

# FCC Part 15

# EMI TEST REPORT

*(Part 1 – 802.11b/g/n)*

of

E.U.T. : Rugged Tablet PC  
Model No. : M9700  
FCC ID. : T5M9700WBW  
IC ID : 4609A-9700WBW

for

APPLICANT : DAP Technologies LTD  
ADDRESS : 4535 Boul. Wilfrid-Hamel Suite  
100, Quebec, G1P 2J7, Canada

Test Performed by

**ELECTRONICS TESTING CENTER, TAIWAN**

NO. 34. LIN 5, DINGFU VIL., LINKOU DIST.,  
NEW TAIPEI CITY, TAIWAN, 24442, R.O.C  
Tel : (02)26023052 Fax : (02)26010910  
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Report Number : 12-10-RBF-008-06

# TEST REPORT CERTIFICATION

Applicant : DAP Technologies LTD  
4535 Boul. Wilfrid-Hamel Suite 100, Quebec, G1P 2J7, Canada

Manufacturer : WINMATE Communication INC.  
9F, No.1111-6, Shing-De Rd., San-Chung District, New Taipei City 241  
Taiwan

Description of EUT

a) Type of EUT : Rugged Tablet PC

b) Trade Name : Winmate

c) Model No. : M9700

d) Power Supply : Adapter:  
Input : 100~240V , 1.8A , 50-60Hz  
Output: DC12V , 4.16A

Regulation Applied : FCC Rules and Regulations Part 15 Subpart C

I HEREBY CERTIFY THAT: The data shown in this report were made in accordance with the procedures given in ANSI C63.4, and the energy emitted by the device was founded to be within the limits applicable. I assume full responsibility for accuracy and completeness of these data.

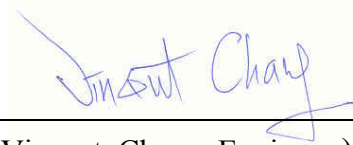
Note: 1. The result of the testing report relate only to the item tested.  
2. The testing report shall not be reproduced expect in full, without the written approval of ETC.

## Summary of Tests

Test	Results
Radiated Emission	<b>Pass</b>
Conducted Emission	<b>Pass</b>
Hopping Channel Separation	<b>Pass</b>
Number of Hopping frequencies used	<b>Pass</b>
Hopping Channel Bandwidth	<b>Pass</b>
Dwell Time of each frequency	<b>Pass</b>
Output Power Requirement	<b>Pass</b>
100 kHz Bandwidth of Frequency Band Edges Requirement	<b>Pass</b>
Out-of-Band Conducted Emission Requirement	<b>Pass</b>

Date Test Item Received : Oct. 09, 2012  
Date Test Campaign Completed : Oct. 23, 2012  
Date of Issue : Nov. 26, 2012

Test Engineer :



( Vincent Chang, Engineer )

Approve & Authorized :



S. S. Liou, Section Manager  
EMC Dept. II of ELECTRONICS  
TESTING CENTER, TAIWAN

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## 2 PROVISIONS APPLICABLE

### 2.1 Definition

**Unintentional radiator:**

A device that intentionally generates and radio frequency energy for use within the device, or that sends radio frequency signals by conduction to associated equipment via connecting wiring, but which is not intended to emit RF energy by radiation or induction.

**Class A Digital Device:**

A digital device which is marketed for use in commercial or business environment; exclusive of a device which is market for use by the general public, or which is intended to be used in the home.

**Class B Digital Device :**

A digital device which is marketed for use in a residential environment notwithstanding use in a commercial, business of industrial environment. Example of such devices that are marketed for the general public.

Note : A manufacturer may also qualify a device intended to be marketed in a commercial, business, or industrial environment as a Class B digital device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B Digital Device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B Digital Device, Regardless of its intended use.

**Intentional radiator:**

A device that intentionally generates and emits radio frequency energy by radiation or induction.

## 2.2 Requirement for Compliance

### (1) Conducted Emission Requirement

Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50 $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Frequency MHz	Quasi Peak dB $\mu$ V	Average dB $\mu$ V
0.15 - 0.5	66-56*	56-46*
0.5 - 5.0	56	46
5.0 - 30.0	60	50

\* Decreases with the logarithm of the frequency

### (2) Radiated Emission Requirement

For unintentional device, according to §15.109(a), except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency MHz	Distance Meters	Radiated dB $\mu$ V/m	Radiated $\mu$ V/m
30 - 88	3	40.0	100
88 - 216	3	43.5	150
216 - 960	3	46.0	200
Above 960	3	54.0	500

For intentional device, according to §15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

### (3) Antenna Requirement

For intentional device, according to §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.



#### **(4) Bandwidth Requirement**

For direct sequence system, according to 15.247(a)(2), the minimum 6dB bandwidth shall be at least 500 kHz.

#### **(5) Output Power Requirement**

For direct sequence system, according to 15.247(b), the maximum peak output power of the transmitter shall not exceed 1 Watt. If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### **(6) 100 kHz Bandwidth of Frequency Band Edges Requirement**

According to 15.247(c), if any 100 kHz bandwidth outside these frequency bands, the radio frequency power that is produced by the modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either at least 20 dB below that in any 100 kHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified in §15.209(a), whichever results in the lesser attenuation.

#### **(7) Power Density Requirement**

According to 15.247(d), for direct sequence systems, the transmitted power density averaged over any 1 second interval shall not be greater than 8 dBm in any 3 kHz bandwidth within these bands.

## 2.3 Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below :

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42-16.423	399.9-410	4.5-5.15
0.495 - 0.505 **	16.69475 - 16.69525	608-614	5.35-5.46
2.1735 - 2.1905	16.80425 - 16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475 - 156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3360-4400	Above 38.6
13.36-13.41			

\*\* : Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

## 2.4 Labeling Requirement

The device shall bear the following statement in a conspicuous location on the device :

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions : (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

## 2.5 User Information

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual.

The Federal Communications Commission Radio Frequency Interference Statement includes the following paragraph.

This equipment has been tested and found to comply with the limits for a Class B Digital Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction may cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
  
- Increase the separation between the equipment and receiver.
  
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
  
- Consult the dealer or an experienced radio / TV technician for help.

### 3. SYSTEM TEST CONFIGURATION

#### 3.1 Justification

For both radiated and conducted emissions below 1 GHz, the system was configured for testing in a typical fashion as a customer would normally use it. The peripherals other than EUT were connected in normally standing by situation. Measurement was performed under the condition that a computer program was exercised to simulate data communication of EUT, and the transmission rate was set to maximum allowed by EUT. Three highest emissions were verified with varying placement of the cables connected to EUT to maximize the emission from EUT.

For conducted and radiated spurious emissions, whichever RF channel is operated, the digital circuits function identically. As the reason, measurement of radiated emissions from digital circuits is only performed with channel 1 by transmitting mode.

#### 3.2 Devices for Tested System

Device	Manufacture	Model / FCC ID	Cable Description
Rugged Tablet PC *	WINMATE Communication INC.	M9700/ T5M9700WBW	1.5 Unshielded AC Adapter
Speaker	----	----	1.5m Unshielded AC Power Line 0.8m Unshielded Audio Cable
Mouse	Lenovo	M028UOL	1.5m Unshielded USB Cable

Remark “\*” means equipment under test.

## 4 RADIATED EMISSION MEASUREMENT

### 4.1 Applicable Standard

For unintentional radiator, the radiated emission shall comply with §15.109(a).

For intentional radiators, according to §15.247 (a), operation under this provision is limited to frequency hopping and direct sequence spread spectrum, and the out band emission shall be comply with §15.247 (c)

### 4.2 Measurement Procedure

#### A. Preliminary Measurement For Portable Devices

For portable devices, the following procedure was performed to determine the maximum emission axis of EUT:

1. With the receiving antenna is H polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
2. With the receiving antenna is V polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
3. Compare the results derived from above two steps. So, the axis of maximum emission from EUT was determined and the configuration was used to perform the final measurement.

#### B. Final Measurement

1. Setup the configuration per figure 1 and 2 for frequencies measured below and above 1 GHz respectively. Turn on EUT and make sure that it is in normal function.
2. For emission frequencies measured below 1 GHz, a pre-scan is performed in a shielded chamber to determine the accurate frequencies of higher emissions will be checked on a open test site. As the same purpose, for emission frequencies measured above 1 GHz, a pre-scan also be performed with a 1 meter measuring distance before final test.
3. For emission frequencies measured below and above 1 GHz, set the spectrum analyzer on a 100 kHz and 1 MHz resolution bandwidth respectively for each frequency measured in step 2.
4. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0 ° to 360 ° with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading. A RF test receiver is also used to confirm

- emissions measured.
- Repeat step 4 until all frequencies need to be measured were complete.
  - Repeat step 5 with search antenna in vertical polarized orientations.
  - Check the three frequencies of highest emission with varying the placement of cables (if any) associated with EUT to obtain the worse case and record the result.

Figure 1 : Frequencies measured below 1 GHz configuration

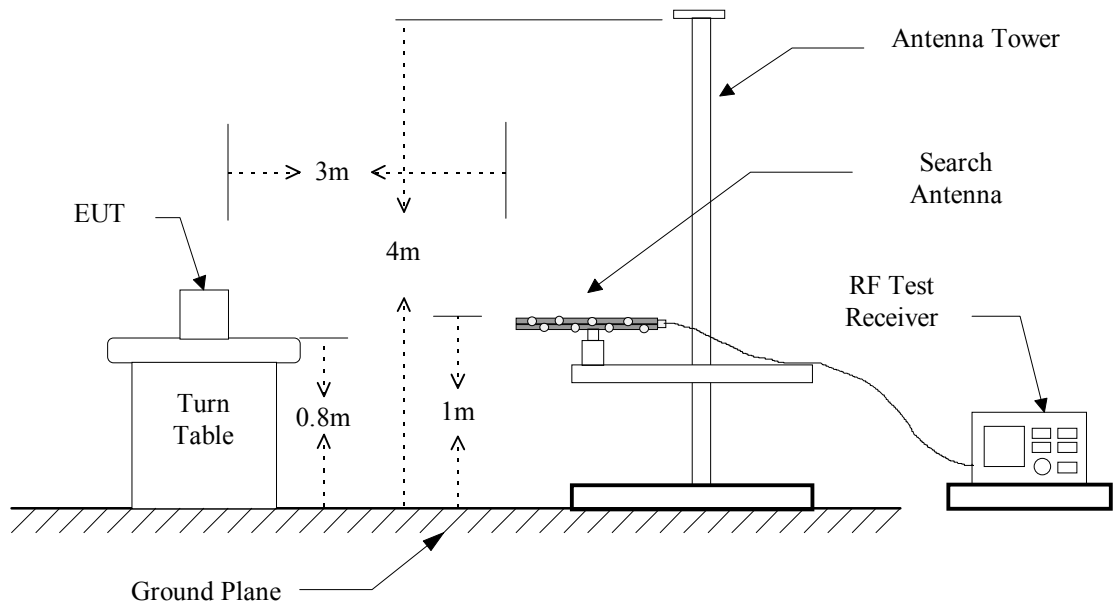
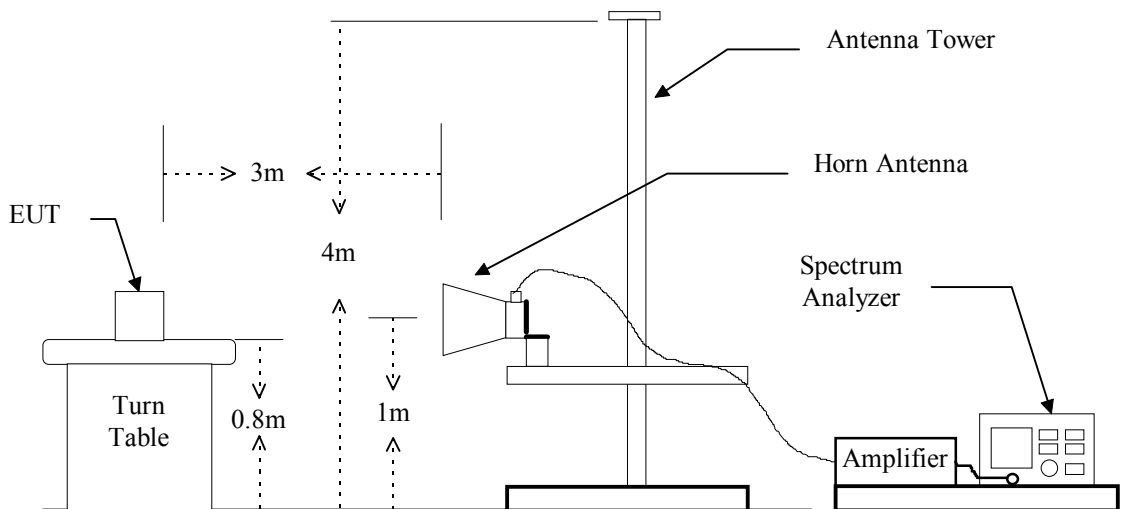


Figure 2 : Frequencies measured above 1 GHz configuration



### 4.3 Measuring Instrument

The following instrument are used for radiated emissions measurement:

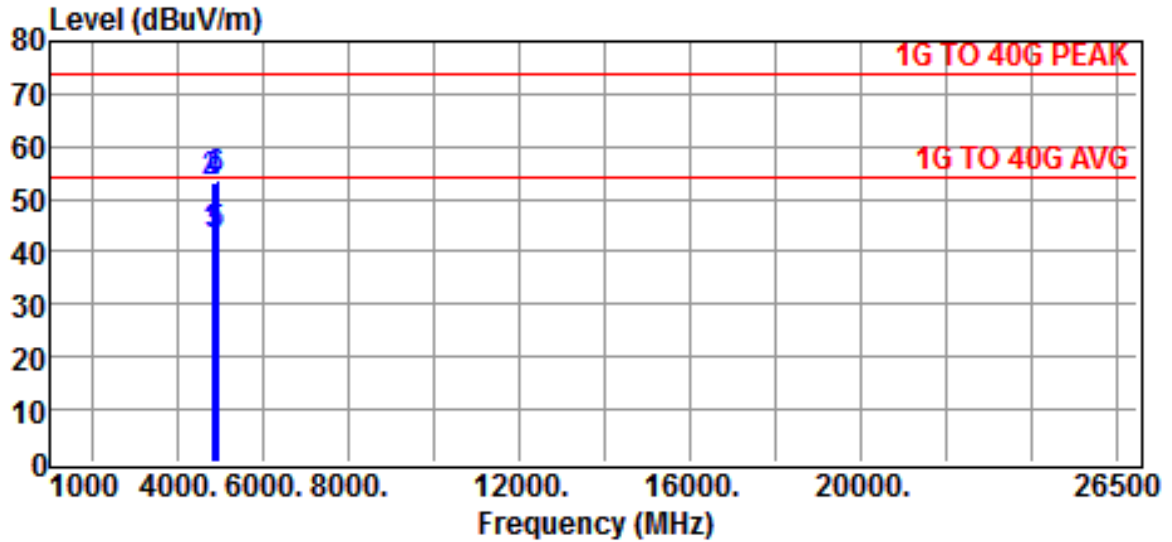
Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Test Receiver	Rohde & Schwarz	ESVS30	2012/05/07	2013/05/07
EMI Test Receiver	Rohde & Schwarz	ESL	2012/07/30	2013/07/30
Bi-Log Antenna	ETC	MCTD 2756	2012/01/10	2013/01/09
Log-periodic Antenna	EMCO	3146	2011/11/04	2012/11/03
Double Ridged Guide Horn Antenna	EMCO	3116	2012/10/26	2013/10/29
Biconical Antenna	EMCO	3110B	2011/11/18	2012/11/17
Double Ridged Antenna	EMCO	3115	2012/05/18	2013/05/18
Amplifier	HP	8449B	2011/12/28	2012/12/27
Amplifier	HP	83051A	2012/05/16	2013/05/16
Amplifier	HP	8447D	2012/05/16	2013/05/16
Spectrum	Rohde & Schwarz	FSP40	2012/09/20	2013/09/20

Measuring instrument setup in measured frequency band when specified detector function is used :

Frequency Band (MHz)	Instrument	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	RF Test Receiver	Quasi-Peak	120 kHz	N/A
	Spectrum Analyzer	Peak	100 kHz	100 kHz
Above 1000	Spectrum Analyzer	Peak	1 MHz	1 MHz
	Spectrum Analyzer	Average	1 MHz	10 Hz

### 4.4 Radiated Emission Data

#### 4.4.1 RF Portion A. (802.11b)



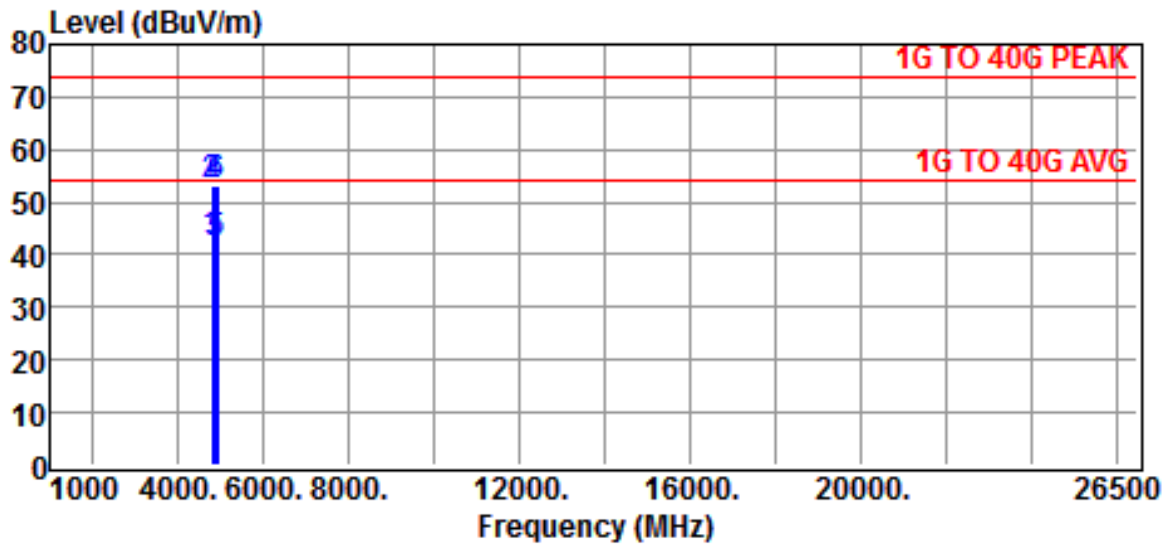
Limit :1G TO 40G PEAK  
 Site :chamber #2 Date :2012-10-30  
 EUT :Rugged Tablet PC Ant. Pol. :HORIZONTAL  
 EUT Pol. :Vertically stands  
 Engineer :VC  
 Temp. :26 °C Humi. :65 %  
 Memo :TX RX-CHLo:2412MHz,Mi:2437MHz,Hi:2462MHz

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
4824.0000	42.3	0.6	42.9	54.0	-11.1	Average
4824.0000	52.5	0.6	53.1	74.0	-20.9	Peak
4874.0000	42.2	0.7	42.9	54.0	-11.1	Average
4874.0000	52.4	0.7	53.1	74.0	-20.9	Peak
4924.0000	42.1	1.0	43.1	54.0	-10.9	Average
4924.0000	52.8	1.0	53.8	74.0	-20.2	Peak

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit - Result





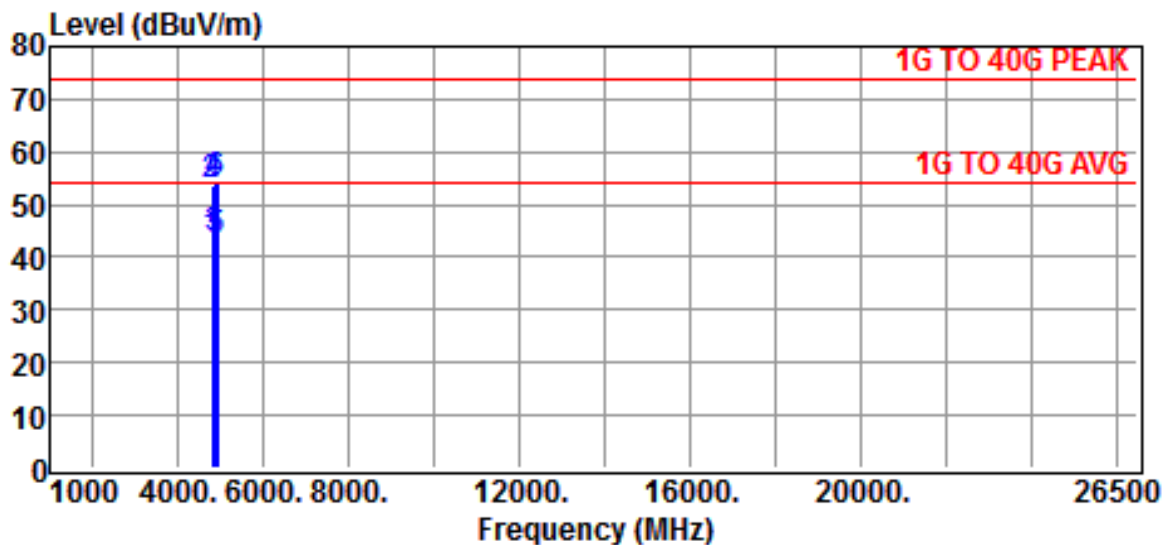
Limit :1G TO 40G PEAK  
 Site :chamber #2 Date :2012-10-30  
 EUT :Rugged Tablet PC Ant. Pol. :VERTICAL  
 EUT Pol. :Vertically stands  
 Engineer :VC  
 Temp. :26 °C Humi. :65 %  
 Memo :TX RX-CHLo:2412MHz,Mi:2437MHz,Hi:2462MHz

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
4824.0000	41.8	0.6	42.4	54.0	-11.6	Average
4824.0000	52.5	0.6	53.1	74.0	-20.9	Peak
4874.0000	41.7	0.7	42.4	54.0	-11.6	Average
4874.0000	52.4	0.7	53.1	74.0	-20.9	Peak
4924.0000	41.3	1.0	42.3	54.0	-11.7	Average
4924.0000	52.2	1.0	53.2	74.0	-20.8	Peak

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit - Result

**B. (802.11g)**

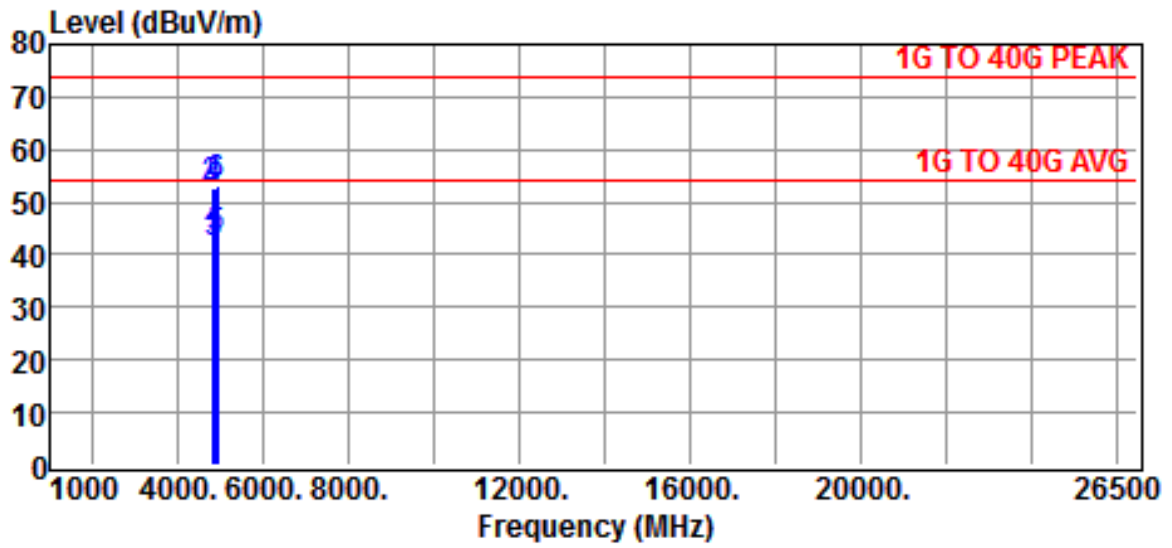


Limit :1G TO 40G PEAK  
 Site :chamber #2 Date :2012-10-30  
 EUT :Rugged Tablet PC Ant. Pol. :HORIZONTAL  
 EUT Pol. :Vertically stands  
 Engineer :VC  
 Temp. :26 °C Humi. :65 %  
 Memo :TX RX-CHLo:2412MHz,Mi:2437MHz,Hi:2462MHz

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
4824.0000	42.6	0.6	43.2	54.0	-10.8	Average
4824.0000	53.2	0.6	53.8	74.0	-20.2	Peak
4874.0000	43.0	0.7	43.7	54.0	-10.3	Average
4874.0000	53.4	0.7	54.1	74.0	-19.9	Peak
4924.0000	42.0	1.0	43.0	54.0	-11.0	Average
4924.0000	53.0	1.0	54.0	74.0	-20.0	Peak

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit - Result



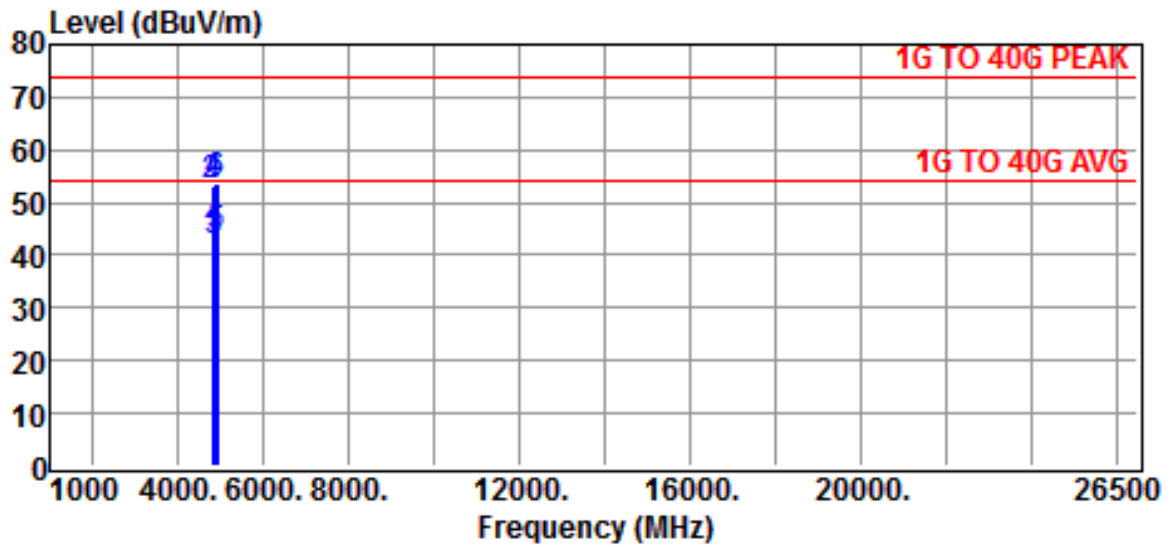
Limit :1G TO 40G PEAK  
 Site :chamber #2  
 EUT :Rugged Tablet PC  
 EUT Pol. :Vertically stands  
 Engineer :VC  
 Temp. :26 °C  
 Memo :TX RX-CHLo:2412MHz,Mi:2437MHz,Hi:2462MHz  
 Date :2012-10-30  
 Ant. Pol. :VERTICAL  
 Humi. :65 %

