CE Test Report

Equipment	:	**45 Series Pluggable module**
Model No.	:	**MSD45N**
Brand Name	:	**Laird Connectivity**
Applicant	:	**Laird Connectivity, Inc.**
Address	:	**W66N220 Commerce Court, Cedarburg, Wisconsin 53012, USA**
Standard	:	**EN 300 328 V2.1.1 (2016-11)**
Received Date	:	**May 13, 2020**
Tested Date	:	**Jan. 20, 2016 (for original test)** **May 14 ~ May 15, 2019 (for original test)** **May 14, 2020 (for new test)**

We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.

Reviewed by: **Approved by:**

James Fan / Assistant Manager **Gary Chang / Manager**

Testing Laboratory 2732

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Release Record

Report No.	Version	Description	Issued Date
ER371704-11AC	Rev. 01	Initial issue	Sep. 16, 2020

Summary of Test Results

Ref. Std. Clause	Test Items	Measured	Result
4.3.2.2	RF Output Power	19.98 dBm.	Pass
4.3.2.3	Power Spectral Density	Meet the requirement of limit.	Pass
4.3.2.4	Duty Cycle, Tx-sequence, Tx-gap	Only for non-adaptive equipment.	N/A
4.3.2.5	Medium Utilisation (MU) factor	Only for non-adaptive equipment.	N/A
4.3.2.6	Adaptivity	Meet the requirement of limit.	Pass
4.3.2.7	Occupied Channel Bandwidth	Meet the requirement of limit.	Pass
4.3.2.8	Transmitter unwanted emissions in the out of band domain	Meet the requirement of limit.	Pass
4.3.2.9	Transmitter unwanted emissions in the spurious domain	Meet the requirement of limit.	Pass
4.3.2.10	Receiver spurious emissions	Meet the requirement of limit.	Pass
4.3.2.11	Receiver Blocking	Meet the requirement of limit.	Pass
4.3.2.12	Geo-location Capability	The device has no this capability.	N/A

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

1 General Description

1.1 Information

This report is issued as a supplementary report to original ICC report no. ER371704-07AC. The difference is concerned with following items:

- ✧ Updating standard version from V2.1.1 to V2.2.2.
- ✧ New applicant name & brand name.

Therefore, related test items had been performed and presented in the following sections.

1.1.1 Specification of the Equipment under Test (EUT)

RF General Information					
Frequency Range (MHz)	**IEEE Std. 802.11**	**Ch. Freq. (MHz)**	**Channel Number**	**Transmit Chains (N_{TX})**	**Data Rate / MCS**
2400-2483.5	b	2412-2472	1-13 [13]	1	1-11 Mbps
2400-2483.5	g	2412-2472	1-13 [13]	1	6-54 Mbps
2400-2483.5	n (HT20)	2412-2472	1-13 [13]	1	MCS 0-7
Note 1: 802.11b uses a combination of DSSS-DBPSK, DQPSK, CCK modulation. Note 2: 802.11g/n uses a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM modulation.					

1.1.2 Antenna Details

Ant. No.	Brand / Model	Type	Connector	Operating Frequencies (MHz) / Antenna Gain (dBi)				
				2400~2483.5	5150~5250	5250~5350	5470~5725	5725~5850
1	MAG.LAYERS/EDA-1513-25GR2-B2-CY	Dipole	SMA Jack Reverse	2	2	2	2	2
2	MAG.LAYERS/PCA-4606-2G4C1-A13-CY	PCB Dipole	UFL	2.21	---	---	---	---
3	Laird/NanoBlade-IP04	PCB Dipole	UFL	2	3.9	3.9	4	4
4	Laird/MAF95310 Mini NanoBlade Flex	PCB Dipole	UFL	2.79	3.38	3.38	3.38	3.38
5	Laird/NanoBlue-IP04	PCB Dipole	UFL	2	---	---	---	---
6	Ethertronics/WLAN_1000146	PIFA	UFL	2.5	3.5	3.5	3.5	3.5
7	SAA / MG7018-41-000-R	Dipole	UFL	1.87	0.85	0.6	0.94	0.92
8	SAA / MG7324-41-000-R	Dipole	UFL	1.32	1.04	1.6	2.75	2.24

1.1.3 EUT Operational Condition

Power Supply Type	3.3Vdc from host		
SW Version	23.3.3.5		
Operational Climatic	☒ Tnom (20°C)	☒ Tmax (70°C)	☒ Tmin (-10°C)

1.1.4 Accessories

N/A

1.1.5 Adaptive Equipment

Adaptive Equipment		
☐	non-Adaptive Equipment:	
	The maximum RF Output Power (e.i.r.p.): dBm	
	The maximum (corresponding) Duty Cycle: %	
☒	Adaptive Equipment without the possibility to switch to a non-adaptive mode:	
	☒	The equipment has implemented an LBT based DAA mechanism:
		☐ The equipment is Frame Based equipment
		☒ The equipment is Load Based equipment
		☐ The equipment can switch dynamically between Frame Based and Load Based equipment
	☐	The equipment has implemented an non-LBT based DAA mechanism
	☐	The equipment can operate in more than one adaptive mode
	☐	Adaptive Frequency Hopping using other forms of DAA (non-LBT based)/without Short Control Signaling Transmissions
☐	Adaptive Equipment which can also operate in a non-adaptive mode	

1.1.6 Channel List

Channel	Frequency(MHz)
1	2412
2	2417
3	2422
4	2427
5	2432
6	2437
7	2442
8	2447
9	2452
10	2457
11	2462
12	2467
13	2472

1.1.7 Test Tool and Duty Cycle

Test Tool	Command	
Modulation Mode	**Duty Cycle Of Test Signal (%)**	**Duty Factor (dB)**
b	100.00%	0.00
g	99.32%	0.03
n (HT20)	99.25%	0.03

1.1.8 Power Index of Test Tool

Modulation Mode	Test Frequency (MHz)		
	2412	**2442**	**2472**
b	16	15.5	16.5
g	16.5	16	17
n (HT20)	16.5	16	17

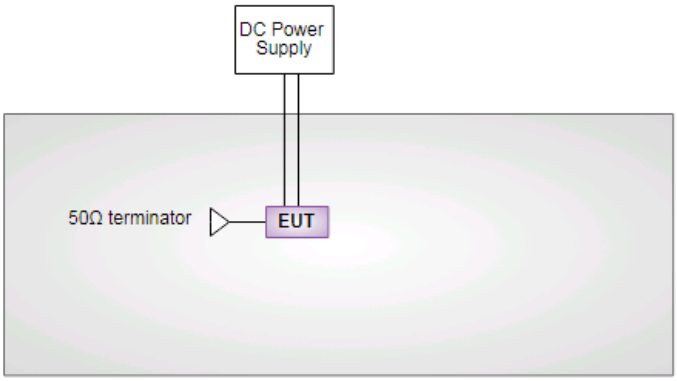
1.2 Local Support Equipment List

Support Equipment List					
No.	**Equipment**	**Brand**	**Model**	**S/N**	**Remarks**
1	DC Power Supply	GWINSTEK	GPC-3060D	---	---
2	Notebook	Lenovo	X61	---	Provided by applicant.

Note: The notebook is disconnected from EUT and removed from test table when EUT is set to transmit continuously.

1.3 Test Setup Chart

Test Setup Diagram



1.4 Test Equipment List and Calibration Data

Test Item	RF Conducted				
Test Site	(TH01-WS)				
Tested Date	Jan. 20, 2016				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum Analyzer	ROHDE&SCHWARZ	FSV40	101486	Oct. 14, 2015	Oct. 13, 2016
TEMP&HUMIDITY CHAMBER	GIANT FORCE	GCT-225-40-SP-SD	MAF1212-002	Nov. 27, 2015	Nov. 26, 2016
Power Meter	Anritsu	ML2495A	1241002	Sep. 21, 2015	Sep. 20, 2016
Power Sensor	Anritsu	MA2411B	1207366	Sep. 21, 2015	Sep. 20, 2016
DC POWER SOURCE	GW INSTEK	GPC-3060D	EM884797	Oct. 20, 2015	Oct. 19, 2016
Measurement Software	Sporton	Sporton_1	1.3.30	NA	NA
Measurement Software	Agilent	EN RF test	1.1501125	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Adaptivity				
Test Site	(TH01-WS)				
Tested Date	Jan. 20, 2016				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum	R&S	FSV-7	101607	Dec. 10, 2015	Dec. 09, 2016
Spectrum	Keysight	N9010A	MY54510374	May. 18, 2015	May. 17, 2016
Signal Generator	R&**S**	SMB100A	175727	Oct. 05, 2015	Oct. 04, 2016
RF cable-4M	HUBER+SUHNER	SUCOFLEX_104	MY15686/4	Dec. 17, 2015	Dec. 16, 2016
RF cable-0.5M	HUBER+SUHNER	SUCOFLEX_104	296081/4	Dec. 17, 2015	Dec. 16, 2016
RF cable-0.2M	HUBER+SUHNER	SUCOFLEX_104	329023/4	Dec. 17, 2015	Dec. 16, 2016
RF cable-0.2M	HUBER+SUHNER	SUCOFLEX_104	329021/4	Dec. 17, 2015	Dec. 16, 2016
MXG-B RF Vector Signal Generator	Agilent	N5182B	MY53050081	Mar. 30, 2015	Mar. 29, 2016
Preamplifier	EMC	EMC02325	980146	Oct. 14, 2015	Oct. 13, 2016
Oscilloscope	National Instruments	USB-5133	F651FF	Jun. 15, 2015	Jun. 14, 2016
Measurement Software	Sporton	Sporton_3	1.0.0.22	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Radiated Emissions				
Test Site	Fully-anechoic chamber 2 / (05CH02-WS)				
Tested Date	May 14 ~ May 15, 2019				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum Analyzer	Agilent	N9010A	MY52221474	Oct. 10, 2018	Oct. 09, 2019
Bilog Antenna 30-1000MHz	SCHWARZBECK	VULB9168	9168-563	Jan. 04, 2019	Jan. 03, 2020
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	9120D-1205	Jan. 18, 2019	Jan. 17, 2020
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170508	Dec. 22, 2018	Dec. 21, 2019
Preamplifier	Agilent	83017A	MY53270013	Dec. 27, 2018	Dec. 26, 2019
Preamplifier	EMC	EMC02325	980188	Dec. 13, 2018	Dec. 12, 2019
Preamplifier	EMC	EMC184045B	980192	Aug. 09, 2018	Aug. 08, 2019
RF cable-1M	HUBER+SUHNER	SUCOFLEX104	MY22622/4	Oct. 16, 2018	Oct. 15, 2019
RF cable-1M	HUBER+SUHNER	SUCOFLEX104	MY22623/4	Oct. 16, 2018	Oct. 15, 2019
RF cable-3M	HUBER+SUHNER	SUCOFLEX104	MY22621/4	Oct. 16, 2018	Oct. 15, 2019
RF cable-4M	HUBER+SUHNER	SUCOFLEX104	MY22579/4	Oct. 16, 2018	Oct. 15, 2019
LF cable-0.8M	EMC	EMC8D-NM-NM-800	EMC8D-NM-NM-800-002	Oct. 16, 2018	Oct. 15, 2019
LF cable-3M	EMC	EMC8D-NM-NM-3000	131102	Oct. 16, 2018	Oct. 15, 2019
LF cable-10M	EMC	EMC8D-NM-NM-10000	131101	Oct. 16, 2018	Oct. 15, 2019
Measurement Software	AUDIX	e3	6.120210g	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Receiver Blocking				
Test Site	(05CH01-WS)				
Tested Date	May 14, 2020				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Wireless connectivity tester	ROHDE&SCHWARZ	CMW270	100856	Oct. 24, 2019	Oct. 23, 2020
Signal Generator	ROHDE&SCHWARZ	SMBV100A	263146	Jan. 15, 2020	Jan. 14, 2021
RF Cable	HUBER+SUHNER	SUCOFLEX_104	500202/4	Oct. 16, 2019	Oct. 15, 2020
RF Cable	HUBER+SUHNER	SUCOFLEX_104	296088/4	Oct. 16, 2019	Oct. 15, 2020
RF Cable	HUBER+SUHNER	SUCOFLEX_104	329023/4	Oct. 16, 2019	Oct. 15, 2020
Combiner(1X2)	WOKEN	2WAYDIV	12101200003	Oct. 16, 2019	Oct. 15, 2020
Note: Calibration Interval of instruments listed above is one year.					

1.5 Testing Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

EN 300 328 V2.1.1 (2016-11)

1.6 Deviation from Test Standard and Measurement Procedure

None

1.7 Measurement Uncertainty

The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)

Measurement Uncertainty		
Parameters	**Uncertainty**	**Limit**
Occupied Channel Bandwidth	±0.0034 %	±5 %
RF output power, conducted	±0.592 dB	±1.5 dB
Power Spectral Density, conducted	±0.583 dB	±3 dB
Unwanted Emissions, conducted	±2.715 dB	±3 dB
All emissions, radiated	±3.14 dB	±6 dB
Temperature	±0.4 ^{o}C	±3 °C
Supply voltages	±0.15 %	±3 %
Time	±0.1 %	±5 %

2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
RF Conducted	TH01-WS	22°C / 63%	Ryan Lee Alex Huang
Radiated Emission	05CH02-WS	24°C / 65%	Ryan Lee
Adaptivity	TH01-WS	24°C / 63%	Ryan Lee
Receiver Blocking	05CH01-WS	25°C / 65%	Nai Xu

2.2 The Worst Test Modes and Channel Details

Test item	Modulation Mode	Test Frequency (MHz)	Data Rate	Test Configuration
RF Output Power Power Spectral Density Transmitter unwanted emissions in the out of band domain	11b 11g HT20	2412 / 2442 / 2472 2412 / 2442 / 2472 2412 / 2442 / 2472	1 Mbps 6 Mbps MCS 0	1, 2, 3
Occupied Channel Bandwidth Adaptivity	11b 11g HT20	2412 / 2472 2412 / 2472 2412 / 2472	1 Mbps 6 Mbps MCS 0	1
Transmitter Spurious Emissions ≤ 1GHz	11g	2412 / 2472	6 Mbps	Note 2
Transmitter Spurious Emissions > 1GHz	11b 11g HT20	2412 / 2472 2412 / 2472 2412 / 2472	1 Mbps 6 Mbps MCS 0	Note 2
Receiver Spurious Emissions	11g	2412 / 2472	6 Mbps	Note 2
Receiver Blocking	11b	2412 / 2472	1 Mbps	2

NOTE:

1. 3 types antenna are used for this device, highest gain antenna of each type is selected to perform radiated emission test as below test configuration.
   1) Configuration 1 : Dipole antenna (Antenna No.1)
   2) Configuration 2 : PCB Dipole antenna (Antenna No.4)
   3) Configuration 3 : PIFA antenna (Antenna No.6)
2. Conducted and radiated emissions are measured. A 50Ω terminator is connected to antenna port of EUT for radiated emission measurement.

3 Transmitter Test Results

3.1 RF Output Power

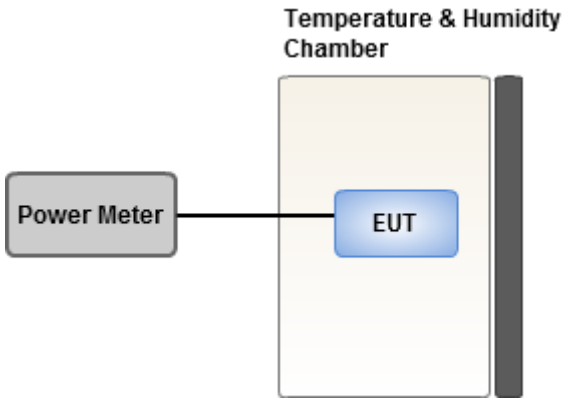
3.1.1 Limit of RF Output Power

For adaptive equipment using wide band modulations other than FHSS, the maximum RF output power shall be 20 dBm.

3.1.2 Test Procedures

Reference to clause 5.4.2.2 of ETSI EN 300 328 V2.1.1 (2016-11).

3.1.3 Test Setup



3.1.4 Test Result of RF Output Power

RF Output Power (dBm)				
Test Configuration	1			
Modulation Mode	11b/1Mbps			
Condition	**Freq. (MHz)**	**EIRP Power**	**Limit (dBm)**	**Results**
$T_{nom}V_{nom}$	2412	17.83	20	Pass
$T_{min}V_{nom}$	2412	18.15	20	Pass
$T_{max}V_{nom}$	2412	18.54	20	Pass
$T_{nom}V_{nom}$	2442	18.08	20	Pass
$T_{min}V_{nom}$	2442	18.68	20	Pass
$T_{max}V_{nom}$	2442	18.84	20	Pass
$T_{nom}V_{nom}$	2472	18.07	20	Pass
$T_{min}V_{nom}$	2472	19.24	20	Pass
$T_{max}V_{nom}$	2472	18.61	20	Pass

RF Output Power (dBm)				
Test Configuration	1			
Modulation Mode	11g/6Mbps			
Condition	**Freq. (MHz)**	**EIRP Power**	**Limit (dBm)**	**Results**
$T_{nom}V_{nom}$	2412	18.16	20	Pass
$T_{min}V_{nom}$	2412	18.03	20	Pass
$T_{max}V_{nom}$	2412	19.17	20	Pass
$T_{nom}V_{nom}$	2442	18.32	20	Pass
$T_{min}V_{nom}$	2442	18.22	20	Pass
$T_{max}V_{nom}$	2442	19.10	20	Pass
$T_{nom}V_{nom}$	2472	18.23	20	Pass
$T_{min}V_{nom}$	2472	18.59	20	Pass
$T_{max}V_{nom}$	2472	18.90	20	Pass

RF Output Power (dBm)				
Test Configuration	1			
Modulation Mode	HT20/MCS 0			
Condition	**Freq. (MHz)**	**EIRP Power**	**Limit (dBm)**	**Results**
$T_{nom}V_{nom}$	2412	18.12	20	Pass
$T_{min}V_{nom}$	2412	17.86	20	Pass
$T_{max}V_{nom}$	2412	18.79	20	Pass
$T_{nom}V_{nom}$	2442	18.25	20	Pass
$T_{min}V_{nom}$	2442	18.31	20	Pass
$T_{max}V_{nom}$	2442	19.14	20	Pass
$T_{nom}V_{nom}$	2472	18.24	20	Pass
$T_{min}V_{nom}$	2472	18.41	20	Pass
$T_{max}V_{nom}$	2472	18.76	20	Pass

RF Output Power (dBm)				
Test Configuration	2			
Modulation Mode	11b/1Mbps			
Condition	**Freq. (MHz)**	**EIRP Power**	**Limit (dBm)**	**Results**
$T_{nom}V_{nom}$	2412	18.62	20	Pass
$T_{min}V_{nom}$	2412	18.94	20	Pass
$T_{max}V_{nom}$	2412	19.33	20	Pass
$T_{nom}V_{nom}$	2442	18.87	20	Pass
$T_{min}V_{nom}$	2442	19.47	20	Pass
$T_{max}V_{nom}$	2442	19.63	20	Pass
$T_{nom}V_{nom}$	2472	18.86	20	Pass
$T_{min}V_{nom}$	2472	**19.98**	20	Pass
$T_{max}V_{nom}$	2472	19.40	20	Pass

RF Output Power (dBm)				
Test Configuration	2			
Modulation Mode	11g/6Mbps			
Condition	**Freq. (MHz)**	**EIRP Power**	**Limit (dBm)**	**Results**
$T_{nom}V_{nom}$	2412	18.95	20	Pass
$T_{min}V_{nom}$	2412	18.82	20	Pass
$T_{max}V_{nom}$	2412	19.96	20	Pass
$T_{nom}V_{nom}$	2442	19.11	20	Pass
$T_{min}V_{nom}$	2442	19.01	20	Pass
$T_{max}V_{nom}$	2442	19.89	20	Pass
$T_{nom}V_{nom}$	2472	19.02	20	Pass
$T_{min}V_{nom}$	2472	19.38	20	Pass
$T_{max}V_{nom}$	2472	19.69	20	Pass

RF Output Power (dBm)				
Test Configuration	2			
Modulation Mode	HT20/MCS 0			
Condition	**Freq. (MHz)**	**EIRP Power**	**Limit (dBm)**	**Results**
$T_{nom}V_{nom}$	2412	18.91	20	Pass
$T_{min}V_{nom}$	2412	18.65	20	Pass
$T_{max}V_{nom}$	2412	19.58	20	Pass
$T_{nom}V_{nom}$	2442	19.04	20	Pass
$T_{min}V_{nom}$	2442	19.10	20	Pass
$T_{max}V_{nom}$	2442	19.93	20	Pass
$T_{nom}V_{nom}$	2472	19.03	20	Pass
$T_{min}V_{nom}$	2472	19.20	20	Pass
$T_{max}V_{nom}$	2472	19.55	20	Pass

RF Output Power (dBm)				
Test Configuration	3			
Modulation Mode	11b/1Mbps			
Condition	**Freq. (MHz)**	**EIRP Power**	**Limit (dBm)**	**Results**
$T_{nom}V_{nom}$	2412	18.33	20	Pass
$T_{min}V_{nom}$	2412	18.65	20	Pass
$T_{max}V_{nom}$	2412	19.04	20	Pass
$T_{nom}V_{nom}$	2442	18.58	20	Pass
$T_{min}V_{nom}$	2442	19.18	20	Pass
$T_{max}V_{nom}$	2442	19.34	20	Pass
$T_{nom}V_{nom}$	2472	18.57	20	Pass
$T_{min}V_{nom}$	2472	19.74	20	Pass
$T_{max}V_{nom}$	2472	19.11	20	Pass

RF Output Power (dBm)				
Test Configuration	3			
Modulation Mode	11g/6Mbps			
Condition	**Freq. (MHz)**	**EIRP Power**	**Limit (dBm)**	**Results**
$T_{nom}V_{nom}$	2412	18.66	20	Pass
$T_{min}V_{nom}$	2412	18.53	20	Pass
$T_{max}V_{nom}$	2412	19.67	20	Pass
$T_{nom}V_{nom}$	2442	18.82	20	Pass
$T_{min}V_{nom}$	2442	18.72	20	Pass
$T_{max}V_{nom}$	2442	19.60	20	Pass
$T_{nom}V_{nom}$	2472	18.73	20	Pass
$T_{min}V_{nom}$	2472	19.09	20	Pass
$T_{max}V_{nom}$	2472	19.40	20	Pass

RF Output Power (dBm)				
Test Configuration	3			
Modulation Mode	HT20/MCS 0			
Condition	**Freq. (MHz)**	**EIRP Power**	**Limit (dBm)**	**Results**
$T_{nom}V_{nom}$	2412	18.62	20	Pass
$T_{min}V_{nom}$	2412	18.36	20	Pass
$T_{max}V_{nom}$	2412	19.29	20	Pass
$T_{nom}V_{nom}$	2442	18.75	20	Pass
$T_{min}V_{nom}$	2442	18.81	20	Pass
$T_{max}V_{nom}$	2442	19.64	20	Pass
$T_{nom}V_{nom}$	2472	18.74	20	Pass
$T_{min}V_{nom}$	2472	18.91	20	Pass
$T_{max}V_{nom}$	2472	19.26	20	Pass

3.2 Power Spectral Density

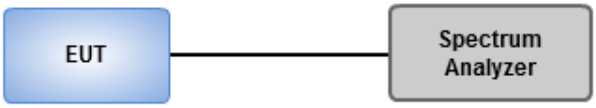
3.2.1 Limit of Power Spectral Density

For equipment using wide band modulations other than FHSS, the maximum Power Spectral Density is limited to 10 dBm per MHz.

3.2.2 Test Procedures

Reference to clause 5.4.3.2 of ETSI EN 300 328 V2.1.1 (2016-11).

3.2.3 Test Setup



3.2.4 Test Result of Power Spectral Density

Test Configuration	1			
Modulation Mode	**Freq. (MHz)**	**Power Density (dBm/1MHz)**	**Limit (dBm/1MHz)**	**Results**
11b/1Mbps	2412	8.73	10	Pass
11b/1Mbps	2442	8.93	10	Pass
11b/1Mbps	2472	8.92	10	Pass
11g/6Mbps	2412	6.52	10	Pass
11g/6Mbps	2442	6.73	10	Pass
11g/6Mbps	2472	6.62	10	Pass
HT20/MCS 0	2412	6.66	10	Pass
HT20/MCS 0	2442	6.82	10	Pass
HT20/MCS 0	2472	6.36	10	Pass

Test Configuration	2			
Modulation Mode	**Freq. (MHz)**	**Power Density (dBm/1MHz)**	**Limit (dBm/1MHz)**	**Results**
11b/1Mbps	2412	9.52	10	Pass
11b/1Mbps	2442	9.72	10	Pass
11b/1Mbps	2472	9.71	10	Pass
11g/6Mbps	2412	7.31	10	Pass
11g/6Mbps	2442	7.52	10	Pass
11g/6Mbps	2472	7.41	10	Pass
HT20/MCS 0	2412	7.45	10	Pass
HT20/MCS 0	2442	7.61	10	Pass
HT20/MCS 0	2472	7.15	10	Pass

Test Configuration	3			
Modulation Mode	**Freq. (MHz)**	**Power Density (dBm/1MHz)**	**Limit (dBm/1MHz)**	**Results**
11b/1Mbps	2412	9.23	10	Pass
11b/1Mbps	2442	9.43	10	Pass
11b/1Mbps	2472	9.42	10	Pass
11g/6Mbps	2412	7.02	10	Pass
11g/6Mbps	2442	7.23	10	Pass
11g/6Mbps	2472	7.12	10	Pass
HT20/MCS 0	2412	7.16	10	Pass
HT20/MCS 0	2442	7.32	10	Pass
HT20/MCS 0	2472	6.86	10	Pass

3.3 Occupied Channel Bandwidth

3.3.1 Limit of Occupied Channel Bandwidth

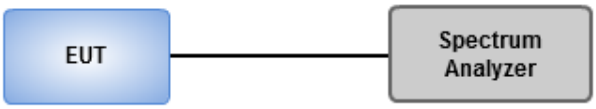
The Occupied Channel Bandwidth shall fall completely within 2.4~2.4835 GHz.

