
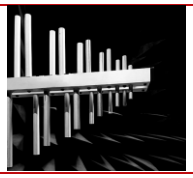
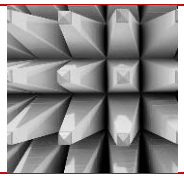

CETECOM™
CETECOM ICT Services
consulting - testing - certification

TEST REPORT

Test report no.: 1-8297/14-02-02-B

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
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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

peiker acustic GmbH & Co. KG
Max-Planck Str. 28-32
61381 Friedrichsdorf / GERMANY
Phone: -/-
Fax: +49 6172 767-220
Contact: Martin Fleckenstein
e-mail: martin.fleckenstein@peiker.de
Phone: +49 6172 767-1379

Manufacturer

peiker acustic GmbH & Co. KG
Max-Planck Str. 28-32
61381 Friedrichsdorf / GERMANY

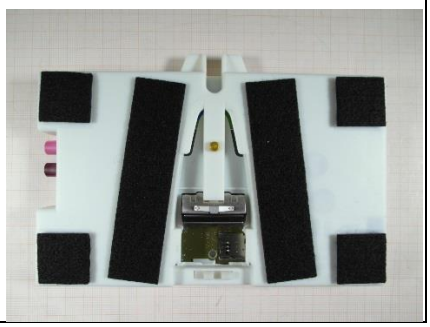
Test standard/s

47 CFR Part 15	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 210 Issue 8	Spectrum Management and Telecommunications Radio Standards Specification - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

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

Test Item

Kind of test item:	**Advanced Telecommunication module (ATM) Roof Version**
Model name:	**ATM-01 R1-US-4GW**
FCC ID:	**QWY-ATM-R-522**
IC:	**6588A-ATMR522**
Frequency:	DTS band 2400 MHz to 2483.5 MHz
Technology tested:	WLAN (DSSS/b-mode; OFDM/g- and n HT20 - mode)
Antenna:	Integrated antenna
Power supply:	14.0 V DC by external power supply
Temperature range:	-20°C to +50°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:

p.o. Stefan Boes

cn=Stefan Boes, o=CETECOM ICT Services GmbH, ou=BOE-111011, email=Stefan.Boes@cetecom.com, c=DE
2015.06.17 07:24:57 +02'00'

Andreas Luckenbill
Radio Communications & EMC

Test performed:

M. Bertolino

cn=Marco Bertolino, o=CETECOM ICT Services GmbH, ou=BTL-100826, email=marco.bertolino@cetecom.com, c=DE
2015.06.17 07:30:17 +02'00'

Marco Bertolino
Radio Communications & EMC

1 Table of contents

2 General information

2.1 Notes and disclaimer

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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.

2.2 Application details

Date of receipt of order:	2014-12-19
Date of receipt of test item:	2015-02-17
Start of test:	2015-02-17
End of test:	2015-02-23
Person(s) present during the test:	-/-

3 Test standard/s

Test standard	Date	Test standard description
47 CFR Part 15	-/-	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 210 Issue 8	01.12.2010	Spectrum Management and Telecommunications Radio Standards Specification - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

3.1 Measurement guidance

DTS : KDB 558074	2014-06	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

4 Test environment

Temperature:	T_{nom}	+22 °C	during room temperature tests
	T_{max}	+50 °C	during high temperature tests
	T_{min}	-20 °C	during low temperature tests
Relative humidity content:		42 %	
Barometric pressure:		not relevant for this kind of testing	
Power supply:	V_{nom}	14.0 V	DC by external power supply
	V_{max}	18.0 V	
	V_{min}	4.5 V	

5 Test item

Kind of test item	:	Advanced Telecommunication module (ATM) Roof Version
HVIN	:	ATM-01 R1-US-4GW
PMN	:	ATM roof version
S/N serial number	:	Radiated unit: 0000506765 Conducted unit: 0000506764
HW hardware status	:	112.010.010
SW software status	:	001.017.047
Frequency band	:	DTS band 2400 MHz to 2483.5 MHz (lowest channel 01 – 2412 MHz; highest channel 11 – 2462 MHz)
Type of radio transmission **Use of frequency spectrum**	: :	DSSS, OFDM
Type of modulation	:	BPSK, QPSK, 16 – QAM and 64 – QAM
Number of channels	:	11
Antenna	:	Integrated antenna
Power supply	:	14.0 V DC by external power supply
Temperature range	:	-20°C to +50°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: 1-8297/14-02-01_AnnexA
1-8297/14-02-01_AnnexB
1-8297/14-02-01_AnnexD

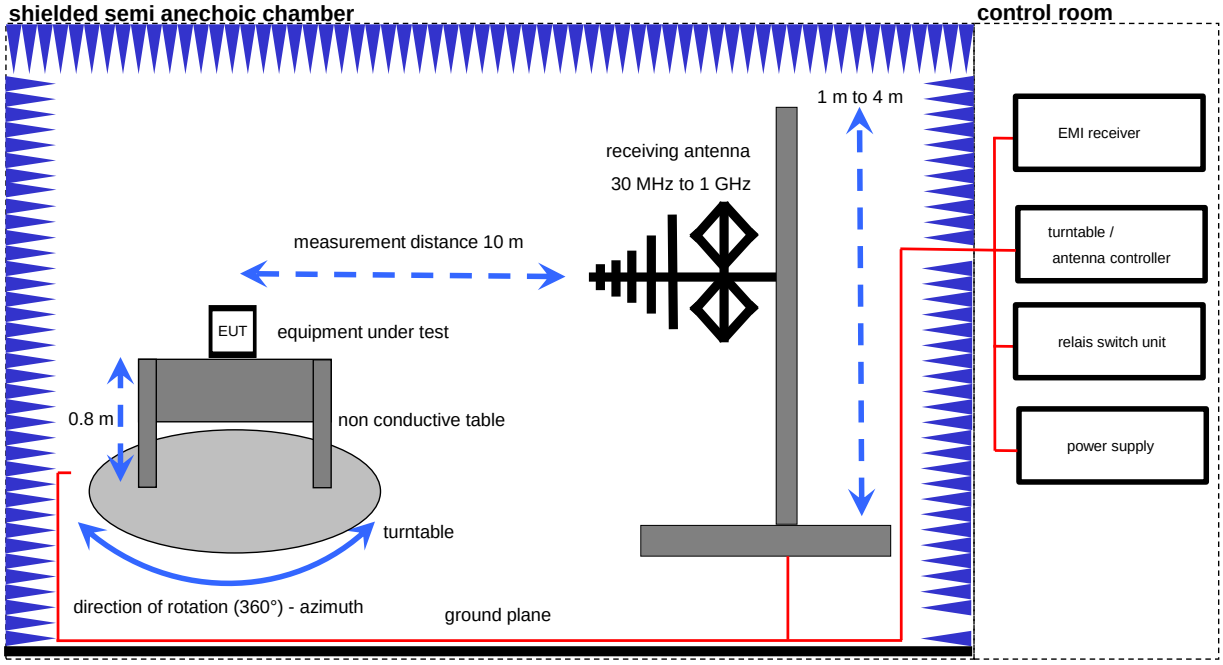
6 Test laboratories sub-contracted

None

7 Description of the test setup

7.1 Radiated measurements chamber F

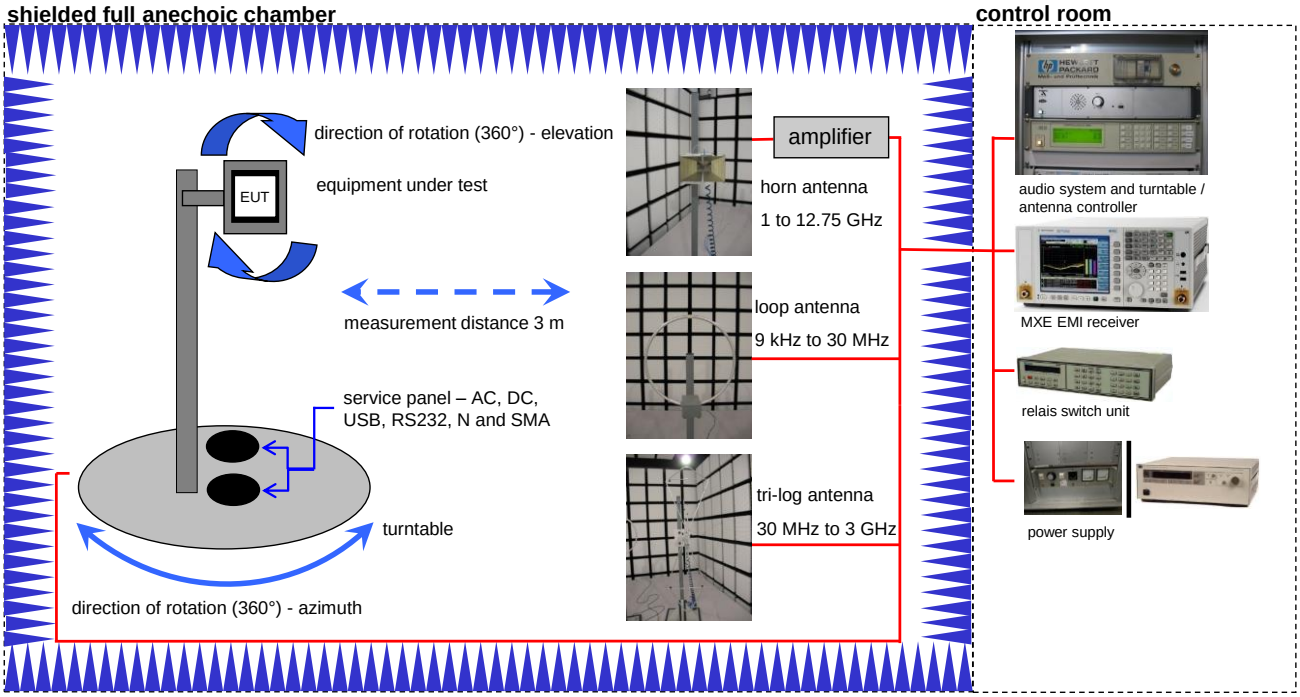
The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are confirmed with specifications ANSI C63.10:2013. 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 C63.10:2013.



Equipment table:

Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom
Software	EMC32 V.| 9.12.05	R&S	-/-	-/-
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

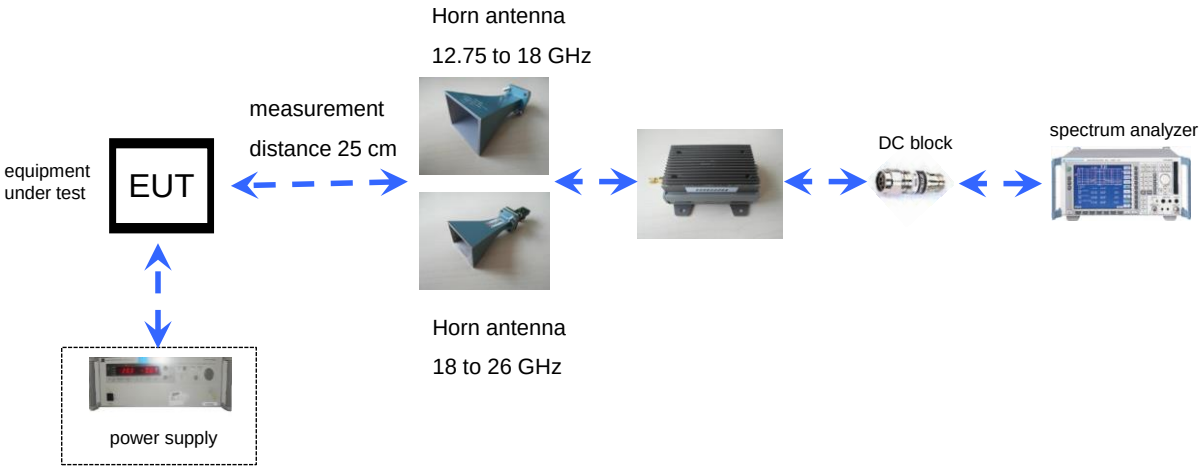
7.2 Radiated measurements chamber C



Equipment table:

Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom
DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2818A03450	300001040
Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032
Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996
Switch / Control Unit	3488A	HP	*	300000199
Artificial Mains 9 kHz to 30 MHz	ESH3-Z5	R&S	828576/020	300001210
Isolating Transformer	MPL IEC625 Bus Regeltrenntravo	Erfi	91350	300001155
Active Loop Antenna 10 kHz to 30 MHz	6502	Kontron Psychotech	8905-2342	300000256
Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143
Band Reject filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	11	300003351
TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854
MXE EMI Receiver 20 Hz to 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405

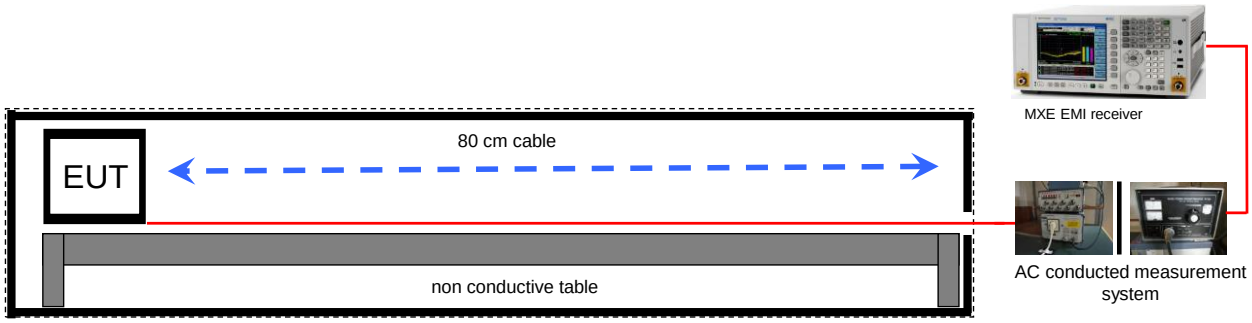
7.3 Radiated measurements 12.75 GHz to 26 GHz



Equipment table:

Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom
Microwave System Amplifier, 0.5-26.5 GHz	83017A	HP	00419	300002268
Std. Gain Horn Antenna 12.4 to 18.0 GHz	639	Narda	8402	300000787
Std. Gain Horn Antenna 18.0 to 26.5 GHz	638	Narda	8205	300002442
Signal Analyzer 40 GHz	FSV40	R&S	101042	300004517
Power Supply 0-20V, 0-5A	6632B	Agilent Technologies	GB42110541	400000562

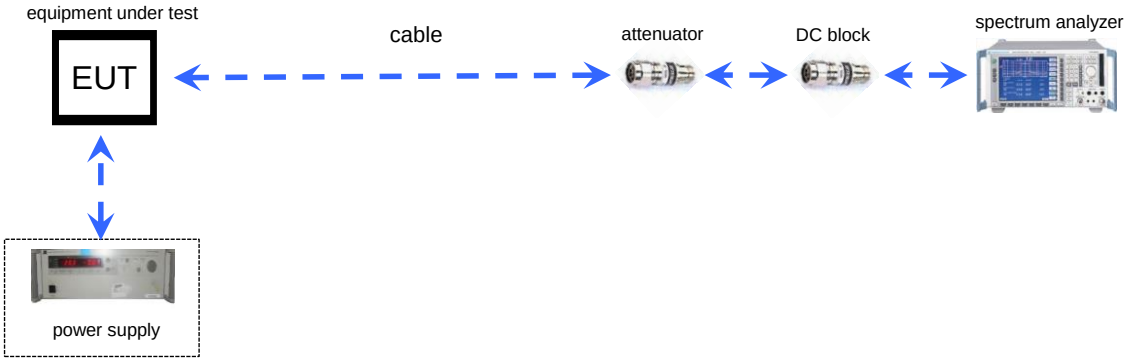
7.4 AC conducted



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	Erfi	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

7.5 Conducted measurements



Equipment table:

Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom
Signal Analyzer 40 GHz	FSV40	R&S	101042	300004517
Power Supply 0-20V, 0-5A	6632B	Agilent Technologies	GB42110541	400000562

8 Summary of measurement results

X	**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	CFR Part 15 RSS 210, Issue 8	See table!	2015-06-17	-/-

Test specification clause	Test case	Guideline	Temperature conditions	Power source voltages	Mode	Pass	Fail	NA	NP	Remark
§15.247(b)(4) RSS 210 / A8.4(2)	System gain	-/-	Nominal	Nominal	DSSS	☒	☐	☐	☐	complies
§15.247(e) RSS 210 / A8.2(b)	Power spectral density	KDB 558074 DTS clause: 10.6	Nominal	Nominal	DSSS OFDM g & n	☒ ☒	☐ ☐	☐ ☐	☐ ☐	complies
§15.247(a)(2) RSS 210 / A8.2(a)	DTS bandwidth – 6 dB bandwidth	KDB 558074 DTS clause: 8.1	Nominal	Nominal	DSSS OFDM g & n	☒ ☒	☐ ☐	☐ ☐	☐ ☐	complies
RSS Gen clause 4.6.1	Occupied bandwidth	-/-	Nominal	Nominal	DSSS OFDM g & n	☒ ☒	☐ ☐	☐ ☐	☐ ☐	complies
§15.247(b)(3) RSS-210 / A8.4(4)	Maximum output power	KDB 558074 DTS clause: 9.2.2.5	Nominal	Nominal	DSSS OFDM g & n	☒ ☒	☐ ☐	☐ ☐	☐ ☐	complies
§15.247(d) RSS-210 / A8.5	Detailed spurious emissions @ the band edge - conducted	-/-	Nominal	Nominal	DSSS OFDM g & n	☒ ☒	☐ ☐	☐ ☐	☐ ☐	complies
§15.205 RSS-210 / A8.5	Band edge compliance radiated	KDB 558074 DTS clause: 13.3.2	Nominal	Nominal	DSSS OFDM g & n	☒ ☒	☐ ☐	☐ ☐	☐ ☐	complies
§15.247(d) RSS-210 / A8.5	TX spurious emissions conducted	KDB 558074 DTS clause: 11.1 & 11.2 11.3	Nominal	Nominal	DSSS OFDM g & n	☒ ☒	☐ ☐	☐ ☐	☐ ☐	complies
§15.247(d) RSS-210 / A8.5	TX spurious emissions radiated	-/-	Nominal	Nominal	DSSS OFDM g & n	☒ ☒	☐ ☐	☐ ☐	☐ ☐	complies
§15.109 RSS-Gen	RX spurious emissions radiated	-/-	Nominal	Nominal	-/-	☒	☐	☐	☐	complies
§15.209(a) RSS-Gen	TX spurious emissions radiated < 30 MHz	-/-	Nominal	Nominal	DSSS OFDM g & n	☒ ☒	☐ ☐	☐ ☐	☐ ☐	complies
§15.107(a) §15.207	Conducted emissions < 30 MHz	-/-	Nominal	Nominal	DSSS OFDM g & n	☒ ☒	☐ ☐	☐ ☐	☐ ☐	complies

Note: NA = Not Applicable; NP = Not Performed

9 Additional comments

Reference documents: RF path loss and antenna gain information Rev. 1.0

Special test descriptions: Power setting 0 dBm was used! (Customer demand)

Configuration descriptions: None

Test mode:

☐ No test mode available.
Iperf was used to ping another device with the largest support packet size

☒ Special software is used.
EUT is transmitting pseudo random data by itself

10 Measurement results

10.1 System gain

Limits:

FCC	IC
Antenna Gain	
6 dBi	

Results:

T_{nom}	V_{nom}	DTS band 2400 MHz to 2483.5 MHz
Gain [dBi] Declared by the customer		5.0
Measurement uncertainty		-/-

Verdict: complies

10.2 Identify worst case data rate

Measurement:

All modes of the module will be measured with spectrum analyser to identify the maximum transmission power on the mid channel.

In further tests only the identified worst case modulation scheme or bandwidth will be measured.

Measurement parameters:

Peak power (RBW/VBW: 3MHz; detector: peak)

Results:

Modulation Frequency	Modulation scheme / bandwidth DTS band 2400 MHz to 2483.5 MHz
DSSS / b – mode	11 Mbit/s
OFDM / g – mode	36 Mbit/s
OFDM / n HT20 – mode	MCS0

10.3 Timing of the transmitter

Measurement:

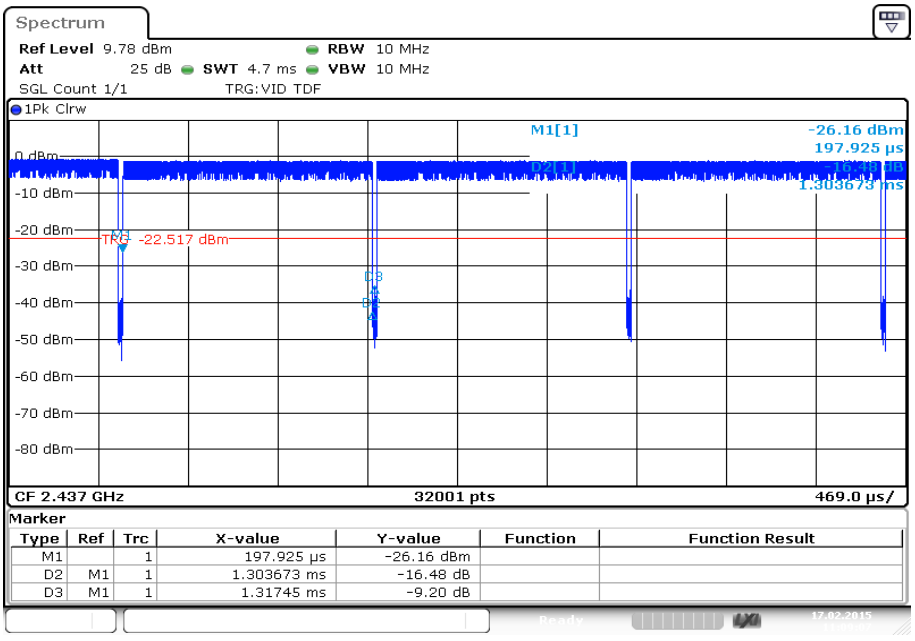
Measurement parameter	
Detector:	Positive peak
Sweep time:	See plots
Resolution bandwidth:	10 MHz
Video bandwidth:	10 MHz
Span:	Zero span
Trace-Mode:	Single sweep

Limits:

FCC	IC
Timing of the transmitter	
(c) Unless otherwise specified, e.g. Section 15.255(b), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.	

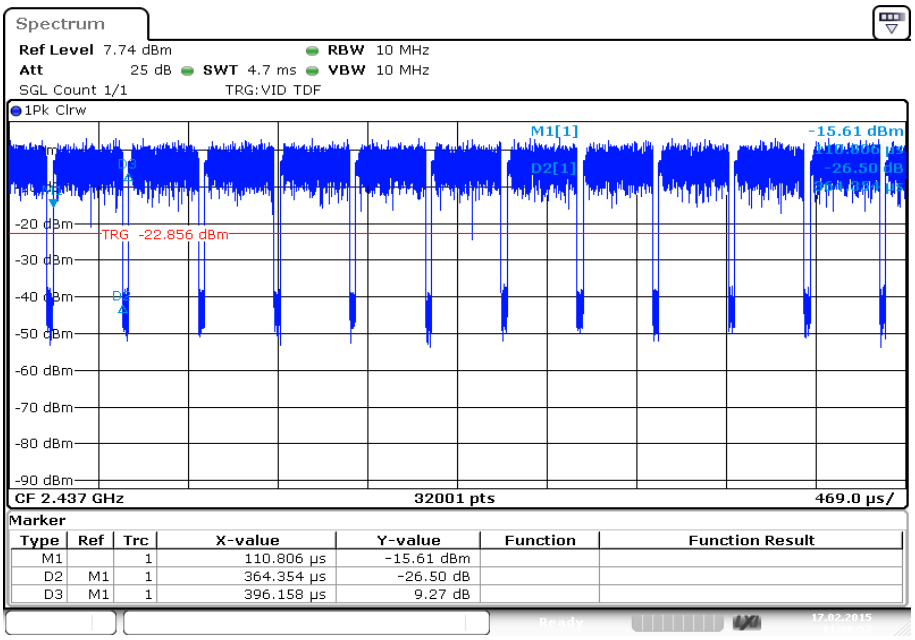
Result:

Plot 1: b-mode



Date: 17.FEB.2015 11:09:07

Plot 2: g-mode



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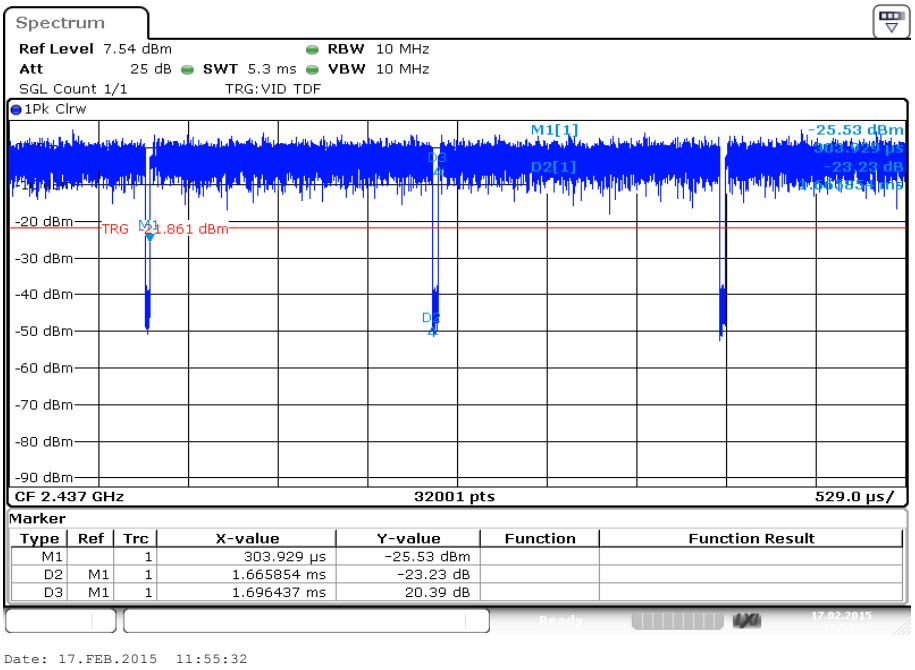
Plot 3: n/HT20-mode



Duty Cycle Correction Factor			
	b-mode	g-mode	n/HT20-mode
Transmit time (Tx on)	1.303673 ms	364.354 µs	1.665854 ms
Tx on + Tx off	1.317450 ms	396.158 µs	1.696437 ms
duty cycle correction factor	-0.09 dB	-0.73 dB	-0.16 dB
The duty cycle correction factor is calculated with 20Log [Tx on/(Tx on + Tx off)].			

10.4 Maximum output power

Description:

Measurement of the maximum output power conducted and radiated. The measurements are performed using the data rate producing the highest conducted output power.

Measurement:

Measurement parameter	
According to DTS clause: 9.2.2.5	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1 – 5 % of the OBW
Video bandwidth:	≥3x RBW
Span:	40 MHz
Integration bandwidth:	99 % power - bandwidth (OBW)
Trace-Mode:	Max hold (allow trace to fully stabilize)
Measurement function:	Channel power with OBW

Limits:

FCC	IC
Maximum Output Power	
Conducted: 1.0 W – Antenna Gain max. 6 dBi	

Results:

DSSS / b – mode	**Maximum Output Power [dBm]**		
Frequency	2412 MHz	2437 MHz	2462 MHz
Output power conducted incl. DC corr. Worst case data rate	-2.54	-2.99	-2.24
OFDM / g – mode	**Maximum Output Power [dBm]**		
Frequency	2412 MHz	2437 MHz	2462 MHz
Output power conducted incl. DC corr. Worst case data rate	-3.08	-3.83	-2.98
OFDM / n HT20 – mode	**Maximum Output Power [dBm]**		
Frequency	2412 MHz	2437 MHz	2462 MHz
Output power conducted incl. DC corr. Worst case data rate	-2.80	-2.84	-1.83
Measurement uncertainty	± 1.5 dB (cond.)		

Verdict: **complies**

10.5 Power spectral density

Description:

Measurement of the power spectral density of a digital modulated system. The measurement is repeated for both modulations at the lowest, middle and highest channel.

Measurement:

Measurement parameter	
According to DTS clause: 10.6	
Detector:	RMS
Sweep time:	3s
Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Span:	40 MHz
Trace-Mode:	Max hold (allow trace to fully stabilize)

Limits:

FCC	IC
Power Spectral Density	
8 dBm / 3kHz (conducted)	

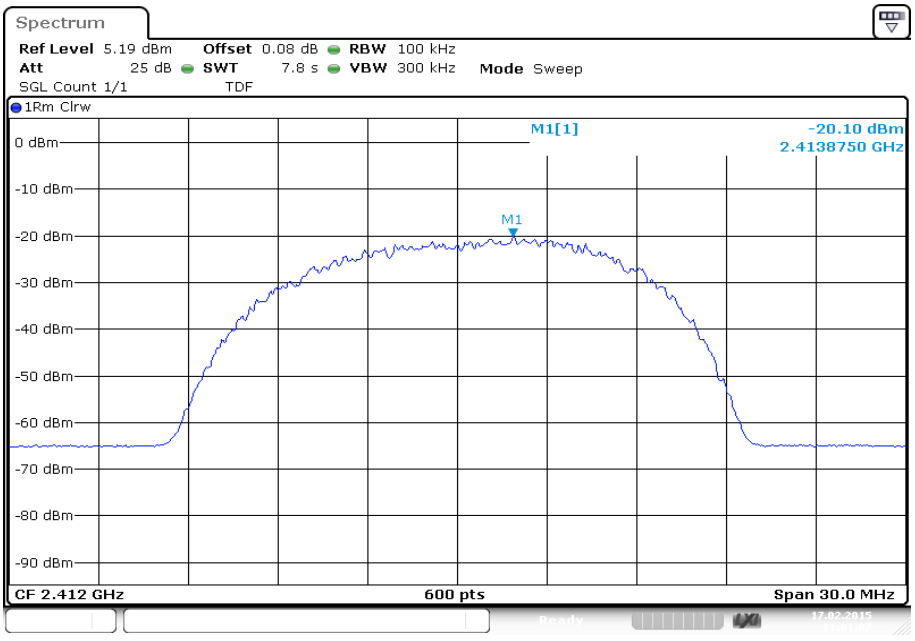
Results:

Modulation	Power Spectral density [dBm]		
Frequency	2412 MHz	2437 MHz	2462 MHz
DSSS / b – mode	-20.10	-21.35	-20.56
OFDM / g – mode	-21.74	-23.42	-22.45
OFDM / n HT20 – mode	-22.09	-23.07	-22.44
Measurement uncertainty	± 1.5 dB (cond.)		

