



L C I E

TEST REPORT

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70 pages

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6230B (FAR) and 6230B-1(Ecuelles)

Standards

47 CFR Part 15.247
RSS-210, Issue 8
RSS-Gen, Issue 3

Issued to

SAGEMCOM
250, route de l'Empereur
92848 RUEIL MALMAISON

Apparatus under test

Trade mark
Manufacturer
Type
Serial number
FCC ID

Home Router Fast 5260CV
OPTIMUM
SAGEMCOM
F@st 5260CV
LK312300942
VW3FAST5260CV

Test date

2013/07

Tests performed by

Stéphane PHOUDIAH, Gilles DE BUYSER & Laurent DENEUX

Test site

Fontenay aux Roses & Ecuelles

Date of issue

2013/09/10

Written by :

Stéphane PHOUDIAH, Laurent DENEUX & Gilles DE

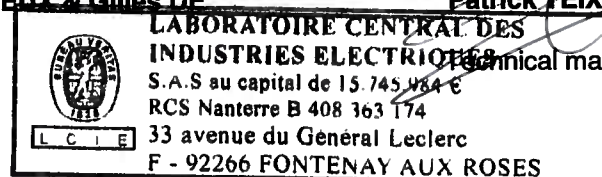
BUYSER

Tests operator

Approved by :

Patrick TEIXEIRA

Technical manager



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1. TEST PROGRAM

References

Standards:

- 47 CFR Part 15C
- RSS-210
- RSS-Gen
- CISPR 16-4-2
- ANSI C63.10

Standard Section	Test Description	TEST RESULT - Comments
RSS-Gen § 4.6.1	Occupied Bandwidth	PASS
CFR 47 § 15.247 (a) (2) RSS-210 § A8.2(a)	-6dB Bandwidth	PASS
CFR 47 § 15.247 (b) RSS-210 § A8.4(4)	Maximum Output Power	PASS
CFR 47 § 15.247 (e) RSS-210 § A8.2 (b)	Power Spectral Density	PASS
CFR 47 § 15.247 (d) RSS-210 § A8.5	Conducted Spurious Emission at the Band Edge	PASS
CFR 47 § 15.247 (d) RSS-210 § A8.5	Unwanted Emissions into Non-Restricted Frequency Bands	PASS
CFR 47 § 15.207 RSS-Gen § 7.2.4	AC Power Line Conducted Emissions	PASS
CFR 47 § 15.209 (a) CFR 47 § 15.205 (a) CFR 47 § 15.247 (d) RSS-210 § A8.5	Unwanted Emissions into Restricted Frequency Bands	PASS

PASS: EUT complies with standard's requirement

FAIL: EUT does not comply with standard's requirement

NA: Not Applicable

NP: Test Not Performed

2. EQUIPMENT DESCRIPTION

2.1. HARDWARE & SOFTWARE IDENTIFICATION

Equipment under test (EUT):



Front view



Rear View

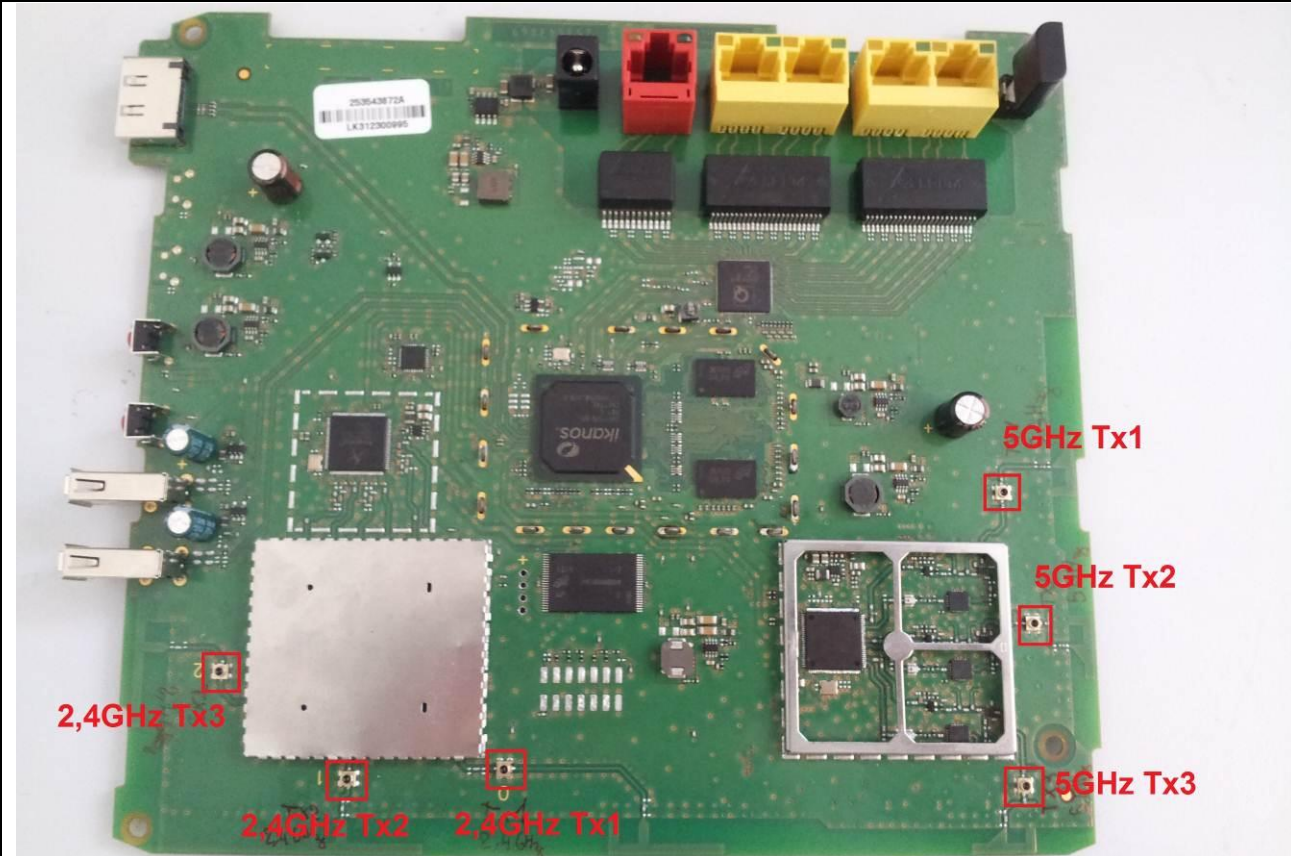


Side view



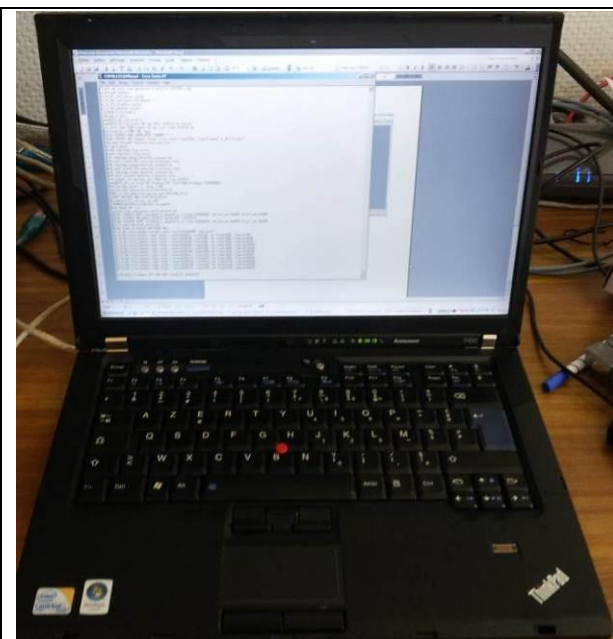
Power Supply

Photograph of EUT



Electronic Card
Photograph of EUT

Auxiliary equipment (AE) used for testing:



Laptop LENOVO T400 for Master Device Setting
Photograph of AE



Input/output:

- Input Power
- 4 Ethernet ports
- 1 WAN port
- 2 USB ports
- 1 eSATA port

Software identification:

-Software version: V6.0.9.1

Equipment information:

- Wifi Version: 802.11a/n HT20/n HT40/ac VHT80
- Modulation technology: OFDM and DSSS modulation
- Transmit operating mode: Multiples antenna without beam forming
- Number of transmit chains: 3 symmetrical
- Number of receiver chains: 3
- Beamforming gain: No
- Type of the equipment: Stand-alone equipment
- Type of power source: External power supply
- Antenna type: Integral
- Test sequence/test software used: See 2.2. Running Mode
- Duty Cycle: Continuous duty
- Operating frequency range:

Frequency Band (MHz)	Test Report
2400MHz to 2483,5MHz	122014-644470A
5150MHz to 5350MHz	122014-644470C&D
5470MHz to 5725MHz (Note 1)	122014-644470C&D
5725MHz to 5850MHz	122014-644470B

(Note1: The Manufacturer declares the 5600MHz -5650MHz band is not available)



- Antenna Characteristics:

Antenna All Tx	
Frequency Band (MHz)	Declared Overall Antenna Gain (dBi)
2.4GHz	6,4 (Note 1)
5GHz	7 (Note 1)

Note 1: Informations given by the customer in "Sagemcom_F@st 5260CV_Radio-tool -Guide_Ed1_20130503" word document.

-Channel plan 802.11a, 802.11n HT20:

Channel	Frequency (MHz)
Cmin: 149	5745
153	5765
Cnom: 157	5785
161	5805
Cmax: 165	5825

-Channel plan 802.11n HT40:

Channel	Frequency (MHz)
Cmin: 149+153	5755
Cmax: 157+161	5795

-Channel plan 802.11ac VHT80:

Channel	Frequency (MHz)
Cnom: 149+153+157+161	5775

-Data Rate:

802.11a	
Data Rate (Mbps)	Modulation Type
6	BPSK
9	BPSK
12	QPSK
18	QPSK
24	16-QAM
36	16-QAM
48	64-QAM
54	64-QAM



MCS index	Spatial streams	Modulation Type	802.11n HT20		802.11n HT40	
			Data rate (Mbit/s)		Data rate (Mbit/s)	
			GI=800ns	GI=400ns	GI=800ns	GI=400ns
0	1	BPSK	6.50	7.20	13.50	15.00
1	1	QPSK	13.00	14.40	27.00	30.00
2	1	QPSK	19.50	21.70	40.50	45.00
3	1	16-QAM	26.00	28.90	54.00	60.00
4	1	16-QAM	39.00	43.30	81.00	90.00
5	1	64-QAM	52.00	57.80	108.00	120.00
6	1	64-QAM	58.50	65.00	121.50	135.00
7	1	64-QAM	65.00	72.20	135.00	150.00
8	2	BPSK	13.00	14.40	27.00	30.00
9	2	QPSK	26.00	28.90	54.00	60.00
10	2	QPSK	39.00	43.30	81.00	90.00
11	2	16-QAM	52.00	57.80	108.00	120.00
12	2	16-QAM	78.00	86.70	162.00	180.00
13	2	64-QAM	104.00	115.60	216.00	240.00
14	2	64-QAM	117.00	130.00	243.00	270.00
15	2	64-QAM	130.00	144.40	270.00	300.00
16	3	BPSK	19.50	21.70	40.50	45.00
17	3	QPSK	39.00	43.30	81.00	90.00
18	3	QPSK	58.50	65.00	121.50	135.00
19	3	16-QAM	78.00	86.70	162.00	180.00
20	3	16-QAM	117.00	130.00	243.00	270.00
21	3	64-QAM	156.00	173.30	324.00	360.00
22	3	64-QAM	175.50	195.00	364.50	405.00
23	3	64-QAM	195.00	216.70	405.00	450.00



MCS index	Spatial streams	Modulation Type	802.11ac VHT80	
			Data rate (Mbit/s)	
			GI=800ns	GI=400ns
0	1	BPSK	29.3	32.5
1	1	QPSK	58.5	65
2	1	QPSK	87.8	97.5
3	1	16-QAM	117	130
4	1	16-QAM	175.5	195
5	1	64-QAM	234	260
6	1	64-QAM	263.3	292.5
7	1	64-QAM	292.5	325
8	1	256-QAM	351	390
9	1	256-QAM	390	433.3
10	2	BPSK	58,6	65
11	2	QPSK	117	130
12	2	QPSK	175.6	195
13	2	16-QAM	234	260
14	2	16-QAM	351	390
15	2	64-QAM	468	520
16	2	64-QAM	526.6	585
17	2	64-QAM	585	650
18	2	256-QAM	702	780
19	2	256-QAM	780	866.6
20	3	BPSK	87.9	97.5
21	3	QPSK	175.5	195
22	3	QPSK	263.4	292.5
23	3	16-QAM	351	390
24	3	16-QAM	526,5	585
25	3	64-QAM	702	780
26	3	64-QAM	789.9	877.5
27	3	64-QAM	877.5	975
28	3	256-QAM	1053	1170
29	3	256-QAM	1170	1299.9



2.2. RUNNING MODE

The EUT is set in the following modes during tests:

- Permanent emission with modulation on a fixed channel in the data rate that produced the highest power (802.11a: 6Mbps, 802.11n HT20: MCS16, 802.11n HT40: MCS16, 802.11ac VHT80: MCS0)
- Permanent reception

Following commands with the specific test software "Atheros Radio Tool client v1.17.3" are used to set the product:

	Modulation	Band	Power Setting	Frequencies	Command
802.11a	6MBps	DTS	22	5745	tx f=5745;r=6;pl=5000;pc=-1;txch=7;tx99=1;tp=22
			23	5785	tx f=5785;r=6;pl=5000;pc=-1;txch=7;tx99=1;tp=23
			23	5825	tx f=5825;r=6;pl=5000;pc=-1;txch=7;tx99=1;tp=23
802.11n HT20	MCS16	DTS	22	5745	tx f=5745;r=t16;pl=8000;pc=-1;txch=7;tx99=1;tp=22
			23	5785	tx f=5785;r=t16;pl=8000;pc=-1;txch=7;tx99=1;tp=23
			23	5825	tx f=5825;r=t16;pl=8000;pc=-1;txch=7;tx99=1;tp=23
802.11n HT40	MCS16	DTS	21	5745, 5765	tx f=5745;r=f16;pl=16000;pc=-1;txch=7;tx99=1;tp=21
			22	5785, 5805	tx f=5785;r=f16;pl=16000;pc=-1;txch=7;tx99=1;tp=22
802.11ac VHT80	MCS0	DTS	19	5745, 5765	tx f=5775;r=ve0;pl=16000;pc=-1;txch=7;tx99=1;tp=19



2.3. EQUIPEMENT LABELLING



EUT Marking plate



EUT Power supply marking plate

2.4. EQUIPMENT MODIFICATIONS

No equipment modification has been necessary during testing.



3. OCCUPIED BANDWIDTH

3.1. TEST CONDITIONS

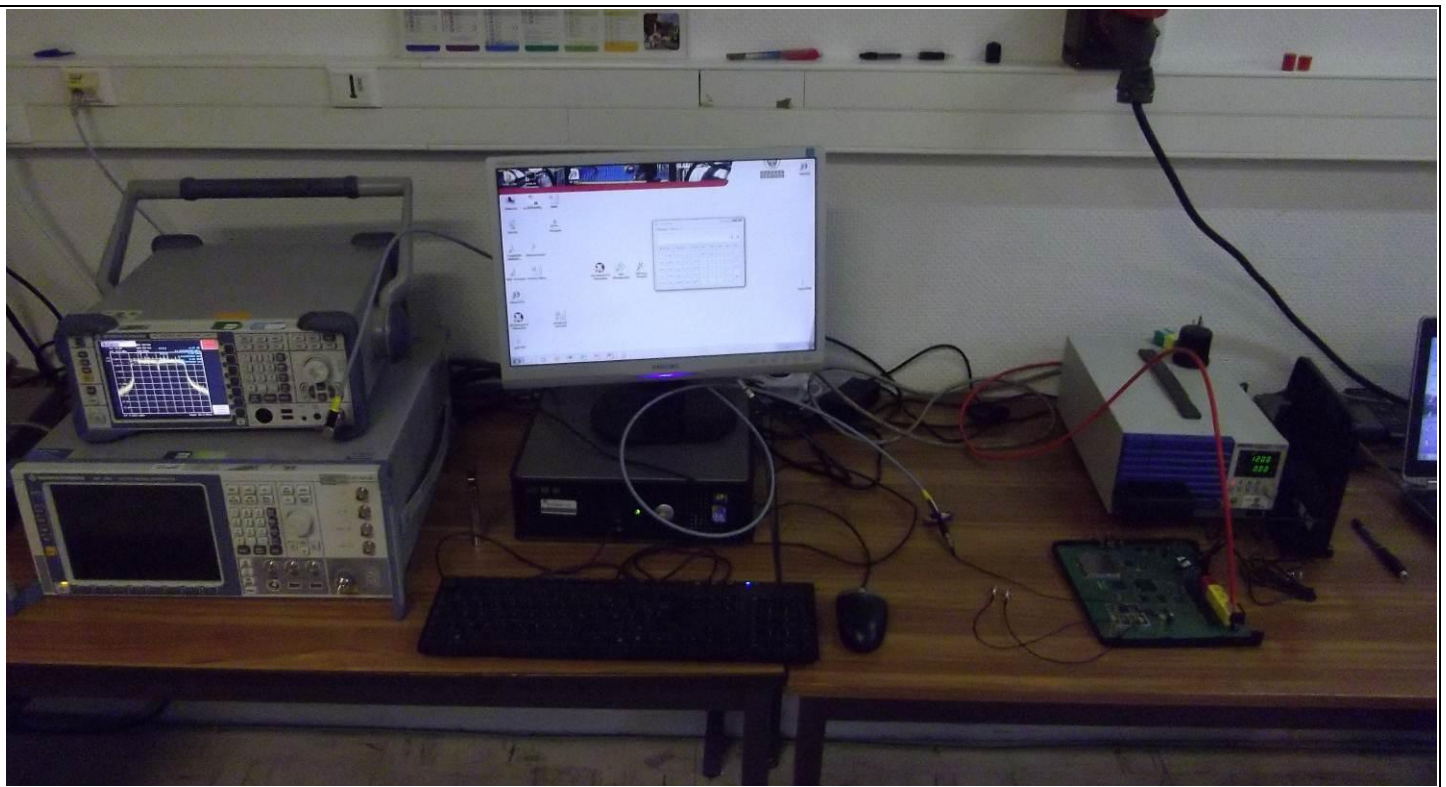
Test performed by : Gilles DE BUYSER
Date of test : 2013/07/04
Ambient temperature : 22°C
Relative humidity : 54%

3.2. TEST SETUP

The Equipment Under Test is installed on a table and set in permanent emission with modulation. Measurement is performed with a spectrum analyzer on the EUT conducted access. The product has been tested according to the RSS-GEN § 4.6.1 reference method.

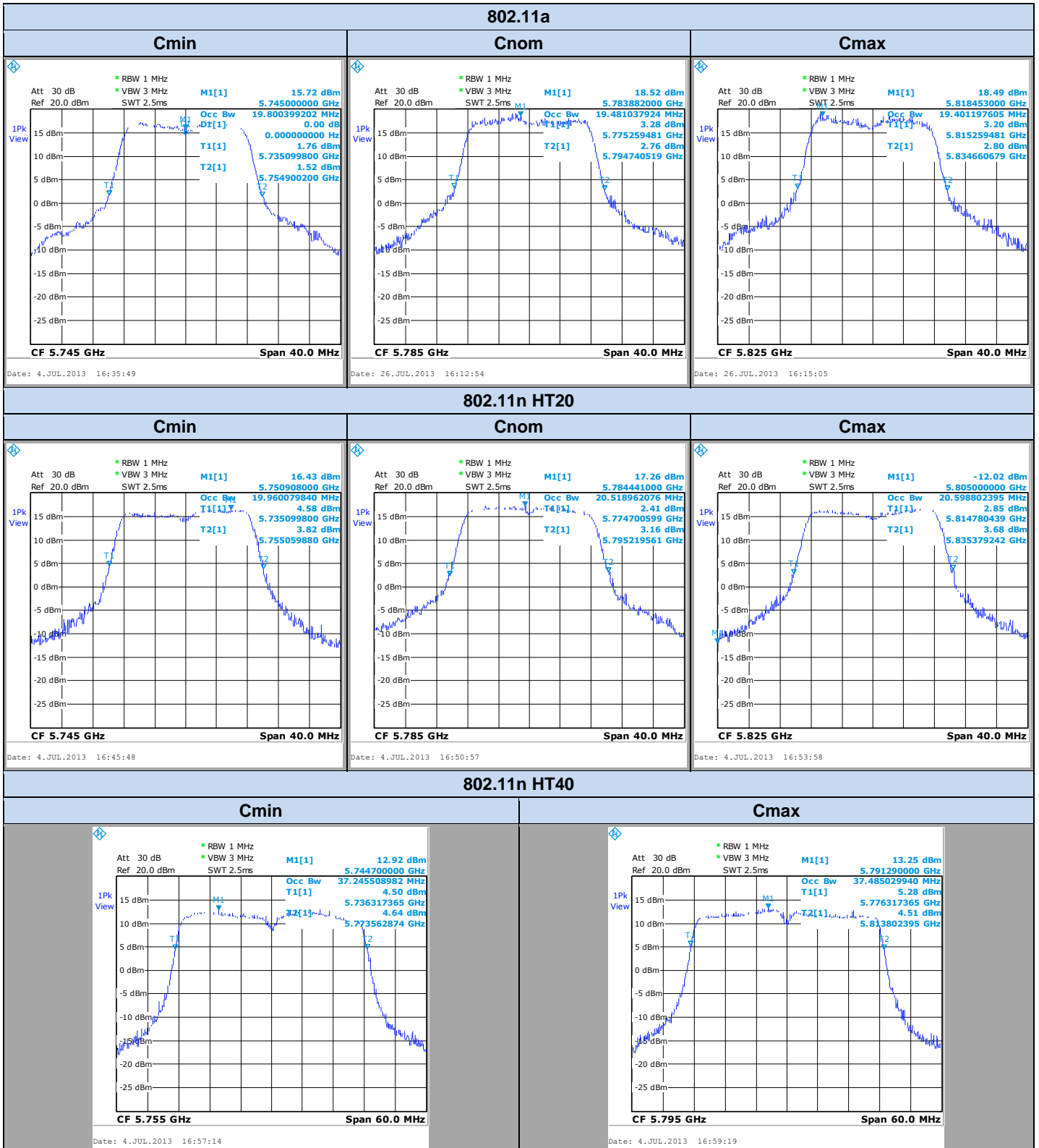
Spectrum Analyzer Setting:

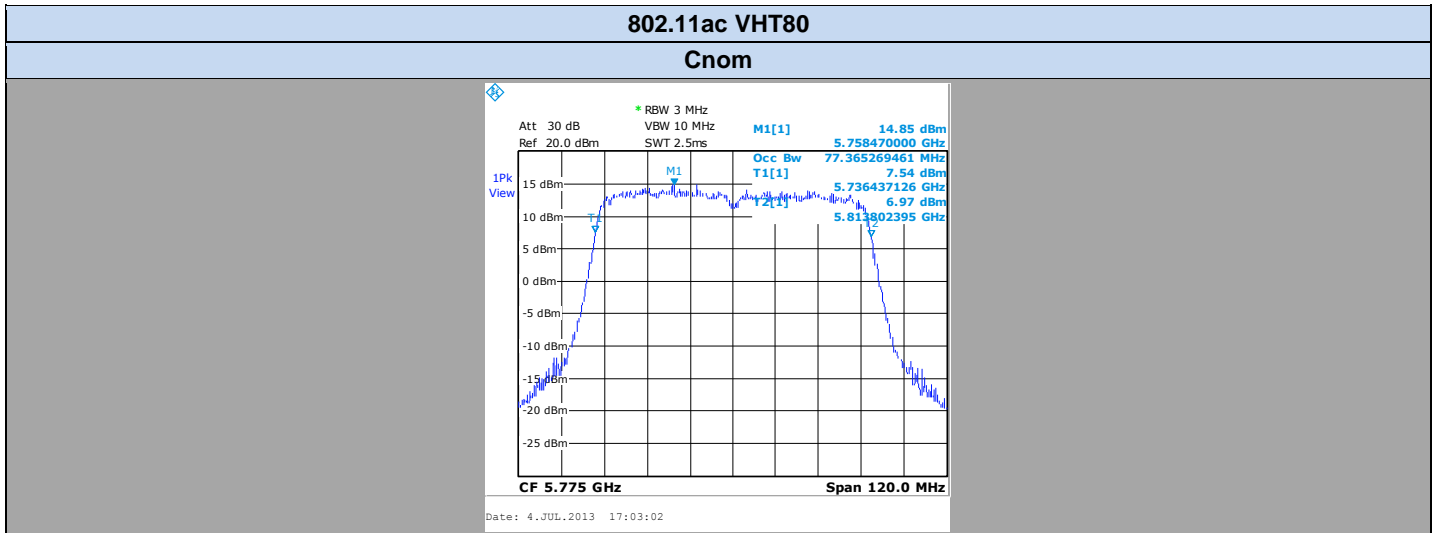
Center frequency= Cmin or Cnom or Cmax
Span= At least twice the emission spectrum
Amplitude= Sufficient to observe the signal amplitude
RBW= 1% of span
VBW= 3*RBW
Sweep= Auto
Trace= Max Hold
Detector= Peak
Occupied Bandwidth 99% activated



Photograph for Occupied Bandwidth

3.3. GRAPHICS & RESULTS





802.11a

Temperature	Tnom		
Voltage	Vnom		
Frequency	Cmin	Cnom	Cmax
Occupied Bandwidth (MHz)	19,8	19,48	19,4

802.11n HT20

Temperature	Tnom		
Voltage	Vnom		
Frequency	Cmin	Cnom	Cmax
Occupied Bandwidth (MHz)	19,96	20,51	20,59

802.11n HT40

Temperature	Tnom	
Voltage	Vnom	
Frequency	Cmin	Cmax
Occupied Bandwidth (MHz)	37,24	37,48

802.11ac VHT80

Temperature	Tnom
Voltage	Vnom
Frequency	Cnom
Occupied Bandwidth (MHz)	77,36

Result: **PASS**

Limit: → None



4. -6dB BANDWIDTH

4.1. TEST CONDITIONS

Test performed by : Gilles DE BUYSER
Date of test : 2013/07/04
Ambient temperature : 22°C
Relative humidity : 54%

4.2. TEST SETUP

The Equipment Under Test is installed on a table and set in permanent emission with modulation. Measurement is performed with a spectrum analyzer on the EUT conducted access. The product has been tested according to the FCC KDB 558074 D01 DTS Meas Guidance v03r1 § 8.1.

