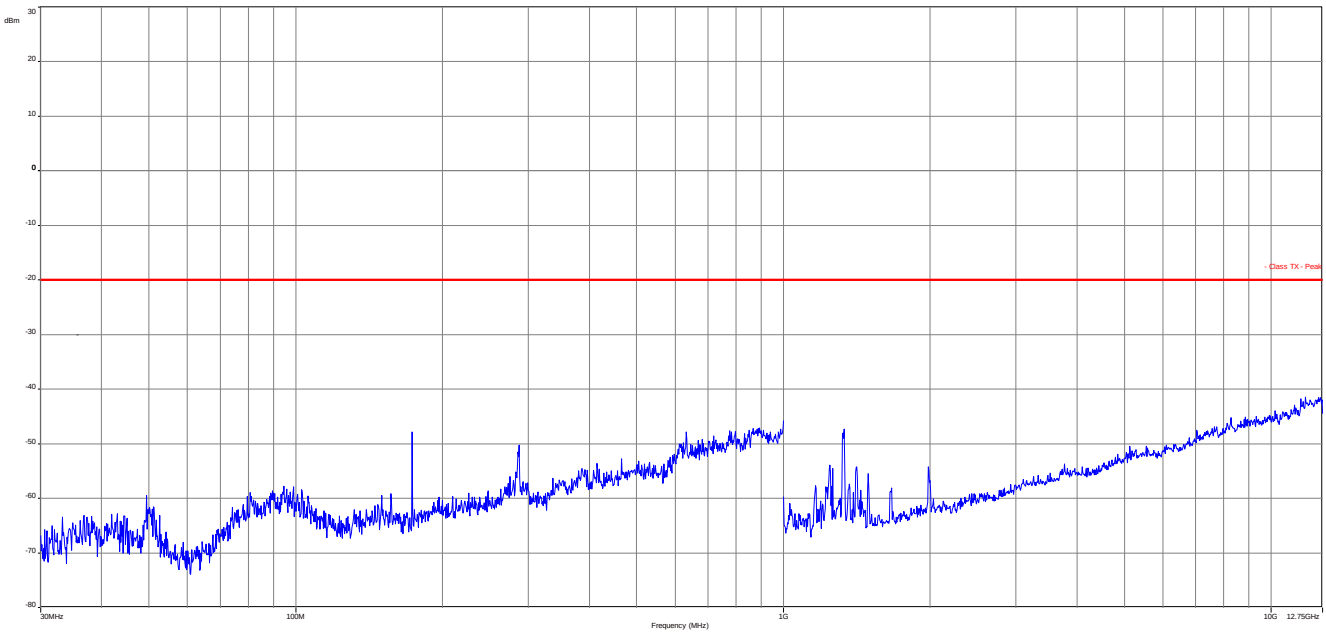
Plot 1: 30 MHz – 12.75 GHz, low channel, antenna vertical/horizontal, Low power



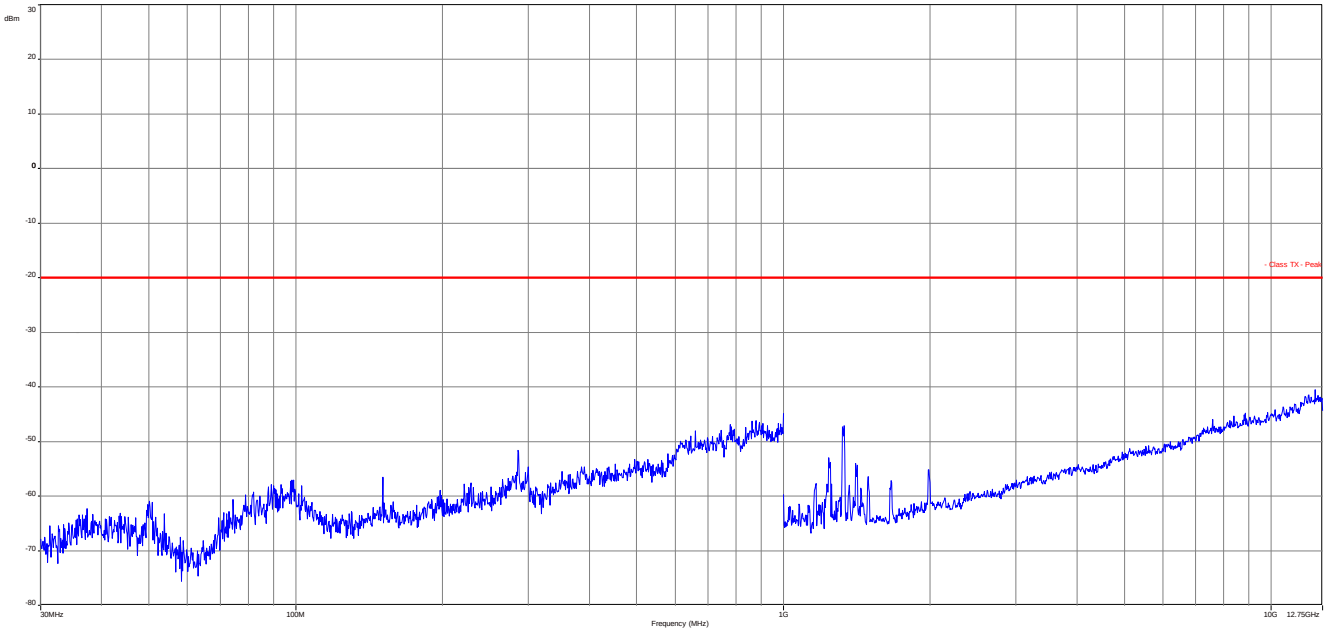
Plot 2: 30 MHz – 12.75 GHz, middle channel, antenna vertical/horizontal, Low power



