

Am 1015, World Venture Center II. 426-5 Gasan-dong, Guncheon-gu, Seoul, 158-803, Korea





# Electromagnetic Interference Test Report

# Test Report for FCC

FCC ID:V2X-PM260

Report Number		ESTF151302-006					
	Company name	POINTN	POINTMOBILE CO.,LTD				
Applicant	Address	GASAN-DONG B-9F KABUL GREAT VALLEY 32 DIGITAL-RO9-GIL GEUMCHEON-GU SEOUL 153-709 KOREA					
	Telephone	82-2-3	3397-7870~1				
	Product name	Handy terminal					
Product	Model No.	PM260 Manufacturer DongGuan BG Electronic Limited.					
	Serial No.		NONE Country of origin CHINA				
Test date	2012-11-2	29 ~ 2013-01-16 Date of issue 28-Feb-13					
Testing location	97-	1 Hoiuk-R		I. Co., Ltd. Icheon-city, Kyu	ıngKi-Do, Korea		
Standard	FC	C PART 1	5(2010), ANSI C	63.4(2003) , KD	B 558074 D01		
Measurement	Measurement facility registration number 915135				35		
Tested by	Senior E	Engineer S.S.An (Similarire)					
Reviewed by	Engineering Manager J.M.Yang (Signature)						
Abbreviation	OK, Pass = Passed, Fail = Failed, N/A = not applicable						

- \* Note
- EUT's the difference is between 1D and 2D scanner by request applicant. (Worst data is 1D Scanner.)
- 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

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Appendix 1. Special diagram

Appendix 2. Antenna Requirement





# 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.

97-1, Hoeok-ri, Majang-myun, Ichion-city, Kyonggi-do, South Korea

# 1.3 Official Qualification(s)

KCC: Granted Accreditation from Ministry of Information & Communication for EMC, Safety and Telecommunication

KOLAS: Accredited Lab By Korea Laboratory Accreditation Schema base on CENELEC requirements

FCC: Filed Laboratory at Federal Communications Commission

VCCI: Granted Accreditation from Voluntary Control Council for Interference from ITE

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# 2. Description of EUT

# 2.1 Summary of Equipment Under Test (WLAN)

Modulation Type : WLAN(DSSS, OFDM)
Transfer Rate : up to 72.2 Mbps

Number of Channel : 11 ch

PEAK Output Power : 802.11b: 0.023 Watts, 802.11g: 0.064 Watts ,802.11n: 0.065 Watts

Rating : INPUT : (100 - 240)Va.c , (50 / 60)Hz , 0.4 A

: DC OUTPUT : 5.0 Vd.c. , 2.0 A

Receipt Date : 2012-10-17

X-tal list(s) or : The highest operating frequency is 2462 MHz(WLAN)

Frequencies generated

# 2.2 General descriptions of EUT

Class		Specification		
	802.11b	(2412 ~ 2462) MHz , Max data rates: 11 Mbps , (1 ~ 11)ch		
WLAN	802.11g	(2412 ~ 2462) MHz , Max data rates: 54 Mbps , (1 ~ 11)ch		
	802.11n (20 MHz)	(2412 ~ 2462) MHz , Max data rates: 72.2 Mbps , (1 ~ 11)ch		
	Chipset Vendor : (F1-media )	(2402 ~ 2480)MHz , BDR (GFSK : 1 Mbps) , (0 ~ 78)ch		
Bluetooth	Bluetooth Version : (Ver 1.0 )	(2402 ~ 2480)MHz , EDR (QPSK : 2 Mbps, 8DPSK : 3 Mbps) , (0 ~ 78)ch		
		1 AFH (Adaptive Frequency Hopping), (0 ~ 78)ch		
Operating System OS	WinCE 6.0 Professional (Kernel: 55.03)			
Processor	PXA300 624 MHz			
Memory	FLASH 128MB -> 256MB expandable RAM128MB -> 256MB expandable			
Memory expansions	Micro SD user accessible, support upto 32 GE	Syte		
	Display Resolution: 240 x 320 pixels (QVGA)			
Display	Size (inch) : 2.8"			
	Touch panel : 4 Wire Analog Resistive Touch			
Keypad and buttons	2 Side scan triggers			
Cara Fasia	1D Laser			
Scan Engine	2D Laser			
Chandard Batter	2200 mAh Li-ion Rechargeable			
Standard Battery	3300 mAh Li-ion Rechargeable			

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#### 3. Test Standards

Test Standard: FCC PART 15 (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 (2003) & KDB558074 D01

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				
Standard	Test Type	Test Type Result Remark		
15.207	AC Power Conducted Emission	Pass	Meet the requirement	
15.205 & 15.209	Intentional Radiated Emission	Pass	Meet the requirement	
15.247(a)(2)	6 dB Bandwidth	Pass	Meet the requirement	Min. 500 kHz
	99 % Bandwidth			
15.247(b)(3)	Maximum Peak ouput power	Pass	Meet the requirement	Max. 30 dBm
15.247(c)	Transmitter Radiated Emission	Pass	Meet the requirement	Table 15.209
15.247(e)	Power Spectral Density	Pass	Meet the requirement	Max. 8 dBm
15.247(d)	Band Edge /out of band emission	Pass	Meet the requirement	20 dB less
15.107	Receiver conducted Emission	Pass	Meet the requirement	
15.109	Receiver radiated emission	Pass	Meet the requirement	

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#### 4. Measurement Condition

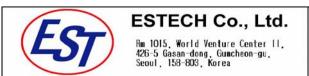
# 4.1 EUT Operation(For 802.11b and 802.11g and 802.11n)

#### a. Channel

Ch.	Frequency	Ch.	Frequency
1	2412 MHz	7	2442 MHz
2	2417 MHz	8	2447 MHz
3	2422 MHz	9	2452 MHz
4	2427 MHz	10	2457 MHz
5	2432 MHz	11	2462 MHz
6	2437 MHz		

- b. Measurement Channel: WLAN: Low(2412 MHz), Middle(2437 MHz), High(2462 MHz)
- c. Test Mode: Continuous Output, DSSS, OFDM
- d. Test rate: the worst case of rate 802.11b(11 Mbps), 802.11g(6 Mbps),802.11n(MCS0)

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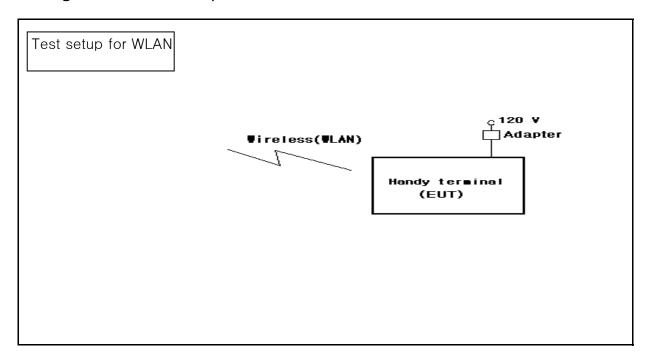




# 4.2 EUT Operation.

- \* 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.
- \*. Test Mode: Handy terminal 1D Scanner: battery 2200 mAh, battery 3300 mAh
- \*. Test Mode: Handy terminal 2D Scanner: battery 2200 mAh, battery 3300 mAh
- \*. 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 times the highest frequency or 40 GHz,

# 4.3 Configuration and Peripherals



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# 4.4 EUT and Support equipment

Equipment Name	Model Name	S/N	Manufacturer	Remark (FCC ID)
Handy terminal	PM260	NONE	DongGuan BG Electronic Co. Limited.	EUT
Adapter	KSAS0100500200D5	NONE	Kuantech(Beihai)Co., Ltd.	

# 4.5 Cable Connecting

Start Equipment		End Equip	End Equipment		tandard		
Name	I/O port	Name	I/O port	Length	Shielded	Remark	
Handy terminal	Power	Adapter	-	1.5	Unshielded		

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EST-QP-20-01(1)-(F15)







#### 5. 6dB Bandwidth Measurement

#### 5.1 Test procedure

558074 D01 DTS Meas Guidance v02 Option 2 :The automatic bandwidth measurement capability of a spectrum analyzer may be employed using the X dB bandwidth mode with X set to 6 dB, if it implements the functionality described above. When using this capability, care should be taken to ensure that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that may be  $\geq$  6 dB.

#### 5.2 Test instruments and measurement setup

The spectrum analyzer is set to as following.

- . RBW= 100KHz
- . VBW= 300KHz
- . Span= 50MHz
- . Sweep= suitable duration based on the EUT specification.

#### 6dB Bandwidth Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E4440A	US42041281	2013-09-11
RF Cable	Length: 6cm	_	
-Spectrum Analyzer <=> EUT	Loss: 0.4dB	_	

#### 5.3 Measurement results

EUT	Handy terminal	MODEL	PM260
MODE	DSSS	ENVIRONMENTAL CONDITION	24 ℃, 44 % R.H.
INPUT POWER	120 Va.c., 60 Hz		

#### (802.11b)

Channel Frequency (MHz)	Emission bandwidth	Bandwidth at 6dB below(MHz)	Minimum Limit (MHz)	PASS/FAIL
2412	16.09	7.84	0.5	PASS
2437	16.16	7.92	0.5	PASS
2462	15.98	7.30	0.5	PASS

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EUT	Handy terminal	MODEL	PM260
MODE	OFDM	ENVIRONMENTAL CONDITION	24 °C, 43 % R.H.
INPUT POWER	120 Va.c., 60 Hz		

# (802.11g)

Channel Frequency (MHz)	Emission bandwidth	Bandwidth at 6dB below(MHz)	Minimum Limit (MHz)	PASS/FAIL
2412	19.27	15.36	0.5	PASS
2437	18.80	15.42	0.5	PASS
2462	19.16	15.73	0.5	PASS

EUT	Handy terminal	MODEL	PM260
MODE	OFDM	ENVIRONMENTAL CONDITION	24 °C, 43 % 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
2412	19.95	15.32	0.5	PASS
2437	19.84	15.09	0.5	PASS
2462	19.47	16.00	0.5	PASS

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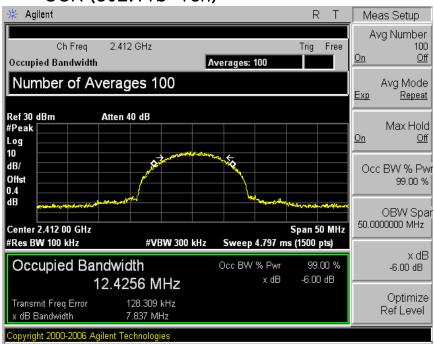




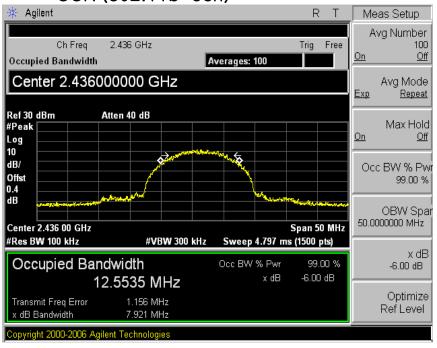
Electromagnetic Interference **Test Report** 

# 5.4 Trace data

CCK (802.11b-1ch)



CCK (802.11b-6ch)



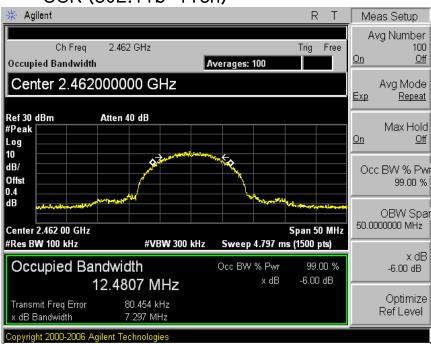
Report Number: ESTF151302-006, Web: www. estech. co. kr EST-QP-20-01(1)-(F15)







# CCK (802.11b-11ch)



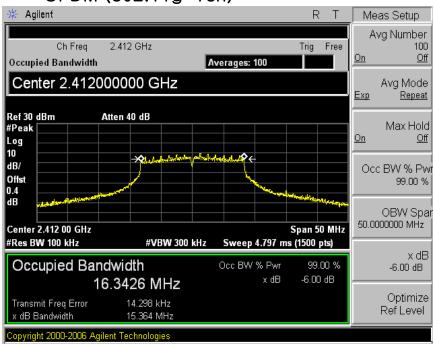




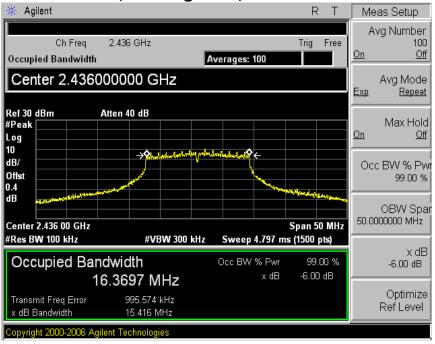




# 5.4 Trace data OFDM (802.11g-1ch)



OFDM (802.11g-6ch)



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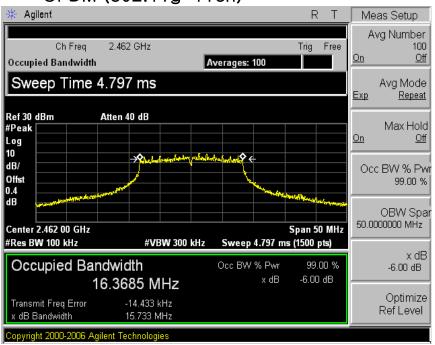
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OFDM (802.11g-11ch)





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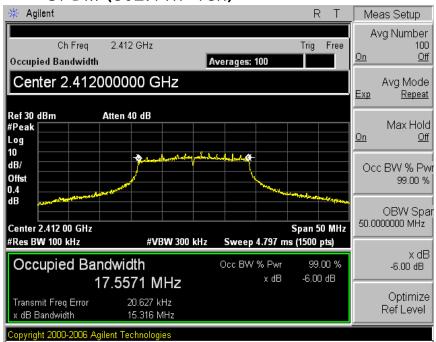




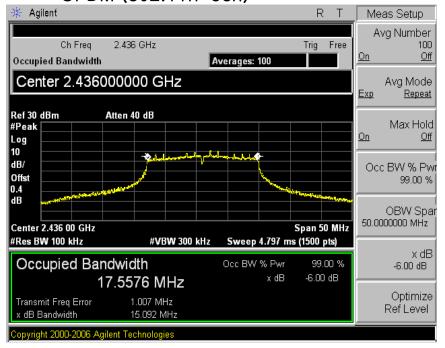


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# 5.4 Trace data OFDM (802.11n-1ch)



OFDM (802.11n-6ch)



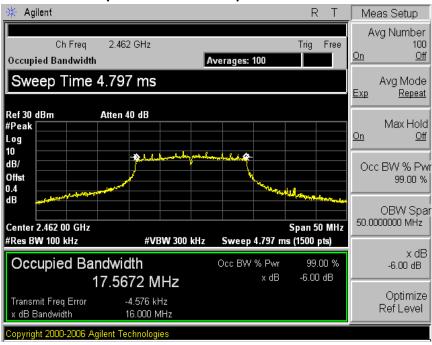
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# OFDM (802.11n-11ch)





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# 5.4 Trace data

CCK (802.11b-1ch)



CCK (802.11b-6ch)



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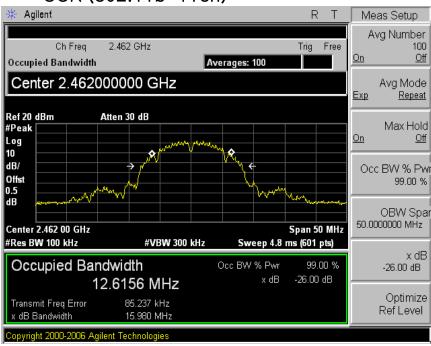
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# CCK (802.11b-11ch)



