

**FCC LISTED, REGISTRATION  
NUMBER: 905266**

**IC LISTED REGISTRATION NUMBER  
IC 4621A-1**

**AT4 wireless, S.A.**  
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Libro 82, Folio 133, Hoja MA3729

**TEST REPORT**

**REFERENCE STANDARD:**

**USA FCC Part 15.247, 15.209 and 15.207**

**CANADA RSS-210, RSS-Gen**

<b>NIE</b> ..... :	36156RRF.001
Approved by (name / position & signature) .....	A. Llamas / RF Lab. Manager .....
Elaboration date .....	2013-05-09
<b>Identification of item tested</b> .....	WiFi Base Station
Trademark .....	Polar
Model and/or type reference .....	Z9
Serial number .....	C239U60502101, C151U60501467
Other identification of the product .....	Commercial name: TEAM2 BASE STATION PRO FCC ID: INWZ9 IC: 6248A-Z9 HW version: 89047839.00 TEAM2 BASE STATION PRO, Model:Z9 SW version: 20100304r2 (SW inside the Access server) ESW T2BS R-2 revision: 26131 (SW inside the T2BS PWBA)
Features .....	2.4-2.4835 GHz band, WiFi 802.11b/g, AC adaptor
Description .....	TEAM2 BASE STATION PRO, Model Z9 is a stand alone unit which connect a PC/PDA to other transmitters or vice versa. Connection can occur via Bluetooth, WLAN or via Ethernet cable (RJ45). The device uses frequency range of 2400-2483,5 MHz and contains:  4 certified WT11i-A Bluetooth modules (FCC ID: QOQWT11IA, IC: 5123A-BGTWT11IA)  1 certified EW-7318Mug 802.11gb WLAN module
<b>Applicant</b> .....	POLAR ELECTRO OY.
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<b>Test samples supplier</b> .....	Same as applicant
<b>Manufacturer</b> .....	Same as applicant

<b>Test method requested</b> .....	See Standard		
<b>Standard</b> .....	USA FCC Part 15.247 10-1-11 Edition: Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 10-1-11 Edition: Radiated emission limits; general requirements. USA FCC Part 15.207 10-1-11 Edition: Conducted limits. RSS-210 Issue 8, December 2010 - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment RSS Gen Issue 3, December 2010 - General Requirements and Information for the Certification of Radio Apparatus Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 558074 D01 DTS Meas Guidance v02 dated 10/04/2012 ANSI C63.10-2009: American National Standard for Testing Unlicensed Wireless Devices.		
<b>Test procedure</b> .....	PERF034, PEEM103		
<b>Non-standardized test method</b> .....	N/A		
<b>Used instrumentation</b> .....	<u>Conducted Measurements</u>		
		Last Cal. date	Cal. due date
1.	Spectrum Analyzer Agilent E4440A	2012/02	2014/02
2.	EMI Test Receiver R&S ESIB26	2011/11	2013/11
3.	Transient limiter. HP 11947A	2012/09	2014/09
4.	Line Impedance Stabilization Network (L.I.S.N.) R&S. ESH2-Z5	2011/01	2013/01
	<u>Radiated Measurements</u>		
		Last Cal. date	Cal. due date
1.	Semianechoic Absorber Lined Chamber IR 11. BS	N.A.	N.A.
2.	Control Chamber IR 12.BC	N.A.	N.A.
3.	Hybrid Bilog antenna Sunol Sciences Corporation JB6	2011/05	2014/05
4.	Antenna mast EM 1072 NMT	N.A.	N.A.
5.	Rotating table EM 1084-4. ON	N.A.	N.A.
6.	Double-ridge Guide Horn antenna 1-18 GHz HP 11966E	2011/05	2014/05
7.	Double-ridge Guide Horn antenna 18-40 GHz Agilent 119665J	2011/09	2014/09
8.	EMI Test Receiver R&S ESIB26	2011/11	2013/11
9.	RF pre-amplifier Miteq JS4-12002600-30-5A.	2012/07	2014/07
10.	Multi Device Controller EMCO 2090	N.A.	N.A.
11.	Spectrum Analyzer Agilent E4440A	2012/02	2014/02
12.	RF pre-amplifier Miteq AFS5-04001300-15-10P-6.	2012/07	2014/07
13.	RF pre-amplifier Schaffner CPA 9231.	2011/06	2013/06
<b>Report template No.</b> .....	FDT08_14		
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### **Competences and guarantees**

AT4 wireless is a laboratory with a measurement facility in compliance with the requirements of Section 2.948 of the FCC rules and has been added to the list of facilities whose measurements data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Registration Number: 905266.

AT4 wireless is a laboratory with a measurement site in compliance with the requirements of RSS 212, Issue 1 (Provisional) and has been added to the list of filed sites of the Canadian Certification and Engineering Bureau. Reference File Number: IC 4621A-1.

In order to assure the traceability to other national and international laboratories, AT4 wireless has a calibration and maintenance programme for its measurement equipment.

AT4 wireless guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at AT4 wireless at the time of performance of the test.

AT4 wireless is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

### **General conditions**

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of AT4 wireless.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of AT4 wireless and the Accreditation Bodies.

### **Uncertainty**

Uncertainty (factor  $k=2$ ) was calculated according to the AT4 wireless internal documents:

PODT000: : Procedimiento para el cálculo de incertidumbres de medida

### Usage of samples

Samples undergoing test have been selected by: **the client**.

#### Sample M/01 is formed by the following elements:

<u>Control No.</u>	<u>Description</u>	<u>Model</u>	<u>Serial No.</u>	<u>Date of reception</u>
36156B/04	WiFi Base station with integral antenna	Z9	C239U60502101	29/10/12
36156B/26	AC adaptor	FRA030E-S18-I	---	29/10/12

#### Sample M/02 is formed by the following elements:

<u>Control No.</u>	<u>Description</u>	<u>Model</u>	<u>Serial No.</u>	<u>Date of reception</u>
36156B/02	WiFi Base station with antenna connector	Z9	C151U60501467	29/10/12
36156B/25	AC adaptor	FRA030E-S18-I	---	29/10/12

1. Sample M/01 has undergone following test(s).  
Radiated RF tests indicated in appendix A and Continuous conducted emission, power leads, in appendix B.
2. Sample M/02 has undergone following test(s).  
Conducted RF tests indicated in appendix A.

### Testing period

The performed test started on 2012-11-06 and finished on 2012-11-23.

The tests have been performed at AT4 wireless.

## Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 19.1 °C Max. = 21.3 °C
Relative humidity	Min. = 47.8% Max. = 48.3 %
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 0,5 Ω

In the semianechoic chamber (21 meters x 11 meters x 8 meters), the following limits were not exceeded during the test.

Temperature	Min. = 19.0 °C Max. = 19.3 °C
Relative humidity	Min. = 47 % Max. = 48 %
Air pressure	Min. = 1020 mbar Max. = 1020 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 0,5 Ω
Normal site attenuation (NSA)	< ±4 dB at 10 m distance between item under test and receiver antenna, (30 MHz to 1000 MHz)
Field homogeneity	More than 75% of illuminated surface is between 0 and 6 dB (26 MHz to 1000 MHz).

In the chamber for conducted measurements the following limits were not exceeded during the test:

Temperature	Min. = 24.6 °C Max. = 25.0 °C
Relative humidity	Min. = 49.3 % Max. = 50.1%
Air pressure	Min. = 1020 mbar Max. = 1020 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 0,5 Ω

### Summary

Considering the results of the performed test according to standards USA FCC Parts 15.247, 15.209 and 15.207, CANADA RSS-210 and RSS-Gen the item under test is **IN COMPLIANCE** with the requested specifications specified in the standard.

NOTE: The results presented in this Test Report apply only to the particular item under test established in page 1 of this document, as presented for test on the date(s) shown in section, "USAGE OF SAMPLES, TESTING PERIOD AND ENVIRONMENTAL CONDITIONS".

### Remarks and comments

1: The total uncertainty of the measurement system for the measured radio disturbance characteristics of EUT from 150 kHz to 30 MHz is  $I = \pm 3,60$  dB for quasi-peak measurements,  $I = \pm 3,48$  dB for peak measurements ( $k = 2$ ).

### Testing verdicts

Not applicable .....: NA  
 Pass.....: P  
 Fail .....: F  
 Not measured.....: NM

FCC PART 15 PARAGRAPH		VERDICT			
		NA	P	F	NM
Section 15.247 Subclause (a) (2) / RSS-210 A8.2. (a)	6 dB Bandwidth		P		
Section 15.247 Subclause (b) / RSS-210 A8.4. (4) .....	Maximum output power and antenna gain		P		
Section 15.247 Subclause (d) / RSS-210 A8.5. .....	Emission limitations conducted (Transmitter)		P		
Section 15.247 Subclause (d) / RSS-210 A8.5. .....	Band-edge emissions compliance (Transmitter)		P		
Section 15.247 Subclause (e) / RSS-210 A8.2. (b)	Power spectral density		P		
Section 15.247 Subclause (d) / RSS-210 A8.5. .....	Emission limitations radiated (Transmitter)		P		
Section 15.207. .....	Conducted limits		P		

## **APPENDIX A: Test result**



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## TEST CONDITIONS

Power supply (V):

$$V_{\text{nominal}} = 100 - 240 \text{ Vac}$$

Type of power supply = AC/DC adaptor.

Type of antenna = Integral antenna.

Maximum Gain for antenna = 5.9 dBi.

### TEST FREQUENCIES:

Lowest channel: 2412 MHz

Middle channel: 2437 MHz

Highest channel: 2462 MHz

### CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is connected to the spectrum analyser using a calibrated low loss RF cable. The reading in the spectrum analyser is compensated with the cable loss at each measurement frequency.

### RADIATED MEASUREMENTS

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1m for the frequency range 1 GHz-25 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

For radiated emissions in the range 1 GHz-25 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive (wooden) platform one meter above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

## 99 % and 26 dB Bandwidth

### RESULTS

#### 1. DSSS modulation. (see next plots).

Preliminary tests were done with the equipment operating with DSSS modulation mode at 1 Mbps, 2 Mbps, 5.5 Mbps and 11 Mbps and the worst case was for 1 Mbps bit rate. Results shown below correspond to 1 Mbps.

	Lowest frequency 2412 MHz	Middle frequency 2437 MHz	Highest frequency 2462 MHz
99% bandwidth (MHz)	15.19	15.19	15.18
26 dB bandwidth (MHz)	18.52	18.53	18.52
Measurement uncertainty (kHz)	±21.7		

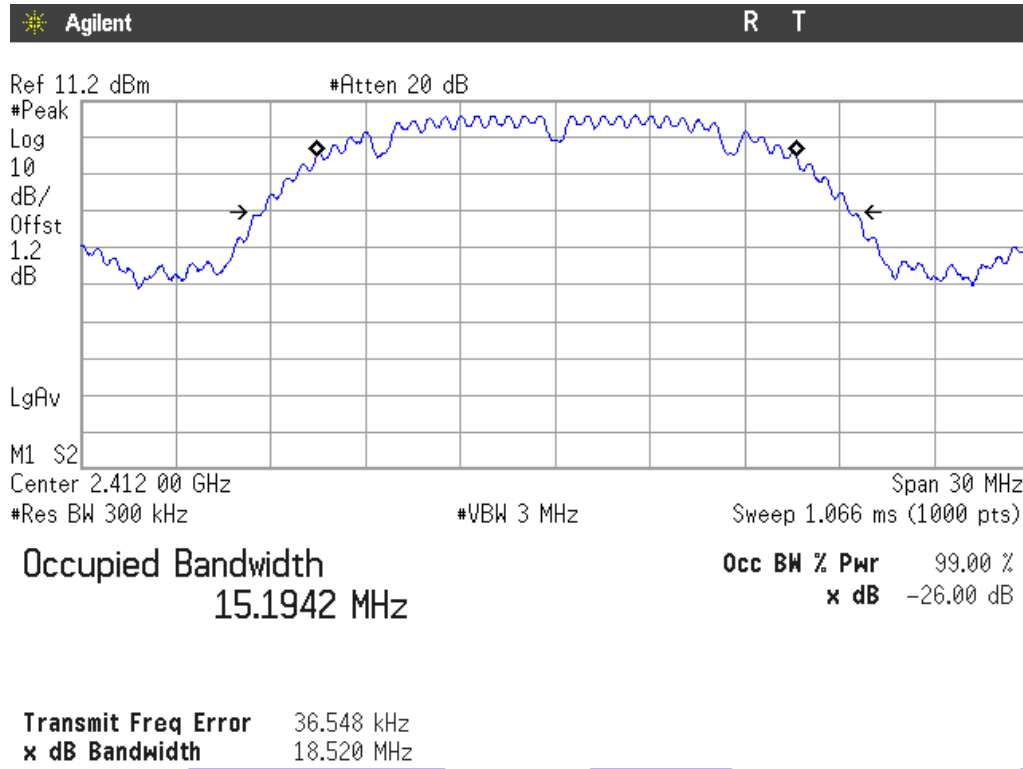
#### 2. OFDM modulation. (see next plots).

Preliminary tests were done with the equipment operating with OFDM modulation mode at 6 Mbps, 9 Mbps, 12 Mbps, 18 Mbps, 24 Mbps, 36 Mbps, 48 Mbps and 54 Mbps and the worst case was for 6 Mbps bit rate. Results shown below correspond to 6 Mbps.

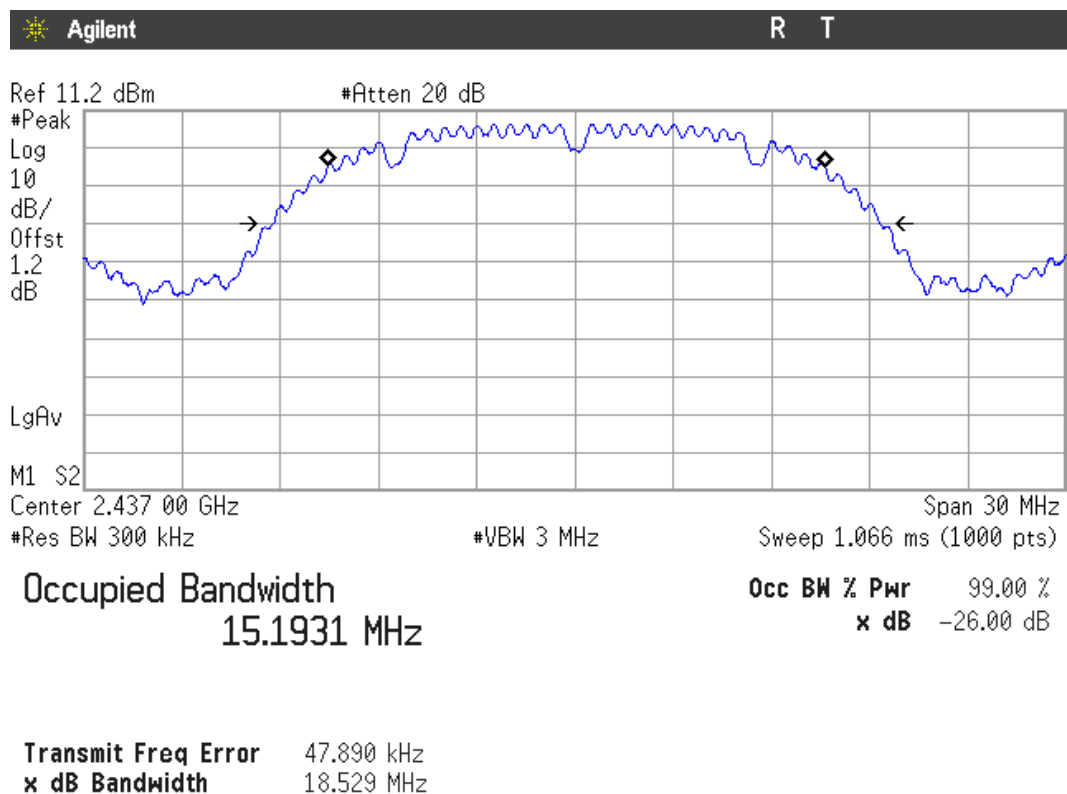
	Lowest frequency 2412 MHz	Middle frequency 2437 MHz	Highest frequency 2462 MHz
99% bandwidth (MHz)	16.86	16.84	16.85
26 dB bandwidth (MHz)	20.80	20.62	20.69
Measurement uncertainty (kHz)	±21.7		

### 1. DSSS modulation

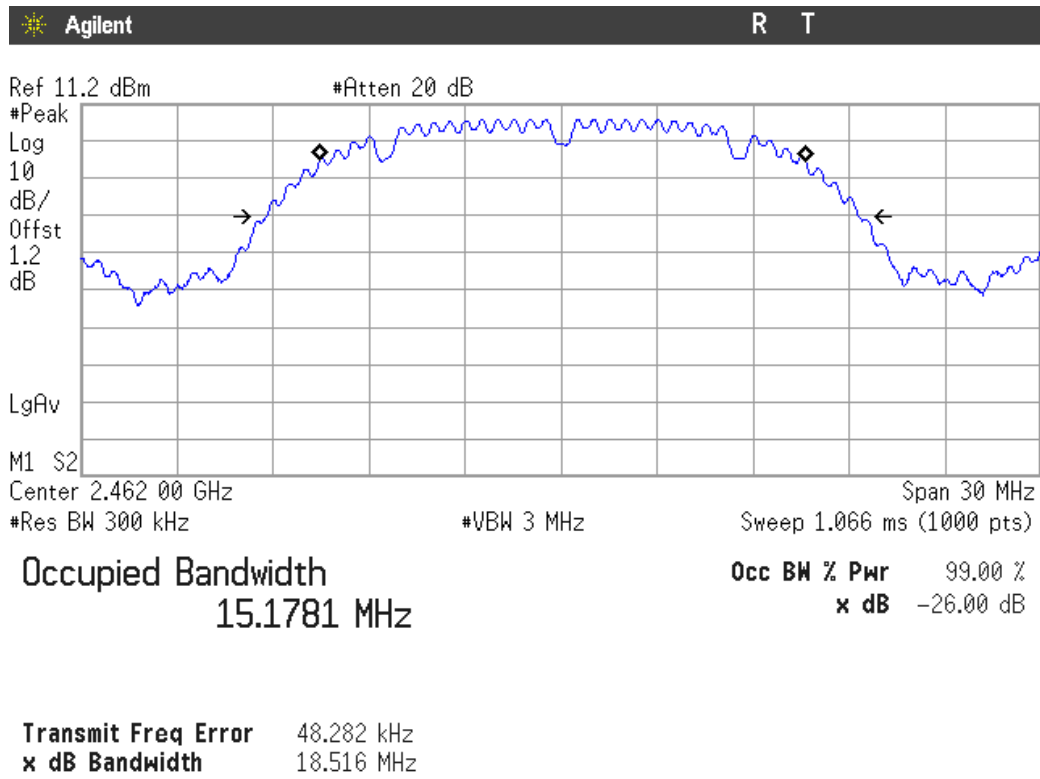
Lowest Channel: 2412 MHz.



Middle Channel: 2437 MHz.

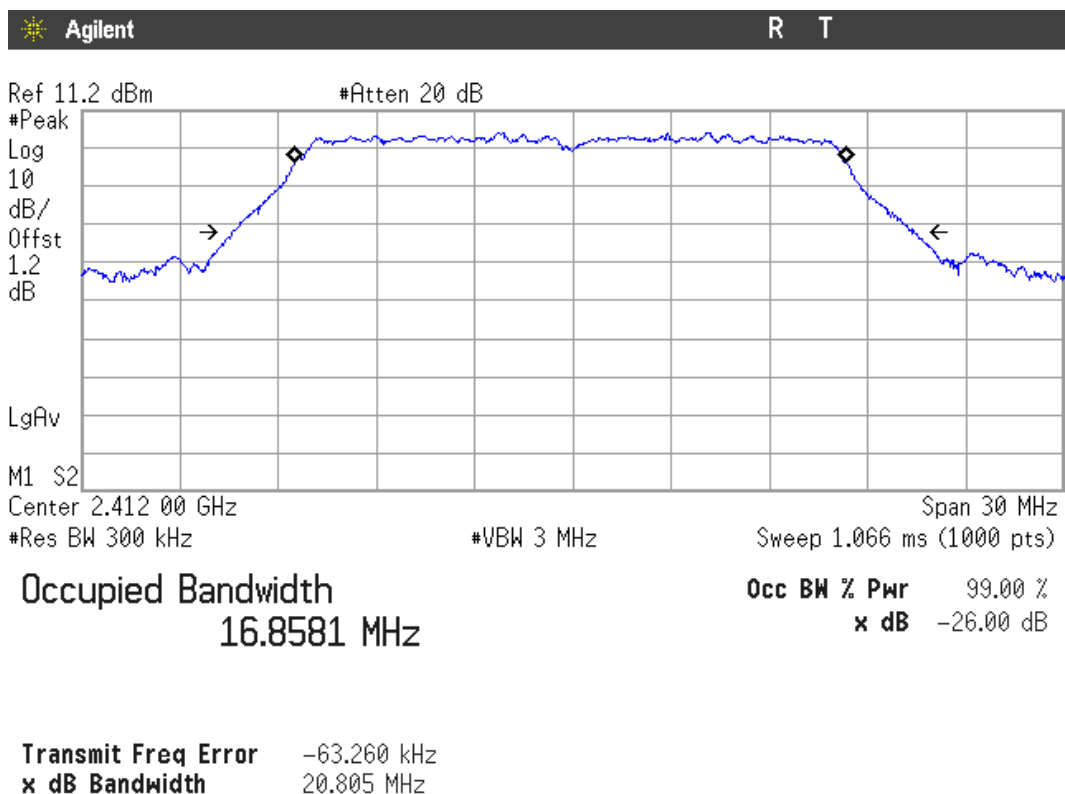


Highest Channel: 2462 MHz.

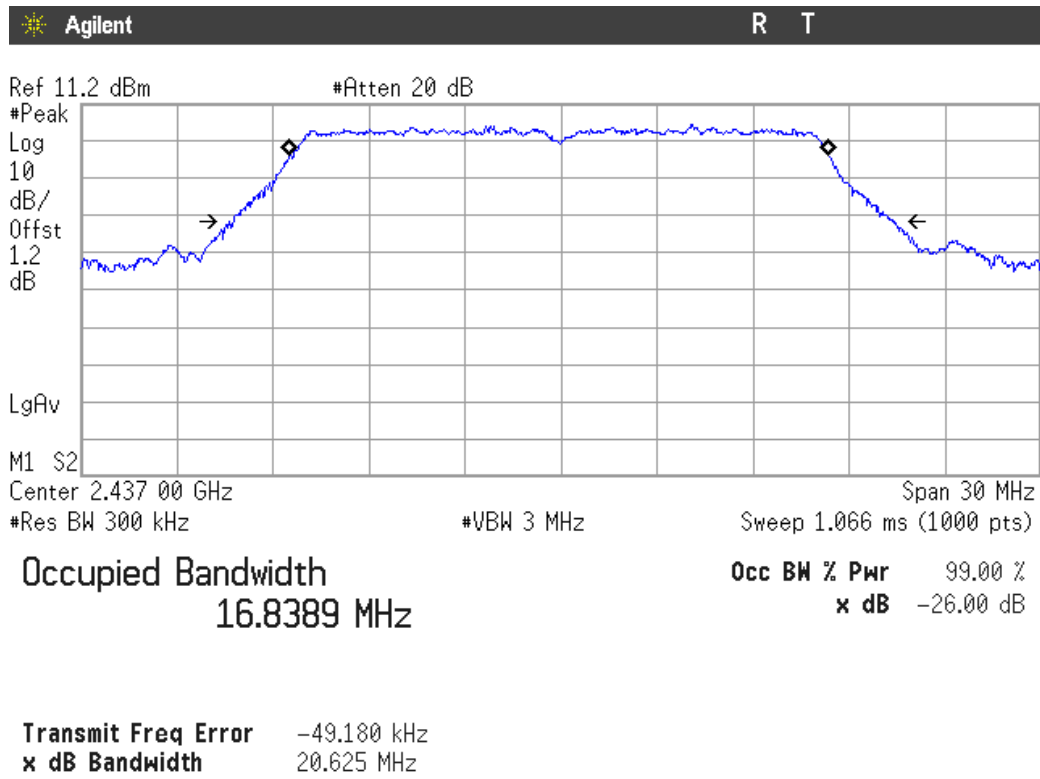


## 2. OFDM modulation

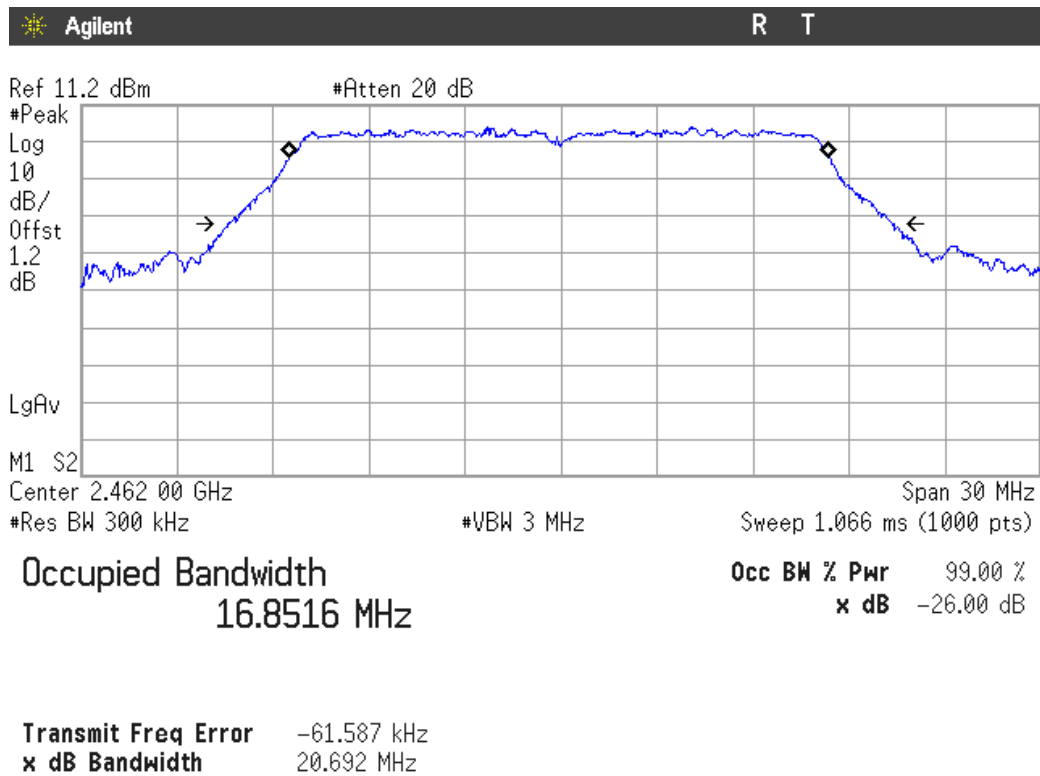
Lowest Channel: 2412 MHz.



Middle Channel: 2437 MHz.



Highest Channel: 2462 MHz.



**Section 15.247 Subclause (a) (2) / RSS-210 A8.2. (a). 6 dB Bandwidth**

SPECIFICATION

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

RESULTS

1. DSSS modulation

Preliminary tests were done with the equipment operating with DSSS modulation mode at 1 Mbps, 2 Mbps, 5.5 Mbps and 11 Mbps and the worst case was for 1 Mbps bit rate. Results shown below correspond to 1 Mbps.

6 dB Bandwidth (see next plots).

	Lowest frequency	Middle frequency	Highest frequency
	2412 MHz	2437 MHz	2462 MHz
6 dB Spectrum bandwidth (MHz)	12.11	12.19	12.23
Measurement uncertainty (kHz)	±89		

2. OFDM modulation

Preliminary tests were done with the equipment operating with OFDM modulation mode at 6 Mbps, 9 Mbps, 12 Mbps, 18 Mbps, 24 Mbps, 36 Mbps, 48 Mbps and 54 Mbps and the worst case was for 6 Mbps bit rate. Results shown below correspond to 6 Mbps.

