RF TEST REPORT

Report No.: SET2016-12625

Product Name: Connected Handheld RFID Reader

FCC ID: P65ALR-H450B

IC: 4370A-ALRH450B

Model No. : ALR-H450

Applicant: Alien Technology, LLC

Address: 845 Embedded Way, San Jose, CA 95138-1030, United States

Dates of Testing: 06/20/2016 — 06/30/2016

Issued by: CCIC-SET

Lab Location: Electronic Testing Building, Shahe Road, Xili, Nanshan District, Shenzhen, 518055, P. R. China

Tel: 86 755 26627338 **Fax:** 86 755 26627238

Test Report

Product Name ..... :	Connected Handheld RFID Reader
Brand Name ..... :	ALIEN
Trade Name ..... :	ALIEN®
Applicant ..... :	Alien Technology, LLC
Applicant Address ..... :	845 Embedded Way, San Jose, CA 95138-1030, United States
Manufacturer ..... :	Alien Technology, LLC
Manufacturer Address ..... :	845 Embedded Way, San Jose, CA 95138-1030, United States
Test Standards ..... :	47 CFR Part 15 Subpart C：2013 Radio Frequency Devices ANSI C63.10-2013：American National Standard for Testing Unlicensed Wireless Devices RSS-247 Issue 1, May 2015 RSS-GEN Issue 4, November 2014 KDB 558074D01 v03r05
Test Result ..... :	PASS
Tested by ..... :	2016.06.30 Lu Lei, Test Engineer
Reviewed by..... :	2016.06.30 Zhu Qi, Senior Egineer
Approved by ..... :	2016.06.30 Wu Li'an, Manager

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Change History		
Issue	Date	Reason for change
1.0	2016.06.30	First edition

1. General Information

1.1. EUT Description

EUT Type	Connected Handheld RFID Reader
Hardware Version	C4050_MB_V5.0
Software Version	V1.0.0_10040006582_20151221
EUT supports Radios application	GSM /GRPS/EDGE/WCDMA/HSPA WLAN2.4GHz 802.11b/g/n (HT20/HT40) Bluetooth V3.0+EDR / Bluetooth V4.0LE
Frequency Range	802.11b/g/n-20MHz: 2.412GHz - 2.462GHz 802.11n-40MHz:2.422GHz – 2.452GHz
Channel Number	802.11b/g/n-20MHz: 11 802.11n-40MHz: 7
Bit Rate of Transmitter	802.11b: 11/5.5/2/1 Mbps 802.11g: 54/48/36/24/18/12/9/6 Mbps 802.11n up to 135 Mbps
Modulation Type	DSSS (802.11b), OFDM (802.11g/n)
Antenna Type	Linearly Polarization Antenna
Antenna Gain	-2dBi

Note 1: The EUT is a Connected Handheld RFID Reader, it contain WIFI operating at 2.4GHz ISM band; it supports 802.11b, 802.11g, 802.11n and they are all tested in this report.

Note 2: The frequencies allocated is F (MHz) =2412+5*(n-1) (1<=n<=11). The lowest, middle, highest channel numbers of the EUT used and tested in this report are separately 1ch (2412MHz), 6ch(2437MHz) and 11ch(2462MHz) for 802.11b/g/n-20MHz and 3ch(2422MHz), 6ch(2437MHz) and 9ch(2452MHz) for 802.11n-40MHz.

Note 3: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

Note 4: The EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98%.

1.2. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C (Bluetooth, 2.4GHz ISM band radiators) for the EUT FCC Certification:

No.	Identity	Document Title
1	47 CFR Part 15 Subpart C 2013	Radio Frequency Devices
2	ANSI C63.10 2013	American National Standard for Testing Unlicensed Wireless Devices
3	RSS-GEN: Issue 4,November 2014:	General Requirements and Information for the Certification of Radio Apparatus
4	RSS-247:Issue 1,December2015:	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

Test detailed items/section required by FCC rules and results are as below:

No.	Standard(s) Section		Description	Result
	FCC	IC		
1	15.203	8.3	Antenna Requirement	PASS
2	15.247(b)(3)	RSS-247 Issue1 - 5.4(4)	Peak Output Power	PASS
3	15.247(a)(2)	RSS-247 Issue1 - 5.2(1)	Bandwidth – 6dB bandwidth	PASS
4	/	RSS Gen clause - 4.6.1	99% Occupied Bandwidth	PASS
5	15.247(d)	RSS-247 Issue1 - 5.5	Conducted Spurious Emission	PASS
6	15.247(e)	RSS-247 Issue1 - 5.2(2)	Power spectral density (PSD)	PASS
7	15.205 15.247(d)	RSS-247 Issue1 - 5.5 RSS - Gen	Band Edge	PASS
8	15.209(a)	RSS-GEN	Spurious emissions radiated below 30MHz	PASS
9	15.247(d) 15.109	RSS-247 Issue1 - 5.5 RSS-Gen	Spurious emissions radiated 30 MHz to 1GHz and above 1GHz	PASS
10	15.107(a), 15.20(c)	RSS-GEN	Conducted Emission	PASS

The tests of Conducted Emission and Radiated Emission were performed according to the method of measurements prescribed in ANSI C63.10-2013.

These RF tests were performed according to the method of measurements prescribed in KDB558074 D01 v03r05.

1.3. Description of test environment test modes

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

There are two bandwidth systems:

For 20MHz bandwidth systems, use Channel 1~ Channel 11

For 40MHz bandwidth systems, use Channel 3~ Channel 9

Channel No.	Frequency	Channel No.	Frequency	Channel No.	Frequency
1	2412MHz	5	2432MHz	9	2452MHz
2	2417MHz	6	2437MHz	10	2457MHz
3	2422MHz	7	2442MHz	11	2462MHz
4	2427MHz	8	2447MHz		

Test Items	Mode	Data Rate	Channel
Peak Conducted Output Power Power Spectral Density Bandwidth Conducted and Spurious Emission Radiated and Spurious Emission	11b/DSSS	1 Mbps	1/6/11
	11g/OFDM	6 Mbps	1/6/11
	11n(20MHz)/OFDM	MCS 0	1/6/11
	11n(40MHz)/OFDM	MCS 0	3/6/9
Band Edge	11b/DSSS	1 Mbps	1/11
	11g/OFDM	6 Mbps	1/11
	11n(20MHz)/OFDM	MCS 0	1/11
	11n(40MHz)/OFDM	MCS 0	3/9

1.4. Table for Supporting Units

No.	Equipment	Brand Name	Model Name	Manufacturer	Serial No.	Note
1	Notebook	DELL	PP11L	DELL	H5914A03	FCC DOC

1.5. Facilities and Accreditations

1.5.1. Facilities

CNAS-Lab Code: L1659

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. CCIC is a third party testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L1659. A 12.8*6.8*6.4 (m) fully anechoic chamber was used for the radiated spurious emissions test.

FCC-Registration No.: 406086

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration 406086, valid time is until October 28, 2017.

IC-Registration No.: 11185A-1

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. EMC Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. on Aug. 04, 2016, valid time is until Aug. 03, 2019.

1.5.2. Test Environment Conditions

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

Temperature (°C):	15°C - 35°C
Relative Humidity (%):	30% -60%
Atmospheric Pressure (kPa):	86KPa-106KPa

2. 47 CFR Part 15C Requirements

2.1. Antenna requirement

2.1.1. Applicable Standard

According to FCC 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

And according to FCC 47 CFR Section 15.247(c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

2.1.2. Antenna Information

Antenna Category: Internal antenna

An Internal antenna was soldered to the antenna port of EUT via an adaptor cable, can't be removed.

Antenna General Information:

No.	EUT	Ant. Type	Gain(dBi)
1	Connected Handheld RFID Reader	Linearly Polarization	-2

2.1.3. Result: comply

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

2.2. Peak Output Power

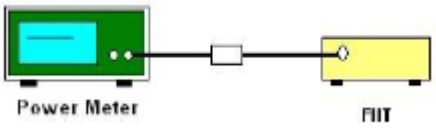
2.2.1. Limit of Peak Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. If transmitting antenna of directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

2.2.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.2.3. Test Setup



2.2.4. Test Procedures

1. The testing follows the Measurement Procedure of FCC KDB 558074 D01 v03r05.

2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.

3. Set to the maximum power setting and enable the EUT transmit continuously.

4. Measure the conducted output power and record the results in the test report.

2.2.5. Power Sensor Specifications

Model	MA2411B
Frequency range	300MHz~40GHz
Standard Video Bandwidth	50MHz

2.2.6. Test Result

Test mode	Channel	Frequency (MHz)	RF Power(dBm)	Limit (dBm)	Verdict
802.11b	1	2412	18.08	30	PASS
	6	2437	18.19		PASS
	11	2462	18.29		PASS
802.11g	1	2412	17.14		PASS
	6	2437	17.49		PASS
	11	2462	17.52		PASS
802.11n20	1	2412	17.13		PASS
	6	2437	17.41		PASS
	11	2462	17.58		PASS
802.11n40	3	2422	15.12		PASS
	6	2437	16.10		PASS
	9	2452	15.48		PASS

Note: All data rates are testing, but the worse case data rate was record in the report.

2.3. 6dB & 99% Bandwidth

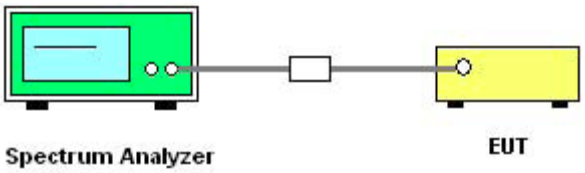
2.3.1. Limit of 6dB Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

2.3.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.3.3. Test Setup



2.3.4. Test Procedures

1. The testing follows FCC KDB558074 D01 v03r05.

2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

3. Set to the maximum power setting and enable the EUT transmit continuously.

4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6dB bandwidth must be greater than 500 kHz.

5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 30 kHz and set the Video bandwidth (VBW) = 100 kHz.

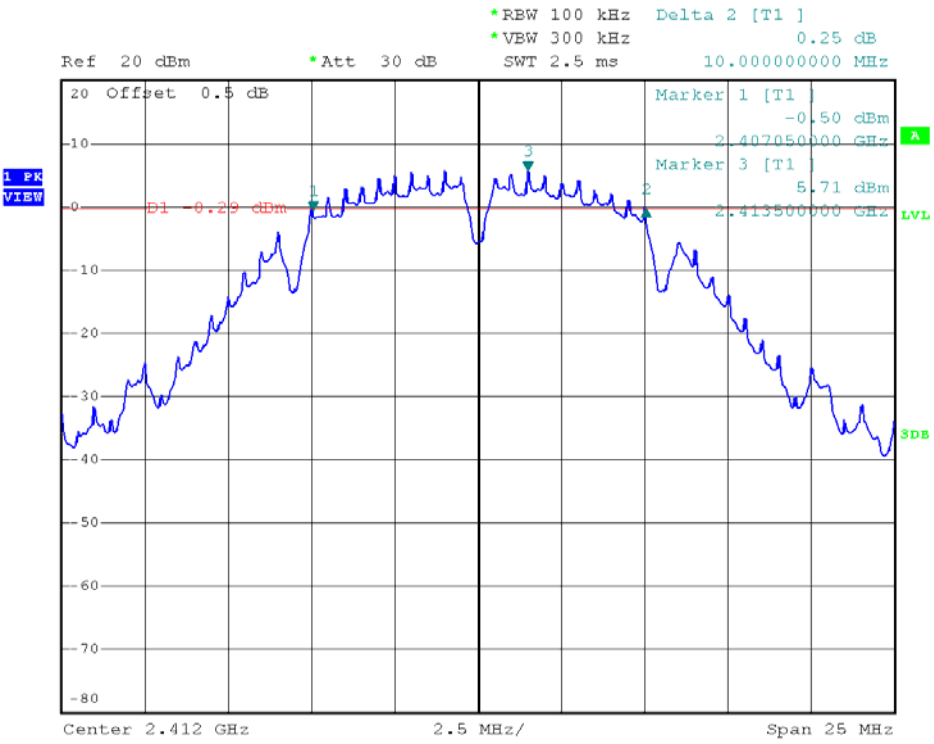
6. Measure and record the results in the test report.

2.3.5. Test Results of 6dB Bandwidth

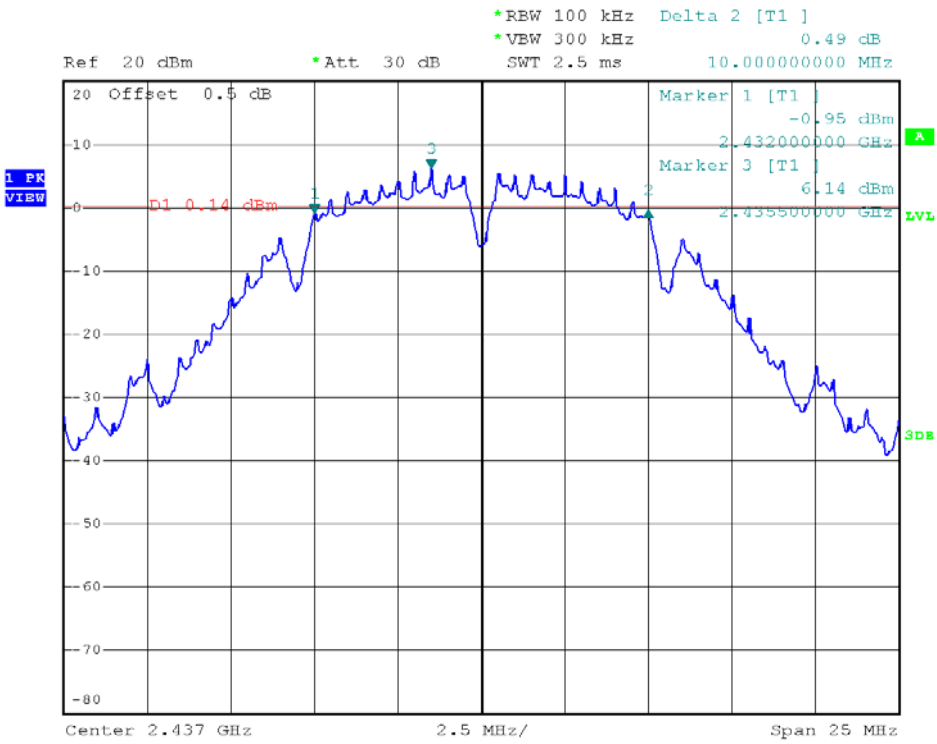
Test mode	Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	99% Occupied Bandwidth(MHz)	Limits (MHz)	Result
802.11b	1	2412	10.00	14.90	≥0.5	PASS
	6	2437	10.00	15.00		PASS
	11	2462	10.00	14.90		PASS
802.11g	1	2412	15.55	16.50		PASS
	6	2437	16.05	16.55		PASS
	11	2462	15.20	16.55		PASS
802.11n20	1	2412	16.65	17.75		PASS
	6	2437	16.75	17.80		PASS
	11	2462	16.50	17.70		PASS
802.11n40	3	2422	35.28	36.09		PASS
	6	2437	35.30	36.18		PASS
	9	2452	34.97	36.18		PASS

2.3.6. Test Results (plots) of 6dB Bandwidth

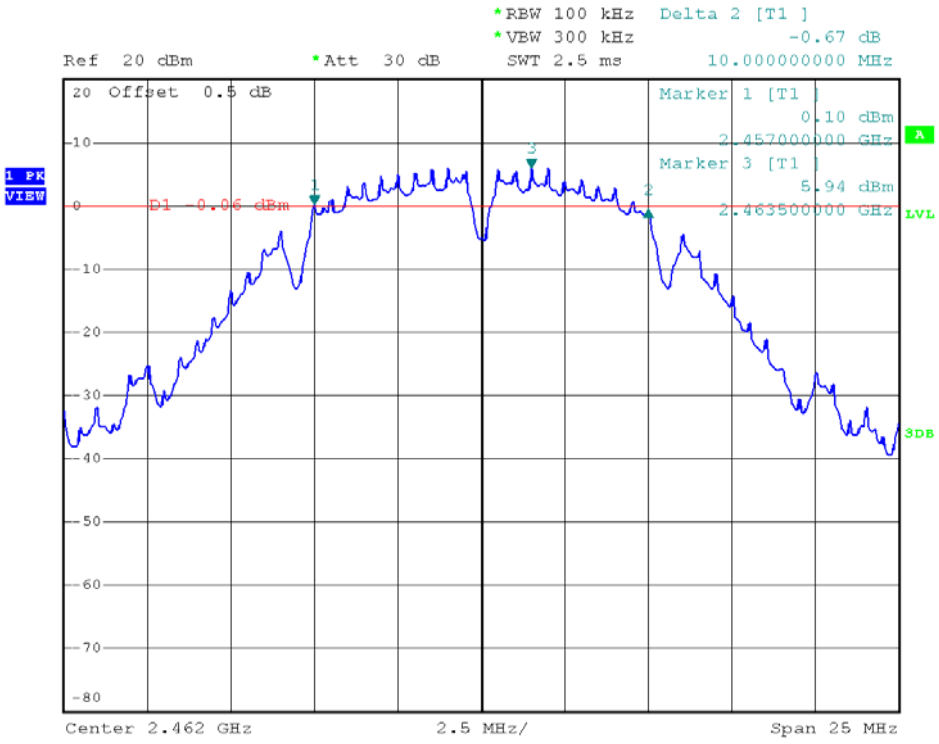
802.11b - 6 dB Bandwidth Plot on channel 1



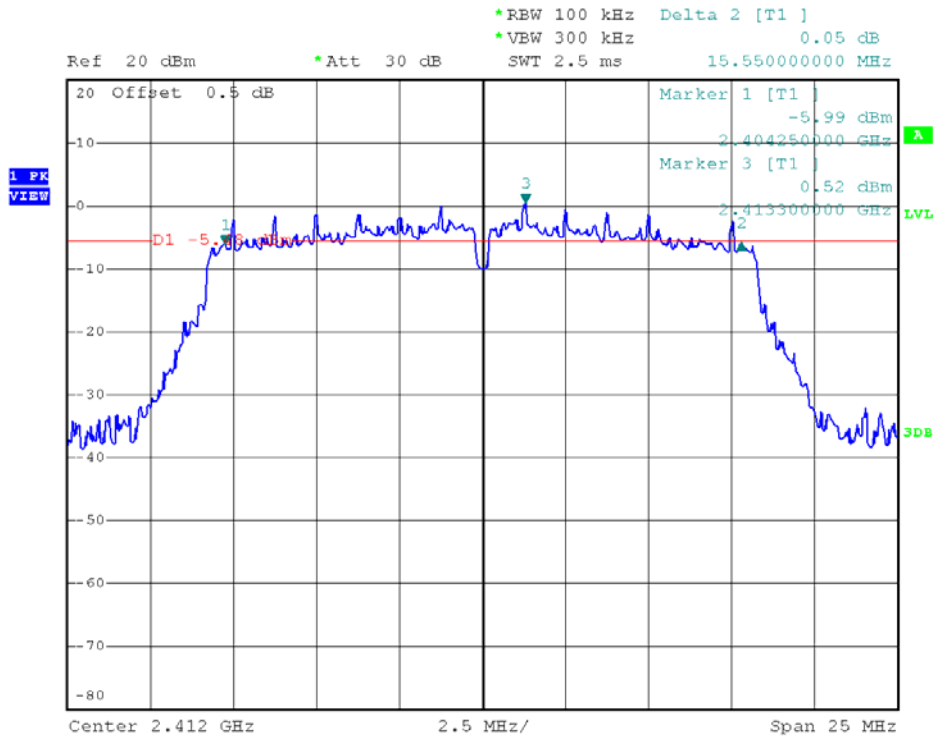
802.11b - 6 dB Bandwidth Plot on channel 6



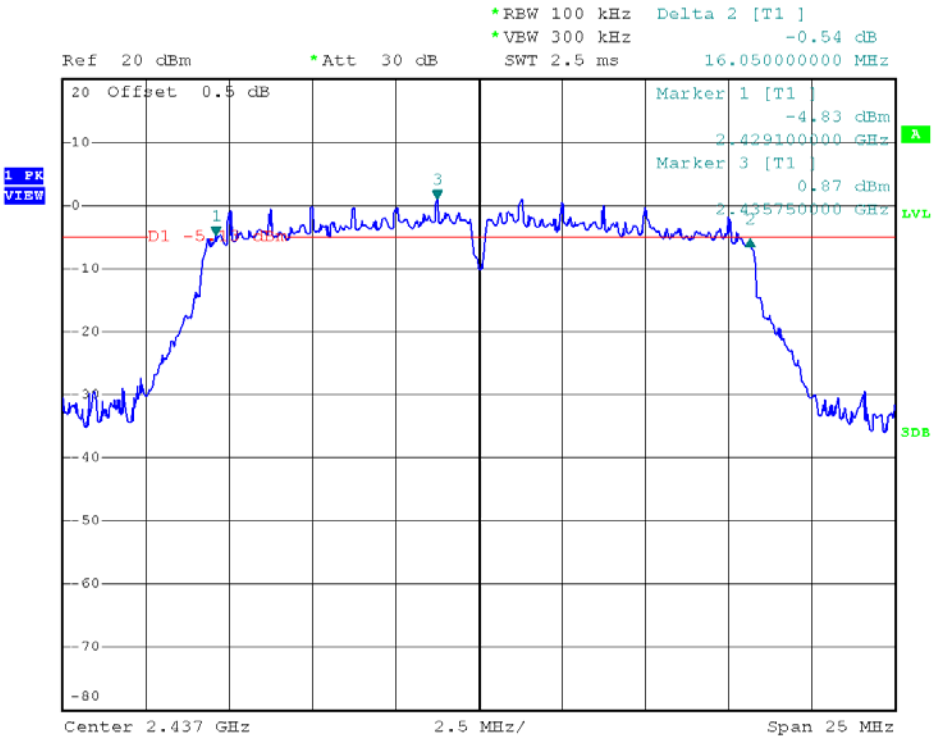
802.11b - 6 dB Bandwidth Plot on channel 11



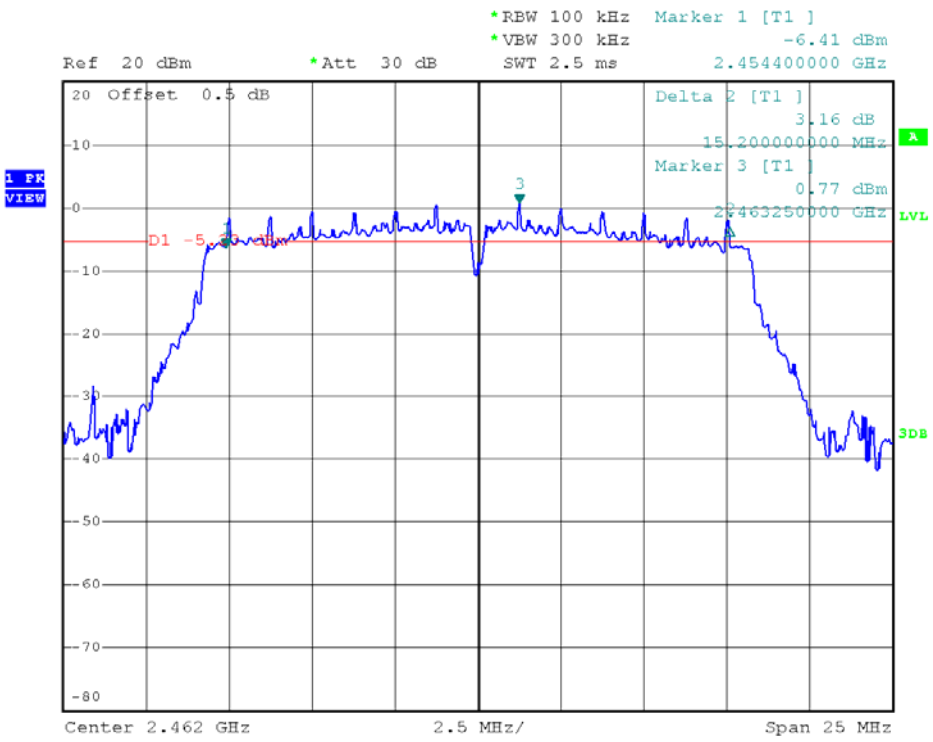
802.11g - 6 dB Bandwidth Plot on channel 1