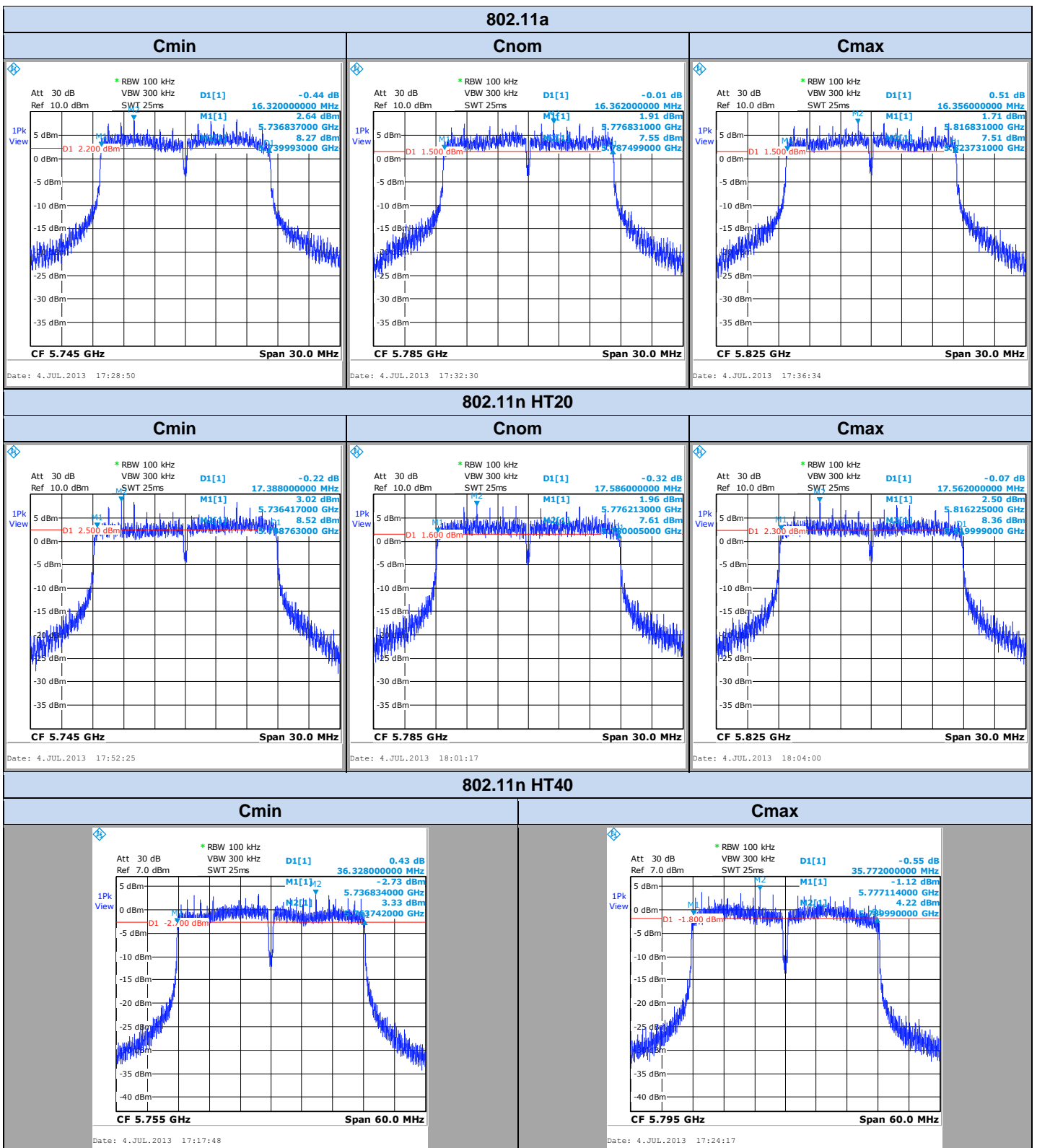
Spectrum Analyzer Setting:

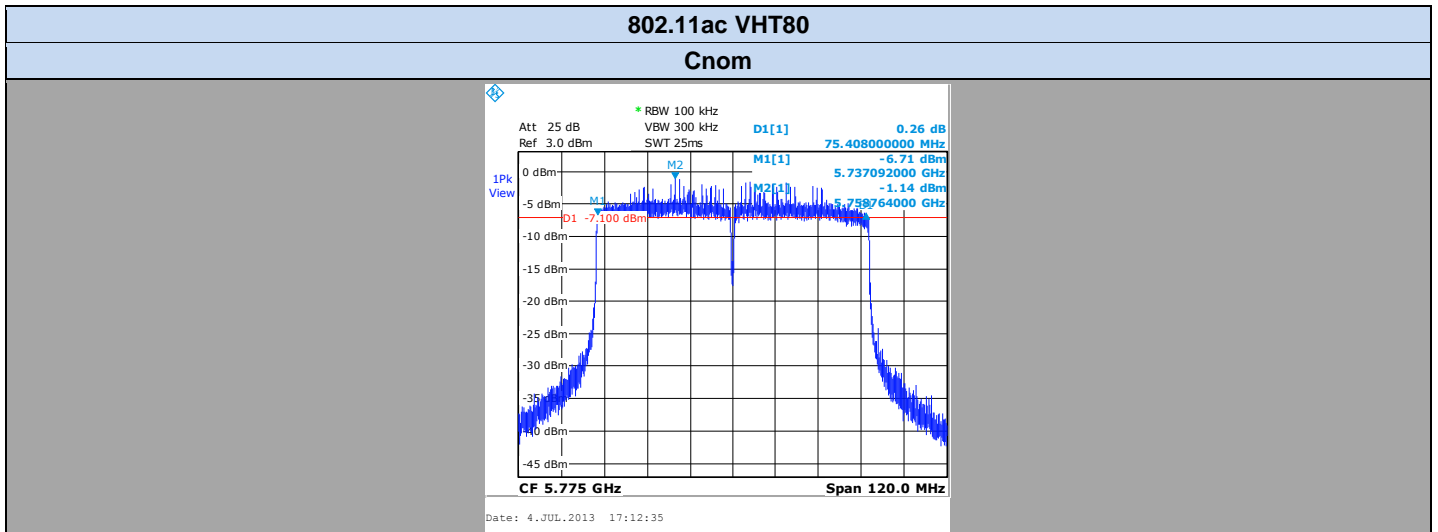
Center frequency= Cmin or Cnom or Cmax
Span= At least twice the emission spectrum
Amplitude= Sufficient to observe the signal amplitude
RBW= 100kHz
VBW= 300kHz
Sweep= Auto
Trace= Max Hold
Detector= Peak



Photograph for Bandwidth

4.1. GRAPHICS & RESULTS





802.11a

Temperature	Tnom		
Voltage	Vnom		
Frequency	Cmin	Cnom	Cmax
-6dB Bandwidth (MHz)	16,32	16,36	16,35

802.11n HT20

Temperature	Tnom		
Voltage	Vnom		
Frequency	Cmin	Cnom	Cmax
-6dB Bandwidth (MHz)	17,38	17,58	17,56

802.11n HT40

Temperature	Tnom		
Voltage	Vnom		
Frequency	Cmin	Cmax	
-6dB Bandwidth (MHz)	36,32	35,77	

802.11ac VHT80

Temperature	Tnom		
Voltage	Vnom		
Frequency	Cnom		
-6dB Bandwidth (MHz)	75,41		

Result: PASS

Limit: → The -6dB bandwidth must be greater than 500kHz



5. MAXIMUM CONDUCTED POWER

5.1. TEST CONDITIONS

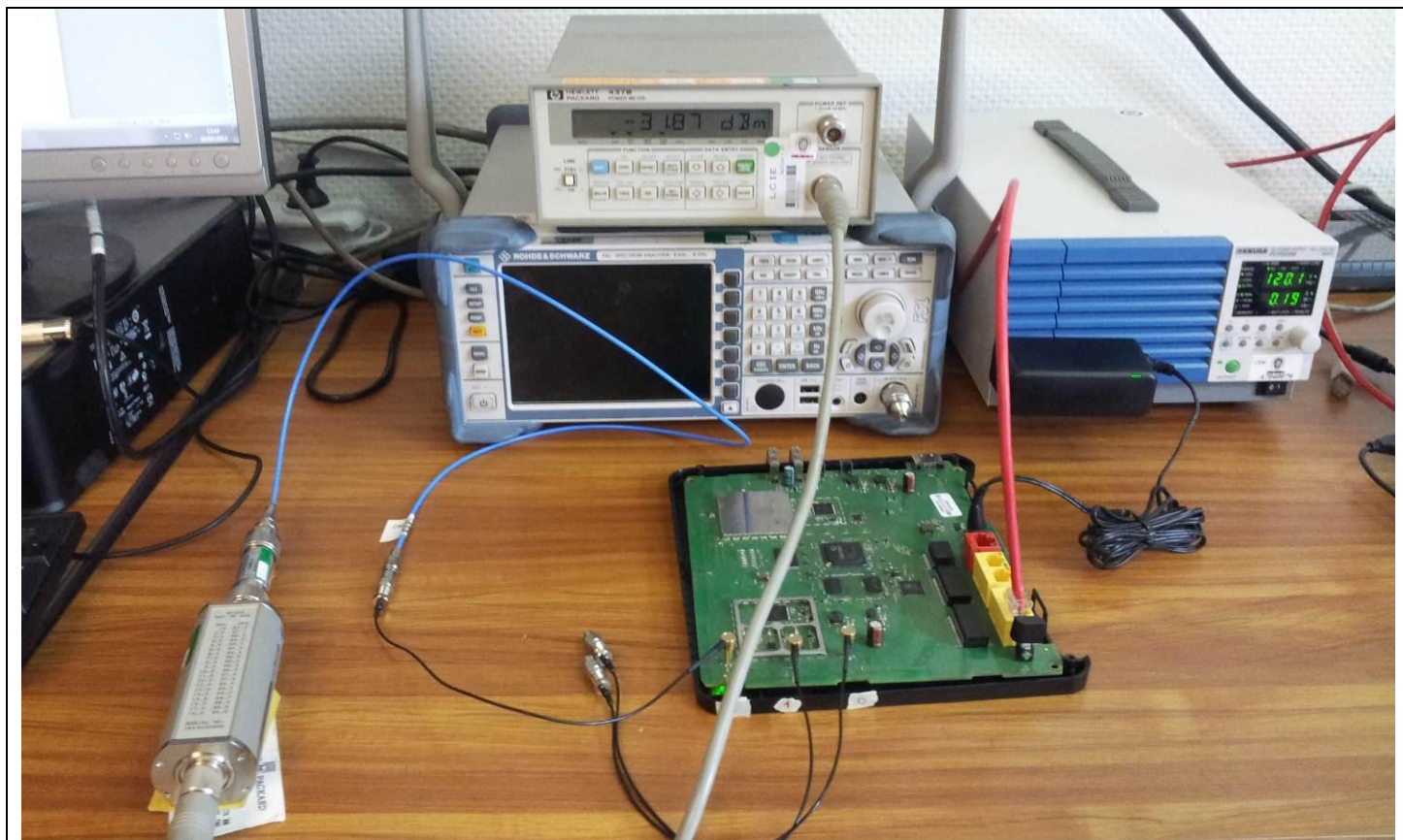
Test performed by : Stéphane PHOUDIAH
Date of test : 2013/07/16
Ambient temperature : 26°C
Relative humidity : 45%

5.2. TEST SETUP

The Equipment Under Test is installed on a table and set in permanent emission with modulation. Measurement is performed with a power meter (average detector) on the EUT conducted access. The product has been tested according to the FCC KDB 558074 D01 DTS Meas Guidance v03r01 § 9.2.3.1 & FCC KDB 662911 D01 Multiple Transmitter Output v02 § E) 1).

Power meter:

RF average power meter with a thermocouple detector
Wide band power meter sensor in a range including EUT transmission band



Photograph for Maximum Conducted Power



5.1. GRAPHICS & RESULTS

Cable Loss= 1,3dB
Attenuator= 51,6dB

802.11a

Temperature	Tnom		
Voltage	Vnom		
Channel	Cmin	Cnom	Cmax
Maximum Conducted Power (dBm)	25,28	26,66	26,31

802.11n HT20

Temperature	Tnom		
Voltage	Vnom		
Channel	Cmin	Cnom	Cmax
Maximum Conducted Power (dBm)	25,48	25,67	25,42

802.11n HT40

Temperature	Tnom	
Voltage	Vnom	
Channel	Cmin	Cmax
Maximum Conducted Power (dBm)	24,41	24,49

802.11ac VHT80

Temperature	Tnom
Voltage	Vnom
Channel	Cnom
Maximum Conducted Power (dBm)	22,39

Remark: The power values in these tables are a summation of conducted power on Tx1, Tx2 and Tx3.

Result: PASS

Limit: → The Maximum Conducted Power must be lower than 29dBm (Antenna Gain=7dBi)

6. POWER SPECTRAL DENSITY

6.1. TEST CONDITIONS

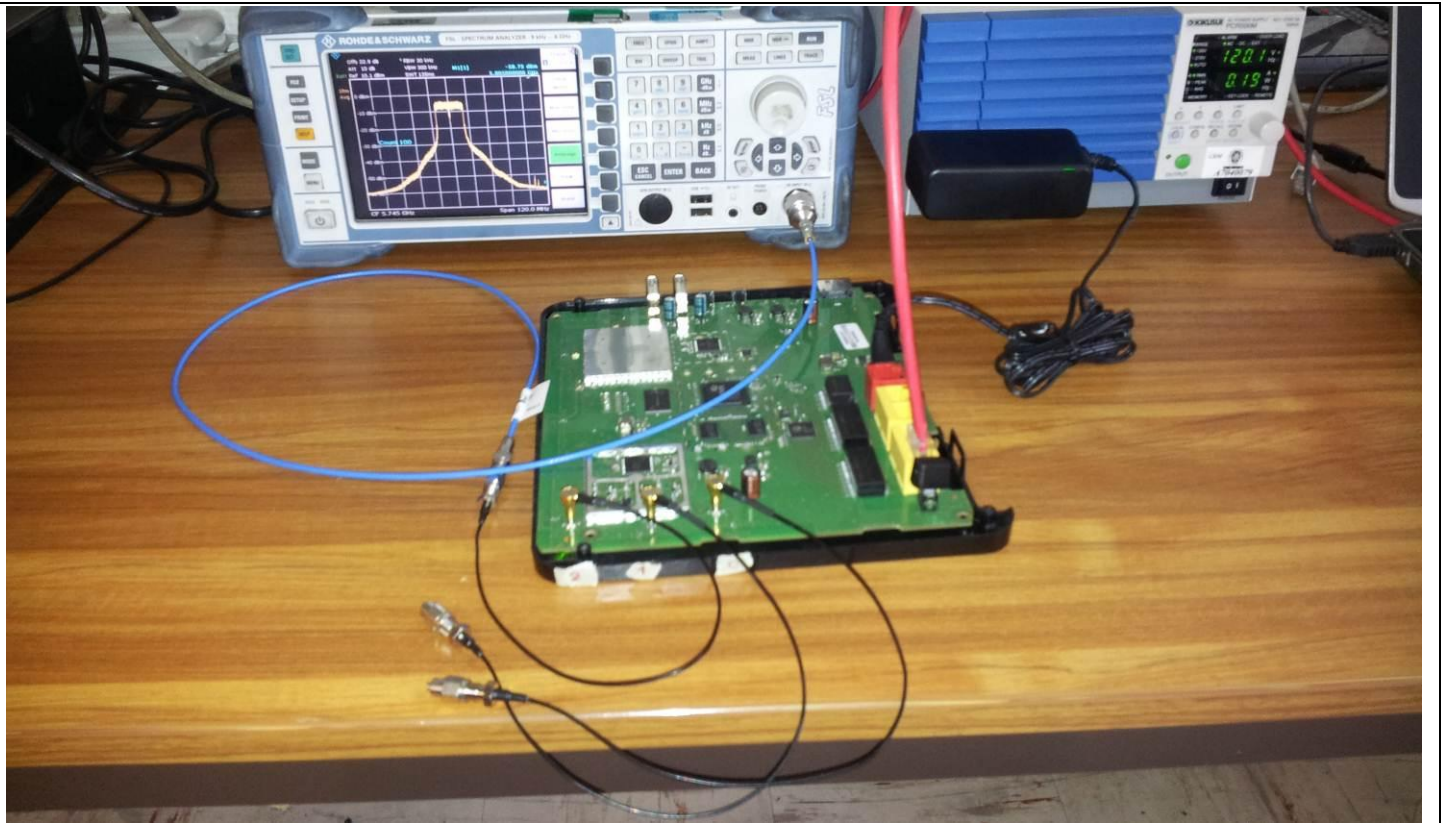
Test performed by : Stéphane PHOUDIAH
Date of test : 2013/07/16
Ambient temperature : 26°C
Relative humidity : 45%

6.2. TEST SETUP

The Equipment Under Test is installed on a table and set in permanent emission with modulation. Measurement is performed with a spectrum analyzer on the EUT conducted access. The product has been tested according to the FCC KDB 558074 D01 DTS Meas Guidance v03r1 § 10.3 & FCC KDB 662911 D01 Multiple Transmitter Output v02 § E) 2) b).

Spectrum Analyzer Setting:

Center frequency= Cmin or Cnom or Cmax
Span= At least 1.5xOBW
Amplitude= Sufficient to observe the signal amplitude
RBW= 30 kHz
VBW= 300 kHz
Sweep= Auto
Sweep Point= 5000 points ($>2 \times \text{SPAN} / \text{RBW}$)
Trace= Average (100)
Detector= RMS



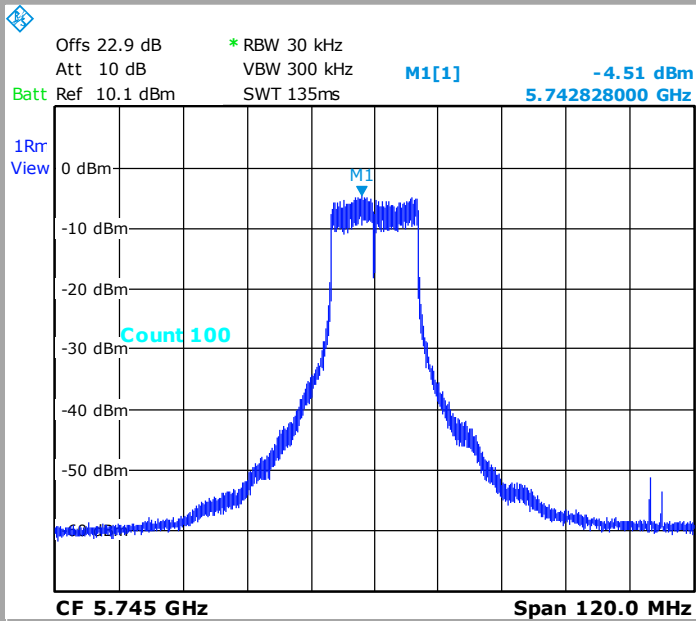
Photograph for Power Spectral Density

6.1. GRAPHICS & RESULTS

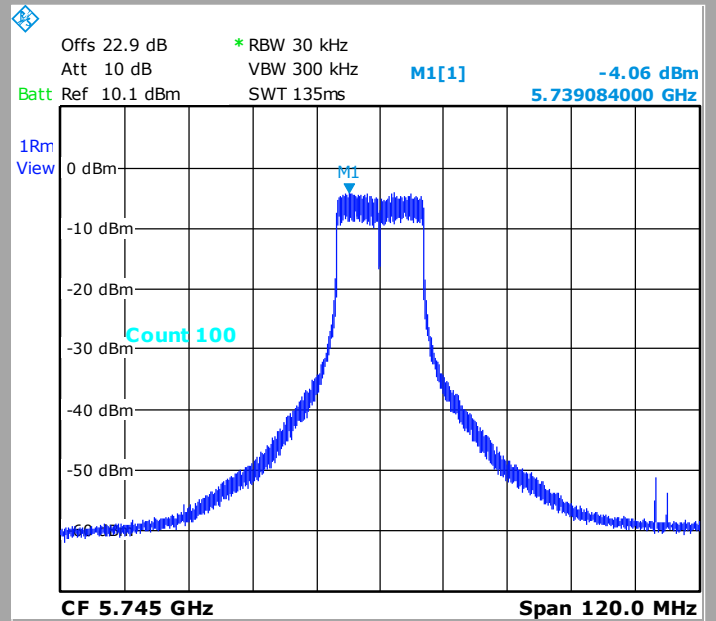
802.11a Cmin

Tx1

Tx2

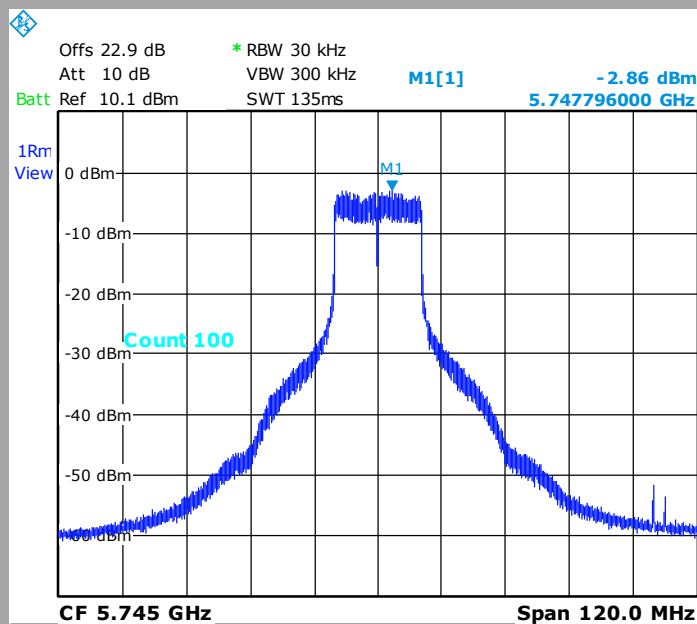


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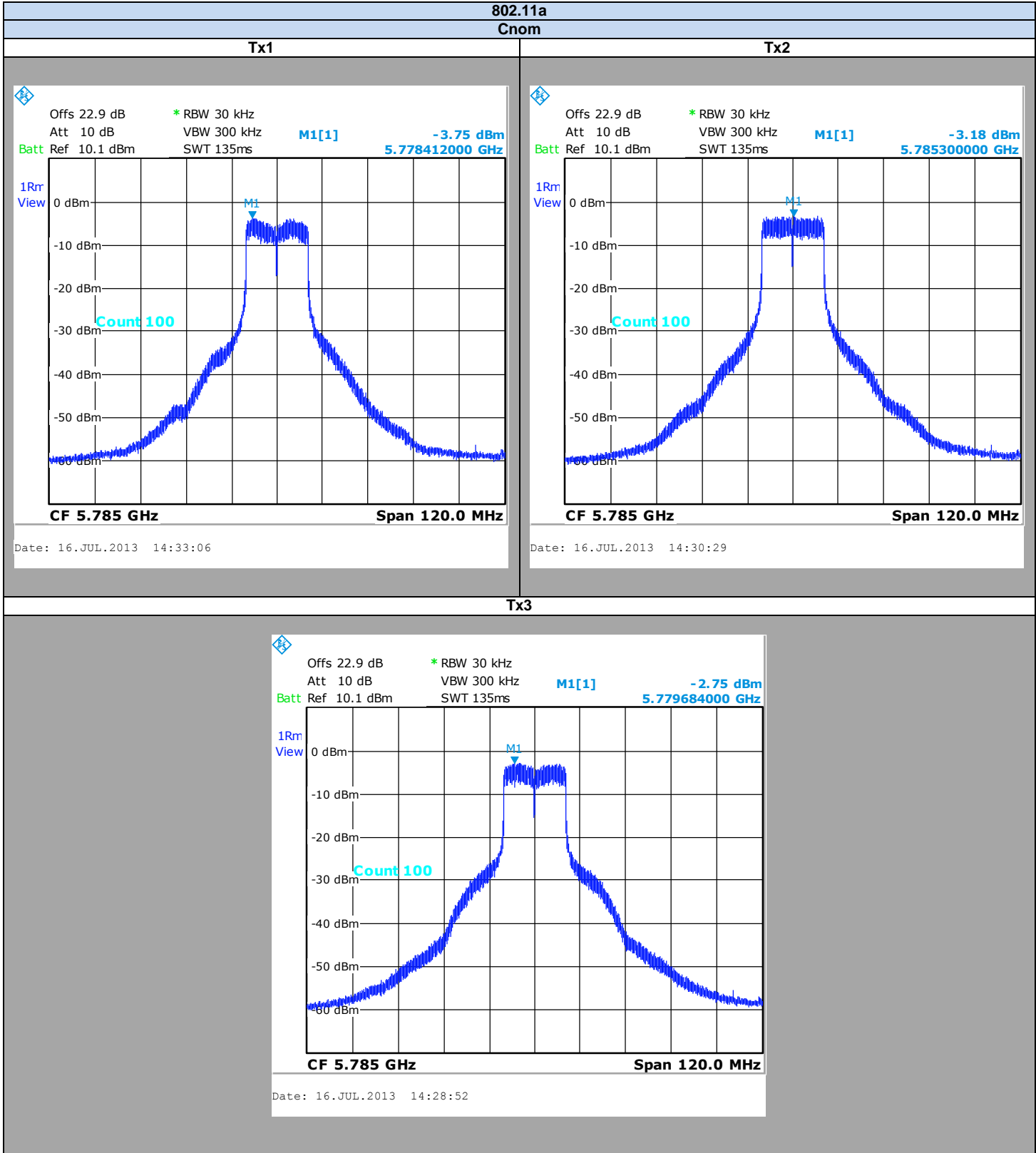


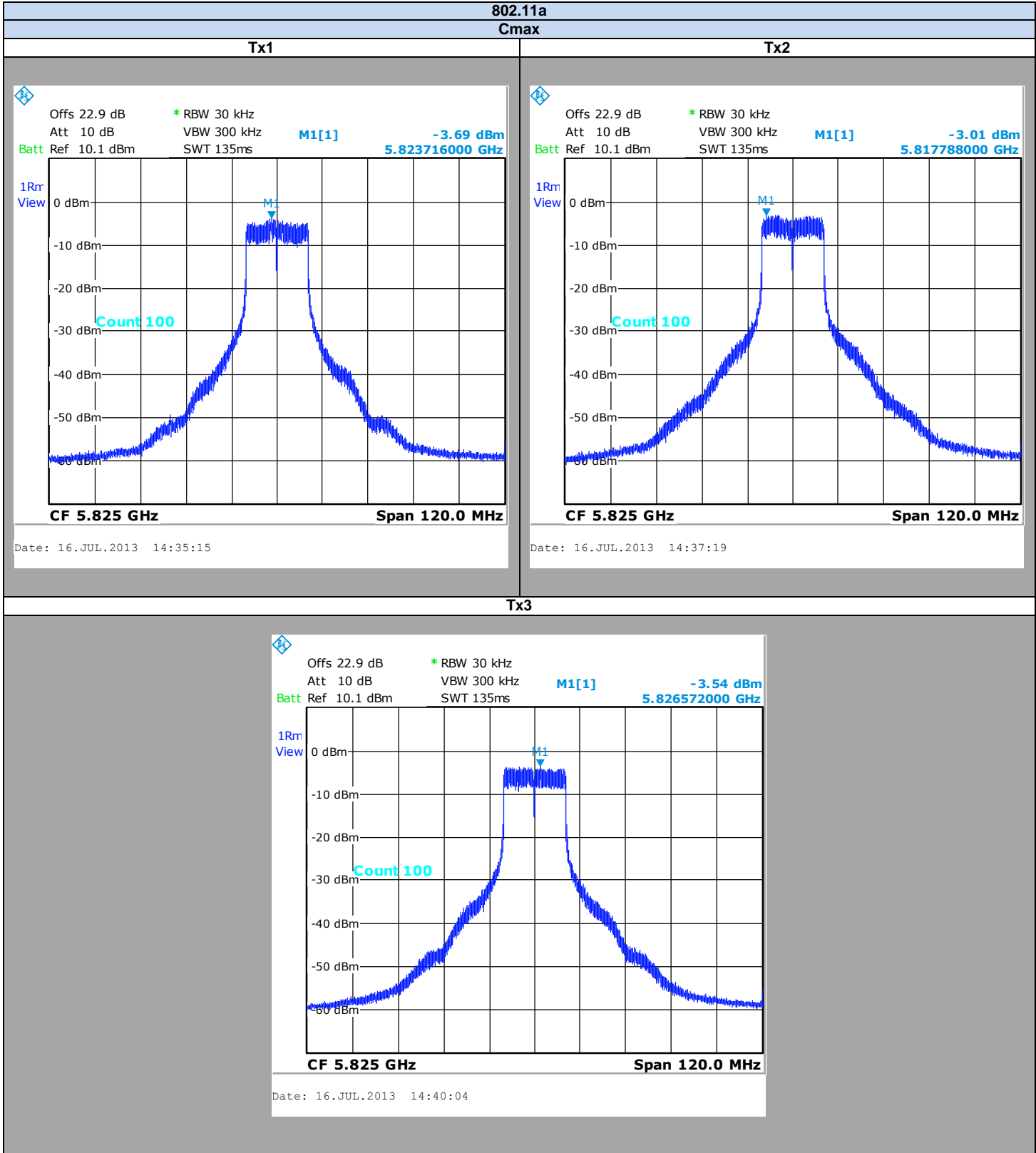
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Tx3



