

**CETECOM™**

**CETECOM ICT Services**  
consulting - testing - certification >>>

## TEST REPORT

Test report no.: 1-9611/15-01-10-A



Deutsche  
Akkreditierungsstelle  
D-PL-12076-01-00

### Testing laboratory

**CETECOM ICT Services GmbH**

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**Accredited Testing Laboratory:**

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

The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-00

### Applicant

**Bowers & Wilkins**

Dale Rd, Worthing,

West Sussex BN11 2BH / UNITED KINGDOM

Phone: -/-

Fax: -/-

Contact: -/-

e-mail: -/-

Phone: -/-

### Manufacturer

**Bowers & Wilkins**

Dale Rd, Worthing,

West Sussex BN11 2BH / UNITED KINGDOM

### 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:** Wireless music system

**Model name:** Zeppelin Wireless

**FCC ID:** 2ACIX-ZW

**IC:** 11946B-ZW

**Frequency:** UNII bands:  
5150 MHz to 5350 MHz  
5470 MHz to 5725 MHz  
5725 MHz to 5850 MHz

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

**Antenna:** Integrated antenna

**Power supply:** 110 V AC by internal power supply unit

**Temperature range:** +5°C to +35°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:

Marco Bertolino  
Lab Manager  
Radio Communications & EMC

### Test performed:

Christoph Schneider  
Testing Manager  
Radio Communications & EMC

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## 2 General information

### 2.1 Notes and disclaimer

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

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

**This test report replaces the test report with the number 1-9611/15-01-10 and dated 2015-06-30**

### 2.2 Application details

Date of receipt of order:	2015-04-22
Date of receipt of test item:	2015-05-28
Start of test:	2015-05-28
End of test:	2015-06-05
Person(s) present during the test:	-/-

## 3 Test standard/s

Test standard	Date	Test standard description
47 CFR Part 15	-/-	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 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

UNII: KDB 789033	2014-06	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E
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#### 4 Test environment

Temperature:	$T_{nom}$	+22 °C during room temperature tests
	$T_{max}$	No tests under extreme conditions
	$T_{min}$	No tests under extreme conditions
Relative humidity content:		44 %
Barometric pressure:		not relevant for this kind of testing
Power supply:	$V_{nom}$	110 V AC by internal power supply unit
	$V_{max}$	No tests under extreme conditions
	$V_{min}$	No tests under extreme conditions

#### 5 Test item

Kind of test item	:	Wireless music system
Type identification	:	Zeppelin Wireless
HMN	:	-/-
PMN	:	Zeppelin Wireless
HVIN	:	1.0
FVIN	:	MCU 1.00, WiFi CP15, BT 1.1
S/N serial number	:	1503-TR110095
HW hardware status	:	TR1
SW software status	:	Wifi ir-ser.tst.ven6.5-f32s16_V2.7.3.58736-1
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	:	110 V AC by internal power supply unit
Temperature range	:	+5°C to +35°C

#### 5.1 Additional information

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

Test setup- and EUT-photos are included in test report: 1-9611/15-01-01\_AnnexA  
1-9611/15-01-01\_AnnexB  
1-9611/15-01-01\_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 signalling equipment as well as measuring receivers and analysers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

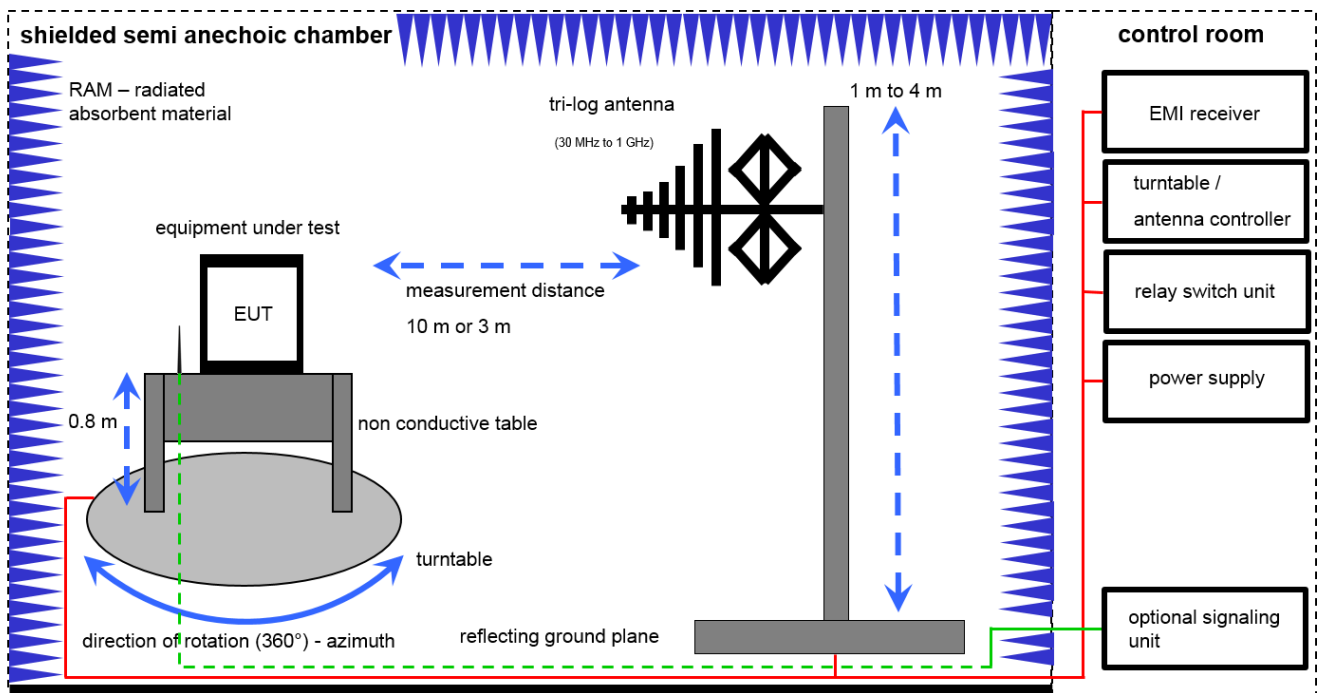
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

### **Agenda:** Kind of Calibration

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

### 7.1 Shielded semi anechoic chamber

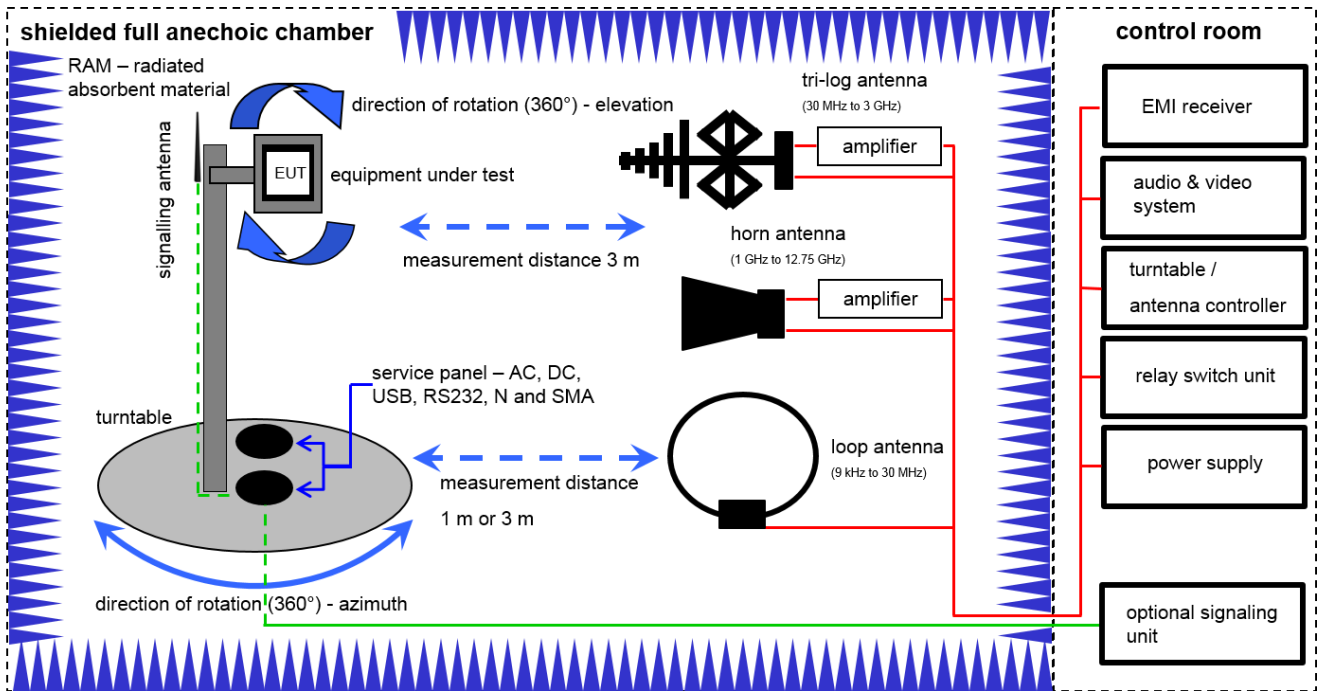
The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas 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 analysers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



**Equipment table:**

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	45	Switch-Unit	3488A	HP	2719A14505	300000368	ev		
2	45	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	26.01.2015	26.01.2016
3	45	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw		
4	45	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw		
5	45	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	22.04.2014	22.04.2016

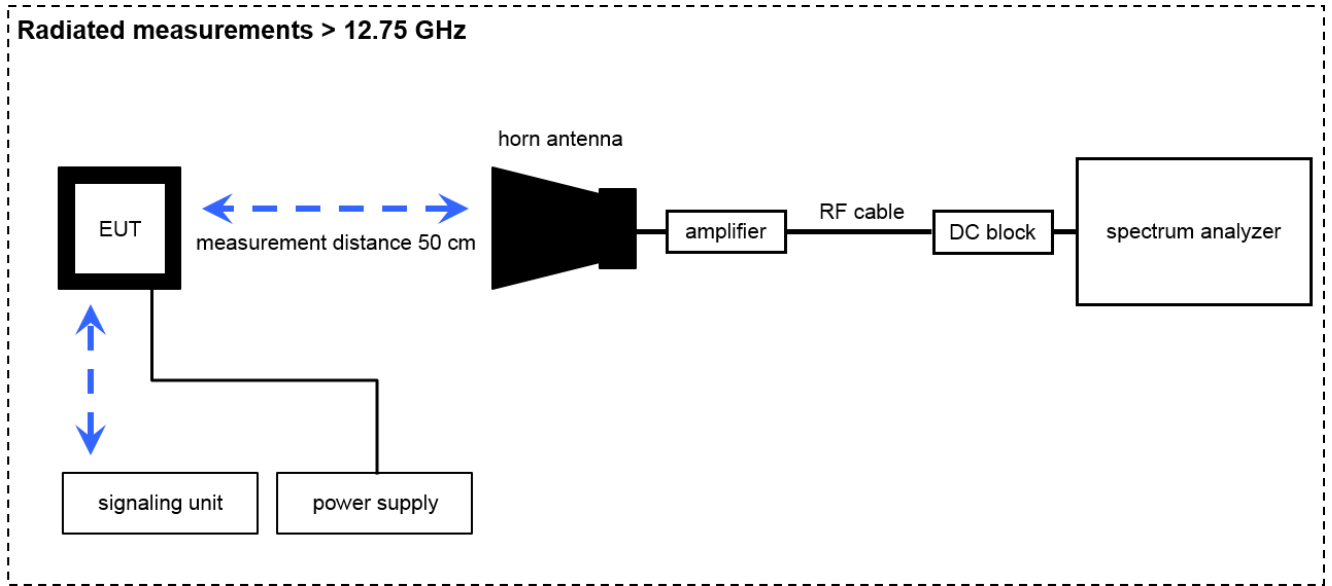
## 7.2 Shielded fully anechoic chamber



### Equipment table:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9709-5290	300000212	k	23.07.2013	23.07.2015
2	n. a.	EMI Test Receiver 20Hz-26,5GHz	ESU26	R&S	100037	300003555	k	22.01.2015	22.01.2016
3	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	318	300003696	k	22.04.2014	22.04.2017
4	n. a.	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22050	300004482	ev		
5	n. a.	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000032	300004510	ne		
6	n. a.	NEXIO EMV-Software	BAT EMC	EMCO	MY50000032	300004682	ne		
7	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev		

### 7.3 Radiated measurements > 12.75 GHz

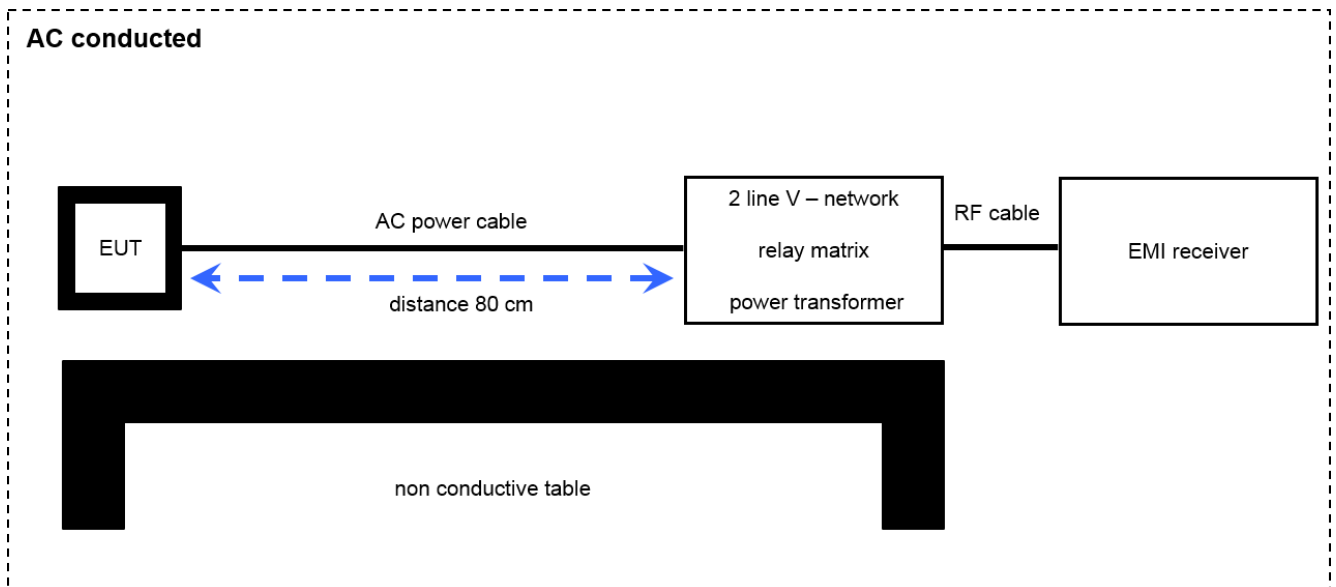


**Equipment table:**

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A026	Std. Gain Horn Antenna 12.4 to 18.0 GHz	639	Narda	8402	300000787	k	22.07.2013	22.07.2015
2	A029	Std. Gain Horn Antenna 18.0 to 26.5 GHz	638	Narda	8205	300002442	k	19.07.2013	19.07.2015
3	A031	Std. Gain Horn Antenna 26.5 to 40.0 GHz	V637	Narda	8205	300000510	k	19.07.2013	19.07.2015
4	A031	Amplifier 2-40 GHz	JS32-02004000-57-5P	MITEQ	1777200	300004541	ev		
5	A031	Signal Analyzer 40 GHz	FSV40	R&S	101353	300004819	k	27.01.2015	27.01.2016



## 7.4 AC conducted



### Equipment table:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Netznachbildung	ESH3-Z5	R&S	892475/017	300002209	k	17.06.2014	17.06.2016
2	85	Koppelnetzwerk	CDN 801 M2/M3	EM-Test	9350105	300000534	k		
3	68	EMI-Receiver	8542E	HP	3617A00170	300000568	k	28.01.2015	28.01.2016

## 8 Summary of measurement results

<input type="checkbox"/>	No deviations from the technical specifications were ascertained
<input type="checkbox"/>	There were deviations from the technical specifications ascertained
<input checked="" type="checkbox"/>	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	2015-07-30	Reduced tests according to customer demand!

Test specification clause	Test case	Temperature conditions	Power source voltages	Pass	Fail	NA	NP	Remark
-/-	Output power verification (conducted)	Nominal	Nominal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	According to main report
-/-	Gain	Nominal	Nominal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No passed / fail criteria!
U-NII Part 15	Duty cycle	Nominal	Nominal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-/-
§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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-/-
§15.407(a)	Spectrum bandwidth 26dB bandwidth	Nominal	Nominal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-/-
RSS Gen clause 6.6	Spectrum bandwidth 99% bandwidth	Nominal	Nominal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-/-
§15.407(a)	Peak excursion measurements	Nominal	Nominal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-/-
§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	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§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	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.109 RSS-Gen	RX spurious emissions radiated	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.209(a) RSS-Gen	Spurious emissions radiated < 30 MHz	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.107(a) §15.207	Spurious emissions conducted emissions < 30 MHz	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies

**Note:** NA = Not Applicable; NP = Not Performed

## 9 Additional comments

Reference documents: Document 75917143 Report 06 Issue 1 (TÜV Süd)

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

## 10 Measurement results

### 10.1 Identify worst case datarate

The worst case datarate identification refers to the Document 75917143 Report 06 Issue 1 (TÜV Süd) which was provided by the customer.

**Results:**

Modulation Frequency / MHz	Modulation scheme / bandwidth									
	5180	5240	5260	5320	5500	5600	5700	5745	5785	5805
OFDM / a – mode	6 Mbit/s									
OFDM / n/ac – mode HT20	MCS0									

## 10.2 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

### Limits:

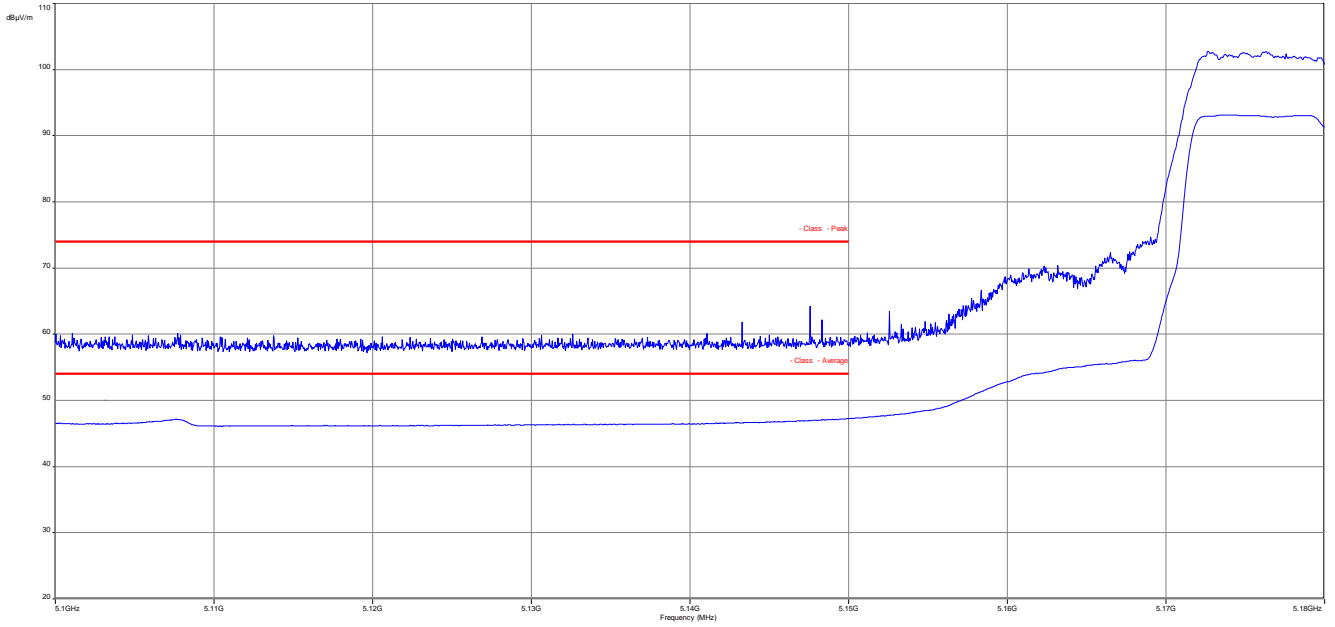
Band Edge Compliance Radiated
<p>In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth 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)).</p>
<p>74 dB<math>\mu</math>V/m PEAK 54 dB<math>\mu</math>V/m AVG</p>

### Result:

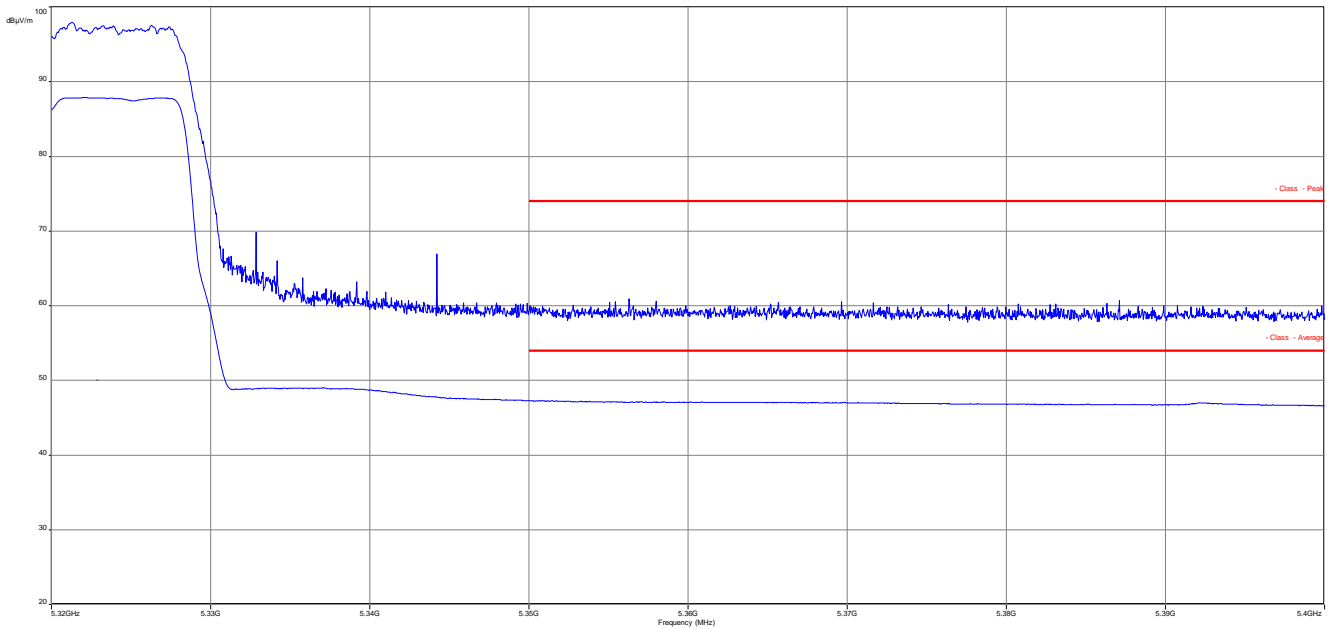
Scenario	Band Edge Compliance Radiated [dB $\mu$ V/m]
band edge	<p>&lt; 74 dB<math>\mu</math>V/m (PEAK) &lt; 54 dB<math>\mu</math>V/m (AVG)</p>
Measurement uncertainty	$\pm 3$ dB

**Plots, a mode:**

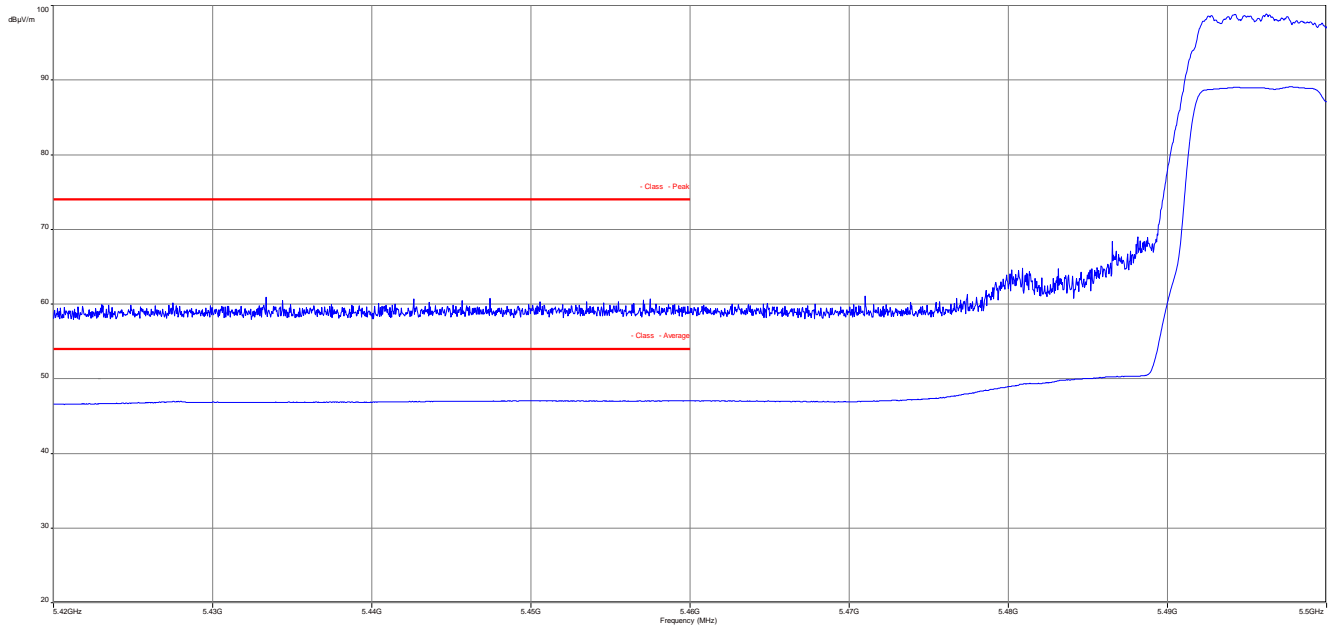
**Plot 1:** lower band edge, vertical & horizontal polarization, channel 36



