

FCC ID:U9A277IWLAN-V211

EMI - TEST REPORT

- FCC Part 15.407 -



Test Report No. : T34493-00-03HS	22. December 2010 Date of issue
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Type / Model Name : MobilePanel277FIWLAN RF

Product Description : Mobile Human Machine Interface

Applicant : Siemens AG, I IA AS RD ST TT

Address : Werner-von-Siemens-Str. 50

92224 AMBERG, GERMANY

Manufacturer : Siemens AG, I IA AS

Address : Gleiwitzer Str. 555

90475 NUERNBERG, GERMANY

Licence holder : Siemens AG, I IA AS RD ST TT

Address : Werner-von-Siemens-Str. 50

92224 AMBERG, GERMANY

Test Result according to the standards listed in clause 1 test standards:	POSITIVE
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The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

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ATTACHMENT A, T34493

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (October, 2009)

Part 15, Subpart A, Section 15.31	Measurement standards
Part 15, Subpart A, Section 15.33	Frequency range of radiated measurements
Part 15, Subpart A, Section 15.35	Measurement detector functions and bandwidths

FCC Rules and Regulations Part 15, Subpart B - Unintentional Radiators (October, 2009)

Part 15, Subpart B, Section 15.107	AC Line conducted emissions
Part 15, Subpart B, Section 15.109	Radiated emissions, general requirements

FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (October, 2009)

Part 15, Subpart C, Section 15.203	Antenna requirement
Part 15, Subpart C, Section 15.204	External radio frequency power amplifiers and antenna modifications
Part 15, Subpart C, Section 15.205	Restricted bands of operation
Part 15, Subpart C, Section 15.207	Conducted limits
Part 15, Subpart C, Section 15.209	Radiated emission limits, general requirements

FCC Rules and Regulations Part 15, Subpart E – Unlicensed National Information Infrastructure Devices (October, 2009)

Part 15, Subpart E, Section 15.407	Operation within the bands 5.15 - 5.25 GHz, 5.25 - 5.35 GHz, 5.47 - 5.725 GHz and 5.725 - 5.825 GHz
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FCC Rules and Regulations Part 1, Subpart I - Procedures Implementing the National Environmental Policy Act of 1969

Part 1, Subpart I, Section 1.1310	Radiofrequency radiation exposure limits
Part 1, Subpart 2, Section 2.1093	Radiofrequency radiation exposure evaluation: portable device

OET Bulletin 65, 65A, 65B, 65C Edition 97-01, August 1997 – Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.

ANSI C63.4: 2003	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI C95.1:1999	IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
CISPR 16-4-2: 2003	Uncertainty in EMC measurement
CISPR 22: 2005	Information technology equipment
EN 55022: 2006	

2 SUMMARY

GENERAL REMARKS:

The EUT consists of 1 WLAN Module and 1 RFID Module (13.56 MHz). The EUT can be configured as client only. The EUT has an input voltage stabilisation and a voltage stabilisation directly in the RF module. Therefore no influence will be expected by voltage variations. For this reason the tests have been performed with nominal voltage only. For the compliance of the RFID Module please refer to test report T34493-00-00AA by mikes-testingpartners gmbh.

Available Features:

The WLAN miniPCI module is compatible with 802.11h technology. It is able to operate in the 5 GHz frequency band. The EUT has no ad-hoc or peer-to-peer mode.

- 802.11h Mode 5.25 GHz – 5.35 GHz and 5.470 GHz – 5.725 GHz

The module uses DSSS or OFDM modulation and is capable to provide following data rates:

- 802.11h 54, 48, 36, 24, 18, 12, 9, 6 Mbps, auto-fallback

The EUT is equipped with 2 internal WLAN antennas (gain = 3 dBi at 2.4 GHz, 5 dBi at 5 GHz) and 1 RFID antenna.

The EUT provides the following channels in 802.11h mode:

Channel	Frequency
52	5260
56	5280
60	5300
64	5320
100	5500
104	5520
108	5540
112	5560
116	5580
120	5600
124	5620
128	5640
132	5660
136	5680
140	5700

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FINAL ASSESSMENT:

The equipment under test **fulfills** the EMI requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 22 November 2010

Testing concluded on : 29 November 2010

Checked by:

Tested by:

Klaus Gegenfurtner
Dipl.-Ing.(FH)
Manager: Radio Group

Hermann Smetana
Dipl.-Ing.(FH)
Radio Expert

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3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EUT – Detailed photos see attachment A

3.2 Power supply system utilised

Power supply voltage : 7.2 VDC Battery
 Power supply voltage (alternative) : Input: 100-240 VAC, 50-60 Hz, Output: 12 VDC

3.3 Short description of the equipment under test (EUT)

The MobilePanel277FIWLAN RF permits remote control to systems are controlled by more than one PLC. The HMI device communicates with the PLC via WLAN. The access to one of the system part is determined by a zone recognition function (RFID) of the HMI.

