

Exhibit 6: Measured Data Report

Measurement Test Report
On the
Motorola
802.11a @ 4.9GHz and 802.11b/g
WDE1100 MINI-PCI Card
Model: F2892A

FCC ID: AZ489FT7023

In Accordance With:
FCC CFR 47 Part 90
FCC CFR 47 Part 15.247

6.1 Tests required:

Section	Test Standard	Description	Pass / Fail
Tests required for 802.11a @ 4.9GHz			
6.2	EUT Description & Test Configuration for 802.11a @ 4.9GHz		
6.3	§90.1215 (a)	Peak Transmit Power	Pass
6.4	§90.1215 (a)	Peak Power Spectral Density	Pass
6.5	§90.210 (m)	Occupied Bandwidth: Emission Mask M	Pass
6.6	§90.210 (m)	Spurious Emissions at Antenna Terminal	Pass
6.7	§90.210 (m)	Radiated spurious Emissions	Pass
6.8	§2.1055 (a)(1); §90.213	Frequency Stability, Temperature Variations	Pass
6.9	§2.1055 (d)(1); §90.213	Frequency Stability; Voltage Variations	Pass
6.10	§15.109(a)	Radiated Emission	Pass
6.11	§15.107(a); §15.207(a)	Conducted Emissions on AC power line	Pass
Tests required for 802.11b/g			
6.12	EUT Description & Test Configuration for 802.11b/g		
6.13	§15.247(b)(3)	Peak output power	Pass
6.14	§15.247(a)(2)	6dB Bandwidth	Pass
6.15	§15.247(d)	Peak Power Spectral Density	Pass
6.16	§15.247(c)	Conducted Spurious Emissions	Pass
6.17	§15.247(c)	Radiated Spurious Emissions	Pass
6.18	§15.109(a)	Radiated Emission	Pass
6.19	§15.107(a); §15.207(a)	Conducted Emission at AC power line	Pass

6.2 EUT Description & Test Configuration for 802.11a @ 4.9GHz:6.2.1 Equipment used as local support for testing:

Table 6.2.1: EUT Support Equipment.

Description	Manufacturer	Model	Serial Number	Notes
Laptop	HP	Compaq nc8230	CNU5111RTB	
Laptop	Motorola	ML900	343CEN0366	Used for Frequency Stability tests only

No Remote support equipment was used during tests.

6.2.2 I/O port configuration during testing:

Table 6.2.2: EUT I/O Ports.

Port Type	Port Description	Connected From/to		Connector Type	Quantity	Cable Type	Cable Length
RF in/out	4.9GHz External Antenna	EUT	External Antenna	UFL	1	Termination	N/A
RF in/out	2.4GHz External Antenna	Not Used in Part 90 Tests		UFL	1	N/A	N/A

6.2.3 EUT operating mode During Tests:

EUT was transmitting at duty cycle of 99% at the Bandwidth stated in each test.
The Rate used for each Bandwidth was the highest rate.
For Frequency stability the EUT was placed into a CW mode.

6.2.4 802.11a @ 4.9GHz Transmitter description

Type of equipment						
Stand-alone (Equipment with or without its own control provisions)						
Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)						
V Plug-in card (Equipment intended for a variety of host systems)						
Intended use		Condition of use				
V fixed		Always at a distance more than 2 m from all people				
V mobile		Always at a distance more than 20 cm from all people				
portable		May operate at a distance closer than 20 cm to human body				
Equipment code		TNB				
Assigned frequency range		4940 – 4990 MHz				
Operating frequency range		4950 – 4980 MHz for 20MHz BW 4945 – 4985 MHz for 10MHz BW 4942.5 – 4987.5 MHz for 5MHz BW				
RF channel spacing		20, 10, 5 MHz				
Maximum rated output power		At transmitter 50 Ω RF output connector		126mW		
		Effective radiated power (for equipment with no RF connector)		N/A		
Is transmitter output power variable?		No				
		Continuous variable				
		V	Yes	V Stepped variable with step size		41%
				Minimum RF power		50.1mW
				Nominal RF power		100mW
Antenna connection						
Unique coupling		V	Standard connector		V Integral	
					V With temporary RF connector	
					V Without temporary RF connector	
Antenna/s technical characteristics						
Type	Manufacturer		Model number		Gain	
N/A	N/A		N/A		N/A	
Transmitter 99% power bandwidth		16.5MHz(20MHz), 8.25MHz(10MHz), 4.125MHz(5MHz)				
Transmitter aggregate data rate/s (Data rates According to 802.11a sec 17.3.2.2)		6, 9, 12, 18, 24, 36, 48, 54 Mbps for 20MHz BW 3, 4.5, 6, 9, 12, 18, 24, 27 Mbps for 10MHz BW 1.5, 2.25, 3, 4.5, 6, 9, 12, 13.5 Mbps for 5MHz BW				
Transmitter aggregate symbol (baud) rate/s (According to 802.11a sec 17.3.2.2)		6, 9, 6, 9, 6, 9, 8, 9 Msps respectively to data rate at 20MHz BW 3, 4.5, 3, 4.5, 3, 4.5, 4, 4.5 Msps respectively to data rate at 10MHz BW 1.5, 2.25, 1.5, 2.25, 1.5, 2.25, 2, 2.25 Msps respectively to data rate at 5MHz BW				
Type of modulation		48 subcarriers modulated with BPSK,/QPSK /16-QAM/ 64-QAM + 4 pilot sub carriers modulated with BPSK				
Type of multiplexing		TDD OFDM				
Modulating test signal (base band)		PN9				
Maximum transmitter duty cycle in normal use		60%	Tx ON time	Period		
1.5Mbps @ 5MHz			21.936mSec	36.56mSec		
13.5Mbps @ 5MHz			2.512mSec	4.186mSec		
3Mbps @ 10MHz			10.968mSec	18.28mSec		
27Mbps @ 10MHz			1.256mSec	2.093mSec		
6Mbps @ 20MHz			5.484mSec	9.14mSec		
54Mbps @ 20MHz			628uSec	1.046mSec		
Transmitter duty cycle supplied for test		99%	Tx ON time	Period		
1.5Mbps @ 5MHz			12.42mSec	12.55mSec		
13.5Mbps @ 5MHz			1.472mSec	1.492mSec		
3Mbps @ 10MHz			6.217mSec	6.28mSec		
27Mbps @ 10MHz			736uSec	746uSec		
6Mbps @ 20MHz			3.1mSec	3.14mSec		
54Mbps @ 20MHz			368uSec	373uSec		
Transmitter power source						
Battery		Nominal rated voltage	VDC	Battery type	Ni- Cd, Lithium, Lead- Acid, other	
V	DC	Nominal rated voltage	3.3 VDC ± 10%			
	AC mains	Nominal rated voltage	VAC	Frequency	Hz	
Is there common power source for transmitter and receiver		V yes no				
Emission designator		20M0X1D, 10M0X1D, 5M00X1D				

6.3 Peak Transmit Power - Pursuant to 47 CFR §90.1215 (a)6.3.1 Test Procedure:

- A laptop was connected to the EUT to control the RF output power and Frequency.
- The EUT 4.9GHz RF Output Connector was connected through Calibrated Attenuators to a Power Meter with a sensor capable of measuring the entire bandwidth of the signal.
- The EUT power was adjusted at the maximum and the minimum output power level.
- Procedure was repeated for the 5MHz, 10MHz and 20MHz bandwidths at lower, mid and upper channels and at highest data rate.
- Transmitter Frequencies for 802.11a @ 4.9GHz are according to Channel BW and will be referred as low, mid and high in 802.11a @ 4.9GHz section.

6.3.2 Results:

Channel Bandwidth [MHz]	Data Rate [MHz]	Transmit Frequency [MHz]	Peak Power [dBm]	Power Peak Limit [dBm]
High Output Power Level				
5	13.5	4942.5	20.98	27
		4962.5	20.80	27
		4987.5	20.97	27
10	27	4945.0	20.75	30
		4965.0	20.78	30
		4985.0	20.84	30
20	54	4950.0	20.80	33
		4965.0	20.84	33
		4980.0	20.90	33
Low Output Power Level				
5	13.5	4942.5	17.76	27
		4962.5	17.45	27
		4987.5	17.80	27
10	27	4945.0	17.50	30
		4965.0	17.65	30
		4985.0	17.49	30
20	54	4950.0	17.66	33
		4965.0	17.55	33
		4980.0	17.70	33

6.4 Peak Power Spectral Density - Pursuant to 47 CFR §90.1215 (a)

6.4.1 Test Procedure:

- A laptop was connected to the EUT to control the RF output power and Frequency.
- The EUT 4.9GHz RF Output Connector was connected through Calibrated Attenuators to a Spectrum Analyzer (E4440A).
- The Spectrum Analyzer was to RBW = 1MHz, VBW = 3MHz, then the highest amplitude was taken.
- The EUT power was adjusted at the maximum output power level.
- Procedure was repeated for the 5MHz, 10MHz and 20MHz bandwidths at lower, mid and upper channels and at highest data rate.

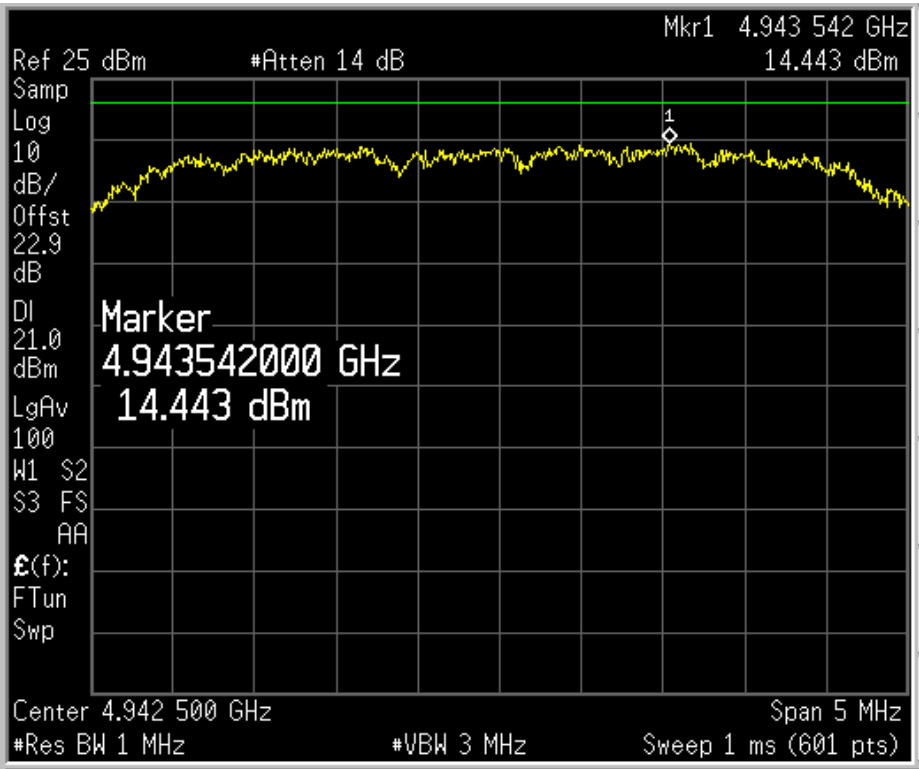
6.4.2 Results:

- Test Results are provided in Table 6.4.1 and associated plots.

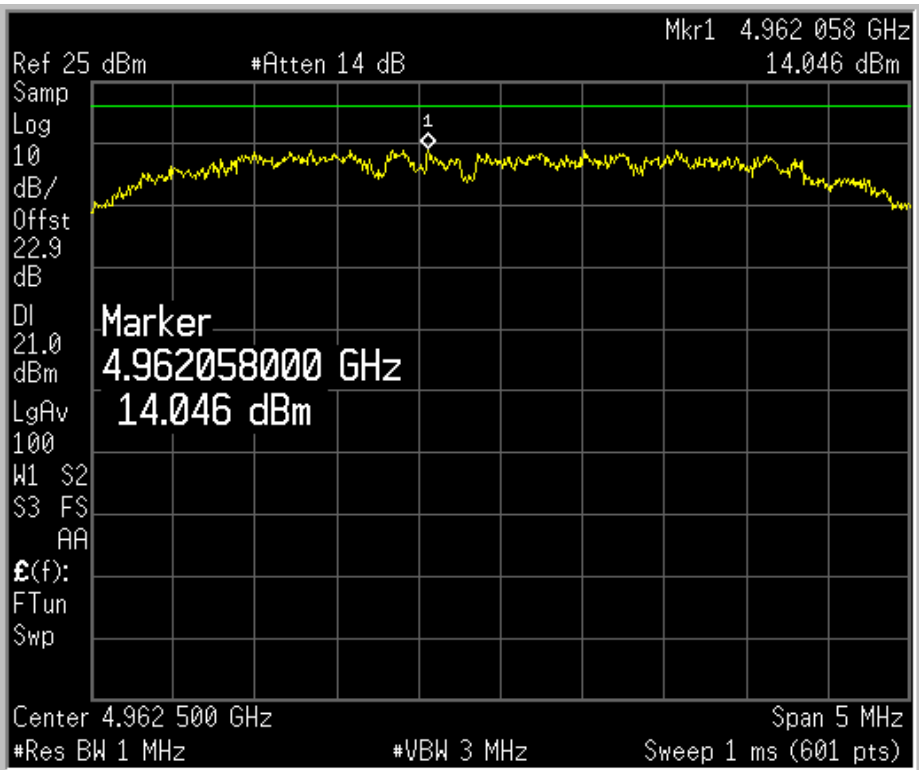
Table 6.4.1: spurious emission test results.

Plot #	Channel Bandwidth [MHz]	Data Rate [MHz]	Frequency [MHz]	Peak Power Spectral Density [dBm]	Limit [dBm]	Margin [dB]
6.4.1	5	13.5	4942.5	14.443	21	6.557
6.4.2			4962.5	14.046	21	6.954
6.4.3			4987.5	14.641	21	6.359
6.4.4	10	27	4945.0	11.585	21	9.415
6.4.5			4965.0	11.774	21	9.226
6.4.6			4985.0	11.352	21	9.648
6.4.7	20	54	4950.0	8.493	21	12.507
6.4.8			4965.0	8.438	21	12.562
6.4.9			4970.0	8.430	21	12.570

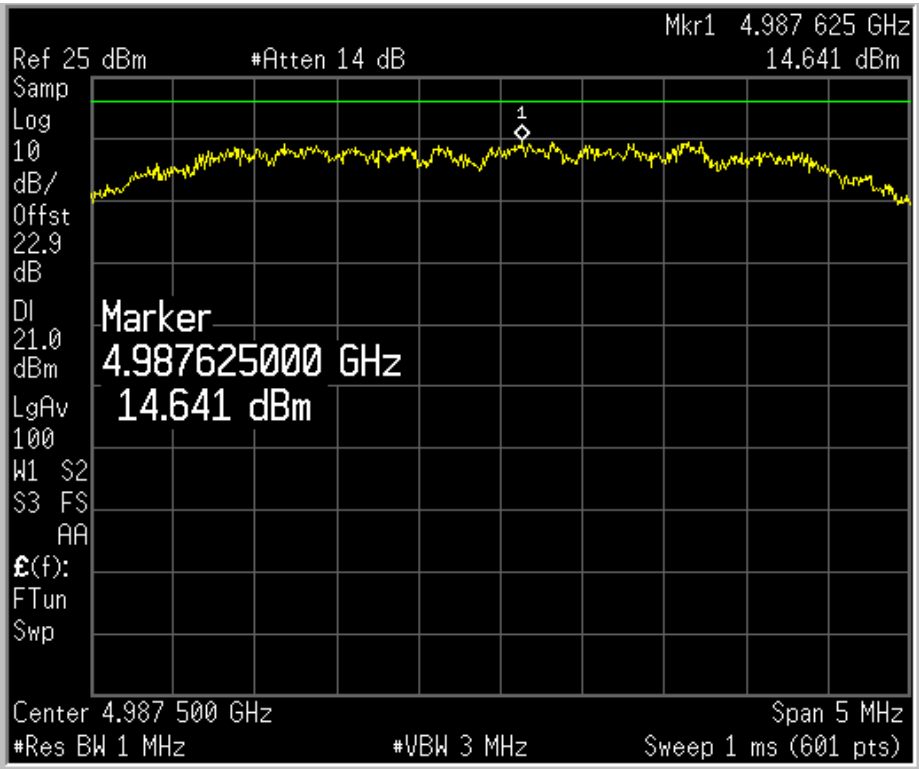
Plot 6.4.1: Peak Power Spectral Density, at low carrier frequency, OBW 5 MHz.



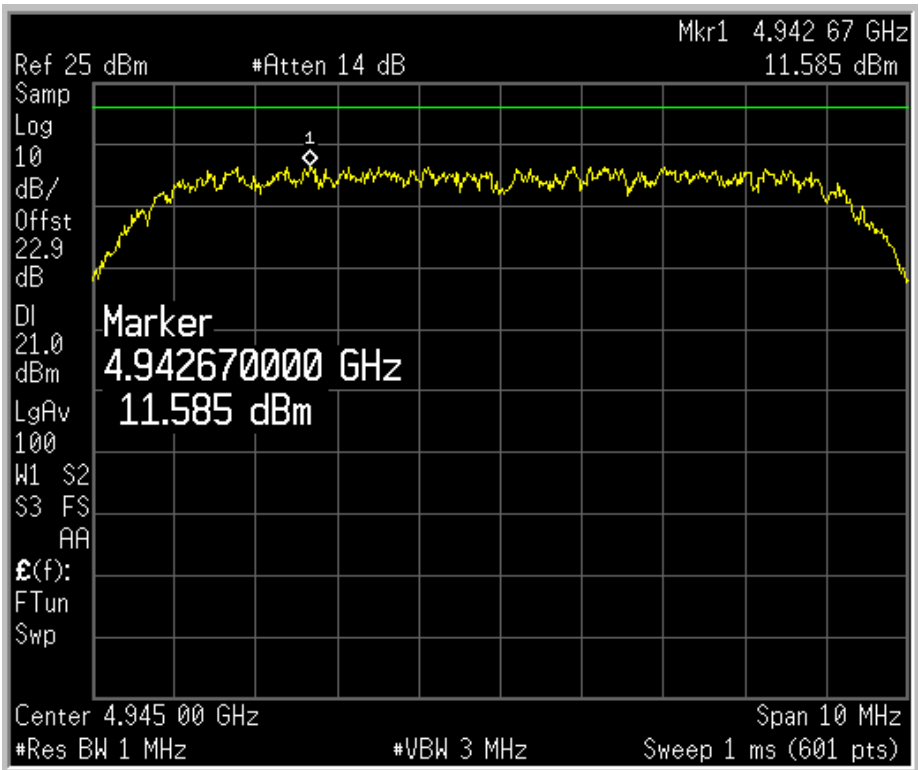
Plot 6.4.2: Peak Power Spectral Density, at mid carrier frequency, OBW 5 MHz.



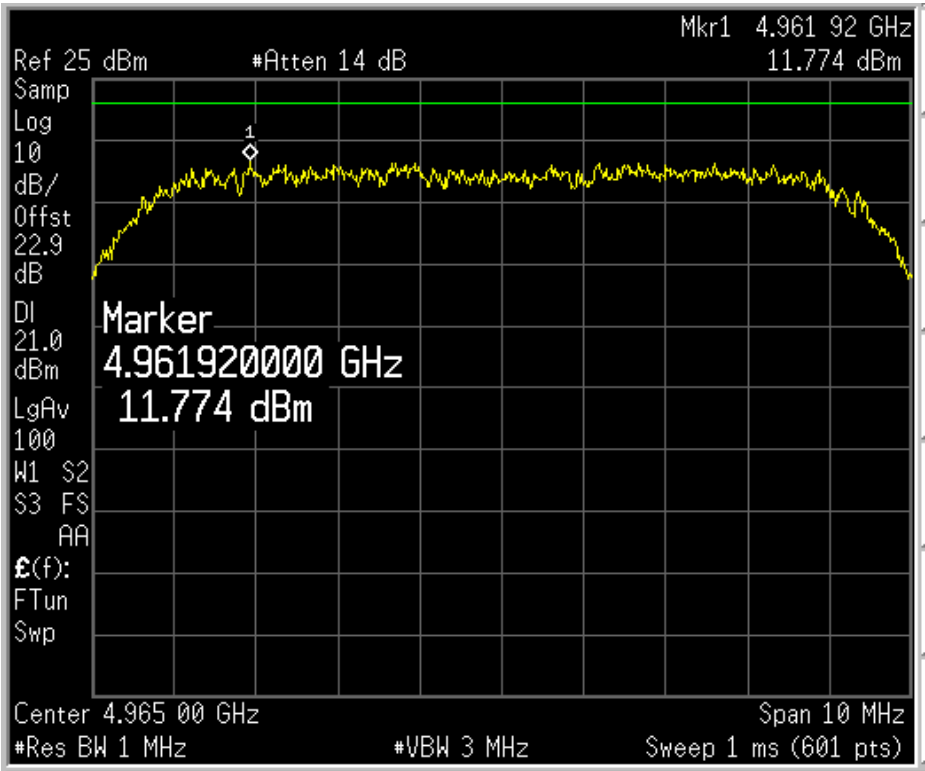
Plot 6.4.3: Peak Power Spectral Density, at high carrier frequency, OBW 5 MHz.



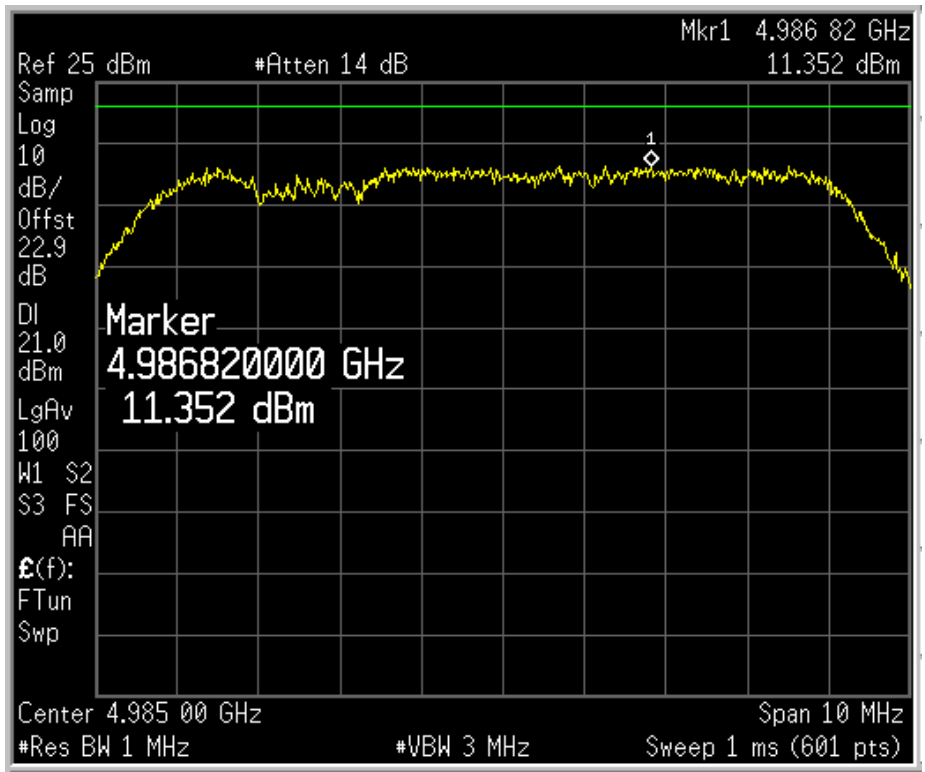
Plot 6.4.4: Peak Power Spectral Density, at low carrier frequency, OBW 10 MHz.



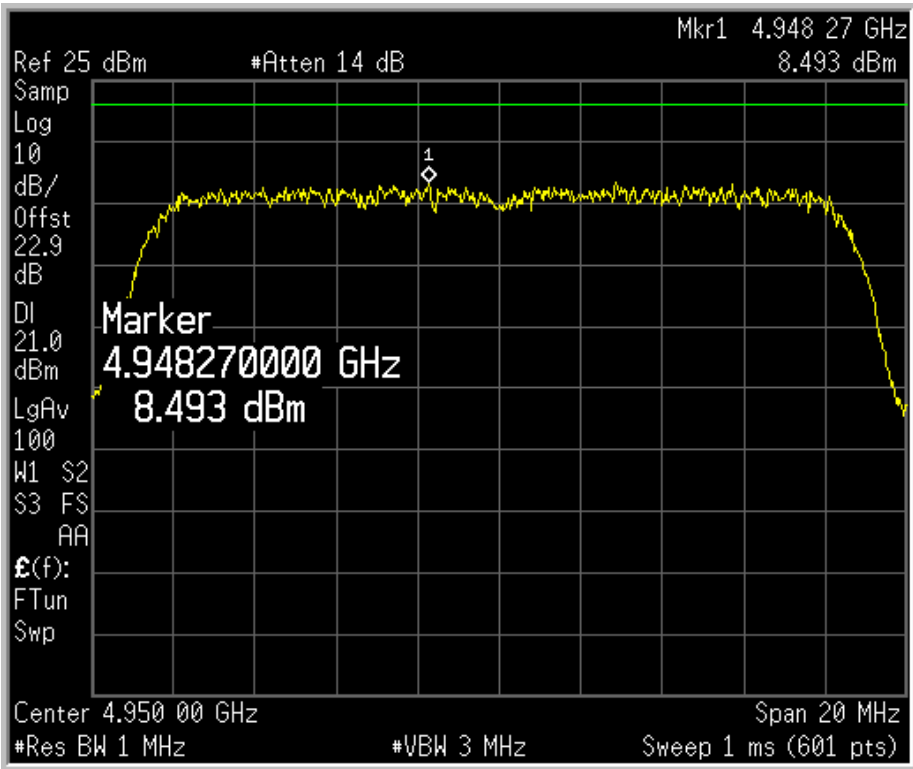
Plot 6.4.5: Peak Power Spectral Density, at mid carrier frequency, OBW 10 MHz.



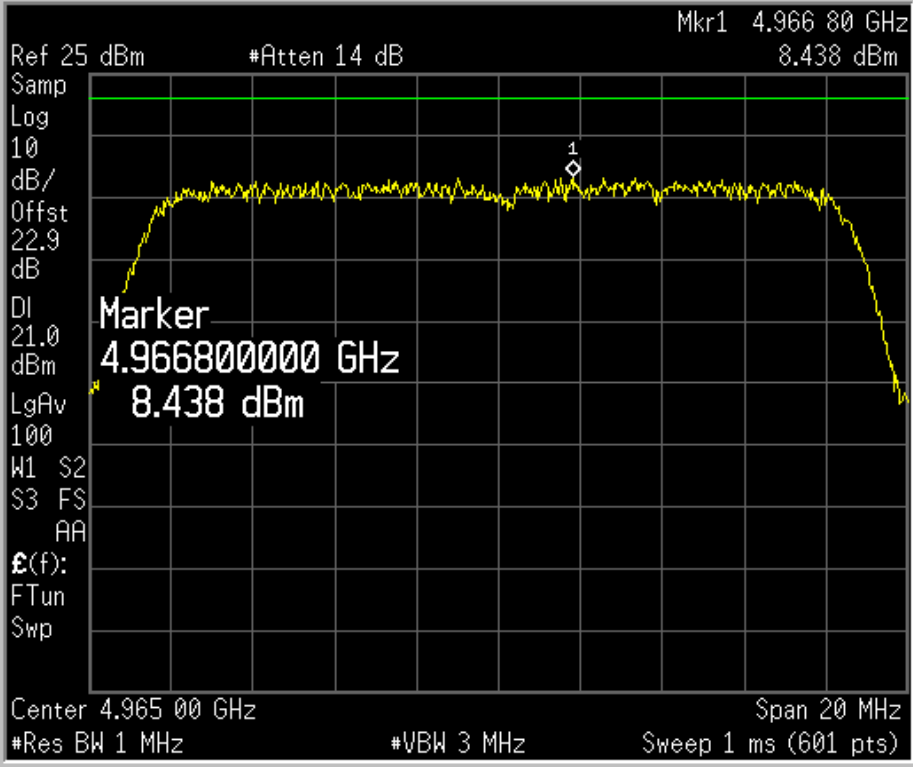
Plot 6.4.6: Peak Power Spectral Density, at high carrier frequency, OBW 10 MHz.



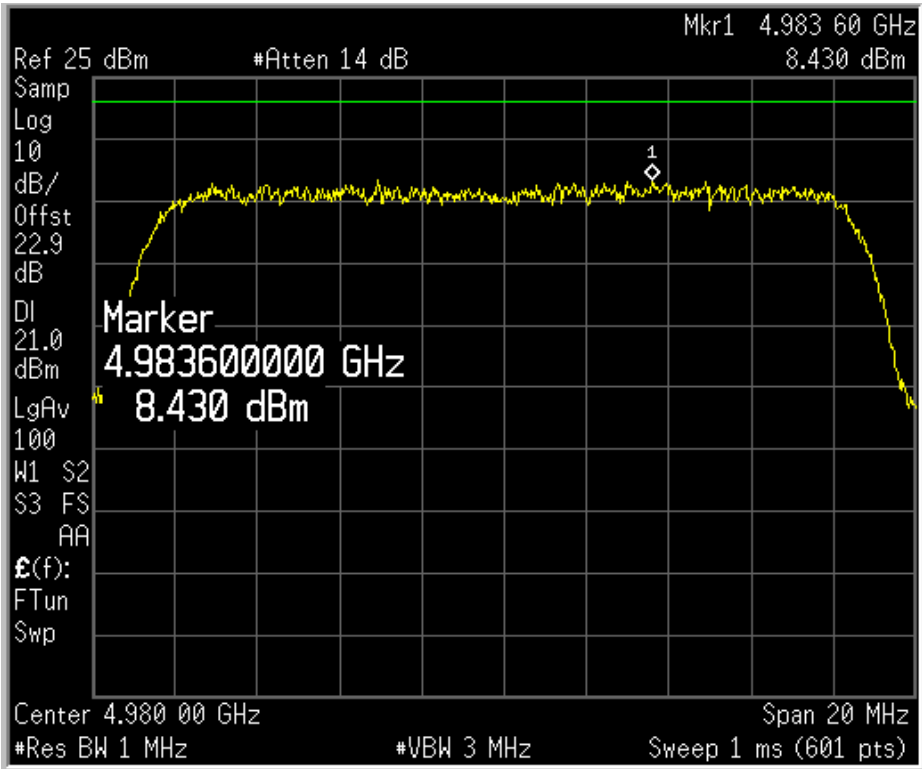
Plot 6.4.7: Peak Power Spectral Density, at low carrier frequency, OBW 20 MHz.



Plot 6.4.8: Peak Power Spectral Density, at mid carrier frequency, OBW 20 MHz.



Plot 6.4.9: Peak Power Spectral Density, at high carrier frequency, OBW 20 MHz.



6.5 Occupied Bandwidth; Emission masks - Pursuant to 47 CFR §90.210 (m)

6.5.1 Test Procedure:

- A laptop was connected to the EUT to control the RF output power and Frequency.
- The EUT 4.9GHz RF Output Connector was connected through Calibrated Attenuators to a Spectrum Analyzer (E4440A).
- The Spectrum Analyzer Resolution Bandwidth was set to at least one percent of the Occupied Bandwidth.
- The EUT power was adjusted at the maximum output power level.
- Procedure was repeated for the 5MHz, 10MHz and 20MHz bandwidths at lower, mid and upper channels and at highest data rate.

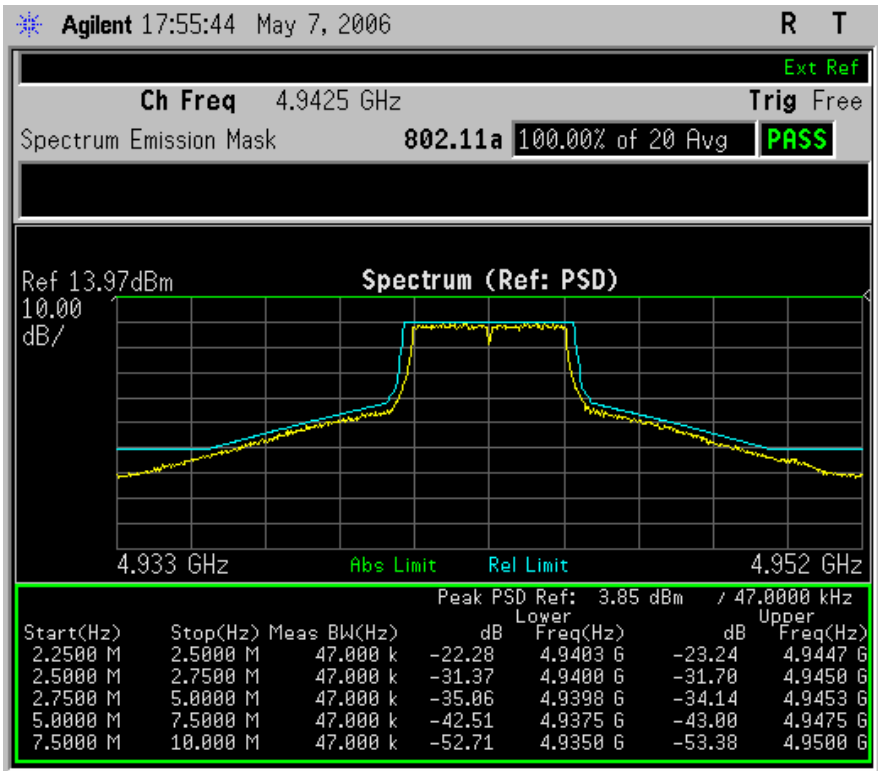
6.5.2 Results:

- Test Results are provided in Table 6.5.1 and associated plots.

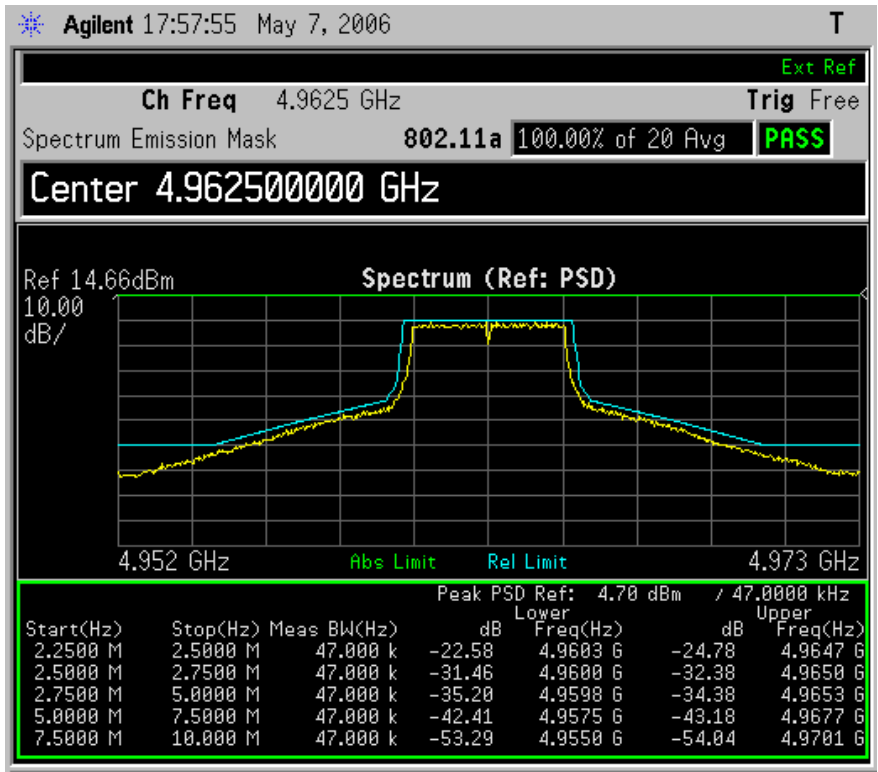
Table 6.5.1: Emission masks test results.

Plot #	Channel Bandwidth [MHz]	Data Rate [MHz]	Frequency [MHz]	Limit	Pass/fail
6.5.1	5	13.5	4942.5	§90.210 (m)	Pass
6.5.2			4962.5	§90.210 (m)	Pass
6.5.3			4987.5	§90.210 (m)	Pass
6.5.4	10	27	4945.0	§90.210 (m)	Pass
6.5.5			4965.0	§90.210 (m)	Pass
6.5.6			4985.0	§90.210 (m)	Pass
6.5.7	20	54	4950.0	§90.210 (m)	Pass
6.5.8			4965.0	§90.210 (m)	Pass
6.5.9			4970.0	§90.210 (m)	Pass

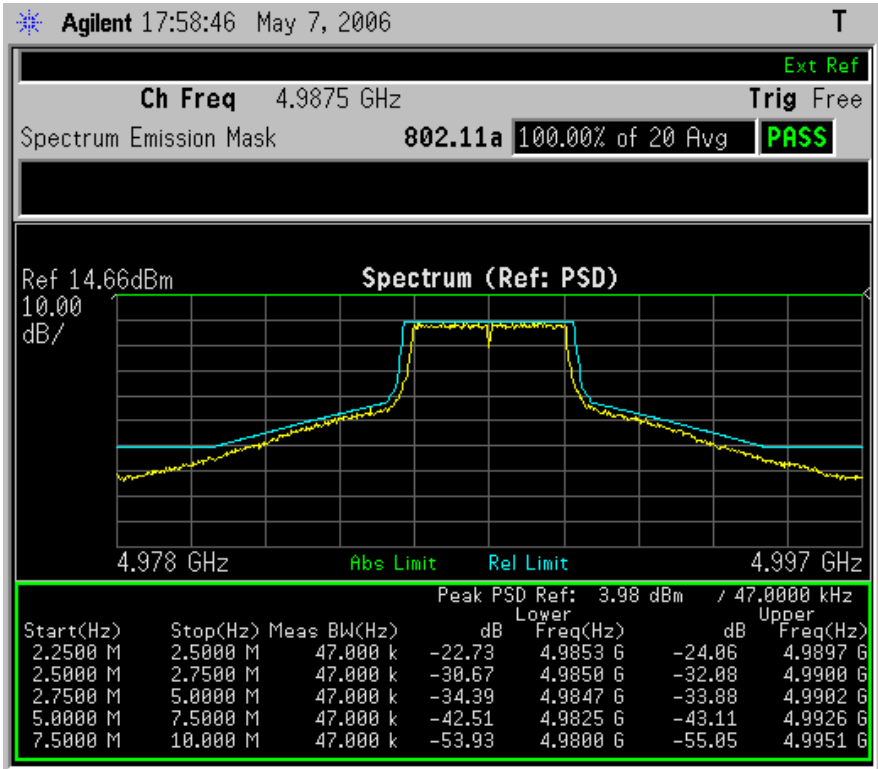
Plot 6.5.1: Emission Mask M, OBW 5MHz, lower Frequency



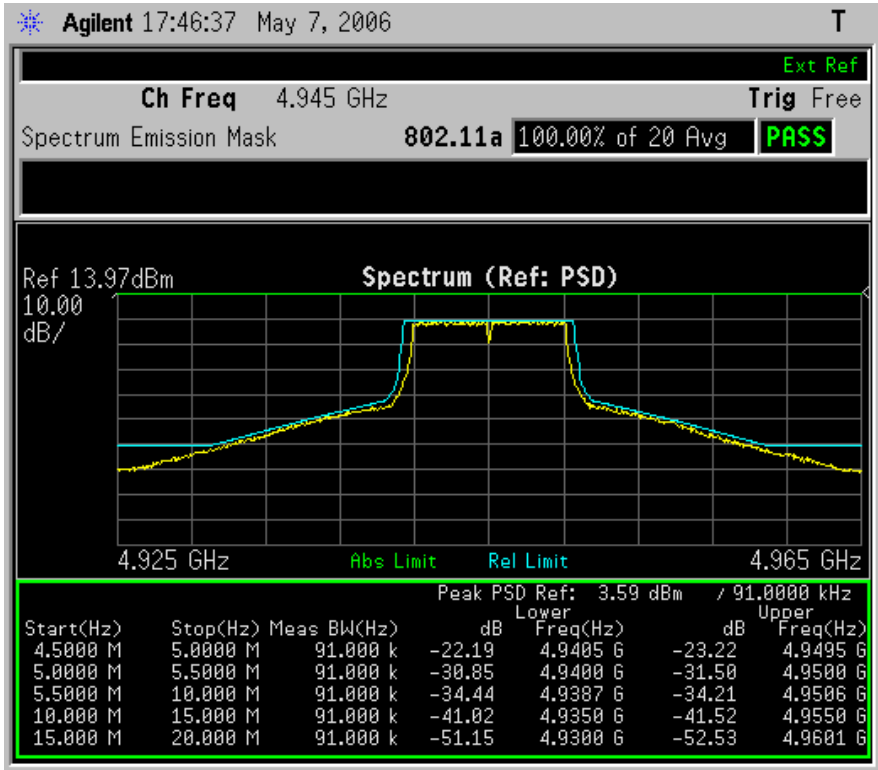
Plot 6.5.2: Emission Mask M, OBW 5MHz, Mid Frequency



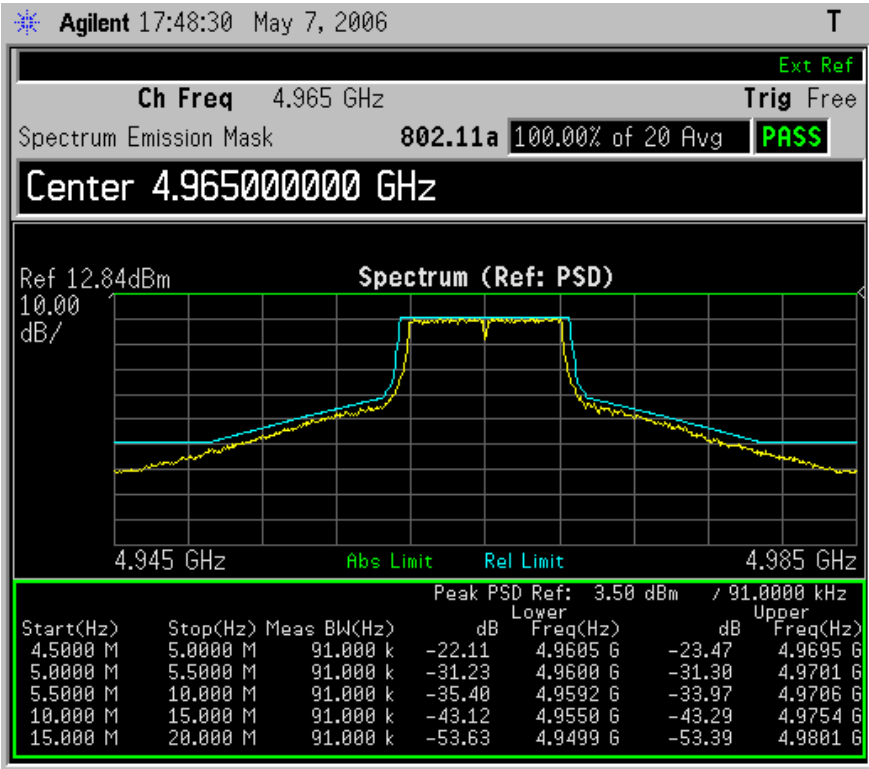
Plot 6.5.3: Emission Mask M, OBW 5MHz, Upper Frequency



