

ISSUED BY Shenzhen BALUN Technology Co., Ltd.



FOR

## AC750 Wi-Fi Travel Router

ISSUED TO TP-Link Technologies Co., Ltd.

Building 24 (floors 1,3,4,5) and 28 (floors1-4) Central Science and Technology Park, Shennan Rd, Nanshan, Shenzhen, China



Report No.: BL-SZ1760138-601 Tested by: EUT Name: AC750 Wi-Fi Travel Router Model Name: TL-WR902AC Zheng Muyi Brand Name: TP-Link (Engineer) Date Test Standard: 47 CFR Part 15 Subpart C FCC Number: TE7WR902ACV3 Approved by Wei Yanguan Test conclusion: Pass (Chief Engineer) Test Date: Aug. 05, 2017 ~ Aug. 09, 2017 Date Date of Issue: Aug. 29, 2017

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# **Revision History**

Version	Issue Date	Revisions Content
<u>Rev. 01</u>	Aug. 09, 2017	Initial Issue
<u>Rev. 02</u>	<u>Aug. 23, 2017</u>	Update the duty cycle and band-edge on
		<u>page 32, 78~84.</u>
<u>Rev. 03</u>	<u>Aug. 24, 2017</u>	Update the test data of band-edge
<u>Rev. 04</u>	<u>Aug. 29, 2017</u>	Update the test data of band-edge and
		<u>RF output power.</u>

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# **1 ADMINISTRATIVE DATA (GENERAL INFORMATION)**

### **1.1 Identification of the Testing Laboratory**

Company Name	Shenzhen BALUN Technology Co., Ltd.	
Adress	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road,	
Address	Nanshan District, Shenzhen, Guangdong Province, P. R. China	
Phone Number	+86 755 6685 0100	

### **1.2 Identification of the Responsible Testing Location**

Test Location	Shenzhen BALUN Technology Co., Ltd.		
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road,		
	Nanshan District, Shenzhen, Guangdong Province, P. R. China		
	The laboratory has been listed by Industry Canada to perform		
	electromagnetic emission measurements. The recognition numbers of		
	test site are 11524A-1.		
	The laboratory is a testing organizatin accredited by FCC as a accredited		
Accreditation	testing laboratory. The designation number is CN1196.		
	The laboratory is a testing organization accredited by American		
Certificate	Association for Laboratory Accreditation(A2LA) according to ISO/IEC		
	17025.The accreditation certificate is 4344.01.		
	The laboratory is a testing organization accredited by China National		
	Accreditation Service for Conformity Assessment (CNAS) according to		
	ISO/IEC 17025. The accreditation certificate number is L6791.		
	All measurement facilities used to collect the measurement data are		
Description	located at Block B, FL 1, Baisha Science and Technology Park, Shahe Xi		
Description	Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China		
	518055		

### **1.3 Laboratory Condition**

Ambient Temperature	20 to 25°C
Ambient Relative Humidity	45% - 55%
Ambient Pressure	100 kPa - 102 kPa

### 1.4 Announce

- (1) The test report reference to the report template version v6.1.
- (2) The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.
- (3) The test report is invalid if there is any evidence and/or falsification.
- (4) The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein.
- (5) This document may not be altered or revised in any way unless done so by BALUN and all revisions are duly noted in the revisions section.
- (6) Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.



# **2 PRODUCT INFORMATION**

### **2.1 Applicant Information**

Applicant TP-Link Technologies Co., Ltd.	
Addross	Building 24 (floors 1,3,4,5) and 28 (floors1-4) Central Science and
Address	Technology Park, Shennan Rd, Nanshan, Shenzhen, China

## 2.2 Manufacturer Information

Manufacturer	TP-Link Technologies Co., Ltd.	
Address	Building 24 (floors 1,3,4,5) and 28 (floors1-4) Central Science and	
Auuress	Technology Park, Shennan Rd, Nanshan, Shenzhen, China	

# 2.3 Factory Information

Factory	N/A
Address	N/A

# 2.4 General Description for Equipment under Test (EUT)

EUT Type	AC750 Wi-Fi Travel Router	
Model Name Under Test	TL-WR902AC	
Series Model Name	N/A	
Description of Model name differentiation	N/A	
Hardware Version	N/A	
Software Version	N/A	
Dimensions (Approx.)	N/A	
Weight (Approx.)	N/A	
Network and Wireless connectivity	WIFI 802.11a,802.11b, 802.11g and 802.11n (HT20/40), 802.11ac	

## 2.5 Ancillary Equipment

Ancillary Equipment 3	Charger 1	
	Brand Name	N/A
	Model Name	AMS135-0502000FU
	Rated Input	100-240 V ~, 50/60 Hz, 0.5 A
	Rated Output	5.0 V =, 2.0 A



# **2.6 Technical Information**

The requirement for the following technical information of the EUT was tested in this report:

	•	•
Frequency Range		802.11b/g/n(20 MHz): 2.412 GHz - 2.462 GHz $f_c = 2412$ MHz + (N-1)*5 MHz, where - $f_c =$ "Operating Frequency" in MHz, - N = "Channel Number" with the range from 1 to 11. 802.11n(40 MHz): 2.422 GHz - 2.452 GHz $f_c = 2412$ MHz + (N-1)*5 MHz, where - $f_c =$ "Operating Frequency" in MHz, - N = "Channel Number" with the range from 3 to 9.
Modulation		DSSS, OFDM
Product Typ		Indoor Access Point
Antenna Sy Smart Anten	ystem (eg., MIMO, ina)	ΜΙΜΟ
Categorization as Correlated or Completely Uncorrelated		Categorization as Correlated
Antenna Type	Antenna 0 (ANT 0) Antenna 1 (ANT 1)	Omni-Directional Antenna
Antenna	Antenna 0 (ANT 0)	2.66 dBi
Gain	Antenna 1 (ANT 1)	3.33 dBi
Total	For power spectral density(PSD) measurements	6.34 dBi Formulas: Directional gain = $G_{ANT}$ + Array Gain, Array Gain = 10 log(N <sub>ANT</sub> /Nss) dB. Nss =1, G <sub>ANT</sub> set equal to the gain of the antenna having the highest gain.
directional gain	For power measurements	3.33 dBi Formulas: Directional gain = $G_{ANT}$ + Array Gain, Array $Gain = 0$ , $G_{ANT}$ set equal to the gain of the antenna having the highest gain.
About the Pr	roduct	Only the WIFI 802.11b, 802.11g and 802.11n (HT20/40) was tested in this report.

	Antenna					
Mode	Antenna 0	Antenna 1	Antenna 0 + Antenna1			
802.11b	$\checkmark$	$\checkmark$	$\checkmark$			
802.11g	$\checkmark$	$\checkmark$	$\checkmark$			
802.11n20	$\checkmark$	$\checkmark$	$\checkmark$			
802.11n40	$\checkmark$	$\checkmark$	$\checkmark$			
Note: All the configurations were tested, but only the Antenna 0 + Antenna1 was reported in						
this report.						



Modulation technology	Modulation Type	Transfer Rate (Mbps)	
		800 ns GI	400 ns GI
	DBPSK	1	
DSSS (802.11b)	DQPSK	2	
	ССК	5.5/ 11	
	BPSK	6 / 9	
	QPSK	12 / 18	
OFDM (802.11g)	16QAM	24 / 36	
	64QAM	48 / 54	
	BPSK	6.5	7.2
OFDM	QPSK	13/19.5	14.4/21.7
(802.11n-20MHz)	16QAM	26/39	28.9/43.3
	64QAM	52/58.5/65	57.8/65/72.2
	BPSK	13.5	15
OFDM	QPSK	27/40.5	30/45
(802.11n-40MHz)	16QAM	54/81/108	60/90/120
	64QAM	121.5/135	135/150

Note: Preliminary tests were performed in different data rate in above table to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Test Items	Mode	Data Rate	Char	nnel
Output Power	11b/11g/11n20/11n40	1/6/6.5/13.5 Mbps	1/6/11	3/6/9
6dB Bandwidth	11b/11g/11n20/11n40	1/6/6.5/13.5 Mbps	1/6/11	3/6/9
Conducted Spurious Emission	11b/11g/11n20/11n40	1/6/6.5/13.5 Mbps	1/6/11	3/6/9
Conducted Emission	11b/11g/11n20/11n40	1/6/6.5/13.5 Mbps	1/6/11	3/6/9
Radiated Spurious Emission	11b/11g/11n20/11n40	1/6/6.5/13.5 Mbps	1/6/11	3/6/9
Band Edge	11b/11g/11n20/11n40	1/6/6.5/13.5 Mbps	1/2/3/9/1 0/11	3/4/8/9
Power spectral density (PSD)	11b/11g/11n20/11n40	1/6/6.5/13.5 Mbps	1/6/11	3/6/9

Note: The above EUT information in section 2.4 and 2.6 was declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.



# 2.7 Additional Instructions

#### EUT Software Settings:

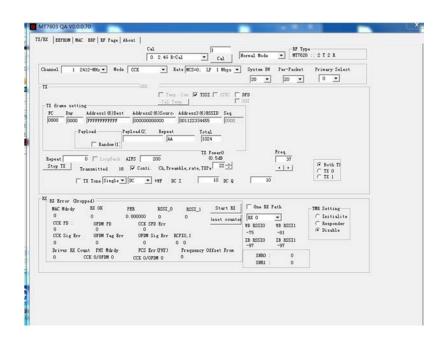
		$\square$	Special software is used.
	Mode		The software provided by client to enable the EUT under
			transmission condition continuously at specific channel
			frequencies individually.

During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

#### EUT Software Settings:

Power level setup in so	Power level setup in software					
Test Software Version	MT7603 C	QA V0.0.0.7	70			
Mode		Channel Soft Set				
802.11 b	CH1	CH6	CH11	25	29	22
802.11 g	CH1	CH6	CH11	1D	2A	1D
802.11 n20	CH1	CH6	CH11	1D	2A	1D
802.11 n40	CH3	CH6	CH9	12	19	13

Run software:





# **3 SUMMARY OF TEST RESULTS**

# 3.1 Test Standards

No.	Identity	Document Title
	47 CFR Part 15,	
1	Subpart C	Miscellaneous Wireless Communications Services
	(10-1-15 Edition)	
2	KDB Publication	Guidance for Performing Compliance Measurements on Digital
2	558074 D01v04	Transmission Systems (DTS) Operating Under §15.247
3	KDB Publication	Emissions Testing of Transmitters with Multiple Outputs in the Same Band
3	662911 D01v02r01	(e.g., MIMO, Smart Antenna, etc)
4	ANSI C63.10-2013	American National Standard of Procedures for Compliance Testing of
4	ANSI C03.10-2013	Unlicensed Wireless Devices

# 3.2 Verdict

No.	Description	FCC PART No.	Test Result	Verdict		
1	Antenna Requirement	15.203; 15.247(b)	N/A	Pass <sup>Note 1</sup>		
2	Output Power	15.247(b)	ANNEX A.1	Pass		
3	6dB Bandwidth	15.247(a)	ANNEX A.2	Pass		
4	Conducted Spurious Emission	15.247(d)	ANNEX A.3	Pass		
5	Band Edge(Authorized-band band-edge)	15.209; 15.247(d)	ANNEX A.4	Pass		
6	Conducted Emission	15.207	ANNEX A.5	Pass		
7	Radiated Spurious Emission	15.209; 15.247(d)	ANNEX A.6	Pass		
8	8 Band Edge(Restricted-band band-edge) 15.209; 15.247(d) ANNEX A.7 Pass					
9	Power spectral density (PSD)	15.247(e)	ANNEX A.8	Pass		
Note <sup>1</sup> : P	lease refer to section 5.1.			•		



# **4 GENERAL TEST CONFIGURATIONS**

## **4.1 Test Environments**

During the measurement, the normal environmental conditions were within the listed ranges:

Relative Humidity	45% - 55%		
Atmospheric Pressure	100 kPa - 102 kPa		
Temperature	NT (Normal Temperature)	+22°C to +25°C	
Working Voltage of the EUT	NV (Normal Voltage)	120 V	