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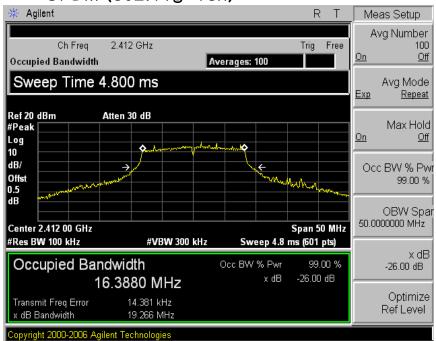




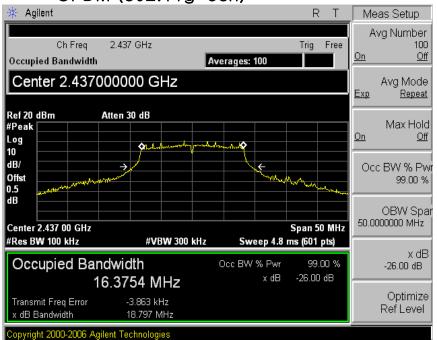


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# 5.4 Trace data OFDM (802.11g-1ch)



OFDM (802.11g-6ch)



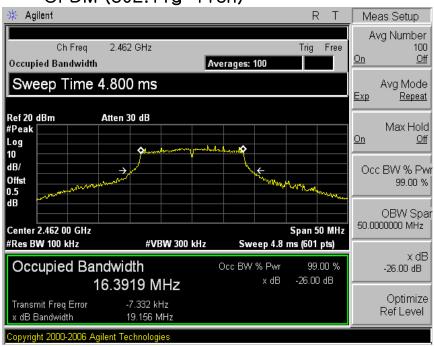
Report Number: ESTF151302-006, Web: www. estech. co. kr EST-QP-20-01(1)-(F15)







OFDM (802.11g-11ch)





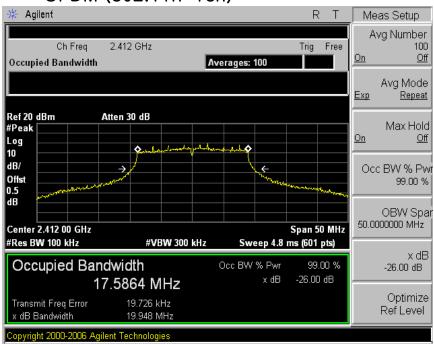
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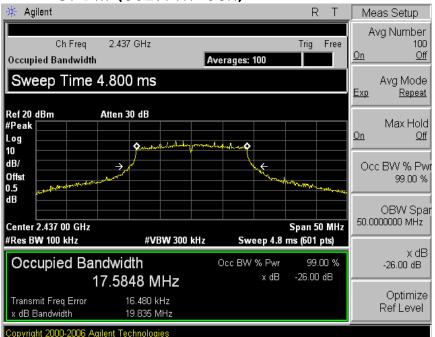


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# 5.4 Trace data OFDM (802.11n-1ch)



OFDM (802.11n-6ch)



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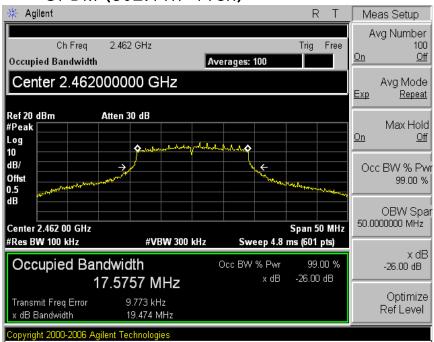
EST-QP-20-01(1)-(F15)







# OFDM (802.11n-11ch)









#### 6. MAXIMUM PEAK OUTPUT POWER

#### 6.1 Test procedure

558074 D01 DTS Meas Guidance v02 8.1.2 Option 2 and 8.2.1 Option 1

- 8.1.2 Option 2 This procedure should only be used when the maximum available RBW of the spectrum/signal analyzer is less than the DTS bandwidth.
- 1. Set the RBW = maximum available (at least 1 MHz).
- 2. Set the VBW = 3 x RBW or maximum available setting (must be  $\geq$  RBW).
- 3. Set the span to fully encompass the DTS bandwidth.
- 4. Detector = peak.
- 5. Sweep time = auto couple.
- 6. Trace mode = max hold.
- 7. Allow trace to fully stabilize.
- 8. Use the spectrum analyzer's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some analyzers, this may require a manual override to ensure use of peak detector). If the spectrum analyzer does not have a band power function, sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the DTS channel bandwidth.
- 8.2.1 Option1 his procedure should be used with an RMS power averaging detector; however, a sample detector can be used when an RMS detector is not available. This is the baseline method for measuring the maximum (average) conducted output power,
- 1. Set the analyzer span to a minimum of 1.5 times the EBW.
- 2. Set the RBW = 1 MHz.
- 3. Set the VBW  $\geq$  3 MHz.
- 4. Ensure that the number of measurement points in the sweep  $\geq 2 \times \text{span/RBW}$ .
- 5. Sweep time = auto couple.
- 6. Detector = power averaging (RMS)
- 7. Employ trace averaging in power averaging (RMS) mode over a minimum of 100 traces.
- 8. Use the spectrum analyzer's band power measurement function with band limits set equal to the The EUT was operating duty cycle(>98%). The trace was averaged over 100 traces to obtain the f

#### Maximum Peak Output Power Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	FSV40	100939	2014-01-26
RF Cable	Length: 6cm	_	
-Spectrum Analyzer <=> EUT	Loss: 0.4 dB	_	

#### 6.2 Measurement results

EUT	Handy terminal	MODEL	PM260
MODE	DSSS	ENVIRONMENTAL CONDITION	24 ℃, 43 % R.H.
INPUT POWER	120 Va.c., 60 Hz		

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(802.11b)

CHANNEL	Channel requency	Conduc	Conducted Power Output(dBm)			PASS/FAIL
CHANNEL	(MHz)	Detector	(dBm)	(W)	(dBm)	PASS/FAIL
1	2412	PEAK	12.72	0.019	30.0	PASS
1	2412	AVG	11.07	0.013	30.0	PASS
6	2437	PEAK	12.94	0.020	30.0	PASS
O	6 2437	AVG	10.61	0.012	30.0	PASS
11	2462	PEAK	13.70	0.023	30.0	PASS
''	2402	AVG	11.09	0.013	30.0	PASS

(802.11g)

EUT	Handy terminal	MODEL	PM260
MODE	OFDM	ENVIRONMENTAL CONDITION	24 ℃, 43 % R.H.
INPUT POWER	120 Va.c., 60 Hz		

CHANNEL	Channel Frequency	Conduc	Conducted Power Output(dBm)			PASS/FAIL
CHAINNEL	(MHz)	Detector	(dBm)	(W)	(dBm)	PASS/FAIL
1	2412	PEAK	16.89	0.049	30.0	PASS
l	2412	AVG	9.06	0.008	30.0	PASS
G	0407	PEAK	18.04	0.064	30.0	PASS
O	6 2437	AVG	10.11	0.010	30.0	PASS
4.4	0.400	PEAK	17.17	0.052	30.0	PASS
	2462	AVG	8.81	0.008	30.0	PASS

(802.11n)

EUT	Handy terminal	MODEL	PM260
MODE	OFDM	ENVIRONMENTAL CONDITION	24 ℃, 43 % R.H.
INPUT POWER	120 Va,c., 60 Hz		

CHANNEL	Channel Frequency	Conduc	Conducted Power Output(dBm)			PASS/FAIL
CHANNEL	(MHz)	Detector	(dBm)	(W)	(dBm)	PASS/FAIL
1	2412	PEAK	16.79	0.048	30.0	PASS
1	2412	AVG	9.19	0.008	30.0	PASS
6	2437	PEAK	18.10	0.065	30.0	PASS
O	6 2437	AVG	10.08	0.010	30.0	PASS
11 2462	2462	PEAK	17.23	0.053	30.0	PASS
1 1	2402	AVG	9.00	0.008	30.0	PASS

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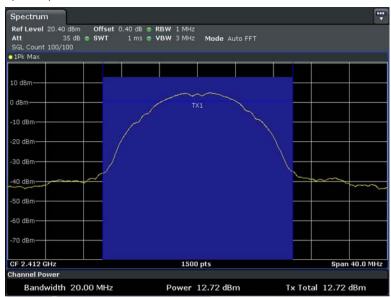




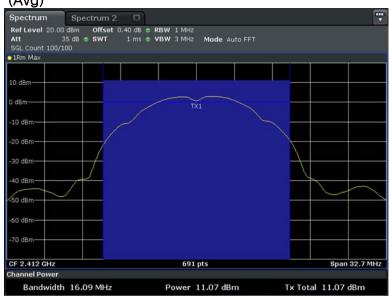
Electromagnetic Interference **Test Report** 

# 5.4 Trace data CCK (802.11b-1ch)

#### (Peak)







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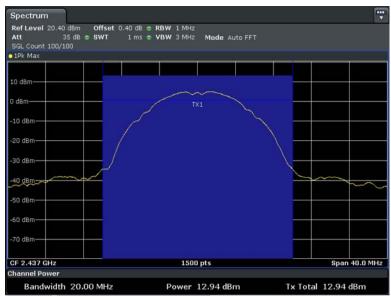




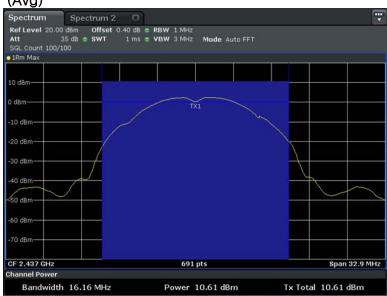
**Electromagnetic** Interference **Test Report** 

# CCK (802.11b-6ch)

#### (Peak)







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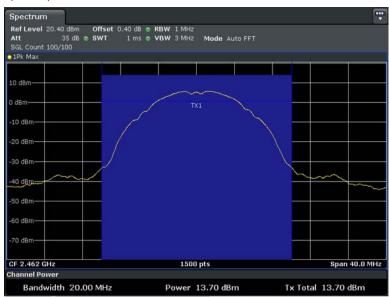




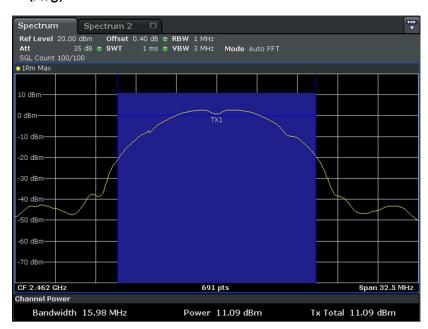
Electromagnetic Interference Test Report

# CCK (802.11b-11ch)

#### (Peak)



#### (Avg)



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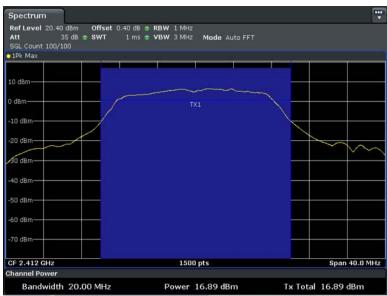




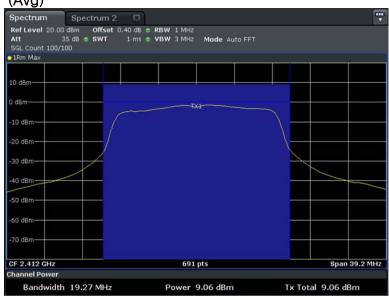
**Electromagnetic** Interference **Test Report** 

# OFDM (802.11g-1ch)

#### (Peak)







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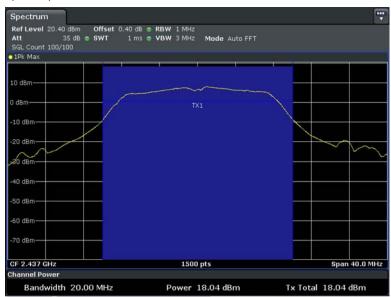




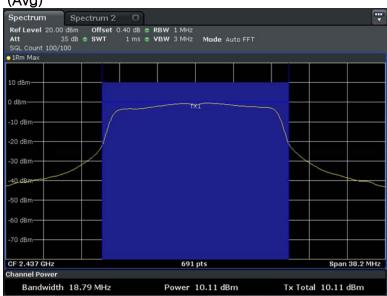
Electromagnetic Interference **Test Report** 

# OFDM (802.11g-6ch)

#### (Peak)







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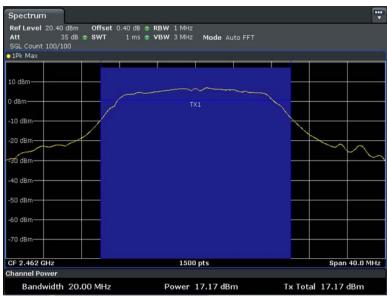




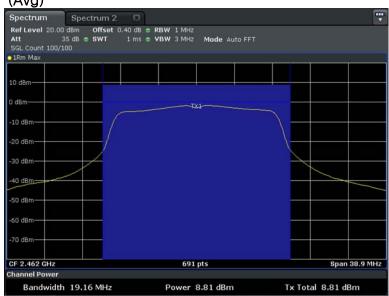
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# OFDM (802.11g-11ch)

#### (Peak)







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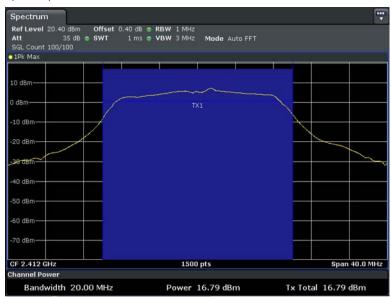




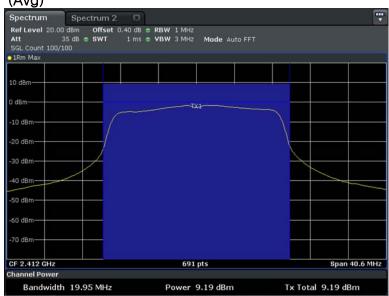
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# OFDM (802.11n-1ch)

#### (Peak)







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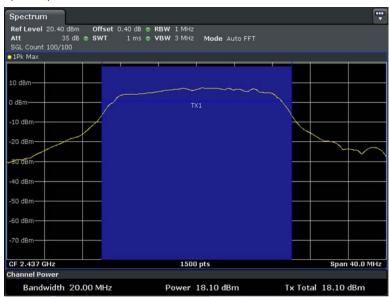




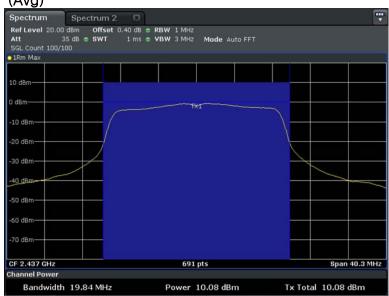
**Electromagnetic** Interference **Test Report** 

# OFDM (802.11n-6ch)

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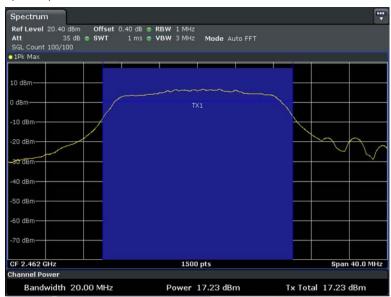




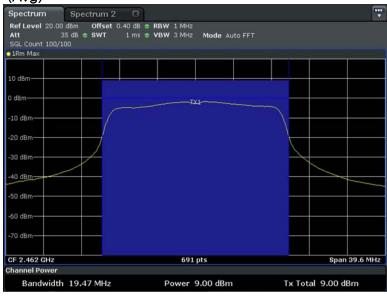
Electromagnetic Interference Test Report

# OFDM (802.11n-11ch)

#### (Peak)







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Electromagnetic Interference Test Report

# 7. Transmitter power spectral density

#### 7.1 Test procedure

558074 D01 DTS Meas Guidance v02 9.1 Option 1: This procedure must be used if maximum peak conducted output power was used to demonstrate compliance to the fundamental output power limit, and is optional if the maximum (average) conducted output power was used to demonstrate compliance.