Date: 16.JUL.2013 14:25:37

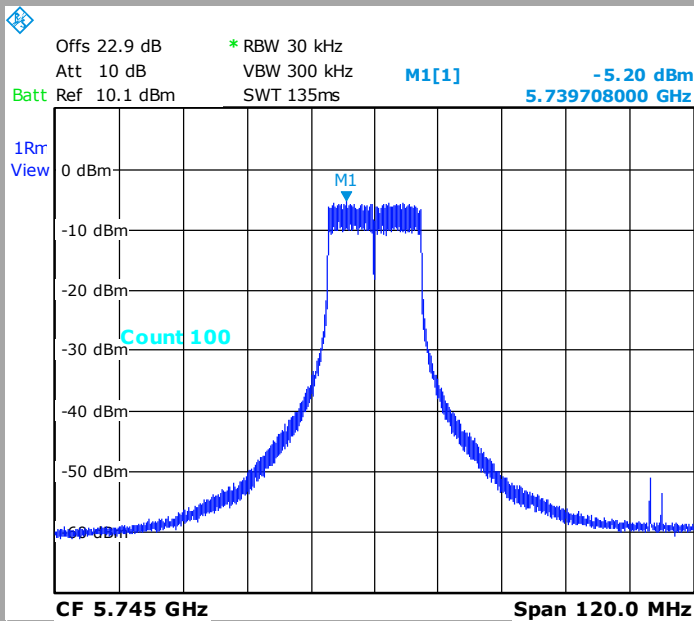




802.11n HT20

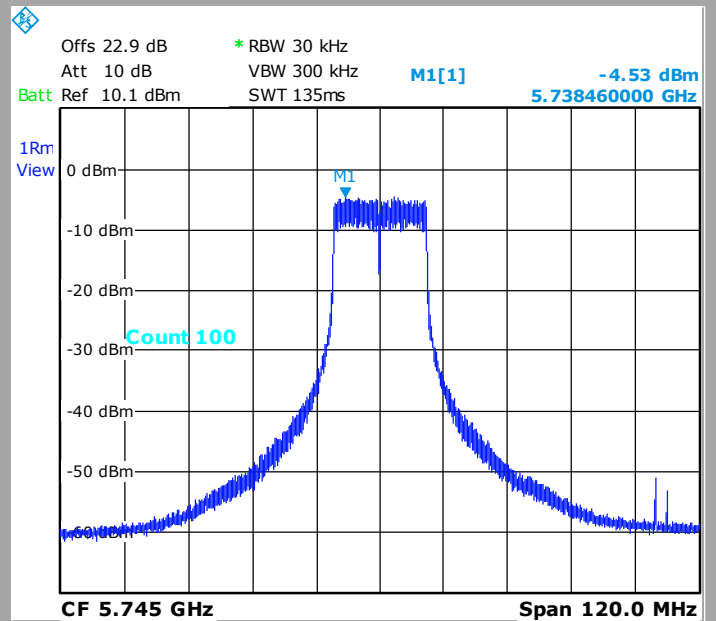
Cmin

Tx1



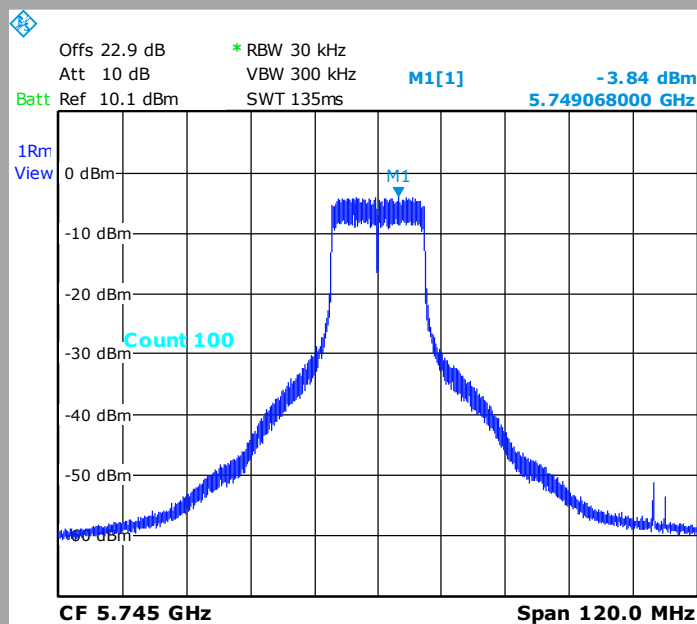
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Tx2



Date: 16.JUL.2013 14:46:36

Tx3



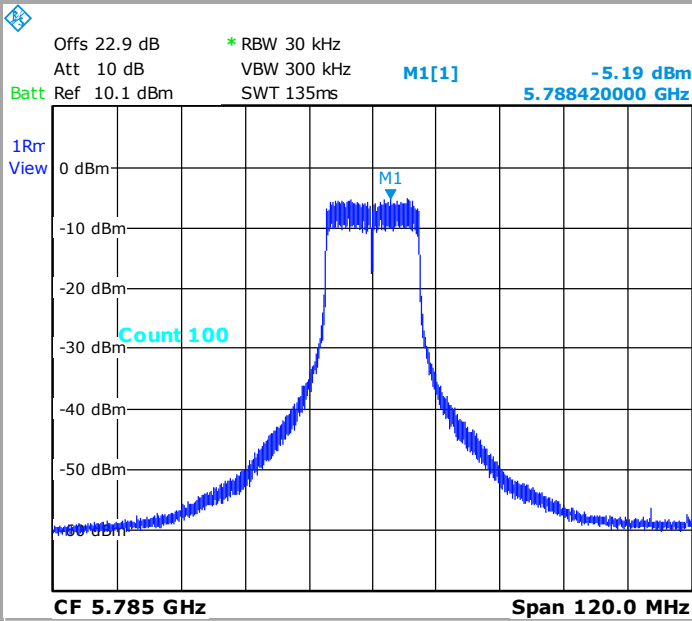
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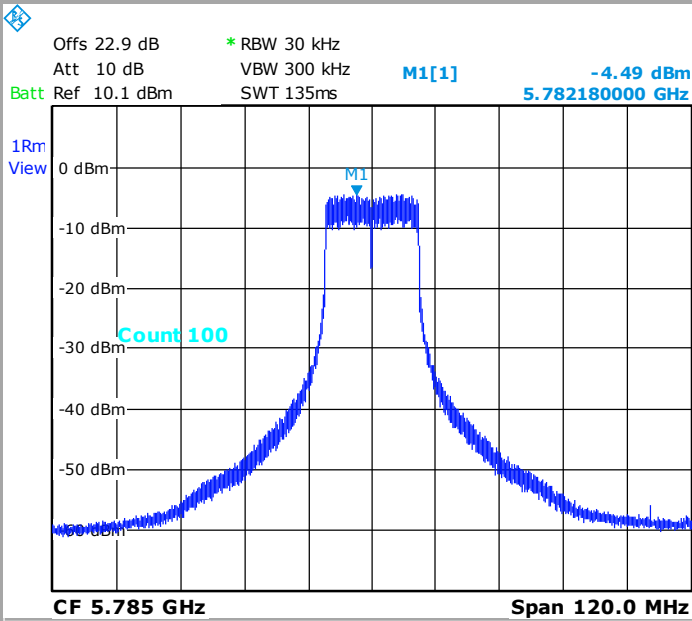
802.11n HT20
Cnom

Tx1

Tx2

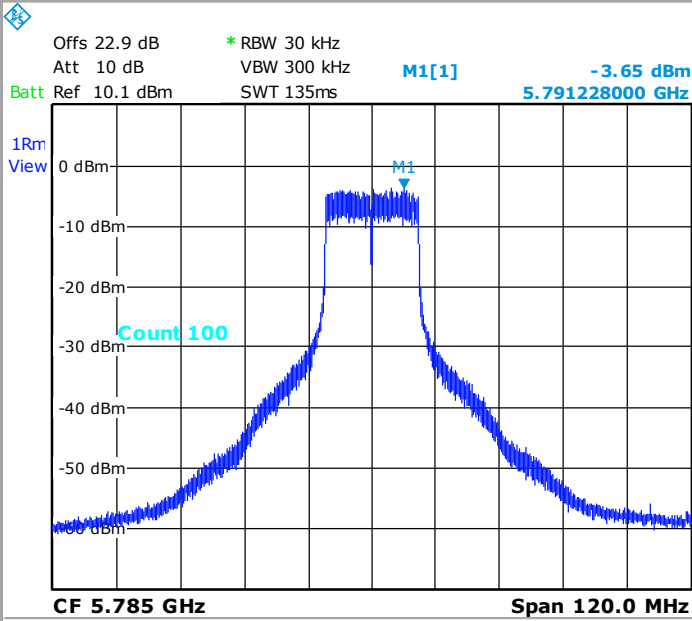


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Tx3



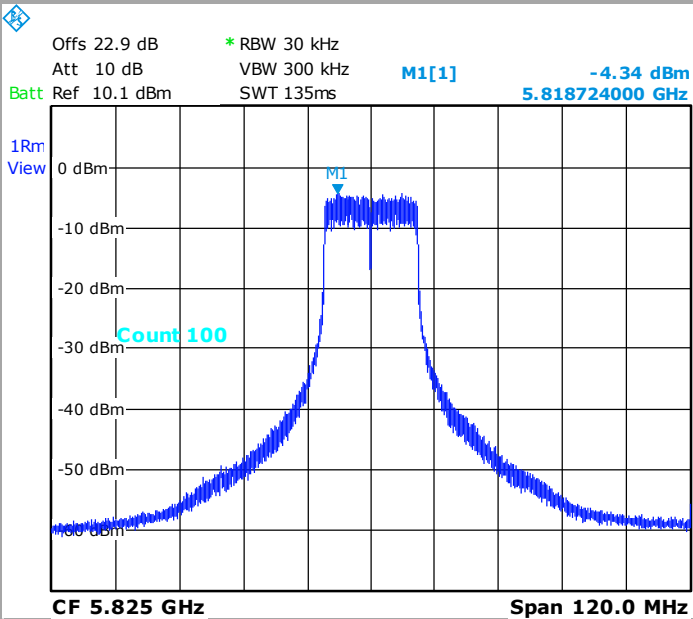
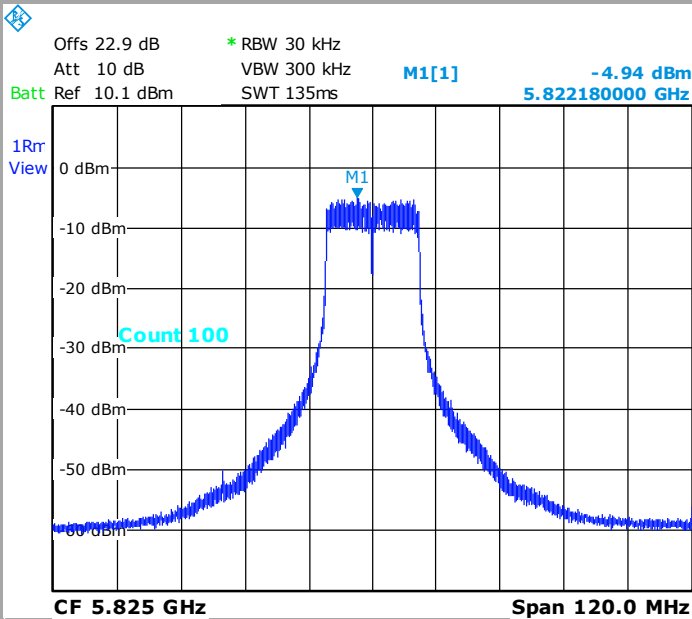
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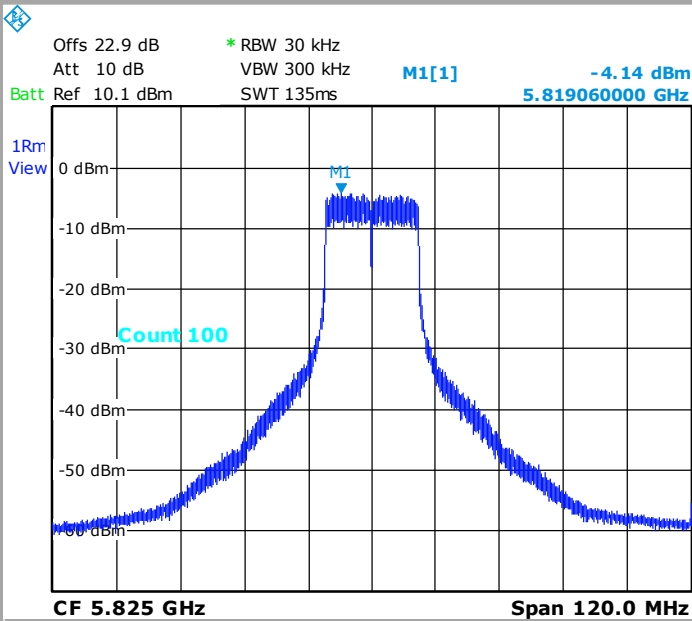
802.11n HT20
Cmax

Tx1

Tx2



Tx3

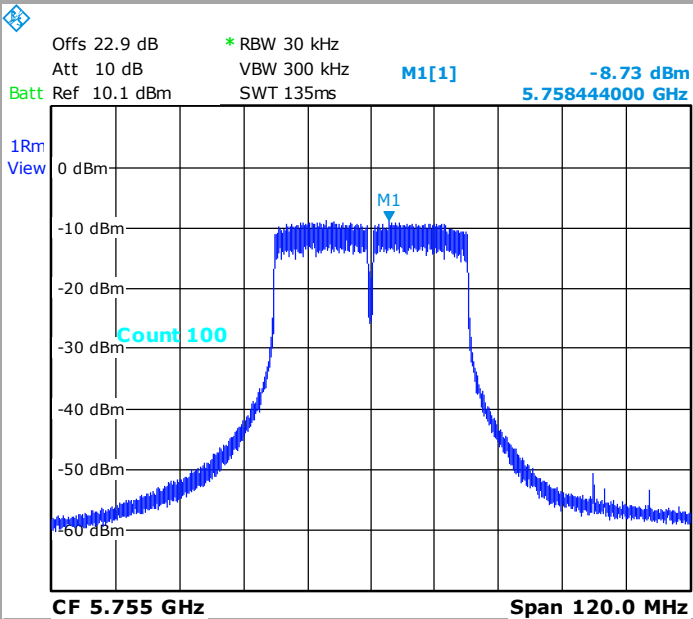
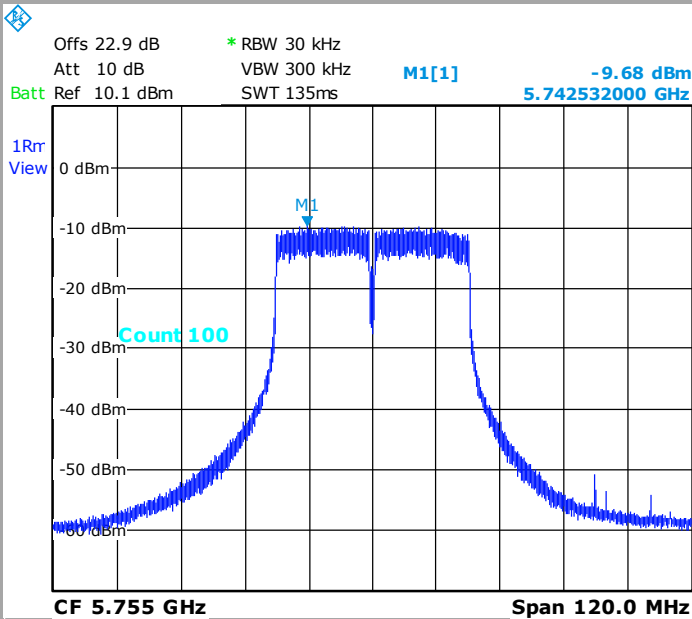




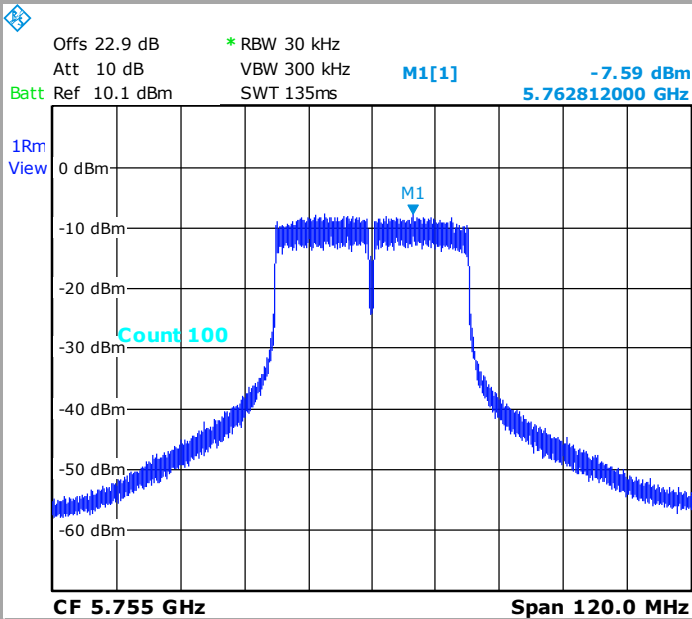
802.11n HT40
Cmin

Tx1

Tx2



Tx3

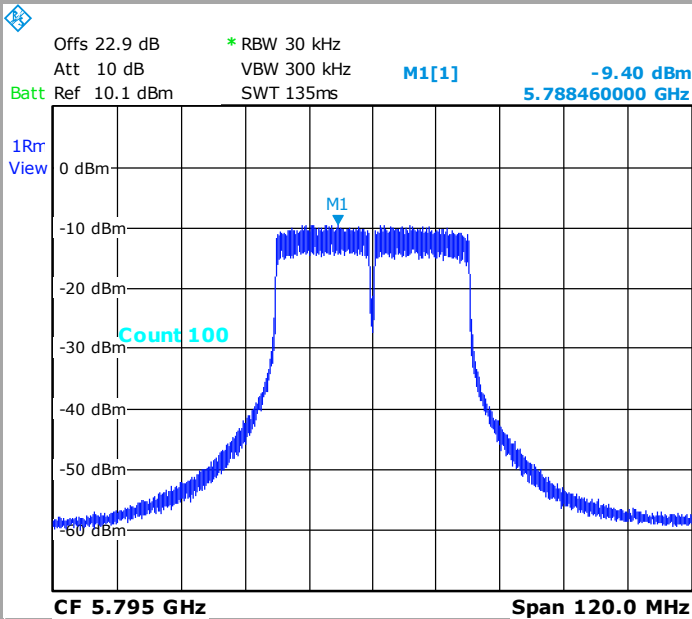




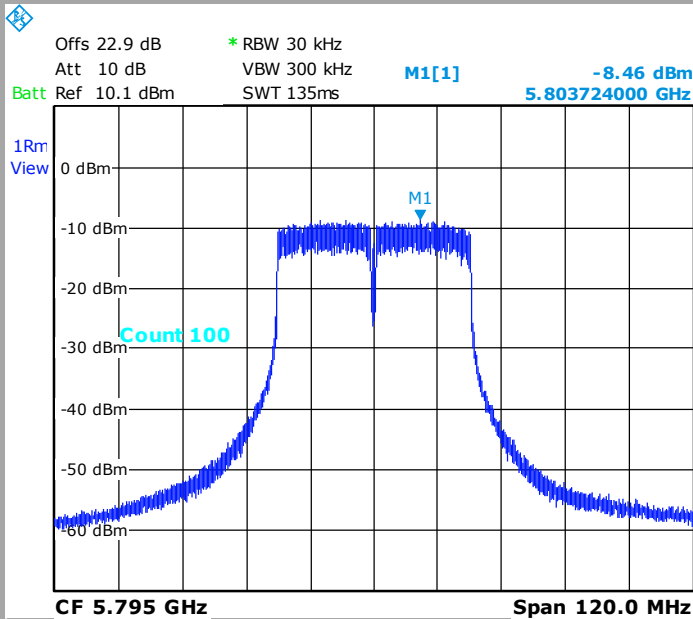
802.11n HT40
Cmax

Tx1

Tx2

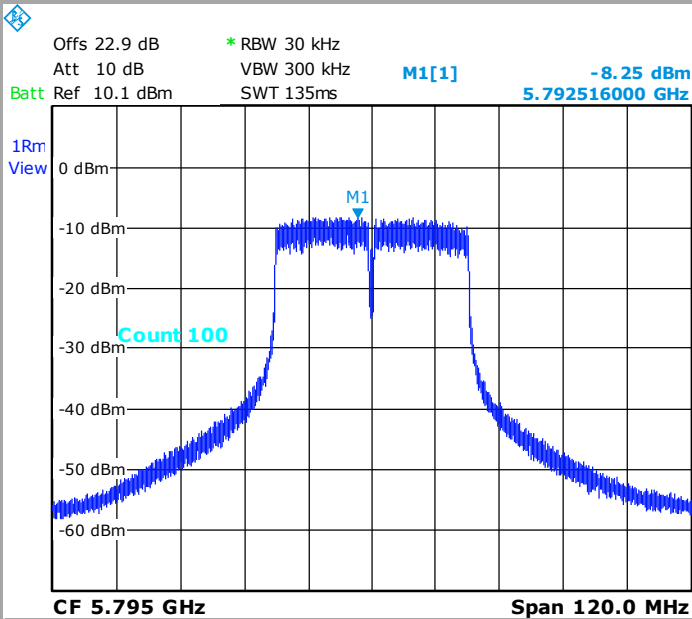


Date: 16.JUL.2013 15:17:26



Date: 16.JUL.2013 15:18:59

Tx3

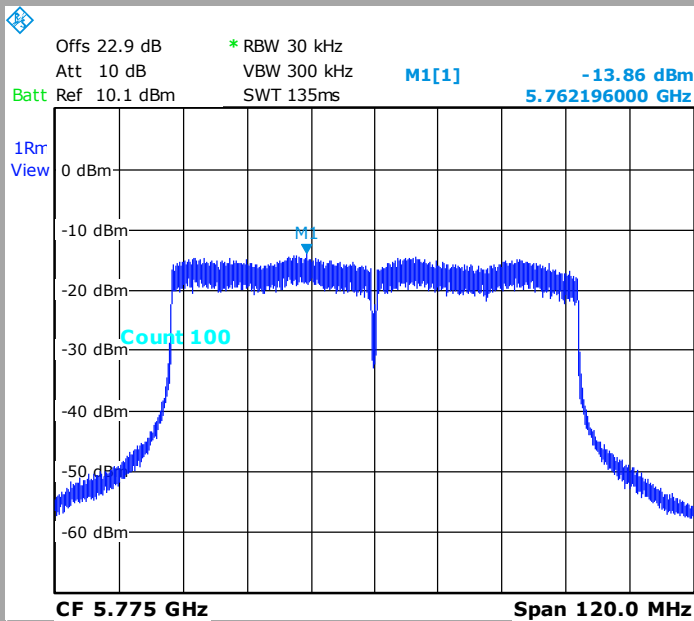


Date: 16.JUL.2013 15:20:24

802.11ac VHT80

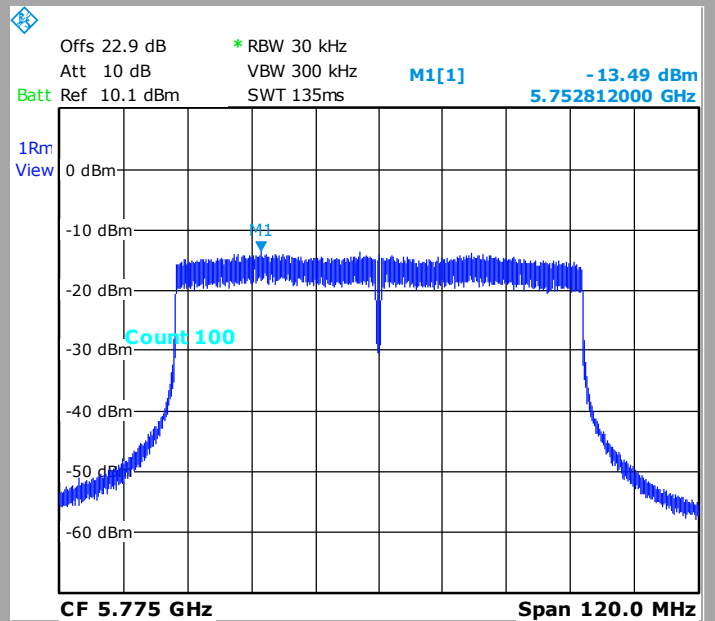
Cnom

Tx1



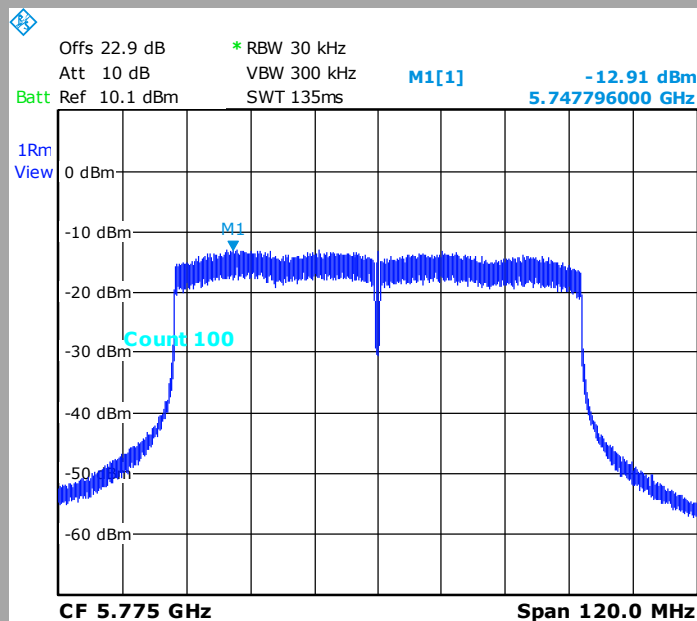
Date: 16.JUL.2013 15:33:45

Tx2



Date: 16.JUL.2013 15:29:26

Tx3



Date: 16.JUL.2013 15:24:48



Cable Loss=1,3dB
Attenuator= 21,6dB

802.11a

Temperature	Tnom		
Voltage	Vnom		
Channel	Cmin	Cnom	Cmax
Power spectral density (dBm/3kHz)	1,02	1,56	1,36

802.11n HT20

Temperature	Tnom		
Voltage	Vnom		
Channel	Cmin	Cnom	Cmax
Power spectral density (dBm/3kHz)	0,28	0,37	0,31

802.11n HT40

Temperature	Tnom		
Voltage	Vnom		
Channel	Cmin	Cmax	
Power spectral density (dBm/3kHz)	-3,81	-3,91	

802.11ac VHT80

Temperature	Tnom		
Voltage	Vnom		
Channel	Cnom		
Power spectral density (dBm/3kHz)	-8,63		

Remark: The power values in these tables are a summation of conducted power on Tx1, Tx2 and TX3.
As recommended, the Power spectral density is measured with a 30kHz RBW, assuming that the same measurement with a 3 kHz RBW will give Power spectral density values lower.