**Plot 2:** upper band edge, vertical & horizontal polarization, channel 64



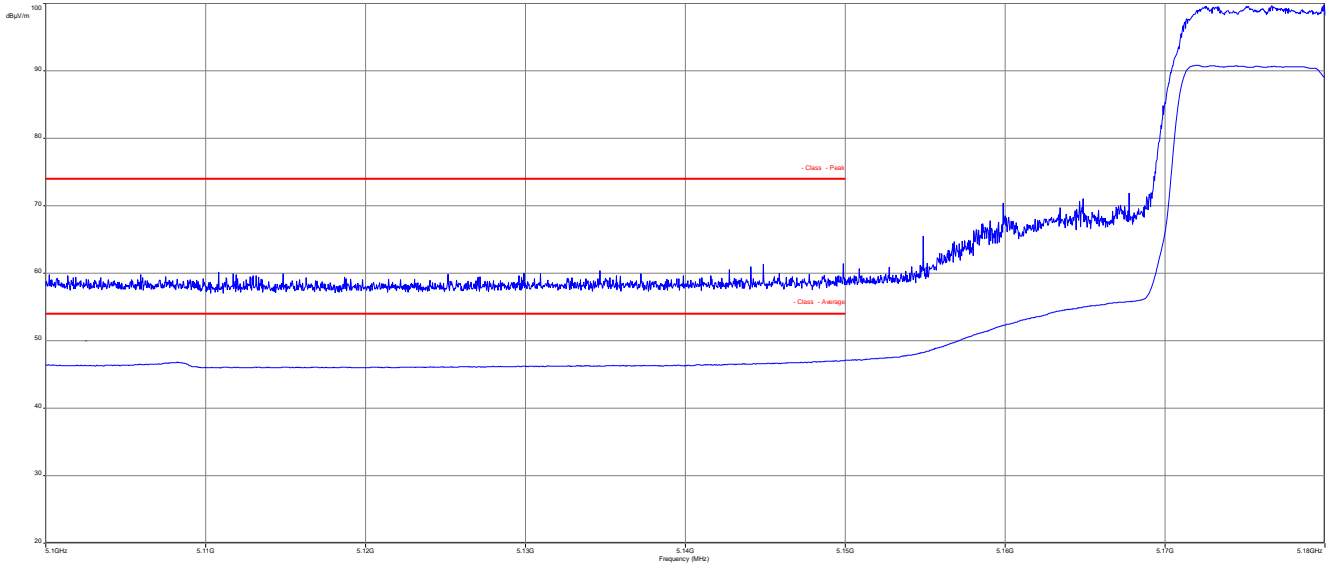
**Plot 3:** lower band edge, vertical & horizontal polarization, channel 100



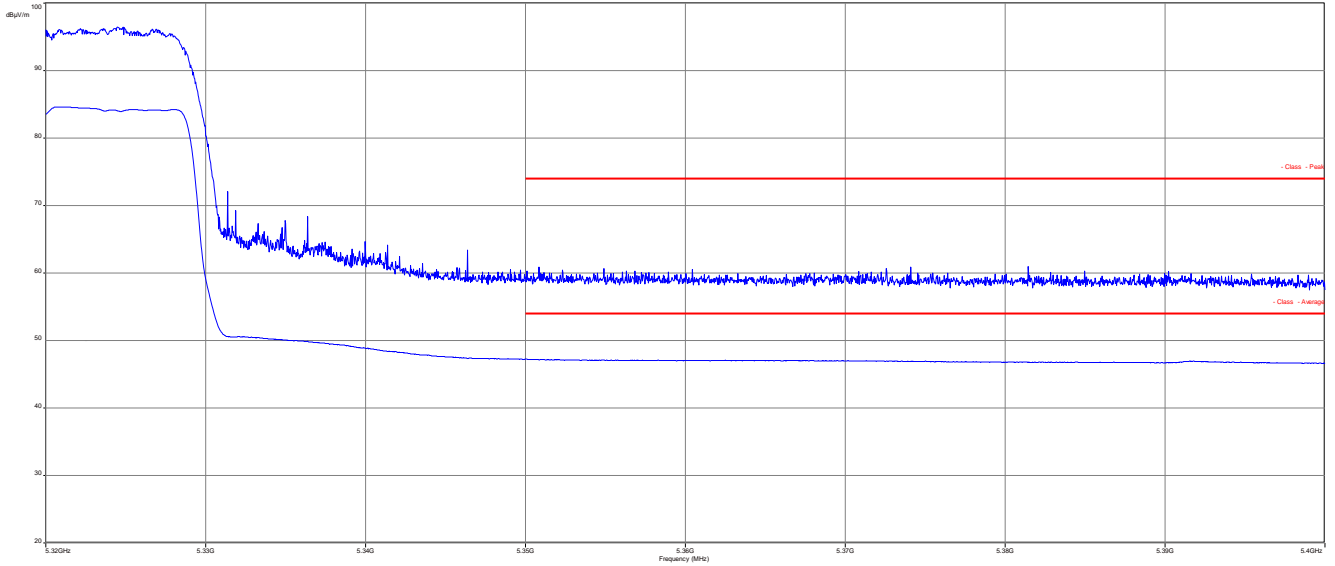
**Verdict:** Complies

**Plots, n mode:**

**Plot 4:** lower band edge, vertical & horizontal polarization, channel 36

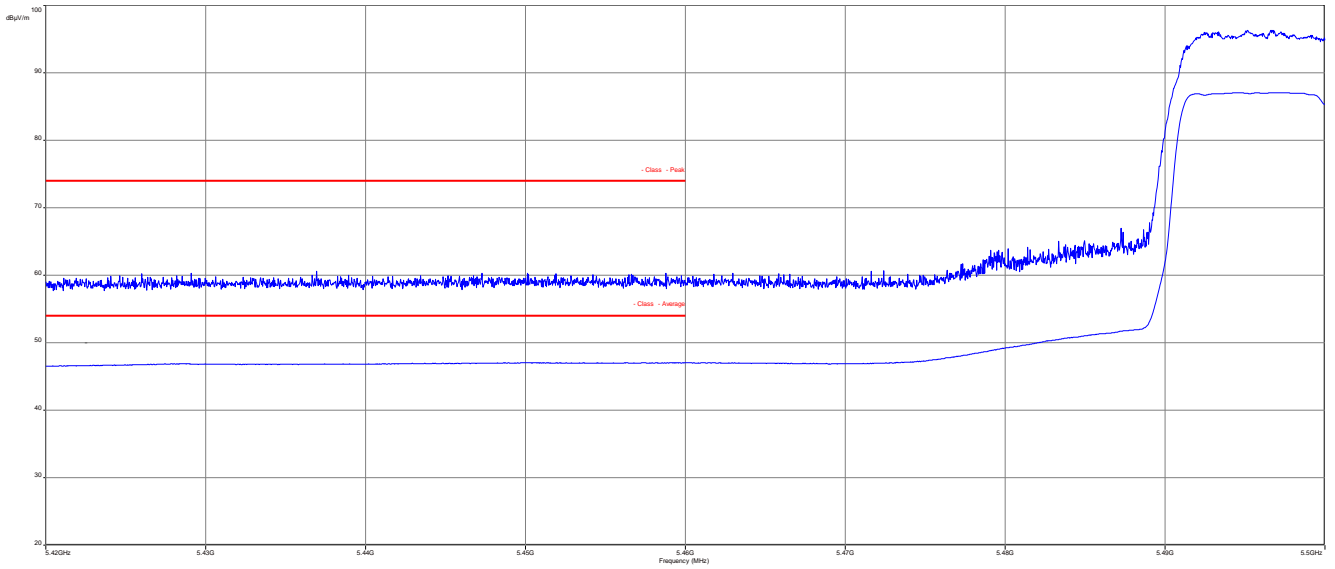


**Plot 5:** upper band edge, vertical & horizontal polarization, channel 64





**Plot 6:** lower band edge, vertical & horizontal polarization, channel 100



**Verdict:** Complies

### 10.3 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 %

**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: a-mode**

TX Spurious Emissions Radiated [dBµV/m] / dBm								
OFDM a – mode								
Lowest 5180 MHz			Middle			Highest 5240 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.		
			-/-	-/-	-/-			
			-/-	-/-	-/-			
Measurement uncertainty			± 3 dB					

TX Spurious Emissions Radiated [dBµV/m] / dBm								
OFDM a – mode								
Lowest 5260 MHz			Middle			Highest 5320 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.		
			-/-	-/-	-/-			
			-/-	-/-	-/-			
Measurement uncertainty			± 3 dB					

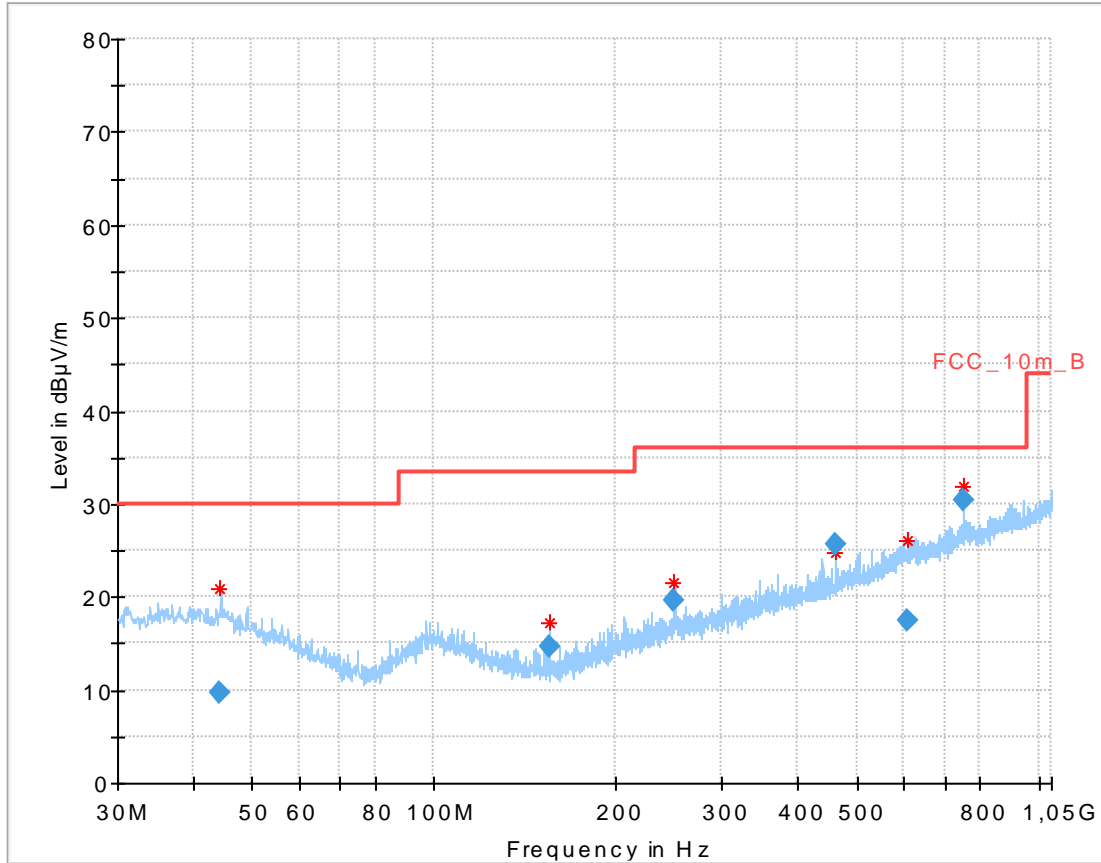
TX Spurious Emissions Radiated [dBµV/m] / dBm								
OFDM a – mode								
Lowest 5500 MHz			Middle 5600 MHz			Highest 5700 MHz		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
No peaks found.			No peaks found.			No peaks found.		
Measurement uncertainty			± 3 dB					

TX Spurious Emissions Radiated [dBµV/m] / dBm								
OFDM a – mode								
Lowest 5745 MHz			Middle 5785 MHz			Highest 5805 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					

**Verdict: complies**

**Plots:** OFDM / a – mode

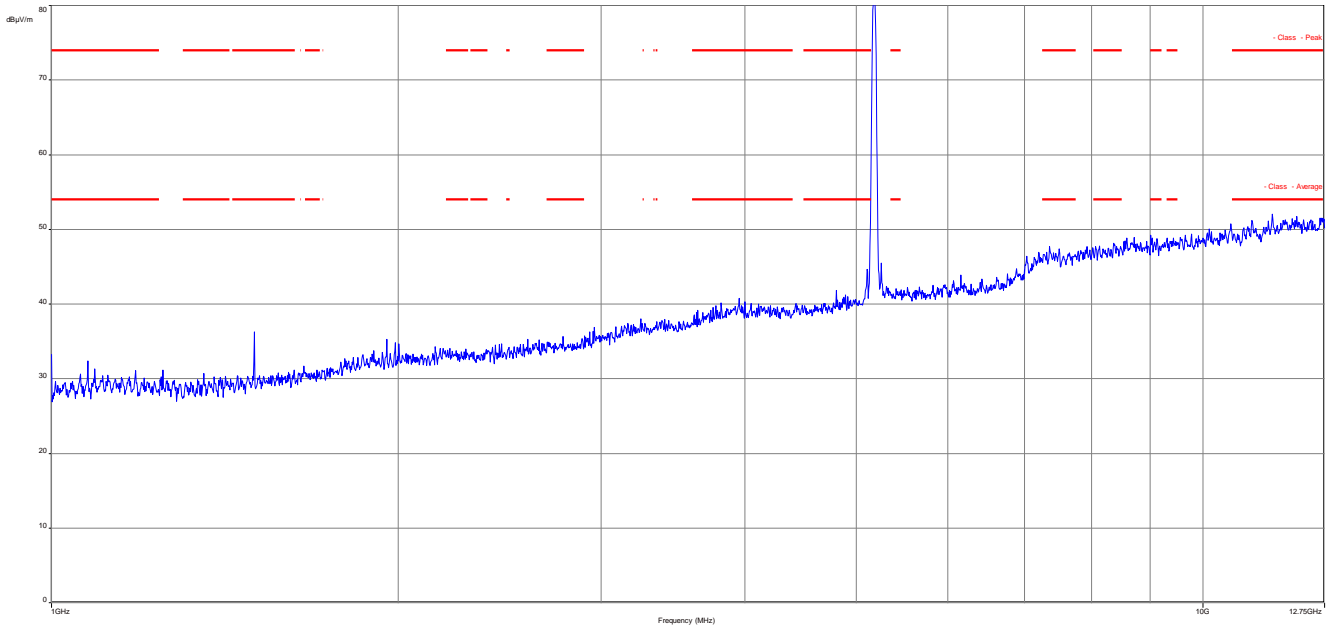
**Plot 1:** 30 MHz to 1 GHz, 5180 MHz, vertical & horizontal polarization



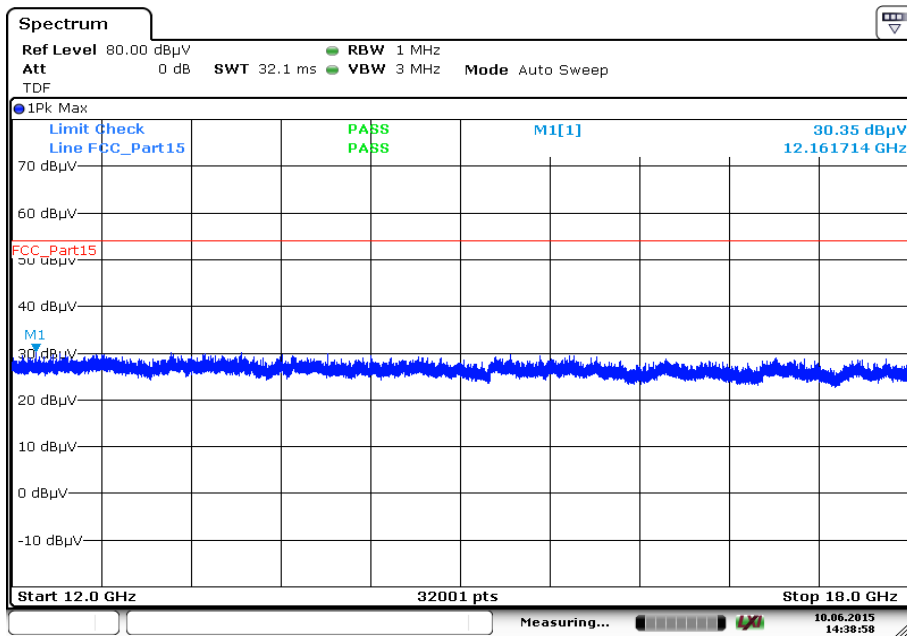
**Final\_Result**

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
44.067300	9.81	30.00	20.19	1000.0	120.000	170.0	V	27	13.9
154.961100	14.57	33.50	18.93	1000.0	120.000	98.0	V	139	9.0
249.997650	19.55	36.00	16.45	1000.0	120.000	98.0	V	203	13.3
460.776900	25.65	36.00	10.35	1000.0	120.000	170.0	H	217	17.8
607.930650	17.57	36.00	18.43	1000.0	120.000	98.0	V	356	20.8
750.026400	30.38	36.00	5.62	1000.0	120.000	101.0	H	266	22.7

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

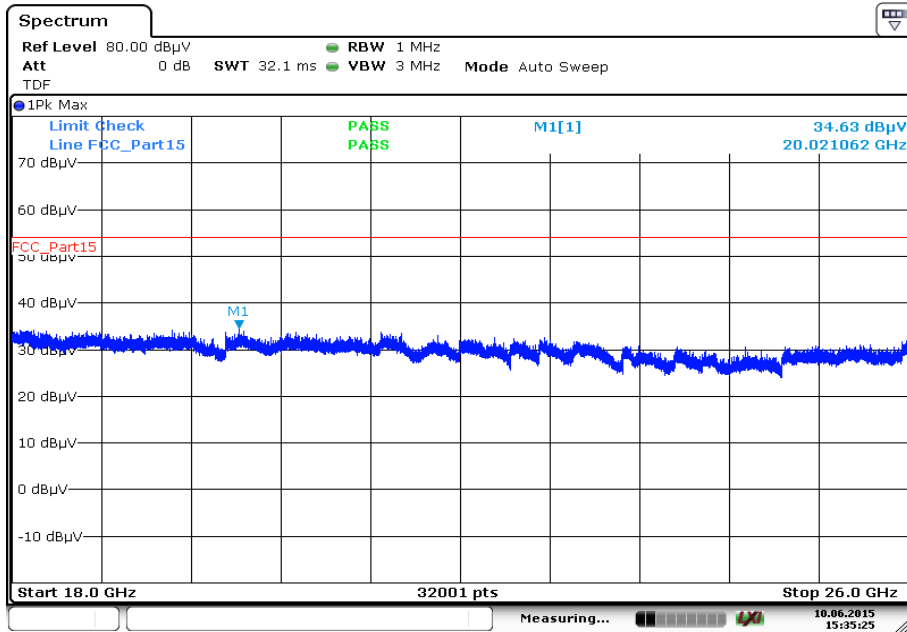


**Plot 3:** 12 GHz to 18 GHz, 5180 MHz, vertical & horizontal polarization

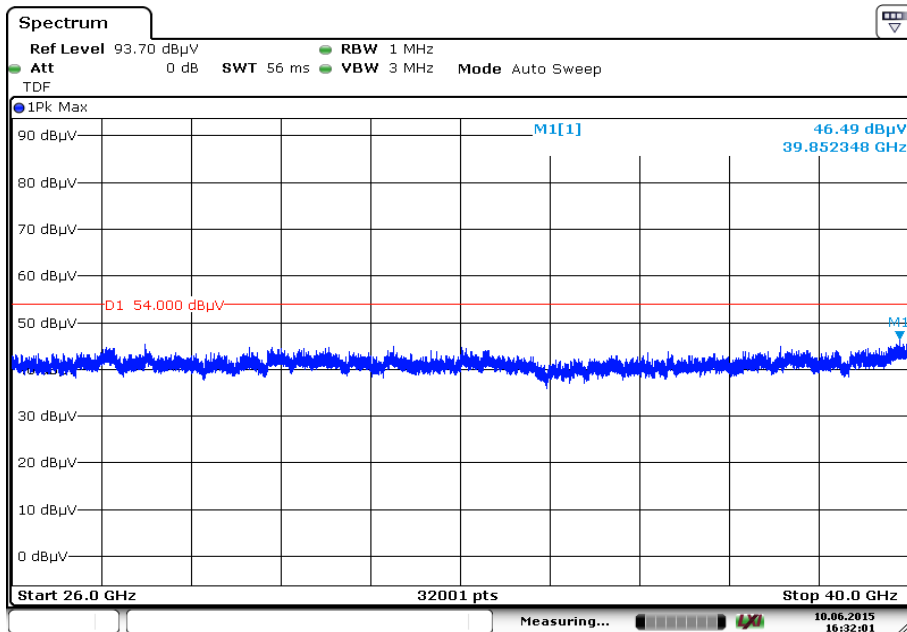


Date: 10. JUN. 2015 14:38:59

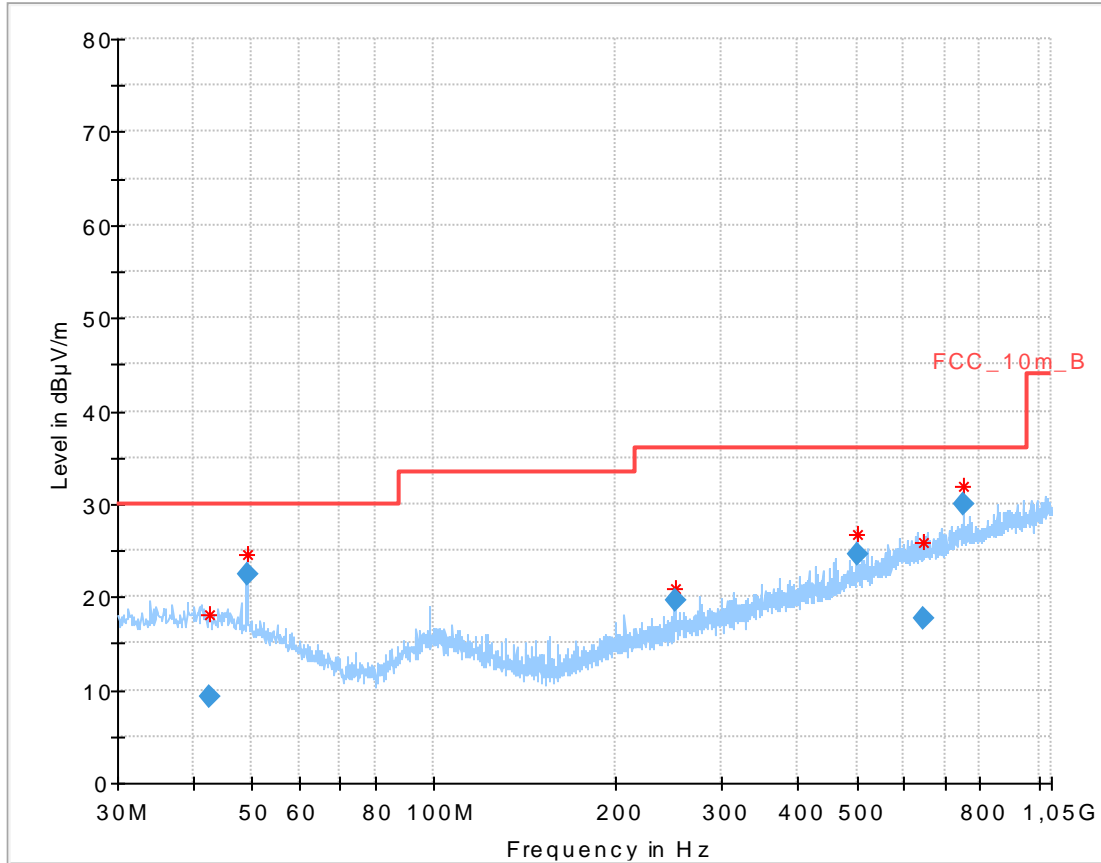
Plot 4: 18 GHz to 26 GHz, 5180 MHz, vertical & horizontal polarization



