TEST REPORT

Report Number: 101287079MPK-003
Project Number: G101287079
September 29, 2013

Testing performed on the
Digital X-Ray Detector System
Model Numbers: XRpad 4336 and XRpad 4336 MED
FCC ID: 2AA8Z-XRPAD4336
IC: 11552A-XRPAD4336

to
FCC Part 15, Subpart E
RSS-210 Issue 8
FCC Part 15, Subpart B
Industry Canada ICES-003

For

PerkinElmer Medical Imaging

Test Performed by:	Test Authorized by:
Intertek	PerkinElmer Medical Imaging
1365 Adams Court	In der Rehbach 22
Menlo Park, CA 94025 USA	65396 Walluf Germany

Prepared by: _____ **Date:** September 29, 2013
Minh Ly

Reviewed by: _____ **Date:** September 29, 2013
Krishna K Vemuri

VERIFICATION OF COMPLIANCE
Report No. 101287079MPK-003

Verification is hereby issued to the named APPLICANT and is VALID ONLY for the equipment identified hereon for use under the rules and regulations listed below.

Equipment Under Test:	Digital X-Ray Detector System
Trade Name:	PerkinElmer Medical Imaging
Model No.:	XRpad 4336
Serial No.:	zzz – E0019
Applicant:	PerkinElmer Medical Imaging
Contact:	Richard L Knispel
Address:	In der Rehbach 22 65396 Walluf
Country	Germany
Tel. Number:	+496123971507
Email:	richard.knispel@perkinelmer.com
Applicable Regulation:	FCC Part 15, Subpart E RSS-210 Issue 8 FCC Part 15, Subpart B Industry Canada ICES-003
Date of Test:	July 31 to September 13, 2013

We attest to the accuracy of this report:

Minh Ly
EMC Project Engineer

Krishna K Vemuri
EMC Senior Staff Engineer

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1.0 Introduction

1.1 Summary of Tests

Test	Reference FCC	Reference RSS-210	Result
26 dB/Occupied Bandwidth	15.407(a)(1)(2)	A9.2(1)(2)(3)	Complies
Conducted Output Power	15.407(a)(1)(2)	A9.2(1)(2)(3)	Complies
Peak Power Spectral Density	15.407(a)(1)(2)	A9.2(1)(2)(3)	Complies
Ratio of the peak excursion of the modulation envelope	15.407(a)(6)	--	Complies
Out-of-band Antenna Conducted Emission	15.407(b)(1)(2)(3)	A9.2(1)(2)(3)	Complies
Transmitter Radiated Emissions	15.407(b)(1)(2)(3) 15.209, 15.205	A9.2(1)(2)(3)	Complies
Radiated Emission from Digital Part and Receiver	15.109	ICES-003	Complies
Frequency stability	15.407(g)	--	Complies
AC Line-conducted Emission	15.207	RSS-Gen	Complies
Dynamic Frequency Selection (DFS)	15.407(h)(2)(iii)(iv)	A9.3 (b)(iii)(iv)(v)	Not Applicable. EUT operates in 5150 – 5250 MHz Band (non-DFS Band) only
RF Exposure Requirement	2.1091	RSS-102	Complies
Antenna Requirement	15.203	RSS-Gen	Complies. The EUT uses PCB antenna and unique antenna connector on the board

EUT receive date: July 31, 2013
EUT receive condition: The EUT was received in good condition with no apparent damage.
Test start date: August 30, 2013
Test completion date: Sept 13, 2013
The test results in this report pertain only to the item tested.

2.0 General Description

2.1 Product Description

PerkinElmer Medical Imaging supplied the following description of the EUT:

The Digital X-Ray Detector System consists of the XRpad 4336 digital flat panel x-ray detector, equipped with the XRpad LBP rechargeable battery pack, or optionally connected to the XRpad IPU interface and power supply unit. The XRpad 4336 detector interfaces with a computer wirelessly or through Gb-Ethernet via the XRpad IPU. The XRpad 4336 detector is intended to be used with a radiographic x-ray system to generate digital radiographic images. The images can be displayed on a computer monitor.

For marketing purposes only, the Digital X-Ray Detector System has two different model names, XRpad 4336 and XRpad 4336 MED. These two models are identical.

This test report covers the 5150 MHz – 5250 MHz band of operation. RF Module consists of three antenna ports and all three are internal PCB antenna.

The EUT supports a wide range of data rates in 5GHz band:

IEEE 802.11n: MCS0 to MCS23.

Note: in 802.11n HT20 an 802.11n HT40 modes the nominal bandwidth is 20 MHz and 40 MHz respectively.

The information about the 5GHz radio, installed in the models: XRpad 4336 and XRpad 4336 MED, is presented below.

Applicant	PerkinElmer Medical Imaging In der Rehbach 22, 65396 Walluf Germany
Model Numbers	XRpad 4336 and XRpad 4336 MED
FCC Identifier	2AA8Z-XRPAD4336
IC	11552A-XRPAD4336
Use of Product	Digital X-Ray Detector System
Modulation Technique	OFDM
Rated RF Output	13.6 dBm (22.9 mW) for 5180~5240 MHz
Frequency Range	U-NII low: 5150 – 5250 MHz
Type of modulation	64-QAM, 16-QAM, QPSK, BPSK
Number of Channel(s)	IEEE 802.11n HT20 5150 – 5250 MHz 5180MHz, 5200MHz, 5220MHz, 5240MHz IEEE 802.11n HT40 5150 – 5250 MHz 5190MHz, 5230MHz
Antenna(s) & Gain	Smart Antenna System (multiple antennas (3no.), no beam forming); Each antenna specification: Internal PCB antenna, 5.8dBi peak gain, U.FL connector;
Manufacturer Name & Address	PerkinElmer Medical Imaging In der Rehbach 22, 65396 Walluf Germany

The EUT supports the following configurations:

Channels in 5150 – 5250 MHz band					
Number	Frequency, MHz	a/n HT20 mode		n HT40 mode	
36	5180	√	X		
38	5190			√	X
40	5200	√	X		
44	5220	√			
46	5230			√	X
48	5240	√	X		

List of channels:
√ - available
X - tested
.

2.2 Related Submittal(s) Grants

None.

2.3 Test Methodology

Antenna conducted measurements were performed according to the FCC documents: "Guidelines for Compliance Testing of U-NII Devices operating under Part 15, Subpart E" (KDB 789033) and "Emissions Testing of Transmitters with Multiple Outputs in the same Band" (KDB 662911).

Both AC mains line-conducted and radiated emissions measurements were performed according to the procedures in ANSI C63.4. Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the **"Data Sheet"** of this Application.

All other measurements were made in accordance with the procedures in part 2 of CFR 47.

2.4 Test Facility

The test site used to collect the radiated data is site 1 (10-m semi-anechoic chamber). This test facility and site measurement data have been fully placed on file with the FCC, IC and A2LA accredited.

2.5 Measurement Uncertainty

Compliance with the limits was based on the results of the measurements and doesn't take into account the measurement uncertainty.

Estimated Measurement Uncertainty

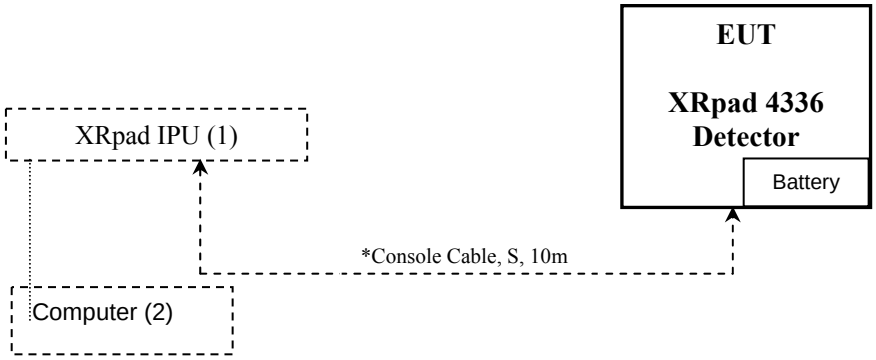
Measurement	Expanded Uncertainty (k=2)		
	0.15 MHz – 1 GHz	1 GHz – 2.5 GHz	> 2.5 GHz
RF Power and Power Density – antenna conducted	-	0.7 dB	-
Unwanted emissions - antenna conducted	1.1 dB	1.3 dB	1.9 dB
Bandwidth – antenna conducted	-	-	1 kHz
Radiated emissions	4.2 dB	3.4 dB	3.6 dB
AC mains conducted emissions	2.4 dB	-	-

3.0 System Test Configuration

3.1 Support Equipment

Item #	Description	Model No.	Serial No.
1	XRpad IPU	IPU	922-H03-001-0027-AP
2	HP Pavillion Laptop	DM 1	Not Labeled

3.2 Block Diagram of Test Setup



* In normal use, the XRpad 4336 does not operate with a console cable while operating in wireless mode. The console cable was used for setup purpose only which allowed control of the radio by test software. Radio tests were performed without this cable.

S = Shielded **U** = Unshielded	**F** = With Ferrite **m** = Meter

3.3 Justification

Preliminary testing was performed for all modulation/data rate modes. The following modes, in which the highest power was detected, were selected for final measurements:

OFDM, MCS23 – for 802.11n HT20
OFDM, MCS23 – for 802.11n HT40

3.4 Mode of Operation During Test

During transmitter testing, the transmitter was setup to transmit continuously at maximum RF power on low, middle and high channels.

3.5 Modifications required for Compliance

Intertek installed no modifications during compliance testing in order to bring the product into compliance.

3.6 Additions, deviations and exclusions from standards

No additions, deviations or exclusion have been made from standard.

4.0 Measurement Results

4.1 26-dB Bandwidth and Occupied Bandwidth
15.407(a)(1)(2)

4.1.1 Procedure

The Procedure, described in the FCC Publication 789033, was used.

The antenna port of the EUT was connected to the input of a spectrum analyzer (SA). For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 26 dB lower than PEAK level. The 26-dB bandwidth was determined from where the channel output spectrum intersected the display line.

The Occupied bandwidth was measured using the build-in spectrum analyzer facility for 99% power bandwidth measurement.

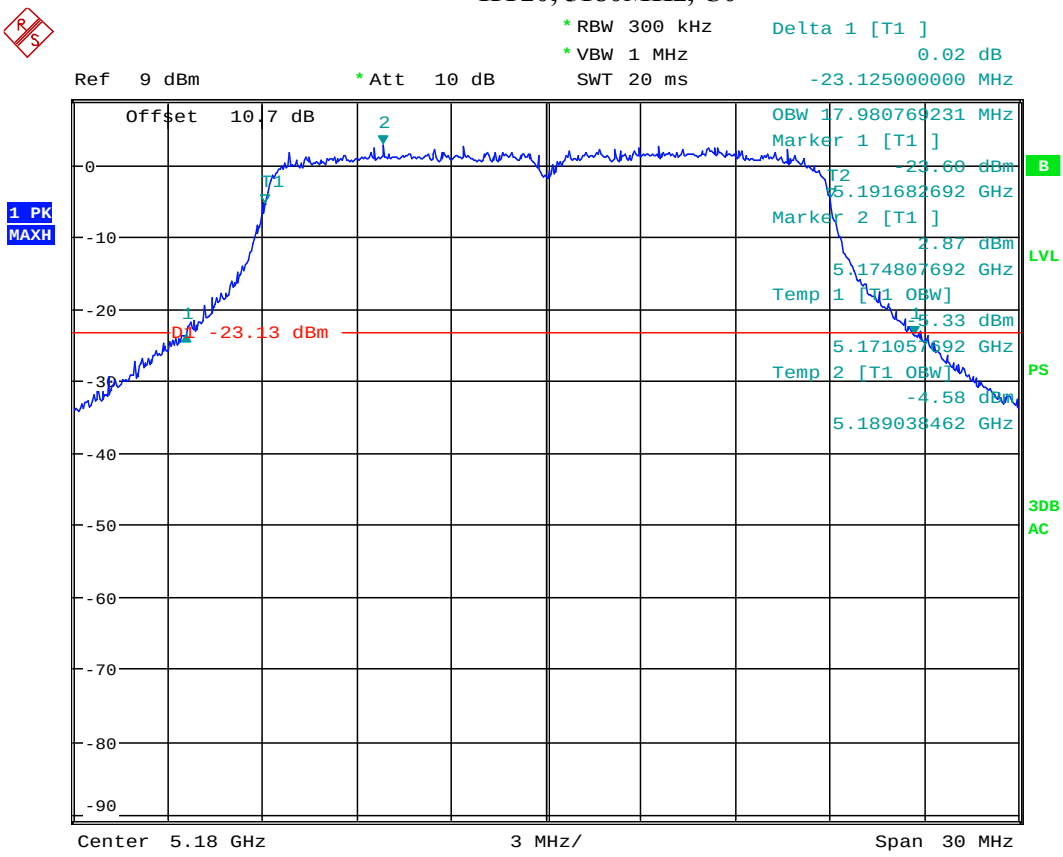
4.1.2 Test Result

Refer to the following plots for the test result:

Standard/ Data rate	Channel	Frequency MHz	RF Output Chain	26-dB Bandwidth, MHz	Occupied Bandwidth, MHz	Plot #
802.11n, HT20	36	5180	C0	23.12	17.98	1.1
			C1	22.83	17.93	1.2
			C2	23.12	17.98	1.3
	40	5200	C0	23.22	17.98	1.4
			C1	22.98	17.93	1.5
			C2	23.17	17.98	1.6
	48	5240	C0	23.07	17.93	1.7
			C1	23.02	17.93	1.8
			C2	23.07	17.98	1.9
802.11n, HT40	38	5190	C0	46.77	36.57	1.10
			C1	46.33	36.68	1.11
			C2	46.44	36.68	1.12
	46	5230	C0	46.04	36.57	1.13
			C1	48.79	36.68	1.14
			C2	50.03	36.79	1.15

Plot 1. 1

HT20, 5180MHz, C0



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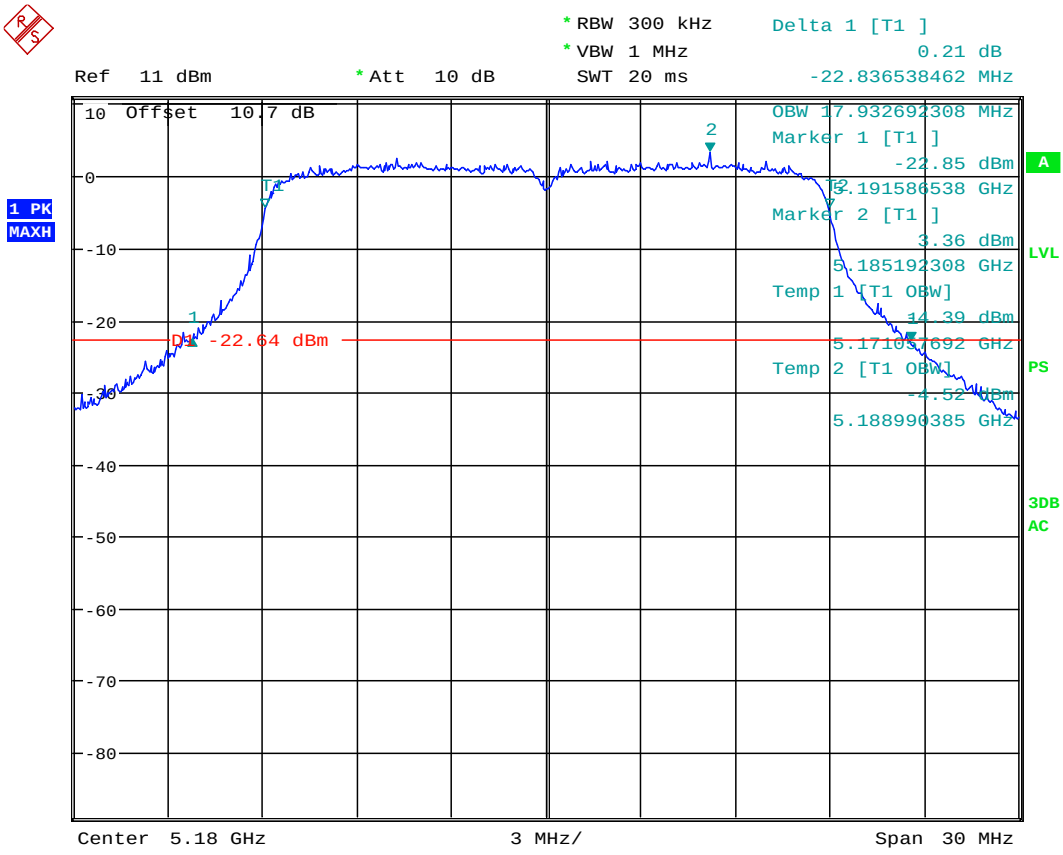
Plot 1. 2

HT20, 5180MHz, C1



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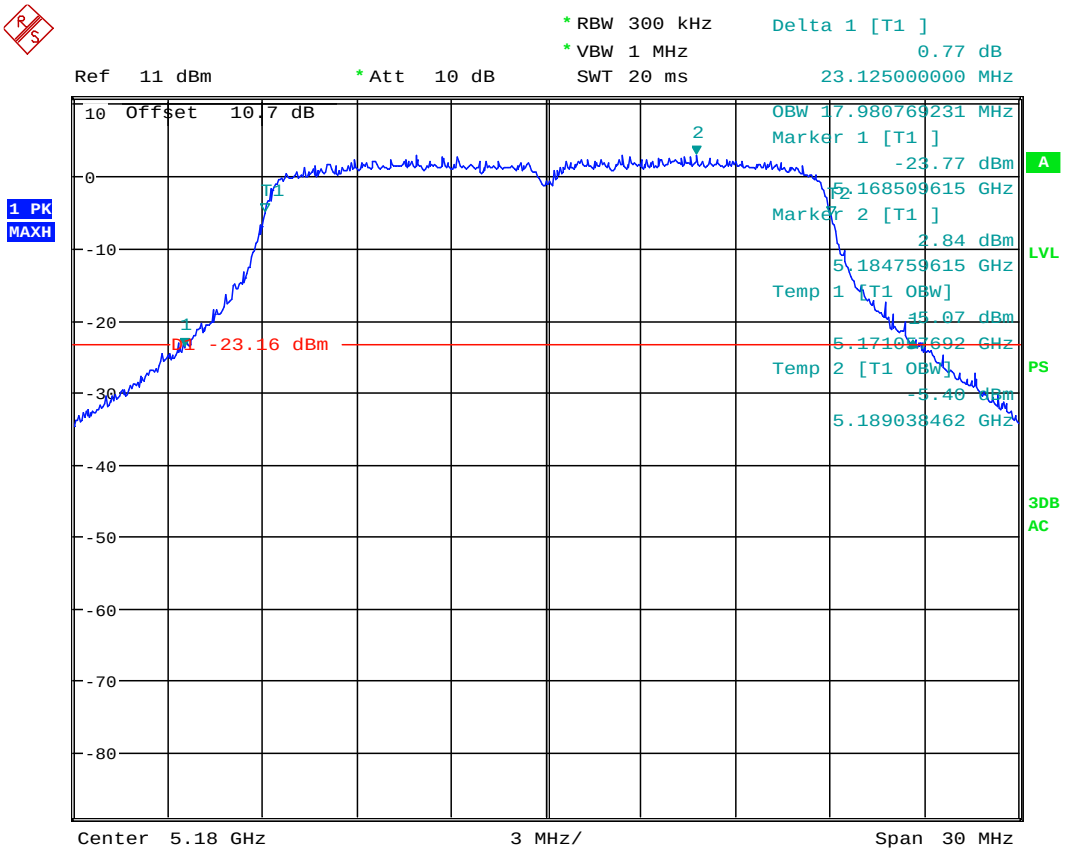
Plot 1. 3

HT20, 5180MHz, C2



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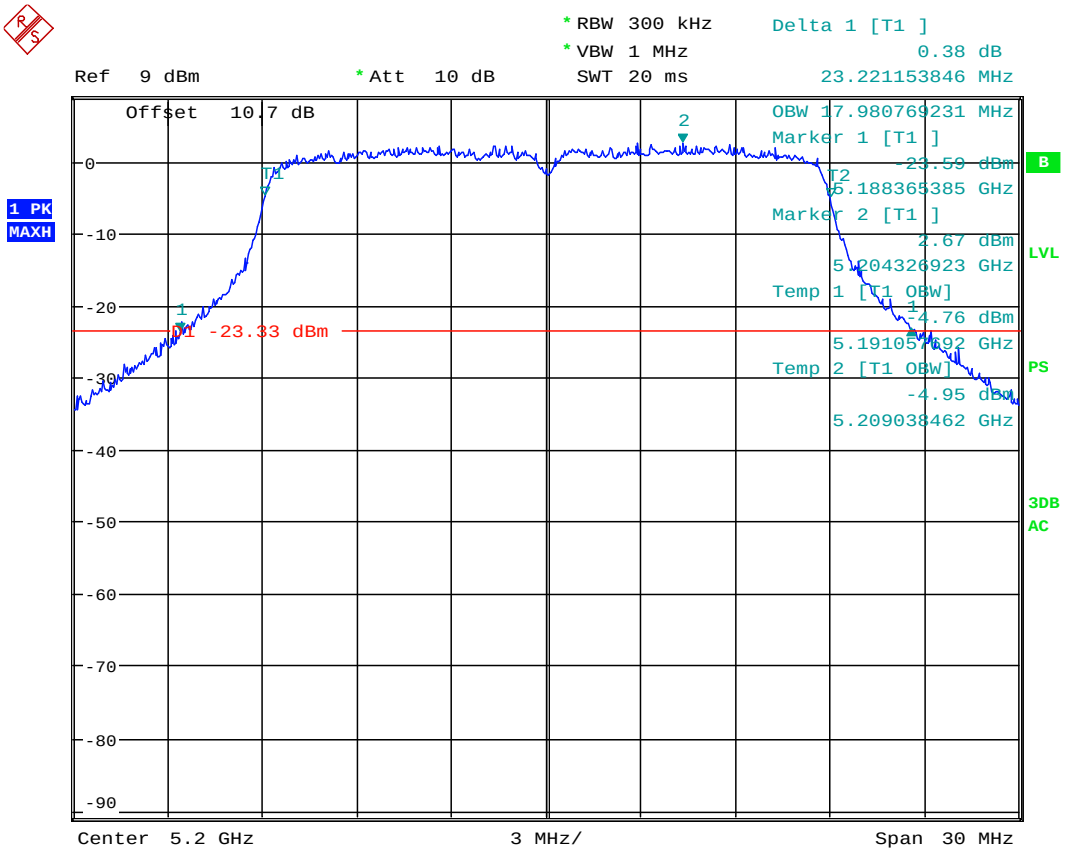
Plot 1. 4

HT20, 5200MHz, C0



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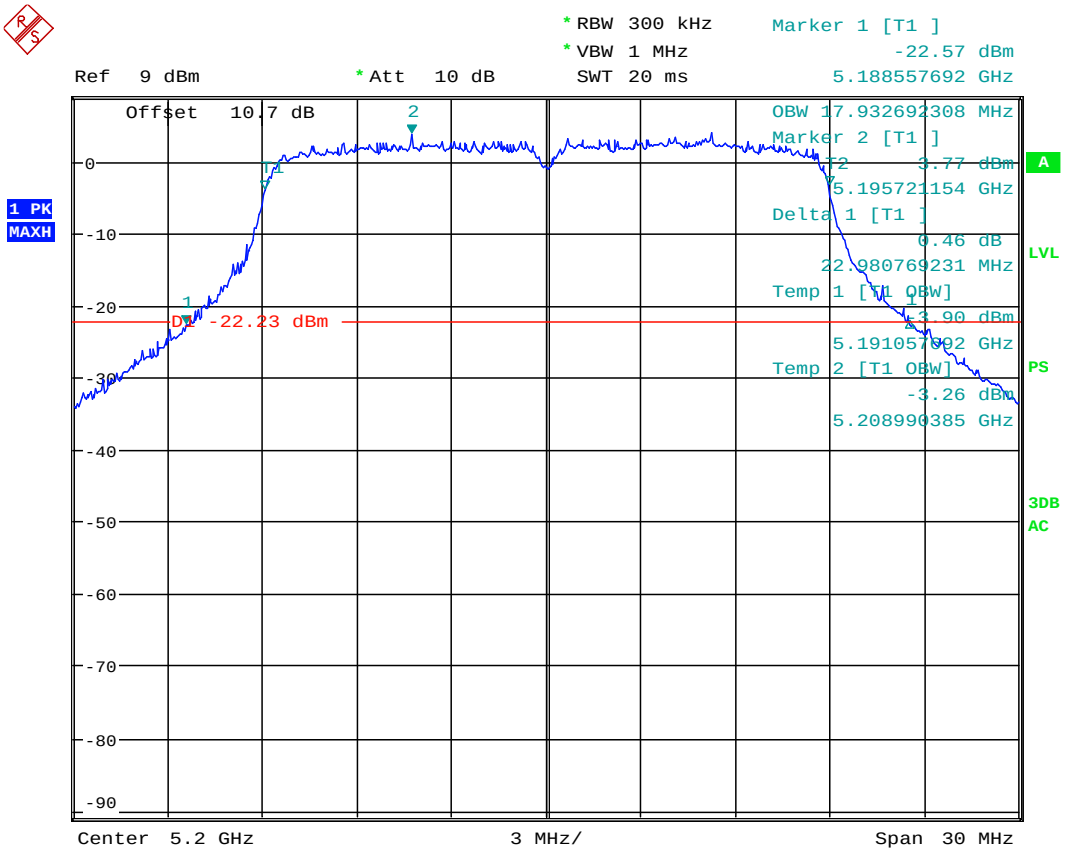
Plot 1. 5

HT20, 5200MHz, C1



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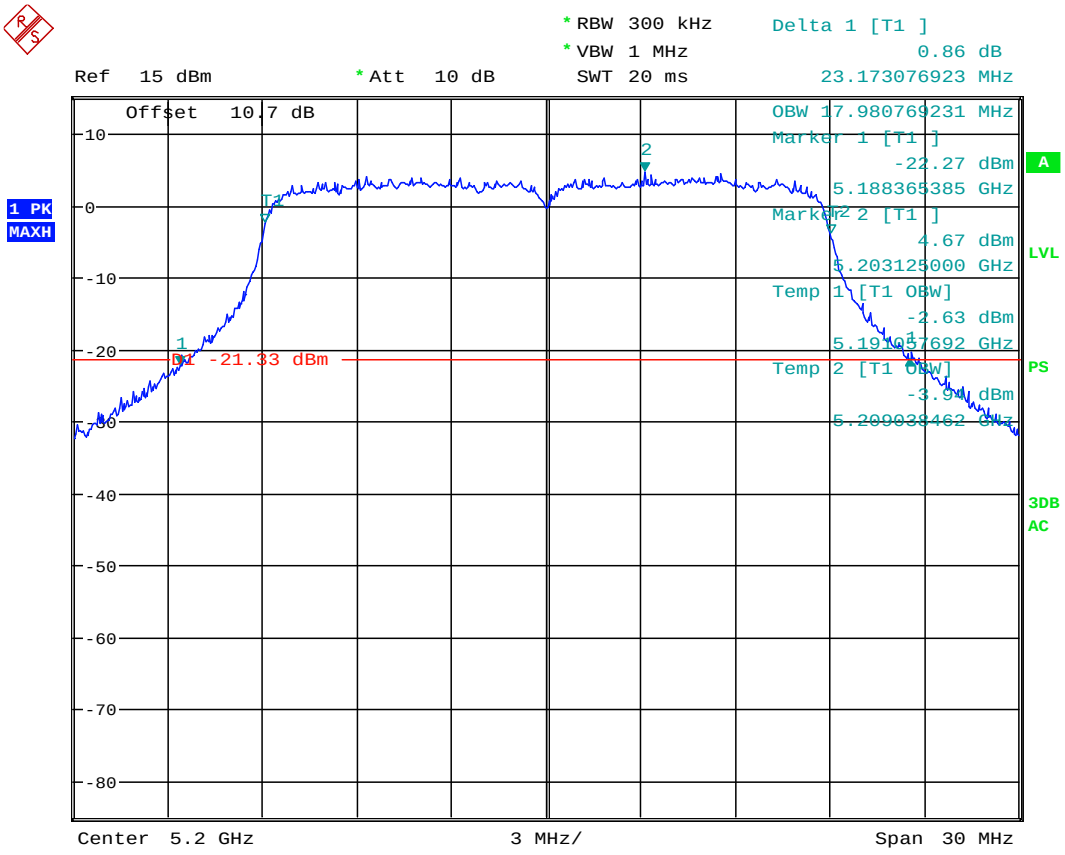
Date: 30.AUG.2013 11:47:50