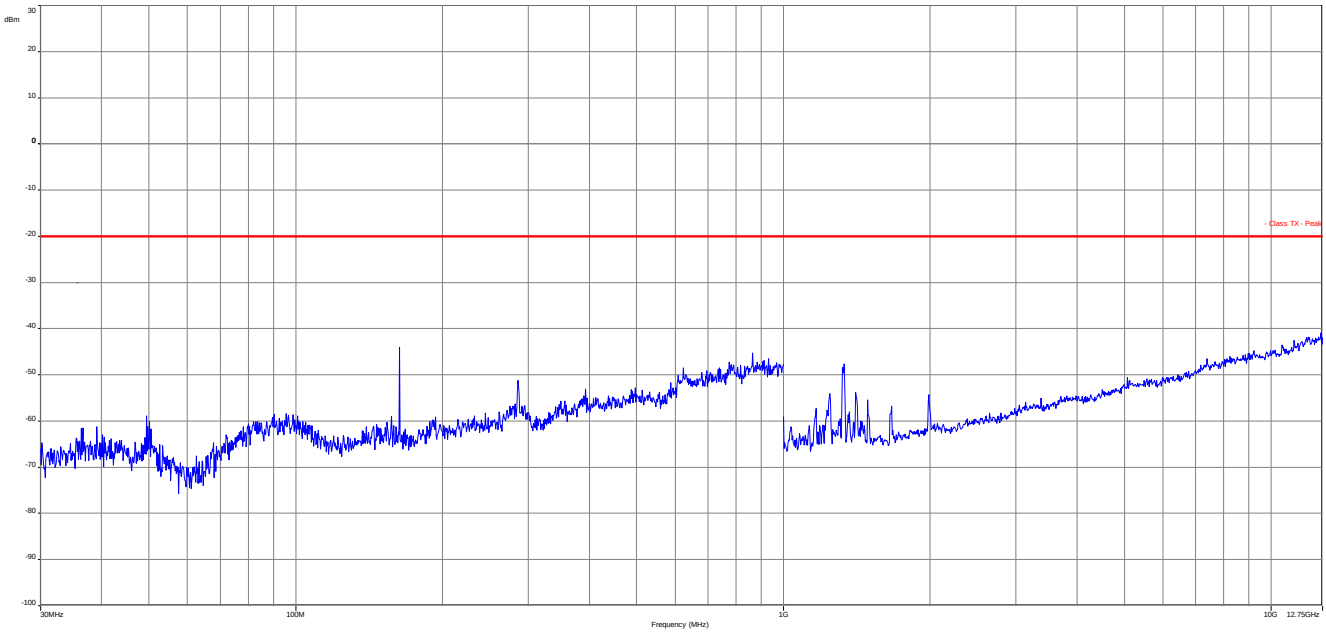
Plot 3: 30 MHz – 12.75 GHz, high channel, antenna vertical/horizontal, Low power



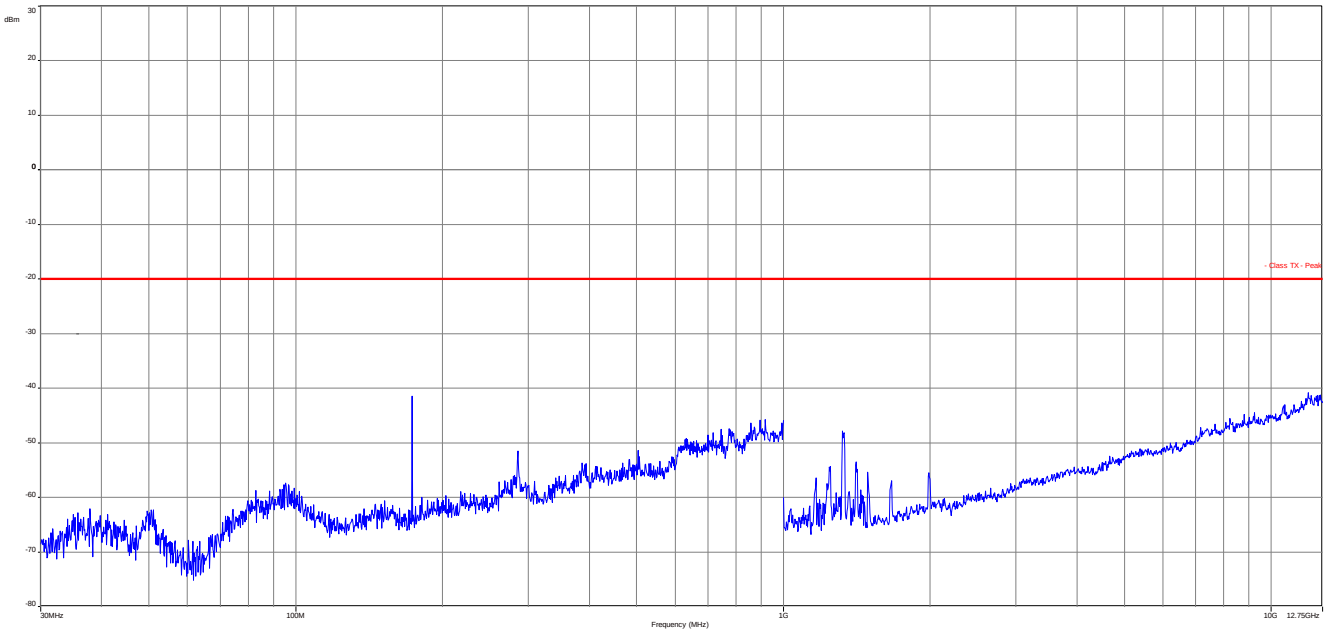
Plot 4: 30 MHz – 12.75 GHz, low channel, antenna vertical/horizontal, High power



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



12.8 Spurious emissions radiated < 30 MHz

Description:

Measurement of the radiated spurious emissions in transmit mode below 30 MHz. 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
Test setup:	See sub clause 8.2 B
Measurement uncertainty	See sub clause 9

Limits:

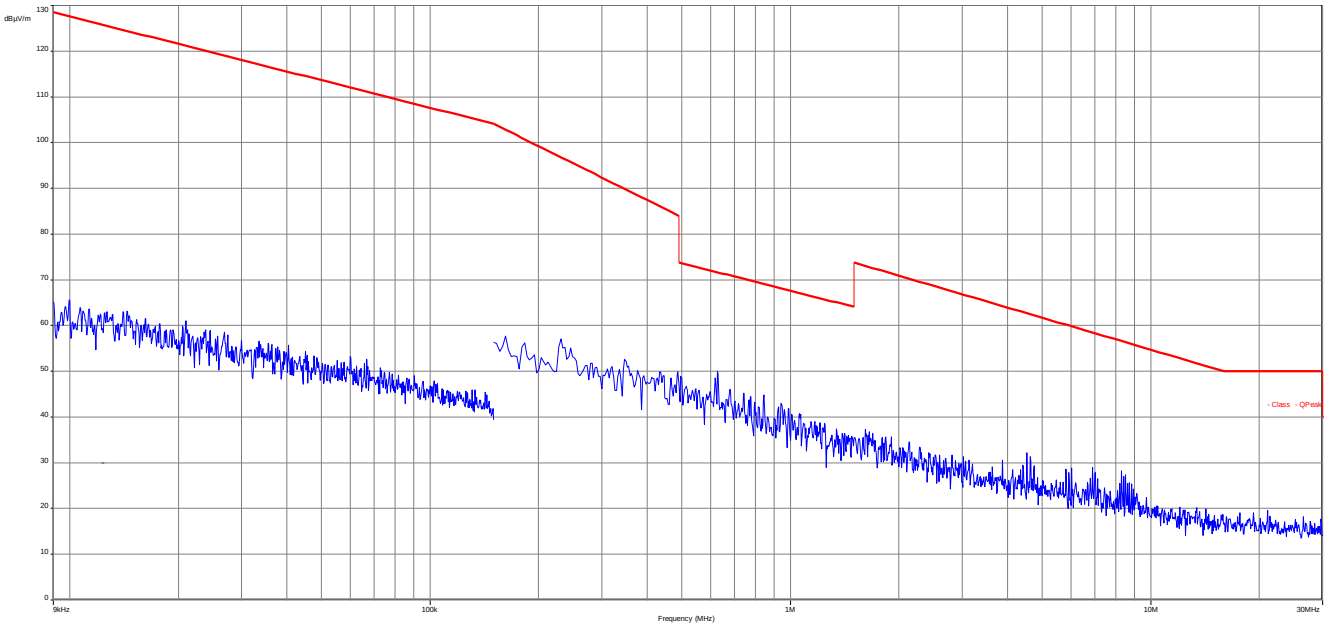
FCC		
TX Spurious emissions radiated < 30 MHz		
Frequency (MHz)	Field strength (dBµV/m)	Measurement distance
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30

Results:

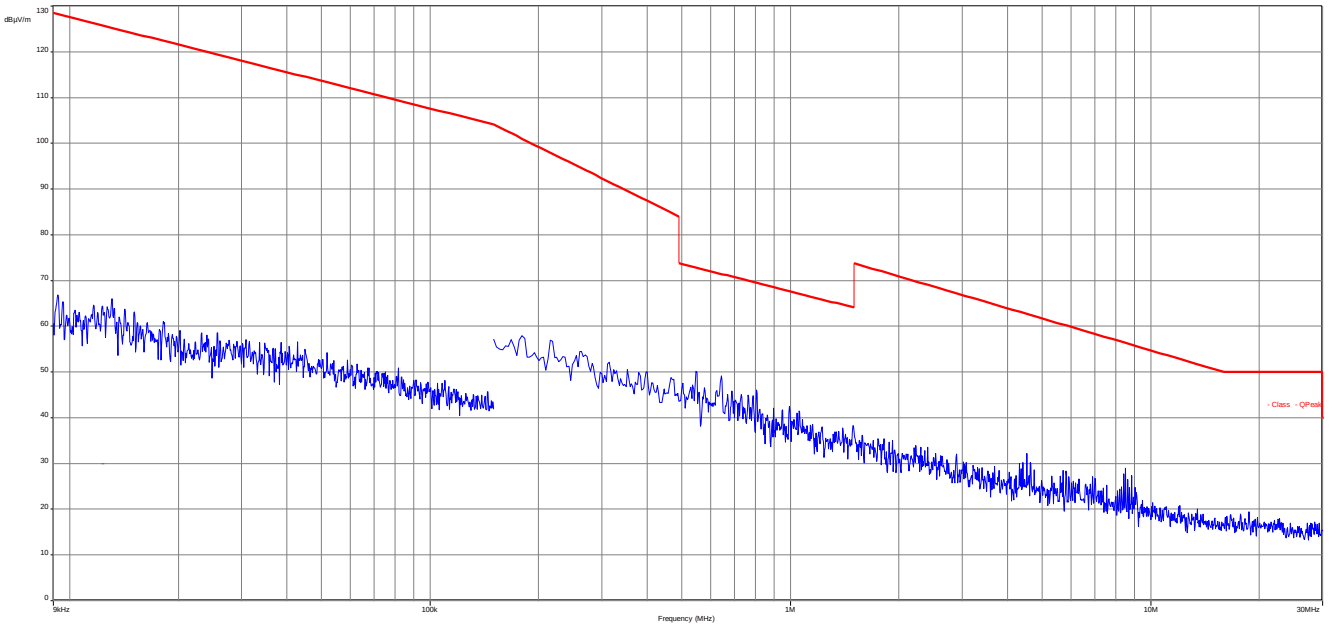
TX Spurious emissions radiated < 30 MHz [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
No peaks detected.		

Plots: TX mode

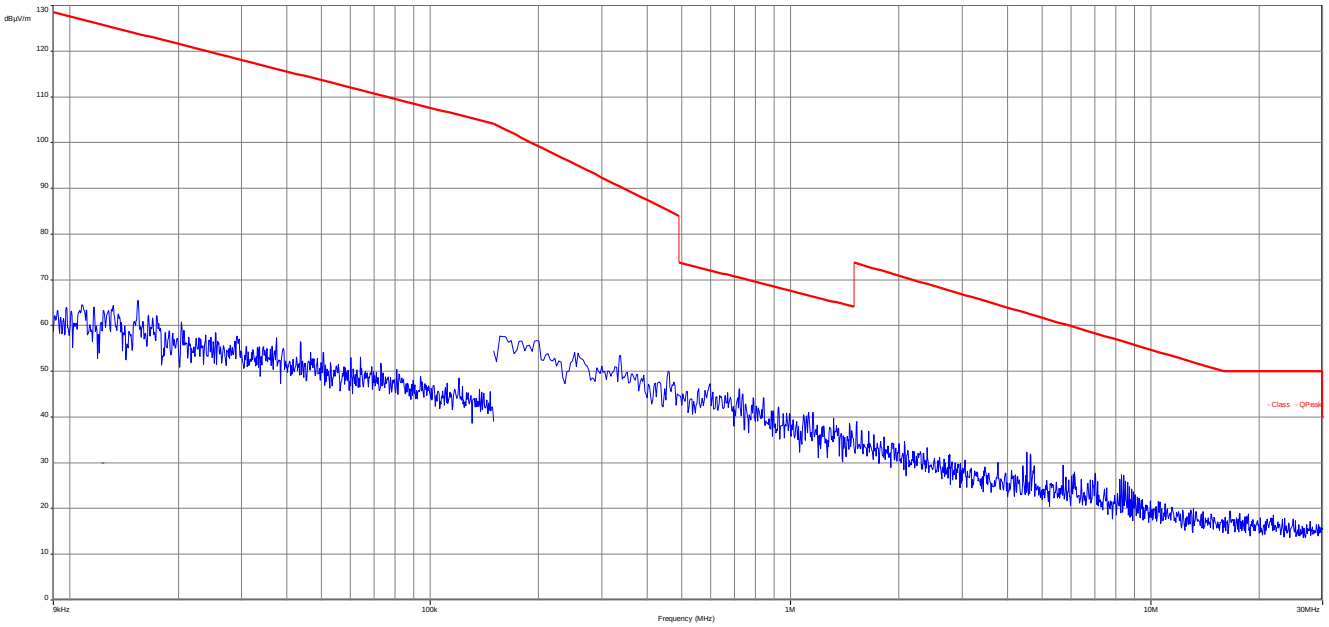
Plot 1: 9 kHz to 30 MHz – Low channel – Low power