Result: PASS

Limit: → The Power Spectral Density must be lower than 7dBm/3kHz (Antenna Gain=7dBi)



7. UNWANTED EMISSIONS INTO NON-RESTRICTED FREQUENCY BANDS AT THE BAND EDGE

7.1. TEST CONDITIONS

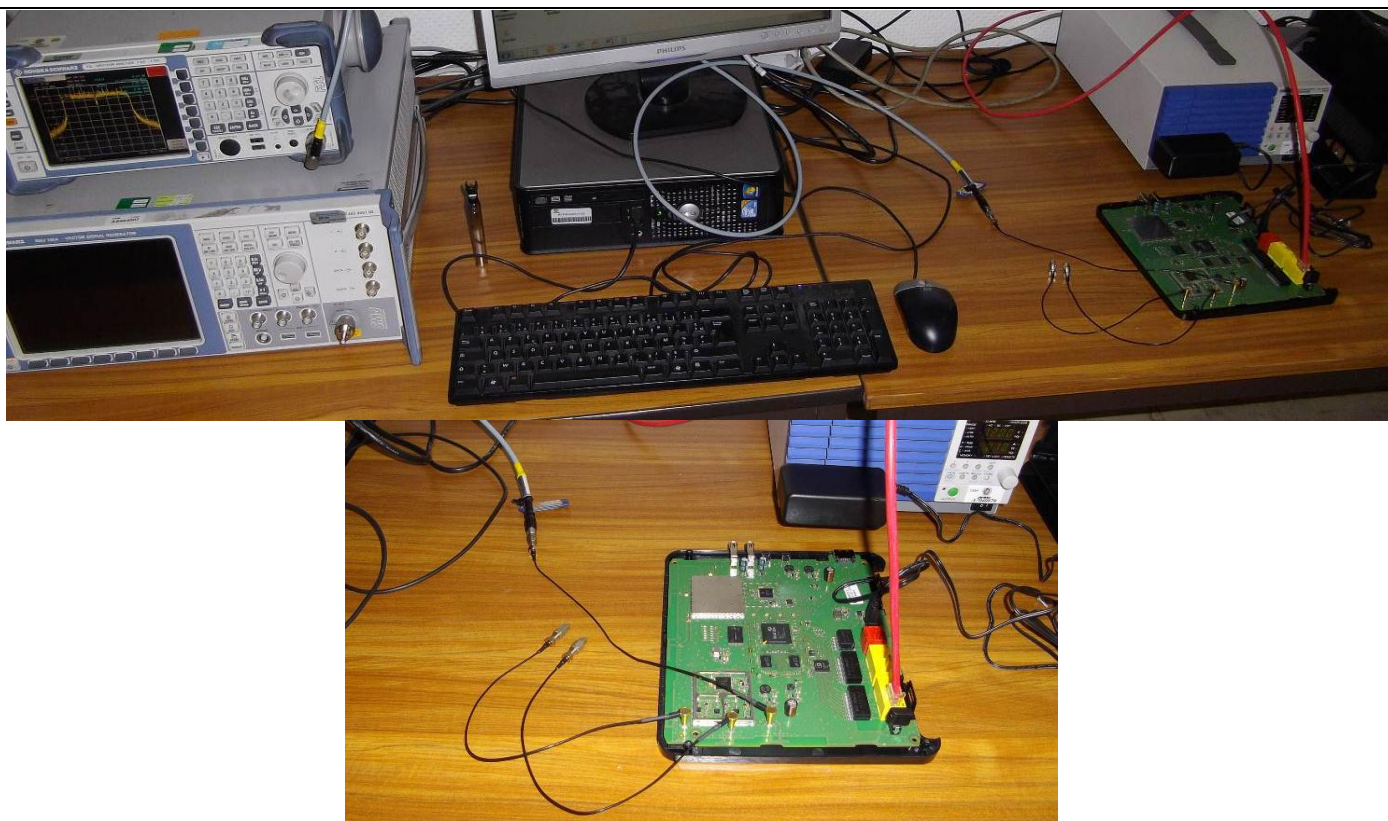
Test performed by : Gilles DE BUYSER
Date of test : 2013/07/05 and 15
Ambient temperature : 21 to 23°C
Relative humidity : 46 to 58%

7.2. TEST SETUP

The Equipment Under Test is installed on a table and set in permanent emission with modulation. Measurement is performed with a spectrum analyzer on the EUT conducted access. The product has been tested according to the FCC KDB 558074 D01 DTS Meas Guidance v03r1 § 11.2 & FCC KDB 662911 D01 Multiple Transmitter Output v02 § E) 3) b).

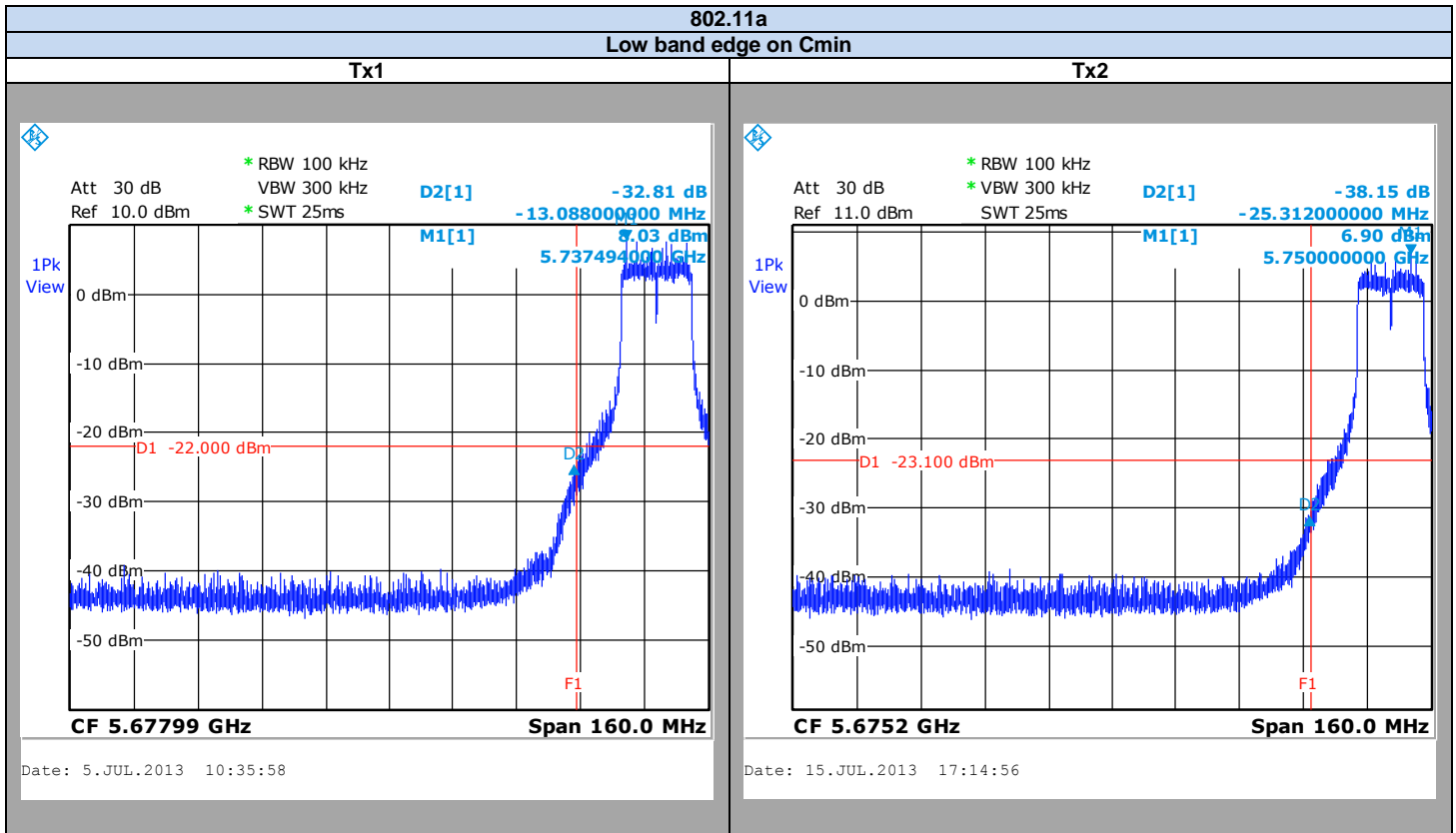
Spectrum Analyzer Setting:

Start frequency= 5600MHz
Stop frequency= 5970MHz
Amplitude= Sufficient to observe the signal amplitude
RBW= 100kHz
VBW= 300kHz
Sweep Time= Auto
Sweep Point= 2500
Trace= Max Hold
Detector= Peak

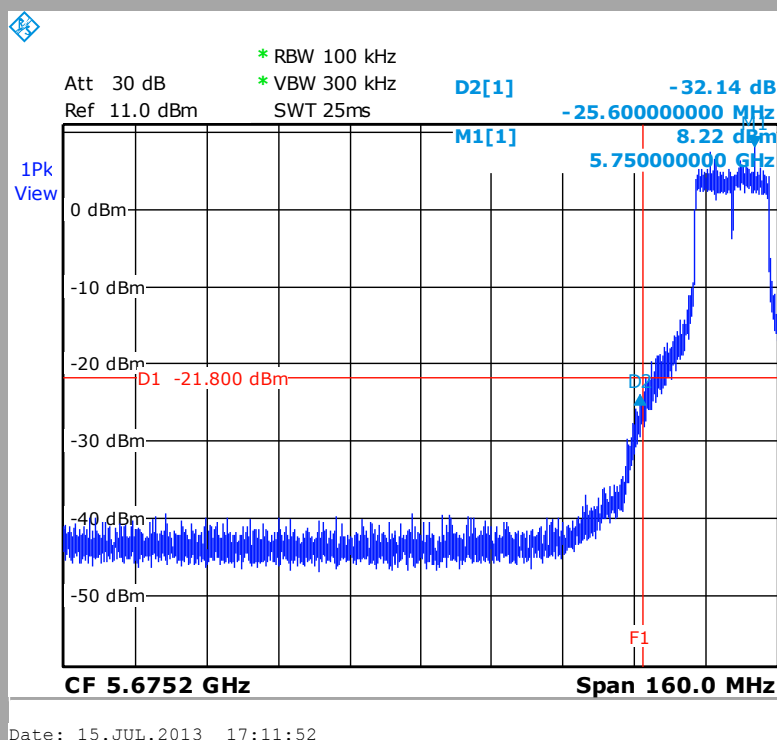


Photograph for Unwanted Emissions into Non-Restricted Frequency Bands At the Band Edge