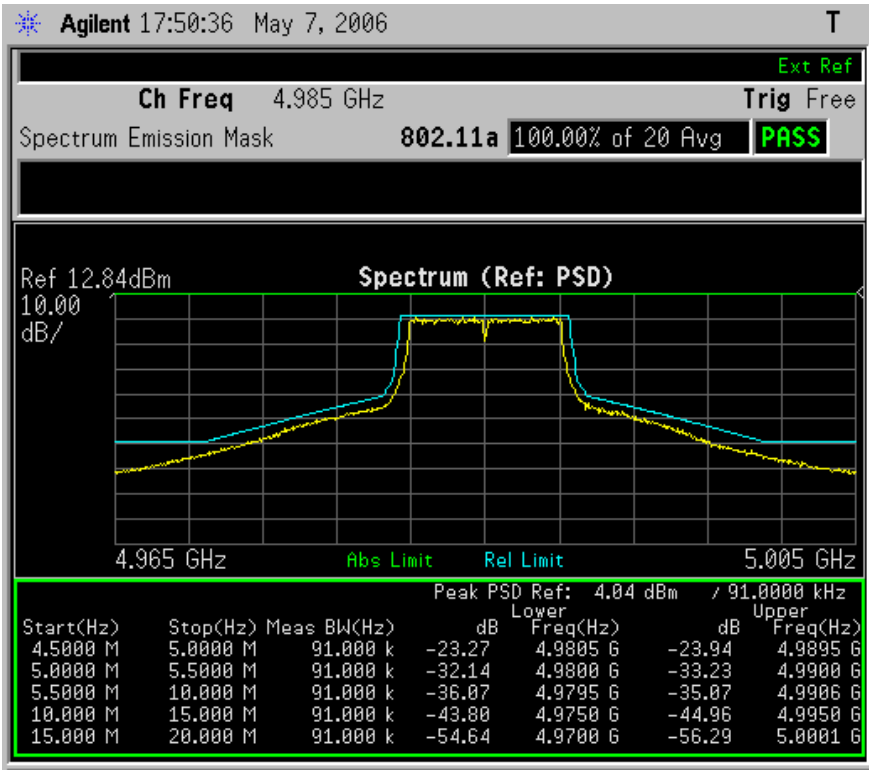
Plot 6.5.4: Emission Mask M, OBW 10MHz, lower Frequency



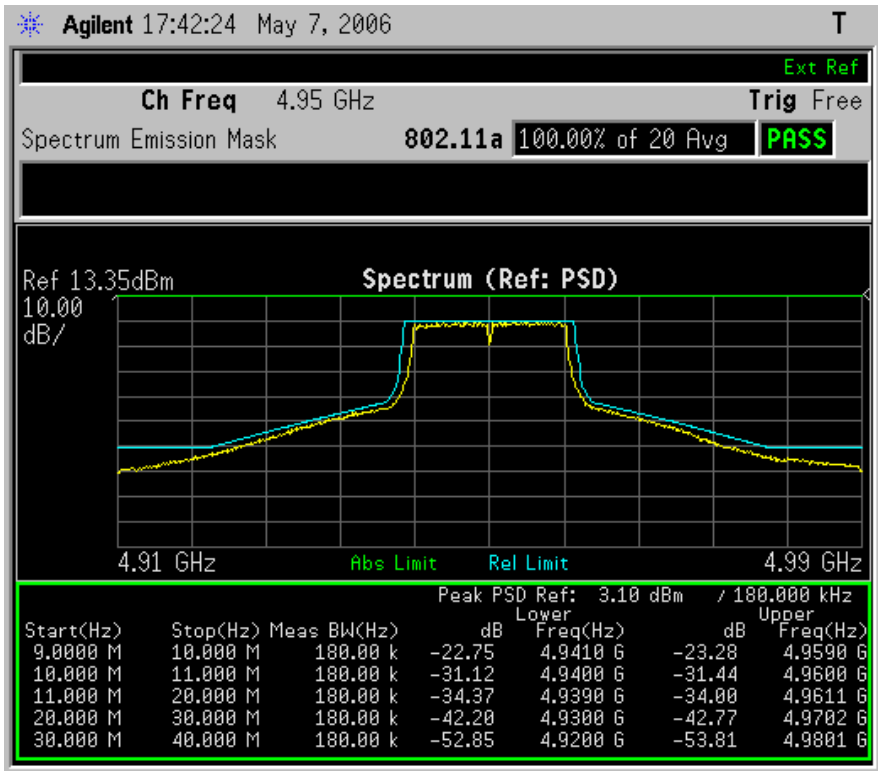
Plot 6.5.5: Emission Mask M, OBW 10MHz, Mid Frequency



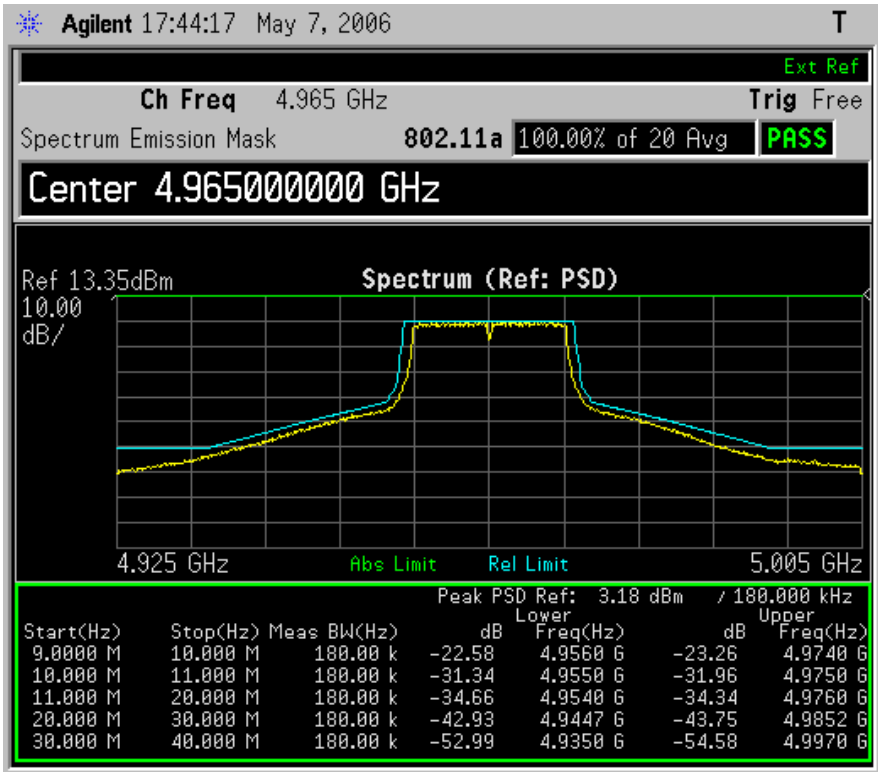
Plot 6.5.6: Emission Mask M, OBW 10MHz, Upper Frequency



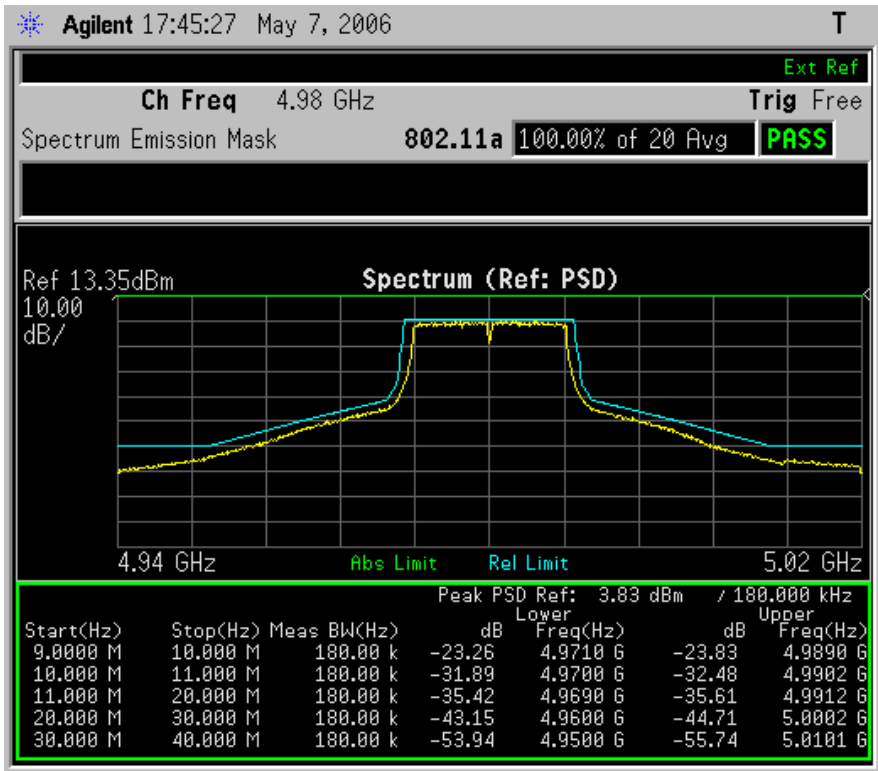
Plot 6.5.7: Emission Mask M, OBW 20MHz, lower Frequency



Plot 6.5.8: Emission Mask M, OBW 20MHz, Mid Frequency



Plot 6.5.9: Emission Mask M, OBW 20MHz, upper Frequency



6.6 Spurious Emissions at Antenna Terminals - Pursuant to 47 CFR §90.210 (m)6.6.1 Test Procedure:

- A laptop was connected to the EUT to control the RF output power and Frequency.
- The EUT 4.9GHz RF Output Connector was connected through Calibrated Attenuators to a Spectrum Analyzer.
- The Spectrum Analyzer RBW and VBW were set according to Frequency Range and Max Hold was activated.
- The EUT power was adjusted at the maximum output power level.
- 5MHz bandwidth, which has the worst case in band peak power spectral density, was chosen for this test.
- Procedure was repeated at lower, mid and upper channels and at highest data rate.
- All bandwidths are shown at frequency range 4900-5030[MHz].

6.6.2 Spurious Emission Limit:

- Specification test limit for maximum output power is given according to:

$$\text{Limit} = 21\text{dBm} - (55 + 10\log(0.126) [\text{dB}]) = 21\text{dBm} - 46\text{dB}$$

$$\text{Limit} = -25\text{dBm}^*$$

* Spurious emission limit do not apply to the in band emission within ± 250 % of the authorized bandwidth from the carrier;

In band Emission within ± 250 % is presented in Emission Mask test.

6.6.3 Results:

- Test Results are provided in Table 6.6.1 and associated plots.

Table 6.6.1: Spurious emission test results.

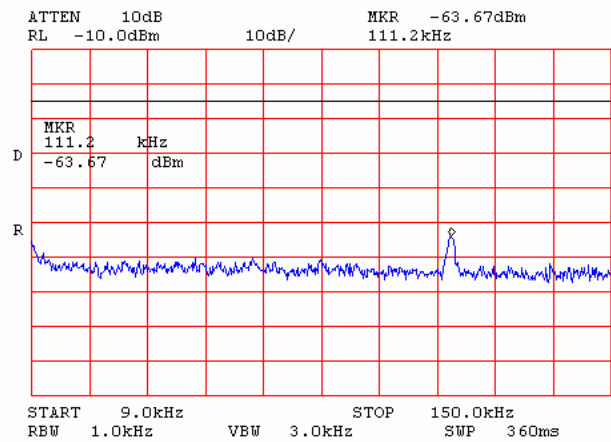
Frequency, MHz	SA reading, dBm	Attenuator, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
Low carrier frequency									
9885	-35.67	Included	Included	1000	-35.67	56.67	46.00	10.67	Pass
14827.5	-37.02	Included	Included	100	-37.02	58.02	46.00	12.02	Pass
19770	-42.50	Included	Included	1000	-42.50	63.50	46.00	17.50	Pass
Mid carrier frequency									
9925	-36.83	Included	Included	1000	-36.83	57.83	46	11.83	Pass
14887.5	-38.39	Included	Included	100	-38.39	59.39	46	13.39	Pass
19850	-41.83	Included	Included	1000	-41.83	62.83	46	16.83	Pass
High carrier frequency									
9975	-37.00	Included	Included	1000	-37.00	58.00	46	12	Pass
14962.5	-39.12	Included	Included	100	-39.12	60.12	46	14.12	Pass
19950	-40.33	Included	Included	1000	-40.33	61.33	46	15.33	Pass

*- Margin = Spurious emission – specification limit.

Table 6.6.2: Spurious emission plots summary.

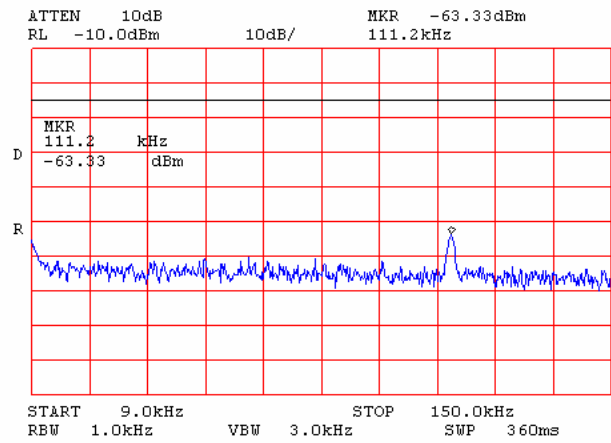
Plot #	Frequency [MHz]	Channel Bandwidth [MHz]	Freq Sweep	Pass/Fail
6.6.1÷3	Low, mid, high	5	9 – 150 [KHz]	Pass
6.6.4÷6	Low, mid, high	5	0.15 - 30 [MHz]	Pass
6.6.7÷9	Low, mid, high	5	30 – 1000 [MHz]	Pass
6.6.10÷12	Low, mid, high	5	1000 – 4900 [MHz]	Pass
6.6.13÷15	Low, mid, high	5	4900[MHz] – in band	Pass
6.6.16÷18	Low, mid, high	10	4900[MHz] – in band	Pass
6.6.19÷21	Low, mid, high	20	4900[MHz] – in band	Pass
6.6.22÷24	Low, mid, high	5	in band - 5030[MHz]	Pass
6.6.25÷27	Low, mid, high	10	in band - 5030[MHz]	Pass
6.6.28÷30	Low, mid, high	20	in band - 5030[MHz]	Pass
6.6.31÷33	Low, mid, high	5	5030 - 40000[MHz]	Pass
6.6.34÷36	Low, mid, high	5	2 nd Harmonic	Pass
6.6.37÷39	Low, mid, high	5	3 rd Harmonic	Pass
6.6.40÷42	Low, mid, high	5	4 th Harmonic	Pass
6.6.43÷45	Low, mid, high	5	5 th Harmonic	Pass
6.6.46÷48	Low, mid, high	5	6 th Harmonic	Pass
6.6.49÷51	Low, mid, high	5	7 th Harmonic	Pass

Plot 6.6.1: Tx Spurious emission measurements in 9 - 150 KHz range at low carrier frequency, OBW 5 MHz



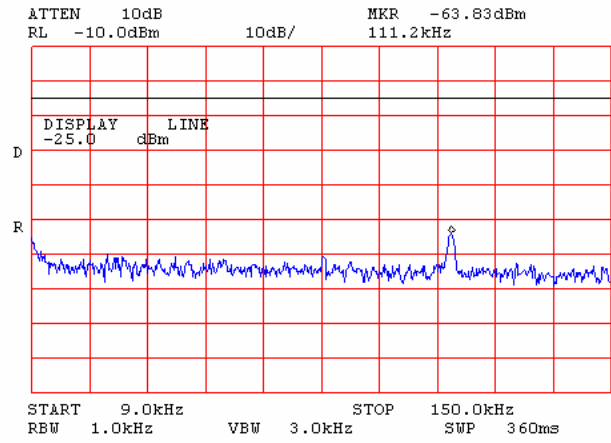
Note: 110 kHz – ambient noise

Plot 6.6.2: Tx Spurious emission measurements in 9 - 150 KHz range at mid carrier frequency, OBW 5 MHz



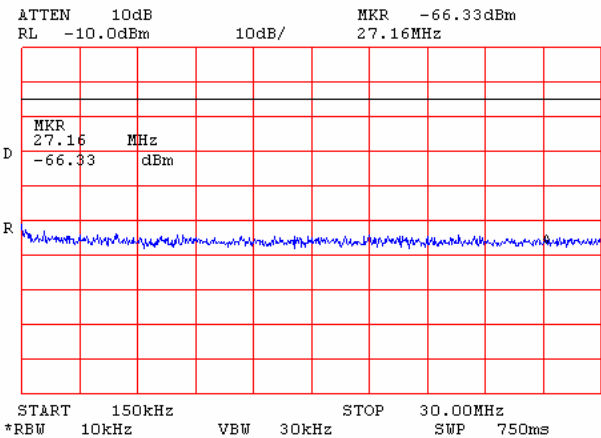
Note: 110 kHz – ambient noise

Plot 6.6.3: Tx Spurious emission measurements in 9 - 150 KHz range at high carrier frequency, OBW 5 MHz

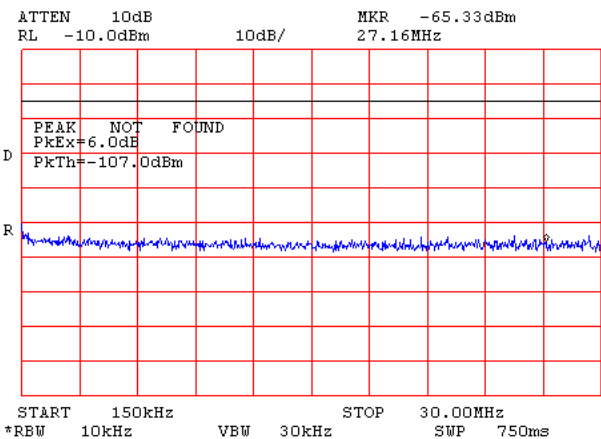


Note: 110 kHz – ambient noise

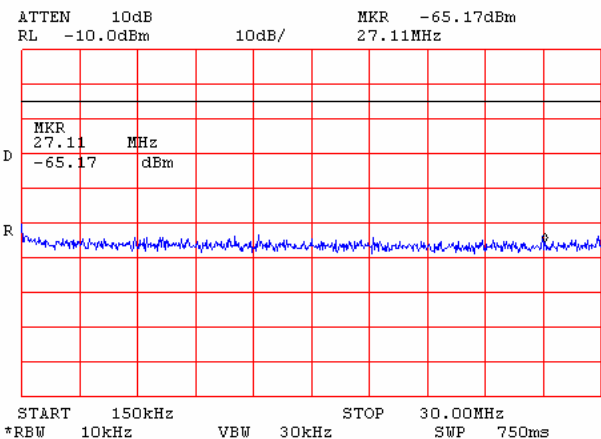
Plot 6.6.4: Tx Spurious emission measurements in 0.15 - 30.0 MHz range at low carrier frequency, OBW 5 MHz



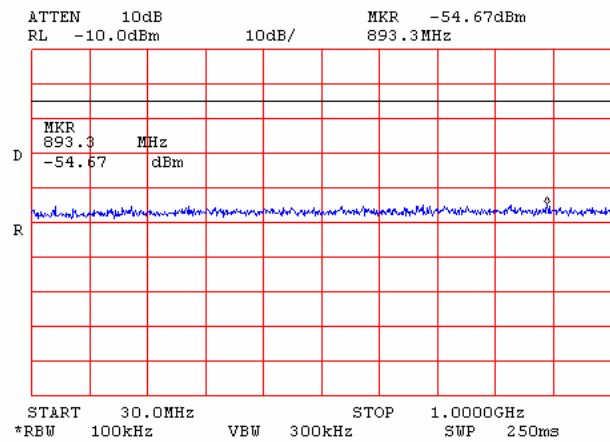
Plot 6.6.5: Tx Spurious emission measurements in 0.15 - 30.0 MHz range at mid carrier frequency, OBW 5 MHz



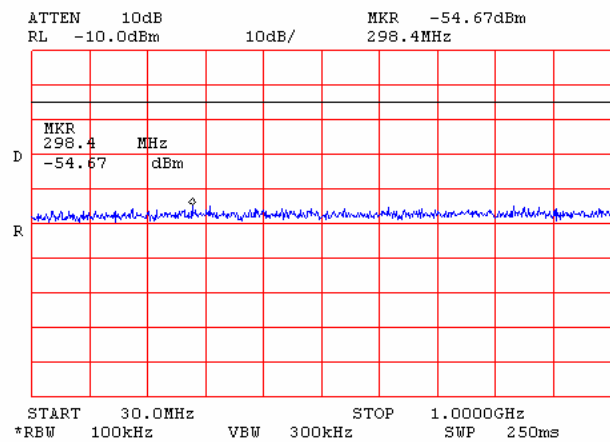
Plot 6.6.6: Tx Spurious emission measurements in 0.15 – 30.0 MHz range at high carrier frequency, OBW 5 MHz



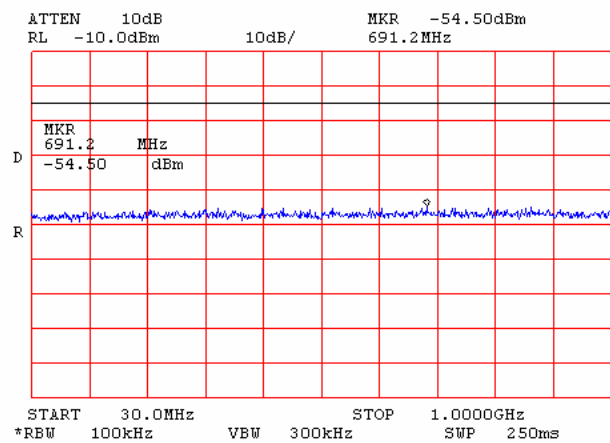
Plot 6.6.7: Tx Spurious emission measurements in 30.0 - 1000 MHz range at low carrier frequency, OBW 5 MHz



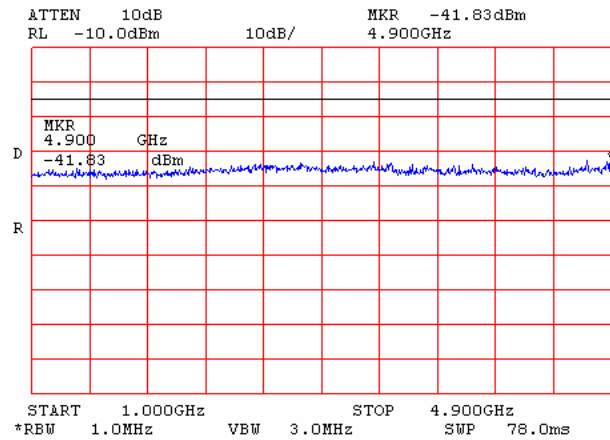
Plot 6.6.8: Tx Spurious emission measurements in 30.0 - 1000 MHz range at mid carrier frequency, OBW 5 MHz



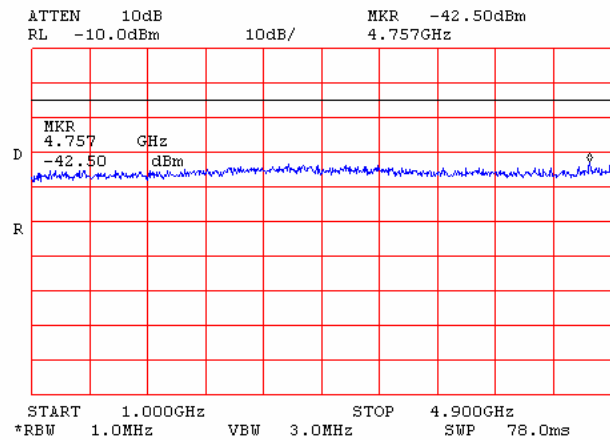
Plot 6.6.9: Tx Spurious emission measurements in 30.0 - 1000 MHz range at high carrier frequency, OBW 5 MHz



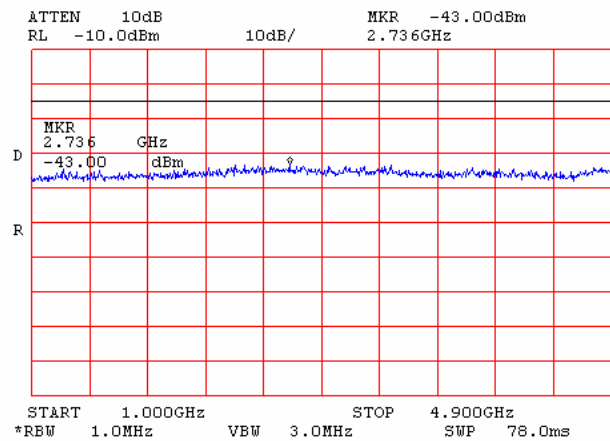
Plot 6.6.10: Tx Spurious emission measurements in 1000 - 4900 MHz range at low carrier frequency, OBW 5 MHz



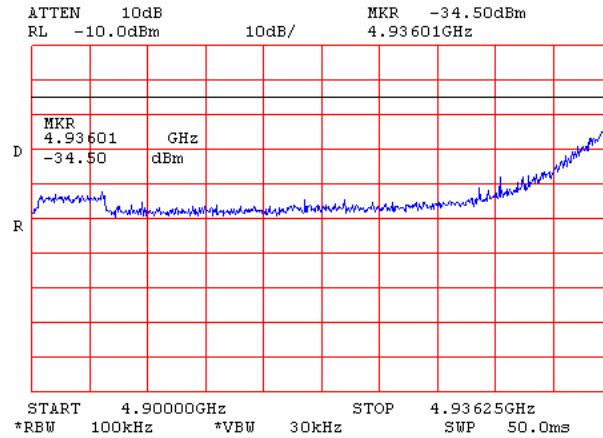
Plot 6.6.11: Tx Spurious emission measurements in 1000 - 4900 MHz range at mid carrier frequency, OBW 5 MHz



Plot 6.6.12: Tx Spurious emission measurements in 1000 - 4900 MHz range at high carrier frequency, OBW 5 MHz

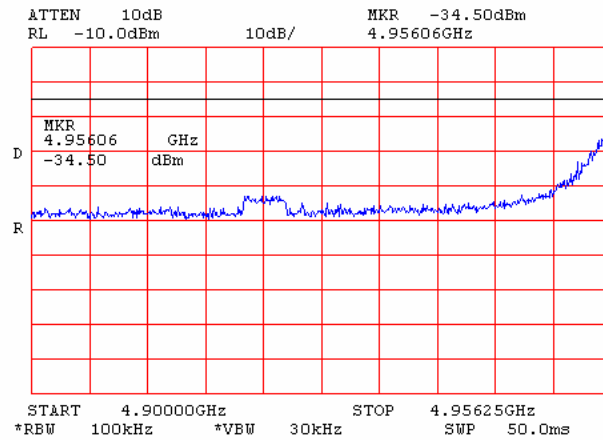


Plot 6.6.13: Tx Spurious emission measurements in 4900 – 4936.25 MHz range at low carrier frequency, OBW 5 MHz



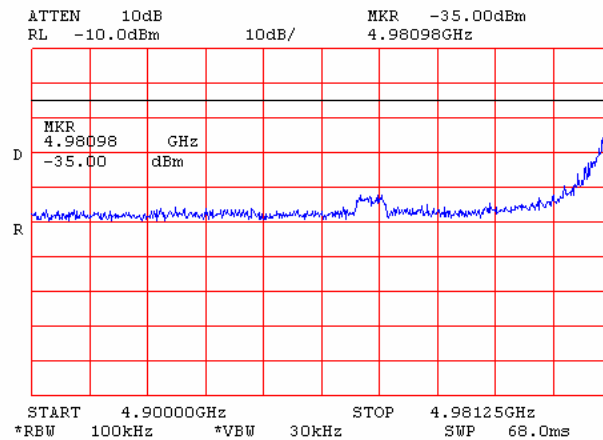
Note: according to 90.210(m)(7) RBW shall be at least 1% of OBW and VBW = 30 kHz.

Plot 6.6.14: Tx Spurious emission measurements in 4900 – 4956.25 MHz range at mid carrier frequency, OBW 5 MHz

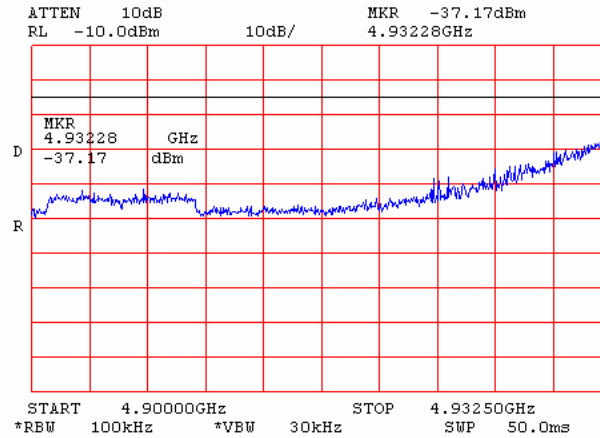


Note: according to 90.210(m)(7) RBW shall be at least 1% of OBW and VBW = 30 kHz.

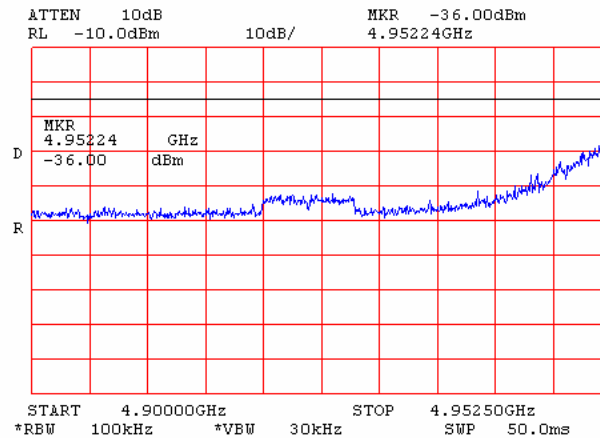
Plot 6.6.15 Tx Spurious emission measurements in 4900 – 4981.25 MHz range at high carrier frequency, OBW 5 MHz



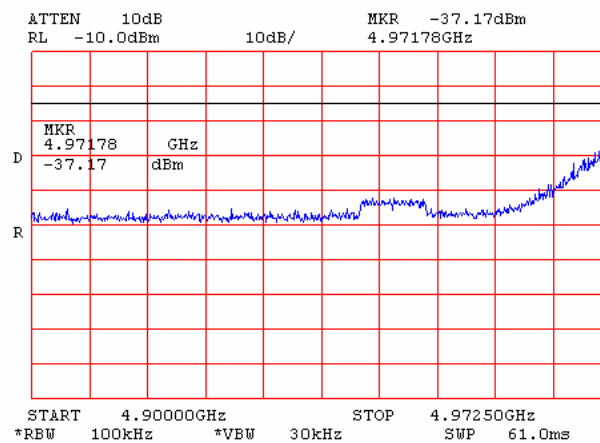
Note: according to 90.210(m)(7) RBW shall be at least 1% of OBW and VBW = 30 kHz.

Plot 6.6.16: Tx Spurious emission measurements in 4900 – 4932.5 MHz range at low carrier frequency, OBW 10 MHz

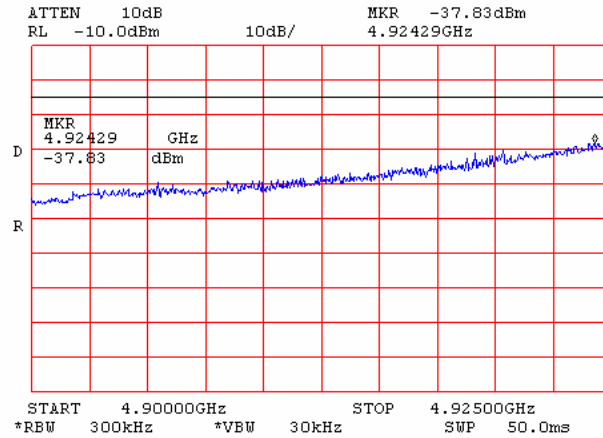
Note: according to 90.210(m)(7) RBW shall be at least 1% of OBW and VBW = 30 kHz.

Plot 6.6.17: Tx Spurious emission measurements in 4900 – 4952.5 MHz range at mid carrier frequency, OBW 10 MHz

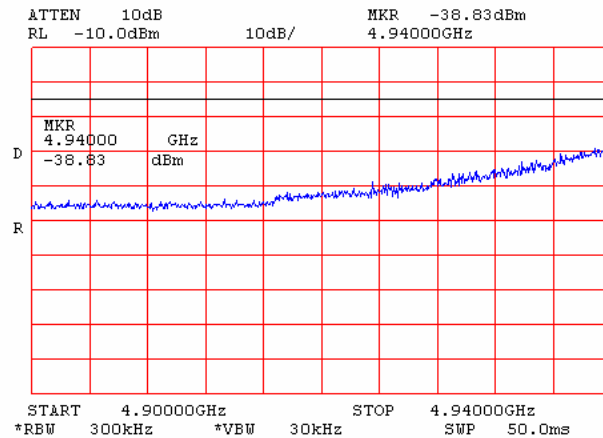
Note: according to 90.210(m)(7) RBW shall be at least 1% of OBW and VBW = 30 kHz.

Plot 6.6.18 Tx Spurious emission measurements in 4900 – 4972.5 MHz range at high carrier frequency, OBW 10 MHz

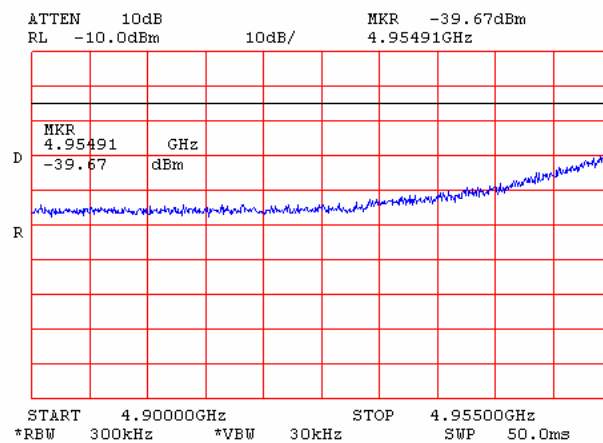
Note: according to 90.210(m)(7) RBW shall be at least 1% of OBW and VBW = 30 kHz.

Plot 6.6.19: Tx Spurious emission measurements in 4900 – 4925 MHz range at low carrier frequency, OBW 20 MHz

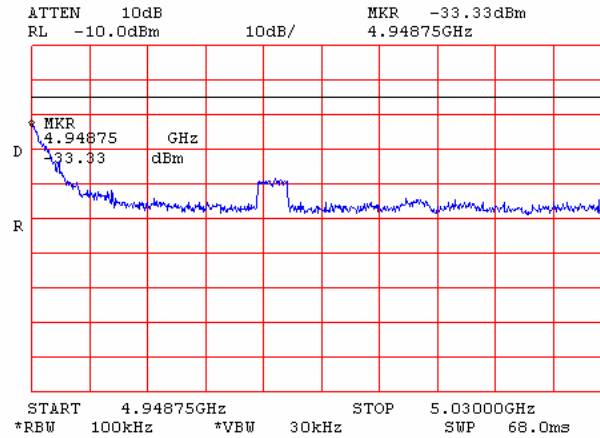
Note: according to 90.210(m)(7) RBW shall be at least 1% of OBW and VBW = 30 kHz.

Plot 6.6.20: Tx Spurious emission measurements in 4900 – 4940 MHz range at mid carrier frequency, OBW 20 MHz

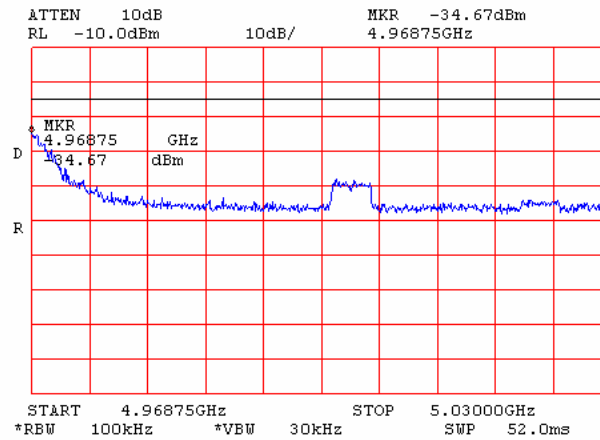
Note: according to 90.210(m)(7) RBW shall be at least 1% of OBW and VBW = 30 kHz.

Plot 6.6.21: Tx Spurious emission measurements in 4900 – 4955 MHz range at high carrier frequency, OBW 20 MHz

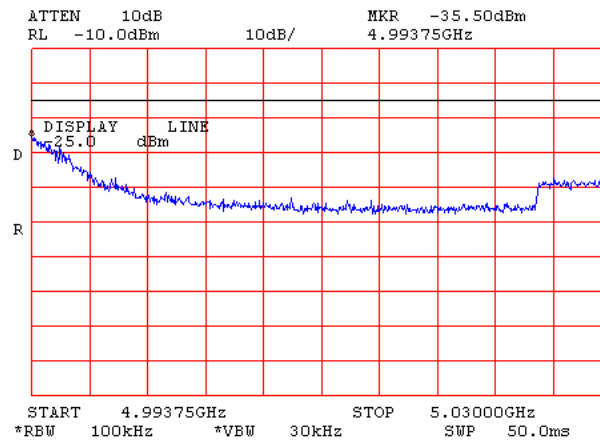
Note: according to 90.210(m)(7) RBW shall be at least 1% of OBW and VBW = 30 kHz.

Plot 6.6.22: Tx Spurious emission measurements in 4948.75 – 5030 MHz range at low carrier frequency, OBW 5 MHz

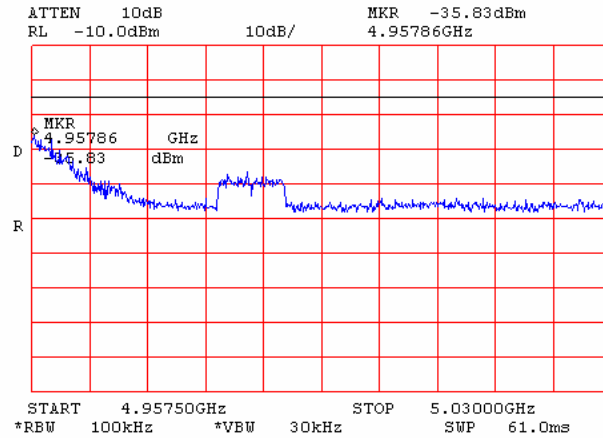
Note: according to 90.210(m)(7) RBW shall be at least 1% of OBW and VBW = 30 kHz.

Plot 6.6.23: Tx Spurious emission measurements in 4968.75 – 5030 MHz range at mid carrier frequency, OBW 5 MHz

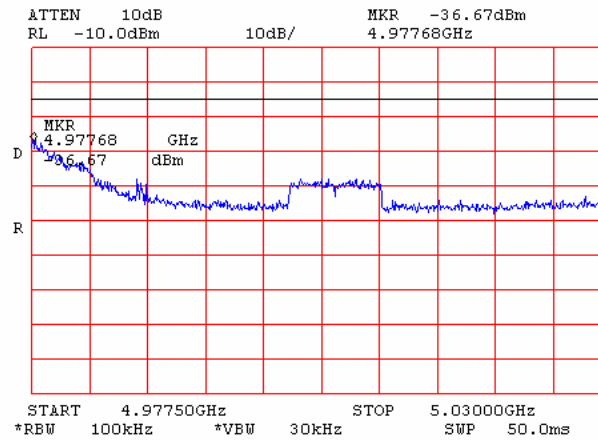
Note: according to 90.210(m)(7) RBW shall be at least 1% of OBW and VBW = 30 kHz.

Plot 6.6.24: Tx Spurious emission measurements in 4993.75 – 5030 MHz range at high carrier frequency, OBW 5 MHz

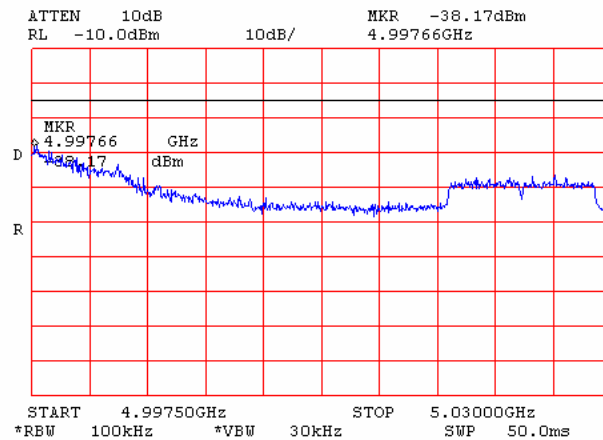
Note: according to 90.210(m)(7) RBW shall be at least 1% of OBW and VBW = 30 kHz.

Plot 6.6.25: Tx Spurious emission measurements in 4957.5 – 5030 MHz range at low carrier frequency, OBW 10 MHz

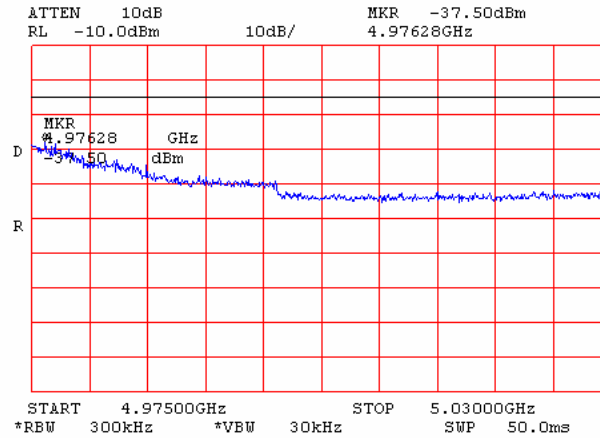
Note: according to 90.210(m)(7) RBW shall be at least 1% of OBW and VBW = 30 kHz.

Plot 6.6.26: Tx Spurious emission measurements in 4977.5 – 5030 MHz range at mid carrier frequency, OBW 10 MHz

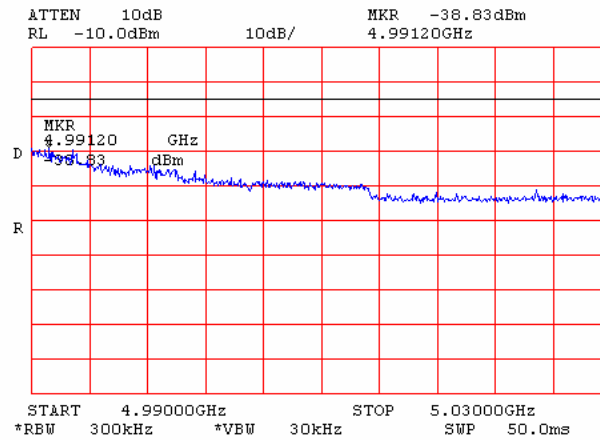
Note: according to 90.210(m)(7) RBW shall be at least 1% of OBW and VBW = 30 kHz.

Plot 6.6.27: Tx Spurious emission measurements in 4997.5 – 5030 MHz range at high carrier frequency, OBW 10 MHz

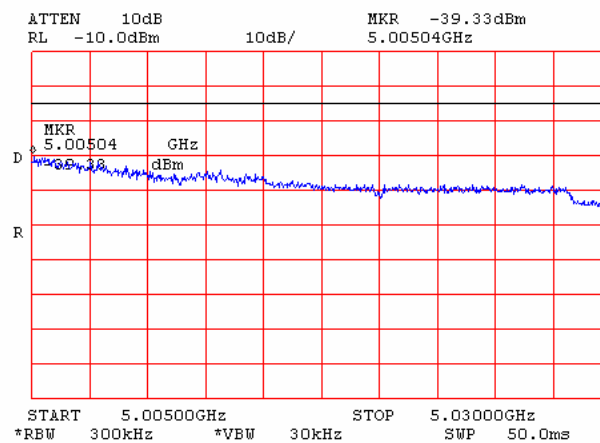
Note: according to 90.210(m)(7) RBW shall be at least 1% of OBW and VBW = 30 kHz.

Plot 6.6.28: Tx Spurious emission measurements in 4975 – 5030 MHz range at low carrier frequency, OBW 20 MHz

Note: according to 90.210(m)(7) RBW shall be at least 1% of OBW and VBW = 30 kHz.