Number of tested samples: 1
 Serial number: 64

EUT operation mode:

The equipment under test was operated during the measurement under the following conditions:

- Data transmission (Client mode)

- Continuous transmit mode (conducted test mode only)

EUT configuration:

(The CDF filled by the applicant can be viewed at the test laboratory.)

The following peripheral devices and interface cables were connected during the measurements:

- AC/DC power supply _____ Model : MEAN WELL GS60A12
 - _____ Model : _____

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

mikes-testingpartners gmbh
Ohmstrasse 2-4
94342 STRASSKIRCHEN
GERMANY

4.2 Environmental conditions

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

Temperature: 15-35 ° C

Humidity: 30-60 %

Atmospheric pressure: 86-106 kPa

4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader may notice that tolerances within the calibration of the equipment and facilities may cause additional uncertainty. The measurement uncertainty is calculated for all measurements listed in this test report acc. to CISPR 16-4-2 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurement“ and documented in the mikes-testingpartners gmbh quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, mikes-testingpartners gmbh, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component diversity and modifications in production process of devices may result in additional deviation. If necessary, refer to the test lab for the actual measurement uncertainty for the specific test. The manufacturer has the sole responsibility of continued compliance of the EUT.

4.4 Measurement protocol for FCC

4.4.1 GENERAL INFORMATION

4.4.1.1 Test methodology

Conducted and radiated disturbance testing is performed according to the procedures set out by the International Special Committee on Radio Interference (CISPR) Publication 22, European Standard EN 55022 as shown under section 1 of this report.

4.4.1.2 Justification

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The equipment under test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral using the appropriate impedance characteristic or left unterminated. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

4.4.2 DETAILS OF TEST PROCEDURES

General Standard information

The test methods used comply with CISPR Publication 22, EN 55022 - "Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement" and with ANSI C63.4 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". In compliance with 47 CFR Part 15 Subpart A, Section 15.38 testing for FCC compliance may be achieved by following the procedures set out in ANSI C63.4 and applying the CISPR 22 limits.

4.4.3 Conducted emission

The final level, expressed in dBµV, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC limit or to the CISPR limit.

To convert between dBµV and µV, the following conversions apply:

$$dB\mu V = 20 \cdot \log(\mu V);$$

$$\mu V = 10^{(dB\mu V/20)};$$

Conducted emissions on the 50 Hz and/or 60 Hz power interface of the EUT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection and a Line Impedance Stabilization Network (LISN) with 50Ω/50 µH (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimetres above the floor and is positioned 40 centimetres from the vertical ground plane (wall) of the screen room. If the minimum limit margin of a peak mode measurement appears to be less than 20 dB, the emissions are remeasured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

4.4.4 Radiated emission (electrical field 30 MHz - 1 GHz)

Spurious emissions from the EUT are measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarised antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection. Table top equipment is placed on a 1.0 X 1.5 m non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is established in accordance with ANSI C63.4. The interface cables that are closer than 40 centimetres to the ground plane are bundled in the center in a serpentine fashion so that they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screened room located outside the test area. The antenna is positioned 3, 10 or 30 meters horizontally from the EUT and is repeated vertically. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters and the EUT is rotated 360 degrees.

The final level in dBµV/m is calculated by taking the reading from the EMI receiver (level dBµV) and adding the correction factors and cable loss factor (dB). The FCC or CISPR limit is subtracted from this result in order to provide the limit margin listed in the measurement protocol.

The resolution bandwidth setting:

30 MHz – 1000 MHz: RBW: 120 kHz

Example:

Frequency	Level	+	Factor	=	Level	-	CISPR Limit	=	Delta
(MHz)	(dBµV)		(dB)		(dBµV/m)		(dBµV/m)		(dB)
719.0	75.0	+	32.6	=	107.6	-	110.0	=	-2.4

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4.4.5 Radiated emission (electrical field 1 GHz - 40 GHz)

Radiated emissions from the EUT are measured in the frequency range 1 GHz up to the maximum frequency as specified in 47 CFR Part 15, Subpart A, Section 15.33, using a spectrum analyser and appropriate linearly polarized antennas. Table top equipment is placed on a 1.0 X 1.5 metre non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is following set out in ANSI C63.4. The interface cables that are closer than 40 centimetres to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screened room located outside the test area. Measurements are made in both the horizontal and vertical polarization planes in a fully anechoic room using a spectrum analyser set to max peak detector function and a RBW = 1 MHz and VBW = 3 MHz for peak and 10 Hz for average measurement. The conditions determined as worst case will then be used for the final measurements. When the EUT is larger than the beam width of the measuring antenna it will be moved over the surface for the four sides of the equipment. Where appropriate, the test distance may be reduced in order to detect emissions under better uncertainty and are calculated at the specified test distance.

