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TEST REPORT

Test report no.: 1-9947/15-01-06-D

Deutsche
Akkreditierungsstelle
D-PL-12076-01-01

Testing laboratory

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

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

Applicant

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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: Multifunctional Ticketing Handheld (Inspection device)**Model name:** FareGo Move MT60**FCC ID:** O5KMT60**IC:** 8312A-MT60UNII bands:
Frequency: 5150 MHz to 5350 MHz
5470 MHz to 5725 MHz

Technology tested: WLAN (OFDM/a-; n HT20-; n HT40 - mode)

Antenna: Integrated antenna

Power supply: 7.2 V DC by battery

Temperature range: -10°C to +40°C



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

Test report authorized:

p.o.

Marco Bertolino
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Test performed:

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1 Table of contents

1	Table of contents	2
2	General information	3
2.1	Notes and disclaimer	3
2.2	Application details	3
3	Test standard/s	3
3.1	Measurement guidance	4
4	Test environment	5
5	Test item	5
5.1	General description	5
5.2	Additional information	5
6	Test laboratories sub-contracted	5
7	Description of the test setup	6
7.1	Radiated measurements chamber F	7
7.2	Radiated measurements chamber C	8
7.3	Radiated measurements 18 GHz to 40 GHz	9
7.4	Conducted measurements	10
8	Measurement uncertainty	11
9	Sequence of testing	12
9.1	Sequence of testing radiated spurious 9 kHz to 30 MHz	12
9.2	Sequence of testing radiated spurious 30 MHz to 1 GHz	13
9.3	Sequence of testing radiated spurious 1 GHz to 18 GHz	14
9.4	Sequence of testing radiated spurious above 18 GHz	15
10	Summary of measurement results	16
11	Additional comments	17
12	Measurement results	18
12.1	Identify worst case data rate	18
12.2	Module verification	19
12.3	Occupied bandwidth – 99% emission bandwidth	20
12.4	Band edge compliance radiated	34
12.5	TX spurious emissions radiated	40
12.6	Spurious emissions radiated < 30 MHz	107
13	Observations	120
Annex A	Document history	120
Annex B	Further information	120
Annex C	Accreditation Certificate	121

2 General information

2.1 Notes and disclaimer

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

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This test report replaces the test report with the number 1-9947/15-01-06-C and dated 2016-07-04

2.2 Application details

Date of receipt of order:	2015-08-06
Date of receipt of test item:	2015-09-01
Start of test:	2015-09-14
End of test:	2016-06-21
Person(s) present during the test:	-/-

3 Test standard/s

Test standard	Date	Test standard description
47 CFR Part 15	01.10.2013	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 247 Issue 1	01.05.2015	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence - Exempt Local Area Network (LE-LAN) Devices

3.1 Measurement guidance

Guidance	Version	Description
ANSI C63.4-2014	-/-	American national standard for methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz
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
KDB 789033 D02	v01	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E

4 Test environment

Temperature	:	T_{nom} +22 °C during room temperature tests T_{max} -/- °C during high temperature tests T_{min} -/- °C during low temperature tests
Relative humidity content	:	55 %
Barometric pressure	:	not relevant for this kind of testing
Power supply	:	V_{nom} 7.2 V DC by battery V_{max} -/- V V_{min} -/- V

5 Test item

5.1 General description

Kind of test item	:	Multifunctional Ticketing Handheld (Inspection device)
Type identification	:	FareGo Move MT60
PMN	:	FareGo Move MT60
HVIN	:	00330600
FVIN	:	07335350
HMN	:	-/-
S/N serial number	:	-/-
HW hardware status	:	00320600
SW software status	:	SW-storage MT60
Frequency band	:	UNII bands: 5150 MHz to 5350 MHz 5470 MHz to 5725 MHz 5725 MHz to 5850 MHz
Type of radio transmission	:	OFDM
Use of frequency spectrum	:	
Type of modulation	:	BPSK, QPSK, 16-QAM, 64-QAM
Number of channels	:	16
Antenna	:	Integrated antenna
Power supply	:	7.2 V DC by battery
Temperature range	:	-10°C to +40°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:

1-9947_15-01-01_AnnexA
 1-9947_15-01-01_AnnexB
 1-9947_15-01-01_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).

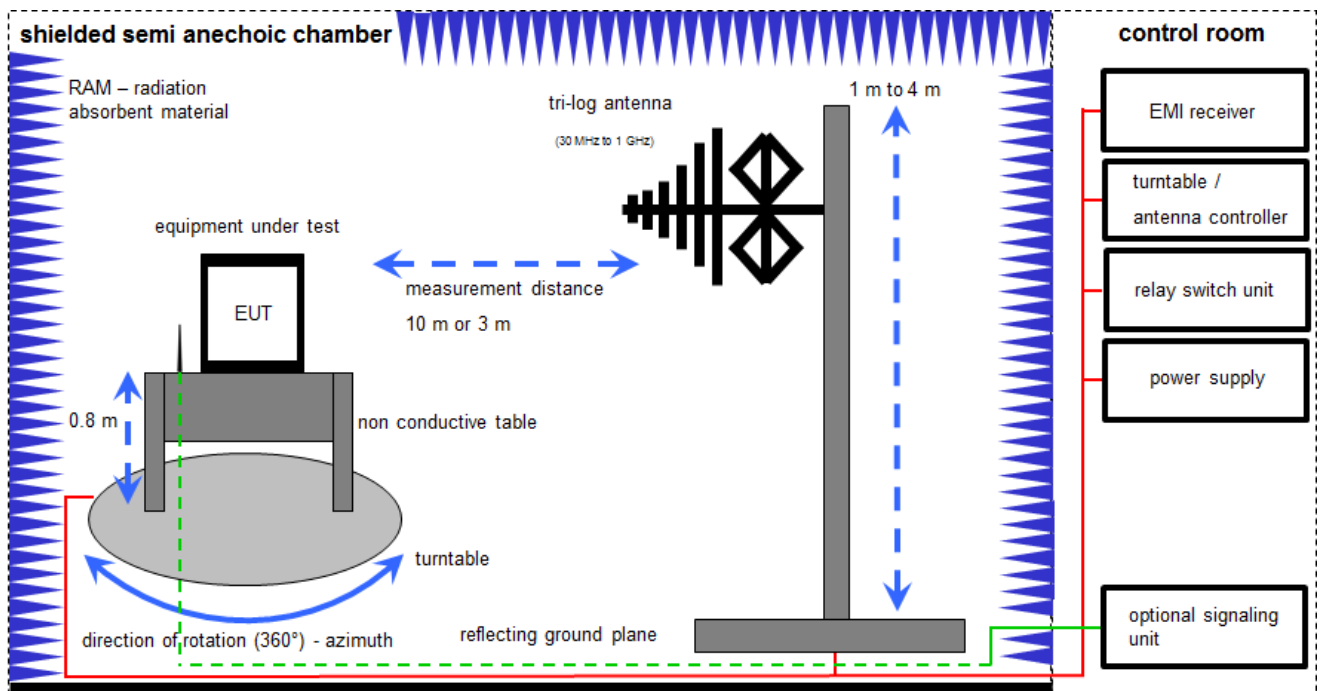
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

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

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 C63.4. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analysers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.4 and ANSI C63.10.



$$SS = U_R + CL + AF$$

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

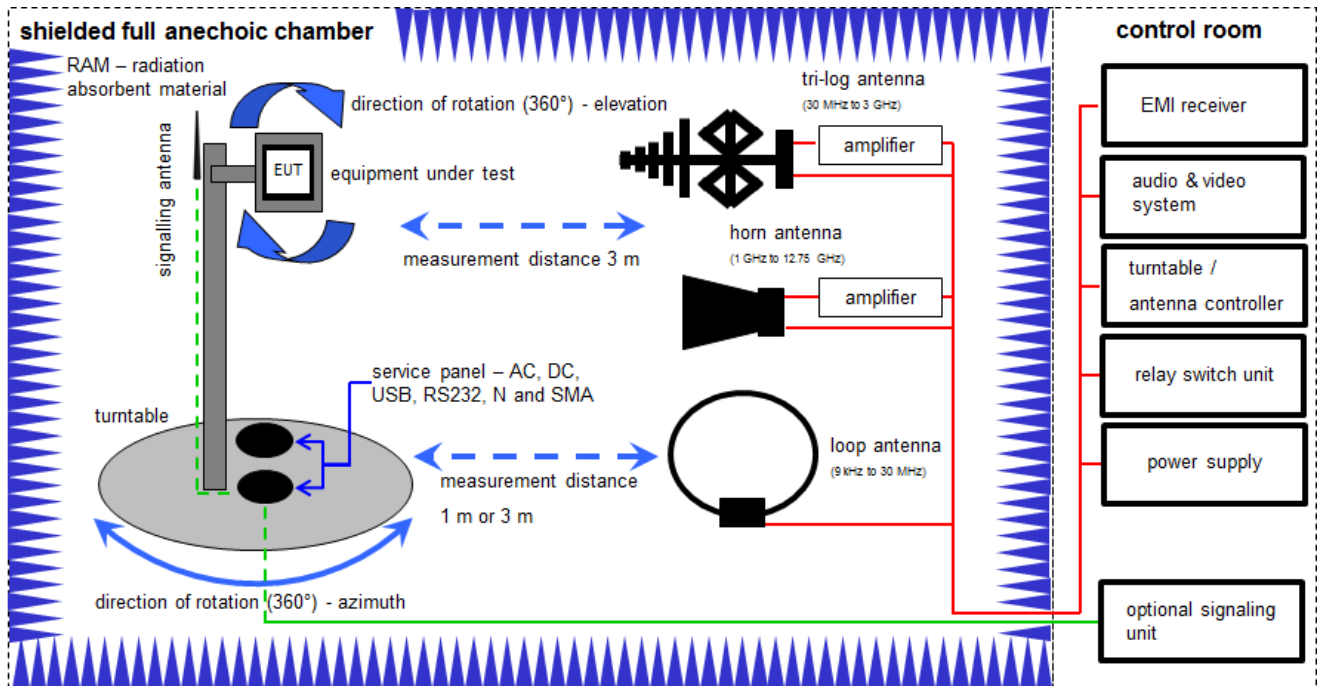
Example calculation:

$$SS \text{ [dB}\mu\text{V/m]} = 12.35 \text{ [dB}\mu\text{V/m]} + 1.90 \text{ [dB]} + 16.80 \text{ [dB}\mu\text{V/m]} = 31.05 \text{ [dB}\mu\text{V/m]} \text{ (35.69 } \mu\text{V/m)}$$

Equipment table:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
2	A	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	30.01.2014	30.01.2016
4	A	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	29.01.2015	29.01.2017
5	A	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	26.08.2014	26.08.2016
6	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	22.04.2014	22.04.2016

7.2 Radiated measurements chamber C



$$SS = U_R + CA + AF$$

(SS-signal strength; U_R -voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

Example calculation:

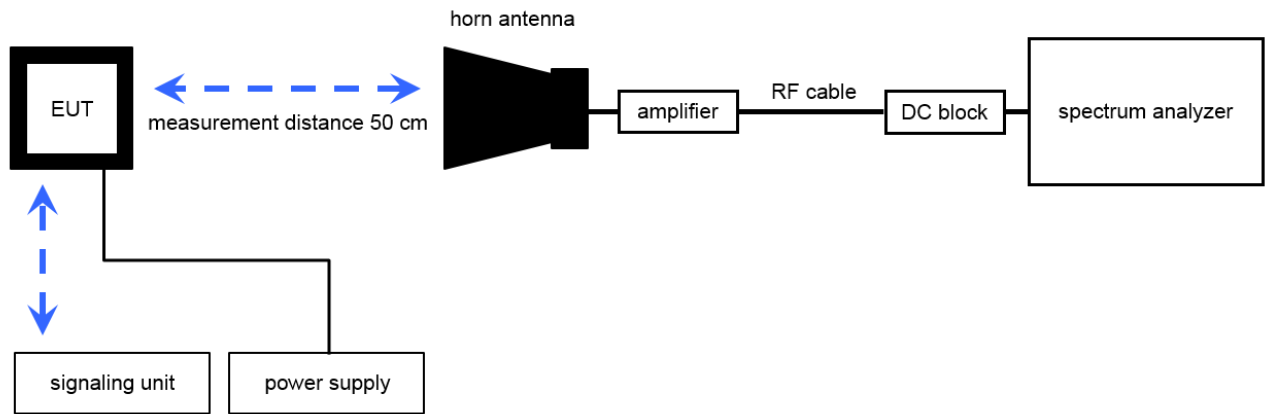
$$SS \text{ [dB}\mu\text{V/m]} = 40.0 \text{ [dB}\mu\text{V/m]} + (-35.8) \text{ [dB]} + 32.9 \text{ [dB}\mu\text{V/m]} = 37.1 \text{ [dB}\mu\text{V/m]} \text{ (71.61 } \mu\text{V/m)}$$

Equipment table:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A,C	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9709-5290	300000212	k	23.07.2013	23.07.2015
2	A,B	EMI Test Receiver 20Hz-26,5GHz	ESU26	R&S	100037	300003555	k	22.01.2015	22.01.2016
3	A,C	Highpass Filter	WHK1.1/15G-10SS	Wainwright	37	400000148	ne	22.04.2014	22.04.2017
4	A	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne	-/-	-/-
5	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	318	300003696	k	22.04.2014	22.04.2017
6	A,C	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22050	300004482	ev	-/-	-/-
7	A	Broadband Amplifier	CBLU5135235	CERNEX	22011	300004492	ev	-/-	-/-
8	A,C	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000032	300004510	ne	-/-	-/-
9	A,B,C	Messrechner und Monitor	Intel Core i3 3220/3,3 GHz, Prozessor	Agilent Technologies	2V2403033A5 421	300004591	ne	-/-	-/-
10	A,B,C	NEXIO EMV-Software	BAT EMC	EMCO	2V2403033A5 421	300004682	ne	-/-	-/-
11	B	Active Loop Antenna 10 kHz to 30 MHz	6502	Kontron Psychotech	8905-2342	300000256	k	24.06.2015	24.06.2017
12	A	Std. Gain Horn Antenna 12.4 to 18.0 GHz	639	Narda	8402	300000787	k	22.07.2013	22.07.2015
13	A	Signal Analyzer 40 GHz	FSV40	R&S	101042	300004517	k	22.01.2015	22.01.2016
14	A	Amplifier 2-40 GHz	JS32-02004000-57-5P	MITEQ	1777200	300004541	ev	-/-	-/-
15	A	RF-Cable	ST18/SMAM/SMAM/48	Huber & Suhner	Batch no. 600918	400001182	ev	-/-	-/-
16	A	RF-Cable	ST18/SMAM/SMAM/48	Huber & Suhner	Batch no. 127377	400001183	ev	-/-	-/-
17	A	DC-Blocker 0.1-40 GHz	8141A	Inmet	Batch no. 127377	400001185	ev	-/-	-/-

7.3 Radiated measurements 18 GHz to 40 GHz

Radiated measurements > 12.75 GHz



$$SS = U_R + CA + AF$$

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

Example calculation:

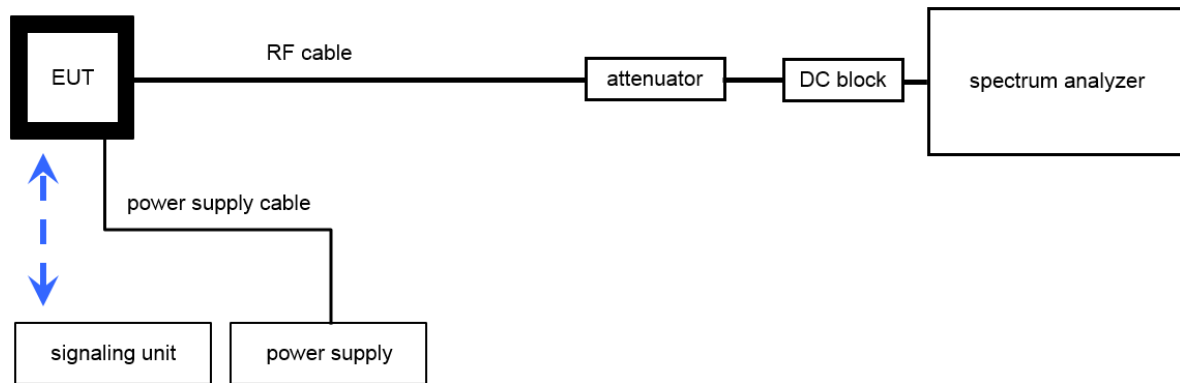
$$SS \text{ [dB}\mu\text{V/m]} = 40.0 \text{ [dB}\mu\text{V/m]} + (-60.1) \text{ [dB]} + 36.74 \text{ [dB}\mu\text{V/m]} = 16.64 \text{ [dB}\mu\text{V/m]} \text{ (6.79 } \mu\text{V/m)}$$

Equipment table:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Std. Gain Horn Antenna 12.4 to 18.0 GHz	639	Narda	8402	300000787	k	22.07.2013	22.07.2015
2	A	Std. Gain Horn Antenna 18.0 to 26.5 GHz	638	Narda	8205	300002442	k	19.07.2013	19.07.2015
3	A	Signal Analyzer 40 GHz	FSV40	R&S	101042	300004517	k	22.01.2015	22.01.2016
4	A	Amplifier 2-40 GHz	JS32-02004000-57-5P	MITEQ	1777200	300004541	ev	-/-	-/-
5	A	RF-Cable	ST18/SMAM/SMAM/48	Huber & Suhner	Batch no. 600918	400001182	ev	-/-	-/-
6	A	RF-Cable	ST18/SMAM/SMm/48	Huber & Suhner	Batch no. 127377	400001183	ev	-/-	-/-
7	A	DC-Blocker 0.1-40 GHz	8141A	Inmet	Batch no. 127377	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:

$$OP \text{ [dBm]} = 6.0 \text{ [dBm]} + 11.7 \text{ [dB]} = 17.7 \text{ [dBm]} \text{ (58.88 mW)}$$

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Signal Analyzer 40 GHz	FSV40	R&S	101042	300004517	k	21.01.2016	21.01.2017
2	A	PC-WLAN Tester	Intel Core i3 3220/3,3 GHz, Prozessor	R&S	2V2403033A4523	300004589	ne	-/-	-/-
3	A	RF-Cable	ST18/SMAM/SMAM/60	Huber & Suhner	Batch no. 606844	400001181	ev	-/-	-/-
4	A	DC-Blocker 0.1-40 GHz	8141A	Inmet	Batch no. 606844	400001185	ev	-/-	-/-
5	A	Coax Attenuator 10 dB 2W 0-40 GHz	MCL BW-K10-2W44+	Mini Circuits	Batch no. 606844	400001186	ev	-/-	-/-

8 Measurement uncertainty

Measurement uncertainty	
Test case	Uncertainty
Antenna gain	± 3 dB
Power spectral density	± 1.5 dB
Spectrum bandwidth	± 100 kHz (depends on the used RBW)
Occupied bandwidth	± 100 kHz (depends on the used RBW)
Maximum output power	± 1.5 dB
Peak excursion measurements	± 1.5 dB
Minimum emissions bandwidth	± 100 kHz (depends on the used RBW)
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

9 Sequence of testing

9.1 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.

9.2 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 $\pm 45^\circ$ and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

9.3 Sequence of testing radiated spurious 1 GHz to 18 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.

9.4 Sequence of testing radiated spurious above 18 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.

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	2016-07-25	Radiated measurements only according customer demand

Test specification clause	Test case	Temperature conditions	Power source voltages	C	NC	NA	NP	Remark
-/-	Output power verification (conducted)	Nominal	Nominal	☐	☐	☐	☒	-/-
-/-	Gain	Nominal	Nominal	☐	☐	☐	☒	-/-
U-NII Part 15	Duty cycle	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)	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	☒	☐	☐	☐	-/-
§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: WiBear11n_FCC_TestReport.pdf
Test report Reference: MDE_UBLOX_1624_FCCd (DF1)
MDE_UBLOX_1624_FCCd (DF1)
MDE_UBLOX_1624_FCCe (DF2)

Special test descriptions: None

Configuration descriptions: None

Test mode: ☐ 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

Datarates selected according WiBear11n_FCC_TestReport.pdf

Results:

Modulation	Modulation scheme / bandwidth					
Frequency	5180 MHz	5320 MHz	5500 MHz	5700 MHz	5745 MHz	5825 MHz
OFDM / a – mode	6 Mbit/s	6 Mbit/s	6 Mbit/s	6 Mbit/s	6 Mbit/s	6 Mbit/s
OFDM / n/ac – mode HT20	MCS7	MCS7	MCS7	MCS7	MCS7	MCS7
Frequency	5190 MHz	5310 MHz	5510 MHz	5670 MHz	5755 MHz	5815 MHz
OFDM / n/ac – mode HT40	MCS7	MCS7	MCS7	MCS7	MCS7	MCS7

12.2 Module verification

Description:

Measurement of the maximum conducted output power. To verify the testability of the used EUT compared to reference test report MDE_LESSW_1302_FCCa and MDE_LESSW_1302_FCCb.

Measurement:

Measurement parameter*	
Detector:	RMS
Sweep time:	Auto
Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Span:	40 MHz
Trace-Mode:	Average

*) according MDE_LESSW_1302_FCCb

Results:

Modulation	Channel	Reference report	Actual measured EUT
OFDM / a – mode	36	12.4	12.6
OFDM / n – mode HT20	36	13.8	13.9
OFDM / n – mode HT40	38	13.3	13.1

12.3 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 sub clause 7.4 – A
Measurement uncertainty:	See sub clause 8

Usage:

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

Result:

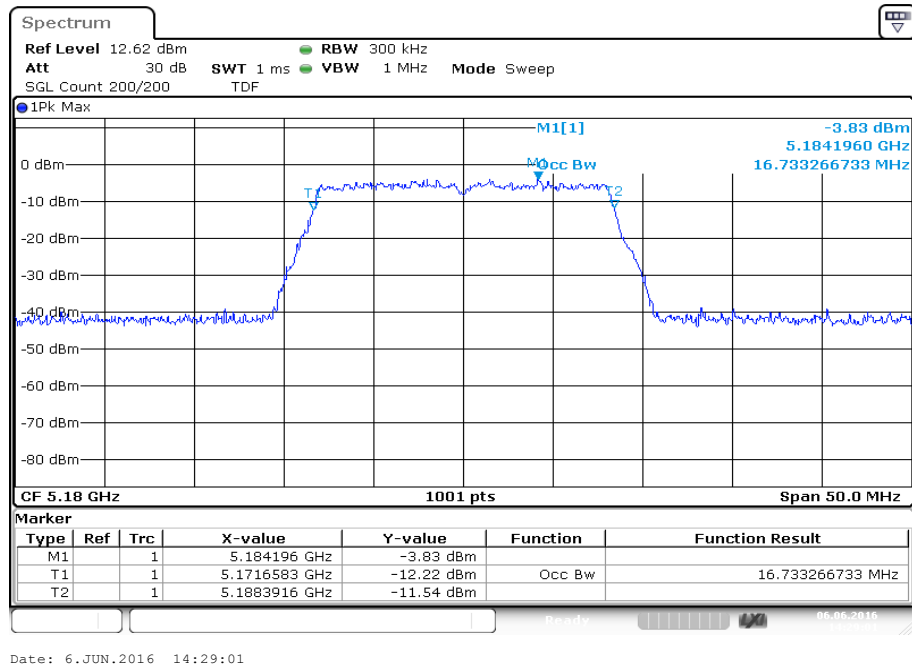
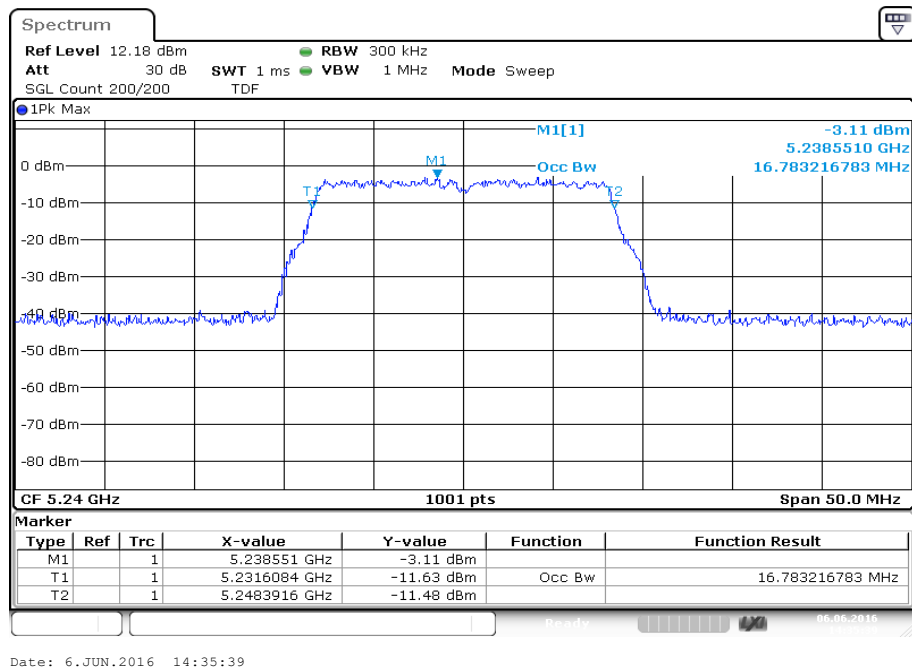
OFDM / a – mode Channel	99% bandwidth [kHz]			
	5180 MHz	5240 MHz	5260 MHz	5320 MHz
	16733	16783	16733	16733
Channel	5500 MHz	5600 MHz	5700 MHz	-/-
	16733	16733	16783	-/-

Result:

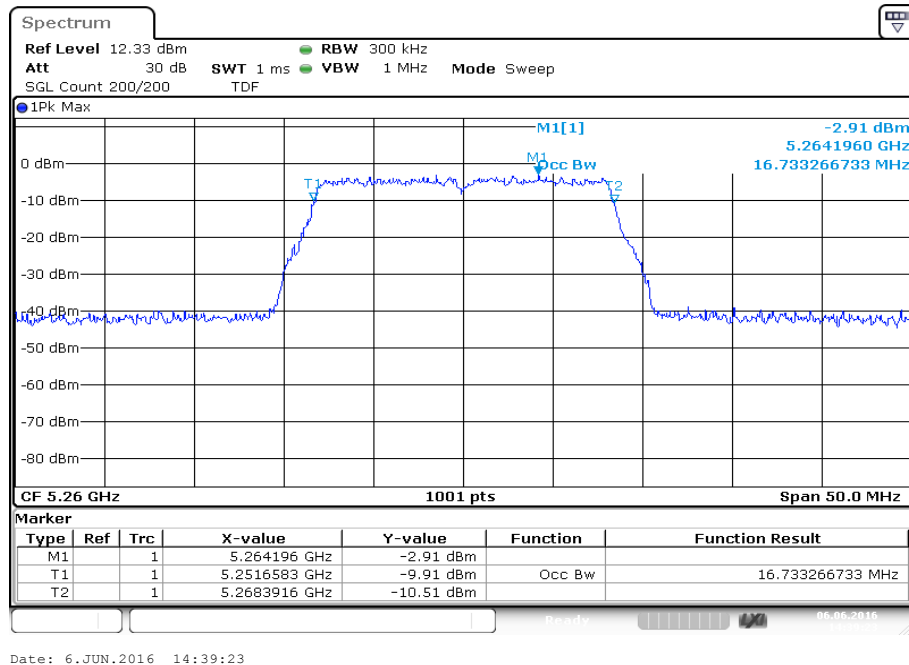
OFDM / n/ac HT20 – mode Channel	99% bandwidth [kHz]			
	5180 MHz	5240 MHz	5260 MHz	5320 MHz
	17882	17832	17832	17832
Channel	5500 MHz	5600 MHz	5700 MHz	-/-
	17832	17832	17882	-/-

Result:

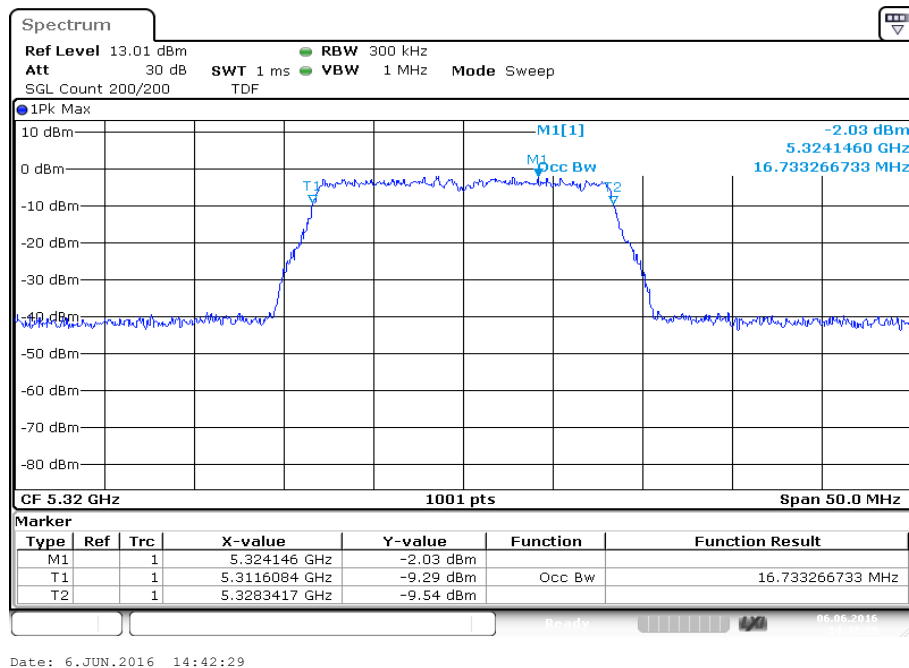
OFDM / n/ac HT40 – mode Channel	99% bandwidth [kHz]			
	5190 MHz	5230 MHz	5270 MHz	5310 MHz
	36663	36563	36663	36563
Channel	5510 MHz	5590 MHz	5670 MHz	-/-
	36464	36563	36563	-/-

Plots: OFDM / a – mode**Plot 1:** 5180 MHz**Plot 2:** 5240 MHz

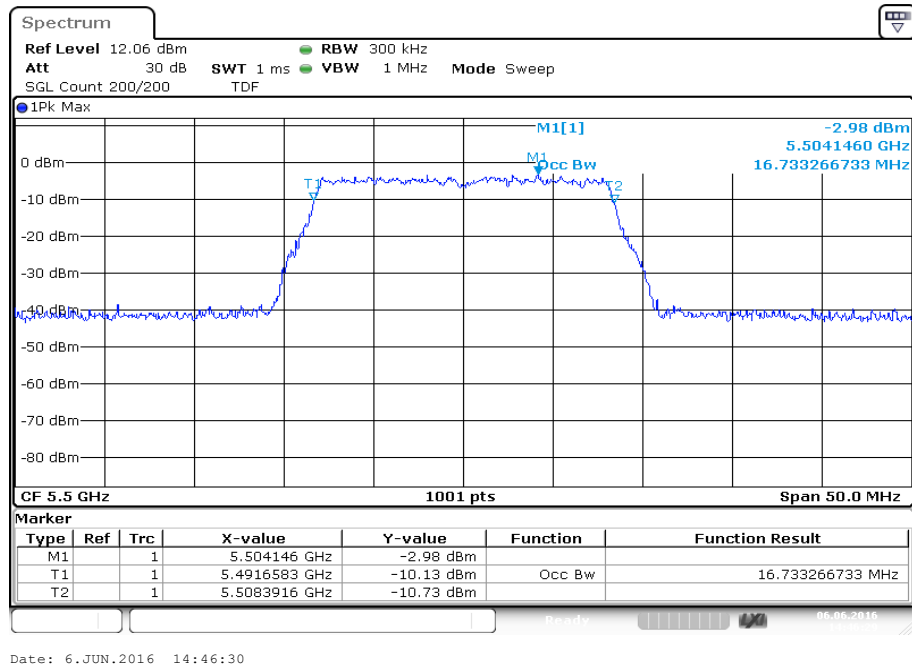
Plot 3: 5260 MHz



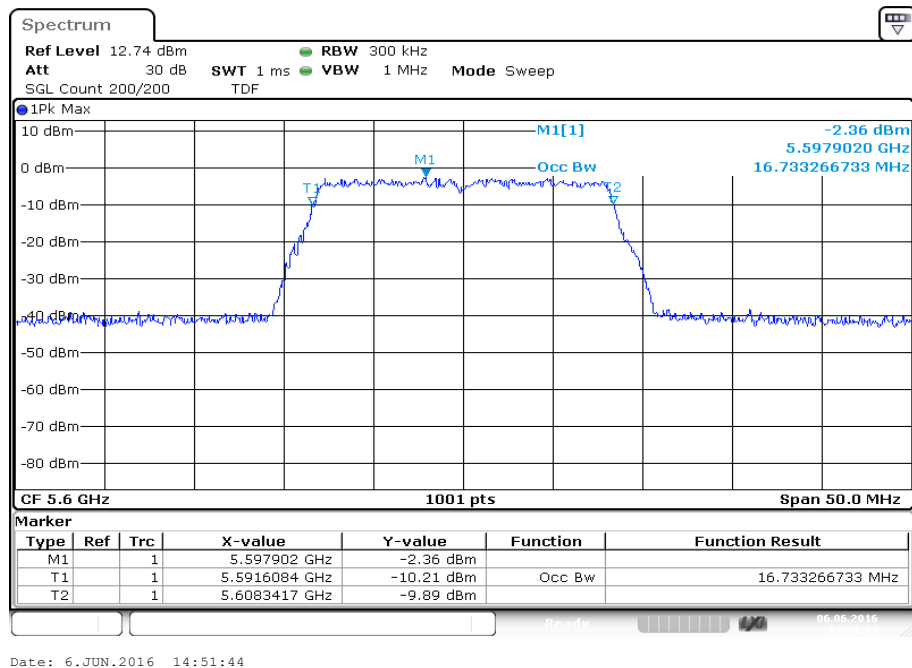
Plot 4: 5320 MHz



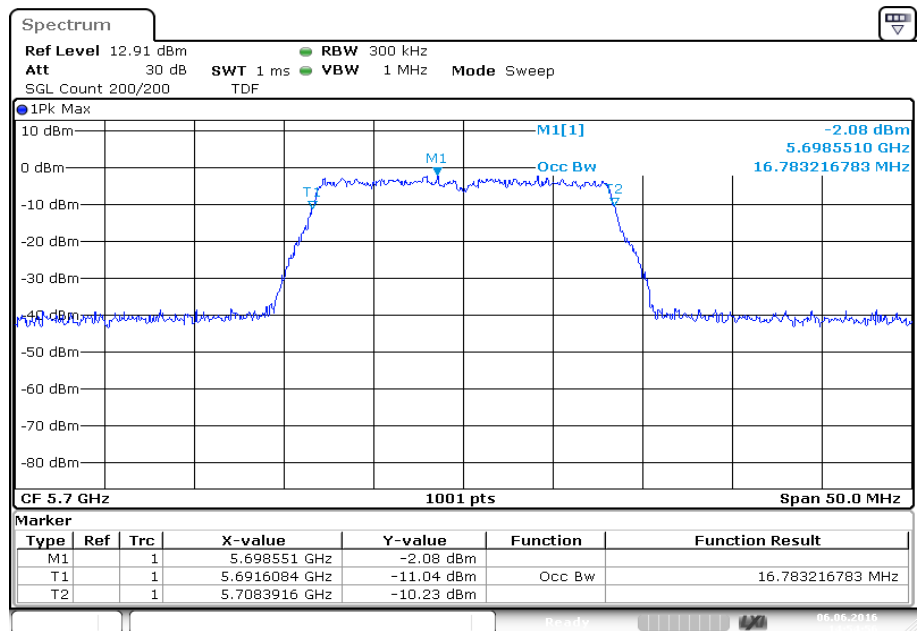
Plot 5: 5500 MHz



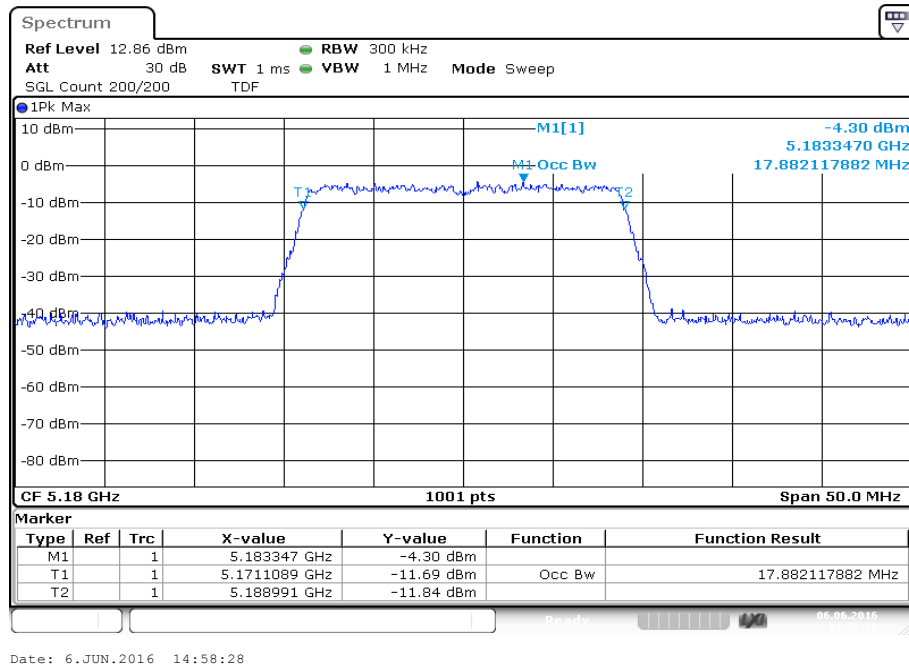
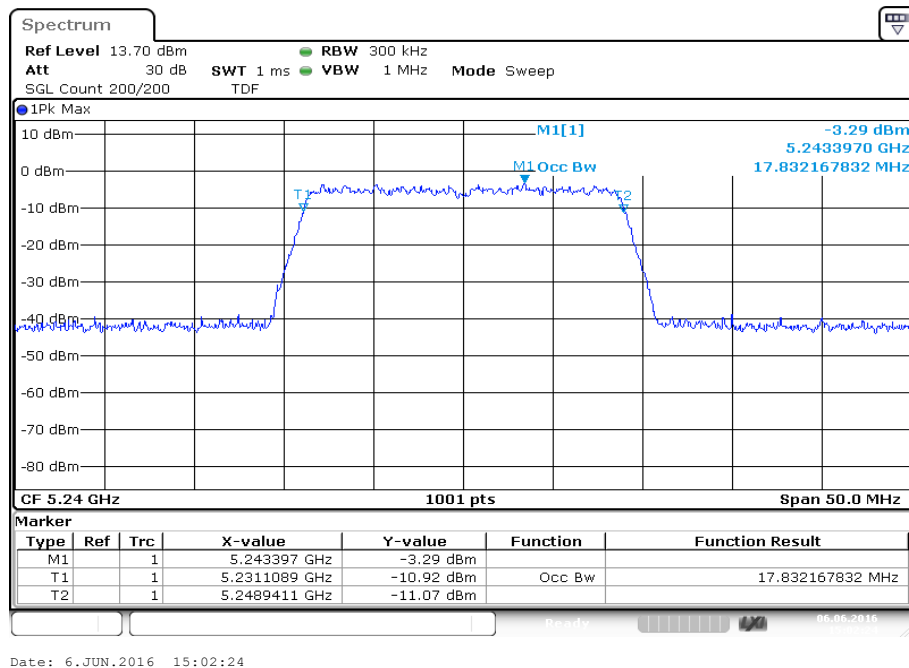
Plot 6: 5600 MHz