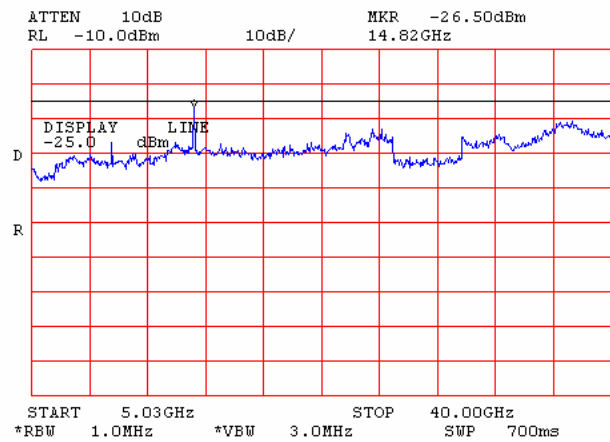
Plot 6.6.29: Tx Spurious emission measurements in 4990 – 5030 MHz range at mid carrier frequency, OBW 20 MHz

Note: according to 90.210(m)(7) RBW shall be at least 1% of OBW and VBW = 30 kHz.

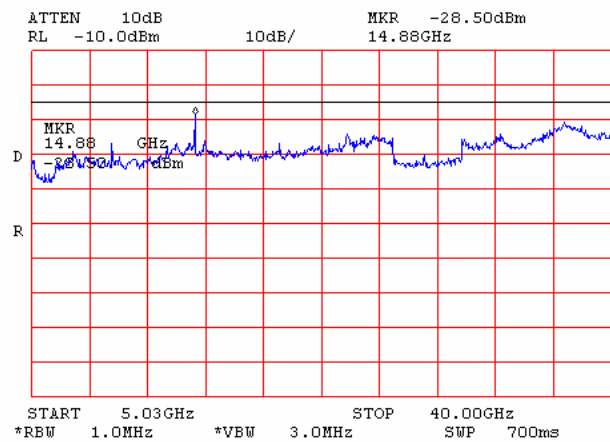
Plot 6.6.30: Tx Spurious emission measurements in 5005 – 5030 MHz range at high carrier frequency, OBW 20 MHz

Note: according to 90.210(m)(7) RBW shall be at least 1% of OBW and VBW = 30 kHz.

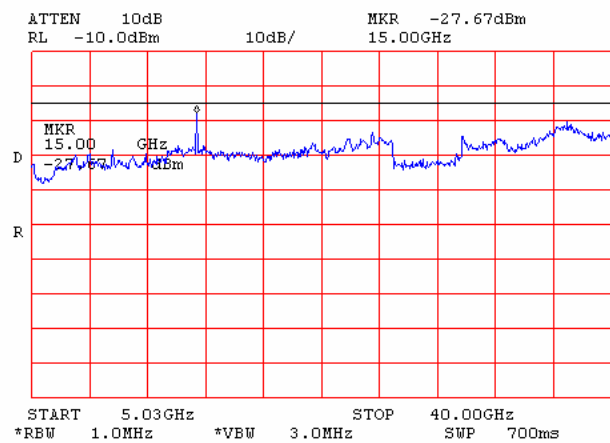
Plot 6.6.31: Tx Spurious emission measurements in 5030 – 40000 MHz range at low carrier frequency, OBW 5 MHz



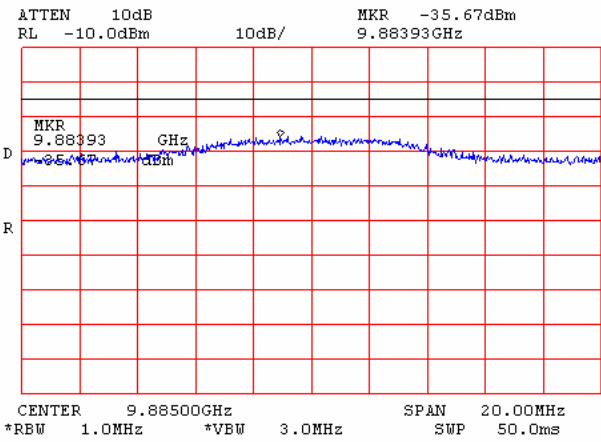
Plot 6.6.32: Tx Spurious emission measurements in 5030 – 40000 MHz range at mid carrier frequency, OBW 5 MHz



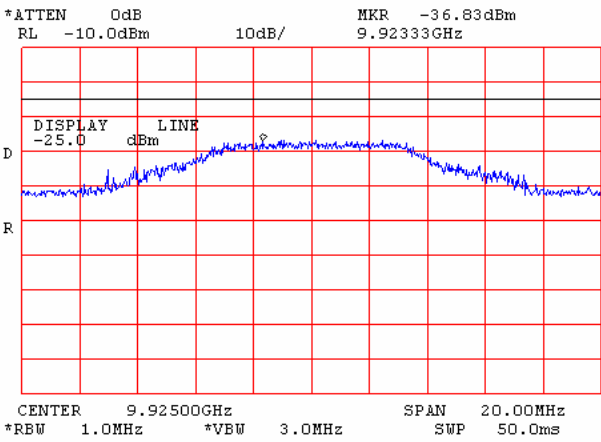
Plot 6.6.33: Tx Spurious emission measurements in 5030 – 40000 MHz range at high carrier frequency, OBW 5 MHz



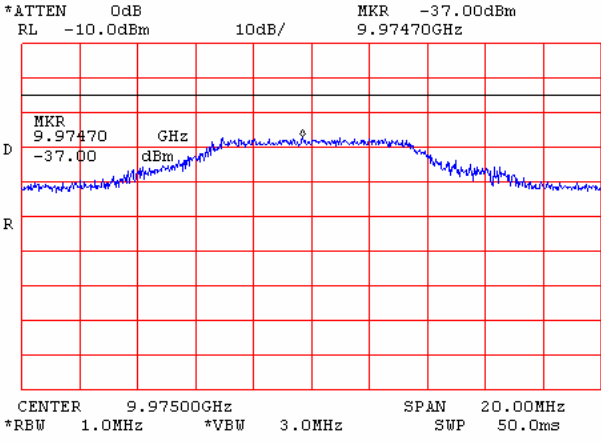
Plot 6.6.34: Tx Conducted spurious emission measurements at the 2nd harmonic of low carrier frequency, OBW 5 MHz

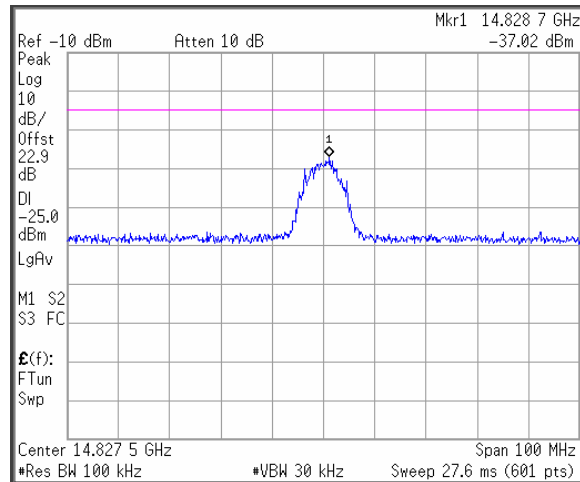


Plot 6.6.35: Tx Conducted spurious emission measurements at the 2nd harmonic of mid carrier frequency, OBW 5MHz

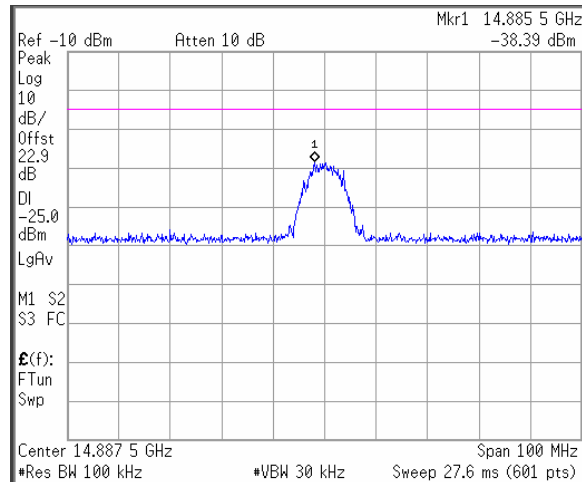


Plot 6.6.36: Tx Conducted spurious emission measurements at the 2nd harmonic of high carrier frequency, OBW 5 MHz

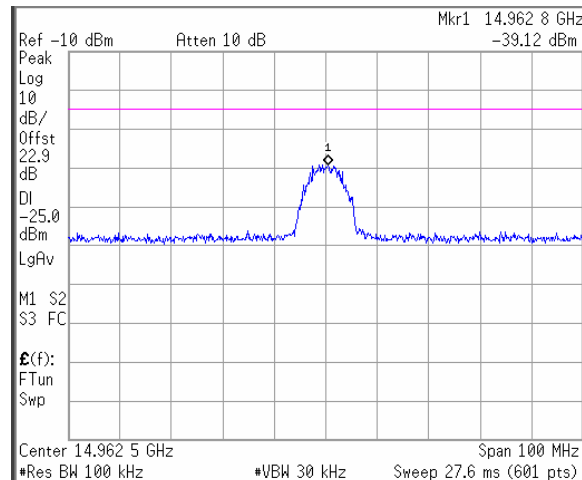


Plot 6.6.37: Tx Conducted spurious emission measurements at the 3rd harmonic of low carrier frequency, OBW 5 MHz

Note: according to 90.210(m)(7) RBW shall be at least 1% of OBW and VBW = 30 kHz.

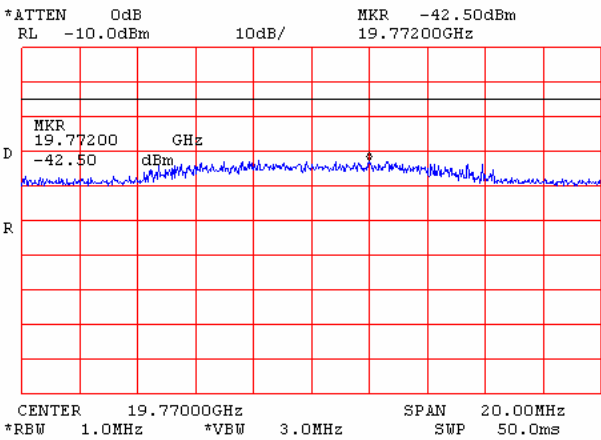
Plot 6.6.38: Tx Conducted spurious emission measurements at the 3rd harmonic of mid carrier frequency, OBW 5 MHz

Note: according to 90.210(m)(7) RBW shall be at least 1% of OBW and VBW = 30 kHz.

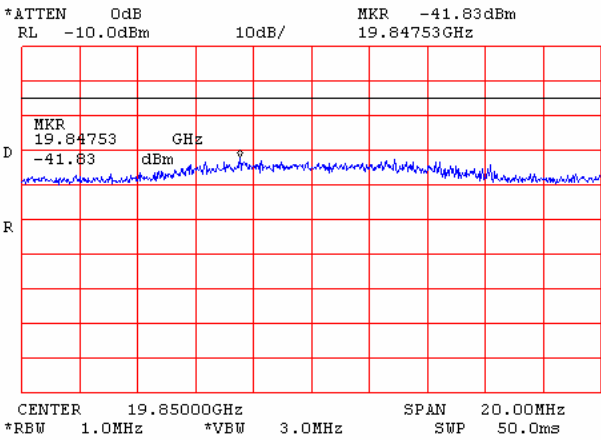
Plot 6.6.39: Tx Conducted spurious emission measurements at the 3rd harmonic of high carrier frequency, OBW 5 MHz

Note: according to 90.210(m)(7) RBW shall be at least 1% of OBW and VBW = 30 kHz.

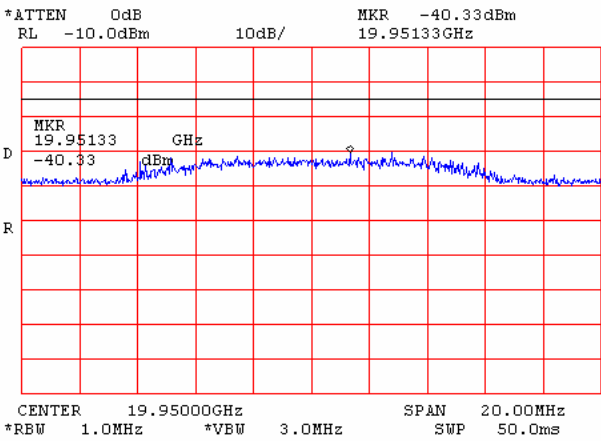
Plot 6.6.40: Tx Conducted spurious emission measurements at the 4th harmonic of low carrier frequency, OBW 5 MHz



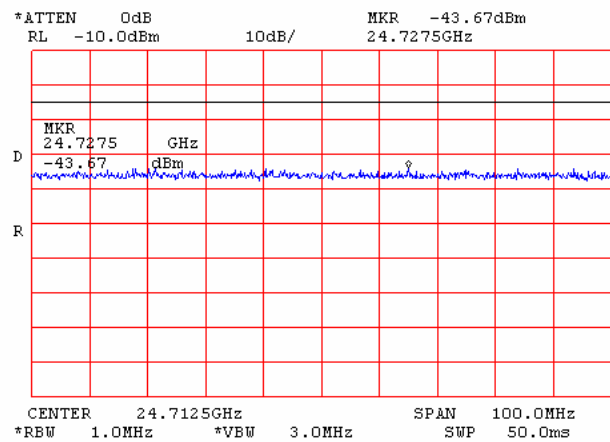
Plot 6.6.41: Tx Conducted spurious emission measurements at the 4th harmonic of mid carrier frequency, OBW 5 MHz



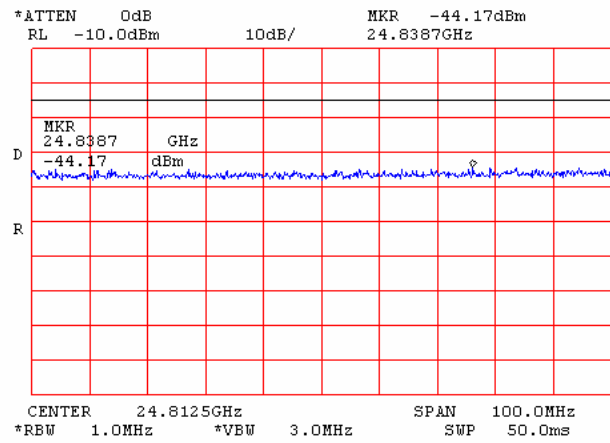
Plot 6.6.42: Tx Conducted spurious emission measurements at the 4th harmonic of high carrier frequency, OBW 5 MHz



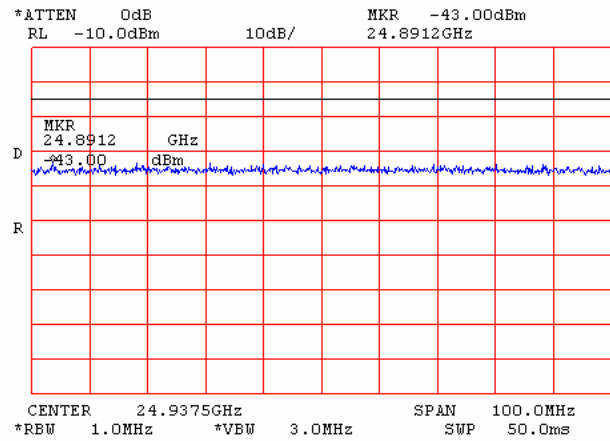
Plot 6.6.43: Tx Conducted spurious emission measurements at the 5th harmonic of low carrier frequency, OBW 5 MHz



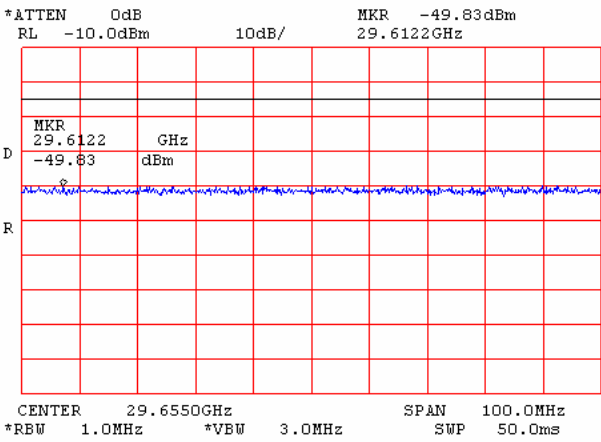
Plot 6.6.44: Tx Conducted spurious emission measurements at the 5th harmonic of mid carrier frequency, OBW 5 MHz



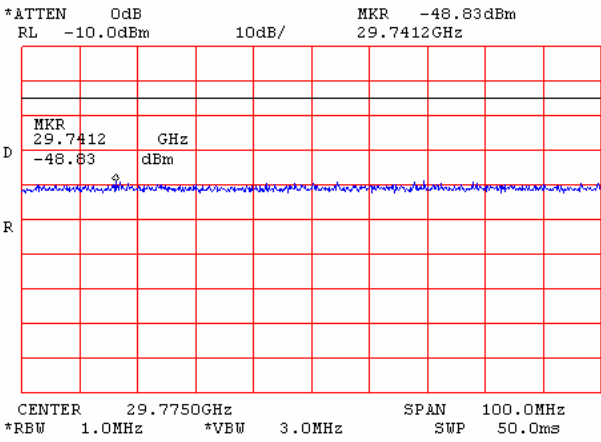
Plot 6.6.45: Tx Conducted spurious emission measurements at the 5th harmonic of high carrier frequency, OBW 5 MHz



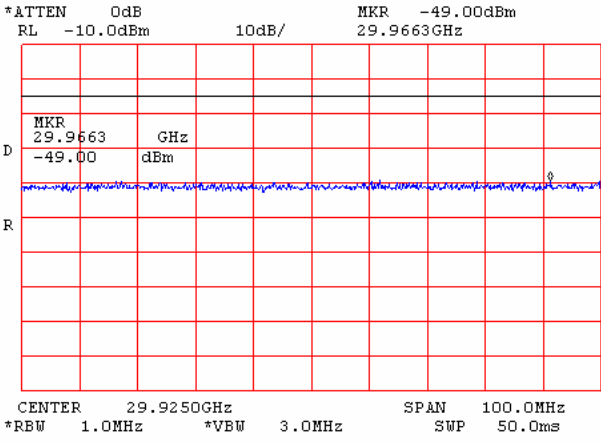
Plot 6.6.46: Tx Conducted spurious emission measurements at the 6th harmonic of low carrier frequency, OBW 5 MHz



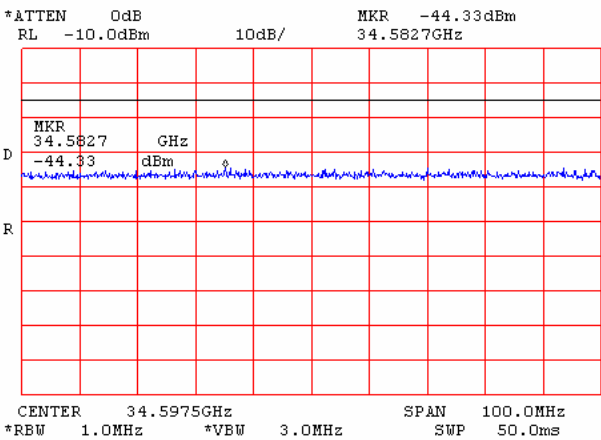
Plot 6.6.47: Tx Conducted spurious emission measurements at the 6th harmonic of mid carrier frequency, OBW 5 MHz



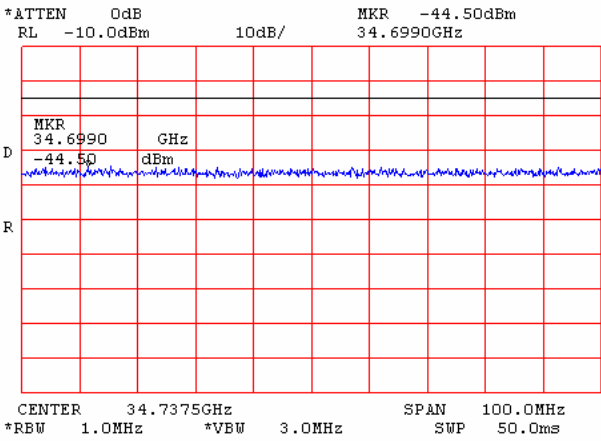
Plot 6.6.48: Tx Conducted spurious emission measurements at the 6th harmonic of high carrier frequency, OBW 5 MHz



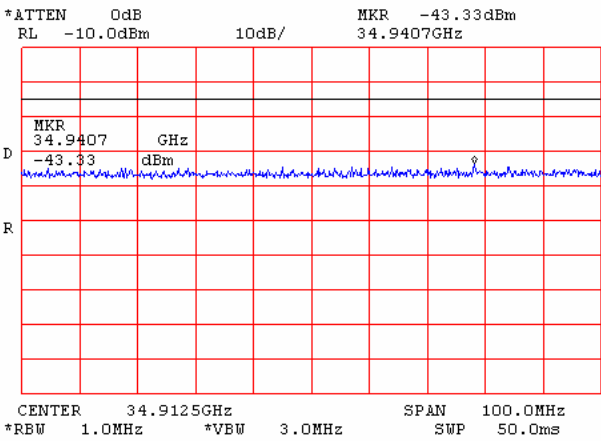
Plot 6.6.49: Tx Conducted spurious emission measurements at the 7th harmonic of low carrier frequency, OBW 5 MHz



Plot 6.6.50: Tx Conducted spurious emission measurements at the 7th harmonic of mid carrier frequency, OBW 5 MHz



Plot 6.6.51: Tx Conducted spurious emission measurements at the 7th harmonic of high carrier frequency, OBW 5 MHz



6.7 Radiated spurious Emissions - Pursuant to 47 CFR §90.210 (m)6.7.1 Test Procedure:

- A laptop was connected to the EUT to control the RF output power and Frequency.
- Laptop was placed on the top of a rotating table 0.8 meters above the ground.
- The EUT power was adjusted at the maximum output power level.
- The table was rotated 360 degree to determine the position of the highest radiation.
- A receiving antenna was set 3 meters away from the EUT and was mounted on a variable height antenna tower.
- The Field strength of radiated spurious emissions was measured..
- Both Horizontal and Vertical Polarization of receiving antenna were tested.
- The EUT 4.9GHz RF Output Connector was terminated with a 50Ω load termination.
- Procedure was repeated for the 5MHz bandwidth, which has the worst case peak power spectral density at lower, mid and upper channels and at highest data rate.
- Test was taken at Semi anechoic chamber and OATS located at “HERMON LABORATORIES”.

6.7.2 Limit:

- Specification test limit is given in Table 6.7.1.

Table 6.7.1: Radiated spurious emission limit.

Frequency* [MHz]	Attenuation below Carrier** [dBc]	ERP of spurious [dBm]	Equivalent Field Strength Limit @3m [dBuV/m] ***
0.009-4000	46	-25	72.38

* Excluding the in band emission within ± 250 % of the authorized bandwidth from the carrier

** Attenuation is calculated according to:

$$55 + 10 * \log(P) = 55 + 10 * \log(0.126)$$

P is transmitter output power in Watts.

*** Equivalent field strength limit was calculated from the maximum allowed ERP of spurious as follows:

$$E = \frac{\sqrt{30 * P * 1.64}}{r}$$

Where: P - ERP in Watts

1.64 - numeric gain of ideal dipole

r – Antenna to EUT distance in Meters.

6.7.3 Results:

- Test Results are provided in Table 6.7.2÷3 and associated plots.

Table 6.7.2: Spurious emission field strength test results

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
Low carrier frequency MHz							
9885	70.00	72.38	-2.38	1000	V	1.2	223
14827.5	68.50	72.38	-3.88	1000	V	1.5	210
19770	56.50	72.38	-15.88	1000	V	1.5	270
24712.5	59.00	72.38	-13.38	1000	V	1.3	270
Mid carrier frequency MHz							
9925	71.17	72.38	-1.21	1000	V	1.2	230
14887.5	69.33	72.38	-3.05	1000	V	1.5	220
19850	59.00	72.38	-13.38	1000	V	1.5	200
24812.5	61.33	72.38	-11.05	1000	V	1.3	270
High carrier frequency MHz							
9975	70.67	72.38	-1.71	1000	V	1.2	230
14962.5	70.83	72.38	-1.55	1000	V	1.5	200
19950	59.33	72.38	-13.05	1000	V	1.5	190
24937.5	63.17	72.38	-9.21	1000	V	1.3	215

*- Margin = Field strength of spurious – calculated field strength limit.

**- EUT front panel refers to 0 degrees position of turntable.

Table 6.7.3: Substitution ERP of spurious test results

ASSIGNED FREQUENCY RANGE: 4940 – 4990 MHz
 TEST SITE: OATS
 TEST DISTANCE: 3 m
 SUBSTITUTION ANTENNA HEIGHT: 0.8 m
 DETECTOR USED: Peak
 VIDEO BANDWIDTH: > Resolution bandwidth
 SUBSTITUTION ANTENNA TYPE: Double ridged guide (1000 MHz – 18000 MHz)
 Standard gain horn (above 18000 MHz)

Frequency, MHz	Field strength, dB(μV/m)	RBW, kHz	Antenna polarization	RF generator output, dBm	Ant gain, dBd	Cable loss, dB	ERP, dBm	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
Low carrier frequency											
9885	70.00	1000	Vertical	-37.0	9.65	2.00	-29.3	50.35	46.0	4.35	Pass
14827.5	68.50	1000	Vertical	-35.5	10.77	2.65	-27.3	48.38	46.0	2.38	Pass
19770	56.50	1000	Vertical	-48.5	21.55	3.06	-30.0	51.01	46.0	5.01	Pass
24712.5	59.00	1000	Vertical	-49.0	23.80	3.68	-28.8	49.88	46.0	3.88	Pass
Mid carrier frequency											
9925	71.17	1000	Vertical	-35.83	9.29	2.03	-28.5	49.57	46.0	3.57	Pass
14887.5	69.33	1000	Vertical	-33.67	10.81	2.65	-25.5	46.51	46.0	0.51	Pass
19850	59.00	1000	Vertical	-46.00	21.75	3.08	-27.3	48.33	46.0	2.33	Pass
24812.5	61.33	1000	Vertical	-49.67	23.90	3.69	-28.4	49.46	46.0	3.46	Pass
High carrier frequency											
9975	70.67	1000	Vertical	-36.33	9.33	2.03	-29.0	50.03	46.0	4.03	Pass
14962.5	70.83	1000	Vertical	-34.17	11.35	2.68	-25.5	46.50	46.0	0.50	Pass
19950	59.33	1000	Vertical	-45.67	21.75	3.10	-27.0	48.02	46.0	2.02	Pass
24937.5	63.17	1000	Vertical	-51.83	24.20	3.70	-27.3	48.33	46.0	2.33	Pass

*- Margin = Spurious emission – specification limit.

6.8 Frequency Stability, Temperature Variations - Pursuant to 47 CFR §2.1055(a)(1); §90.2136.8.1 Test Procedure:

- The EUT was connected to a host computer.
- EUT only was placed inside an environmental chamber.
- The EUT 4.9GHz RF Output Connector was connected through Attenuators to Frequency measurement equipment.
- Output signal was set to CW.
- Procedure was made at center frequency.
- Limit : +/- 1ppm over Temperature range

6.8.2 Results:

Temperature [°C]	Ref Frequency [MHz]	Frequency at T [MHz]	Drift [Hz]	Drift [ppm]
-30	4964.999069	4965.000035	966	0.194
-20	4964.999069	4965.001637	2568	0.517
-10	4964.999069	4965.000392	1323	0.266
0	4964.999069	4965.000094	1025	0.206
10	4964.999069	4964.999422	353	0.071
20	4964.999069	4964.999069	0	0
30	4964.999069	4964.999147	78	0.015
40	4964.999069	4964.999647	578	0.116
50	4964.999069	4965.000768	1699	0.342
Frequency Drift			+2568/0	+0.517/0

- Note: Reference Frequency measured at 20°C and nominal voltage.

6.9 Frequency Stability, Voltage Variations - Pursuant to 47 CFR §2.1055(d)(1); §90.2136.9.1 Test Procedure:

- The EUT was connected to a Laptop via extender card.
- The EUT 4.9GHz RF Output Connector was connected through Attenuators to Frequency measurement equipment.
- The EUT input Voltage was connected to external power supply and the voltage was varied from +/- 15% of the nominal.
- Output signal was set to CW.
- Procedure was made at center frequency.
- Limit : +/- 1 ppm over Voltage range

6.9.2 Results:

Voltage [V]	Ref Frequency [MHz]	Frequency at V [MHz]	Drift [Hz]	Drift [ppm]
2.805	4964.999829	4964.998209	-1620	0.326
3.3	4964.999829	4964.999829	0	0
3.795	4964.999829	4964.999812	17	0.003

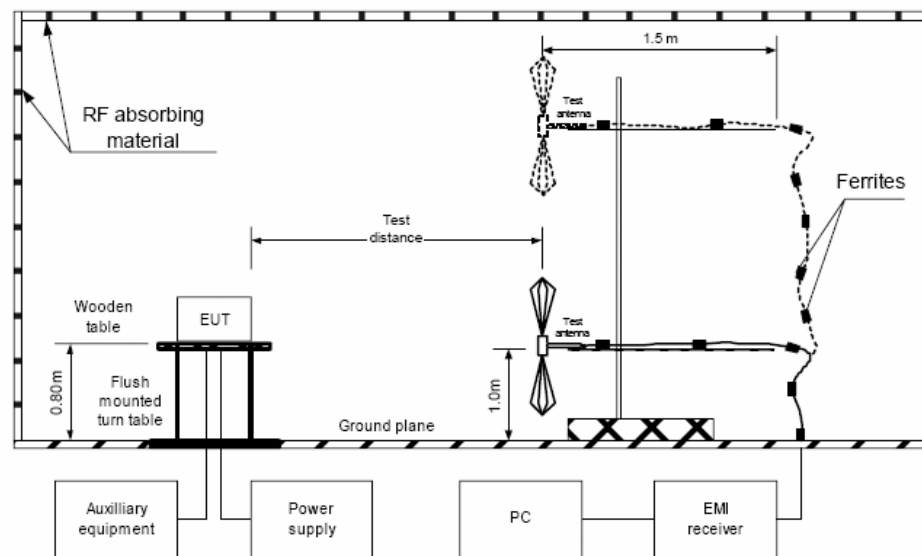
- Note: Reference Frequency measured at room temperature and nominal voltage.

6.10 Radiated Emission, General requirements – pursuant to §15.109(a)

6.10.1 Test Procedure:

- A laptop was connected to the EUT to control the RF output power and Frequency.
- EUT and Laptop were set up as shown in plot 6.10.1.
- The EUT was adjusted to receive/standby at 802.11a @ 4.9GHz mode.
- The table was rotated 360 degree to determine the position of the highest radiation.
- A receiving antenna was set 3 meters away from the EUT and was mounted on a variable height antenna tower.
- The Field strength of radiated spurious emissions was measured.
- The Tested Frequency range was 30 ÷ 16625MHz.
- Both Horizontal and Vertical Polarization of receiving antenna were tested.
- Test was taken at Semi anechoic chamber located at “HERMON LABORATORIES”.

Plot 6.10.1: Setup for Radiated Emission Measurement.



6.10.2 Limits:

- Specification of Class B limits is given in table 6.10.1.

Table 6.10.1: Limits for Radiated emissions

Frequency, MHz	Class B limit, dB(μV/m)
	3 m distance
30 - 88	40.0
88 - 216	43.5
216 - 960	46.0
Above 960	54.0

6.10.3 Results:

- Test Results are provided in Table 6.10.2 and associated plots.

Table 6.10.2: Radiated emission test results below 1GHz.

LIMIT: Class B
 TEST DISTANCE: 3 m
 DETECTORS USED: PEAK / QUASI-PEAK
 FREQUENCY RANGE: 30 MHz – 1000 MHz
 RESOLUTION BANDWIDTH: 120 kHz

Frequency, MHz	Peak emission, dB(μV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
166.656250	43.68	43.01	43.50	-0.49	V	1.2	45	Pass
233.320000	43.53	42.88	46.00	-3.12	V	1.2	65	
266.655000	43.34	41.21	46.00	-4.79	V	1.0	120	
366.647500	45.76	44.95	46.00	-1.05	V	1.2	213	
433.312500	41.95	39.96	46.00	-6.04	V	1.0	230	
499.982500	42.92	41.56	46.00	-4.44	H	1.4	16	
799.897500	47.55	38.79	46.00	-7.21	V	1.0	210	

Table 6.10.3: Radiated emission test results above 1GHz.

TEST DISTANCE: 3 m
 DETECTORS USED: PEAK / AVERAGE
 FREQUENCY RANGE: 1000 MHz – 16625 MHz***
 RESOLUTION BANDWIDTH: 1000 kHz

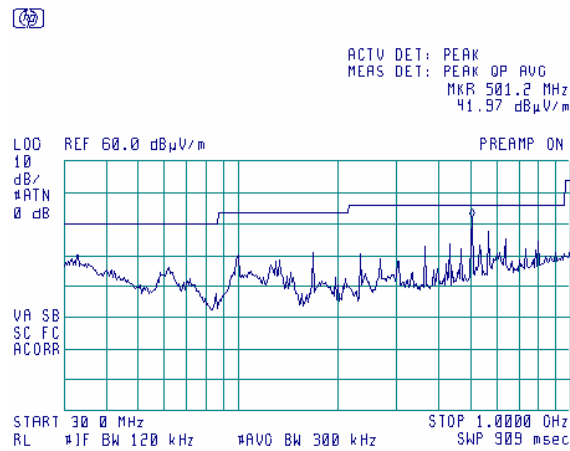
Frequency, MHz	Peak emission, dB(μV/m)	Average			Antenna polarization	Antenna height, m	Turn- table position** , degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
No spurious were found								Pass

*- Margin = Measured emission - specification limit.

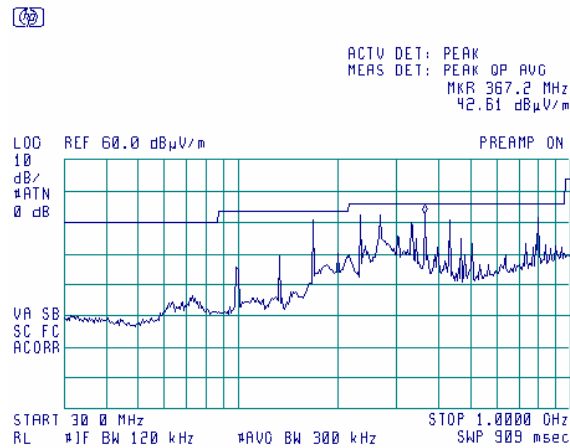
** - EUT front panel refer to 0 degrees position of turntable.

*** - The fifth harmonic of highest LO frequency is: 5 x 3325 MHz = 16625 MHz

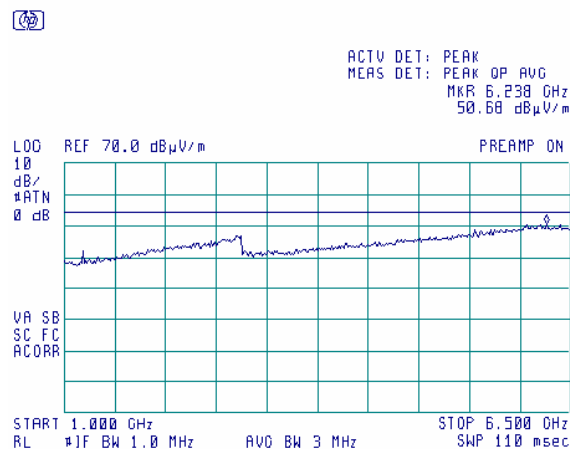
Plot 6.10.2: Rx Radiated Emission measurements in 30-1000 MHz range, Vertical Antenna polarization.



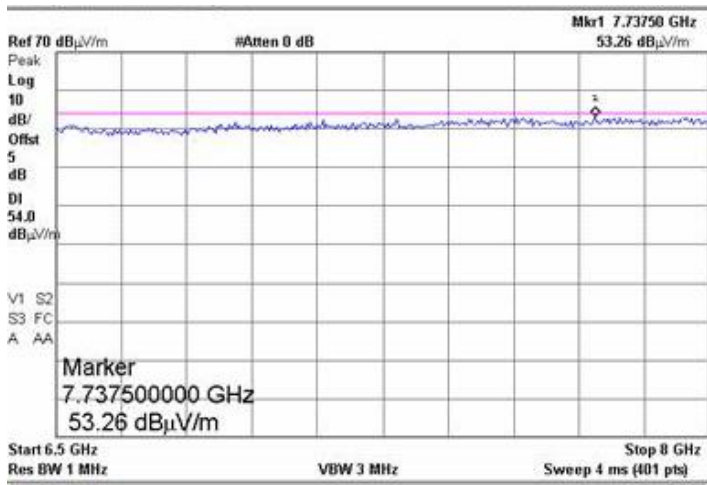
Plot 6.10.3: Rx Radiated Emission measurements in 30-1000 MHz range, Horizontal Antenna polarization.



Plot 6.10.4: Rx Radiated Emission measurements in 1000-6500MHz range, Vertical & horizontal Antenna polarization.

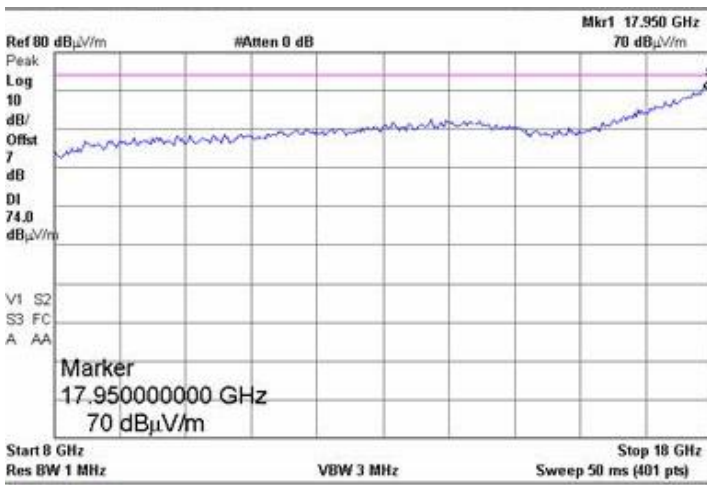


Plot 6.10.5: Rx Radiated Emission measurements in 6500-8000MHz range,
Vertical & horizontal Antenna polarization.



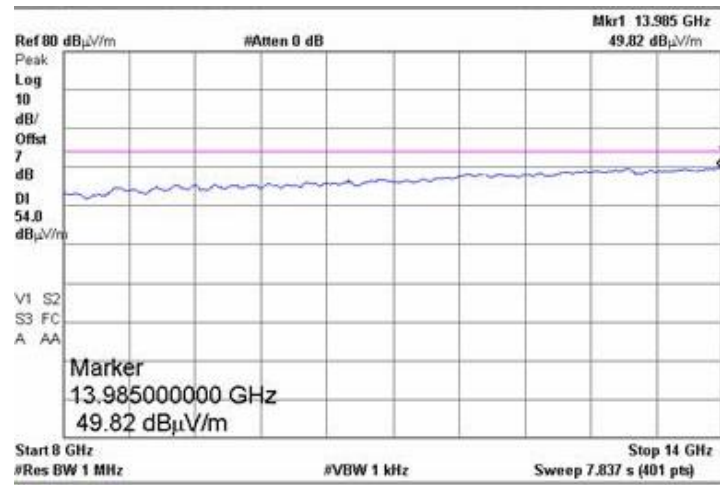
Plot 6.10.6: Rx Radiated Emission measurements in 8000- 18000MHz range,
Vertical & Horizontal Antenna polarization.

LIMIT: PEAK



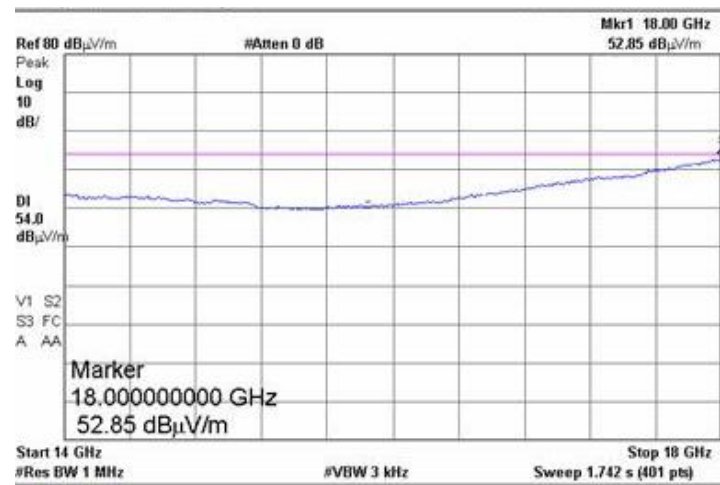
Plot 6.10.7: Rx Radiated Emission measurements in 8000-14000 MHz range,
Vertical & Horizontal Antenna polarization.

LIMIT: AVERAGE



Plot 6.10.8: Rx Radiated Emission measurements in 14000-18050 MHz range,
Vertical & Horizontal Antenna polarization.

LIMIT: AVERAGE

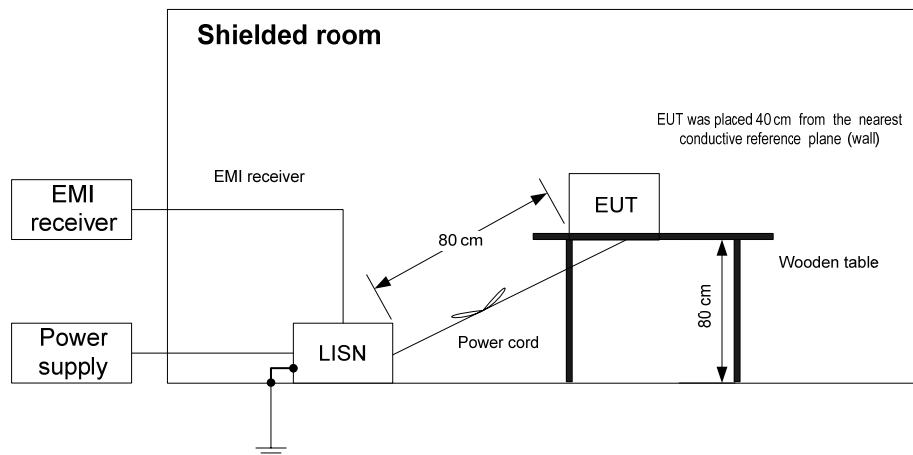


6.11 Conducted Emission at AC power line - Pursuant to 47 CFR §15.107(a); §15.207(a)

6.11.1 Test Procedure:

- A laptop was connected to the EUT to control the RF output power and Frequency.
- The EUT was set up as shown in plot 6.10.1.
- The EUT 4.9GHz RF Output Connector was terminated with a 50Ω load termination.
- The EUT power was adjusted at the maximum output power level.
- The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer in the frequency range 150 KHz to 30MHz.
- Unused coaxial connector of the LISN was terminated with 50 Ohm. Quasi-peak and average detectors were used throughout the testing.
- The position of the device cables was varied to determine maximum emission level.
- Laptop's AC conducted data was recorded for both NEUTRAL and HOT lines.
- Data was recorder for 802.11a @ 4.9GHz Rx/Stand-by mode and Tx mode.
- Test was taken at Shielded room located at “HERMON LABORATORIES”.

Plot 6.11.1: Conducted emission measurements setup.