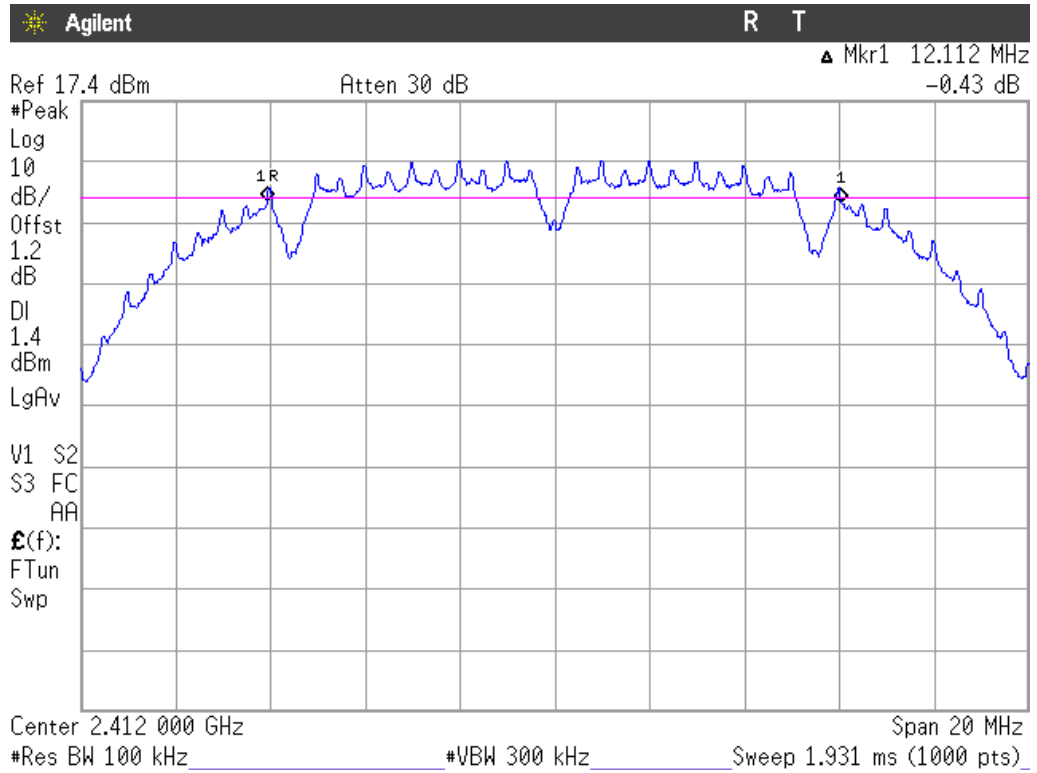
6 dB Bandwidth (see next plots).

	Lowest frequency	Middle frequency	Highest frequency
	2412 MHz	2437 MHz	2462 MHz
6 dB Spectrum bandwidth (MHz)	16.36	16.36	16.24
Measurement uncertainty (kHz)	±89		

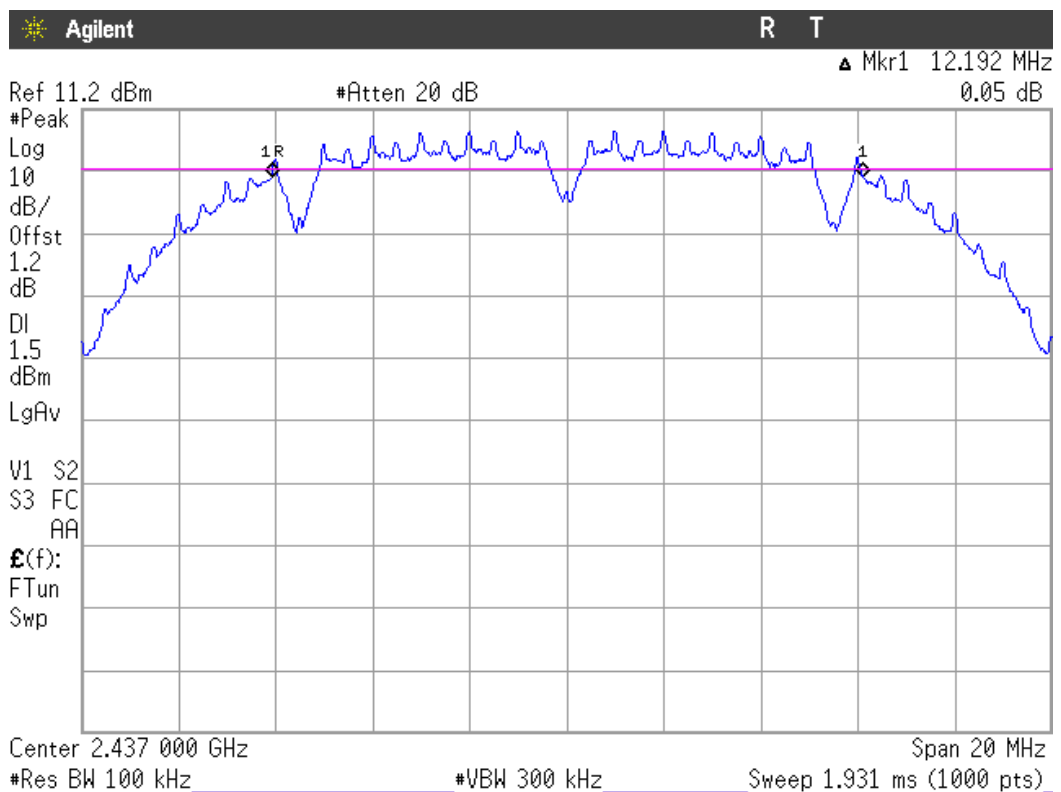
Verdict: PASS

### 1. DSSS modulation

Lowest Channel: 2412 MHz.

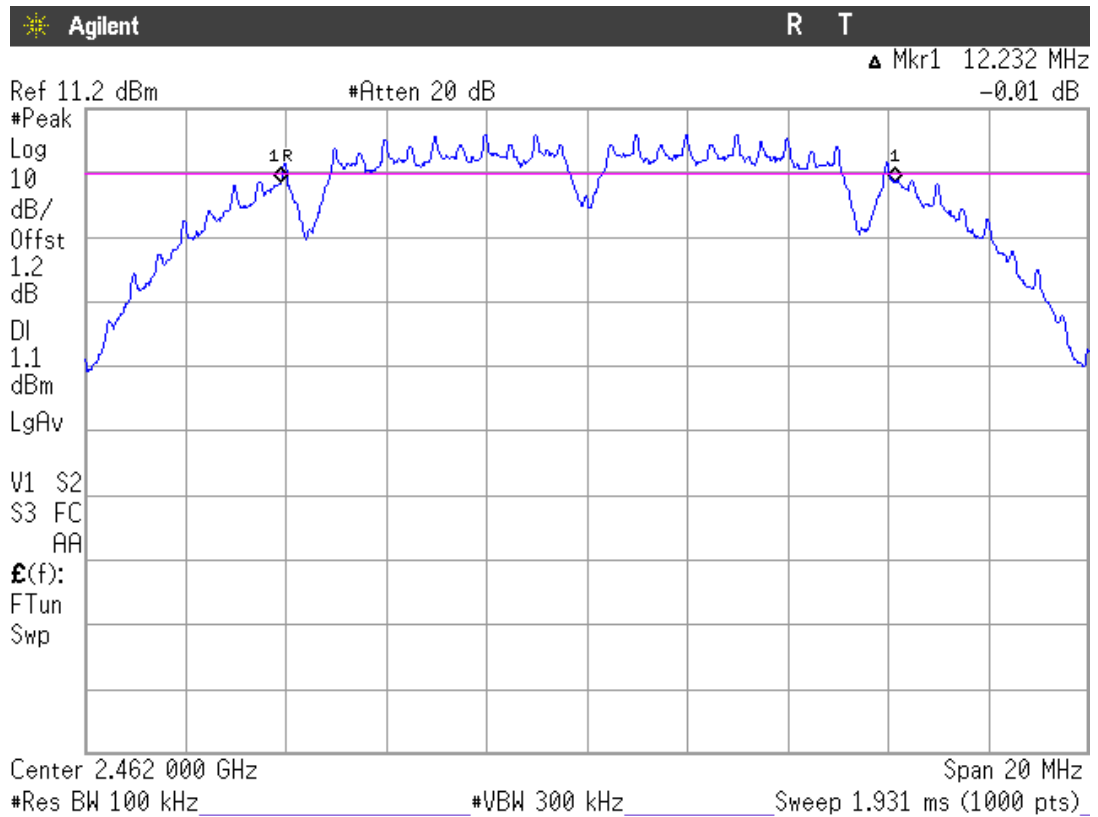


Middle Channel: 2437 MHz.



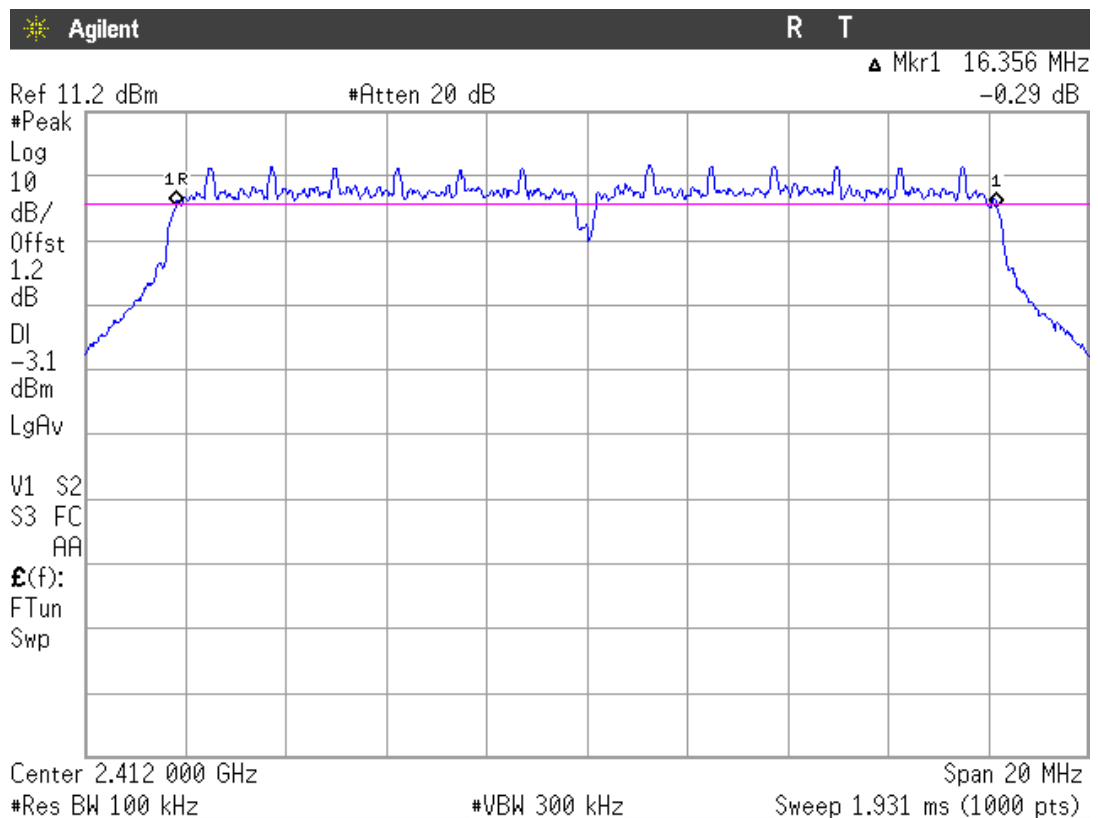


Highest Channel: 2462 MHz.

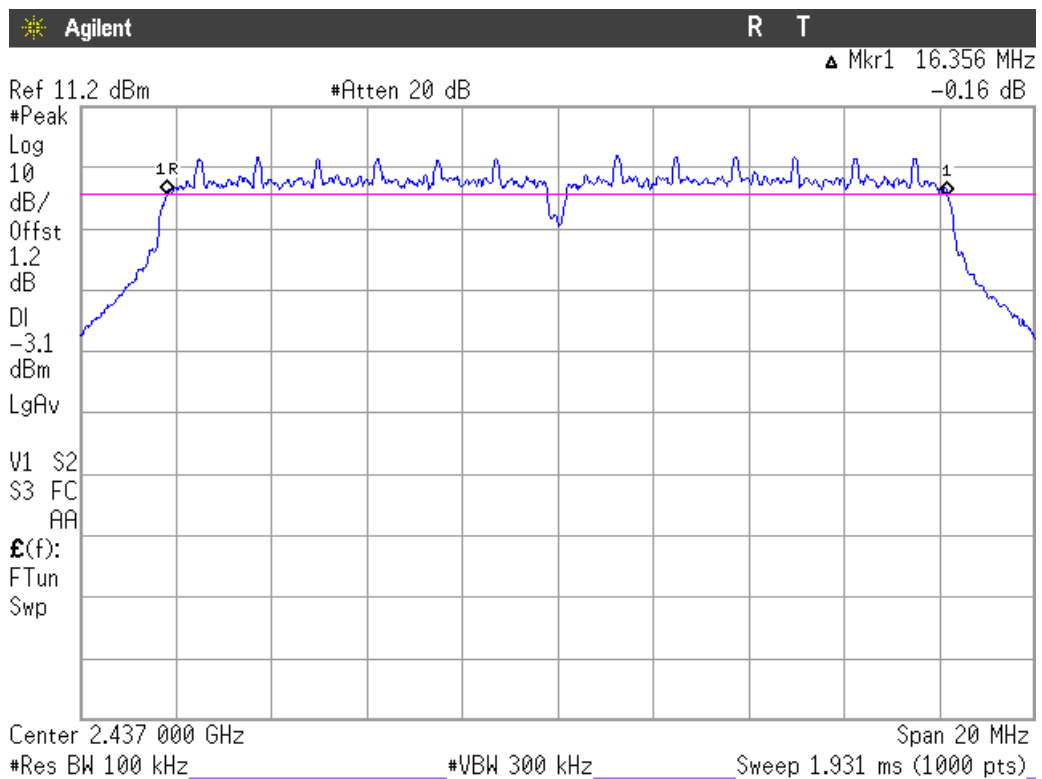


## 2. OFDM modulation

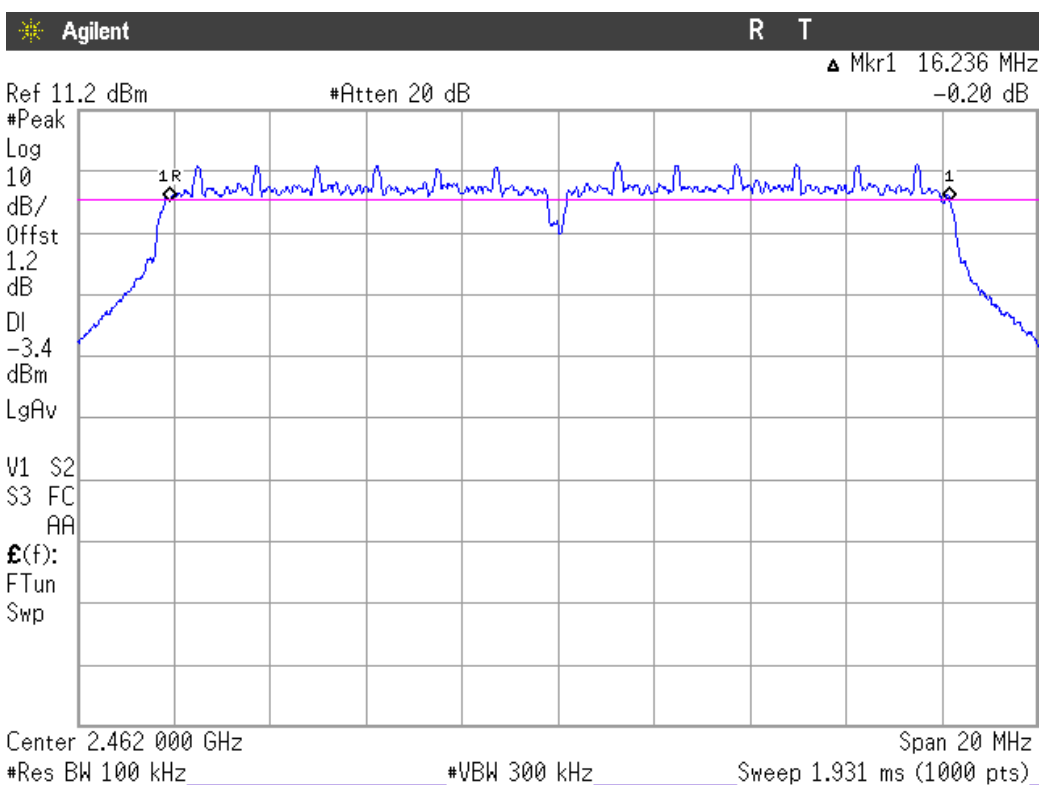
Lowest Channel: 2412 MHz.



Middle Channel: 2437 MHz.



Highest Channel: 2462 MHz.



**Section 15.247 Subclause (b) / RSS-210 A8.4. (4). Maximum output power and antenna gain**

SPECIFICATION

For systems using digital modulation in the 2400-2483.5 MHz band: 1 watt (30 dBm).

RESULTS

The maximum Peak Conducted Output Power was measured using the channel integration method according to point 8.1.2. Option 2 of Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 558074 D01 DTS Meas Guidance v02 dated 10/04/2012.

1. DSSS modulation

MAXIMUM OUTPUT POWER. See next plots.

Preliminary tests were done with the equipment operating with DSSS modulation mode at 1 Mbps, 2 Mbps, 5.5 Mbps and 11 Mbps and the worst case was for 1 Mbps bit rate. Results shown below correspond to 1 Mbps.

Maximum declared antenna gain: 5.9 dBi.

	Lowest frequency 2412 MHz	Middle frequency 2437 MHz	Highest frequency 2462 MHz
Maximum conducted power (dBm)	19.00	19.09	18.77
Maximum EIRP power (dBm)	24.90	24.99	24.67
Measurement uncertainty (dB)	±1.5		

The maximum directional gain of the antenna is less than 6 dBi and therefore the maximum output power is not required to be reduced from the stated values.

## 2. OFDM modulation

MAXIMUM OUTPUT POWER. See next plots.

Preliminary tests were done with the equipment operating with OFDM modulation mode at 6 Mbps, 9 Mbps, 12 Mbps, 18 Mbps, 24 Mbps, 36 Mbps, 48 Mbps and 54 Mbps, and the worst case was for 6 Mbps bit rate. Results shown below correspond to 6 Mbps.

Maximum declared antenna gain: 5.9 dBi.

	Lowest frequency 2412 MHz	Middle frequency 2437 MHz	Highest frequency 2462 MHz
Maximum conducted power (dBm)	16.10	16.45	16.18
Maximum EIRP power (dBm)	22.00	22.35	22.08
Measurement uncertainty (dB)	±1.5		

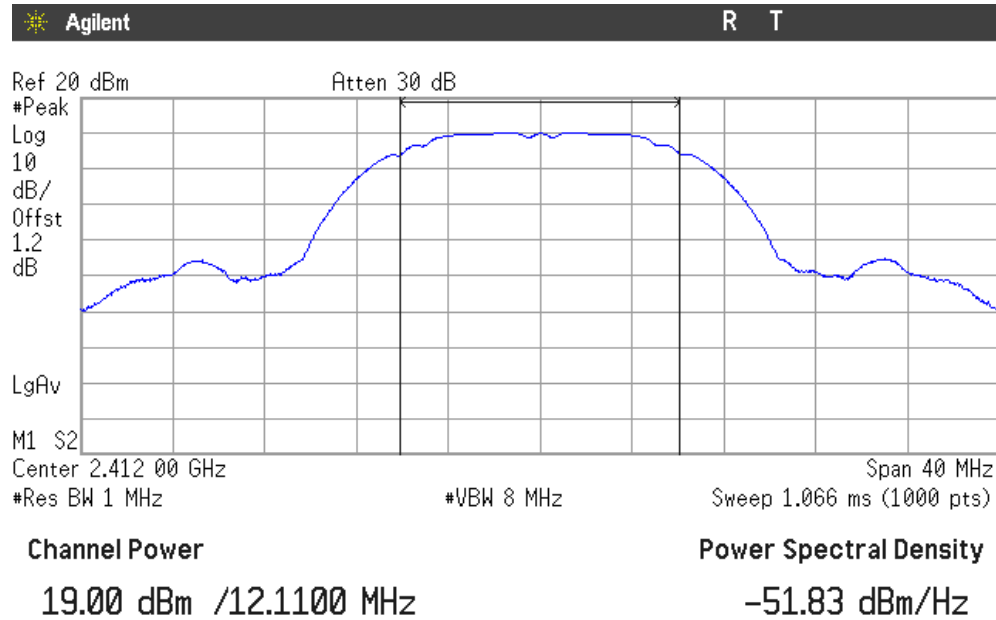
The maximum directional gain of the antenna is less than 6 dBi and therefore the maximum output power is not required to be reduced from the stated values.

Verdict: PASS

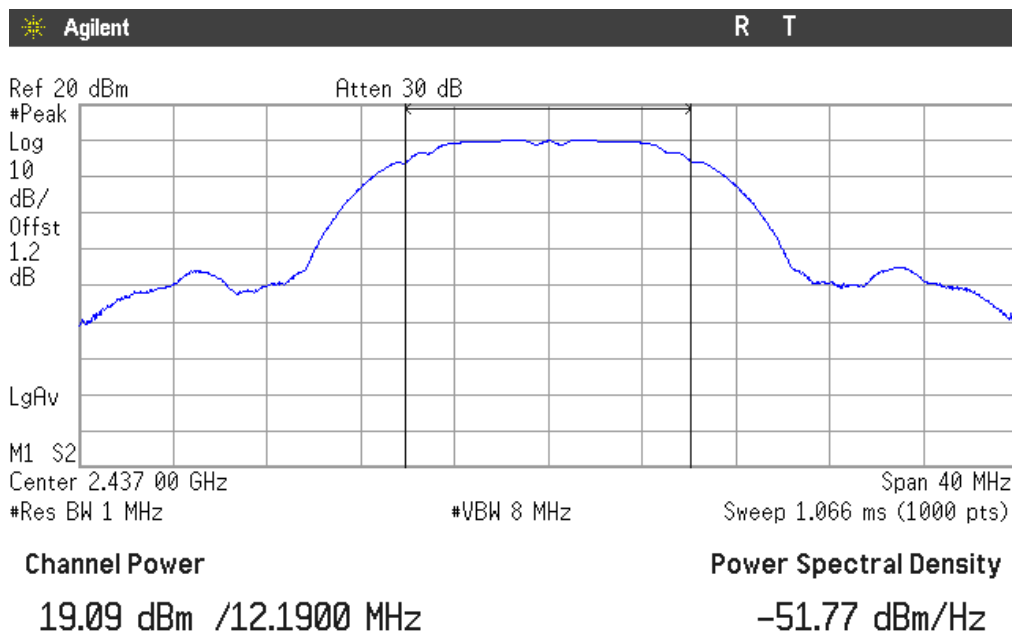
1. CONDUCTED PEAK POWER.

DSSS modulation

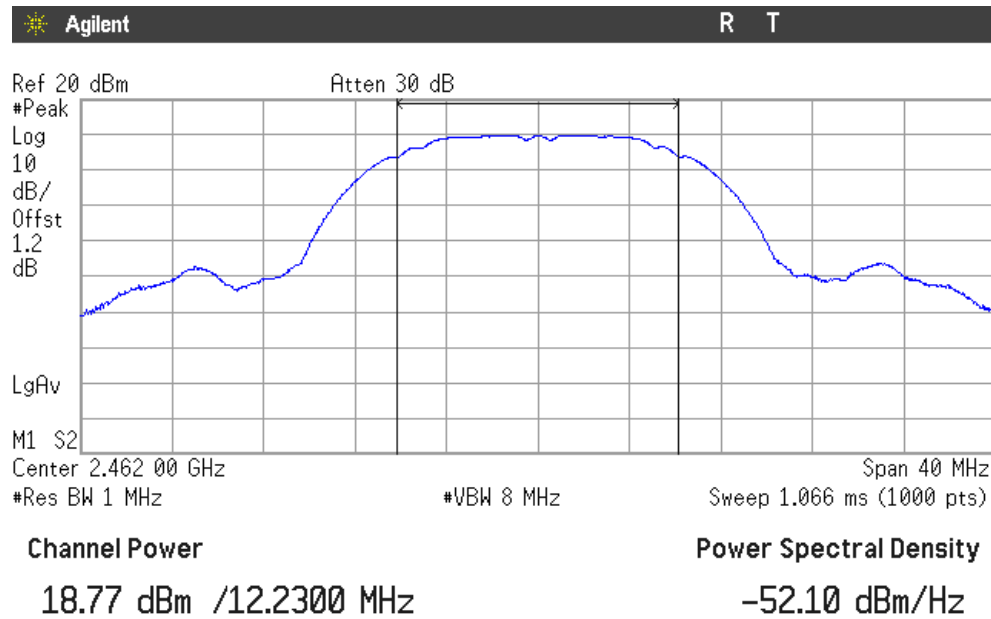
Lowest frequency 2412 MHz



Middle frequency 2437 MHz

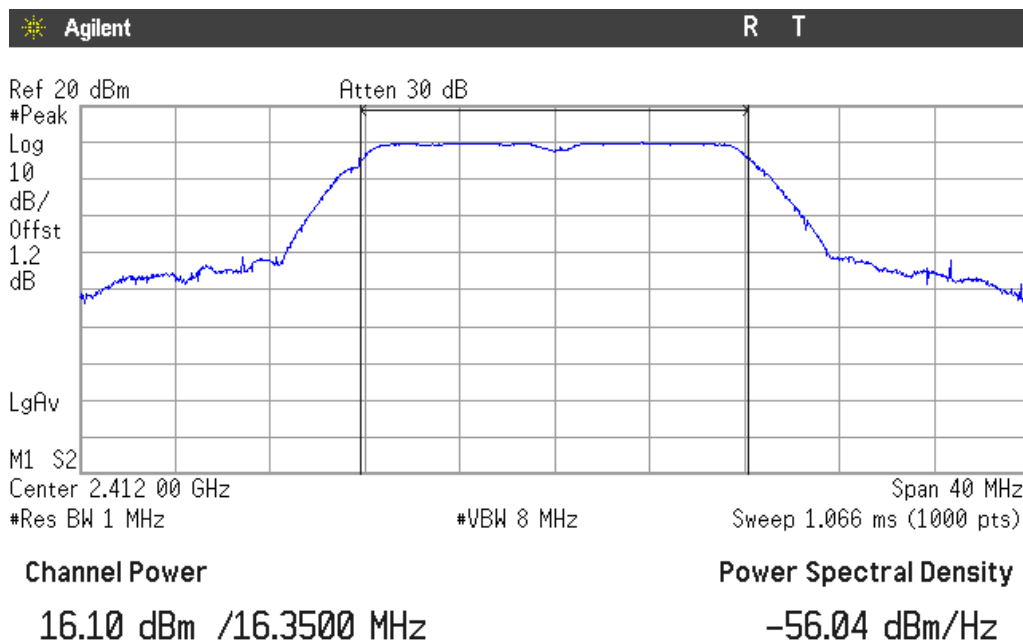


Highest frequency 2462 MHz

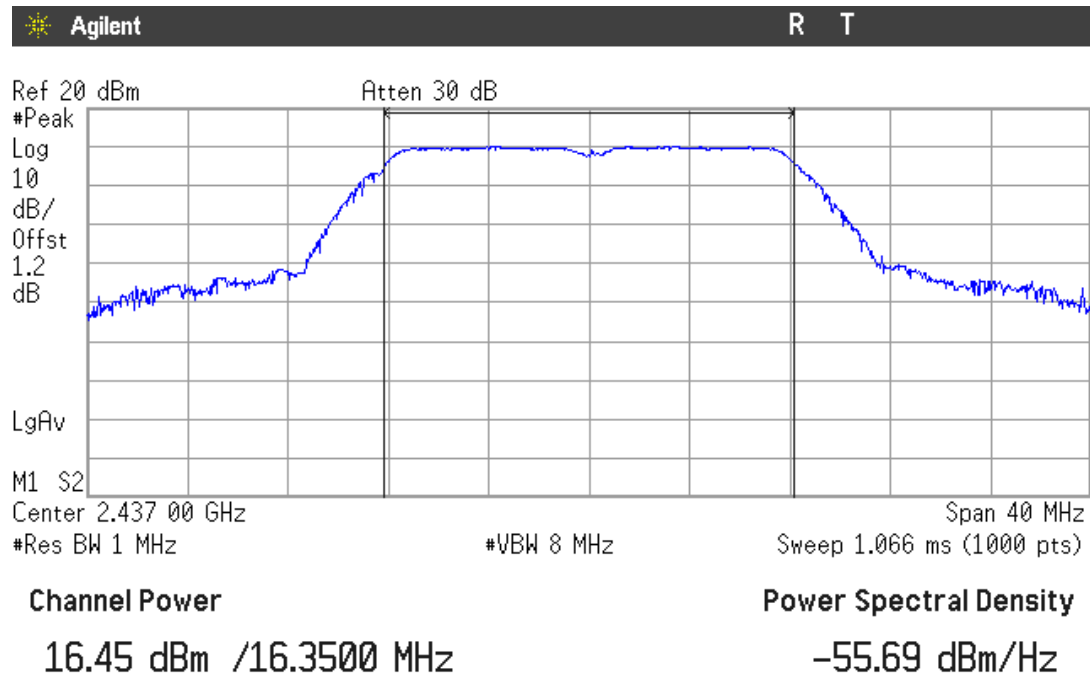


OFDM modulation

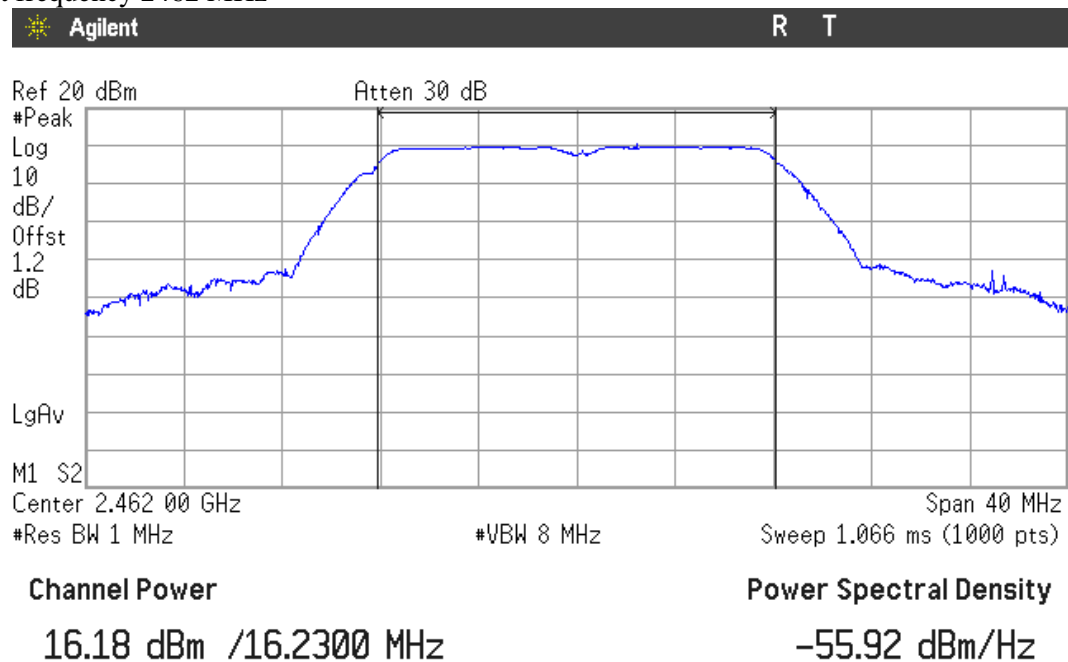
Lowest frequency 2412 MHz



Middle frequency 2437 MHz



Highest frequency 2462 MHz



**Section 15.247 Subclause (d) / RSS-210 A8.5. Emission limitations conducted (Transmitter)**

**SPECIFICATION**

In any 100 kHz bandwidth outside the frequency band in which the digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 30dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

