
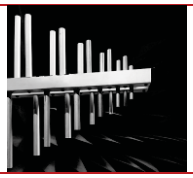
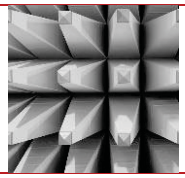

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consulting - testing - certification ➤➤➤

TEST REPORT

Test report no.: 1-0375/15-01-02-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

Echostar Technologies
90 Inverness Circle East
CO 80112 Englewood / UNITED STATES
Phone: +1 303 706 4000
Fax: -/-
Contact: Ian Schroeder
e-mail: ian.schroeder@echostar.com
Phone: +1 303 706 5234

Manufacturer

Echostar Technologies
90 Inverness Circle East
CO 80112 Englewood / UNITED STATES

Test standard/s

47 CFR Part 15	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 247 Issue 1	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence - Exempt Local Area Network (LE-LAN) Devices

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

Test Item

Kind of test item:	**TV streaming media device (Slingbox)**
Model name:	**M2**
FCC ID:	**DKN-L37**
IC:	**1707A-L37**
Frequency:	U-NII band 5725 MHz to 5850 MHz
Technology tested:	WLAN (OFDM / a –; n HT20 & HT40 – mode)
Antenna:	Integrated antenna
Power supply:	110 V AC by mains adapter
Temperature range:	-30°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:

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2016.01.27 11:42:12 +01'00'

Marco Bertolino
Lab Manager
Radio Communications & EMC

Test performed:

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Andreas Luckenbill
Lab Manager
Radio Communications & EMC

1 Table of contents

2 General information

2.1 Notes and disclaimer

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2.2 Application details

Date of receipt of order:	2015-12-07
Date of receipt of test item:	2016-01-11
Start of test:	2016-01-13
End of test:	2016-01-15
Person(s) present during the test:	-/-

3 Test standard/s and references

Test standard	Date	Description
47 CFR Part 15	-/-	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 247 Issue 1	May 2015	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence - Exempt Local Area Network (LE-LAN) Devices

Guidance	Version	Description
UNII: KDB 789033 D02	v01r01	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E
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
ANSI C63.10-2013	-/-	American national standard of procedures for compliance testing of unlicensed wireless devices
KDB 662911 D01	V02r01	Emissions Testing of Transmitters with Multiple Outputs in the Same Band

4 Test environment

Temperature	:	T_{nom} T_{max} T_{min}	+22 °C during room temperature tests +50 °C during high temperature tests -30 °C during low temperature tests
Relative humidity content	:		55 %
Barometric pressure	:		not relevant for this kind of testing
Power supply	:	V_{nom} V_{max} V_{min}	110 V AC by mains adapter 121 V 99 V

5 Test item

5.1 General description

Kind of test item	:	TV streaming media device (Slingbox)
Type identification	:	M2
HMN	:	-/-
PMN	:	-/-
HVIN	:	-/-
FVIN	:	-/-
S/N serial number	:	No information available
HW hardware status	:	1.0.1
FW software status	:	Secured: 0.2.272 (No 364 & 383) Unsecured: 0.2.270 (No 257)
Frequency band	:	U-NII band 5725 MHz to 5850 MHz (lowest channel 149 – 5745 MHz; highest channel 165 – 5825 MHz)
Type of radio transmission Use of frequency spectrum	: :	OFDM
Type of modulation	:	BPSK, QPSK, 16 – QAM, 64 – QAM, 256 - QAM
Number of channels	:	5 (20 MHz) 2 (40 MHz)
Antenna	:	Integrated antenna
Power supply	:	99 V to 121 V AC by mains adapter
Temperature range	:	-30°C to +50°C

5.2 Additional information

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

Test setup- and EUT-photos are included in test report: 1-7682/14-01-01_AnnexA
1-7682/14-01-01_AnnexB
1-7682/14-01-01_AnnexD

6 Test laboratories sub-contracted

None

7 Description of the test setup

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

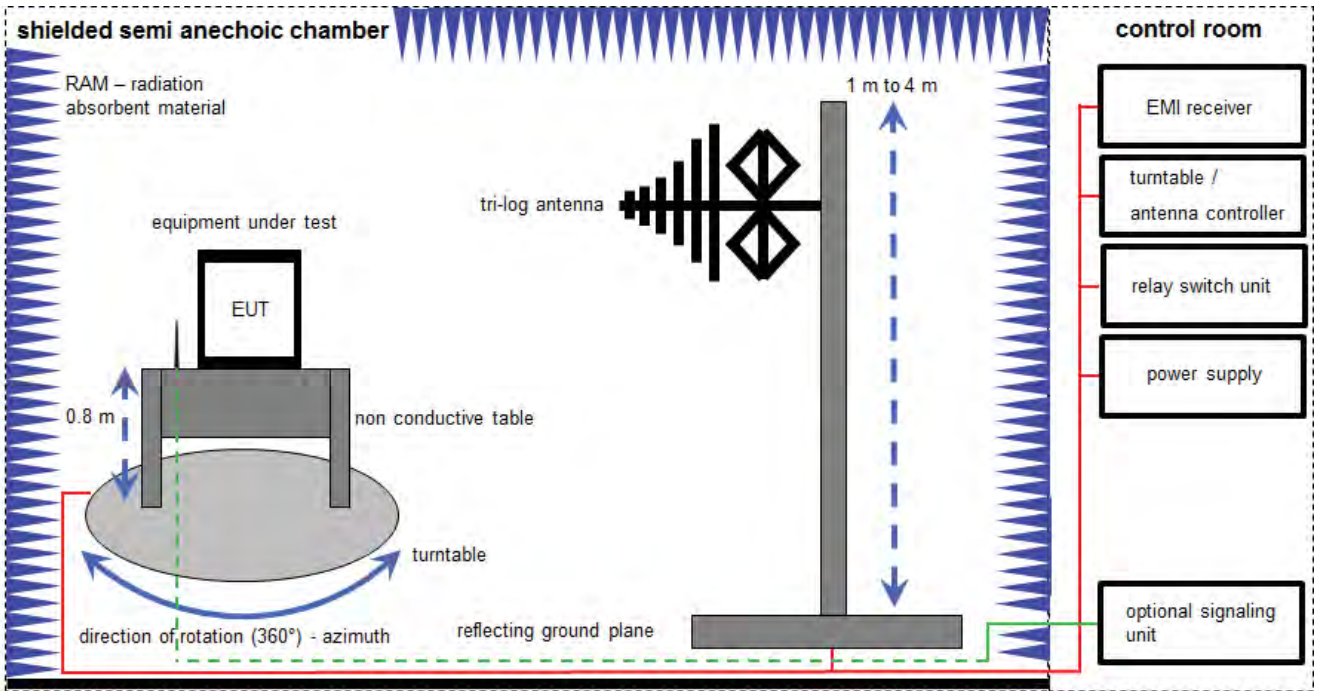
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

Agenda: Kind of Calibration

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

7.1 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. 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 analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



Measurement distance: tri-log antenna 10 meter

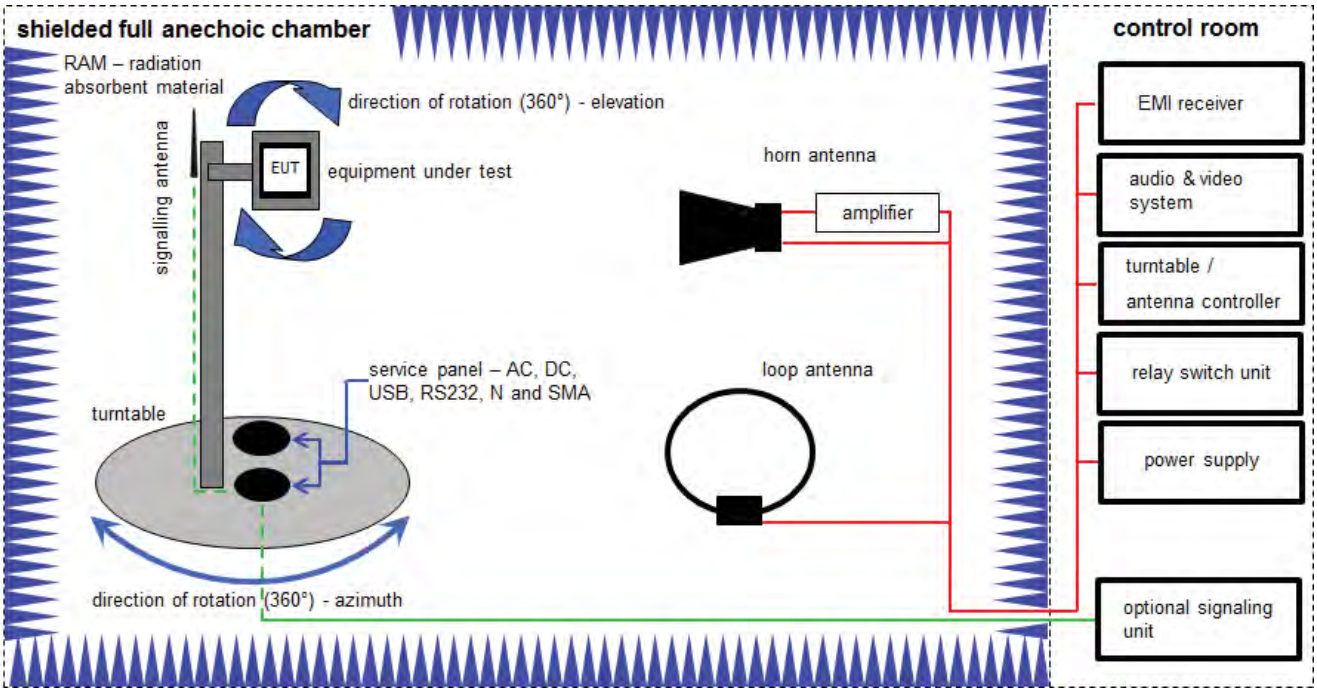
FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

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

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
2	A	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	26.01.2015	26.01.2016
3	A	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
4	A	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
5	A	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
6	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	22.04.2014	22.04.2016

7.2 Shielded fully anechoic chamber



Measurement distance: horn antenna 3 meter; loop antenna 3 meter

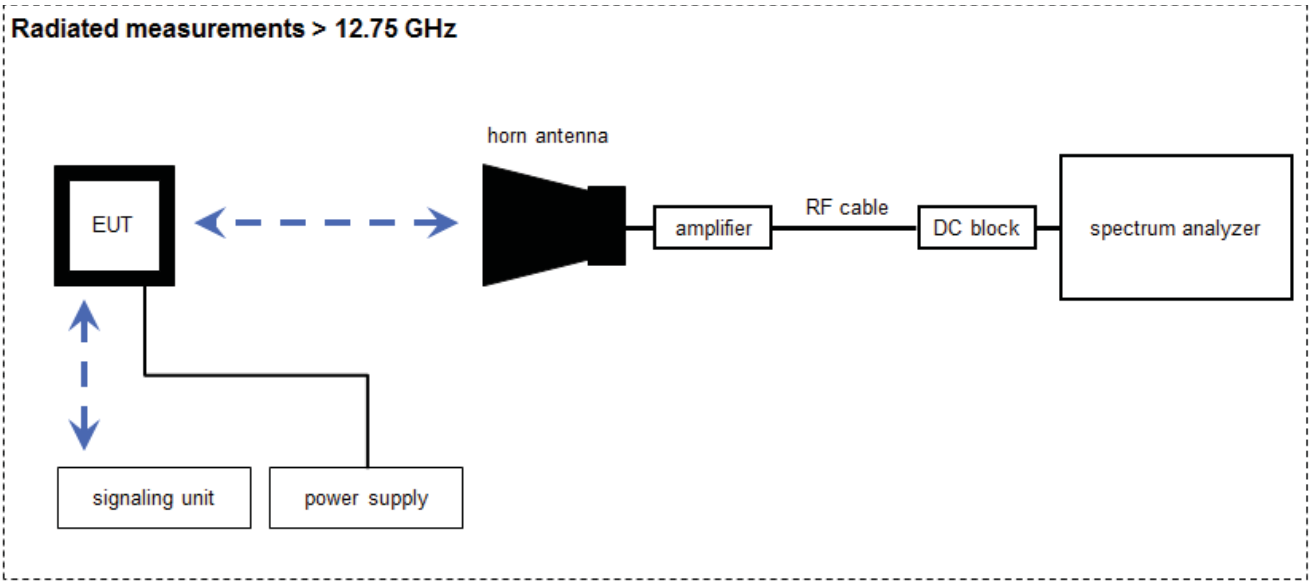
FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

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

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vIKI!	20.05.2015	20.05.2017
2	A	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
3	A	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
4	A	Active Loop Antenna 10 kHz to 30 MHz	6502	EMCO/2	8905-2342	300000256	k	24.06.2015	24.06.2017
5	A	Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143	ne	-/-	-/-
6	A	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne	-/-	-/-
7	A	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
8	A	EMI Test Receiver 9kHz-26,5GHz	ESR26	R&S	101376	300005063	k	04.09.2015	04.09.2016

7.3 Radiated measurements > 12.75 GHz



Measurement distance: horn antenna 50 cm

FS = U_R + CA + AF
(FS-field strength; U_R-voltage at the receiver; CA-loss signal path & distance correction; AF-antenna factor)

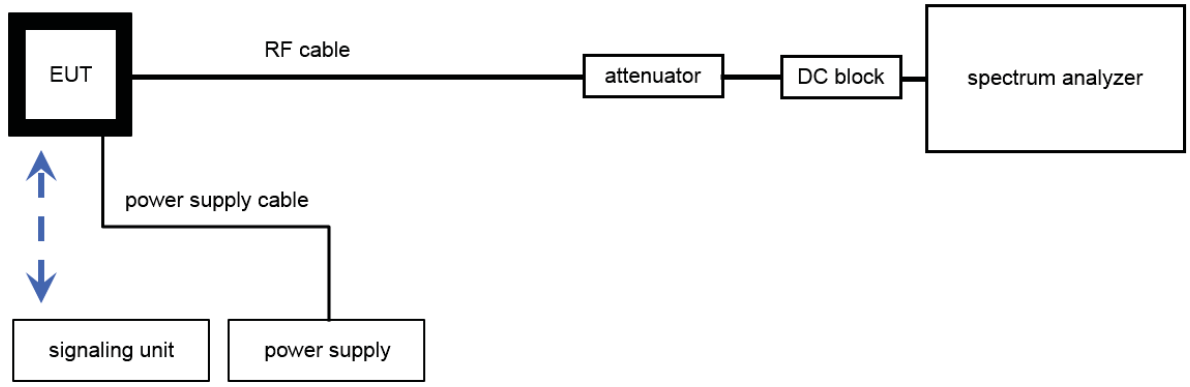
Example calculation:
FS [dBµV/m] = 40.0 [dBµV/m] + (-60.1) [dB] + 36.74 [dB/m] = 16.64 [dBµV/m] (6.79 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Signal Analyzer 40 GHz	FSV40	R&S	101042	300004517	k	22.01.2015	22.01.2016
2	A	Horn Antenna 18,0-40,0 GHz	LHAF180	Microw.Devel	39180-103-022	300001748	k	22.05.2015	22.05.2018
3	A	Std. Gain Horn Antenna 12.4 to 18.0 GHz	639	Narda	8402	300000787	k	14.08.2015	14.08.2017
4	A	Amplifier 2-40 GHz	JS32-02004000-57-5P	MITEQ	1777200	300004541	ev	-/-	-/-
5	A	RF-Cable	ST18/SMAm/SMAm/72	Huber & Suhner	Batch no. 699714	400001184	ev	-/-	-/-
6	A	DC-Blocker 0.1-40 GHz	8141A	Inmet	Batch no. 699714	400001185	ev	-/-	-/-

7.4 Conducted measurements

Conducted measurements normal conditions



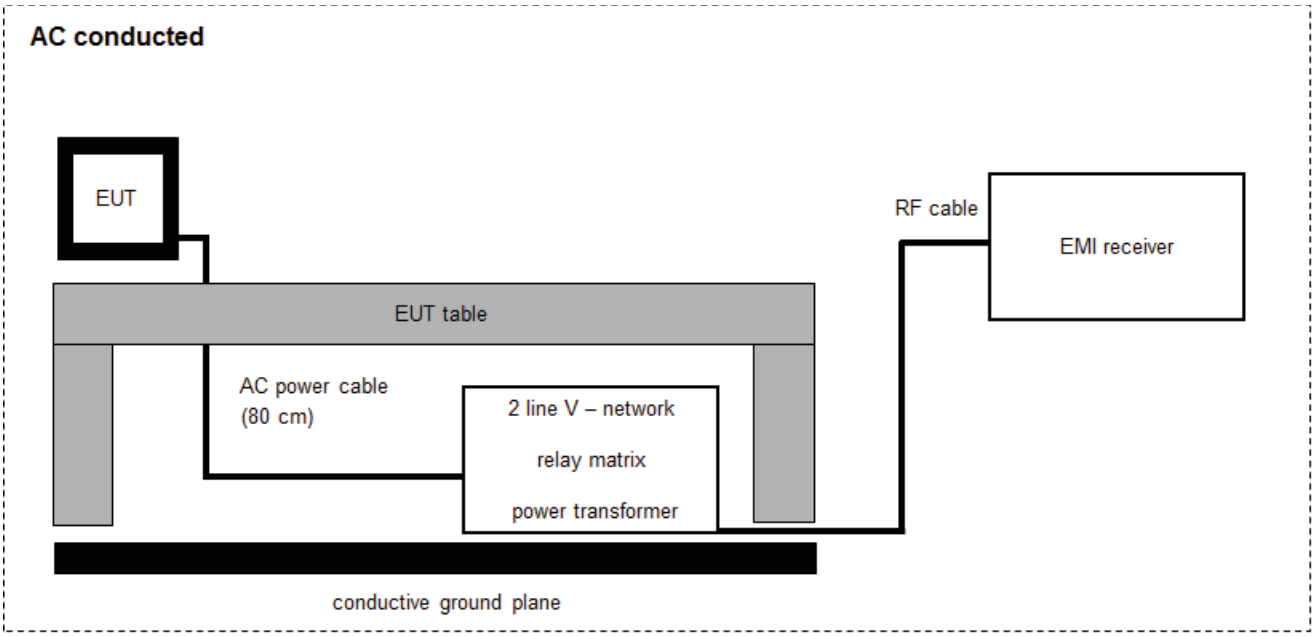
OP = AV + CA
(OP-output power; AV-analyzer value; CA-loss signal path)

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

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Switch / Control Unit	3488A	HP	2719A15013	300000151	ne	-/-	-/-
2	A	Signal Analyzer 40 GHz	FSV40	R&S	101042	300004517	k	22.01.2015	22.01.2016
3	A	PC-WLAN Tester	Intel Core i3 3220/3,3 GHz, Prozessor	Agilent Technologies	2V2403033A4523	300004589	ne	-/-	-/-
4	A	Teststand	Teststand Custom Sequence Editor	National Instruments GmbH	2V2403033A4523	300004590	ne	-/-	-/-
5	A	RF-Cable	ST18/SMAm/SMAm/60	Huber & Suhner	Batch no. 606844	400001181	ev	-/-	-/-
6	A	RF-Cable	ST18/SMAm/SMAm/72	Huber & Suhner	Batch no. 699714	400001184	ev	-/-	-/-
7	A	DC-Blocker 0.1-40 GHz	8141A	Inmet	Batch no. 699714	400001185	ev	-/-	-/-
8	A	Coax Attenuator 10 dB 2W 0-40 GHz	MCL BW-K10-2W44+	Mini Circuits	Batch no. 699714	400001186	ev	-/-	-/-

7.5 AC conducted



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

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

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Netznachbildung	ESH3-Z5	R&S	892475/017	300002209	k	17.06.2014	17.06.2016
2	A	EMI-Receiver	8542E	HP	3617A00170	300000568	k	28.01.2015	28.01.2016
3	A.	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	Ve	11.02.2014	11.02.2016

8 Sequence of testing

8.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

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

Final measurement

- Identified emissions during the premeasurement are maximized by the software by rotating the turntable from 0° to 360°. In case of the 2-axis positioner is used the elevation axis is also rotated from 0° to 360°.
- The final measurement is done in the position (turntable and elevation) causing the highest emissions with quasi-peak (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. A plot with the graph of the premeasurement and the limit is stored.

8.2 Sequence of testing radiated spurious 30 MHz to 1 GHz

Setup

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

Premeasurement

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

Final measurement

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

8.3 Sequence of testing radiated spurious 1 GHz to 12.75 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

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

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximizes the peaks by rotating the turntable from 0° to 360°. This measurement is repeated for different EUT-table positions (0° to 150° in 30°-steps) and for both antenna polarizations.
- The final measurement is done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

8.4 Sequence of testing radiated spurious above 12.75 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet.
- The measurement distance is as appropriate (e.g. 0.5 m).
- The EUT is set into operation.

Premeasurement

- The test antenna is handheld and moved carefully over the EUT to cover the EUT's whole sphere and different polarizations of the antenna.

Final measurement

- The final measurement is performed at the position and antenna orientation causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement and the limit is stored.

9 Measurement uncertainty

Measurement uncertainty	
Test case	**Uncertainty**
Antenna gain	± 3 dB
Power spectral density	± 1.5 dB
26dB bandwidth	± 100 kHz (depends on the used RBW)
6dB bandwidth	± 100 kHz (depends on the used RBW)
Occupied bandwidth	± 100 kHz (depends on the used RBW)
Maximum output power	± 1.5 dB
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	± 3.7 dB
Spurious emissions radiated above 12.75 GHz	± 4.5 dB
Spurious emissions conducted below 30 MHz (AC conducted)	± 2.6 dB

10 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	CFR Part 15 RSS 247, Issue 1	see table	2016-01-27	-/-

Test specification clause	Test case	Temperature conditions	Power source voltages	C	NC	NA	NP	Remark
-/-	Output power verification (conducted)	Nominal	Nominal	☐	☐	☐	☐	No passed / fail criteria!
-/-	Gain	Nominal	Nominal	☐	☐	☐	☐	No passed / fail criteria!
U-NII Part 15	Duty cycle	Nominal	Nominal	☐	☐	☐	☐	No passed / fail criteria!
§15.407(a) RSS - 247 (6.2.1) (1) RSS - 247 (6.2.2) (1) RSS - 247 (6.2.3) (1) RSS - 247 (6.2.4) (1)	Maximum output power (conducted & radiated)	Nominal	Nominal	☒	☐	☐	☐	-/-
§15.407(a) RSS - 247 (6.2.1) (1) RSS - 247 (6.2.2) (1) RSS - 247 (6.2.3) (1) RSS - 247 (6.2.4) (1)	Power spectral density	Nominal	Nominal	☒	☐	☐	☐	-/-
§15.407(a)	Spectrum bandwidth 26dB bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-
RSS Gen clause 6.6	Spectrum bandwidth 99% bandwidth	Nominal	Nominal	☐	☐	☐	☐	No passed / fail criteria!
§15.407(a)	Peak excursion measurements	Nominal	Nominal	☒	☐	☐	☐	-/-
§15.205 RSS - 247 (6.2.1) (2) RSS - 247 (6.2.2) (2) RSS - 247 (6.2.3) (2) RSS - 247 (6.2.4) (2)	Band edge compliance radiated	Nominal	Nominal	☒	☐	☐	☐	-/-
§15.407(b) RSS - 247 (6.2.1) (2) RSS - 247 (6.2.2) (2) RSS - 247 (6.2.3) (2) RSS - 247 (6.2.4) (2)	TX spurious emissions radiated	Nominal	Nominal	☒	☐	☐	☐	-/-
§15.109 RSS-Gen	RX spurious emissions radiated	Nominal	Nominal	☐	☐	☐	☐	-/-
§15.209(a) RSS-Gen	Spurious emissions radiated < 30 MHz	Nominal	Nominal	☐	☐	☐	☐	-/-
§15.107(a) §15.207	Spurious emissions conducted emissions < 30 MHz	Nominal	Nominal	☐	☐	☐	☐	-/-

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

11 Additional comments

Reference documents: Cetecom Testreport 1-7682/14-01-04-B

Special test descriptions: None

Configuration descriptions: None

Test mode:

OFDM/a – mode:

Mode	Lowest channel	Middle channel	Highest channel
6-24	16	16	16
36	14	14	14
48	12	11	11
54	11	9	9

OFDM/n HT20 – mode:

Mode	Lowest channel	Middle channel	Highest channel
MCS0	16	16	16
MCS1	14	14	14
MCS2	14	14	14
MCS3	14	14	14
MCS4	14	14	14
MCS5	12	12	11
MCS6	11	11	9
MCS7	9	9	8

OFDM/n HT40 – mode:

Mode	Lowest channel	Middle channel	Highest channel
MCS0	14	14	14
MCS1	13	13	13
MCS2	13	13	13
MCS3	13	13	13
MCS4	13	13	13
MCS5	11	11	11
MCS6	9	9	9
MCS7	8	8	8

☐ No test mode available.

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

12 Measurement results

12.1 Identify worst case datarate

Measurement:

All modes of the module will be measured with an average powermeter to identify the maximum transmission power on low, mid and high channel. In the case that only one or two channels are available, only these will be measured.

In further tests only the identified worst case modulation scheme or bandwidth will be measured.
Additional the band edge compliance test will be performed in the lowest and highest modulation scheme.

Measurement parameters:

Average Power Meter

Results:

Modulation	Modulation scheme / bandwidth		
Frequency	5745 MHz	5785 MHz	5825 MHz
OFDM / a – mode	6Mbit/s	6Mbit/s	6Mbit/s
OFDM / n/ac – mode HT20	MCS0	MCS0	MCS0
Frequency	5755 MHz		5795 MHz
OFDM / n/ac – mode HT40	MCS0		MCS0

12.2 Gain

Description:

Measurement of the maximum output power conduced and radiated

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	5s
Resolution bandwidth:	3 MHz
Video bandwidth:	3 MHz
Span:	See complete signal!
Trace-Mode:	Max hold / view
Test setup:	see chapter 7.2 & 7.4
Measurement uncertainty:	see chapter 9

Limits:

Antenna Gain
Maximum 6 dBi

Results: ANT0

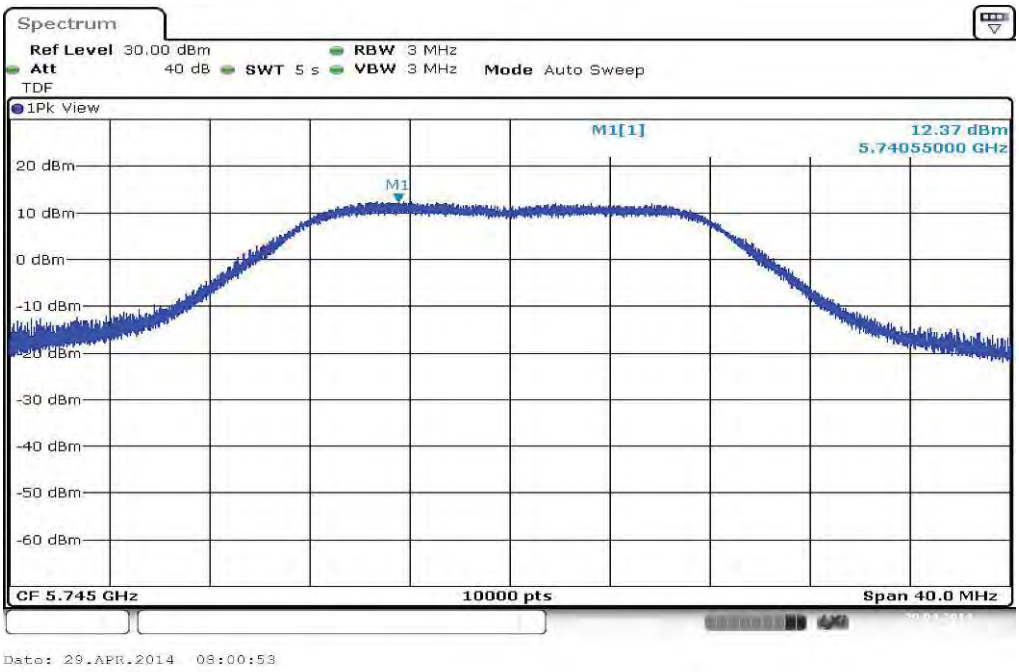
T_{nom}	V_{nom}	lowest channel 5745 MHz	middle channel 5785 MHz	highest channel 5825 MHz
Conducted power [dBm]		12.37	12.97	13.03
Radiated power [dBm]		12.89	14.14	15.87
Gain [dBi] Calculated		+0.52	+1.17	+2.84

Results: ANT1

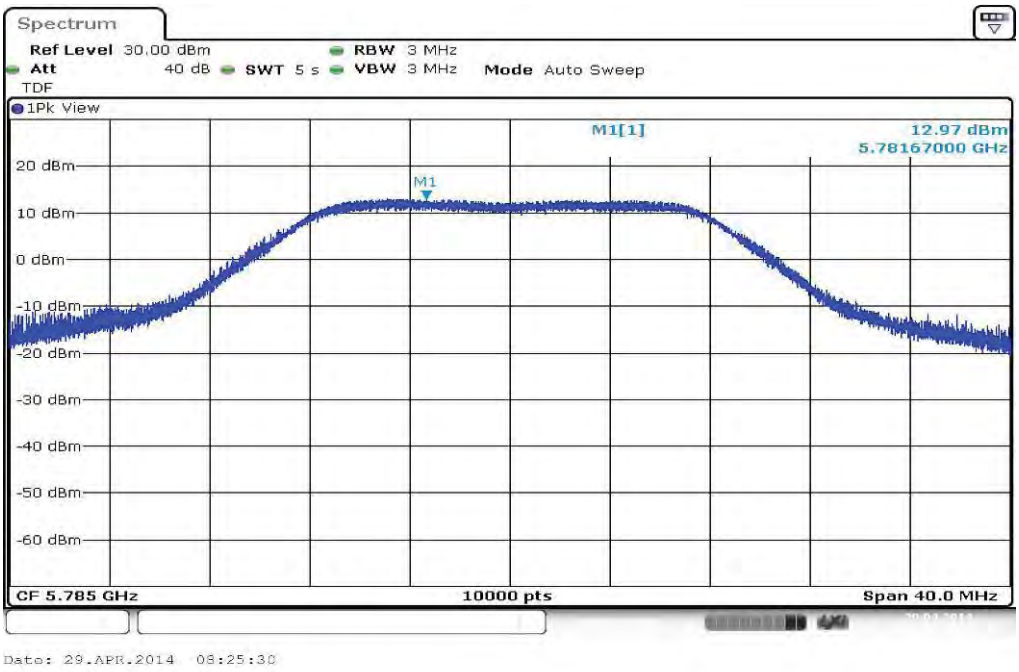
T_{nom}	V_{nom}	lowest channel 5745 MHz	middle channel 5785 MHz	highest channel 5825 MHz
Conducted power [dBm]		13.87	14.62	14.75
Radiated power [dBm]		16.36	16.45	17.49
Gain [dBi] Calculated		+2.49	+1.83	+2.74

Plots: ANT0

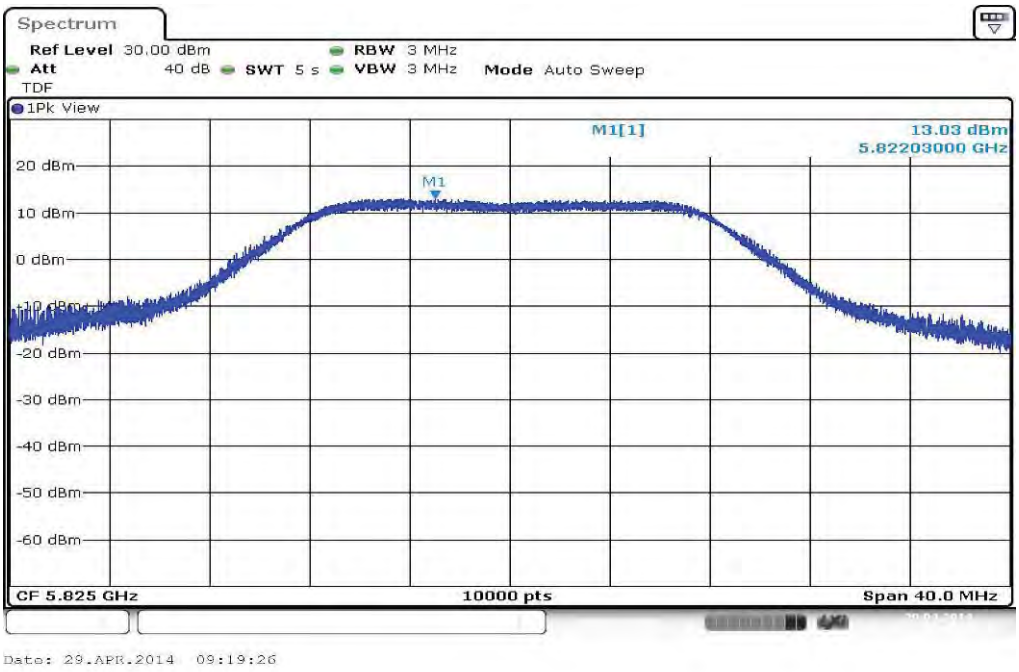
Plot 1: low channel



Plot 2: middle channel

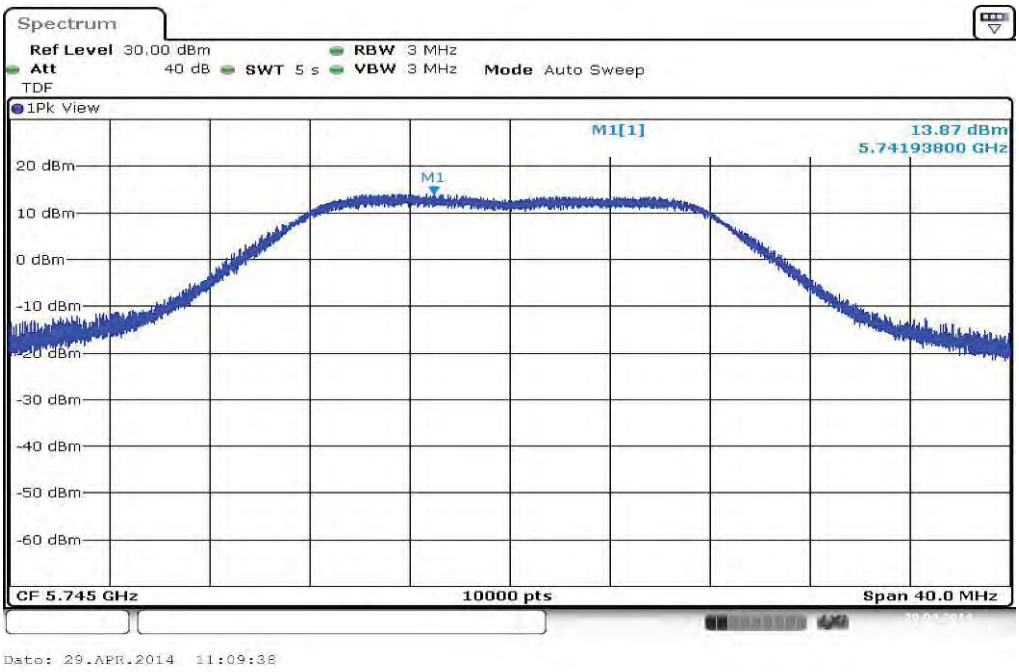


Plot 3: high channel

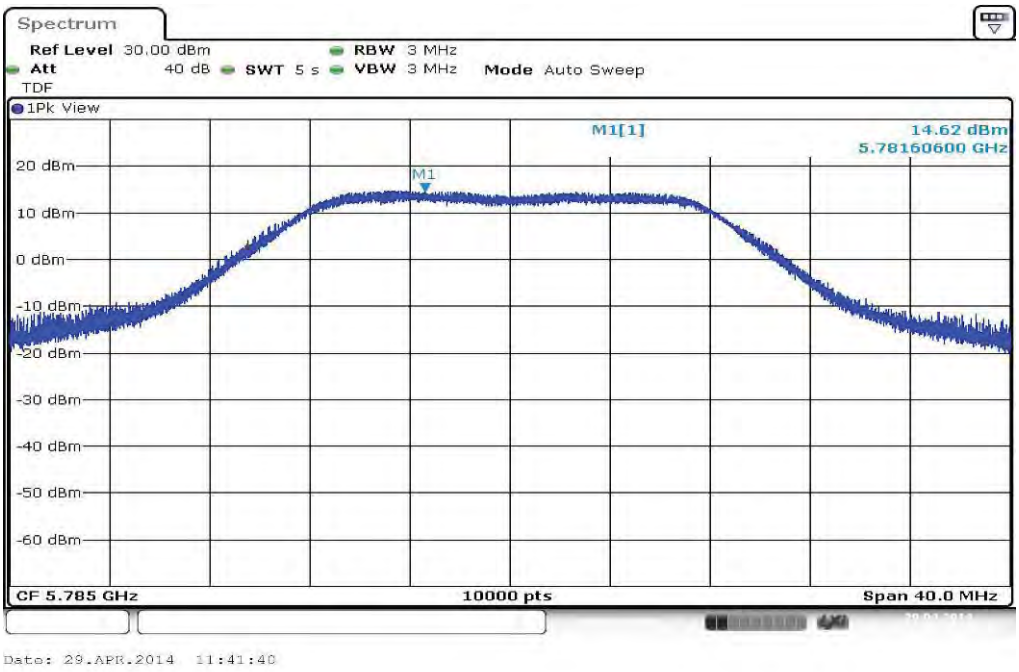


Plots: ANT1

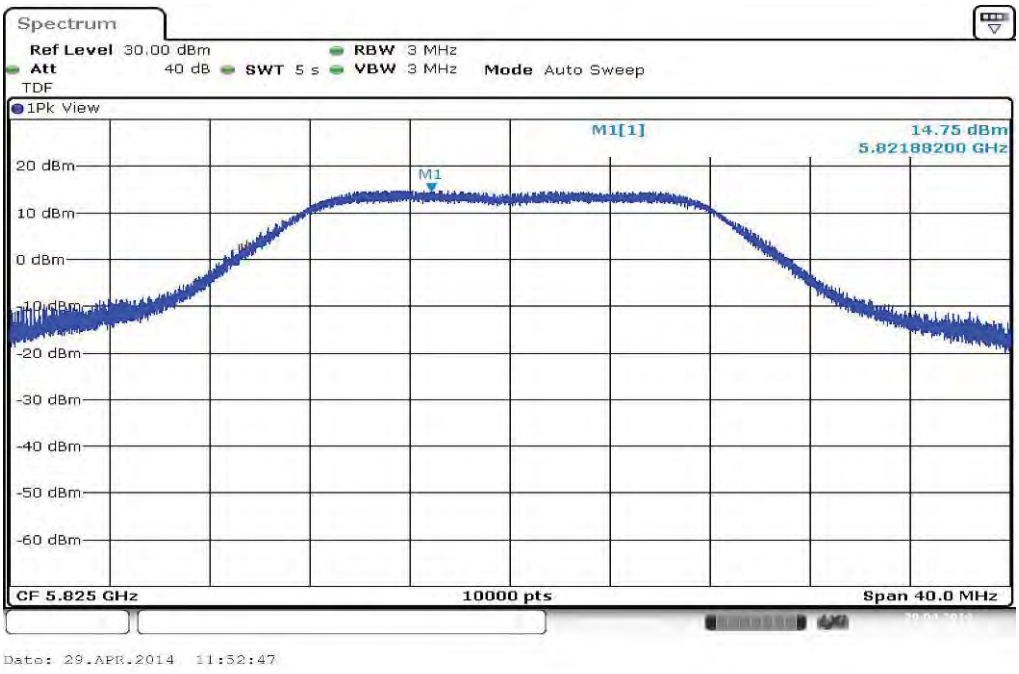
Plot 1: low channel



Plot 2: middle channel



Plot 3: high channel



12.3 Duty cycle

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	10 MHz
Video bandwidth:	10 MHz
Span:	Zero
Trace-Mode:	Video trigger / view / single sweep
Test setup:	see chapter 7.4
Measurement uncertainty:	see chapter 9

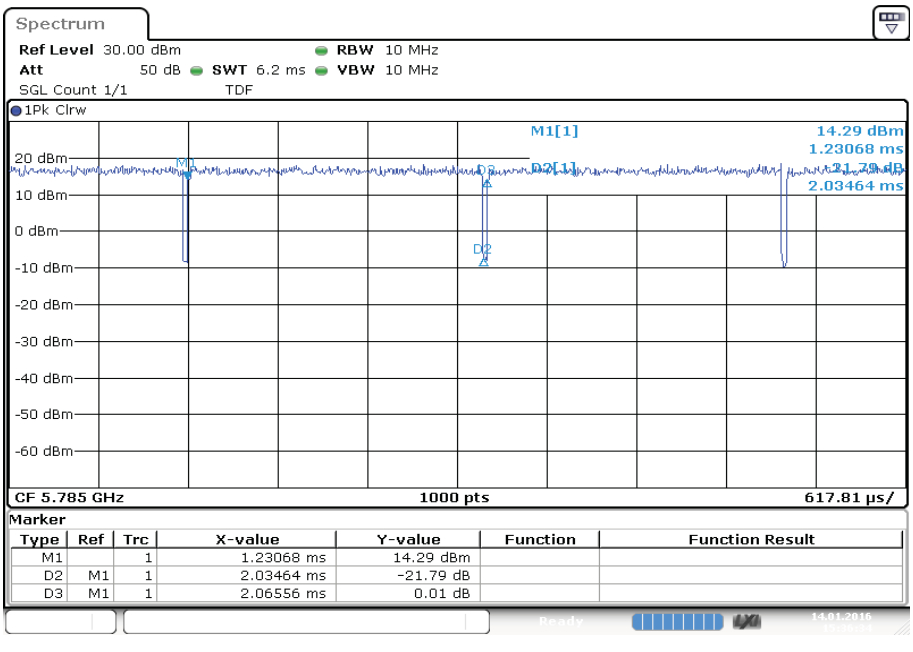
Results:

Duty cycle and correction factor:

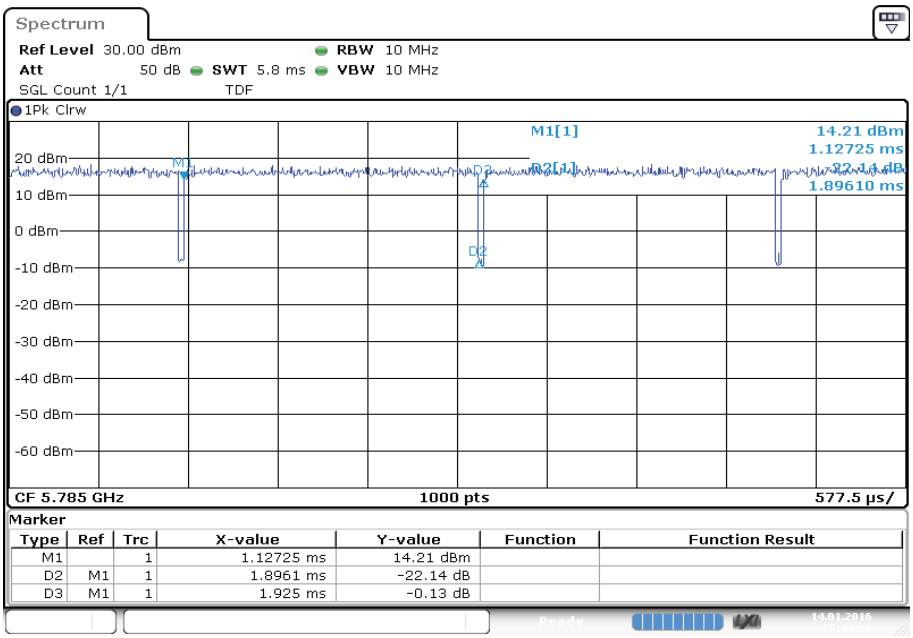
OFDM / a – mode:	98.50 % duty cycle	=>	0.07 dB
OFDM / n – mode HT20:	98.50 % duty cycle	=>	0.07 dB
OFDM / n – mode HT40:	96.70 % duty cycle	=>	0.15 dB

Plots:

Plot 1: duty cycle of the transmitter – OFDM / a – mode

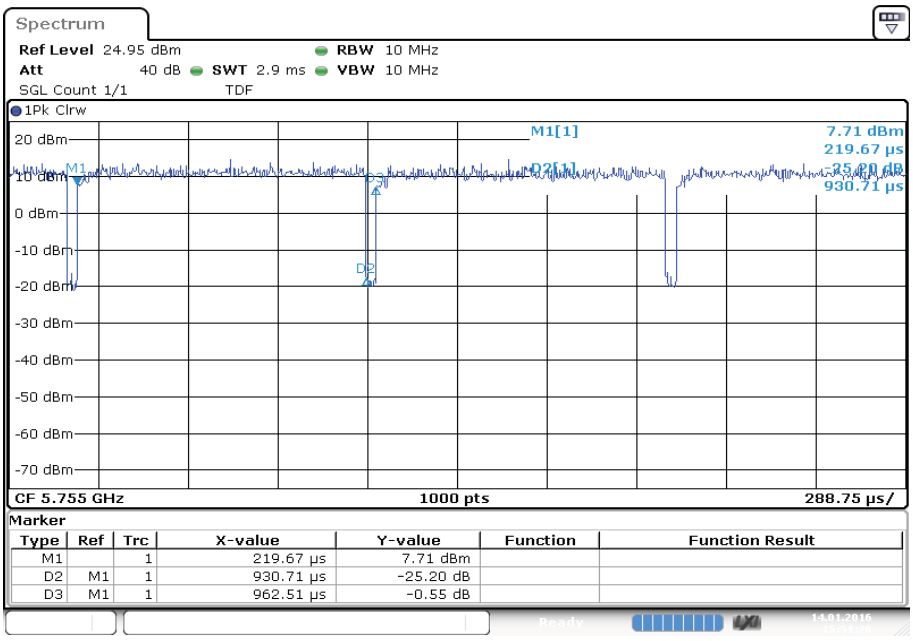


Plot 2: duty cycle of the transmitter – OFDM / n – mode HT20



Date: 14.JAN.2016 15:43:20

Plot 3: duty cycle of the transmitter – OFDM / n – mode HT40



Date: 14.JAN.2016 15:51:27

12.4 Maximum output power conducted

Description:

Measurement of the maximum output power conduced

Measurement:

Measurement parameter	
Detector:	RMS
Sweep time:	≥10*(swp points)*(total on/off time)
Resolution bandwidth:	1 MHz
Video bandwidth:	≥ 3 MHz
Span:	> EBW
Trace-Mode:	Max hold
Analyzer function	Band power / channel power Interval > 26 dB EBW
Test setup:	see chapter 7.4
Measurement uncertainty:	see chapter 9

Limits:

Radiated output power	Conducted output power
Conducted power + 6dBi antenna gain	1W 5.725-5.825 GHz

Result: ANT0

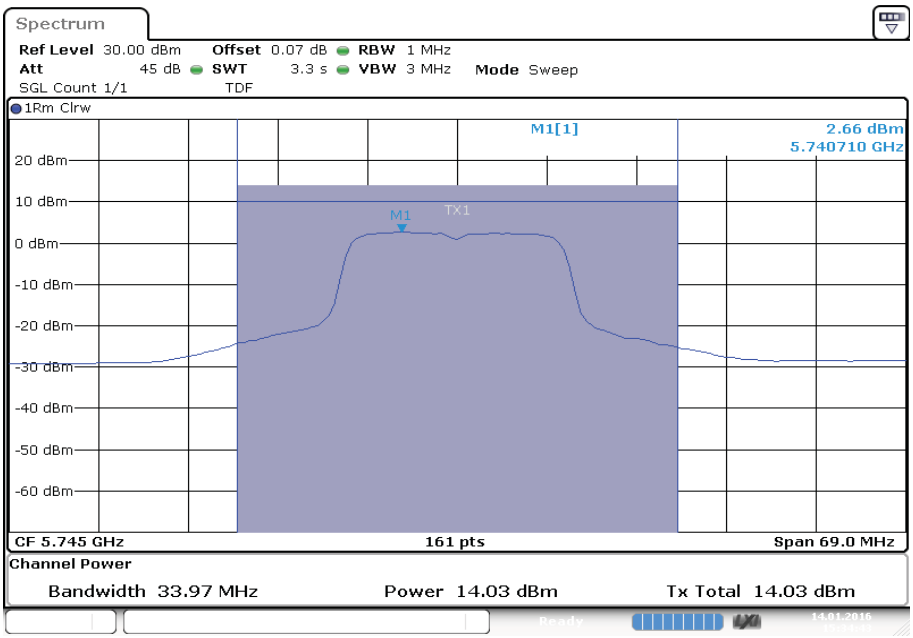
	Maximum output power conducted [dBm]		
Channel	Lowest 5745 MHz	Middle 5785 MHz	Highest 5825 MHz
OFDM / a-mode +0.07 dB duty cycle correction	14.0	12.9	13.0
OFDM / n20-mode +0.07 dB duty cycle correction	12.9	12.8	12.9
Channel	Lowest 5755 MHz		Highest 5795 MHz
OFDM / n40-mode +0.15 dB duty cycle correction	10.3		10.3

Result: ANT1

	Maximum output power conducted [dBm]		
Channel	Lowest 5745 MHz	Middle 5785 MHz	Highest 5825 MHz
OFDM / a-mode +0.07 dB duty cycle correction	13.5	13.5	13.5
OFDM / n20-mode +0.07 dB duty cycle correction	13.3	13.0	13.4
Channel	Lowest 5755 MHz		Highest 5795 MHz
OFDM / n40-mode +0.15 dB duty cycle correction	10.5		10.8

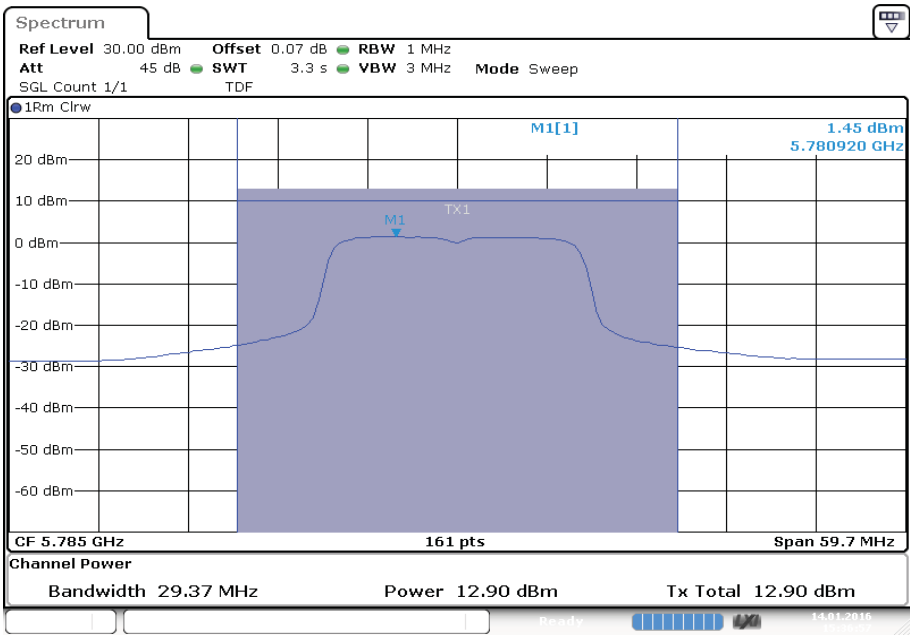
Plots: OFDM / a – mode – ANT0

Plot 1: 5745 MHz



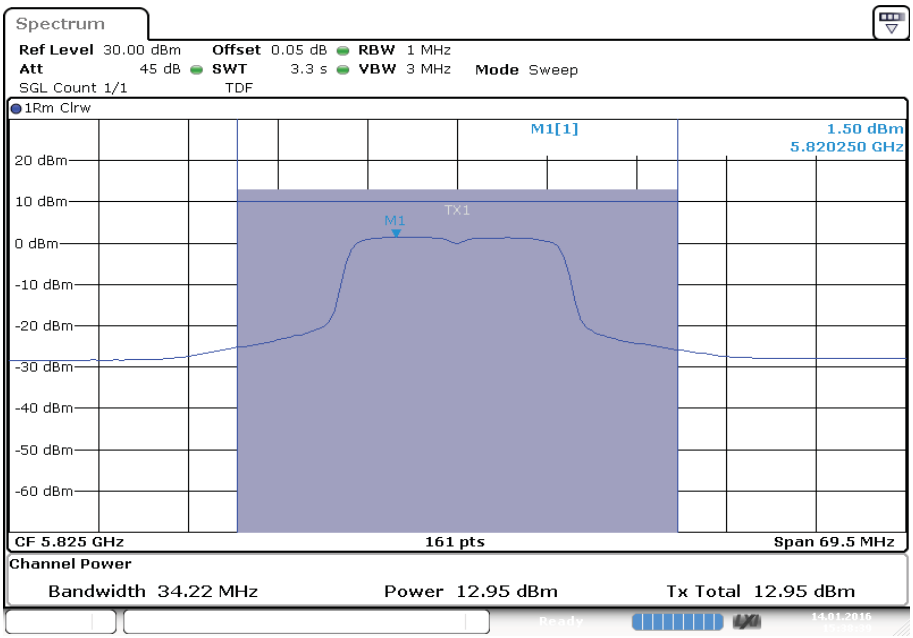
Date: 14.JAN.2016 15:34:43

Plot 2: 5785 MHz



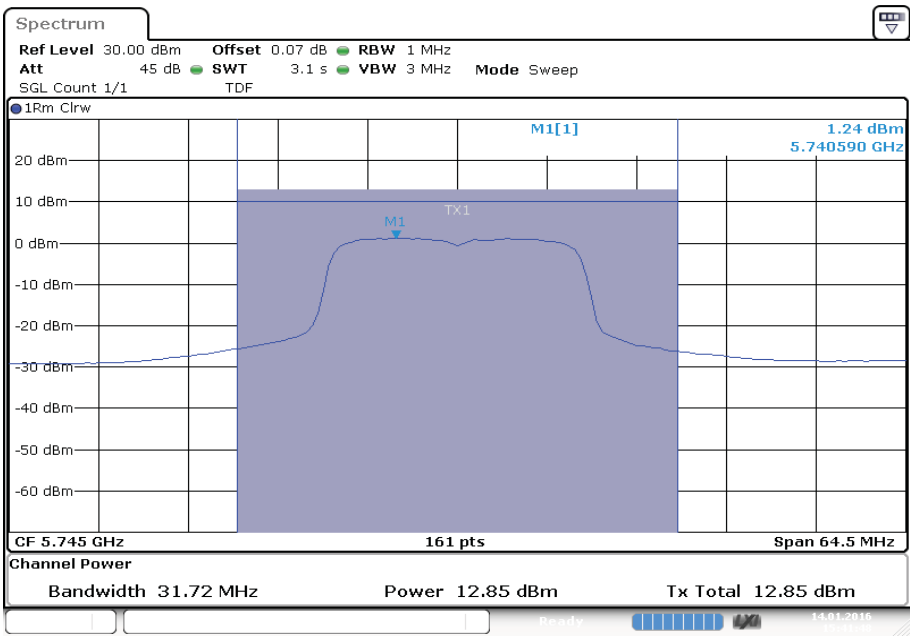
Date: 14.JAN.2016 15:36:58

Plot 3: 5825 MHz



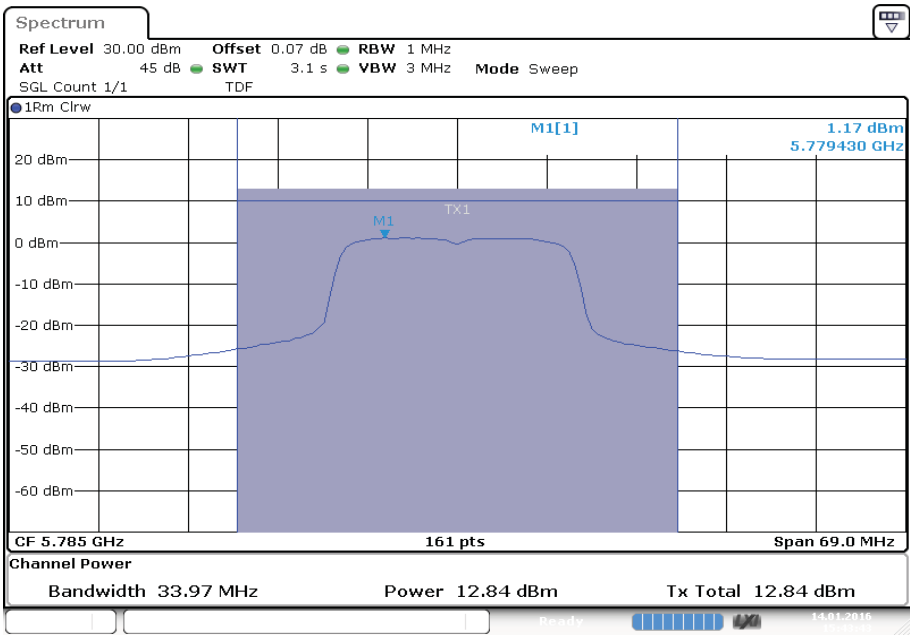
Plots: OFDM / n – mode HT20 – ANT0

Plot 1: 5745 MHz



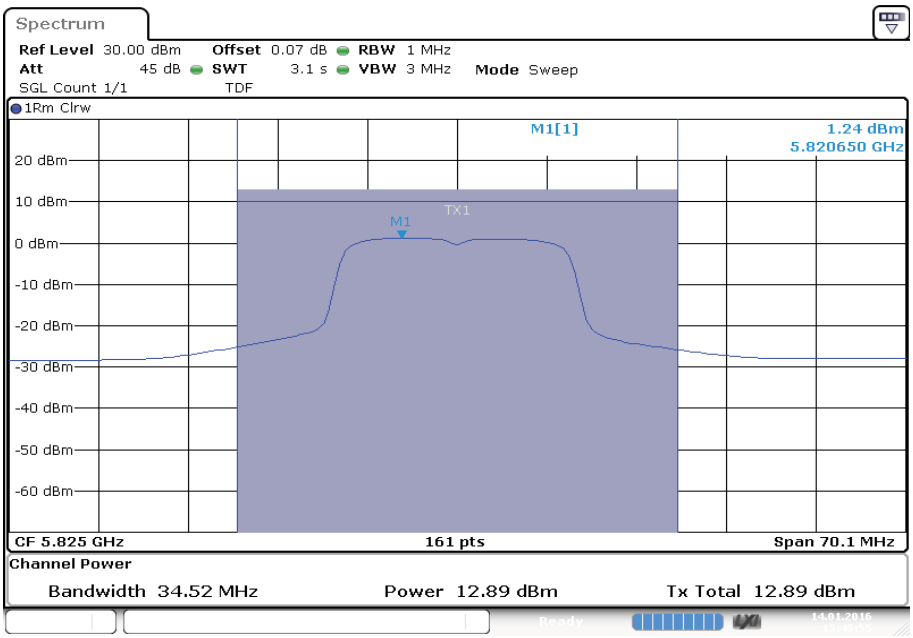
Date: 14.JAN.2016 15:41:47

Plot 2: 5785 MHz



Date: 14.JAN.2016 15:43:43

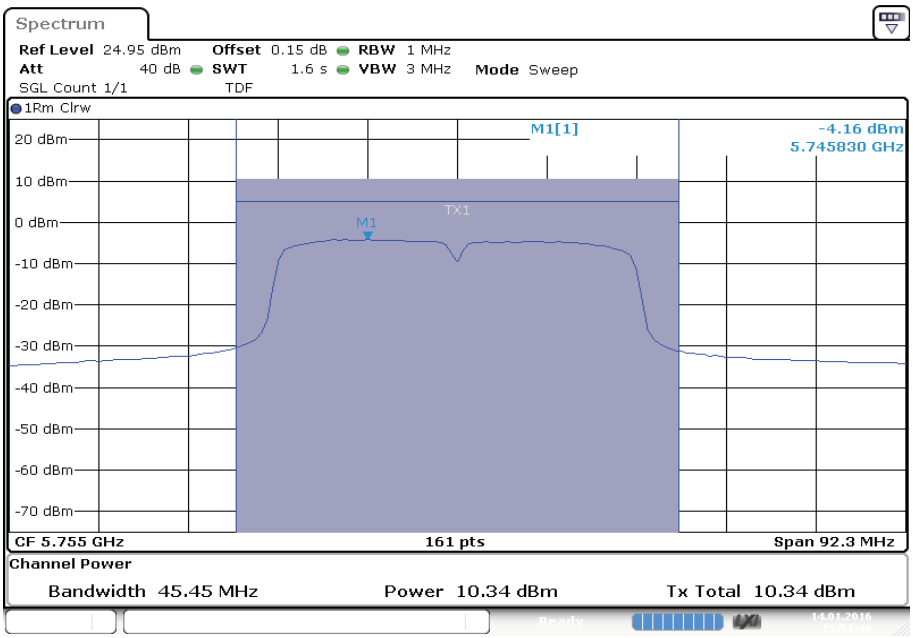
Plot 3: 5825 MHz



Date: 14.JAN.2016 15:45:55

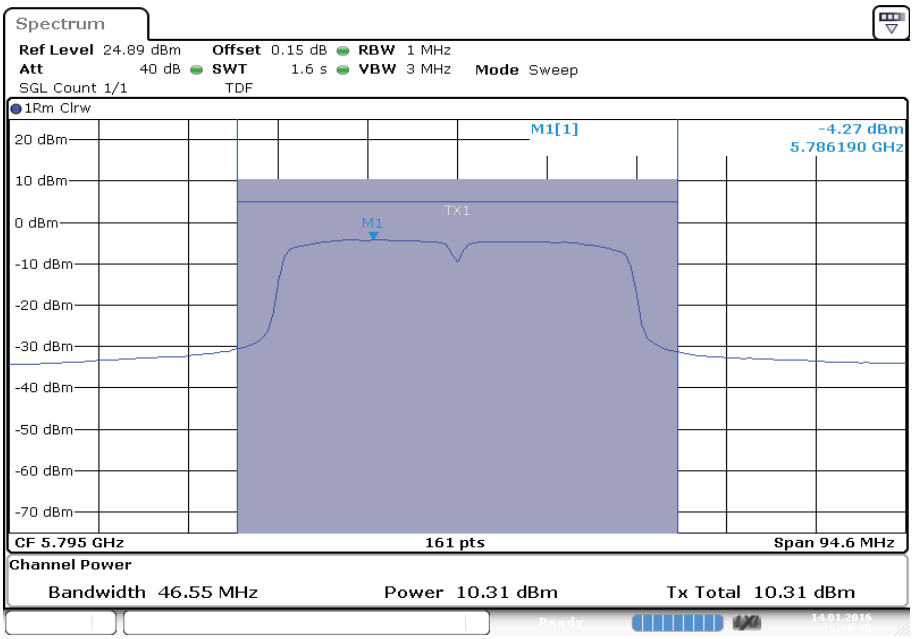
Plots: OFDM / n – mode HT40 – ANT0

Plot 1: 5755 MHz



Date: 14.JAN.2016 15:51:46

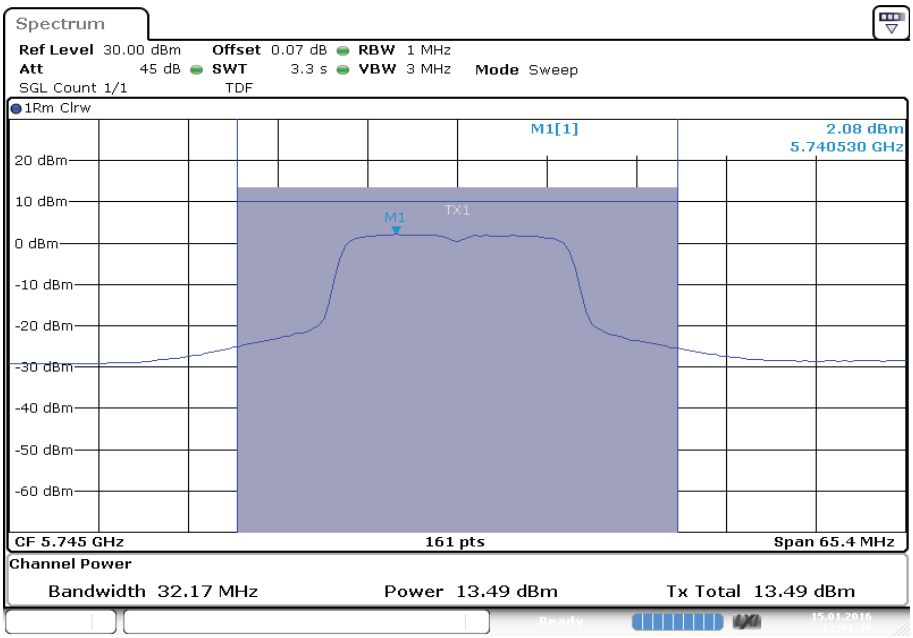
Plot 2: 5795 MHz



Date: 14.JAN.2016 15:49:35

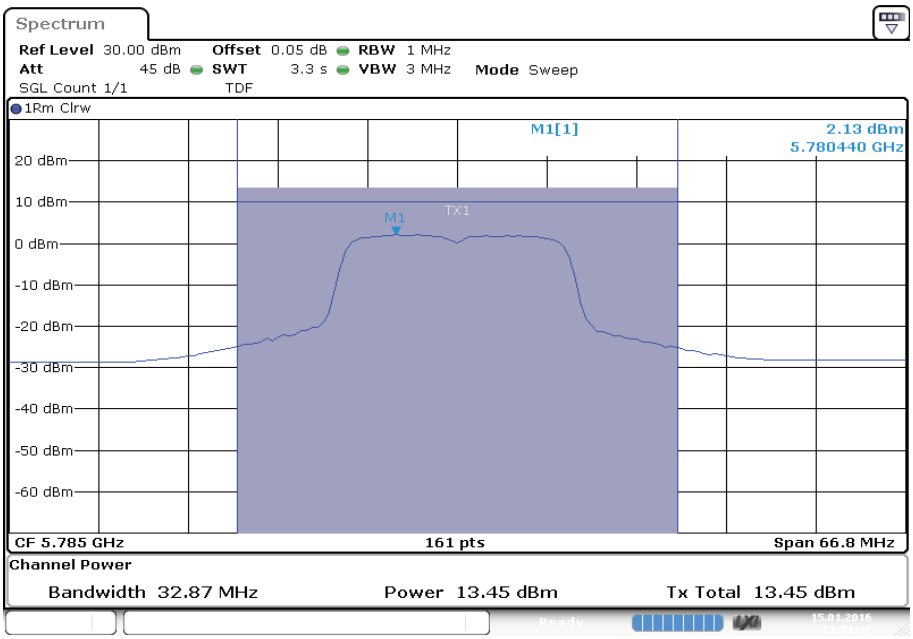
Plots: OFDM / a – mode – ANT1

Plot 1: 5745 MHz



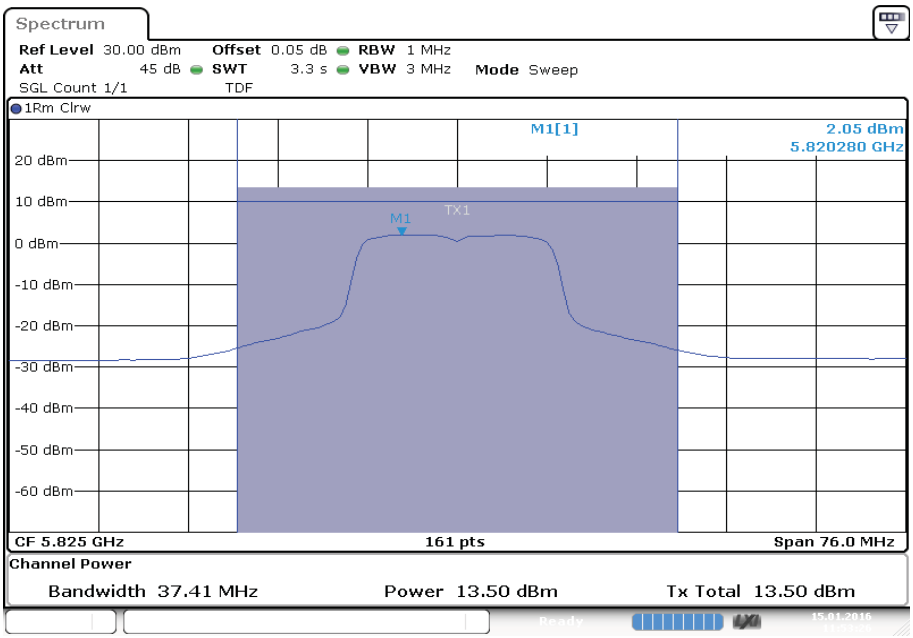
Date: 15.JAN.2016 12:01:39

Plot 2: 5785 MHz



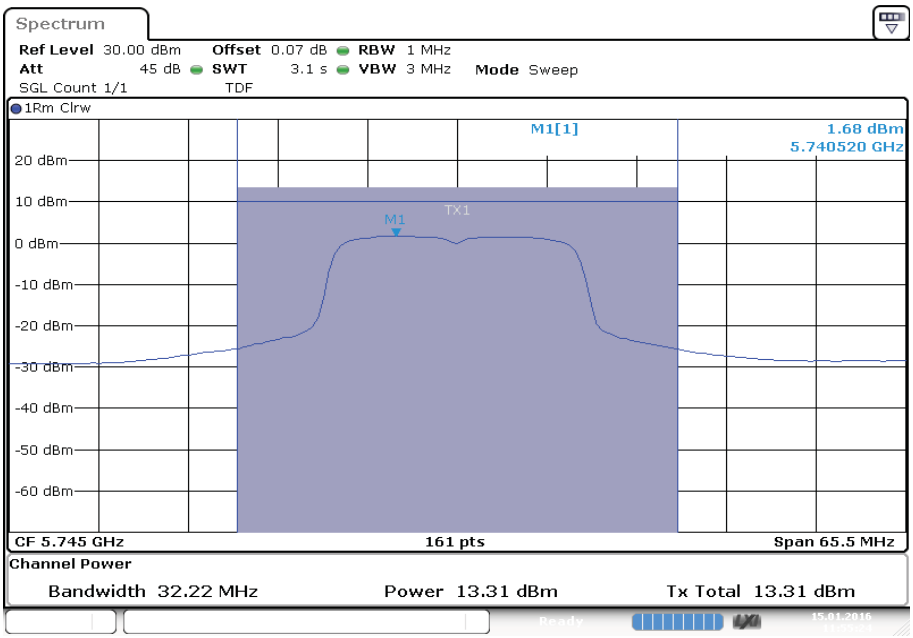
Date: 15.JAN.2016 11:51:42

Plot 3: 5825 MHz



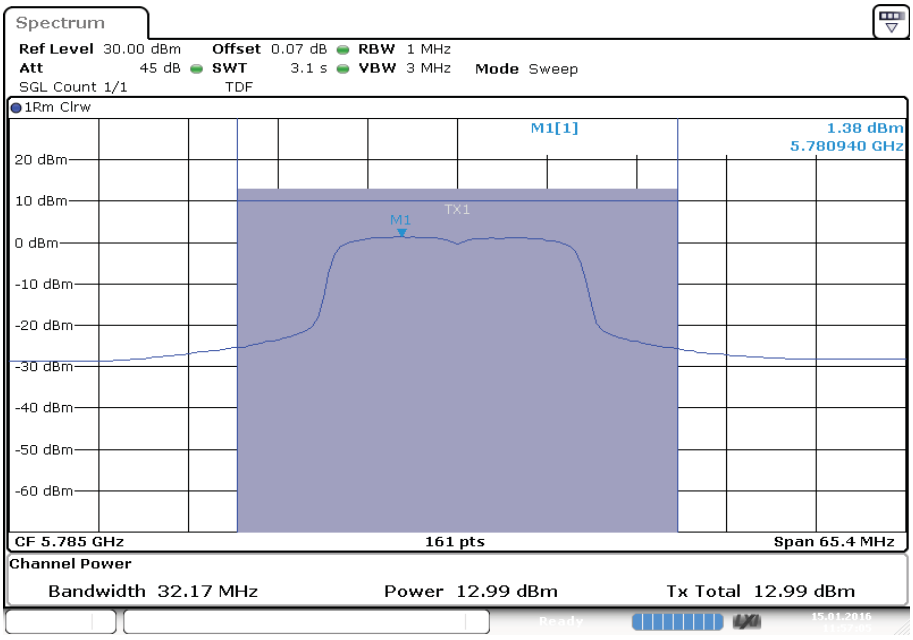
Plots: OFDM / n – mode HT20 – ANT1

Plot 1: 5745 MHz



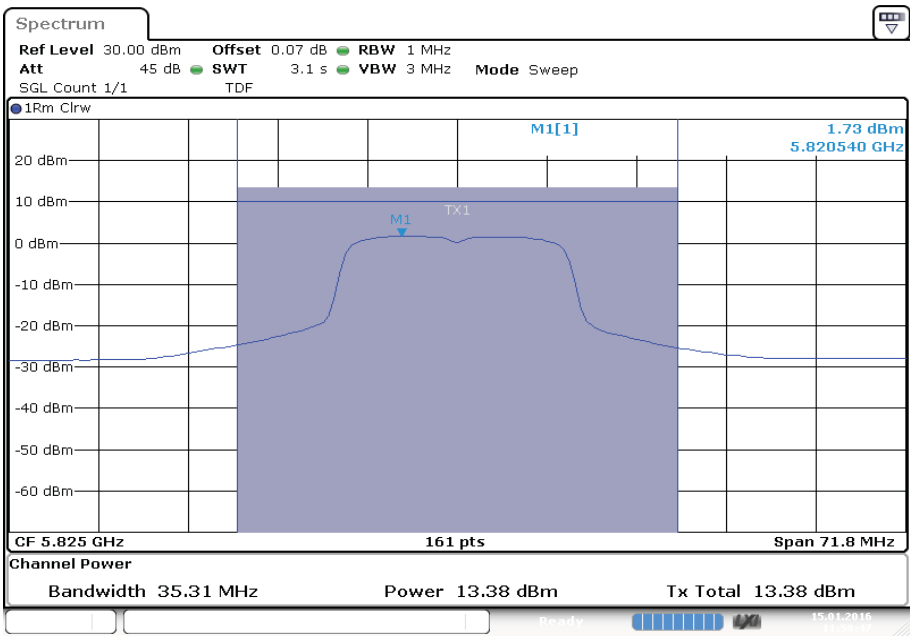
Date: 15.JAN.2016 11:55:25

Plot 2: 5785 MHz



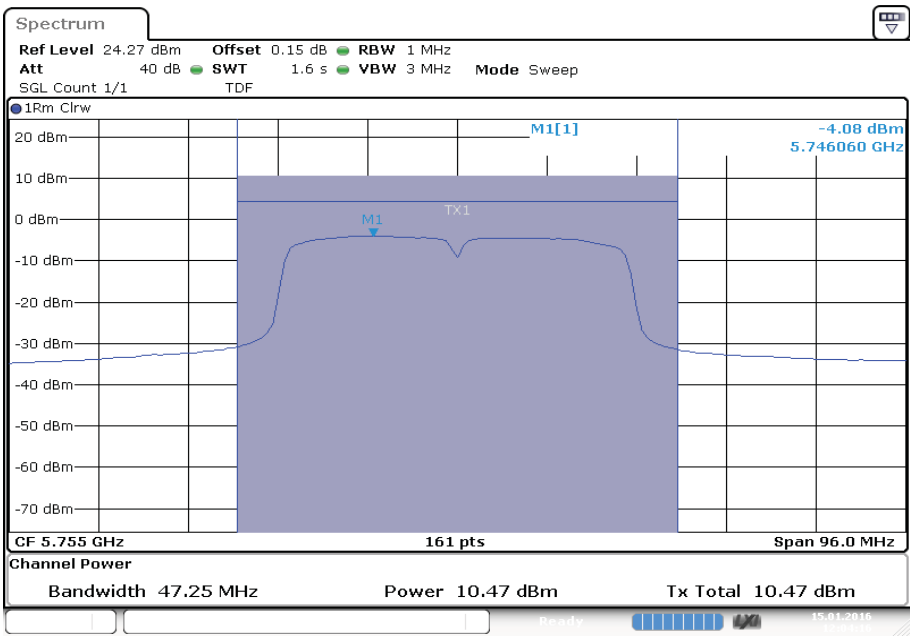
Date: 15.JAN.2016 11:57:05

Plot 3: 5825 MHz



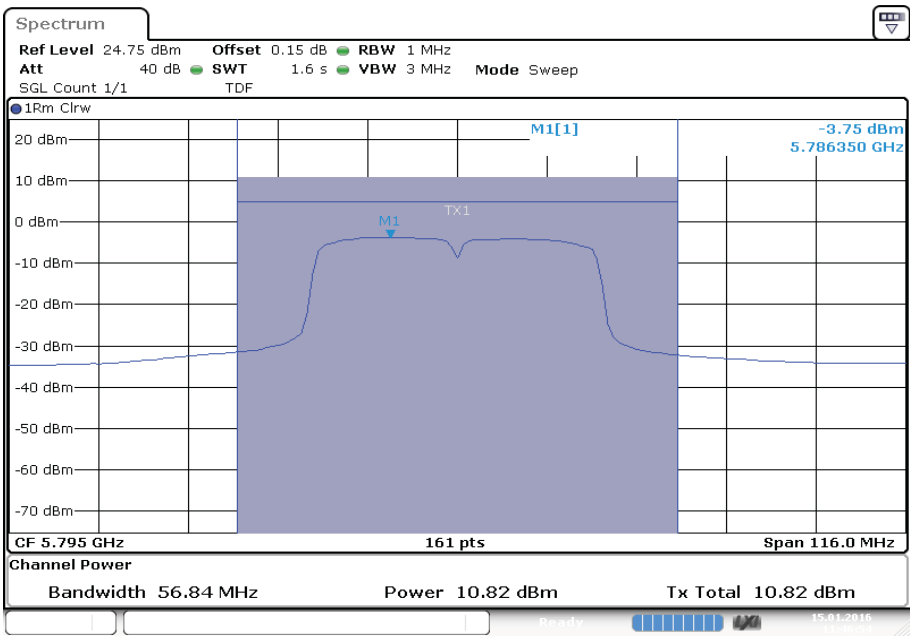
Plots: OFDM / n – mode HT40 – ANT1

Plot 1: 5755 MHz



Date: 15.JAN.2016 12:04:16

Plot 2: 5795 MHz



Date: 15.JAN.2016 11:46:54

12.5 Power spectral density

Description:

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

Measurement:

Measurement parameter	
Detector:	RMS
Sweep time:	≥10*(swp points)*(total on/off time)
Resolution bandwidth:	1 MHz (500 kHz for 5.8 GHz band)
Video bandwidth:	≥ 3 x RBW
Span:	> EBW
Trace-Mode:	Max hold
Test setup:	see chapter 7.4
Measurement uncertainty:	see chapter 9

Limits:

Power Spectral Density
FCC
power spectral density conducted ≤ 30 dBm in any 1 MHz band (band 5725 – 5850 MHz)
IC
power spectral density conducted ≤ 30 dBm in any 1 MHz band (band 5725 – 5850 MHz)

Result: ANT0

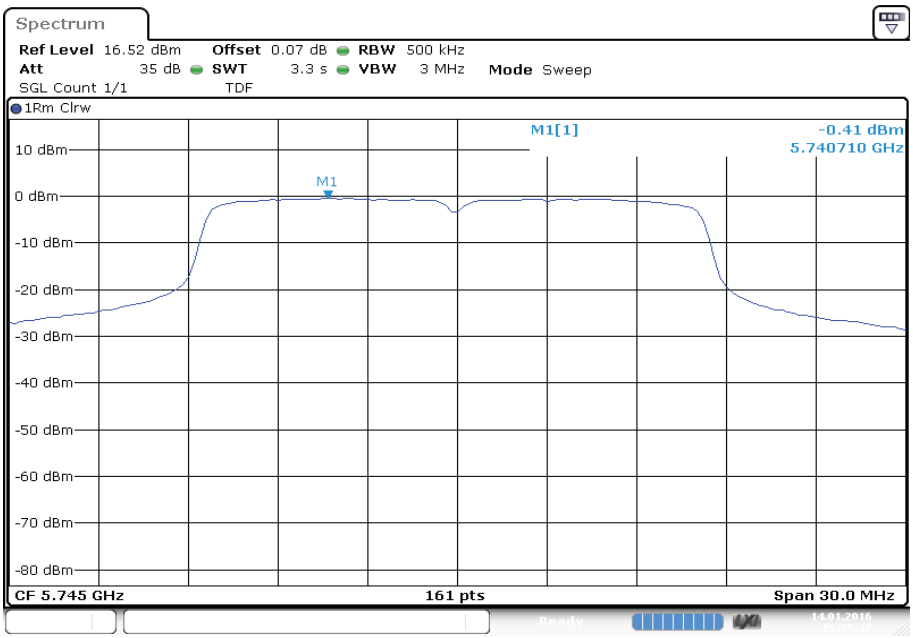
	Power Spectral density [dBm/MHz]		
Channel	Lowest 5745 MHz	Middle 5785 MHz	Highest 5825 MHz
OFDM / a-mode +0.07 dB duty cycle correction	-0.41	-1.50	-1.55
OFDM / n20-mode +0.07 dB duty cycle correction	-1.75	-1.82	-1.84
Channel	Lowest 5755 MHz		Highest 5795 MHz
OFDM / n40-mode +0.15 dB duty cycle correction	-7.01		-7.26

Result: ANT1

	Power Spectral density [dBm/MHz]		
Channel	Lowest 5745 MHz	Middle 5785 MHz	Highest 5825 MHz
OFDM / a-mode +0.07 dB duty cycle correction	-1.01	-0.81	-1.04
OFDM / n20-mode +0.07 dB duty cycle correction	-1.46	-1.67	-1.33
Channel	Lowest 5755 MHz		Highest 5795 MHz
OFDM / n40-mode +0.15 dB duty cycle correction	-6.96		-6.59