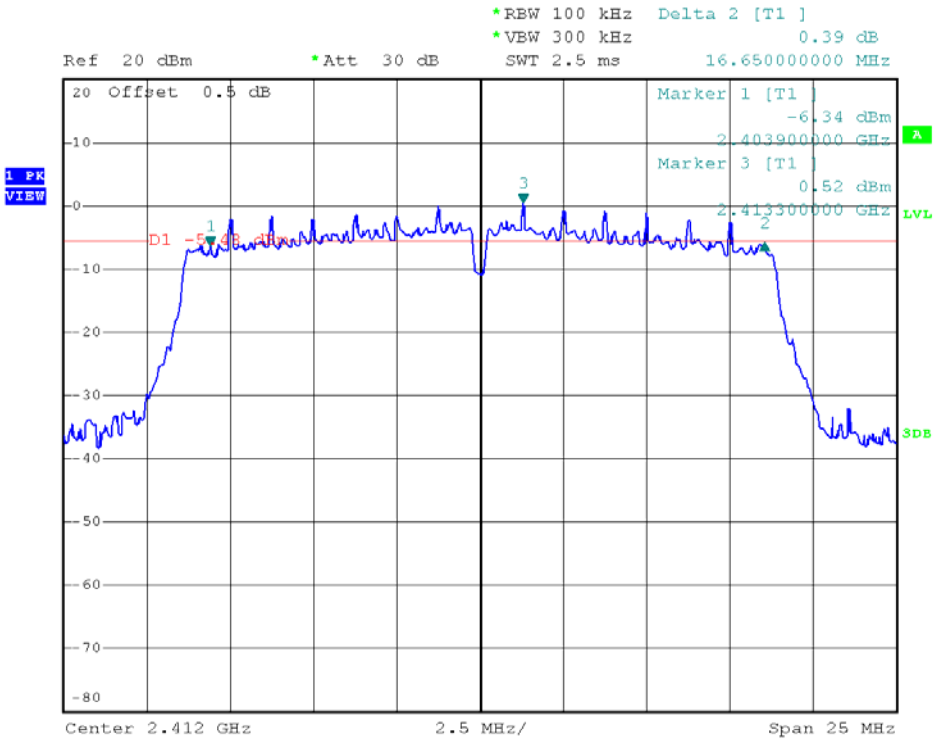
802.11g - 6 dB Bandwidth Plot on channel 6



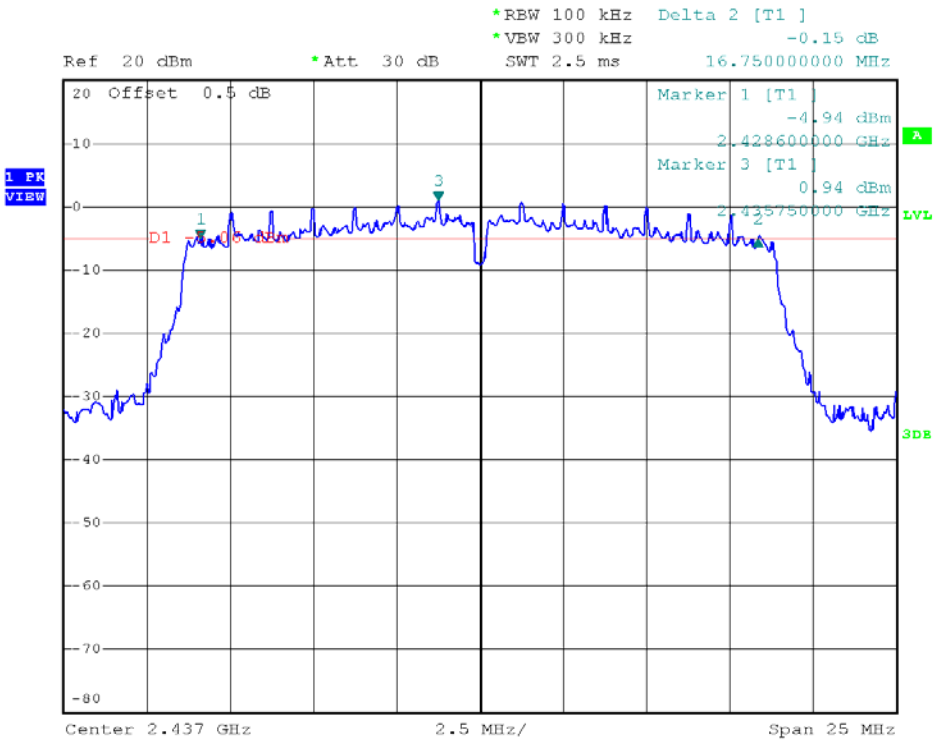
802.11g - 6 dB Bandwidth Plot on channel 11



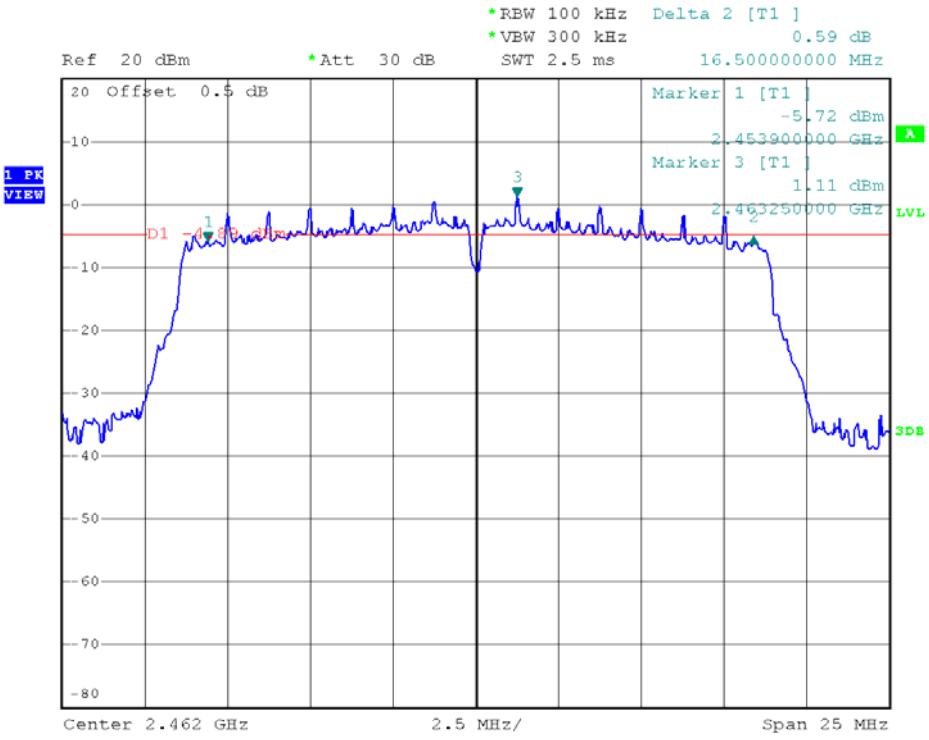
802.11n20 - 6 dB Bandwidth Plot on channel 1



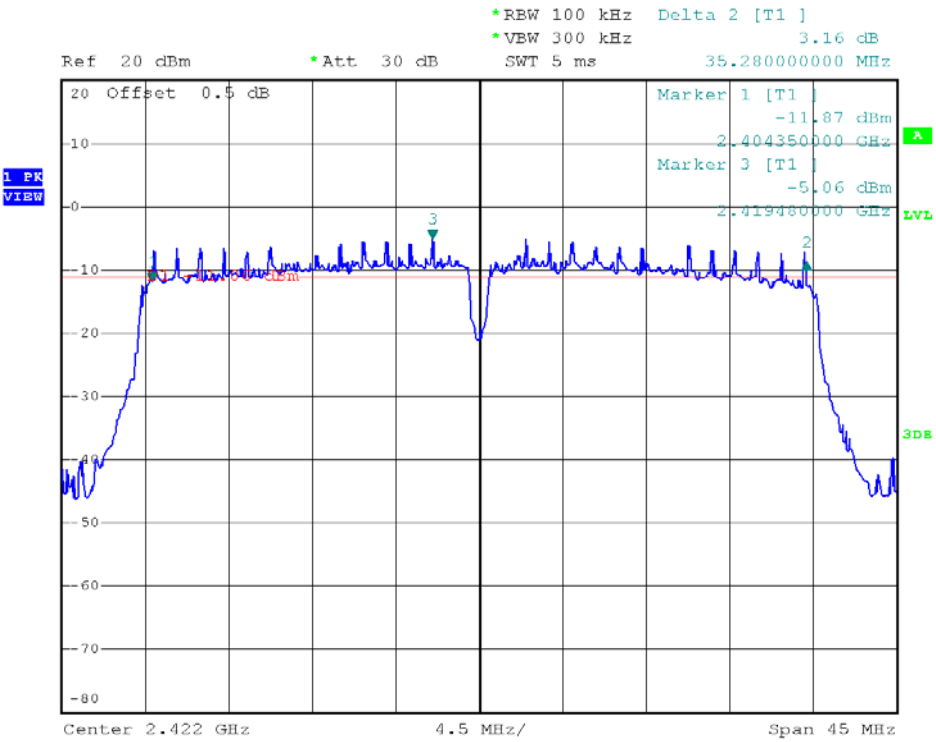
802.11n20 - 6 dB Bandwidth Plot on channel 6



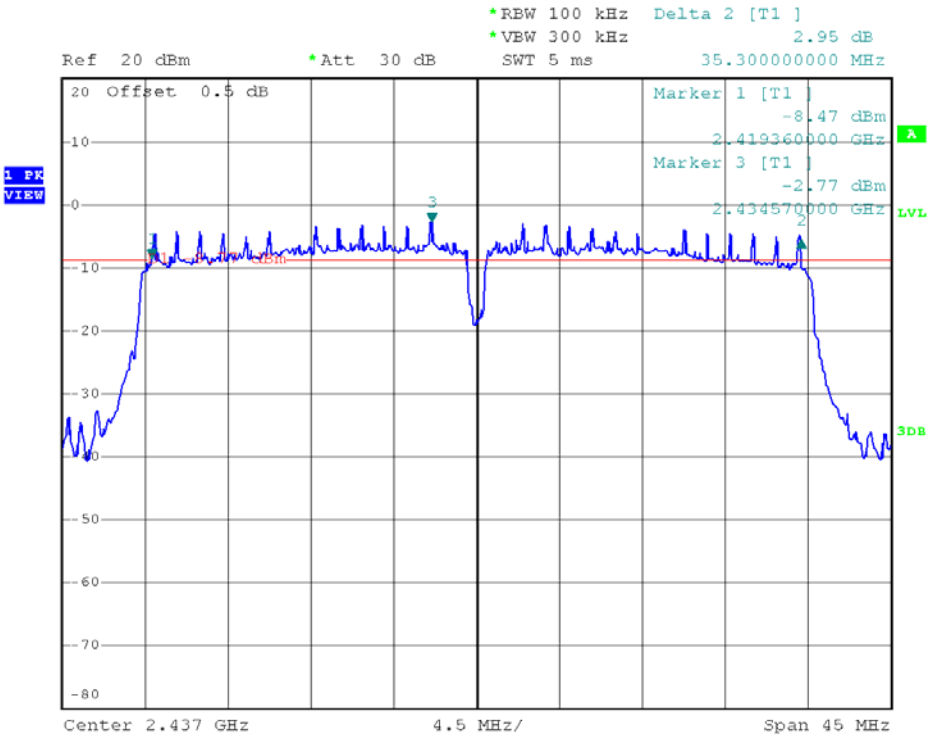
802.11n20 - 6 dB Bandwidth Plot on channel 11



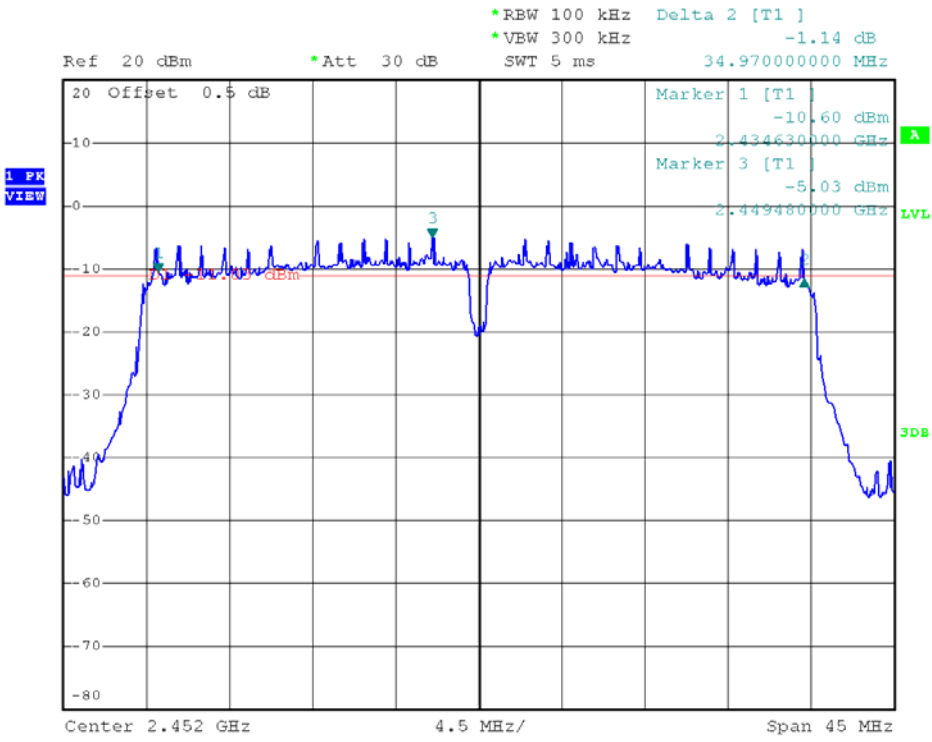
802.11n40 - 6 dB Bandwidth Plot on channel 3



802.11n40 - 6 dB Bandwidth Plot on channel 6

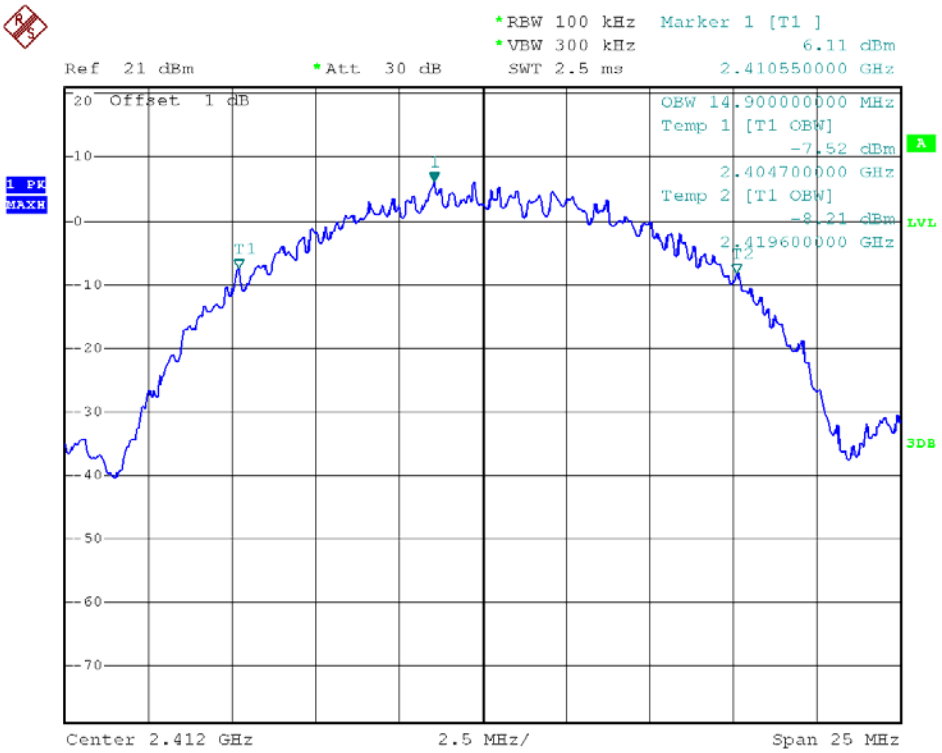


802.11n40 - 6 dB Bandwidth Plot on channel 9

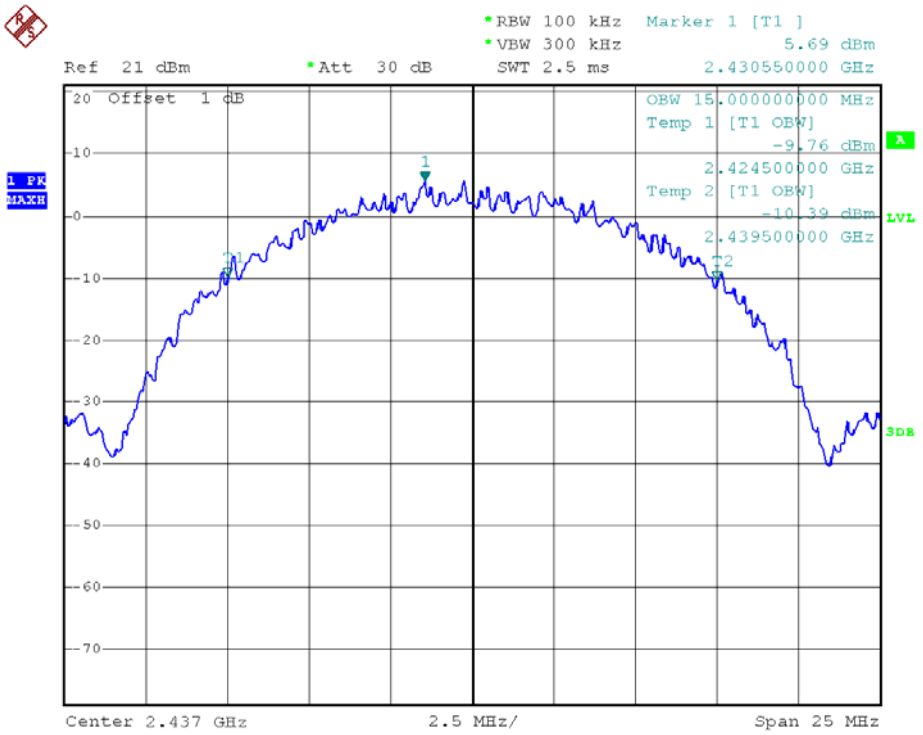


2.3.7. Test Results (plots) of 6dB Bandwidth

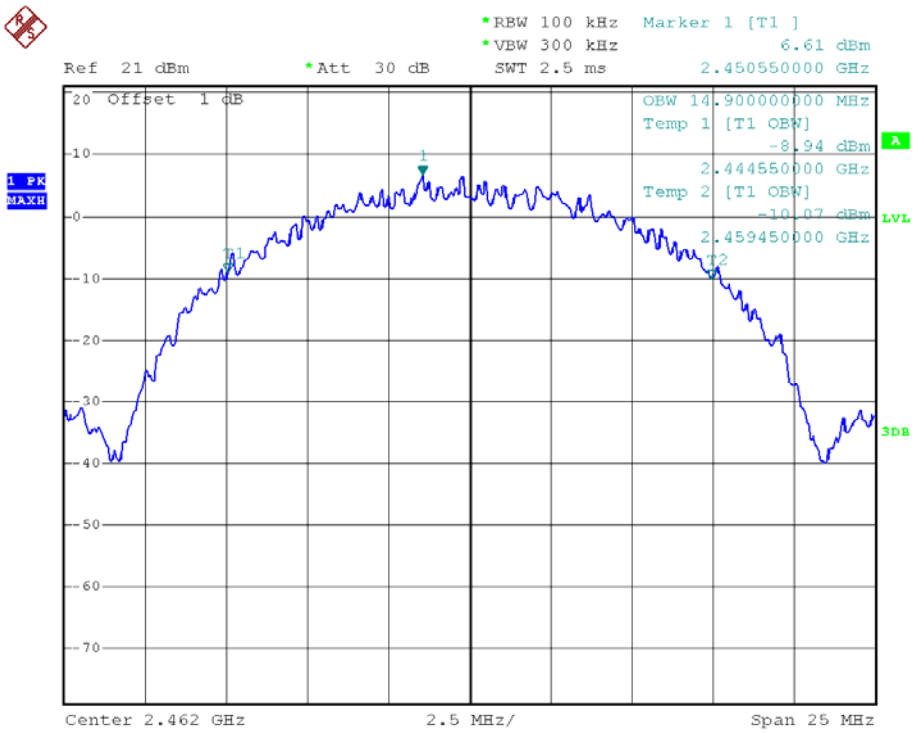
802.11b – 99% Bandwidth Plot on channel 1



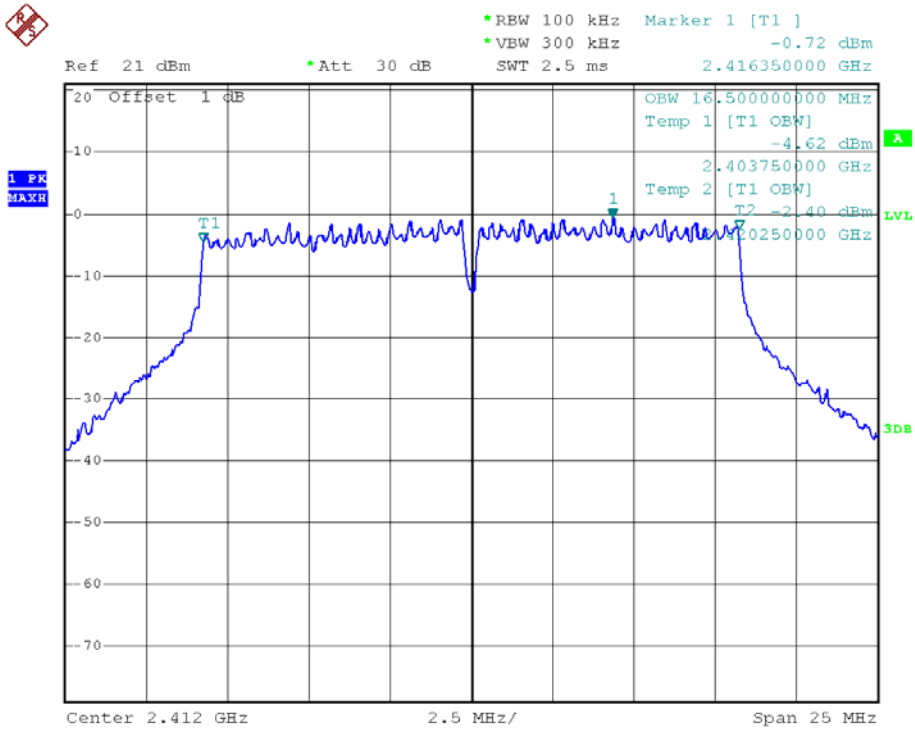
802.11b – 99% Bandwidth Plot on channel 6



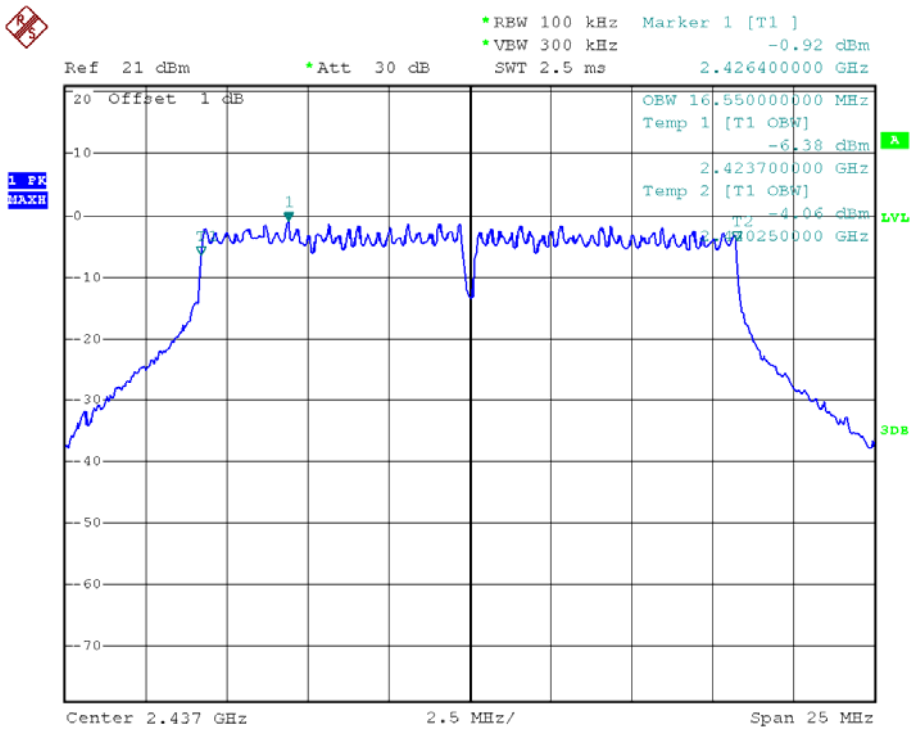
802.11b – 99% Bandwidth Plot on channel 11