In addition, for non-adaptive equipment using wide band modulations other than FHSS and with e.i.r.p greater than 10 dBm, the occupied channel bandwidth shall be less than 20 MHz.

3.3.2 Test Procedures

Reference to clause 5.4.7.2 of ETSI EN 300 328 V2.1.1 (2016-11).

3.3.3 Test Setup

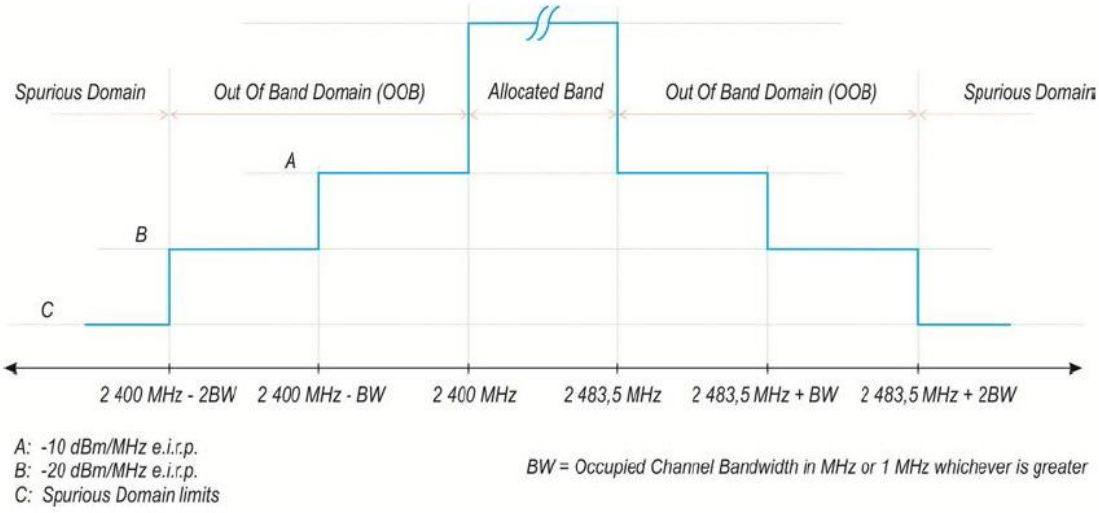


3.3.4 Test Result of Occupied Channel Bandwidth

Test Configuration	1				
Modulation Mode	**Frequency (MHz)**	**99% Bandwidth (MHz)**	**F_L at 99% BW (MHz)**	**F_H at 99% BW (MHz)**	**Limit F_L / F_H (MHz)**
11b/1Mbps	2412	13.95	2405.05	2419.00	2400.0
11b/1Mbps	2472	13.95	2465.05	2479.00	2483.5
11g/6Mbps	2412	17.08	2403.49	2420.57	2400.0
11g/6Mbps	2472	17.08	2463.49	2480.57	2483.5
HT20/MCS 0	2412	18.23	2402.91	2421.15	2400.0
HT20/MCS 0	2472	18.18	2462.91	2481.09	2483.5

3.4 Transmitter Unwanted Emissions in the Out-Of-Band Domain

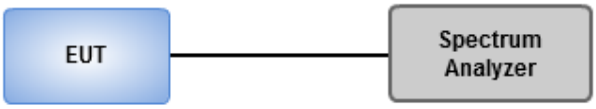
3.4.1 Limit of Transmitter Unwanted Emissions in the Out-Of-Band Domain



3.4.2 Test Procedures

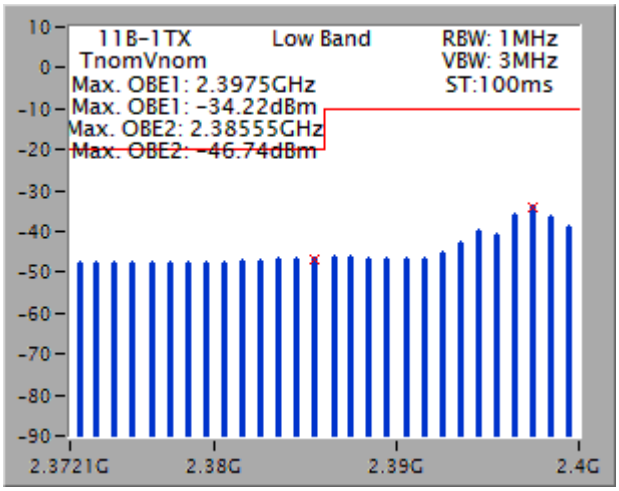
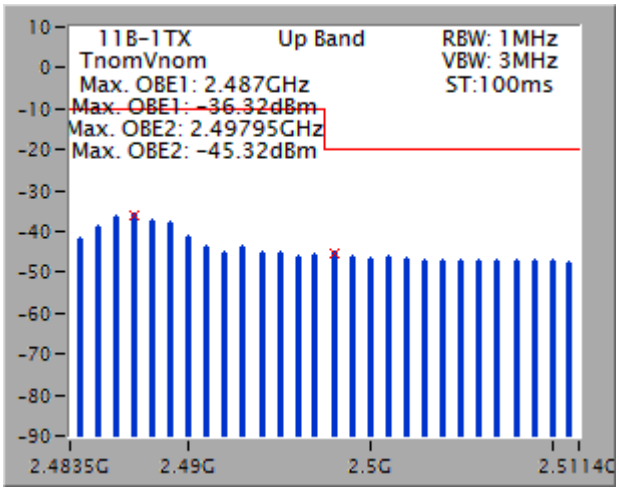
Reference to clause 5.4.8.2 of ETSI EN 300 328 V2.1.1 (2016-11).

3.4.3 Test Setup

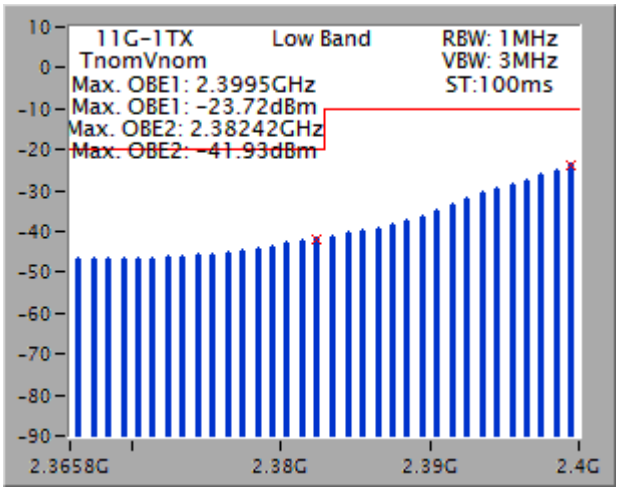


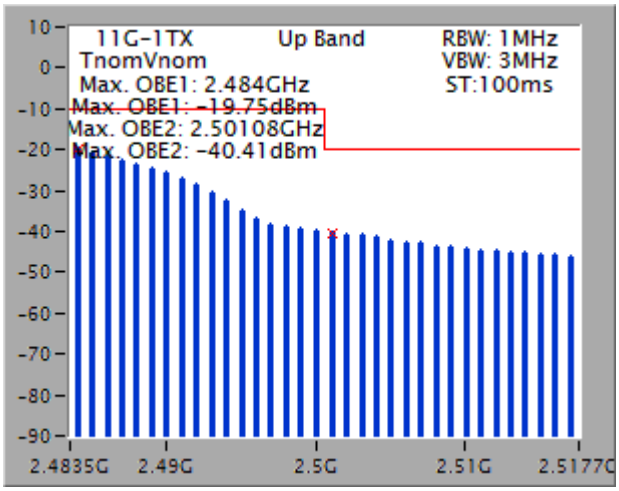
3.4.4 Test Result of Transmitter Unwanted Emissions in the Out-Of-Band Domain

Test Configuration	1				
Condition	**Modulation Mode**	**Freq. (MHz)**	**OOB Freq. (MHz)**	**OOB Emissions (dBm)**	**Limit (dBm)**
$T_{nom}V_{nom}$	11b/1Mbps	2412	2397.50	-34.22	-10
$T_{nom}V_{nom}$	11b/1Mbps	2472	2487.00	-36.32	-10
$T_{nom}V_{nom}$	11b/1Mbps	2412	2385.55	-46.74	-20
$T_{nom}V_{nom}$	11b/1Mbps	2472	2497.95	-45.32	-20

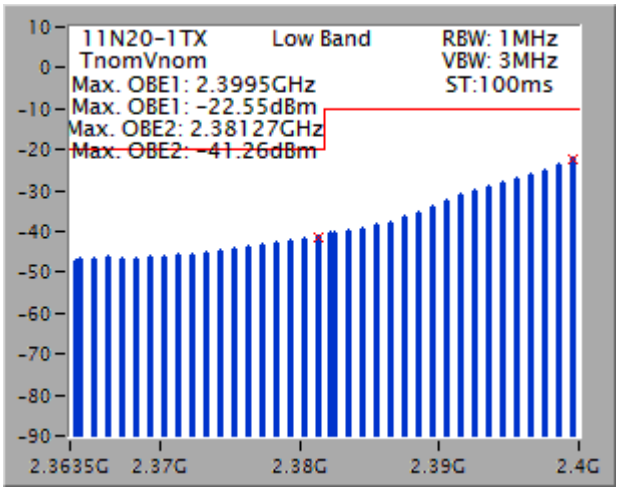
Low Band	Up Band
	

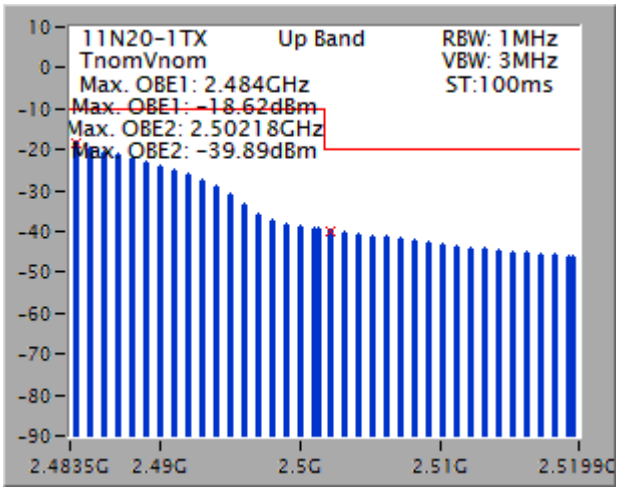
Test Configuration	1				
Condition	**Modulation Mode**	**Freq. (MHz)**	**OOB Freq. (MHz)**	**OOB Emissions (dBm)**	**Limit (dBm)**
$T_{nom}V_{nom}$	11g/6Mbps	2412	2399.50	-23.72	-10
$T_{nom}V_{nom}$	11g/6Mbps	2472	2484.00	-19.75	-10
$T_{nom}V_{nom}$	11g/6Mbps	2412	2382.42	-41.93	-20
$T_{nom}V_{nom}$	11g/6Mbps	2472	2501.08	-40.41	-20
Low Band			**Up Band**		



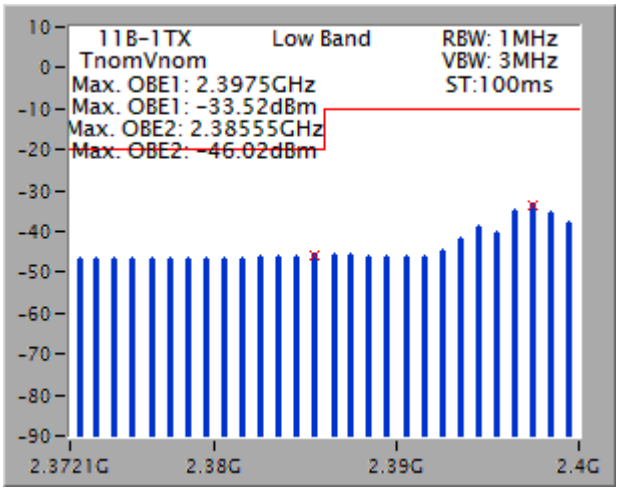


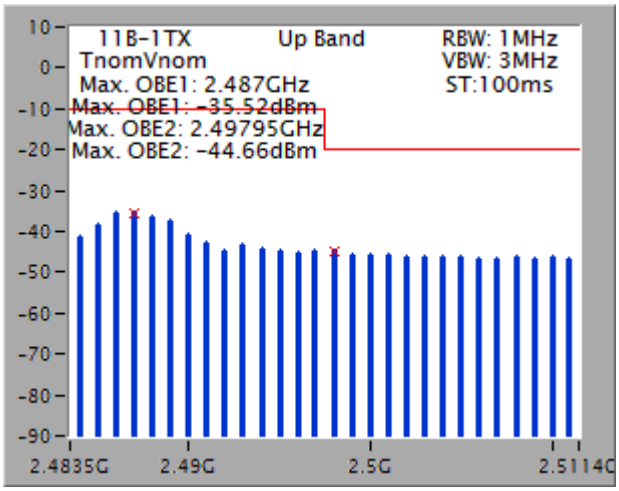
Test Configuration	1				
Condition	**Modulation Mode**	**Freq. (MHz)**	**OOB Freq. (MHz)**	**OOB Emissions (dBm)**	**Limit (dBm)**
$T_{nom}V_{nom}$	HT20/MCS 0	2412	2399.50	-22.55	-10
$T_{nom}V_{nom}$	HT20/MCS 0	2472	2484.00	-18.62	-10
$T_{nom}V_{nom}$	HT20/MCS 0	2412	2381.27	-41.26	-20
$T_{nom}V_{nom}$	HT20/MCS 0	2472	2502.18	-39.89	-20
Low Band			**Up Band**		



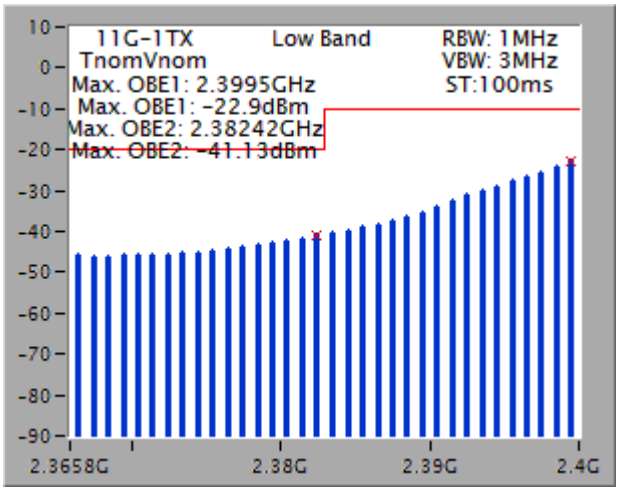


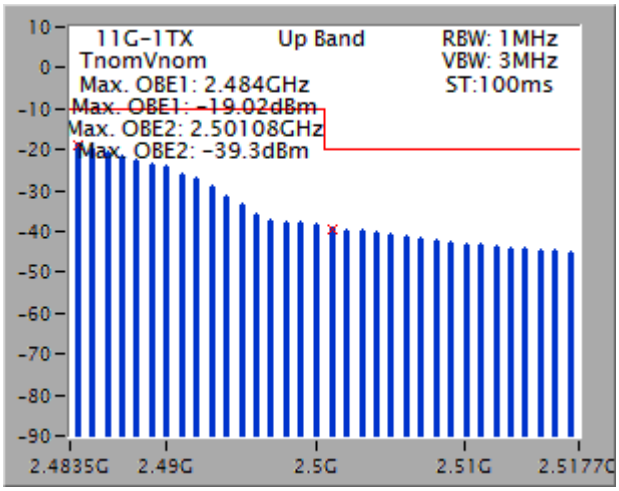
Test Configuration	2				
Condition	**Modulation Mode**	**Freq. (MHz)**	**OOB Freq. (MHz)**	**OOB Emissions (dBm)**	**Limit (dBm)**
$T_{nom}V_{nom}$	11b/1Mbps	2412	2397.50	-33.52	-10
$T_{nom}V_{nom}$	11b/1Mbps	2472	2487.00	-35.52	-10
$T_{nom}V_{nom}$	11b/1Mbps	2412	2385.55	-46.02	-20
$T_{nom}V_{nom}$	11b/1Mbps	2472	2497.95	-44.66	-20
Low Band			**Up Band**		



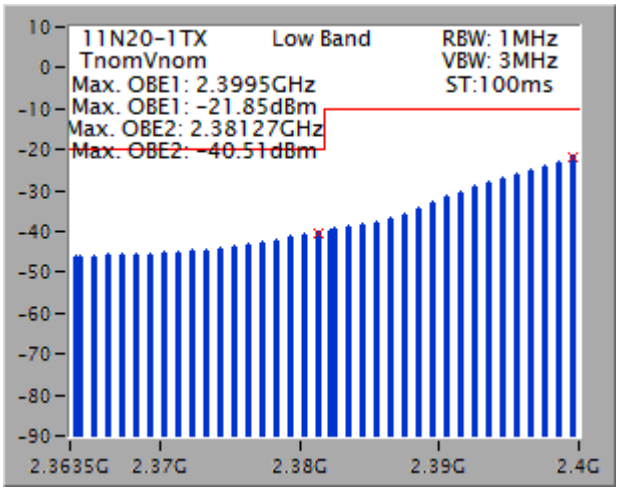


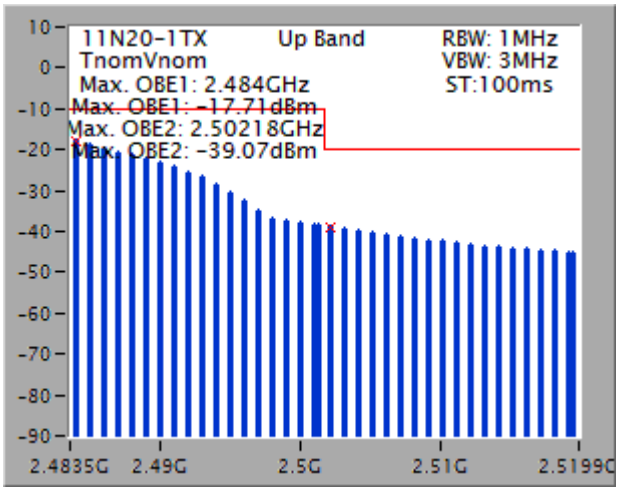
Test Configuration	2				
Condition	**Modulation Mode**	**Freq. (MHz)**	**OOB Freq. (MHz)**	**OOB Emissions (dBm)**	**Limit (dBm)**
$T_{nom}V_{nom}$	11g/6Mbps	2412	2399.50	-22.90	-10
$T_{nom}V_{nom}$	11g/6Mbps	2472	2484.00	-19.02	-10
$T_{nom}V_{nom}$	11g/6Mbps	2412	2382.42	-41.13	-20
$T_{nom}V_{nom}$	11g/6Mbps	2472	2501.08	-39.3	-20
Low Band			**Up Band**		



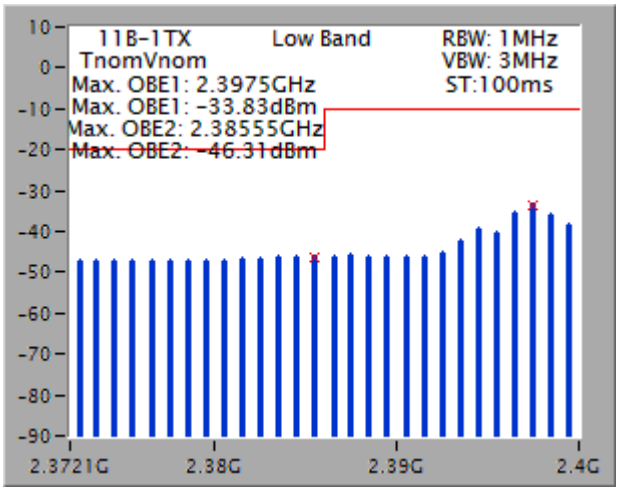


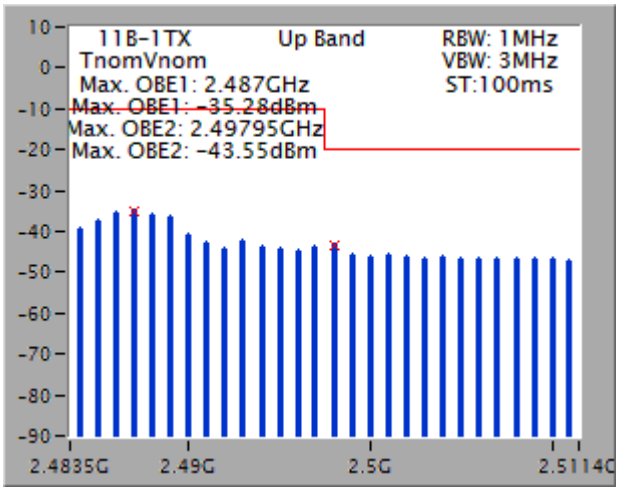
Test Configuration	2				
Condition	**Modulation Mode**	**Freq. (MHz)**	**OOB Freq. (MHz)**	**OOB Emissions (dBm)**	**Limit (dBm)**
$T_{nom}V_{nom}$	HT20/MCS 0	2412	2399.50	-21.85	-10
$T_{nom}V_{nom}$	HT20/MCS 0	2472	2484.00	-17.71	-10
$T_{nom}V_{nom}$	HT20/MCS 0	2412	2381.27	-40.51	-20
$T_{nom}V_{nom}$	HT20/MCS 0	2472	2502.18	-39.07	-20
Low Band			**Up Band**		



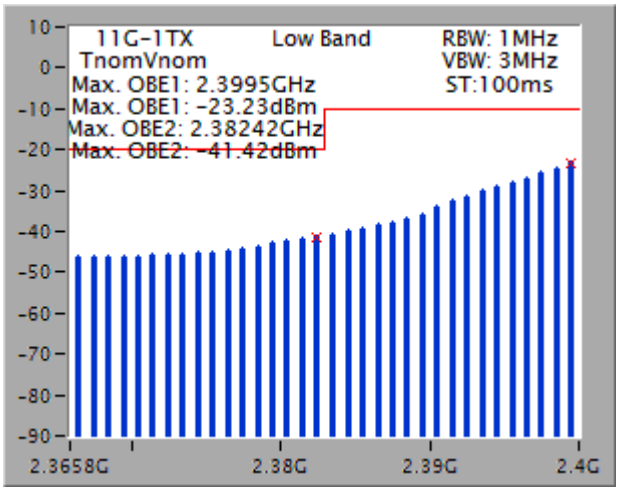


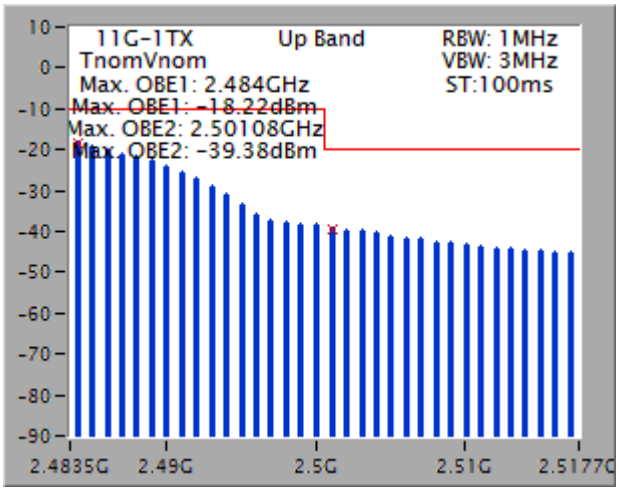
Test Configuration	3				
Condition	**Modulation Mode**	**Freq. (MHz)**	**OOB Freq. (MHz)**	**OOB Emissions (dBm)**	**Limit (dBm)**
$T_{nom}V_{nom}$	11b/1Mbps	2412	2397.50	-33.83	-10
$T_{nom}V_{nom}$	11b/1Mbps	2472	2487.00	-35.28	-10
$T_{nom}V_{nom}$	11b/1Mbps	2412	2385.55	-46.31	-20
$T_{nom}V_{nom}$	11b/1Mbps	2472	2497.95	-43.55	-20
Low Band			**Up Band**		