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
4824.0000	41.5	0.6	42.1	54.0	-11.9	Average
4824.0000	52.1	0.6	52.7	74.0	-21.3	Peak
4874.0000	41.6	0.7	42.3	54.0	-11.7	Average
4874.0000	52.0	0.7	52.7	74.0	-21.3	Peak
4924.0000	41.9	1.0	42.9	54.0	-11.1	Average
4924.0000	52.1	1.0	53.1	74.0	-20.9	Peak

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit - Result

**C. (802.11n HT-20)**

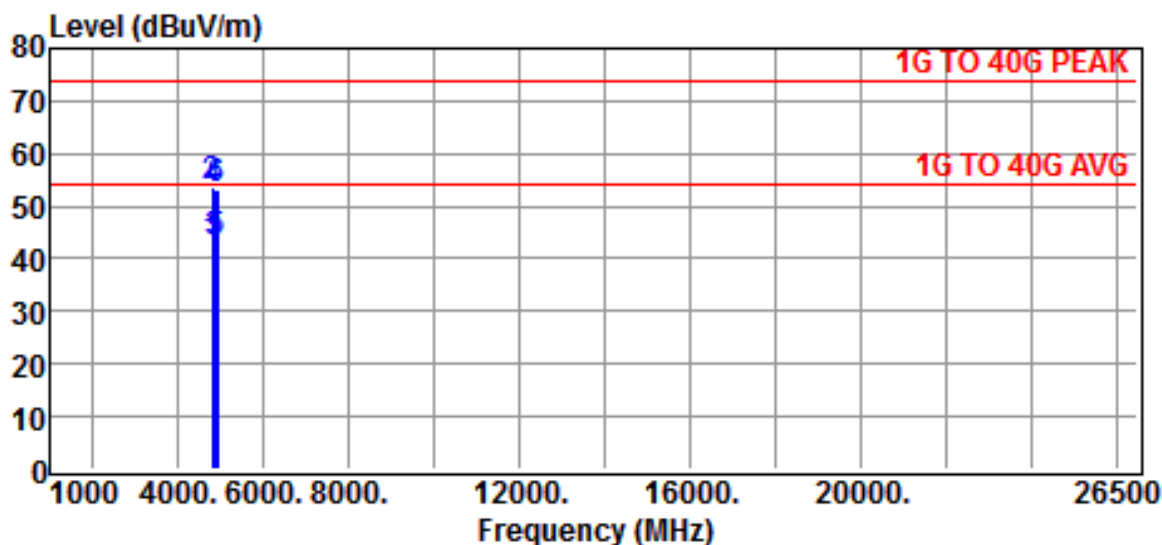


Limit	:1G TO 40G PEAK	Date	:2012-10-30
Site	:chamber #2	Ant. Pol.	:HORIZONTAL
EUT	:Rugged Tablet PC		
EUT Pol.	:Vertically stands		
Engineer	:VC		
Temp.	:26 °C	Humi.	:65 %
Memo	:TX RX-CHLo:2412MHz,Mi:2437MHz,Hi:2462MHz		

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
4824.0000	42.1	0.6	42.7	54.0	-11.3	Average
4824.0000	52.6	0.6	53.2	74.0	-20.8	Peak
4874.0000	41.9	0.7	42.6	54.0	-11.4	Average
4874.0000	52.9	0.7	53.6	74.0	-20.4	Peak
4924.0000	42.4	1.0	43.4	54.0	-10.6	Average
4924.0000	52.8	1.0	53.8	74.0	-20.2	Peak

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit - Result



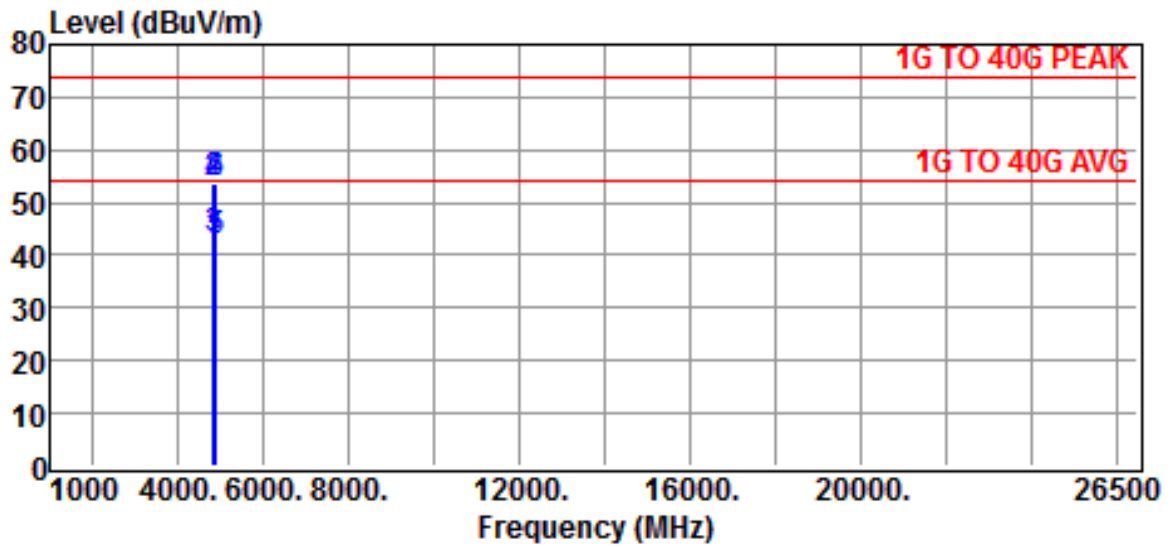
Limit :1G TO 40G PEAK  
 Site :chamber #2 Date :2012-10-30  
 EUT :Rugged Tablet PC Ant. Pol. :VERTICAL  
 EUT Pol. :Vertically stands  
 Engineer :VC  
 Temp. :26 °C Humi. :65 %  
 Memo :TX RX-CHLo:2412MHz,Mi:2437MHz,Hi:2462MHz

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
4824.0000	42.2	0.6	42.8	54.0	-11.2	Average
4824.0000	52.8	0.6	53.4	74.0	-20.6	Peak
4874.0000	42.2	0.7	42.9	54.0	-11.1	Average
4874.0000	52.5	0.7	53.2	74.0	-20.8	Peak
4924.0000	42.0	1.0	43.0	54.0	-11.0	Average
4924.0000	52.2	1.0	53.2	74.0	-20.8	Peak

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit - Result

**D. (802.11n HT-40)**

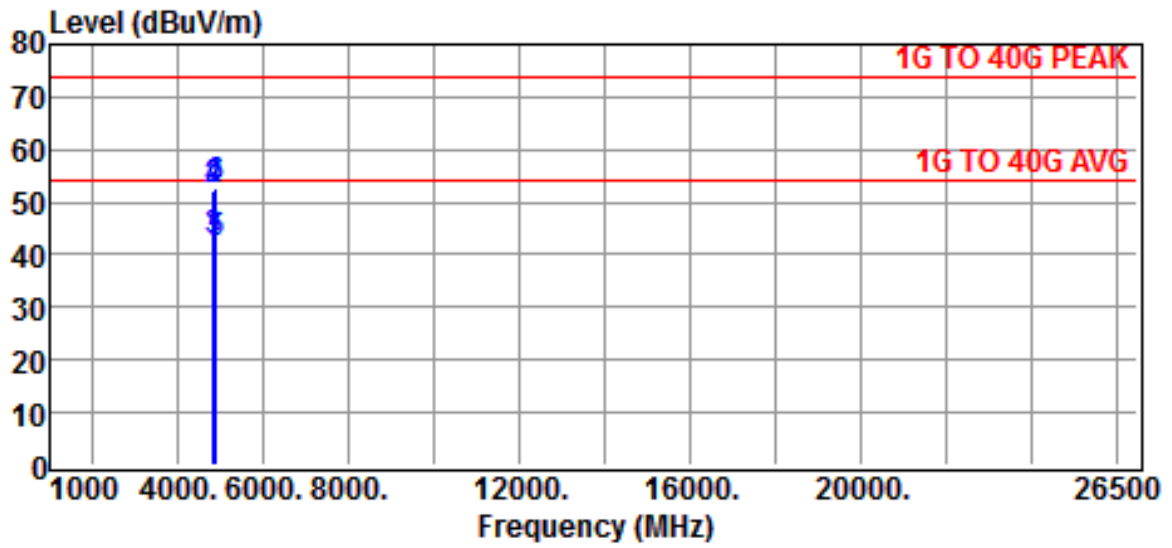


Limit :1G TO 40G PEAK  
 Site :chamber #2 Date :2012-10-30  
 EUT :Rugged Tablet PC Ant. Pol. :HORIZONTAL  
 EUT Pol. :Vertically stands  
 Engineer :VC  
 Temp. :26 °C Humi. :65 %  
 Memo :TX RX-CHLo:2422MHz,Mi:2437MHz,Hi:2452MHz

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
4844.0000	42.1	0.7	42.8	54.0	-11.2	Average
4844.0000	52.8	0.7	53.5	74.0	-20.5	Peak
4874.0000	42.2	0.7	42.9	54.0	-11.1	Average
4874.0000	53.0	0.7	53.7	74.0	-20.3	Peak
4904.0000	41.9	0.9	42.8	54.0	-11.2	Average
4904.0000	52.7	0.9	53.6	74.0	-20.4	Peak

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit - Result



Limit :1G TO 40G PEAK  
 Site :chamber #2 Date :2012-10-30  
 EUT :Rugged Tablet PC Ant. Pol. :VERTICAL  
 EUT Pol. :Vertically stands  
 Engineer :VC  
 Temp. :26 °C Humi. :65 %  
 Memo :TX RX-CHLo:2422MHz,Mi:2437MHz,Hi:2452MHz

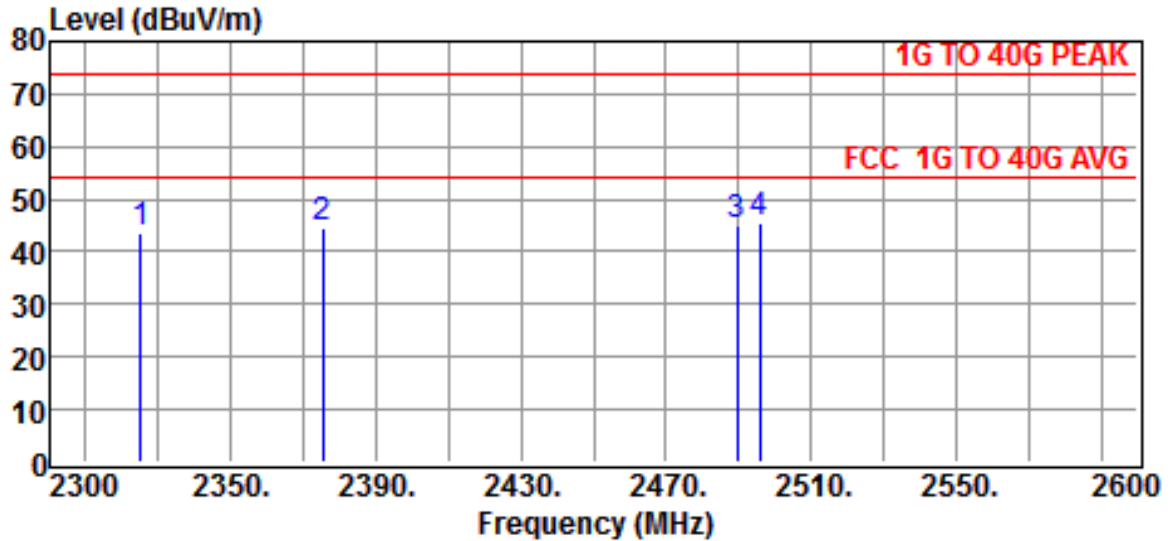
Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
4844.0000	41.8	0.7	42.5	54.0	-11.5	Average
4844.0000	51.5	0.7	52.2	74.0	-21.8	Peak
4874.0000	42.0	0.7	42.7	54.0	-11.3	Average
4874.0000	51.6	0.7	52.3	74.0	-21.7	Peak
4904.0000	41.5	0.9	42.4	54.0	-11.6	Average
4904.0000	51.8	0.9	52.7	74.0	-21.3	Peak

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit - Result

**4.4.2 Radiated Emission of Restricted bands**

**A. (802.11b)**



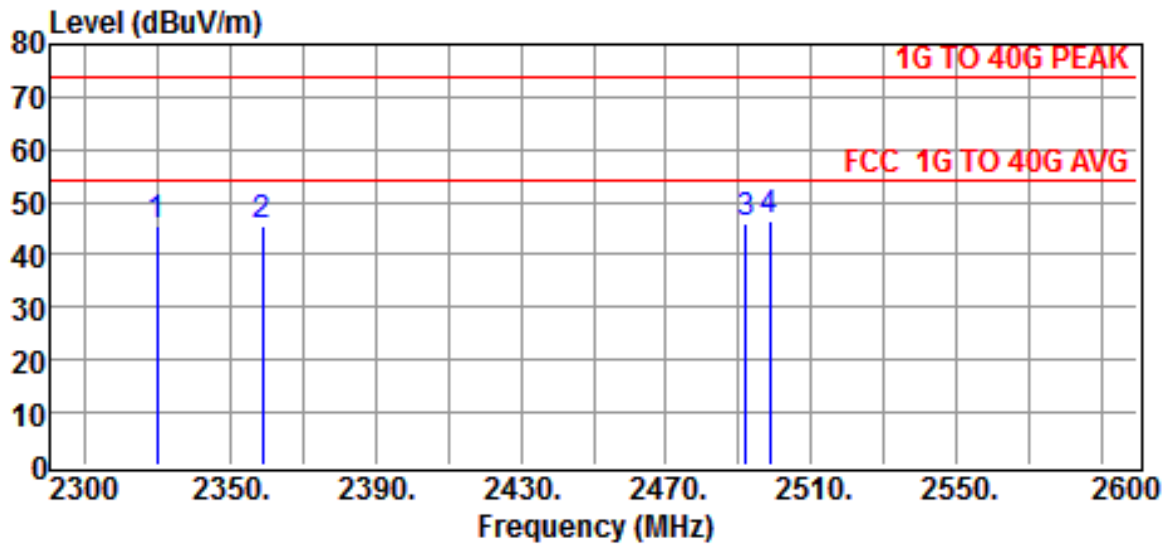
Limit	:1G TO 40G PEAK	Date	:2012-10-30
Site	:chamber #2	Ant. Pol.	: HORIZONTAL
EUT	:Rugged Tablet PC	Humi.	:65 %
EUT Pol.	:Vertically stands		
Engineer	:VC		
Temp.	:26 °C		
Memo	:CH LO & HI - Restricted Bands		

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
2325.1500	50.1	-6.4	43.7	74.0	-30.3	Peak
2375.2500	50.7	-6.3	44.4	74.0	-29.6	Peak
2489.6900	50.7	-5.9	44.8	74.0	-29.2	Peak
2495.8500	51.2	-5.9	45.3	74.0	-28.7	Peak

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit - Result





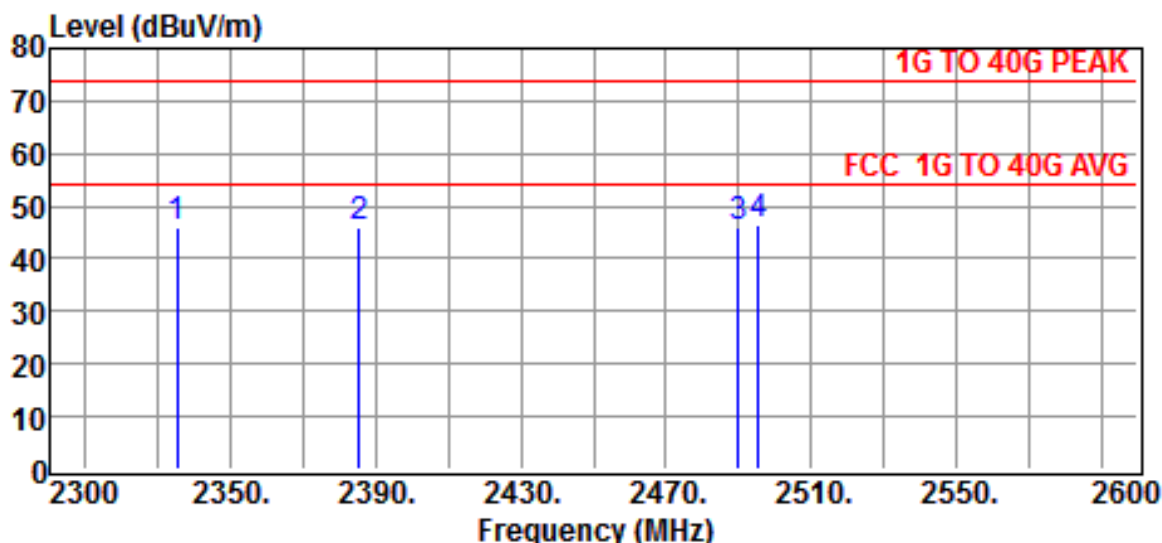
Limit	:1G TO 40G PEAK	Date	:2012-10-30
Site	:chamber #2	Ant. Pol.	:VERTICAL
EUT	:Rugged Tablet PC		
EUT Pol.	:Vertically stands		
Engineer	:VC		
Temp.	:26 °C	Humi.	:65 %
Memo	:CH LO & HI - Restricted Bands		

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
2329.5200	51.9	-6.4	45.5	74.0	-28.5	Peak
2358.5800	52.0	-6.3	45.7	74.0	-28.3	Peak
2492.2500	52.1	-5.9	46.2	74.0	-27.8	Peak
2498.6500	52.5	-5.9	46.6	74.0	-27.4	Peak

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit - Result

**B. (802.11g)**

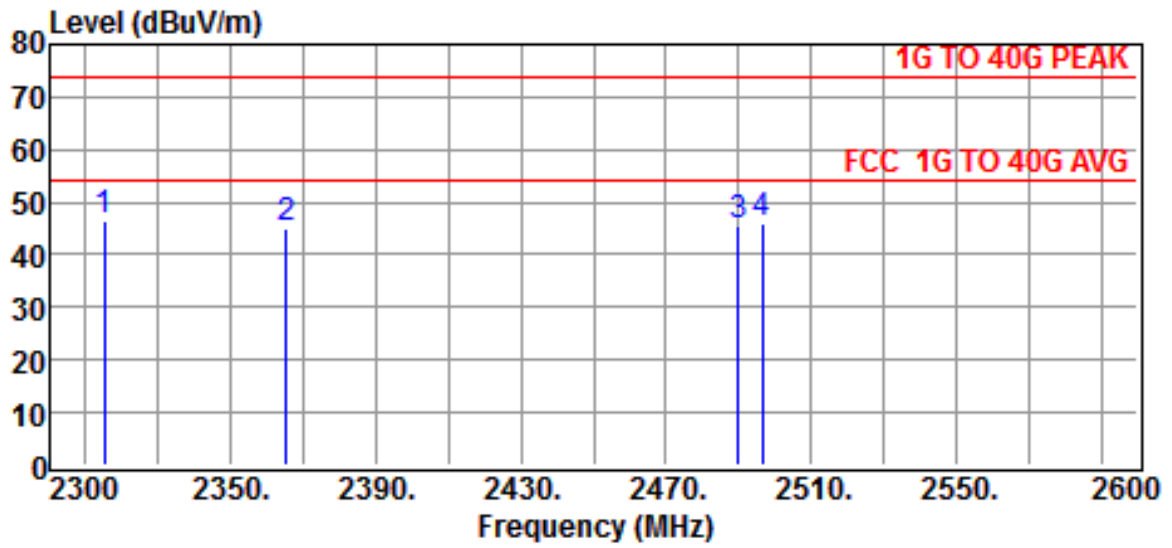


Limit	:1G TO 40G PEAK	Date	:2012-10-30
Site	:chamber #2	Ant. Pol.	: HORIZONTAL
EUT	:Rugged Tablet PC		
EUT Pol.	:Vertically stands		
Engineer	:VC		
Temp.	:26 °C	Humi.	:65 %
Memo	:CH LO & HI - Restricted Bands		

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
2335.2500	52.5	-6.3	46.2	74.0	-27.8	Peak
2385.5200	52.4	-6.2	46.2	74.0	-27.8	Peak
2489.9600	51.9	-5.9	46.0	74.0	-28.0	Peak
2495.6200	52.3	-5.9	46.4	74.0	-27.6	Peak

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit - Result



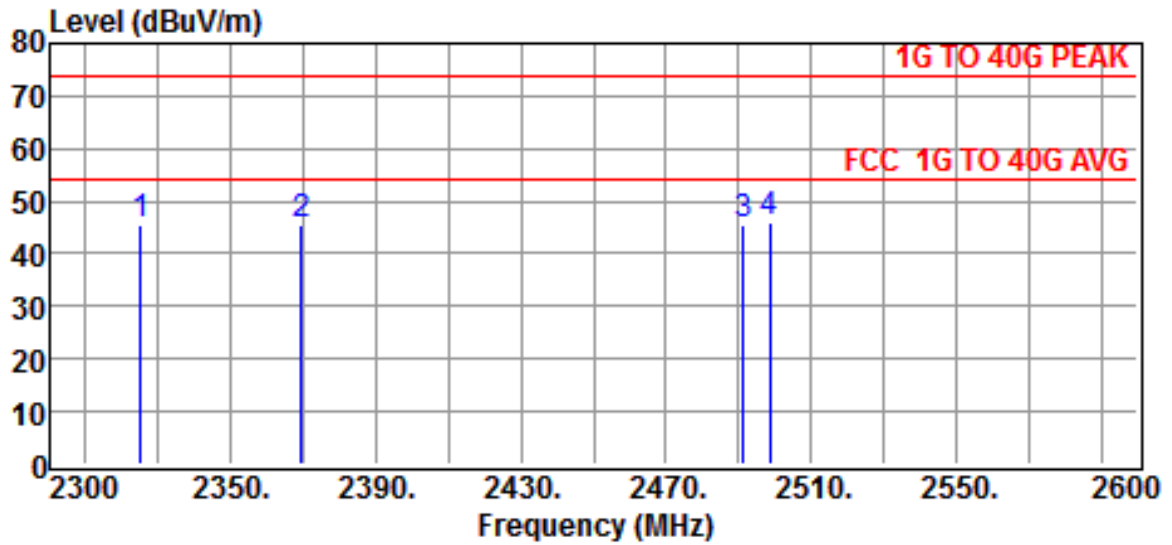
Limit	:1G TO 40G PEAK	Date	:2012-10-30
Site	:chamber #2	Ant. Pol.	: VERTICAL
EUT	:Rugged Tablet PC		
EUT Pol.	:Vertically stands		
Engineer	:VC		
Temp.	:26 °C	Humi.	:65 %
Memo	:CH LO & HI - Restricted Bands		

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
2315.1500	52.9	-6.4	46.5	74.0	-27.5	Peak
2365.2500	51.3	-6.3	45.0	74.0	-29.0	Peak
2489.9500	51.3	-5.9	45.4	74.0	-28.6	Peak
2496.6200	51.7	-5.9	45.8	74.0	-28.2	Peak

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit - Result

**C. (802.11n HT-20)**

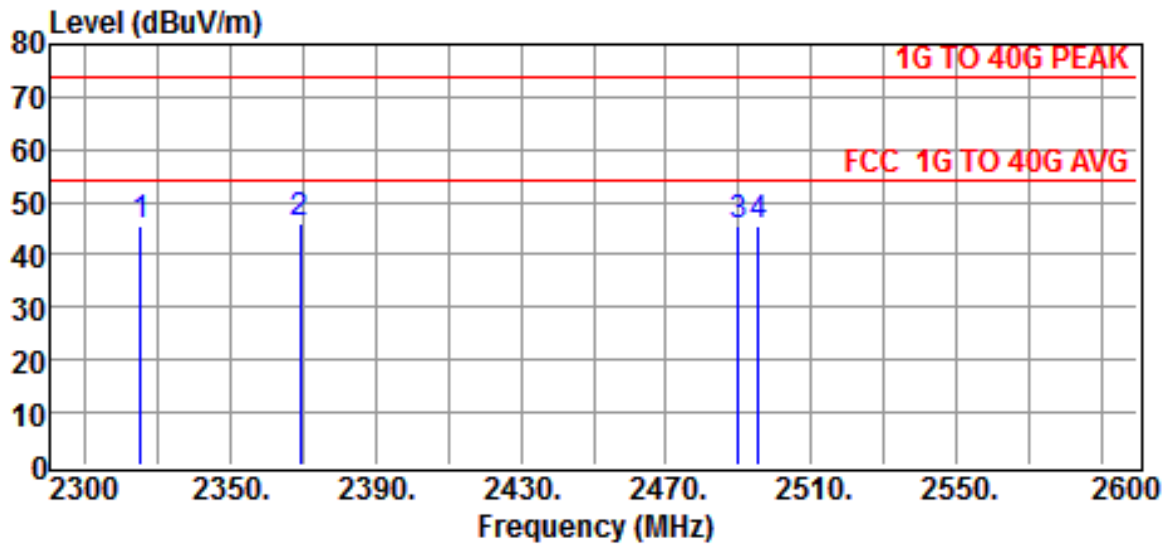


Limit	:1G TO 40G PEAK	Date	:2012-10-30
Site	:chamber #2	Ant. Pol.	:HORIZONTAL
EUT	:Rugged Tablet PC		
EUT Pol.	:Vertically stands		
Engineer	:VC		
Temp.	:26 °C	Humi.	:65 %
Memo	:CH LO & HI - Restricted Bands		

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
2325.2400	52.1	-6.4	45.7	74.0	-28.3	Peak
2369.5200	52.0	-6.3	45.7	74.0	-28.3	Peak
2491.2500	51.6	-5.9	45.7	74.0	-28.3	Peak
2498.5500	51.9	-5.9	46.0	74.0	-28.0	Peak

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit - Result



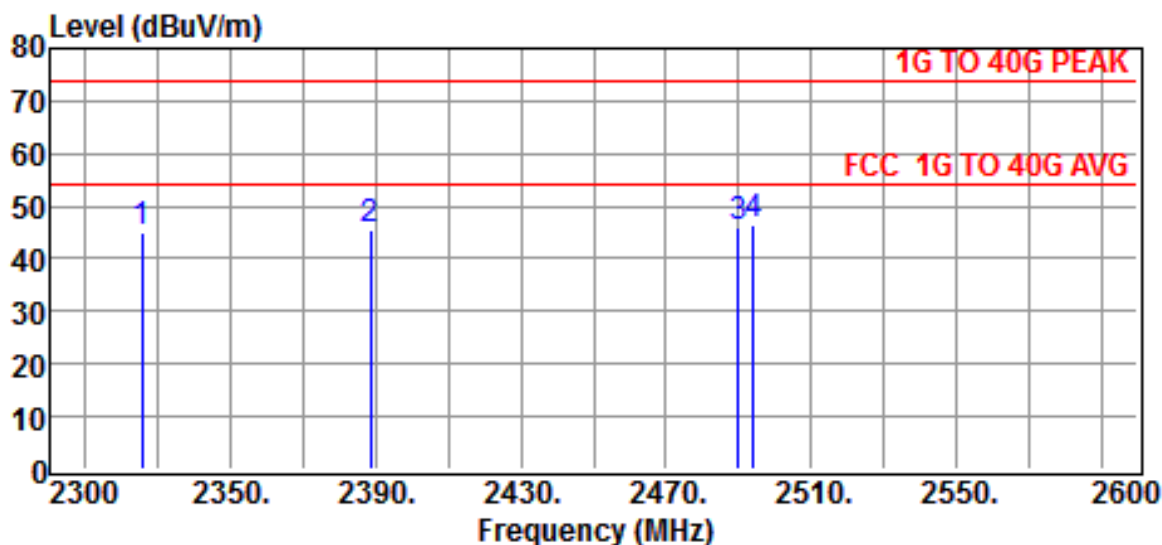
Limit :1G TO 40G PEAK  
 Site :chamber #2 Date :2012-10-30  
 EUT :Rugged Tablet PC Ant. Pol. :VERTICAL  
 EUT Pol. :Vertically stands  
 Engineer :VC  
 Temp. :26 °C Humi. :65 %  
 Memo :CH LO & HI - Restricted Bands