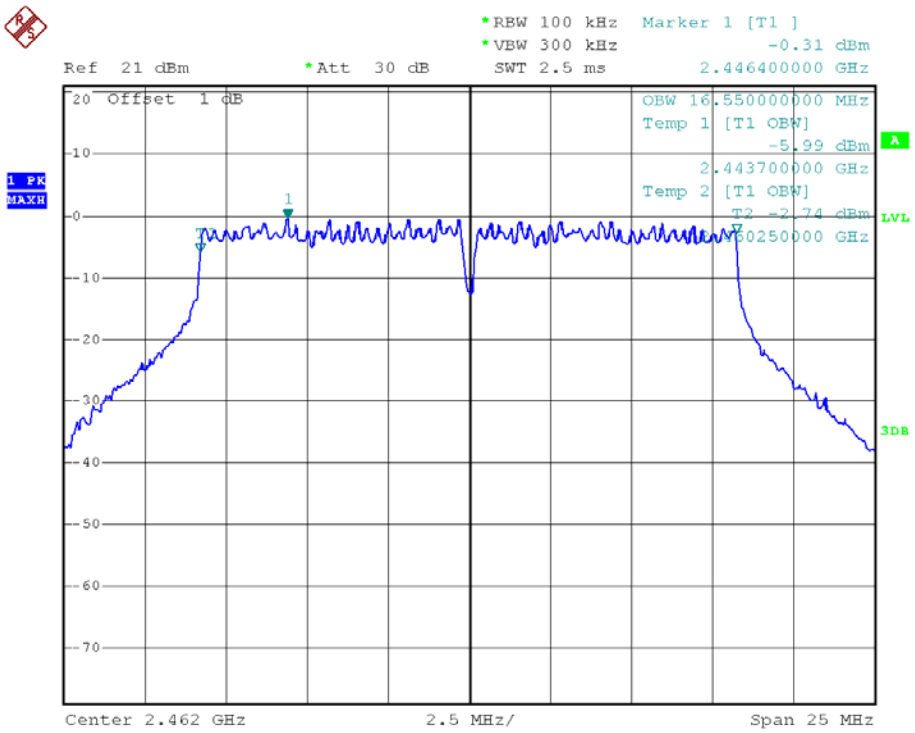
802.11g – 99% Bandwidth Plot on channel 1



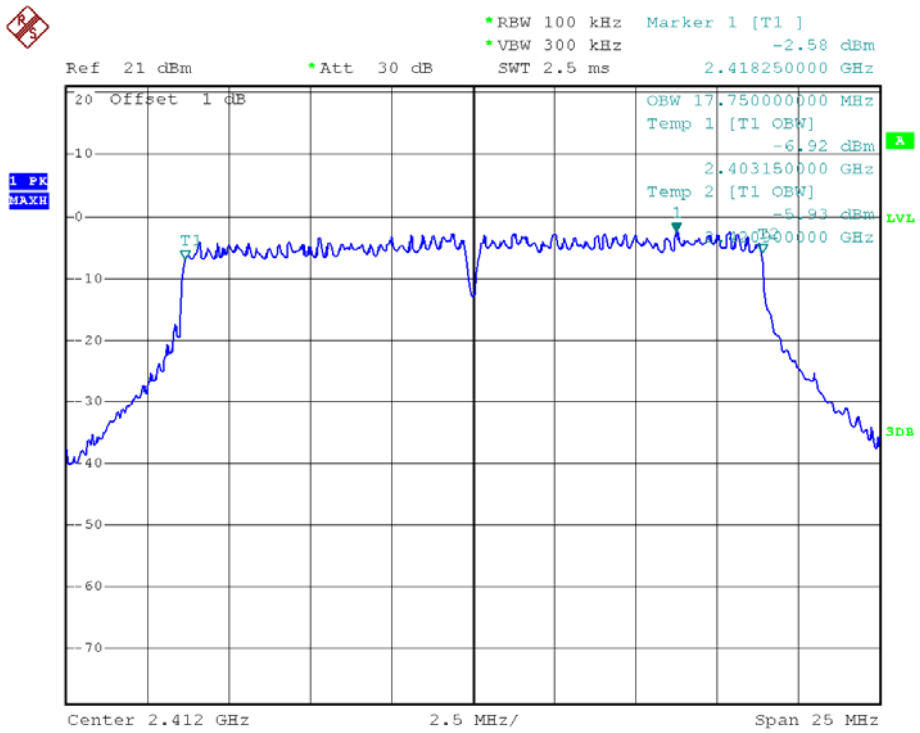
802.11g – 99% Bandwidth Plot on channel 6



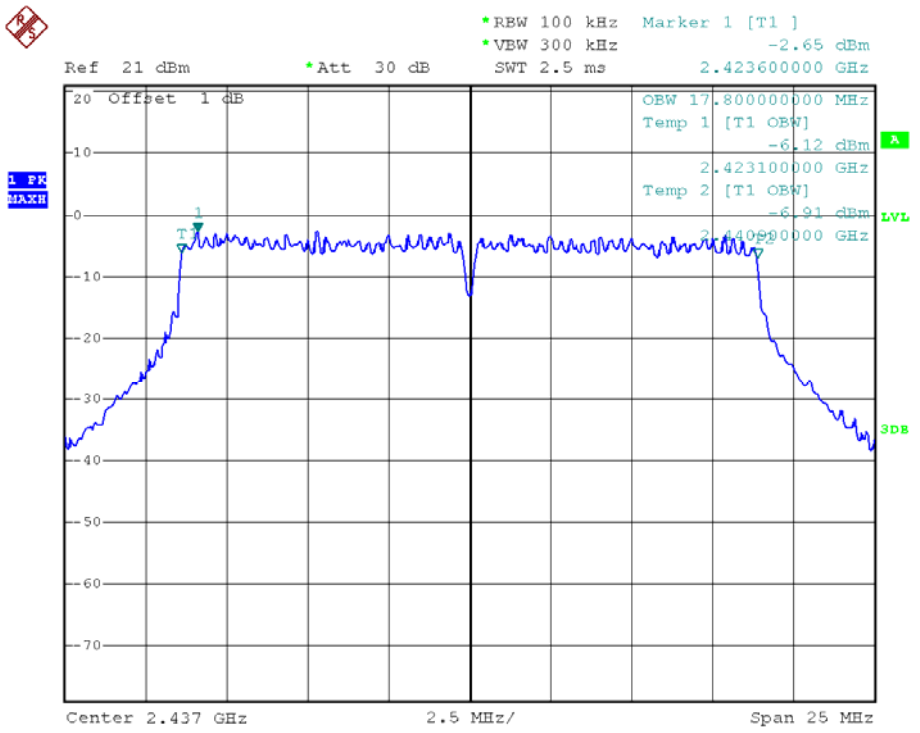
802.11g – 99% Bandwidth Plot on channel 11



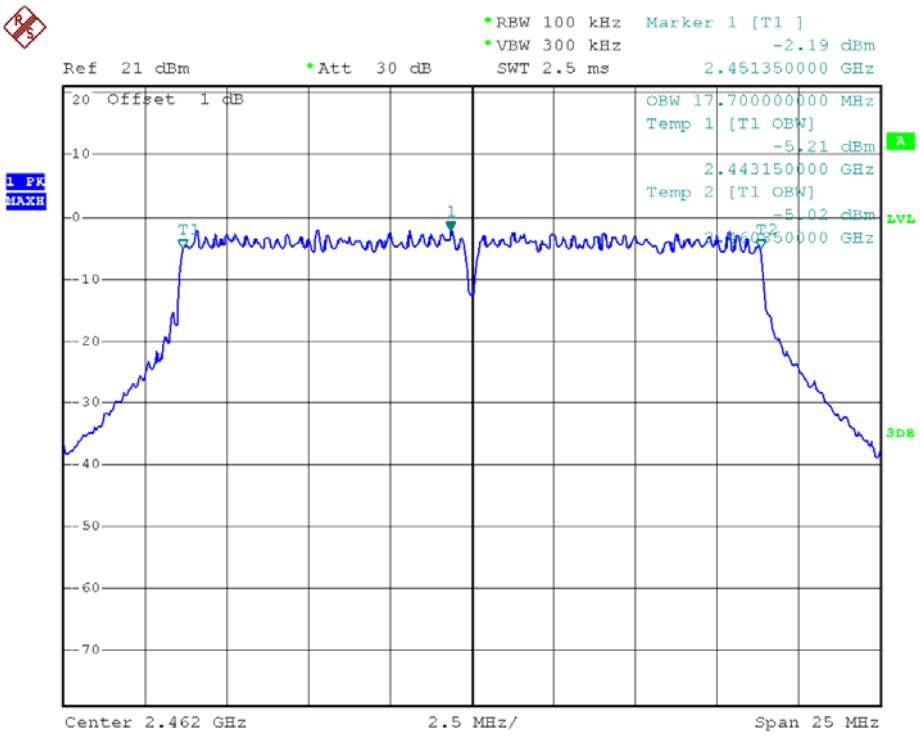
802.11n20 – 99% Bandwidth Plot on channel 1



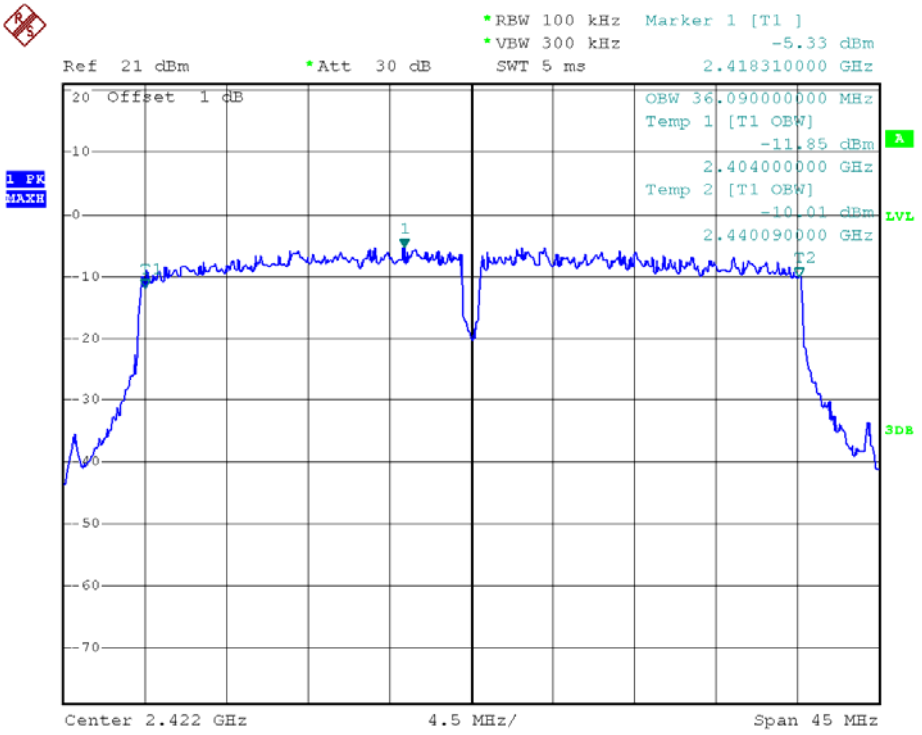
802.11n20 – 99% Bandwidth Plot on channel 6



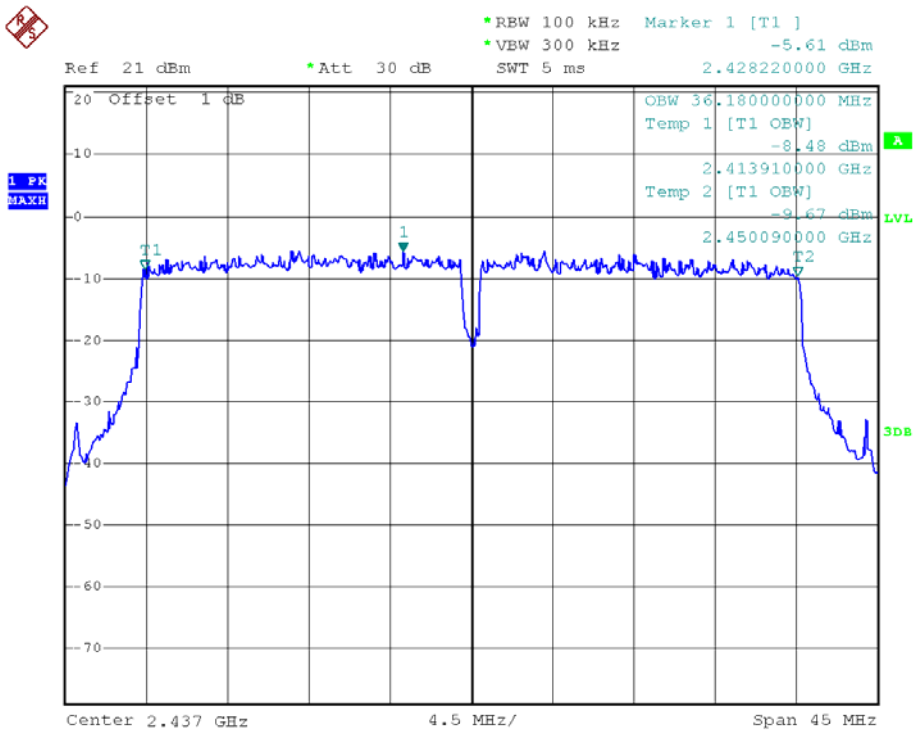
802.11n20 – 99% Bandwidth Plot on channel 11



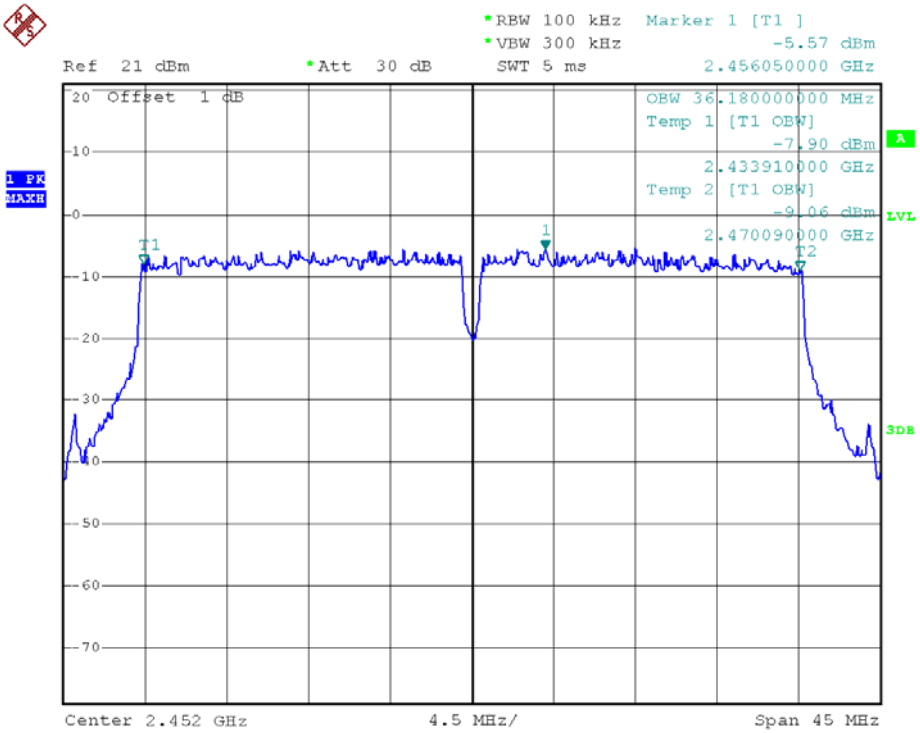
802.11n40 – 99% Bandwidth Plot on channel 3



802.11n40 – 99% Bandwidth Plot on channel 6



802.11n40 – 99% Bandwidth Plot on channel 9



2.4. Conducted Band Edges and Spurious Emissions

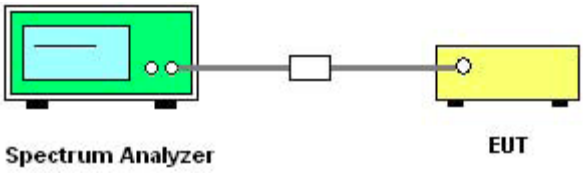
2.4.1. Limit of Conducted Band Edges and Spurious Emissions

All harmonics/spurious must be at least 20 dB down from the highest emission level within the authorized band.

2.4.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

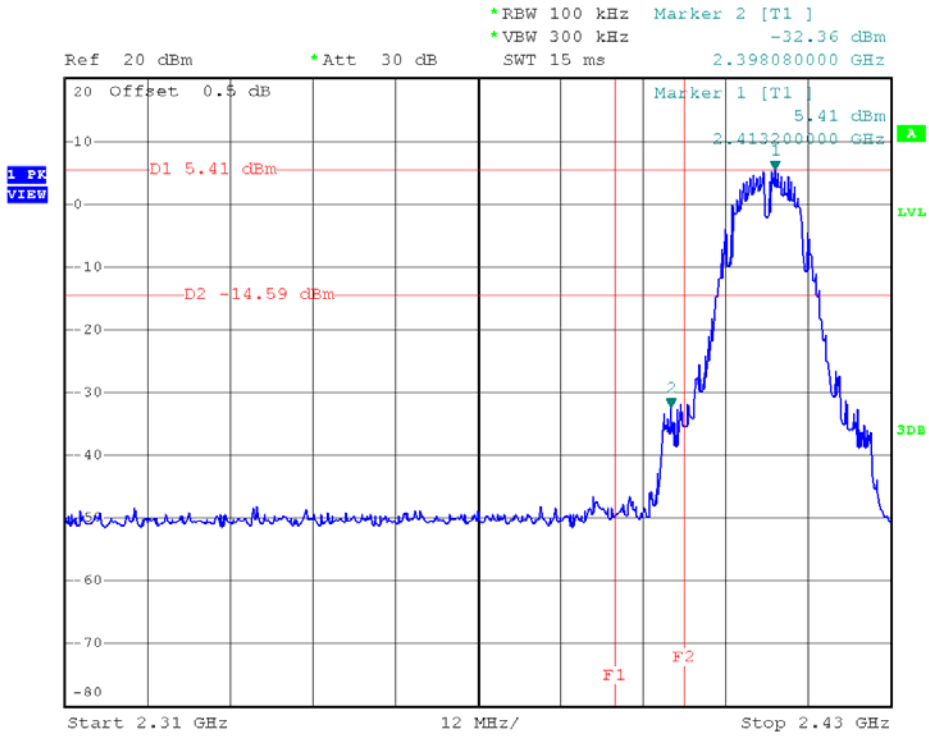
2.4.3. Test Setup



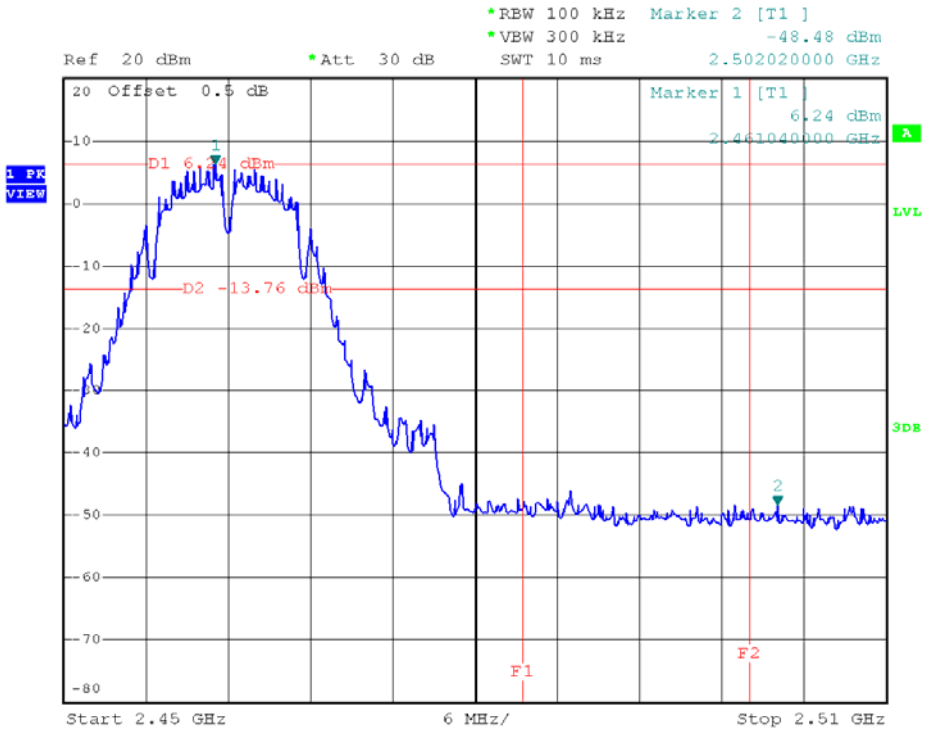
2.4.4. Test Procedure

1. The testing follows FCC KDB558074 D01 v03r05.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

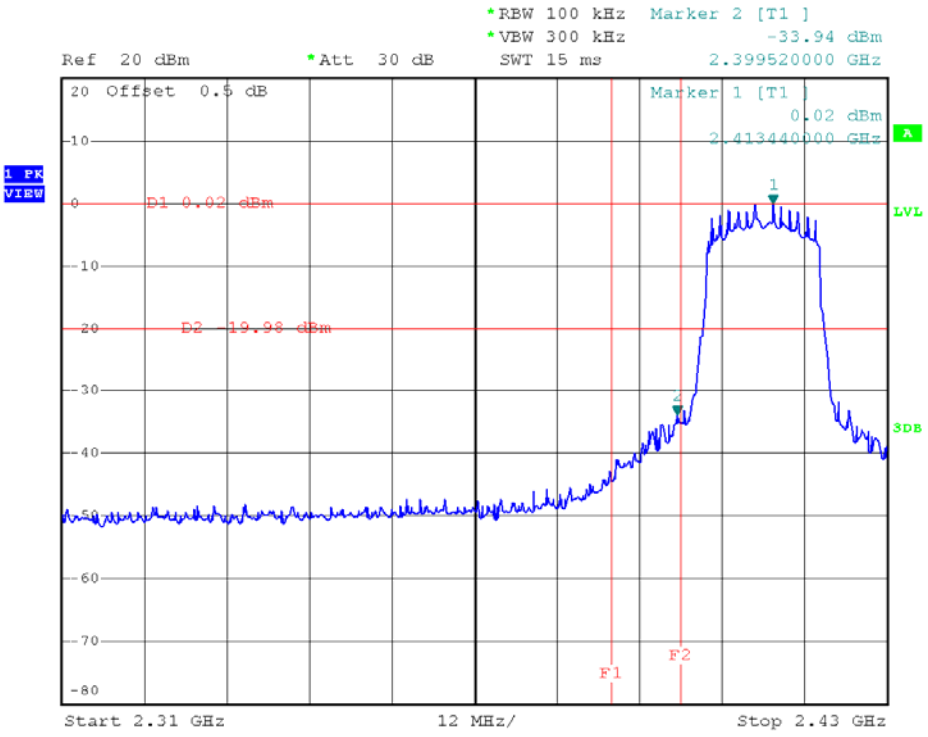
2.4.5. Test Results of Conducted Band Edges



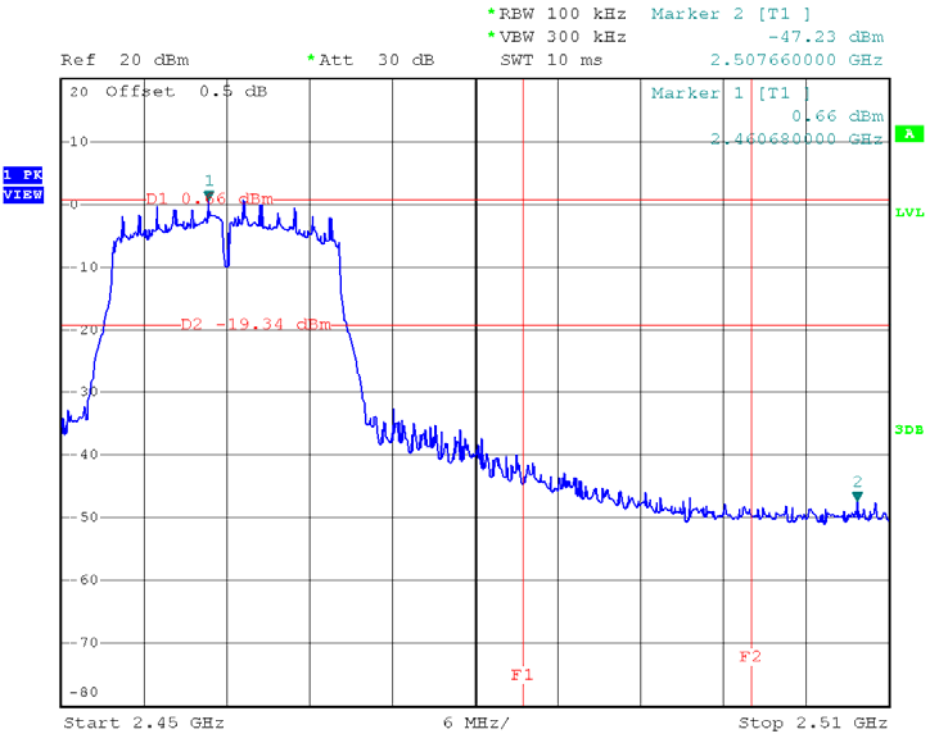
802.11b - Low Band Edge Plot on Channel 1