Verdict: complies

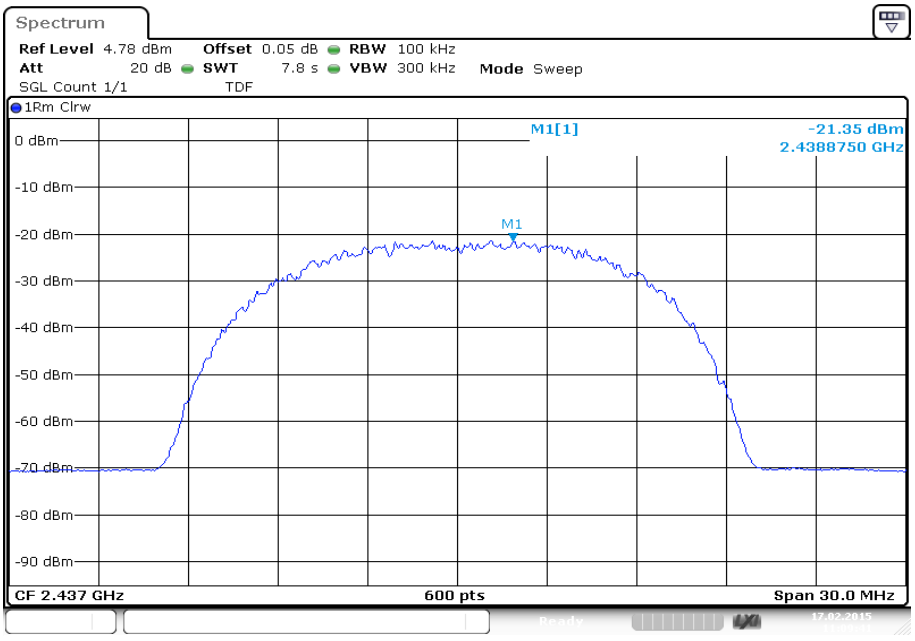
Plots: DSSS / b – mode

Plot 1: TX mode, lowest channel



Date: 17.FEB.2015 11:01:07

Plot 2: TX mode, middle channel



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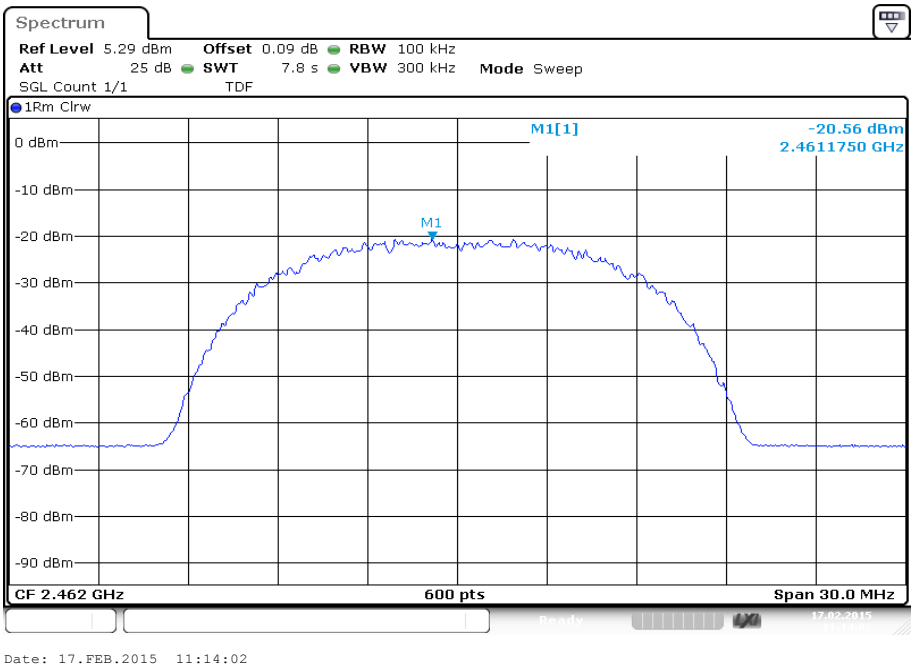
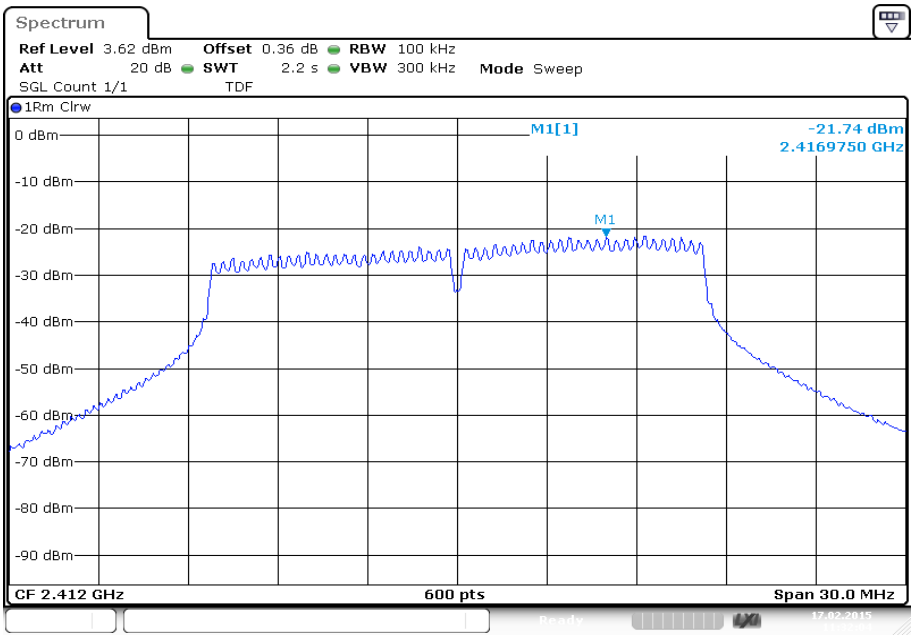
Plot 3: TX mode, highest channel



Plots: OFDM / g – mode

Plot 1: TX mode, lowest channel



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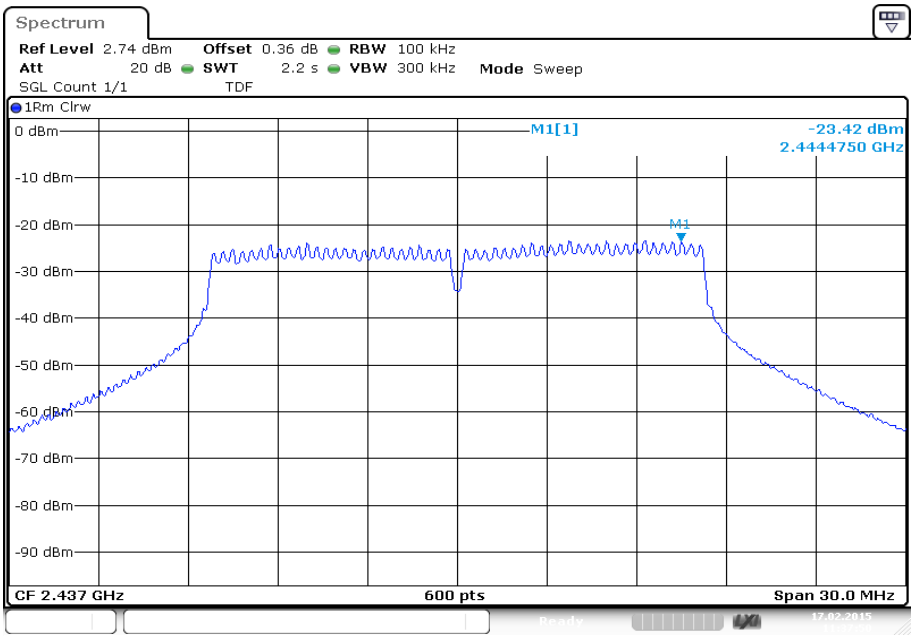
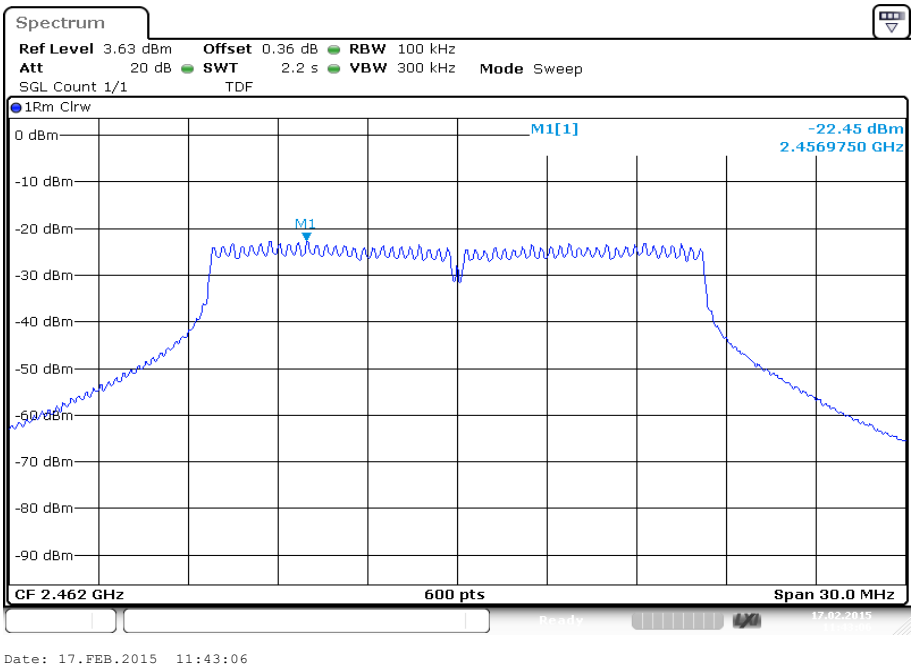
Plot 2: TX mode, middle channel



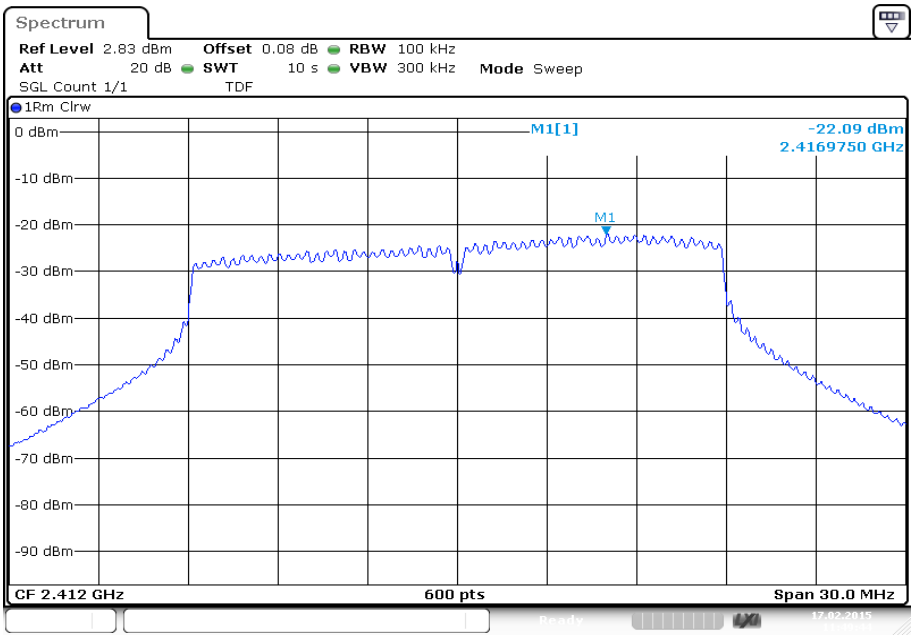
Date: 17.FEB.2015 11:37:50

Plot 3: TX mode, highest channel



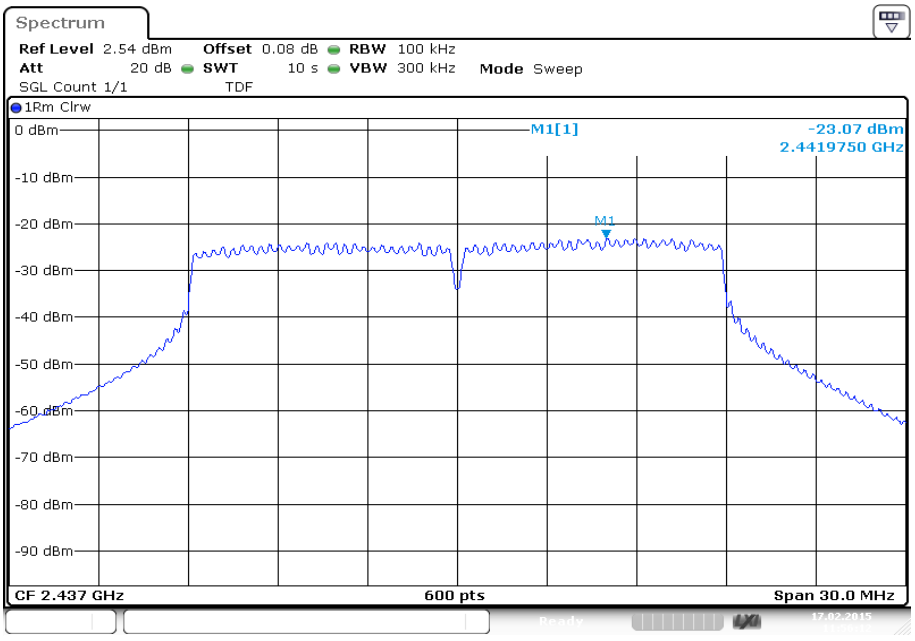
Plots: OFDM / n HT20 – mode

Plot 1: TX mode, lowest channel



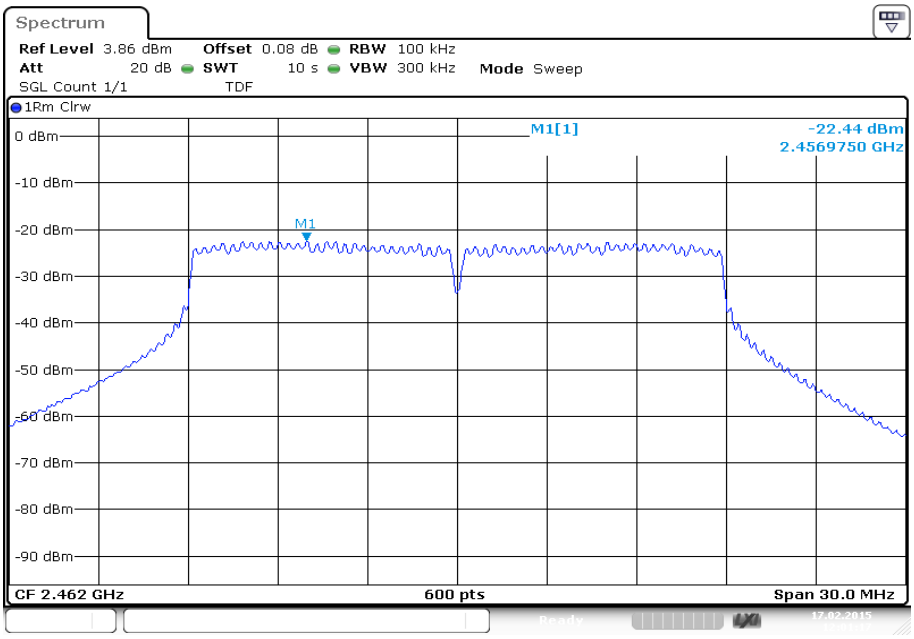
Date: 17.FEB.2015 11:49:44

Plot 2: TX mode, middle channel



Date: 17.FEB.2015 11:56:12

Plot 3: TX mode, highest channel



10.6 DTS bandwidth – 6 dB

Description:

Measurement of the 6 dB bandwidth of the modulated signal.

Measurement:

Measurement parameter	
According to DTS clause: 8.1	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Span:	40 MHz
Measurement procedure:	Measurement of the 75% bandwidth using the integration function of the analyzer
Trace-Mode:	Max hold (allow trace to stabilize)

Limits:

FCC	IC
DTS Bandwidth – 6 dB	
Systems using digital modulation techniques may operate in the 2400–2483.5 MHz band. The minimum 6 dB bandwidth shall be at least 500 kHz.	

Results:

Frequency	6 dB bandwidth [MHz]		
	2412 MHz	2437 MHz	2462 MHz
DSSS / b – mode	9.98	10.44	11.04
OFDM / g – mode	15.75	16.46	16.48
OFDM / n HT20 – mode	16.31	17.41	17.55
Measurement uncertainty	± RBW		

Verdict: complies

10.7 Occupied bandwidth – 99% emission bandwidth

Description:

Measurement of the 99% bandwidth of the modulated signal acc. RSS-GEN.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	300 kHz
Video bandwidth:	1 MHz
Span:	30 MHz
Measurement procedure:	Measurement of the 99% bandwidth using the integration function of the analyzer
Trace-Mode:	Max hold (allow trace to stabilize)

Usage:

-/-	IC
Occupied Bandwidth – 99% emission bandwidth	
OBW is necessary for Emission Designator	

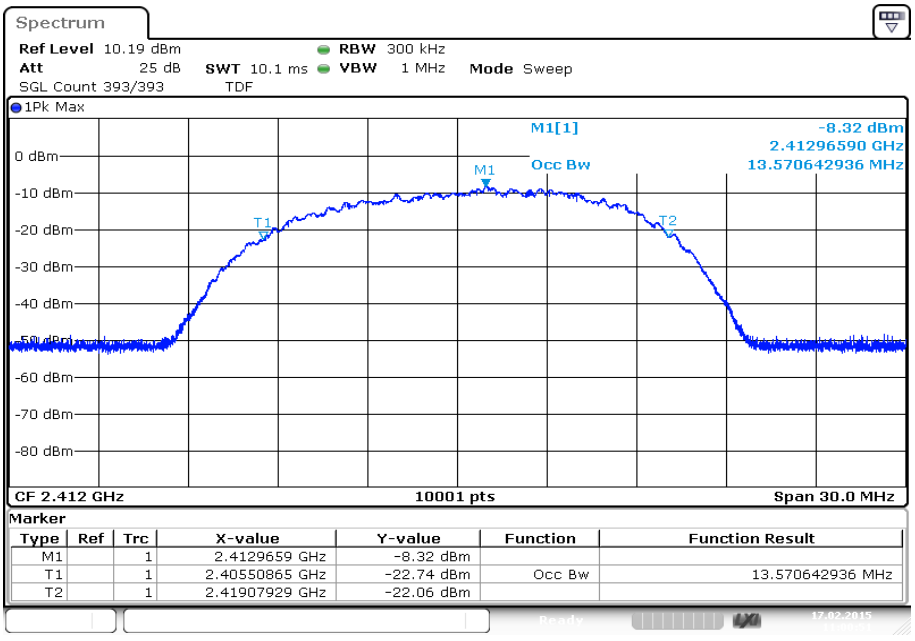
Results:

Modulation	99% bandwidth [MHz]		
Frequency	2412 MHz	2437 MHz	2462 MHz
DSSS / b – mode	13.57	13.83	13.89
OFDM / g – mode	16.76	16.92	16.96
OFDM / n HT20 – mode	17.88	18.04	18.04
Measurement uncertainty	± RBW		

