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Test Report for FCC

FCC ID : V2X-PM60-P

Report Number		ESTF151411-005		
Applicant	Company name	POINTMOBILE CO.,LTD		
	Address	GASAN-DONG B-9F KABUL GREAT VALLEY 32 DIGITAL-RO9-GIL GEUMCHEON-GU SEOUL 153-709 KOREA		
	Telephone	82-70-7090-2676		
Product	Product name	Mobile Computer		
	Model No.	PM60	Manufacturer	POINTMOBILE CO.,LTD
	Serial No.	NONE	Country of origin	KOREA
Test date	2014-10-17 ~ 2014-11-18		Date of issue	19-Nov-14
Testing location	ESTECH Co., Ltd. 97-1, Hoeeok-ri, Majang-myeon, Icheon-si, Gyeonggi-do, Korea			
Standard	FCC PART 15 Subpart C (15.247):2010 , ANSI C 63.4(2009) , KDB 558074 D01(2014)			
Measurement facility registration number	915135			
Tested by	Engineer K.H.Chung	(Signature)		
Reviewed by	Engineering Manager J.M.Yang	(Signature)		
Abbreviation	OK, Pass = Passed, Fail = Failed, N/A = not applicable			

* Note

- This test report is not permitted to copy partly without our permission
- This test result is dependent on only equipment to be used
- This test result based on a single evaluation of one sample of the above mentioned
- SUK's (P/N) : PM60GP52356E0T, PM60GP54356E0T, PM60GP72356E0T

Contents

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1. Laboratory Information

1.1 General

This EUT (Equipment Under Test) has been shown to be capable of compliance with the applicable technical standards and is tested in accordance with the measurement procedures as indicated in this report.
ESTECH Lab attests to accuracy of test data. All measurement reported herein were performed by ESTECH Co., Ltd.
ESTECH Lab assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

1.2 Test Lab.

Corporation Name : ESTECH Co., Ltd.

Head Office : Rm 1015, World Venture Center II, 426-5, Gasan-dong, Geumcheon-gu, Seoul, Korea

EMC/Telecom/Safety Test Lab : 97-1, Hoeeok-ri, Majang-myeon, Icheon-si, Gyeonggi-do, Korea

1.3 Official Qualification(s)

KCC : Granted Accreditation from Ministry of Information & Communication for EMC, Safety and Telecommunication
FCC : Conformity Assessment Body(CAB) with registration number 659627 under APEC TEL MRA between the RRA and the FCC
VCCI : Granted Accreditation from Voluntary Control Council for Interference from ITE

2. Description of EUT

2.1 Summary of Equipment Under Test (WLAN)

Modulation Type	:	WLAN(OFDM)
Transfer Rate	:	up to 65 Mbps
Number of Channel	:	5.0 GHz : 5 CH
PEAK Output Power	:	802.11a:0.078 W, 802.11n(5 GHz) : 0.078 W
Rating	:	INPUT : (100 - 240)Va.c , (50 / 60)Hz , 21~34VA 0.4 A OUTPUT : 5.0 Vd.c. , 2.0 A
Receipt Date	:	28-Apr-14
X-tal list(s) or Frequencies generated	:	The highest operating frequency is 5825 MHz(WLAN) XTAL : 32.768 kHz , OSC : 26 MHz , WLAN : 5825 MHz

2.2 General descriptions of EUT

Operating System	Microsoft Windows Embedded Handheld 6.5 Pro
Application Software	Tools and Demos
Processor	Cortex-A8 1GHz
Memory	512MB RAM X 1GB Flash
Storage Expansion	User accessible Micro SD memory card slot.
Display	3.5 in. transmissive active matrix 65K color LCD with backlight, VGA (480 x 640)
Scan Engine	1D engine: N4313 2D engine : N560x
Keypad	Numeric , Qwerty
Audio	Built-in microphone and speaker
I/O	High speed USB 2.0 from cradle (or I/O cable)
Battery	Li-ion battery 3.7V / 4000 mAh / 14.8Wh
Expected Hours of Operation	8.5+ hours (with scan and continuously transmittingif using new standard Li-ion battery)
Charging	5Vinput throughMicroUSB port.
Expected Charge Time	Capacity: 4000mAh–approx.5 hours
Charging Peripherals	MicroUSBAdaptor Single Slot cradle–single-bay terminal charge/communicate Single Ethernet cradle–single-bay terminal charge/communication base (Via Ethernet connection) Quad Battery Charger
WPAN	Bluetooth Class II (10 m) v2.1 Enhanced Data Rate (EDR) with internalantenna.
WLAN	Dual Mode 802.11 a/b/g/n (11 Mbps/54 Mbps) with internal antenna
WLAN Security	Wi-Fi Certified, 802.1X, WPA2, EAP, WEP, LEAP, TKIP, MSD, EAP-TLS, EAP-TTLS, WPAPSK,PEAP, CCXv4

2.2 General descriptions of EUT

GPS	Standalone and Assisted GPS
Operating Temperature	-20° to55°C
Charging Temperature	0~45 ℃ (±3 ℃)
Storage Temperature	-25°C to 70°C
Humidity	95% humidity, non-condensing
Construction	High impact resistant PC/ABS housings Magnesium alloy internal chassis with component shock mounts
Drop	1.22m multiple drops to concrete, MIL-STD-810G, Method 516.6, Procedure
Tumble	3.3 ft (1.0m) tumbles (500 drops)
ESD	Air: ± 15kV Direct: ± 8kV
Environmental	Independently certified to meet IP65 standards for moisture and particle resistance
Dimensions	H; 157.4mm x W; 74.2mm x L; 25.8mm(top)
Scanner / Decode Capabilities	1D Laser model : N4313 Laser engine. Decodes all standard 1D codes. 2D engine model : N560X 2D Imager. Decodes all standard 1D, 2D Postal, and OCR codes.

3. Test Standards

Test Standard : FCC PART 15 Subpart C (15.247) : 2010 & IC RSS-210 Issue8 : 2010

This Standard sets out the regulations under which an intentional, unintentional, or incidental radiator may be operated without an individual license. It also contains the technical specifications, administrative requirements and other conditions relating to the marketing of Part 15 devices.

Test Method : ANSI C 63.4 (2009) & KDB558074 D01(2014)

This standard sets forth uniform methods of measurement of radio-frequency (RF) signals and noise emitted from both unintentional and intentional emitters of RF energy in the frequency range 9 kHz to 40 GHz. Methods for the measurement of radiated and AC power-line conducted radio noise are covered and may be applied to any such equipment unless otherwise specified by individual equipment requirements. These methods cover measurement of certain decides that deliberately radiate energy, such as intentional emitters, but does not cover licensed transmitters. This standard is not intended for certification/approval of avionic equipment or for industrial, scientific, and medical (ISM) equipment These method apply to the measurement of individual units or systems comprised of multiple units

Summary of Test Results

Applied Satandard : 47 CFR Part 15 Subpart C & RSS 210-Part I and II					remark
Standard	IC Standard	Test Type	Result	Remark	Limit
15.207	RSS-Gen 7.2.2	AC Power Conducted Emission	Pass	Meet the requirement	
15.205 & 15.209	A8.5	Restricted band / Intentional Radiated Emission	Pass	Meet the requirement	
15.247(a)(2)	A8.2(a)	6 dB Bandwidth	Pass	Meet the requirement	Min. 500 kHz
	RSS-Gen 4.6.1	99 % Bandwidth			
15.247(b)(3)	A8.4(4)	Maximum Peak/average ouput power	Pass	Meet the requirement	Max. 30 dBm
15.247(c)	A8.5	Transmitter Radiated Emission	Pass	Meet the requirement	Table 15.209
15.247(e)	A8.2(b)	Power Spectral Density	Pass	Meet the requirement	Max. 8 dBm
15.247(d)	A8.5	Band Edge Measurement	Pass	Meet the requirement	20 dB less
15.107	RSS-Gen 7.2.2	Receiver conducted Emission	Pass	Meet the requirement	
15.109	RSS-Gen 7.2.3.2	Receiver radiated emission	Pass	Meet the requirement	

4. Measurement Condition

4.1 EUT Operation(For 802.11a and 802.11n)

a. Channel

Ch.	Frequency
149	5745 MHz
153	5765 MHz
157	5785 MHz
161	5805 MHz
165	5825 MHz

b. Measurement Channel : Low(5745 MHz),Middle(5785 MHz),High(5825 MHz)

c. Test Mode : Continuous Output, DSSS, OFDM

d. Test rate : the worst case of rate 802.11a (6Mbps), 802.11n-5 GHz (6.5 Mbps)

4.2 EUT Operation.

* The EUT was in the following operation mode during all testing

* The operational conditions of the EUT was determined by the manufacturer according to the typical use of the EUT with respect to the expected hightest level of emission

* Execute a RF test program to enable EUT under transmission/receiving condition continuously at specific channel frequency.

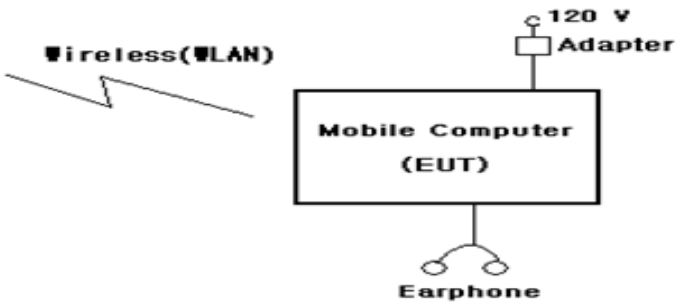
* The worst data were recorded 1D scanner the results after testing each of the 1D scanner and 2D scanner.

*. Transmit mode and receive mode was each test.

*. Highest frequency of the EUT is above 1 GHz, the measurement shall be made up to 10 th the highest frequency or 40 GHz, But the EUT wasn't Detected from 3th any other spurings and harmonic emissions.

4.3 Configuration and Peripherals

Test setup for WLAN



4.4 EUT and Support equipment

Equipment Name	Model Name	S/N	Manufacturer	Remark (FCC ID)
Mobile Computer	PM60	NONE	POINTMOBILE CO.,LTD	EUT
Adapter	KSAS0100500200D5	NONE	Kuantech(BeiHai) Co., Ltd.	
Earphone	NONE	NONE	SAMSUNG	

4.5 Cable Connecting

Start Equipment		End Equipment		Cable Standard		Remark
Name	I/O port	Name	I/O port	Length	Shielded	
Mobile Computer	Power	Adapter	-	2.0	Unshielded	
Mobile Computer	Head Phone	Earphone	-	1.0	Unshielded	
Mobile Computer	WLAN (5.0 GHz)	WLAN SETUP SYSTEM	WLAN (5.0 GHz)	-	-	

5. DTS bandwidth

5.1 Test procedure

558074 D01 DTS Meas Guidance v03 8.2 Option 2 :The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW ≥ 3 RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

5.2 Test instruments and measurement setup

The spectrum analyzer is set to as following.

. RBW= 100 KHz

. VBW= 4 MHz

. Span= 50 MHz

. Sweep= suitable duration based on the EUT specification.

Limits : FCC § 15.247(a)(2) , IC RSS-210 A8.2(a)

6dB Bandwidth Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E4440A	US42041281	2015-01-27
RF Cable	Length: 6cm	-	
-Spectrum Analyzer <=> EUT	Loss: 11dB	-	

5.3 Measurement results

EUT	Mobile Computer	MODEL	PM60
MODE	OFDM	ENVIRONMENTAL CONDITION	24 ℃, 44 % R.H.
INPUT POWER	120 Va.c., 60 Hz		

(802.11a)

Channel Frequency (MHz)	Emission bandwidth	Bandwidth at 6dB below(MHz)	Minimum Limit (MHz)	PASS/FAIL
5745	16.36	12.28	0.5	PASS
5785	16.39	16.29	0.5	PASS
5825	16.38	16.18	0.5	PASS

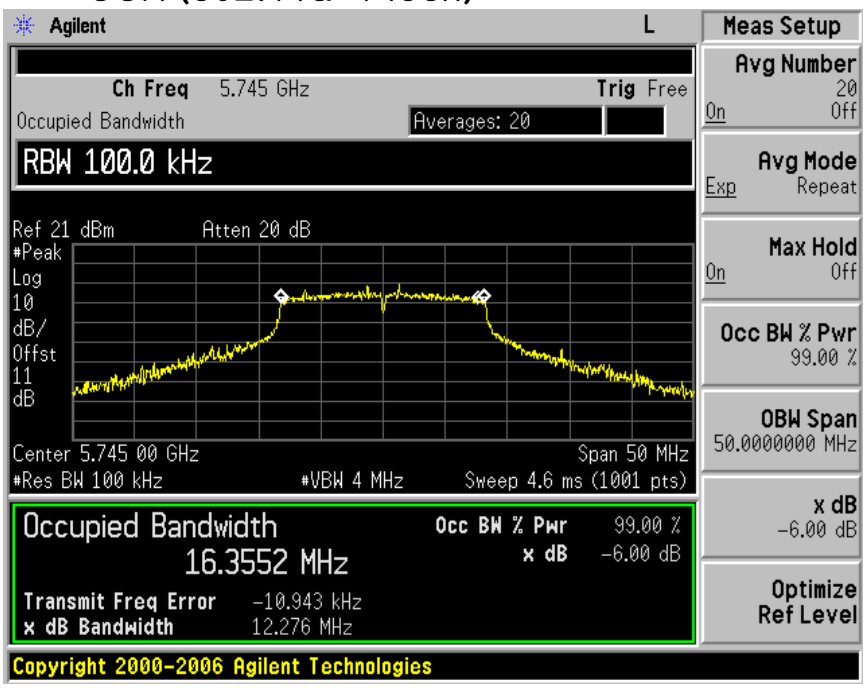
EUT	Mobile Computer	MODEL	PM60
MODE	OFDM	ENVIRONMENTAL CONDITION	24 ℃, 44 % R.H.
INPUT POWER	120 Va.c., 60 Hz		

(802.11n)

Channel Frequency (MHz)	Emission bandwidth	Bandwidth at 6dB below(MHz)	Minimum Limit (MHz)	PASS/FAIL
5745	17.58	17.27	0.5	PASS
5785	17.59	17.01	0.5	PASS
5825	17.60	17.06	0.5	PASS

5.4 Trace data

CCK (802.11a-149ch)



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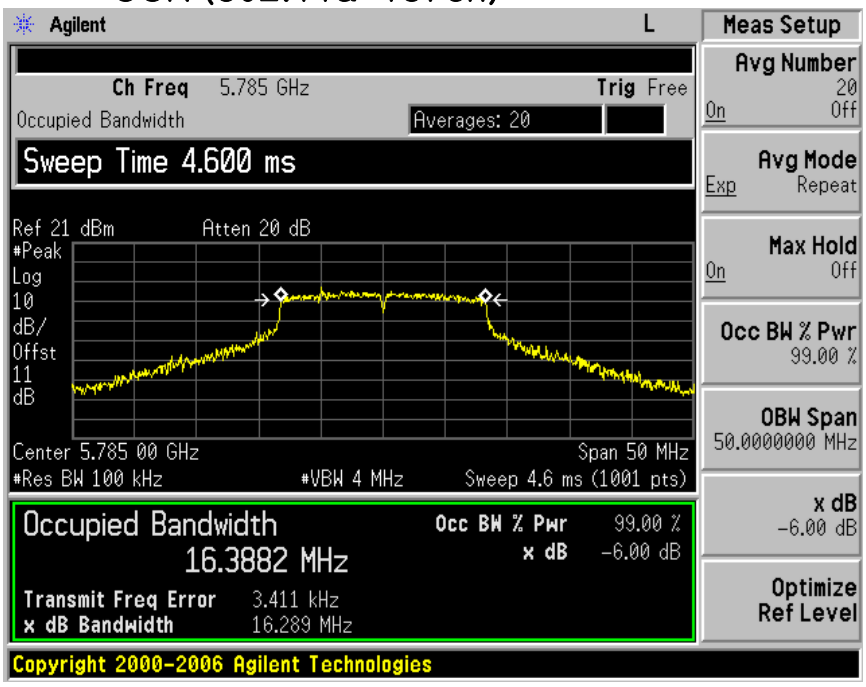