7.1. GRAPHICS & RESULTS



Tx3

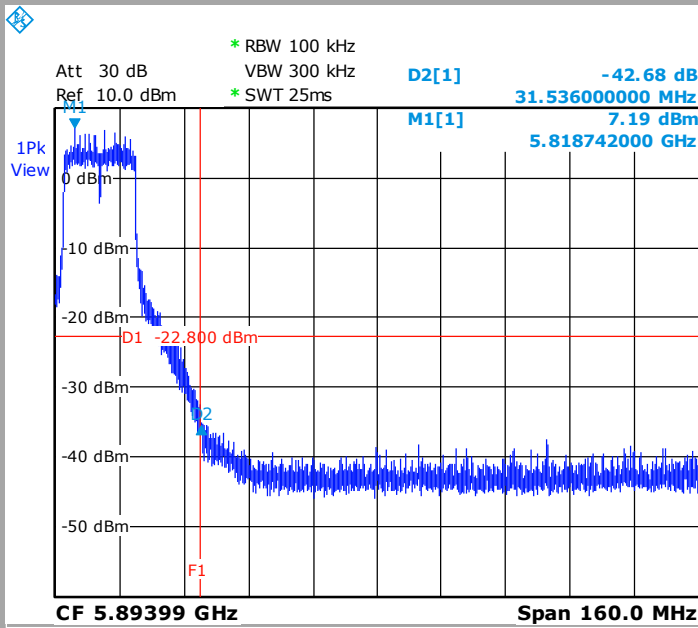


802.11a

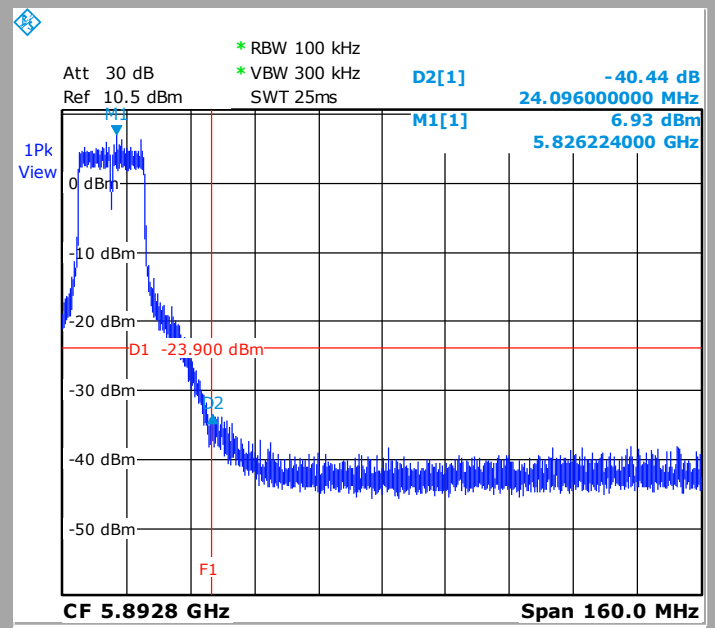
High band edge on Cmax

Tx1

Tx2

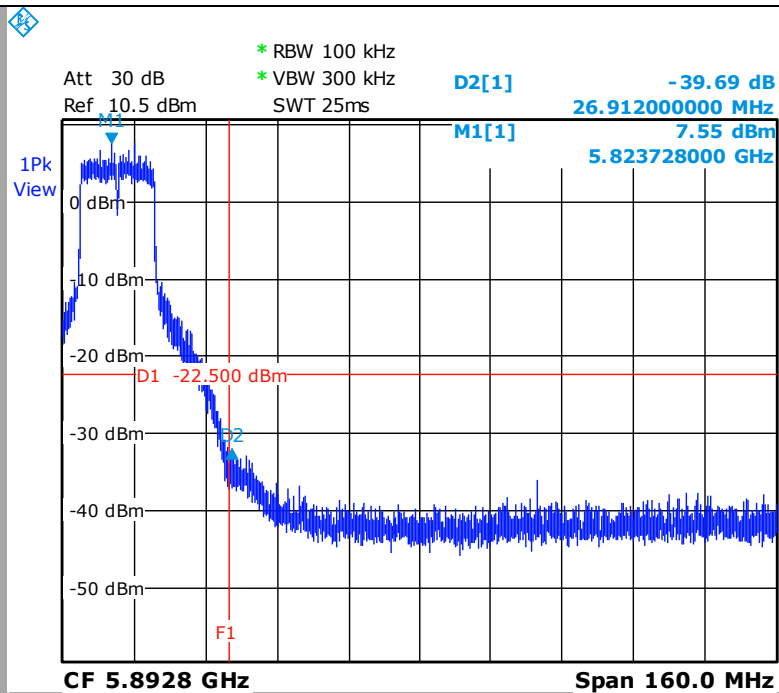


Date: 5.JUL.2013 10:39:15



Date: 15.JUL.2013 18:07:37

Tx3



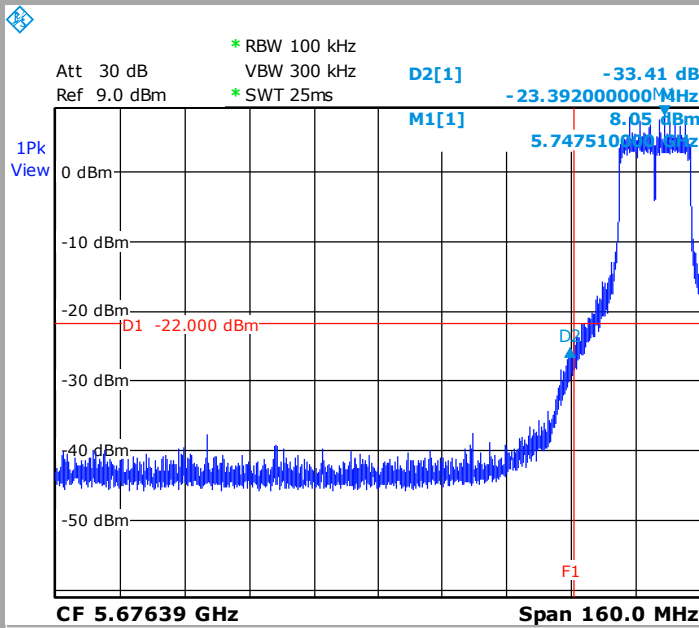
Date: 15.JUL.2013 18:04:19



802.11 nHT20

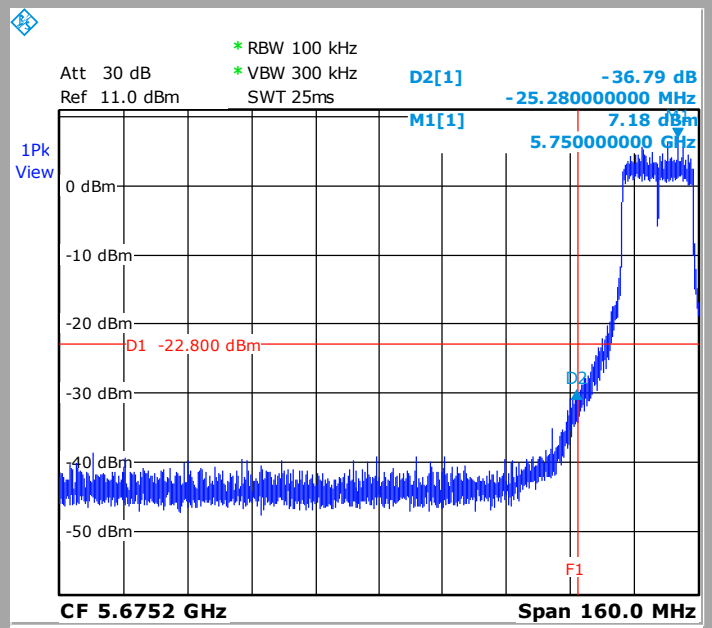
Low band edge on Cmin

Tx1



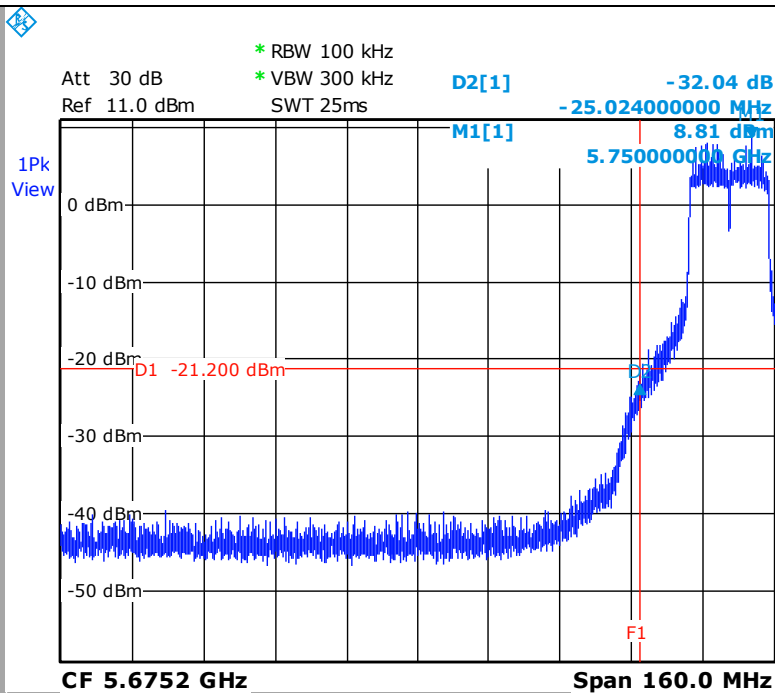
Date: 5.JUL.2013 10:25:33

Tx2



Date: 15.JUL.2013 17:17:22

Tx3

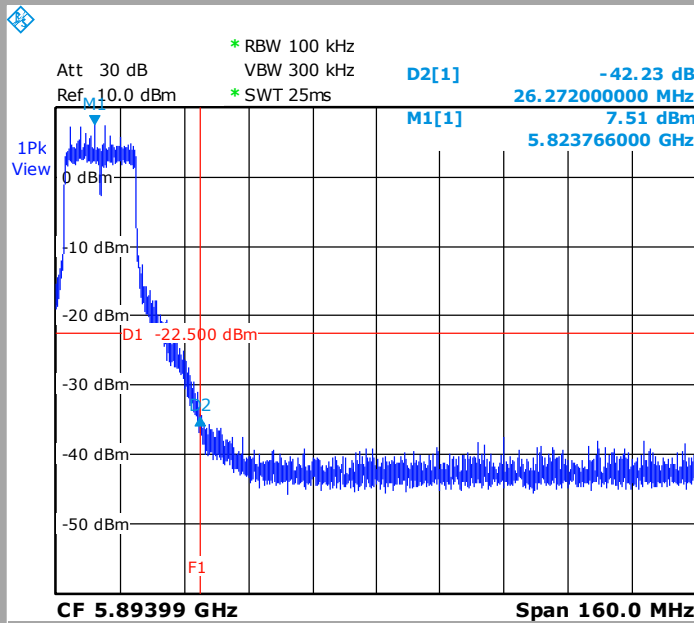


Date: 15.JUL.2013 16:49:17

802.11n HT20

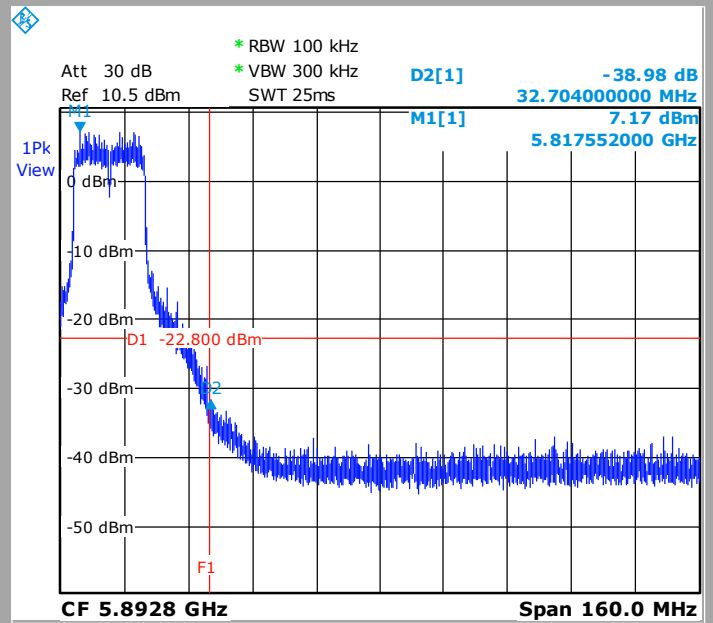
High band edge on Cmax

Tx1



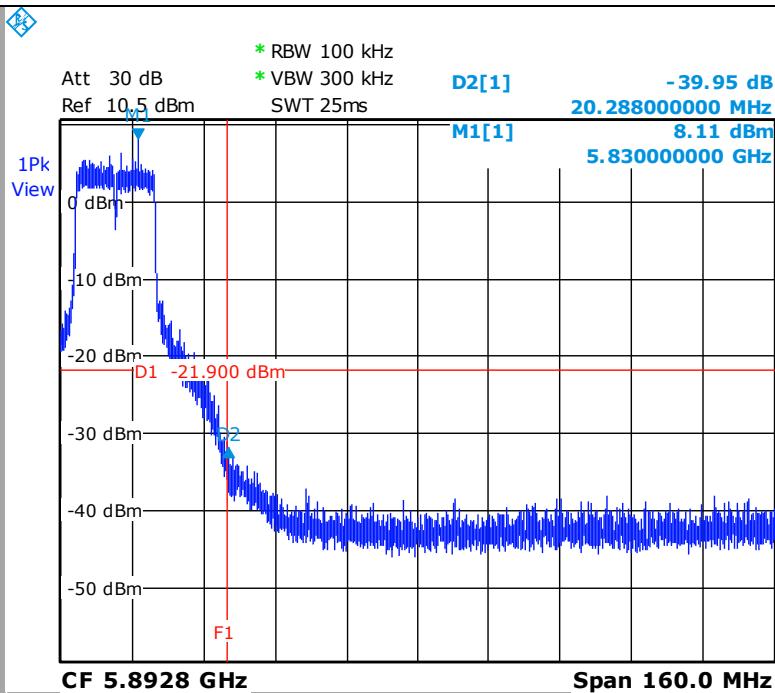
Date: 5.JUL.2013 10:42:15

Tx2



Date: 15.JUL.2013 17:55:51

Tx3

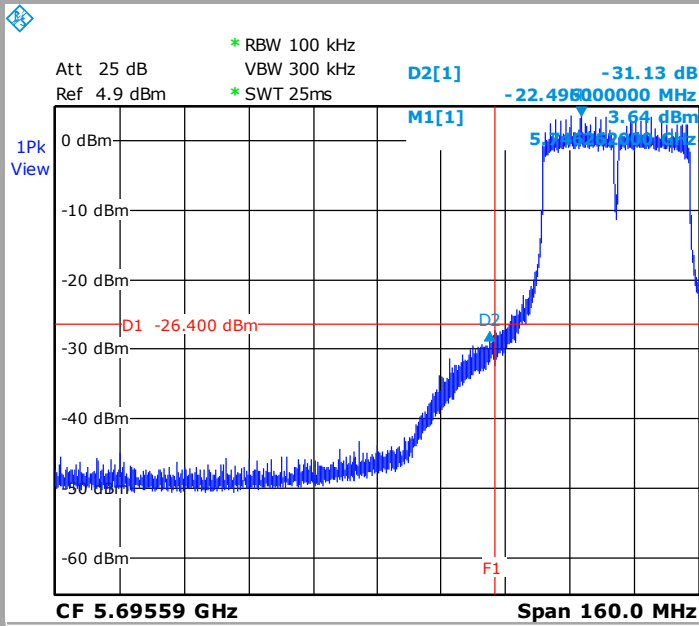


Date: 15.JUL.2013 17:58:11

802.11n HT40

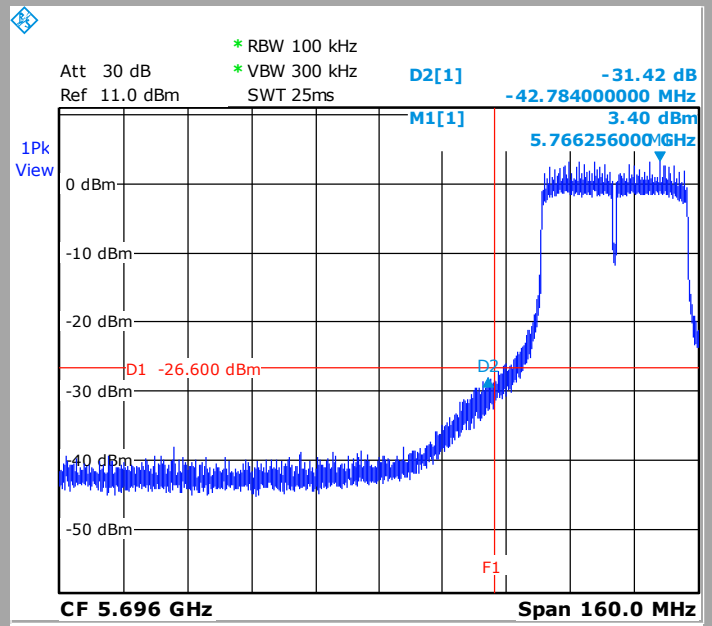
Low band edge on Cmin

Tx1



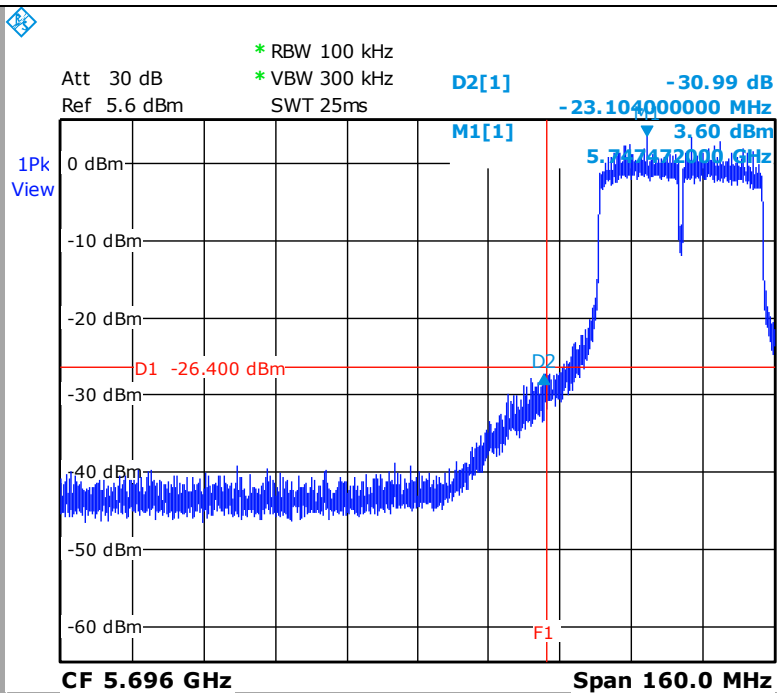
Date: 5.JUL.2013 10:32:50

Tx2



Date: 15.JUL.2013 17:22:01

Tx3



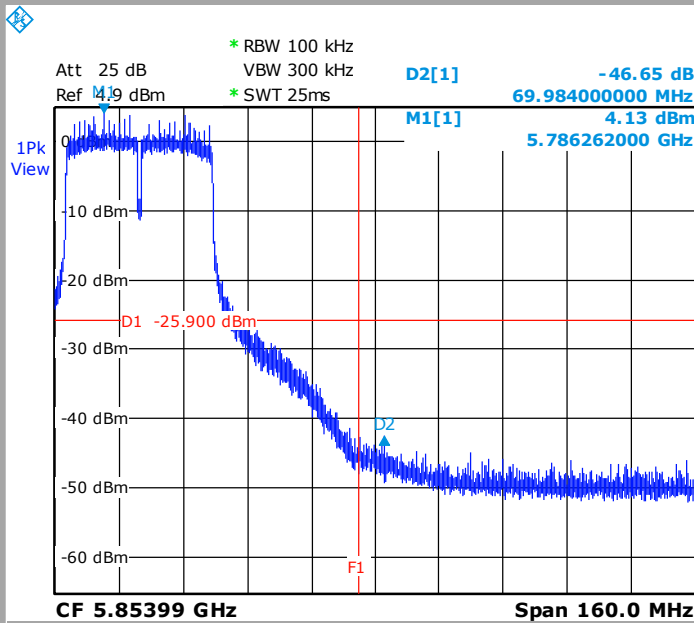
Date: 15.JUL.2013 17:27:56



802.11n HT40

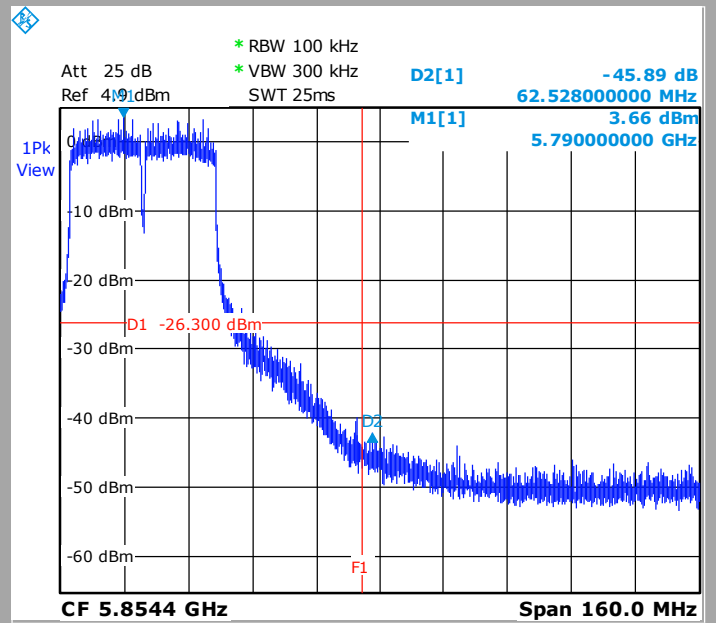
High band edge on Cmax

Tx1



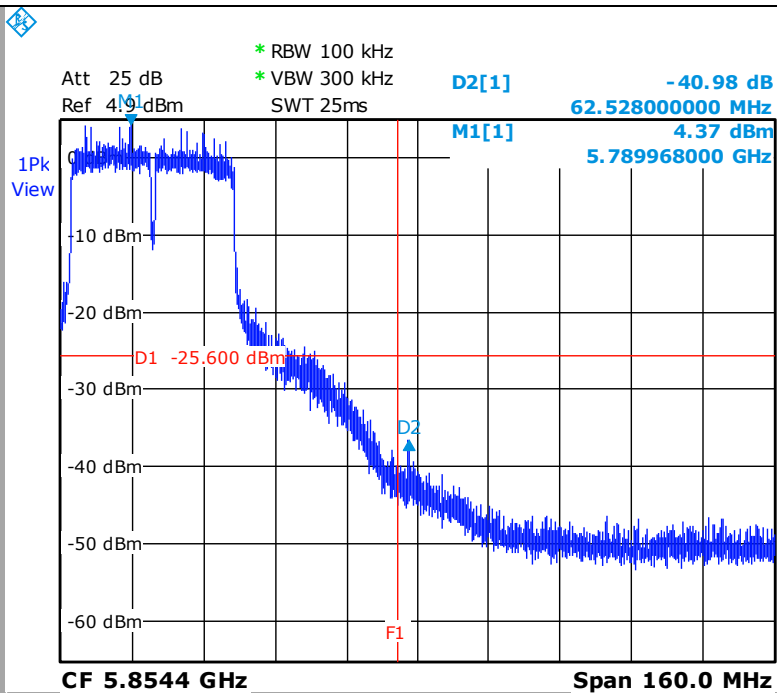
Date: 5.JUL.2013 10:14:41

Tx2



Date: 15.JUL.2013 17:52:34

Tx3



Date: 15.JUL.2013 17:50:39

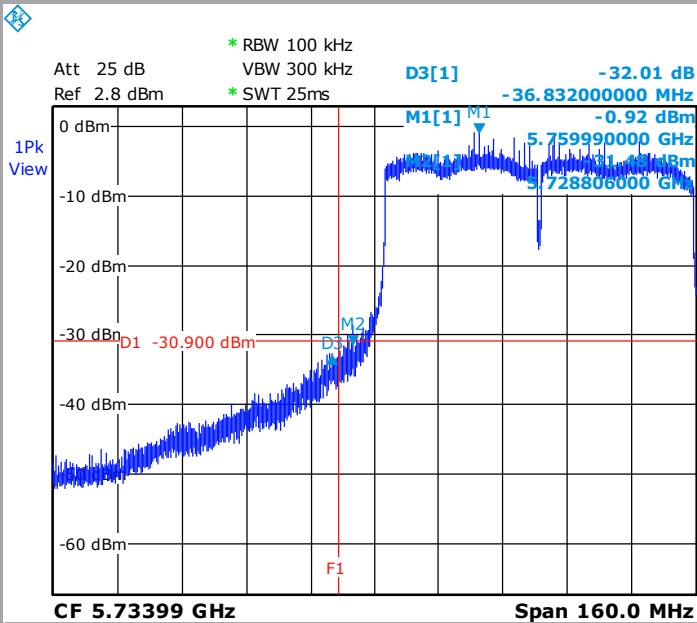


802.11ac VHT80

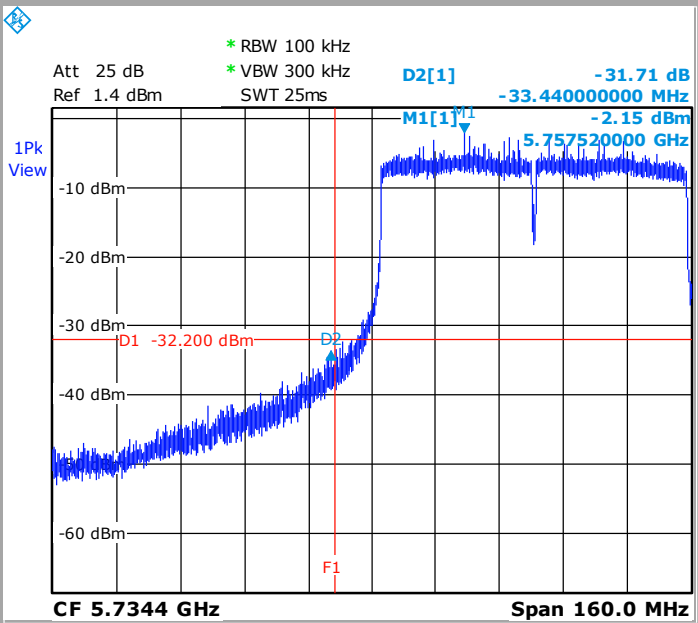
Low band edge on Cnom

Tx1

Tx2

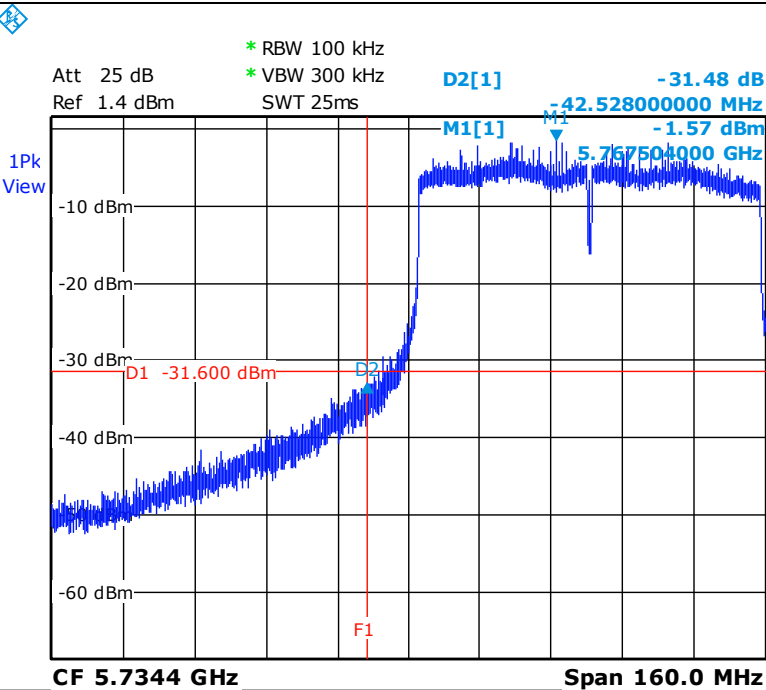


Date: 5.JUL.2013 10:04:55



Date: 15.JUL.2013 17:42:33

Tx3



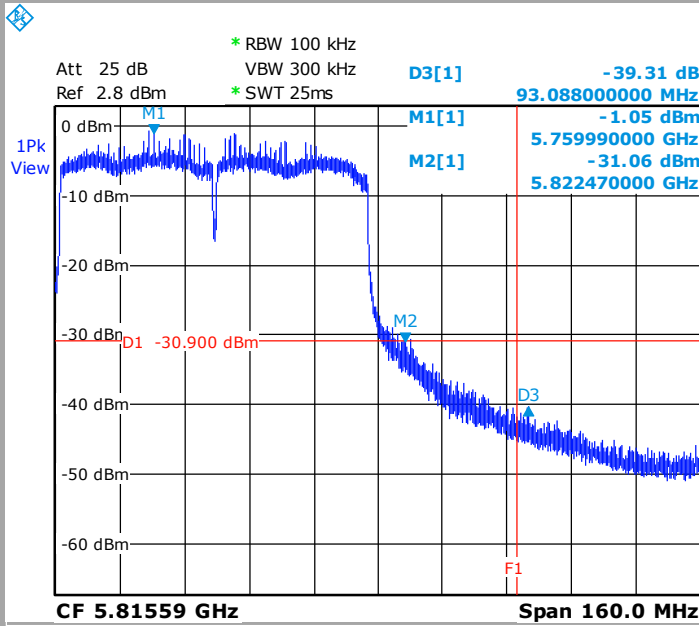
Date: 15.JUL.2013 17:39:15



802.11ac VHT80

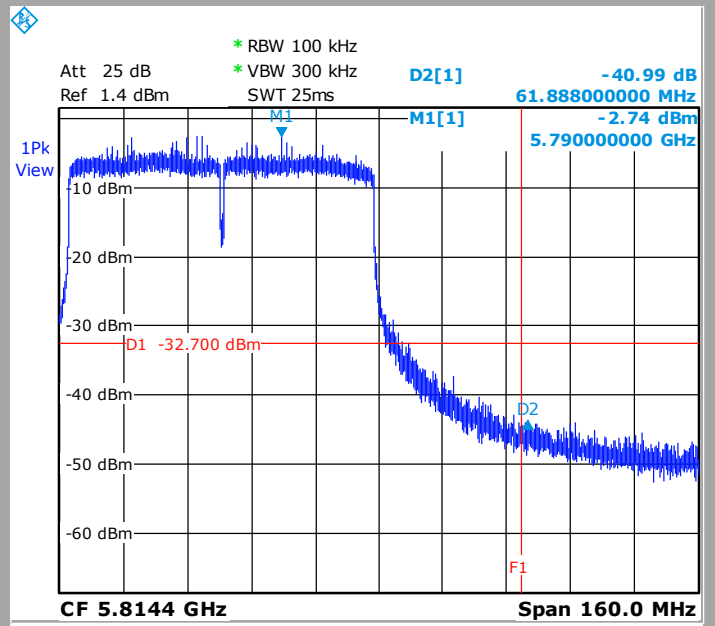
High band edge on Cnom

Tx1



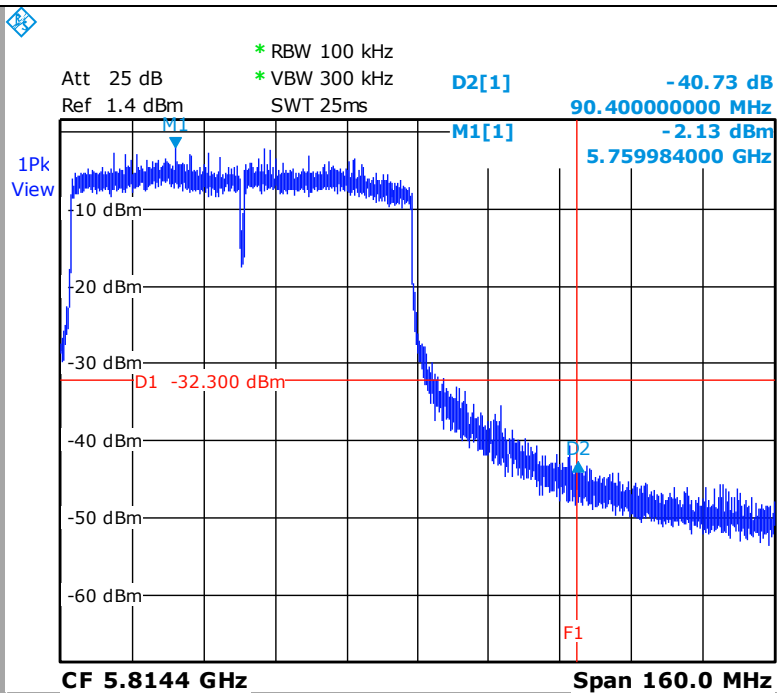
Date: 5.JUL.2013 10:08:23

Tx2



Date: 15.JUL.2013 17:45:04

Tx3



Date: 15.JUL.2013 17:47:12



802.11a

Temperature	Tnom	
Voltage	Vnom	
Conducted Spurious Emission at the Band Edge (MHz)	5725	5850
Spurious Level (dBc)	-32.1	-39.7

802.11n HT20

Temperature	Tnom	
Voltage	Vnom	
Conducted Spurious Emission at the Band Edge (MHz)	5725	5850
Spurious Level (dBc)	-32.0	-39.0

802.11n HT40

Temperature	Tnom	
Voltage	Vnom	
Conducted Spurious Emission at the Band Edge (MHz)	5725	5850
Spurious Level (dBc)	-31,0	-41.0

802.11ac VHT80

Temperature	Tnom	
Voltage	Vnom	
Conducted Spurious Emission at the Band Edge (MHz)	5725	5850
Spurious Level (dBc)	-31.5	-39.3

Result: PASS

Limit: → All Spurious Emissions must be at least 30dB below the Fundamental Radiator Level at the Band Edge "5725MHz & 5850MHz"



8. UNWANTED EMISSIONS INTO NON-RESTRICTED FREQUENCY BANDS

8.1. TEST CONDITIONS

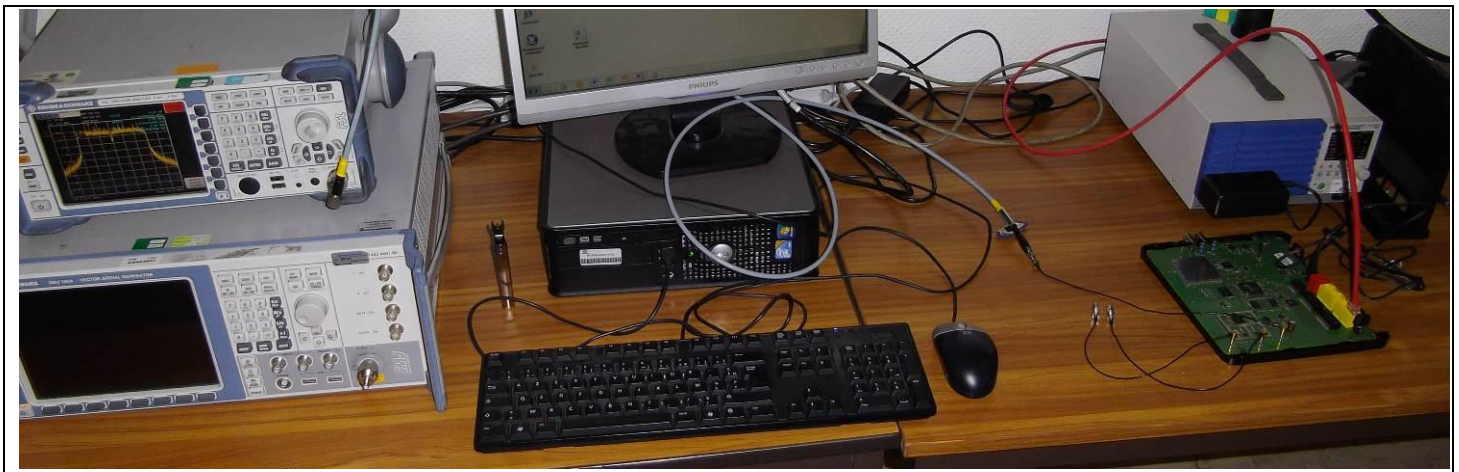
Test performed by : Gilles DE BUYSER
Date of test : 2013/07/05
Ambient temperature : 23°C
Relative humidity : 58%

8.2. TEST SETUP

The Equipment Under Test is installed on a table and set in permanent emission with modulation. Measurement is performed with a spectrum analyzer on the EUT conducted access. The product has been tested according to the FCC KDB 558074 D01 DTS Meas Guidance v03r1 § 11.3 & FCC KDB 662911 D01 Multiple Transmitter Output v02 § E) 3) b).

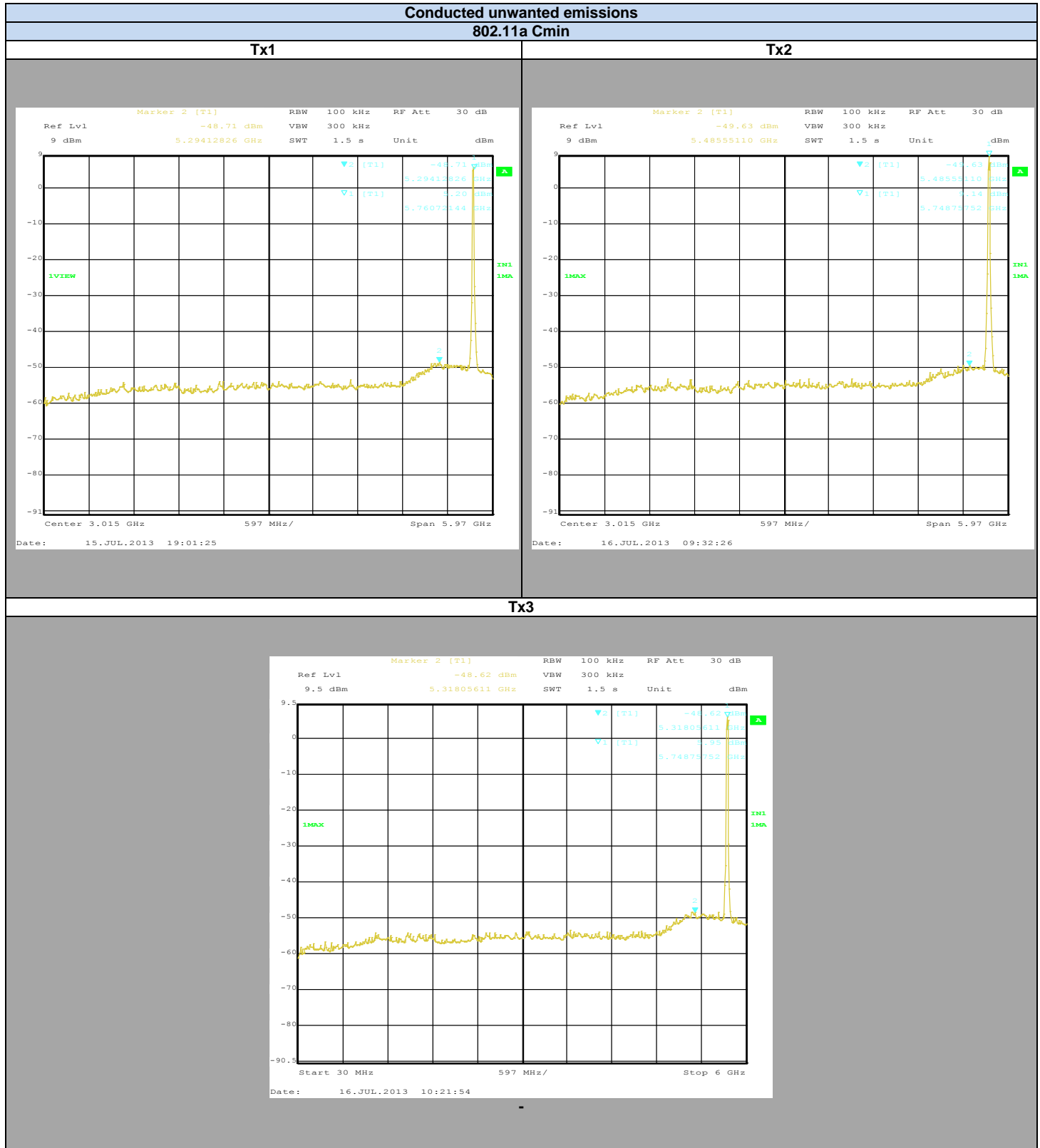
Spectrum Analyzer Setting:

Start frequency= 30MHz
Stop frequency= 40GHz
Amplitude= Sufficient to observe the signal amplitude
RBW= 100kHz
VBW= 300kHz
Sweep Time= Auto
Trace= Max Hold
Detector= Peak