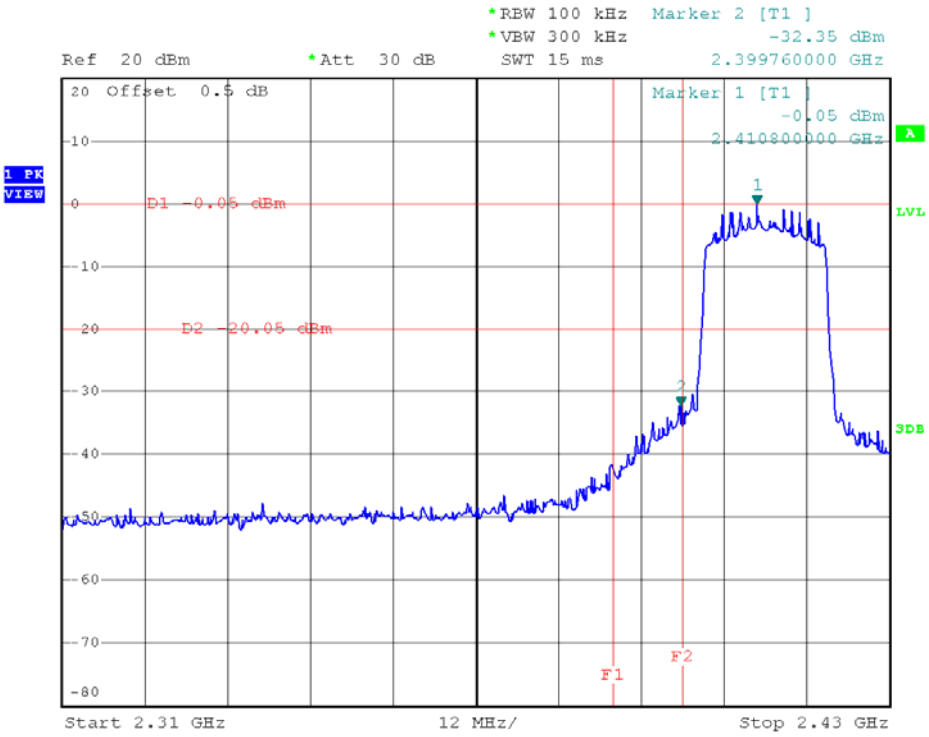
802.11b - High Band Edge Plot on Channel 11



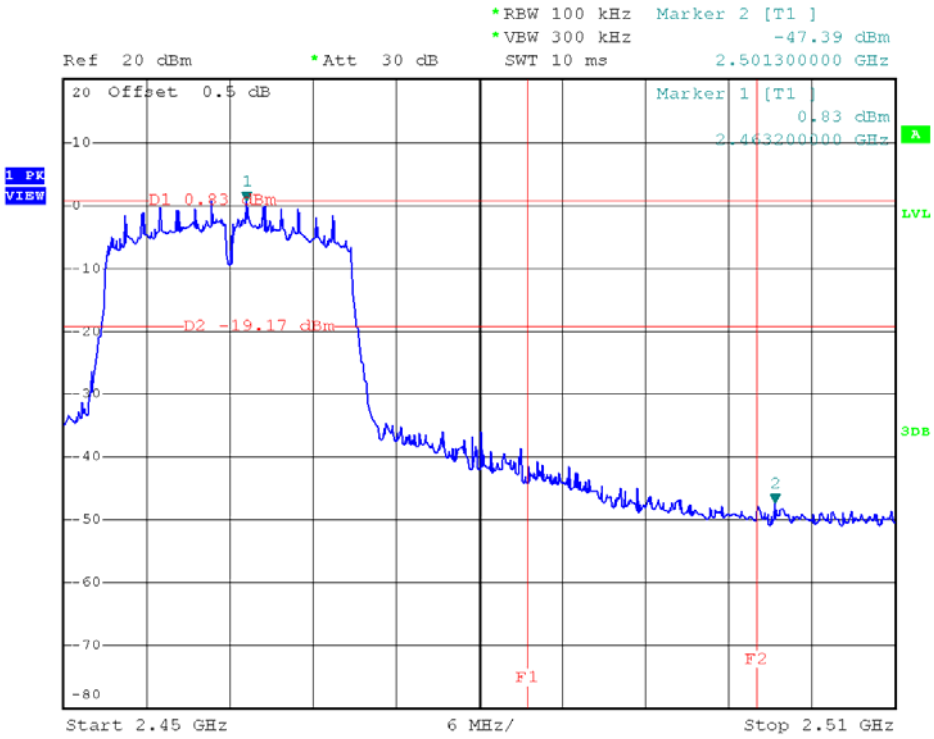
802.11g - Low Band Edge Plot on Channel 1



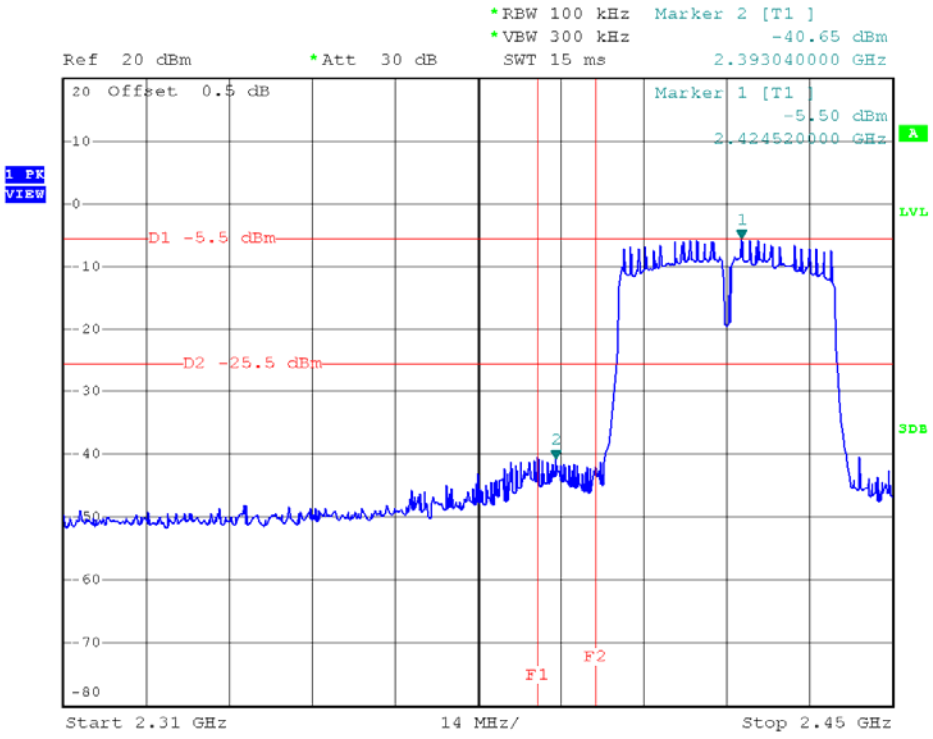
802.11g - High Band Edge Plot on Channel 11



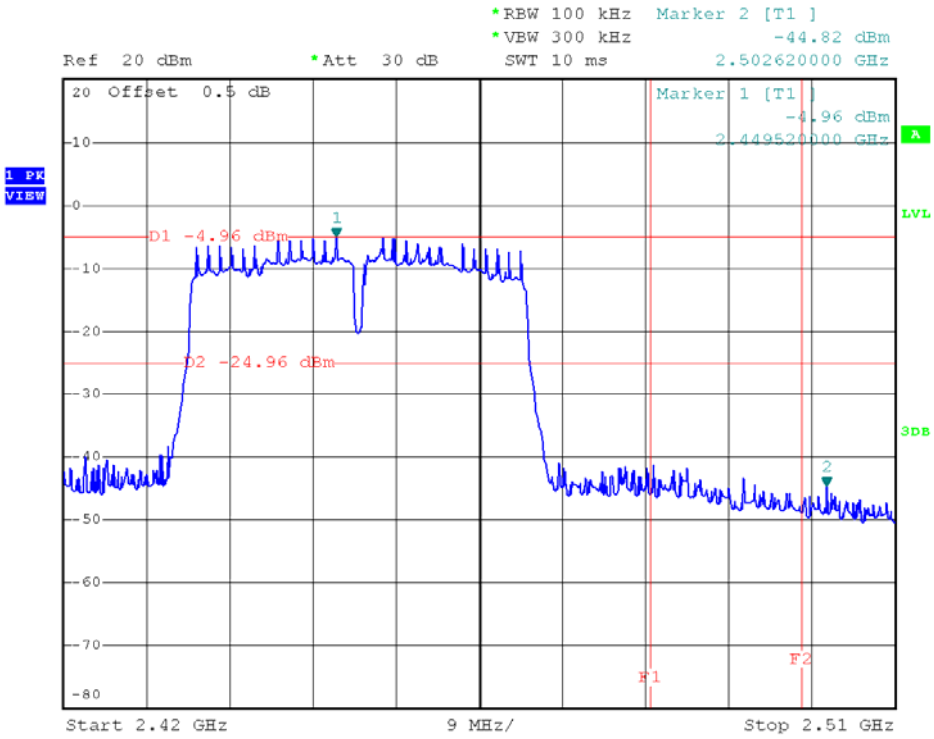
802.11n20 - Low Band Edge Plot on Channel 1



802.11n20 - High Band Edge Plot on Channel 11



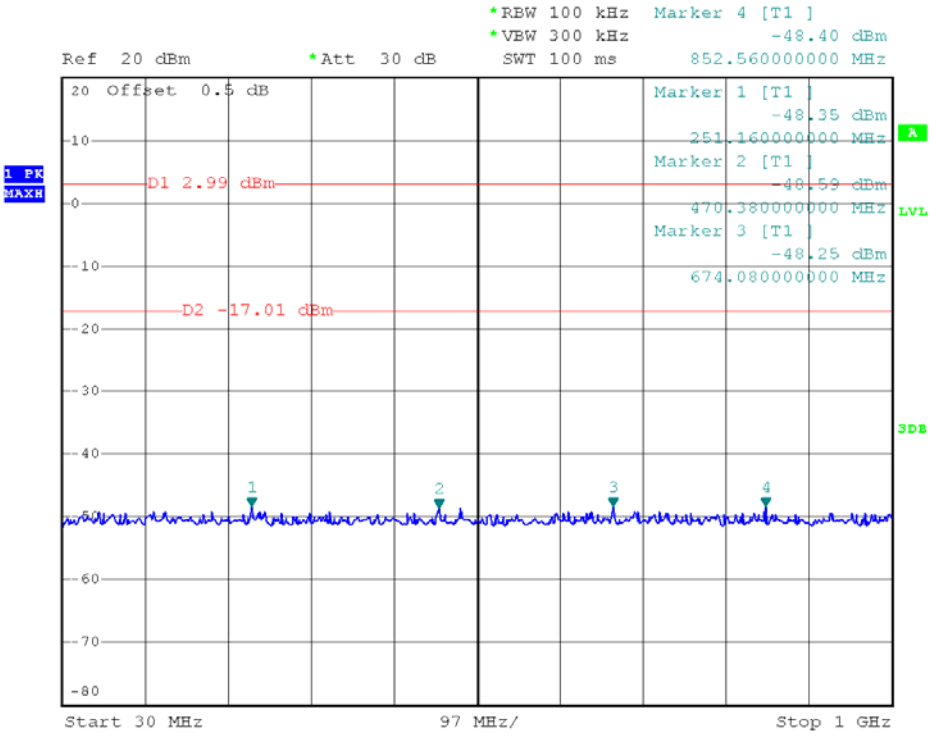
802.11n40 - Low Band Edge Plot on Channel 3



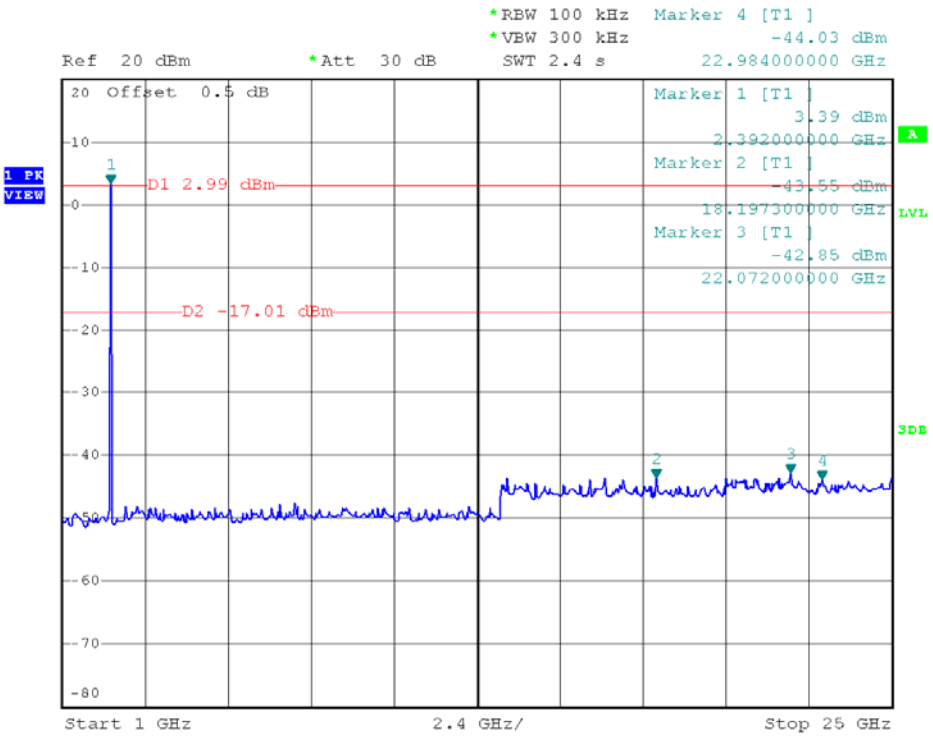
802.11n40 - High Band Edge Plot on Channel 9