# 4.2 Test Equipment List

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	ROHDE&SCHWARZ	FSV-30	103118	2017.06.22	2018.06.21
Switch Unit with OSP- B157	ROHDE&SCHWARZ	OSP120	101270	2017.06.22	2018.06.21
EMI Receiver	KEYSIGHT	N9038A	MY53220118	2016.09.09	2017.09.08
EMI Receiver	ROHDE&SCHWARZ	ESRP	101036	2017.06.22	2018.06.21
LISN	SCHWARZBECK	NSLK 8127	8127-687	2017.06.22	2018.06.21
Bluetooth Tester	ROHDE&SCHWARZ	CBT	101005	2017.06.22	2018.06.21
Power Splitter	KMW	DCPD-LDC	1305003215		
Power Sensor	ROHDE&SCHWARZ	NRP-Z21	103971	2017.06.22	2018.06.21
Attenuator (20 dB)	KMW	ZA-S1-201	110617091		
Attenuator (6 dB)	KMW	ZA-S1-61	1305003189		
DC Power Supply	ROHDE&SCHWARZ	HMP2020	018141664	2017.06.22	2018.06.21
Temperature Chamber	ANGELANTIONI SCIENCE	NTH64-40A	1310	2017.06.22	2018.06.21
Test Antenna- Loop(9 kHz-30 MHz)	SCHWARZBECK	FMZB 1519	1519-037	2017.06.22	2018.06.21
Test Antenna- Bi-Log(30 MHz-3 GHz)	SCHWARZBECK	VULB 9163	9163-624	2017.06.22	2018.06.21
Test Antenna- Horn(1-18 GHz)	SCHWARZBECK	BBHA 9120D	9120D-1148	2017.06.22	2018.06.21
Test Antenna- Horn(15-26.5 GHz)	SCHWARZBECK	BBHA 9170	9170-305	2017.06.22	2018.06.21
Anechoic Chamber	RAINFORD	9m*6m*6m	N/A	2017.02.24	2019.02.23
Anechoic Chamber	EMC Electronic Co., Ltd	20.10*11.60 *7.35m	N/A	2016.08.09	2018.08.08
Shielded Enclosure	ChangNing	CN-130701	130703		
Signal Generator	ROHDE&SCHWARZ	SMB100A	177746	2017.06.22	2018.06.21
Power Amplifier	OPHIR RF	5225F	1037	2017.02.17	2018.02.16
Power Amplifier	OPHIR RF	5273F	1016	2017.02.17	2018.02.16
Directional Coupler	Werlantone	C5982-10	109275	N/A	N/A
Directional Coupler	Werlantone	CHP-273E	S00801z-01	N/A	N/A
Feld Strength Meter	Narda	EP601	511WX51129	2017.02.23	2018.02.22



Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Mouth Simulator	B&K	4227	2423931	2016.11.15	2017.11.14
Sound Calibrator	B&K	4231	2430337	2016.11.09	2017.11.08
Sound Level Meter	B&K	NL-20	00844023	2016.11.11	2017.11.10
Ear Simulator	B&K	4185	2409449	2016.11.15	2017.11.14
Ear Simulator	B&K	4195	2418189	2016.11.15	2017.11.14
Audio analyzer	B&K	UPL 16	100129	2016.11.08	2017.11.07
Network Card	N/A	ZM30	N/A	N/A	N/A



### 4.3 Measurement Uncertainty

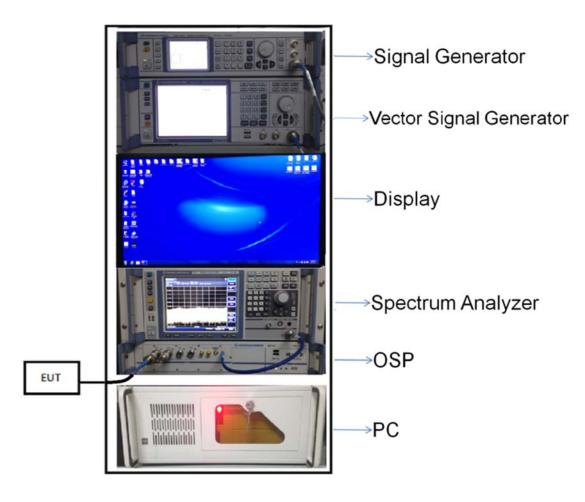
The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2.

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Measurement	Value
Occupied Channel Bandwidth	±4%
RF output power, conducted	±1.4 dB
Power Spectral Density, conducted	±2.5 dB
Unwanted Emissions, conducted	±2.8 dB
All emissions, radiated	±5.4 dB
Temperature	±1°C
Humidity	±4%

### 4.4 Description of Test Setup

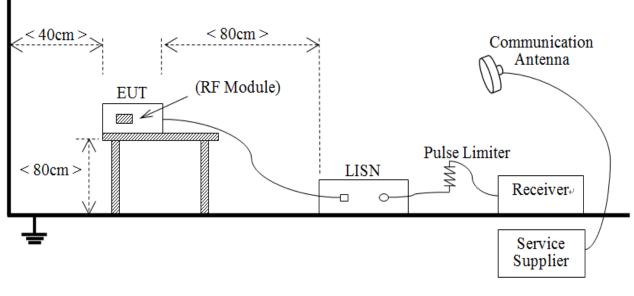
4.4.1 For Antenna Port Test



(Diagram 1)

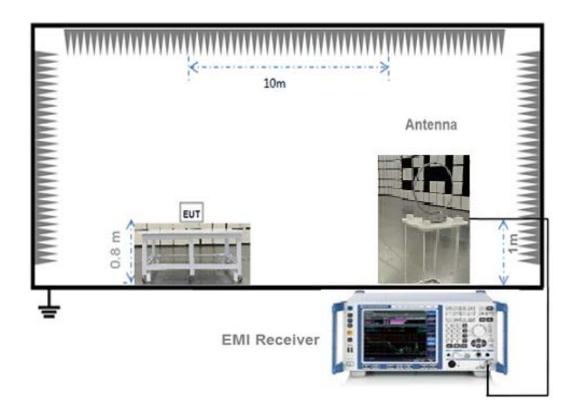


### 4.4.2 For AC Power Supply Port Test





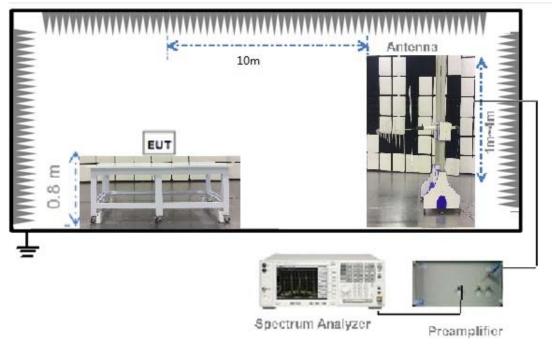
4.4.3 For Radiated Test (Below 30 MHz)



### (Diagram 3)

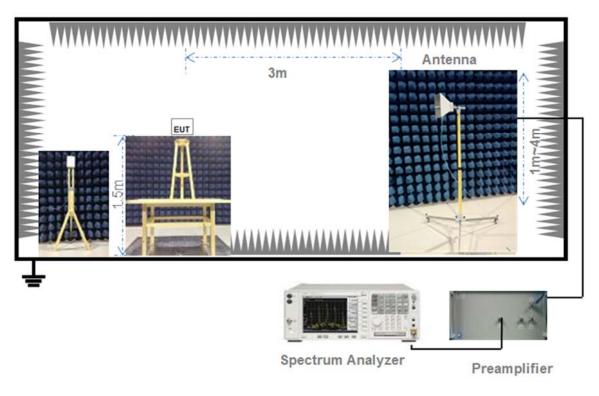


### 4.4.4 For Radiated Test (30 MHz-1 GHz)



(Diagram 4)

4.4.5 For Radiated Test (Above 1 GHz)







### 4.5 Measurement Results Explanation Example

4.5.1 For conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

4.5.2 For radiated band edges and spurious emission test:

E = EIRP - 20log D + 104.8

Where:

E = electric field strength in  $dB\mu V/m$ ,

EIRP = equivalent isotropic radiated power in dBm

D = specified measurement distance in meters.

EIRP= Measure Conducted output power Value (dBm) + Maximum transmit antenna gain (dBi) + the appropriate maximum ground reflection factor (dB)





# 5 TEST ITEMS

## 5.1 Antenna Requirements

### 5.1.1 Standard Applicable

### FCC §15.203 & 15.247(b); RSS-247, 5.4 (6)

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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of § 15.211, § 15.213, § 15.217, § 15.219, or § 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

If directional gain of transmitting antennas is greater than 6 dBi, the power shall be reduced by the same level in dB comparing to gain minus 6 dBi. For the fixed point-to-point operation, the power shall be reduced by one dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the FCC rule.

### 5.1.2 Antenna Anti-Replacement Construction

I	he Antenna Anti-Replacement as following method:								
	Protected Method	Description							
	The antenna is An embedded-in	An embedded-in antenna design is used.							
		Omni-Directional Antenna							
	Reference Documents	Item							
	Photo	RF Chip							

The Antenna Anti-Replacement as following method:

### 5.1.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.



### 5.2 Output Power

#### 5.2.1 Test Limit

FCC § 15.247(b); RSS-247, 5.4 (4)

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antennas and antennas and antennas and antennas elements.

#### 5.2.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

#### 5.2.3 Test Procedure

#### Maximum peak conducted output power

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

#### Maximum conducted (average) output power (Reporting Only)

a) As an alternative to spectrum analyzer or EMI receiver measurements, measurements may be performed

using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied.

1) The EUT is configured to transmit continuously, or to transmit with a constant duty factor.

2) At all times when the EUT is transmitting, it shall be transmitting at its maximum power control level.

3) The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a

factor of five.

b) If the transmitter does not transmit continuously, measure the duty cycle (x) of the transmitter output signal as

described in Section 6.0.

c) Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.

d) Adjust the measurement in dBm by adding 10log (1/x), where x is the duty cycle to the measurement result.

#### Measurements of duty cycle

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal.

Set the center frequency of the instrument to the center frequency of the transmission.



Set RBW  $\geq$  OBW if possible; otherwise, set RBW to the largest available value.

Set VBW  $\geq$  RBW. Set detector = peak or average.

The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T  $\leq$  16.7 microseconds.)

5.2.4 Test Result

Please refer to ANNEX A.1.



### 5.36dB Bandwidth

5.3.1 Limit

FCC §15.247(a); RSS-GEN, 6.6

Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW. The 6 dB bandwidth must be greater than 500 kHz.

5.3.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.3.3 Test Procedure

Use the following spectrum analyzer settings:

Set RBW = 100 kHz.

Set the video bandwidth (VBW)  $\geq$  3 RBW.

Detector = Peak.

Trace mode = max hold.

Sweep = auto couple.

Allow the trace to stabilize.

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

5.3.4 Test Result

Please refer to ANNEX A.2.



## 5.4 Conducted Spurious Emission

### 5.4.1 Limit

FCC §15.247(d); RSS-247, 5.5

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 30 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.

### 5.4.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

### 5.4.3 Test Procedure

The DTS rules specify that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions:

a) If the maximum peak conducted output power procedure was used to demonstrate compliance as described in 9.1, then the peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 20 dBc).

 b) If maximum conducted (average) output power was used to demonstrate compliance as described in 9.2, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 30 dBc).

c) In either case, attenuation to levels below the 15.209 general radiated emissions limits is not required.

The following procedures shall be used to demonstrate compliance to these limits. Note that these procedures can be used in either an antenna-port conducted or radiated test set-up. Radiated tests must conform to the test site requirements and utilize maximization procedures defined herein.

#### Reference level measurement

Establish a reference level by using the following procedure:

Set instrument center frequency to DTS channel center frequency.

Set the span to  $\geq$  1.5 times the DTS bandwidth.

Set the RBW = 100 kHz.

Set the VBW  $\geq$  3 x RBW.

- Detector = peak.
- Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum PSD level.



#### Emission level measurement

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.

Set the RBW = 100 kHz.

Set the VBW  $\geq$  3 x RBW.

Detector = peak.

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

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

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in 11.1 a) or 11.1 b). Report the three highest emissions relative to the limit.

5.4.4 Test Result

Please refer to ANNEX A.3.





### 5.5 Band Edge (Authorized-band band-edge)

#### 5.5.1 Limit

FCC §15.247(d); RSS-GEN, 8.9, RSS-247, 5.5

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.

#### 5.5.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

#### 5.5.3 Test Procedure

The following procedures may be used to determine the peak or average field strength or power of an unwanted emission that is within 2 MHz of the authorized band edge. If a peak detector is utilized, use the procedure described in 13.2.1. Use the procedure described in 13.2.2 when using an average detector and the EUT can be configured to transmit continuously (i.e., duty cycle  $\geq$  98%). Use the procedure described in 13.2.3 when using an average detector and the EUT cannot be configured to transmit continuously but the duty cycle is constant (i.e., duty cycle variations are less than ± 2 percent). Use the procedure described in 13.2.4 when using an average detector for those cases where the EUT cannot be configured to transmit continuously and the duty cycle is not constant (duty cycle variations equal or exceed 2 percent).

When using a peak detector to measure unwanted emissions at or near the band edge (within 2 MHz of the authorized band), the following integration procedure can be used.

Set instrument center frequency to the frequency of the emission to be measured (must be within 2 MHz of the authorized band edge).

Set span to 2 MHz

RBW = 100 kHz.

VBW  $\geq$  3 x RBW.

Detector = peak.

Sweep time = auto.

Trace mode = max hold.

Allow sweep to continue until the trace stabilizes (required measurement time may increase for low duty cycle applications)

Compute the power by integrating the spectrum over 1 MHz using the analyzer's band power measurement function with band limits set equal to the emission frequency (femission)  $\pm$  0.5 MHz. If the instrument does not have a band power function, then sum the amplitude levels (in power units) at 100 kHz intervals extending across the 1 MHz spectrum defined by femission  $\pm$  0.5 MHz.

Standard method(The 99% OBW of the fundamental emission is without 2 MHz of the authorized band):

Span: Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products that fall outside of the authorized band of operation.



Reference level: As required to keep the signal from exceeding the maximum instrument input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2.

Attenuation: Auto (at least 10 dB preferred).

Sweep time: Coupled.

Resolution bandwidth: 100 kHz.