# 7.2 Test instruments and measurement setup

The spectrum analyzer is set to as following.

- . RBW= 3KHz
- . VBW= 9.1KHz
- . Span= 1.5 X DTS channel bandwidth
- . Detector= peak

#### The peak power density Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E4407B	US42041281	2013-09-11
-Spectrum Analyzer <=> EUT	Loss: 0.4 dB	-	

#### 7.3 Measurement results

#### 802.11b

EUT	Handy terminal	MODEL	PM260
MODE	DSSS	ENVIRONMENTAL CONDITION	23 °C, 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
1	2412	2.80	8.0	5.20
6	2437	1.77	8.0	6.23
11	2462	3.25	8.0	4.75

\*PSD = MPSD + BWCF

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# Electromagnetic Interference Test Report

# 802.11g

EUT	Handy terminal	MODEL	PM260
MODE	OFDM	ENVIRONMENTAL CONDITION	23 °C, 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
1	2412	-15.41	8.0	23.41
6	2437	-16.08	8.0	24.08
11	2462	-15.71	8.0	23.71

#### 802.11n

EUT	Handy terminal	MODEL	PM260
MODE	OFDM	ENVIRONMENTAL CONDITION	23 °C, 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
1	2412	-15.46	8.0	23.46
6	2437	-14.94	8.0	22.94
11	2462	-16.10	8.0	24.10

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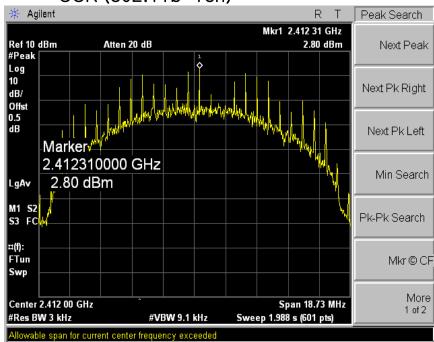




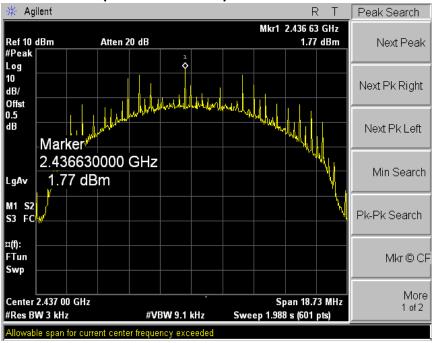
Electromagnetic Interference Test Report

#### 7.4 Trace data

CCK (802.11b-1ch)

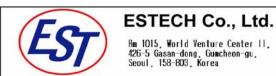


CCK (802.11b-6ch)



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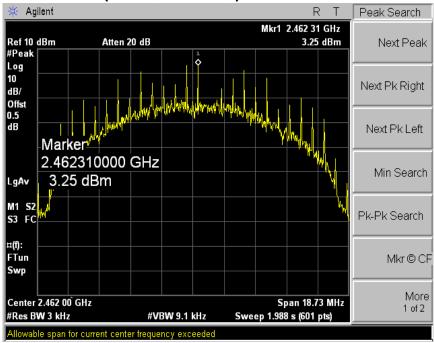






# Electromagnetic Interference **Test Report**

CCK (802.11b-11ch)



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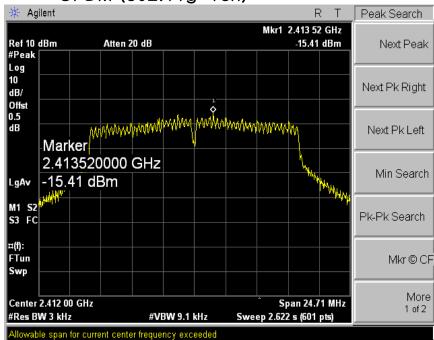




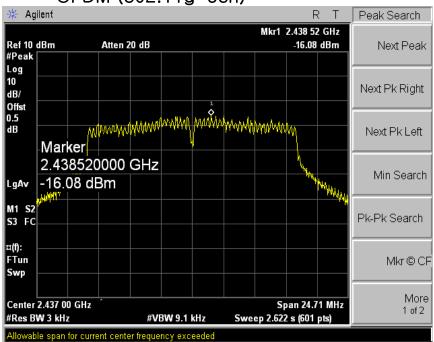
Electromagnetic Interference Test Report

#### 7.4 Trace data

OFDM (802.11g-1ch)



OFDM (802.11g-6ch)



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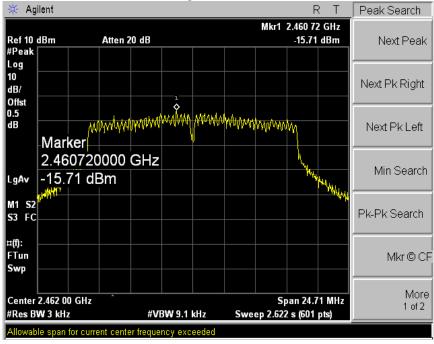






# Electromagnetic Interference **Test Report**

OFDM (802.11g-11ch)



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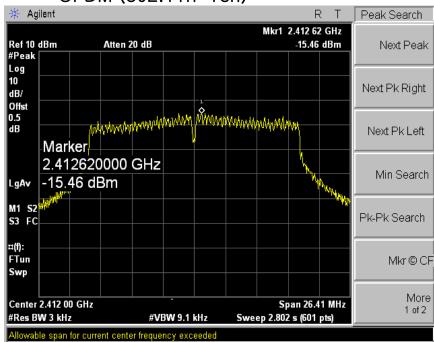




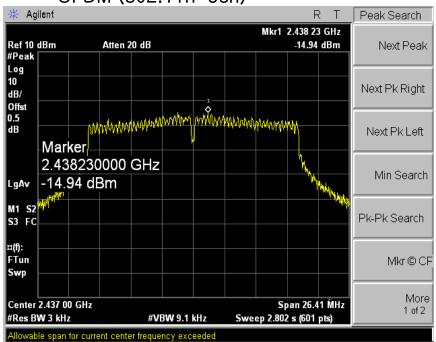
Electromagnetic Interference Test Report

#### 7.4 Trace data

OFDM (802.11n-1ch)



OFDM (802.11n-6ch)



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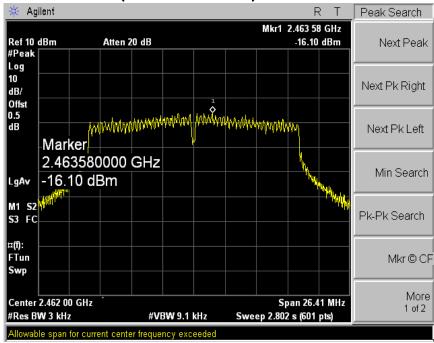
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Electromagnetic Interference Test Report

# OFDM (802.11n-11ch)



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Electromagnetic Interference Test Report

## 8. band-edge and out of band emissions.

## 8.1 Test procedure

Per the guidance of KDB 558074, section 5.4.1.1, the reference level for out of band emissions is established from the plots of this section since the band edge emissions are measured with a RBW of 100 kHz. This reference level is then used as the limit in subsequent plots for out of band spurious emissions shown in section 8.4 The limit for out of band spurious emission at the band edge is 20 dB below the fundamental emission level measured in a 100 kHz bandwidth.

## 8.2 Test instruments and measurement setup

The spectrum analyzer is set to as following.

- . RBW= 100KHz
- . VBW= 300KHz
- . Span= suitable frequency span
- . Sweep= suitable duration based on the EUT specification.

#### Band Edge&Out of Emission Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E4407B	US42041281	2013-09-11
RF Cable	Length: 6cm		_
-Spectrum Analyzer <=> EUT	Loss: 1.5dB		_

# 8.3 Measurement results of band-edge & out of emission

#### 802.11b

EUT	Handy terminal	MODEL	PM260
MODE	DSSS	ENVIRONMENTAL CONDITION	23 ℃, 43 % R.H.
INPUT POWER	120 Va.c., 60 Hz		

CHANNEL	Channel Frequency (MHz)	limit	PASS/FAIL
1	2412	20dBc	PASS
11	2462	20dBc	PASS

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Electromagnetic Interference Test Report

# 802.11g

EUT	Handy terminal	MODEL	PM260
MODE OFDM		ENVIRONMENTAL CONDITION	23 ℃, 43 % R.H.
INPUT POWER	120 Va.c., 60 Hz		

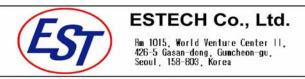
CHANNEL	CHANNEL Channel Frequency (MHz) limit		PASS/FAIL
1	2412	20dBc	PASS
11	2462	20dBc	PASS

# 802.11n

EUT	Handy terminal	MODEL	PM260		
		ENVIRONMENTAL CONDITION	23 ℃, 43 % R.H.		
INPUT POWER	120 Va.c., 60 Hz				

CHANNEL	Channel Frequency (MHz)	limit	PASS/FAIL	
1	2412	20dBc	PASS	
11	2462	20dBc	PASS	

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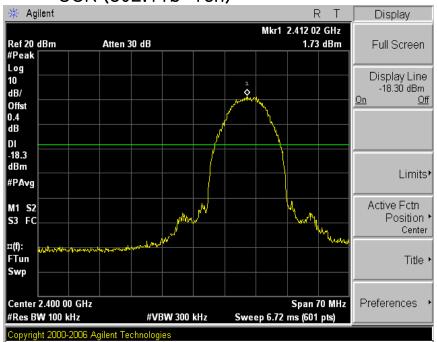




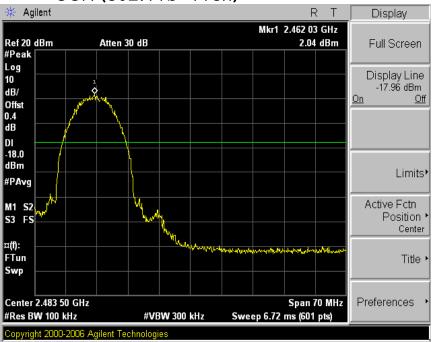


Electromagnetic Interference Test Report

# 8.4 Trace data of band-edge & Out of Emission CCK (802.11b-1ch)



# CCK (802.11b-11ch)



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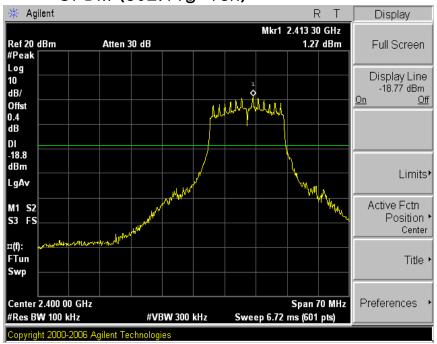




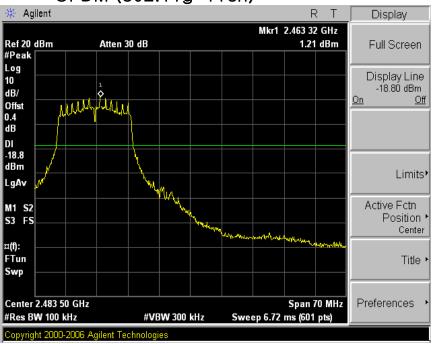


Electromagnetic Interference Test Report

# OFDM (802.11g-1ch)



# OFDM (802.11g-11ch)



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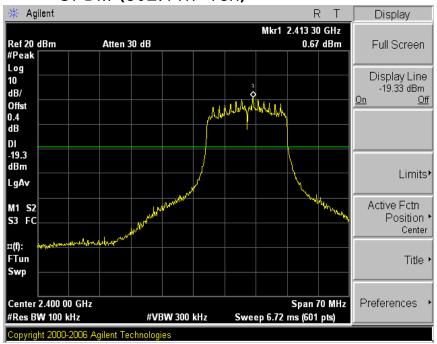




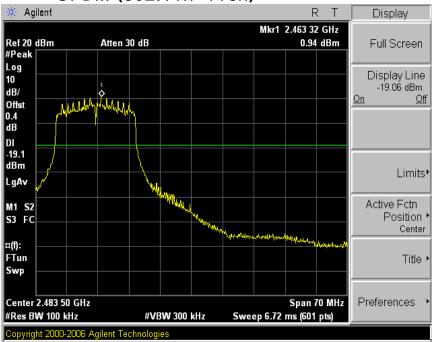


Electromagnetic Interference Test Report

## OFDM (802.11n-1ch)



# OFDM (802.11n-11ch)



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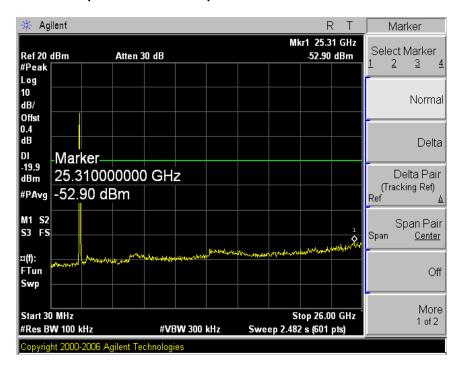


Electromagnetic Interference Test Report

# CCK (802.11b-1ch)



## CCK (802.11b-6ch)



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# CCK (802.11b-11ch)



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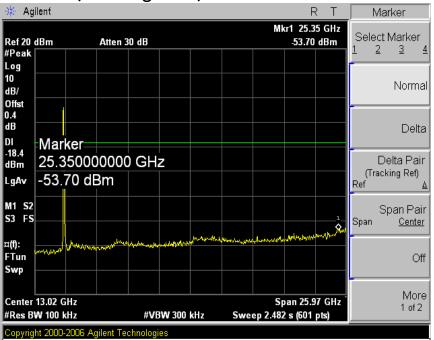


Electromagnetic Interference Test Report

# CCK (802.11g-1ch)



# CCK (802.11g-6ch)



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Electromagnetic Interference Test Report

# CCK (802.11g-11ch)



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Electromagnetic Interference Test Report

## OFDM (802.11n-1ch)



# OFDM (802.11n-6ch)



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# OFDM (802.11n-11ch)



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## Electromagnetic Interference Test Report

#### 9. Measurement of radiated disturbance

Above 30 MHz Electric Field strength was measured in accordance with FCC Part 15 (2010). The test setup was made according to ANSI C 63.4 (2003) & KDB 558074 D01 on an open test site, which allows a 3 m distance measurement. The EUT was placed in the center of wooden 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.

## 9.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
TEST Receiver	ESCI7	ROHDE & SCHWARZ	1166.5950.07	28-Mar-13
Logbicon Antenna	VULB 9168	SCHWARZBECK	237	20-Jan-13
Turn Table	DT3000-2t	Innco System GmbH	N/A	-
Antenna Mast	MA4000-EP	Innco System GmbH	N/A	-
Antenna Master & Turn table controller	CO2000-P	-P Innco System GmbH CO2000 /280511		-
TEST Receiver	ESPI7	ROHDE & SCHWARZ	100185	25-Jan-13
PREAMPLIFIER	8449B	AGILENT	3008A00595	25-Jan-13
Horn Antenna	BBHA9120D	SCHWARZBECK	352	15-May-13
Spectrum Analyzer	R3273	ADVANTEST	110600592	26-Jan-13
Pyramidal Horn Antenna	3160-09-01	ETS-LINDGREN	102642	22-Oct-13
Turn Table	DT1500-S	Innco System GmbH	N/A	-
Antenna Mast	MA4000-EP	Innco System GmbH	N/A	-
Antenna Master & Turn table controller	C02000-P	Innco System GmbH	CO2000/642 /28051111/L	-

#### 9.2 Environmental Condition

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

Wireless LAN 802.11b Mode

Temperature (°C) : 22.9 °C Humidity (% R.H.) : 50.1 % R.H.

Wireless LAN 802.11g Mode

Temperature (°C) : 23.2 ℃ Humidity (% R.H.) : 46.8 % R.H.

Wireless LAN 802.11n Mode

Temperature (°C) : 21.8 °C Humidity (% R.H.) : 54.5 % R.H.