6.11.2 Limits:

- Specification Class B limits is given in table 6.11.1.

Table 6.11.1: Limits for conducted emissions

Frequency, MHz	Class B limit, dB(μV)	
	QP	AVRG
0.15 - 0.5	66 - 56*	56 - 46*
0.5 - 5.0	56	46
5.0 - 30	60	50

* The limit decreases linearly with the logarithm of frequency.

6.11.3 Results:

- Results are shown in Table 6.11.2 and the associated plots.

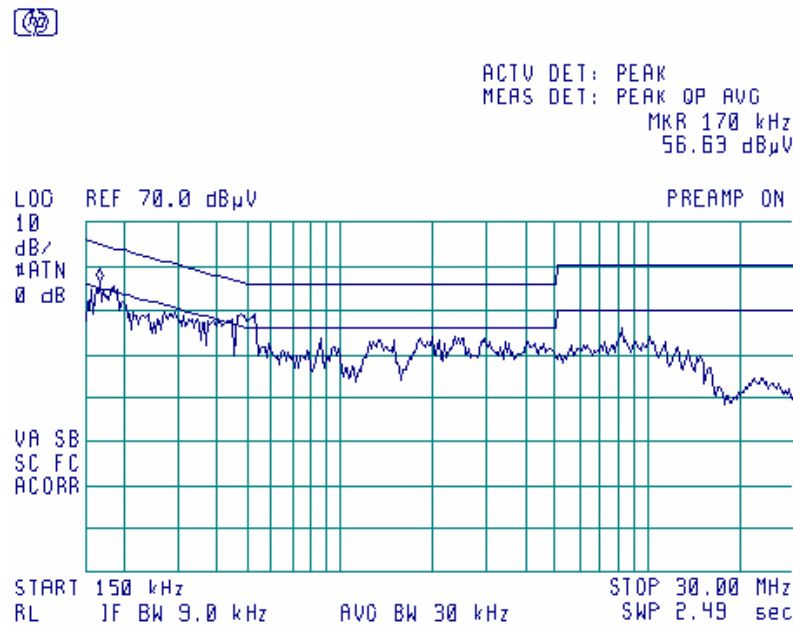
Table 6.11.2: Conducted emission test results.

LINE: AC mains
 LIMIT: Class B
 DETECTORS USED: QUASI-PEAK / AVERAGE
 FREQUENCY RANGE: 150 kHz - 30 MHz
 RESOLUTION BANDWIDTH: 9 kHz

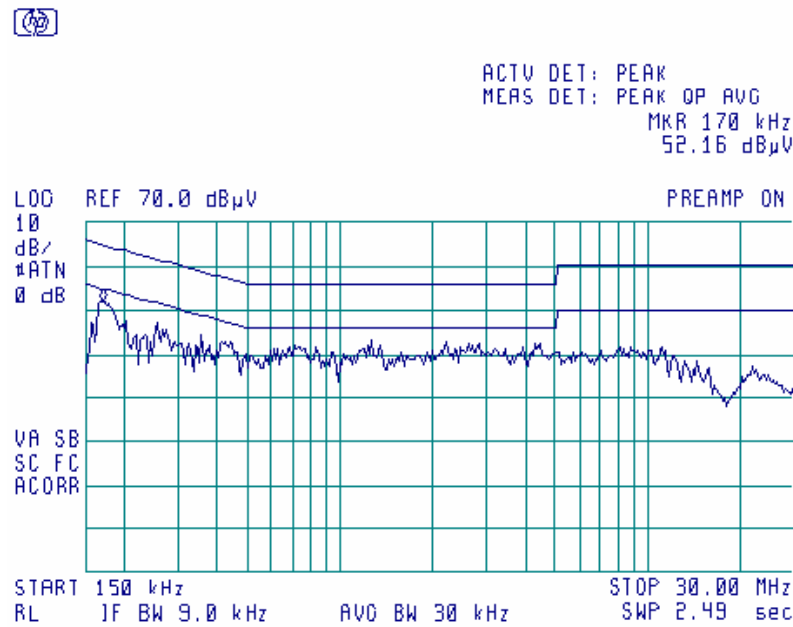
Frequency, MHz	Peak emission, dB(μV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(μV)	Limit, dB(μV)	Margin , dB*	Measured emission, dB(μV)	Limit, dB(μV)	Margin , dB*		
Receive / Stand-by mode									
0.159489	56.58	53.27	65.54	-12.27	35.80	55.54	-19.74	L1	Pass
0.174138	56.85	52.89	64.82	-11.93	43.19	54.82	-11.63		
0.304822	49.55	42.97	60.13	-17.16	30.96	50.13	-19.17		
0.368013	49.42	42.86	58.59	-15.73	32.92	48.59	-15.67		
0.476091	49.72	43.48	56.45	-12.97	31.41	46.45	-15.04		
1.267067	43.31	39.70	56.00	-16.30	34.15	46.00	-11.85		
0.164474	53.05	47.38	65.29	-17.91	39.75	55.29	-15.54	L2	Pass
0.171974	51.75	46.72	64.93	-18.21	38.83	54.93	-16.10		
0.232818	44.39	37.77	62.39	-24.62	28.44	52.39	-23.95		
0.278520	44.49	39.24	60.92	-21.68	33.44	50.92	-17.48		
0.430607	45.31	41.20	57.30	-16.10	36.15	47.30	-11.15		
0.770114	41.91	39.66	56.00	-16.34	35.33	46.00	-10.67		

*- Margin = Measured emission - specification limit.

Plot 6.11.2: Conducted emission measurements, Rx/Stand-by mode, Line L1, Quasi-Peak & Average Limits.



Plot 6.11.3: Conducted emission measurements, Rx/Stand by mode, Line L2, Quasi-Peak & Average Limits.



6.12 EUT Description & Test Configuration for 802.11b/g:6.12.1 Equipment used as local support for testing:

Table 6.12.1 EUT Support Equipment

Description	Manufacturer	Model	Serial Number	Notes
Laptop	HP	Compaq nc8230	CNU5111RTB	

No Remote support equipment was used during tests.

6.12.2 I/O port configuration during testing:

Table 6.12.2 EUT I/O Ports

Port Type	Port Description	Connected From/to		Connector Type	Quantity	Cable Type	Cable Length
RF in/out	4.9GHz External Antenna	Not Used in Part 15 Tests		UFL	1	N/A	N/A
RF in/out	2.4GHz External Antenna	EUT	External Antenna	UFL	1	Semi rigid	4 cm

6.12.3 EUT operating mode During Tests:

EUT was transmitting at duty cycle of 99% at the Bandwidth stated in each test.
The Rate used for each Bandwidth was the highest rate.

6.12.4 802.11b/g Transmitter description

Type of equipment										
Stand-alone (Equipment with or without its own control provisions)										
Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)										
V Plug-in card (Equipment intended for a variety of host systems)										
Intended use					Condition of use					
V Fixed					Always at a distance more than 2 m from all people					
V Mobile					Always at a distance more than 20 cm from all people					
Portable					May operate at a distance closer than 20 cm to human body					
Assigned frequency range					2400 – 2483.5 MHz					
Operating frequency range					2412 – 2462 MHz					
RF channel spacing					22MHz (802.11b), 20MHz (802.11g)					
Maximum rated output power					At transmitter 50 Ω RF output connector					71mW
					Effective radiated power with Reference Antenna.					127mW
Is transmitter output power variable?					No					
					Continuous variable					
					V Yes					
					Stepped variable with stepsize					41%, 58%
					Minimum RF power					25.1mW
					Nominal RF power					63mW
Antenna connection										
Unique coupling			V	Standard connector		V	Integral		With temporary RF connector	
						V			Without temporary RF connector	
Antenna/s technical characteristics										
Type		Manufacturer		Model number		Gain				
PIFA						2.56dBi (Peak Gain)				
Transmitter 99% power bandwidth				15.6 MHz for 802.11b, 16.4 MHz for 802.11g						
Transmitter aggregate data rate/s				1, 2, 5.5, 11 Mbps for 802.11b 6, 9, 12, 18, 24, 36, 48, 54 Mbps for 802.11g						
Transmitter aggregate symbol (baud) rate/s				1, 1, 1.375, 1.375 Msps respectively to data rate at 802.11b 6, 9, 6, 9, 6, 9, 8, 9 Msps respectively to data rate at 802.11g						
Type of modulation				802.11b: DSSS: 1M-DBPSK, 2M-DQPSK, CCK: 5.5M-DQPSK, 11M QPSK 802.11g: BPSK, QPSK, 16QAM, 64QAM						
Type of multiplexing				802.11b: TDD DSSS/CCK 802.11g: TDD OFDM						
Modulating test signal (baseband)				PN9						
Maximum transmitter duty cycle in normal use				Tx ON time		Period				
802.11g : 54Mbps				60%		628uSec		1.0466mSec		
6Mbps						5.484mSec		9.14mSec		
802.11b : 11Mbps						3.17mSec		5.283mSec		
1Mbps						32.952mSec		54.92mSec		
Transmitter duty cycle supplied for test				Tx ON time		Period				
802.11g : 54Mbps				99%		374uSec		378uSec		
6Mbps						3.10mSec		3.14mSec		
802.11b : 11Mbps						1.881mSec		1.9mSec		
1Mbps						1.881mSec		1.9mSec		
Transmitter power source										
Battery		Nominal rated voltage		VDC		Battery type		Ni- Cd, Lithium, Lead- Acid, other		
V	DC	Nominal rated voltage		3.3 VDC $\pm$ 10%						
	AC mains	Nominal rated voltage		VAC		Frequency		Hz		
Is there common power source for transmitter and receiver										
yes V no										
Spread spectrum technique used					Frequency hopping (FHSS)					
					V Digital transmission system (DTS)					
					Hybrid					
Spread spectrum parameters for transmitters tested per FCC 15.247 only										
DSSS		chip sequence length			11bits (Apply to 802.11b only)					
		spectrum width			22MHz					

6.13 Peak output power - Pursuant to 47 CFR §15.247(b)(3)

6.13.1 Test Procedure:

- A laptop was connected to the EUT to control the RF output power and Frequency.
- The EUT 2.4GHz RF Output Connector was connected through Calibrated Attenuators to a Power Meter with a sensor capable of measuring the entire bandwidth of the signal.
- The EUT power was adjusted at the maximum and minimum output power level.
- Procedure was made for the 802.11b and 802.11g at highest data rate and at low, med and high Frequency.
- Transmitter Frequencies for 802.11b/g are as in table 6.13.1 and will be referred as low, mid and high in 802.11b/g section.

6.13.2 Results:

- Test Results are presented in Table 6.13.1.

Table 6.13.1: Output power results.

Channel #	Frequency [MHz]	Rate [MHz]	Peak Power [dBm]	Limit [dBm]	Margin [dB]
High Power Level					
802.11b Mode					
1	2412	11	18.45	30	11.55
6	2437	11	18.50	30	11.50
11	2462	11	18.45	30	11.55
802.11g Mode					
1	2412	54	18.46	30	11.54
6	2437	54	18.47	30	11.53
11	2462	54	18.48	30	11.52
Low Power Level					
802.11b Mode					
1	2412	11	14.42	30	15.58
6	2437	11	14.35	30	15.65
11	2462	11	14.28	30	15.72
802.11g Mode					
1	2412	54	14.80	30	15.20
6	2437	54	14.70	30	15.30
11	2462	54	14.70	30	15.30

6.14 6dB Bandwidth - Pursuant to 47 CFR §15.247(a)(2)

6.14.1 Test Procedure:

- A laptop was connected to the EUT to control the RF output power and Frequency.
- The EUT 2.4GHz RF Output Connector was connected through Calibrated Attenuators to a Spectrum Analyzer (E4440A) and RBW, VBW were set to 100 KHz.
- The EUT power was adjusted at the maximum output power level.
- Procedure was made for the 802.11b and 802.11g at highest data rate.
- Procedure was made at low, mid and high Frequency for 802.11b and 802.11g.

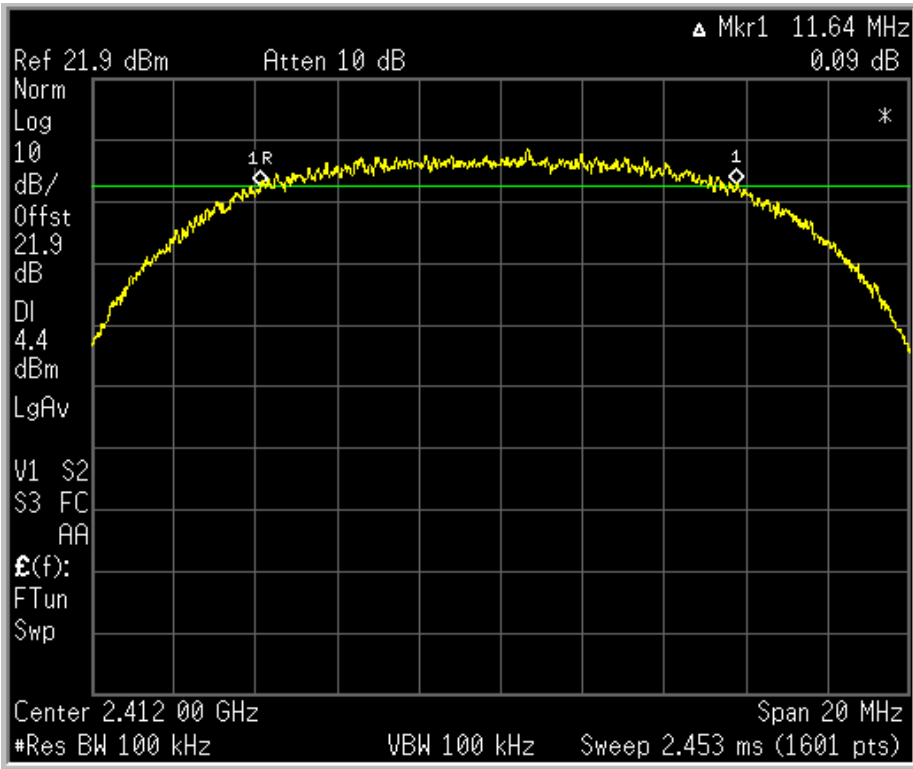
6.14.2 Results:

- Test Results are presented in Table 6.14.1 and associated plots.

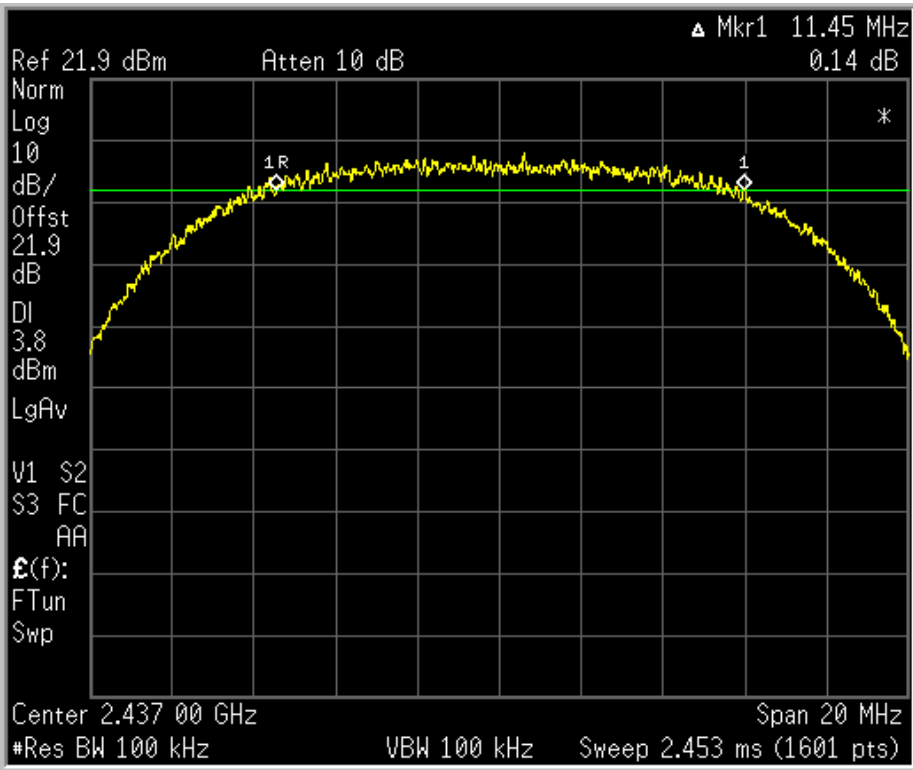
Table 6.14.1: 6dB Bandwidth results.

Plot #	Channel #	Frequency [MHz]	Rate [MHz]	6dB Bandwidth [KHz]	Minimum Limit [KHz]	Margin [KHz]
802.11b Mode						
6.13.1	1	2412	11	11640	500	11140
6.13.2	6	2437	11	11450	500	10950
6.13.3	11	2462	11	11620	500	11120
802.11g Mode						
6.13.4	1	2412	54	16500	500	16000
6.13.5	6	2437	54	16500	500	16000
6.13.6	11	2462	54	16500	500	16000

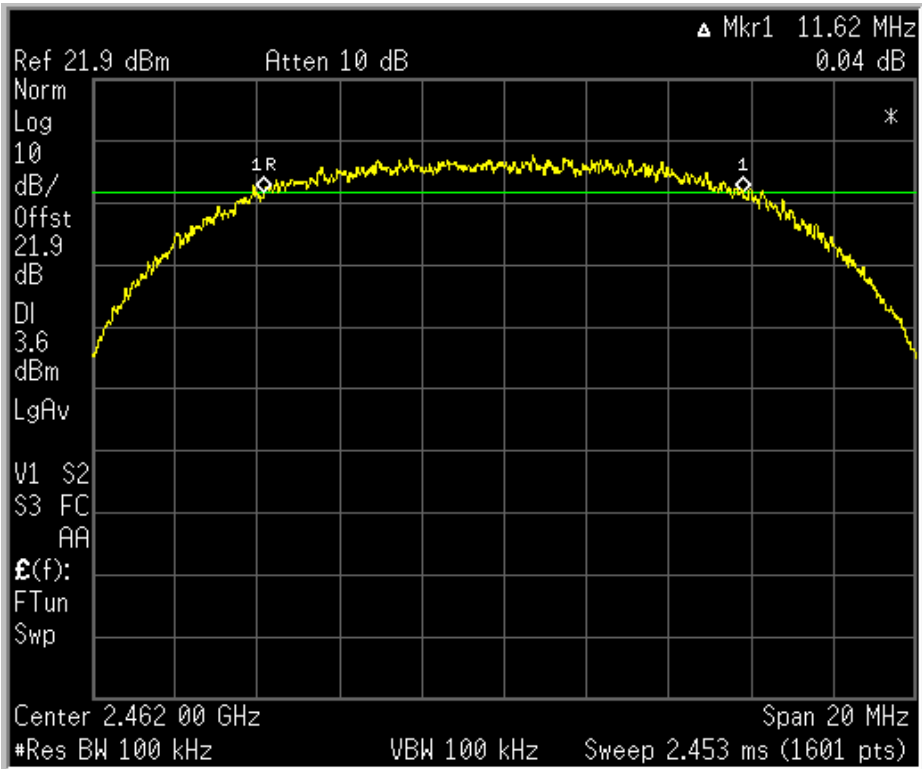
Plot 6.14.1: 6dB Bandwidth at CH1, 11Mbps, 802.11b mode



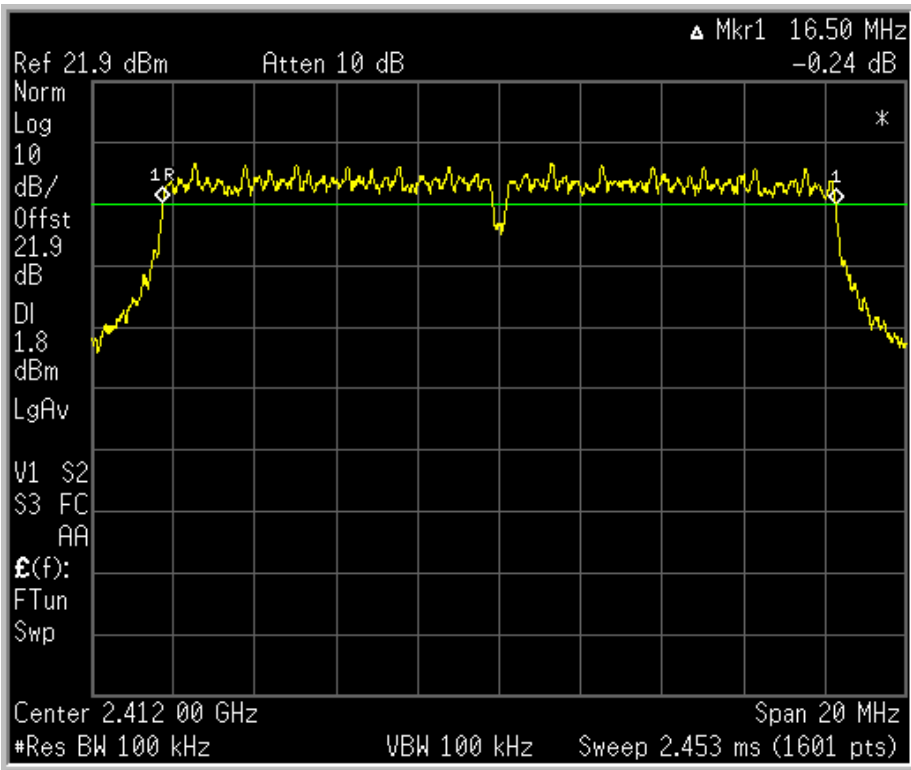
Plot 6.14.2: 6dB Bandwidth at CH6, 11Mbps, 802.11b mode



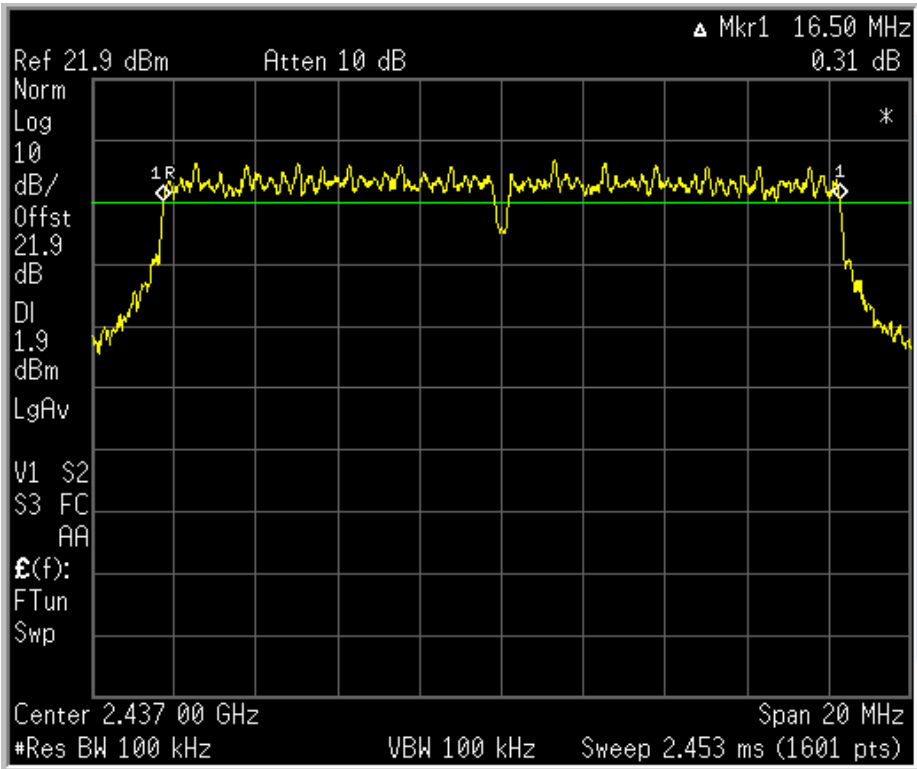
Plot 6.14.3: 6dB Bandwidth at CH11, 11Mbps, 802.11b mode



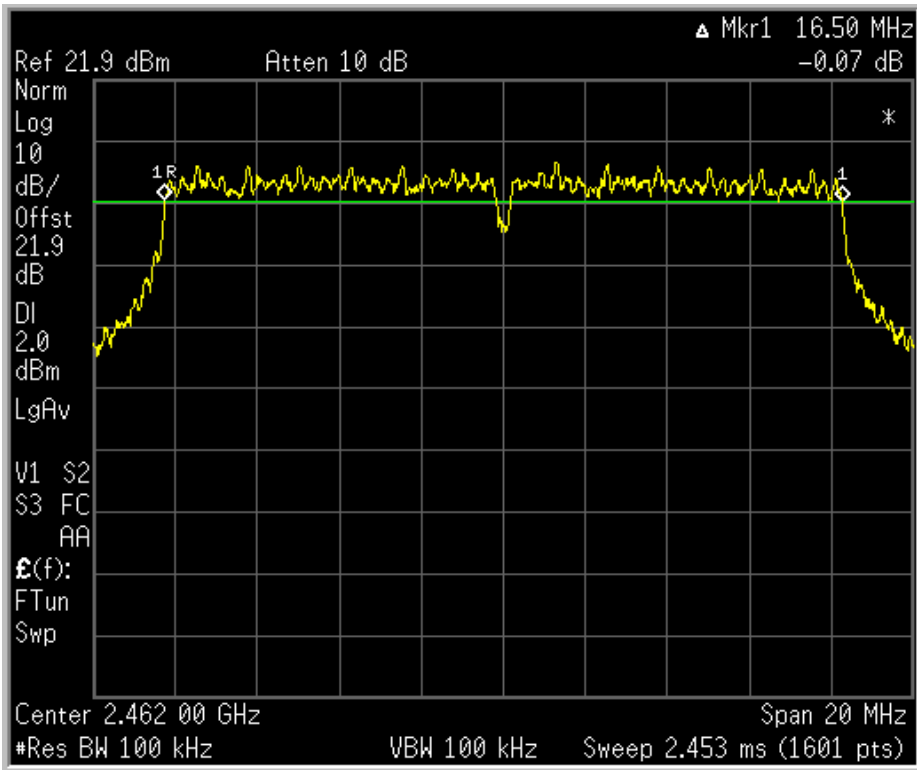
Plot 6.14.4: 6dB Bandwidth at CH1, 54Mbps, 802.11g mode



Plot 6.14.5: 6dB Bandwidth at CH6, 54Mbps, 802.11g mode



Plot 6.14.6: 6dB Bandwidth at CH11, 54Mbps, 802.11g mode



6.15 Peak Power Spectral Density - Pursuant to 47 CFR §15.247(d)

6.15.1 Test Procedure:

- A laptop was connected to the EUT to control the RF output power and Frequency.
- The EUT 2.4GHz RF Output Connector was connected through Calibrated Attenuators to a Spectrum analyzer.
- The Maximum level in a 3 KHz bandwidth is measured with the spectrum analyzer using RBW = 3 KHz, VBW = 10 KHz.
- The Spectrum Analyzer was put in max hold mode to recall the highest PPSD level found across the emission in any 3 KHz band.
- The EUT power was adjusted at the maximum output power level.
- Procedure was made for the 802.11b and 802.11g at highest data rate and at low, mid and high Frequency.

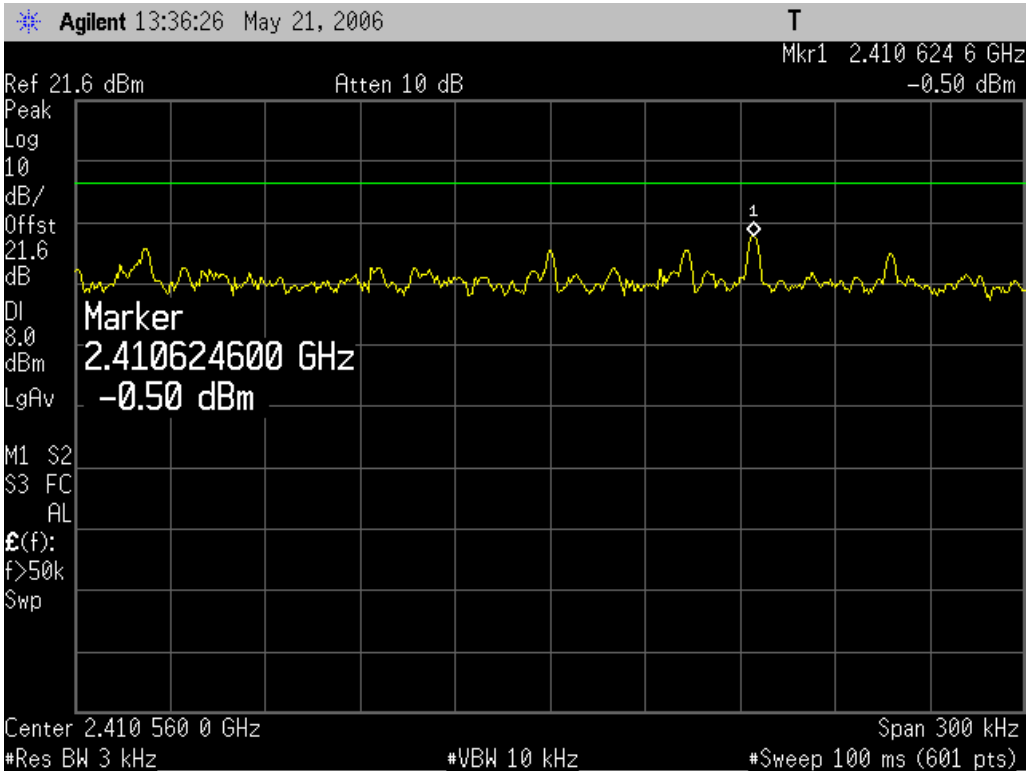
6.15.2 Results:

- Results are shown in Table 6.14.1 and the associated plots.

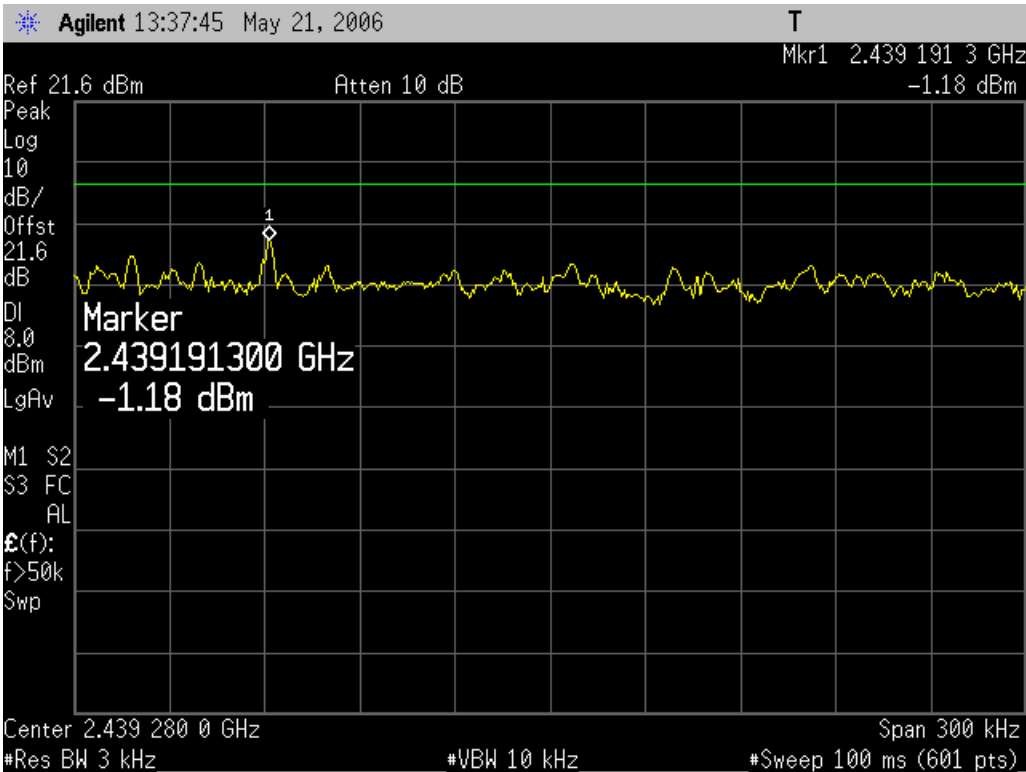
Table 6.14.1: Peak Power Spectral Density Results.

Plot #	Channel #	Frequency [MHz]	Rate [MHz]	PPSD [dBm]	Limit [dBm]	Margin [dB]
802.11b Mode						
6.15.1	1	2412	11	-5.06	8	13.06
6.15.2	6	2437	11	-5.51	8	13.51
6.15.3	11	2462	11	-4.05	8	12.05
802.11g Mode						
6.15.4	1	2412	54	-8.81	8	16.81
6.15.5	6	2437	54	-10.45	8	18.45
6.15.6	11	2462	54	-8.31	8	16.31

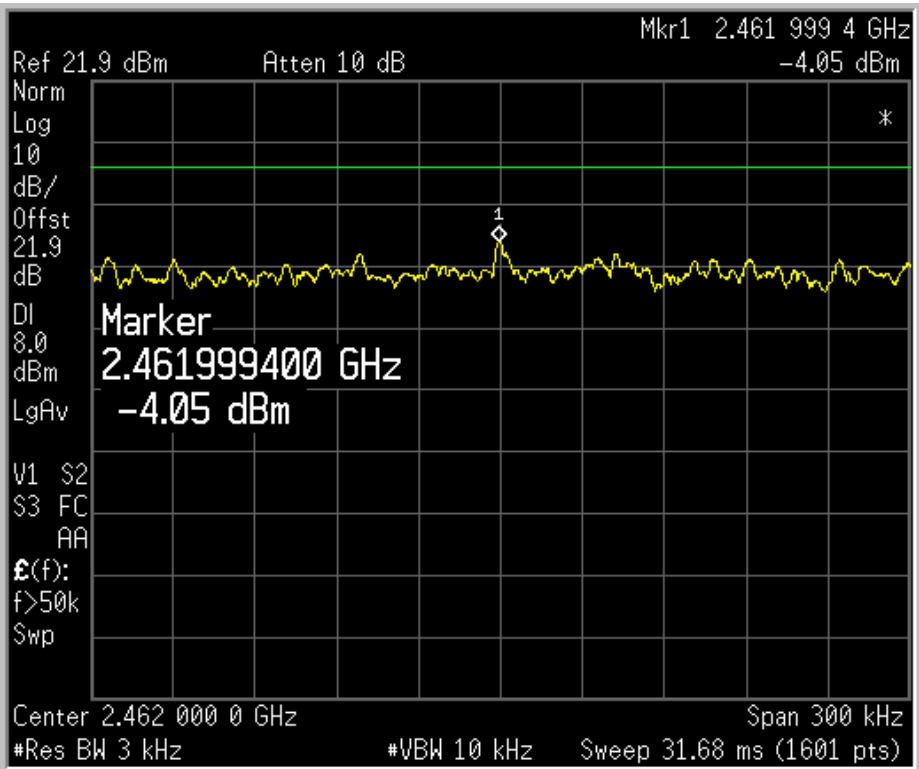
Plot 6.15.1: Peak Power Spectral Density at low carrier frequency, 11Mbps, 802.11b mode



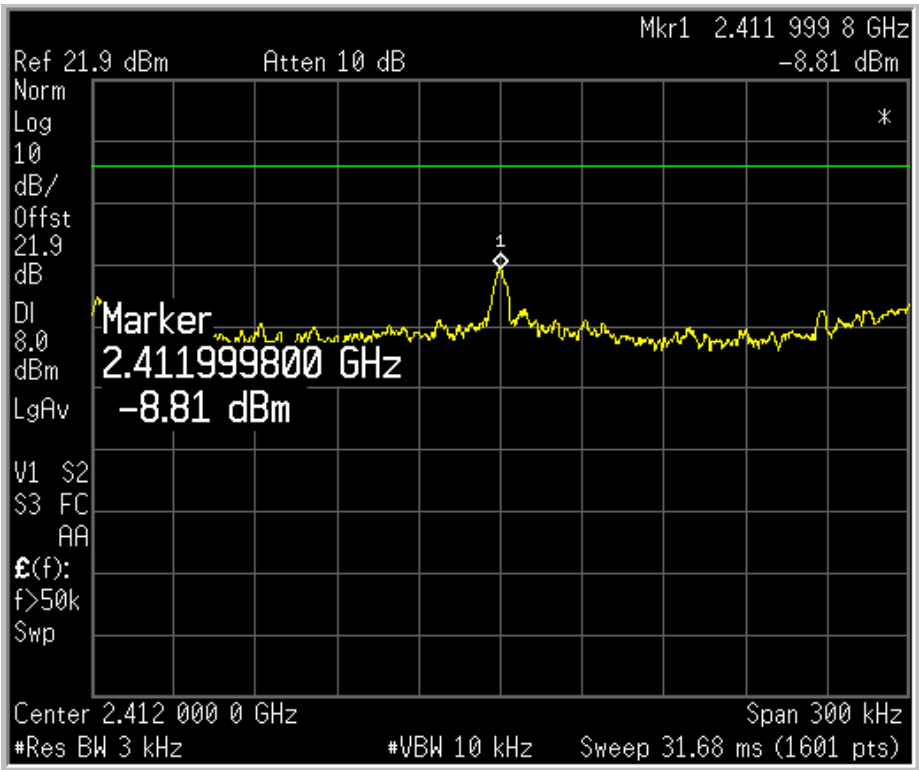
Plot 6.15.2: Peak Power Spectral Density at mid carrier frequency, 11Mbps, 802.11b mode



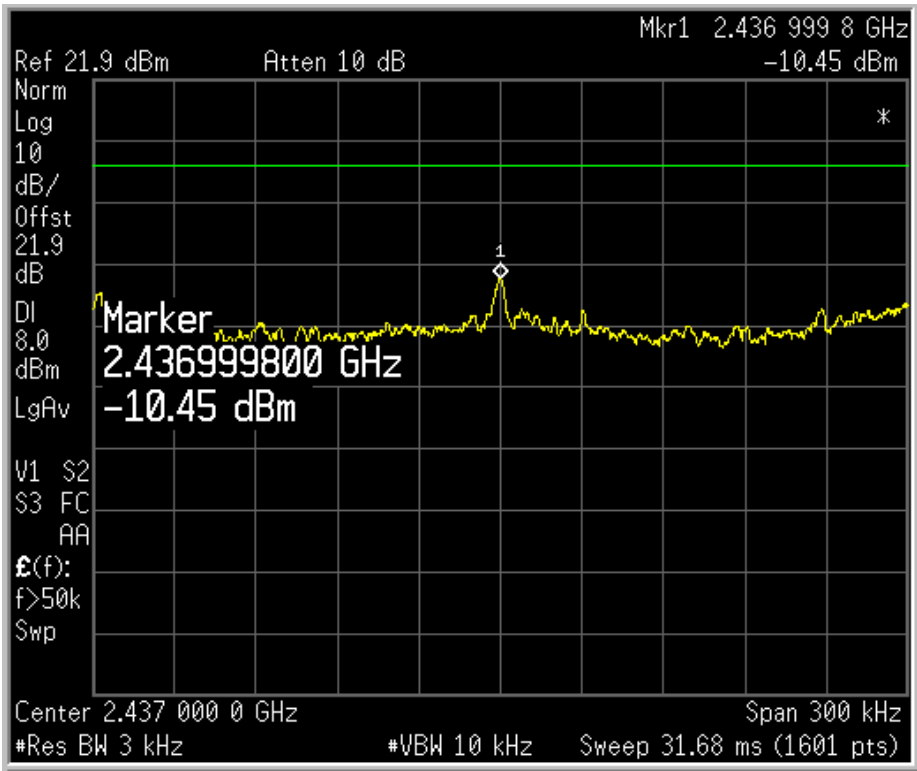
Plot 6.15.3: Peak Power Spectral Density at high carrier frequency, 11Mbps, 802.11b mode



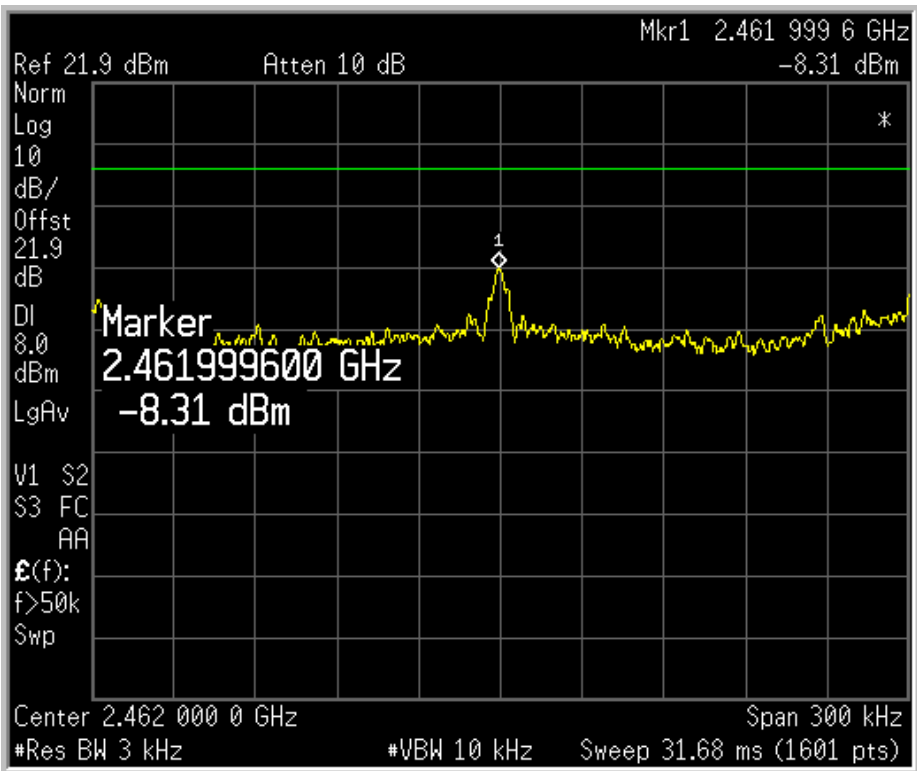
Plot 6.15.4: Peak Power Spectral Density at low carrier frequency, 54Mbps, 802.11g mode



Plot 6.15.5: Peak Power Spectral Density at mid carrier frequency, 54Mbps, 802.11g mode



Plot 6.15.6: Peak Power Spectral Density at high carrier frequency, 54Mbps, 802.11g mode



6.16 Conducted Spurious Emissions - Pursuant to 47 CFR §15.247(c)6.16.1 Test Procedure:

- A laptop was connected to the EUT to control the RF output power and Frequency.
- The EUT 2.4GHz RF Output Connector was connected through Calibrated Attenuators to a Spectrum Analyzer.
- The Spectrum Analyzer was set to RBW=100 KHz and VBW=100 KHz and Max hold was activated.
- The EUT power was adjusted at the maximum output power level.
- Procedure was repeated at both 802.11b and 802.11g standards.
- Procedure was repeated at lower, mid and upper channels and at highest data rate.
- Tested Frequency range: 0.03-26.5GHz.

6.16.2 Limit:

- Specification test limit:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.