4.5 Determination of worst case measurement conditions

Pre-scan has been performed to determine the worst-case mode from all possible combinations between available modulations and data rates. The maximum output power depends on used data rate. The tests have been carried out in the following frequency bands: 5.25 - 5.35 GHz and 5.470 - 5.725 GHz.

Conducted measurements are performed using an access point (LAP) as a test jig. The EUT (WLAN module) is mounted in the AP and controlled via LAN by a Laptop. Radiated measurements are performed with normal configuration of the Mobile Panel (WLAN Module inside the MP).

The EUT is controlled for conducted measurements by special test software enables continuous transmission during the tests with a duty cycle (x) of about x = 1.

As worst case the following data rates are used:

- **802.11h: 6 Mbits**

Following channels were selected for the final test as listed below:

Technology	Available Channel	Tested Channel	Modulation	Modulation Type	Data Rate (Mbps)
802.11h	52 to 64	52, 56 and 64	OFDM	BPSK	6
802.11h	100 to 140	100, 120 and 140	OFDM	BPSK	6

The IEEE 802.11 Standard defines data transmission as concatenated timeslots of TX and RX. Received data packets have to be acknowledged for proper reception. For this fast changes from TX mode to RX mode and back only the application of the TX limits make sense. Therefore the measurements were performed in TX mode only.

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5 TEST CONDITIONS AND RESULTS

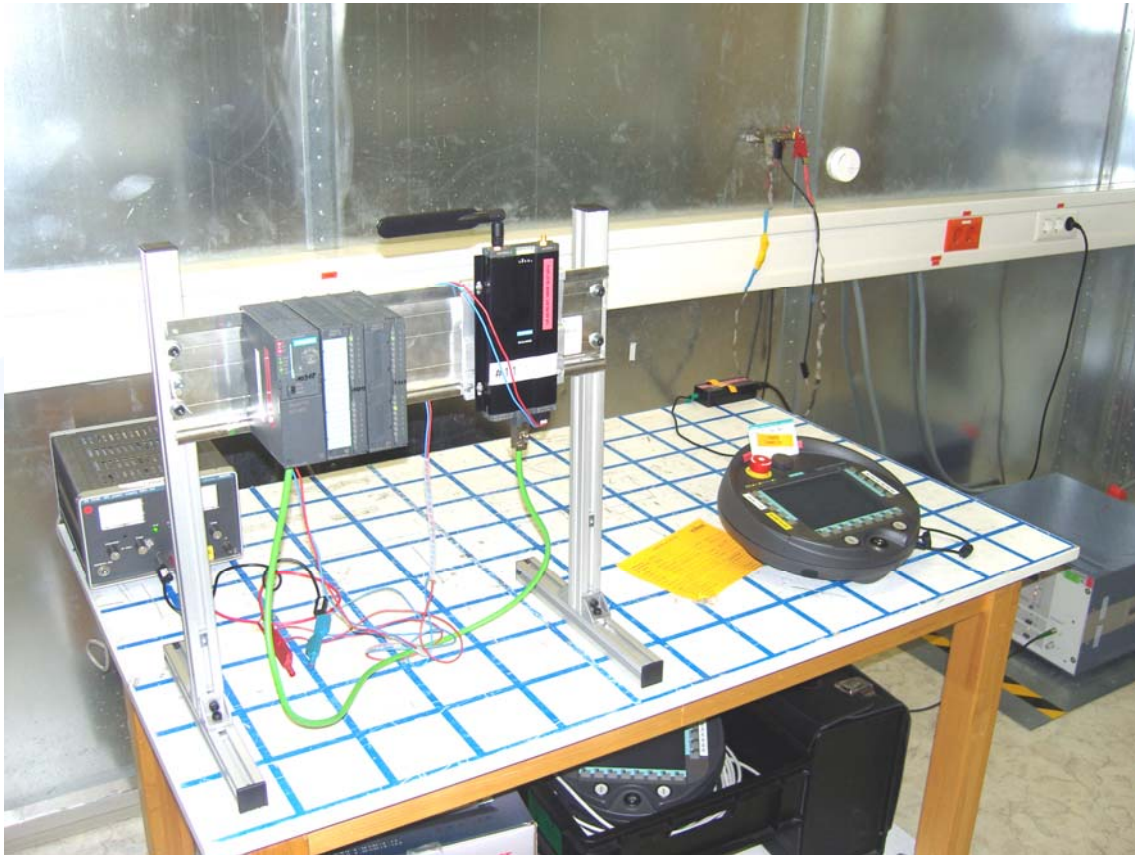
5.1 Conducted emissions

For test instruments and accessories used see section 6 Part A 4.