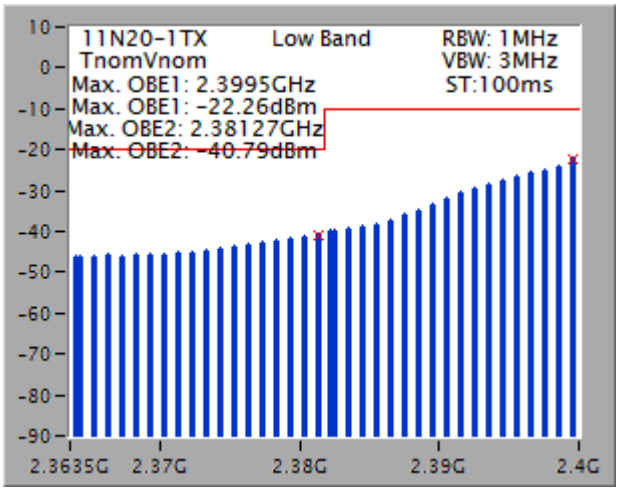


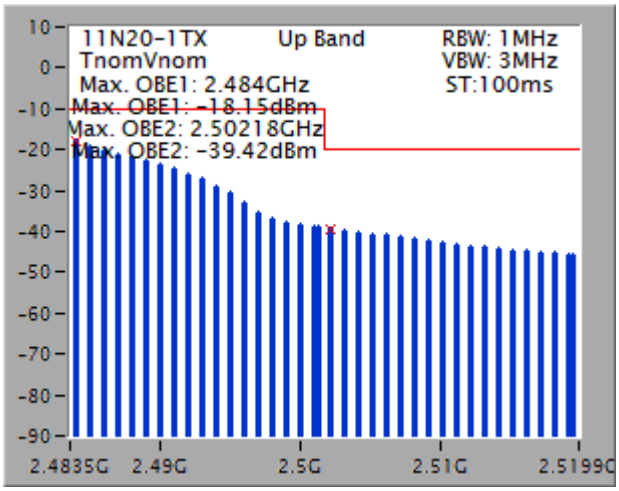
Test Configuration	3				
Condition	**Modulation Mode**	**Freq. (MHz)**	**OOB Freq. (MHz)**	**OOB Emissions (dBm)**	**Limit (dBm)**
$T_{nom}V_{nom}$	11g/6Mbps	2412	2399.50	-23.23	-10
$T_{nom}V_{nom}$	11g/6Mbps	2472	2484.00	-18.22	-10
$T_{nom}V_{nom}$	11g/6Mbps	2412	2382.42	-41.42	-20
$T_{nom}V_{nom}$	11g/6Mbps	2472	2501.08	-39.38	-20
Low Band			**Up Band**		





Test Configuration	3				
Condition	**Modulation Mode**	**Freq. (MHz)**	**OOB Freq. (MHz)**	**OOB Emissions (dBm)**	**Limit (dBm)**
$T_{nom}V_{nom}$	HT20/MCS 0	2412	2399.50	-22.26	-10
$T_{nom}V_{nom}$	HT20/MCS 0	2472	2484.00	-18.15	-10
$T_{nom}V_{nom}$	HT20/MCS 0	2412	2381.27	-40.79	-20
$T_{nom}V_{nom}$	HT20/MCS 0	2472	2502.18	-39.42	-20
Low Band			**Up Band**		





3.5 Transmitter Unwanted Emissions in the Spurious Domain

3.5.1 Limit of Transmitter Unwanted Emissions in the Spurious Domain

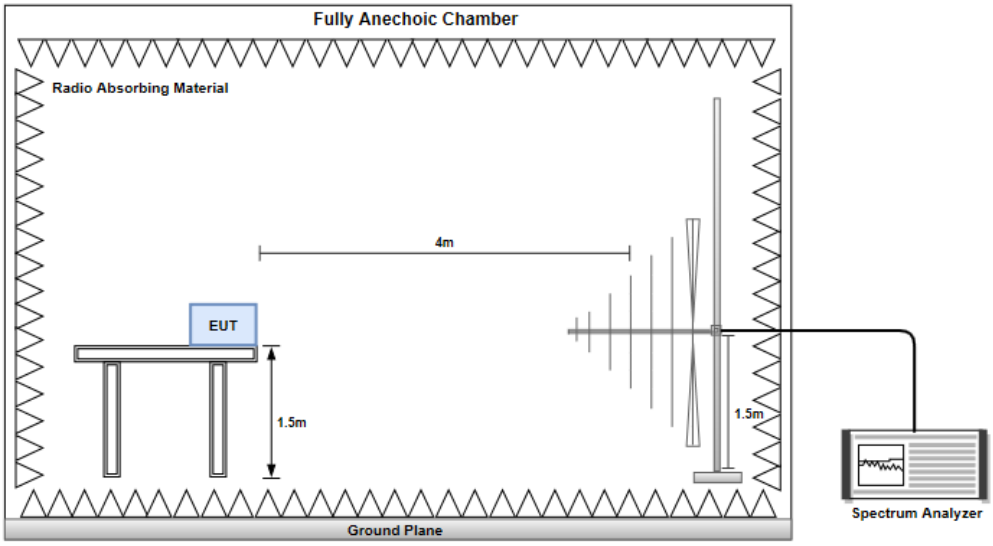
Frequency Range (MHz)	Maximum power (dBm)	Bandwidth (kHz)
30 to 47	-36	100
47 to 74	-54	100
74 to 87,5	-36	100
87,5 to 118	-54	100
118 to 174	-36	100
174 to 230	-54	100
230 to 470	-36	100
470 to 694	-54	100
694 to 1000	-36	100
1000 to 12750	-30	1000

3.5.2 Test Procedures

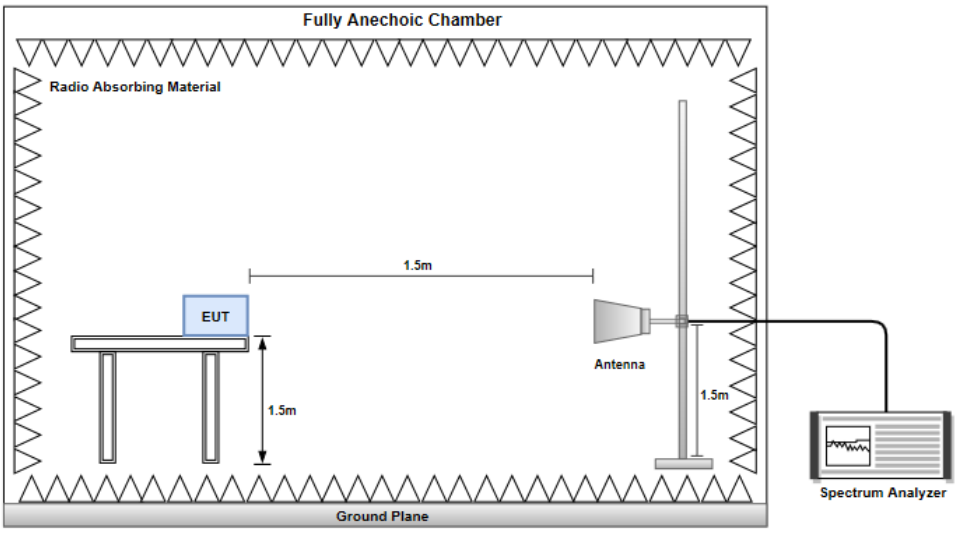
Reference to clause 5.4.9.2 of ETSI EN 300 328 V2.1.1 (2016-11).

3.5.3 Test Setup

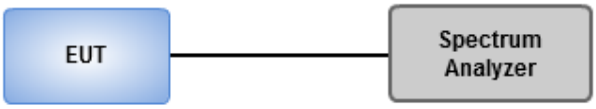
Below 1GHz



Above 1 GHz

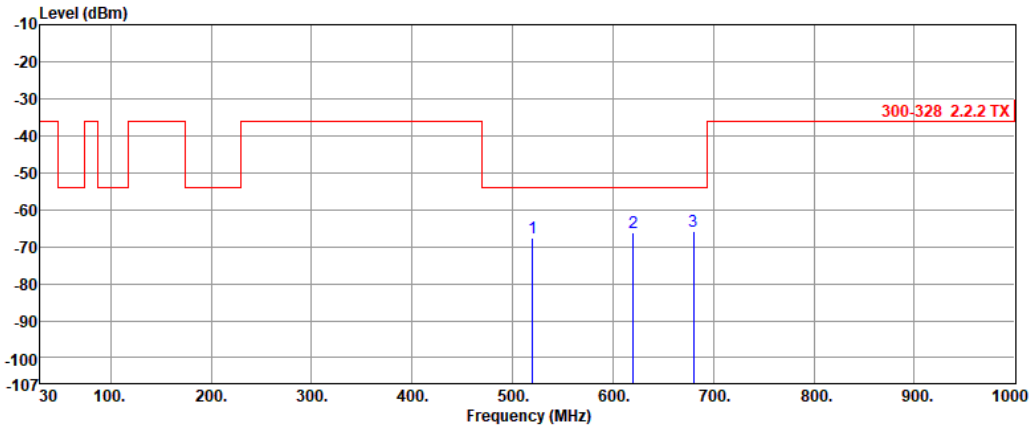


For Conducted Test



3.5.4 Radiated Results of Transmitter Spurious Emissions (Below 1GHz)

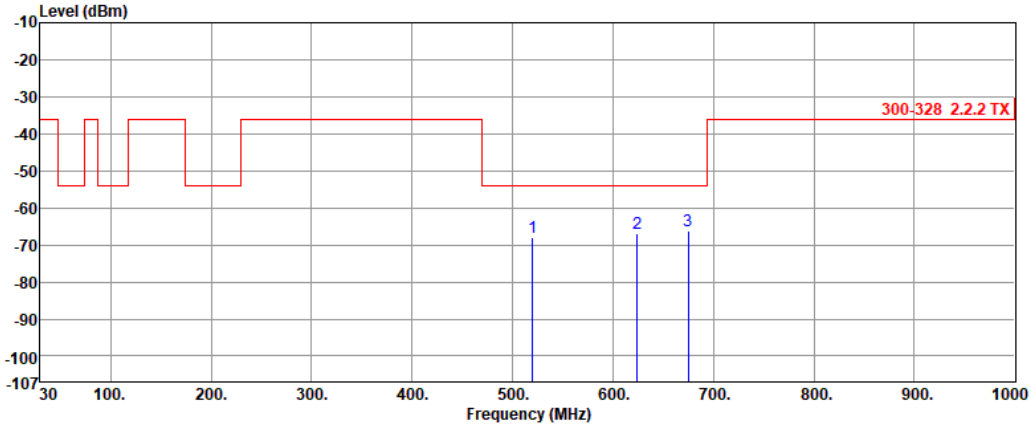
Modulation	11g	**Test Freq. (MHz)**	2412
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	519.85	-67.69	-54.00	-13.69	4.67	-72.36
2	619.95	-66.19	-54.00	-12.19	6.81	-73.00
3	679.90	-66.01	-54.00	-12.01	7.50	-73.51

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

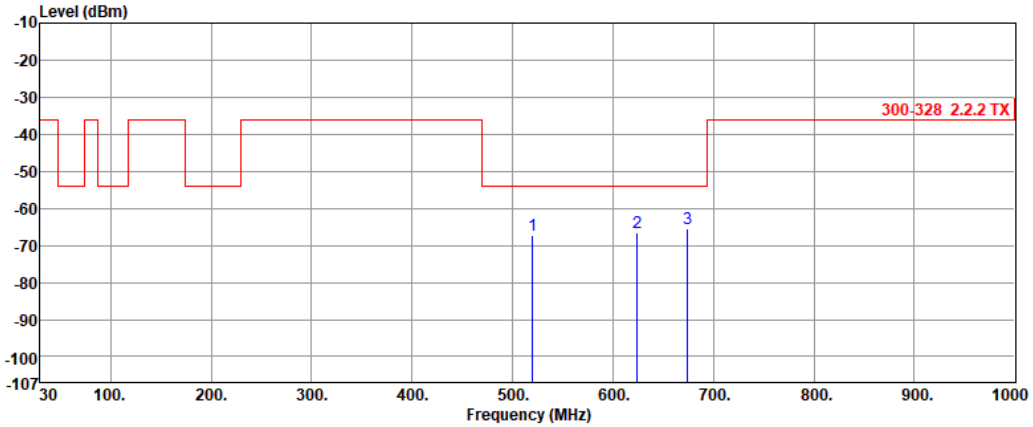
Modulation	11g	Test Freq. (MHz)	2412
Polarization	Vertical		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	519.85	-67.99	-54.00	-13.99	4.47	-72.46
2	624.43	-66.76	-54.00	-12.76	6.69	-73.45
3	675.05	-66.30	-54.00	-12.30	6.85	-73.15

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

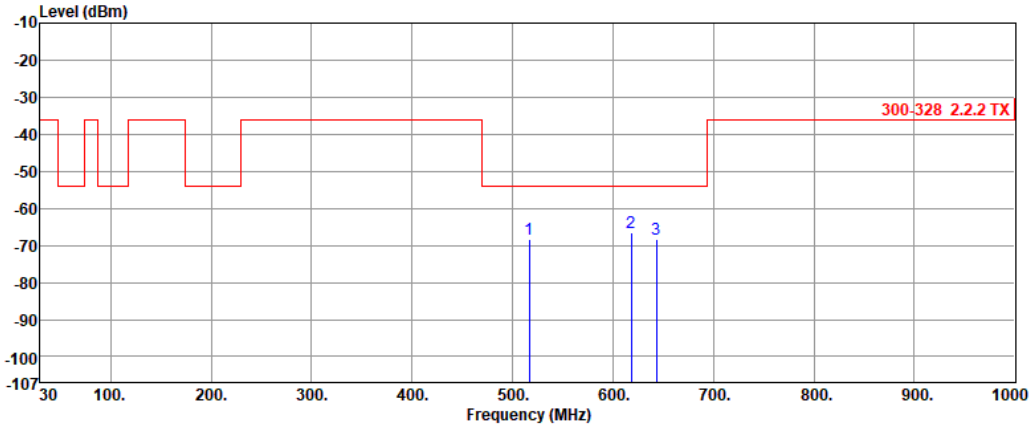
Modulation	11g	Test Freq. (MHz)	2472
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	519.85	-67.19	-54.00	-13.19	4.67	-71.86
2	624.43	-66.44	-54.00	-12.44	6.66	-73.10
3	674.08	-65.61	-54.00	-11.61	7.35	-72.96

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

Modulation	11g	Test Freq. (MHz)	2472
Polarization	Vertical		

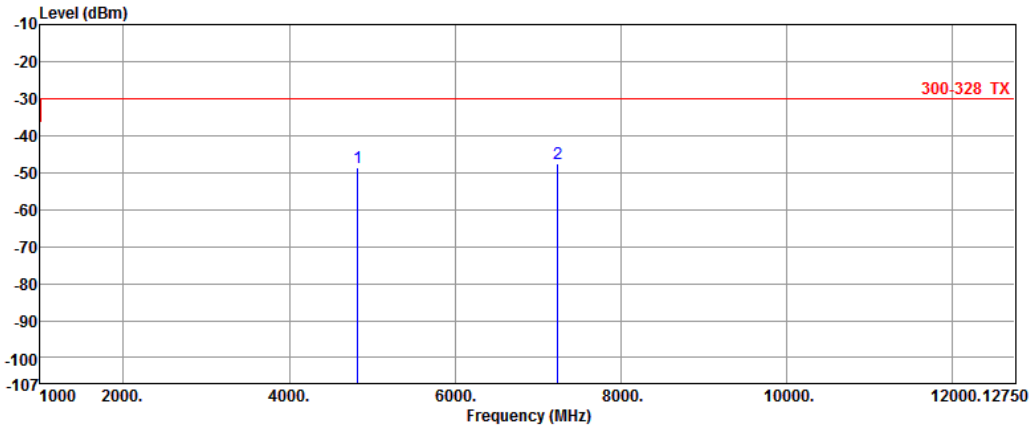


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	516.94	-68.45	-54.00	-14.45	4.41	-72.86
2	618.31	-66.52	-54.00	-12.52	7.06	-73.58
3	643.04	-68.49	-54.00	-14.49	6.39	-74.88

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

3.5.5 Radiated Results of Transmitter Spurious Emissions (Above 1GHz) for 802.11b

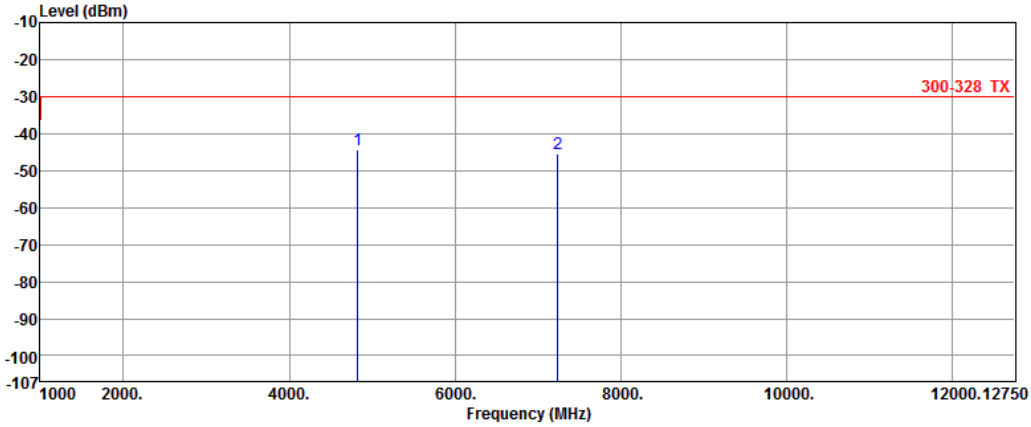
Modulation	11b	**Test Freq. (MHz)**	2412
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4823.95	-48.53	-30.00	-18.53	13.43	-61.96
2	7236.25	-47.67	-30.00	-17.67	18.62	-66.29

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

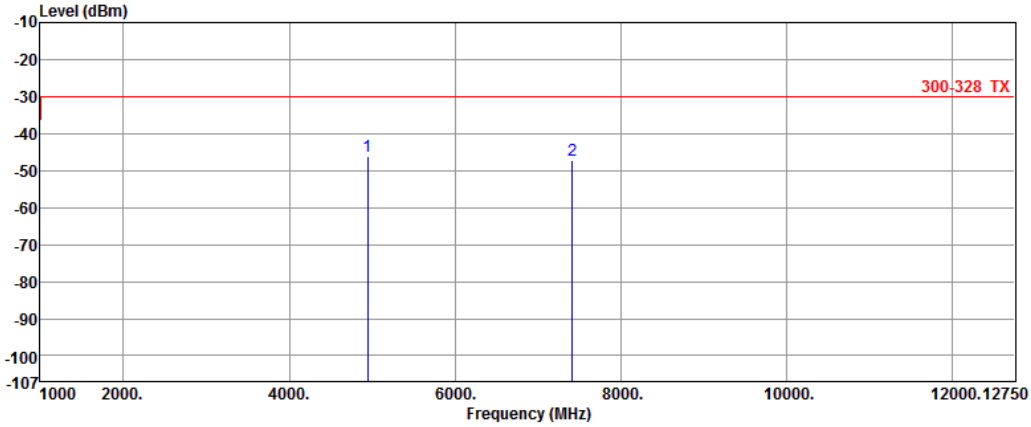
Modulation	11b	Test Freq. (MHz)	2412
Polarization	Vertical		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4824.09	-44.25	-30.00	-14.25	13.49	-57.74
2	7236.25	-45.60	-30.00	-15.60	18.80	-64.40

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

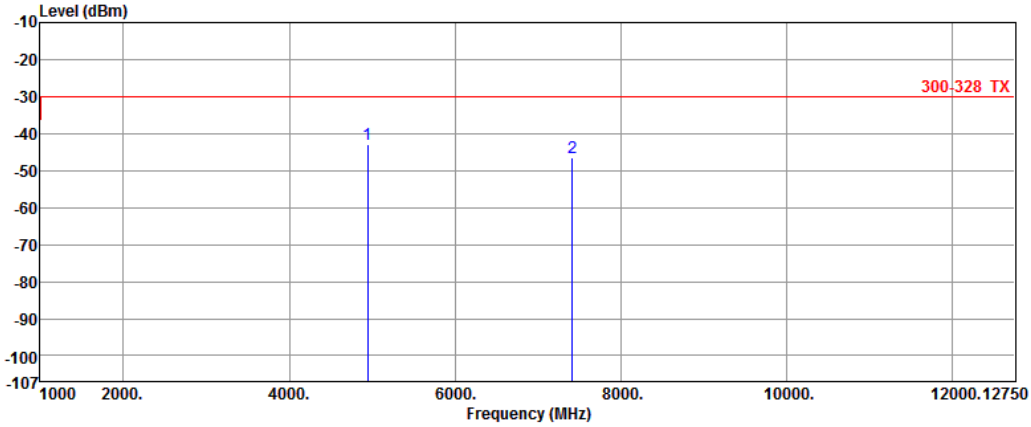
Modulation	11b	Test Freq. (MHz)	2472
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4944.17	-46.01	-30.00	-16.01	13.17	-59.18
2	7416.20	-47.33	-30.00	-17.33	18.92	-66.25

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

Modulation	11b	Test Freq. (MHz)	2472
Polarization	Vertical		

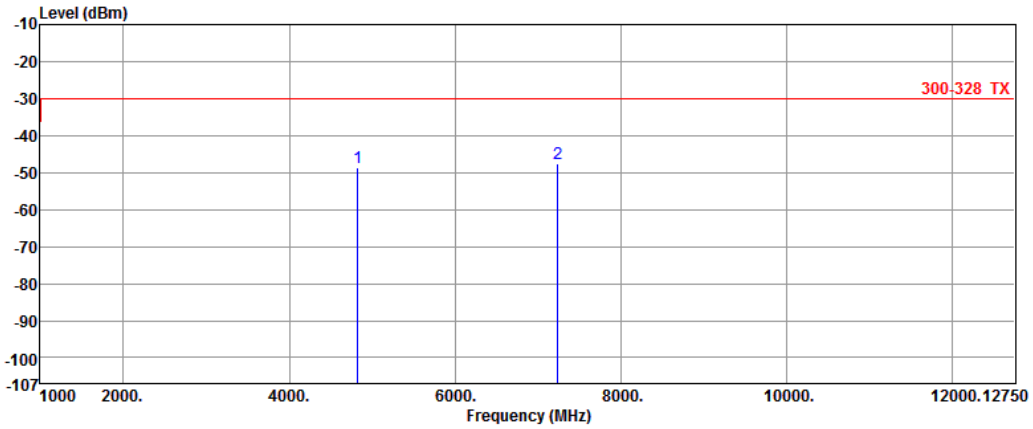


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4943.96	-42.88	-30.00	-12.88	13.04	-55.92
2	7416.65	-46.55	-30.00	-16.55	18.83	-65.38

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

3.5.6 Radiated Results Transmitter Spurious Emissions (Above 1GHz) for 802.11g

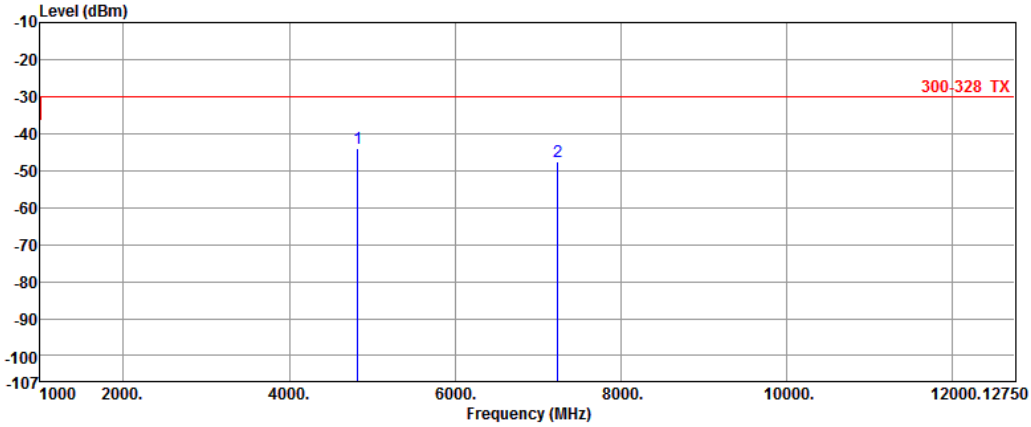
Modulation	11g	**Test Freq. (MHz)**	2412
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4824.60	-48.55	-30.00	-18.55	13.43	-61.98
2	7236.65	-47.68	-30.00	-17.68	18.62	-66.30

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

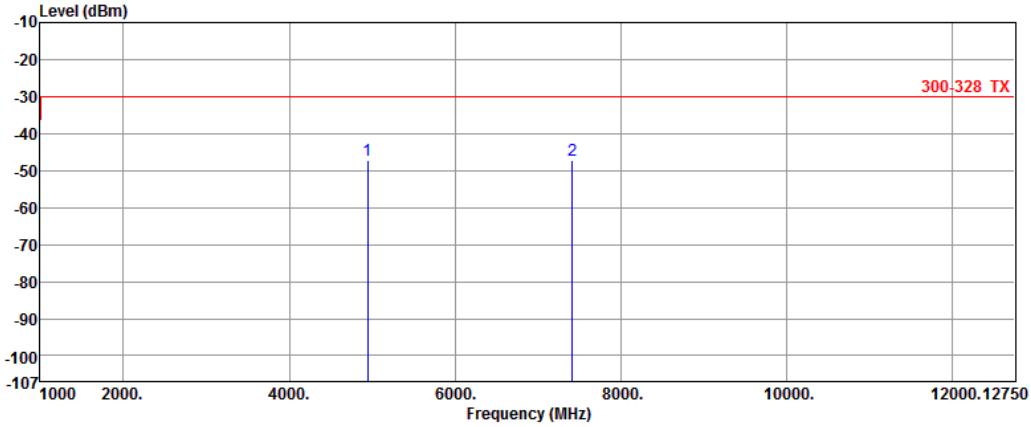
Modulation	11g	Test Freq. (MHz)	2412
Polarization	Vertical		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4824.15	-44.02	-30.00	-14.02	13.49	-57.51
2	7236.00	-47.73	-30.00	-17.73	18.80	-66.53