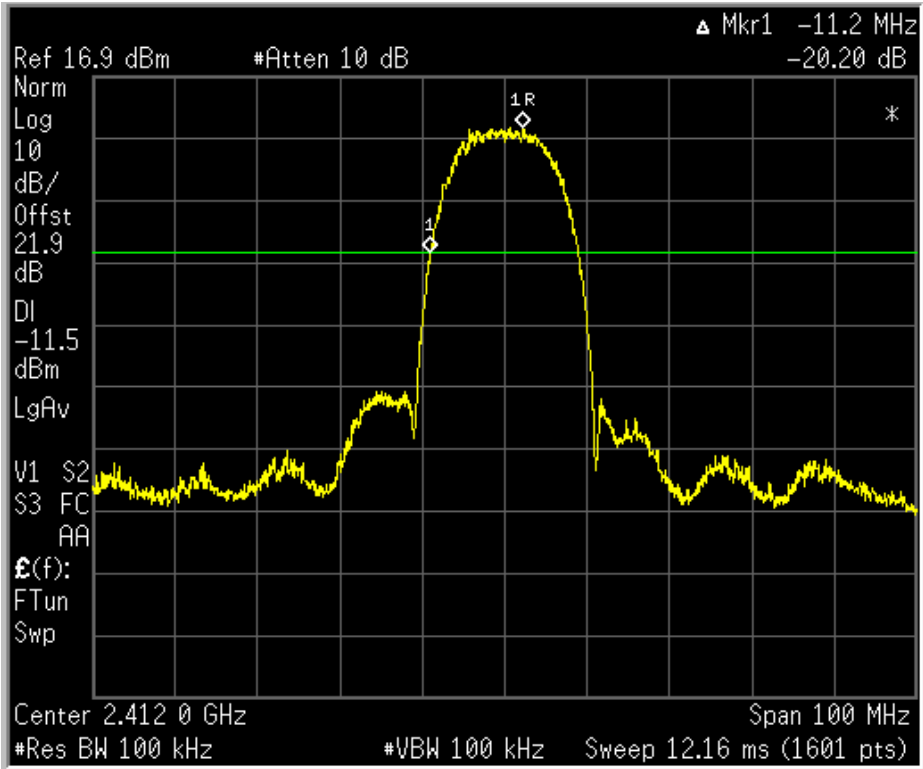
6.16.3 Results:

- Test Results are provided in Table 6.16.1 and the associated plots.

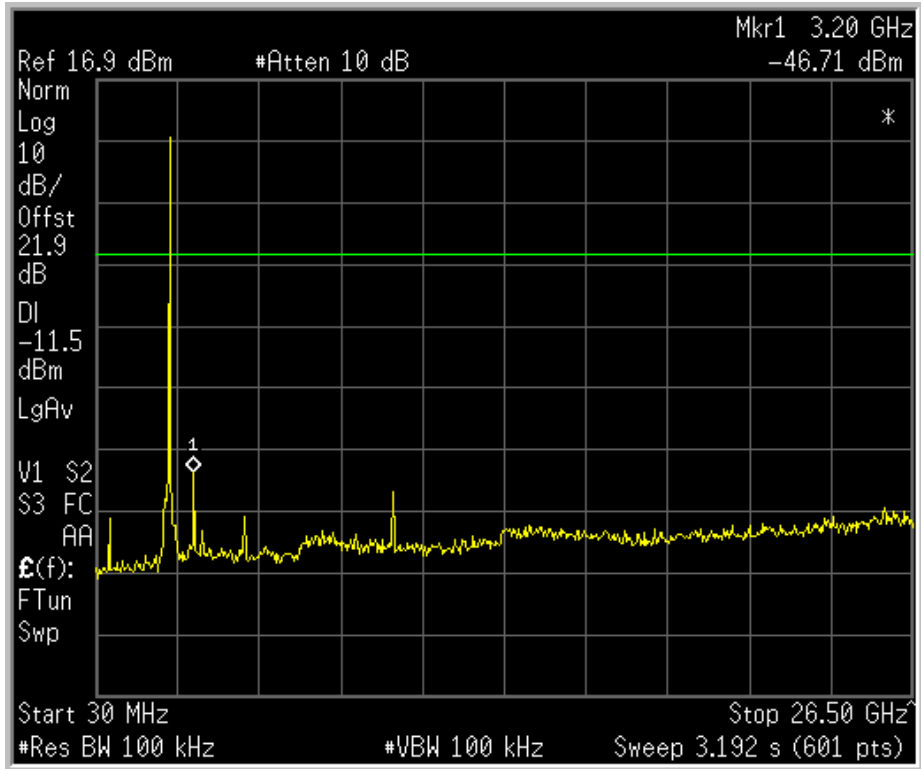
Table 6.16.1: Conducted emission plots summary.

Plot #	Frequency [MHz]	Standard	Freq Sweep	Pass/Fail
6.16.1÷6	Low, mid, high	802.11b	0.03 – 26.5 [GHz]	Pass
6.16.7÷12	Low, mid, high	802.11g	0.03 – 26.5 [GHz]	Pass

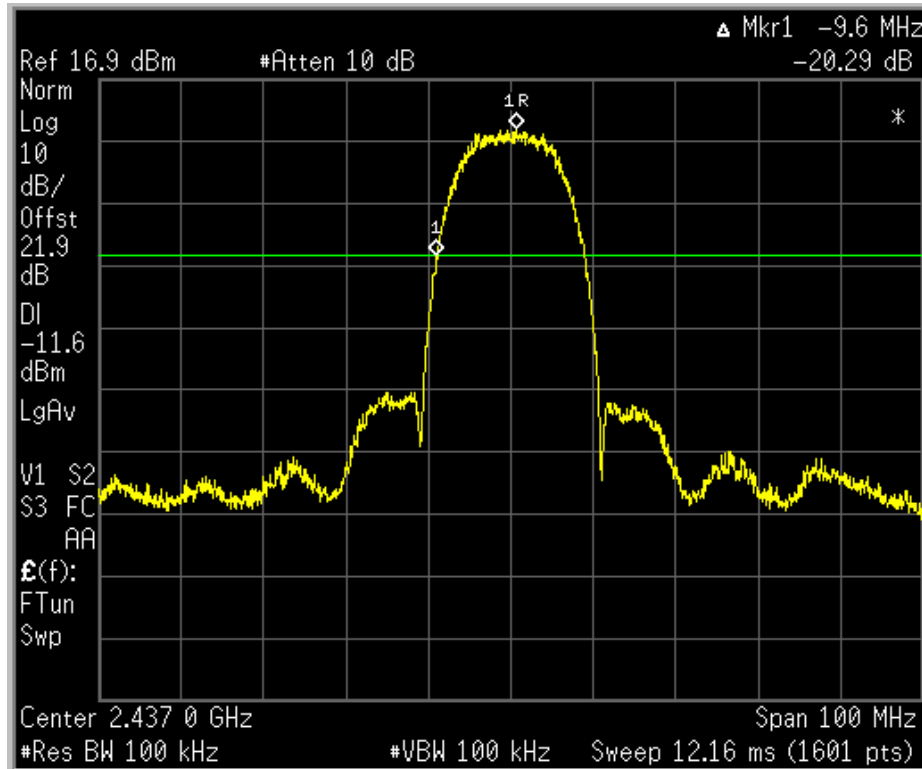
Plot 6.16.1: Tx Conducted emission measurement at the low carrier frequency, low band edge, 802.11b mode.



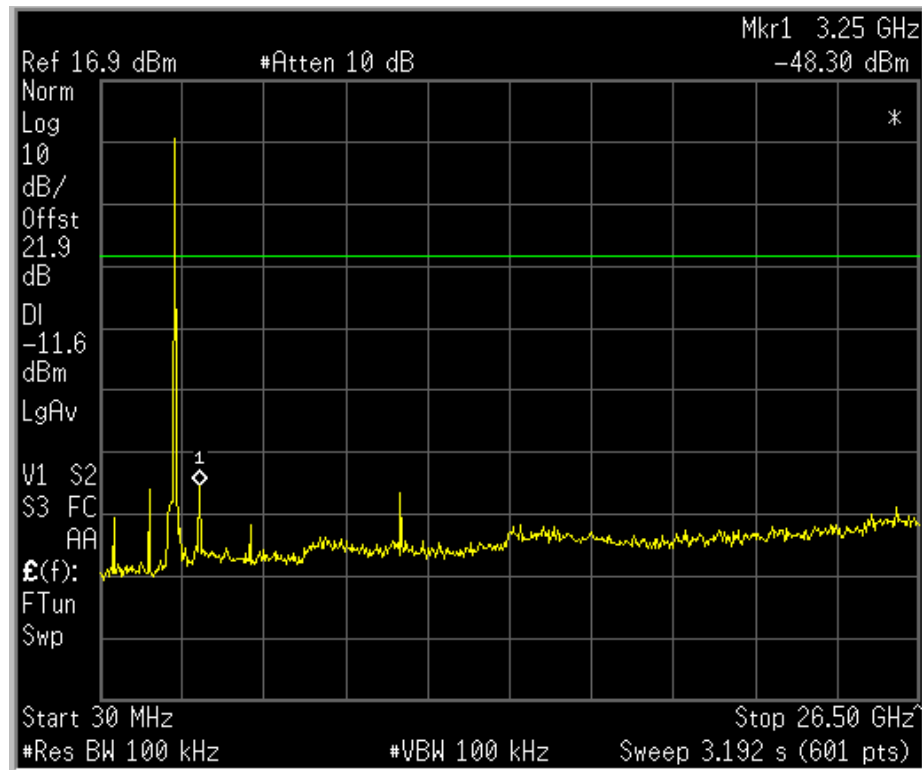
Plot 6.16.2: Tx Conducted emission measurements 0.03-26.5GHz at the low carrier frequency, 802.11b mode,



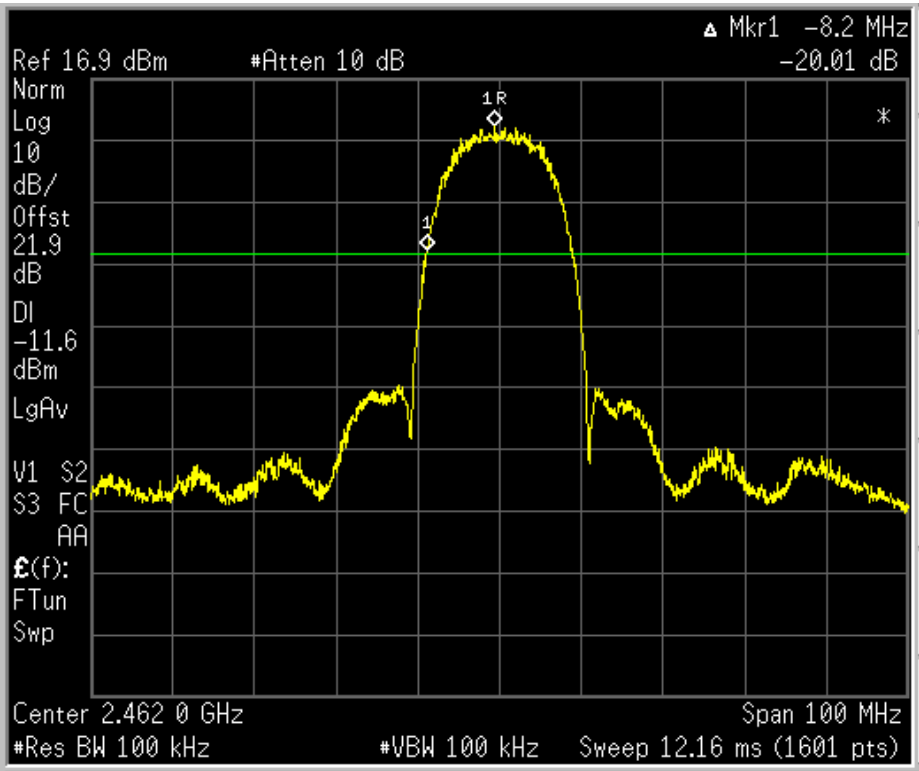
Plot 6.16.3: Tx Conducted emission measurement at the mid carrier frequency, 802.11b mode.



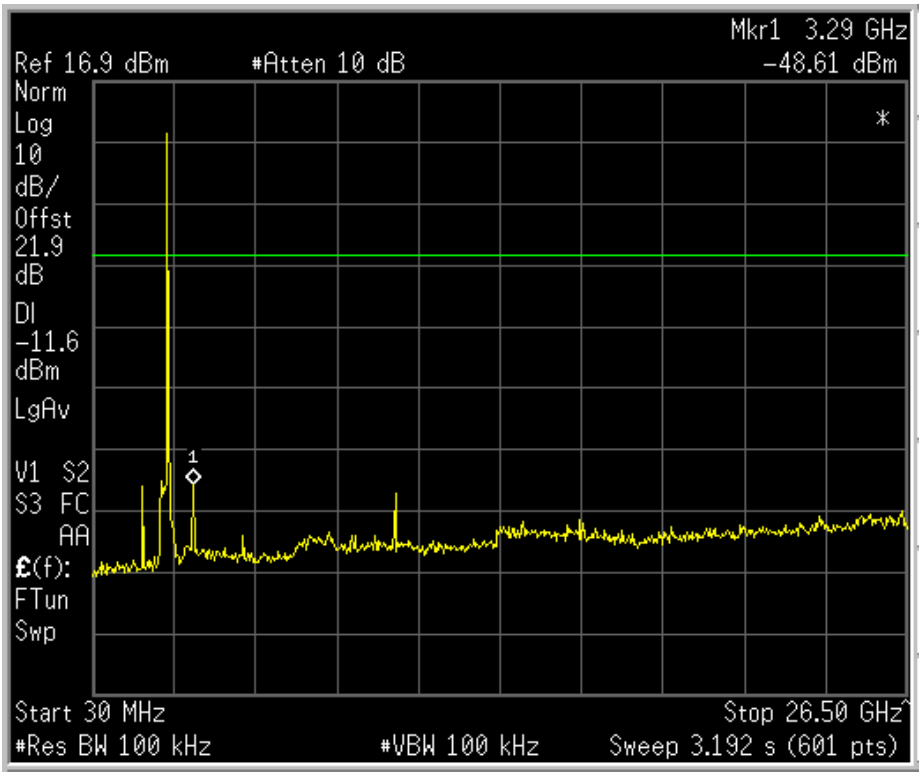
Plot 6.16.4: Tx Conducted emission measurements 0.03-26.5GHz at the mid carrier frequency, 802.11b mode,



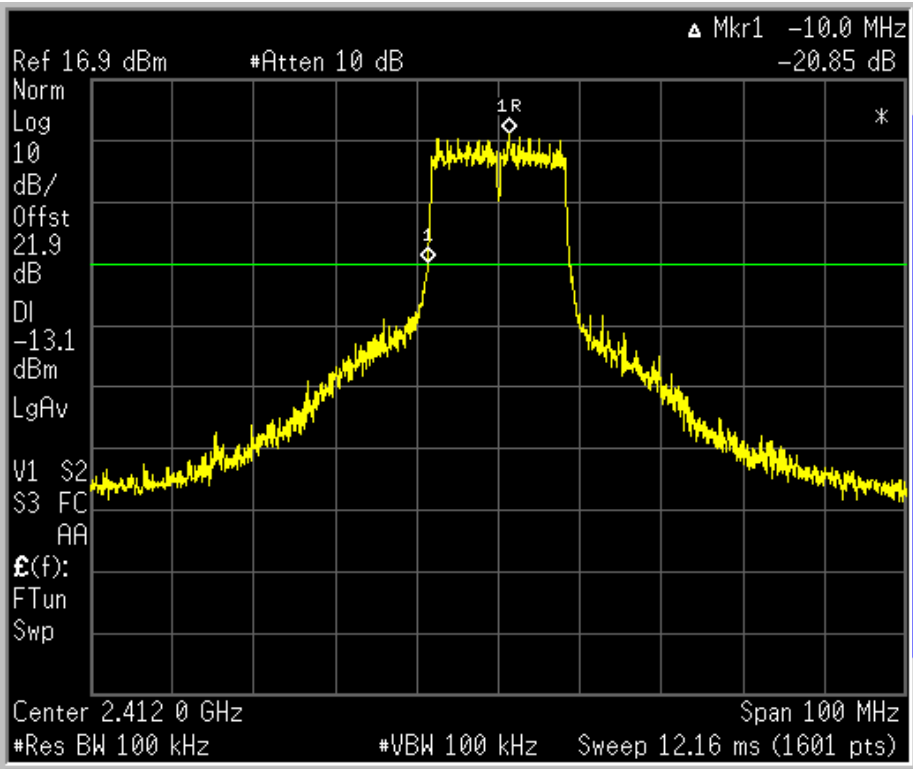
Plot 6.16.5: Tx Conducted emission measurement at the high carrier frequency, high band edge, 802.11b mode.



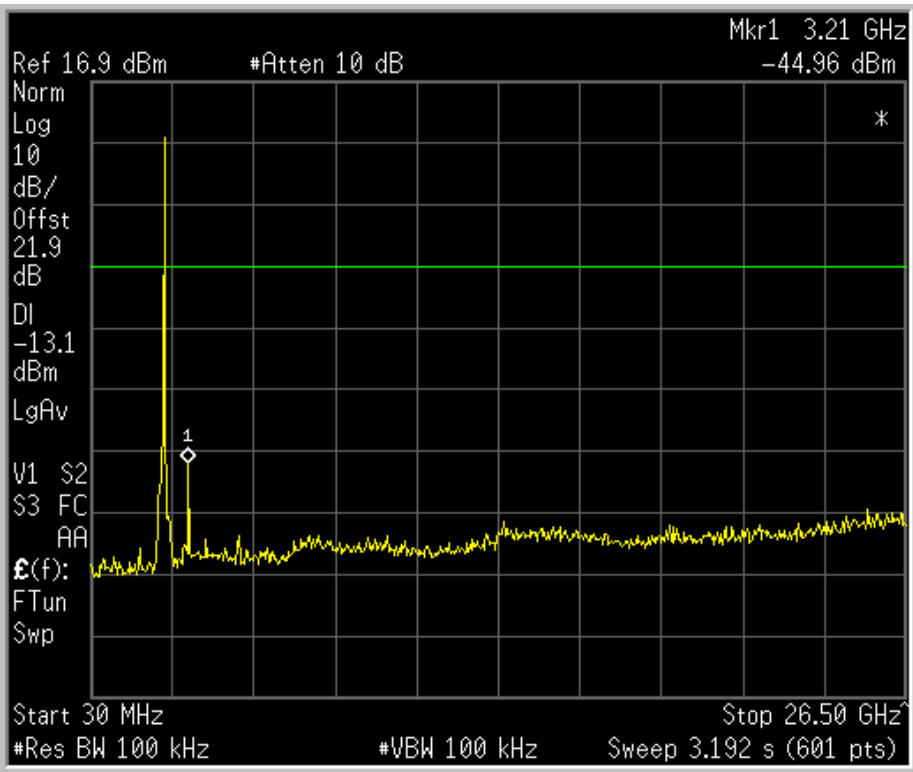
Plot 6.16.6: Tx Conducted emission measurements 0.03-26.5GHz at the high carrier frequency, 802.11b mode,



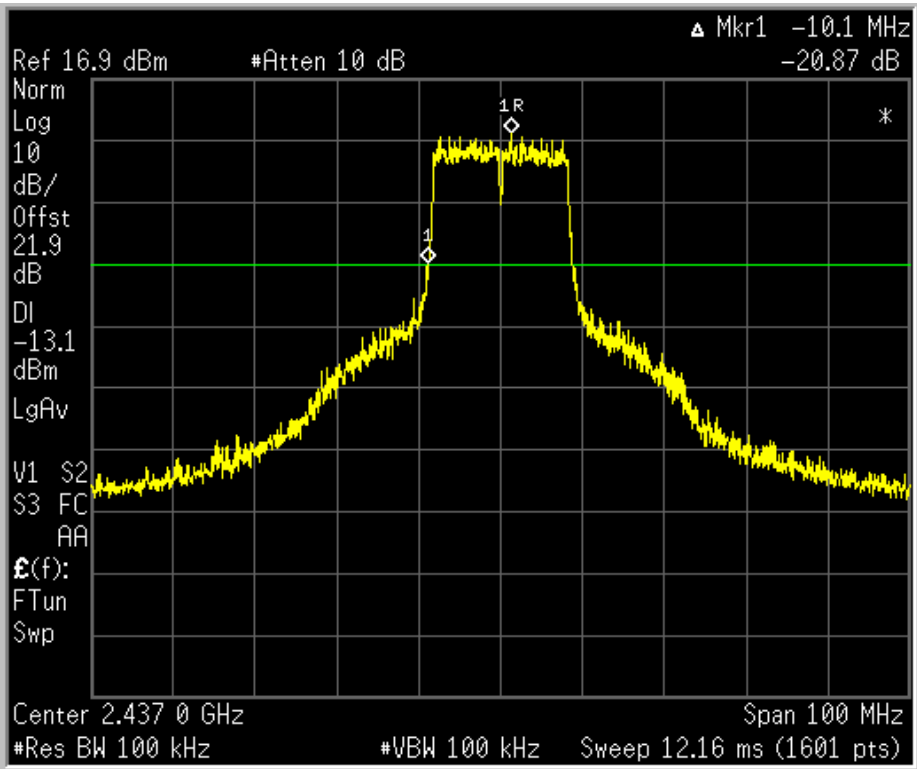
Plot 6.16.7: Tx Conducted emission measurement at the low carrier frequency, low band edge, 802.11g mode.



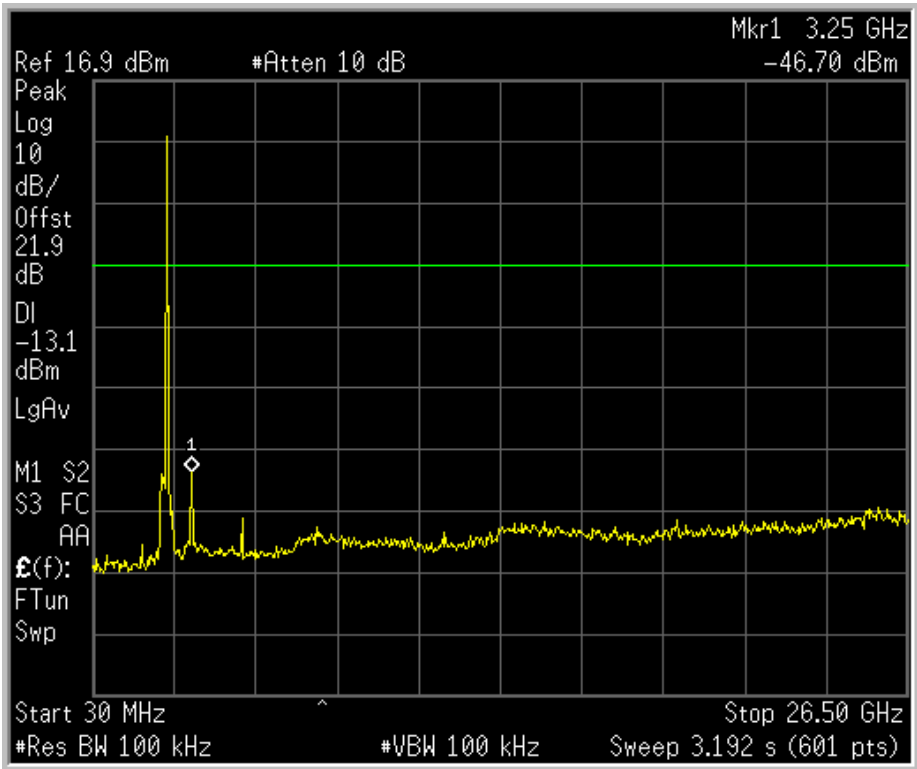
Plot 6.16.8: Tx Conducted emission measurements 0.03-26.5GHz at the low carrier frequency, 802.11g mode,



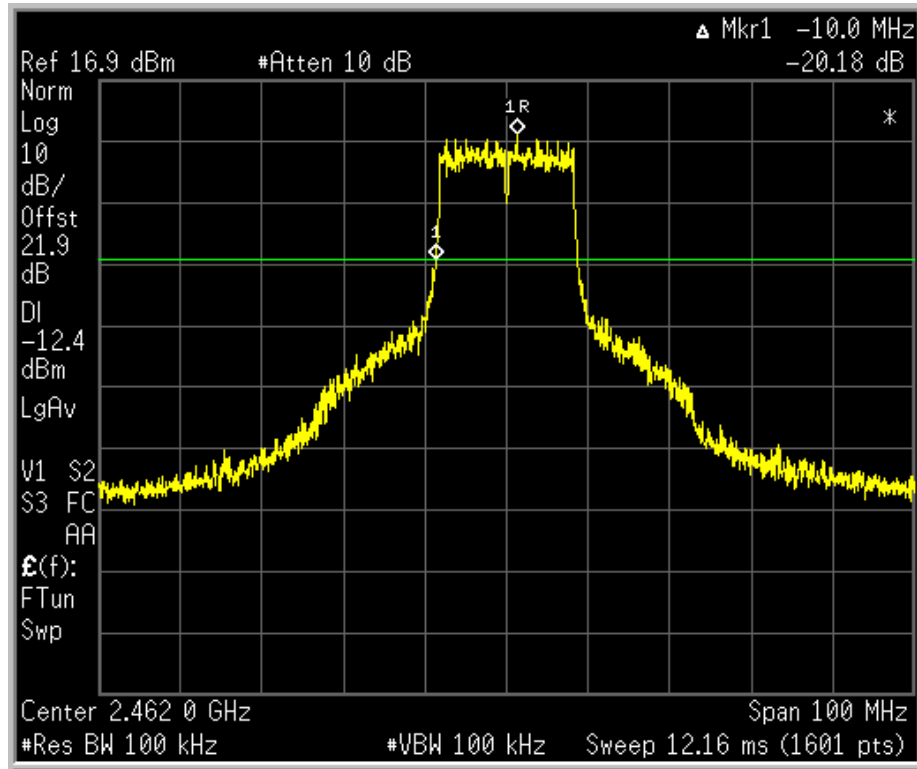
Plot 6.16.9: Tx Conducted emission measurement at the mid carrier frequency, 802.11g mode.



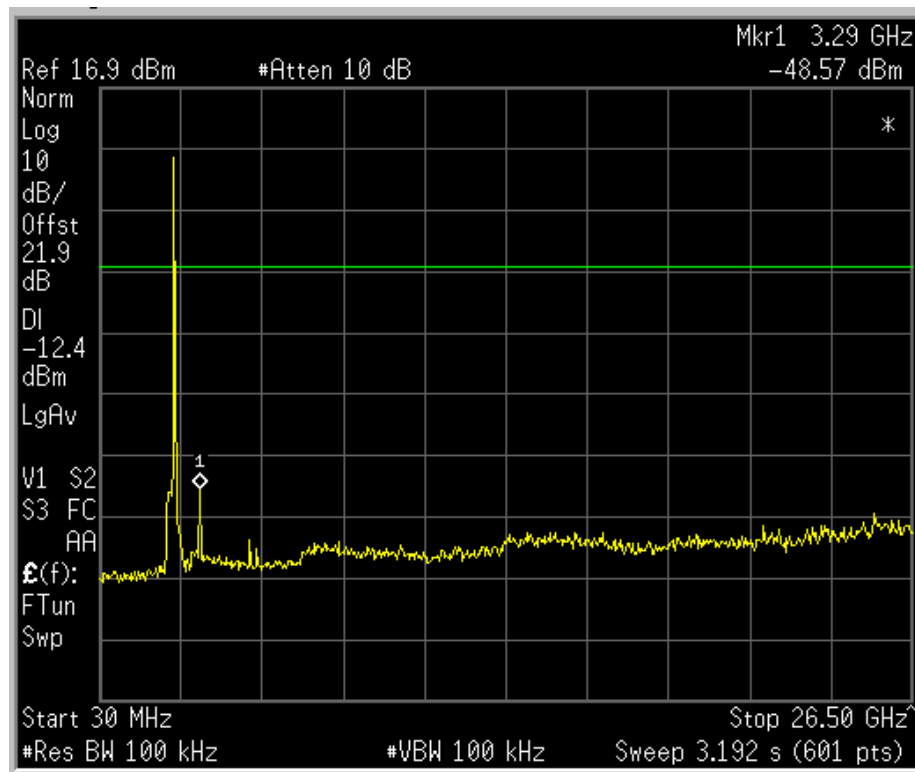
Plot 6.16.10: Tx Conducted emission measurements 0.03-26.5GHz at the mid carrier frequency, 802.11g mode,



Plot 6.16.11: Tx Conducted emission measurement at the high carrier frequency, high band edge, 802.11g mode.



Plot 6.16.12: Tx Conducted emission measurements 0.03-26.5GHz at the high carrier frequency, 802.11g mode,



6.17 Radiated Spurious Emissions - Pursuant to 47 CFR §15.247(c)

6.17.1 Test Procedure:

- A laptop was connected to the EUT to control the RF output power and Frequency.
- Laptop was placed on the top of a rotating table 0.8 meters above the ground.
- The table was rotated 360 degree to determine the position of the highest radiation.
- A receiving antenna was set 3 meters away from the EUT and was mounted on a variable height antenna tower.
- The Field strength of radiated spurious emissions was measured.
- Both Horizontal and Vertical Polarization of receiving antenna were tested.
- The EUT 2.4GHz was set to transmit via external reference antenna.
- The EUT power was adjusted at the maximum output power level.
- Standard 802.11g was chosen as worst case for this test, except for 30÷4000 MHz ranges.
- Procedure was made at highest data rate and at low, mid and high Frequency.
- Tested Frequency Range: 9KHz to 26.5GHz
- Test was taken at Semi anechoic chamber and OATS located at “HERMON LABORATORIES”.

6.17.2 Limits:

- Specification test limits are given in Table 6.17.1.

Table 6.17.1: Radiated Field strength limit

Frequency, MHz	Field strength at 3 m within restricted bands, dB(μV/m)***			Attenuation of field strength of spurious versus carrier outside restricted bands, dBc***
	Peak	Quasi-peak	Average	
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**	20.0
0.090 – 0.110	NA	108.5 – 106.8**	NA	
0.110 – 0.490	126.8 – 113.8	NA	106.8 – 93.8**	
0.490 – 1.705	NA	73.8 – 63.0**	NA	
1.705 – 30.0		69.5		
30 - 88		40.0		
88 - 216		43.5		
216 - 960		46.0		
960 - 1000		54.0		
1000 – 10 th harmonic	74.0	NA	54.0	

*- The limit for 3m test distance was calculated using the inverse square distance extrapolation factor as follows:

$$\text{Lim}_{S_2} = \text{Lim}_{S_1} + 40 \log (S_1/S_2),$$

Where S_1 and S_2 – standard defined and test distance respectively in meters.

** - The limit decreases linearly with the logarithm of frequency.

*** - The field strength limits applied from the lowest radio frequency generated in the device, without going below 9 kHz up to the tenth harmonic of the highest fundamental frequency.

6.17.3 Results:

- Test results are described at tables 6.17.2 ÷ 5 and the associated plots.
- Results describe emission outside restricted bands and within restricted bands.

Table 6.17.2: Field strength of emissions outside restricted bands

ASSIGNED FREQUENCY: 2400 – 2483.5 MHz
 INVESTIGATED FREQUENCY RANGE: 0.009 - 26500 MHz
 TEST DISTANCE: 3 m
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	Field strength of spurious, dB(μV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	Field strength of carrier, dB(μV/m)	Attenuation below carrier, dBc	Limit, dBc	Margin, dB**	Verdict
All carrier frequencies									
99.99875	44.87	Vertical	1.5	50	105.35	60.48	20.0	-40.48	Pass
366.6475	43.77	Vertical	1.2	20		61.58	20.0	-41.58	Pass
433.3037	37.35	Vertical	1.2	49		68.00	20.0	-48.00	Pass
499.9685	46.30	Horizontal	1.0	230		59.05	20.0	-39.05	Pass
801.0000	42.88	Vertical	1.5	150		62.47	20.0	-42.47	Pass
802.11g									
Low carrier frequency									
1658	44.83	Vertical	1.2	215	105.35	60.52	20.0	-40.52	Pass
9648	70.67	Vertical	1.5	210		34.68		-14.68	
Mid carrier frequency									
9748	72.67	Vertical	1.0	150	106.29	33.62	20.0	-13.62	Pass
High carrier frequency									
1731.00	48.4	Vertical	1.5	150	107.81	59.41	20.0	-29.41	Pass
9848	72.67	Vertical	1.2	200		35.14		-15.14	

*- EUT front panel refers to 0 degrees position of turntable.

** - Margin = Attenuation below carrier – specification limit.

Table 6.17.3: Restricted bands.

MHz	MHz	MHz	MHz	MHz	GHz
0.09 - 0.11	8.37625 - 8.38675	73 - 74.6	399.9 - 410	2655 - 2900	10.6 - 12.7
0.495 - 0.505	8.41425 - 8.41475	74.8 - 75.2	608 - 614	3260 - 3267	13.25 - 13.4
2.1735 - 2.1905	12.29 - 12.293	108 - 121.94	960 - 1240	3332 - 3339	14.47 - 14.5
4.125 - 4.128	12.51975 - 12.52025	123 - 138	1300 - 1427	3345.8 - 3358	15.35 - 16.2
4.17725 - 4.17775	12.57675 - 12.57725	149.9 - 150.05	1435 - 1626.5	3600 - 4400	17.7 - 21.4
4.20725 - 4.20775	13.36 - 13.41	156.52475 - 156.52525	1645.5 - 1646.5	4500 - 5150	22.01 - 23.12
6.215 - 6.218	16.42 - 16.423	156.7 - 156.9	1660 - 1710	5350 - 5460	23.6 - 24
6.26775 - 6.26825	16.69475 - 16.69525	162.0125 - 167.17	1718.8 - 1722.2	7250 - 7750	31.2 - 31.8
6.31175 - 6.31225	16.80425 - 16.80475	167.72 - 173.2	2200 - 2300	8025 - 8500	36.43 - 36.5
8.291 - 8.294	25.5 - 25.67	240 - 285	2310 - 2390	9000 - 9200	Above 38.6
8.362 - 8.366	37.5 - 38.25	322 - 335.4	2483.5 - 2500	9300 - 9500	

Table 6.17.4: Field strength of spurious emissions below 1GHz within restricted bands

ASSIGNED FREQUENCY: 2400 – 2483.5 MHz
 INVESTIGATED FREQUENCY RANGE: 0.009 – 1000 MHz
 TEST DISTANCE: 3 m
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	Peak emission, dB(μV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
All carrier frequencies								
166.6512	40.29	39.06	43.50	-4.44	V	1.2	50	Pass
233.3237	40.35	38.54	46.00	-7.46	V	1.2	25	

Table 6.17.5: Field strength of spurious emissions above 1GHz within restricted bands

ASSIGNED FREQUENCY: 2400 – 2483.5 MHz
 INVESTIGATED FREQUENCY RANGE: 1000 - 26500 MHz
 TEST DISTANCE: 3 m
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

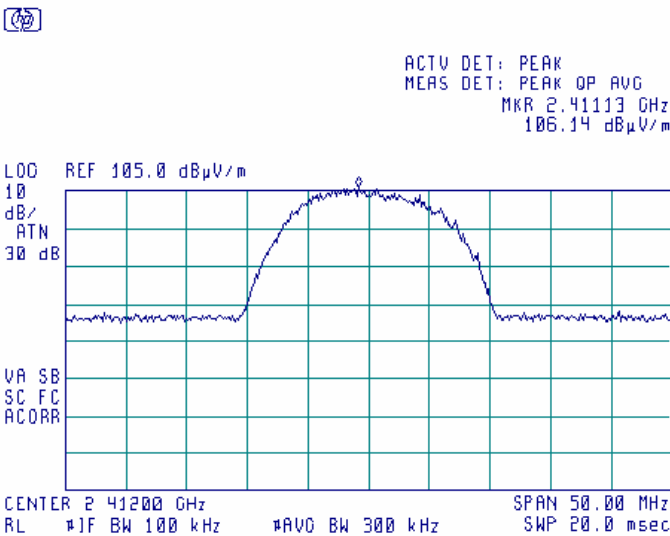
Frequency, MHz	Antenna		Azimuth, degrees*	Peak field strength(VBW=3 MHz)			Average field strength(VBW=10 Hz)			Verdict
	Polarization	Height, m		Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB	
802.11 b										
Low carrier frequency										
4824.00	Vertical	1.2	250	58.00	74.00	-16.00	41.50	54.00	-12.5	Pass
Mid carrier frequency										
All spurious below 20dB										Pass
High carrier frequency										
1699.0	Vertical	1.2	285	59.18	74	-14.82	44.99	54	-9.01	Pass
802.11 g										
Low carrier frequency										
4824.00	Vertical	1.2	250	54.33	74.00	-19.67	40.83	54.00	-13.17	Pass
Mid carrier frequency										
All spurious below 20dB										Pass
High carrier frequency										
1730.0	Vertical	1.2	285	59.34	74	-14.66	45.48	54	-8.52	Pass

** - Margin = Measured field strength - specification limit.

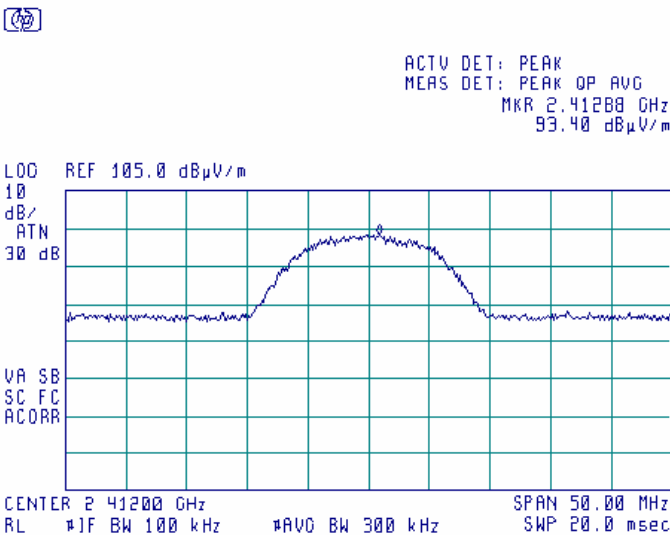
Table 6.17.2 Radiated Spurious emission plots summary

Plot #	Frequency [MHz]	Mode	Freq Sweep	Pass/Fail
6.17.1÷6	low, mid, high	802.11b	Ref Channel	
6.17.7÷12	low, mid, high	802.11g	Ref Channel	
6.17.13÷15	low, mid, high	802.11g	9 ÷ 150 KHz	Pass
6.17.16÷18	low, mid, high	802.11g	0.15÷30 MHz	Pass
6.17.19÷21	low, mid, high	802.11b	30÷1000 MHz	Pass
6.17.22÷24	low, mid, high	802.11g	30÷1000 MHz	Pass
6.17.25÷28	low	802.11b	1000÷2400 MHz	Pass
6.17.29÷32	mid	802.11b	1000÷2400 MHz	Pass
6.17.33÷37	high	802.11b	1000÷2400 MHz	Pass
6.17.38÷42	low	802.11g	1000÷2400 MHz	Pass
6.17.43÷47	mid	802.11g	1000÷2400 MHz	Pass
6.17.48÷52	high	802.11g	1000÷2400 MHz	Pass
6.17.53÷56	low, mid, high	802.11b	2483.5÷4000 MHz	Pass
6.17.57÷61	low, mid, high	802.11g	2483.5÷4000 MHz	Pass
6.17.62÷64	low, mid, high	802.11b	4÷6.5 GHz	Pass
6.17.65÷67	low, mid, high	802.11g	4÷6.5 GHz	Pass
6.17.68÷70	low, mid, high	802.11g	6.5÷8 GHz	Pass
6.17.71÷76	low, mid, high	802.11g	8÷14 GHz	Pass
6.17.77÷82	low, mid, high	802.11g	14÷18 GHz	Pass
6.17.83÷85	low, mid, high	802.11g	18÷26.5 GHz	Pass
6.17.86÷89	low, mid, high	802.11b	2 nd Harmonic	Pass
6.17.90÷93	low, mid, high	802.11g	2 nd Harmonic	Pass
6.17.94÷96	low, mid, high	802.11g	3 rd Harmonic	Pass
6.17.97÷99	low, mid, high	802.11g	4 th Harmonic	Pass
6.17.100÷102	low, mid, high	802.11g	5 th Harmonic	Pass
6.17.103÷105	low, mid, high	802.11g	6 th Harmonic	Pass
6.17.106÷108	low, mid, high	802.11g	7 th Harmonic	Pass

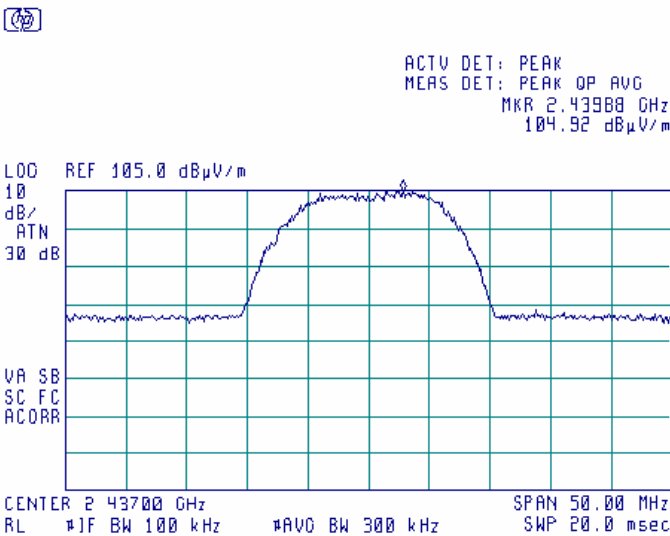
Plot 6.17.1: Tx Radiated emission measurements at the low carrier frequency, 11Mbps, 802.11b mode, Vertical polarization.



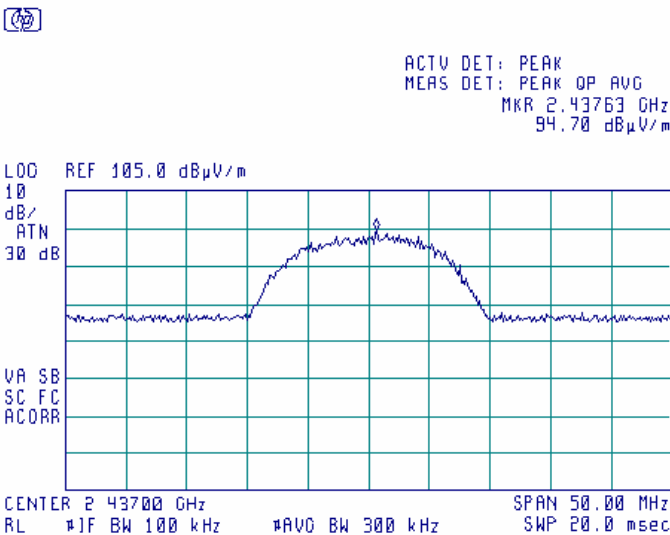
Plot 6.17.2: Tx Radiated emission measurements at the low carrier frequency, 11Mbps, 802.11b mode, Horizontal polarization.



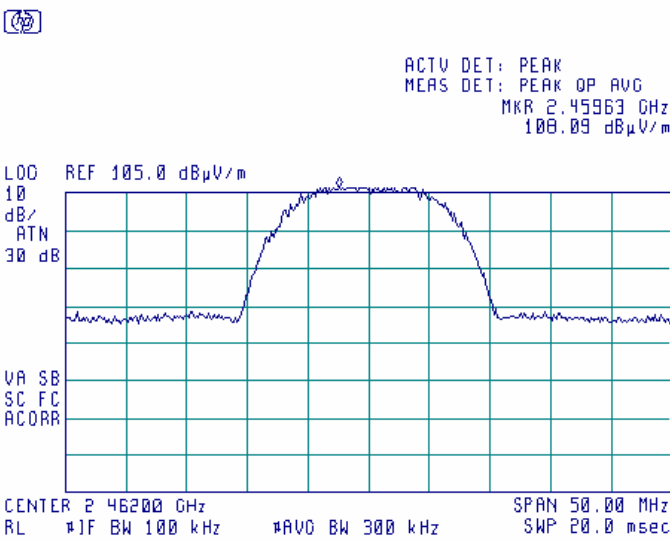
Plot 6.17.3: Tx Radiated emission measurements at the mid carrier frequency, 11Mbps, 802.11b mode, Vertical polarization.



