TESTING (OR CALIBRATION)
NVLAP LAB CODE 600141-0

Registration
No.788871

TEST REPORT FOR WLAN TESTING

Report No: SRTC2019-9004(F)-19042601(F)

Product Name: LTE Ufi

Product Model: MF971V

Applicant: ZTE Corporation

Manufacturer: ZTE Corporation

Specification: FCC Part 15, Subpart C (2019)

FCC ID: SRQ-ZTE-MF971V

The State Radio_monitoring_center Testing Center (SRTC)

15th Building, No.30 Shixing Street, Shijingshan District,

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1. GENERAL INFORMATION

1.1 Notes of the test report

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The test results relate only to individual items of the samples which have been tested.
The certification and accreditation identifiers used in this report shall not be applicable to the tested or calibrated samples thereof. The manufacturer shall not mark the tested samples or items (or a separate part of the item) with the identifiers of certification and accreditation to mislead relevant parties about the tested samples or items.

1.2 Information about the testing laboratory

Company:	The State Radio_monitoring_center Testing Center (SRTC)
Address:	15th Building, No.30 Shixing Street, Shijingshan District, P.R.China
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1.3 Applicant's details

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Country or Region:	P.R.China
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1.4 Manufacturer's details

Company:	ZTE Corporation
Address:	ZTE Plaza, #55 Keji Road South, Hi-Tech, Industrial Park, Nanshan District,Guangdong
City:	Shenzhen
Country or Region:	P.R.China
Contacted person:	Yang Zhao
Tel:	029-83600770
Fax:	---
Email:	zhao.yangxa@zte.com.cn

1.5 Test Environment

Date of Receipt of test sample at SRTC:	2019-04-26
Testing Start Date:	2019-05-09
Testing End Date:	2019-05-23

Environmental Data:	Temperature (°C)	Humidity (%)
Ambient	25	30

Normal Supply Voltage (V d.c.):	3.80

2 DESCRIPTION OF THE DEVICE UNDER TEST

2.1Final Equipment Build Status

Frequency Band	2.412GHz~2.462GHz
Number of Channel For 20MHz	11
Number of Channel For 40MHz	7
Modulation Type	DBPSK/DQPSK/CCK/BPSK/QPSK/16QAM/64QAM
Duplex Mode	TDD
Channel Spacing	5MHz
Data Rate	802.11b:1Mbps-11Mbps 802.11g:6Mbps-54Mbps 802.11n HT20:MCS0-MCS7 802.11n HT40:MCS0-MCS7
Power Supply	Battery/AC adapter
HW Version	dqaA
SW Version	BD_MF971VV1.0.0B01
IMEI	869626021438454
Antenna type	Refer to Note
Antenna connector	Refer to Note

Note：The antenna provide to the EUT, please refer to the following table:

Brand	Model	Antenna gain	Frequency range(GHz)	Antenna type	Connecter Type
N/A	N/A	Ant1=1.35dBi Ant2=0.54dBi	2.412GHz~2.462GHz	PIFA Antenna	N/A
Manufacturers ensure that their designs will not be modified by the user or third parties arbitrary antenna parameters and performance.					

2.2 Description of Test Modes

11 channels are provided to this EUT:

CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437	---	---

2.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE ≥ 1G	RE<1G	PLC	APCM	-
-	√	√	√	√	-

Where **RE 1G:** Radiated Emission above 1GHz **RE<1G:** Radiated Emission below 1GHz

PLC: Power Line Conducted Emission **APCM:** Antenna Port Conducted Measurement

Radiated Emission Test (Above 1GHz):

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
1 to 11	6	DBPSK/ BPSK	1,6,6.5

Radiated Emission Test (Below 1GHz):

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
1 to 11	6	DBPSK/ BPSK	1,6,6.5

Power Line Conducted Emission Test:

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
1 to 11	6	DBPSK	1

Antenna Port Conducted Measurement:

This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
1 to 11	1,3, 6,9, 11	DBPSK/ BPSK	1,6,6.5

2.3 Duty Cycle of Test Signal

Modulation Type	Data Rate	Duty Cycle	Correction factor
11b	1Mbps	98.9%	N/A
11g	6Mbps	96.7%	0.15dB
11n(HT20)	6.5Mbps	95.3%	0.21dB
11n(HT40)	13.5Mbps	93.8%	0.28dB
Duty cycle of test signal is > 98 %, duty factor shall not be considered. Correction factor = 10* log (1/duty cycle)			

2.4 EUT Operating conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

2.5 Support Equipment

The following support equipment was used to exercise the DUT during testing:

Equipment	Battery
Manufacturer	Zhongshan Tianmao Battery Co., Ltd.
Model Number	Li3823T43P3h715345
Serial Number	---

Equipment	Charger
Manufacturer	AOHAI
Model Number	STC-A51A-B
Serial Number	---

Equipment	Charger
Manufacturer	AOHAI
Model Number	STC-A51A-Z
Serial Number	---

Equipment	Charger
Manufacturer	SHENZHEN RUIJING INDUSTRIAL CO LTD
Model Number	STC-A51A-Z
Serial Number	---

Equipment	USB cable
Manufacturer	Shen Zhen Shi Yi HUA XING Electron Co.,Ltd
Model Number	USB-MU5-W-100-L
Serial Number	---

3 REFERENCE SPECIFICATION

Specification	Version	Title
15.35	2019	Measurement detector functions and bandwidths.
15.209	2019	Radiated emission limits; general requirements.
15.247	2019	Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.
15.203	2019	Antenna requirement
ANSI C63.10	2013	Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
KDB 558074 D01	v05, August 24,2018,	GUIDANCE FOR PERFORMING COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEMS (DTS) OPERATING UNDER SECTION 15.247

4 KEY TO NOTES AND RESULT CODES

The following are the definition of the test result.

Code	Meaning
PASS	Test result shows that the requirements of the relevant specification have been met.
FAIL	Test result shows that the requirements of the relevant specification have not been met.
N/T	Test case is not tested.
NTC	Nominal voltage, Normal Temperature
HV	High voltage, Normal Temperature
LV	Low voltage, Normal Temperature
HTHV	high voltage, High Temperature
LTHV	High voltage, Low Temperature
HTLV	Low voltage, High Temperature
LTLV	Low voltage, Low Temperature

5 RESULT SUMMARY

No.	Test case	Reference	Verdict
1	Peak Power Output	15.247(a)(2)	Pass
2	Occupied Bandwidth	15.247(b)(3))	Pass
3	Transmitter Power Spectral Density	15.247(e))	Pass
4	Conducted Out of band emission measurement	15.247(d)	Pass
5	Band Edge	15.247(d)	Pass
6	Spurious Radiated Emissions	15.247(d)/15.35(b)/15.209	Pass
7	AC Power line Conducted Emission	15.207	Pass
8	Antenna requirement	15.203	Pass（refer to section 2.1）

This Test Report Is Issued by: Mr. Peng Zhen	Checked by: Mr. Li Bin
Tested by: Tong Daocheng	Issued date: 20190528

6 TEST RESULT

6.1 Peak Power Output

6.1.1 Ambient condition

Temperature	Relative humidity	Pressure
23°C	42%	101.5kPa

6.1.2 Test Description

A transmitter antenna terminal of EUT is connected to the power meter. Measurement is made using a broadband power meter capable of making peak and average measurements while the EUT is operating at its maximum duty cycle (>98%), at maximum power, and at the appropriate frequencies.

6.1.3 Test limit

FCC Part15.247(b)(3)
The maximum permissible conducted output power is 1 Watt.
Used conversion factor: Limit (dBm) = 10 log (Limit (W)/1mW)
==> Maximum Output Power: 30.0 dBm

6.1.4 Test Procedure Used

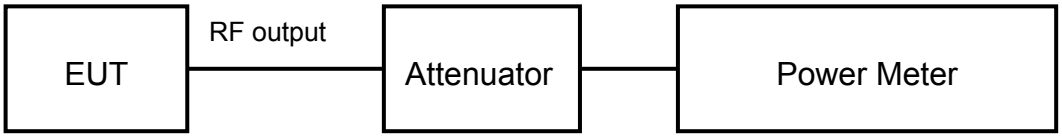
KDB 558074 D01 DTS Meas Guidance v05 – Section 9.1.3

6.1.5 Test Settings

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.

6.1.6 Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.



6.1.7 Test result

The test results are shown in Appendix A .

6.2 Occupied Bandwidth

6.2.1 Ambient condition

Temperature	Relative humidity	Pressure
23°C	42%	101.5kPa

6.2.2 Test Description

The bandwidth at 6dB down from the highest in-band spectral density is measured with a spectrum analyzer and Bluetooth test set via a power splitter with a known loss. Which connected to the transmitter antenna terminal of the EUT while the EUT is operating at maximum power and at the appropriate frequencies. All modes of operation were investigated and the worst case configuration results are reported in this section.

6.2.3 Test limit

FCC Part15.247(a)(2)
The minimum permissible 6dB bandwidth is 500 kHz

6.2.4 Test Procedure Used

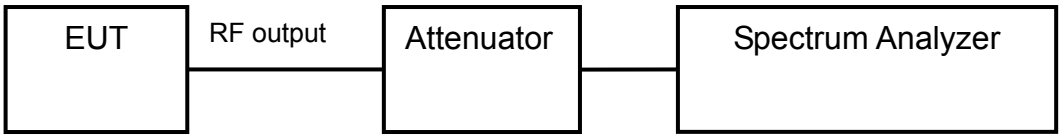
KDB 558074 D01 DTS Meas Guidance v05 – Section 8.1 Option 1

6.2.5 Test Settings

a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 x RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) 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.

6.2.6 Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.



6.2.7 Test result

The test results are shown in Appendix A.

6.3 Transmitter Power Spectral Density

6.3.1 Ambient condition

Temperature	Relative humidity	Pressure
23°C	42%	101.5kPa

6.3.2 Test Description

The peak power density is measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle (>98%), at maximum power, and at the appropriate frequencies. All data rates were investigated and the worst case configuration results are reported in this section.

6.3.3 Test limit

FCC Part15.247(e)
The maximum permissible power spectral density is 8.0 dBm in any 3 kHz band.

6.3.4 Test Procedure Used

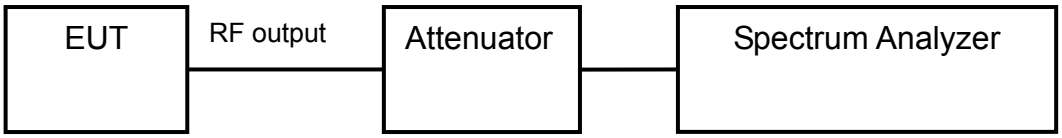
KDB 558074 D01 DTS Meas Guidance v05 Section 10.2.

6.3.5 Test Settings

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ 3 x RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

6.3.6 Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.



6.3.7 Test result

The test results are shown in Appendix A.

6.4 Conducted Out of band emission measurement

6.4.1 Ambient condition

Temperature	Relative humidity	Pressure
23°C	42%	101.5kPa

6.4.2 Test Description

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle (>98%), at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration.

6.4.3 Test limit

FCC Part 15.247(d)
The limit for out-of-band spurious emissions at the band edge is 20dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100 kHz bandwidth.

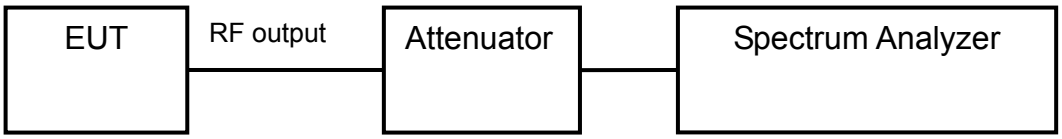
6.4.4 Test Procedure Used

KDB 558074 D01 DTS Meas Guidance v05 Section 11.3

6.4.5 Test Settings

a) Set the center frequency and span to encompass frequency range to be measured.
b) Set the RBW = 100kHz.
c) Set the VBW ≥ 300kHz.
d) Detector = peak.
e) Set span to encompass the spectrum to be examined
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level.

6.4.6 Test Setup



6.4.7 Test result

The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.

The test results are shown in Appendix A.

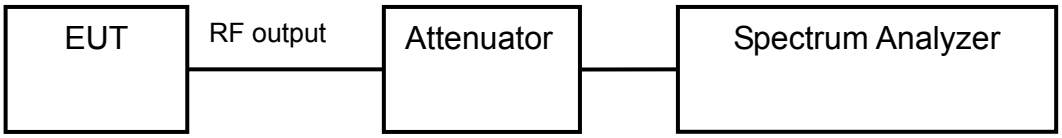
6.5 Band-edge measurement

6.5.1 Ambient condition

Temperature	Relative humidity	Pressure
23°C	42%	101.5kPa

6.5.2 Test Description

For the following out of band conducted spurious emissions plots, the EUT was set to transmit at maximum power with the largest packet size available. The worst case spurious emissions were found in this configuration.



6.5.3 Test limit

Part 15.247(d)

The limit for out-of-band spurious emissions at the band edge is 20dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100 kHz bandwidth.

6.5.4 Test Procedure Used

KDB 558074 D01 DTS Meas Guidance v05 Section 12.1

6.5.5 Test Settings

a) Set the center frequency and span to encompass frequency range to be measured.
b) Set the RBW = 100kHz.
c) Set the VBW ≥ 300kHz.
d) Detector = peak.
e) Set span to encompass the spectrum to be examined
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level.

6.5.6 Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

6.5.7 Test result

The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.
The test results are shown in Appendix A .

6.6 Spurious Radiated Emissions

6.6.1 Ambient condition

Temperature	Relative humidity	Pressure
23°C	45%	101.5kPa

6.6.2 Test Description

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna while the EUT is operating at maximum power and at the appropriate frequencies. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

6.6.3 Test limit

Part15.205, 15.209, 15.247(d)

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in below Table per Section 15.209.

Frequency [MHz]	Field strength [μV/m]	Measured Distance [meters]
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

Radiated Limits

Part15.35(b):

there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit

Used conversion factor: Limit (dBμV/m) = 20 log (Limit (μV/m)/1μV/m)

Frequency [MHz]	Detector	Unit (dBμV/m)
30～88	Quasi-peak	40.0
88～216	Quasi-peak	43.5
216～960	Quasi-peak	46.0
960～1000	Quasi-peak	54.0
1000～5th harmonic of the highest frequency or 40GHz, whichever is lower	Average	54.0
	Peak	74.0

Conversion Radiated limits

6.6.4 Test Procedure Used

KDB 558074 D01 DTS Meas Guidance v05 – Section 12.2.7

For Radiated emission below 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. Both X and Y axes of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz
a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

For the radiated emission test above 1GHz:
Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The

final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

NOTE:
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Average detection (AV) at frequency above 1GHz. If duty cycle of test signal is < 98%, the duty factor need added to measured value.
4. All modes of operation were investigated and the worst-case emissions are reported.

6.6.5 Test Settings

Average Field Strength Measurements per Section 12.2.7 of KDB 558074 (Part 15.35)
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz > 1/T
4. Averaging type was set to RMS to ensure that video filtering was applied in the power domain
5. Detector = average
6. Sweep time = auto
7. Trace mode = max hold
8. Trace was allowed to run for at least 50 times (1/duty cycle) traces

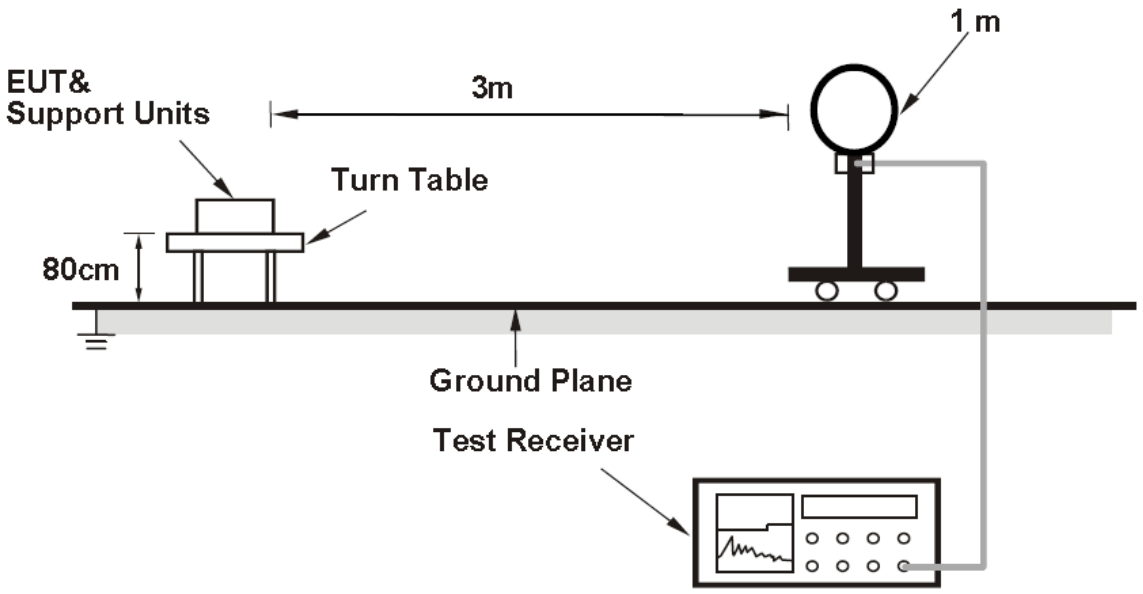
Peak Field Strength Measurements per Section 12.2.7of KDB 558074 (Part 15.35)
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW is set depending on measurement frequency, as specified in following table

Frequency	RBW
9-150kHz	200-300Hz
0.15-30MHz	9-10kHz
30-1000MHz	100-120kHz
>1000MHz	1MHz

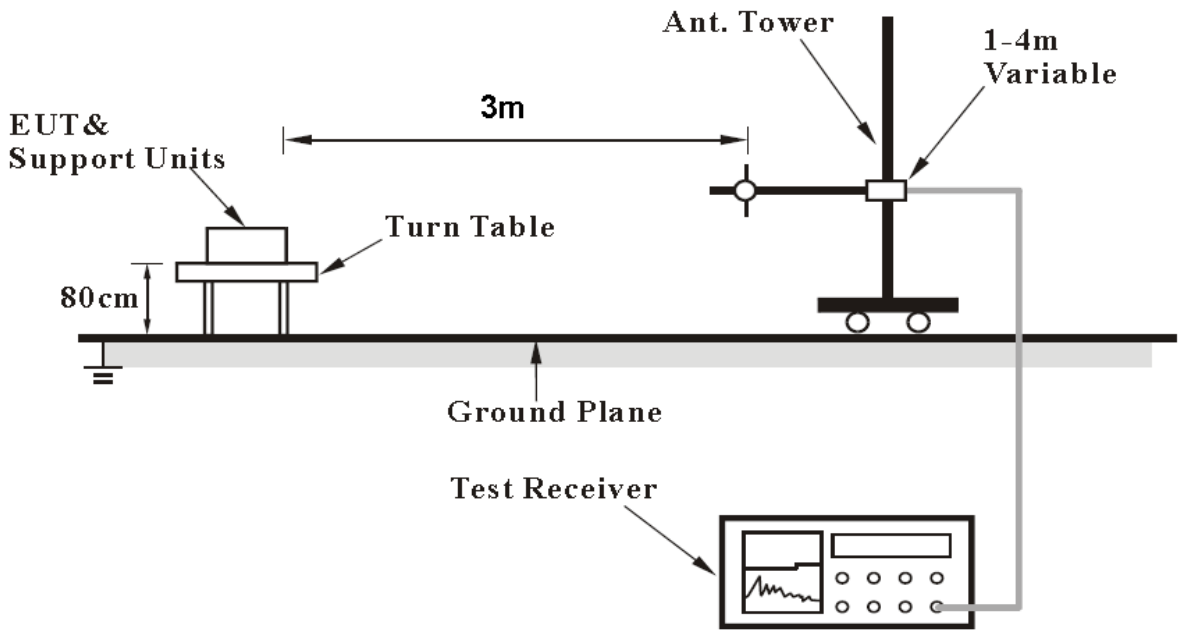
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

6.6.6 Test Setup

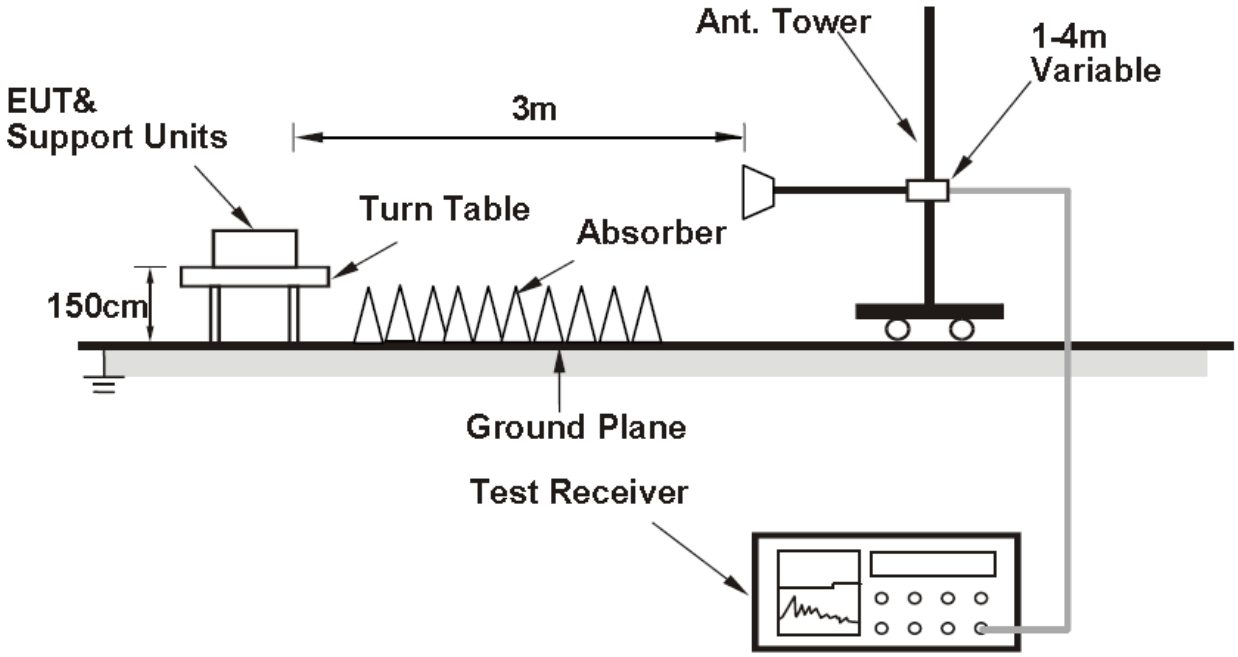
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



6.6.7 Test result

The test results are shown in Appendix B.