Plot 1. 6

HT20, 5200MHz, C2



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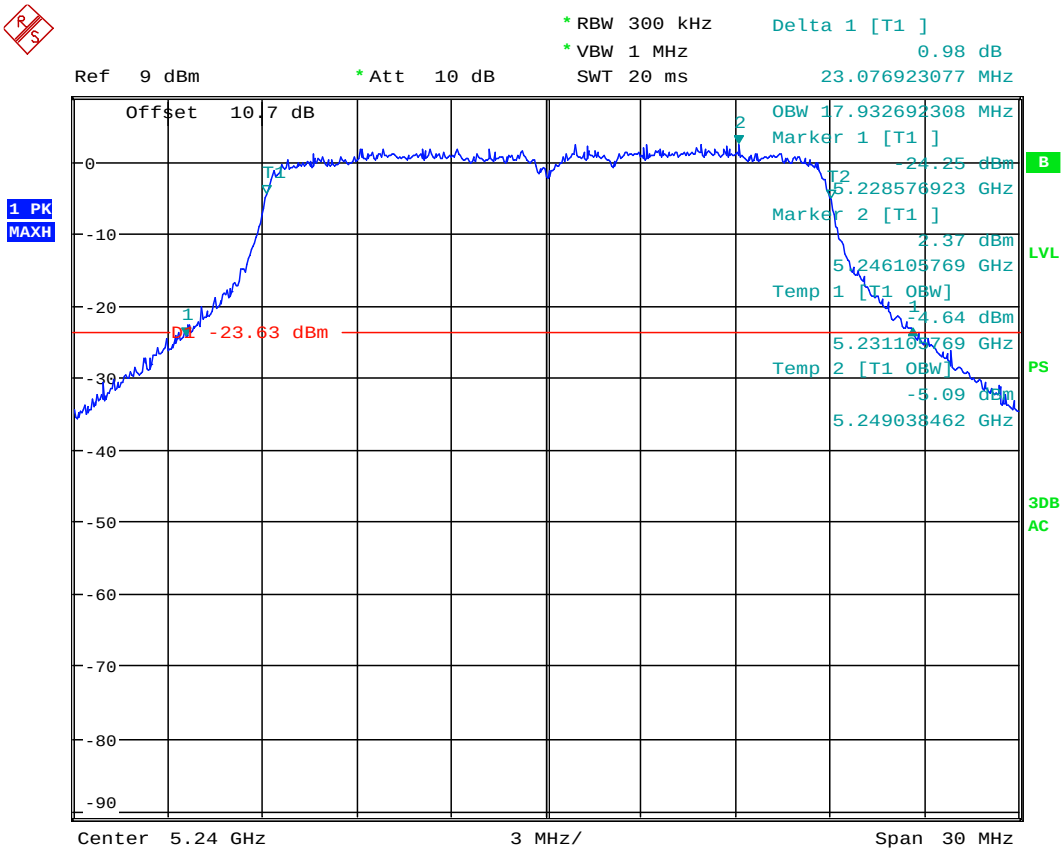
Plot 1. 7

HT20, 5240MHz, C0



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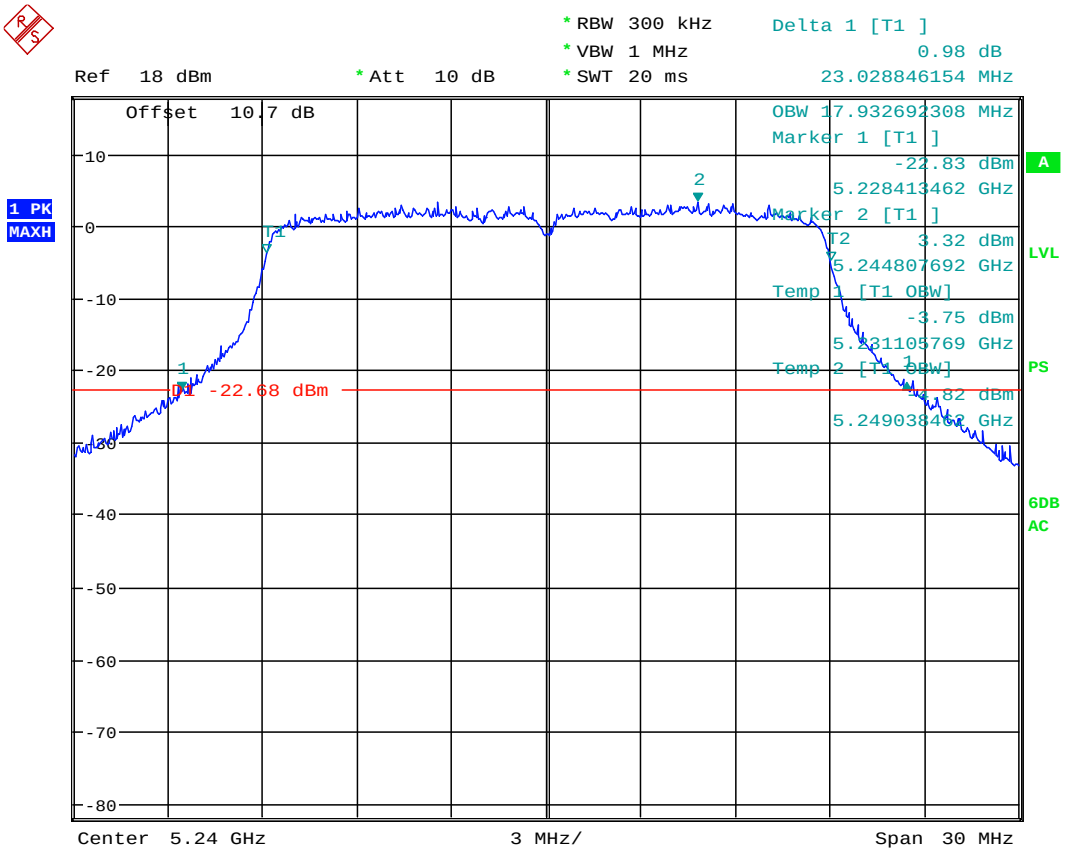
Plot 1. 8

HT20, 5240MHz, C1



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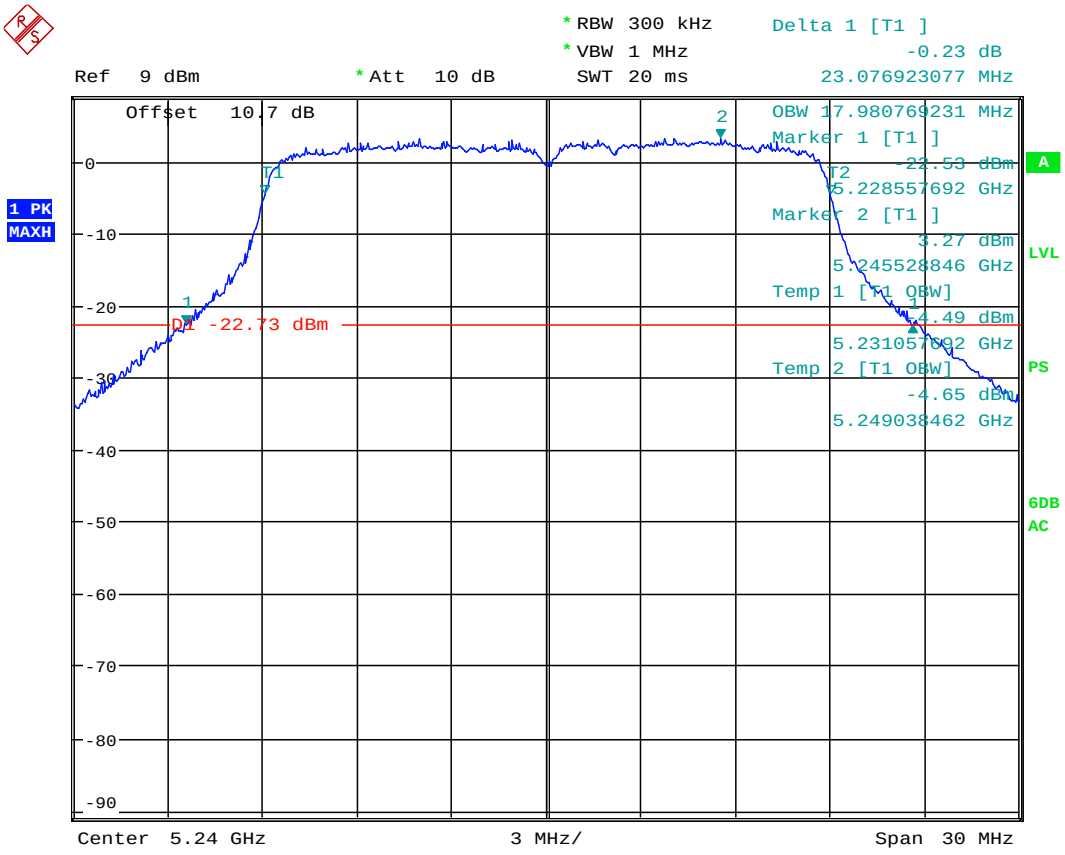
Plot 1. 9

HT20, 5240MHz, C2



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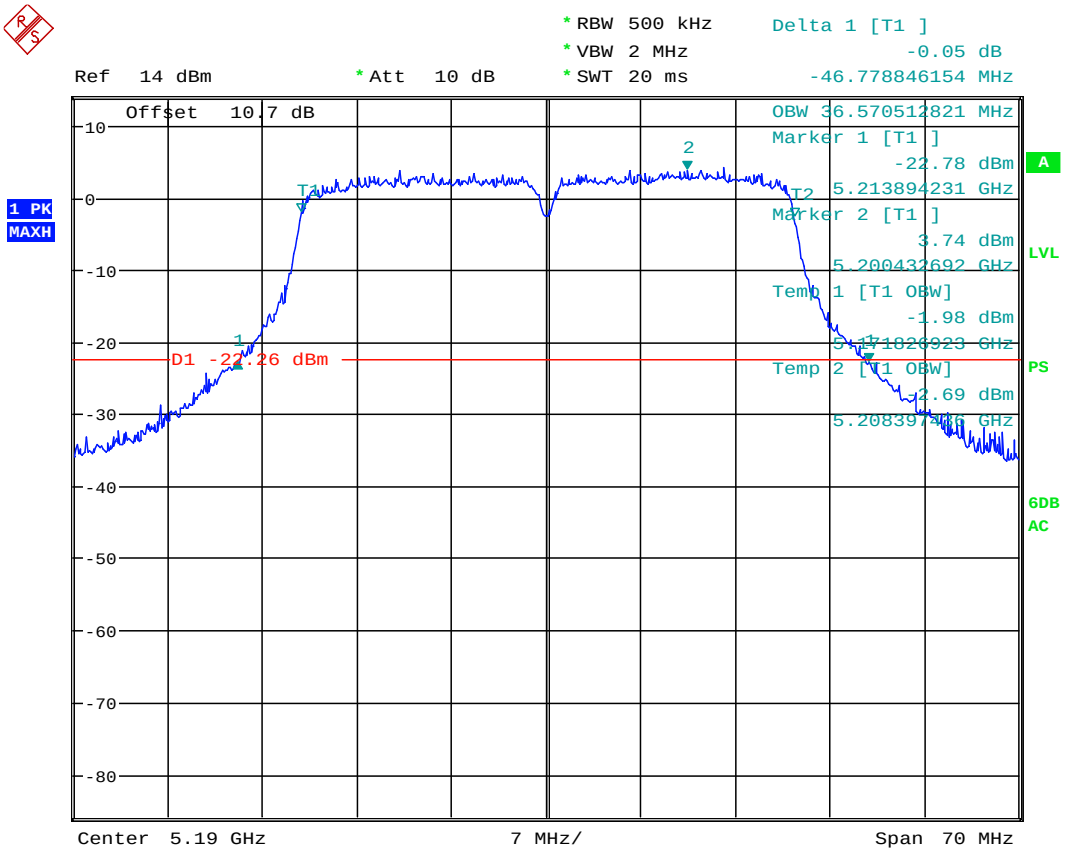
Plot 1. 10

HT40, 5190MHz, C0



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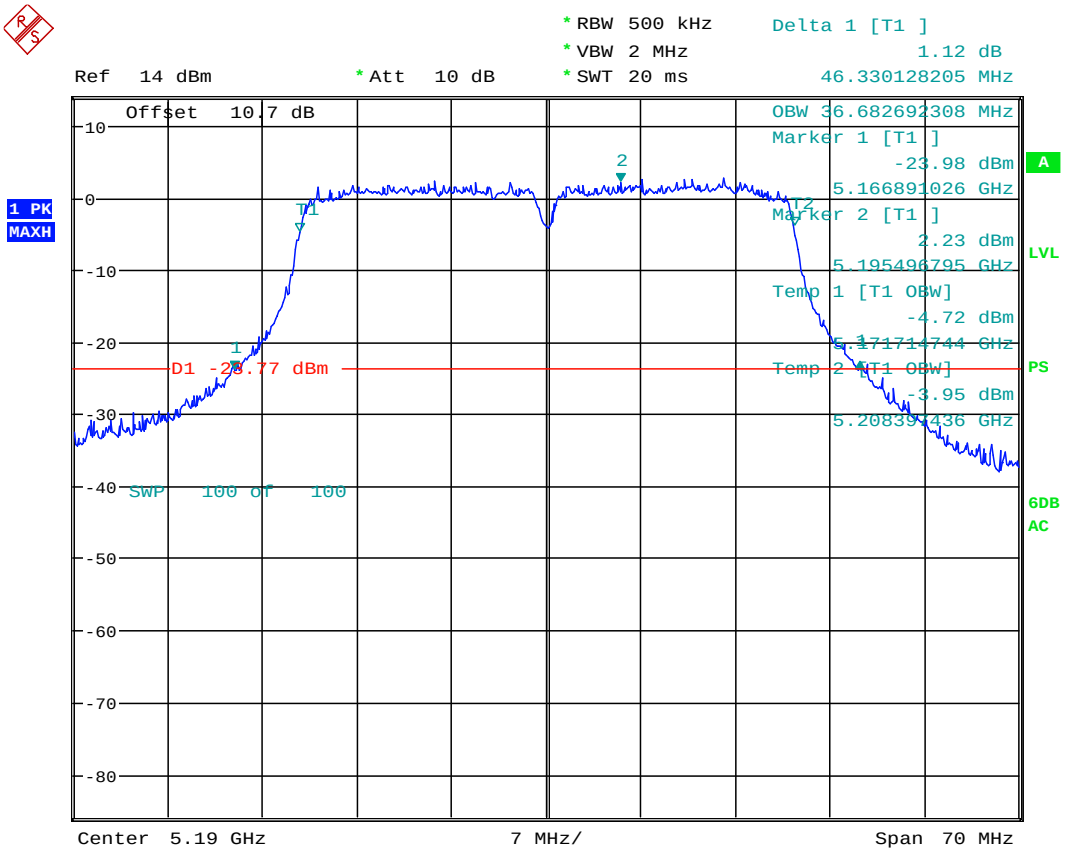
Plot 1. 11

HT40, 5190MHz, C1



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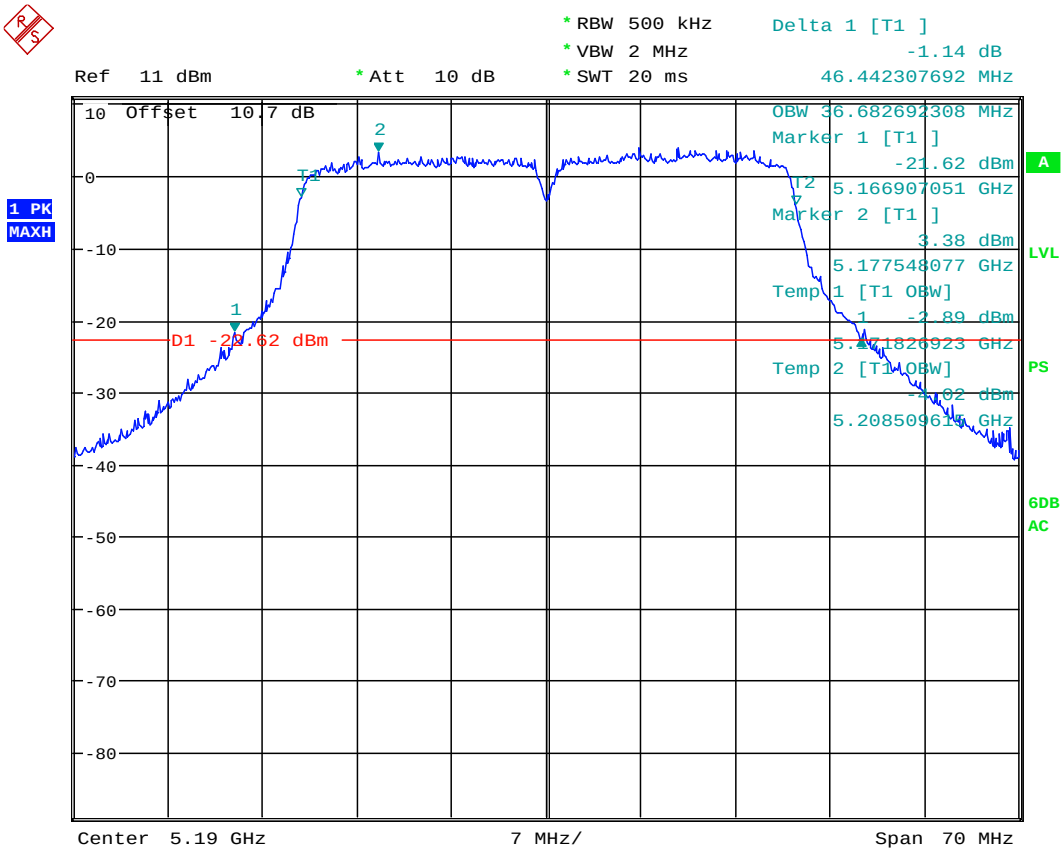
Date: 30.AUG.2013 15:03:18

Plot 1. 12

HT40, 5190MHz, C2



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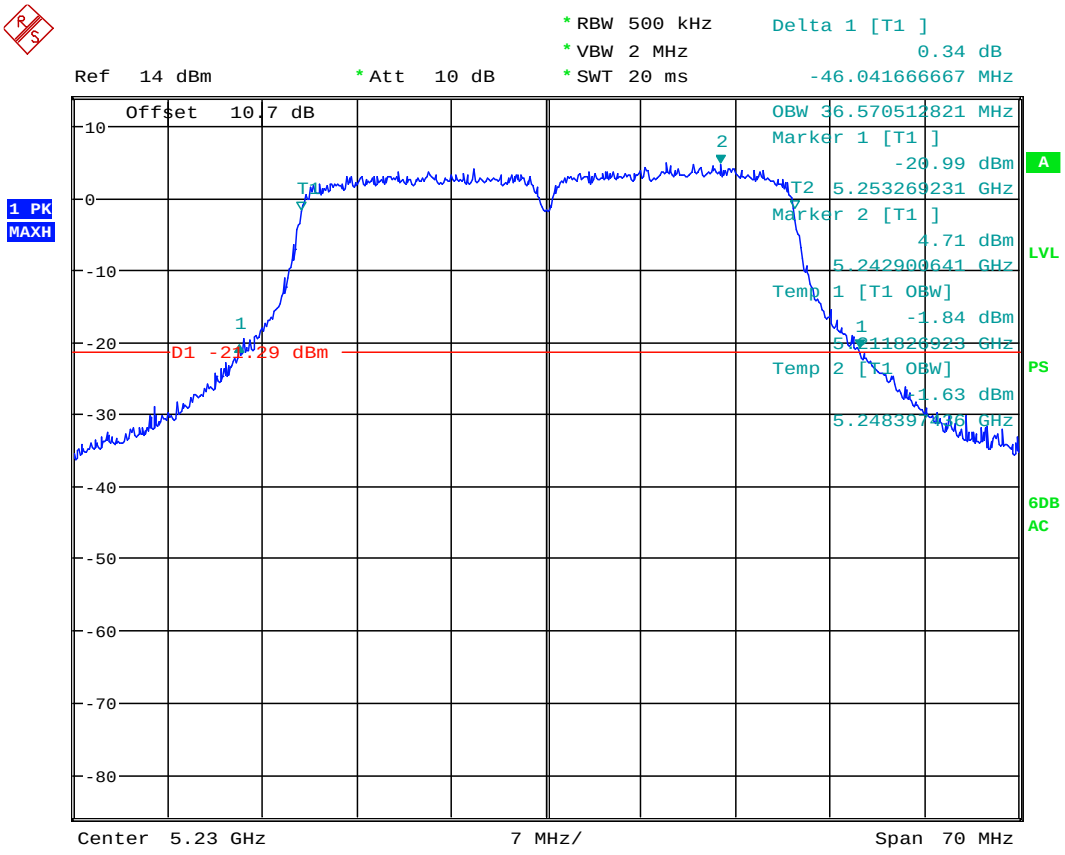
Date: 30.AUG.2013 14:42:38

Plot 1. 13

HT40, 5230MHz, C0



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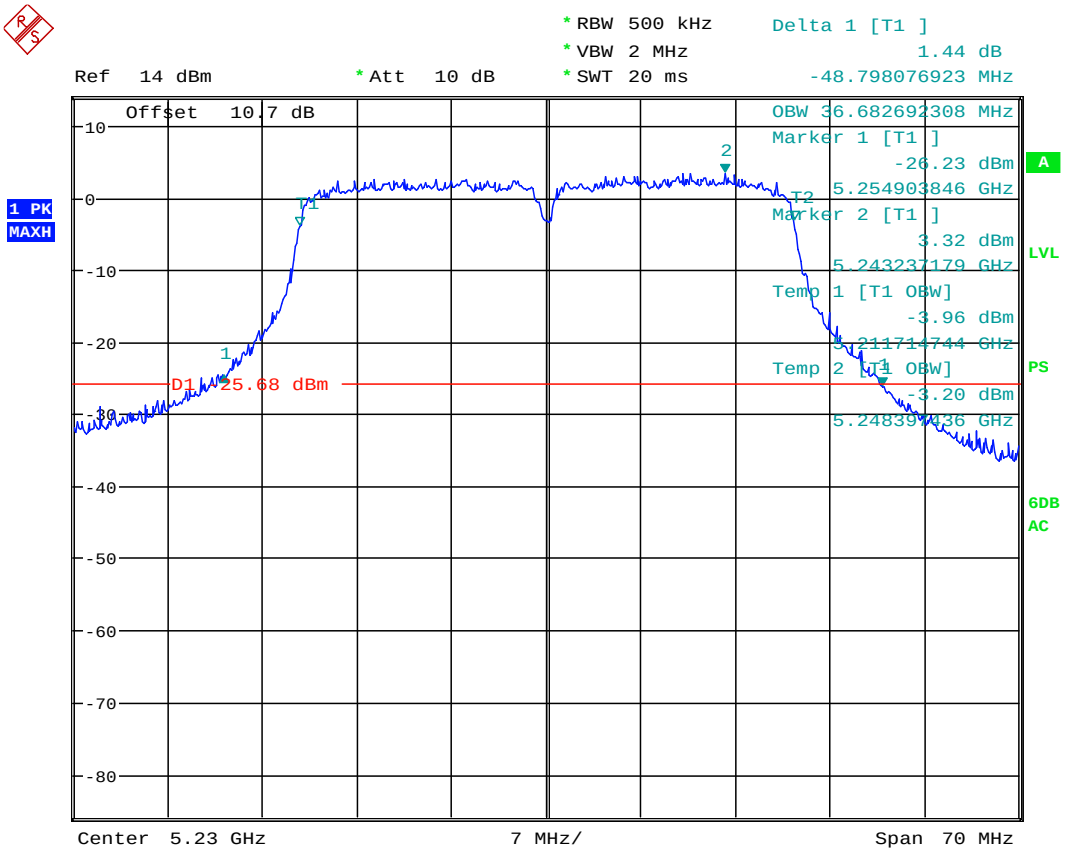
Date: 30.AUG.2013 15:15:53

Plot 1. 14

HT40, 5190MHz, C1



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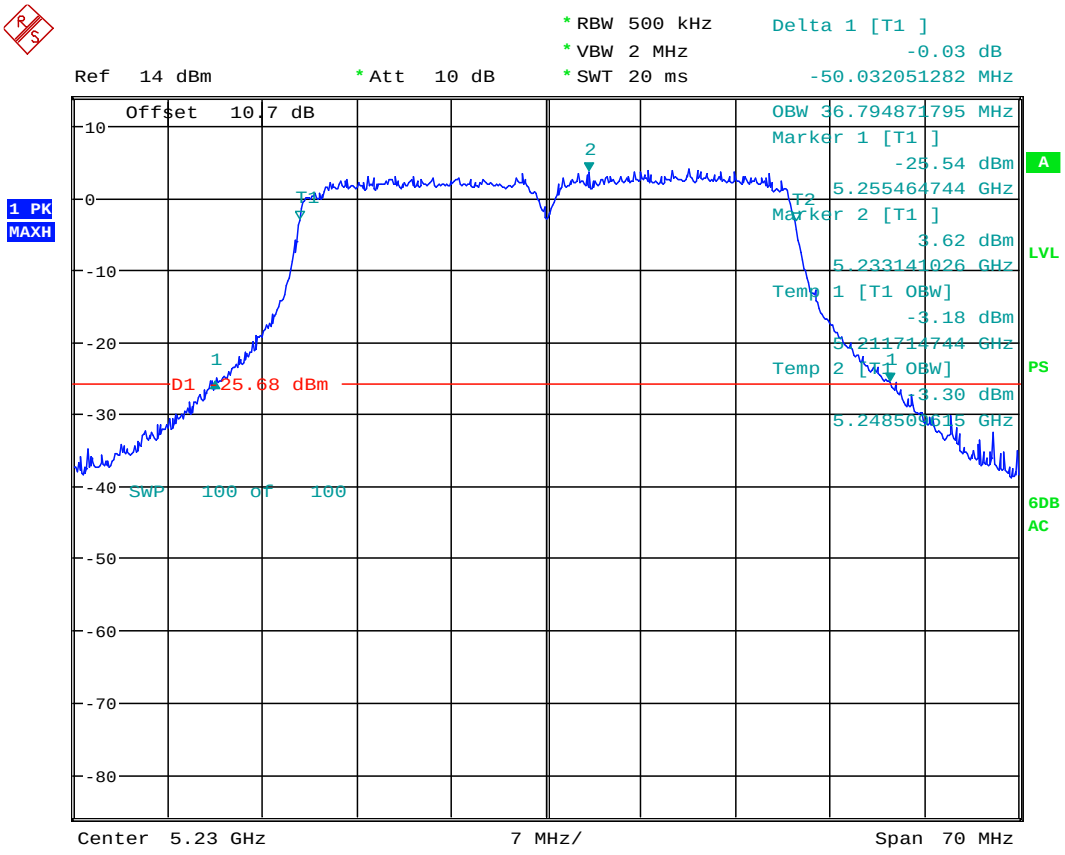
Date: 30.AUG.2013 15:20:25

Plot 1. 15

HT40, 5190MHz, C2



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4.2 Conducted Output Power
FCC Rule 15.407(a)(1)(2)

4.2.1 Requirement

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26 dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.2.2 Procedure

Each antenna port output of the EUT was connected to the input of a spectrum analyzer to measure the Maximum Conducted Transmitter Output Power respectively and recorded.