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

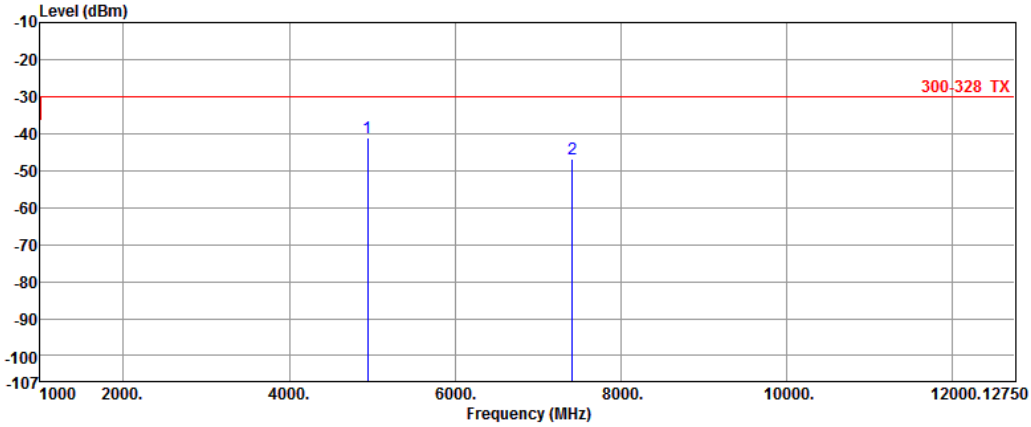
Modulation	11g	Test Freq. (MHz)	2472
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4944.40	-47.17	-30.00	-17.17	13.17	-60.34
2	7416.85	-47.33	-30.00	-17.33	18.93	-66.26

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

Modulation	11g	Test Freq. (MHz)	2472
Polarization	Vertical		

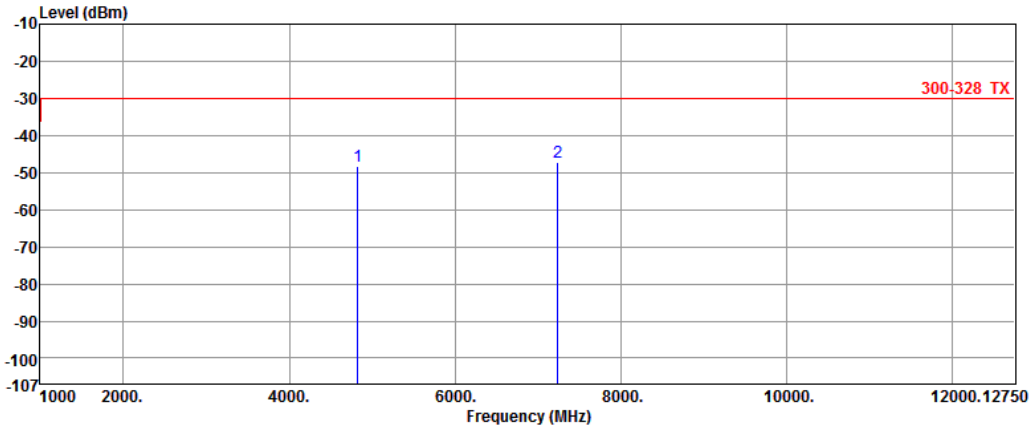


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4943.70	-41.22	-30.00	-11.22	13.05	-54.27
2	7416.40	-46.88	-30.00	-16.88	18.83	-65.71

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

3.5.7 Radiated Results Transmitter Spurious Emissions (Above 1GHz) for 802.11n HT 20

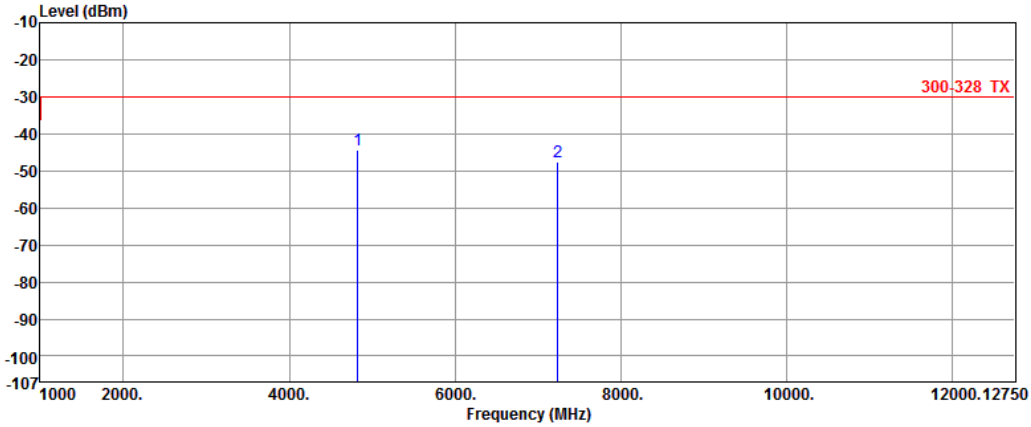
Modulation	HT20	**Test Freq. (MHz)**	2412
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4824.56	-48.45	-30.00	-18.45	13.43	-61.88
2	7236.14	-47.34	-30.00	-17.34	18.62	-65.96

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

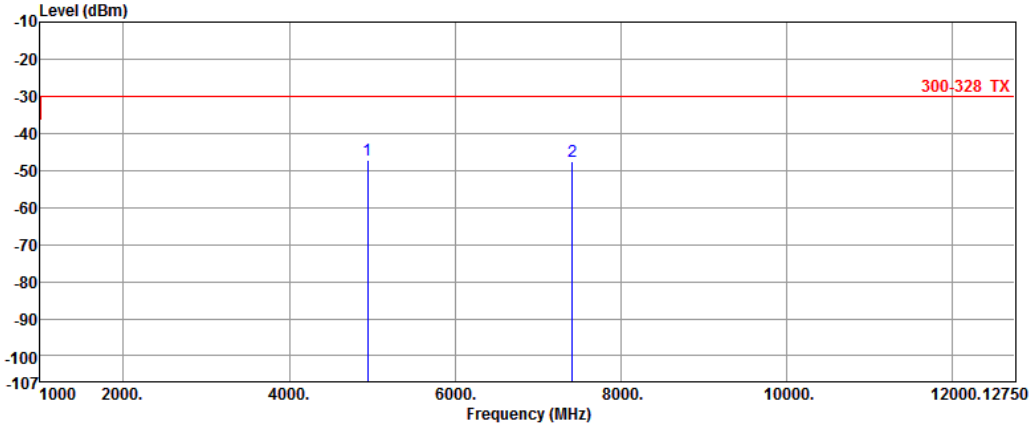
Modulation	HT20	Test Freq. (MHz)	2412
Polarization	Vertical		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4824.05	-44.32	-30.00	-14.32	13.49	-57.81
2	7236.12	-47.63	-30.00	-17.63	18.80	-66.43

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

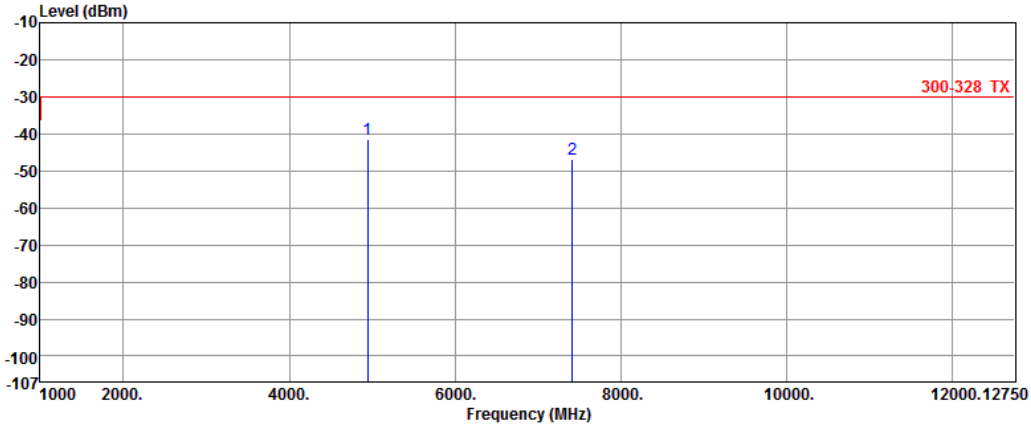
Modulation	HT20	Test Freq. (MHz)	2472
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4944.31	-47.27	-30.00	-17.27	13.17	-60.44
2	7416.75	-47.43	-30.00	-17.43	18.93	-66.36

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

Modulation	HT20	Test Freq. (MHz)	2472
Polarization	Vertical		

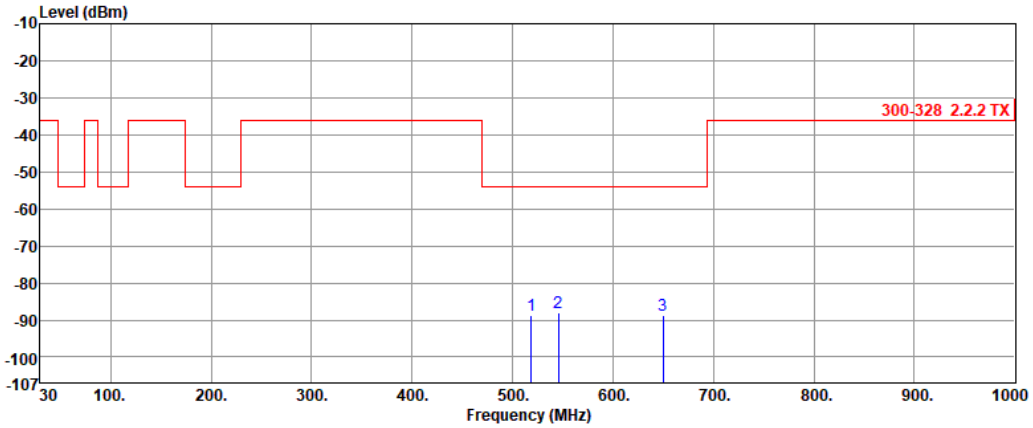


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	4943.34	-41.55	-30.00	-11.55	13.05	-54.60
2	7416.24	-46.75	-30.00	-16.75	18.83	-65.58

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

3.5.8 Conducted Results of Transmitter Spurious Emissions (Below 1GHz)

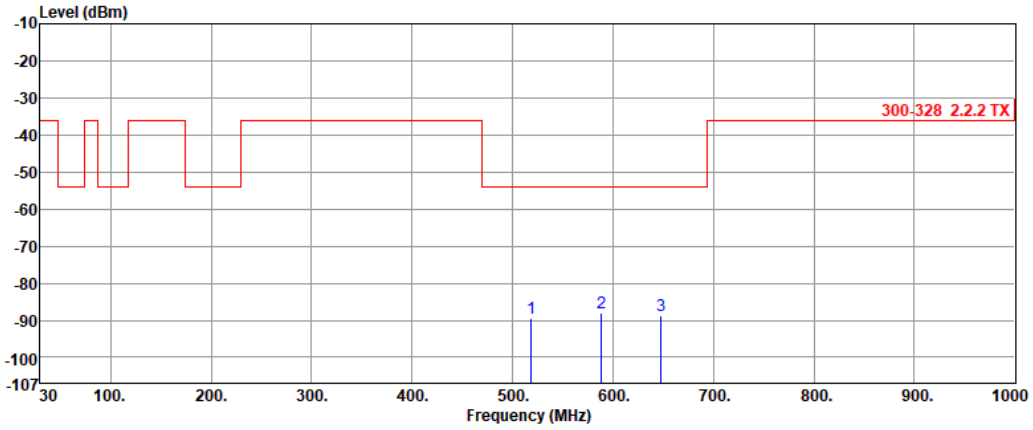
Modulation	11g	Test Freq. (MHz)	2412



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	518.88	-88.78	-54.00	-34.78	0.00	-88.78
2	545.77	-87.90	-54.00	-33.90	0.00	-87.90
3	649.83	-88.58	-54.00	-34.58	0.00	-88.58

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

Modulation	11g	Test Freq. (MHz)	2472

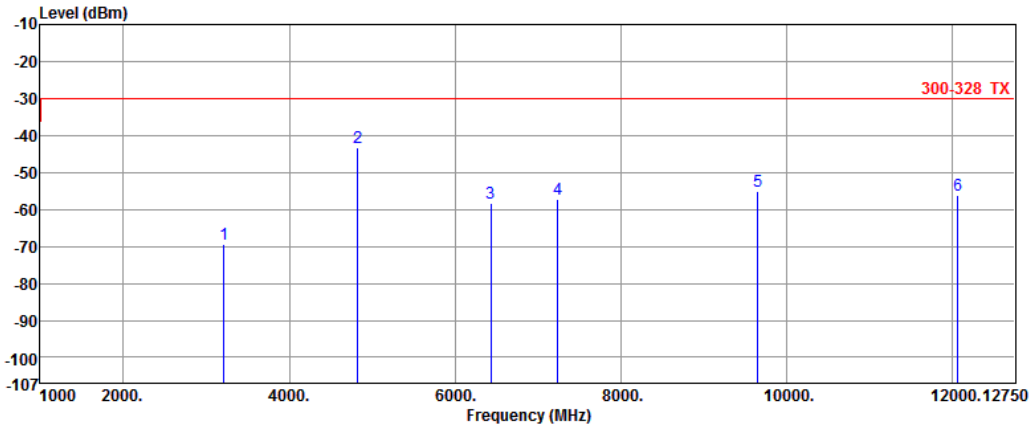


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	518.88	-89.40	-54.00	-35.40	0.00	-89.40
2	588.31	-88.09	-54.00	-34.09	0.00	-88.09
3	647.89	-88.89	-54.00	-34.89	0.00	-88.89

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

3.5.9 Conducted Results of Transmitter Spurious Emissions (Above 1GHz) for 802.11b

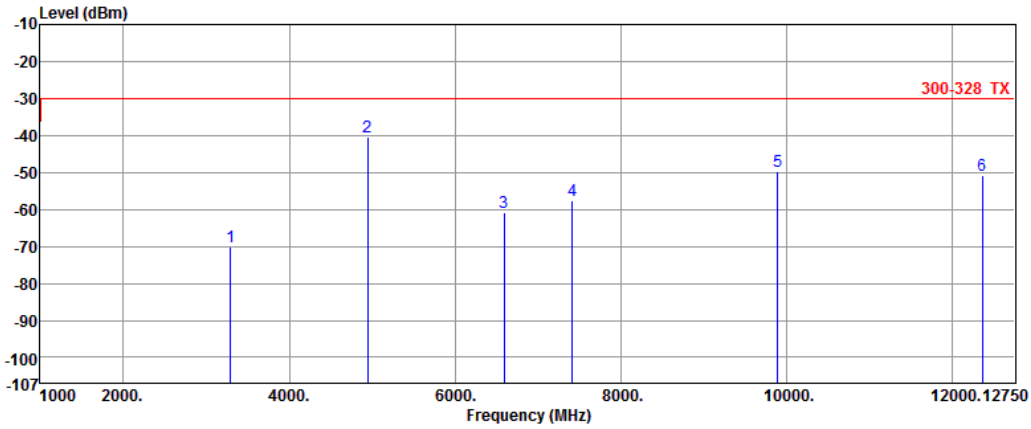
Modulation	11b	Test Freq. (MHz)	2412



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	3216.05	-69.39	-30.00	-39.39	0.00	-69.39
2	4823.92	-43.39	-30.00	-13.39	0.00	-43.39
3	6432.07	-58.18	-30.00	-28.18	0.00	-58.18
4	7234.50	-57.42	-30.00	-27.42	0.00	-57.42
5	9647.98	-55.08	-30.00	-25.08	0.00	-55.08
6	12061.52	-56.11	-30.00	-26.11	0.00	-56.11

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

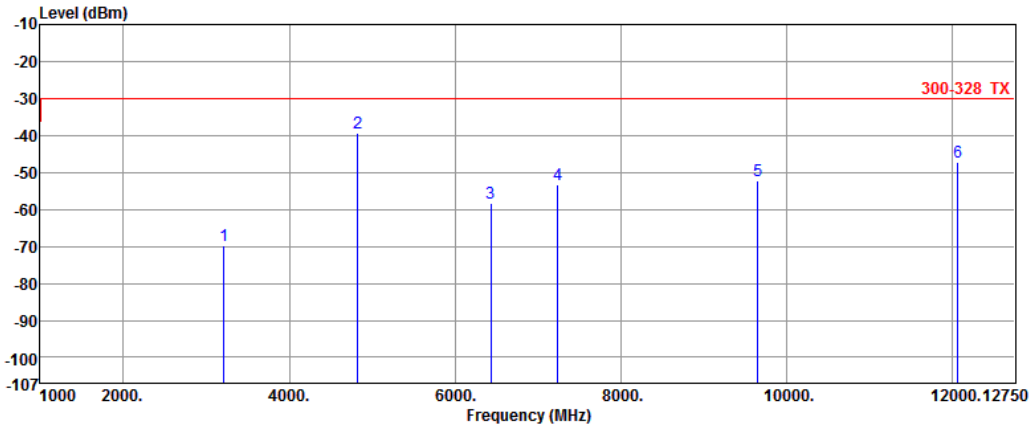
Modulation	11b	Test Freq. (MHz)	2472



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	3295.72	-70.12	-30.00	-40.12	0.00	-70.12
2	4944.02	-40.59	-30.00	-10.59	0.00	-40.59
3	6591.87	-60.76	-30.00	-30.76	0.00	-60.76
4	7414.57	-57.59	-30.00	-27.59	0.00	-57.59
5	9888.04	-49.64	-30.00	-19.64	0.00	-49.64
6	12358.42	-50.84	-30.00	-20.84	0.00	-50.84

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

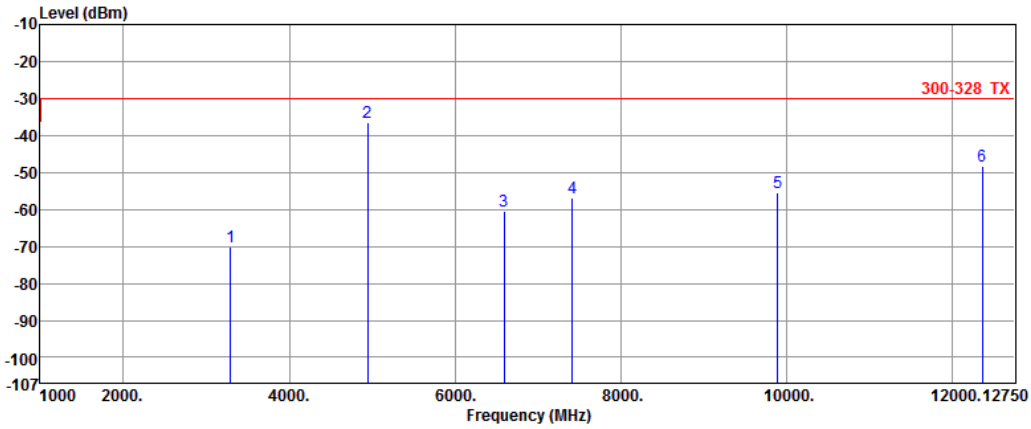
Modulation	11g	Test Freq. (MHz)	2412



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	3216.19	-69.69	-30.00	-39.69	0.00	-69.69
2	4824.65	-39.29	-30.00	-9.29	0.00	-39.29
3	6432.03	-58.21	-30.00	-28.21	0.00	-58.21
4	7236.75	-53.36	-30.00	-23.36	0.00	-53.36
5	9648.40	-52.15	-30.00	-22.15	0.00	-52.15
6	12060.90	-47.33	-30.00	-17.33	0.00	-47.33

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

Modulation	11g	Test Freq. (MHz)	2472

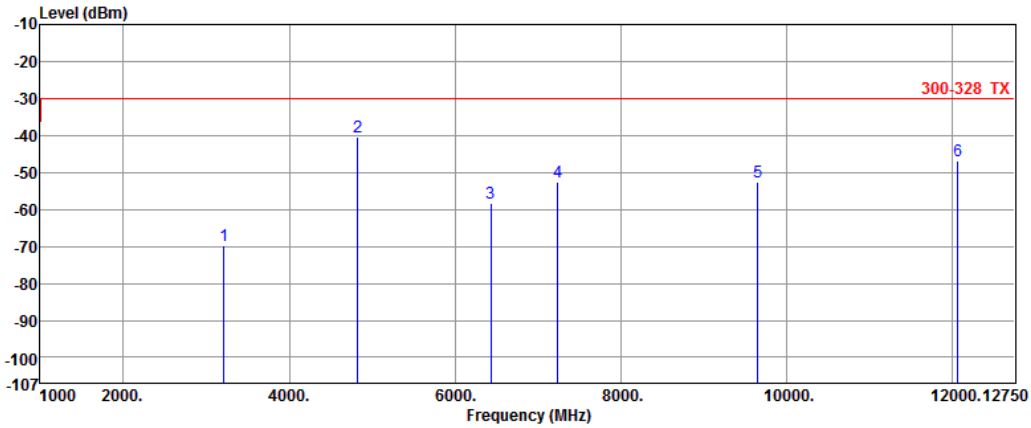


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	3295.83	-70.02	-30.00	-40.02	0.00	-70.02
2	4944.90	-36.59	-30.00	-6.59	0.00	-36.59
3	6592.02	-60.42	-30.00	-30.42	0.00	-60.42
4	7416.90	-56.72	-30.00	-26.72	0.00	-56.72
5	9888.00	-55.41	-30.00	-25.41	0.00	-55.41
6	12360.05	-48.38	-30.00	-18.38	0.00	-48.38

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

3.5.10 Conducted Results of Transmitter Spurious Emissions (Above 1GHz) for 802.11n HT 20

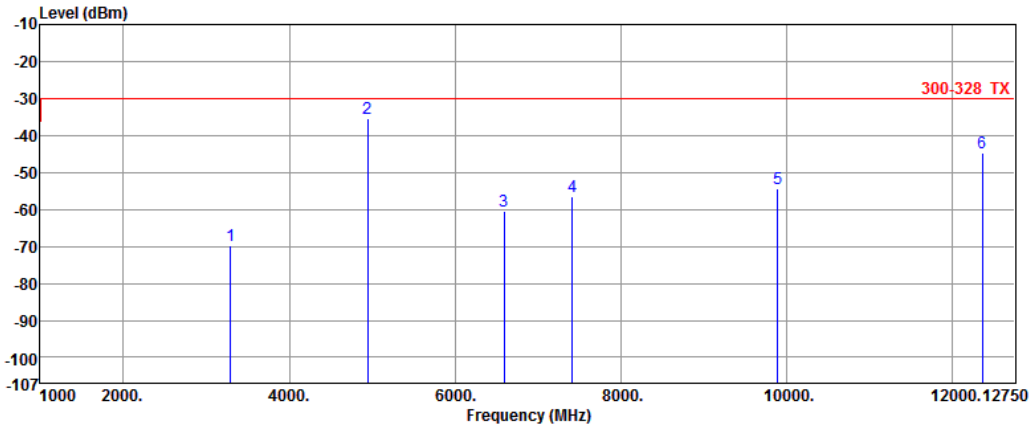
Modulation	HT20	Test Freq. (MHz)	2412



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	3215.99	-69.88	-30.00	-39.88	0.00	-69.88
2	4824.40	-40.35	-30.00	-10.35	0.00	-40.35
3	6431.93	-58.20	-30.00	-28.20	0.00	-58.20
4	7236.80	-52.69	-30.00	-22.69	0.00	-52.69
5	9648.50	-52.61	-30.00	-22.61	0.00	-52.61
6	12060.55	-46.69	-30.00	-16.69	0.00	-46.69

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

Modulation	HT20	Test Freq. (MHz)	2472



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	3296.07	-69.64	-30.00	-39.64	0.00	-69.64
2	4944.05	-35.48	-30.00	-5.48	0.00	-35.48
3	6591.88	-60.29	-30.00	-30.29	0.00	-60.29
4	7416.95	-56.46	-30.00	-26.46	0.00	-56.46
5	9888.75	-54.30	-30.00	-24.30	0.00	-54.30
6	12360.30	-44.83	-30.00	-14.83	0.00	-44.83

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

4 Receiver Test Results

4.1 Receiver Spurious Emissions

4.1.1 Limit of Receiver Spurious Emissions

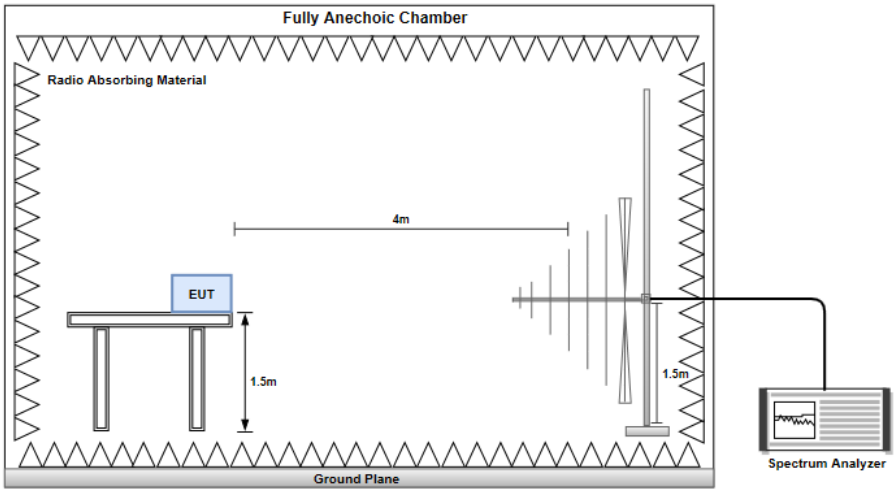
Frequency Range	Maximum power (dBm)	Measurement bandwidth (kHz)
30 MHz to 1 GHz	-57	100
Above 1 GHz to 12.75 GHz	-47	1000

4.1.2 Test Procedures

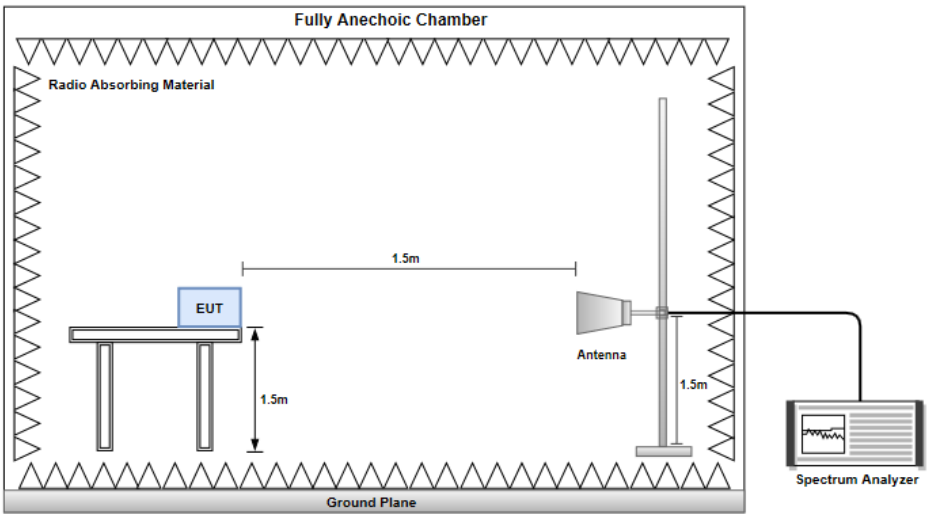
Reference to clause 5.4.10.2 of ETSI EN 300 328 V2.1.1 (2016-11).