6.7 AC Power line Conducted Emission

6.7.1 Ambient condition

Temperature	Relative humidity	Pressure
23°C	45%	101.5kPa

6.7.2 Test limit

FCC Part15.207, RSS-247

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

The measurement is made according to ANSI C63.10-2013

6.7.3 Test Procedures

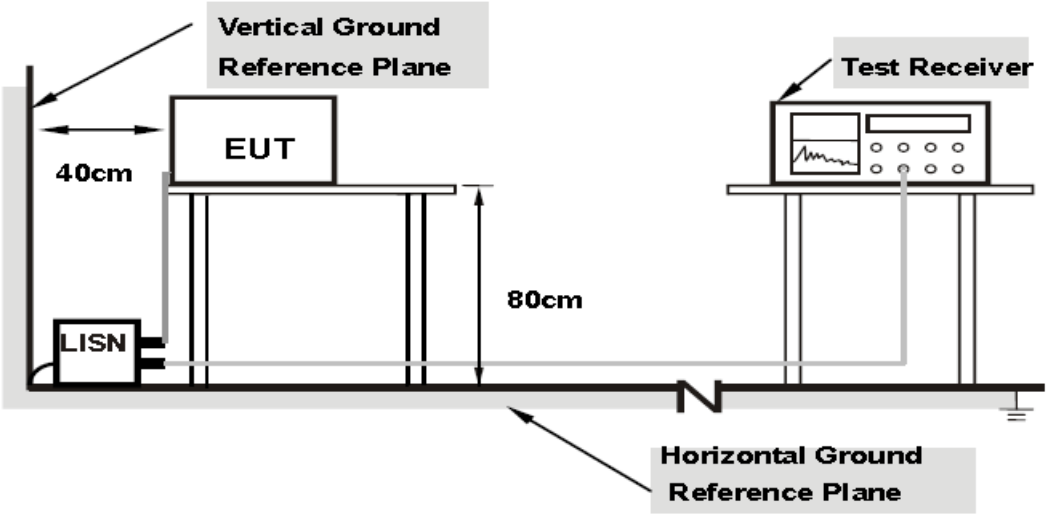
a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.
The EUT shall test under the power AC120V/60Hz.

6.7.4 Test Setup



For the actual test configuration, please refer to the attached file (Test Setup Photo).

6.7.5 Test result

The test results are shown in AppendixB .

7 MEASUREMENT UNCERTAINTIES

Items	Uncertainty	
Occupied Bandwidth	3kHz	
Peak power output	0.67dB	
Band edge compliance	1.20dB	
Spurious emissions	30MHz～1GHz	2.83dB
	1GHz～12.75GHz	2.50dB
	12.75GHz～25GHz	2.75dB

8 TEST EQUIPMENTS

No.	Name/ Model	Manufacturer	S/N	Cal date	Cal Due date
1.	Spectrum Analyzer FSV	ROHDE&SCHWARZ	101065	2018.08.20	2019.08.19
2.	Power Meter E4416A	Agilent	MY52370013	2019.03.01	2020.02.28
3.	Power Sensor E9327A	Agilent	MY52420006	2019.03.01	2020.02.28
4.	Attenuator 6810.17.B	HUBER+SUHNER	768710	2018.08.20	2019.08.19
5.	23.18m×16.88m×9.60m Semi-Anechoic Chamber	FRANKONIA	---	-----	-----
6.	Turn table Diameter:5m	FRANKONIA	-----	-----	-----
7.	Antenna master SAC(MA4.0)	MATURO	-----	-----	-----
8.	9.080m×5.255m×3.525m Shielding room	FRANKONIA	-----	-----	-----
9.	HF 907 Double-Ridged Waveguide Horn Antenna	R&S	100512	2018.08.20	2019.08.19
10.	3160-09 Receive antenna	SCHWARZ-BECK	002058-002	2018.08.20	2019.08.19
11.	ESI 40 EMI test receiver	R&S	100015	2018.08.20	2019.08.19
12.	ESCS30 EMI test receiver	R&S	100029	2018.08.20	2019.08.19
13.	HL562 Receive antenna	R&S	100167	2018.08.20	2019.08.19
14.	ENV216 AMN	R&S	3560.6550.12	2018.08.20	2019.08.19

APPENDIX A – TEST DATA OF CONDUCTED EMISSION

Please refer to the attachment.

APPENDIX B – TEST DATA OF RADIATED EMISSION

Please refer to the attachment.

APPENDIX A – TEST DATA OF CONDUCTED EMISSION

In order to find the worst case condition, Pre-tests are needed at the presence of different data rate. Data rate below means worst-case rate of each test item.

Worst-case data rates are shown as following table.

Test Mode	Data Rate
802.11b	1Mbps
802.11g	6Mbps
802.11n HT20	MCS0(6.5 Mbps)
802.11n HT40	MCS0(13.5 Mbps)

Directional Antenna Gain
The TX chains are correlated and the antenna gain is unequal among the chains. The directional gain is:

Chain1 Antenna Gain(dBi)	Chain2 Antenna Gain(dBi)	Correlated Chains Directional Gain(dBi)
1.35	0.54	3.94

Antenna Gain and Limits

Frequency (MHz)	Correlated Chains Directional Gain (dBi)	Power Limit (dBm)	PSD Limit (dBm)
2412	3.94	30.0	8.0
2422	3.94	30.0	8.0
2442	3.94	30.0	8.0
2452	3.94	30.0	8.0
2462	3.94	30.0	8.0

Average power in SISO Mode

Test Mode	Ant	Average power (dBm)		
		2412MHz	2437MHz	2462MHz
802.11b	Ant1	13.33	13.03	12.93
802.11b	Ant2	13.59	13.36	13.44
802.11g	Ant1	13.57	13.54	13.44
802.11g	Ant2	13.93	13.95	13.99
802.11n HT20	Ant1	13.36	13.37	13.27
802.11n HT20	Ant2	13.78	13.81	13.88
Test Mode	Ant	Average power (dBm)		
		2422MHz	2437MHz	2452MHz
802.11n HT40	Ant1	12.28	12.47	12.58
802.11n HT40	Ant2	13.11	13.15	13.25

Output Power in SISO Mode

Test Mode	Ant	Peak power output (dBm)			
		2412MHz	2437MHz	2462MHz	Power Limit(dBm)
802.11b	Ant1	17.66	17.38	17.28	30.0
802.11b	Ant2	17.95	17.77	17.89	30.0
802.11g	Ant1	18.73	18.70	18.52	30.0
802.11g	Ant2	19.15	19.19	19.32	30.0
802.11n HT20	Ant1	19.21	19.23	18.97	30.0
802.11n HT20	Ant2	19.33	19.45	19.51	30.0
Test Mode	Ant	Peak power output (dBm)			
		2422MHz	2437MHz	2452MHz	Power Limit(dBm)
802.11n HT40	Ant1	18.31	18.44	18.49	30.0
802.11n HT40	Ant2	19.28	19.16	19.33	30.0

Average power in MIMO Mode

Test Mode	Ant	Average power (dBm)		
		2412MHz	2437MHz	2462MHz
802.11n HT20	Ant1	13.43	13.41	13.38
802.11n HT20	Ant2	13.67	13.71	13.62
802.11n HT20	Ant1+Ant2	16.56	16.57	16.51
Test Mode	Ant	Average power (dBm)		
		2422MHz	2437MHz	2452MHz
802.11n HT40	Ant1	12.43	12.41	12.32
802.11n HT40	Ant2	13.37	13.41	13.53
802.11n HT40	Ant1+Ant2	15.94	15.95	15.98

Output Power in MIMO Mode

Test Mode	Ant	Peak power output (dBm)			
		2412MHz	2437MHz	2462MHz	Power Limit(dBm)
802.11n HT20	Ant1	19.39	19.13	19.05	30.0
802.11n HT20	Ant2	19.32	19.25	19.56	30.0
802.11n HT20	Ant1+Ant2	22.37	22.20	22.32	30.0
Test Mode	Ant	Peak power output (dBm)			
		2422MHz	2437MHz	2452MHz	Power Limit(dBm)
802.11n HT40	Ant1	18.11	18.26	18.32	30.0
802.11n HT40	Ant2	19.22	19.34	19.53	30.0
802.11n HT40	Ant1+Ant2	21.71	21.84	21.98	30.0

We chose the Worst-modes are shown as following table:

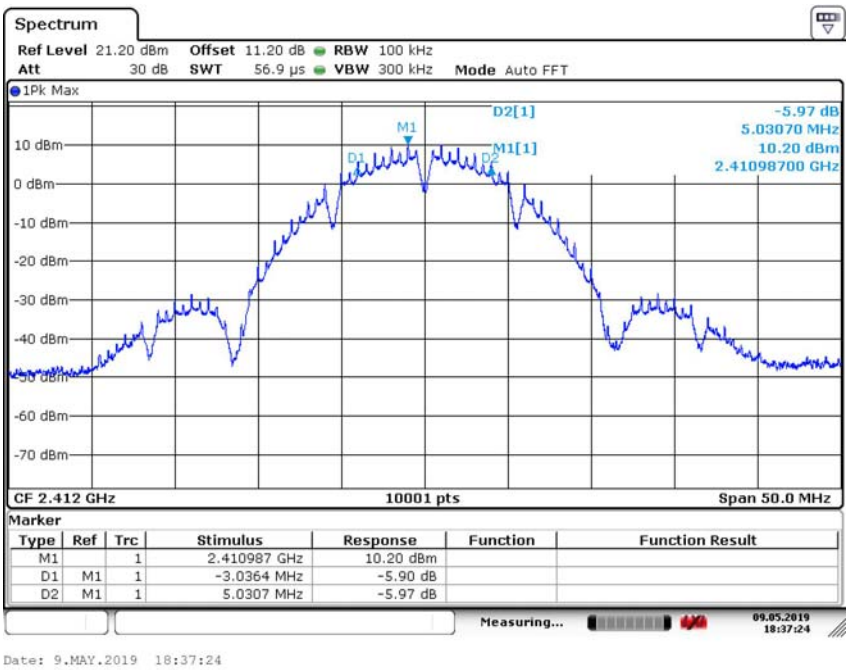
Test Mode	Ant
802.11b	SISO Ant2
802.11g	SISO Ant2
802.11n HT20	SISO Ant2
802.11n HT40	SISO Ant2
802.11n HT20	MIMO Ant1+Ant2
802.11n HT40	MIMO Ant1+Ant2

6dB Bandwidth

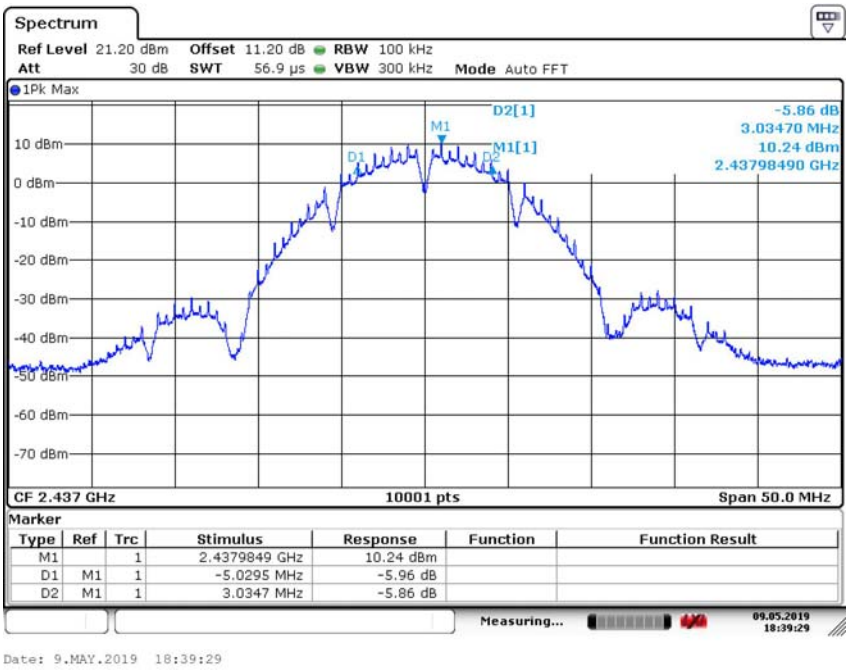
Offset 11.2dB = Attenuator 10dB+ Temporary antenna connector loss 0.2dB+ Cable loss 1.0dB

Test Mode: 802.11b (SISO Ant2)

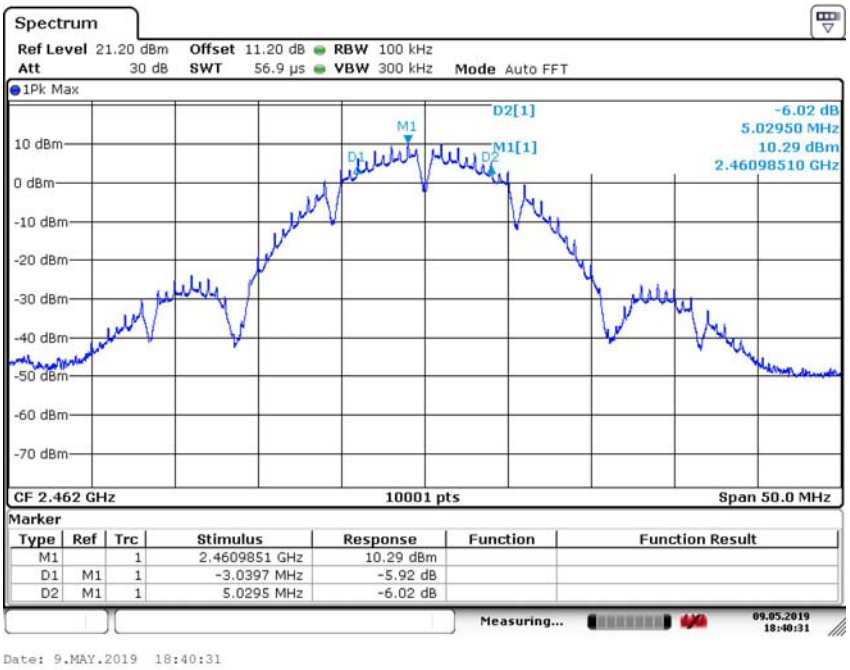
Carrier frequency (MHz)	Channel No.	6 dB bandwidth(kHz)
2412	1	8067.1
2437	6	8064.2
2462	11	8069.2



Carrier frequency (MHz): 2412
Channel No.:1
Test Mode: 802.11b



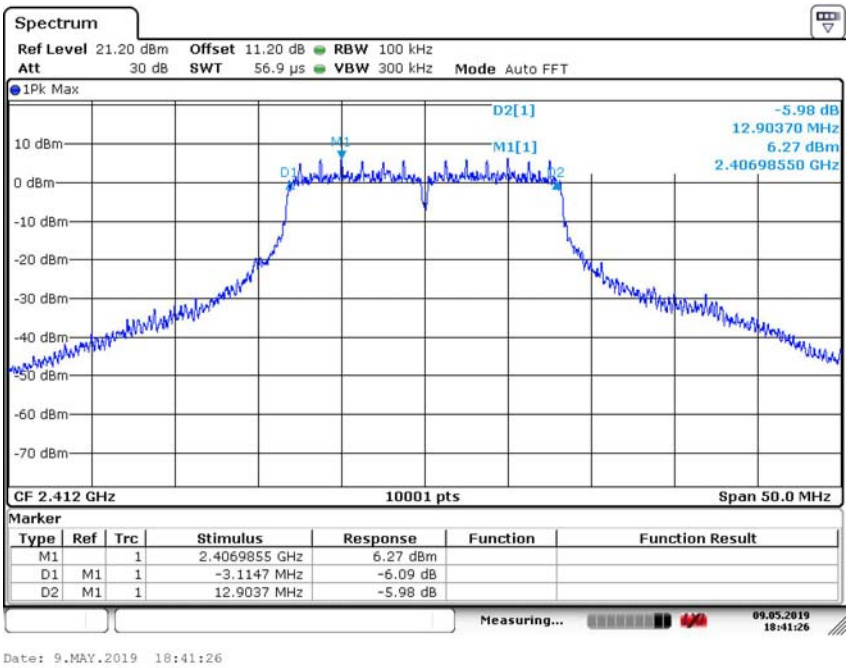
Carrier frequency (MHz): 2437
Channel No.:6
Test Mode: 802.11b