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



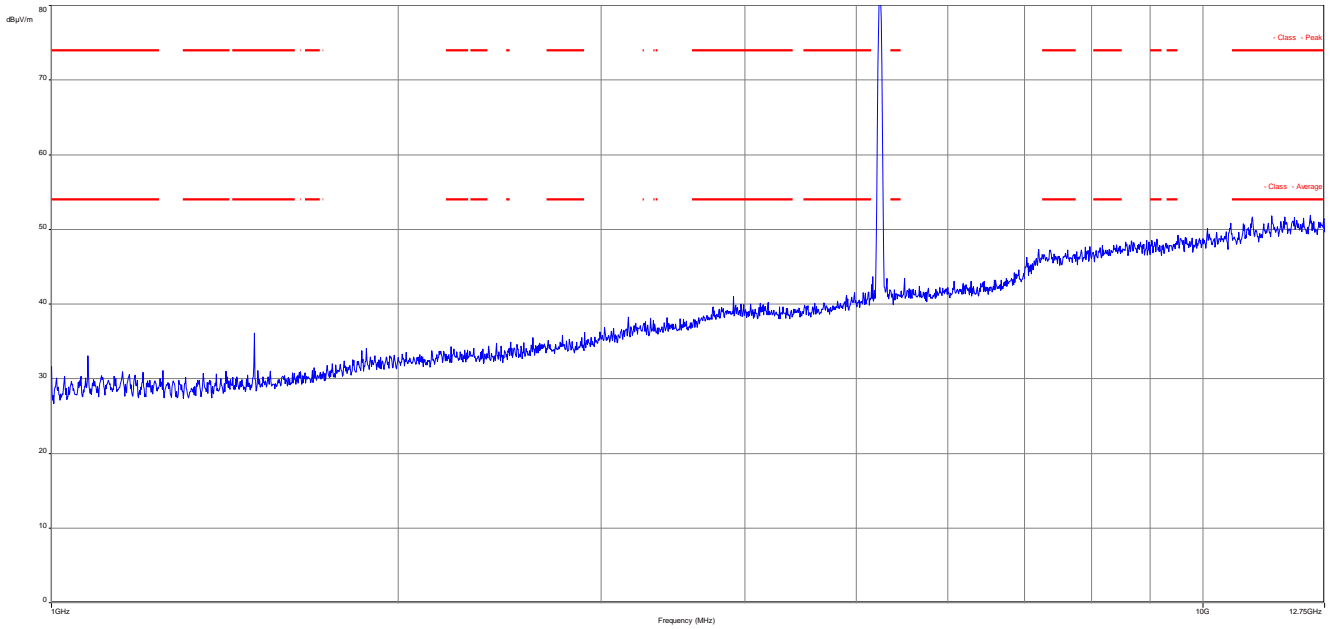
**Plot 6:** 30 MHz to 1 GHz, 5240 MHz, vertical & horizontal polarization



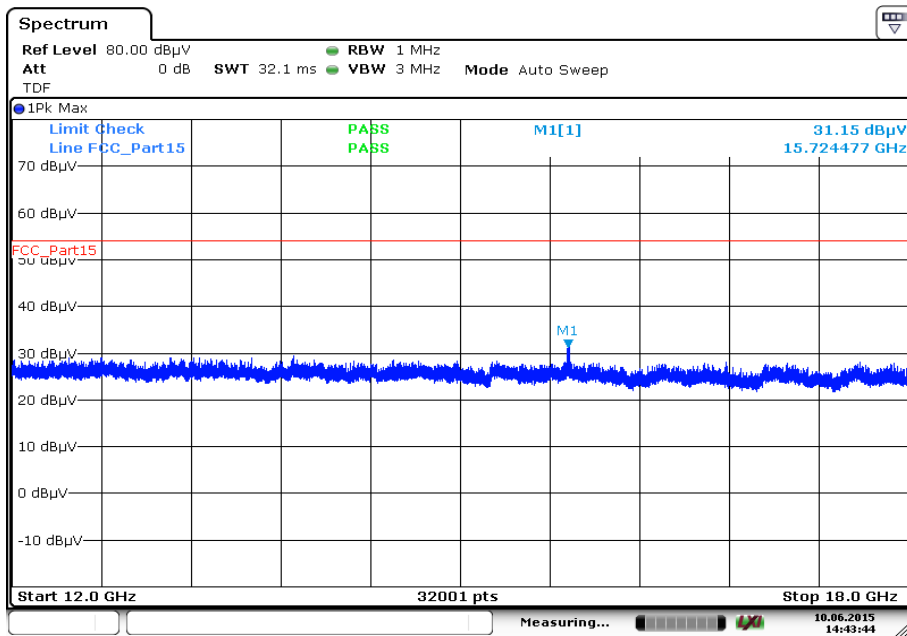
**Final\_Result**

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
42.722550	9.32	30.00	20.68	1000.0	120.000	170.0	H	216	13.9
49.138200	22.48	30.00	7.52	1000.0	120.000	98.0	V	94	12.8
250.025400	19.56	36.00	16.44	1000.0	120.000	98.0	V	201	13.4
500.038200	24.50	36.00	11.50	1000.0	120.000	170.0	H	45	18.7
644.794050	17.75	36.00	18.25	1000.0	120.000	101.0	V	216	21.1
750.043950	30.05	36.00	5.95	1000.0	120.000	98.0	H	254	22.7

**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

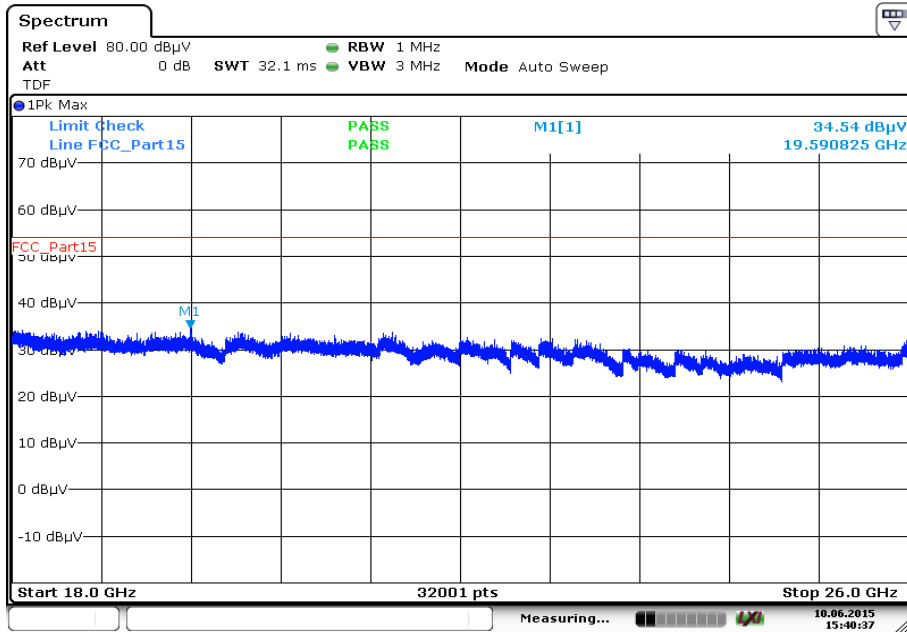


Date: 10.JUN.2015 14:43:44

10.06.2015 14:43:44

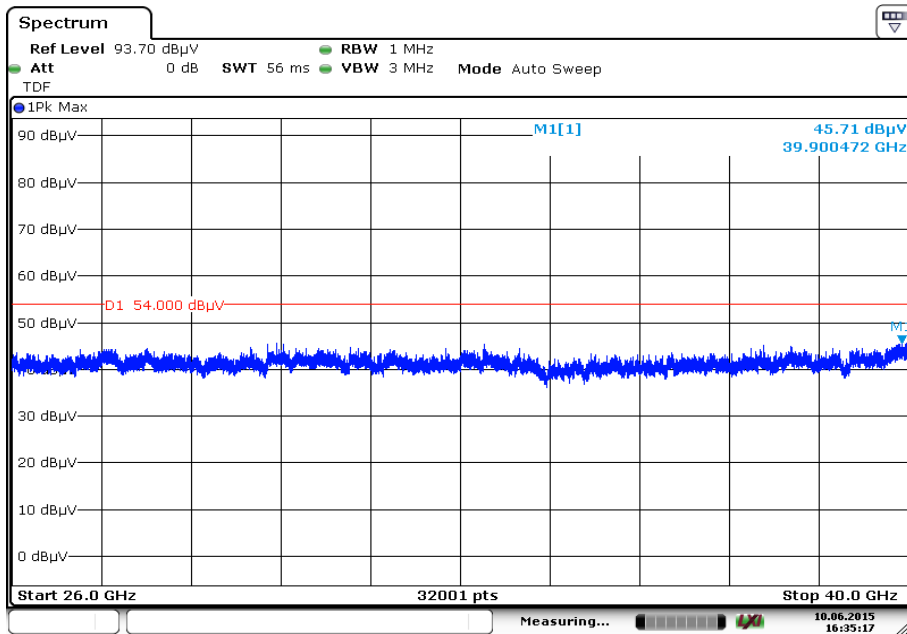


**Plot 9:** 18 GHz to 26 GHz, 5240 MHz, vertical & horizontal polarization



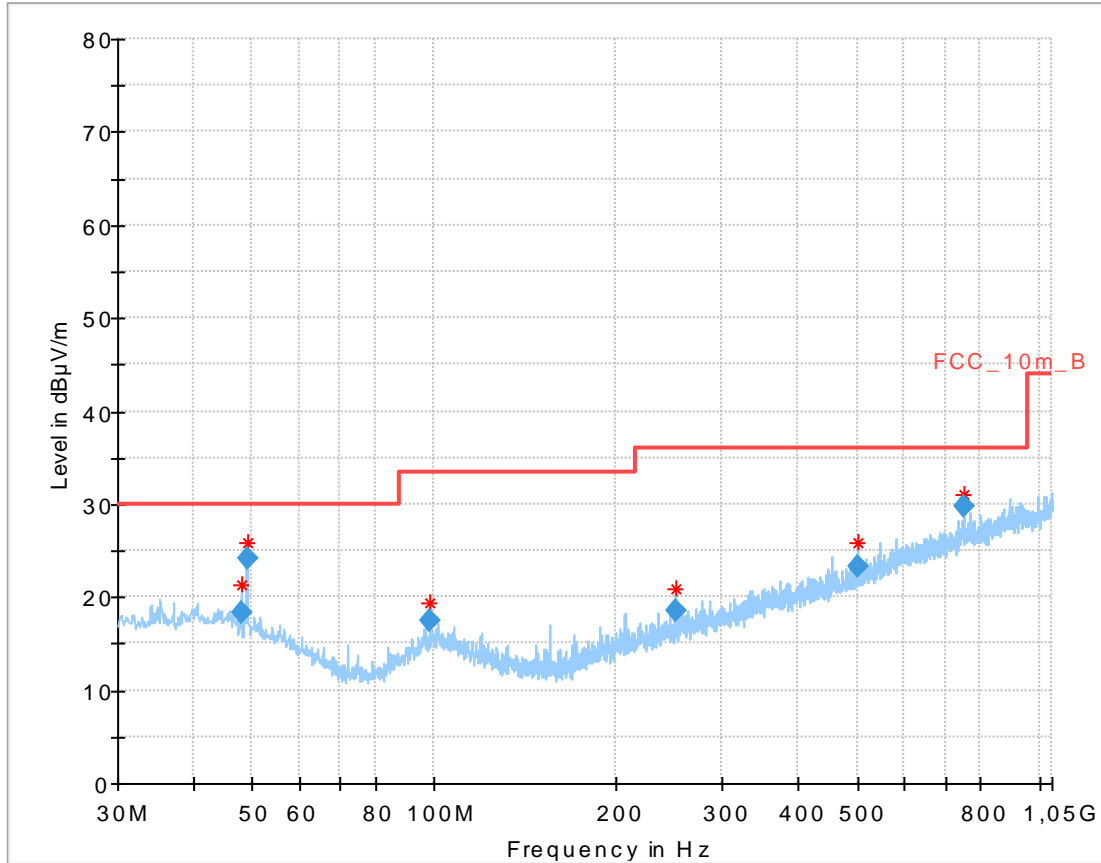
Date: 10.JUN.2015 15:40:37

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



Date: 10.JUN.2015 16:35:18

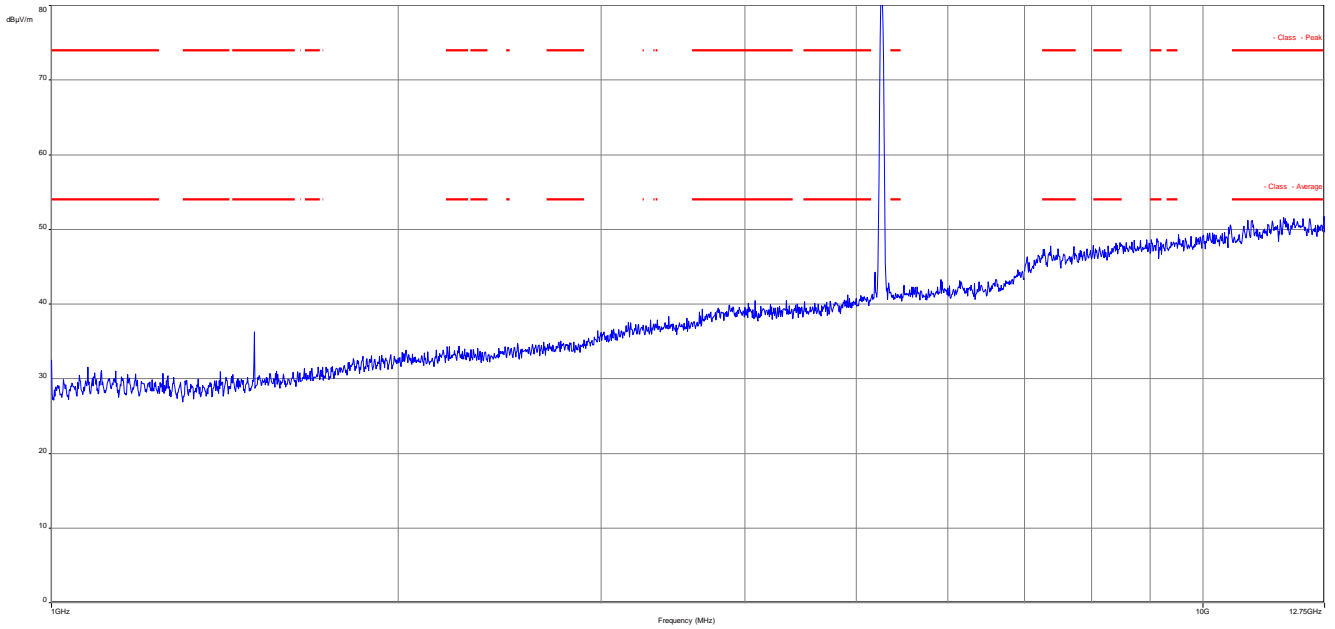
Plot 11: 30 MHz to 1 GHz, 5260 MHz, vertical & horizontal polarization



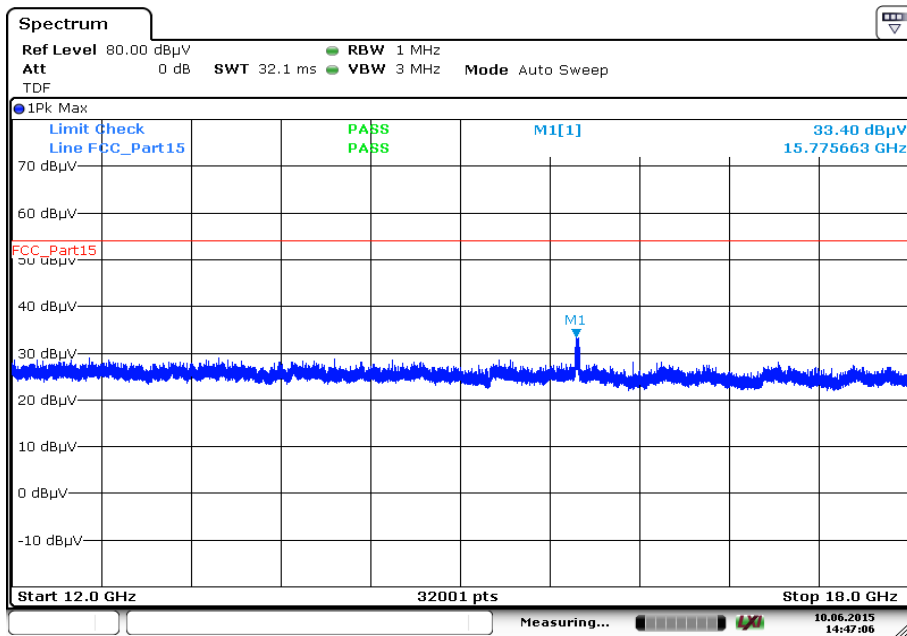
Final\_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
48.002850	18.33	30.00	11.67	1000.0	120.000	101.0	V	102	13.1
49.147800	24.15	30.00	5.85	1000.0	120.000	98.0	V	125	12.8
98.299800	17.53	33.50	15.97	1000.0	120.000	101.0	V	358	11.9
250.026750	18.65	36.00	17.35	1000.0	120.000	98.0	V	161	13.4
500.007450	23.29	36.00	12.71	1000.0	120.000	101.0	H	51	18.7
750.049650	29.70	36.00	6.30	1000.0	120.000	98.0	H	265	22.7

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

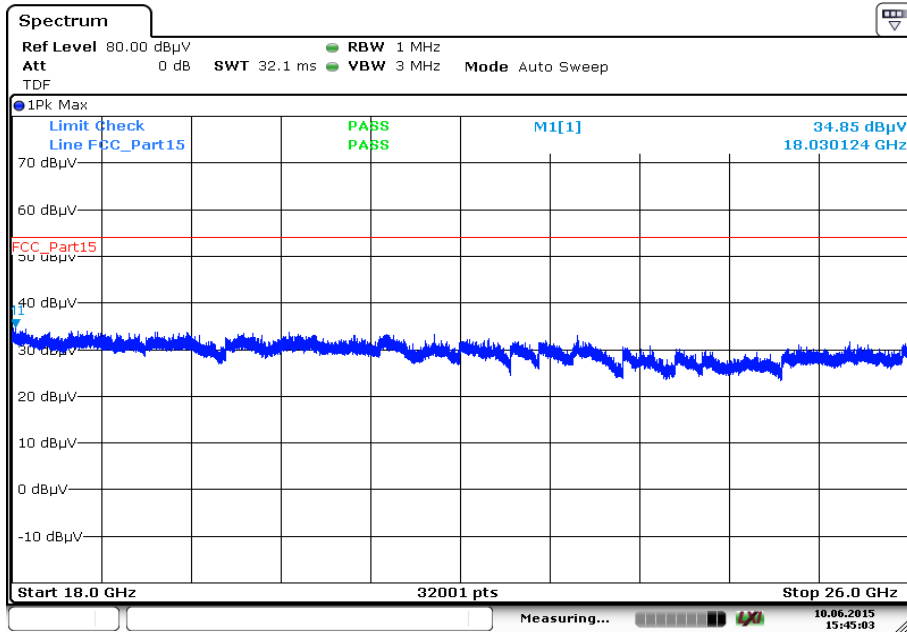


**Plot 13:** 12 GHz to 18 GHz, 5260 MHz, vertical & horizontal polarization



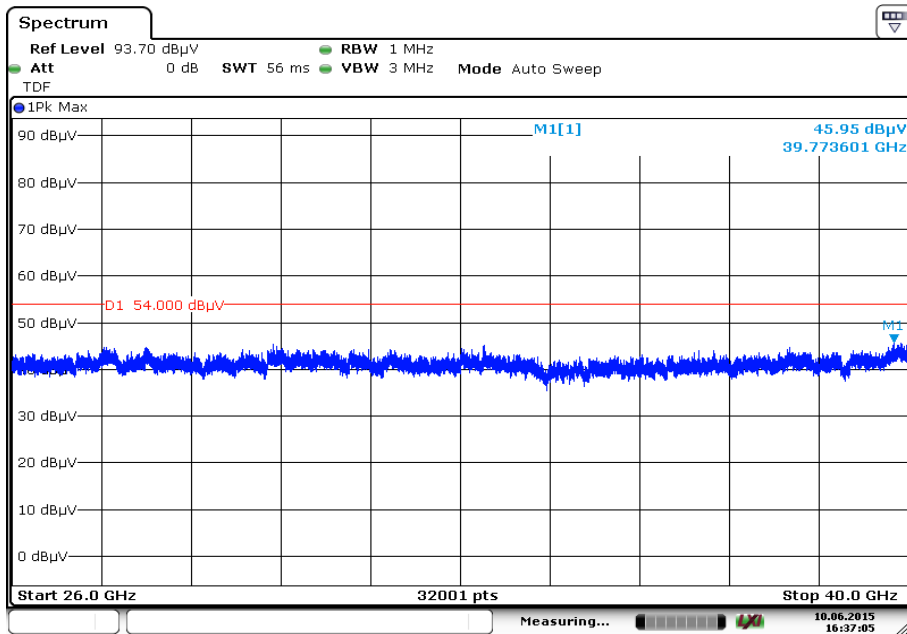
Date: 10.JUN.2015 14:47:07

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



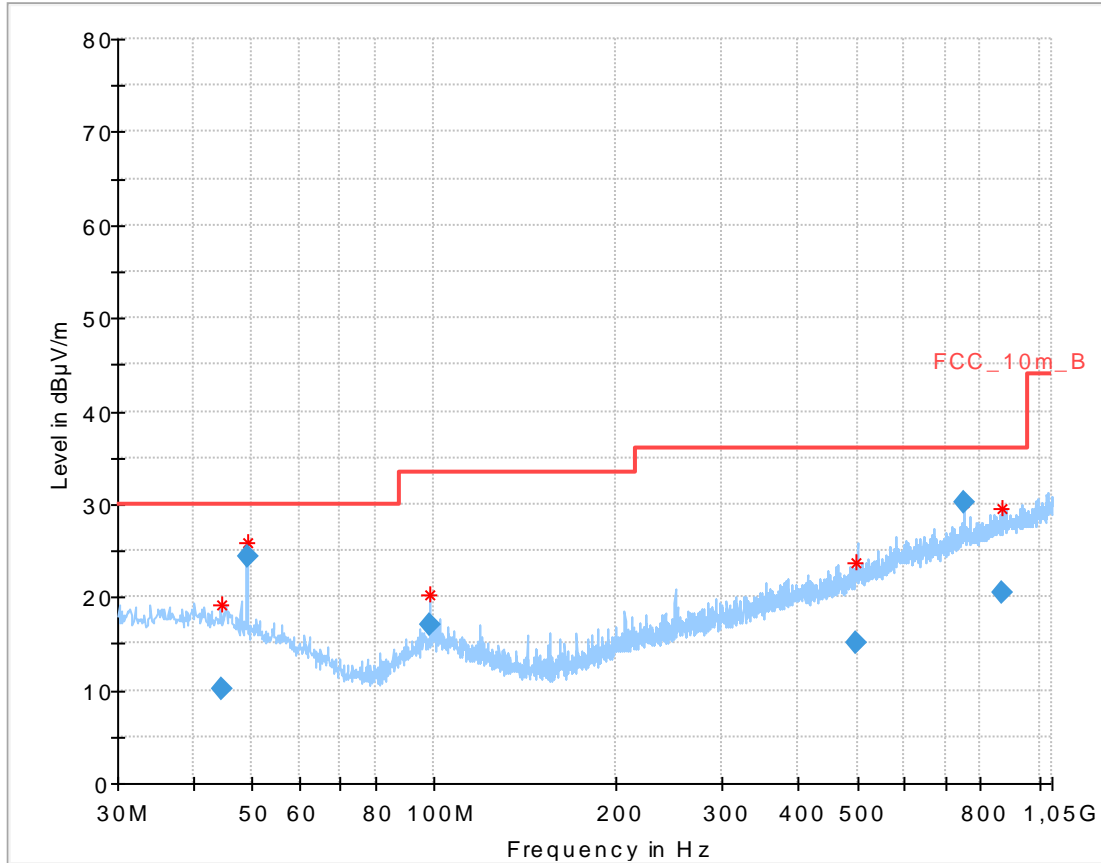
Date: 10.JUN.2015 15:45:03

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



Date: 10.JUN.2015 16:37:05

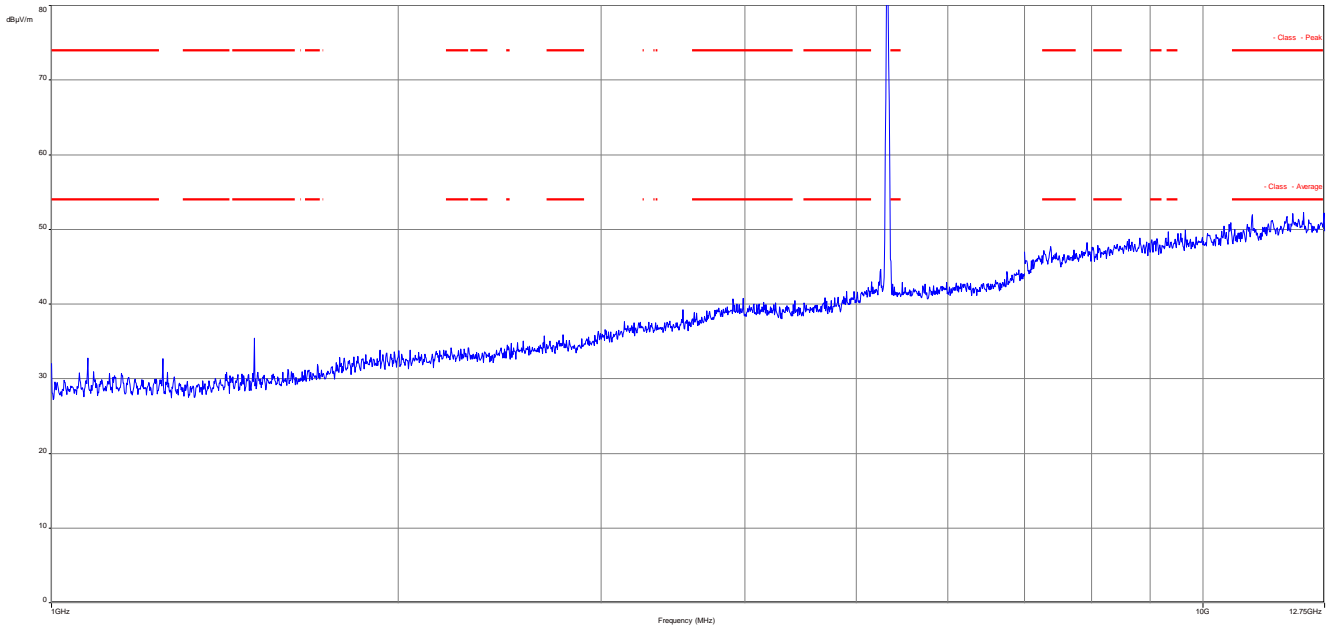
Plot 16: 30 MHz to 1 GHz, 5320 MHz, vertical & horizontal polarization