5.1.1 Description of the test location

Test location: Shielded Room S2

5.1.2 Photo documentation of the test set-up



5.1.3 Applicable standard

According to FCC Part 15C, Section 15.207(a):

Except as shown in paragraphs (b) and (c) of this Section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

5.1.4 Description of Measurement

The measurements are performed following the procedures mentioned in Item 4.4.3.

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5.1.5 Test result

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin -9.0 dB at 1.18 MHz

Limit according to FCC Part 15C, Section 15.207(a):

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

* Decreases with the logarithm of the frequency

The requirements are **FULFILLED**.

Remarks: For detailed test result please see to following test protocols. The RFID transmitter is not permitted to be active while connecting to mains (see manual).

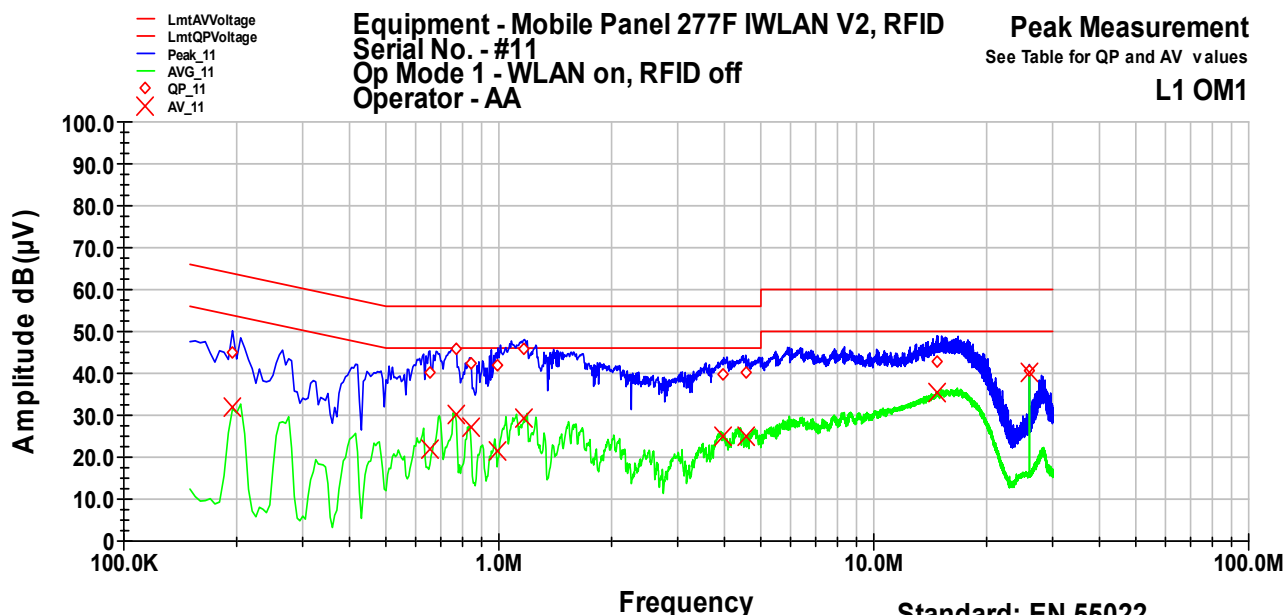


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5.1.6 Test protocol

Test point: L1
 Operation mode: Data transmission (Client mode)
 Remarks:

Result: passed



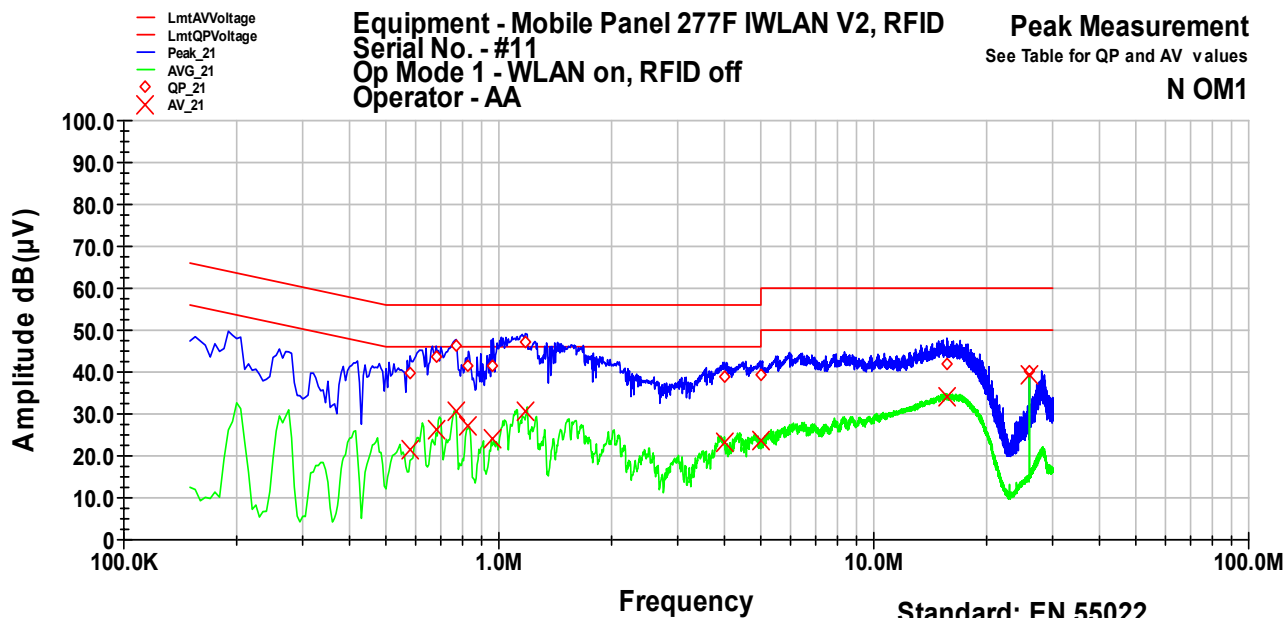
Standard: EN 55022
 File Number: T34493-00