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

Wireless LAN 802.11b Mode

Temperature (°C) : 21.4 °C Humidity (% R.H.) : 47.2 % R.H.

Wireless LAN 802.11g Mode

Temperature (°C) : 23.1  $^{\circ}$ C Humidity ( $^{\circ}$ R.H.) : 44.8  $^{\circ}$ R.H.

Wireless LAN 802.11n Mode

Temperature (°C) : 23.6 °C Humidity (% R.H.) : 51.4 % R.H.

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Electromagnetic Interference Test Report

## 9.3 Measurement Instrument setting for Radiated Emission

9.3.1 Frequency range below 1 GHz

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

9.3.2 Frequency range above 1 GHz

Peak Power Measurement Procedure (KDB 558074 section 10.2.3.2)

a.RBW: 1 MHz , VBW: 3 MHz b.Trace mode = max hold

c.Detector: Peak

d.Sweep time = auto couple

#### Average Power Measurement Procedures (KDB 558074 section 10.2.3.3)

- a. Set analyzer center frequency to the frequency associated with the emission
- b.Set span to at least 1 MHz c.RBW: 1 MHz , VBW: 3 MHz
- d.Detector: power average (RMS) detector
- e.Sweep time = 1 s  $\geq$ 10 x (number of measurement points in sweep) x (maximum data rate per stream)

#### Note

Band Duty cycle(%)		Ton (ms)	Ton + Toff (ms)	DCF=20*log(1/Duty) (dB)
802.11b 98.9		98.9 1.349 1.364		not applicable
802.11g	98.3	2.09	2.126	not applicable
802.11n	99.1	1.983	2.001	not applicable

\*There did not applied of duty cycle factor for average value because of measured with the EUT transmitting continuously (≥ 98% duty cycle) at its maximum power control level.

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# **Electromagnetic** Interference **Test Report**

# 9.4 Test Data for wireless LAN (802.11b)

Measurement Distance: 3 m Test Date: 26-Dec-12

Frequency	Reading	Position	Height	Correction	n Factor	[	Result Value	e
(MHz)	(dB#V)	(V/H)	(m)	Ant Factor (dB)	Cable (dB)	Limit (dB#V/m)	Result (dB#V/m)	Margin (dB)
48.00	5.02	V	1.0	12.65	1.06	40.00	18.73	-21.27
72.00	4.92	V	1.0	10.67	1.24	40.00	16.83	-23.17
82.00	4.94	V	1.0	8.90	1.40	40.00	15.24	-24.76
100.00	7.01	V	1.0	8.10	1.60	43.50	16.71	-26.79
103.00	6.74	V	1.0	8.37	1.60	43.50	16.71	-26.79
144.00	4.32	Н	2.0	12.02	1.90	43.50	18.24	-25.26
180.80	4.98	V	1.0	10.97	2.01	43.50	17.96	-25.54
204.90	6.25	V	1.0	9.30	2.15	43.50	17.69	-25.81
208.10	6.53	V	1.0	9.43	2.18	43.50	18.14	-25.36
664.50	4.05	Н	1.5	20.33	4.00	46.00	28.38	-17.62
744.30	3.72	V	1.0	21.33	4.20	46.00	29.25	-16.75
993.60	3.64	Н	1.0	23.66	4.97	54.00	32.27	-21.73
_								

H: Horizontal, V: Vertical TEST MODE: 802.11b-CH6(2437 MHz)

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<sup>\*</sup>Checked in all 3 axis and the maximum measured data were reported.( Worst data is Z axis of position) Remark

<sup>\*</sup>CL = Cable Loss(In case of below 1000 MHz)

<sup>\*</sup>The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection at frequency below 1 GHz.



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## Electromagnetic Interference Test Report

## 9.4-1 Test Data for wireless LAN

Test Date 29-Dec-12

Measurement Distance: 3 m

Frequency Reading		Position Height		Correction	Correction Factor		Result Value				
(MHz)	(dB#V)	(V/H)	(m)	Ant Factor (dB)	Cable (dB)	Duty Cycle Correction(dB)	Limit (dB#V/m)	Result (dB#V/m)	Margin (dB)		
	PEAK(RBW: 1 MHz VBW: 3 MHz)										
2333.1	31.19	Н	1.1	26.52	5.0	0	74.0	62.71	-11.29		
2330.9	30.67	V	1.2	26.51	5.0	0	74.0	62.18	-11.82		
2386.7	29.83	Н	1.1	26.68	5.0	0	74.0	61.51	-12.49		
2386.7	29.26	V	1.2	26.68	5.0	0	74.0	60.94	-13.06		
2390.0	30.78	Н	1.1	26.69	5.0	0	74.0	62.47	-11.53		
2390.0	29.35	V	1.2	26.69	5.0	0	74.0	61.04	-12.96		
4824.1	50.65	Н	1.1	31.40	-22.7	0	74.0	59.31	-14.69		
4824.1	48.72	V	1.2	31.40	-22.7	0	74.0	57.38	-16.62		
7236.1	49.48	Н	1.1	35.50	-19.1	0	74.0	65.87	-8.13		
7236.1	47.44	V	1.2	35.50	-19.1	0	74.0	63.83	-10.17		
			AV(	RBW: 1 MH	lz VBW	/: 3 MHz)					
2332.8	16.40	Н	1.1	26.52	5.0	0	54.0	47.92	-6.08		
2332.2	15.16	V	1.2	26.51	5.0	0	54.0	46.67	-7.33		
2390.0	15.95	Н	1.1	26.69	5.0	0	54.0	47.64	-6.36		
2390.0	14.58	V	1.2	26.69	5.0	0	54.0	46.27	-7.73		
4824.1	37.22	Н	1.1	31.40	-22.7	0	54.0	45.88	-8.12		
4824.1	36.45	V	1.2	31.40	-22.7	0	54.0	45.11	-8.89		
7236.1	34.28	Н	1.1	35.50	-19.1	0	54.0	50.67	-3.33		
7236.1	33.54	V	1.2	35.50	-19.1	0	54.0	49.93	-4.07		
						<u> </u>					

H: Horizontal, V: Vertical TEST MODE: 802.11b-CH1(2412 MHz)

FYI

Remark

a. Ton Time = 1.349 ms

b. duty cycle: 98.9 %

c.There did not applied of duty cycle factor for average value.

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<sup>\*</sup>The TX signal isn't detected from 4th harmonics.

<sup>\*</sup>Checked in all 3 axis and the maximum measured data were reported.( Worst data is Z axis of position)

<sup>\*</sup>Multiple of CL = Cable Loss-Amplifier Gain(In case of above1000 MHz)

<sup>\*</sup>Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain



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## **Electromagnetic** Interference **Test Report**

## 9.4-2 Test Data for wireless LAN

Test Date	Test Date 30-Dec-12 Measurement Distance: 3 m								
Frequency	uency Reading Position H		Height	Correction	Factor	Duty Cycle	Result Value		
(MHz)	(dB#V)	(V/H)	(m)	Ant Factor (dB)	Cable (dB)	Correction(dB)	Limit (dB₩/m)	Result (dB#V/m)	Margin (dB)
	PEAK(RBW: 1 MHz VBW: 3 MHz)								
4874.0	48.35	Н	1.1	31.48	-22.5	0	74.0	57.28	-16.72
4874.0	47.62	V	1.2	31.48	-22.5	0	74.0	56.55	-17.45
7311.0	47.25	Н	1.1	35.69	-19.0	0	74.0	63.98	-10.02
7311.0	46.49	V	1.2	35.69	-19.0	0	74.0	63.22	-10.78
			AV(	RBW: 1 MH	lz VBW	/: 3 MHz)			
4874.0	36.12	Н	1.1	31.48	-22.5	0	54.0	45.05	-8.95
4874.0	35.41	V	1.2	31.48	-22.5	0	54.0	44.34	-9.66
7311.0	33.24	Н	1.1	35.69	-19.0	0	54.0	49.97	-4.03
7311.0	32.65	\	1.2	35.69	-19.0	0	54.0	49.38	-4.62

H: Horizontal, V: Vertical TEST MODE: 802.11b-CH6(2437 MHz)

FYI

Remark

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<sup>\*</sup>The TX signal isn't detected from 4th harmonics.

<sup>\*</sup>Checked in all 3 axis and the maximum measured data were reported.( Worst data is Z axis of position)

<sup>\*</sup>Multiple of CL = Cable Loss-Amplifier Gain(In case of above1000 MHz)

<sup>\*</sup>Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain

a. Ton Time = 1.349 ms

b. duty cycle: 98.9 %

c.There did not applied of duty cycle factor for average value.



Rm 1015, World Venture Center II, 426-5 Gasan-dong, Guncheon-gu, Seoul, 158-803, Korea







## Electromagnetic Interference Test Report

# 9.4-3 Test Data for wireless LAN

Test Date 31-Dec-12

Measurement Distance: 3 m

Frequency	Reading	Position	Haiaht	Correction	Factor	Duty Cycle	R	esult Value	,
(MHz)	(dB#V)	(V/H)	(m)	Ant Factor (dB)	Cable (dB)	Correction(dB)		Result (dBW/m)	Margin (dB)
			PEAŁ	K(RBW: 1 N	1Hz VE	BW: 3 MHz)			
2483.5	31.76	Τ	1.1	26.98	5.0	0	74.0	63.74	-10.26
2483.5	29.11	V	1.2	26.98	5.0	0	74.0	61.09	-12.91
2487.2	32.32	Τ	1.1	27.00	5.0	0	74.0	64.32	-9.68
2486.0	31.45	V	1.2	26.99	5.0	0	74.0	63.44	-10.56
4924.1	49.86	I	1.1	31.57	-22.4	0	74.0	59.06	-14.94
4924.1	49.20	V	1.2	31.57	-22.4	0	74.0	58.40	-15.60
7386.1	47.35	Н	1.1	35.88	-18.8	0	74.0	64.42	-9.58
7386.1	45.49	V	1.2	35.88	-18.8	0	74.0	62.56	-11.44
AV(RBW: 1 MHz VBW: 3 MHz)									
2483.5	16.83	Н	1.1	26.98	5.0	0	54.0	48.81	-5.19
2483.5	18.83	V	1.2	26.98	5.0	0	54.0	50.81	-3.19
2486.7	18.89	Τ	1.1	26.99	5.0	0	54.0	50.88	-3.12
2486.7	18.63	V	1.2	26.99	5.0	0	54.0	50.62	-3.38
4924.1	37.41	Н	1.1	31.57	-22.4	0	54.0	46.61	-7.39
4924.1	35.75	V	1.2	31.57	-22.4	0	54.0	44.95	-9.05
7386.1	33.42	Н	1.1	35.88	-18.8	0	54.0	50.49	-3.51
7386.1	33.27	V	1.2	35.88	-18.8	0	54.0	50.34	-3.66
Remark	*The TX signa *Checked in *Multiple of C	al isn't detect all 3 axis and CL = Cable Lo ding Value + 7 = 1.349 ms	ted from 4 the maxir ss-Amplif	MODE: 802.1 th harmonics. num measured fier Gain(In cas actor + Cable I	data were e of above	reported.( Worst data 1000 MHz)	ı is Z axis of p	osition)	

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c. There did not applied of duty cycle factor for average value.



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# Electromagnetic Interference Test Report

# 9.5 Test Data for wireless LAN (802.11g)

Test Date: 27-Dec-12 Measurement Distance: 3 m

Frequency	Reading	Position	Height	Correction	n Factor	1	Result Value	)
(MHz)	(dB₩)	(V/H)	(m)	Ant Factor (dB)	Cable (dB)	Limit (dB#V/m)	Result (dB#V/m)	Margin (dB)
44.60	3.17	\	1.0	12.53	1.00	40.00	16.70	-23.30
48.00	1.73	Т	2.5	12.65	1.06	40.00	15.44	-24.56
72.00	3.68	Н	2.5	10.67	1.24	40.00	15.59	-24.41
74.10	9.45	\	1.0	10.28	1.28	40.00	21.02	-18.98
76.10	7.93	V	1.0	9.92	1.32	40.00	19.17	-20.83
77.20	8.96	\	1.0	9.72	1.34	40.00	20.02	-19.98
79.10	8.22	\	1.0	9.37	1.38	40.00	18.98	-21.02
201.30	6.39	Н	2.0	9.14	2.11	43.50	17.65	-25.85
206.70	6.31	V	1.0	9.37	2.17	43.50	17.85	-25.65
623.30	3.64	\	1.0	19.97	3.82	46.00	27.42	-18.58
636.00	3.84	Н	1.5	20.08	3.88	46.00	27.80	-18.20
810.80	3.65	Н	1.0	22.28	4.40	46.00	30.33	-15.67

H: Horizontal, V: Vertical TEST MODE: 802.11g-CH6(2437 MHz)

Remark

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<sup>\*</sup>Checked in all 3 axis and the maximum measured data were reported.( Worst data is Z axis of position)

<sup>\*</sup>CL = Cable Loss(In case of below 1000 MHz)

<sup>\*</sup>The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection at frequency below 1 GHz.



Rm 1015, World Venture Center II. 426-5 Gasan-dong, Guncheon-gu, Seoul, 158-803, Korea





Electromagnetic Interference Test Report

## 9.5-1 Test Data for wireless LAN

Test Date 29-Dec-12

Measurement Distance: 3 m

Frequency	Reading	Position	Hojaht	Correction	r Factor	Duty Cycle	Result Value			
(MHz)	(dB#V)	(V/H)	(m)	Ant Factor (dB)	Cable (dB)	Correction(dB)	Limit (dB#V/m)	Result (dB⊬V/m)	Margin (dB)	
			PEAŁ	K(RBW: 1 N	ЛНz VE	BW: 3 MHz)				
2389.2	36.41	Н	1.1	26.69	5.0	0	74.0	68.10	-5.90	
2389.2	37.15	V	1.2	26.69	5.0	0	74.0	68.84	-5.16	
2390.0	39.29	Н	1.1	26.69	5.0	0	74.0	70.98	-3.02	
2390.0	38.15	V	1.2	26.69	5.0	0	74.0	69.84	-4.16	
4824.1	51.62	I	1.1	31.40	-22.7	0	74.0	60.28	-13.72	
4824.1	50.55	\	1.2	31.40	-22.7	0	74.0	59.21	-14.79	
7236.1	50.41	I	1.1	35.50	-19.1	0	74.0	66.80	-7.20	
7236.1	48.36	\	1.2	35.50	-19.1	0	74.0	64.75	-9.25	
			AV(	RBW: 1 MH	tz VBV	/: 3 MHz)				
2389.6	17.43	I	1.1	26.69	5.0	0	54.0	49.12	-4.88	
2389.6	18.22	\	1.2	26.69	5.0	0	54.0	49.91	-4.09	
2390.0	17.73	Н	1.1	26.69	5.0	0	54.0	49.42	-4.58	
2390.0	18.44	\	1.2	26.69	5.0	0	54.0	50.13	-3.87	
4824.1	37.99	Н	1.1	31.40	-22.7	0	54.0	46.65	-7.35	
4824.1	37.02	V	1.2	31.40	-22.7	0	54.0	45.68	-8.32	
7236.1	34.35	Н	1.1	35.50	-19.1	0	54.0	50.74	-3.26	
7236.1	33.78	V	1.2	35.50	-19.1	0	54.0	50.17	-3.83	
				M085 - 000						

H: Horizontal, V: Vertical TEST MODE: 802.11g-CH1(2412 MHz)

FYI

Remark

a. Ton Time = 2.09 ms

b. duty cycle: 98.3 %

c. There did not applied of duty cycle factor for average value.

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<sup>\*</sup>The TX signal isn't detected from 4th harmonics.