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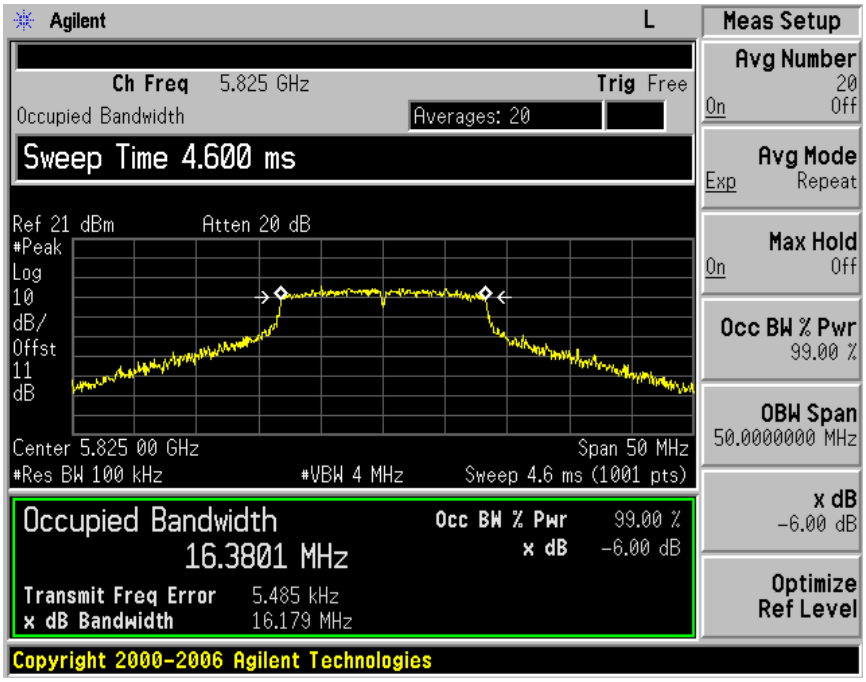
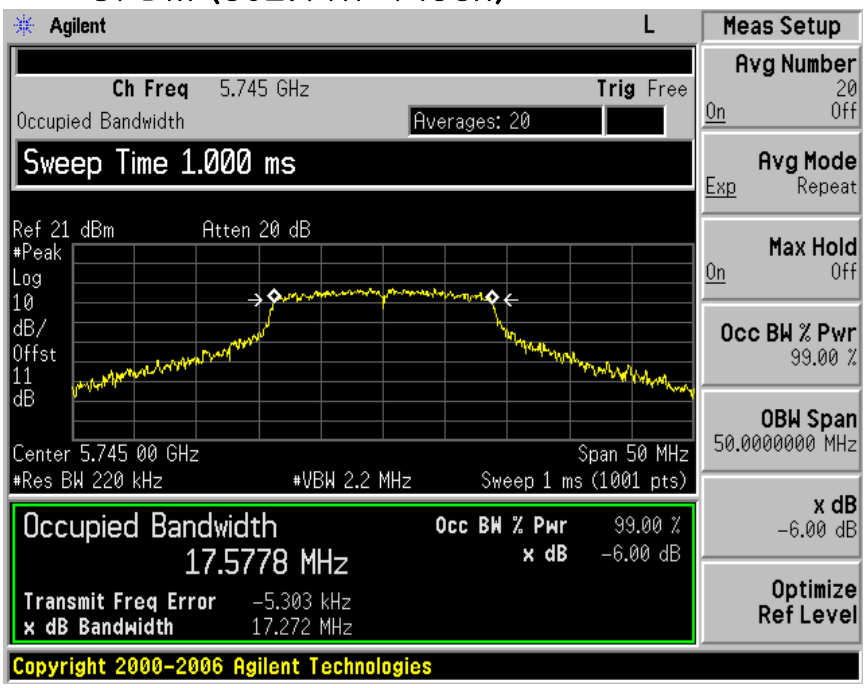


5.4-1 Trace data

OFDM (802.11n-149ch)



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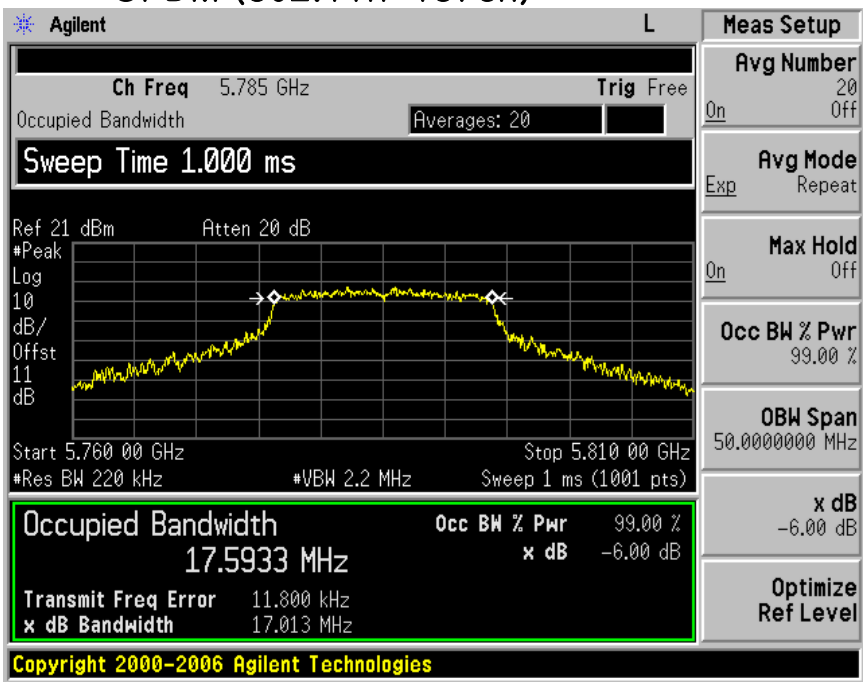

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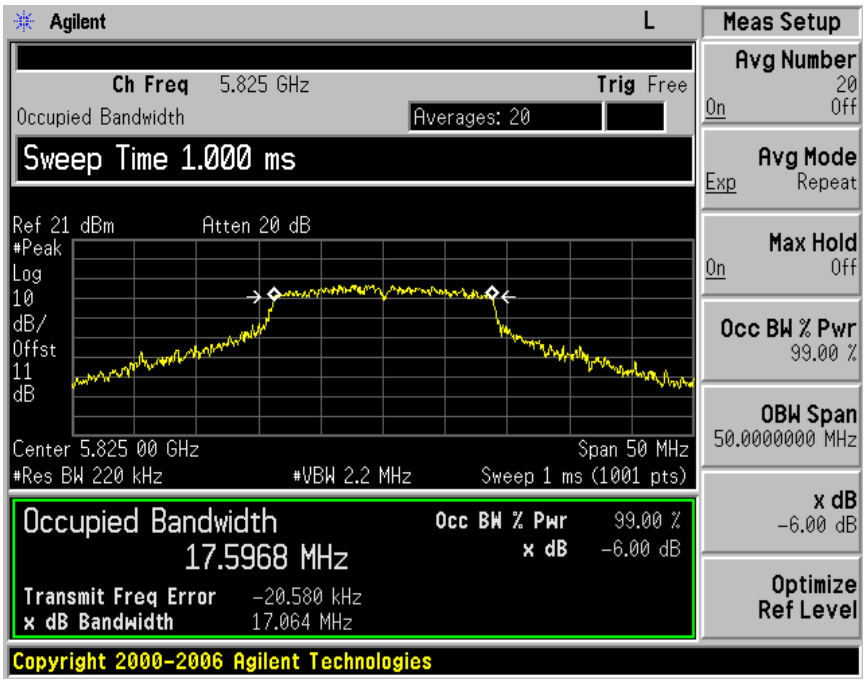


6. Maximum peak conducted output power

6.1 Test procedure

KDB 558074 D01 DTS Meas Guidance v03r02 9.1.1 RBW ≥ DTS bandwidth

6.2 Test instruments and measurement setup

a) Set the RBW ≥ DTS bandwidth.
b) Set VBW ≥ 3 × RBW.
c) Set span ≥ 3 x RBW
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

Limits : FCC § 15.247 , IC RSS-210 A8.4

Maximum Peak Output Power Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	FSV40	100939	2015-01-23
Spectrum Analyzer	4440A	US41421291	2015-01-27
RF Cable	Length: 6cm	-	
-Spectrum Analyzer <=> EUT	Loss: 11 dB	-	

6.3 Measurement results

EUT	Mobile Computer	MODEL	PM60
MODE	OFDM	ENVIRONMENTAL CONDITION	24 ℃, 43 % R.H.
INPUT POWER	120 Va.c., 60 Hz		

(802.11a)

CHANNEL	Channel requency (MHz)	Conducted Power Output(dBm)			Limit[1W] (dBm)	PASS/FAIL
		Detector	(dBm)	(W)		
149	5745	PEAK	20.19	0.10	30.0	PASS
157	5785	PEAK	19.36	0.09	30.0	PASS
165	5825	PEAK	18.68	0.07	30.0	PASS

(802.11n)

EUT	Mobile Computer	MODEL	PM60
MODE	OFDM	ENVIRONMENTAL CONDITION	24 ℃, 43 % R.H.
INPUT POWER	120 Va.c., 60 Hz		

CHANNEL	Channel Frequency (MHz)	Conducted Power Output(dBm)			Limit[1W] (dBm)	PASS/FAIL
		Detector	(dBm)	(W)		
149	5745	PEAK	19.84	0.10	30.0	PASS
157	5785	PEAK	19.02	0.08	30.0	PASS
165	5825	PEAK	18.46	0.07	30.0	PASS

7. Maximum conducted (average) output power

7.1 Test procedure

KDB 558074 D01 DTS Meas Guidance V03r02 9.2.2.4 Method AVGSA-2 (trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction)

7.2 Test instruments and measurement setup

a) Measure the duty cycle, x, of the transmitter output signal as described in 6.0.
b) Set span to at least 1.5 times the OBW.
c) Set RBW = 1-5% of the OBW, not to exceed 1 MHz.
d) Set VBW ≥ 3 x RBW.
e) Number of points in sweep ≥ 2 span / RBW. (This gives bin-to-bin spacing ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)
f) Sweep time = auto.
g) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
h) Do not use sweep triggering. Allow the sweep to "free run".
i) Trace average at least 100 traces in power averaging (i.e., RMS) mode; however, the number of traces to be averaged shall be increased above 100 as needed such that the average accurately represents the true average over the on and off periods of the transmitter.
j) Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.
k) Add 10 log (1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add 10 log (1/0.25) = 6 dB if the duty cycle is 25 %.

Maximum Peak Output Power Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	4440A	US42041281	2015-01-27
RF Cable	Length: 6cm	-	
-Spectrum Analyzer <=> EUT	Loss: 11 dB	-	

7.3 Measurement results

EUT	Mobile Computer	MODEL	PM60
MODE	OFDM	ENVIRONMENTAL CONDITION	24 ℃, 43 % R.H.
INPUT POWER	120 Va.c., 60 Hz		

(802.11a)

CHANNEL	Channel requency (MHz)	Conducted Power Output(dBm)			Measured + Factor(dBm)	Measured + Factor(mW)
		Detector	(dBm)	Factor		
149	5745	AVG	8.08	2.35	10.43	11.04
157	5785	AVG	7.27	2.35	9.62	9.16
165	5825	AVG	7.18	2.35	9.53	8.97

(802.11n)

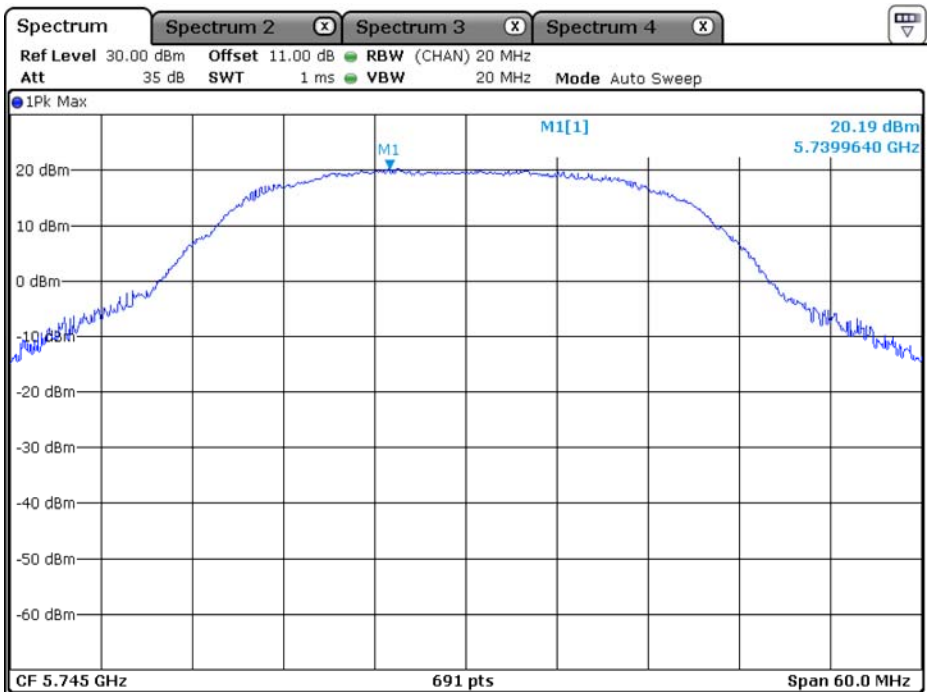
EUT	Mobile Computer	MODEL	PM60
MODE	OFDM	ENVIRONMENTAL CONDITION	24 ℃, 43 % R.H.
INPUT POWER	120 Va.c., 60 Hz		

CHANNEL	Channel requency (MHz)	Conducted Power Output(dBm)			Measured + Factor(dBm)	Measured + Factor(mW)
		Detector	(dBm)	Factor		
149	5745	AVG	6.79	2.37	9.16	8.24
157	5785	AVG	6.14	2.37	8.51	7.10
165	5825	AVG	5.73	2.37	8.10	6.46

7.4 Trace data

OFDM (802.11a-149ch)

(Peak)



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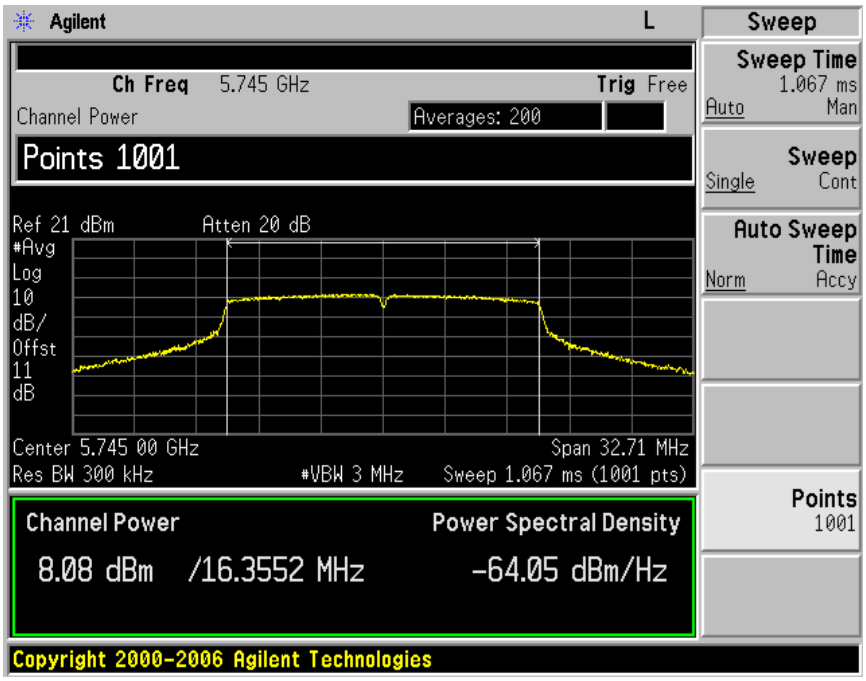