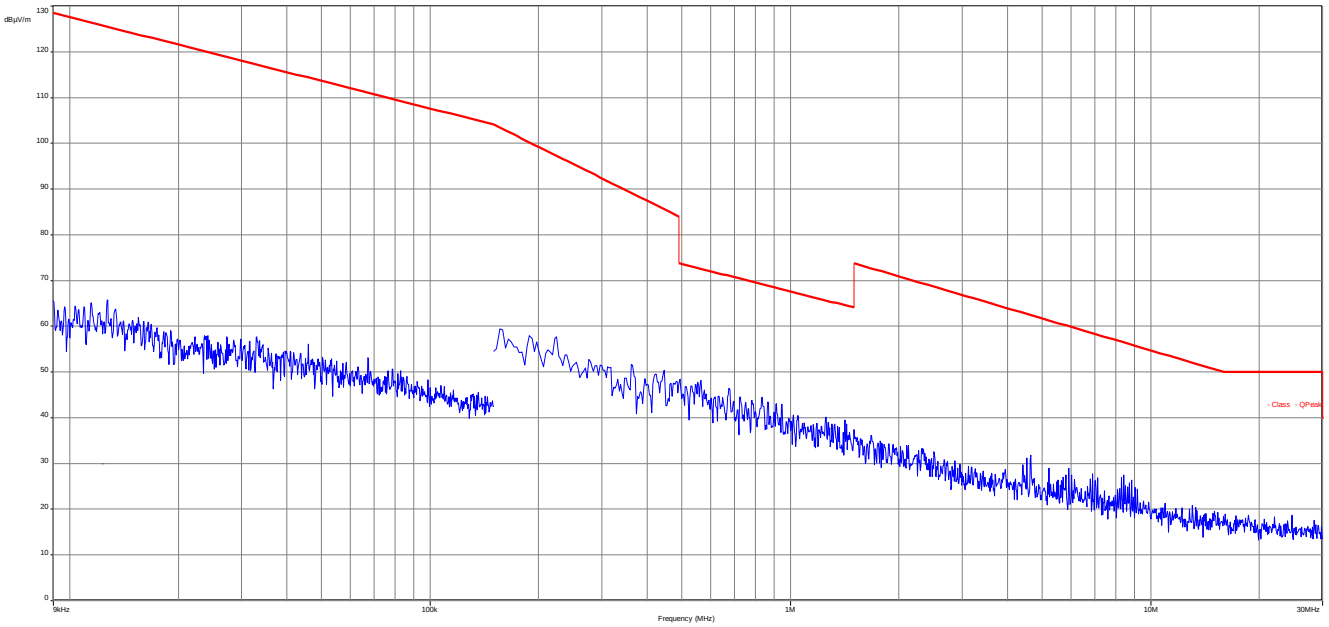
Plot 2: 9 kHz to 30 MHz – Middle channel – Low power



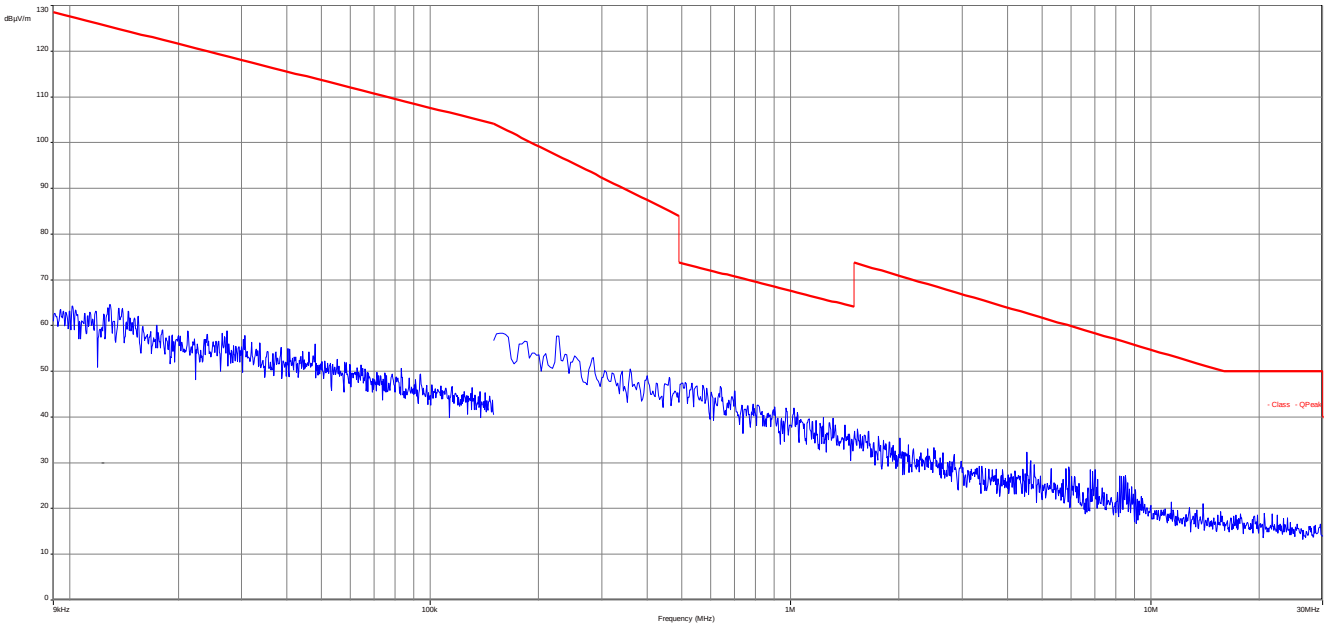
Plot 3: 9 kHz to 30 MHz – High channel – Low power