Verdict: complies

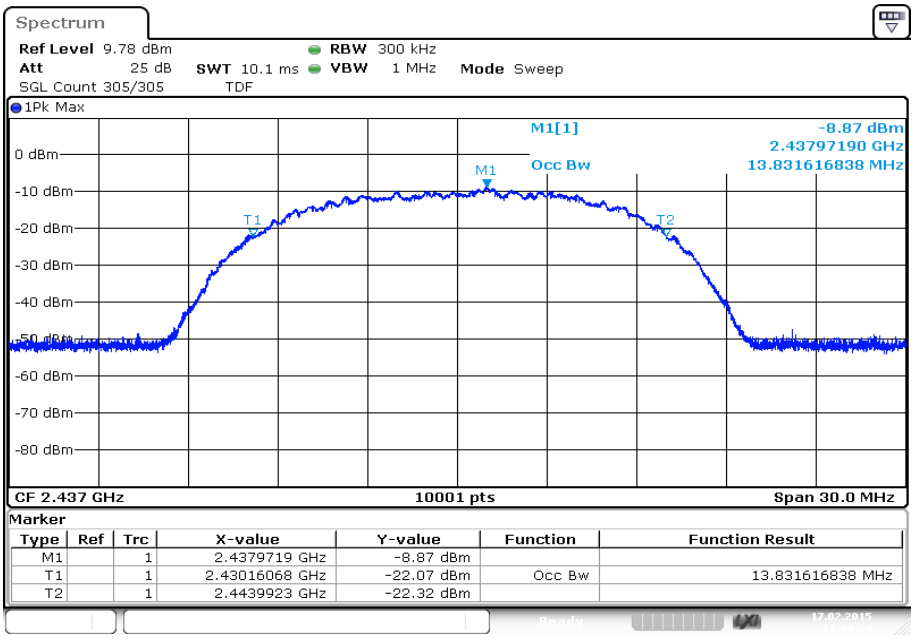
Plots: DSSS / b – mode

Plot 1: TX mode, lowest channel



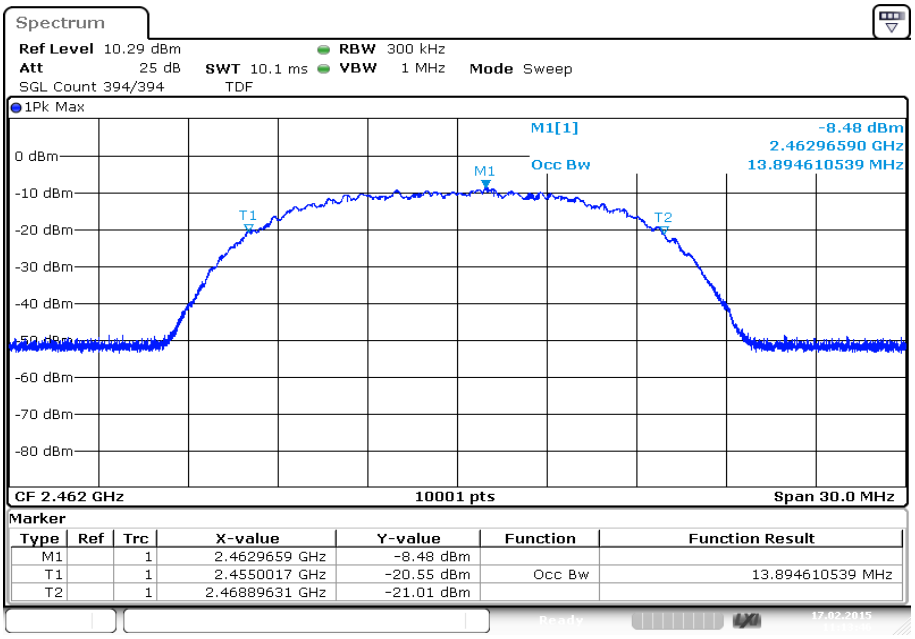
Date: 17.FEB.2015 11:00:50

Plot 2: TX mode, middle channel



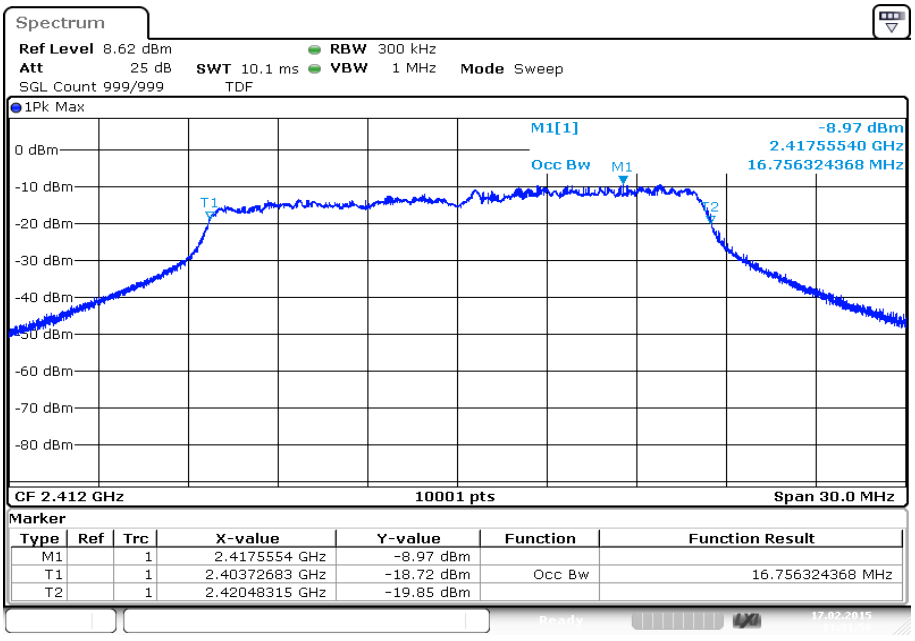
Date: 17.FEB.2015 11:09:24

Plot 3: TX mode, highest channel



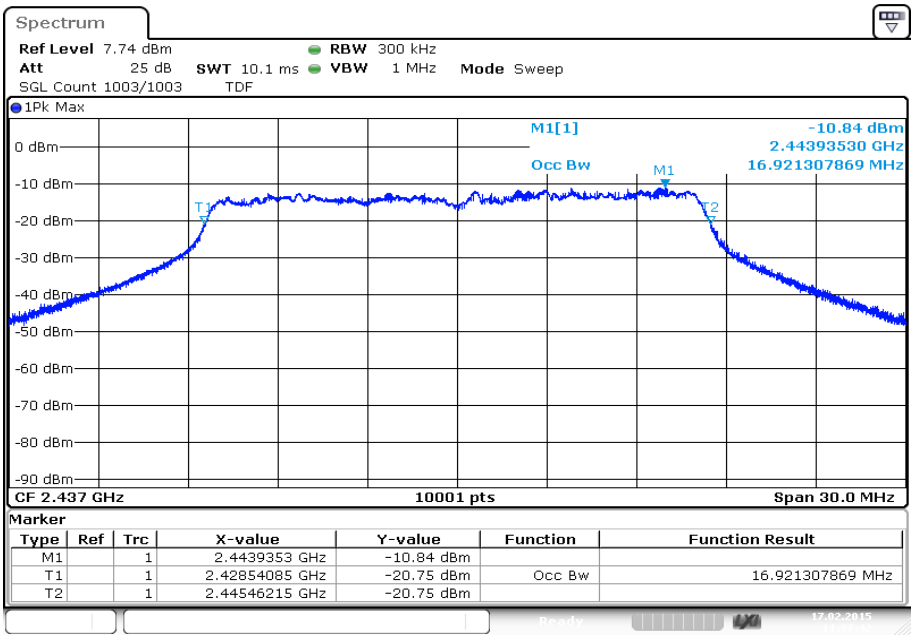
Plots: OFDM / g – mode

Plot 1: TX mode, lowest channel



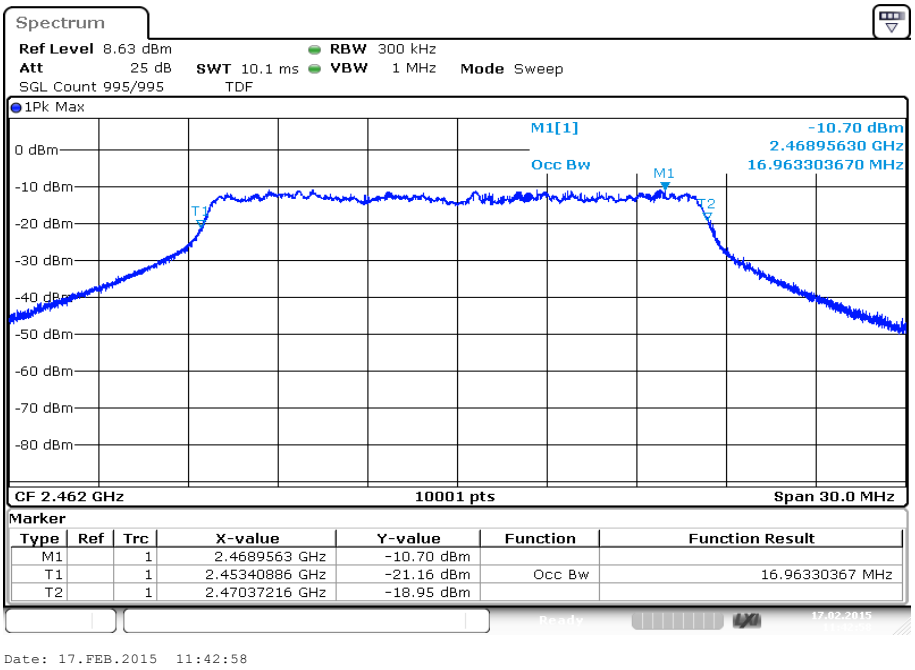
Date: 17.FEB.2015 11:31:56

Plot 2: TX mode, middle channel



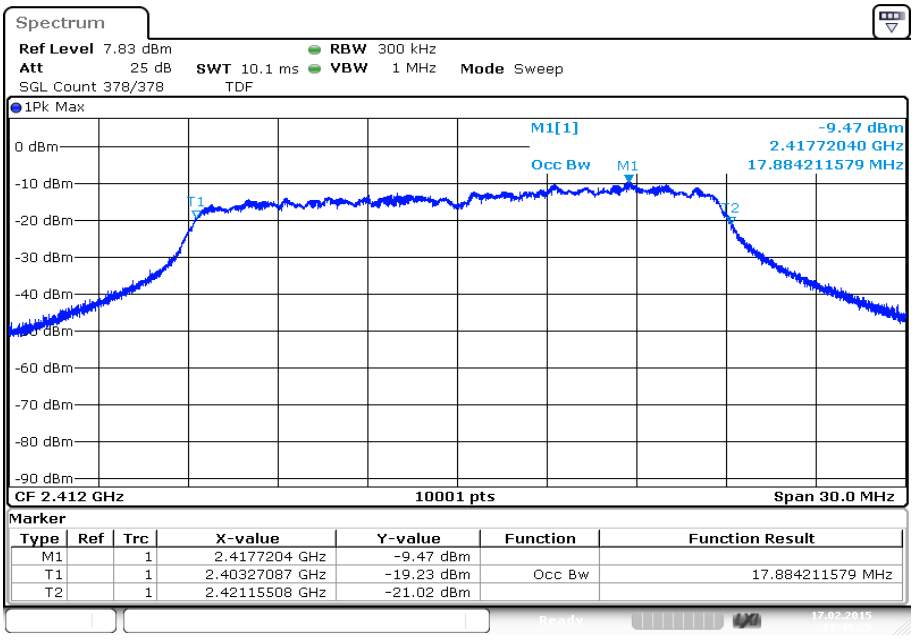
Date: 17.FEB.2015 11:37:42

Plot 3: TX mode, highest channel

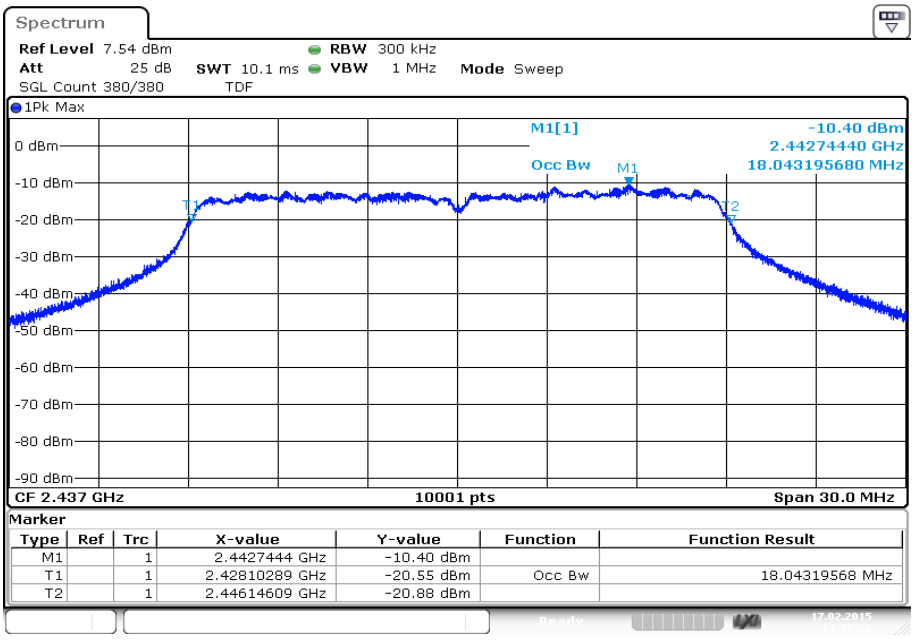


Plots: OFDM / n HT20 – mode

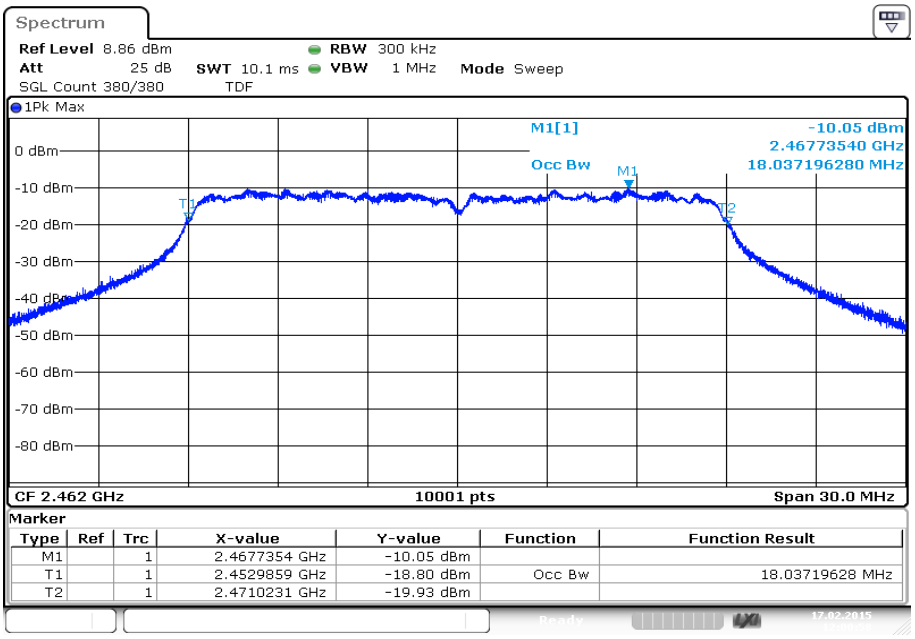
Plot 1: TX mode, lowest channel



Plot 2: TX mode, middle channel



Plot 3: TX mode, highest channel



10.8 Detailed spurious emissions @ the band edge - conducted

Description:

Measurement of the conducted band edge compliance. EUT is measured at the lower and upper band edge in both modes.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	100 kHz
Video bandwidth:	500 kHz
Span:	Lower Band Edge: 2300 – 2425 MHz Upper Band Edge: 2450 – 2550 MHz
Trace-Mode:	Max hold

Limits:

FCC	IC
Band Edge Compliance Conducted	
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.	

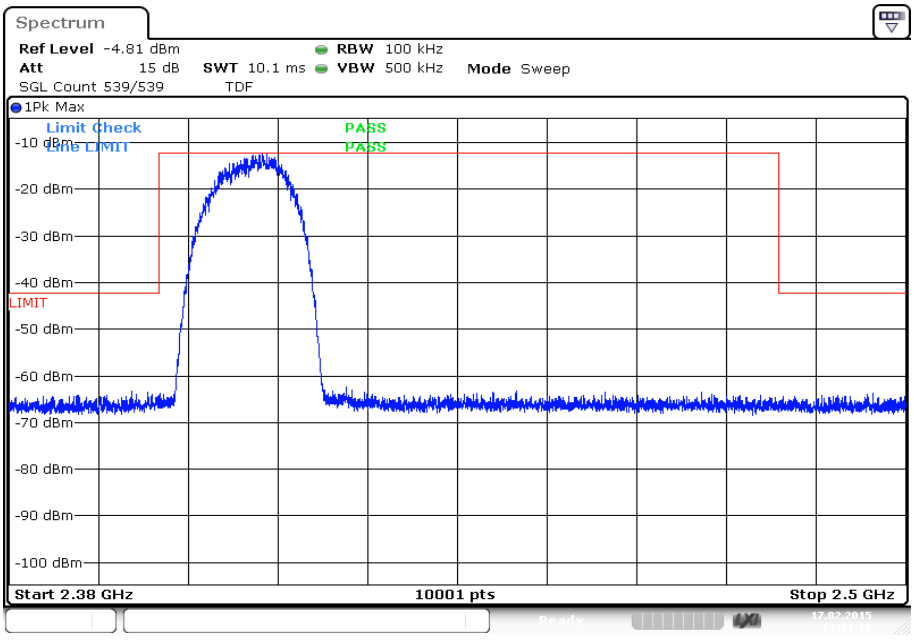
Results:

Scenario	Compliance Conducted [dB]		
Modulation	DSSS / b – mode	OFDM / g – mode	OFDM / n HT20 – mode
Lower Band Edge – Channel 1	> 30 dB	> 30 dB	> 30 dB
Upper Band Edge – Channel 11	> 30 dB	> 30 dB	> 30 dB
Measurement uncertainty	± 1.5 dB		

Verdict: complies

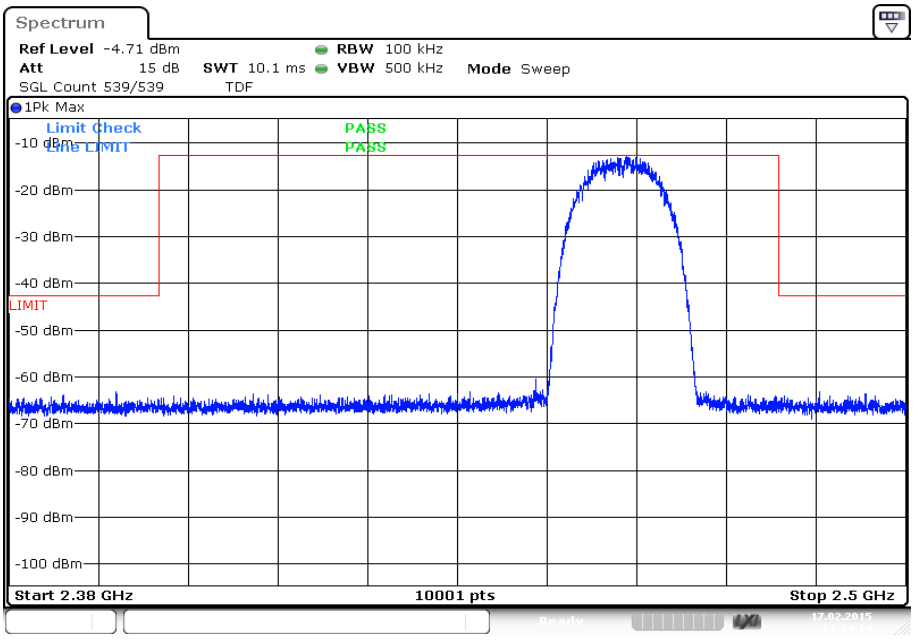
Plots: DSSS / b – mode

Plot 1: TX mode, lower band edge



Date: 17.FEB.2015 11:01:18

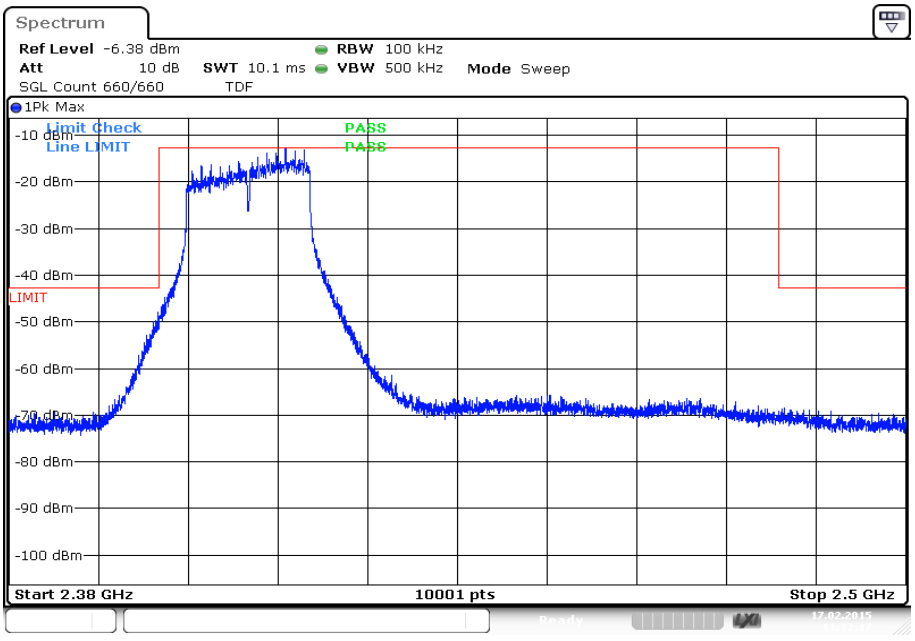
Plot 2: TX mode, upper band edge



Date: 17.FEB.2015 11:14:14

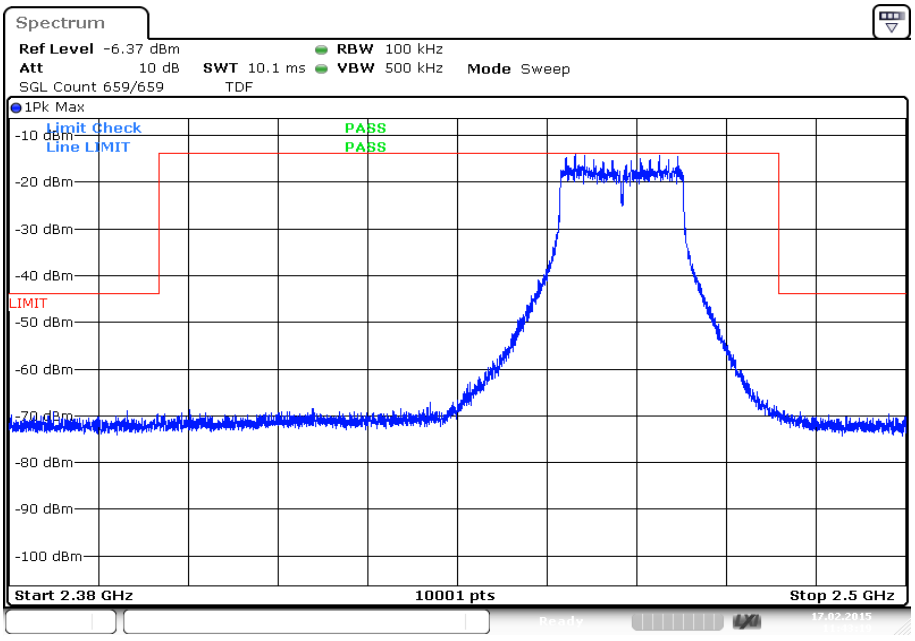
Plots: OFDM / g – mode

Plot 1: TX mode, lower band edge



Date: 17.FEB.2015 11:32:17

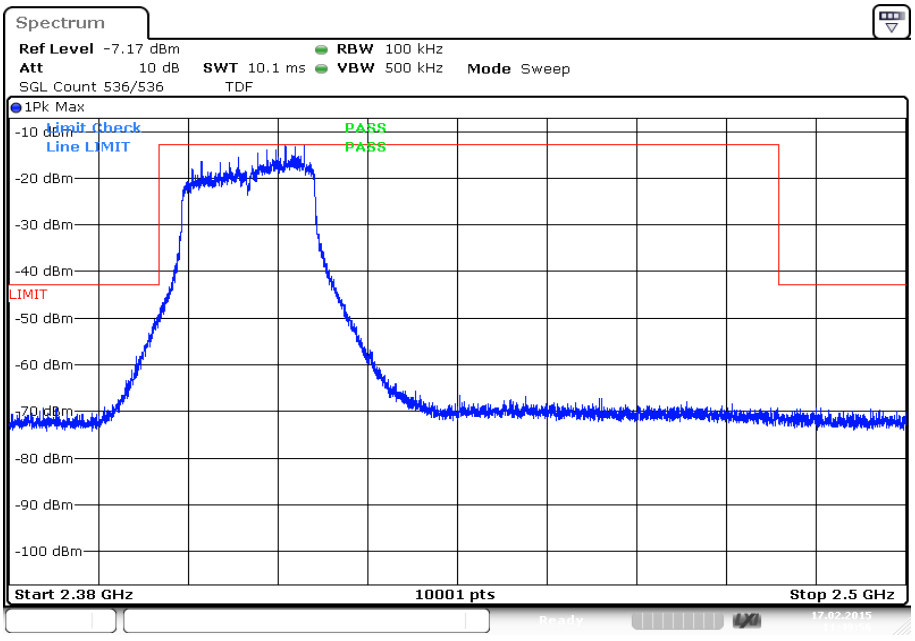
Plot 2: TX mode, upper band edge



Date: 17.FEB.2015 11:43:19

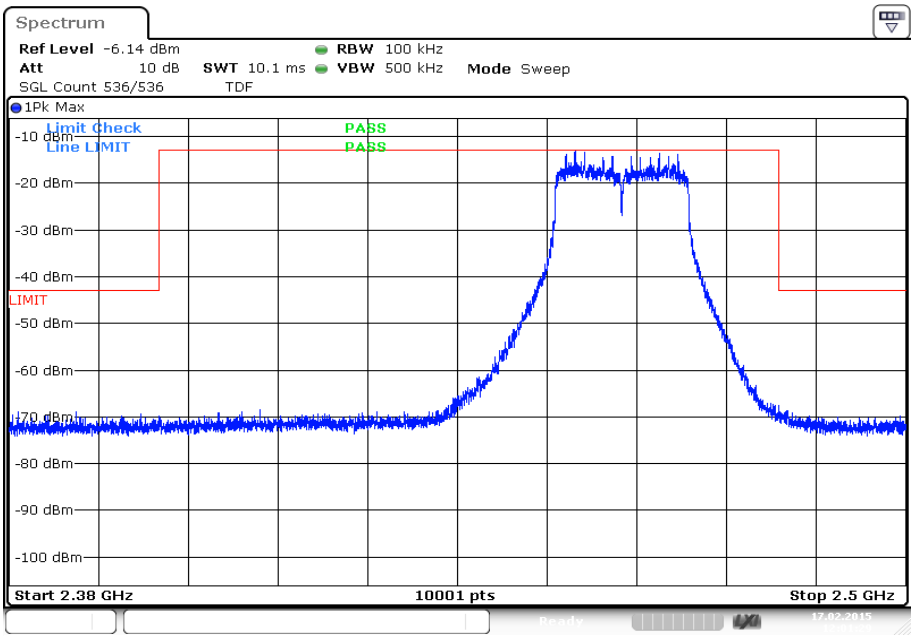
Plots: OFDM / n HT20 – mode

Plot 1: TX mode, lower band edge



Date: 17.FEB.2015 11:49:56

Plot 2: TX mode, upper band edge



Date: 17.FEB.2015 12:01:28

10.9 Band edge compliance radiated

Description:

Measurement of the radiated band edge compliance. The EUT is turned in the position that results in the maximum level at the band edge. Then a sweep over the corresponding restricted band is performed. The EUT is set to channel 1 for the lower restricted band and to channel 11 for the upper restricted band. The measurement is repeated for all modulations. Measurement distance is 3m.

Measurement:

Measurement parameter for peak measurements	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1 MHz
Video bandwidth:	1 MHz
Span:	See plot!
Trace-Mode:	Max Hold

Measurement parameter for average measurements	
According to DTS clause: 13.3.2	
Detector:	RMS
Sweep time:	Auto
Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Span:	2 MHz
Trace-Mode:	RMS Average over 101 sweeps

Limits:

FCC	IC
Band Edge Compliance Radiated	
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 5.205(c)).	
74 dBµV/m Peak 54 dBµV/m AVG	

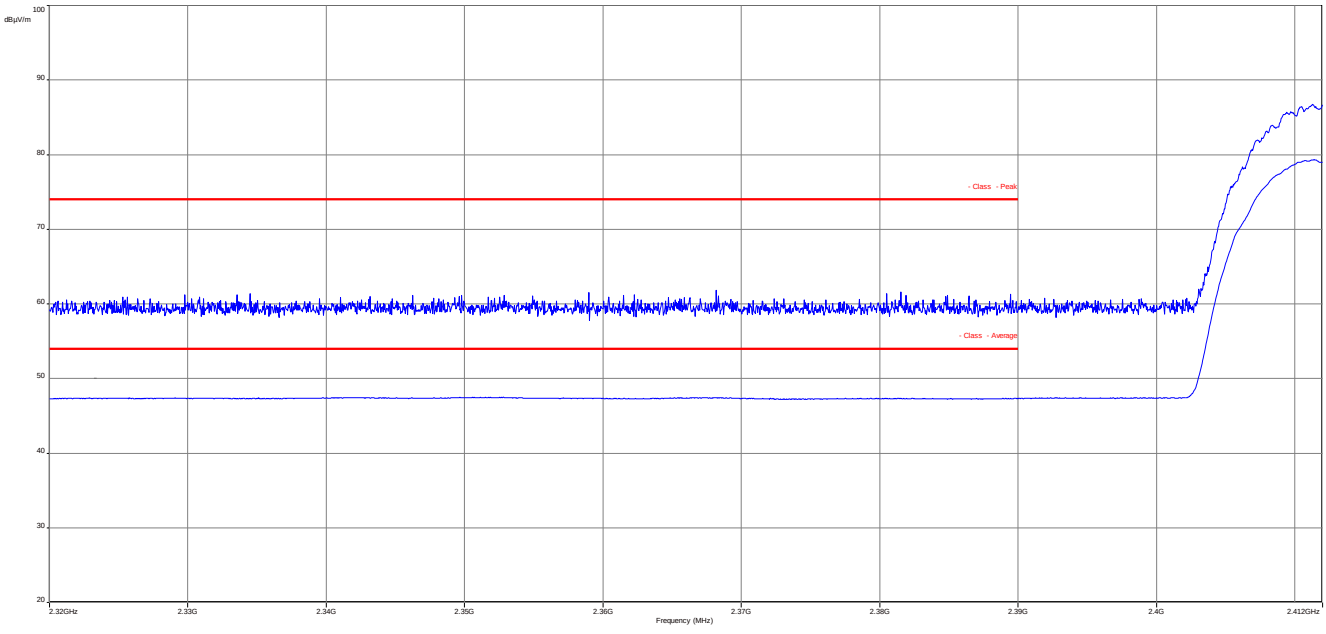
Results:

Scenario Modulation	Band Edge Compliance Conducted [dB]		
	DSSS / b – mode	OFDM / g – mode	OFDM / n HT20 – mode
Lower Band Edge – Channel 1	> 20 dB (Peak) > 20 dB (AVG)	> 10 dB (Peak) > 20 dB (AVG)	> 10 dB (Peak) > 20 dB (AVG)
Upper Band Edge – Channel 11	> 20 dB (Peak) > 20 dB (AVG)	> 10 dB (Peak) > 20 dB (AVG)	> 10 dB (Peak) > 20 dB (AVG)
Measurement uncertainty	± 3 dB		