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
2325.1900	51.9	-6.4	45.5	74.0	-28.5	Peak
2368.9500	52.5	-6.3	46.2	74.0	-27.8	Peak
2489.9900	51.6	-5.9	45.7	74.0	-28.3	Peak
2495.6200	51.5	-5.9	45.6	74.0	-28.4	Peak

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit - Result

**D. (802.11n HT-40)**

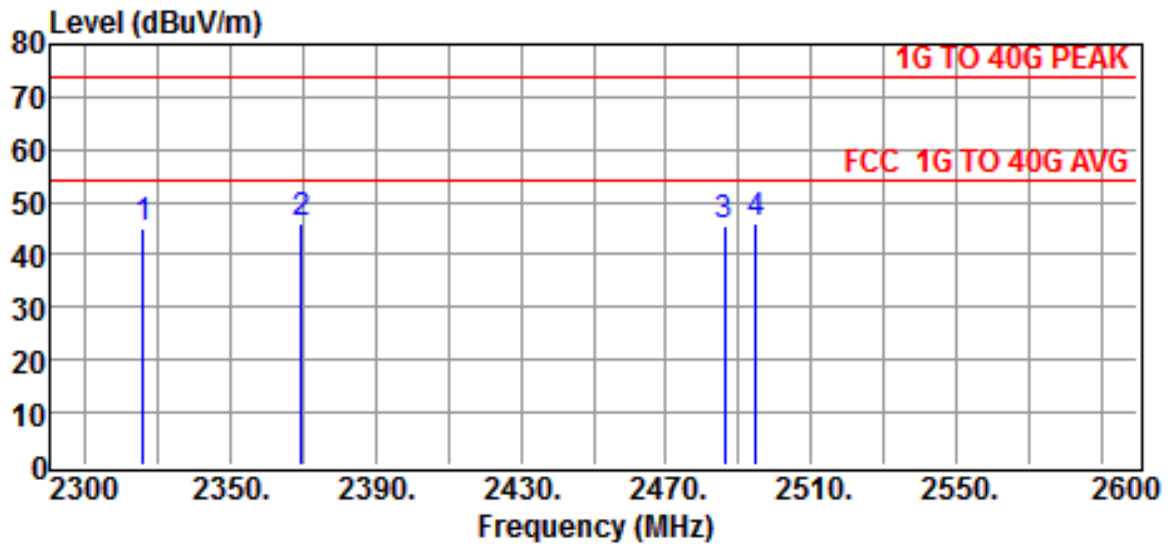


Limit	:1G TO 40G PEAK	Date	:2012-10-30
Site	:chamber #2	Ant. Pol.	:HORIZONTAL
EUT	:Rugged Tablet PC		
EUT Pol.	:Vertically stands		
Engineer	:VC		
Temp.	:26 °C	Humi.	:65 %
Memo	:CH LO & HI - Restricted Bands		

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
2325.6200	51.2	-6.4	44.8	74.0	-29.2	Peak
2388.6500	51.5	-6.2	45.3	74.0	-28.7	Peak
2489.9600	52.1	-5.9	46.2	74.0	-27.8	Peak
2494.2500	52.4	-5.9	46.5	74.0	-27.5	Peak

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit - Result



Limit	:1G TO 40G PEAK	Date	:2012-10-30
Site	:chamber #2	Ant. Pol.	:VERTICAL
EUT	:Rugged Tablet PC		
EUT Pol.	:Vertically stands		
Engineer	:VC		
Temp.	:26 °C	Humi.	:65 %
Memo	:CH LO & HI - Restricted Bands		

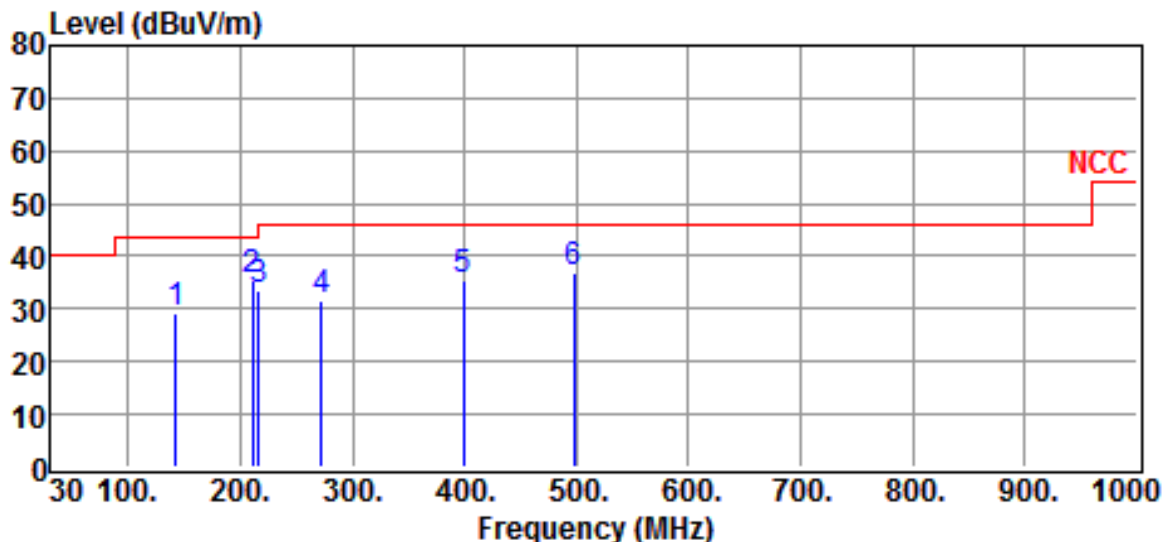
Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
2325.6500	51.6	-6.4	45.2	74.0	-28.8	Peak
2369.5800	52.1	-6.3	45.8	74.0	-28.2	Peak
2486.2500	51.6	-5.9	45.7	74.0	-28.3	Peak
2494.7500	52.0	-5.9	46.1	74.0	-27.9	Peak

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit - Result

### 4.4.3 Other Emission

a) Emission frequencies below 1 GHz



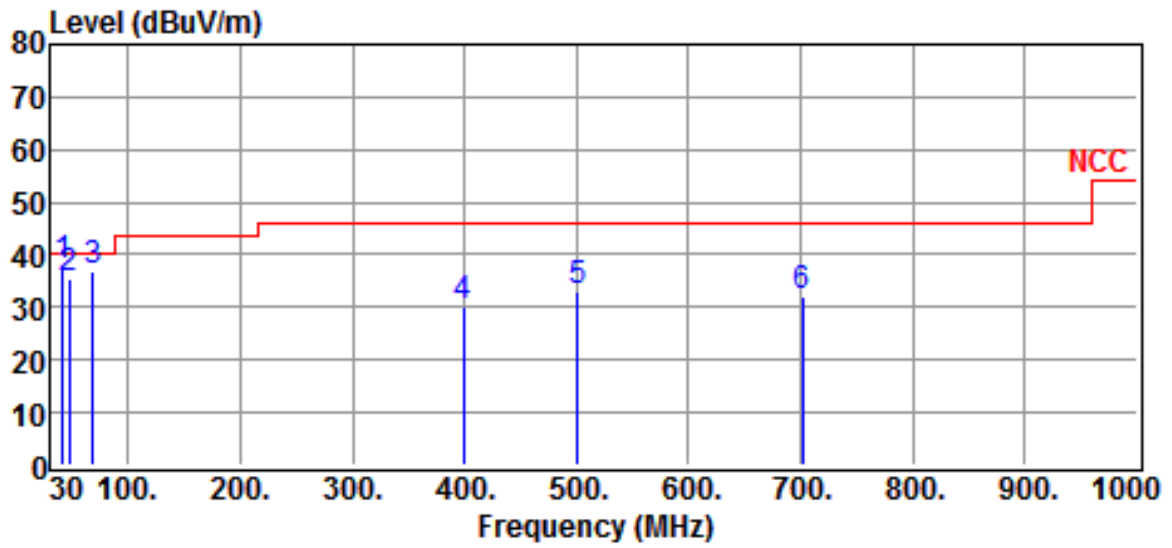
Site	:OPEN SITE	Date	:2012-10-23
Limit	:FCC	Ant. Pol.	:HORIZONTAL
EUT	:Rugged Tablet PC	Temp.	:25°C
Power Rating	:AC 120V / 60Hz (POWER FROM ADAPTER)	Humi.	:65%
Model	: M970DXXXXXX (X=0-9, X=A-Z,BLANK OR ANY CHARACTER)		
Engineer.	:VC		
Test Mode	:CHARGE & WIFI OPERATION MODE		

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
142.5200	15.2	13.9	29.1	43.5	-14.4	Peak
210.4200	21.2	14.2	35.4	43.5	-8.1	Peak
216.2400	19.4	13.9	33.3	46.0	-12.7	Peak
272.5000	15.8	15.9	31.7	46.0	-14.3	Peak
398.6000	16.2	19.0	35.2	46.0	-10.8	Peak
497.5400	15.2	21.5	36.7	46.0	-9.3	Peak

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss
3. The margin value=Limit - Result





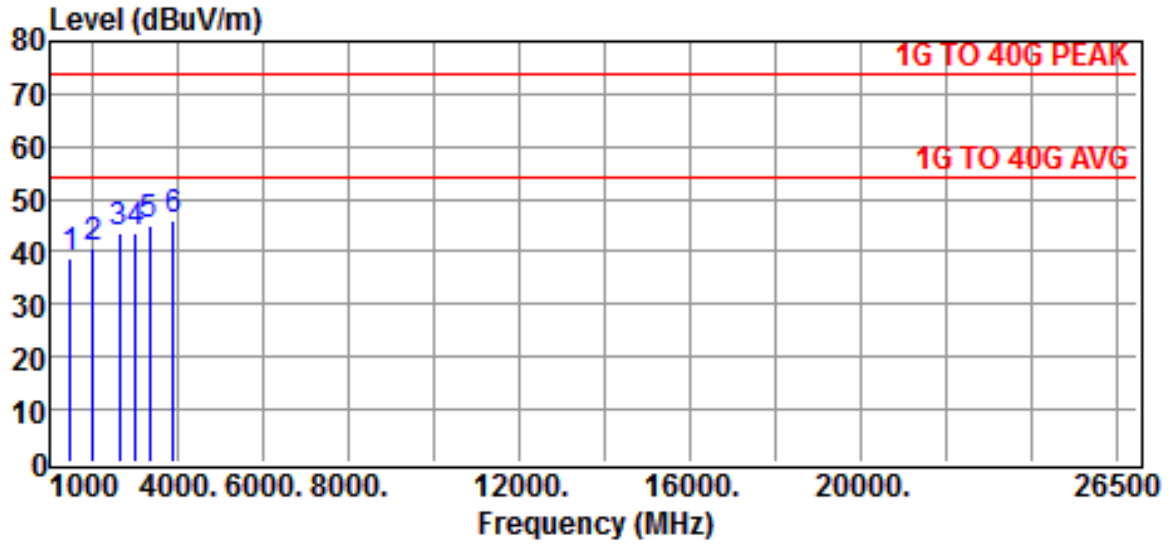
Site : OPEN SITE Date : 2012-10-23  
 Limit : FCC Ant. Pol. : VERTICAL  
 EUT : Rugged Tablet PC Temp. : 25°C  
 Power Rating : AC 120V / 60Hz (POWER FROM ADAPTER) Humi. : 65%  
 Model : M970DXXXXXX (X=0-9, X=A-Z, BLANK OR ANY CHARACTER)  
 Engineer. : VC  
 Test Mode : CHARGE & WIFI OPERATION MODE

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
41.6400	24.5	13.2	37.7	40.0	-2.3	Peak
47.4600	23.2	12.2	35.4	40.0	-4.6	Peak
68.8000	26.2	10.8	37.0	40.0	-3.0	Peak
398.6000	11.3	19.0	30.3	46.0	-15.7	Peak
501.4200	11.4	21.7	33.1	46.0	-12.9	Peak
701.2400	6.8	25.3	32.1	46.0	-13.9	Peak

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss
3. The margin value=Limit - Result

**b) Emission frequencies above 1 GHz**

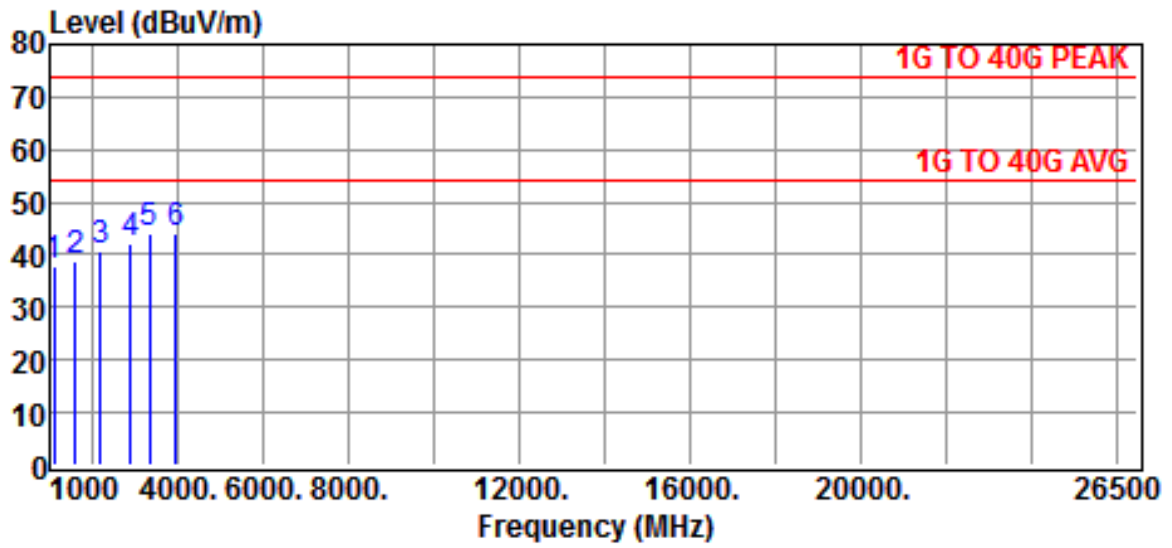


Site :chamber #2 Date :2012-10-23  
 Limit :1G TO 40G PEAK Ant. Pol. :HORIZONTAL  
 EUT :Rugged Tablet PC Temp. :25°C  
 Power Rating :AC 120V / 60Hz (Power From Adapter) Humi. :65%  
 Model : M970DXXXXXX (X=0-9, X=A-Z,BLANK OR ANY CHARACTER)  
 Engineer. :VC  
 Test Mode :Charge & Full System Working

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
1484.5000	48.6	-10.0	38.6	74.0	-35.4	Peak
2020.0000	47.9	-7.2	40.7	74.0	-33.3	Peak
2632.0000	48.6	-5.0	43.6	74.0	-30.4	Peak
3014.5000	47.2	-3.7	43.5	74.0	-30.5	Peak
3346.0000	47.4	-2.6	44.8	74.0	-29.2	Peak
3907.0000	46.4	-0.4	46.0	74.0	-28.0	Peak

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit - Result



Site :chamber #2 Date :2012-10-23  
 Limit :1G TO 40G PEAK Ant. Pol. :VERTICAL  
 EUT :Rugged Tablet PC Temp. :25°C  
 Power Rating :AC 120V / 60Hz (Power From Adapter) Humi. :65%  
 Model : M970DXXXXXX (X=0-9, X=A-Z,BLANK OR ANY CHARACTER)  
 Engineer. :VC  
 Test Mode :Charge & Full System Working

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
1102.0000	49.5	-11.8	37.7	74.0	-36.3	Peak
1612.0000	48.2	-9.3	38.9	74.0	-35.1	Peak
2198.5000	47.1	-6.5	40.6	74.0	-33.4	Peak
2887.0000	46.2	-4.0	42.2	74.0	-31.8	Peak
3346.0000	46.5	-2.6	43.9	74.0	-30.1	Peak
3958.0000	44.5	-0.3	44.2	74.0	-29.8	Peak

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit - Result

## 4.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor, High Pass Filter Loss(if used) and Cable Loss, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation calculation is as follows:

$$\mathbf{Result = Reading + Corrected Factor}$$

where

$$\text{Corrected Factor} = \text{Antenna FACTOR} + \text{Cable Loss} + \text{High Pass Filter Loss} - \text{Amplifier Gain}$$

#### 4.6 Photos of Radiation Measuring Setup



## 5 CONDUCTED EMISSION MEASUREMENT

### 5.1 Standard Applicable

According to §15.207(a), except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

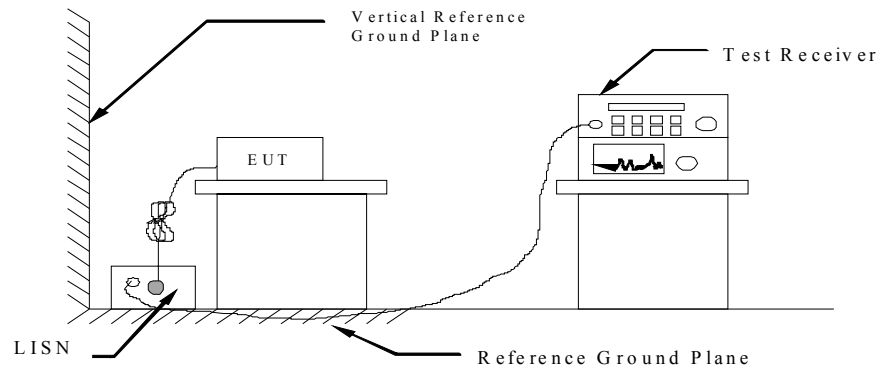
Frequency MHz	Quasi Peak dB $\mu$ V	Average dB $\mu$ V
0.15 - 0.5	66-56*	56-46*
0.5 - 5.0	56	46
5.0 - 30.0	60	50

\* Decreases with the logarithm of the frequency

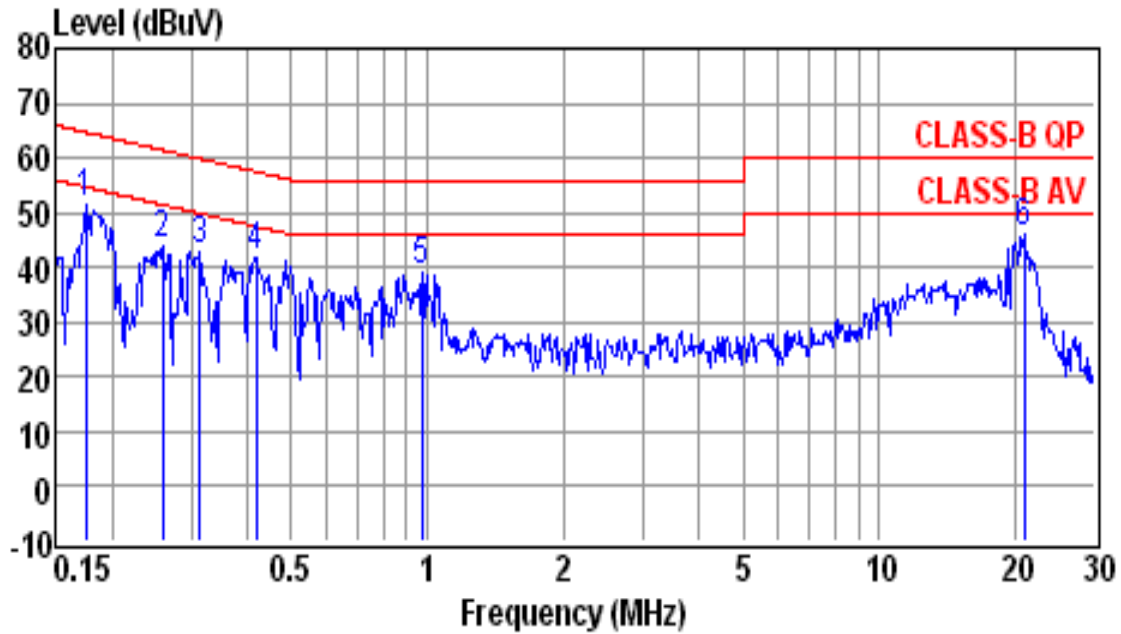
### 5.2 Measurement Procedure

1. Setup the configuration per figure 5.
2. A preliminary scan with a spectrum monitor is performed to identify the frequency of emission that has the highest amplitude relative to the limit by operating the EUT in selected modes of operation, typical cable positions, and with a typical system configuration.
3. Record the 6 or 8 highest emissions relative to the limit.
4. Measure each frequency obtained from step 3 by a test receiver set on quasi peak detector function, and then records the accuracy frequency and emission level. If all emissions measured in the specified band are attenuated more than 20 dB from the limit, this step would be ignored, and the peak detector function would be used.
5. Confirm the highest three emissions with variation of the EUT cable configuration and record the final data.
6. Repeat all above procedures on measuring each operation mode of EUT.

Figure 5: Conducted emissions measurement configuration



### 5.3 Conducted Emission Data



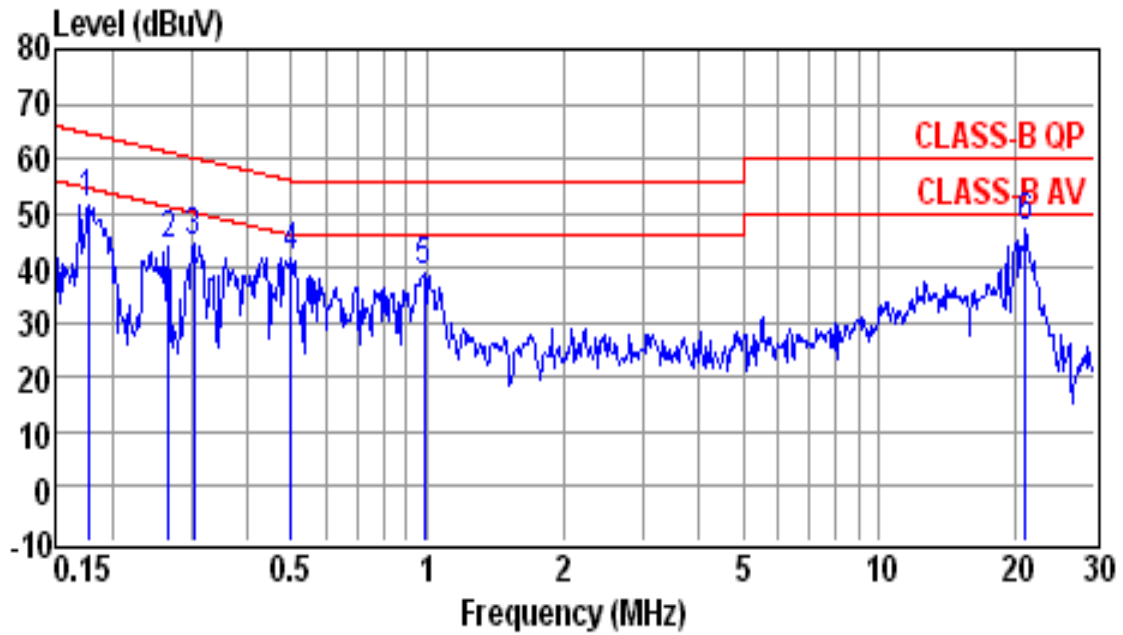
Site : conducted #1 Date : 10-23-2012  
 Condition : CLASS-B QP LISN : NEUTRAL  
 Tem / Hum : 25 °C / 65%  
 Test Mode : CHARGE & WIFI OPERATION MODE  
 EUT : Rugged Tablet PC  
 Power Rating : AC 120V / 60Hz (POWER FROM ADAPTER)

Freq (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV)	Limit Line (dBuV)	Over Limit (dB)	Remark
0.1758	51.5	0.2	51.7	64.7	-13.0	QP
0.2589	43.4	0.2	43.6	61.5	-17.9	QP
0.3133	42.7	0.2	42.9	59.9	-17.0	QP
0.4171	41.7	0.2	41.9	57.5	-15.6	QP
0.9735	38.6	0.2	38.8	56.0	-17.2	QP
20.9240	45.3	0.9	46.2	60.0	-13.8	QP

Note :

1. Result = Reading + Factor
2. Factor = LISN Factor + Cable Loss





Site : conducted #1 Date : 10-23-2012  
 Condition : CLASS-B QP LISN : LINE  
 Tem / Hum : 25 °C / 65%  
 Test Mode : CHARGE & WIFI OPERATION MODE  
 EUT : Rugged Tablet PC  
 Power Rating : AC 120V / 60Hz (POWER FROM ADAPTER)

Freq (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV)	Limit Line (dBuV)	Over Limit (dB)	Remark
0.1777	51.1	0.3	51.4	64.6	-13.2	QP
0.2672	43.4	0.3	43.7	61.2	-17.5	QP
0.3035	44.1	0.3	44.4	60.1	-15.7	QP
0.4994	41.5	0.3	41.8	56.0	-14.2	QP
0.9839	38.7	0.3	39.0	56.0	-17.0	QP
21.1470	46.1	1.2	47.3	60.0	-12.7	QP

Note :

1. Result = Reading + Factor
2. Factor = LISN Factor + Cable Loss

## 5.4 Result Data Calculation

The result data is calculated by adding the LISN Factor to the measured reading. The basic equation with a sample calculation is as follows:

$$\mathbf{RESULT = READING + LISN FACTOR}$$

Assume a receiver reading of 22.5 dB  $\mu$  V is obtained, and LISN Factor is 0.1 dB, then the total of disturbance voltage is 22.6 dB  $\mu$  V.

$$\text{RESULT} = 22.5 + 0.1 = 22.6 \text{ dB } \mu \text{ V}$$

$$\begin{aligned} \text{Level in } \mu \text{ V} &= \text{Common Antilogarithm}[(22.6 \text{ dB } \mu \text{ V})/20] \\ &= 13.48 \mu \text{ V} \end{aligned}$$

## 5.5 Conducted Measurement Equipment

The following test equipments are used during the conducted test.

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
EMI Test Receiver	Rohde & Schwarz	ESCI	2012/07/16	2013/07/16
LISN	EMCO	3825/2	2011/10/27	2012/10/26
LISN	Rohde & Schwarz	ESH2-Z5	2012/08/23	2013/08/23

## 5.6 Photos of Conduction Measuring Setup



## **6 ANTENNA REQUIREMENT**

### **6.1 Standard Applicable**

For intentional device, according to §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 §15.247 (b), if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### **6.2 Antenna Construction and Directional Gain**

Please see photos submitted in Exhibit.

The antenna was embedded in the EUT. No consideration of replacement. The antenna gain is 2.0dBi. No need to reduce the peak output power.

## 7 EMISSION BANDWIDTH MEASUREMENT

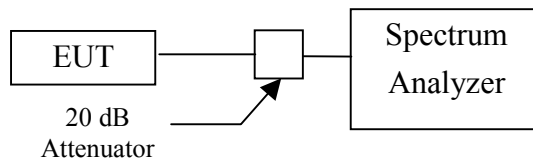
### 7.1 Standard Applicable

According to 15.247(a)(2), for direct sequence system, the minimum 6dB bandwidth shall be at least 500 kHz.