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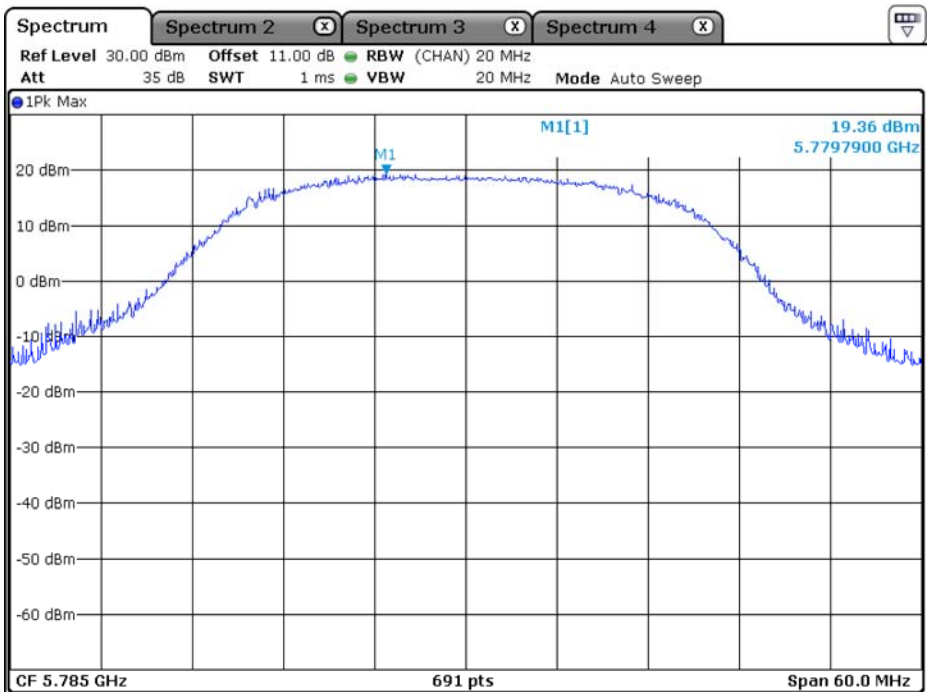
(Peak)



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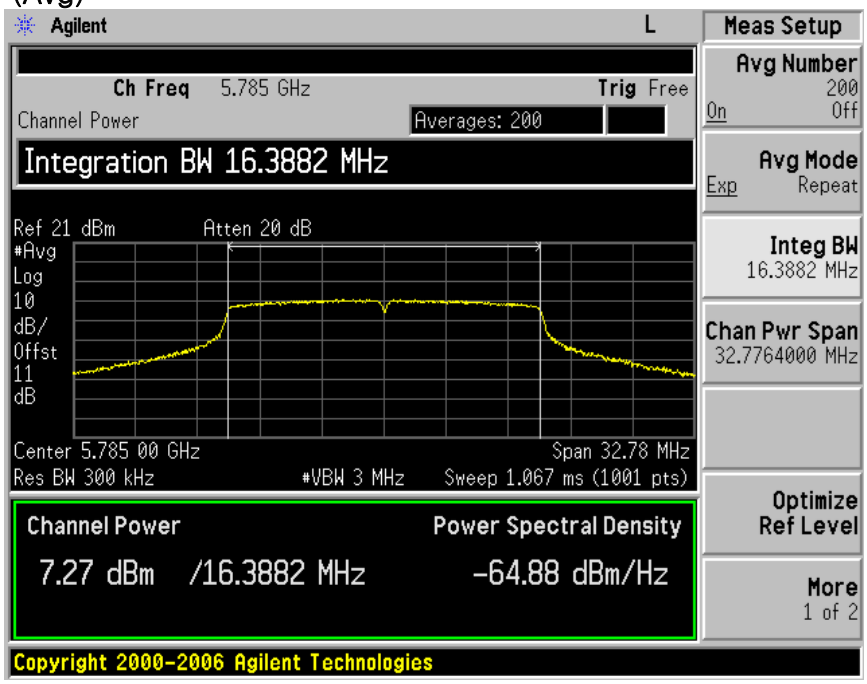
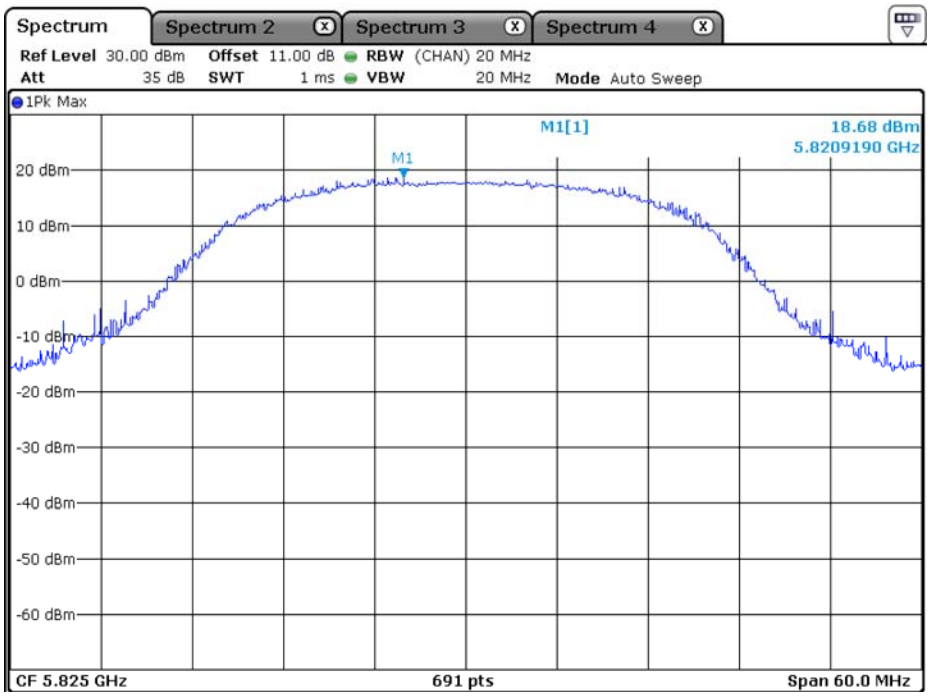


OFDM (802.11a-165ch)

(Peak)



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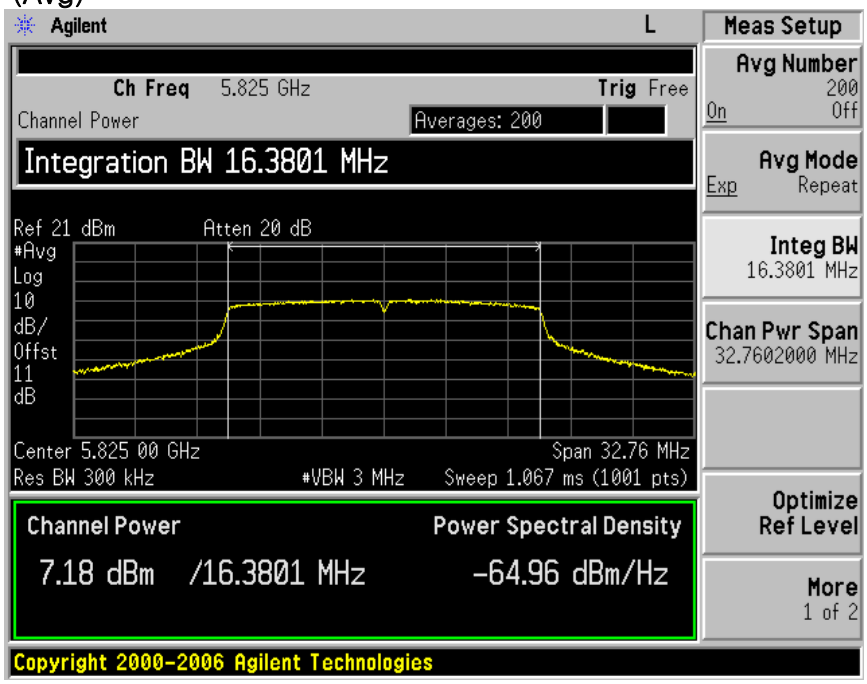
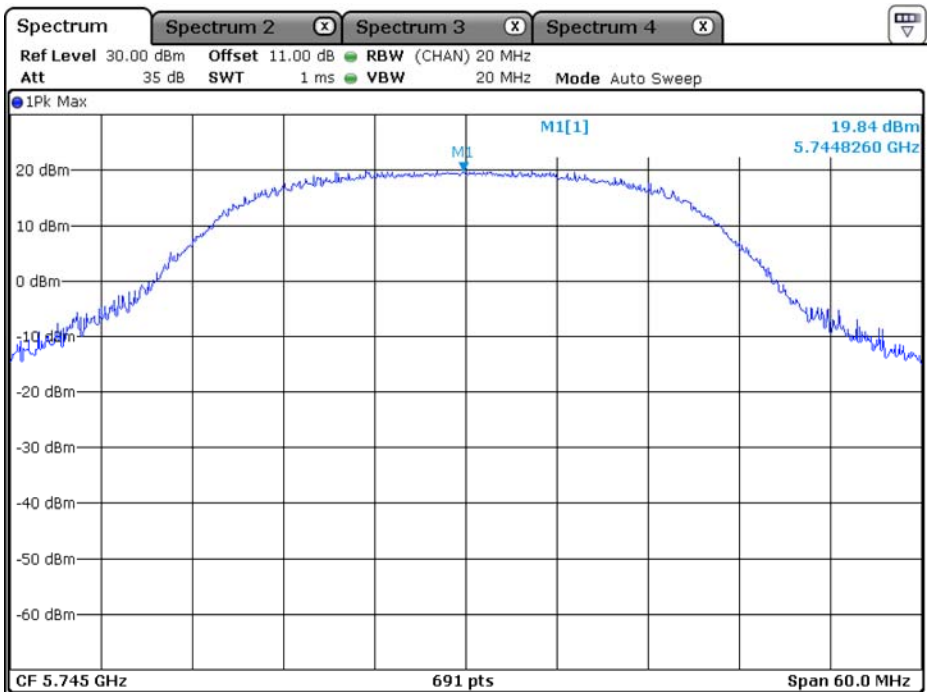


OFDM (802.11n-149ch)

(Peak)



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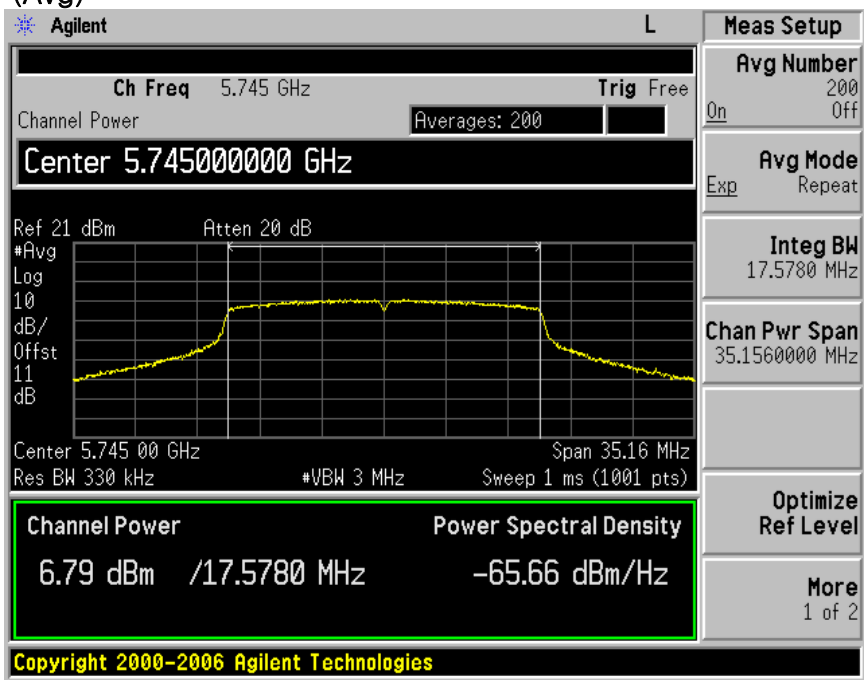

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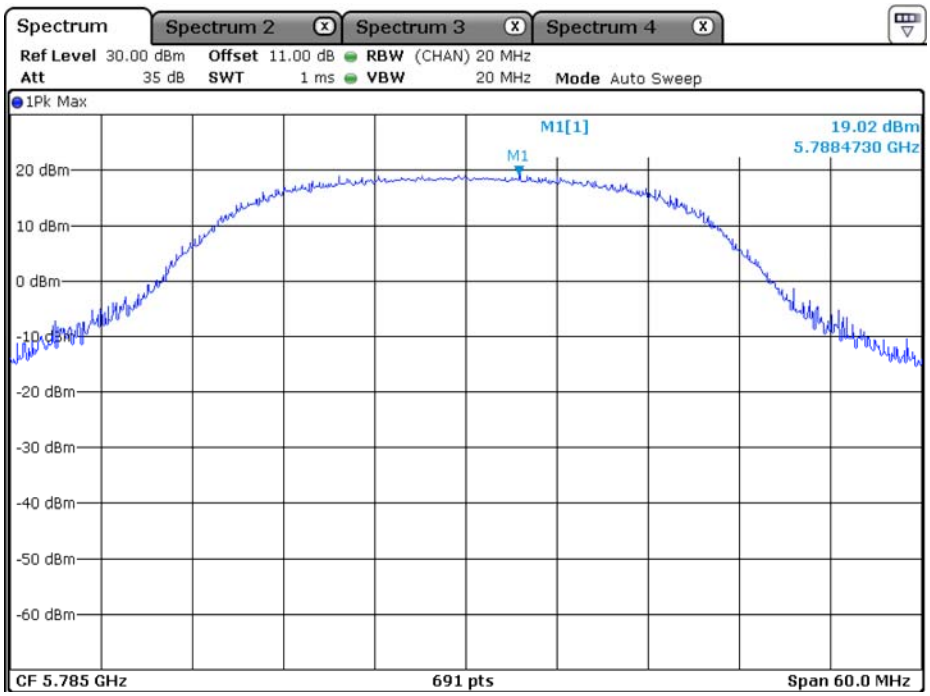
(Peak)



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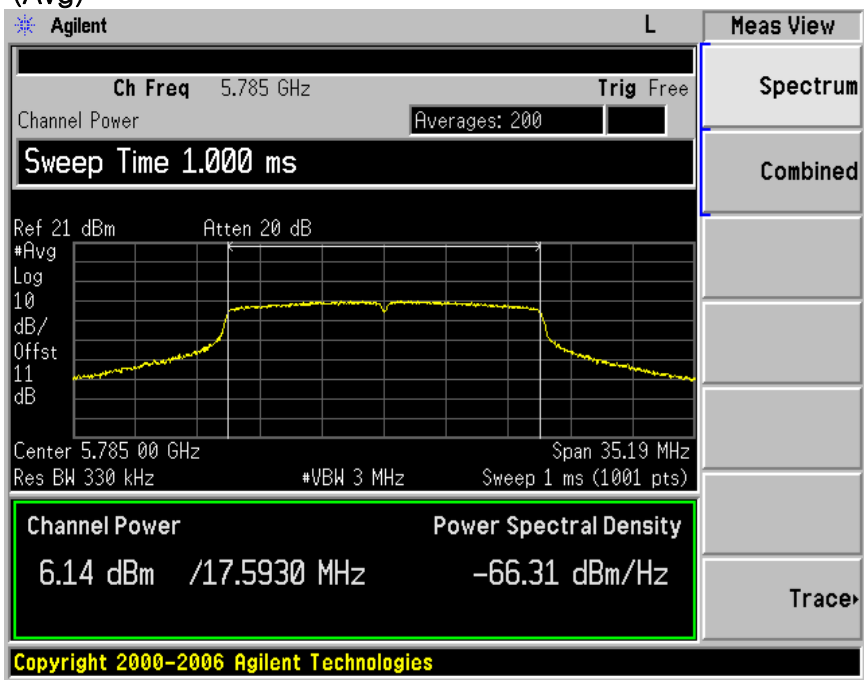
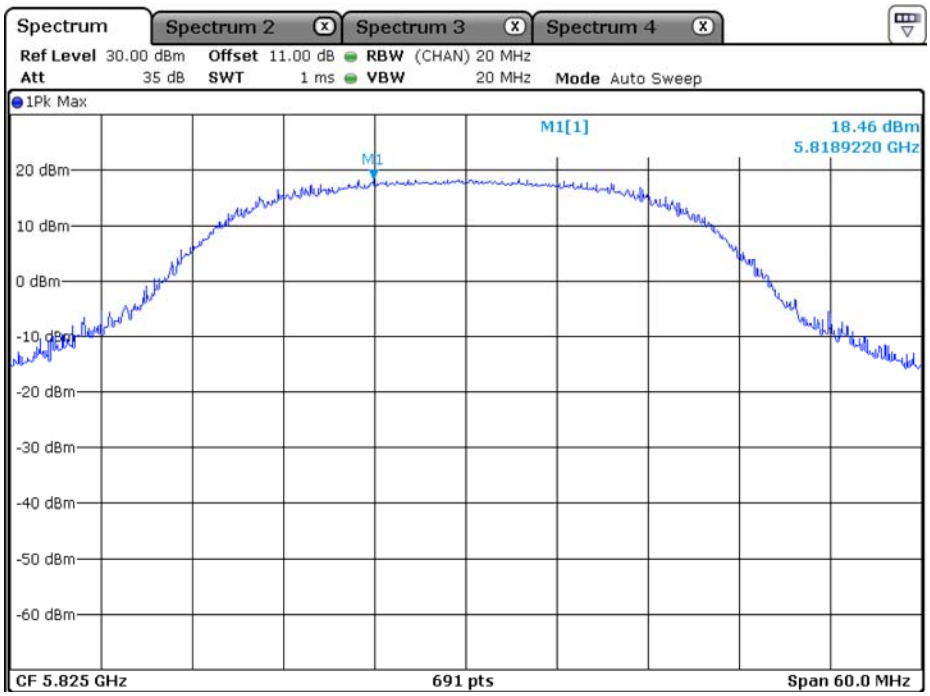