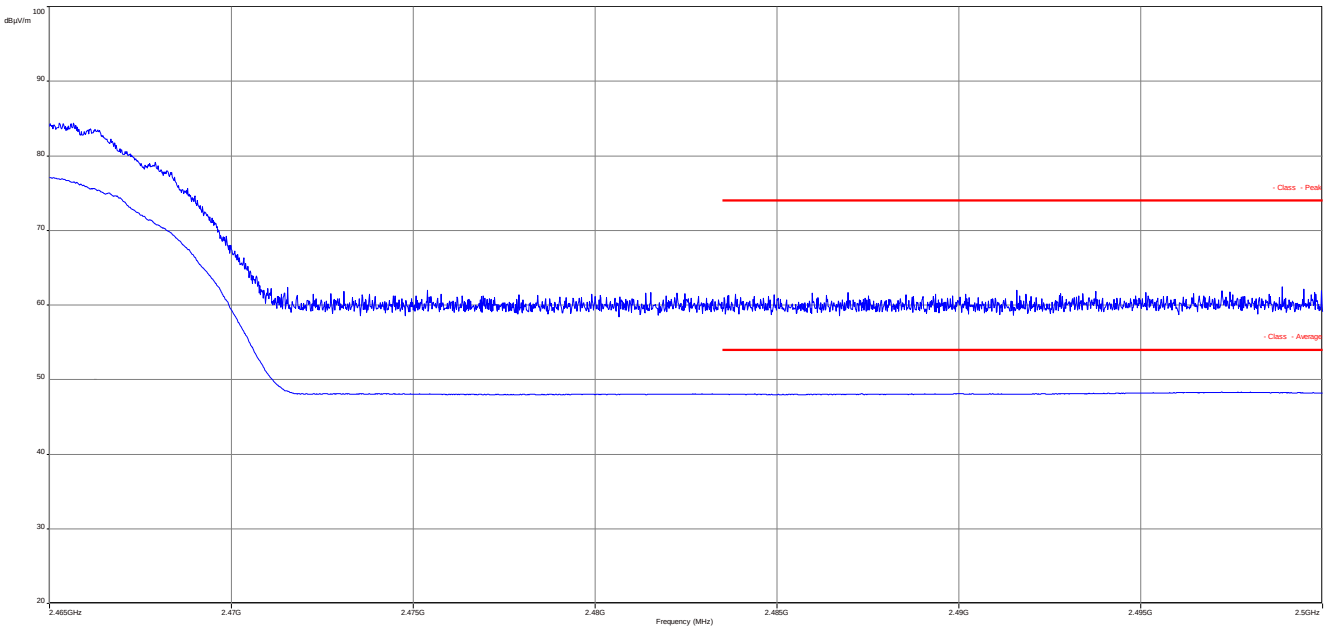
Verdict: **complies**

Plots: DSSS/ b – mode peak / average

Plot 1: TX mode, lower band edge, vertical & horizontal polarization

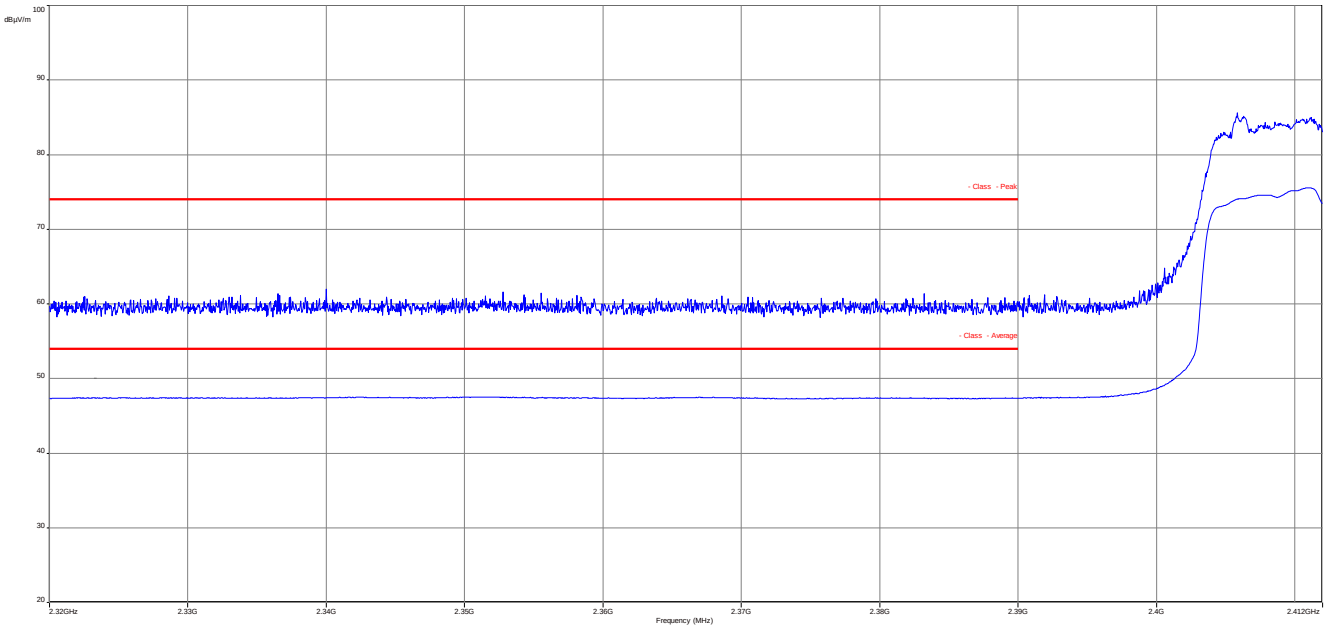


Plot 2: TX mode, upper band edge, vertical & horizontal polarization

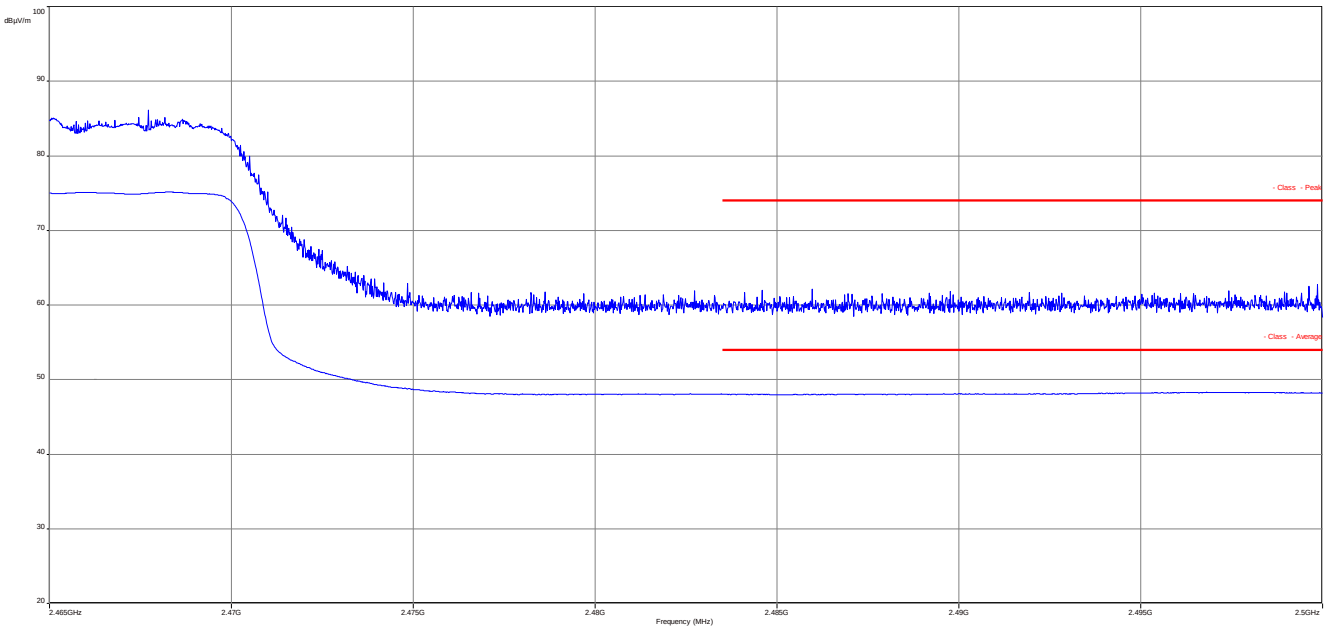


Plots: OFDM / g – mode peak / average

Plot 1: TX mode, lower band edge, vertical & horizontal polarization

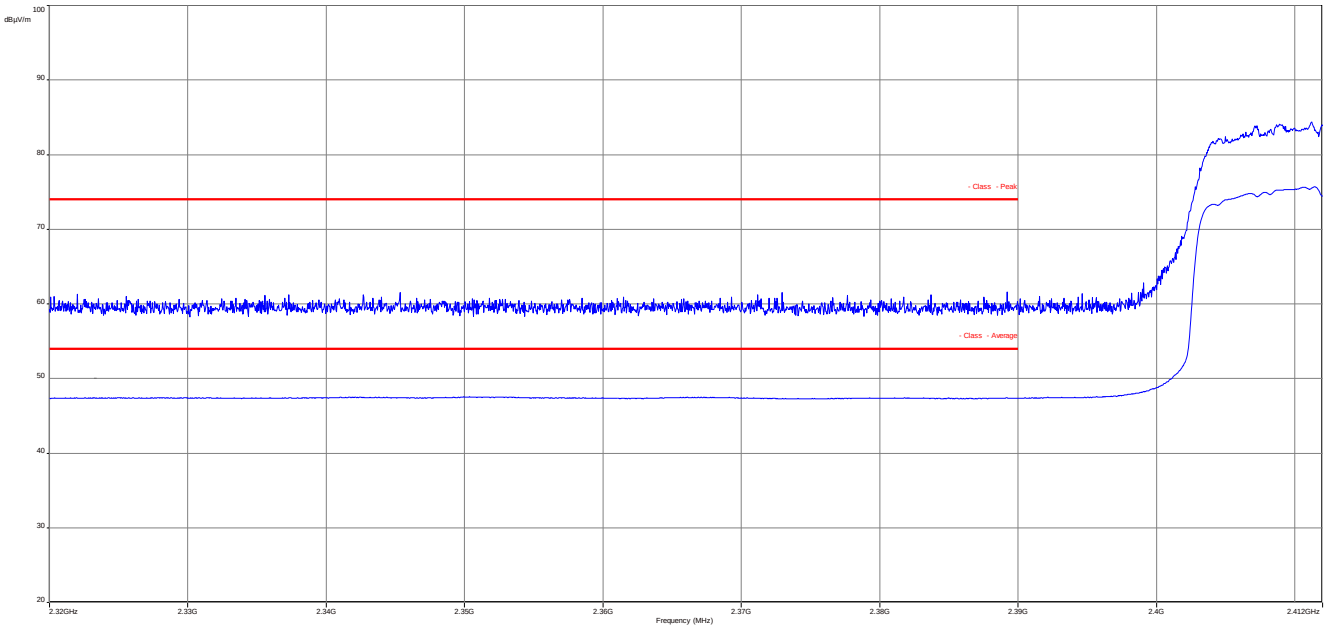


Plot 2: TX mode, upper band edge, vertical & horizontal polarization

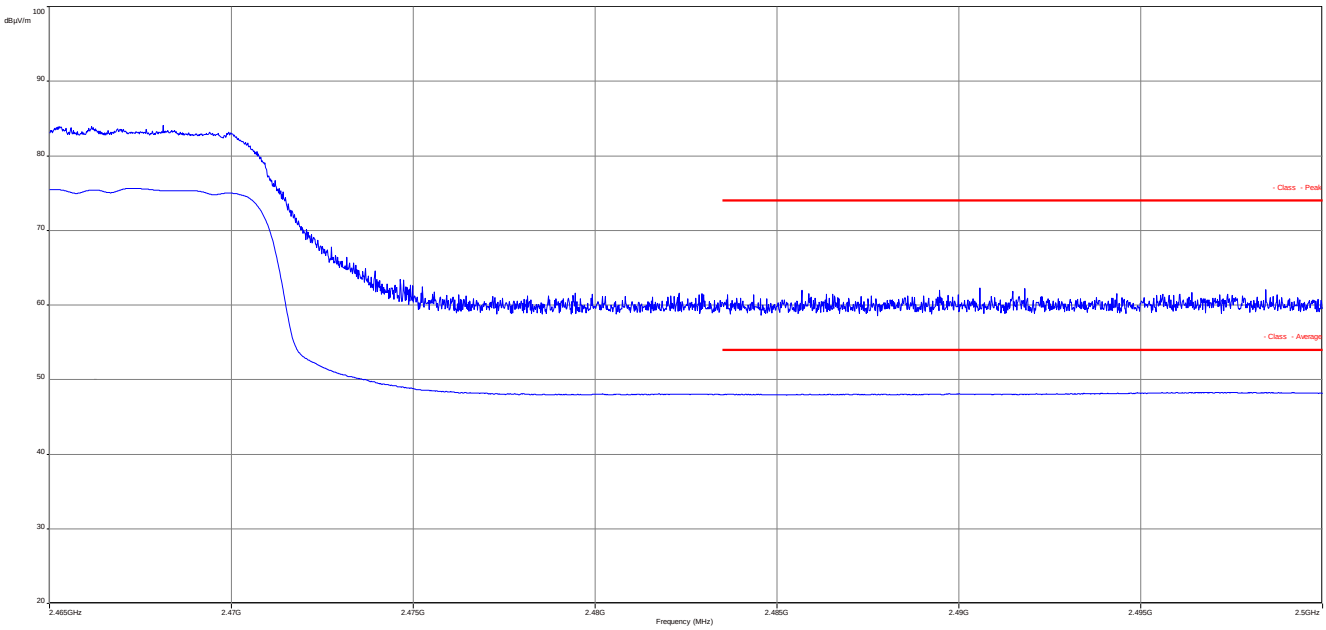


Plots: OFDM / n HT20 – mode peak / average

Plot 1: TX mode, lower band edge, vertical & horizontal polarization



Plot 2: TX mode, upper band edge, vertical & horizontal polarization



10.10 TX spurious emissions conducted

Description:

Measurement of the conducted spurious emissions in transmit mode. The measurement is performed at channel 1, 6 and 11. The measurement is repeated for all modulations.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	100 kHz
Video bandwidth:	500 kHz
Span:	9 kHz to 25 GHz
Trace-Mode:	Max Hold

Limits:

FCC	IC
TX Spurious Emissions Conducted	
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required	

Results: DSSS / b – mode

TX Spurious Emissions Conducted					
DSSS / b – mode					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
2412		-12.66	30 dBm		Operating frequency
No peaks detected. All detected emissions are below the -20 dBc criteria.			-20 dBc (peak) -30 dBc (average)		complies
2437		-13.18	30 dBm		Operating frequency
No peaks detected. All detected emissions are below the -20 dBc criteria.			-20 dBc (peak) -30 dBc (average)		complies
2462		-13.16	30 dBm		Operating frequency
No peaks detected. All detected emissions are below the -20 dBc criteria.			-20 dBc (peak) -30 dBc (average)		complies
Measurement uncertainty		± 3 dB			

Verdict: **complies**

Results: OFDM / g – mode

TX Spurious Emissions Conducted					
OFDM / g – mode					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
2412		-13.18	30 dBm		Operating frequency
No peaks detected. All detected emissions are below the -20 dBc criteria.			-20 dBc (peak) -30 dBc (average)		complies
2437		-14.88	30 dBm		Operating frequency
No peaks detected. All detected emissions are below the -20 dBc criteria.			-20 dBc (peak) -30 dBc (average)		complies
2462		-14.16	30 dBm		Operating frequency
No peaks detected. All detected emissions are below the -20 dBc criteria.			-20 dBc (peak) -30 dBc (average)		complies
Measurement uncertainty		± 3 dB			

Verdict: **complies**

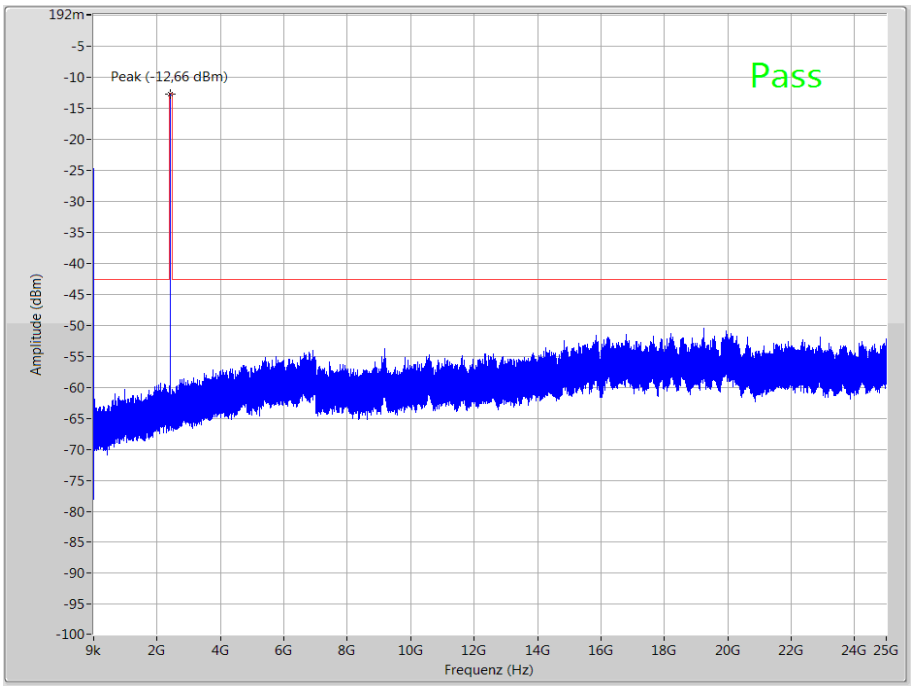
Results: OFDM / n HT20 – mode

TX Spurious Emissions Conducted					
OFDM / n HT20 – mode					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
2412		-12.69	30 dBm		Operating frequency
No peaks detected. All detected emissions are below the -20 dBc criteria.			-20 dBc (peak) -30 dBc (average)		complies
2437		-13.81	30 dBm		Operating frequency
No peaks detected. All detected emissions are below the -20 dBc criteria.			-20 dBc (peak) -30 dBc (average)		complies
2462		-13.92	30 dBm		Operating frequency
No peaks detected. All detected emissions are below the -20 dBc criteria.			-20 dBc (peak) -30 dBc (average)		complies
Measurement uncertainty		± 3 dB			

Verdict: **complies**

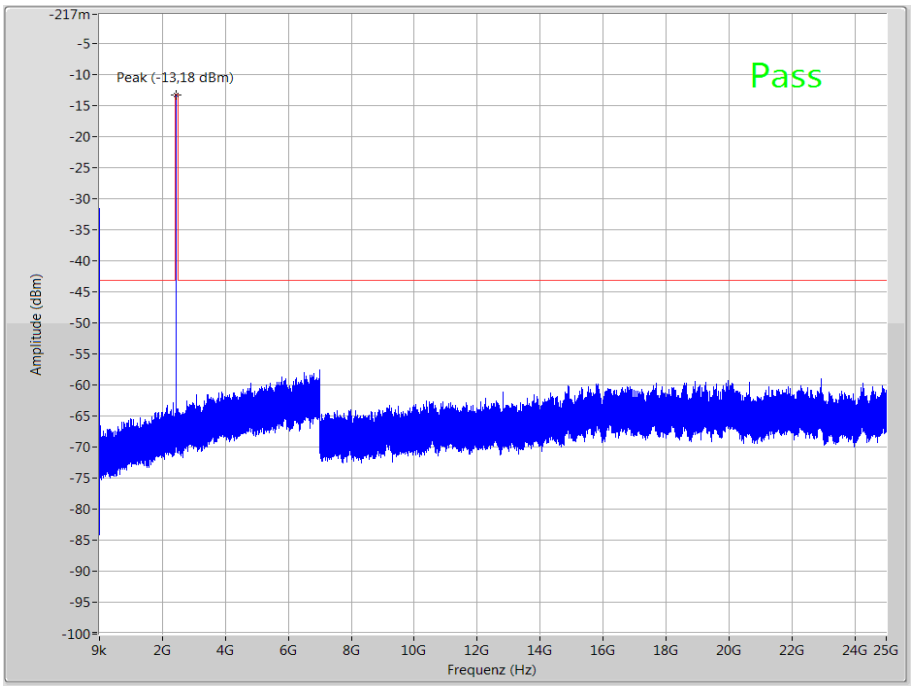
Plots: DSSS / b – mode

Plot 1: TX mode, lowest channel, up to 25 GHz



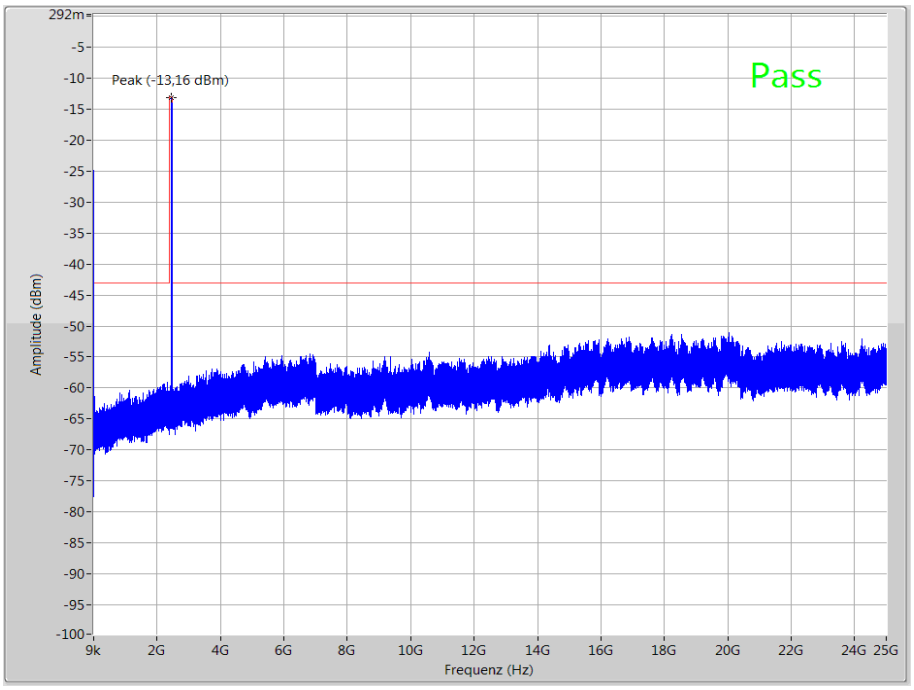
The peak at the beginning of the plot is the LO from the SA.

Plot 2: TX mode, middle channel, up to 25 GHz



The peak at the beginning of the plot is the LO from the SA.

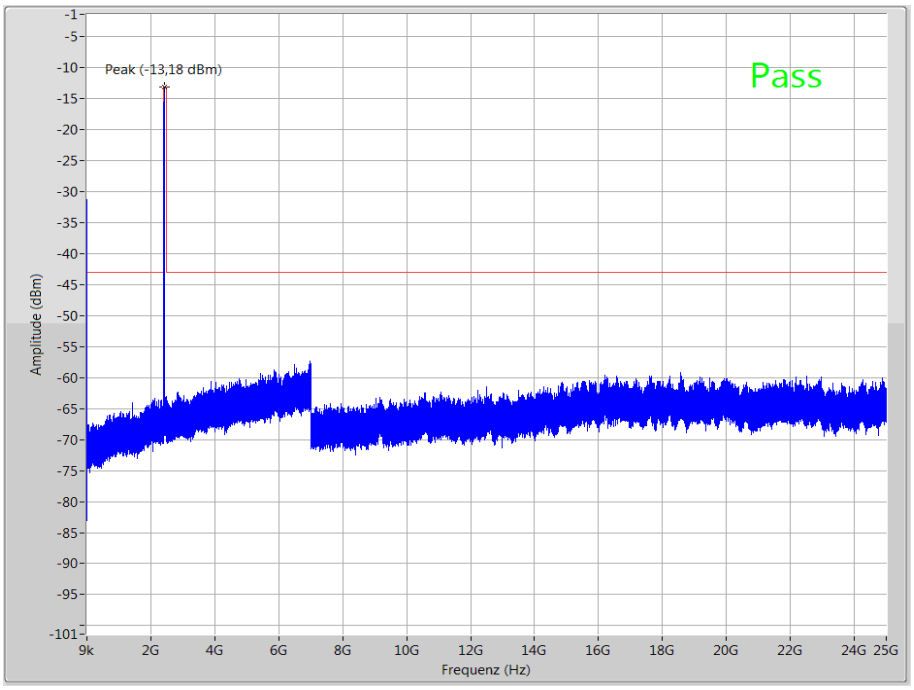
Plot 3: TX mode, highest channel, up to 25 GHz



The peak at the beginning of the plot is the LO from the SA.

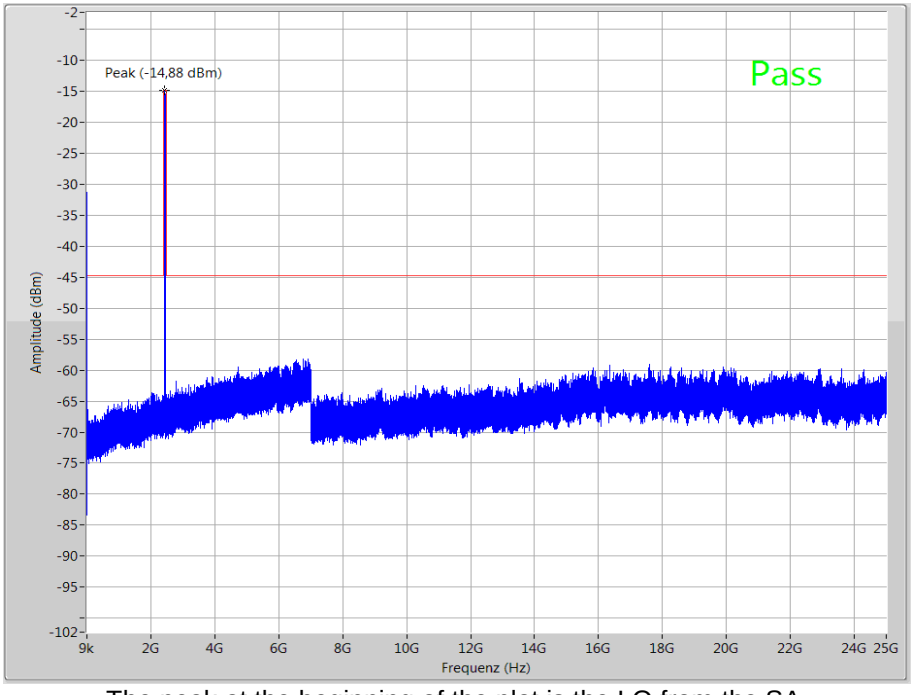
Plots: OFDM / g – mode

Plot 1: TX mode, lowest channel, up to 25 GHz



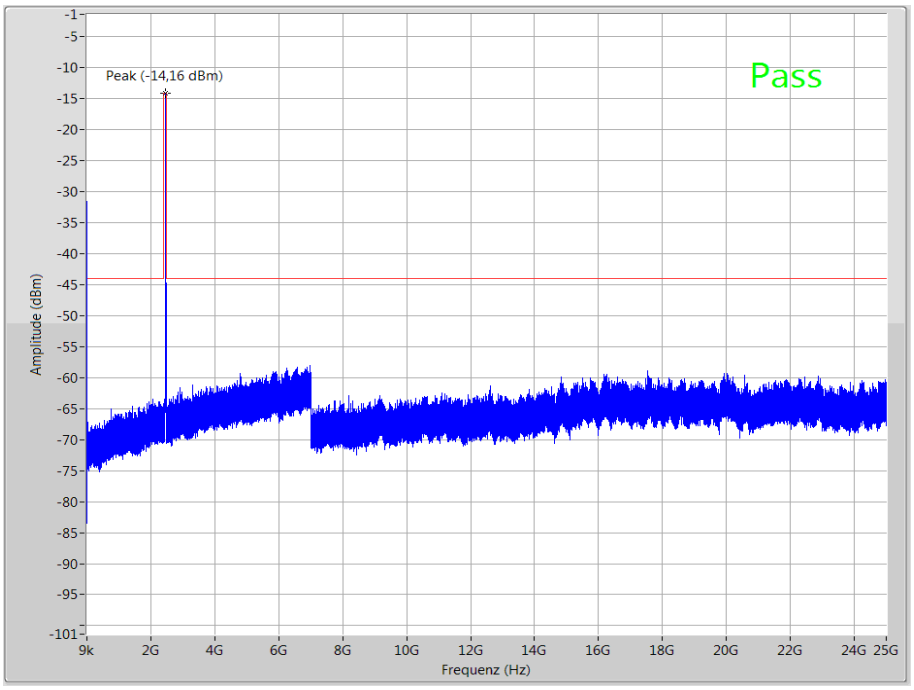
The peak at the beginning of the plot is the LO from the SA.

Plot 2: TX mode, middle channel, up to 25 GHz



The peak at the beginning of the plot is the LO from the SA.

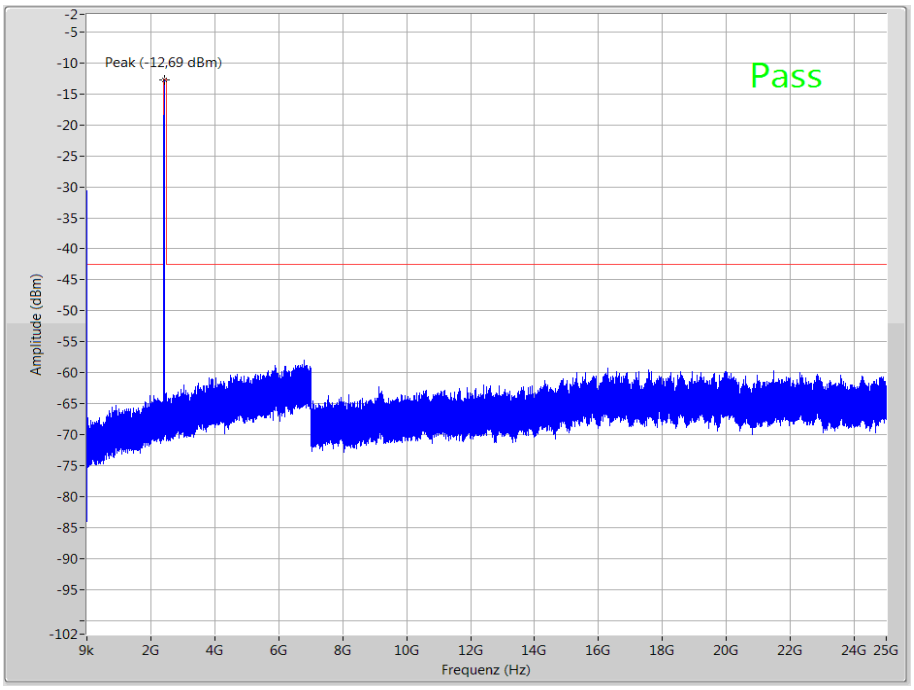
Plot 3: TX mode, highest channel, up to 25 GHz



The peak at the beginning of the plot is the LO from the SA.

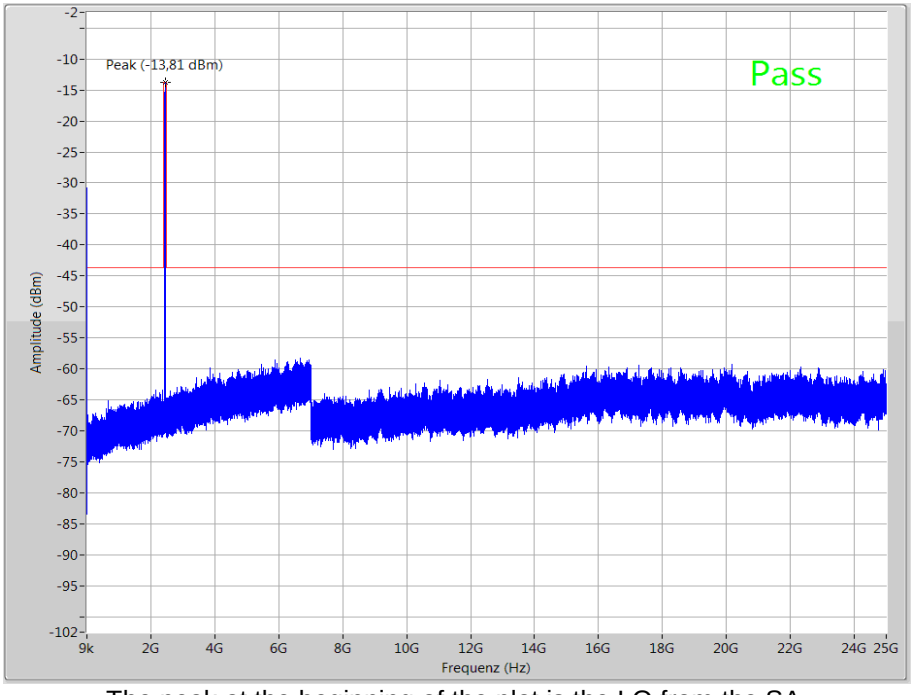
Plots: OFDM / n – mode

Plot 1: TX mode, lowest channel, up to 25 GHz



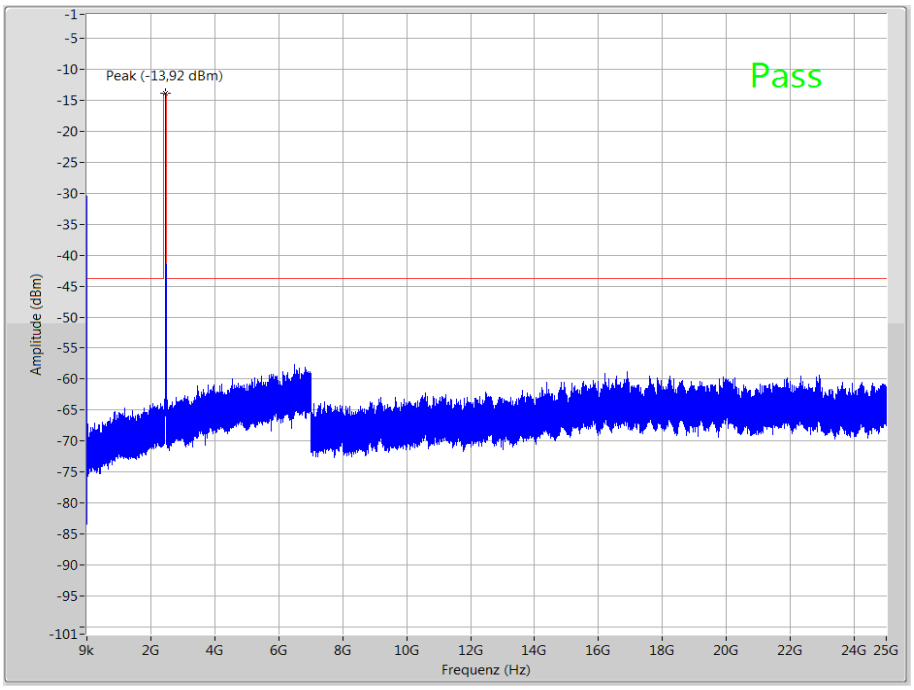
The peak at the beginning of the plot is the LO from the SA.

Plot 2: TX mode, middle channel, up to 25 GHz



The peak at the beginning of the plot is the LO from the SA.

Plot 3: TX mode, highest channel, up to 25 GHz



The peak at the beginning of the plot is the LO from the SA.

10.11 TX spurious emissions radiated

Description:

Measurement of the radiated spurious emissions in transmit mode. The measurement is performed at channel 1, 6 and 11. The measurement is repeated for all modulations.

Measurement:

Measurement parameter	
Detector:	Peak / Quasi Peak / RMS
Sweep time:	Auto
Resolution bandwidth:	F > 1 GHz: 1 MHz F < 1 GHz: 100 kHz
Video bandwidth:	3 x RBW
Span:	30 MHz to 26 GHz
Trace-Mode:	Max Hold
Measured Modulation	☒ DSSS b – mode ☒ OFDM g – mode ☒ OFDM n – mode

The modulation with the highest output power was used to perform the transmitter spurious emissions. If spurious were detected a re-measurement was performed on the detected frequency with each modulation.