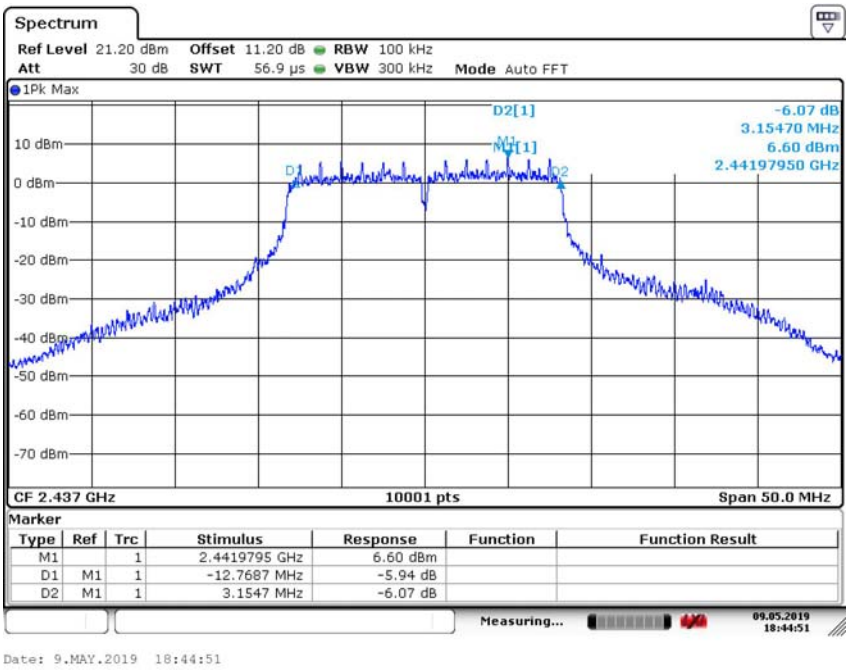
Carrier frequency (MHz): 2462
Channel No.:11
Test Mode: 802.11b

Test Mode: 802.11g (SISO Ant2)

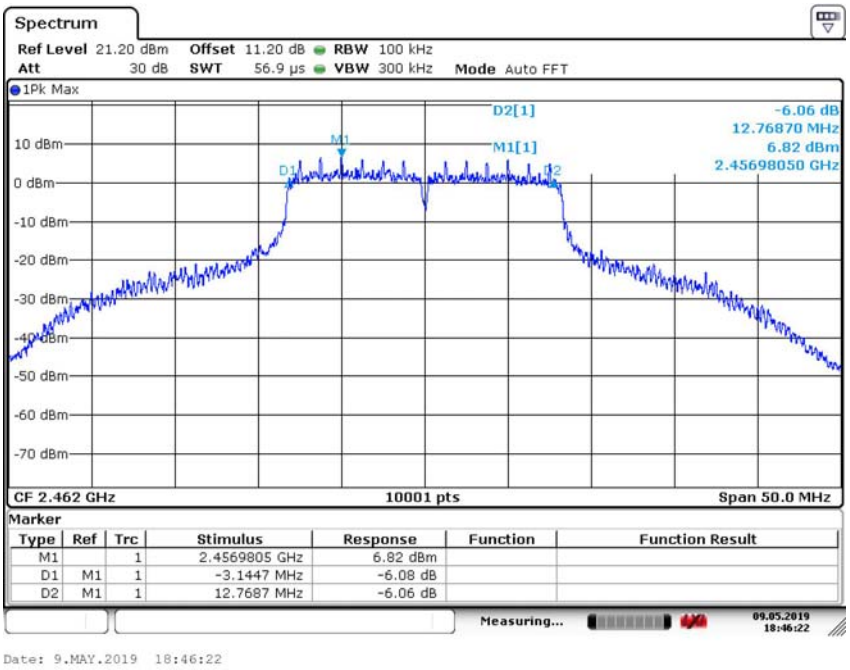
Carrier frequency (MHz)	Channel No.	6 dB bandwidth(kHz)
2412	1	16018.4
2437	6	15923.4
2462	11	15913.4



Carrier frequency (MHz): 2412
Channel No.:1
Test Mode: 802.11g



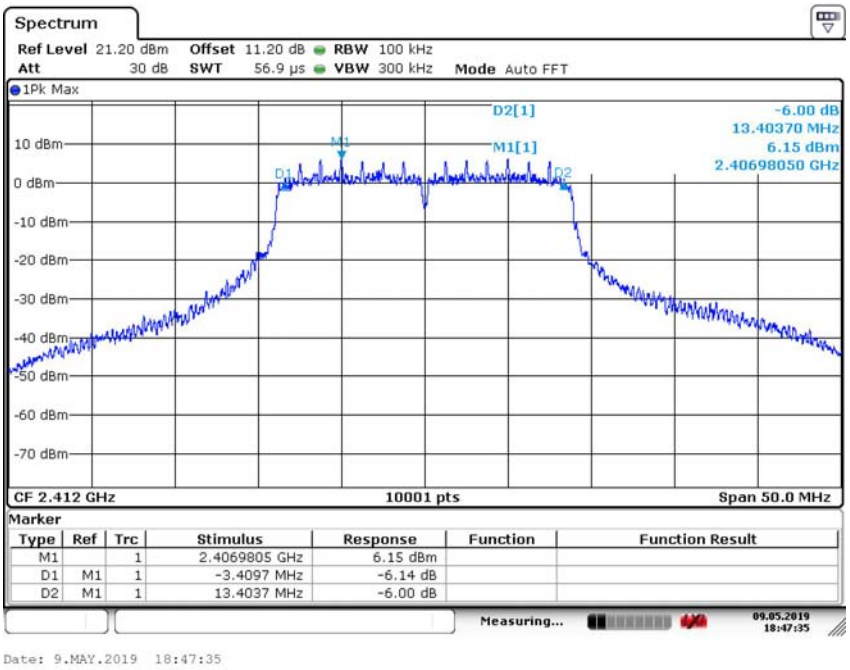
5Carrier frequency (MHz): 2437
Channel No.:6
Test Mode: 802.11g



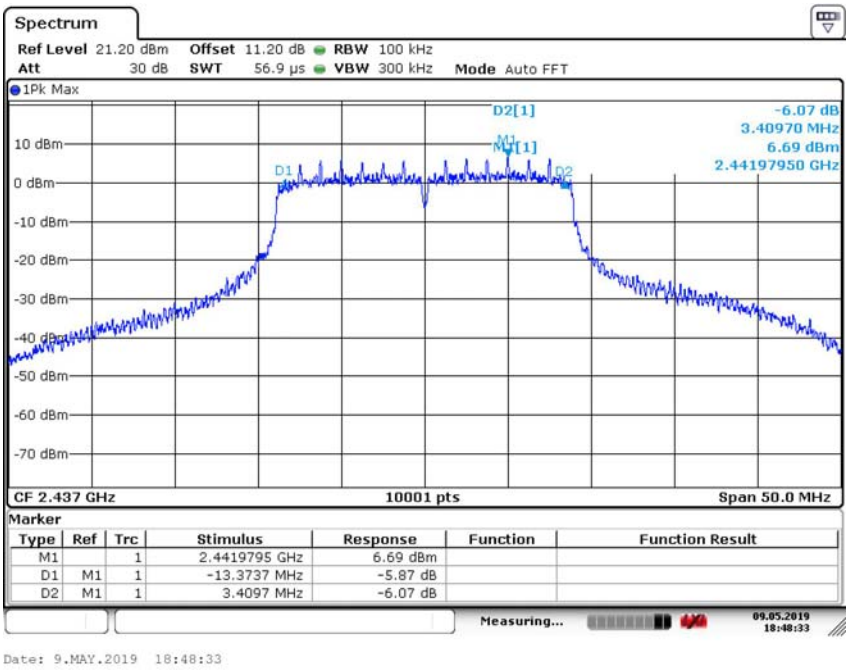
Carrier frequency (MHz): 2462
Channel No.:11
Test Mode: 802.11g

Test Mode: 802.11n (HT20) (SISO Ant2)

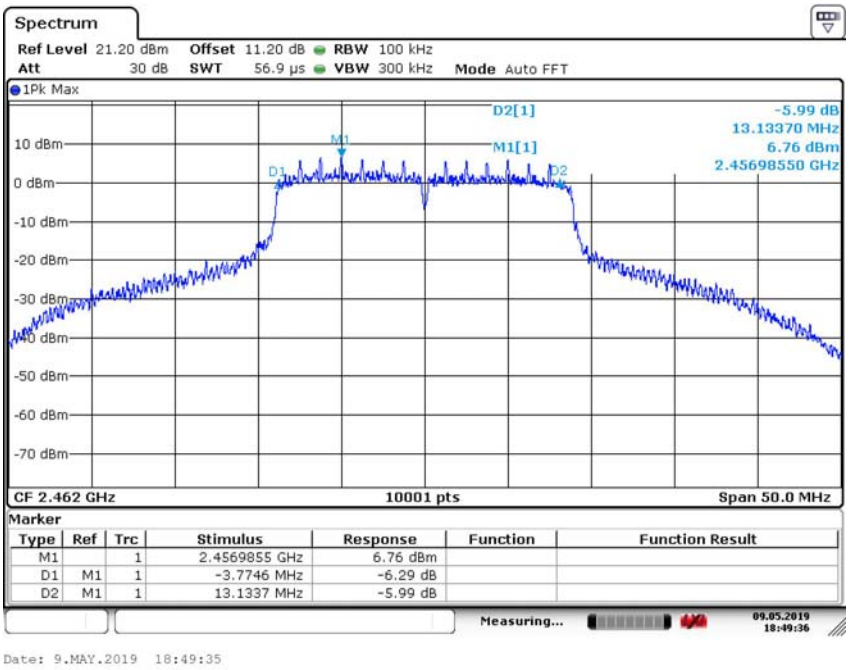
Carrier frequency (MHz)	Channel No.	6 dB bandwidth(kHz)
2412	1	16813.4
2437	6	16783.4
2462	11	16908.3



Carrier frequency (MHz): 2412
Channel No.:1
Test Mode: 802.11n (HT20)



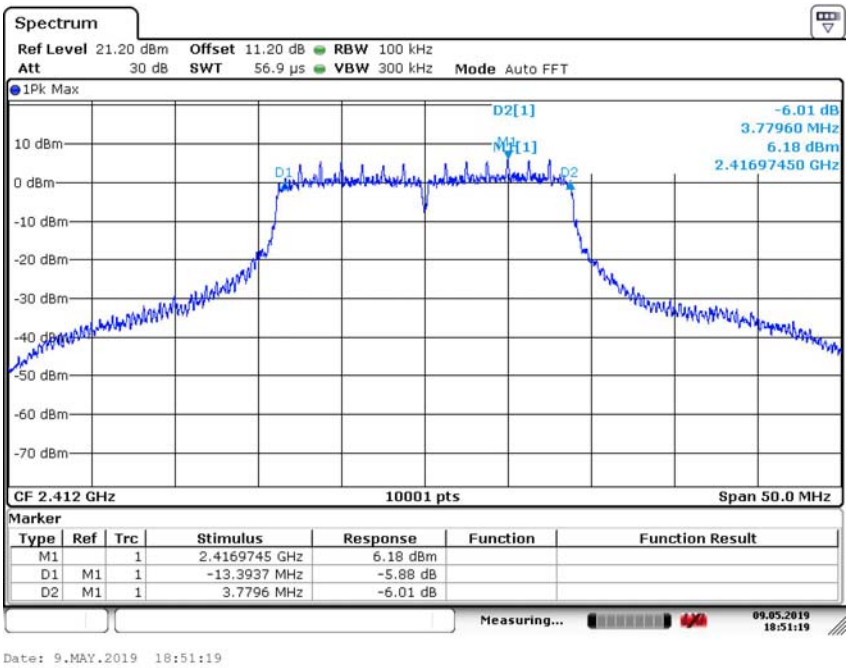
Carrier frequency (MHz): 2437
Channel No.:6
Test Mode: 802.11n (HT20)



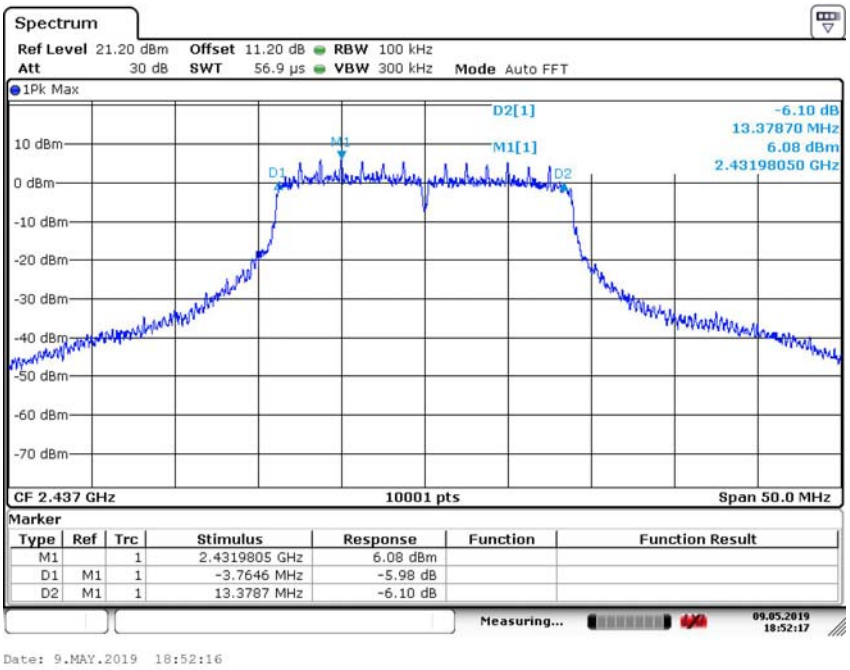
Carrier frequency (MHz): 2462
Channel No.:11
Test Mode: 802.11n (HT20)

Test Mode: 802.11n (HT20) (MIMO Ant1)

Carrier frequency (MHz)	Channel No.	6 dB bandwidth(kHz)
2412	1	17173.3
2437	6	17143.3
2462	11	16788.4

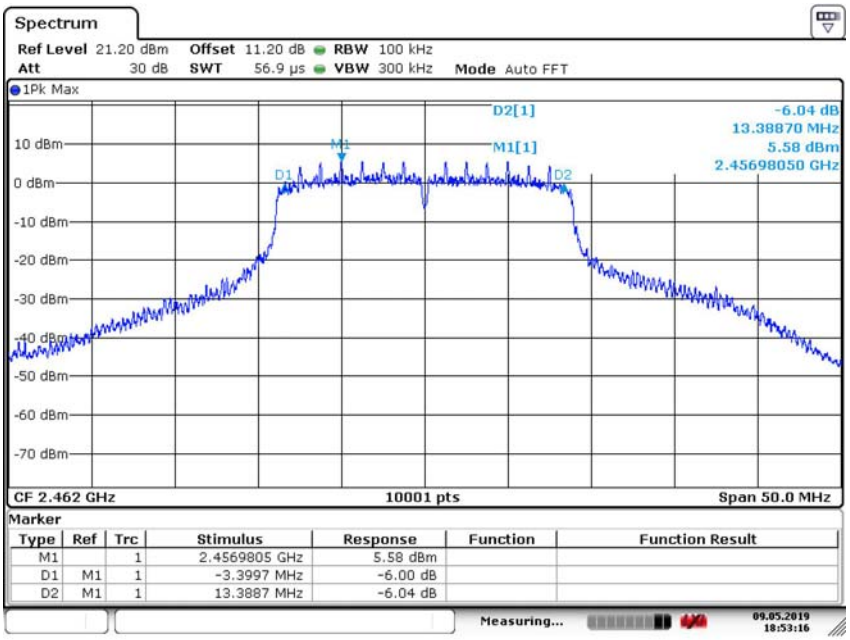


Carrier frequency (MHz): 2412
Channel No.:1
Test Mode: 802.11n (HT20)



Date: 9.MAY.2019 18:52:16

Carrier frequency (MHz): 2437
Channel No.:6
Test Mode: 802.11n (HT20)

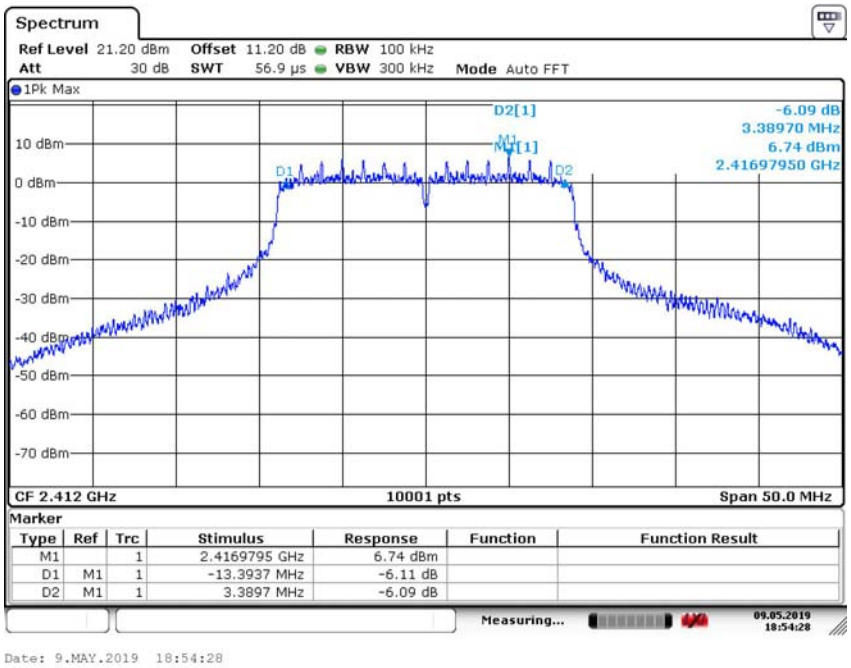


Date: 9.MAY.2019 18:53:15

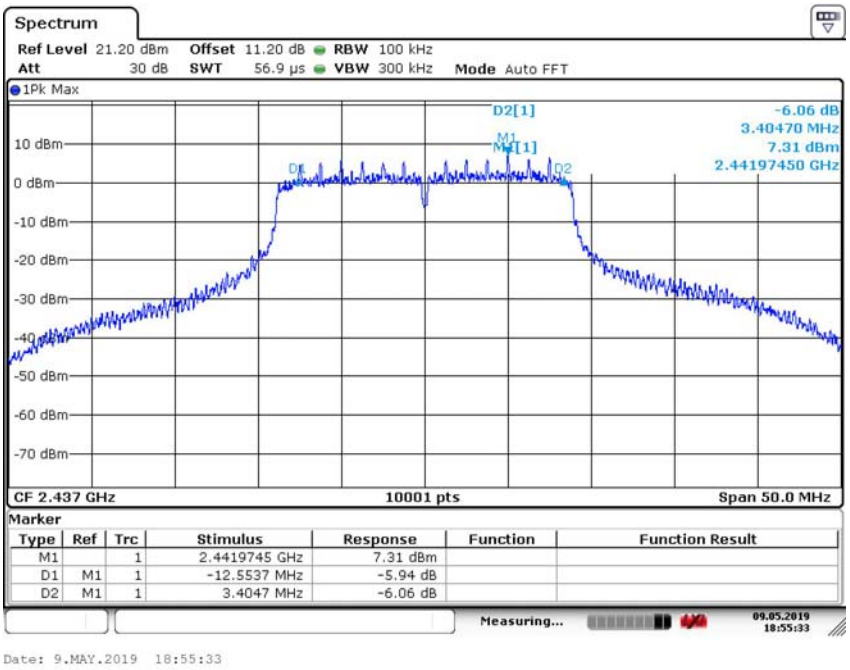
Carrier frequency (MHz): 2462
Channel No.:11
Test Mode: 802.11n (HT20)

Test Mode: 802.11n (HT20) (MIMO Ant2)