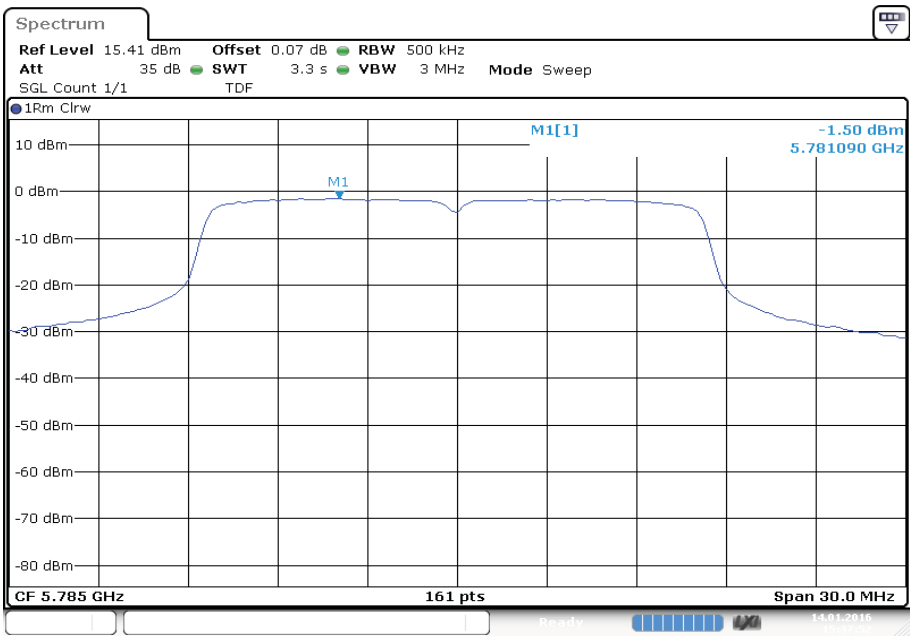
Plots: OFDM / a – mode – ANT0

Plot 1: 5745 MHz



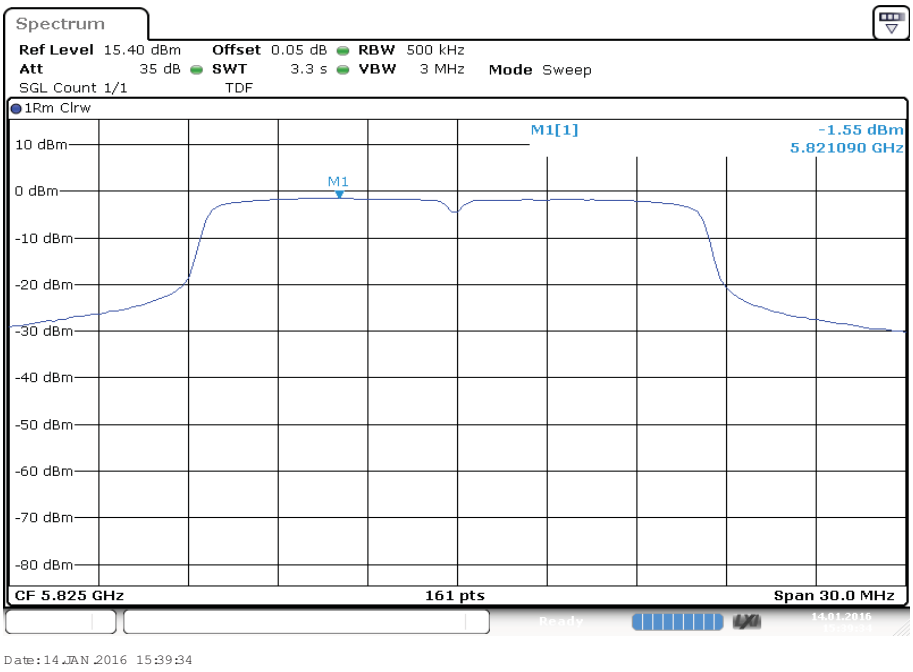
Date: 14.JAN.2016 15:35:38

Plot 2: 5785 MHz



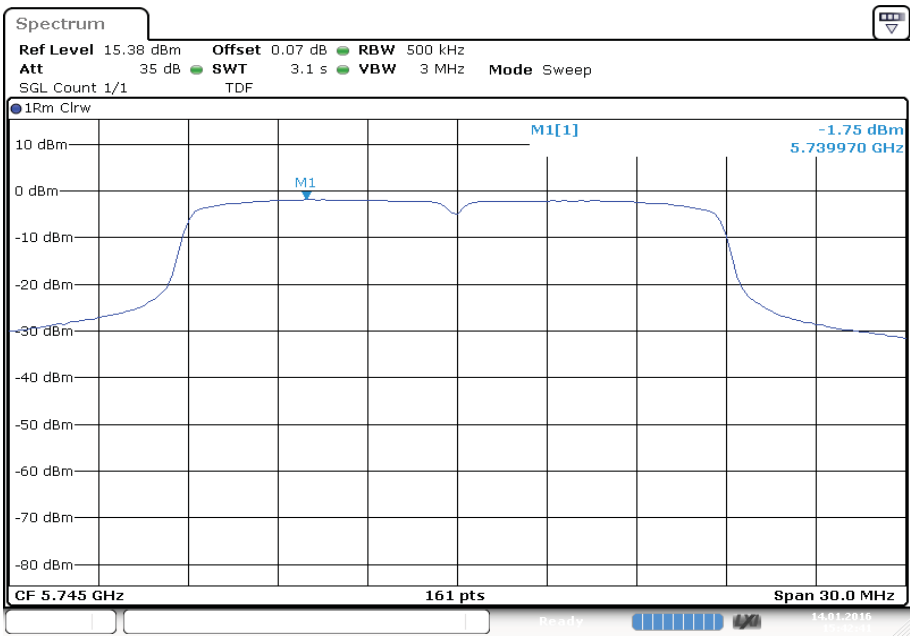
Date: 14.JAN.2016 15:37:53

Plot 3: 5825 MHz



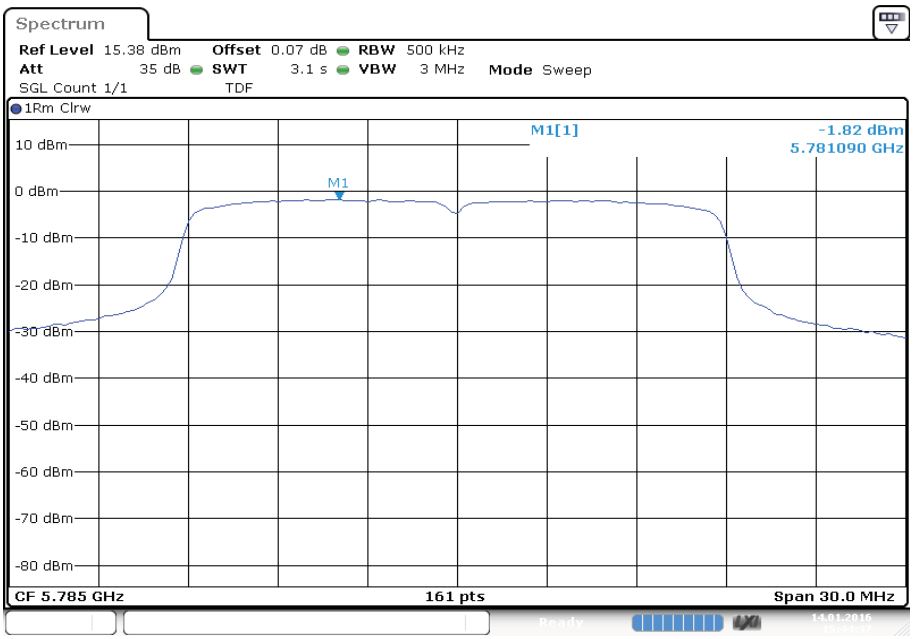
Plots: OFDM / n – mode HT20 – ANT0

Plot 1: 5745 MHz



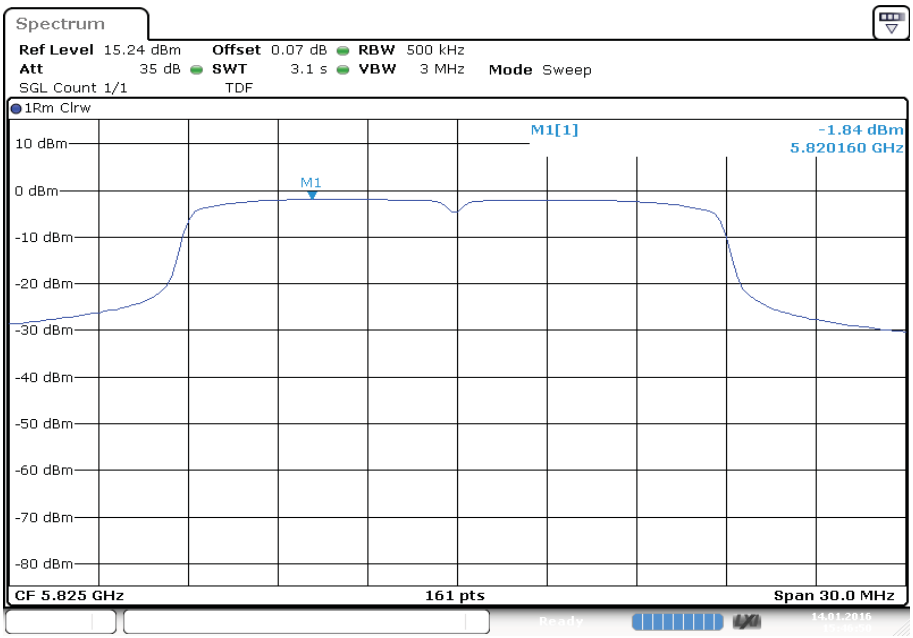
Date: 14.JAN.2016 15:42:42

Plot 2: 5785 MHz



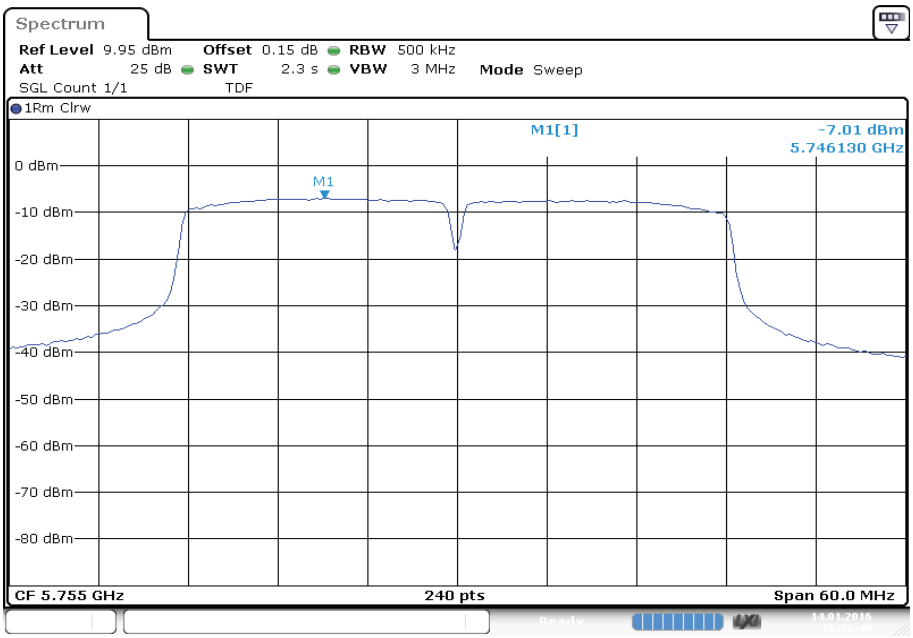
Date: 14.JAN.2016 15:44:37

Plot 3: 5825 MHz



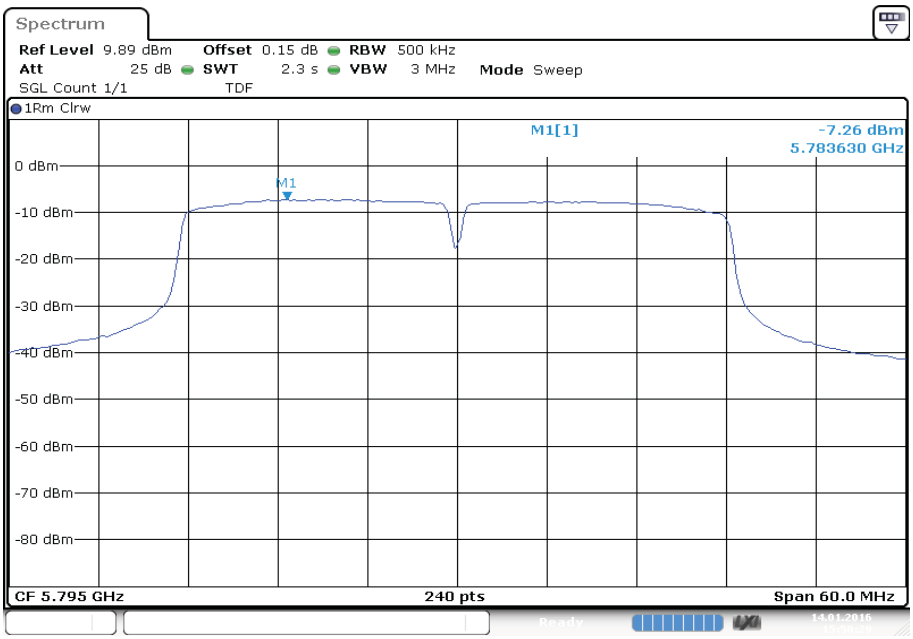
Plots: OFDM / n – mode HT40 – ANT0

Plot 1: 5755 MHz



Date: 14.JAN.2016 15:52:40

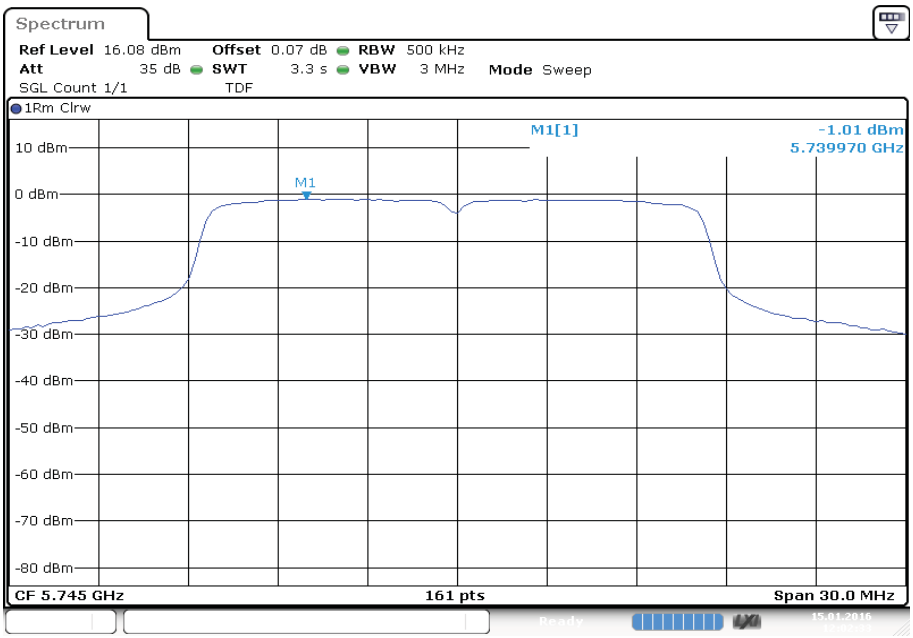
Plot 2: 5795 MHz



Date: 14.JAN.2016 15:50:29

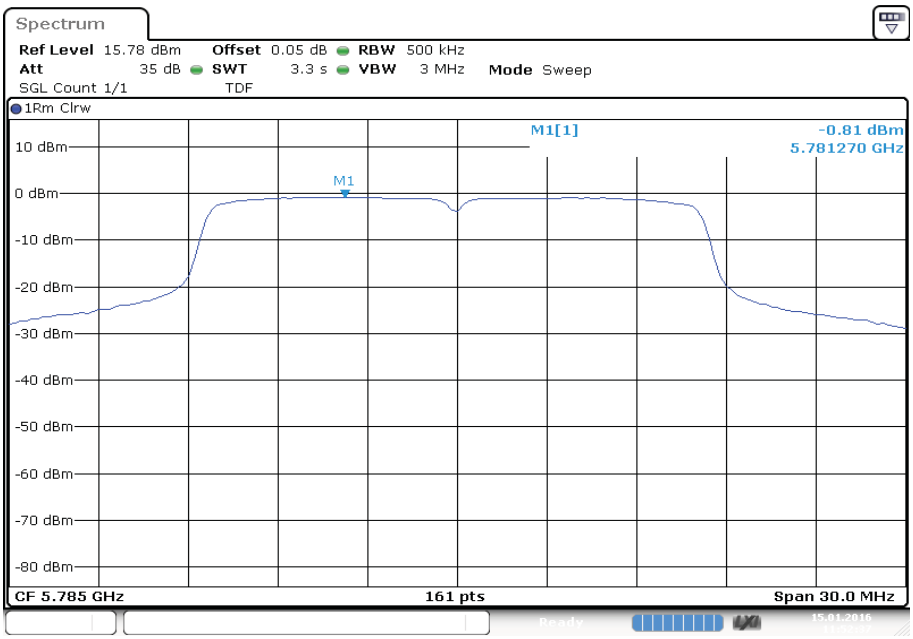
Plots: OFDM / a – mode – ANT1

Plot 1: 5745 MHz



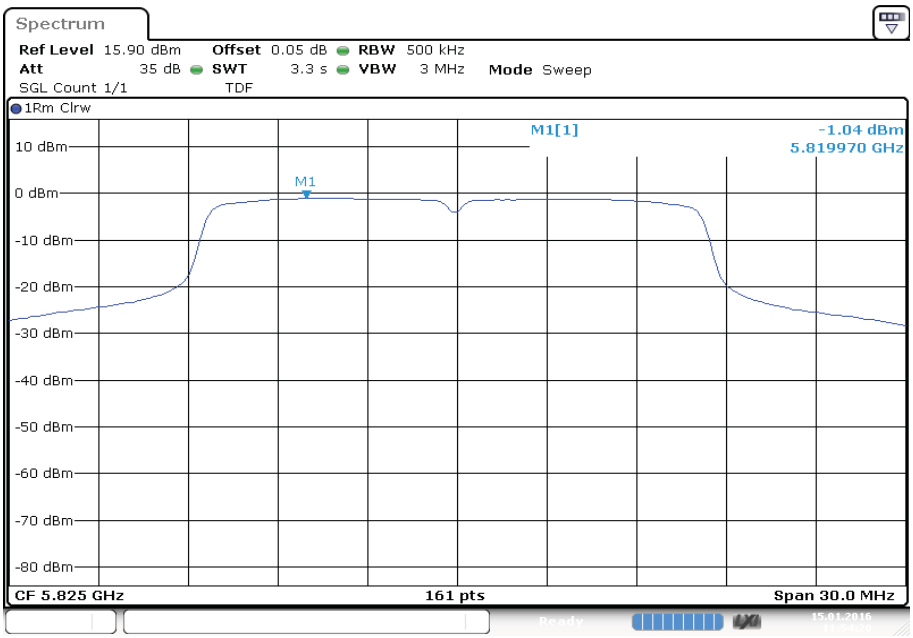
Date: 15.JAN.2016 12:02:34

Plot 2: 5785 MHz



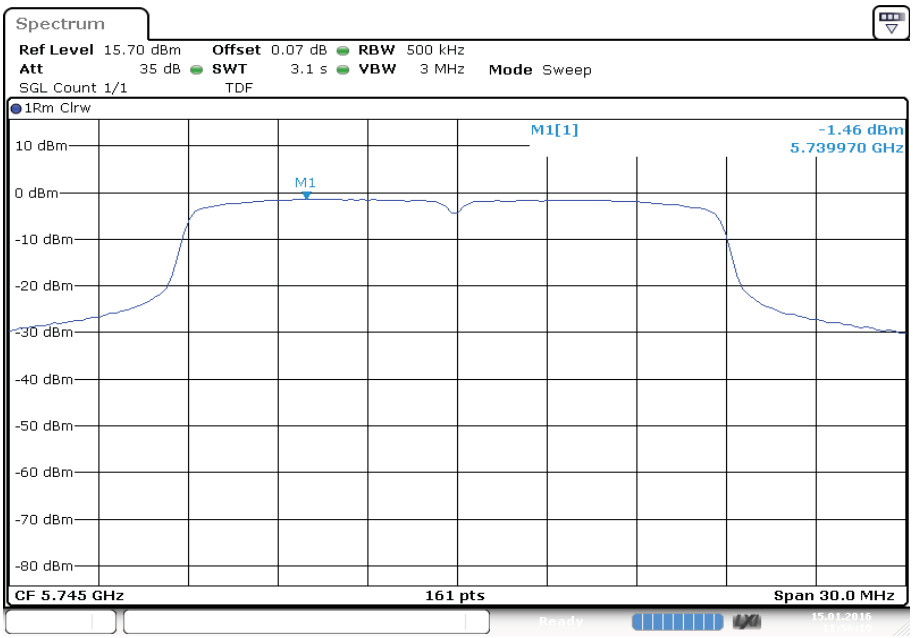
Date: 15.JAN.2016 11:52:37

Plot 3: 5825 MHz



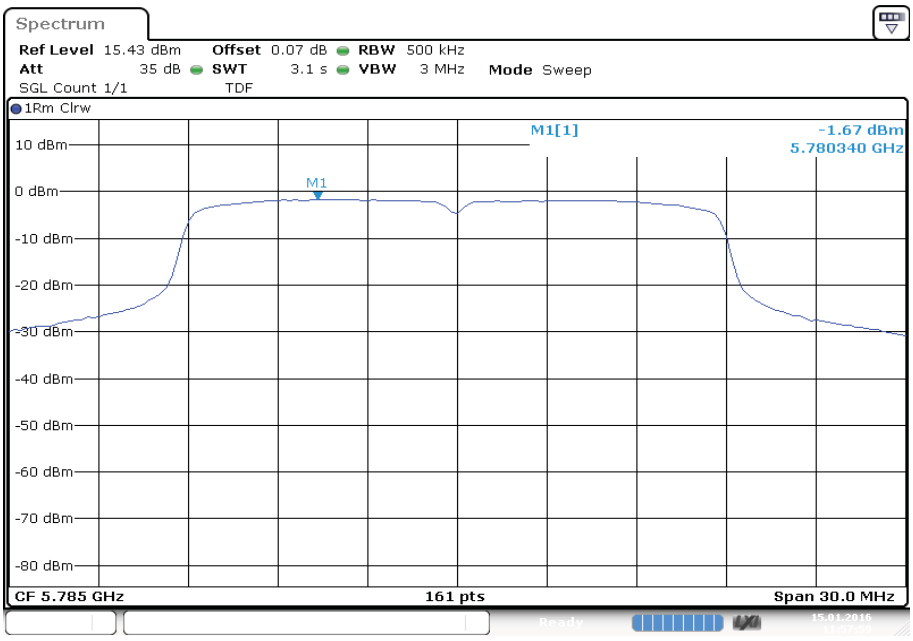
Plots: OFDM / n – mode HT20 – ANT1

Plot 1: 5745 MHz



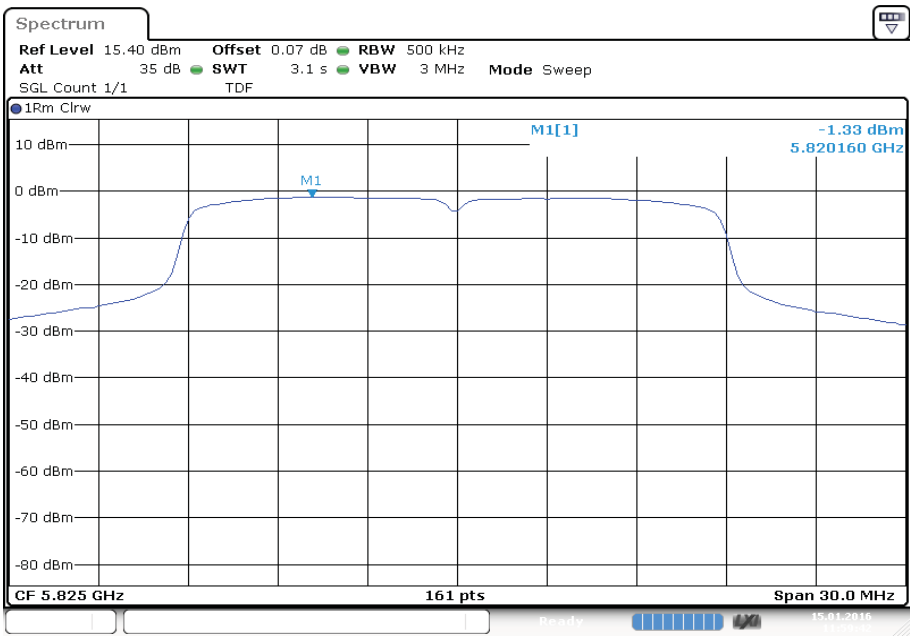
Date: 15.JAN.2016 11:56:19

Plot 2: 5785 MHz



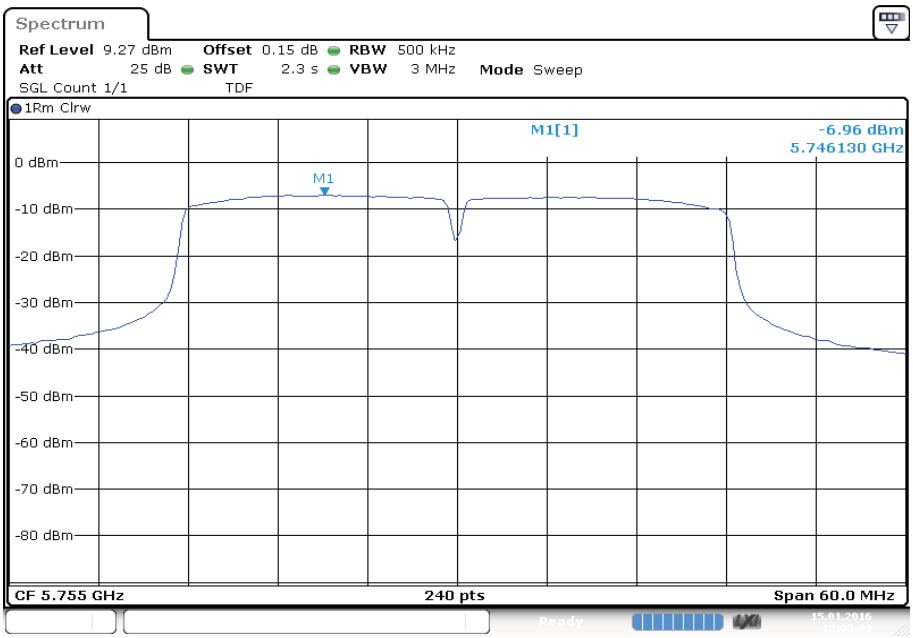
Date: 15.JAN.2016 11:58:00

Plot 3: 5825 MHz



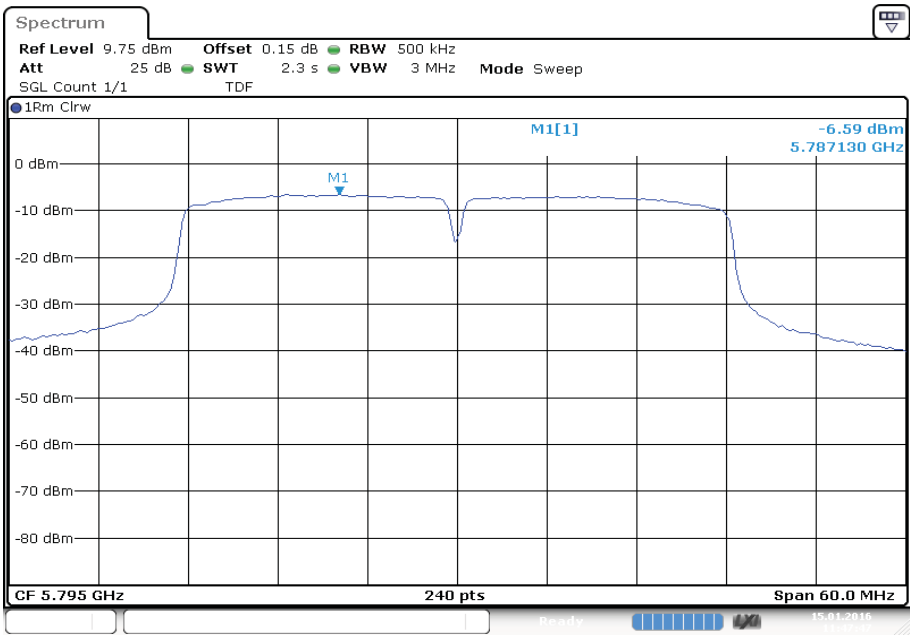
Plots: OFDM / n – mode HT40 – ANT1

Plot 1: 5755 MHz



Date: 15.JAN.2016 12:05:09

Plot 2: 5795 MHz



Date: 15.JAN.2016 11:47:48

12.6 Spectrum bandwidth – 6 dB

Description:

Measurement of the 6 dB bandwidth of the modulated signal.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Span:	2 x nominal bandwidth
Measurement procedure:	Using marker to find the outermost amplitude points that are attenuated by 6dBc
Trace-Mode:	Max hold (allow trace to stabilize)
Test setup:	see chapter 7.4
Measurement uncertainty:	see chapter 9

Limits:

FCC
Spectrum Bandwidth – 6 dB
Systems using digital modulation techniques may operate in the 5715–5850 MHz band. The minimum 6 dB bandwidth shall be at least 500 kHz.

Result: ANT0

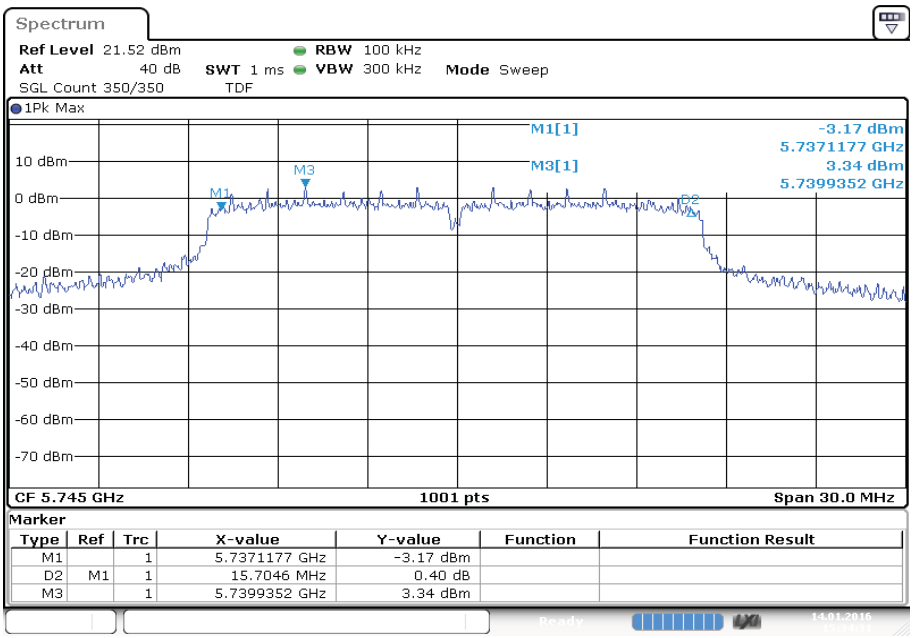
	26 dB bandwidth [kHz]		
Channel	Lowest 5745 MHz	Middle 5785 MHz	Highest 5825 MHz
OFDM / a-mode	15705	16064	15944
OFDM / n20-mode	16963	16094	16064
Channel	Lowest 5755 MHz		Highest 5795 MHz
OFDM / n40-mode	35245		35245

Result: ANT1

	26 dB bandwidth [kHz]		
Channel	Lowest 5745 MHz	Middle 5785 MHz	Highest 5825 MHz
OFDM / a-mode	16094	16334	16334
OFDM / n20-mode	16334	16334	16334
Channel	Lowest 5755 MHz		Highest 5795 MHz
OFDM / n40-mode	35245		35185