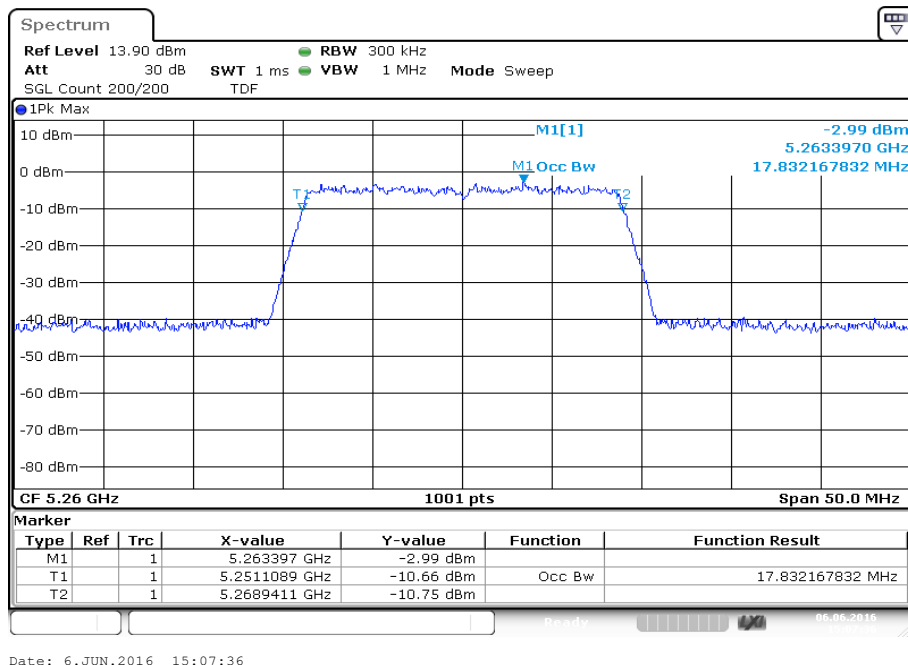
Plot 7: 5700 MHz



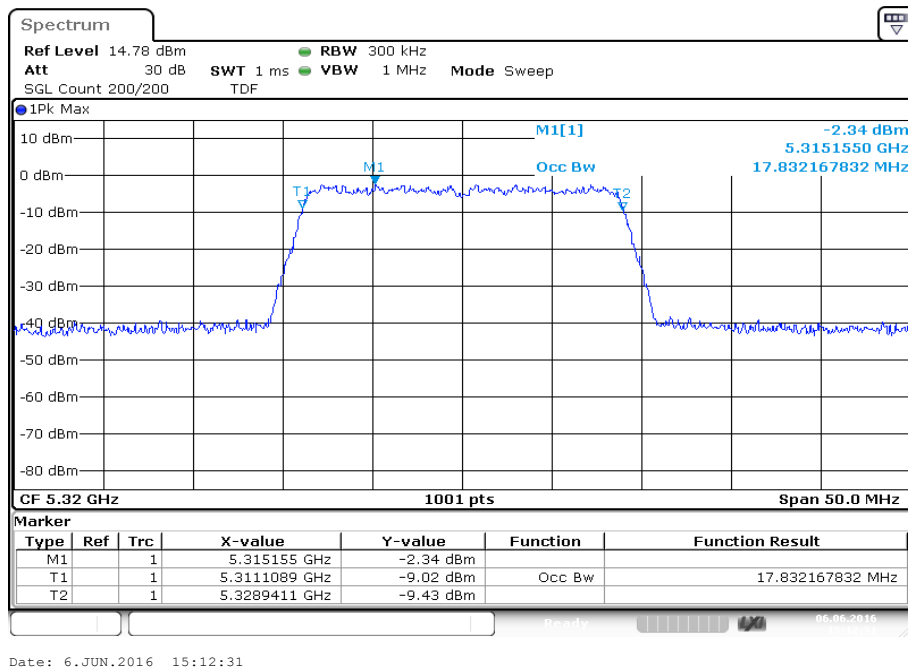
Date: 6.JUN.2016 14:54:56

Plots: OFDM / n HT20 – mode**Plot 1:** 5180 MHz**Plot 2:** 5240 MHz

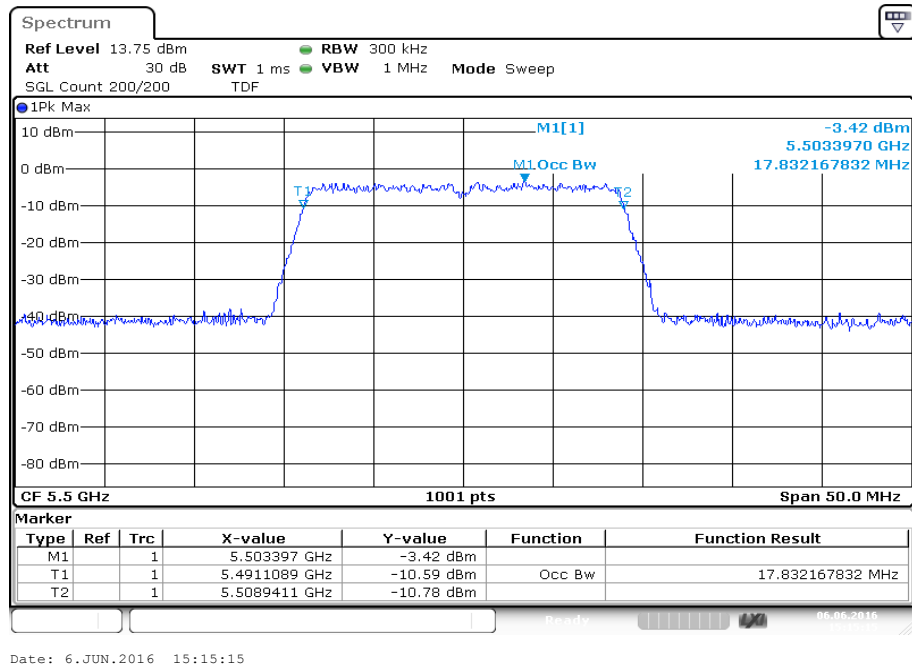
Plot 3: 5260 MHz



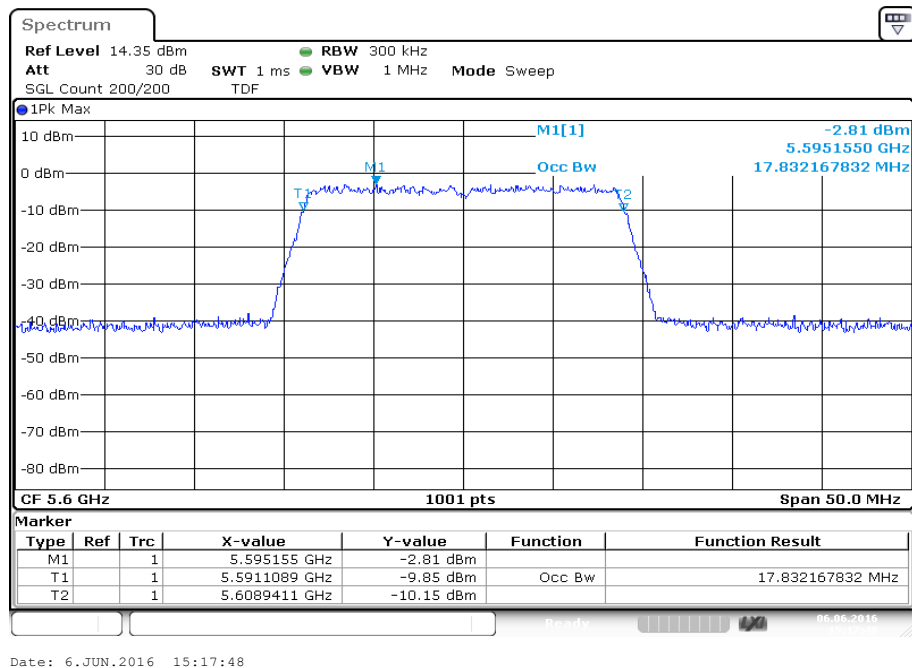
Plot 4: 5320 MHz



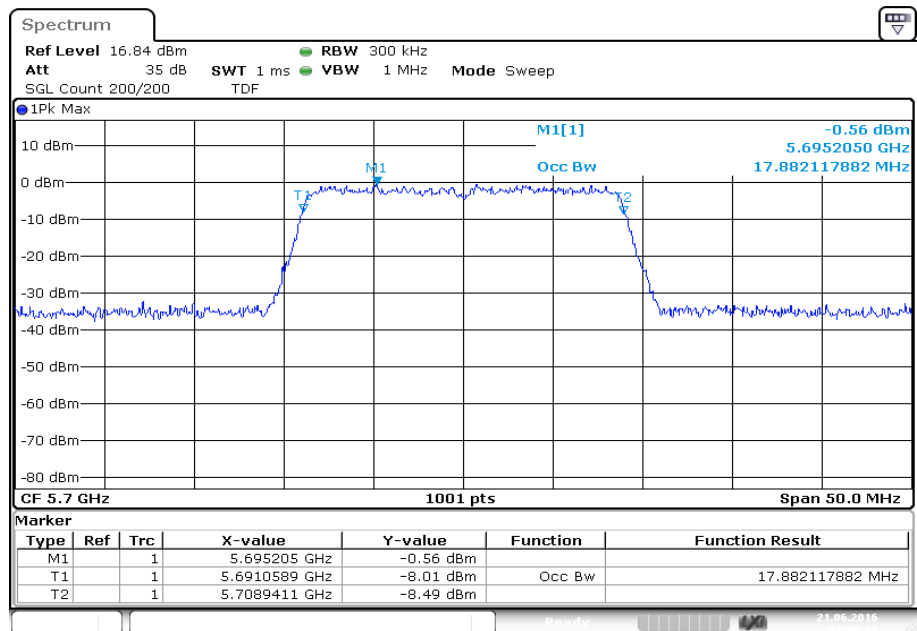
Plot 5: 5500 MHz



Plot 6: 5600 MHz



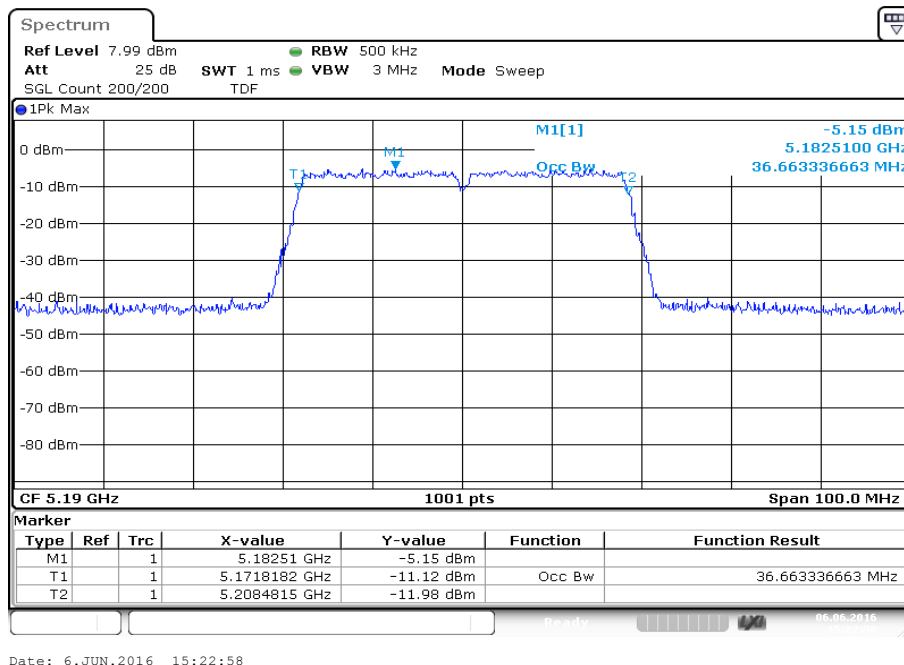
Plot 7: 5700 MHz



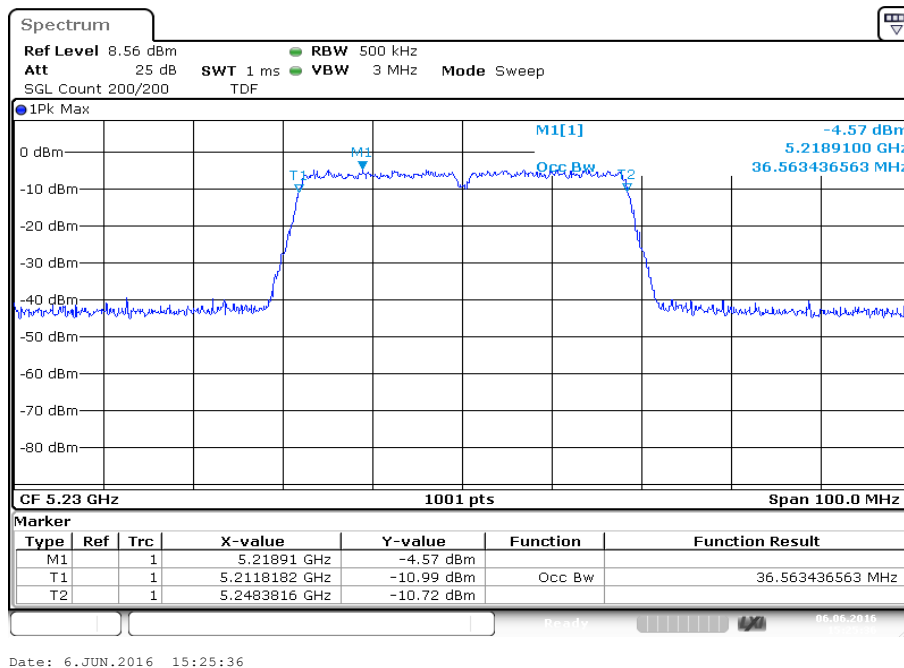
Date: 21.JUN.2016 07:00:49

Plots: OFDM / n HT40 – mode

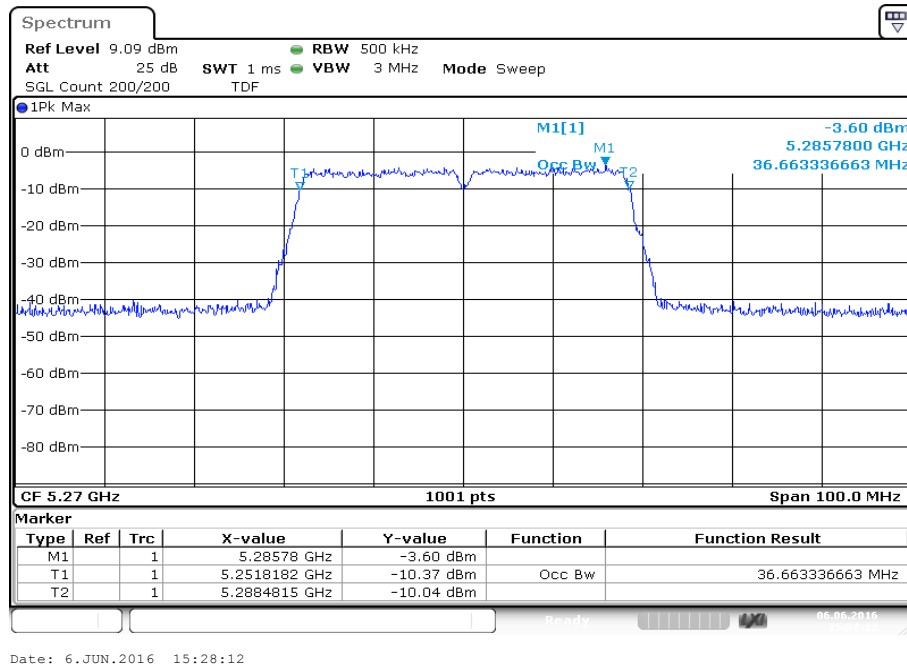
Plot 1: 5190 MHz



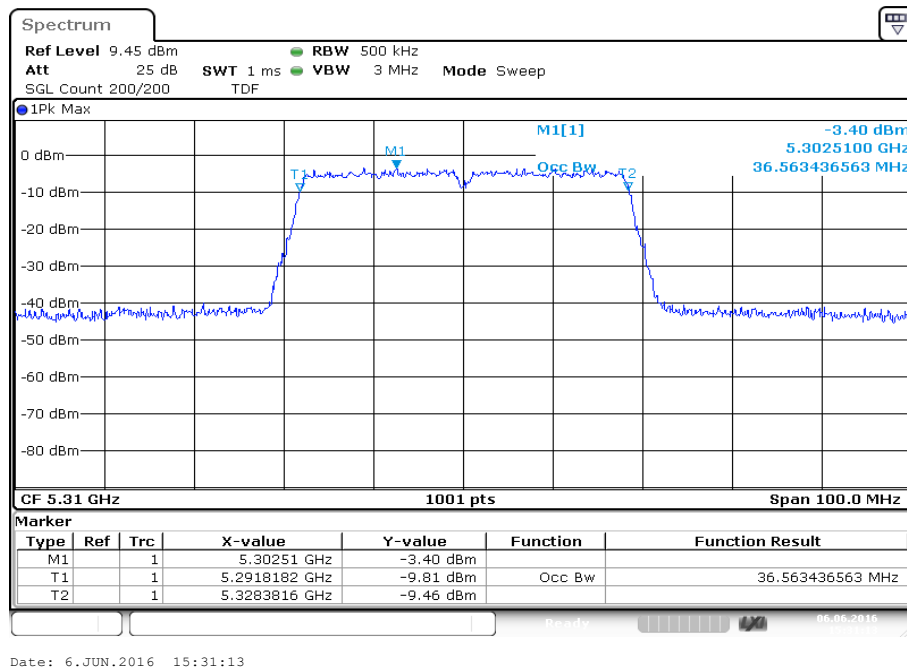
Plot 2: 5230 MHz



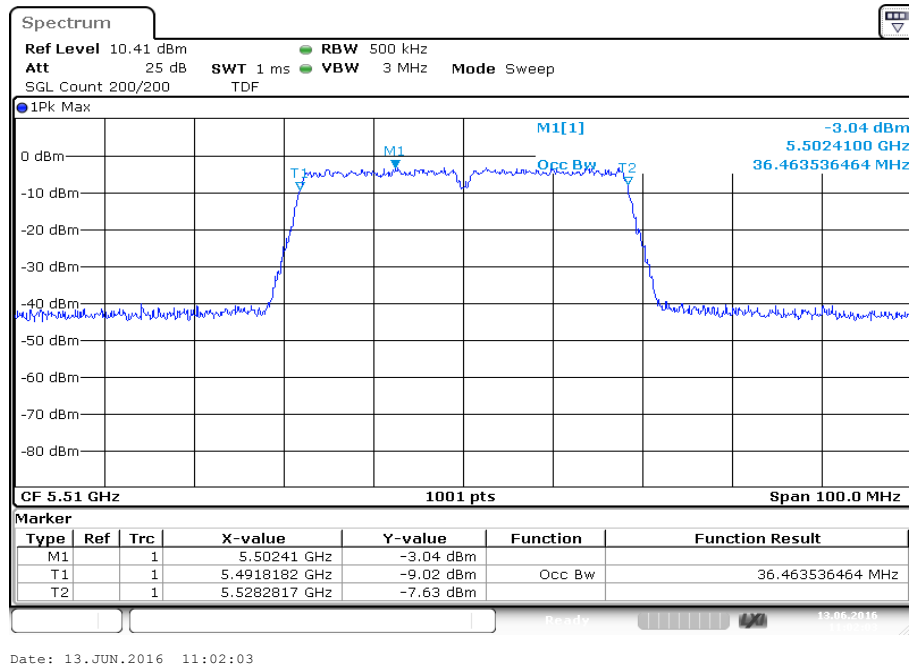
Plot 3: 5270 MHz



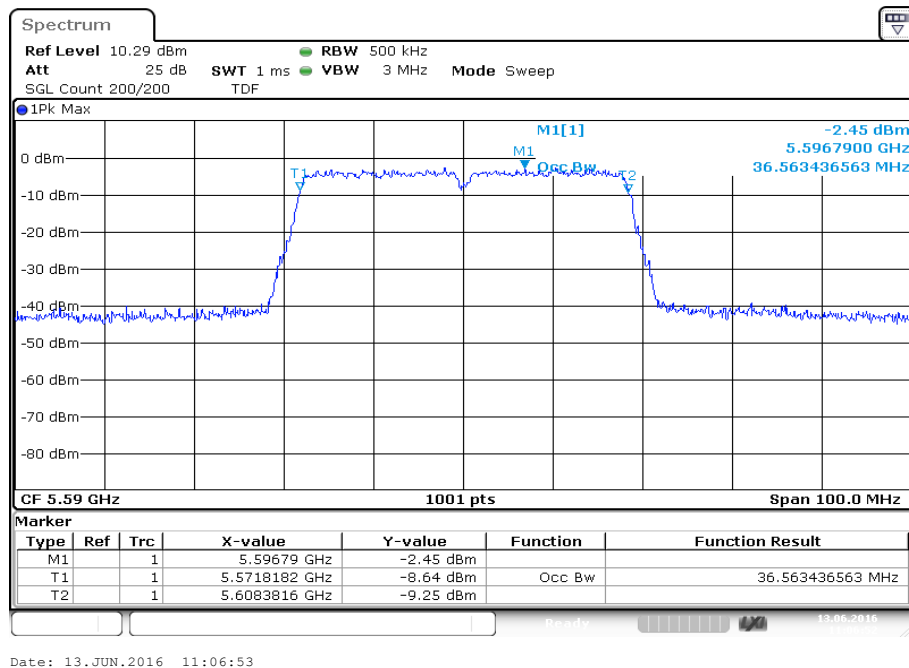
Plot 4: 5310 MHz



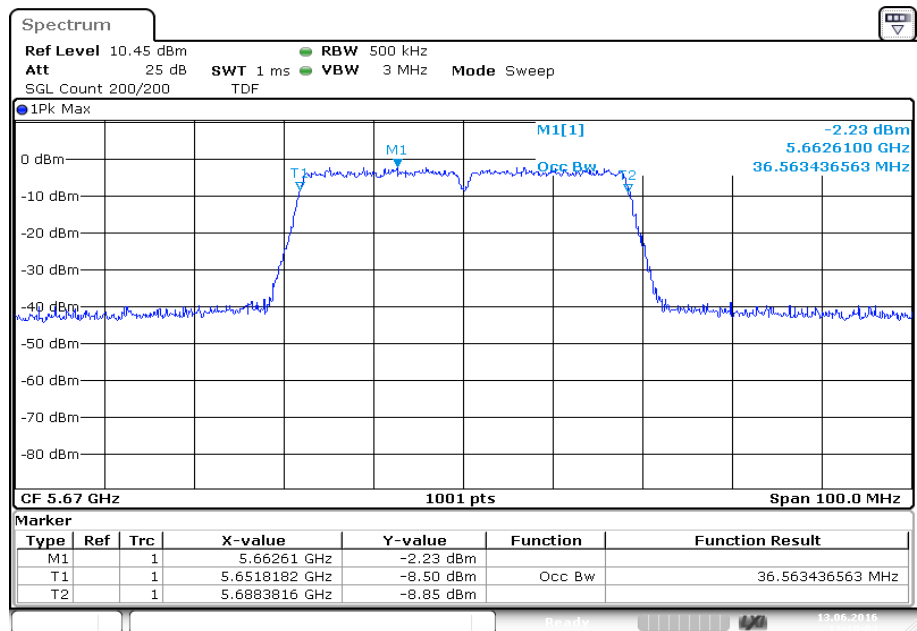
Plot 5: 5510 MHz



Plot 6: 5590 MHz



Plot 7: 5670 MHz



Date: 13.JUN.2016 11:10:04

12.4 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 the lowest channel for the lower restricted band and to the highest channel for the upper restricted band. Measurement distance is 3m.

Measurement:

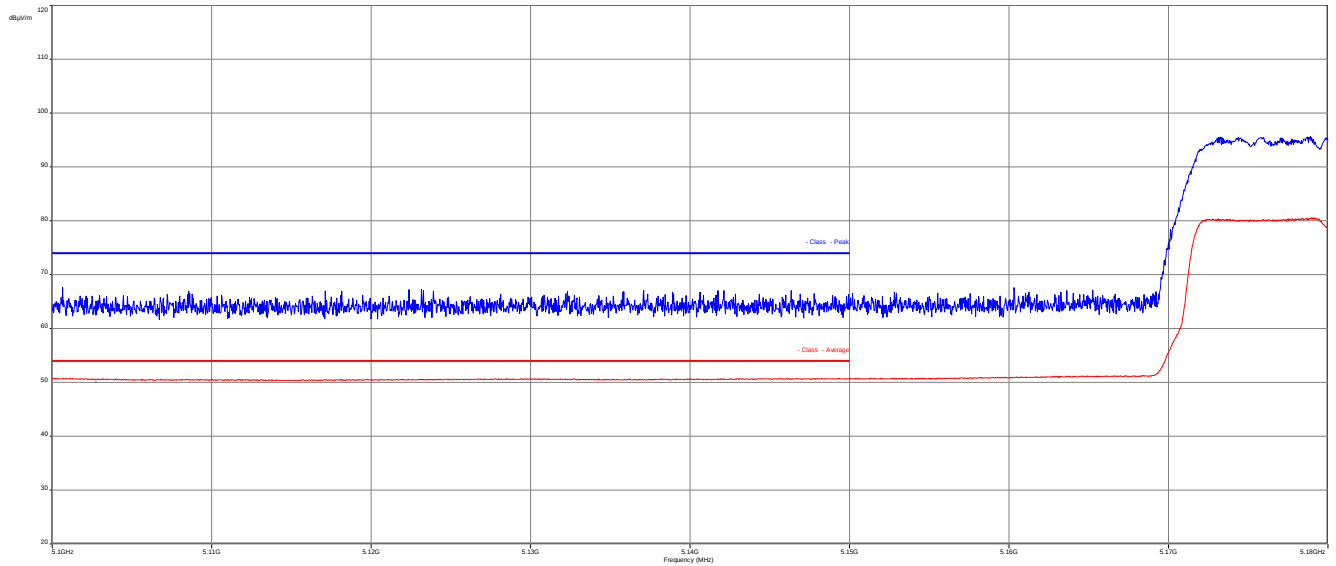
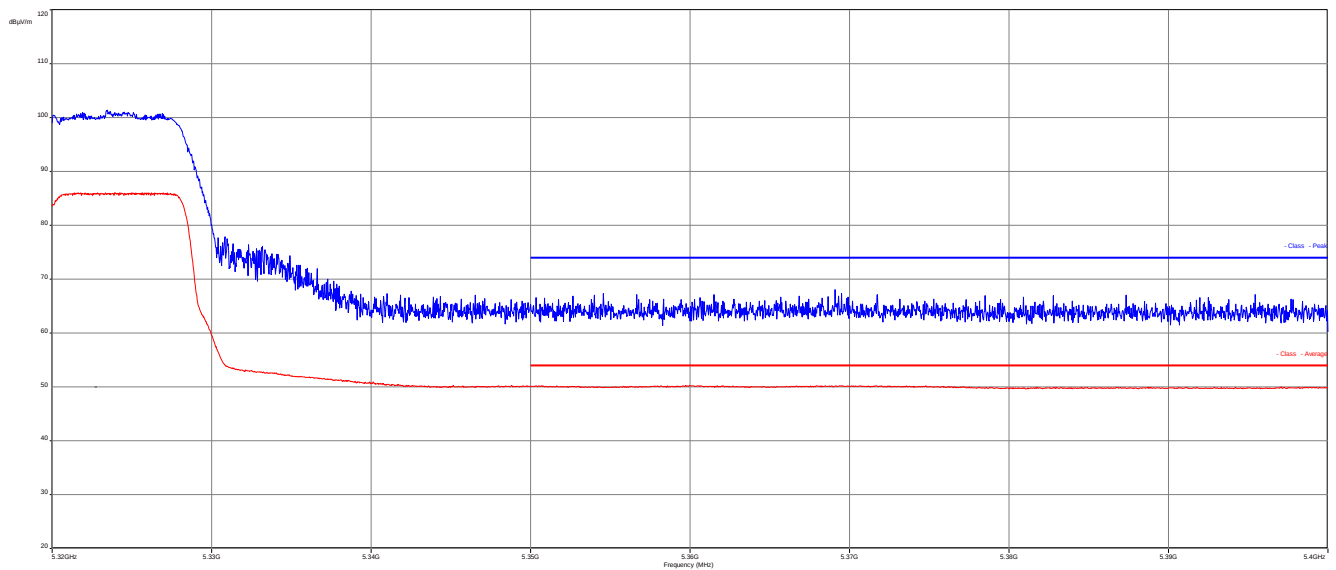
Measurement parameter	
Detector:	Peak / RMS
Sweep time:	Auto
Resolution bandwidth:	1 MHz
Video bandwidth:	10 Hz / 1 MHz
Span:	See plots!
Trace-Mode:	Max Hold
Test setup:	See sub clause 7.2 A
Measurement uncertainty	See sub clause 8

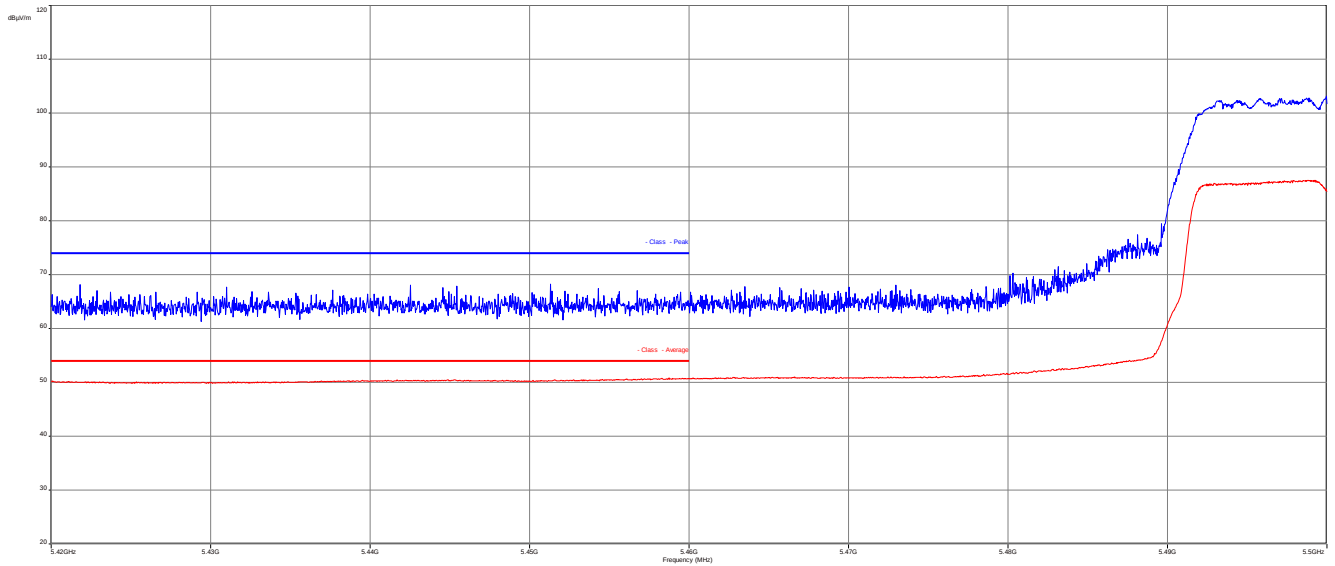
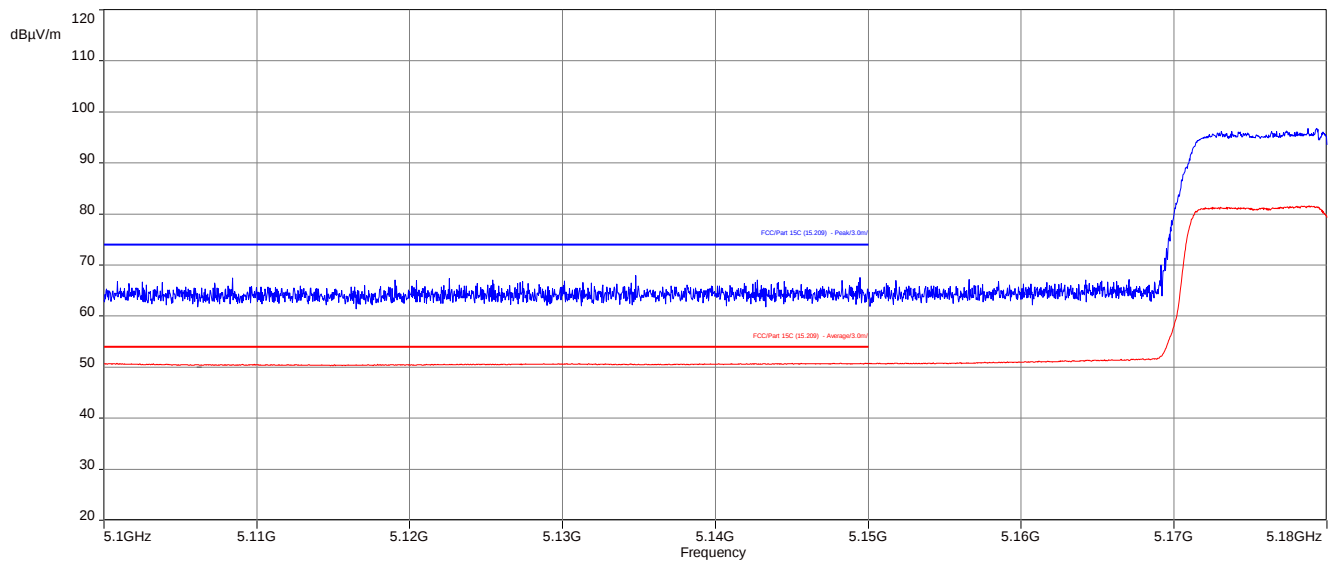
Limits:

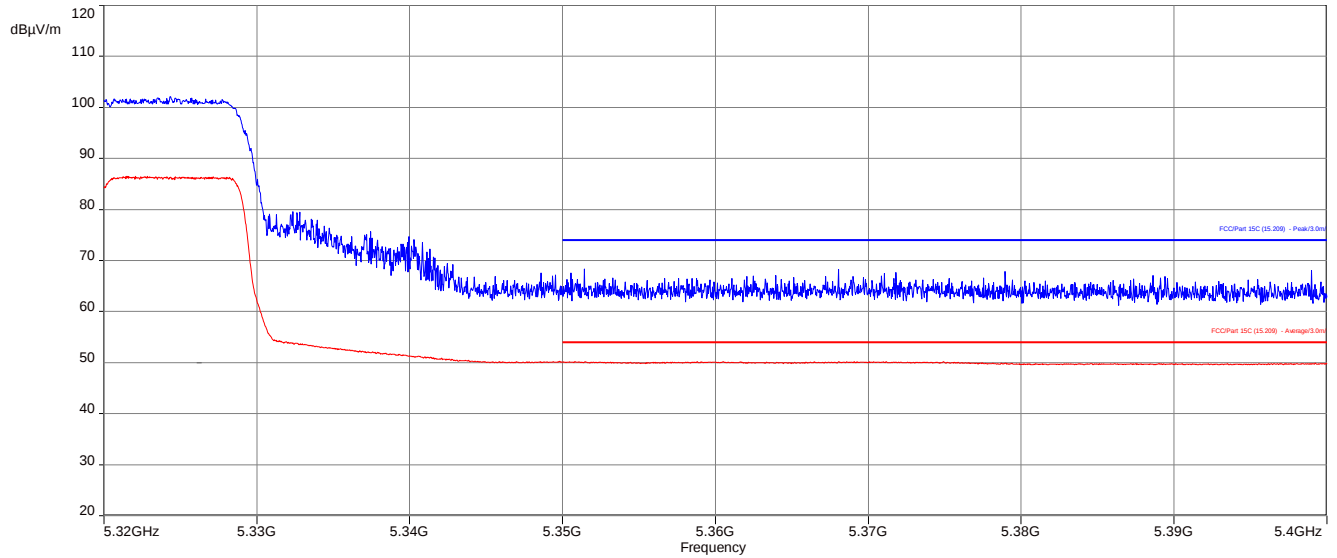
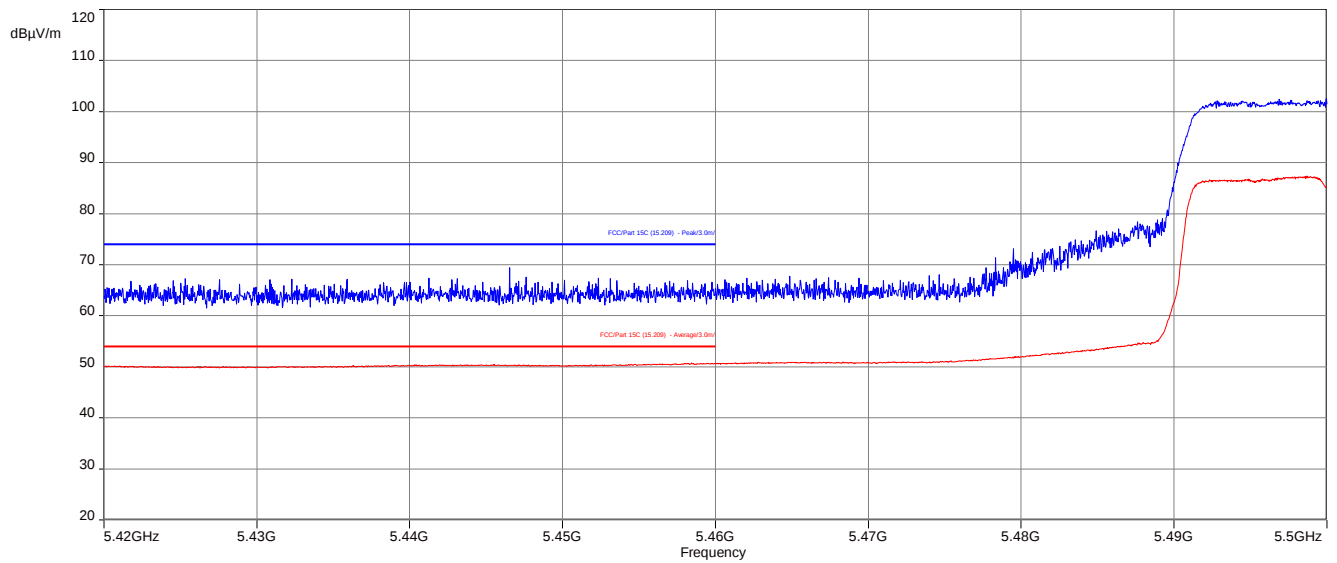
Band Edge Compliance Radiated
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within 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

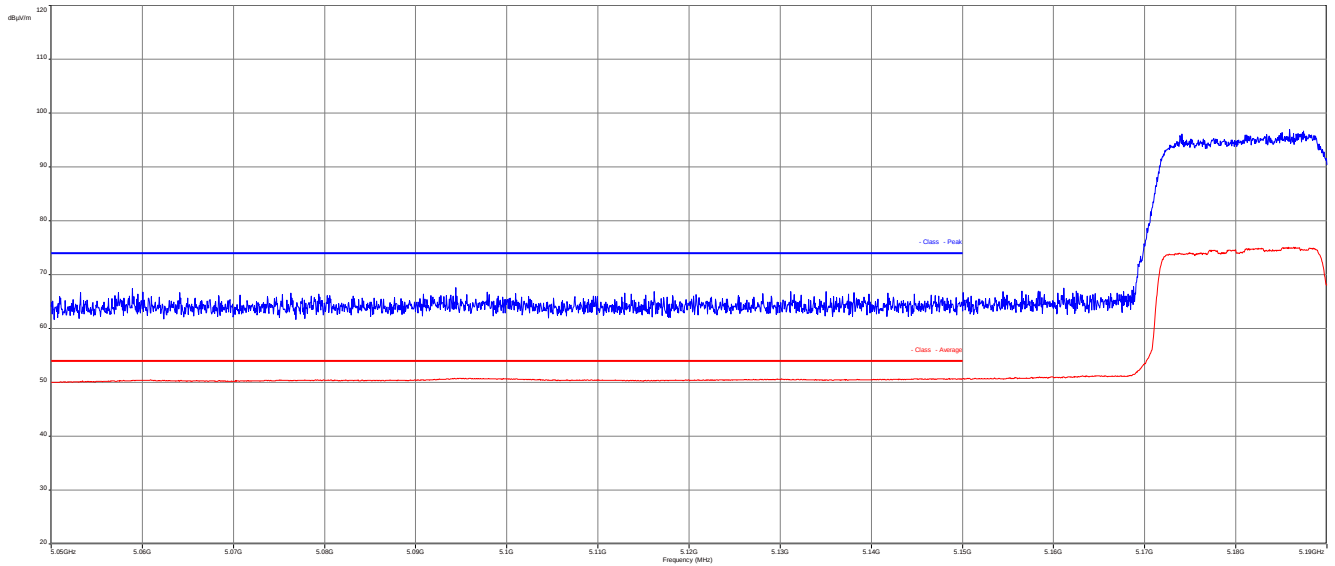
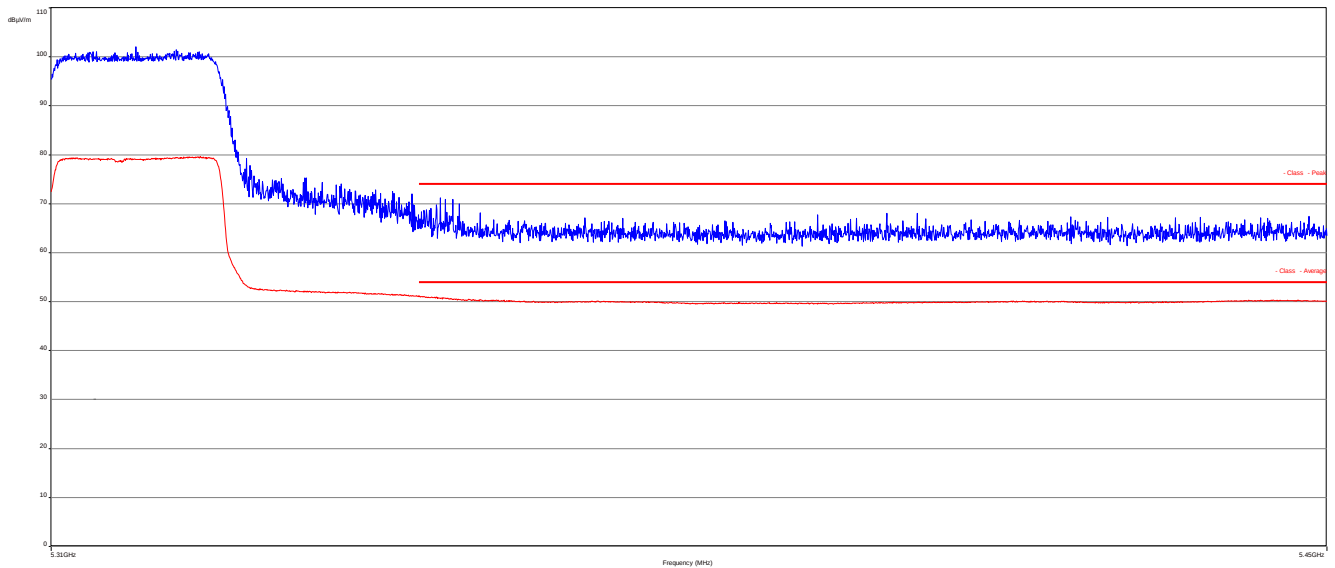
Result:

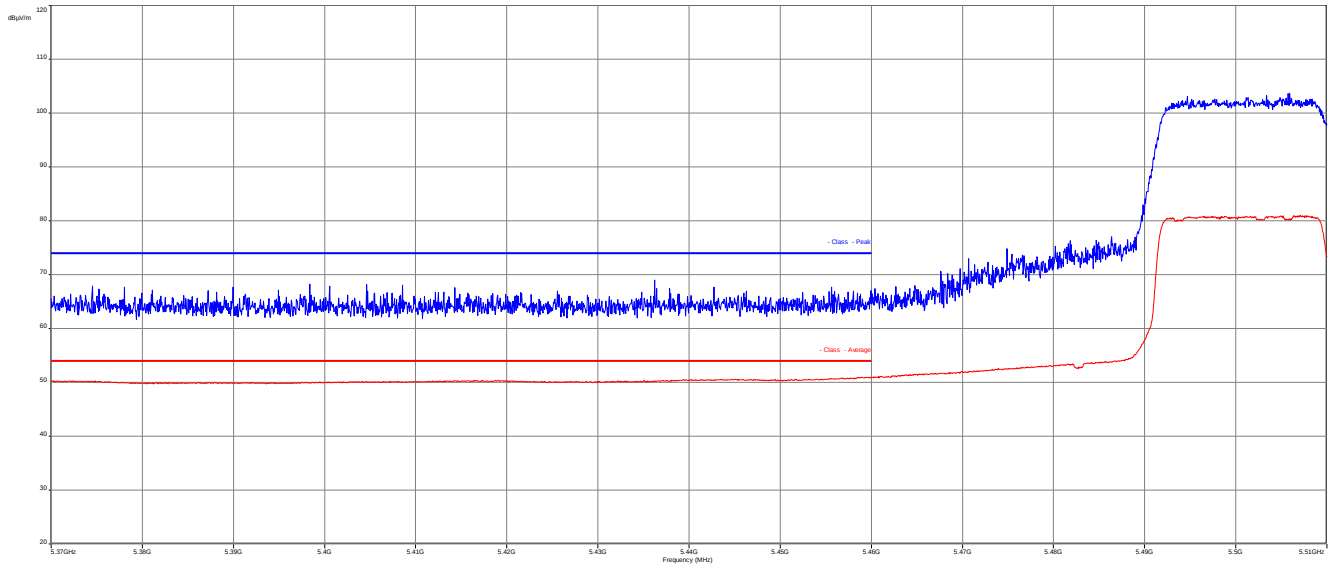
Scenario	Band Edge Compliance Radiated [dB μ V/m]
band edge	< 74 dBμV/m (AVG) < 54 dBμV/m (PEAK)
Measurement uncertainty	± 3 dB

Plots:**Plot 1:** lower band edge, vertical & horizontal polarization (a mode), channel 36**Plot 2:** upper band edge, vertical & horizontal polarization (a mode), channel 64

Plot 3: lower band edge, vertical & horizontal polarization (a mode), channel 100**Plot 4:** lower band edge, vertical & horizontal polarization (n HT 20 mode), channel 36

Plot 5: upper band edge, vertical & horizontal polarization (n HT 20 mode), channel 64**Plot 6:** lower band edge, vertical & horizontal polarization (n HT 20 mode), channel 100

Plot 7: lower band edge, vertical & horizontal polarization (n HT 40 mode), channel 38**Plot 8:** upper band edge, vertical & horizontal polarization (n HT 40 mode), channel 62

Plot 9: lower band edge, vertical & horizontal polarization (n HT 40 mode), channel 102

12.5 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 / 1 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 sub clause 7.1 A / 7.2 A / 7.3 A
Measurement uncertainty	See sub clause 8

Limits:

TX Spurious Emissions Radiated		
§15.209		
Frequency (MHz)	Field Strength (dB μ V/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								
5180 MHz			5240 MHz			5260 MHz		
F [MHz]	Detector	Level [dBμV/m]	F [MHz]	Detector	Level [dBμV/m]	F [MHz]	Detector	Level [dBμV/m]
No peaks found.			No peaks found.			No peaks found.		
Measurement uncertainty			± 3 dB					

TX Spurious Emissions Radiated [dBμV/m] / dBm								
OFDM a – mode								
5320 MHz			5500 MHz			5600 MHz		
F [MHz]	Detector	Level [dBμV/m]	F [MHz]	Detector	Level [dBμV/m]	F [MHz]	Detector	Level [dBμV/m]
No peaks found.			No peaks found.			No peaks found.		
Measurement uncertainty			± 3 dB					

TX Spurious Emissions Radiated [dBμV/m] / dBm								
OFDM a – mode								
5700 MHz			-/-			-/-		
F [MHz]	Detector	Level [dBμV/m]						
No peaks found.								
Measurement uncertainty			± 3 dB					

Results: OFDM / n – mode HT20

TX Spurious Emissions Radiated [dBμV/m] / dBm								
OFDM n – mode HT20								
5180 MHz			5240 MHz			5260 MHz		
F [MHz]	Detector	Level [dBμV/m]	F [MHz]	Detector	Level [dBμV/m]	F [MHz]	Detector	Level [dBμV/m]
No peaks found.			No peaks found.			No peaks found.		
Measurement uncertainty			± 3 dB					

TX Spurious Emissions Radiated [dBμV/m] / dBm								
OFDM n – mode HT20								
5320 MHz			5500 MHz			5600 MHz		
F [MHz]	Detector	Level [dBμV/m]	F [MHz]	Detector	Level [dBμV/m]	F [MHz]	Detector	Level [dBμV/m]
No peaks found.			No peaks found.			No peaks found.		
Measurement uncertainty			± 3 dB					

TX Spurious Emissions Radiated [dBμV/m] / dBm								
OFDM n – mode HT20								
5700 MHz			-/-			-/-		
F [MHz]	Detector	Level [dBμV/m]	F [MHz]	Detector	Level [dBμV/m]	F [MHz]	Detector	Level [dBμV/m]
No peaks found.								
Measurement uncertainty			± 3 dB					

Results: OFDM / n – mode HT40

TX Spurious Emissions Radiated [dBμV/m] / dBm								
OFDM n – mode HT40								
5190 MHz			5230 MHz			5270 MHz		
F [MHz]	Detector	Level [dBμV/m]	F [MHz]	Detector	Level [dBμV/m]	F [MHz]	Detector	Level [dBμV/m]
All detected peak emissions are below the average limit or not within the restricted bands.			All detected peak emissions are below the average limit or not within the restricted bands.			All detected peak emissions are below the average limit or not within the restricted bands.		
Measurement uncertainty			± 3 dB					

TX Spurious Emissions Radiated [dBμV/m] / dBm								
OFDM n – mode HT40								
5310 MHz			5510 MHz			5590 MHz		
F [MHz]	Detector	Level [dBμV/m]	F [MHz]	Detector	Level [dBμV/m]	F [MHz]	Detector	Level [dBμV/m]
All detected peak emissions are below the average limit or not within the restricted bands.			All detected peak emissions are below the average limit or not within the restricted bands.			All detected peak emissions are below the average limit or not within the restricted bands.		
Measurement uncertainty			± 3 dB					

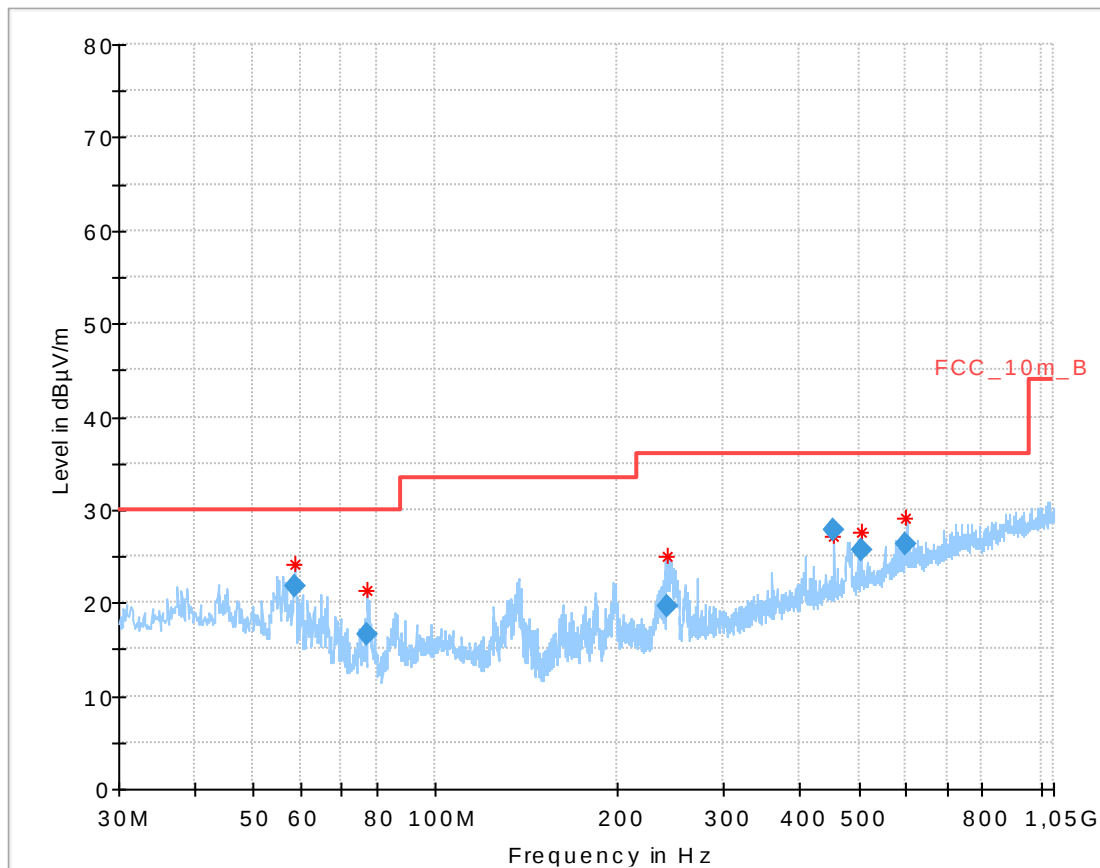
TX Spurious Emissions Radiated [dBμV/m] / dBm								
OFDM n – mode HT40								
5670 MHz			-/-			-/-		
F [MHz]	Detector	Level [dBμV/m]	F [MHz]	Detector	Level [dBμV/m]	F [MHz]	Detector	Level [dBμV/m]
All detected peak emissions are below the average limit or not within the restricted bands.			-/-			-/-		
Measurement uncertainty			± 3 dB					

Note:

Results of the OFDM / n – mode HT20 and HT40 are added to show the behaviour of the EUT.