OFDM (802.11n-165ch)

(Peak)



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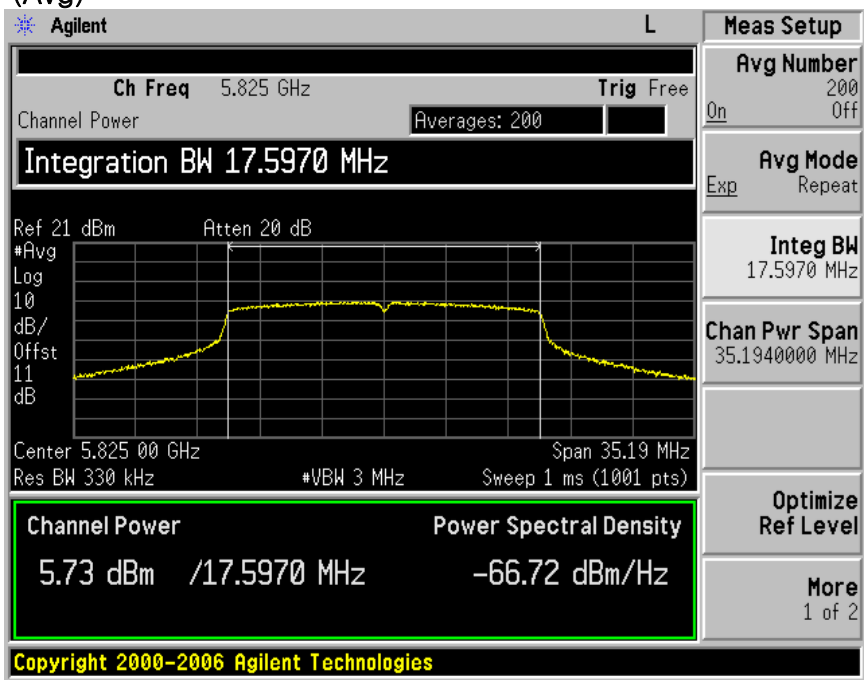


8. Maximum power spectral density level in the fundamental emission

8.1 Test procedure

KDB 558074 D01 DTS Meas Guidance V03r02 10.2 Method PKPSD (peak PSD)

8.2 Test instruments and measurement setup

The spectrum analyzer is set to as following.

a) Set analyzer center frequency to DTS channel center frequency.

b) Set the span to 1.5 times the DTS bandwidth.

c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.

d) Set the VBW ≥ 3 RBW.

e) Detector = peak.

f) Sweep time = auto couple.

g) Trace mode = max hold.

h) Allow trace to fully stabilize.

i) Use the peak marker function to determine the maximum amplitude level within the RBW.

j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Limits FCC § 15.247 , IC RSS-210 A8.2

The peak power density Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E440A	US42041281	2015-01-27
RF Cable	Length: 6cm	-	
-Spectrum Analyzer <=> EUT	Loss: 11 dB	-	

8.3 Measurement results

802.11a

EUT	Mobile Computer	MODEL	PM60
MODE	OFDM	ENVIRONMENTAL CONDITION	23 ℃, 43 % R.H.
INPUT POWER	120 Va.c., 60 Hz		

CHANNEL	Channel Frequency (MHz)	Measured Power Spectral Density (dBm)	Maximum Permissible Power Density (dBm/3kHz)	Margin
149	5745	-8.31	8.0	16.31
157	5785	-10.69	8.0	18.69
165	5825	-9.62	8.0	17.62

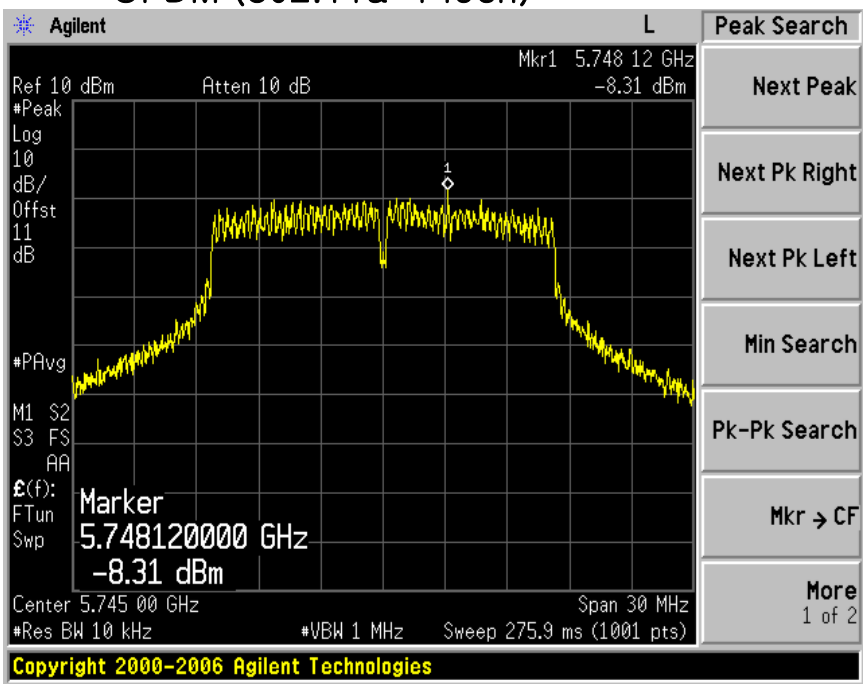
EUT	Mobile Computer	MODEL	PM60
MODE	OFDM	ENVIRONMENTAL CONDITION	23 ℃, 43 % R.H.
INPUT POWER	120 Va.c., 60 Hz		

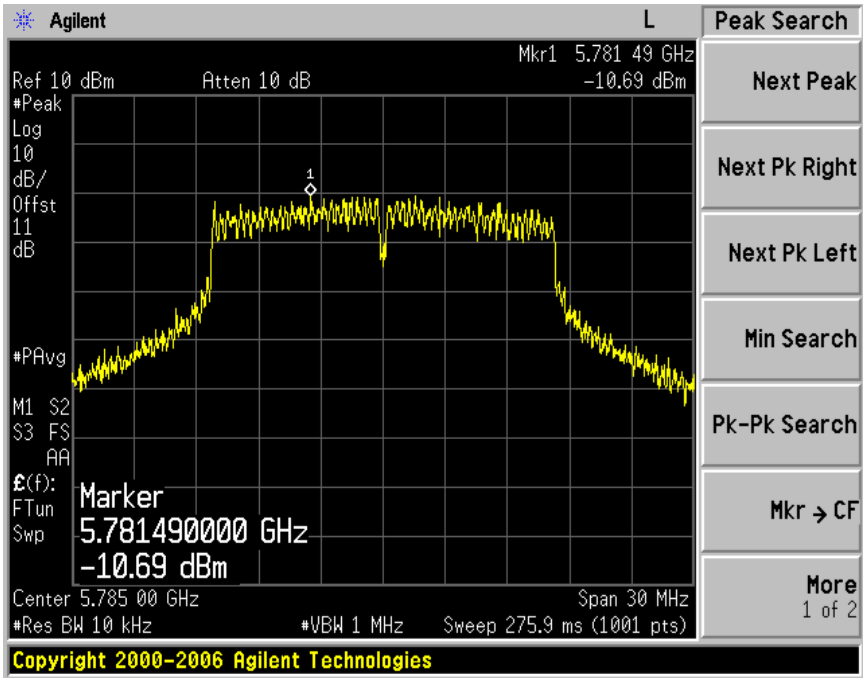
802.11n

CHANNEL	Channel Frequency (MHz)	Measured Power Spectral Density (dBm)	Maximum Permissible Power Density (dBm/3kHz)	Margin
149	5745	-10.55	8.0	18.55
157	5785	-11.24	8.0	19.24
165	5825	-11.28	8.0	19.28

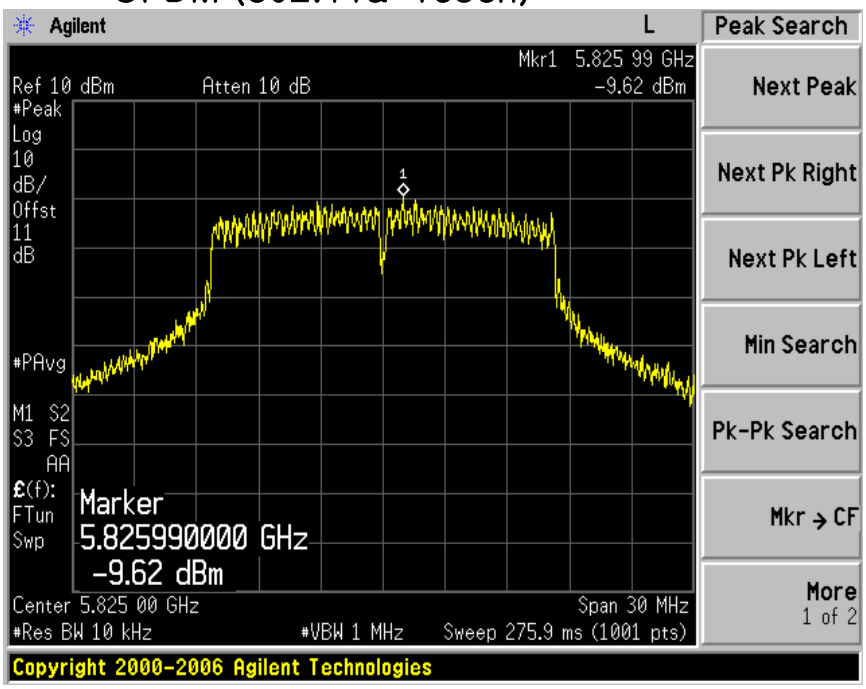
8.4 Trace data

OFDM (802.11a-149ch)

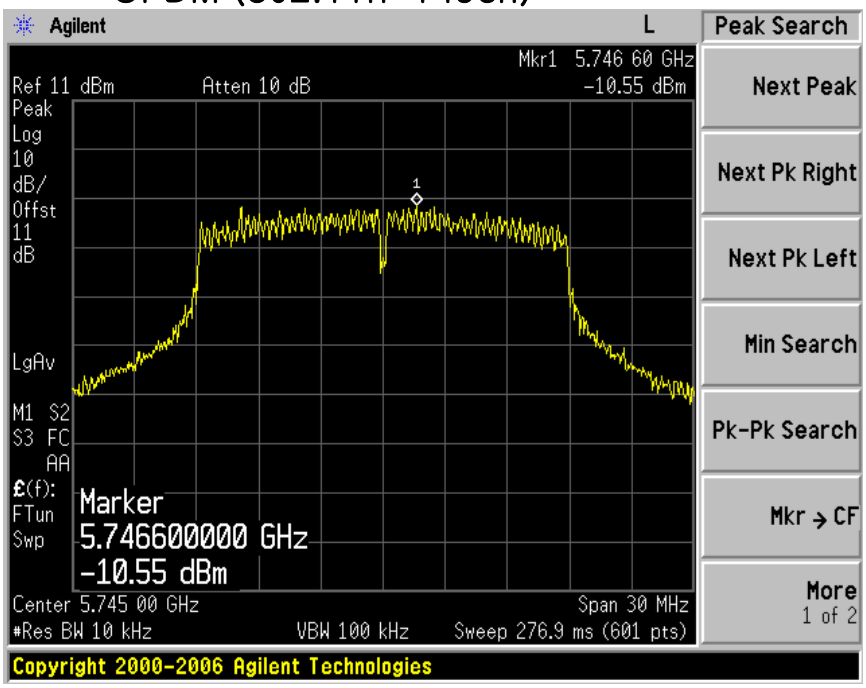


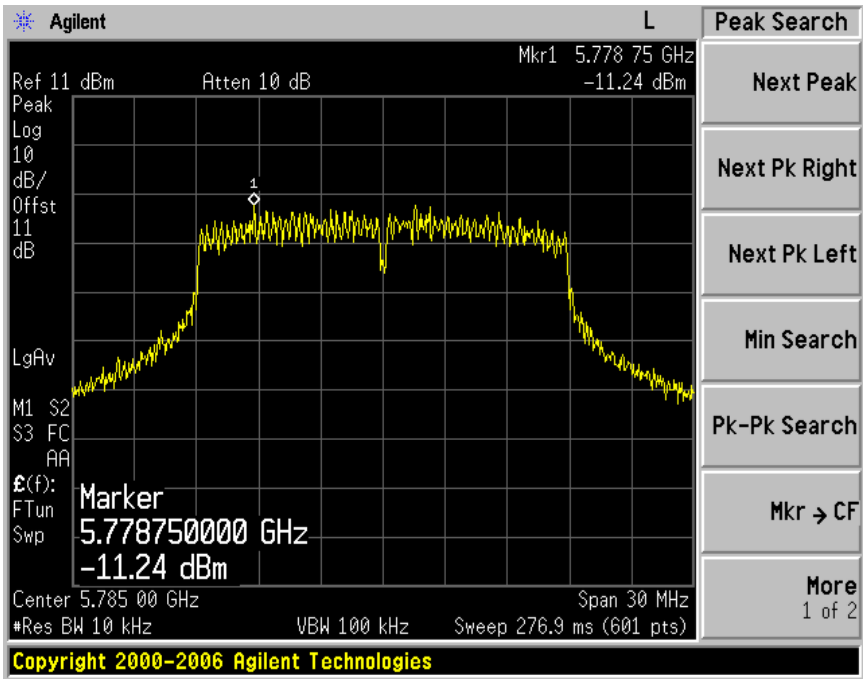


OFDM (802.11a-165ch)

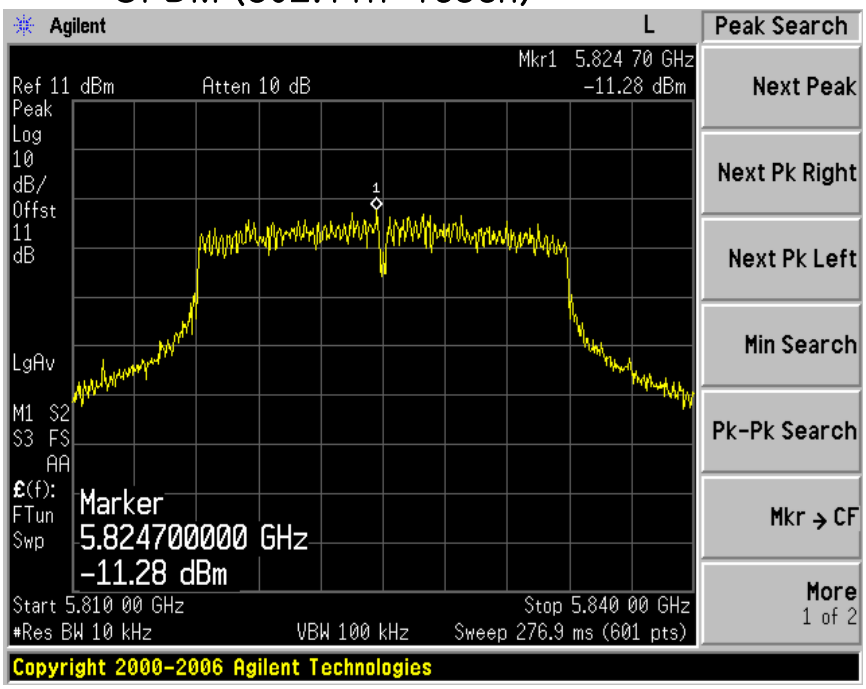


OFDM (802.11n-149ch)





OFDM (802.11n-165ch)



9. Emissions in non-restricted frequency bands

9.1 Test procedure

KDB 558074 D01 DTS Meas Guidance V03r02 11.0 Emissions in non-restricted frequency

9.2 Test instruments and measurement setup

The spectrum analyzer is set to as following.

a) Set the center frequency and span to encompass frequency range to be measured.

b) Set the RBW = 100 kHz)

c) Set the VBW ≥ 3 x RBW)

d) Detector = peak.

e) Ensure that the number of measurement points ≥ span/RBW

f) Sweep time = auto couple.

g) Trace mode = max hold.

h) Allow trace to fully stabilize.

i) Use the peak marker function to determine the maximum amplitude level.