4.1.3 Test Setup

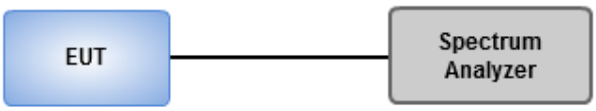
Below 1GHz



Above 1 GHz

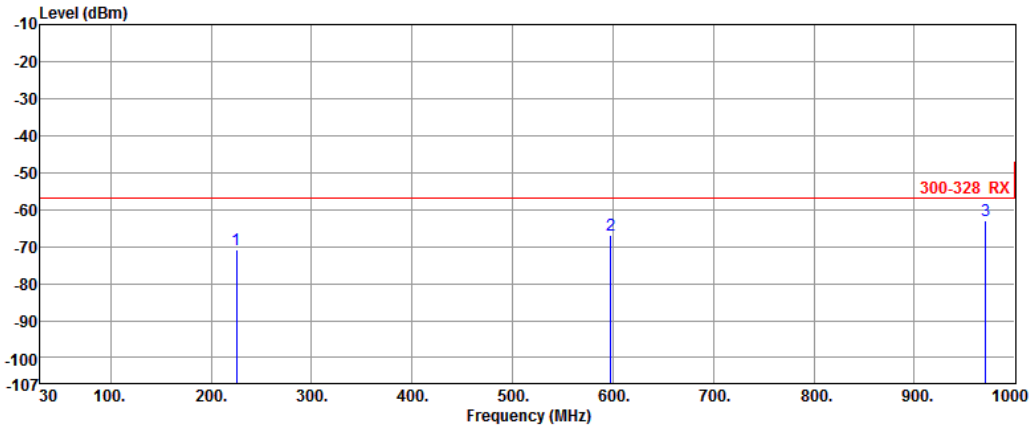


For Conducted Test



4.1.4 Radiated Results of Receiver Spurious Emissions (Below 1GHz)

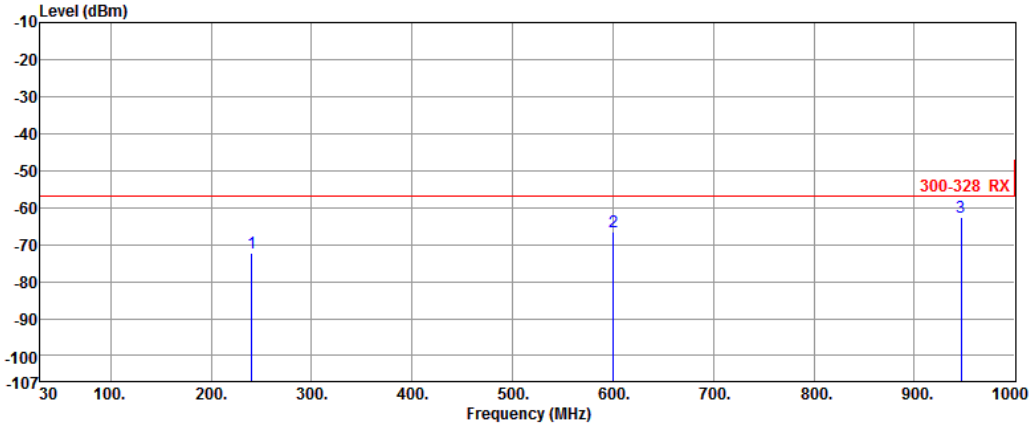
Modulation	11g	**Test Freq. (MHz)**	2412
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	224.97	-70.83	-57.00	-13.83	-4.62	-66.21
2	597.45	-66.80	-57.00	-9.80	6.56	-73.36
3	970.90	-62.94	-57.00	-5.94	11.84	-74.78

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

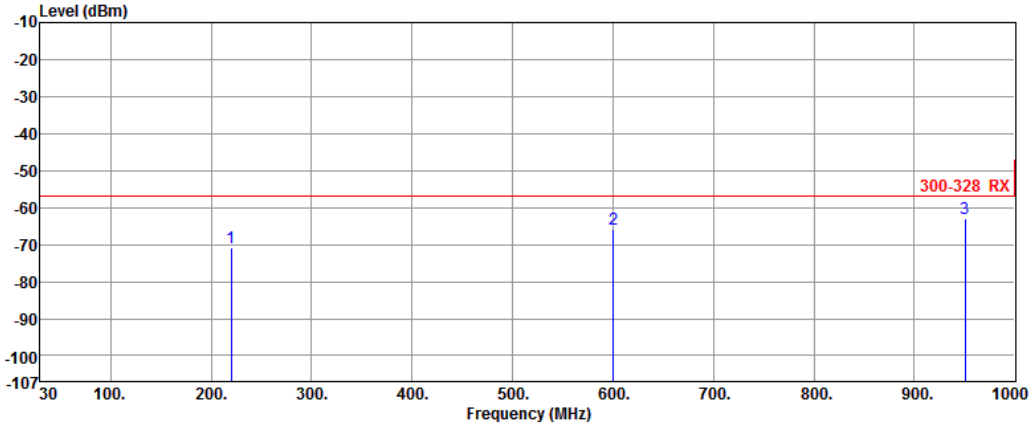
Modulation	11g	Test Freq. (MHz)	2412
Polarization	Vertical		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	240.49	-72.41	-57.00	-15.41	-1.01	-71.40
2	600.36	-66.48	-57.00	-9.48	6.71	-73.19
3	946.65	-62.79	-57.00	-5.79	11.60	-74.39

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

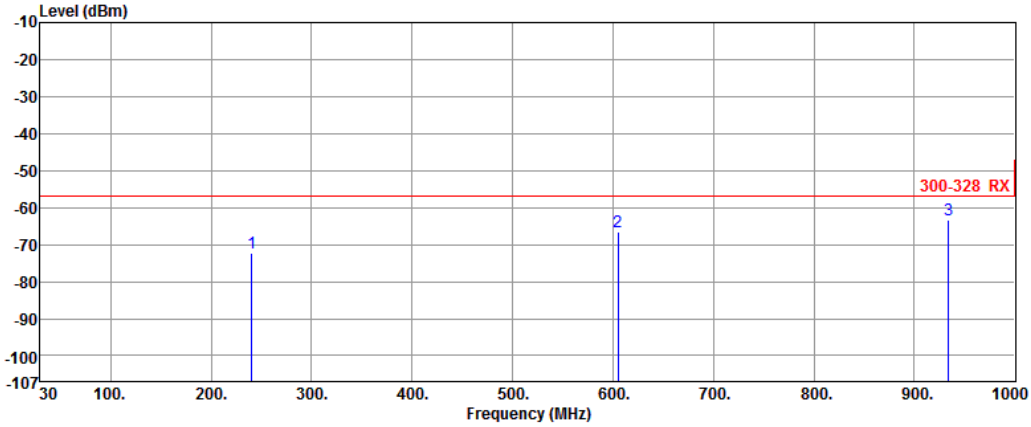
Modulation	11g	Test Freq. (MHz)	2472
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	220.12	-70.78	-57.00	-13.78	-3.64	-67.14
2	600.36	-65.98	-57.00	-8.98	6.56	-72.54
3	950.53	-63.03	-57.00	-6.03	12.02	-75.05

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

Modulation	11g	Test Freq. (MHz)	2472
Polarization	Vertical		

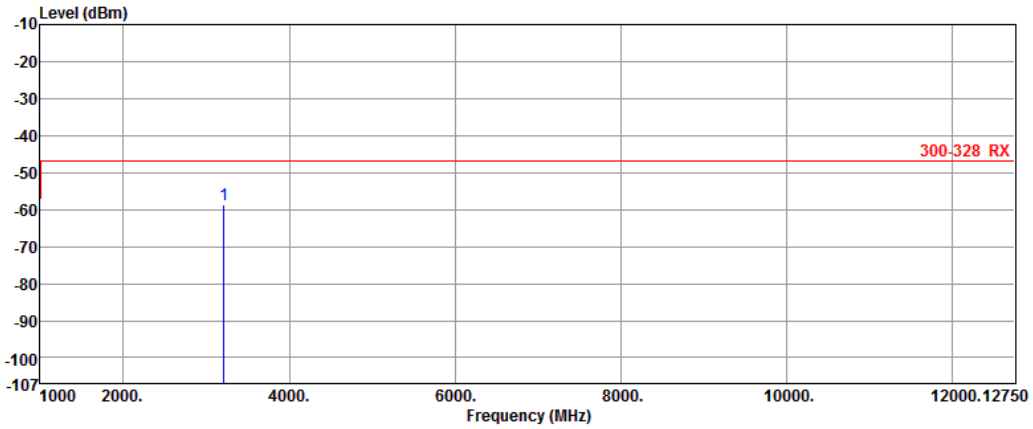


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	240.49	-72.40	-57.00	-15.40	-1.01	-71.39
2	605.21	-66.69	-57.00	-9.69	7.07	-73.76
3	934.04	-63.27	-57.00	-6.27	11.49	-74.76

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

4.1.5 Receiver Radiated Unwanted Emissions (Above 1GHz)

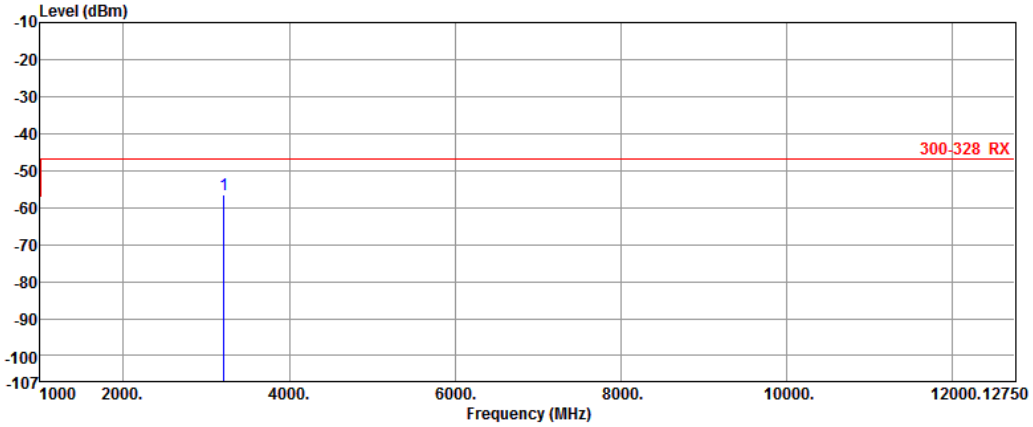
Modulation	11g	**Test Freq. (MHz)**	2412
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	3216.02	-58.65	-47.00	-11.65	8.21	-66.86

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

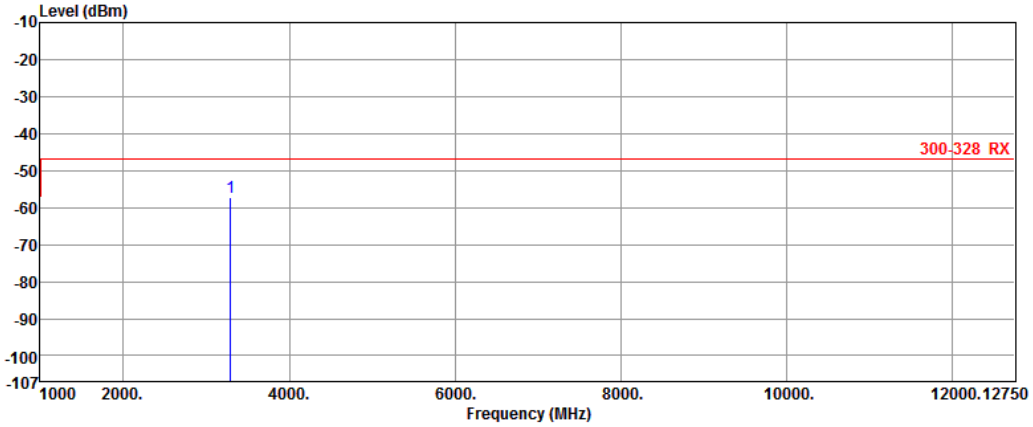
Modulation	11g	Test Freq. (MHz)	2412
Polarization	Vertical		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	3215.98	-56.70	-47.00	-9.70	7.88	-64.58

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

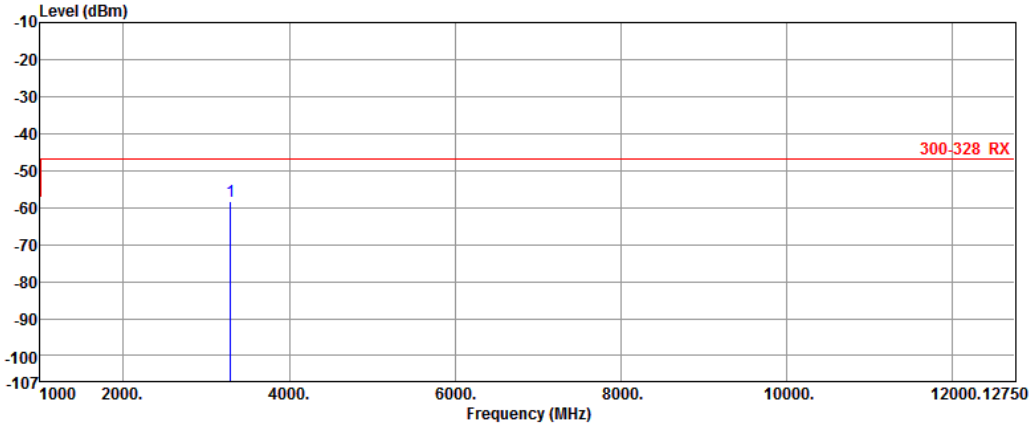
Modulation	11g	Test Freq. (MHz)	2472
Polarization	Horizontal		



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	3295.99	-57.35	-47.00	-10.35	7.56	-64.91

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

Modulation	11g	Test Freq. (MHz)	2472
Polarization	Vertical		

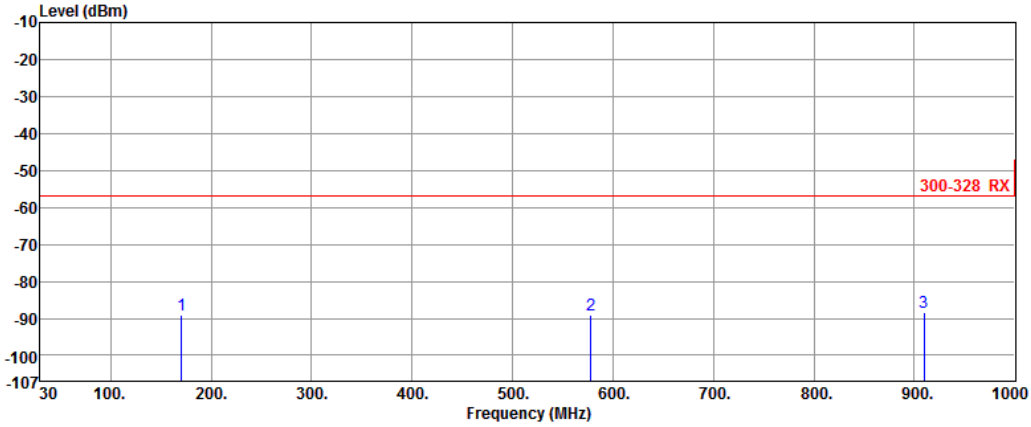


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	3296.01	-58.27	-47.00	-11.27	7.32	-65.59

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

4.1.6 Conducted Results of Receiver Spurious Emissions (Below 1GHz)

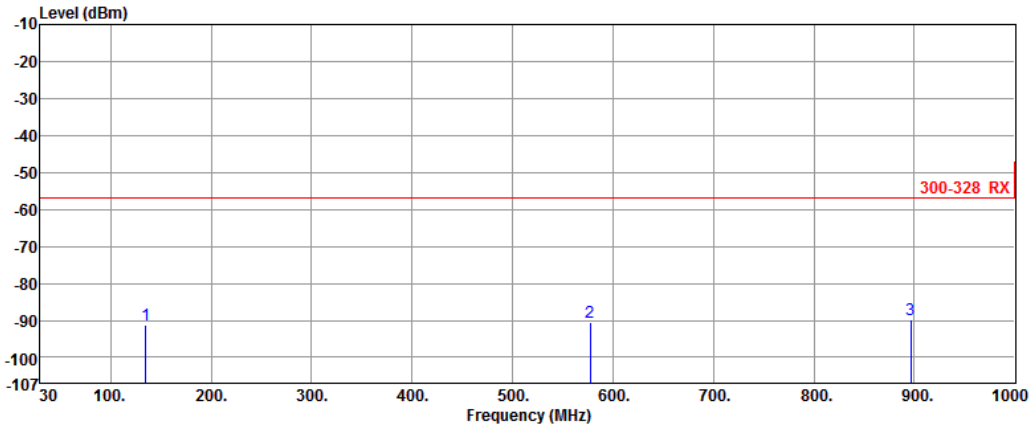
Modulation	11g	Test Freq. (MHz)	2412



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	170.65	-89.18	-57.00	-32.18	0.00	-89.18
2	578.05	-88.96	-57.00	-31.96	0.00	-88.96
3	909.79	-88.22	-57.00	-31.22	0.00	-88.22

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

Modulation	11g	Test Freq. (MHz)	2472

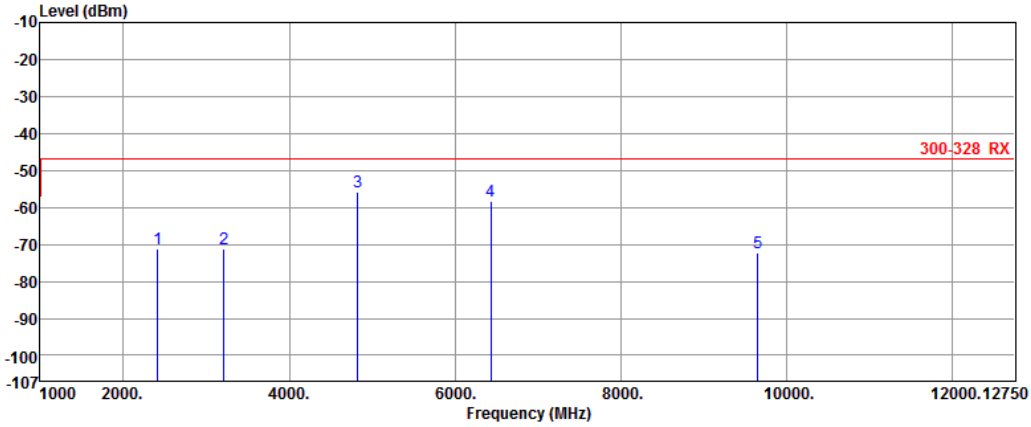


	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	134.76	-91.18	-57.00	-34.18	0.00	-91.18
2	577.08	-90.67	-57.00	-33.67	0.00	-90.67
3	896.21	-89.83	-57.00	-32.83	0.00	-89.83

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

4.1.7 Conducted Results of Receiver Spurious Emissions (Above 1GHz) for 802.11g

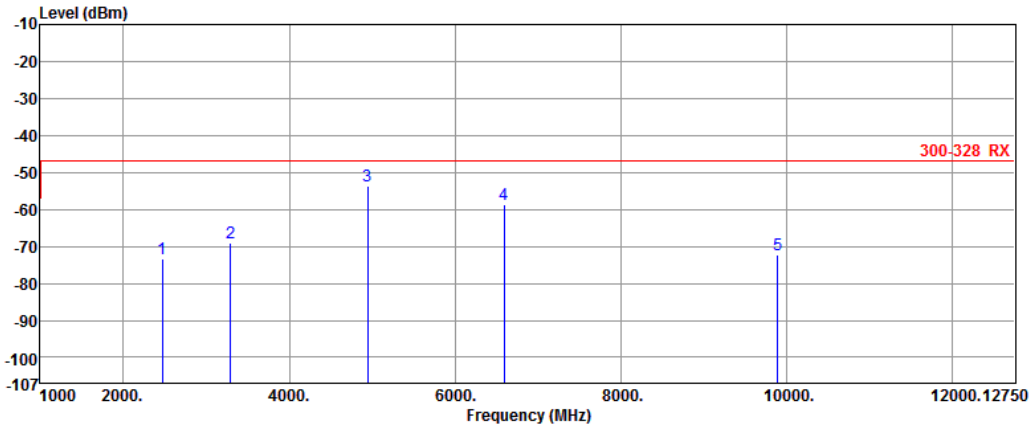
Modulation	11g	Test Freq. (MHz)	2412



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	2411.72	-71.18	-47.00	-24.18	0.00	-71.18
2	3215.99	-71.29	-47.00	-24.29	0.00	-71.29
3	4823.99	-55.67	-47.00	-8.67	0.00	-55.67
4	6432.02	-58.45	-47.00	-11.45	0.00	-58.45
5	9648.35	-72.19	-47.00	-25.19	0.00	-72.19

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

Modulation	11g	Test Freq. (MHz)	2472



	Freq.	Measured value	Limit	Margin	Factor	Reading
	MHz	dBm	dBm	dB	dB	dBm
1	2472.14	-73.49	-47.00	-26.49	0.00	-73.49
2	3295.91	-69.23	-47.00	-22.23	0.00	-69.23
3	4944.01	-53.80	-47.00	-6.80	0.00	-53.80
4	6592.05	-58.60	-47.00	-11.60	0.00	-58.60
5	9888.79	-72.27	-47.00	-25.27	0.00	-72.27

Note 1: Measured Value (dBm) = Reading (dBm) + Factor (dB)
Note 2: Margin (dB) = Measured Value (dBm) – Limit (dBm)

5 Adaptivity Test Results

5.1 Adaptivity and Unwanted Signal Parameters

5.1.1 Limit of Adaptivity and Unwanted Signal Parameters

Adaptivity and Unwanted Signal Limit	
☒	Only for adaptive systems and RF Output Power > 10 dBm
☐	Non-LBT based Detect and Avoid: ◆ minimum remain unavailable = 1sec; ◆ minimum Idle Period time = 100us; ◆ maximum Channel Occupancy Time (COT) = 40ms ◆ detection threshold level = -70 dBm/MHz + 10 x $\log_{10}$(100mW / Pout) (Pout in mW e.i.r.p);
☐	LBT based Detect and Avoid (Frame Based Equipment): ◆ minimum Clear Channel Assessment (CCA) time = 18 us; ◆ COT = 1 ms to 10 ms ◆ Idle Period = 5% of COT ◆ detection threshold level = -70 dBm/MHz + 10 x $\log_{10}$(100mW / Pout) (Pout in mW e.i.r.p);
☒	LBT based Detect and Avoid (Load Based Equipment with spectrum sharing mechanism IEEE Std.): ◆ LBT based spectrum sharing mechanism may implement IEEE 802.11™-2012 [i.3] clause 9, clause 10, clause 16,clause 17, clause 19 and clause 20, or in IEEE 802.15.4™-2011 [i.4], clause 4, clause 5 and clause 8 ◆ detection threshold level = -70 dBm/MHz + 10 x $\log_{10}$(100mW / Pout) (Pout in mW e.i.r.p);
☒	Short Control Signalling Transmissions: ◆ Short Control Signalling Transmissions shall have a maximum duty cycle of 10 % within an observation period of 50 ms.

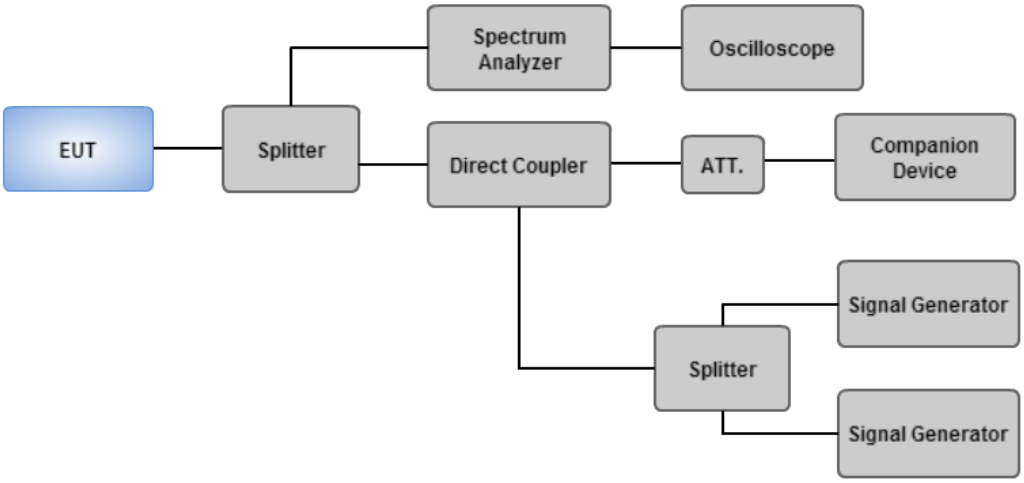
Unwanted Signal Parameters				
Equipment Type	**Wanted Signal Mean Power from Companion Device**	**Blocking Signal Frequency (MHz)**	**Blocking Signal Mean power (dBm)**	**Type of Interfering Signal**
LBT	sufficient to maintain the link (see note 2)	2395 or 2488,5 (see note 1)	-35 (see note 3)	CW
Non-LBT	-30 dBm			

Note 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz.
Note 2: A typical value which can be used in most cases is -50 dBm/MHz.
Note 3: The level specified is the level in front of the UUT antenna. In case of conducted measurements, this level has to be corrected by the actual antenna assembly gain.