Video bandwidth: 300 kHz.

Detector: Peak.

Trace: Max hold.

5.5.4 Test Result

Please refer to ANNEX A.4.



# 5.6 Conducted Emission

### 5.6.1 Limit

### FCC §15.207; RSS-GEN, 8.8

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 within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a  $50\mu$ H/50 $\Omega$  line impedance stabilization network (LISN).

Frequency range	Conducted Limit (dBµV)					
(MHz)	Quai-peak	Average				
0.15 - 0.50	66 to 56	56 to 46				
0.50 - 5	56	46				
0.50 - 30	60	50				

### 5.6.2 Test Setup

See section 4.4.2 for test setup description for the AC power supply port. The photo of test setup please refer to ANNEX B.

#### 5.6.3 Test Procedure

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.

Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a nominal 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz) for which the device is capable of operation. A device rated for 50/60 Hz operation need not be tested at both frequencies provided the radiated and line conducted emissions are the same at both frequencies.

#### 5.6.4 Test Result

Please refer to ANNEX A.5.



## 5.7 Radiated Spurious Emission

### 5.7.1 Limit

FCC §15.209&15.247(c); RSS-247, 5.5

Radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (µV/m)	Measurement Distance (m)	
0.009 - 0.490	2400/F(kHz)	300	
0.490 - 1.705	24000/F(kHz)	30	
1.705 - 30.0	30	30	
30 - 88	100	3	
88 - 216	150	3	
216 - 960	200	3	
Above 960	500	3	

Note:

- 1. For Above 1000 MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
- 2. For above 1000 MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK).

#### 5.7.2 Test Setup

See section 4.4.3 to 4.4.5 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

#### 5.7.3 Test Procedure

Since the emission limits are specified in terms of radiated field strength levels, measurements performed to demonstrate compliance have traditionally relied on a radiated test configuration. Radiated measurements remain the principal method for demonstrating compliance to the specified limits; however antenna-port conducted measurements are also now acceptable to demonstrate compliance (see below for details). When radiated measurements are utilized, test site requirements and procedures for maximizing and measuring radiated emissions that are described in ANSI C63.10 shall be followed.

Antenna-port conducted measurements may also be used as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands. If conducted measurements are performed, then proper impedance matching must be ensured and an additional radiated test for cabinet/case spurious emissions is required.

#### General Procedure for conducted measurements in restricted bands

a) Measure the conducted output power (in dBm) using the detector specified (see guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).



b) Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see guidance on determining the applicable antenna gain)

c) Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies  $\leq$  30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000 MHz).

d) For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW).

e) Convert the resultant EIRP level to an equivalent electric field strength using the following relationship:

#### E = EIRP - 20log D + 104.8

where:

E = electric field strength in  $dB\mu V/m$ ,

EIRP = equivalent isotropic radiated power in dBm

D = specified measurement distance in meters.

f) Compare the resultant electric field strength level to the applicable limit.

g) Perform radiated spurious emission test.

#### Quasi-Peak measurement procedure

The specifications for measurements using the CISPR quasi-peak detector can be found in Publication 16 of the International Special Committee on Radio Frequency Interference (CISPR) of the International Electrotechnical Commission.

As an alternative to CISPR quasi-peak measurement, compliance can be demonstrated to the applicable emission limits using a peak detector.

#### Peak power measurement procedure

Peak emission levels are measured by setting the instrument as follows:

a) RBW = as specified in Table 1.

b) VBW  $\geq$  3 x RBW.

- c) Detector = Peak.
- d) Sweep time = auto.

e) Trace mode = max hold.

f) Allow sweeps to continue until the trace stabilizes. (Note that the required measurement time may be longer for low duty cycle applications).

Table 1—RBW as a function of frequency

Frequency	RBW
9-150 kHz	200-300 Hz
0.15-30 MHz	9-10 kHz
30-1000 MHz	100-120 kHz



> 1000 MHz

1 MHz

If the peak-detected amplitude can be shown to comply with the average limit, then it is not necessary to perform a separate average measurement.

Trace averaging across on and off times of the EUT transmissions followed by duty cycle correction

If continuous transmission of the EUT (i.e., duty cycle  $\geq$  98 percent) cannot be achieved and the duty cycle is constant (i.e., duty cycle variations are less than ± 2 percent), then the following procedure shall be used:

a) The EUT shall be configured to operate at the maximum achievable duty cycle.

b) Measure the duty cycle, x, of the transmitter output signal as described in section 6.0.

c) RBW = 1 MHz (unless otherwise specified).

d) VBW  $\geq$  3 x RBW.

e) Detector = RMS, if span/(# of points in sweep)  $\leq$  (RBW/2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.

f) Averaging type = power (i.e., RMS).

As an alternative, the detector and averaging type may be set for linear voltage averaging.

2) Some instruments require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.

g) Sweep time = auto.

h) Perform a trace average of at least 100 traces.

i) A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:

1) If power averaging (RMS) mode was used in step f), then the applicable correction factor is  $10 \log(1/x)$ , where x is the duty cycle.

2) If linear voltage averaging mode was used in step f), then the applicable correction factor is  $20 \log(1/x)$ , where x is the duty cycle.

3) If a specific emission is demonstrated to be continuous (≥ 98 percent duty cycle) rather than turning on and off with the transmit cycle, then no duty cycle correction is required for that emission.

NOTE: Reduction of the measured emission amplitude levels to account for operational duty factor is not permitted. Compliance is based on emission levels occurring during transmission - not on an average across on and off times of the transmitter.

#### Determining the applicable transmit antenna gain

A conducted power measurement will determine the maximum output power associated with a restricted band emission; however, in order to determine the associated EIRP level, the gain of the transmitting antenna (in dBi) must be added to the measured output power (in dBm).



Since the out-of-band characteristics of the EUT transmit antenna will often be unknown, the use of a conservative antenna gain value is necessary. Thus, when determining the EIRP based on the measured conducted power, the upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands, or 2 dBi, whichever is greater. However, for devices that operate in multiple frequency bands while using the same transmit antenna, the highest gain of the antenna within the operating band nearest in frequency to the restricted band emission being measured may be used in lieu of the overall highest gain when the emission is at a frequency that is within 20 percent of the nearest band edge frequency, but in no case shall a value less than 2 dBi be used.

See KDB 662911 for guidance on calculating the additional array gain term when determining the effective antenna gain for a EUT with multiple outputs occupying the same or overlapping frequency ranges in the same band.

#### Radiated spurious emission test

An additional consideration when performing conducted measurements of restricted band emissions is that unwanted emissions radiating from the EUT cabinet, control circuits, power leads, or intermediate circuit elements will likely go undetected in a conducted measurement configuration. To address this concern, a radiated test shall be performed to ensure that emissions emanating from the EUT cabinet (rather than the antenna port) also comply with the applicable limits.

For these cabinet radiated spurious emission measurements the EUT transmit antenna may be replaced with a termination matching the nominal impedance of the antenna. Procedures for performing radiated measurements are specified in ANSI C63.10. All detected emissions shall comply with the applicable limits.

The measurement frequency range is from 30 MHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from 0° to 360°, and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured RBW = 1 MHz for  $f \ge 1$  GHz, 100 kHz for f < 1 GHz VBW  $\ge$  RBW Sweep = auto Detector function = peak Trace = max hold

#### 5.7.4 Test Result

Please refer to ANNEX A.6.



## 5.8 Band Edge (Restricted-band band-edge)

#### 5.8.1 Limit

FCC §15.209&15.247(c); RSS-247, 5.5

Radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

#### 5.8.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

#### 5.8.3 Test Procedure

The measurement frequency range is from 9 kHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from 0° to 360°, and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured RBW = 1 MHz for  $f \ge 1$  GHz, 100 kHz for f < 1 GHz VBW  $\ge$  RBW Sweep = auto Detector function = peak Trace = max hold

For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported, Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

For transmitters operating above 1 GHz repeat the measurement with an average detector.

#### 5.8.4 Test Result

Please refer to ANNEX A.7.



# 5.9 Power Spectral density (PSD)

5.9.1 Limit

FCC §15.247(d); RSS-247, 5.2 (2)

The same method of determining the conducted output power shall be used to determine the power spectral density. If a peak output power is measured, then a peak power spectral density measurement is required. If an average output power is measured, then an average power spectral density measurement should be used.

### 5.9.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

#### 5.9.3 Test Procedure

Set analyzer center frequency to DTS channel center frequency.

Set the span to 1.5 times the DTS bandwidth.

Set the RBW to: 3 kHz  $\leq$  RBW  $\leq$  100 kHz.

Set the VBW  $\geq$  3 RBW.

Detector = peak.

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

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

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

5.9.4 Test Result

Please refer to ANNEX A.8.



# ANNEX A TEST RESULT

# A.1 Output Power

#### Duty Cycle

Test Mode	Duty Cycle	T (ms)	1/T(kHz)
802.11b	100%	-	-
802.11g	100%	-	-
802.11n-20 MHz	100%	-	-
802.11n-40 MHz	100%	-	-

### Average Power Test Data

802.11b Mode:

		Measu	ured Output Average Power					Limit		
Channel	AN	NT 0	AN	NT 1	ANT 0	+ ANT 1	LII	m	Verdict	
	dBm	mW	dBm	mW	dBm	mW	dBm	mW		
CH01	18.87	77.09	18.61	72.61	21.75	149.70			Pass	
CH02	20.22	105.20	20.15	103.51	23.20	208.71			Pass	
CH03	21.12	129.42	20.48	111.69	23.82	241.11			Pass	
CH06	21.09	128.53	20.83	121.06	23.97	249.59	30	30 1000	Pass	
CH09	21.11	129.12	20.52	112.72	23.84	241.84			Pass	
CH10	20.85	121.62	20.34	108.14	23.61	229.76			Pass	
CH11	17.74	59.43	17.16	52.00	20.47	111.43			Pass	

### 802.11g Mode:

		Measu	red Outp	ut Average	Power		Lir	mit	
Channel	ANT 0		ANT 1		ANT 0+ ANT 1		– Limit		Verdict
	dBm	mW	dBm	mW	dBm	mW	dBm	mW	
CH01	15.31	33.96	15.12	32.51	18.23	66.47			Pass
CH02	20.55	113.50	20.21	104.95	23.39	218.46			Pass
CH03	20.86	121.90	20.51	112.46	23.70	234.36			Pass
CH06	21.03	126.77	20.82	120.78	23.94	247.55	30	1000	Pass
CH09	20.8	120.23	20.41	109.90	23.62	230.13			Pass
CH10	20.54	113.24	20.22	105.20	23.39	218.44			Pass
CH11	15.39	34.59	14.88	30.76	18.15	65.35			Pass



#### 802.11n-20 MHz Mode:

	Measured Output		ut Average	Power		- Limit			
Channel	ANT 0		ANT 1		ANT 0+ ANT 1				Verdict
	dBm	mW	dBm	mW	dBm	mW	dBm	mW	
CH01	15.15	32.73	14.99	31.55	18.08	64.28			Pass
CH02	20.62	115.35	20.52	112.72	23.58	228.07			Pass
CH03	20.85	121.62	20.55	113.50	23.71	235.12			Pass
CH06	21.27	133.97	20.86	121.90	24.08	255.87	30	1000	Pass
CH09	20.69	117.22	20.58	114.29	23.65	231.51			Pass
CH10	20.16	103.75	20.22	105.20	23.20	208.95	]		Pass
CH11	15.41	34.75	14.58	28.71	18.03	63.46			Pass

#### 802.11n-40 MHz Mode:

	Measured Output Average Power						Lie	nit	
Channel	AN	NT 0	AN	NT 1	ANT 0	+ ANT 1	LII	m	Verdict
	dBm	mW	dBm	mW	dBm	mW	dBm	mW	
CH03	13.18	20.80	12.76	18.88	15.99	39.68			Pass
CH04	15.74	37.50	15.05	31.99	18.42	69.49			Pass
CH06	16.22	41.88	15.61	36.39	18.94	78.27	30	30 1000	Pass
CH08	15.66	36.81	15.31	33.96	18.50	70.78			Pass
CH09	13.71	23.50	13.14	20.61	16.44	44.10			Pass



# A.2 Bandwidth

#### Test Data

#### 802.11b Mode:

	AN	ГО	AN	IT1	6 dB Bandwidth
Channel	6 dB Bandwidth	99% Bandwidth	6 dB Bandwidth	99% Bandwidth	Limits (kHz)
	(MHz)	(MHz)	(MHz)	(MHz)	
Low	10.162598	14.645441	9.161621	14.703329	≥500
Middle	9.662109	15.340087	9.511963	15.629522	≥500
High	9.662109	14.413893	10.162598	14.819103	≥500

### 802.11g Mode:

	AN	ГО	AN	IT1	6 dB Bandwidth
Channel	6 dB Bandwidth	99% Bandwidth	6 dB Bandwidth	99% Bandwidth	Limits (kHz)
	(MHz)	(MHz)	(MHz)	(MHz)	
Low	16.470703	17.597685	16.420654	17.134588	≥500
Middle	16.420654	25.817656	15.519531	24.891462	≥500
High	16.170166	17.713459	15.819824	17.192475	≥500