The procedure described in the FCC Publication 789033, was used. In particular – the C)3)c) Method SA-1 Alternative (RMS detection with slow sweep and EUT transmitting continuously at full power), with RMS detector, use the spectrum analyzer's band power measurement function with band limits set equal to the 26-dB EBW bandwidth.

The guidance described in the FCC Publication 662911 D01 Section E1, was used for summing the power.

Note: The conducted power was measured and limited by the manufacture specification of 27.6 mW.

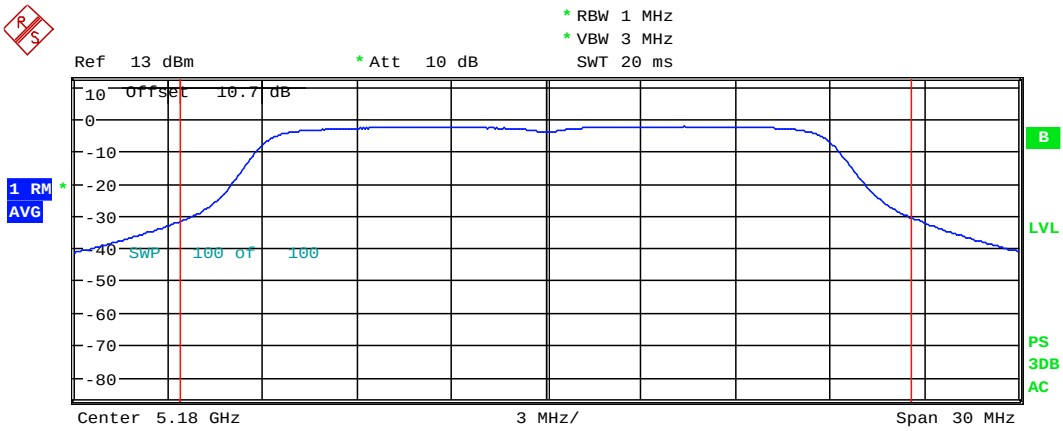
4.2.3 Test Results

Refer to the following plots for the test result:

Standard/ Data rate	Channel	Frequency (MHz)	RF Output Chain	Conducted power (average) dBm	Sum of the power (average) dBm	Conducted power Limit dBm	Margin dB	Plot #
802.11n, HT20	36	5180	C0	8.85	13.6	17.0	-3.4	2.1
			C1	8.48				2.2
			C2	9.00				2.3
	40	5200	C0	8.80	13.4	17.0	-3.6	2.4
			C1	8.31				2.5
			C2	8.80				2.6
	48	5240	C0	8.62	13.2	17.0	-3.8	2.7
			C1	7.95				2.8
			C2	8.64				2.9
802.11n, HT40	38	5190	C0	9.16	13.5	17.0	-3.5	2.10
			C1	8.47				2.11
			C2	8.67				2.12
	46	5230	C0	8.76	13.5	17.0	-3.5	2.13
			C1	8.41				2.14
			C2	8.99				2.15

Plot 2. 1

HT20, 5180MHz, C0



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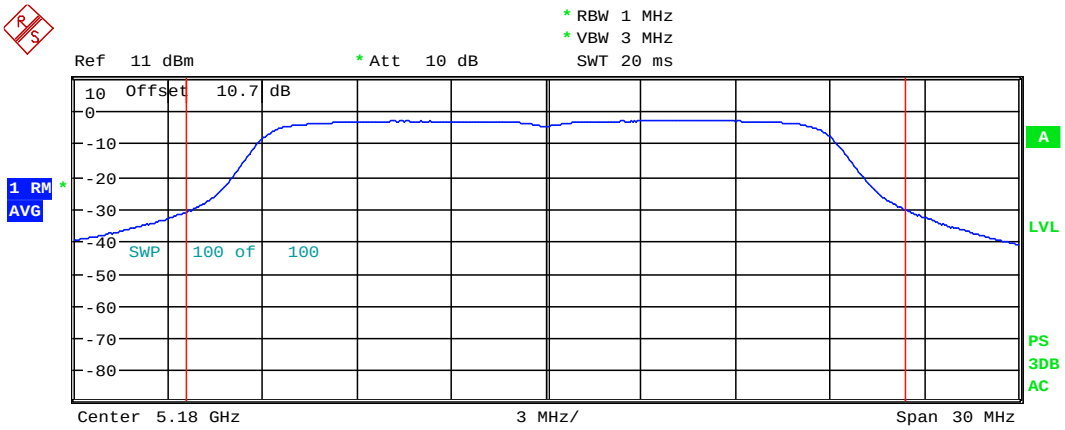
Plot 2. 2

HT20, 5180MHz, C1



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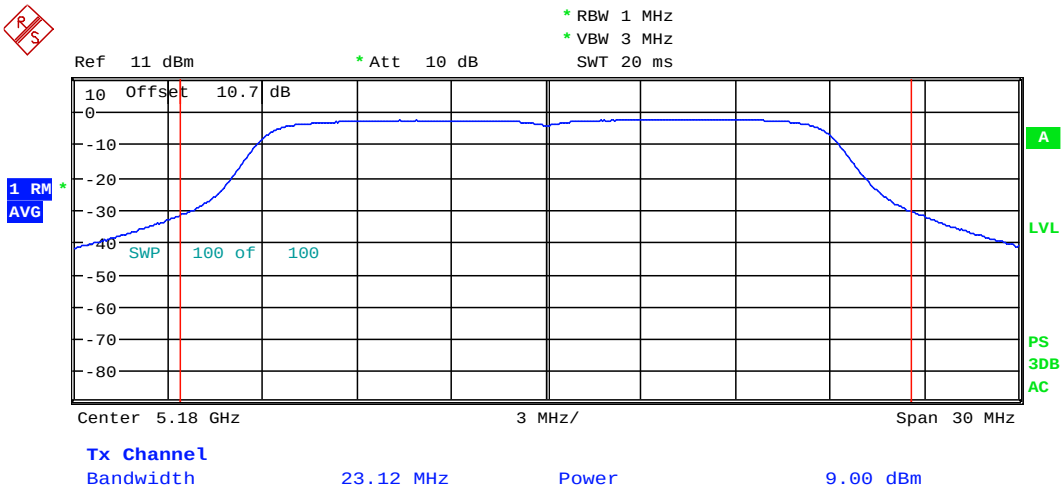
Plot 2. 3

HT20, 5180MHz, C2



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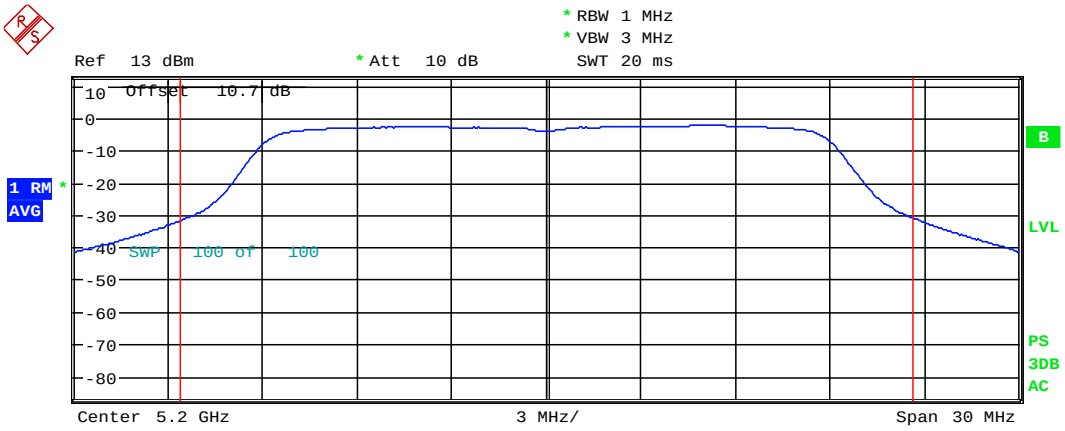
Plot 2. 4

HT20, 5200MHz, C0



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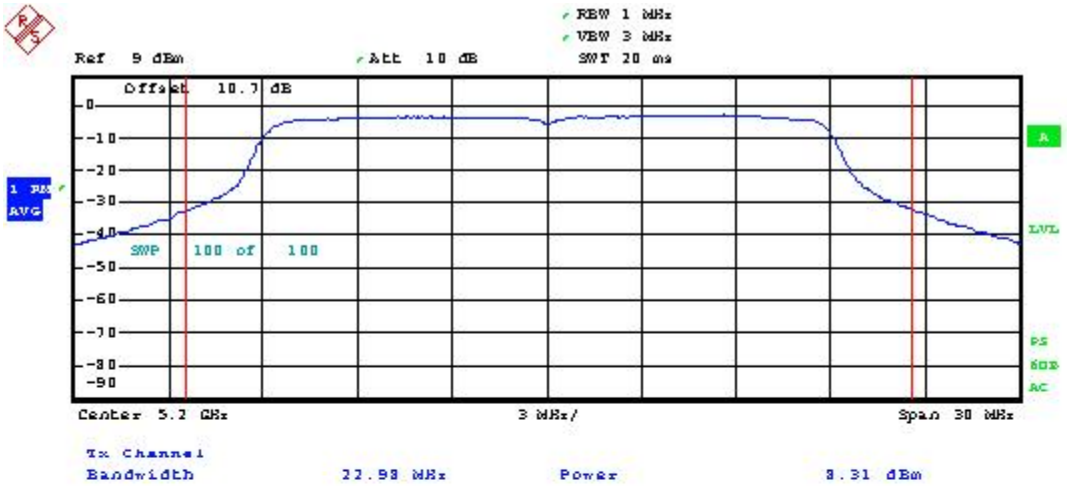
Plot 2. 5

HT20, 5200MHz, C1



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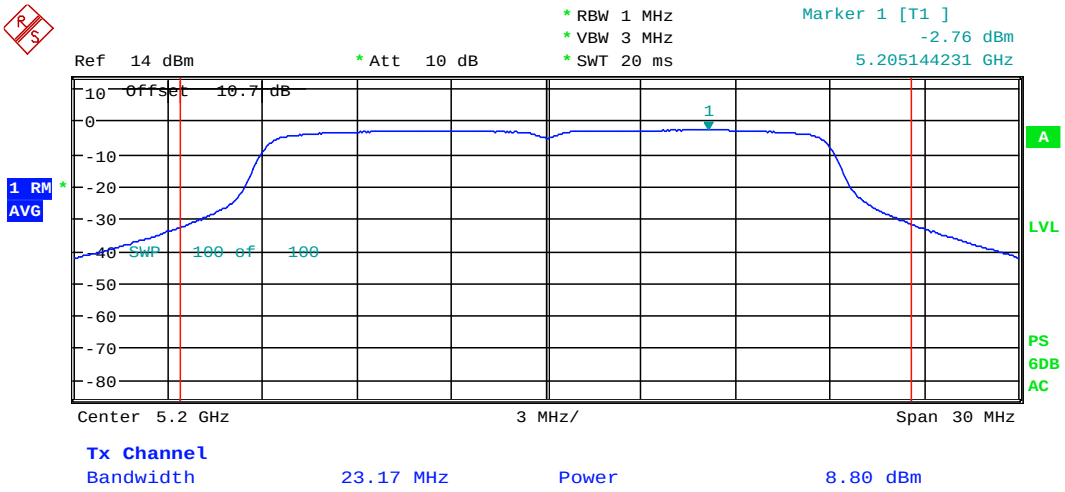
Date: 30.AUG.2013 11:49:28

Plot 2. 6

HT20, 5200MHz, C2



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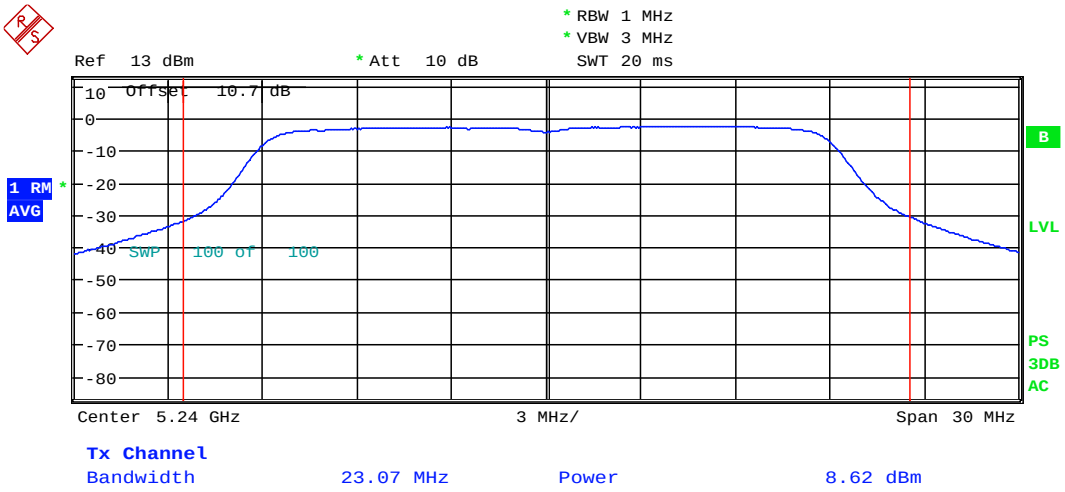
Plot 2. 7

HT20, 5240MHz, C0



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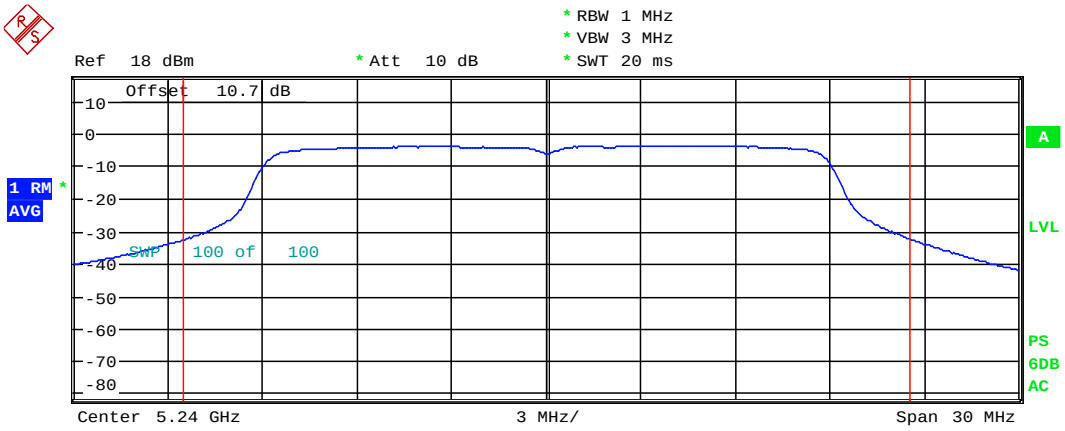
Date: 28.AUG.2013 17:17:50

Plot 2. 8

HT20, 5240MHz, C1



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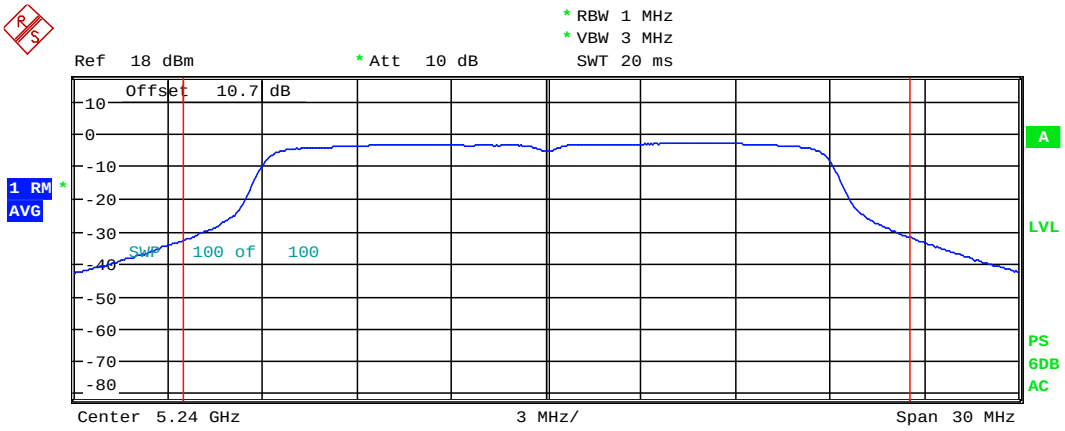
Date: 30.AUG.2013 12:40:31

Plot 2. 9

HT20, 5240MHz, C2



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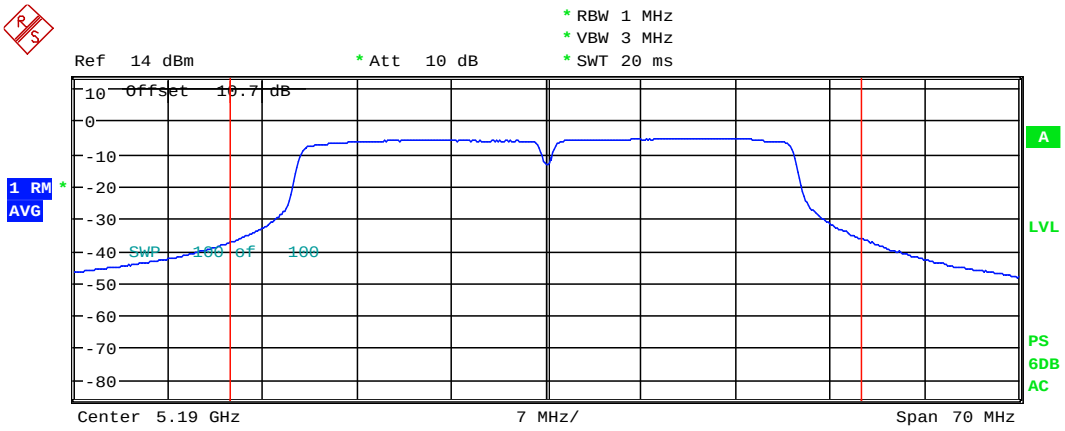
Date: 30.AUG.2013 12:34:53

Plot 2. 10

HT40, 5190MHz, C0



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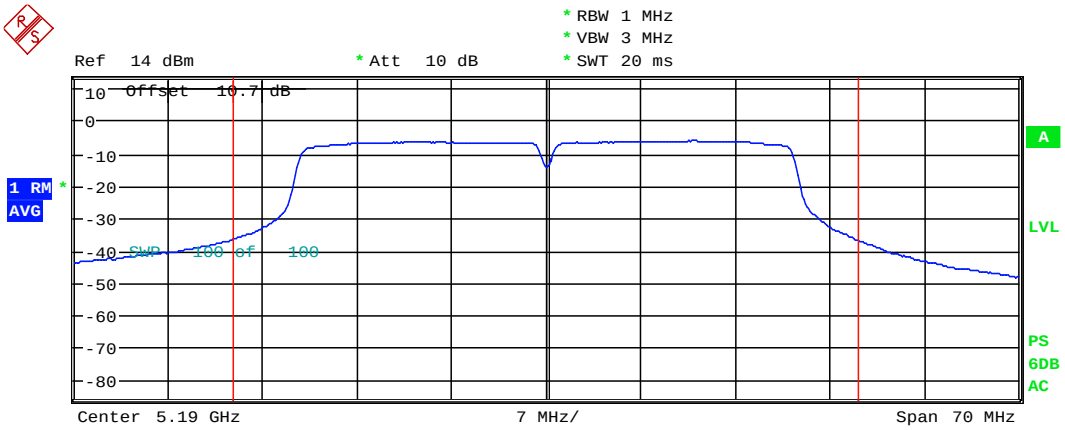
Date: 30.AUG.2013 15:12:23

Plot 2. 11

HT40, 5190MHz, C1



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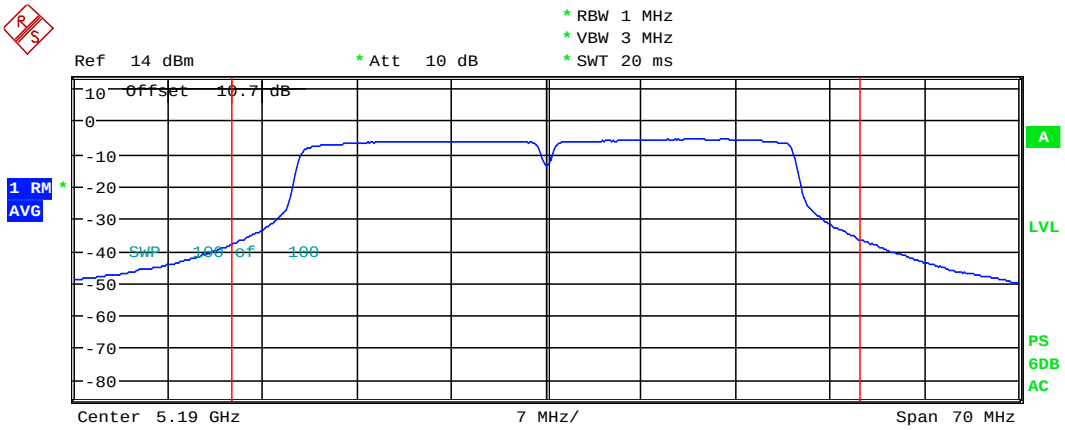
Date: 30.AUG.2013 15:05:49

Plot 2. 12

HT40, 5190MHz, C2

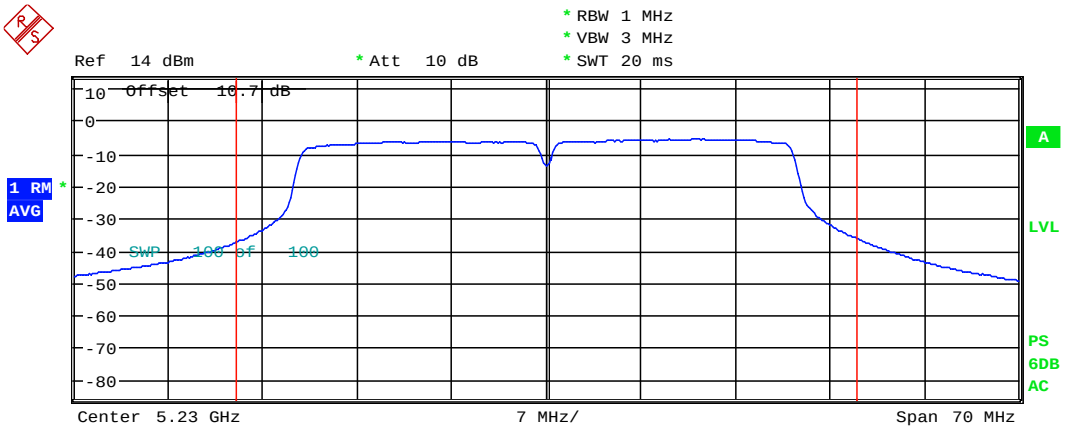


OP

Date: 30.AUG.2013 14:49:47

Plot 2. 13

HT40, 5230MHz, C0

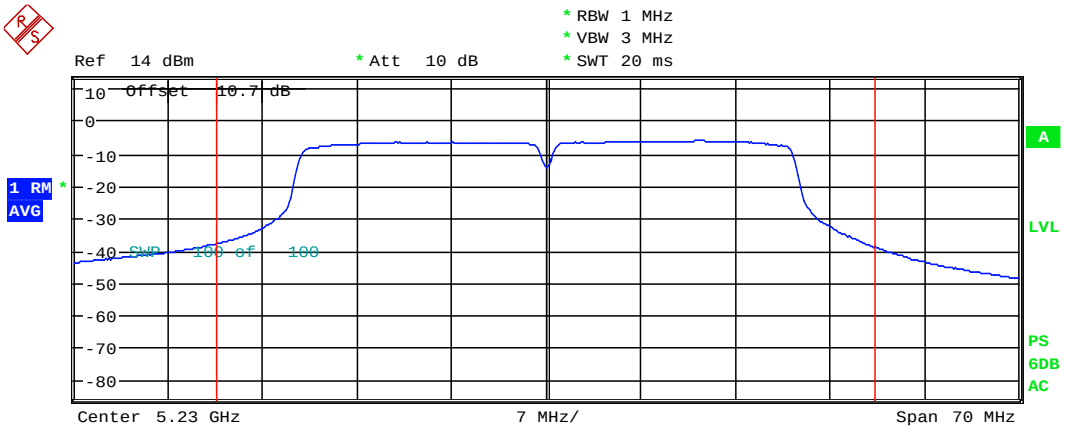


OP

Date: 30.AUG.2013 15:16:58

Plot 2. 14

HT40, 5230MHz, C1

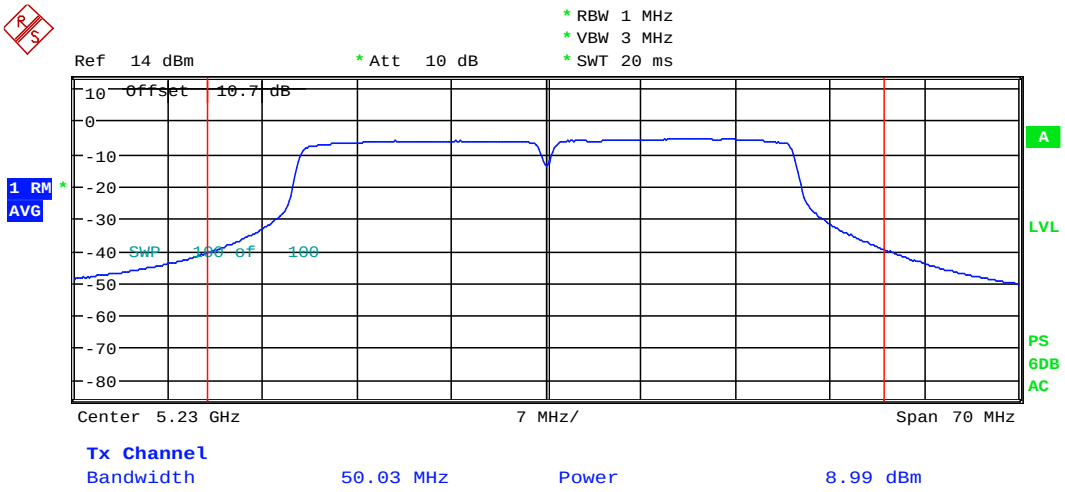


OP

Date: 30.AUG.2013 15:22:00

Plot 2. 15

HT40, 5190MHz, C2



OP

Date: 30.AUG.2013 15:26:01

4.3 Peak Power Spectral Density
FCC Rule 15.407(a)(1)(2)

4.3.1 Requirement

For the band 5.15–5.25 GHz, the peak power spectral density shall not exceed 4 dBm in any 1MHz bandwidth.
If transmitting antennas of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.3.2 Procedure

Each antenna port of the EUT was connected to the input of a spectrum analyzer to measure the Peak Power Spectral Density (PPSD) and recorded.

The procedure described in the FCC Publication 789033, was used. In particular – the C)3)c) Method SA-1 Alternative (RMS detection with slow sweep and EUT transmitting continuously at full power), with RMS detector, use the spectrum analyzer's band power measurement function with band limits set equal to the EBW band edges, used to create the average spectrum. The PPSD was determined using peak search method.