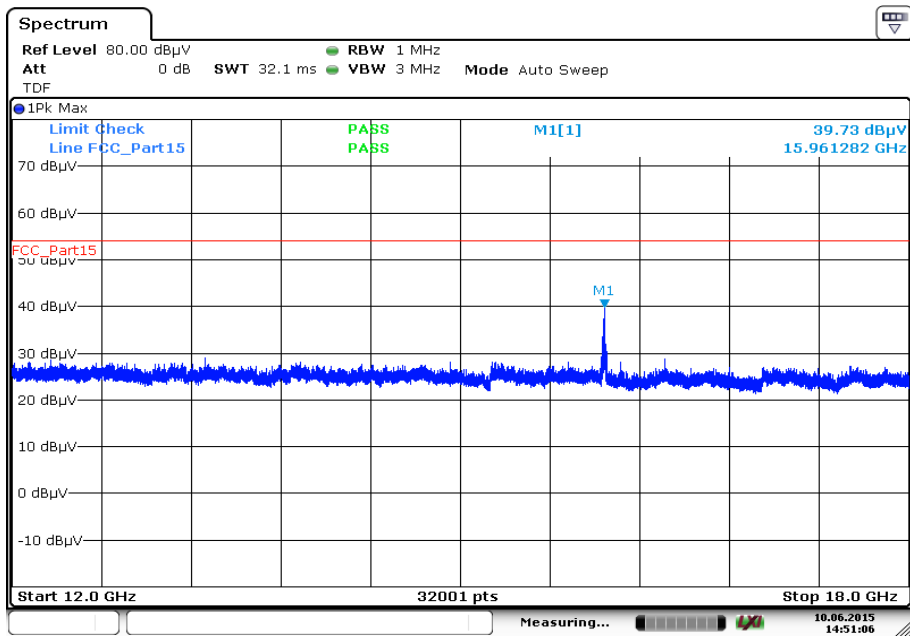
Final\_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
44.711700	10.19	30.00	19.81	1000.0	120.000	98.0	V	238	13.9
49.147200	24.43	30.00	5.57	1000.0	120.000	98.0	V	93	12.8
98.286450	17.05	33.50	16.45	1000.0	120.000	98.0	V	352	11.9
497.603700	15.08	36.00	20.92	1000.0	120.000	170.0	V	35	18.7
750.036150	30.29	36.00	5.71	1000.0	120.000	98.0	H	3	22.7
867.949800	20.57	36.00	15.43	1000.0	120.000	170.0	H	28	23.7

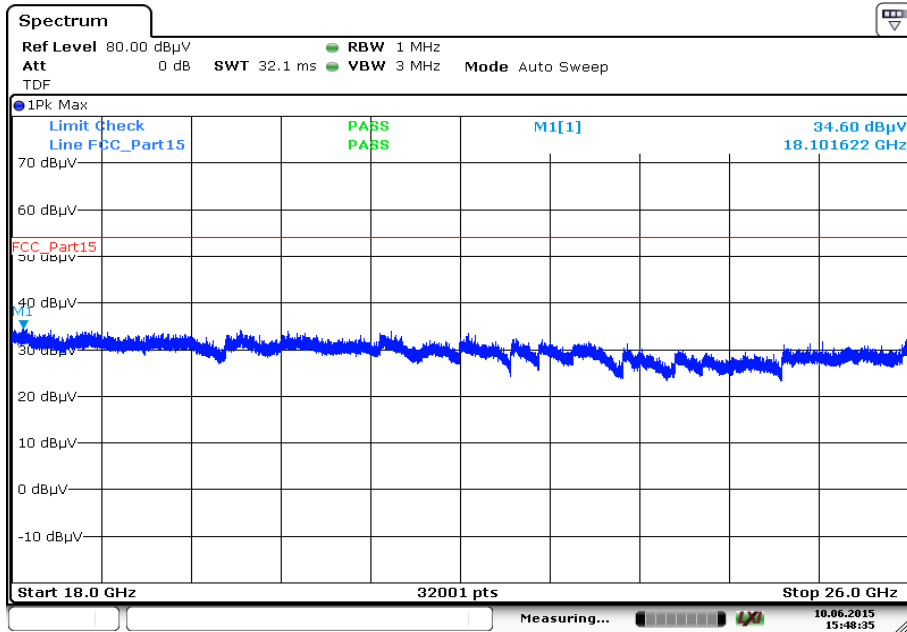
**Plot 17:** 1 GHz to 12.75 GHz, 5320 MHz, vertical & horizontal polarization



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

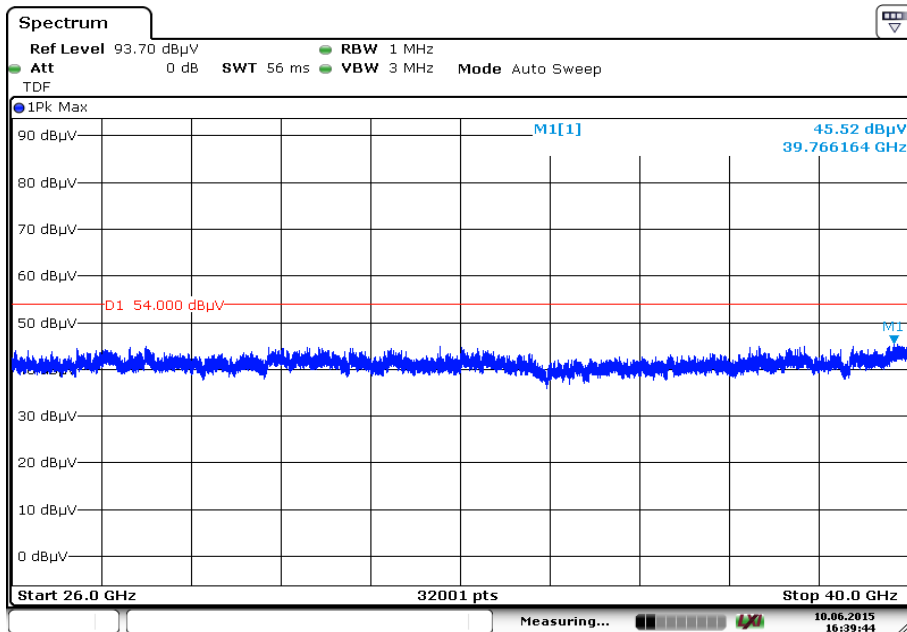


Plot 19: 18 GHz to 26 GHz, 5320 MHz, vertical & horizontal polarization



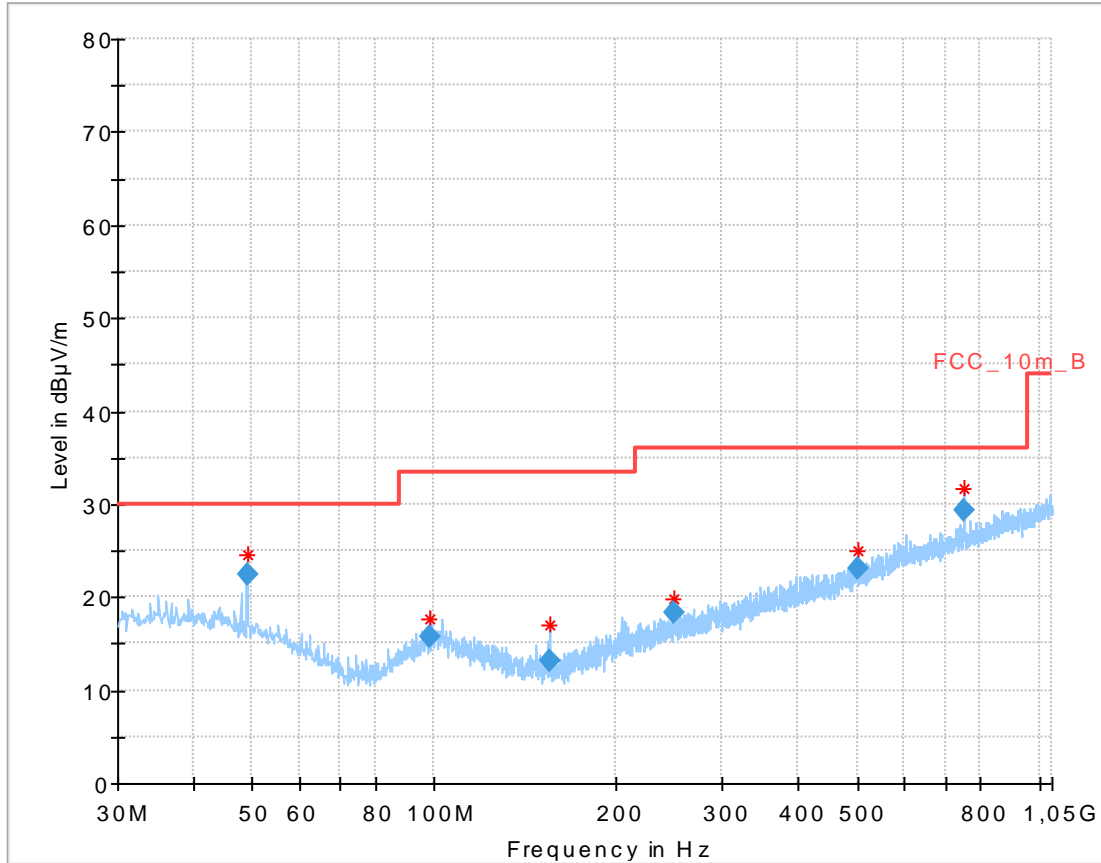
Date: 10.JUN.2015 15:48:36

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



Date: 10.JUN.2015 16:39:45

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

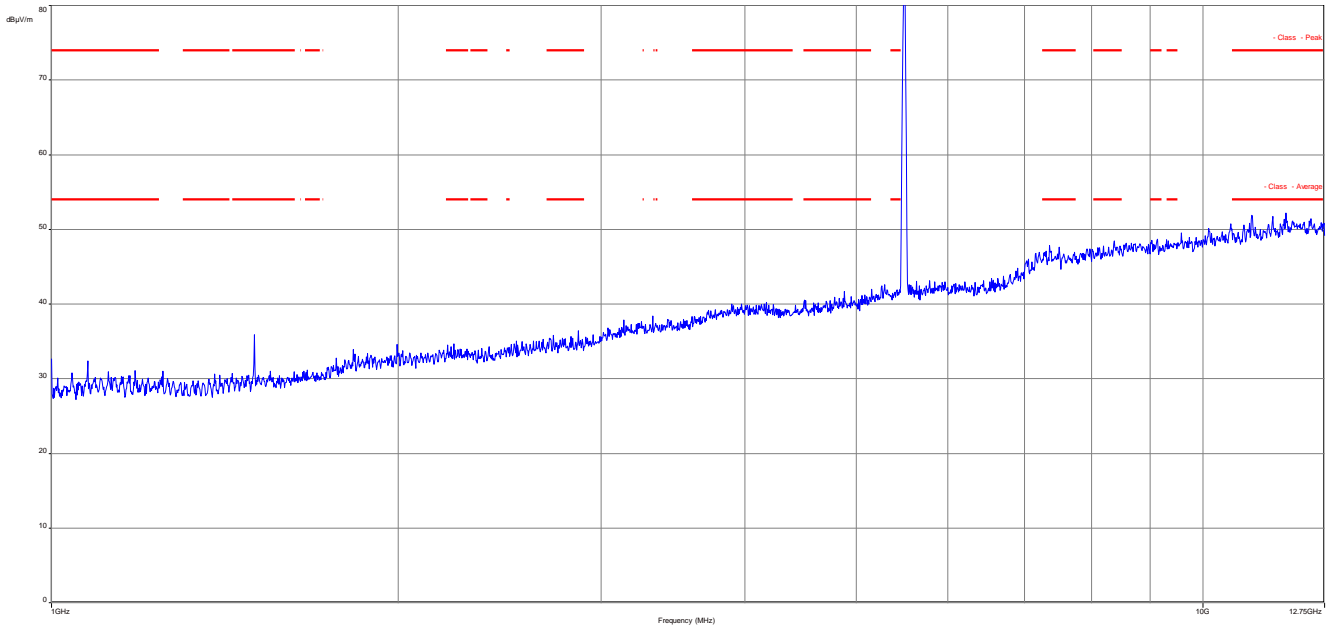


Final\_Result

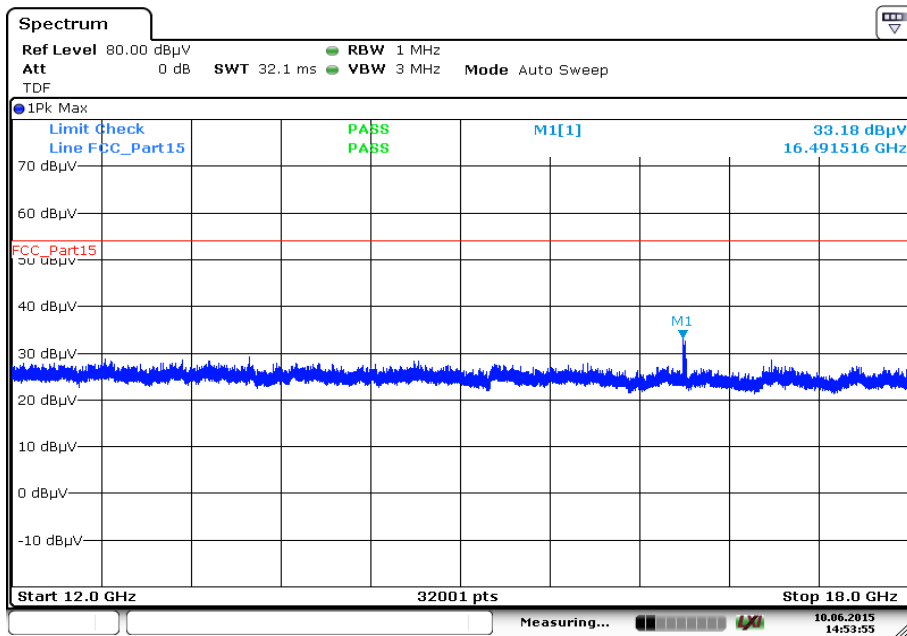
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
49.146600	22.48	30.00	7.52	1000.0	120.000	98.0	V	136	12.8
98.304600	15.81	33.50	17.69	1000.0	120.000	101.0	V	350	11.9
154.950450	13.26	33.50	20.24	1000.0	120.000	98.0	V	151	9.0
249.979500	18.31	36.00	17.69	1000.0	120.000	98.0	V	177	13.3
500.004450	23.18	36.00	12.82	1000.0	120.000	100.0	H	52	18.7
750.049650	29.22	36.00	6.78	1000.0	120.000	98.0	H	281	22.7



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

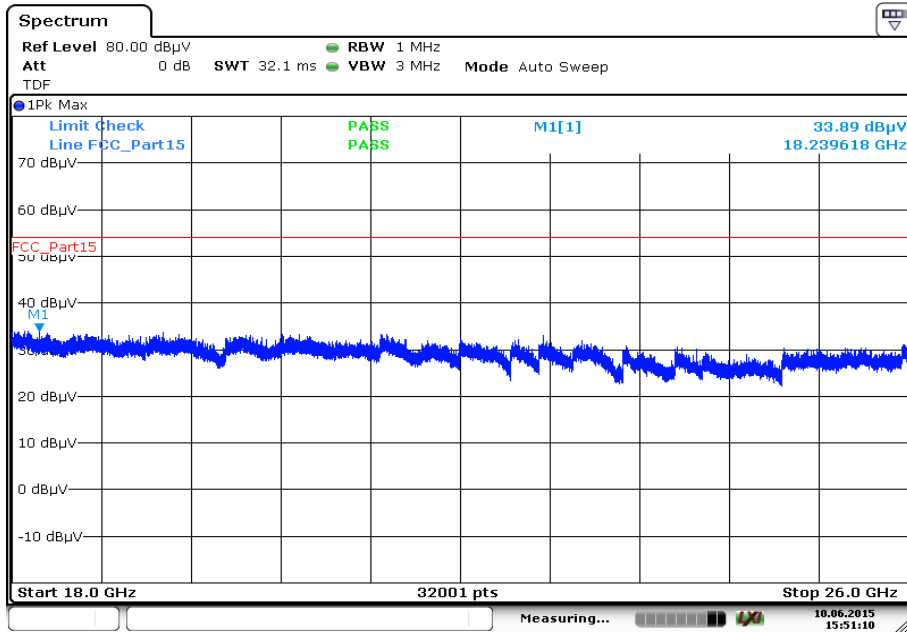


**Plot 23:** 12 GHz to 18 GHz, 5500 MHz, vertical & horizontal polarization



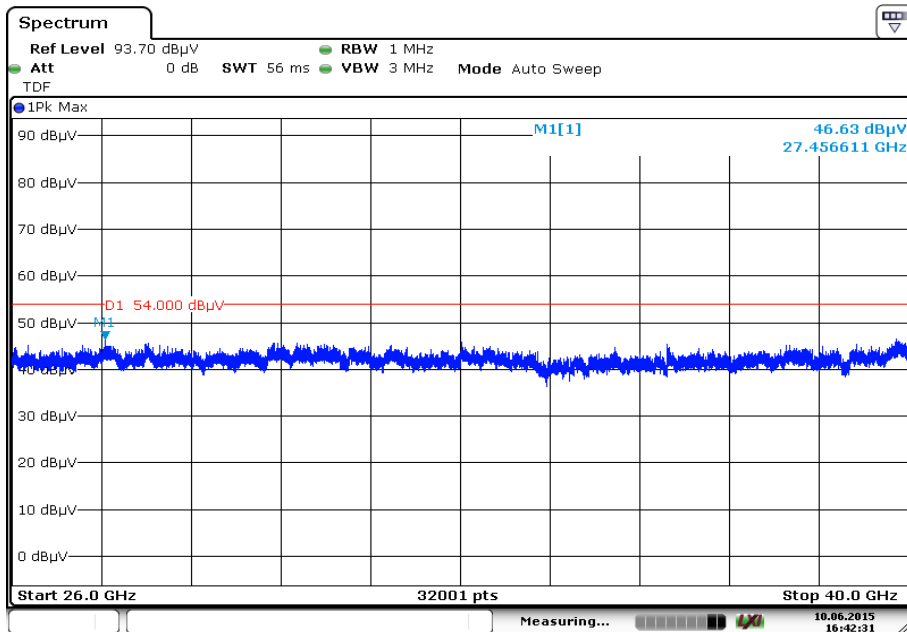
Date: 10.JUN.2015 14:53:55

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



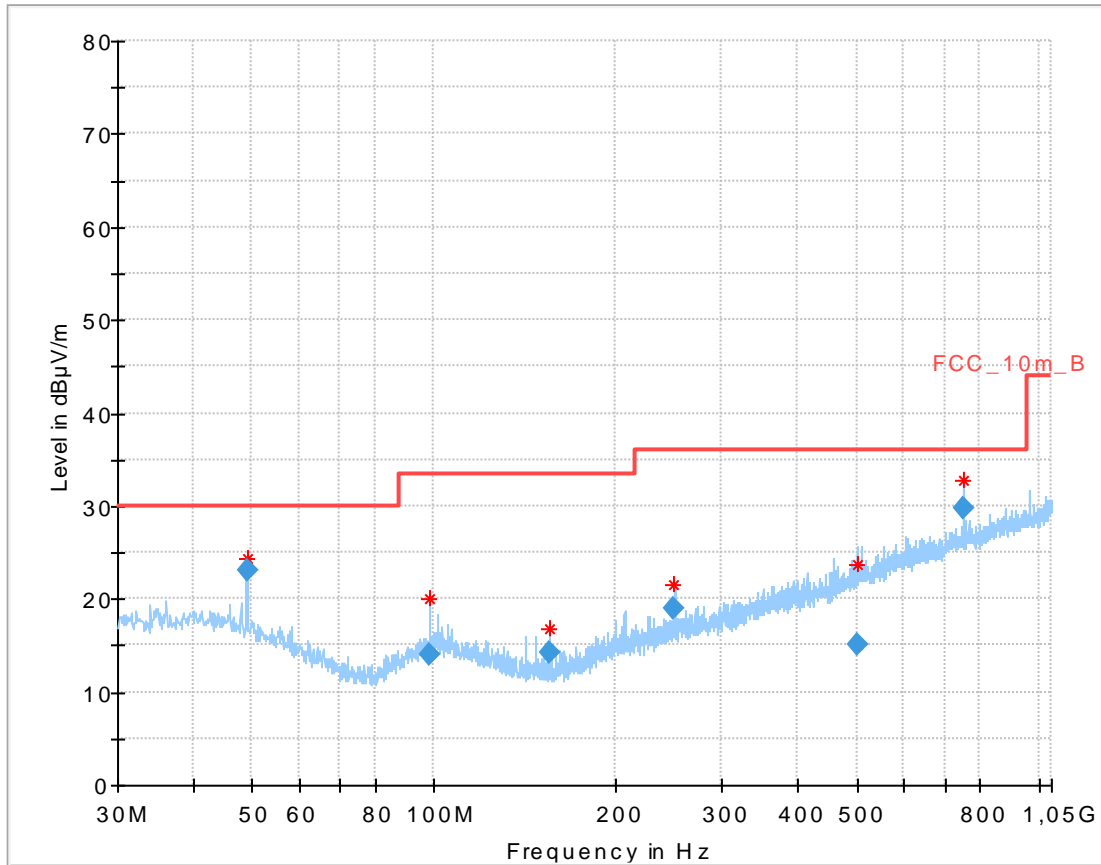
Date: 10.JUN.2015 15:51:11

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



Date: 10.JUN.2015 16:42:32

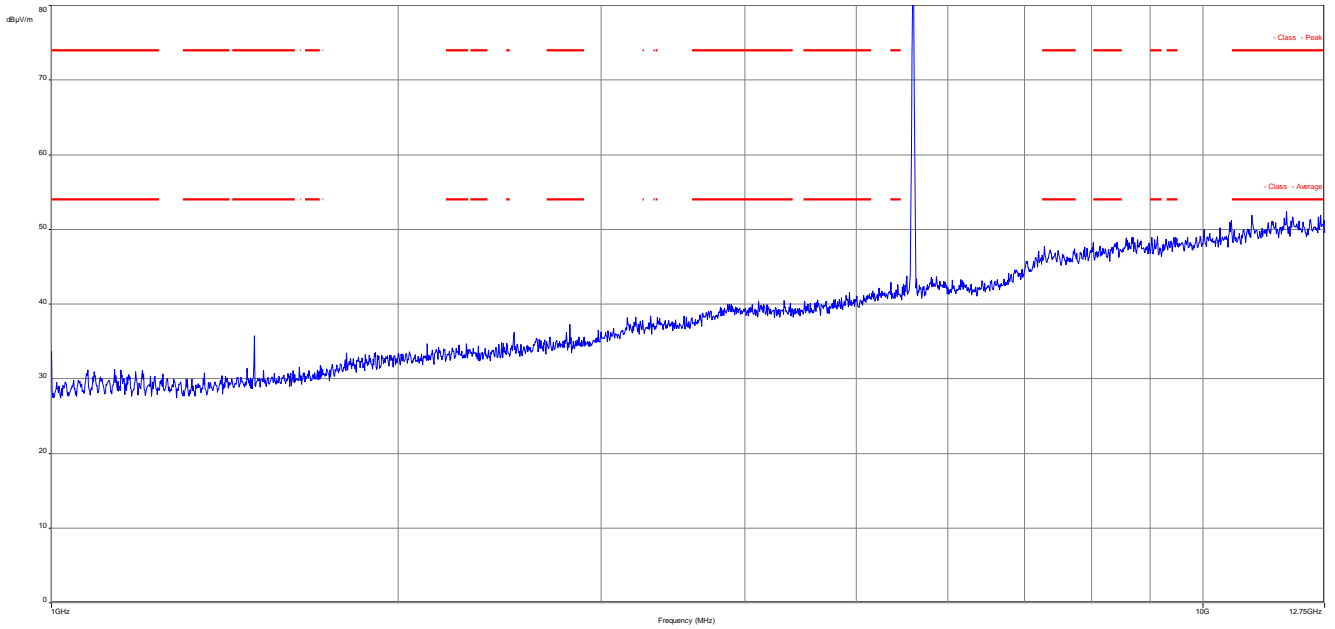
**Plot 26:** 30 MHz to 1 GHz, 5600 MHz, vertical & horizontal polarization