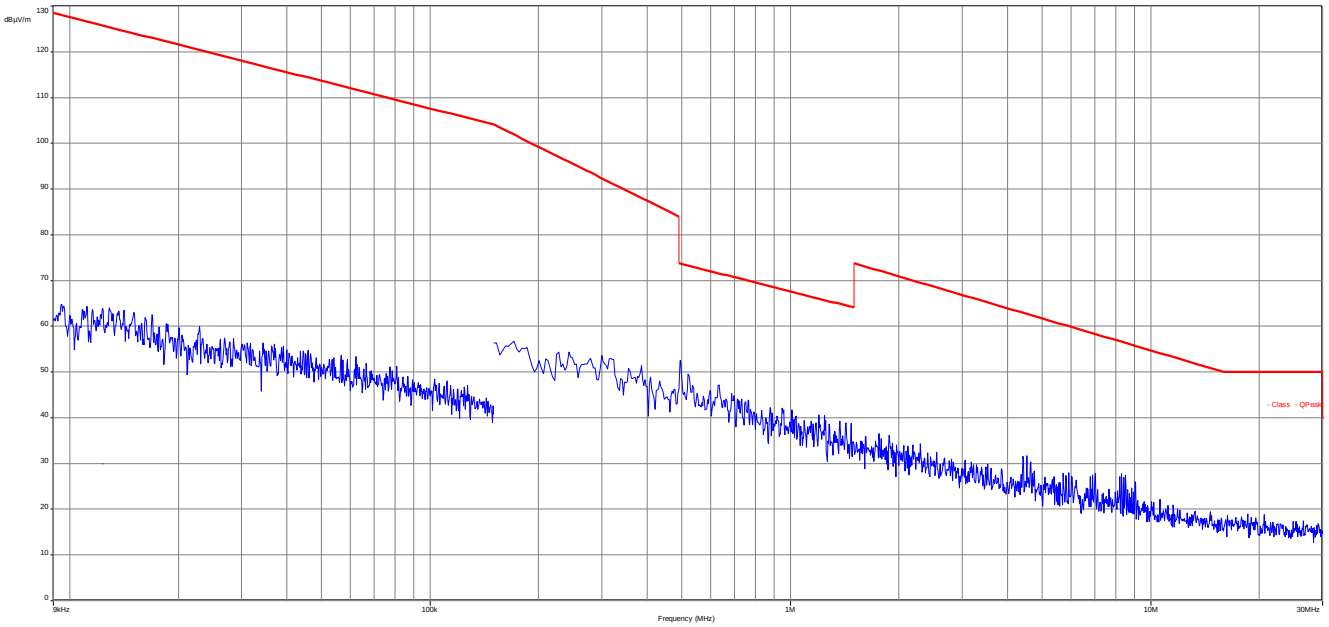
Plot 4: 9 kHz to 30 MHz – Low channel – High power



Plot 5: 9 kHz to 30 MHz – Middle channel – High power



Plot 6: 9 kHz to 30 MHz – High channel – High power



12.9 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
Test setup:	See sub clause 8.1 / 8.2 A & B
Measurement uncertainty	See sub clause 9

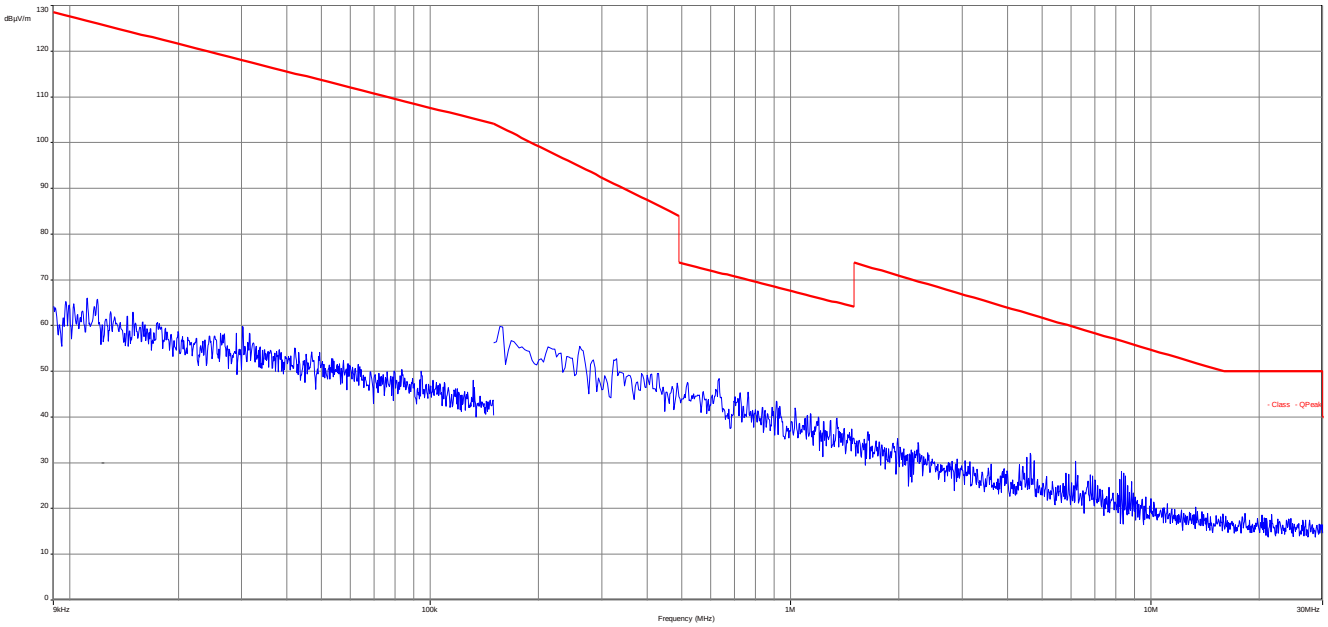
Limits:

FCC		
FCC 47 CFR § 15.209		
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