**RESULTS:** (see next plots)

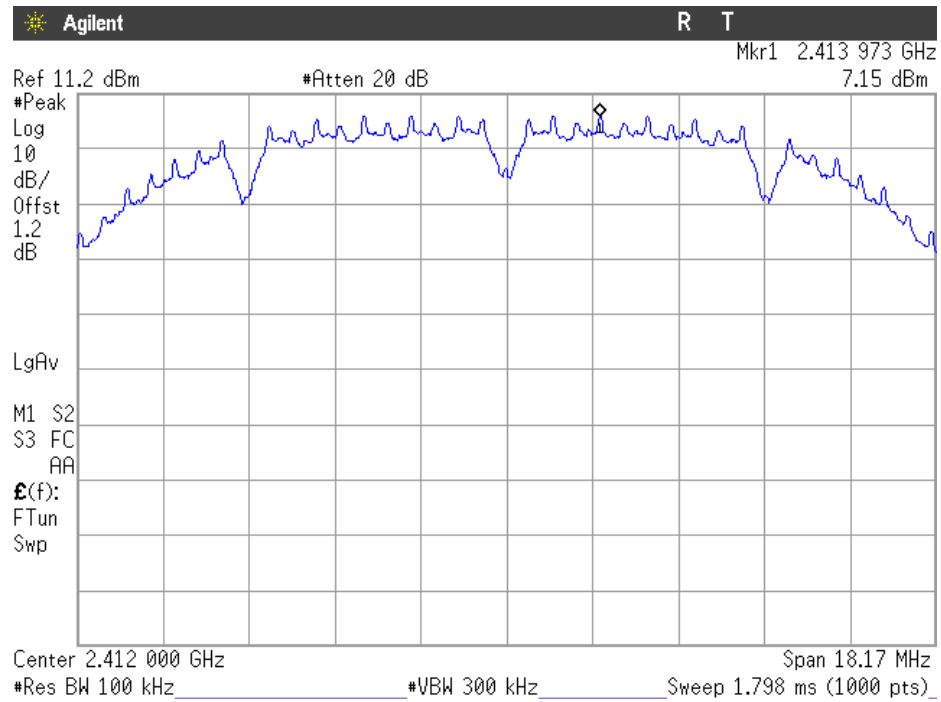
**1. DSSS modulation**

Preliminary tests were done with the equipment operating with DSSS modulation mode at 1 Mbps, 2 Mbps, 5.5 Mbps and 11 Mbps and the worst case was for 1 Mbps bit rate. Results shown below correspond to 1 Mbps.

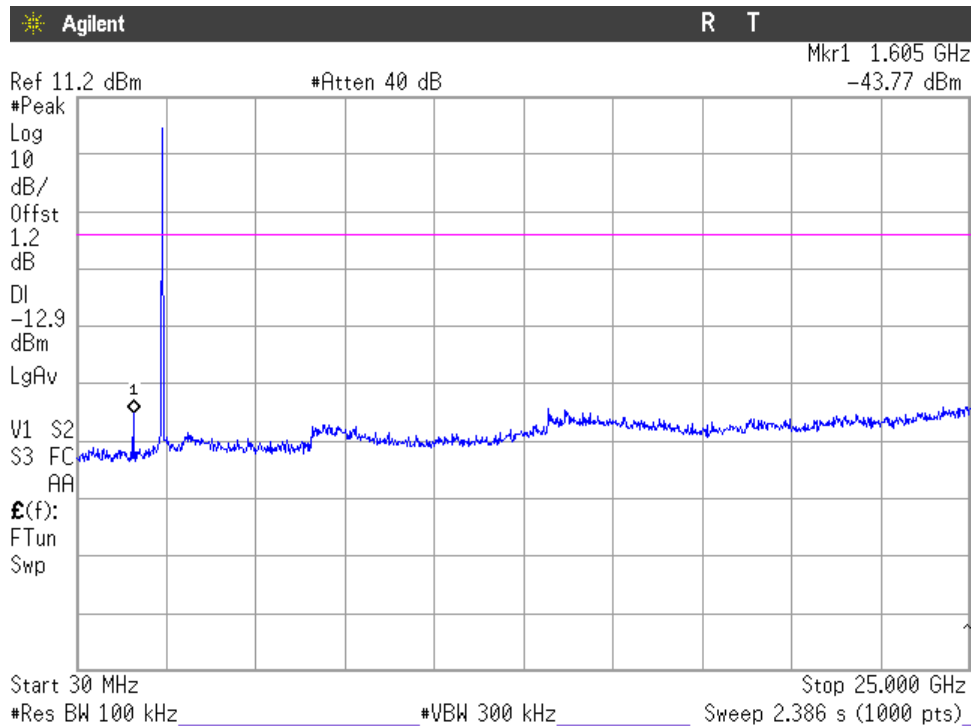


Lowest Channel: 2412 MHz.

Reference Level Measurement



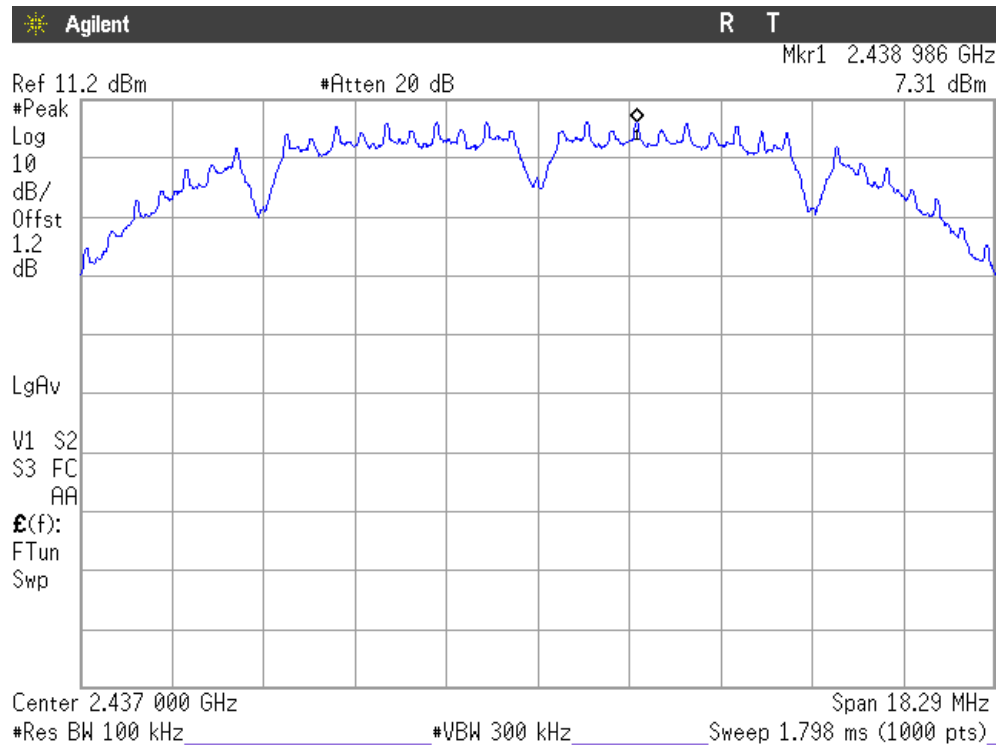
Unwanted Emissions Level Measurement



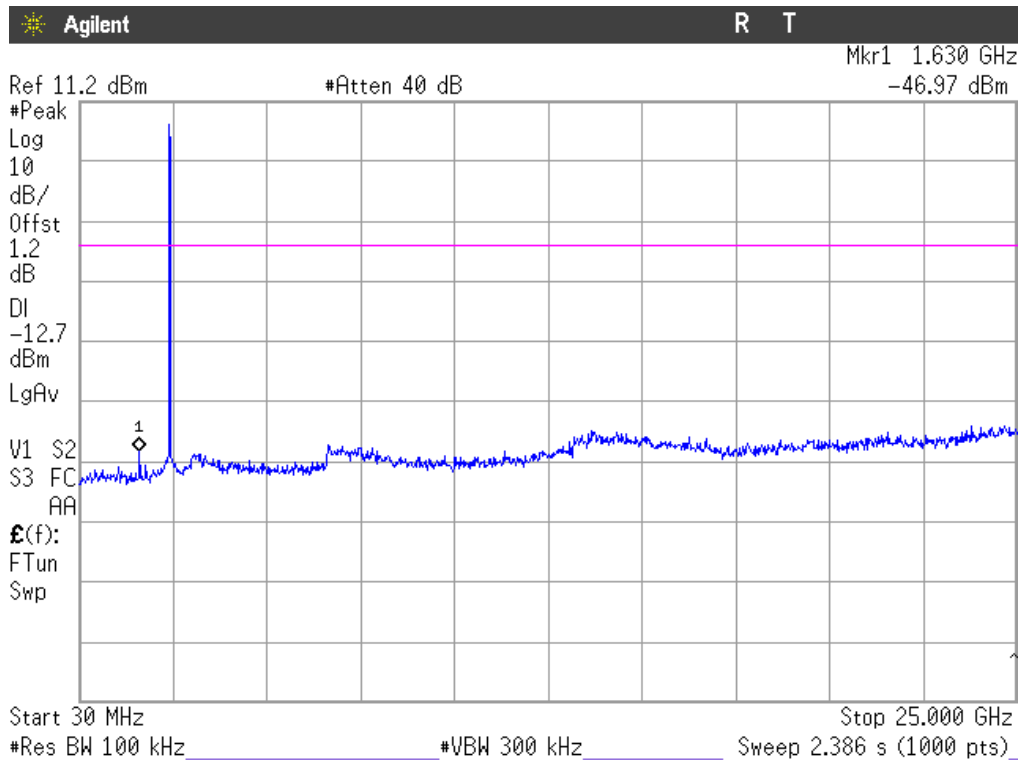
Note: The peak above the limit is the carrier frequency.

Middle Channel: 2437 MHz.

Reference Level Measurement



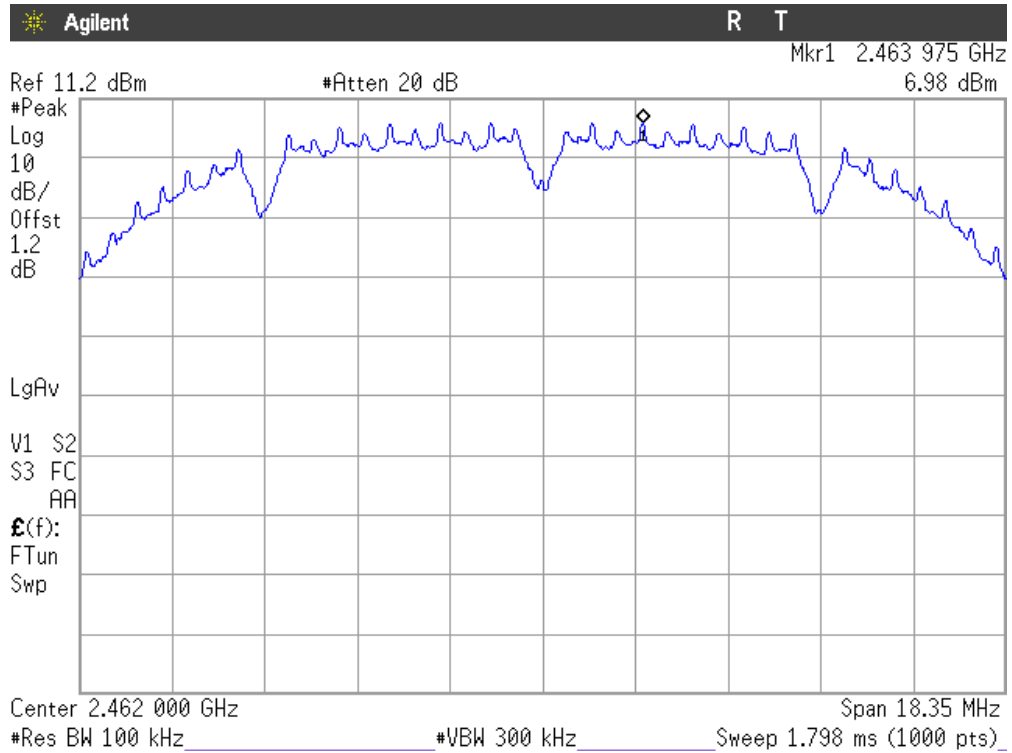
Unwanted Emissions Level Measurement



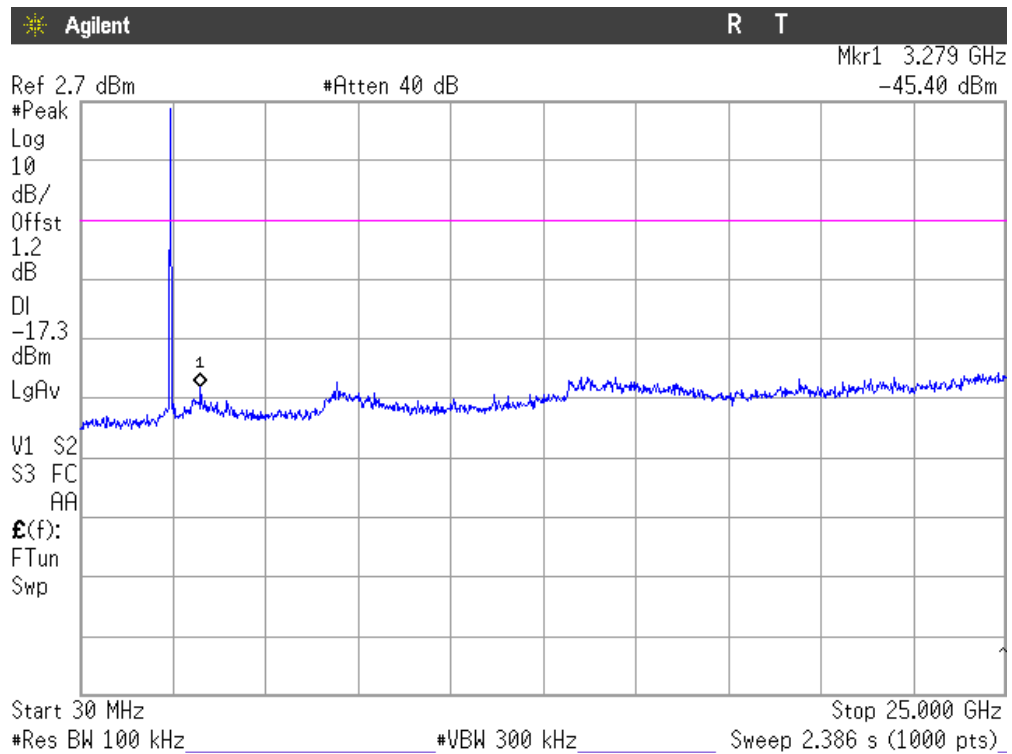
Note: The peak above the limit is the carrier frequency.

Highest Channel: 2462 MHz.

Reference Level Measurement



Unwanted Emissions Level Measurement



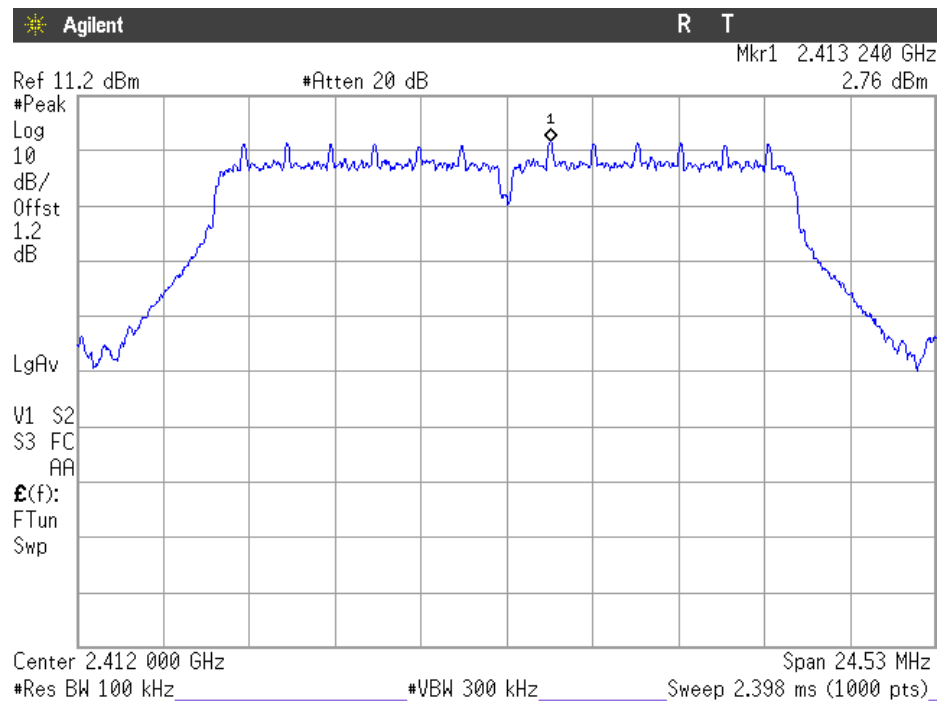
Note: The peak above the limit is the carrier frequency.

## 2. OFDM Modulation

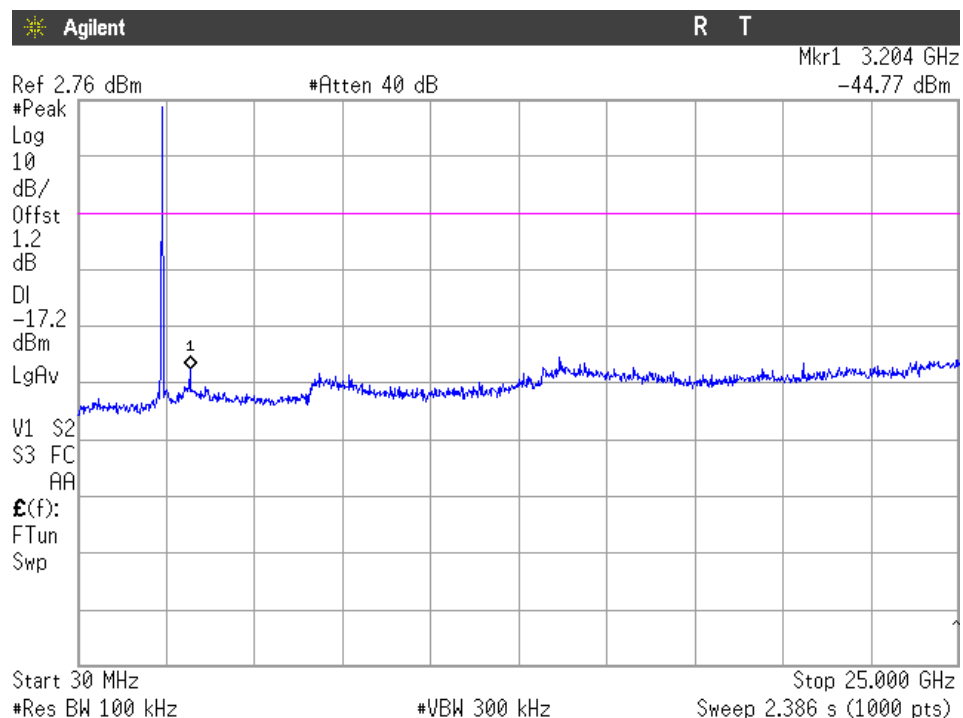
Preliminary tests were done with the equipment operating with OFDM modulation mode at 6 Mbps, 9 Mbps, 12 Mbps, 18 Mbps, 24 Mbps, 36 Mbps, 48 Mbps and 54 Mbps, and the worst case was for 6 Mbps bit rate. Results shown below correspond to 6 Mbps.

Lowest Channel: 2412 MHz.

### Reference Level Measurement



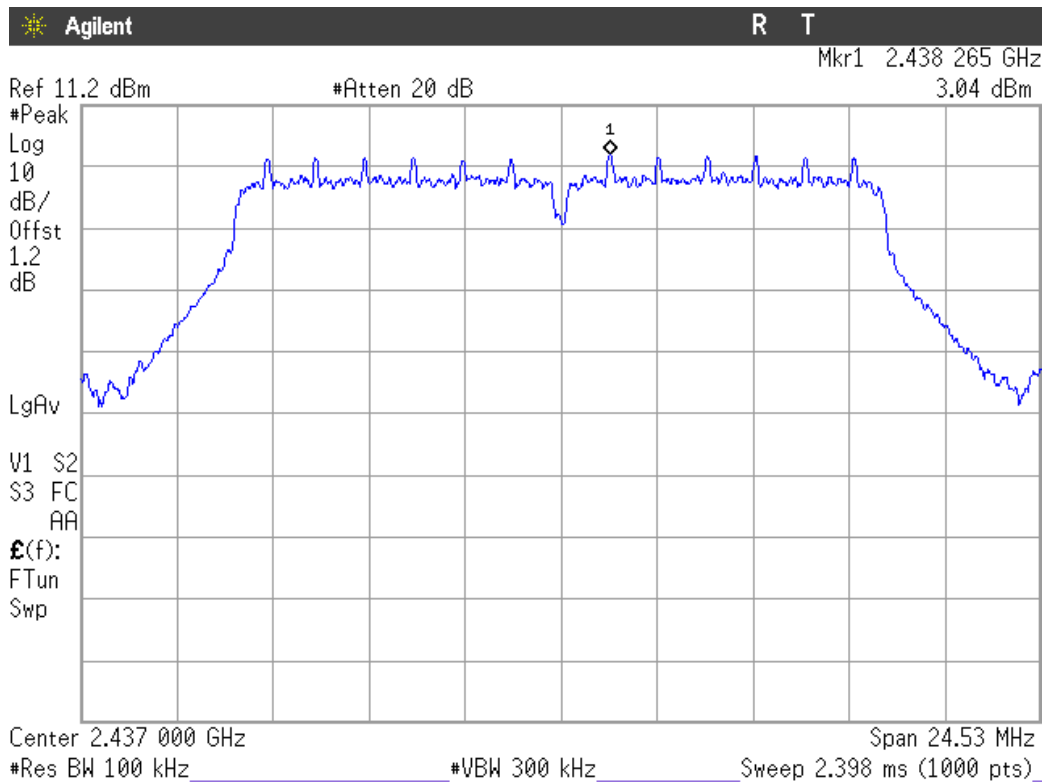
### Unwanted Emissions Level Measurement



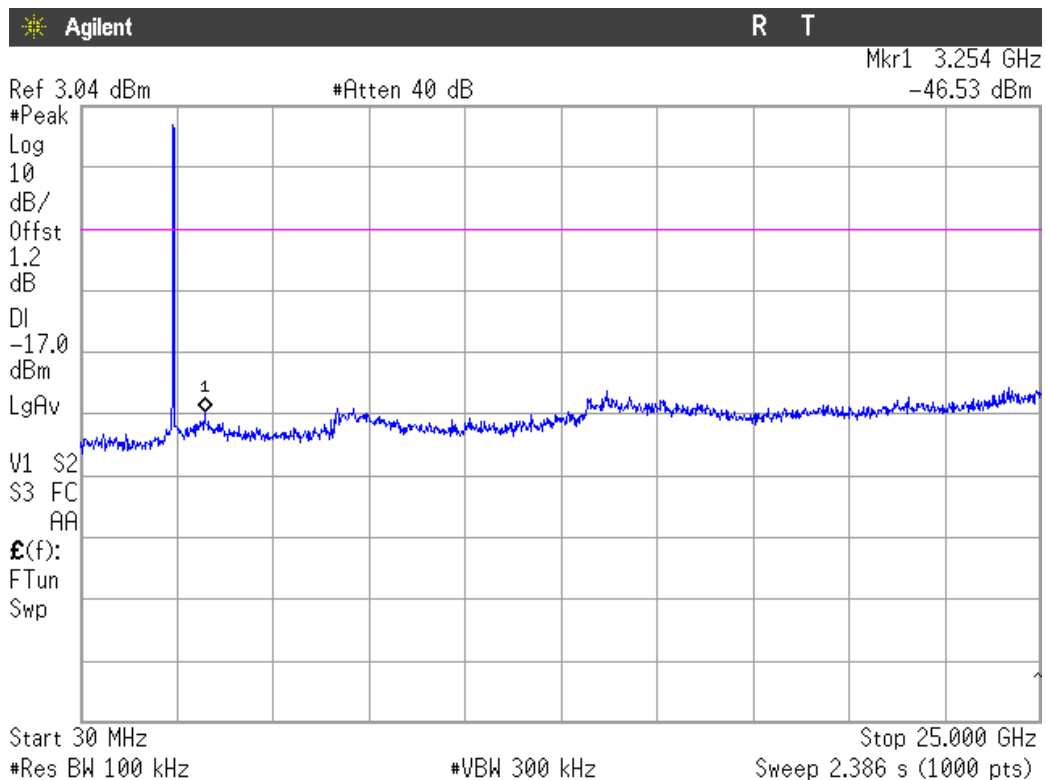
Note: The peak above the limit is the carrier frequency.

Middle Channel: 2437 MHz.