### 7.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Figure 4: Emission bandwidth measurement configuration.



### 7.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Spectrum Analyzer	Rohde & Schwarz	FSP40	2012/09/20	2013/09/20

## 7.4 Measurement Data

Test Date : Nov. 02, 2012      Temperature : 25 °C      Humidity : 65 %

### A 802.11b

- a) Channel Low: 6 dB Emission Bandwidth is 10.6 MHz
- b) Channel Mid: 6 dB Emission Bandwidth is 10.6 MHz
- c) Channel High: 6 dB Emission Bandwidth is 10.6 MHz

### B 802.11g

- a) Channel Low: 6 dB Emission Bandwidth is 16.7 MHz
- b) Channel Mid: 6 dB Emission Bandwidth is 16.7 MHz
- c) Channel High: 6 dB Emission Bandwidth is 16.7 MHz

### C 802.11n HT-20

- a) Channel Low: 6 dB Emission Bandwidth is 17.8 MHz
- b) Channel Mid: 6 dB Emission Bandwidth is 17.8 MHz
- c) Channel High: 6 dB Emission Bandwidth is 17.8 MHz

### D 802.11n HT-40

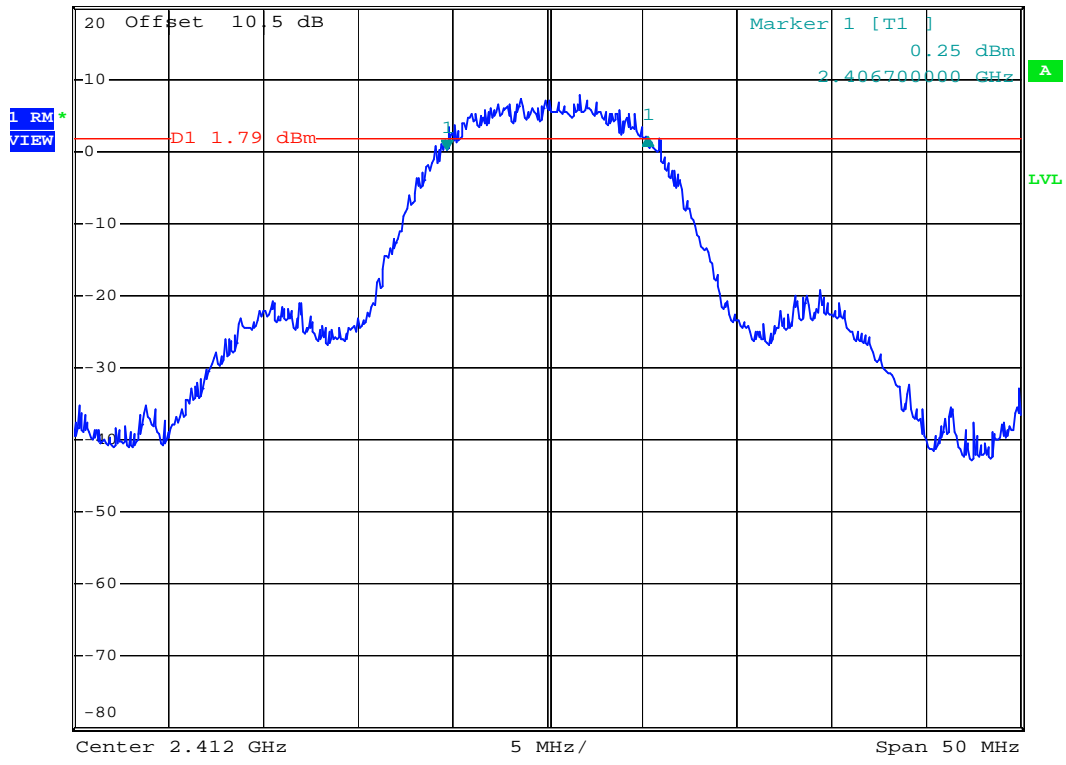
- a) Channel Low: 6 dB Emission Bandwidth is 36.2 MHz
- b) Channel Mid: 6 dB Emission Bandwidth is 36.2 MHz
- c) Channel High: 6 dB Emission Bandwidth is 36.2 MHz

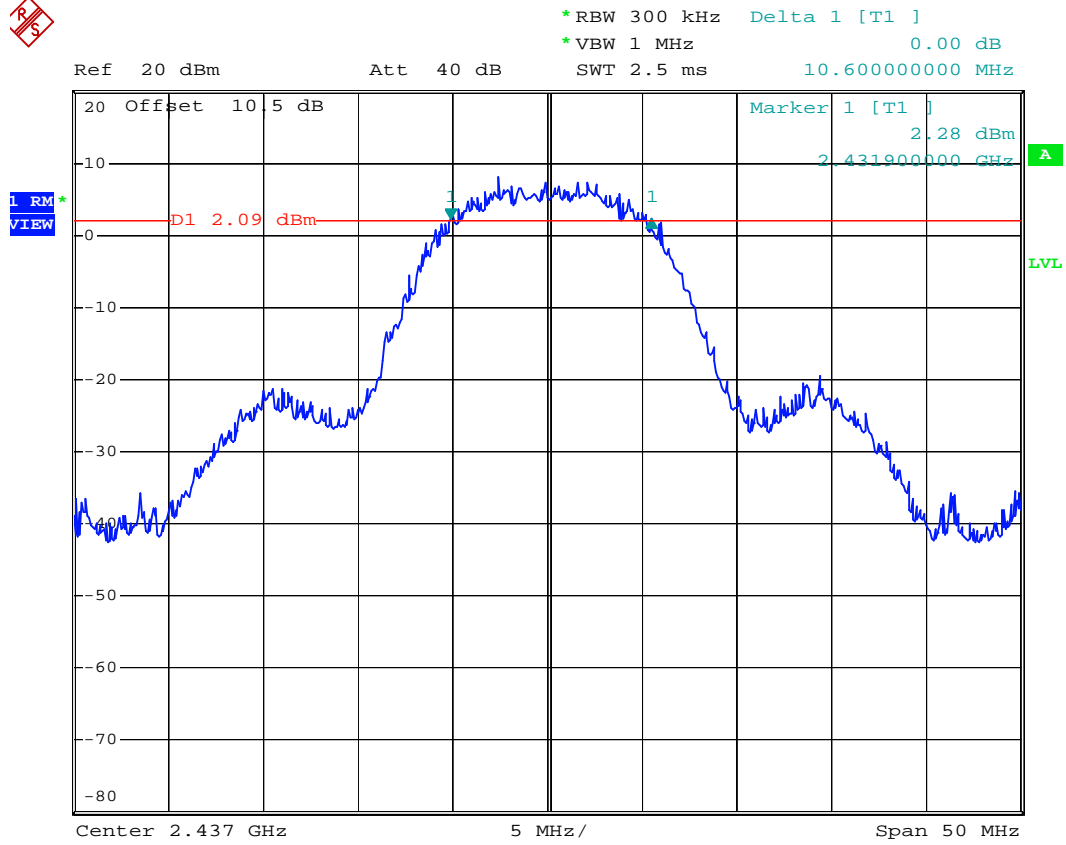
*Note : The expanded uncertainty: frequency  $\times 1.65 \times 10^{-6}$  ( $1 \text{ GHz} < f \leq 18 \text{ GHz}$ ).*

### 802.11b

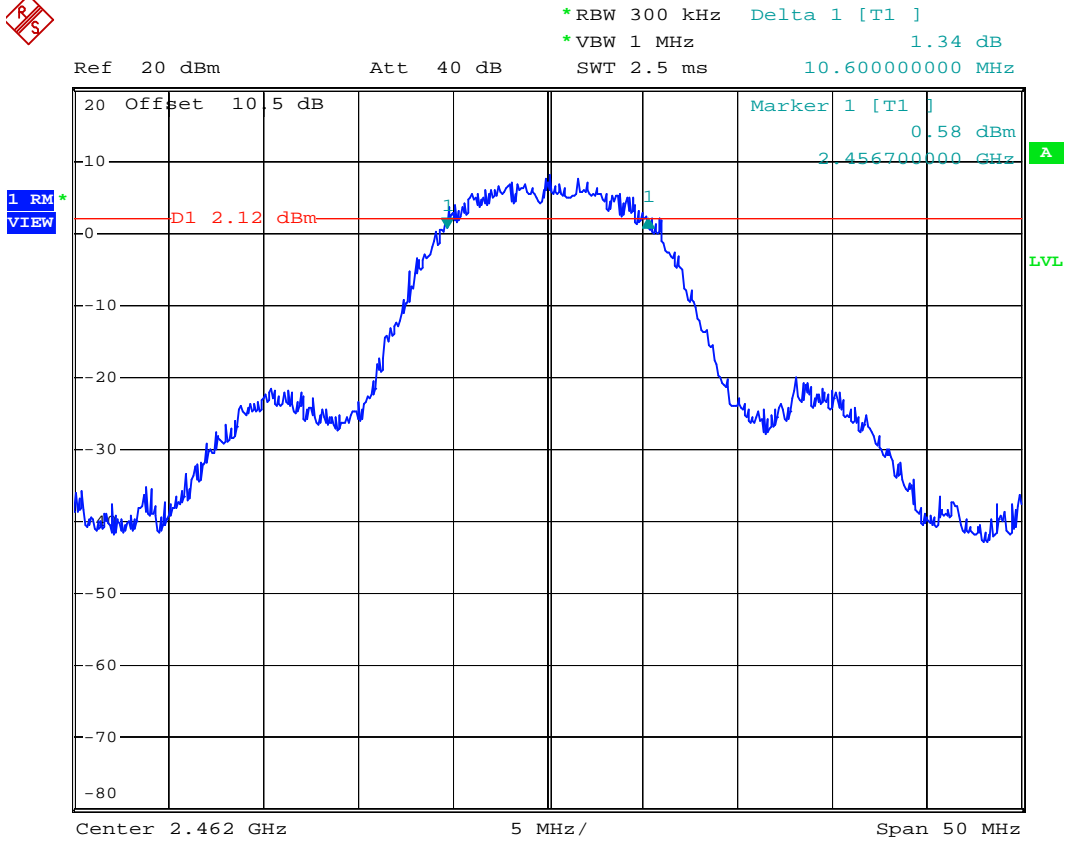


Ref 20 dBm Att 40 dB SWT 2.5 ms 10.60000000 MHz  
\*RBW 300 kHz Delta 1 [T1 ]  
\*VBW 1 MHz 1.82 dB