2.4.6. Test Result of Conducted Spurious Emission

802.11b - Conducted Spurious Emission Plot on channel 1

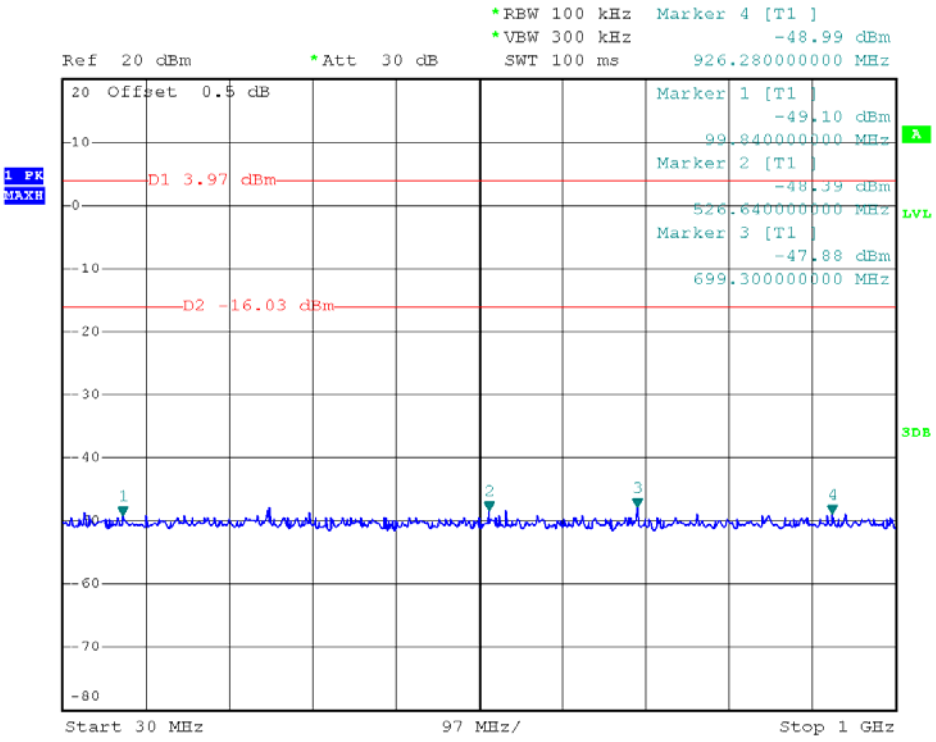


Channel = 1, 30MHz to 1GHz

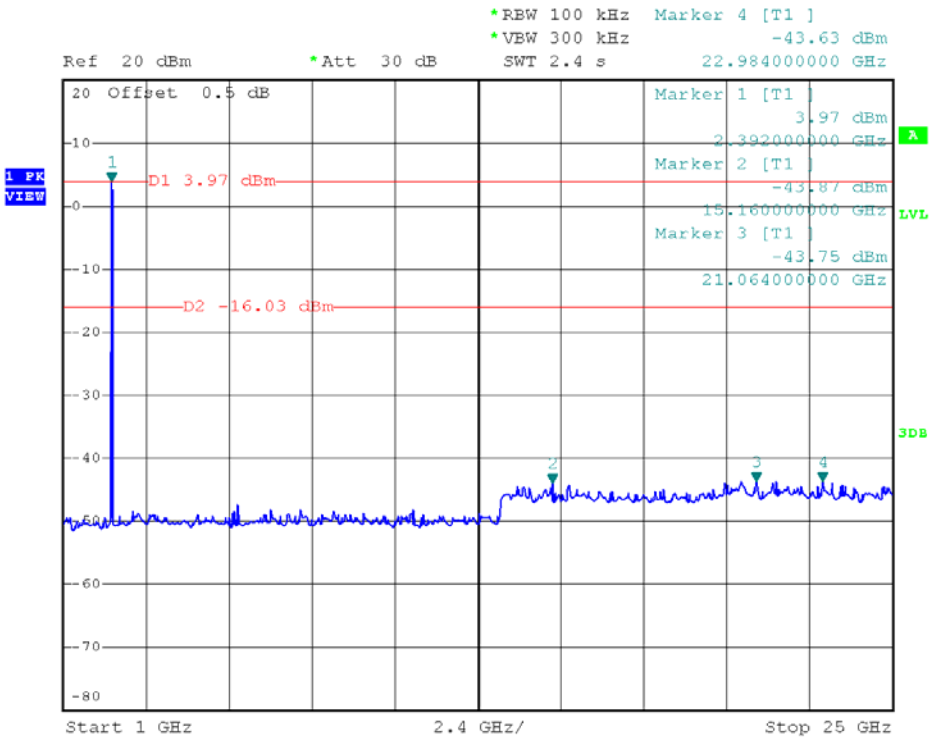


Channel = 1, 1GHz to 25GHz

802.11b - Conducted Spurious Emission Plot on channel 6

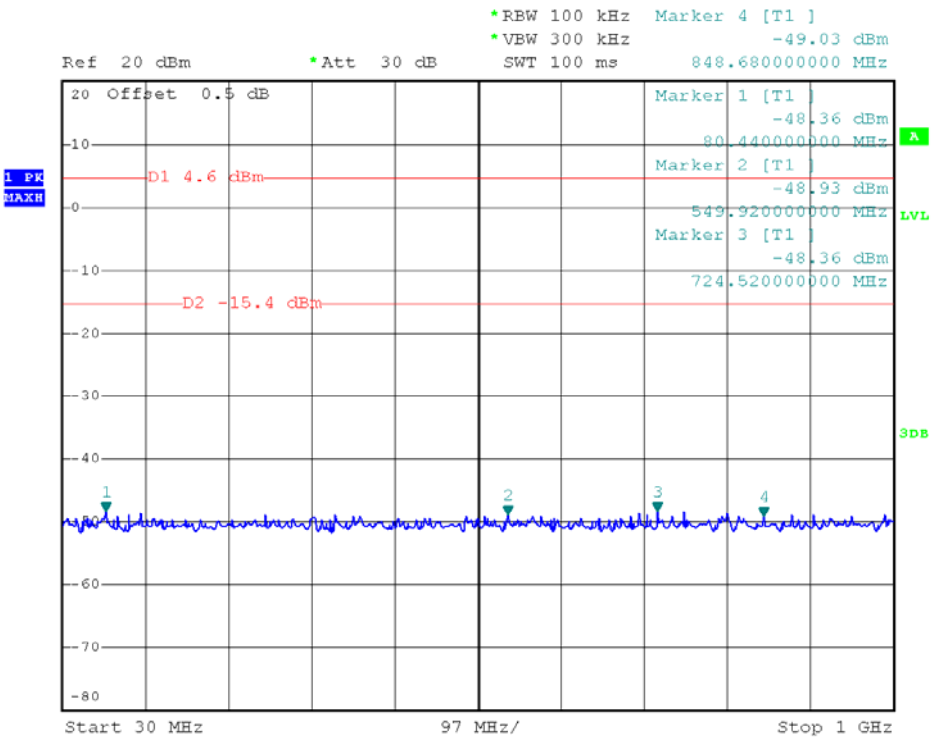


Channel = 6, 30MHz to 1GHz

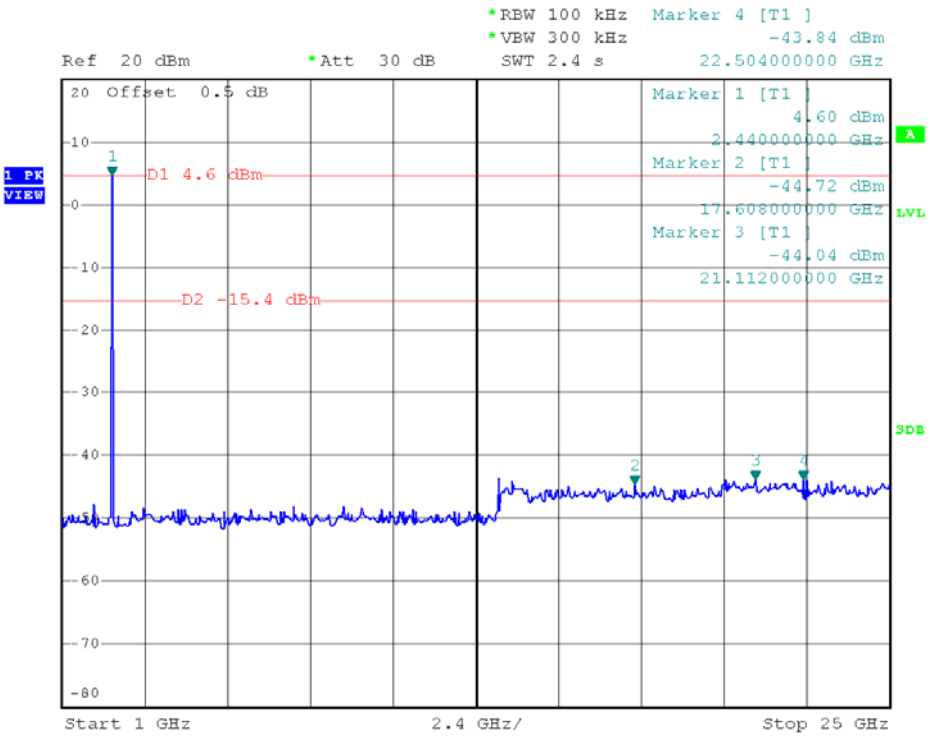


Channel = 6, 1GHz to 25GHz

802.11b - Conducted Spurious Emission Plot on channel 11

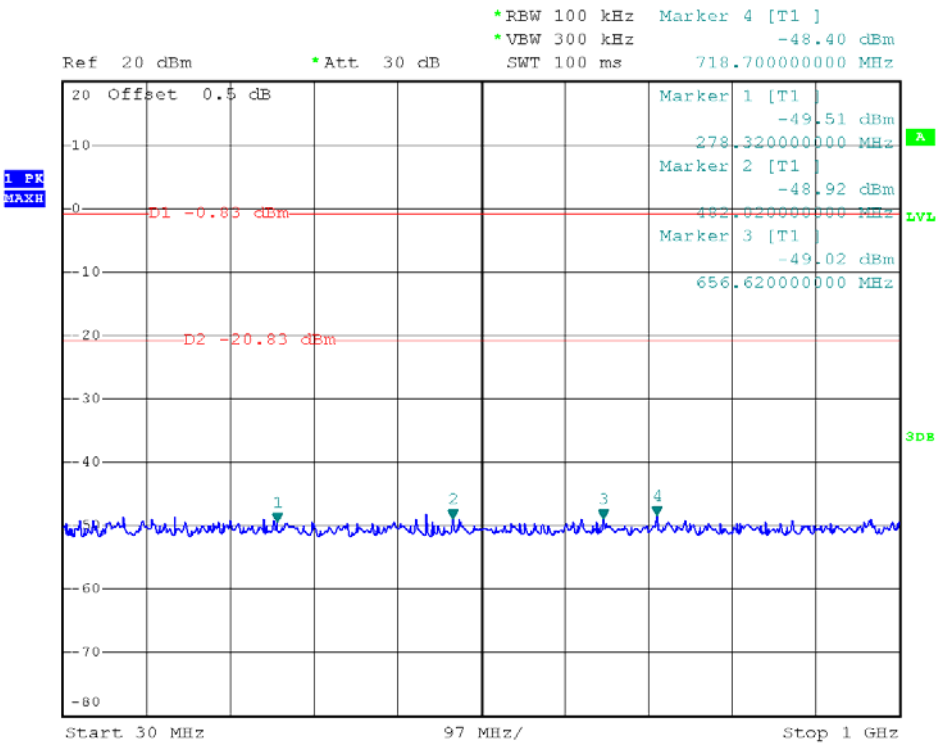


Channel = 11, 30MHz to 1GHz

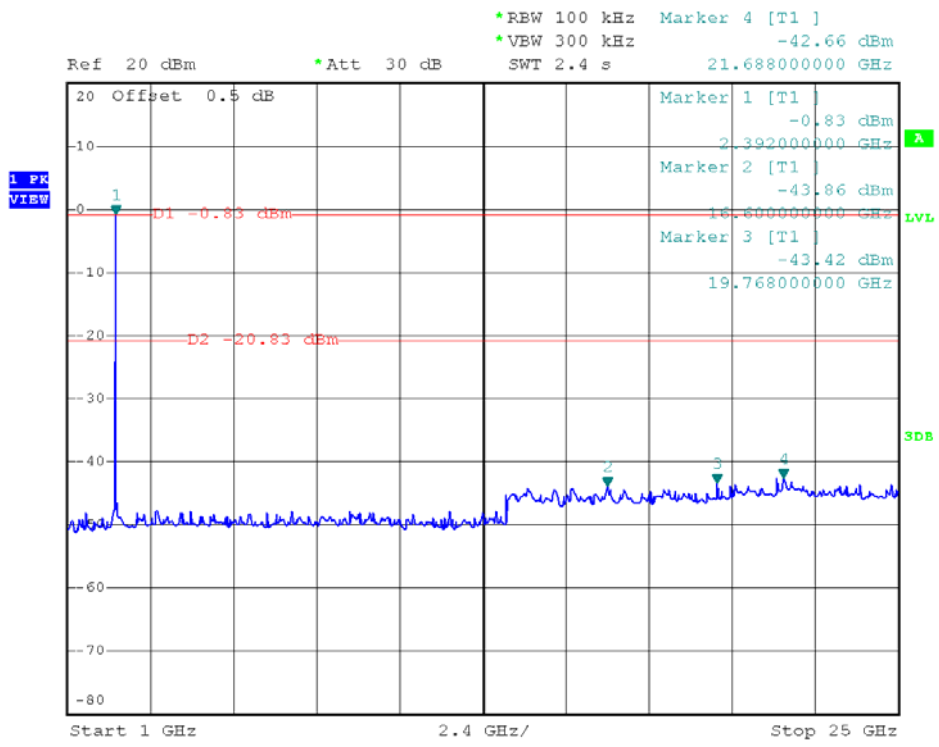


Channel = 11, 1GHz to 25GHz

802.11g - Conducted Spurious Emission Plot on channel 1

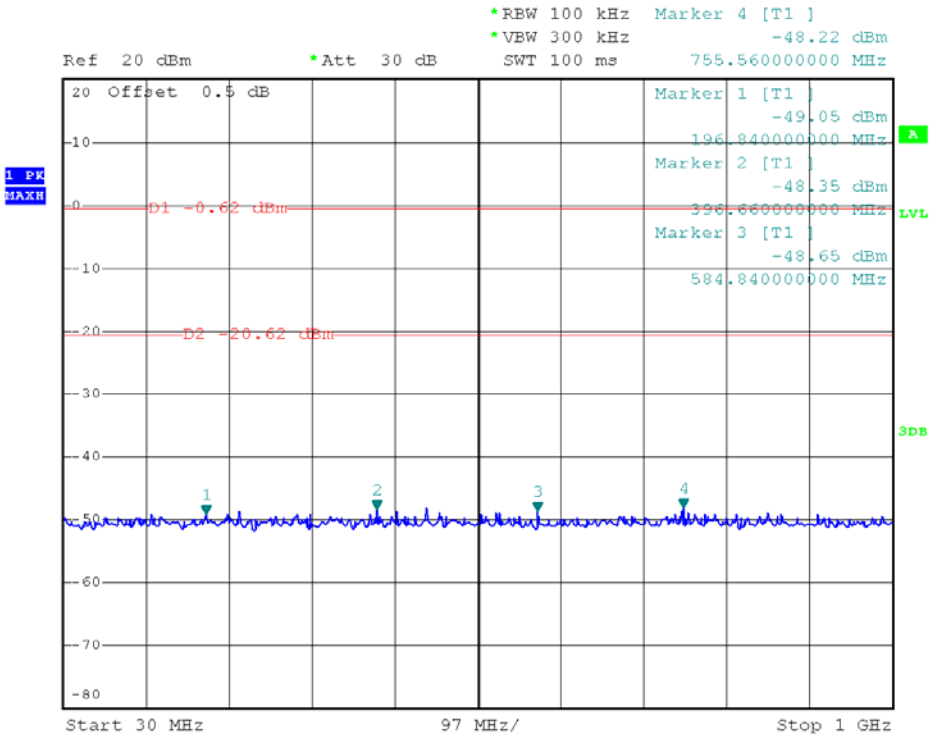


Channel = 1, 30MHz to 1GHz

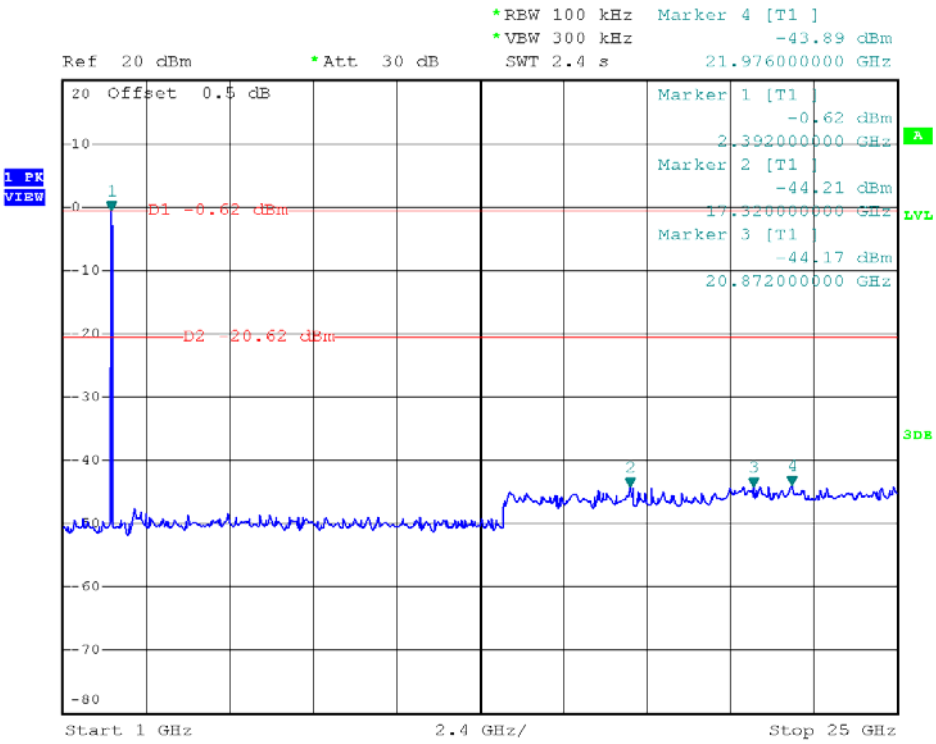


Channel = 1, 1GHz to 25GHz

802.11g - Conducted Spurious Emission Plot on channel 6

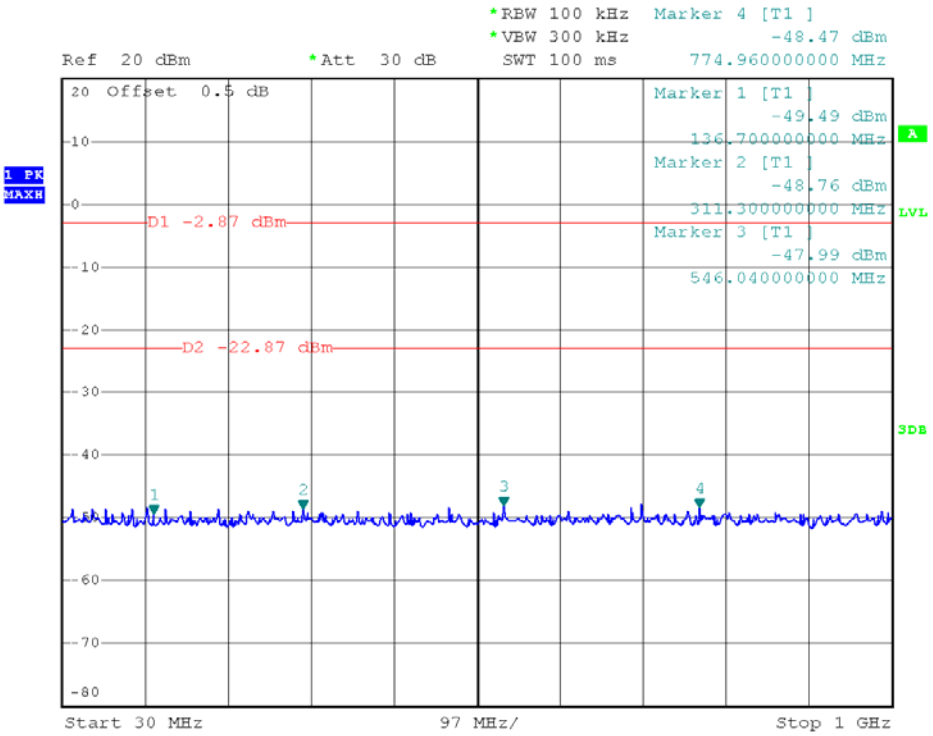


Channel = 6, 30MHz to 1GHz

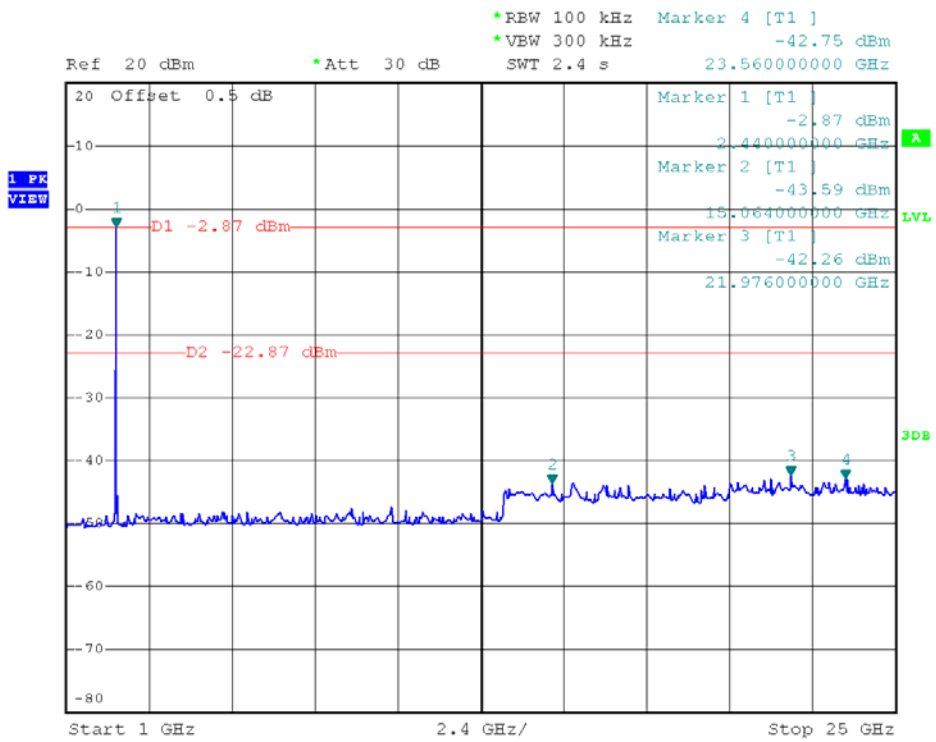


Channel = 6, 1GHz to 25GHz

802.11g - Conducted Spurious Emission Plot on channel 11

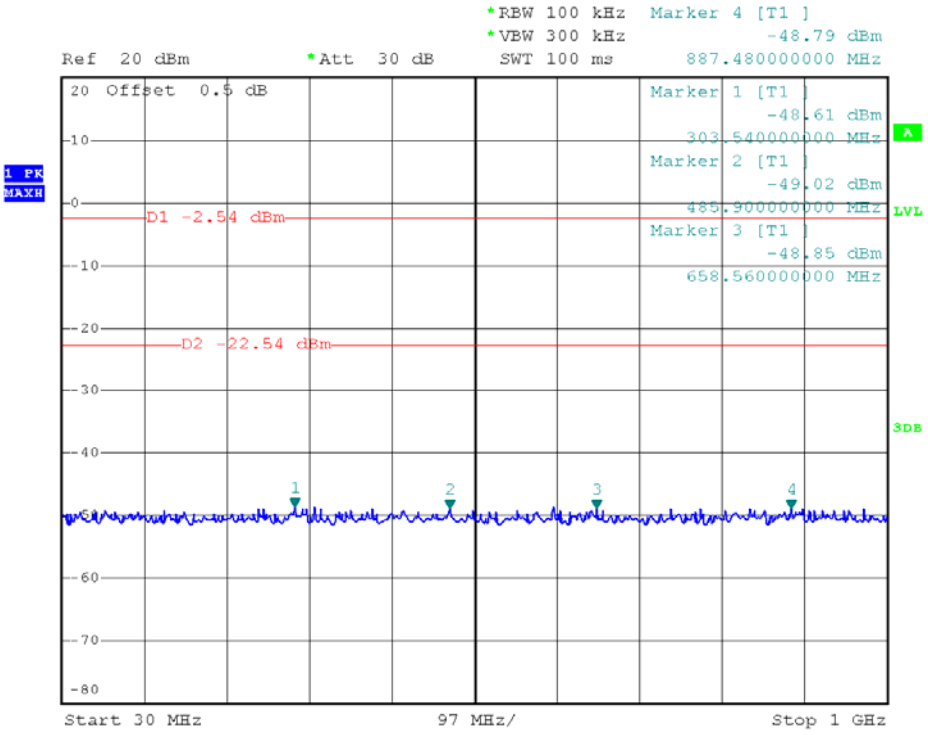


Channel = 11, 30MHz to 25GHz

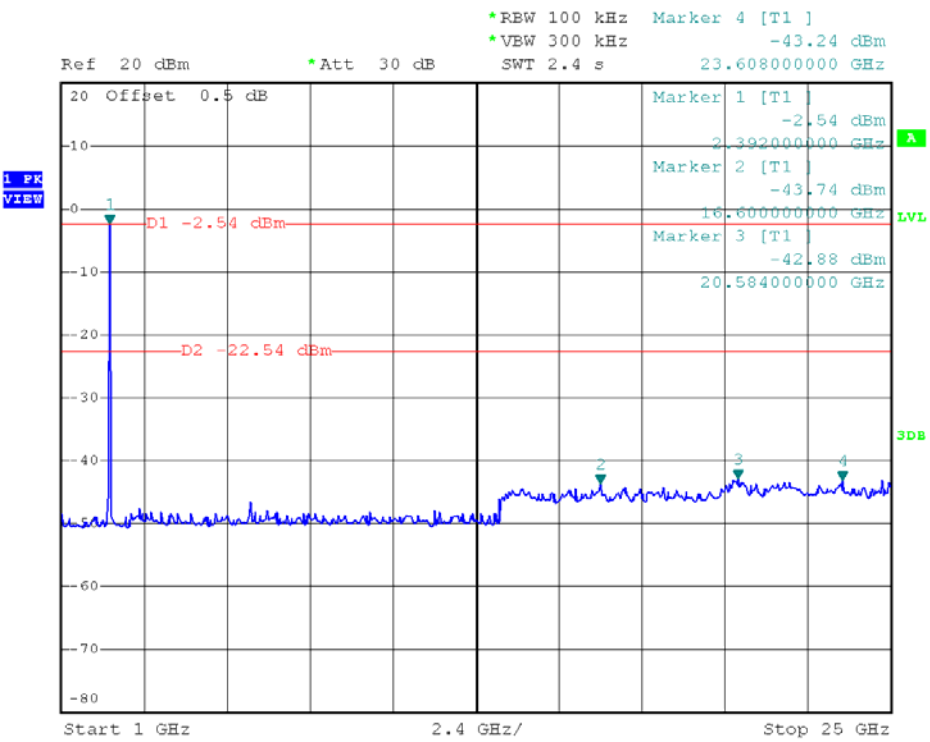


Channel = 11, 30MHz to 25GHz

802.11n20 - Conducted Spurious Emission Plot on channel 1

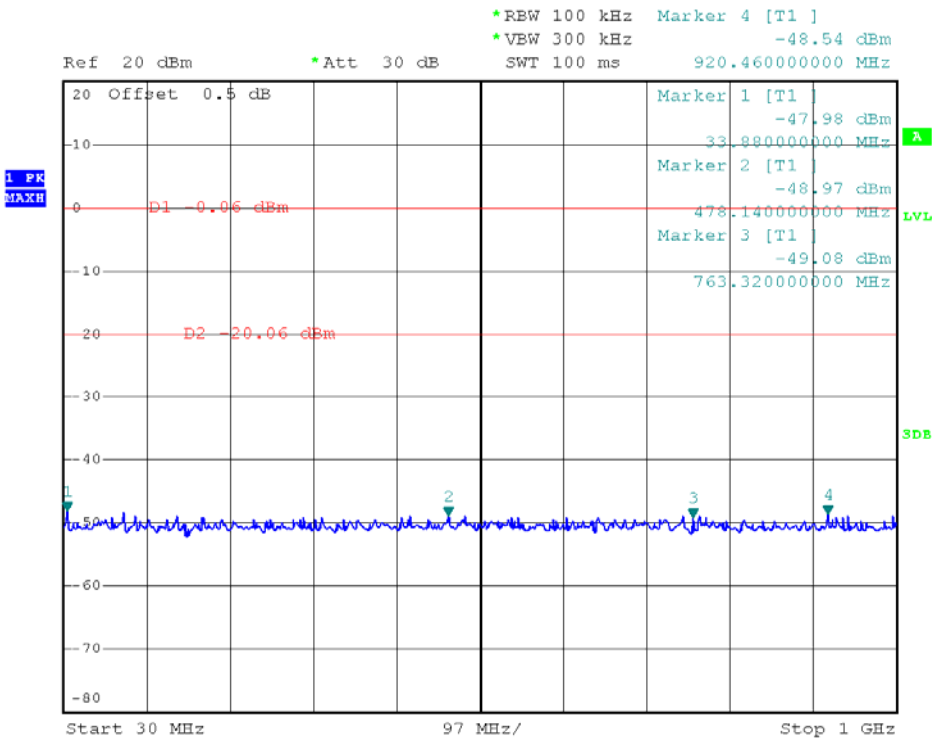


Channel = 1, 30MHz to 1GHz

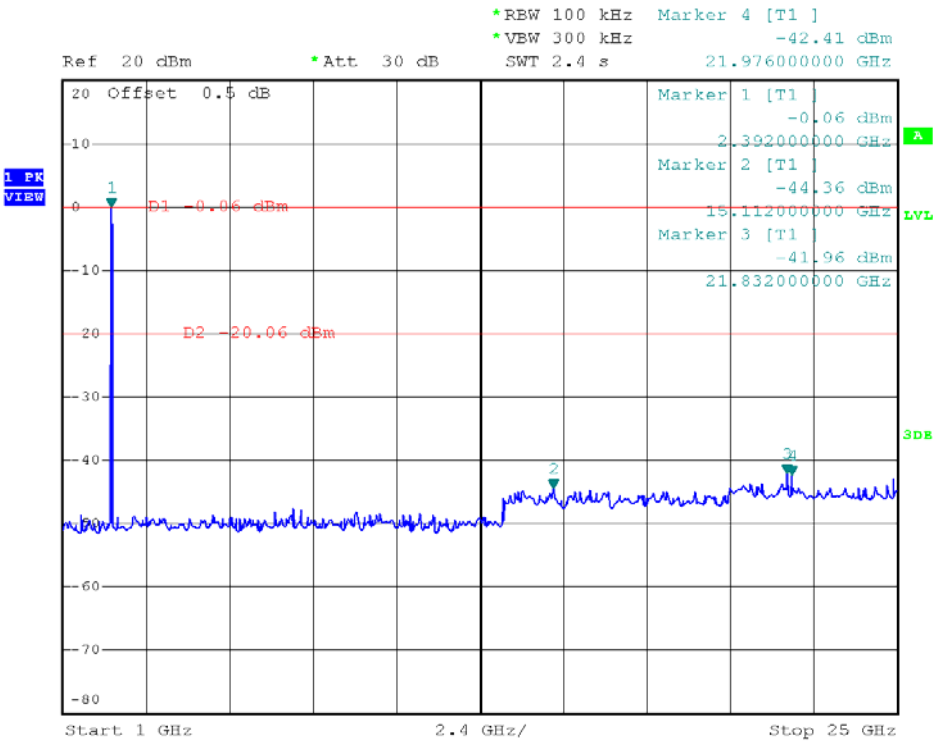


Channel = 1, 1GHz to 25GHz

802.11n20 - Conducted Spurious Emission Plot on channel 6

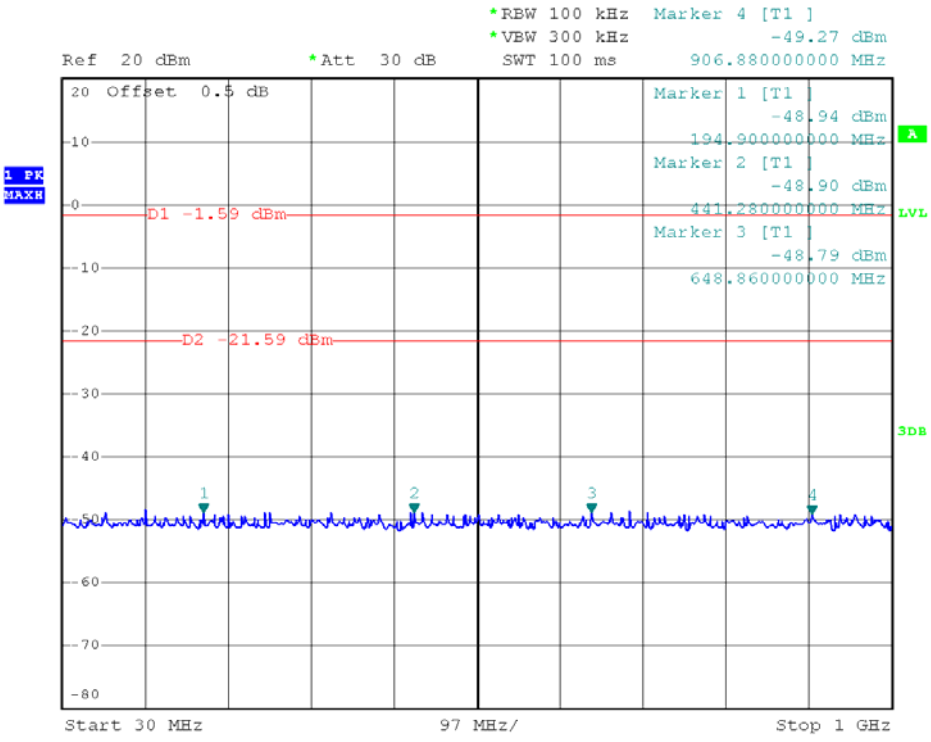


Channel = 6, 30MHz to 1GHz

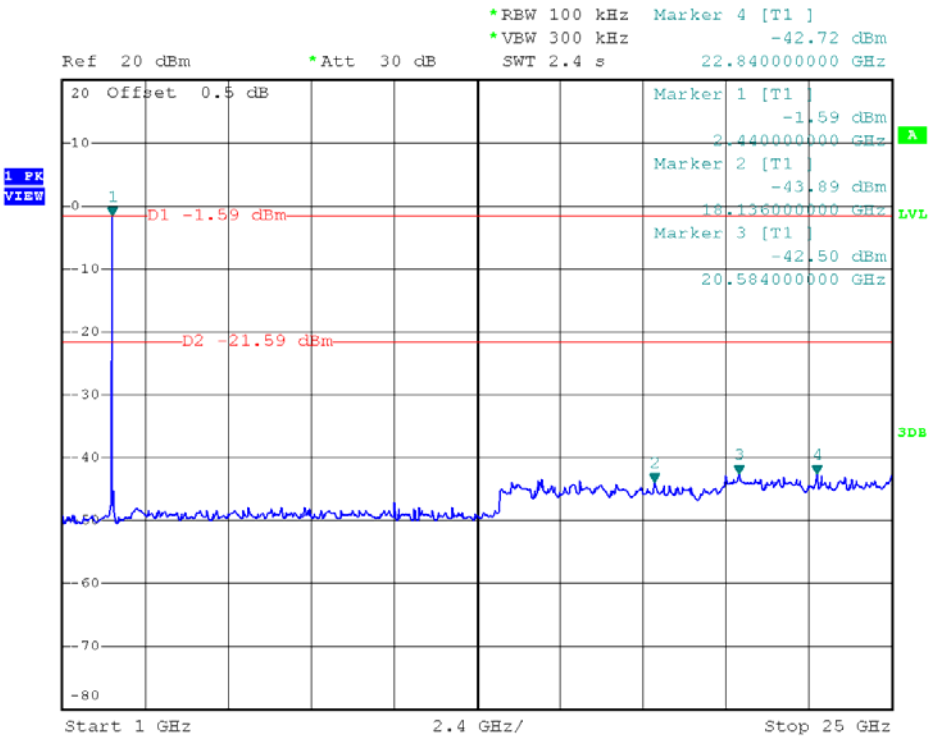


Channel = 6, 1GHz to 25GHz

802.11n20 - Conducted Spurious Emission Plot on channel 11

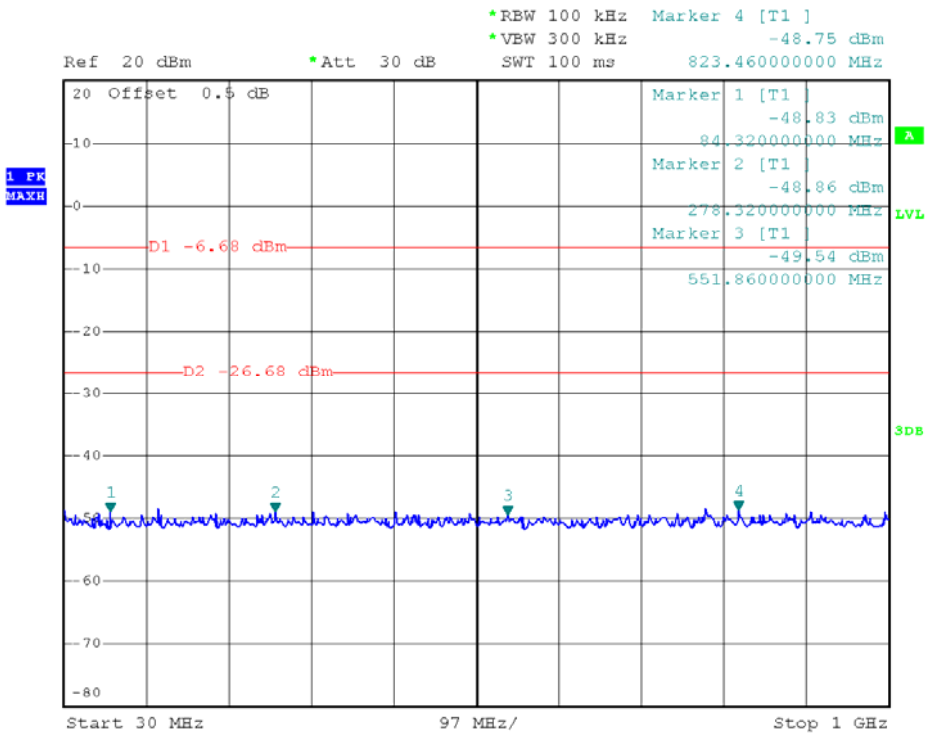


Channel = 11, 30MHz to 25GHz

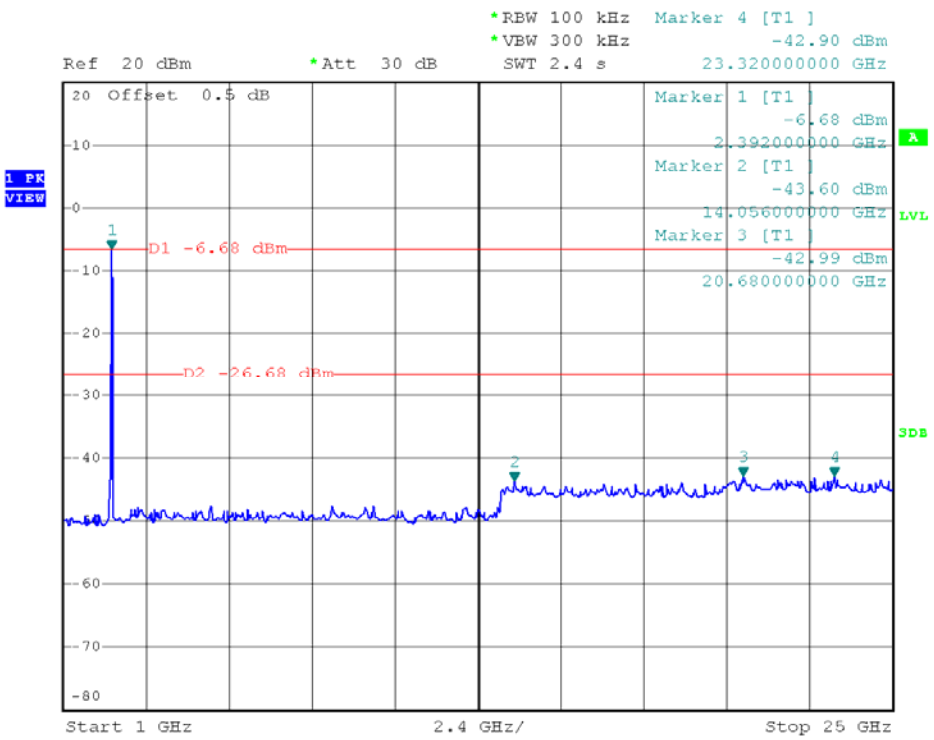


Channel = 11, 30MHz to 25GHz