Reference Level Measurement



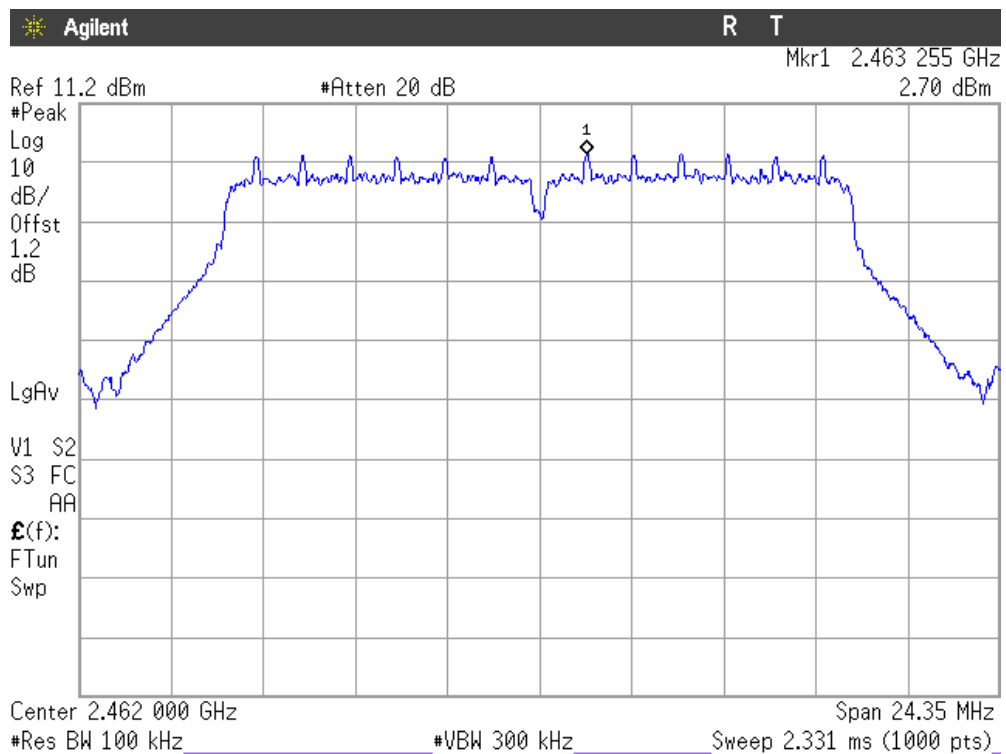
Unwanted Emissions Level Measurement



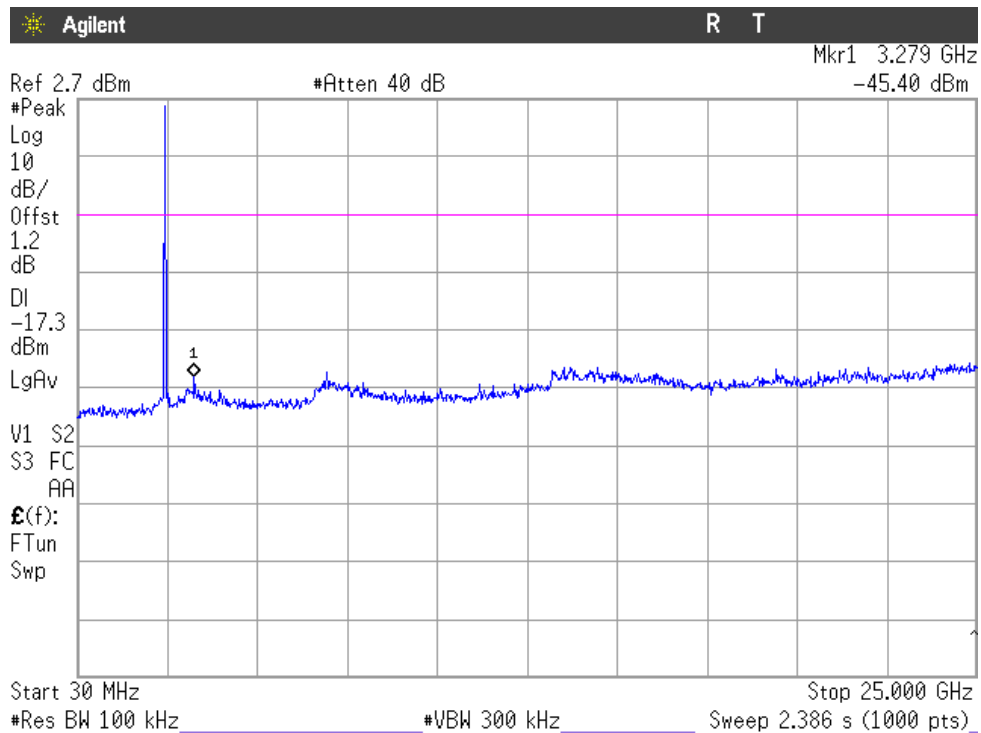
Note: The peak above the limit is the carrier frequency.

Highest Channel: 2462 MHz.

Reference Level Measurement



Unwanted Emissions Level Measurement



Note: The peak above the limit is the carrier frequency.

Verdict: PASS

**Section 15.247 Subclause (d) / RSS-210 A8.5. Band-edge emissions compliance (Transmitter)**

**SPECIFICATION**

Emissions outside the frequency band in which the intentional radiator is operating shall be at least 20dB below the highest level of the desired power.

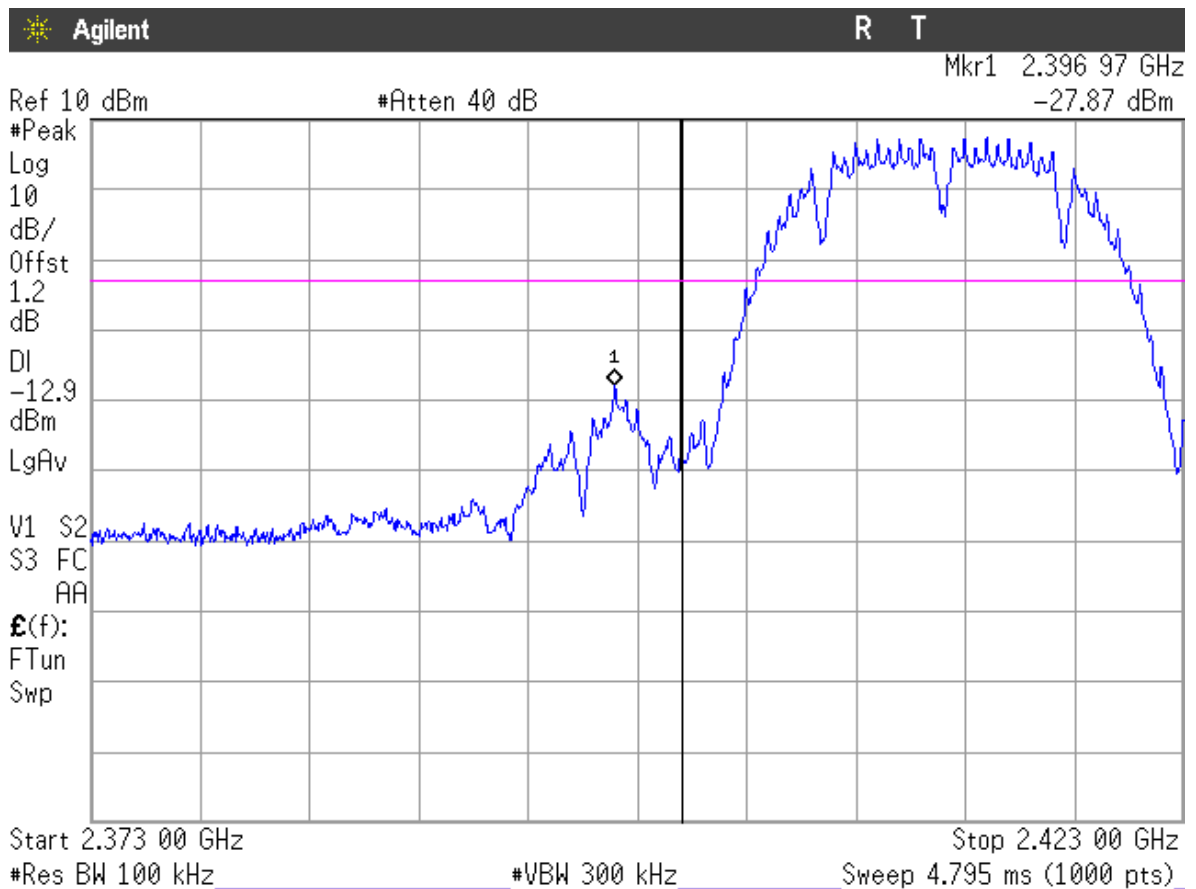
**RESULTS:**

**1. DSSS Modulation**

Preliminary tests were done with the equipment operating with DSSS modulation mode at 1 Mbps, 2 Mbps, 5.5 Mbps and 11 Mbps and the worst case was for 1 Mbps bit rate. Results shown below correspond to 1 Mbps.

**1. LOW FREQUENCY SECTION 2412 MHZ. CONDUCTED.**

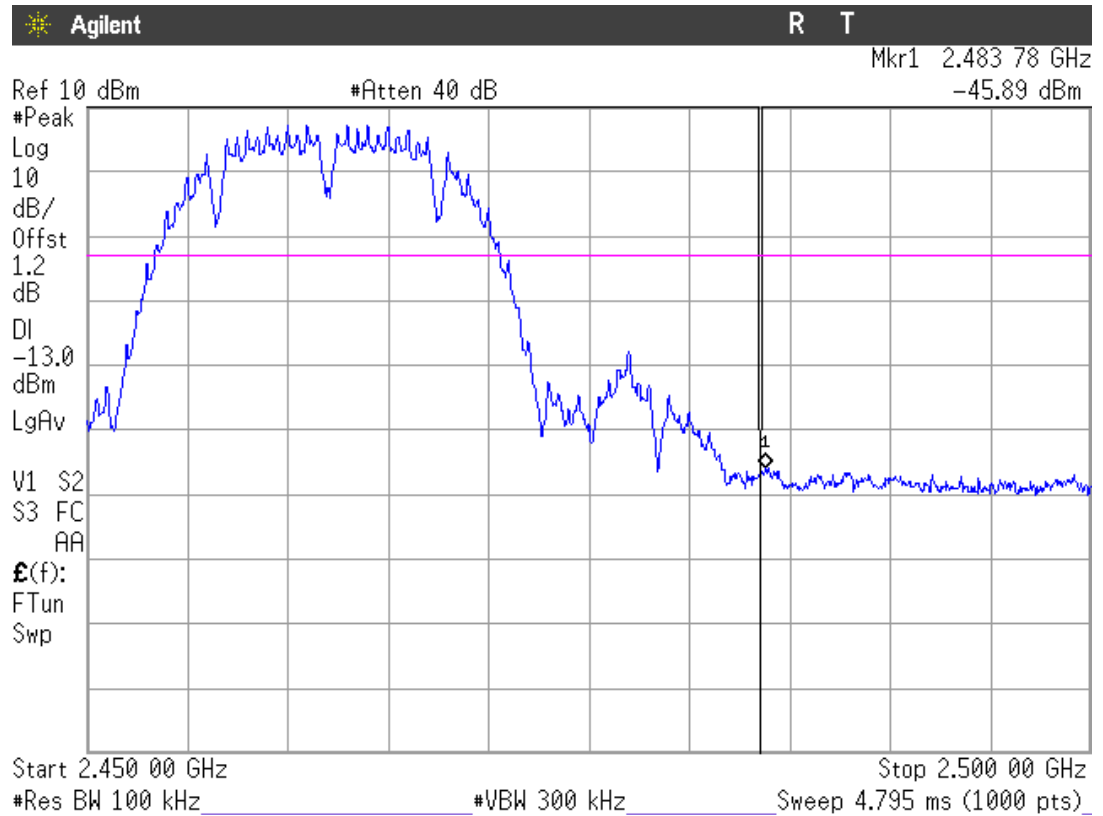
See next plot.



Verdict: PASS

2. HIGH FREQUENCY SECTION 2462 MHz. CONDUCTED.

See next plot.



Verdict: PASS

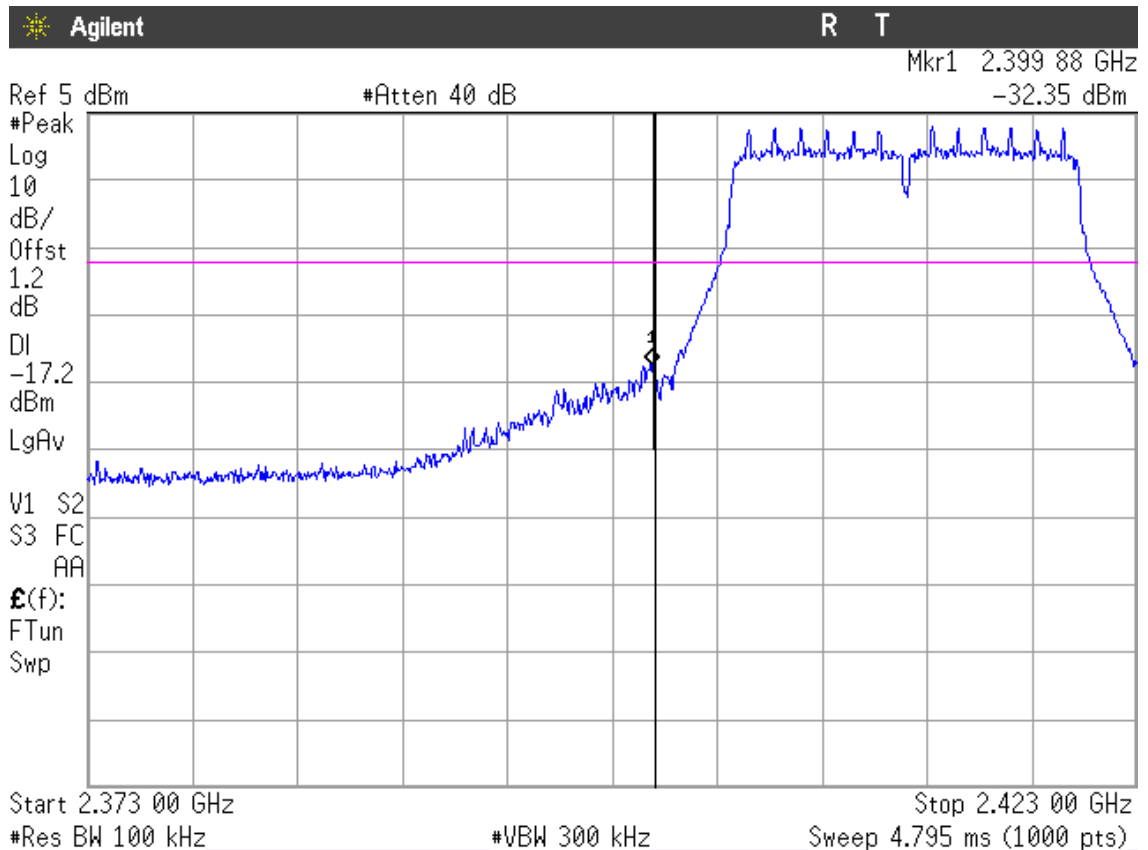


## 2. OFDM Modulation

Preliminary tests were done with the equipment operating with OFDM modulation mode at 6 Mbps, 9 Mbps, 12 Mbps, 18 Mbps, 24 Mbps, 36 Mbps, 48 Mbps and 54 Mbps, and the worst case was for 6 Mbps bit rate. Results shown below correspond to 6 Mbps.

### 1. LOW FREQUENCY SECTION 2412 MHz. CONDUCTED.

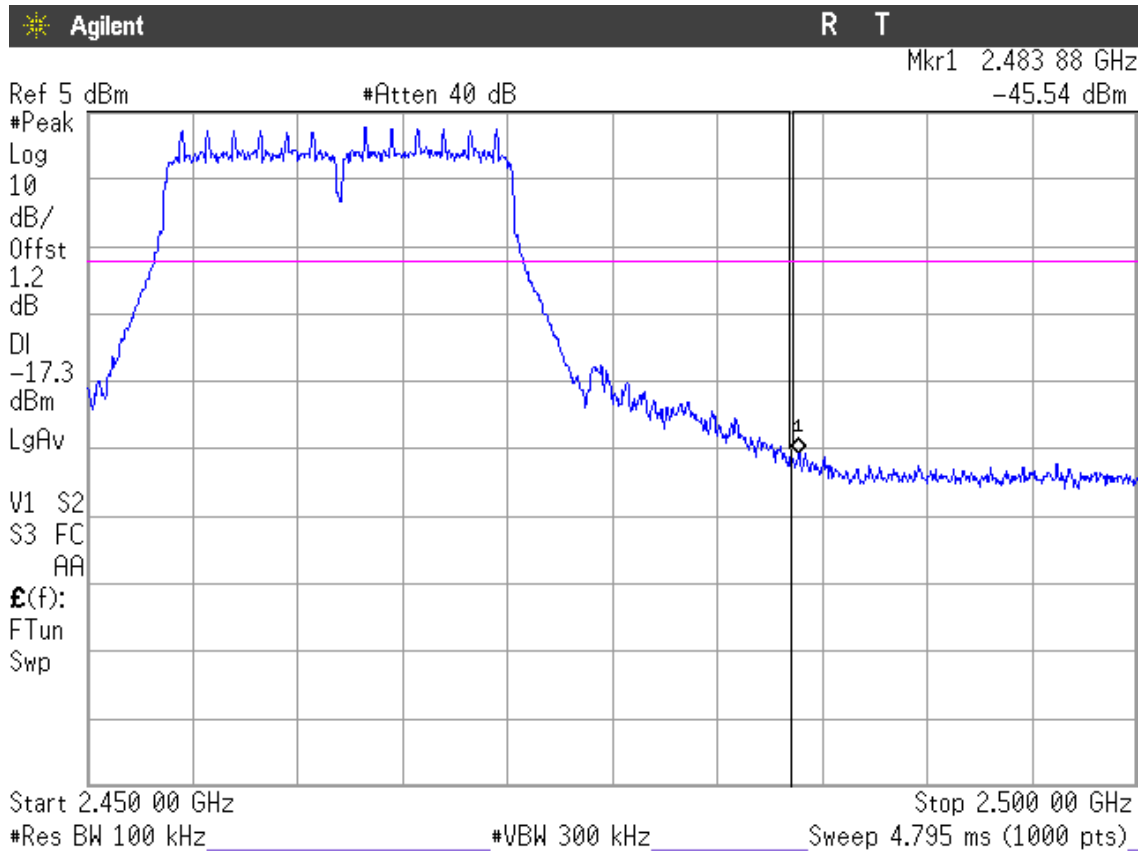
See next plot.



Verdict: PASS

2. HIGH FREQUENCY SECTION 2462 MHz. CONDUCTED.

See next plot.



Verdict: PASS

## Band-edge compliance of radiated emissions

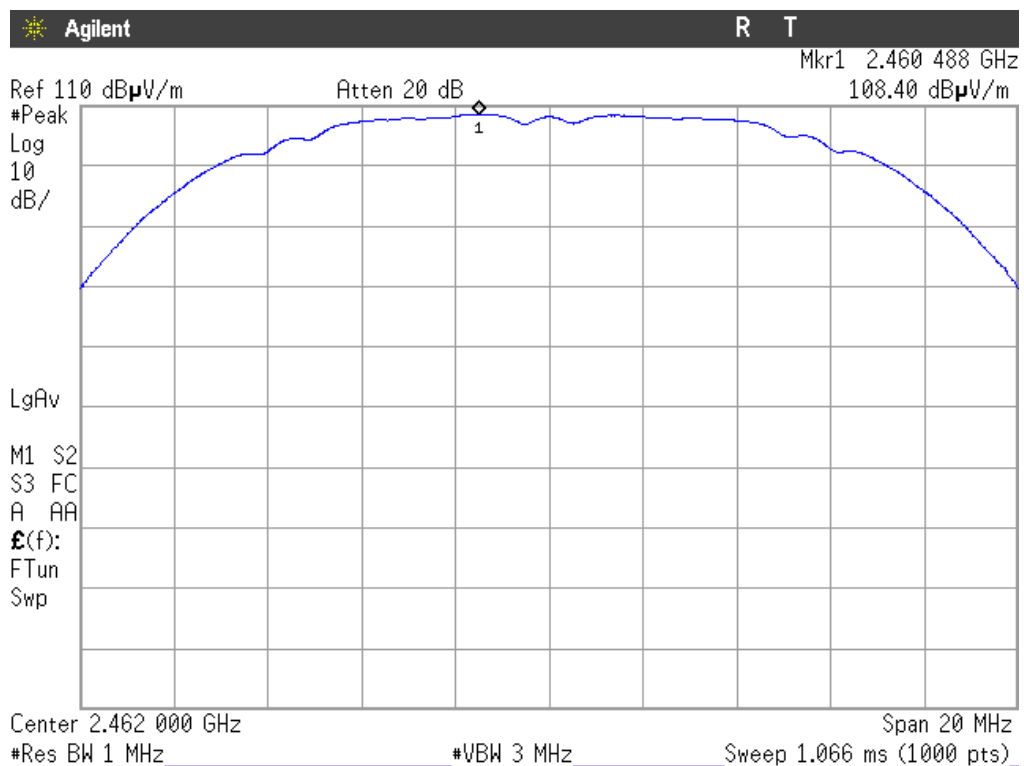
### 1. DSSS Modulation

Preliminary tests were done with the equipment operating with DSSS modulation mode at 1 Mbps, 2 Mbps, 5.5 Mbps and 11 Mbps and the worst case was for 1 Mbps bit rate. Results shown below correspond to 1 Mbps.

Maximum peak and average field strength of fundamental emission at 3 m distance.

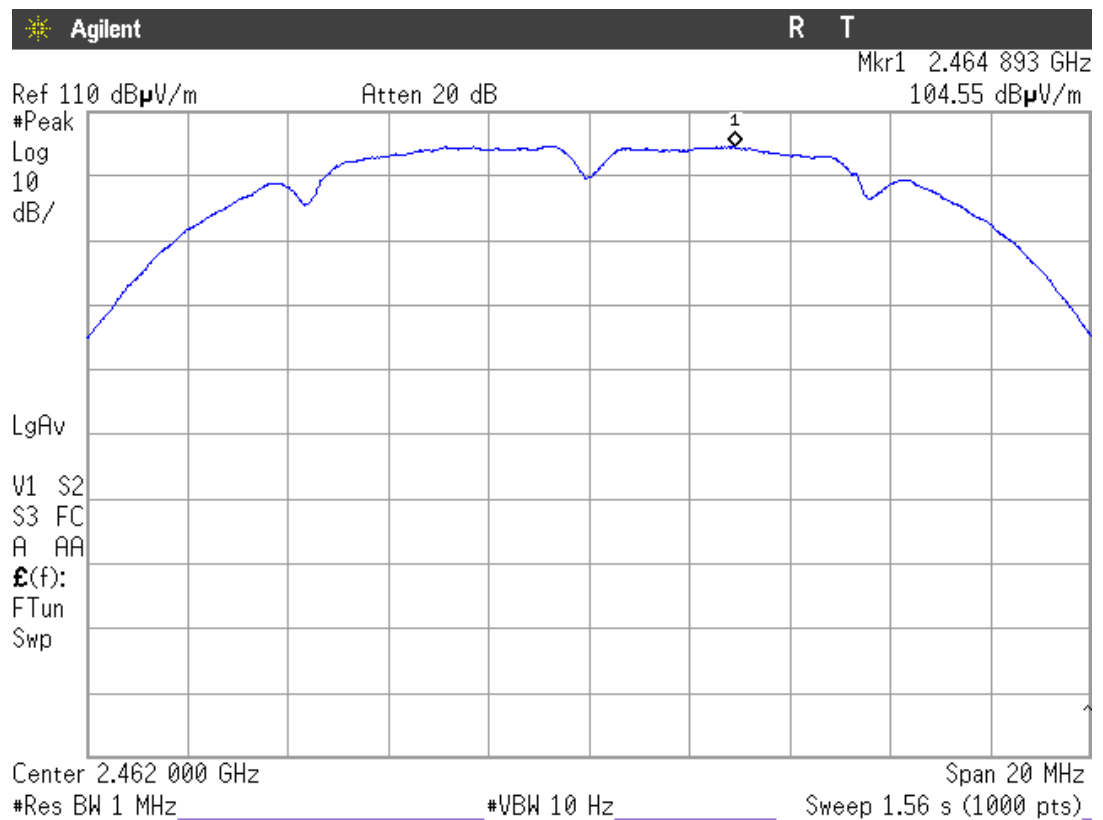
HIGHEST CHANNEL (2462 MHz):

Maximum field strength at 3 m. Peak value.



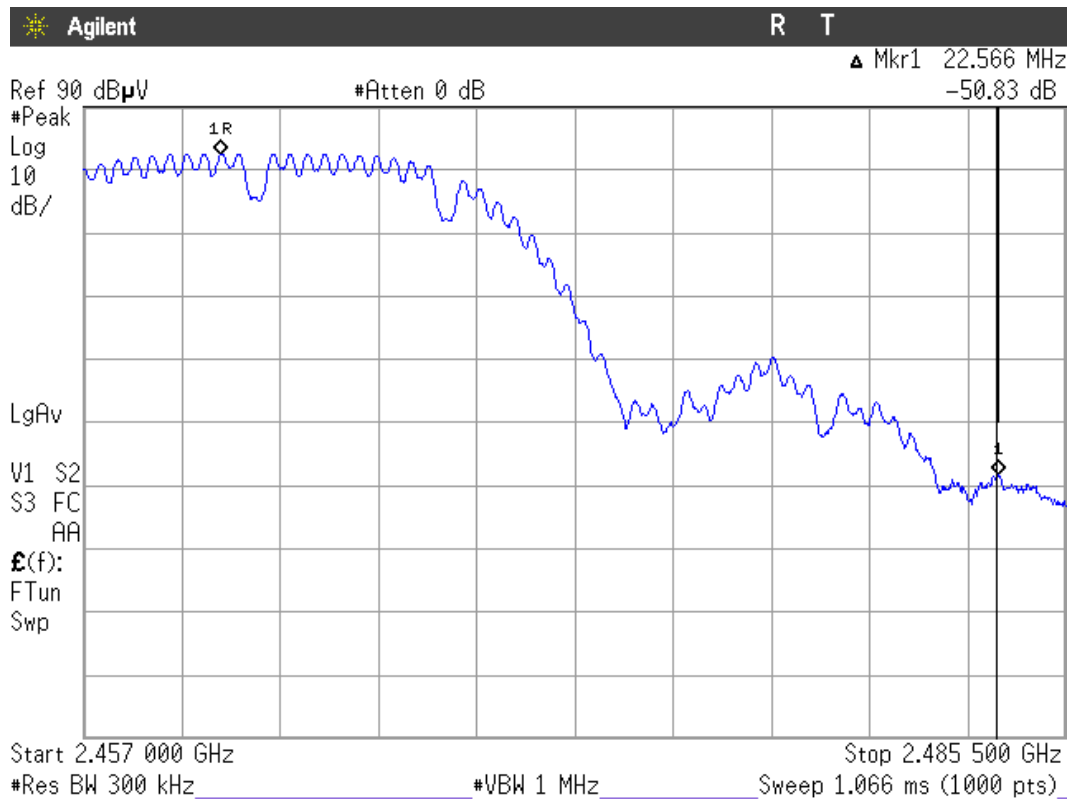
Note: The correction factor is already included in the spectrum analyzer as a transducer factor so that the marker shows directly the field strength level.

Maximum field strength at 3 m. Average value.



Note: The correction factor is already included in the spectrum analyzer as a transducer factor so that the marker shows directly the field strength level.

BAND-EDGE COMPLIANCE. RADIATED. Marker-Delta Method.



Note: No correction is applied for this relative measurement.

Band edge compliance of radiated emissions

Fundamental max. average value 3 m	Delta value	Calculated value 3 m	Limit
104.55 dB $\mu$ V/m	50.83 dB	53.72 dB $\mu$ V/m	54 dB $\mu$ V/m

Fundamental max. Peak value 3 m	Delta value	Calculated value 3 m	Limit
108.40 dB $\mu$ V/m	50.83 dB	57.57 dB $\mu$ V/m	74 dB $\mu$ V/m

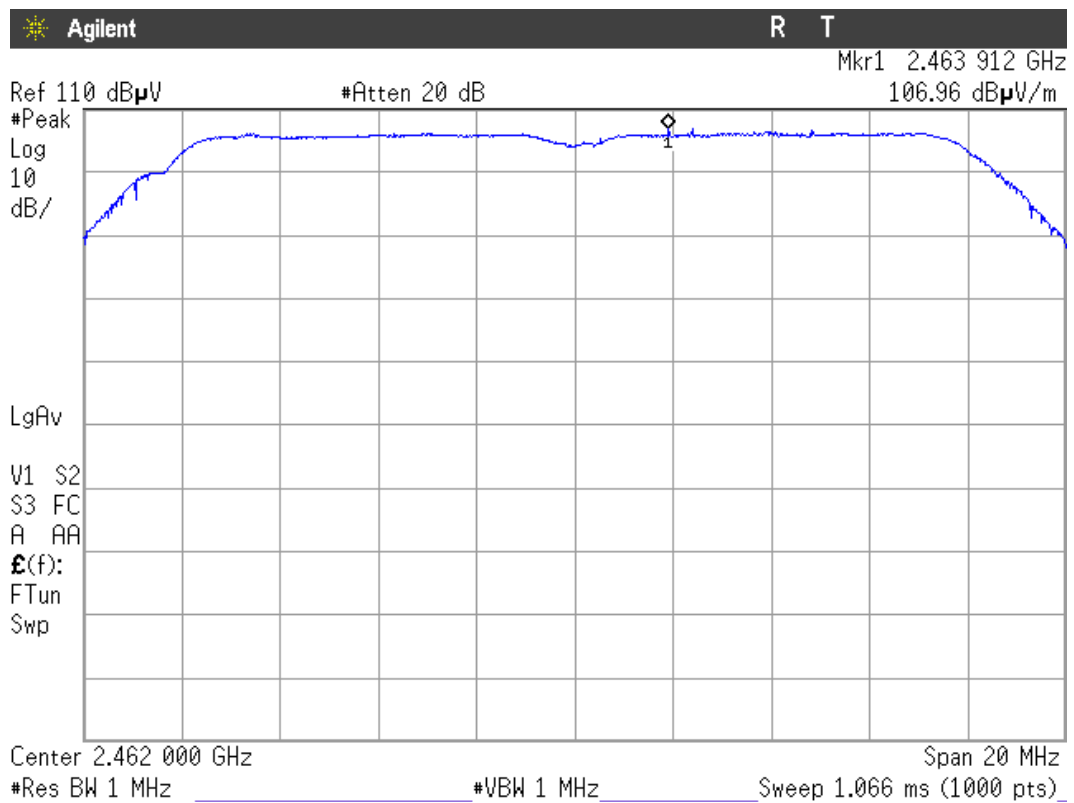
Verdict: PASS

## 2. OFDM Modulation

Preliminary tests were done with the equipment operating with OFDM modulation mode at 6 Mbps, 9 Mbps, 12 Mbps, 18 Mbps, 24 Mbps, 36 Mbps, 48 Mbps and 54 Mbps, and the worst case was for 6 Mbps bit rate. Results shown below correspond to 6 Mbps.