Limits:

FCC		IC
TX Spurious Emissions Radiated		
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).		
Frequency (MHz)	Field Strength (dBµV/m)	Measurement distance
30 - 88	30.0	10
88 – 216	33.5	10
216 – 960	36.0	10
Above 960	54.0	3

Results: DSSS / b – mode

TX Spurious Emissions Radiated [dBµV/m]								
DSSS / b – mode								
2412 MHz			2437 MHz			2462 MHz		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
For emissions below 1 GHz, please take a look at the table below the 1 GHz plot.			For emissions below 1 GHz, please take a look at the table below the 1 GHz plot.			For emissions below 1 GHz, please take a look at the table below the 1 GHz plot.		
1025	Peak	44.3	All detected peak emissions are more than 10 dB below the average limit.			All detected peak emissions are more than 10 dB below the average limit.		
Measurement uncertainty			± 3 dB					

Verdict: **complies**

Results: OFDM / g – mode

TX Spurious Emissions Radiated [dBµV/m]								
DSSS / g – mode								
2412 MHz			2437 MHz			2462 MHz		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
For emissions below 1 GHz, please take a look at the table below the 1 GHz plot.			For emissions below 1 GHz, please take a look at the table below the 1 GHz plot.			For emissions below 1 GHz, please take a look at the table below the 1 GHz plot.		
All detected peak emissions are more than 10 dB below the average limit.			All detected peak emissions are more than 10 dB below the average limit.			All detected peak emissions are more than 10 dB below the average limit.		
Measurement uncertainty			± 3 dB					

Verdict: **complies**

Results: OFDM / n HT20 – mode

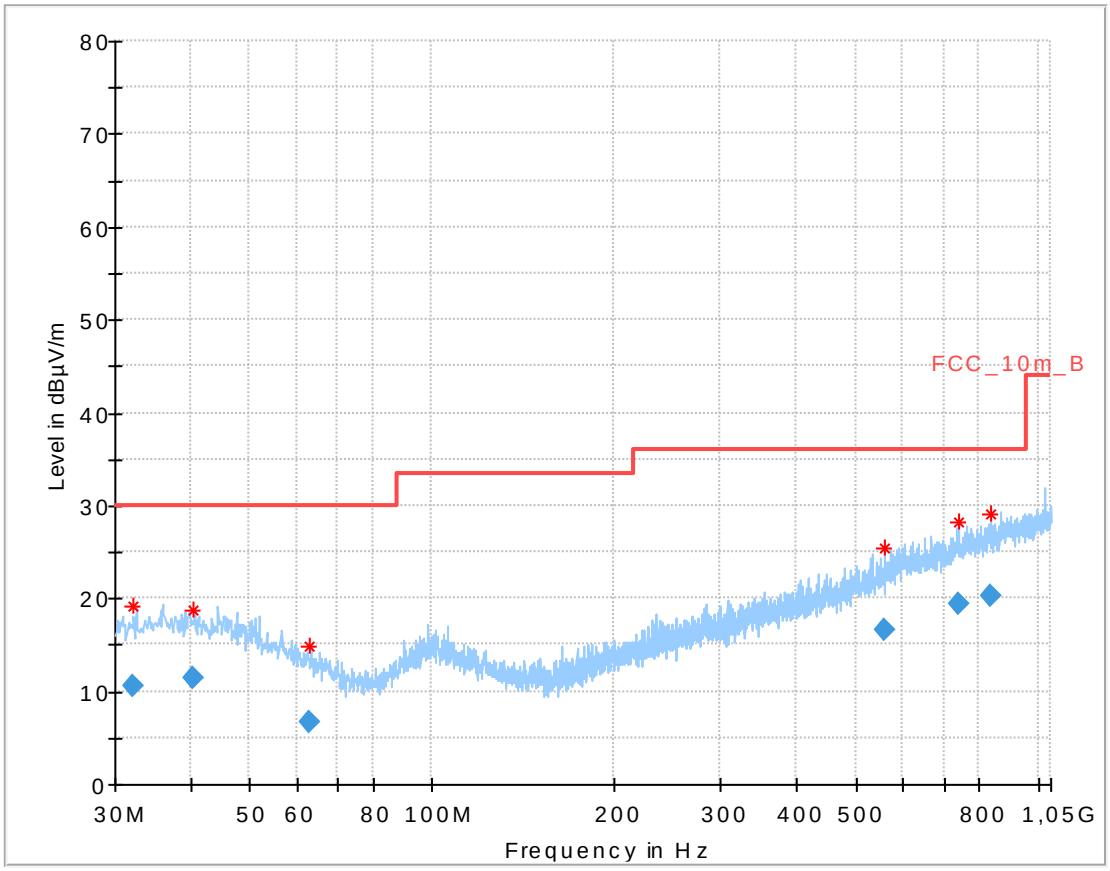
TX Spurious Emissions Radiated [dBµV/m]								
DSSS / n HT20 – mode								
2412 MHz			2437 MHz			2462 MHz		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
For emissions below 1 GHz, please take a look at the table below the 1 GHz plot.			For emissions below 1 GHz, please take a look at the table below the 1 GHz plot.			For emissions below 1 GHz, please take a look at the table below the 1 GHz plot.		
All detected peak emissions are more than 10 dB below the average limit.			All detected peak emissions are more than 10 dB below the average limit.			All detected peak emissions are more than 10 dB below the average limit.		
Measurement uncertainty			± 3 dB					

Verdict: **complies**

Note: The limit was recalculated with 20 dB / decade (Part 15.31) for all radiated spurious emissions 30 MHz to 1 GHz from 3 meter limit to a 10 meter distance. (40dB/decade for emissions < 30MHz)

Plots: DSSS / b – mode

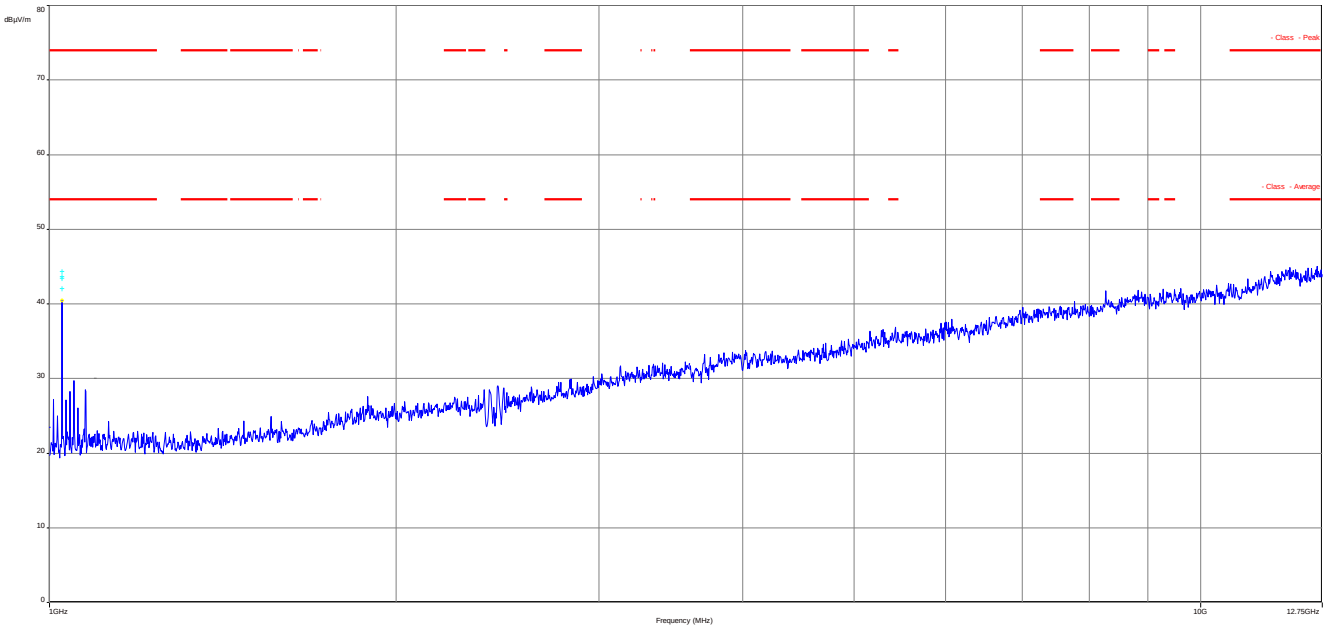
Plot 1: Lowest channel, 30 MHz to 1 GHz, vertical & horizontal polarization



Final_Result:

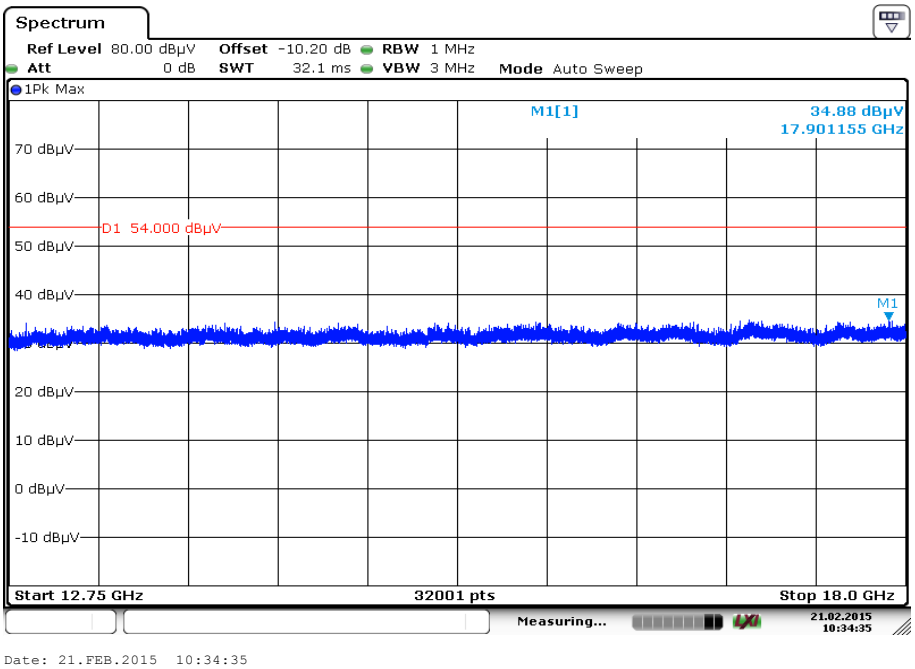
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
32.125350	10.60	30.00	19.40	1000.0	120.000	101.0	V	197	13.5
40.257000	11.42	30.00	18.58	1000.0	120.000	101.0	V	263	14.0
62.652450	6.63	30.00	23.37	1000.0	120.000	170.0	V	295	10.0
558.300000	16.70	36.00	19.30	1000.0	120.000	98.0	H	245	19.5
737.621550	19.38	36.00	16.62	1000.0	120.000	98.0	V	173	22.4
838.278150	20.30	36.00	15.70	1000.0	120.000	170.0	H	84	23.3

Plot 2: Lowest channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization



The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 3: Lowest channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization



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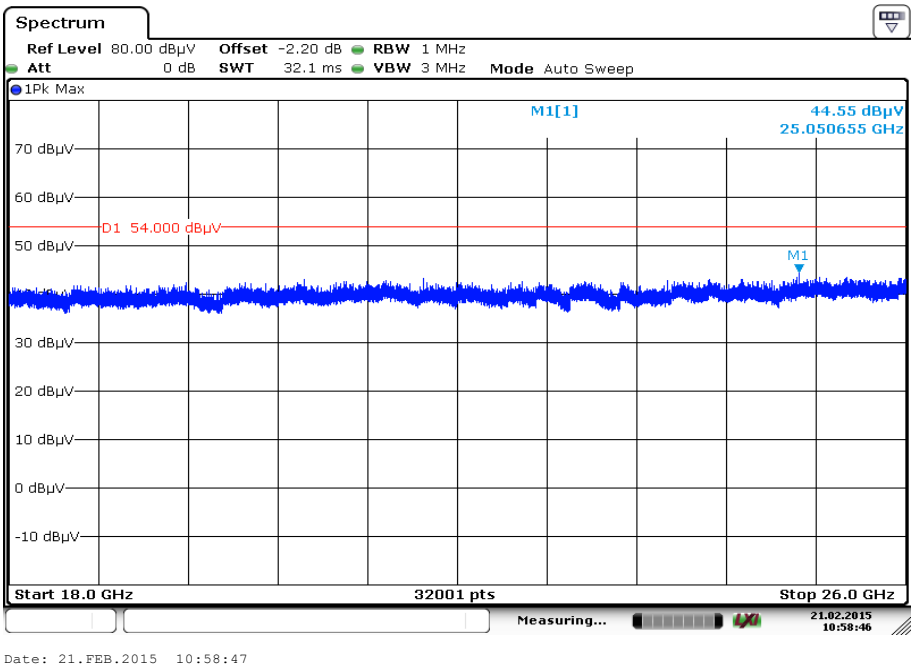
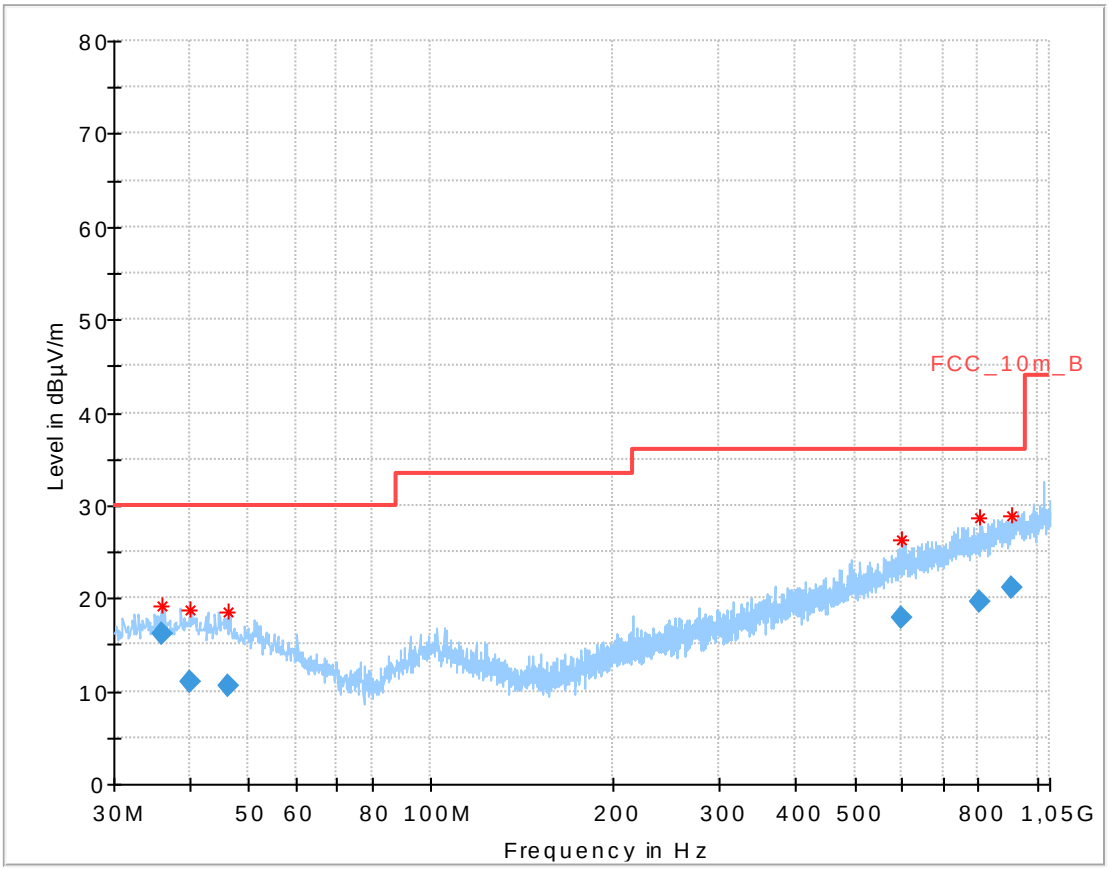
Plot 4: Lowest channel, 18 GHz to 26 GHz, vertical & horizontal polarization



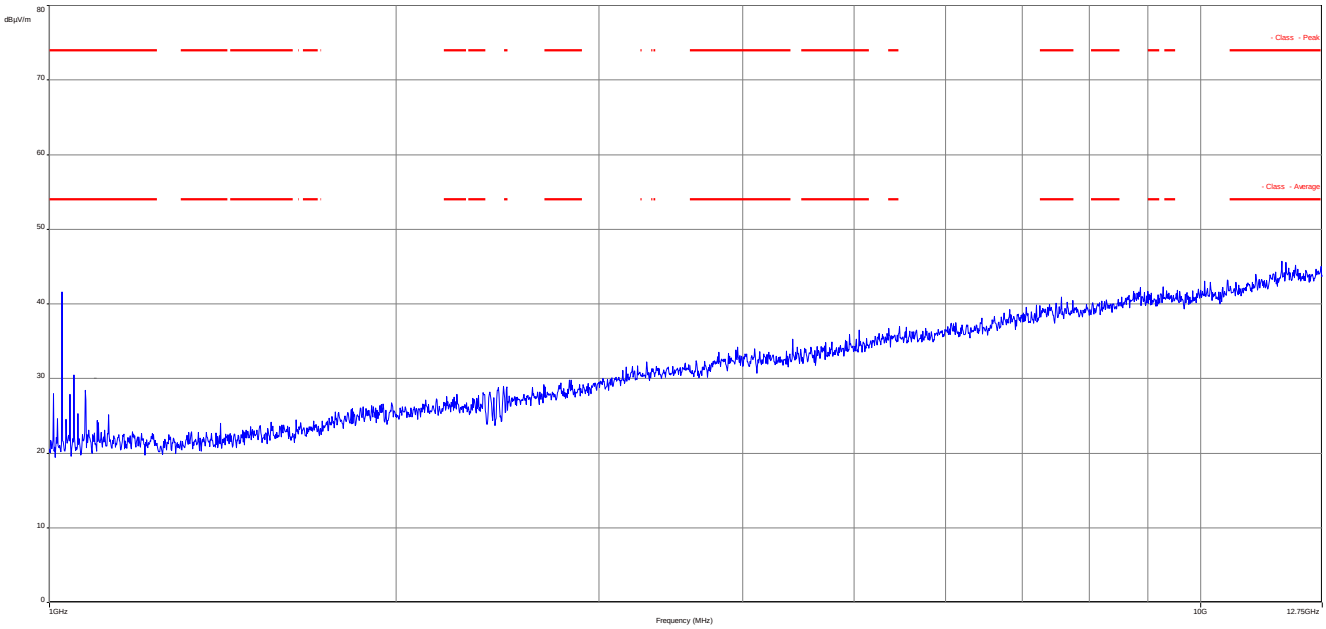
Plot 5: Middle channel, 30 MHz to 1 GHz, vertical & horizontal polarization



Final_Result:

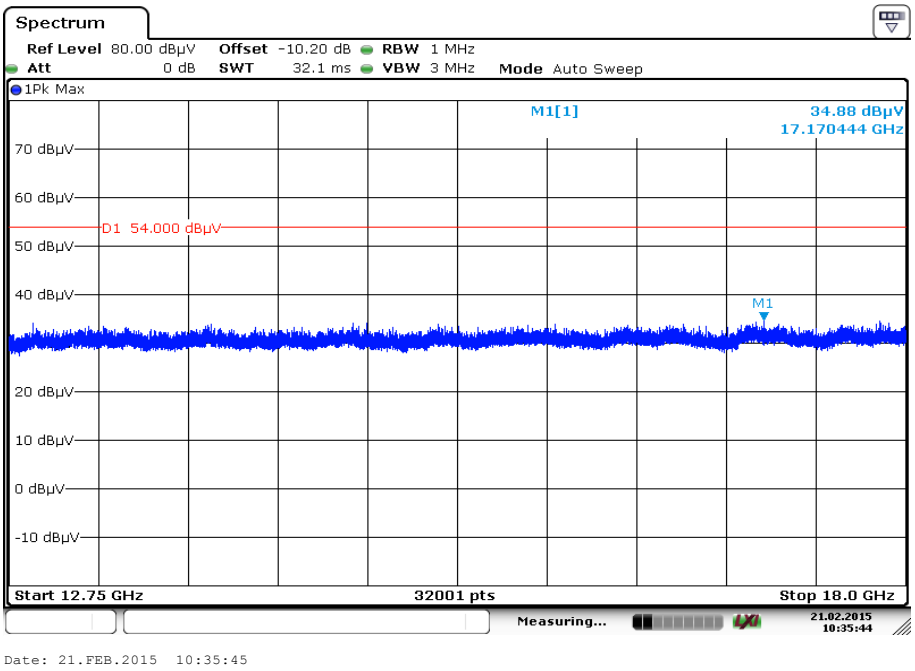
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
36.003900	16.26	30.00	13.74	1000.0	120.000	170.0	V	83	13.8
40.191450	10.90	30.00	19.10	1000.0	120.000	98.0	H	-7	14.0
46.352850	10.54	30.00	19.46	1000.0	120.000	101.0	V	265	13.5
599.823450	17.91	36.00	18.09	1000.0	120.000	98.0	H	83	20.7
805.351500	19.68	36.00	16.32	1000.0	120.000	170.0	H	197	22.8
908.726700	21.03	36.00	14.97	1000.0	120.000	101.0	H	197	24.1

Plot 6: Middle channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization



The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 7: Middle channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization



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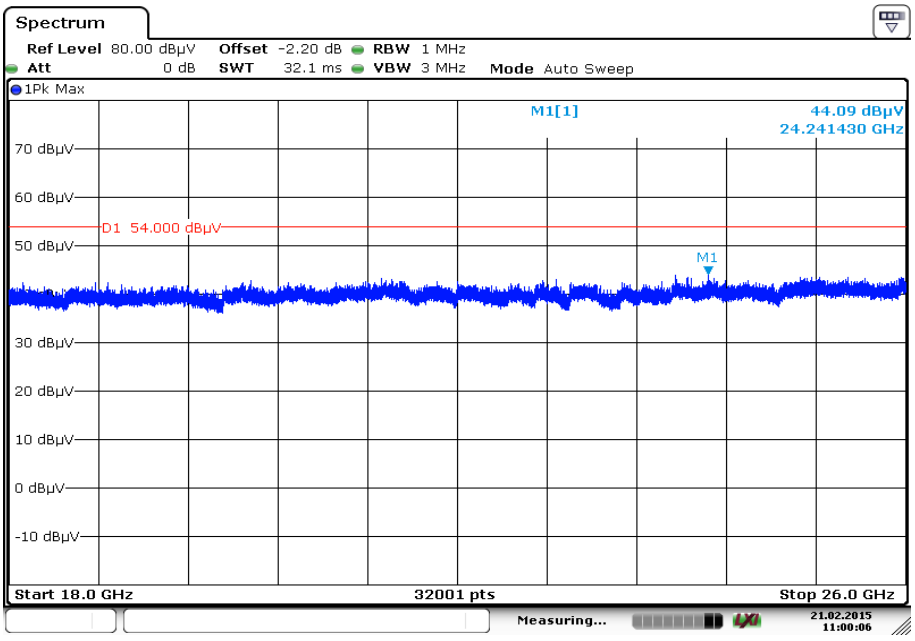
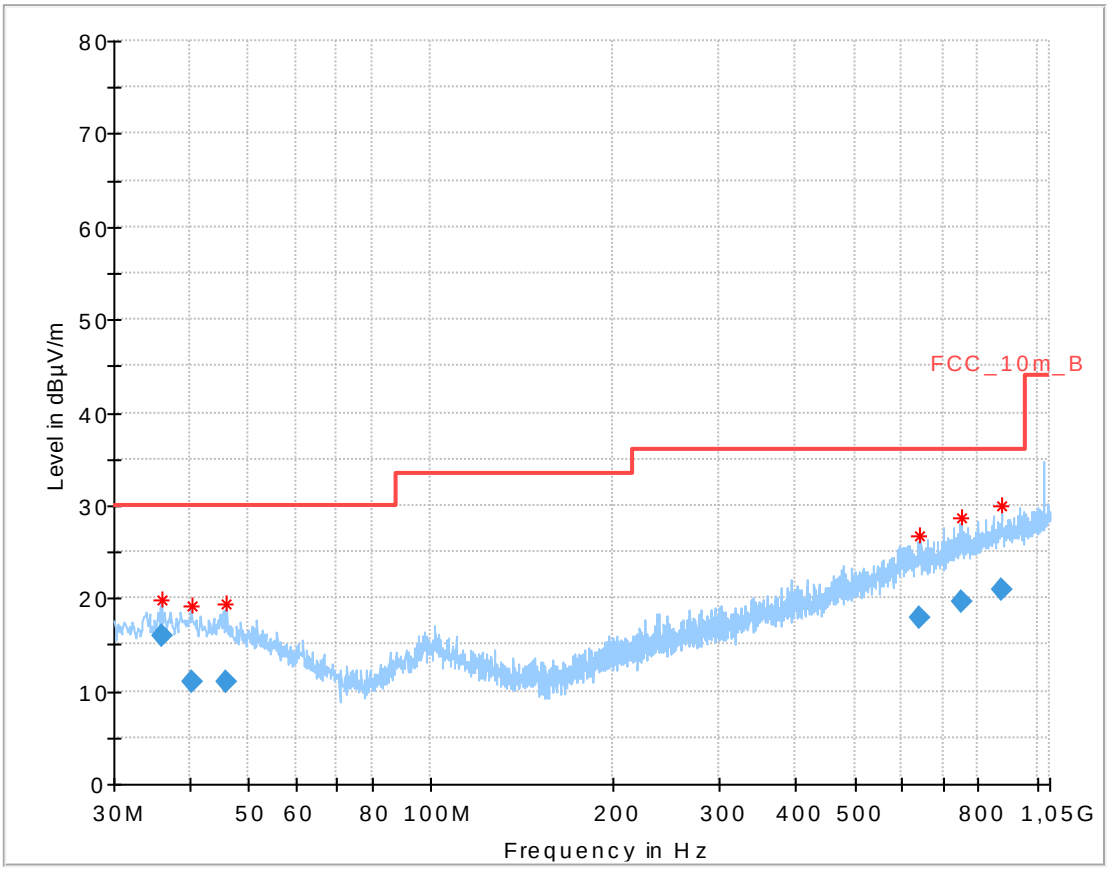
Plot 8: Middle channel, 18 GHz to 26 GHz, vertical & horizontal polarization



Date: 21.FEB.2015 11:00:06

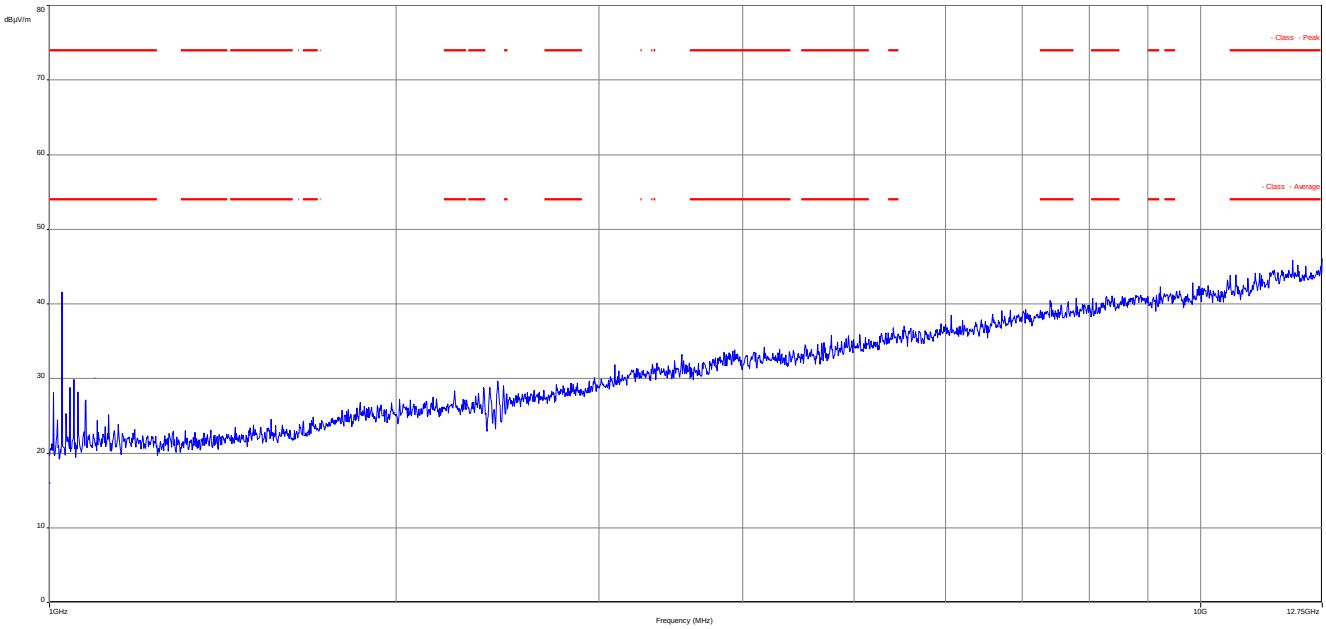
Plot 9: Highest channel, 30 MHz to 1 GHz, vertical & horizontal polarization



Final_Result:

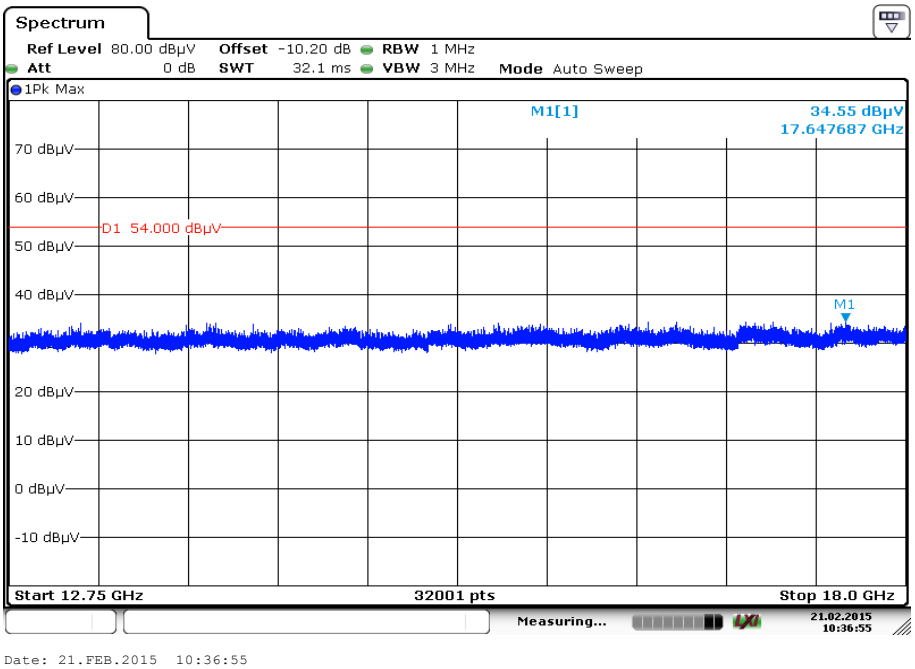
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
35.979900	15.95	30.00	14.05	1000.0	120.000	101.0	V	205	13.8
40.225950	10.95	30.00	19.05	1000.0	120.000	170.0	H	205	14.0
46.122750	11.06	30.00	18.94	1000.0	120.000	170.0	V	245	13.6
641.865600	17.94	36.00	18.06	1000.0	120.000	98.0	V	205	21.1
753.941400	19.63	36.00	16.37	1000.0	120.000	170.0	V	-6	22.7
875.311050	20.97	36.00	15.03	1000.0	120.000	170.0	V	295	23.8

Plot 10: Highest channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization



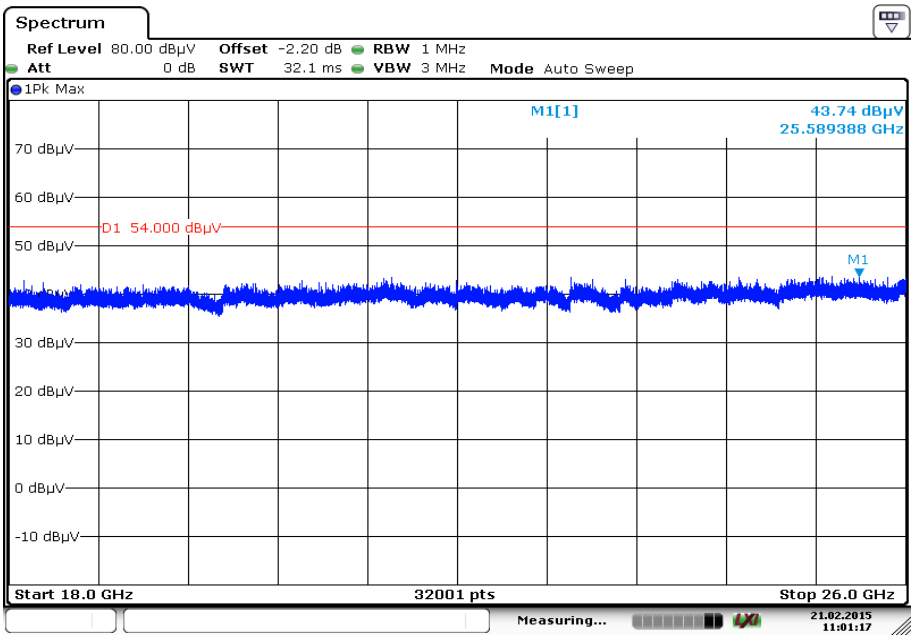
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 11: Highest channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization



Date: 21.FEB.2015 10:36:55

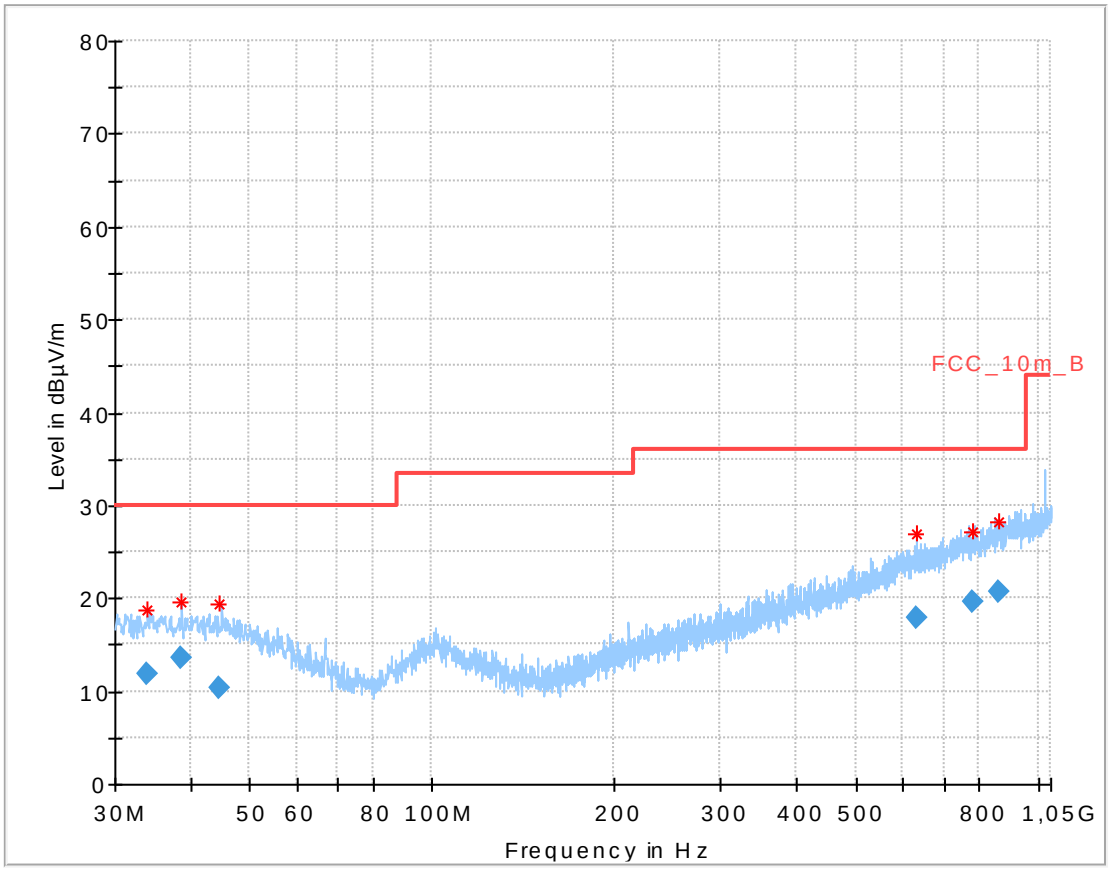
Plot 12: Highest channel, 18 GHz to 26 GHz, vertical & horizontal polarization



Date: 21.FEB.2015 11:01:17

Plots: OFDM / g – mode

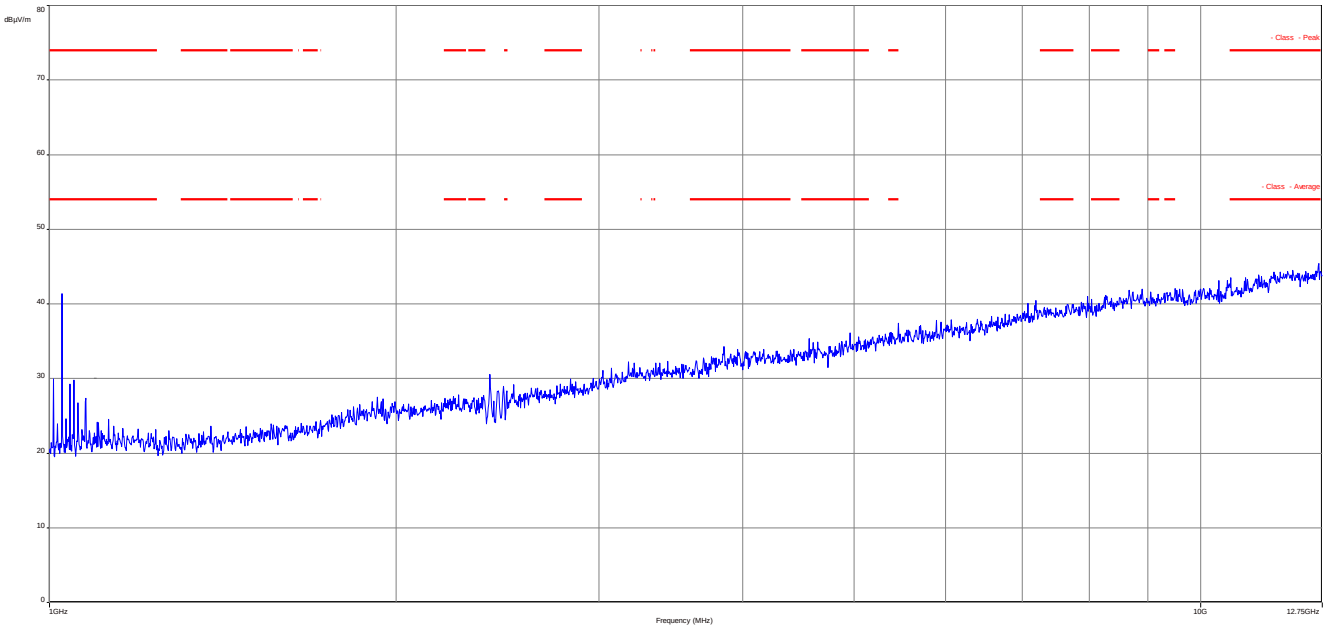
Plot 1: Lowest channel, 30 MHz to 1 GHz, vertical & horizontal polarization



Final_Result:

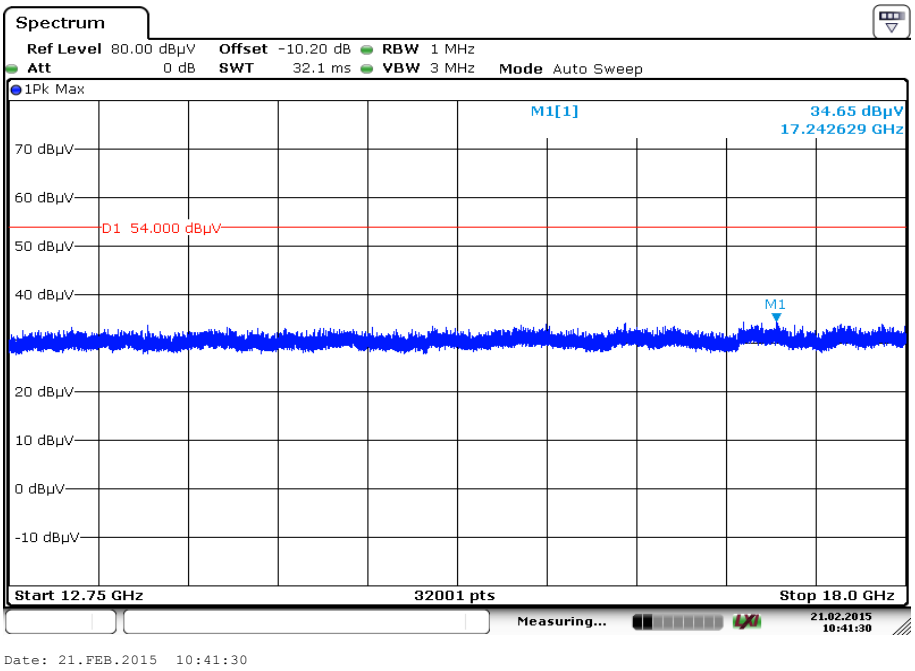
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
33.966150	11.85	30.00	18.15	1000.0	120.000	170.0	V	89	13.7
38.677200	13.52	30.00	16.48	1000.0	120.000	170.0	V	173	14.0
44.536500	10.28	30.00	19.72	1000.0	120.000	100.0	H	65	13.9
631.717200	17.97	36.00	18.03	1000.0	120.000	170.0	H	155	21.0
782.158200	19.58	36.00	16.42	1000.0	120.000	170.0	V	65	22.7
862.598250	20.69	36.00	15.31	1000.0	120.000	170.0	H	287	23.6

Plot 2: Lowest channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization

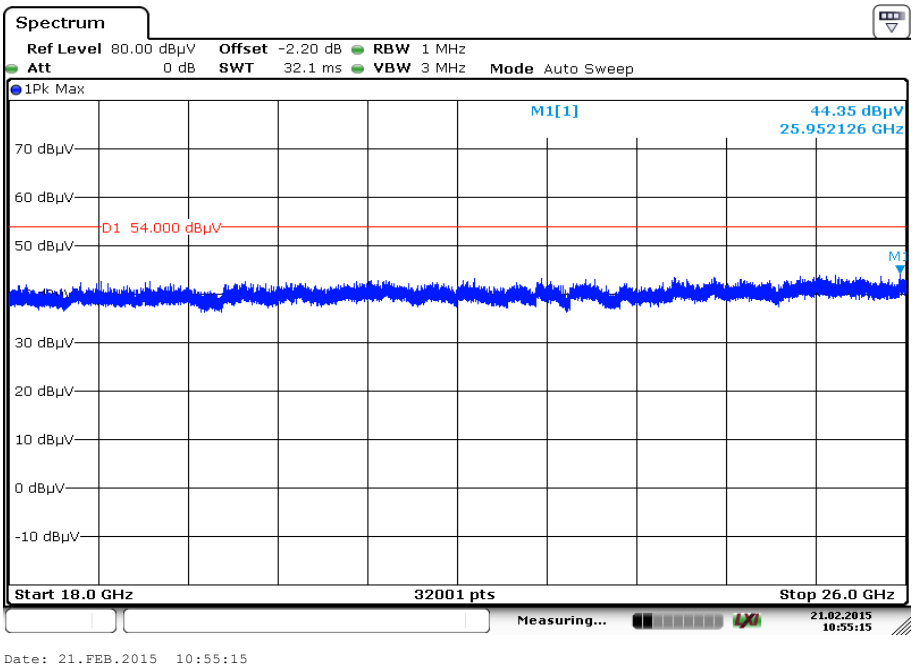


The carrier signal is notched with a 2.4 GHz band rejection filter.

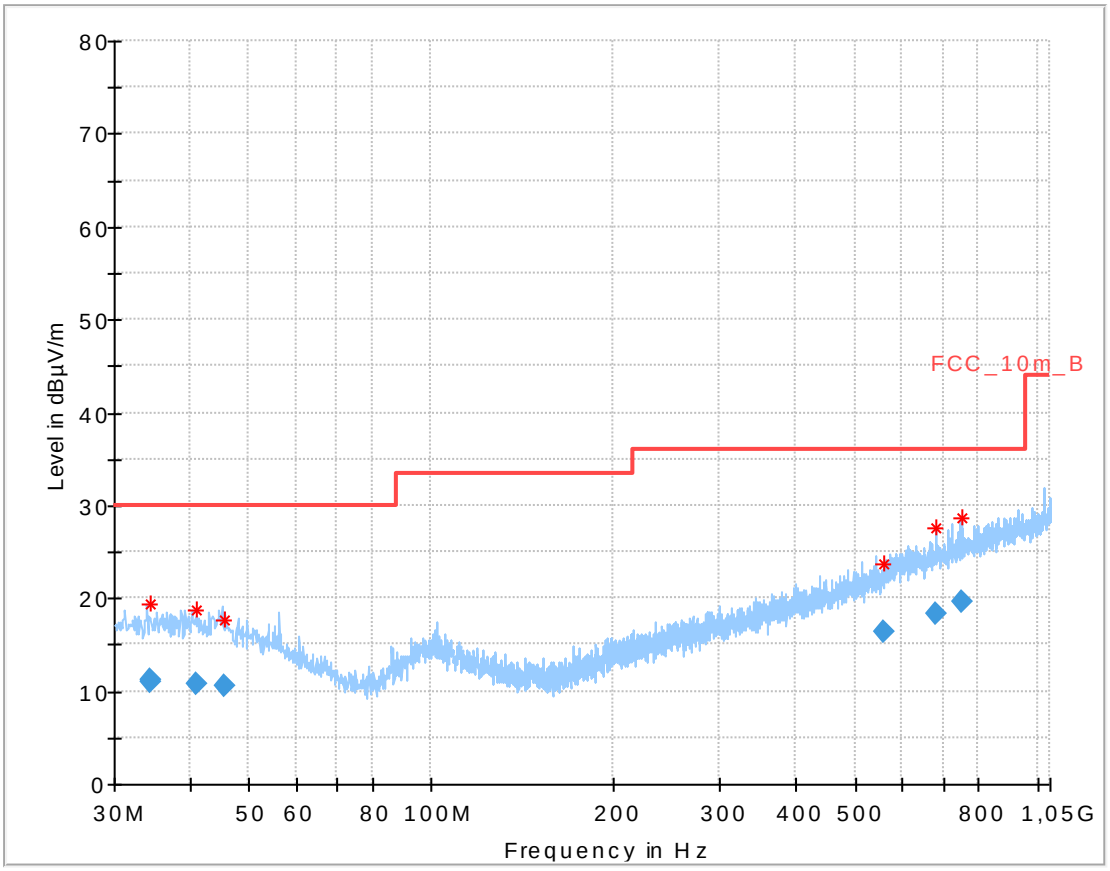
Plot 3: Lowest channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization



Plot 4: Lowest channel, 18 GHz to 26 GHz, vertical & horizontal polarization



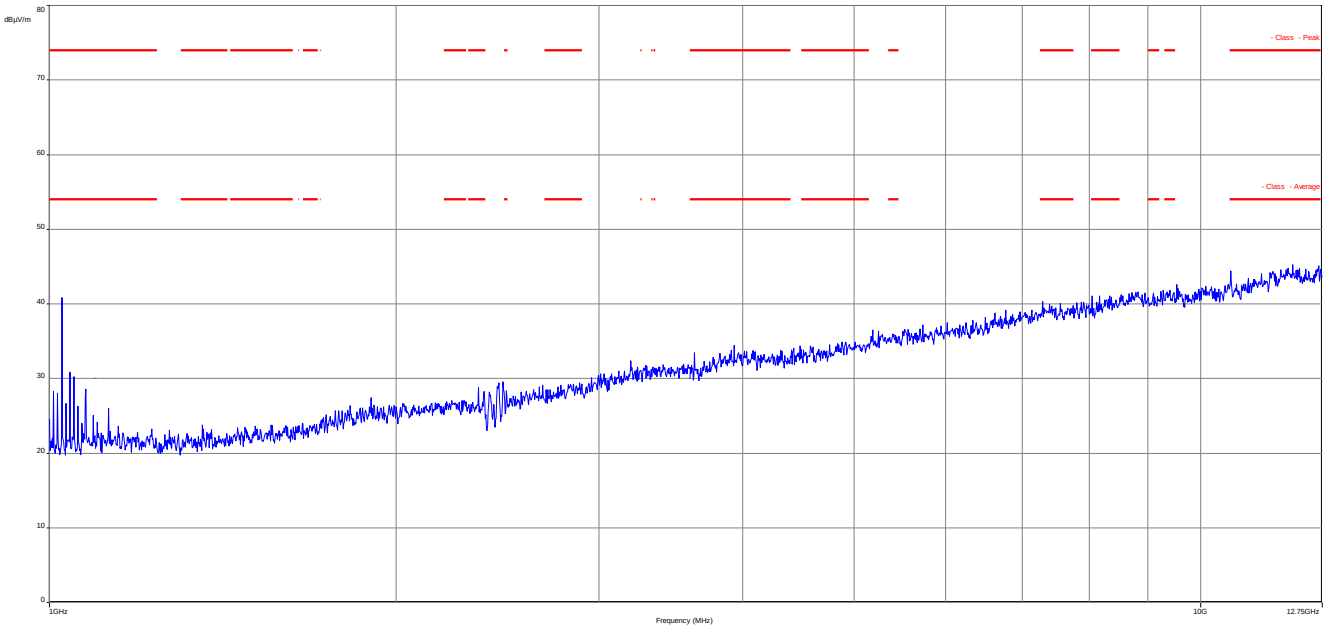
Plot 5: Middle channel, 30 MHz to 1 GHz, vertical & horizontal polarization



Final_Result:

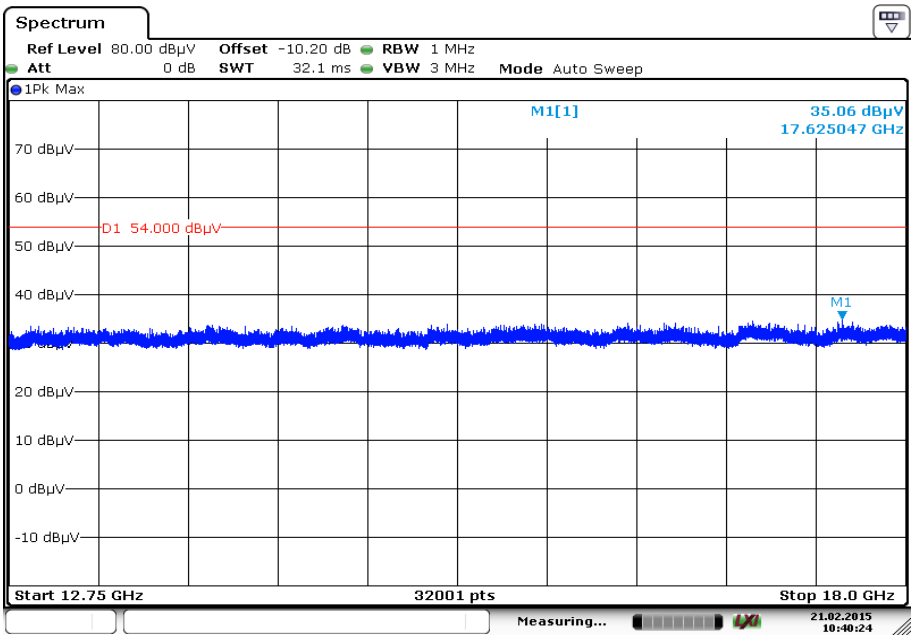
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
34.348500	10.92	30.00	19.08	1000.0	120.000	101.0	V	287	13.7
34.348500	11.12	30.00	18.88	1000.0	120.000	101.0	V	287	13.7
40.906200	10.83	30.00	19.17	1000.0	120.000	170.0	H	25	14.0
45.463050	10.59	30.00	19.41	1000.0	120.000	101.0	H	287	13.7
557.599500	16.37	36.00	19.63	1000.0	120.000	170.0	V	83	19.5
681.126750	18.29	36.00	17.71	1000.0	120.000	170.0	V	173	21.4
749.045400	19.61	36.00	16.39	1000.0	120.000	170.0	H	205	22.7

Plot 6: Middle channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization



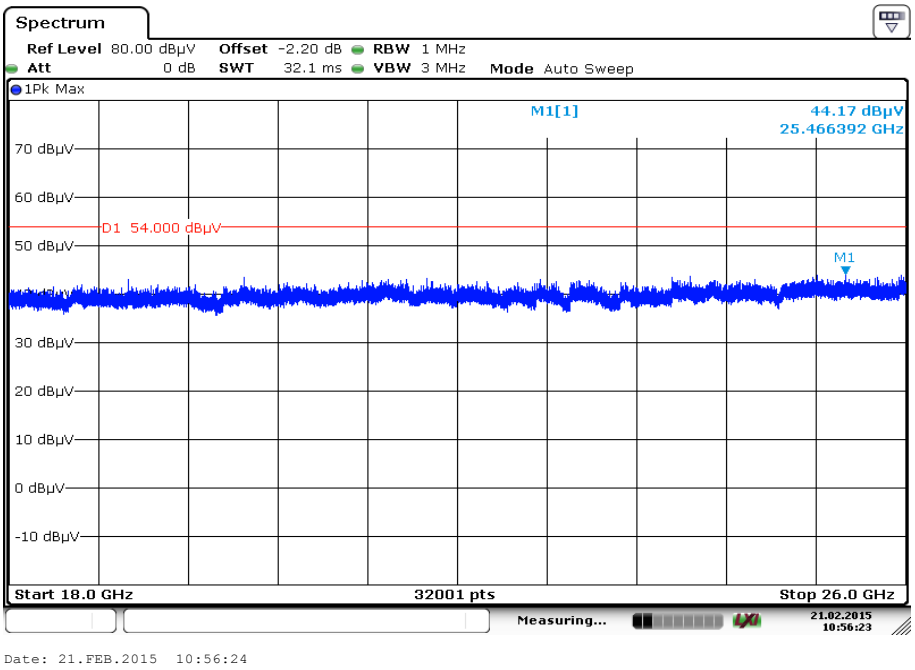
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 7: Middle channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization



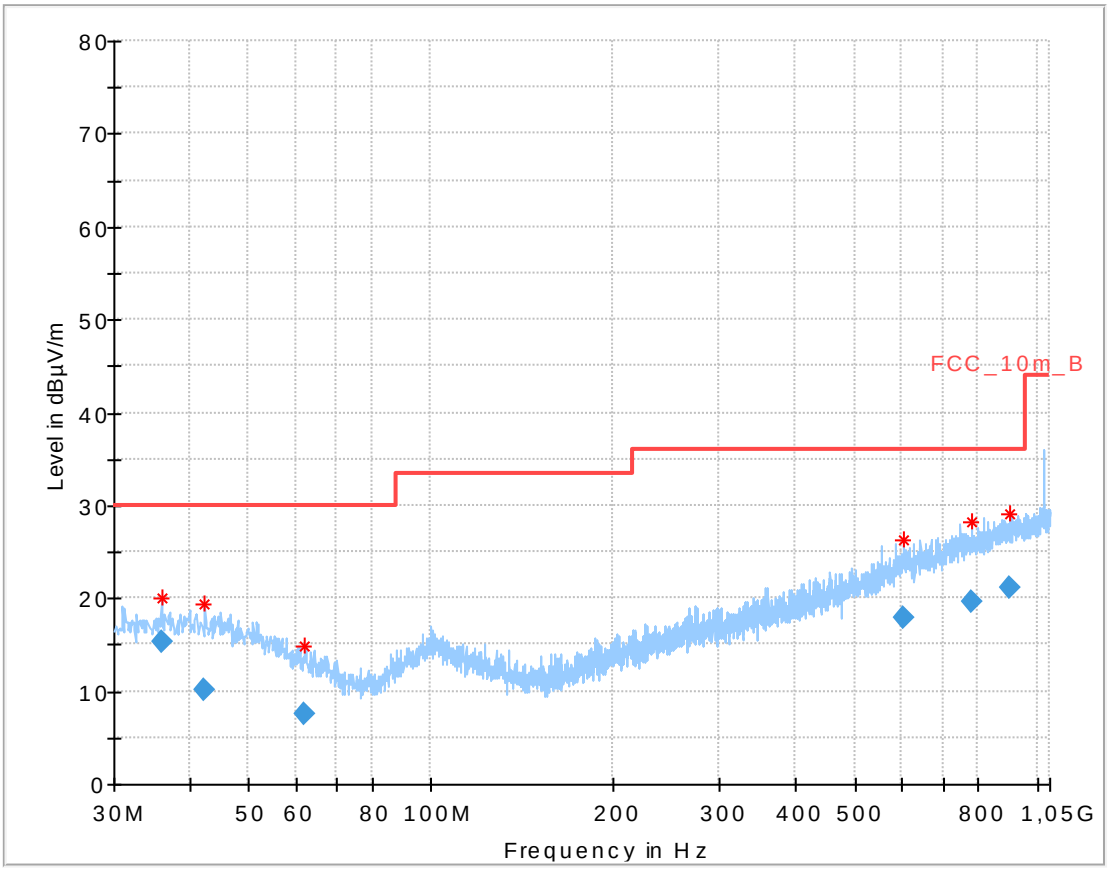
Date: 21.FEB.2015 10:40:24

Plot 8: Middle channel, 18 GHz to 26 GHz, vertical & horizontal polarization



Date: 21.FEB.2015 10:56:24

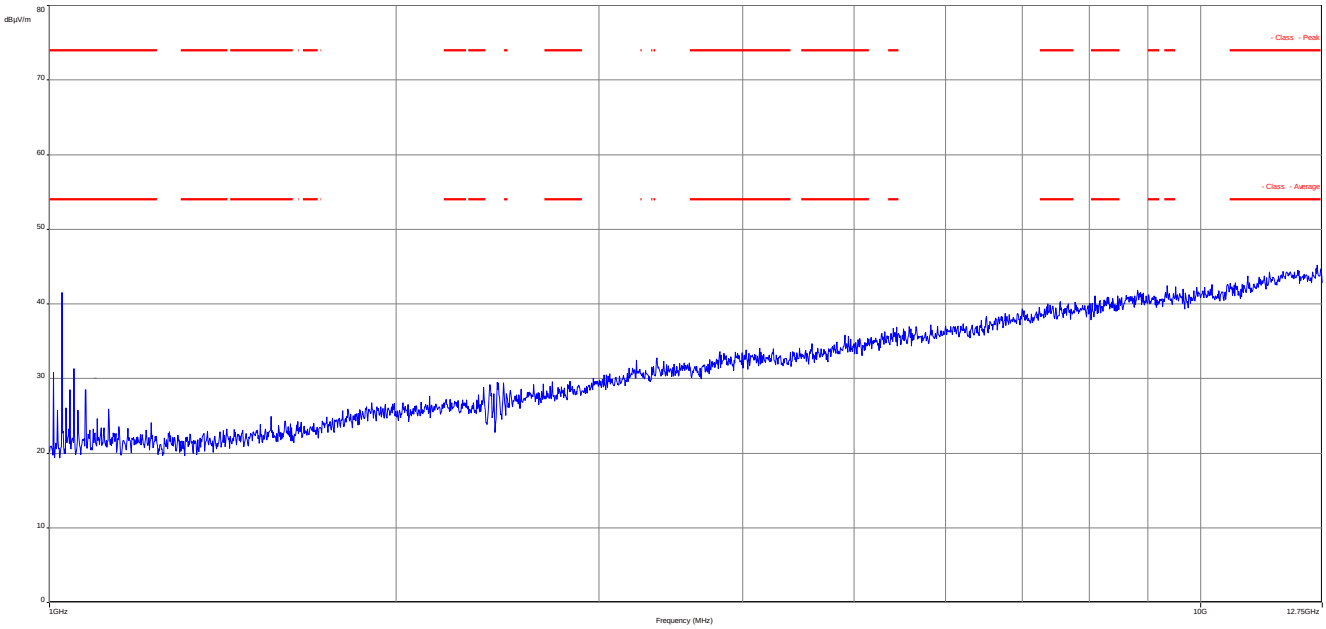
Plot 9: Highest channel, 30 MHz to 1 GHz, vertical & horizontal polarization



Final_Result:

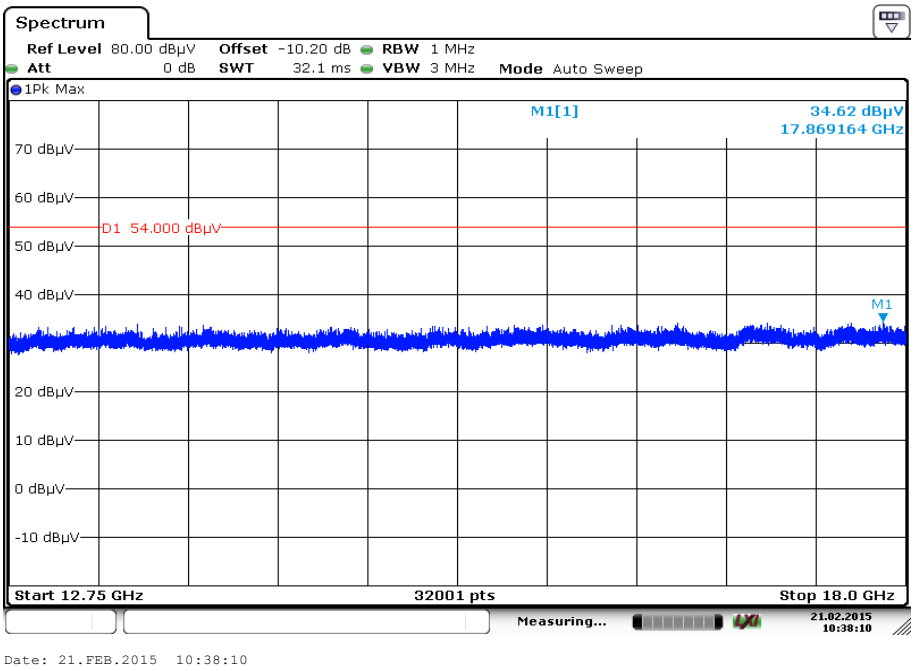
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
35.975100	15.31	30.00	14.69	1000.0	120.000	101.0	V	295	13.8
42.325650	10.17	30.00	19.83	1000.0	120.000	170.0	V	65	14.0
61.961550	7.51	30.00	22.49	1000.0	120.000	170.0	V	263	10.1
603.978750	17.80	36.00	18.20	1000.0	120.000	170.0	H	155	20.7
779.915400	19.56	36.00	16.44	1000.0	120.000	170.0	H	65	22.7
904.243350	21.12	36.00	14.88	1000.0	120.000	170.0	V	205	24.1