802.11n40 - Conducted Spurious Emission Plot on channel 3

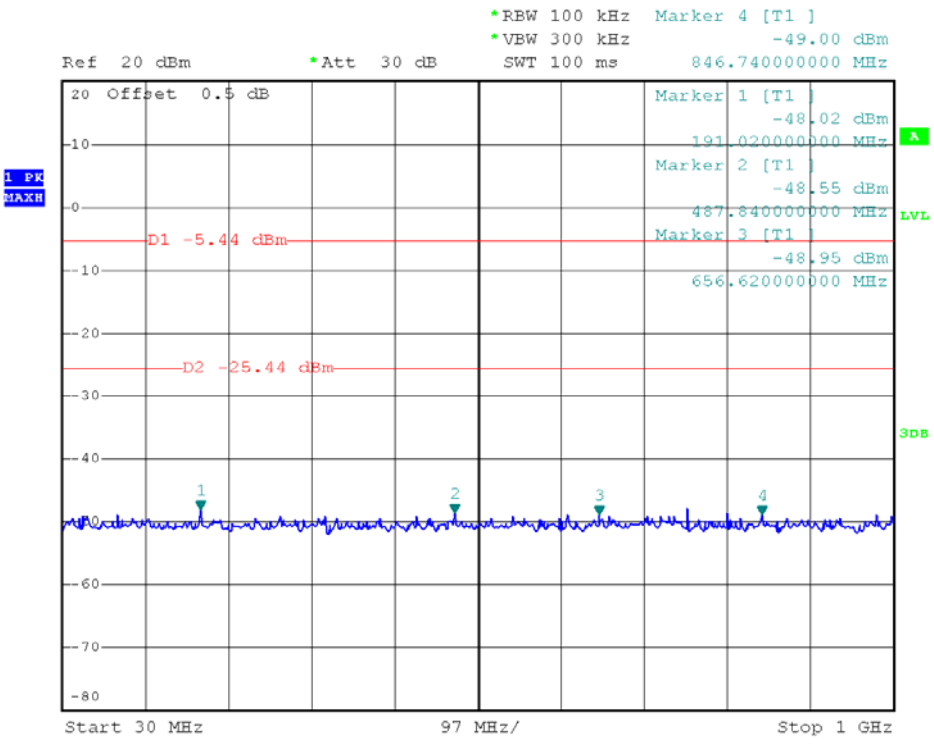


Channel = 3, 30MHz to 1GHz

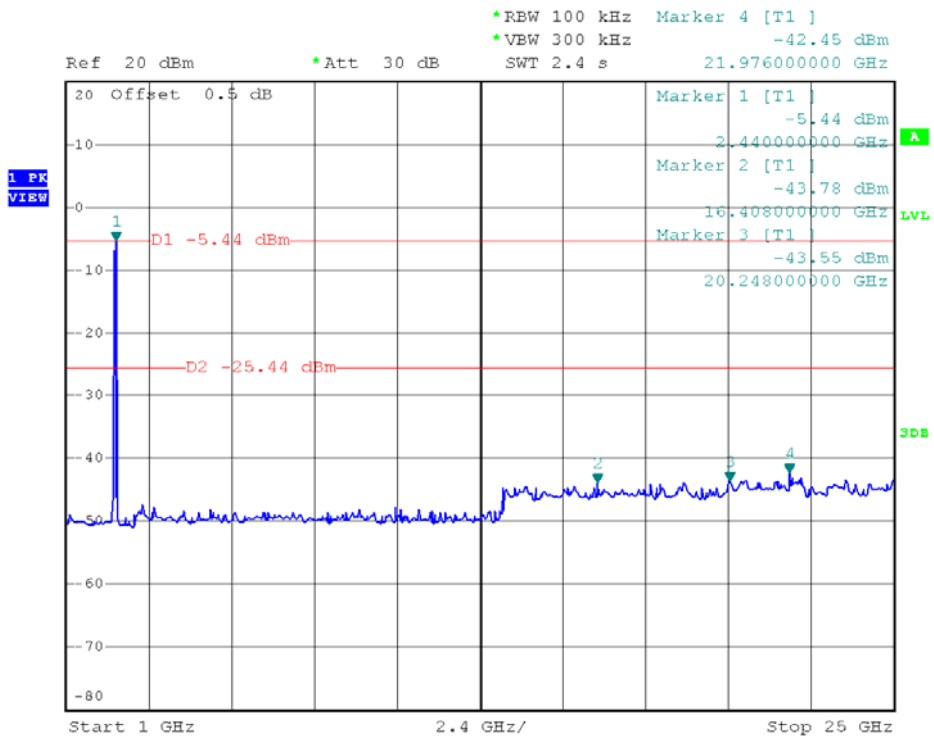


Channel = 3, 1GHz to 25GHz

802.11n40 - Conducted Spurious Emission Plot on channel 6

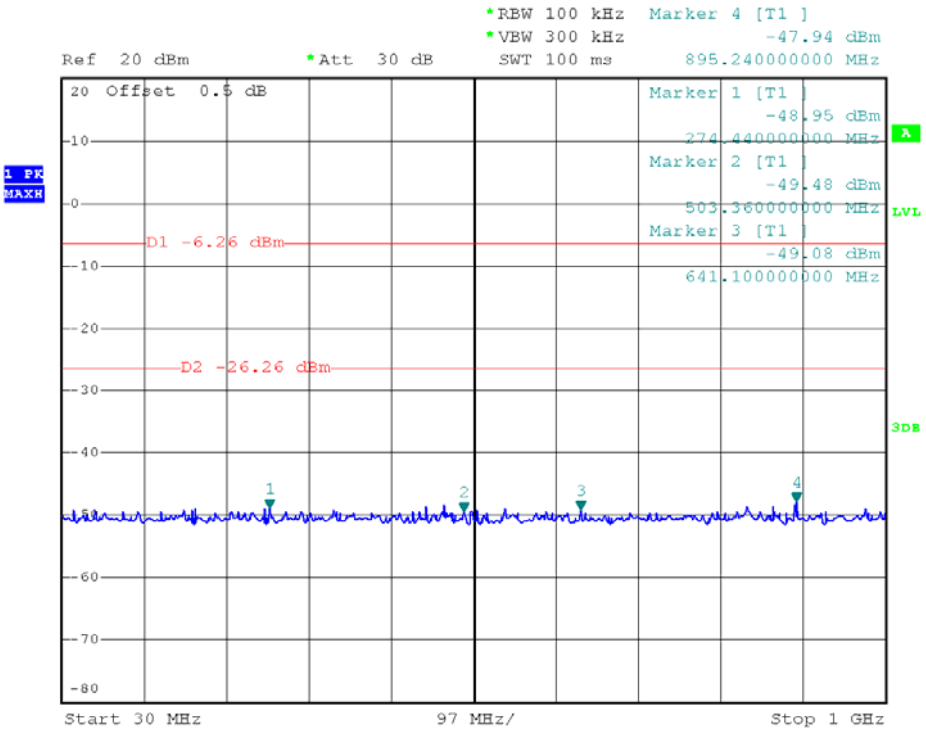


Channel = 6, 30MHz to 1GHz

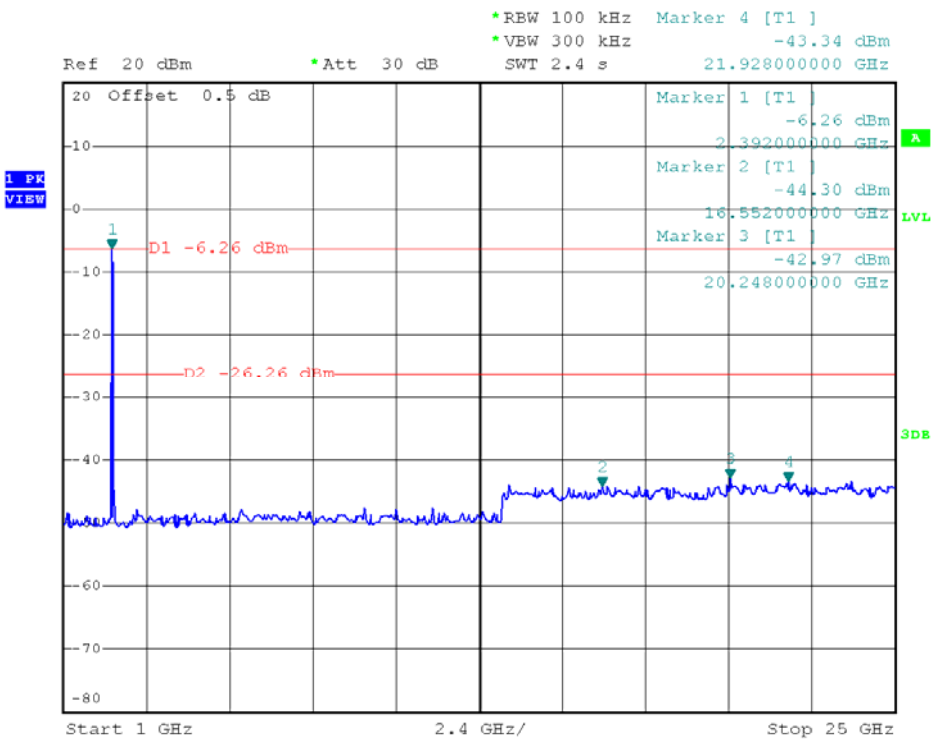


Channel = 6, 1GHz to 25GHz

802.11n40 - Conducted Spurious Emission Plot on channel 9



Channel = 9, 30MHz to 1GHz



Channel = 9, 1GHz to 25GHz

2.5. Power spectral density (PSD)

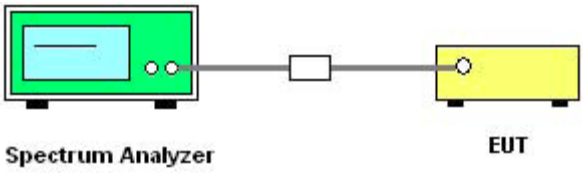
2.5.1. Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

2.5.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.5.3. Test Setup



2.5.4. Test Procedures

1. The testing follows Measurement Procedure 10.2 Method PKPSD of FCC KDB558074 D01 v03r05.

2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

3. Set to the maximum power setting and enable the EUT transmit continuously.

4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)

5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.

6. Measure and record the results in the test report.

7. The Measured power density (dBm)/ 100kHz is a reference level and used as 20dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

2.5.5. Test Results of Power spectral density

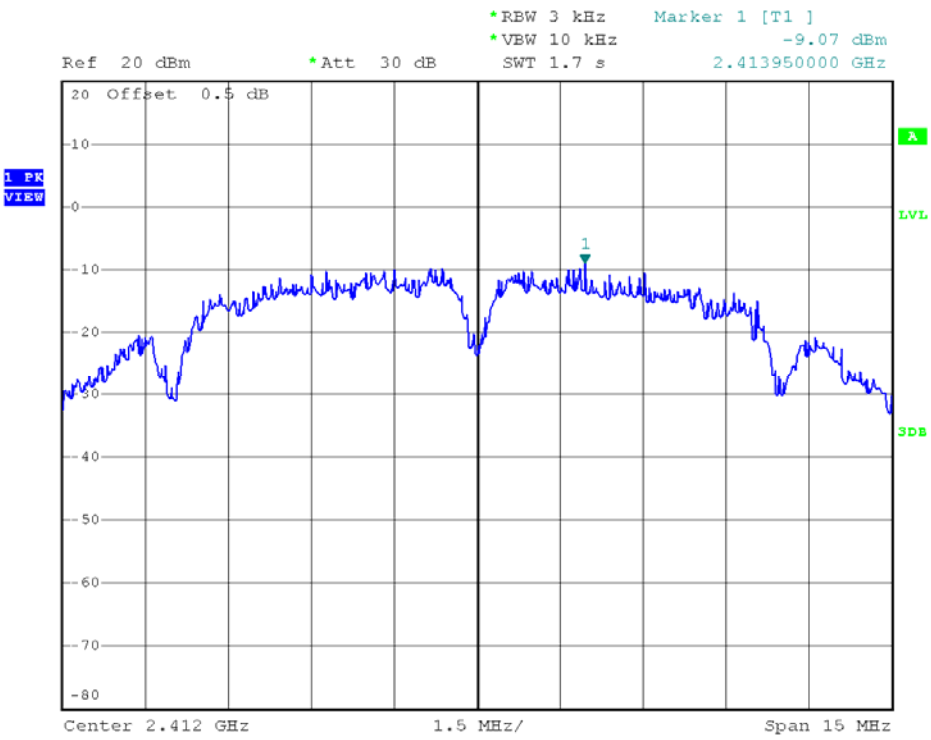
Spectral power density (dBm)					
Test mode	Channel	Frequency (MHz)	PSD/3kHz (dBm)	Limit (dBm/3kHz)	Verdict
802.11b	1	2412	-9.07	8	PASS
	6	2437	-7.85		PASS
	11	2462	-8.05		PASS
802.11g	1	2412	-15.00		PASS
	6	2437	-12.57		PASS
	11	2462	-13.02		PASS
802.11n20	1	2412	-14.65		PASS
	6	2437	-13.77		PASS
	11	2462	-14.89		PASS
802.11n40	3	2422	-21.26		PASS
	6	2437	-18.32		PASS
	9	2452	-18.40c		PASS
Measurement uncertainty: ±1.3dB					

Note:

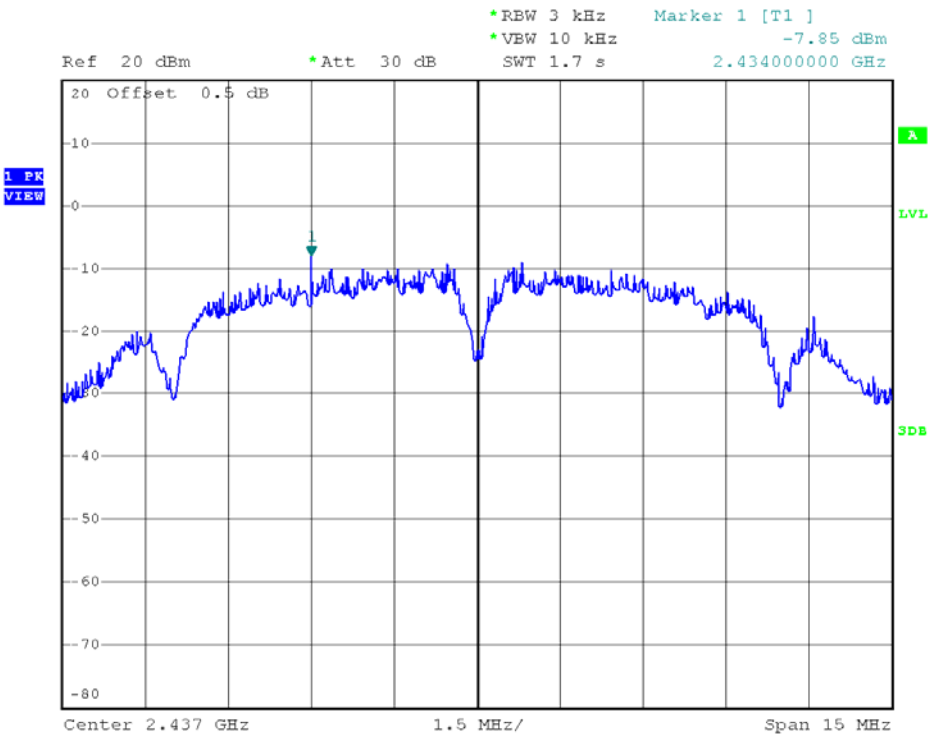
1. Measured power density (dBm) has offset with cable loss.