#### 802.11n-20MHz Mode:

		AN	ГО	AN	T1	6 dB Bandwidth
	Channel	6 dB Bandwidth	99% Bandwidth	6 dB Bandwidth	99% Bandwidth	Limits (kHz)
		(MHz)	(MHz)	(MHz)	(MHz)	
	Low	17.671875	18.234443	17.671875	18.060781	≥500
ſ	Middle	17.671875	27.033285	17.421631	25.238784	≥500
	High	17.421631	18.29233	17.071289	17.88712	≥500

#### 802.11n-40MHz Mode:

	Channel	ANT0		ANT1		6 dB Bandwidth
		6 dB Bandwidth	99% Bandwidth	6 dB Bandwidth	99% Bandwidth	Limits (kHz)
		(MHz)	(MHz)	(MHz)	(MHz)	
	Low	34.171387	36	29.918701	36.000000	≥500
Ē	Middle	33.921387	36.2	31.169434	36.100000	≥500
	High	34.521484	36.1	34.571533	35.900000	≥500

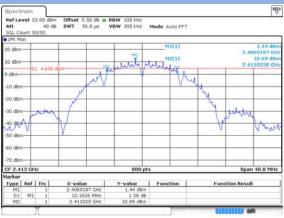


#### Test plots

#### <u>ANT0</u>

#### 6 dB Bandwidth





Date: 5 JUL 2017 10:04:45

#### 802.11b HIGH CHANNEL



Date: 5 JUL 2017 10:11:15

#### 802.11g MIDDLE CHANNEL



Date: 5 JUL 2017 10:19:38





#### 802.11g LOW CHANNEL



Date: 5 JUL 2017 10:13:44

#### 802.11g HIGH CHANNEL



Date: 5 JUL 2017 10:22:27



M1[1]

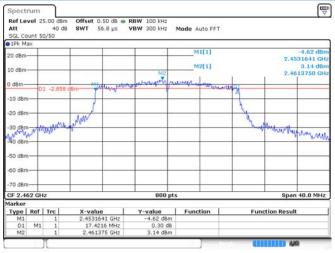
₩

#### 802.11n-20 MHz LOW CHANNEL



Date: 5 JUL 2017 10:24:58

#### 802.11n-20 MHz HIGH CHANNEL



0.53 dBn 2.4281641 GH 20 dBm-M2[1] 9.39 dBm 2.4363750 GHz hour hours and Inpertition 10 dBm-Moundar D1 3.392 0 dBmnon-of many which And Aster Mary Mark al d -30 dBm -40 dBm -50 dBm--60 dBm--70 dBm CF 2.437 GHz 800 pts Span 40.0 MHz larke Y-value 0.53 dB X-value 2.4281641 GHz 17.6719 MHz 2.436375 GHz Type Ref Trc 1 Function Function Result D1 M1 M2 1.23 dE 9.39 dBm dŧ 440 Date: 5 JUL 2017 10:28:28

#### 802.11n-40 MHz LOW CHANNEL

802.11 n-20 MHz MIDDLE CHANNEL

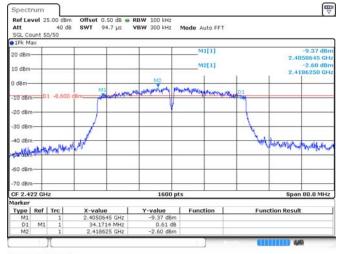
0 dBm Offset 0.50 dB 
 RBW 100 kHz
 40 dB SWT 56.8 µs VBW 300 kHz Mode Auto FFT

Spectrum

Att

Ref Level 25.00 dBm

Count 50/50 SGL Cou 1Pk Max





Date: 5 JUL 2017 10:36:33

Date: 5.JUL 2017 10:34:05



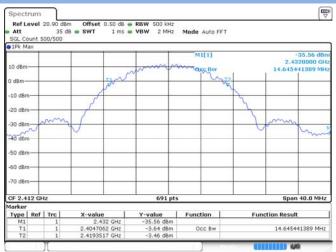
Date: 5 JUL 2017 10:40:46

Date: 5 JUL 2017 10:30:59



## 99% Bandwidth

### 802.11b LOW CHANNEL



Date: 5.JUL 2017 10:04:53

## 802.11b HIGH CHANNEL

Att SGL Co	unt S		dB e SWT		RBW 500 kHz VBW 2 MHz		т	
1Pk M	×				mont	M1[1]		-38.16 dBr 2.4820000 GH 14.413892909 MH
0 dBm—	+		-	JI N		10	UT .	
-10 dBm	+		1	P	+ +		7	
-20 dBm	+		1		-		7	
30 dan	h	m	1	-				mym
40 dBm	+		1	+				
50 dBm	+		-	-				
-60 dBm	+			+			_	
-70 dBm	+		-					
CF 2.46	52 GH	z			691 p	ts		Span 40.0 MHz
larker		I	X-yak		Y-value	Function		tion Result
Type M1	Ref	1		482 GHz	-38,16 dBm		Func	tion Result
T1 T2		1	2.4548	799 GHz 938 GHz	-3.00 dBm -4.46 dBm	Occ Bw		14.413892909 MHz

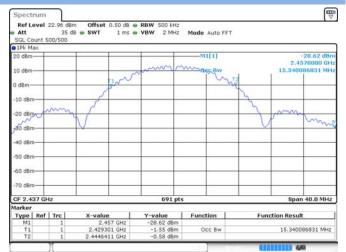
Date: 5.JUL 2017 10:11:24

## 802.11g MIDDLE CHANNEL



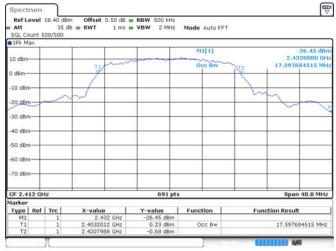
Date: 5.JUL 2017 10:19:47

## 802.11b MIDDLE CHANNEL



Date: 5 JUL 2017 10:07:11

## 802.11g LOW CHANNEL



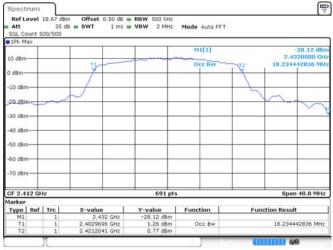
Date: 5.JUL 2017 10:13:53



Date: 5 JUL 2017 10:22:35



## 802.11n-20 MHz LOW CHANNEL



Spectrum 
 Ref Level 23.52 dBm
 Offset 0.50 dB
 RBW 500 kHz

 Att
 35 dB
 SWT
 1 ms
 VBW
 2 MHz

 SGL Count 500/500
 1 ms
 VBW
 2 MHz
 Mode Auto FFT -7.05 dB 2.4570000 GF 27.033285094 MF 20 dBm-10 dBm 0 dBm -10 dBm -20 dBr -30 dBr 40 dBm -50 dBm -60 dBm 70 dBr CF 2.437 GHz 691 pt Span 40.0 MHz 2.457 GHz Y-value Type | Ref | Trc | Function Function Result 2.4236281 GHz 2.4506614 GHz -1.07 dBm -0.71 dBm Occ Bw 27.033285094 MHz T1 T2 440

802.11 n-20 MHz MIDDLE CHANNEL

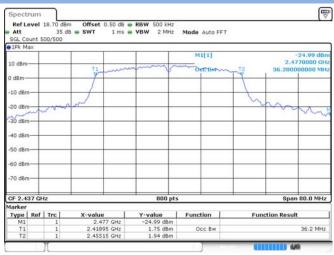
Date: 5 JUL 2017 10:25:07

## 802.11n-20 MHz HIGH CHANNEI



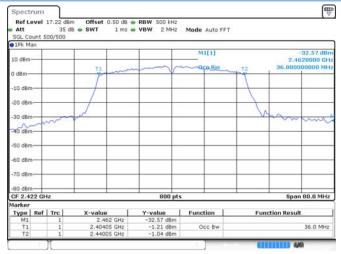
Date: 5.JUL 2017 10:31:08

## 802.11n-40 MHz MIDDLE CHANNEL



Date: 5 JUL 2017 10:36:44

## 802.11n-40 MHz LOW CHANNEL



Date: 5.JUL 2017 10:34:16

Date: 5 JUL 2017 10:28:37

### Spectrum Ref Level 17.16 dBm Offset 0.50 dB RBW 500 kHz Att 35 dB SWT 1 ms VBW 2 MHz SGL Count 500/500 Mode Auto FFT SGL Co 1Pk Ma 34.71 di 10 dBm 2.49 0 dBm--10 dBm -20 dBr -30 dBm 40 dBm -50 dBm -60 dBm -70 dBm -80 dBm CF 2.452 GH Span 80.0 MHz 800 pts larke X-value 2.492 GHz Y-value Type Ref Trc Function Function Result 36.1 MHz -0.54 dBm -0.46 dBm Occ Bw 2.43395 GHz 2.47005 GHz T1 T2

Date: 5 JUL 2017 10:40:57

802.11n-40 MHz HIGH CHANNEL



## <u>ANT1</u>

## 6 dB Bandwidth

## 802.11b LOW CHANNEL



### 802.11b MIDDLE CHANNEL



Date: 5.JUL 2017 10:54:27

### 802.11g LOW CHANNEL



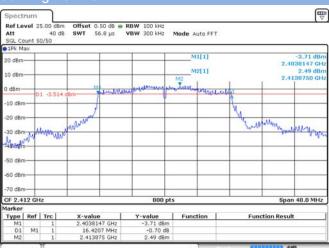
Date: 5.JUL 2017 10:57:15

Date: 5 JUL 2017 10:49:50

## 802.11g MIDDLE CHANNEL

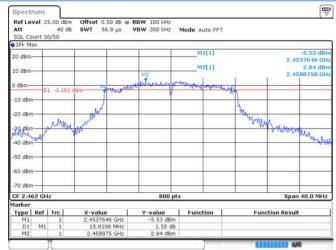


Date: 5.JUL 2017 11:18:16



Date: 5 JUL 2017 11:12:42

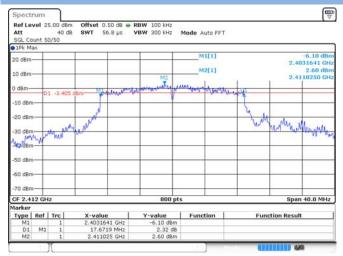
## 802.11g HIGH CHANNEL



Date: 5.JUL 2017 11:20:33

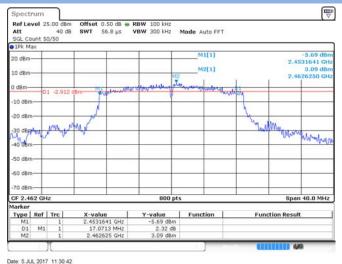


### 802.11n-20 MHz LOW CHANNEL



Date: 5 JUL 2017 11:22:59

## 802.11n-20 MHz HIGH CHANNEL



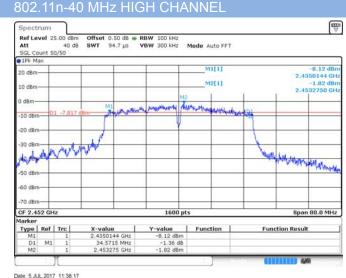
Spectrum 
 Ref Level 25.00 dBm
 Offset
 0.50 dB
 RBW
 100 kHz

 Att
 40 dB
 SWT
 94.7 μs
 VBW 300 kHz
 Mode Auto FFT

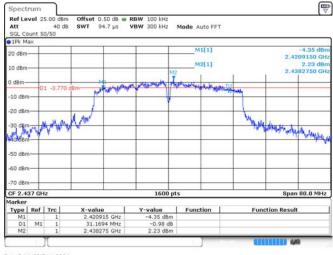
 SGL Count 50/50
 12k Max
 -8.07 dBn 2.4081663 GH -1.13 dBn 2.4207750 GH 20 dBm-M2[1] 10 dBm-0 dBmnortherfy shalling the planta gale Stuchet 01 -7.131 -10 dBm-20 dBm--30 dBm-WHANNER -40 dBm - A A A

-60 dBm -70 dBm CF 2.422 GH 1600 pts Span 80.0 MHz Type | Ref | Trc X-value 2.4081663 GHz 29.9187 MHz 2.420775 GHz Y-value Function Function Result D1 M1 M2 -1.24 dB -1.13 dBm