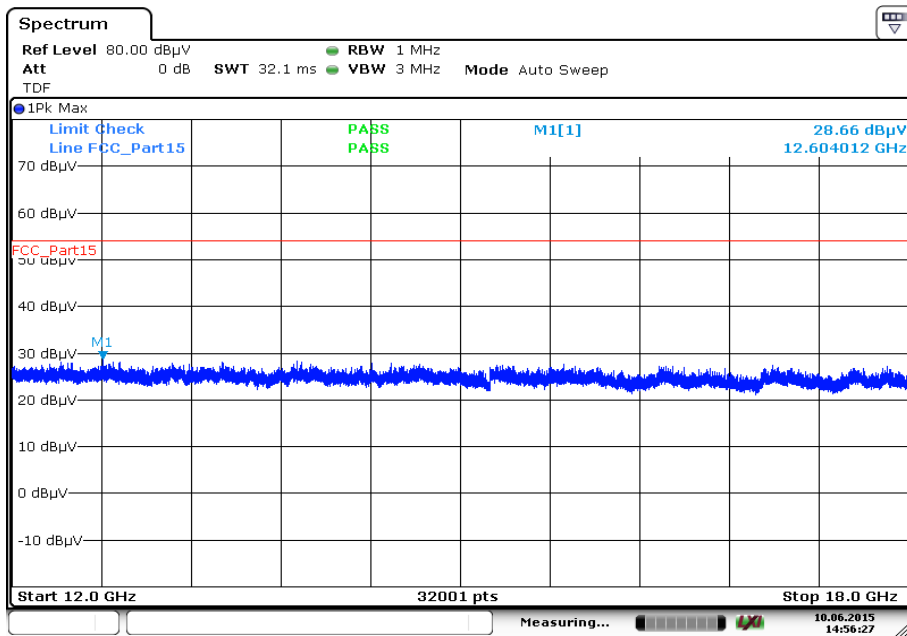
**Final\_Result**

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
49.144500	23.00	30.00	7.00	1000.0	120.000	98.0	V	99	12.8
98.314800	14.11	33.50	19.39	1000.0	120.000	170.0	V	99	11.9
154.981050	14.16	33.50	19.34	1000.0	120.000	98.0	V	146	9.0
249.990150	19.00	36.00	17.00	1000.0	120.000	98.0	V	166	13.3
502.301700	15.06	36.00	20.94	1000.0	120.000	170.0	V	107	18.7
750.045750	29.73	36.00	6.27	1000.0	120.000	170.0	H	247	22.7

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



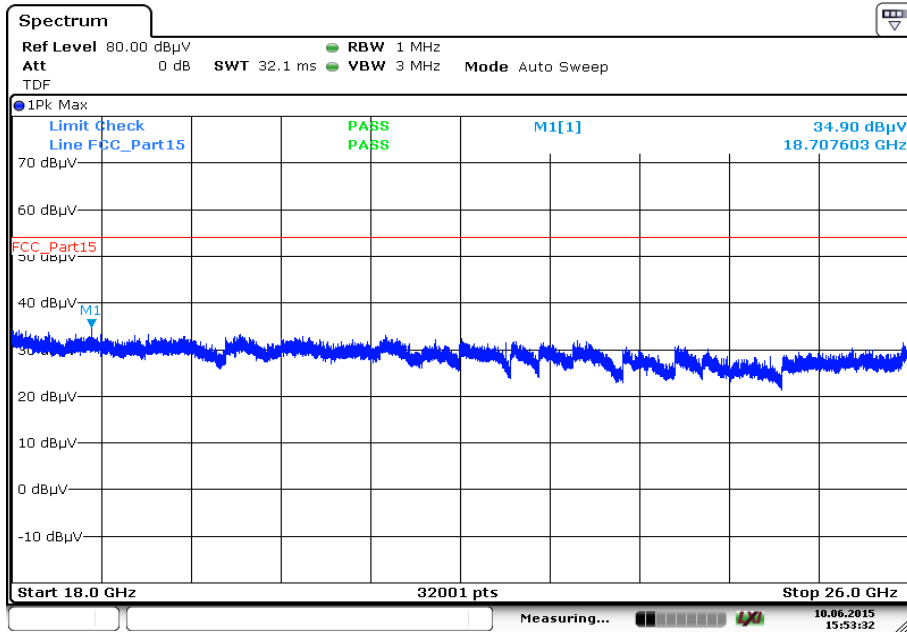
**Plot 28:** 12 GHz to 18 GHz, 5600 MHz, vertical & horizontal polarization



Date: 10.JUN.2015 14:56:27

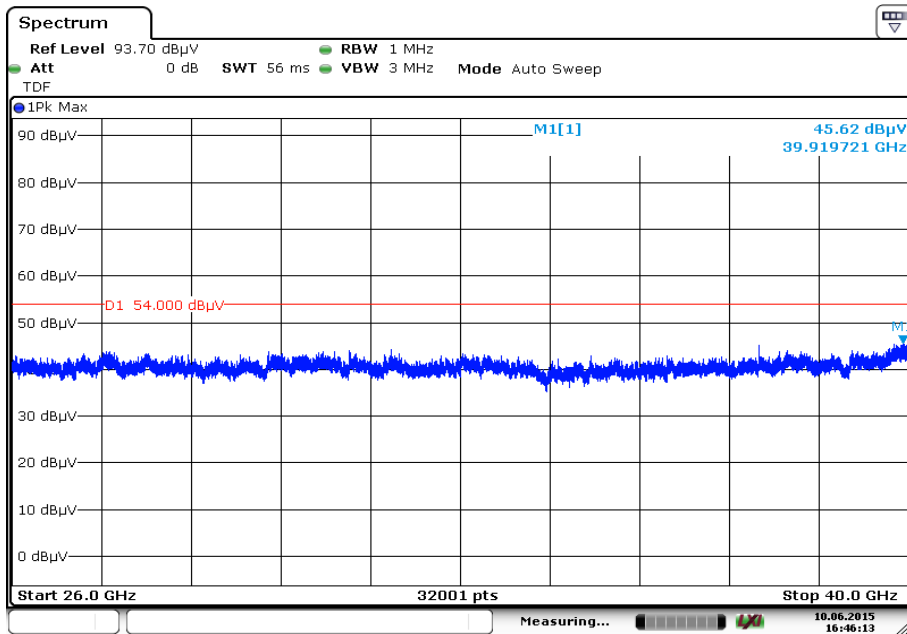
10.06.2015 14:56:27

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



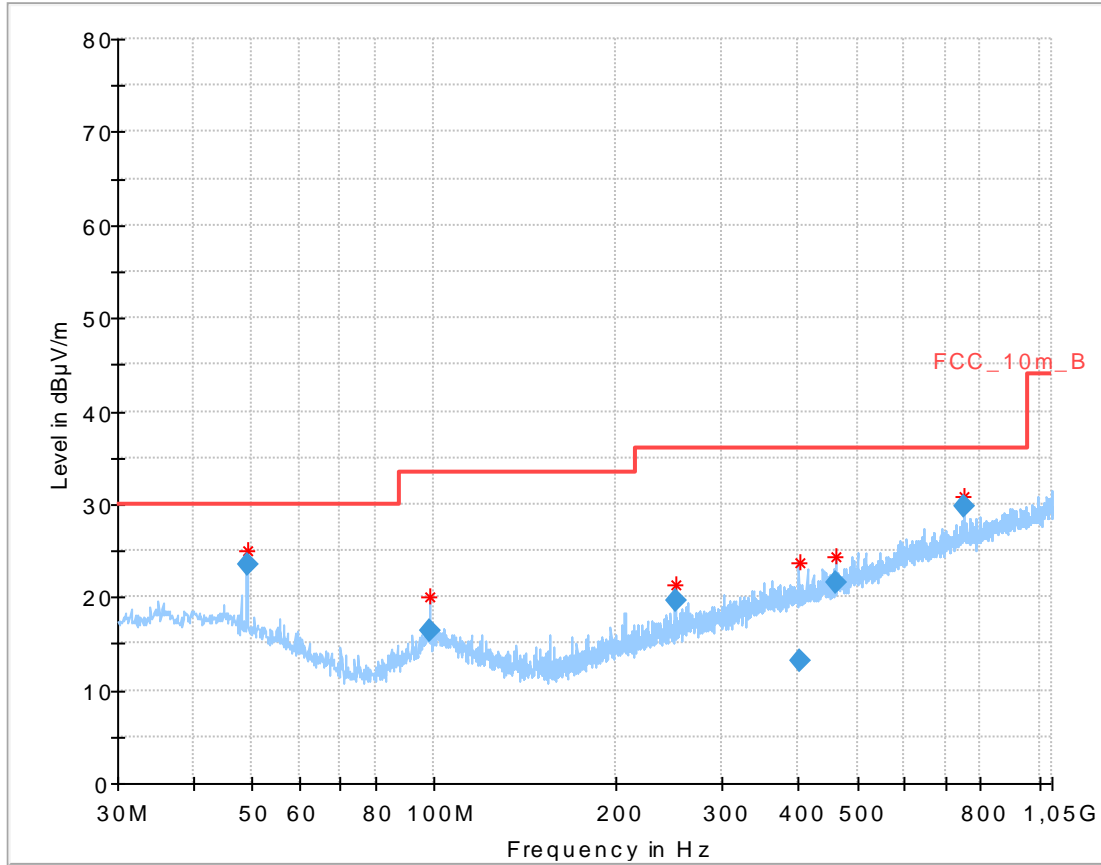
Date: 10.JUN.2015 15:53:32

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



Date: 10.JUN.2015 16:46:14

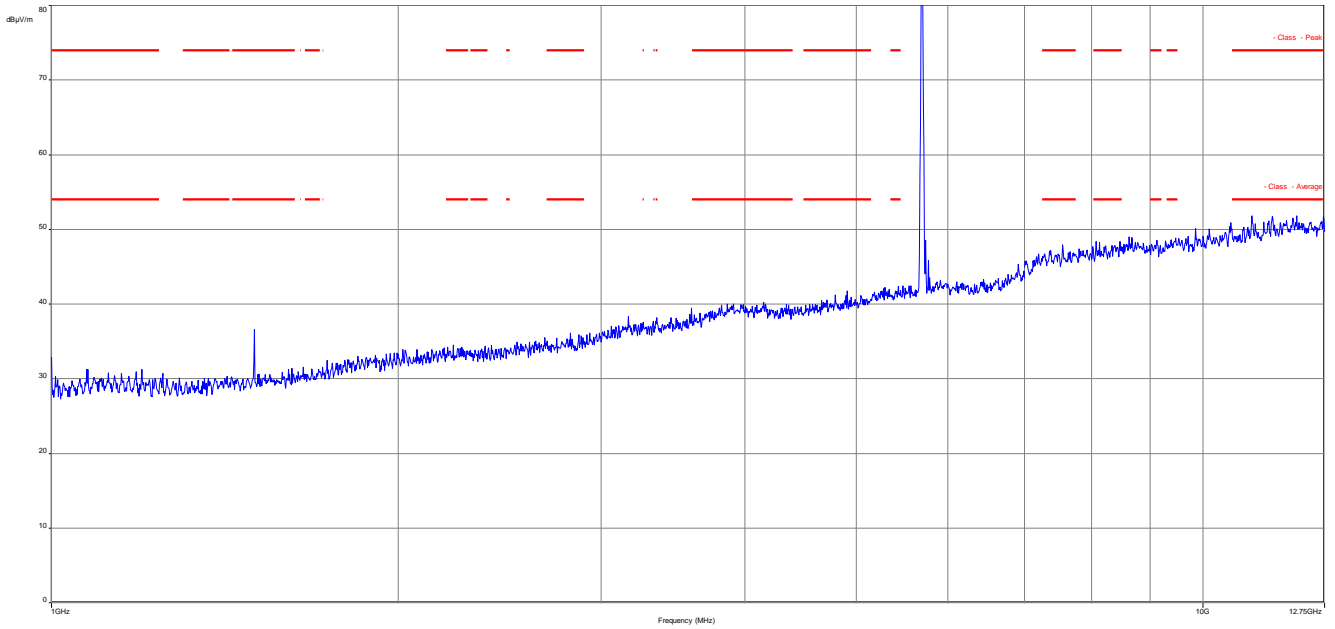
Plot 31: 30 MHz to 1 GHz, 5700 MHz, vertical & horizontal polarization



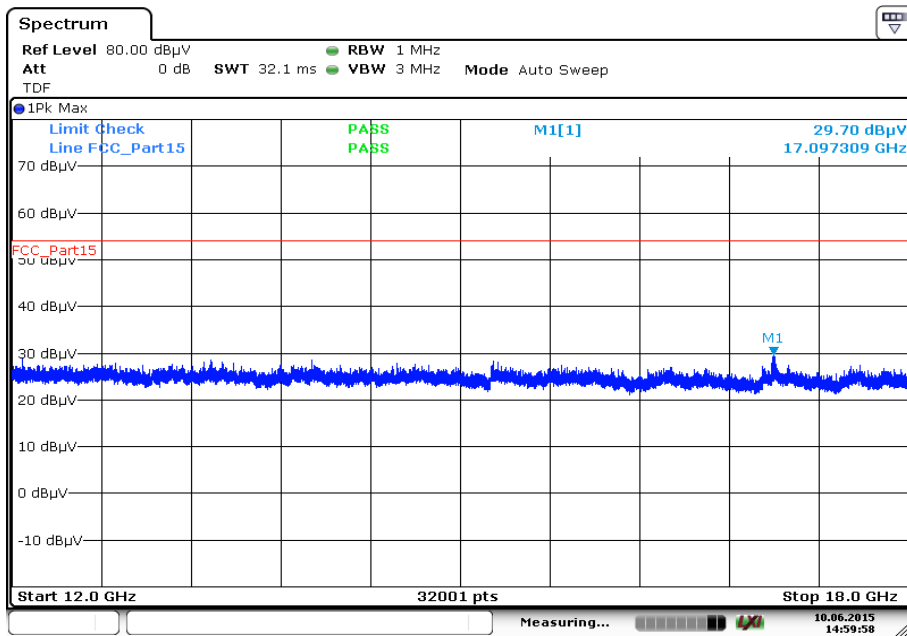
Final\_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
49.145400	23.52	30.00	6.48	1000.0	120.000	98.0	V	115	12.8
98.294400	16.41	33.50	17.09	1000.0	120.000	101.0	V	6	11.9
250.019850	19.55	36.00	16.45	1000.0	120.000	98.0	V	171	13.4
400.911150	13.17	36.00	22.83	1000.0	120.000	170.0	H	128	16.9
460.775850	21.57	36.00	14.43	1000.0	120.000	170.0	H	349	17.8
750.029700	29.67	36.00	6.33	1000.0	120.000	101.0	H	266	22.7

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

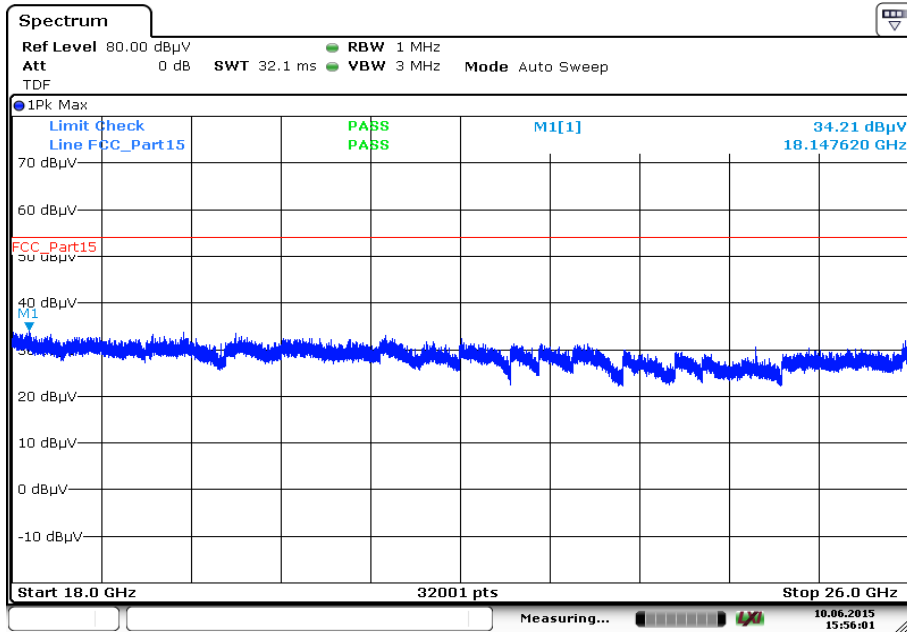


**Plot 33:** 12 GHz to 18 GHz, 5700 MHz, vertical & horizontal polarization



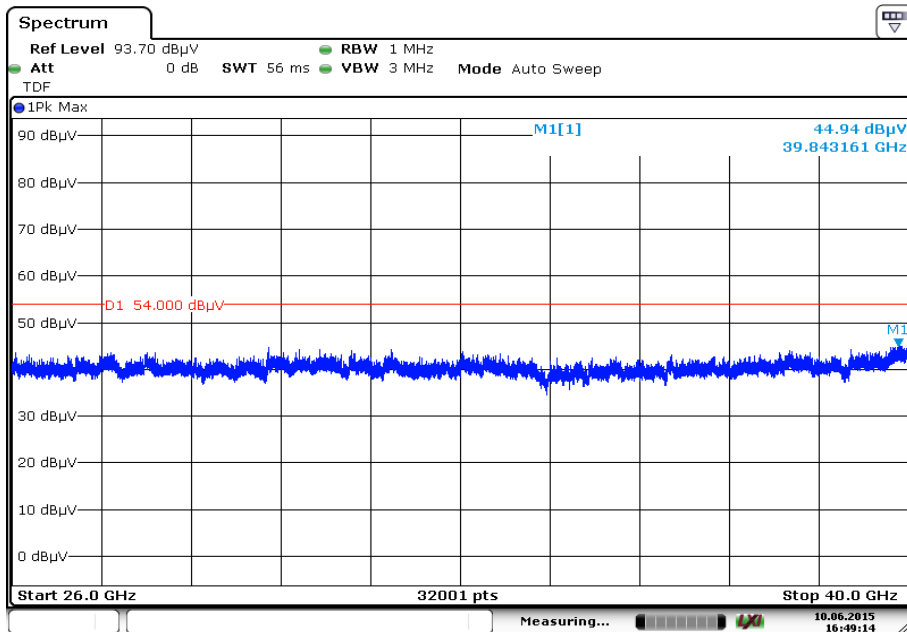
Date: 10.JUN.2015 14:59:58

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



Date: 10.JUN.2015 15:56:01

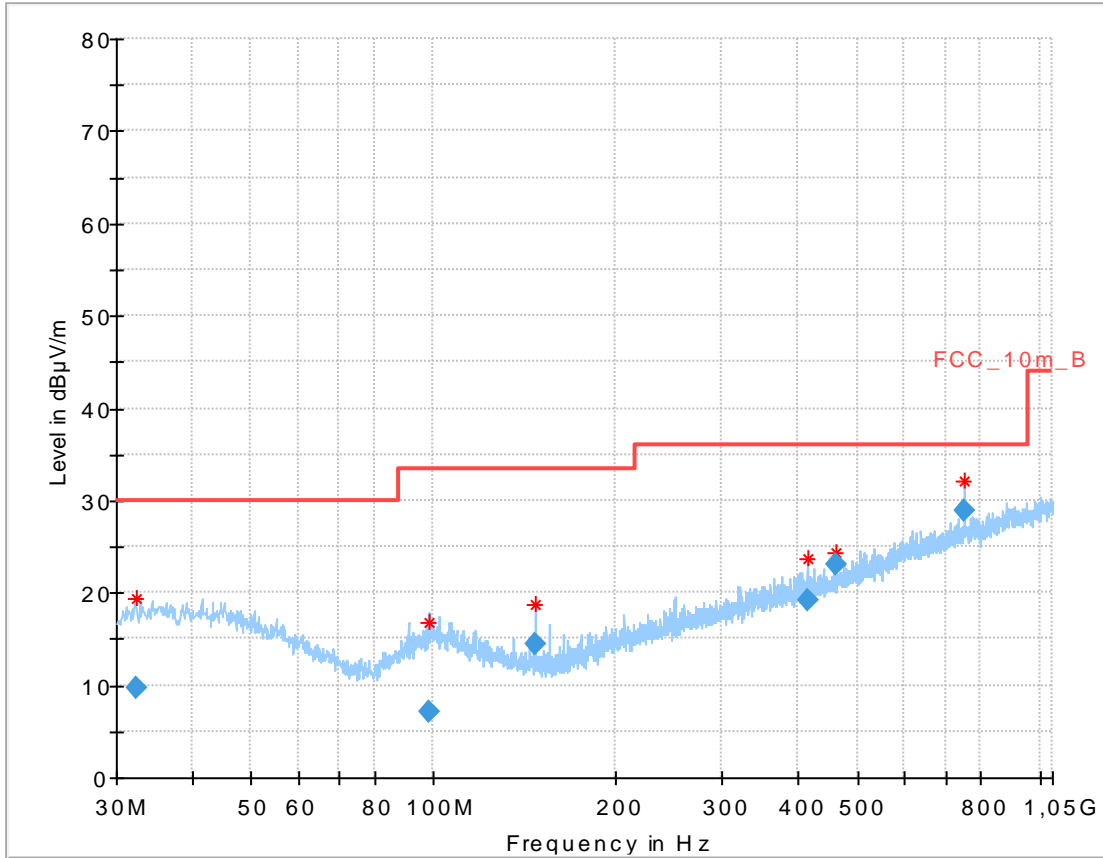
Plot 35: 26 GHz to 40 GHz, 5700 MHz, vertical & horizontal polarization



Date: 10.JUN.2015 16:49:15



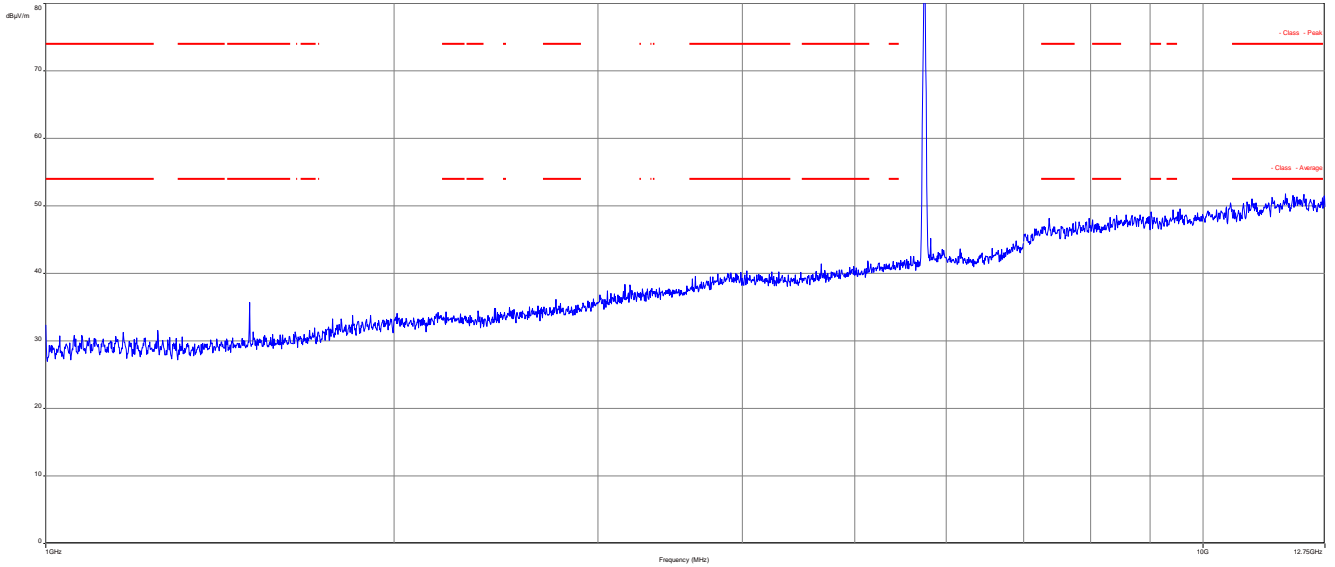
**Plot 36:** 30 MHz to 1 GHz, 5745 MHz, vertical & horizontal polarization



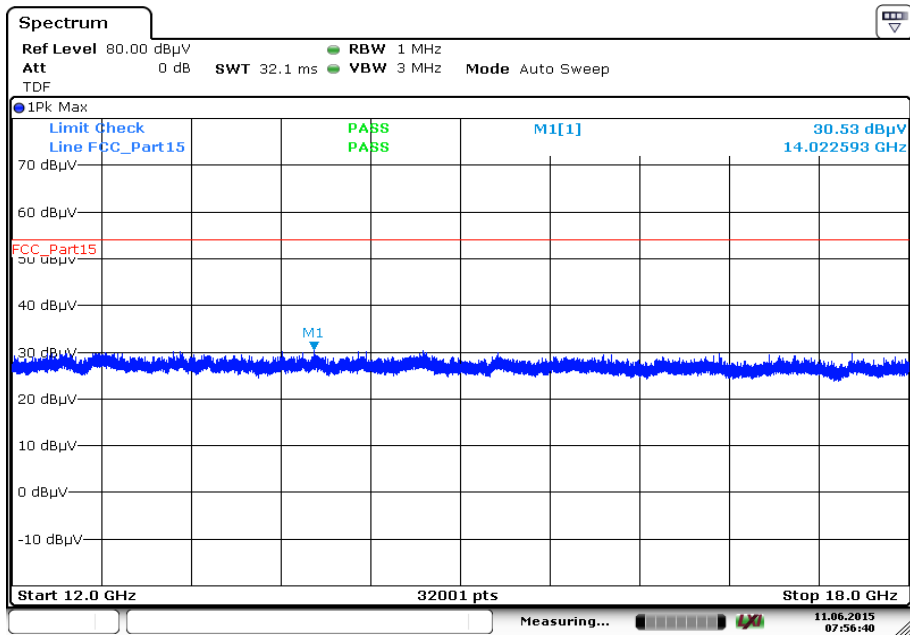
**Final\_Result**

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
32.440200	9.80	30.00	20.20	1000.0	120.000	101.0	H	11	13.6
98.543550	7.17	33.50	26.33	1000.0	120.000	100.0	H	182	11.9
147.437850	14.54	33.50	18.96	1000.0	120.000	98.0	V	182	8.8
413.406600	19.25	36.00	16.75	1000.0	120.000	170.0	H	105	17.1
460.763700	23.00	36.00	13.00	1000.0	120.000	170.0	H	11	17.8
750.008850	28.98	36.00	7.02	1000.0	120.000	101.0	H	266	22.7