Plot 10: Highest channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization



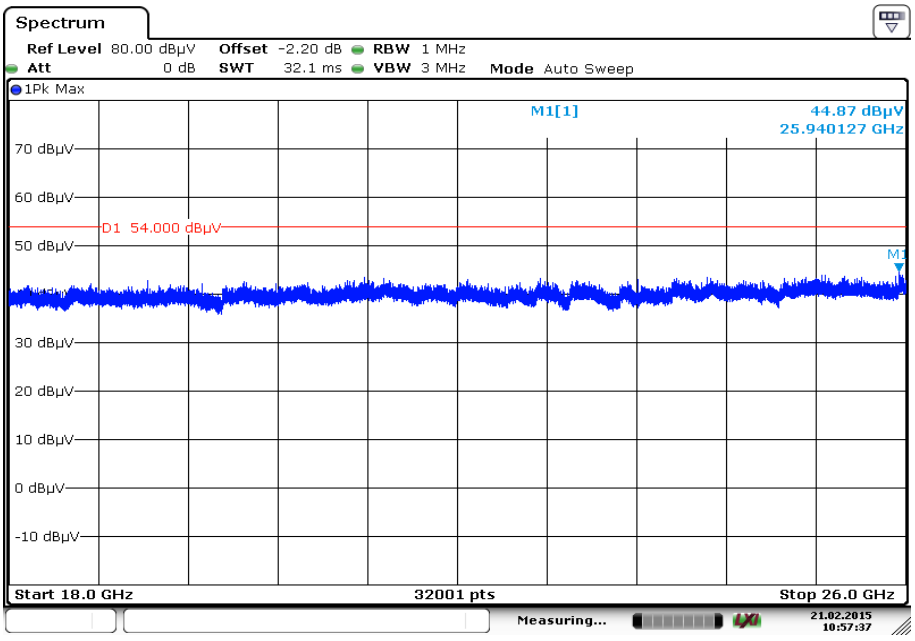
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 11: Highest channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization



Date: 21.FEB.2015 10:38:10

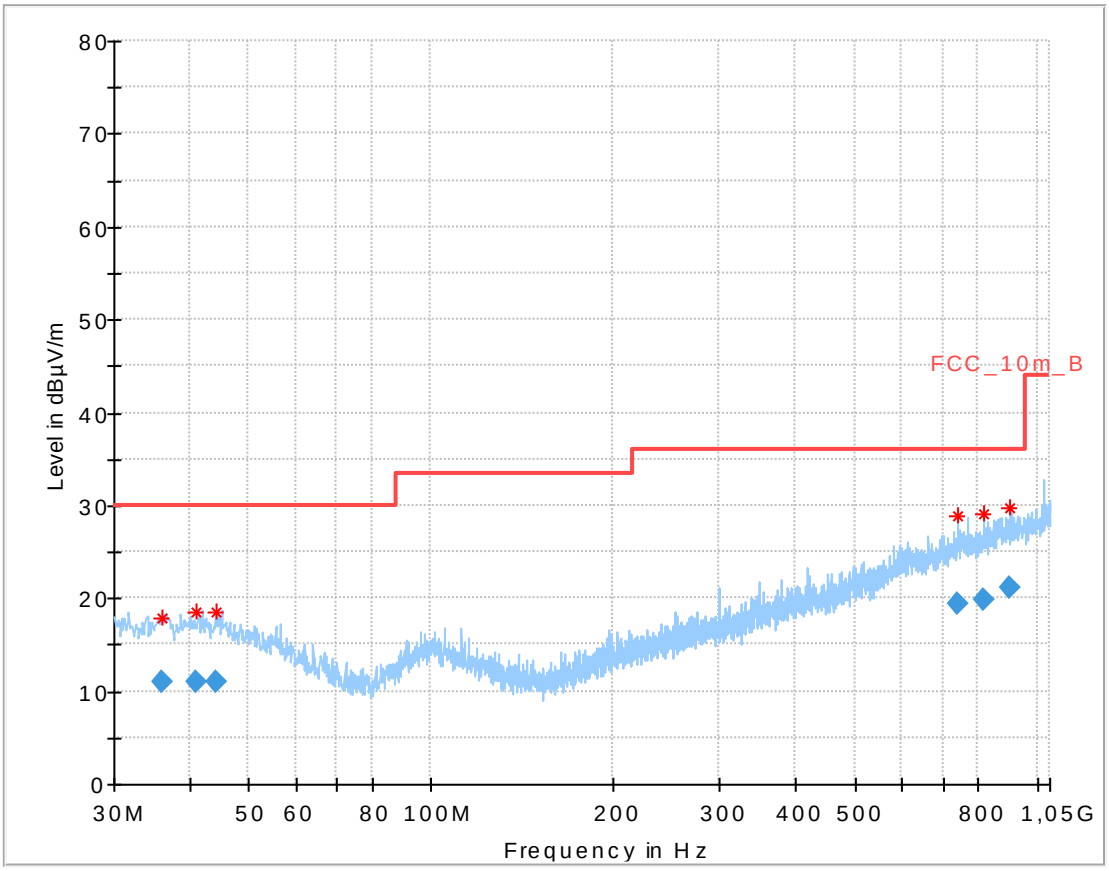
Plot 12: Highest channel, 18 GHz to 26 GHz, vertical & horizontal polarization



Date: 21.FEB.2015 10:57:37

Plots: OFDM / n HT20 – mode

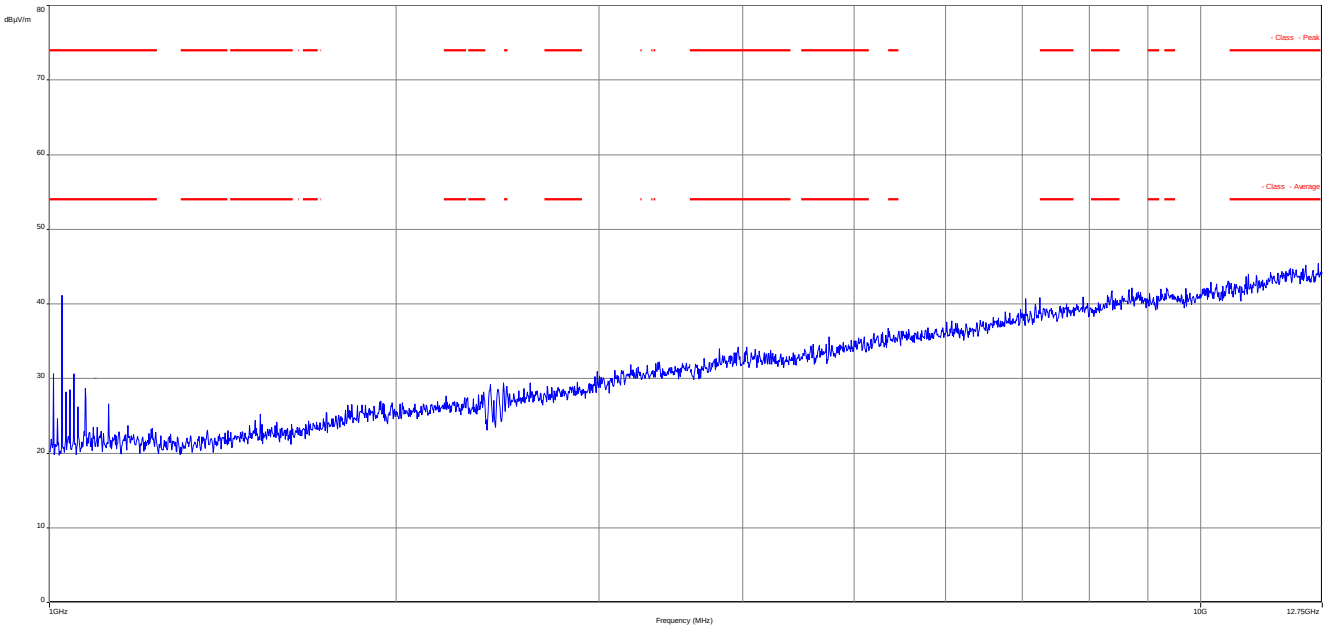
Plot 1: Lowest channel, 30 MHz to 1 GHz, vertical & horizontal polarization



Final_Result:

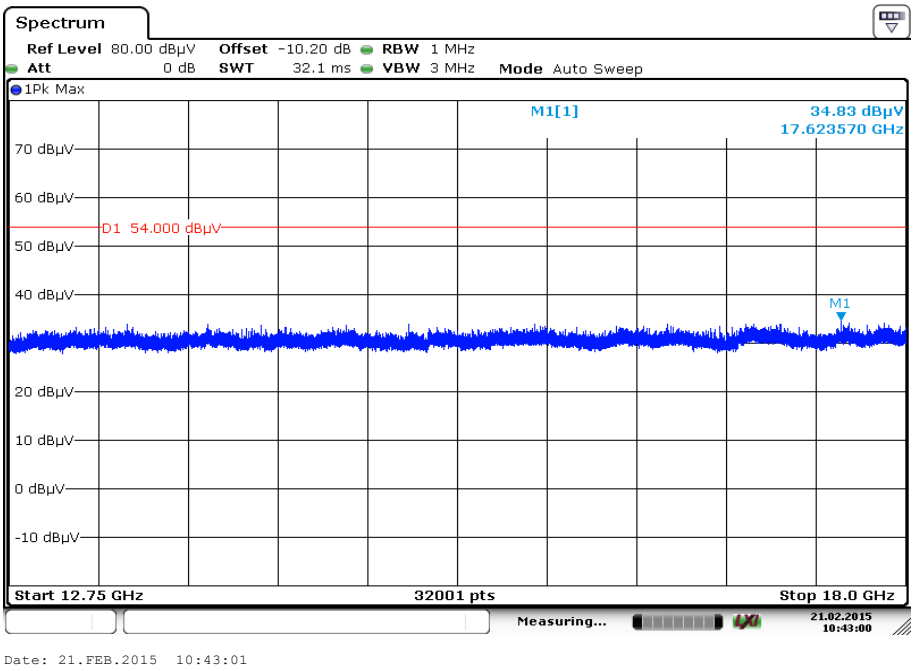
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
35.907900	10.92	30.00	19.08	1000.0	120.000	101.0	H	173	13.8
40.923000	10.96	30.00	19.04	1000.0	120.000	101.0	V	-25	14.0
44.161950	10.96	30.00	19.04	1000.0	120.000	98.0	V	18	13.9
740.956050	19.45	36.00	16.55	1000.0	120.000	170.0	H	-6	22.5
814.594200	19.79	36.00	16.21	1000.0	120.000	170.0	V	266	22.9
899.169900	21.11	36.00	14.89	1000.0	120.000	170.0	H	84	24.1

Plot 2: Lowest channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization

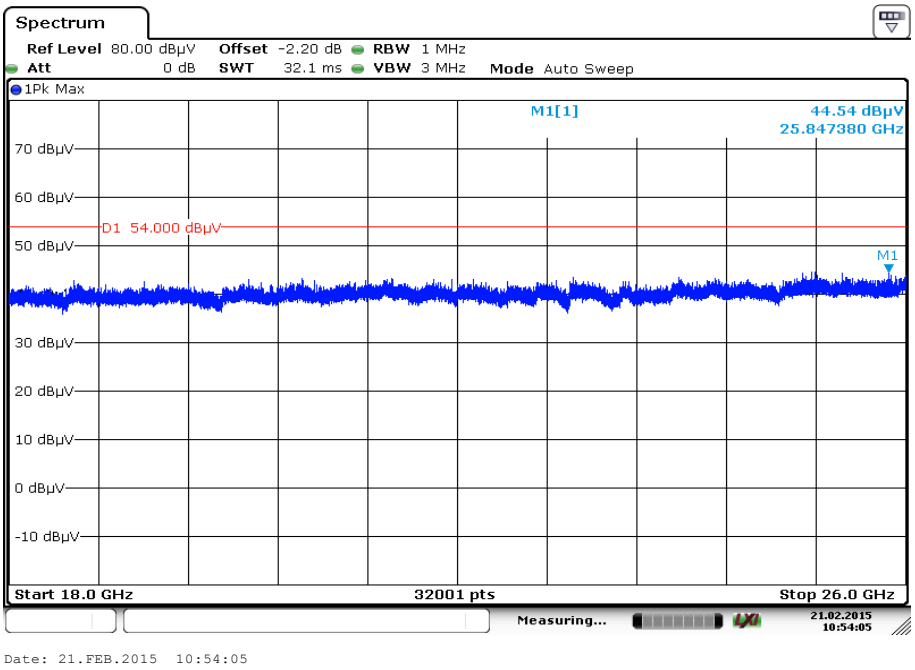


The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 3: Lowest channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization

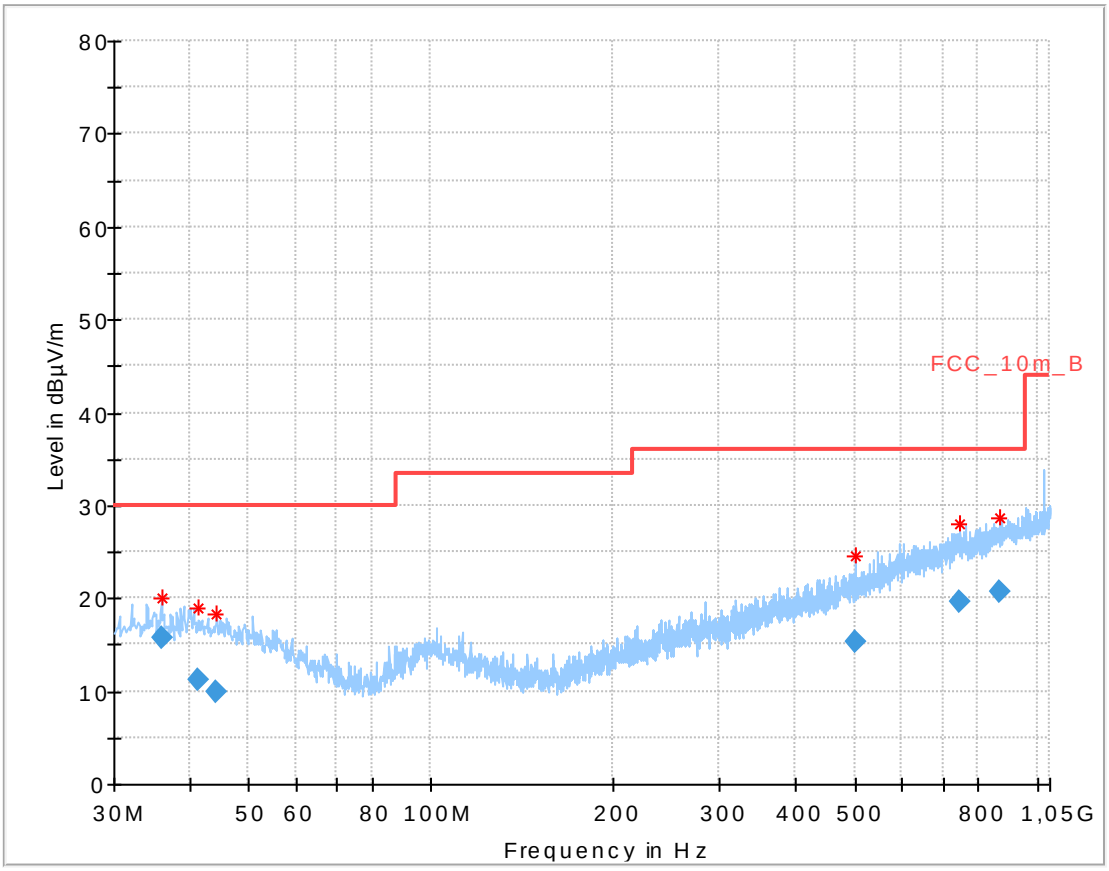


Plot 4: Lowest channel, 18 GHz to 26 GHz, vertical & horizontal polarization



Date: 21.FEB.2015 10:54:05

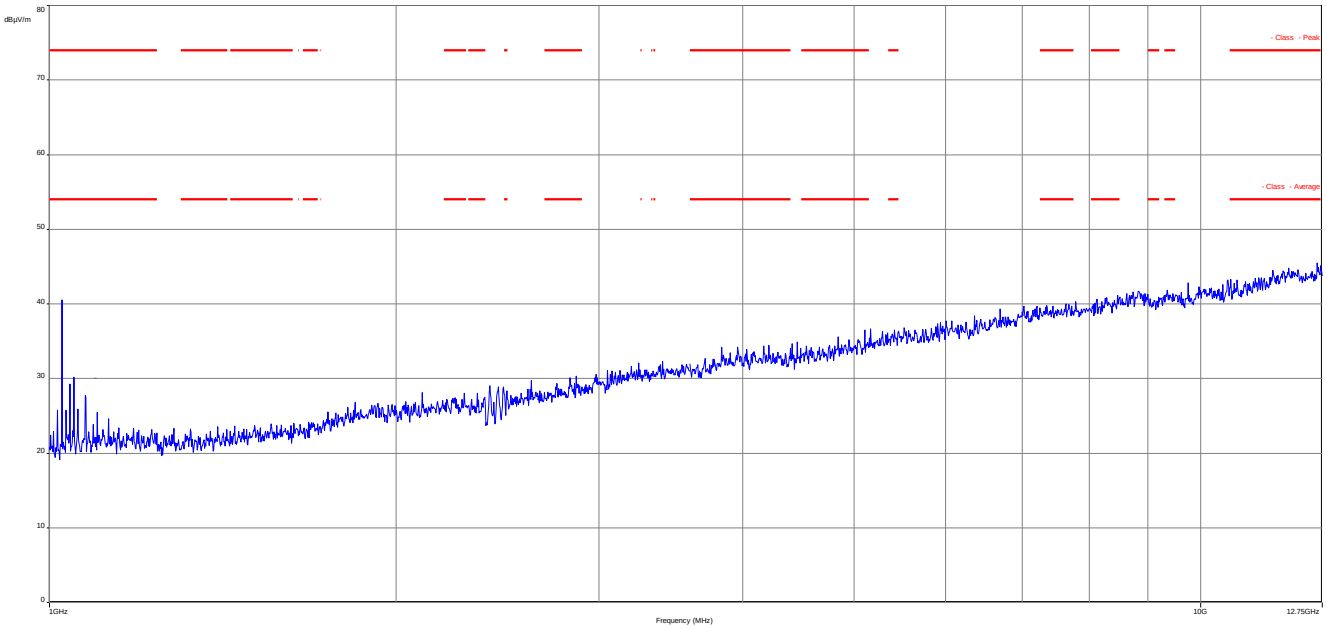
Plot 5: Middle channel, 30 MHz to 1 GHz, vertical & horizontal polarization



Final_Result:

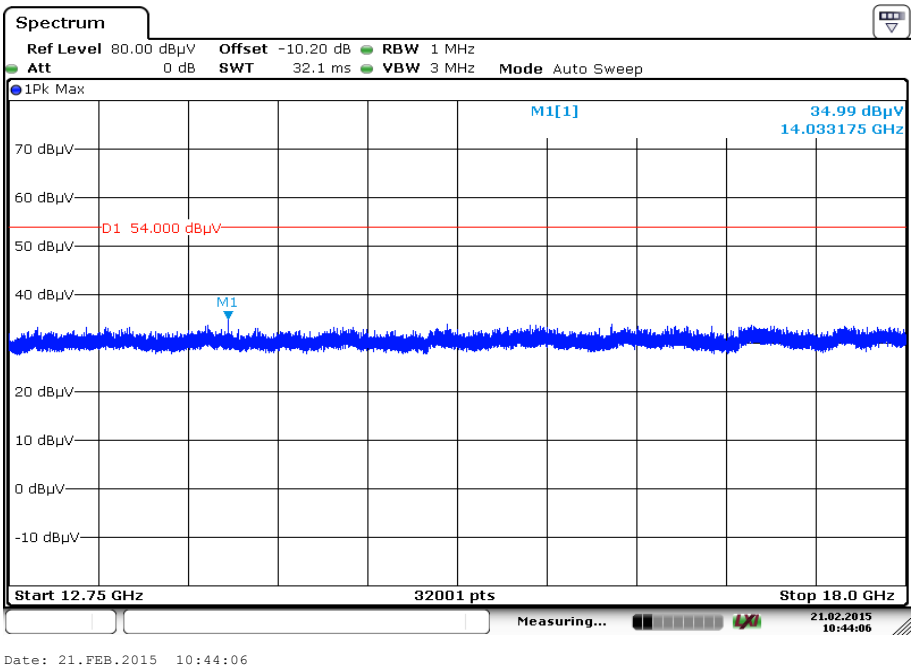
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
36.008850	15.73	30.00	14.27	1000.0	120.000	101.0	V	197	13.8
41.171700	11.30	30.00	18.70	1000.0	120.000	170.0	V	-6	14.0
44.182800	9.98	30.00	20.02	1000.0	120.000	170.0	H	173	13.9
502.399500	15.25	36.00	20.75	1000.0	120.000	170.0	V	107	18.7
744.934050	19.53	36.00	16.47	1000.0	120.000	170.0	H	115	22.6
869.244600	20.79	36.00	15.21	1000.0	120.000	98.0	V	17	23.7

Plot 6: Middle channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization



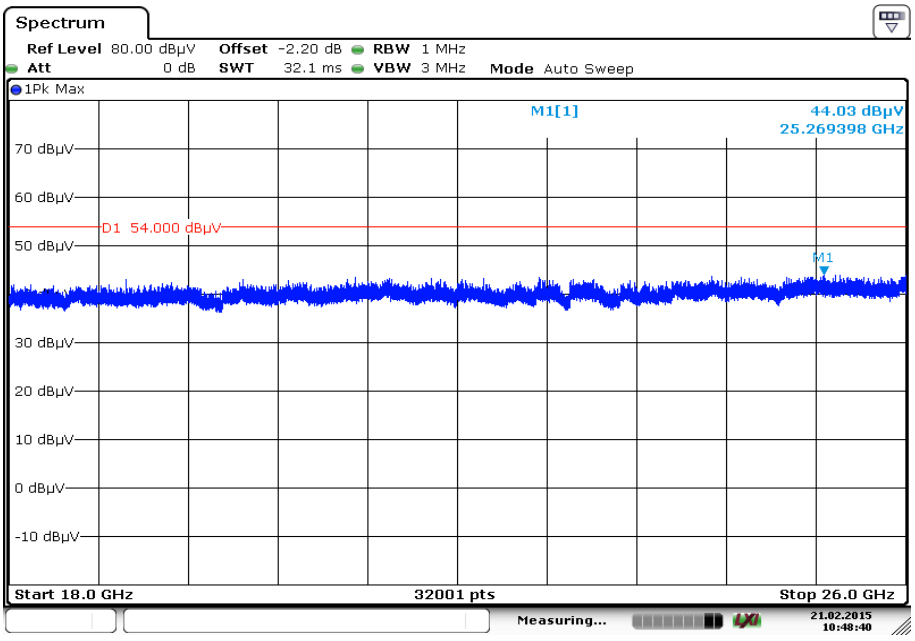
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 7: Middle channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization



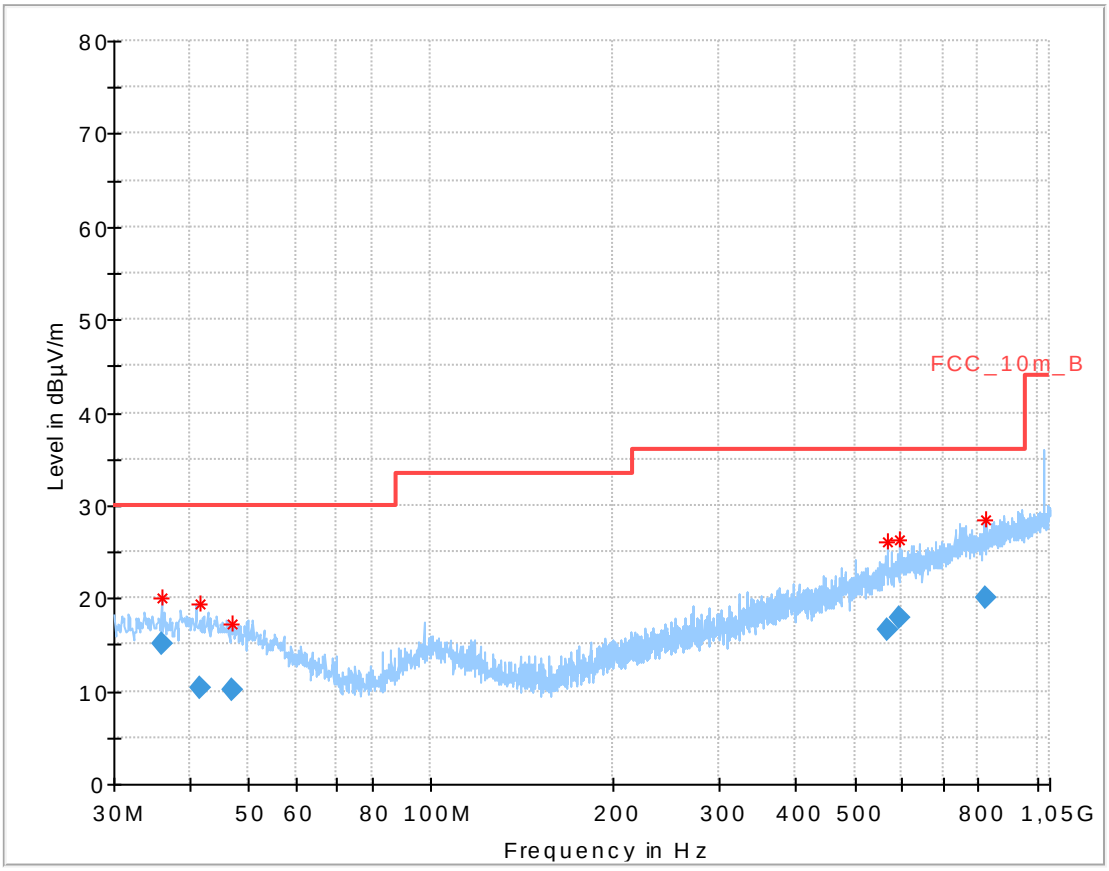
Date: 21.FEB.2015 10:44:06

Plot 8: Middle channel, 18 GHz to 26 GHz, vertical & horizontal polarization



Date: 21.FEB.2015 10:48:41

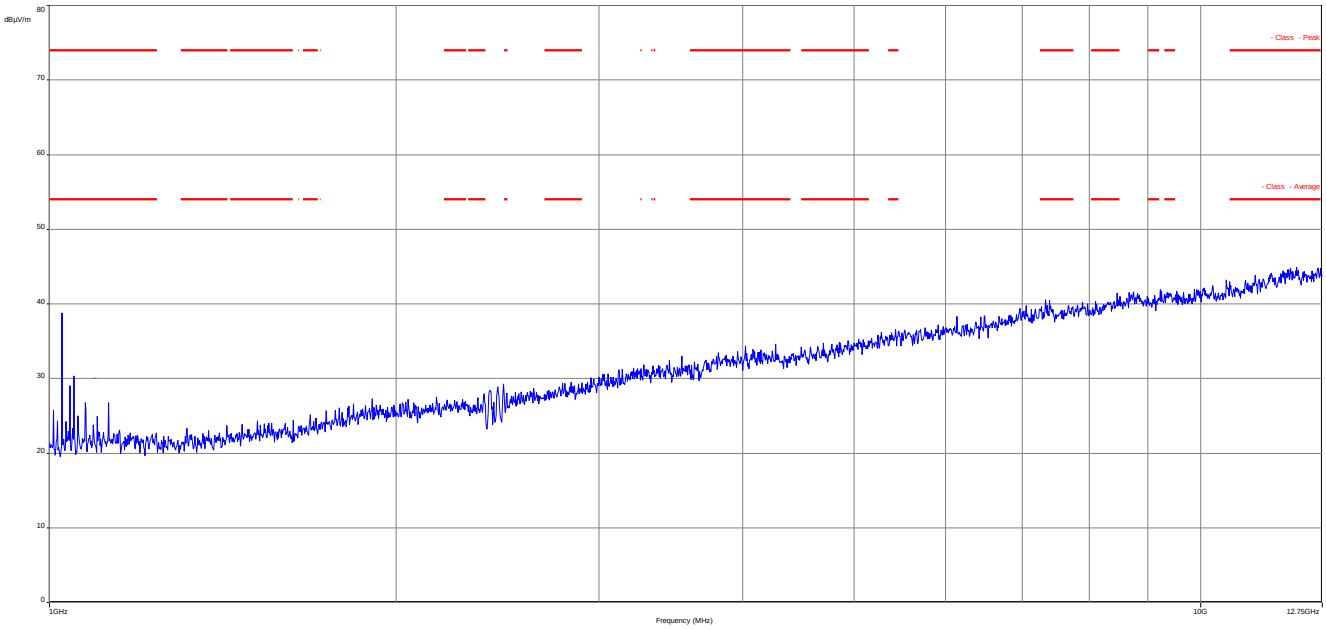
Plot 9: Highest channel, 30 MHz to 1 GHz, vertical & horizontal polarization



Final_Result:

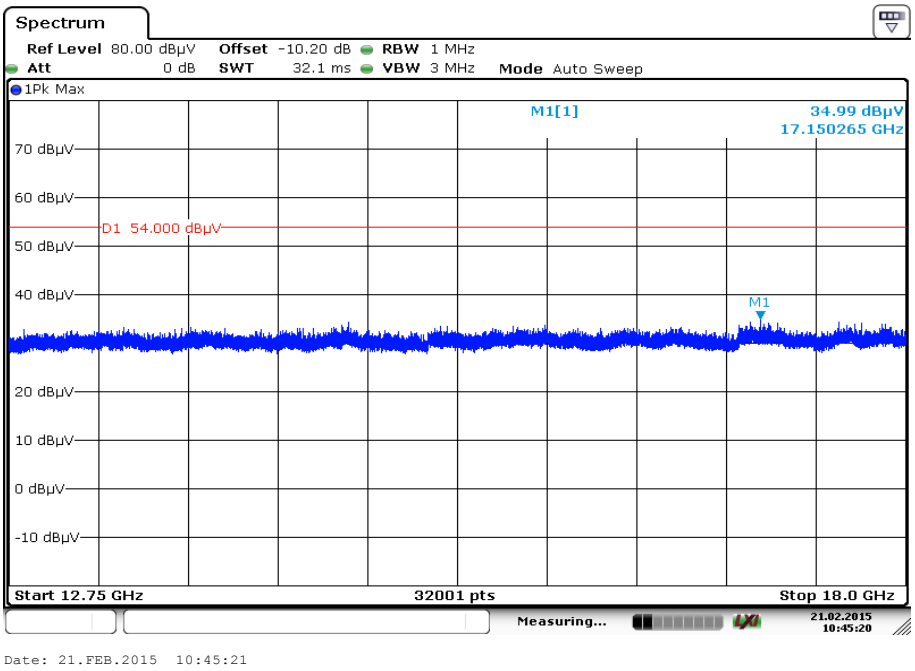
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
35.968800	15.01	30.00	14.99	1000.0	120.000	101.0	V	295	13.8
41.523150	10.40	30.00	19.60	1000.0	120.000	170.0	H	65	14.0
47.008200	10.14	30.00	19.86	1000.0	120.000	170.0	V	-4	13.4
565.284300	16.69	36.00	19.31	1000.0	120.000	170.0	H	25	19.7
595.318200	17.81	36.00	18.19	1000.0	120.000	98.0	H	245	20.6
825.853950	20.06	36.00	15.94	1000.0	120.000	170.0	H	83	23.1

Plot 10: Highest channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization

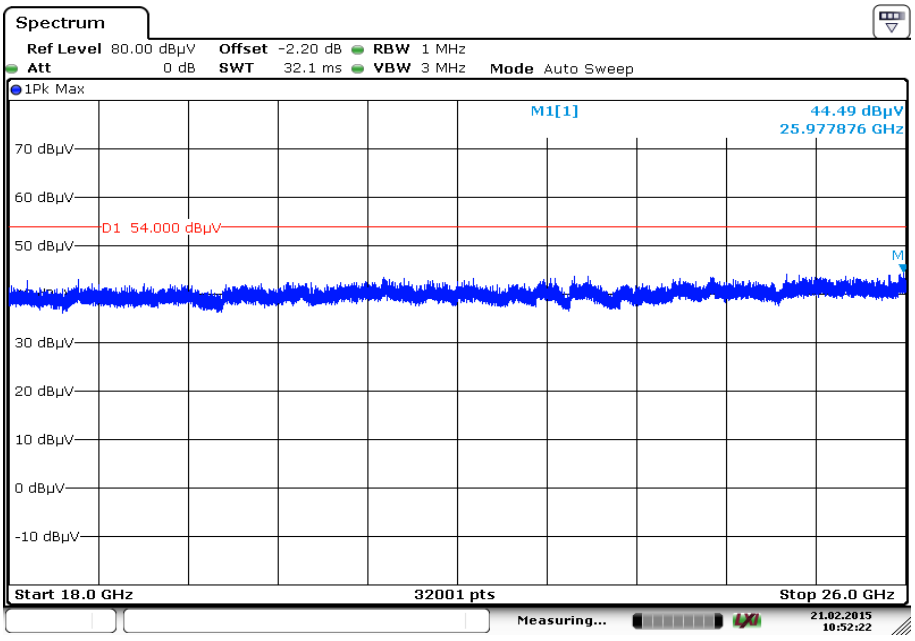


The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 11: Highest channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization



Plot 12: Highest channel, 18 GHz to 26 GHz, vertical & horizontal polarization



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10.12 RX spurious emissions radiated

Description:

Measurement of the radiated spurious emissions in idle/receive mode. The results are valid for both modes.