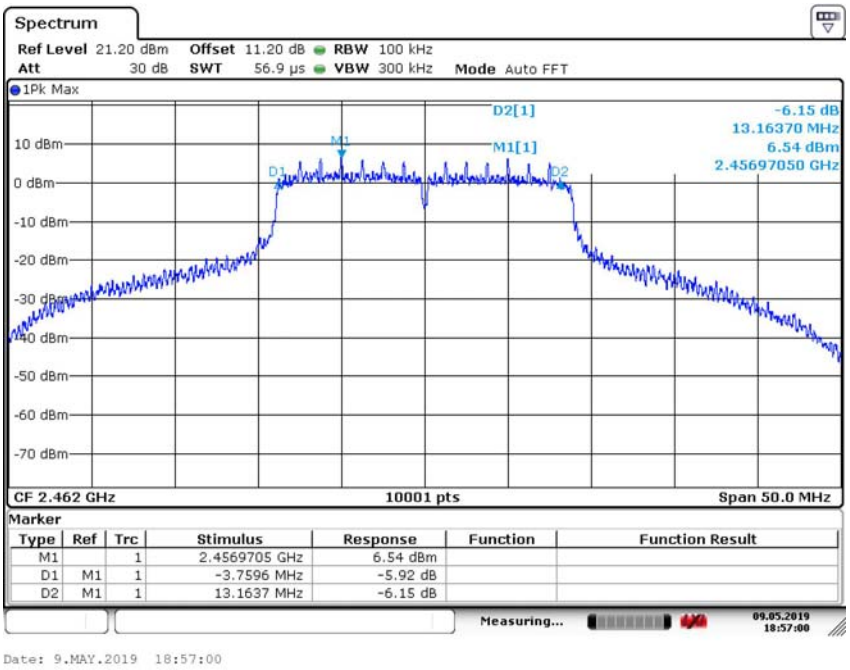
Carrier frequency (MHz)	Channel No.	6 dB bandwidth(kHz)
2412	1	16783.4
2437	6	15958.4
2462	11	16923.3



Carrier frequency (MHz): 2412
Channel No.:1
Test Mode: 802.11n (HT20)



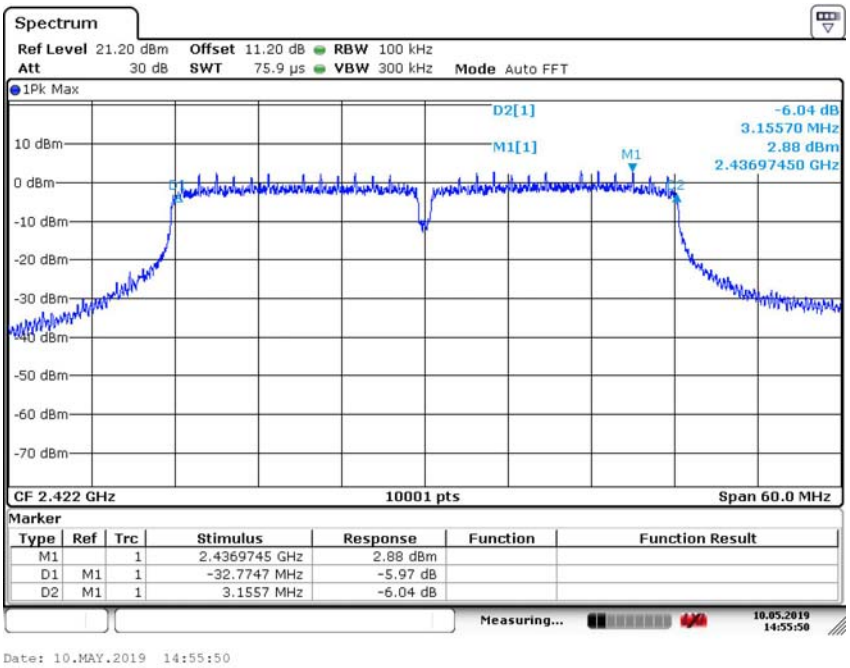
Carrier frequency (MHz): 2437
Channel No.:6
Test Mode: 802.11n (HT20)



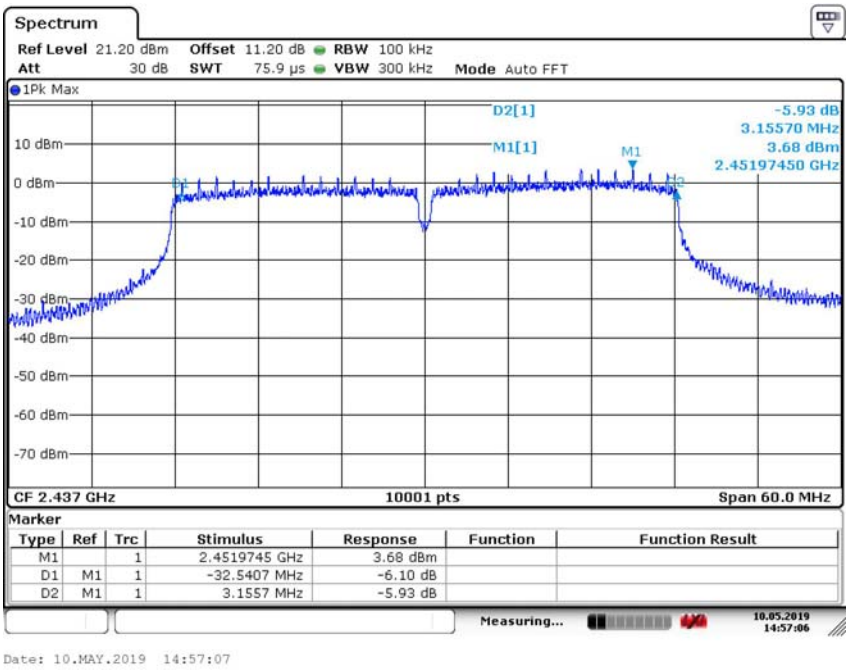
Carrier frequency (MHz): 2462
Channel No.:11
Test Mode: 802.11n (HT20)

Test Mode: 802.11n (HT40) (SISO Ant2)

Carrier frequency (MHz)	Channel No.	6 dB bandwidth(kHz)
2422	3	35930.4
2437	6	35696.4
2452	9	35108.4

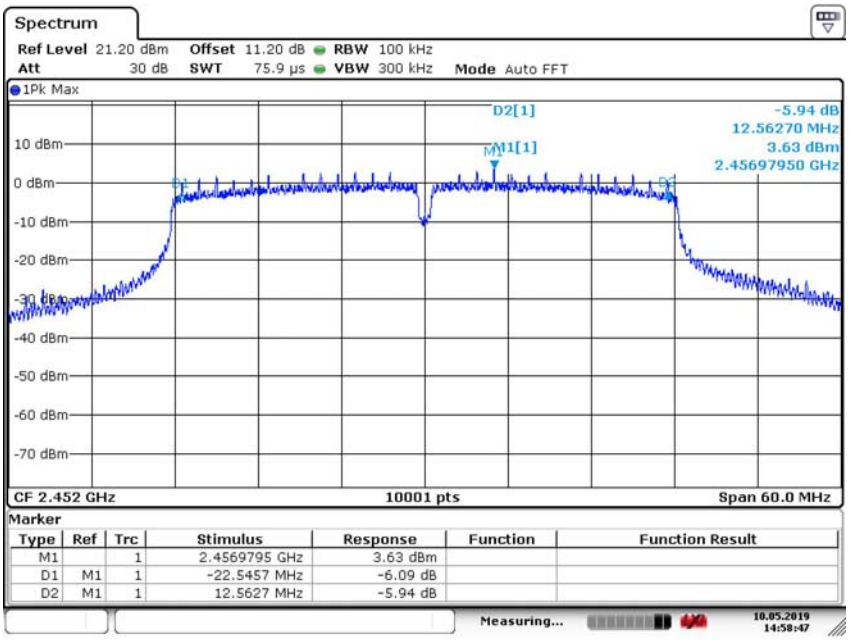


Carrier frequency (MHz): 2422
Channel No.:3
Test Mode: 802.11n (HT40)



Date: 10.MAY.2019 14:57:07

Carrier frequency (MHz): 2437
Channel No.:6
Test Mode: 802.11n (HT40)

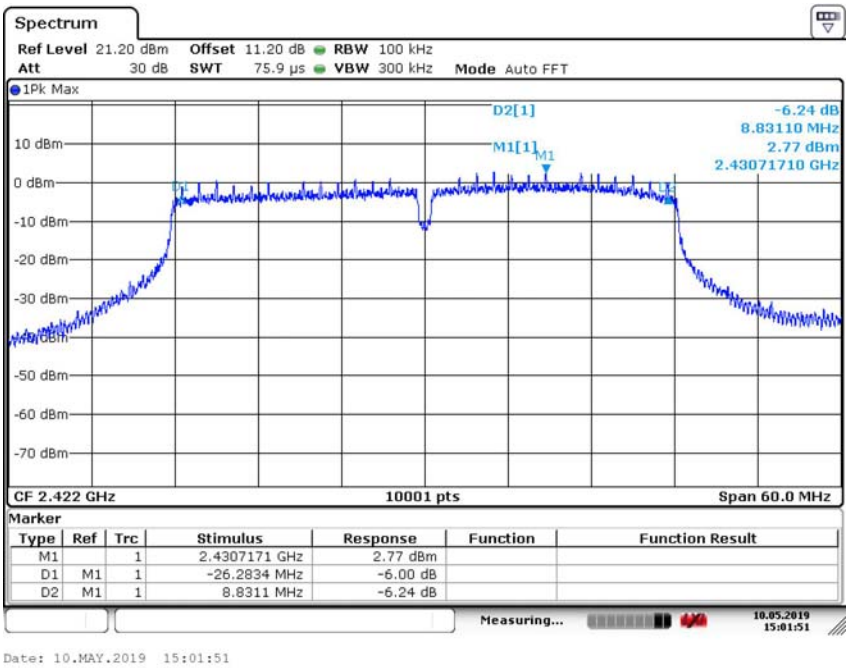


Date: 10.MAY.2019 14:58:48

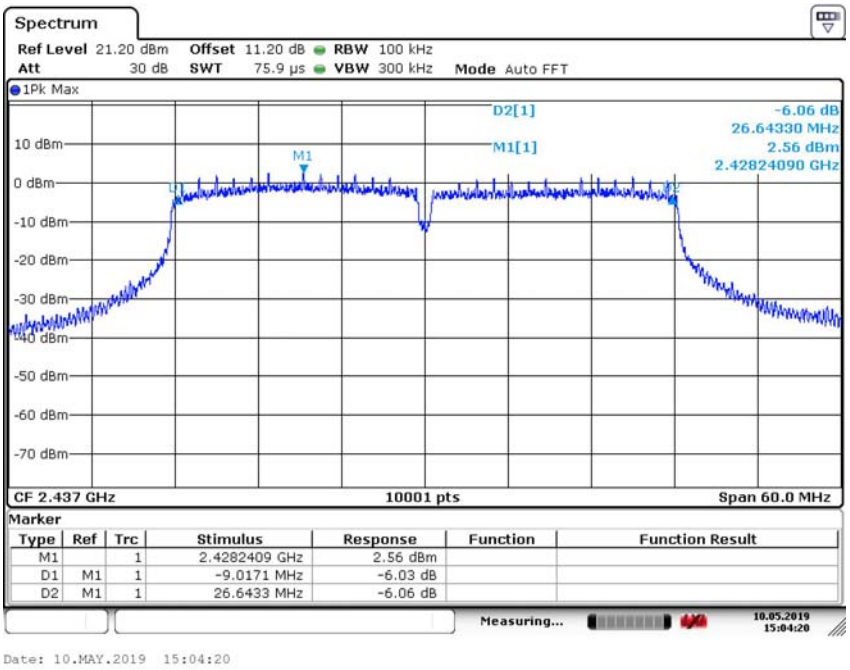
Carrier frequency (MHz): 2452
Channel No.:9
Test Mode: 802.11n (HT40)

Test Mode: 802.11n (HT40) (MIMO Ant1)

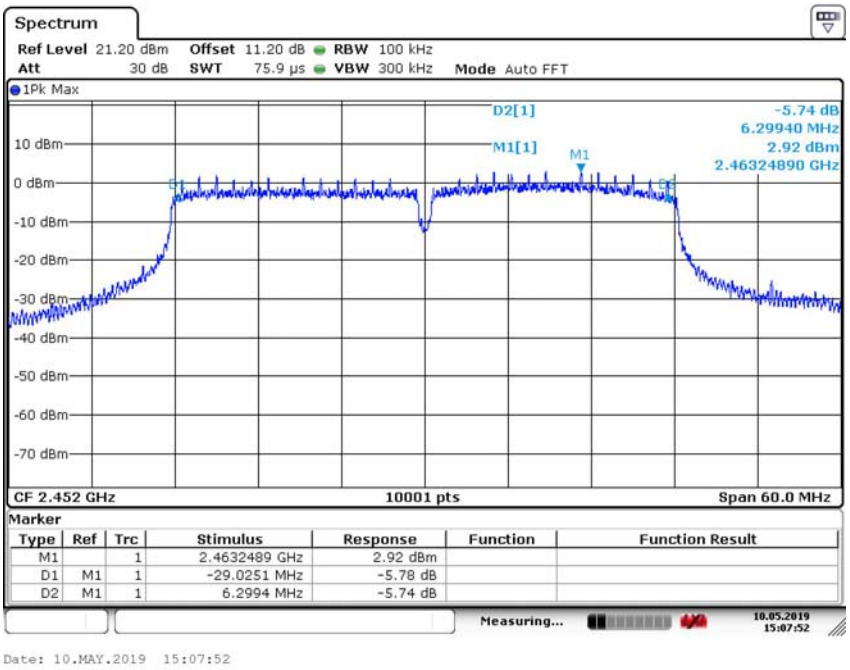
Carrier frequency (MHz)	Channel No.	6 dB bandwidth(kHz)
2422	3	35114.5
2437	6	35660.4
2452	9	35324.5



Carrier frequency (MHz): 2422
Channel No.:3
Test Mode: 802.11n (HT40)



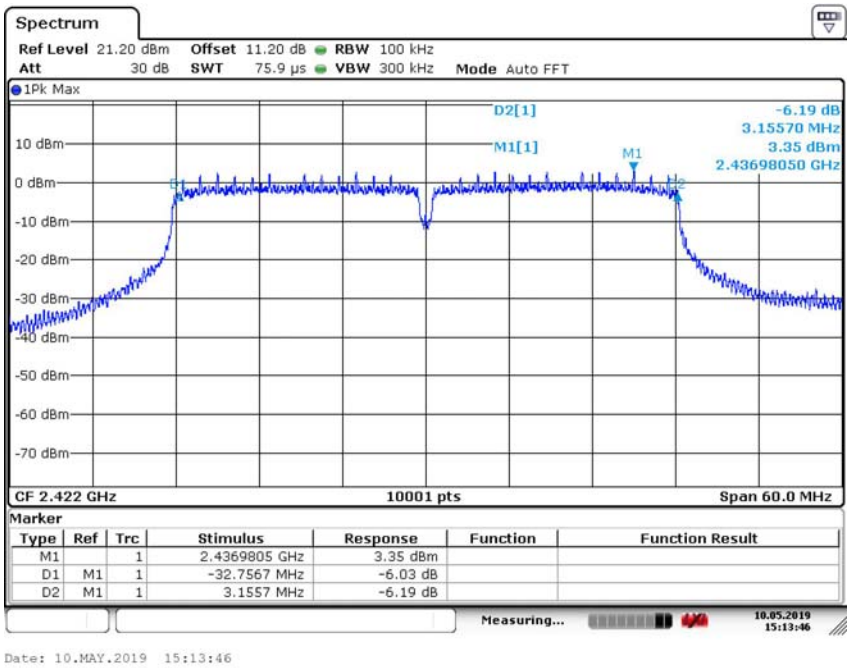
Carrier frequency (MHz): 2437
Channel No.:6
Test Mode: 802.11n (HT40)



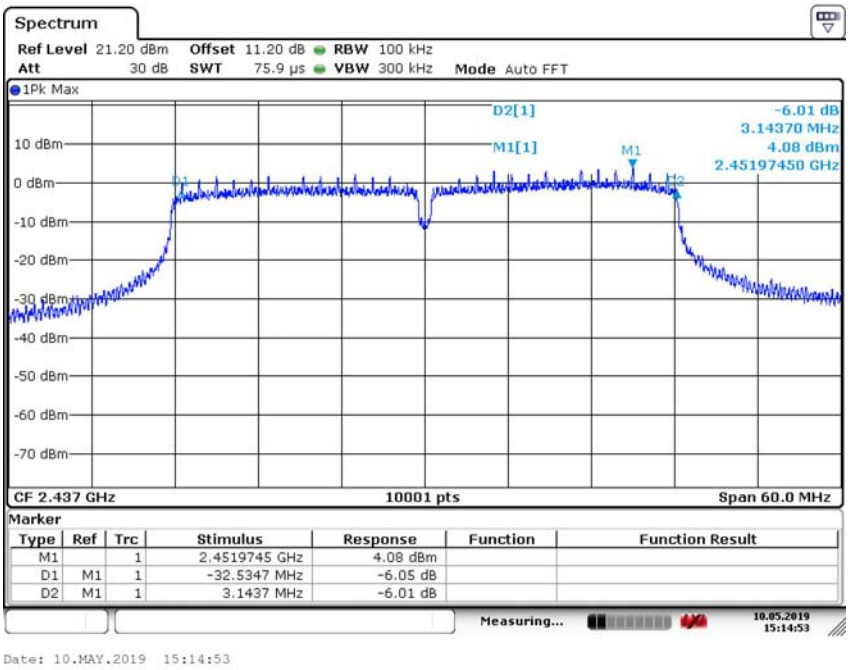
Carrier frequency (MHz): 2452
Channel No.:9
Test Mode: 802.11n (HT40)

Test Mode: 802.11n (HT40) (MIMO Ant2)

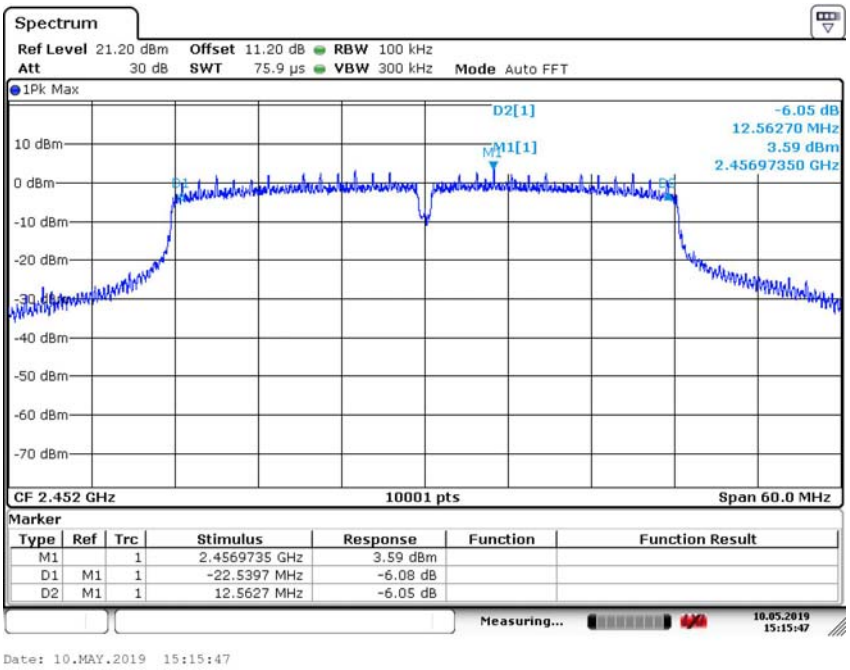
Carrier frequency (MHz)	Channel No.	6 dB bandwidth(kHz)
2422	3	35912.4
2437	6	35678.4
2452	9	35102.4



Carrier frequency (MHz): 2422
Channel No.:3
Test Mode: 802.11n (HT40)



Carrier frequency (MHz): 2437
Channel No.:6
Test Mode: 802.11n (HT40)