Frequency MHz	QP Level dB(µV)	QP Margin dB	QP Limit dB	AV Level dB(µV)	AV Margin dB	AV Limit dB
0.195	45.1	-18.7	63.8	31.7	-22.1	53.8
0.655	40.3	-15.7	56.0	21.8	-24.2	46.0
0.77	45.7	-10.3	56.0	30.2	-15.8	46.0
0.84	42.5	-13.5	56.0	27.0	-19.0	46.0
0.995	42.0	-14.0	56.0	21.7	-24.3	46.0
1.17	45.7	-10.3	56.0	29.2	-16.8	46.0
3.98	39.8	-16.2	56.0	24.8	-21.2	46.0
4.555	40.3	-15.7	56.0	25.1	-20.9	46.0
14.735	42.9	-17.1	60.0	35.5	-14.5	50.0
26	40.8	-19.2	60.0	40.2	-9.8	50.0

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Test point: N
 Operation mode: Data transmission (Client mode)
 Remarks:

Result: passed



Peak Measurement
 See Table for QP and AV values
N OM1

Standard: EN 55022
 File Number: T34493-00

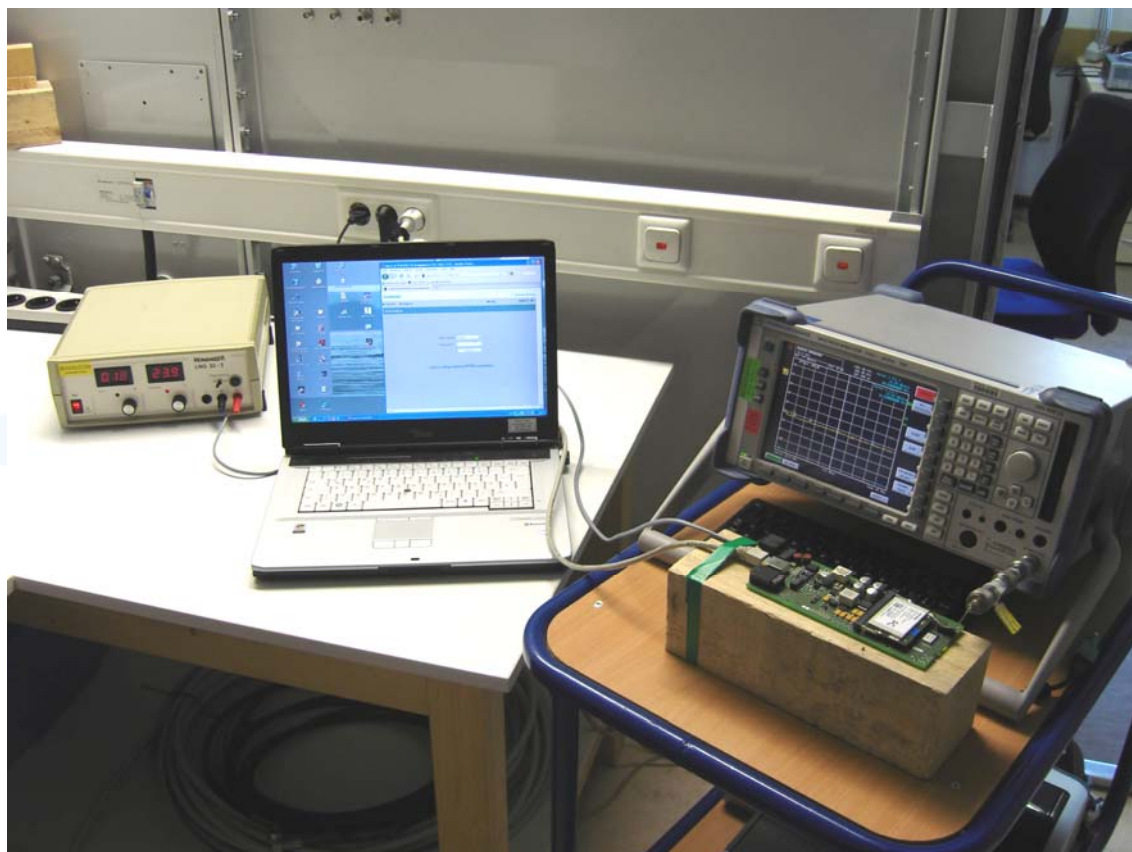
Frequency MHz	QP Level dB(µV)	QP Margin dB	QP Limit dB	AV Level dB(µV)	AV Margin dB	AV Limit dB
0.58	39.6	-16.4	56.0	21.5	-24.5	46.0
0.68	43.5	-12.5	56.0	26.3	-19.8	46.0
0.77	46.3	-9.7	56.0	30.6	-15.4	46.0
0.83	41.5	-14.5	56.0	27.2	-18.8	46.0
0.965	41.7	-14.3	56.0	24.2	-21.8	46.0
1.18	47.0	-9.0	56.0	30.5	-15.5	46.0
3.995	38.9	-17.1	56.0	23.2	-22.8	46.0
4.985	39.4	-16.6	56.0	23.9	-22.1	46.0
15.655	41.8	-18.2	60.0	34.1	-15.9	50.0
26	40.1	-19.9	60.0	39.4	-10.6	50.0