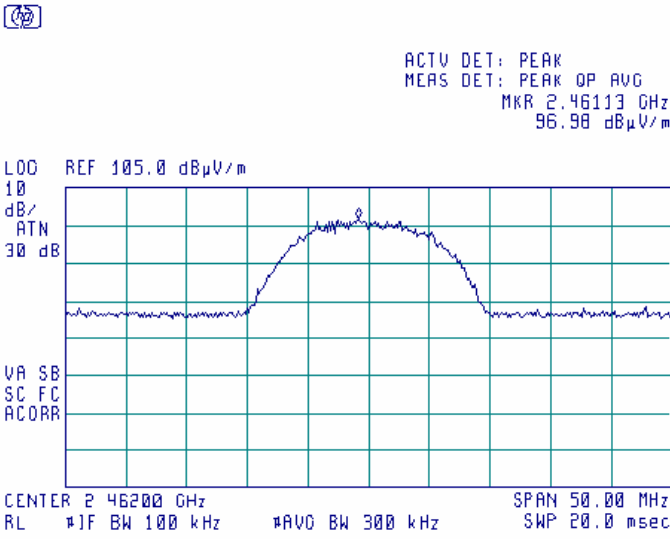
Plot 6.17.4: Tx Radiated emission measurements at the mid carrier frequency, 11Mbps, 802.11b mode, Horizontal polarization.



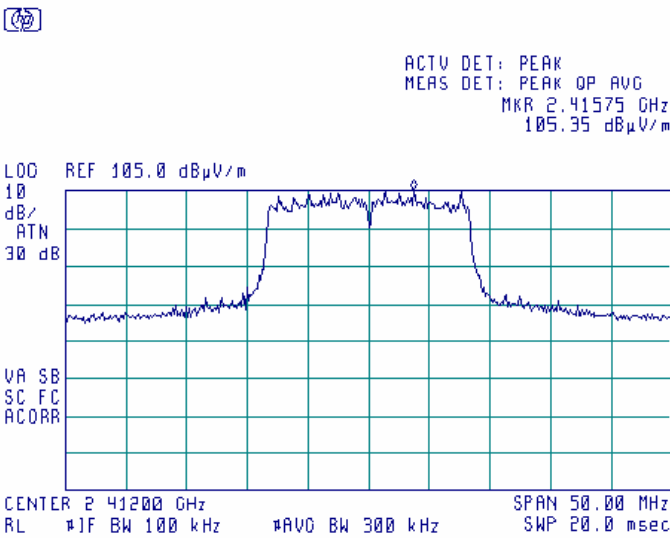
Plot 6.17.5: Tx Radiated emission measurements at the high carrier frequency, 11Mbps, 802.11b mode, Vertical polarization.



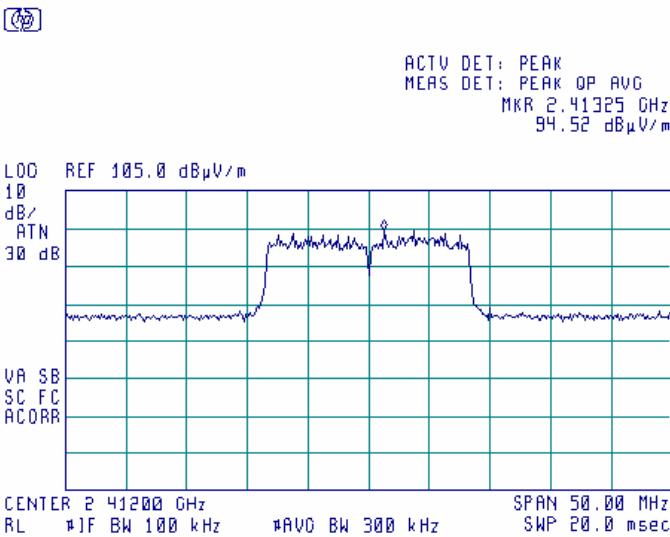
Plot 6.17.6: Tx Radiated emission measurements at the high carrier frequency, 11Mbps, 802.11b mode, Horizontal polarization.



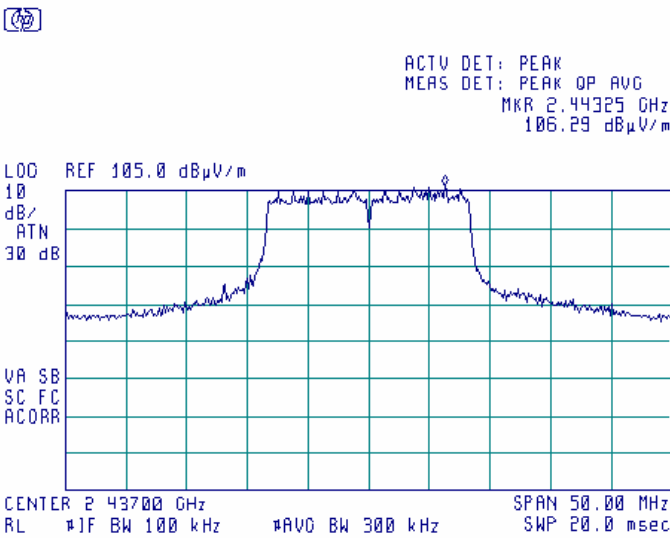
Plot 6.17.7: Tx Radiated emission measurements at the low carrier frequency, 54Mbps, 802.11g mode, Vertical polarization.



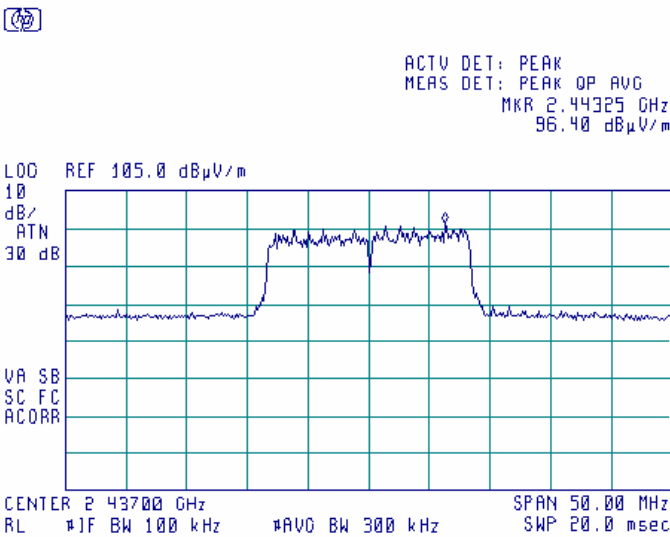
Plot 6.17.8: Tx Radiated emission measurements at the low carrier frequency, 54Mbps, 802.11g mode, Horizontal polarization.



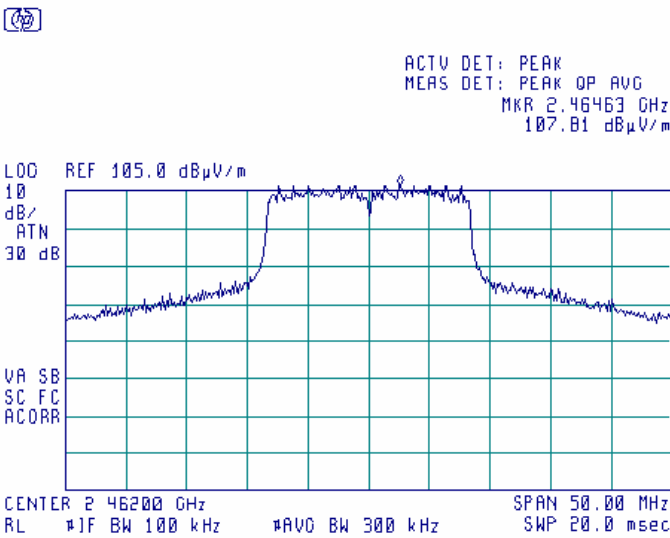
Plot 6.17.9: Tx Radiated emission measurements at the mid carrier frequency, 54Mbps, 802.11g mode, Vertical polarization.



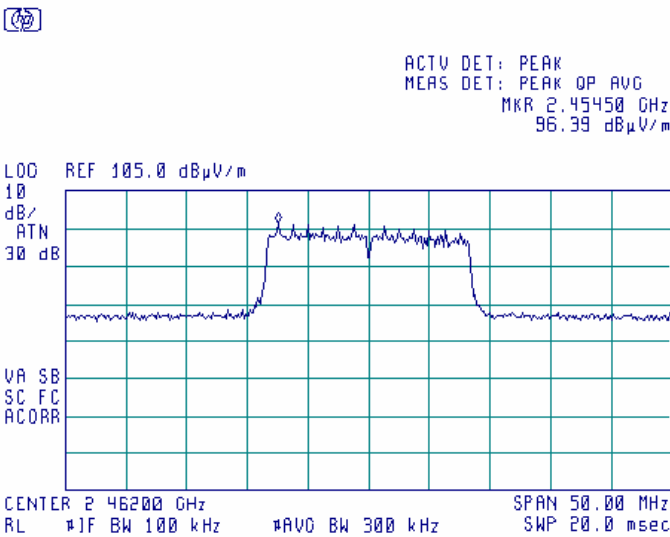
Plot 6.17.10: Tx Radiated emission measurements at the mid carrier frequency, 54Mbps, 802.11g mode, Horizontal polarization.



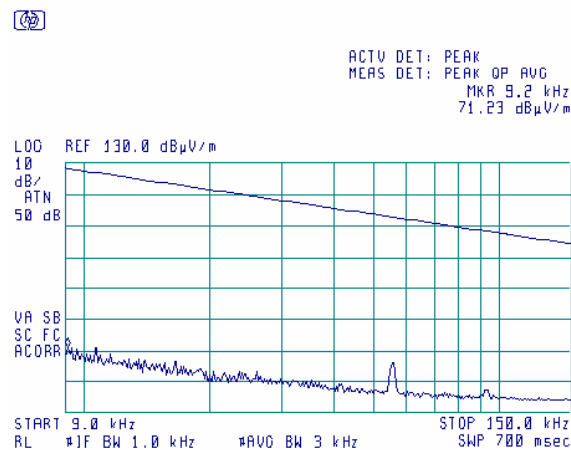
Plot 6.17.11: Tx Radiated emission measurements at the high carrier frequency, 54Mbps, 802.11g mode, Vertical polarization.



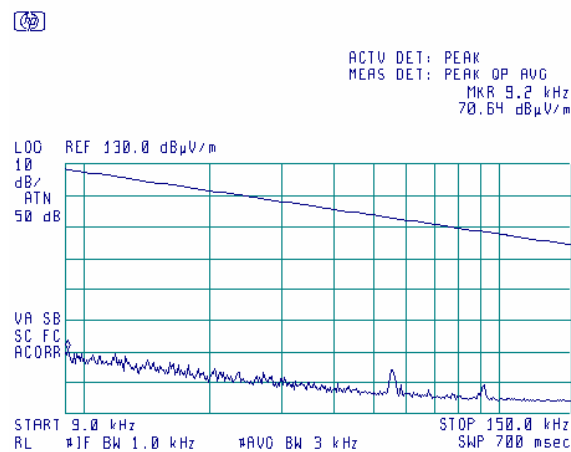
Plot 6.17.12: Tx Radiated emission measurements at the high carrier frequency, 54Mbps, 802.11g mode, Horizontal polarization.



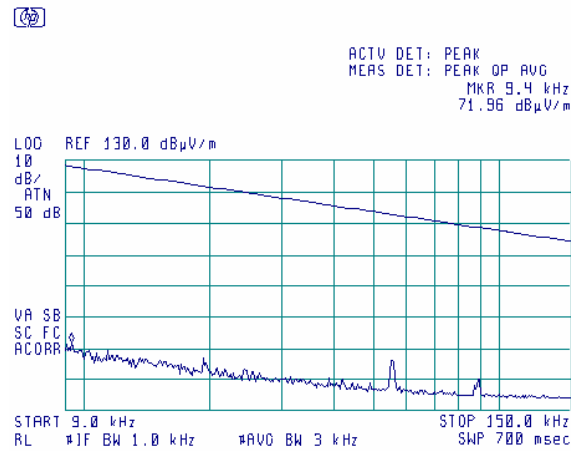
Plot 6.17.13: Tx Radiated emission measurements, 9-150 kHz at the low carrier frequency, 802.11g mode.



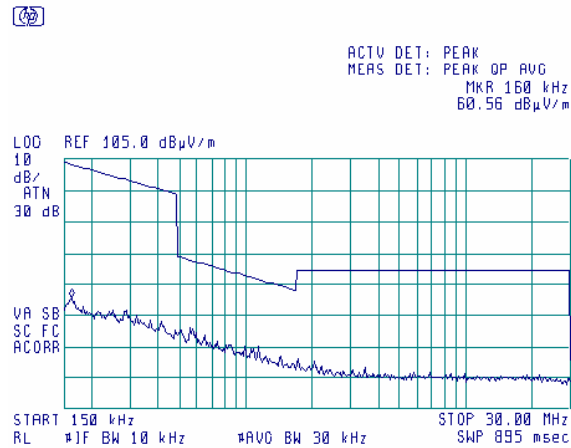
Plot 6.17.14: Tx Radiated emission measurements, 9-150 kHz at the mid carrier frequency, 802.11g mode.



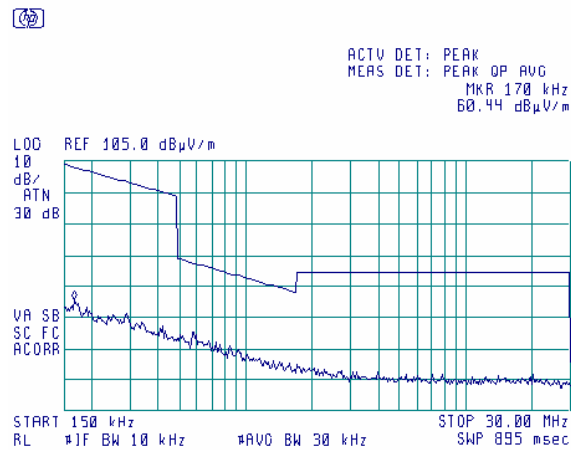
Plot 6.17.15: Tx Radiated emission measurements, 9-150 kHz at the high carrier frequency, 802.11g mode.



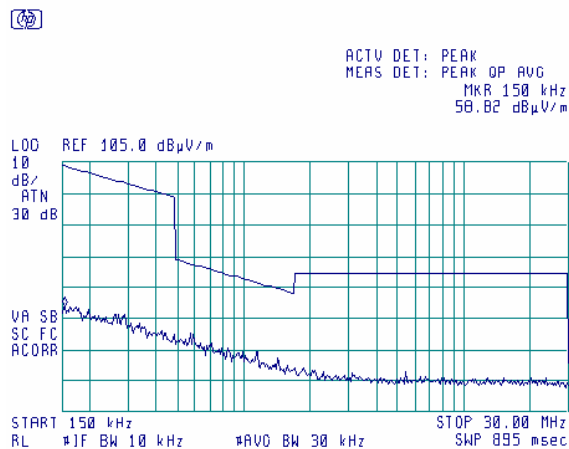
Plot 6.17.16: Tx Radiated emission measurements, 0.15 - 30 MHz at the low carrier frequency, 802.11g mode.



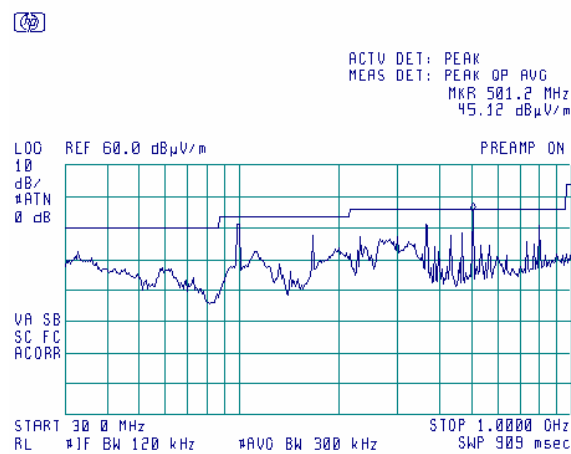
Plot 6.17.17: Tx Radiated emission measurements, 0.15 - 30 MHz at the mid carrier frequency, 802.11g mode.



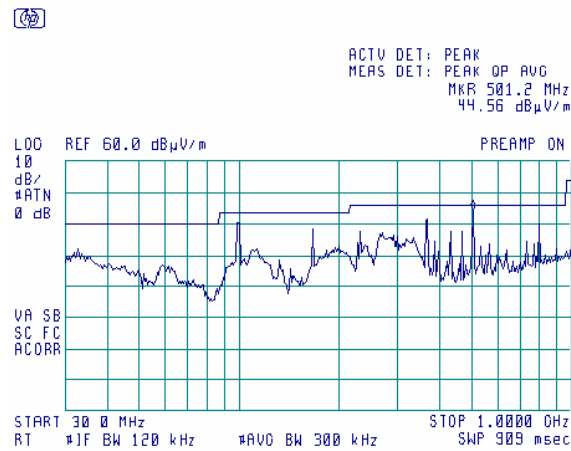
Plot 6.17.18: Tx Radiated emission measurements, 0.15 - 30 MHz at the high carrier frequency, 802.11g mode.



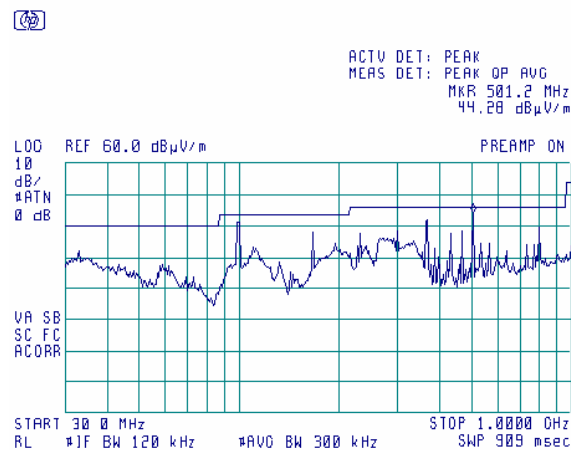
Plot 6.17.19: Tx Radiated emission measurements, 30 - 1000 MHz at the low carrier frequency, 802.11b mode.



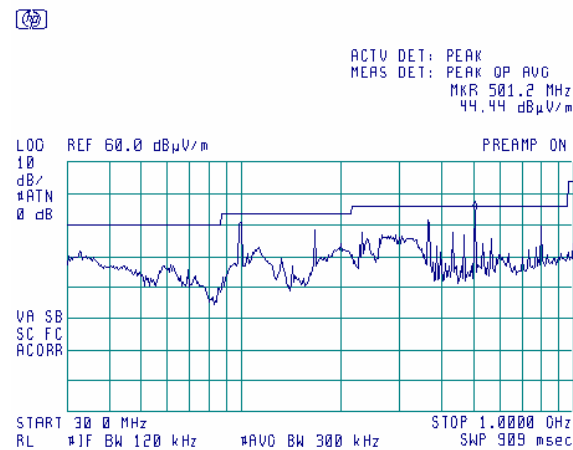
Plot 6.17.20: Tx Radiated emission measurements, 30 - 1000 MHz at the mid carrier frequency, 802.11b mode.



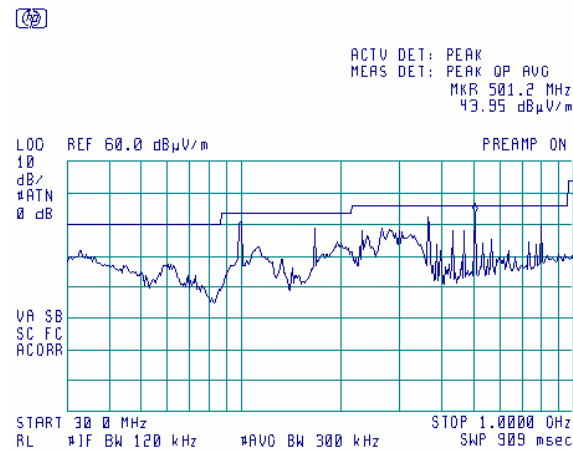
Plot 6.17.21: Tx Radiated emission measurements, 30 - 1000 MHz at the high carrier frequency, 802.11b mode.



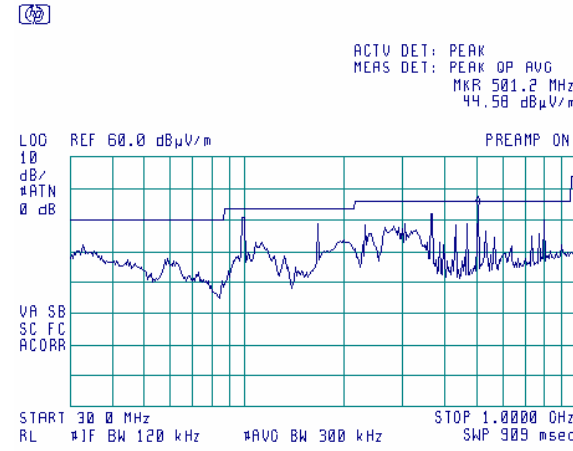
Plot 6.17.22: Tx Radiated emission measurements, 30 - 1000 MHz at the low carrier frequency, 802.11g mode.



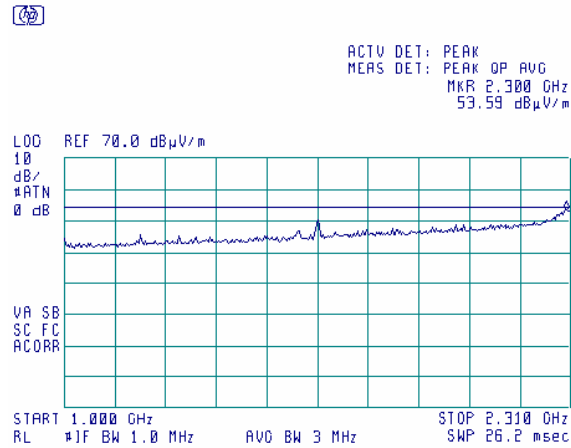
Plot 6.17.23: Tx Radiated emission measurements, 30 - 1000 MHz at the mid carrier frequency, 802.11g mode.



Plot 6.17.24: Tx Radiated emission measurements, 30 - 1000 MHz at the high carrier frequency, 802.11g mode.

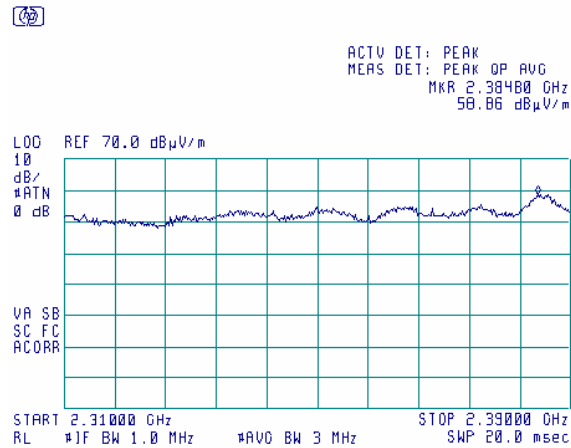


Plot 6.17.25: Tx Radiated emission measurements, 1000 - 2310 MHz at the low carrier frequency, 802.11b mode.



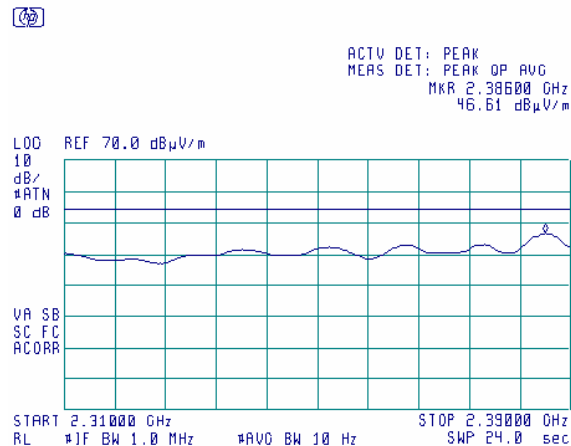
Plot 6.17.26: Tx Radiated emission measurements, 2310 - 2390 MHz at the low carrier frequency, 802.11b mode.

DETECTOR: PEAK

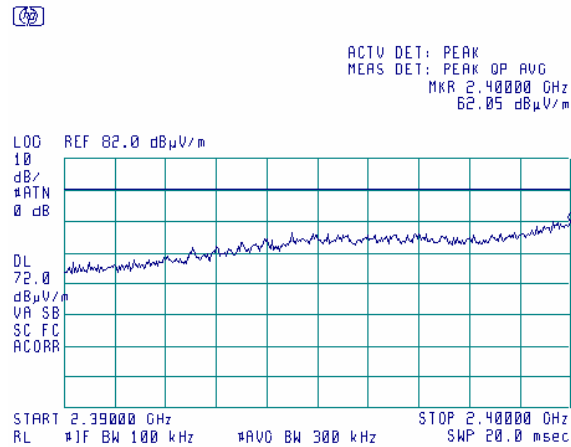


Plot 6.17.27: Tx Radiated emission measurements, 2310 - 2390 MHz at the low carrier frequency, 802.11b mode.

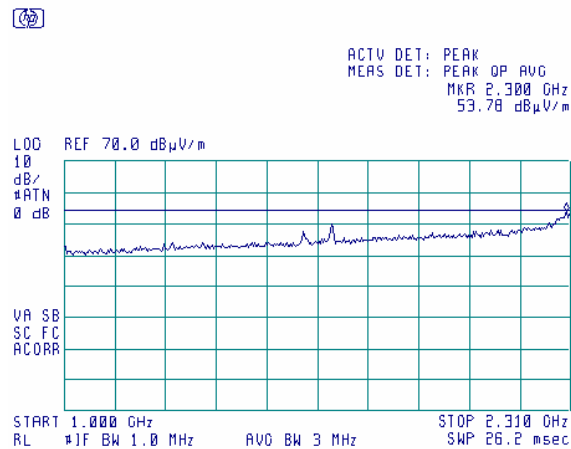
DETECTOR: AVERAGE



Plot 6.17.28: Tx Radiated emission measurements, 2390 - 2400 MHz at the low carrier frequency, 802.11b mode.

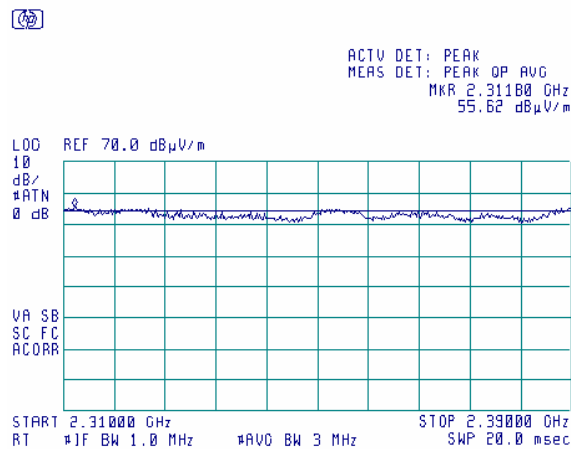


Plot 6.17.29: Tx Radiated emission measurements, 1000 - 2310 MHz at the mid carrier frequency, 802.11b mode.



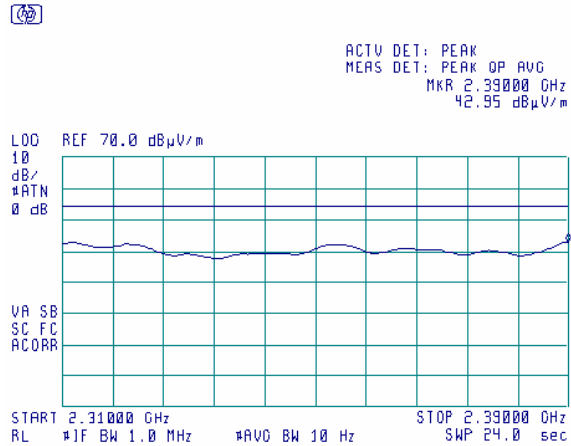
Plot 6.17.30: Tx Radiated emission measurements, 2310 - 2390 MHz at the mid carrier frequency, 802.11b mode.

DETECTOR: PEAK

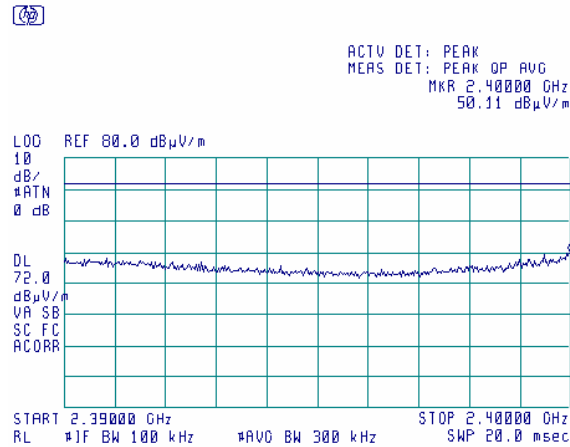


Plot 6.17.31: Tx Radiated emission measurements, 2310 - 2390 MHz at the mid carrier frequency, 802.11b mode.

DETECTOR: AVERAGE

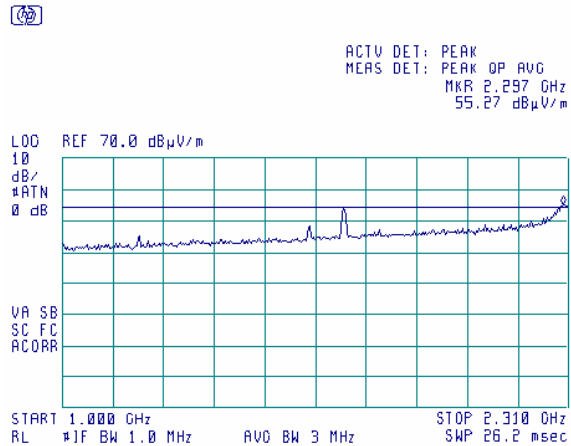


Plot 6.17.32: Tx Radiated emission measurements, 2390 - 2400 MHz at the mid carrier frequency, 802.11b mode.



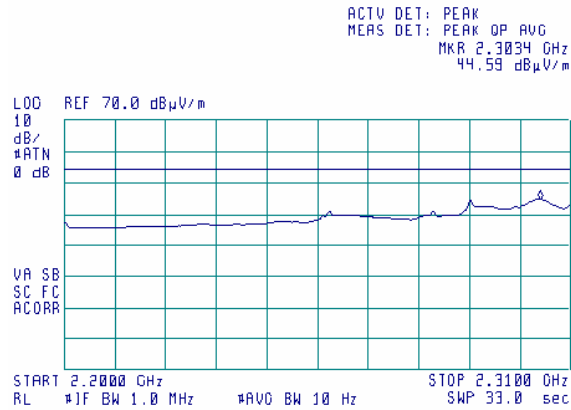
Plot 6.17.33: Tx Radiated emission measurements, 1000 - 2310 MHz at the high carrier frequency, 802.11b mode.

DETECTOR: PEAK



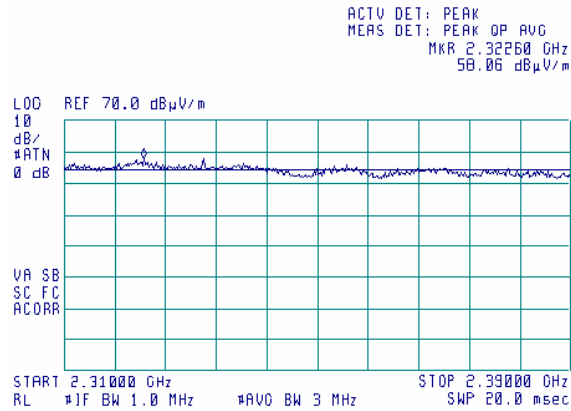
Plot 6.17.34: Tx Radiated emission measurements, 1000 - 2310 MHz at the high carrier frequency, 802.11b mode.

DETECTOR: AVERAGE



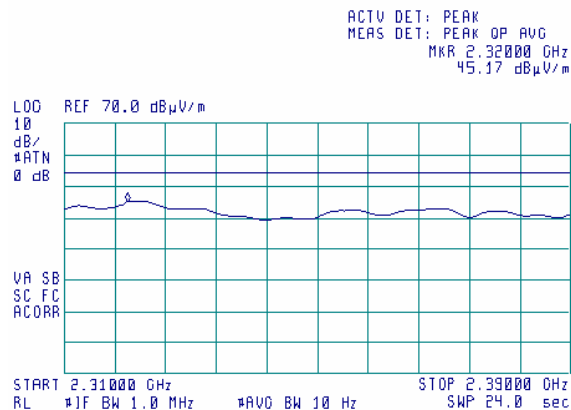
Plot 6.17.35: Tx Radiated emission measurements, 2310 - 2390 MHz at the high carrier frequency, 802.11b mode.

DETECTOR: PEAK

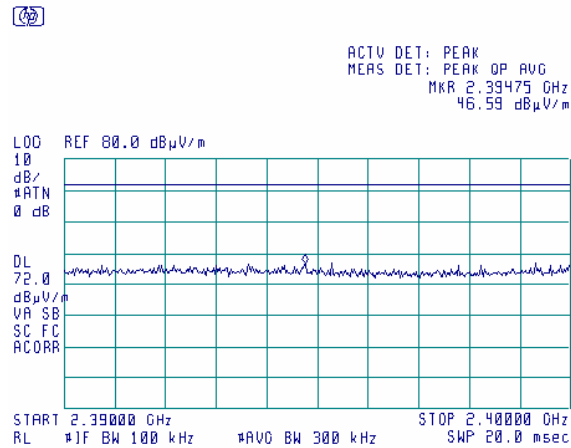


Plot 6.17.36: Tx Radiated emission measurements, 2310 - 2390 MHz at the high carrier frequency, 802.11b mode.

DETECTOR: AVERAGE

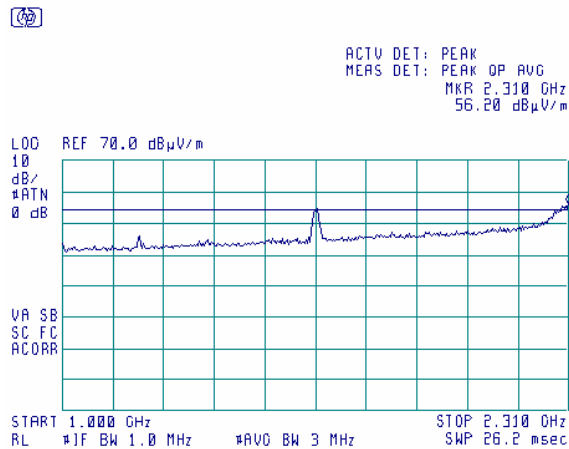


Plot 6.17.37: Tx Radiated emission measurements, 2390 - 2400 MHz at the high carrier frequency, 802.11b mode.



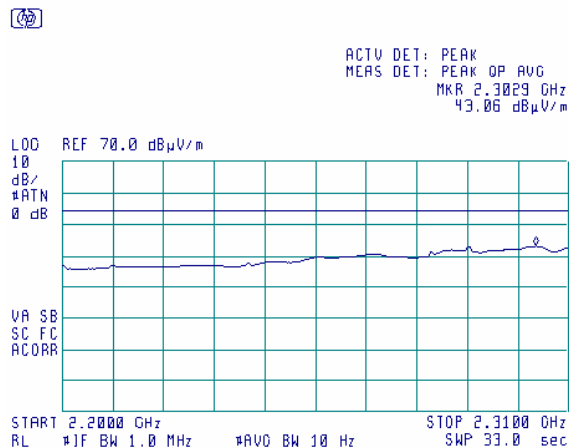
Plot 6.17.38: Tx Radiated emission measurements, 1000 - 2310 MHz at the low carrier frequency, 802.11g mode.

DETECTOR: PEAK



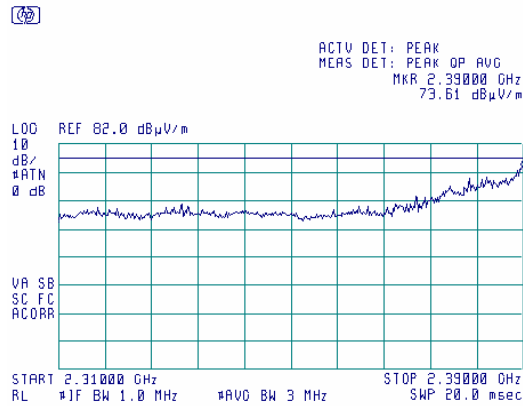
Plot 6.17.39: Tx Radiated emission measurements, 1000 - 2310 MHz at the low carrier frequency, 802.11g mode.

DETECTOR: AVERAGE



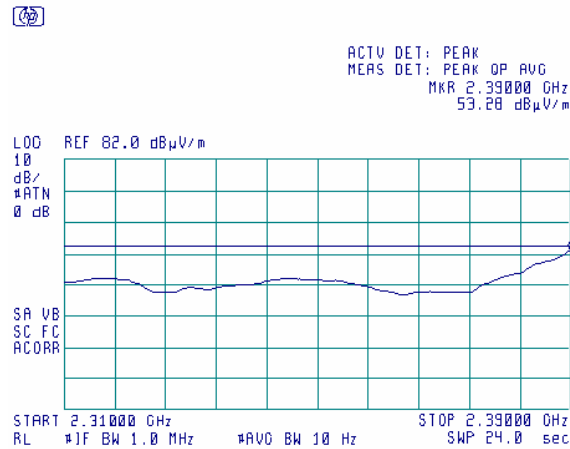
Plot 6.17.40: Tx Radiated emission measurements, 2310 - 2390 MHz, at the low carrier frequency, 802.11g mode.

DETECTOR: PEAK

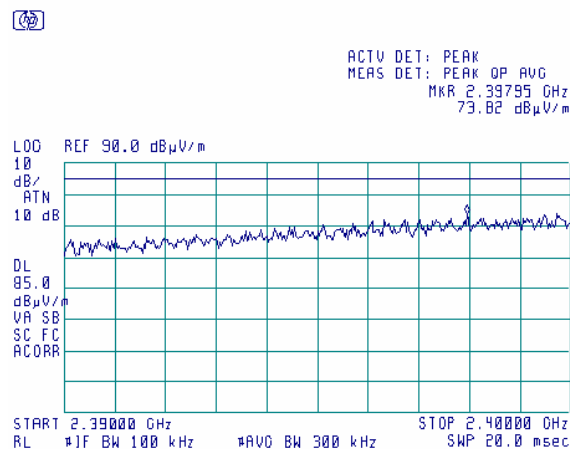


Plot 6.17.41: Tx Radiated emission measurements, 2310 - 2390 MHz, at the low carrier frequency, 802.11g mode.

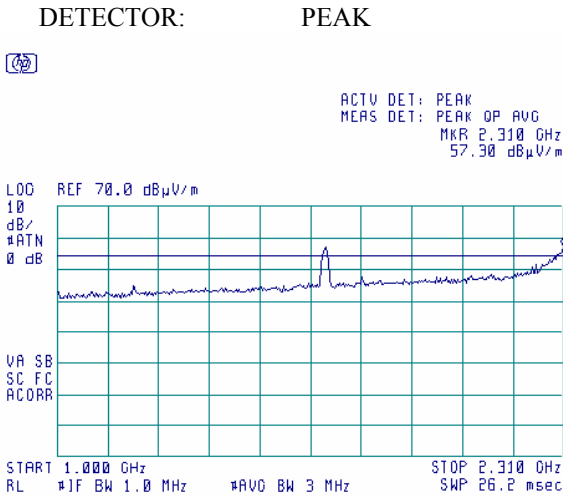
DETECTOR: AVERAGE



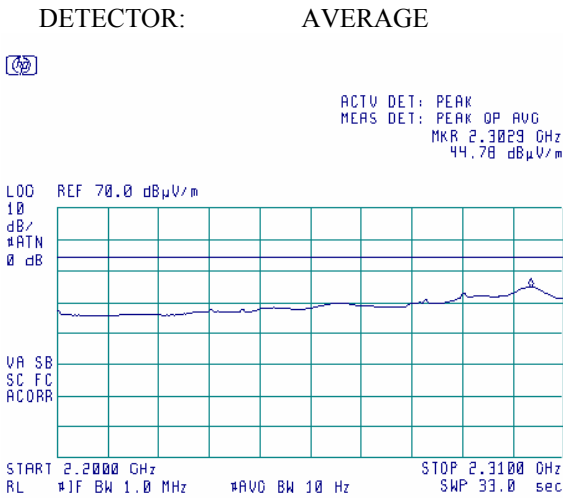
Plot 6.17.42: Tx Radiated emission measurements, 2390 - 2400 MHz, at the low carrier frequency, 802.11g mode.



Plot 6.17.43: Tx Radiated emission measurements, 1000 - 2310 MHz, at the mid carrier frequency, 802.11g mode.

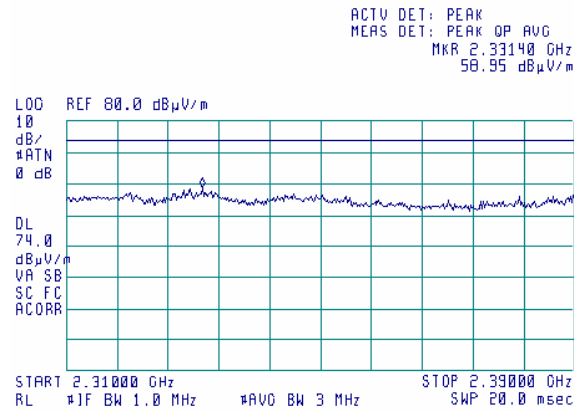


Plot 6.17.44: Tx Radiated emission measurements, 1000 - 2310 MHz, at the mid carrier frequency, 802.11g mode.



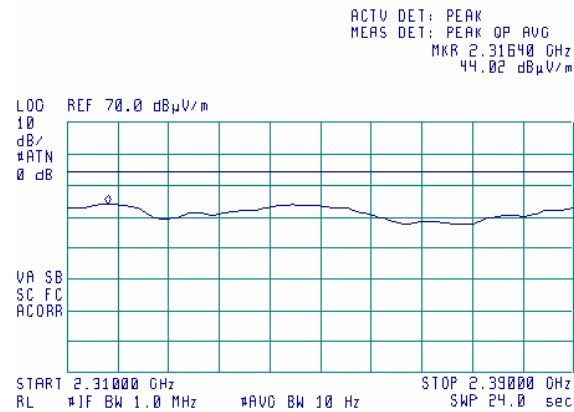
Plot 6.17.45: Tx Radiated emission measurements, 2310 - 2390MHz, at the mid carrier frequency, 802.11g mode.

DETECTOR: PEAK

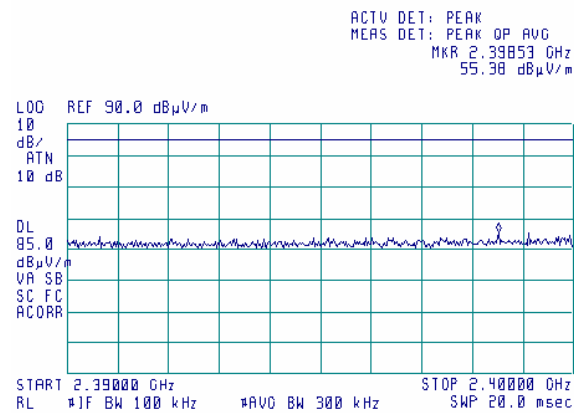


Plot 6.17.46: Tx Radiated emission measurements, 2310 - 2390MHz, at the mid carrier frequency, 802.11g mode.