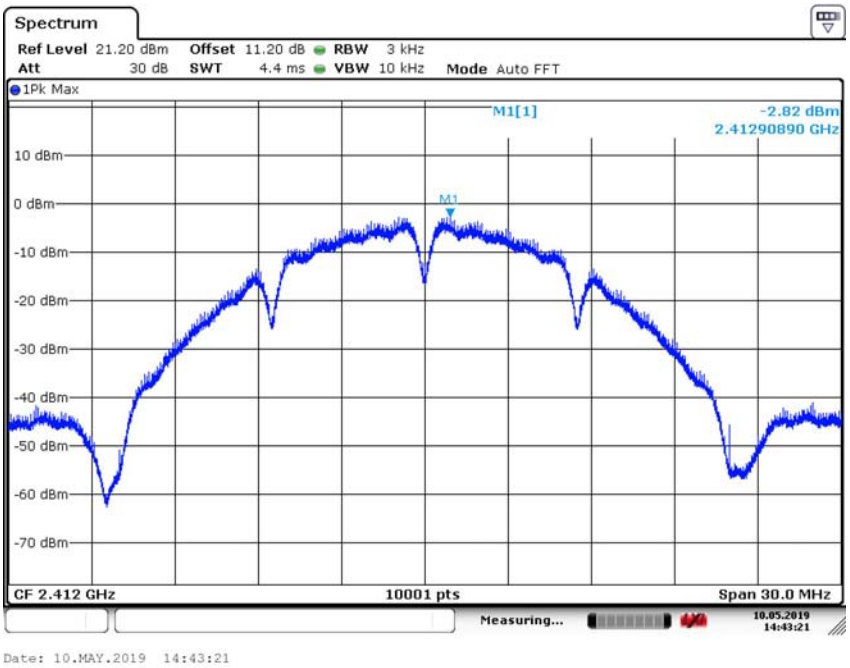


Carrier frequency (MHz): 2452
Channel No.:9
Test Mode: 802.11n (HT40)

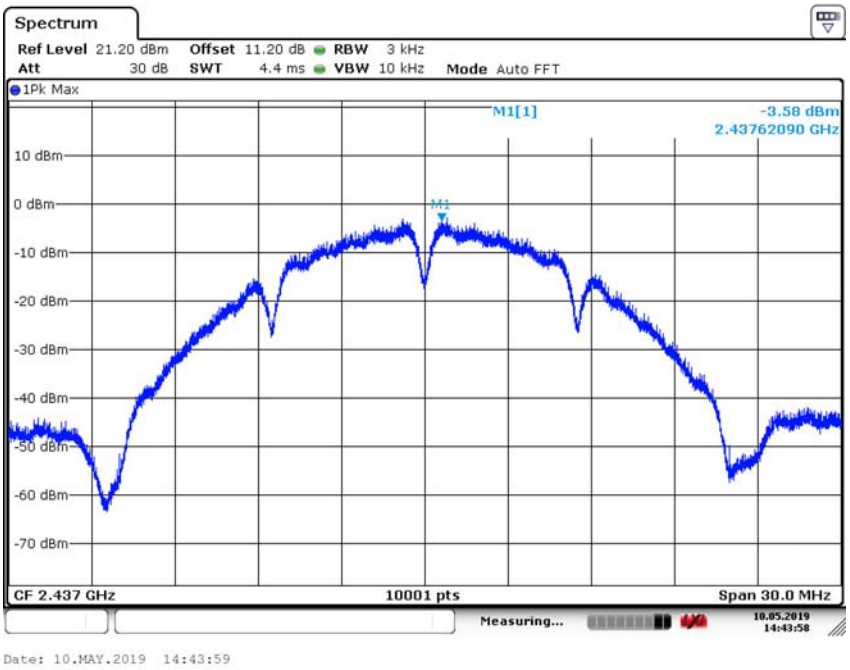
Transmitter Power Spectral Density

Offset 11.2dB = Attenuator 10dB+ Temporary antenna connector loss 0.2dB+ Cable loss 1.0dB
Test Mode: 802.11b (SISO Ant 2)

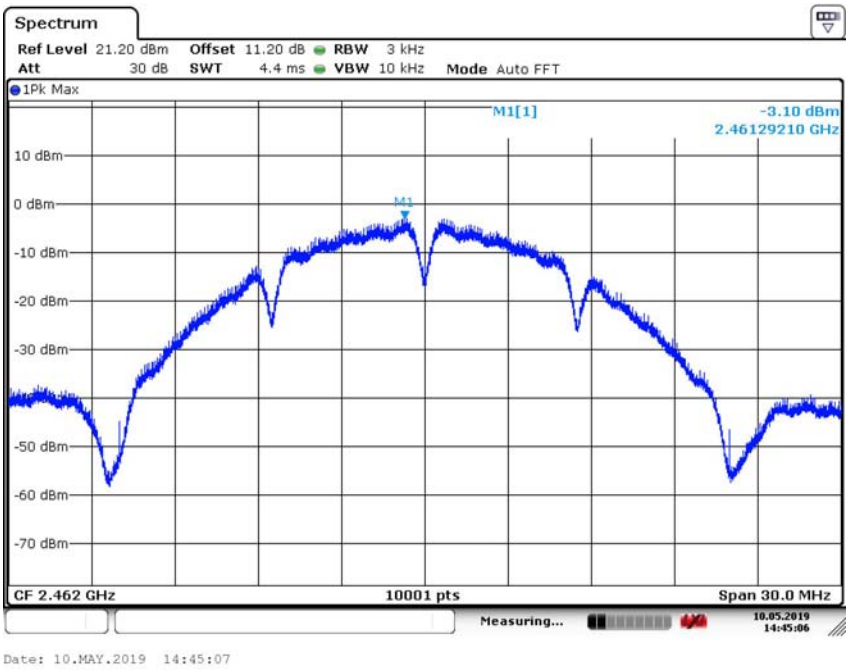
Carrier frequency (MHz)	Channel No	Power Density (dBm)
2412	1	-2.82
2437	6	-3.58
2462	11	-3.10



Carrier frequency (MHz): 2412
Channel No.1
Test Mode: 802.11b



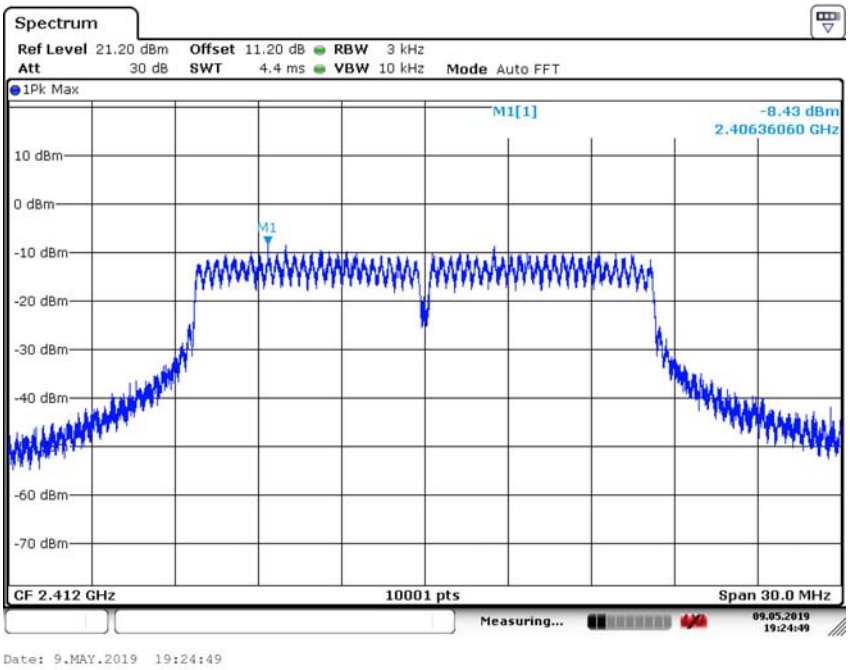
Carrier frequency (MHz): 2437
Channel No.6
Test Mode: 802.11b



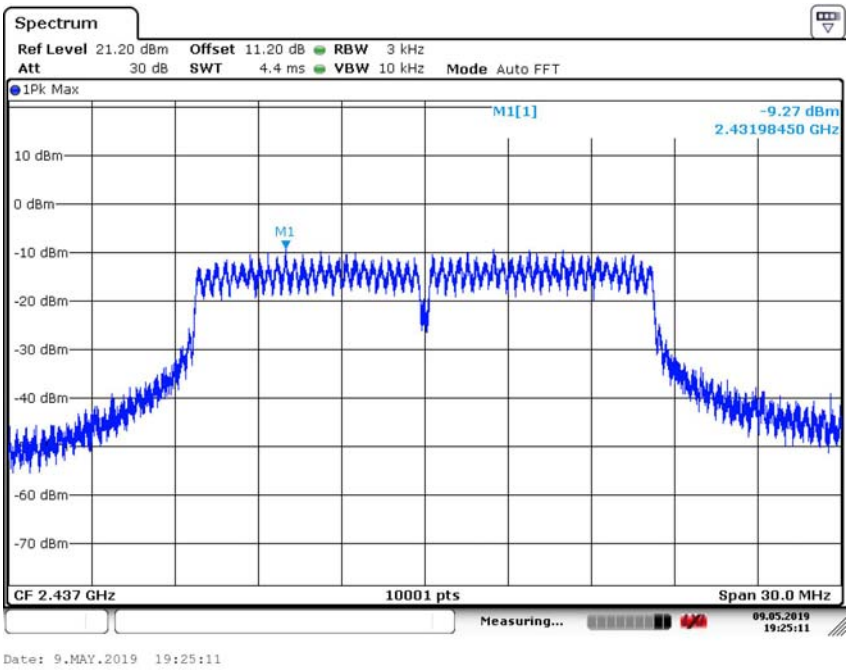
Carrier frequency (MHz): 2462
Channel No.11
Test Mode: 802.11b

Test Mode: 802.11g (SISO Ant 2)

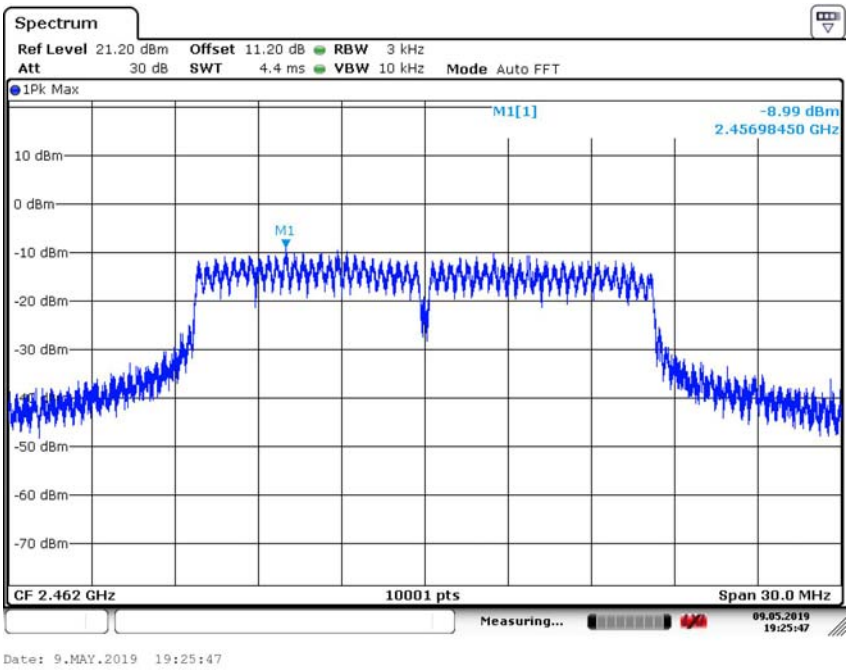
Carrier frequency (MHz)	Channel No	Power Density (dBm)
2412	1	-8.43
2442	6	-9.27
2472	11	-8.99



Carrier frequency (MHz): 2412
Channel No.1
Test Mode: 802.11g



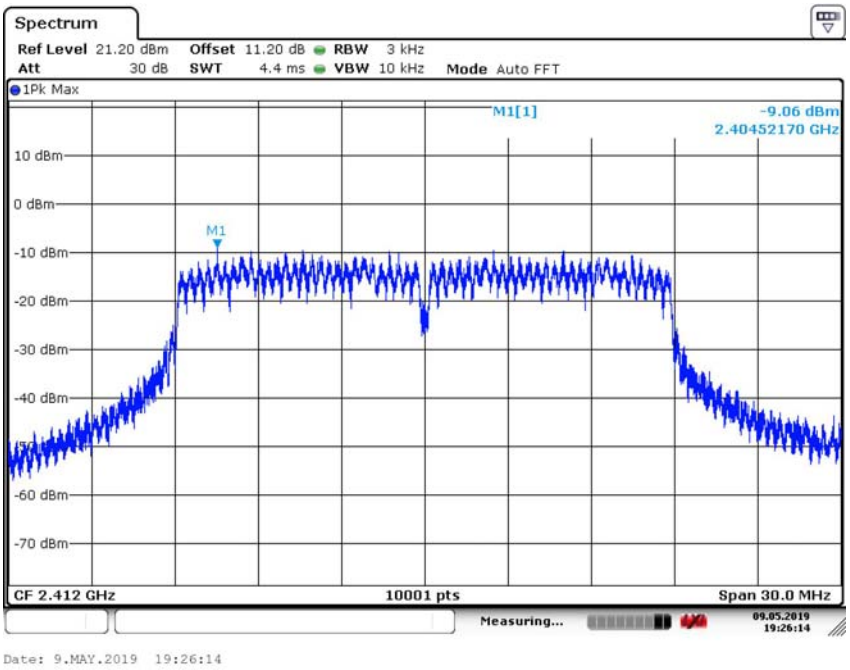
Carrier frequency (MHz): 2437
Channel No.6
Test Mode: 802.11g



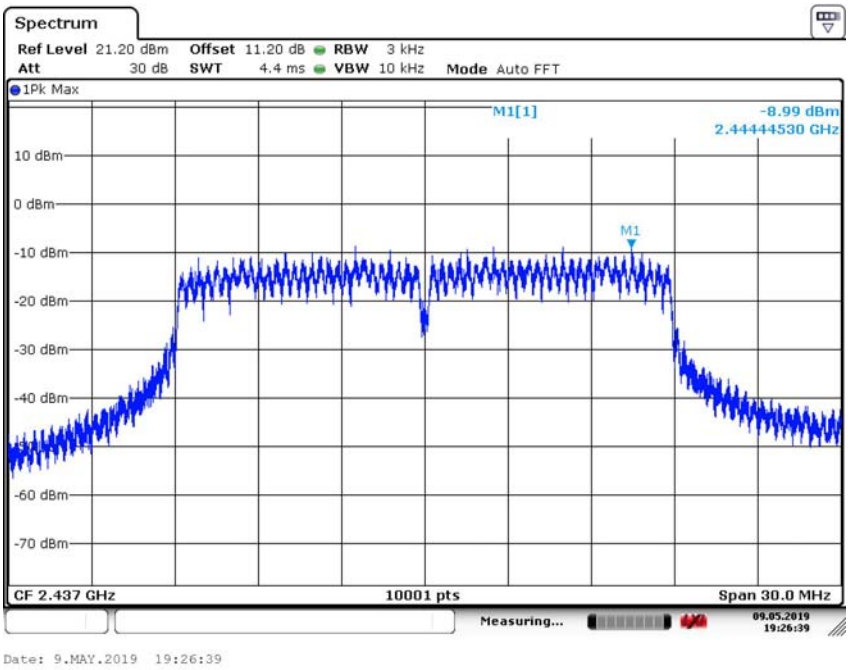
Carrier frequency (MHz): 2462
Channel No.11
Test Mode: 802.11g

Test Mode: 802.11n (HT20) (SISO Ant 2)

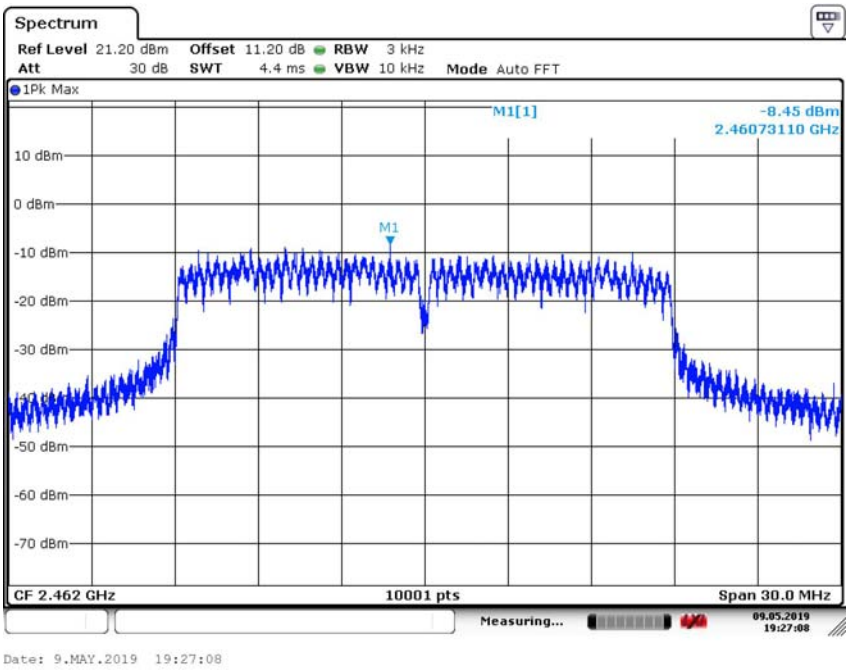
Carrier frequency (MHz)	Channel No	Power Density (dBm)
2412	1	-9.06
2437	6	-8.99
2462	11	-8.45



Carrier frequency (MHz): 2412
Channel No.1
Test Mode: 802.11n (HT20)



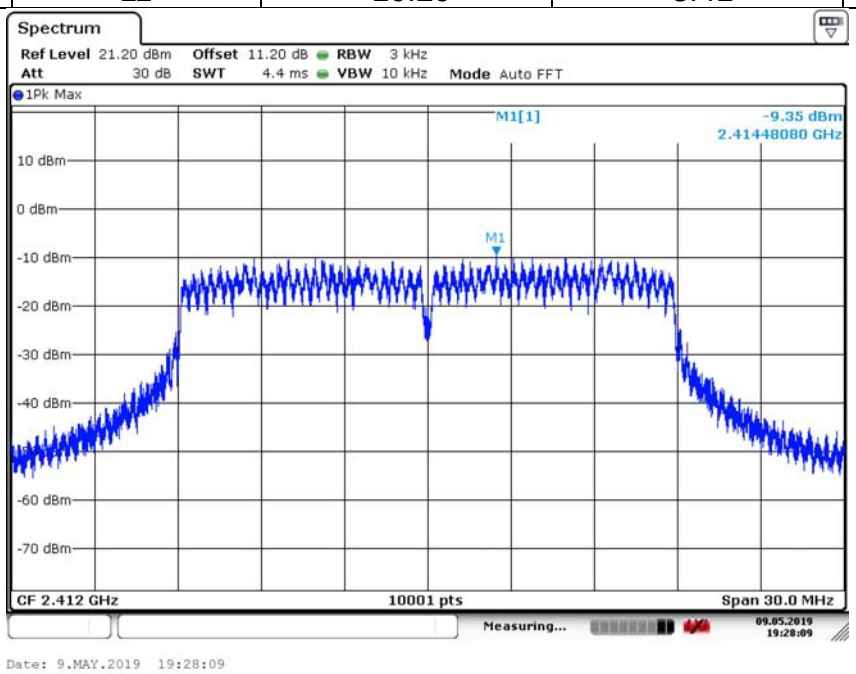
Carrier frequency (MHz): 2437
Channel No.6
Test Mode: 802.11n (HT20)