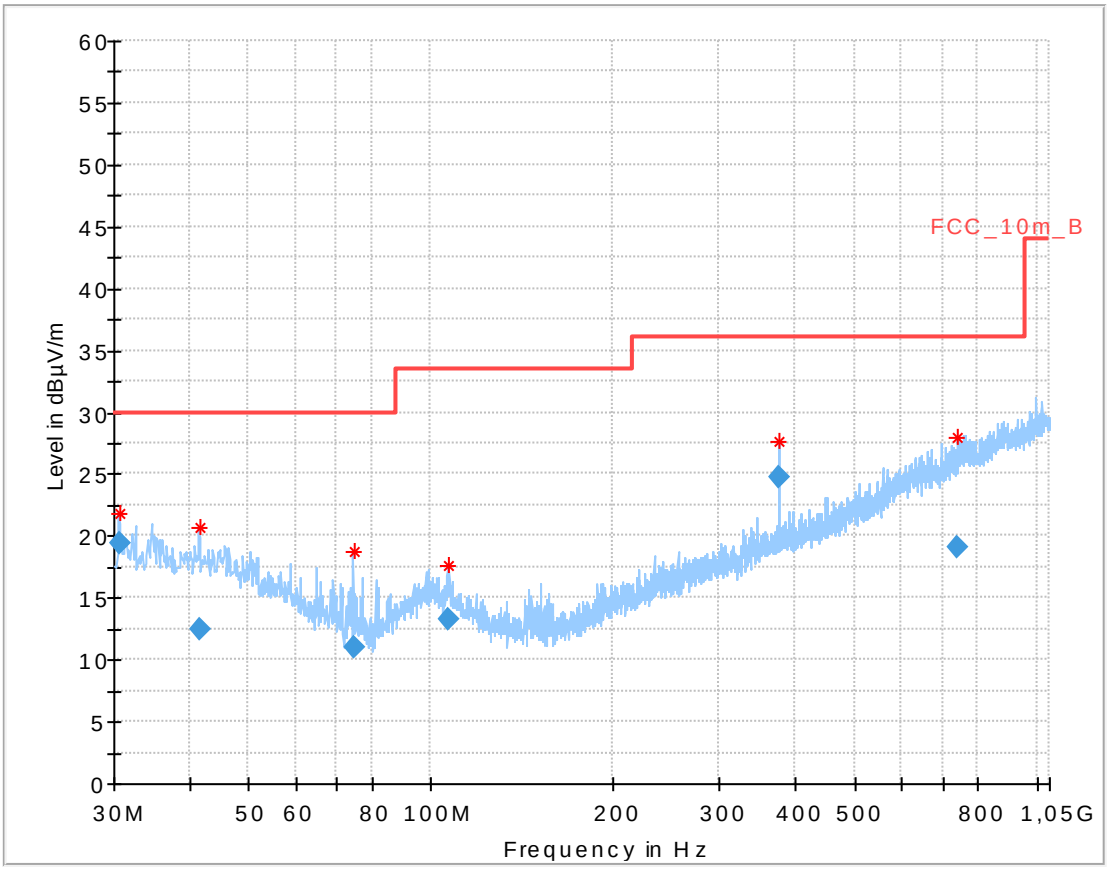
Receiver spurious emissions (dBµV/m)		
RX-mode		
Frequency	Detector	Level
All detected spurious emissions are more than 6 dB below the limit. Also see table below plot 2.		

Plots of the measurements

Plot 1: 9 kHz - 30 MHz



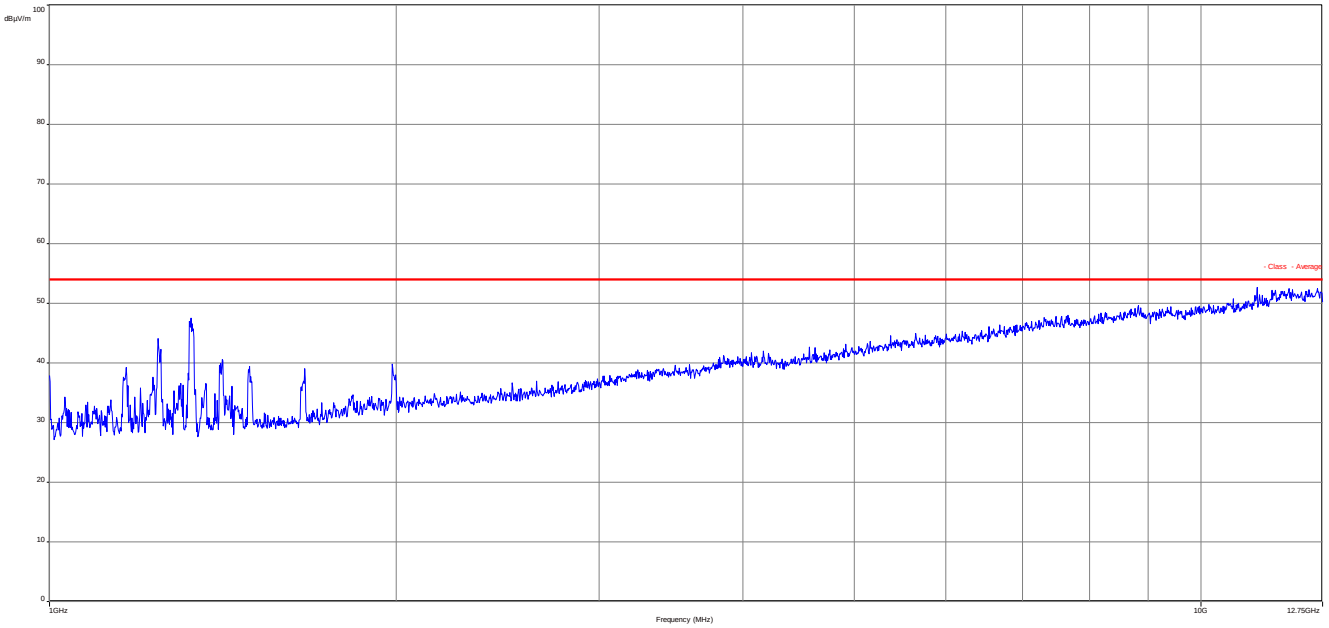
Plot 2: 30 MHz – 1 GHz



Final_result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.609390	19.38	30.00	10.62	1000.0	120.000	174.0	V	8	13.4
41.541900	12.49	30.00	17.51	1000.0	120.000	172.0	V	33	14.0
74.576550	11.07	30.00	18.93	1000.0	120.000	352.0	V	2	8.3
106.728300	13.30	33.50	20.20	1000.0	120.000	172.0	V	5	11.5
375.018000	24.71	36.00	11.29	1000.0	120.000	200.0	H	148	16.5
740.388300	19.15	36.00	16.85	1000.0	120.000	200.0	H	5	22.5