Photograph for Unwanted Emissions into Non-Restricted Frequency Bands

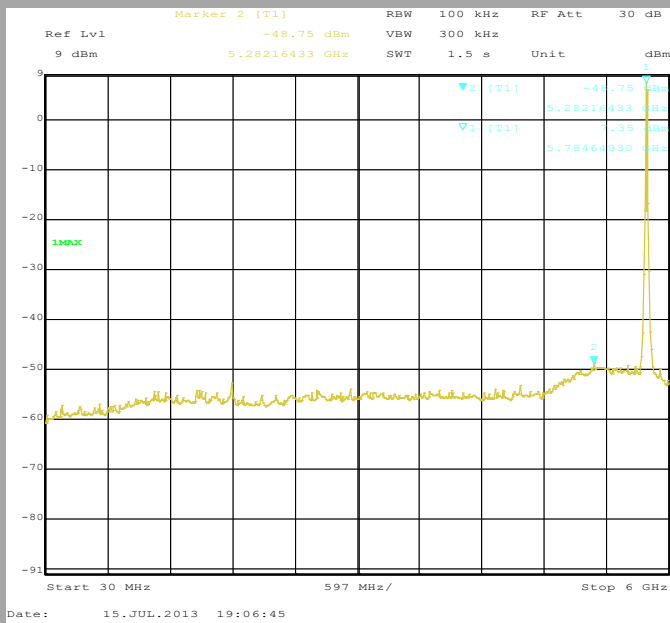
8.3. GRAPHICS & RESULTS



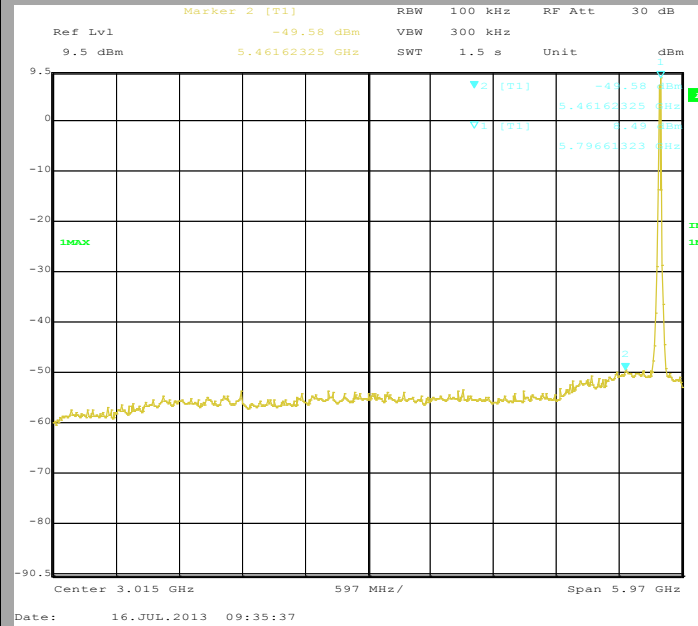


Conducted unwanted emissions
802.11a Cnom

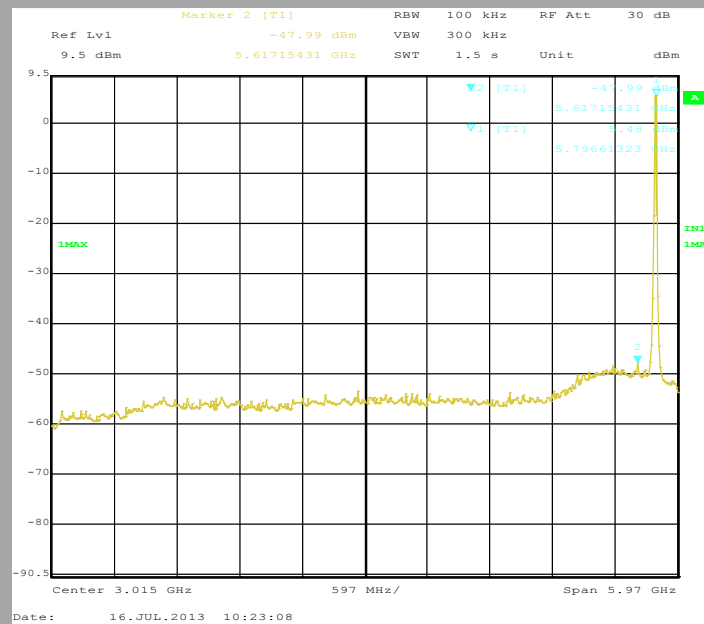
Tx1



Tx2



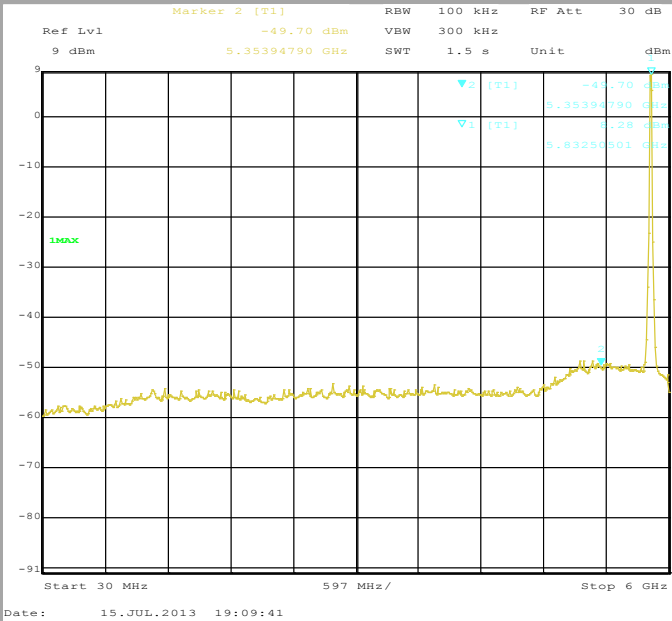
Tx3



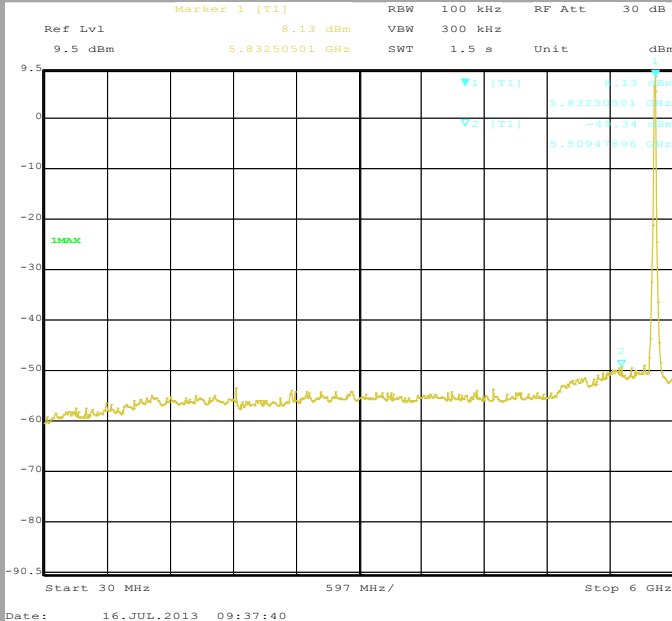


Conducted unwanted emissions
802.11a Cmax

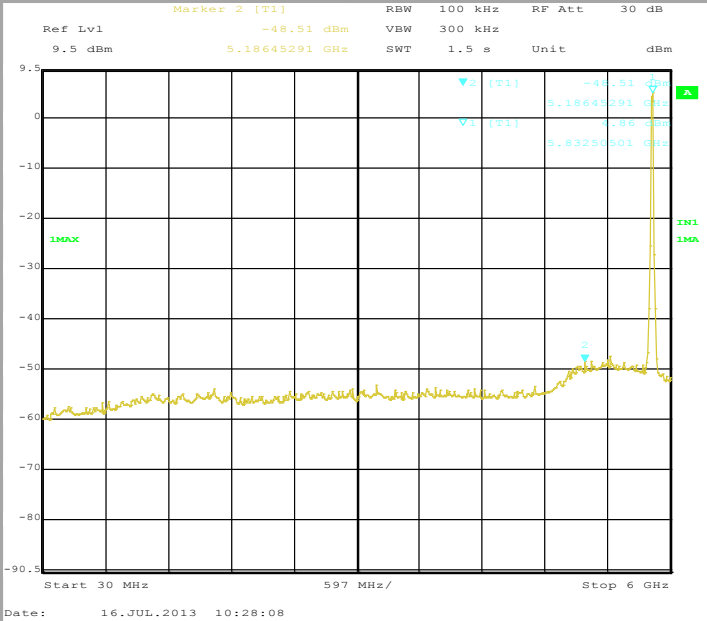
Tx1



Tx2



Tx3

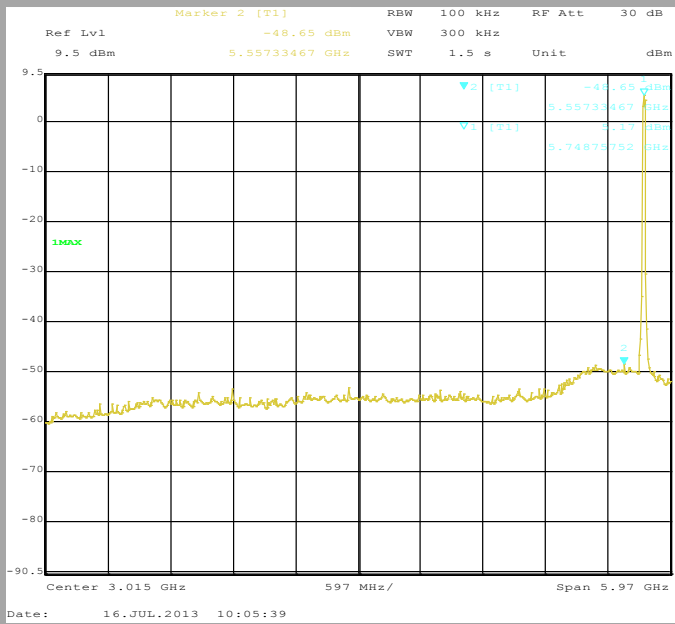




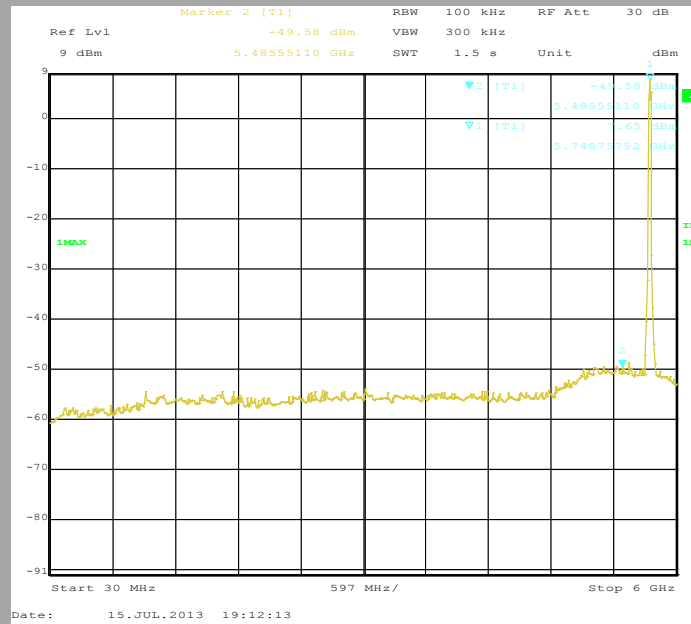
Conducted unwanted emissions in the band edge

802.11n HT20 Cmin

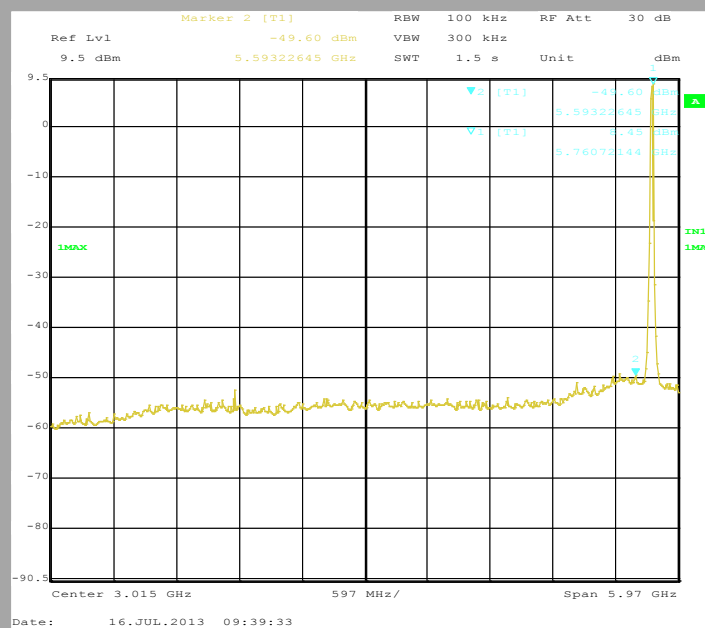
Tx1



Tx2



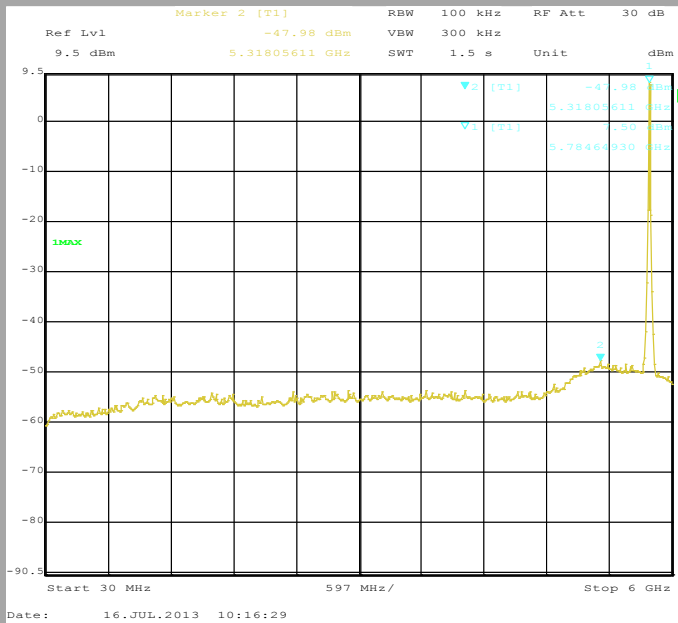
Tx3



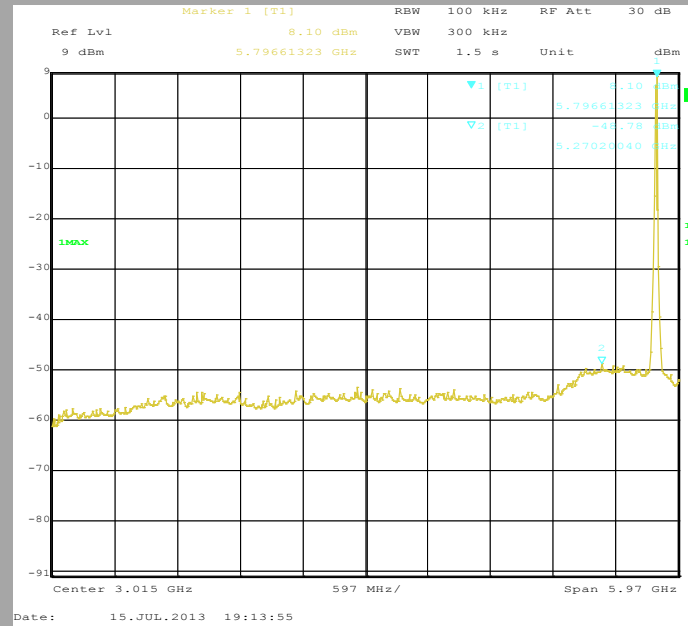


Conducted unwanted emissions
802.11n HT20 Cnom

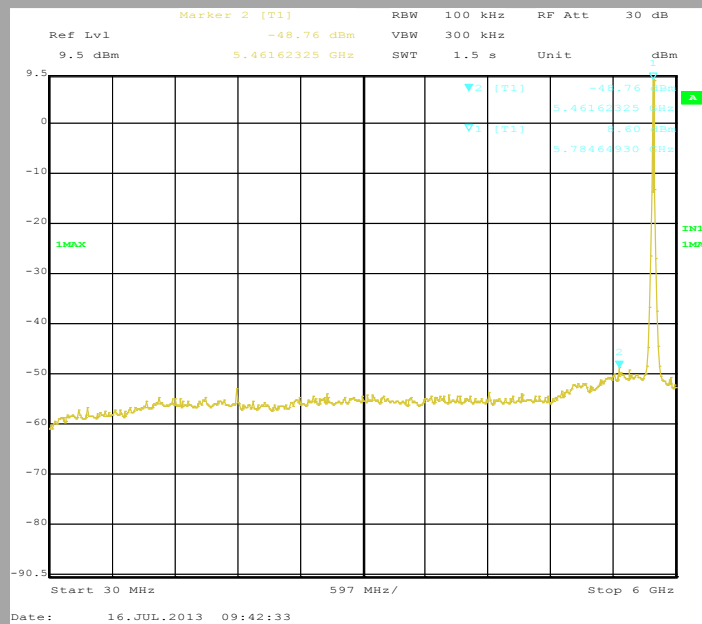
Tx1



Tx2



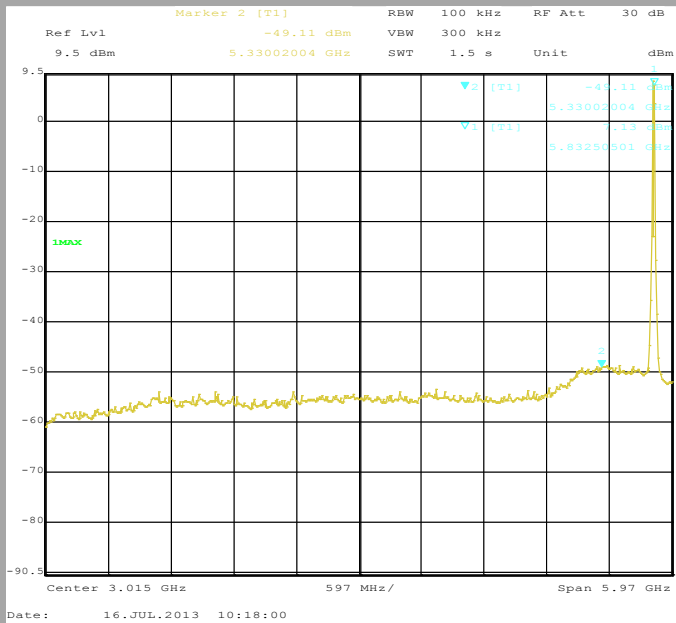
Tx3



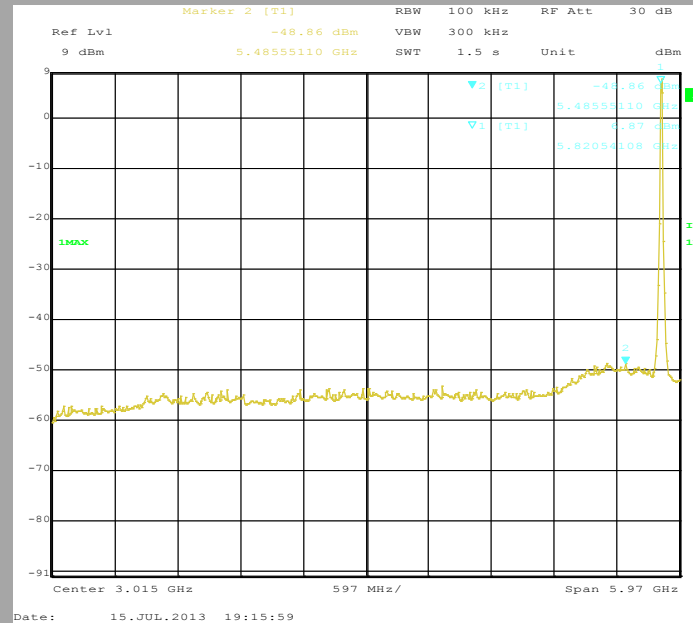


Conducted unwanted emissions
802.11n HT20 Cmax

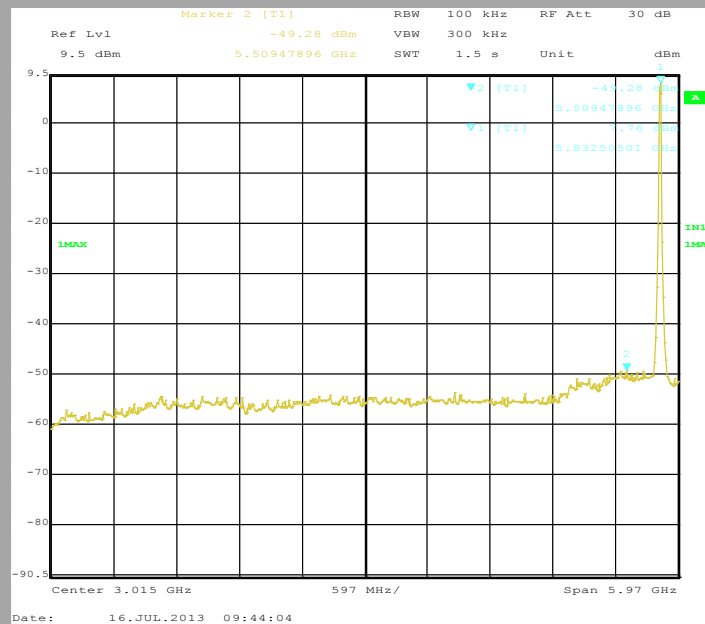
Tx1



Tx2



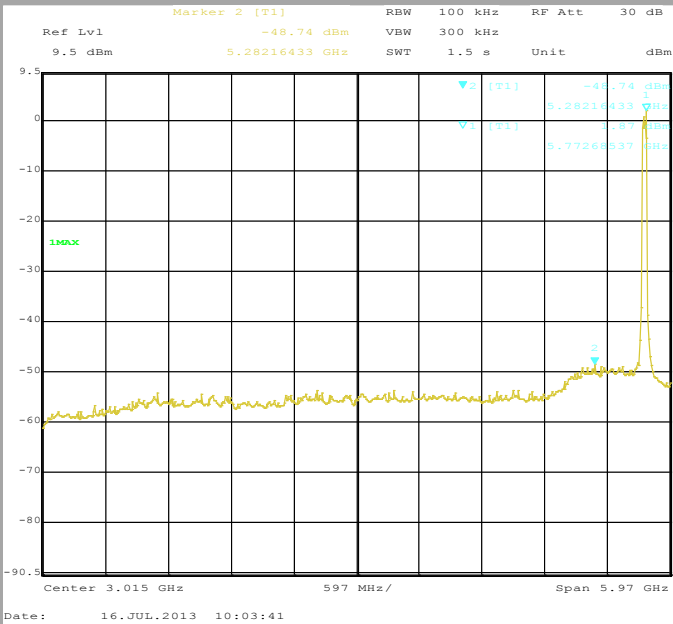
Tx3



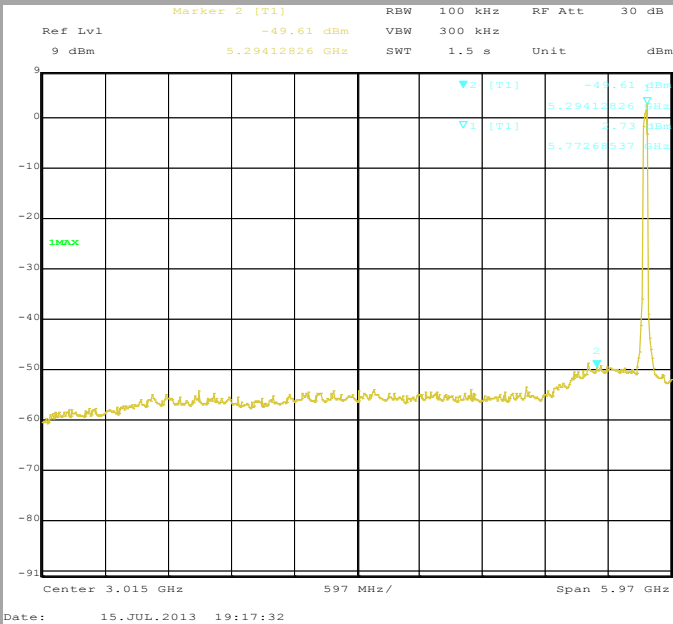


Conducted unwanted emissions
802.11n HT40 Cmin

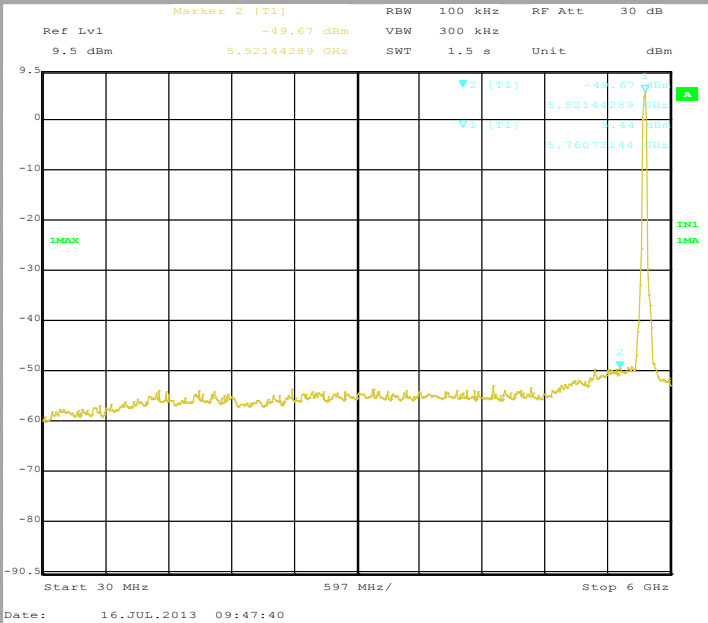
Tx1



Tx2



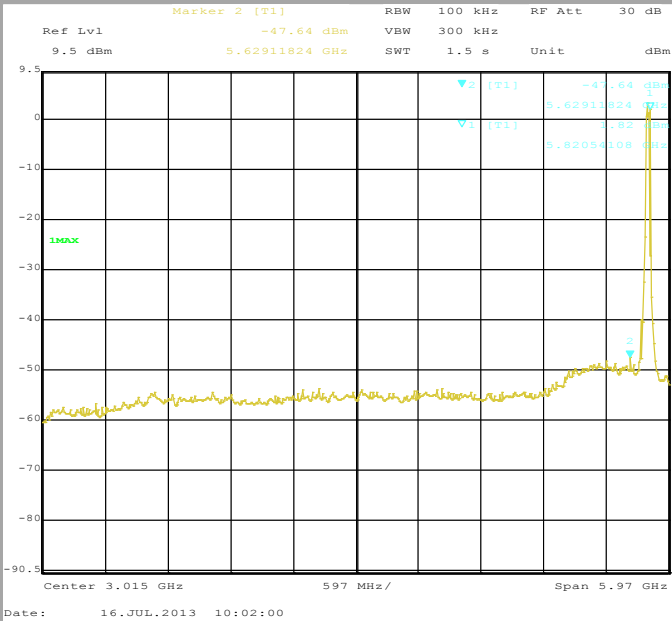
Tx3



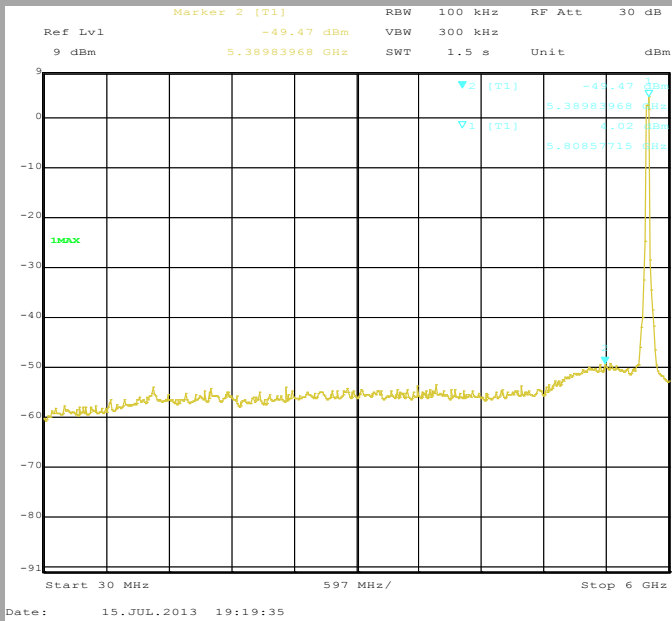


802.11n HT40 Cmax
802.11n HT40

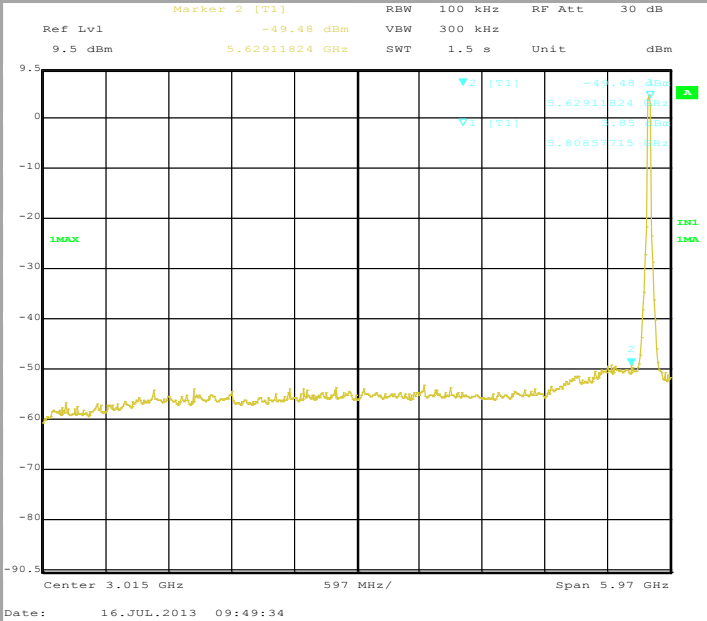
Tx1



Tx2



Tx3

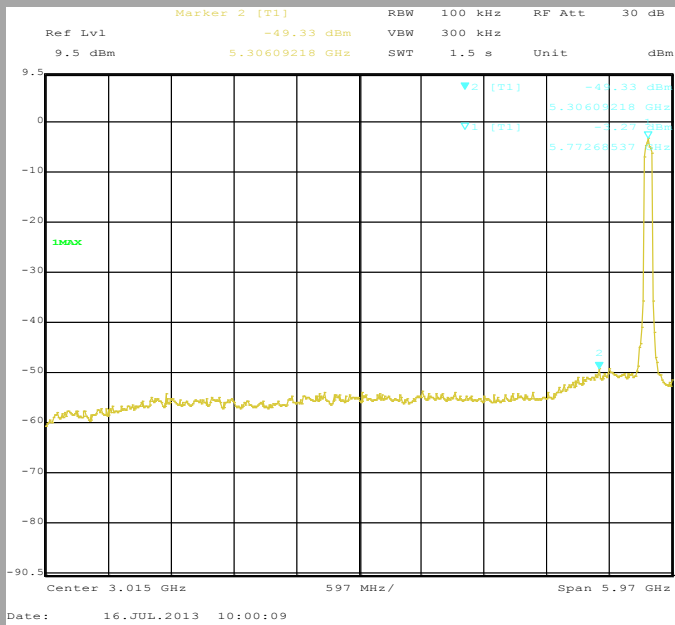




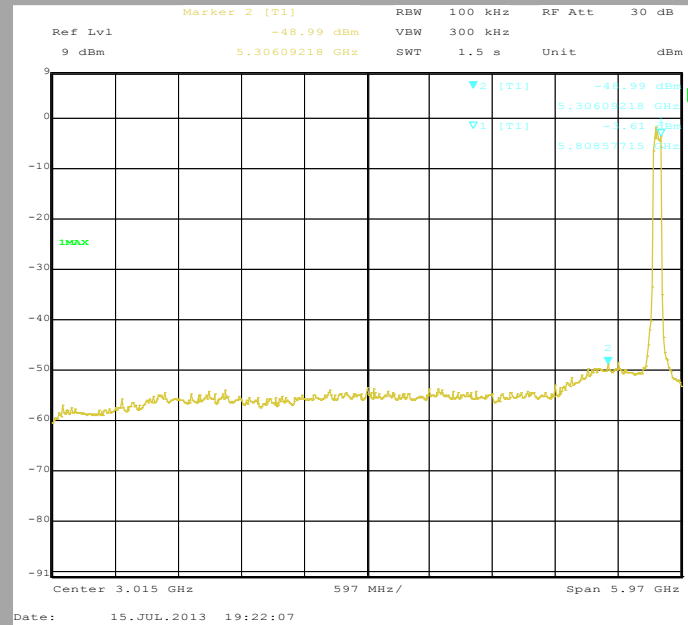
Conducted unwanted emissions

802.11 VHT80 Cnom

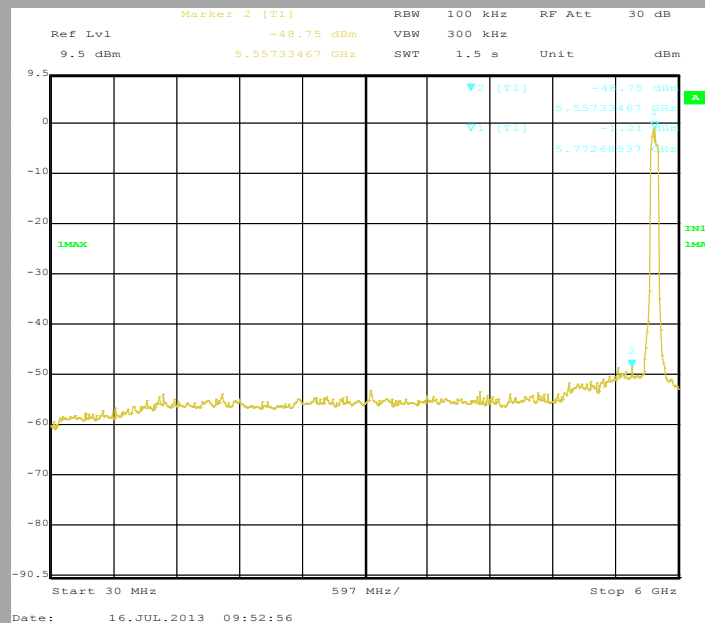
Tx1



Tx2



Tx3





Remark: the conducted emissions observed in the range 6GHz to 40GHz are at least 45 dB below the fundamental transmitter level.