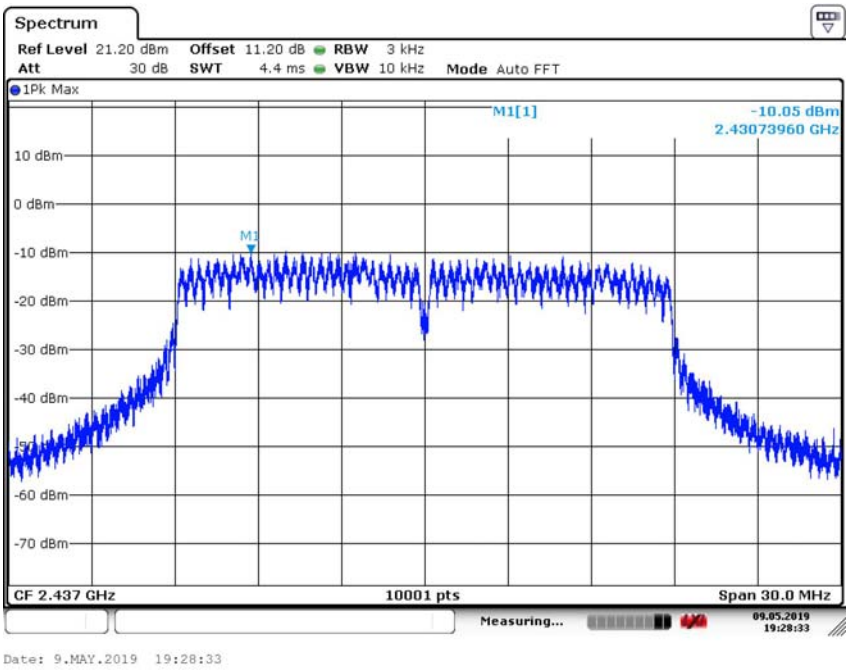
Carrier frequency (MHz): 2462
Channel No.11
Test Mode: 802.11n (HT20)

Test Mode: 802.11n (HT20) (MIMO Ant1 + Ant 2)

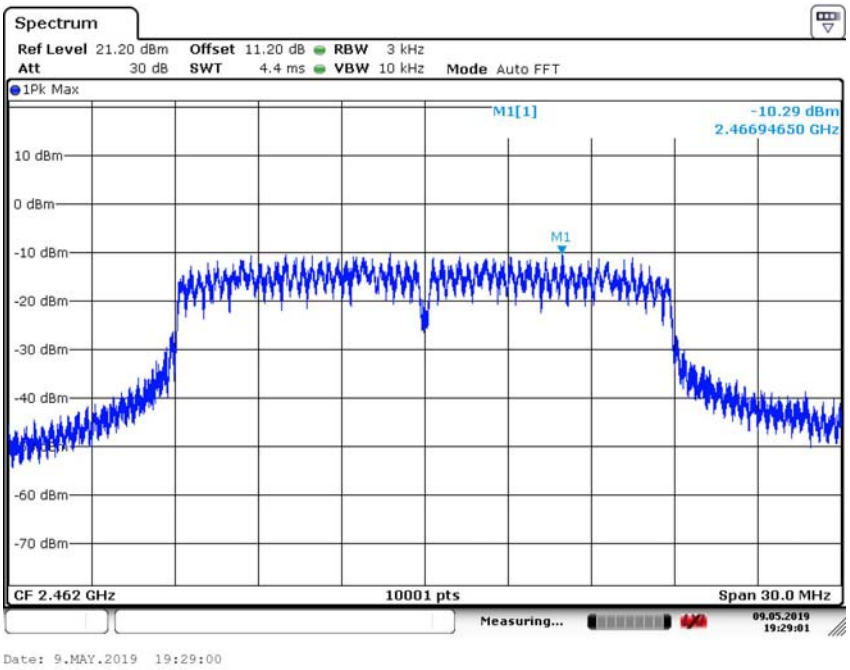
Carrier frequency (MHz)	Channel No	Power Density (dBm)(Ant1)	Power Density (dBm)(Ant2)	Total Corr'd (dBm)
2412	1	-9.35	-8.89	-6.10
2437	6	-10.05	-8.80	-6.37
2462	11	-10.29	-8.41	-6.24



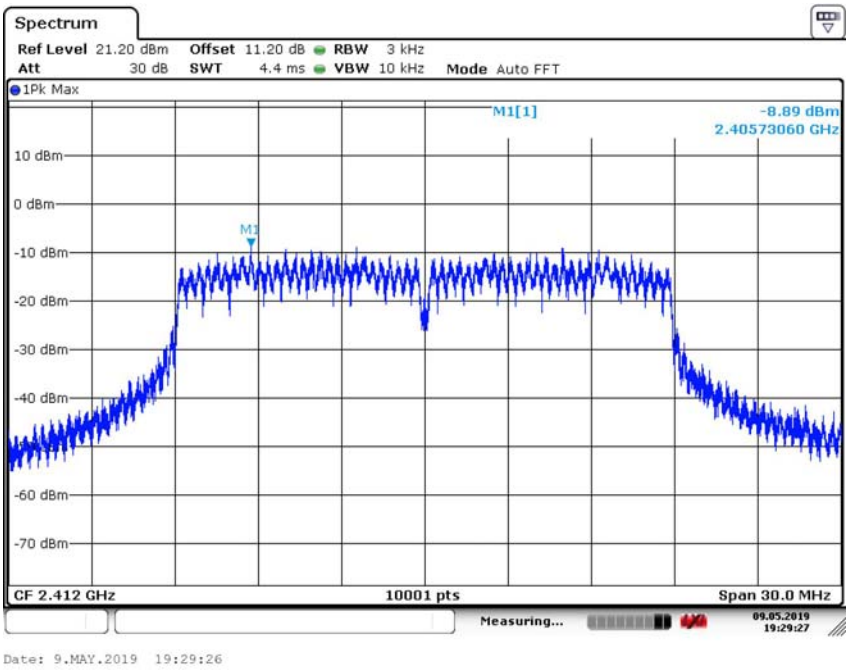
Carrier frequency (MHz): 2412
Channel No.1
Test Mode: 802.11n (HT20 MIMO Ant1)



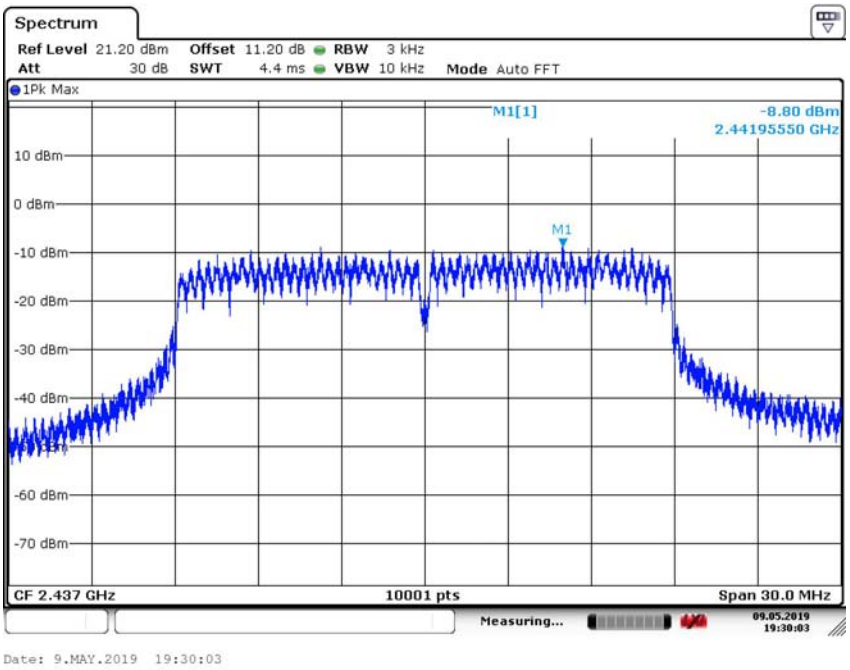
Carrier frequency (MHz): 2437
Channel No.6
Test Mode: 802.11n (HT20 MIMO Ant1)



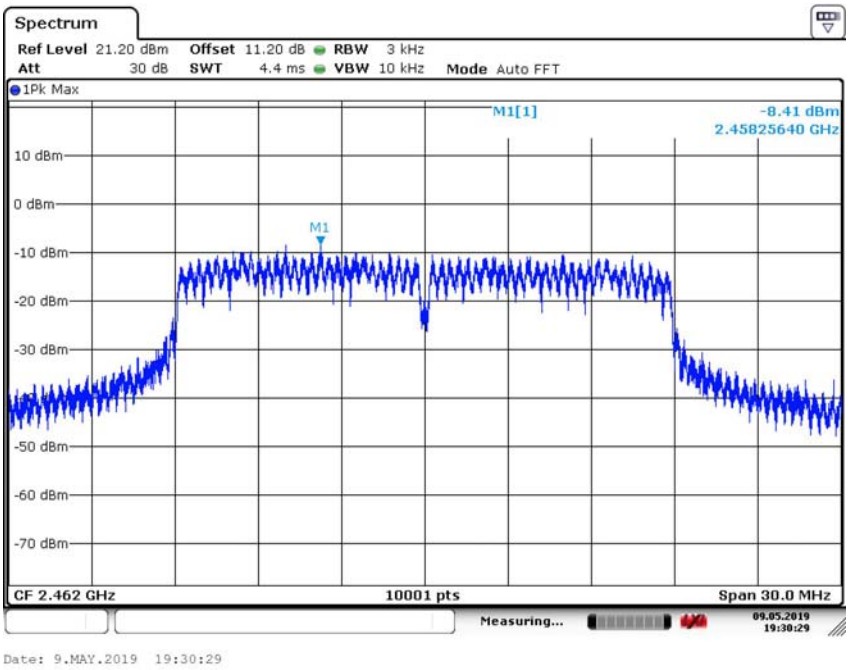
Carrier frequency (MHz): 2462
Channel No.11
Test Mode: 802.11n (HT20 MIMO Ant1)



Carrier frequency (MHz): 2412
Channel No.1
Test Mode: 802.11n (HT20 MIMO Ant2)



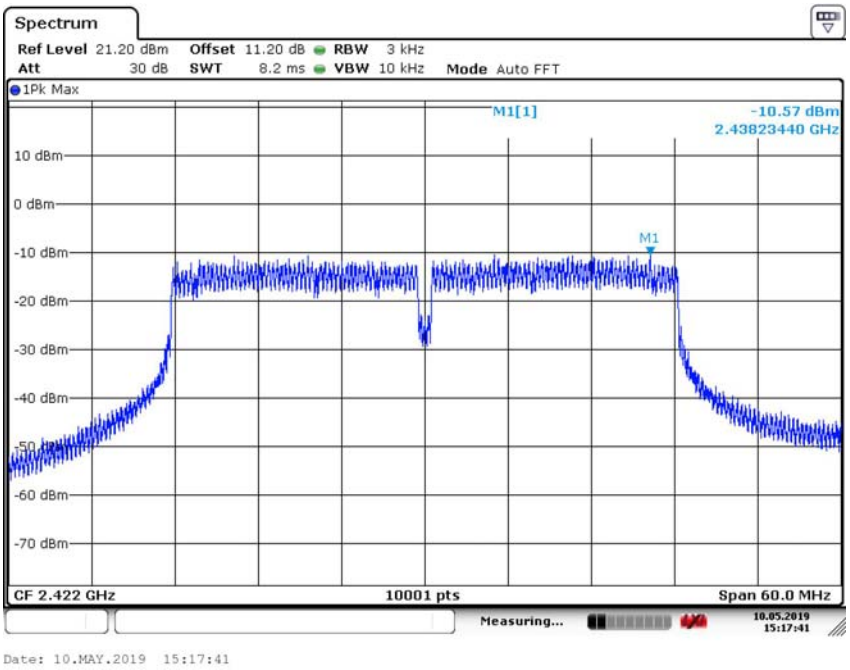
Carrier frequency (MHz): 2437
Channel No.6
Test Mode: 802.11n (HT20 MIMO Ant2)



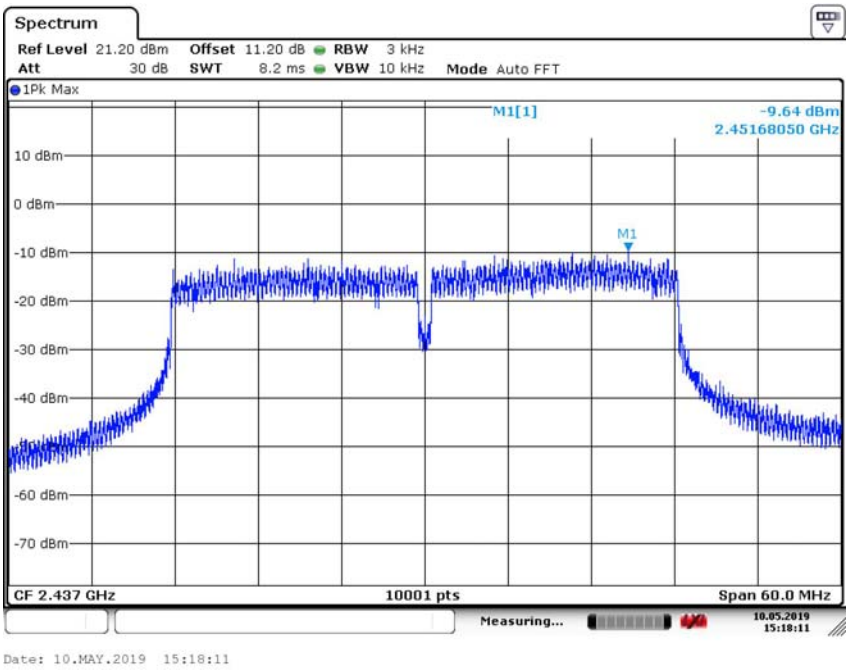
Carrier frequency (MHz): 2462
Channel No.11
Test Mode: 802.11n (HT20 MIMO Ant2)

Test Mode: 802.11n (HT40) (SISO Ant 2)

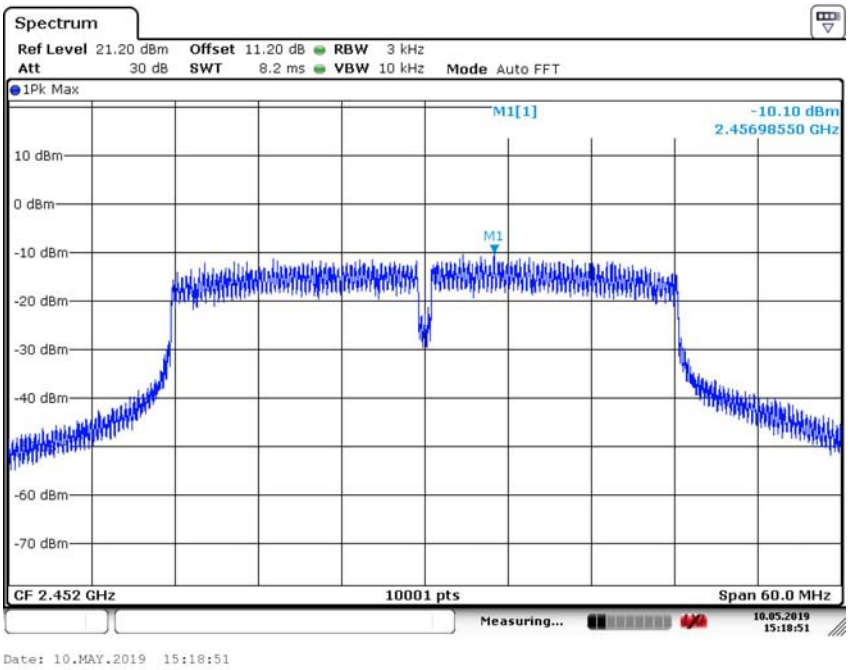
Carrier frequency (MHz)	Channel No	Power Density (dBm)
2422	3	-10.57
2437	6	-9.64
2452	9	-10.10



Carrier frequency (MHz): 2422
Channel No.3
Test Mode: 802.11n (HT40)



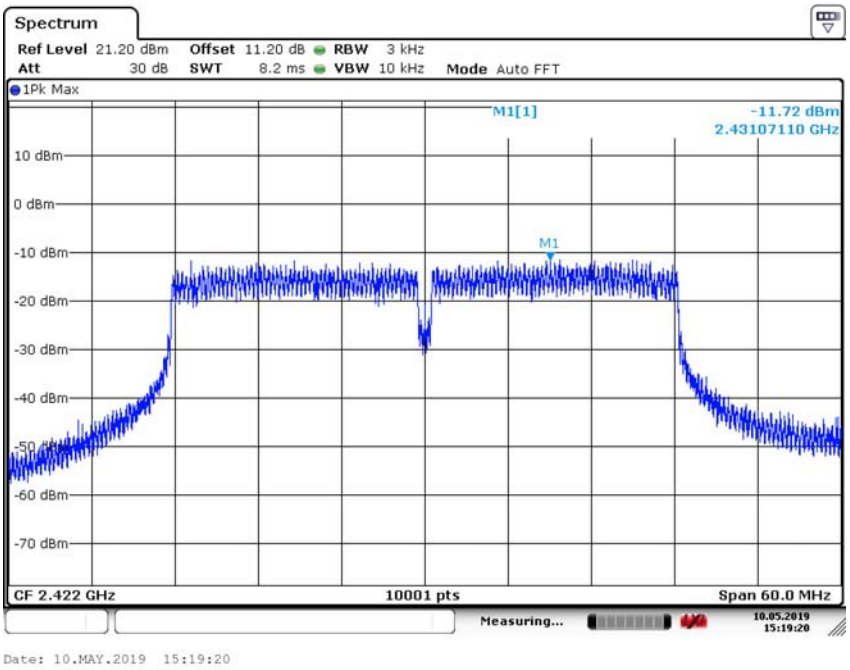
Carrier frequency (MHz): 2437
Channel No.6
Test Mode: 802.11n (HT40)



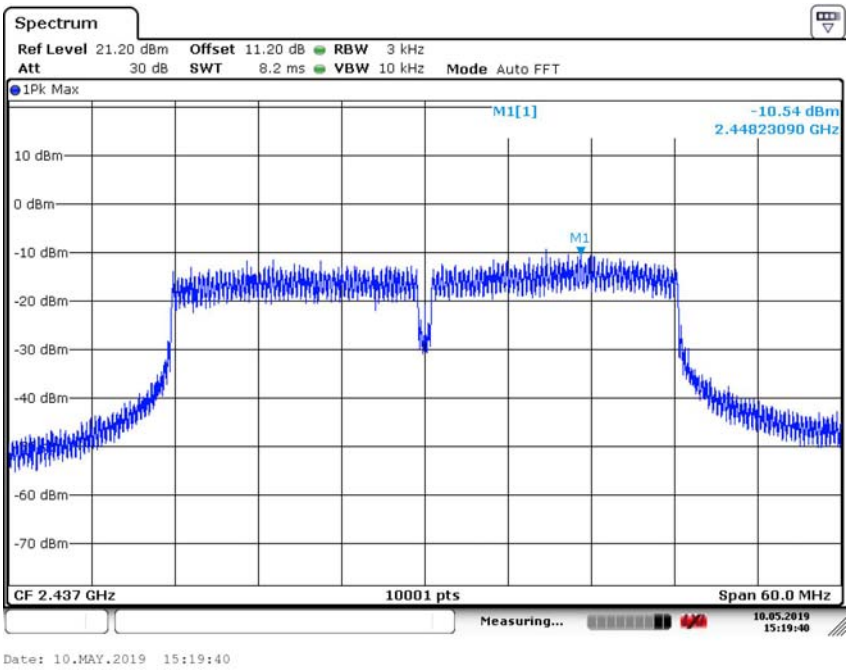
Carrier frequency (MHz): 2452
Channel No.9
Test Mode: 802.11n (HT40)

Test Mode: 802.11n (HT40) (MIMO Ant1 + Ant 2)