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



12.10 Spurious emissions conducted < 30 MHz

Description:

Measurement of the conducted spurious emissions in transmit mode below 30 MHz. 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
Test setup:	See sub clause 8.4
Measurement uncertainty	See sub clause 9

Limits: Class A device according manufacturer declaration

FCC				
TX Spurious emissions conducted < 30 MHz				
Frequency (MHz)	Quasi-peak [dBµV]		Average [dBµV]	
	Class A	Class B	**Class A**	Class B
0.15 – 0.5	**79**	66 to 56*	**66**	56 to 46*
0.5 – 5	**73**	56	**60**	46
5 – 30.0	**73**	60	**60**	50

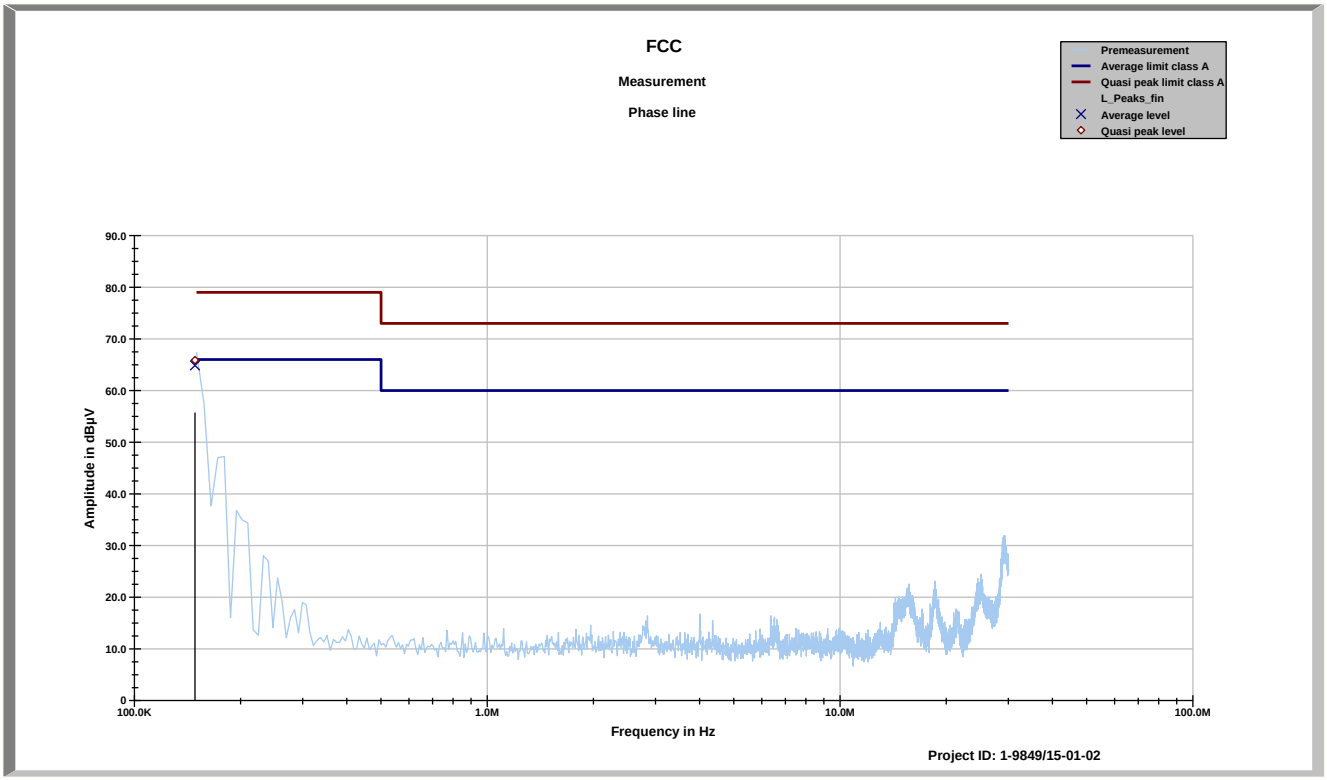
*Decreases with the logarithm of the frequency

Results:

TX Spurious emissions conducted < 30 MHz [dBµV]		
F [MHz]	Detector	Level [dBµV/m]
See tables below the plots		

Plots:

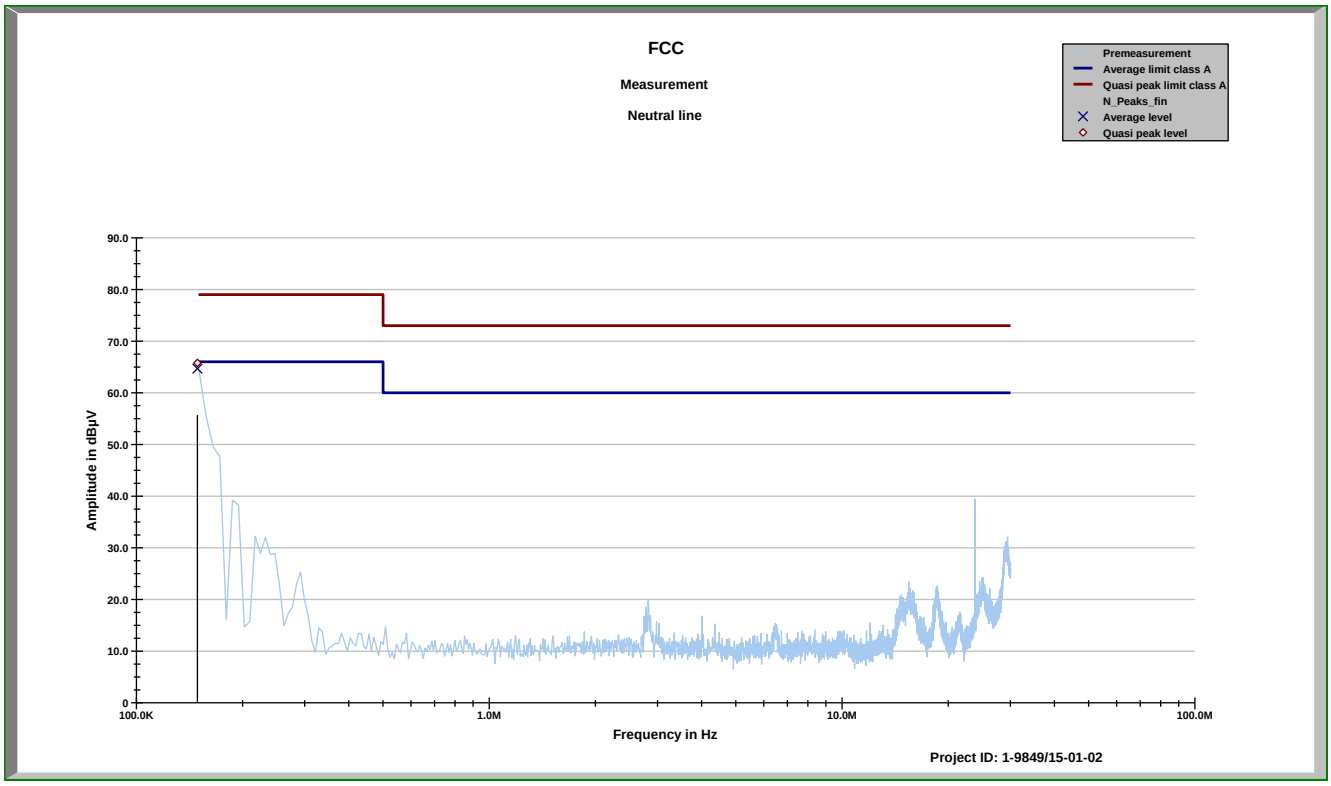
Plot 1: TX mode, 150 kHz to 30 MHz, phase line, high power