<sup>\*</sup>Checked in all 3 axis and the maximum measured data were reported.( Worst data is Z axis of position)

<sup>\*</sup>Multiple of CL = Cable Loss-Amplifier Gain(In case of above1000 MHz)

<sup>\*</sup>Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain









# **Electromagnetic** Interference **Test Report**

# 9.5-2 Test Data for wireless LAN

Test Date	Test Date 30-Dec-12 Measurement Distance: 3 m										
Frequency	Reading	Position	Haiaht	Correction	Factor	Duty Cycle	F	Result Value			
(MHz)	(dB#V)	(V/H)	(m)	Ant Factor (dB)	Cable (dB)	Correction(dB)	Limit (dB₩/m)	Result (dB#V/m)	Margin (dB)		
			PEA	K(RBW: 1 N	1Hz VE	BW: 3 MHz)					
4874.0	49.28	Н	1.1	31.48	-22.5	0	74.0	58.21	-15.79		
4874.0	48.35	V	1.2	31.48	-22.5	0	74.0	57.28	-16.72		
7311.0	48.96	Н	1.1	35.69	-19.0	0	74.0	65.69	-8.31		
7311.0	47.45	V	1.2	35.69	-19.0	0	74.0	64.18	-9.82		
			AV(	RBW: 1 MH	lz VBW	/: 3 MHz)					
4874.0	37.35	Н	1.1	31.48	-22.5	0	54.0	46.28	-7.72		
4874.0	36.25	V	1.2	31.48	-22.5	0	54.0	45.18	-8.82		
7311.0	33.02	Н	1.1	35.69	-19.0	0	54.0	49.75	-4.25		
7311.0	32.49	V	1.2	35.69	-19.0	0	54.0	49.22	-4.78		
Remark	*Checked in a *Multiple of C	al isn't detect all 3 axis and L = Cable Lo ling Value + /	ted from 4 the maxir ss-Amplit	MODE: 802. th harmonics. num measured fier Gain(In cas actor + Cable I	data were	reported.( Worst data 1000 MHz)	is Z axis of p	osition)			

a. Ton Time = 2.09 ms b. duty cycle: 98.3 %

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c.There did not applied of duty cycle factor for average value.



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Electromagnetic Interference Test Report

## 9.5-3 Test Data for wireless LAN

Test Date 31-Dec-12

Measurement Distance: 3 m	Measu	rement	Distance	:	3	m
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Test Date of Dec 12 Measurement distance : 5										
Frequency	Reading	Position	Height	Correction	Factor	Duty Cycle	F	Result Value		
(MHz)	(dB#V)	(V/H)	(m)	Ant Factor (dB)	Cable (dB)	Correction(dB)	Limit (dB#V/m)	Result (dB#V/m)	Margin (dB)	
			PEAŁ	K(RBW: 1 N	1Hz VE	BW: 3 MHz)				
2483.5	39.08	Н	1.1	26.98	5.0	0	74.0	71.06	-2.94	
2483.5	37.69	V	1.2	26.98	5.0	0	74.0	69.67	-4.33	
2484.6	39.40	Н	1.1	26.99	5.0	0	74.0	71.39	-2.61	
2484.6	38.76	V	1.2	26.99	5.0	0	74.0	70.75	-3.25	
4924.1	50.01	Н	1.1	31.57	-22.4	0	74.0	59.21	-14.79	
4924.1	49.81	V	1.2	31.57	-22.4	0	74.0	59.01	-14.99	
7386.1	48.74	Н	1.1	35.88	-18.8	0	74.0	65.81	-8.19	
7386.1	47.25	V	1.2	35.88	-18.8	0	74.0	64.32	-9.68	
			AV(	RBW: 1 MH	łz VBV	/: 3 MHz)				
2483.5	18.75	Н	1.1	26.98	5.0	0	54.0	50.73	-3.27	
2483.5	18.45	V	1.2	26.98	5.0	0	54.0	50.43	-3.57	
2483.6	18.50	Н	1.1	26.98	5.0	0	54.0	50.48	-3.52	
2483.6	18.47	V	1.2	26.98	5.0	0	54.0	50.45	-3.55	
4924.1	37.85	Н	1.1	31.57	-22.4	0	54.0	47.05	-6.95	
4924.1	36.25	V	1.2	31.57	-22.4	0	54.0	45.45	-8.55	
7386.1	33.85	Н	1.1	35.88	-18.8	0	54.0	50.92	-3.08	
7386.1	33.29	V	1.2	35.88	-18.8	0	54.0	50.36	-3.64	
	H: Horizonta	l, V:Vertic	al TEST	MODE: 802.	11g-CH11(	(2462 MHz)				

<sup>\*</sup>The TX signal isn't detected from 4th harmonics.

FYI

Remark

a. Ton Time = 2.09 ms

b. duty cycle: 98.3 %

c. There did not applied of duty cycle factor for average value.

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<sup>\*</sup>Checked in all 3 axis and the maximum measured data were reported.( Worst data is Z axis of position)

<sup>\*</sup>Multiple of CL = Cable Loss-Amplifier Gain(In case of above1000 MHz)

<sup>\*</sup>Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain



Rm 1015, World Venture Center II. 426-5 Gasan-dong, Guncheon-gu, Seoul, 158-803, Korea







## **Electromagnetic** Interference **Test Report**

## 9.6 Test Data for wireless LAN (802.11n)

Measurement Distance: 3 m Test Date: 28-Dec-12

Frequency	Reading	Position	Height	Correction	n Factor	[	Result Value	)
(MHz)	(dB₩)	(V/H)	(m)	Ant Factor (dB)	Cable (dB)	Limit (dB#V/m)	Result (dB#V/m)	Margin (dB)
61.40	6.54	\	1.0	11.84	1.20	40.00	19.58	-20.42
71.80	5.36	V	1.0	10.70	1.24	40.00	17.30	-22.70
75.10	12.11	V	1.0	10.10	1.30	40.00	23.51	-16.49
102.80	6.80	V	1.0	8.35	1.60	43.50	16.75	-26.75
144.00	3.34	V	1.0	12.02	1.90	43.50	17.26	-26.24
155.00	2.52	Н	2.0	12.21	1.95	43.50	16.68	-26.82
170.40	2.61	Н	1.9	11.65	2.00	43.50	16.26	-27.24
204.80	5.81	V	1.0	9.29	2.15	43.50	17.25	-26.25
277.90	4.34	Н	1.5	12.29	2.50	46.00	19.13	-26.87
302.60	3.12	Н	1.5	13.22	2.61	46.00	18.95	-27.05
953.20	3.28	Н	1.0	23.37	4.81	46.00	31.46	-14.54
991.80	3.07	V	1.0	23.65	4.96	54.00	31.68	-22.32

H: Horizontal, V: Vertical TEST MODE: 802.11n-CH6(2437 MHz)

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<sup>\*</sup>Checked in all 3 axis and the maximum measured data were reported.( Worst data is Z axis of position) Remark

<sup>\*</sup>CL = Cable Loss(In case of below 1000 MHz)

<sup>\*</sup>The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection at frequency below 1 GHz.



Rm 1015, World Venture Center II. 426-5 Gasan-dong, Guncheon-gu, Seoul, 158-803, Korea





# Electromagnetic Interference Test Report

## 9.6-1 Test Data for wireless LAN

Test Date 29-Dec-12

Measurement Distance: 3 m

Frequency	Reading	Reading Position Hei		Correction	Factor	Duty Cycle	Result Value			
(MHz)	(dB#V)	(V/H)	(m)	Ant Factor (dB)	Cable (dB)	Correction(dB)		Result (dB#V/m)	Margin (dB)	
			PEAŁ	K(RBW: 1 N	1Hz VE	BW: 3 MHz)				
2389.2	37.61	Τ	1.1	26.69	5.0	0	74.0	69.30	-4.70	
2389.2	37.30	\	1.2	26.69	5.0	0	74.0	68.99	-5.01	
2390.0	39.88	I	1.1	26.69	5.0	0	74.0	71.57	-2.43	
2390.0	39.15	\	1.2	26.69	5.0	0	74.0	70.84	-3.16	
4824.1	52.71	Н	1.1	31.40	-22.7	0	74.0	61.37	-12.63	
4824.1	51.62	V	1.2	31.40	-22.7	0	74.0	60.28	-13.72	
7236.1	51.35	Н	1.1	35.50	-19.1	0	74.0	67.74	-6.26	
7236.1	50.46	V	1.2	35.50	-19.1	0	74.0	66.85	-7.15	
			AV(	RBW: 1 MH	łz VBV	/: 3 MHz)				
2389.6	18.21	Н	1.1	26.69	5.0	0	54.0	49.90	-4.10	
2389.6	19.06	V	1.2	26.69	5.0	0	54.0	50.75	-3.25	
2390.0	18.33	Н	1.1	26.69	5.0	0	54.0	50.02	-3.98	
2390.0	19.00	V	1.2	26.69	5.0	0	54.0	50.69	-3.31	
4824.1	38.22	Н	1.1	31.40	-22.7	0	54.0	46.88	-7.12	
4824.1	37.65	V	1.2	31.40	-22.7	0	54.0	46.31	-7.69	
7236.1	34.52	Н	1.1	35.50	-19.1	0	54.0	50.91	-3.09	
7236.1	33.99	V	1.2	35.50	-19.1	0	54.0	50.38	-3.62	
	H: Horizonta	,		MODE: 802.	 11n-CH1(2	412 MHz)				

<sup>\*</sup>The TX signal isn't detected from 4th harmonics.

FYI

Remark

a. Ton Time = 1.983 ms

b. duty cycle: 99.1 %

c. There did not applied of duty cycle factor for average value.

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<sup>\*</sup>Checked in all 3 axis and the maximum measured data were reported.( Worst data is Z axis of position)

<sup>\*</sup>Multiple of CL = Cable Loss-Amplifier Gain(In case of above1000 MHz)

<sup>\*</sup>Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain



Rm 1015, World Venture Center II, 426-5 Gasan-dong, Guncheon-gu, Seoul, 158-803, Korea





# **Electromagnetic** Interference **Test Report**

# 9.6-2 Test Data for wireless LAN

Test Date	30-Dec-12					Mea	asurement	Distance:	3 m
Frequency	Reading	Position	Height	Correction	Factor	Duty Cycle	F	Result Value	<del>,</del>
(MHz)	(dB#V)	(V/H)	(m)	Ant Factor (dB)	Cable (dB)	Correction(dB)	Limit (dB#V/m)	Result (dB#V/m)	Margin (dB)
			PEAŁ	K(RBW: 1 N	ЛНz VE	BW: 3 MHz)			
4874.0	50.98	Η	1.1	31.48	-22.5	0	74.0	59.91	-14.09
4874.0	49.74	\	1.2	31.48	-22.5	0	74.0	58.67	-15.33
7311.0	49.85	Н	1.1	35.69	-19.0	0	74.0	66.58	-7.42
7311.0	48.26	\	1.2	35.69	-19.0	0	74.0	64.99	-9.01
	AV(RBW: 1 MHz VBW: 3 MHz)								
4874.0	38.52	Τ	1.1	31.48	-22.5	0	54.0	47.45	-6.55
4874.0	37.41	V	1.2	31.48	-22.5	0	54.0	46.34	-7.66
7311.0	34.00	Н	1.1	35.69	-19.0	0	54.0	50.73	-3.27
7311.0	33.28	V	1.2	35.69	-19.0	0	54.0	50.01	-3.99
Remark	*Checked in a *Multiple of C *Total = Read FYI a. Ton Time = b. duty cycle	al isn't detectall 3 axis and CL = Cable Loding Value + 7 = 1.983 ms : 99.1 %	ted from 4 the maxir oss-Amplit Antenna F	MODE: 802.  th harmonics.  num measured fier Gain(In cas actor + Cable I	data were se of above Loss - Am	reported.( Worst data 1000 MHz) o Gain	ı is Z axis of p	osition)	

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## Electromagnetic Interference Test Report

## 9.6-3 Test Data for wireless LAN

Test Date 31-Dec-12

Measurement Distance	:	3	m
----------------------	---	---	---

Frequency	Reading	Position	Height	Correction	Factor	Duty Cycle	F	Result Value	!
(MHz)	(dB#V)	(V/H)	(m)	Ant Factor (dB)	Cable (dB)	Correction(dB)	Limit (dB#V/m)	Result (dB#V/m)	Margin (dB)
			PEAŁ	K(RBW: 1 N	1Hz VE	BW: 3 MHz)			
2483.5	38.97	Τ	1.1	26.98	5.0	0	74.0	70.95	-3.05
2483.5	39.05	V	1.2	26.98	5.0	0	74.0	71.03	-2.97
2484.6	39.46	Н	1.1	26.99	5.0	0	74.0	71.45	-2.55
2483.9	39.36	\	1.2	26.98	5.0	0	74.0	71.34	-2.66
4924.1	51.25	I	1.1	31.57	-22.4	0	74.0	60.45	-13.55
4924.1	50.42	V	1.2	31.57	-22.4	0	74.0	59.62	-14.38
7386.1	50.35	Н	1.1	35.88	-18.8	0	74.0	67.42	-6.58
7386.1	49.72	\	1.2	35.88	-18.8	0	74.0	66.79	-7.21
			AV(	RBW: 1 MH	łz VBW	/: 3 MHz)			
2483.5	18.95	Н	1.1	26.98	5.0	0	54.0	50.93	-3.07
2483.5	18.66	V	1.2	26.98	5.0	0	54.0	50.64	-3.36
2483.6	18.73	Н	1.1	26.98	5.0	0	54.0	50.71	-3.29
2483.6	18.58	\	1.2	26.98	5.0	0	54.0	50.56	-3.44
4924.1	38.02	Н	1.1	31.57	-22.4	0	54.0	47.22	-6.78
4924.1	37.25	V	1.2	31.57	-22.4	0	54.0	46.45	-7.55
7386.1	34.00	Н	1.1	35.88	-18.8	0	54.0	51.07	-2.93
7386.1	33.26	V	1.2	35.88	-18.8	0	54.0	50.33	-3.67

H: Horizontal, V: Vertical TEST MODE: 802.11n-CH11(2462 MHz)

FYI

Remark

a. Ton Time = 1.983 ms

b. duty cycle: 99.1 %

c. There did not applied of duty cycle factor for average value.

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<sup>\*</sup>The TX signal isn't detected from 4th harmonics.