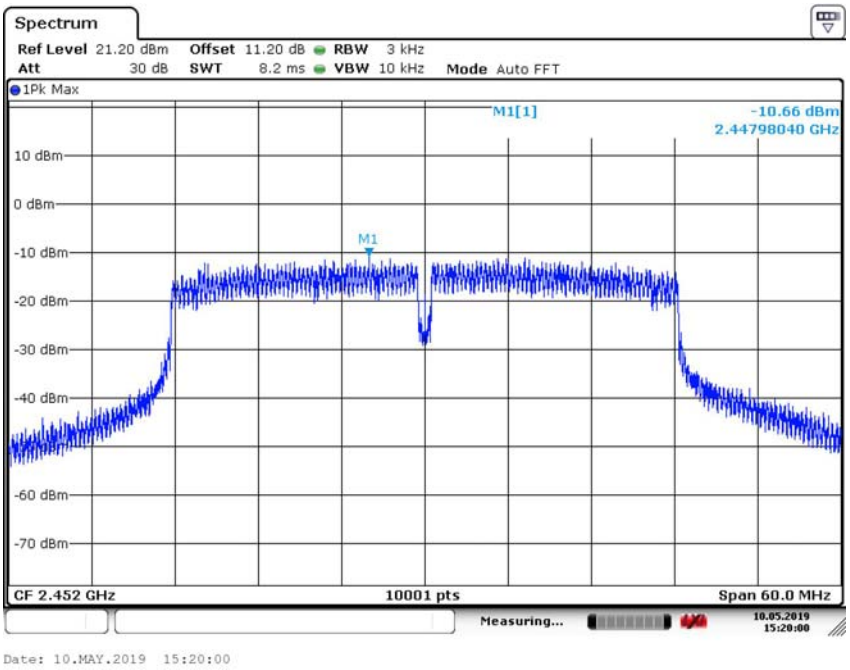
Carrier frequency (MHz)	Channel No	Power Density (dBm)(Ant1)	Power Density (dBm)(Ant2)	Total Corr'd (dBm)
2422	3	-11.72	-10.62	-8.12
2437	6	-10.54	-9.15	-6.78
2452	9	-10.66	-10.33	-7.48



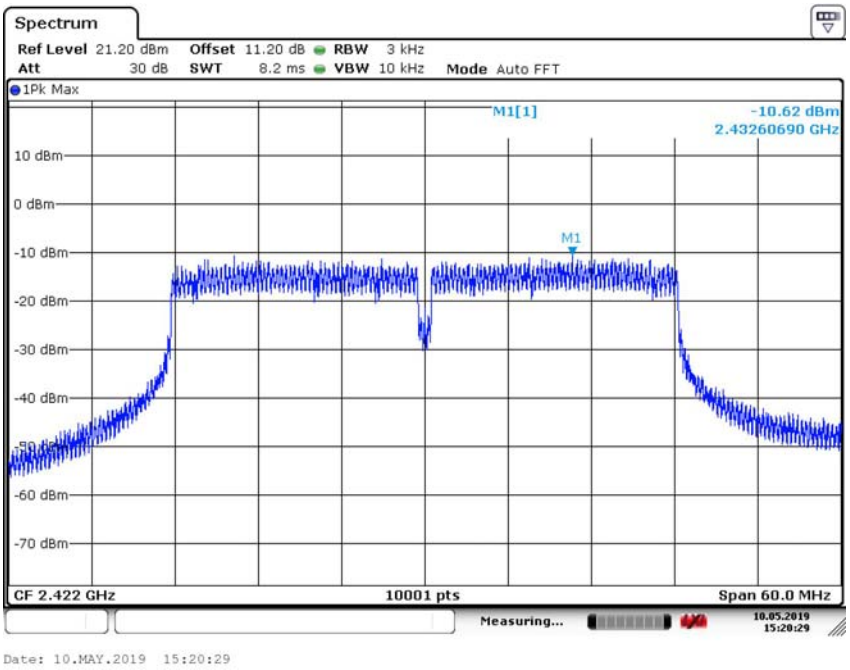
Carrier frequency (MHz): 2422
Channel No.3
Test Mode: 802.11n (HT40 MIMO Ant1)



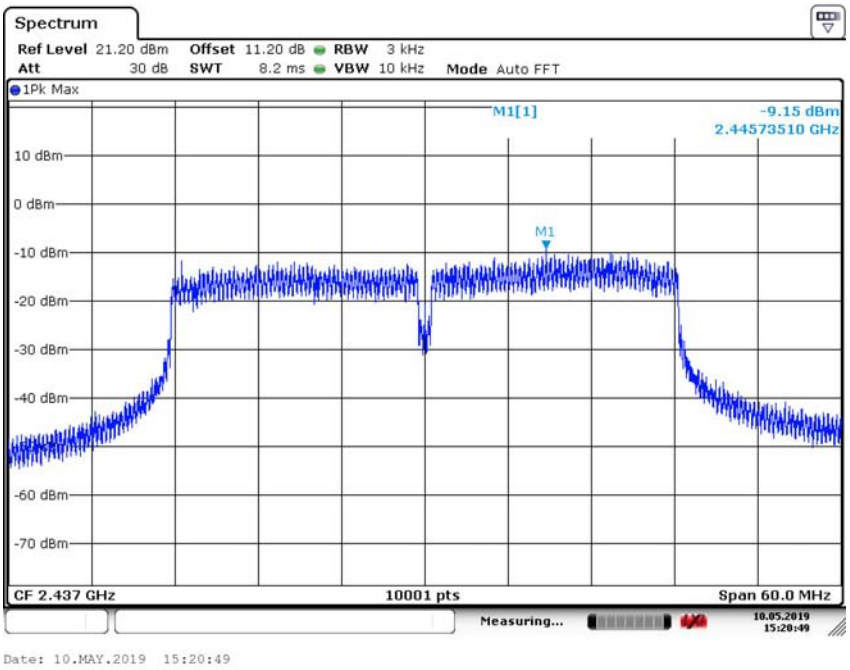
Carrier frequency (MHz): 2437
Channel No.6
Test Mode: 802.11n (HT40 MIMO Ant1)



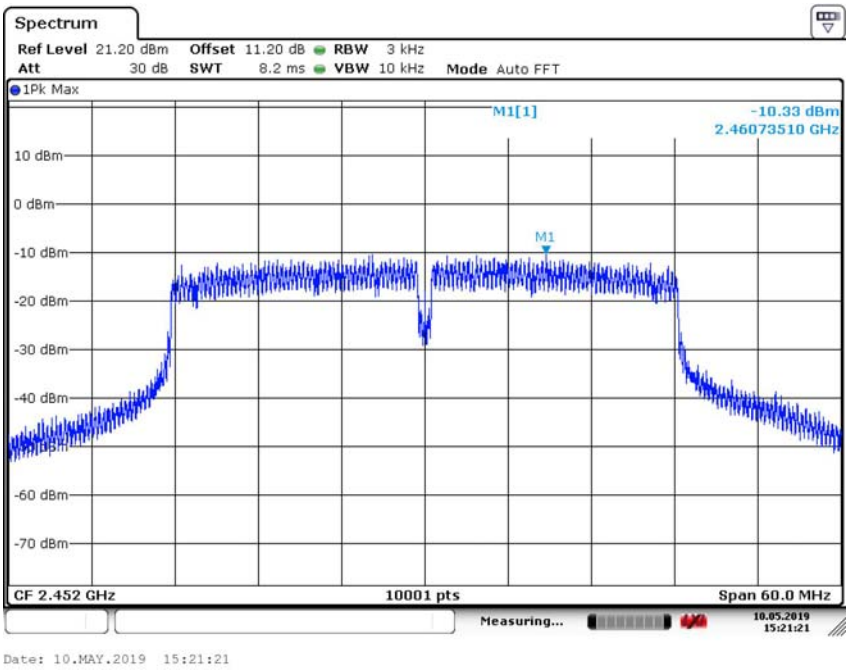
Carrier frequency (MHz): 2452
Channel No.9
Test Mode: 802.11n (HT40 MIMO Ant1)



Carrier frequency (MHz): 2422
Channel No.3
Test Mode: 802.11n (HT40 MIMO Ant2)



Carrier frequency (MHz): 2437
Channel No.6
Test Mode: 802.11n (HT40 MIMO Ant2)



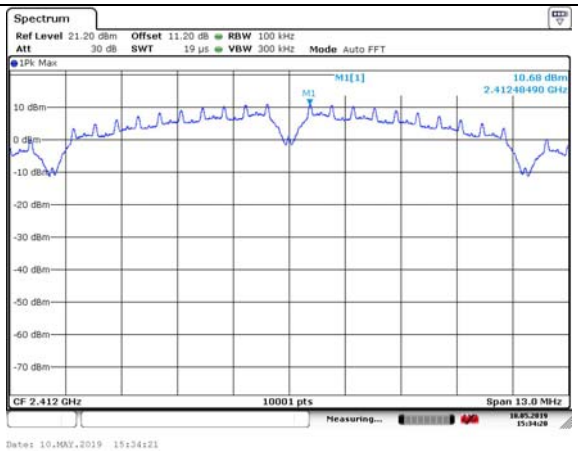
Carrier frequency (MHz): 2452
Channel No.9
Test Mode: 802.11n (HT40 MIMO Ant2)

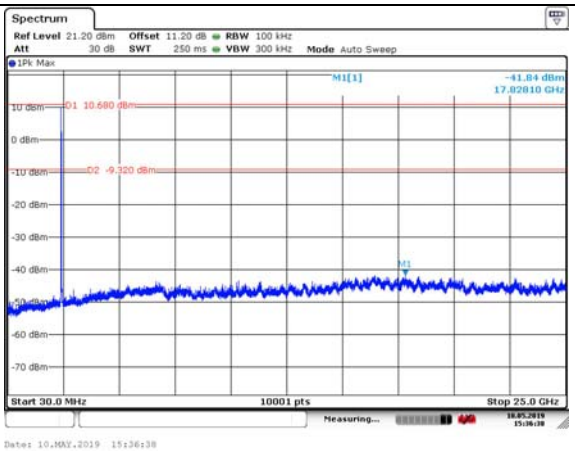
Conducted Out of band emission measurement

Offset 11.2dB = Attenuator 10dB+ Temporary antenna connector loss 0.2dB+ Cable loss 1.0dB

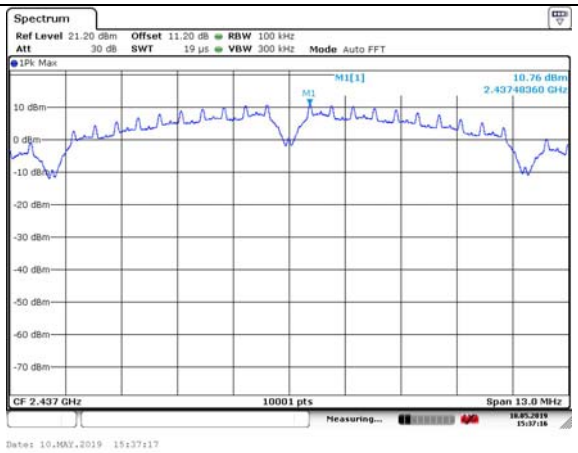
802.11b (SISO Ant2)

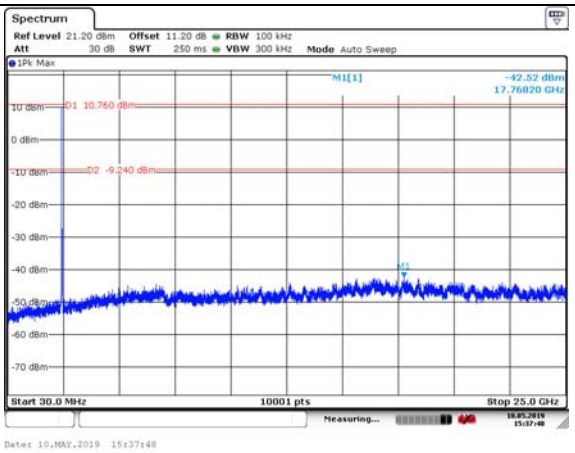
CH1



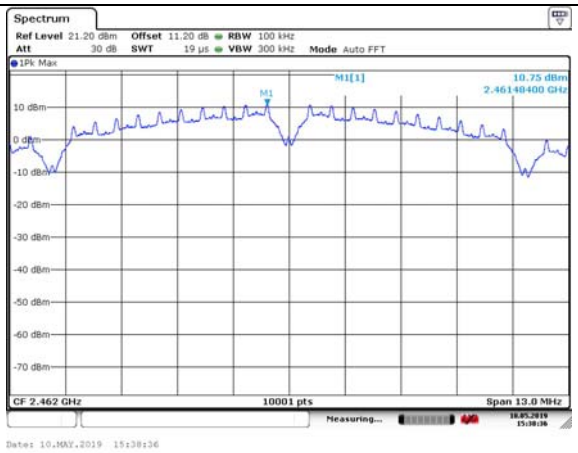


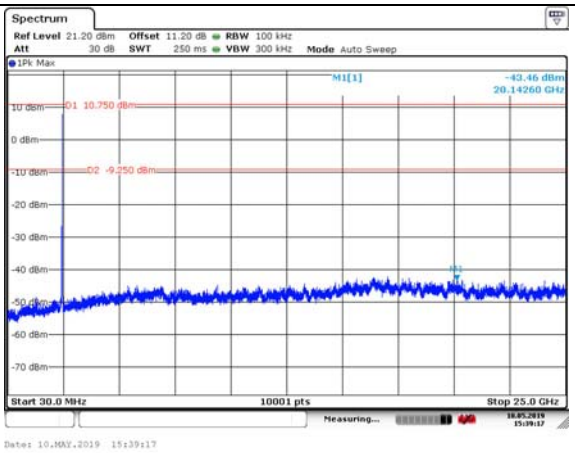
CH6





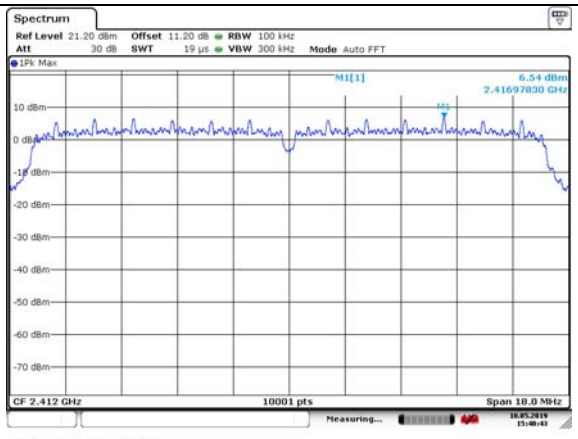
CH11

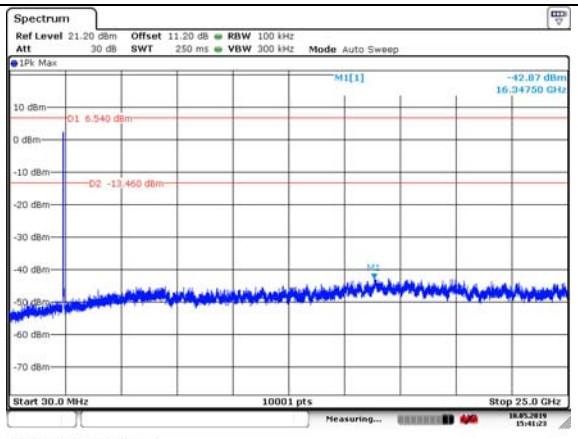




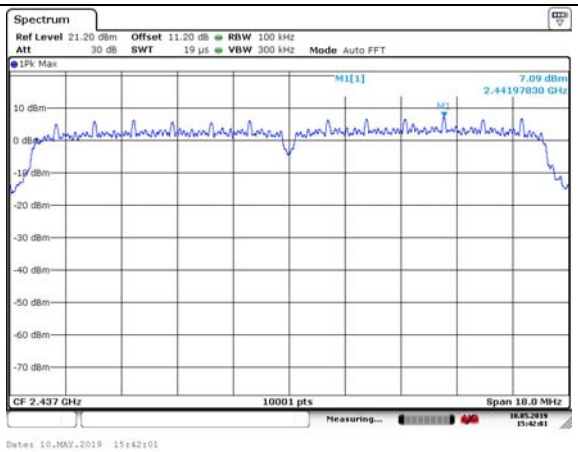
802.11g (SISO Ant2)

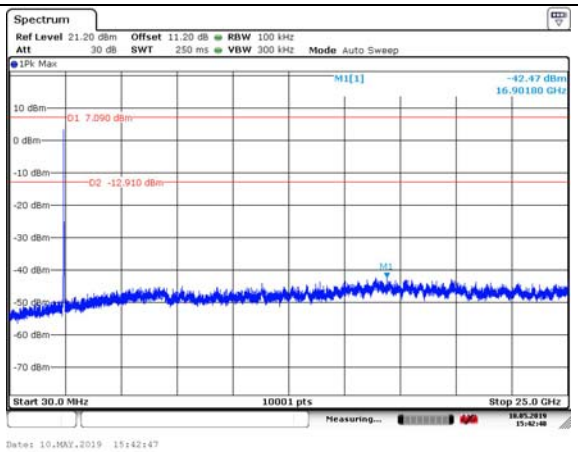
CH1



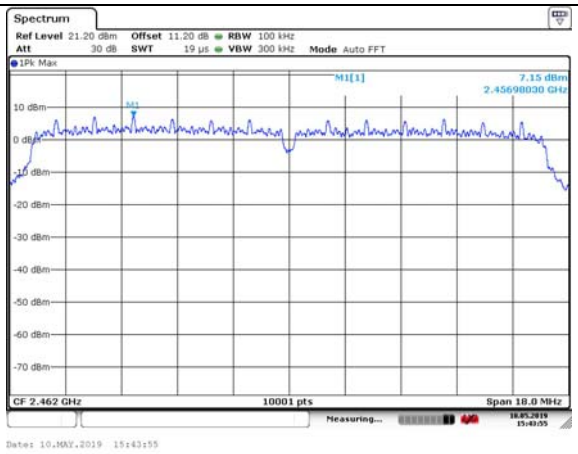


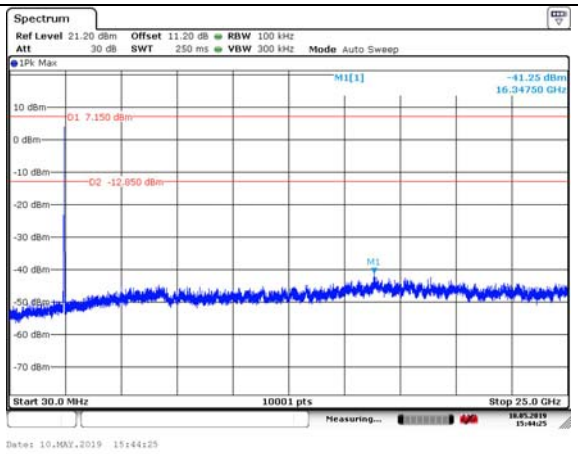
CH6





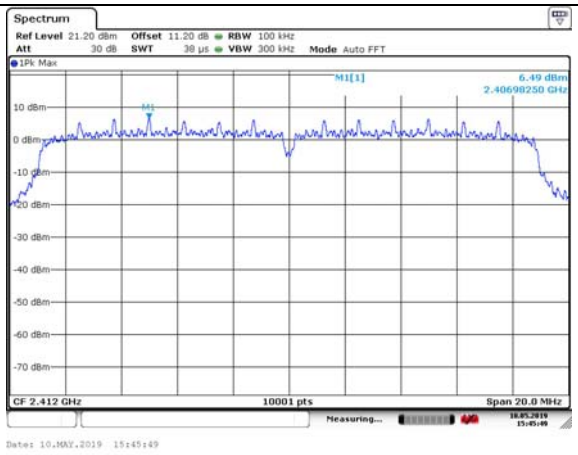
CH11

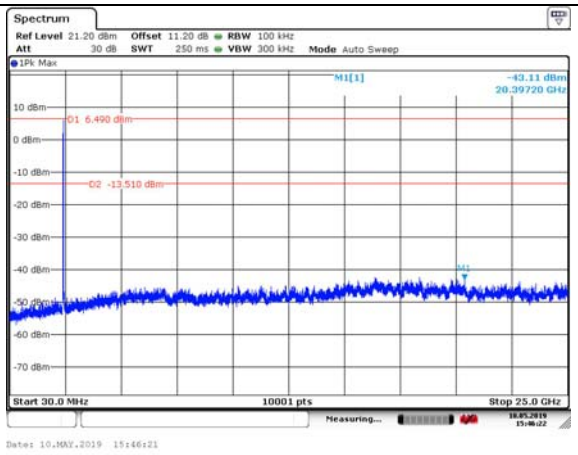




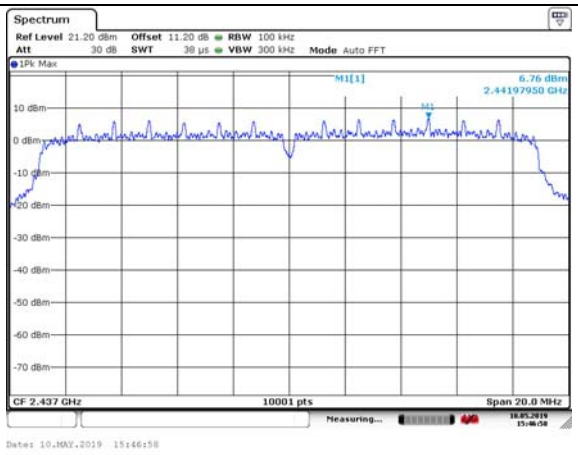
802.11n (20MHz) (SISO Ant2)