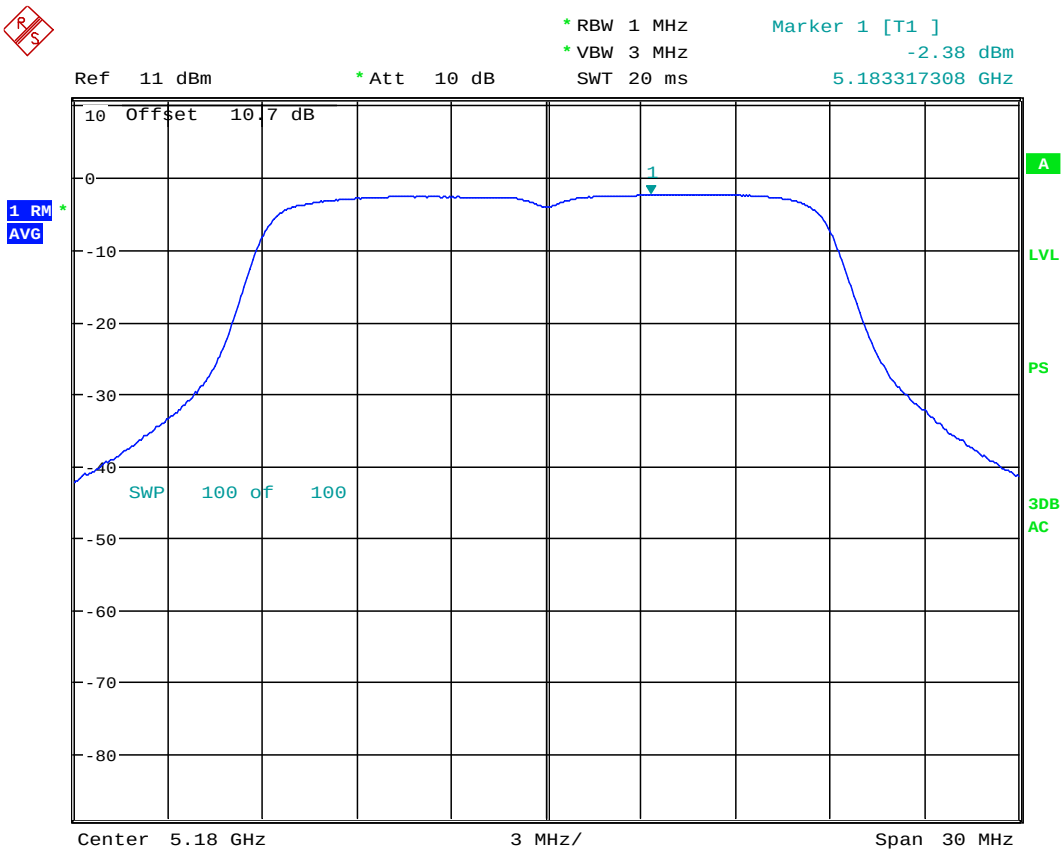
The procedure described in the FCC Publication 662911 section E/2/c, was used to determine the maximum peak power spectral density from the multiple outputs of the unit.

4.3.3 Test Result

Standard/ Data rate	Channel	Frequency MHz	RF Output Chain	PSD dBm	PSD+10 log(N_{ANT}) dBm	PSD Limit dBm	Margin dB
802.11n, HT20	36	5180	C0	-2.56	2.21	4.0	-1.79
			C1	-3.16	1.61	4.0	-2.39
			C2	-2.38	2.39	4.0	-1.61
	40	5200	C0	-3.93	0.84	4.0	-3.16
			C1	-2.54	2.23	4.0	-1.77
			C2	-1.49	3.28	4.0	-0.72
	48	5240	C0	-3.27	1.50	4.0	-2.5
			C1	-3.71	1.06	4.0	-2.94
			C2	-3.06	1.71	4.0	-2.29
802.11n, HT40	38	5190	C0	-5.30	-0.52	4.0	-4.52
			C1	-6.20	-1.42	4.0	-5.42
			C2	-5.72	-0.94	4.0	-4.94
	46	5230	C0	-5.75	-0.97	4.0	-4.97
			C1	-6.16	-1.38	4.0	-5.38
			C2	-5.48	-0.70	4.0	-4.7

Refer to the following plots (worst case for each frequency) for the test result.

Plot 3.1
HT20, 5180MHz, C2

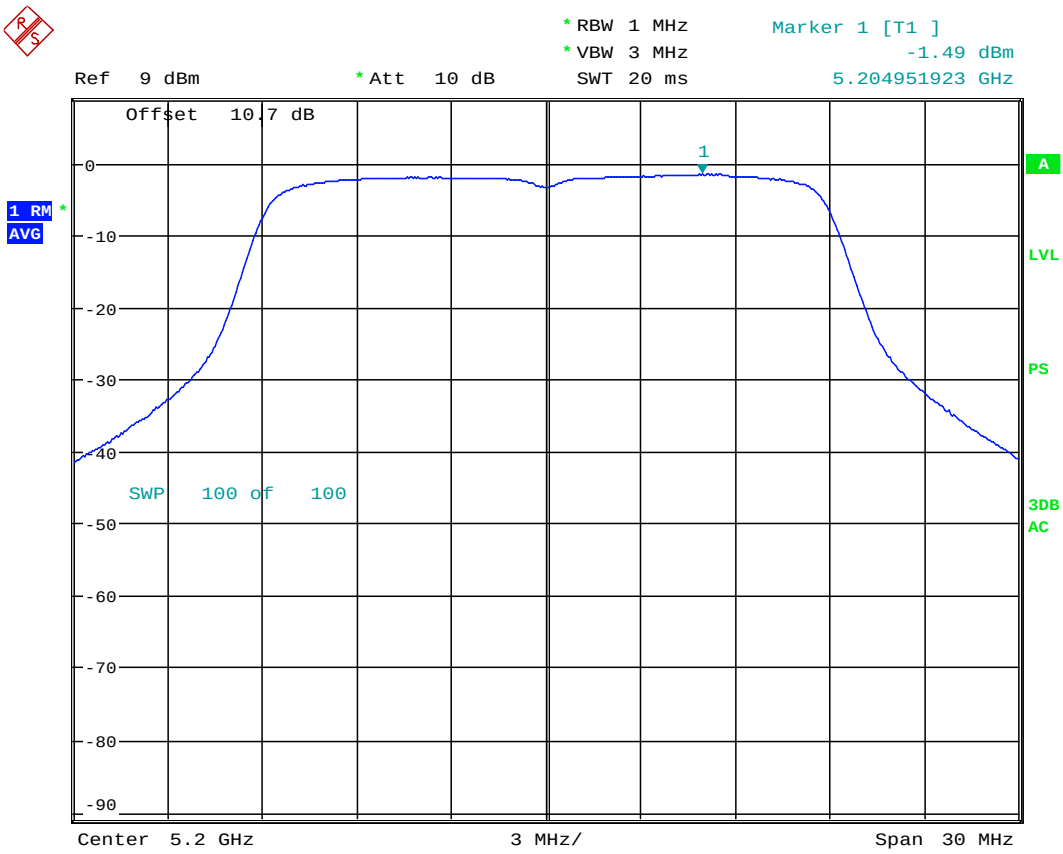


PPSD

Date: 29.AUG.2013 16:30:58

Plot 3.2

HT20, 5200MHz, C2

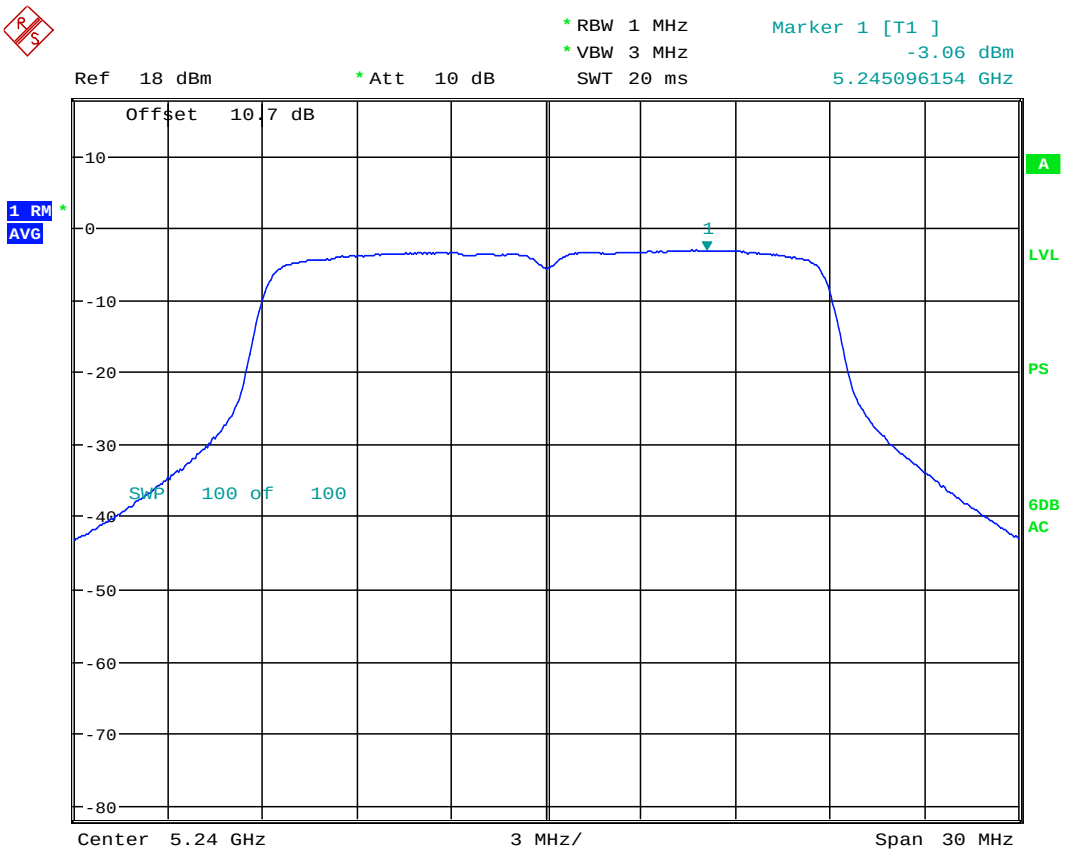


PPSD

Date: 30.AUG.2013 11:44:40

Plot 3.3

HT20, 5230MHz, C2

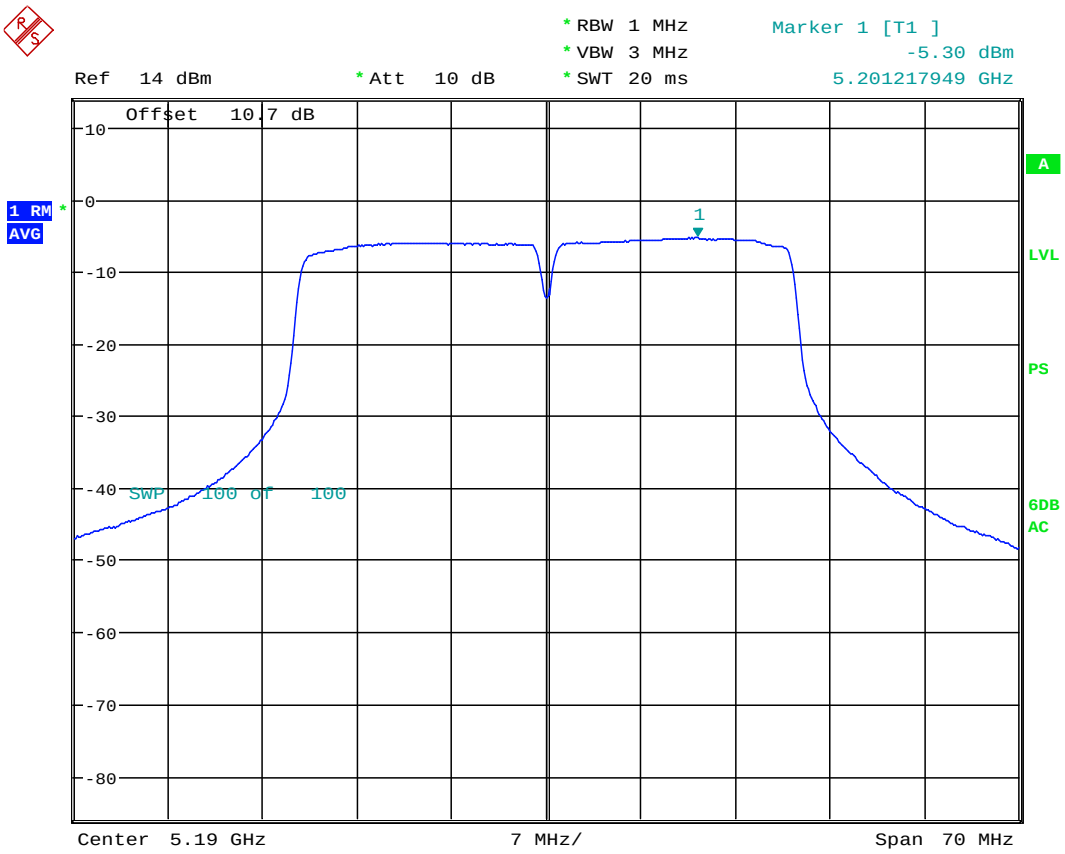


PPSD

Date: 30.AUG.2013 12:36:25

Plot 3.4

HT40, 5190MHz, C0

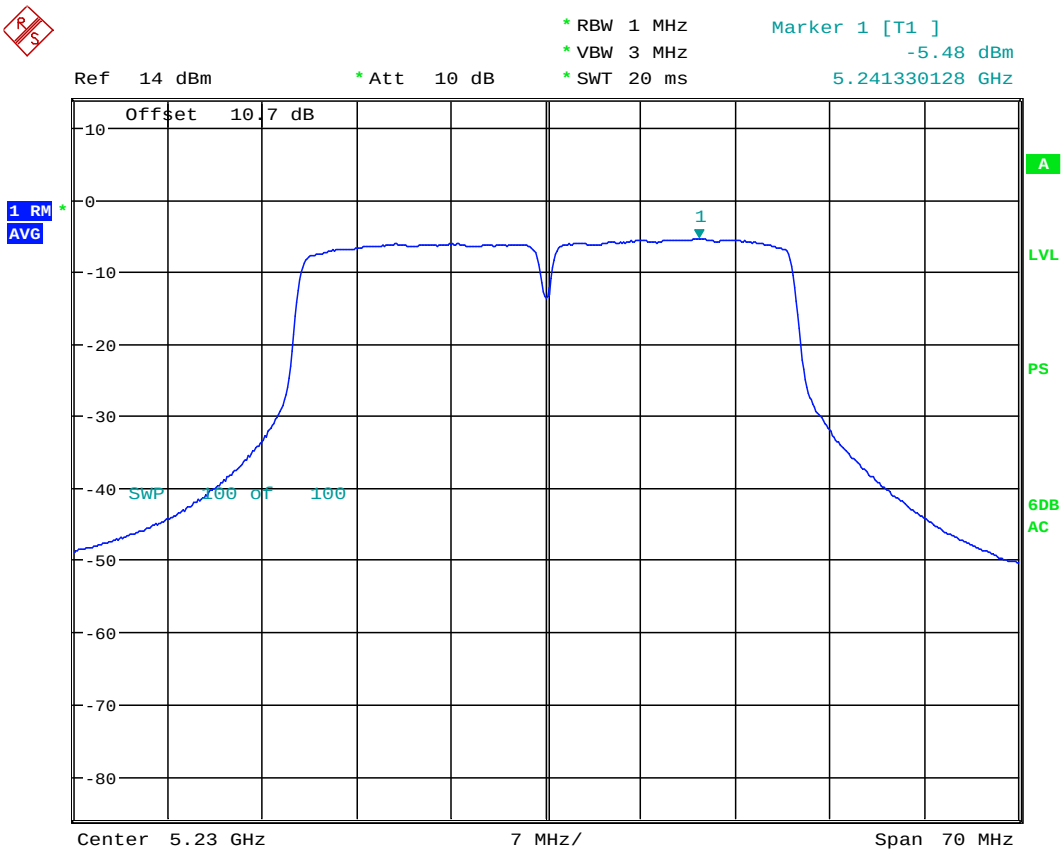


PPSD

Date: 30.AUG.2013 15:12:54

Plot 3.5

HT40, 5230MHz, C2



PPSD

Date: 30.AUG.2013 15:26:30

4.4 Ratio of the peak excursion of the modulation envelope
FCC Rule: 15.407(a)(6)

4.4.1 Requirement

The Ratio of the peak excursion of the modulation envelope to the maximum conducted output power shall not exceed 13 dB across any 1 MHz bandwidth.

4.4.2 Procedure

The antenna port of the EUT was connected to the input of a spectrum analyzer to measure the Ratio of the peak excursion of the modulation envelope.

The procedure described in the FCC Publication 789033, was used. In particular – the G) Peak excursion measurement, measured the max peak hold of the spectrum using Peak detector and max peak hold spectrum using the procedure of PPSD. The difference of these peaks was noted as the Ratio of the peak excursion of the modulation envelope.

4.4.3 Results

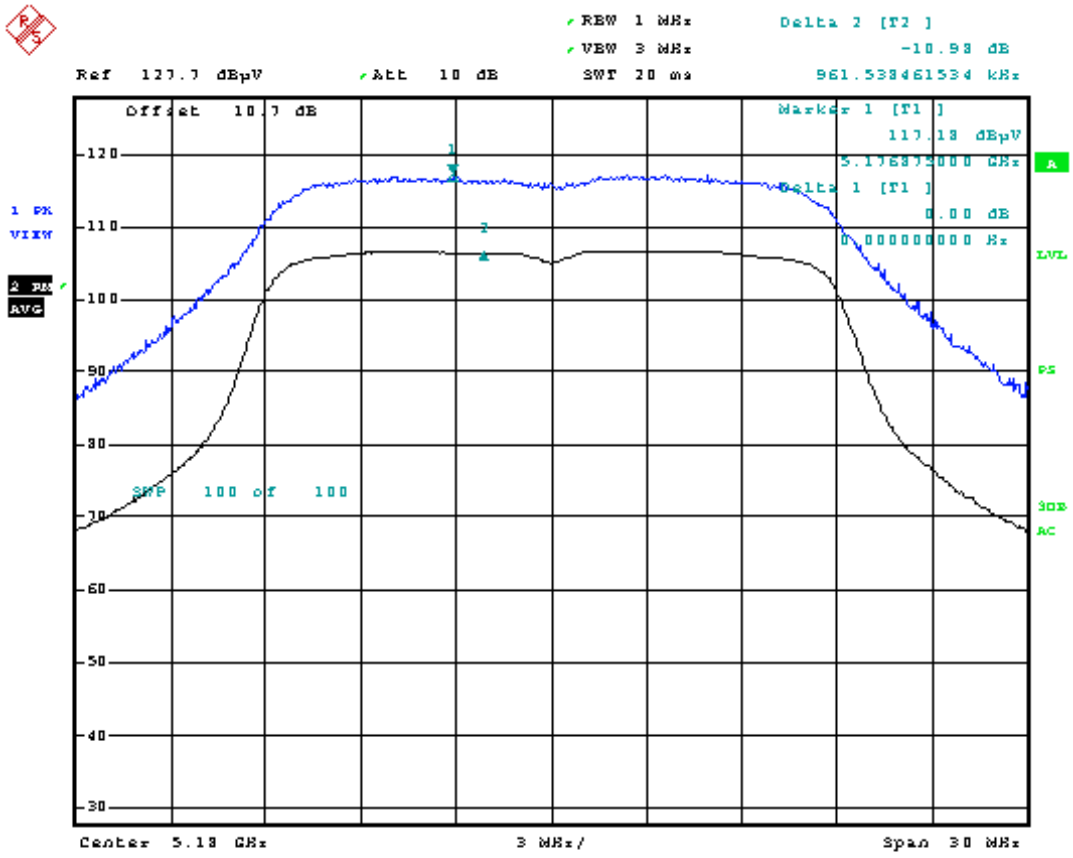
Refer to the following plots for the test result:

Standard / Data rate	Channel	Frequency MHz	Data Rates	Ratio of the peak excursion dBm	Limit dBm	Margin dB	Plot #
802.11n, HT20	36	5180	MCS0	10.98	13	-2.02	4.1
			MCS23	11.90	13	-1.10	4.2
802.11n, HT40	38	5190	MCS0	11.98	13	-1.02	4.3
			MCS23	11.03	13	-1.97	4.4

The EUT passed by 1.02 dB.

Plot 4.1

HT20, 5180MHz, MCS0

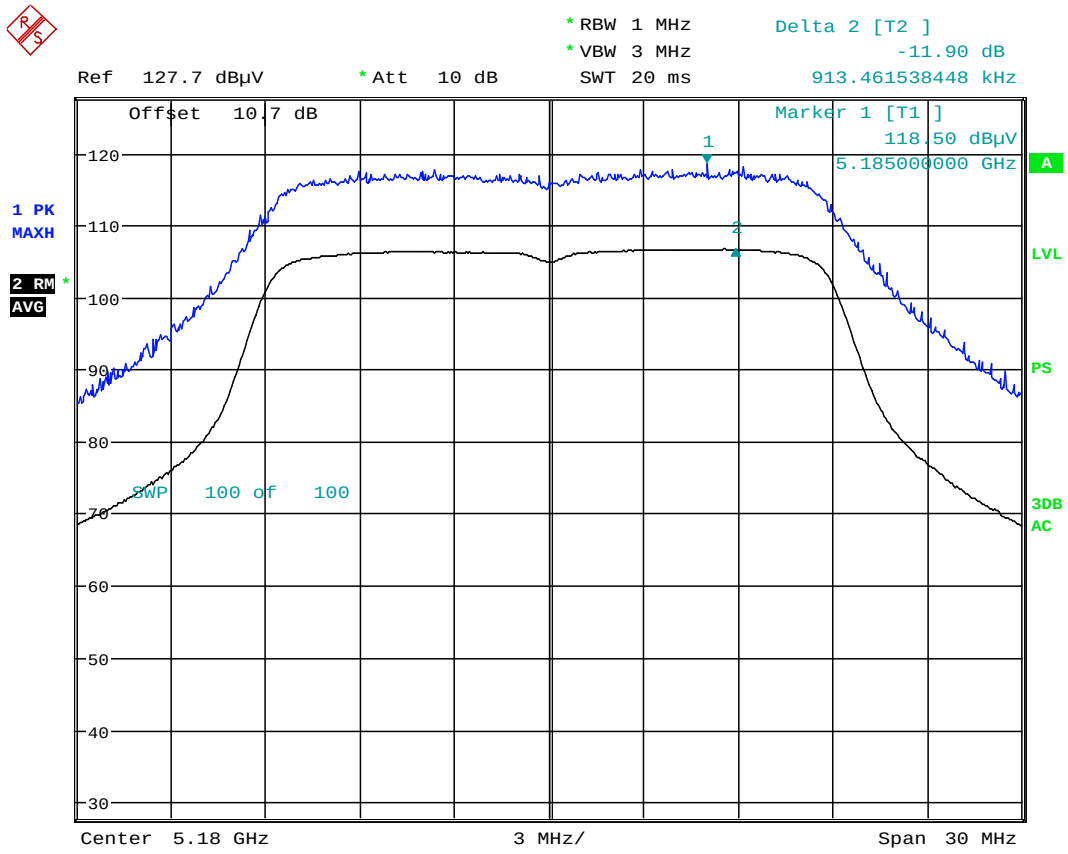


PE

Date: 4.SEP.2013 14:18:24

Plot 4.2

HT20, 5180MHz, MCS23

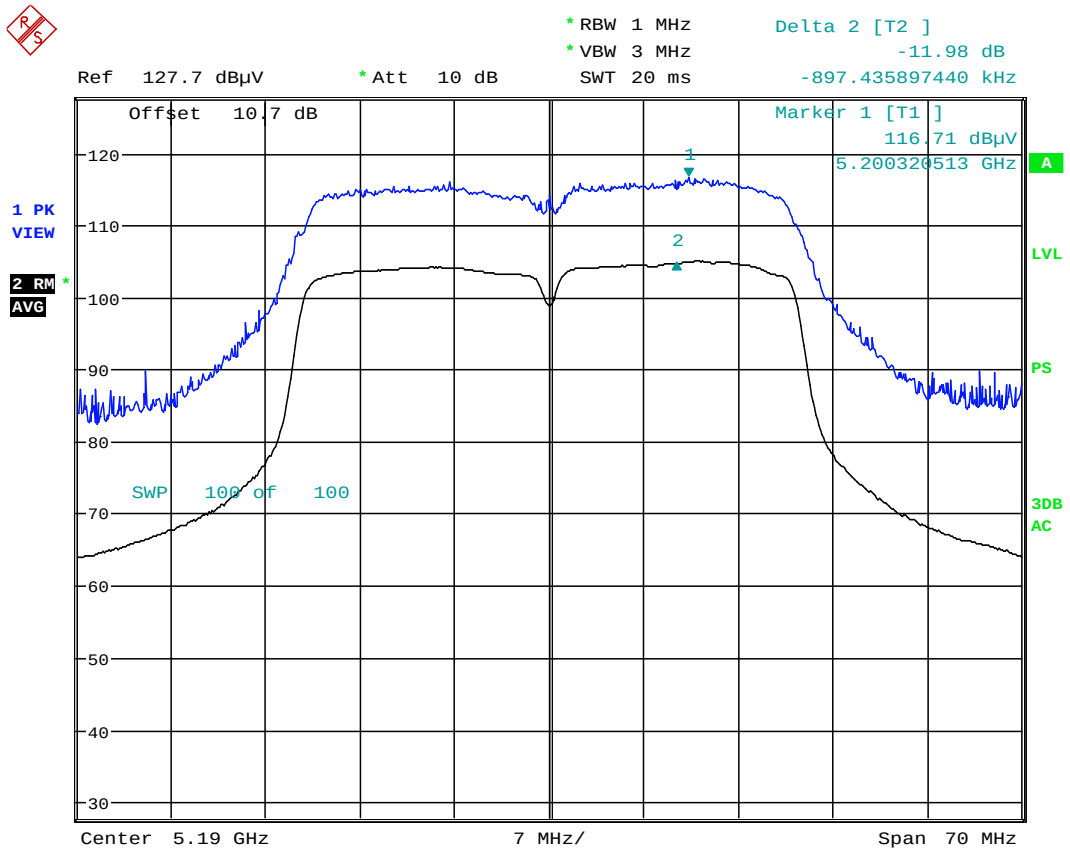


PE

Date: 4.SEP.2013 14:23:46

Plot 4.3

HT40, 5190MHz, MCS0

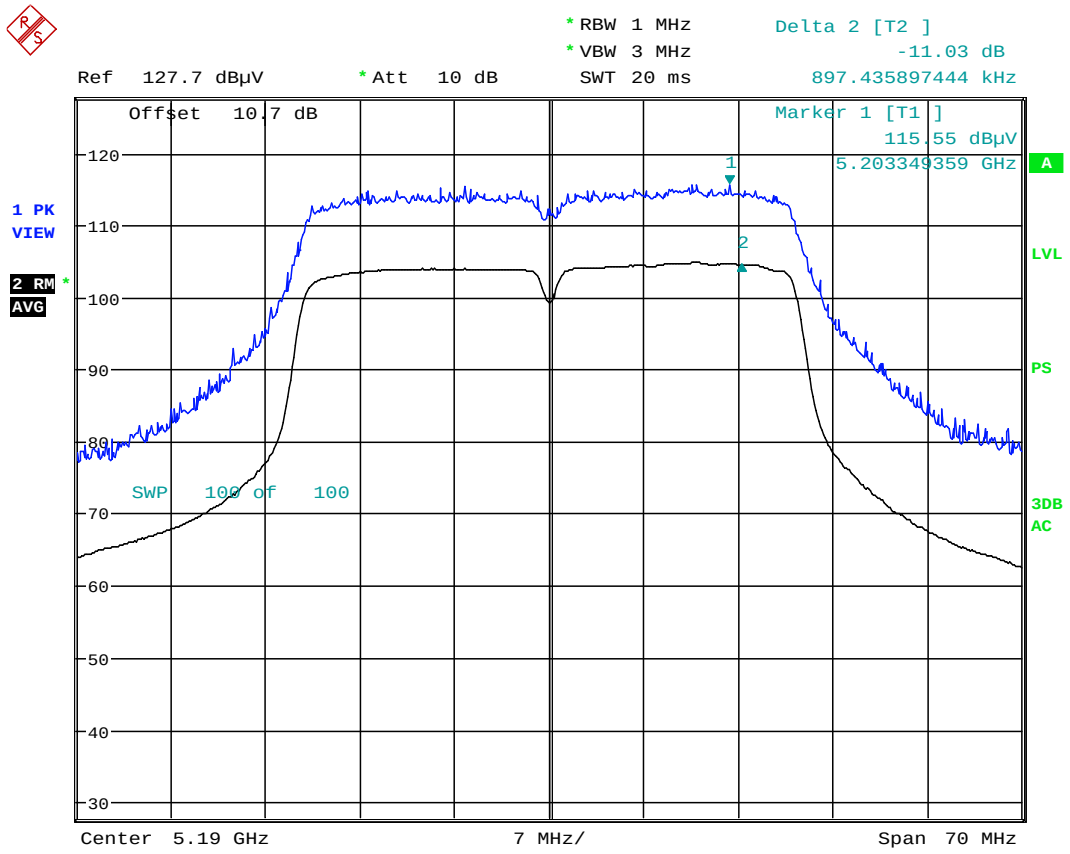


PE

Date: 4.SEP.2013 14:48:46

Plot 4.4

HT40, 5190MHz, MCS23



PE

Date: 4.SEP.2013 14:50:02

4.5 Transmitter Radiated Emissions
FCC Rule 15.407(b)(1)(2)(3) 15.209, 15.205

4.5.1 Requirement

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz.
Note: This corresponds to the field strength level of 68.3 dB(μV/m) at 3 m distance when measure with 1 MHz resolution bandwidth.