2.5.6. Test Results (plots) of Power spectral density

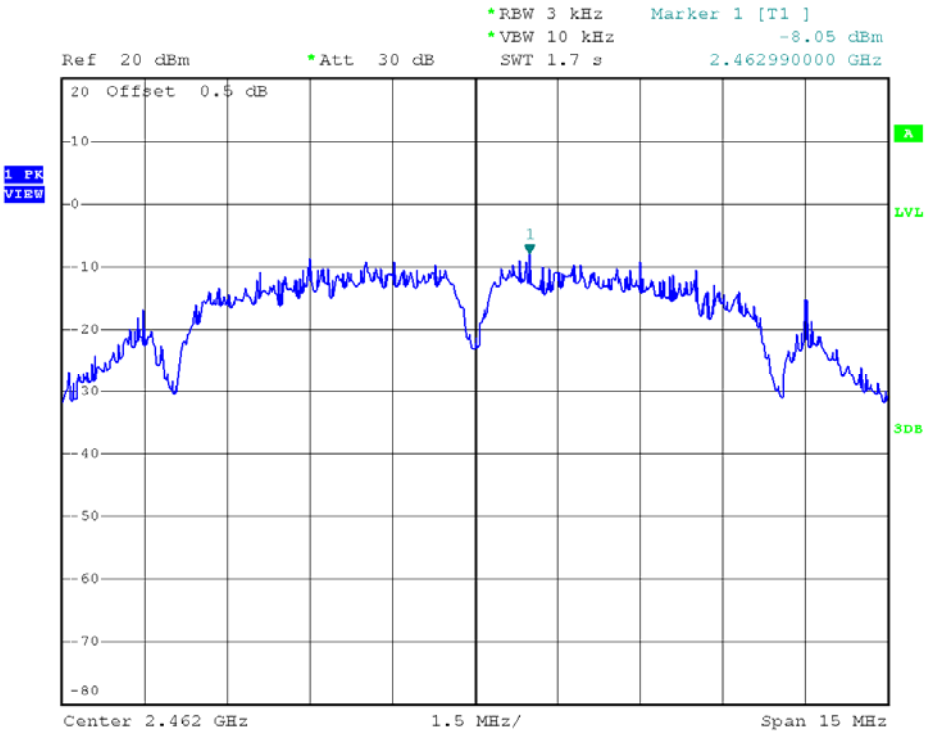
802.11b - Channel 1



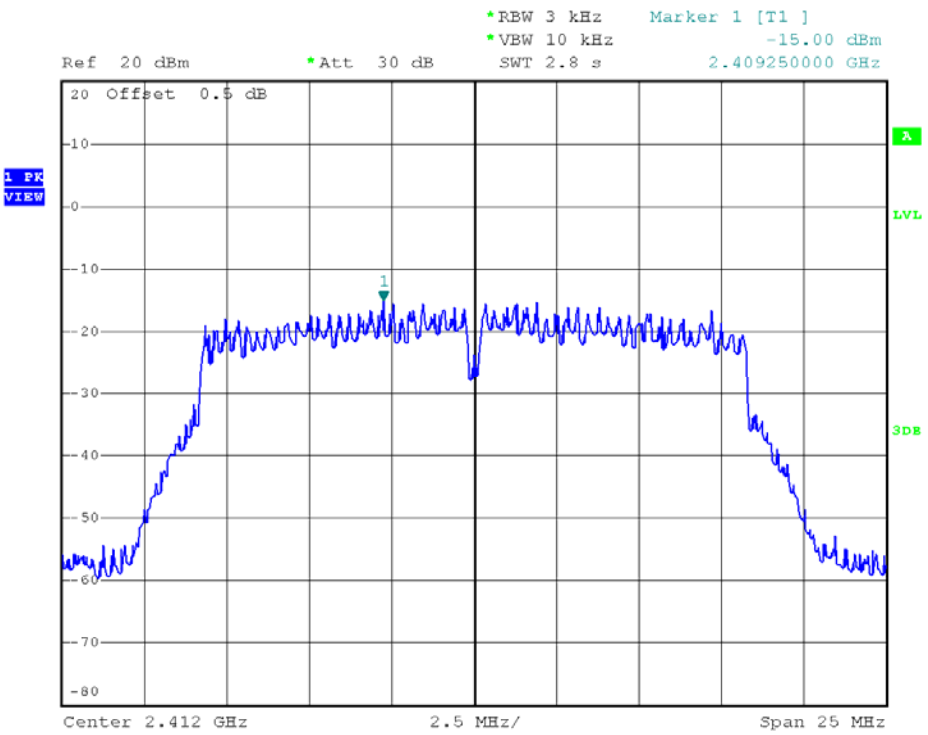
802.11b - Channel 6



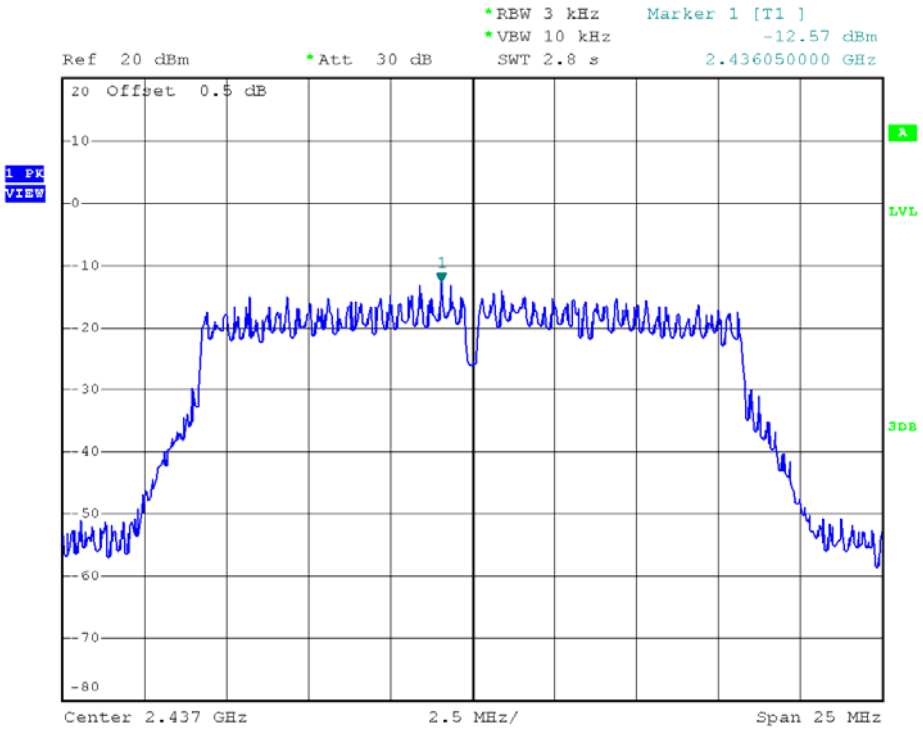
802.11b - Channel 11



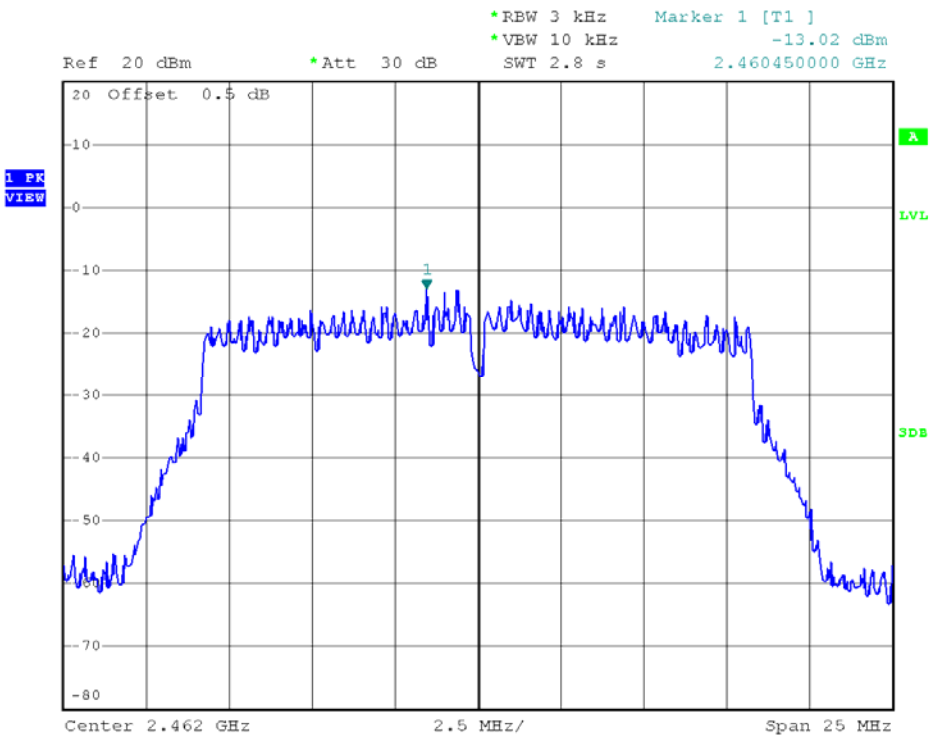
802.11g - Channel 1



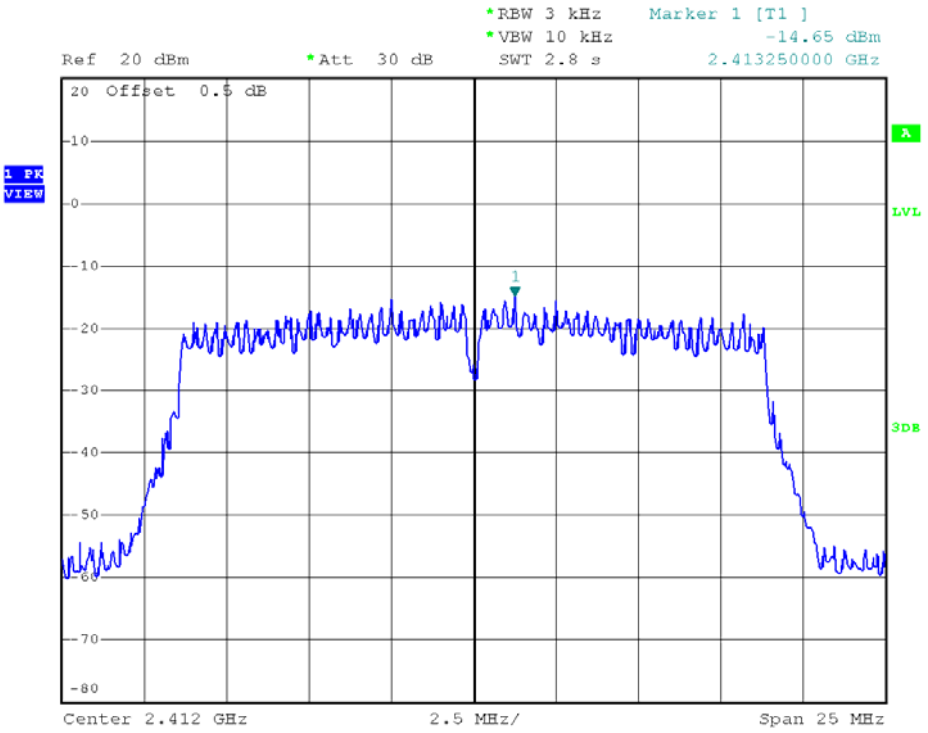
802.11g - Channel 6



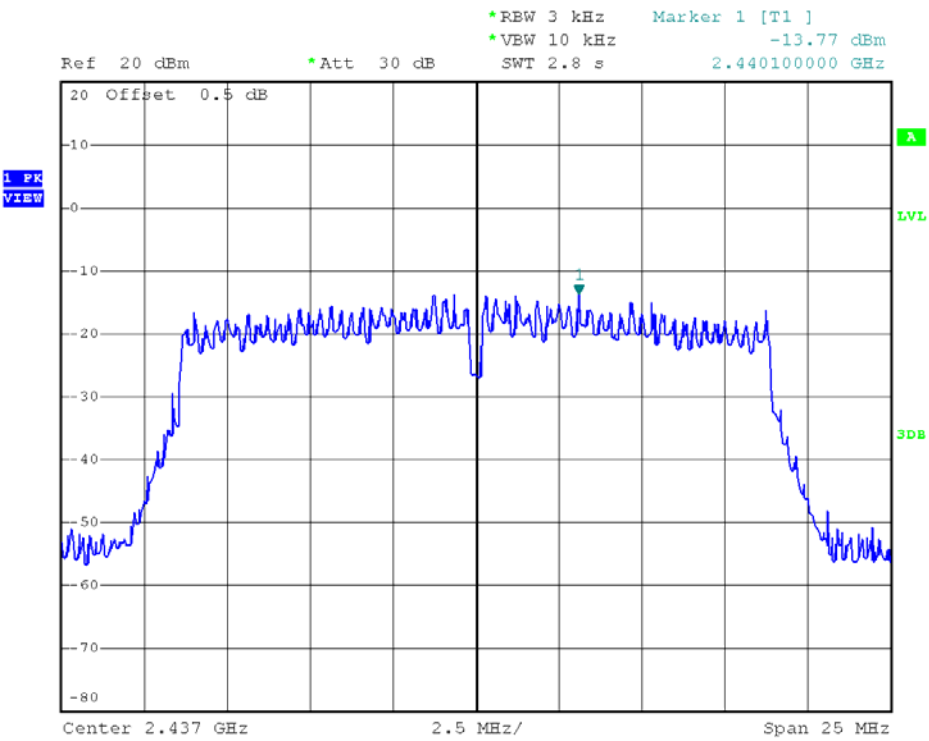
802.11g - Channel 11



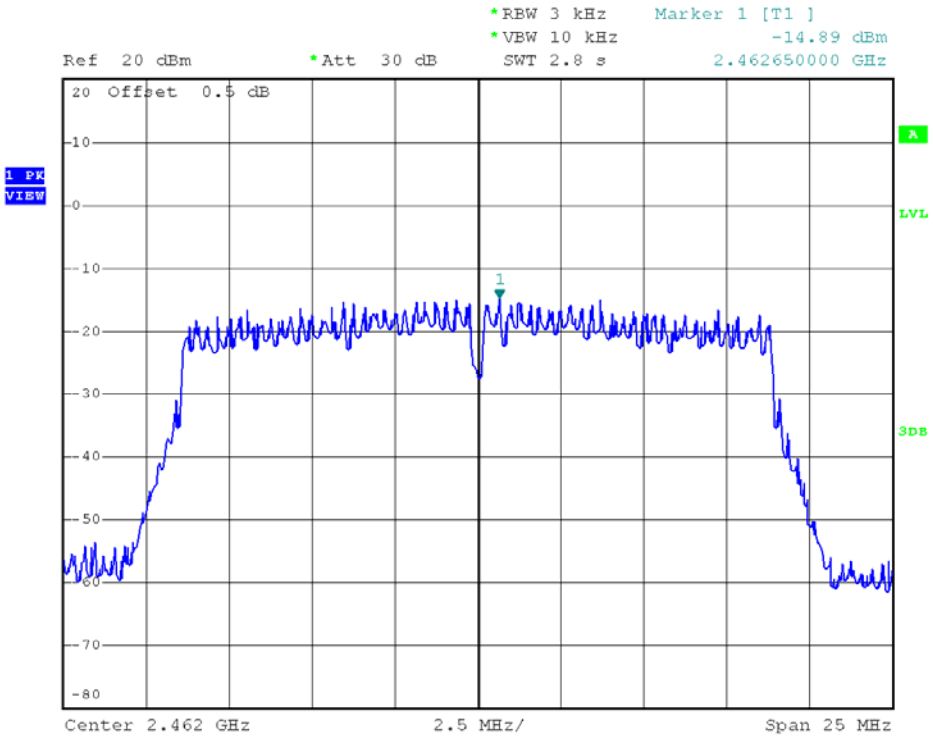
802.11n20 - Channel 1



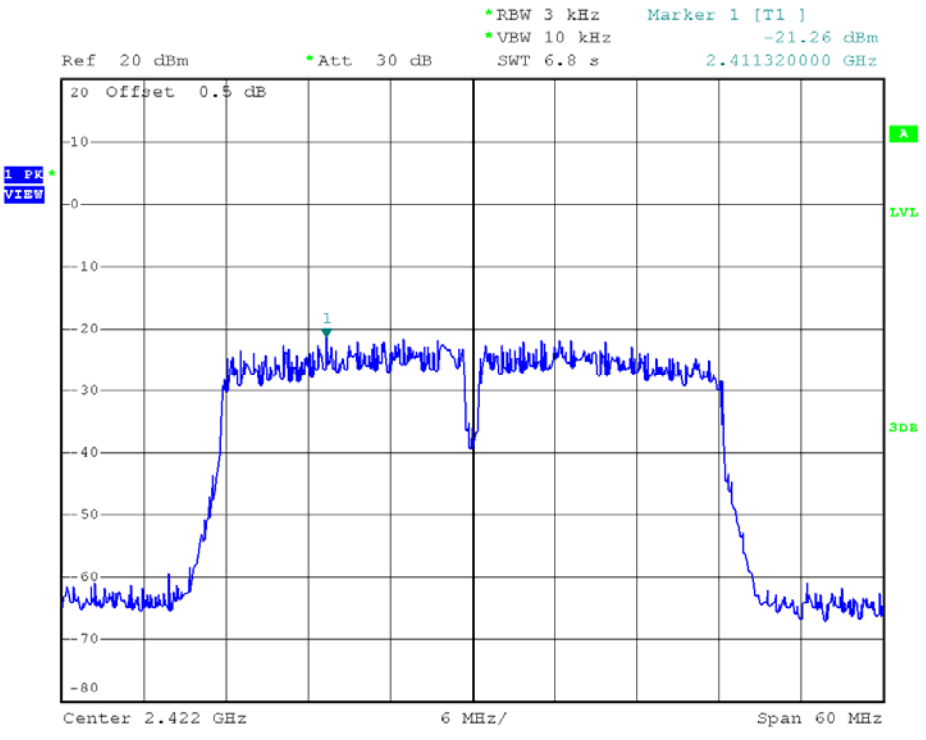
802.11n20 - Channel 6



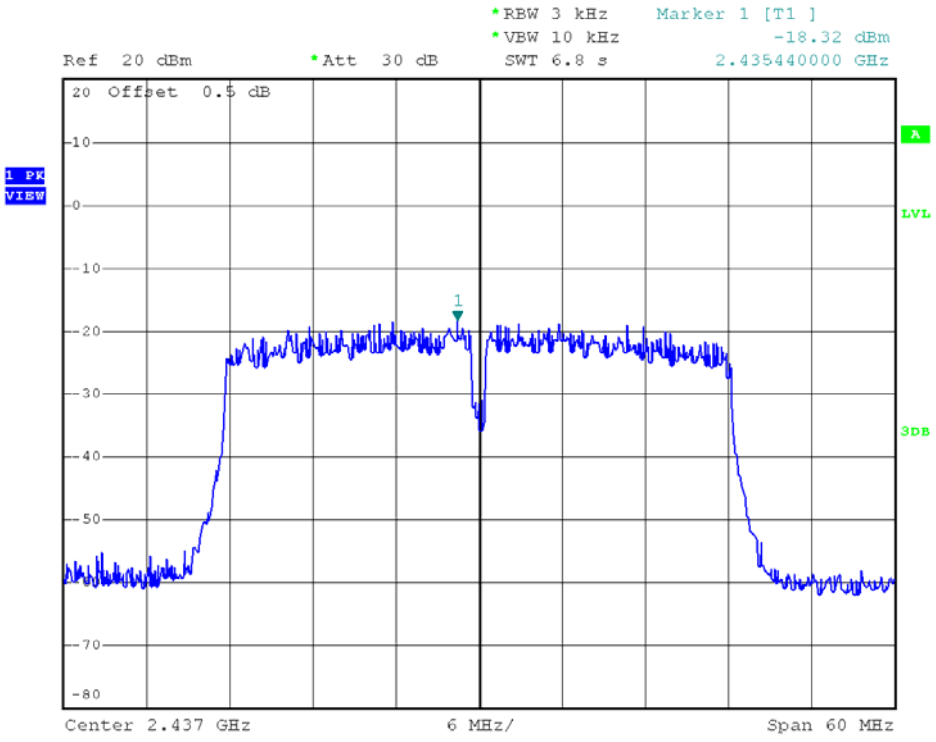
802.11n20 - Channel 11



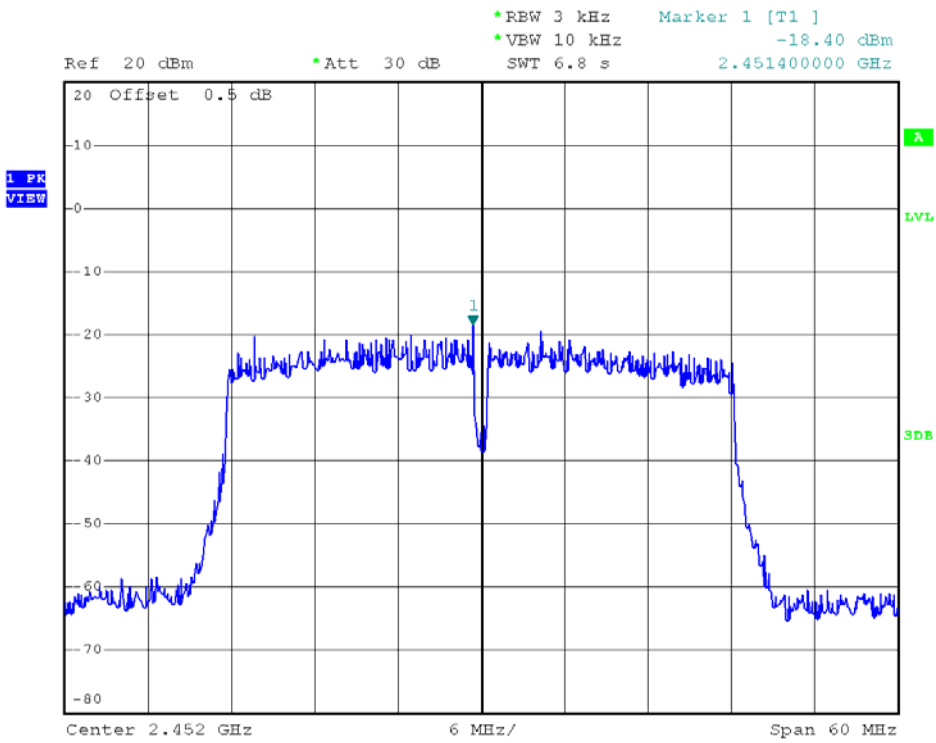
802.11n40 - Channel 3



802.11n40 - Channel 6



802.11n40 - Channel 9



2.6. Radiated Band Edge and Spurious Emission

2.6.1. Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

Note: Wireless charger configuration was evaluated.

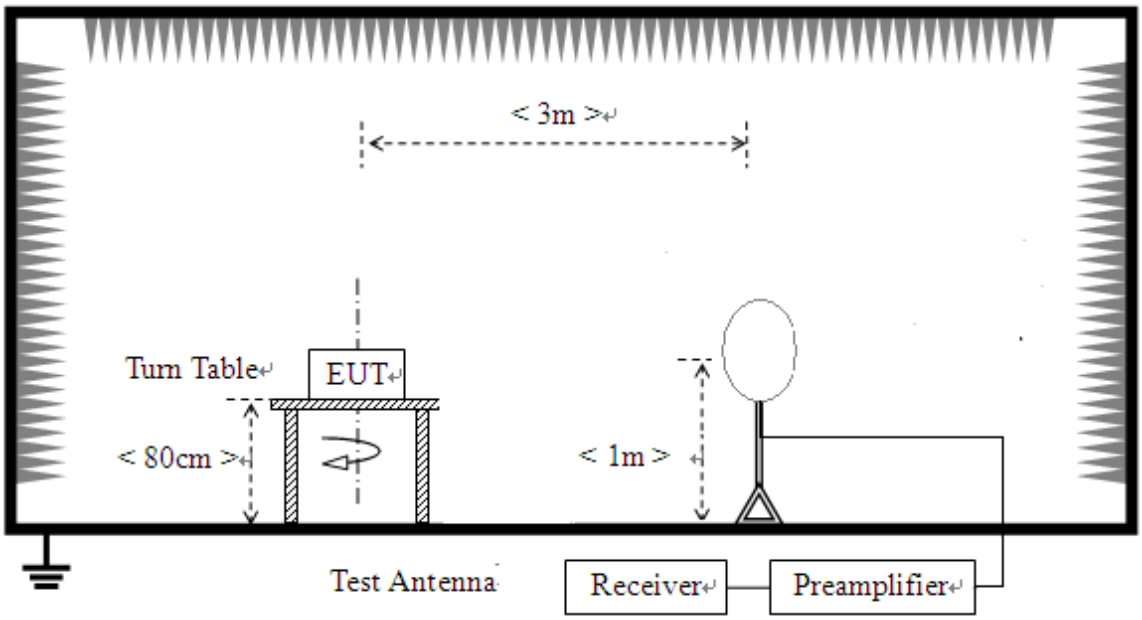
Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

2.6.2. Measuring Instruments

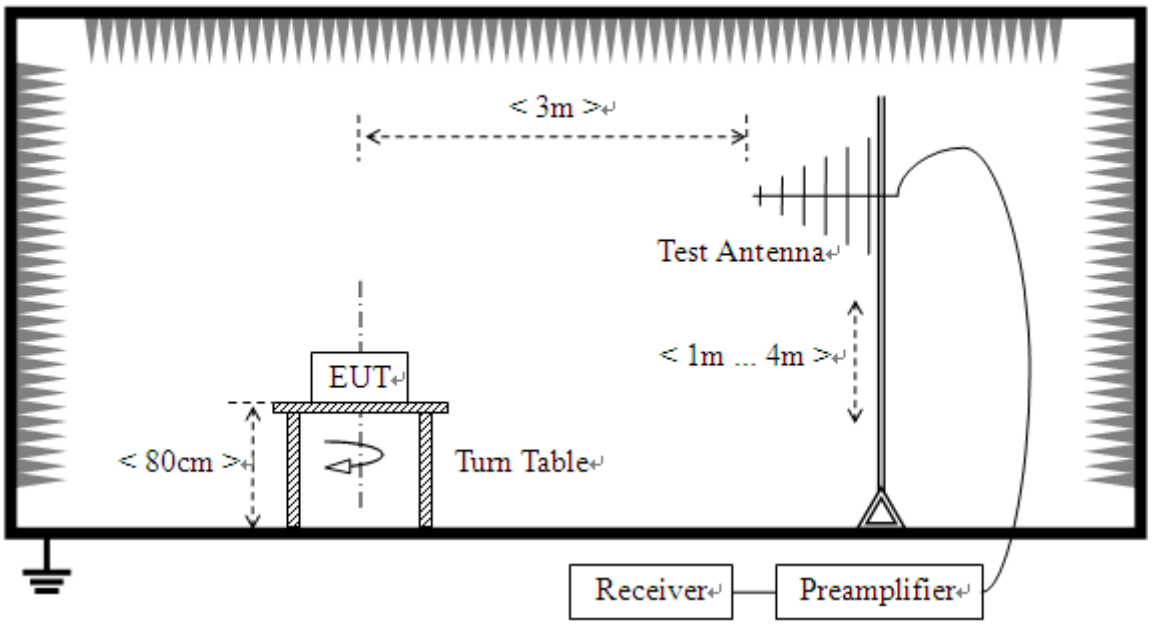
The measuring equipment is listed in the section 3 of this test report.