Results:

Frequency	Quasi peak level	Margin quasi peak	Average level	Margin average
MHz	dBµV	dBµV	dBµV	dBµV
0.15	64.28	14.72	63.16	2.84

Plot 2: TX mode, 150 kHz to 30 MHz, neutral line, high power



Results:

Frequency	Quasi peak level	Margin quasi peak	Average level	Margin average
MHz	dBµV	dBµV	dBµV	dBµV
0.15	64.29	14.71	62.35	3.65

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	2015-09-08
-A	References to Canadian requirements removed	2015-10-27

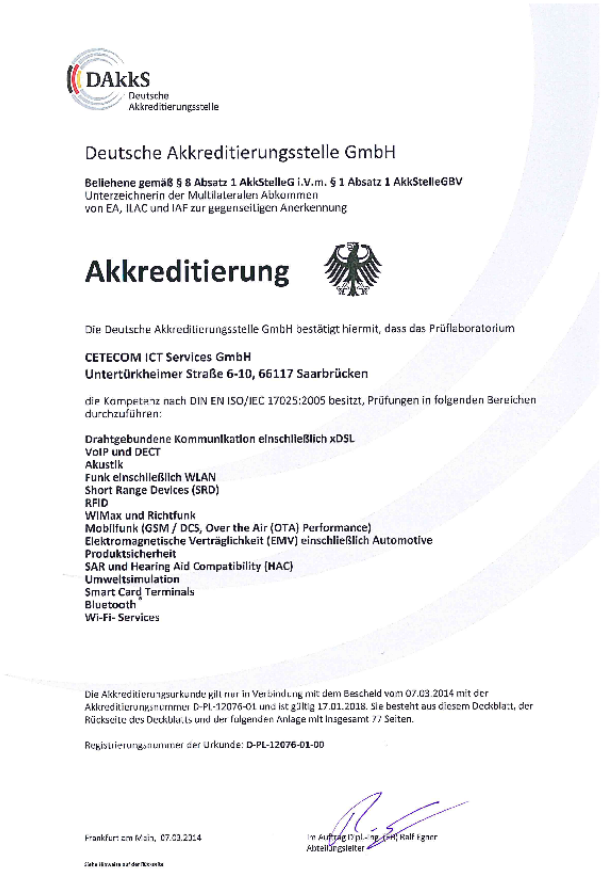
Annex B Further information

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



DAkkS
Deutsche
Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH

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Unterzeichnerin der Multilateralen Abkommen
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Untertürkheimer Straße 6-10, 66117 Saarbrücken

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Drahtgebundene Kommunikation einschließlich xDSL
VoIP und DECT
Akustik
Funk einschließlich WLAN
Short Range Devices (SRD)
RFID
WiMax und Richtfunk
Mobilfunk (GSM / DCS, Over the Air (OTA) Performance)
Elektromagnetische Verträglichkeit (EMV) einschließlich Automotive
Produktsicherheit
SAR und Hearing Aid Compatibility (HAC)
Umweltsimulation
Smart Card Terminals
Bluetooth
Wi-Fi- Services

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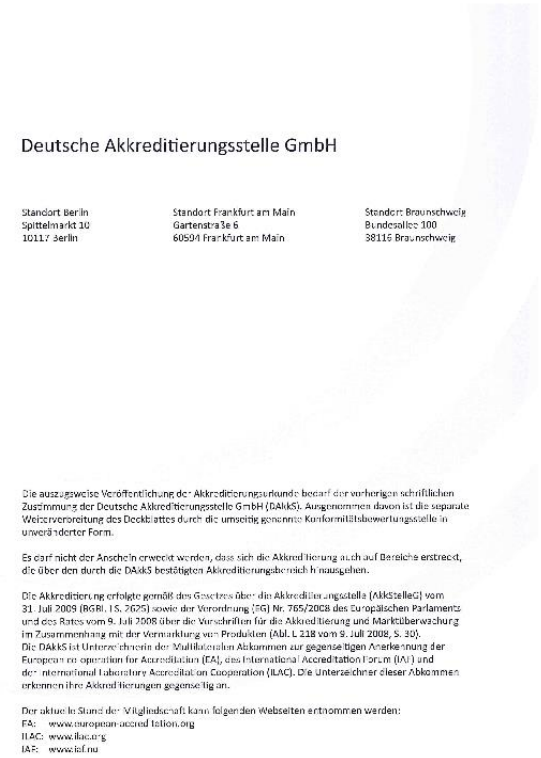
Registrierungsnummer der Urkunde: **D-PL-12076-01-00**

Frankfurt am Main, 07.03.2014

Im Auftrag Dipl.-Ing. (FH) Rolf Egner
Abteilungsleiter

Back side of certificate



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Note:

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