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For test instruments and accessories used see section 6 Part MB.

5.2.1 Description of the test location

Test location: AREA4

5.2.2 Photo documentation of the test set-up**5.2.3 Applicable standard**

According to FCC Part 15E, Section 15.407(i):

The emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum of the modulated carrier.

5.2.4 Description of Measurement

The bandwidth was measured at an amplitude level reduced from the reference level by a specified ratio of -26 dB. The reference level is the level of the highest amplitude of the signal observed from the transmitter frequency. The spectrum analyser function "n-dB-down" is used to determine the bandwidth.

Spectrum analyzer settings: RBW: 300 kHz, VBW: 1 MHz, Detector: Peak

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5.2.5 Test result

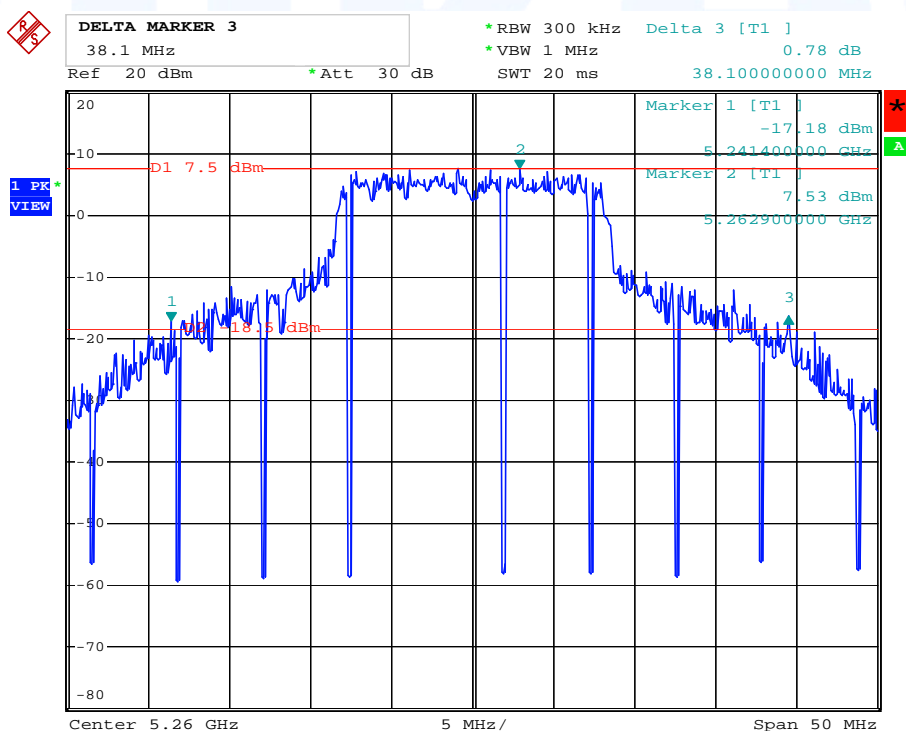
Channel number	Fundamental frequency (MHz)	26 dB Bandwidth (MHz)
52	5260	38.1
56	5280	38.3
64	5320	25.7
100	5500	28.7
120	5600	37.1
140	5700	32.6

Remarks: For detailed test result please refer to following test protocols.