Measurement:

Measurement parameter	
Detector:	Peak / Quasi Peak / RMS
Sweep time:	Auto
Resolution bandwidth:	F > 1 GHz: 1 MHz F < 1 GHz: 100 kHz
Video bandwidth:	3 x RBW
Span:	30 MHz to 26 GHz
Trace-Mode:	Max Hold

Limits:

FCC		IC
RX Spurious Emissions Radiated		
Frequency (MHz)	Field Strength (dBµV/m)	Measurement distance
30 - 88	30.0	10
88 – 216	33.5	10
216 – 960	36.0	10
Above 960	54.0	3

Results:

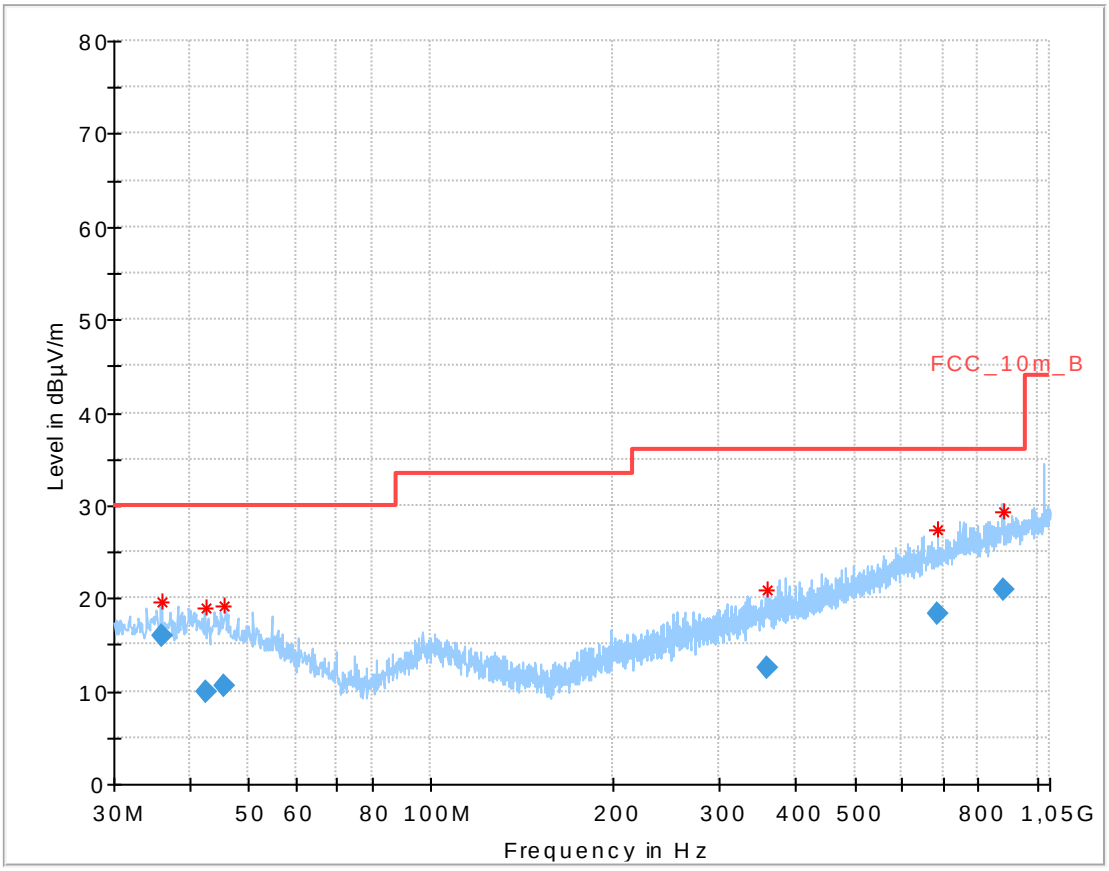
RX Spurious Emissions Radiated [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
For emissions below 1 GHz, please take a look at the table below the 1 GHz plot.		
All detected peak emissions are more than 10 dB below the average limit.		
Measurement uncertainty	± 3 dB	

Verdict: complies

Note: The limit was recalculated with 20 dB / decade (Part 15.31) for all radiated spurious emissions 30 MHz to 1 GHz from 3 meter limit to a 10 meter distance. (40dB/decade for emissions < 30MHz)

Plots: RX / idle – mode

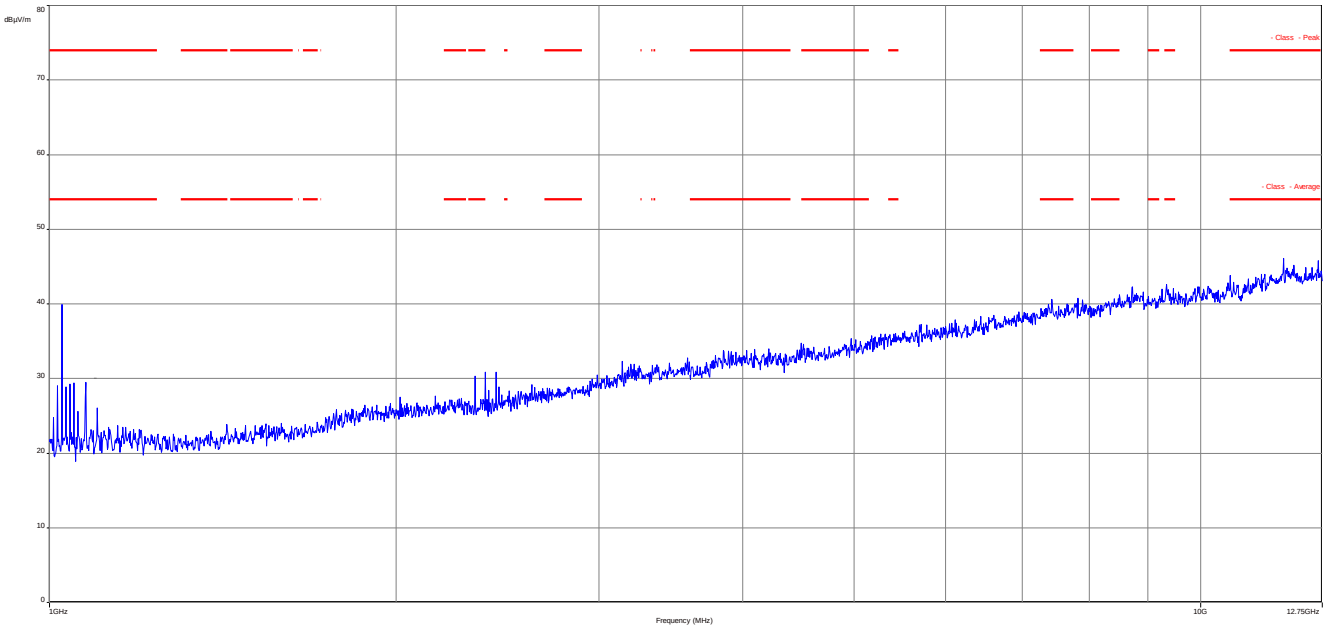
Plot 1: 30 MHz to 1 GHz, vertical & horizontal polarization



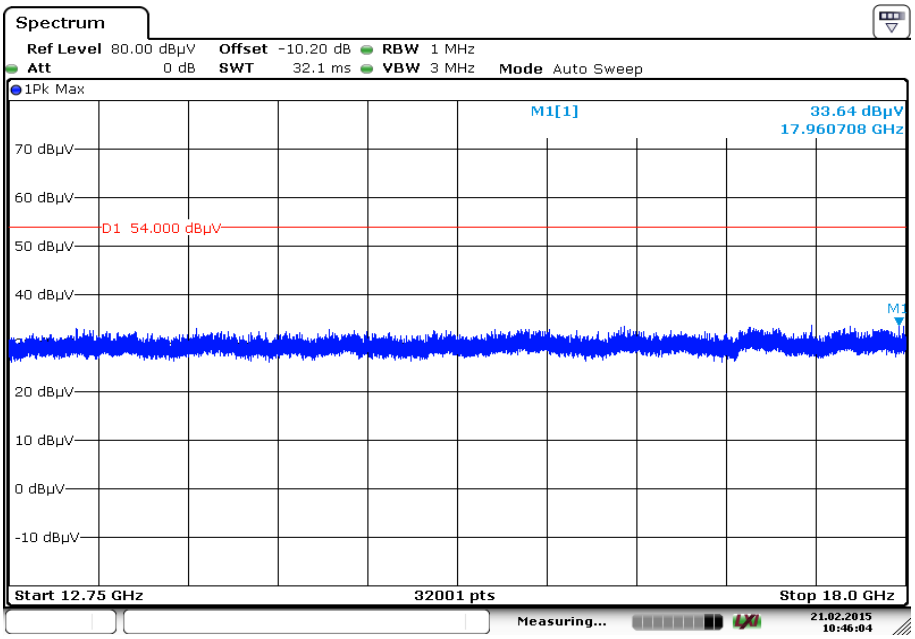
Final_Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
36.002400	15.99	30.00	14.01	1000.0	120.000	101.0	V	173	13.8
42.638250	9.94	30.00	20.06	1000.0	120.000	170.0	V	83	13.9
45.722400	10.53	30.00	19.47	1000.0	120.000	100.0	H	84	13.7
357.597600	12.56	36.00	23.44	1000.0	120.000	101.0	V	295	16.2
684.947100	18.35	36.00	17.65	1000.0	120.000	170.0	V	-6	21.4
878.382750	20.98	36.00	15.02	1000.0	120.000	170.0	V	-7	23.8

Plot 2: 1 GHz to 12.75 GHz, vertical & horizontal polarization



Plot 3: 12.75 GHz to 18 GHz, vertical & horizontal polarization



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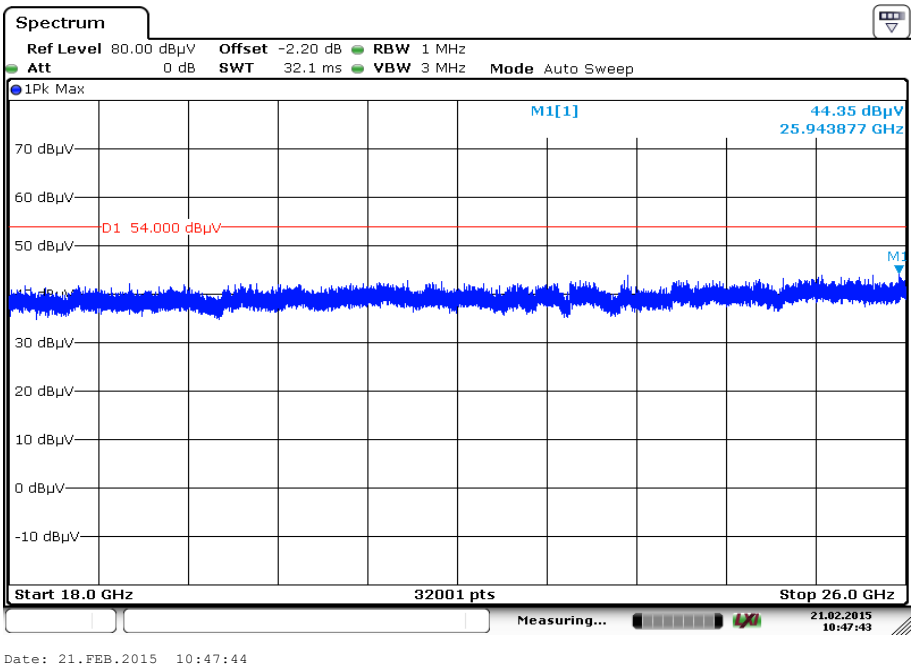
Plot 4: 18 GHz to 26 GHz, vertical & horizontal polarization



10.13 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

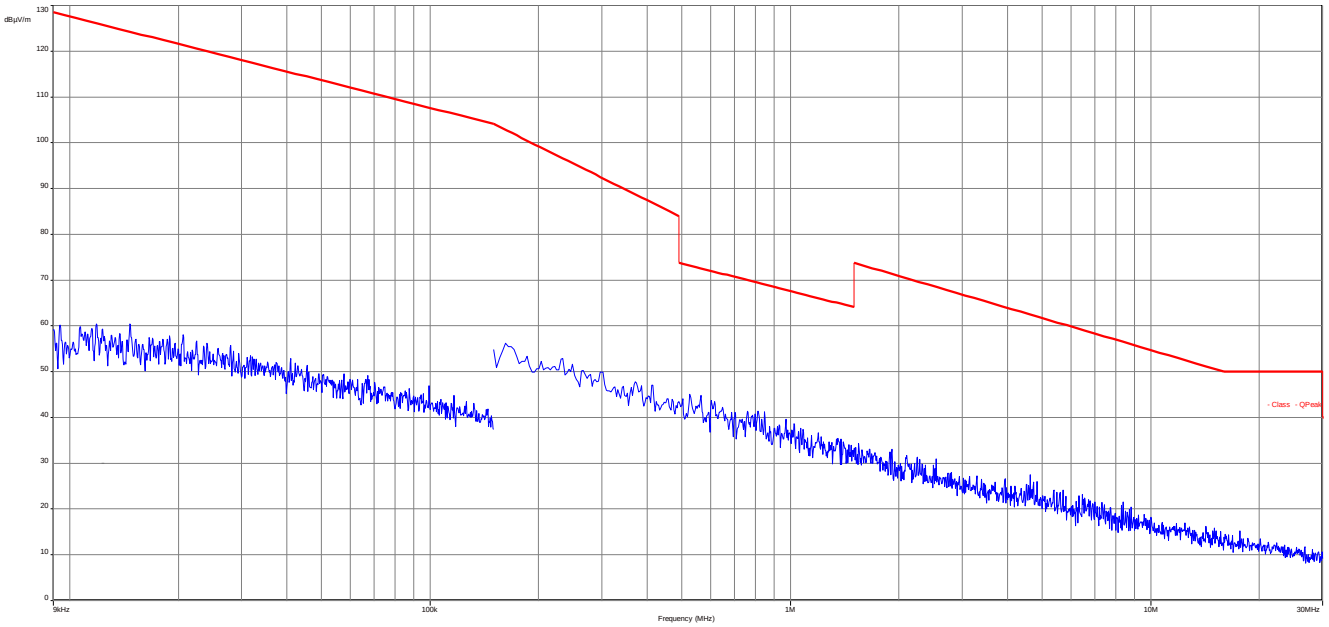
Results:

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

Verdict: complies

Plots: TX mode

Plot 1: 9 kHz to 30 MHz



10.14 Spurious emissions conducted < 30 MHz

Description:

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

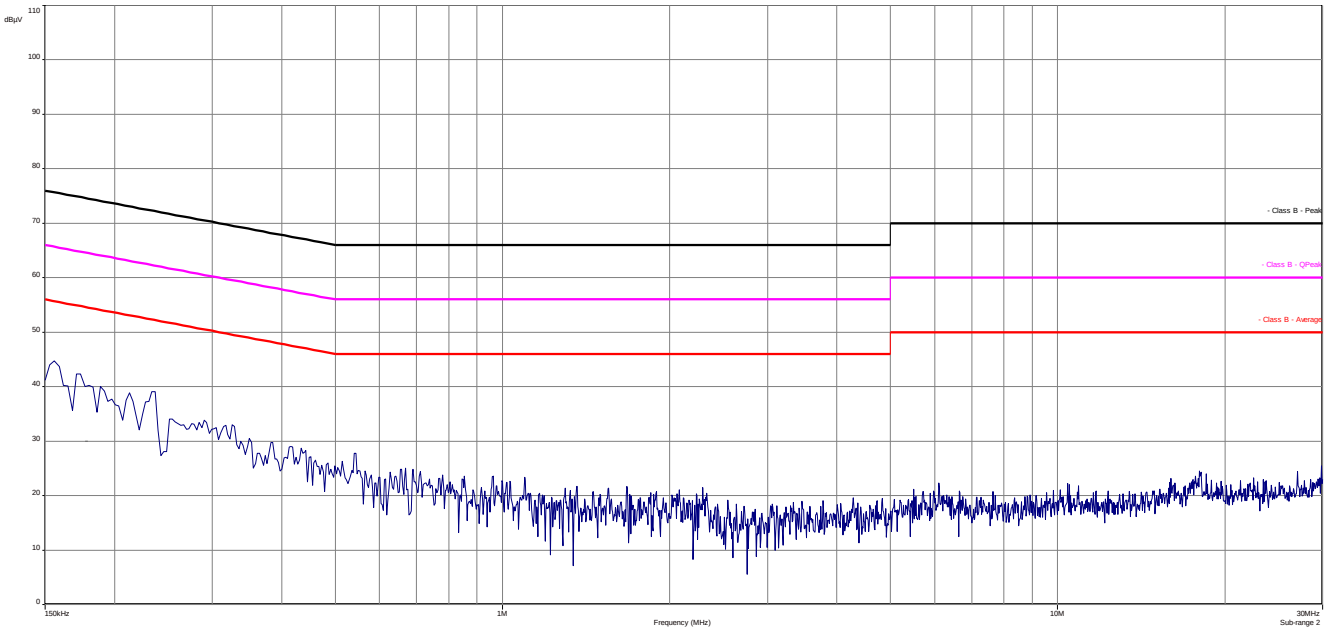
Results:

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

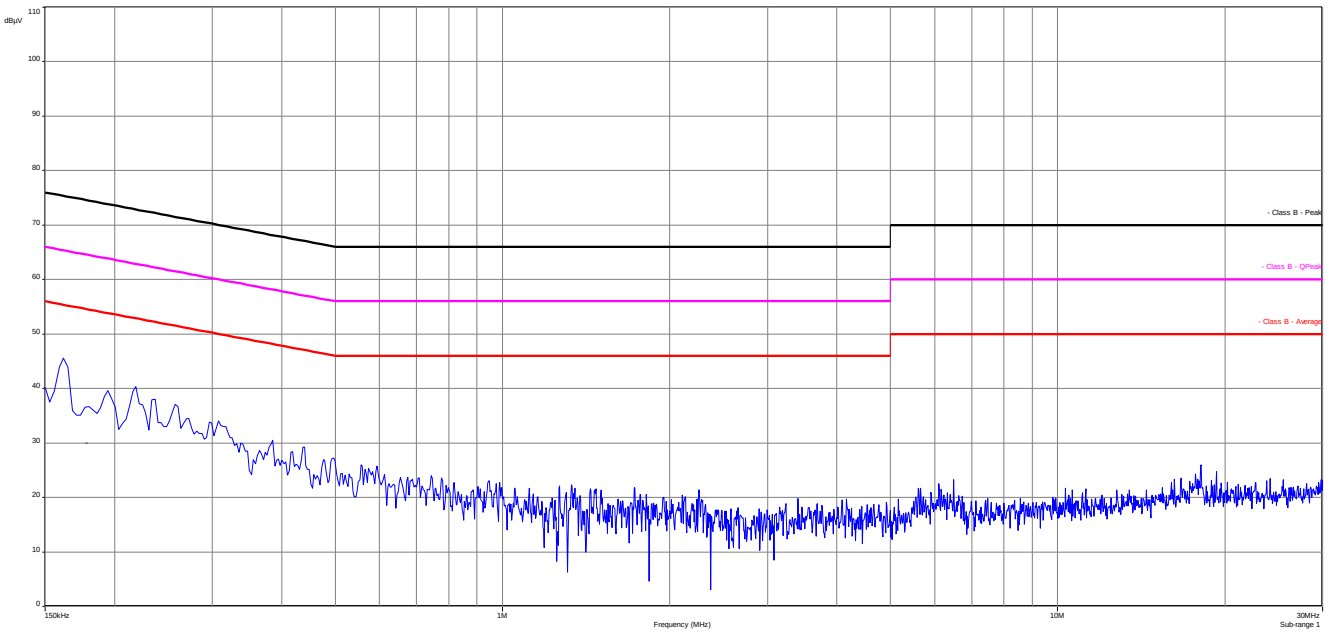
Verdict: complies

Plots:

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



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



11 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	45	Switch-Unit	3488A	HP	2719A14505	300000368	g		
2	50	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04466	300000580	ne		
3	50	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	26.01.2015	26.01.2016
4	50	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw		
5	50	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw		
6	50	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw		
7	50	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	22.04.2014	22.04.2016
8	n. a.	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2818A03450	300001040	Ve	20.01.2015	20.01.2018
9	n. a.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vlKl!	08.05.2013	08.05.2015
10	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev		
11	n. a.	Switch / Control Unit	3488A	HP	*	300000199	ne		
12	9	Artificial Mains 9 kHz to 30 MHz	ESH3-Z5	R&S	828576/020	300001210	Ve	30.01.2014	30.01.2016
13	9	Isolating Transformer	MPL IEC625 Bus Regeltrenntravo	Erfi	91350	300001155	ne		
14	90	Active Loop Antenna 10 kHz to 30 MHz	6502	Kontron Psychotech	8905-2342	300000256	k	13.06.2013	13.06.2015
15	90	Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143	ne		
16	90	Band Reject filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	11	300003351	ev		
17	90	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854	vlKl!	29.10.2014	29.10.2017
18	90	MXE EMI Receiver 20 Hz to 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	13.03.2014	13.03.2015
19	11b	Microwave System Amplifier, 0.5-26.5 GHz	83017A	HP	00419	300002268	ev		
20	A026	Std. Gain Horn Antenna 12.4 to 18.0 GHz	639	Narda	8402	300000787	k	22.07.2013	22.07.2015
21	A029	Std. Gain Horn Antenna 18.0 to 26.5 GHz	638	Narda	8205	300002442	k	19.07.2013	19.07.2015
22	A029	Signal Analyzer 40 GHz	FSV40	R&S	101042	300004517	k	22.01.2015	22.01.2016
23	n. a.	Power Supply 0-20V, 0-5A	6632B	Agilent Technologies	GB42110541	400000562	vlKl!	10.01.2013	10.01.2016

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

12 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	2015-03-25
A	New editorial requirements (Canada)	2015-04-28
B	Timing measurements added	2015-06-17

Annex B Further information

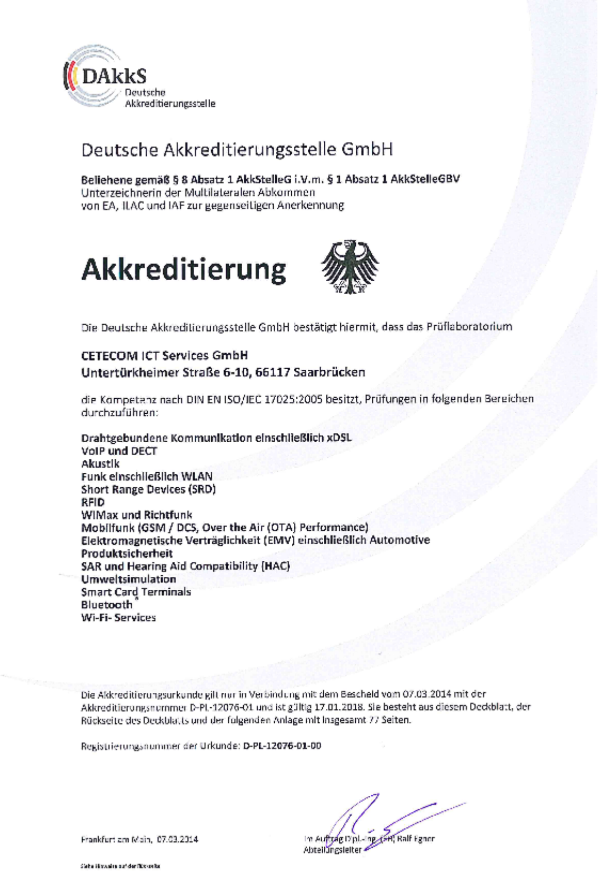
Glossary

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

Annex C Accreditation Certificate

Front side of certificate

Back side of certificate



Deutsche Akkreditierungsstelle GmbH

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Akkreditierung

Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

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

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

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Akustik
Funk einschließlich WLAN
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RFID
WIMax und Richtfunk
Mobilfunk (GSM / DCS, Over the Air (OTA) Performance)
Elektromagnetische Verträglichkeit (EMV) einschließlich Automotive
Produktsicherheit
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Frankfurt am Main, 07.03.2014

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

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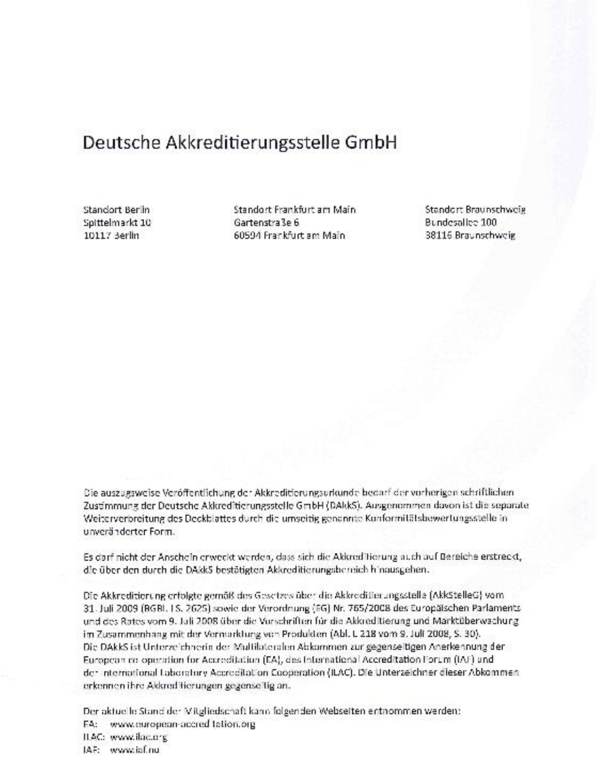

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ILAC: www.ilac.org
IAF: www.iaf.nu

Note:

The current certificate including annex is published on our website (see link below) or may be received from CETECOM ICT Services on request.

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