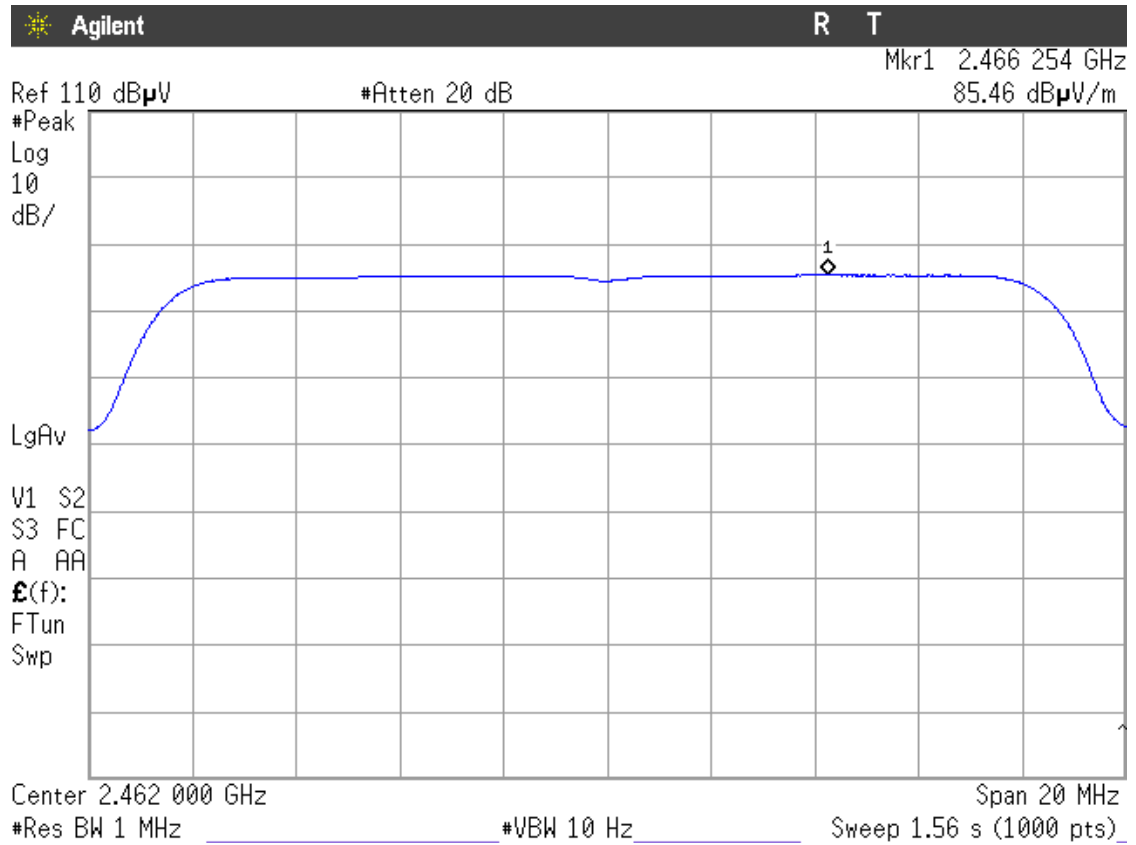
HIGHEST CHANNEL (2462 MHz):

Maximum field strength at 3 m. Peak value.



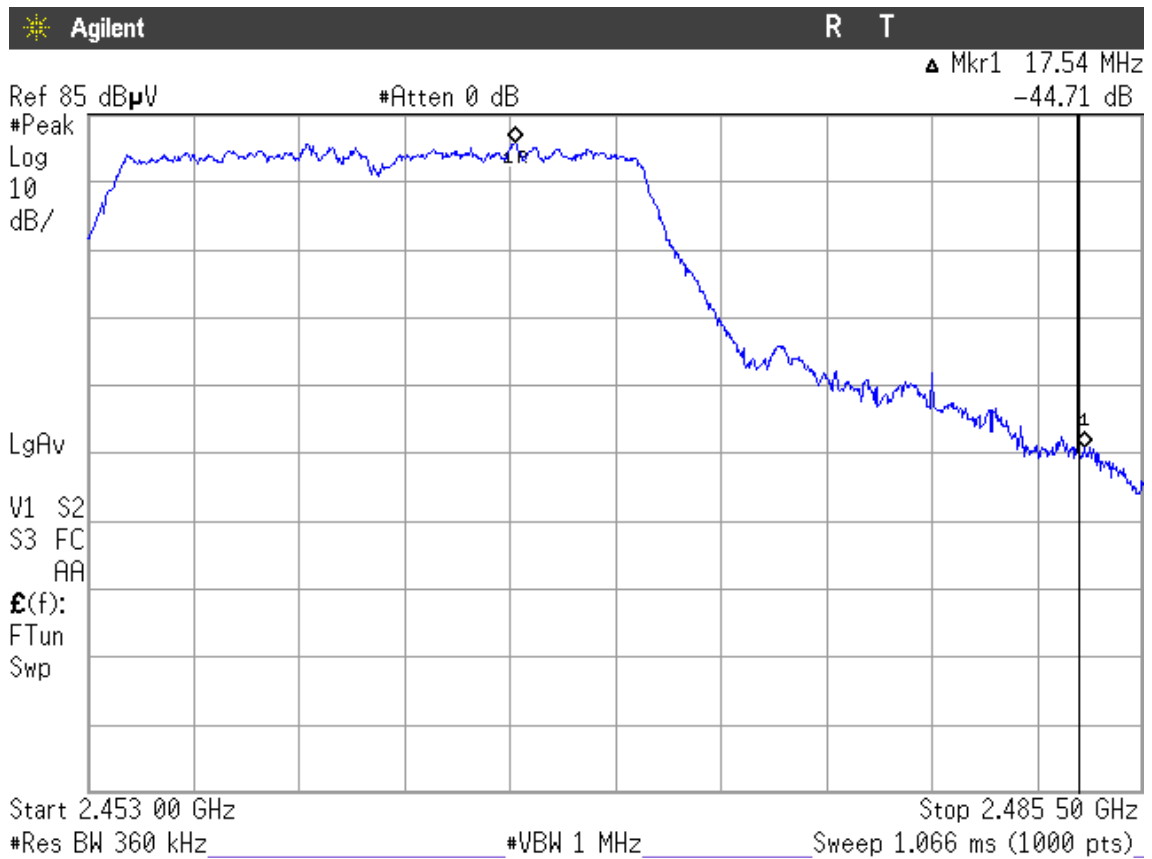
Note: The correction factor is already included in the spectrum analyzer as a transducer factor so that the marker shows directly the field strength level.

Maximum field strength at 3 m. Average value.



Note: The correction factor is already included in the spectrum analyzer as a transducer factor so that the marker shows directly the field strength level.

BAND-EDGE COMPLIANCE. RADIATED. Marker-Delta Method.



Note: No correction is applied for this relative measurement.

Band edge compliance of radiated emissions

Fundamental max. average value 3 m	Delta value	Calculated value 3 m	Limit
85.46 dB $\mu$ V/m	44.71 dB	40.75 dB $\mu$ V/m	54 dB $\mu$ V/m

Fundamental max. Peak value 3 m	Delta value	Calculated value 3 m	Limit
106.96 dB $\mu$ V/m	44.71 dB	62.25 dB $\mu$ V/m	74 dB $\mu$ V/m

Verdict: PASS



**Section 15.247 Subclause (e) / RSS-210 A8.5. Power spectral density**

SPECIFICATION

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS

The maximum power spectral density level was measured using the method according to point 9.1. Option 1 of Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 558074 D01 DTS Meas Guidance v02 dated 10/04/2012.

1. DSSS modulation

Preliminary tests were done with the equipment operating with DSSS modulation mode at 1 Mbps, 2 Mbps, 5.5 Mbps and 11 Mbps and the worst case was for 1 Mbps bit rate. Results shown below correspond to 1 Mbps.

Power spectral density (see next plots).

	Lowest frequency	Middle frequency	Highest frequency
	2412 MHz	2437 MHz	2462 MHz
Power spectral density (dBm) in 3 kHz bandwidth	6.90	7.14	6.84
Measurement uncertainty (dB)	±1.5		

2. OFDM modulation

Preliminary tests were done with the equipment operating with OFDM modulation mode at 6 Mbps, 9 Mbps, 12 Mbps, 18 Mbps, 24 Mbps, 36 Mbps, 48 Mbps and 54 Mbps, and the worst case was for 6 Mbps bit rate. Results shown below correspond to 6 Mbps.

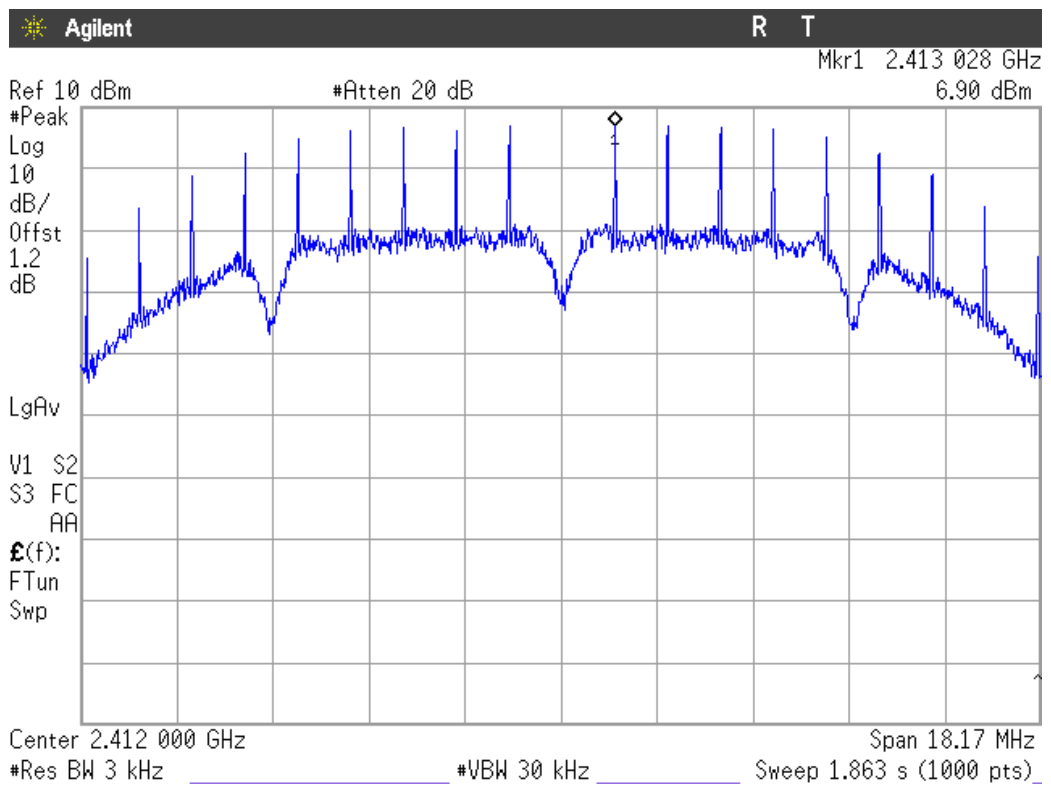
Power spectral density (see next plots).

	Lowest frequency	Middle frequency	Highest frequency
	2412 MHz	2437 MHz	2462 MHz
Power spectral density (dBm) in 3 kHz bandwidth	-12.09	-11.41	-12.96
Measurement uncertainty (dB)	±1.5		

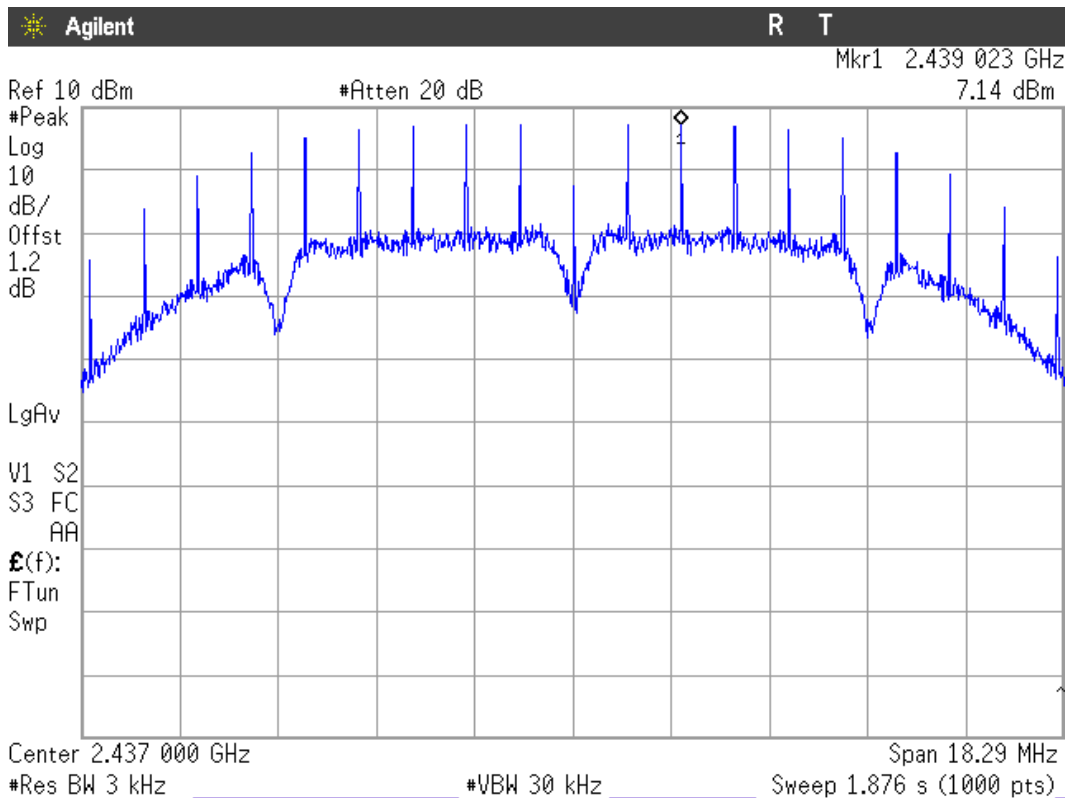
Verdict: PASS

### 1. DSSS modulation

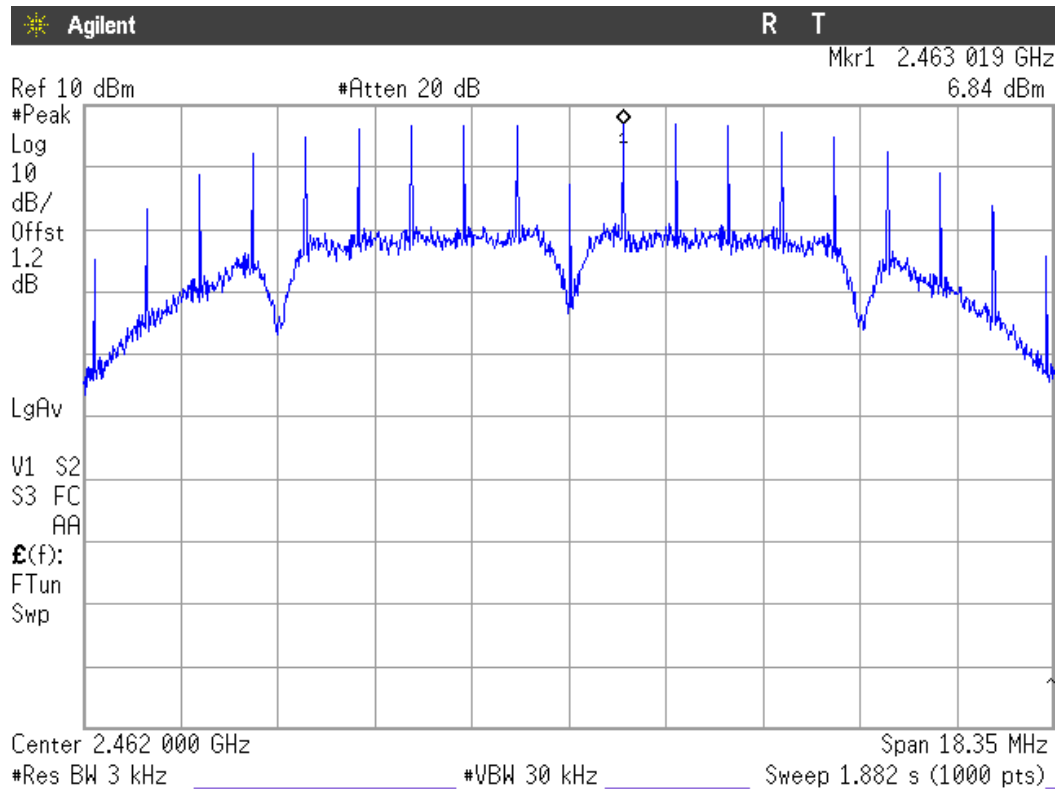
Lowest Channel: 2412 MHz.



Middle Channel: 2437 MHz.

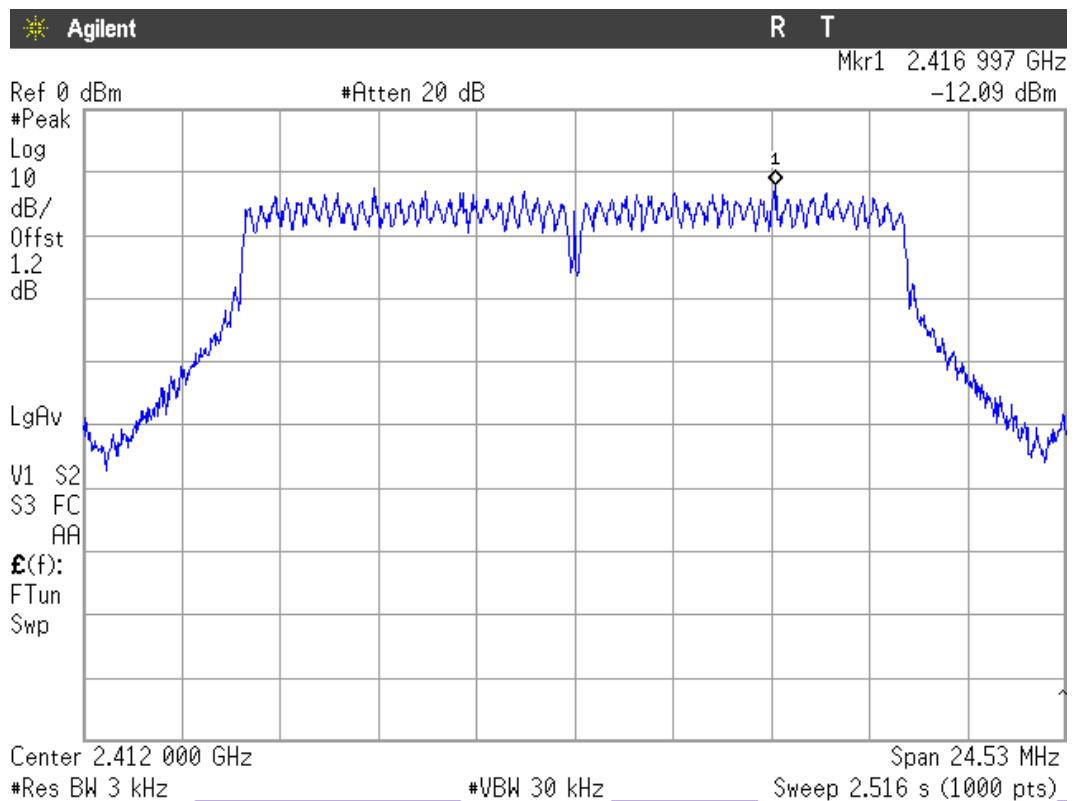


Highest Channel: 2462 MHz.

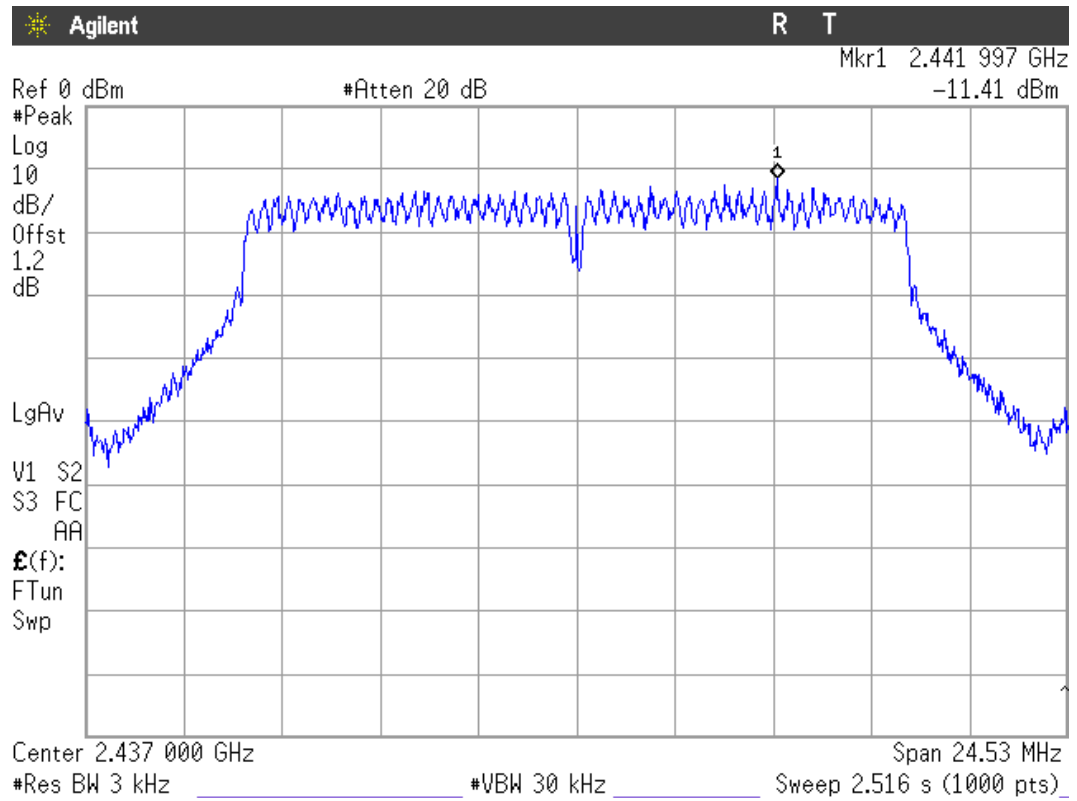


## 2. OFDM modulation

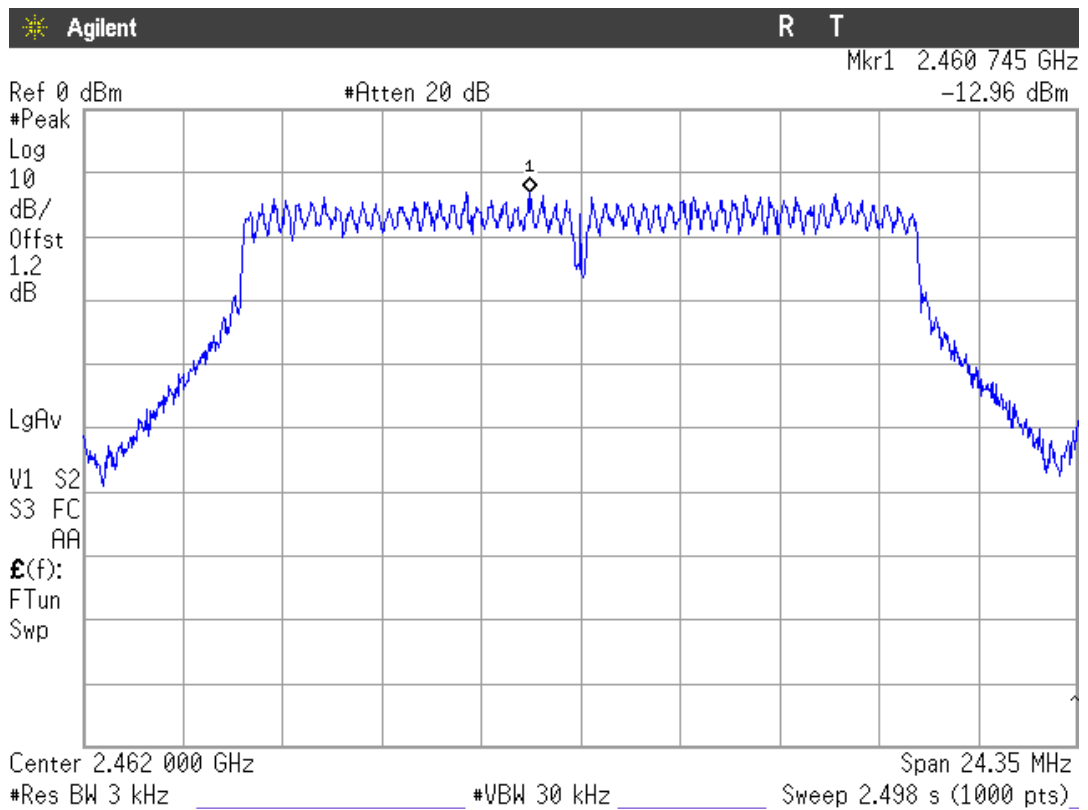
Lowest Channel: 2412 MHz.



Middle Channel: 2437 MHz.



Highest Channel: 2462 MHz.



**Section 15.247 Subclause (d) / RSS-210 A8.5. Emission limitations radiated (Transmitter)**

**SPECIFICATION**

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)):

Frequency Range (MHz)	Field strength ( $\mu\text{V/m}$ )	Field strength ( $\text{dB}\mu\text{V/m}$ )	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	300
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 25000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

**RESULTS:**

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-1000 MHz and at distance of 1m for the frequency range 1 GHz-25 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

The equipment transmits continuously in the selected channel so it is not necessary a duty cycle correction factor.

**Frequency range 30 MHz-1000 MHz.**

The spurious signals detected do not depend on either the operating channel or the modulation mode.

Highest spurious levels:

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB $\mu$ V/m)	Measurement Uncertainty (dB)
450.6126	V	Quasi-Peak	33.73	$\pm 3.8$
501.0860	H	Quasi-Peak	34.06	$\pm 3.8$
551.5601	H	Quasi-Peak	33.94	$\pm 3.8$
600.0926	V	Quasi-Peak	34.85	$\pm 3.8$
650.5663	V	Quasi-Peak	33.04	$\pm 3.8$
961.1740	H	Quasi-Peak	39.73	$\pm 3.8$

## Frequency range 1 GHz-25 GHz

### DSSS Modulation

Preliminary tests were done with the equipment operating with DSSS modulation mode at 1 Mbps, 2 Mbps, 5.5 Mbps and 11 Mbps and the worst case was for 1 Mbps bit rate. Results shown below correspond to 1 Mbps.

Spurious signals with peak levels above the average limit (54 dB $\mu$ V/m at 3 m) are measured with average detector for checking compliance with the average limit.

#### 1. CHANNEL: LOWEST (2412 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB $\mu$ V/m)	Measurement Uncertainty (dB)
1.608178	V	Peak	48.04	$\pm 4.09$
2.30222	V	Peak	55.43	$\pm 4.09$
		Average	45.69	$\pm 4.09$
2.39000	V	Peak	58.30	$\pm 4.09$
		Average	50.93	$\pm 4.09$
4.82382	V	Peak	44.91	$\pm 4.09$
6.431902	V	Peak	53.14	$\pm 4.09$
9.648025	V	Peak	50.97	$\pm 4.09$

#### 2. CHANNEL: MIDDLE (2437 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB $\mu$ V/m)	Measurement Uncertainty (dB)
2.35949	V	Peak	55.66	$\pm 4.09$
		Average	43.38	$\pm 4.09$
2.484338	V	Peak	56.02	$\pm 4.09$
		Average	43.84	$\pm 4.09$
3.249485	V	Peak	44.67	$\pm 4.09$
4.874030	V	Peak	45.70	$\pm 4.09$
6.498595	V	Peak	52.78	$\pm 4.09$
9.747944	V	Peak	52.16	$\pm 4.09$

3. CHANNEL: HIGHEST (2462 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB $\mu$ V/m)	Measurement Uncertainty (dB)
2.306200	V	Peak	55.07	$\pm 4.09$
		Average	44.05	$\pm 4.09$
3.282657	V	Peak	43.11	$\pm 4.09$
4.923996	V	Peak	52.49	$\pm 4.09$
6.565318	V	Peak	52.06	$\pm 4.09$
9.847982	V	Peak	56.79	$\pm 4.09$
		Average	53.28	$\pm 4.09$

Verdict: PASS



### OFDM Modulation

Preliminary tests were done with the equipment operating with OFDM modulation mode at 6 Mbps, 9 Mbps, 12 Mbps, 18 Mbps, 24 Mbps, 36 Mbps, 48 Mbps and 54 Mbps, and the worst case was for 6 Mbps bit rate. Results shown below correspond to 6 Mbps.