Date: 5.JUL 2017 11:33:21



802.11n-40 MHz MIDDLE CHANNEL



Date: 5 JUL 2017 11:36:04

802.11 n-20 MHz MIDDLE CHANNEL



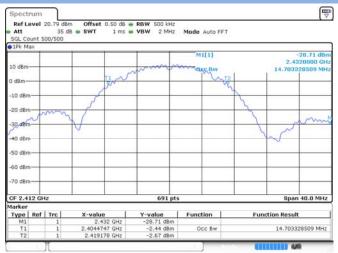
Date: 5.JUL 2017 11:26:03

## 802.11n-40 MHz LOW CHANNEL



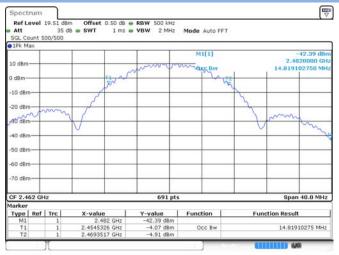
## 99% Bandwidth

## 802.11b LOW CHANNEL



Date: 5 JUL 2017 10:49:59

## 802.11b HIGH CHANNEL



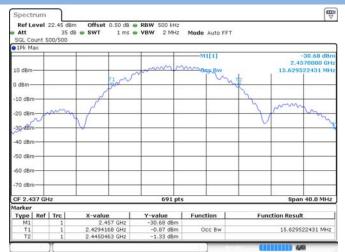
Date: 5 JUL 2017 10:57:24

## 802.11g MIDDLE CHANNEL



Date: 5.JUL 2017 11:18:25

## 802.11b MIDDLE CHANNEL



Date: 5 JUL 2017 10:54:36

## 802.11g LOW CHANNEL

Spectrum 
 Ref Level 18.34 dBm
 Offset 0.50 dB
 RBW 500 kHz

 Att
 35 dB
 SWT
 1 ms
 VBW
 2 MHz

 SGL Count 500/500

 2 MHz
 Mode Auto FFT SGL Cou 1Pk Max M1[1] 20.41 dB 2.4320000 GH 17.134587554 MH 10 dBm 200 ) dBm -10 dBm 20 dBr 30 dBm 40 dBm -50 dBm -60 dBm -70 dBm CF 2.412 G 691 Span 40.0 MHz pt: Y-value Type Ref Trc X-value 2.432 GHz 2.4035485 GHz 2.4206831 GHz Function Function Result T1 T2 0.31 dBm dBm Occ Bw 17.134587554 MHz

Date: 5.JUL 2017 11:12:51



Date: 5.JUL 2017 11:20:42



35.01 dB

00000 MH

Via

Span 80.0 MHz

430

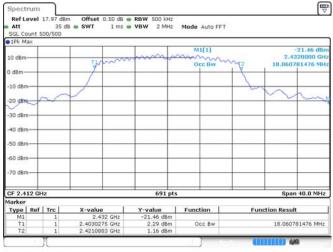
36.0 MHz

Function Result

0 GH

2.4620

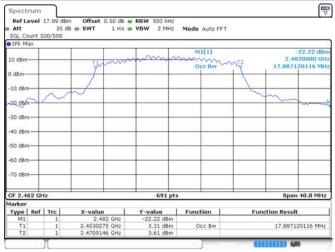
## 802.11n-20 MHz LOW CHANNEL



Spectrum Ref Level 22.80 dBm Offset Att 35 dB SWT SGL Count 500/500 PIPk Max 0.50 dB e RBW 500 kHz 1 ms VBW 2 MHz Mode Auto FFT M1[1] -6.80 dB 2.4570000 GH 238784370 MH 0 dBm m 25.236 10 dBn dBn 10 dB 20 dBm -30 dBm 40 dBm -50 dBm 60 dBn 70 dBm CF 2.437 GHz 691 pts Span 40.0 MHz X-value 2.457 GHz 2.4244964 GHz 2.4497352 GHz Y-value Type | Ref | Trc | Function Function Result -1.68 dBm -0.08 dBm Occ Bw 25.23878437 MHz T1 T2 440

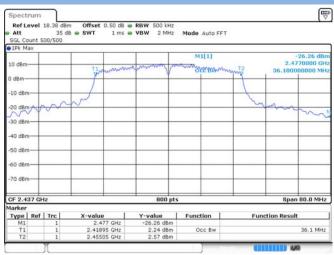
802.11 n-20 MHz MIDDLE CHANNEL

Date: 5 JUL 2017 11:23:08



Date: 5.JUL 2017 11:30:51

## 802.11n-40 MHz MIDDLE CHANNEL



Date: 5.JUL 2017 11:38:28

## 802.11n-40 MHz HIGH CHANNEL

X-value 2.462 GHz 2.40395 GHz 2.43995 GHz

 
 Ref Level
 16.57
 dBm
 Offset
 0.50
 dB
 RBW
 500
 kHz

 Att
 35
 dB
 SWT
 1
 ms
 VBW
 2
 MHz

 SGL Count
 500/500

 1
 ms
 VBW
 2
 MHz

 IPk
 Max

 </td Mode Auto FFT -34.42 de 2.49200 10 dBm 0 dBm -10 dBm -20 dBm S Sin dam 40 dBm -50 dBm -60 dBm 70 dBm CF 2.452 GH Span 80.0 MHz 800 pts larke X-value 2.492 GHz Y-value Type Ref Trc Function Function Result 35.9 MHz Occ Bw 2.43405 GHz 2.46995 GHz -0.99 dBm -0.51 dBm

201

-0.41 dBm -0.37 dBm

Y-value -35.01 dP

Function

Occ Bw





CF 2.422 GH

Type | Ref | Trc |

Date: 5 JUL 2017 11:33:32

arker

Date: 5.JUL 2017 11:36:15



## A.3 Conducted Spurious Emissions

Test Data

## <u>ANT0</u>

## 802.11b Mode:

Observal	Measured Max. Out of	Limit (	dBm)	
Channel	Band Emission (dBm)	Carrier Level	Calculated 30 dBc Limit	Verdict
Low	-42.95	10.57	-19.43	Pass
Middle	-42.93	13.06	-16.94	Pass
High	-43.23	10.28	-19.72	Pass

## 802.11g Mode:

	Measured Max. Out of	Limit (	dBm)	
Channel	Band Emission (dBm)	Carrier Level	Calculated 30 dBc Limit	Verdict
Low	-42.71	3.34	-26.66	Pass
Middle	-42.75	10.46	-19.54	Pass
High	-42.93	4.29	-25.71	Pass

## 802.11n-20MHz Mode:

	<u>.</u>	Measured Max. Out of	Limit (		
	Channel	Band Emission (dBm)	Carrier Level	Calculated 30 dBc Limit	Verdict
	Low	-42.11	3.68	-26.32	Pass
	Middle	-42.79	9.60	-20.40	Pass
Γ	High	-43.00	3.82	-26.18	Pass

## 802.11n-40MHz Mode:

	Measured Max. Out of	Limit (		
Channel	Band Emission (dBm)	Carrier Level	Calculated 30 dBc Limit	Verdict
Low	-42.65	-2.29	-32.29	Pass
Middle	-42.18	1.61	-28.39	Pass
High	-42.51	-0.84	-30.84	Pass



## ANT1 802.11b Mode:

	Measured Max. Out of	Limit (	dBm)	
Channel	Band Emission (dBm)	Carrier Level	Calculated 30 dBc Limit	Verdict
Low	-42.90	10.14	-19.86	Pass
Middle	-42.53	11.06	-18.94	Pass
High	-43.05	8.59	-21.41	Pass

## 802.11g Mode:

	Measured Max. Out of	Limit (d	dBm)	
Channel	Band Emission (dBm)	Carrier Level	Calculated 30 dBc Limit	Verdict
Low	-41.95	4.62	-25.38	Pass
Middle	-43.18	9.16	-20.84	Pass
High	-42.42	3.54	-26.46	Pass

## 802.11n-20MHz Mode:

Ohanad	Measured Max. Out of	Limit (	dBm)	
Channel	Band Emission (dBm)	Carrier Level	Calculated 30 dBc Limit	Verdict
Low	-42.79	3.62	-26.38	Pass
Middle	-43.52	9.64	-20.36	Pass
High	-42.93	3.95	-26.05	Pass

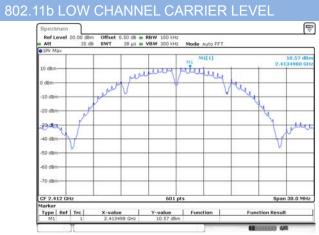
## 802.11n-40MHz Mode:

	Measured Max. Out of	Limit (	dBm)	
Channel	Band Emission (dBm)	Carrier Level	Calculated 30 dBc Limit	Verdict
Low	-43.26	0.66	-29.34	Pass
Middle	-43.41	1.49	-28.51	Pass
High	-43.08	-1.73	-31.73	Pass



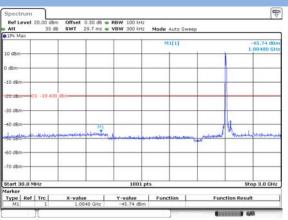
## Test Plots

## <u>ANT0</u>

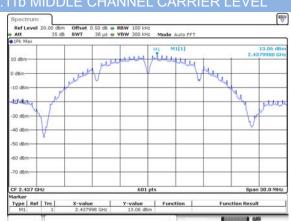


Date: 6 JUL 2017 10:49:47

## 802.11b LOW CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



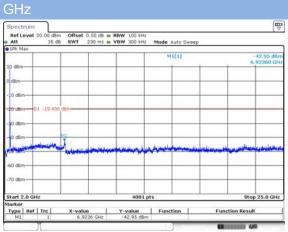
Date: 6 JUL 2017 10:50:15



## 802.11b MIDDLE CHANNEL CARRIER LEVEL

Date: 6 JUL 2017 10:51:08

# 802.11b LOW CHANNEL, SPURIOUS 2 GHz ~ 25

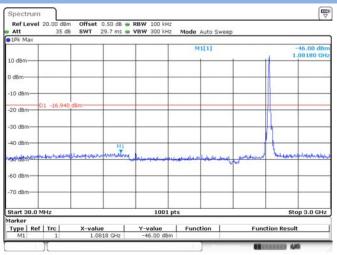


Date: 6 JUL 2017 10:50:25



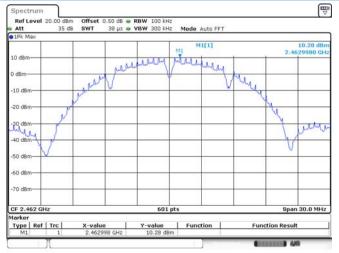
## 802.11b MIDDLE CHANNEL, SPURIOUS

### 30 MHz ~ 3 GHz



Date: 6.JUL 2017 10:51:36

## 802.11b HIGH CHANNEL CARRIER LEVEL

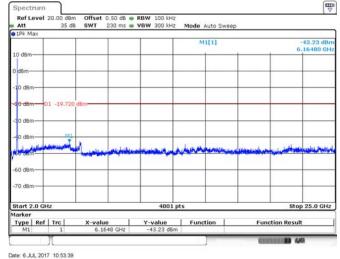


Date: 6 JUL 2017 10:52:39

### 30 MHz ~ 3 GHz Spectrum Ref Level 20.00 dBm Offset 0.50 dB RBW 100 kHz Att 35 dB SWT 29.7 ms VBW 300 kHz Mode Auto Sweep P1Pk M 44.57 dB 30.50 MF 10 dBr dB -10 dBm -19.73 20 d 30 dBm 40 dBm bu dam neor -60 dBm -70 dBn Start 30.0 MHz 1001 pts Stop 3.0 GHz arke X-value 930.5 MHz Type Ref Trc Y-value -44.57 dBm Function Function Result Т

# 802.11b HIGH CHANNEL, SPURIOUS

## 802.11b HIGH CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



Date: 6 JUL 2017 10:53:28

## 802.11b MIDDLE CHANNEL, SPURIOUS

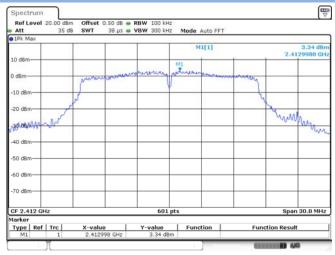
## 2 GHz ~ 25 GHz

Att	vel 20.00 dBr 35 d		8 BW 100 kHz 8 VBW 300 kHz	Mode Auto Swee	PP	
1Pk Ma	×			- Contractory		
				M1[1]		-42.93 dBr 6.96390 GH
10 dBm-			-		1 1	
dBm—						
10 dBm	_					_
20 dBm	01 -16.94	0 d8m	_			
30 dBm	-		_			_
0 dBm		MI				
e osm	manine	and fine and a state	and the state of the second	a in the second second		Publication
60 dBm	-					_
70 dBm		-				
start 2.	0 GHz		4001 p	ots		Stop 25.0 GHz
larker	Ref   Trc	X-value	Y-value	Function	Function R	

Date: 6.JUL 2017 10:51:43

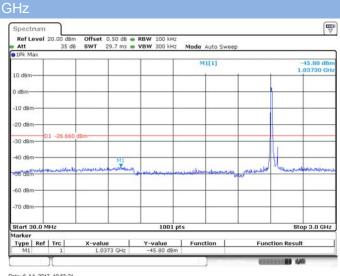


## 802.11g LOW CHANNEL CARRIER LEVEL



Date: 6.JUL.2017 10:54:48

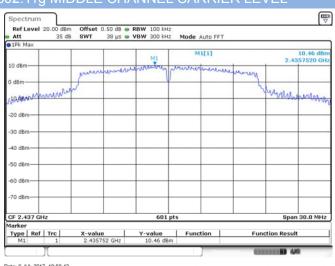
## 802.11g LOW CHANNEL, SPURIOUS 30 MHz ~ 3