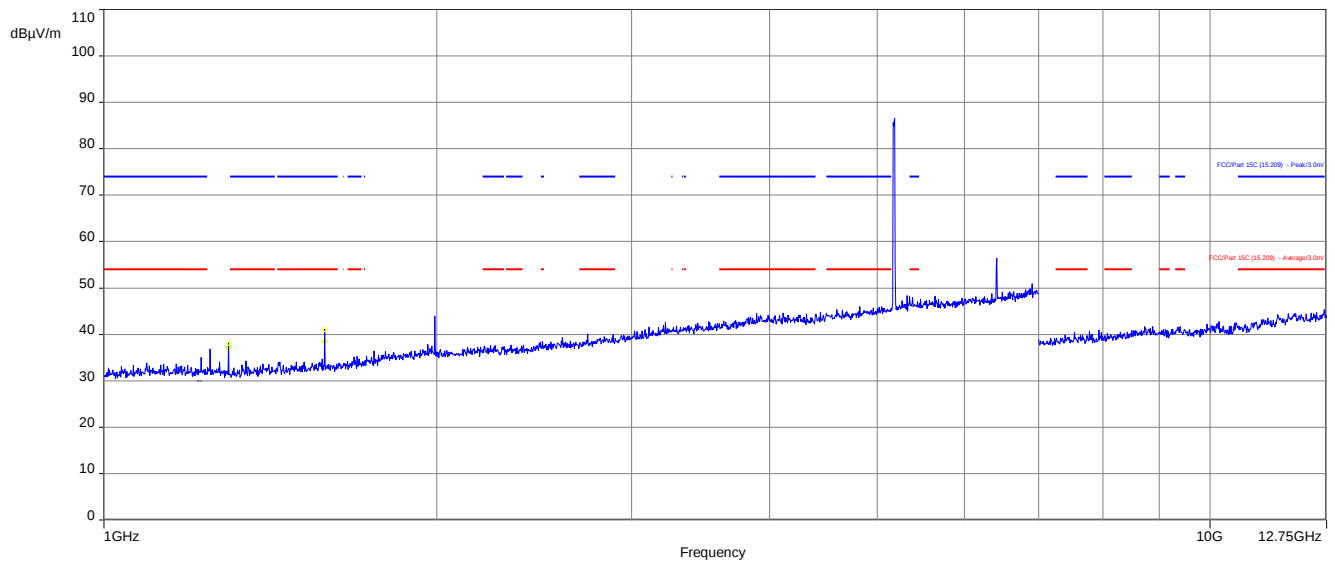
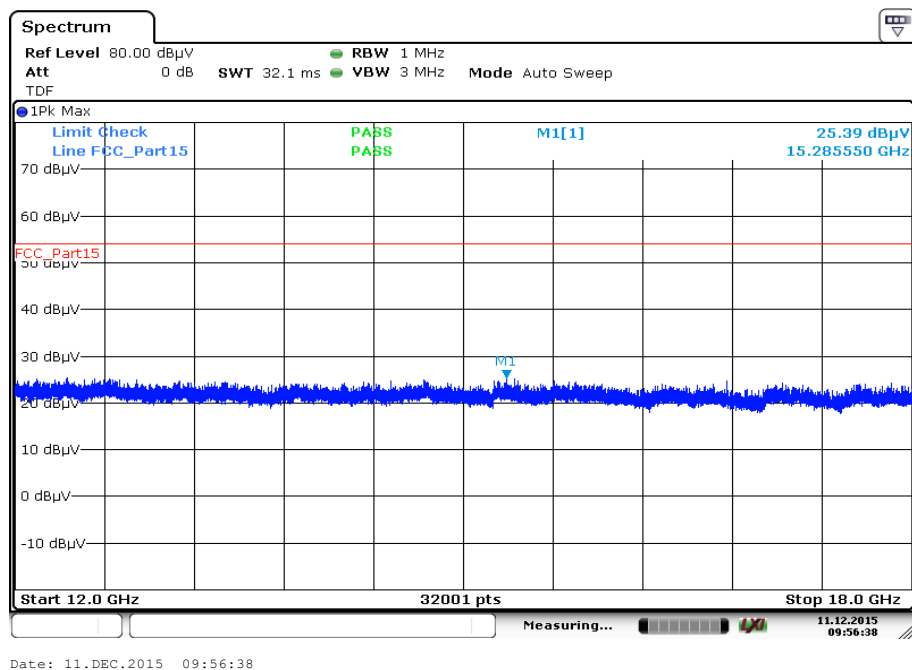
Plots: OFDM / a – mode

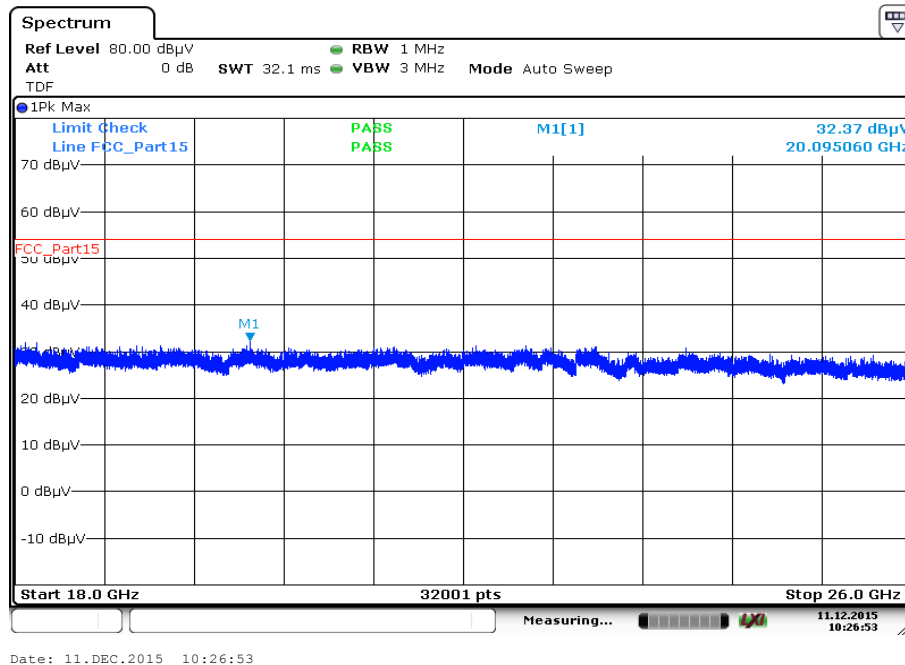
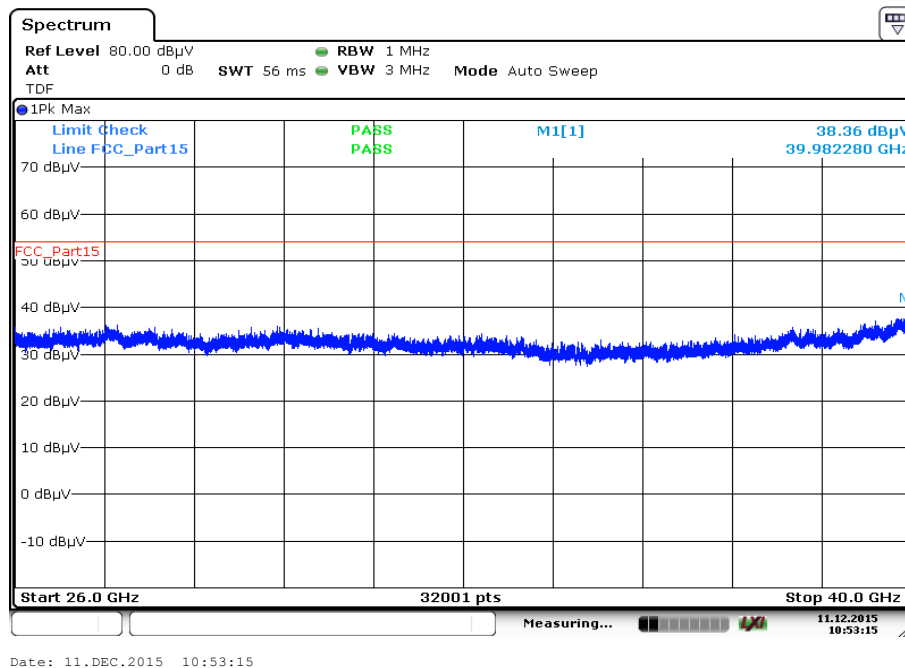
Plot 1: 30 MHz to 1 GHz, 5180 MHz, vertical & horizontal polarization

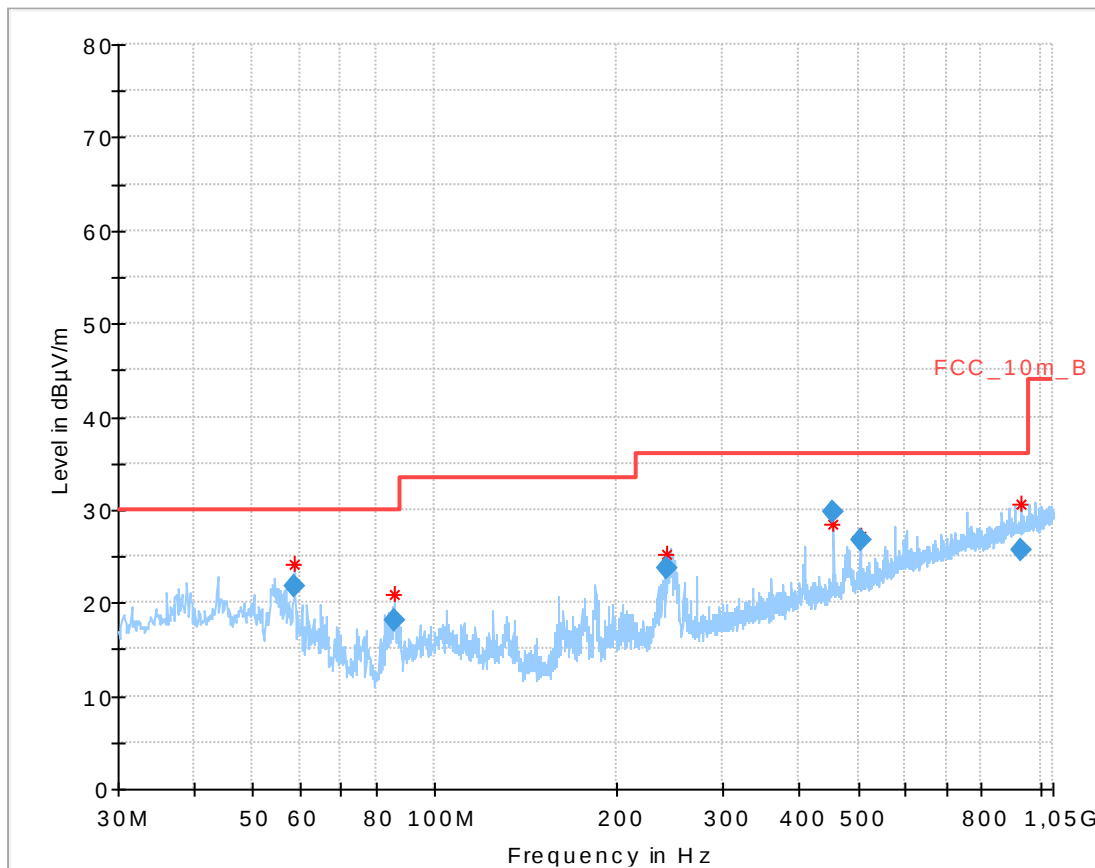


Final Result

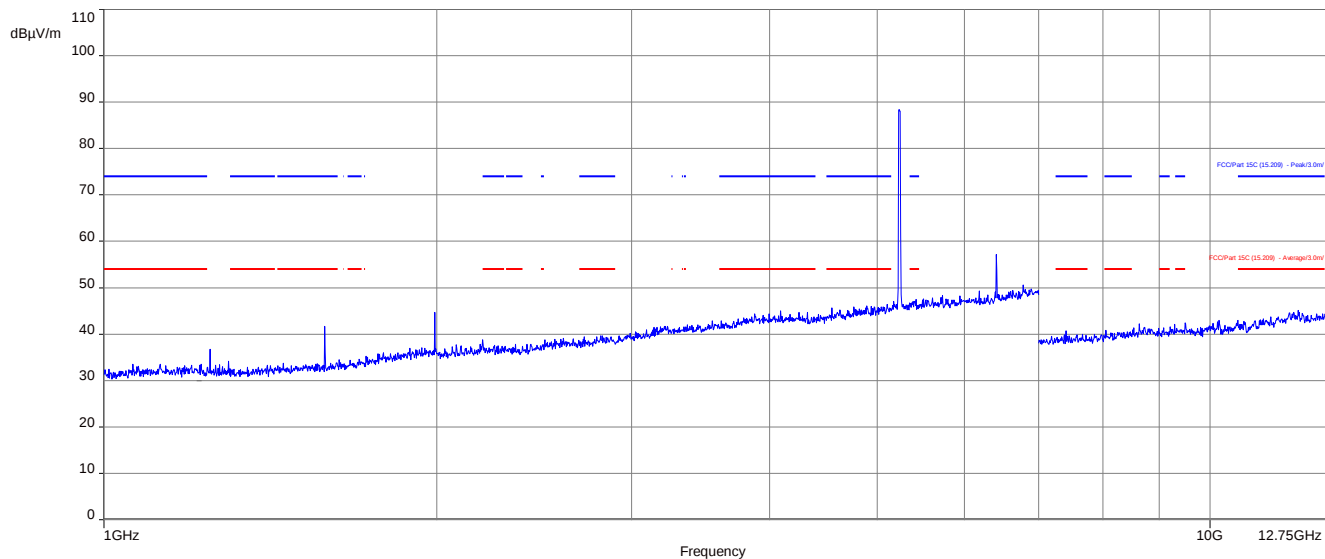
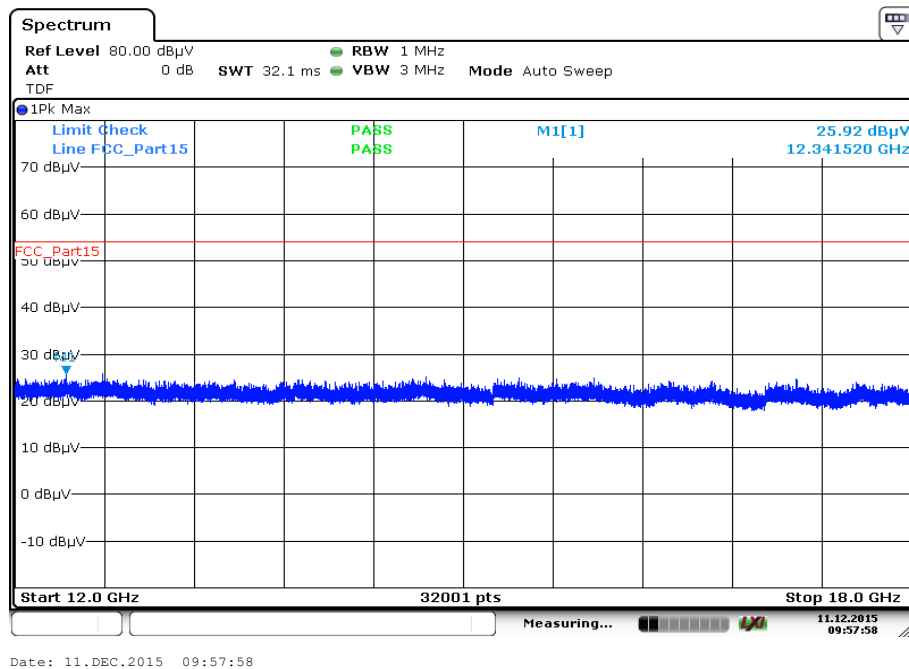
Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
58.716150	21.73	30.00	8.27	1000.0	120.000	101.0	V	95	10.9
77.217000	16.55	30.00	13.45	1000.0	120.000	170.0	V	95	8.2
241.998600	19.52	36.00	16.48	1000.0	120.000	98.0	V	152	13.1
456.013200	27.76	36.00	8.24	1000.0	120.000	170.0	H	34	17.7
504.021600	25.71	36.00	10.29	1000.0	120.000	100.0	H	34	18.8
600.001800	26.35	36.00	9.65	1000.0	120.000	170.0	H	246	20.7

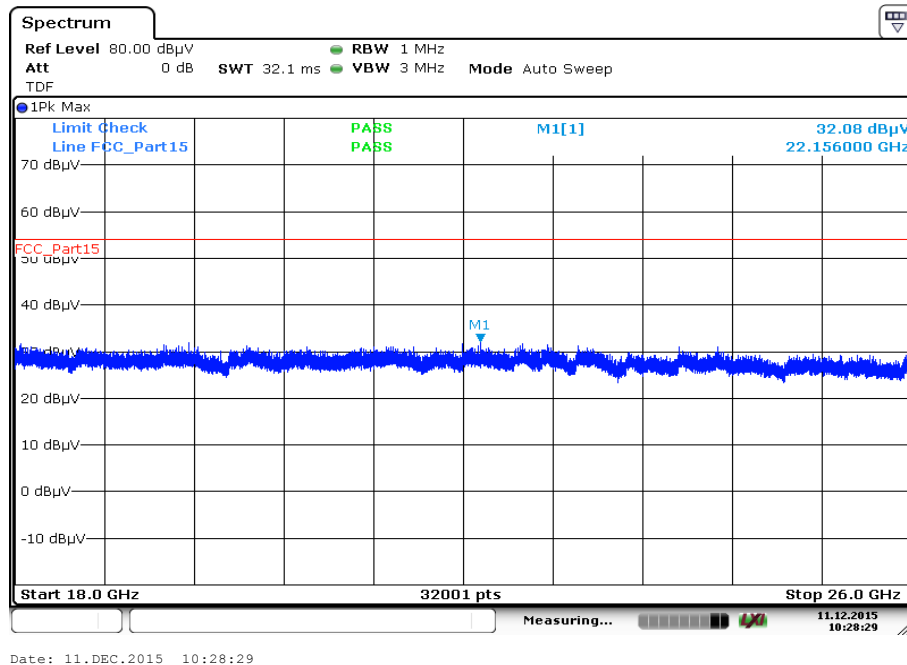
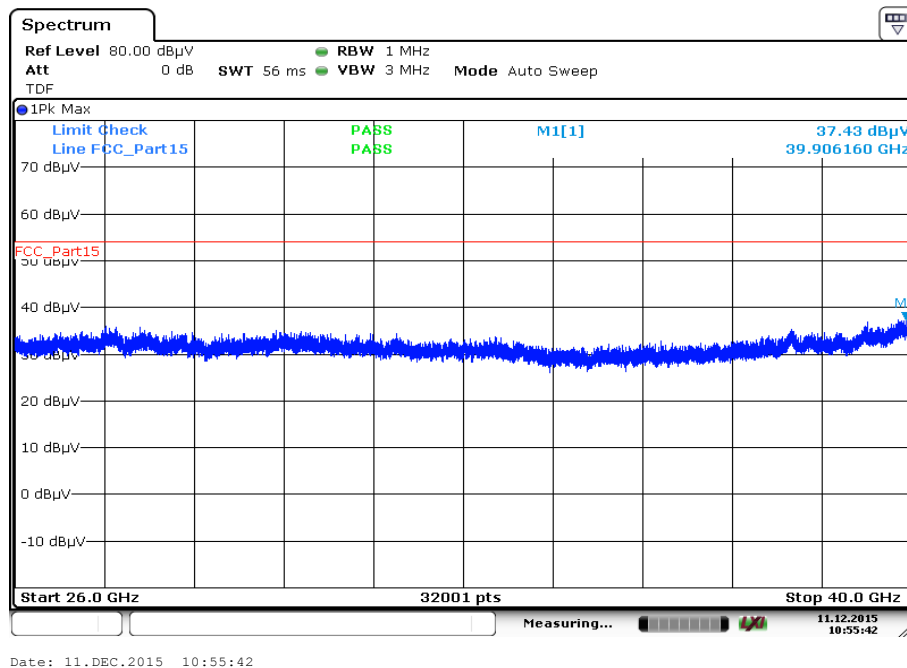
Plot 2: 1 GHz to 12.75 GHz, 5180 MHz, vertical & horizontal polarization**Plot 3:** 12 GHz to 18 GHz, 5180 MHz, vertical & horizontal polarization

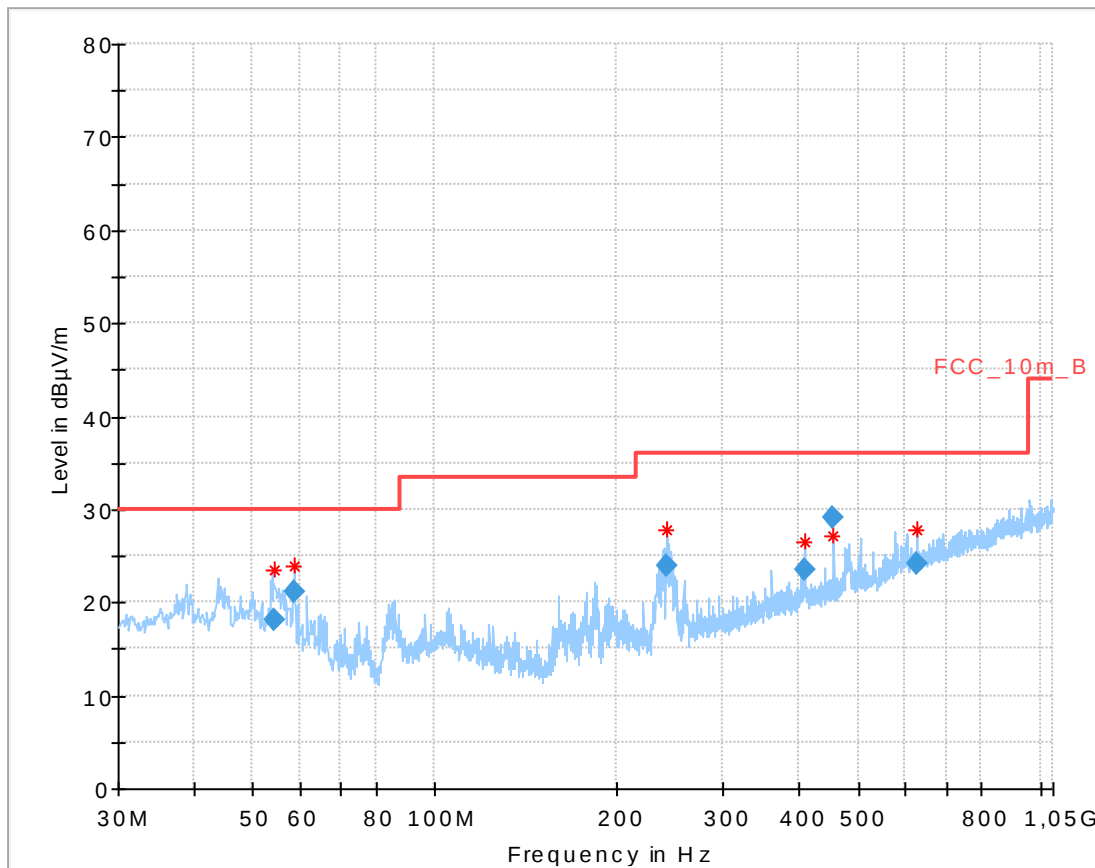
Plot 4: 18 GHz to 26 GHz, 5180 MHz, vertical & horizontal polarization**Plot 5:** 26 GHz to 40 GHz, 5180 MHz, vertical & horizontal polarization

Plot 6: 30 MHz to 1 GHz, 5240 MHz, 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)
58.691700	21.85	30.00	8.15	1000.0	120.000	101.0	V	82	10.9
86.053500	18.07	30.00	11.93	1000.0	120.000	101.0	V	82	9.5
242.380500	23.79	36.00	12.21	1000.0	120.000	98.0	V	323	13.1
456.018450	29.76	36.00	6.24	1000.0	120.000	170.0	H	204	17.7
504.003600	26.65	36.00	9.35	1000.0	120.000	170.0	H	41	18.8
927.373350	25.70	36.00	10.30	1000.0	120.000	100.0	H	29	24.2

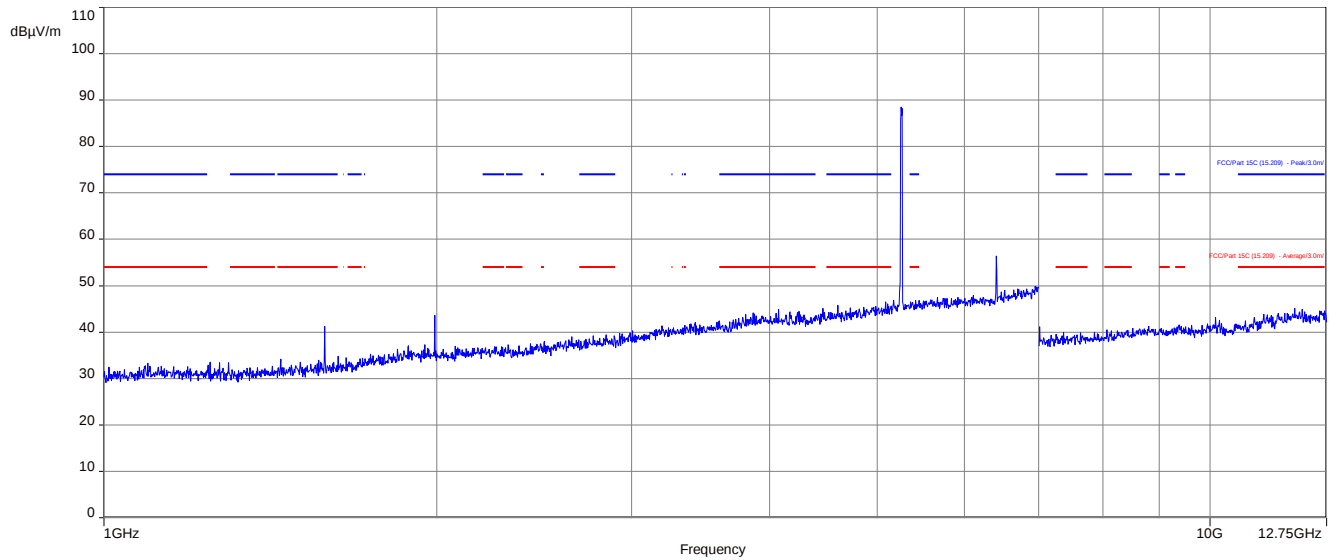
Plot 7: 1 GHz to 12.75 GHz, 5240 MHz, vertical & horizontal polarization**Plot 8:** 12 GHz to 18 GHz, 5240 MHz, vertical & horizontal polarization

Plot 9: 18 GHz to 26 GHz, 5240 MHz, vertical & horizontal polarization**Plot 10:** 26 GHz to 40 GHz, 5240 MHz, vertical & horizontal polarization

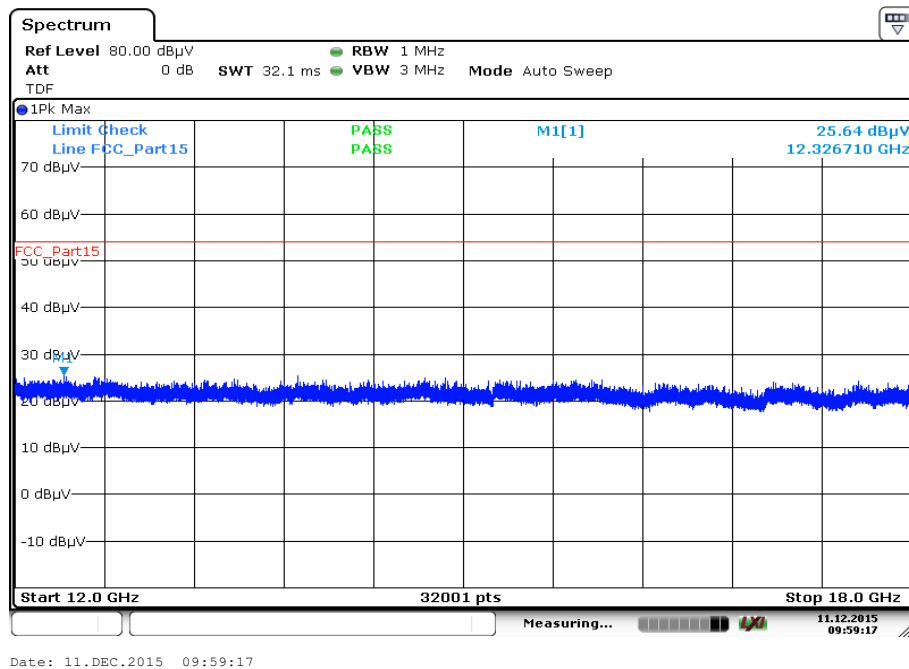
Plot 11: 30 MHz to 1 GHz, 5260 MHz, vertical & horizontal polarization**Final Result**

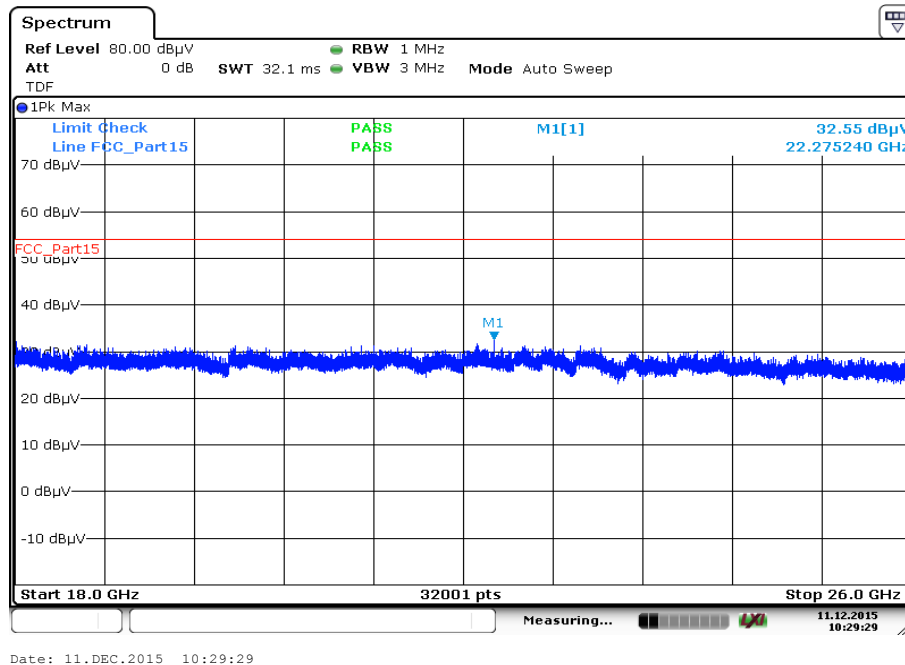
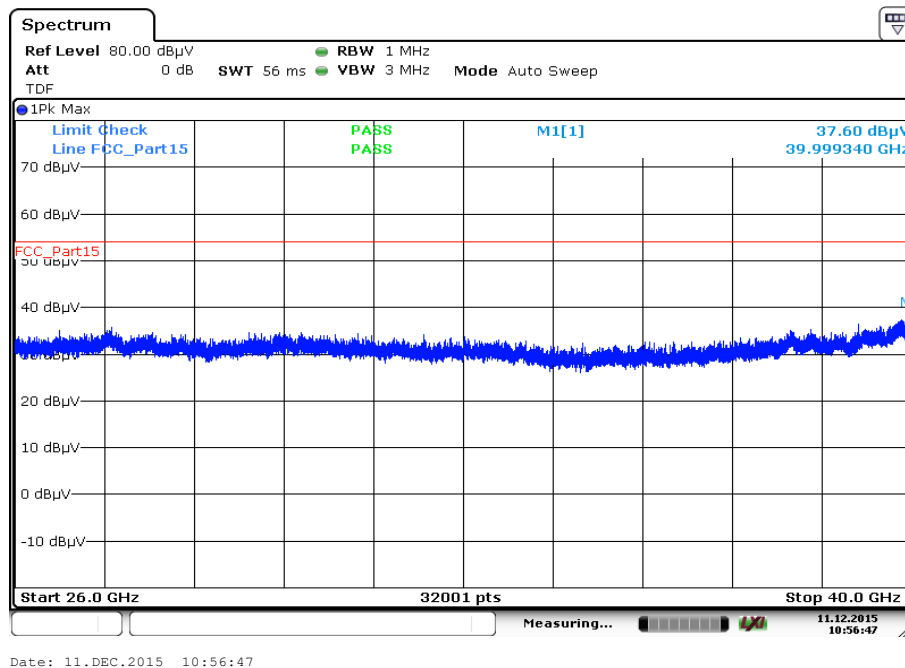
Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
54.180600	18.06	30.00	11.94	1000.0	120.000	170.0	V	74	12.0
58.713600	21.14	30.00	8.86	1000.0	120.000	101.0	V	42	10.9
241.554600	23.97	36.00	12.03	1000.0	120.000	98.0	V	322	13.1
407.999400	23.55	36.00	12.45	1000.0	120.000	101.0	H	0	17.0
456.006600	29.16	36.00	6.84	1000.0	120.000	170.0	H	194	17.7
624.002550	24.17	36.00	11.83	1000.0	120.000	101.0	H	10	20.9

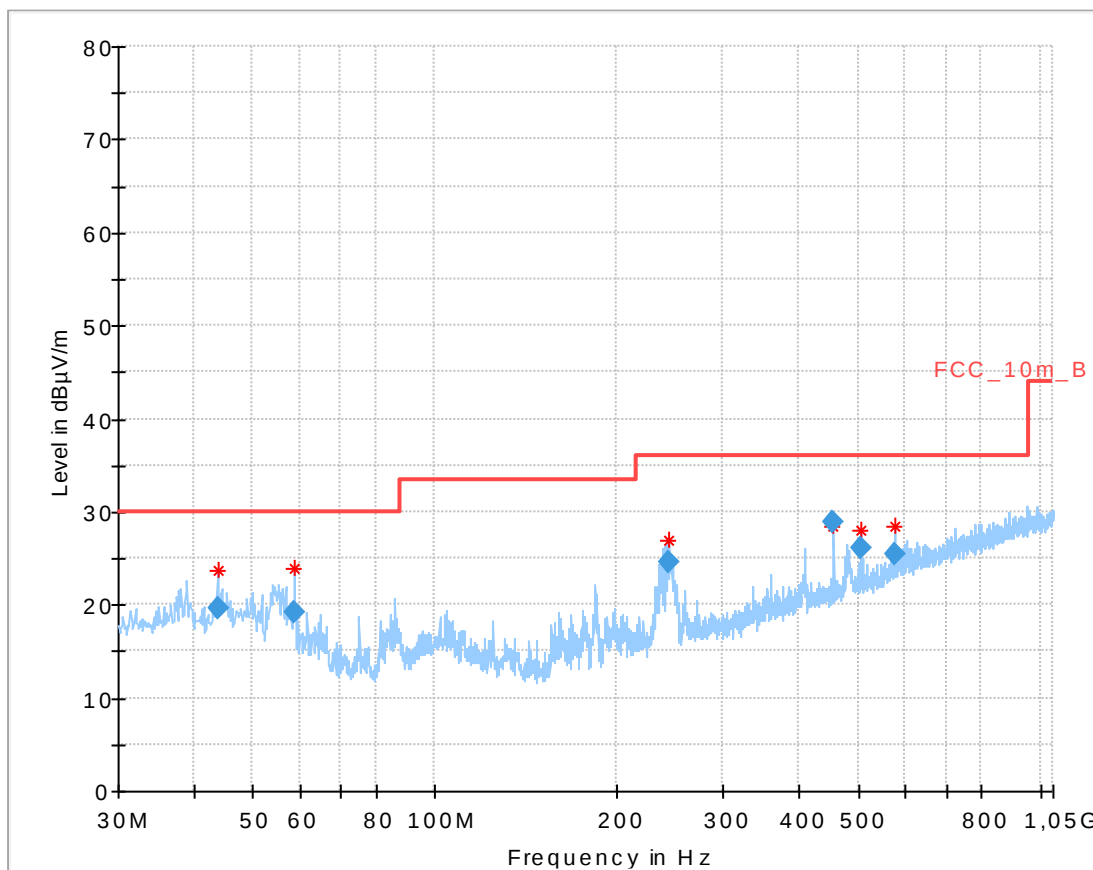
Plot 12: 1 GHz to 12.75 GHz, 5260 MHz, vertical & horizontal polarization



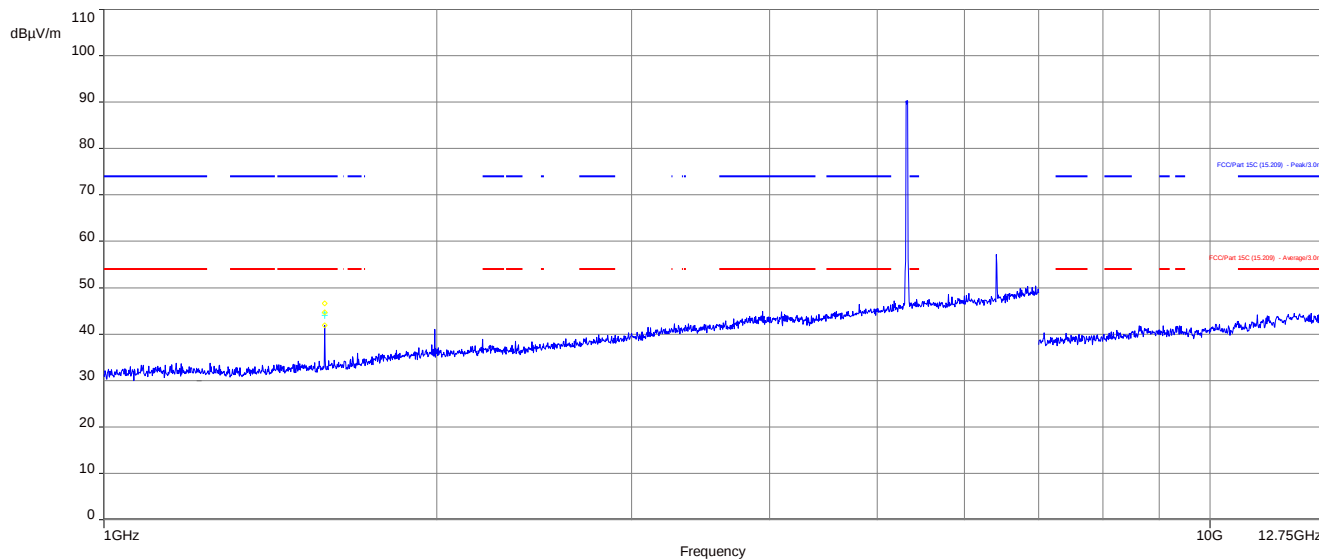
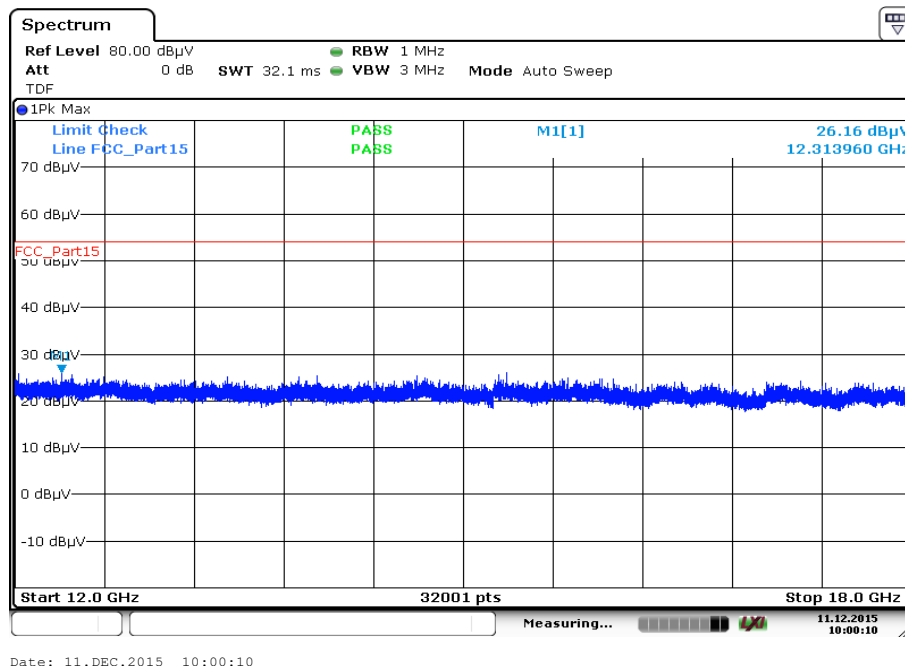
Plot 13: 12 GHz to 18 GHz, 5260 MHz, vertical & horizontal polarization

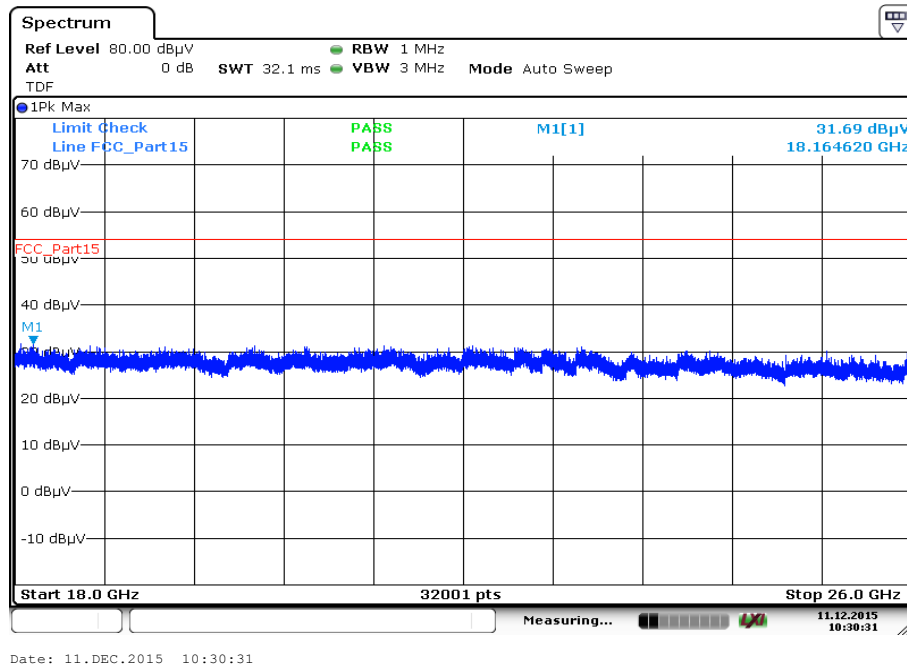
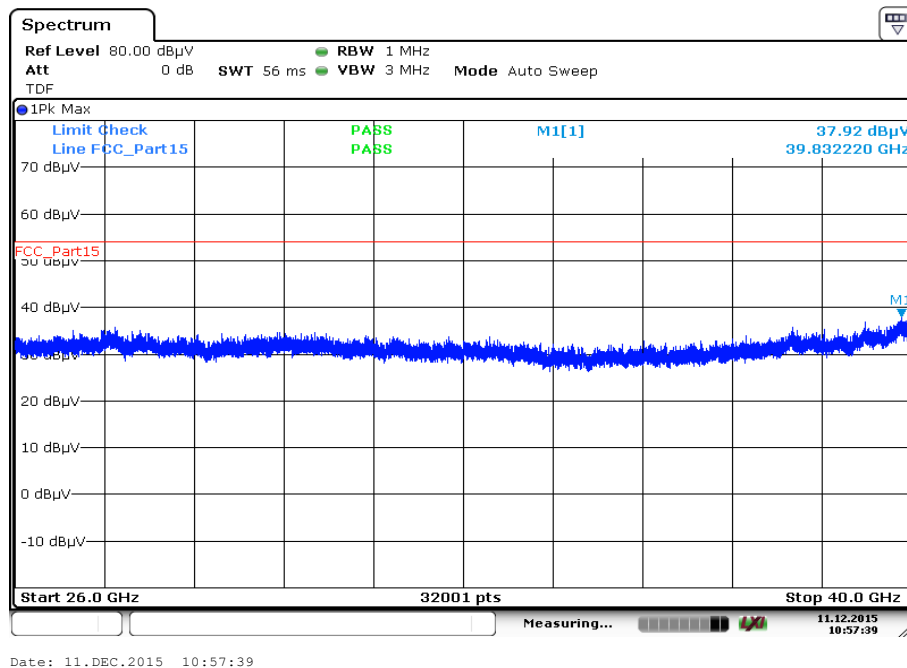


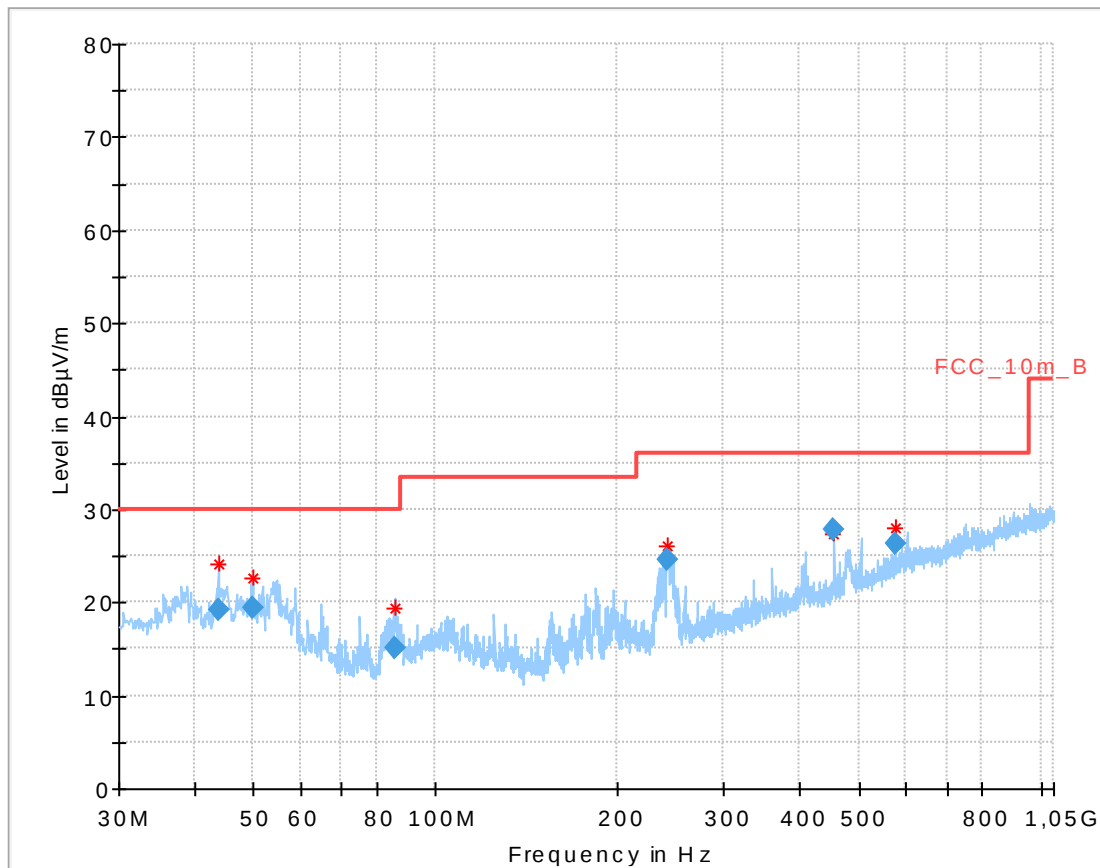
Plot 14: 18 GHz to 26 GHz, 5260 MHz, vertical & horizontal polarization**Plot 15:** 26 GHz to 40 GHz, 5260 MHz, vertical & horizontal polarization

Plot 16: 30 MHz to 1 GHz, 5320 MHz, vertical & horizontal polarization**Final Result**

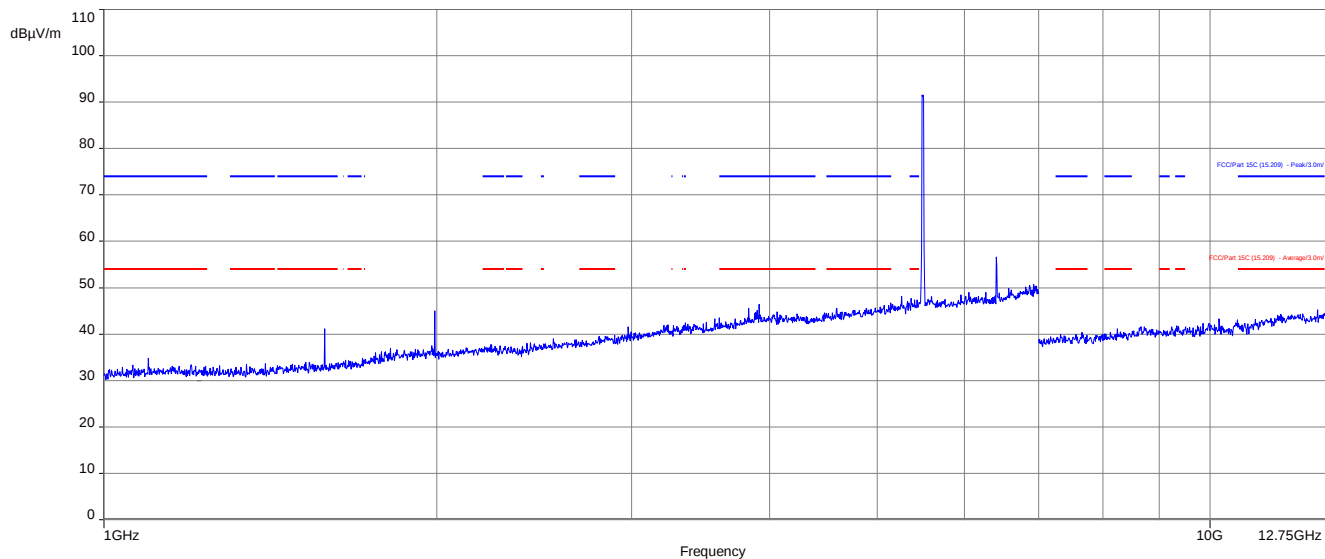
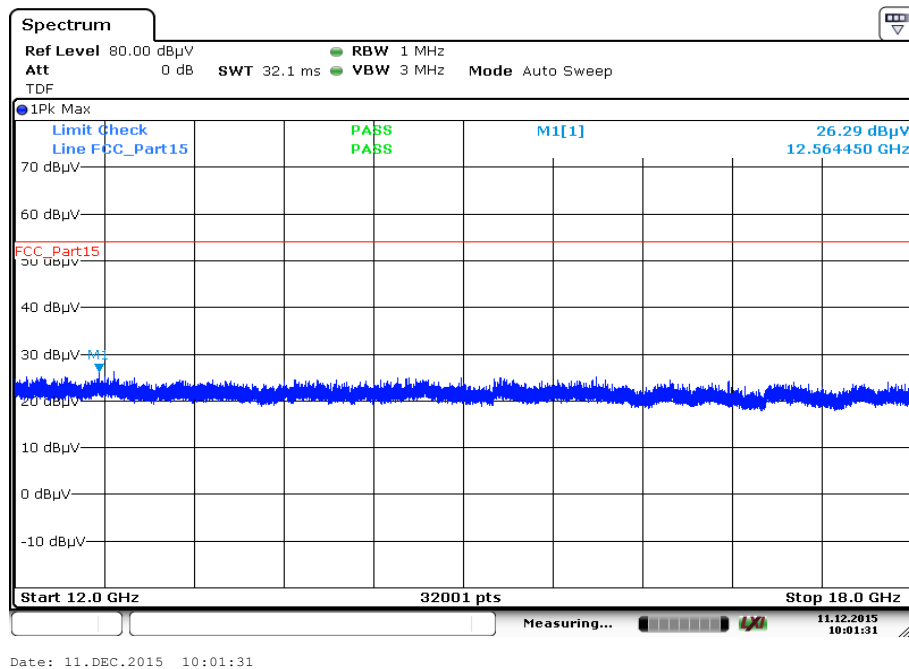
Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
43.801050	19.57	30.00	10.43	1000.0	120.000	101.0	V	118	13.9
58.671900	19.27	30.00	10.73	1000.0	120.000	101.0	V	188	10.9
243.184350	24.67	36.00	11.33	1000.0	120.000	98.0	V	341	13.1
456.007350	28.97	36.00	7.03	1000.0	120.000	170.0	H	215	17.7
504.012150	26.05	36.00	9.95	1000.0	120.000	170.0	H	63	18.8
576.011550	25.46	36.00	10.54	1000.0	120.000	101.0	H	0	20.0

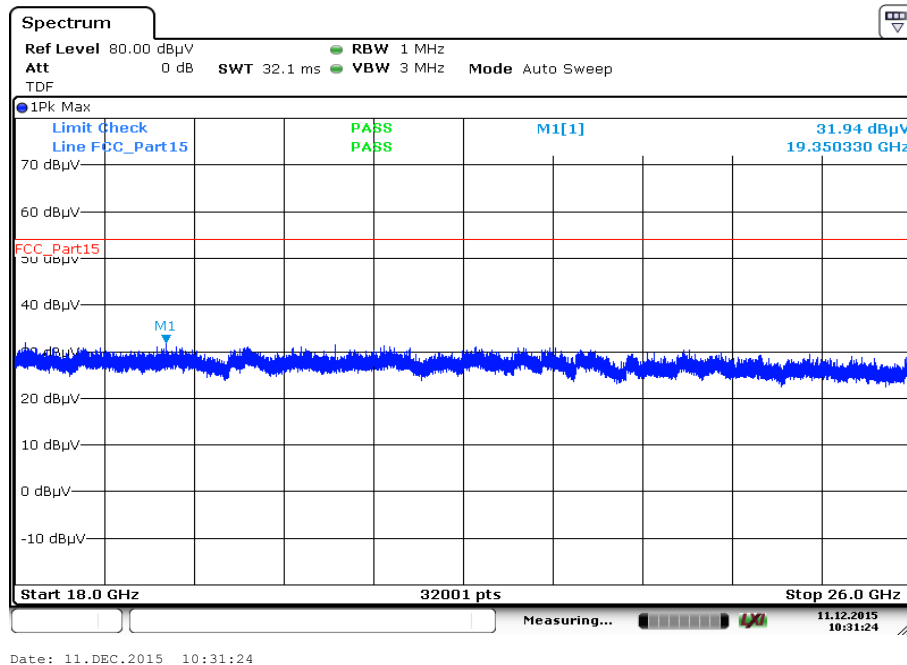
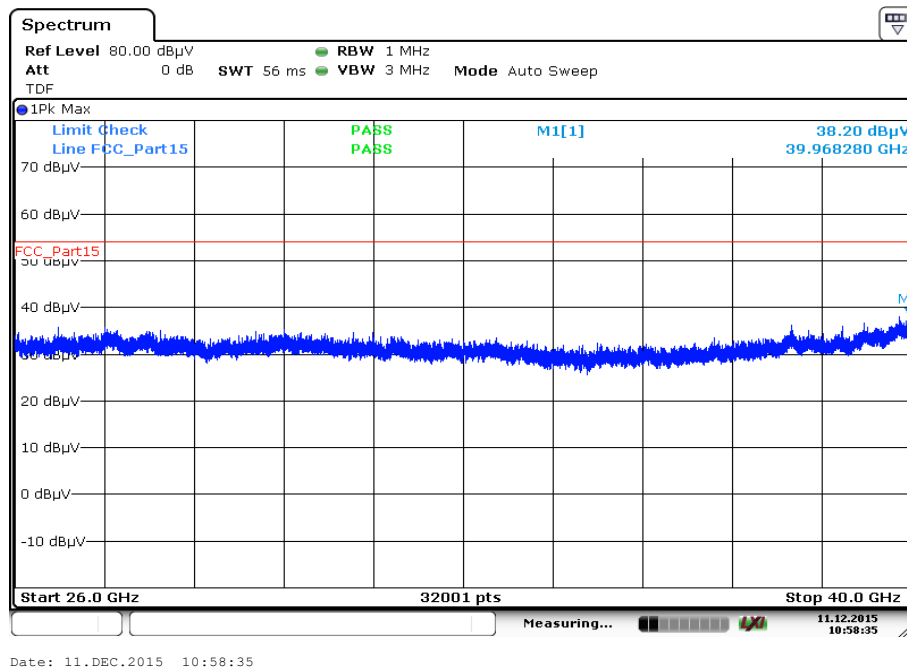
Plot 17: 1 GHz to 12.75 GHz, 5320 MHz, vertical & horizontal polarization**Plot 18:** 12 GHz to 18 GHz, 5320 MHz, vertical & horizontal polarization