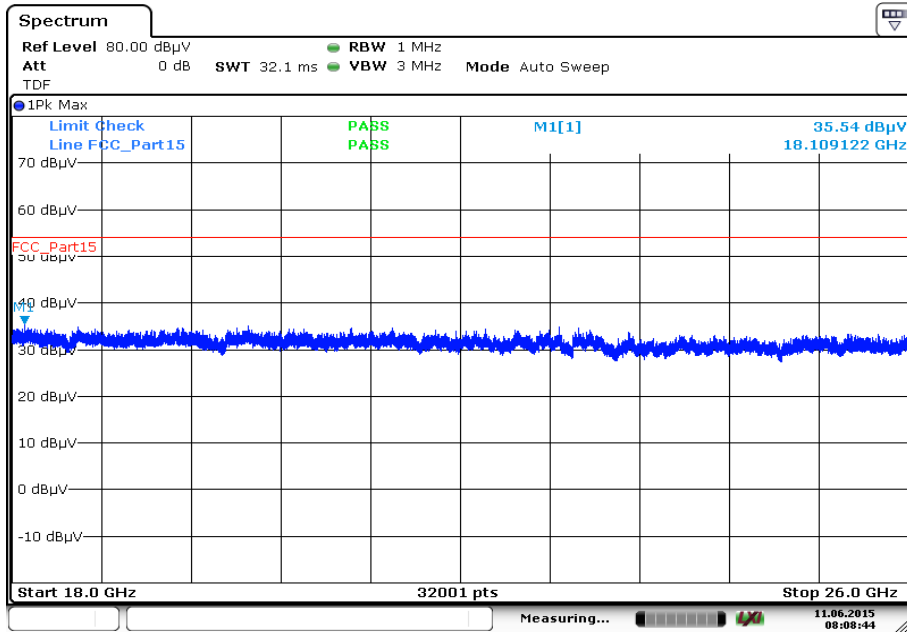
**Plot 37:** 1 GHz to 12.75 GHz, 5745 MHz, vertical & horizontal polarization



**Plot 38:** 12 GHz to 18 GHz, 5745 MHz, vertical & horizontal polarization

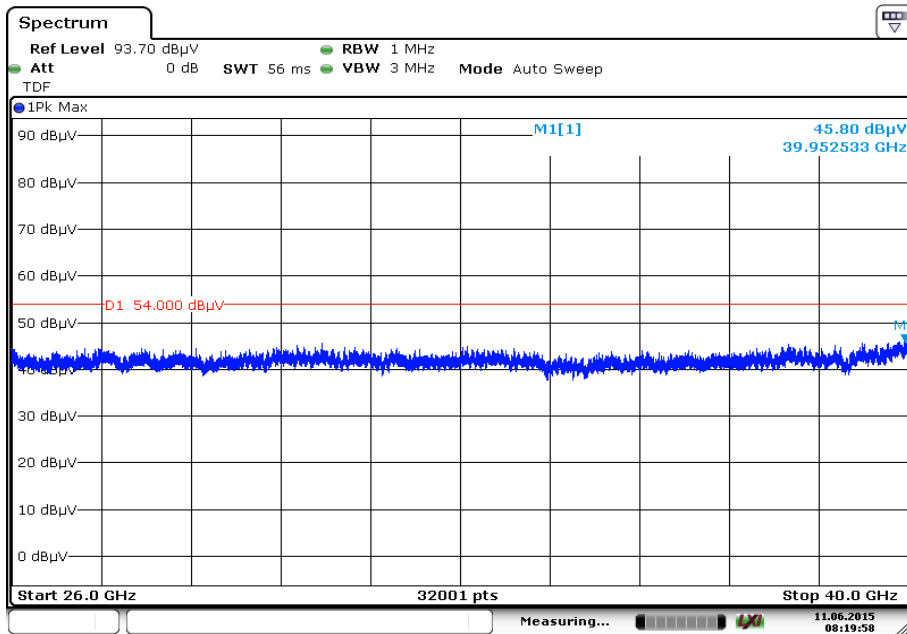


Plot 39: 18 GHz to 26 GHz, 5745 MHz, vertical & horizontal polarization



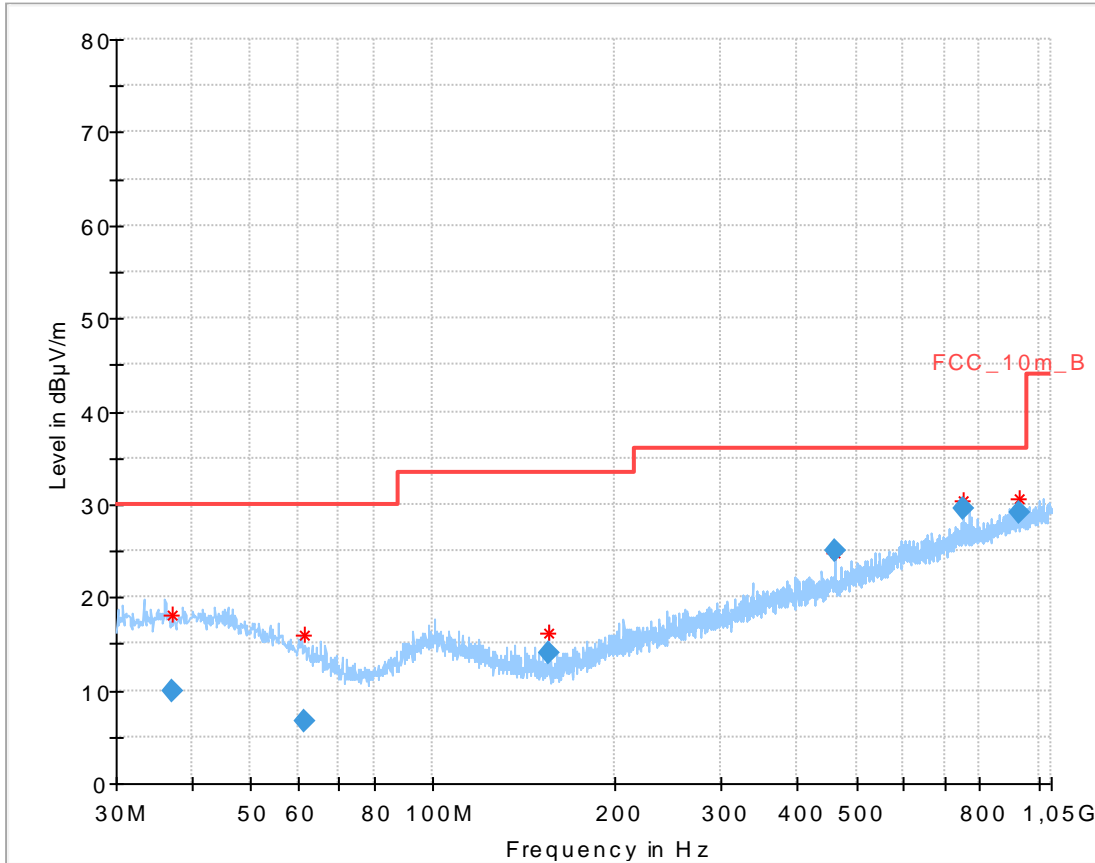
Date: 11.JUN.2015 08:08:43

Plot 40: 26 GHz to 40 GHz, 5745 MHz, vertical & horizontal polarization



Date: 11.JUN.2015 08:19:58

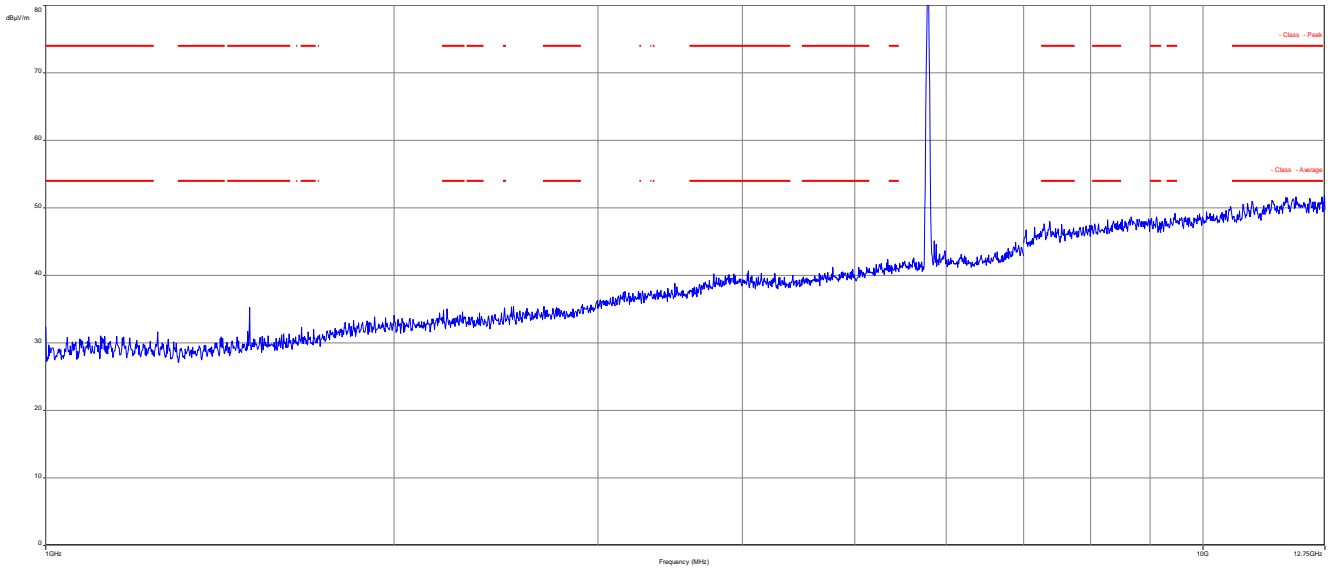
Plot 41: 30 MHz to 1 GHz, 5785 MHz, vertical & horizontal polarization



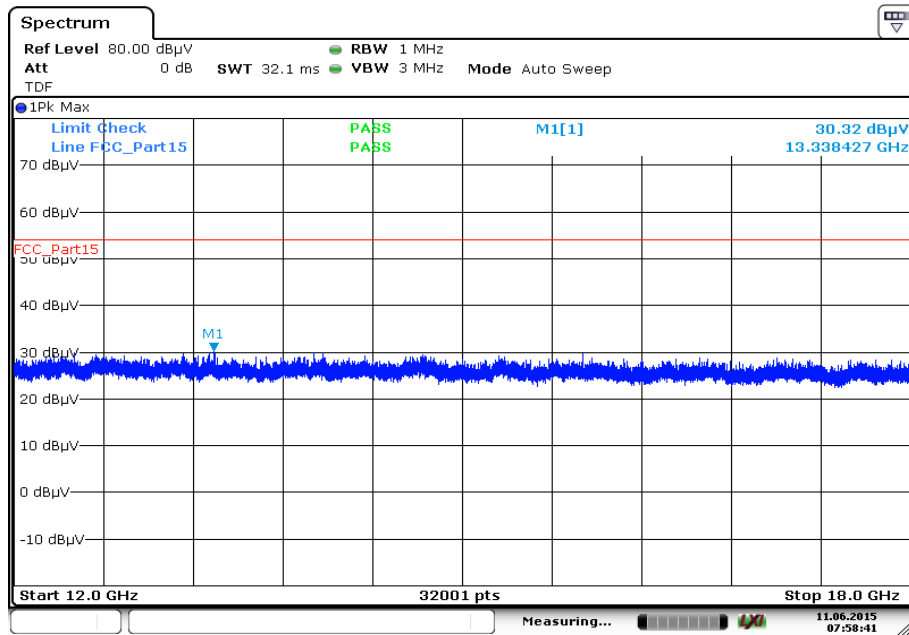
**Final Result**

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
37.086600	9.94	30.00	20.06	1000.0	120.000	101.0	V	34	13.9
61.162500	6.75	30.00	23.25	1000.0	120.000	170.0	H	34	10.3
155.043150	14.07	33.50	19.43	1000.0	120.000	98.0	V	223	9.0
460.773600	25.05	36.00	10.95	1000.0	120.000	170.0	H	223	17.8
750.039450	29.44	36.00	6.56	1000.0	120.000	101.0	H	288	22.7
927.479700	29.04	36.00	6.96	1000.0	120.000	101.0	V	306	24.2

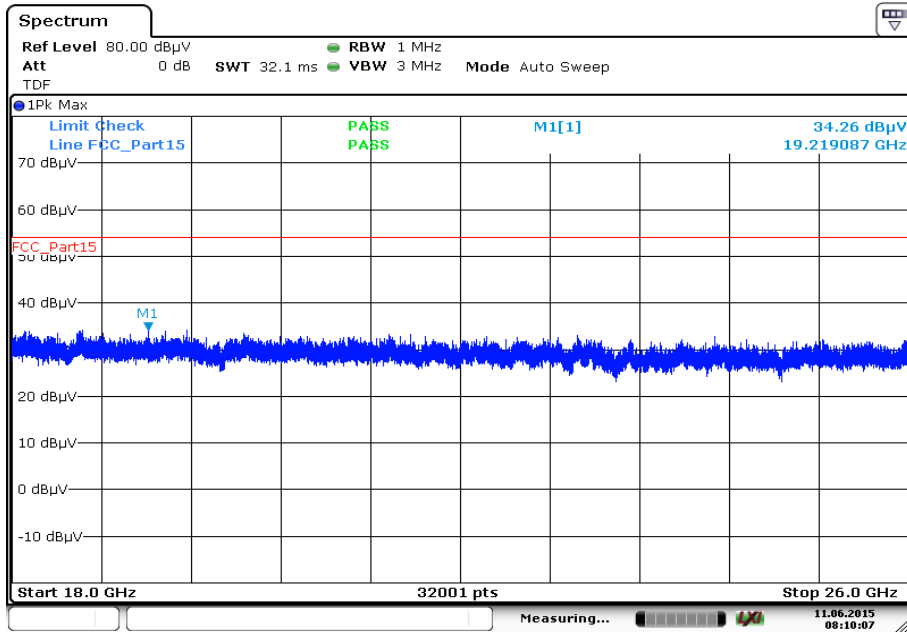
**Plot 42:** 1 GHz to 12.75 GHz, 5785 MHz, vertical & horizontal polarization



**Plot 43:** 12 GHz to 18 GHz, 5785 MHz, vertical & horizontal polarization

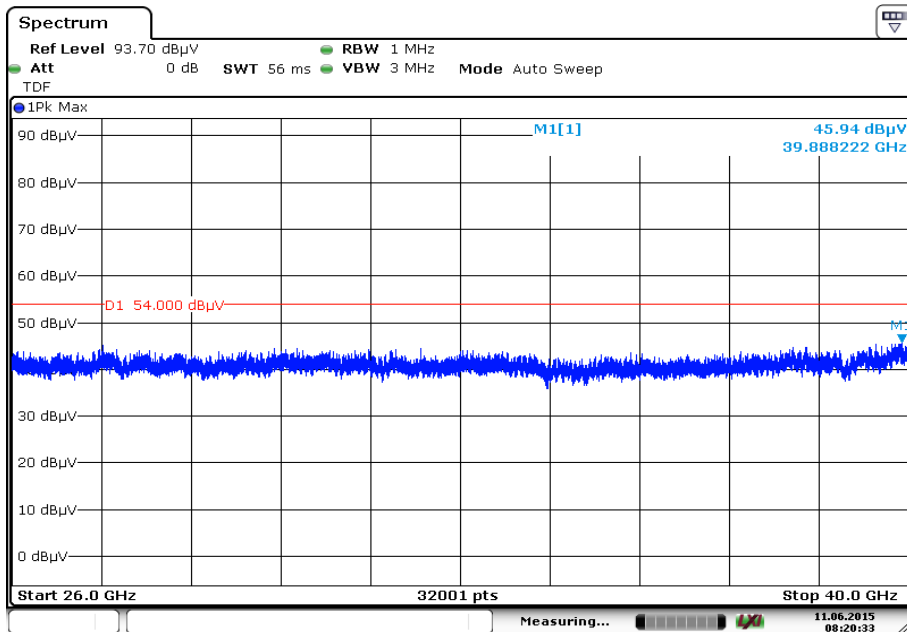


Plot 44: 18 GHz to 26 GHz, 5785 MHz, vertical & horizontal polarization



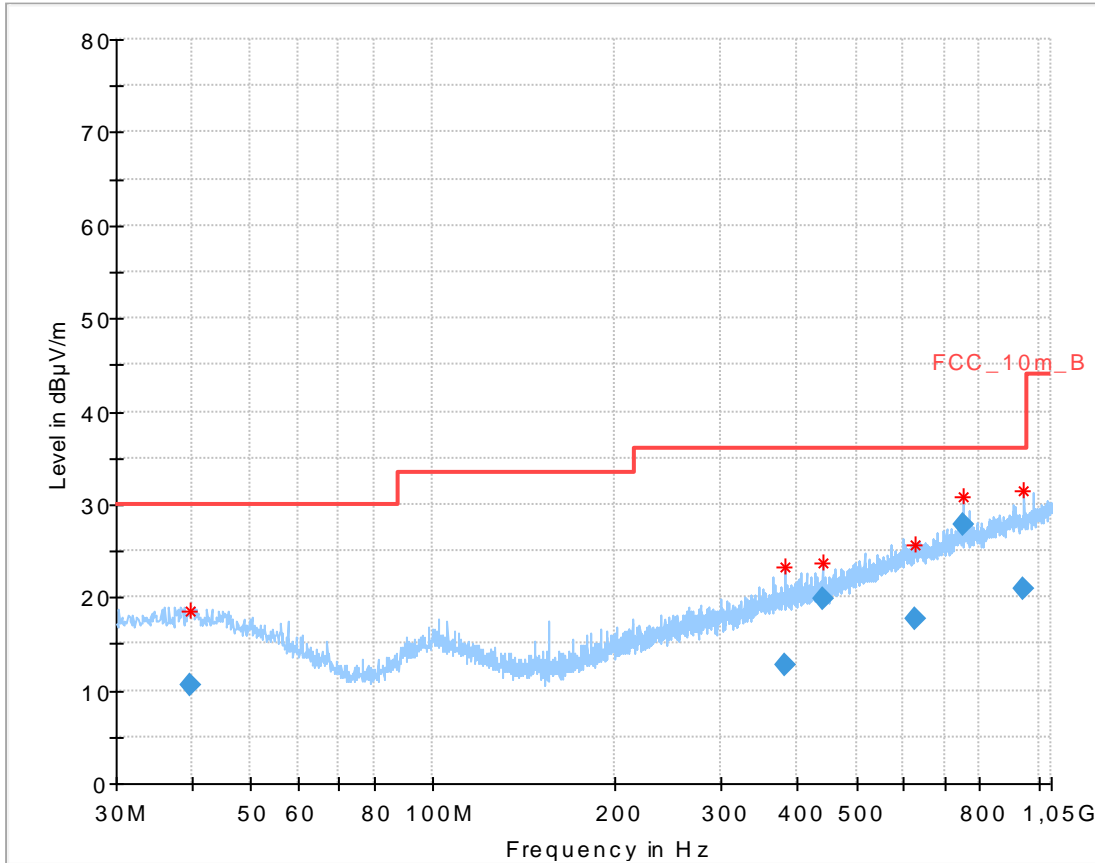
Date: 11.JUN.2015 08:10:07

Plot 45: 26 GHz to 40 GHz, 5785 MHz, vertical & horizontal polarization



Date: 11.JUN.2015 08:20:33

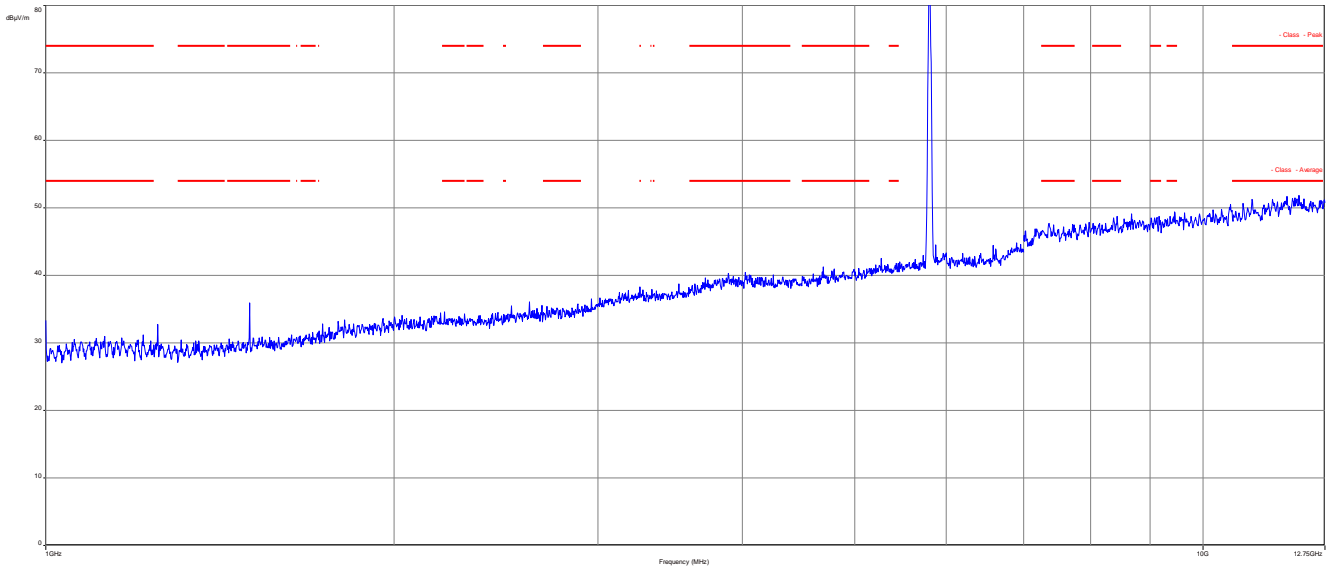
**Plot 46:** 30 MHz to 1 GHz, 5805 MHz, vertical & horizontal polarization



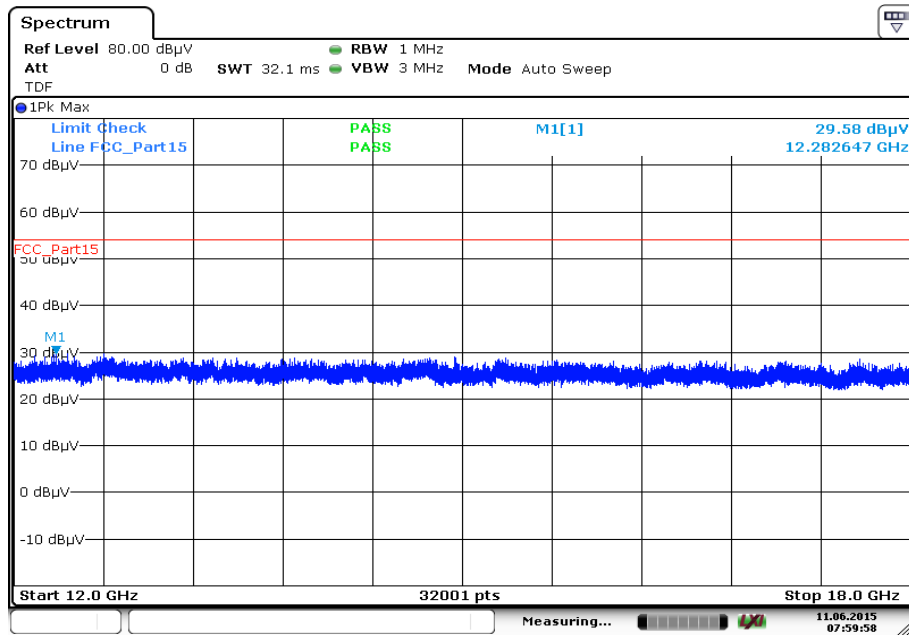
**Final Result**

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
39.867150	10.55	30.00	19.45	1000.0	120.000	101.0	H	1	14.0
380.984700	12.66	36.00	23.34	1000.0	120.000	170.0	H	350	16.6
439.262700	19.90	36.00	16.10	1000.0	120.000	98.0	V	39	17.4
626.637900	17.65	36.00	18.35	1000.0	120.000	170.0	V	335	20.9
750.070650	27.72	36.00	8.28	1000.0	120.000	98.0	H	15	22.7
946.856700	20.98	36.00	15.02	1000.0	120.000	170.0	H	118	24.3