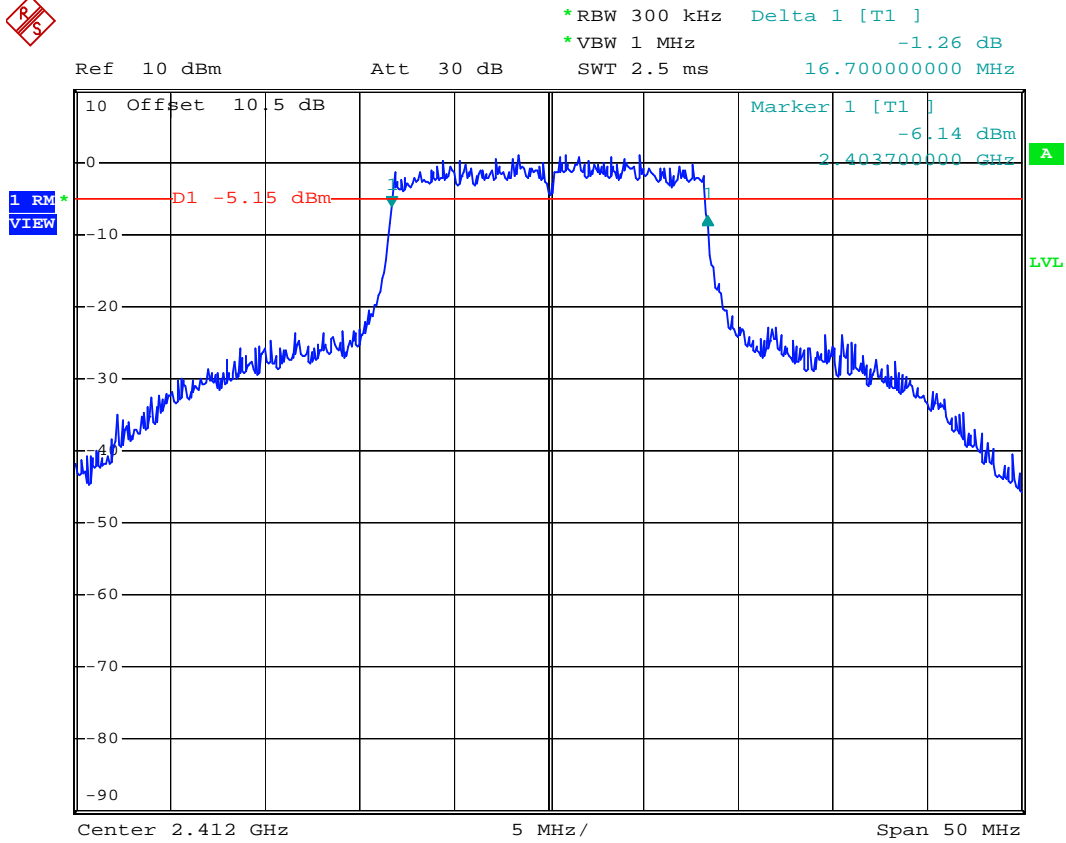


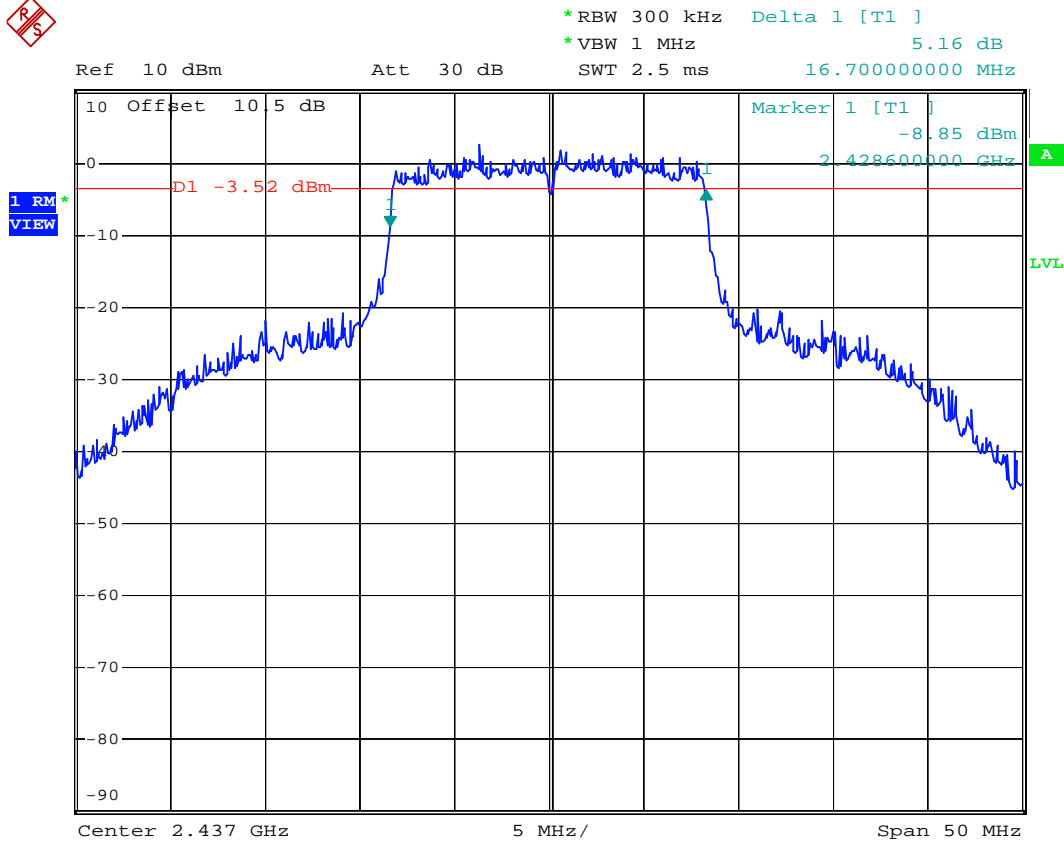


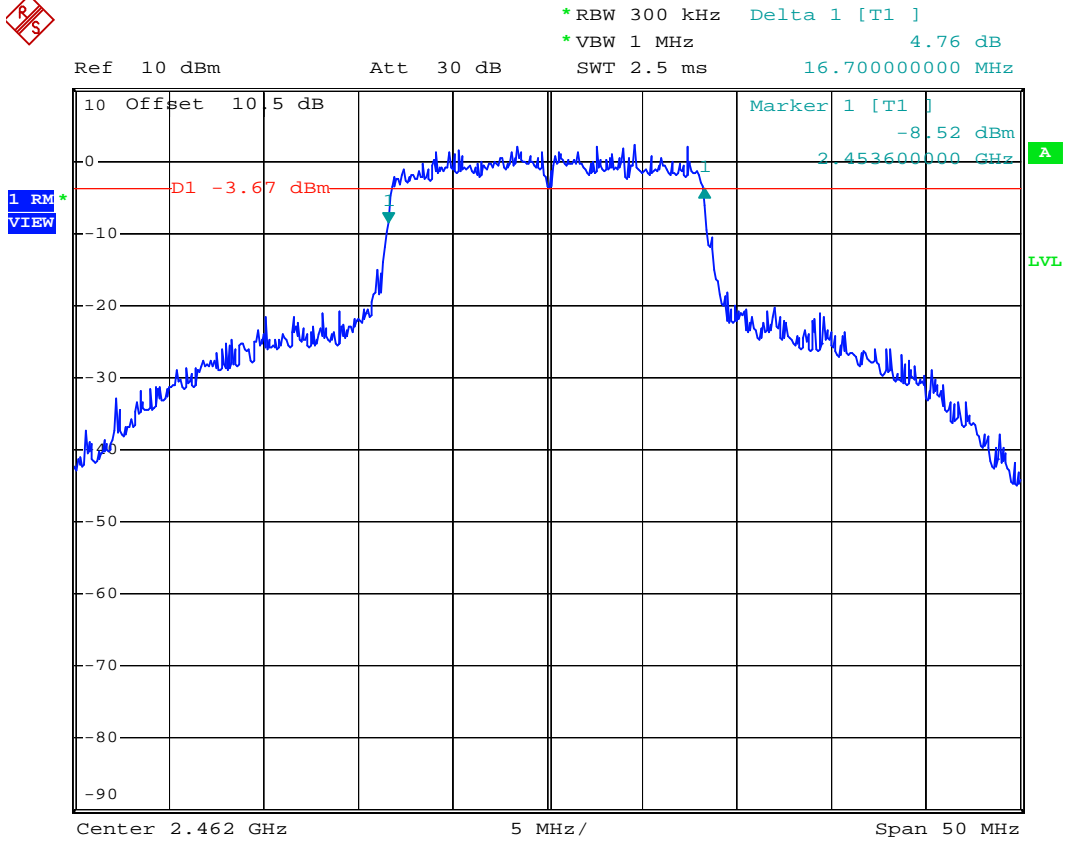




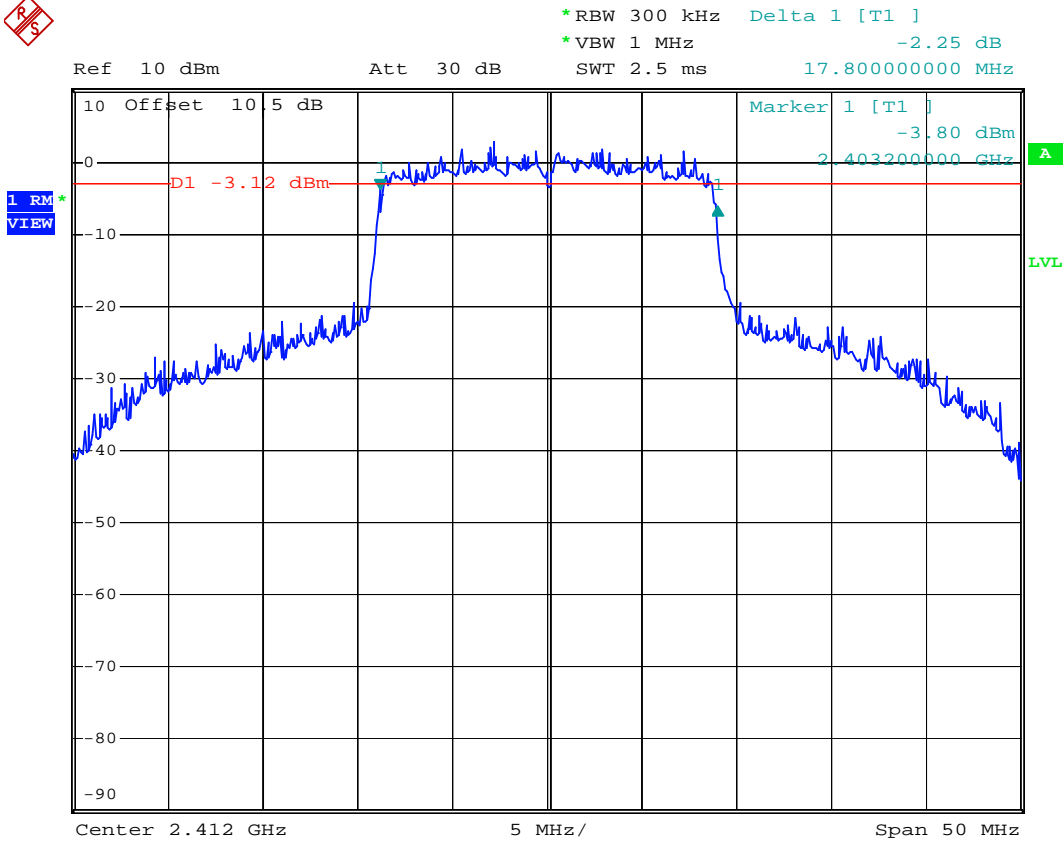
### 802.11g

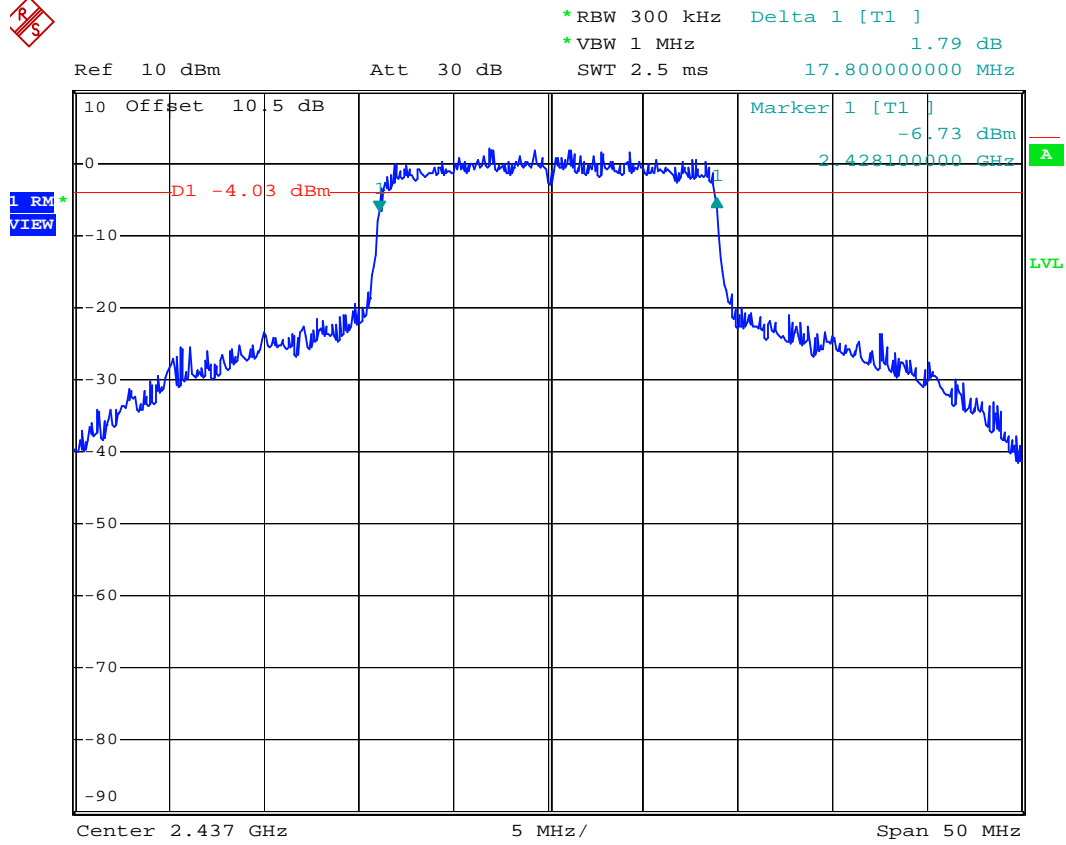


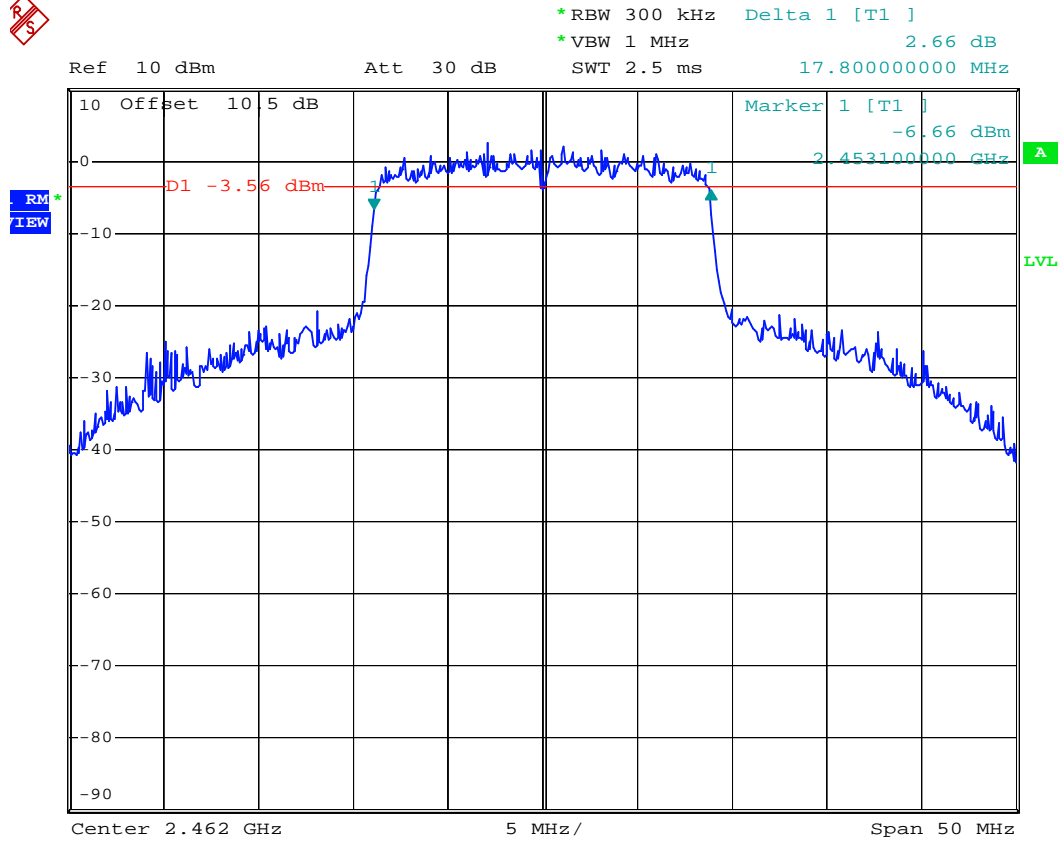




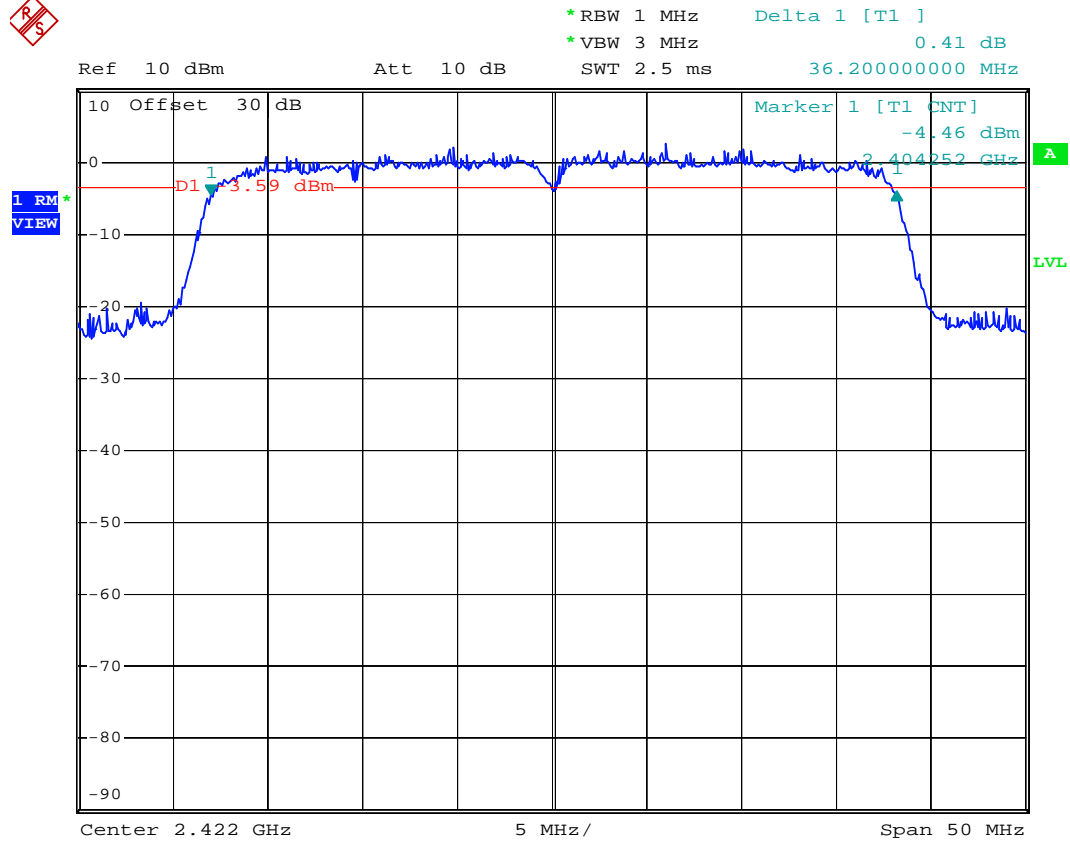
### 802.11n HT-20



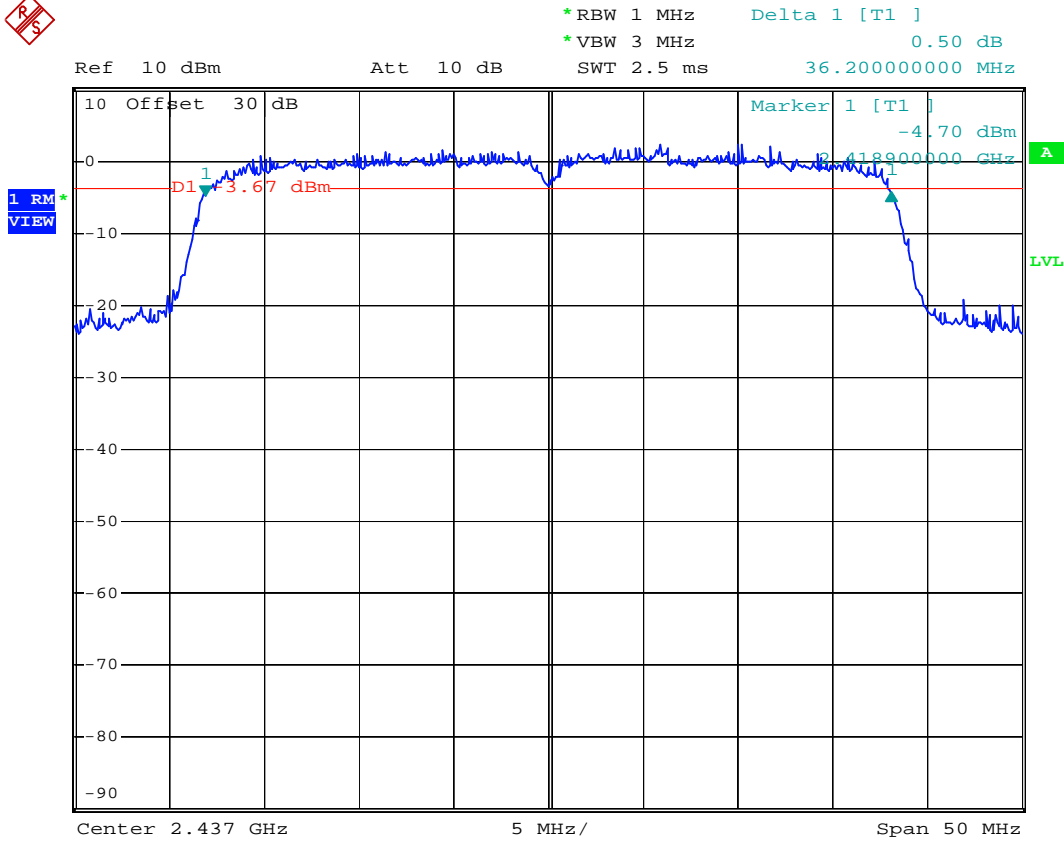


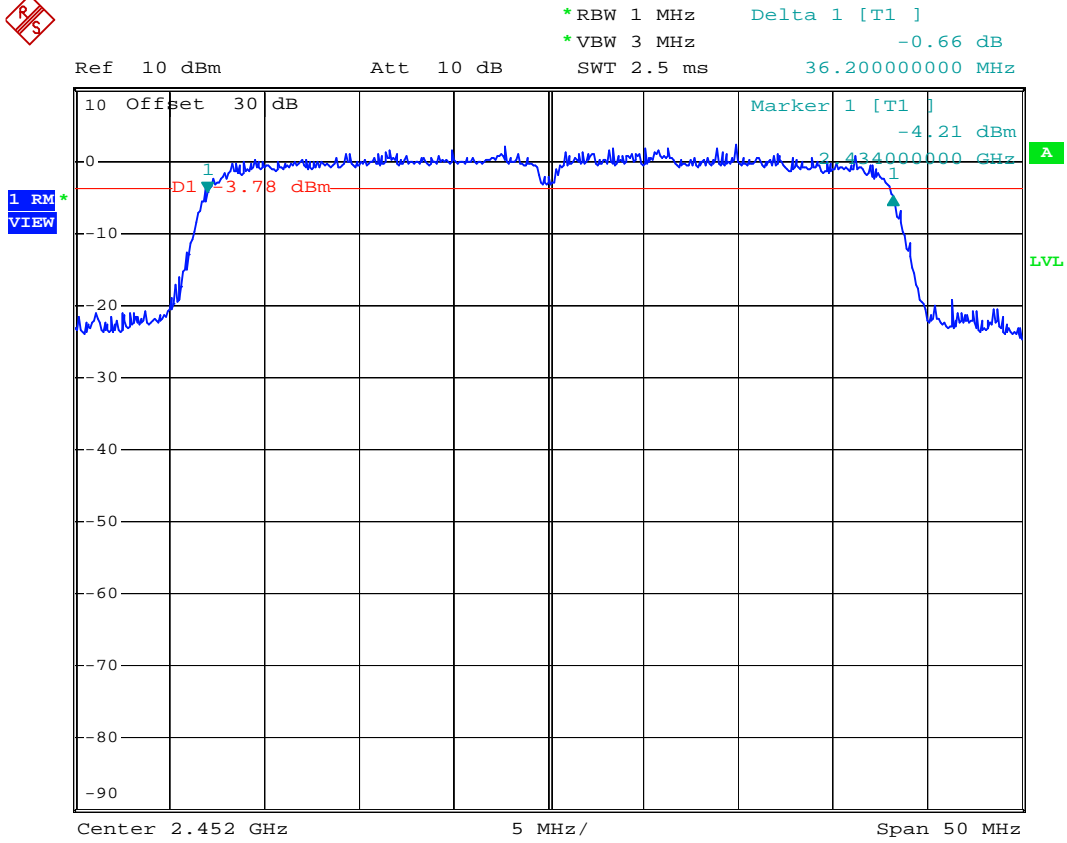


### 802.11n HT-40









## 8 OUTPUT POWER MEASUREMENT

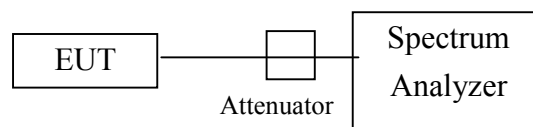
### 8.1 Standard Applicable

For direct sequence system, according to 15.247(b), the maximum peak output power of the transmitter shall not exceed 1 Watt. If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### 8.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 5 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 1 MHz and VBW to 1 MHz.
4. Use channel power function and record the level displayed.
5. Repeat above procedures until all frequencies measured were complete.

Figure 5: Output power and measurement configuration.



### 8.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
POWER METER+SENSOR	ANRITSU	ML2487A+MA2491A	2011/12/28	2012/12/27

## 8.4 Measurement Data

Test Date : Nov. 02, 2012      Temperature : 25 °C      Humidity : 65 %

### A 802.11b

- a) Channel Low: Output Peak Power is 16.90 dBm **48.978** mW
- b) Channel Mid: Output Peak Power is 16.72 dBm **46.989** mW
- c) Channel High: Output Peak Power is 16.54 dBm **45.082** mW

### B 802.11g

- a) Channel Low: Output Peak Power is 13.30 dBm **24.547** mW
- b) Channel Mid: Output Peak Power is 13.51 dBm **22.439** mW
- c) Channel High: Output Peak Power is 13.46 dBm **22.182** mW

### C.802.11n HT-20

- a) Channel Low: Output Peak Power is 13.93 dBm **24.717** mW
- b) Channel Mid: Output Peak Power is 13.79 dBm **23.933** mW
- c) Channel High: Output Peak Power is 13.59 dBm **22.856** mW

### D.802.11n HT-40

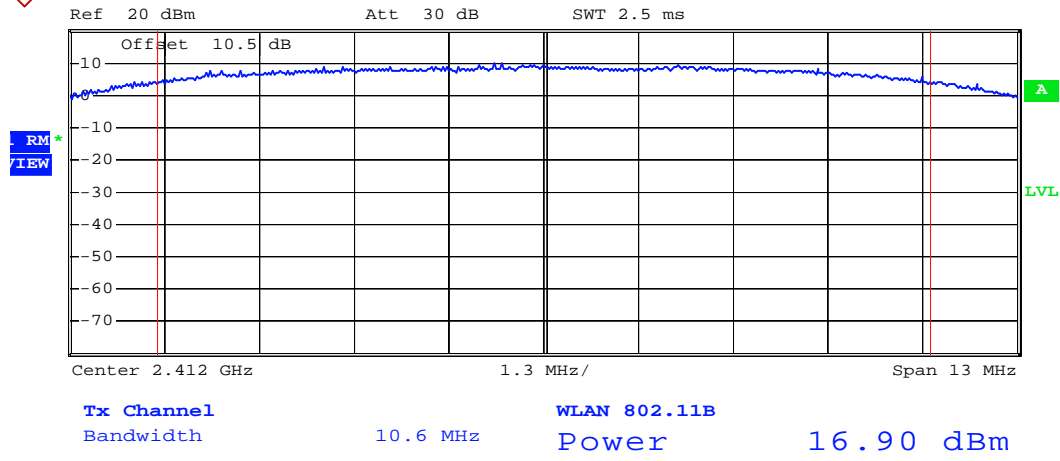
- a) Channel Low: Output Peak Power is 13.92 dBm **24.660** mW
- b) Channel Mid: Output Peak Power is 13.74 dBm **23.659** mW
- c) Channel High: Output Peak Power is 13.50 dBm **22.387** mW