Spurious signals with peak levels above the average limit (54 dB $\mu$ V/m at 3 m) are measured with average detector for checking compliance with the average limit.

#### 1. CHANNEL: LOWEST (2412 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB $\mu$ V/m)	Measurement Uncertainty (dB)
2.291300	V	Peak	55.49	$\pm 4.0$
		Average	44.52	$\pm 4.0$
2.390000	V	Peak	66.56	$\pm 4.0$
		Average	52.52	$\pm 4.0$
3.216011	V	Peak	47.17	$\pm 4.0$
6.431867	V	Peak	53.77	$\pm 4.0$

#### 2. CHANNEL: MIDDLE (2437 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB $\mu$ V/m)	Measurement Uncertainty (dB)
2.301300	V	Peak	54.09	$\pm 4.0$
		Average	43.19	$\pm 4.0$
2.384630	V	Peak	54.48	$\pm 4.0$
		Average	45.82	$\pm 4.0$
2.489149	V	Peak	55.57	$\pm 4.0$
		Average	46.08	$\pm 4.0$
3.249239	V	Peak	45.53	$\pm 4.0$
6.498491	V	Peak	53.43	$\pm 4.0$

3. CHANNEL: HIGHEST (2462 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB $\mu$ V/m)	Measurement Uncertainty (dB)
2.295850	V	Peak	55.90	$\pm 4.0$
		Average	44.76	$\pm 4.0$
2.312160	V	Peak	55.71	$\pm 4.0$
		Average	44.75	$\pm 4.0$
2.514140	V	Peak	55.15	$\pm 4.0$
		Average	45.90	$\pm 4.0$
3.282903	V	Peak	46.04	$\pm 4.0$
4.923080	V	Peak	44.49	$\pm 4.0$
6.565358	V	Peak	52.63	$\pm 4.0$

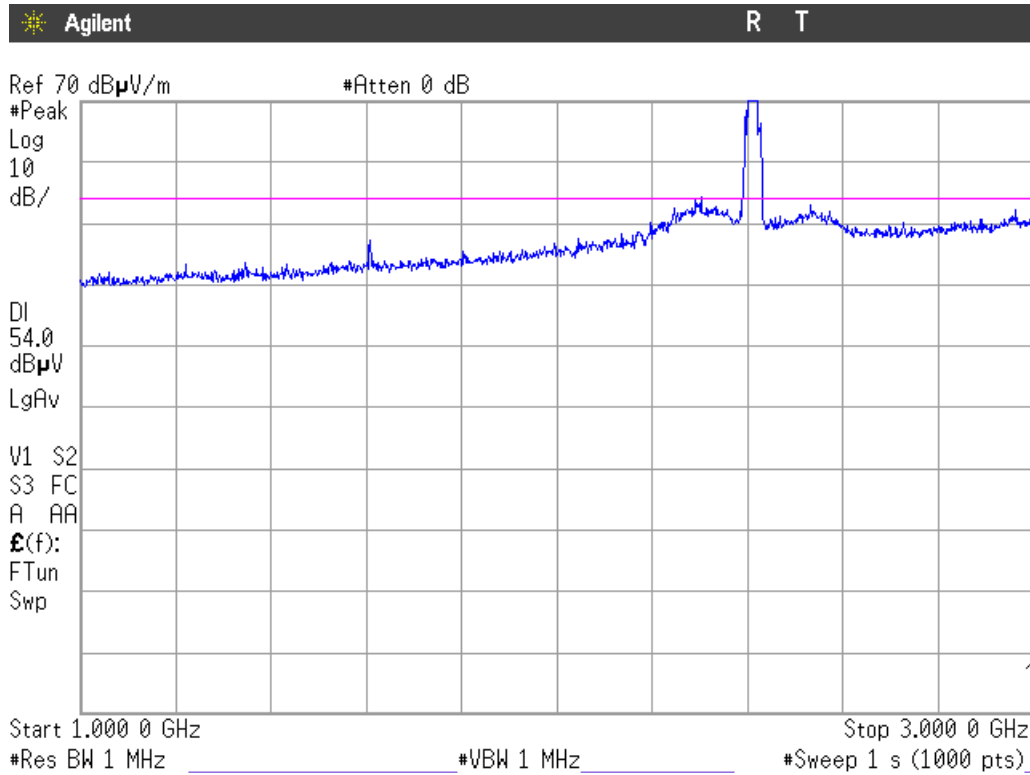
Verdict: PASS



FREQUENCY RANGE 1 GHz to 3 GHz.

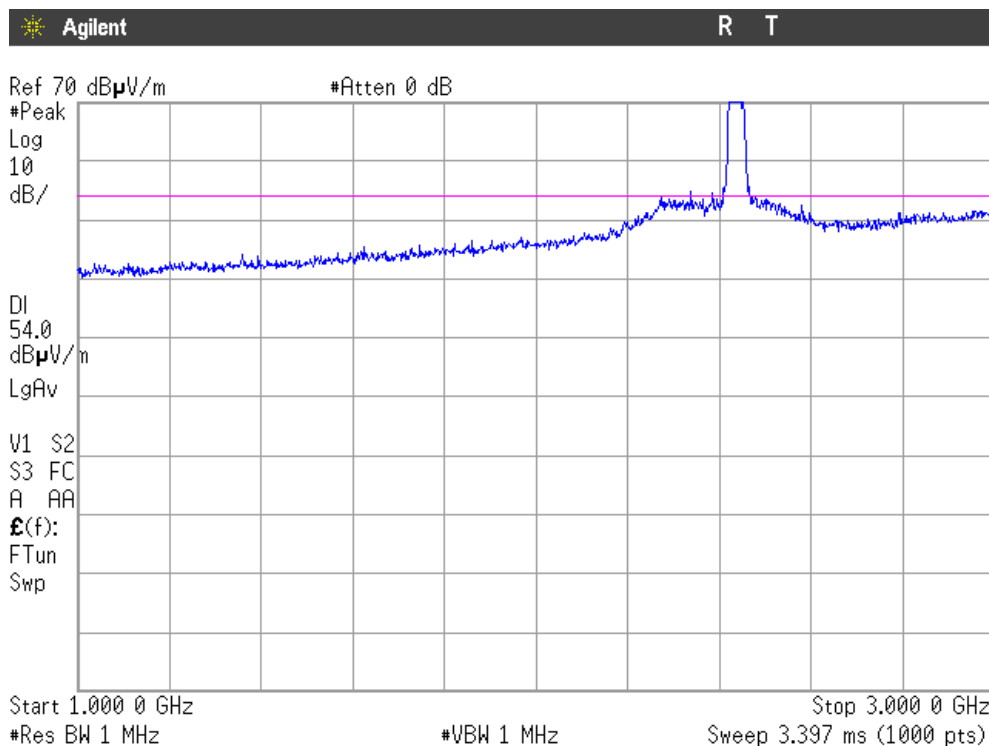
1. DSSS modulation

**CHANNEL: Lowest (2412 MHz).**



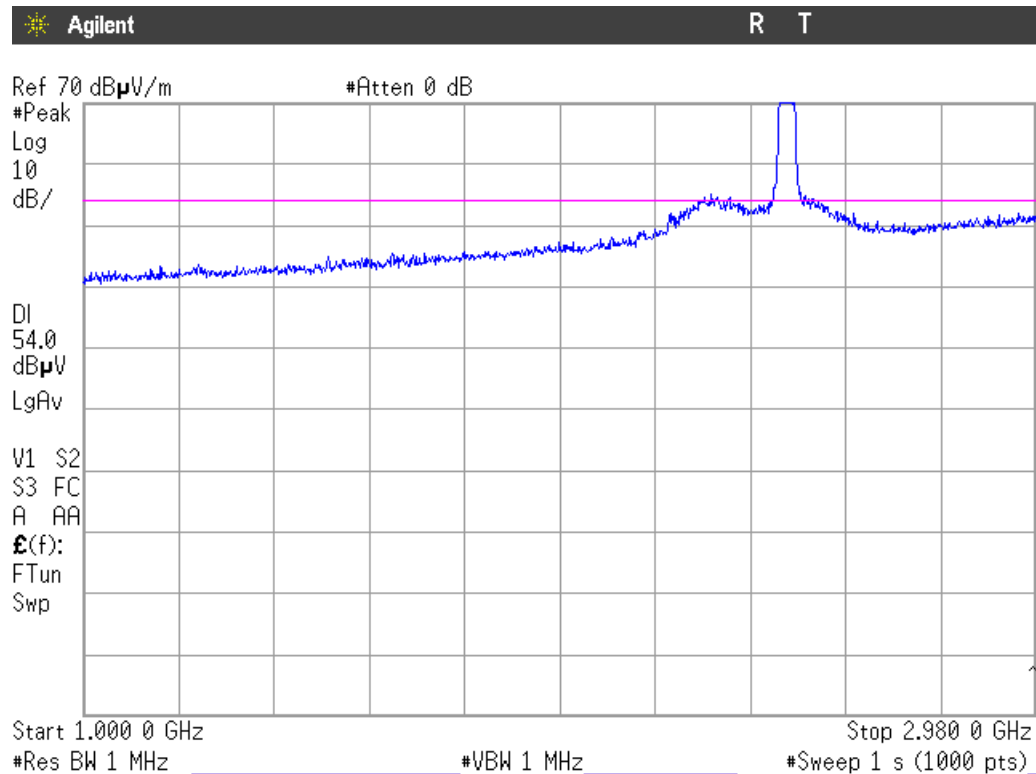
Note: The peak above the limit is the carrier frequency.

**CHANNEL: Middle (2437 MHz).**



Note: The peak above the limit is the carrier frequency.

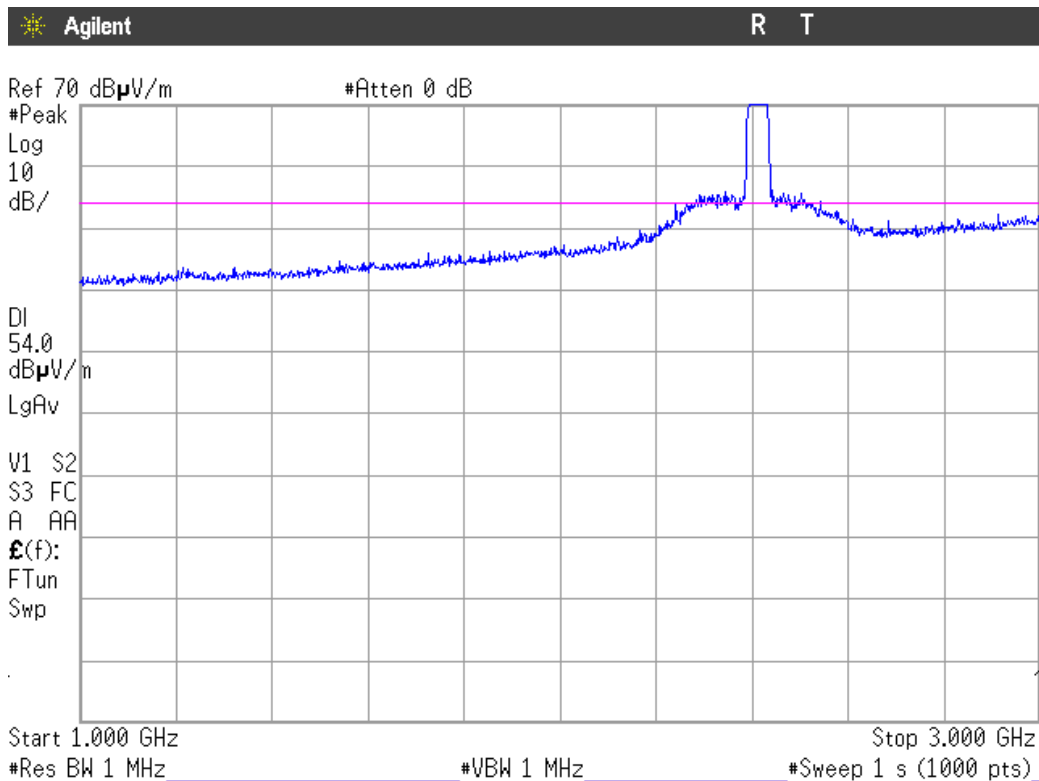
**CHANNEL: Highest (2462 MHz).**



Note: The peak above the limit is the carrier frequency.

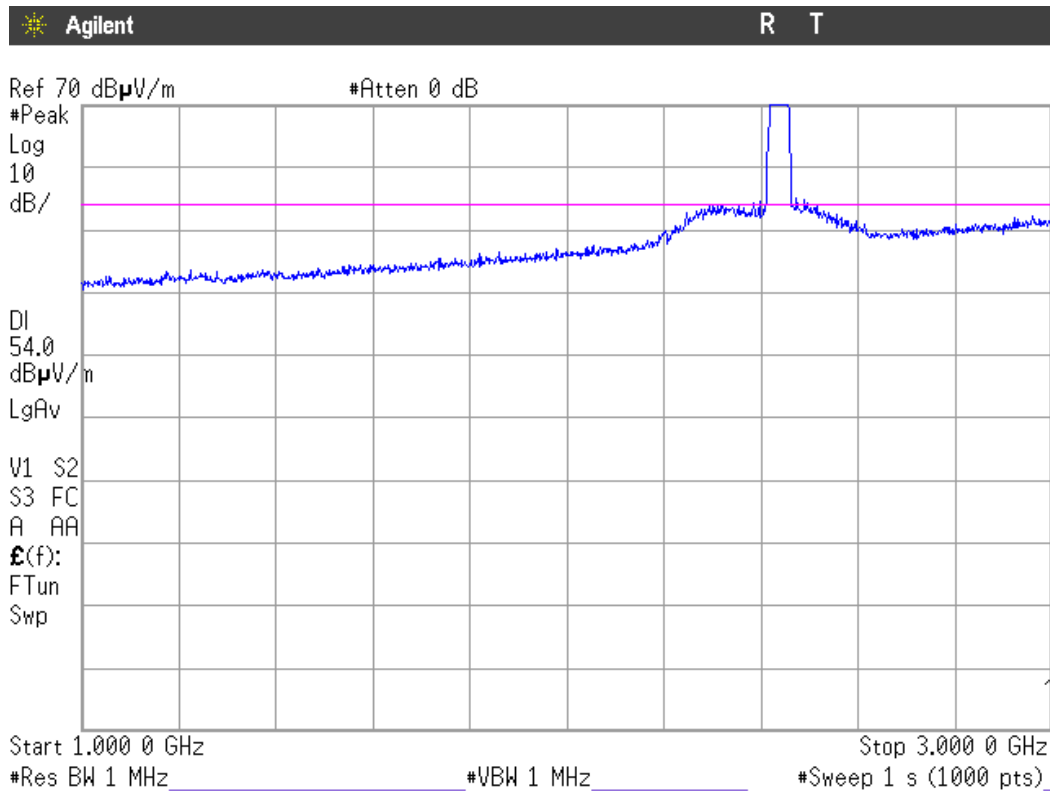
**2. OFDM modulation**

**CHANNEL: Lowest (2412 MHz).**



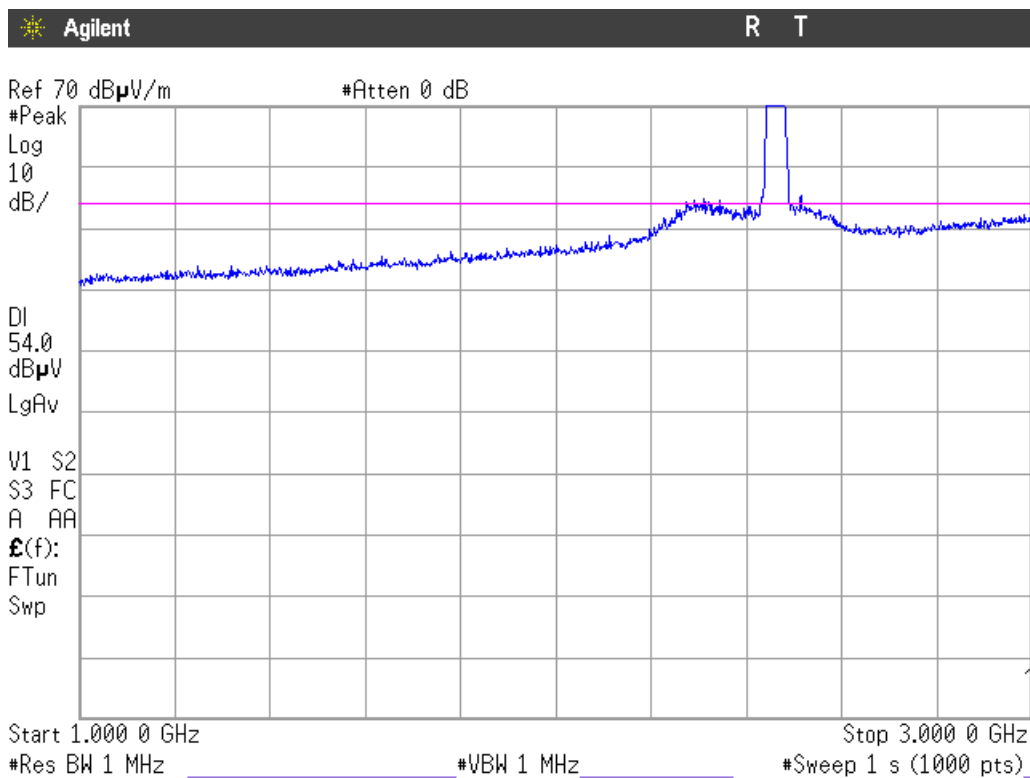
Note: The peak above the limit is the carrier frequency.

**CHANNEL: Middle (2437 MHz).**



Note: The peak above the limit is the carrier frequency.

**CHANNEL: Highest (2462 MHz).**

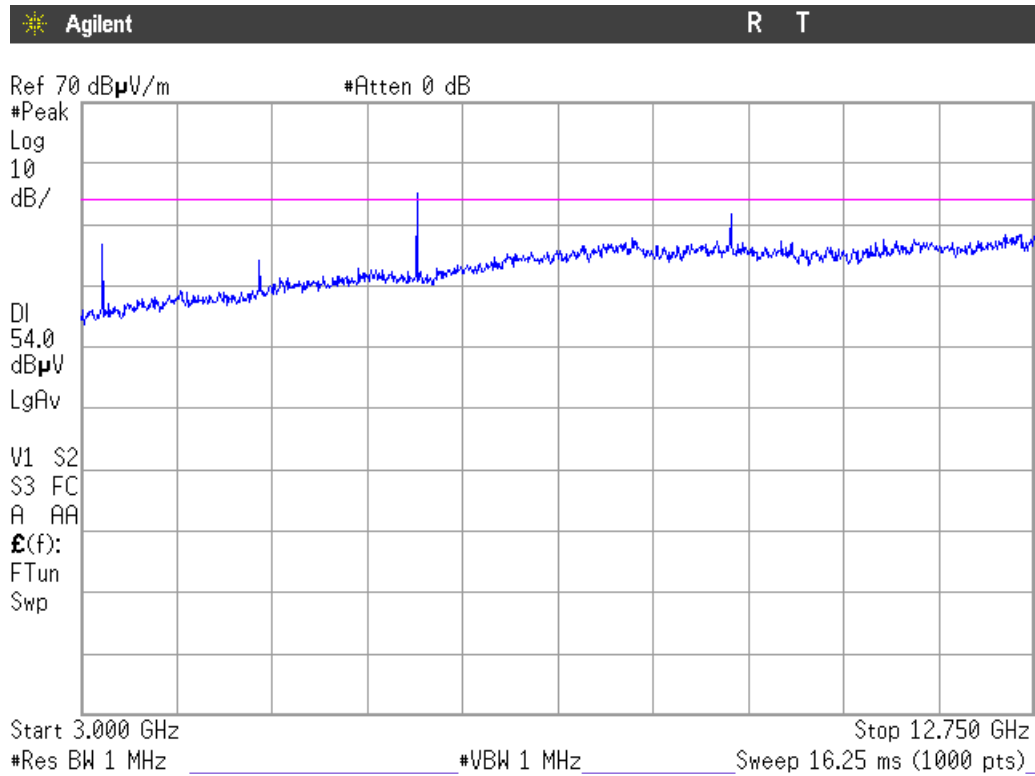


Note: The peak above the limit is the carrier frequency.

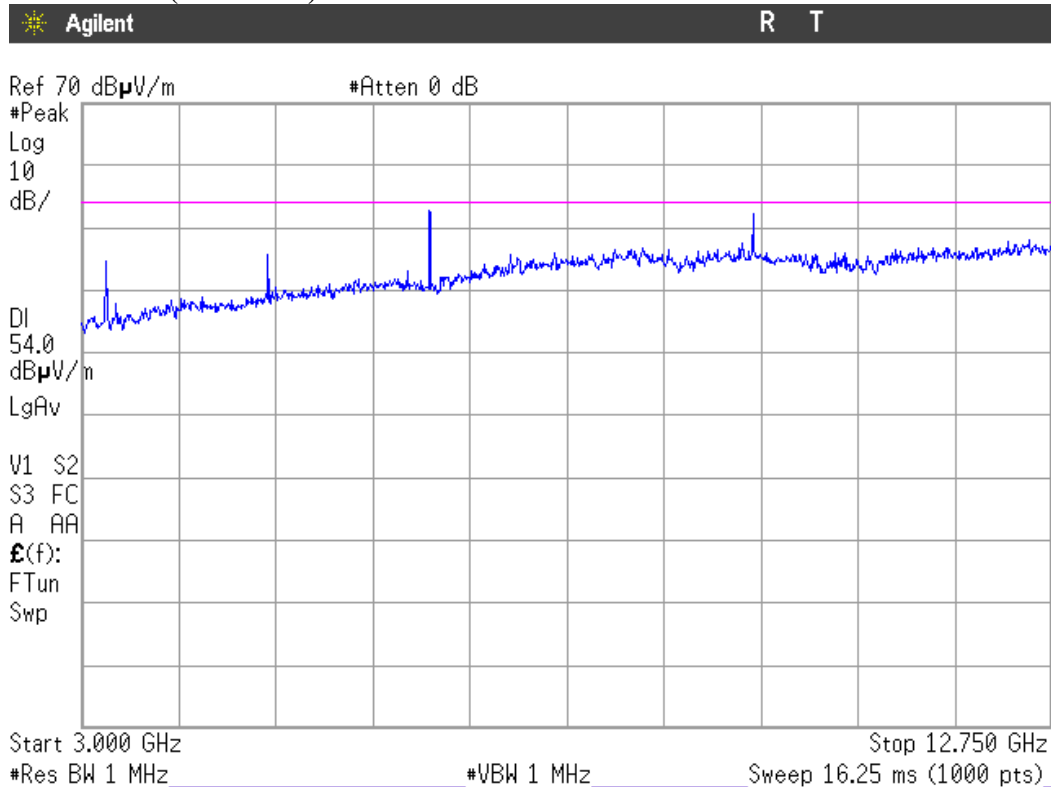
FREQUENCY RANGE 3 GHz to 12.75 GHz.