4.5.2 Procedure

Radiated emission measurements were performed from 30 MHz to 40,000 MHz. Spectrum Analyzer Resolution Bandwidth is 100 kHz or greater for frequencies 30 MHz to 1000 MHz, 1 MHz for frequencies above 1000 MHz.

The EUT is placed on a plastic turntable that is 80 cm in height. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). During testing, all cables were manipulated to produce worst-case emissions. The signal is maximized through rotation. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at three meters for frequencies above 1 GHz unless specified otherwise and at 10 meters for frequencies below 1 GHz.

Data is included of the worst-case configuration (the configuration which resulted in the highest emission levels).

The procedure described in the FCC Publication 789033 Section H, was used.

Note:
- All the spurious emission above 1GHz was measured at 3m distance with preamp and notch filter except for the frequency range from 4.5 GHz to 5.55 GHz. The plots show all peak measurements satisfy the average limit as specified under Section H of the “KDB 789033 D01 General UNII Test Procedures”.
- For the frequency range from 4.5 GHz to 5.55 GHz, the measurement was made at 1m distance without preamp and notch filter. The measurement was recorded at 5150 MHz and 5350 MHz to show compliance at the band edge for both peak and average limit.

4.5.3 Field Strength Calculation

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF – AG; if measurement is performed at a distance other than specified in the rule, a Distance Correction Factor (DCF) shall be added.

Where FS = Field Strength in dB(μV/m)
RA = Receiver Amplitude (including preamplifier) in dB(μV); AF = Antenna Factor in dB(1/m)
CF = Cable Attenuation Factor in dB; AG = Amplifier Gain in dB

Assume a receiver reading of 52.0 dB(μV) is obtained. The antennas factor of 7.4 dB(1/m) and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving field strength of 32 dB(μV/m). This value in dB(μV/m) was converted to its corresponding level in μV/m.
RA = 52.0 dB(μV)
AF = 7.4 dB(1/m)
CF = 1.6 dB
AG = 29.0 dB
FS = 52.0+7.4+1.6-29.0 = 32 dB(μV/m).
Level in μV/m = Common Antilogarithm [(32 dBμV/m)/20] = 39.8 μV/m.

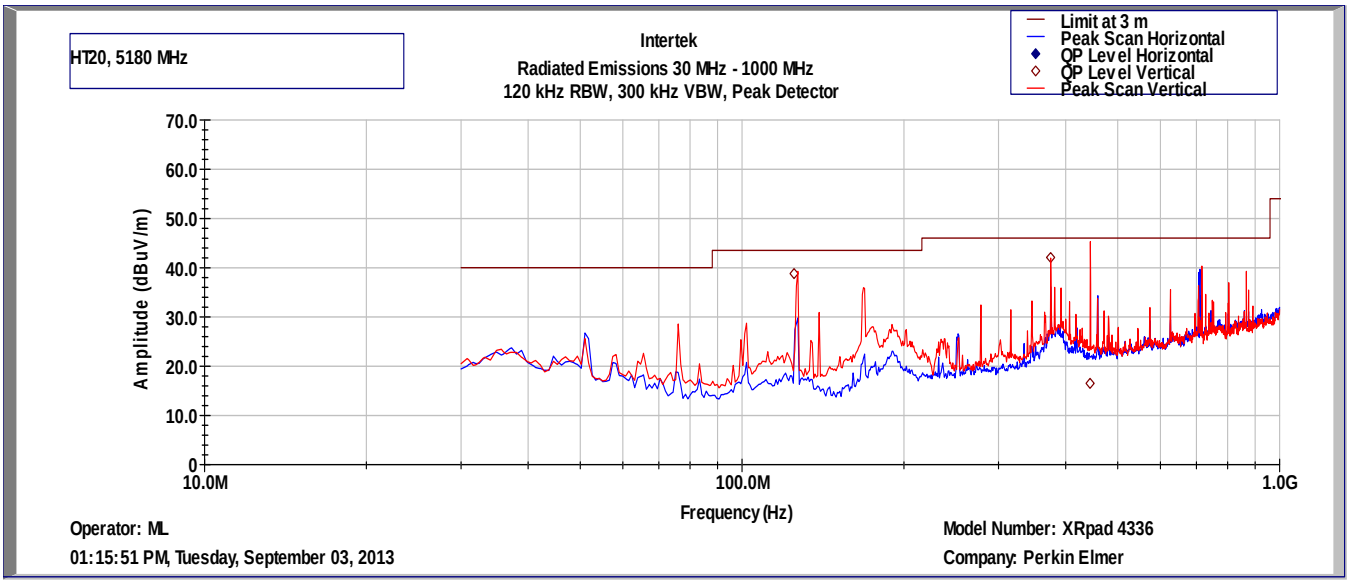
4.5.4 Test Results

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

The EUT passed the test by 0.5dB.

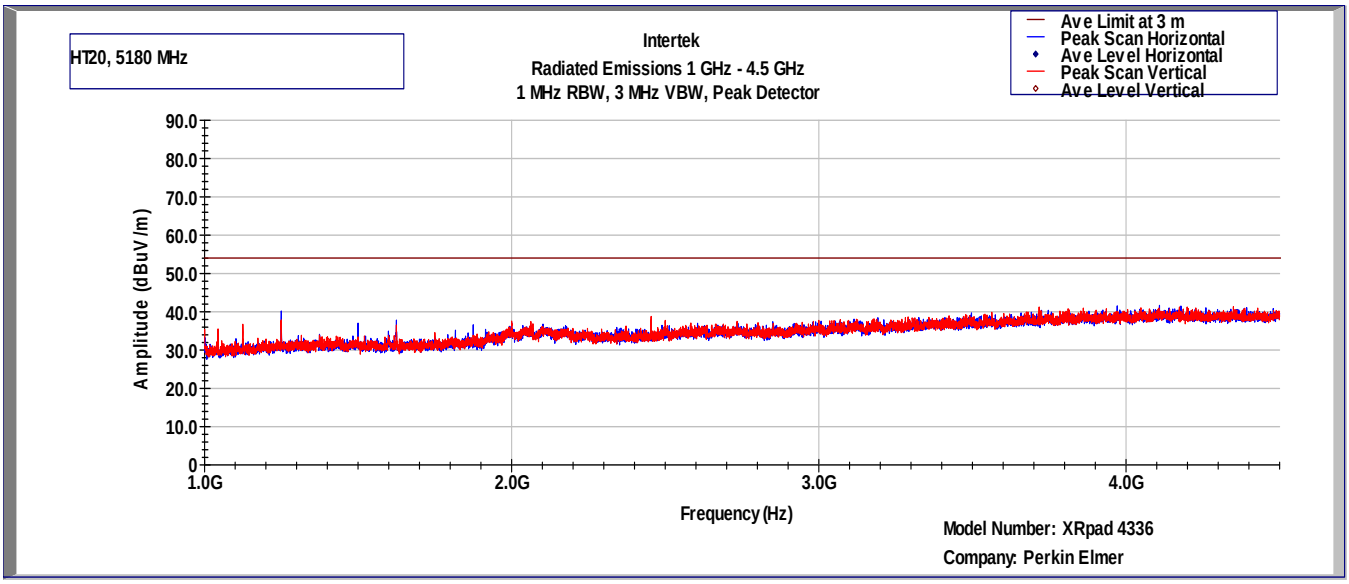
HT20, 802.11n, 5180MHz, MCS23

Plot 5.1, Radiated Spurious 30 MHz to 1000 MHz

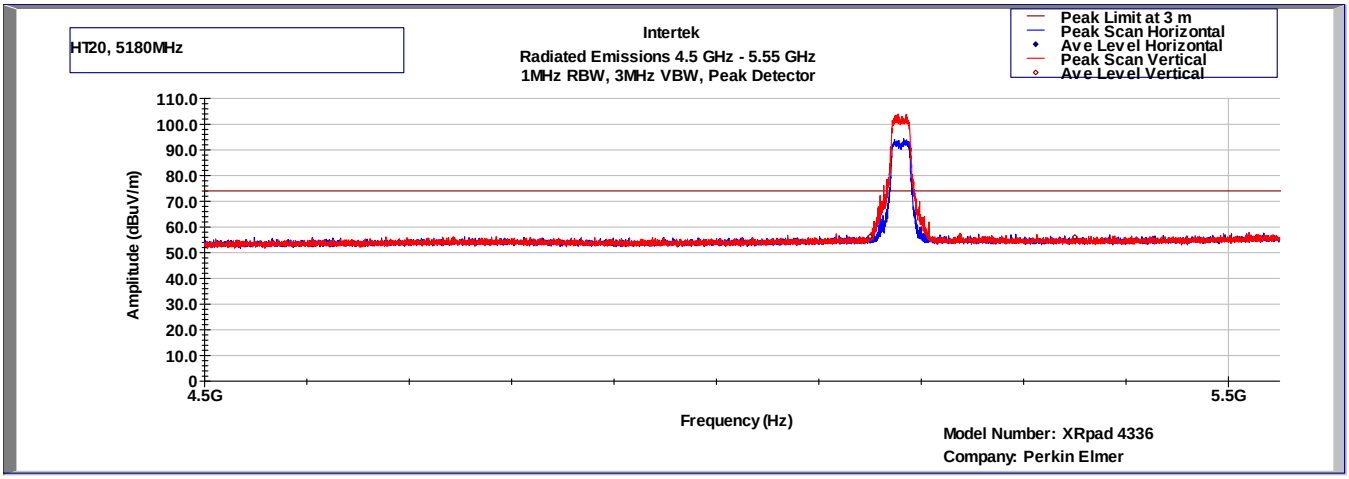


Frequency	Quasi Pk FS	Limit@3m	Margin	RA	Cable	AG	DCF	AF
Hz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB	dB(1/m)
1.25E+08	39.5	43.5	-4	47.9	1.3	32	10.5	11.8
3.75E+08	43.2	46	-2.8	47.3	2.3	32	10.5	15.1
4.44E+08	17.8	46	-28.2	21.2	2.5	32	10.5	15.6

Plot 5.2, Radiated Spurious 1 GHz to 4.5 GHz



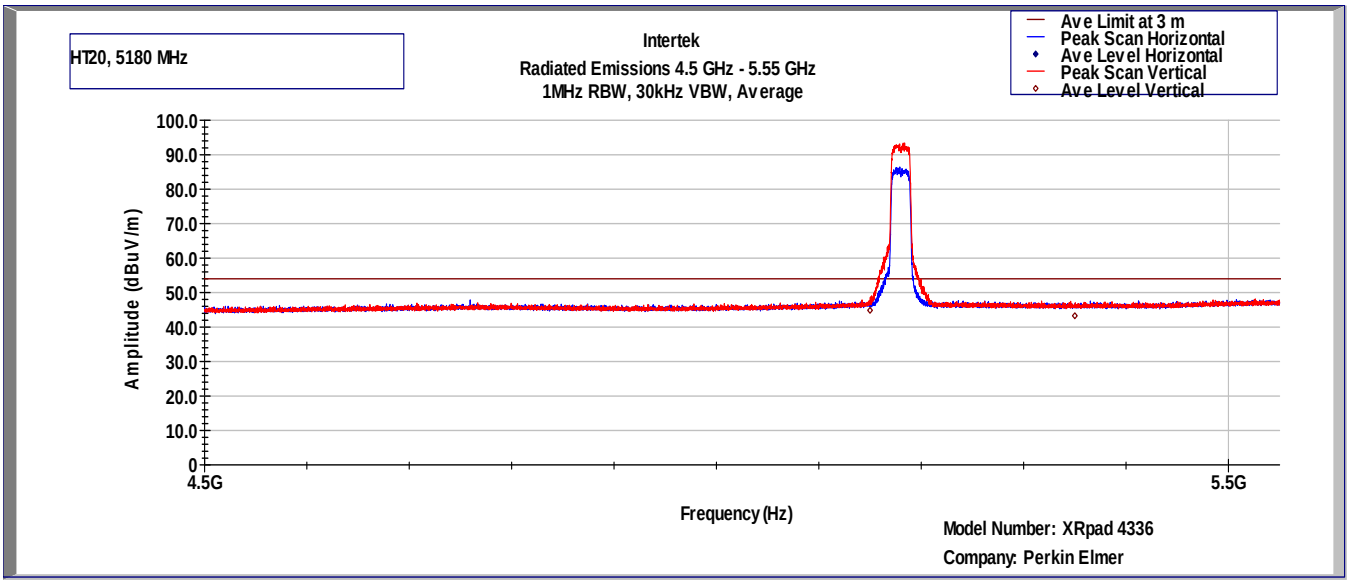
Plot 5.3, Radiated Spurious 4.5 GHz to 5.55 GHz, Peak



Intertek Testing Services
Radiated Emissions 4.5 GHz – 5.55 GHz
FCC Part 15.209 (Peak-Vertical)
Operator: ML

Frequency	Peak Level	Peak Limit@3m	Margin	Raw	Cable	DCF	AF
MHz	(dBuV/m)	(dBuV/m)	(dB)	(dBuV)	(dB)	(dB)	dB(1/m)
5150	56.4	74	-17.6	28	4.9	9.5	33.0
5350	56	74	-18	27.1	5.0	9.5	33.4

Plot 5.4, Radiated Spurious 4.5 GHz to 5.55 GHz, Average

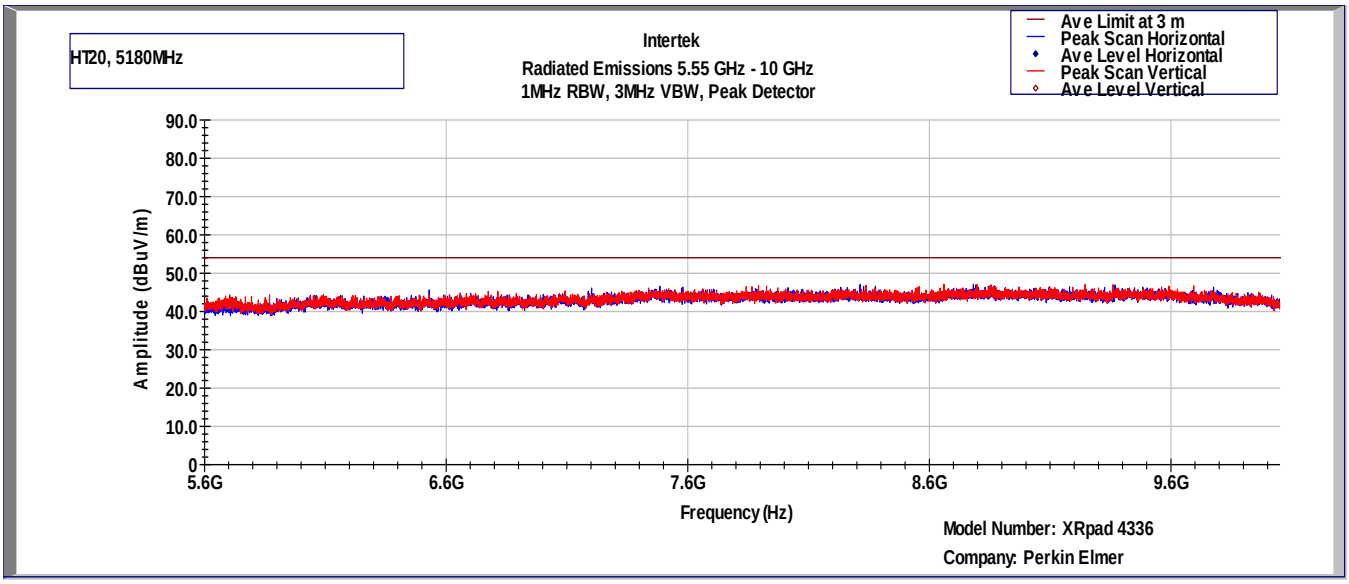


Intertek Testing Services
Radiated Emissions 4.5 GHz – 5.55 GHz
FCC 15.209 (Ave-Vertical)
Operator: ML

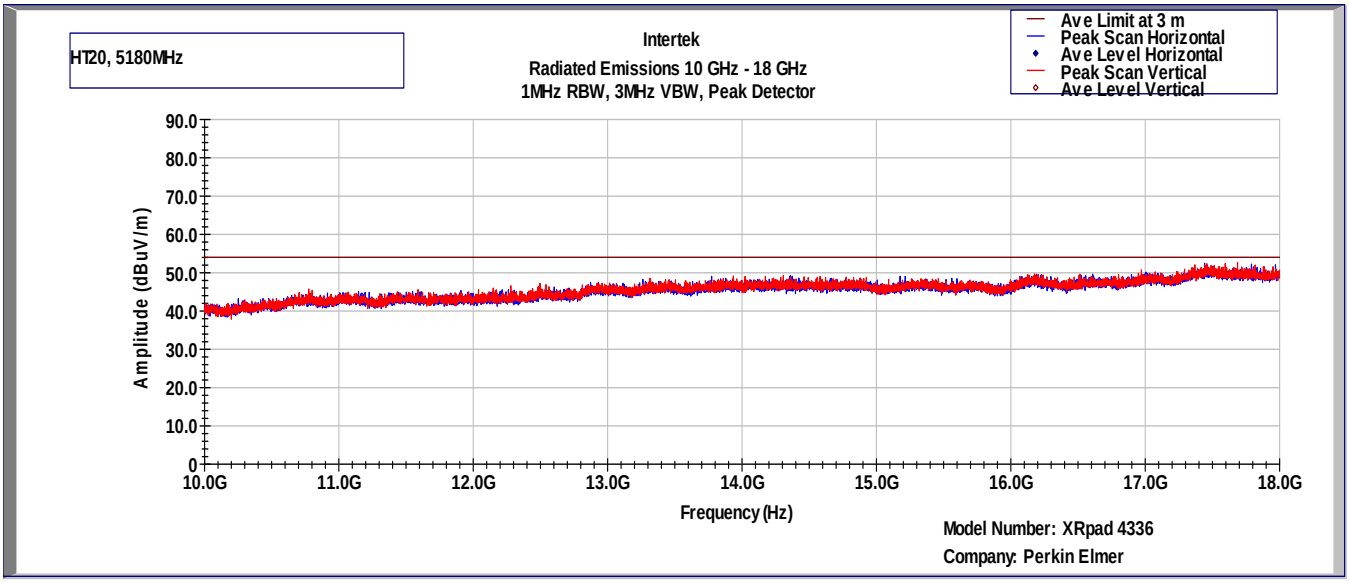
Frequency	Ave Level	Ave Limit@3m	Margin	Raw	Cable	DCF	AF
MHz	(dBuV/m)	(dBuV/m)	(dB)	(dBuV)	(dB)	(dB)	dB(1/m)
5150	44.9	54	-9.1	16.5	4.9	9.5	33.0
5350	43.3	54	-10.7	14.4	5.0	9.5	33.4

Note: The final average measurement was made with 10Hz VBW.

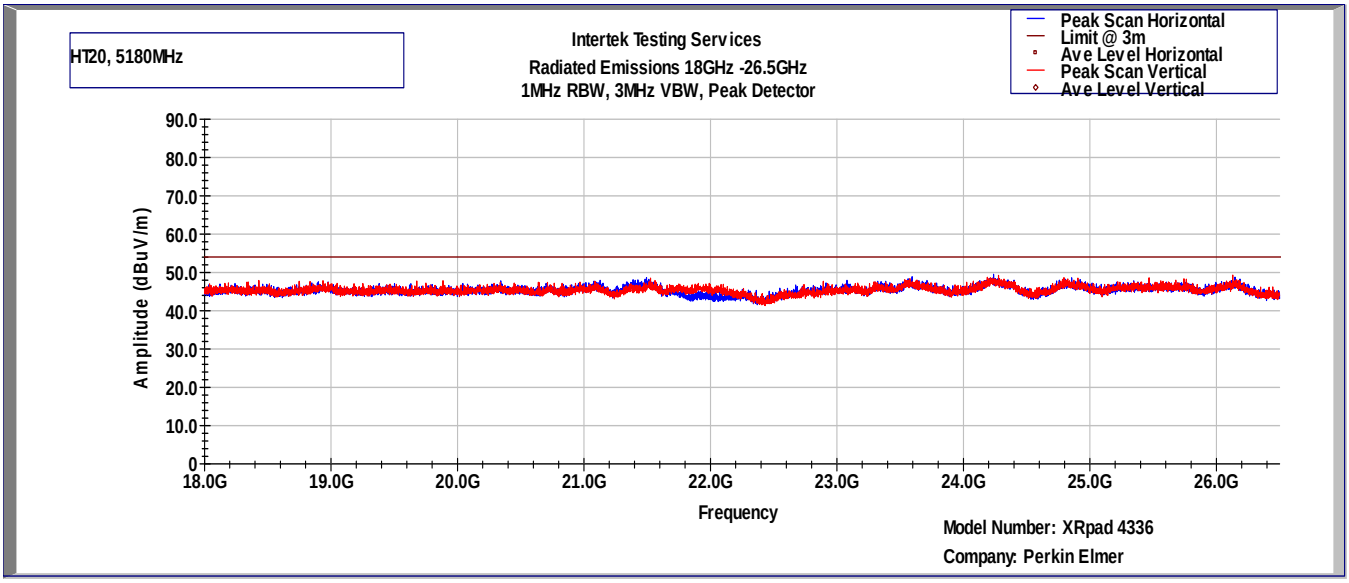
Plot 5.5, Radiated Spurious 5.55 GHz – 10 GHz



Plot 5.6, Radiated Spurious 10 GHz – 18GHz



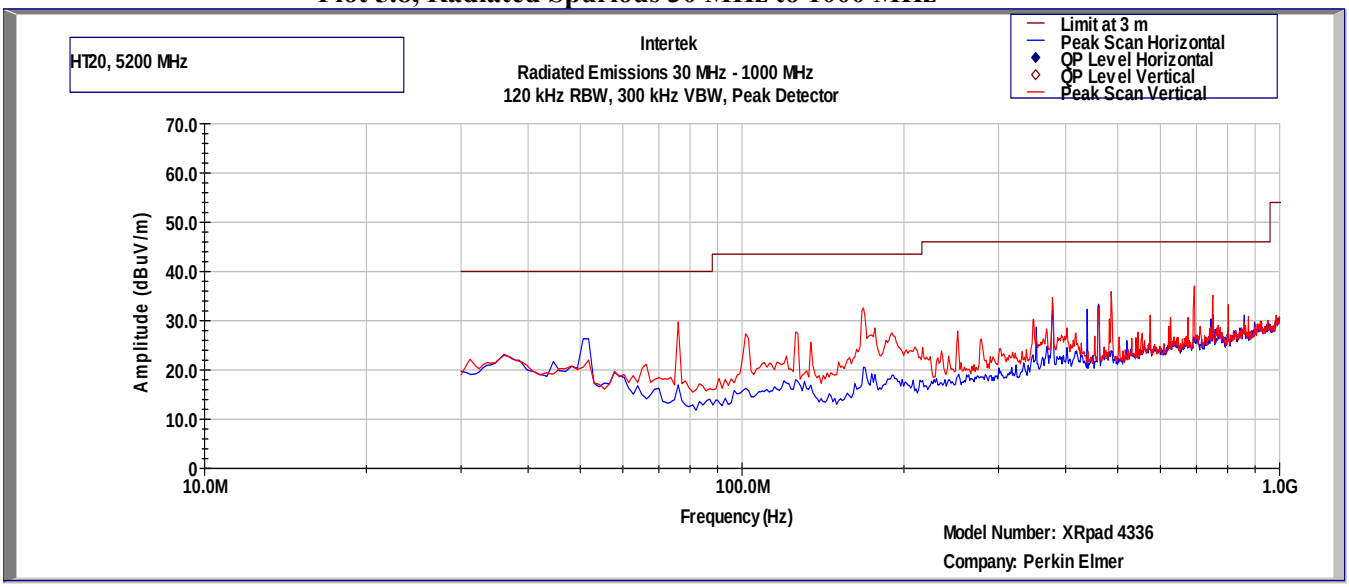
Plot 5.7, Radiated Spurious 18 GHz – 26.5 GHz



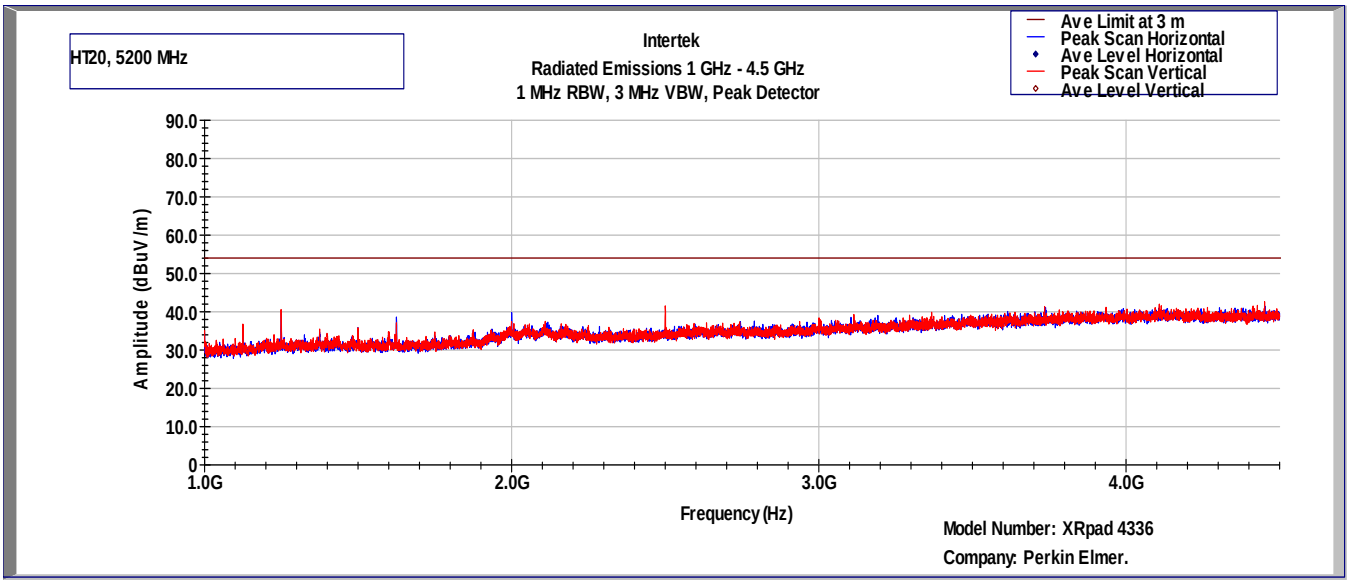
Note**:** Radiated emission measurements were performed up to 40GHz. No other emissions were detected above the noise floor which is at least 10 dB below the limit.