**Plot 47:** 1 GHz to 12.75 GHz, 5805 MHz, vertical & horizontal polarization



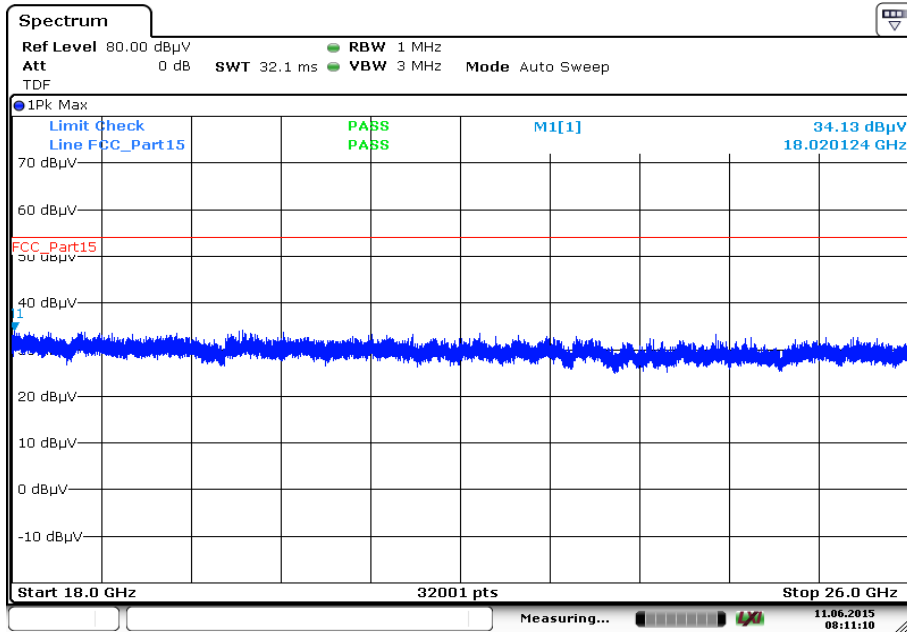
**Plot 48:** 12 GHz to 18 GHz, 5805 MHz, vertical & horizontal polarization



Date: 11.JUN.2015 07:59:58

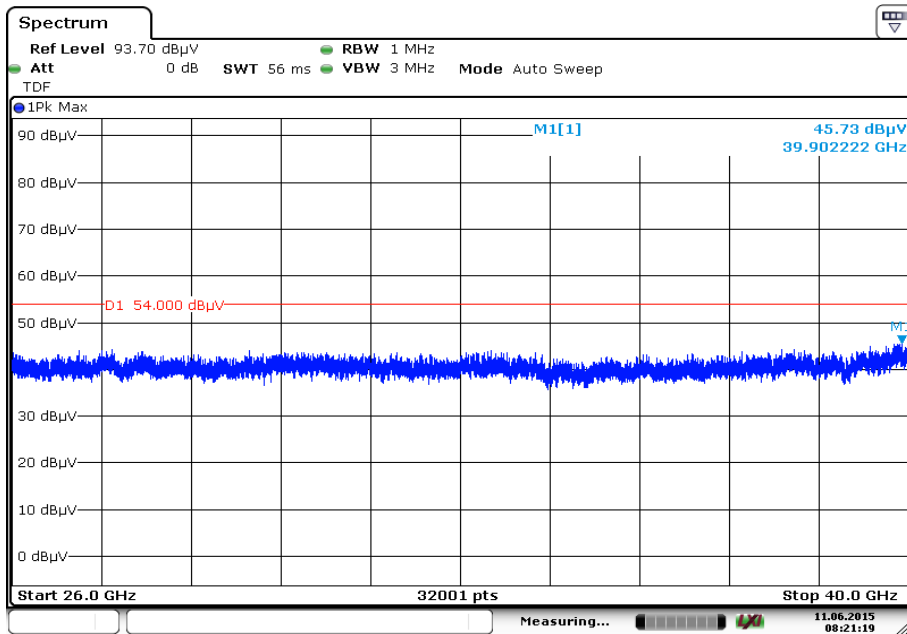


Plot 49: 18 GHz to 26 GHz, 5805 MHz, vertical & horizontal polarization



Date: 11.JUN.2015 08:11:10

Plot 50: 26 GHz to 40 GHz, 5805 MHz, vertical & horizontal polarization



Date: 11.JUN.2015 08:21:19

## 10.4 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 %

**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:**

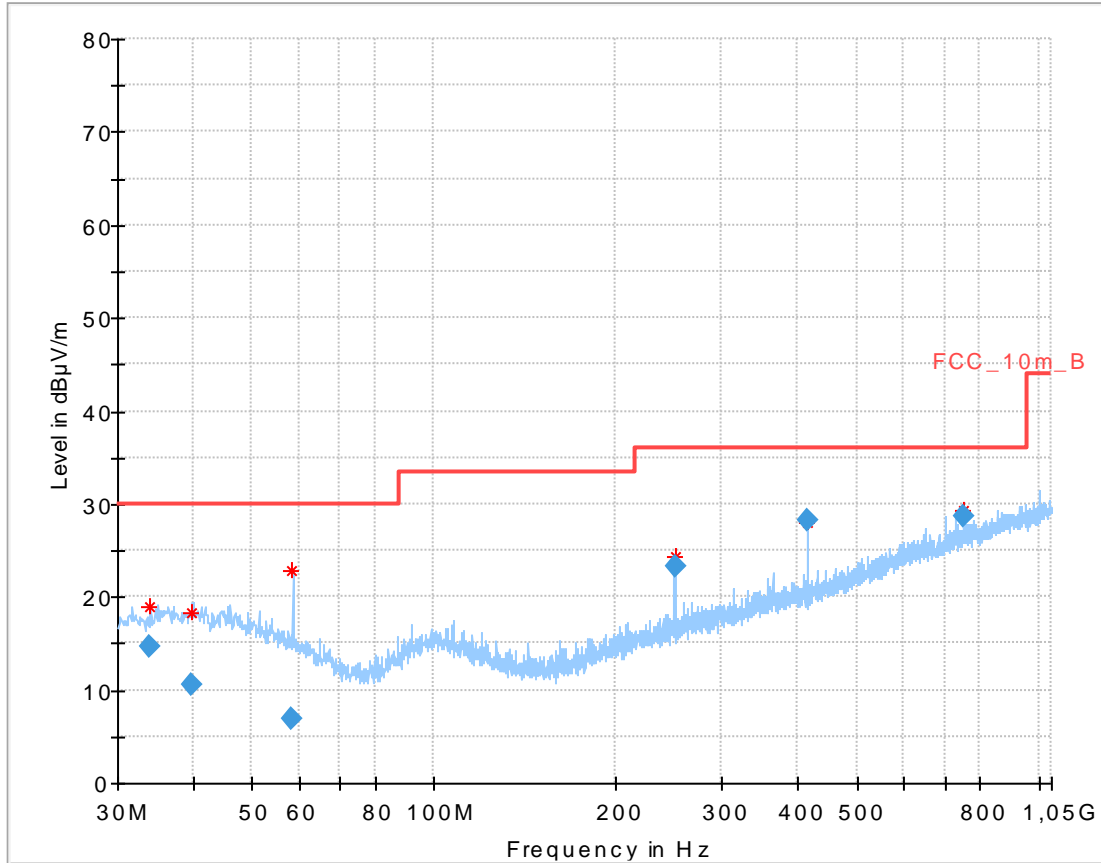
RX Spurious Emissions Radiated [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
1000	Peak	36.9
1250	Peak	31.1
1500	Peak	37.1
1830	Peak	32.2
Measurement uncertainty	± 3 dB	

**Verdict: Complies**

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

**Plots:** RX / Idle – mode

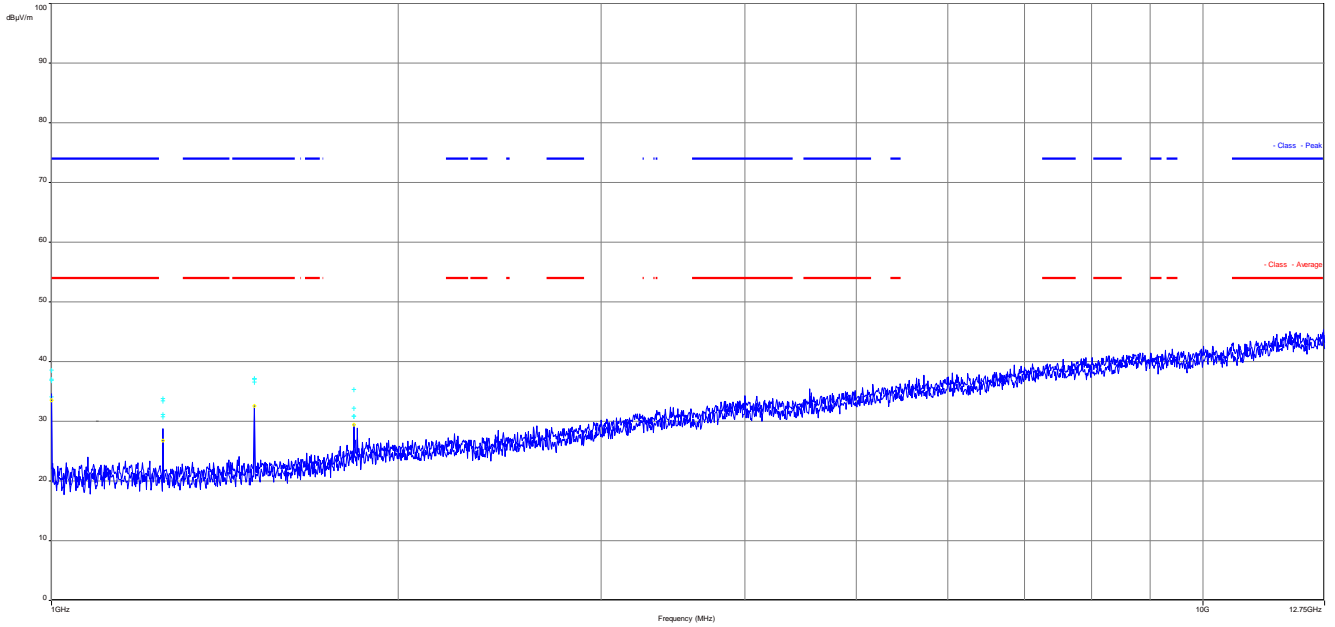
**Plot 1:** 30 MHz to 1 GHz, vertical & horizontal polarization



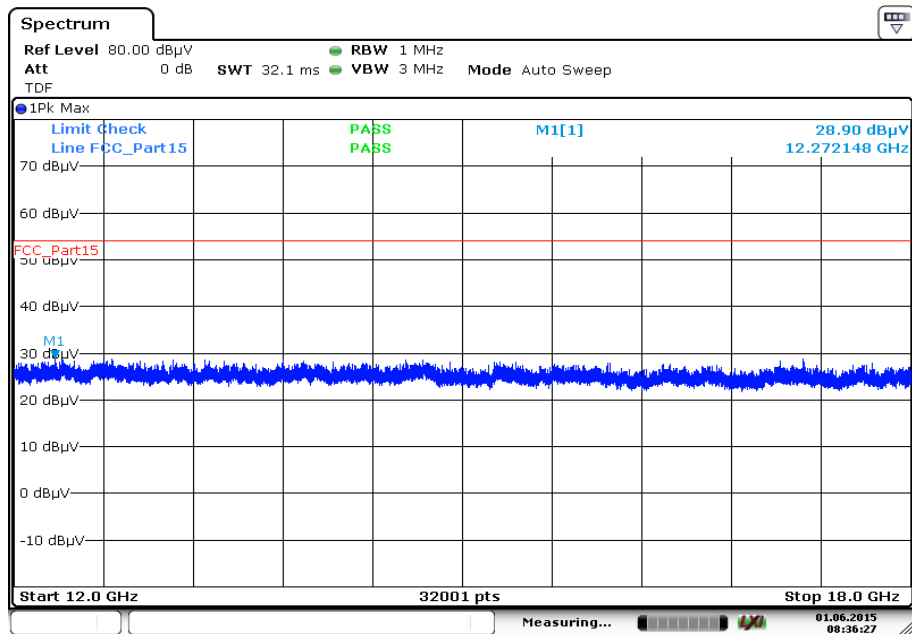
**Final\_Result:**

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
34.006950	14.59	30.00	15.41	1000.0	120.000	101.0	V	7	13.7
39.648750	10.61	30.00	19.39	1000.0	120.000	101.0	V	25	14.0
58.230900	6.89	30.00	23.11	1000.0	120.000	101.0	V	56	11.0
250.007700	23.22	36.00	12.78	1000.0	120.000	98.0	V	164	13.4
415.008600	28.19	36.00	7.81	1000.0	120.000	170.0	H	49	17.1
750.042900	28.68	36.00	7.32	1000.0	120.000	98.0	H	270	22.7

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

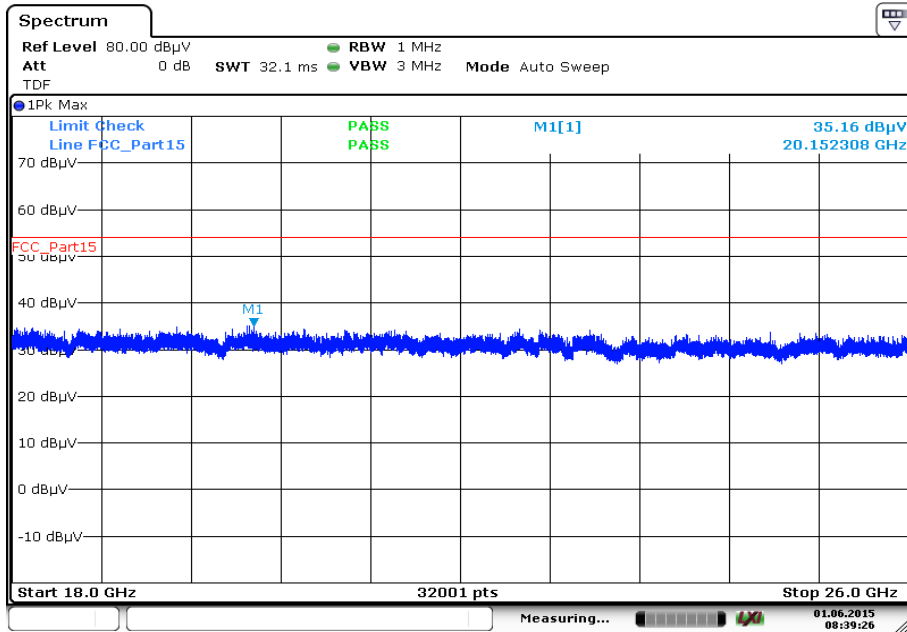


**Plot 3:** 12 GHz to 18 GHz, vertical & horizontal polarization



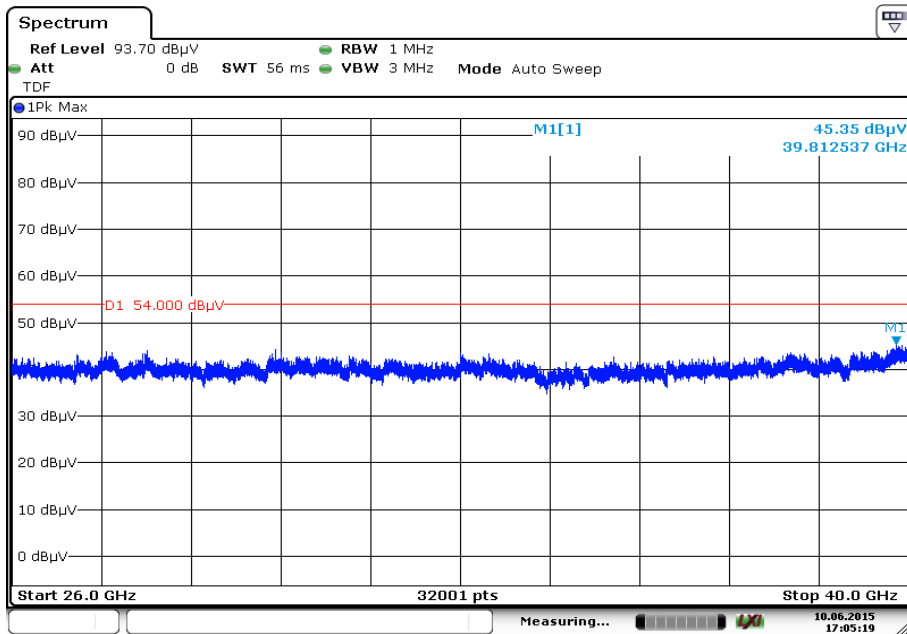
Date: 1.JUN.2015 08:36:28

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



Date: 1.JUN.2015 08:39:26

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



Date: 10.JUN.2015 17:05:20

## 10.5 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 $\mu$ 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: a-mode**

Spurious Emissions Radiated < 30 MHz [dBµV/m]								
Lowest 5180 MHz			Middle			Highest 5240 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 20 dBµV/m below the limit			-/-			All detected peaks are more than 20 dBµV/m below the limit		
			-/-	-/-	-/-			
			-/-	-/-	-/-			
Measurement uncertainty			± 3 dB					

Spurious Emissions Radiated < 30 MHz [dBµV/m]								
Lowest 5260 MHz			Middle			Highest 5320 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 20 dBµV/m below the limit			-/-			All detected peaks are more than 20 dBµV/m below the limit		
			-/-	-/-	-/-			
			-/-	-/-	-/-			
Measurement uncertainty			± 3 dB					

Spurious Emissions Radiated < 30 MHz [dBµV/m]								
Lowest 5500 MHz			Middle 5600 MHz			Highest 5700 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 20 dBµV/m below the limit			All detected peaks are more than 20 dBµV/m below the limit			All detected peaks are more than 20 dBµV/m below the limit		
Measurement uncertainty			± 3 dB					

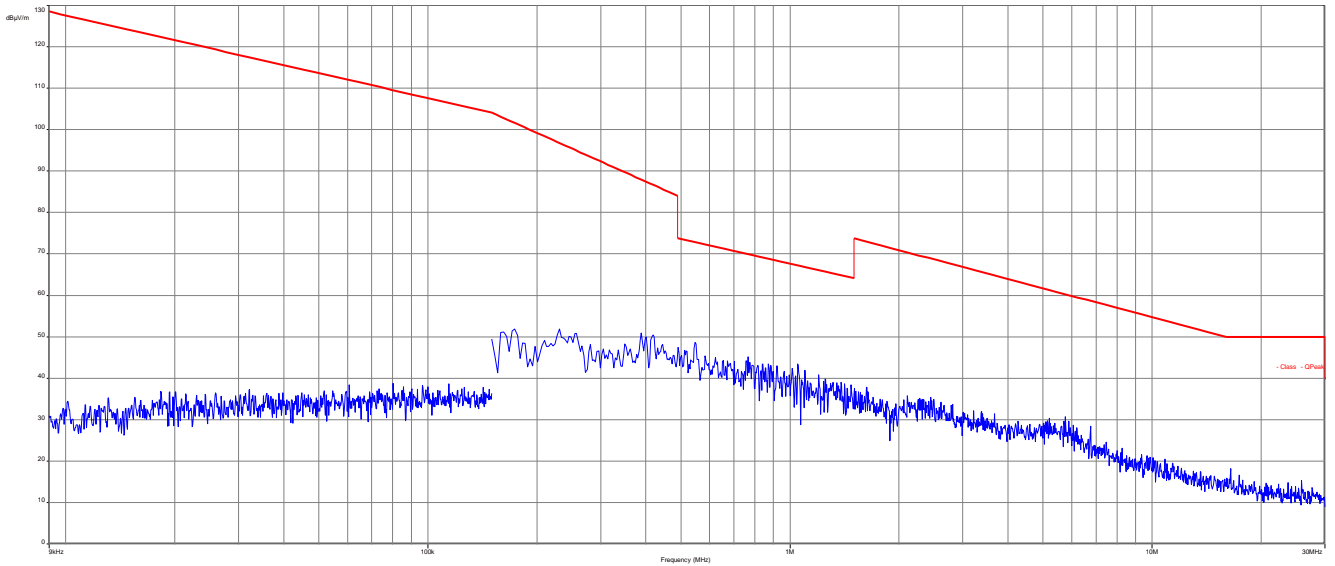
Spurious Emissions Radiated < 30 MHz [dBµV/m]								
Lowest 5745 MHz			Middle 5785 MHz			Highest 5805 MHz		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
All detected peaks are more than 20 dBµV/m below the limit			All detected peaks are more than 20 dBµV/m below the limit			All detected peaks are more than 20 dBµV/m below the limit		
Measurement uncertainty			± 3 dB					

**Verdict: Complies**

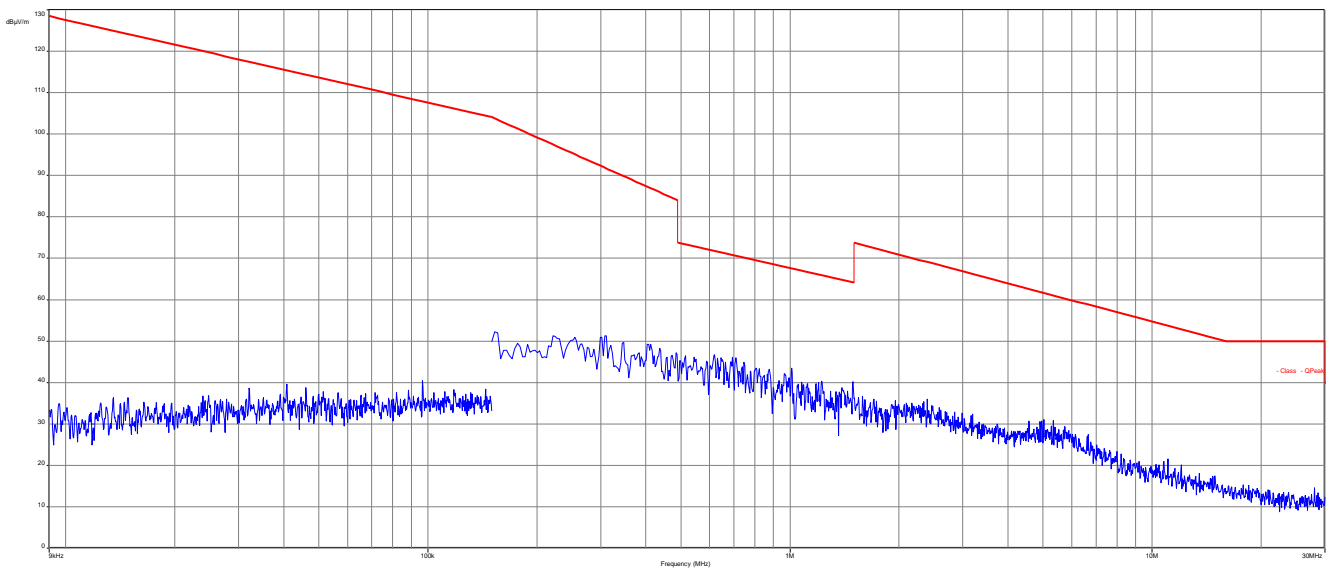
**Note:** The limit was recalculated with 20 dB / decade (Part 15.31) for all radiated spurious emissions 30 MHz to 1 GHz from 3 meter limit to a 10 meter distance. (40dB/decade for emissions < 30MHz)