5.1.2 Test Procedures

Reference to clause 5.4.6.2 of ETSI EN 300 328 V2.1.1 (2016-11).

5.1.3 Test Setup

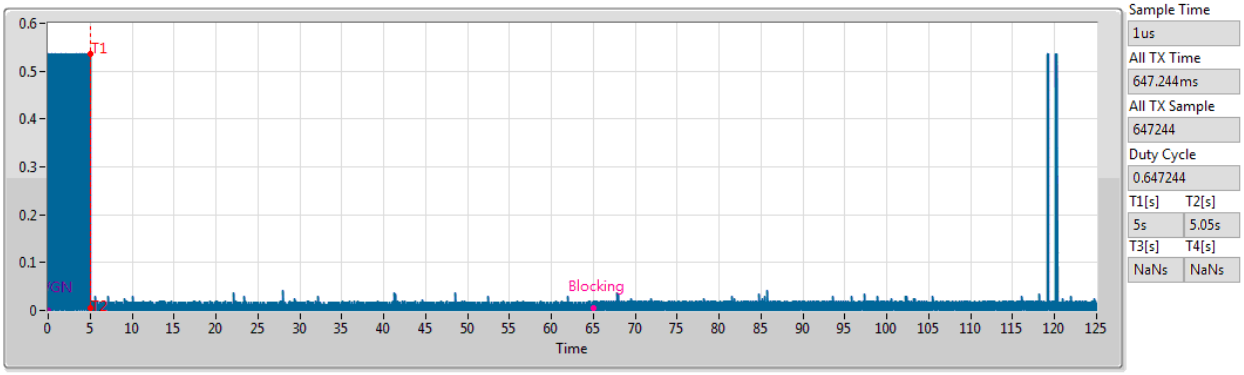


5.1.4 Test Result of Adaptivity、Unwanted Signal and Short Control Signalling Transmissions

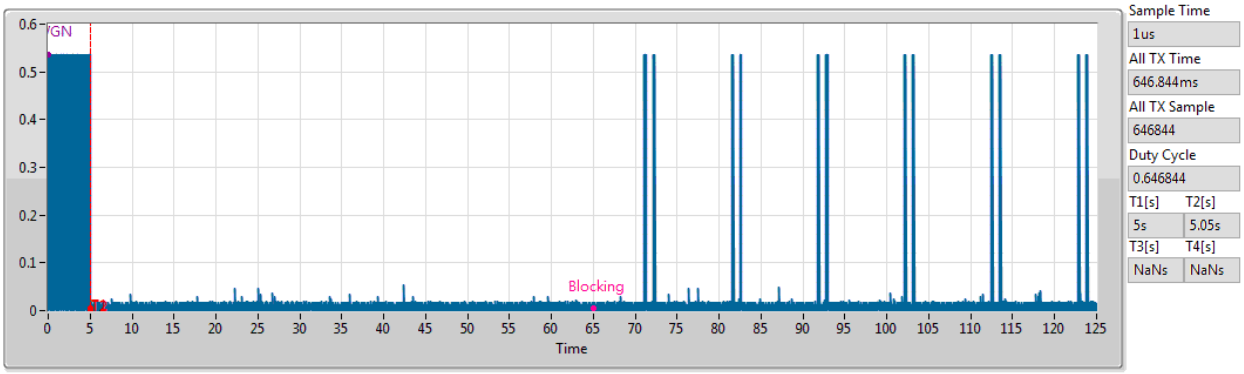
Adaptivity and Unwanted Signal Result						
EUT firmware / software version		23.3.3.5				
Adaptivity Detection Threshold Level (dBm)		-68.66				
Unwanted Signal Level (dBm)		-32.21				
Modulation Mode	**Freq. (MHz)**	**Short Control Signalling Transmissions (ms)**	**Channel Occupancy Time (ms)**	**Idle Period Time (μs)**	**Adaptivity**	**Unwanted Signal Test Status**
802.11b	2412	4.863	1.312	68	Pass	Pass
802.11b	2472	4.864	1.312	68		
802.11g	2412	4.865	12.482	41		
802.11g	2472	4.86	12.483	41		
802.11n (HT20)	2412	4.241	1.307	41		
802.11n (HT20)	2472	4.98	1.307	41		
Limit		< 5 ms	< 13 ms	>18μs		
Result		**Complied**				

5.1.5 Test Result of Adaptivity and Unwanted Signal Plots

Adaptivity & Unwanted Signal Result Plots
Unwanted signal: 2488.5 MHz
802.11b - 2412MHz
Time Analysis

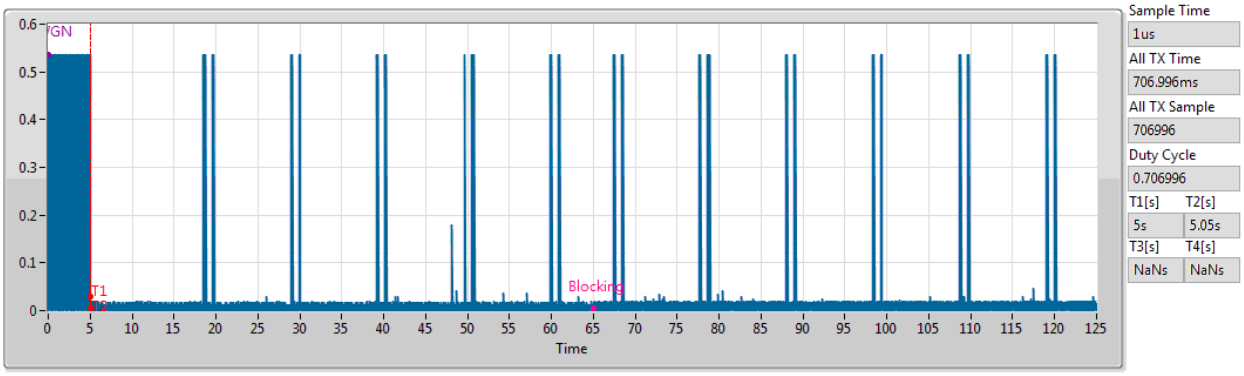


Unwanted signal: 2395 MHz
802.11b - 2472MHz
Time Analysis



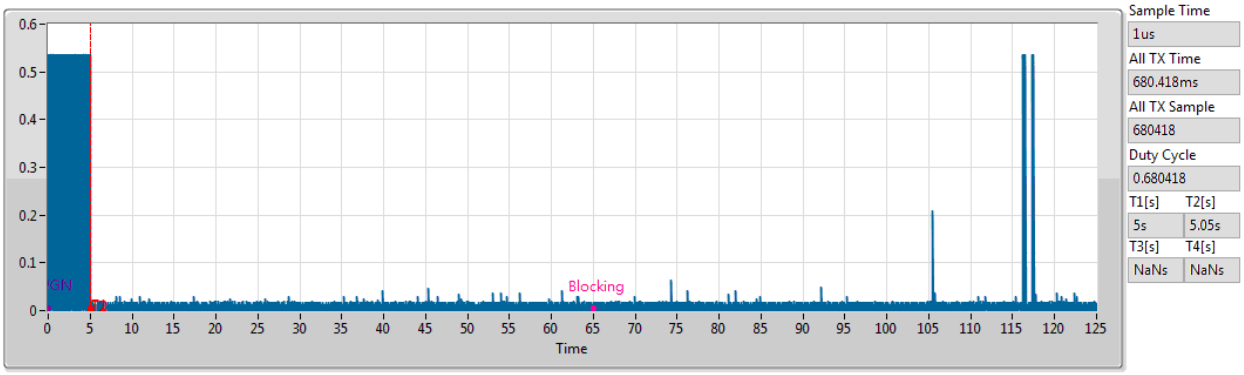
Adaptivity & Unwanted Signal Result Plots
Unwanted signal: 2488.5 MHz
802.11g - 2412MHz

Time Analysis



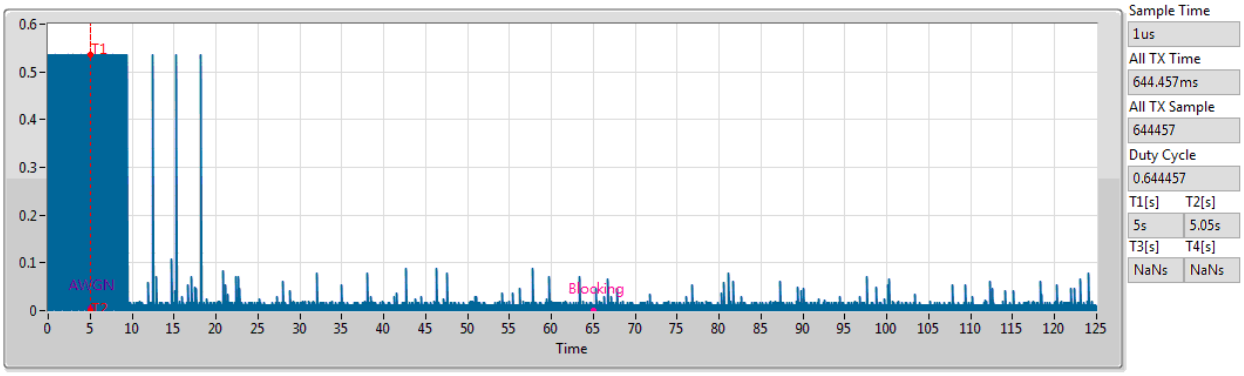
Unwanted signal: 2395 MHz
802.11g - 2472MHz

Time Analysis



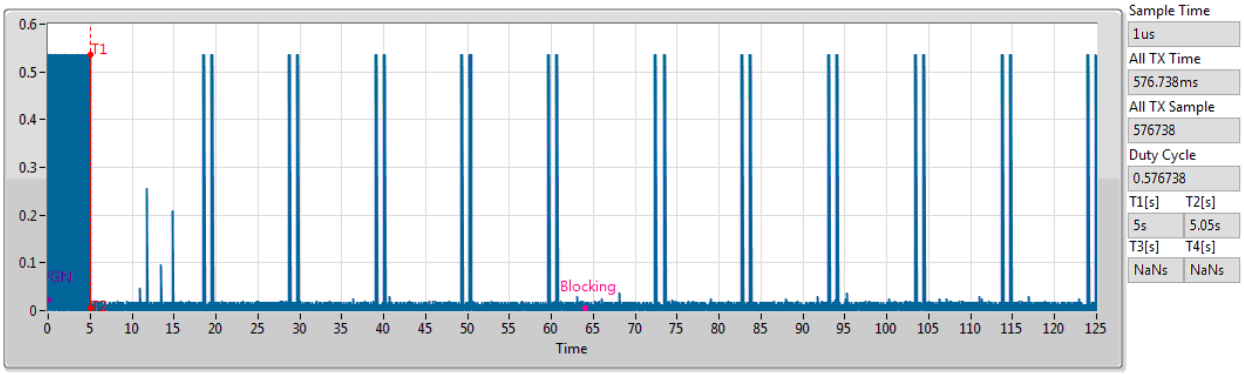
Adaptivity & Unwanted Signal Result Plots
Unwanted signal: 2488.5 MHz
802.11n (HT20) - 2412MHz

Time Analysis

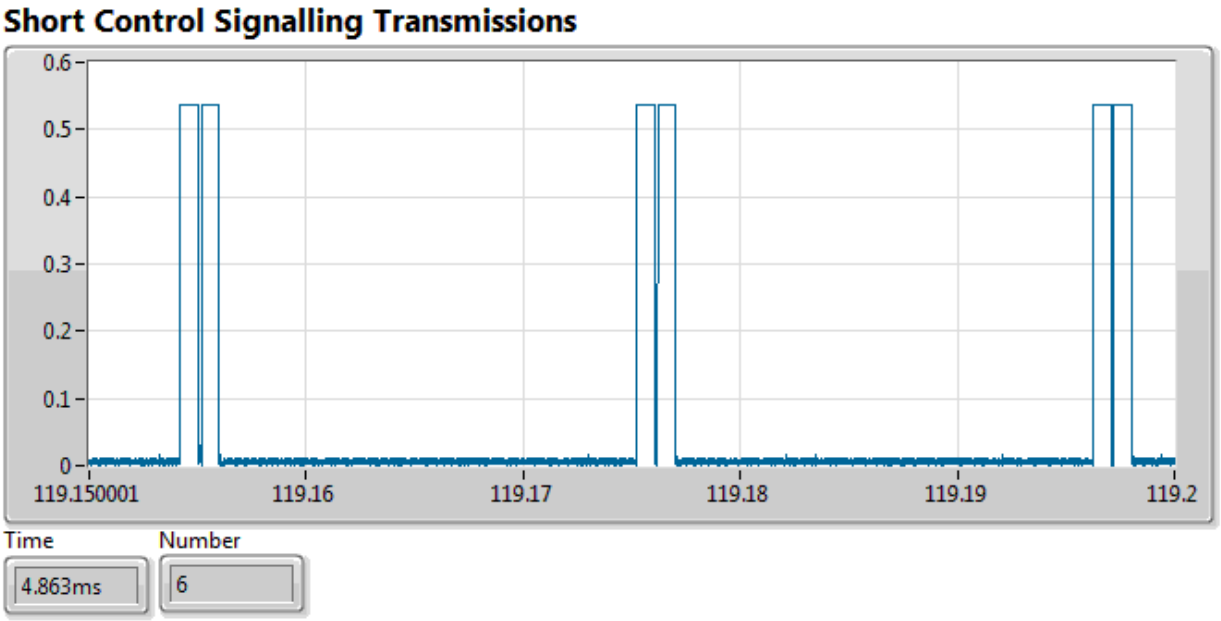
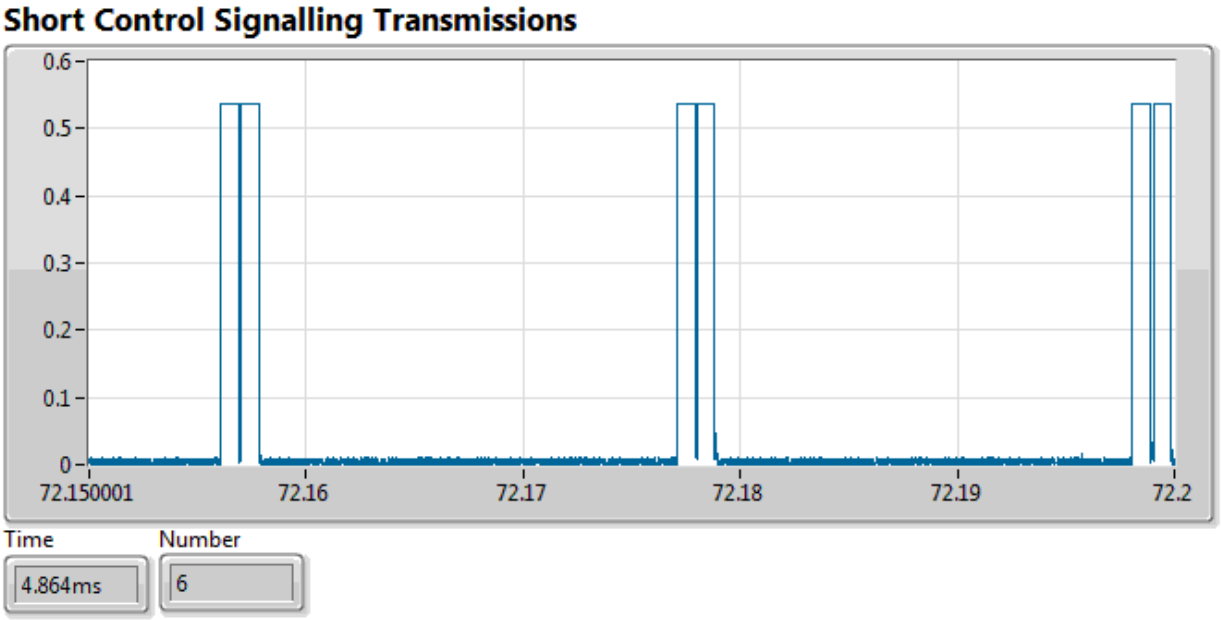


Unwanted signal: 2395 MHz
802.11n (HT20) - 2472MHz

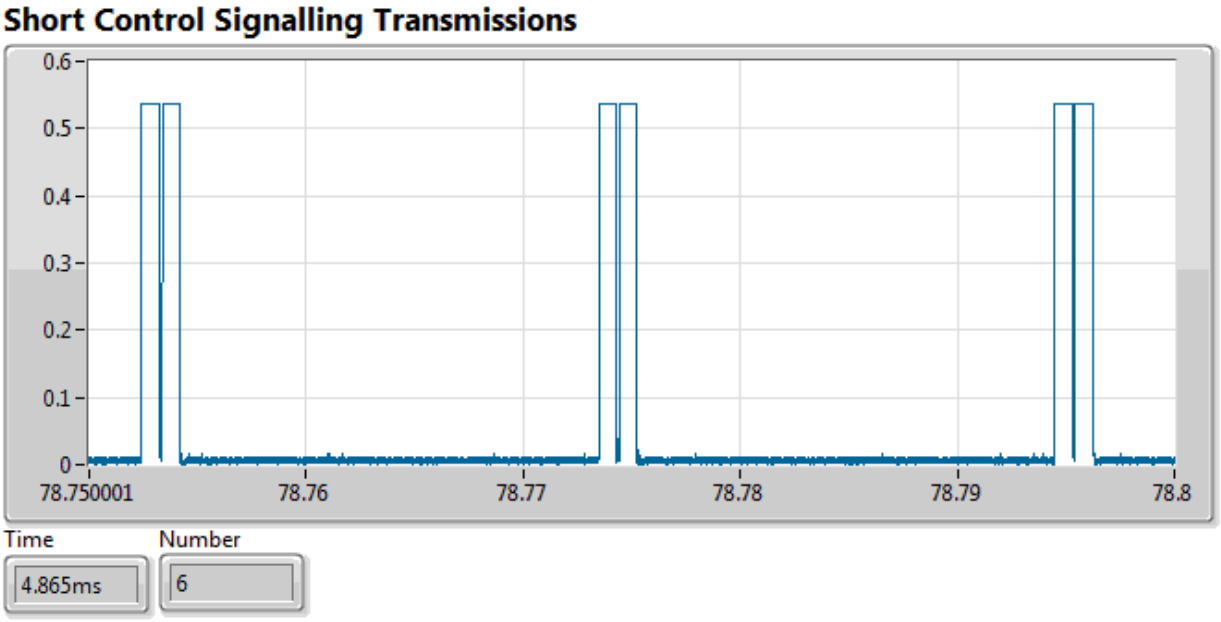
Time Analysis



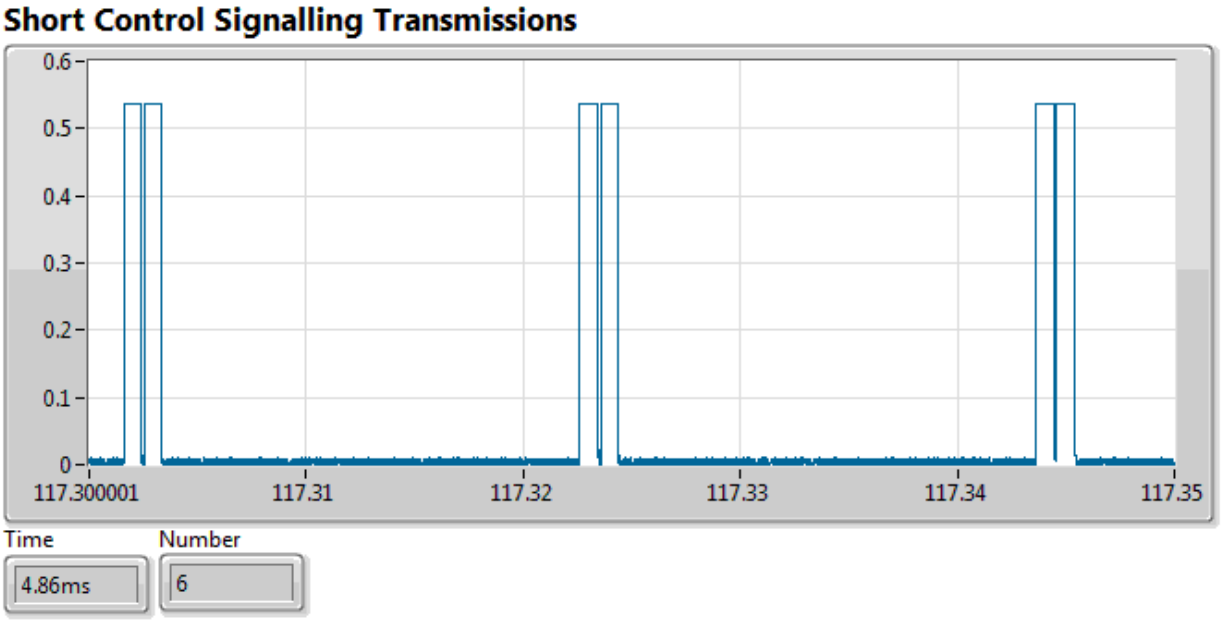
5.1.6 Test Result of Short Control Signalling Transmissions Plots

Short Control Signalling Transmissions Plots
802.11b - 2412MHz

802.11b - 2472MHz


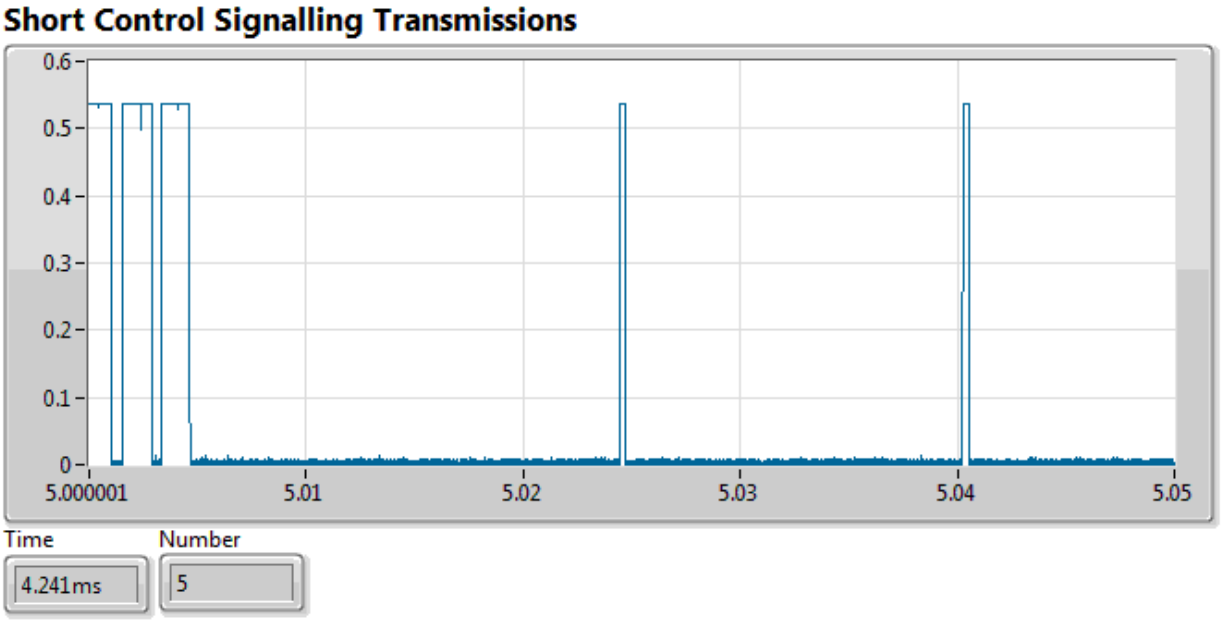
Short Control Signalling Transmissions Plots
802.11g - 2412MHz