HT20, 802.11n, 5200MHz, MCS23

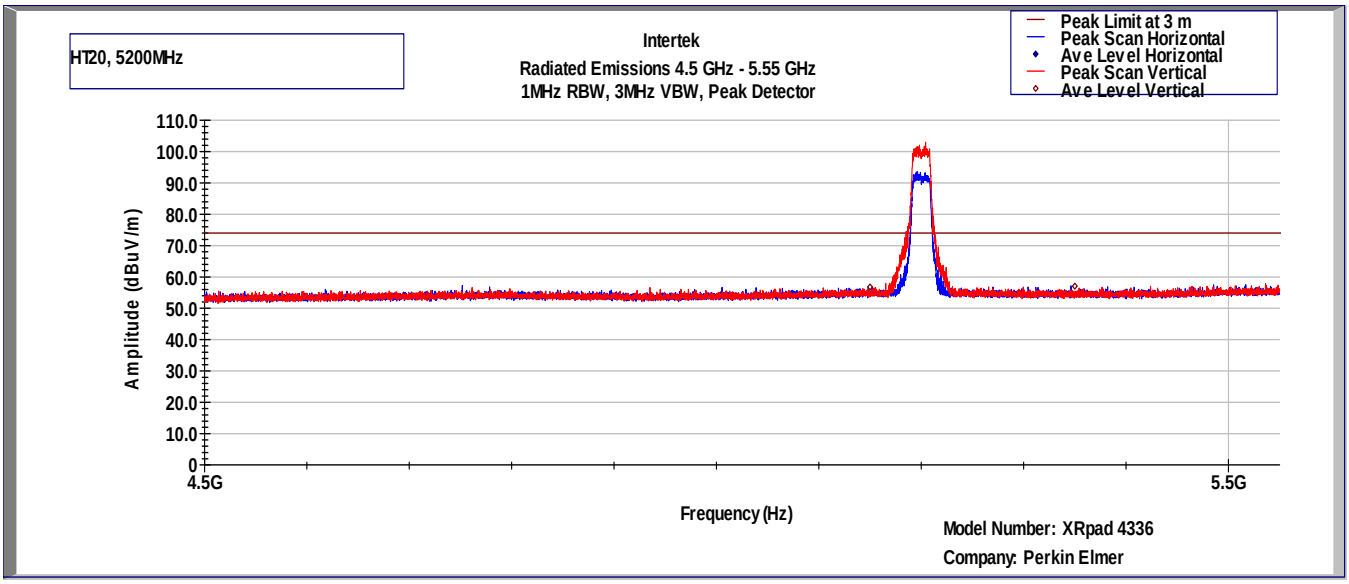
Plot 5.8, Radiated Spurious 30 MHz to 1000 MHz



Plot 5.9, Radiated Spurious 1 GHz to 4.5 GHz



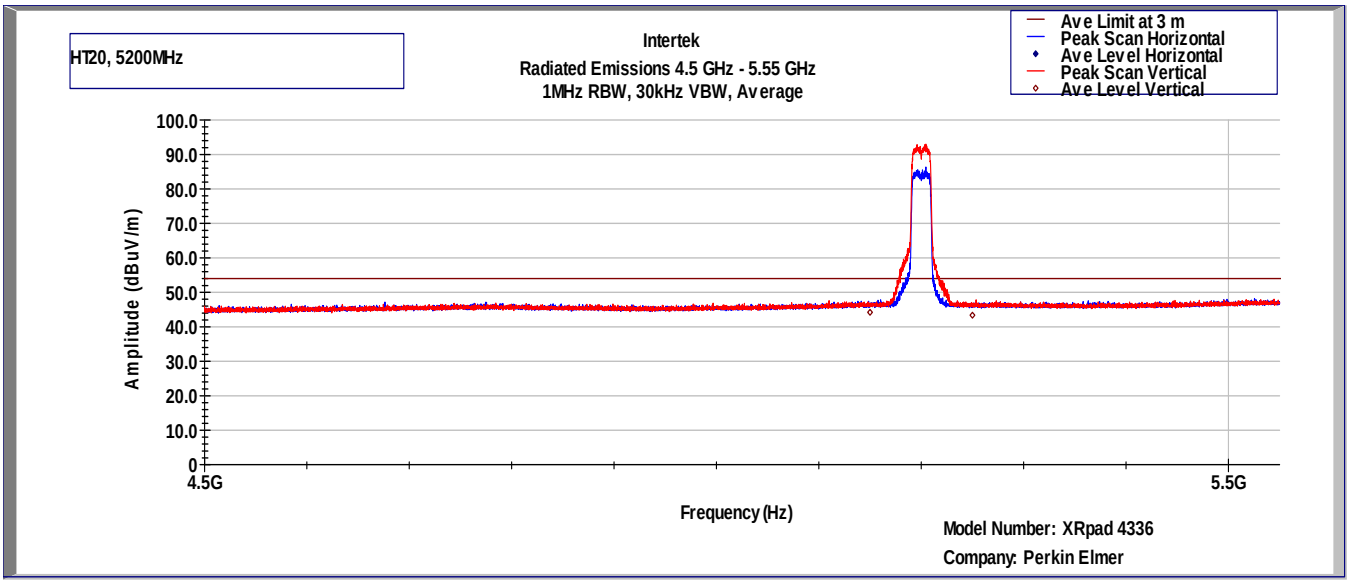
Plot 5.10, Radiated Spurious 4.5 GHz to 5.55 GHz, Peak



Intertek Testing Services
Radiated Emissions 4.5 GHz – 5.55 GHz
FCC Part 15.209 (Peak-Vertical)
Operator: ML

Frequency	Peak Level	Peak Limit@3m	Margin	Raw	Cable	DCF	AF
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB(1/m)
5150	56.8	74	-17.2	28.4	4.9	9.5	33.0
5350	57	74	-17	28.1	5.0	9.5	33.4

Plot 5.11, Radiated Spurious 4.5 GHz to 5.55 GHz, Average

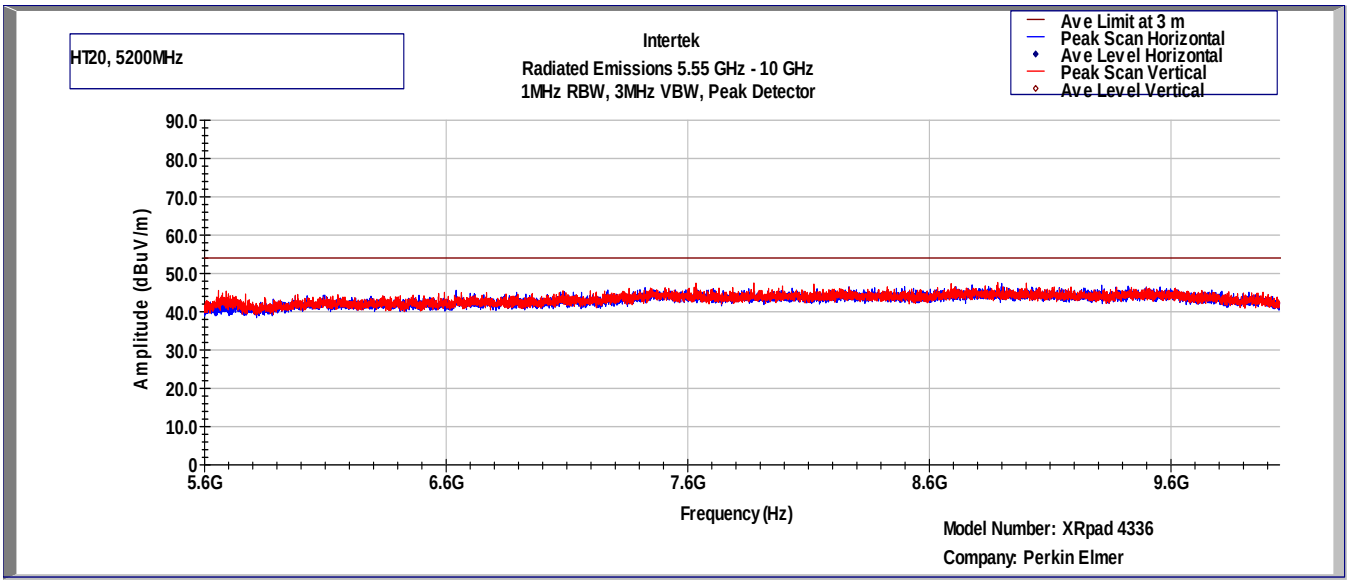


Intertek Testing Services
Radiated Emissions 4.5 GHz – 5.55 GHz
FCC 15.209 (Ave-Vertical)
Operator: ML

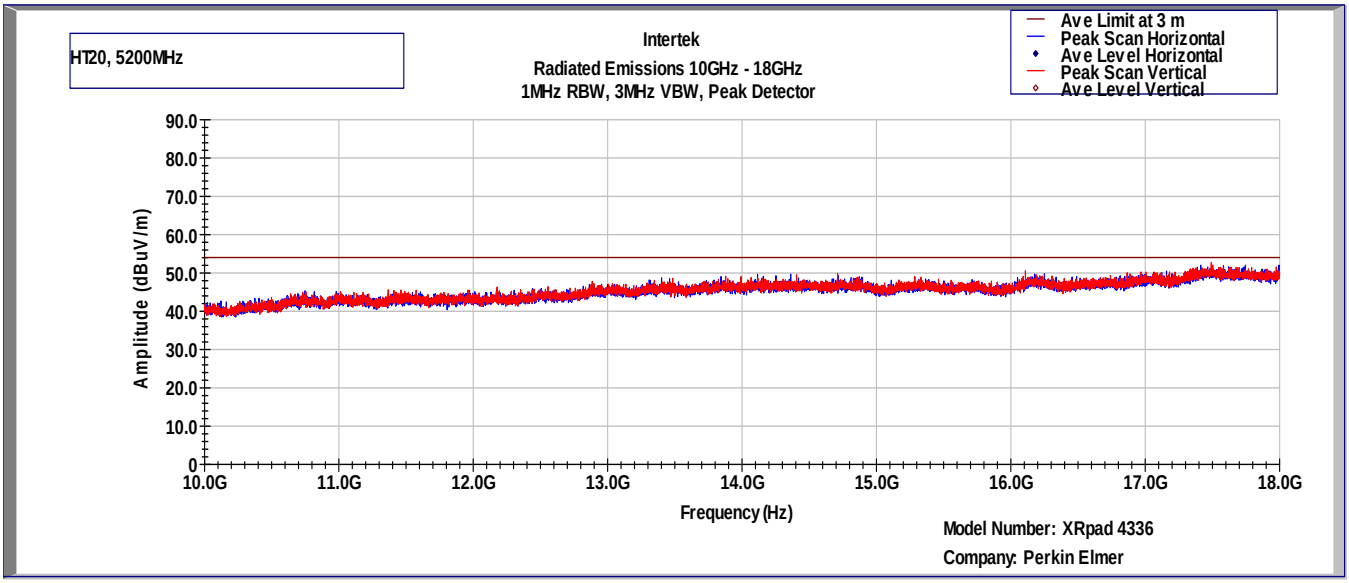
Frequency	Ave Level	Ave Limit@3m	Margin	Raw	Cable	DCF	AF
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB(1/m)
5150	44.2	54	-9.8	15.9	4.9	9.5	33.0
5350	43.3	54	-10.7	14.8	4.9	9.5	33.1

Note: The final average measurement was made with 10Hz VBW.

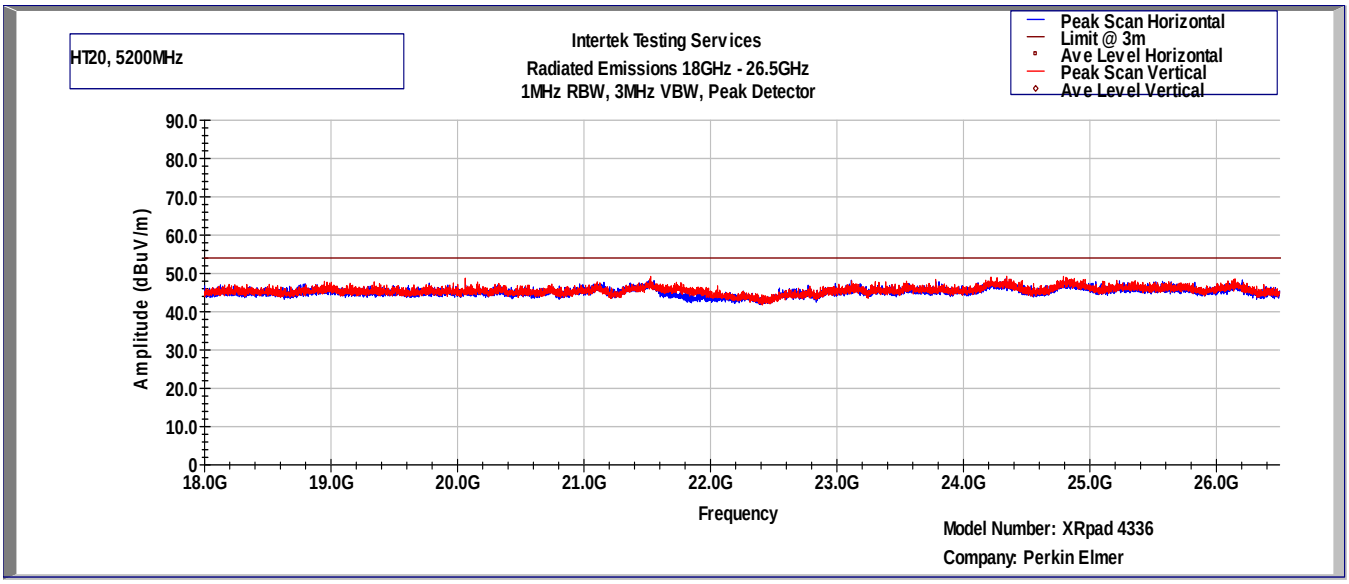
Plot 5.12, Radiated Spurious 5.55 GHz – 10 GHz



Plot 5.13, Radiated Spurious 10 GHz – 18GHz



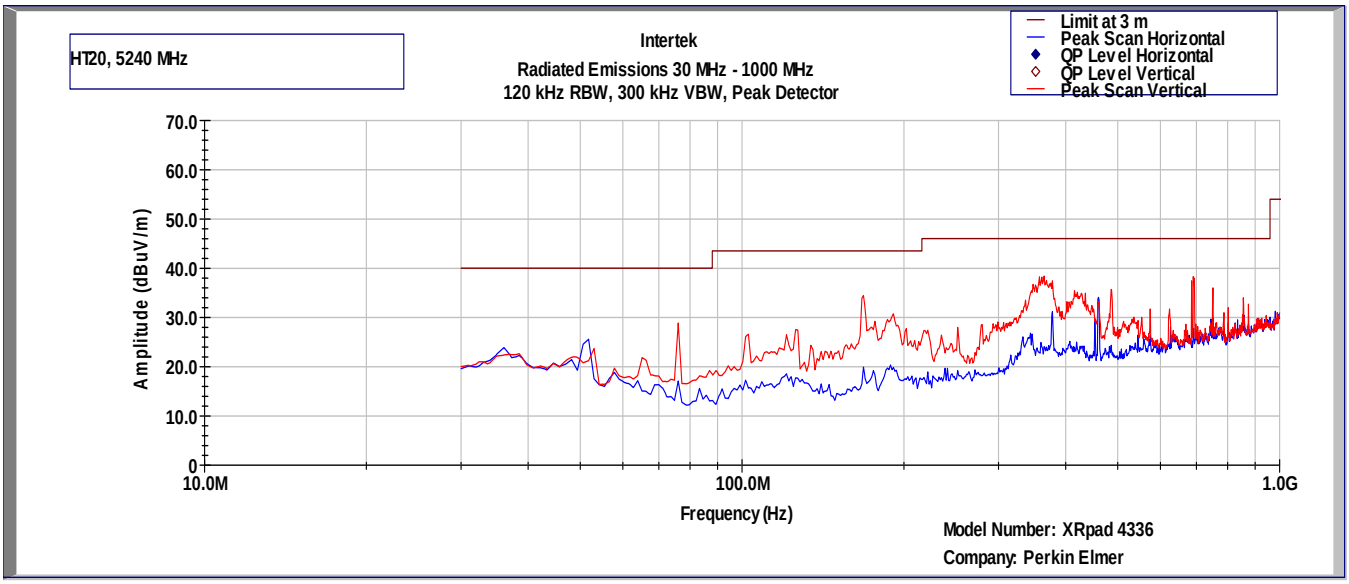
Plot 5.14, Radiated Spurious 18 GHz – 26.5 GHz



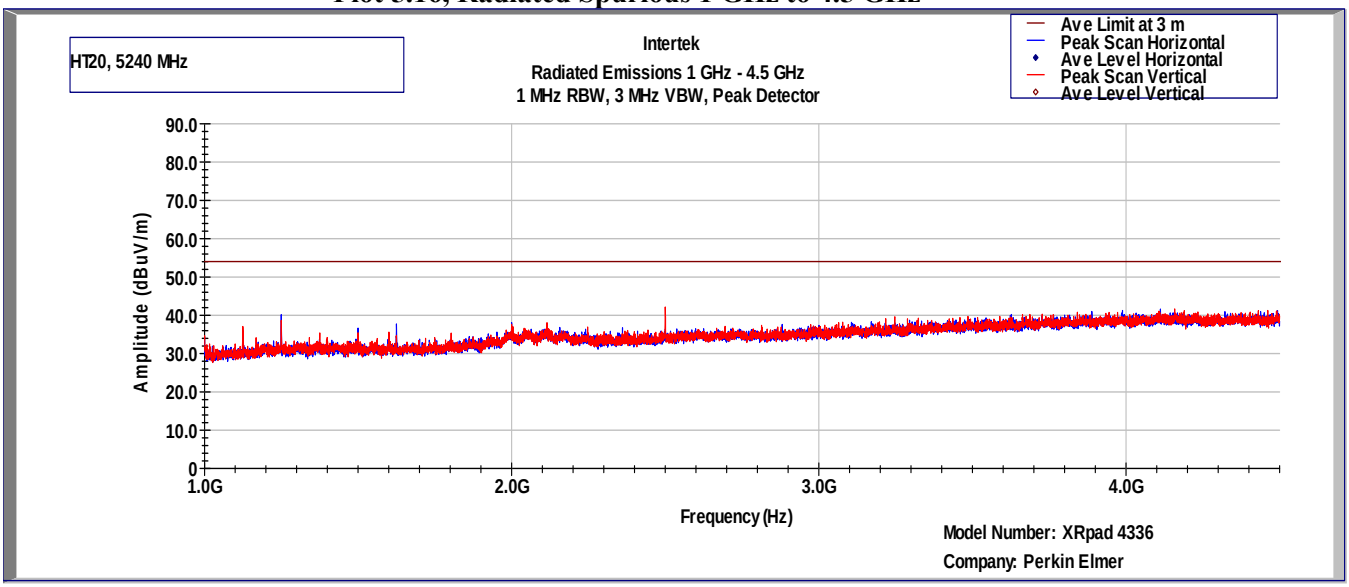
Note**:** Radiated emission measurements were performed up to 40GHz. No other emissions were detected above the noise floor which is at least 10 dB below the limit

HT20, 802.11n, 5240MHz, MCS23

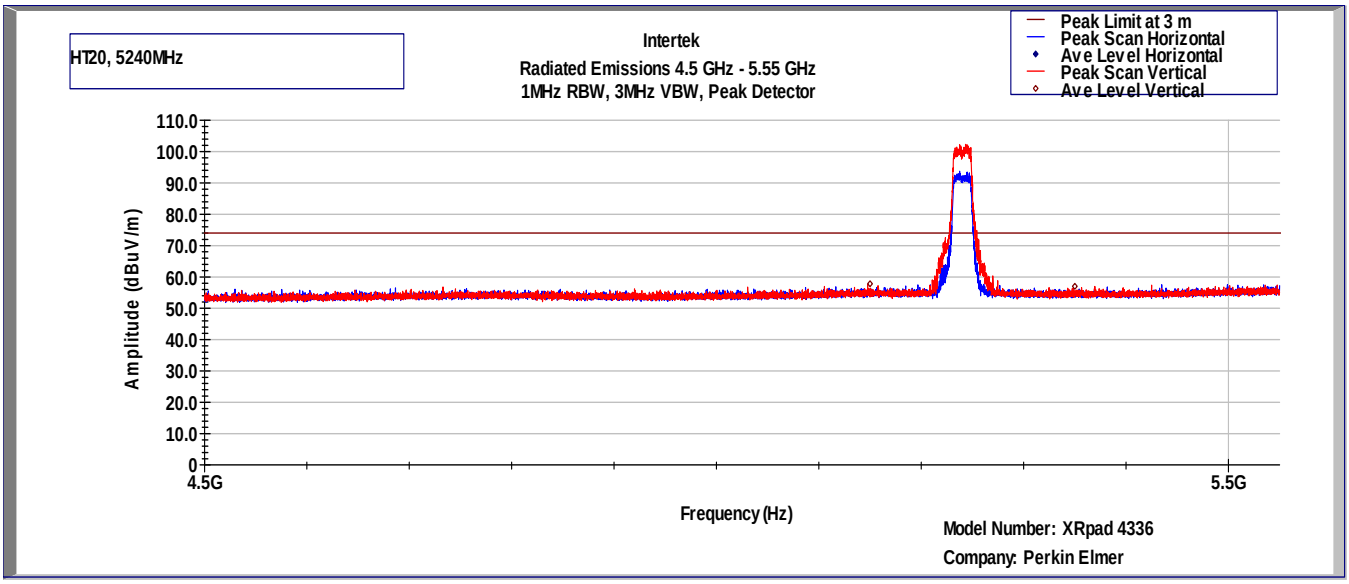
Plot 5.15, Radiated Spurious 30 MHz to 1000 MHz



Plot 5.16, Radiated Spurious 1 GHz to 4.5 GHz



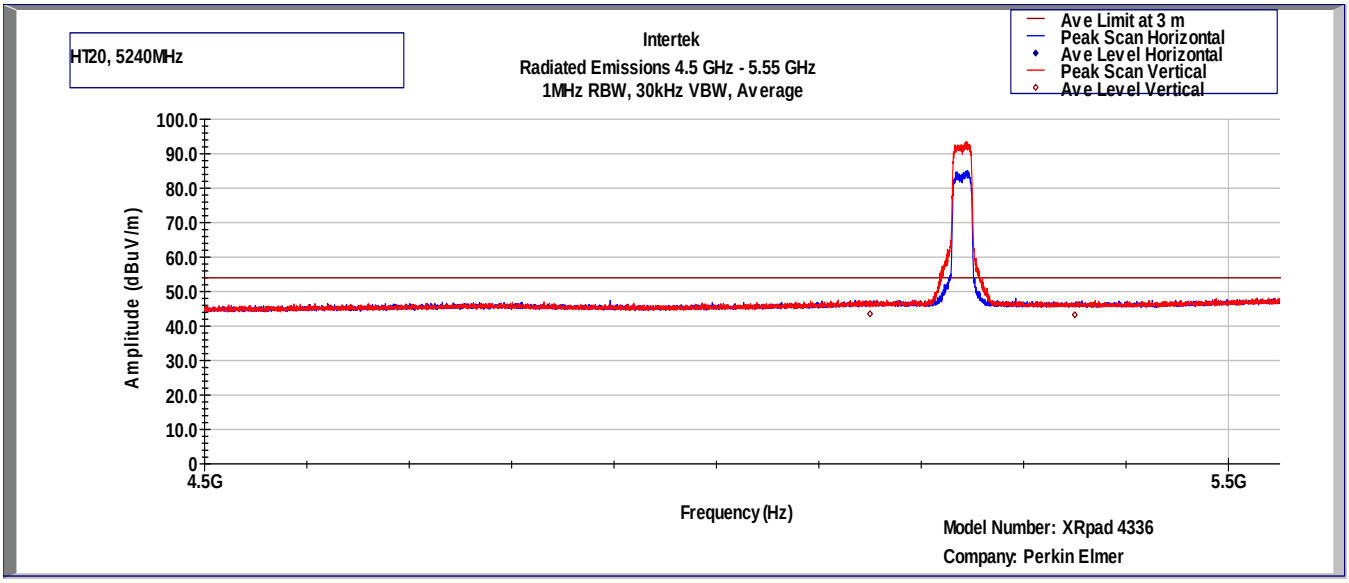
Plot 5.17, Radiated Spurious 4.5 GHz to 5.55 GHz, Peak



Intertek Testing Services
Radiated Emissions 4.5 GHz – 5.55 GHz
FCC 15.209 (Peak-Vertical)
Operator: ML

Frequency	Peak Level	Peak Limit@3m	Margin	Raw	Cable	DCF	AF
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB(1/m)
5150	57.8	74	-16.2	29.5	4.9	9.5	33.0
5350	57	74	-17	28.1	5.0	9.5	33.4

Plot 5.18, Radiated Spurious 4.5 GHz to 5.55 GHz, Average

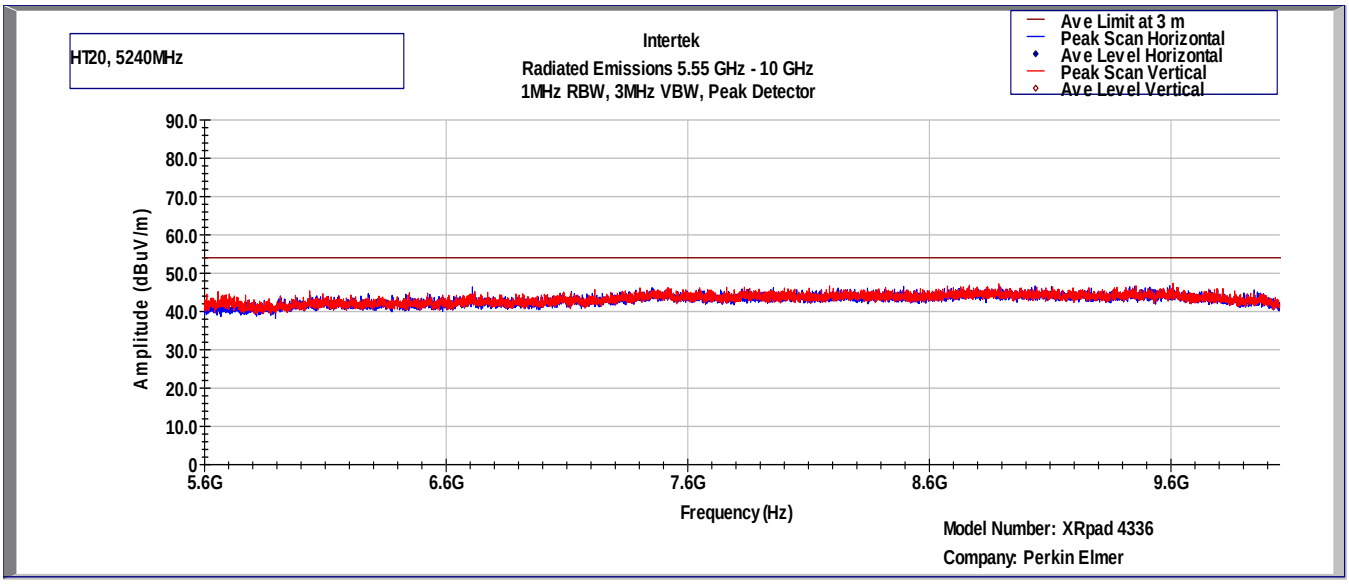


Intertek Testing Services
Radiated Emissions 4.5 GHz – 5.55 GHz
FCC 15.209 (Ave-Vertical)
Operator: ML

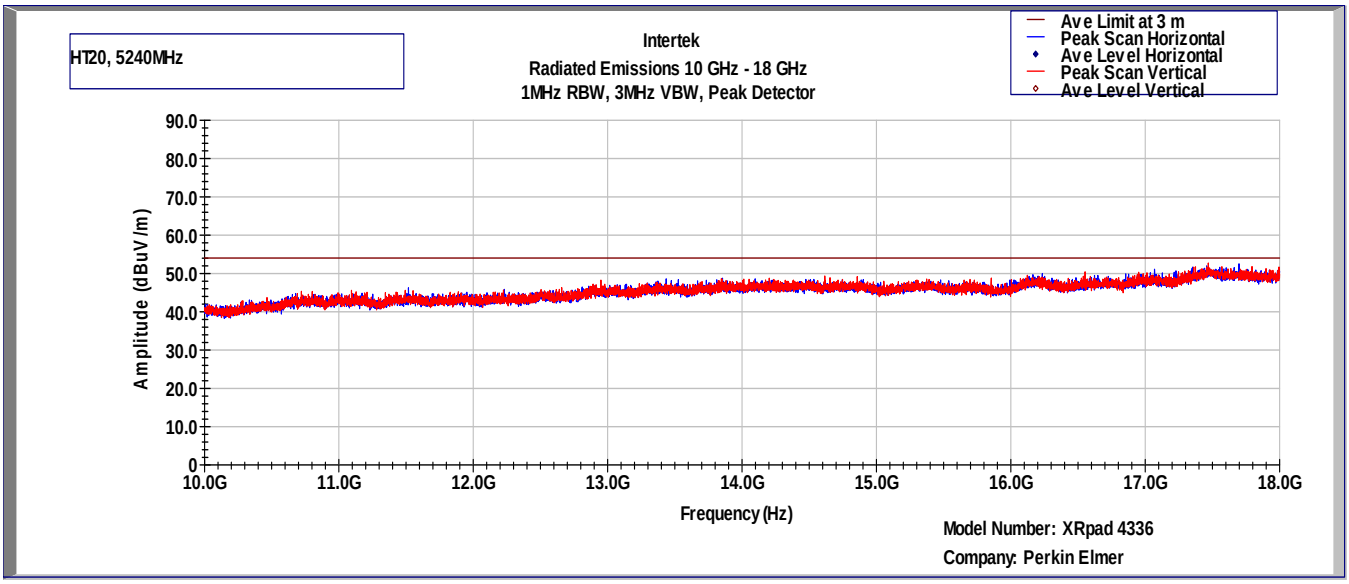
Frequency	Ave Level	Ave Limit@3m	Margin	Raw	Cable	DCF	AF
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB(1/m)
5150	43.5	54	-10.5	15.2	4.9	9.5	33.0
5350	43.2	54	-10.8	14.3	5.0	9.5	33.4

Note: The final average measurement was made with 10Hz VBW.