<sup>\*</sup>Checked in all 3 axis and the maximum measured data were reported.( Worst data is Z axis of position)

<sup>\*</sup>Multiple of CL = Cable Loss-Amplifier Gain(In case of above1000 MHz)

<sup>\*</sup>Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain







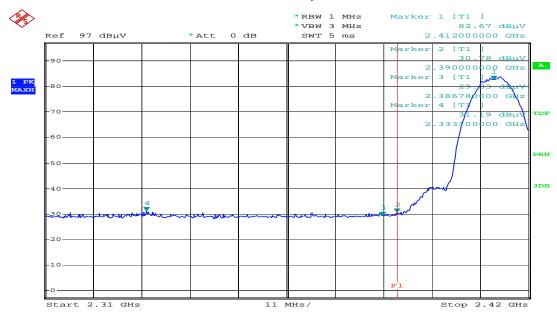


**Electromagnetic** Interference **Test Report** 

# 9.7 Restricted Band Edges for 802.11b

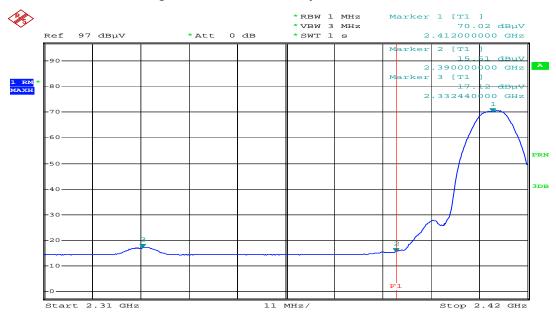
Band Edges(CH Low)

Detector mode:Peak Polarity: Horizontal



Detector mode: Average

Polarity: Horizontal



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Marker 1 [T1 ]



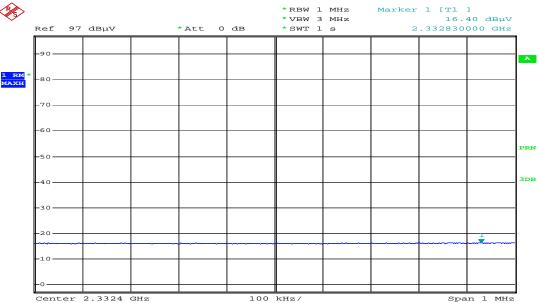
# **Electromagnetic** Interference **Test Report**

#### Band Edges(CH Low)

#### Detector mode: Average

#### Polarity: Horizontal

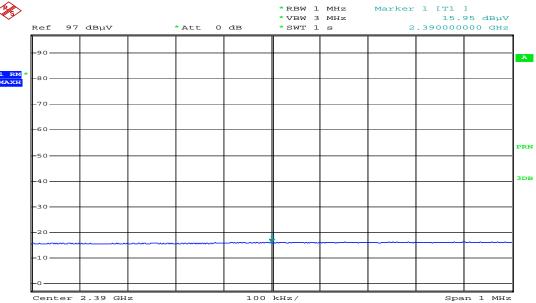




#### Detector mode: Average

#### Polarity: Horizontal







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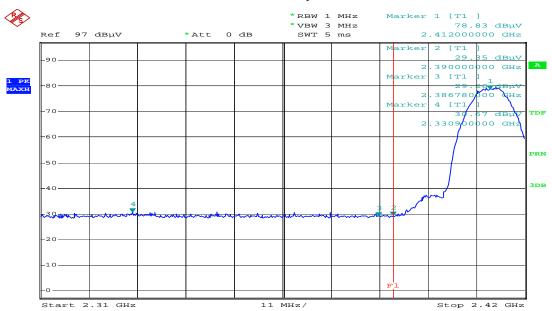


Electromagnetic Interference Test Report

#### Band Edges(CH Low)

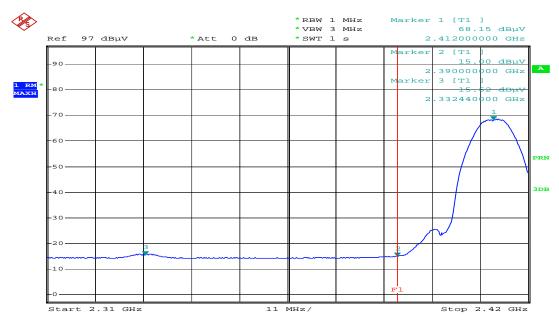
#### Detector mode:Peak

#### Polarity: Vertical



#### Detector mode: Average

#### Polarity: Vertical



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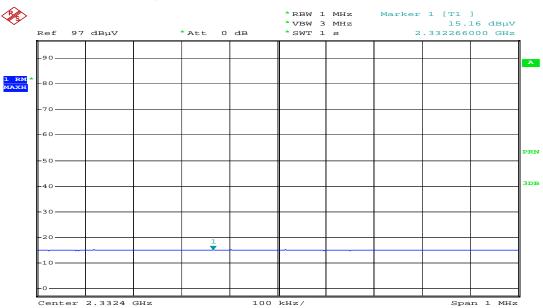


Electromagnetic Interference Test Report

#### Band Edges(CH Low)

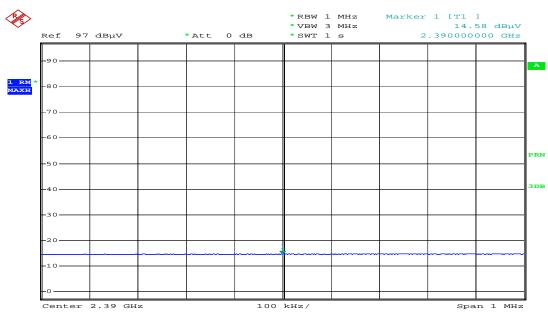
#### Detector mode: Average

#### Polarity: Vertical



## Detector mode: Average

#### Polarity: Vertical



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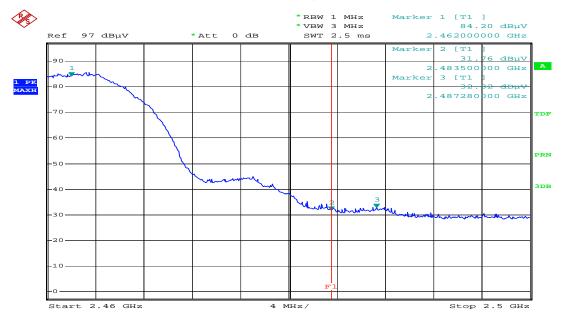


Electromagnetic Interference Test Report

#### Band Edges(CH High)

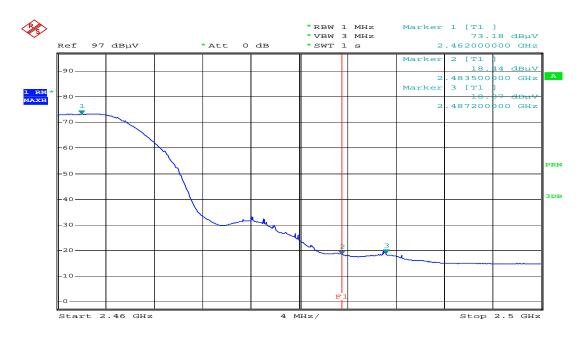
Detector mode:Peak

#### Polarity: Horizontal



Detector mode: Average

#### Polarity: Horizontal



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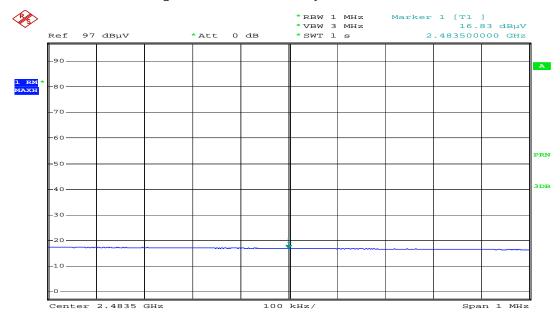


Electromagnetic Interference Test Report

#### Band Edges(CH High)

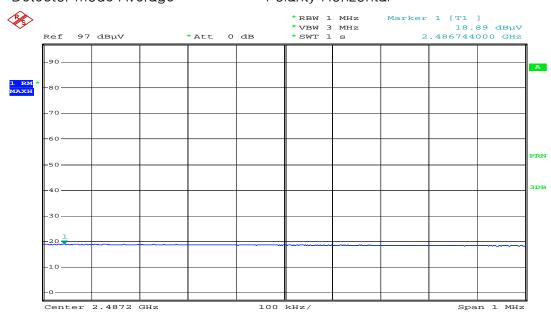
Detector mode: Average

#### Polarity: Horizontal



#### Detector mode: Average

#### Polarity: Horizontal



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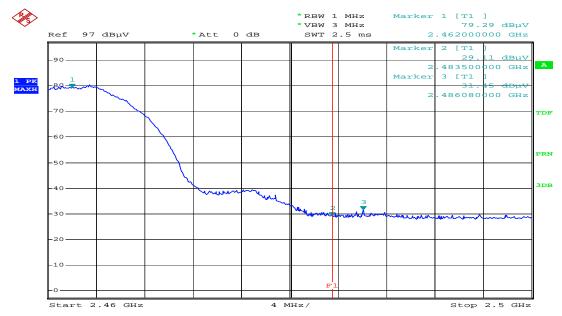


# Electromagnetic Interference Test Report

#### Band Edges(CH High)

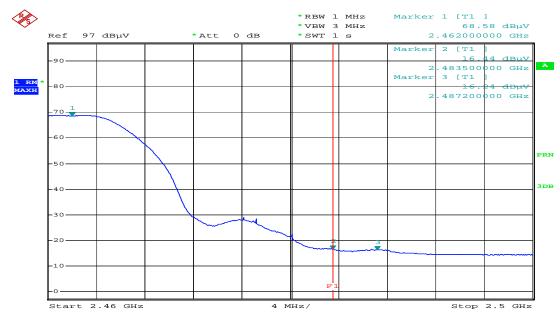
Detector mode:Peak

#### Polarity: Vertical



#### Detector mode: Average

#### Polarity:Vertical



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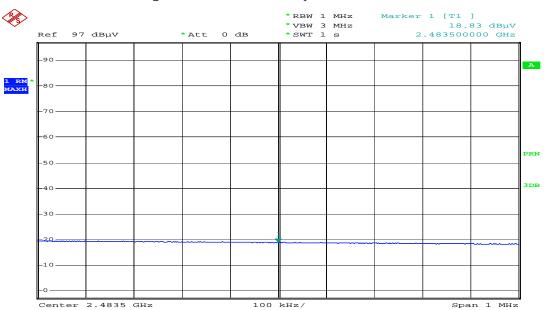


## Electromagnetic Interference Test Report

#### Band Edges(CH High)

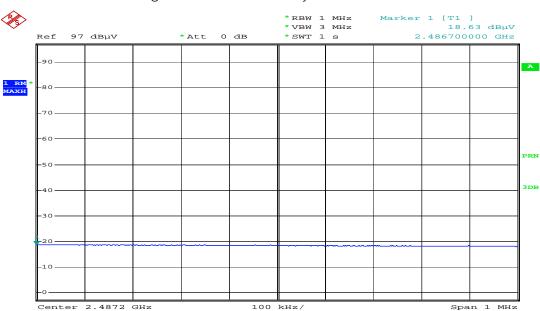
#### Detector mode: Average

#### Polarity: Vertical



#### Detector mode: Average

#### Polarity:Vertical



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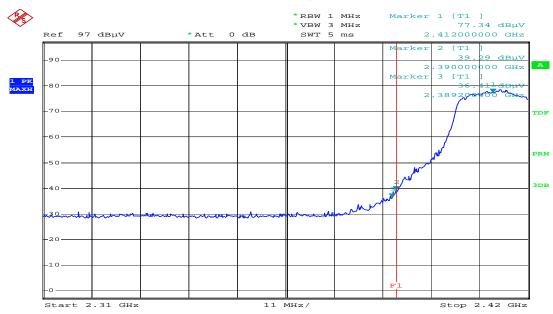


Electromagnetic Interference Test Report

# Restricted Band Edges for 802.11g

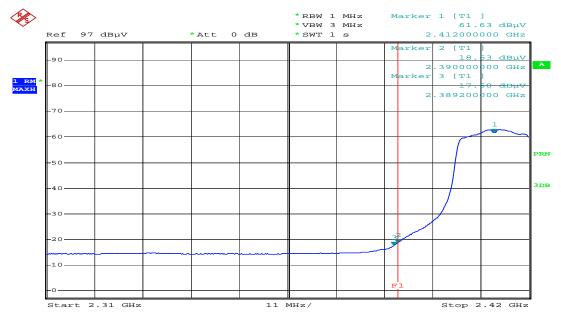
Band Edges(CH Low)

Detector mode:Peak Polarity:Horizontal



Detector mode: Average

Polarity: Horizontal



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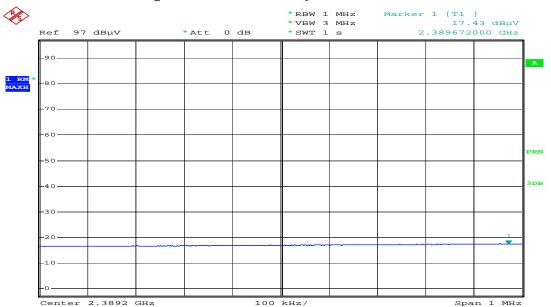


Electromagnetic Interference Test Report

#### Band Edges(CH Low)

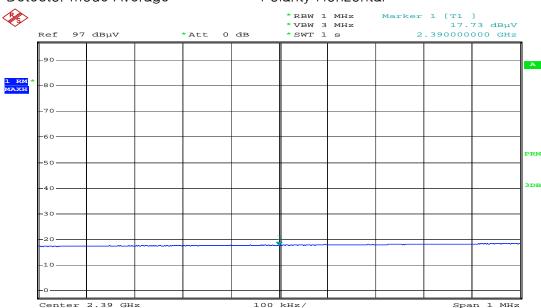
## Detector mode: Average

### Polarity:Horizontal



#### Detector mode: Average

#### Polarity:Horizontal



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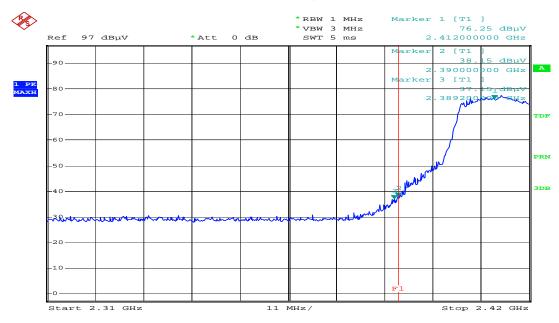


Electromagnetic Interference Test Report

#### Band Edges(CH Low)

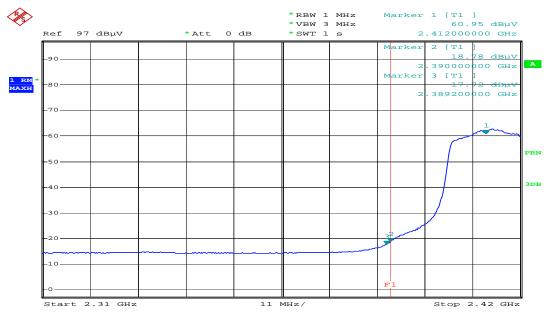
#### Detector mode:Peak

#### Polarity: Vertical



## Detector mode: Average

#### Polarity: Vertical



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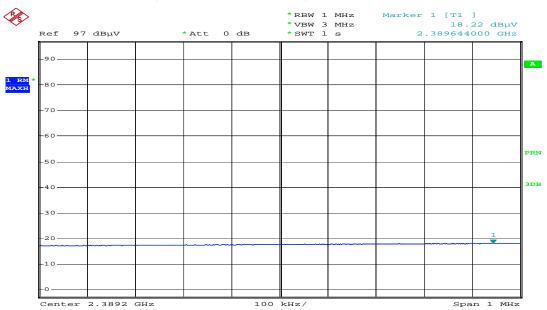


Electromagnetic Interference Test Report

#### Band Edges(CH Low)

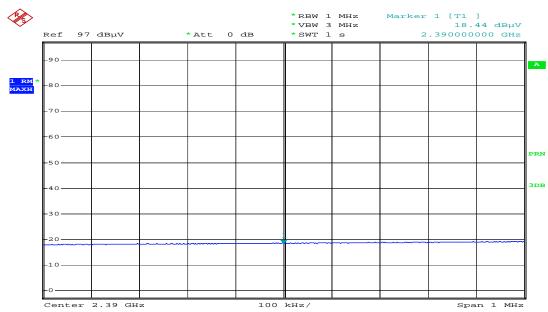
#### Detector mode: Average

#### Polarity: Vertical



#### Detector mode: Average

#### Polarity:Vertical



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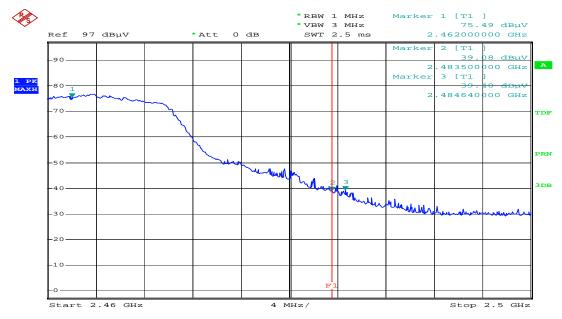