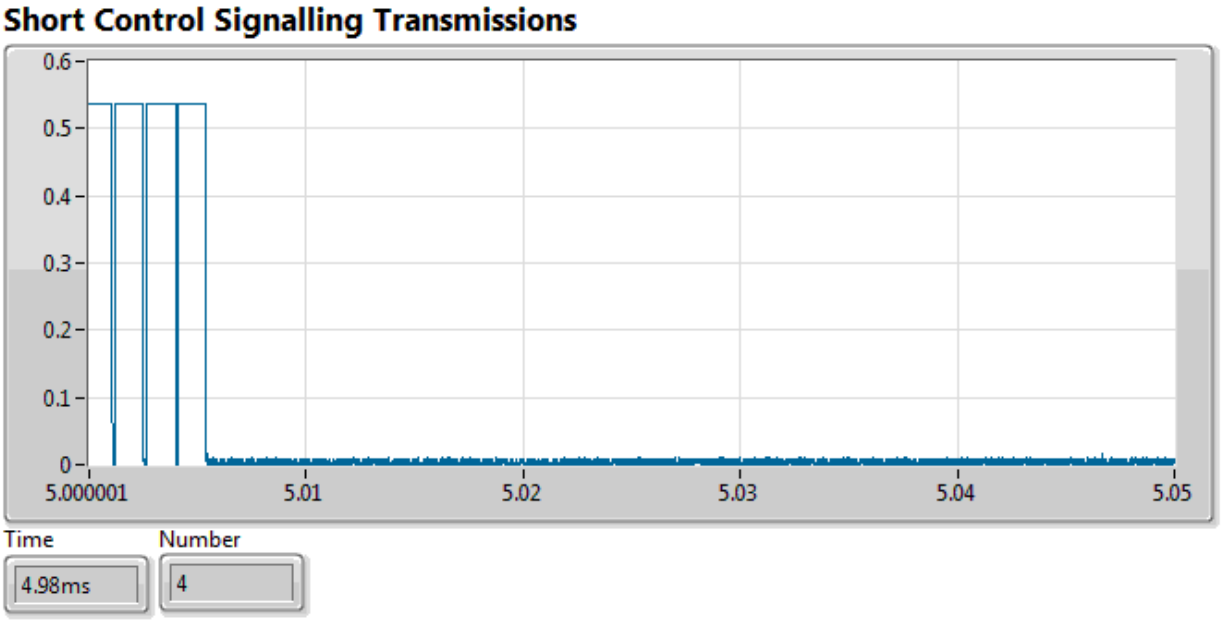
802.11g - 2472MHz



Short Control Signalling Transmissions Plots
802.11n (HT20) - 2412MHz

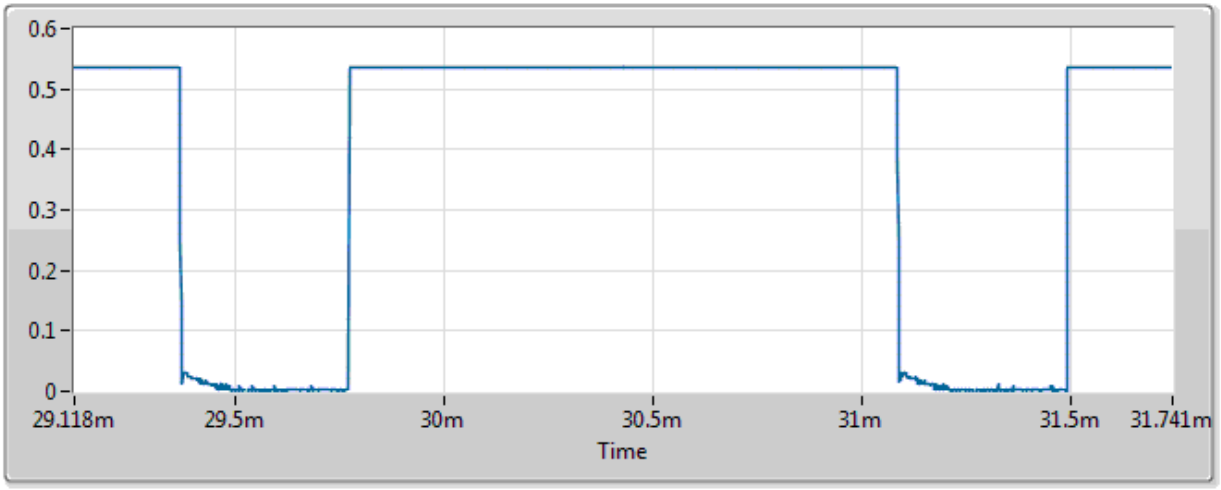


802.11n (HT20) - 2472MHz



Channel Occupancy Time
802.11b - 2412MHz

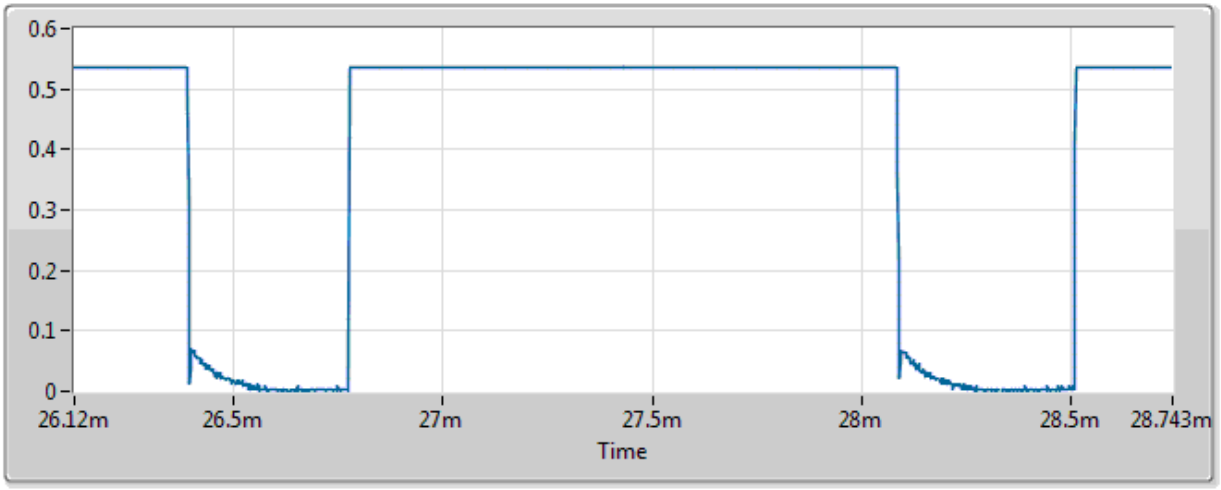
Max On Time



1.312ms

802.11b - 2472MHz

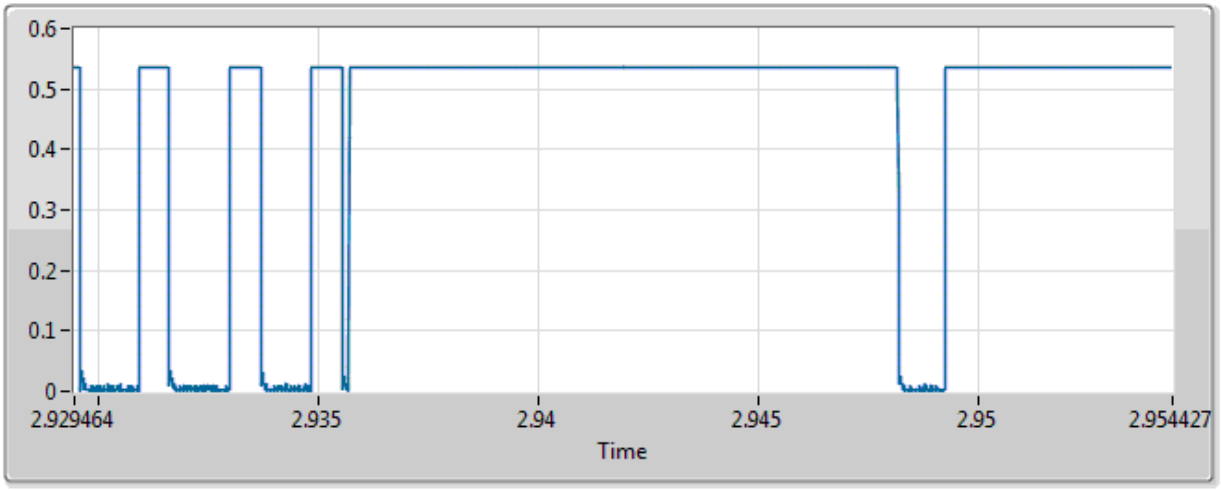
Max On Time



1.312ms

Channel Occupancy Time
802.11g - 2412MHz

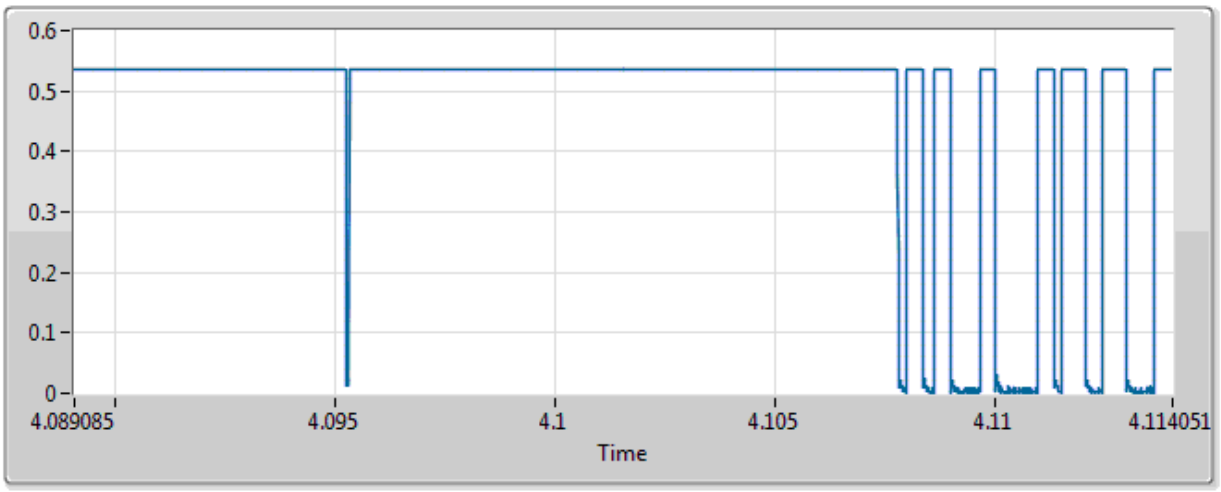
Max On Time



12.482ms

802.11g - 2472MHz

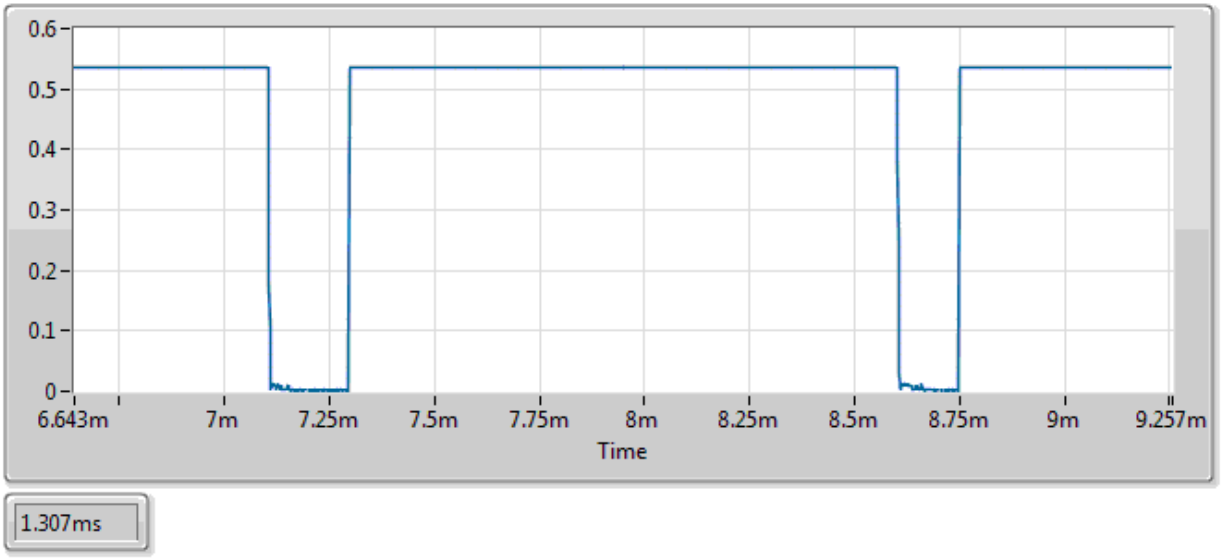
Max On Time



12.483ms

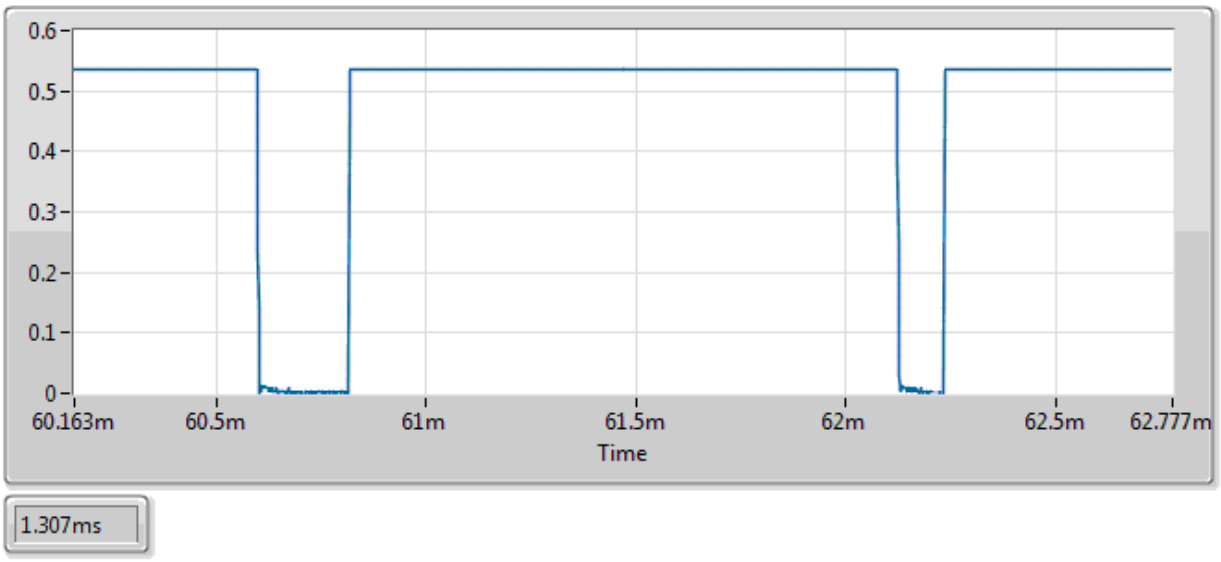
Channel Occupancy Time
802.11n (HT20) - 2412MHz

Max On Time

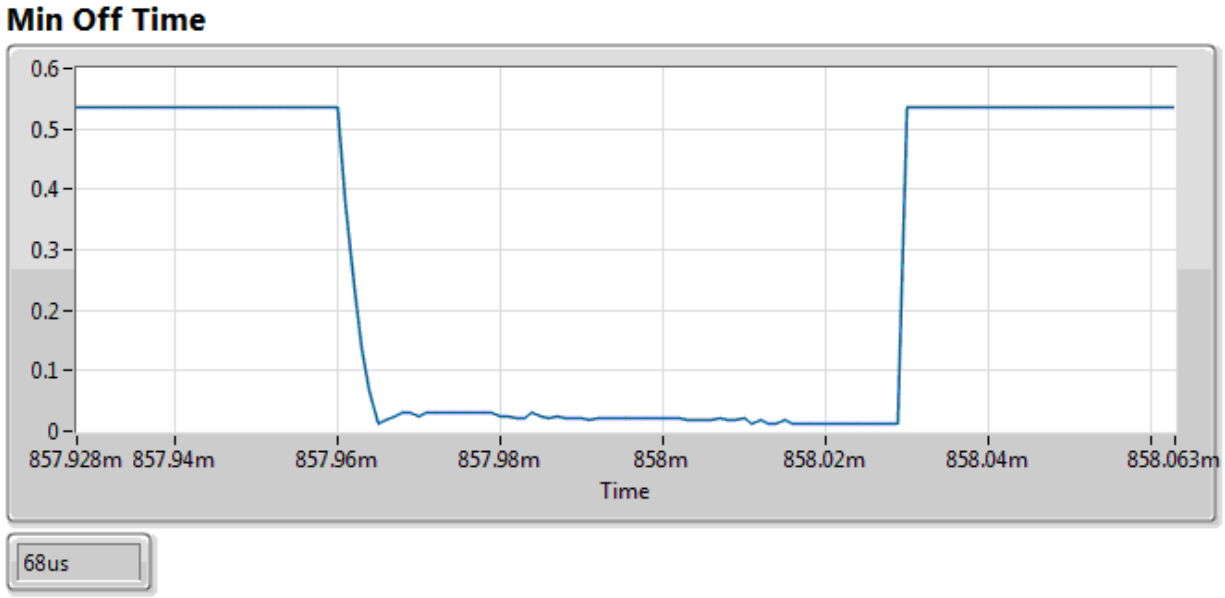


802.11n (HT20) - 2472MHz

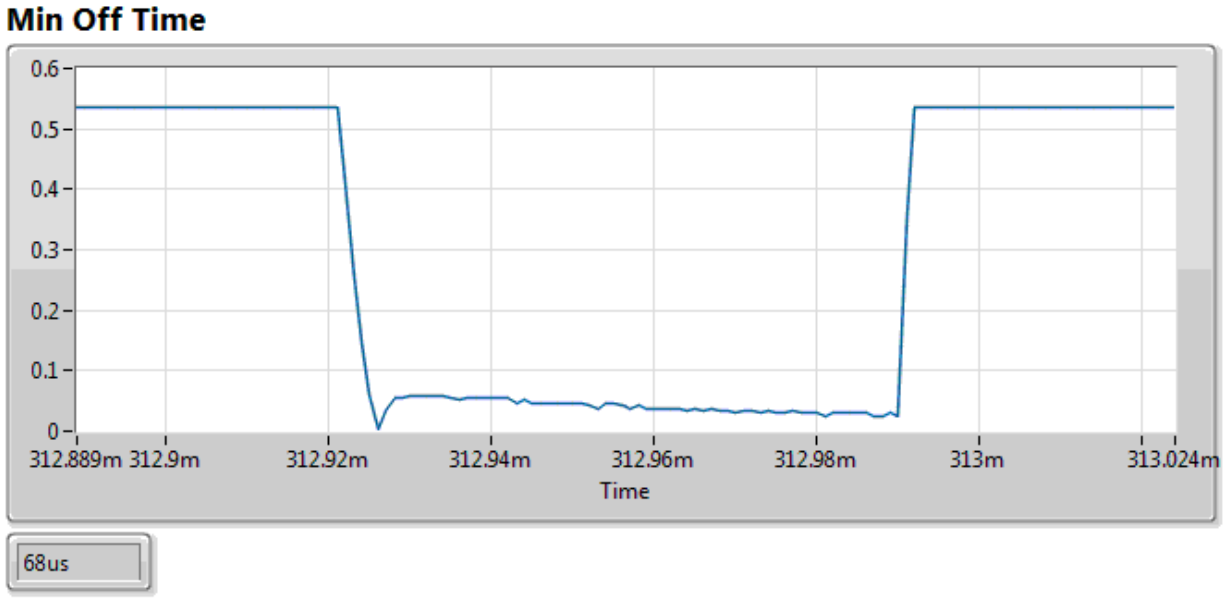
Max On Time



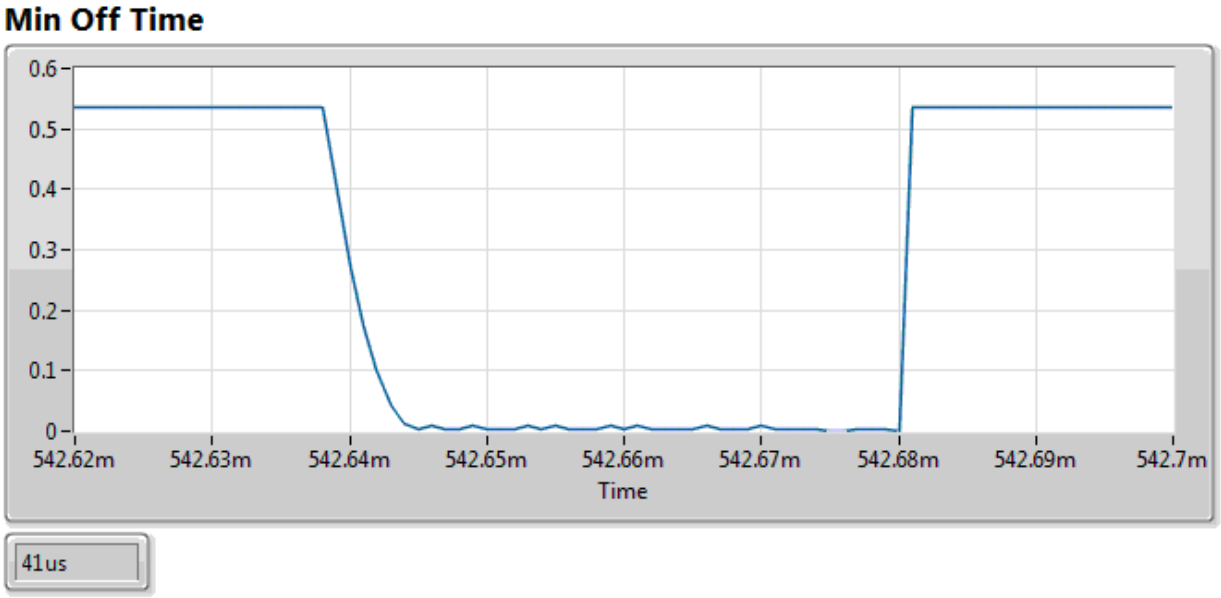
Idle Period Time
802.11b - 2412MHz



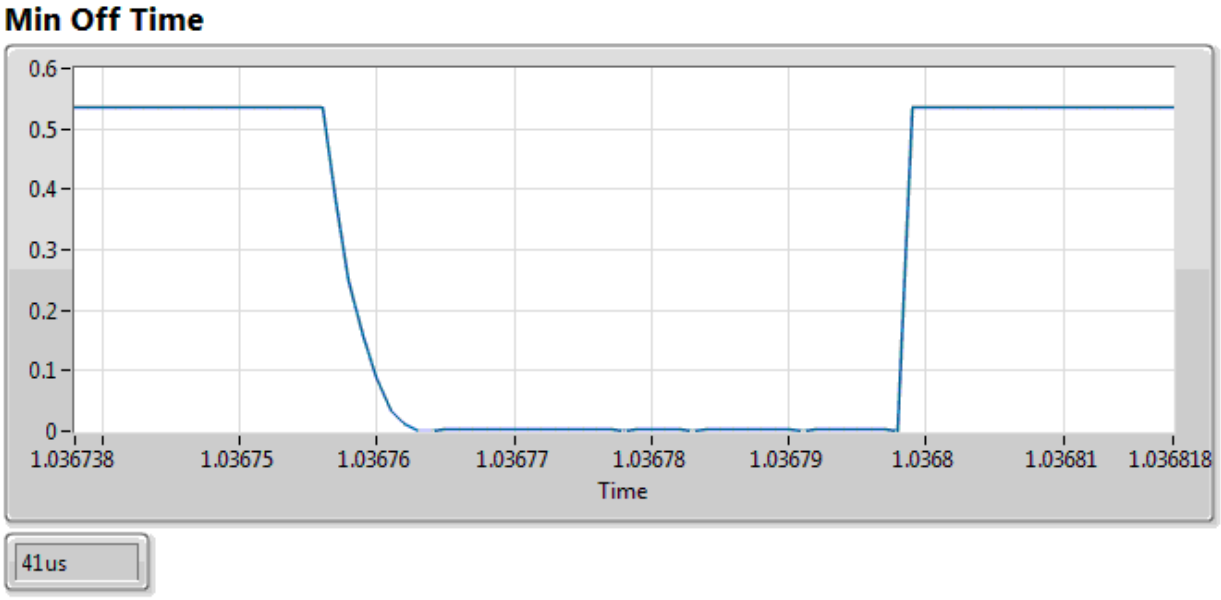
802.11b - 2472MHz



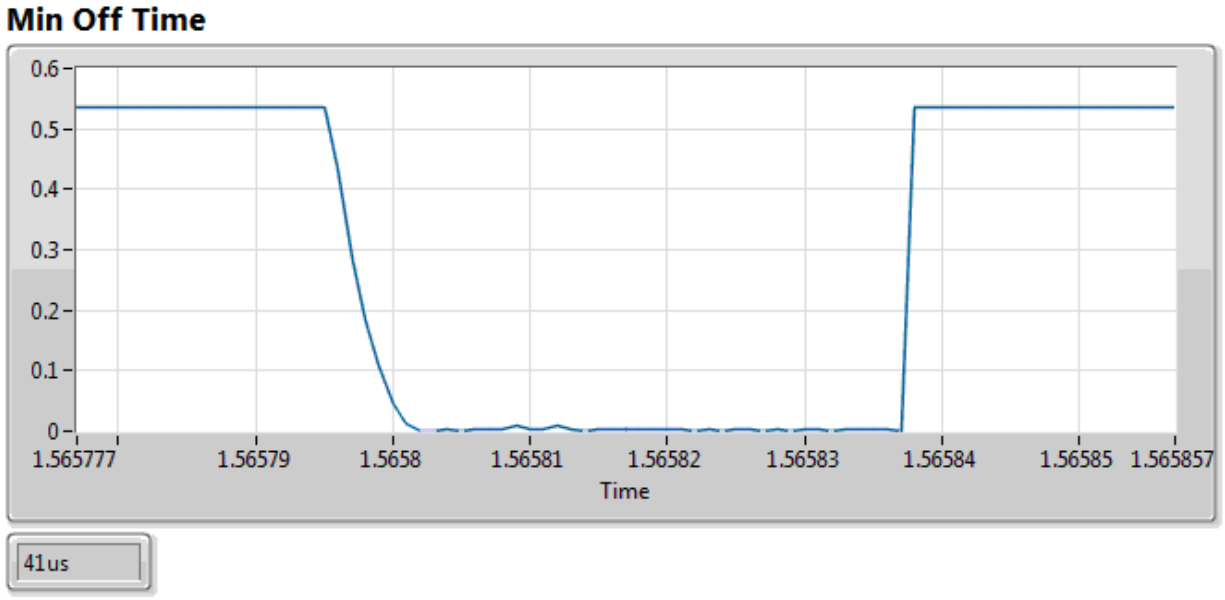
Idle Period Time
802.11g - 2412MHz



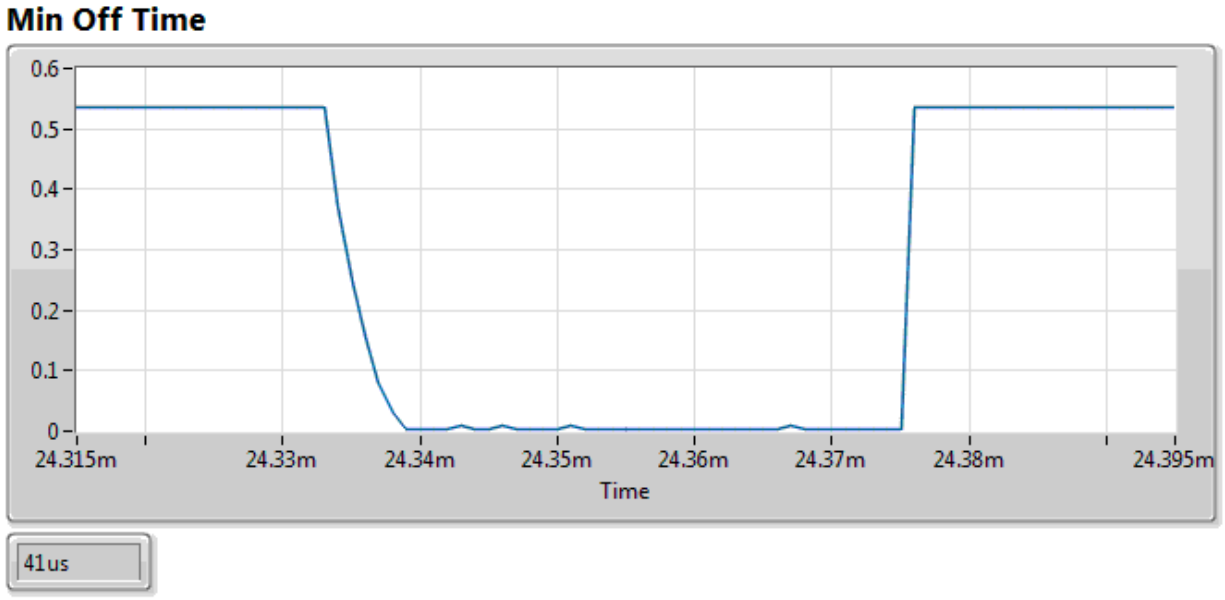
802.11g - 2472MHz



Idle Period Time
802.11n (HT20) - 2412MHz



802.11n (HT20) - 2472MHz



6 Receiver Blocking Test Results

6.1 Receiver Blocking

6.1.1 Limit of Receiver Blocking

Receiver Blocking Parameters for Receiver Category 1 Equipment Limit			
Wanted Signal Mean Power from Companion Device (dBm) (see notes 1 and 4)	**Blocking Signal Frequency (MHz)**	**Blocking Signal Power (dBm) (see note 4)**	**Type of Blocking Signal**
(-133 dBm + 10 × log10(OCBW)) or -68 dBm whichever is less (see note 2)	2 380 2 504	-34	CW
(-139 dBm + 10 × log10(OCBW)) or -74 dBm whichever is less (see note 3)	2 300 2 330 2 360 2 524 2 584 2 674		

Note 1: OCBW is in Hz.
Note 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 26 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
Note 3: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 20 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
Note 4: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned.