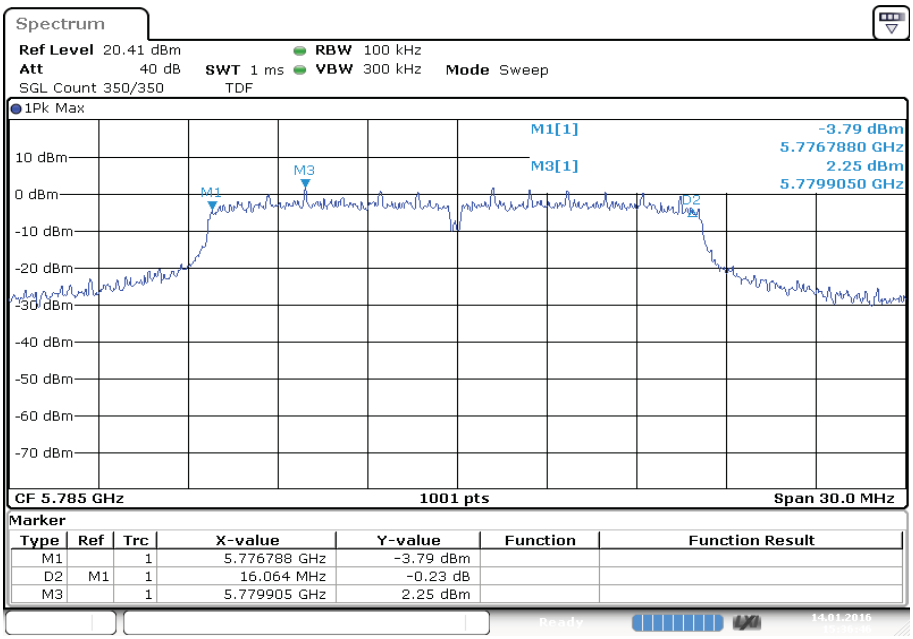
Plots: OFDM / a – mode – ANT0

Plot 1: 5745 MHz



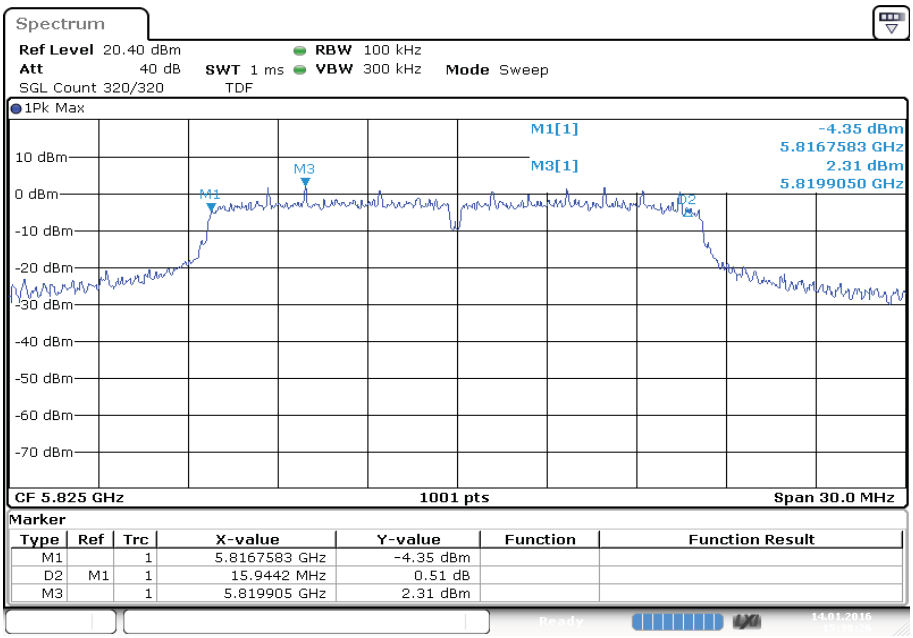
Date: 14.JAN.2016 15:34:31

Plot 2: 5785 MHz



Date: 14.JAN.2016 15:36:46

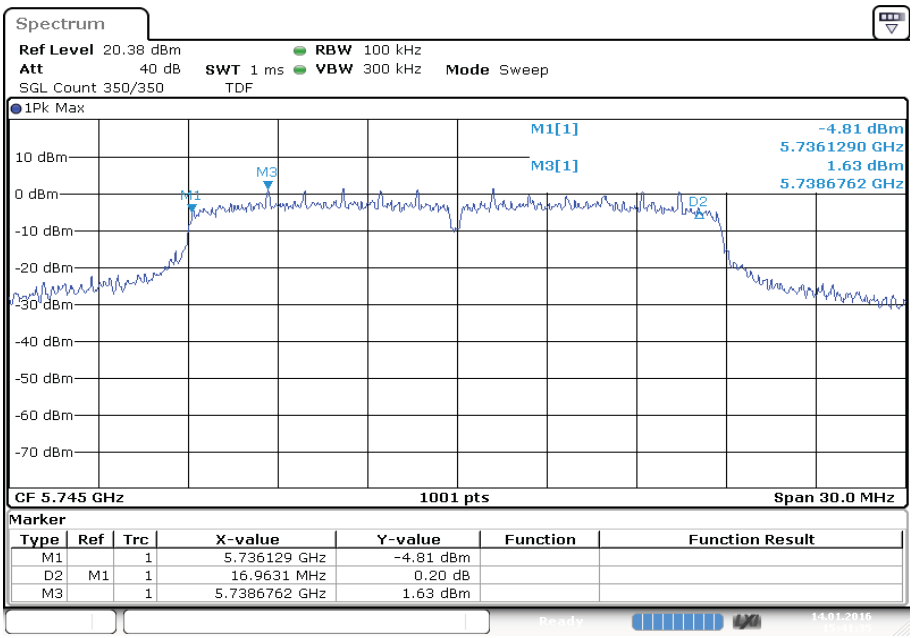
Plot 3: 5825 MHz



Date: 14.JAN.2016 15:38:27

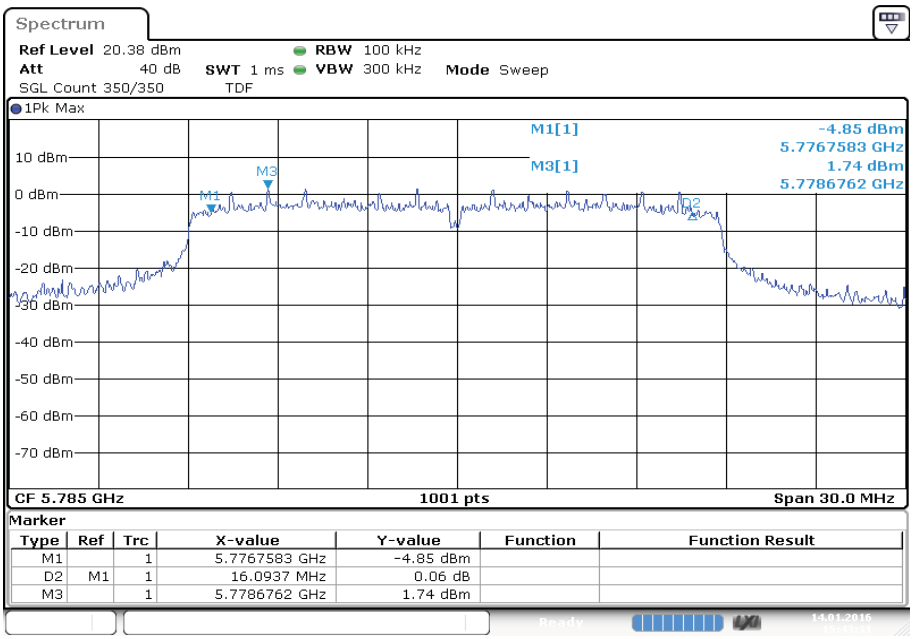
Plots: OFDM / n – mode HT20 – ANT0

Plot 1: 5745 MHz



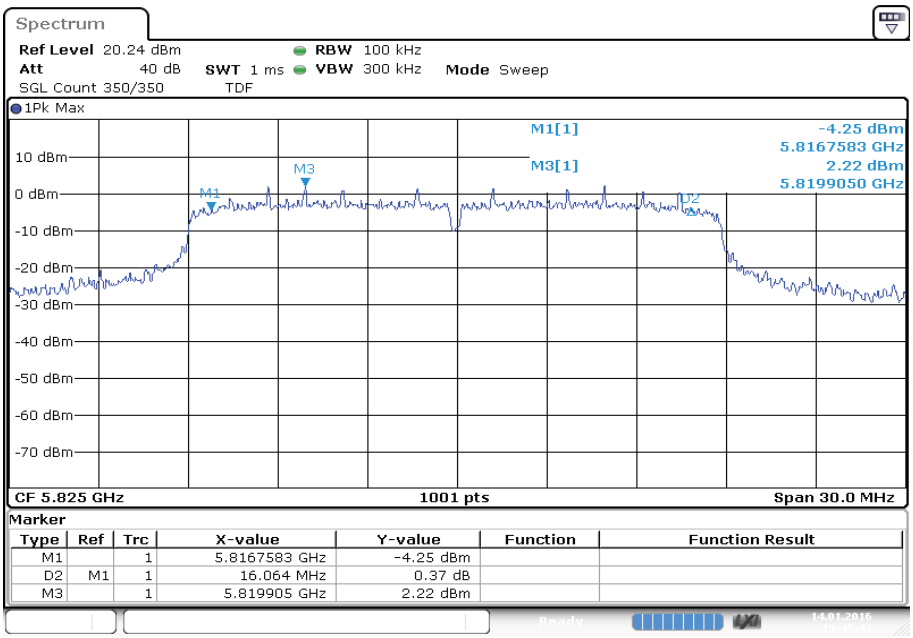
Date: 14.JAN.2016 15:41:36

Plot 2: 5785 MHz



Date: 14.JAN.2016 15:43:31

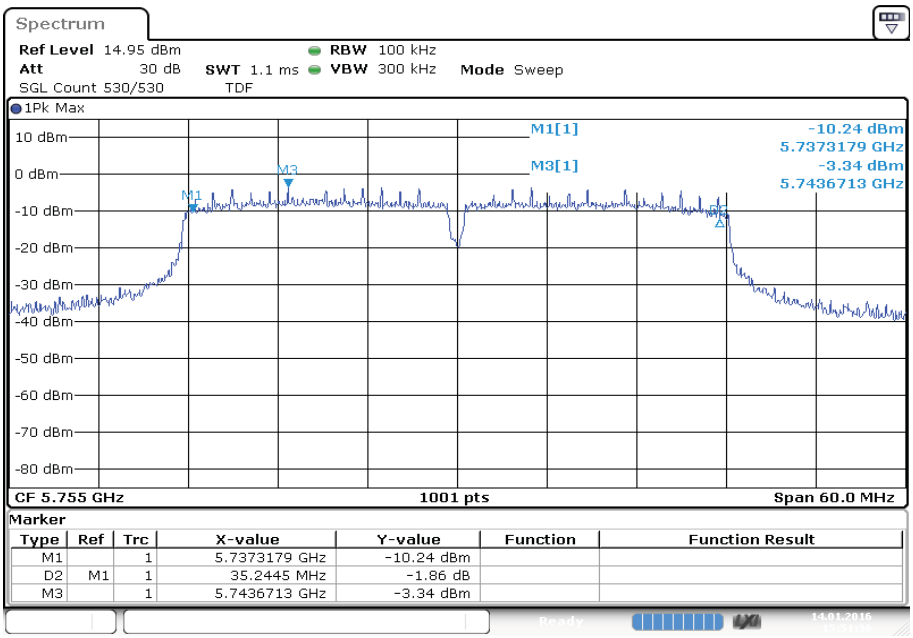
Plot 3: 5825 MHz



Date: 14.JAN.2016 15:45:43

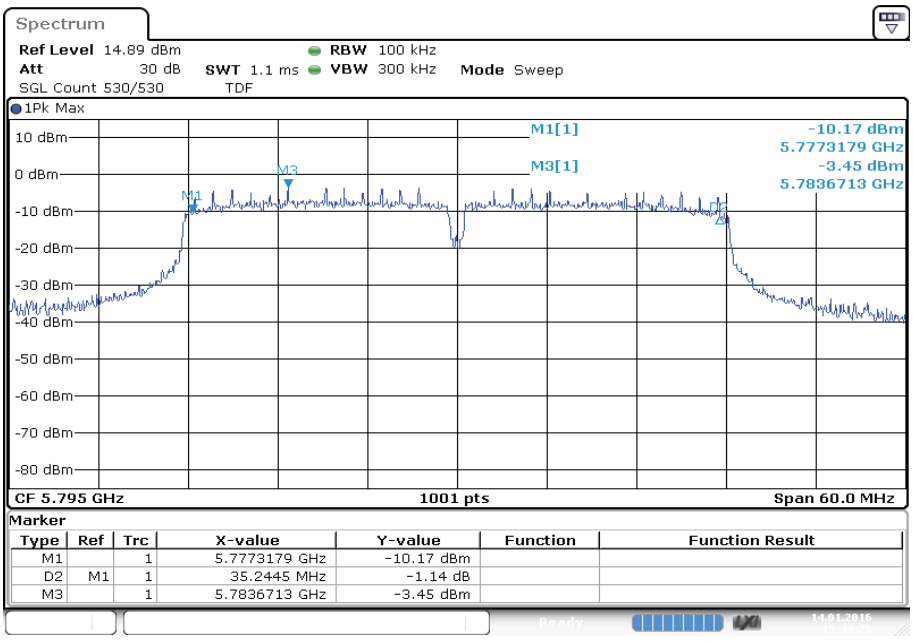
Plots: OFDM / n – mode HT40 – ANT0

Plot 1: 5755 MHz



Date: 14.JAN.2016 15:51:36

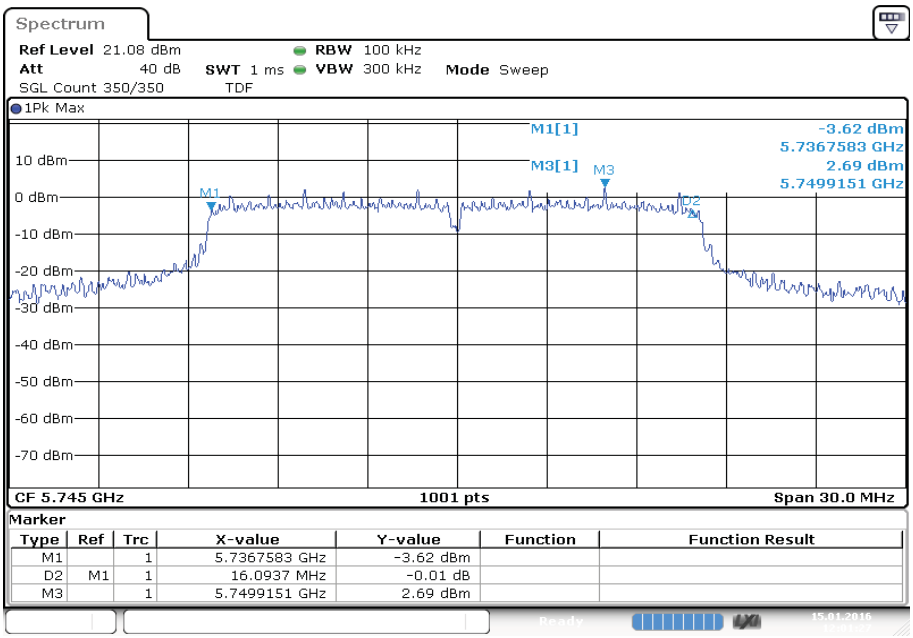
Plot 2: 5795 MHz



Date: 14.JAN.2016 15:49:25

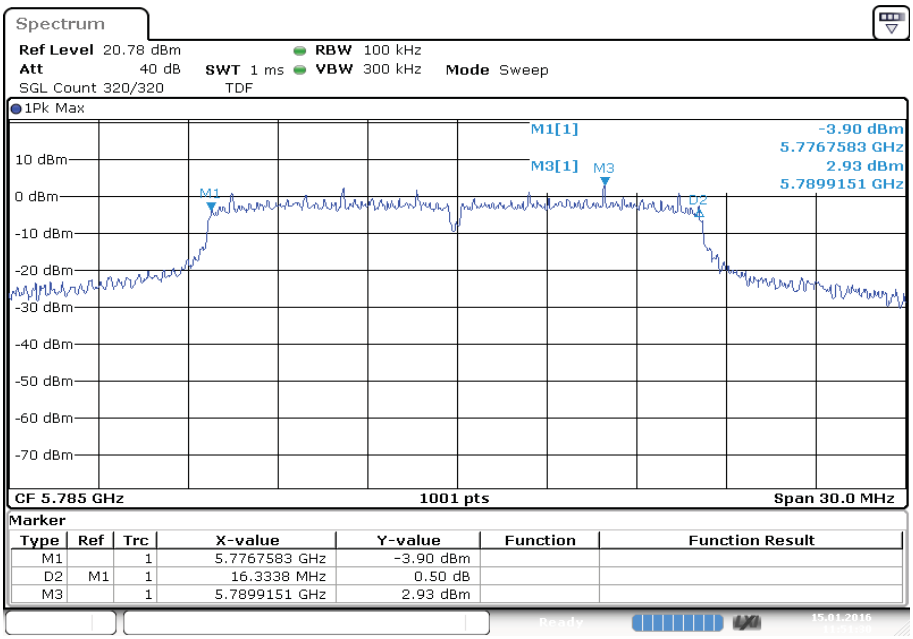
Plots: OFDM / a – mode – ANT1

Plot 1: 5745 MHz



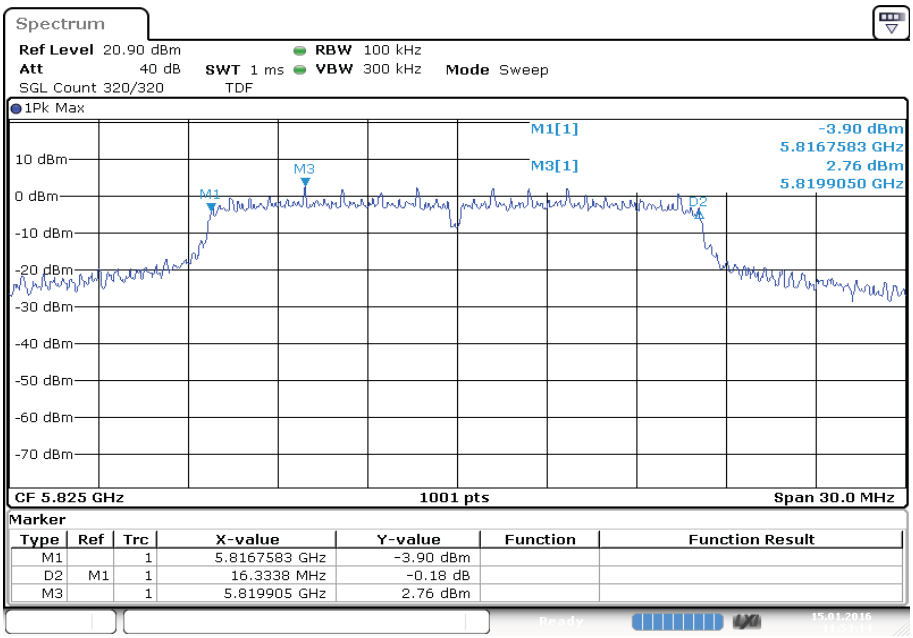
Date: 15.JAN.2016 12:01:27

Plot 2: 5785 MHz



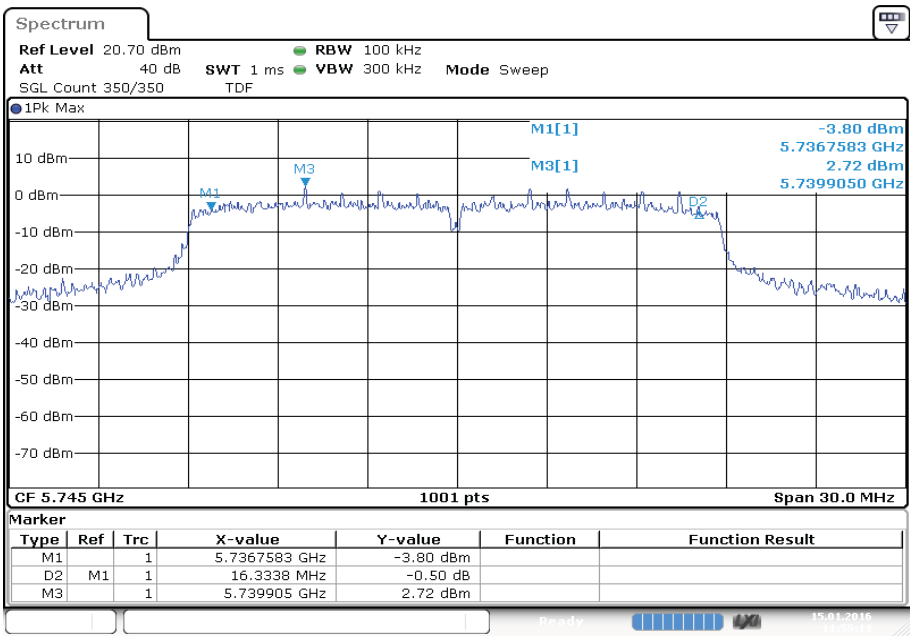
Date: 15.JAN.2016 11:51:30

Plot 3: 5825 MHz



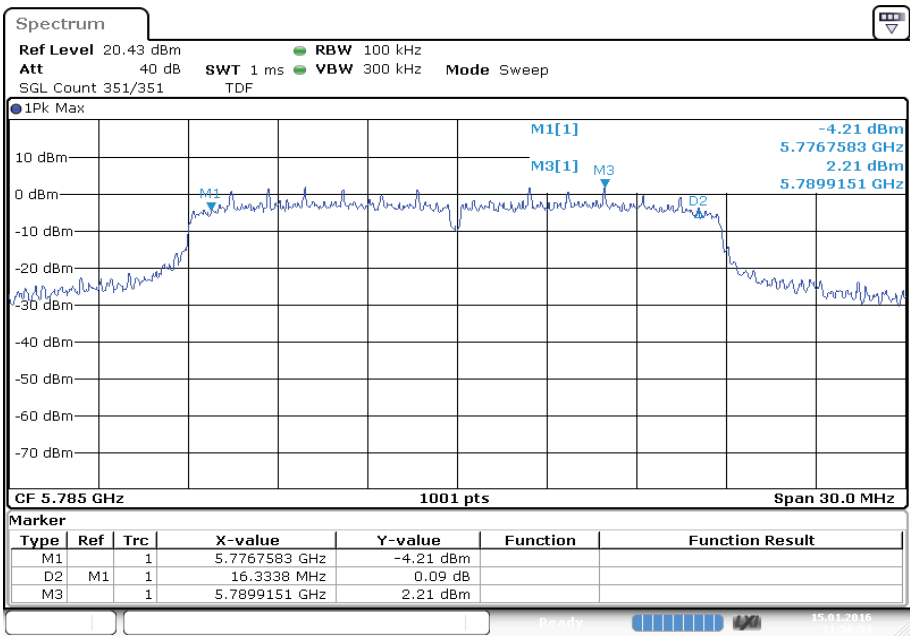
Plots: OFDM / n – mode HT20 – ANT1

Plot 1: 5745 MHz



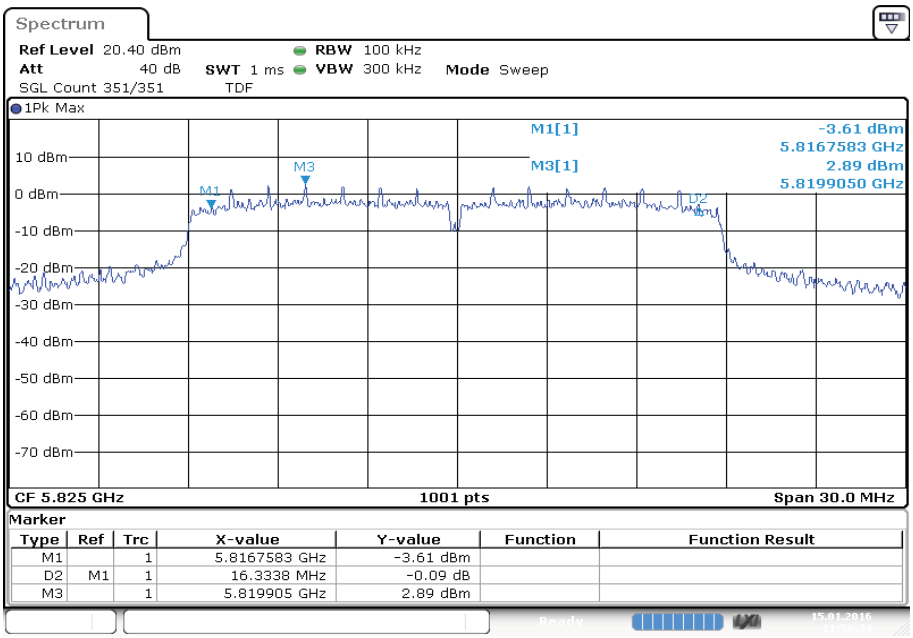
Date: 15.JAN.2016 11:55:13

Plot 2: 5785 MHz



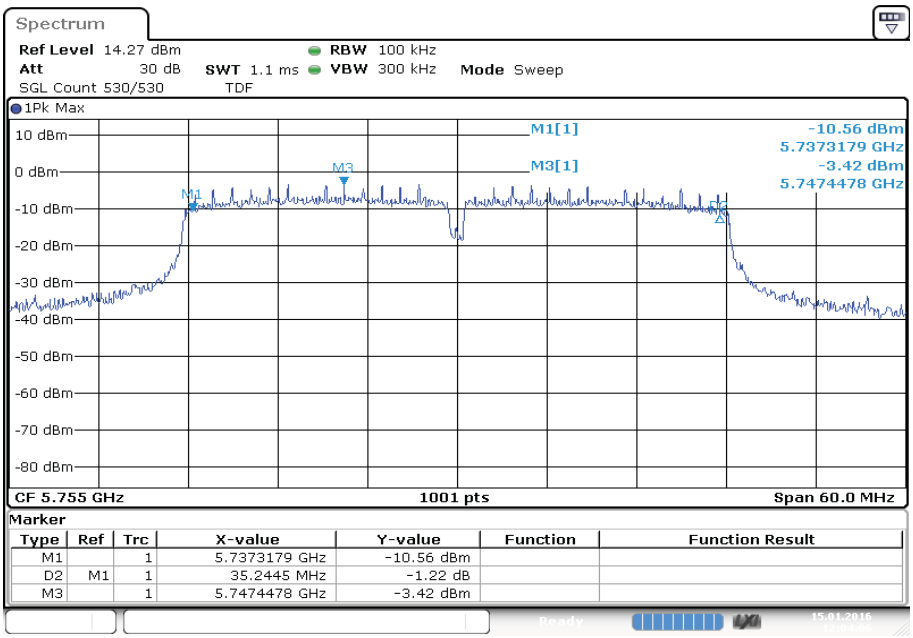
Date: 15.JAN.2016 11:56:54

Plot 3: 5825 MHz



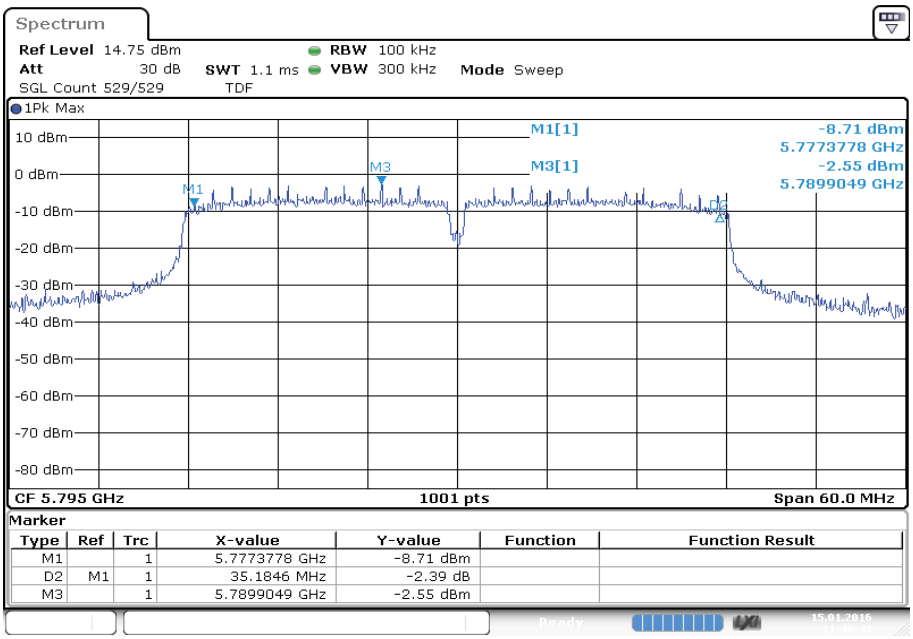
Plots: OFDM / n – mode HT40 – ANT1

Plot 1: 5755 MHz



Date: 15.JAN.2016 12:04:05

Plot 2: 5795 MHz



Date: 15.JAN.2016 11:46:44

12.7 Spectrum bandwidth – 26 dB bandwidth

Description:

Measurement of the 26 dB bandwidth of the modulated signal.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1% EBW
Video bandwidth:	≥ RBW
Span:	> complete signal!
Trace-Mode:	Max hold
Test setup:	see chapter 7.4
Measurement uncertainty:	see chapter 9

Limits:

Spectrum Bandwidth – 26 dB Bandwidth
-/-

Result: ANT0

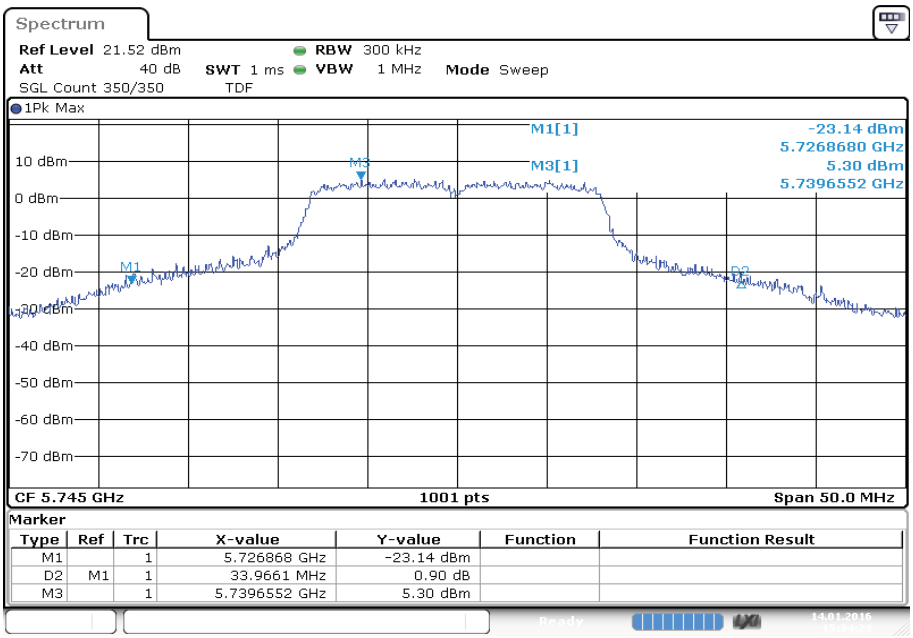
	26 dB bandwidth [kHz]		
Channel	Lowest 5745 MHz	Middle 5785 MHz	Highest 5825 MHz
OFDM / a-mode	33966	29370	34216
OFDM / n20-mode	31718	33966	34516
Channel	Lowest 5755 MHz		Highest 5795 MHz
OFDM / n40-mode	45454		46554

Result: ANT1

	26 dB bandwidth [kHz]		
Channel	Lowest 5745 MHz	Middle 5785 MHz	Highest 5825 MHz
OFDM / a-mode	32168	32867	37412
OFDM / n20-mode	32218	32168	35315
Channel	Lowest 5755 MHz		Highest 5795 MHz
OFDM / n40-mode	47253		56843