5.2.6 Test protocol

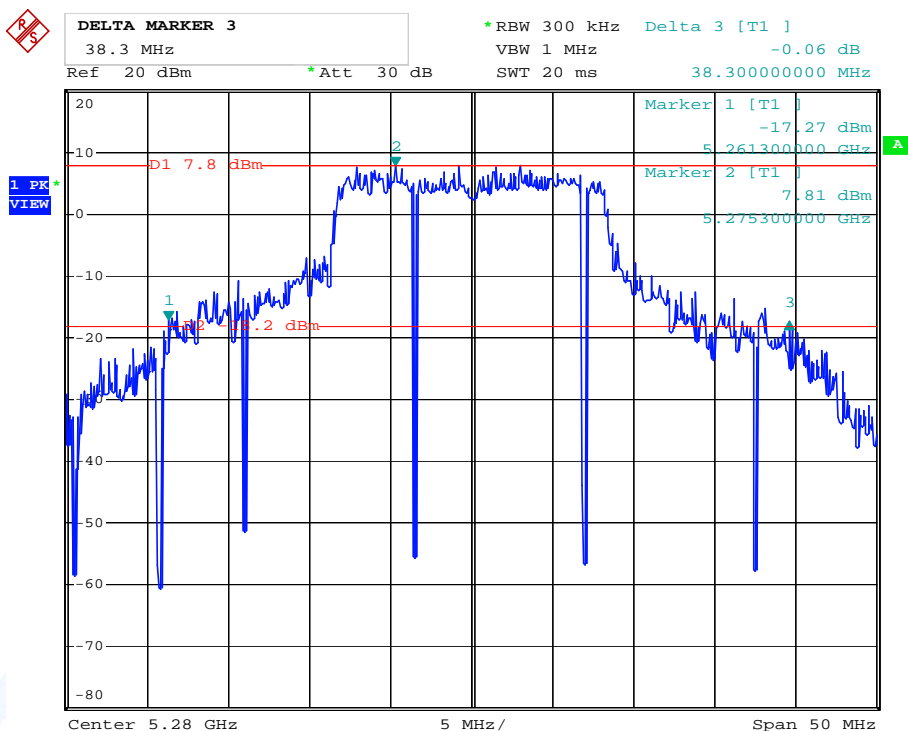
26dB Bandwidth Measurement plots

802.11h, Channel 52 (5260 MHz)

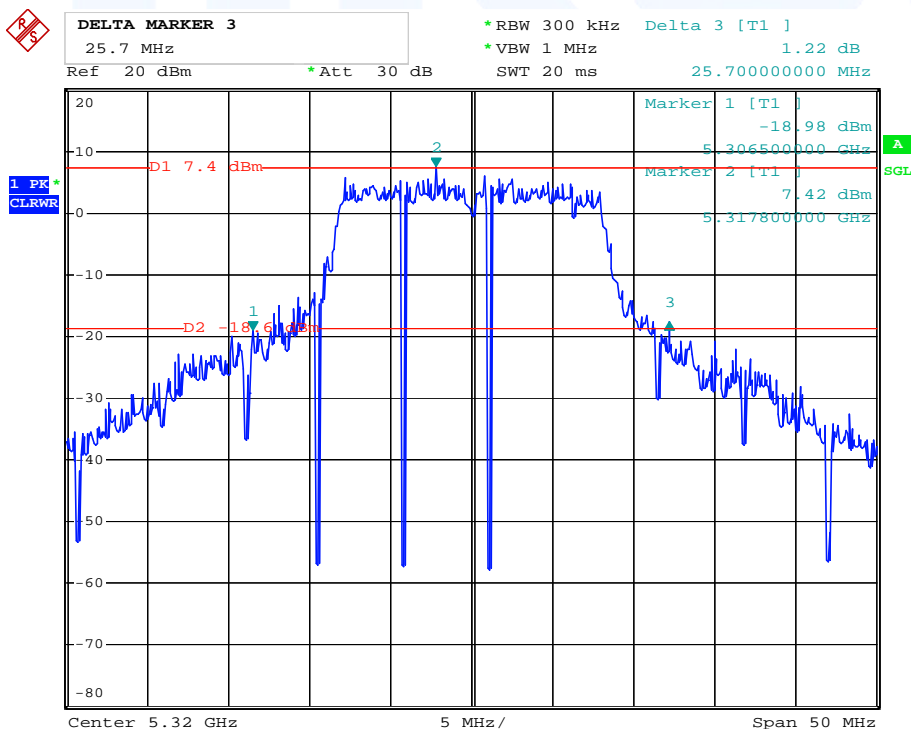


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802.11h, Channel 56 (5280 MHz)