DETECTOR: AVERAGE

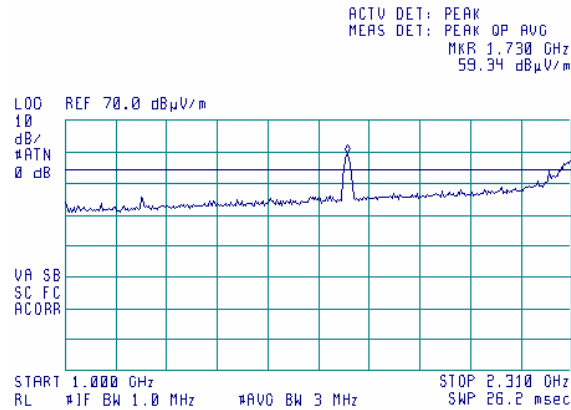


Plot 6.17.47: Tx Radiated emission measurements, 2390 - 2400MHz, at the mid carrier frequency, 802.11g mode.



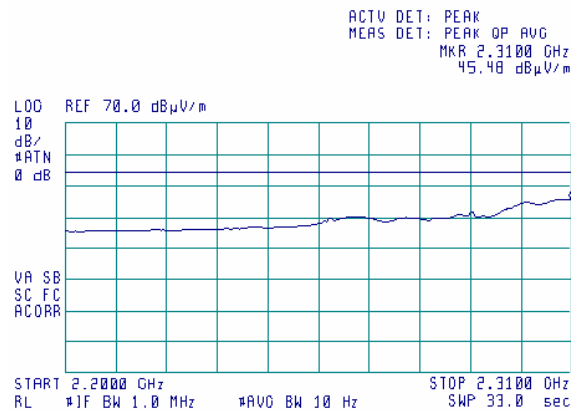
Plot 6.17.48: Tx Radiated emission measurements, 1000 - 2310 MHz, at the high carrier frequency, 802.11g mode.

DETECTOR: PEAK



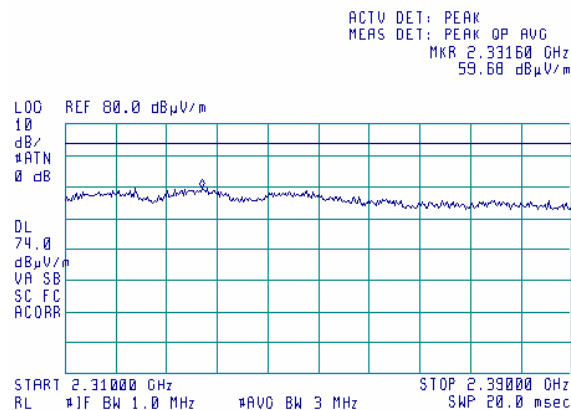
Plot 6.17.49: Tx Radiated emission measurements, 1000 - 2310 MHz, at the high carrier frequency, 802.11g mode.

DETECTOR: AVERAGE



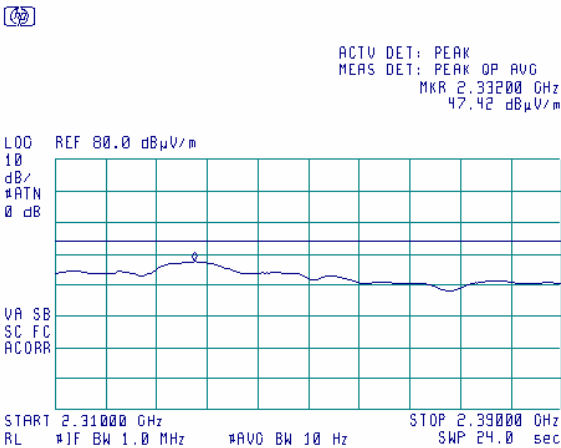
Plot 6.17.50: Tx Radiated emission measurements, 2310 - 2390MHz, at the high carrier frequency, 802.11g mode.

DETECTOR: PEAK

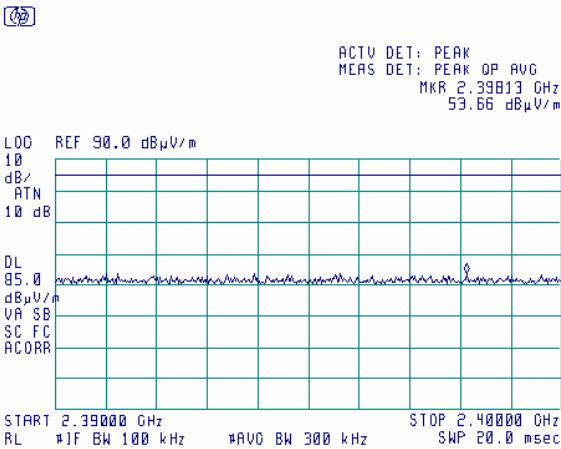


Plot 6.17.51: Tx Radiated emission measurements, 2310 - 2390MHz, at the high carrier frequency, 802.11g mode.

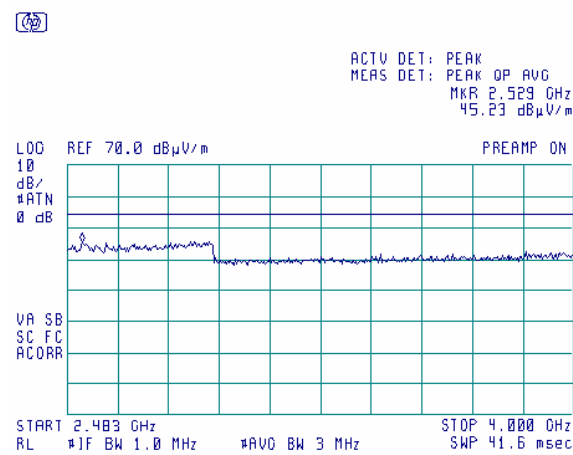
DETECTOR: AVERAGE



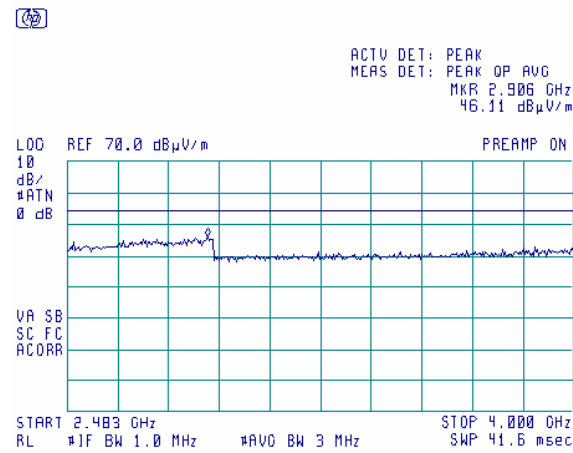
Plot 6.17.52: Tx Radiated emission measurements, 2390 - 2400MHz, at the high carrier frequency, 802.11g mode.



Plot 6.17.53: Tx Radiated emission measurements, 2483.5 - 4000MHz, at the low carrier frequency, 802.11b mode.

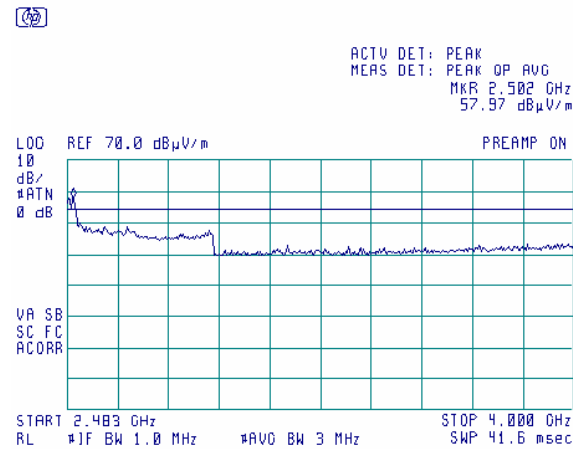


Plot 6.17.54: Tx Radiated emission measurements, 2483.5 - 4000MHz, at the mid carrier frequency, 802.11b mode.



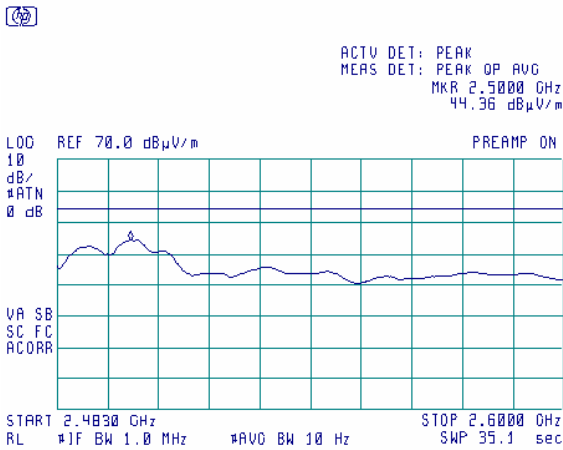
Plot 6.17.55: Tx Radiated emission measurements, 2483.5 - 2500MHz, at the high carrier frequency, 802.11b mode.

DETECTOR: PEAK

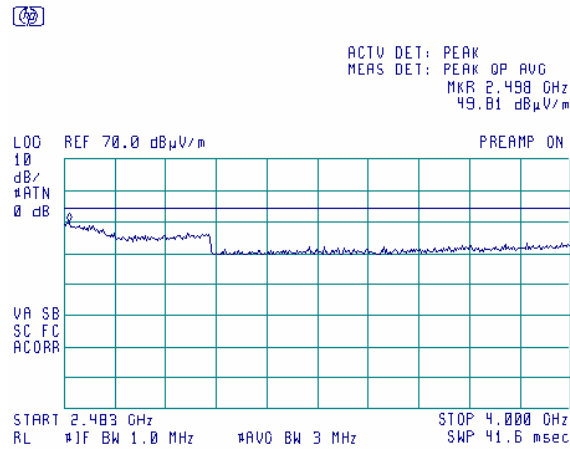


Plot 6.17.56: Tx Radiated emission measurements, 2483.5 - 2500MHz, at the high carrier frequency, 802.11b mode.

DETECTOR: AVERAGE

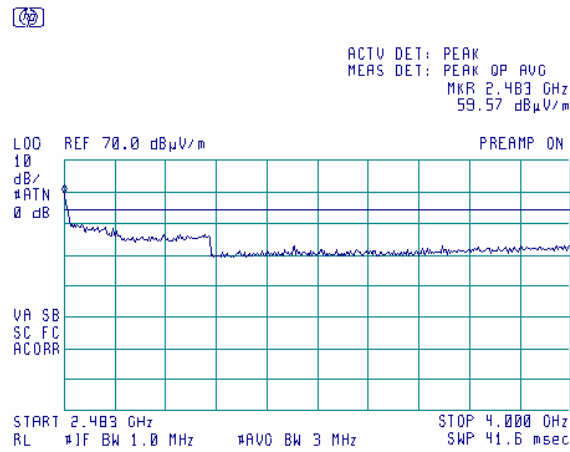


Plot 6.17.57: Tx Radiated emission measurements, 2483.5 - 4000MHz, at the low carrier frequency, 802.11g mode.



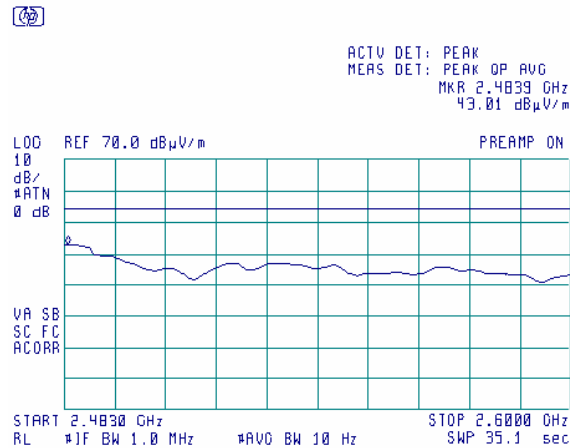
Plot 6.17.58: Tx Radiated emission measurements, 2483.5 - 4000MHz, at the mid carrier frequency, 802.11g mode.

DETECTOR: PEAK



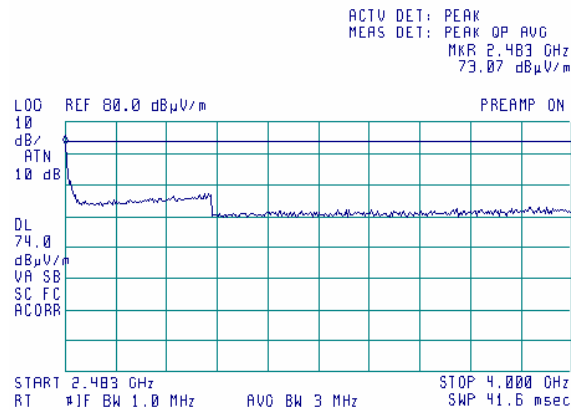
Plot 6.17.59: Tx Radiated emission measurements, 2483.5 - 4000MHz, at the mid carrier frequency, 802.11g mode.

DETECTOR: AVERAGE

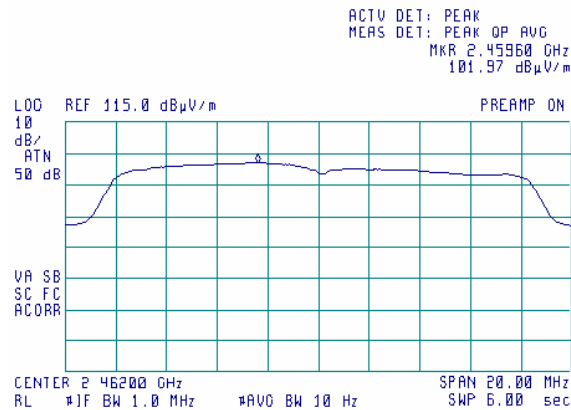


Plot 6.17.60: Tx Radiated emission measurements, 2483.5 - 4000MHz, at the high carrier frequency, 802.11g mode.

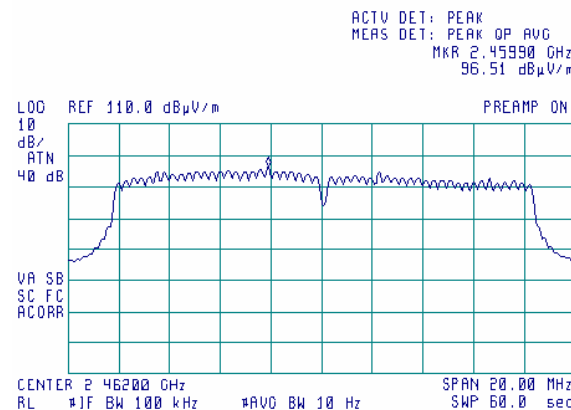
DETECTOR: PEAK

**Plot 6.17.61: Tx Radiated emission measurements, 2483.5 - 4000MHz, at the high carrier frequency, 802.11g mode.**

DETECTOR: AVERAGE

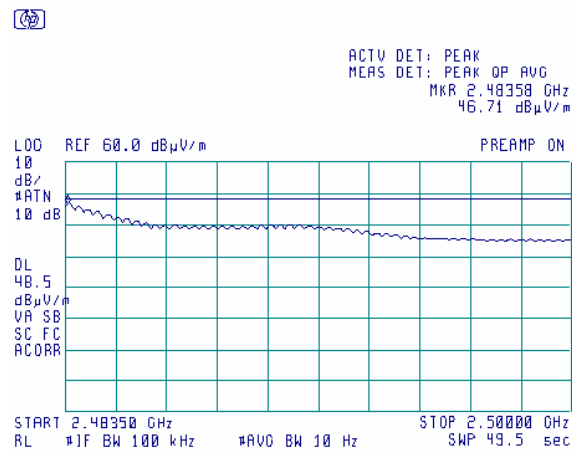


Plot 6.17.61(a): The Peak power at average detector was taken to calculate difference to 54dBμV/m:
Difference = 101.97-54= 47.97dBc

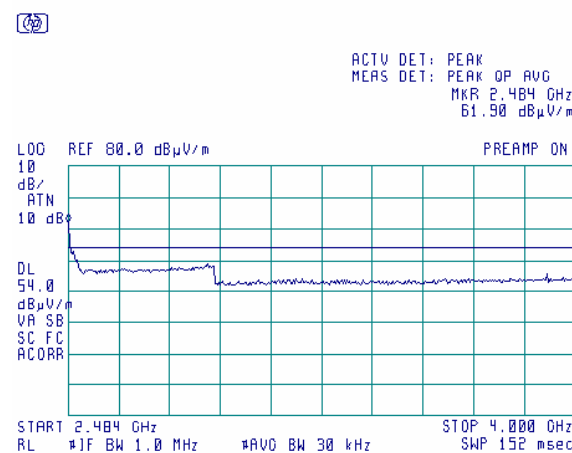


Plot 6.17.61(b): The peak power at RBW=100 KHz was taken to calculate 100 KHz limit:
Limit =96.51-47.97=48.54dBμV/m

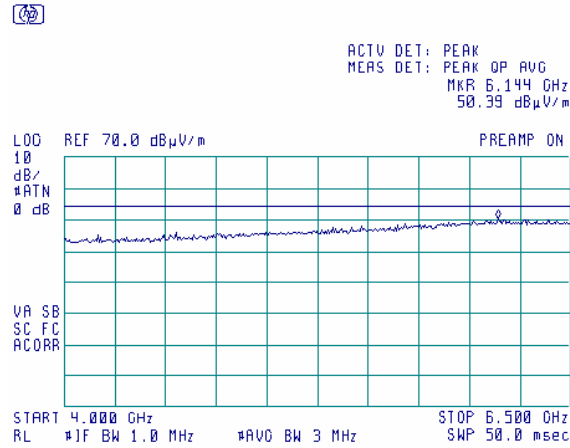
Plot 6.17.61(c): Tx Radiated emission measurements, 2483.5 - 2500MHz, at the high carrier frequency, 802.11g mode according to 100KHz limit



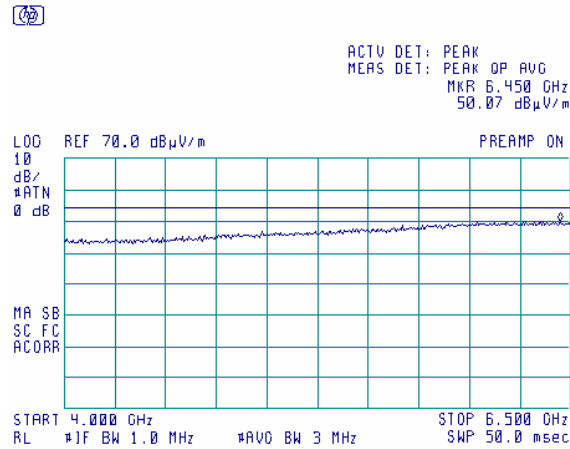
Plot 6.17.61(d): Tx Radiated emission measurements, 2500 - 4000MHz, at the high carrier frequency, 802.11g mode according to 1MHz limit



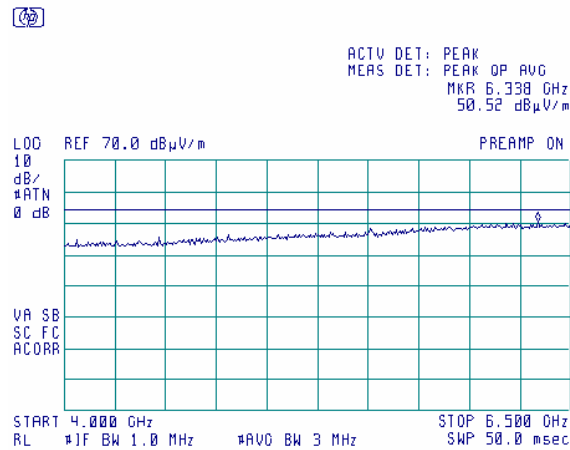
Plot 6.17.62: Tx Radiated emission measurements, 4000 - 6500MHz, at the low carrier frequency, 802.11b mode.



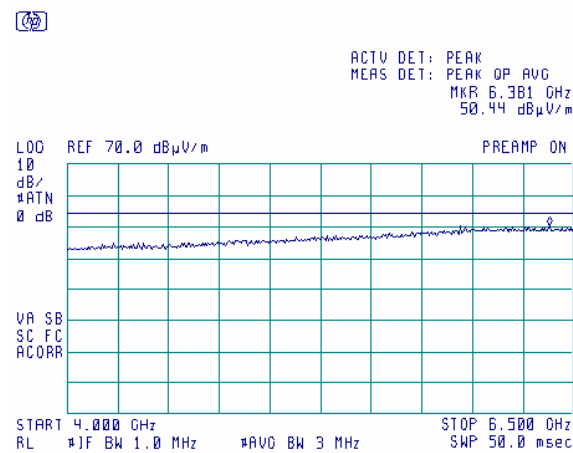
Plot 6.17.63: Tx Radiated emission measurements, 4000 - 6000MHz, at the mid carrier frequency, 802.11b mode.



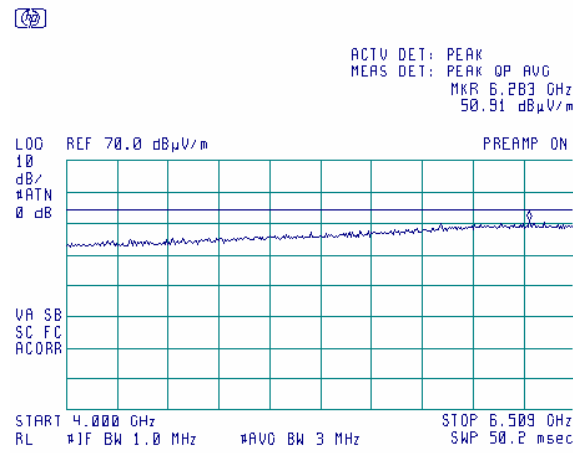
Plot 6.17.64: Tx Radiated emission measurements, 4000 - 6500MHz, at the high carrier frequency, 802.11b mode.



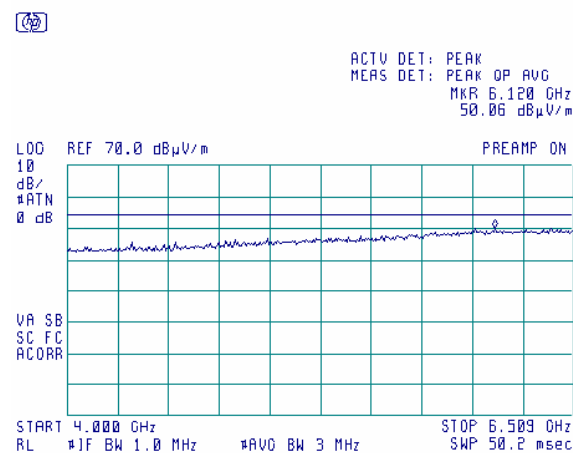
Plot 6.17.65: Tx Radiated emission measurements, 4000 - 6500MHz, at the low carrier frequency, 802.11g mode.



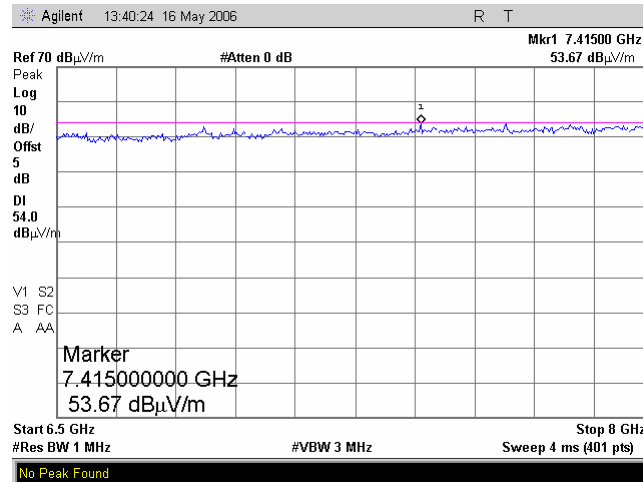
Plot 6.17.66: Tx Radiated emission measurements, 4000 - 6500MHz, at the mid carrier frequency, 802.11g mode.



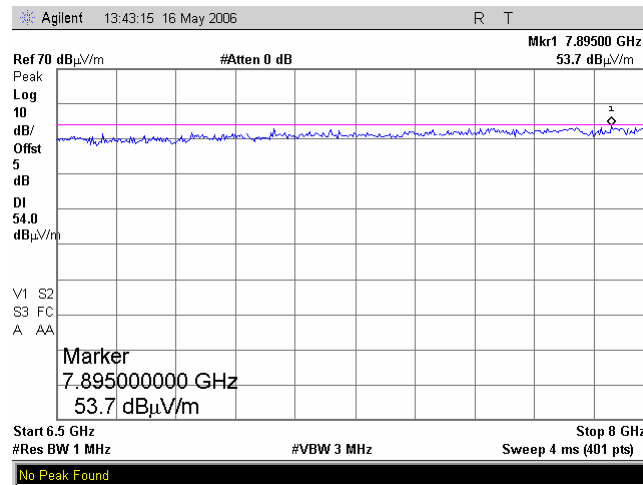
Plot 6.17.67: Tx Radiated emission measurements, 4000 - 6500MHz, at the high carrier frequency, 802.11g mode.



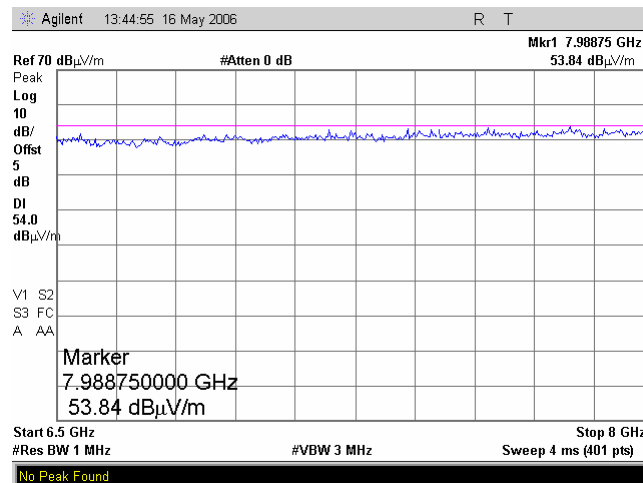
Plot 6.17.68: Tx Radiated emission measurements, 6500 - 8000MHz, at the low carrier frequency, 802.11g mode.



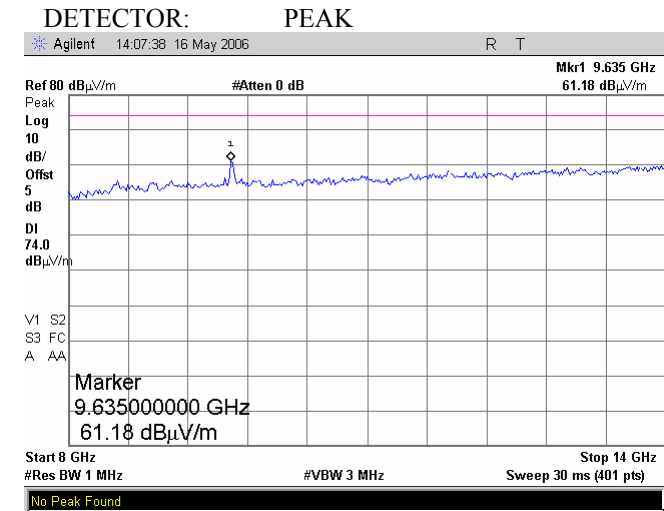
Plot 6.17.69: Tx Radiated emission measurements, 6500 - 8000MHz, at the mid carrier frequency, 802.11g mode.



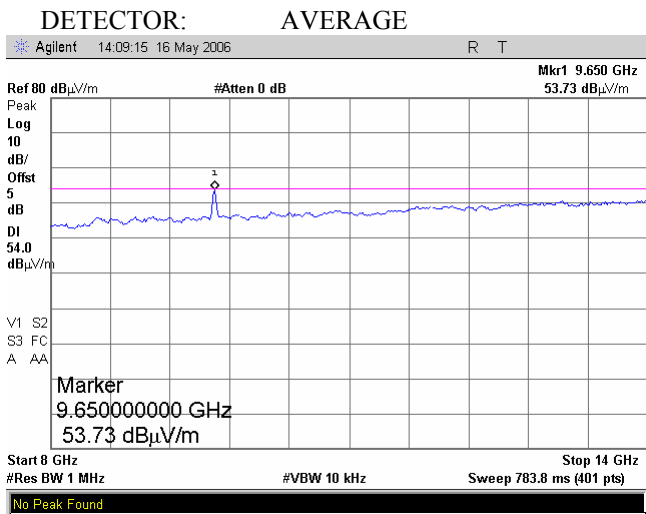
Plot 6.17.70: Tx Radiated emission measurements, 6500 - 8000MHz, at the high carrier frequency, 802.11g mode.



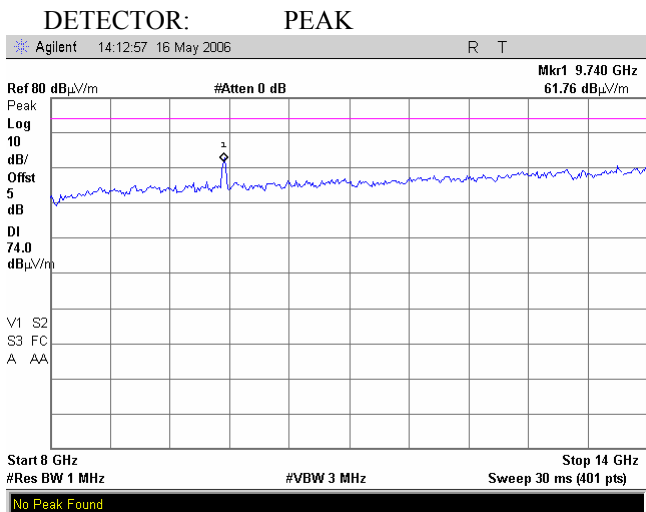
Plot 6.17.71: Tx Radiated emission measurements, 8 – 14GHz at the low carrier frequency, 802.11g mode.

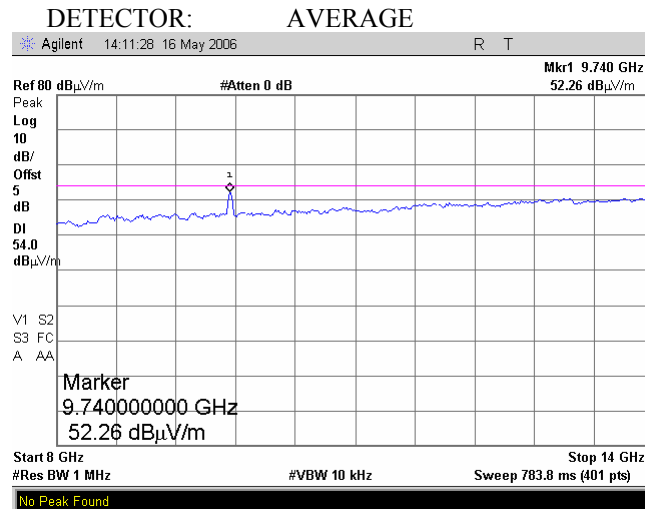
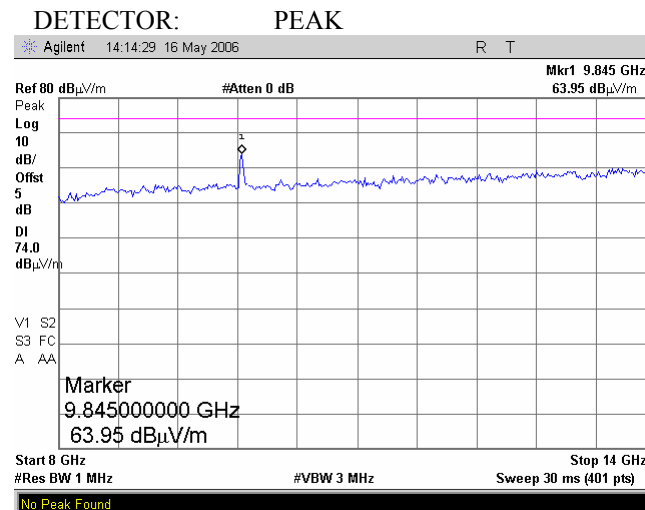
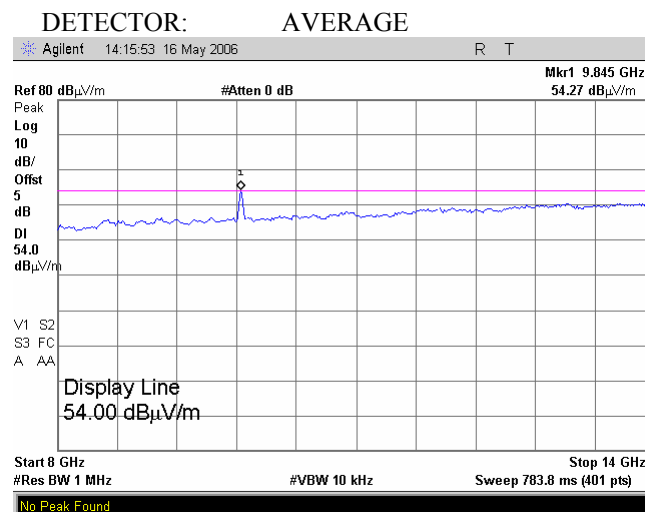


Plot 6.17.72: Tx Radiated emission measurements, 8 – 14GHz at the low carrier frequency, 802.11g mode.

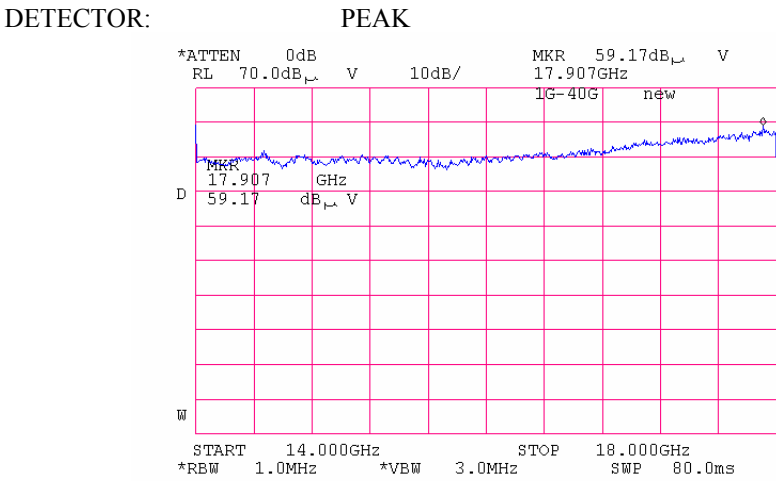


Plot 6.17.73: Tx Radiated emission measurements, 8 – 14GHz at the mid carrier frequency, 802.11g mode.

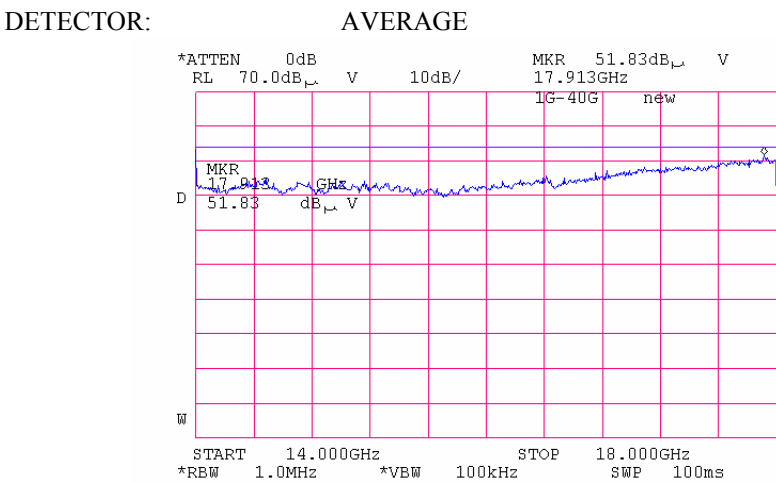


Plot 6.17.74: Tx Radiated emission measurements, 8 – 14GHz at the mid carrier frequency, 802.11g mode.**Plot 6.17.75: Tx Radiated emission measurements, 8 – 14GHz at the high carrier frequency, 802.11g mode.****Plot 6.17.76: Tx Radiated emission measurements, 8 – 14GHz at the high carrier frequency, 802.11g mode.**

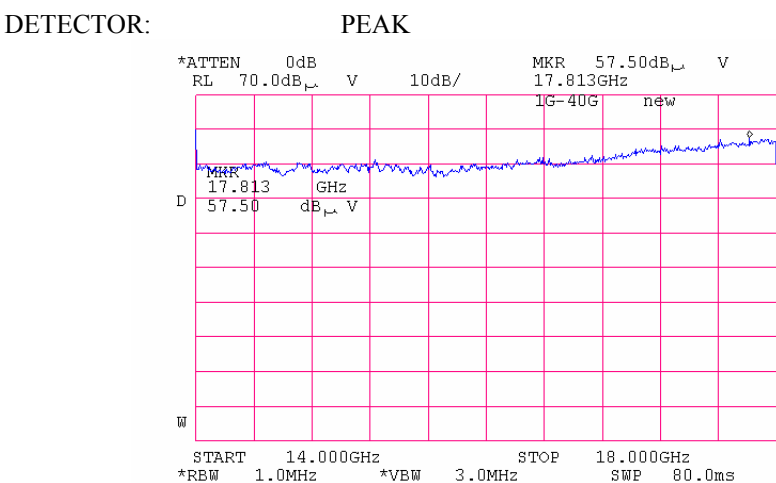
Plot 6.17.77: Tx Radiated emission measurements, 14 - 18GHz, at the low carrier frequency, 802.11g mode.



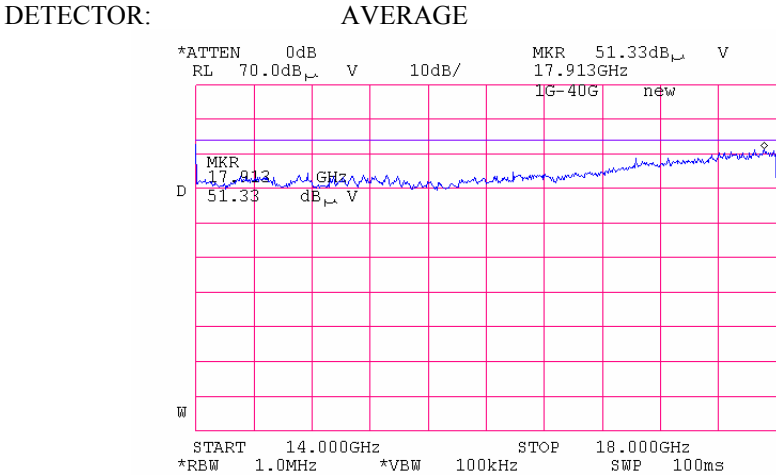
Plot 6.17.78: Tx Radiated emission measurements, 14 - 18GHz, at the low carrier frequency, 802.11g mode.



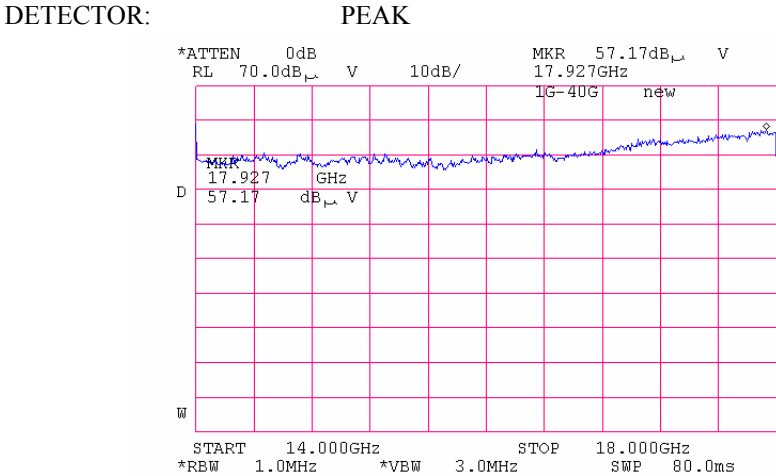
Plot 6.17.79: Tx Radiated emission measurements, 14 - 18GHz, at the mid carrier frequency, 802.11g mode.



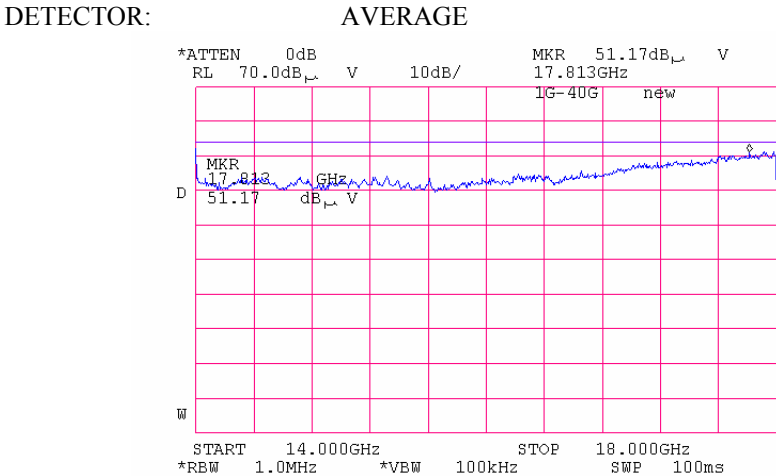
Plot 6.17.80: Tx Radiated emission measurements, 14 - 18GHz, at the mid carrier frequency, 802.11g mode.



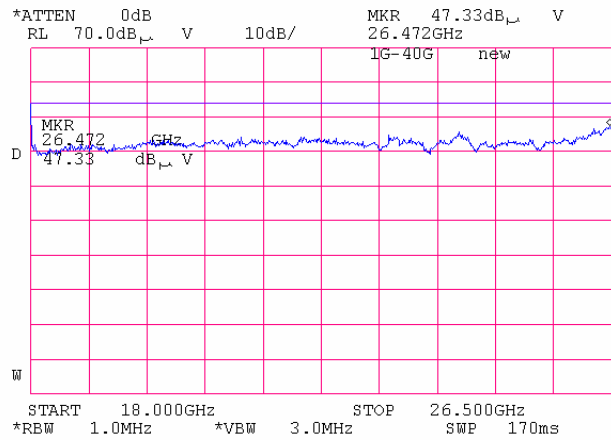
Plot 6.17.81: Tx Radiated emission measurements, 14 - 18GHz, at the high carrier frequency, 802.11g mode.



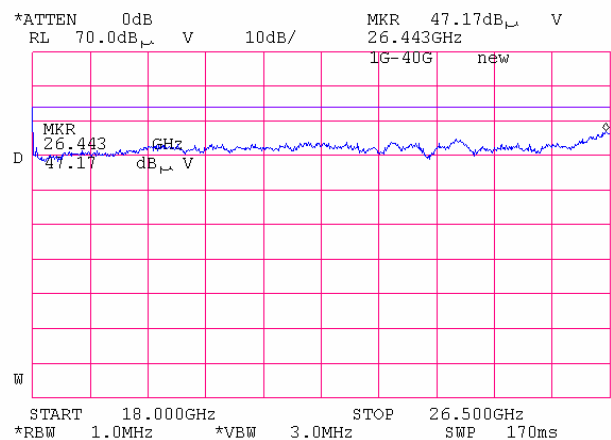
Plot 6.17.82: Tx Radiated emission measurements, 14 - 18GHz, at the high carrier frequency, 802.11g mode.



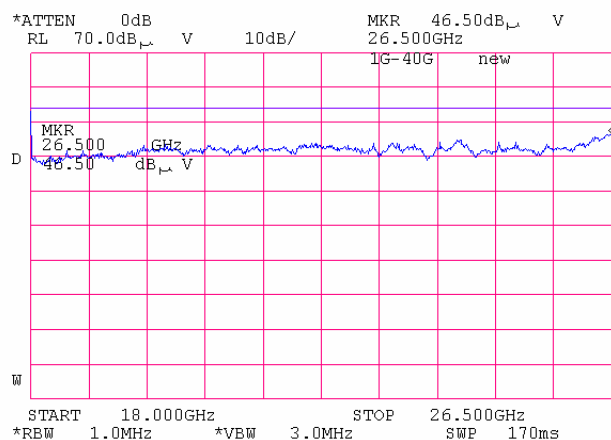
Plot 6.17.83: Tx Radiated emission measurements, 18 - 26.5GHz, at the low carrier frequency, 802.11g mode.