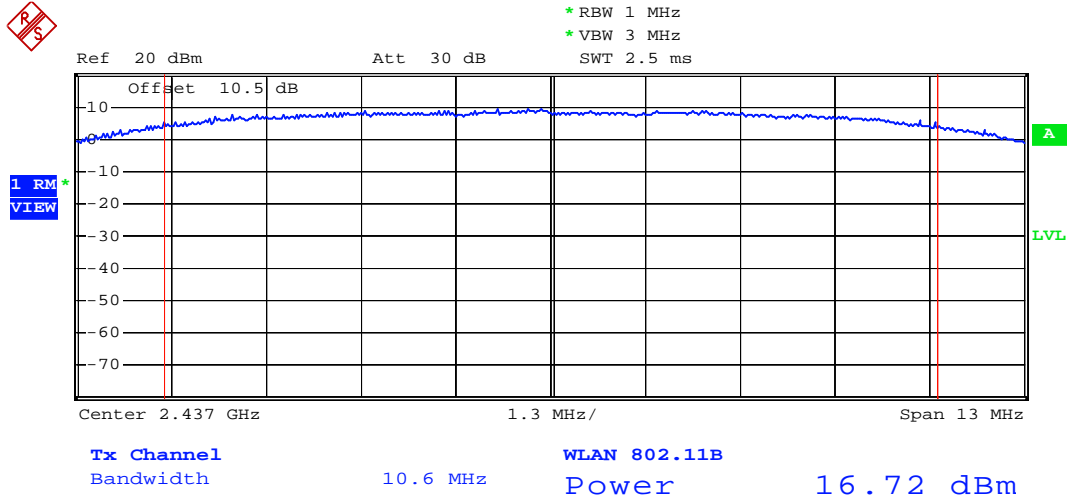
*Note : The expanded uncertainty: 2dB.*

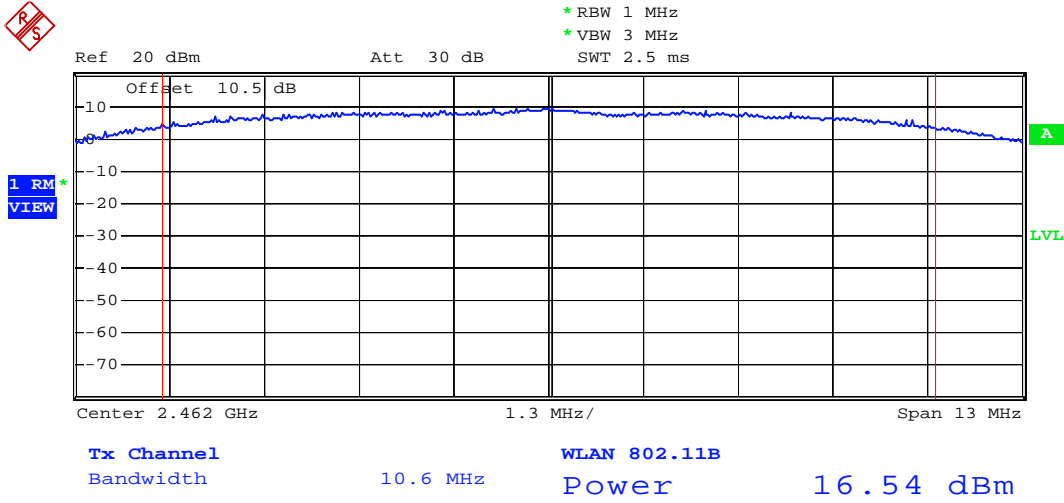
### 802.11b



\*RBW 1 MHz  
\*VBW 3 MHz  
SWT 2.5 ms



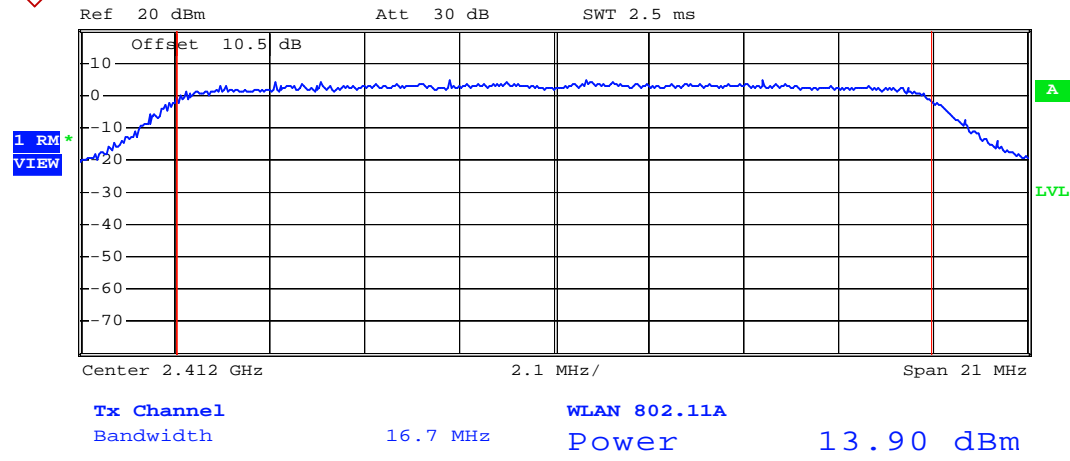




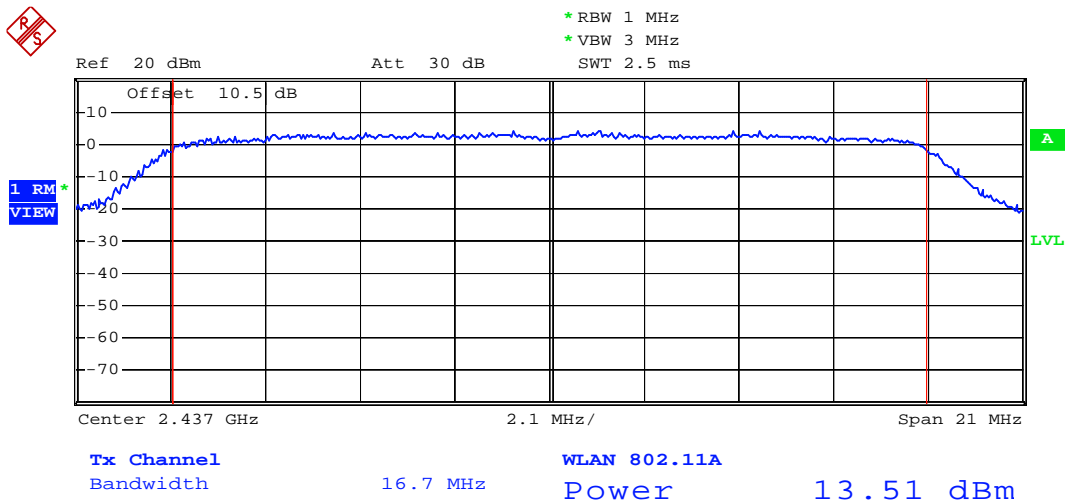
### 802.11g

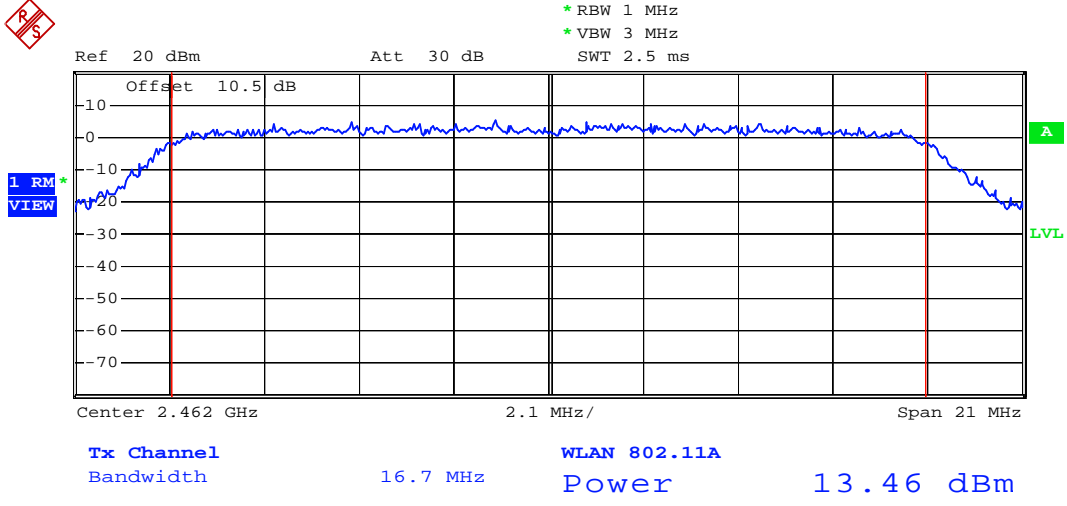


\* RBW 1 MHz  
\* VBW 3 MHz  
SWT 2.5 ms





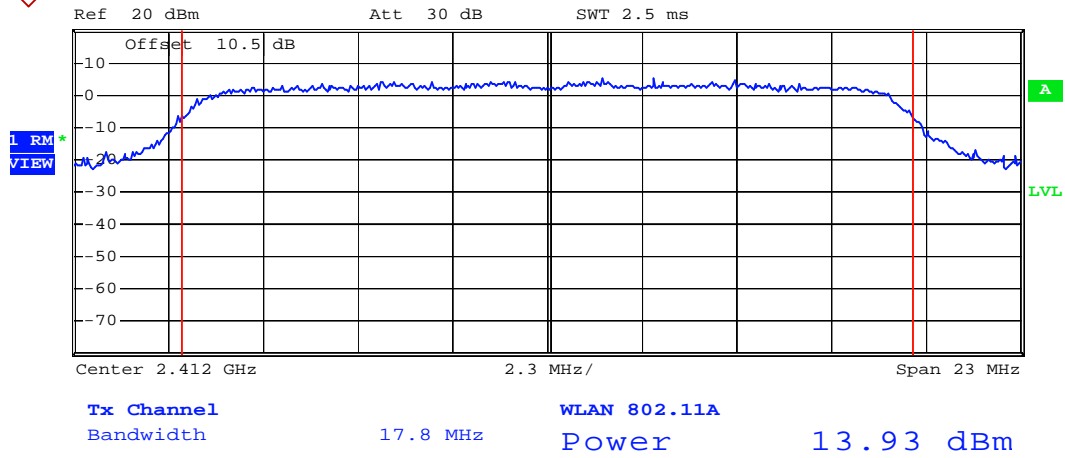


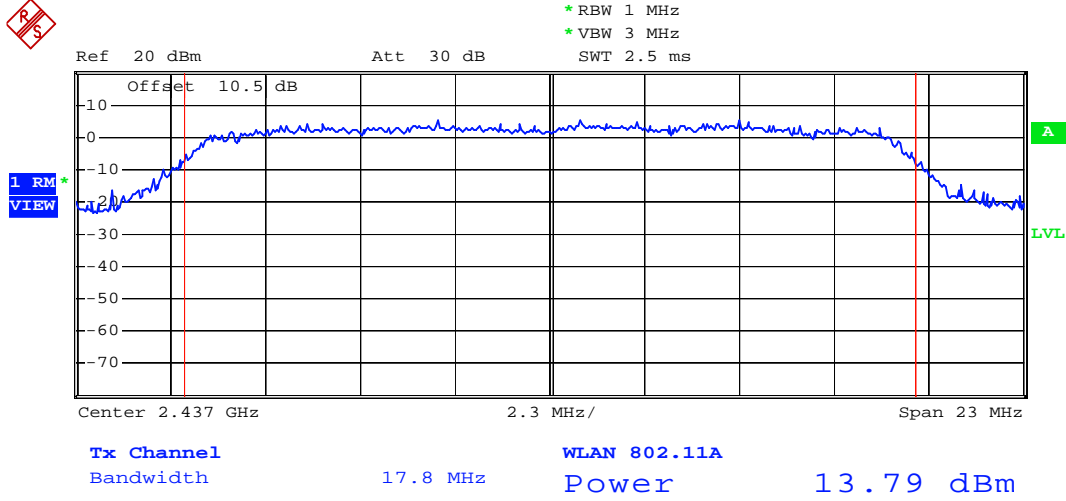


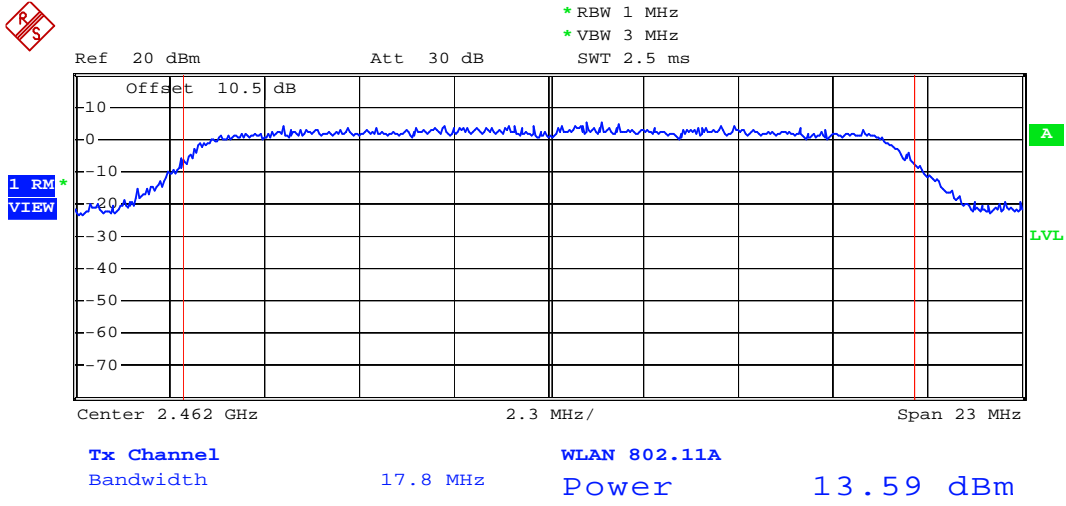
### 802.11n HT-20



\* RBW 1 MHz  
\* VBW 3 MHz  
SWT 2.5 ms



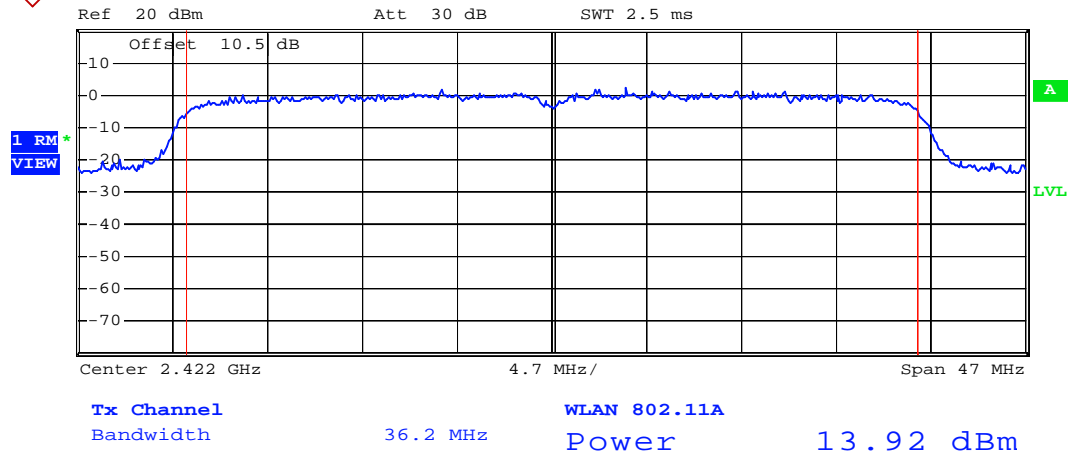


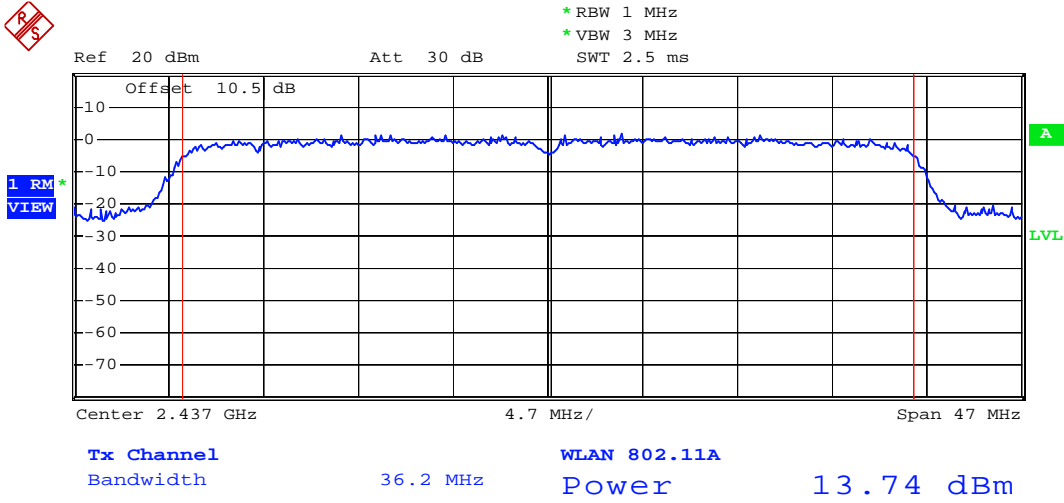


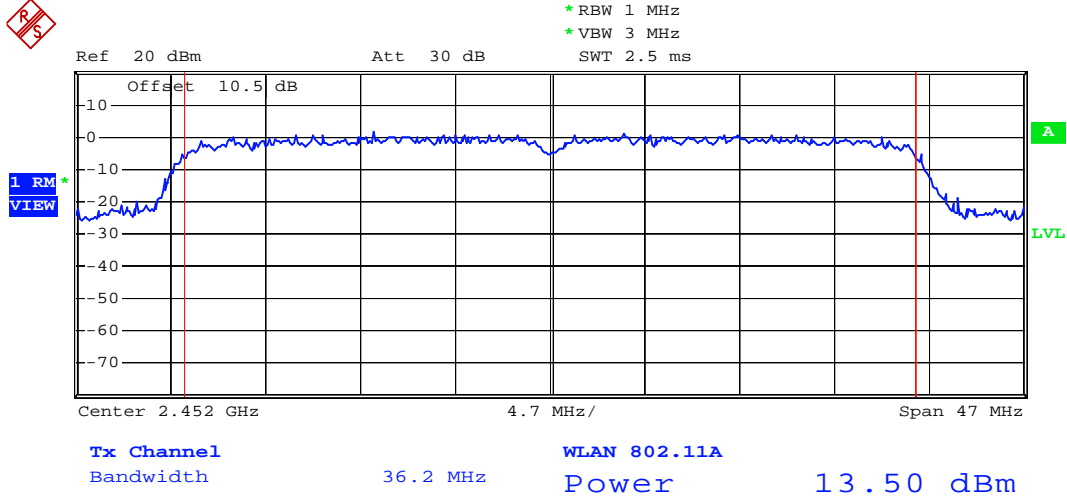
### 802.11n HT-40



\* RBW 1 MHz  
\* VBW 3 MHz  
SWT 2.5 ms









## 9 100 kHz BANDWIDTH OF BAND EDGES MEASUREMENT

### 9.1 Standard Applicable

According to 15.247(c), if any 100 kHz bandwidth outside these frequency bands, the radio frequency power that is produced by the modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either at least 20 dB below that in any 100 kHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified in §15.209(a), whichever results in the lesser attenuation.

### 9.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 5 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Set both RBW of spectrum analyzer to 100kHz and VBW to 1 MHz with a convenient frequency span including 100kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

### 9.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Spectrum Analyzer	Rohde & Schwarz	FSP40	2012/09/20	2013/09/20

## 9.4 Measurement Data

Test Date : Nov. 02, 2012      Temperature : 25 °C      Humidity : 65 %

### A 802.11b

- a) Lower Band Edge : All emissions in this 100kHz bandwidth are attenuated more than 20dB from the carrier.
- b) Upper Band Edge : All emissions in this 100kHz bandwidth are attenuated more than 20dB from the carrier.

### B 802.11g

- a) Lower Band Edge : All emissions in this 100kHz bandwidth are attenuated more than 20dB from the carrier.
- b) Upper Band Edge : All emissions in this 100kHz bandwidth are attenuated more than 20dB from the carrier.

### C 802.11n HT-20

- a) Lower Band Edge : All emissions in this 100kHz bandwidth are attenuated more than 20dB from the carrier.
- b) Upper Band Edge : All emissions in this 100kHz bandwidth are attenuated more than 20dB from the carrier.

### D 802.11n HT-40

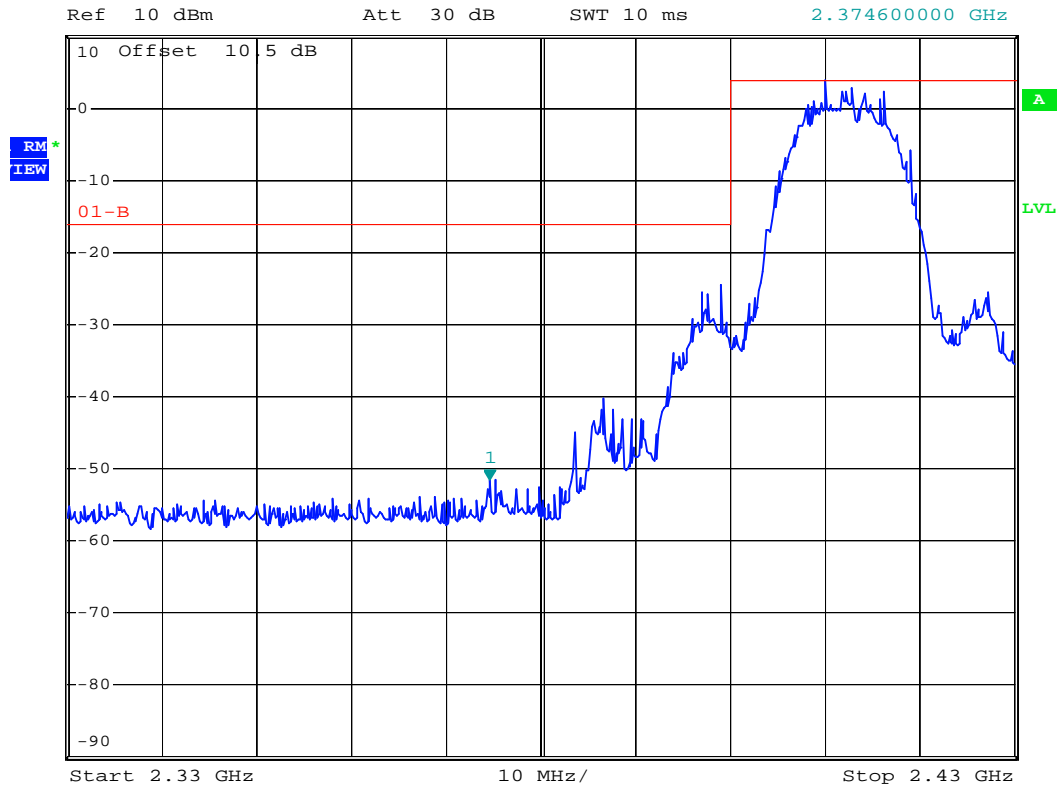
- a) Lower Band Edge : All emissions in this 100kHz bandwidth are attenuated more than 20dB from the carrier.
- b) Upper Band Edge : All emissions in this 100kHz bandwidth are attenuated more than 20dB from the carrier.

*Note : The expanded uncertainty: 2dB.*

### 802.11b

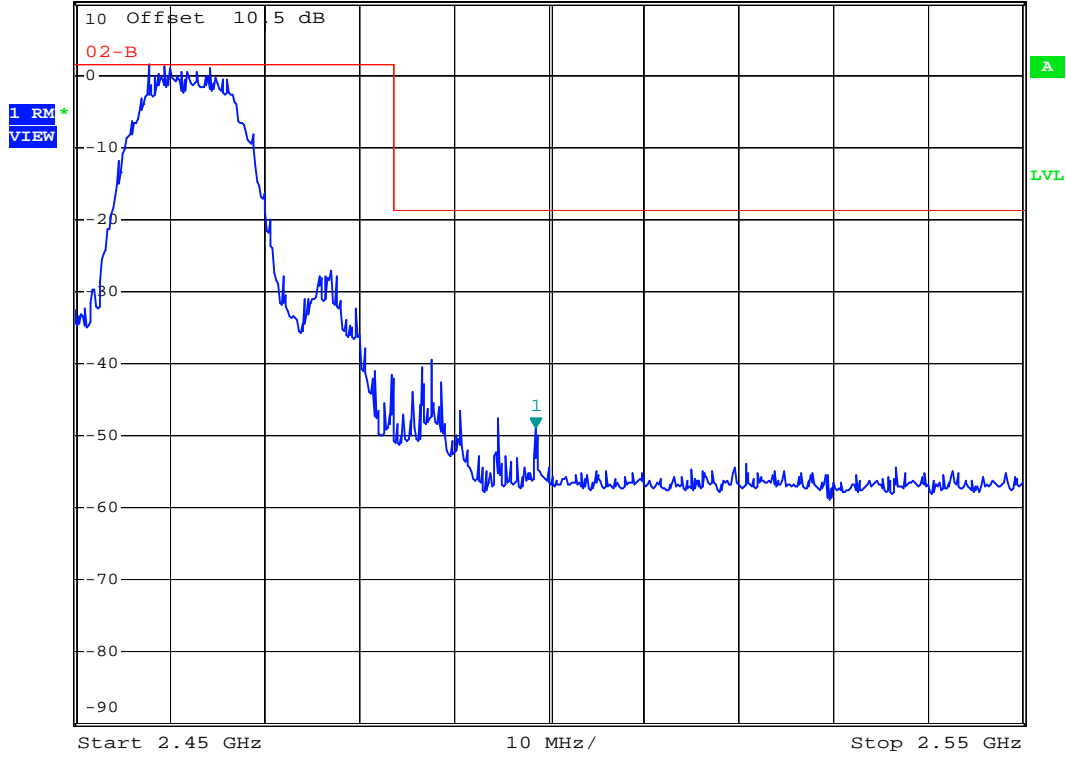


\*RBW 100 kHz    Marker 1 [T1 ]  
\*VBW 300 kHz                    -51.52 dBm  
SWT 10 ms                        2.374600000 GHz





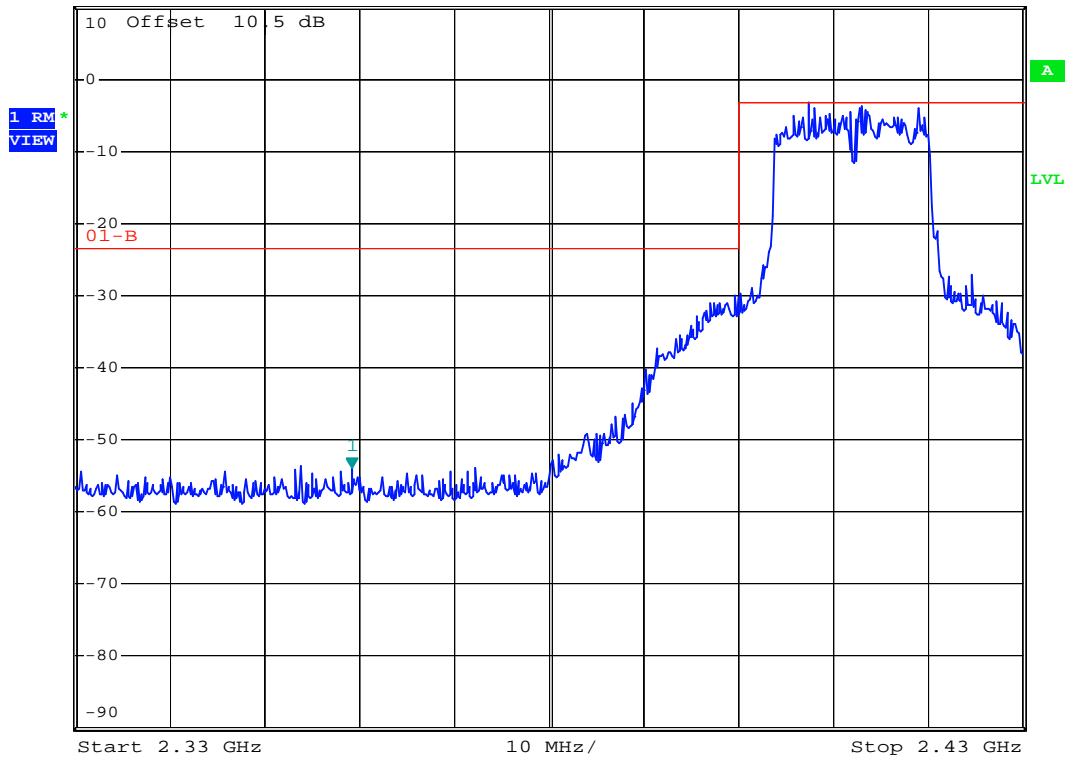
Ref 10 dBm Att 30 dB SWT 10 ms  
\*RBW 100 kHz Marker 1 [T1 ]  
\*VBW 300 kHz -48.99 dBm  
2.498600000 GHz



### 802.11g

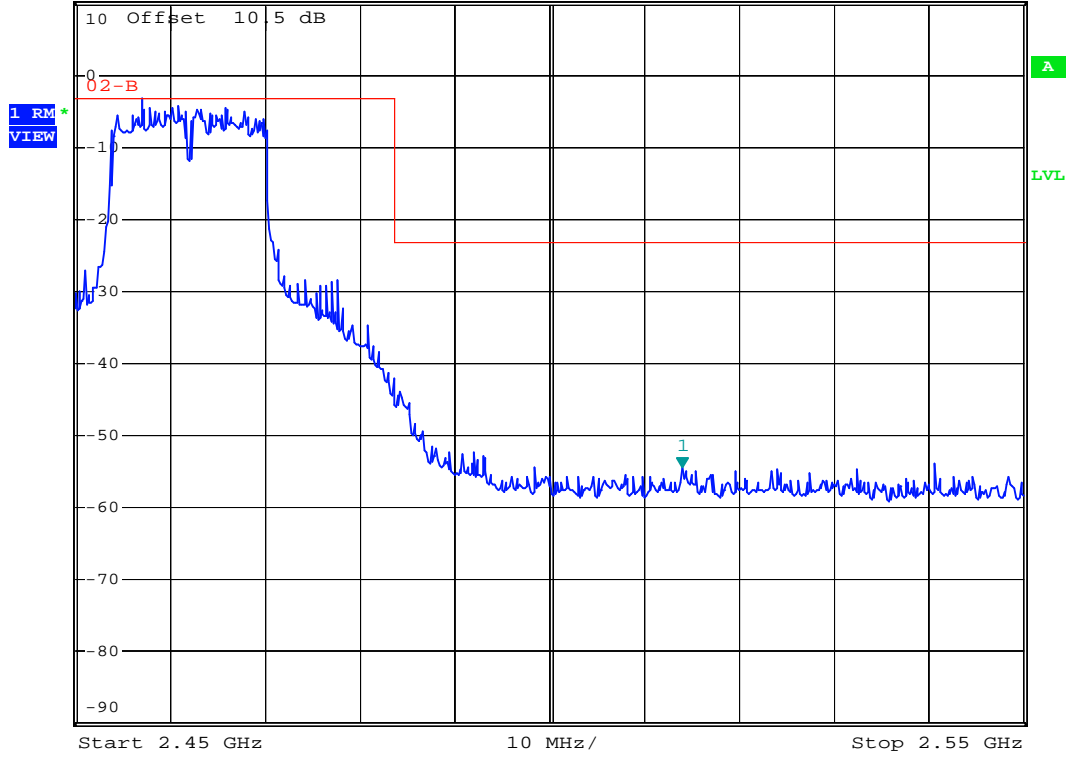


\*RBW 100 kHz Marker 1 [T1 ]  
\*VBW 300 kHz -53.86 dBm  
Ref 10 dBm Att 30 dB SWT 10 ms 2.359200000 GHz





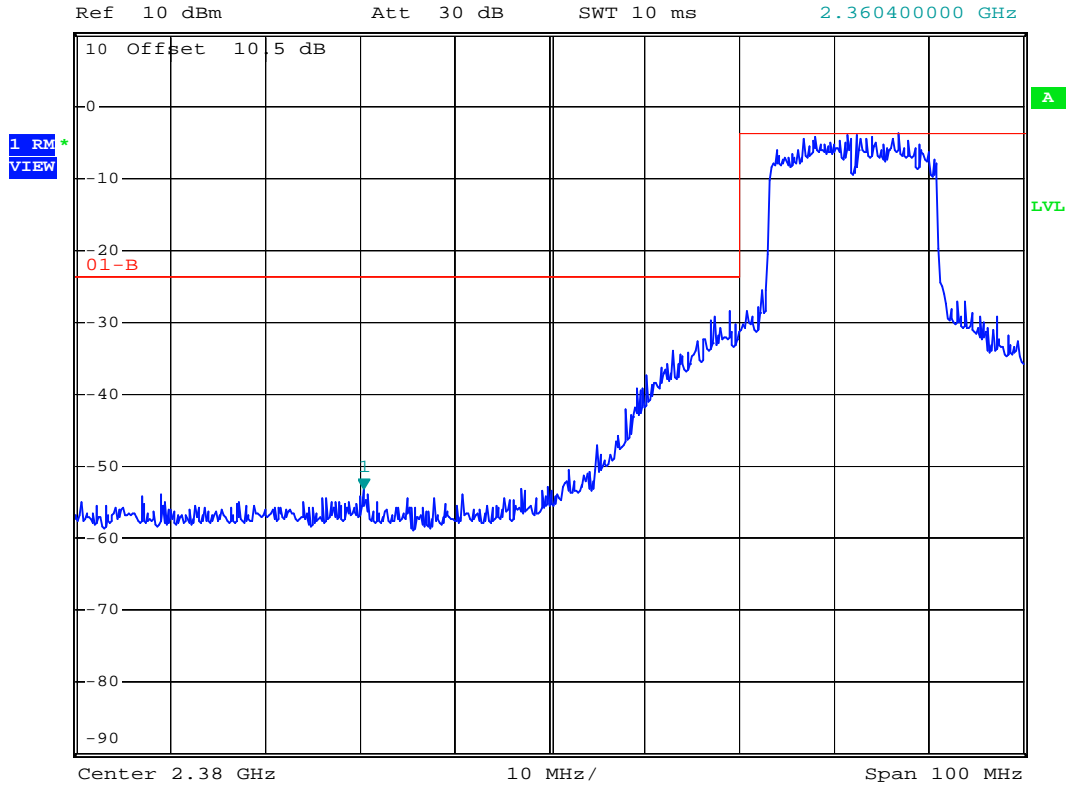
Ref 10 dBm Att 30 dB \*RBW 100 kHz Marker 1 [T1 ]  
\*VBW 300 kHz -54.33 dBm  
SWT 10 ms 2.514000000 GHz



### 802.11n 20M

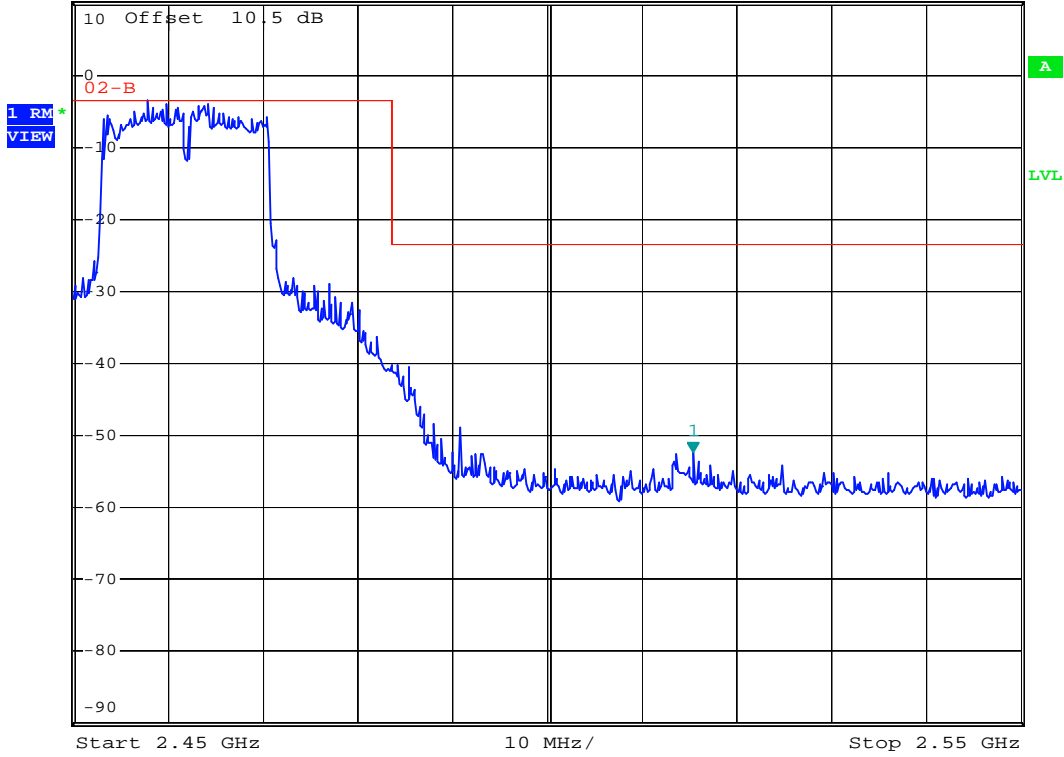


\*RBW 100 kHz    Marker 1 [T1 ]  
\*VBW 300 kHz                    -53.18 dBm  
SWT 10 ms                        2.360400000 GHz





Ref 10 dBm Att 30 dB SWT 10 ms  
\*RBW 100 kHz Marker 1 [T1 ]  
\*VBW 300 kHz -52.39 dBm  
2.515400000 GHz

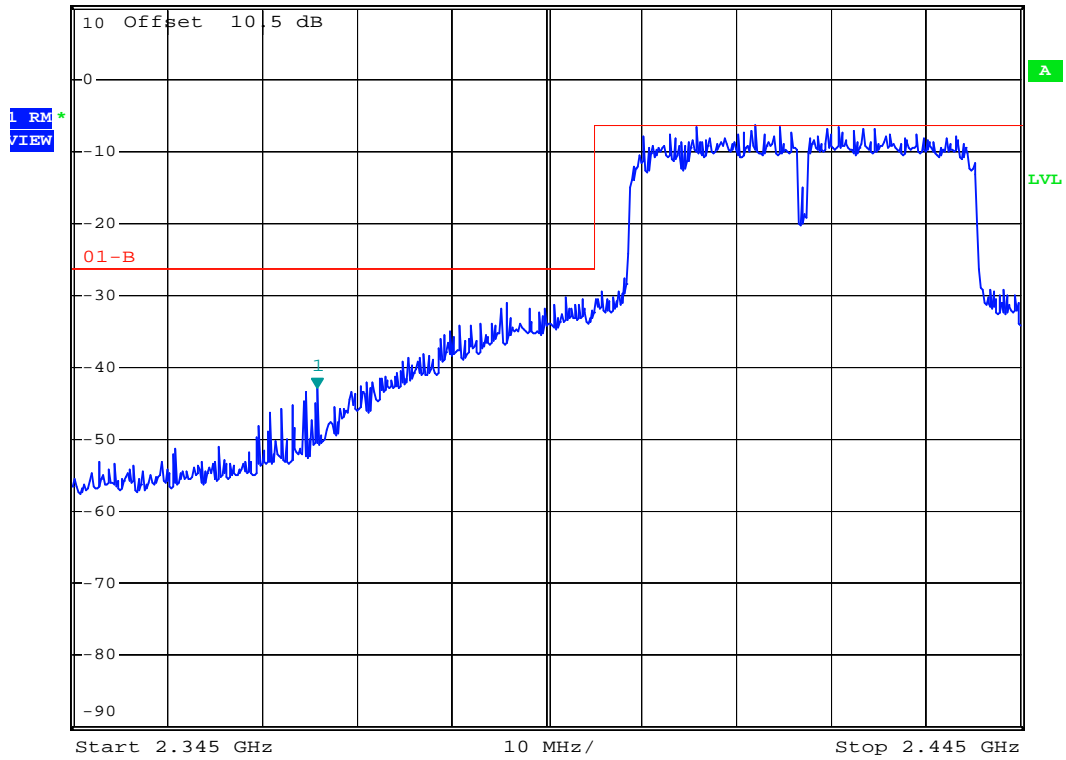




### 802.11n 40M

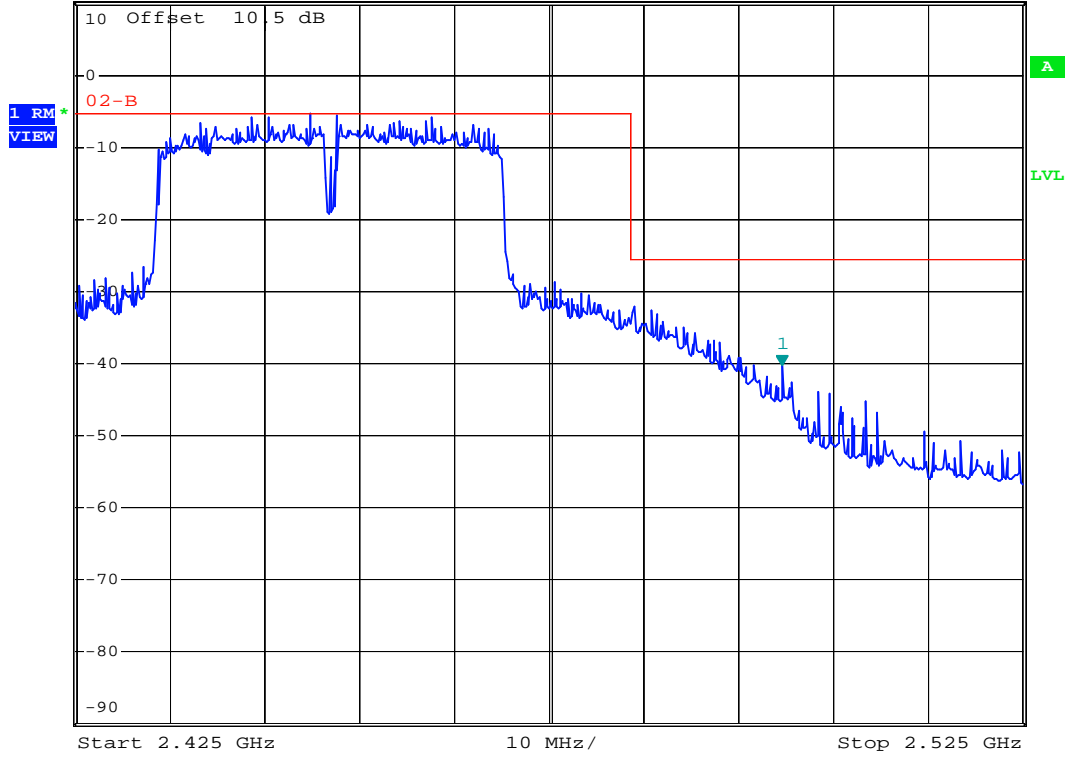


\*RBW 100 kHz Marker 1 [T1 ]  
\*VBW 300 kHz -43.01 dBm  
Ref 10 dBm Att 30 dB SWT 10 ms 2.370800000 GHz





Ref 10 dBm Att 30 dB SWT 10 ms  
\*RBW 100 kHz Marker 1 [T1 ]  
\*VBW 300 kHz -40.34 dBm  
2.499600000 GHz



## 10 POWER DENSITY MEASUREMENT

### 10.1 Standard Applicable

According to 15.247(d), for direct sequence systems, the transmitted power density averaged over any 1 second interval shall not be greater than 8 dBm in any 3 kHz bandwidth within these bands.