## 802.11g LOW CHANNEL, SPURIOUS 2 GHz ~ 25 Spectrum -

Att	35 di	B SWT	230 ms 🖷	VBW 300 kH;	Z Mode A	uto Sweep		
1Pk Max								
					MJ	[1]		-42.71 dB
10 dBm—			-			-		6.16480 G
0 dBm-	-		-					
-10 dBm-					-			
-20 dBm-								
-30 dBm-	D1 -26.660	) dBm			-			
O dBm	MI		-					
So dem-	adiministic	Lange	-	-	manuni	-		
-60 dBm-								-
-70 dBm-		-	-					
Start 2.0	GHz			4001	pts			Stop 25.0 GH
Marker	NI				12			
Type F M1	tef Trc	X-valu	648 GHz	-42.71 dB	Funct	ion	Functi	on Result

Date: 6.JUL 2017 10:55:21



## 802.11g MIDDLE CHANNEL CARRIER LEVEL

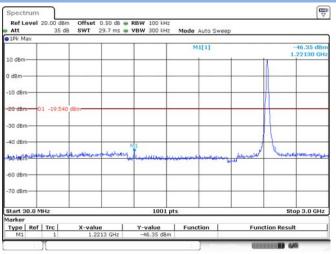
Date: 6.JUL.2017 10:56:42

Date: 6.JUL 2017 10:55:50



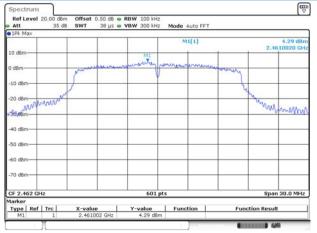
# 802.11g MIDDLE CHANNEL, SPURIOUS

### 30 MHz ~ 3 GHz



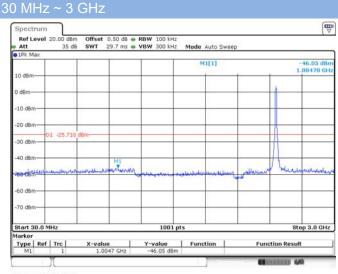
Date: 6 JUL 2017 10:57:15

## 802.11g HIGH CHANNEL CARRIER LEVEL



Date: 6.JUL.2017 10:58:35

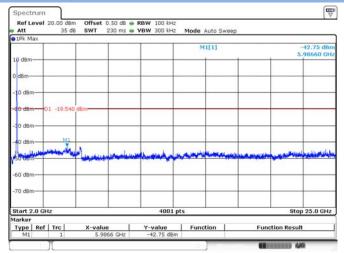
## 802.11g HIGH CHANNEL, SPURIOUS



Date: 6 JUL 2017 10:58:58

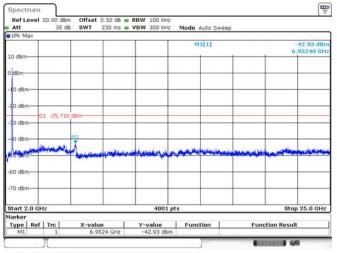
## 802.11g MIDDLE CHANNEL, SPURIOUS

### 2 GHz ~ 25 GHz



Date: 6 JUL 2017 10:57:35

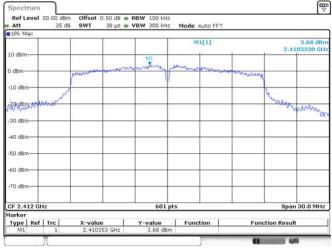
## 802.11g HIGH CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



Date: 6.JUL 2017 10:59:10

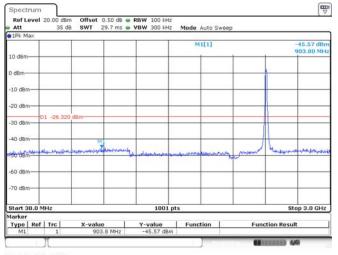


## 802.11n-20 MHz LOW CHANNEL CARRIER LEVEL



Date: 6.JUL.2017 12:37:24

## 802.11n-20 MHz LOW CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



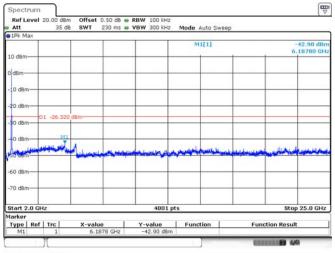
Date: 6 JUL 2017 12 38:01

### Spectrum Ref Level 20.00 dBm Offset 0.50 dB ● RBW 100 kHz Att 35 dB SWT 38 µs • VBW 300 kHz Mode Auto FFT • 1Pk Max 2.43 8970 G 10 dBm trun monormany anens un 0 dBm more unde -JAAAA 20 dBr -30 dBm 40 dBm 50 dBm -60 dBm -70 dBm CF 2.437 GHz Span 30.0 MHz 601 pts Type Ref Trc Function X-value Y-value 2.438897 GHz 9.60 dBm Function Result for a second second second

802.11n-20 MHz MIDDLE CHANNEL CARRIER LEVEL

Date: 6.JUL.2017 11:02:12

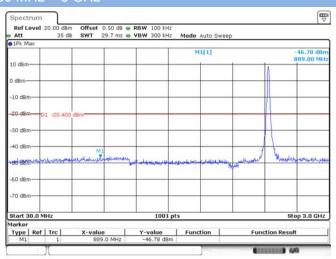
## 802.11n-20 MHz LOW CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



Date: 6.JUL 2017 12:38:16

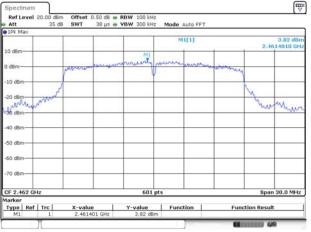


# 802.11n-20 MHz MIDDLE CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



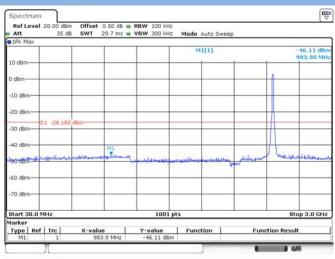
Date: 6 JUL 2017 11:02:29

### 802.11n-20 MHz HIGH CHANNEL CARRIER LEVEL



Date: 6.JUL.2017 11:03:30

# 802.11n-20 MHz HIGH CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



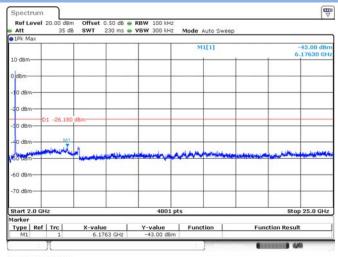
Date: 6.JUL 2017 11:04:07

# 802.11n-20 MHz MIDDLE CHANNEL, SPURIOUS 2 GHz ~ 25 GHz

Att		0.00 dBm 35 dB			RBW 100 ki VBW 300 ki		Auto Sweep	2		
1Pk Max					-					
						M	1[1]			42.79 dB
10 dBm-	+			+	-		1			
0 dBm-	+		_	-	-					
-10 dBm-	+				-	-			-	
-20 dBm-	01	-20.400	dBm							
-30 dBm-	+			-						
0 dBm			M1			-				
So bem-	al and	and the second second	-	a statistics	in the states in the	-	Perilihan	Alighter and a feature	a junistimi	the states
-60 dBm-	+					-				
-70 dBm-	+			-		-				
Start 2.0	) GHz				400	1 pts			Stop	25.0 GH
Marker Type   I	Pof 1	Inc.	X-valı	ie I	Y-value	Func	tion	Func	tion Result	20

Date: 6.JUL 2017 11:02:38

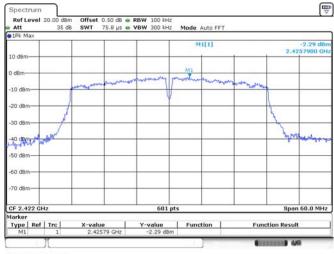
# 802.11n-20 MHz HIGH CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



Date: 6.JUL 2017 11:04:25

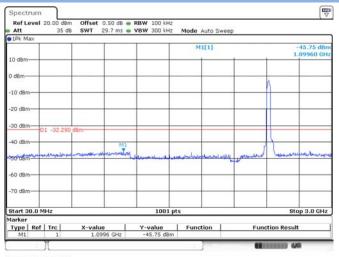


## 802.11n-40 MHz LOW CHANNEL CARRIER LEVEL



Date: 6.JUL 2017 11:06:31

## 802.11n-40 MHz LOW CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



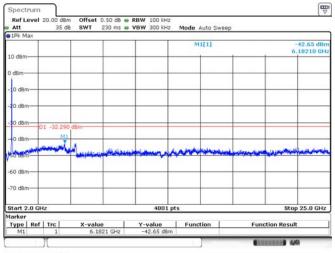
Date: 6.JUL 2017 11:06:59



## 802.11n-40 MHz MIDDLE CHANNEL CARRIER LEVEL

Date: 6.JUL.2017 11:08:24

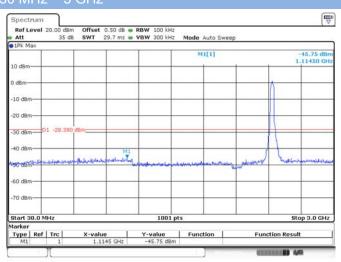
## 802.11n-40 MHz LOW CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



Date: 6.JUL 2017 11:07:14

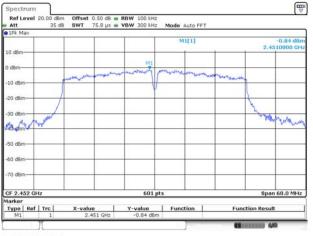


# 802.11n-40 MHz MIDDLE CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



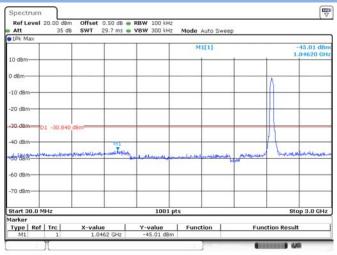
Date: 6.JUL 2017 11:08:48

## 802.11n-40 MHz HIGH CHANNEL CARRIER LEVEL



Date: 6.JUL 2017 11:09:45

# 802.11-n40 MHz HIGH CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



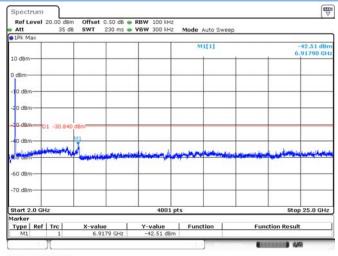
Date: 6.JUL 2017 11:10:11

# 802.11n-40 MHz MIDDLE CHANNEL, SPURIOUS 2 GHz ~ 25 GHz

Att	35 dB	SWT 230 n	is 🔹 VBW 3	00 kHz Mod	e Auto Swee	p		
1Pk Max			1	_	M1[1]			42.18 dBr
					wiftl			90060 GH
10 dBm				-		1		
0 <sub>1</sub> dBm-					_	-		_
- 0 dBm				_				
-20 dBm			_					
-30 dBm-0	1 -28.390 di	Bm	_	_	_			-
-40 dBm	M	1	_			_		
-	في المالين الم	La maria	المنابسة والاستغلب	man	A prise diago	-	Linger Refer	- and
-60 dBm								
-70 dBm								
Start 2.0 GH	2		_	4001 pts			Stor	25.0 GHz
				toox pts			orop	2010 011

Date: 6.JUL 2017 11:09:00

# 802.11n-40 MHz HIGH CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



Date: 6.JUL 2017 11:10:27

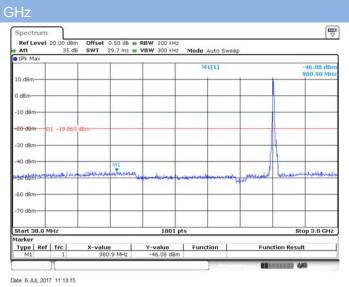


## <u>ANT1</u>



Date: 6.JUL 2017 11:12:46

## 802.11b LOW CHANNEL, SPURIOUS 30 MHz ~ 3



## 802.11b LOW CHANNEL, SPURIOUS 2 GHz ~ 25 GHz

Ref Level 20.00 dBn Att 35 dB		• VBW 300 kHz	Mode Auto Swee	ab de la companya de	
1Pk Max			M1[1]		-42,90 dB
			with		5.88320 GH
10 dBm					1
0 dBm					
0 dBm					-
20 dBm 01 -19.860	d8m	_			_
30 dBm		_			_
-0 dBm - M1					_
es com	- minane matrix	-	in the production	-	liter and a liter
60 dBm					_
70 dBm		_			_
Start 2.0 GHz		4001	ots	S	Stop 25.0 GH
larker			18 U.S.		