Result: **PASS**

Limit: → All Spurious Emissions must be at least 30dB below the Fundamental Radiator Level outside of the 5725MHz-5850MHz band



9. AC POWER LINE CONDUCTED EMISSIONS

9.1. TEST CONDITIONS

Test performed by :Laurent DENEUX
Date of test :2013/07/23
Ambient temperature : 22°C
Relative humidity : 51%

9.2. TEST SETUP

The product has been tested according to ANSI C63.10 (2009) method. The EUT is placed on the ground reference plane, at 80cm from the LISN. The distance between the EUT and the vertical ground plane is 40cm. Auxiliaries are powered by another LISN. The cable has been shorted to 1meter length. The EUT is powered through the LISN. Measurement is made with a receiver in peak mode. This was followed by a Quasi-Peak, i.e. CISPR measurement for any strong signal. If the average limit is met when using a Quasi-Peak detector, the EUT shall be deemed to meet both limits and measurement with the average detector is unnecessary. The LISN (measure) is $50\Omega / 50\mu\text{H}$. Interconnecting cables and equipment's were moved to position that maximized emission.



Photograph for AC Power Line Conducted Emissions (Front view)



Photograph for AC Power Line Conducted Emissions (Rear view)

9.3. RESULTS

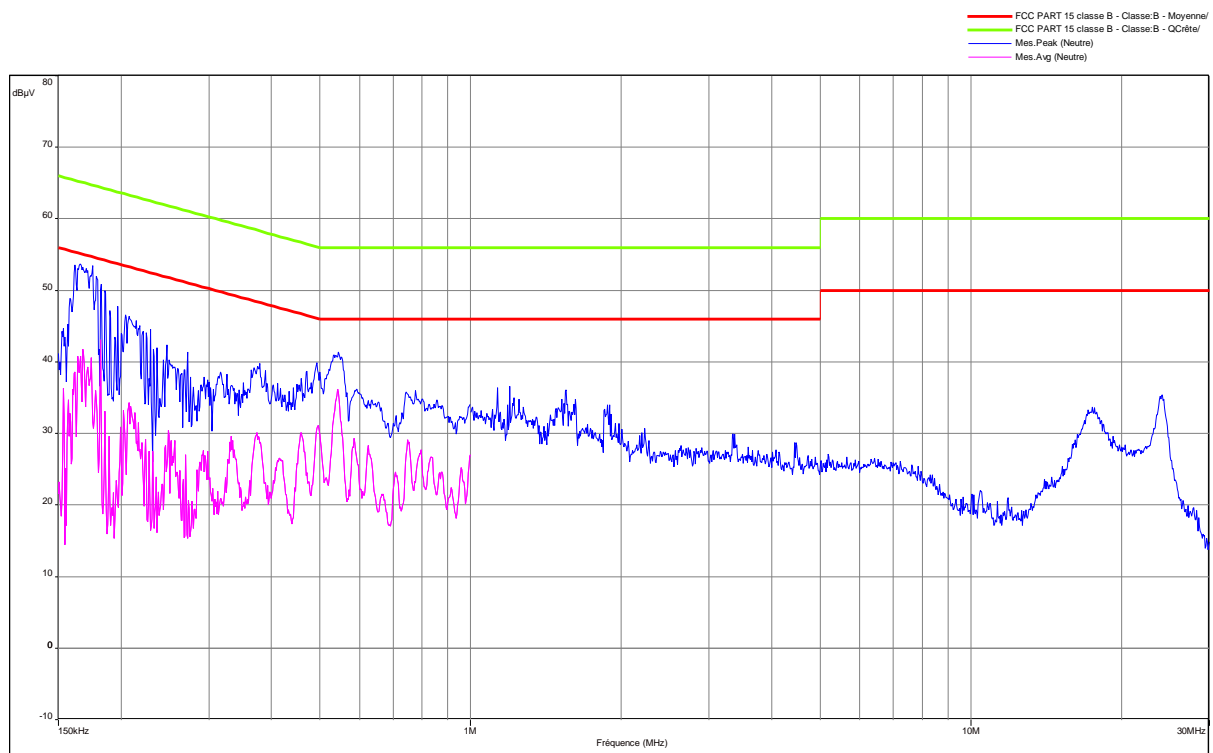
802.11a/802.11n HT20/802.11n HT40/802.11ac VHT80

Phase Line

FCC Part.15 class B

SAGEMCOM
WIFI BOX
TYPE : FAST 5260CV
CONDUCTOR 1 ; 120V-60Hz

Peak and average value



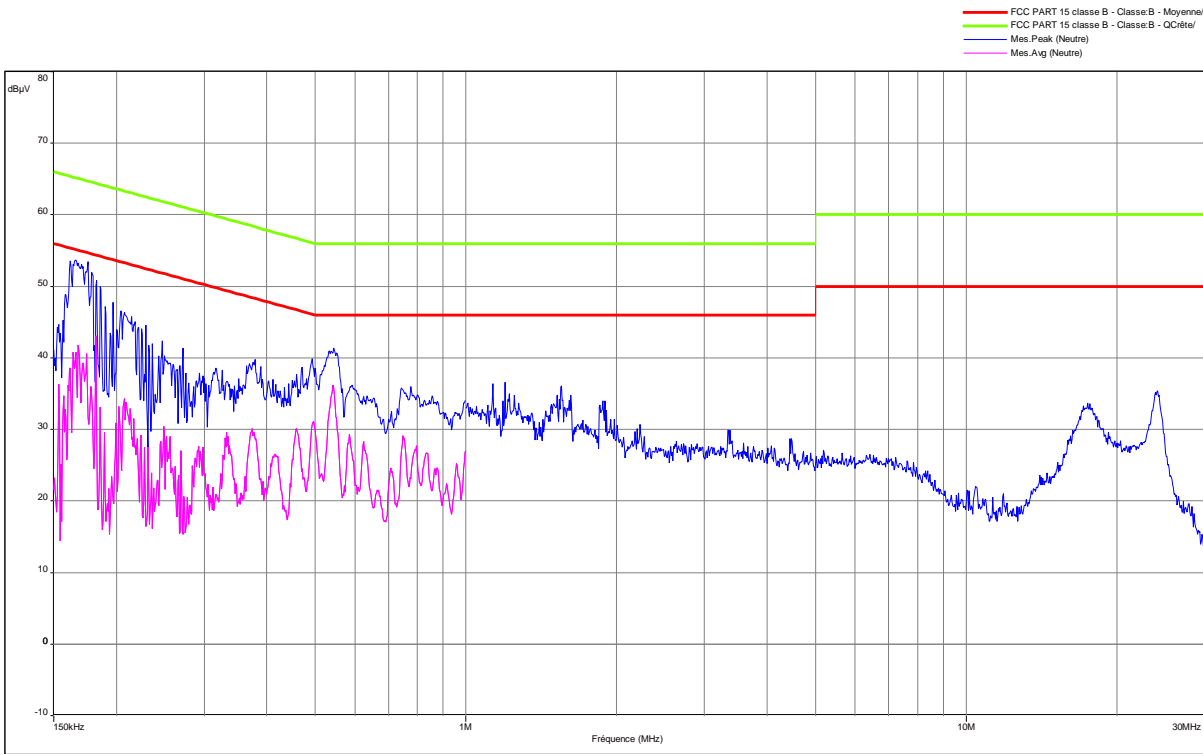


Neutral Line

FCC Part.15 class B

SAGEMCOM
WIFI BOX
TYPE : FAST 5260CV
CONDUCTOR 2 ; 120V-60Hz

Peak and average value





Phase Line

Frequency (MHz)	Peak Level (dBμV/m)	Quasi-Peak Level (dBμV/m)	Quasi-Peak Limit (dBμV/m)	Average Level (dBμV/m)	Average Limit (dBμV/m)
0.166	53.6	-	65	43	55
0.544	41.3	-	56	36	46
1.552	36	-	56	-	46
17.52	33.7	-	60	-	50
24	35.4	-	60	-	50

Neutral Line

Frequency (MHz)	Peak Level (dBμV/m)	Quasi-Peak Level (dBμV/m)	Quasi-Peak Limit (dBμV/m)	Average Level (dBμV/m)	Average Limit (dBμV/m)
0.167	53.5	-	64.9	43.6	55
0.499	39	-	56.1	32.8	46
1.554	34.5	-	56	-	46
17.216	36	-	60	-	50

Result: **PASS**

Limit: → **Quasi-Peak**
0,15kHz to 0,5MHz: 66dBμV/m to 56dBμV/m*
0,5MHz to 5MHz: 56dBμV/m
5MHz to 30MHz: 60dBμV/m

Average
0,15kHz to 0,5MHz: 56dBμV/m to 46dBμV/m*
0,5MHz to 5MHz: 46dBμV/m
5MHz to 30MHz: 50dBμV/m

*Decreases with the logarithm of the frequency

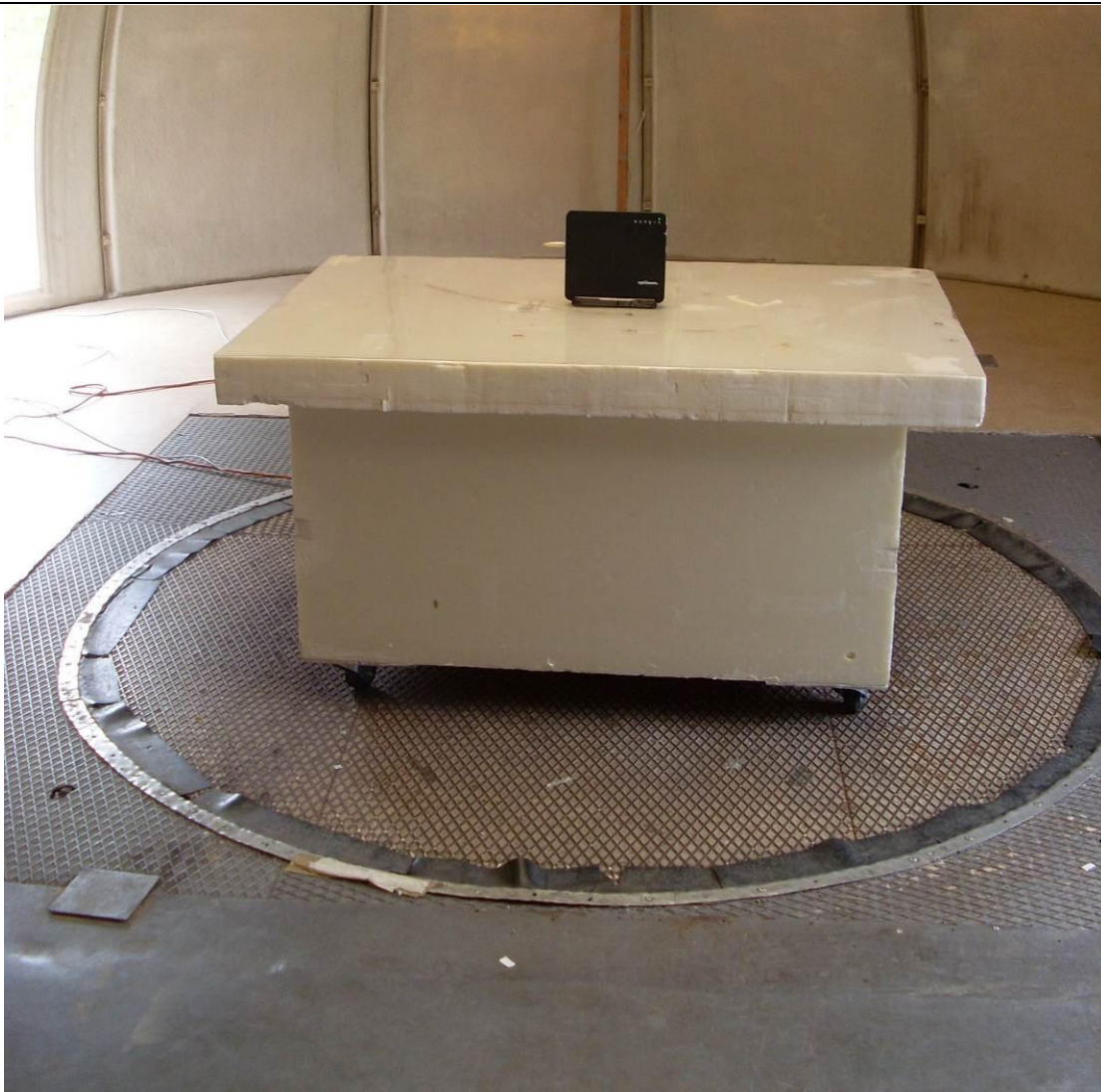
10. UNWANTED EMISSIONS INTO RESTRICTED FREQUENCY BANDS

10.1. TEST CONDITIONS

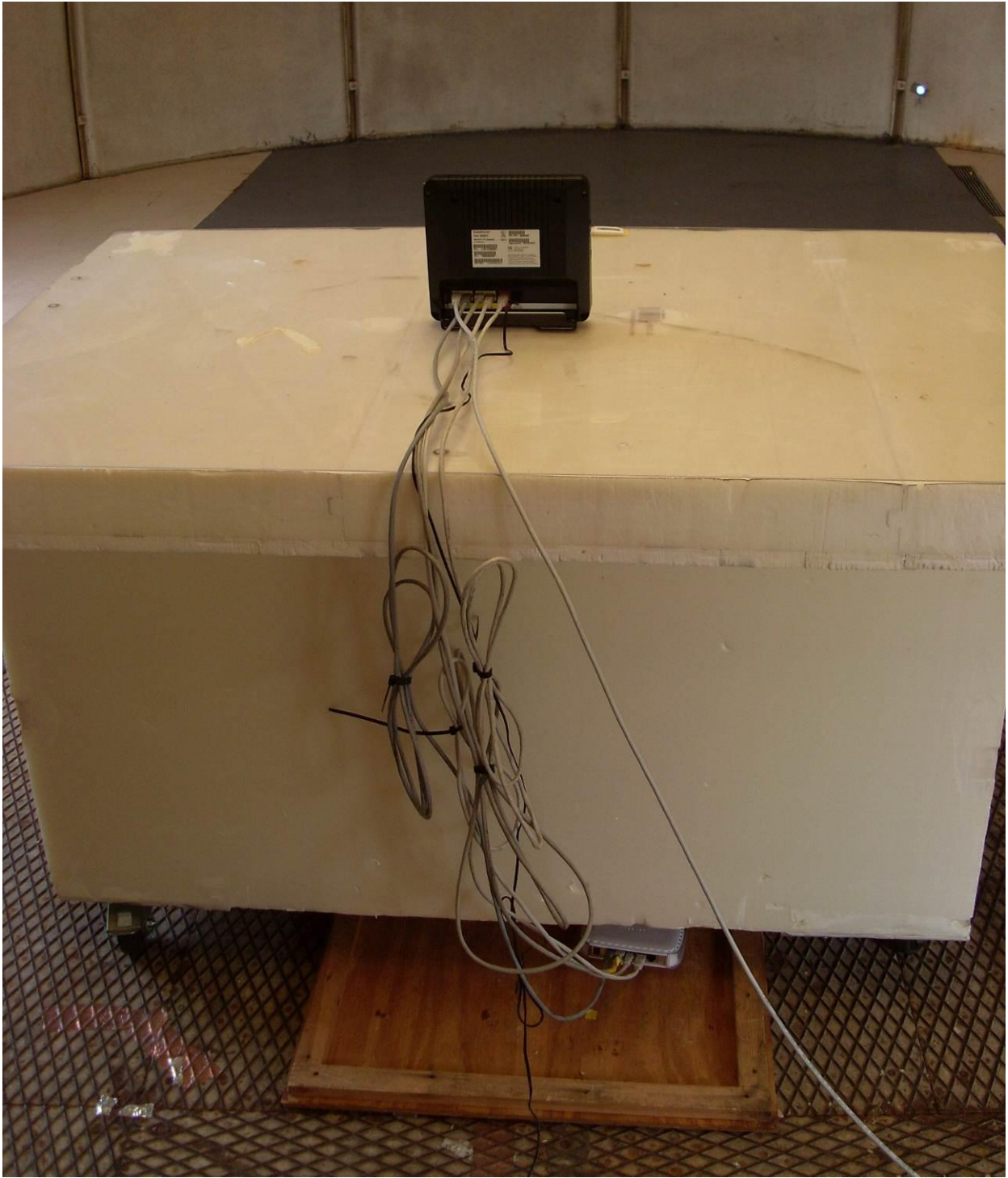
Test performed by : Laurent DENEUX
Date of test : 2013/07/23
Ambient temperature : 26 °C to 35°C
Relative humidity : 51%

10.2. TEST SETUP

The product has been tested according to ANSI C63.10 (2009). The EUT is placed on an open area test site. Distance between measuring antenna and the EUT is 10m. Test is performed in horizontal (H) and vertical (V) polarization with bilog antenna below 1GHz and with a horn antenna above 1GHz. Measurement bandwidth was 120kHz below 1GHz and 1MHz above 1GHz. The level has been maximised by the turntable rotation of 360 degrees range on the 3 axis of EUT. Antenna height search was performed from 1 to 4m.



Photograph for Unwanted Emissions into Restricted Frequency Bands



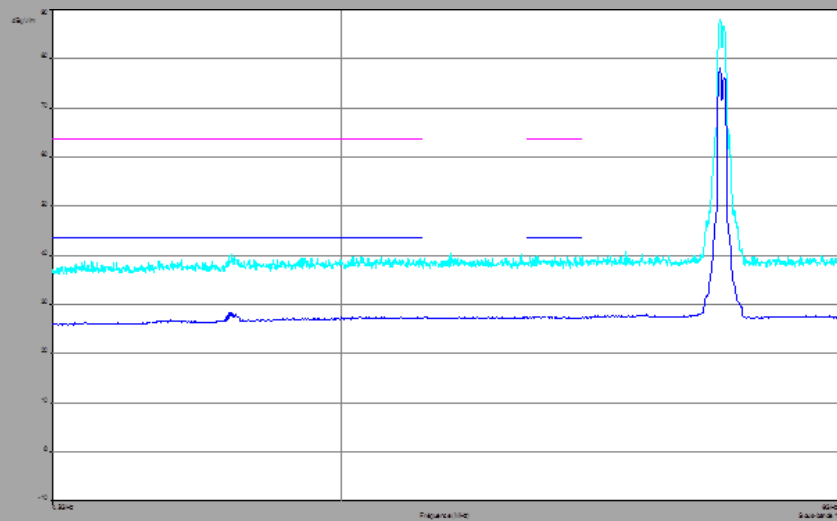
Photograph for Unwanted Emissions into Restricted Frequency Bands

10.3. RESULTS

802.11a

C139

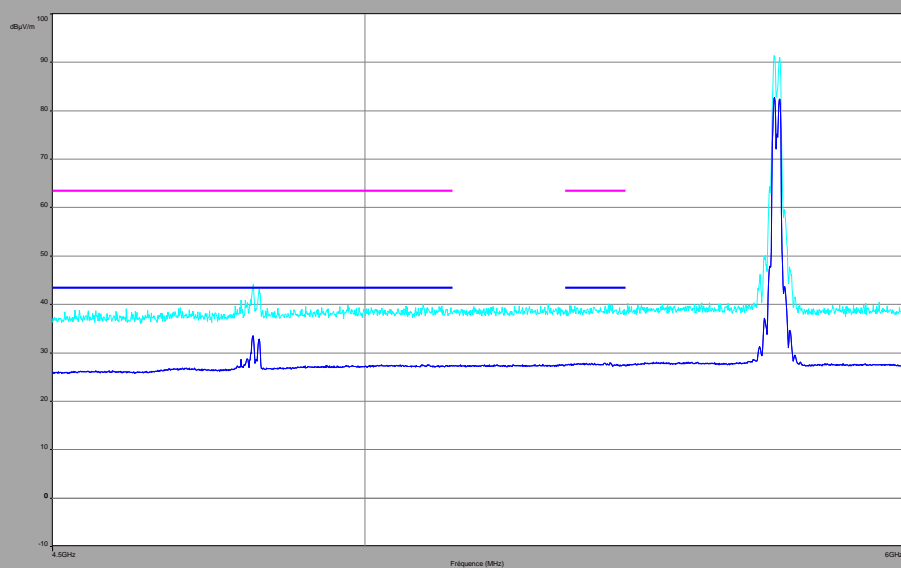
vertical



— FCC Part.15 restricted band – peak limit
— FCC Part.15 restricted band – average value limit
— Peak measurement
— Average value

C139

Horizontal



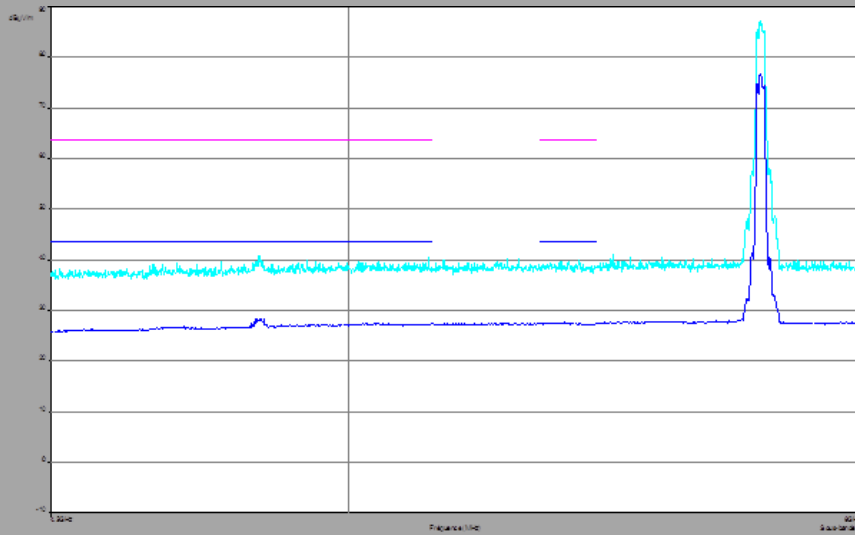
— FCC Part.15 restricted band – peak limit
— FCC Part.15 restricted band – average value limit
— Peak measurement
— Average value



802.11a

C157

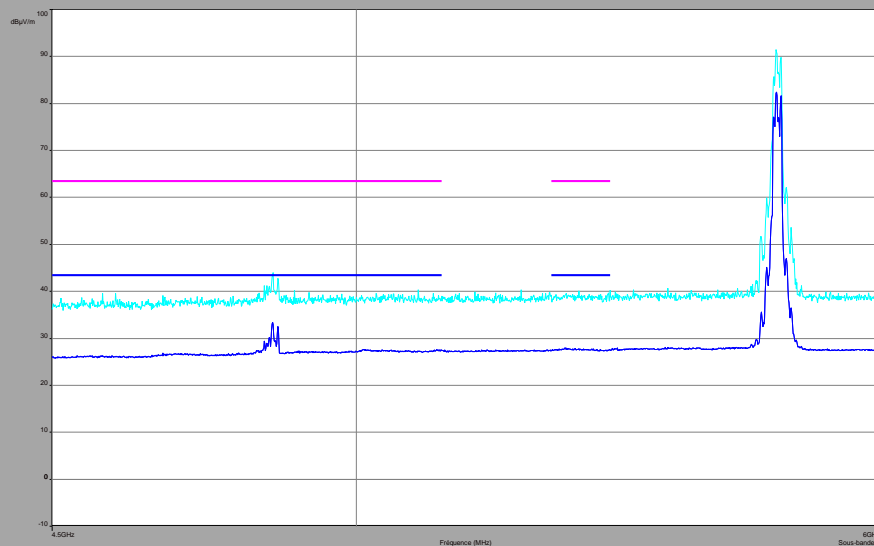
vertical



- FCC Part.15 restricted band – peak limit
- FCC Part.15 restricted band – average value limit
- Peak measurement
- Average value

C157

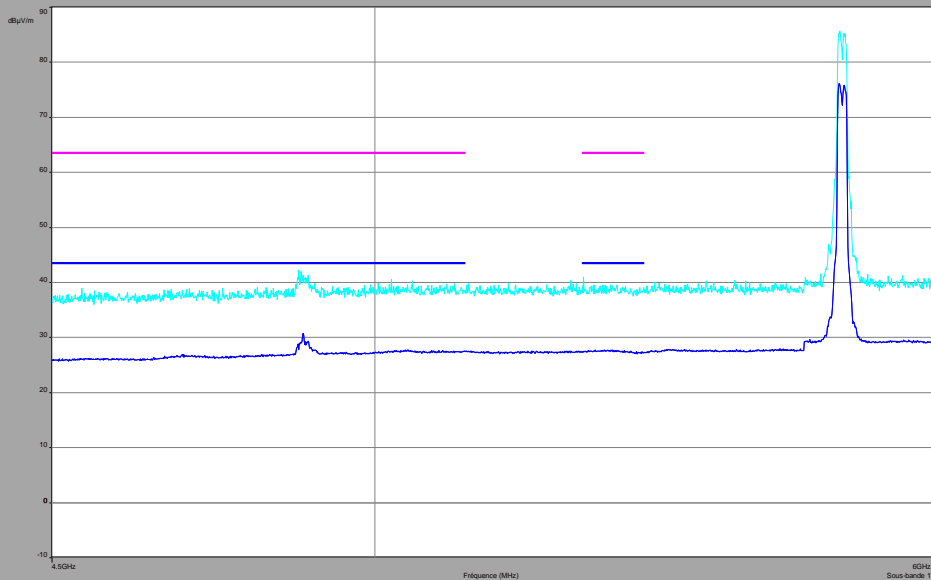
Horizontal



- FCC Part.15 restricted band – peak limit
- FCC Part.15 restricted band – average value limit
- Peak measurement
- Average value

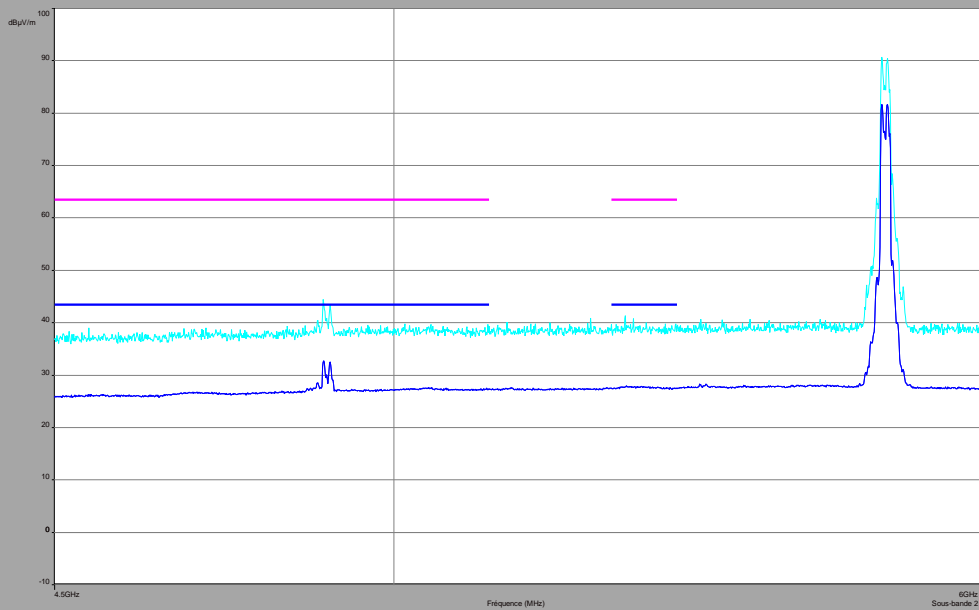


802.11a
C165
vertical



- FCC Part.15 restricted band – peak limit
- FCC Part.15 restricted band – average value limit
- Peak measurement
- Average value