2.6.3. Test Setup

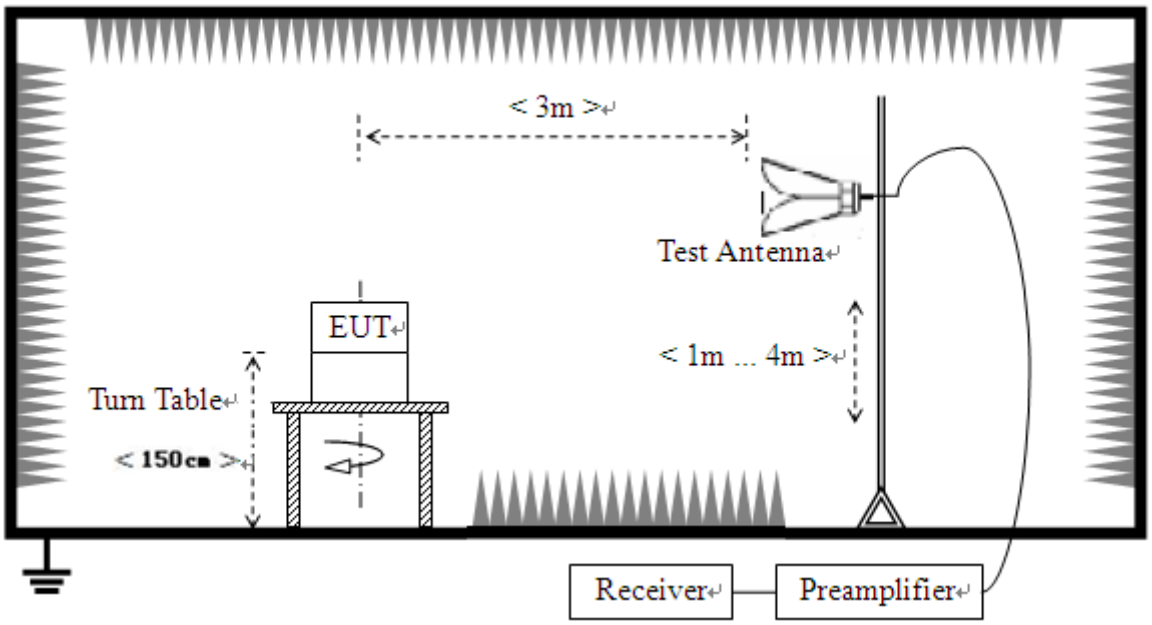
For radiated emissions from 9 KHz to 30 MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



2.6.4. Test Procedures

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meters semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. Height of receiving 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.
4. 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.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported.
   Otherwise the emissions would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
7. 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:

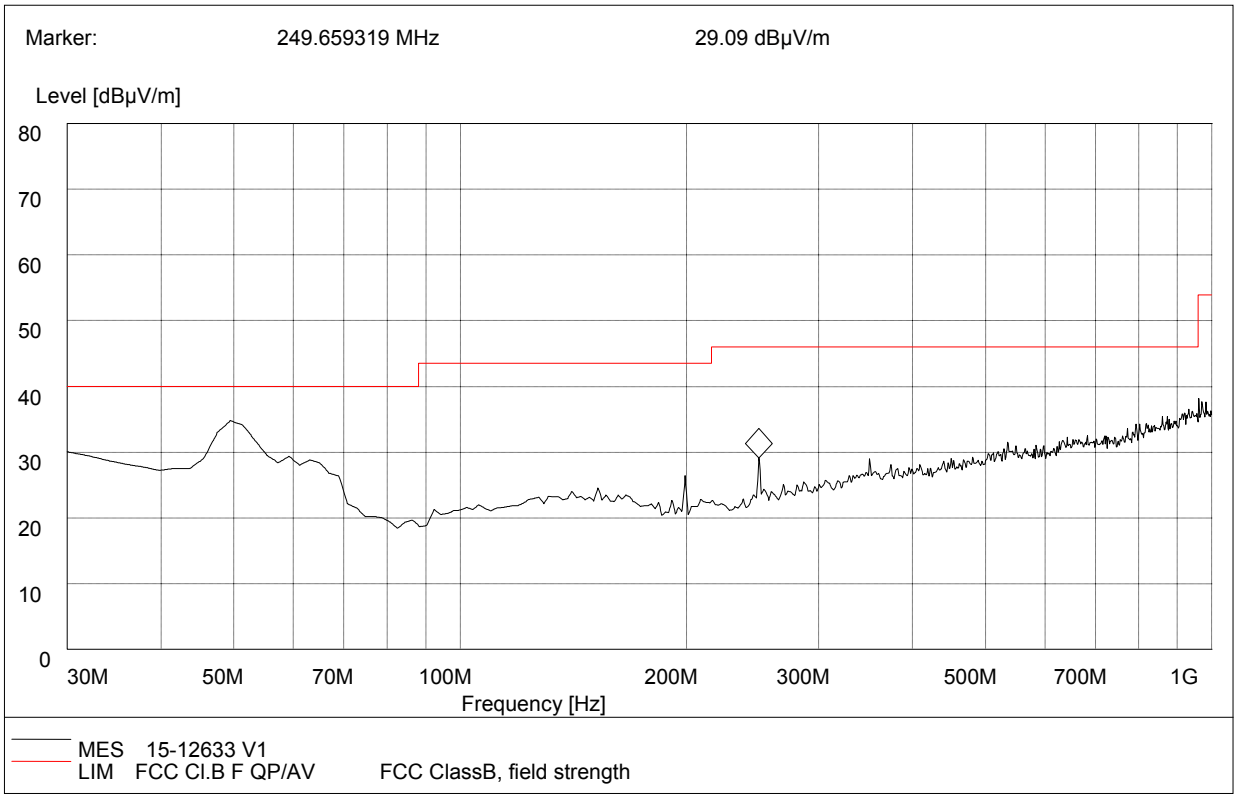
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is≥ 1/T (Duty cycle < 98%) or 10Hz(Duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

2.6.5. Test Results of Radiated Band Edge and Spurious Emission

For 9 kHz to 30MHz

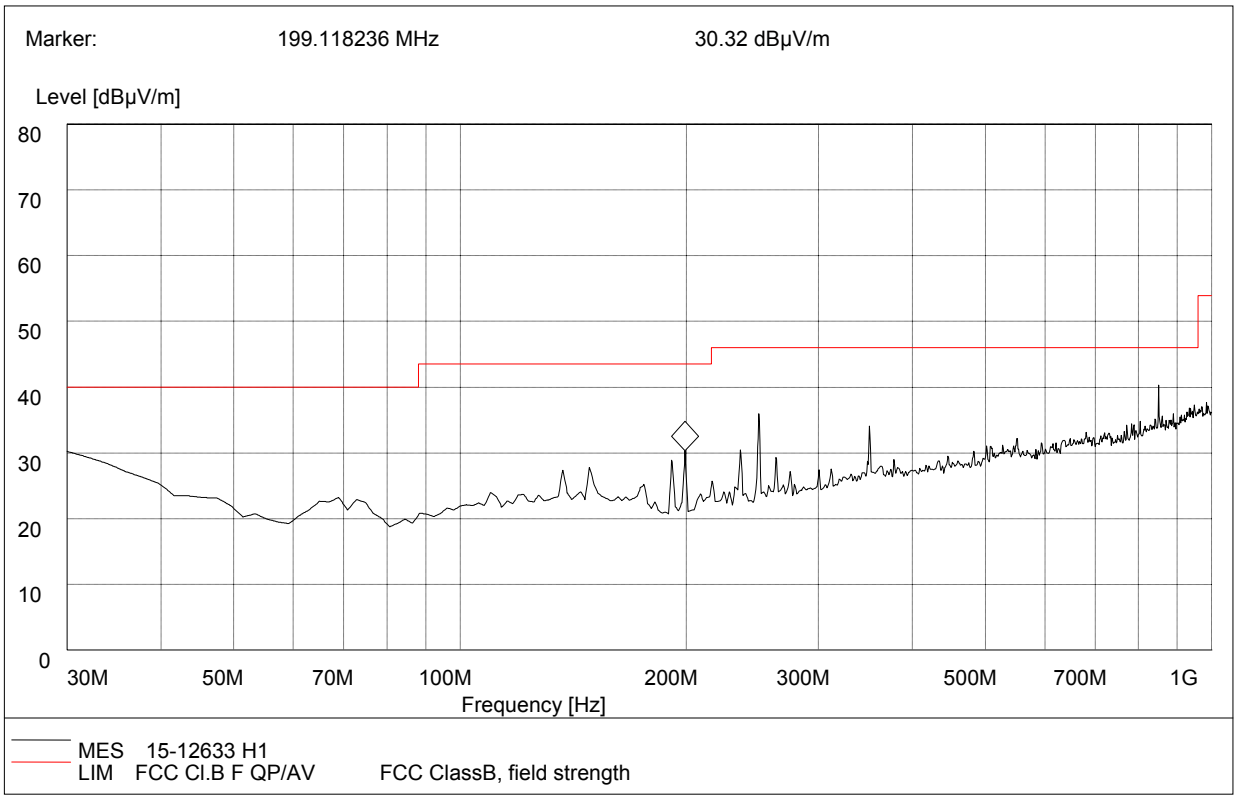
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

For 30MHz to 1000 MHz



30MHz to 1GHz, Antenna Vertical

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dBµV/m)	Antenna	Verdict
49.260	34.92	120.000	100.0	40.00	Vertical	Pass
249.659	29.09	120.000	100.0	46.00	Vertical	Pass



30MHz to 1GHz, Antenna Horizontal

Frequency (MHz)	QuasiPeak (dB µ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB µ V/m)	Antenna	Verdict
199.118	30.32	120.000	100.0	43.5	Horizontal	Pass
249.360	37.15	120.000	100.0	46.0	Horizontal	Pass
850.360	40.19	120.000	100.0	46.0	Horizontal	Pass

For 1GHz to 25 GHz

Mode: b (Worst Case)

L Channel (2412MHz) (b mode worst case)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（802.11b--2412MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2412.00	108.63	PK	/	/	1.00 H	118	112.03	28.30	4.90	36.60
1	*2412.00	97.89	AV	/	/	1.00 H	118	101.29	28.30	4.90	36.60
2	4824.00	51.52	PK	74.00	22.48	1.00 H	24	48.32	32.70	7.00	36.50
2	4824.00	45.84	AV	54.00	8.16	1.00 H	24	42.64	32.70	7.00	36.50
3	7236.00	50.27	PK	74.00	23.73	1.00 H	107	40.87	35.80	8.90	35.30
3	7236.00	42.98	AV	54.00	11.02	1.00 H	107	33.58	35.80	8.90	35.30
4	9648.00	50.11	PK	74.00	23.89	1.00 H	39	37.51	37.20	10.20	34.80
4	9648.00	44.37	AV	54.00	9.63	1.00 H	39	31.77	37.20	10.20	34.80

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（802.11b--2412MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2412.00	108.95	PK	/	/	1.00 V	109	112.35	28.30	4.90	36.60
1	*2412.00	98.40	AV	/	/	1.00 V	109	101.80	28.30	4.90	36.60
2	4824.00	52.07	PK	74.00	21.93	1.00 V	62	48.87	32.70	7.00	36.50
2	4824.00	45.24	AV	54.00	8.76	1.00 V	62	42.04	32.70	7.00	36.50
3	7236.00	50.91	PK	74.00	23.09	1.00 V	349	41.51	35.80	8.90	35.30
3	7236.00	43.59	AV	54.00	10.41	1.00 V	349	34.19	35.80	8.90	35.30
4	9648.00	54.40	PK	74.00	19.60	1.00 V	211	41.80	37.20	10.20	34.80
4	9648.00	45.42	AV	54.00	8.58	1.00 V	211	32.82	37.20	10.20	34.80

M Channel (2437MHz) (b mode worst case)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（802.11b--2437MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2437.00	106.95	PK	/	/	1.00 H	202	110.15	28.30	5.10	-36.60
1	*2437.00	99.28	AV	/	/	1.00 H	202	102.48	28.30	5.10	-36.60
2	4874.00	53.18	PK	74.00	20.82	1.00 H	187	49.78	32.30	7.60	-36.50
2	4874.00	47.42	AV	54.00	6.58	1.00 H	187	44.02	32.30	7.60	-36.50
3	7311.00	53.91	PK	74.00	20.09	1.00 H	107	44.51	36.10	8.60	-35.30
3	7311.00	47.61	AV	54.00	6.39	1.00 H	107	38.21	36.10	8.60	-35.30
4	9748.00	49.28	PK	74.00	24.72	1.00 H	144	36.68	37.20	10.20	-34.80
4	9748.00	42.82	AV	54.00	11.18	1.00 H	144	30.22	37.20	10.20	-34.80

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（802.11b--2437MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2437.00	107.86	PK	/	/	1.00 V	104	111.06	28.30	5.10	-36.60
1	*2437.00	97.23	AV	/	/	1.00 V	104	100.43	28.30	5.10	-36.60
2	4874.00	50.59	PK	74.00	23.41	1.00 V	304	47.19	32.30	7.60	-36.50
2	4874.00	47.37	AV	54.00	6.63	1.00 V	304	43.97	32.30	7.60	-36.50
3	7311.00	49.00	PK	74.00	25.00	1.00 V	203	39.60	36.10	8.60	-35.30
3	7311.00	46.50	AV	54.00	7.50	1.00 V	203	37.10	36.10	8.60	-35.30
4	9748.00	48.79	PK	74.00	25.21	1.00 V	172	36.19	37.20	10.20	-34.80
4	9748.00	43.86	AV	54.00	10.14	1.00 V	172	31.26	37.20	10.20	-34.80

H Channel (2462MHz) (b mode worst case)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（802.11b--2462MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2462.00	110.00	PK	/	/	1.00 H	325	113.30	28.60	4.70	-36.60
1	*2462.00	99.65	AV	/	/	1.00 H	325	102.95	28.60	4.70	-36.60
2	4924.00	51.96	PK	74.00	22.04	1.00 H	311	48.16	33.00	7.00	-36.20
2	4924.00	46.94	AV	54.00	7.06	1.00 H	311	43.14	33.00	7.00	-36.20
3	7386.00	49.93	PK	74.00	24.07	1.00 H	330	40.53	36.20	8.50	-35.30
3	7386.00	46.15	AV	54.00	7.85	1.00 H	330	36.75	36.20	8.50	-35.30
4	9848.00	50.98	PK	74.00	23.02	1.00 H	42	38.38	37.20	10.20	-34.80
4	9848.00	48.15	AV	54.00	5.85	1.00 H	42	35.55	37.20	10.20	-34.80

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（802.11b--2462MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2462.00	112.14	PK	/	/	1.00 V	34	115.44	28.60	4.70	-36.60
1	*2462.00	99.33	AV	/	/	1.00 V	34	102.63	28.60	4.70	-36.60
2	4924.00	50.29	PK	74.00	23.71	1.00 V	55	46.49	33.00	7.00	-36.20
2	4924.00	42.93	AV	54.00	11.07	1.00 V	55	39.13	33.00	7.00	-36.20
3	7386.00	50.93	PK	74.00	23.07	1.00 V	258	41.53	36.20	8.50	-35.30
3	7386.00	47.34	AV	54.00	6.66	1.00 V	258	37.94	36.20	8.50	-35.30
4	9848.00	50.09	PK	74.00	23.91	1.00 V	254	37.49	37.20	10.20	-34.80
4	9848.00	47.97	AV	54.00	6.03	1.00 V	254	35.37	37.20	10.20	-34.80

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
   - Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level - Limit value
5. " * ": Fundamental frequency.

2.7. Conducted Emission

2.7.1. Limit of Conducted Emission

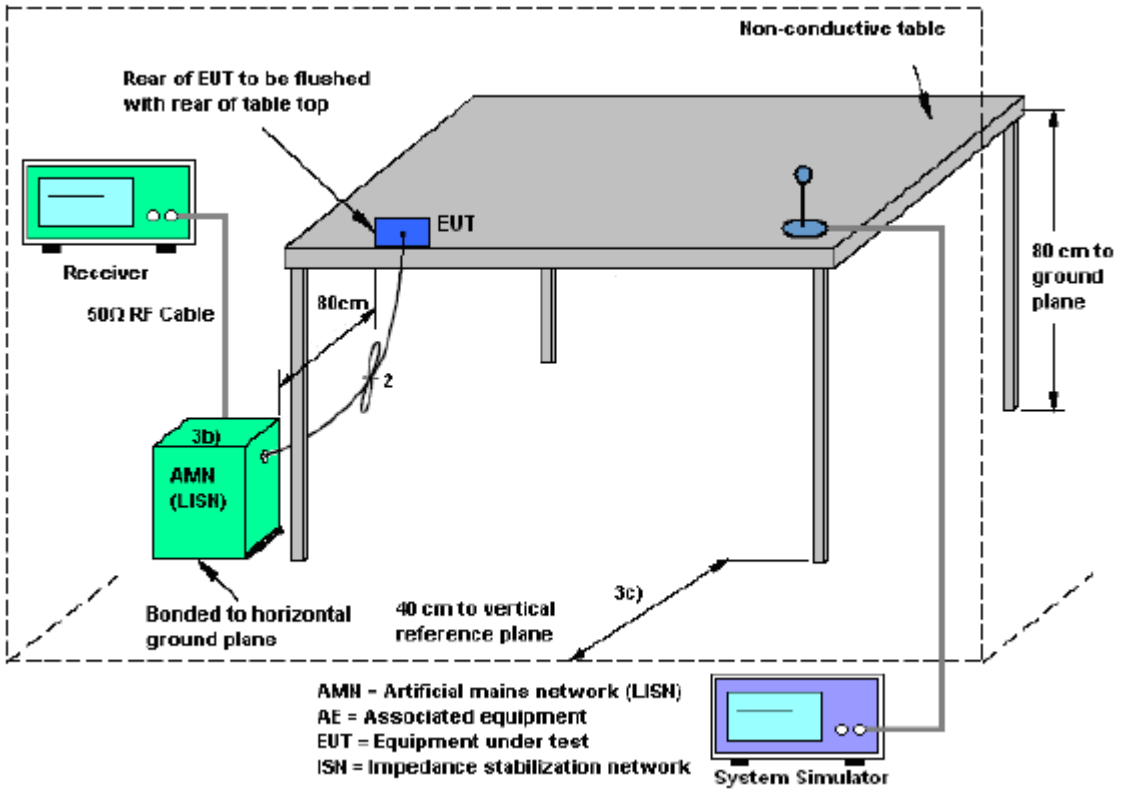
For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

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

2.7.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.7.3. Test Setup

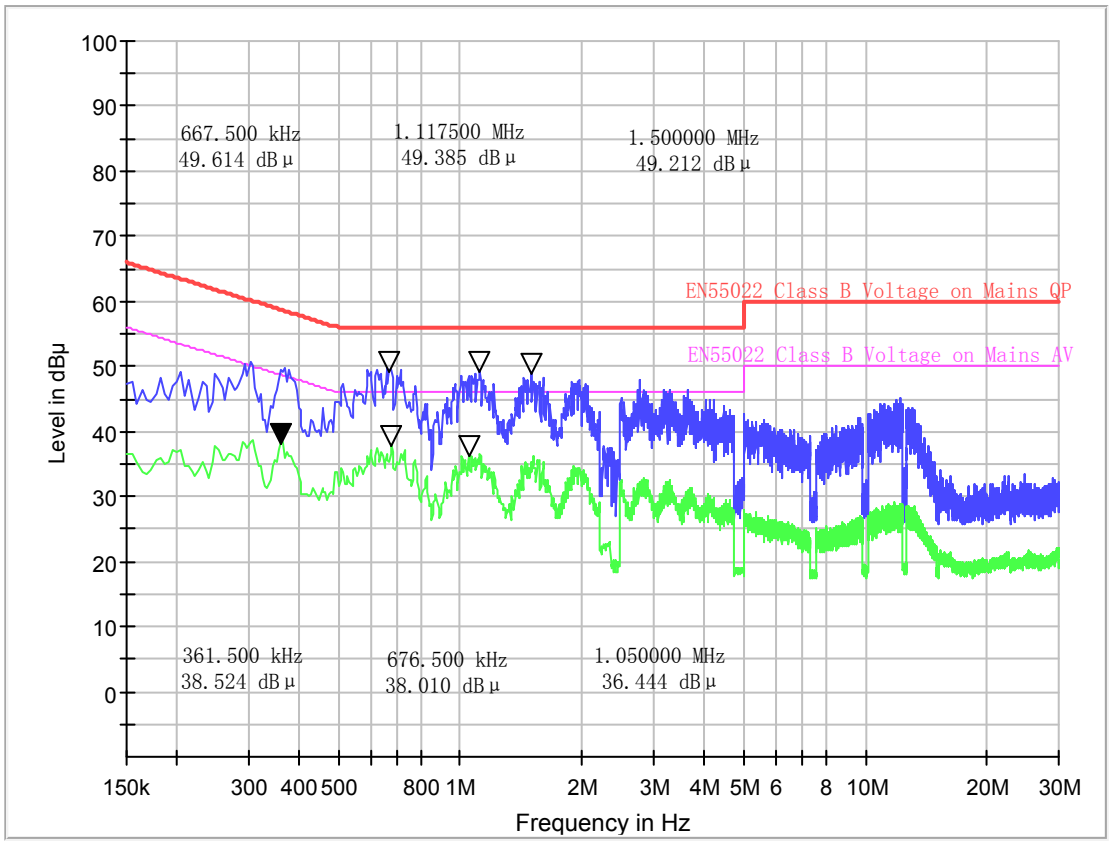


2.7.4. Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 micrometry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

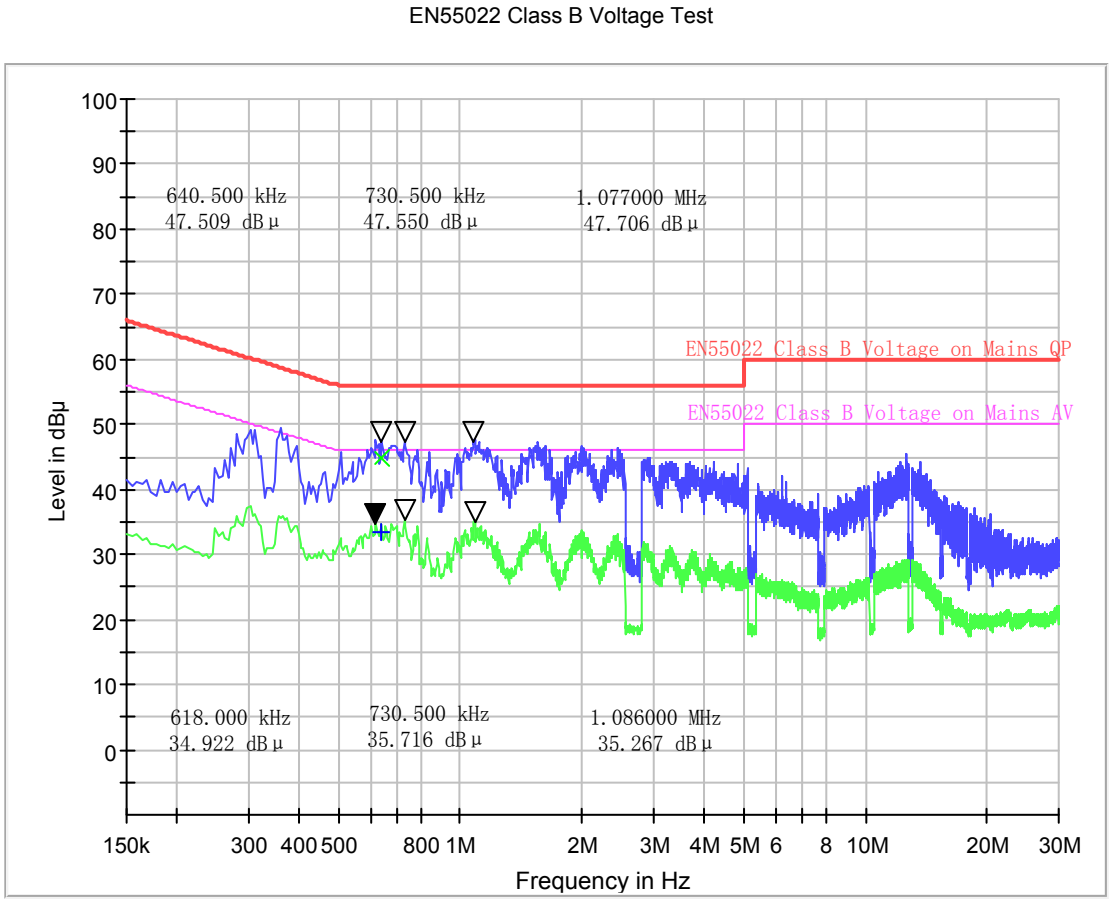
2.7.5. Test Results of Conducted Emission

The EUT configuration of the emission tests is Bluetooth Link + WLAN Link + USB Cable (Charging from Adapter) + Earphone.



(Plot A: L Phase)

Conducted Disturbance at Mains Terminals					
L Test Data					
QP			AV		
Frequency (MHz)	Limits (dBµV)	Measurement Value (dBµV)	Frequency (MHz)	Limits (dBµV)	Measurement Value (dBµV)
0.668	56.0	49.614	0.362	48.7	38.524
1.118	56.0	49.385	0.677	46.0	38.010
1.500	56.0	49.212	1.050	46.0	36.444



(Plot B: N Phase)

Conducted Disturbance at Mains Terminals					
N Test Data					
QP			AV		
Frequency (MHz)	Limits (dBµV)	Measurement Value (dBµV)	Frequency (MHz)	Limits (dBµV)	Measurement Value (dBµV)
0.641	56.0	47.509	0.618	46.0	34.922
0.731	56.0	47.550	0.731	46.0	35.716
1.077	56.0	47.706	1.086	46.0	35.267

Test Result: PASS

3. List of measuring equipment

Description	Manufacturer	Model	Serial No.	Test Date	Due Date	Remark
EMI Test Receiver	R&S	ESIB26	A0304218	2016.06.02	2017.06.01	Radiation
Full-Anechoic Chamber	Albatross	12.8m*6.8m*6.4m	A0412372	2016.06.02	2017.06.01	Radiation
Loop Antenna	Schwarz beck	HFH2-Z2	100047	2016.06.02	2017.06.01	Radiation
Bilog Antenna	Schwarzbeck	VULB 9163	9163-274	2016.06.02	2017.06.01	Radiation
Double ridge horn antenna	R&S	HF906	100150	2016.06.02	2017.06.01	Radiation
Ultra-wideband antenna	R&S	HL562	100089	2016.06.02	2017.06.01	Radiation
Test Antenna – Horn (18-26.5GHz)	ETS	3160-09	A0902607	2016.06.02	2017.06.01	Radiation
Amplifier 20M~3GHz	R&S	PAP-0203H	22018	2016.06.02	2017.06.01	Radiation
Ampilier 1G~18GHz	R&S	MITEQ AFS42-00101800	25-S-42	2016.06.02	2017.06.01	Radiation
Ampilier 18G~40GHz	R&S	JS42-18002600-28-5A	12111.0980.00	2016.06.02	2017.06.01	Radiation
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2016.06.02	2017.06.01	Conducted
Power Meter	Anritsu	ML2495A	1421017	2016.06.02	2017.06.01	Conducted
Power Sensor	Anritsu	MA2411B	1417208	2016.06.02	2017.06.01	Conducted
LISN	ROHDE&SCHWARZ	ESH2-Z5	A0304221	2016.06.02	2017.06.01	Conducted
Test Receiver	R&S	ESCS30	A0304260	2016.06.02	2017.06.01	Conducted
Cable	SUNHNER	SUCOFLEX 100	/	2016.06.02	2017.06.01	Radiation
Cable	SUNHNER	SUCOFLEX 104	/	2016.06.02	2017.06.01	Radiation

4. Uncertainty of Evaluation

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

Measurement	Frequency	Uncertainty
Conducted emissions	9kHz~30MHz	2.35dB
Radiated emissions	30MHz~1000MHz	2.45dB
	1G~18GHz	2.21dB
	18G~40GHz	1.96dB

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

** END OF REPORT **