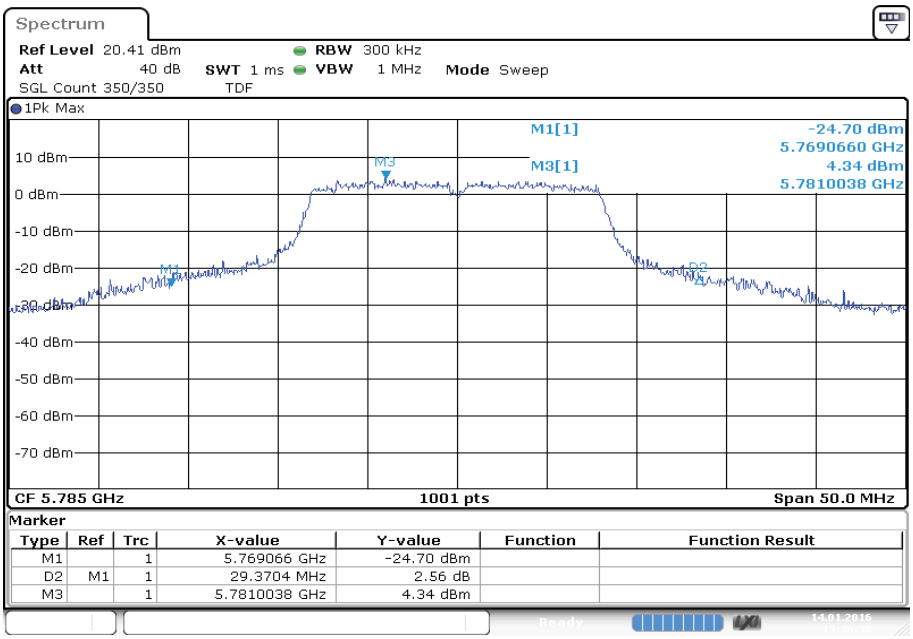
Plots: OFDM / a – mode – ANT0

Plot 4: 5745 MHz



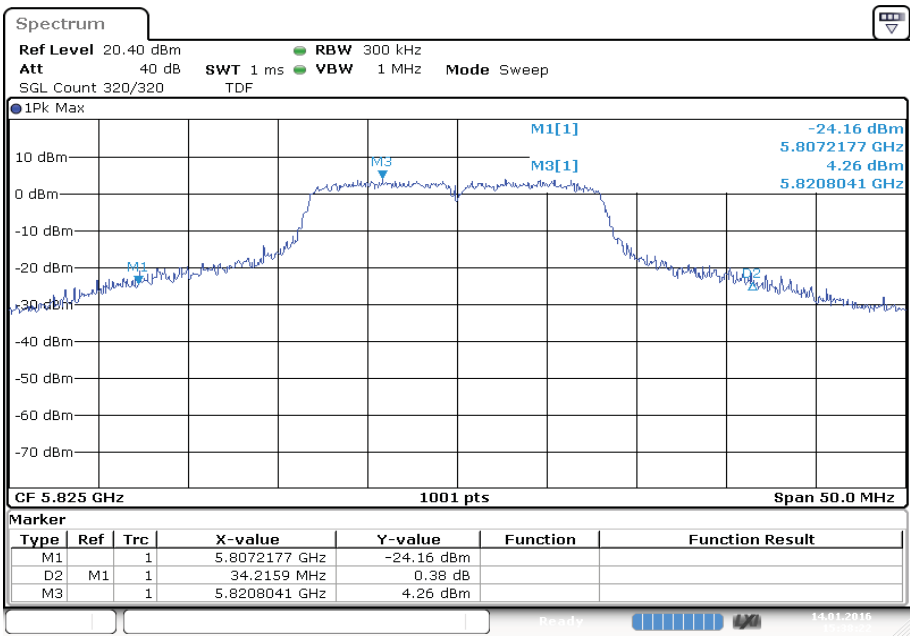
Date: 14.JAN.2016 15:34:24

Plot 5: 5785 MHz



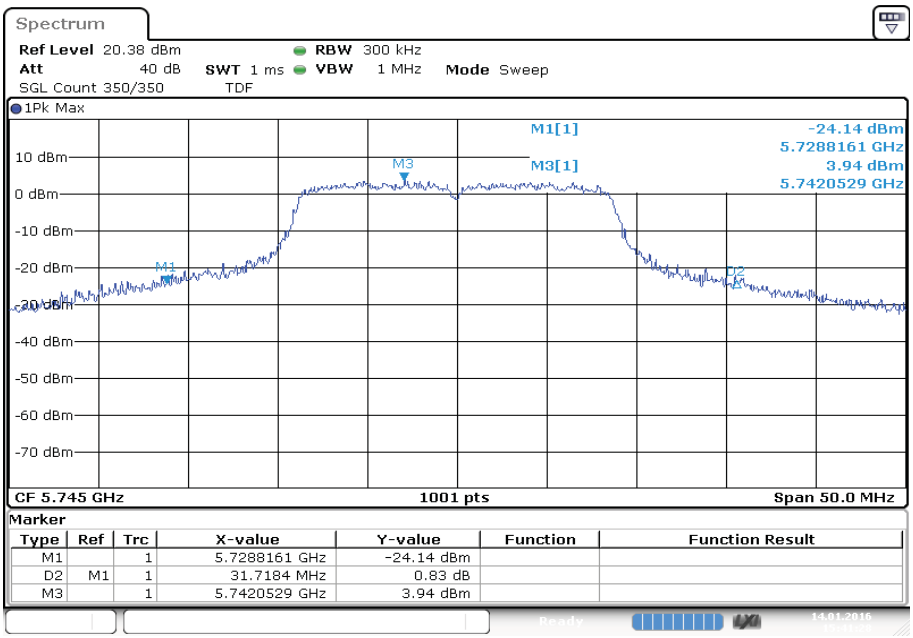
Date: 14.JAN.2016 15:36:38

Plot 6: 5825 MHz

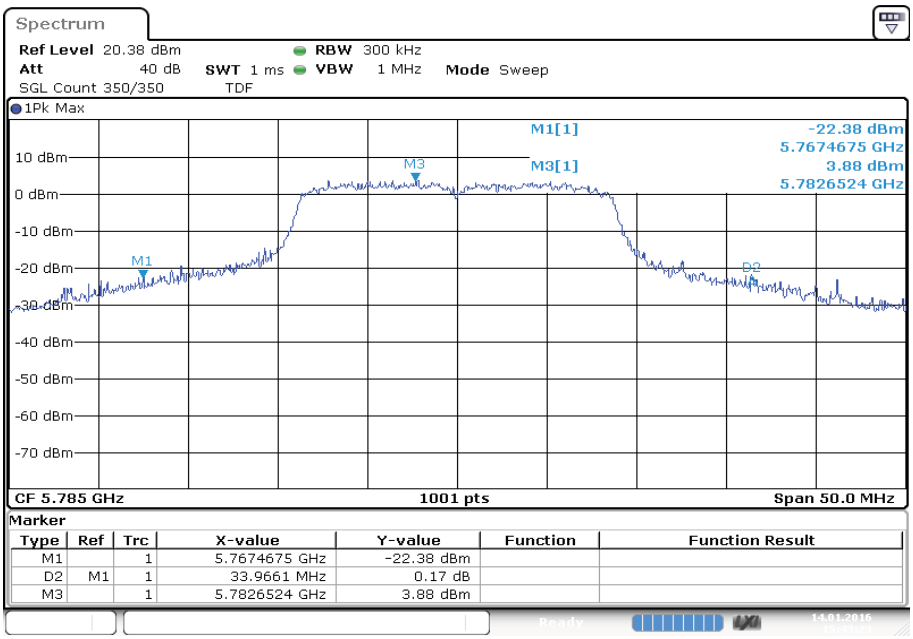


Plots: OFDM / n – mode HT20 – ANT0

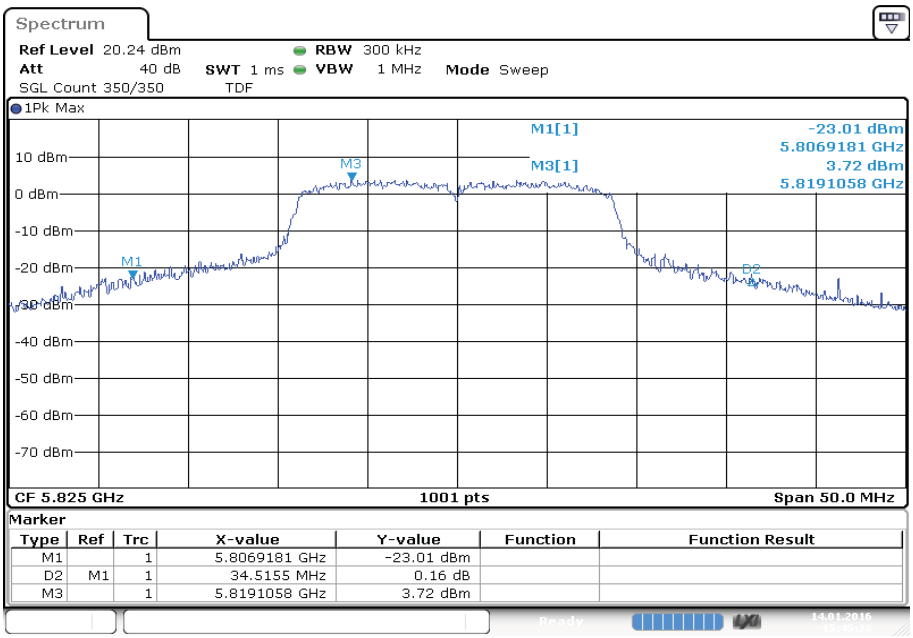
Plot 4: 5745 MHz



Plot 5: 5785 MHz

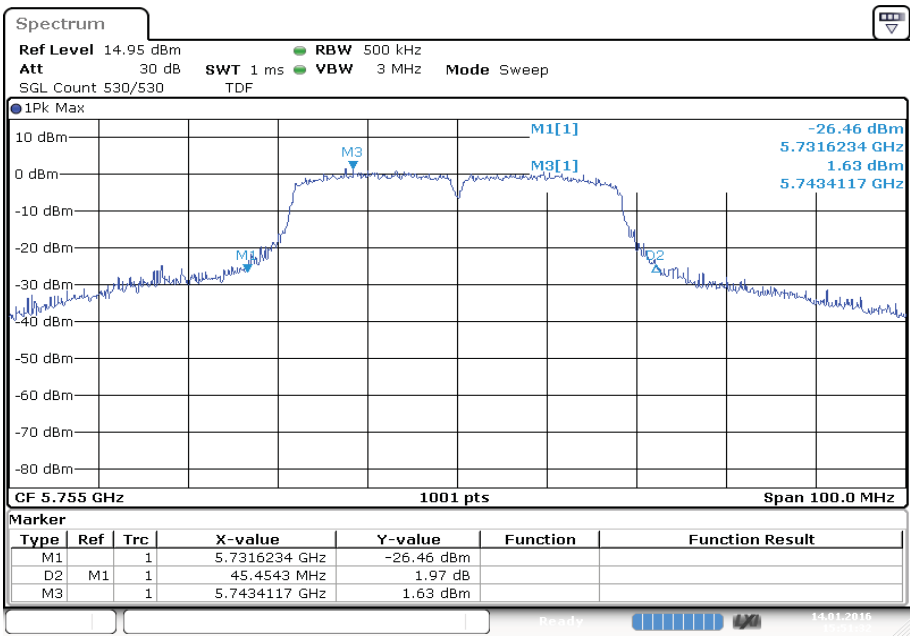


Plot 6: 5825 MHz



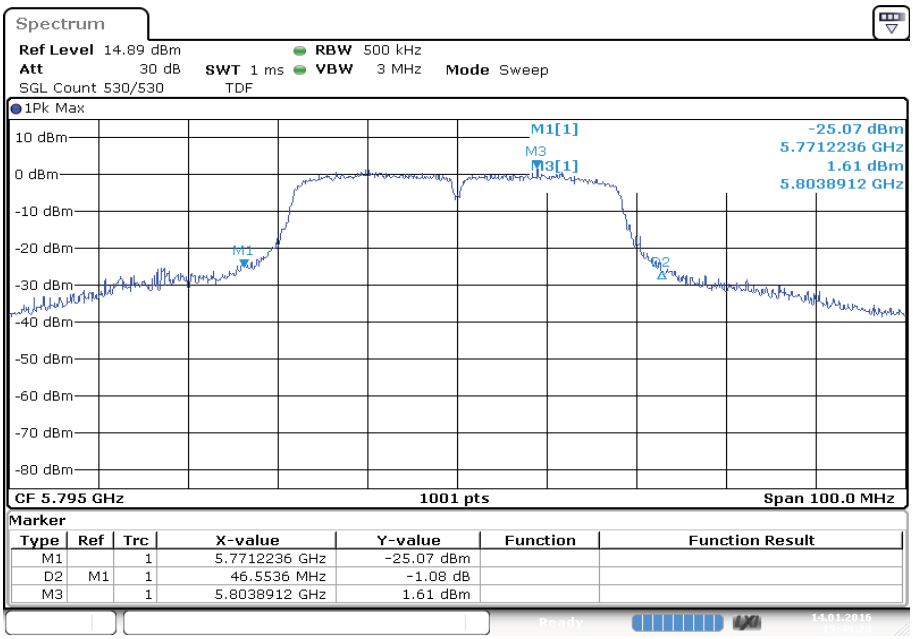
Plots: OFDM / n – mode HT40 – ANT0

Plot 3: 5755 MHz



Date: 14.JAN.2016 15:51:31

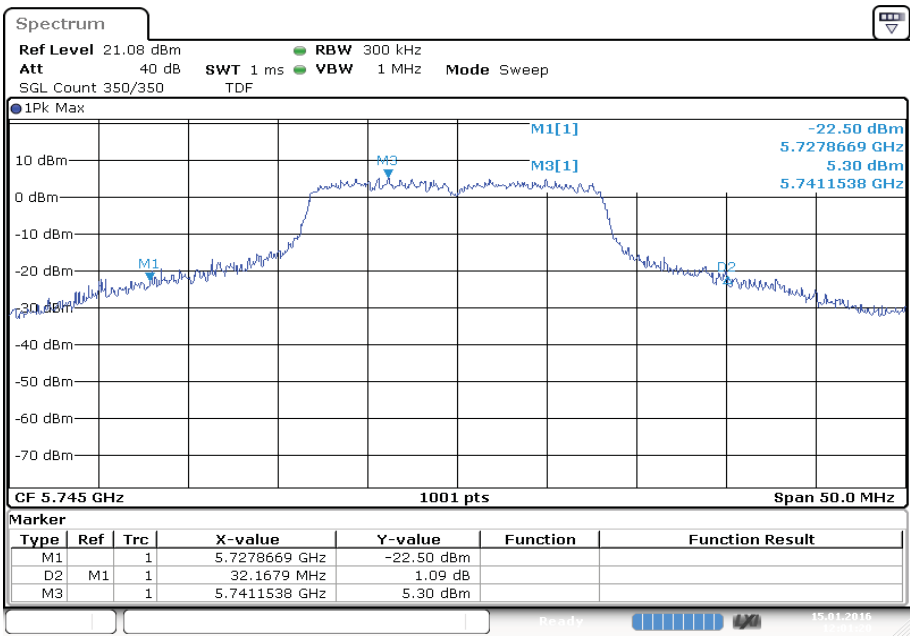
Plot 4: 5795 MHz



Date: 14.JAN.2016 15:49:20

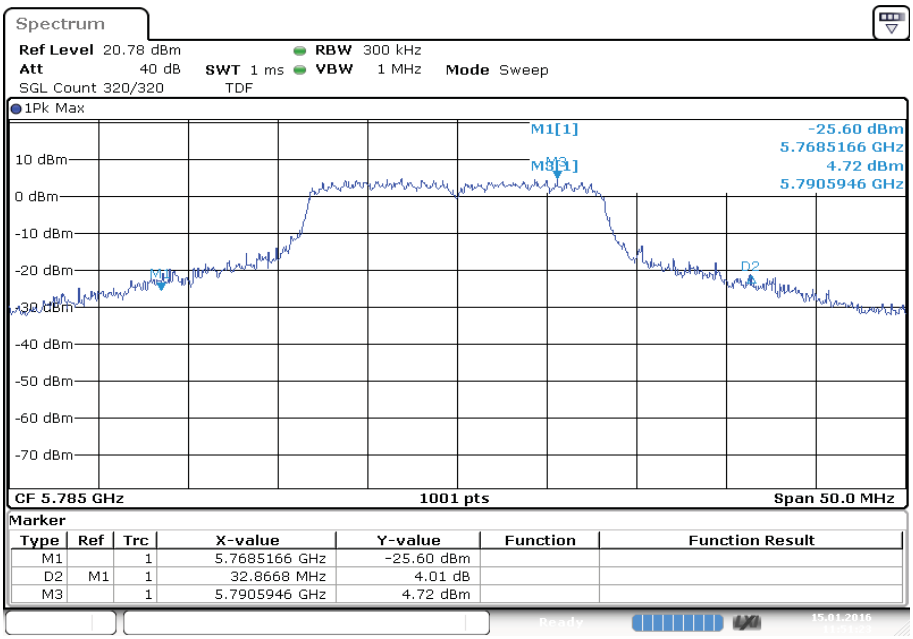
Plots: OFDM / a – mode – ANT1

Plot 4: 5745 MHz



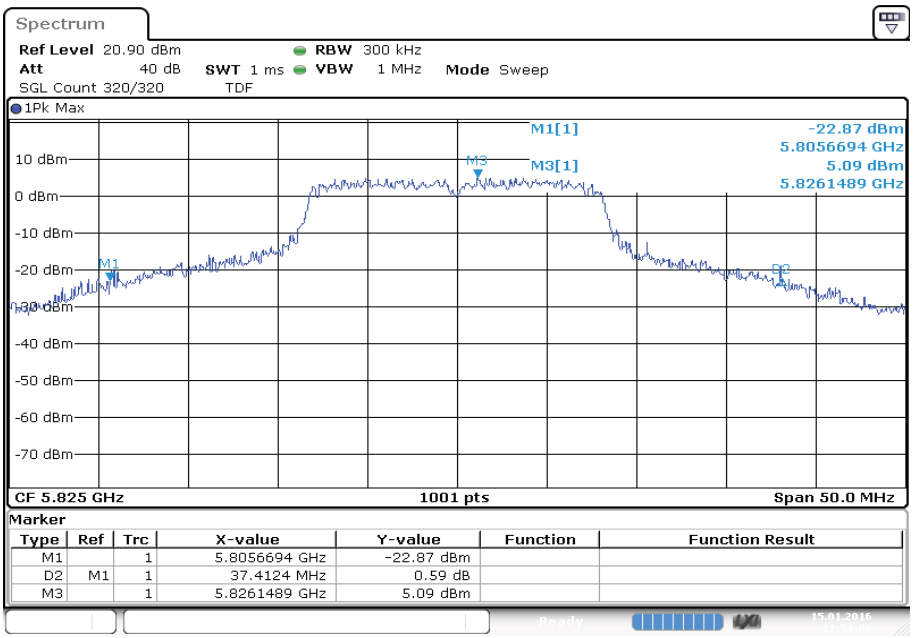
Date: 15.JAN.2016 12:01:20

Plot 5: 5785 MHz



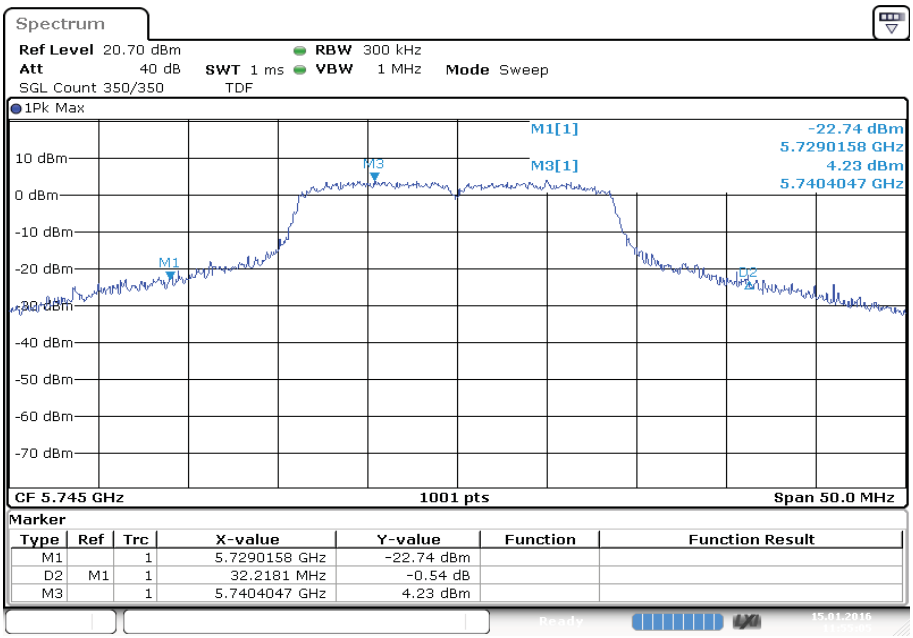
Date: 15.JAN.2016 11:51:23

Plot 6: 5825 MHz



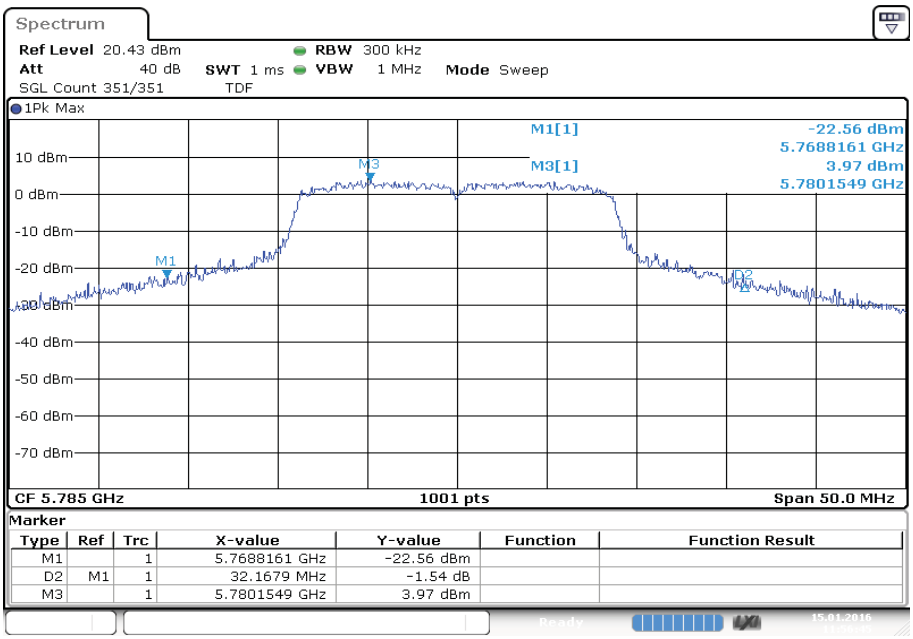
Plots: OFDM / n – mode HT20 – ANT1

Plot 4: 5745 MHz



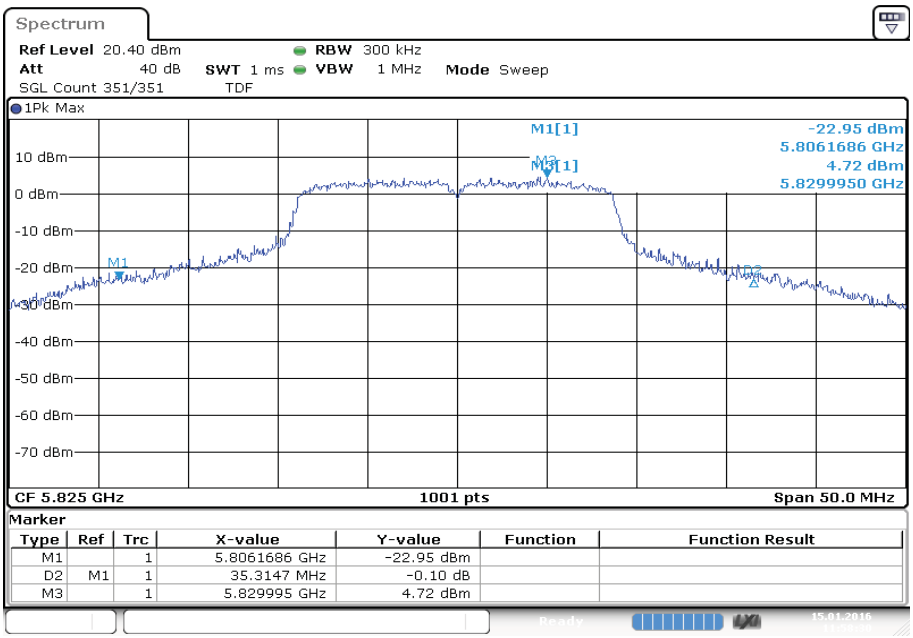
Date: 15.JAN.2016 11:55:06

Plot 5: 5785 MHz



Date: 15.JAN.2016 11:56:46

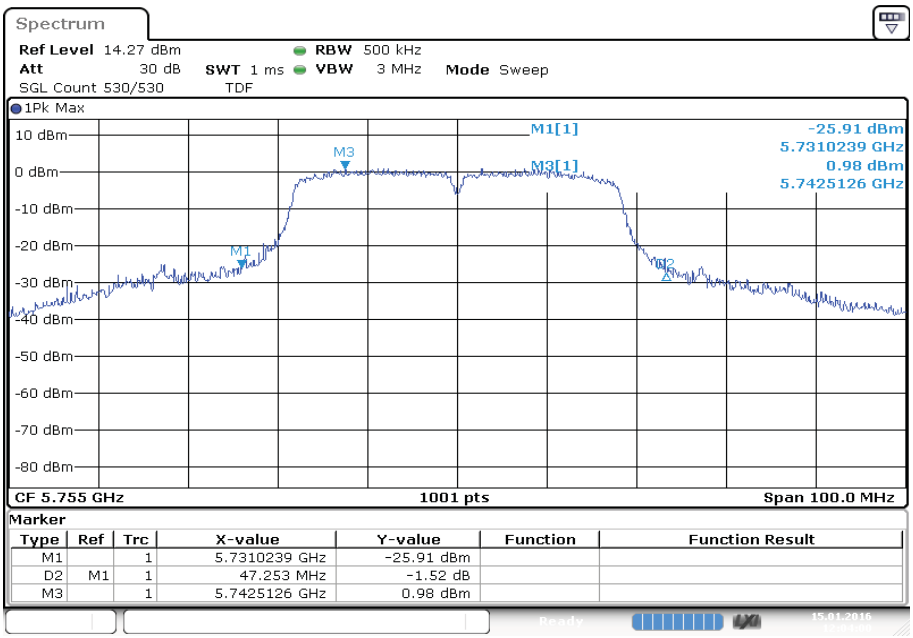
Plot 6: 5825 MHz



Date: 15.JAN.2016 11:58:30

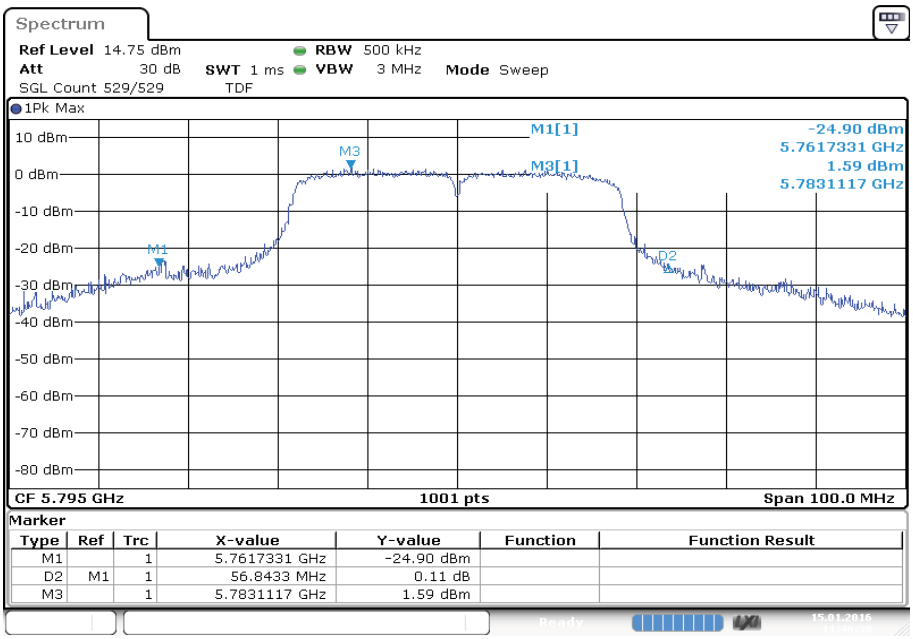
Plots: OFDM / n – mode HT40 – ANT1

Plot 3: 5755 MHz



Date: 15.JAN.2016 12:04:01

Plot 4: 5795 MHz



Date: 15.JAN.2016 11:46:39

12.8 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 / 500 kHz
Video bandwidth:	1 MHz / 3 MHz
Span:	50 MHz / 100 MHz
Measurement procedure:	Measurement of the 99% bandwidth using the integration function of the analyzer
Trace-Mode:	Max hold (allow trace to stabilize)
Test setup:	see chapter 7.4
Measurement uncertainty:	see chapter 9

Usage:

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

Result: ANT0

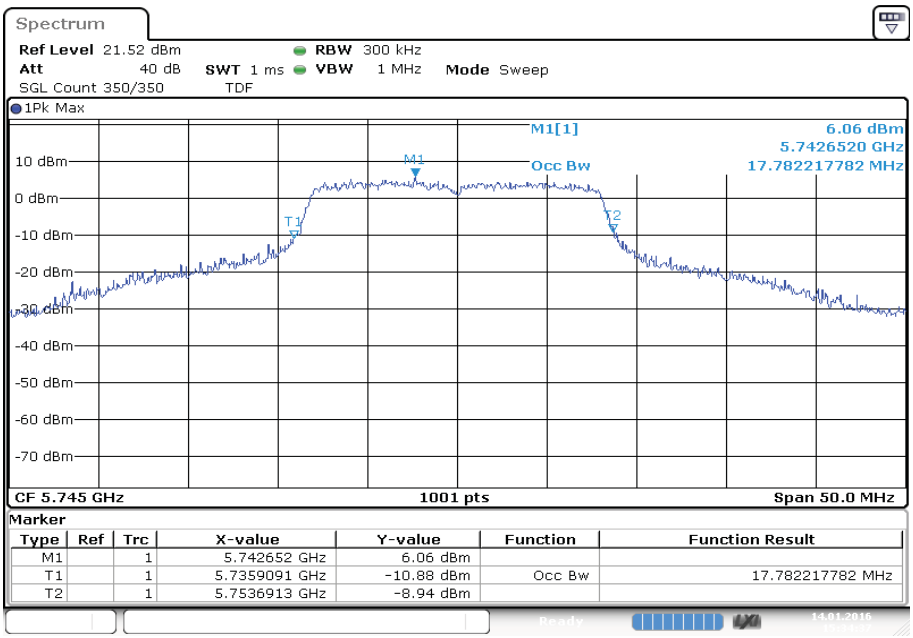
	OBW [kHz]		
Channel	Lowest 5745 MHz	Middle 5785 MHz	Highest 5825 MHz
OFDM / a-mode	17782	17333	17383
OFDM / n20-mode	18132	18232	18432
Channel	Lowest 5755 MHz		Highest 5795 MHz
OFDM / n40-mode	36663		36563

Result: ANT1

	OBW [kHz]		
Channel	Lowest 5745 MHz	Middle 5785 MHz	Highest 5825 MHz
OFDM / a-mode +0.07 dB duty cycle correction	17433	17333	18282
OFDM / n20-mode +0.07 dB duty cycle correction	18182	18282	18731
Channel	Lowest 5755 MHz		Highest 5795 MHz
OFDM / n40-mode +0.15 dB duty cycle correction	36464		36563

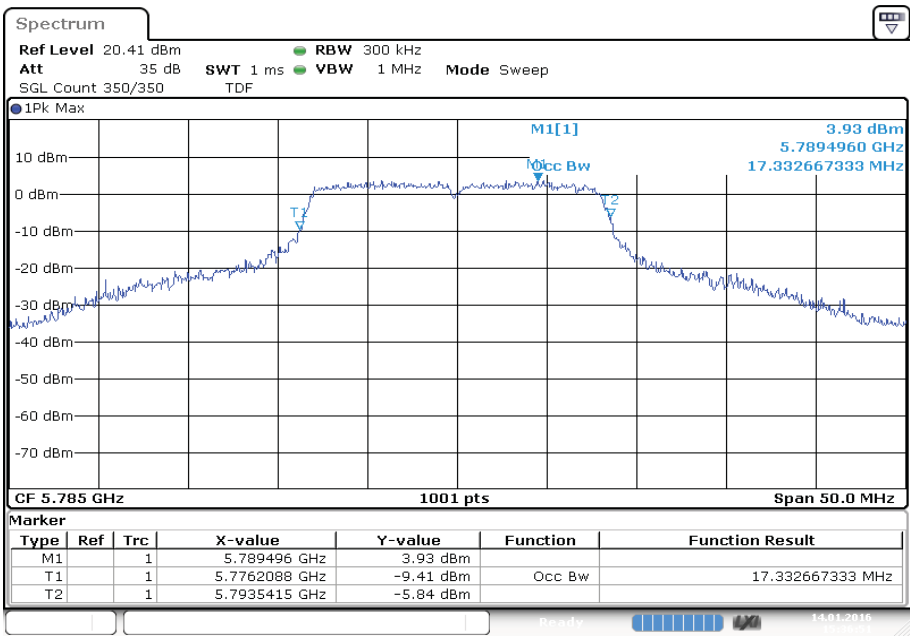
Plots: OFDM / a – mode – ANT0

Plot 1: 5745 MHz



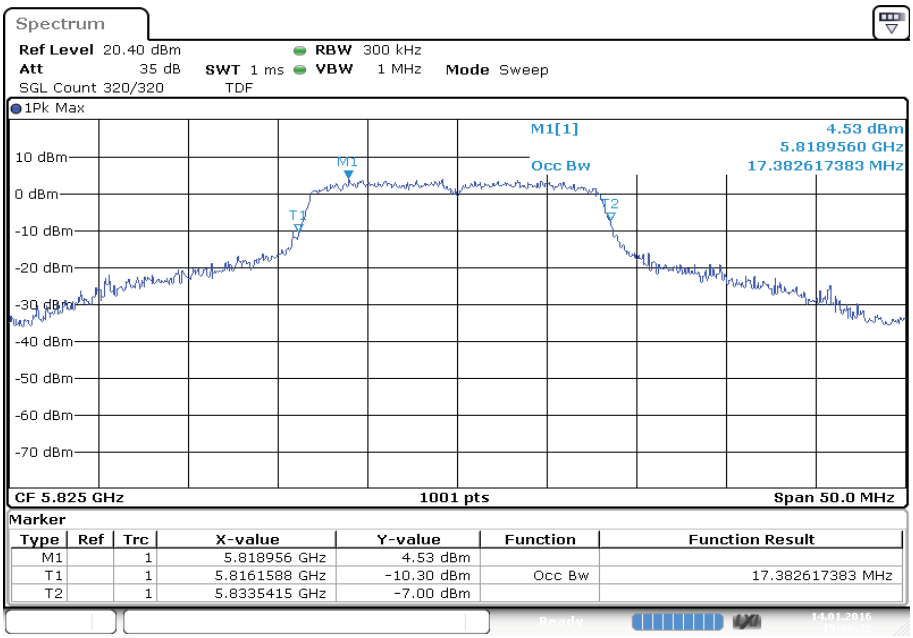
Date: 14.JAN.2016 15:34:36

Plot 2: 5785 MHz



Date: 14.JAN.2016 15:36:51

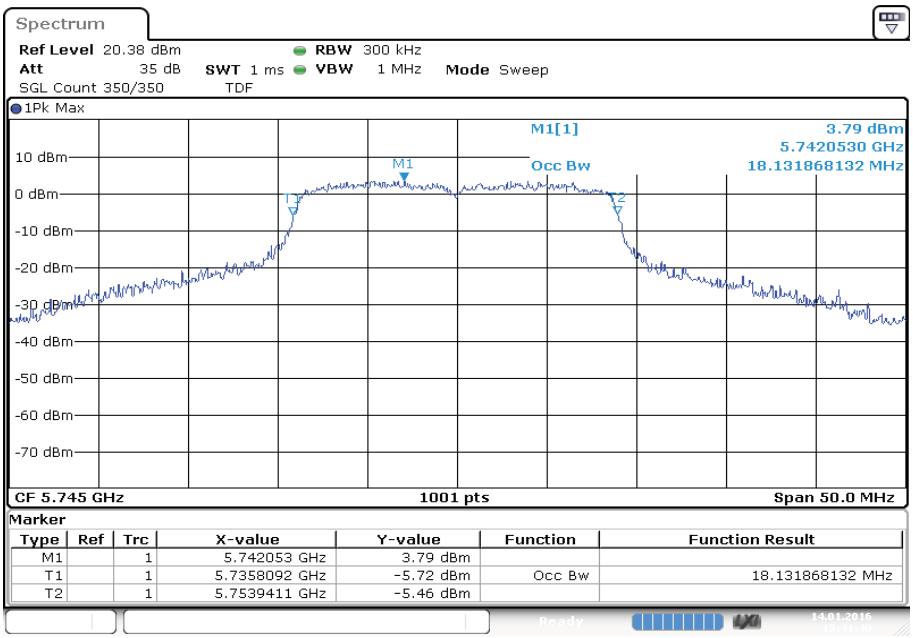
Plot 3: 5825 MHz



Date: 14.JAN.2016 15:38:33

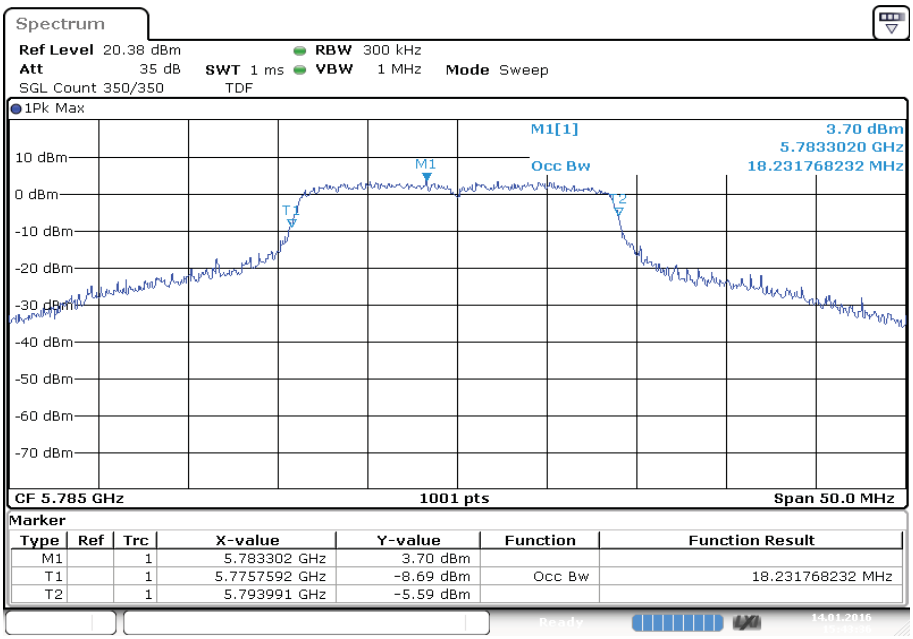
Plots: OFDM / n – mode HT20 – ANT0

Plot 1: 5745 MHz



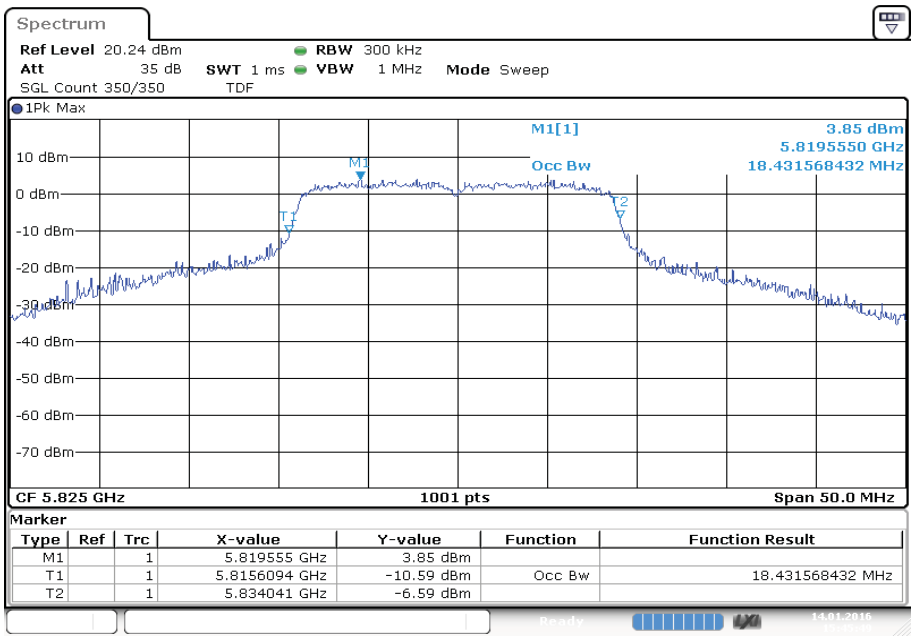
Date: 14.JAN.2016 15:41:41

Plot 2: 5785 MHz



Date: 14.JAN.2016 15:43:36

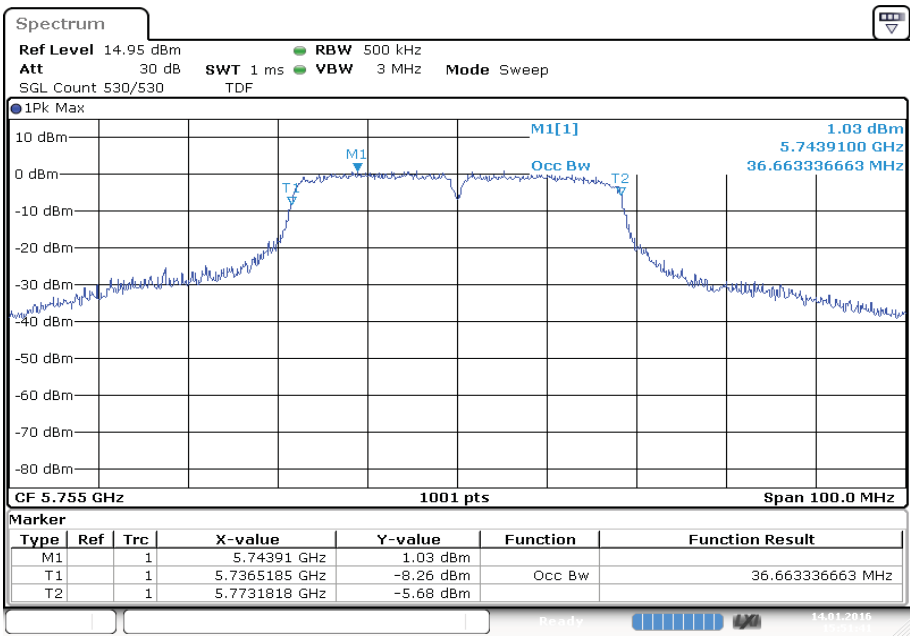
Plot 3: 5825 MHz



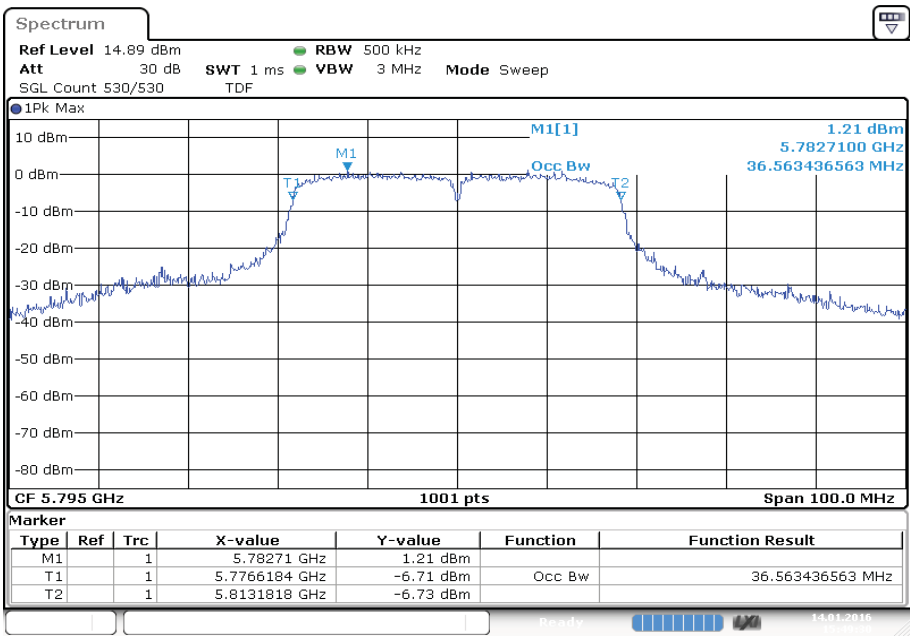
Date: 14.JAN.2016 15:45:49

Plots: OFDM / n – mode HT40 – ANT0

Plot 1: 5755 MHz

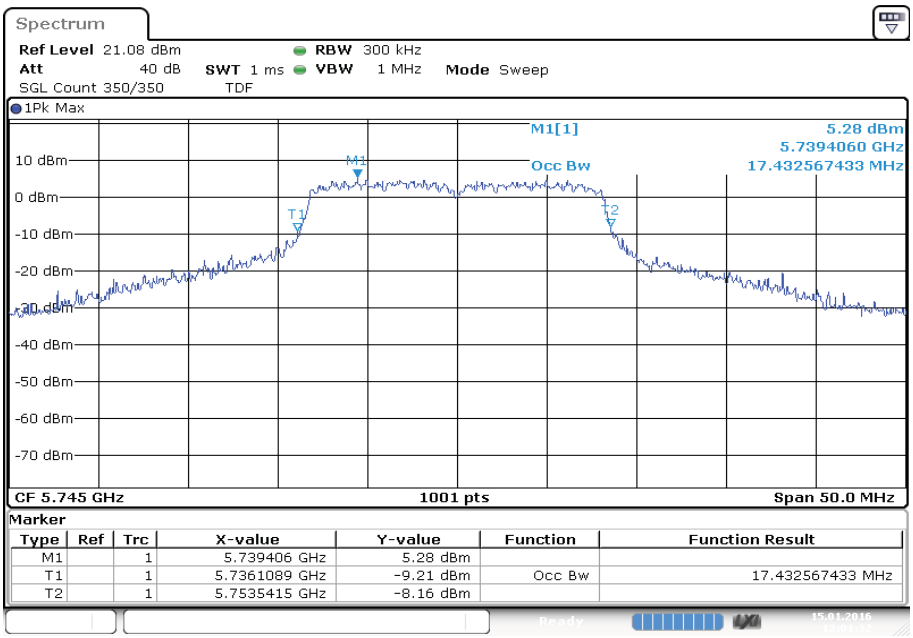


Plot 2: 5795 MHz



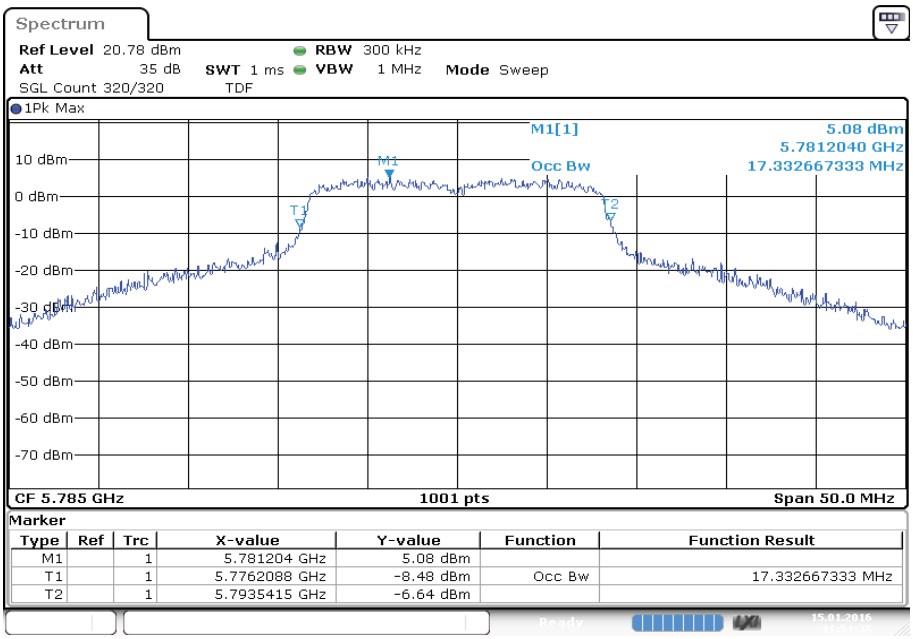
Plots: OFDM / a – mode – ANT1

Plot 1: 5745 MHz



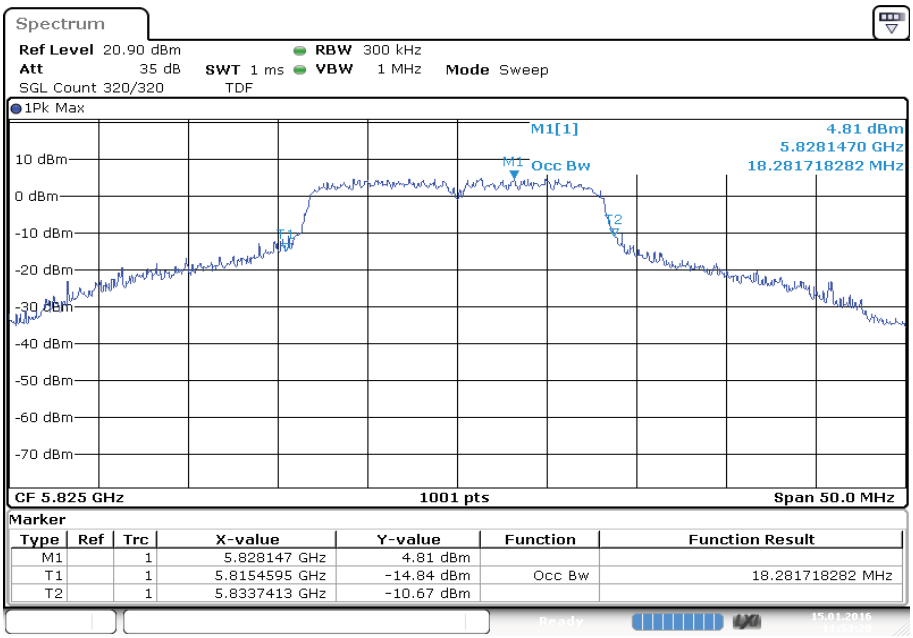
Date: 15.JAN.2016 12:01:32

Plot 2: 5785 MHz



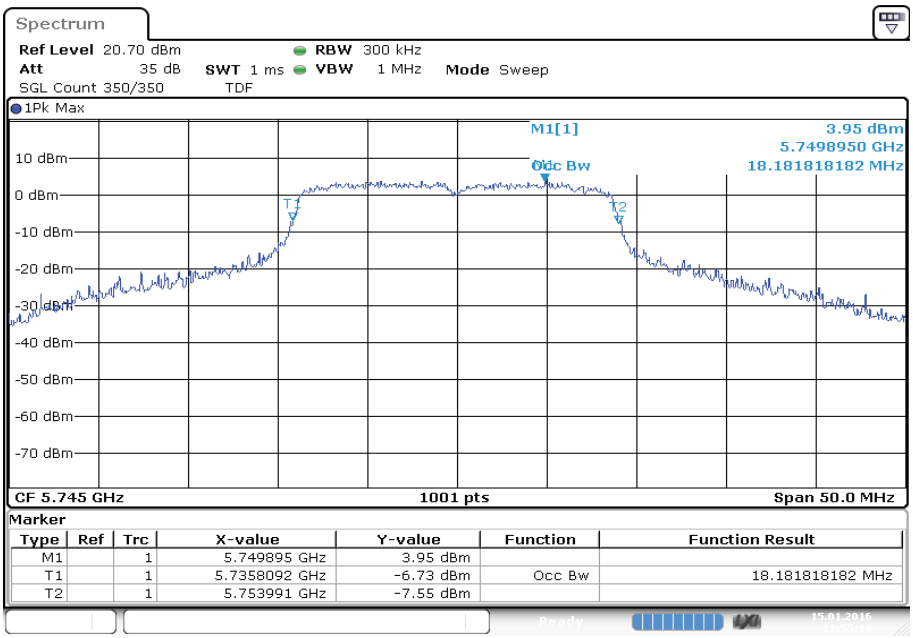
Date: 15.JAN.2016 11:51:35

Plot 3: 5825 MHz



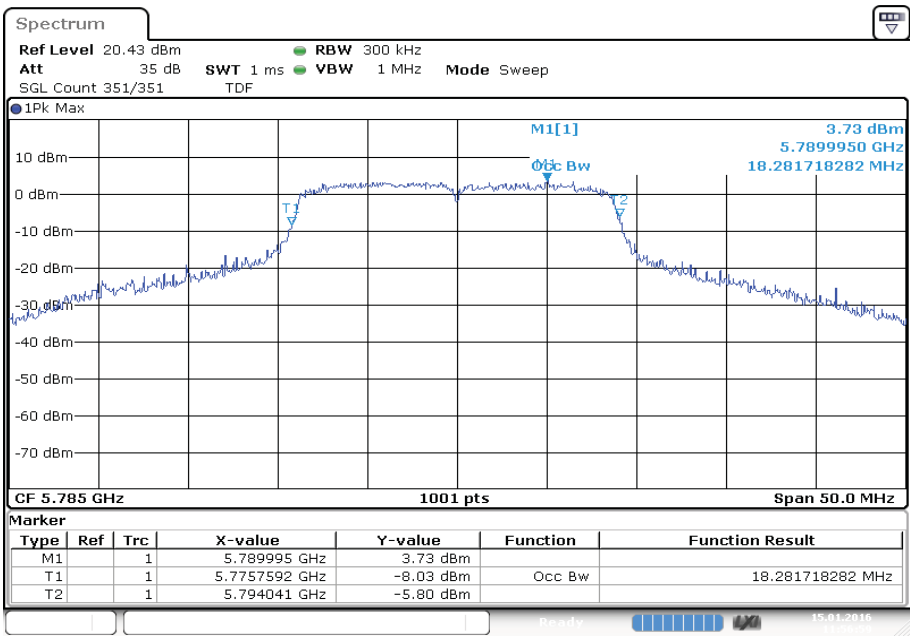
Plots: OFDM / n – mode HT20 – ANT1

Plot 1: 5745 MHz



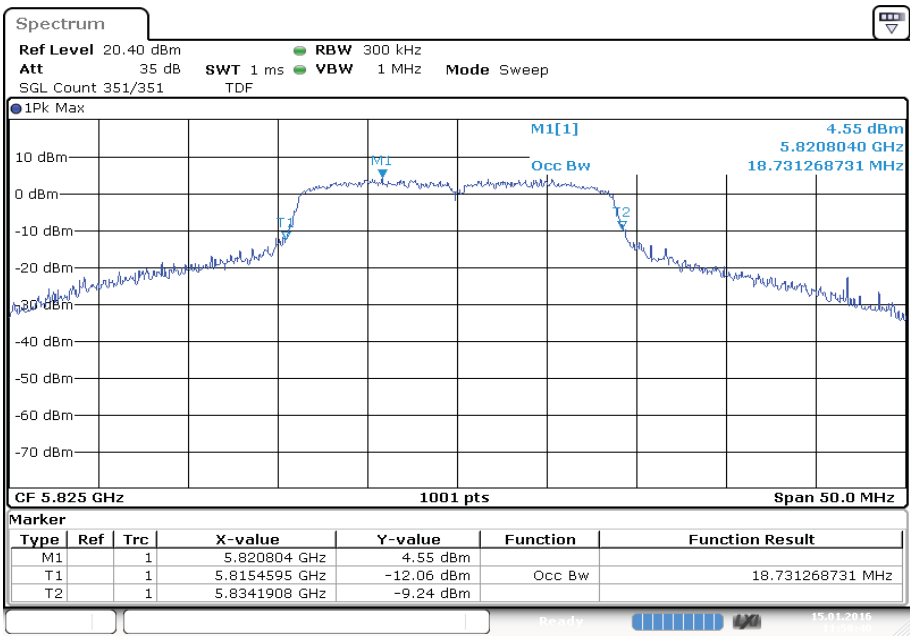
Date: 15.JAN.2016 11:55:18

Plot 2: 5785 MHz



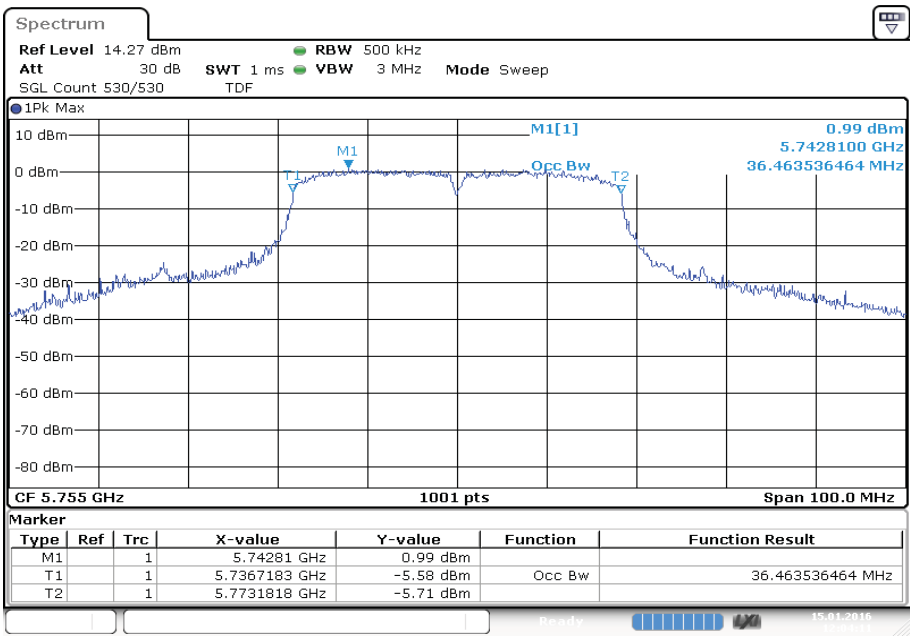
Date: 15.JAN.2016 11:56:59

Plot 3: 5825 MHz



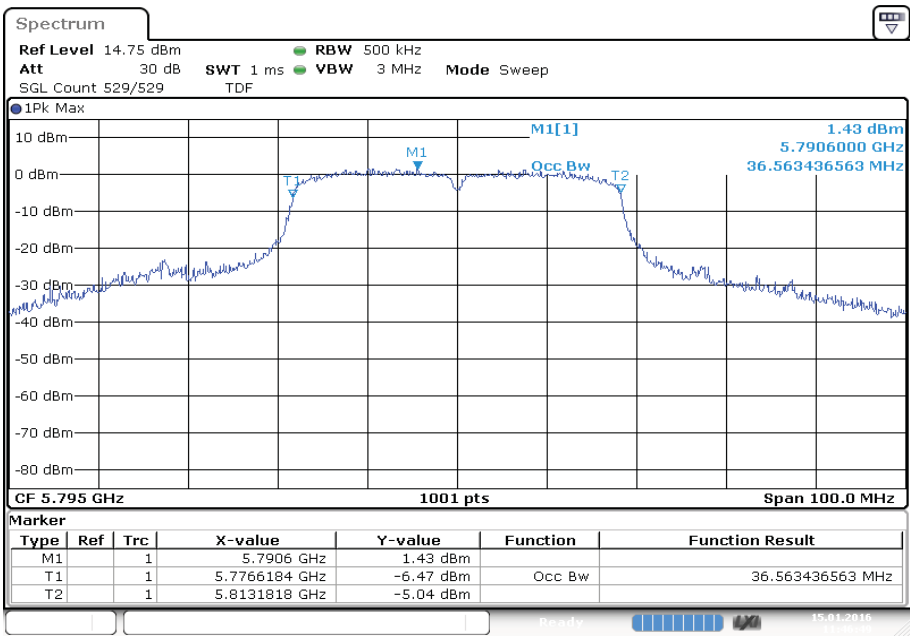
Plots: OFDM / n – mode HT40 – ANT1

Plot 1: 5755 MHz



Date: 15.JAN.2016 12:04:11

Plot 2: 5795 MHz



Date: 15.JAN.2016 11:46:49

12.9 TX spurious emissions radiated

Description:

Measurement of the radiated spurious emissions in transmit mode. The measurement is performed at lowest, middle and highest channel.

Measurement:

Measurement parameter	
Detector:	Quasi Peak below 1 GHz (alternative Peak) Peak above 1 GHz / RMS
Sweep time:	Auto
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz
Video bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: ≥ 3 MHz
Span:	30 MHz to 40 GHz
Trace-Mode:	Max Hold / Average with 100 counts + 20 log (1 / X) for duty cycle lower than 100 %
Test setup:	see chapter 7.1 & 7.2 & 7.3
Measurement uncertainty:	see chapter 9

Limits:

TX Spurious Emissions Radiated		
§15.209		
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
§15.407		
Outside the restricted bands!	-27 dBm / MHz	

Results: OFDM / a – mode

TX Spurious Emissions Radiated [dBµV/m] / dBm								
OFDM a – mode								
Lowest 5745 MHz			Middle 5785 MHz			Highest 5825 MHz		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
All detected peaks are more than 6dB below the limit.			All detected peaks are more than 6dB below the limit.			All detected peaks are more than 6dB below the limit.		

Results: OFDM / n – modeHT20

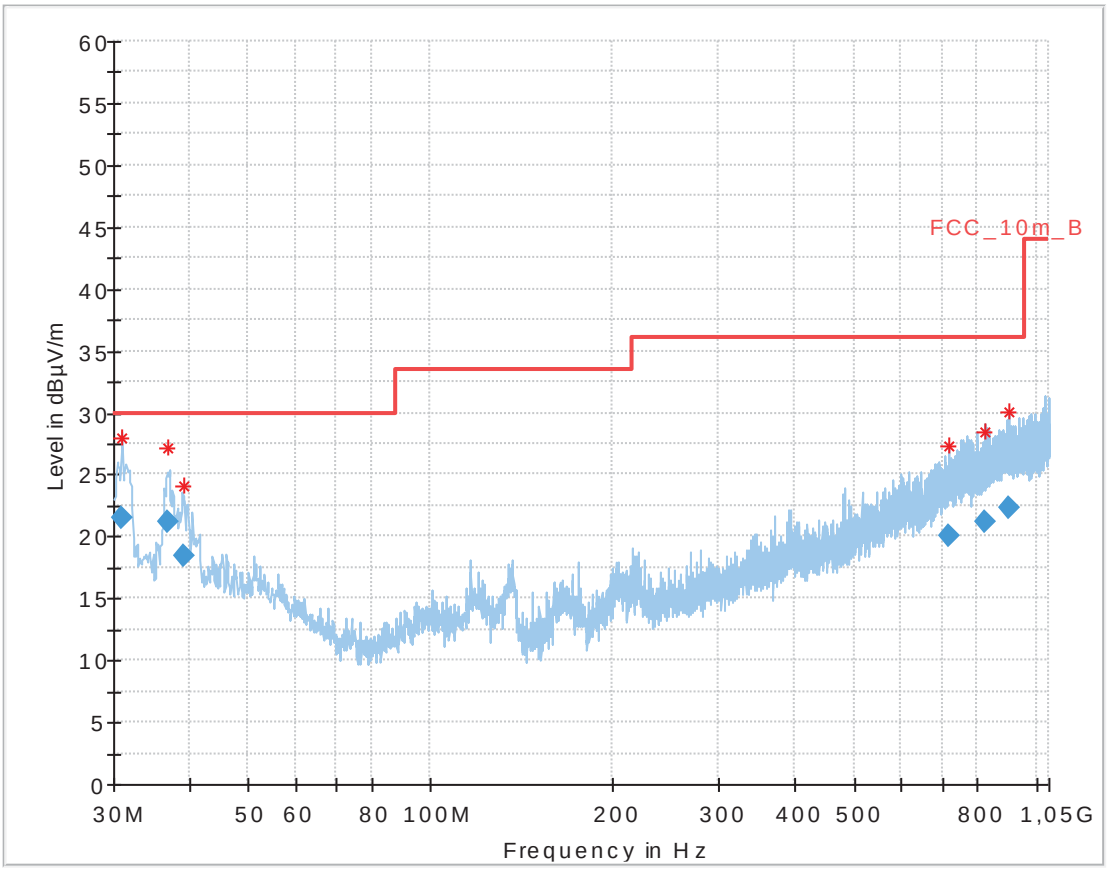
TX Spurious Emissions Radiated [dBµV/m] / dBm								
OFDM n – mode HT20								
Lowest 5745 MHz			Middle 5785 MHz			Highest 5825 MHz		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
All detected peaks are more than 6dB below the limit.			All detected peaks are more than 6dB below the limit.			All detected peaks are more than 6dB below the limit.		