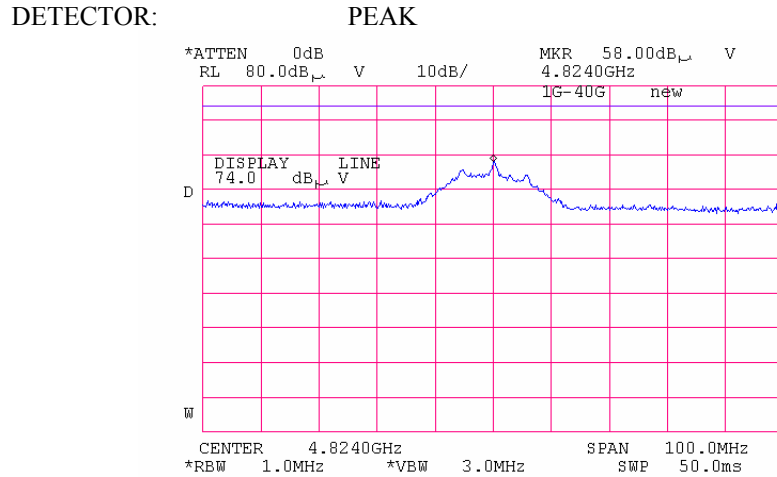
Plot 6.17.84: Tx Radiated emission measurements, 18 - 26.5GHz, at the mid carrier frequency, 802.11g mode.



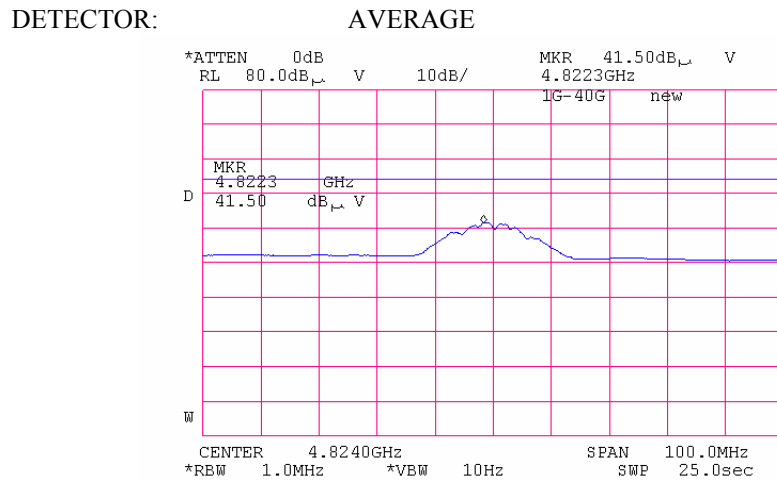
Plot 6.17.85: Tx Radiated emission measurements, 18 - 26.5GHz, at the high carrier frequency, 802.11g mode.



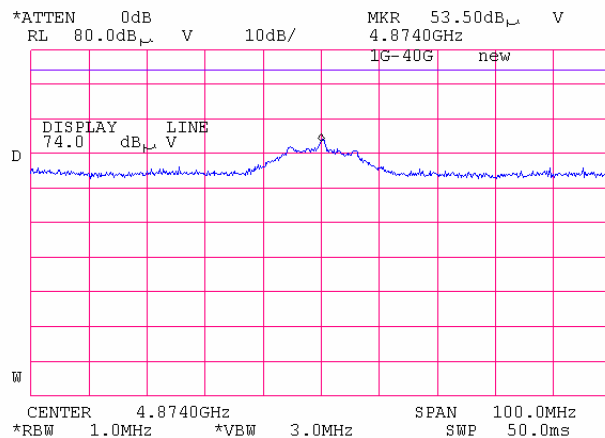
Plot 6.17.86: Tx Radiated emission measurement, at the 2nd harmonic, at the low carrier frequency, 802.11b mode.



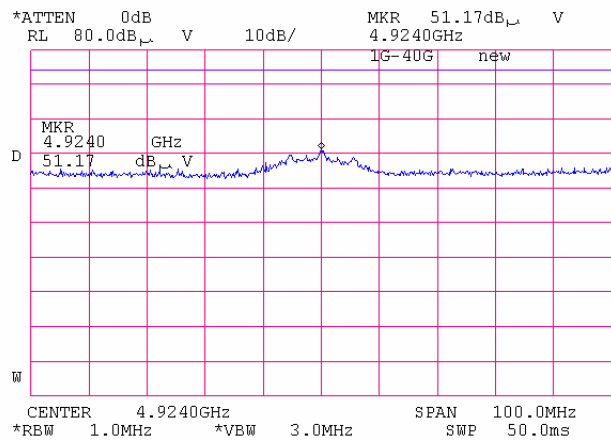
Plot 6.17.87: Tx Radiated emission measurement, at the 2nd harmonic, at the low carrier frequency, 802.11b mode.



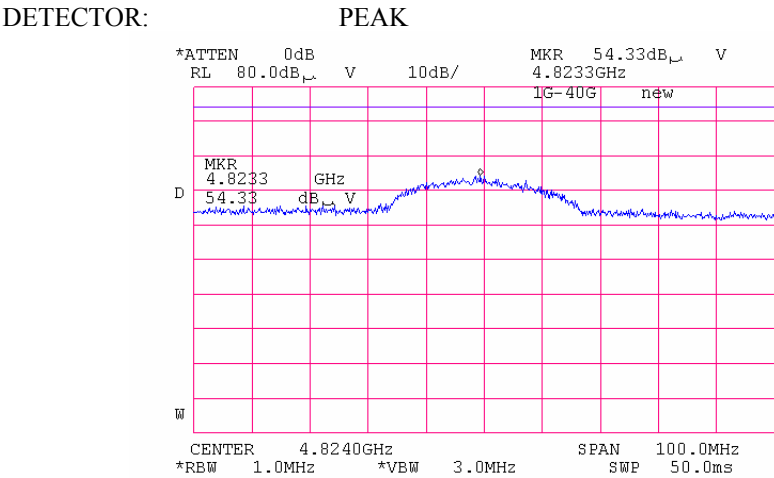
Plot 6.17.88: Tx Radiated emission measurement, at the 2nd harmonic, at the mid carrier frequency, 802.11b mode.



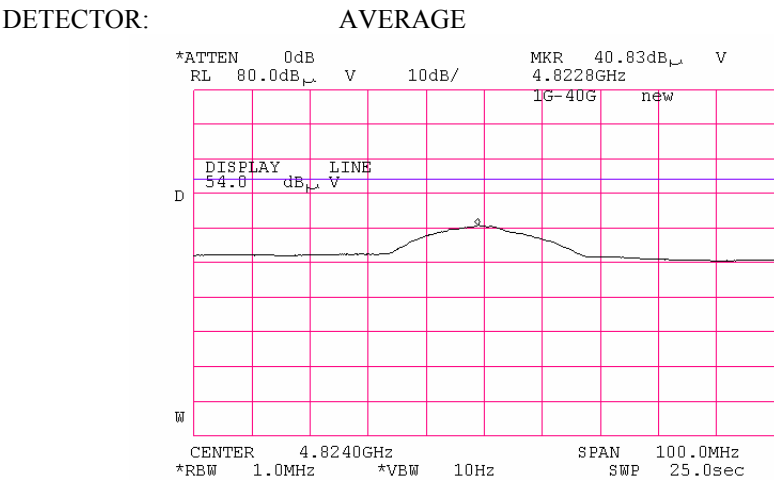
Plot 6.17.89: Tx Radiated emission measurement, at the 2nd harmonic, at the high carrier frequency, 802.11b mode.



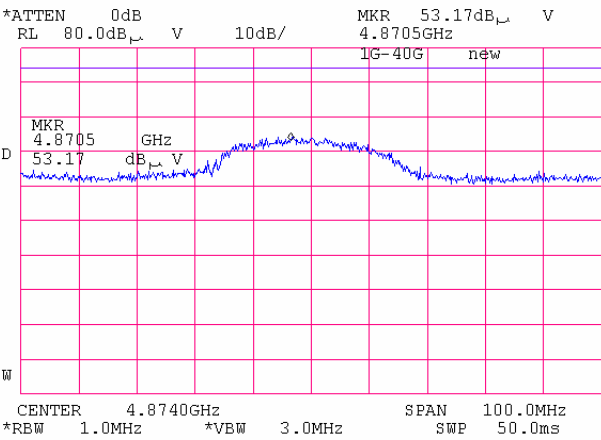
Plot 6.17.90: Tx Radiated emission measurement, at the 2nd harmonic, at the low carrier frequency, 802.11g mode.



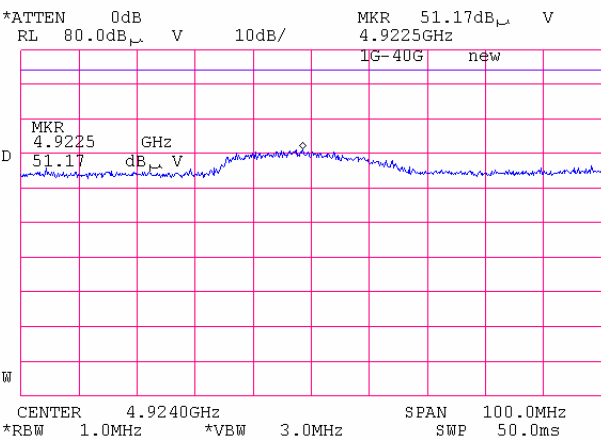
Plot 6.17.91: Tx Radiated emission measurement, at the 2nd harmonic, at the low carrier frequency, 802.11g mode.



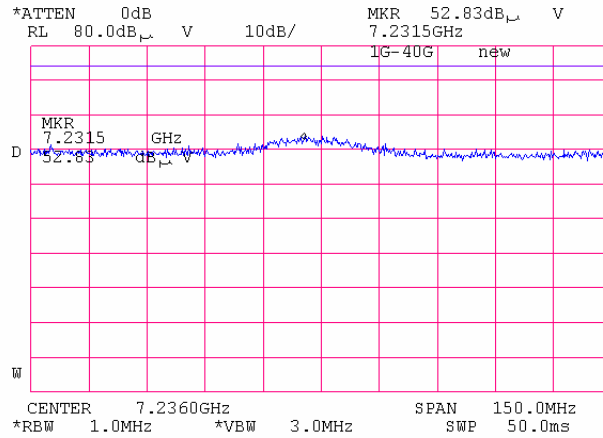
Plot 6.17.92: Tx Radiated emission measurement, at the 2nd harmonic, at the mid carrier frequency, 802.11g mode.



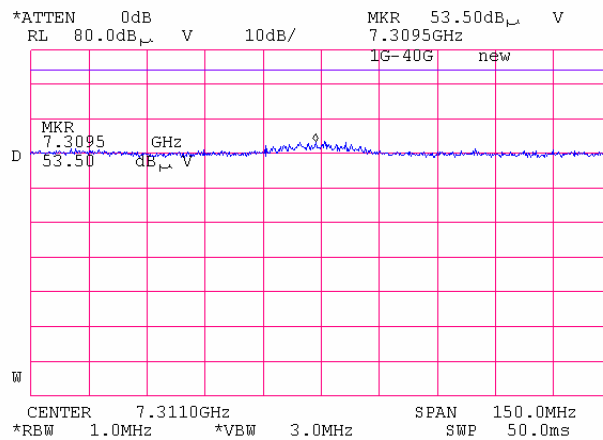
Plot 6.17.93: Tx Radiated emission measurement, at the 2nd harmonic, at the high carrier frequency, 802.11g mode.



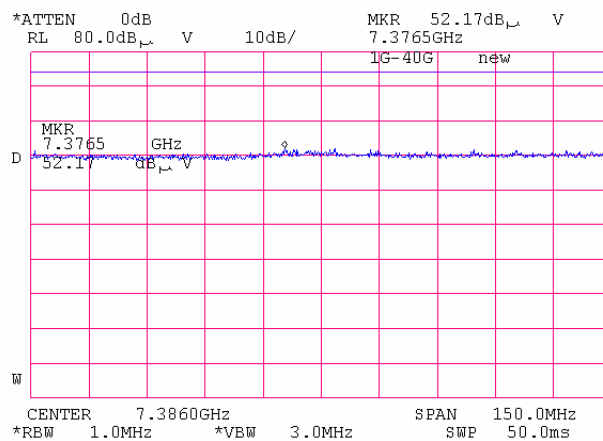
Plot 6.17.94: Tx Radiated emission measurement, at the 3rd harmonic, at the low carrier frequency, 802.11g mode.



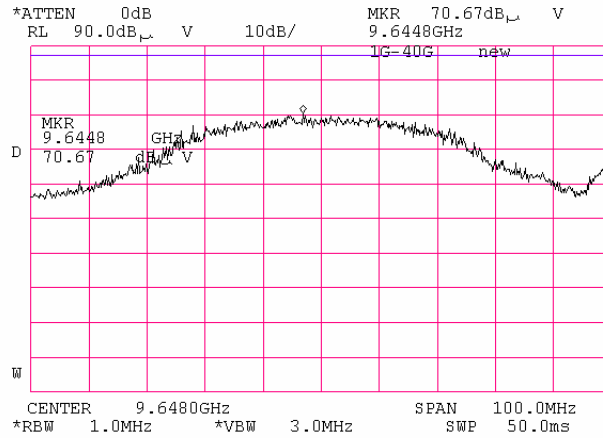
Plot 6.17.95: Tx Radiated emission measurement, at the 3rd harmonic, at the mid carrier frequency, 802.11g mode.



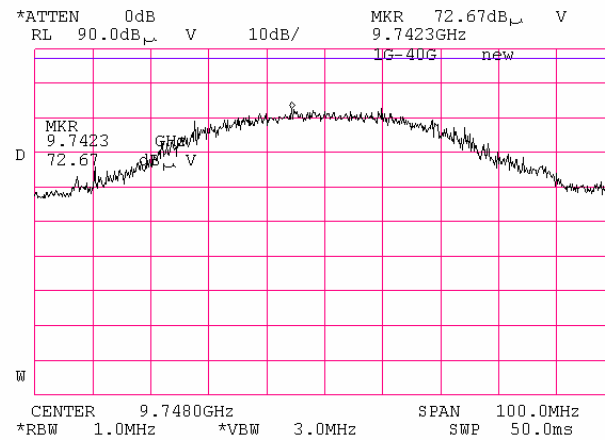
Plot 6.17.96: Tx Radiated emission measurement, at the 3rd harmonic, at the high carrier frequency, 802.11g mode.



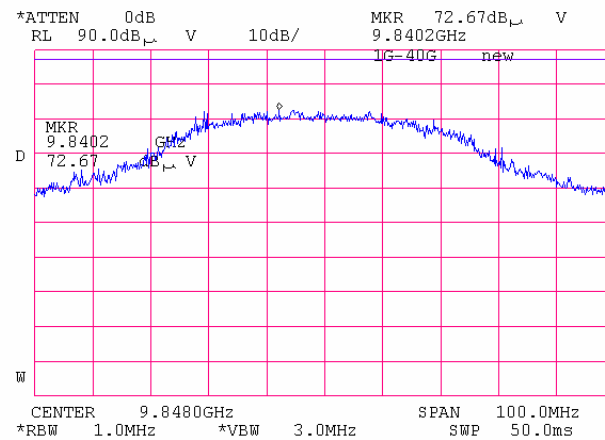
Plot 6.17.97: Tx Radiated emission measurement, at the 4th harmonic, at the low carrier frequency, 802.11g mode.



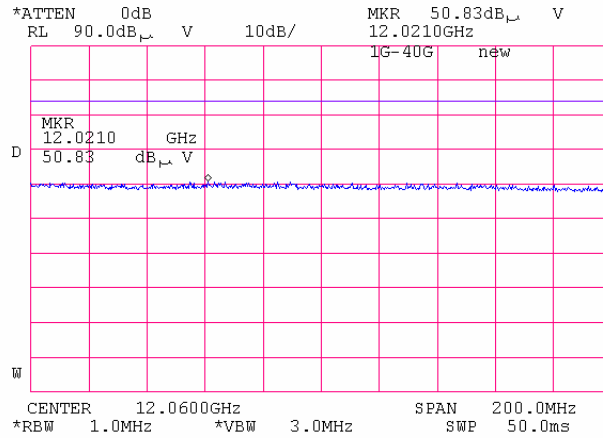
Plot 6.17.98: Tx Radiated emission measurement, at the 4th harmonic, at the mid carrier frequency, 802.11g mode.



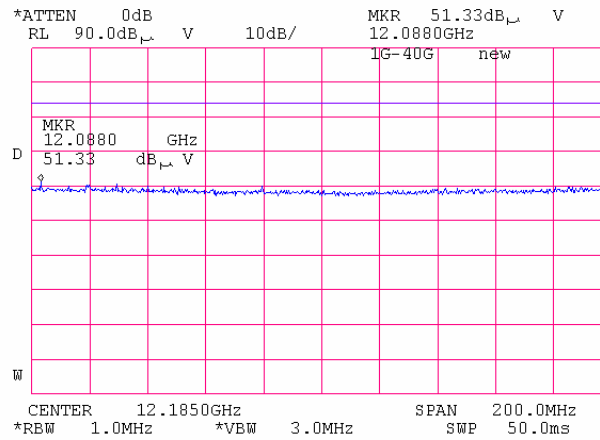
Plot 6.17.99: Tx Radiated emission measurement, at the 4th harmonic, at the high carrier frequency, 802.11g mode.



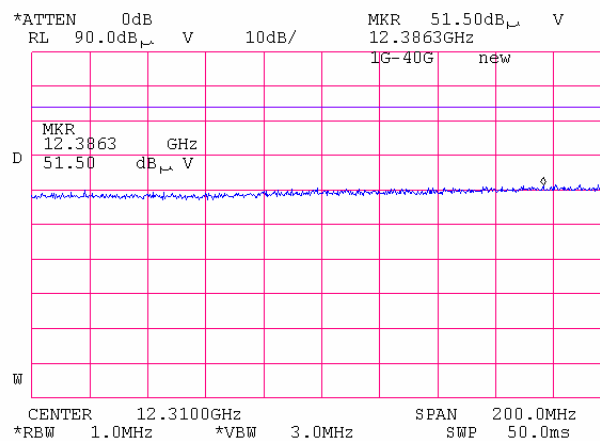
Plot 6.17.100: Tx Radiated emission measurement, at the 5th harmonic, at the low carrier frequency, 802.11g mode.

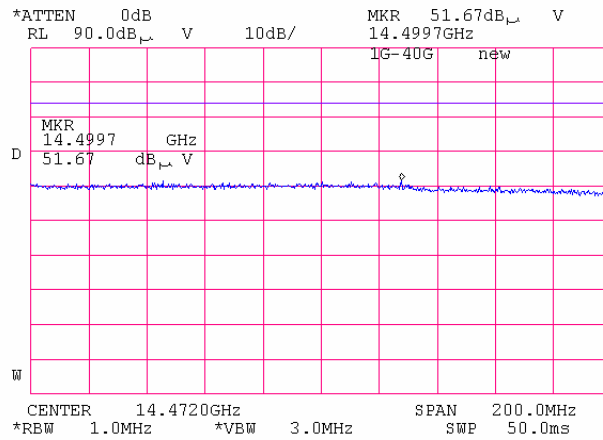
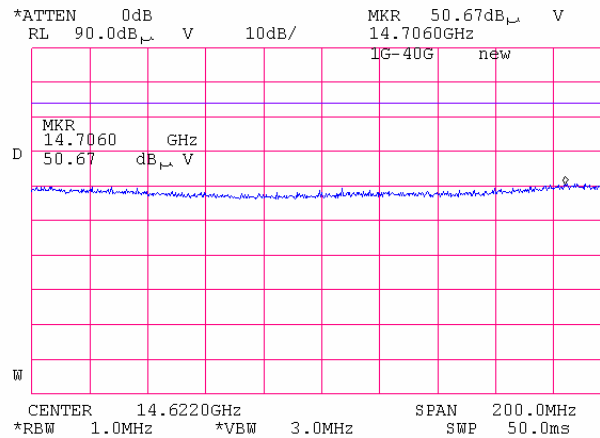
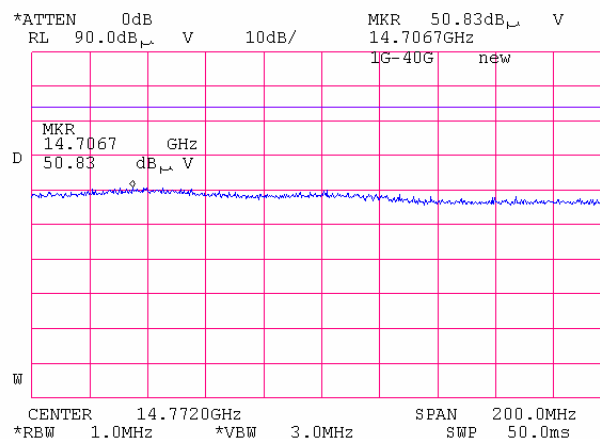


Plot 6.17.101: Tx Radiated emission measurement, at the 5th harmonic, at the mid carrier frequency, 802.11g mode.

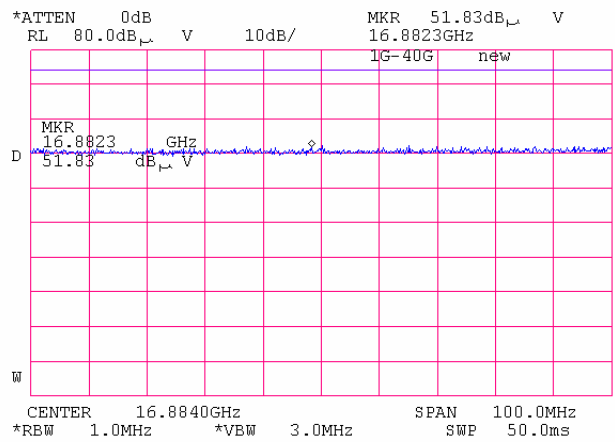


Plot 6.17.102: Tx Radiated emission measurement, at the 5th harmonic, at the high carrier frequency, 802.11g mode.

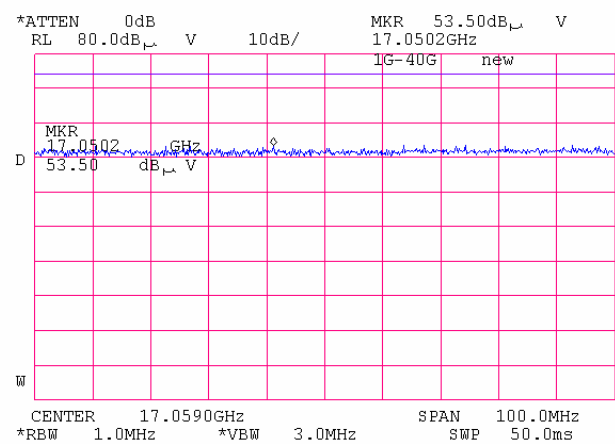


Plot 6.17.103: Tx Radiated emission measurement, at the 6th harmonic, at the low carrier frequency, 802.11g mode.**Plot 6.17.104: Tx Radiated emission measurement, at the 6th harmonic, at the mid carrier frequency, 802.11g mode.****Plot 6.17.105: Tx Radiated emission measurement, at the 6th harmonic, at the high carrier frequency, 802.11g mode.**

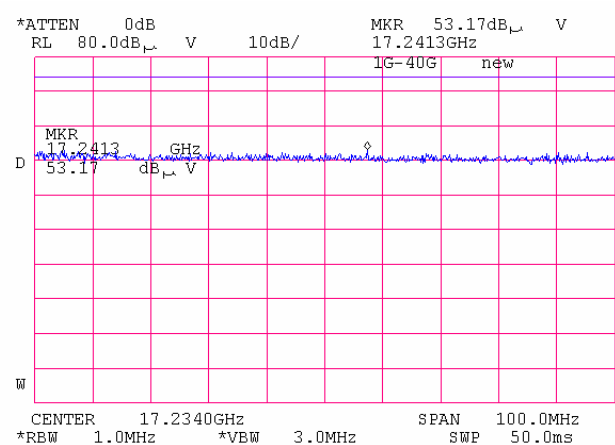
Plot 6.17.106: Tx Radiated emission measurement, at the 7th harmonic, at the low carrier frequency, 802.11g mode.



Plot 6.17.107: Tx Radiated emission measurement, at the 7th harmonic, at the mid carrier frequency, 802.11g mode.



Plot 6.17.108: Tx Radiated emission measurement, at the 7th harmonic, at the high carrier frequency, 802.11g mode.

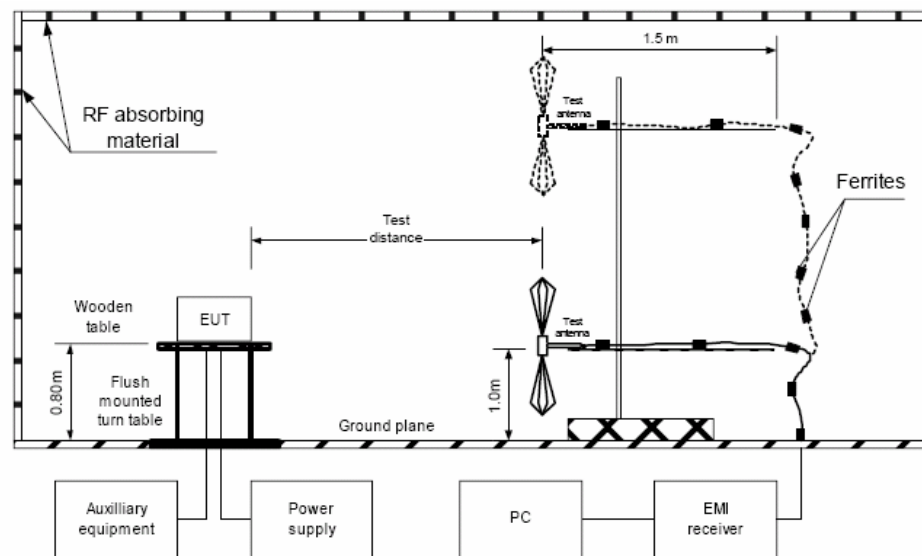


6.18 Radiated Emission, General requirements – pursuant to §15.109(a)

6.18.1 Test Procedure:

- A laptop was connected to the EUT to control the RF output power and Frequency.
- EUT and Laptop were set up as shown in plot 6.18.1.
- The EUT was adjusted to receive/standby at 802.11b/g mode.
- The table was rotated 360 degree to determine the position of the highest radiation.
- A receiving antenna was set 3 meters away from the EUT and was mounted on a variable height antenna tower.
- The Field strength of radiated spurious emissions was measured.
- The Tested Frequency range was 30 ÷ 8650MHz.
- Both Horizontal and Vertical Polarization of receiving antenna were tested.
- Test was taken at Semi anechoic chamber located at “HERMON LABORATORIES”.

Plot 6.18.1: Setup for Radiated Emission Measurement.



6.18.2 Limits:

- Specification Class B limits is given in table 6.18.1.

Table 6.18.1: Limits for Radiated emissions

Frequency, MHz	Class B limit, dB(μV/m)
	3 m distance
30 - 88	40.0
88 - 216	43.5
216 - 960	46.0
Above 960	54.0

6.18.3 Results:

- Test Results are provided in Table 6.18.2÷3 and associated plots.

Table 6.18.2 Radiated emission test results below 1GHz

LIMIT: Class B
 TEST DISTANCE: 3 m
 DETECTORS USED: PEAK / QUASI-PEAK
 FREQUENCY RANGE: 30 MHz – 1000 MHz
 RESOLUTION BANDWIDTH: 120 kHz

Frequency, MHz	Peak emission, dB(μV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
166.658750	43.82	43.00	43.50	-0.50	Horizontal	1.2	250	Pass
233.325000	46.17	45.00	46.00	-1.00	Horizontal	1.0	220	
266.650000	43.54	41.55	46.00	-4.45	Horizontal	1.5	23	
433.305000	34.65	32.71	46.00	-13.29	Horizontal	1.2	45	
499.974000	39.52	38.13	46.00	-7.87	Vertical	1.2	50	
799.965000	46.02	39.86	46.00	-6.14	Horizontal	1.0	100	

Table 6.18.3 Radiated emission test results above 1GHz

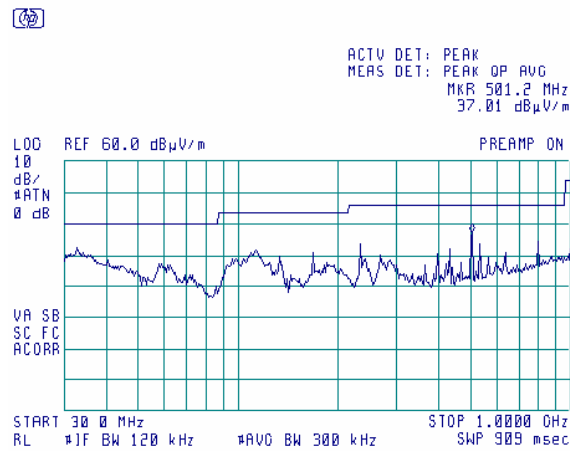
TEST DISTANCE: 3 m
 DETECTORS USED: PEAK / AVERAGE
 FREQUENCY RANGE: 1000 MHz – 8650 MHz
 RESOLUTION BANDWIDTH: 1000 kHz

Frequency, MHz	Peak emission, dB(μV/m)	Average			Antenna polarization	Antenna height, m	Turn- table position** , degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
No spurious were found								Pass

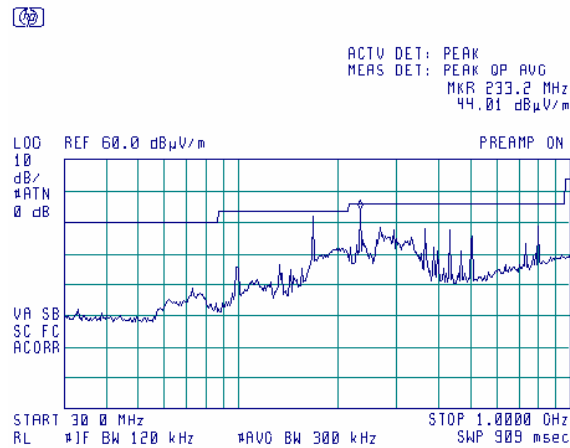
*- Margin = Measured emission - specification limit.

**- EUT front panel refer to 0 degrees position of turntable.

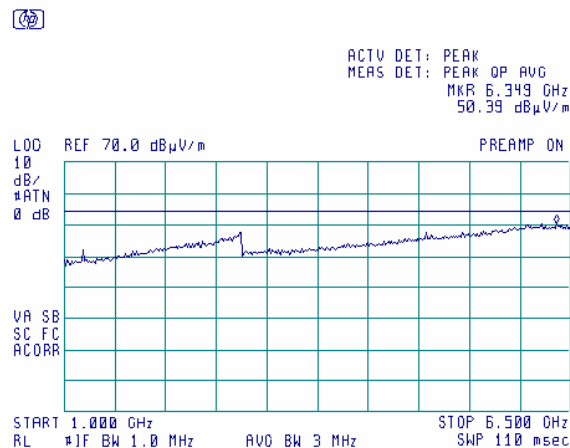
Plot 6.18.2: Rx Radiated Emission measurements in 30 - 1000 MHz range, Vertical Antenna polarization.



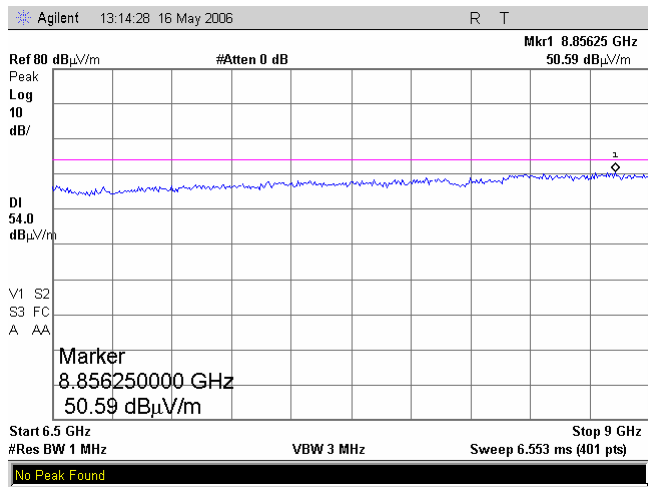
Plot 6.18.3: Rx Radiated Emission measurements in 30 - 1000 MHz range, Horizontal Antenna polarization.



Plot 6.18.4: Rx Radiated Emission measurements in 1000 - 6500 MHz range, Vertical and Horizontal Antenna polarization.



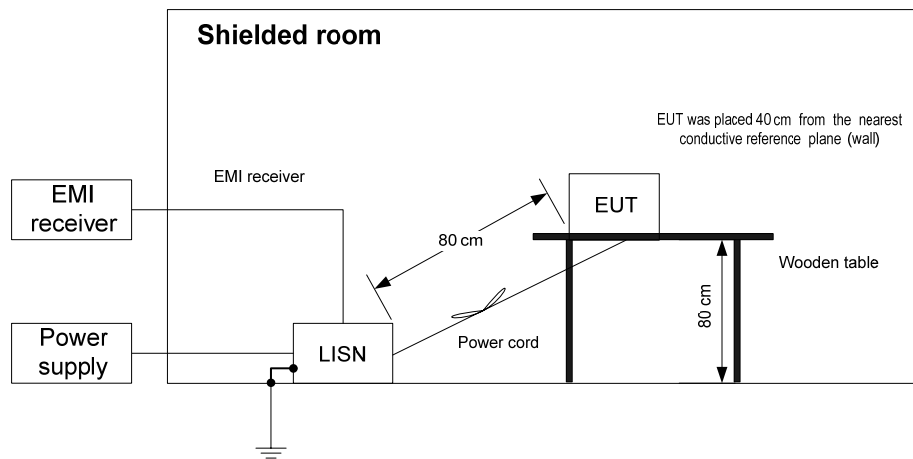
Plot 6.18.5: Rx Radiated Emission measurements in 6500 - 9000 MHz range,
Vertical & Horizontal Antenna polarization.



6.19 Conducted Emissions on AC power line - Pursuant to 47 CFR §15.107(a); §15.207(a)6.19.1 Test Procedure:

- A laptop was connected to the EUT to control the RF output power and Frequency.
- The EUT was set up as shown in plot 6.19.1.
- The EUT power was adjusted at the maximum output power level.
- The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer in the frequency range 150 KHz to 30MHz.
- Unused coaxial connector of the LISN was terminated with 50 Ohm. Quasi-peak and average detectors were used throughout the testing.
- The position of the device cables was varied to determine maximum emission level.
- Laptop's AC conducted data was recorded for both NEUTRAL and HOT lines.
- Data was recorder for 802.11b/g Rx/Stand-by mode and Tx mode.
- Test was taken at Shielded room located at “HERMON LABORATORIES”.

Plot 6.19.1: Conducted emission measurements setup.

6.19.2 Limits:

- Specification Class B limits is given in table 6.19.1.

Table 6.19.1: Limits for conducted emissions

Frequency, MHz	Class B limit, dB(μV)	
	QP	AVRG
0.15 - 0.5	66 - 56*	56 - 46*
0.5 - 5.0	56	46
5.0 - 30	60	50

* The limit decreases linearly with the logarithm of frequency.

6.19.3 Results:

- Results are shown in Table 6.19.2 and the associated plots.

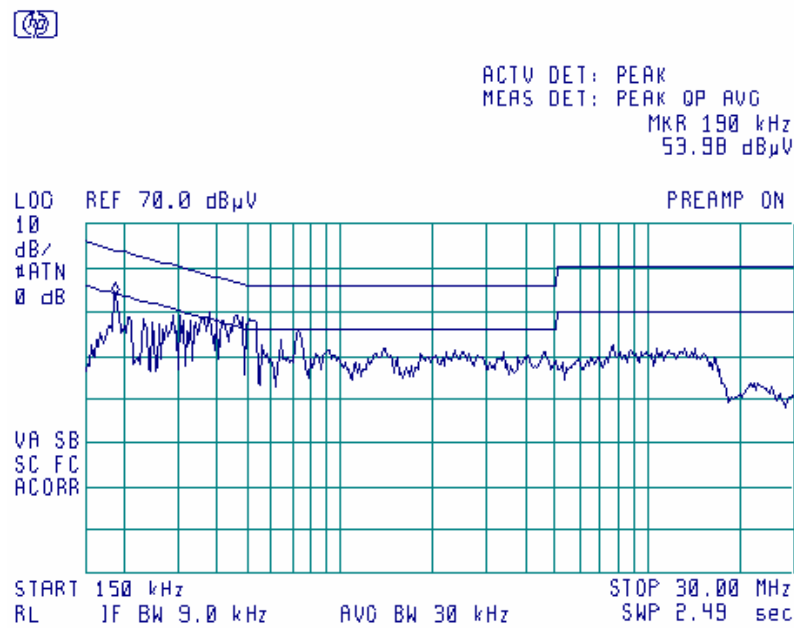
Table 6.19.2: Conducted emission test results

LINE: AC mains
LIMIT: Class B
FREQUENCY RANGE: 150 kHz - 30 MHz
RESOLUTION BANDWIDTH: 9 kHz

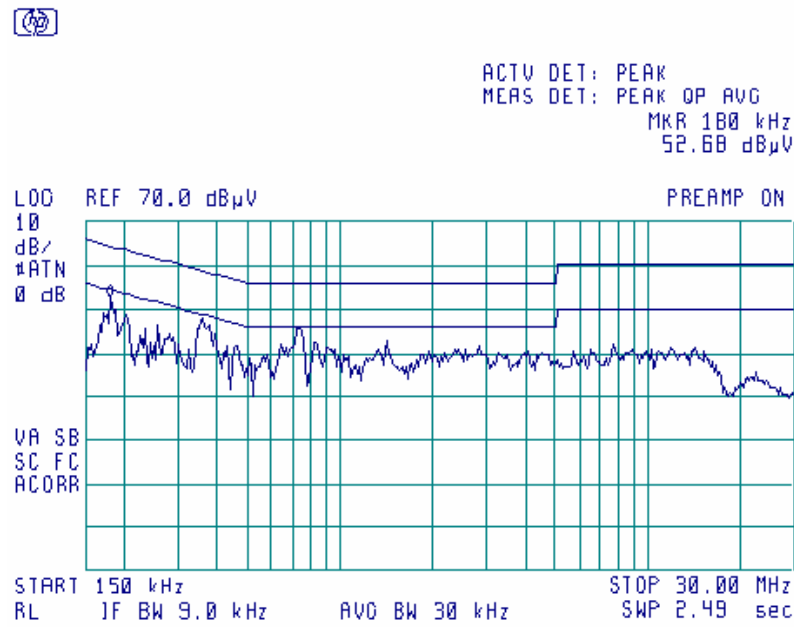
Frequency, MHz	Peak emission , dB(μV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(μV)	Limit, dB(μV)	Margin , dB*	Measured emission, dB(μV)	Limit, dB(μV)	Margin , dB*		
Receive / Stand-by mode									
0.176587	53.98	49.61	64.70	-15.09	38.13	54.70	-16.57	L1	Pass
0.189576	54.49	50.37	64.07	-13.70	41.51	54.07	-12.56		
0.288752	49.50	42.52	60.61	-18.09	32.95	50.61	-17.66		
0.294025	49.72	42.72	60.45	-17.73	36.28	50.45	-14.17		
0.364658	52.01	48.09	58.67	-10.58	44.75	48.67	-3.92		
0.532537	49.80	48.35	56.00	-7.65	37.23	46.00	-8.77		
0.740682	48.81	44.67	56.00	-11.33	40.51	46.00	-5.49		
0.182479	53.23	49.23	64.42	-15.19	39.68	54.42	-14.74	L2	Pass
0.198933	50.56	45.51	63.69	-18.18	37.90	53.69	-15.79		
0.237670	46.24	38.61	62.21	-23.60	33.41	52.21	-18.80		
0.360460	50.33	46.59	58.77	-12.18	43.44	48.77	-5.33		
0.675834	42.15	40.56	56.00	-15.44	36.42	46.00	-9.58		
0.738777	47.44	45.02	56.00	-10.98	40.36	46.00	-5.64		
Transmit mode									
0.160583	51.48	47.18	65.48	-18.30	32.16	55.48	-23.32	L1	Pass
0.175626	51.55	46.63	64.75	-18.12	39.30	54.75	-15.45		
0.192726	50.89	48.11	63.93	-15.82	41.31	53.93	-12.62		
0.299636	47.59	41.70	60.28	-18.58	37.19	50.28	-13.09		
0.348832	48.19	43.01	59.05	-16.04	36.56	49.05	-12.49		
0.746190	46.62	44.59	56.00	-11.41	39.83	46.00	-6.17	L2	Pass
0.181408	52.46	46.63	64.47	-17.84	39.52	54.47	-14.95		
0.313687	50.18	44.55	59.89	-15.34	31.48	49.89	-18.41		
0.376967	52.46	45.68	58.38	-12.70	37.36	48.38	-11.02		
0.389105	52.47	44.92	58.09	-13.17	37.03	48.09	-11.06		
0.469327	49.91	44.16	56.57	-12.41	30.52	46.57	-16.05		
0.522742	49.21	45.74	56.00	-10.26	27.90	46.00	-18.10		
0.738708	46.83	44.35	56.00	-11.65	40.63	46.00	-5.37		

*- Margin = Measured emission - specification limit.

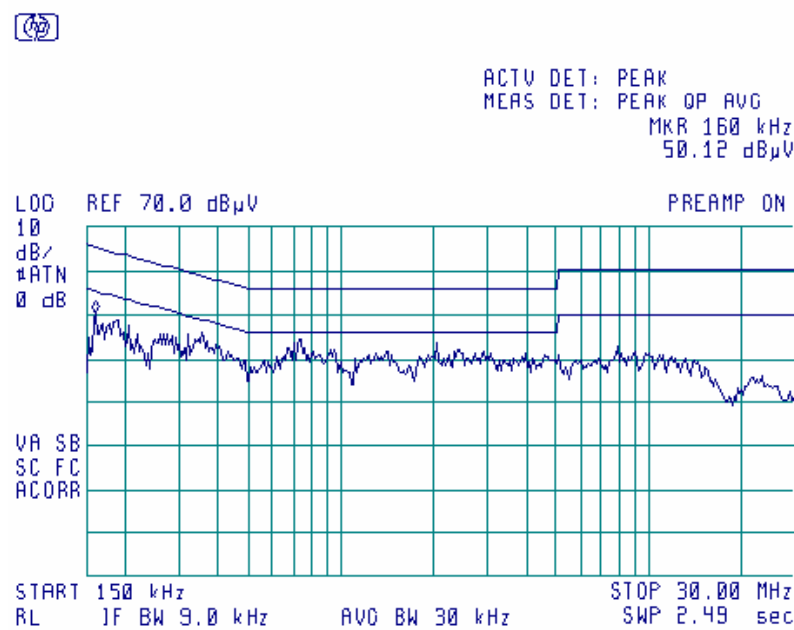
Plot 6.19.2: Conducted emission measurements, Rx/Stand-by mode, Line L1, Quasi-Peak & Average Limits.



Plot 6.19.3: Conducted emission measurements, Rx/Stand-by mode, Line L2, Quasi-Peak & Average Limits.



Plot 6.19.3: Conducted emission measurements, Transmit mode, Line L1, Quasi-Peak & Average Limits.



Plot 6.19.3: Conducted emission measurements, Transmit mode, Line L2, Quasi-Peak & Average Limits.