Limits FCC § 15.247 , IC RSS-210 A8.5

Band Edge&Out of Emission Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E4440A	US42041281	2015-01-27
Spectrum Analyzer	FSV40	100939	2015-01-23
RF Cable	Length: 6cm		-
-Spectrum Analyzer <=> EUT	Loss: 11 dB		-

not

1. RBW was set to 1MHz rather than 100khz in order to increase the measurement speed

2. The display line shown in the following plots denotes the limit at 20dB below the fundamental emission level measured in a 100khz bandwidth. however, since the traces in the following plots are measured with a 1mhz rbw , the display line may not necessarily appear to be 20dB below the level of the fundamental in a 1MHz

3. for plots showing conducted spurious emissions near the limit, the frequencies were investigated with a reduced rbw to ensure that no emissions were present

9.3 Measurement results of band-edge & out of emission

EUT	Mobile Computer	MODEL	PM60
MODE	OFDM	ENVIRONMENTAL CONDITION	23 ℃, 43 % R.H.
INPUT POWER	120 Va.c., 60 Hz		

802.11a

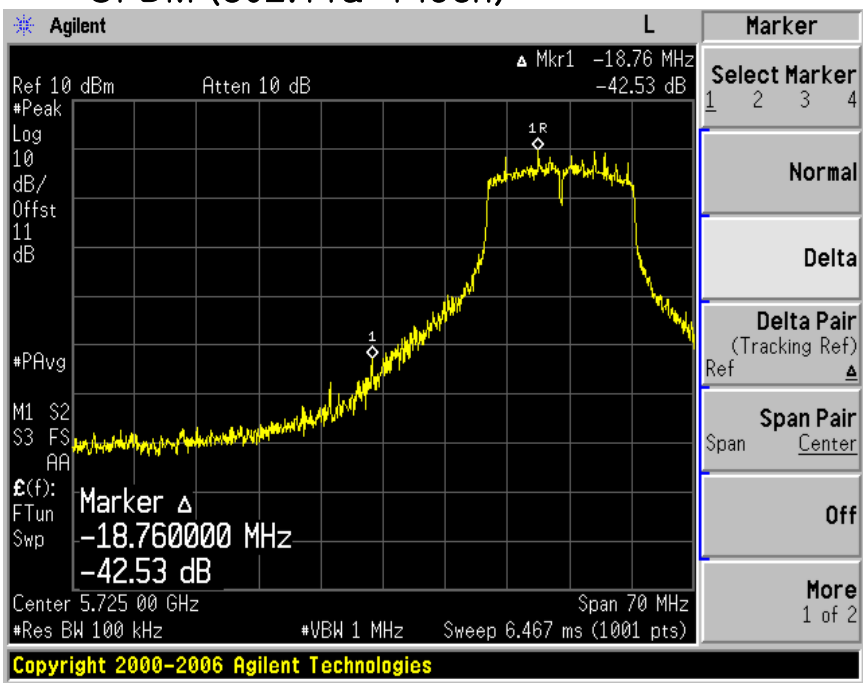
CHANNEL	Channel Frequency (MHz)	limit	PASS/FAIL
149	5745	20dBc	PASS
165	5825	20dBc	PASS

802.11n

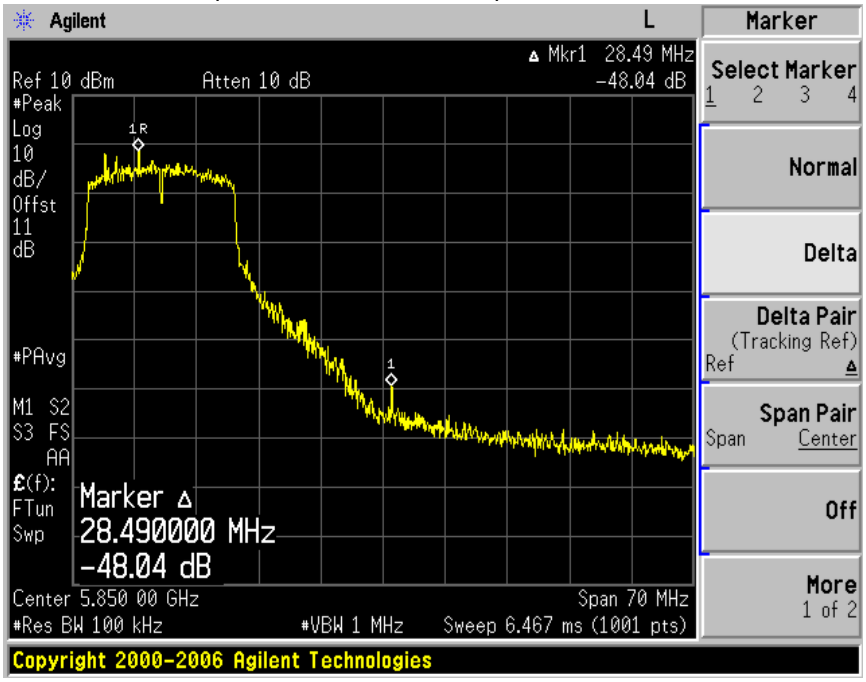
CHANNEL	Channel Frequency (MHz)	limit	PASS/FAIL
149	5745	20dBc	PASS
165	5825	20dBc	PASS

9.4 Trace data of band-edge & Out of Emission

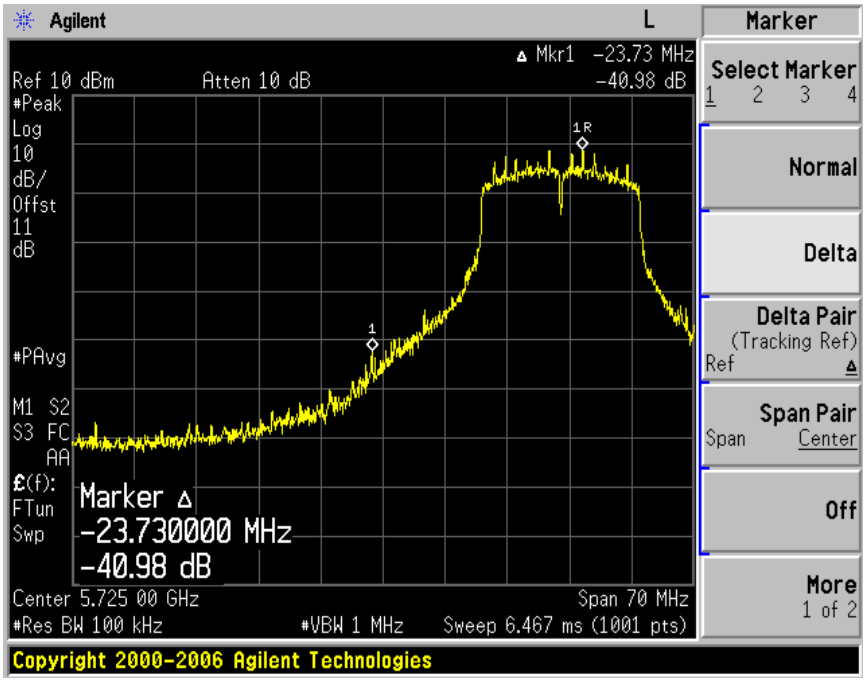
OFDM (802.11a-149ch)



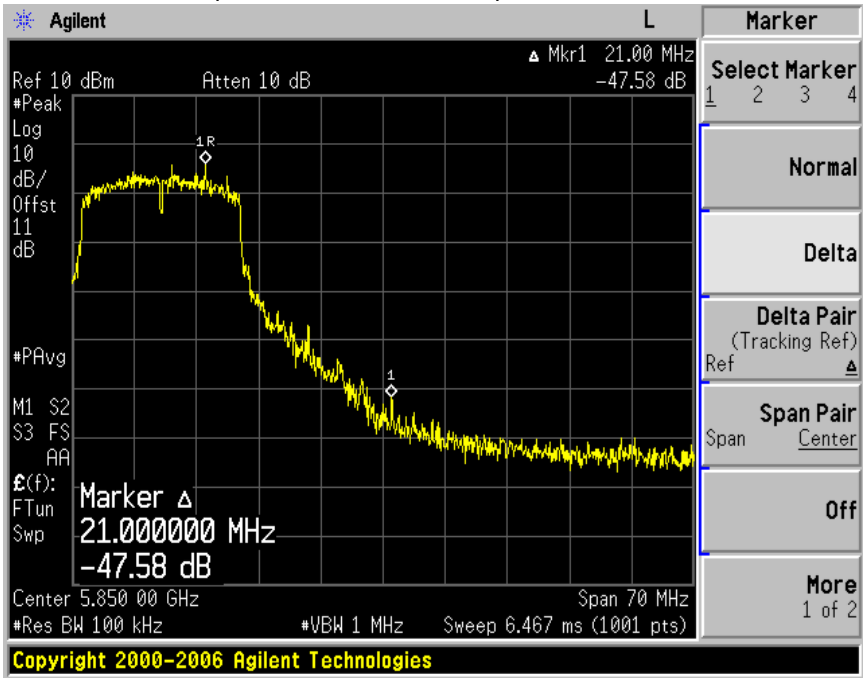
OFDM (802.11a-165ch)



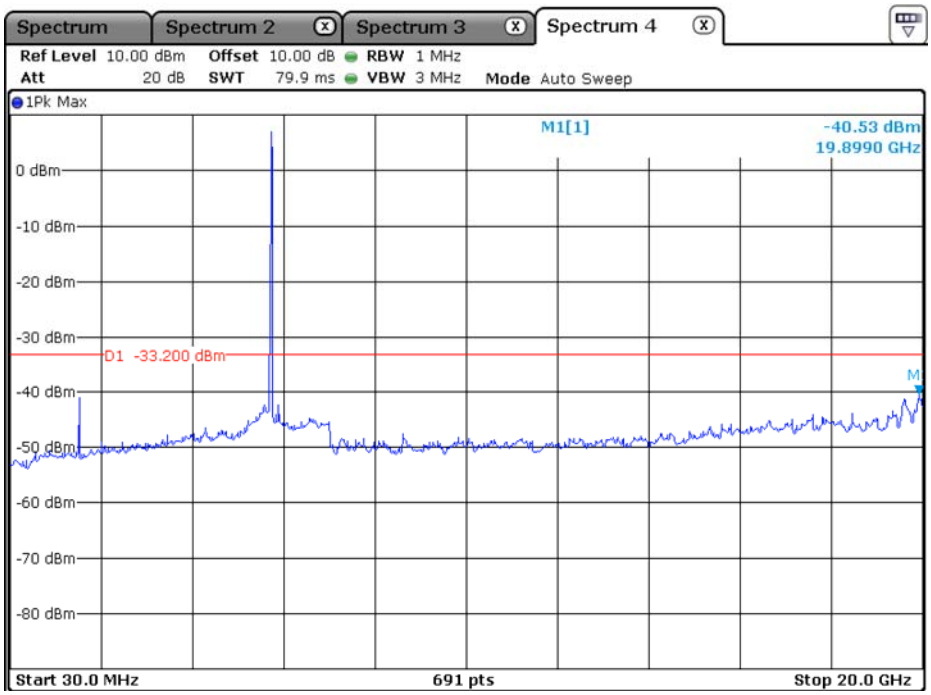
OFDM (802.11n-149ch)

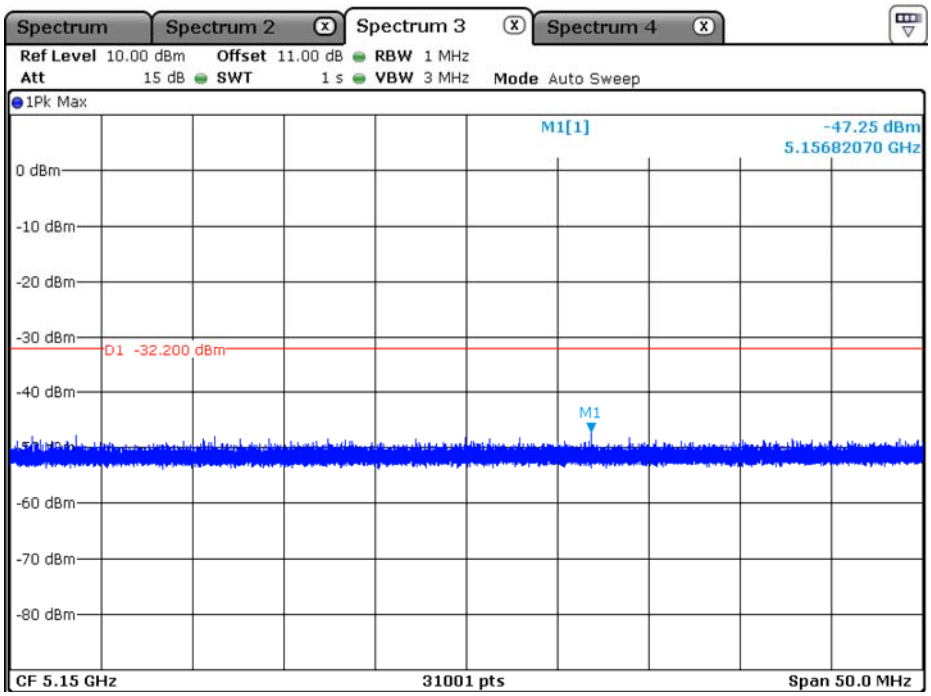


OFDM (802.11n-165ch)

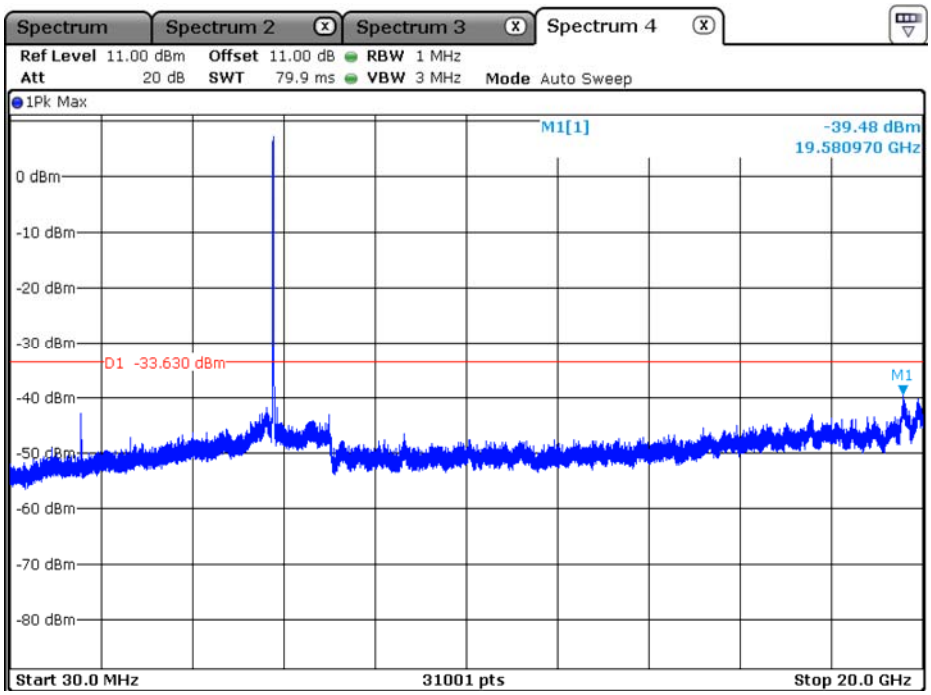


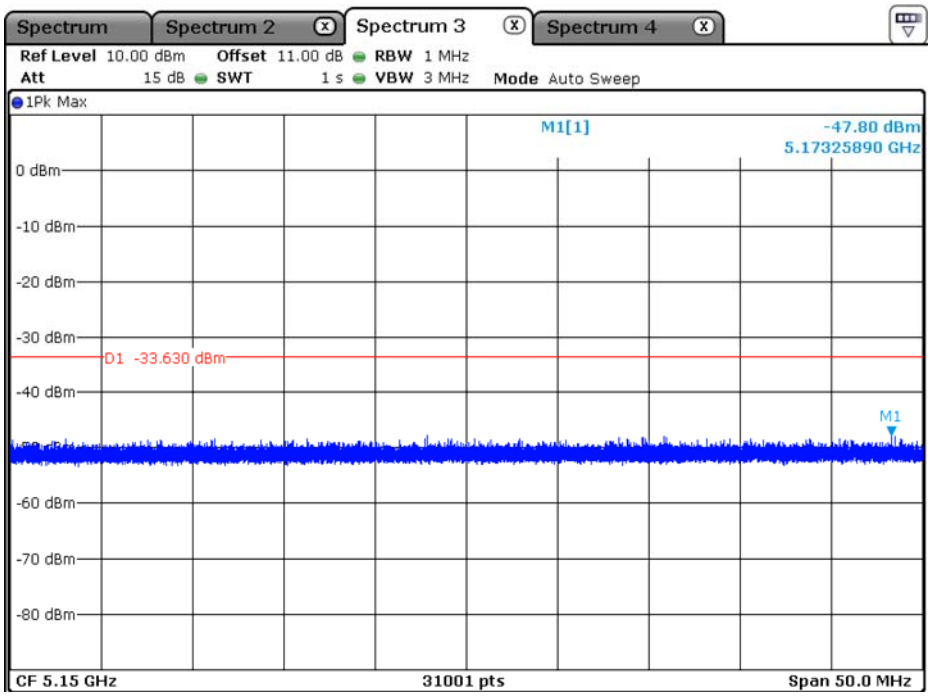
OFDM (802.11a-149ch)