Results: OFDM / n – modeHT40

TX Spurious Emissions Radiated [dBµV/m] / dBm								
OFDM n – mode HT40								
Lowest 5755 MHz			-/-			Highest 5795 MHz		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
All detected peaks are more than 6dB below the limit.			-/-			All detected peaks are more than 6dB below the limit.		

Plots: OFDM / a – mode

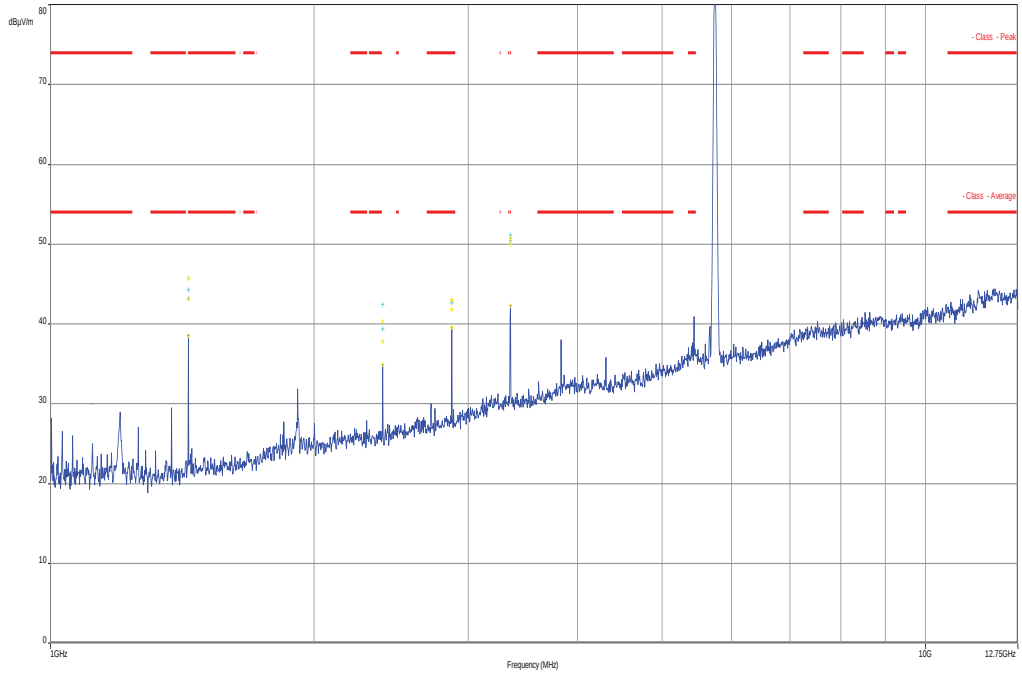
Plot 1: Lowest channel, 30 MHz to 1 GHz, vertical & horizontal polarization



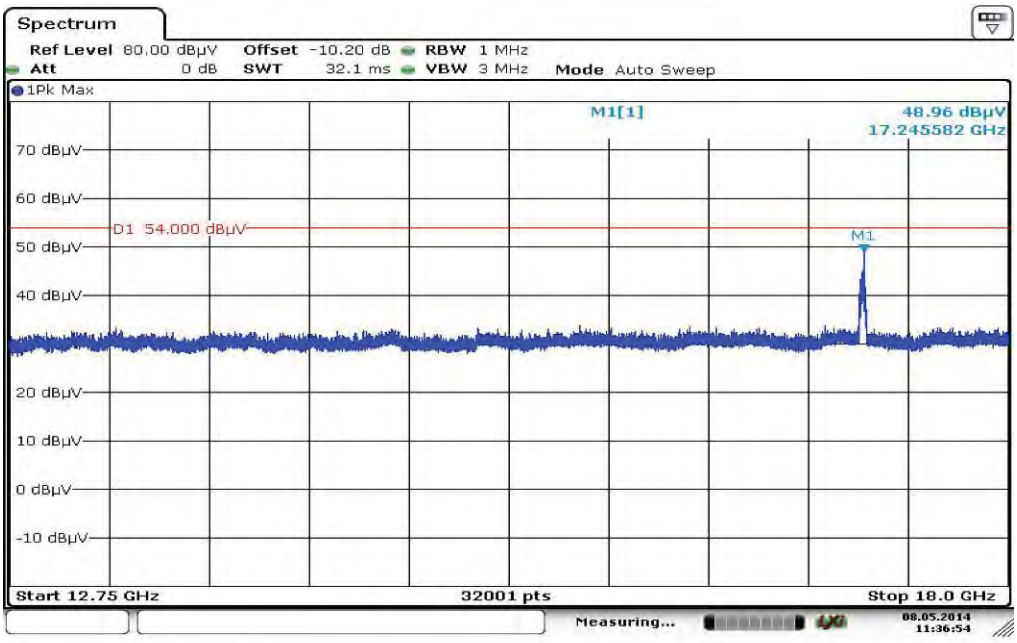
Final results:

Frequency (MHz)	Quasi Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.901800	21.49	30.00	8.51	1000.0	120.000	101.0	V	-10.0	12.6
36.828450	21.24	30.00	8.76	1000.0	120.000	101.0	V	177.0	13.2
39.170400	18.37	30.00	11.63	1000.0	120.000	101.0	V	280.0	13.4
717.699300	20.10	36.00	15.90	1000.0	120.000	101.0	H	-3.0	22.9
822.269850	21.17	36.00	14.83	1000.0	120.000	170.0	H	85.0	24.1
899.326950	22.26	36.00	13.74	1000.0	120.000	170.0	H	100.0	25.2

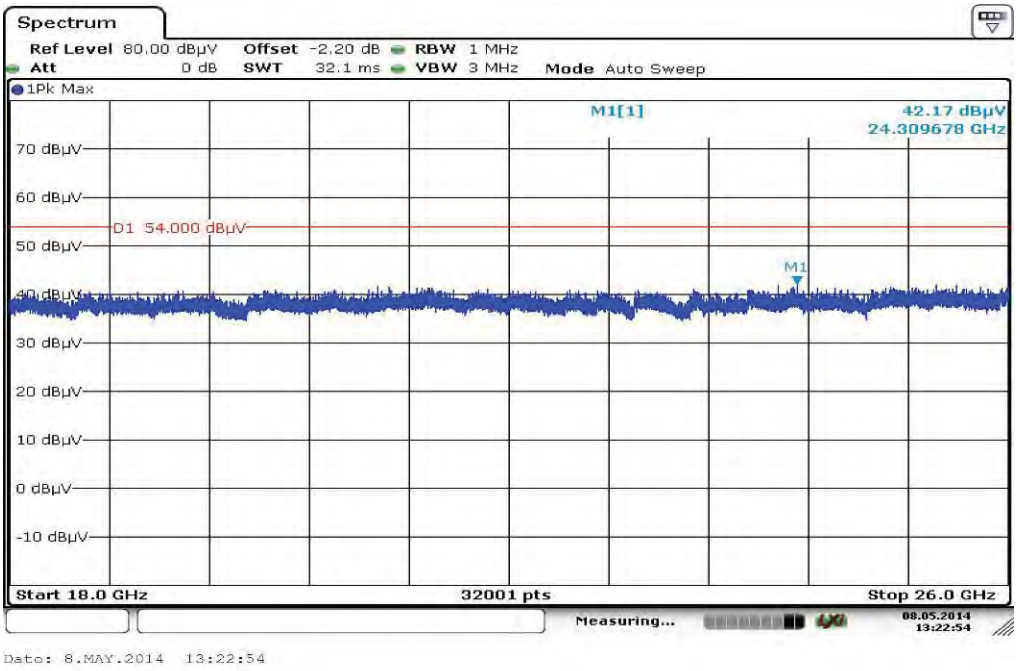
Plot 2: Lowest channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization



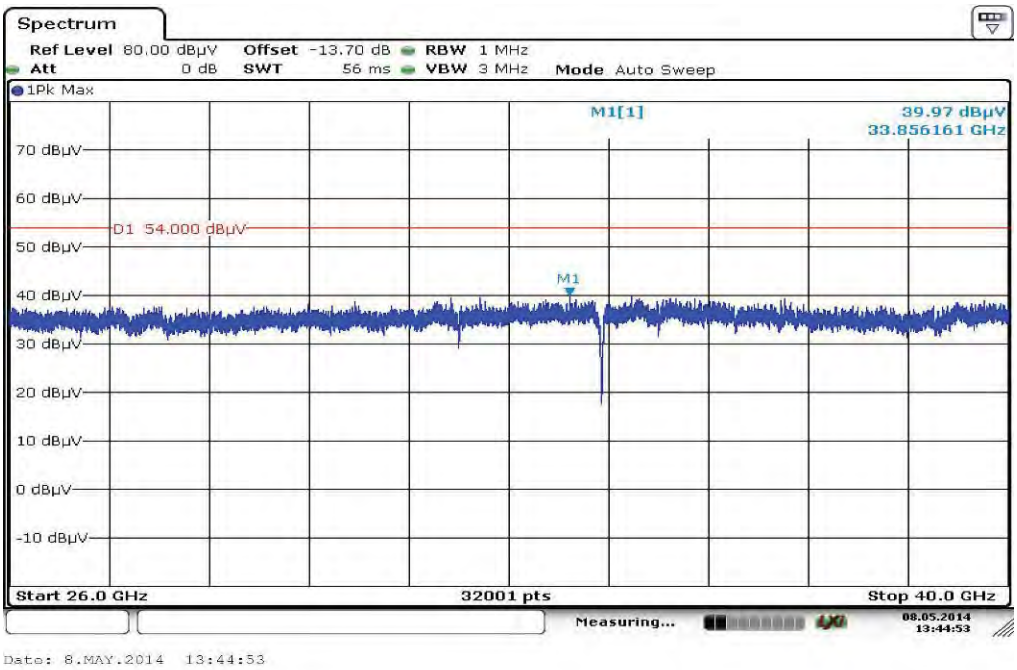
Plot 3: Lowest channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization



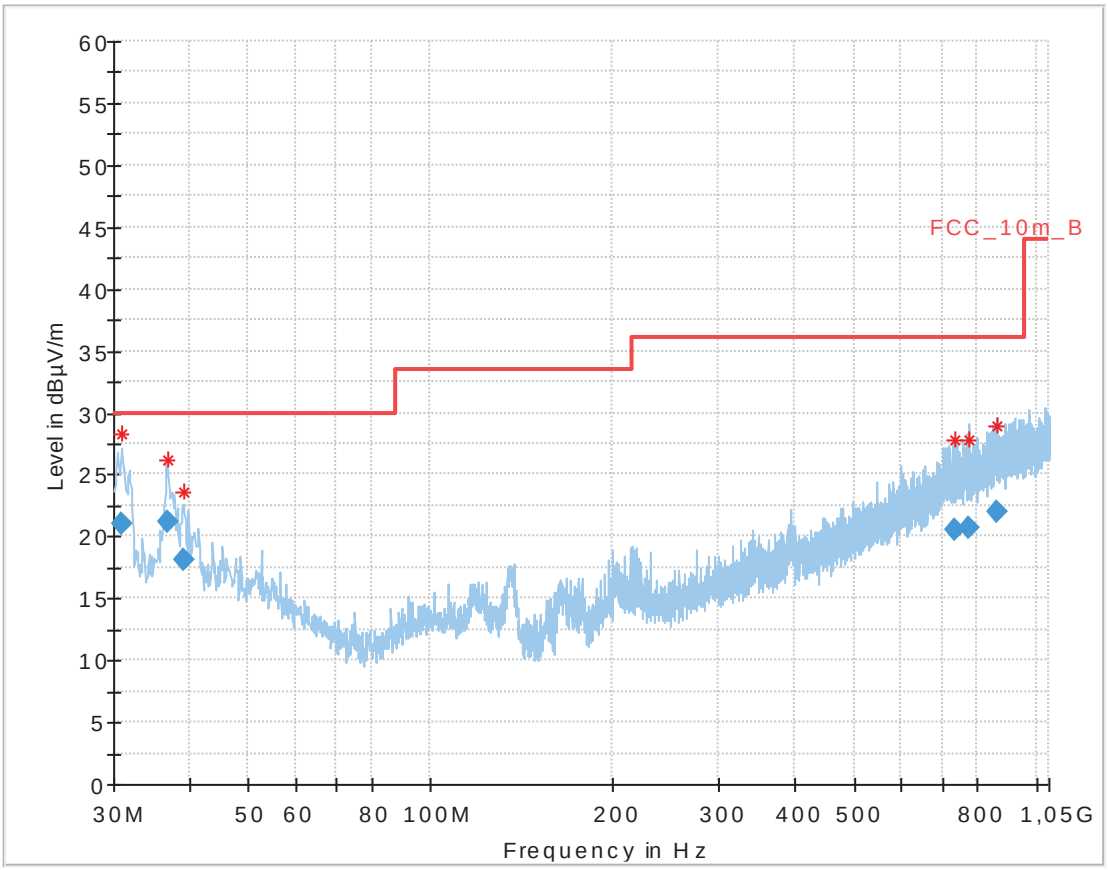
Plot 4: Lowest channel, 18 GHz to 26 GHz, vertical & horizontal polarization



Plot 5: Lowest channel, 26 GHz to 40 GHz, vertical & horizontal polarization



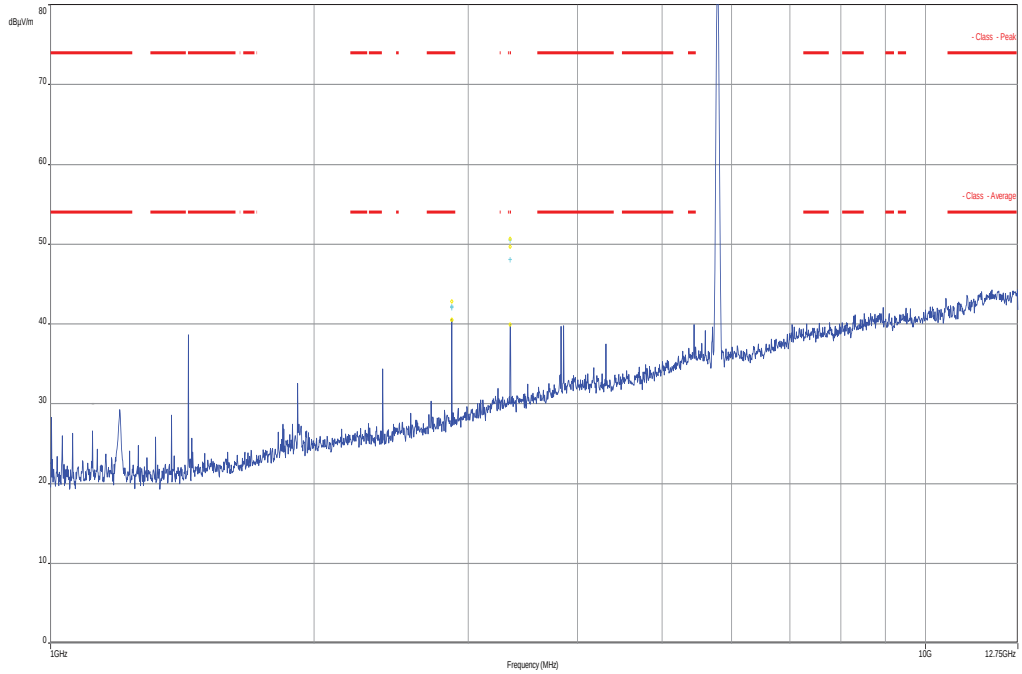
Plot 6: Middle channel, 30 MHz to 1 GHz, vertical & horizontal polarization



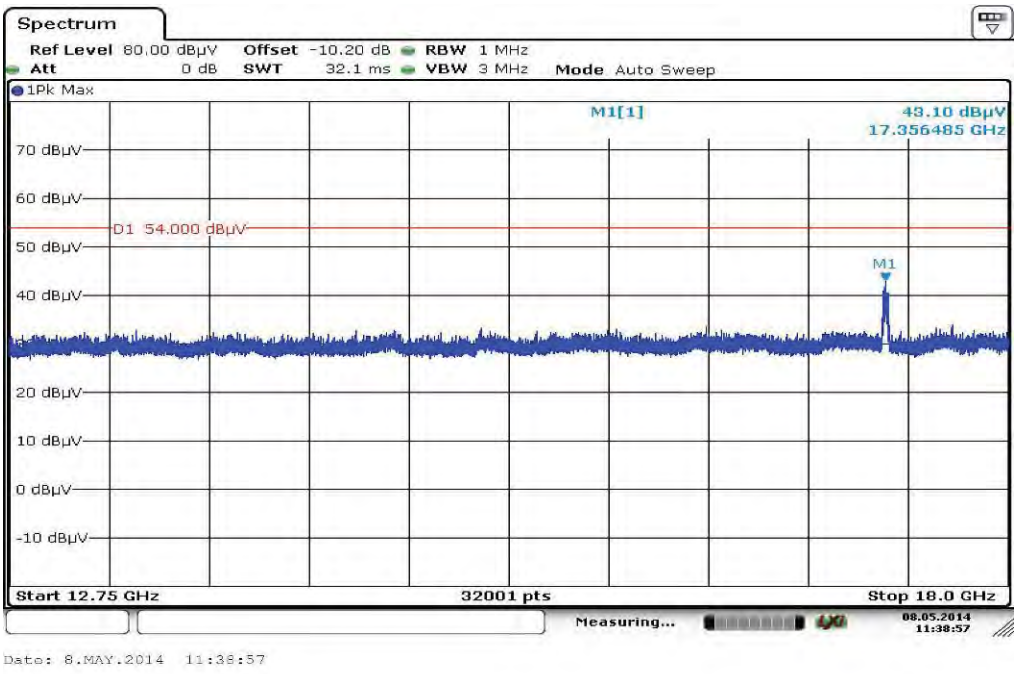
Final results:

Frequency (MHz)	Quasi Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.987300	21.07	30.00	8.93	1000.0	120.000	155.0	V	190.0	12.6
36.782100	21.26	30.00	8.74	1000.0	120.000	100.0	V	190.0	13.2
39.116250	18.07	30.00	11.93	1000.0	120.000	105.0	V	90.0	13.4
734.788200	20.47	36.00	15.53	1000.0	120.000	170.0	H	175.0	23.3
776.638950	20.70	36.00	15.30	1000.0	120.000	170.0	H	190.0	23.7
864.473400	21.93	36.00	14.07	1000.0	120.000	170.0	V	93.0	24.7

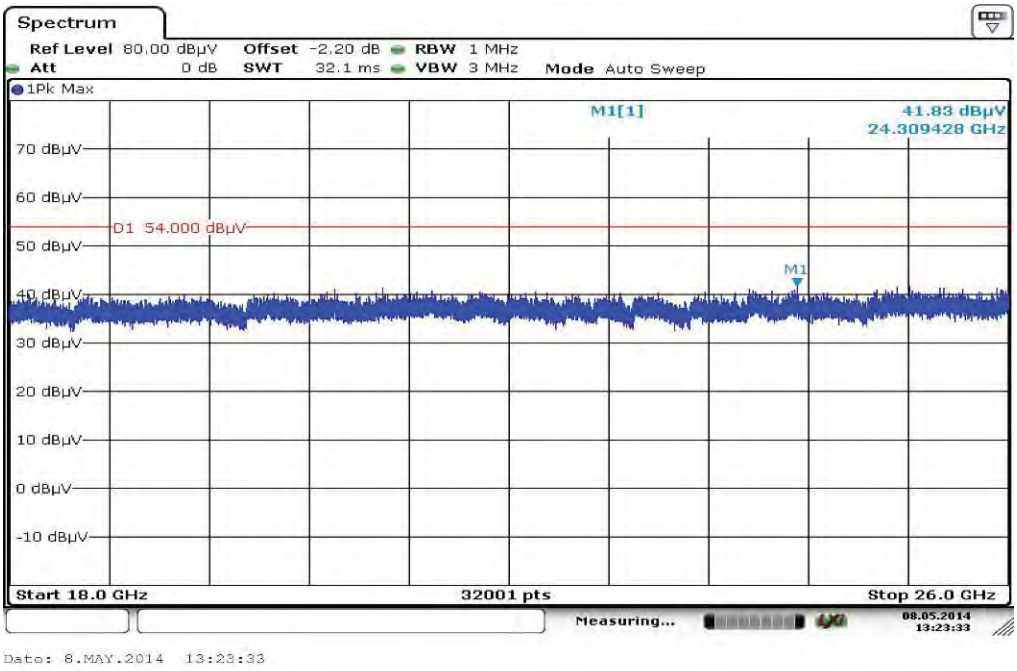
Plot 7: Middle channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization



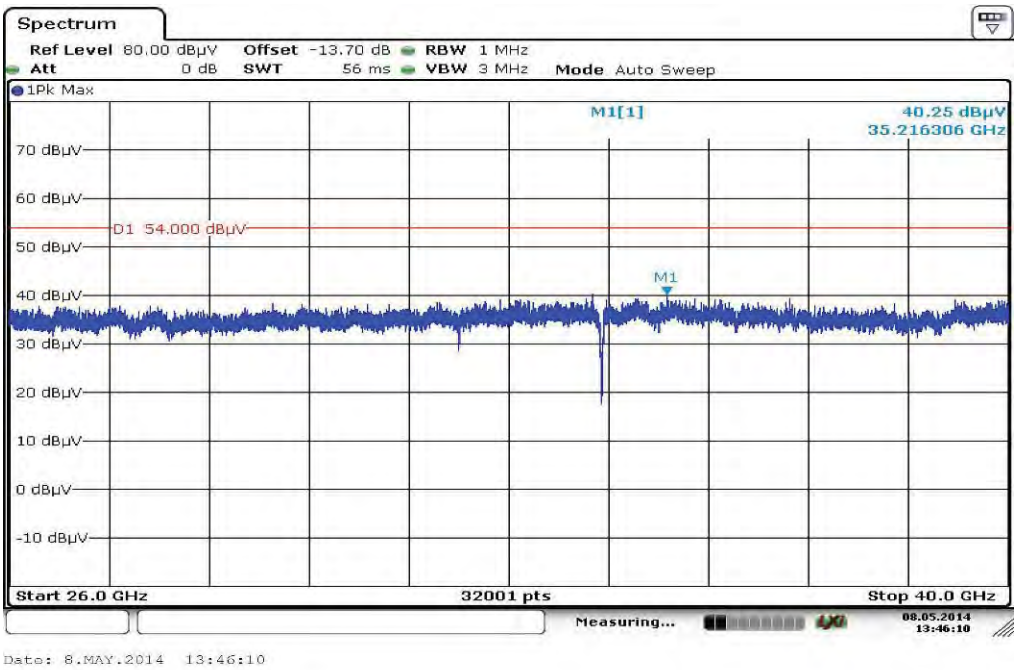
Plot 8: Middle channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization



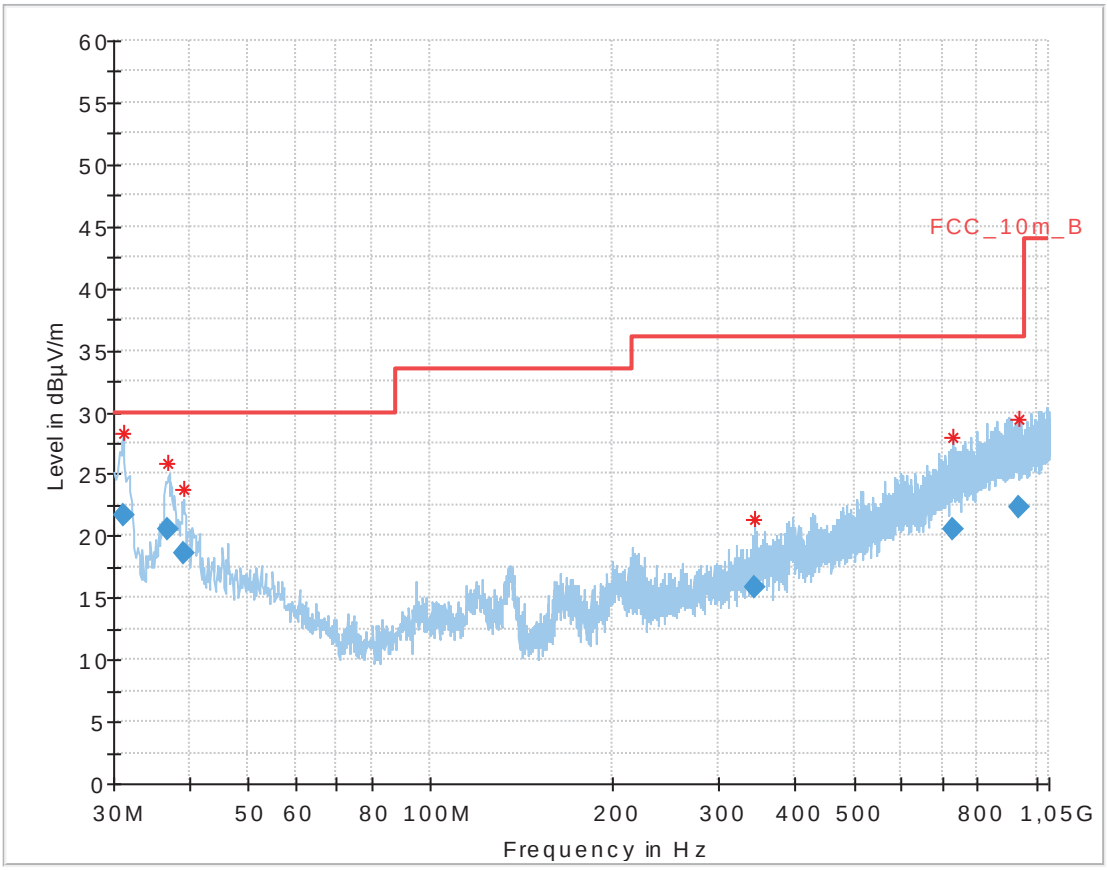
Plot 9: Middle channel, 18 GHz to 26 GHz, vertical & horizontal polarization



Plot 10: Middle channel, 26 GHz to 40 GHz, vertical & horizontal polarization



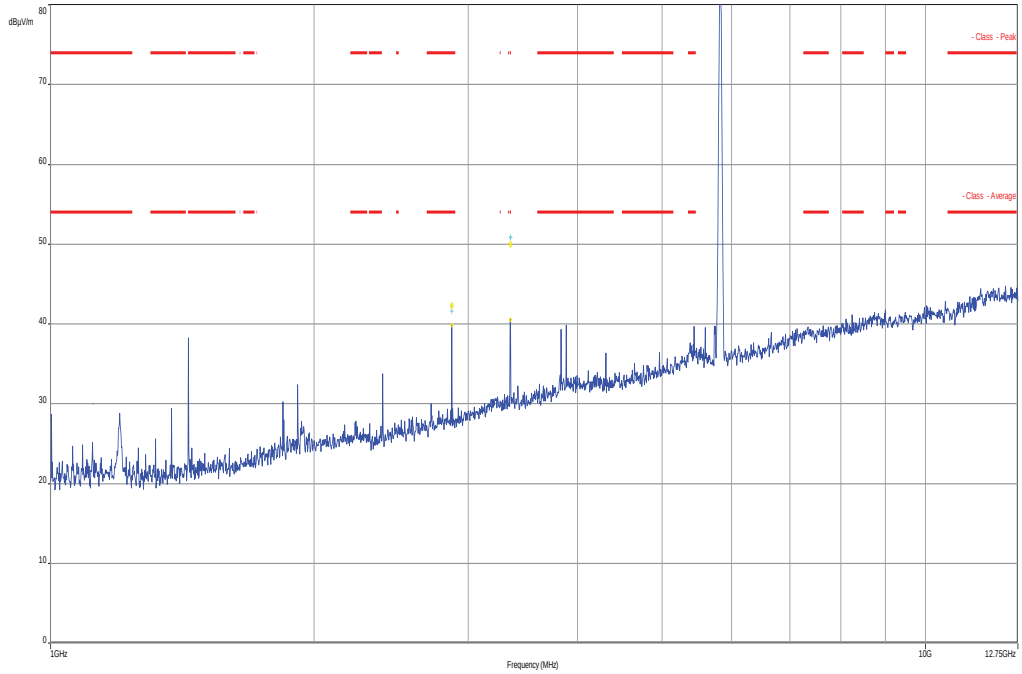
Plot 11: Highest channel, 30 MHz to 1 GHz, vertical & horizontal polarization



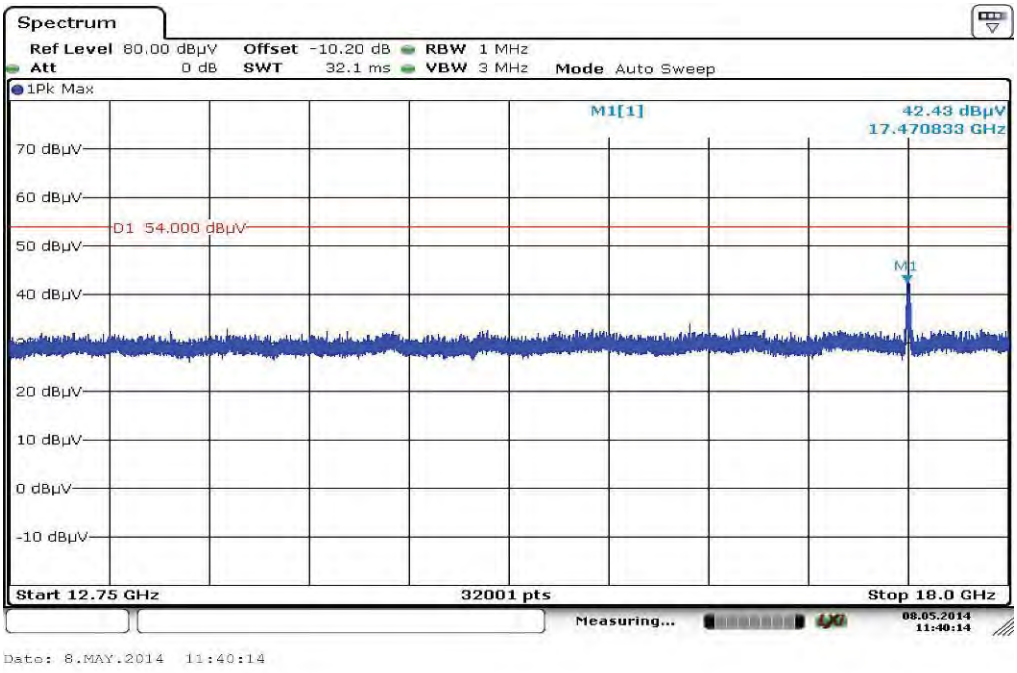
Final results:

Frequency (MHz)	Quasi Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
31.106700	21.60	30.00	8.40	1000.0	120.000	101.0	V	-10.0	12.6
36.922500	20.52	30.00	9.48	1000.0	120.000	98.0	V	-9.0	13.2
39.071250	18.67	30.00	11.33	1000.0	120.000	112.0	V	180.0	13.4
342.825600	15.89	36.00	20.11	1000.0	120.000	145.0	V	190.0	15.9
730.225050	20.51	36.00	15.49	1000.0	120.000	170.0	H	175.0	23.2
935.472300	22.37	36.00	13.63	1000.0	120.000	170.0	H	100.0	25.3

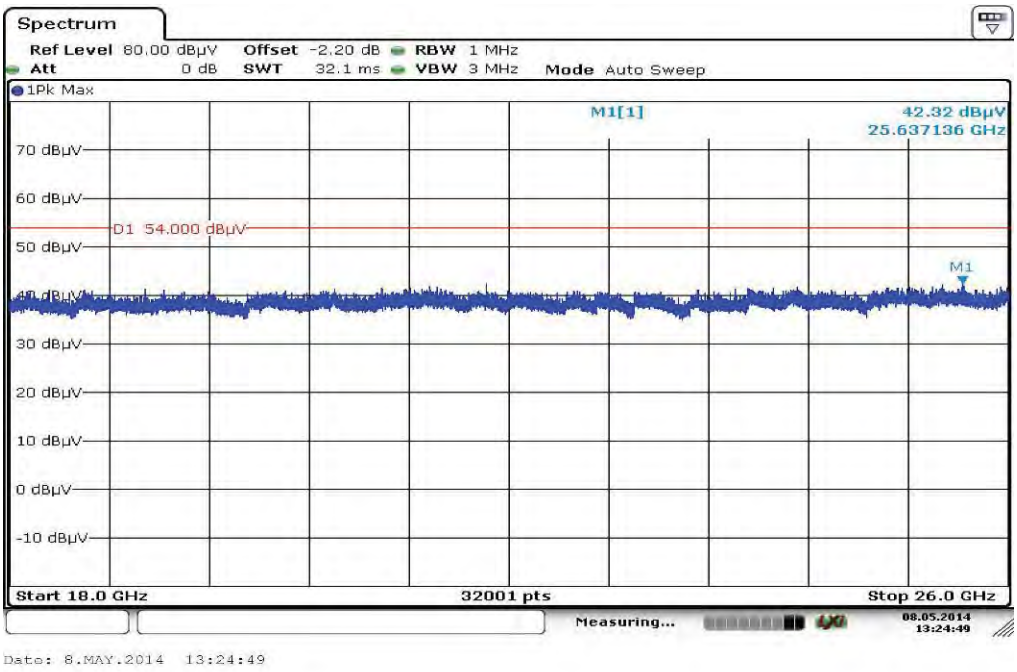
Plot 12: Highest channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization



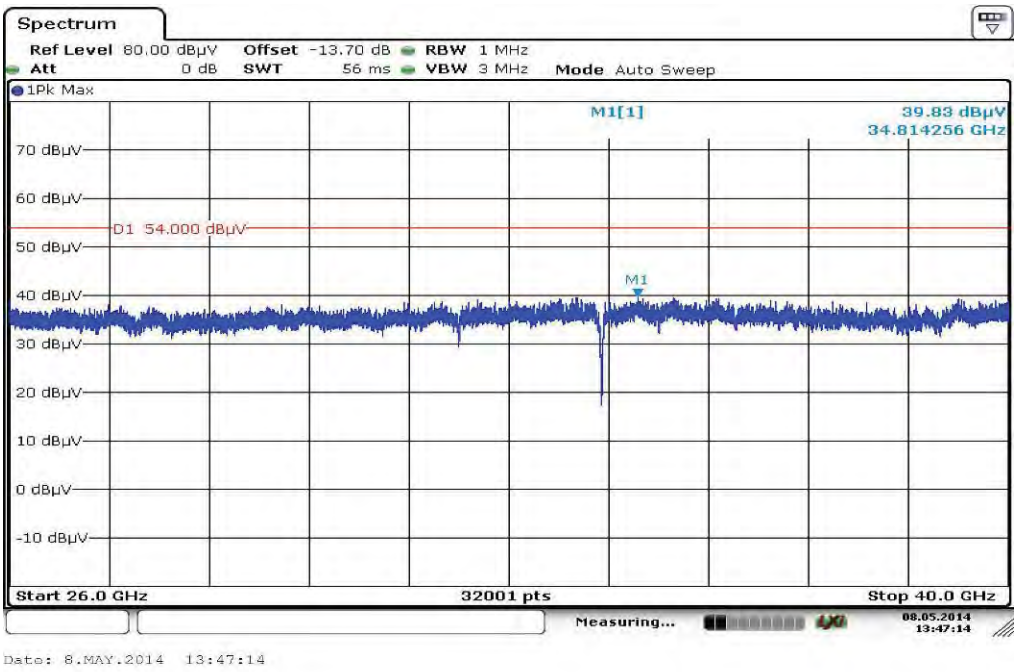
Plot 13: Highest channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization



Plot 14: Highest channel, 18 GHz to 26 GHz, vertical & horizontal polarization

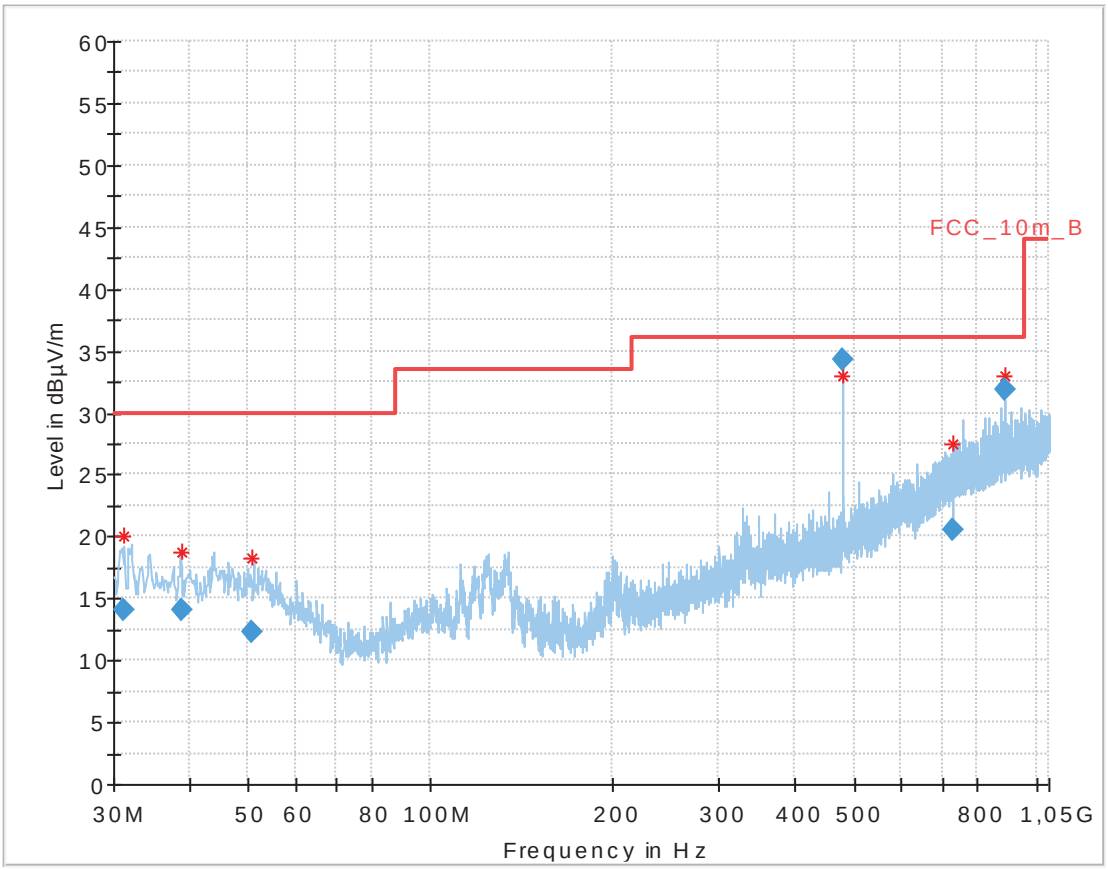


Plot 15: Highest channel, 26 GHz to 40 GHz, vertical & horizontal polarization



Plots: OFDM / n HT20 – mode

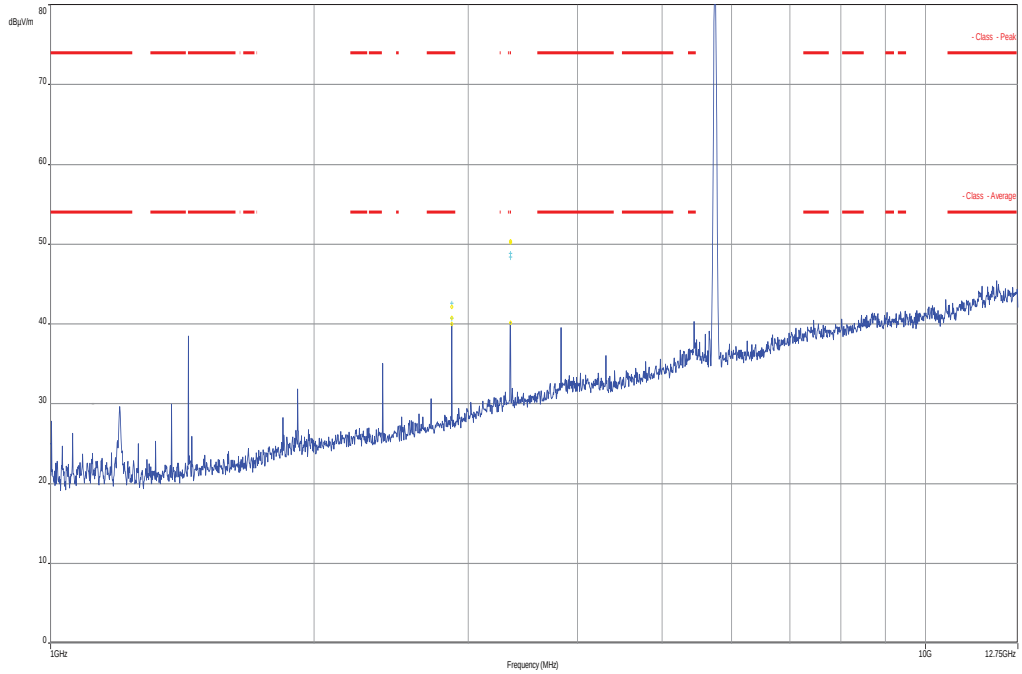
Plot 1: Lowest channel, 30 MHz to 1 GHz, vertical & horizontal polarization