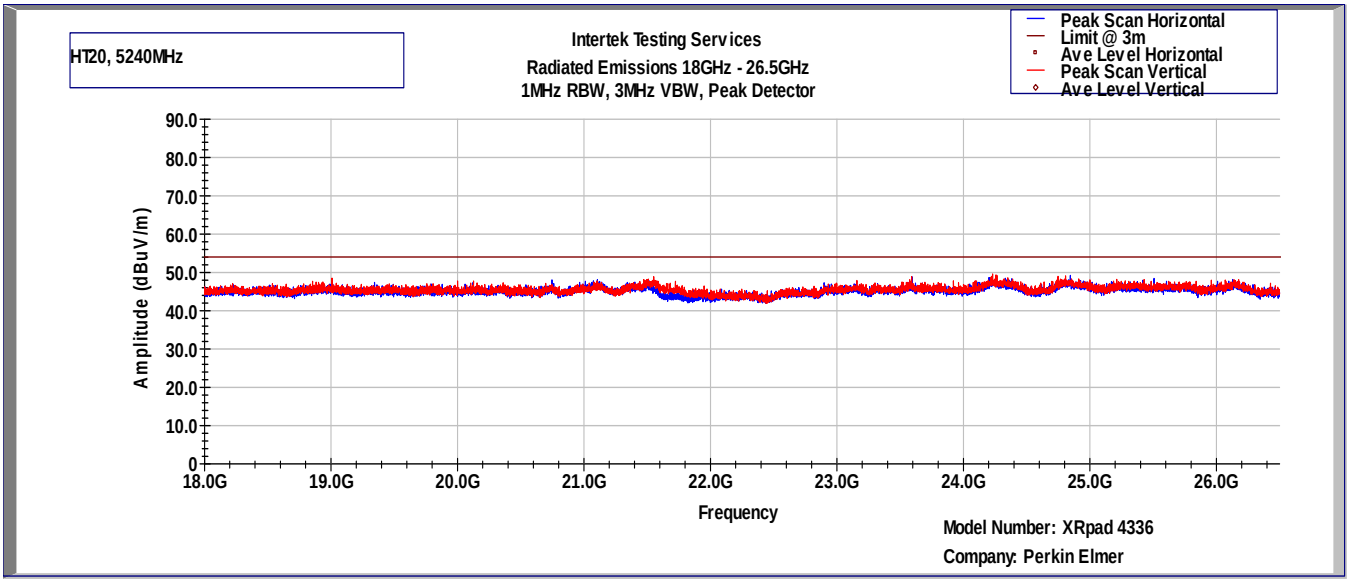
Plot 5.19, Radiated Spurious 5.55 GHz – 10 GHz



Plot 5.20, Radiated Spurious 10 GHz – 18GHz



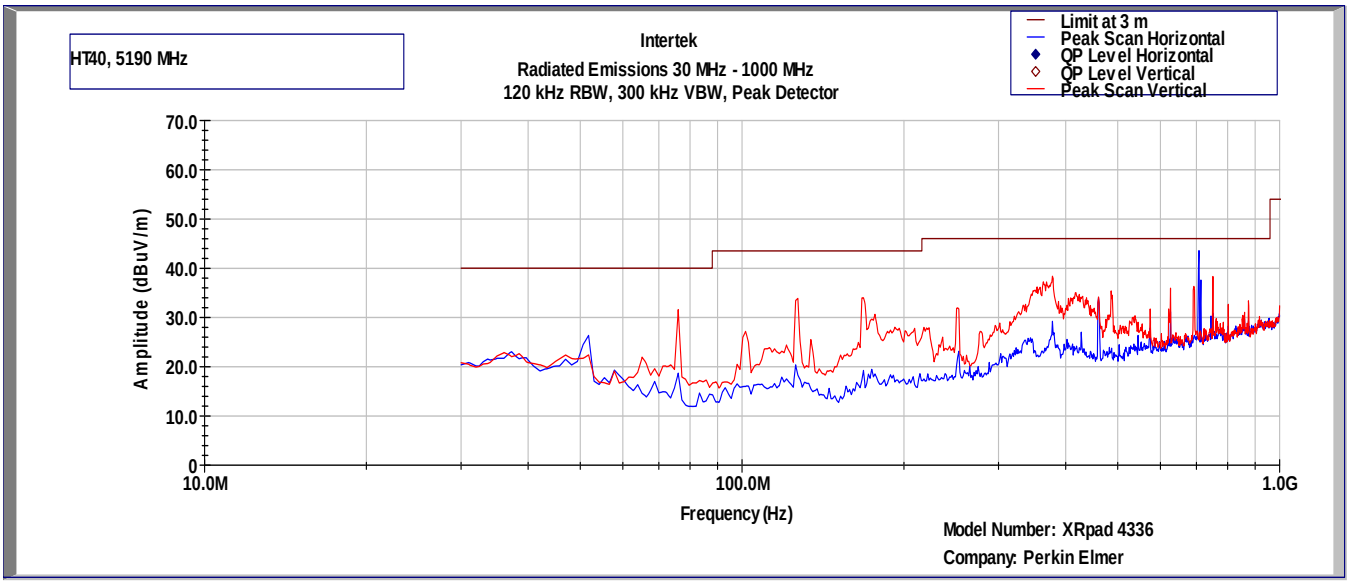
Plot 5.21, Radiated Spurious 18 GHz – 26.5 GHz



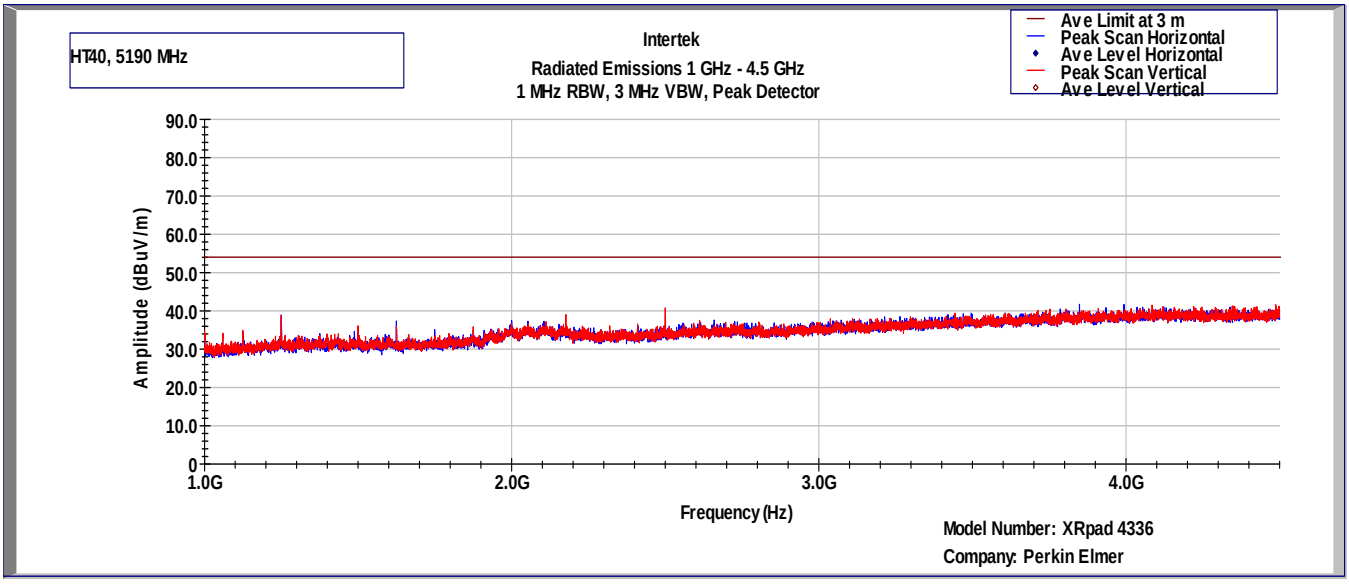
Note**:** Radiated emission measurements were performed up to 40GHz. No other emissions were detected above the noise floor which is at least 10 dB below the limit

HT40, 802.11n, 5190MHz, MCS23

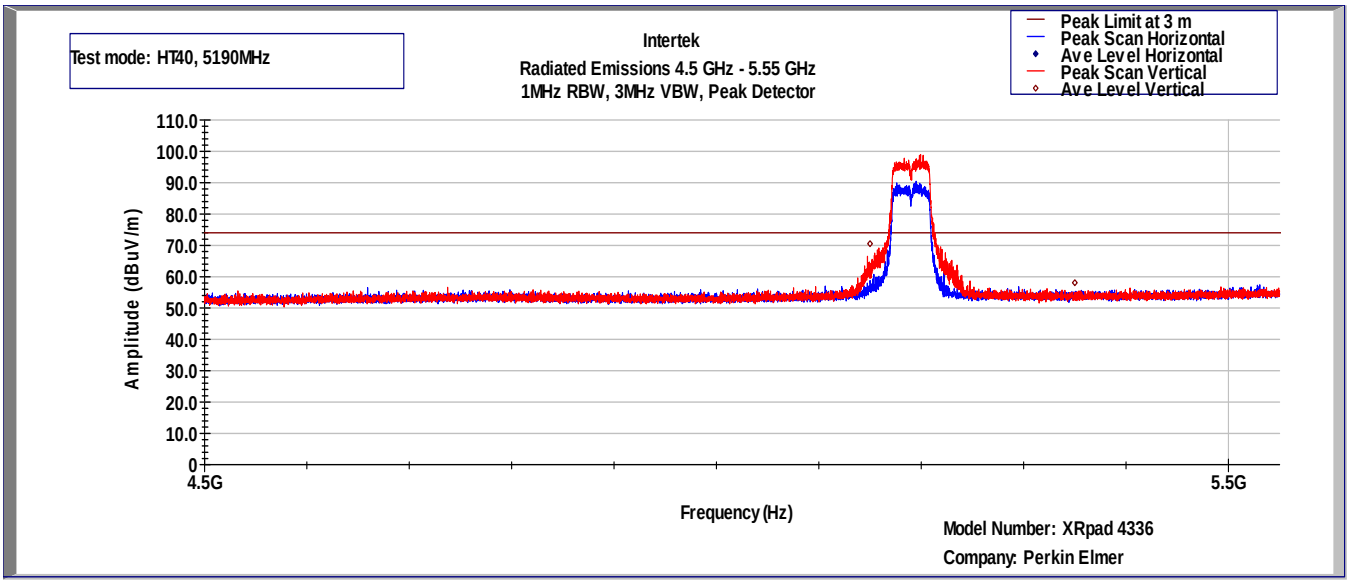
Plot 5.22, Radiated Spurious 30 MHz to 1000 MHz



Plot 5.23, Radiated Spurious 1 GHz to 4.5 GHz



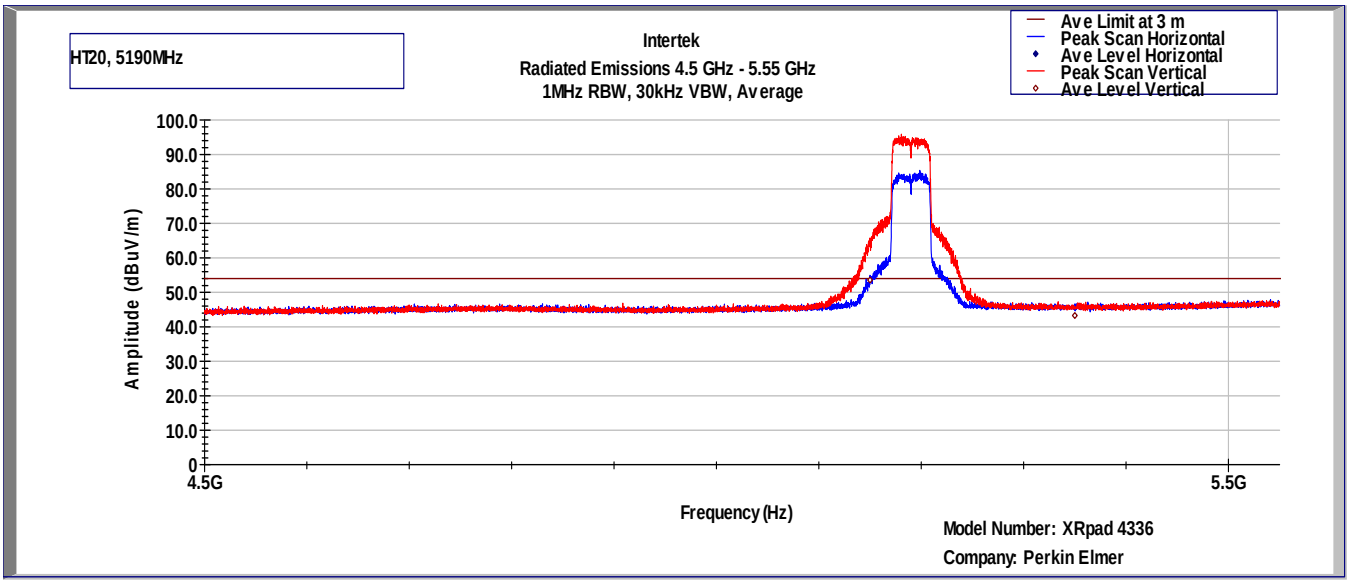
Plot 5.24, Radiated Spurious 4.5 GHz to 5.55 GHz, Peak



Intertek Testing Services
Radiated Emissions 4.5 GHz – 5.55 GHz
FCC 15.209 (Peak-Vertical)
Operator: ML

Frequency	Peak Level	Peak Limit@3m	Margin	Raw	Cable	DCF	AF
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB(1/m)
5150	70.5	74	-3.5	42.2	4.9	9.5	33.0
5350	58.0	74	-16	29.1	5.0	9.5	33.4

Plot 5.25, Radiated Spurious 4.5 GHz to 5.55 GHz, Average

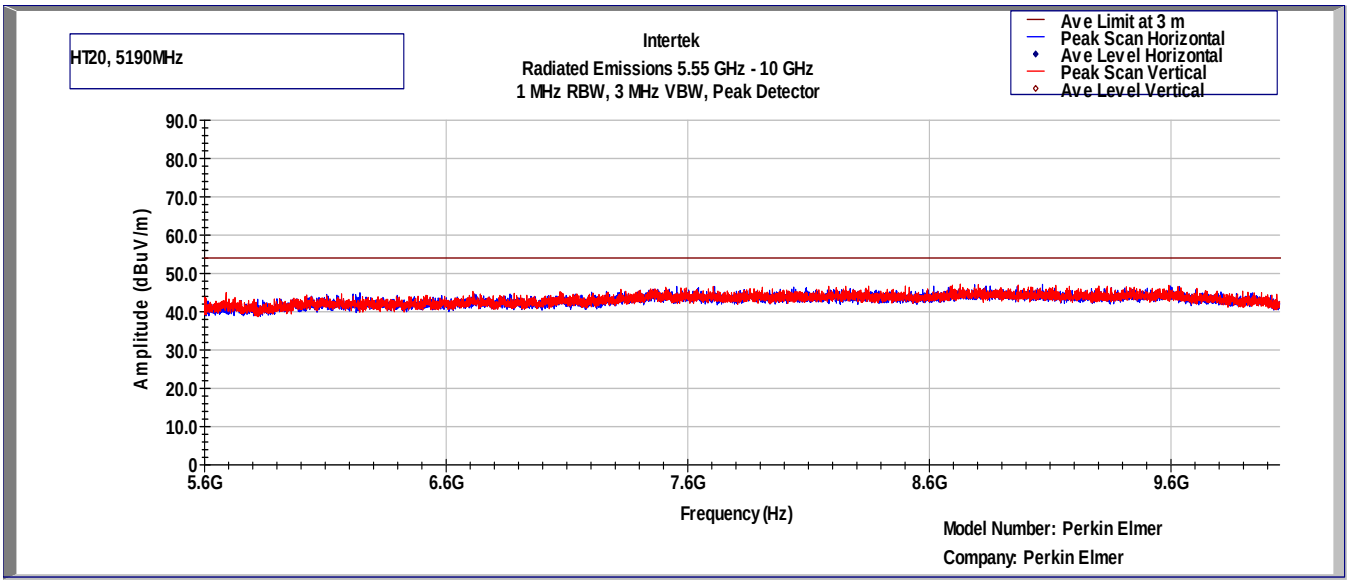


Intertek Testing Services
Radiated Emissions 4.5 GHz – 5.55 GHz
FCC 15.209 (Ave-Vertical)
Operator: ML

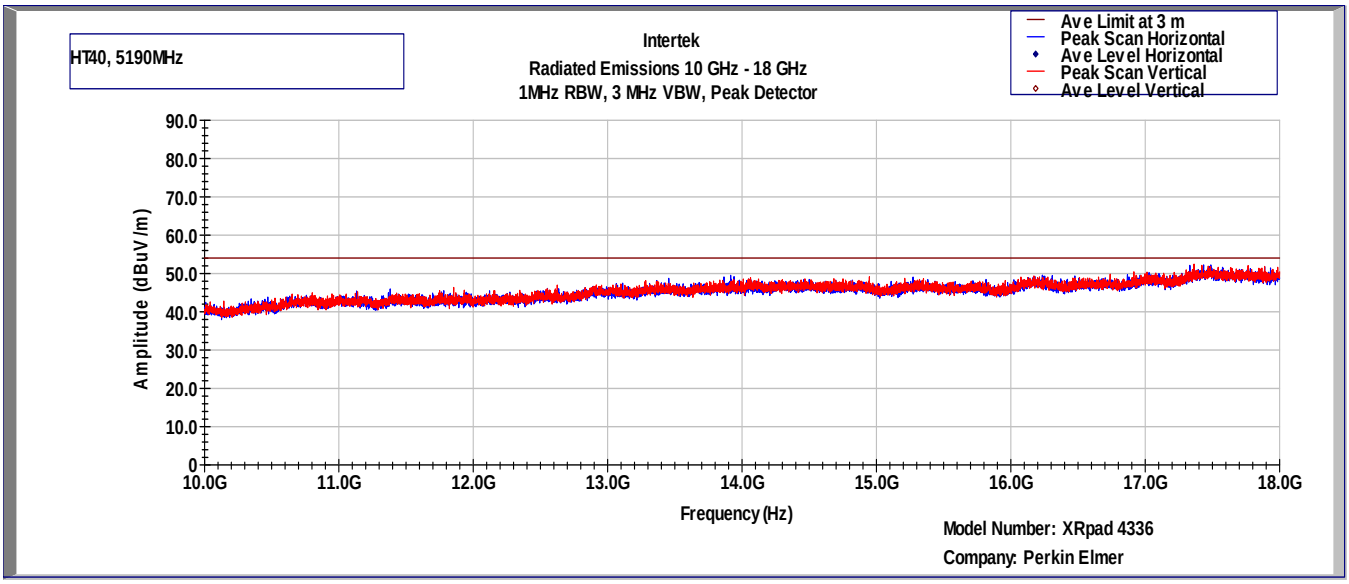
Frequency	Ave Level	Ave Limit@3m	Margin	Raw	Cable	DCF	AF
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB(1/m)
5150	53.5	54	-0.5	25.1	4.9	9.5	33.0
5350	43.2	54	-10.8	14.3	5.0	9.5	33.4

Note: The final average measurement was made with 10Hz VBW

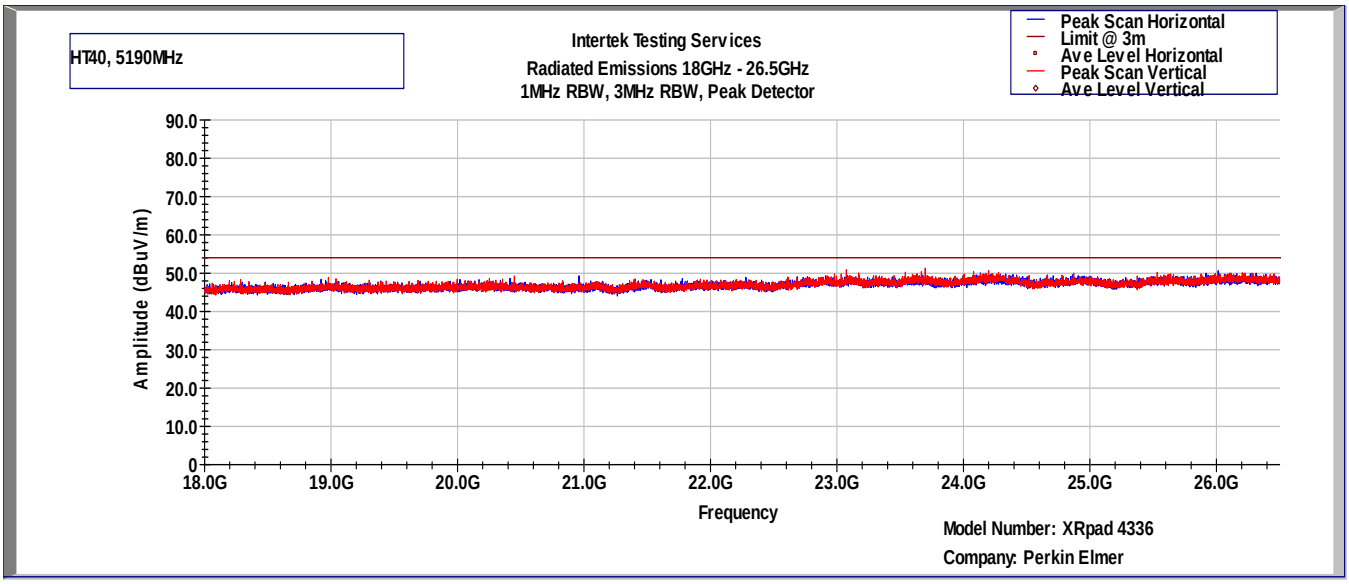
Plot 5.26, Radiated Spurious 5.55 GHz – 10 GHz



Plot 5.27, Radiated Spurious 10 GHz – 18GHz



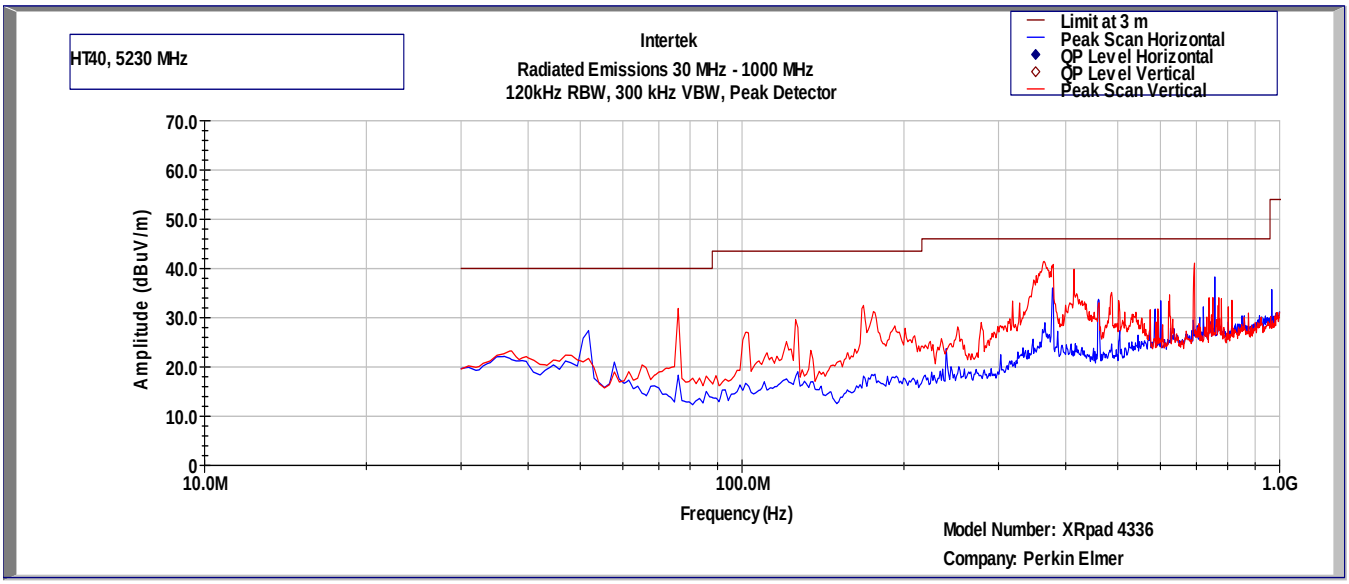
Plot 5.28, Radiated Spurious 18 GHz – 26.5 GHz



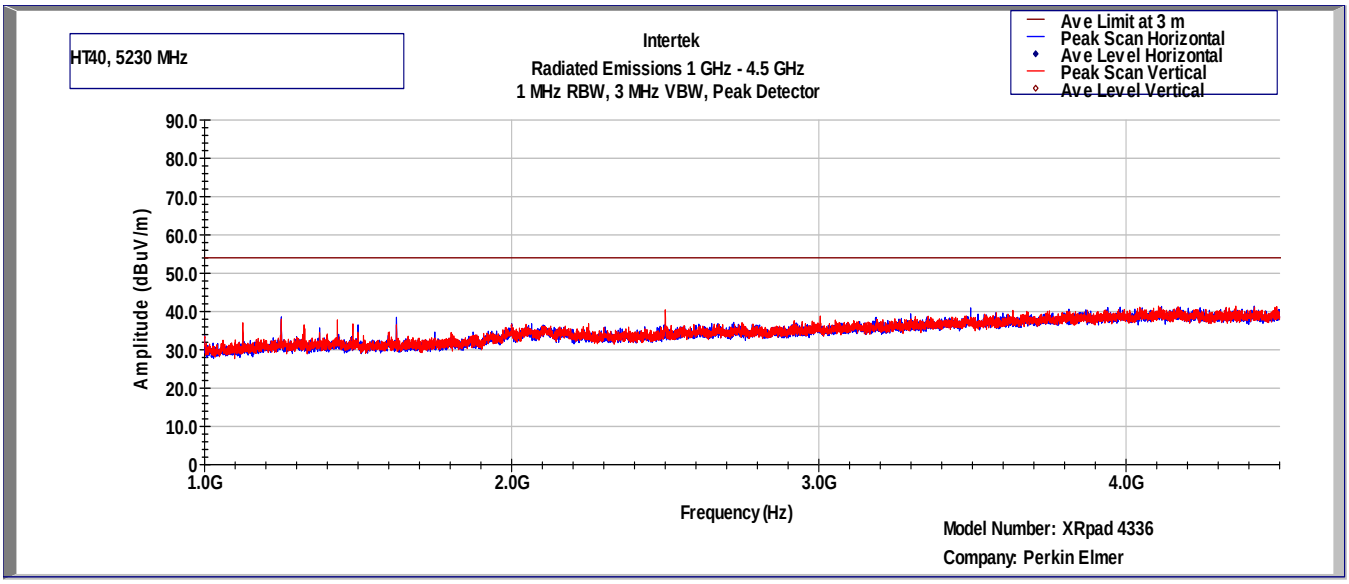
Note**:** Radiated emission measurements were performed up to 40GHz. No other emissions were detected above the noise floor which is at least 10 dB below the limit.