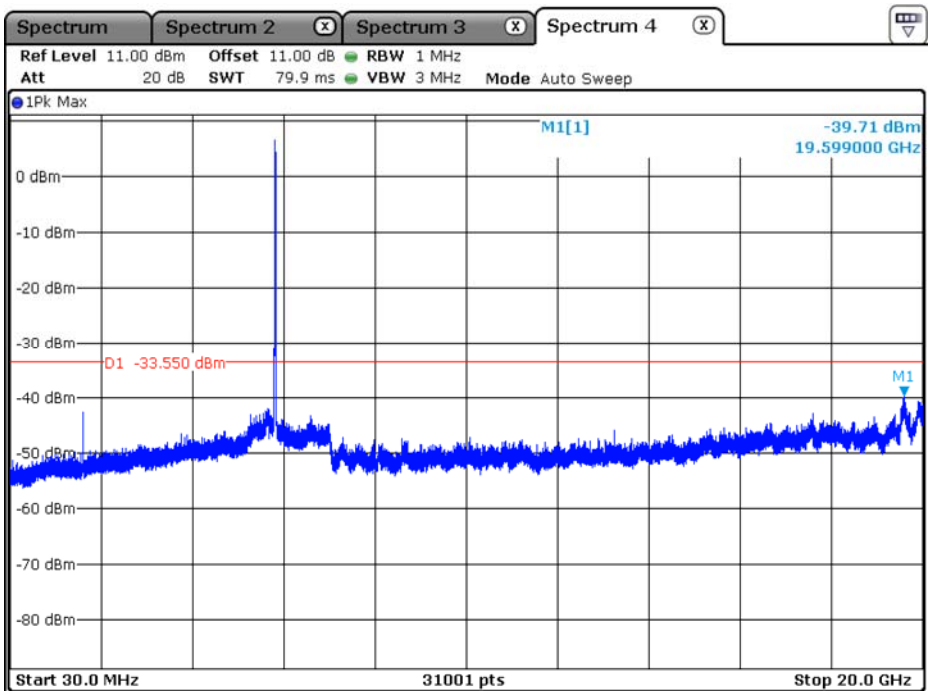


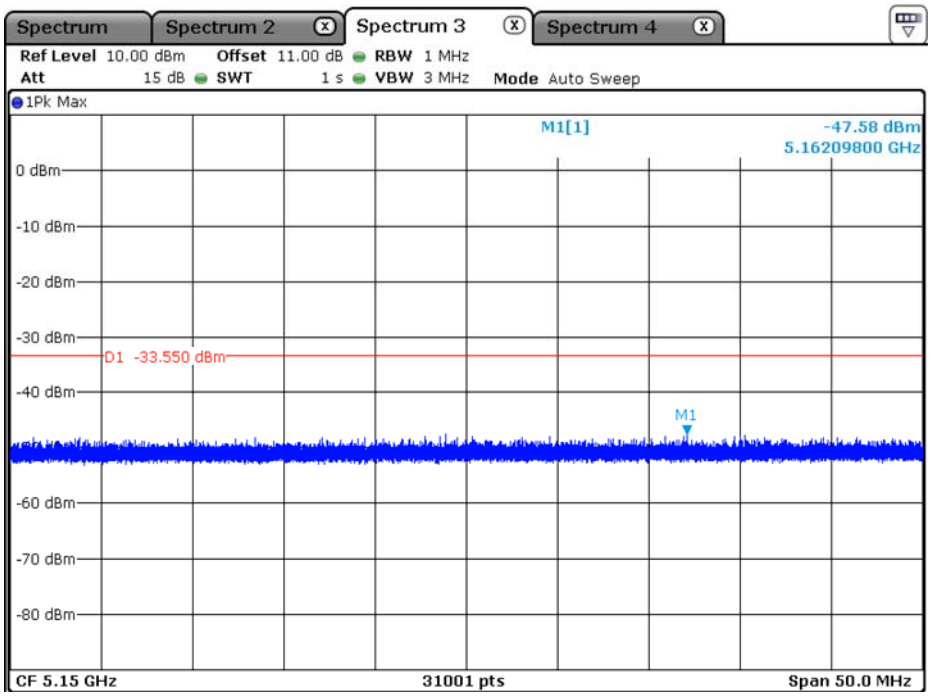
OFDM (802.11a-157ch)



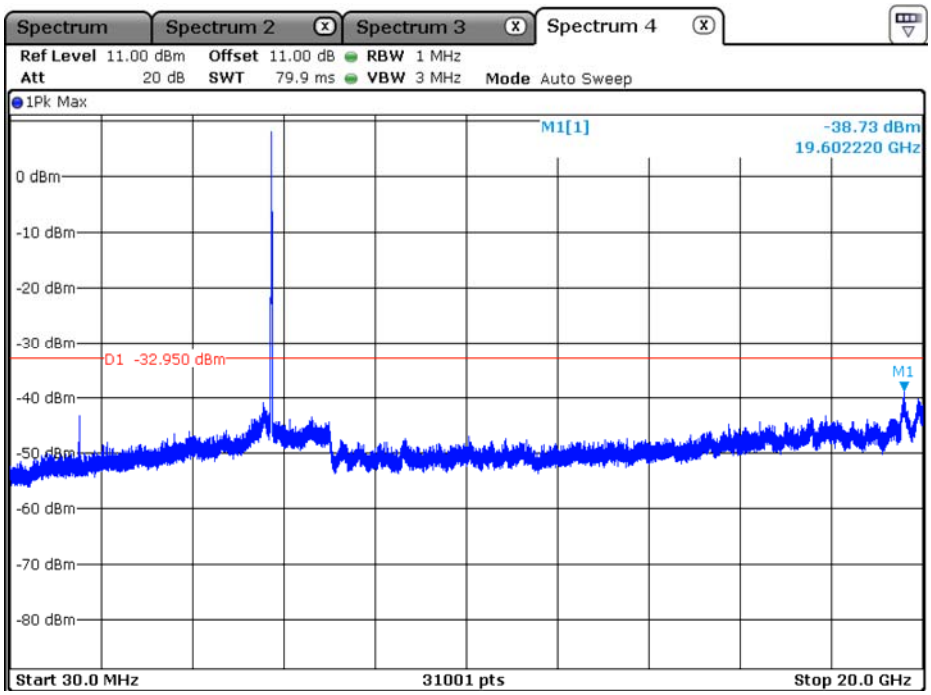


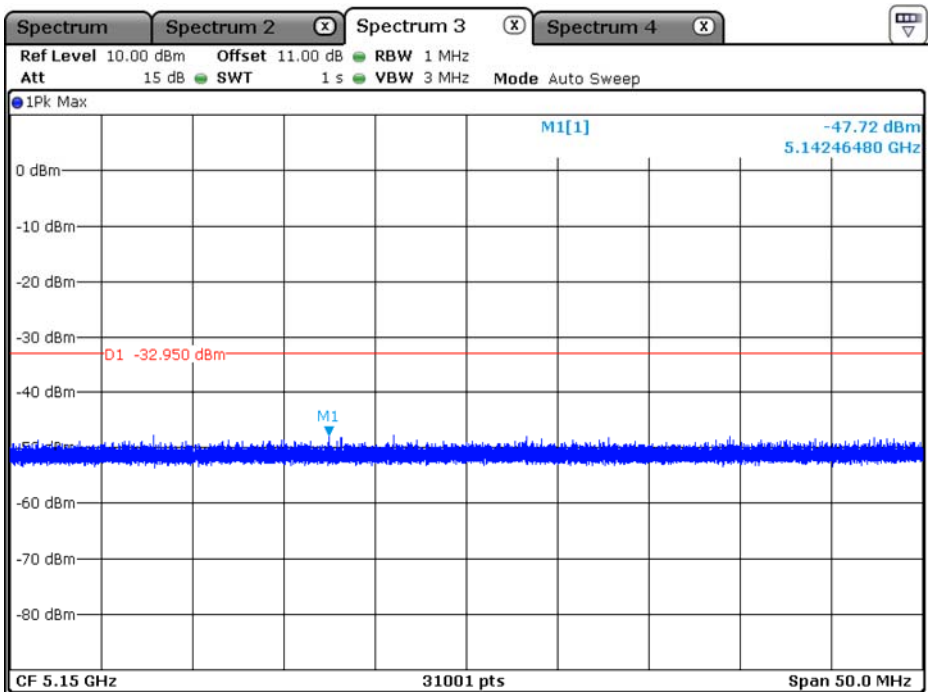
OFDM (802.11a-165ch)



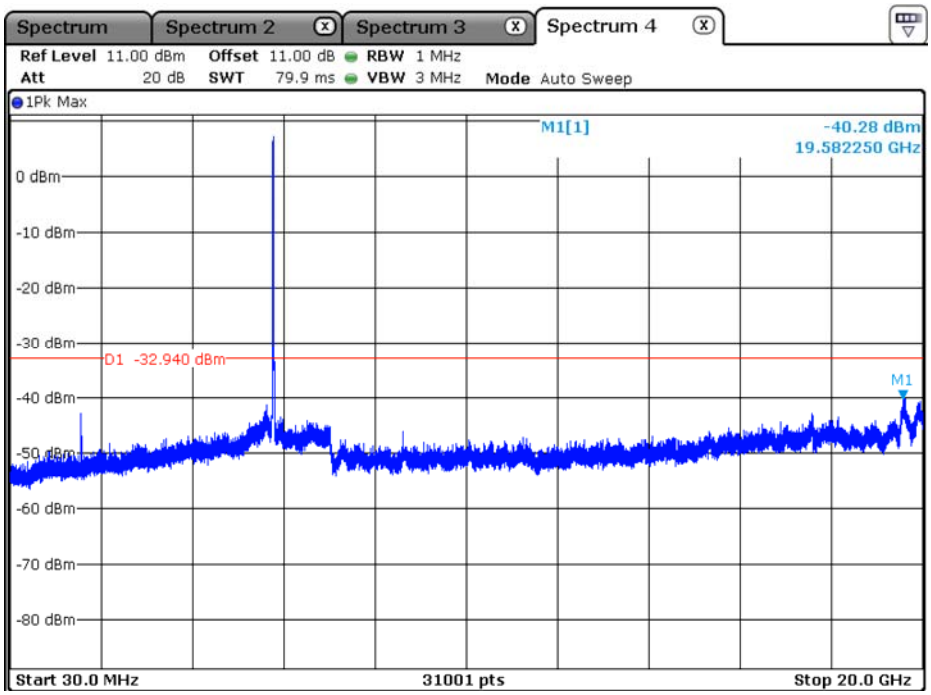


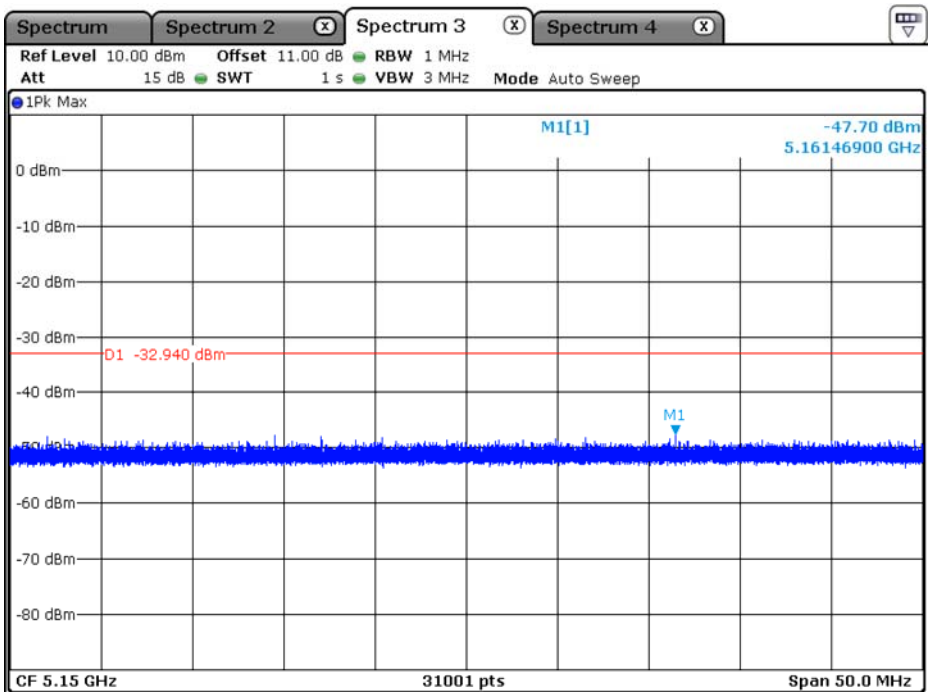
OFDM (802.11n-149ch)



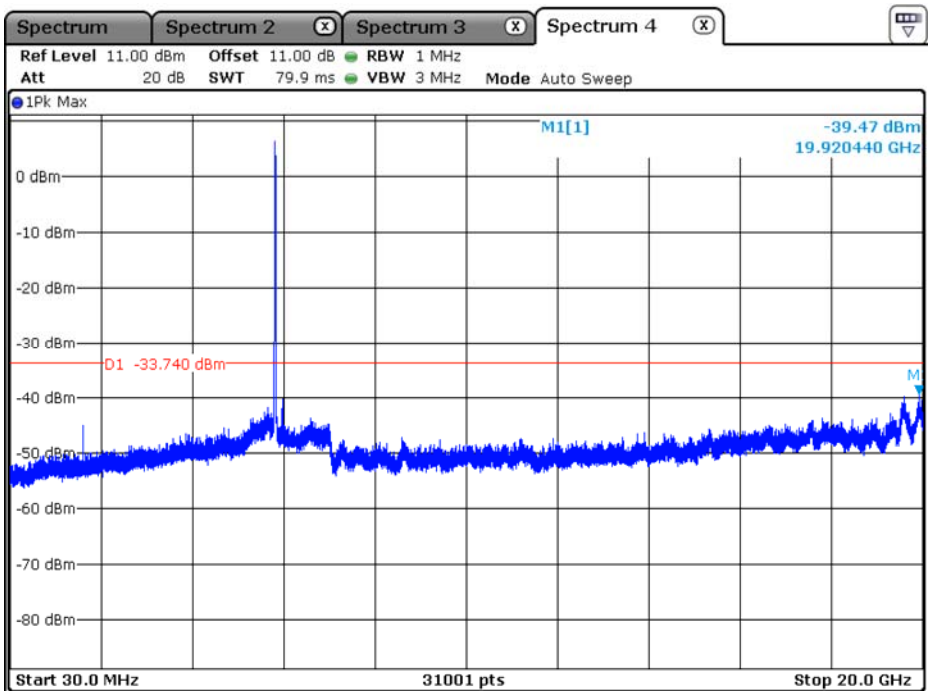


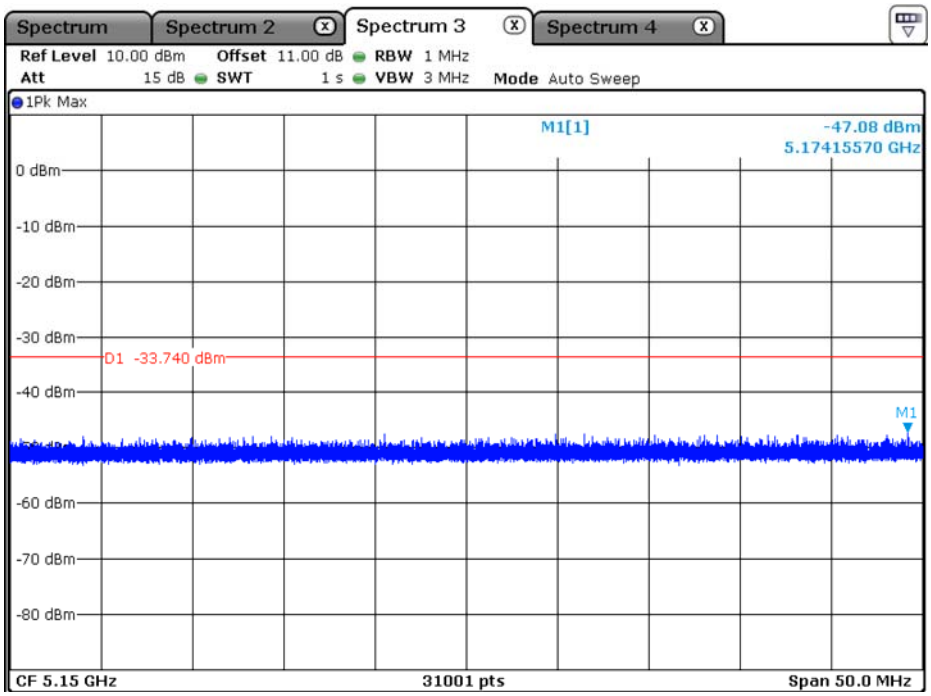
OFDM (802.11n-157ch)