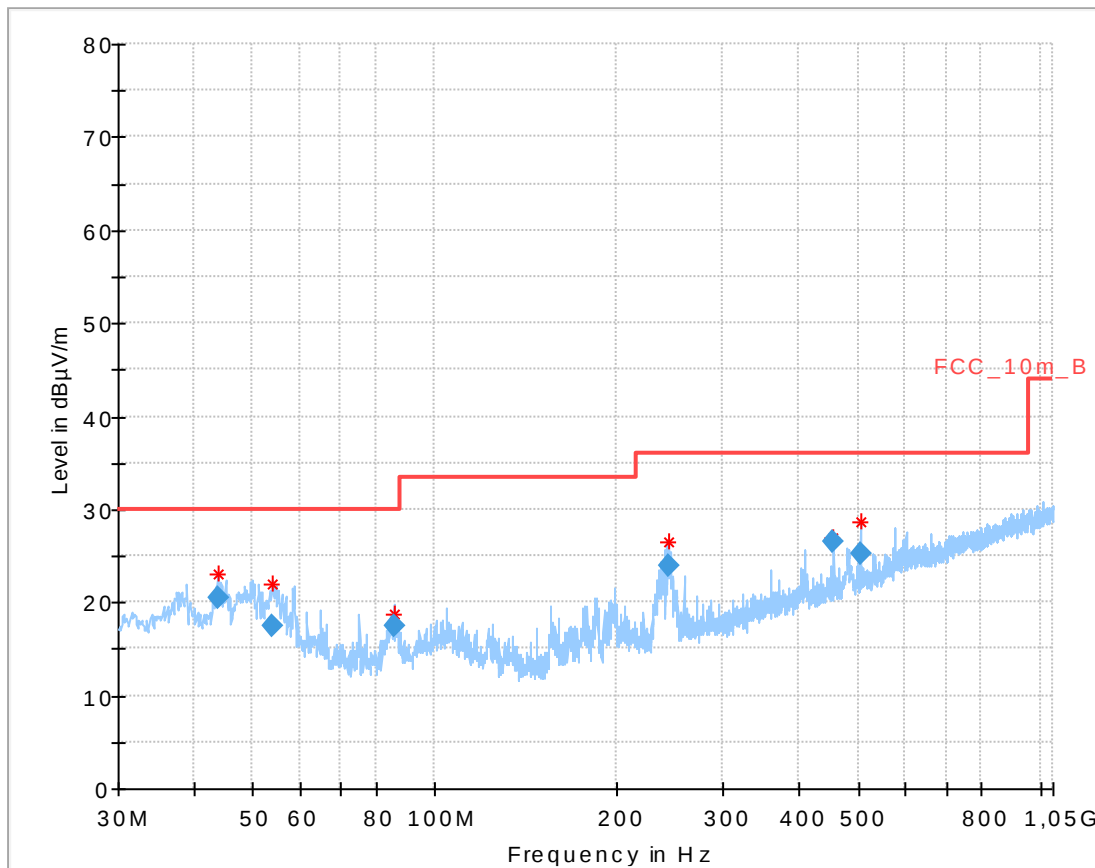
Plot 19: 18 GHz to 26 GHz, 5320 MHz, vertical & horizontal polarization**Plot 20:** 26 GHz to 40 GHz, 5320 MHz, vertical & horizontal polarization

Plot 21: 30 MHz to 1 GHz, 5500 MHz, vertical & horizontal polarization**Final Result**

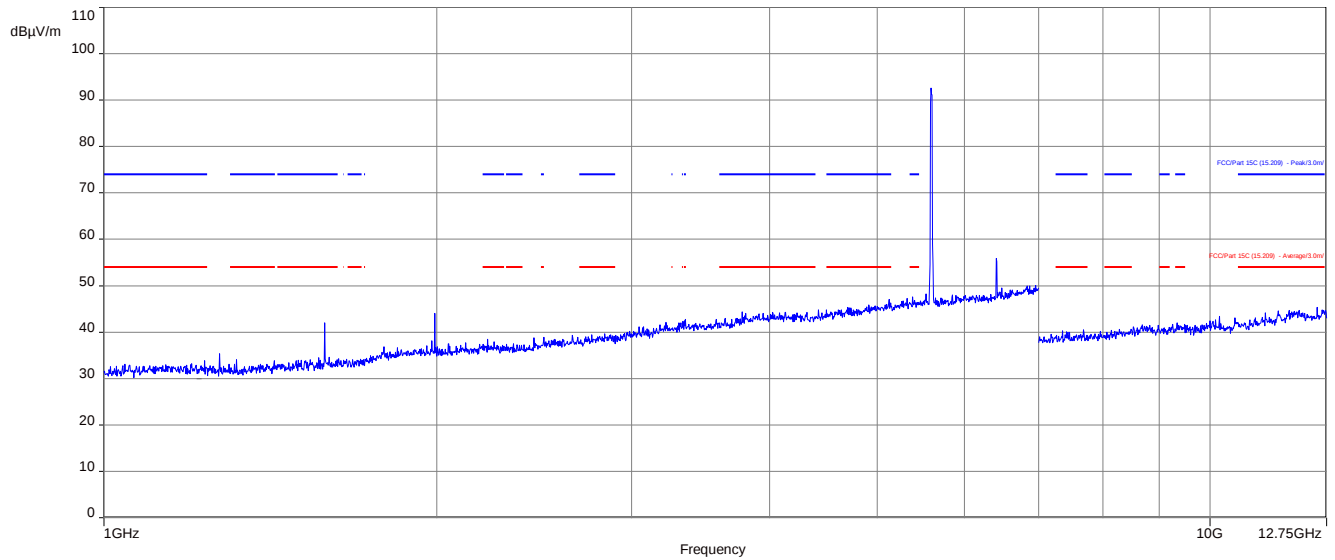
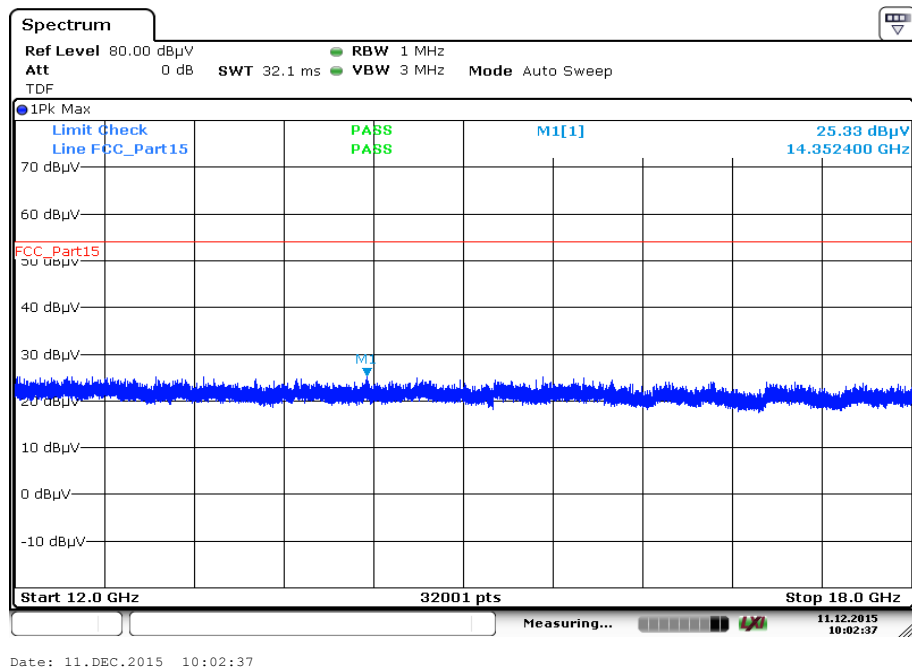
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
43.810050	19.18	30.00	10.82	1000.0	120.000	101.0	V	278	13.9
49.991700	19.50	30.00	10.50	1000.0	120.000	98.0	V	88	12.6
85.565400	15.00	30.00	15.00	1000.0	120.000	101.0	V	88	9.4
241.177650	24.60	36.00	11.40	1000.0	120.000	98.0	V	346	13.1
456.017400	27.88	36.00	8.12	1000.0	120.000	170.0	H	226	17.7
576.000300	26.37	36.00	9.63	1000.0	120.000	101.0	H	331	20.0

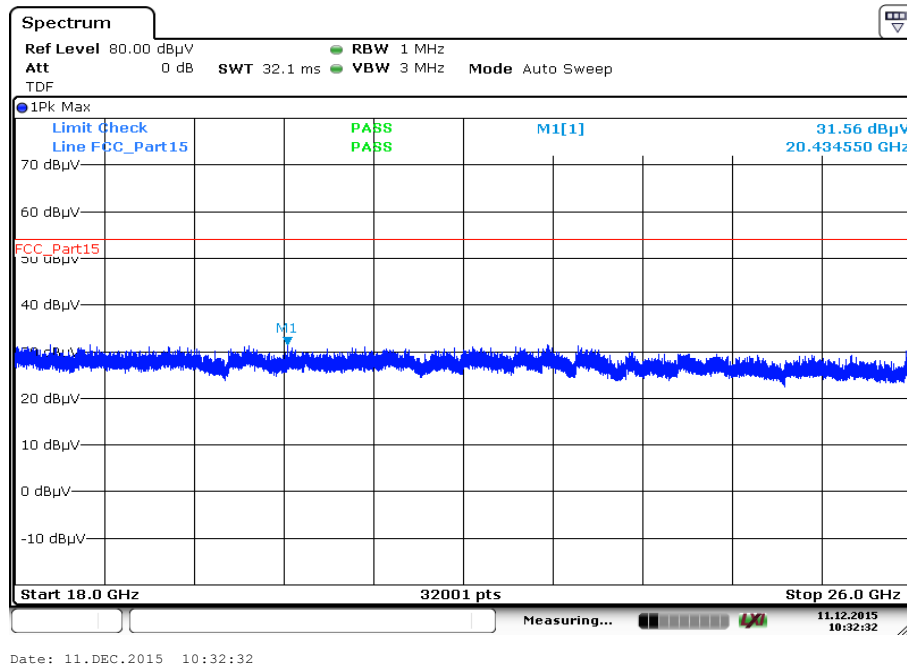
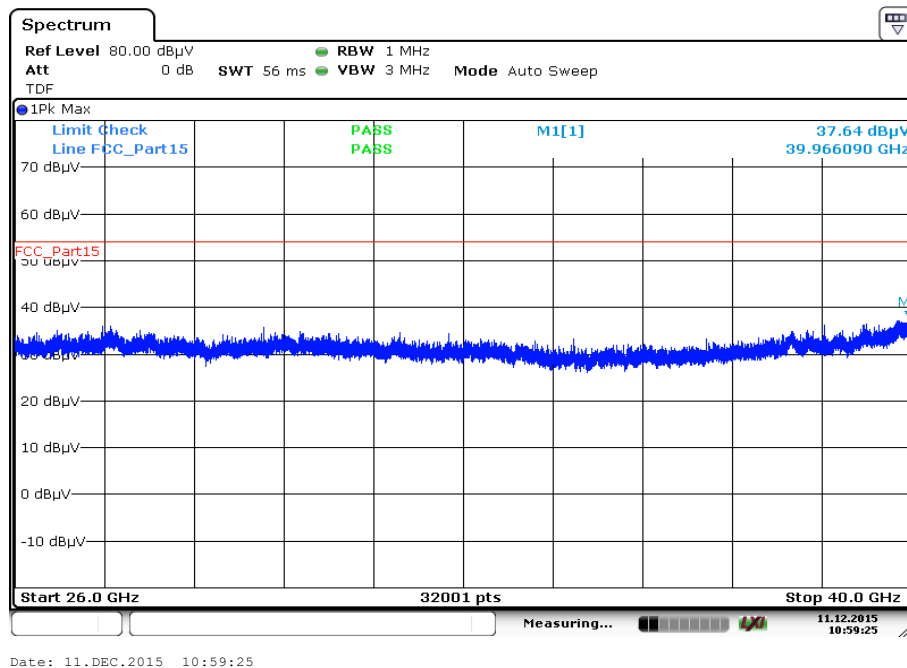
Plot 22: 1 GHz to 12.75 GHz, 5500 MHz, vertical & horizontal polarization**Plot 23:** 12 GHz to 18 GHz, 5500 MHz, vertical & horizontal polarization

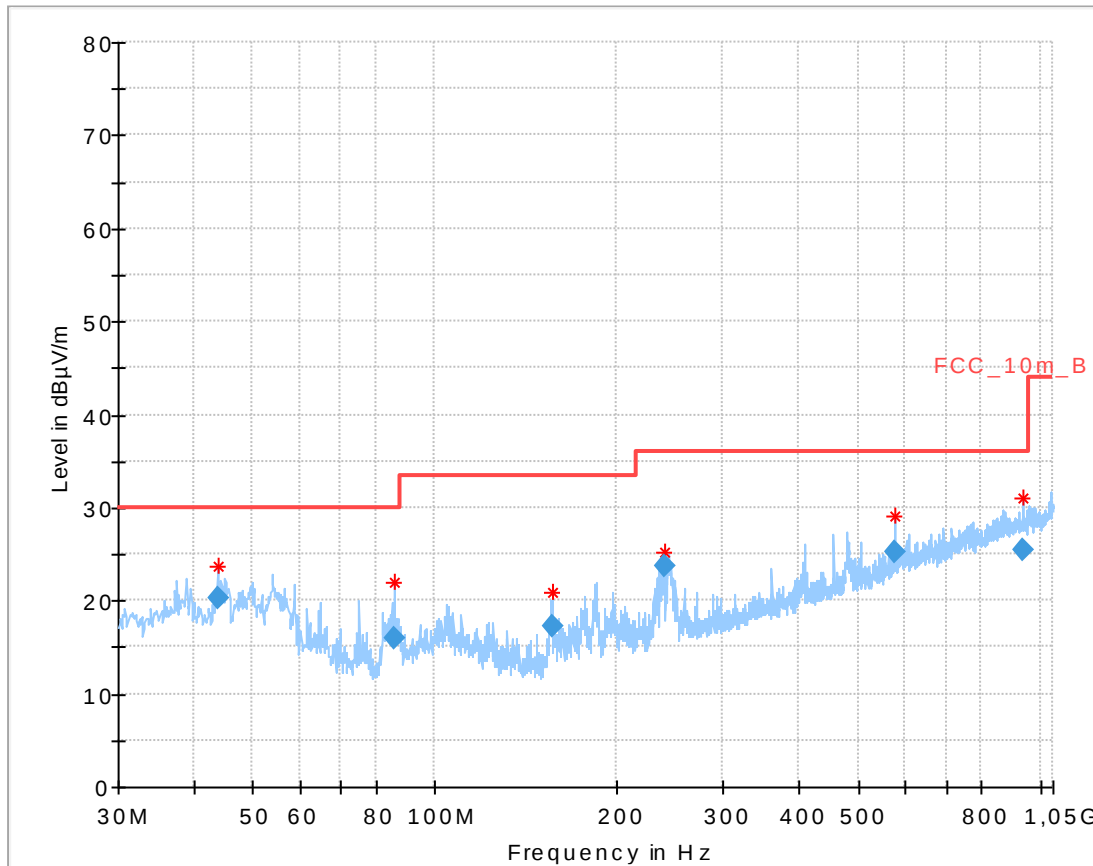
Plot 24: 18 GHz to 26 GHz, 5500 MHz, vertical & horizontal polarization**Plot 25:** 26 GHz to 40 GHz, 5500 MHz, vertical & horizontal polarization

Plot 26: 30 MHz to 1 GHz, 5600 MHz, vertical & horizontal polarization**Final Result**

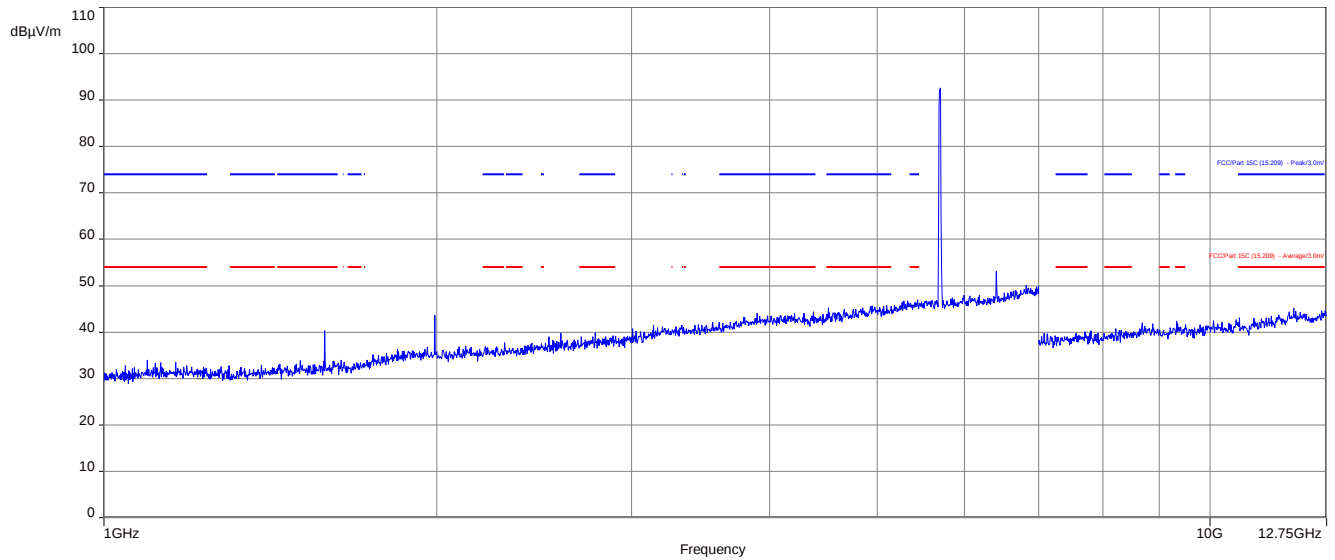
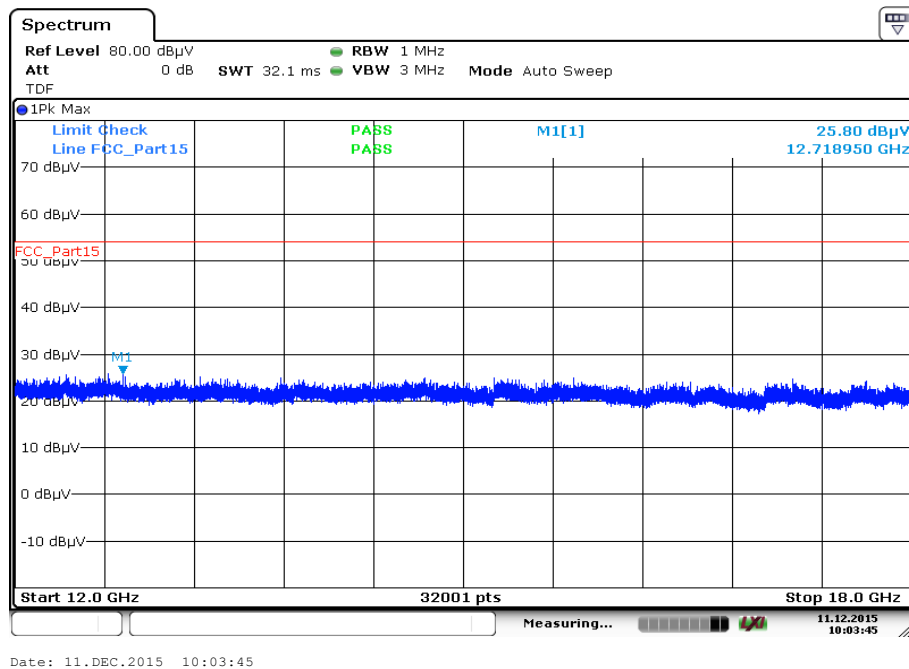
Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
43.804800	20.42	30.00	9.58	1000.0	120.000	98.0	V	118	13.9
53.995500	17.46	30.00	12.54	1000.0	120.000	170.0	V	359	12.0
86.016300	17.45	30.00	12.55	1000.0	120.000	101.0	V	92	9.5
242.801850	23.84	36.00	12.16	1000.0	120.000	98.0	V	339	13.1
456.004800	26.62	36.00	9.38	1000.0	120.000	170.0	H	17	17.7
504.014850	25.25	36.00	10.75	1000.0	120.000	101.0	H	17	18.8

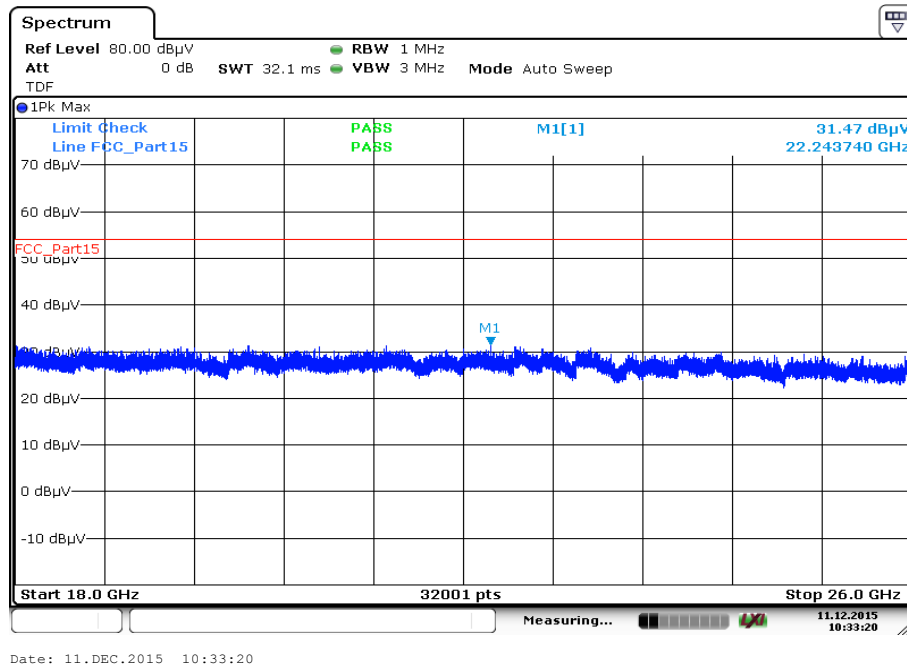
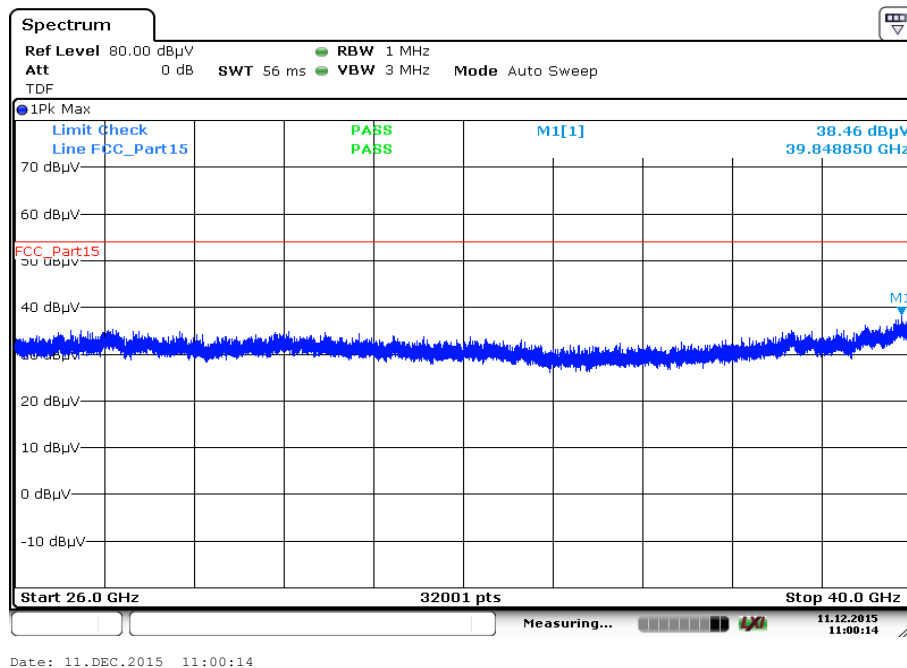
Plot 27: 1 GHz to 12.75 GHz, 5600 MHz, vertical & horizontal polarization**Plot 28:** 12 GHz to 18 GHz, 5600 MHz, vertical & horizontal polarization

Plot 29: 18 GHz to 26 GHz, 5600 MHz, vertical & horizontal polarization**Plot 30:** 26 GHz to 40 GHz, 5600 MHz, vertical & horizontal polarization

Plot 31: 30 MHz to 1 GHz, 5700 MHz, vertical & horizontal polarization**Final Result**

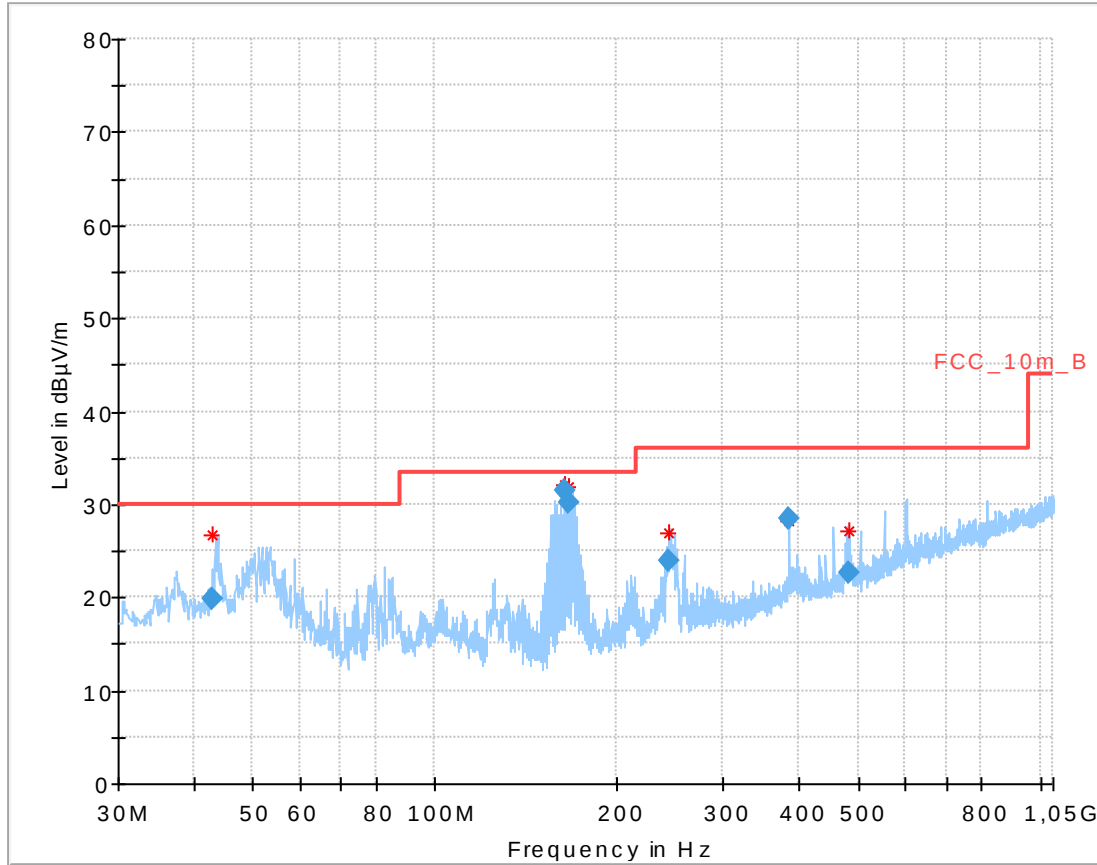
Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
43.799700	20.33	30.00	9.67	1000.0	120.000	98.0	V	199	13.9
85.995750	15.96	30.00	14.04	1000.0	120.000	101.0	V	136	9.5
156.445950	17.24	33.50	16.26	1000.0	120.000	98.0	V	2	9.0
240.392550	23.81	36.00	12.19	1000.0	120.000	98.0	V	355	13.1
576.035400	25.15	36.00	10.85	1000.0	120.000	101.0	H	355	20.0
936.031350	25.45	36.00	10.55	1000.0	120.000	101.0	H	277	24.2

Plot 32: 1 GHz to 12.75 GHz, 5700 MHz, vertical & horizontal polarization**Plot 33:** 12 GHz to 18 GHz, 5700 MHz, vertical & horizontal polarization

Plot 34: 18 GHz to 26 GHz, 5700 MHz, vertical & horizontal polarization**Plot 35:** 26 GHz to 40 GHz, 5700 MHz, vertical & horizontal polarization

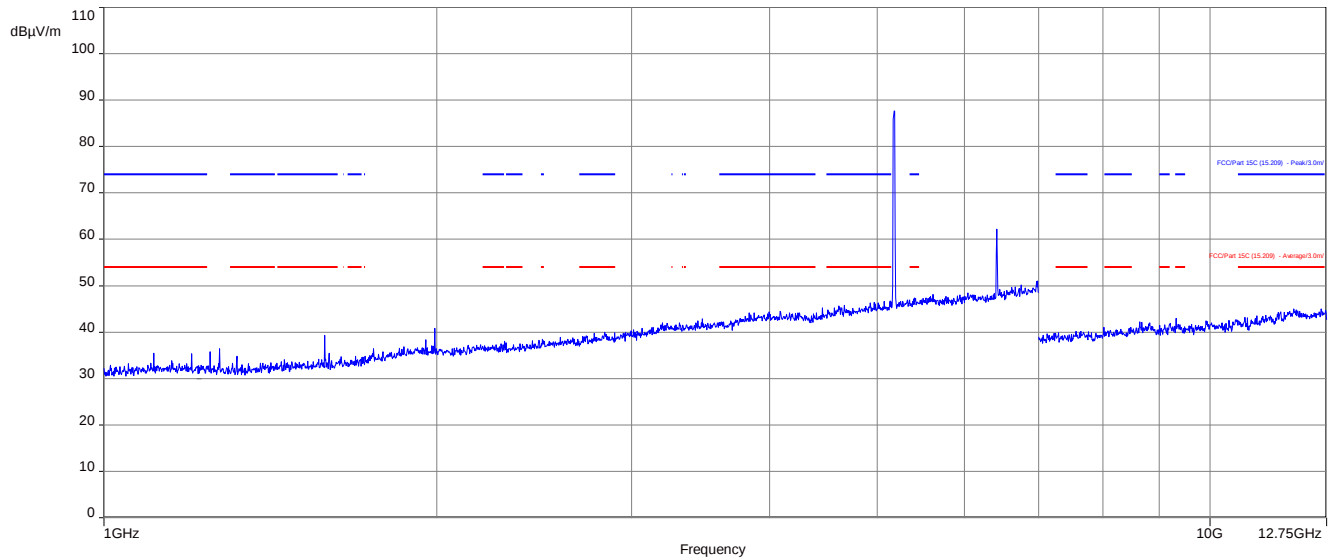
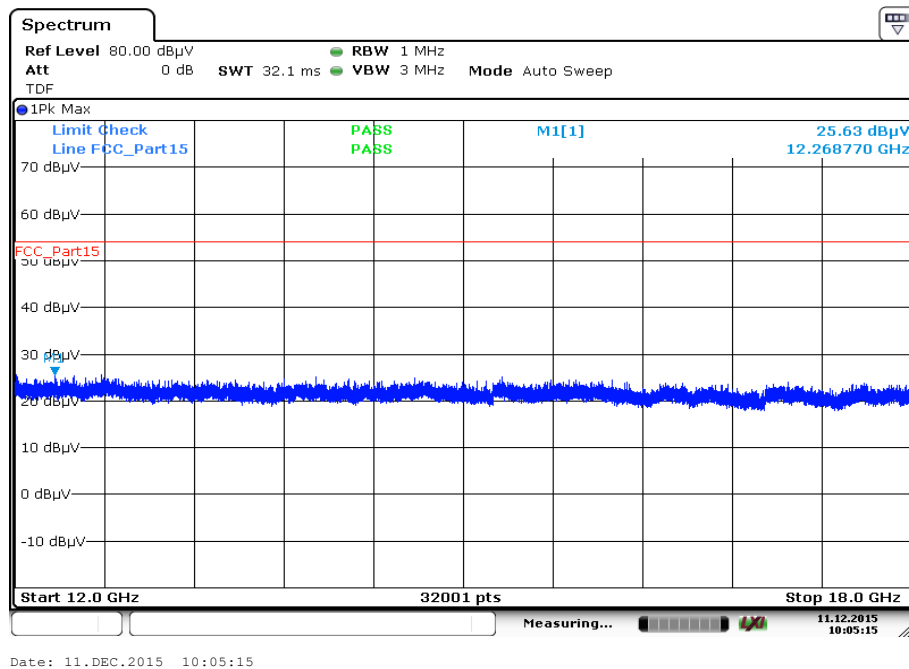
Plots: OFDM / n – mode HT20

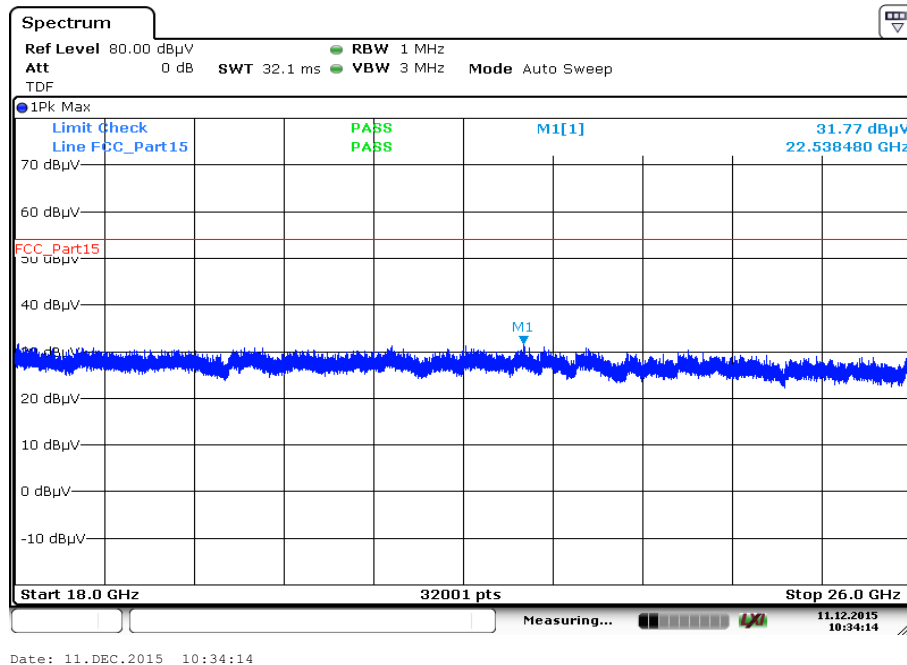
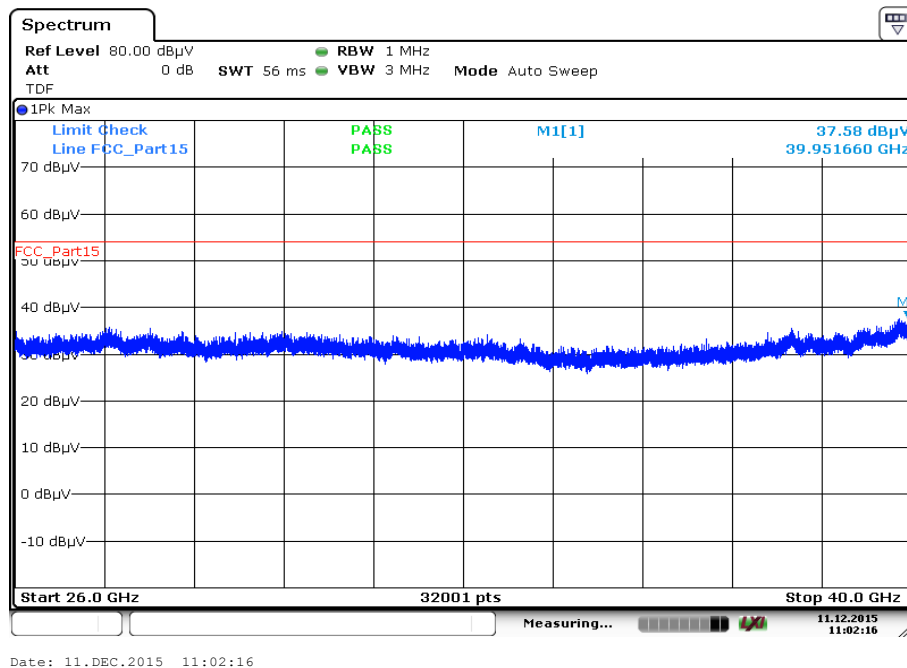
Plot 1: 30 MHz to 1 GHz, 5180 MHz, vertical & horizontal polarization

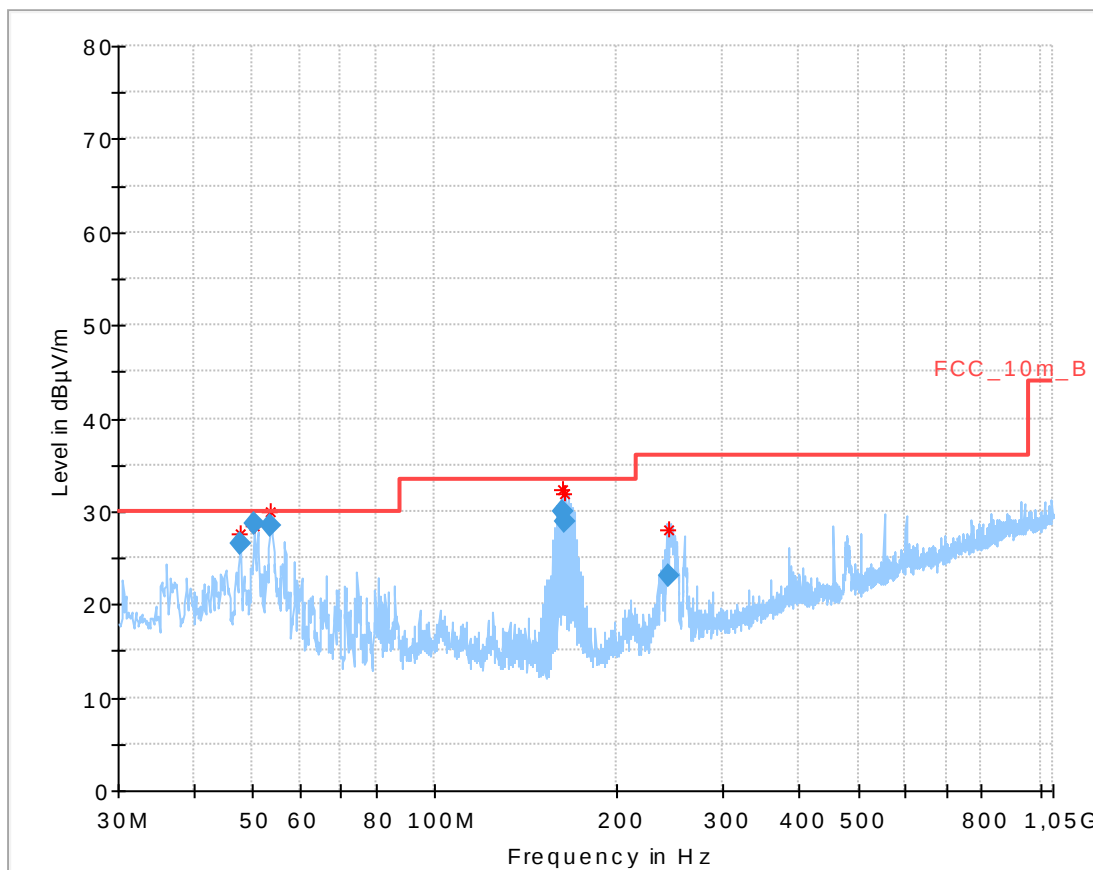


Final Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
42.965700	19.81	30.00	10.19	1000.0	120.000	98.0	V	6	13.9
163.323000	31.48	33.50	2.02	1000.0	120.000	98.0	V	359	9.3
166.473150	30.28	33.50	3.22	1000.0	120.000	98.0	V	359	9.5
244.068300	23.94	36.00	12.06	1000.0	120.000	98.0	V	359	13.2
384.017250	28.57	36.00	7.43	1000.0	120.000	170.0	H	147	16.6
482.822850	22.64	36.00	13.36	1000.0	120.000	98.0	V	79	18.3

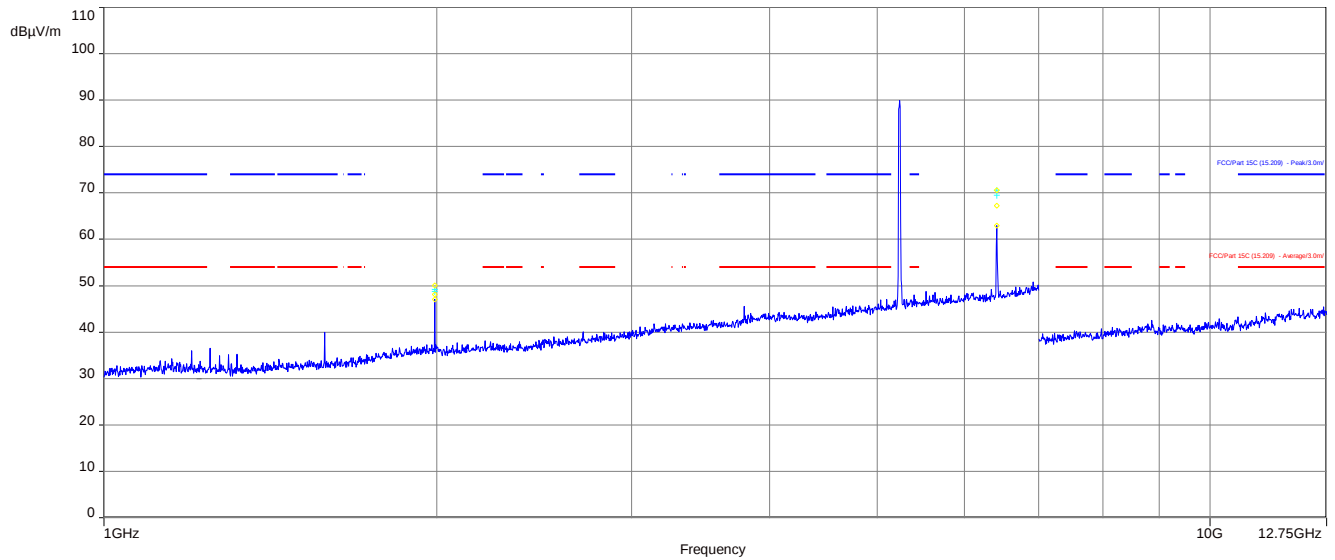
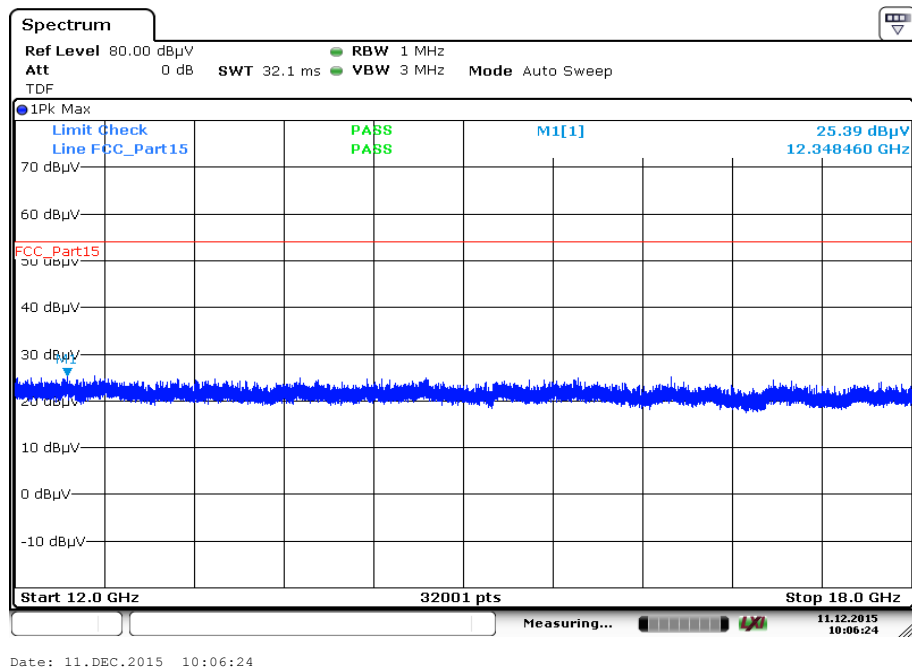
Plot 2: 1 GHz to 12.75 GHz, 5180 MHz, vertical & horizontal polarization**Plot 3:** 12 GHz to 18 GHz, 5180 MHz, vertical & horizontal polarization

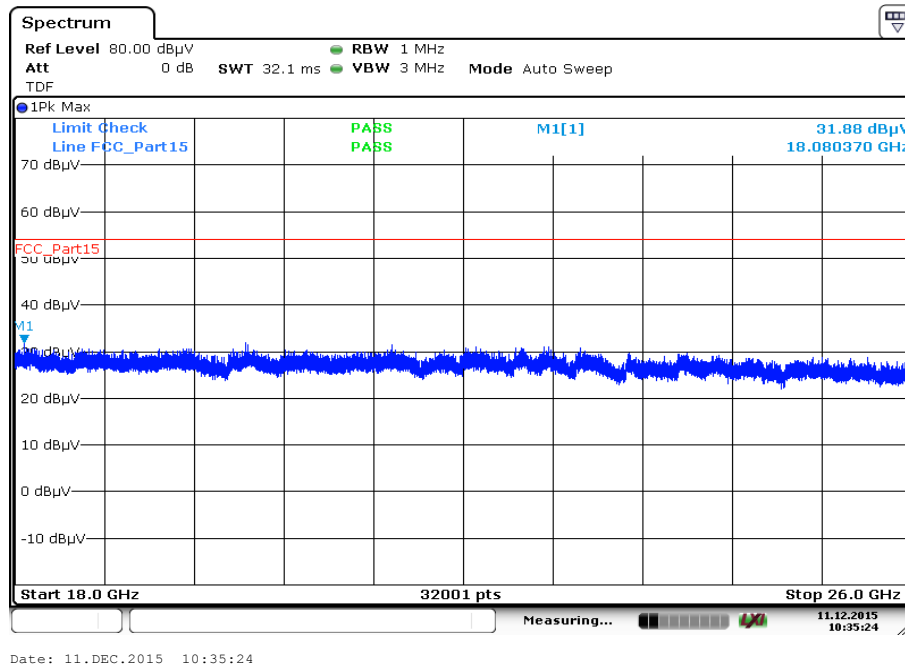
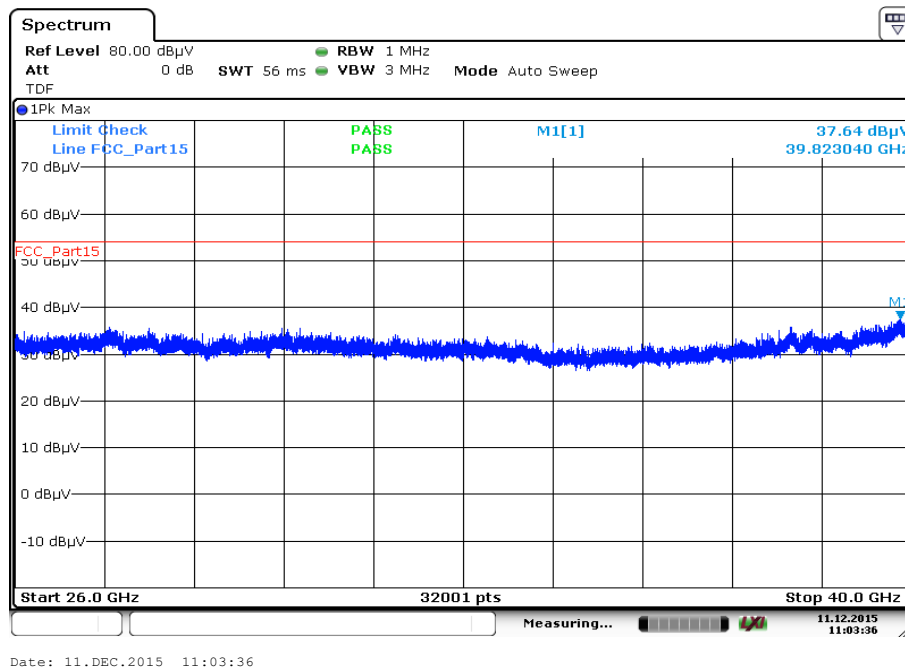
Plot 4: 18 GHz to 26 GHz, 5180 MHz, vertical & horizontal polarization**Plot 5:** 26 GHz to 40 GHz, 5180 MHz, vertical & horizontal polarization