## Electromagnetic Interference Test Report

#### Band Edges(CH High)

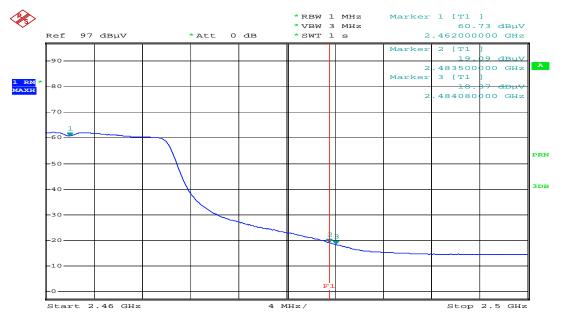
#### Detector mode:Peak

#### Polarity: Horizontal



#### Detector mode: Average

#### Polarity: Horizontal



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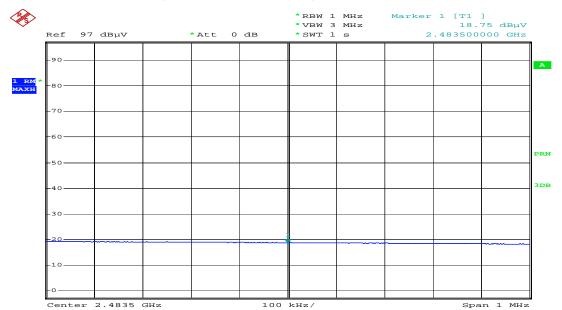


## Electromagnetic Interference Test Report

## Band Edges(CH High)

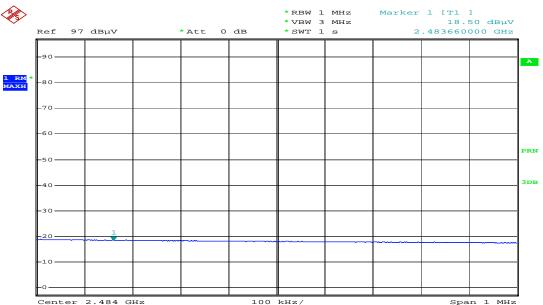
## Detector mode: Average

#### Polarity: Horizontal



#### Detector mode: Average

#### Polarity: Horizontal



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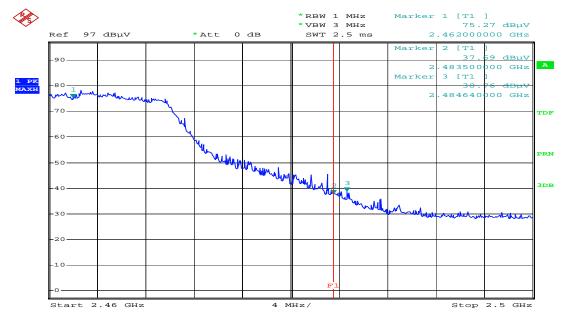




## Electromagnetic Interference Test Report

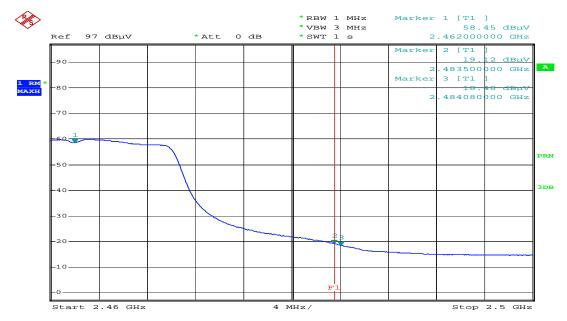
### Band Edges(CH High)

## Detector mode:Peak Polarity:Vertical



#### Detector mode: Average

#### Polarity:Vertical



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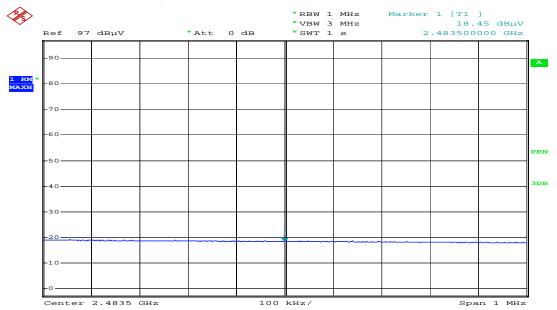


## Electromagnetic Interference Test Report

## Band Edges(CH High)

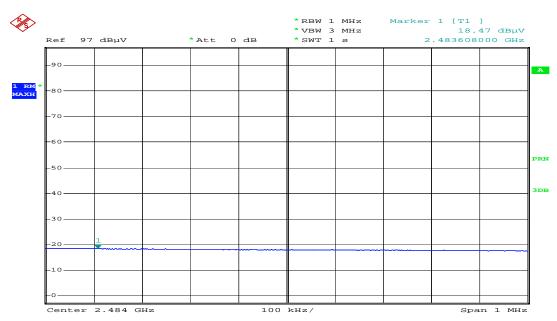
#### Detector mode: Average

#### Polarity:Vertical



#### Detector mode: Average

#### Polarity:Vertical



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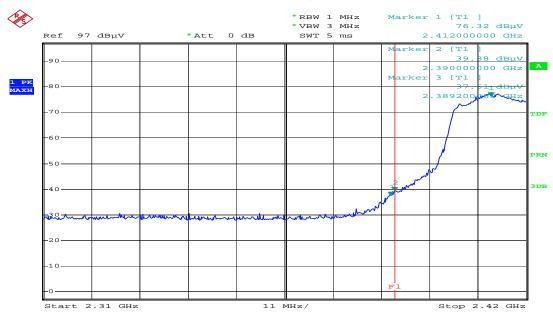
Electromagnetic Interference Test Report

## Restricted Band Edges for 802.11n

Band Edges(CH Low)

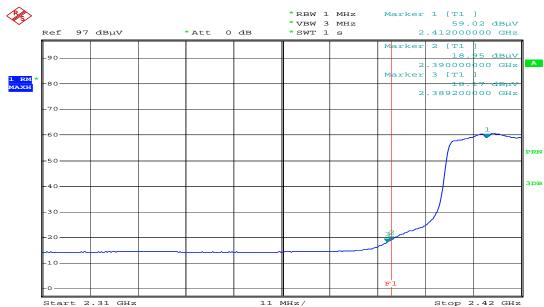
Detector mode:Peak

#### Polarity: Horizontal



#### Detector mode: Average

#### Polarity: Horizontal



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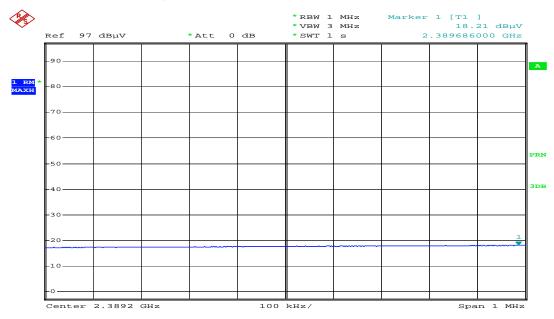


Electromagnetic Interference Test Report

#### Band Edges(CH Low)

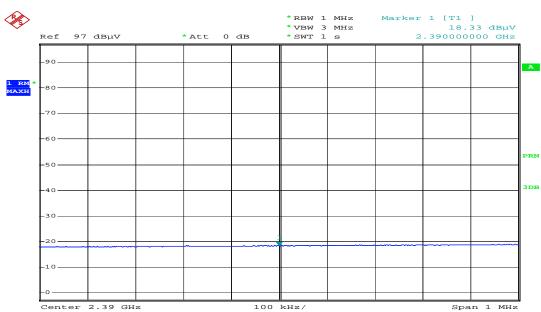
#### Detector mode: Average

#### Polarity: Horizontal



#### Detector mode: Average

#### Polarity: Horizontal



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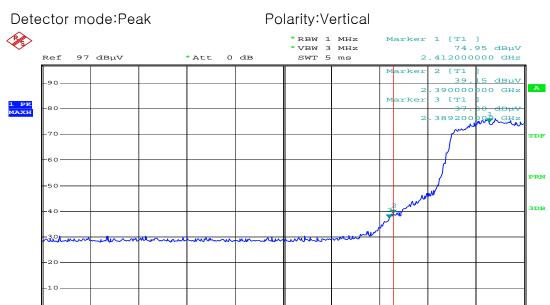




Stop 2.42 GHz

Electromagnetic Interference Test Report

#### Band Edges(CH Low)

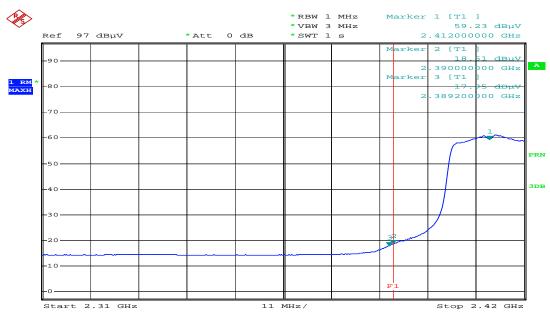


#### Detector mode: Average

Start 2.31 GHz

#### Polarity: Vertical

11 MHz/



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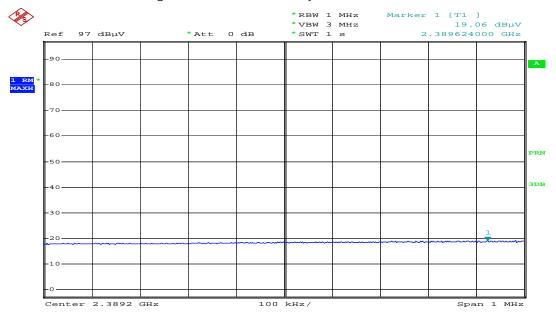


Electromagnetic Interference Test Report

#### Band Edges(CH Low)

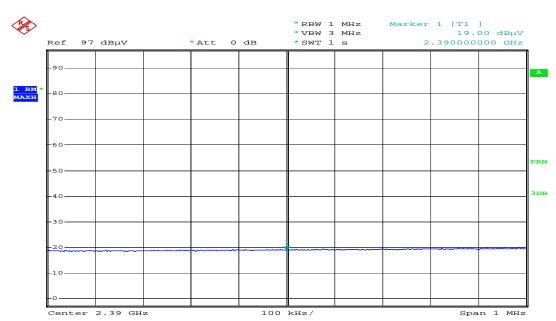
#### Detector mode: Average

#### Polarity:Vertical



#### Detector mode: Average

#### Polarity: Vertical



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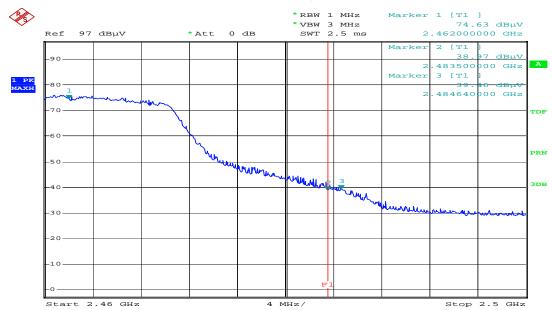


# Electromagnetic Interference Test Report

#### Band Edges(CH High)

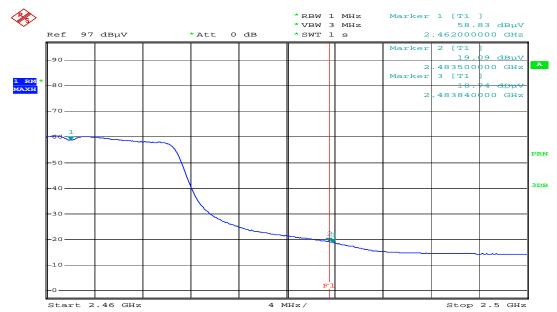
#### Detector mode:Peak

## Polarity:Horizontal



#### Detector mode: Average

#### Polarity: Horizontal



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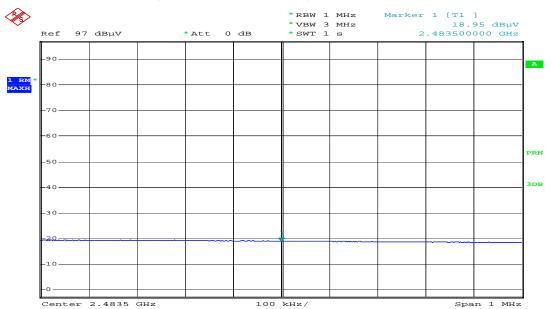


Electromagnetic Interference Test Report

## Band Edges(CH High)

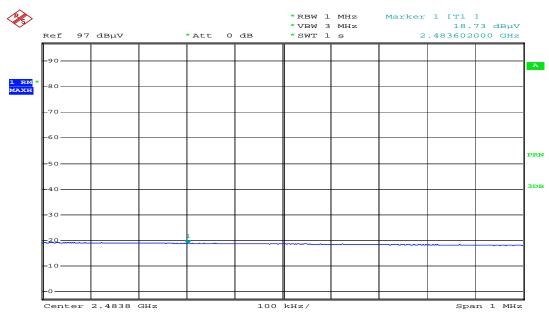
## Detector mode: Average

#### Polarity: Horizontal



### Detector mode: Average

#### Polarity: Horizontal



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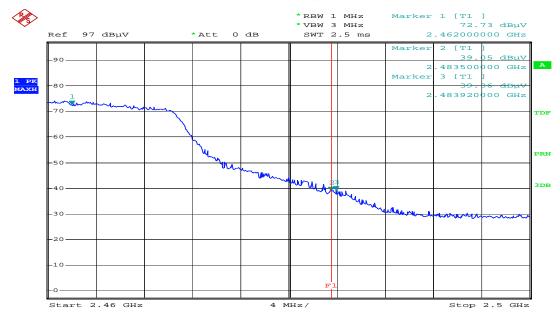






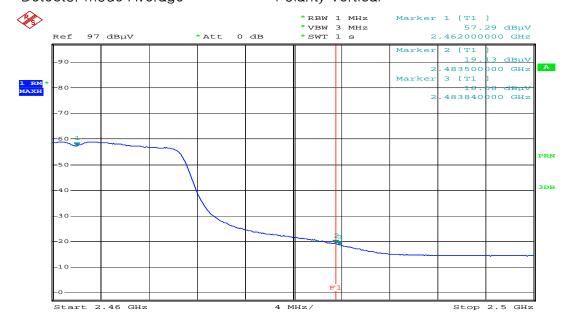
### Band Edges(CH High)

## Detector mode: Peak Polarity: Vertical



#### Detector mode: Average

#### Polarity:Vertical



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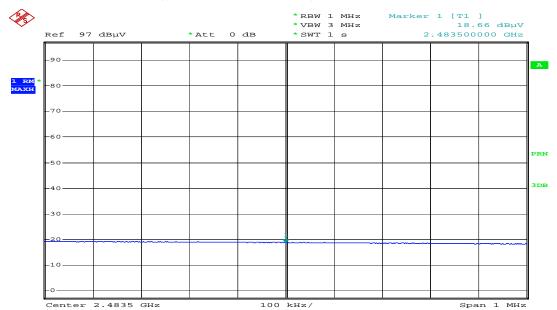


# Electromagnetic Interference Test Report

#### Band Edges(CH High)

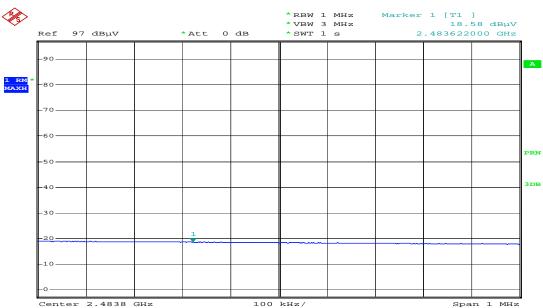
Detector mode: Average

#### Polarity:Vertical



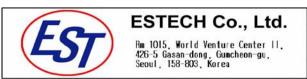
#### Detector mode: Average

#### Polarity:Vertical



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Electromagnetic Interference Test Report

## 10. Measurement of conducted disturbance

The continuous disturbance voltage of AC Mains in the frequency from 0.15 to 30 MHz was measured in accordance to FCC Part 15 (2010). The test setup was made according to ANSI C 63.4 (2003) in a shielded. 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.

## 10.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date	
TEST Receiver	ESHS 30	Rohde & Schwarz	828765/002	14-Dec-13	
LISN	ENV216	Rohde & Schwarz	101231	19-Sep-13	
LISN	ESH3-Z5	Rohde & Schwarz	838979/010	26-Jan-13	
Pulse Limiter	ESH3Z2	Rohde & Schwarz	NONE	25-Jan-13	
Bluetooth Tester	TC-3000A	TESCOM	3000A570224	23-Aug-13	

#### 10.2 Environmental Condition

Test Place : Shielded Room

Wireless LAN 802.11b Mode

Temperature (°C) : 23.2 °C Humidity (% R.H.) : 52.4 % R.H.