Date: 6.JUL 2017 11:13:26

### Spectrum Offset 0.50 dB ⊕ RBW 100 kHz SWT 38 µs ⊕ VBW 300 kHz Ref Level 20.00 dB Att 35 d 35 dB Mode Auto FFT • 1Pk Ma 11.06 dt 2.43600 97 MARANNE 020 G 10 dBm at he have been and the second Mark they 0 dBn -10 dBmull 4 K. -20 dBr -30 dBm 40 dBm 50 dBm -60 dBm -70 dBm CF 2.437 GHz Span 30.0 MHz 601 pts Type Ref Trc Function X-value Y-value 2.436002 GHz 11.06 dBm Function Result STREET, STREET, SAL

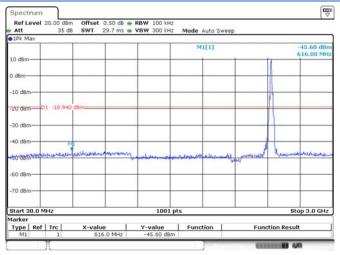
802.11b MIDDLE CHANNEL CARRIER LEVEL

Date: 6.JUL 2017 11:14:22

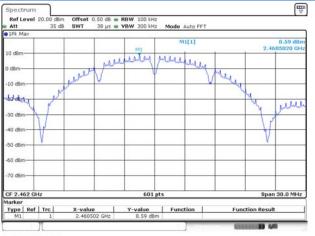


## 802.11b MIDDLE CHANNEL, SPURIOUS

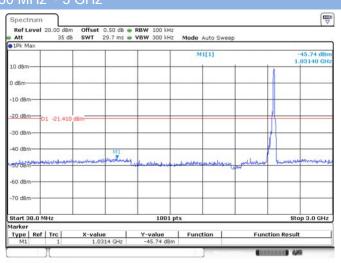
## 30 MHz ~ 3 GHz



Date: 6 JUL 2017 11:14:51



Date: 6.JUL 2017 11:16:15



# 30 MHz ~ 3 GHz

802.11b HIGH CHANNEL, SPURIOUS

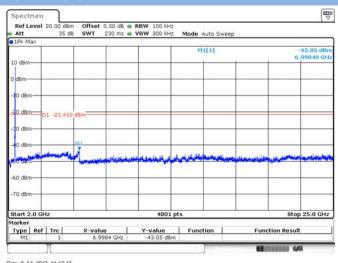
Date: 6.JUL 2017 11:17:23

# 802.11b MIDDLE CHANNEL, SPURIOUS

Ref Level 20.00	dBm Offset 0.50 dB	RBW 100 kHz			
Att 3	5 dB SWT 230 ms	VBW 300 kHz	Mode Auto Swee	ep.	
1Pk Max					
			M1[1]		-42.53 dBr
10 dBm		-			4.87140 GH
1.1.1				1	
0 dBm	-	-		-	
0.000					
-10 dBm					
-10 dBm	940 d8m			-	
-30 dBm					
MI		_			
-10 dBm					
A A A A A A A A A A A A A A A A A A A	Mar Hand Sugar Stands	A REAL PROPERTY OF THE OWNER	-	A PROVIDENCE AND A PROV	والاراف مور بالمحمد الرده
De dom			Contraction of the second		
-60 dBm-		_			
-70 dBm-				+ +	
Start 2.0 GHz		4001 p	ts		Stop 25.0 GHz
Marker					
Type   Ref   Trc	X-value	Y-value	Function	Function	n Result

Date: 6 JUL 2017 11:15:01

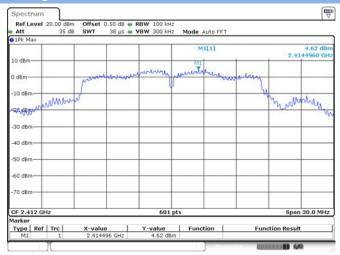
## 802.11b HIGH CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



Date: 6.JUL 2017 11:17:47

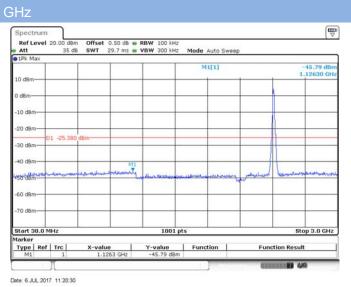


## 802.11g LOW CHANNEL CARRIER LEVEL



Date: 6.JUL.2017 11:20:03

## 802.11g LOW CHANNEL, SPURIOUS 30 MHz ~ 3

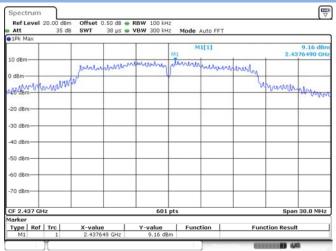


## 802.11g LOW CHANNEL, SPURIOUS 2 GHz ~ 25 GHz

Att	35 d	B SWT 230 n	15 🖷 VBW 300 kH	Hz Mode Au	to Sweep		
1Pk M.	ax			MI	1]		-41.95 dB
10 dBm-		+ +		+ +			0.10210 G
0 dBm—	-						
-10 dBm	-						
-20 dBrr	01 -25.39	0 dBm					_
-30 dBm							
O dBm	Linener		ار المتحطر المتصمي	Landa	minune	الا مر الللا سامعان	بالمداية والمعالمة
50 08m							
-70 dBm							
Start 2	.0 GHz		.400	1 pts			Stop 25.0 GH
larker							

Date: 6.JUL 2017 11:21:03

## 802.11g MIDDLE CHANNEL CARRIER LEVEL

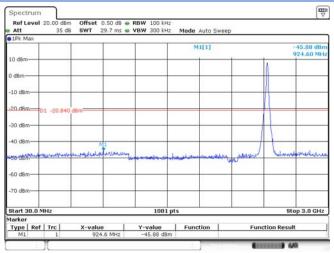


Date: 6.JUL.2017 11:22:13

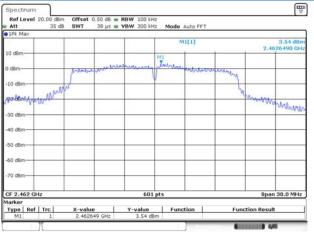


## 802.11g MIDDLE CHANNEL, SPURIOUS

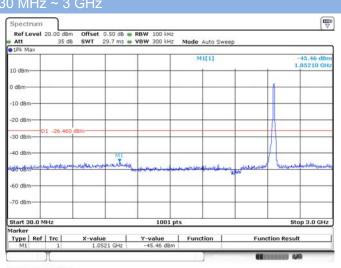
## 30 MHz ~ 3 GHz



Date: 6 JUL 2017 11:22:46



Date: 6.JUL.2017 11:24:53



# 802.11g HIGH CHANNEL, SPURIOUS

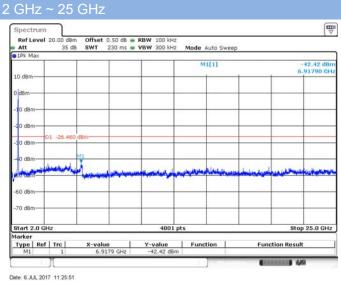
# Spectrum Att 1Pk Ma: 10 dBr

## 802.11g MIDDLE CHANNEL, SPURIOUS 2 GHz ~ 25 GHz

Att	35 dB	SWT 230	ms 🔹 VE	W 300 kH;	Mode	Auto Sweep			
					м	u[1]			43.18 dBr 89490 GH
10 dBm-									
0 dBm			-						
- 0 dBm	-		-						-
-and Bm	1 -20.840 d	8m							
-30 dBm									
-40 dBm-	an and				L and de			-	
mais do		househouse	Si Antolia	-	A WAR	we have designed as the second	and the second	Alland	
-60 dBm								-	
-70 dBm									
Start 2.0 GH	z			4001	pts			Stop	25.0 GHz
tarker	Trc				Fund			ion Result	

Date: 6 JUL 2017 11:22:55

## 802.11g HIGH CHANNEL, SPURIOUS

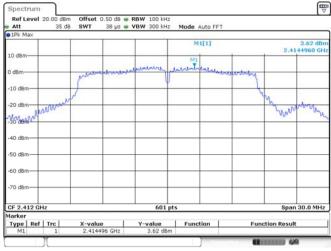


# 30 MHz ~ 3 GHz

Date: 6.JUL 2017 11:25:41

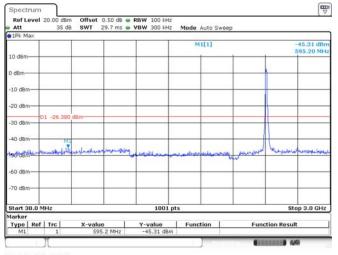


## 802.11n-20 MHz LOW CHANNEL CARRIER LEVEL



Date: 6.JUL.2017 12:30:08

## 802.11n-20 MHz LOW CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



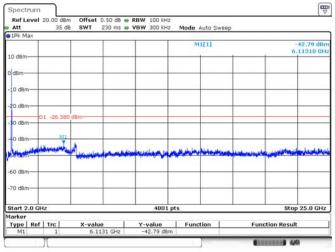
Date: 6 JUL 2017 12:30:38

### Spectrum Ref Level 20.00 dBm Offset 0.50 dB ● RBW 100 kHz Att 35 dB SWT 38 µs ● VBW 300 kHz ● 1Pk Max Mode Auto FFT 9.64 dBi 82480 GH M2 Marrielland 2.43 10 dBr intriture havenmennen 0 dBr CTO de ANTRA CONTRACTOR mon -20 dBr -30 dBm -40 dBm -50 dBm -60 dBm -70 dBm CF 2.437 GHz Span 30.0 MHz 601 pts Type Ref Trc 2.438248 GHz Function Y-value 9.64 dBm Function Result

802.11n-20 MHz MIDDLE CHANNEL CARRIER LEVEL

Date: 6.JUL.2017 11:29:26

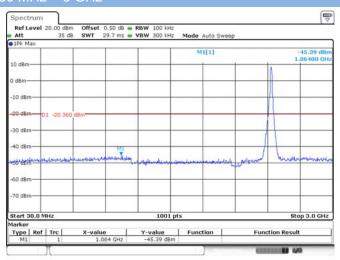
## 802.11n-20 MHz LOW CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



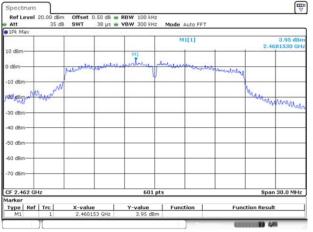
Date: 6.JUL 2017 12:30:47



## 802.11n-20 MHz MIDDLE CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



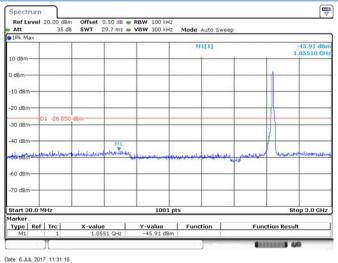
Date: 6 JUL 2017 11 29 54



Date: 6.JUL.2017 11:30:54

## 802.11n-20 MHz HIGH CHANNEL, SPURIOUS



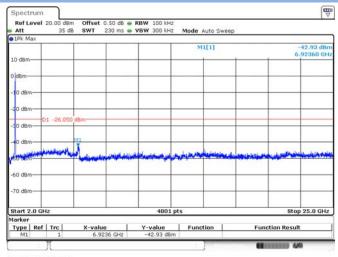


# 802.11n-20 MHz MIDDLE CHANNEL, SPURIOUS

Ref Level 20.00 d Att 35		<ul> <li>RBW 100 kHz</li> <li>VBW 300 kHz</li> </ul>	Mode Auto Swee	10	
• 1Pk Max			. tode mate enter	F	
			M1[1]		-43.52 dBr
10 dBm				1 1	6.98110 GH
0 dBm					_
					_
- 0 dBm					
-20 dBm 01 -20.3	360 dBm				-
-30 dBm					
-40 dBm	MI	-			_
a statistic manage	May 14 minutes and the second	and second second	where the second de la construction de la construct	الرجر بجره وحرائي جرائية أونا	-
			1000		
-60 dBm					-
-70 dBm					
Start 2.0 GHz		4001 p	ts	S	top 25.0 GHz
Marker					
Type Ref Trc	X-value 6.9811 GHz	-43.52 dBm	Function	Function Re:	sult

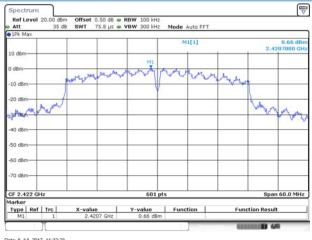
Date: 6 JUL 2017 11:30:05

## 802.11n-20 MHz HIGH CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



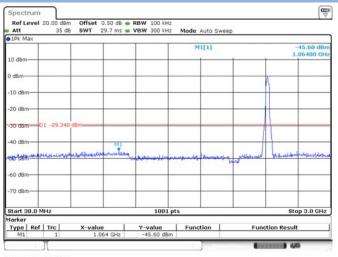
Date: 6.JUL 2017 11:31:25



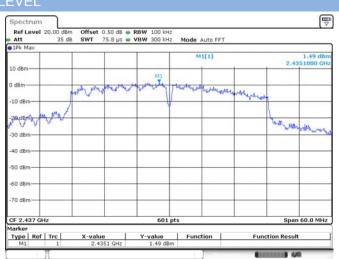


Date: 6.JUL.2017 11:32:23

## 802.11n-40 MHz LOW CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



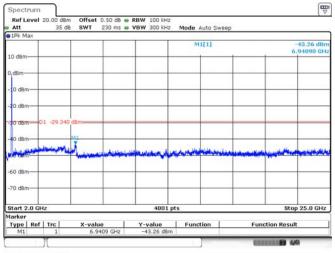
Date: 6.JUL 2017 11:32:40



## 802.11n-40 MHz MIDDLE CHANNEL CARRIER LEVEL

Date: 6.JUL.2017 11:33:31

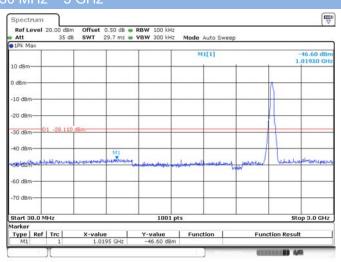
## 802.11n-40 MHz LOW CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