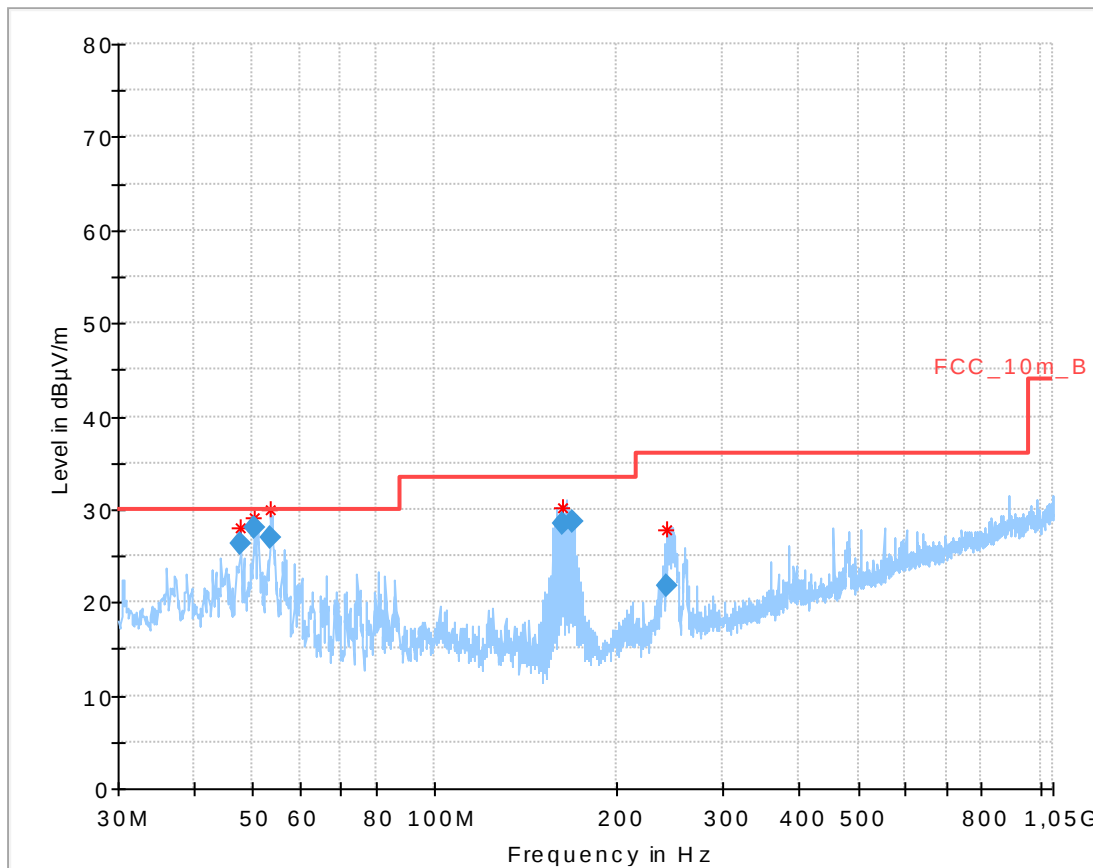
Plot 6: 30 MHz to 1 GHz, 5240 MHz, vertical & horizontal polarization


Final Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
47.797500	26.62	30.00	3.38	1000.0	120.000	98.0	V	115	13.2
50.427300	28.65	30.00	1.35	1000.0	120.000	98.0	V	107	12.6
53.549850	28.56	30.00	1.44	1000.0	120.000	98.0	V	152	12.1
162.346650	29.96	33.50	3.54	1000.0	120.000	98.0	V	351	9.2
164.442600	28.90	33.50	4.60	1000.0	120.000	98.0	V	345	9.4
243.200400	23.09	36.00	12.91	1000.0	120.000	98.0	V	337	13.1

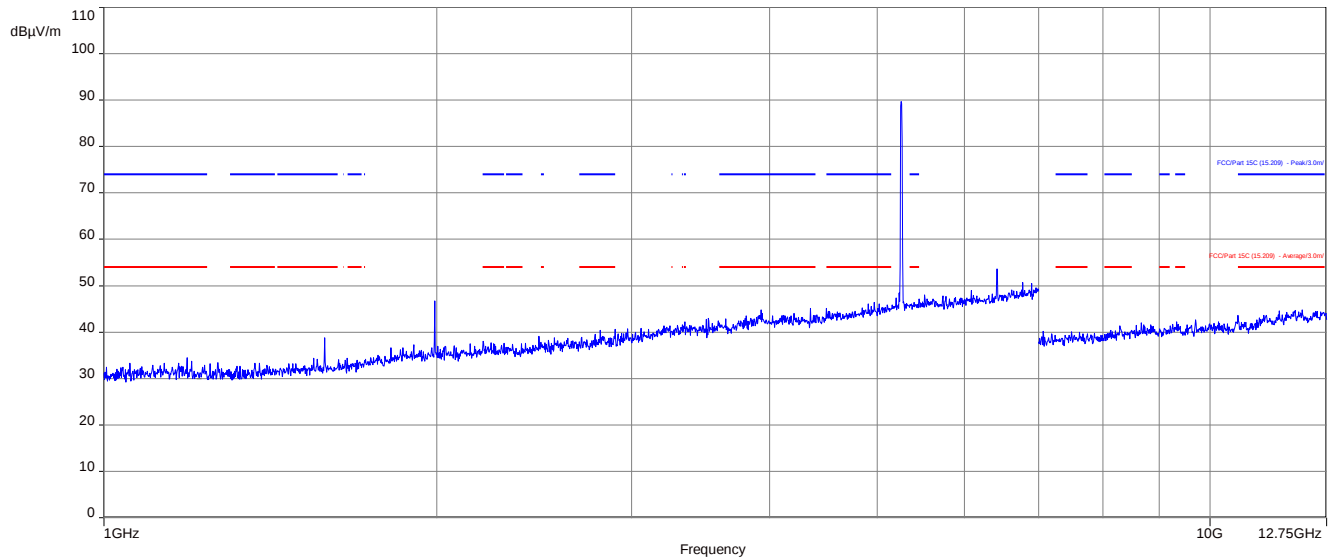
Plot 7: 1 GHz to 12.75 GHz, 5240 MHz, vertical & horizontal polarization**Plot 8:** 12 GHz to 18 GHz, 5240 MHz, vertical & horizontal polarization

Plot 9: 18 GHz to 26 GHz, 5240 MHz, vertical & horizontal polarization**Plot 10:** 26 GHz to 40 GHz, 5240 MHz, vertical & horizontal polarization

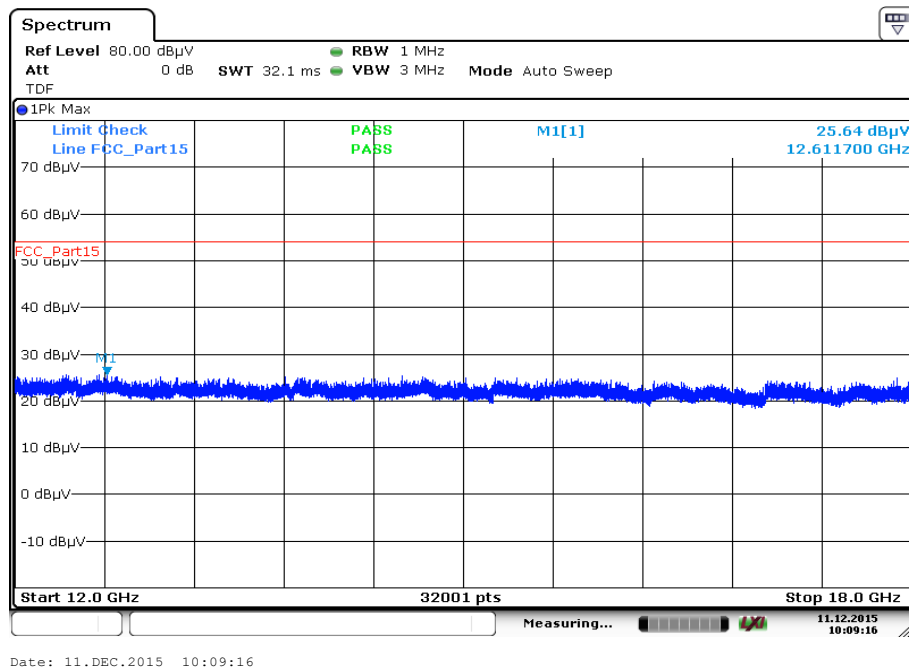
Plot 11: 30 MHz to 1 GHz, 5260 MHz, vertical & horizontal polarization**Final Result**

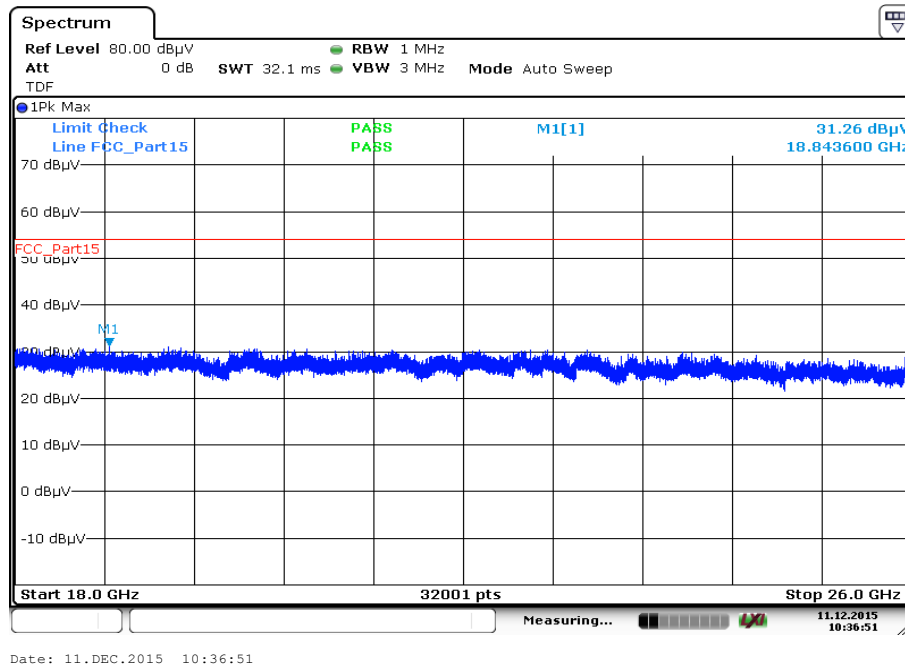
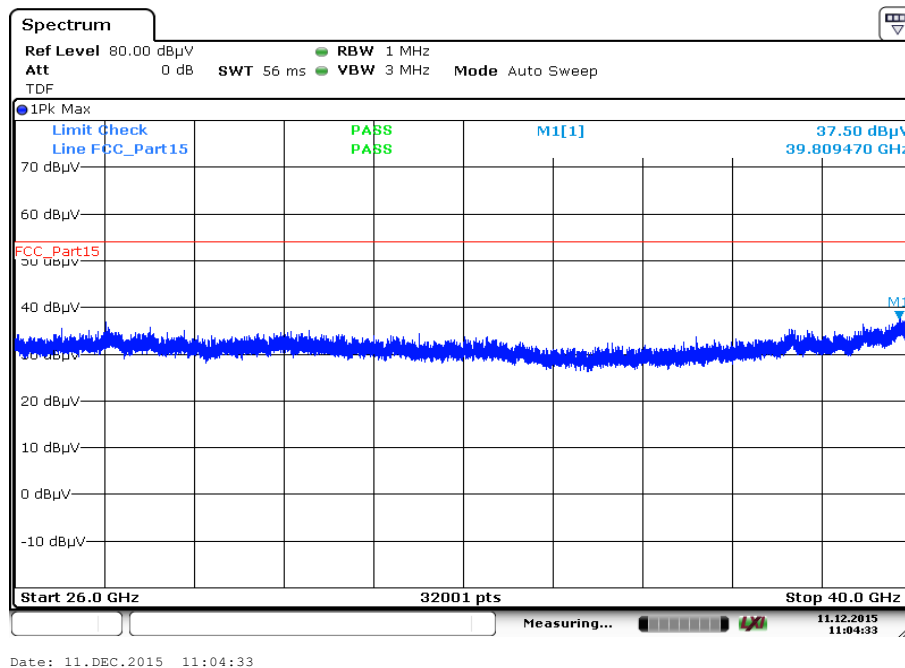
Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
47.814300	26.39	30.00	3.61	1000.0	120.000	98.0	V	31	13.2
50.423100	28.11	30.00	1.89	1000.0	120.000	98.0	V	66	12.6
53.530200	27.00	30.00	3.00	1000.0	120.000	98.0	V	4	12.1
162.417450	28.52	33.50	4.98	1000.0	120.000	98.0	V	357	9.2
168.693450	28.78	33.50	4.72	1000.0	120.000	98.0	V	357	9.7
242.427600	21.76	36.00	14.24	1000.0	120.000	98.0	V	339	13.1

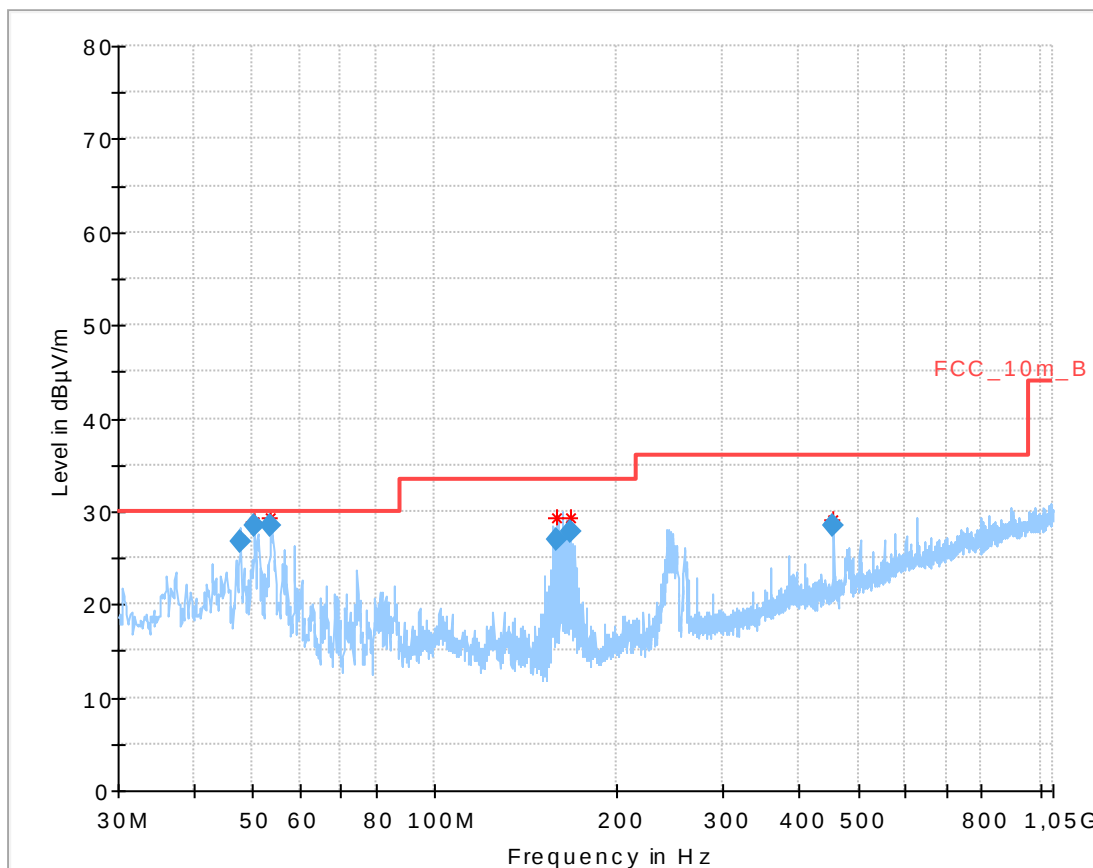
Plot 12: 1 GHz to 12.75 GHz, 5260 MHz, vertical & horizontal polarization



Plot 13: 12 GHz to 18 GHz, 5260 MHz, vertical & horizontal polarization

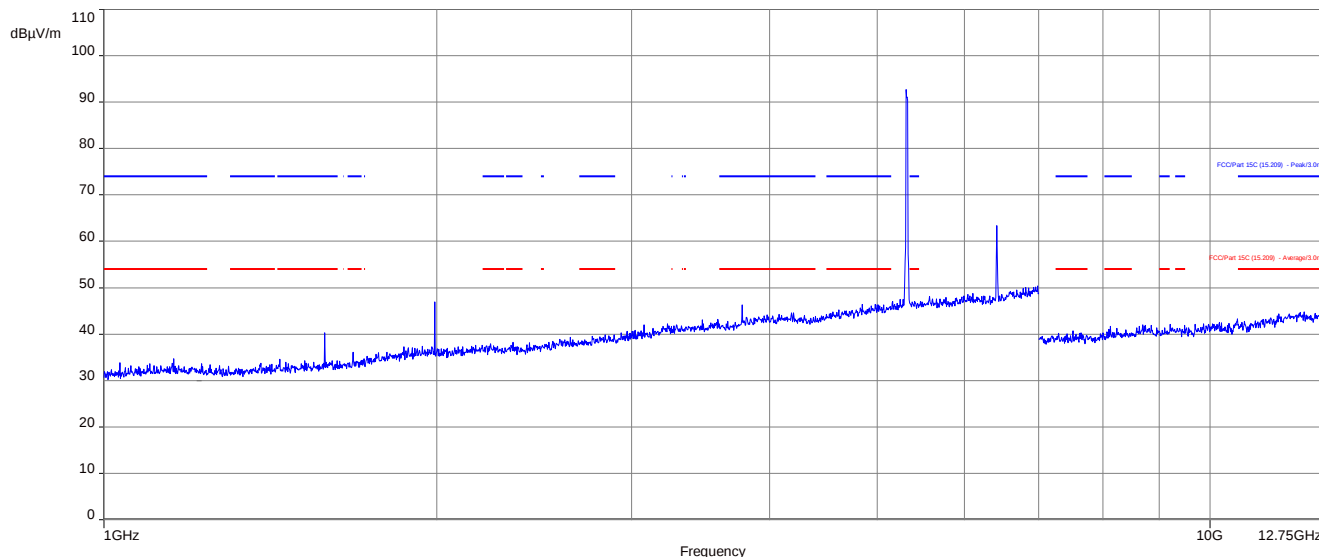


Plot 14: 18 GHz to 26 GHz, 5260 MHz, vertical & horizontal polarization**Plot 15:** 26 GHz to 40 GHz, 5260 MHz, vertical & horizontal polarization

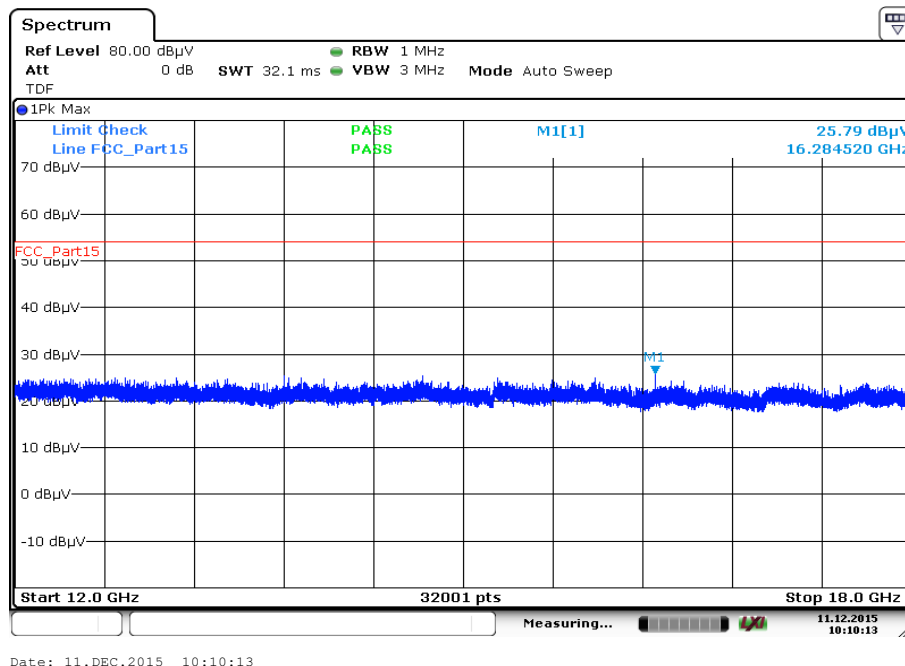
Plot 16: 30 MHz to 1 GHz, 5320 MHz, vertical & horizontal polarization**Final Result**

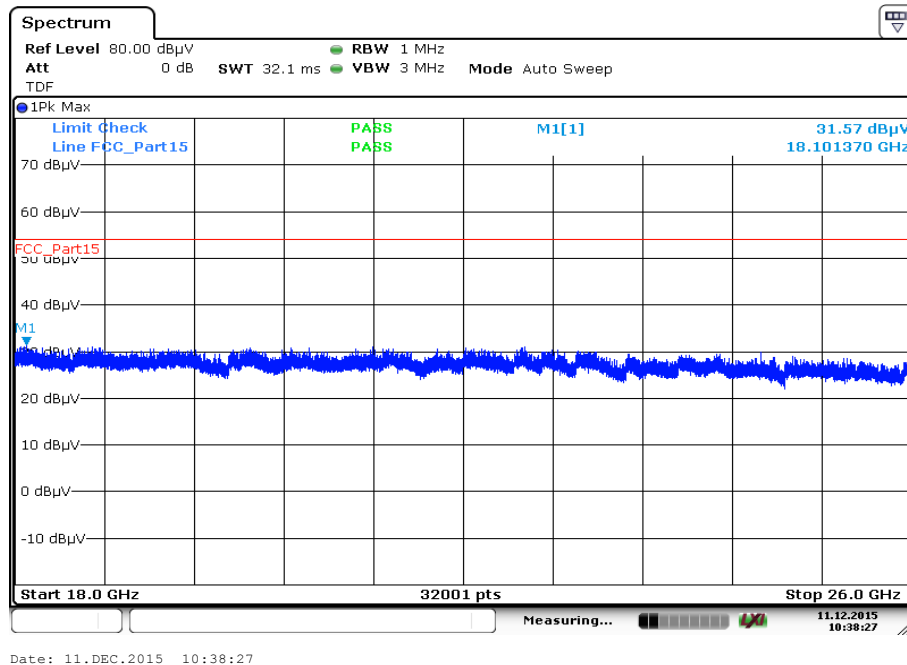
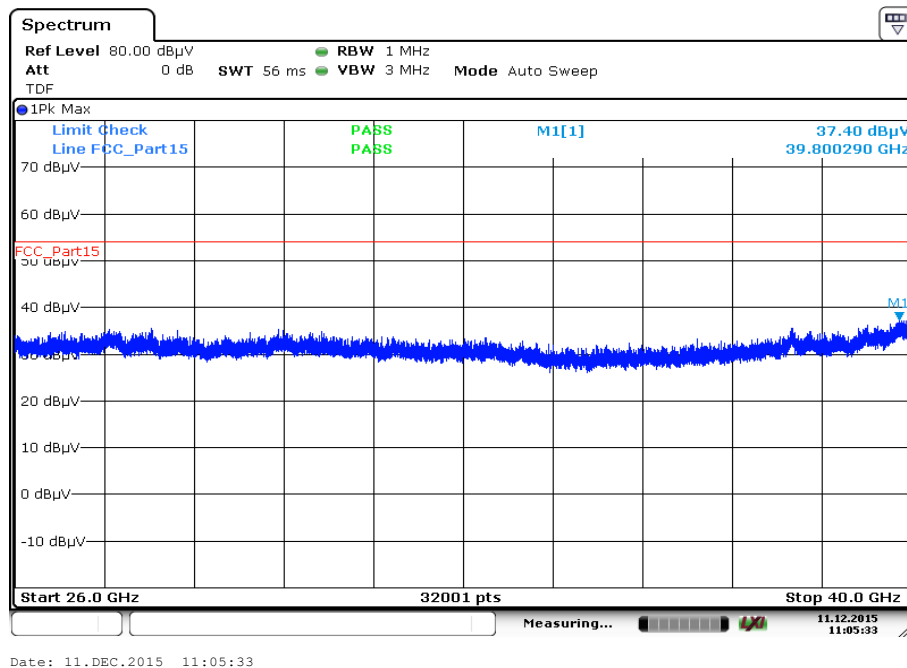
Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
47.811750	26.69	30.00	3.31	1000.0	120.000	98.0	V	100	13.2
50.436450	28.37	30.00	1.63	1000.0	120.000	98.0	V	67	12.6
53.536950	28.40	30.00	1.60	1000.0	120.000	98.0	V	117	12.1
159.301800	26.94	33.50	6.56	1000.0	120.000	98.0	V	1	9.1
167.672700	27.72	33.50	5.78	1000.0	120.000	98.0	V	359	9.6
456.018450	28.55	36.00	7.45	1000.0	120.000	170.0	H	51	17.7

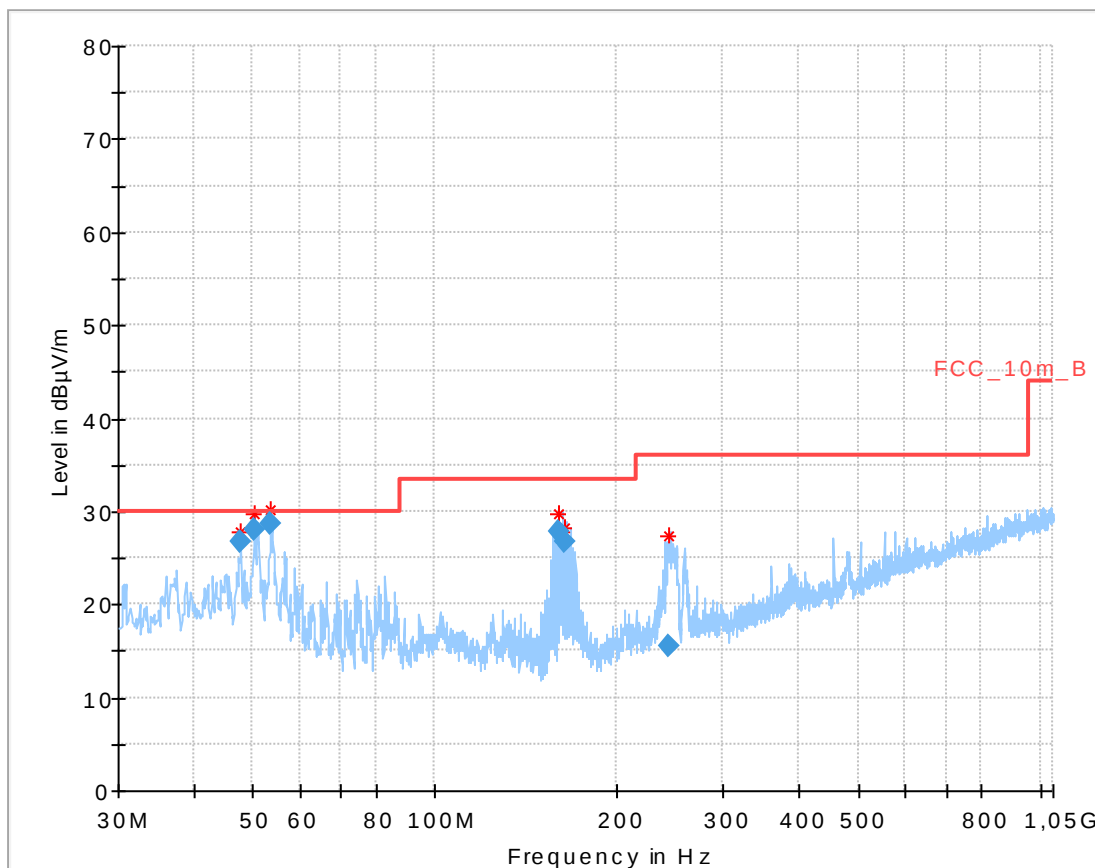
Plot 17: 1 GHz to 12.75 GHz, 5320 MHz, vertical & horizontal polarization



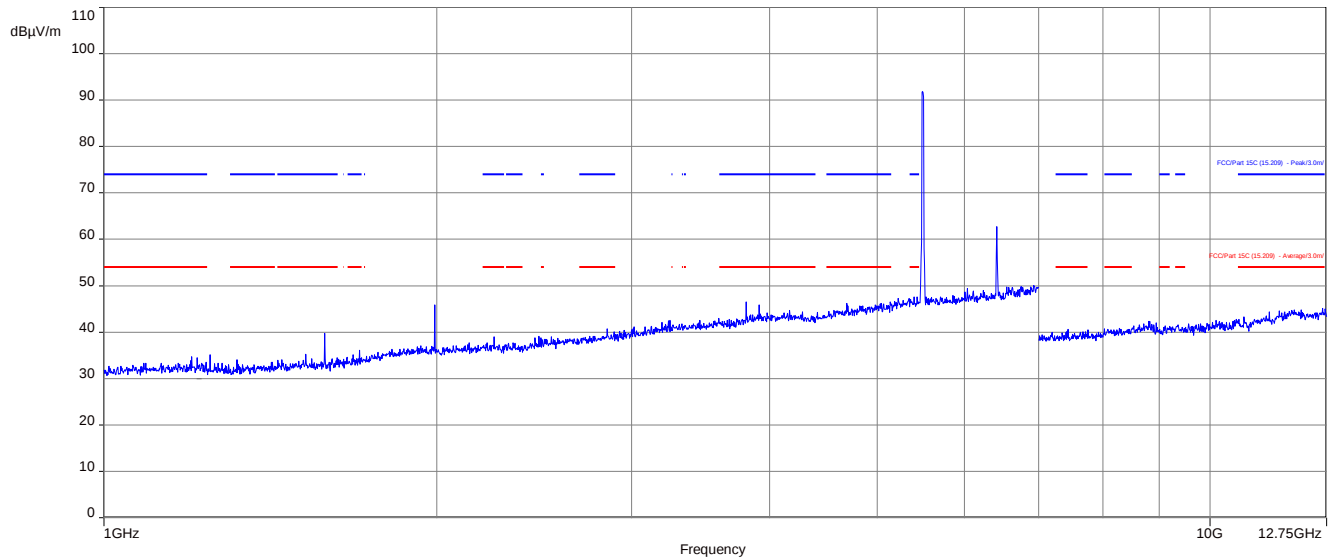
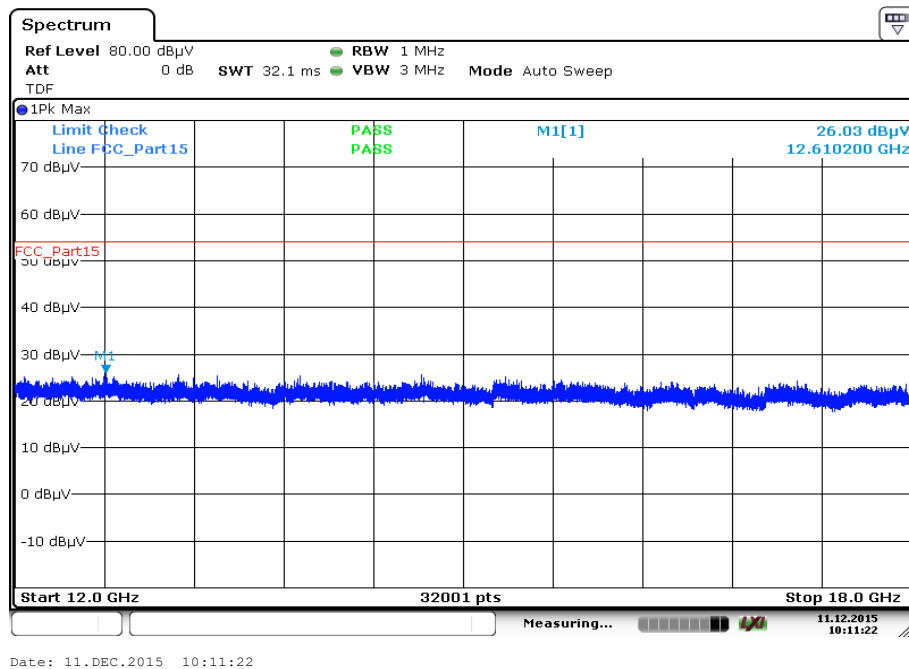
Plot 18: 12 GHz to 18 GHz, 5320 MHz, vertical & horizontal polarization

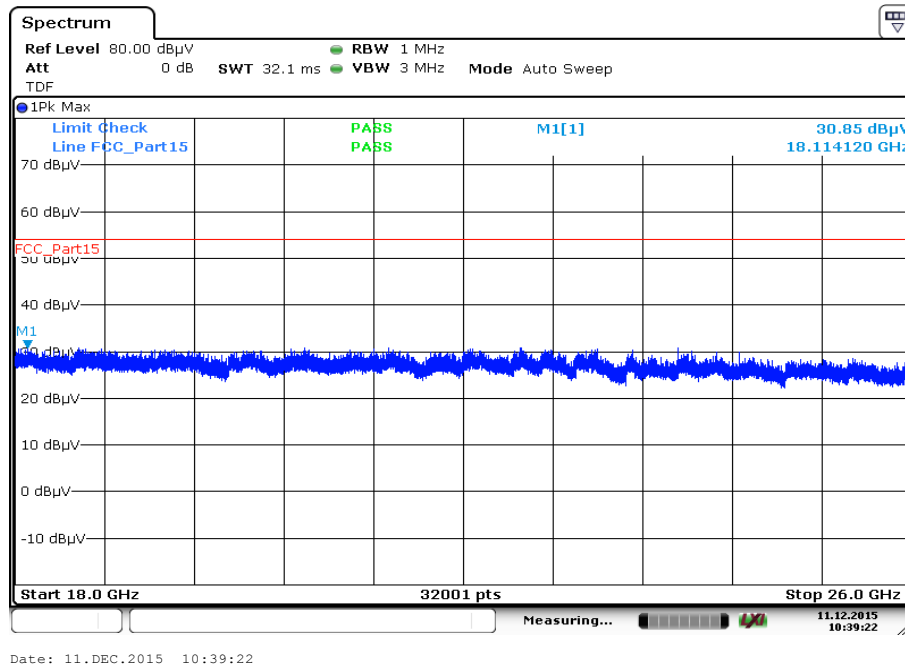
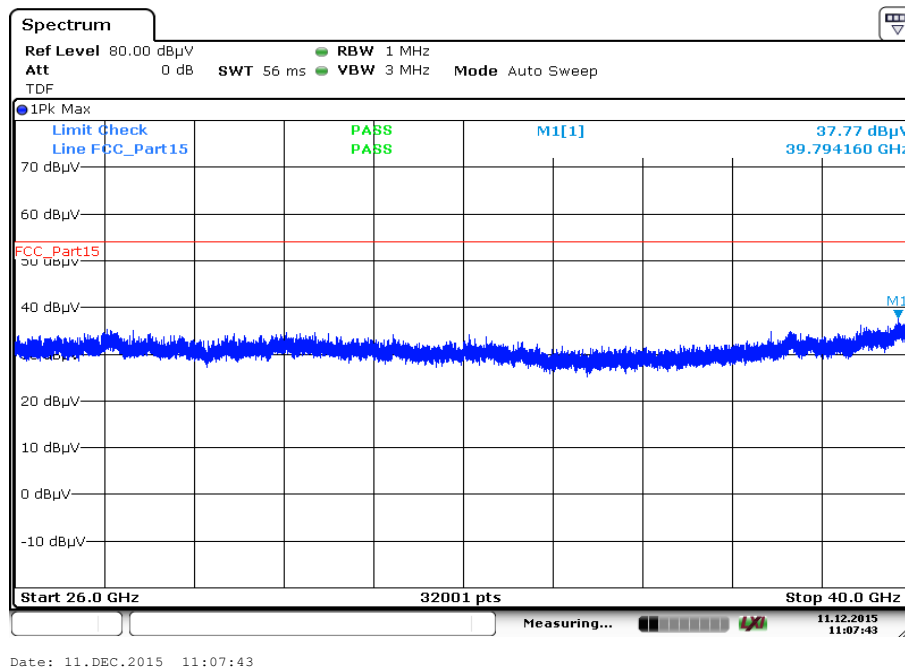


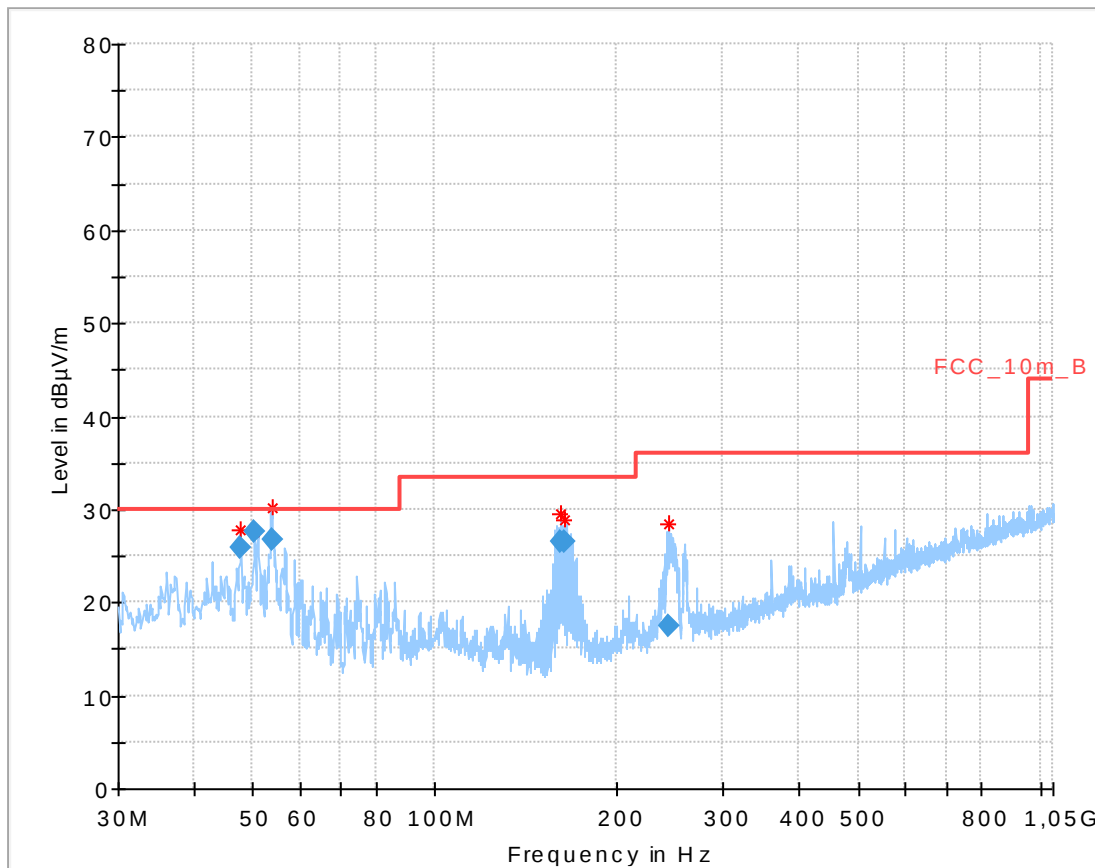
Plot 19: 18 GHz to 26 GHz, 5320 MHz, vertical & horizontal polarization**Plot 20:** 26 GHz to 40 GHz, 5320 MHz, vertical & horizontal polarization

Plot 21: 30 MHz to 1 GHz, 5500 MHz, 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)
47.808300	26.74	30.00	3.26	1000.0	120.000	98.0	V	106	13.2
50.419650	27.93	30.00	2.07	1000.0	120.000	98.0	V	75	12.6
53.553150	28.63	30.00	1.37	1000.0	120.000	98.0	V	39	12.1
160.359900	27.72	33.50	5.78	1000.0	120.000	98.0	V	331	9.1
163.505250	26.70	33.50	6.80	1000.0	120.000	98.0	V	355	9.3
244.052850	15.47	36.00	20.53	1000.0	120.000	98.0	V	291	13.2

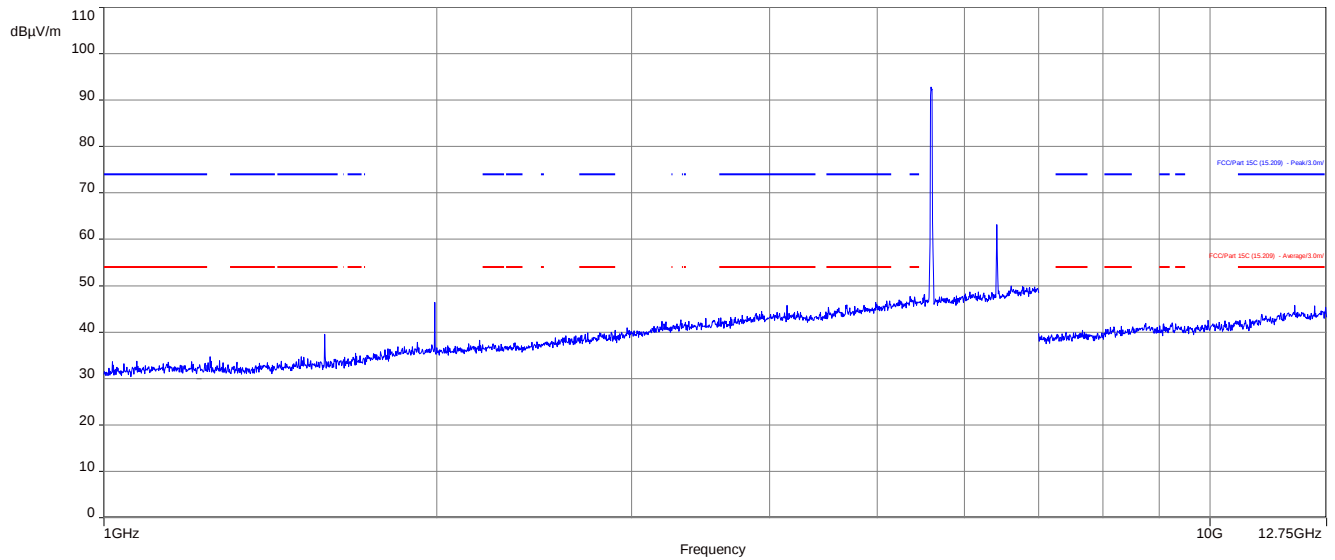
Plot 22: 1 GHz to 12.75 GHz, 5500 MHz, vertical & horizontal polarization**Plot 23:** 12 GHz to 18 GHz, 5500 MHz, vertical & horizontal polarization

Plot 24: 18 GHz to 26 GHz, 5500 MHz, vertical & horizontal polarization**Plot 25:** 26 GHz to 40 GHz, 5500 MHz, vertical & horizontal polarization

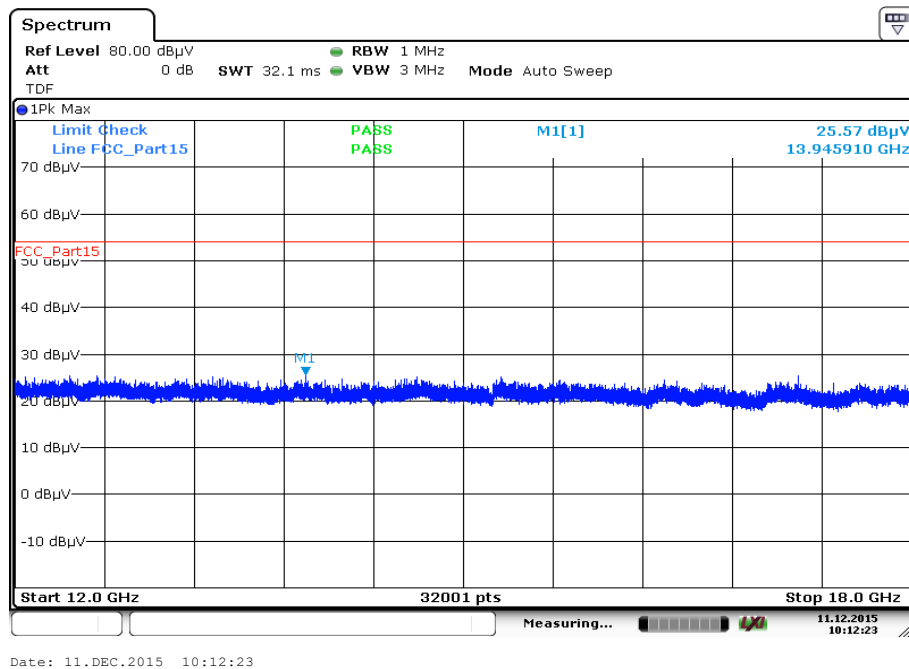
Plot 26: 30 MHz to 1 GHz, 5600 MHz, vertical & horizontal polarization**Final Result**

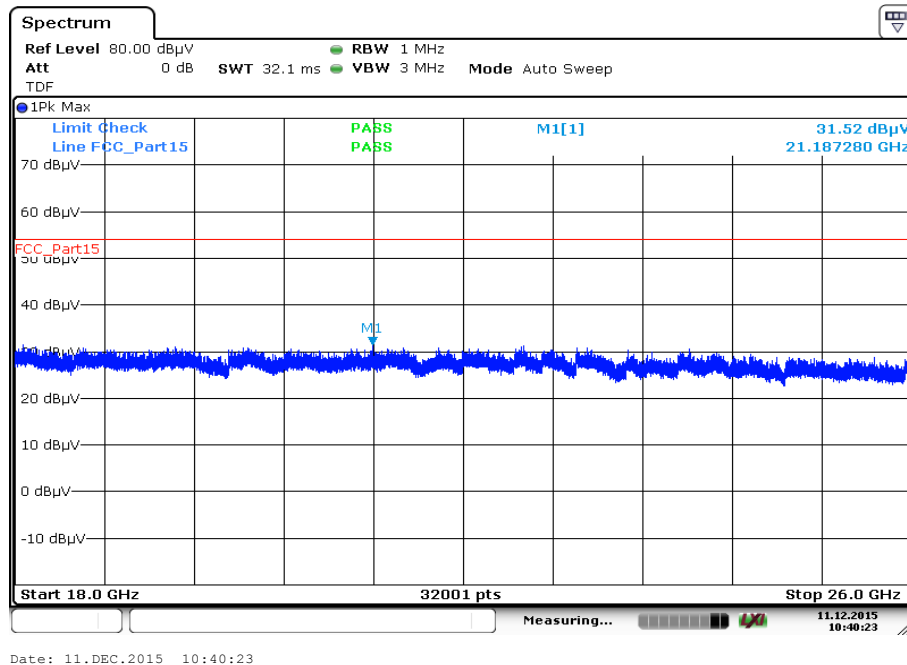
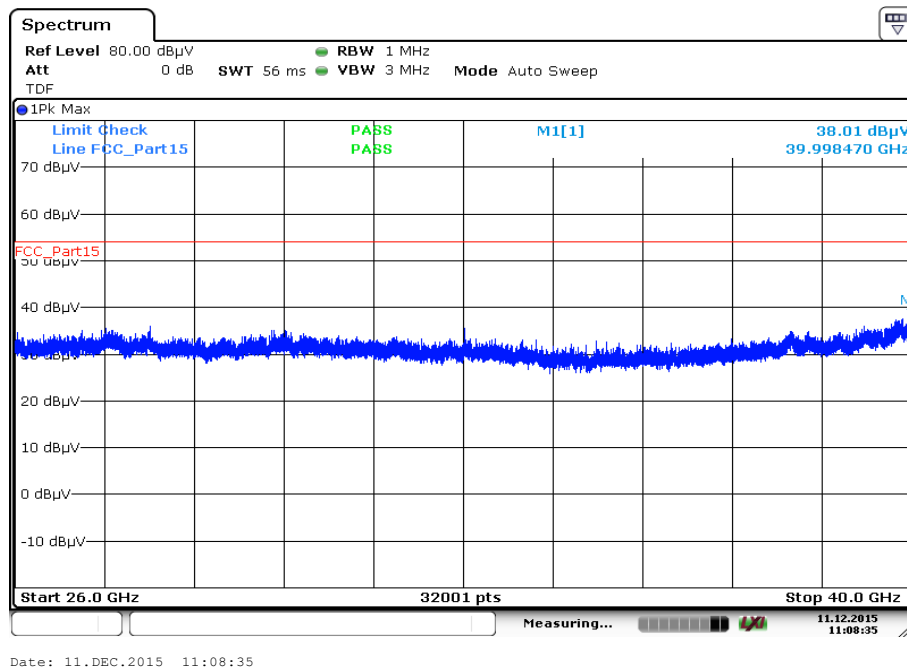
Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
47.815500	25.85	30.00	4.15	1000.0	120.000	98.0	V	61	13.2
50.433150	27.68	30.00	2.32	1000.0	120.000	98.0	V	88	12.6
53.913000	26.67	30.00	3.33	1000.0	120.000	170.0	V	103	12.0
161.477850	26.61	33.50	6.89	1000.0	120.000	98.0	V	359	9.2
163.544550	26.58	33.50	6.92	1000.0	120.000	98.0	V	359	9.3
244.340850	17.54	36.00	18.46	1000.0	120.000	98.0	V	319	13.2