1. DSSS modulation

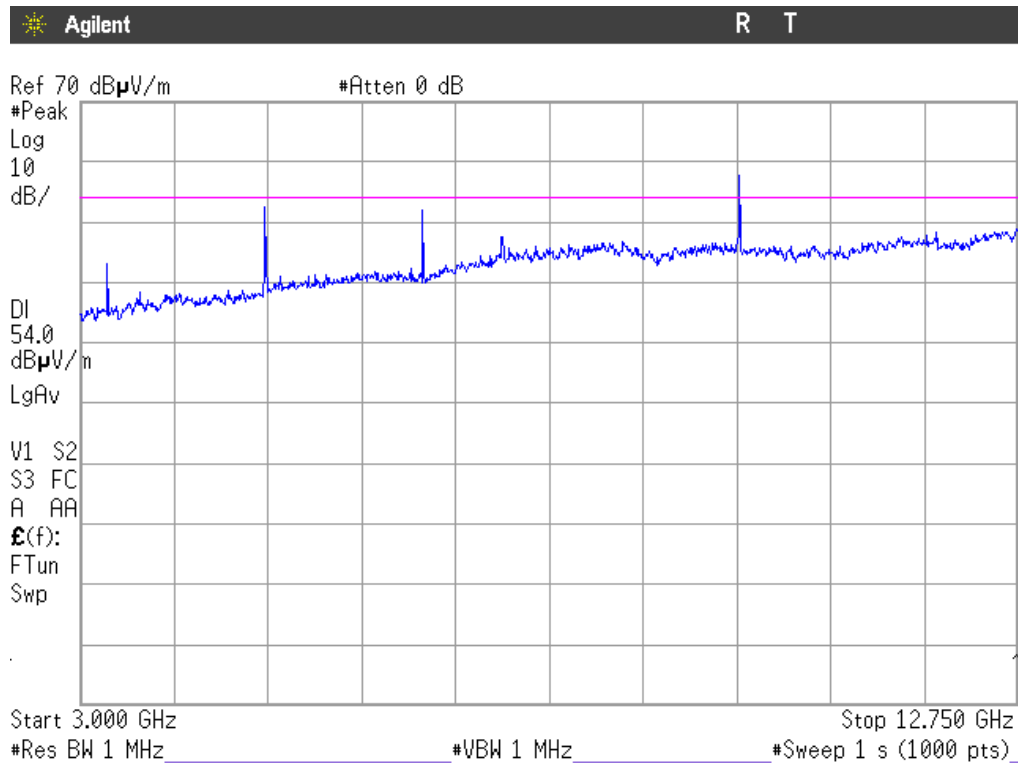
**CHANNEL: Lowest (2412 MHz).**



**CHANNEL: Middle (2437 MHz).**

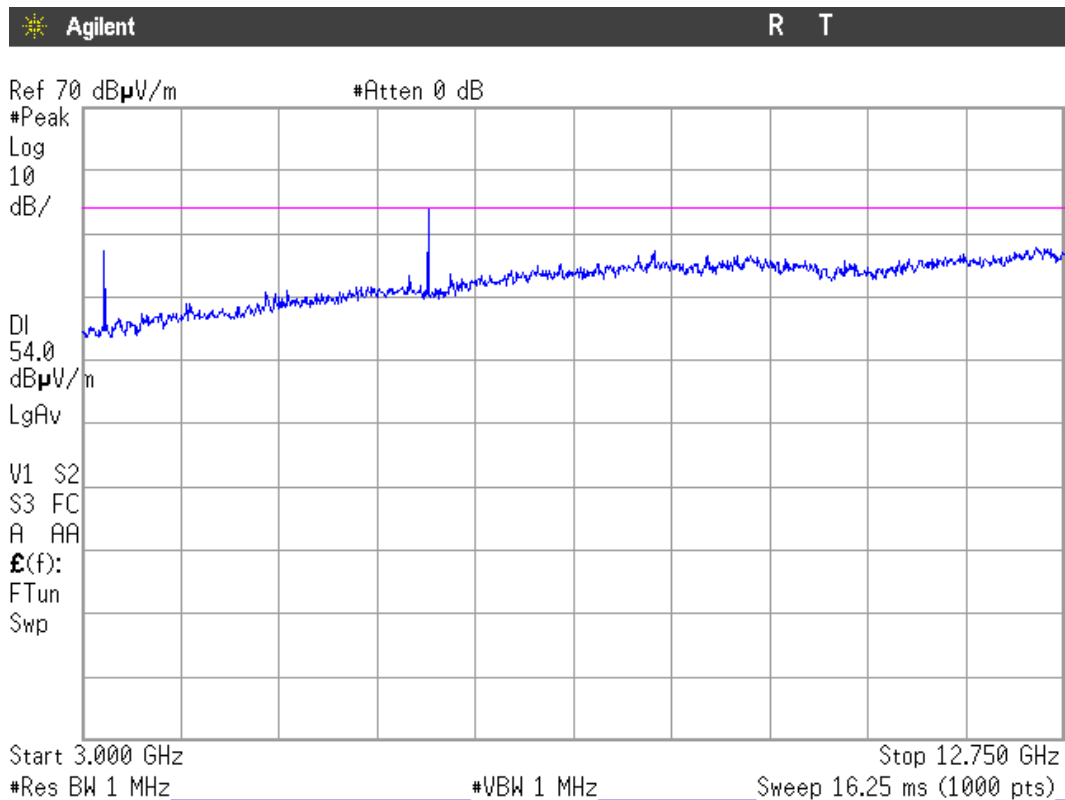


**CHANNEL: Highest (2462 MHz).**



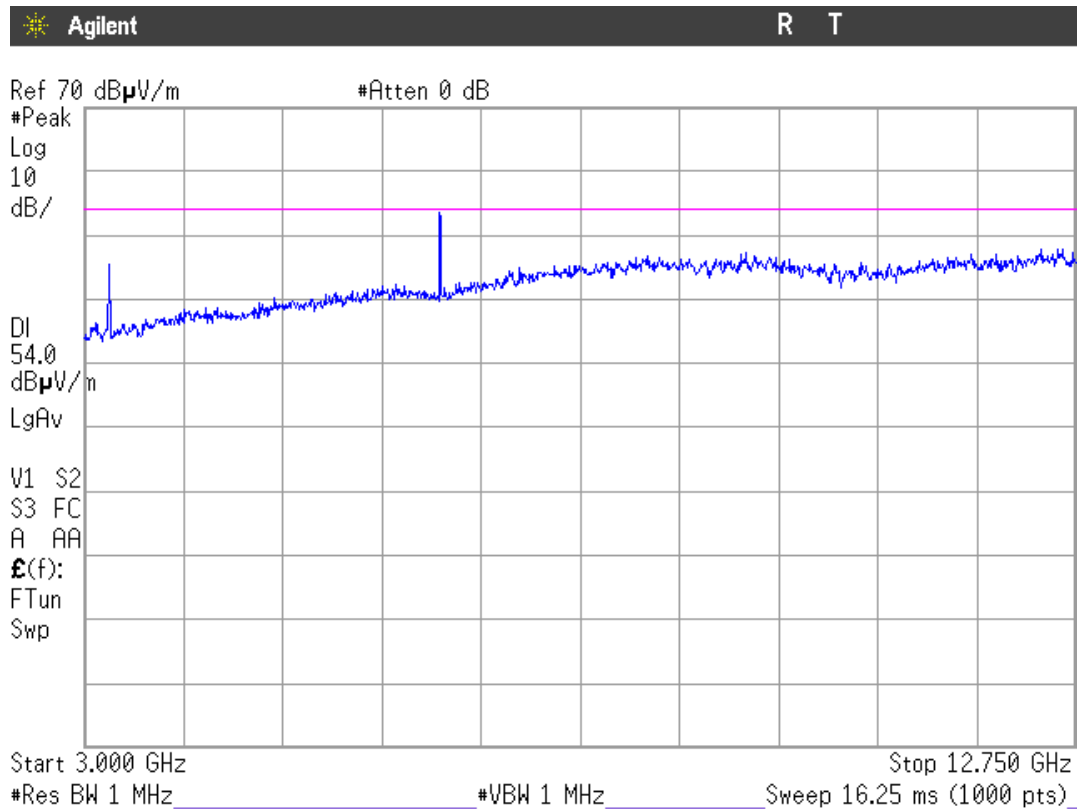
**2. OFDM modulation**

**CHANNEL: Lowest (2412 MHz).**

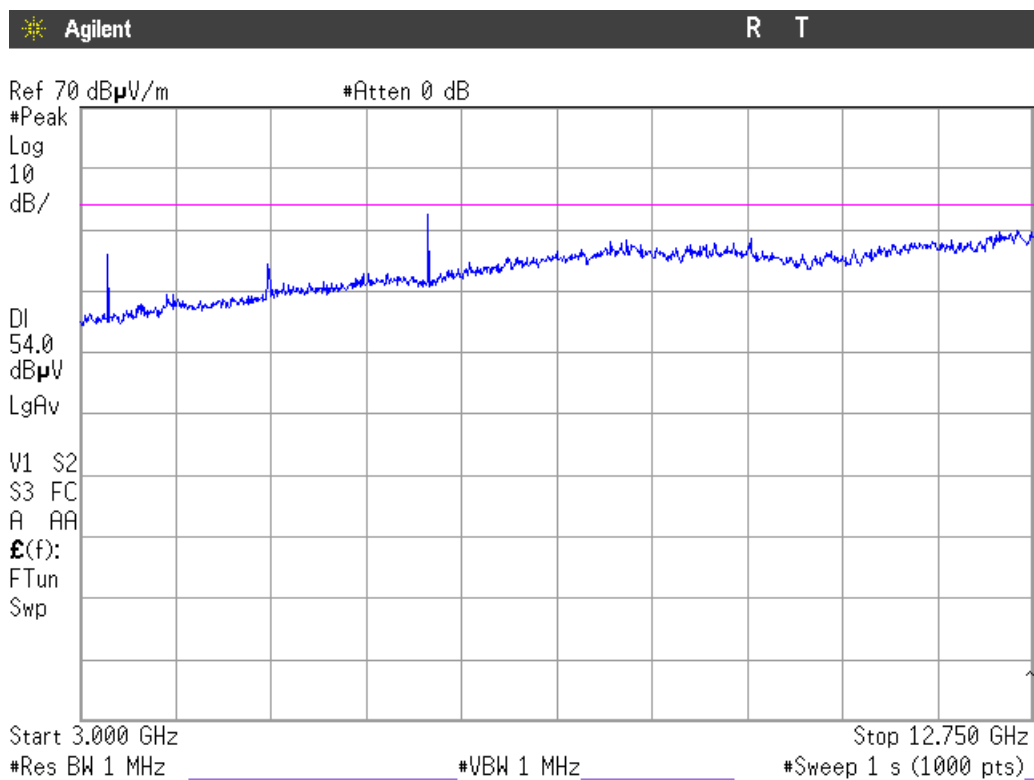




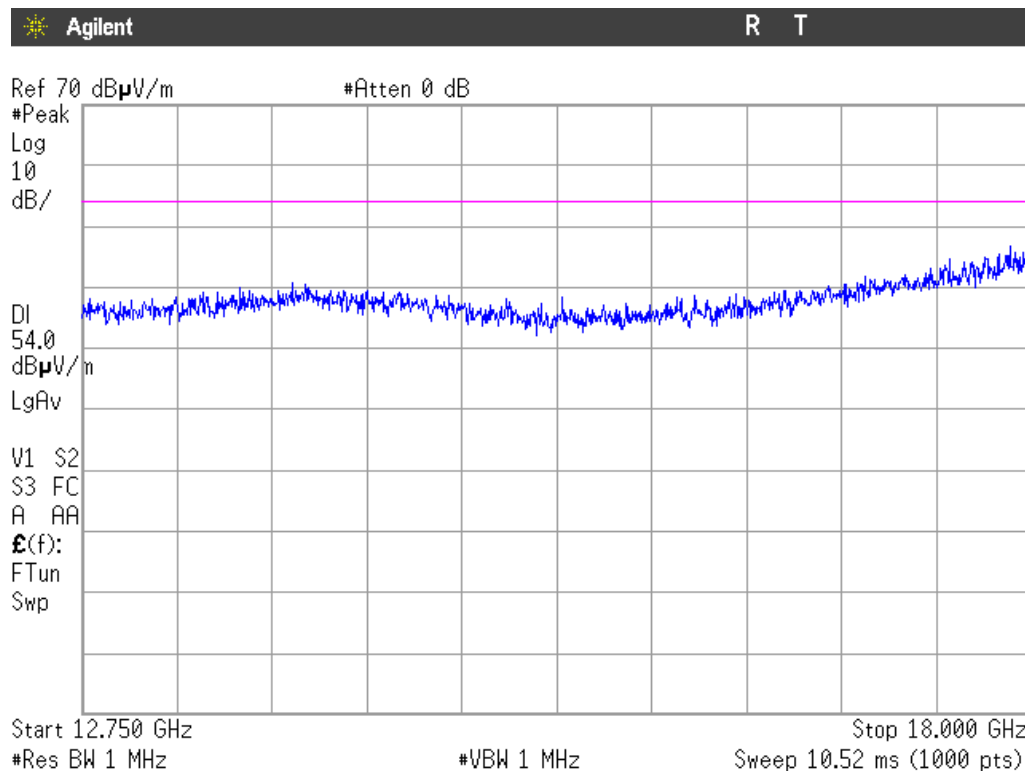
**CHANNEL: Middle (2437 MHz).**



**CHANNEL: Highest (2462 MHz).**

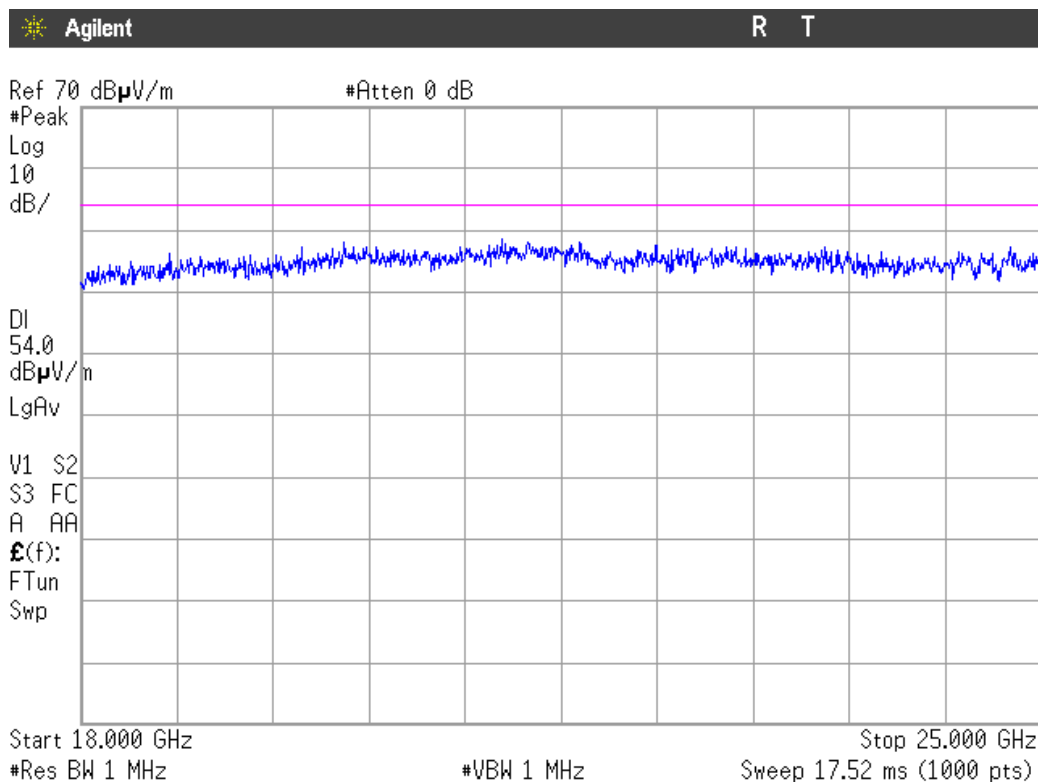


FREQUENCY RANGE 12.75 GHz to 18 GHz.



(This plot is valid for all three channels and all modulation modes).

FREQUENCY RANGE 18 GHz to 25 GHz.

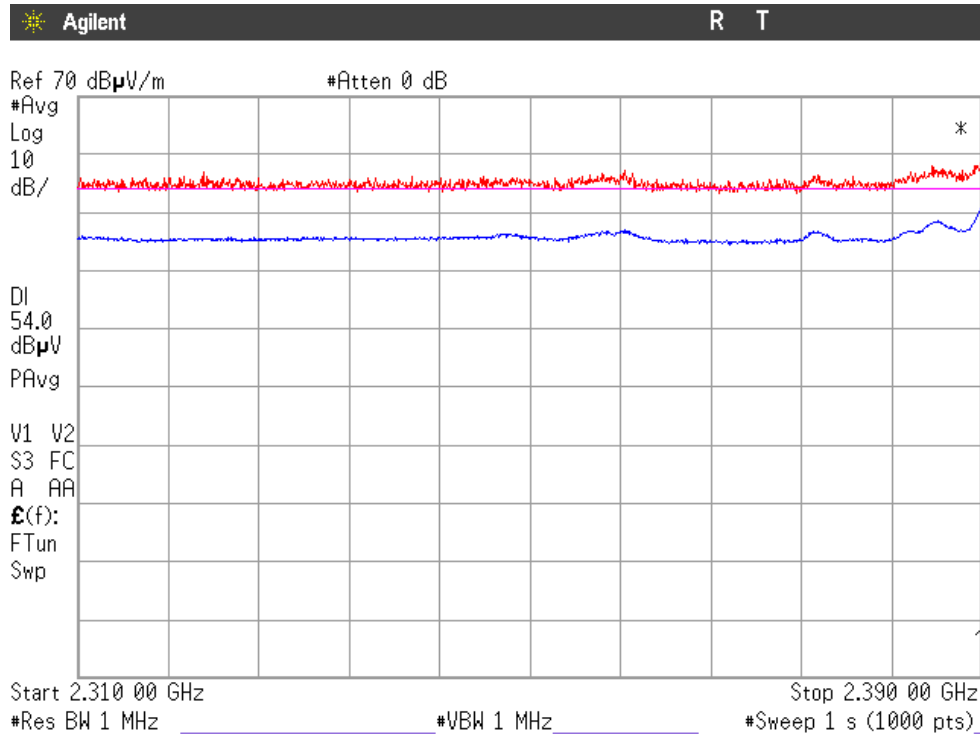


(This plot is valid for all three channels and all modulation modes).

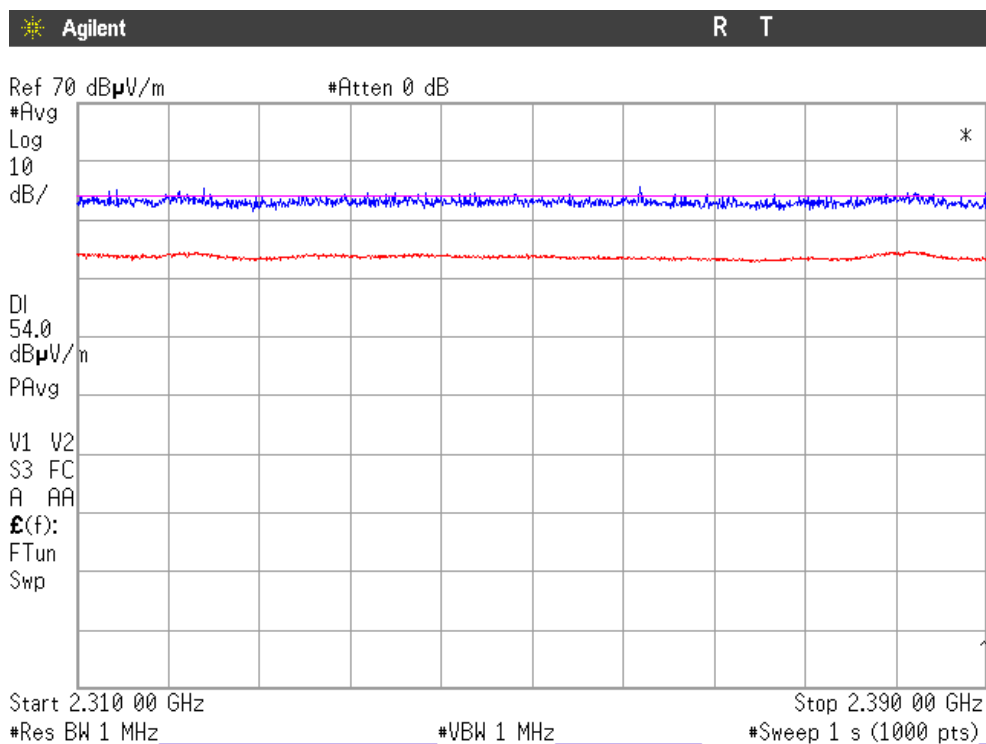
FREQUENCY RANGE 2.31 GHz to 2.39 GHz. (RESTRICTED BAND)

1. DSSS Modulation

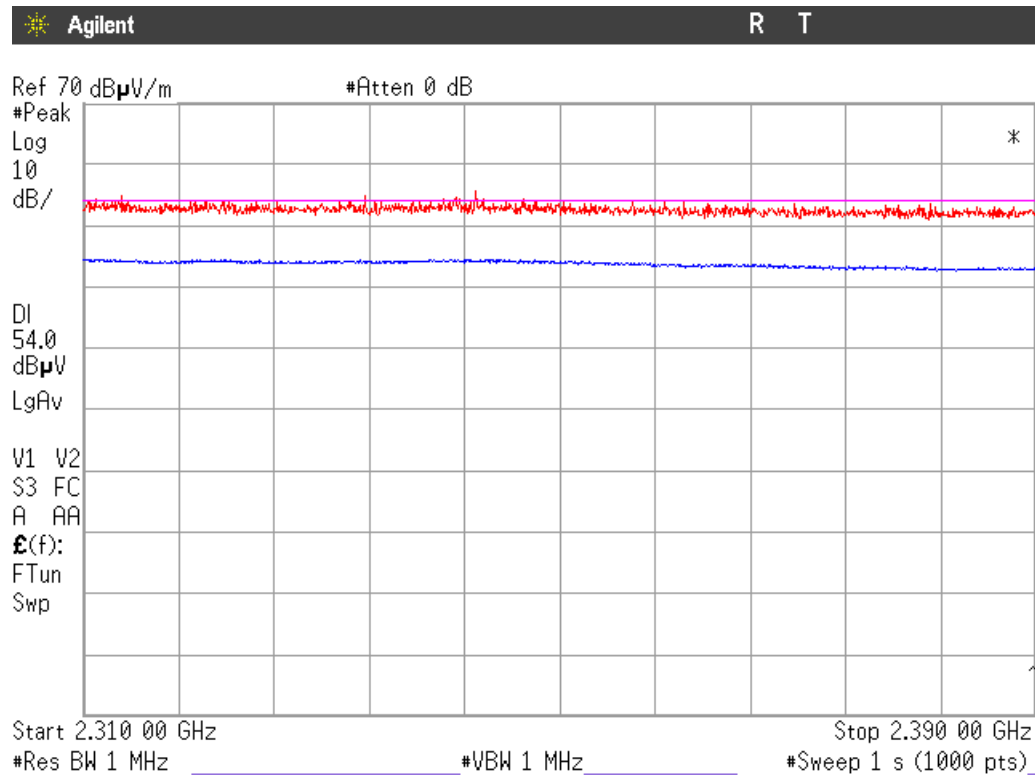
**CHANNEL: Lowest (2412 MHz).**



**CHANNEL: Middle (2437 MHz).**

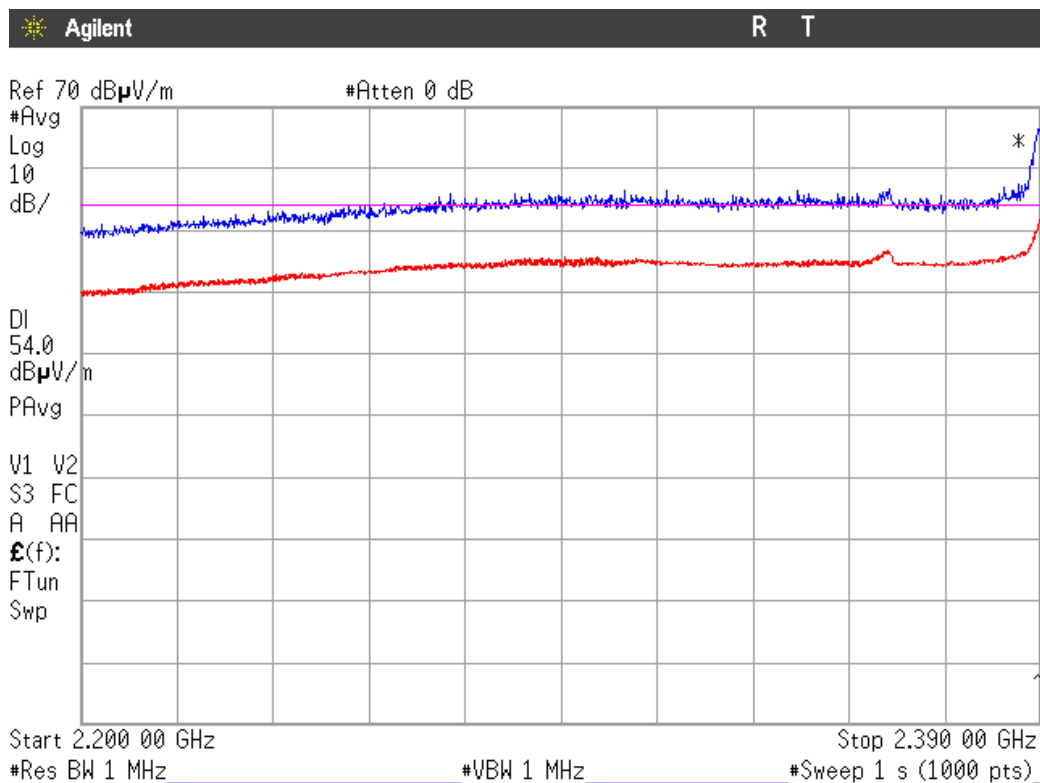


**CHANNEL: Highest (2462 MHz).**

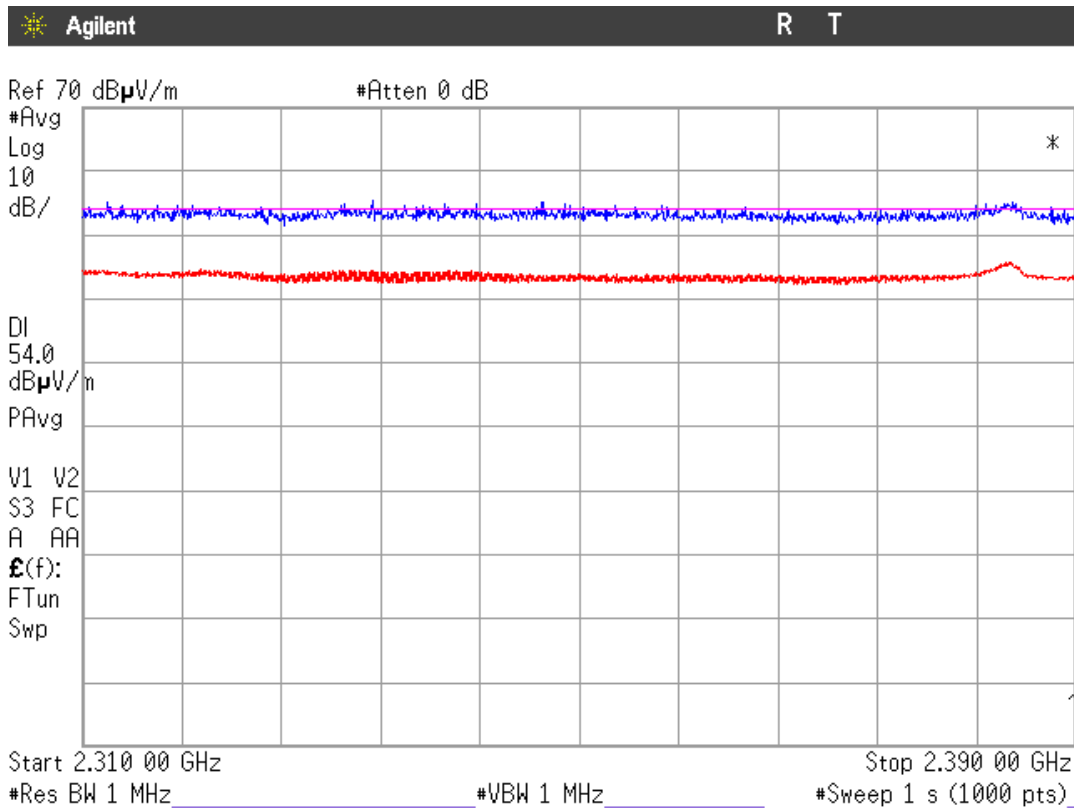


**2. OFDM Modulation**

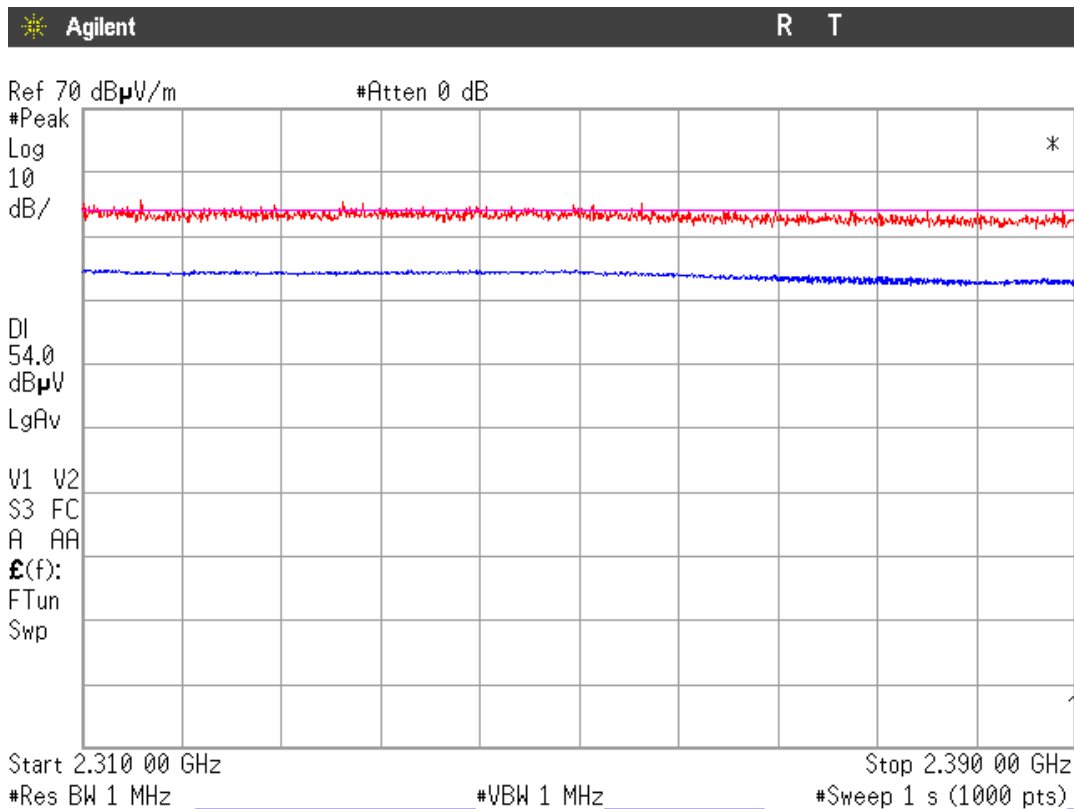
**CHANNEL: Lowest (2412 MHz).**



**CHANNEL: Middle (2437 MHz).**



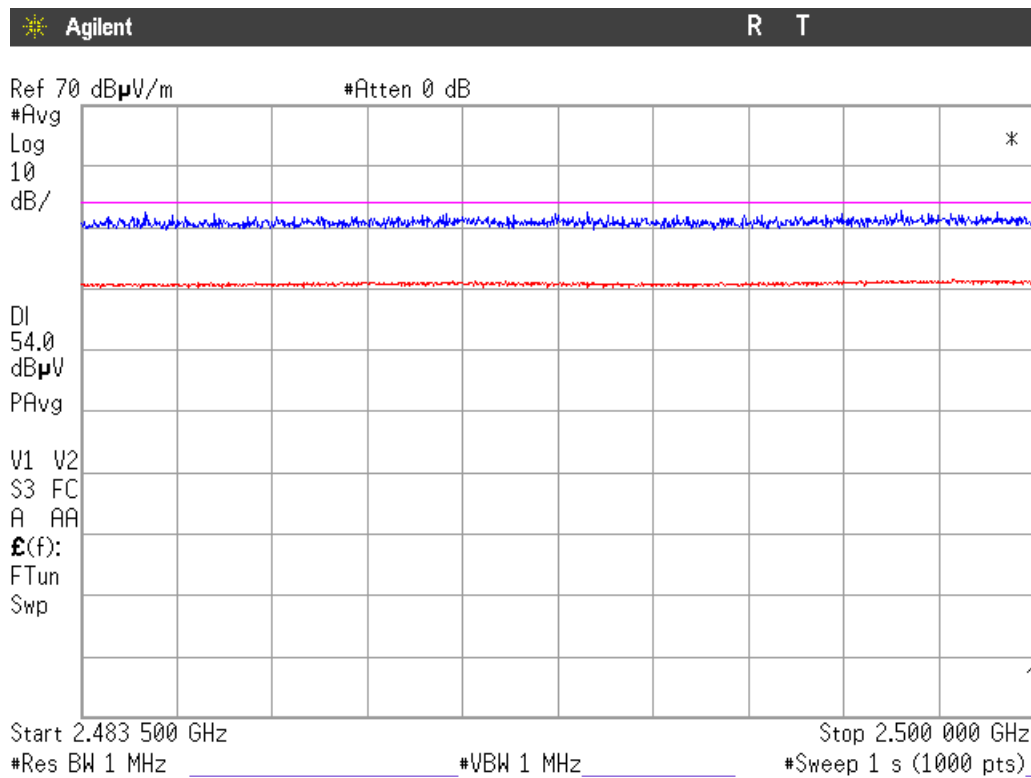
**CHANNEL: Highest (2462 MHz).**



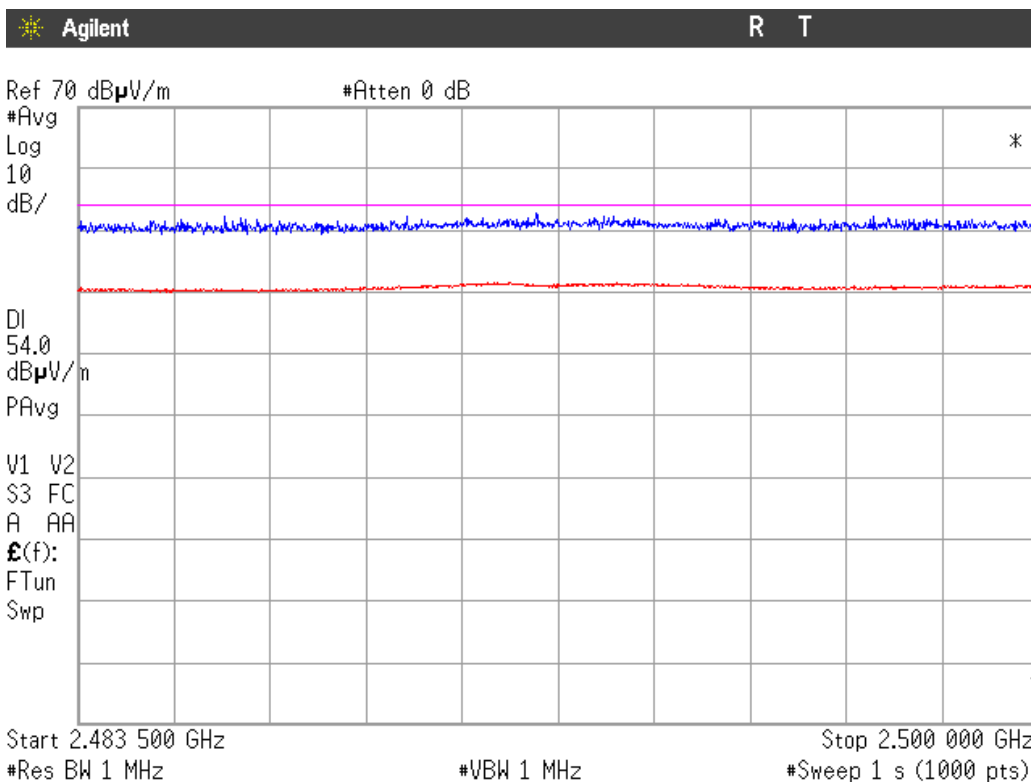
FREQUENCY RANGE 2.4835 GHz to 2.5 GHz. (RESTRICTED BAND)