Date: 6.JUL 2017 11:32:49

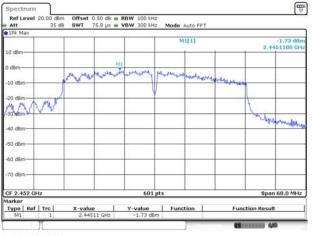


# 802.11n-40 MHz MIDDLE CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



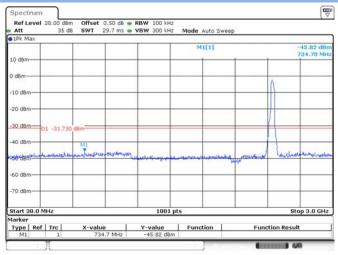
Date: 6.JUL 2017 11:33:50

## 802.11n-40 MHz HIGH CHANNEL CARRIER LEVEL



Date: 6.JUL.2017 11:34:36

## 802.11-n40 MHz HIGH CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



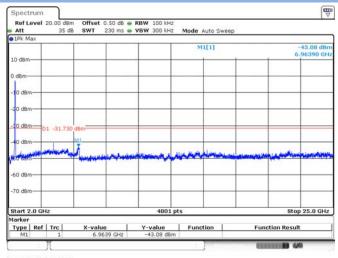
Date: 6 JUL 2017 11:34:53

# 802.11n-40 MHz MIDDLE CHANNEL, SPURIOUS 2 GHz ~ 25 GHz

Ref Level Att	35 dB			RBW 100 kH VBW 300 kH		Auto Sweep	1		
• 1Pk Max									
					м	1[1]			-43.41 dBr .95240 GH
10 dBm-					-	-	-		1
0.dBm									
UldBm-									
- O dBm			-					-	
-20 dBm					-			-	
-30 dBm 0	1 -28.110	d8m							-
- CO GBIN									
-40 dBm		M1			-				
L. war	Starting and	1		Buckeye Ar in	بالمطرقان بر	Historia ca.	and the second	- In files	- Hilling
SU april		Anthonio			a distant of	and the second second	and a share	April 10	
-60 dBm									
-70 dBm			-		-			-	
Start 2.0 GH	lz		-	4001	pts			Stop	25.0 GHz
Marker									

Date: 6.JUL 2017 11:33:57

# 802.11n-40 MHz HIGH CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



Date: 6.JUL 2017 11:35:03



## A.4 Band Edge (Authorized-band band-edge)

Test Data

Note: The 99% OBW of the fundamental emission is without 2 MHz of the authorized band. <u>ANT0</u>

802.11b Mode:

Observat	Measured Max. Band	Limit	(dBm)	
Channel	Edge Emission (dBm)	Carrier Level	Calculated 30 dBc Limit	- Verdict
Low Channel	-33.05	10.57	-19.43	Pass
High Channel	-45.80	10.28	-19.72	Pass

## 802.11g Mode:

Channel	Measured Max. Band	Limit	(dBm)	
Channel	Edge Emission (dBm)	Carrier Level	Calculated 30 dBc Limit	Verdict
Low Channel	-30.49	3.34	-26.66	Pass
High Channel	-39.00	4.29	-25.71	Pass

## 802.11n-20 MHz Mode:

	Measured Max. Band	Limit	(dBm)	., ., .
Channel	Edge Emission (dBm)	Carrier Level	Calculated 30 dBc Limit	Verdict
Low Channel	-28.06	3.68	-26.32	Pass
High Channel	-35.10	3.82	-26.18	Pass

## 802.11n-40 MHz Mode:

	Measured Max. Band	Limit	(dBm)	
Channel	Edge Emission (dBm)	Carrier Level	Calculated 30 dBc Limit	Verdict
Low Channel	-41.89	-2.29	-32.29	Pass
High Channel	-34.63	-0.84	-30.84	Pass





## ANT1 802.11b Mode:

	Measured Max. Band	Limit	(dBm)	
Channel	Edge Emission (dBm)	Carrier Level	Calculated 30 dBc Limit	- Verdict
Low Channel	-28.11	10.14	-19.86	Pass
High Channel	-48.89	8.59	-21.41	Pass

## 802.11g Mode:

Channel	Measured Max. Band Edge Emission (dBm)	Limit (dBm)		
		Carrier Level	Calculated 30 dBc Limit	Verdict
Low Channel	-27.71	4.62	-25.38	Pass
High Channel	-41.15	3.54	-26.46	Pass

## 802.11n-20 MHz Mode:

Channel	Measured Max. Band Edge Emission (dBm)	Limit (dBm)		
		Carrier Level	Calculated 30 dBc Limit	Verdict
Low Channel	-28.09	3.62	-26.38	Pass
High Channel	-38.06	3.95	-26.05	Pass

## 802.11n-40 MHz Mode:

Channel	Measured Max. Band Edge Emission (dBm)	Limit (dBm)		
		Carrier Level	Calculated 30 dBc Limit	Verdict
Low Channel	-34.67	0.66	-29.34	Pass
High Channel	-39.25	-1.73	-31.73	Pass

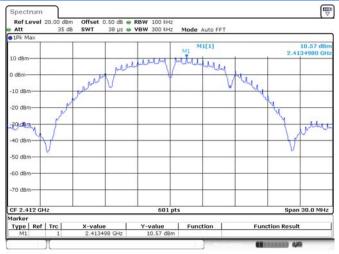


440

## Test Plots

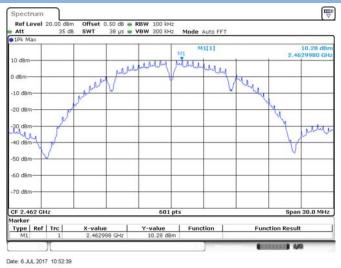
## <u>ANT0</u>

## 802.11b LOW CHANNEL, Carrier level



Date: 6 JUL 2017 10:49:47

### 802.11b HIGH CHANNEL, Carrier level

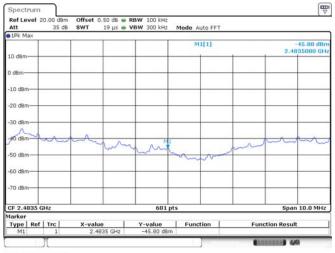


### Ref Level 20.00 dBm Att 35 dB Offset 0.50 dB - RBW 100 kHz SWT 19 µs - VBW 300 kHz Mode Auto FFT 1Pk Max M1[1] 33.05 dB 2.4 0 GH 10 dB 0 dB r -10 dBm--20 dBn -30 dBm 40 dBn -50 dBm -60 dBm -70 dB CF 2.4 GH Span 10.0 MHz 601 pt arke X-value 2.4 GH Y-value Type | Ref | Trc | Т Function Function Result

Date: 5 JUL 2017 10:05:38

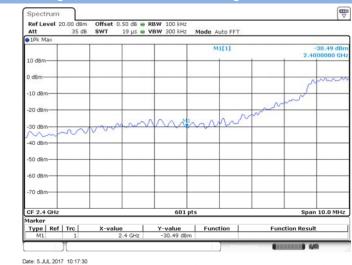
Spectrum

802.11b LOW CHANNEL, Band Edge



Date: 5.JUL 2017 10:12:17

## 802.11g LOW CHANNEL, Band Edge

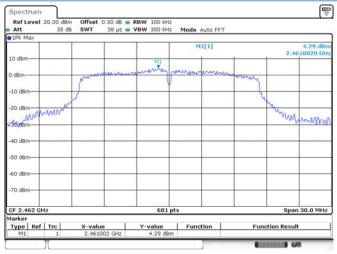


802.11g LOW CHANNEL, Carrier level

Spectrum Ref Level 20.00 Att 3 Offset 0.50 dB • RBW 100 kHz SWT 38 µs • VBW 300 kHz 35 dB Mode Auto FFT • 1Pk Ma 3.34 dt 2.4129980 G 10 dBn M1 -10 dBn 20 dB humpry Ac ANABAINE 40 dBm 50 dB -60 dBm -70 dBm CF 2.412 GHz Span 30.0 MHz 601 pts arke Type Ref Trc 2.412998 GHz Y-value Function Function Result Date: 6.JUL.2017 10:54:48

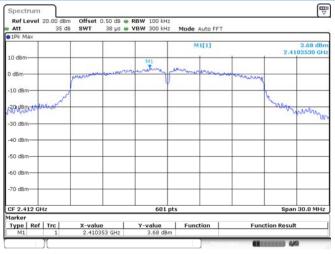


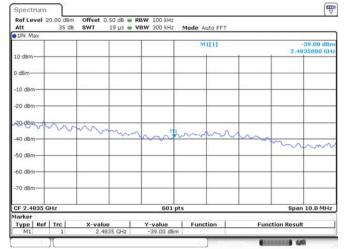
### 802.11g HIGH CHANNEL, Carrier leve



Date: 6.JUL.2017 10:58:35

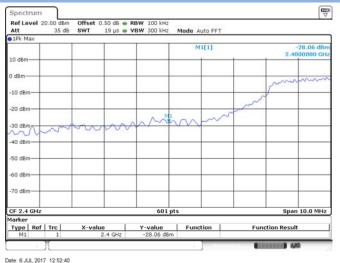
## 802.11n-20 MHz LOW CHANNEL, Carrier level





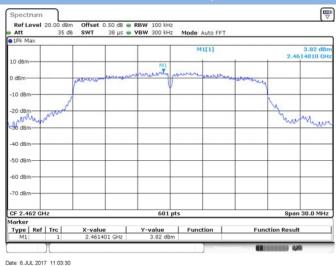
Date: 5 JUL 2017 10:23:25

## 802.11n-20 MHz LOW CHANNEL, Band Edge



Date: 6.JUL.2017 12:37:24

## 802.11n-20 MHz HIGH CHANNEL, Carrier level



## 802.11n-20 MHz HIGH CHANNEL, Band Edge

Spectrum 
 Offset
 0.50 dB
 RBW
 100 kHz

 SWT
 19 μs
 VBW
 300 kHz
 Mode
 Auto FFT
 Ref Level 20.00 Att 35 dB SWT 1Pk Max MI[1] -35.10 dBr 2.4835000 GH 10 dBn 0 dBr -10 dBm -20 dBm -20-dBm V m 20 n -40 dBr -50 dBm -60 dBn -70 dBm CF 2.4835 GHz 601 pts Span 10.0 MHz Type Ref Trc 
 X-value
 Y-value
 Function

 2.4835 GHz
 -35.10 dBm
 -35.10 dBm
 Function Result -

Date: 5.JUL 2017 10:32:06

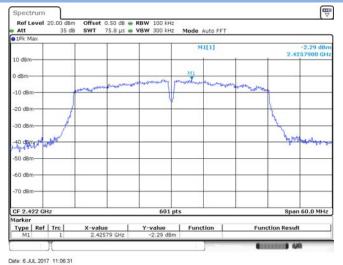
64 / 94



34.63 dB

CH

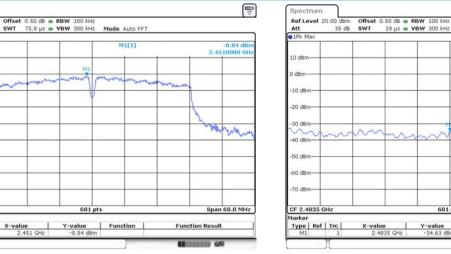
## 802.11n-40 MHz LOW CHANNEL, Carrier level



₩) Spectrum Ref Level 20.00 Att Offset 0.50 dB - RBW 100 kHz SWT 19 µs - VBW 300 kHz Mode Auto FFT 35 di 2,4 0 GH 10 dBn 0 dB -10 dBm -20 dBm -30 dBm 40 dBm S -50 dBm -60 dBm -70 dB CF 2.4 GH Span 10.0 MHz 601 pt X-value 2.4 GHz Type Ref Trc Y-value Function Function Result SCHWARTER AND

802.11n-40 MHz LOW CHANNEL, Band Edge

Date: 5 JUL 2017 10:35:06



Date: 6.JUL 2017 11:09:45

Spectrum

Att

10 dBn

dBr

10 dBn

-20 dB 30 dBr

48.48m

-50 dBn

-60 dB

-70 dB

CF 2.452 GHz

Type Ref Trc

Att 1Pk Max

Ref Level 20.00

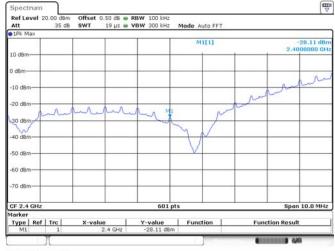
35 dB

## <u>ANT1</u>



## Spectrum

802.11b LOW CHANNEL, Band Edge



Date: 6.JUL 2017 11:12:46

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2.4 601 pt Span 10.0 MHz Function Y-value Function Result 4.00

Mode Auto FFT

MI[1]

Date: 5.JUL 2017 10:44:35