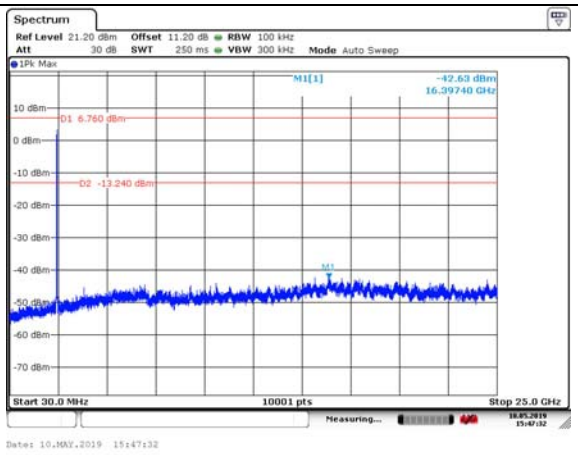
CH1



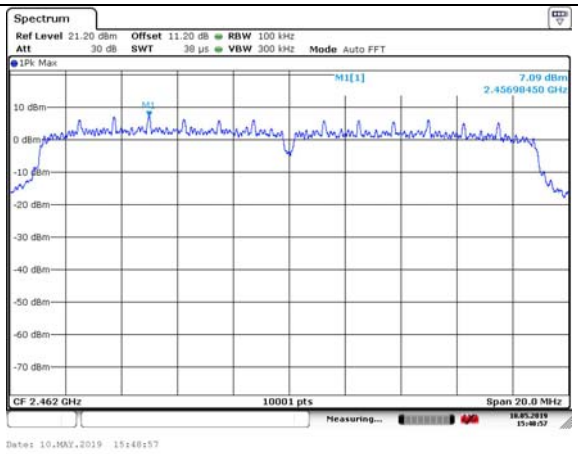


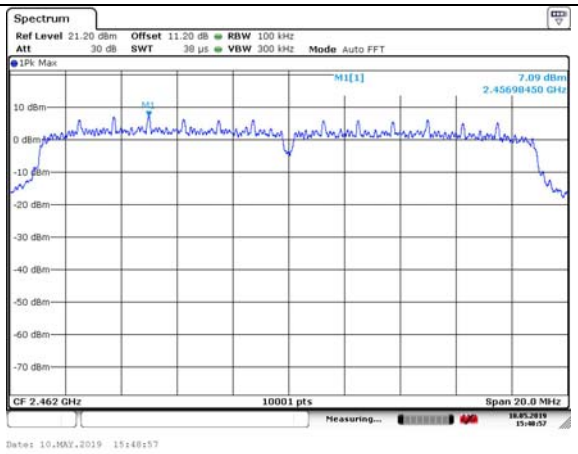
CH6





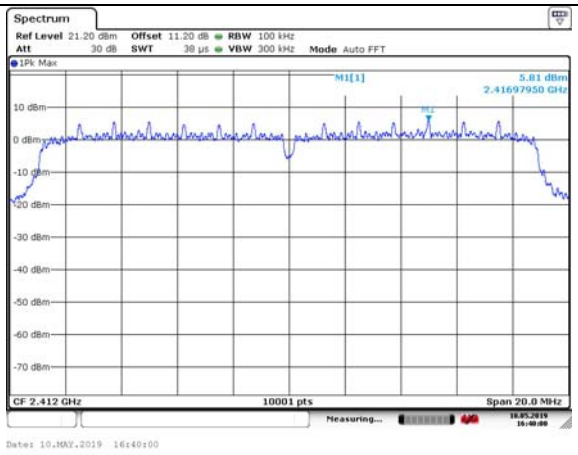
CH11

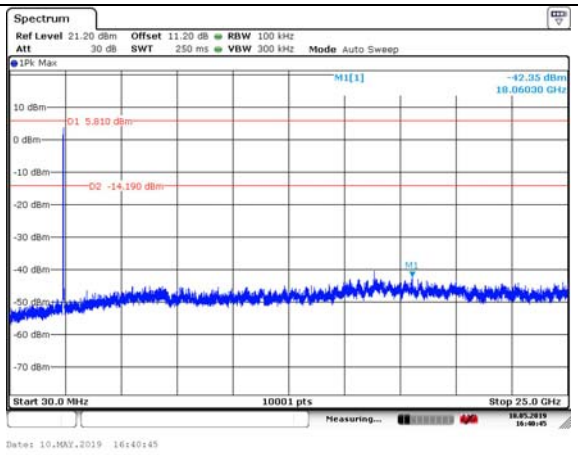




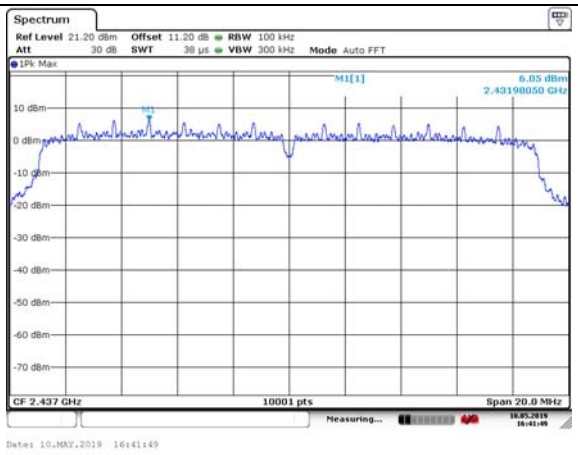
802.11n (20MHz) (MIMO Ant1)

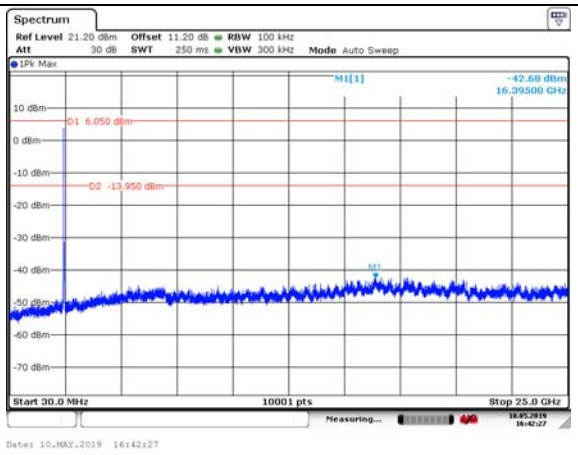
CH1



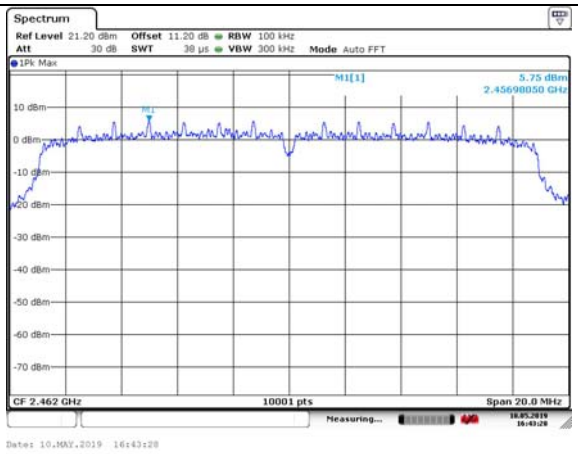


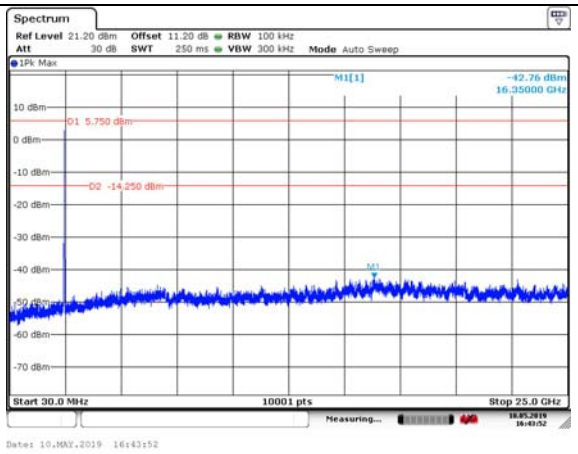
CH6





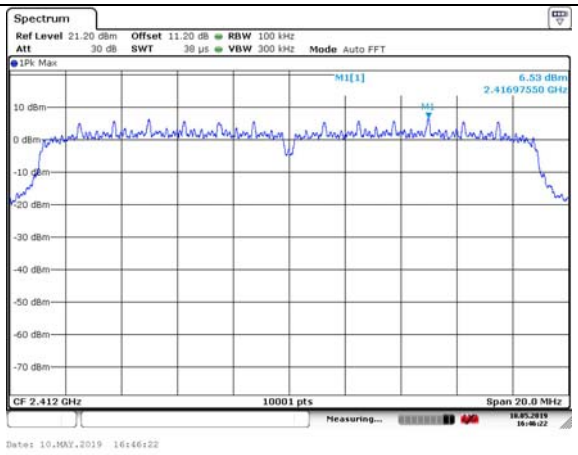
CH11

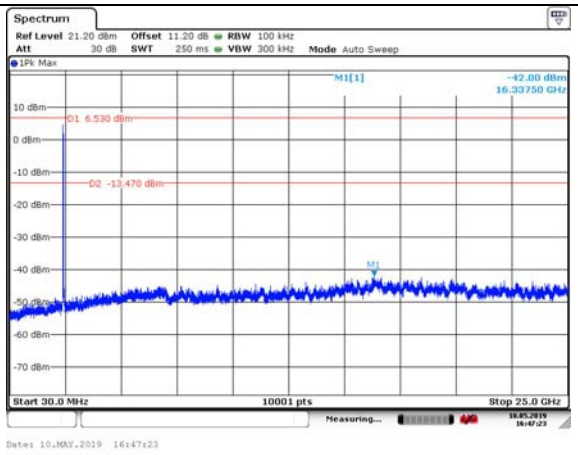




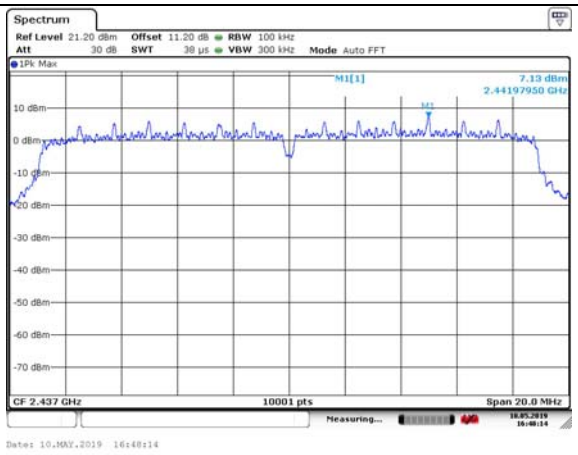
802.11n (20MHz) (MIMO Ant2)

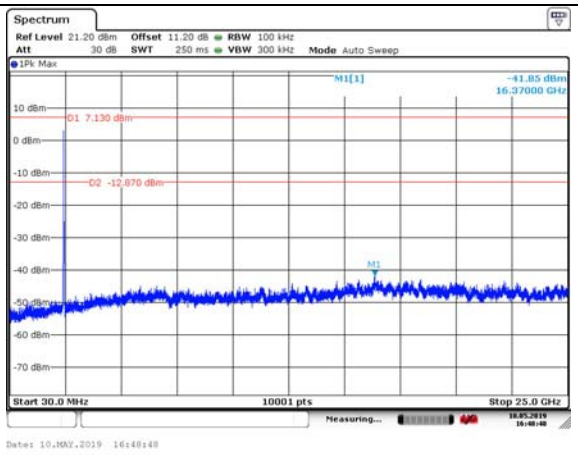
CH1



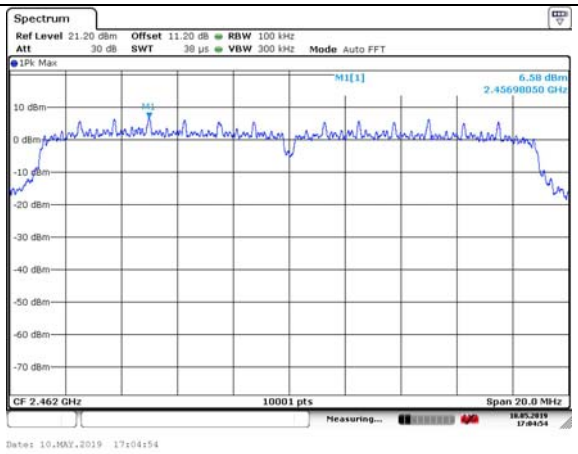


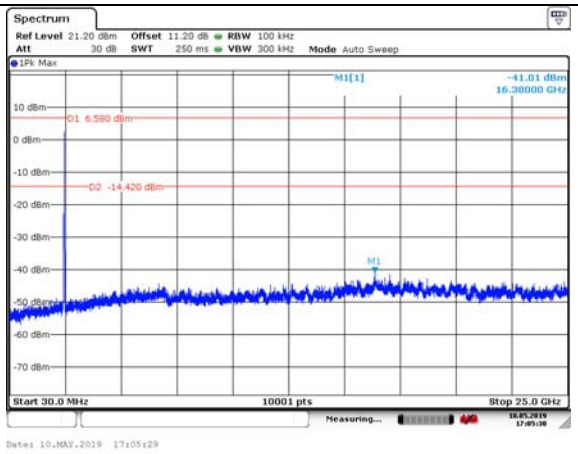
CH6





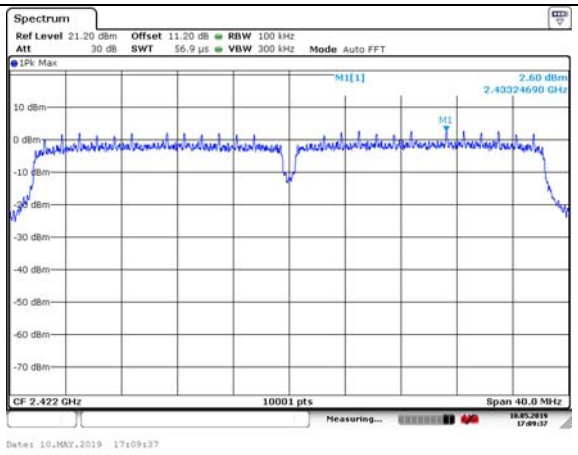
CH11

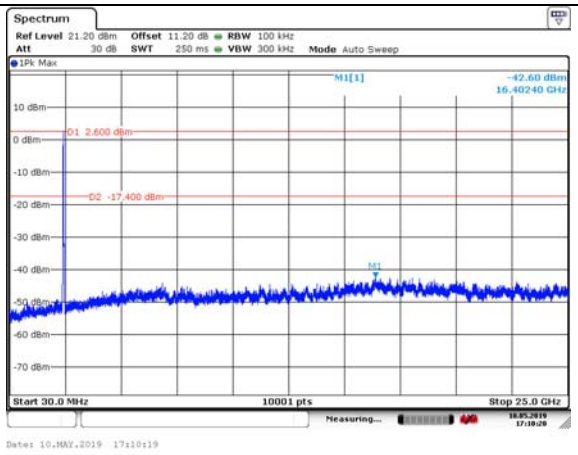




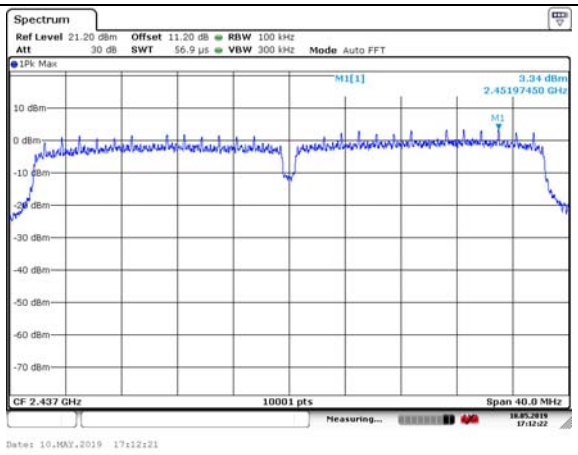
802.11n (40MHz) (SISO Ant2)

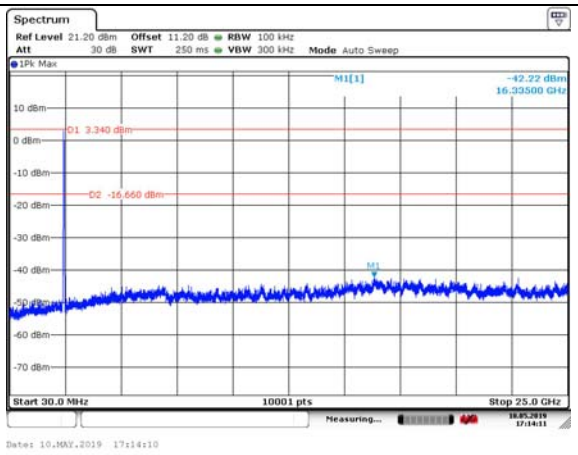
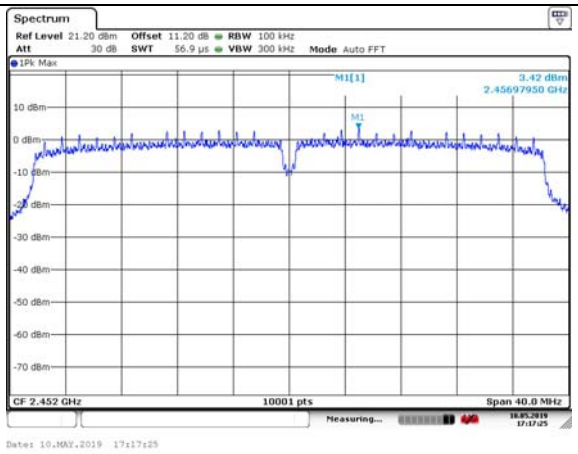
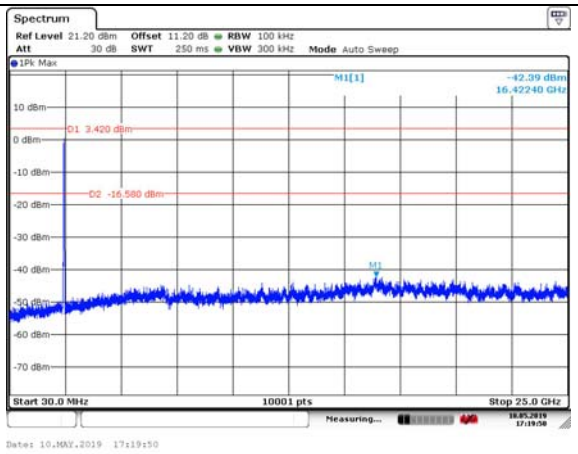
CH3





CH6





CH9