Wireless LAN 802.11g Mode

Temperature (°C) : 21.6 °C Humidity (% R.H.) : 49.2 % R.H.

Wireless LAN 802.11n Mode

Temperature (°C) : 22.5 °C Humidity (% R.H.) : 51.0 % R.H.

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## Electromagnetic Interference Test Report

# 10.3 Test Data for wireless LAN (802.11b)

Test Date: 26-Dec-12

Frequency (MHz)	Correction Factor		Line	Quasi-peak Value			Average Value		
	Lisn (dB)	Cable (dB)	(H/N)	Limit (dB#V)	Reading (dB#V)	Result (dB#V)	Limit (dB#V)	Reading (dB#V)	Result (dB)
0.15	0.06	0.27	Ν	66.00	37.44	37.77	56.00	13.08	13.41
0.16	0.06	0.27	Н	65.46	36.35	36.68	55.46	14.81	15.14
0.17	0.06	0.27	Н	64.96	35.91	36.24	54.96	15.57	15.90
0.18	0.05	0.28	N	64.49	48.69	49.02	54.49	31.90	32.23
0.20	0.05	0.28	Н	63.61	47.50	47.83	53.61	33.08	33.41
0.27	0.05	0.30	N	61.12	42.22	42.57	51.12	29.64	29.99
0.28	0.05	0.30	Н	60.82	40.93	41.28	50.82	30.79	31.14
0.29	0.05	0.30	N	60.52	32.69	33.05	50.52	14.50	14.86
0.30	0.05	0.31	Н	60.24	40.04	40.40	50.24	30.68	31.04
				-		-	-		

Remark

H: Hot Line, N: Neutral Line TEST MODE: 802.11b - CH 6(2437 MHz)

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## Electromagnetic Interference Test Report

# 10.3 Test Data for wireless LAN (802.11g)

Test Date: 27-Dec-12

Frequency (MHz)	Correction Factor		Line	Quasi-peak Value			Average Value		
	Lisn (dB)	Cable (dB)	(H/N)	Limit (dB#V)	Reading (dB#V)	Result (dB#V)	Limit (dB#V)	Reading (dB#V)	Result (dB)
0.15	0.06	0.27	Н	66.00	45.48	45.81	56.00	27.54	27.87
0.16	0.06	0.27	Н	65.46	41.56	41.89	55.46	25.05	25.38
0.17	0.06	0.27	Н	64.77	39.97	40.30	54.77	24.42	24.75
0.18	0.05	0.28	N	64.49	47.16	47.49	54.49	28.76	29.09
0.19	0.05	0.28	N	64.04	46.49	46.82	54.04	29.18	29.51
0.20	0.05	0.28	N	63.61	42.78	43.11	53.61	24.55	24.88
0.25	0.05	0.29	N	61.76	42.14	42.49	51.76	26.78	27.13
0.26	0.05	0.30	N	61.43	40.32	40.67	51.43	23.88	24.23
					<u> </u>				
_			N N.		COT MOD			/O 4OZ NALL	,

Remark

H: Hot Line, N: Neutral Line TEST MODE: 802.11g - CH 6(2437 MHz)

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# Electromagnetic Interference Test Report

# 10.3 Test Data for wireless LAN (802.11n)

Test Date: 28-Dec-12

Frequency (MHz)	Correction Factor		Line	Quasi-peak Value			Average Value		
	Lisn (dB)	Cable (dB)	(H/N)	Limit (dB#V)	Reading (dB#V)	Result (dB#V)	Limit (dB#V)	Reading (dB#V)	Result (dB)
0.15	0.06	0.27	N	66.00	47.64	47.97	56.00	28.62	28.95
0.16	0.06	0.27	N	65.46	49.70	50.03	55.46	31.39	31.72
0.17	0.06	0.27	Н	64.96	43.02	43.35	54.96	27.12	27.45
0.19	0.05	0.28	N	64.04	41.33	41.66	54.04	23.63	23.96
0.20	0.05	0.28	Н	63.61	42.98	43.31	53.61	27.62	27.95
0.21	0.05	0.28	Н	63.21	44.59	44.92	53.21	29.51	29.84
0.26	0.05	0.30	N	61.43	40.34	40.69	51.43	25.15	25.50
0.27	0.05	0.30	Н	61.12	40.58	40.93	51.12	28.90	29.25
0.31	0.05	0.31	N	59.97	35.90	36.26	49.97	21.56	21.92
		l	l	l	l		l	l	
Domark	H: Hot Line N: Neutral Line TEST MODE: 802 11N - CH 6(2/37 MHz)								

Remark

H: Hot Line, N: Neutral Line TEST MODE: 802.11N - CH 6(2437 MHz)

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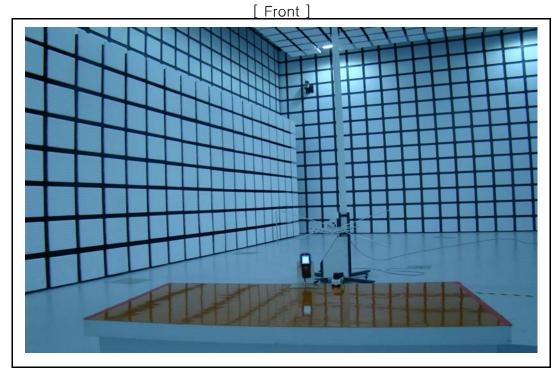




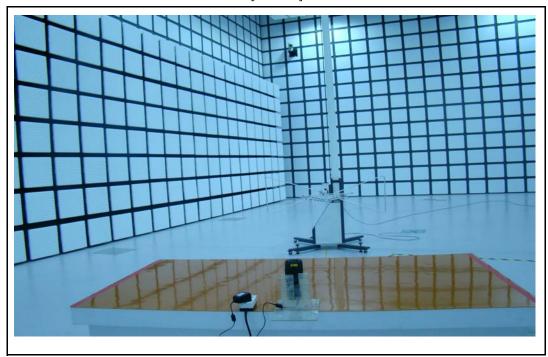
Electromagnetic Interference Test Report

# 11. Photographs of test setup

11.1.Setup for Radiated Test : (30  $\sim$  1 000) MHz



[Rear]



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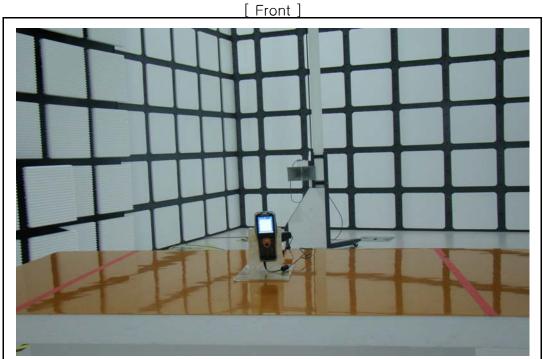




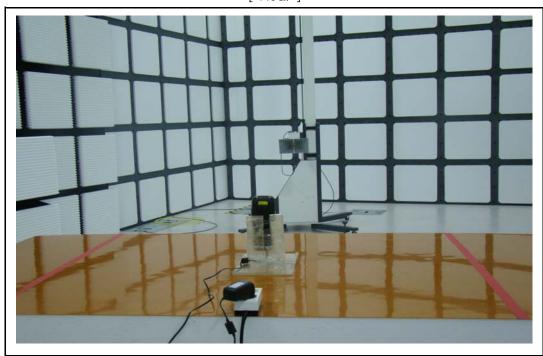


**Electromagnetic** Interference **Test Report** 

# 11.2.Setup for Radiated Test : Above 1 GHz



[Rear]



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**Electromagnetic** Interference **Test Report** 

# 11.3. Setup for Conducted Test : (0.15 $\sim$ 30) MHz

[ Front ]



[Rear]



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Electromagnetic Interference Test Report

# 11.4. Photographs of EUT

[ Front ]



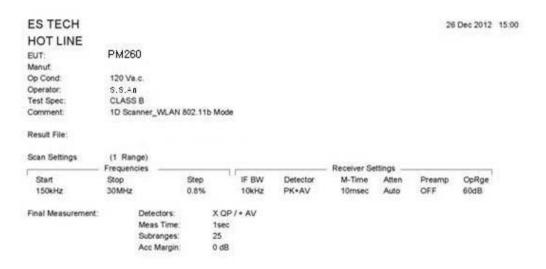
[Rear]

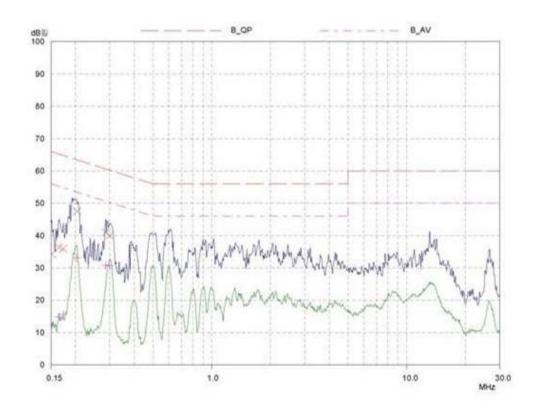


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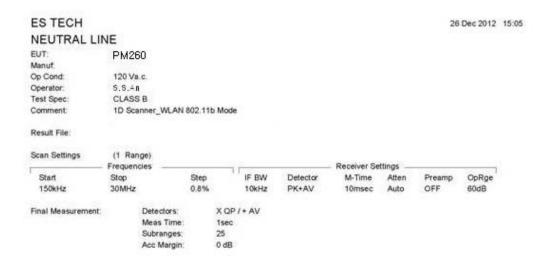
# Appendix 1. Special diagram for Wireless LAN

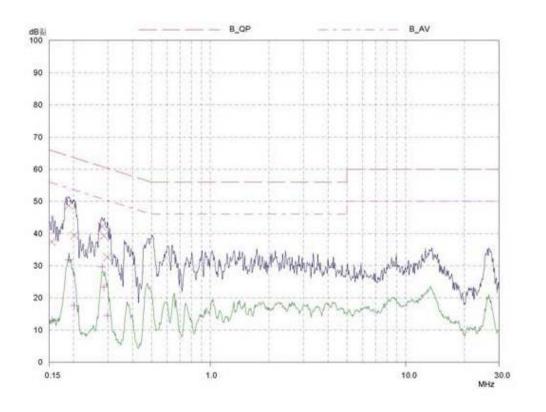
802.11b - CH 6 \*HOT



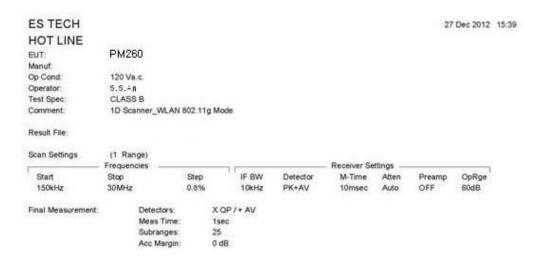


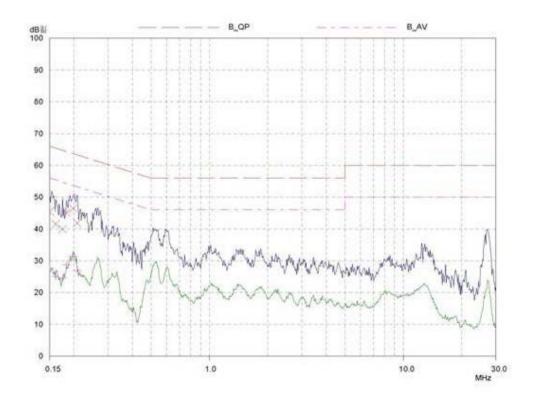
802.11b - CH 6 \*NEUTRAL



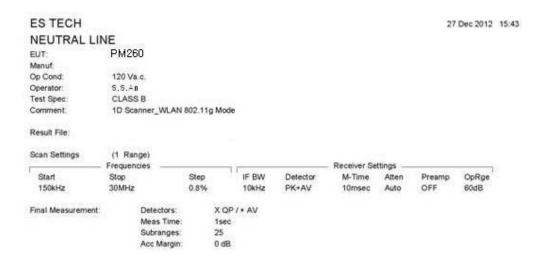


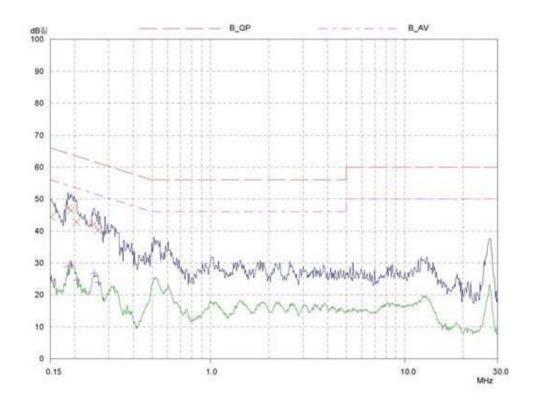
802.11g - CH 6 \*HOT



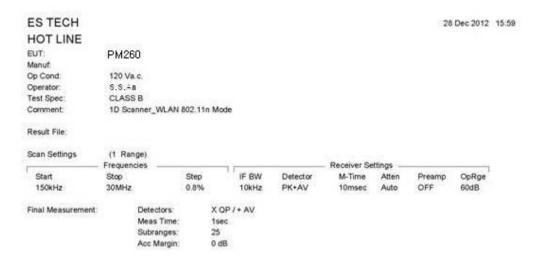


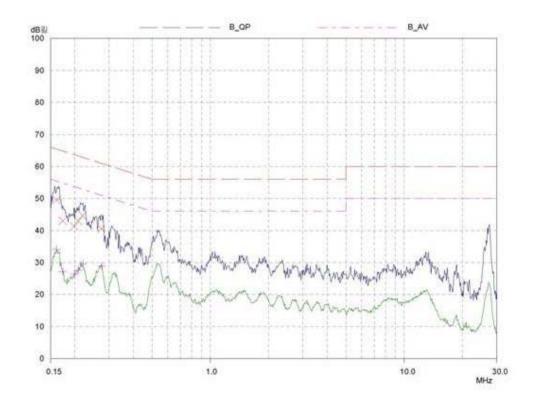
802.11g - CH 6 \*NEUTRAL



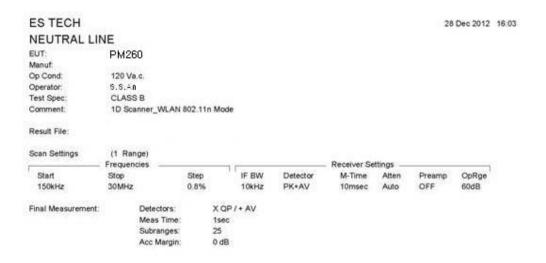


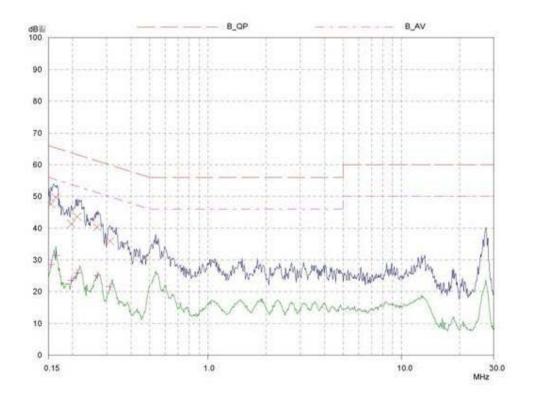
802.11n - CH 6 \*HOT





802.11n - CH 6 \*NEUTRAL





# Appendix 2. Antenna Requirement

# 1. Antenna Requirement

#### 1.1 Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.24

#### 1.2 Antenna Connected Construction

The antenna types used in this product are Intergrated Sandwich antenna. The maximum Gain of this antenna is 2.42 dBi.