### 10.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set EUT to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of spectrum analyzer on highest level appearing on spectral display within a 300 kHz frequency span.
4. Set the spectrum analyzer on a 3 kHz resolution bandwidth and 300 kHz video bandwidth as well as max hold function.
5. Repeat above procedures until all measured frequencies were complete.

### 10.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Spectrum Analyzer	Rohde & Schwarz	FSP40	2012/09/20	2013/09/20

## 10.4 Measurement Data

Test Date : Nov. 02, 2012      Temperature : 25 °C      Humidity : 65 %

### A 802.11b

- a) Channel Low: Maximun Power Density of 3 kHz Bandwidth is 7.29 dBm
- b) Channel Mid: Maximun Power Density of 3 kHz Bandwidth is 7.64 dBm
- c) Channel High: Maximun Power Density of 3 kHz Bandwidth is 7.67 dBm

### B 802.11g

- a) Channel Low: Maximun Power Density of 3 kHz Bandwidth is -0.49 dBm
- b) Channel Mid: Maximun Power Density of 3 kHz Bandwidth is -0.02 dBm
- c) Channel High: Maximun Power Density of 3 kHz Bandwidth is -0.16 dBm

### C 802.11n HT-20

- a) Channel Low: Maximun Power Density of 3 kHz Bandwidth is -0.25 dBm
- b) Channel Mid: Maximun Power Density of 3 kHz Bandwidth is -0.24 dBm
- c) Channel High: Maximun Power Density of 3 kHz Bandwidth is -0.48 dBm

### D 802.11n HT-40

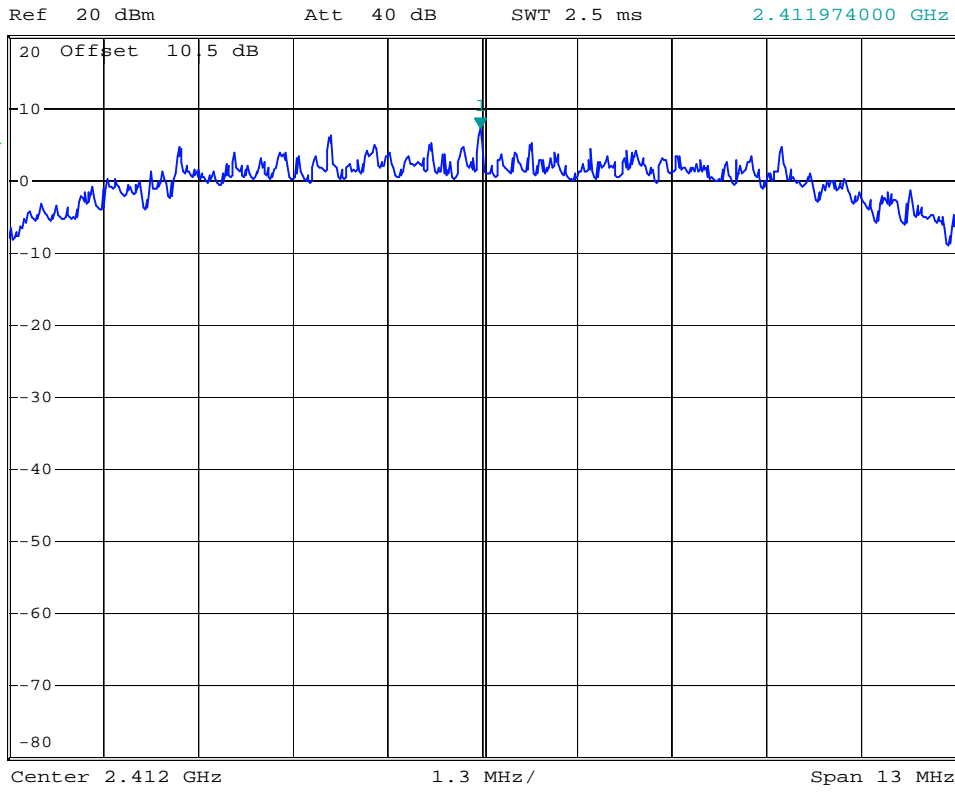
- a) Channel Low: Maximun Power Density of 3 kHz Bandwidth is -4.15 dBm
- b) Channel Mid: Maximun Power Density of 3 kHz Bandwidth is -4.52 dBm
- c) Channel High: Maximun Power Density of 3 kHz Bandwidth is -3.79 dBm

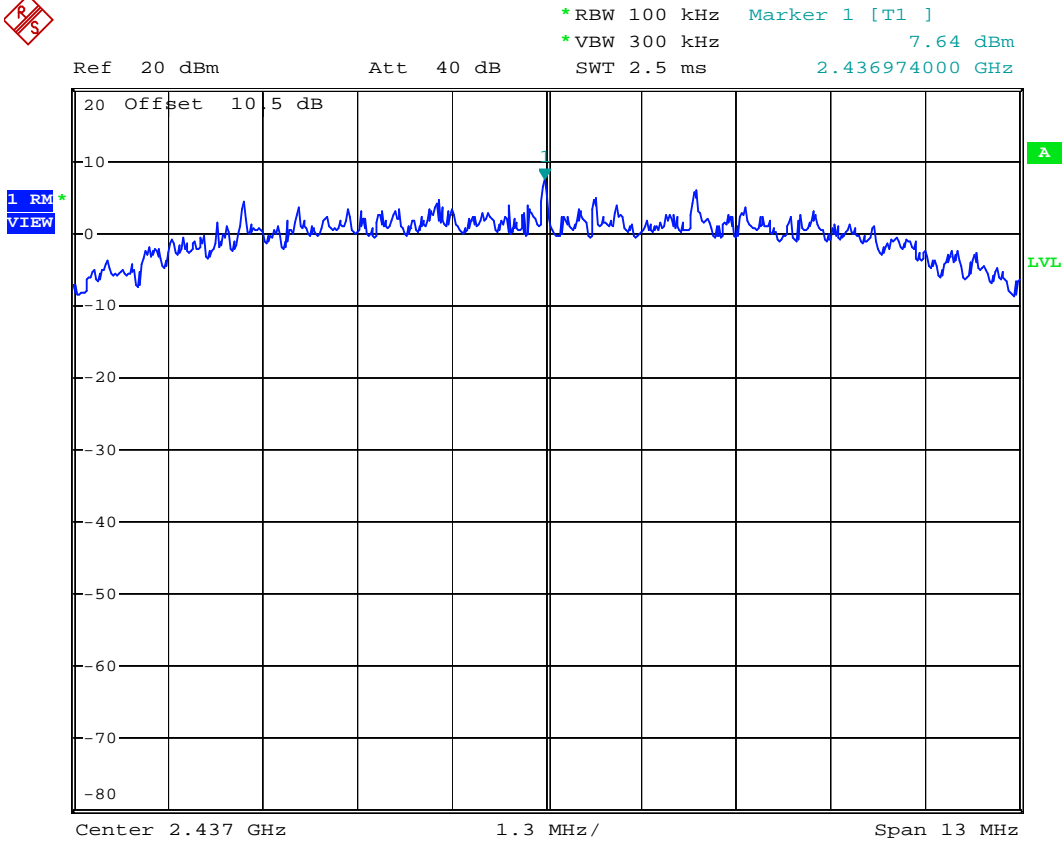
**Note : The expanded uncertainty: 2dB.**

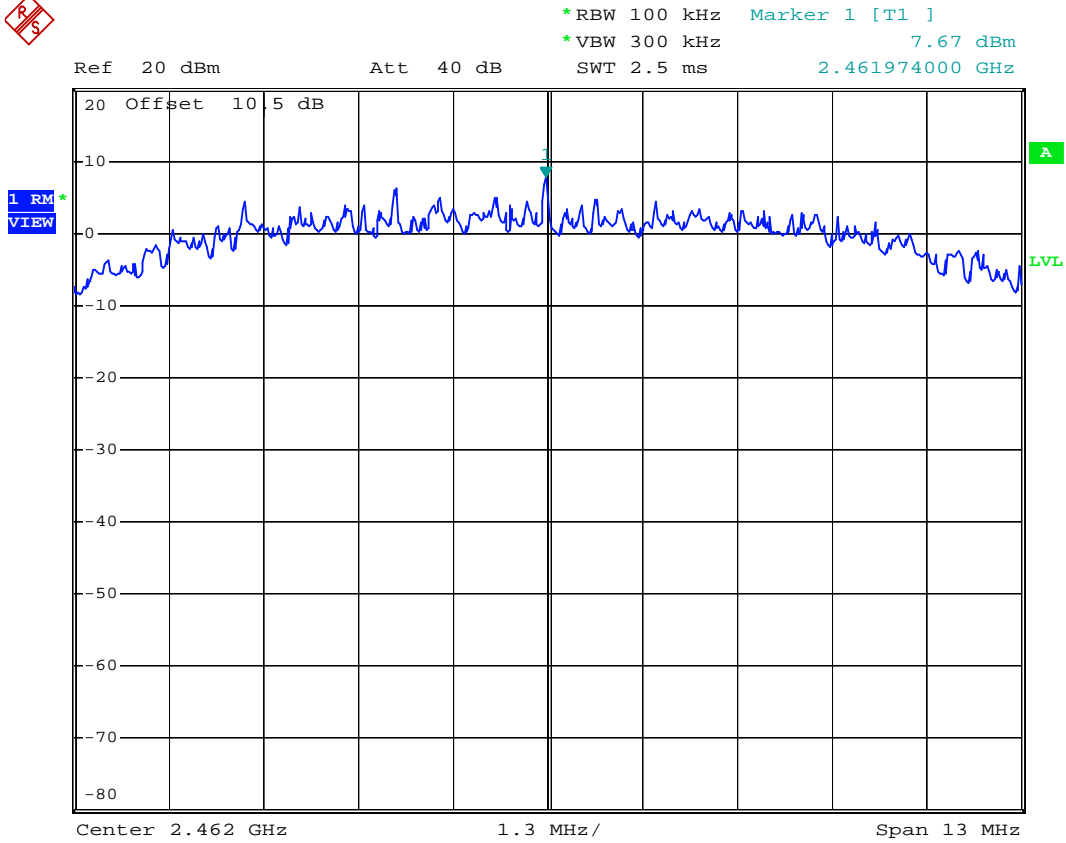
802.11b



\*RBW 100 kHz Marker 1 [T1 ]  
\*VBW 300 kHz 7.29 dBm  
SWT 2.5 ms 2.411974000 GHz



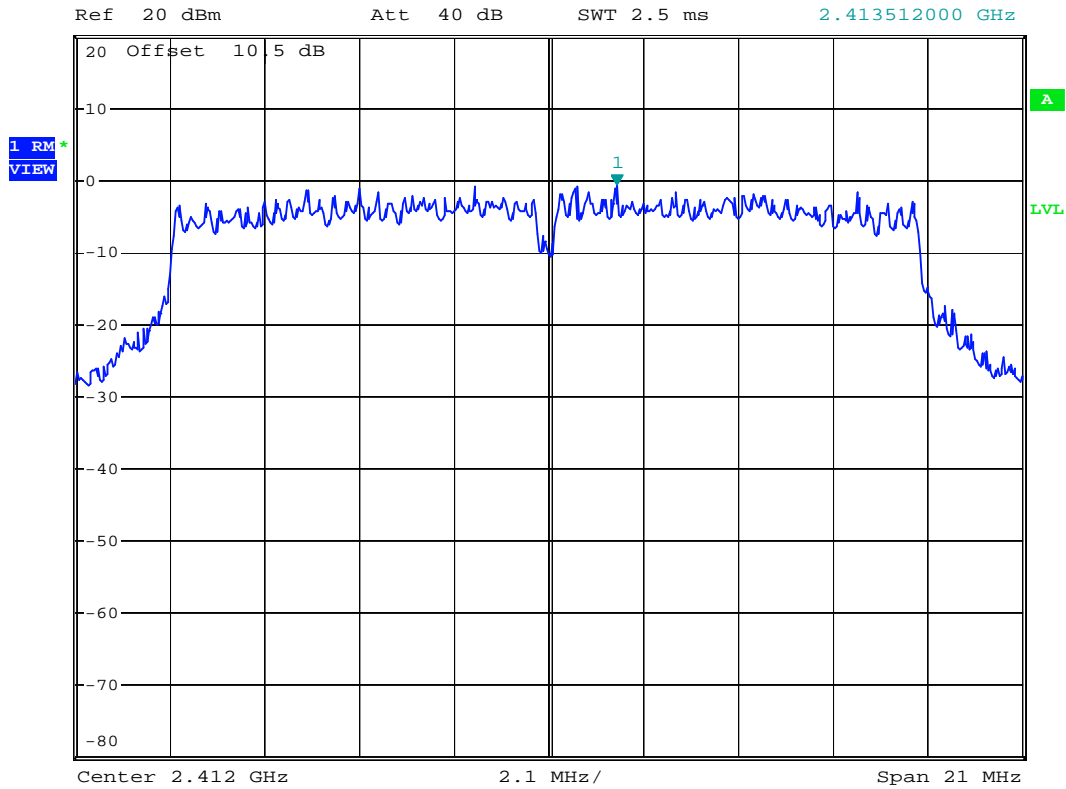




### 802.11g



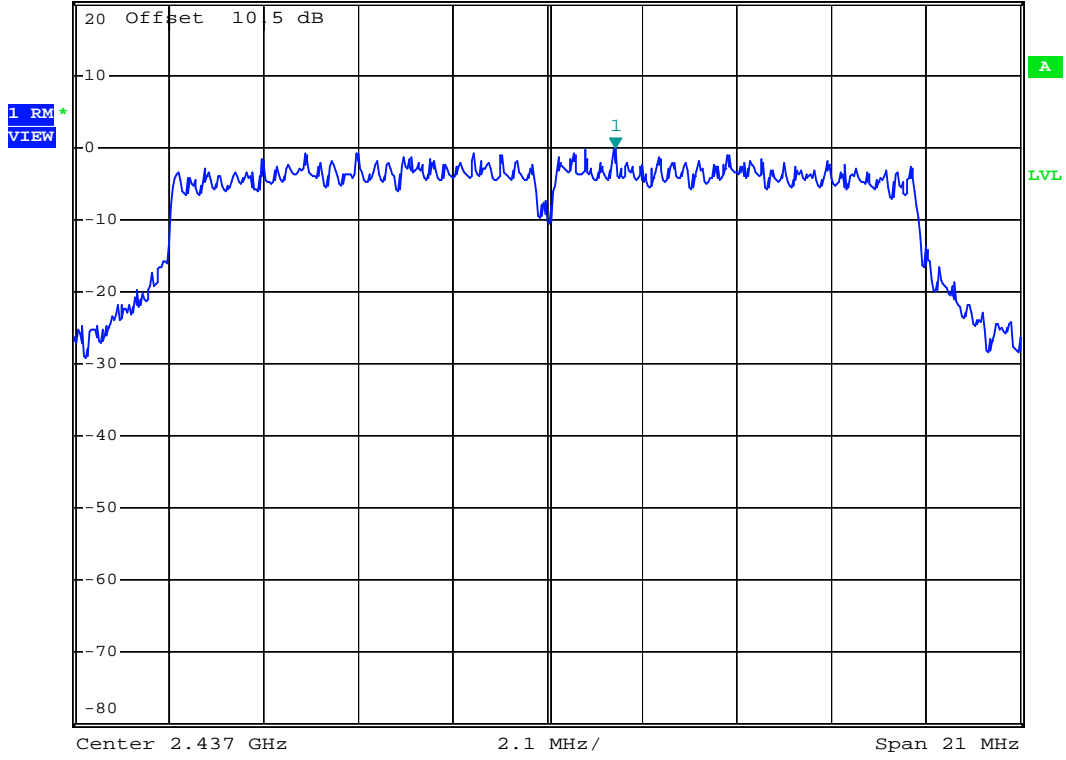
\*RBW 100 kHz    Marker 1 [T1 ]  
\*VBW 300 kHz    -0.49 dBm  
SWT 2.5 ms      2.413512000 GHz





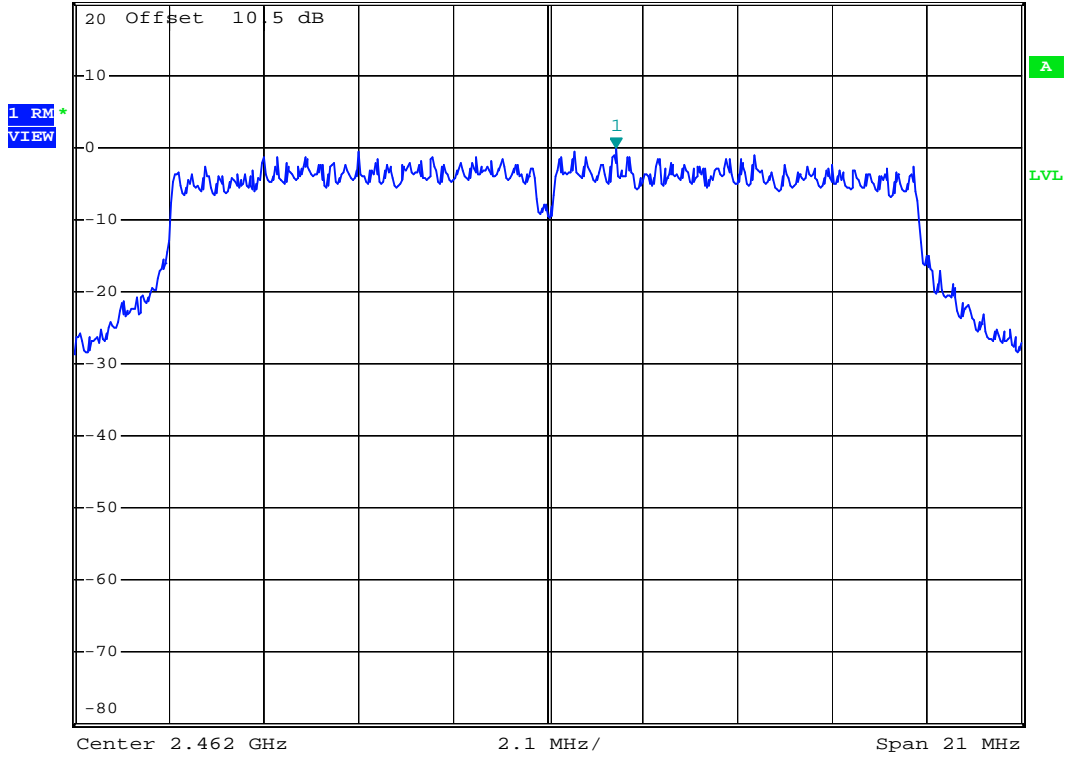


Ref 20 dBm Att 40 dB \*RBW 100 kHz Marker 1 [T1 ]  
\*VBW 300 kHz 0.02 dBm  
SWT 2.5 ms 2.438512000 GHz





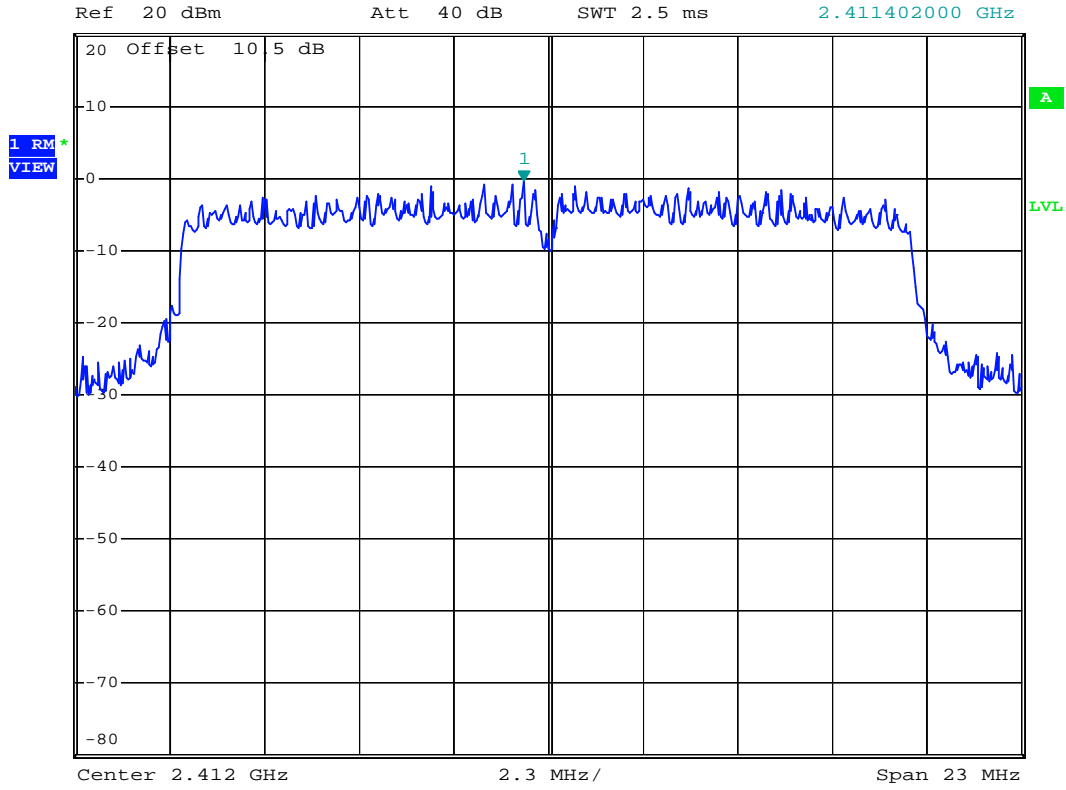
Ref 20 dBm Att 40 dB \*RBW 100 kHz Marker 1 [T1 ]  
\*VBW 300 kHz -0.16 dBm  
SWT 2.5 ms 2.463512000 GHz



### 802.11n 20M



\*RBW 100 kHz    Marker 1 [T1 ]  
\*VBW 300 kHz    -0.25 dBm  
SWT 2.5 ms      2.411402000 GHz

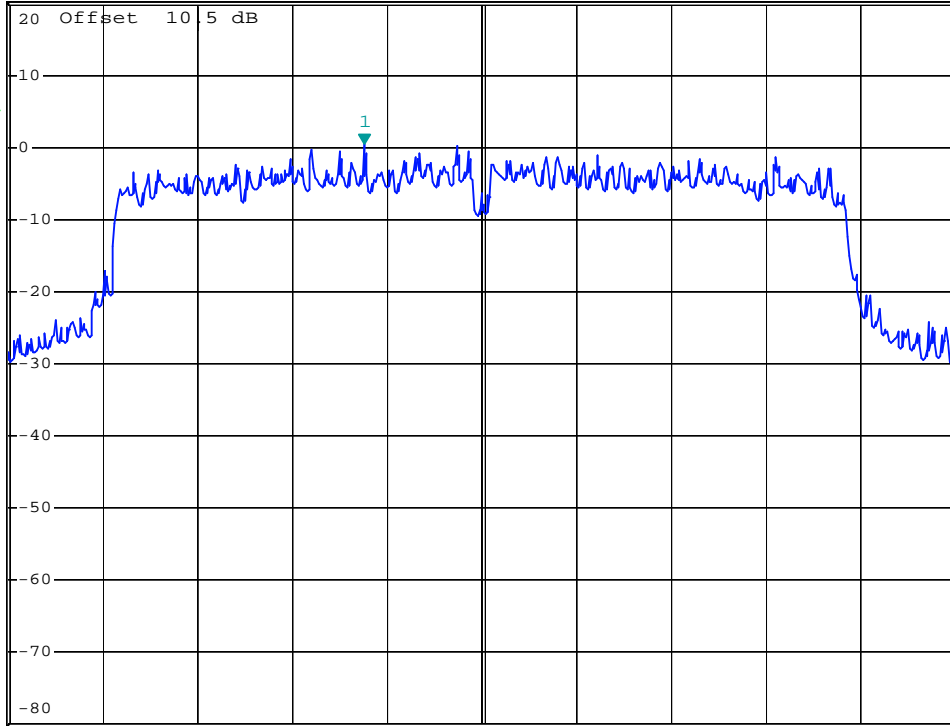


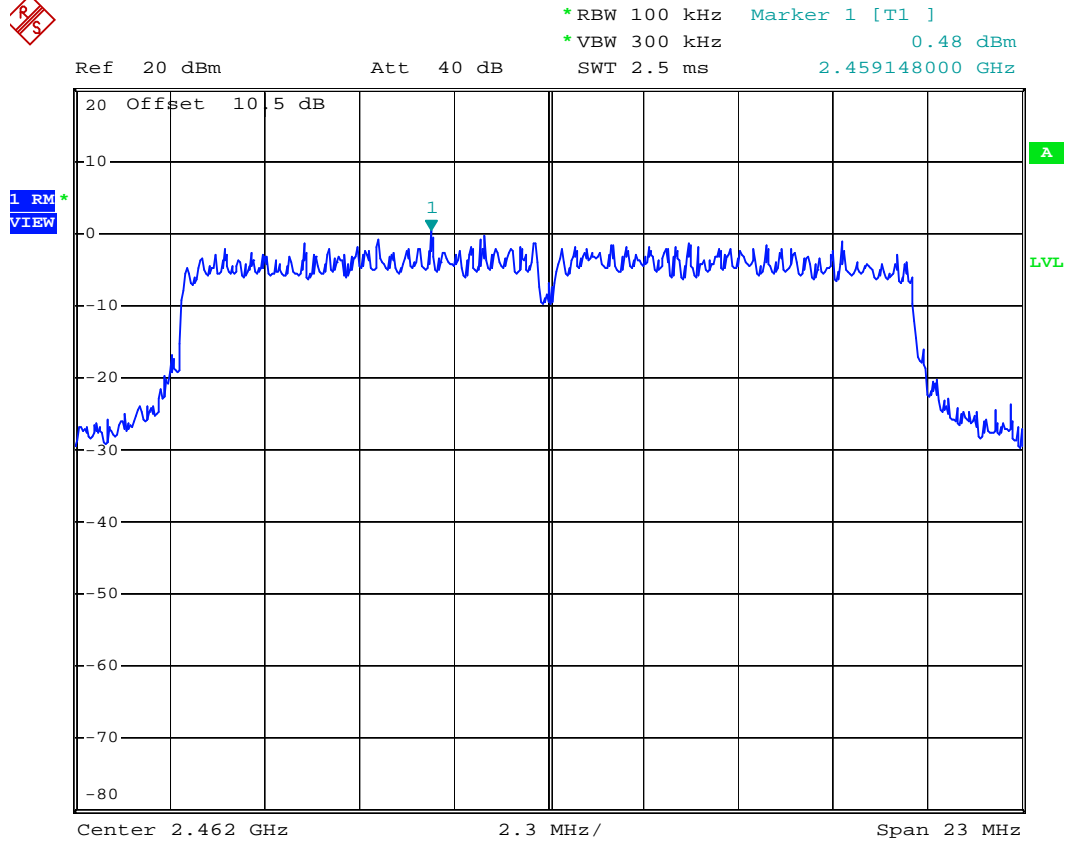


\*RBW 100 kHz Marker 1 [T1 ]  
\*VBW 300 kHz 0.34 dBm  
SWT 2.5 ms 2.434148000 GHz