**Plots:** OFDM / a – mode

**Plot 1:** 9 kHz to 30 MHz, 5180 MHz

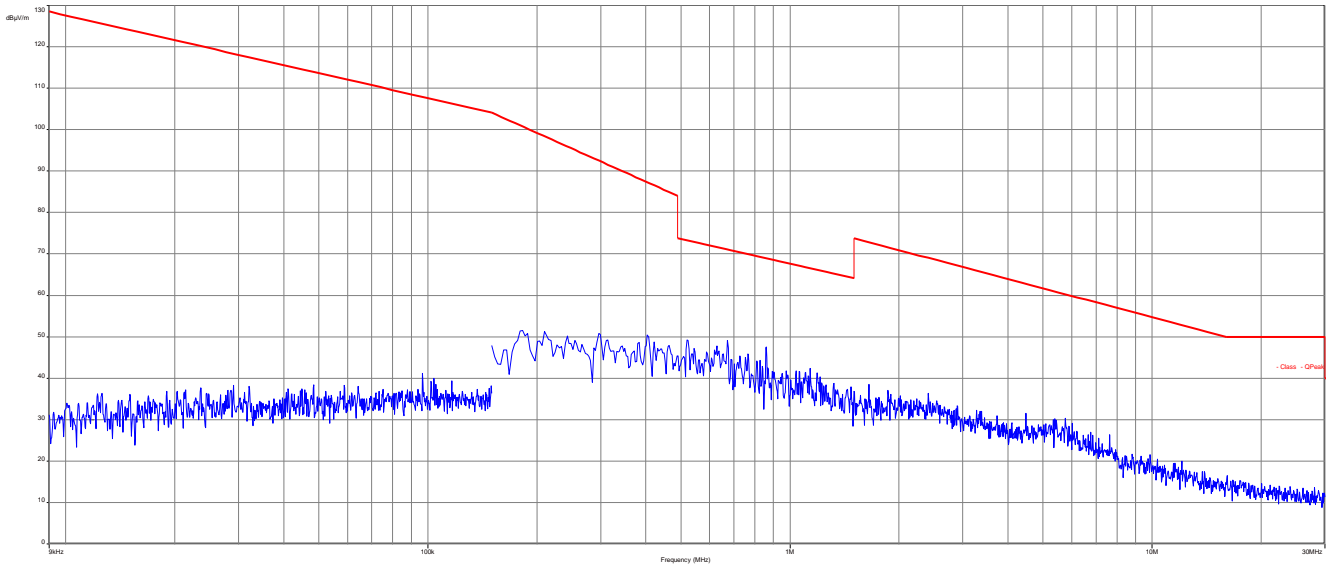


**Plot 2:** 9 kHz to 30 MHz, 5240 MHz

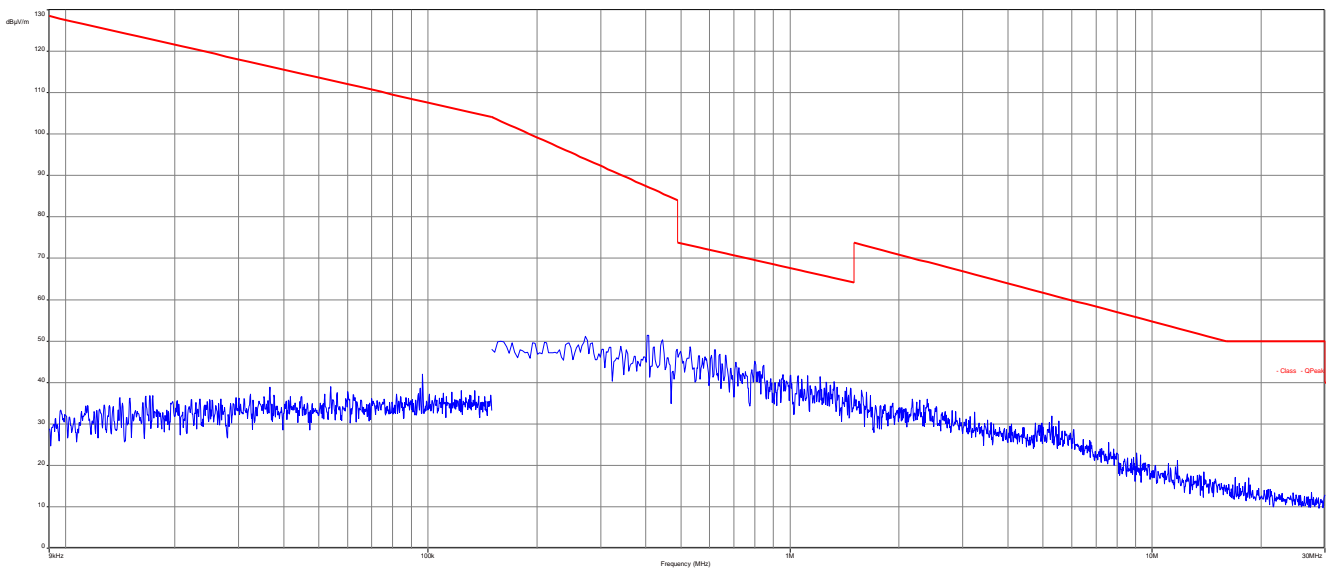




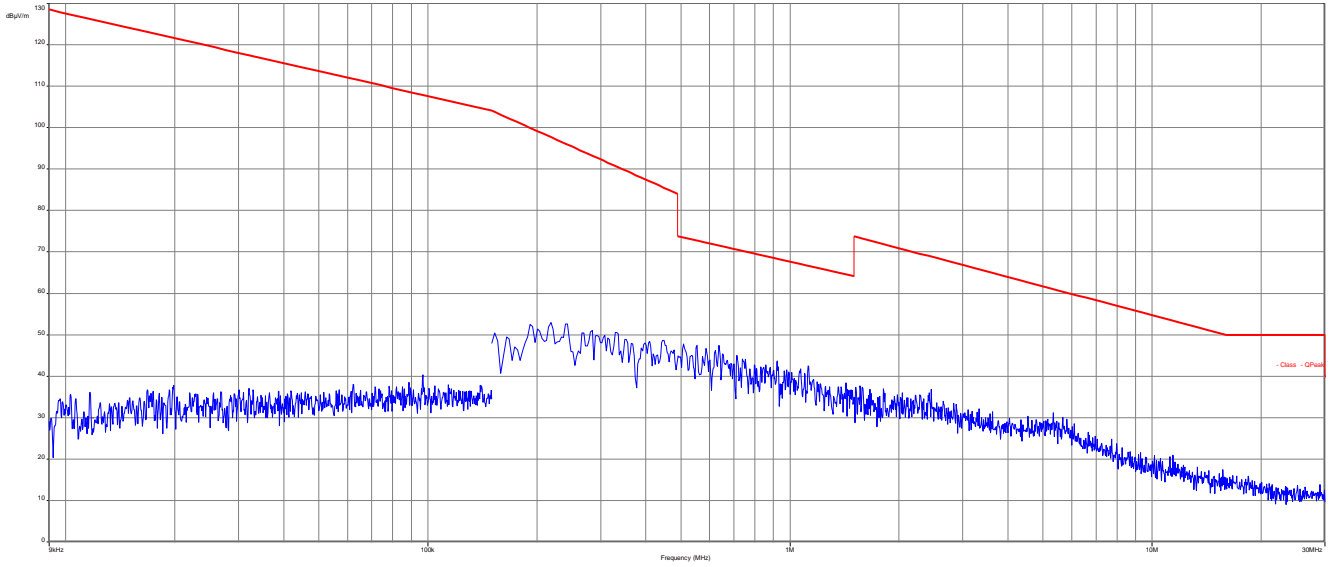
**Plot 3:** 9 kHz to 30 MHz, 5260 MHz



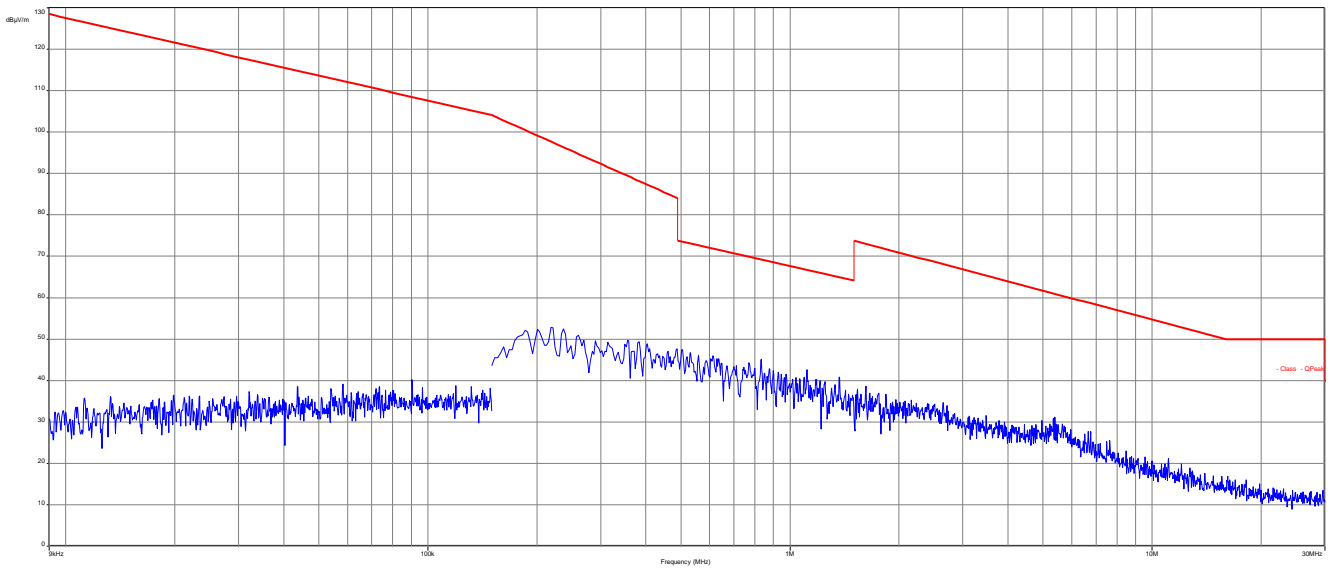
**Plot 4:** 9 kHz to 30 MHz, 5320 MHz



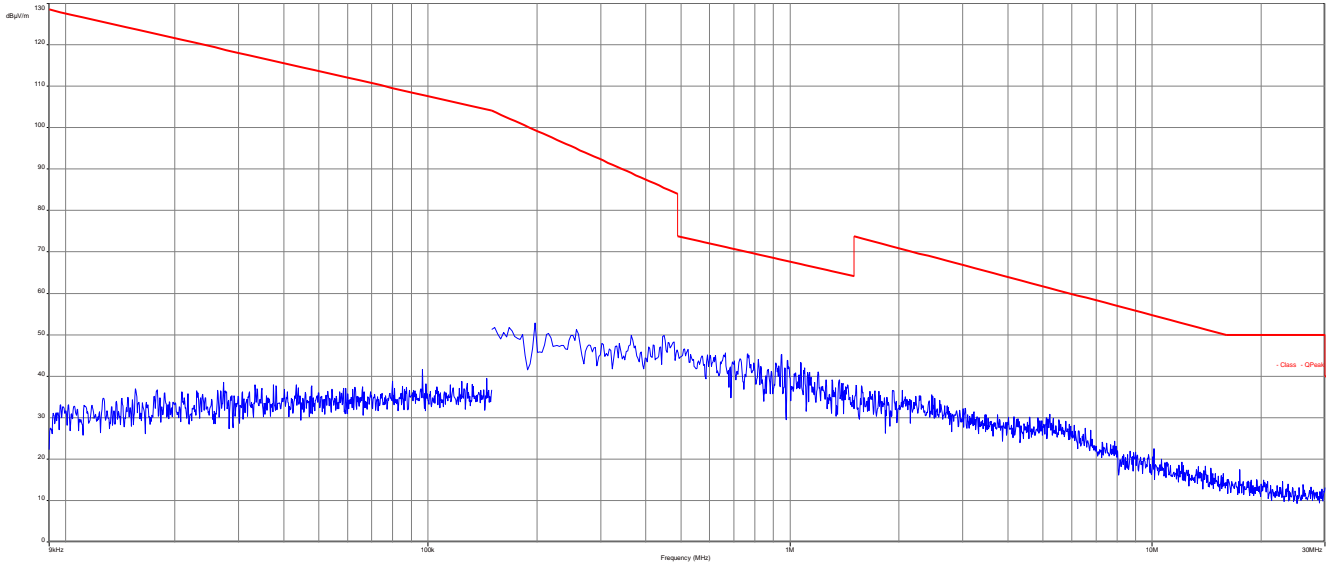
Plot 5: 9 kHz to 30 MHz, 5500 MHz



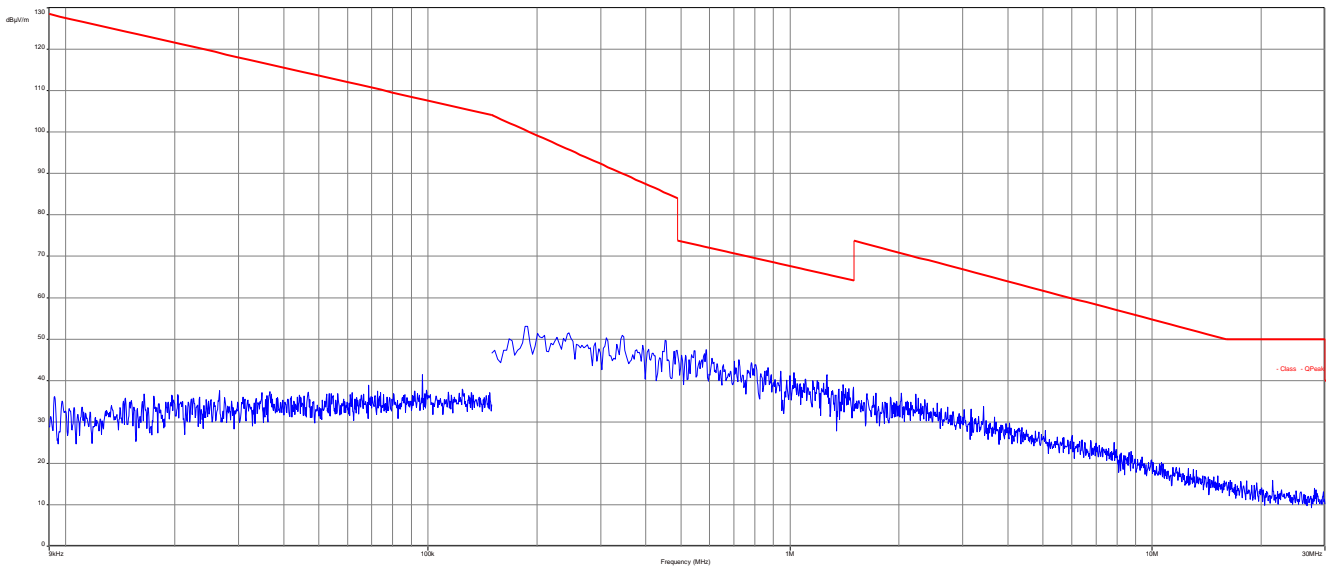
Plot 6: 9 kHz to 30 MHz, 5600 MHz



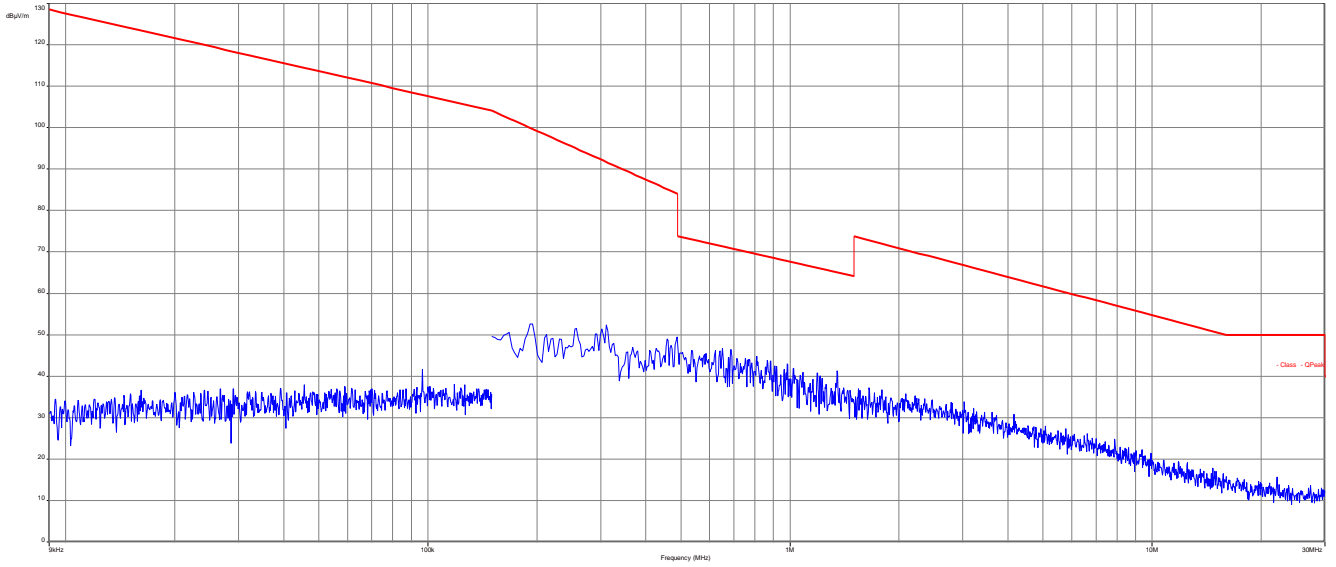
Plot 7: 9 kHz to 30 MHz, 5700 MHz



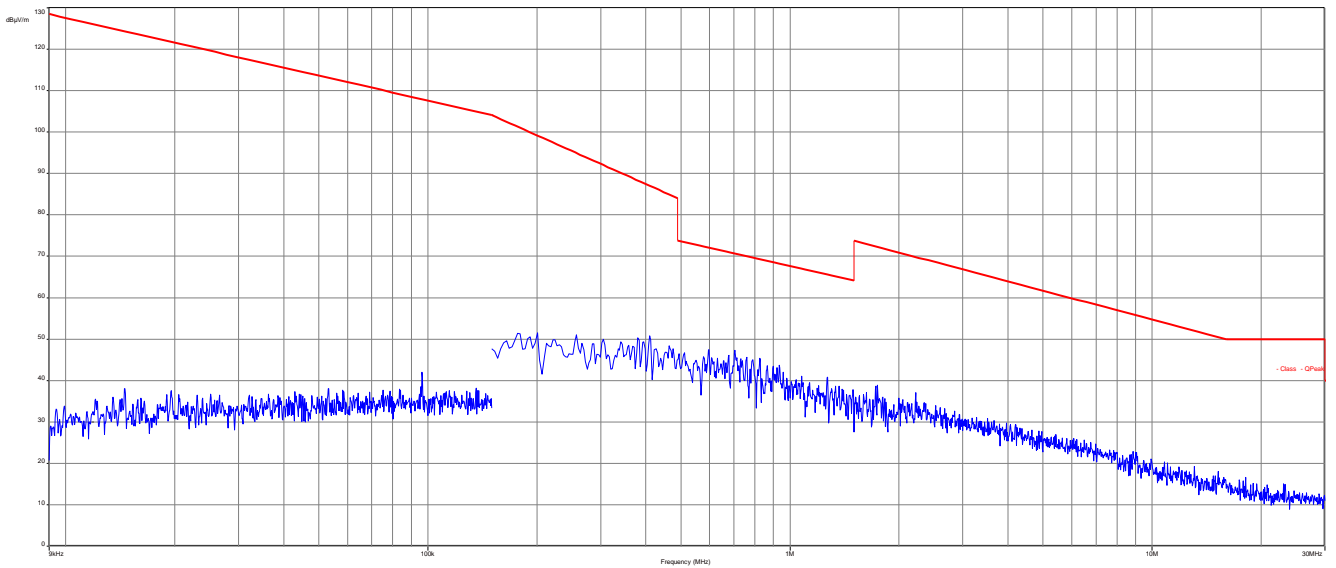
Plot 8: 9 kHz to 30 MHz, 5745 MHz



Plot 9: 9 kHz to 30 MHz, 5785 MHz



Plot 10: 9 kHz to 30 MHz, 5805 MHz



## 10.6 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

### Limits:

Spurious Emissions Conducted < 30 MHz		
Frequency (MHz)	Quasi-Peak (dB $\mu$ V/m)	Average (dB $\mu$ V/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

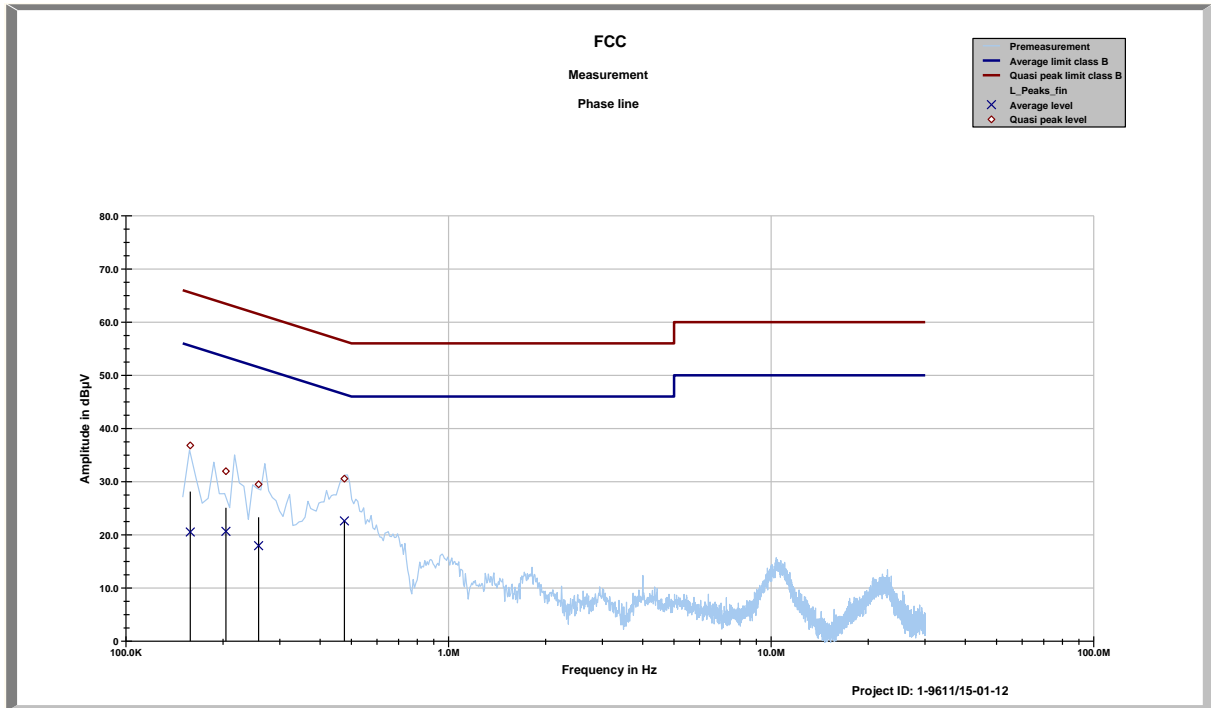
### Results:

Spurious Emissions Conducted < 30 MHz [dB $\mu$ V/m]		
F [MHz]	Detector	Level [dB $\mu$ V/m]
No peaks found		
Measurement uncertainty		
± 3 dB		

**Verdict:** **Complies**

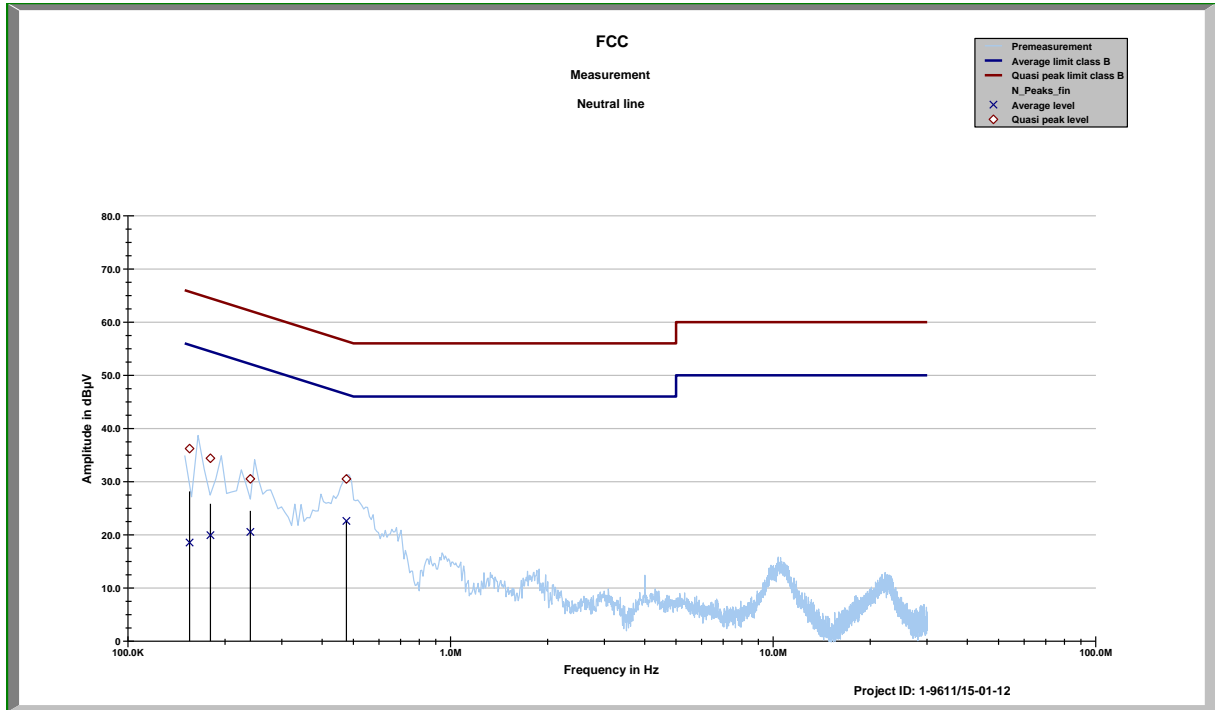
**Plots:**

**Plot 1:** 150 kHz to 30 MHz, phase line



Frequency MHz	Quasi peak level dBµV	Margin quasi peak dBµV	Average level dBµV	Margin average dBµV
0.15834	36.81	28.74	20.53	35.23
0.20414	31.97	31.47	20.66	33.80
0.25777	29.50	32.00	17.95	34.97
0.47553	30.56	25.85	22.62	24.08

Plot 2: 150 kHz to 30 MHz, neutral line



Frequency MHz	Quasi peak level dBµV	Margin quasi peak dBµV	Average level dBµV	Margin average dBµV
0.15532	36.22	29.49	18.55	37.30
0.18018	34.39	30.09	19.93	35.21
0.23959	30.52	31.59	20.54	32.90
0.47546	30.51	25.90	22.61	24.09

## 11 Observations

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



**Annex A Document history**

Version	Applied changes	Date of release
	Initial release	2015-06-30
A	Measurements for channels 149, 157 and 161 added	2015-07-30

**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

Back side of certificate



Deutsche Akkreditierungsstelle GmbH

Beliehene 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:

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- VoIP und DECT
- Akustik
- Funk einschließlich WLAN
- Short Range Devices (SRD)
- RFID
- WiFiMax und Richtfunk
- Mobilfunk (GSM / GPRS / UTRAN Performance)
- Elektromagnetische Verträglichkeit (EMV) einschließlich Automotive
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Deutsche Akkreditierungsstelle

In Auftrag der: CETECOM ICT Services GmbH  
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