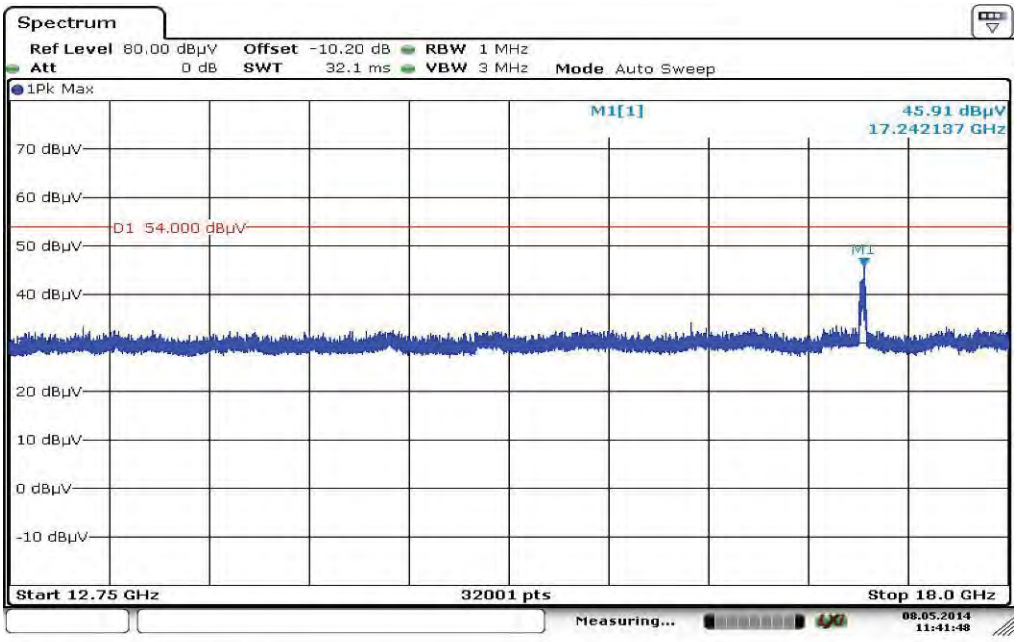
Final results:

Frequency (MHz)	Quasi Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
31.161450	14.03	30.00	15.97	1000.0	120.000	146.0	V	81.0	12.6
38.725200	14.07	30.00	15.93	1000.0	120.000	101.0	V	1.0	13.3
50.615700	12.32	30.00	17.68	1000.0	120.000	98.0	V	190.0	13.3
478.989450	34.31	36.00	1.69	1000.0	120.000	131.0	H	10.0	18.3
729.657150	20.57	36.00	15.43	1000.0	120.000	170.0	H	170.0	23.2
887.746950	31.92	36.00	4.08	1000.0	120.000	106.0	H	280.0	25.0

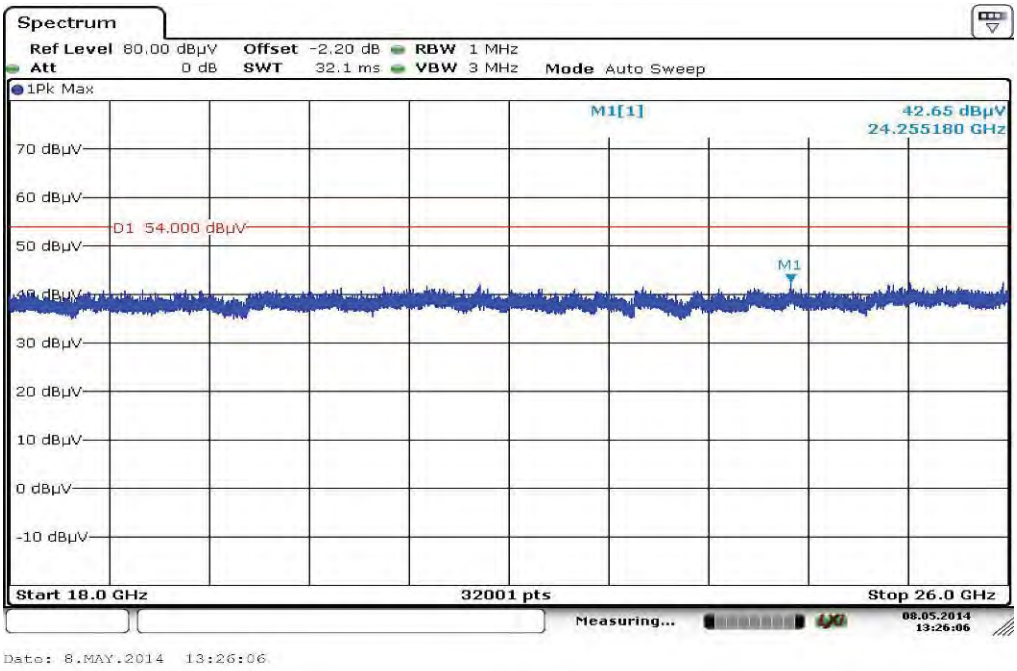
Plot 2: Lowest channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization



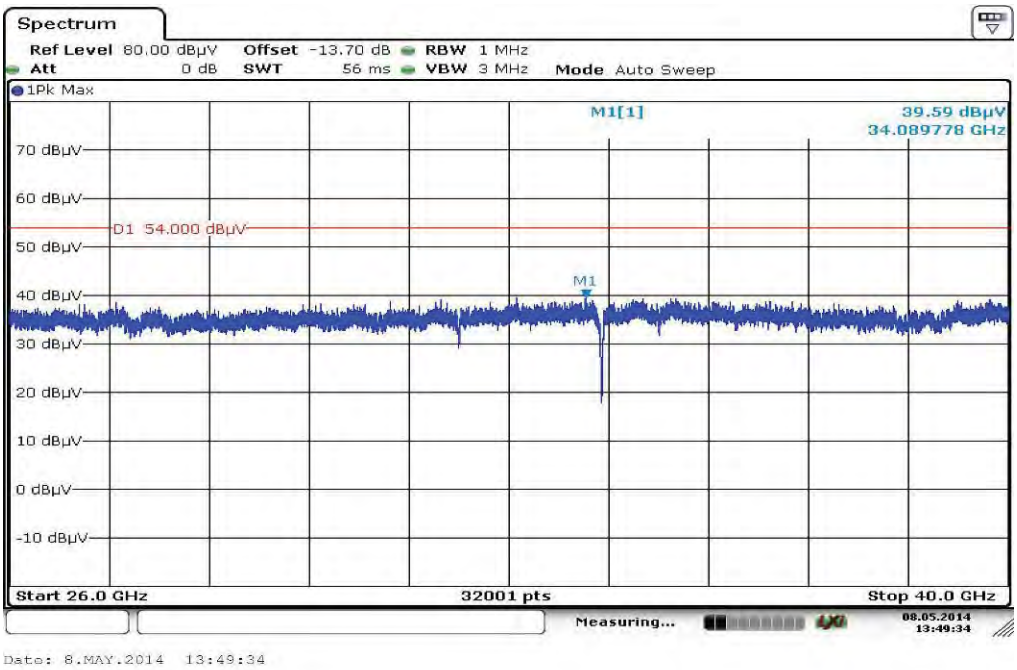
Plot 3: Lowest channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization



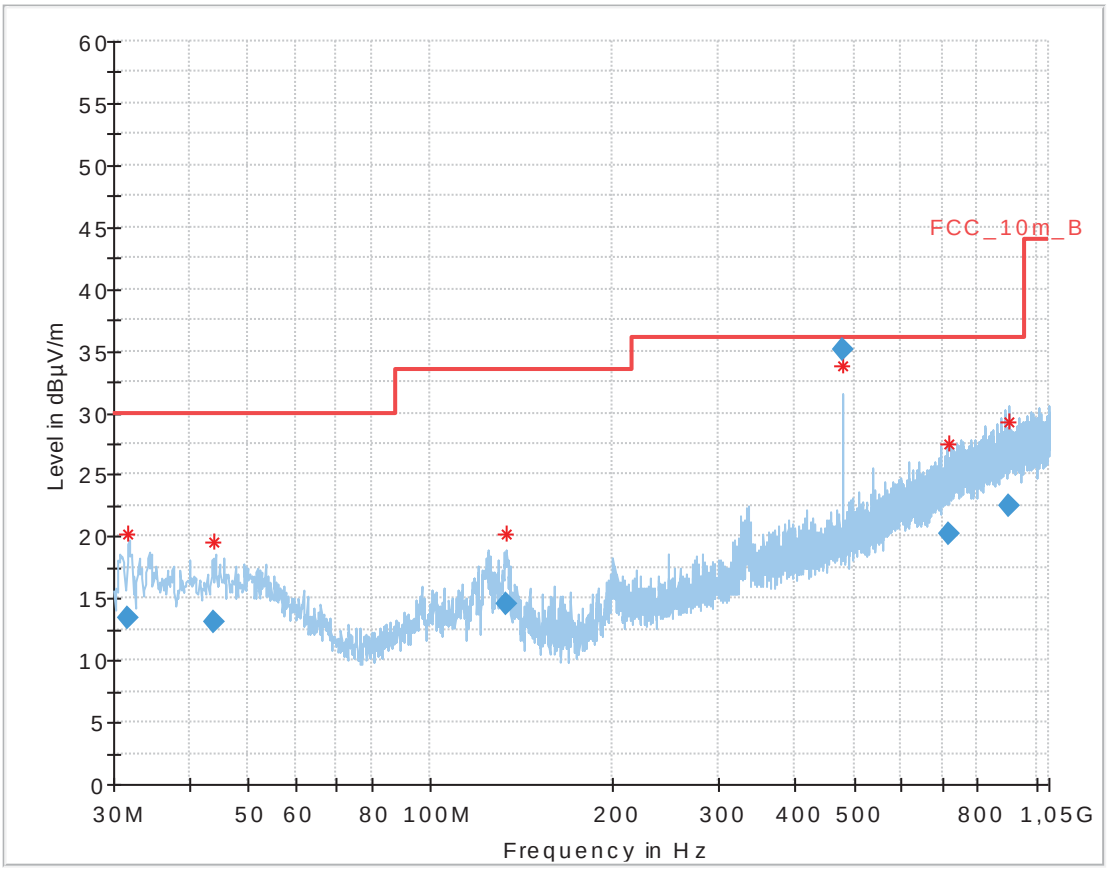
Plot 4: Lowest channel, 18 GHz to 26 GHz, vertical & horizontal polarization



Plot 5: Lowest channel, 26 GHz to 40 GHz, vertical & horizontal polarization



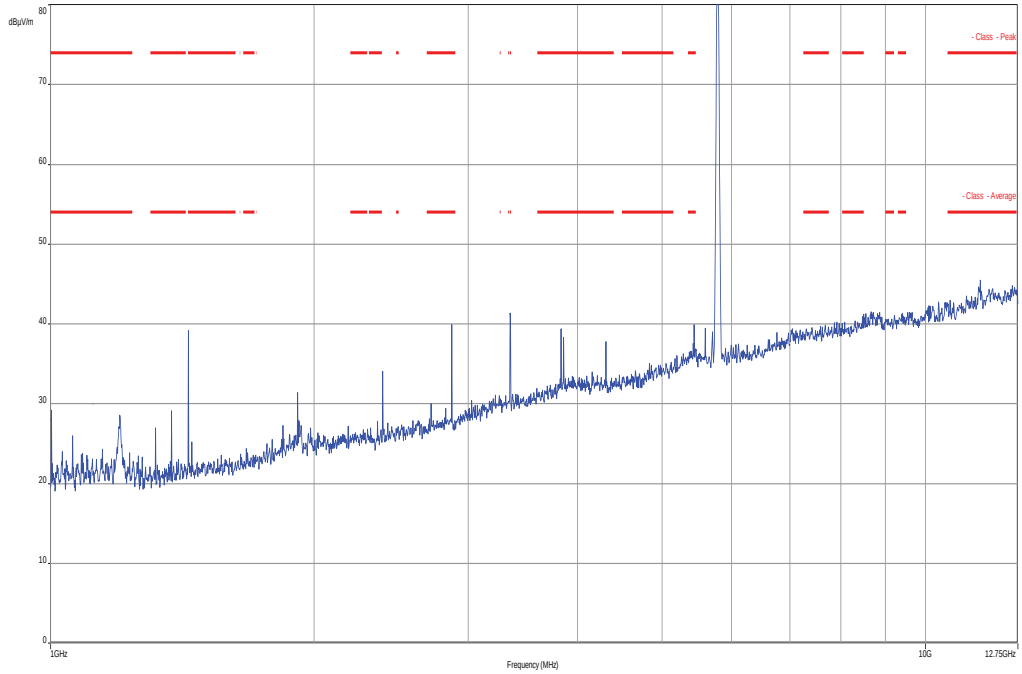
Plot 6: Middle channel, 30 MHz to 1 GHz, vertical & horizontal polarization



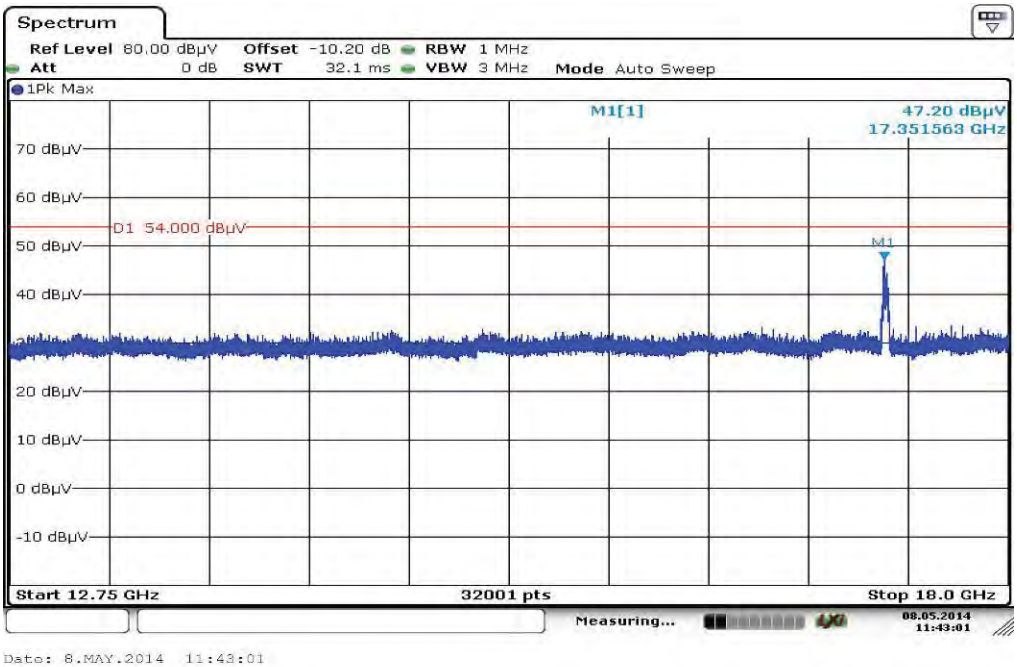
Final results:

Frequency (MHz)	Quasi Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
31.710300	13.47	30.00	16.53	1000.0	120.000	101.0	V	176.0	12.7
43.762650	13.13	30.00	16.87	1000.0	120.000	170.0	V	190.0	13.3
133.156800	14.56	33.50	18.94	1000.0	120.000	170.0	V	83.0	9.2
478.985250	35.14	36.00	0.86	1000.0	120.000	129.0	H	10.0	18.3
714.900750	20.26	36.00	15.74	1000.0	120.000	131.0	V	100.0	22.9
904.066050	22.52	36.00	13.48	1000.0	120.000	161.0	V	260.0	25.2

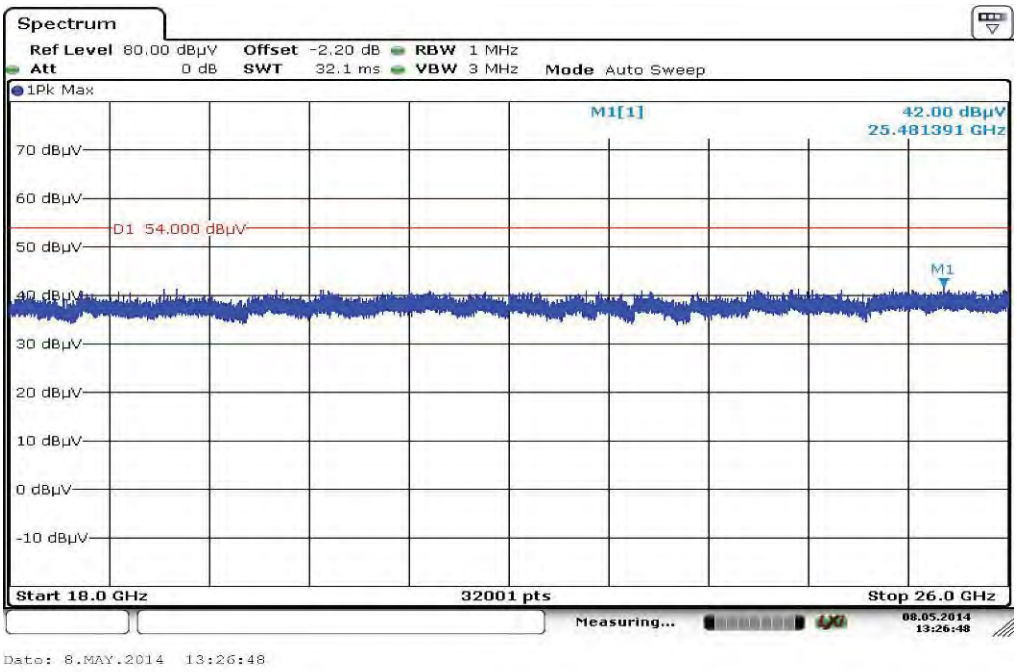
Plot 7: Middle channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization



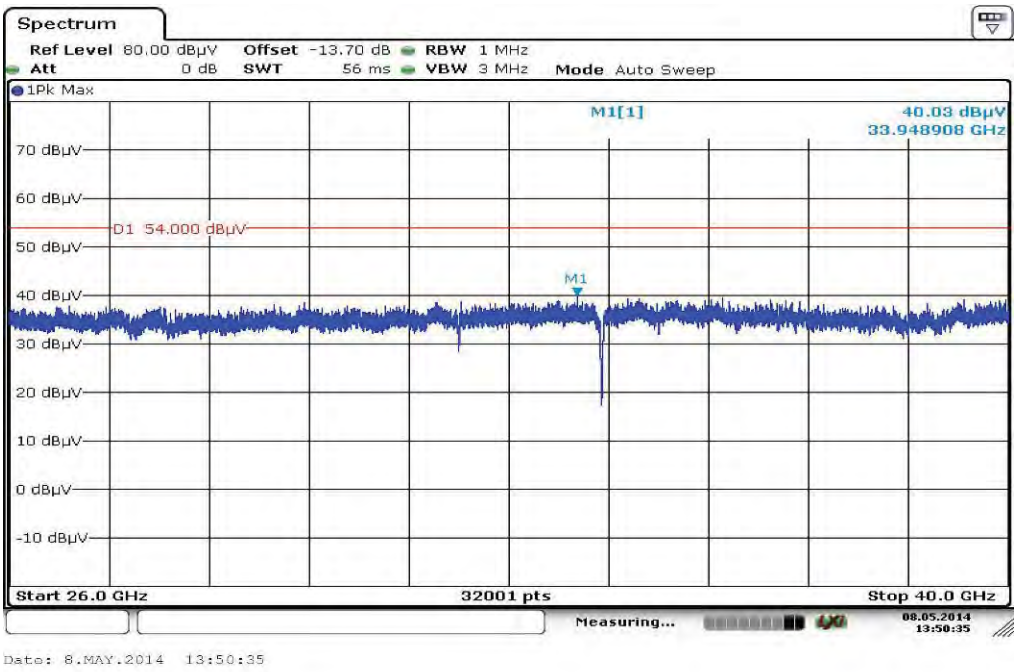
Plot 8: Middle channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization



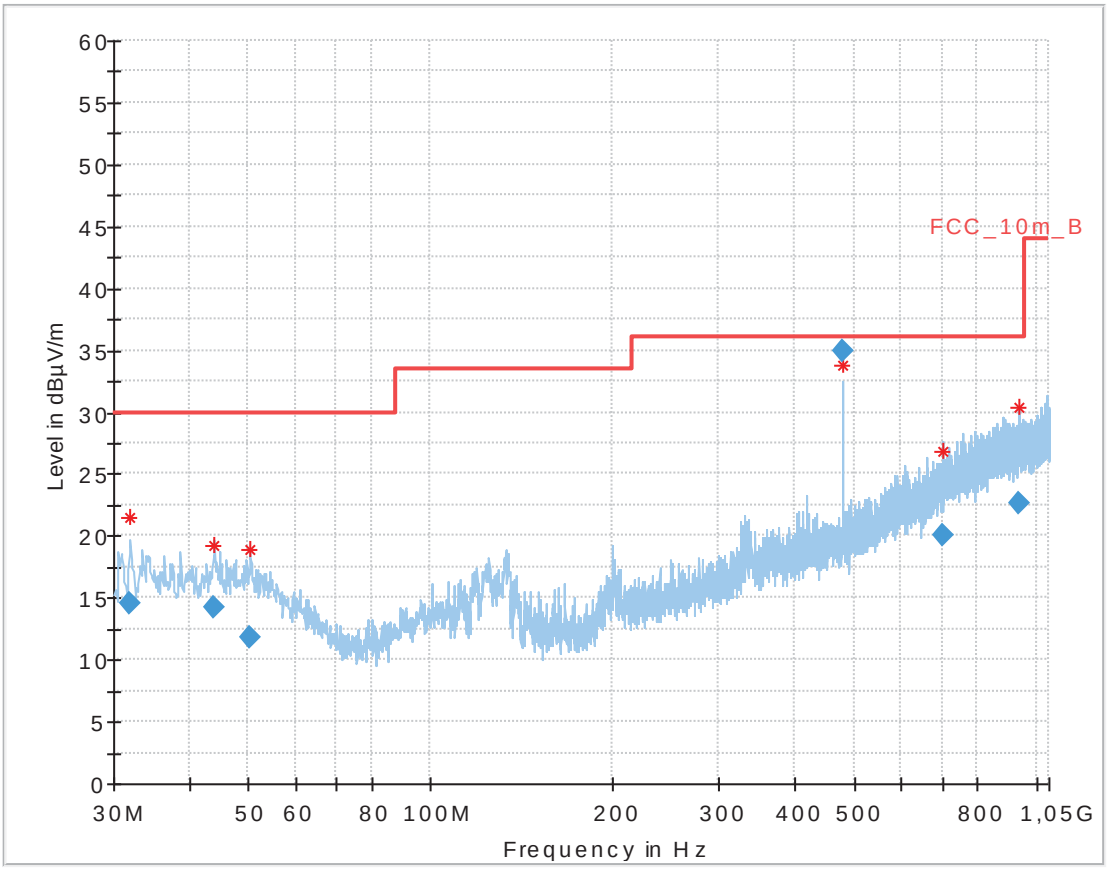
Plot 9: Middle channel, 18 GHz to 26 GHz, vertical & horizontal polarization



Plot 10: Middle channel, 26 GHz to 40 GHz, vertical & horizontal polarization



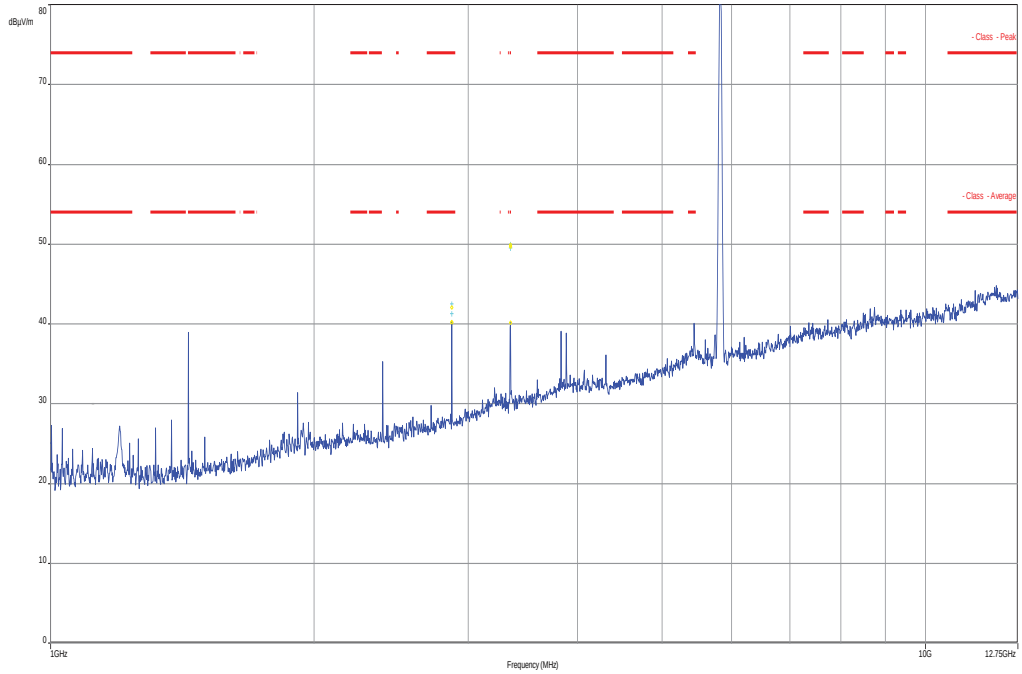
Plot 11: Highest channel, 30 MHz to 1 GHz, vertical & horizontal polarization



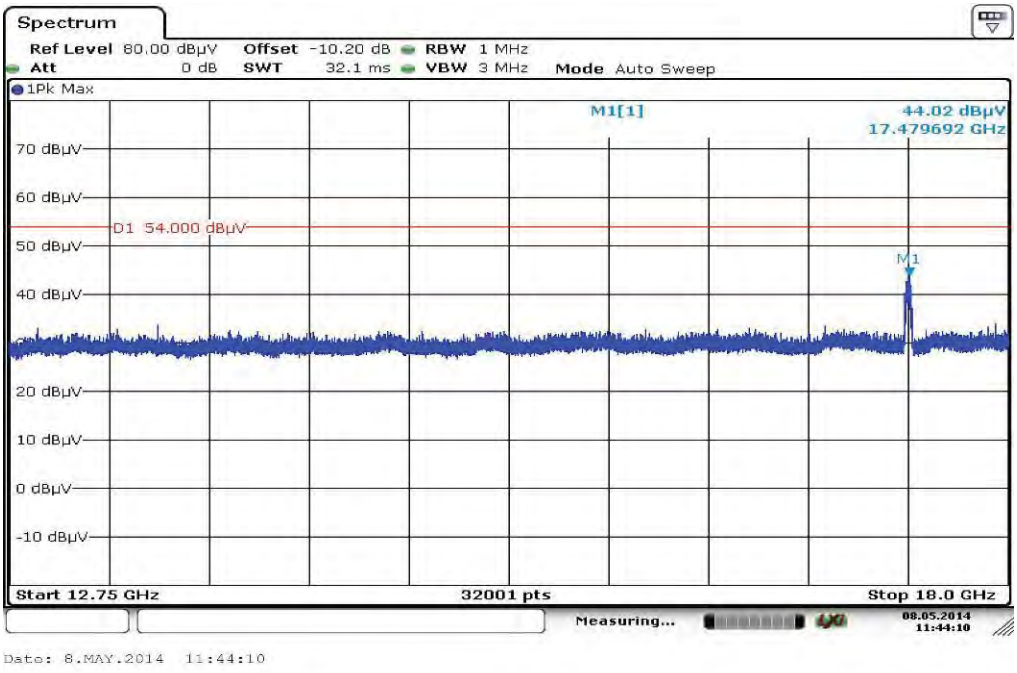
Final results:

Frequency (MHz)	Quasi Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
31.995750	14.57	30.00	15.43	1000.0	120.000	151.0	V	81.0	12.7
43.753050	14.29	30.00	15.71	1000.0	120.000	98.0	V	100.0	13.3
50.510700	11.82	30.00	18.18	1000.0	120.000	101.0	V	10.0	13.3
478.996050	34.90	36.00	1.10	1000.0	120.000	163.0	H	10.0	18.3
703.243350	19.99	36.00	16.01	1000.0	120.000	170.0	H	83.0	22.6
940.070250	22.70	36.00	13.30	1000.0	120.000	170.0	V	181.0	25.3

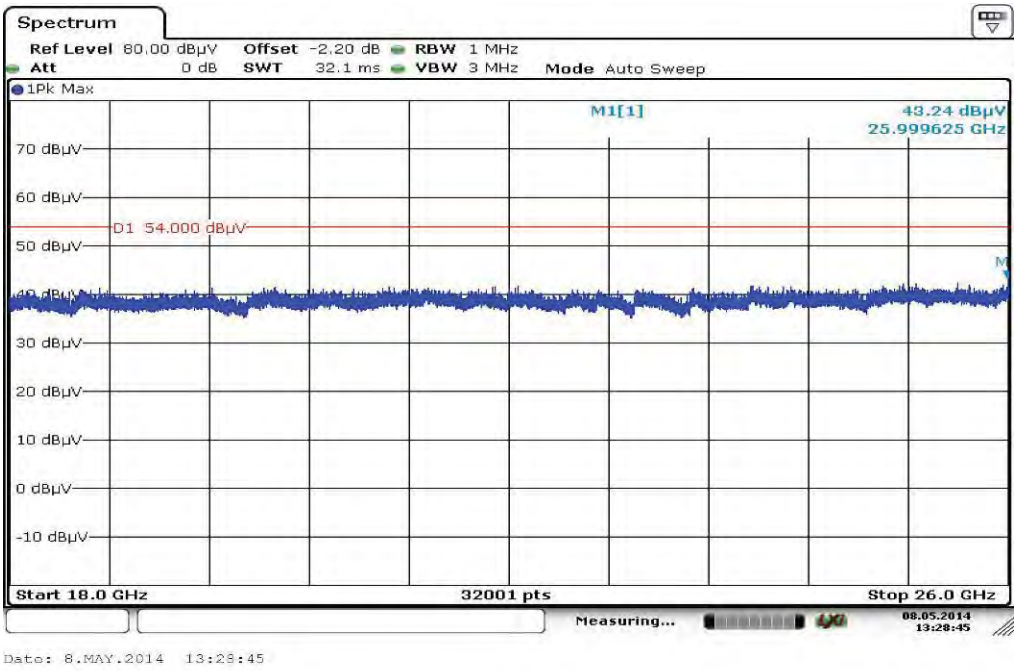
Plot 12: Highest channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization



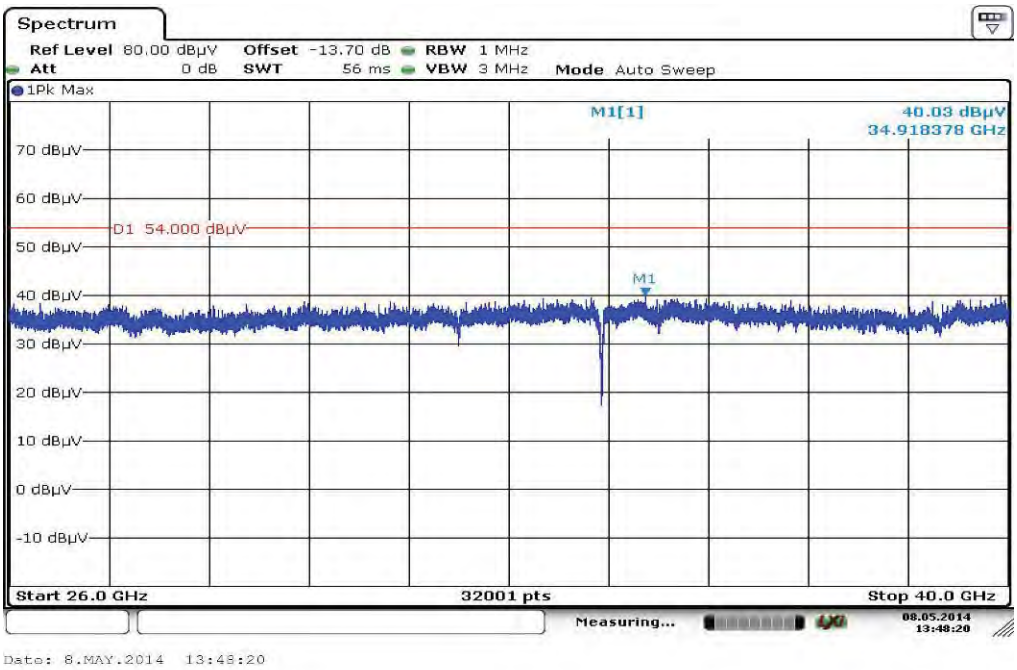
Plot 13: Highest channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization



Plot 14: Highest channel, 18 GHz to 26 GHz, vertical & horizontal polarization

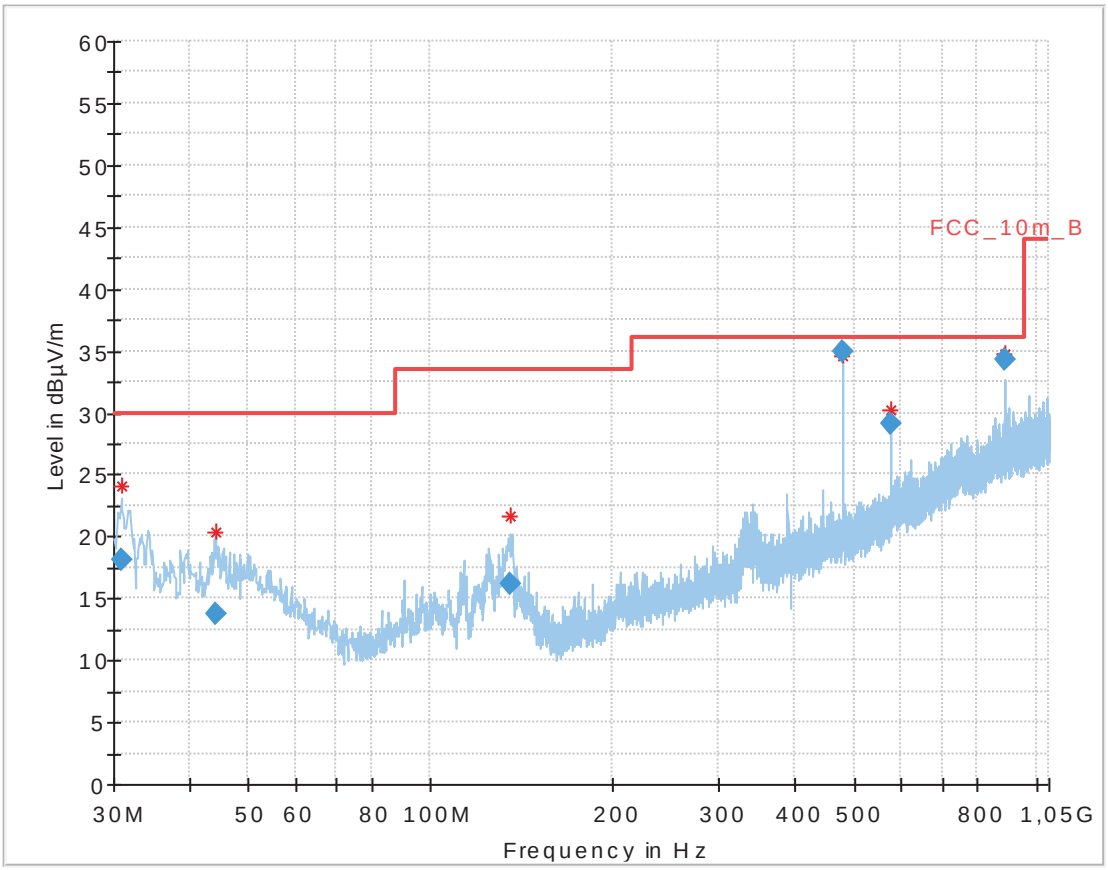


Plot 15: Highest channel, 26 GHz to 40 GHz, vertical & horizontal polarization



Plots: OFDM / n HT40 – mode

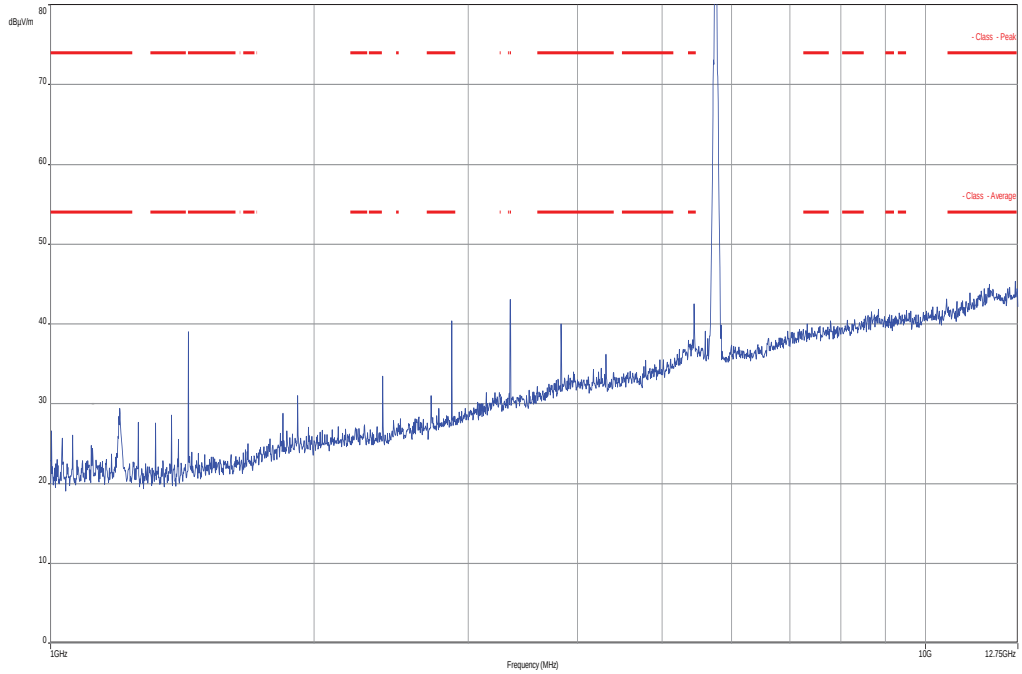
Plot 1: Lowest channel, 30 MHz to 1 GHz, vertical & horizontal polarization



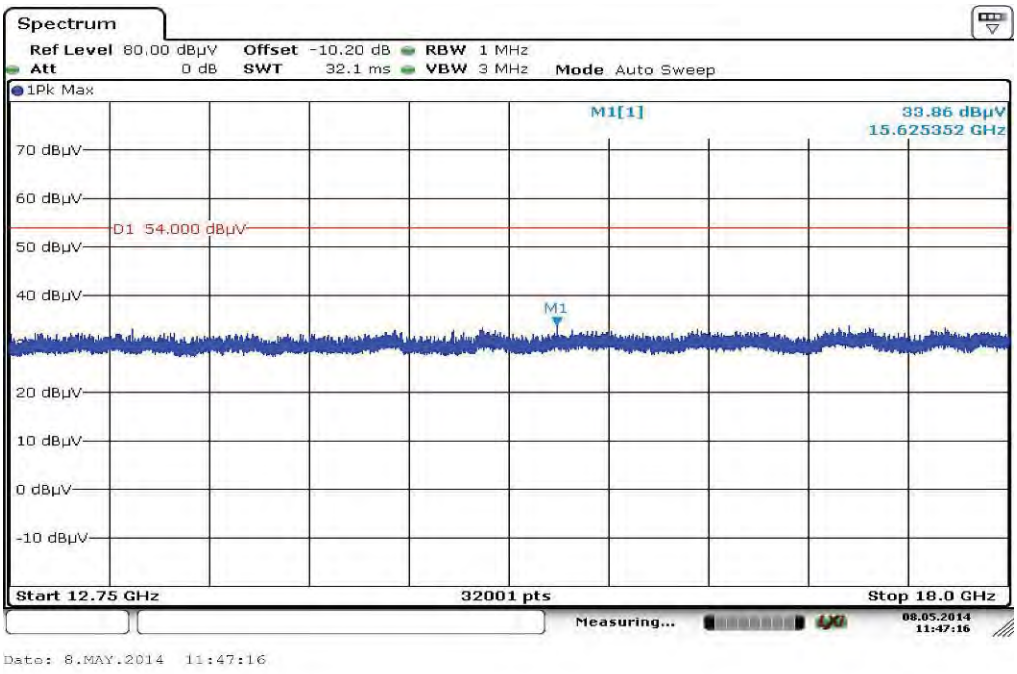
Final results:

Frequency (MHz)	Quasi Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.867900	18.13	30.00	11.87	1000.0	120.000	101.0	V	261.0	12.6
44.283300	13.70	30.00	16.30	1000.0	120.000	122.0	V	181.0	13.3
135.150900	16.10	33.50	17.40	1000.0	120.000	170.0	V	83.0	9.0
478.983900	34.99	36.00	1.01	1000.0	120.000	170.0	H	-2.0	18.3
574.996800	29.14	36.00	6.86	1000.0	120.000	170.0	H	81.0	20.1
887.757000	34.25	36.00	1.75	1000.0	120.000	118.0	H	190.0	25.0

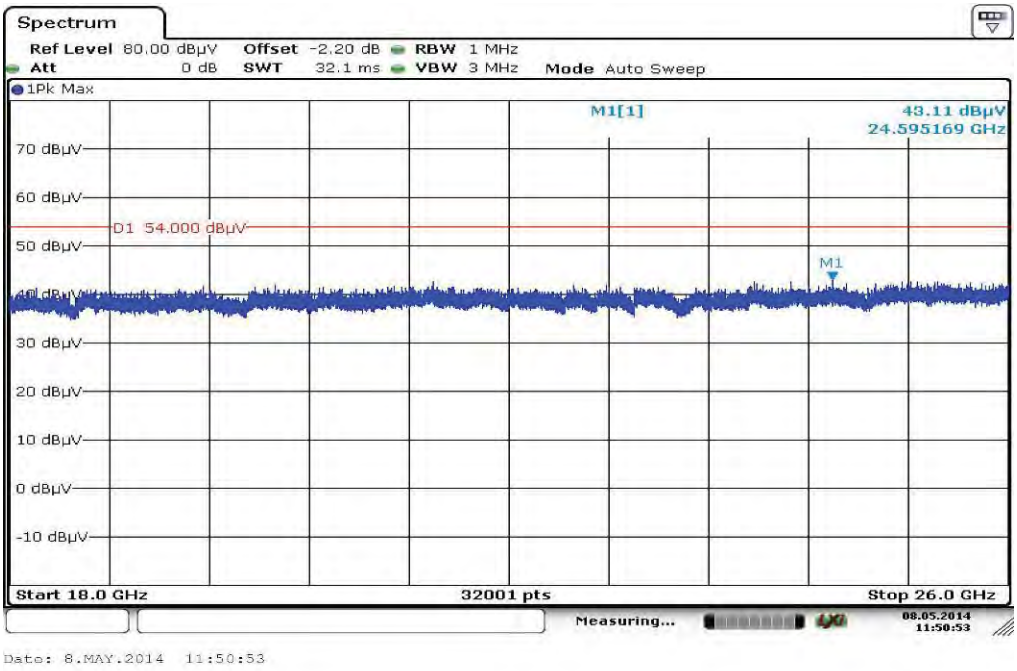
Plot 2: Lowest channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization



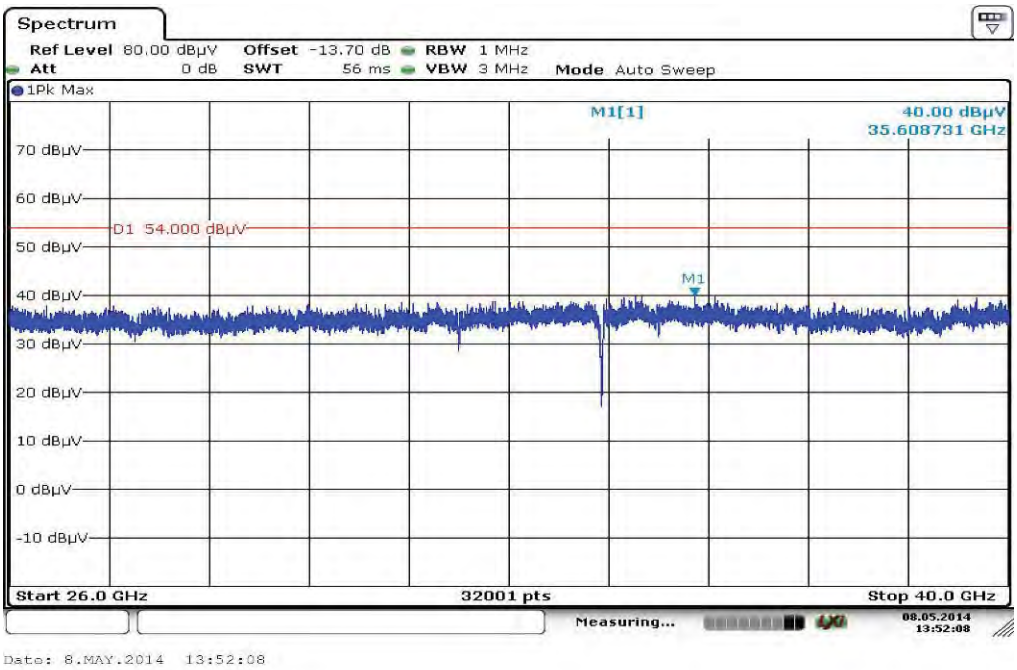
Plot 3: Lowest channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization



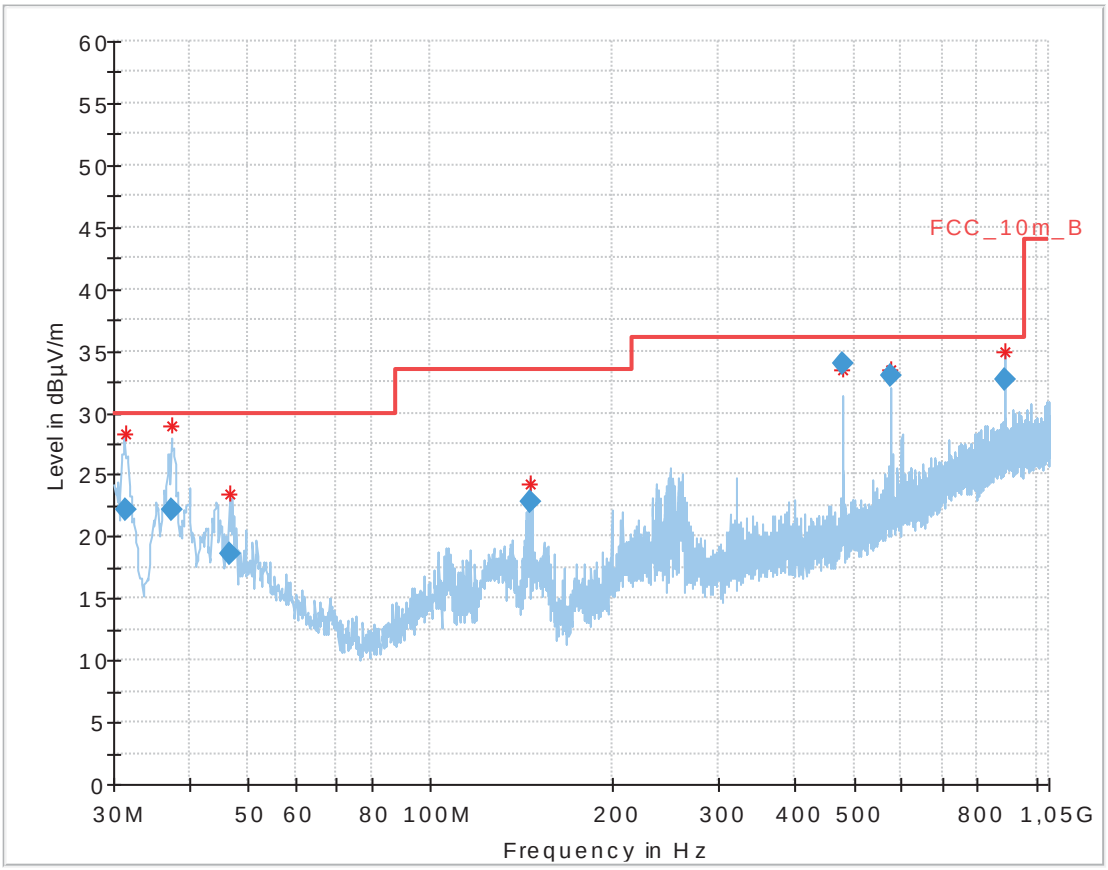
Plot 4: Lowest channel, 18 GHz to 26 GHz, vertical & horizontal polarization



Plot 5: Lowest channel, 26 GHz to 40 GHz, vertical & horizontal polarization



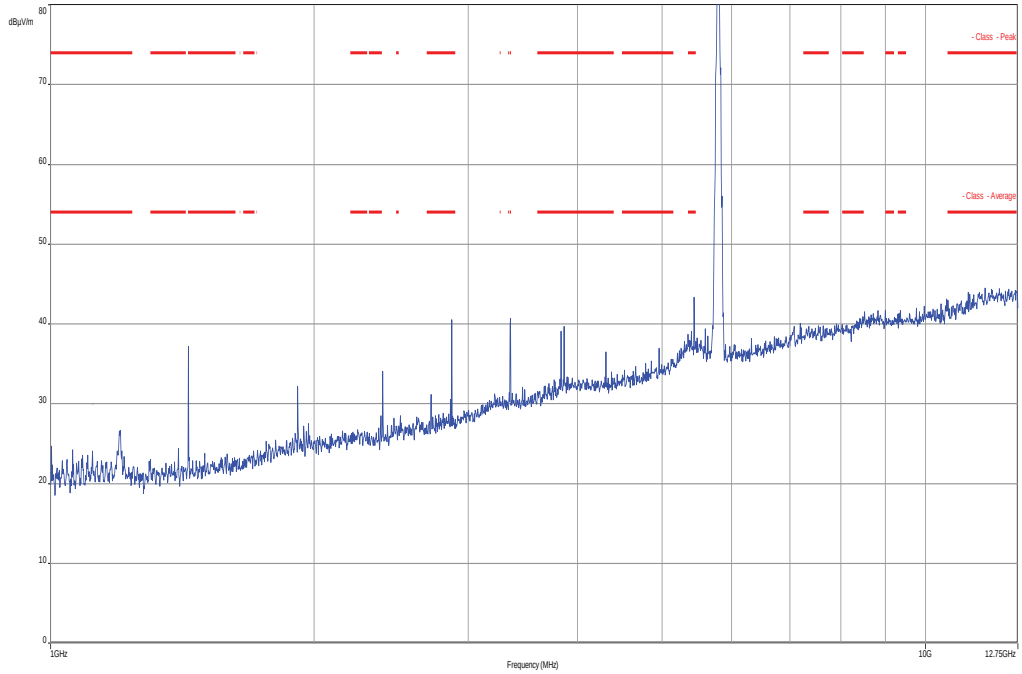
Plot 6: Highest channel, 30 MHz to 1 GHz, vertical & horizontal polarization



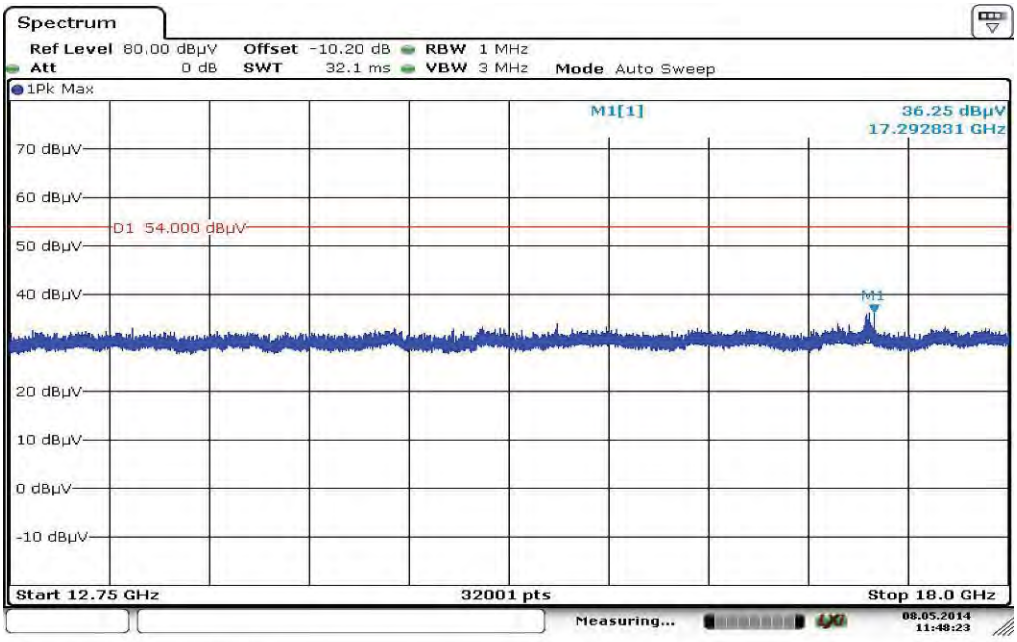
Final results:

Frequency (MHz)	Quasi Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
31.442400	22.13	30.00	7.87	1000.0	120.000	117.0	V	10.0	12.7
37.424850	22.18	30.00	7.82	1000.0	120.000	98.0	V	10.0	13.2
46.663800	18.61	30.00	11.39	1000.0	120.000	170.0	V	280.0	13.3
145.931250	22.76	33.50	10.74	1000.0	120.000	115.0	V	100.0	8.8
478.980900	33.99	36.00	2.01	1000.0	120.000	170.0	H	1.0	18.3
574.980300	33.00	36.00	3.00	1000.0	120.000	145.0	H	10.0	20.1
887.753550	32.61	36.00	3.39	1000.0	120.000	112.0	H	88.0	25.0

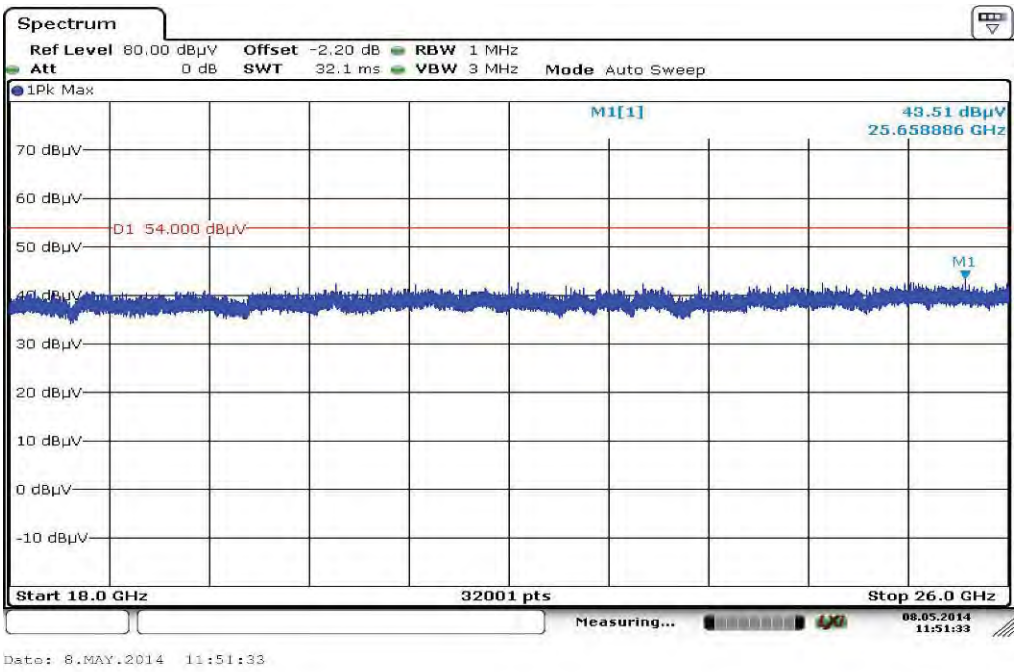
Plot 7: Highest channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization



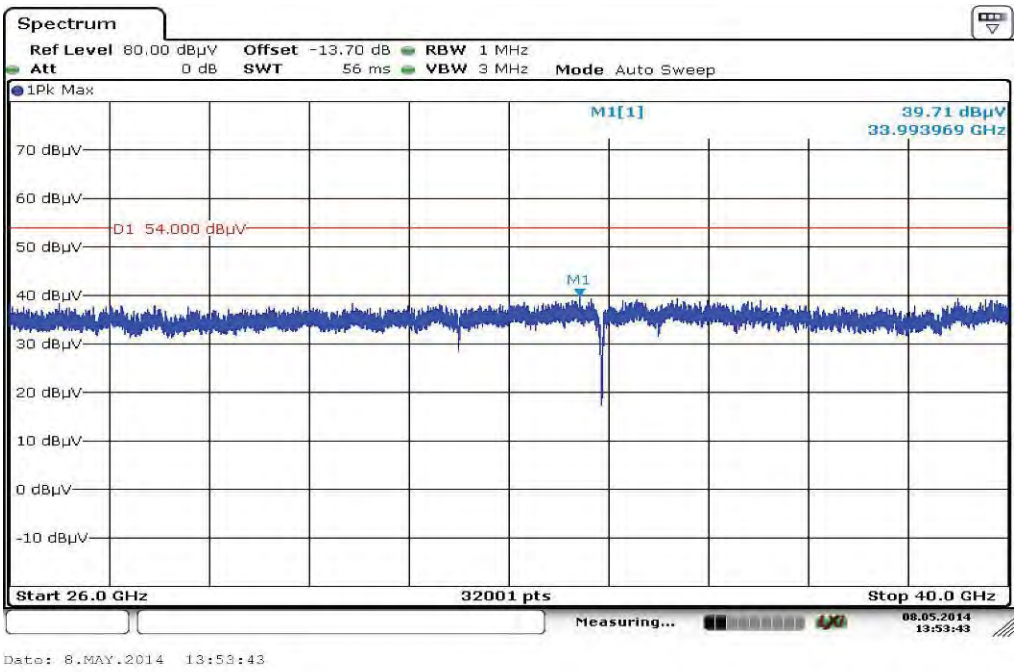
Plot 8: Highest channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization



Plot 9: Highest channel, 18 GHz to 26 GHz, vertical & horizontal polarization



Plot 10: Highest channel, 26 GHz to 40 GHz, vertical & horizontal polarization



12.10 RX spurious emissions radiated

Description:

Measurement of the radiated spurious emissions in idle/receive mode.

Measurement:

Measurement parameter	
Detector:	Quasi Peak below 1 GHz (alternative Peak) Peak above 1 GHz / RMS
Sweep time:	Auto
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz
Video bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: ≥ 3 MHz
Span:	30 MHz to 40 GHz
Trace-Mode:	Max Hold / Average with 100 counts + 20 log (1 / X) for duty cycle lower than 100 %
Test setup:	see chapter 7.1 & 7.2 & 7.3
Measurement uncertainty:	see chapter 9

Limits:

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

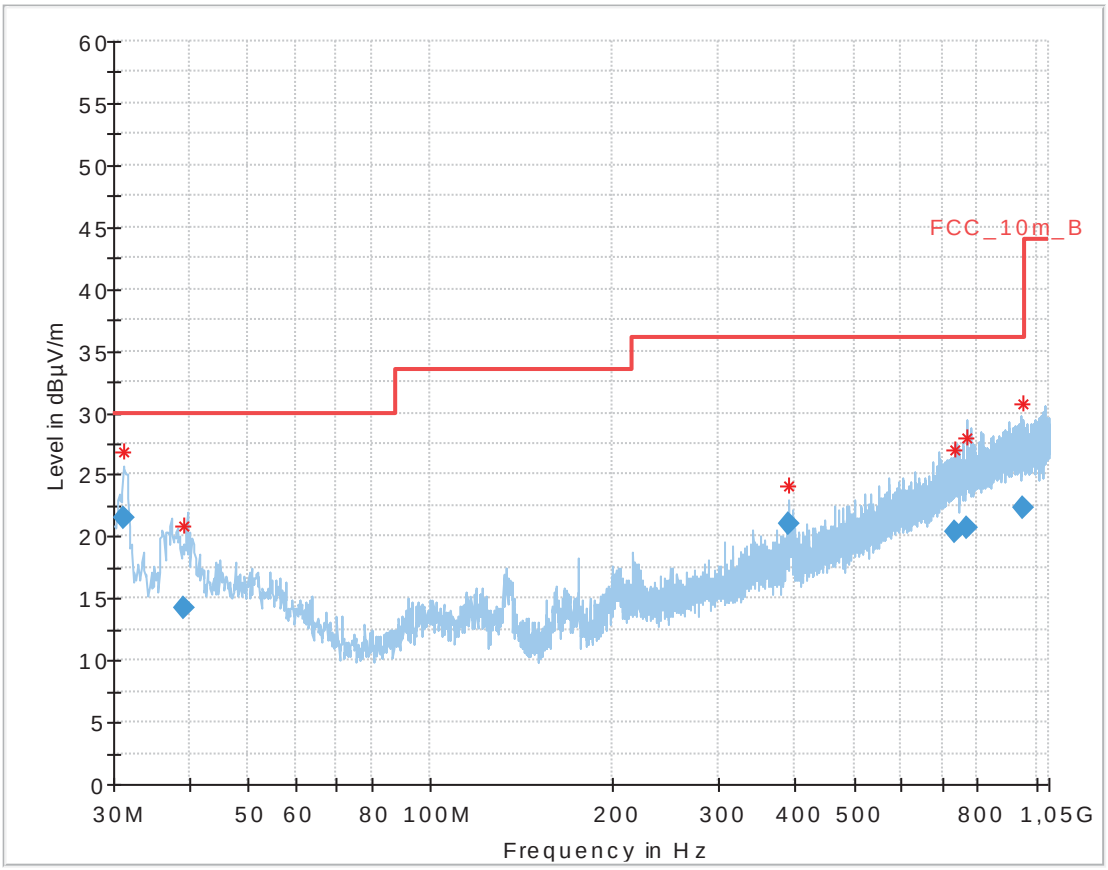
Results:

RX Spurious Emissions Radiated [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
All detected emissions are more than 8 dB below the limit.		

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

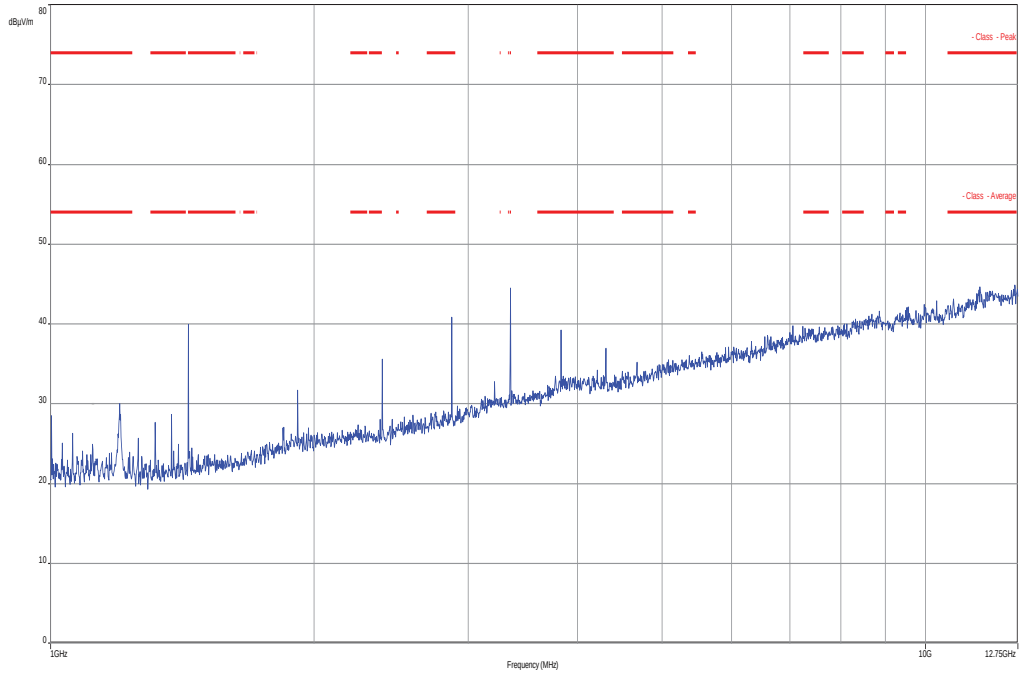
Plot 1: 30 MHz to 1 GHz, vertical & horizontal polarization



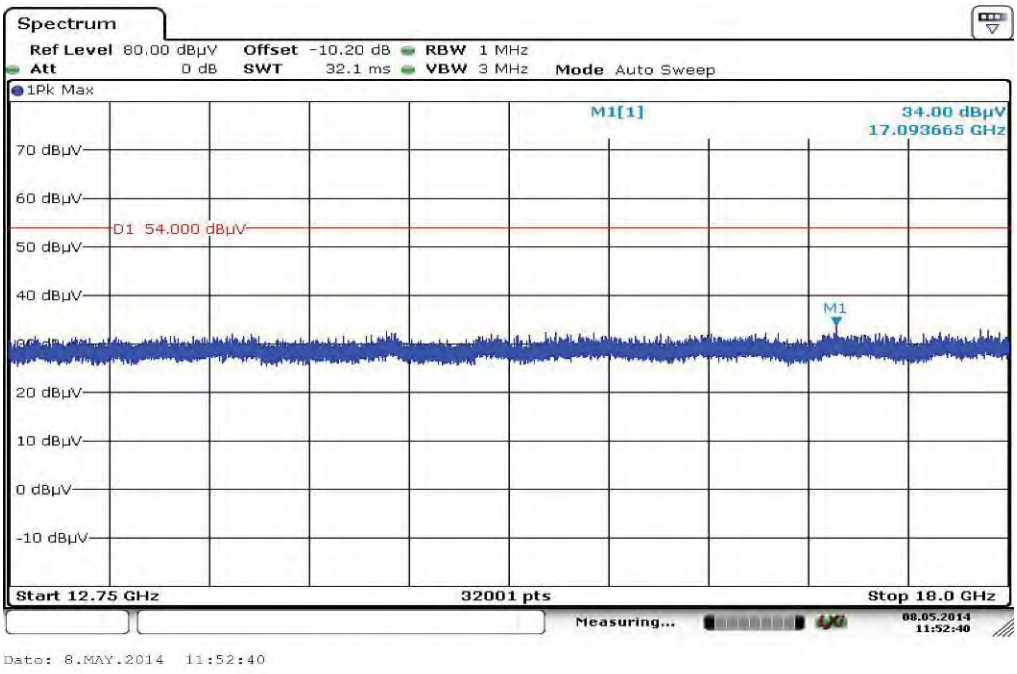
Final results:

Frequency (MHz)	Quasi Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
31.179450	21.48	30.00	8.52	1000.0	120.000	101.0	V	10.0	12.6
39.225900	14.25	30.00	15.75	1000.0	120.000	98.0	V	10.0	13.4
391.199700	20.98	36.00	15.02	1000.0	120.000	170.0	H	180.0	16.8
732.138750	20.33	36.00	15.67	1000.0	120.000	170.0	V	-10.0	23.2
769.060350	20.65	36.00	15.35	1000.0	120.000	114.0	H	80.0	23.7
947.718600	22.33	36.00	13.67	1000.0	120.000	170.0	V	-5.0	25.3

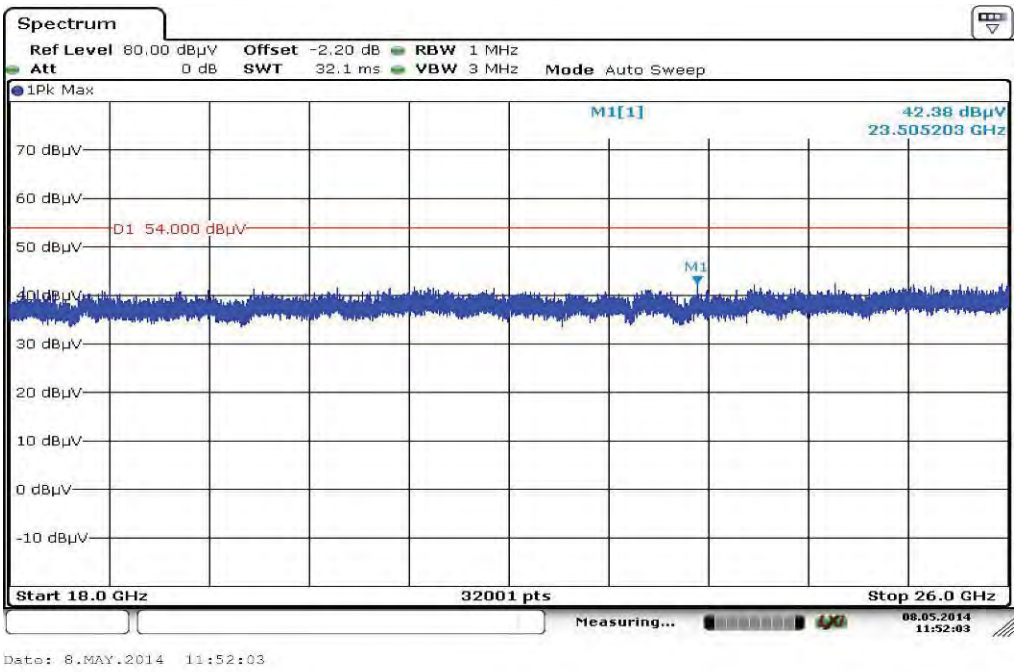
Plot 2: 1 GHz to 12.75 GHz, vertical & horizontal polarization



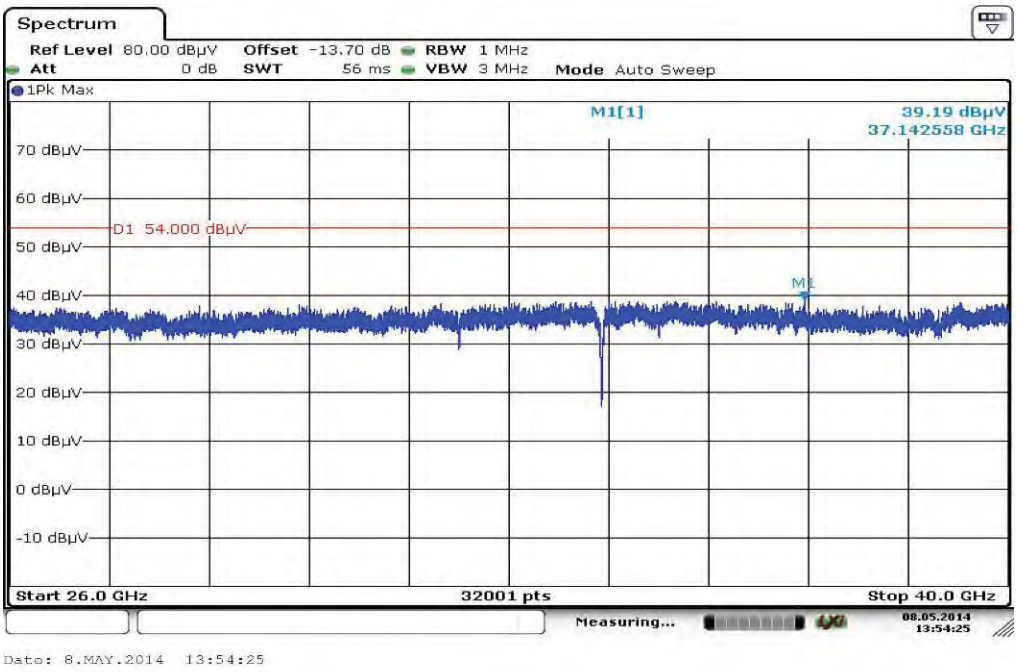
Plot 3: 12.75 GHz to 18 GHz, vertical & horizontal polarization



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



Plot 5: 26 GHz to 40 GHz, vertical & horizontal polarization



12.11 Spurious emissions radiated < 30 MHz

Description:

Measurement of the radiated spurious emissions in transmit mode and receive mode below 30 MHz. The EUT is set first to middle channel. This measurement is representative for all channels and modes. If critical peaks are found the lowest channel and the highest channel will be measured too. Then the EUT is set to receive or idle mode. 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 chapter 7.2
Measurement uncertainty:	see chapter 9

Limits:

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

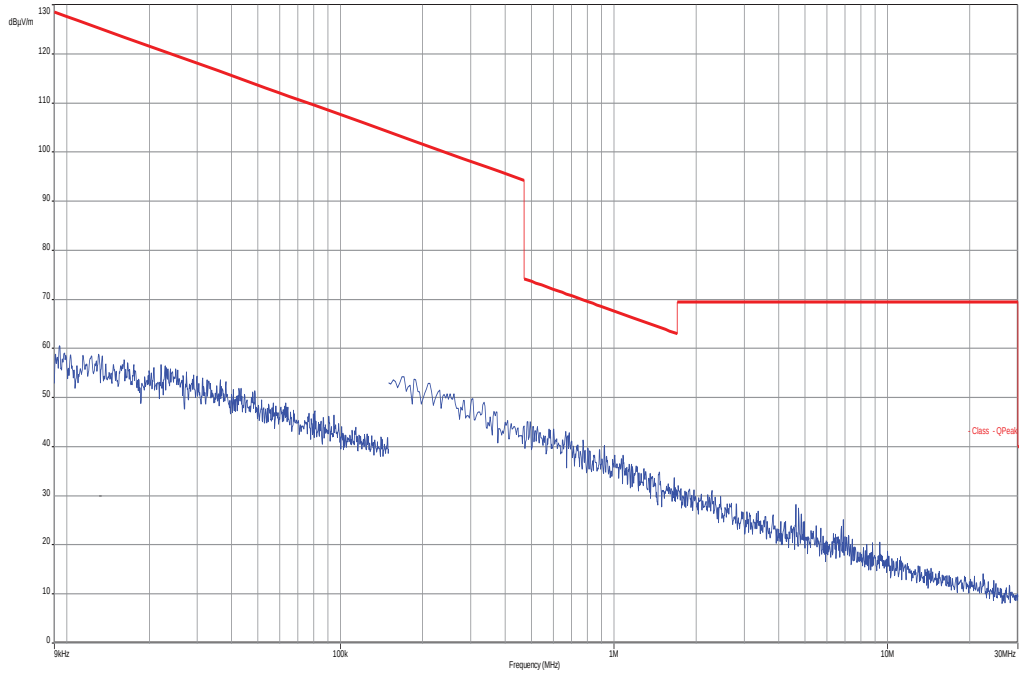
Results:

Spurious Emissions Radiated < 30 MHz [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
All detected emissions are more than 10 dB below the limit.		

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:

Plot 1: 9 kHz to 30 MHz, TX mode



12.12 Spurious emissions conducted < 30 MHz

Description:

Measurement of the conducted spurious emissions in transmit mode below 30 MHz. The EUT is set to middle channel. If critical peaks are found the lowest channel and the highest channel will be measured too. 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: 9 kHz
Resolution bandwidth:	F > 150 kHz: 100 kHz
Span:	150 kHz to 30 MHz
Trace-Mode:	Max Hold
Test setup:	see chapter 7.5
Measurement uncertainty:	see chapter 9

Limits:

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

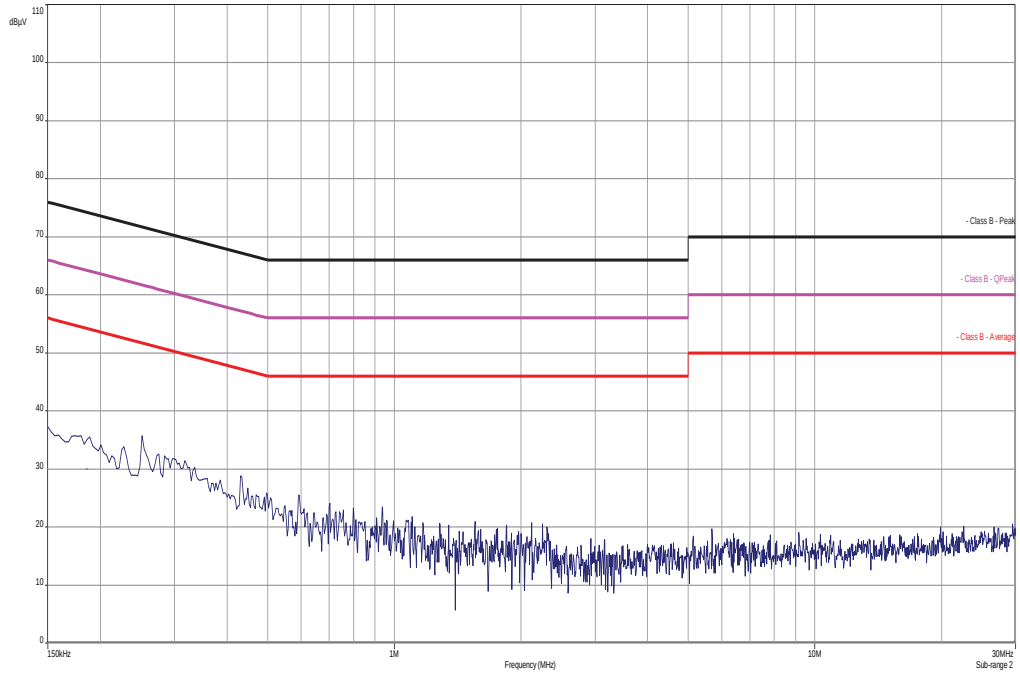
*Decreases with the logarithm of the frequency

Results:

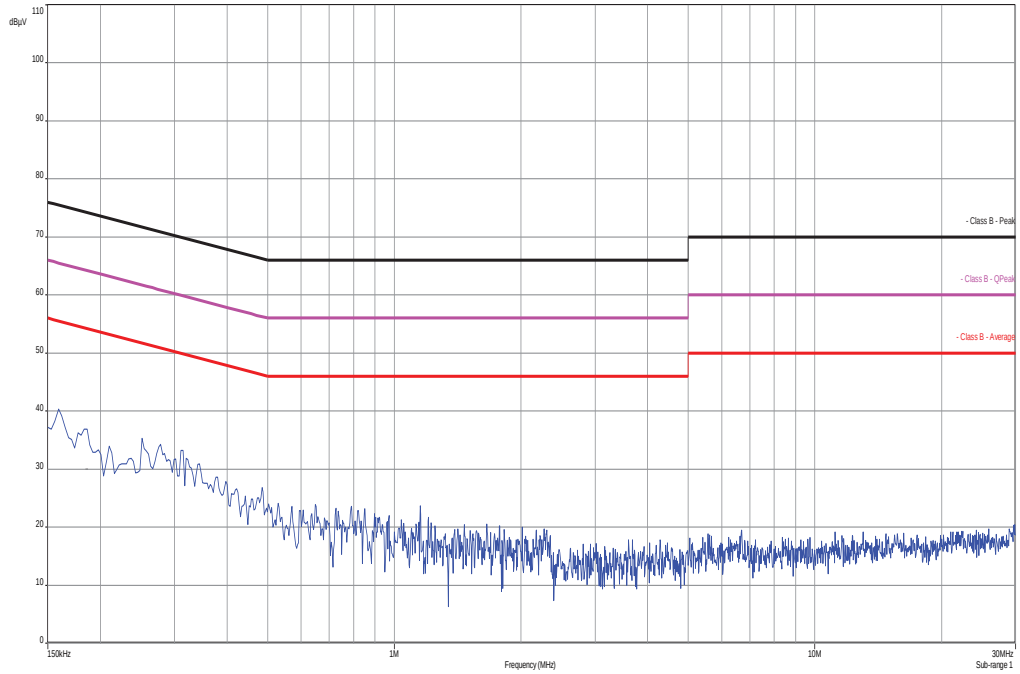
Spurious Emissions Conducted < 30 MHz [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
All detected emissions are more than 10 dB below the limit.		

Plots:

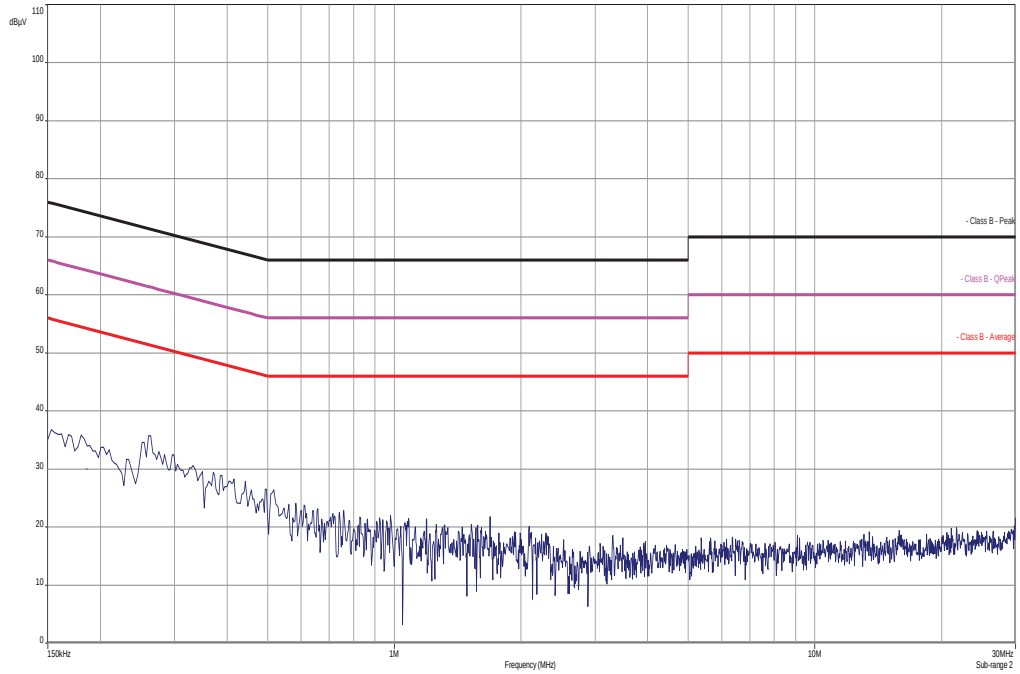
Plot 1: TX mode, 150 kHz to 30 MHz, phase line



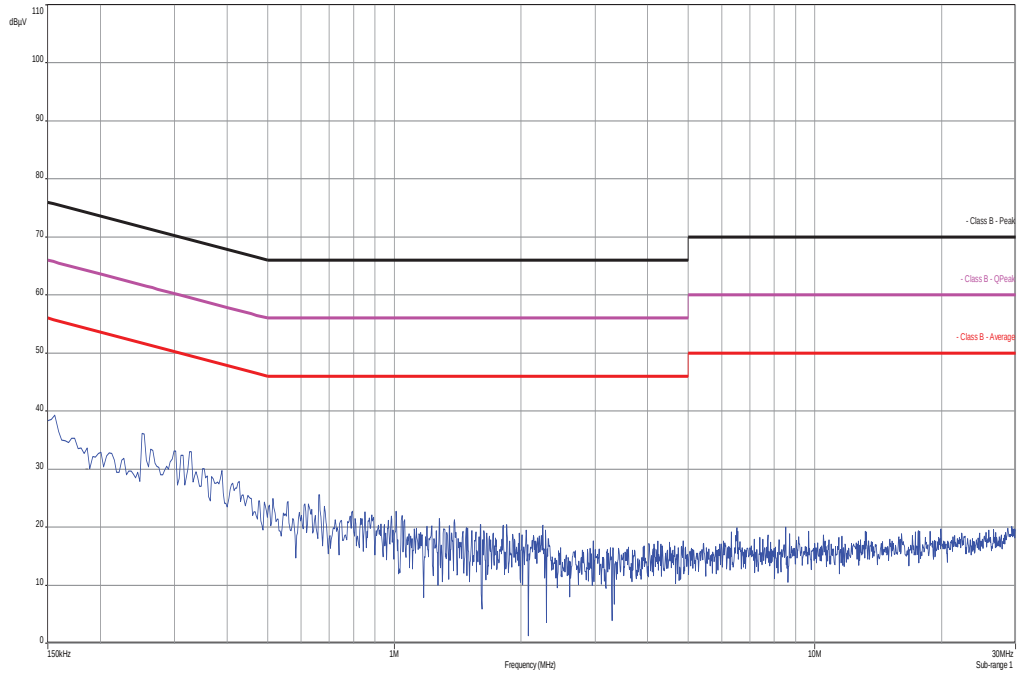
Plot 2: TX mode, 150 kHz to 30 MHz, neutral line



Plot 3: RX / Idle – mode, 150 kHz to 30 MHz, phase line



Plot 4: RX / Idle – mode, 150 kHz to 30 MHz, neutral line



Annex A Document history

Version	Applied changes	Date of release
	Initial release	2016-01-16
A	Date: Start of testing corrected	2016-01-27
B	Changed model name	

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

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

Akkreditierung

Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

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

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

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

Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 07.03.2014 mit der Akkreditierungsnummer D-PL-12076-01 und ist gültig 17.01.2018. Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 7 / Seiten.

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

Frankfurt am Main, 07.03.2014

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

Back side of certificate

Deutsche Akkreditierungsstelle GmbH

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Spittelmarkt 10
10117 Berlin

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Gartenstraße 6
60594 Frankfurt am Main

Standort Braunschweig
Bundesallee 100
38116 Braunschweig

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