OFDM (802.11n-165ch)





10. Measurement of radiated disturbance

Above 30 MHz Electric Field strength was measured in accordance with FCC PART 15.205, 15.209 & IC RSS-210 (A8.5). The test setup was made according to ANSI C 63.4 (2009) & KDB 558074 D01 Semi-anechoic chamber, which allows a 3 m distance measurement. The EUT was placed in the center of styrofoam. turntable. The height of this table was 0.8 m. The measurement was conducted with both horizontal and vertical antenna polarization. The turntable has fully rotated. For further description of the configuration refer to the picture of the test setup.

10.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
TEST Receiver	ESCI7	ROHDE & SCHWARZ	1166.5950.07	23-Jan-15
Logbicon Antenna	VULB 9168	SCHWARZBECK	237	13-Jan-15
Turn Table	DT3000-2t	Innco System GmbH	N/A	-
Antenna Mast	MA4000-EP	Innco System GmbH	N/A	-
PREAMPLIFIER	8449B	AGILENT	3008A00595	13-Jan-15
Horn Antenna	BBHA9120D	SCHWARZBECK	469	11-Nov-14
Test Receiver	ESPI7	ROHDE & SCHWARZ	100185	13-Jan-15
Spectrum Analyzer	R3273	ADVANTEST	110600592	13-Jan-15
Turn Table	DT1500-S	Innco System GmbH	N/A	-
Antenna Mast	MA4000-EP	Innco System GmbH	N/A	-
Pyramidal Horn Antenna	3160-09-01	EST-LINDGREN	102642	14-Nov-14
Antenna Master & Turn table controller	CO2000-P	Innco System GmbH	CO2000/642 /28051111/L	-
Spectrum Analyzer	FSV40	ROHDE & SCHWARZ	100939	23-Jan-15
Double Ridged Horn Antenna	SAS-574	A.H.SYSTEMS	154	17-Mar-15
PREAMPLIFIER	83051A	AGILENT	3950M00201	2-Jun-15

10.2 Environmental Condition

Below 1 GHz -Test Place : 10 m Semi-anechoic chamber

Wireless LAN 802.11a Mode
Temperature (°C) : 21.8 ℃
Humidity (% R.H.) : 42.9 % R.H.

Wireless LAN 802.11n Mode
Temperature (°C) : 21.4 ℃
Humidity (% R.H.) : 49.9 % R.H.

Above 1 GHz-Test Place : 3 m Semi-anechoic chamber

Wireless LAN 802.11a Mode
Temperature (°C) : 21.1 ℃
Humidity (% R.H.) : 52.9 % R.H.

Wireless LAN 802.11n Mode
Temperature (°C) : 21.8 ℃
Humidity (% R.H.) : 49.7 % R.H.

10.3 Measurement Instrument setting for Radiated Emission

10.3.1 Frequency range below 1 GHz

RBW: 120 kHz , VBW: 3 x RBW , Detector: Quasi Peak

10.3.2 Frequency range above 1 GHz

Peak Power Measurement Procedure (KDB 558074 section 12.2.4)

a.RBW: 1 MHz , VBW: 3 MHz
b.Trace mode = max hold
c.Detector: Peak
d.Sweep time = auto

Average Power Measurement Procedures (KDB 558074 section 12.2.5.2)

a.Set analyzer center frequency to the frequency associated with the emission
b.RBW: 1 MHz , VBW: 3 MHz
c.Detector : power average (RMS) detector
d.Sweep time = auto

Note

	Duty cycle(%)	Ton (ms)	Ton + Toff (ms)	DCF=10*log(1/Duty) (dB)
802.11a	60.8	1.485	2.444	2.16
802.11b	89.1	8.420	9.454	0.50
802.11g	57.7	1.390	2.409	2.39
802.11n 2.4 GHz	58.9	1.353	2.298	2.30
802.11n 5 GHz	58.9	1.372	2.331	2.30

*This was applied of duty cycle factor for average value because of measured with the EUT transmitting continuously less than 98% duty cycle at its maximum power control level.

10.4 Test Data for wireless LAN (802.11a)

Test Date : 6-Nov-14 Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Result Value		
				Ant Factor (dB)	Cable (dB)	Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
33.70	14.54	V	1.4	11.33	0.87	40.00	26.74	-13.26
72.00	17.42	V	2.1	10.85	1.30	40.00	29.57	-10.43
172.80	10.73	V	2.8	11.98	2.00	43.50	24.71	-18.79
193.60	11.66	V	2.1	10.13	2.12	43.50	23.91	-19.59
197.50	12.61	H	3.9	9.73	2.15	43.50	24.49	-19.01
300.00	13.81	H	2.4	13.55	2.66	46.00	30.02	-15.98
420.00	5.04	H	2.9	16.27	3.16	46.00	24.46	-21.54

Remark	H : Horizontal, V : Vertical TEST MODE : 802.11a-CH157 (5785 MHz) *Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position) *CL = Cable Loss(In case of below 1000 MHz) *Result Value = Reading + Ant Factor + Cable loss *The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection at frequency below 1 GHz.

10.4-1 Test Data for wireless LAN

Test Date 4-Nov-14 Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction(dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK(RBW: 1 MHz VBW: 3 MHz)									
11490.00	36.72	H	1.2	39.93	-16.46	0.00	74.00	60.19	-13.81
11490.00	34.44	V	1.1	39.93	-16.46	0.00	74.00	57.91	-16.09
AV(RBW: 1 MHz VBW: 3 MHz)									
11490.00	24.08	H	1.2	39.93	-16.46	2.16	54.00	49.71	-4.29
11490.00	23.02	V	1.1	39.93	-16.46	2.16	54.00	48.65	-5.35

Remark

H : Horizontal, V : Vertical TEST MODE : 802.11a-CH149 (5745 MHz)

*The TX signal wasn't detected from 3th harmonics.
*Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position)
*Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Duty Cycle Correction

FYI
a. Ton Time : 1.485 ms
b. duty cycle : 60.8 %
c. DCF : 2.16 dB

10.4-2 Test Data for wireless LAN

Test Date 4-Nov-14 Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction(dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK(RBW: 1 MHz VBW: 3 MHz)									
11570.0	36.82	H	1.1	39.79	-16.43	0.00	74.00	60.18	-13.82
11570.0	36.87	V	1.1	39.79	-16.43	0.00	74.00	60.23	-13.77
AV(RBW: 1 MHz VBW: 3 MHz)									
11570.0	23.94	H	1.1	39.79	-16.43	2.16	54.00	49.46	-4.54
11570.0	24.11	V	1.1	39.79	-16.43	2.16	54.00	49.63	-4.37

Remark

H : Horizontal, V : Vertical TEST MODE : 802.11a-CH157(5785 MHz)

*The TX signal wasn't detected from 3th harmonics.
*Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position)
*Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Duty Cycle Correction
FYI
a. Ton Time : 1.485 ms
b. duty cycle : 60.8 %
c. DCF : 2.16 dB

10.4-4 Test Data for wireless LAN

Test Date 4-Nov-13 Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction(dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK(RBW: 1 MHz VBW: 3 MHz)									
11650.0	35.76	H	1.2	39.64	-16.40	0.00	74.00	59.00	-15.00
11650.0	36.10	V	1.1	39.64	-16.40	0.00	74.00	59.34	-14.66
AV(RBW: 1 MHz VBW: 3 MHz)									
11650.0	24.58	H	1.2	39.64	-16.40	2.16	54.00	49.98	-4.02
11650.0	23.21	V	1.1	39.64	-16.40	2.16	54.00	48.61	-5.39

Remark	H : Horizontal, V : Vertical TEST MODE : 802.11a-CH165 (5825 MHz) *The TX signal wasn't detected from 3th harmonics. *Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position) *Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Duty Cycle Correction FYI a. Ton Time : 1.485 ms b. duty cycle : 60.8 % c. DCF : 2.16 dB

10.5 Test Data for wireless LAN (802.11n)

Test Date : 6-Nov-14 Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Result Value		
				Ant Factor (dB)	Cable (dB)	Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
73.20	17.89	V	1.4	10.63	1.31	40.00	29.82	-10.18
148.10	6.71	H	1.8	12.46	1.86	43.50	21.03	-22.47
159.10	10.10	V	1.8	12.79	1.92	43.50	24.82	-18.68
172.80	11.32	H	3.5	11.98	2.00	43.50	25.30	-18.20
197.50	12.92	H	2.5	9.73	2.15	43.50	24.80	-18.70
300.00	11.21	H	2.1	13.55	2.66	46.00	27.42	-18.58

Remark	H : Horizontal, V : Vertical TEST MODE : 802.11n-CH157 (5785 MHz) *Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position) *CL = Cable Loss(In case of below 1000 MHz) *Result Value = Reading + Ant Factor + Cable loss *The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection at frequency below 1 GHz.

10.5-1 Test Data for wireless LAN

Test Date 3-Nov-14 Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction(dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK(RBW: 1 MHz VBW: 3 MHz)									
11490.0	36.78	H	1.1	39.93	-16.46	0.00	74.00	60.25	-13.75
11490.0	36.88	V	1.0	39.93	-16.46	0.00	74.00	60.35	-13.65
AV(RBW: 1 MHz VBW: 3 MHz)									
11490.0	25.14	H	1.1	39.93	-16.46	2.30	54.00	50.91	-3.09
11490.0	25.22	V	1.0	39.93	-16.46	2.30	54.00	50.99	-3.01

Remark

H : Horizontal, V : Vertical TEST MODE : 802.11n-CH149 (5745 MHz)

*The TX signal wasn't detected from 3th harmonics.
*Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position)
*Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Duty Cycle Correction
FYI
a. Ton Time : 1.372 ms
b. duty cycle : 58.9 %
c. DCF : 2.30 dB

10.5-2 Test Data for wireless LAN

Test Date 3-Nov-14 Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction(dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK(RBW: 1 MHz VBW: 3 MHz)									
11570.0	36.79	H	1.2	39.79	-16.43	0.00	74.00	60.15	-13.85
11570.0	36.31	V	1.2	39.79	-16.43	0.00	74.00	59.67	-14.33
AV(RBW: 1 MHz VBW: 3 MHz)									
11570.0	25.06	H	1.2	39.79	-16.43	2.30	54.00	50.72	-3.28
11570.0	25.21	V	1.2	39.79	-16.43	2.30	54.00	50.87	-3.13

Remark

H : Horizontal, V : Vertical TEST MODE : 802.11n-CH157(5785 MHz)

*The TX signal wasn't detected from 3th harmonics.
*Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position)
*Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Duty Cycle Correction
FYI
a. Ton Time : 1.372 ms
b. duty cycle : 58.9 %
c. DCF : 2.30 dB

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10.5-3 Test Data for wireless LAN

Test Date 3-Nov-14 Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction(dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK(RBW: 1 MHz VBW: 3 MHz)									
11650.0	34.94	H	1.2	39.64	-16.40	0.00	74.00	58.18	-15.82
11650.0	34.21	V	1.1	39.64	-16.40	0.00	74.00	57.45	-16.55
AV(RBW: 1 MHz VBW: 3 MHz)									
11650.0	24.91	H	1.2	39.64	-16.40	2.30	54.00	50.45	-3.55
11650.0	25.02	V	1.1	39.64	-16.40	2.30	54.00	50.56	-3.44

Remark

H : Horizontal, V : Vertical TEST MODE : 802.11n-CH161(5805 MHz)

*The TX signal wasn't detected from 3th harmonics.
*Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position)
*Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Duty Cycle Correction
FYI
a. Ton Time : 1.372 ms
b. duty cycle : 58.9 %
c. DCF : 2.30 dB

11. Measurement of conducted disturbance

The continuous disturbance voltage of AC Mains in the frequency from 0.15 MHz to 30 MHz was measured in accordance to FCC PART 15.207 & IC RSS-Gen 7.2.2. The test setup was made according to ANSI C 63.4 (2009) in a shielded room. The EUT was placed on a non-conductive table at least 0.8 m above the ground plan. A grounded vertical reference plane was positioned in a distance of 0.4 m from the EUT. The distance from the EUT to other metal surfaces was at least 0.8 m. The EUT was only earthen by its power cord through the line impedance stabilizing network. The power cord has been bundled to a length of 1.0 m. The test receiver with Quasi Peak detector complies with CISPR 16.

11.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
EMI TEST Receiver	ESPI	Rohde & Schwarz	100005	13-Jan-15
LISN	ESH3-Z5	Rohde & Schwarz	836679/025	15-Jan-15
Pulse Limiter	ESH3Z2	Rohde & Schwarz	NONE	13-Jan-15

11.2 Environmental Condition

Test Place : Shielded Room

Wireless LAN 802.11a Mode

Temperature (°C) : 20.8 ℃

Humidity (% R.H.) : 42.9 % R.H.

Wireless LAN 802.11n 5G Mode

Temperature (°C) : 20.9 ℃

Humidity (% R.H.) : 48.8 % R.H.