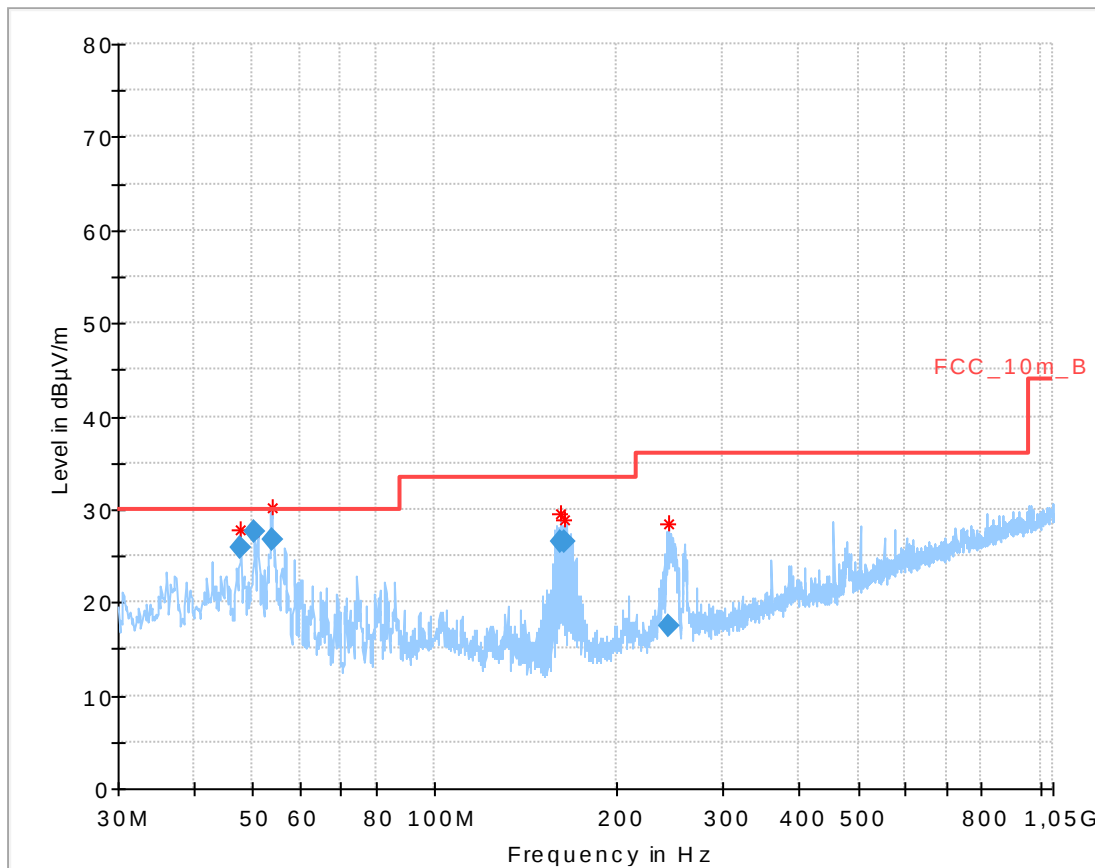
Plot 27: 1 GHz to 12.75 GHz, 5600 MHz, vertical & horizontal polarization



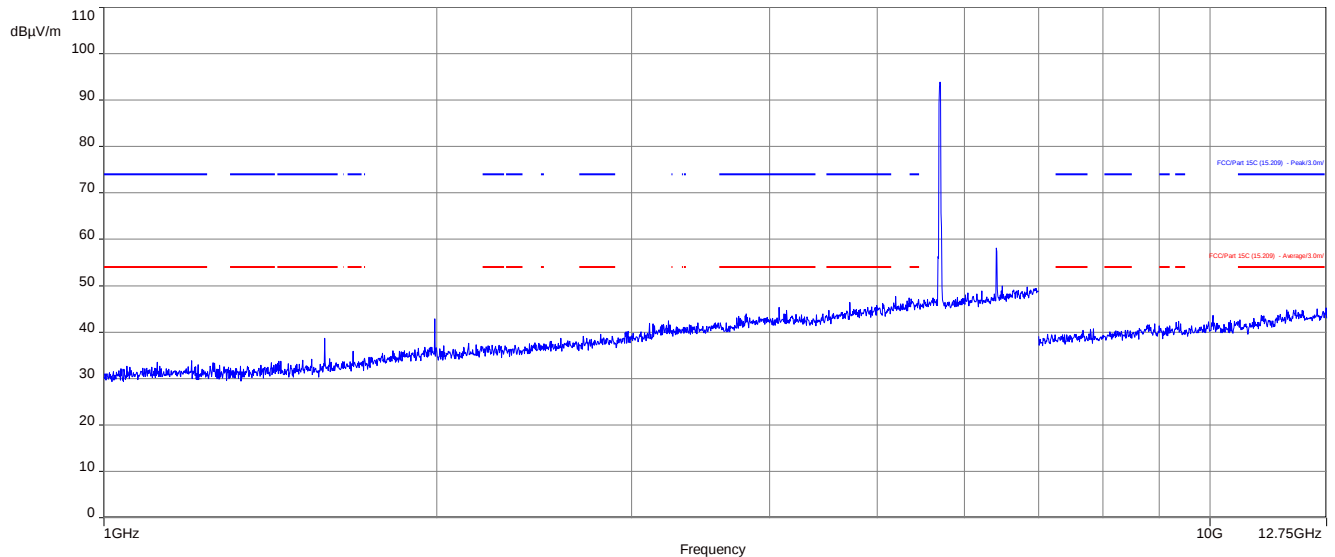
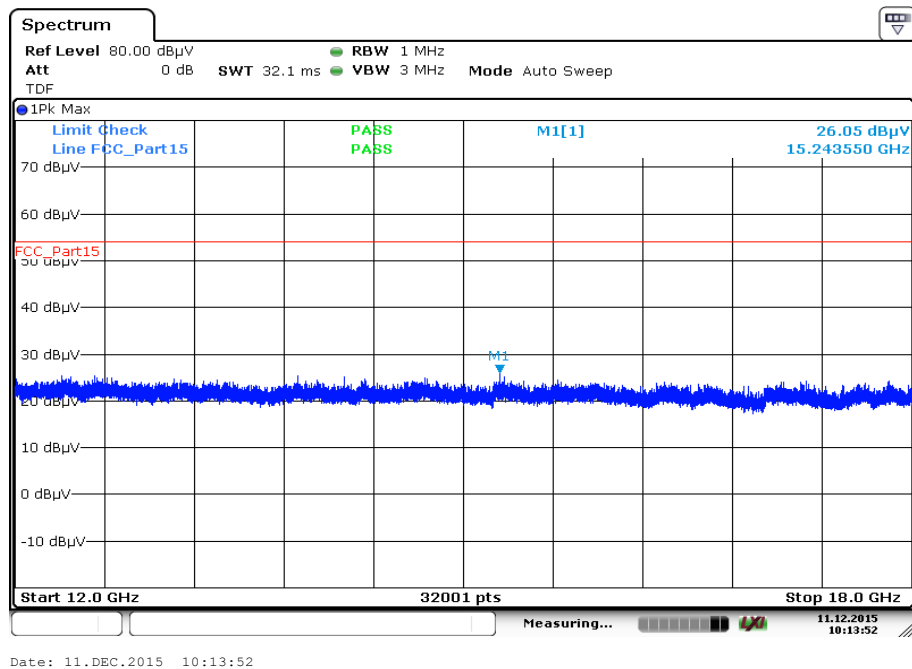
Plot 28: 12 GHz to 18 GHz, 5600 MHz, vertical & horizontal polarization

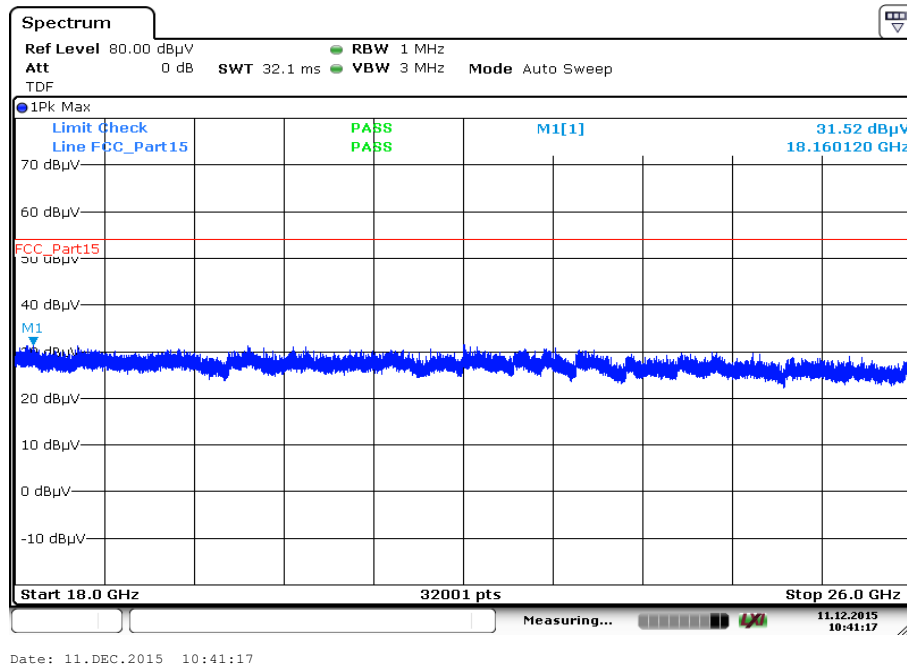
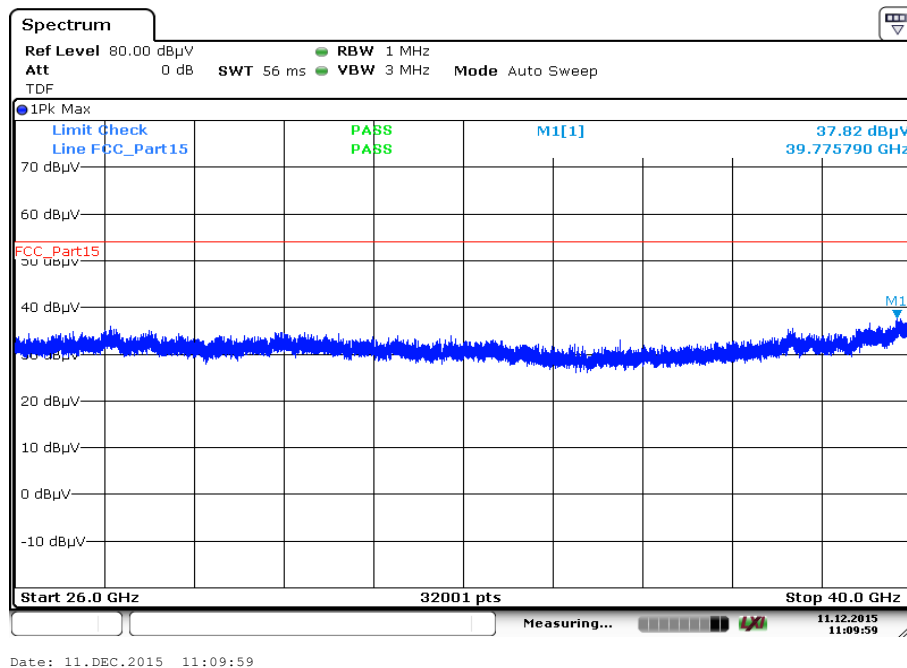


Plot 29: 18 GHz to 26 GHz, 5600 MHz, vertical & horizontal polarization**Plot 30:** 26 GHz to 40 GHz, 5600 MHz, vertical & horizontal polarization

Plot 31: 30 MHz to 1 GHz, 5700 MHz, vertical & horizontal polarization**Final Result**

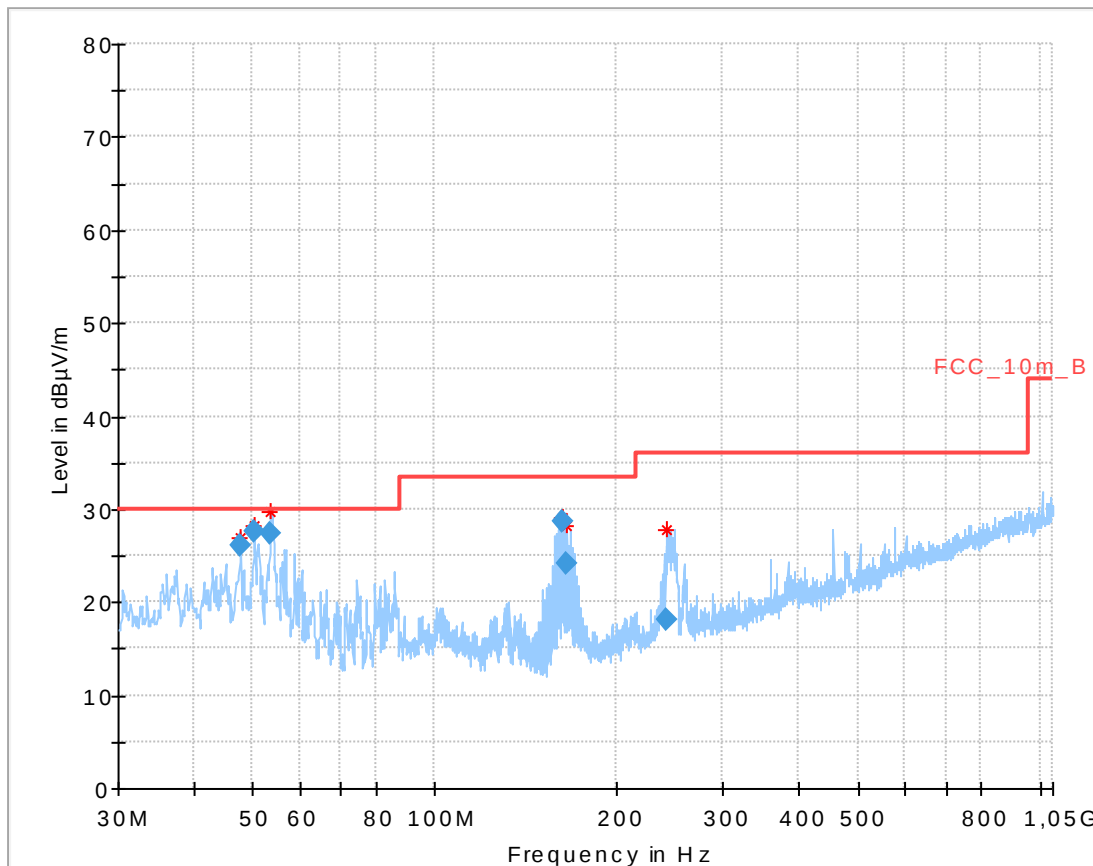
Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
47.815500	25.85	30.00	4.15	1000.0	120.000	98.0	V	61	13.2
50.433150	27.68	30.00	2.32	1000.0	120.000	98.0	V	88	12.6
53.913000	26.67	30.00	3.33	1000.0	120.000	170.0	V	103	12.0
161.477850	26.61	33.50	6.89	1000.0	120.000	98.0	V	359	9.2
163.544550	26.58	33.50	6.92	1000.0	120.000	98.0	V	359	9.3
244.340850	17.54	36.00	18.46	1000.0	120.000	98.0	V	319	13.2

Plot 32: 1 GHz to 12.75 GHz, 5700 MHz, vertical & horizontal polarization**Plot 33:** 12 GHz to 18 GHz, 5700 MHz, vertical & horizontal polarization

Plot 34: 18 GHz to 26 GHz, 5700 MHz, vertical & horizontal polarization**Plot 35:** 26 GHz to 40 GHz, 5700 MHz, vertical & horizontal polarization

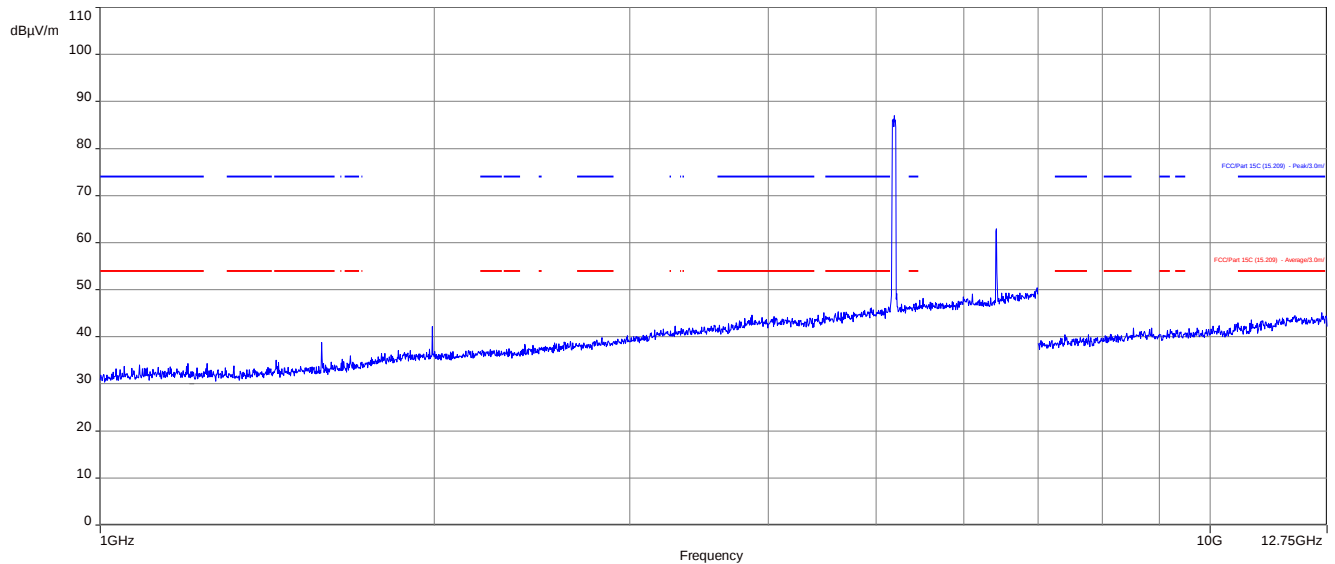
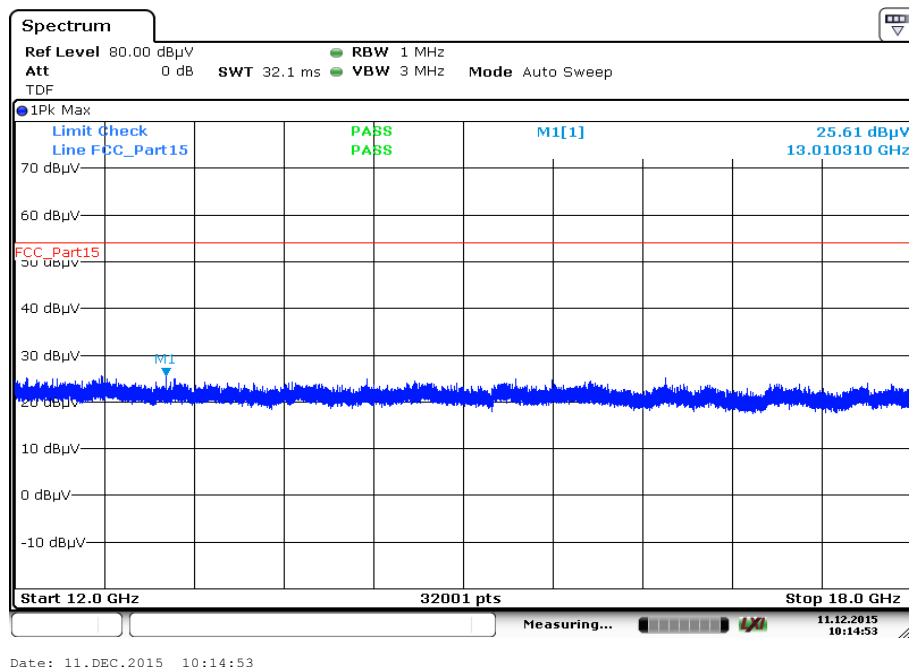
Plots: OFDM / n – mode HT40

Plot 1: 30 MHz to 1 GHz, 5190 MHz, vertical & horizontal polarization

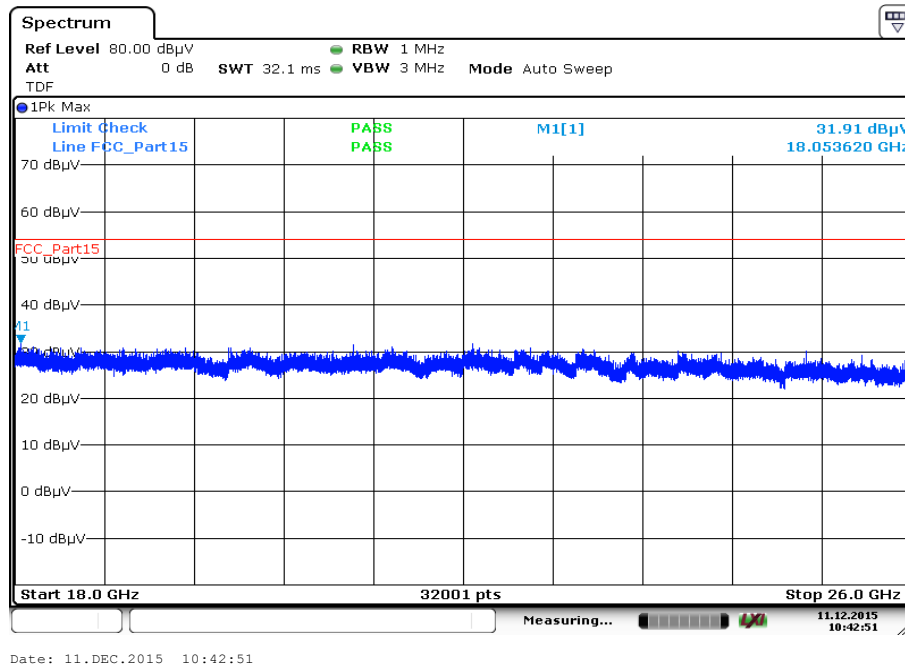
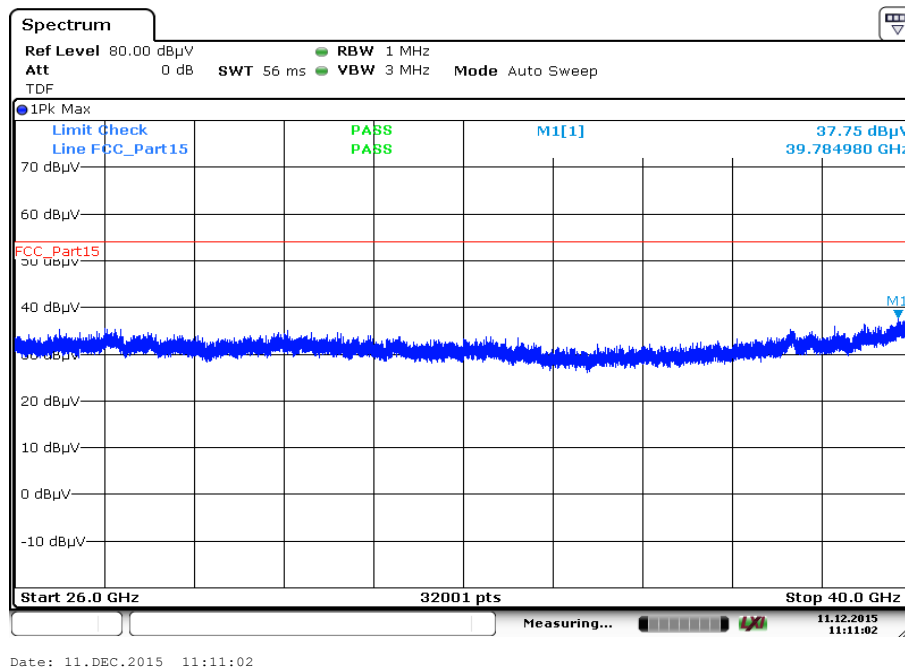


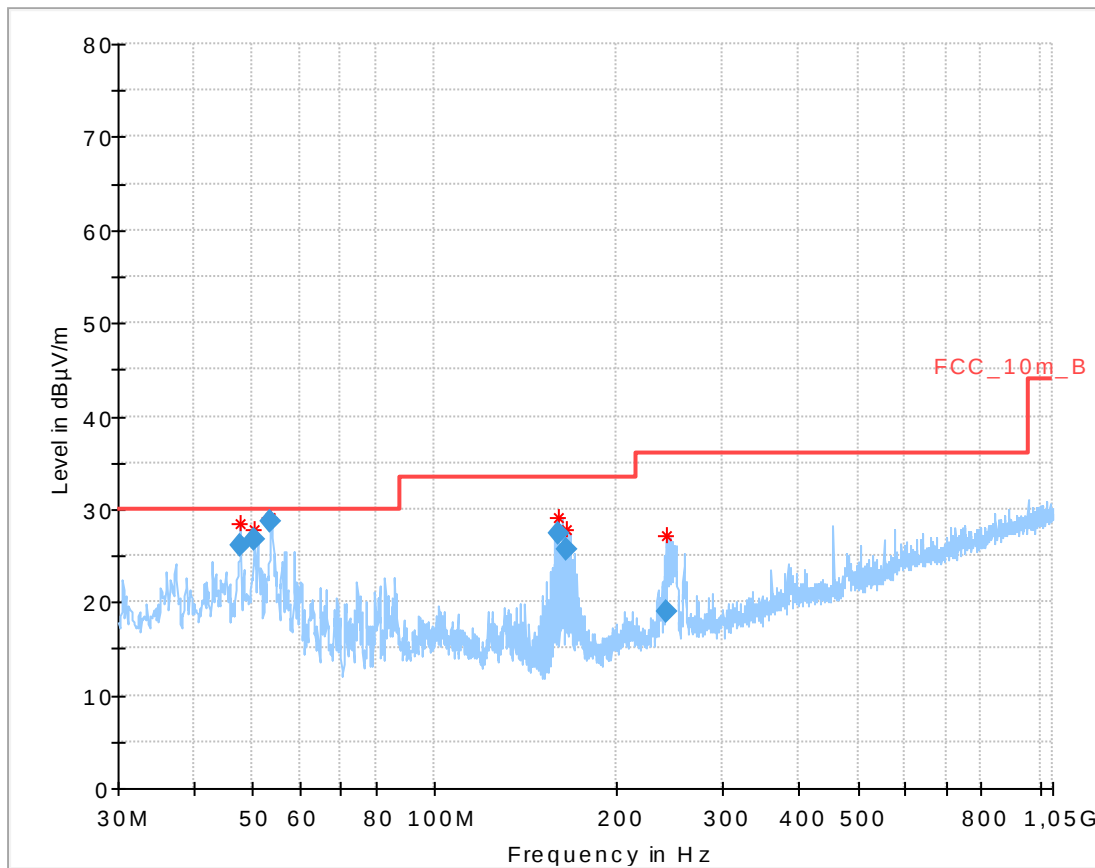
Final Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
47.814750	26.09	30.00	3.91	1000.0	120.000	98.0	V	102	13.2
50.428650	27.60	30.00	2.40	1000.0	120.000	98.0	V	78	12.6
53.525700	27.37	30.00	2.63	1000.0	120.000	98.0	V	112	12.1
162.538350	28.63	33.50	4.87	1000.0	120.000	98.0	V	356	9.2
165.639450	24.11	33.50	9.39	1000.0	120.000	98.0	V	356	9.5
242.406600	18.10	36.00	17.90	1000.0	120.000	98.0	V	272	13.1

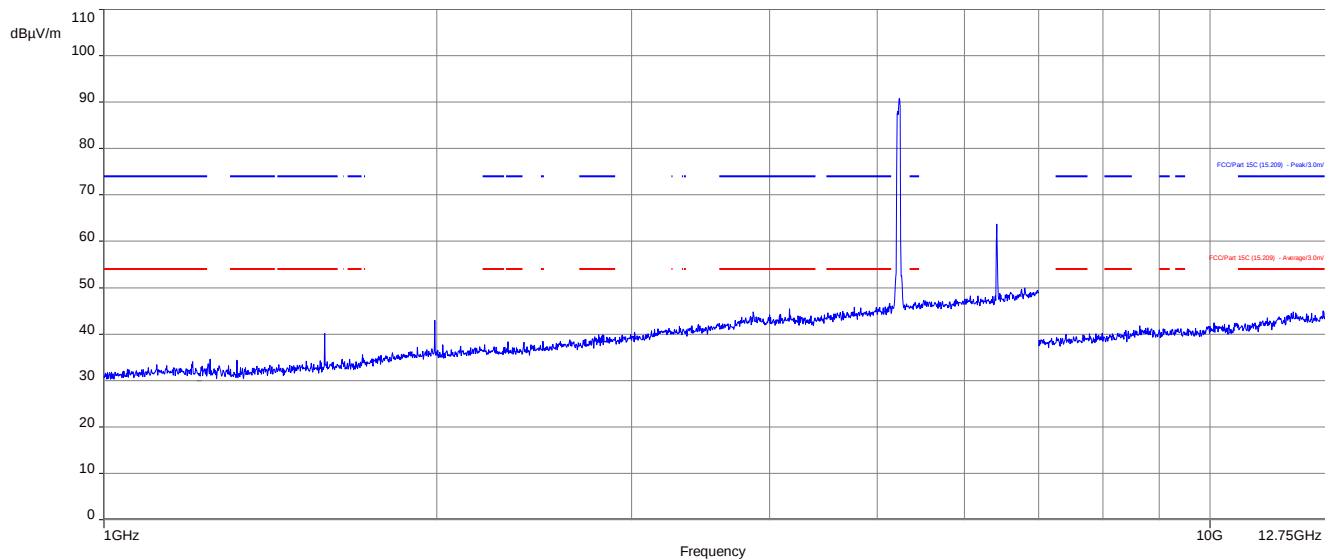
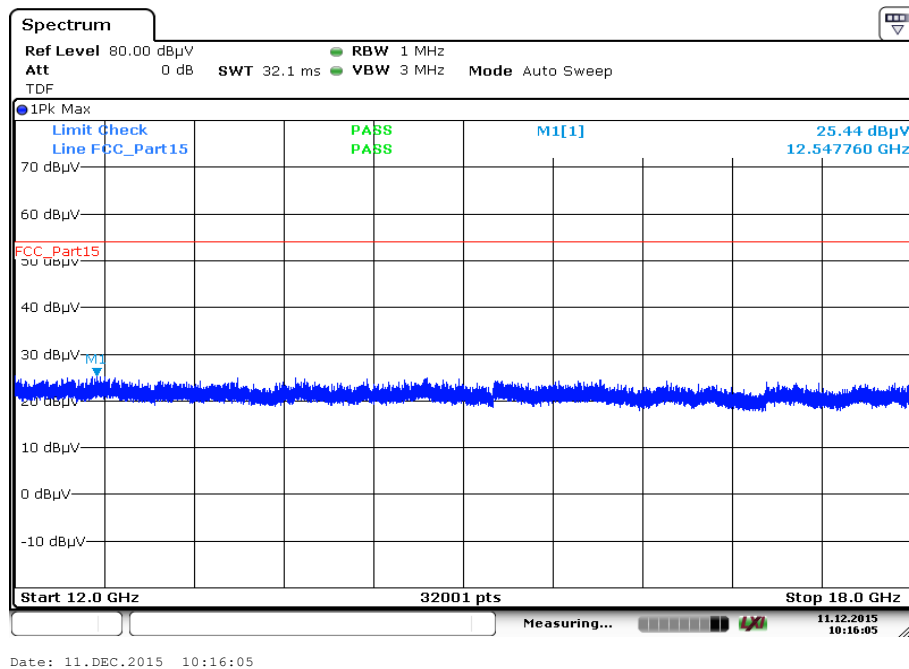
Plot 2: 1 GHz to 12.75 GHz, 5190 MHz, vertical & horizontal polarization**Plot 3:** 12 GHz to 18 GHz, 5190 MHz, vertical & horizontal polarization

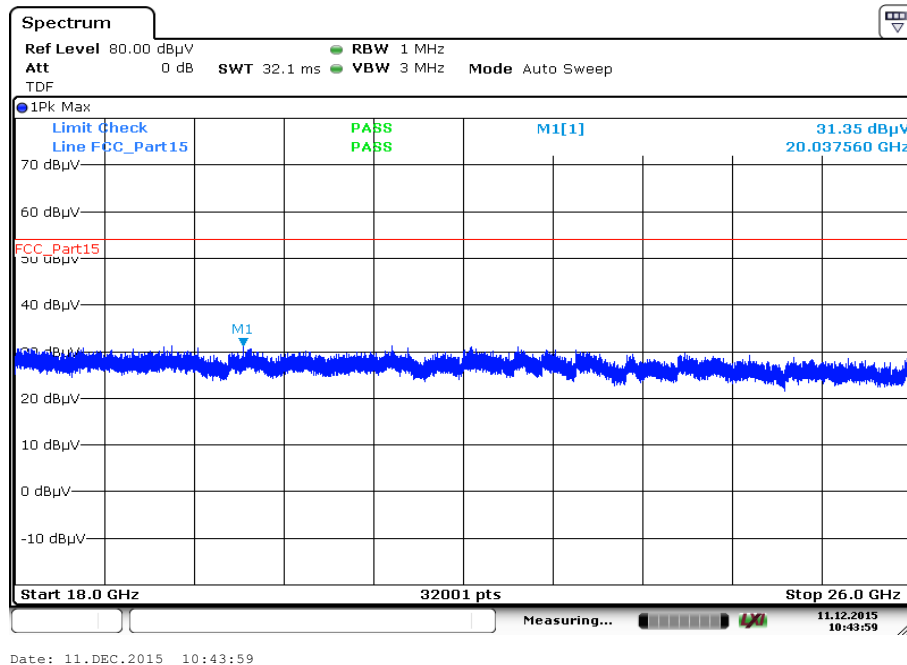
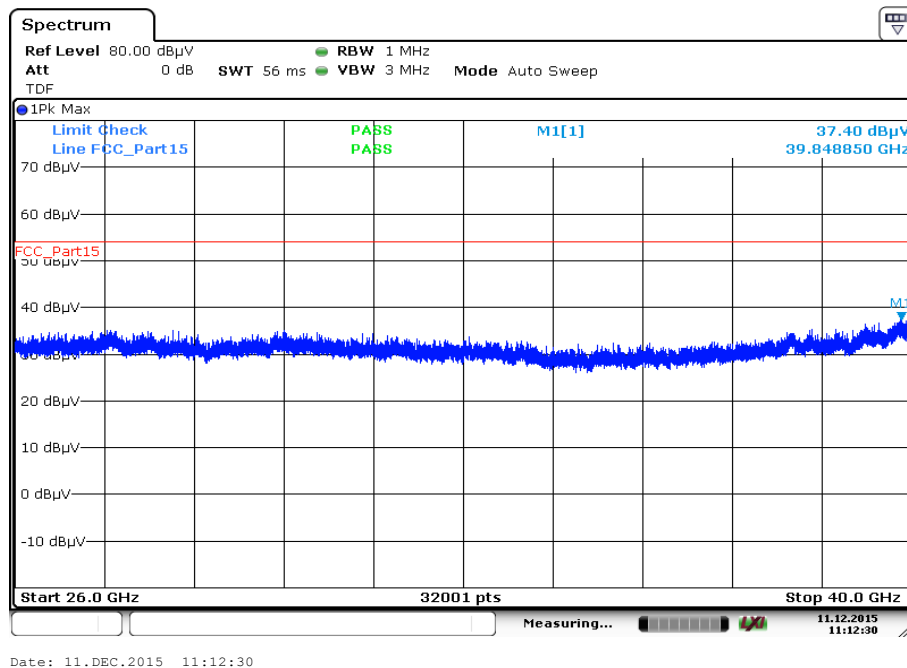
Date: 11.DEC.2015 10:14:53

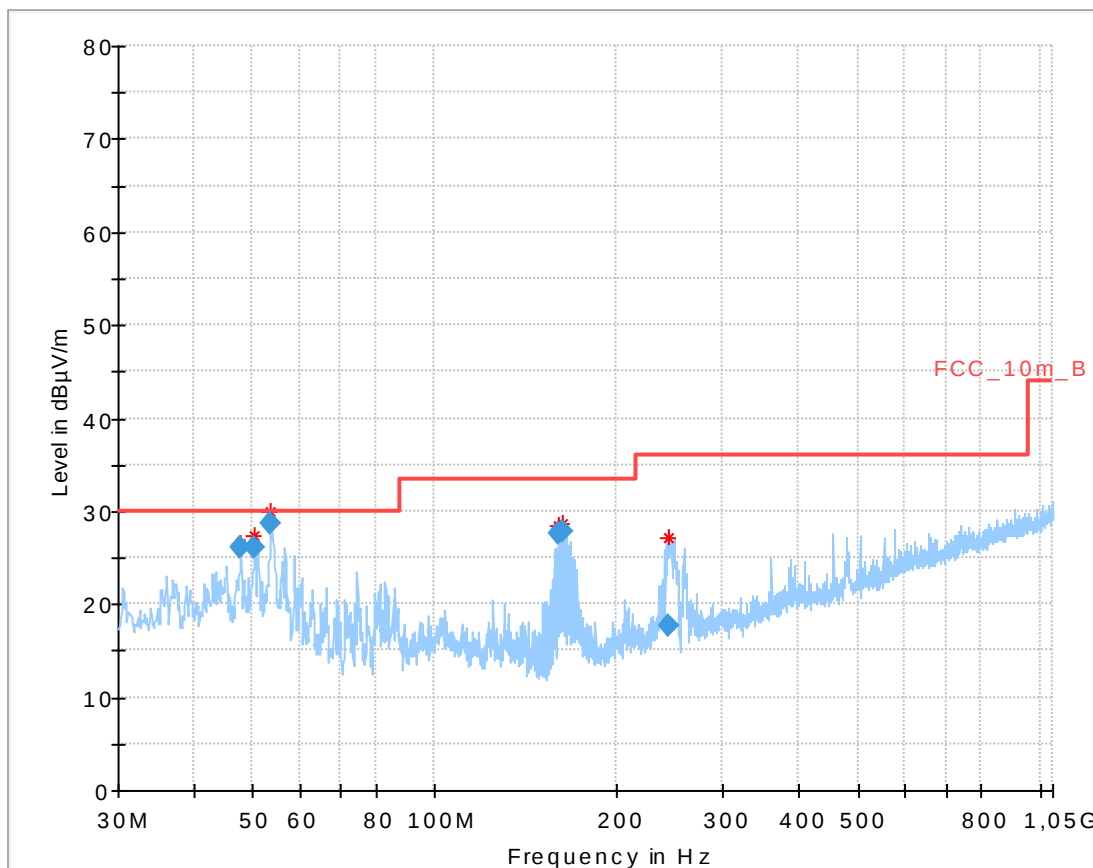
Plot 4: 18 GHz to 26 GHz, 5190 MHz, vertical & horizontal polarization**Plot 5:** 26 GHz to 40 GHz, 5190 MHz, vertical & horizontal polarization

Plot 6: 30 MHz to 1 GHz, 5230 MHz, 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)
47.788200	26.19	30.00	3.81	1000.0	120.000	98.0	V	92	13.2
50.410800	26.82	30.00	3.18	1000.0	120.000	98.0	V	92	12.6
53.564700	28.76	30.00	1.24	1000.0	120.000	98.0	V	124	12.1
160.459800	27.36	33.50	6.14	1000.0	120.000	98.0	V	9	9.1
164.665350	25.58	33.50	7.92	1000.0	120.000	101.0	V	9	9.4
241.613400	18.93	36.00	17.07	1000.0	120.000	98.0	V	286	13.1

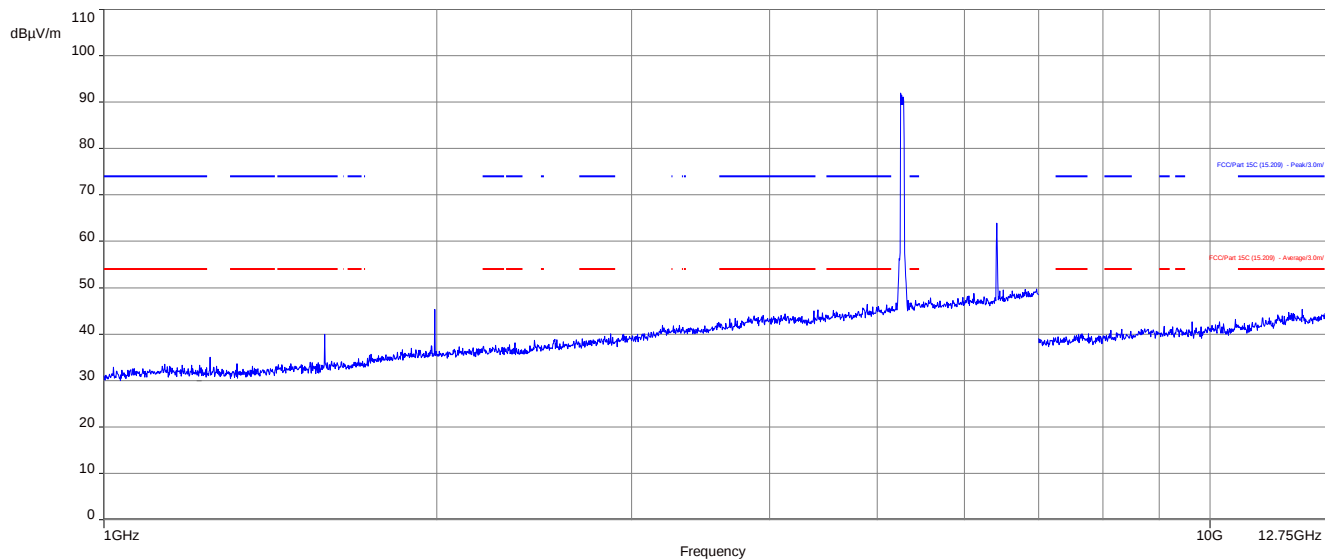
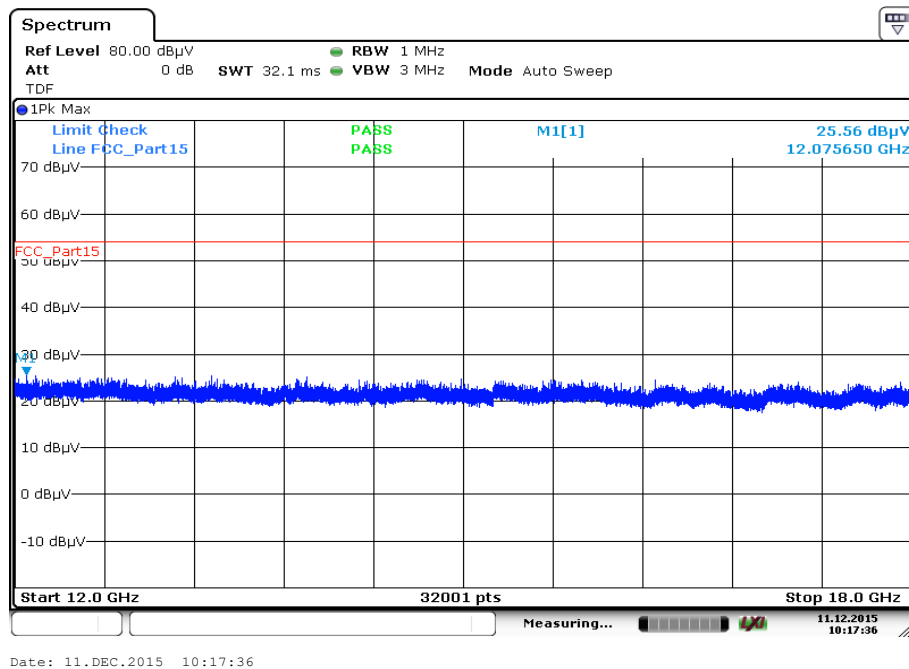
Plot 7: 1 GHz to 12.75 GHz, 5230 MHz, vertical & horizontal polarization**Plot 8:** 12 GHz to 18 GHz, 5230 MHz, vertical & horizontal polarization

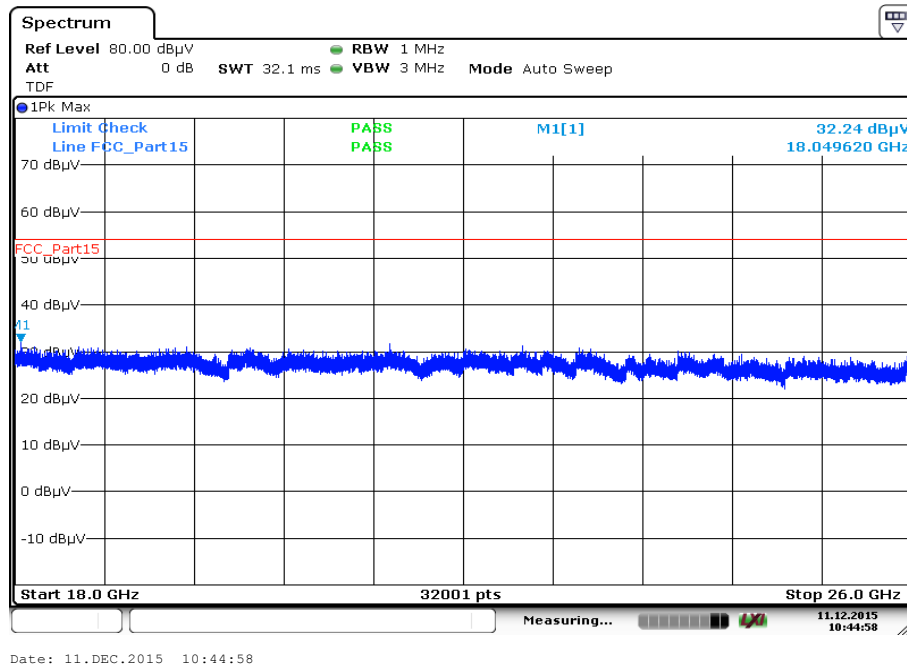
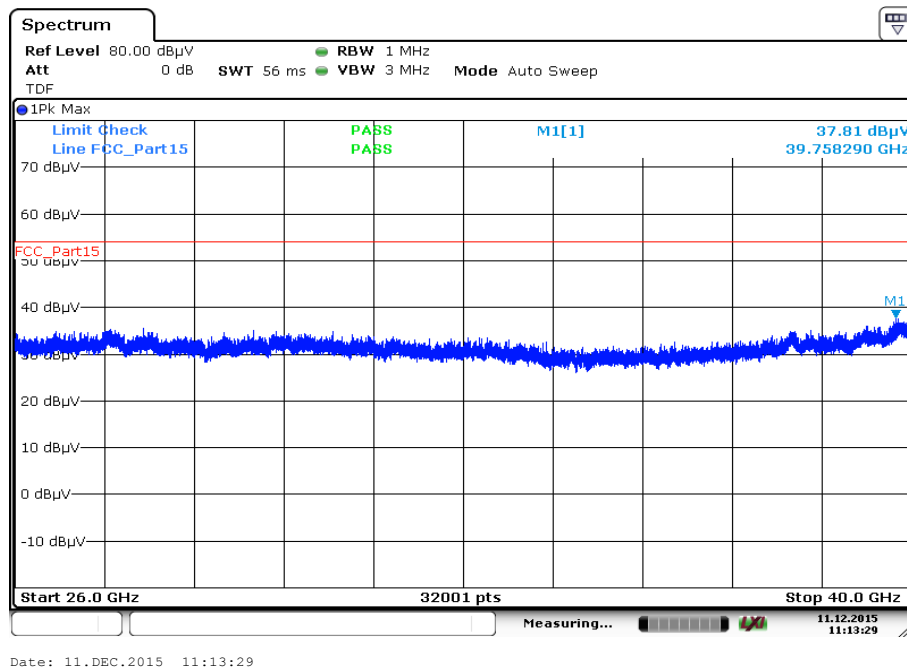
Plot 9: 18 GHz to 26 GHz, 5230 MHz, vertical & horizontal polarization**Plot 10:** 26 GHz to 40 GHz, 5230 MHz, vertical & horizontal polarization

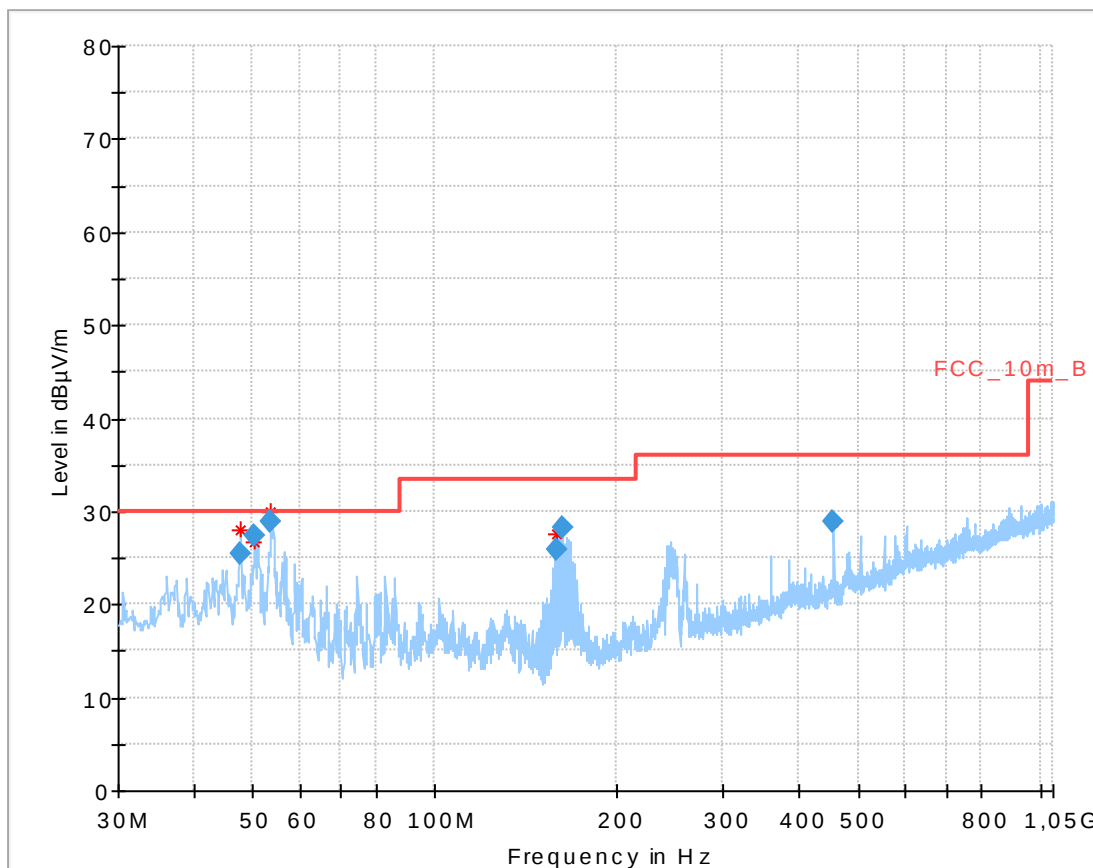
Plot 11: 30 MHz to 1 GHz, 5270 MHz, vertical & horizontal polarization