Ref 20 dBm

Att 40 dB





### 802.11n 40M



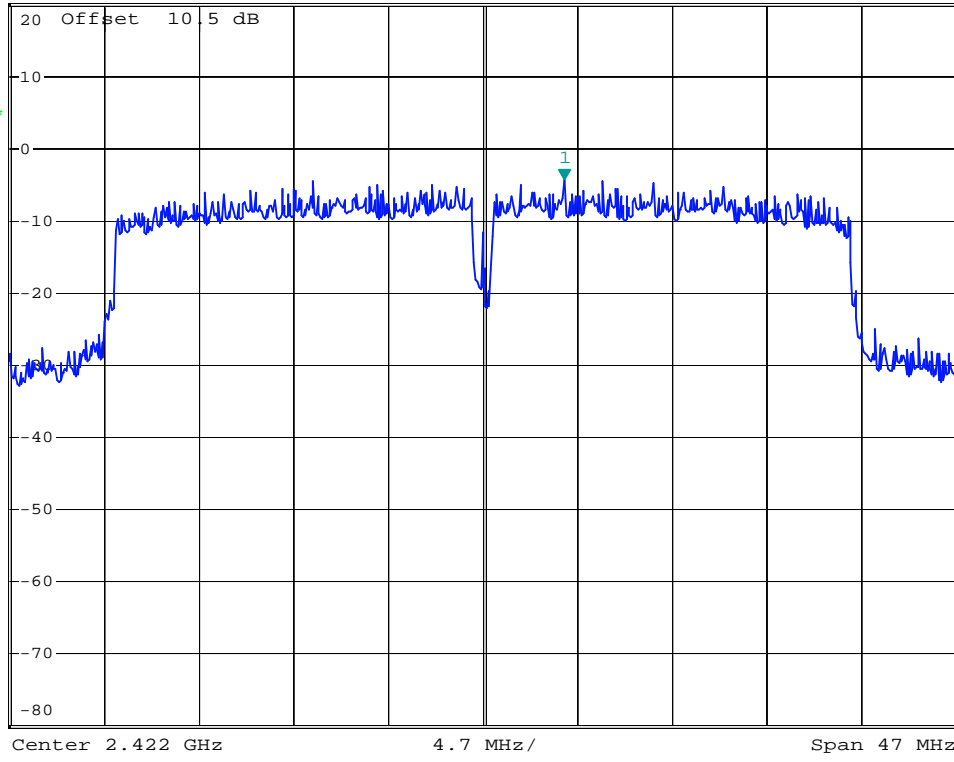
\*RBW 100 kHz    Marker 1 [T1 ]  
\*VBW 300 kHz                    -4.15 dBm  
SWT 5 ms                            2.426042000 GHz

Ref 20 dBm

Att 40 dB

SWT 5 ms

2.426042000 GHz

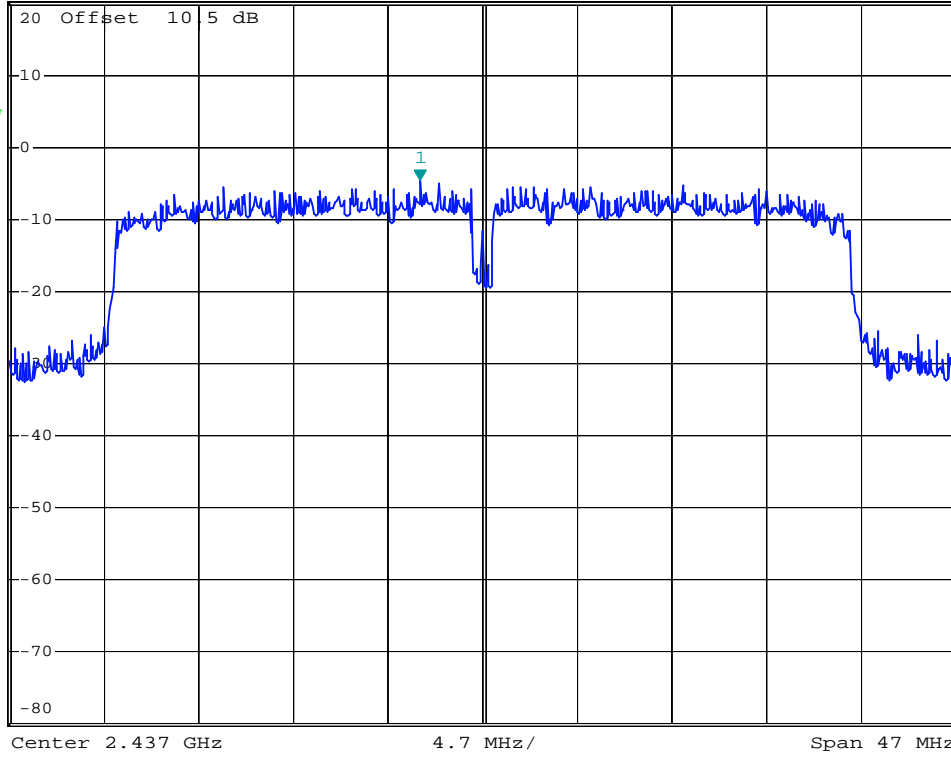




\*RBW 100 kHz    Marker 1 [T1 ]  
\*VBW 300 kHz                    -4.52 dBm  
SWT 5 ms                            2.433898000 GHz

Ref 20 dBm

Att 40 dB





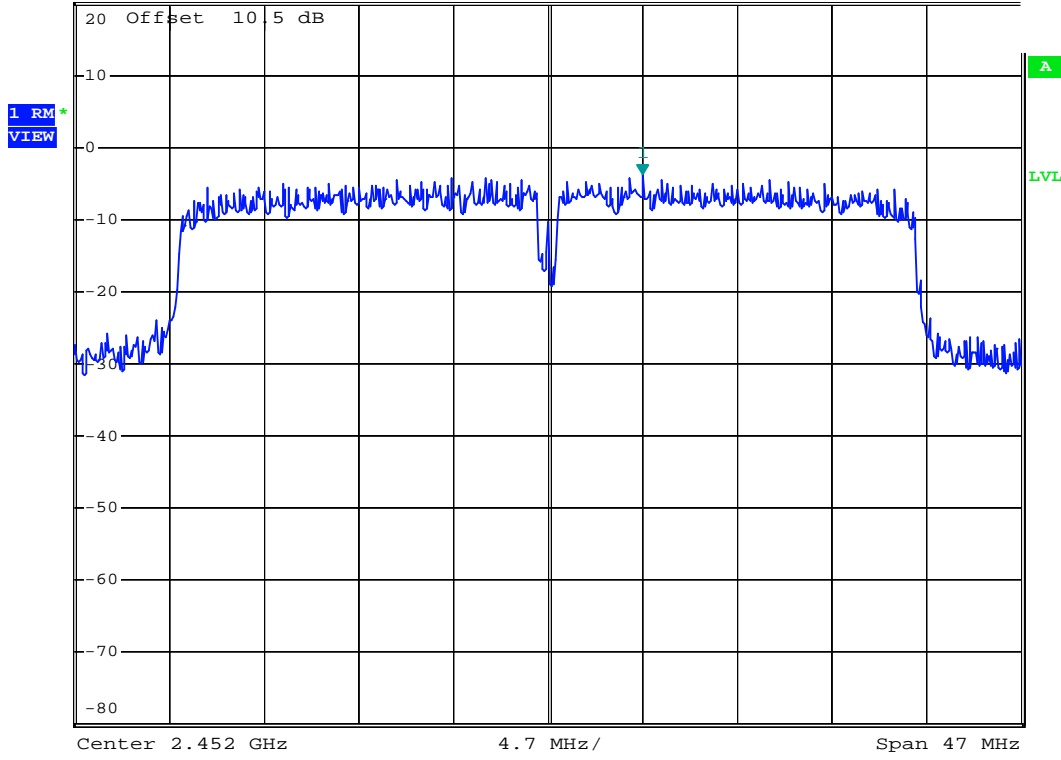
\*RBW 100 kHz    Marker 1 [T1 ]  
\*VBW 300 kHz                    -3.79 dBm  
SWT 5 ms                            2.456700000 GHz

Ref 20 dBm

Att 40 dB

SWT 5 ms

2.456700000 GHz





## 11. OUT-OF-BAND CONDUCTED EMISSION MEASUREMENT

### 11.1 Standard Applicable

According to 15.247(c), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.

### 11.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Use the following spectrum analyzer settings:
  - Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
  - RBW = 100 kHz
  - VBW  $\geq$  RBW
  - Sweep = auto
  - Detector function = peak
  - Trace = max hold.
4. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded. Plot the result on the screen of spectrum analyzer.
5. Repeat above procedures until all measured frequencies were complete.

### 11.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Spectrum Analyzer	Rohde & Schwarz	FSP40	2012/09/20	2013/09/20

## 11.4 Measurement Data

Test Date : Nov. 02, 2012      Temperature : 25 °C      Humidity : 65 %

### A 802.11b

#### Model : Channel Low

- a) 1 GHz to 3 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.
- b) 3 GHz to 25 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.

#### Model : Channel Mid

- a) 1 GHz to 3 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.
- b) 3 GHz to 25 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.

#### Model : Channel High

- a) 1 GHz to 3 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.
- b) 3 GHz to 25 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.

**Note : The expanded uncertainty: 2dB.**

Test Date : Nov. 02, 2012      Temperature : 25 °C      Humidity : 65 %

**B 802.11g**

**Model : Channel Low**

- a) 1 GHz to 3 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.
- b) 3 GHz to 25 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.

**Model : Channel Mid**

- a) 1 GHz to 3 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.
- b) 3 GHz to 25 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.

**Model : Channel High**

- a) 1 GHz to 3 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.
- b) 3 GHz to 25 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.

***Note : The expanded uncertainty: 2dB.***

Test Date : Nov. 02, 2012      Temperature : 25 °C      Humidity : 65 %

**C 802.11n HT-20**

**Model : Channel Low**

- a) 1 GHz to 3 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.
- b) 3 GHz to 25 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.

**Model : Channel Mid**

- a) 1 GHz to 3 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.
- b) 3 GHz to 25 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.

**Model : Channel High**

- a) 1 GHz to 3 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.
- b) 3 GHz to 25 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.

***Note : The expanded uncertainty: 2dB.***

Test Date : Nov. 02, 2012      Temperature : 25 °C      Humidity : 65 %

**D 802.11n HT-40**

**Model : Channel Low**

- c) 1 GHz to 3 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.
- d) 3 GHz to 25 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.

**Model : Channel Mid**

- c) 1 GHz to 3 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.
- d) 3 GHz to 25 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.

**Model : Channel High**

- c) 1 GHz to 3 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.
- d) 3 GHz to 25 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.

***Note : The expanded uncertainty: 2dB.***

**802.11b**

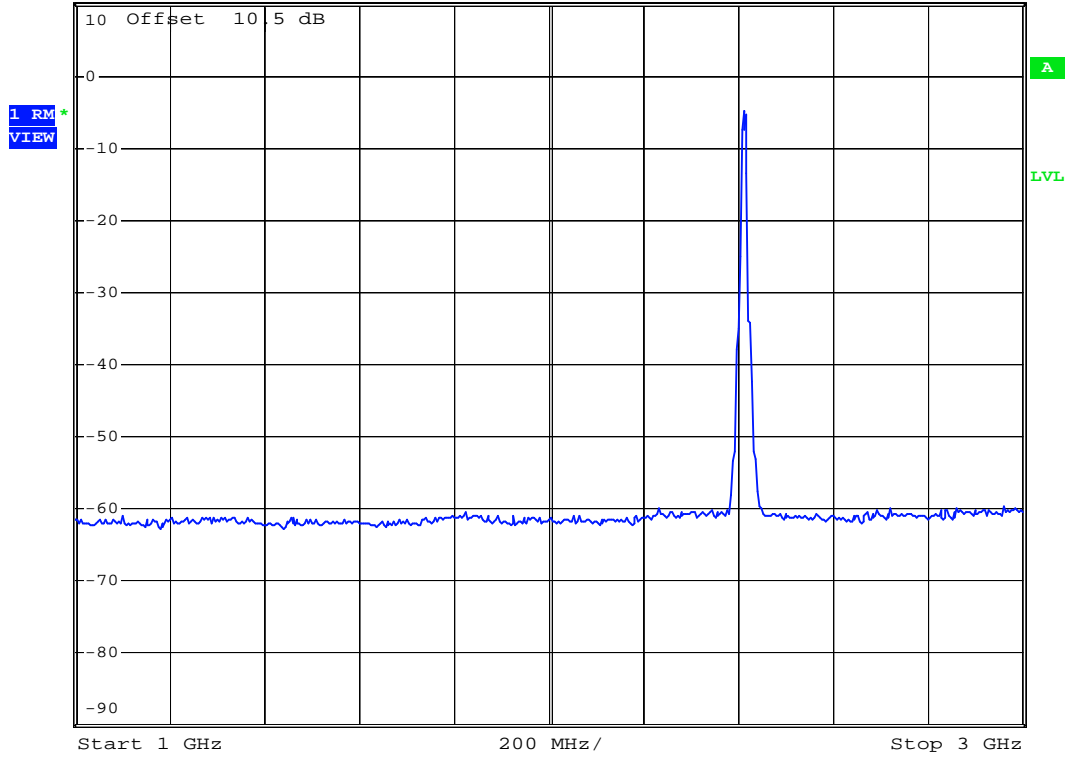


\*RBW 100 kHz  
\*VBW 300 kHz  
SWT 200 ms

Ref 10 dBm

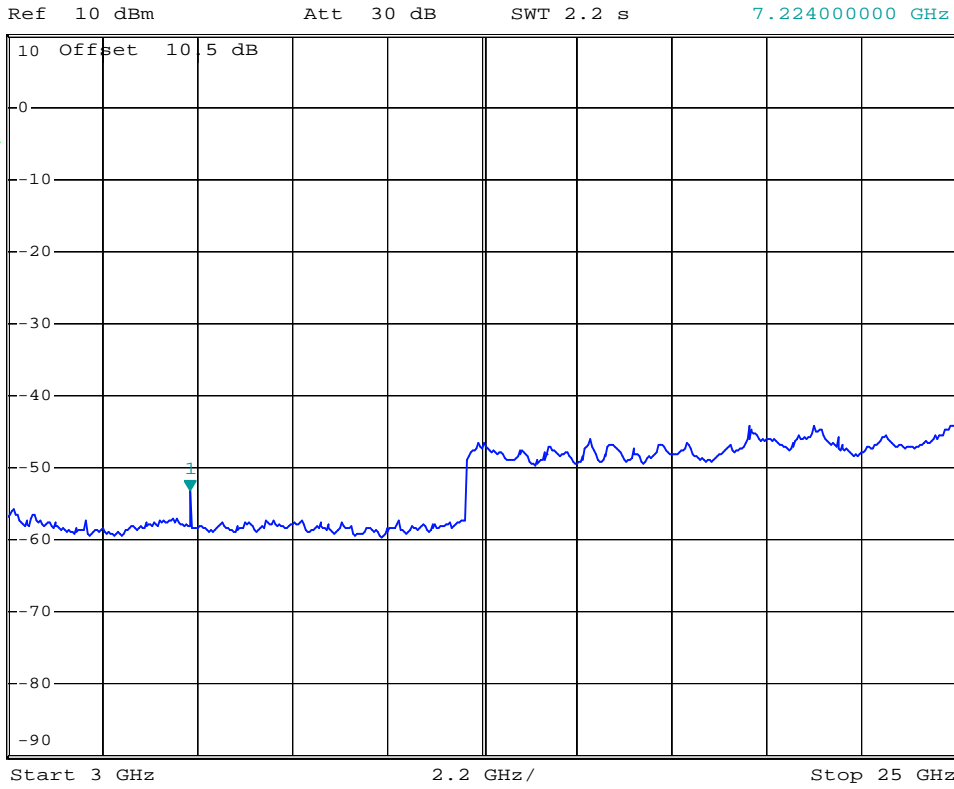
Att 30 dB

SWT 200 ms





\*RBW 100 kHz Marker 1 [T1 ]  
\*VBW 300 kHz -53.03 dBm  
SWT 2.2 s 7.224000000 GHz



**802.11g**

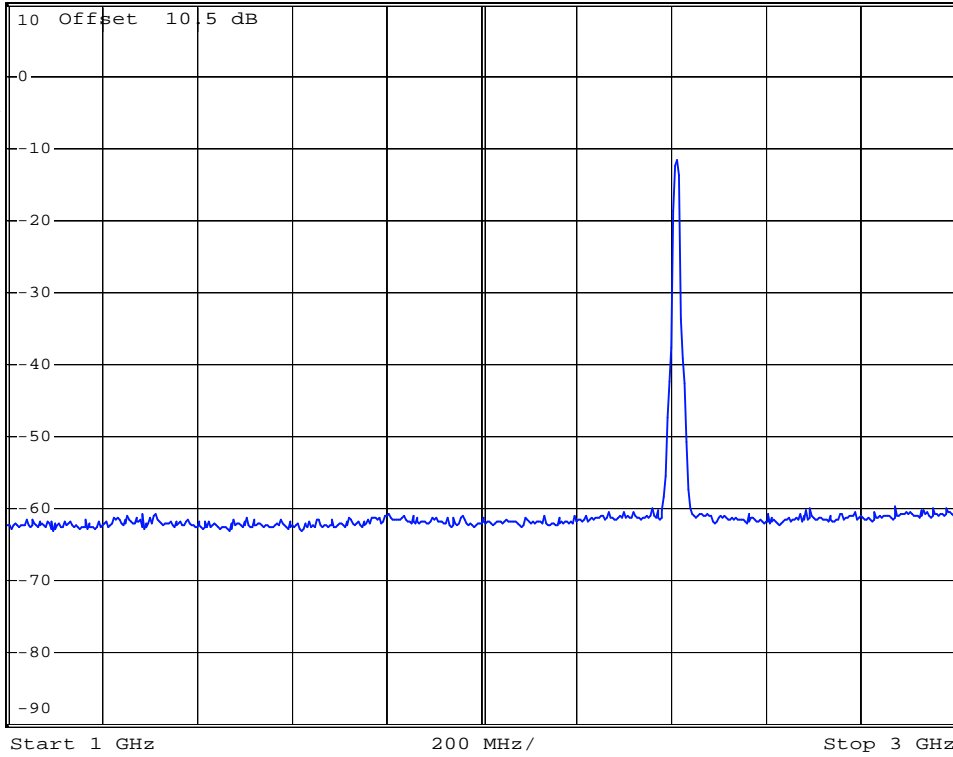


\*RBW 100 kHz  
\*VBW 300 kHz  
SWT 200 ms

Ref 10 dBm

Att 30 dB

1 RM\*  
VIEW





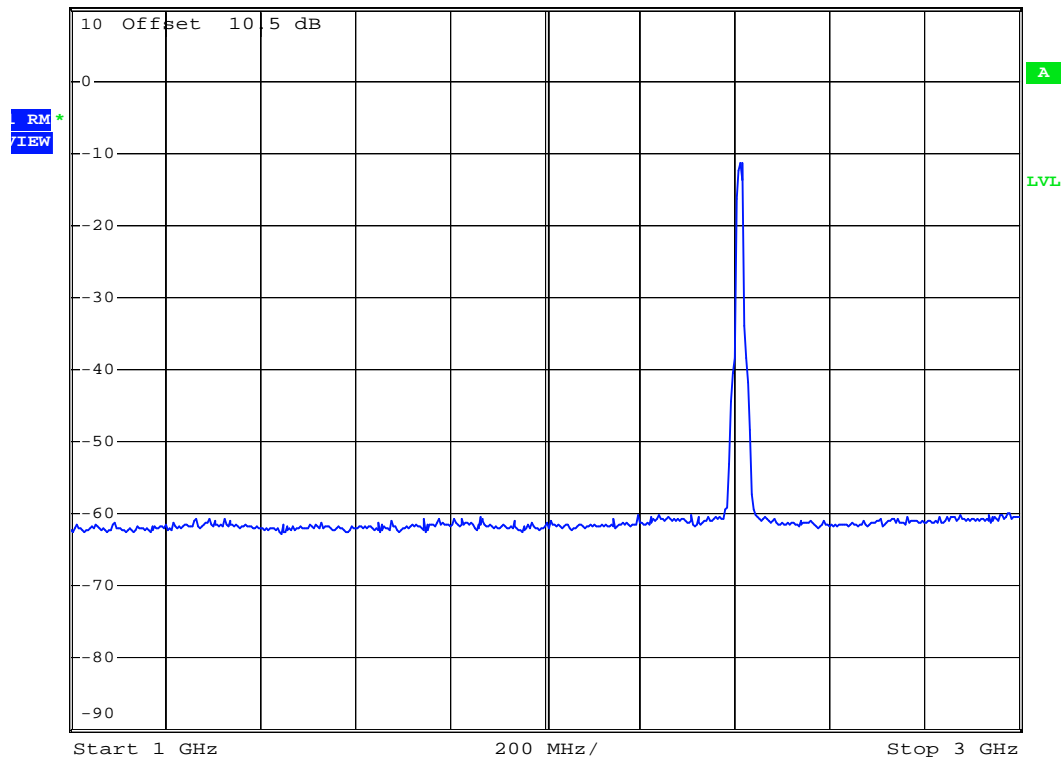


### 802.11n 20M



\* RBW 100 kHz  
\* VBW 300 kHz

Ref 10 dBm      Att 30 dB      SWT 200 ms

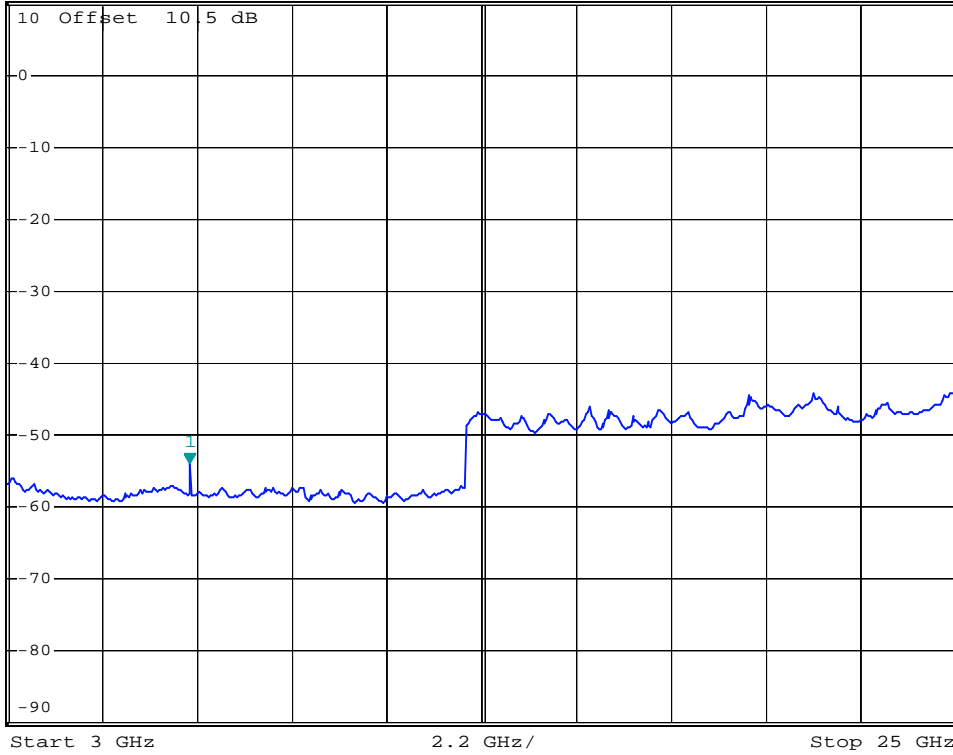




\*RBW 100 kHz Marker 1 [T1 ]  
\*VBW 300 kHz -53.99 dBm  
SWT 2.2 s 7.224000000 GHz

Ref 10 dBm

Att 30 dB

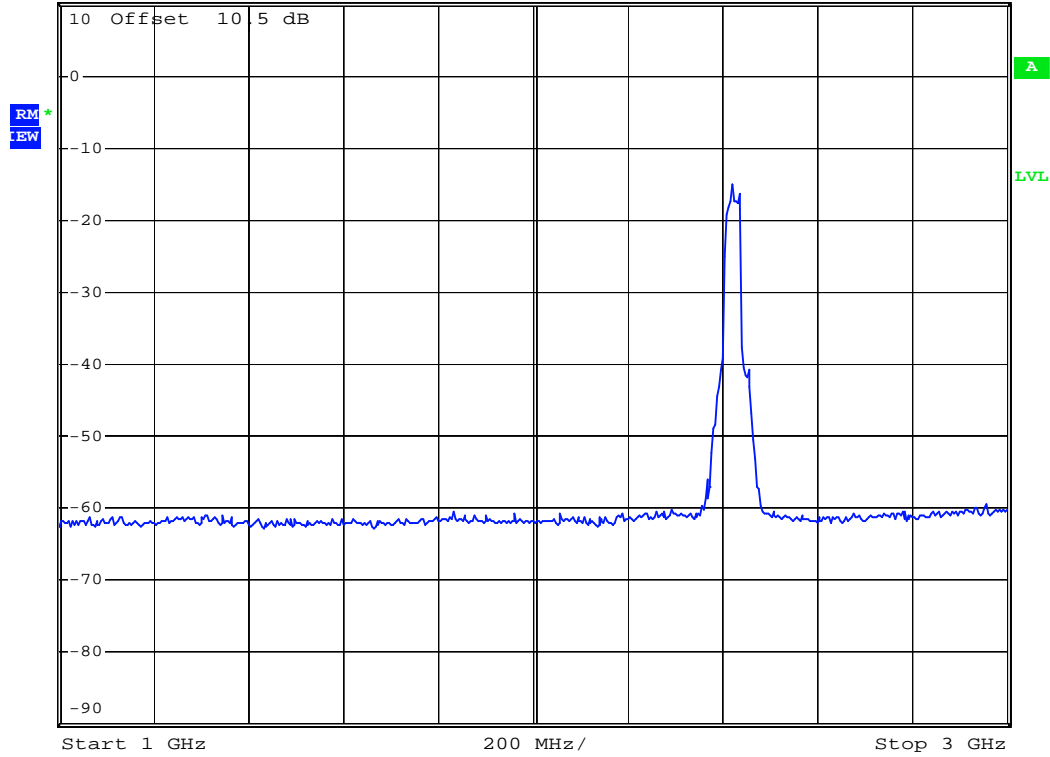


### 802.11n 40M



\*RBW 100 kHz  
\*VBW 300 kHz

Ref 10 dBm      Att 30 dB      SWT 200 ms





\*RBW 100 kHz  
\*VBW 300 kHz  
SWT 2.2 s

Ref 10 dBm

Att 30 dB

SWT 2.2 s