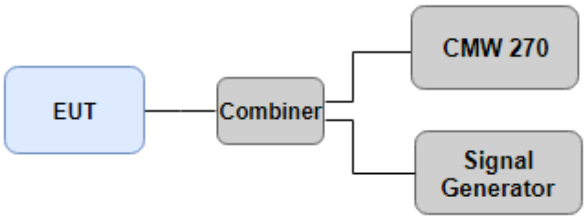
Receiver Blocking Parameters for Receiver Category 2 Equipment Limit			
Wanted Signal Mean Power from Companion Device (dBm) (see notes 1 and 3)	**Blocking Signal Frequency (MHz)**	**Blocking Signal Power (dBm) (see note 3)**	**Type of Blocking Signal**
(-139 dBm + 10 × log10(OCBW) + 10 dB) or (-74 dBm + 10 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW
Note 1: OCBW is in Hz. Note 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 26 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. Note 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned.			

Receiver Blocking Parameters for Receiver Category 3 Equipment Limit			
Wanted Signal Mean Power from Companion Device (dBm) (see notes 1 and 3)	**Blocking Signal Frequency (MHz)**	**Blocking Signal Power (dBm) (see note 3)**	**Type of Blocking Signal**
(-139 dBm + 10 × log10(OCBW) + 20 dB) or (-74 dBm + 20 dB) whichever is less	2 380 2 504 2 300 2 584	-34	CW
Note 1: OCBW is in Hz. Note 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative the test may be performed using a wanted signal up to P_{min} + 30 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal Note 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned.			

6.1.2 Test Procedures

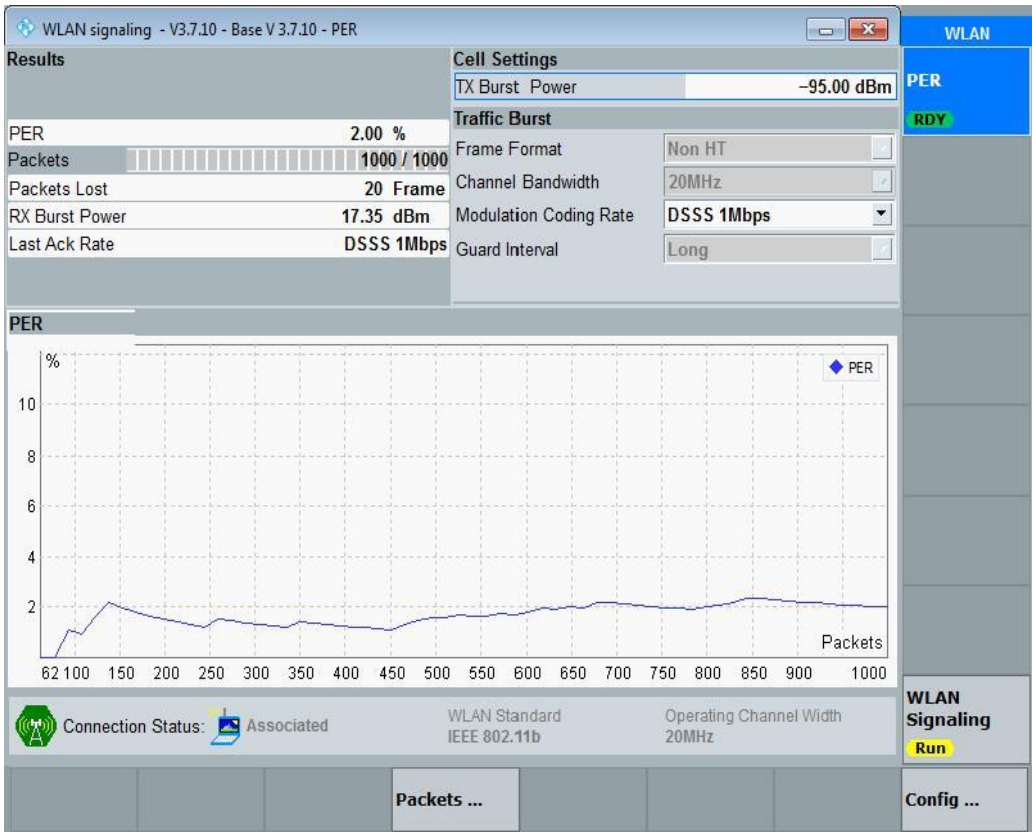
Reference to clause 5.4.11.2 of ETSI EN 300 328 V2.1.1 (2016-11).

6.1.3 Test Setup



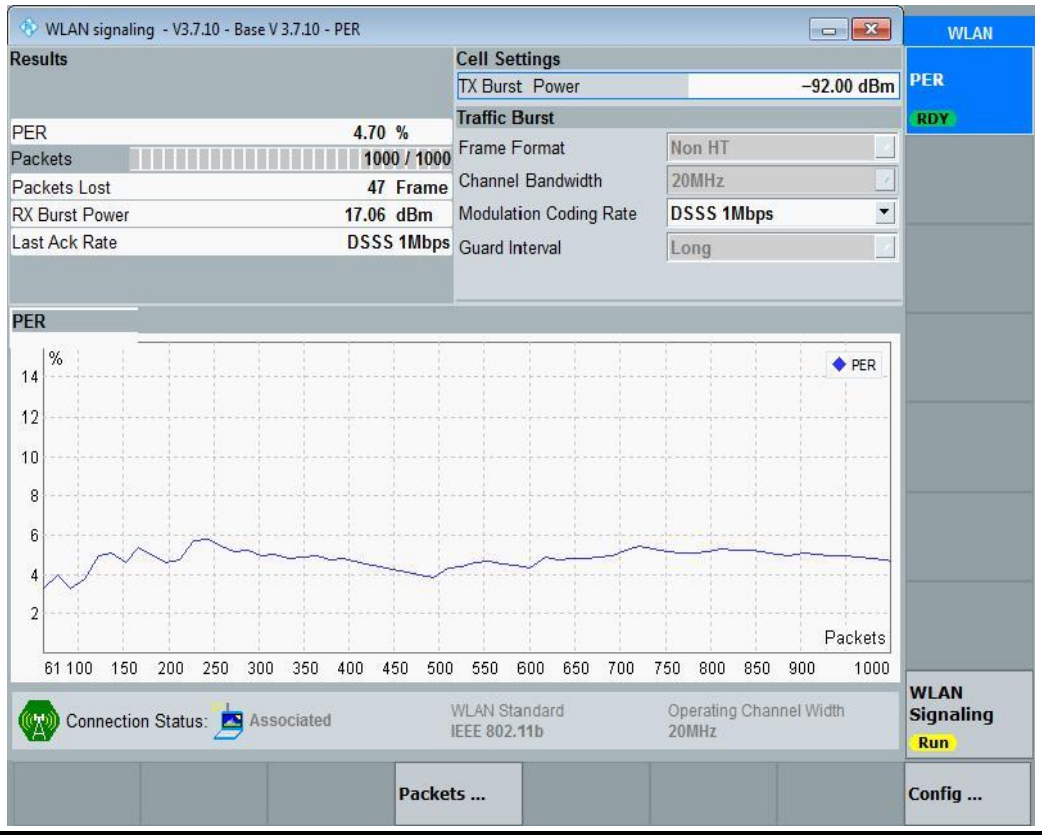
6.1.4 Test Result of Receiver Blocking

11b / 2412 MHz
Without Interference Signal Sensitivity Level



Receiver Category	1		
Performance Criteria Limit	PER ≤ 10 %		
Wanted Signal Mean Power from Companion Device (dBm)	Blocking Signal Frequency (MHz)	Blocking Signal Power (dBm)	Test Result
-65.21	2380	-31.21	Pass
-65.21	2504	-31.21	Pass
-71.21	2300	-31.21	Pass
-71.21	2330	-31.21	Pass
-71.21	2360	-31.21	Pass
-71.21	2524	-31.21	Pass
-71.21	2584	-31.21	Pass
-71.21	2674	-31.21	Pass

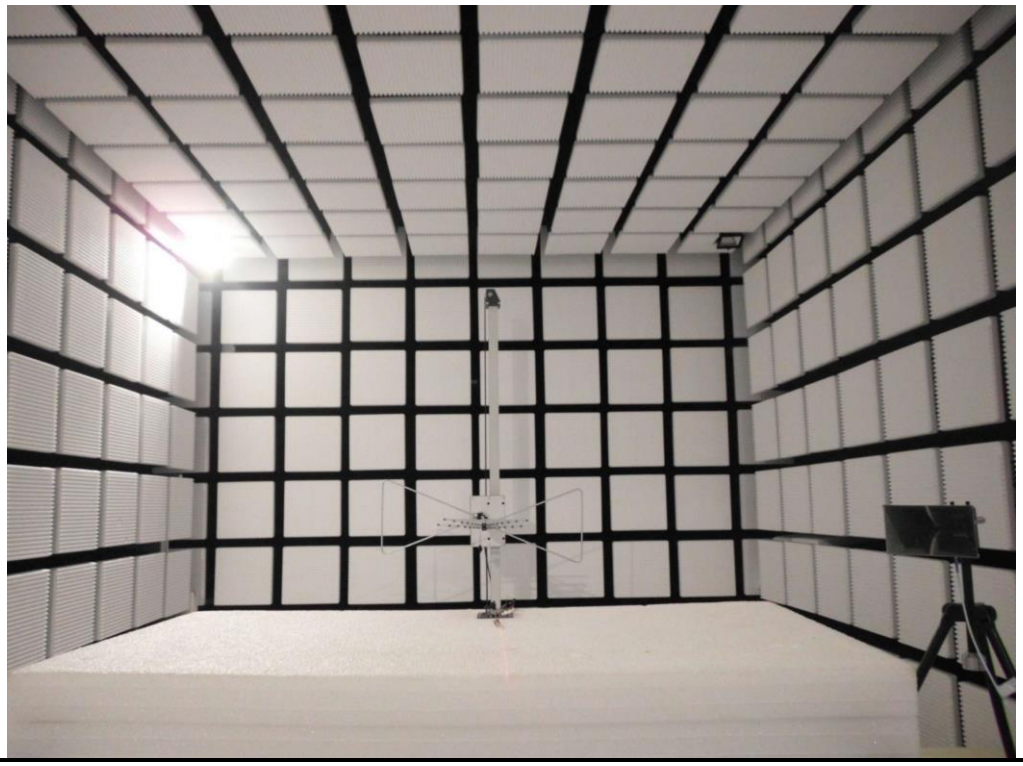
11b / 2472 MHz
Without Interference Signal Sensitivity Level

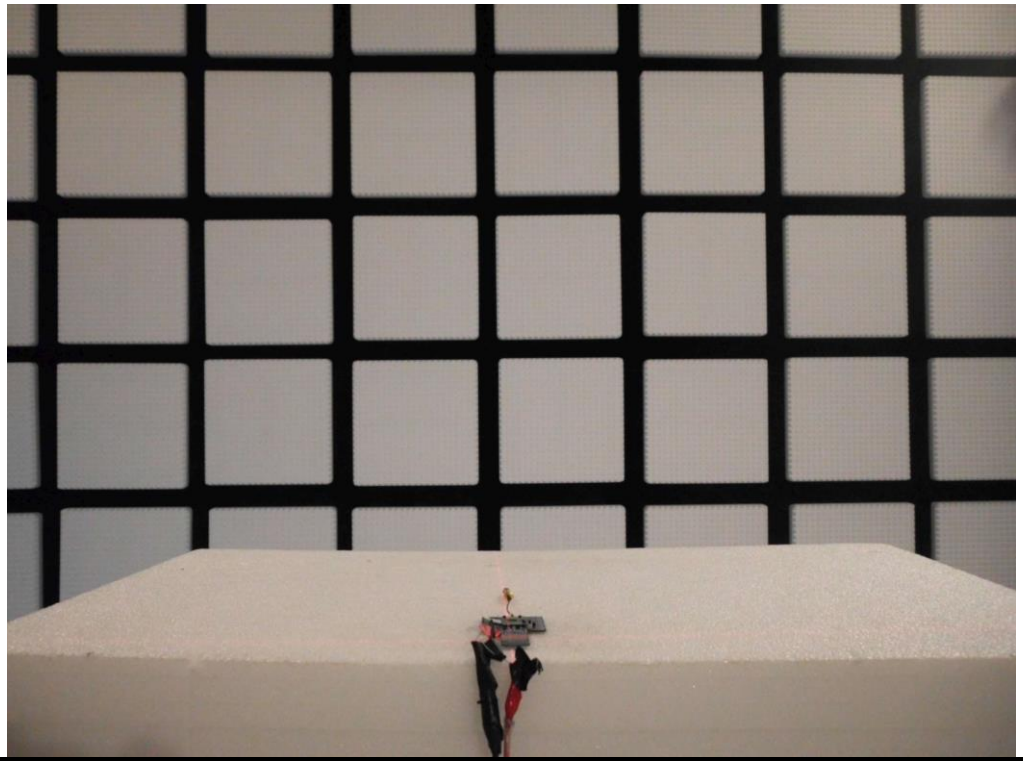


Receiver Category	1		
Performance Criteria Limit	PER ≤ 10 %		
Wanted Signal Mean Power from Companion Device (dBm)	Blocking Signal Frequency (MHz)	Blocking Signal Power (dBm)	Test Result
-65.21	2380	-31.21	Pass
-65.21	2504	-31.21	Pass
-71.21	2300	-31.21	Pass
-71.21	2330	-31.21	Pass
-71.21	2360	-31.21	Pass
-71.21	2524	-31.21	Pass
-71.21	2584	-31.21	Pass
-71.21	2674	-31.21	Pass

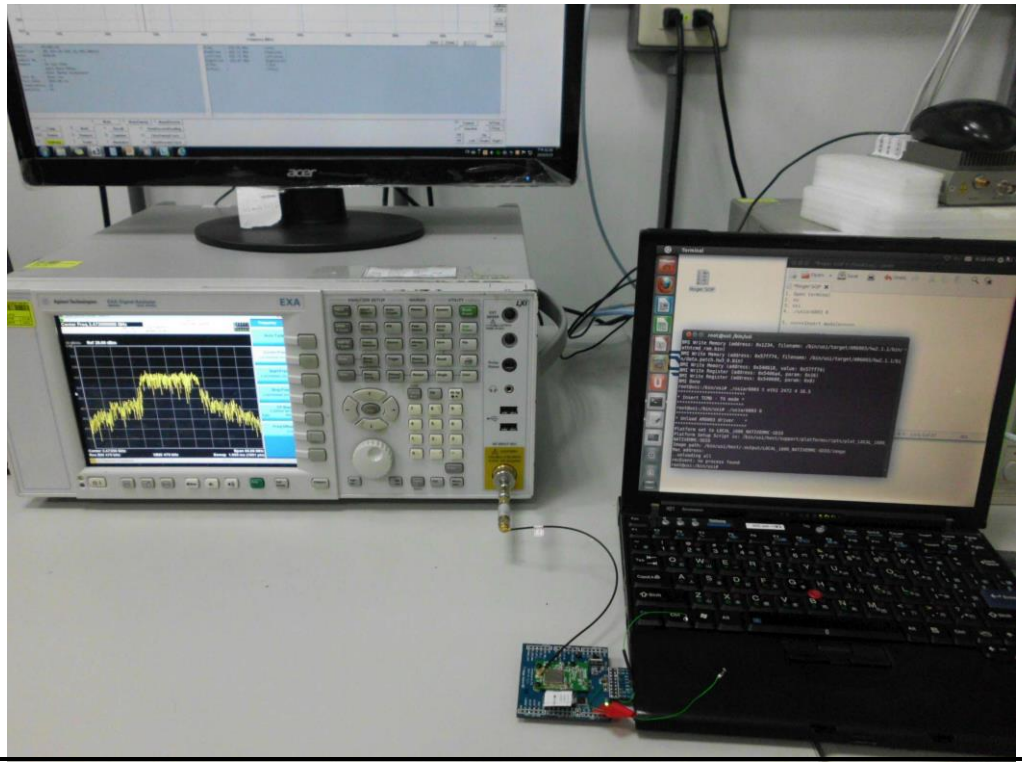
7 Photographs of the Test Configuration

Spurious Emission Test

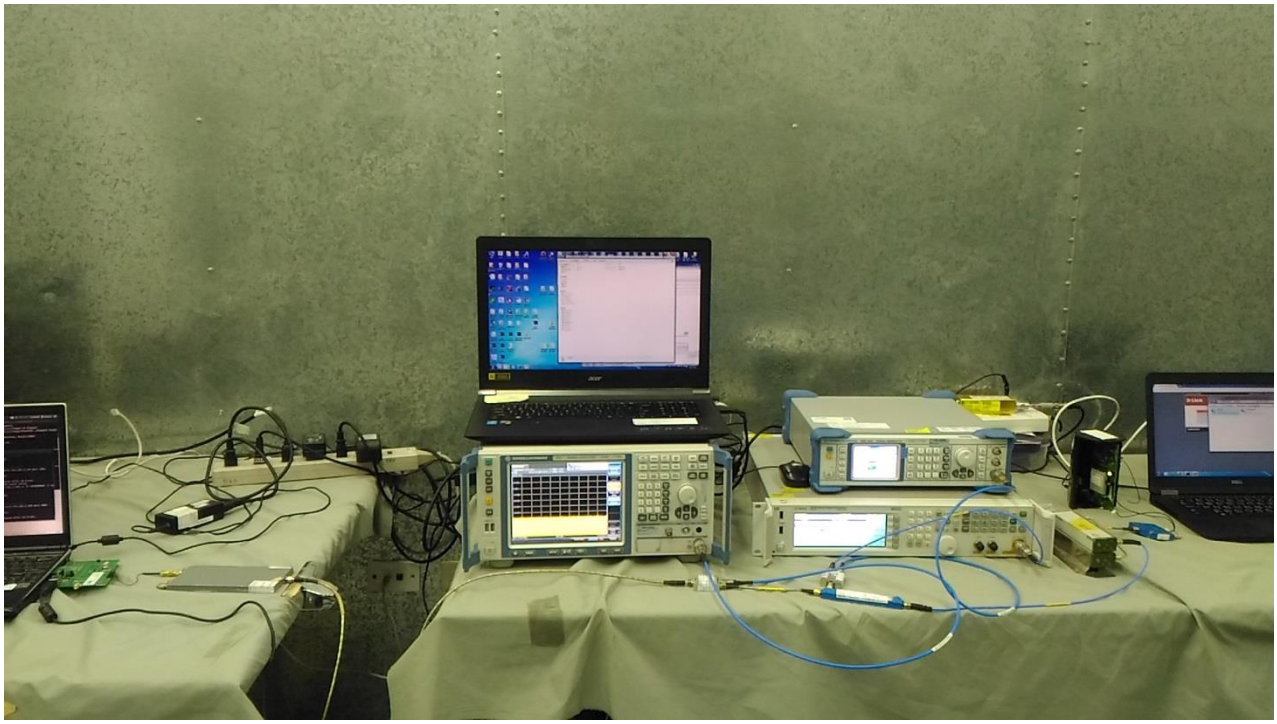




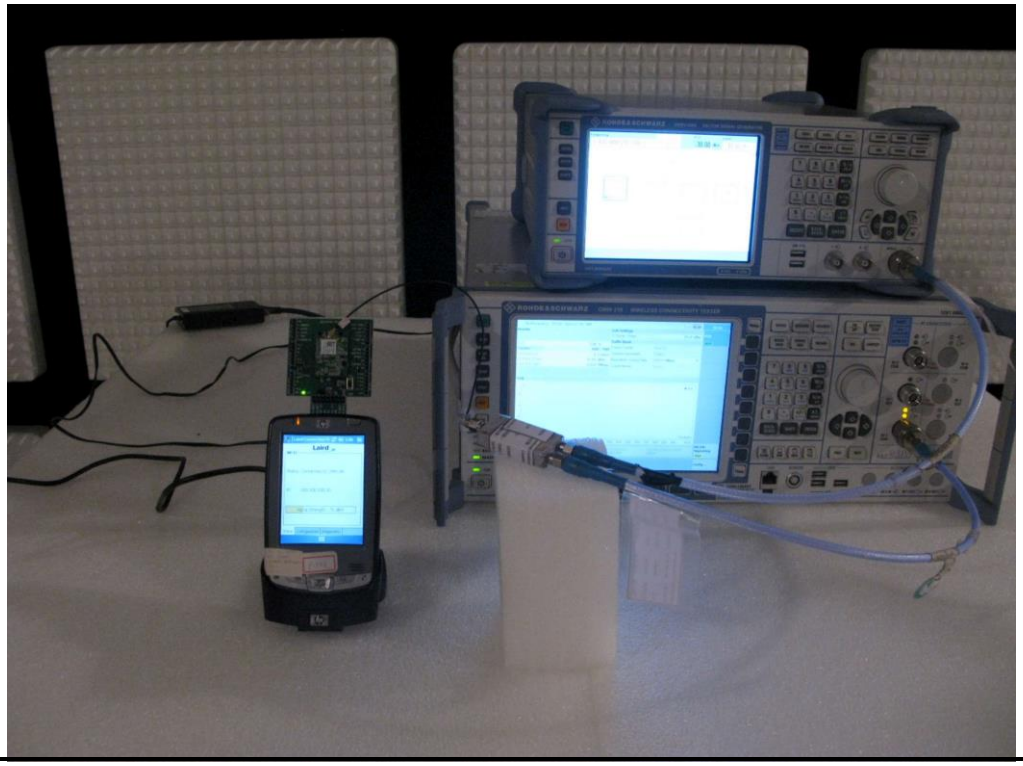
Spurious Emission Conducted Test



Adaptivity, Unwanted Signal and Short Control Signalling Transmissions Test



Receiver Blocking Test



8 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp (EMC and Wireless Communication Laboratory), it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan District. Location map can be found on our website http://www.icertifi.com.tw.

Linkou	**Kwei Shan**	**Kwei Shan Site II**
Tel: 886-2-2601-1640	Tel: 886-3-271-8666	Tel: 886-3-271-8640
No. 30-2, Ding Fwu Tsuen, Lin Kou District, New Taipei City, Taiwan, R.O.C.	No. 3-1, Lane 6, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.	No. 14-1, Lane 19, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C..

If you have any suggestion, please feel free to contact us as below information

Tel: 886-3-271-8666
Fax: 886-3-318-0155
Email: ICC_Service@icertifi.com.tw

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