HT40, 802.11n, 5230MHz, MCS23

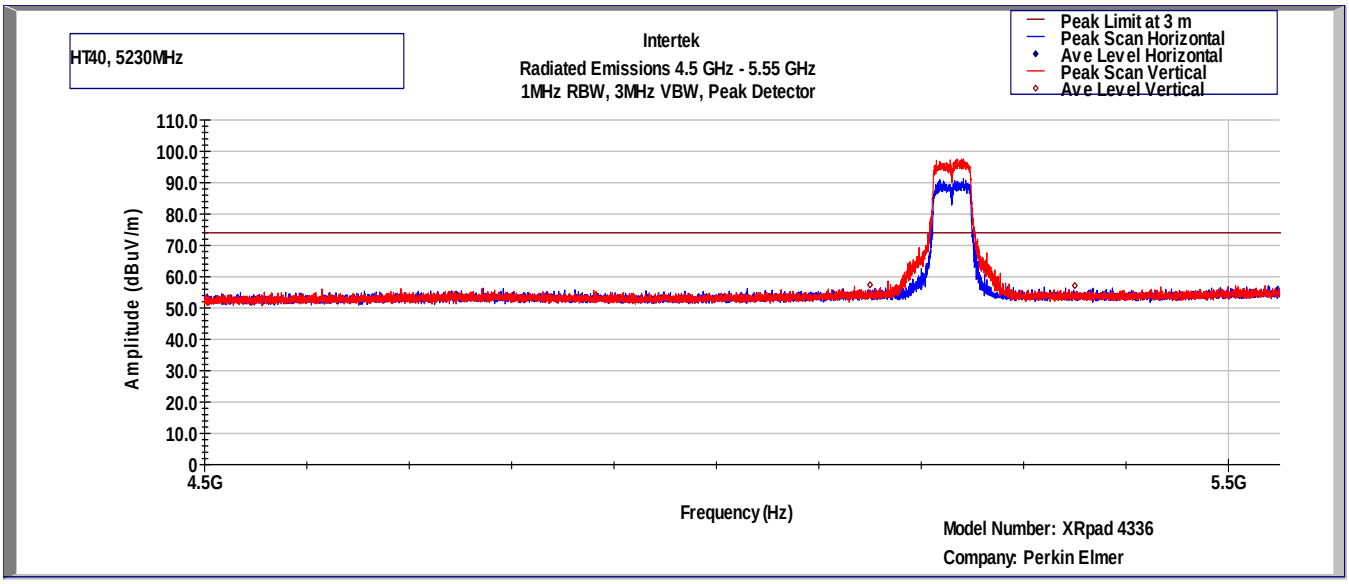
Plot 5.29, Radiated Spurious 30 MHz to 1000 MHz



Plot 5.30, Radiated Spurious 1 GHz to 4.5 GHz



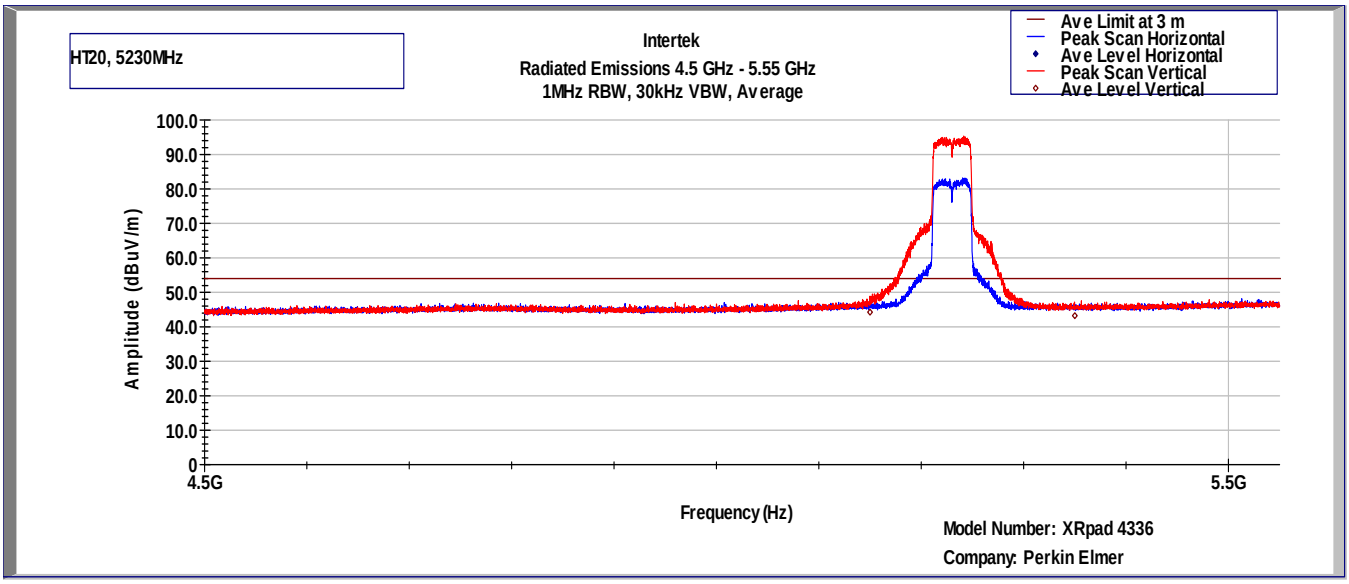
Plot 5.31, Radiated Spurious 4.5 GHz to 5.55 GHz, Peak



Intertek Testing Services
Radiated Emissions 4.5 GHz – 5.55 GHz
FCC 15.209 (Peak-Vertical)
Operator: ML

Frequency	Peak Level	Peak Limit@3m	Margin	Raw	Cable	DCF	AF
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB(1/m)
5150	57.4	74	-16.6	29.0	4.9	9.5	33.0
5350	57.1	74	-16.9	28.2	5.0	9.5	33.4

Plot 5.32, Radiated Spurious 4.5 GHz to 5.55 GHz, Average

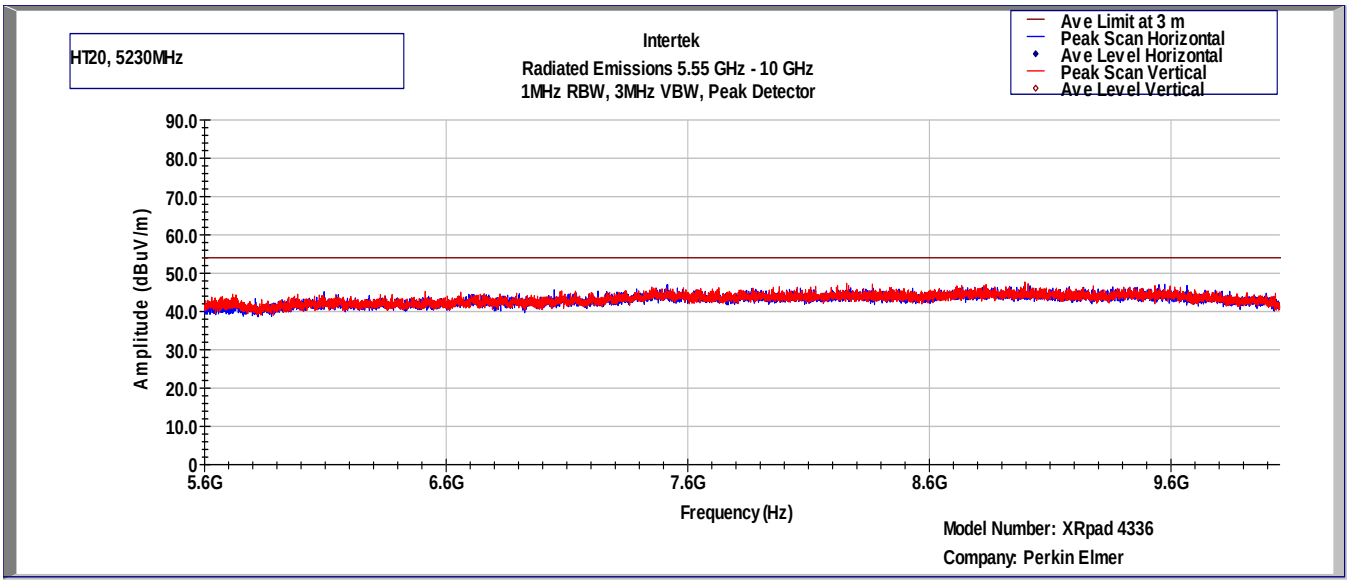


Intertek Testing Services
Radiated Emissions 4.5 GHz – 5.55 GHz
FCC 15.209 (Ave-Vertical)
Operator: ML

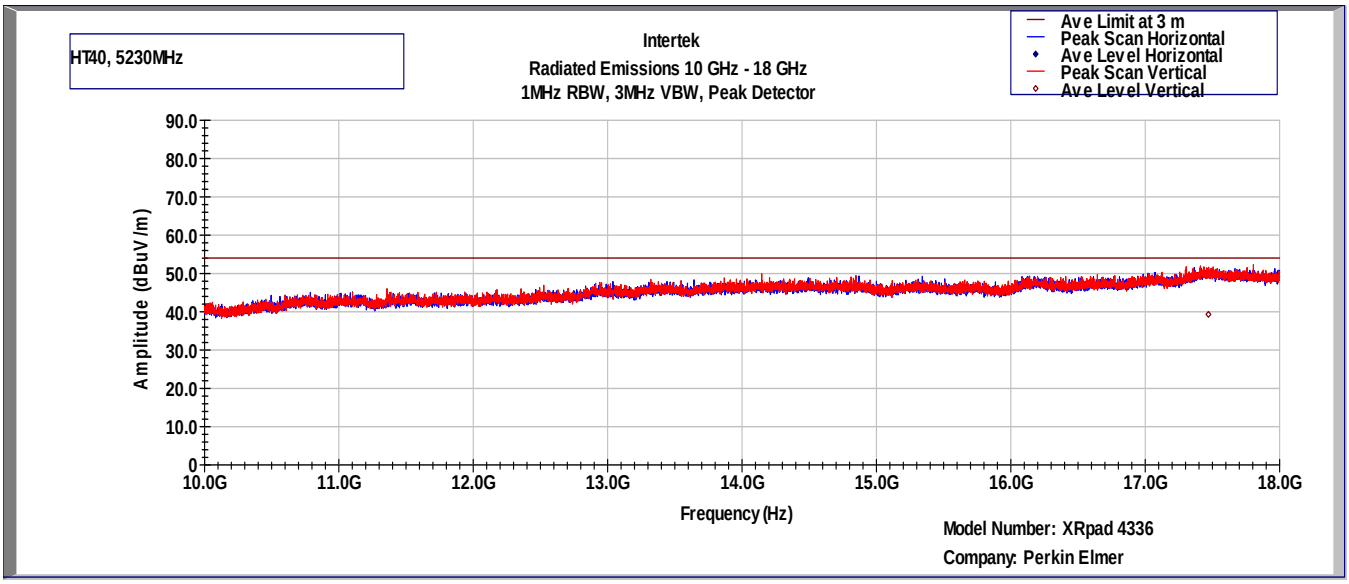
Frequency	Ave Level	Ave Limit@3m	Margin	Raw	Cable	DCF	AF
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB(1/m)
5150	44.2	54	-9.8	15.9	4.9	9.5	33.0
5350	43.2	54	-10.8	14.3	5.0	9.5	33.4

Note: The final average measurement was made with 10Hz VBW

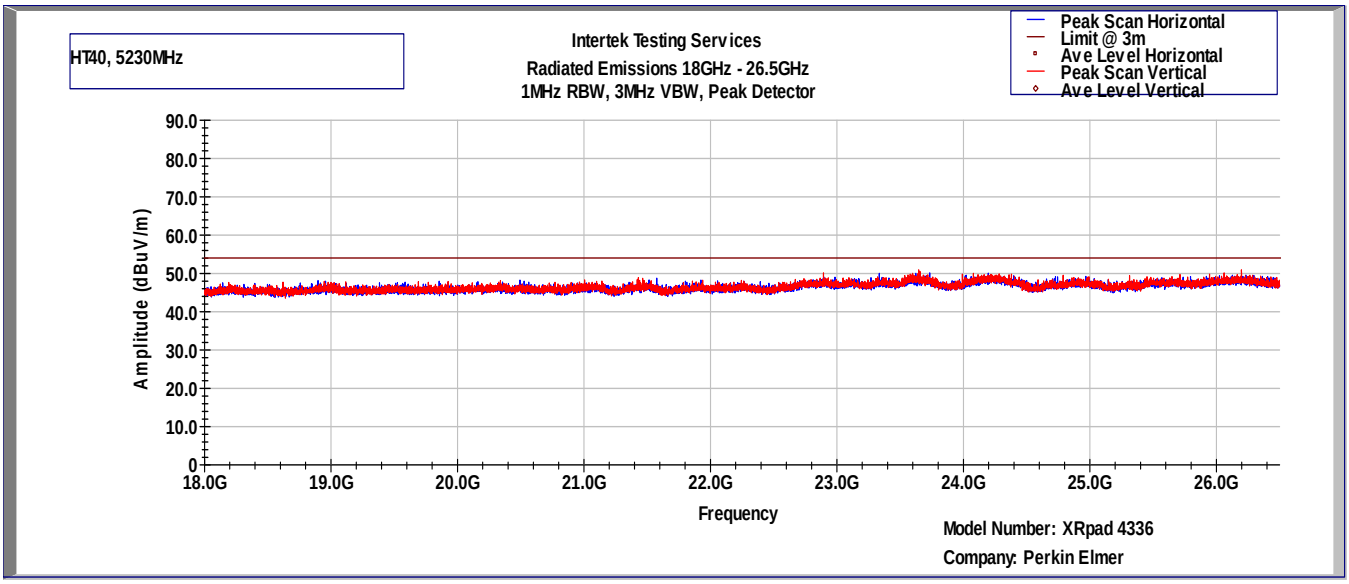
Plot 5.33, Radiated Spurious 5.55 GHz – 10 GHz



Plot 5.34, Radiated Spurious 10 GHz – 18GHz



Plot 5.35, Radiated Spurious 18 GHz – 26.5 GHz



Note**:** Radiated emission measurements were performed up to 40GHz. No other emissions were detected above the noise floor which is at least 10 dB below the limit.

4.5.5 Test setup photographs

Please refer to file “Test setup photos”.

4.6 Radiated Emissions from Digital Parts and Receiver
FCC Ref: 15.109

4.6.1 Requirement

Limits for Electromagnetic Radiated Emissions, FCC Section 15.109(b) and ICES 003 *

Frequency (MHz)	Class A at 10m dB(µV/m)	Class B at 3m dB(µV/m)
30-88	39	40.0
88-216	43.5	43.5
216-960	46.4	46.0
Above 960	49.5	54.0

* According to FCC Part 15.109(g) an alternative to the radiated emission limits shown above, digital devices may be shown to comply with the limit of CISPR Pub. 22

4.6.2 Procedure

Measurements are conducted with a quasi-peak detector instrument in the frequency range of 30 MHz to 1000 MHz and with the average detector instrument in the frequency range above 1000 MHz. The measuring receiver meets the requirements of Section One of CISPR 16 and the measuring antenna correlates to a balanced dipole.

Measurements of the radiated field are made with the antenna located at a distance of 10 meters from the EUT. If the field-strength measurements at 10m cannot be made because of high ambient noise level or for other reasons, measurements of Class B equipment may be made at a closer distance, for example 3m. An inverse proportionality factor of 20 dB per decade should be used to normalize the measured data to the specified distance for determining compliance.

The antenna is adjusted between 1m and 4m in height above the ground plane for maximum meter reading at each test frequency.

The antenna-to-EUT azimuth is varied during the measurement to find the maximum field-strength readings.

The antenna-to-EUT polarization (horizontal and vertical) is varied during the measurements to find the maximum field-strength readings.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for a larger EUT.

Floor standing EUTs are placed on a horizontal metal ground plane and isolated from the ground plane by 3 to 12 mm of insulating material.

Equipment setup for radiated disturbance tests followed the guidelines of ANSI C63.4 (2009).

Tested By:	Ram Shrestha
Test Date:	July 31, 2013

Example Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor to from the measured reading, followed by subtracting the Amplifier Gain (if any) and Distance Correction Factor (if any). The basic equation with a sample calculation is as follows:

FS = RA + AF + CF – PA – DCF
Where FS = Field Strength in dB (μV/m)
RA = Receiver Amplitude (including preamplifier) in dB (μV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB (1/m)
AG = Amplifier Gain in dB
DCF=Distance Correction Factor in dB
(Formula: DCF = $20\log_{10}$ (measurement distance/specification distance)

Assume a receiver reading of 52.0 dB (μV) is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB and DCF of 10.5 dB (DCF in this example: $20\log_{10}$ (10/3)) is subtracted, giving field strength of 21.5 dB (μV/m).

RA = 52.0 dB (μV)
AF = 7.4 dB (1/m)
CF = 1.6 dB
AG = 29.0 dB
DCF=10.5 dB
FS = RF + AF + CF – AG – DCF
FS = 52.0 + 7.4 + 1.6 – 29.0 – 10.5
FS = 21.5 dB (μV/m)

4.6.3 Test Results

Radiated emission measurements were performed from 30 MHz to 1000 MHz. Spectrum Analyzer Resolution Bandwidth is 100 kHz or greater below 1000 MHz and 1 MHz - above 1000 MHz.

The EUT passed for Class B.

Radiated Disturbance, 30MHz – 1GHz

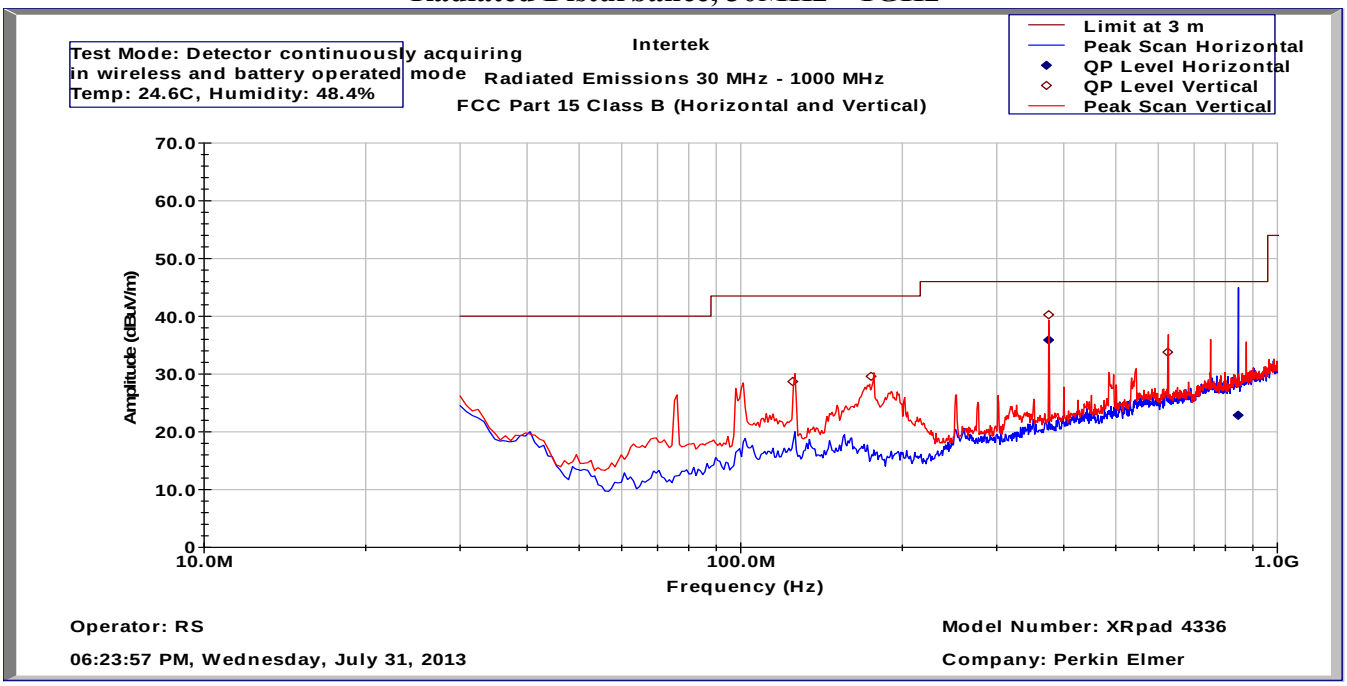


Table 6.1
Radiated Emissions from Digital Parts and Receiver below 1GHz

FCC Class B (QP – Horizontal)

Frequency	Quasi Pk FS	Limit@3m	Margin	RA	CF	AG	DCF	AF
Hz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB	dB(1/m)
3.75E+08	35.9	46	-10.1	41.2	2.3	32	10.5	15.1
8.45E+08	22.8	46	-23.2	20.3	3.5	32	10.5	22.3

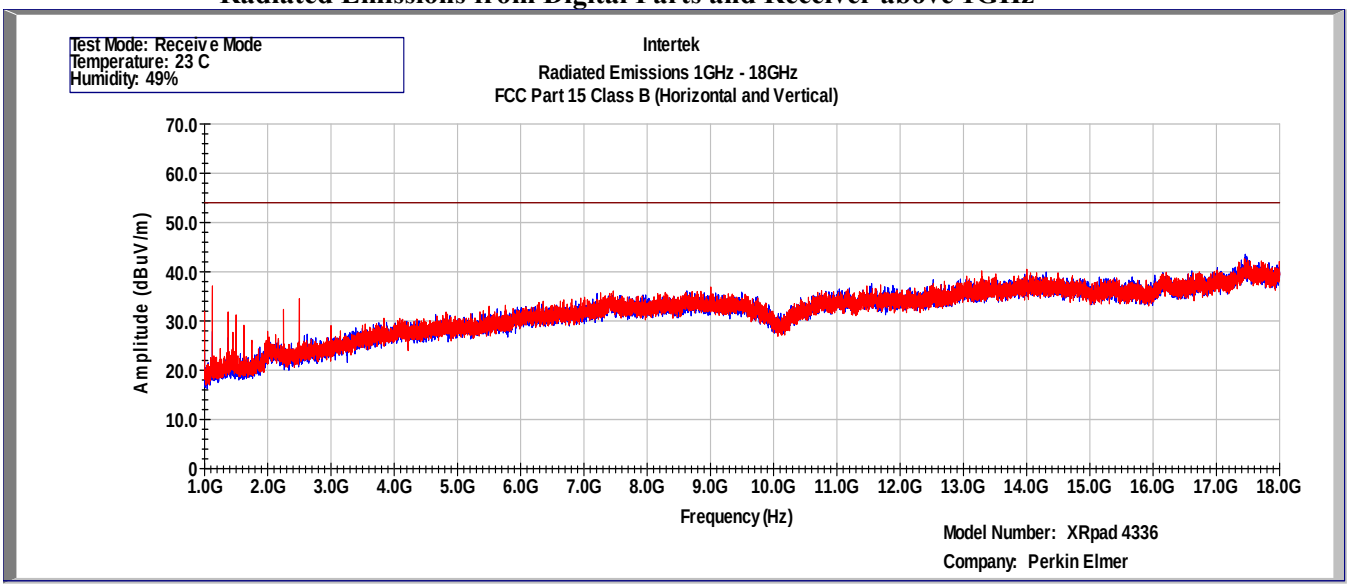
FCC Class B (QP – Vertical)

Frequency	Quasi Pk FS	Limit@3m	Margin	RA	Cable	AG	DCF	AF
Hz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB	dB(1/m)
1.25E+08	28.7	43.5	-14.8	38.1	1.3	32	10.5	11.5
1.75E+08	29.6	43.5	-13.9	41	1.5	32	10.5	9.4
3.75E+08	40.2	46	-5.8	45.5	2.3	32	10.5	15.1
6.25E+08	33.8	46	-12.2	33.8	3	32.3	10.5	20.3

Notes: Measurements made at 10 meters distance.

Table 7.2

Radiated Emissions from Digital Parts and Receiver above 1GHz



Note: Measurements made at 1 meters distance. Radiated emission measurements were performed up to 40GHz. No other emissions were detected above the noise floor which is at least 10 dB below the limit.

Results:	**Complies** by 5.8 dB.

4.6.4 Test setup photographs

Please refer to file “Test setup photos”.

4.7 Frequency stability
FCC 15.407(g)

4.7.1 Requirement

An emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

4.7.2 Procedure

The EUT was placed in a temperature chamber and setup to transmit a carrier without modulation.

The carrier frequency was measured with the spectrum analyzer with resolution bandwidth of 1 kHz. The temperature was varied from 5^0C to 40^0C, as stated in the user manual.

In normal operation, the XRPAD 4336 model is powered from an adjustable external power supply.

At the room temperature, the frequency was measured when the EUT was powered with 11.1VDC (nominal) and with 90% and 110% of the nominal voltage. After the temperature stabilized for approximately 20 minutes, the transmitting frequency was measured.

4.7.3 Result

Temperature, ^{0}C	Frequency at nominal voltage, (GHz)	Maximum deviation from frequency at 20°C, ppm
Nominal Frequency: 5180 MHz		
5	5179.979407	2.293
10	5179.980449	2.092
20	5179.991286	0.000
30	5180.003205	2.301
40	5180.002876	2.237
Nominal Frequency: 5240 MHz		
5	5239.989846	3.724
10	5239.991590	3.391
20	5240.009358	0.000
30	5240.019351	1.907
40	5240.019886	2.009

No change in carrier frequency was observed when the DC voltage was varied.

4.8 AC Line Conducted Emission
FCC 15.207

4.8.1 Requirement

Frequency Band MHz	Class B Limit dB (μV)	
	Quasi-Peak	**Average**
0.15-0.50	66 to 56 Decreases linearly with the logarithm of the frequency	56 to 46 Decreases linearly with the logarithm of the frequency
0.50-5.00	56	46
5.00-30.00	60	50

Not Applicable. EUT is battery powered. The EUT does not contain any AC power ports.

5.0 List of Test Equipment

Measurement equipment used for emission compliance testing utilized the equipment on the following list:

Equipment	Manufacturer	Model/Type	Serial #	Cal Int	Cal Due
RF Filter Section	Hewlett Packard	85460A	3448A00267	12	03/12/14
EMI Receiver	Hewlett Packard	8546A	3710A00373	12	03/12/14
Spectrum Analyzer	Rohde&Schwarz	FSU	200482	12	04/05/14
Spectrum Analyzer	Rohde&Schwarz	ESU	100172	12	10/05/13
BI-Log Antenna	ARA	LPB-2513/A	1154	12	08/01/14
Horn Antenna	EMCO	3115	9107-3712	12	11/15/13
Pyramidal Horn Antenna	EMCO	3160-09	Not Labeled	#	#
Pyramidal Horn Antenna	EMCO	3160-10	Not Labeled	#	#
Preamp	Sonoma	310N	185634	12	12/12/13
Pre-Amplifier (1-18GHz)	Miteq	AMF-4D-001180-24-10P	799159	12	09/27/13
Pre-Amplifier (18-40GHz)	Miteq	JSD44-18004000-30-5P	1071636	12	05/13/14

No Calibration required

6.0 Document History

Revision/ Job Number	Writer Initials	Date	Change
1.0 / G101287079	ML	September 25, 2013	Original document