Final Result

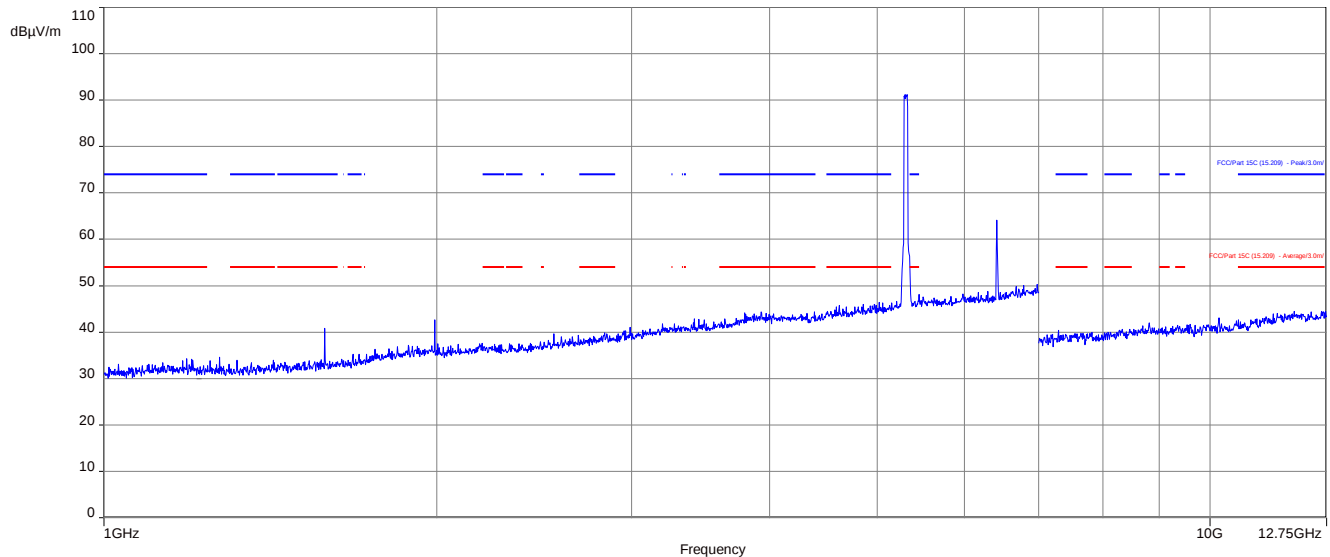
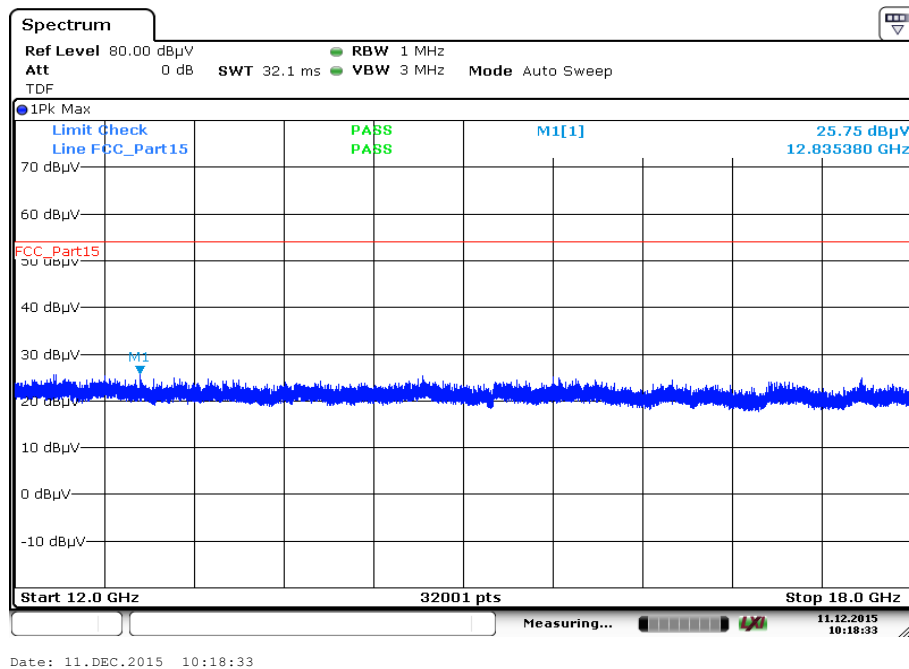
Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
47.814450	26.08	30.00	3.92	1000.0	120.000	98.0	V	89	13.2
50.424150	26.08	30.00	3.92	1000.0	120.000	98.0	V	140	12.6
53.544300	28.72	30.00	1.28	1000.0	120.000	98.0	V	66	12.1
160.447500	27.65	33.50	5.85	1000.0	120.000	98.0	V	6	9.1
162.572850	27.80	33.50	5.70	1000.0	120.000	98.0	V	359	9.2
243.202800	17.70	36.00	18.30	1000.0	120.000	98.0	V	275	13.1

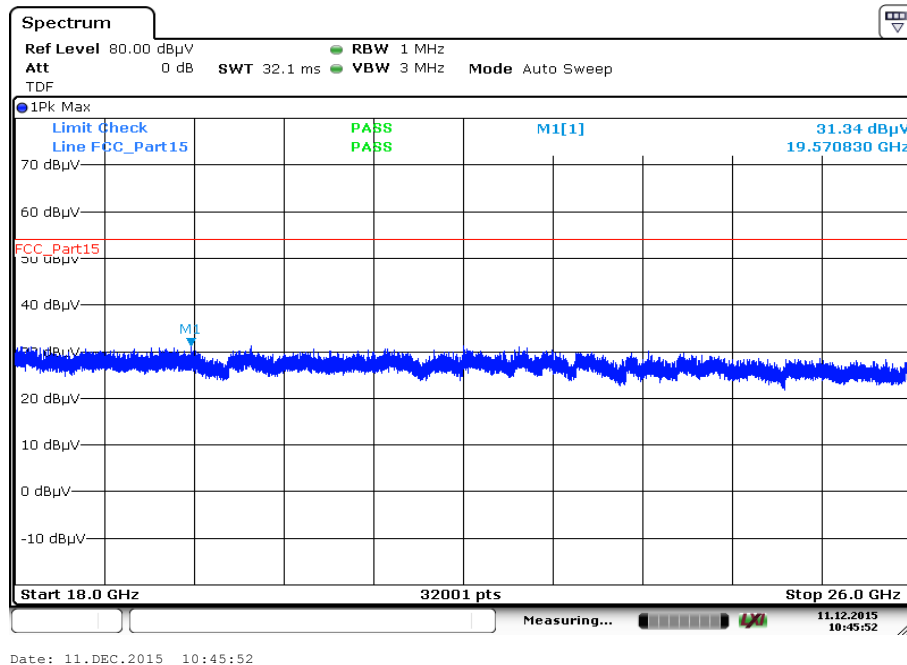
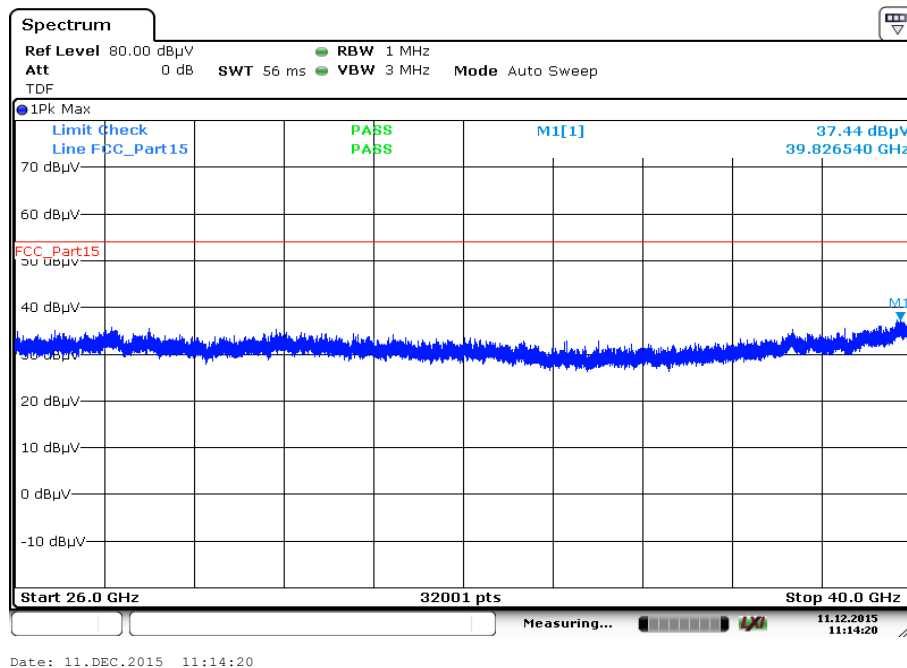
Plot 12: 1 GHz to 12.75 GHz, 5270 MHz, vertical & horizontal polarization**Plot 13:** 12 GHz to 18 GHz, 5270 MHz, vertical & horizontal polarization

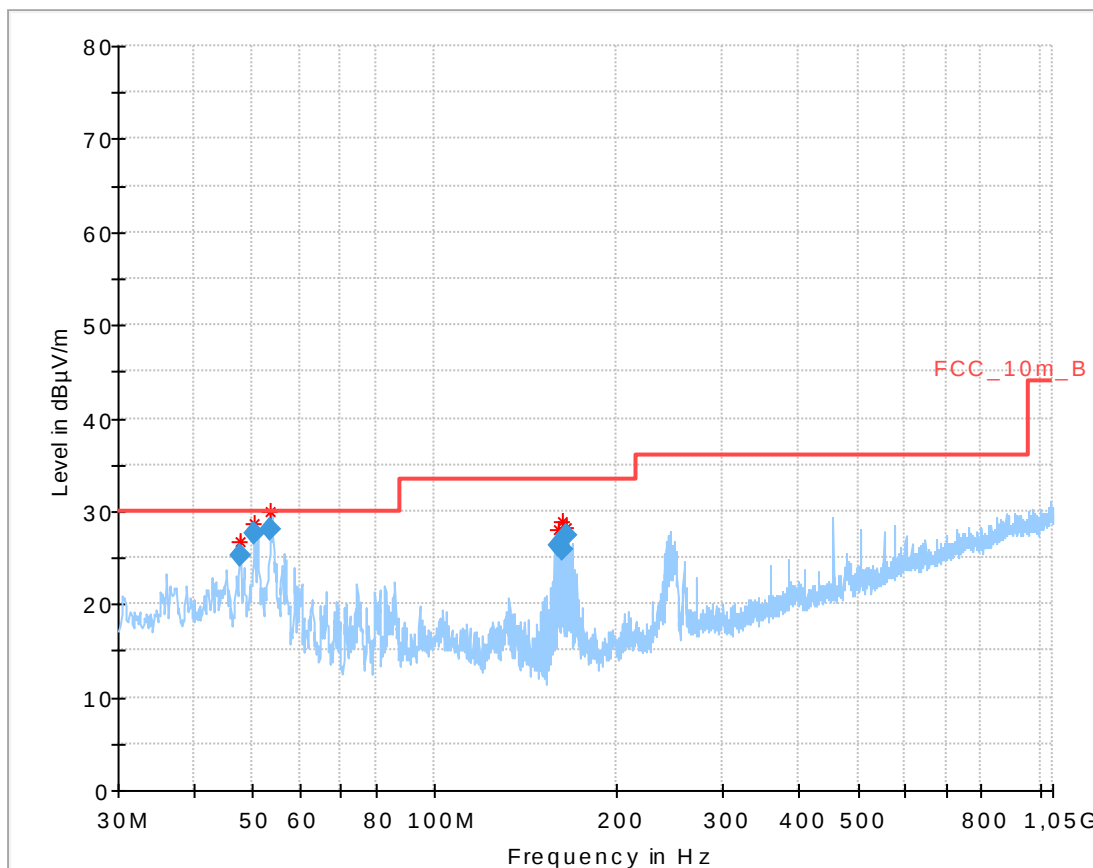
Plot 14: 18 GHz to 26 GHz, 5270 MHz, vertical & horizontal polarization**Plot 15:** 26 GHz to 40 GHz, 5270 MHz, vertical & horizontal polarization

Plot 16: 30 MHz to 1 GHz, 5310 MHz, vertical & horizontal polarization**Final Result**

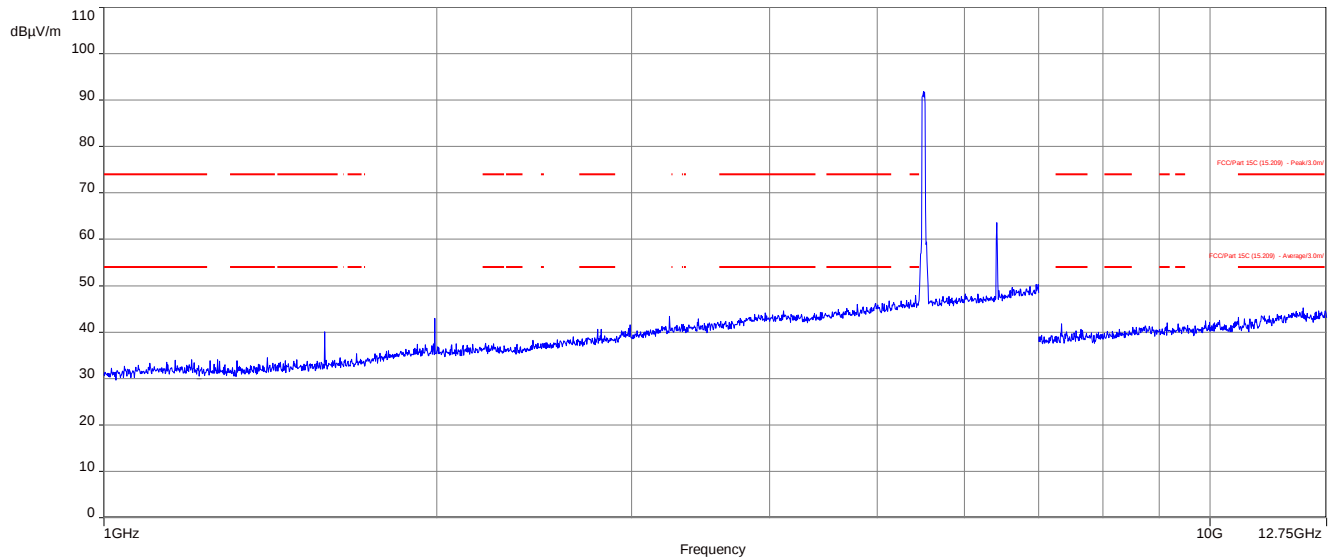
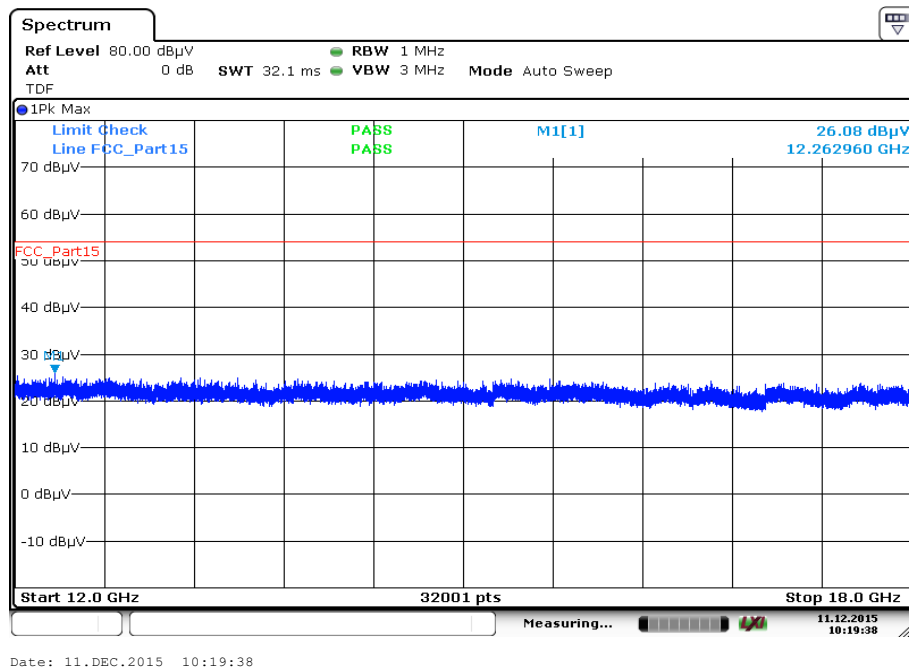
Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
47.824050	25.49	30.00	4.51	1000.0	120.000	98.0	V	88	13.2
50.452650	27.39	30.00	2.61	1000.0	120.000	98.0	V	71	12.6
53.561400	28.98	30.00	1.02	1000.0	120.000	98.0	V	79	12.1
158.340300	25.85	33.50	7.65	1000.0	120.000	98.0	V	0	9.0
162.552150	28.19	33.50	5.31	1000.0	120.000	98.0	V	348	9.2
455.992200	28.81	36.00	7.19	1000.0	120.000	170.0	H	71	17.7

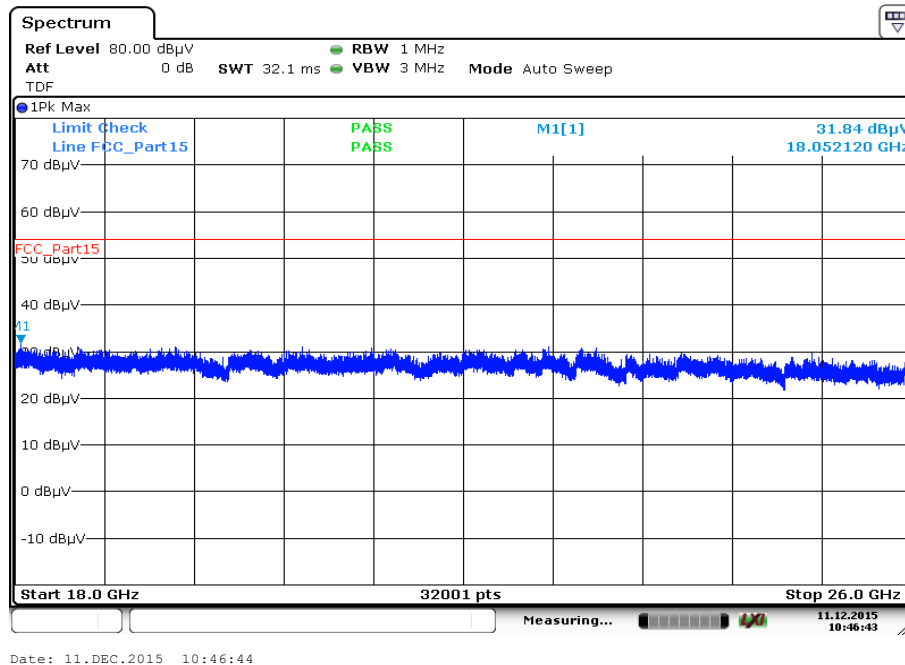
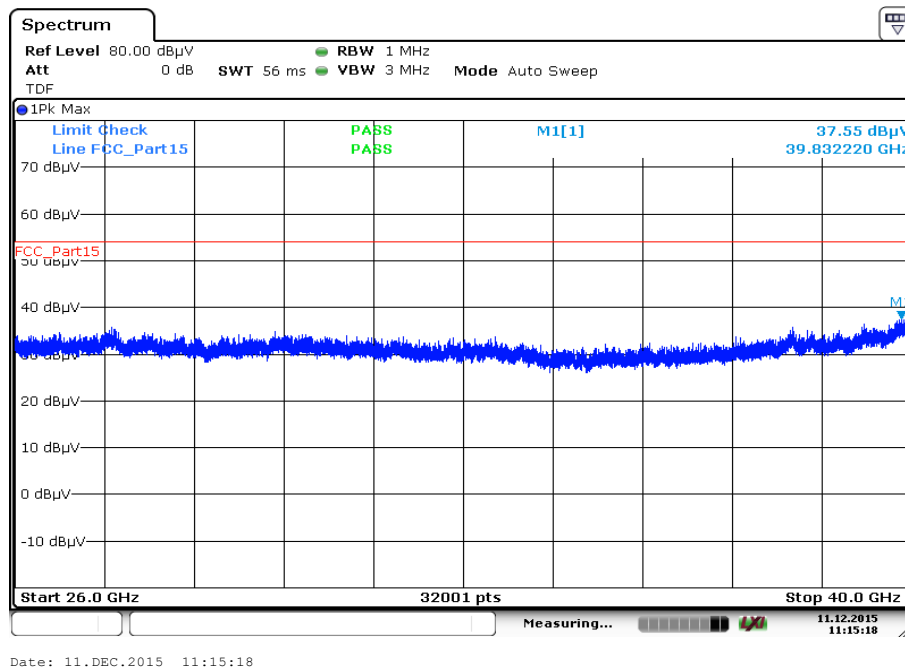
Plot 17: 1 GHz to 12.75 GHz, 5310 MHz, vertical & horizontal polarization**Plot 18:** 12 GHz to 18 GHz, 5310 MHz, vertical & horizontal polarization

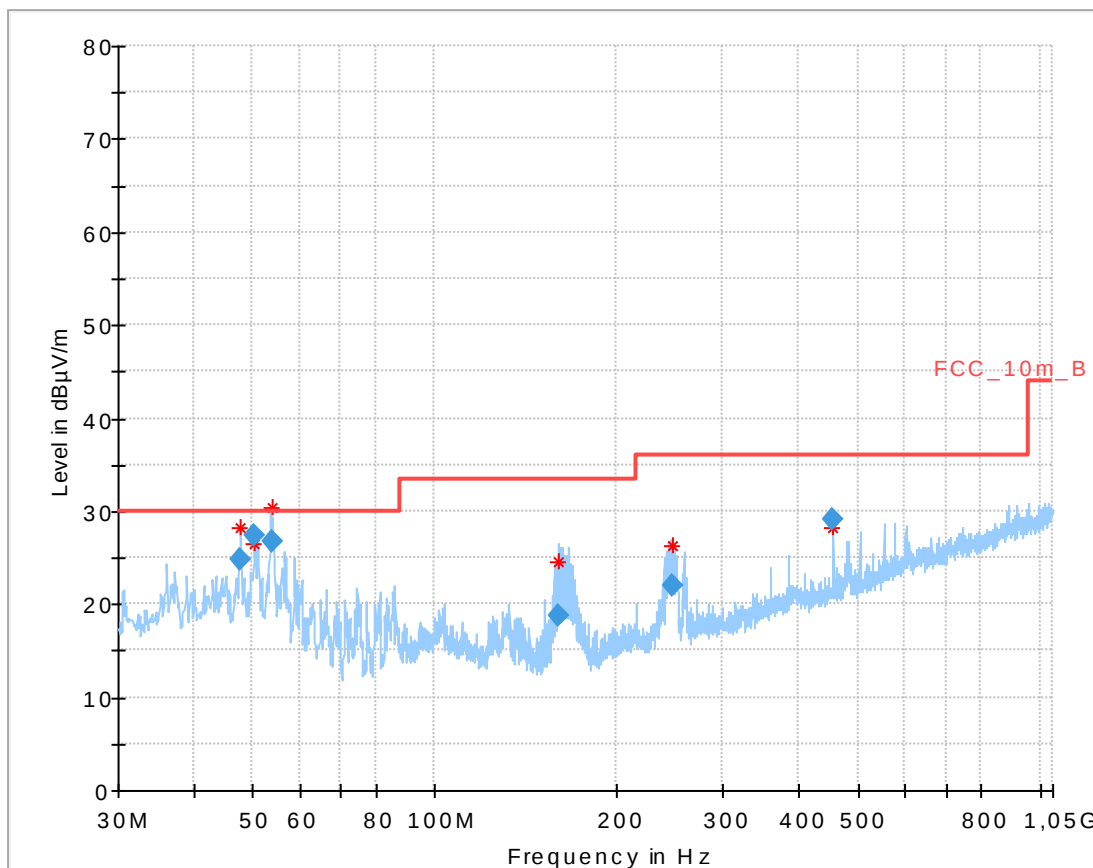
Plot 19: 18 GHz to 26 GHz, 5310 MHz, vertical & horizontal polarization**Plot 20:** 26 GHz to 40 GHz, 5310 MHz, vertical & horizontal polarization

Plot 21: 30 MHz to 1 GHz, 5510 MHz, vertical & horizontal polarization**Final Result**

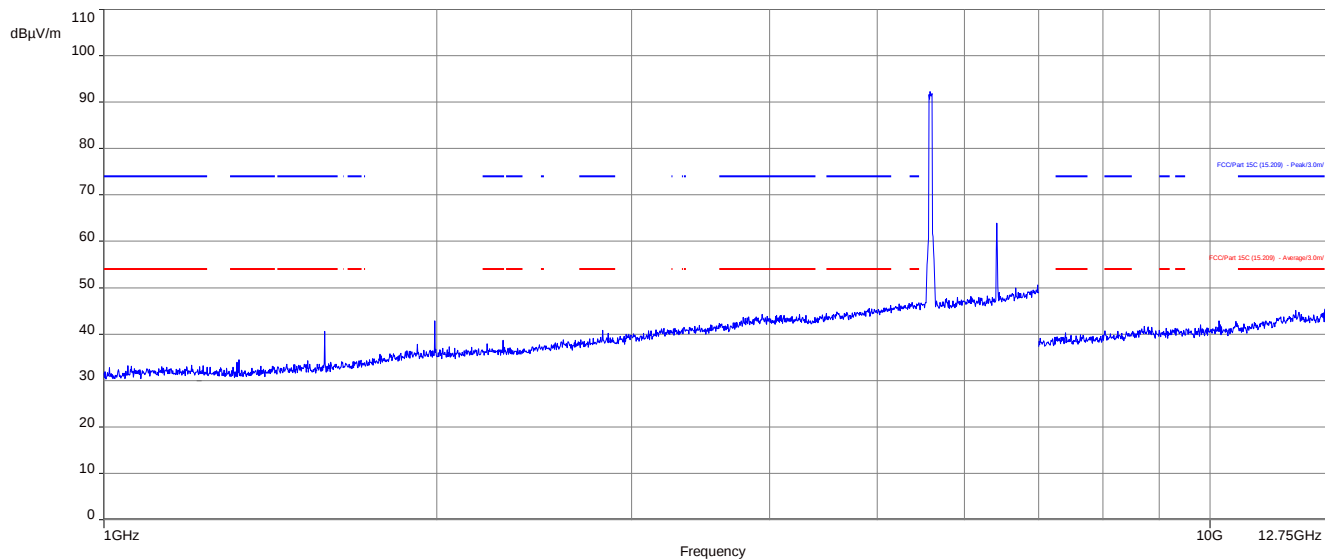
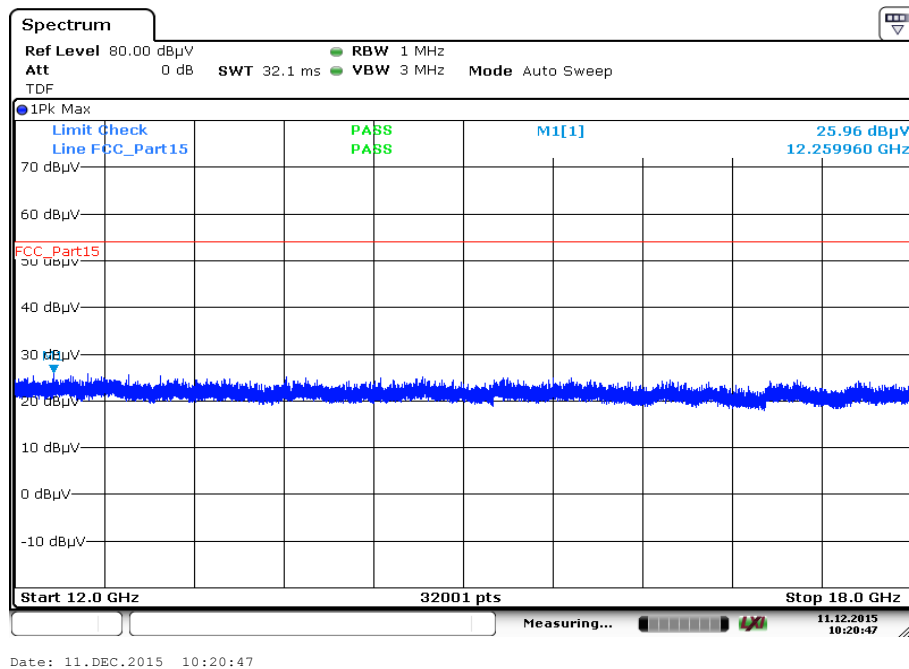
Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
47.825550	25.20	30.00	4.80	1000.0	120.000	98.0	V	17	13.2
50.450400	27.66	30.00	2.34	1000.0	120.000	98.0	V	75	12.6
53.532300	27.99	30.00	2.01	1000.0	120.000	98.0	V	75	12.1
160.411200	26.24	33.50	7.26	1000.0	120.000	98.0	V	0	9.1
162.518550	25.93	33.50	7.57	1000.0	120.000	98.0	V	324	9.2
164.628300	27.33	33.50	6.17	1000.0	120.000	98.0	V	358	9.4

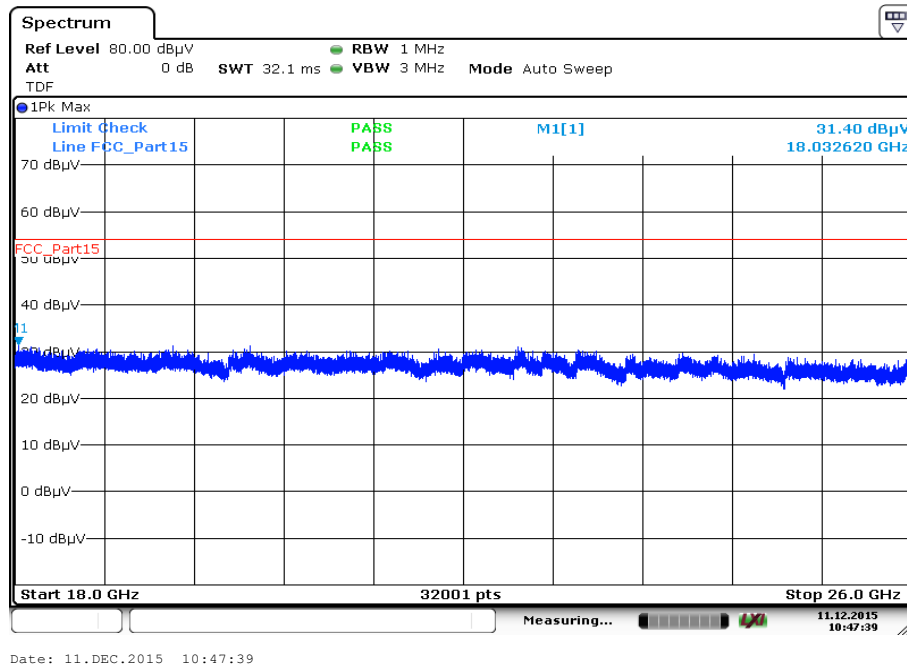
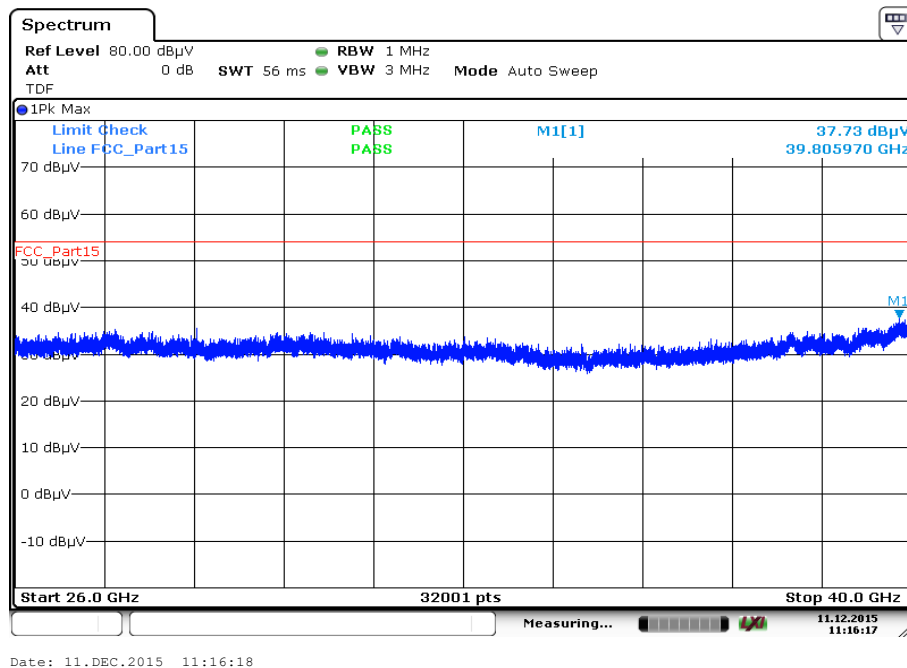
Plot 22: 1 GHz to 12.75 GHz, 5510 MHz, vertical & horizontal polarization**Plot 23:** 12 GHz to 18 GHz, 5510 MHz, vertical & horizontal polarization

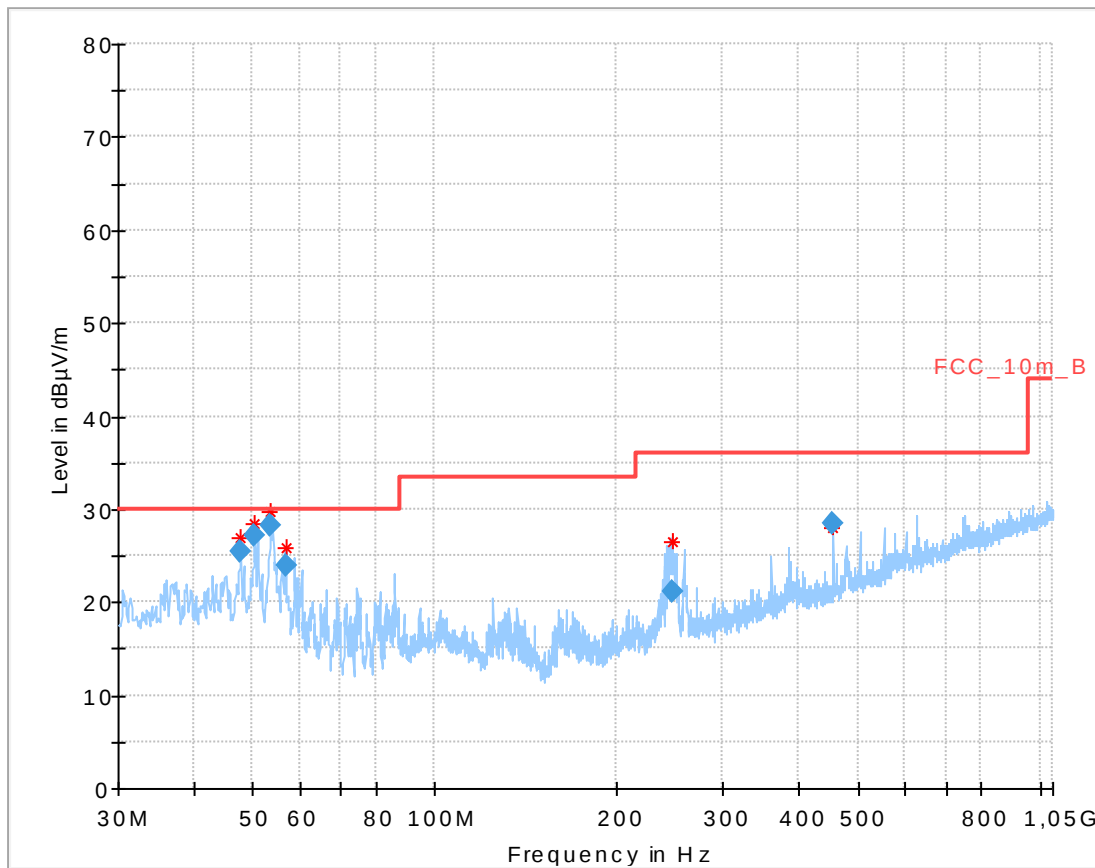
Plot 24: 18 GHz to 26 GHz, 5510 MHz, vertical & horizontal polarization**Plot 25:** 26 GHz to 40 GHz, 5510 MHz, vertical & horizontal polarization

Plot 26: 30 MHz to 1 GHz, 5590 MHz, 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)
47.829750	24.80	30.00	5.20	1000.0	120.000	98.0	V	76	13.2
50.446350	27.36	30.00	2.64	1000.0	120.000	98.0	V	110	12.6
53.915250	26.68	30.00	3.32	1000.0	120.000	170.0	V	117	12.0
159.633750	18.71	33.50	14.79	1000.0	120.000	98.0	V	9	9.1
246.561300	22.01	36.00	13.99	1000.0	120.000	98.0	V	248	13.2
456.023850	29.02	36.00	6.98	1000.0	120.000	170.0	H	76	17.7

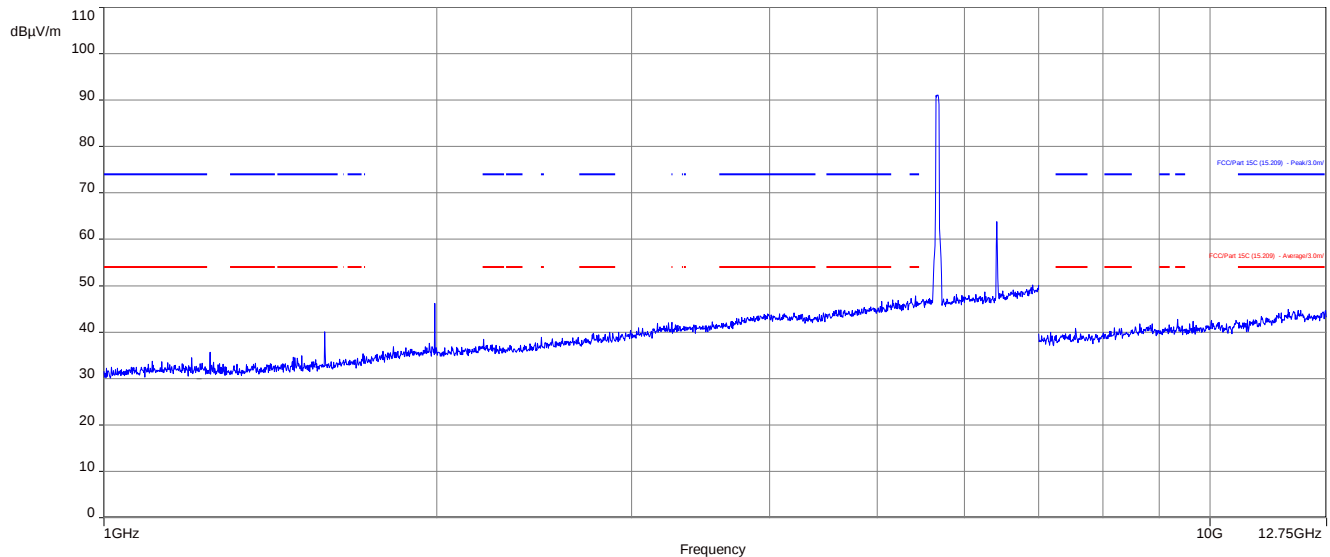
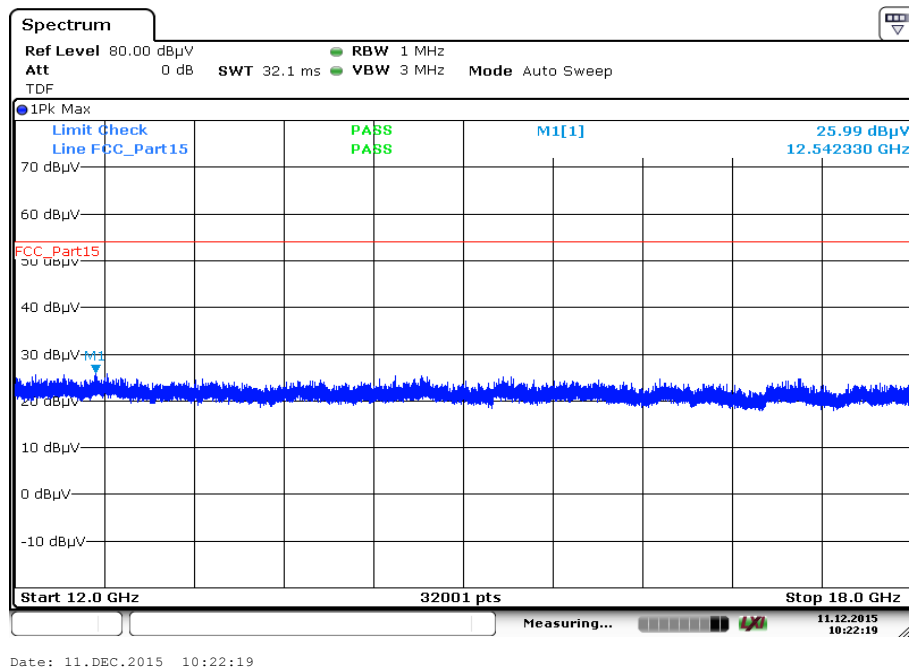
Plot 27: 1 GHz to 12.75 GHz, 5590 MHz, vertical & horizontal polarization**Plot 28:** 12 GHz to 18 GHz, 5590 MHz, vertical & horizontal polarization

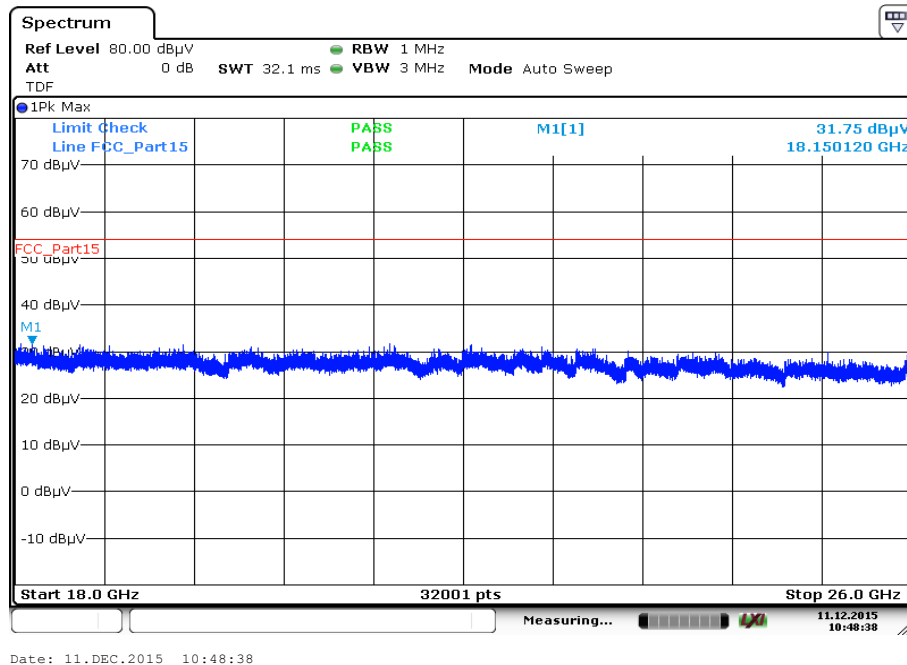
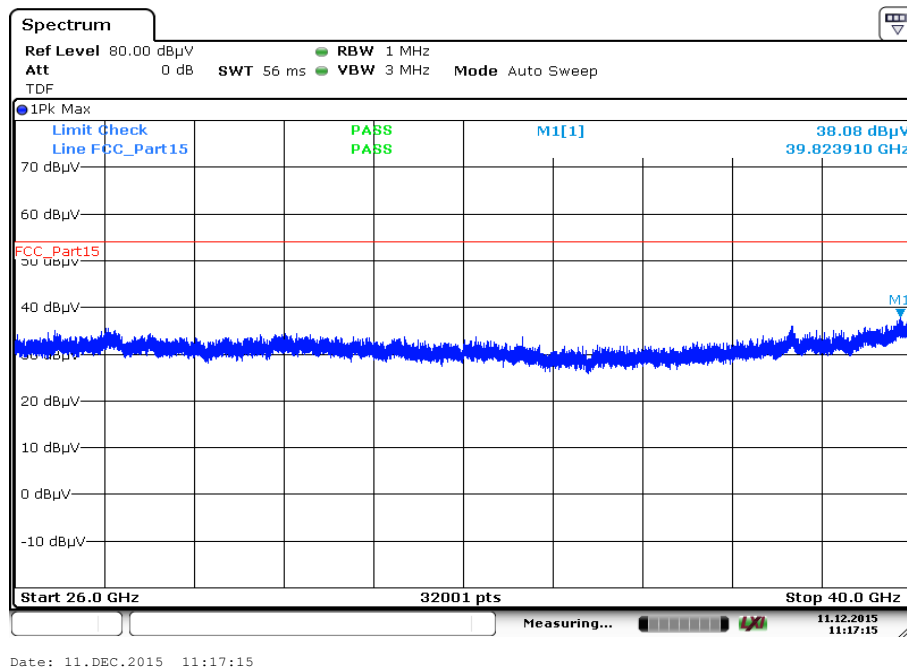
Plot 29: 18 GHz to 26 GHz, 5590 MHz, vertical & horizontal polarization**Plot 30:** 26 GHz to 40 GHz, 5590 MHz, vertical & horizontal polarization

Plot 31: 30 MHz to 1 GHz, 5670 MHz, 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)
47.798100	25.47	30.00	4.53	1000.0	120.000	98.0	V	126	13.2
50.431350	27.18	30.00	2.82	1000.0	120.000	98.0	V	62	12.6
53.542800	28.29	30.00	1.71	1000.0	120.000	98.0	V	75	12.1
56.777100	24.00	30.00	6.00	1000.0	120.000	101.0	V	114	11.4
246.396000	21.15	36.00	14.85	1000.0	120.000	98.0	V	270	13.2
455.986500	28.48	36.00	7.52	1000.0	120.000	170.0	H	75	17.7

Plot 32: 1 GHz to 12.75 GHz, 5670 MHz, vertical & horizontal polarization**Plot 33:** 12 GHz to 18 GHz, 5670 MHz, vertical & horizontal polarization

Plot 34: 18 GHz to 26 GHz, 5670 MHz, vertical & horizontal polarization**Plot 35:** 26 GHz to 40 GHz, 5670 MHz, vertical & horizontal polarization

12.6 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

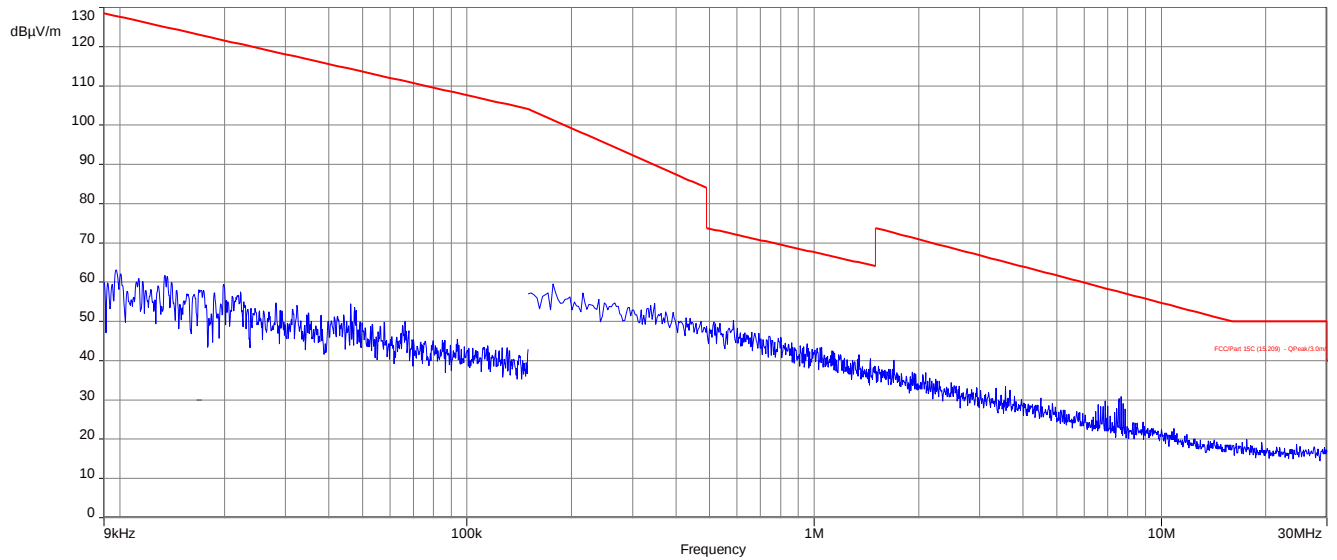
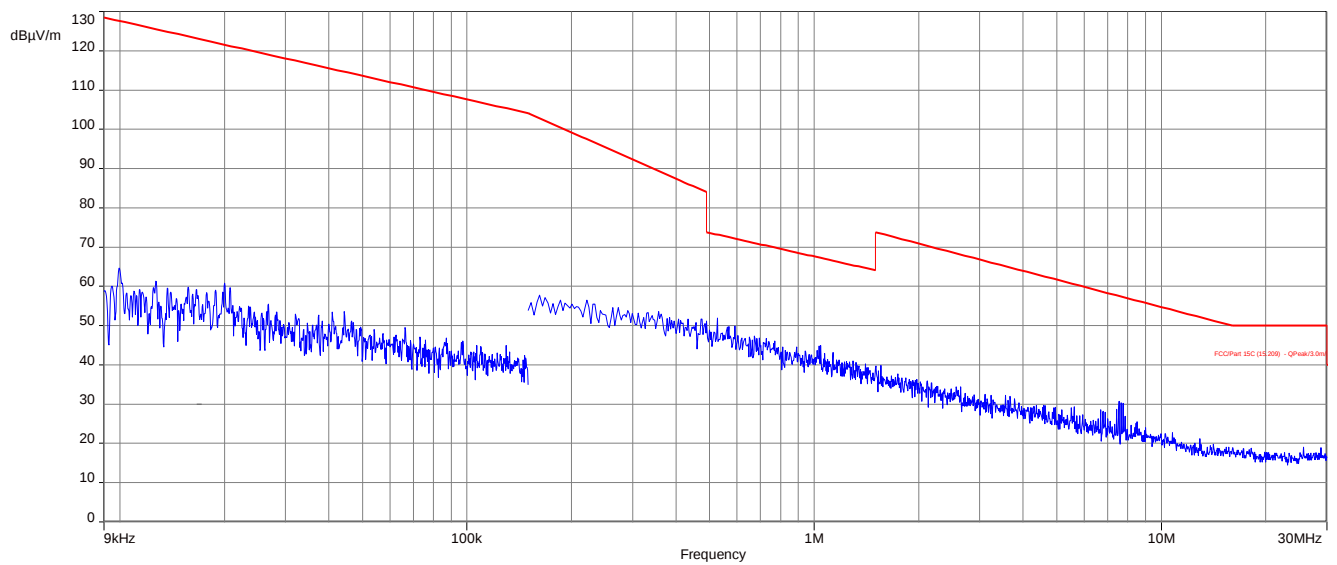
Limits:

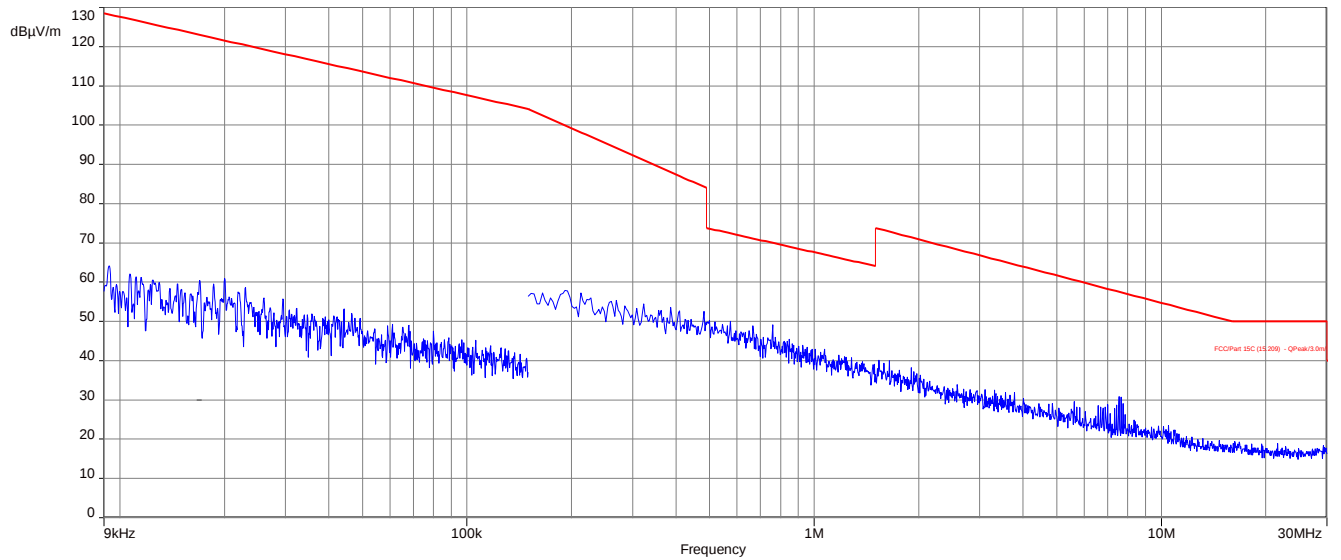
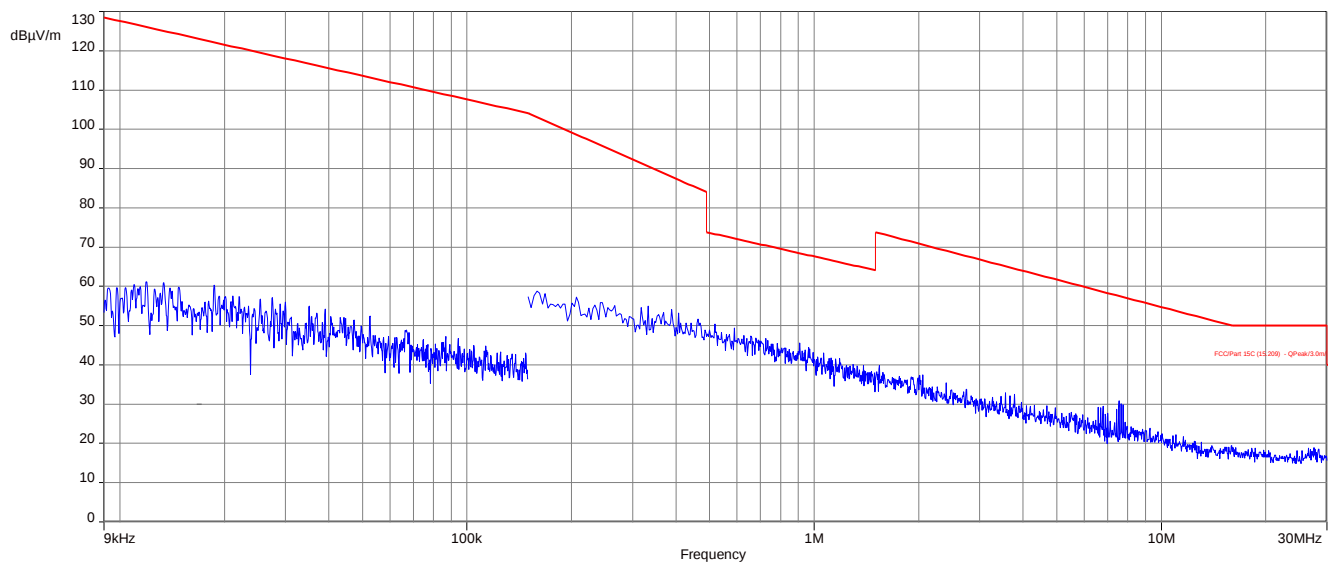
Spurious Emissions Radiated < 30 MHz		
Frequency (MHz)	Field Strength (dB μ V/m)	Measurement distance
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30

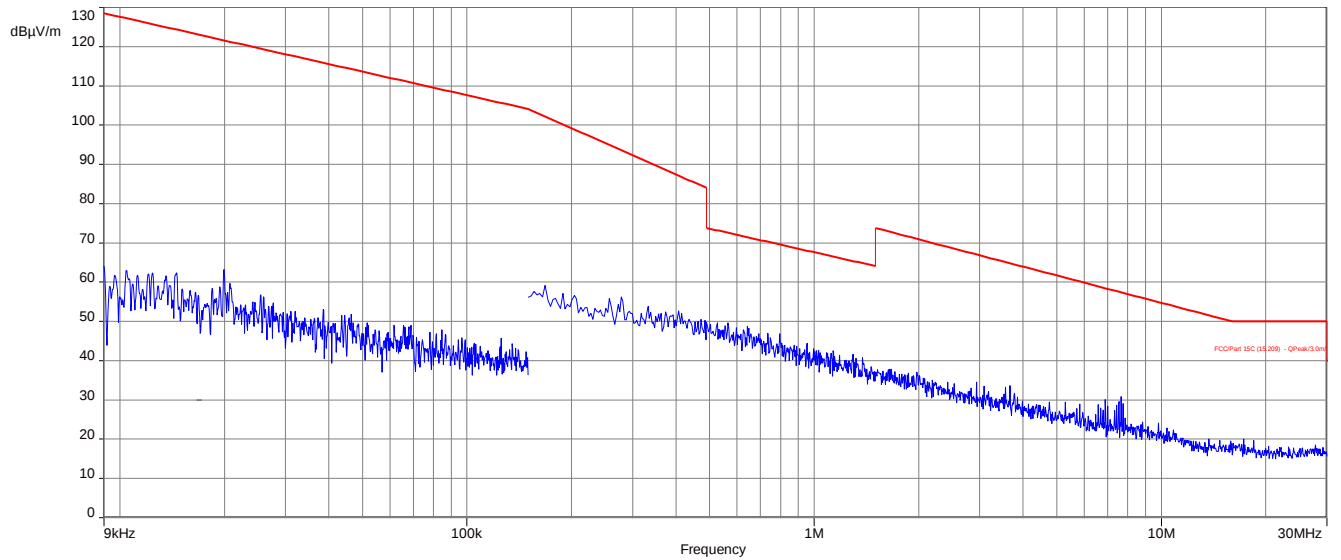
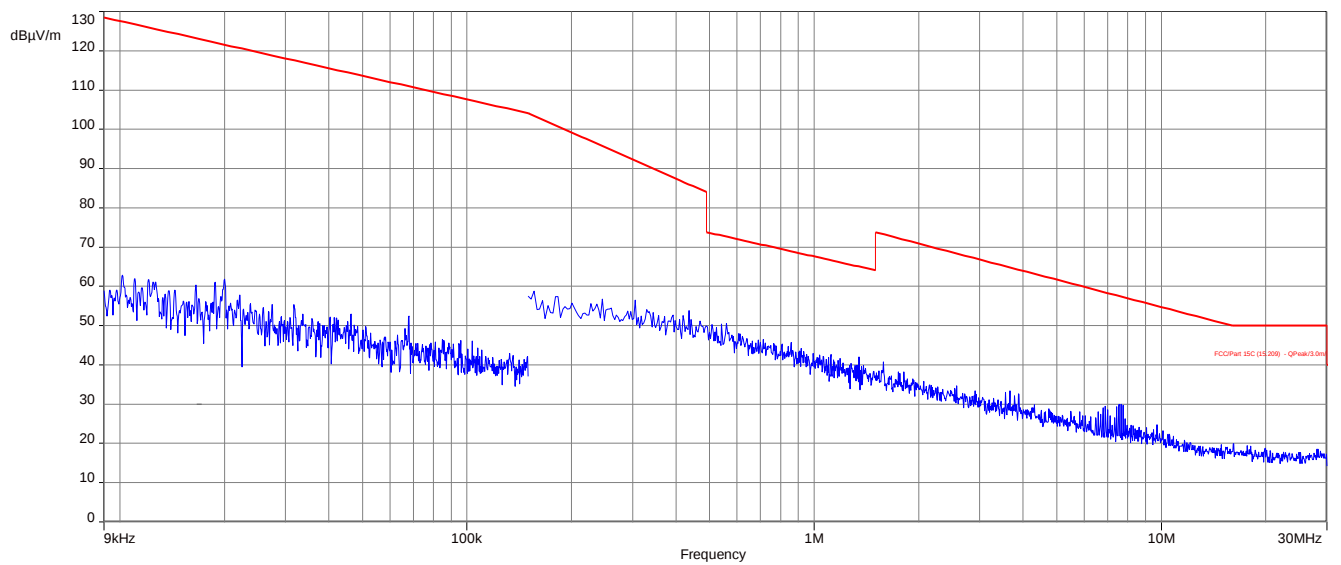
Results:

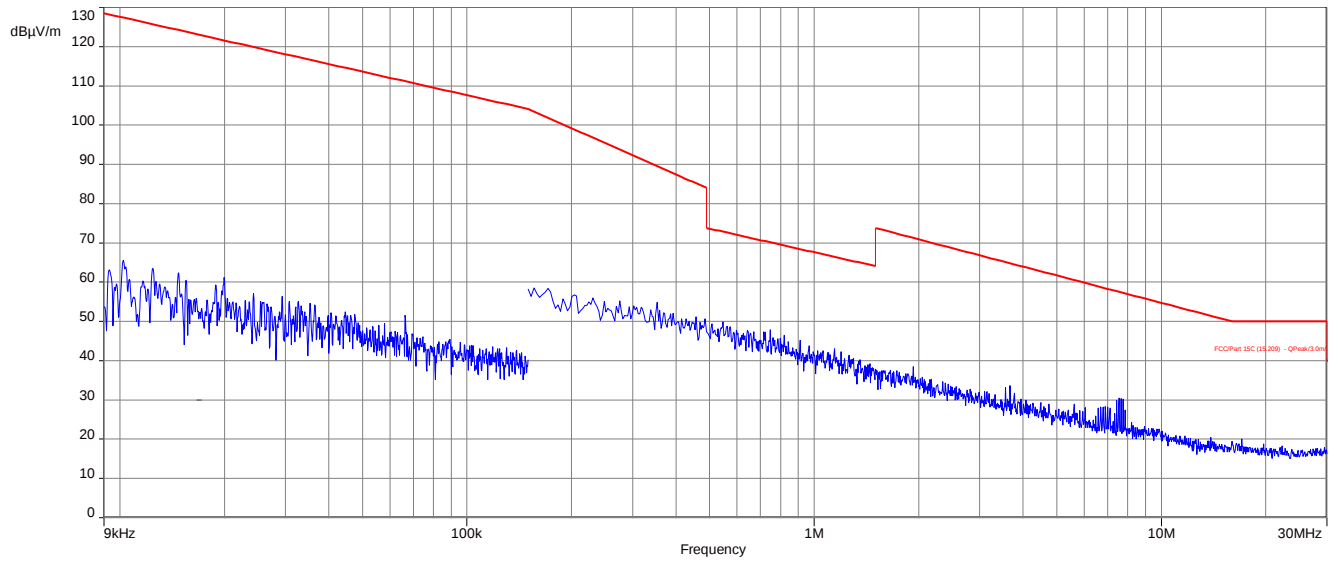
Spurious Emissions Radiated < 30 MHz [dB μ V/m]		
F [MHz]	Detector	Level [dB μ V/m]
No critical peaks found		
Measurement uncertainty	± 3 dB	

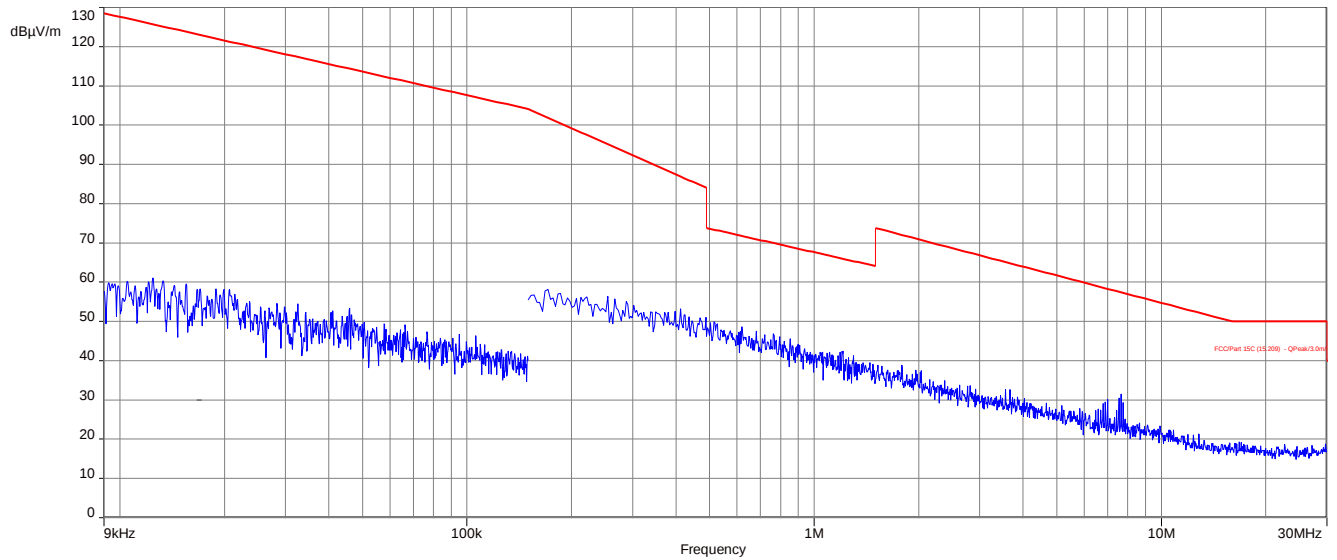
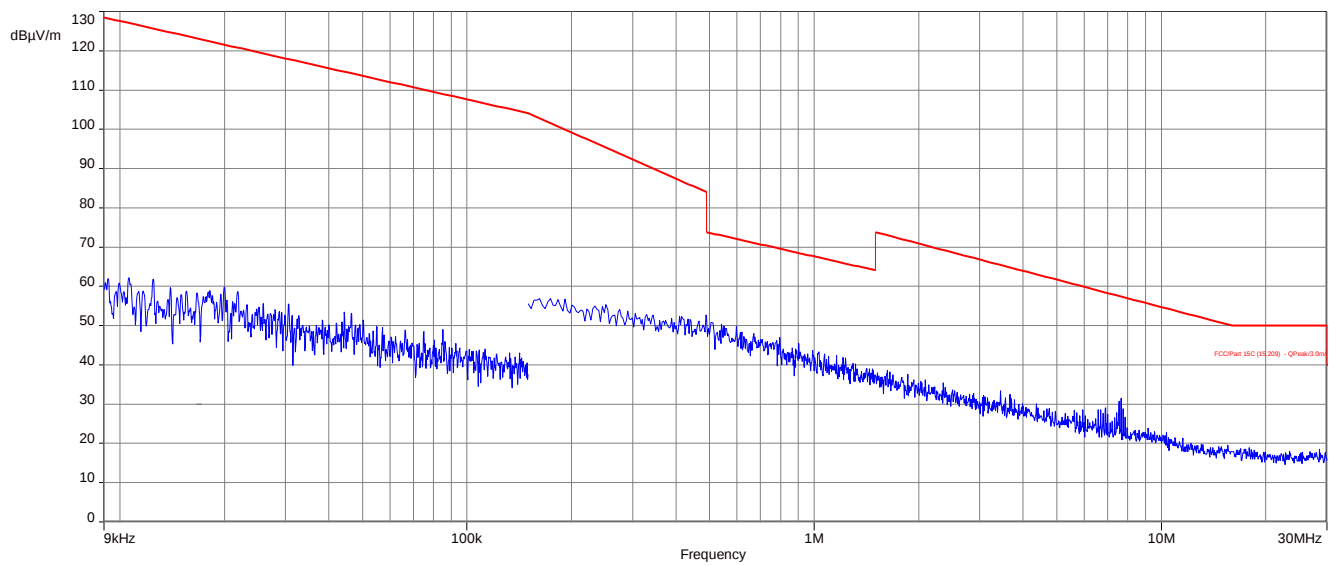
Note: The limit was recalculated with 20 dB / decade (Part 15.31) for all radiated spurious emissions 30 MHz to 1 GHz from 3 meter limit to a 10 meter distance. (40dB/decade for emissions < 30MHz)

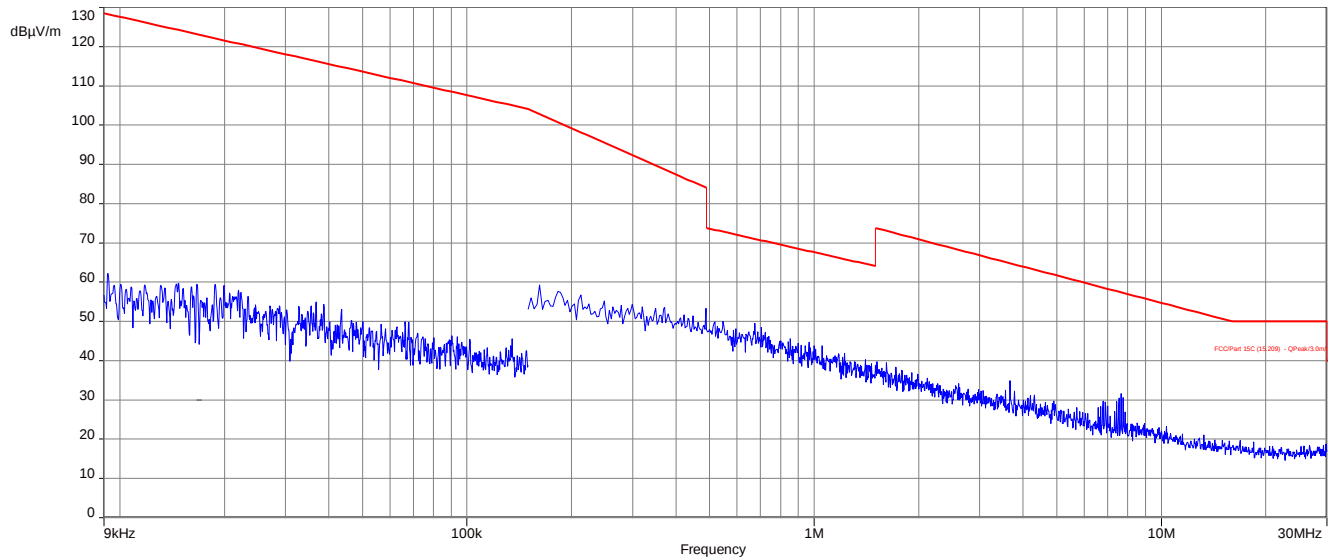
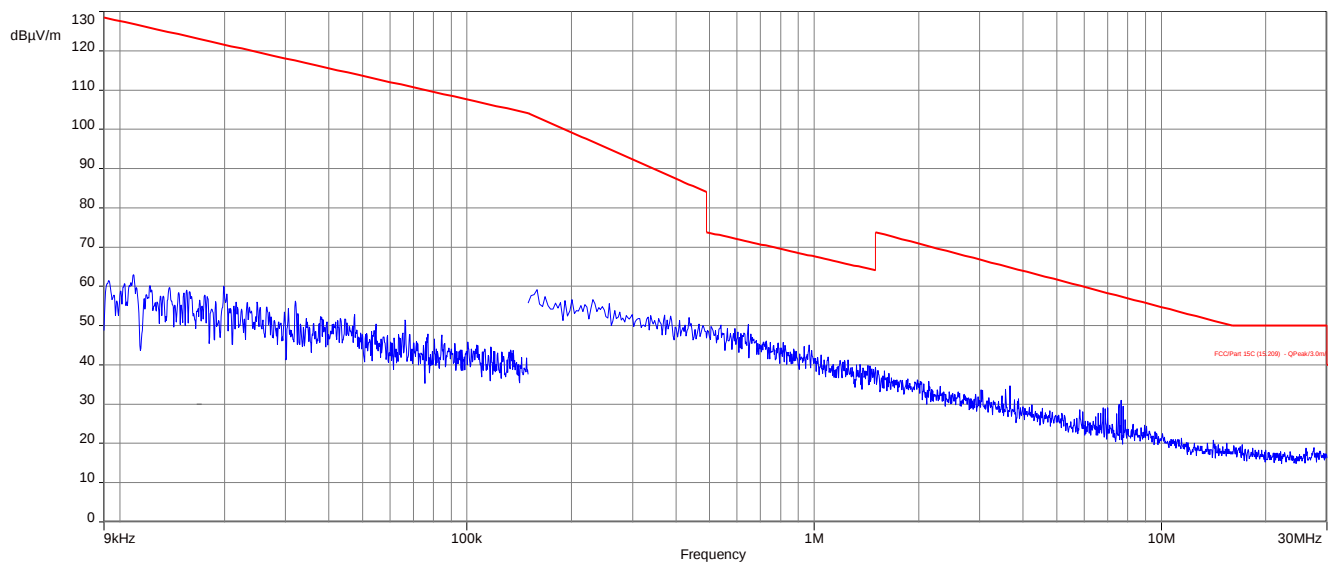
Plots: OFDM / a – mode**Plot 1:** 9 kHz to 30 MHz, 5180 MHz, vertical & horizontal polarization**Plot 2:** 9 kHz to 30 MHz, 5240 MHz, vertical & horizontal polarization

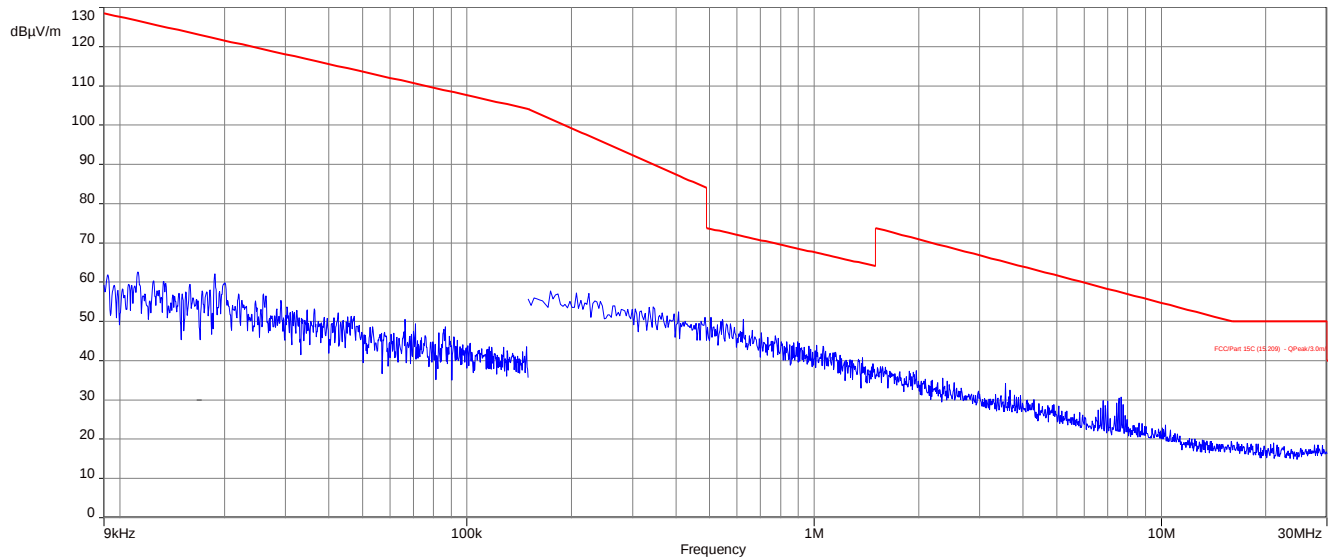
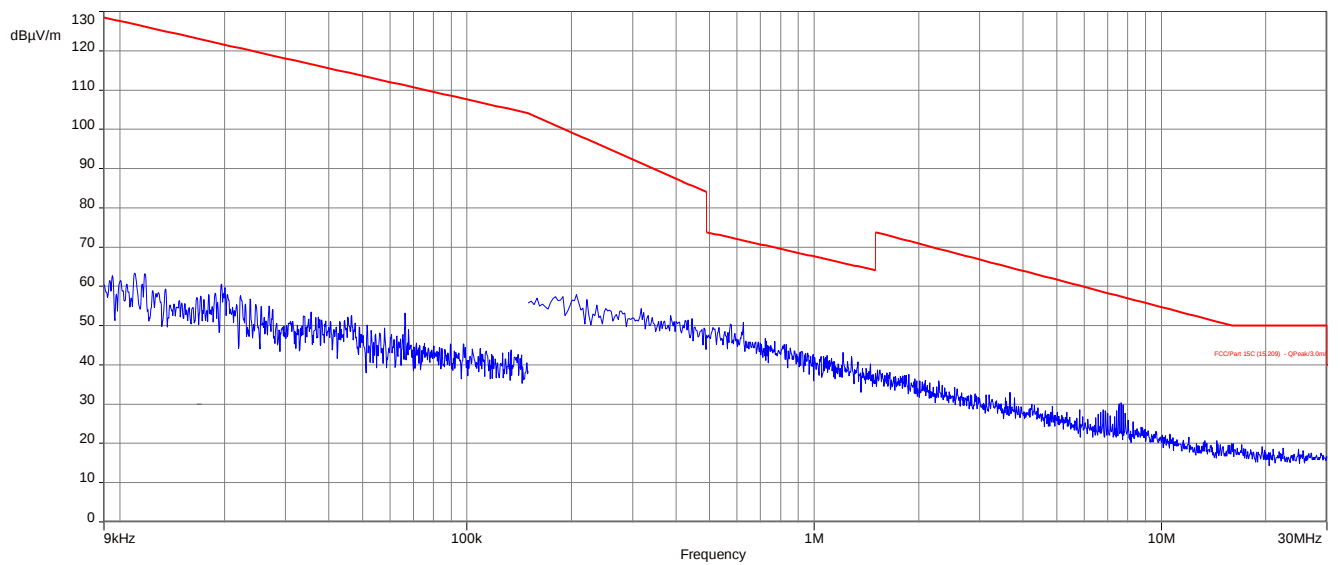
Plot 3: 9 kHz to 30 MHz, 5260 MHz, vertical & horizontal polarization**Plot 4:** 9 kHz to 30 MHz, 5320 MHz, vertical & horizontal polarization

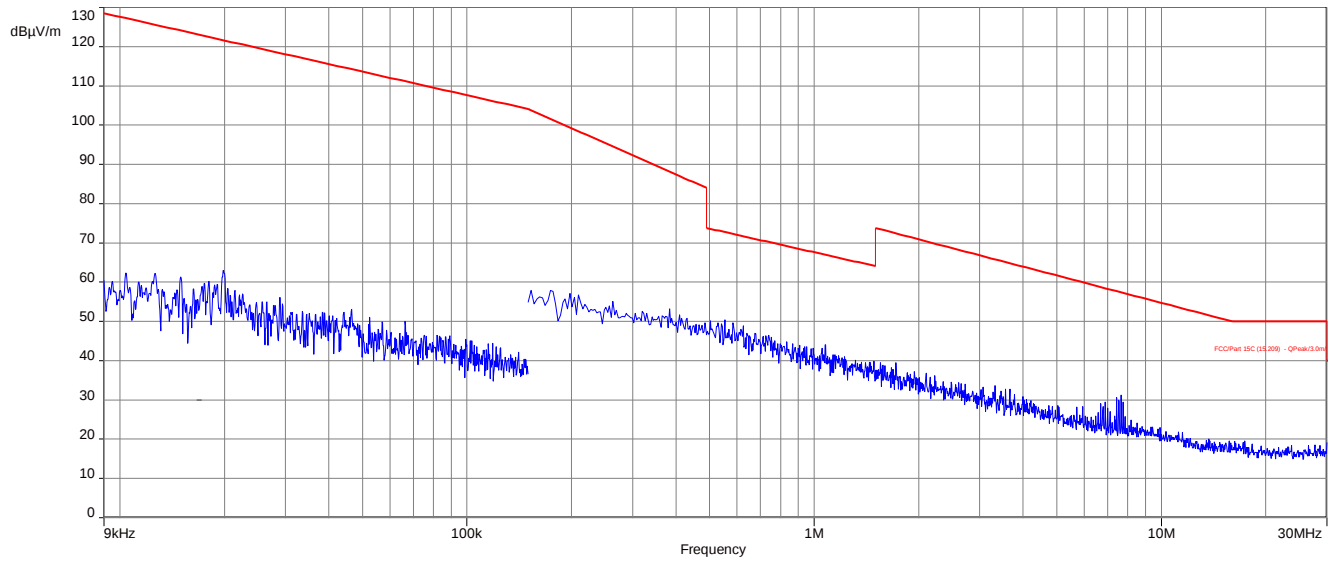
Plot 5: 9 kHz to 30 MHz, 5500 MHz, vertical & horizontal polarization**Plot 6:** 9 kHz to 30 MHz 5600 MHz, vertical & horizontal polarization

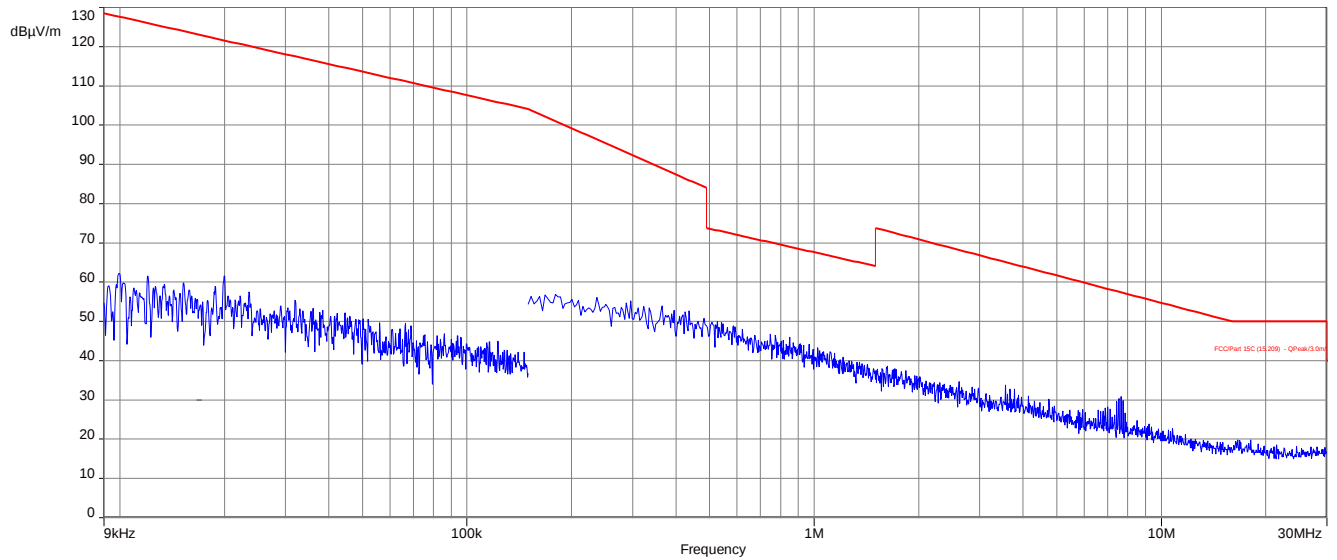
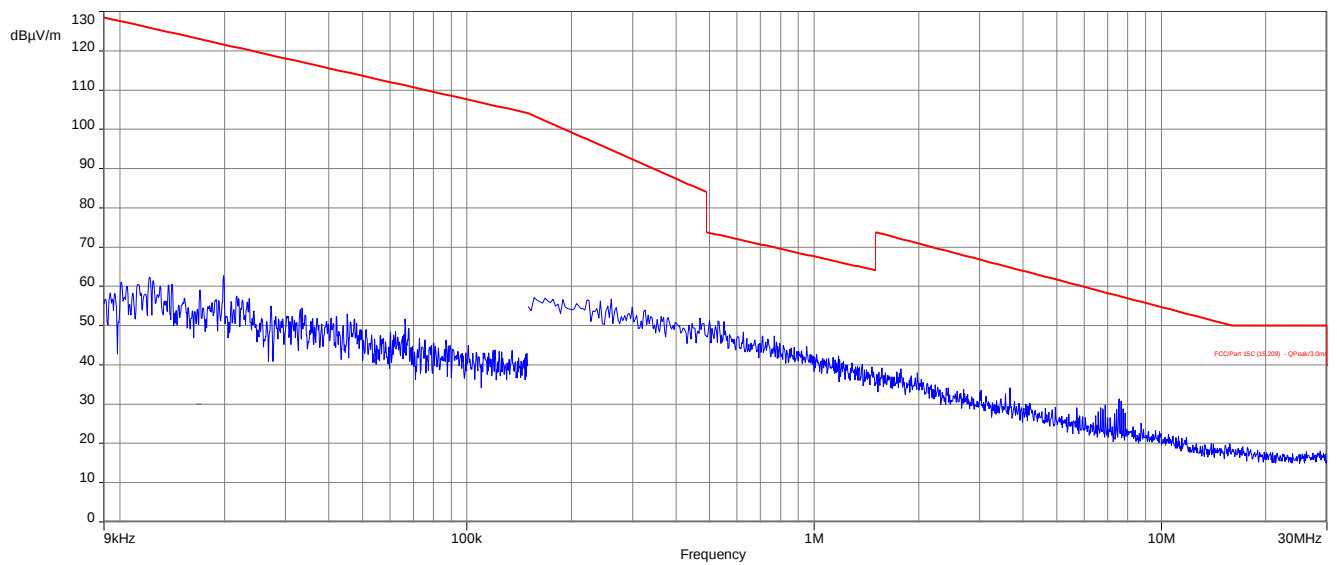
Plot 7: 9 kHz to 30 MHz, 5700 MHz, vertical & horizontal polarization

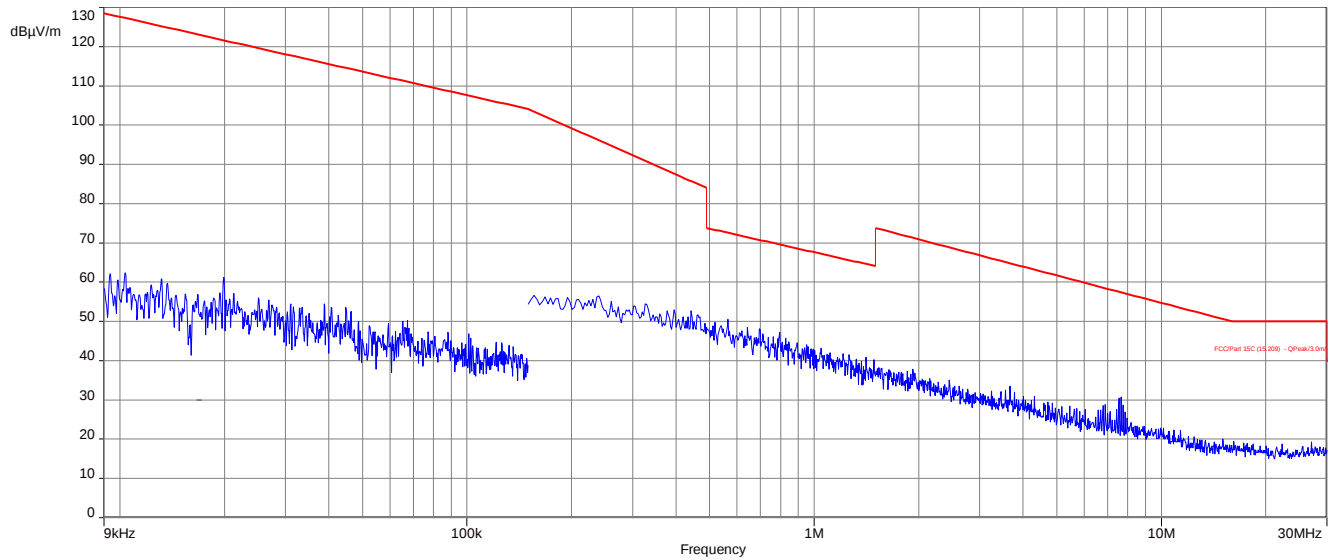
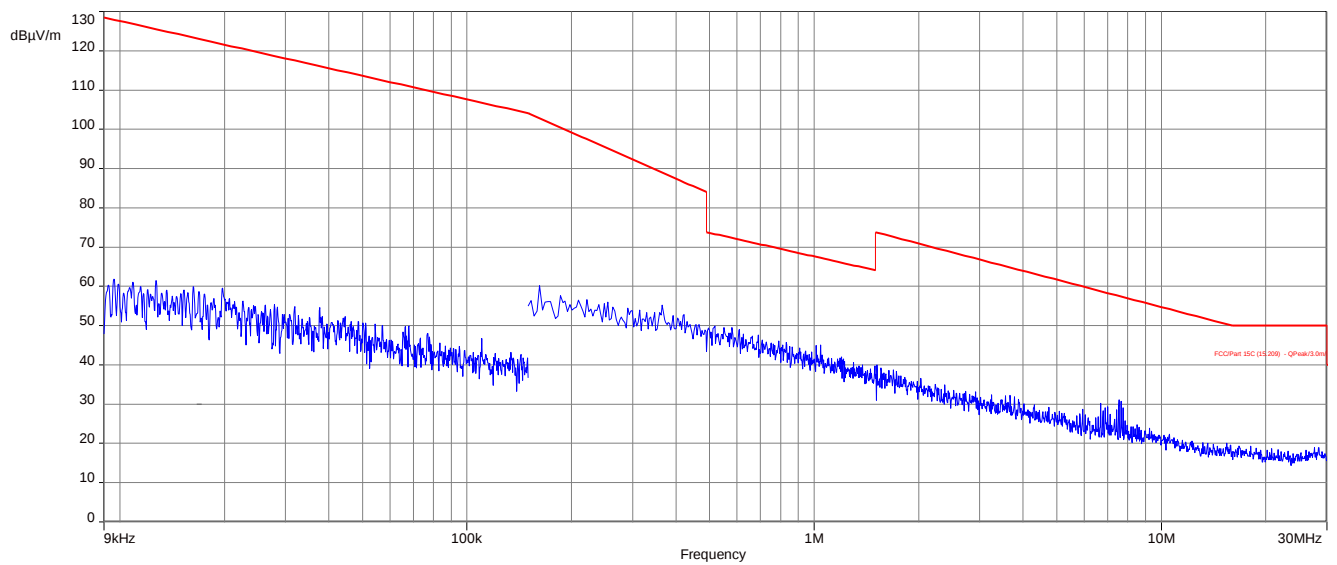
Plots: OFDM / n – mode HT20**Plot 1:** 9 kHz to 30 MHz, 5180 MHz, vertical & horizontal polarization**Plot 2:** 9 kHz to 30 MHz, 5240 MHz, vertical & horizontal polarization

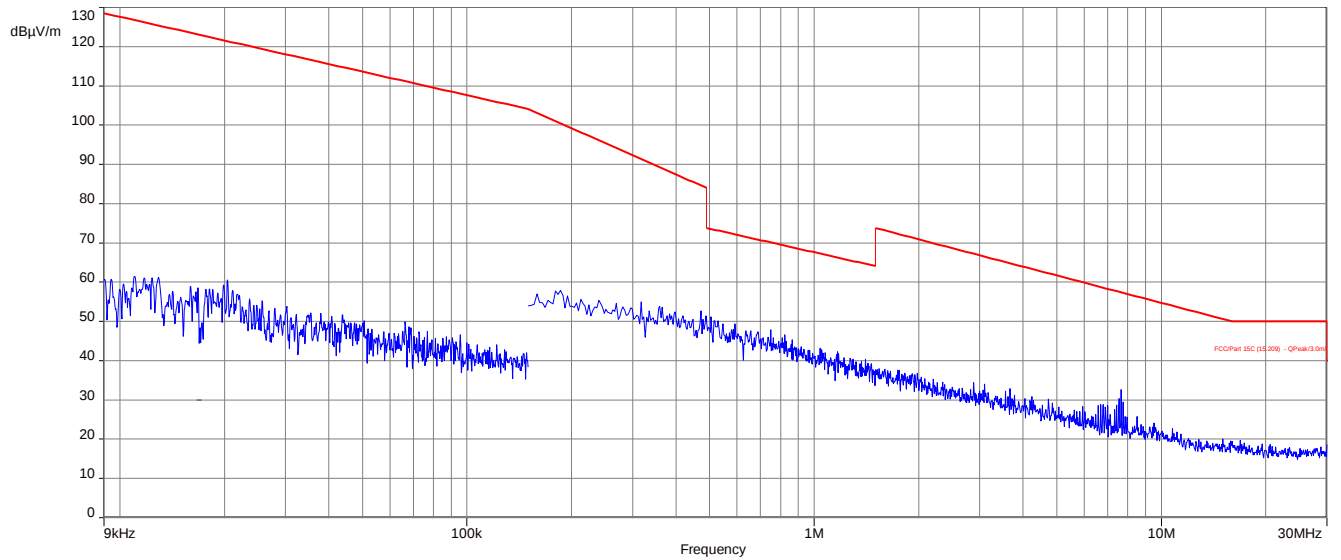
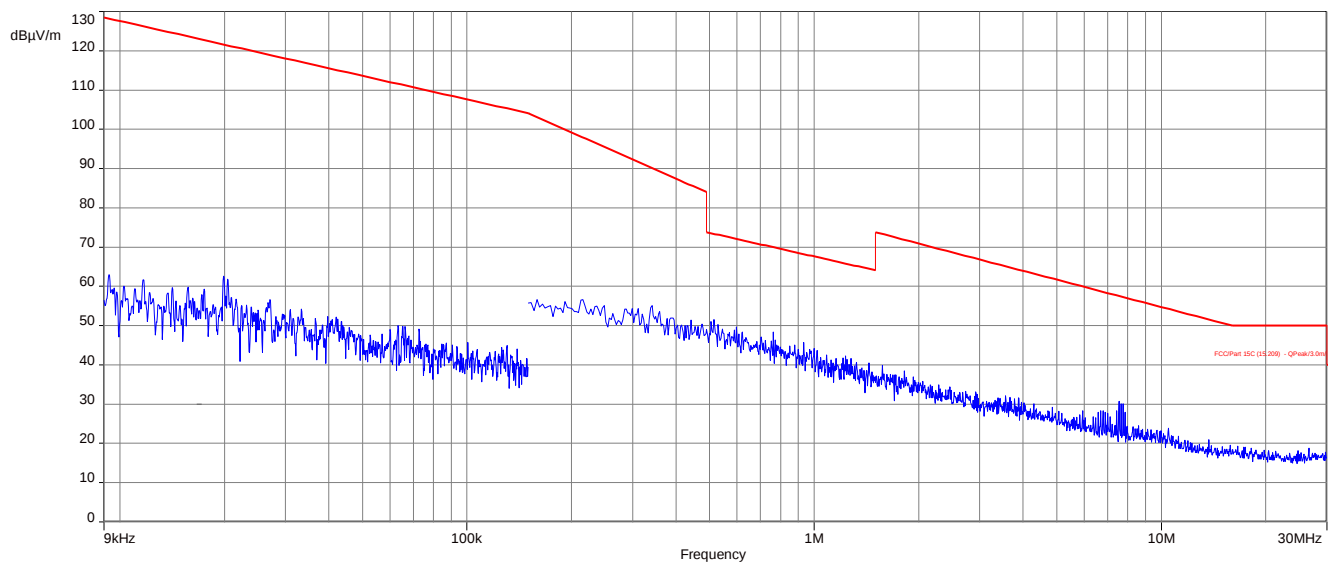
Plot 3: 9 kHz to 30 MHz, 5260 MHz, vertical & horizontal polarization**Plot 4:** 9 kHz to 30 MHz, 5320 MHz, vertical & horizontal polarization

Plot 5: 9 kHz to 30 MHz, 5500 MHz, vertical & horizontal polarization**Plot 6:** 9 kHz to 30 MHz, 5600 MHz, vertical & horizontal polarization

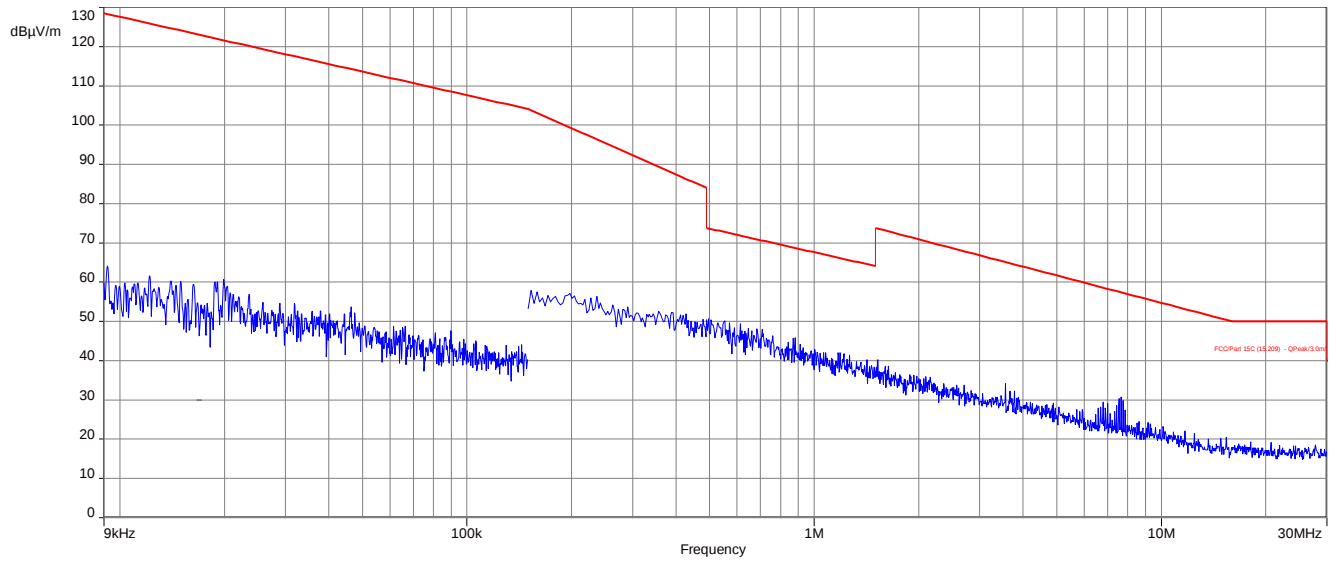
Plot 7: 9 kHz to 30 MHz, 5700 MHz, vertical & horizontal polarization

Plots: OFDM / n – mode HT40**Plot 1:** 9 kHz to 30 MHz, 5190 MHz, vertical & horizontal polarization**Plot 2:** 9 kHz to 30 MHz, 5230 MHz, vertical & horizontal polarization

Plot 3: 9 kHz to 30 MHz, 5270 MHz, vertical & horizontal polarization**Plot 4:** 9 kHz to 30 MHz, 5310 MHz, vertical & horizontal polarization

Plot 5: 9 kHz to 30 MHz, 5510 MHz, vertical & horizontal polarization**Plot 6:** 9 kHz to 30 MHz, 5590 MHz, vertical & horizontal polarization

Plot 7: 9 kHz to 30 MHz, 5670 MHz, vertical & horizontal polarization



13 Observations

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

Annex A Document history

Version	Applied changes	Date of release
	Initial release	2016-03-30
A	OBW measurements added	2016-06-21
B	Additional reference document added	2016-06-23
C	Chapter 12.2 added	2016-07-04
D	Reference documents updated (chapter 11)	2016-07-25

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

**Deutsche Akkreditierungsstelle GmbH**

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

Akkreditierung

Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

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

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

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

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

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

Frankfurt, 04.05.2016

Siehe Hinweise auf der Rückseite

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

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60327 Frankfurt am Main

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ILAC: www.ilac.org

IAF: www.iaf.nu

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