C165
Horizontal



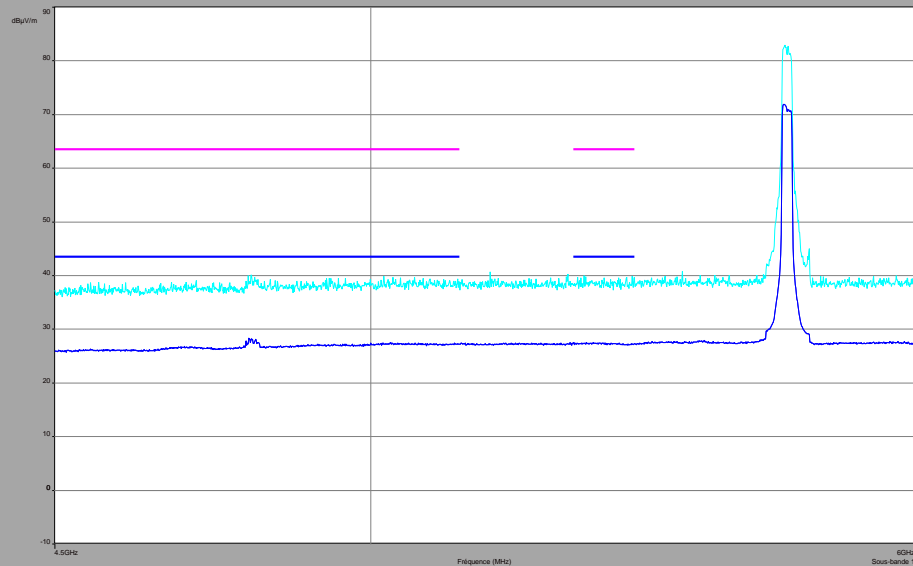
- FCC Part.15 restricted band – peak limit
- FCC Part.15 restricted band – average value limit
- Peak measurement
- Average value



802.11n HT20

C139

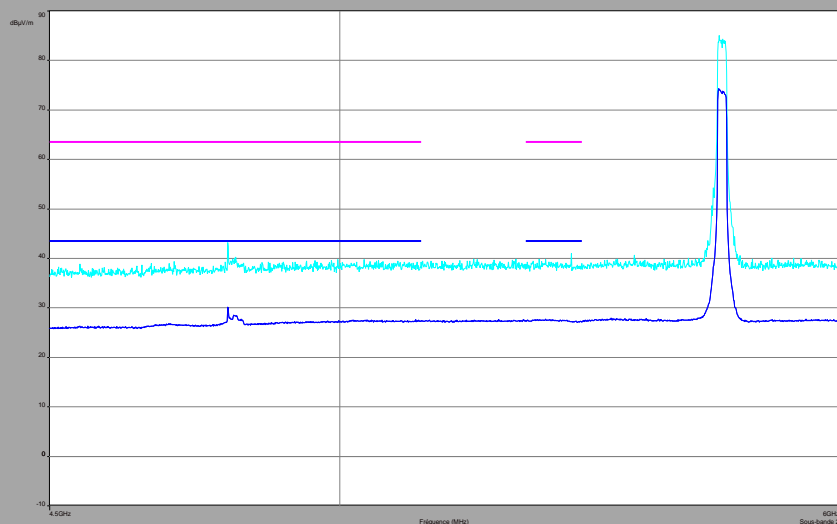
vertical



- FCC Part.15 restricted band – peak limit
- FCC Part.15 restricted band – average value limit
- Peak measurement
- Average value

C139

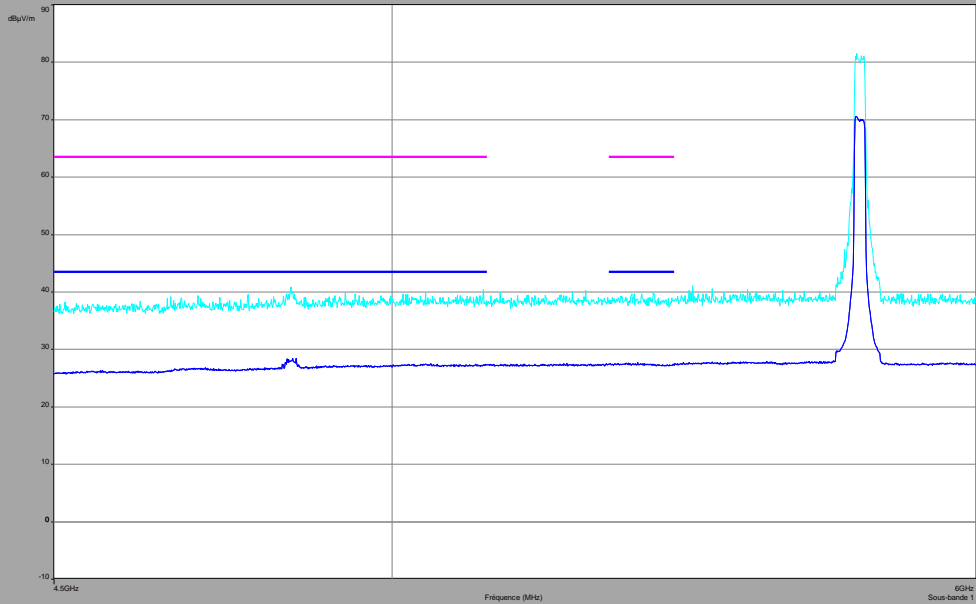
Horizontal



- FCC Part.15 restricted band – peak limit
- FCC Part.15 restricted band – average value limit
- Peak measurement
- Average value

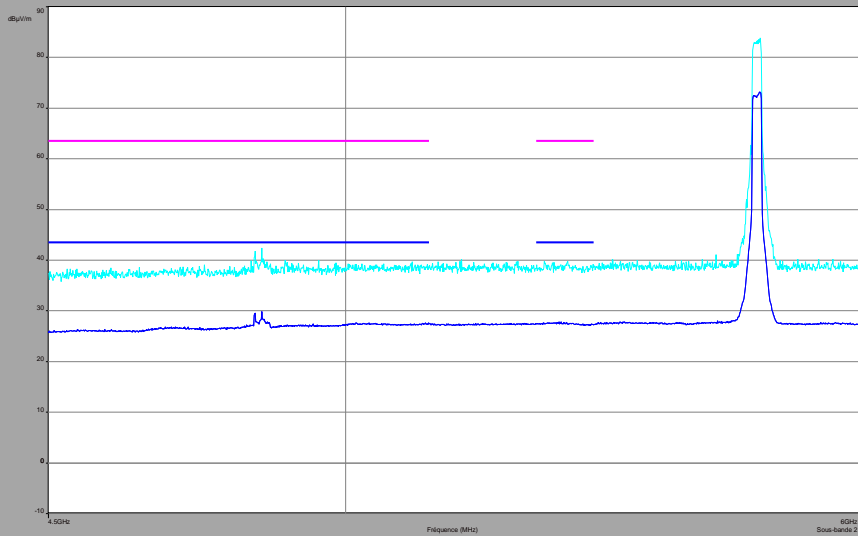


802.11n HT20
C157
vertical



- FCC Part.15 restricted band – peak limit
- FCC Part.15 restricted band – average value limit
- Peak measurement
- Average value

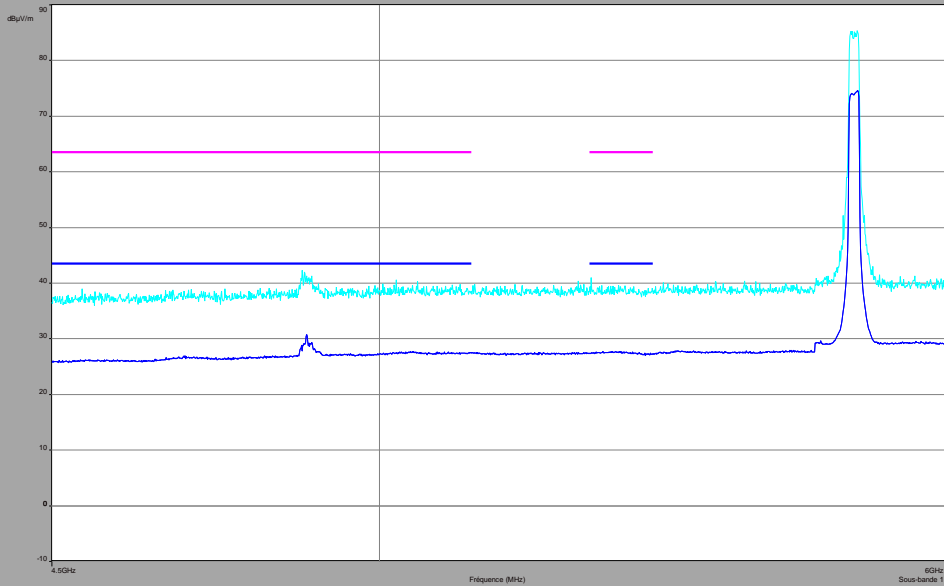
C157
Horizontal



- FCC Part.15 restricted band – peak limit
- FCC Part.15 restricted band – average value limit
- Peak measurement
- Average value

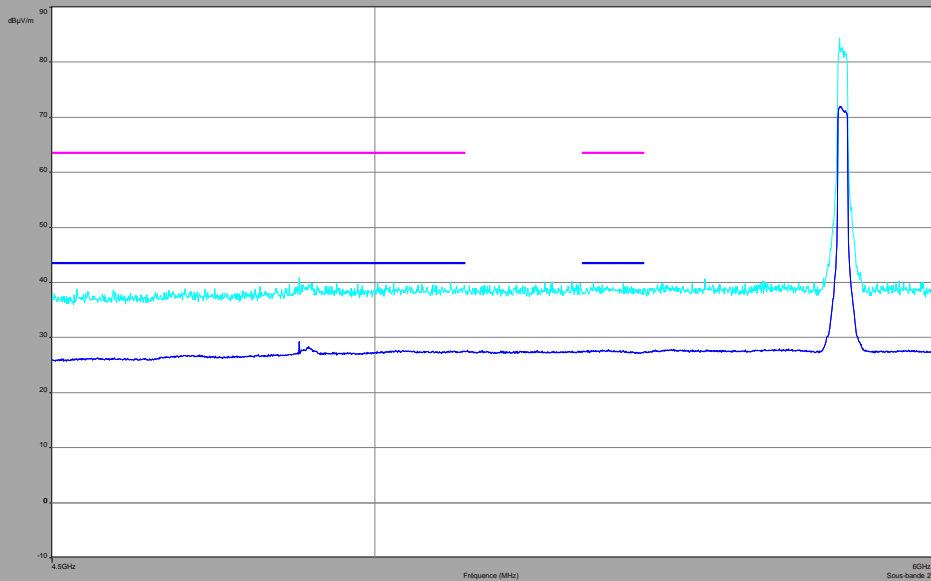


802.11n HT20
C165
vertical



- FCC Part.15 restricted band – peak limit
- FCC Part.15 restricted band – average value limit
- Peak measurement
- Average value

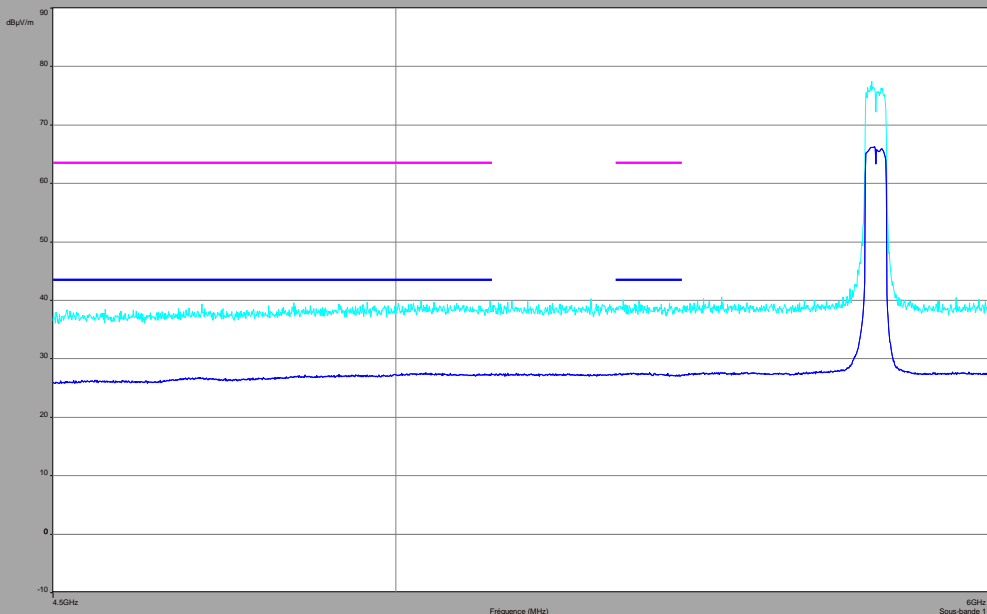
C165
Horizontal



- FCC Part.15 restricted band – peak limit
- FCC Part.15 restricted band – average value limit
- Peak measurement
- Average value

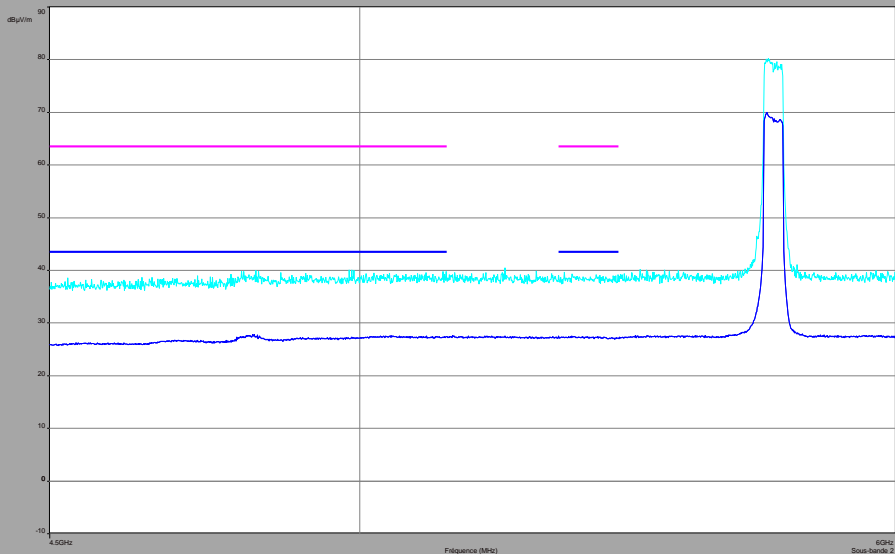


802.11n HT40
C149+153
vertical



- FCC Part.15 restricted band – peak limit
- FCC Part.15 restricted band – average value limit
- Peak measurement
- Average value

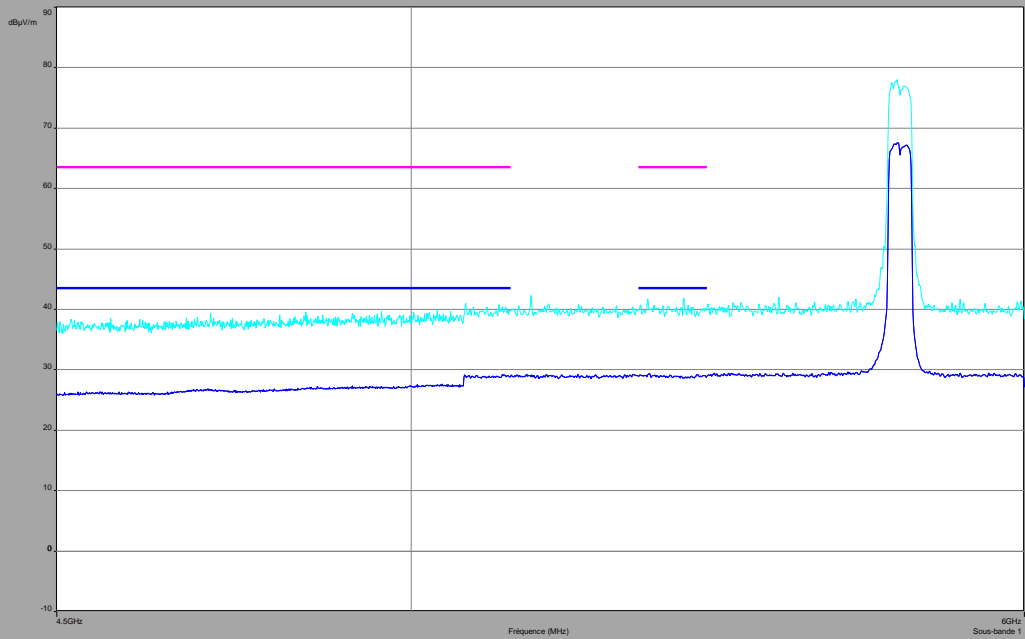
C149+153
Horizontal



- FCC Part.15 restricted band – peak limit
- FCC Part.15 restricted band – average value limit
- Peak measurement
- Average value

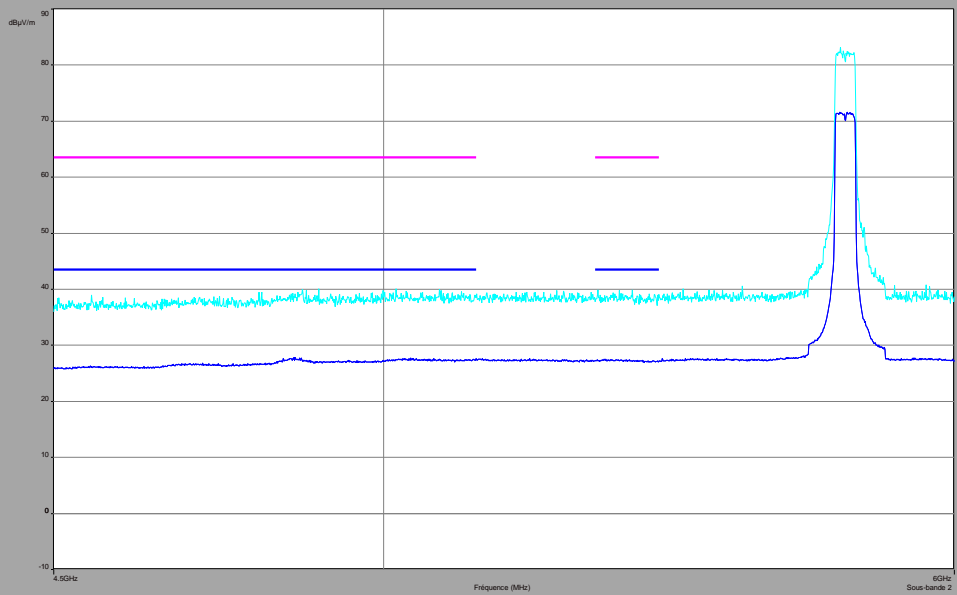


802.11n HT40
C157+161
vertical



- FCC Part.15 restricted band – peak limit
- FCC Part.15 restricted band – average value limit
- Peak measurement
- Average value

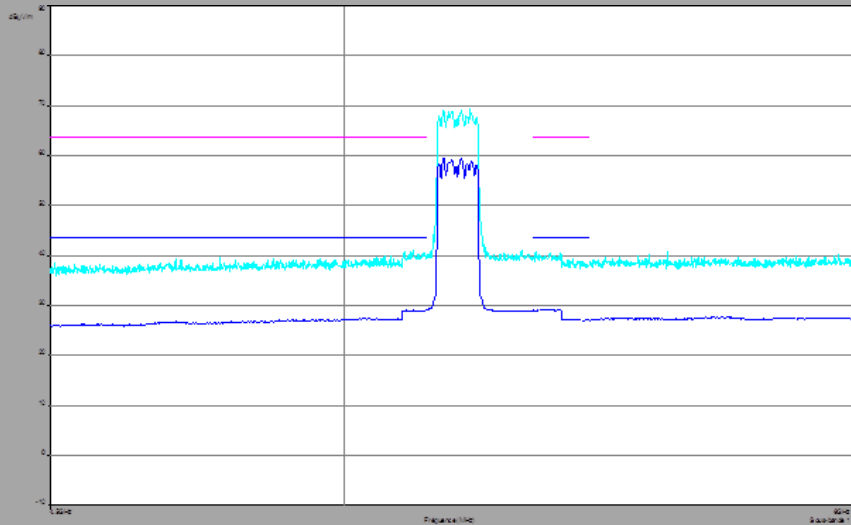
C157+161
Horizontal



- FCC Part.15 restricted band – peak limit
- FCC Part.15 restricted band – average value limit
- Peak measurement
- Average value

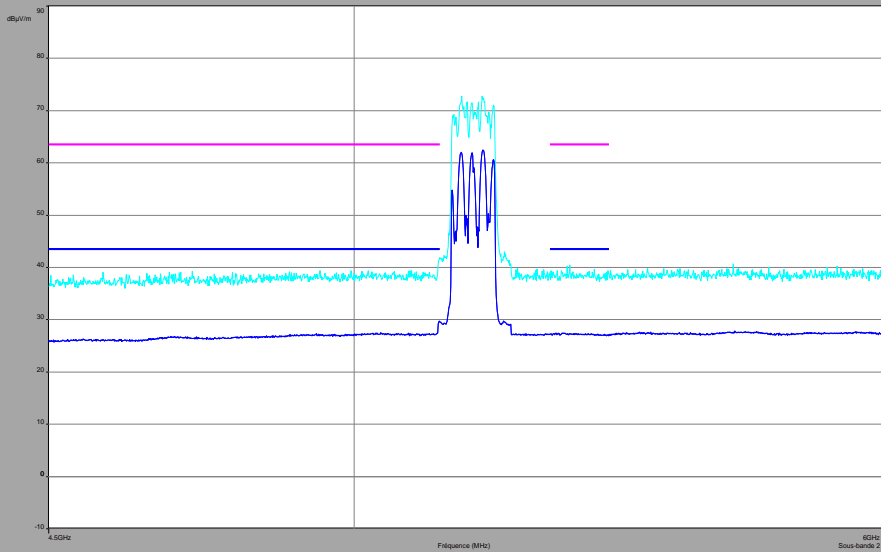


802.11n HT80
C149+153+157+161
vertical



- FCC Part.15 restricted band – peak limit
- FCC Part.15 restricted band – average value limit
- Peak measurement
- Average value

C149+153+157+161
Horizontal



- FCC Part.15 restricted band – peak limit
- FCC Part.15 restricted band – average value limit
- Peak measurement
- Average value



Characterization on an open test site (30MHz to 40GHz):

Below 1GHz

Frequency (MHz)	Peak Level (dBμV/m)	QPeak Level (dBμV/m)	Limit (dBμV/m)
37.5	22.7	18.5	29.5
114.1	26	19	33
115	25	18.6	33
118.1	22.2	20.6	33
131.4	25.8	24.7	33
135.8	27.3	18	33
250	31.8	27.8	35.5
999.9	36	30	44

Above 1GHz

Frequency (MHz)	Average Level (dBμV/m)	Average Limit (dBμV/m)	Peak Level (dBμV/m)	Peak Limit (dBμV/m)
1125	27.3	44	36.3	64
1375	24.6	44	30.3	64
1500	29.6	44	33.7	64
1625	27	44	39.5	64
2250	31.5	44	43.6	64
2500	29.4	44	38.2	64
3000	32	44	36	64
4891	33	44	44.4	64
5150	40	44	28	64
5350	40	44	26.8	64
5460	40	44	27.5	64

Result: PASS

Limit: →

30MHz to 88MHz:	29.50dBμV/m QPeak
88MHz to 216MHz:	33dBμV/m QPeak
216MHz to 960MHz:	35.5dBμV/m QPeak
960MHz to 1000MHz:	44dBμV/m QPeak
Above 1000MHz:	64dBμV/m Peak
	44dBμV/m Average



11. TEST EQUIPMENT LIST

Occupied Bandwidth, -6dB Bandwidth, Maximum Peak Output Power, Power Spectral Density and Unwanted Emissions into Non-Restricted Frequency Bands					
Apparatus	Trade Mark	Type	Registration number	Calibration date	Calibration due
RF Cable	-	2.92 mm	A5329441	2013/03	2014/03
Attenuator 3 dB	MINI CIRCUITS	BW-S3W2+	A7122210	2013/07	2014/07
Spectrum Analyser	ROHDE & SCHWARZ	FSL	A4060032	2012/12	2013/12
EMI Test Receiver	ROHDE & SCHWARZ	ESIB26	A2642021	2013/04	2014/04
EMI Test receiver	RHODE & SCHWARZ	ESI40	A2642010	2012/09	2013/09
Power meter	HEWLETT PACKARD	437B	A1503001	2013/01	2014/01
Power meter sensor	HEWLETT PACKARD	8484A	A1509070	2013/01	2014/01
Attenuator 30 dB	HEWLETT PACKARD	11708A	A7122215	2013/01	2014/01
Signal Generator	ROHDE & SCHWARZ	SMJ100A	A544407	2013/01	2014/01
RF Cable	Pasternack	095 Series	A5329592	Calibrated with Power Meter & Signal Generator before use	Calibrated with Power Meter & Signal Generator before use
Power supply	KIKUSUI	PCR500M	A7040079	-	-
Unwanted Emissions into Restricted Frequency Bands & Receiver Spurious Emissions					
Apparatus	Trade Mark	Type	Registration number	Calibration date	Calibration due
Open test site	LCIE	-	F2000400	2013/04	2014/04
EMI Test Receiver	ROHDE & SCHWARZ	ESU	A2642018	2013/04	2014/04
Horn antenna	PASTERNAK	PE9850/2F-20	A2642010	-	-
EMI Test receiver	RHODE & SCHWARZ	ESI40	A2642010	2012 /09	2013/09
Preamplifier	HEWLETT PACKARD	8449B	A4069002	2013/11	2014/11
Bilog antenna	CHASE	CBL 6112A	C2040040	2013/04	2014/04
Dipole	ROHDE & SCHWARZ	HUF-Z1	C2040011	2013/03	2014/03
Logperiodic antenna	ROHDE & SCHWARZ	HL 023 A2	C2040001	2013/03	2014/03
Horn antenna	EMV	3115	C2040023	2013/04	2014/04
Horn antenna	AH SYSTEMS	SAS-572	C2042026	2012/10	2013/10
AC Power Line Conducted Emissions					
Apparatus	Trade Mark	Type	Registration number	Calibration date	Calibration due
Receiver	RHODE & SCHWARZ	ESU	A2642018	2013/04	2014/04
V ISLN	ROHDE & SCHWARZ	ESH2-Z5	C2322001	2013/06	2014/06
Pulse limiter	ROHDE & SCHWARZ	ESH3-Z2	A2649008	2013/02	2014/02
ground plan 2m x 3m	LCIE	-	-		



12. UNCERTAINTIES CHART

Kind of test	Measurement uncertainties (k=2) $\pm x(\text{dB})$ / (Hz)	Limit for uncertainties $\pm y(\text{dB})$
TRANSMITTER REQUIREMENTS		
Radio frequency	$\pm 2.10^{-8}$ Hz	$\pm 1.10^{-7}$ Hz
RF Conducted power	± 0.6 dB	± 1.5 dB
Spurious emissions <ul style="list-style-type: none">Frequency < 1000 MHzFrequency > 1000 MHz	± 3.9 dB ± 3.1 dB	± 6 dB
Spurious in conduction	± 1.6 dB	± 3 dB
Temperature	$\pm 0.5^{\circ}\text{C}$	$\pm 1^{\circ}\text{C}$
Humidity	± 2.5 %	± 10 %
RECEIVER REQUIREMENTS		
Spurious emissions <ul style="list-style-type: none">Frequency < 1000 MHzFrequency > 1000 MHz	± 3.9 dB ± 3.1 dB	± 6 dB