1. DSSS Modulation

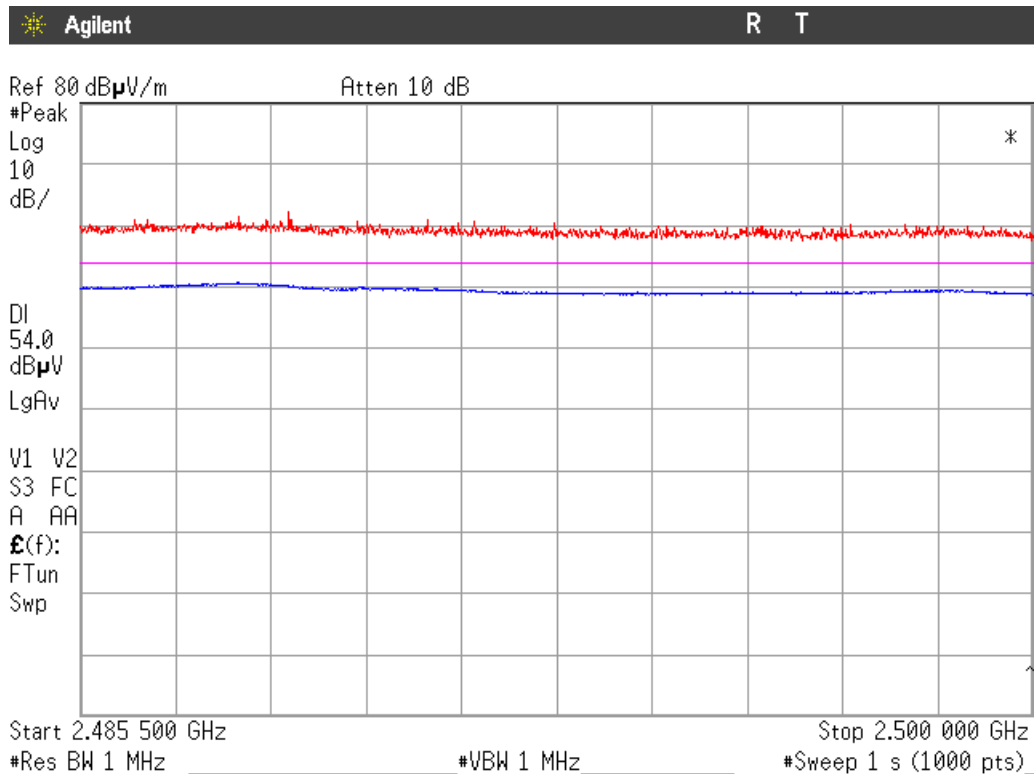
**CHANNEL: Lowest (2412 MHz).**



**CHANNEL: Middle (2437 MHz).**

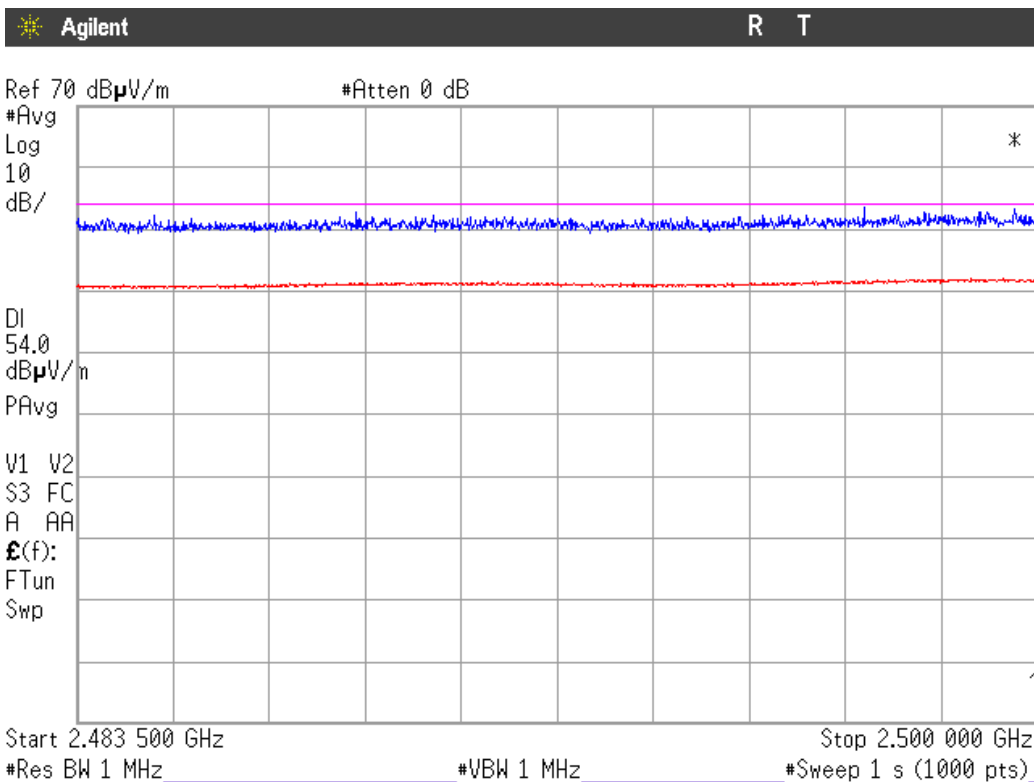


**CHANNEL: Highest (2462 MHz).**

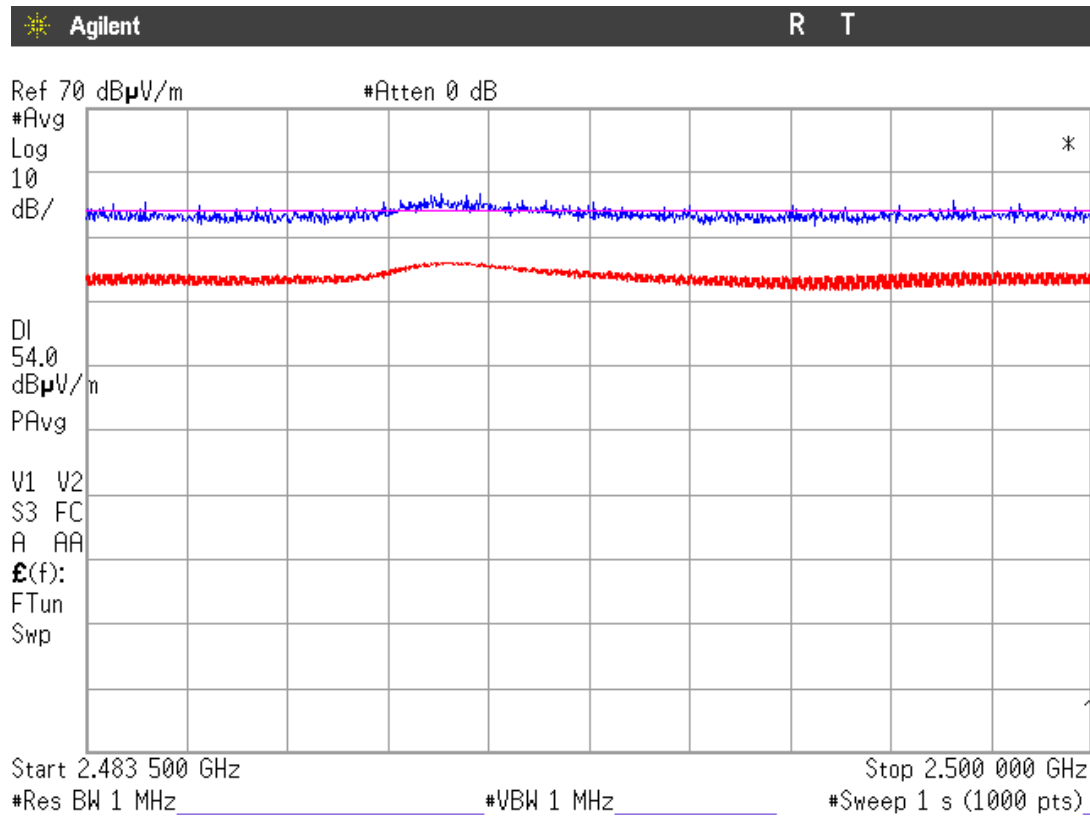


**2. OFDM Modulation**

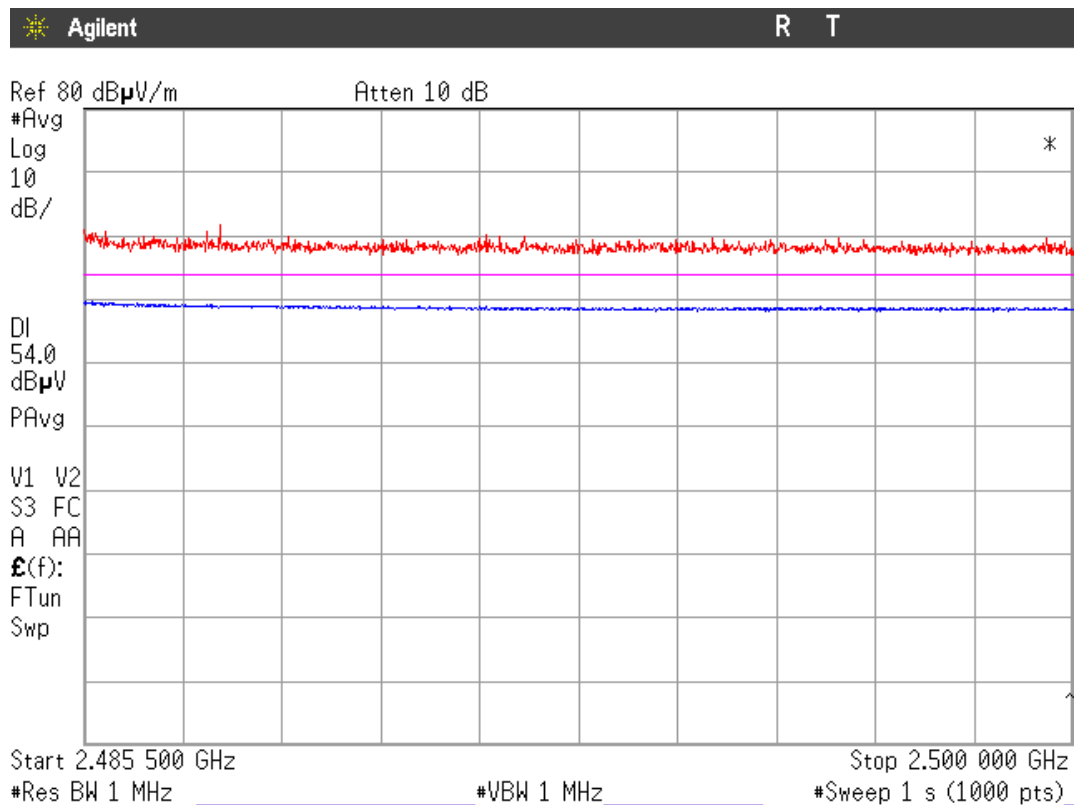
**CHANNEL: Lowest (2412 MHz).**



**CHANNEL: Middle (2437 MHz).**



**CHANNEL: Highest (2462 MHz).**





## **APPENDIX B: Measuring results for electromagnetic conducted emission**

**CONTENT:**

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## DESCRIPTION OF THE OPERATION MODES

The operation modes described in this paragraph constitute a functionality of the sample under test for itself. Every operation mode takes a failure criteria for the immunity test that they were applying to it and a monitoring to guarantee performance of the same ones.

In the following table appears the operation modes used by the samples tested to that it refers the present test report.

<b>OPERATION MODE</b>	<b>DESCRIPTION</b>
OM#01	EUT ON. Equipment switched ON with WiFi and Bluetooth in IDLE mode. Equipment charging battery. Power supply: 115Vac. 60Hz.
OM#02	EUT ON. WiFi in communication mode with an auxiliary PC, Bluetooth in communication mode with the transmitters. Equipment charging batteries. Power supply: 115Vac. 60Hz.

**CONTINUOUS CONDUCTED EMISSION ON POWER LEADS**

<b>LIMITS:</b>	Product standard :	FCC RULES AND REGULATIONS 47 CFR PART 15, SUBPART B
	Test standard :	FCC RULES AND REGULATIONS 47 CFR PART 15, SUBPART B

**CLASS B**

The applied limit for continuous conducted emissions in power leads, according with the requirements of FCC Rules and Regulations 47 CFR Part 15, Subpart B & IC RSS-Gen Issue 2, June 2007 in the frequency range 0,15 to 30 MHz, for Class B equipment was:

Frequency range (MHz)	Limit (dB $\mu$ V)	
	Quasi-peak	Average
0,15 to 0,5	66-56	56-46
0,5 to 5	56	46
5 to 30	60	50

<b>TESTED SAMPLES:</b>	S/01
<b>TESTED OPERATION MODES:</b>	OM#01 & 02
<b>TEST RESULTS :</b>	CCmmnnhh: CC, Conducted Condition; mm: Sample number; nn: Operation mode; hh: wire

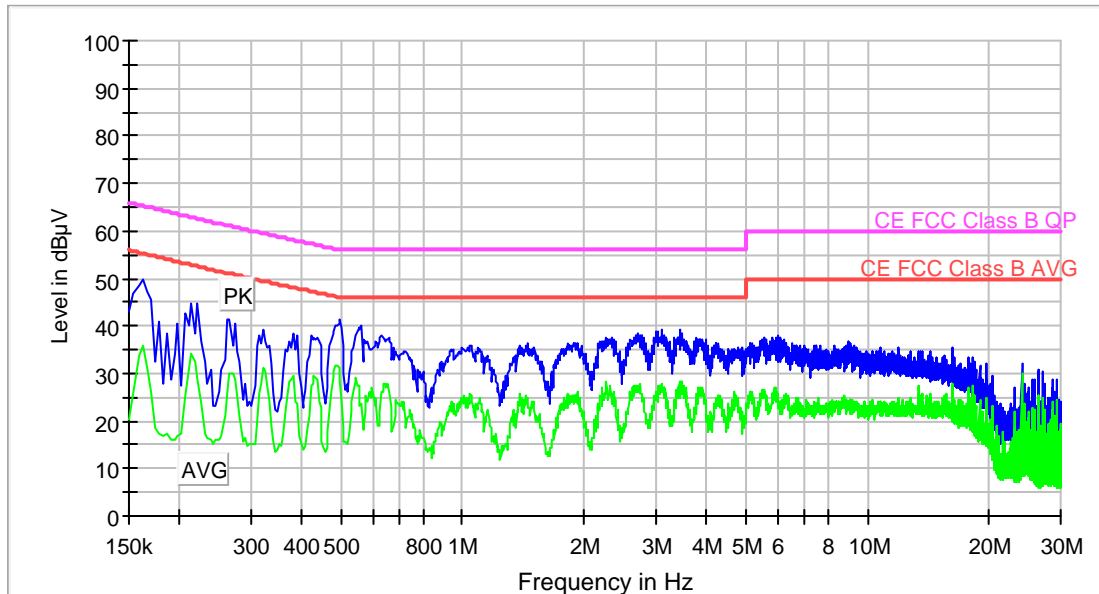
CCmmnnhh	Description	Result
CC01010N	Neutral wire noise	P
CC0101L1	Phase wire noise	P
CC01020N	Neutral wire noise	P
CC0102L1	Phase wire noise	P

Continuous Conducted emission : CC01010N

Detector : Peak / Average / Cuasi-peak

Project: 36156REM.002  
 Company: POLAR  
 Sample: S/01  
 Operation Mode: OM#01  
 Mode: EUT ON. IDLE WIFI & Bluetooth. Charging batteries. Neutral noise.

EC FCC Class B ESU Lab1



— Preview Max PK      — Preview AVG  
— CE FCC Class B AVG      — CE FCC Class B QP

### Max PK-AVG

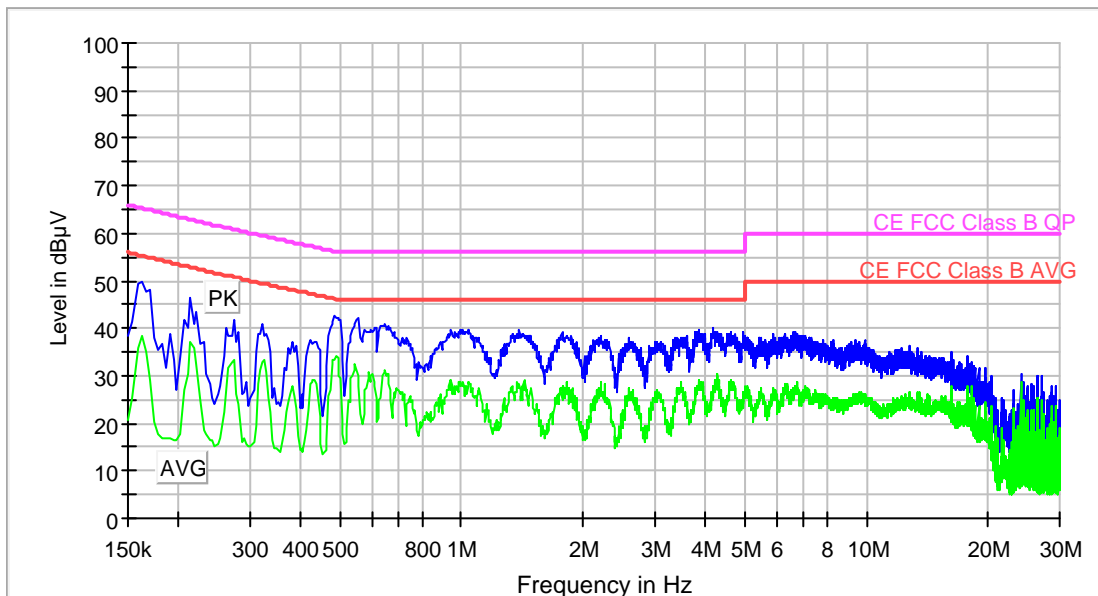
Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)	PE	Line	Corr. (dB)	Comment
0.162000	49.7	35.8	Local	Local	10.0	
0.266000	41.3	30.1	Local	Local	10.0	
0.498000	41.3	28.9	Local	Local	10.0	
0.630000	37.8	26.0	Local	Local	10.0	
1.046000	35.9	25.9	Local	Local	10.0	
1.926000	36.4	26.3	Local	Local	10.0	
3.094000	39.1	27.9	Local	Local	10.0	
3.454000	39.1	26.0	Local	Local	10.0	
6.050000	37.9	22.6	Local	Local	10.0	
9.006000	36.6	23.8	Local	Local	10.0	
16.226000	35.4	27.7	Local	Local	9.9	
19.710000	32.0	24.9	Local	Local	9.9	

Continuous Conducted emission : CC0101L1

Detector : Peak / Average / Cuasi-peak

Project: 36156REM.002  
 Company: POLAR  
 Sample: S/01  
 Operation Mode: OM#01  
 Mode: EUT ON. Idle WIFI & Bluetooth. Charging batteries. Phase noise.

EC FCC Class B ESU Lab1



— Max Preview PK      — Preview AVG  
 — CE FCC Class B AVG      — CE FCC Class B QP

### Max PK-AVG

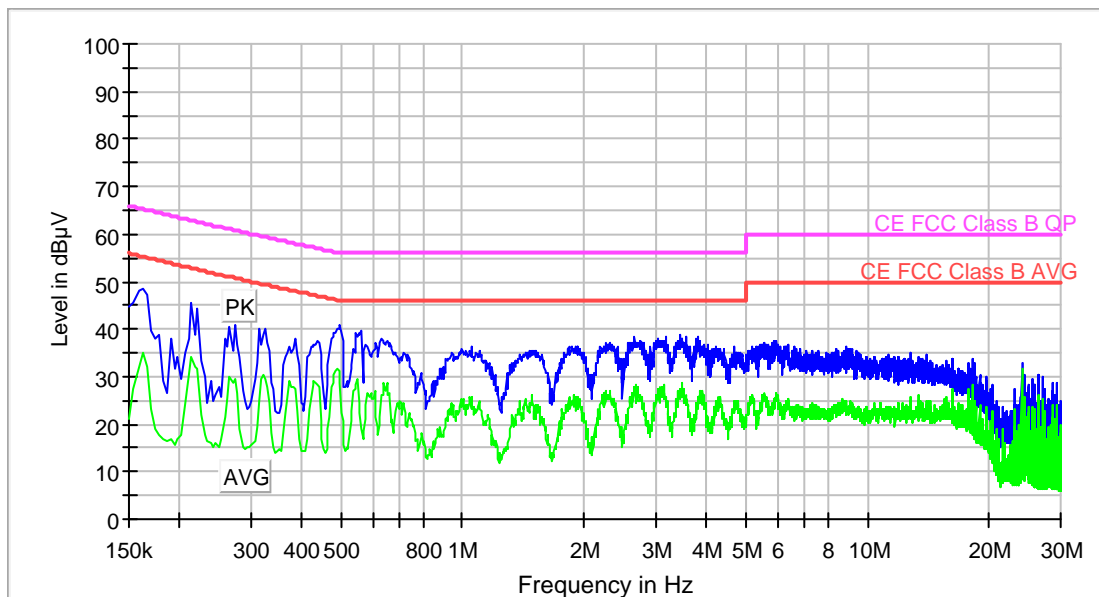
Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)	PE	Line	Corr. (dB)	Comment
0.162000	49.8	38.5	Local	Local	10.0	
0.322000	41.0	32.8	Local	Local	10.0	
0.486000	42.8	33.2	Local	Local	10.0	
0.646000	40.8	31.0	Local	Local	10.0	
0.994000	39.8	28.2	Local	Local	10.0	
1.390000	39.6	28.2	Local	Local	10.0	
2.210000	38.3	28.6	Local	Local	10.0	
4.174000	39.9	27.8	Local	Local	10.0	
6.598000	39.4	26.4	Local	Local	10.0	
9.422000	37.5	25.4	Local	Local	10.0	
12.746000	36.4	26.6	Local	Local	10.0	
19.710000	31.8	24.7	Local	Local	9.9	

Continuous Conducted emission : CC01020N

Detector : Peak / Average / Cuasi-peak

Project: 36156REM.002  
 Company: POLAR  
 Sample: S/01  
 Operation Mode: OM#02  
 Mode: EUT ON. TCH WIFI & Bluetooth. Charging batteries. Neutral noise.

EC FCC Class B ESU Lab1



— Preview Max PK      — Preview AVG  
 — CE FCC Class B AVG      — CE FCC Class B QP

### Max PK-AVG

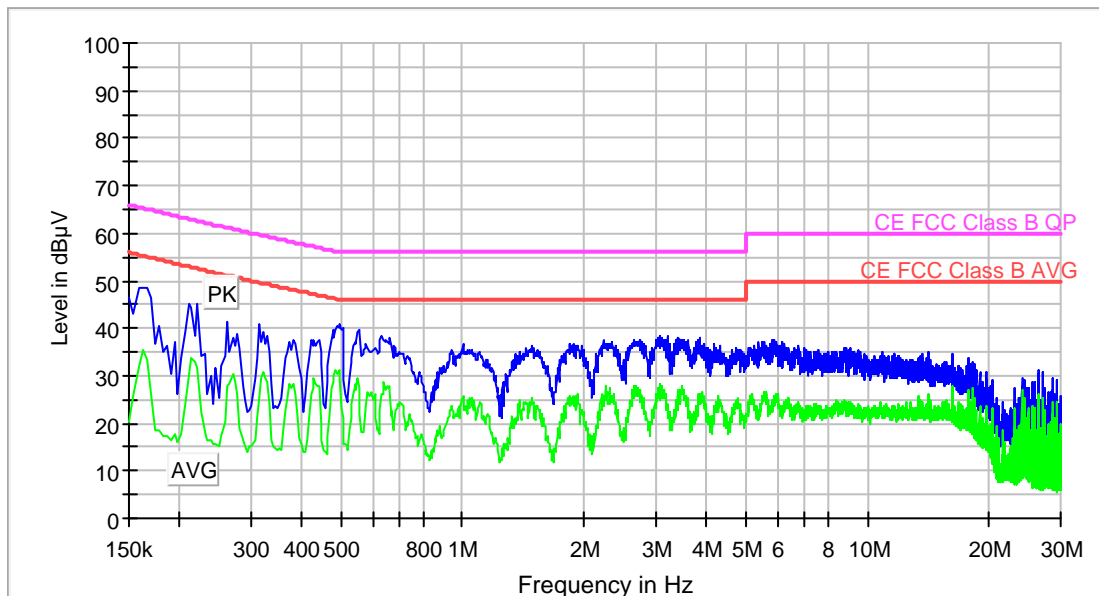
Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)	PE	Line	Corr. (dB)	Comment
0.162000	48.5	35.1	Local	Local	10.0	
0.326000	40.1	29.5	Local	Local	10.0	
0.498000	40.8	28.9	Local	Local	10.0	
0.630000	38.1	26.1	Local	Local	10.0	
1.054000	36.5	25.7	Local	Local	10.0	
1.830000	36.4	25.8	Local	Local	10.0	
3.186000	38.4	25.9	Local	Local	10.0	
3.438000	38.9	27.5	Local	Local	10.0	
5.946000	37.5	26.8	Local	Local	10.0	
8.826000	36.5	25.0	Local	Local	10.0	
12.806000	34.8	24.9	Local	Local	10.0	
24.030000	33.0	31.6	Local	Local	9.9	

Continuous Conducted emission : CC0102L1

Detector : Peak / Average / Cuasi-peak

Project: 36156REM.002  
 Company: POLAR  
 Sample: S/01  
 Operation Mode: MO#02  
 Mode: EUT ON. TCH WIFI & Bluetooth. Charging batteries. Phase noise.

EC FCC Class B ESU Lab1



— Preview Max PK      — Preview AVG  
 — CE FCC Class B AVG      — CE FCC Class B QP

### Max PK-AVG

Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)	PE	Line	Corr. (dB)	Comment
0.166000	48.5	33.5	Local	Local	10.0	
0.314000	40.9	25.2	Local	Local	10.0	
0.498000	41.1	29.7	Local	Local	10.0	
0.630000	38.2	26.1	Local	Local	10.0	
1.002000	36.6	25.6	Local	Local	10.0	
1.874000	36.6	25.8	Local	Local	10.0	
3.198000	38.5	24.2	Local	Local	10.0	
3.422000	38.0	26.8	Local	Local	10.0	
5.878000	37.7	24.9	Local	Local	10.0	
8.870000	36.0	22.9	Local	Local	10.0	
14.214000	35.1	26.1	Local	Local	10.0	
26.486000	31.1	25.9	Local	Local	9.9	