11.3 Test Data for wireless LAN (802.11a)

Test Date : 4-Nov-14

Frequency (MHz)	Correction Factor		Line (H/N)	Quasi-peak Value			Average Value		
	Lisn (dB)	Cable (dB)		Limit (dBμV)	Reading (dBμV)	Result (dBμV)	Limit (dBμV)	Reading (dBμV)	Result (dB)
0.19	0.15	0.19	H	64.04	47.94	48.28	54.04		
0.21	0.15	0.19	N	63.21	46.53	46.87	53.21		
0.29	0.15	0.20	N	60.52	41.65	42.00	50.52		
0.31	0.15	0.20	H	59.97	40.94	41.29	49.97		
0.49	0.16	0.21	H	56.17	37.84	38.21	46.17		
13.80	0.73	0.46	N	60.00	38.38	39.57	50.00		

TEST MODE : 802.11a - CH 157(5785 MHz)

H : Hot Line, N : Neutral Line
*Correction Factor = Lisn + Cable
*Result = Correction Factor + Reading

11.4 Test Data for wireless LAN (802.11n-5 GHz)

Test Date : 4-Nov-14

Frequency (MHz)	Correction Factor		Line (H/N)	Quasi-peak Value			Average Value		
	Lisn (dB)	Cable (dB)		Limit (dBμV)	Reading (dBμV)	Result (dBμV)	Limit (dBμV)	Reading (dBμV)	Result (dB)
0.19	0.15	0.19	N	64.04	48.32	48.66	54.04	35.14	35.48
0.20	0.15	0.19	H	63.61	45.86	46.20	53.61	32.37	32.71
0.29	0.15	0.20	H	60.52	41.08	41.43	50.52	29.04	29.39
0.29	0.15	0.20	N	60.52	39.58	39.93	50.52	29.50	29.85
0.39	0.16	0.20	N	58.06	37.70	38.06	48.06	25.08	25.44
13.93	0.74	0.46	N	60.00	38.36	39.56	50.00	26.58	27.78

TEST MODE : 802.11N - CH 157(5785 MHz)

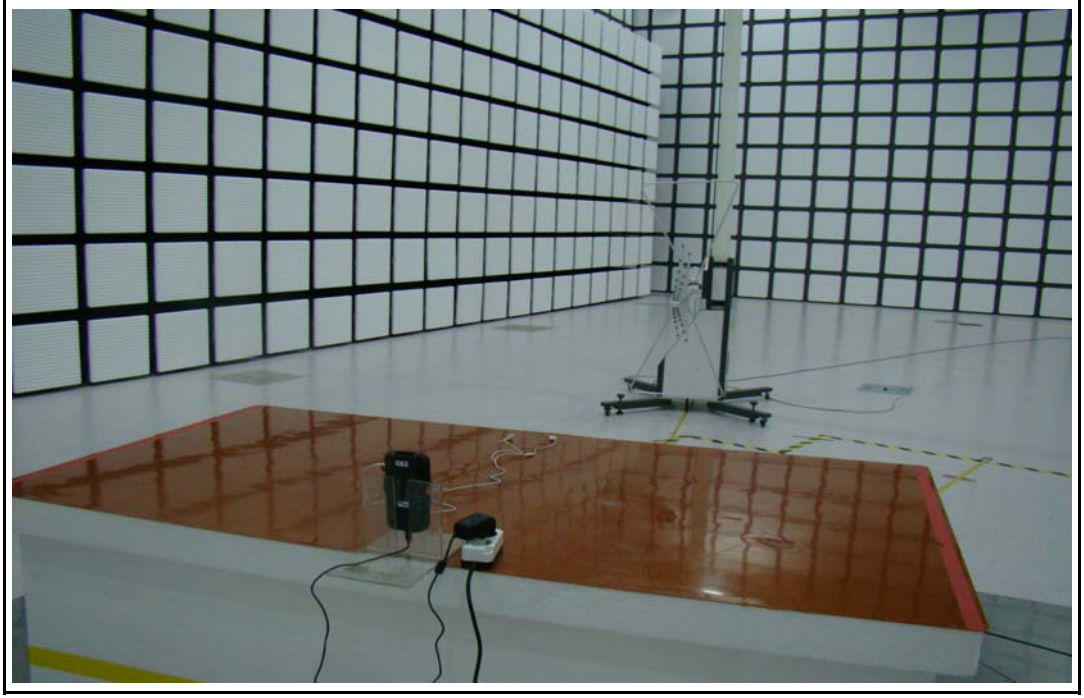
H : Hot Line, N : Neutral Line
*Correction Factor = Lisn + Cable
*Result = Correction Factor + Reading

12. Photographs of test setup

12.1.Setup for Radiated Test : (30 ~ 1 000) MHz

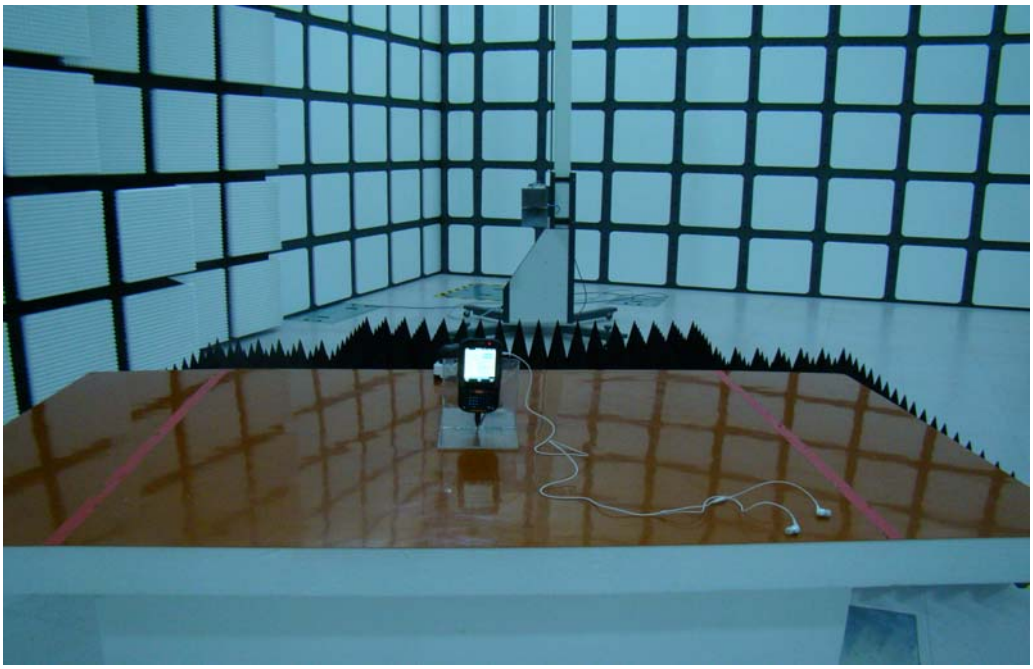
[Front]

[Rear]

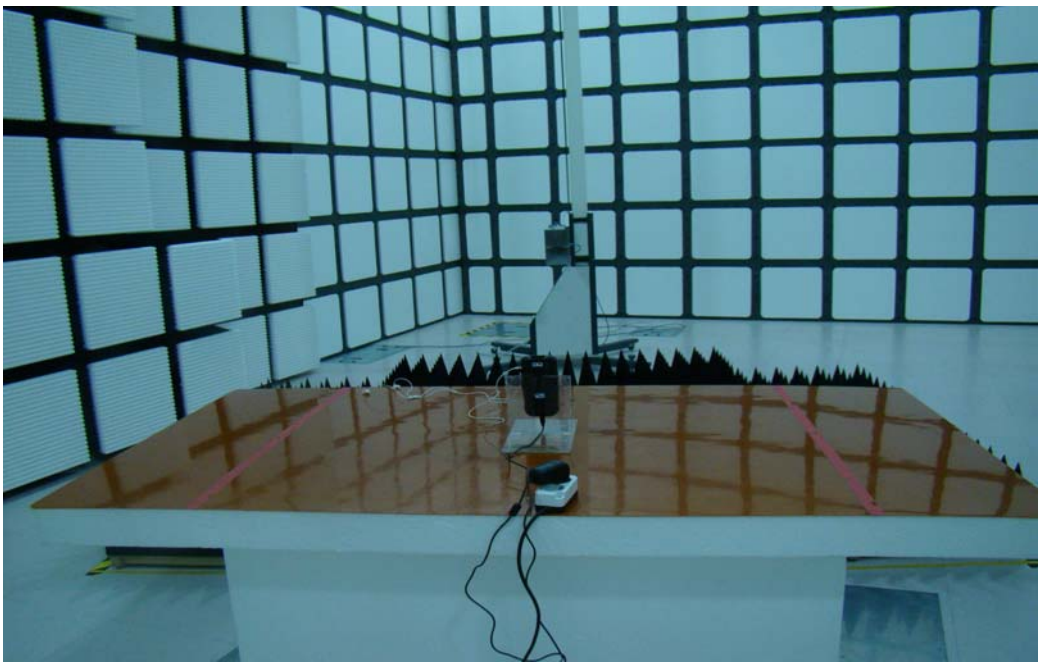


12.2.Setup for Radiated Test : Above 1 GHz

[Front]



[Rear]



12.3. Setup for Conducted Test : (0.15 ~ 30) MHz

[Front]

[Rear]

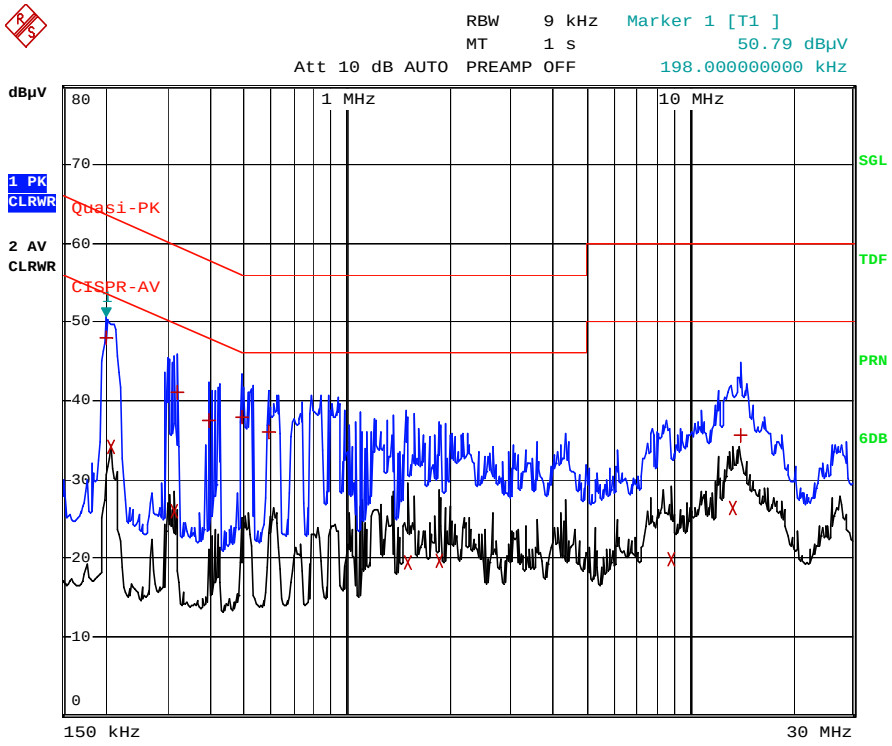
12.4. Photographs of EUT

[Front]

[Rear]

Appendix 1. Special diagram for Wireless LAN

802.11a – CH 157



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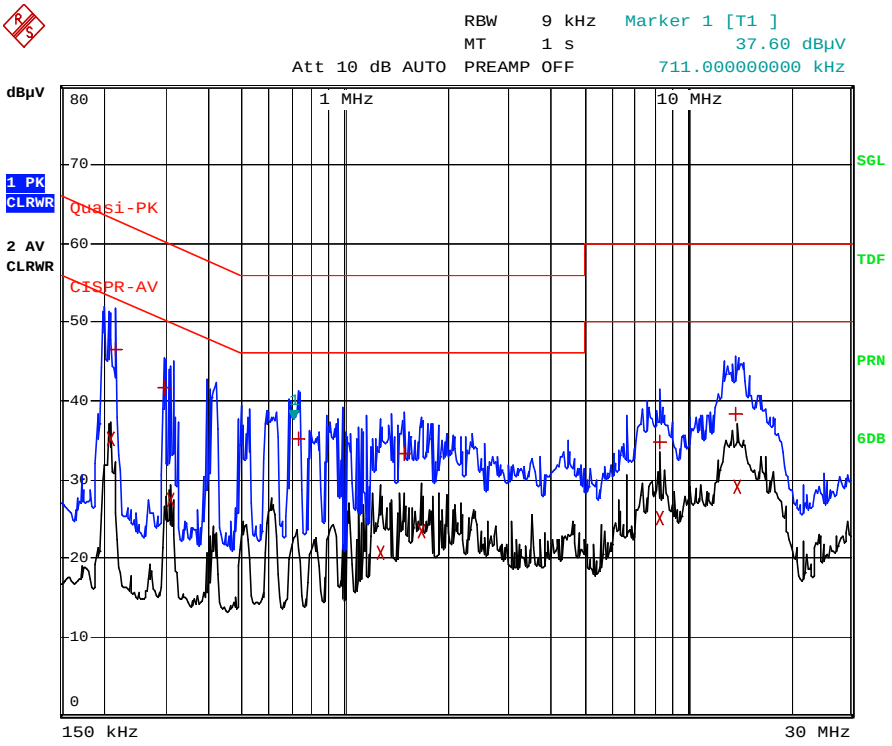
Date: 4.NOV.2014 10:25:50



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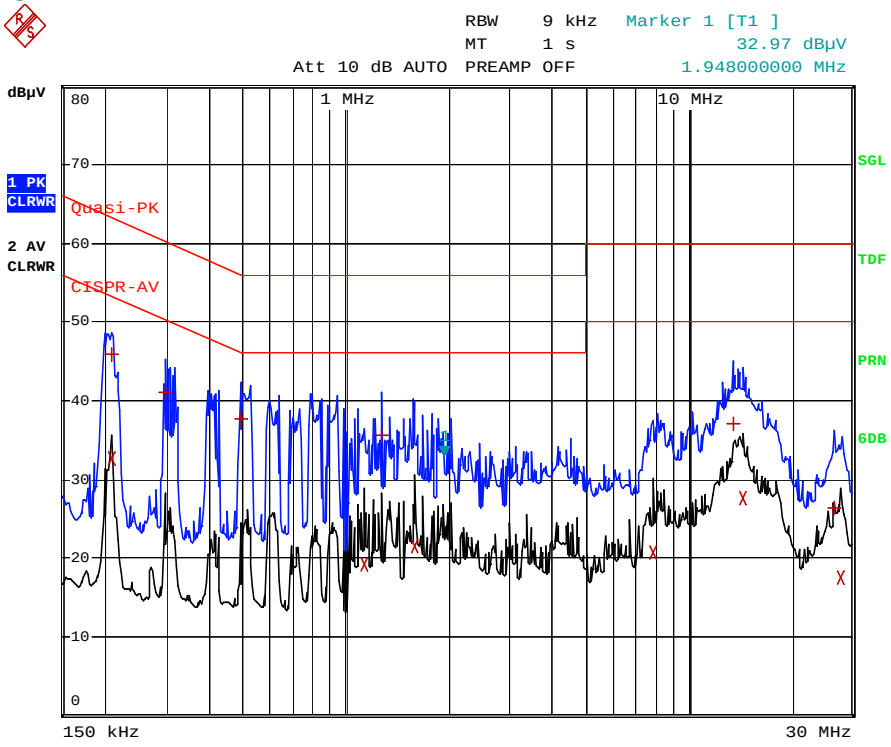
Date: 4.NOV.2014 10:28:50

Special diagram for Wireless LAN

802.11n - CH 157



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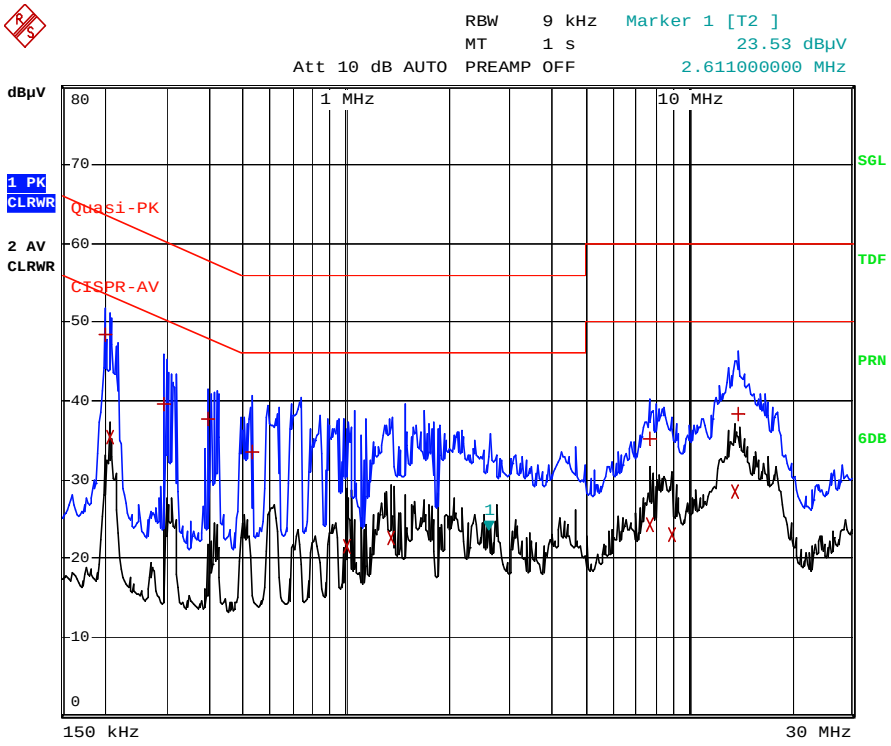

Comment: 14-00729_NEUTRAL(15.407)
Date: 4.NOV.2014 10:35:59