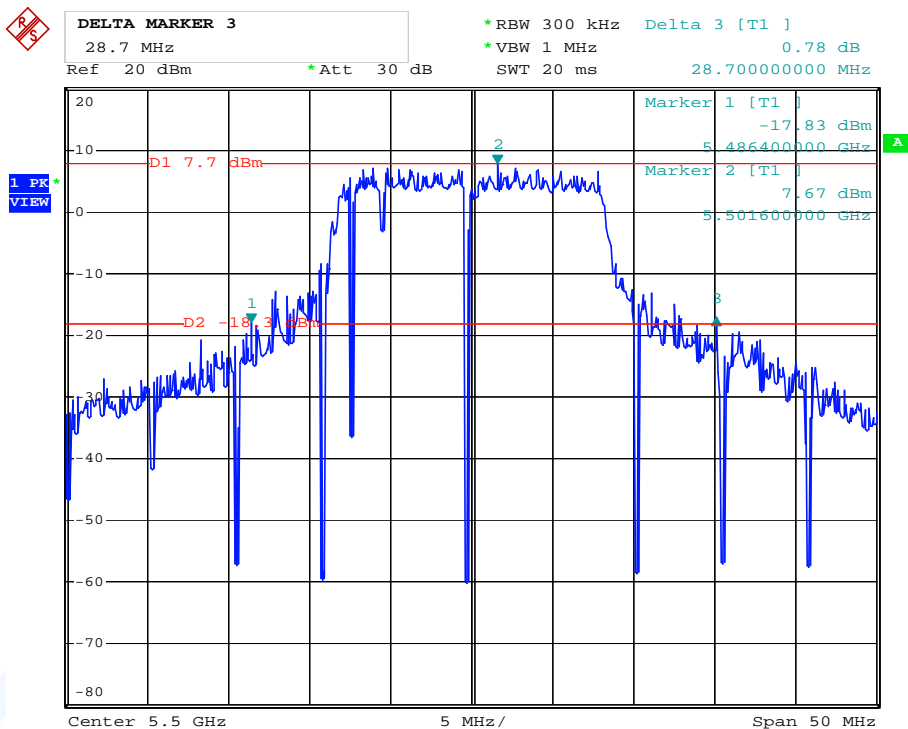


802.11h, Channel 64 (5320 MHz)

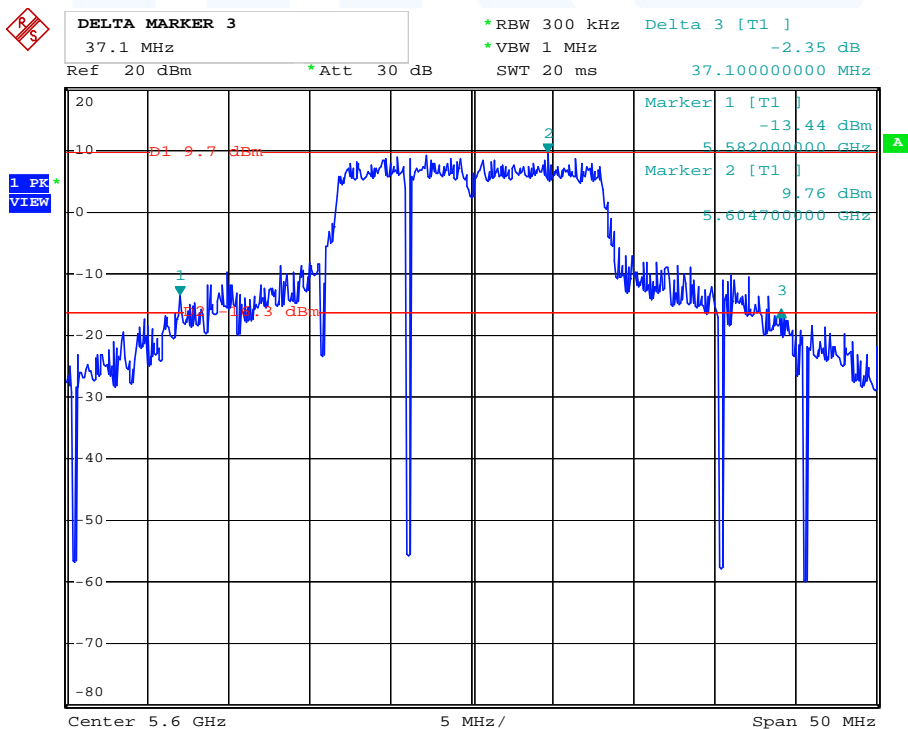


FCC ID:U9A277IWLAN-V211

802.11h, Channel 100 (5500 MHz)

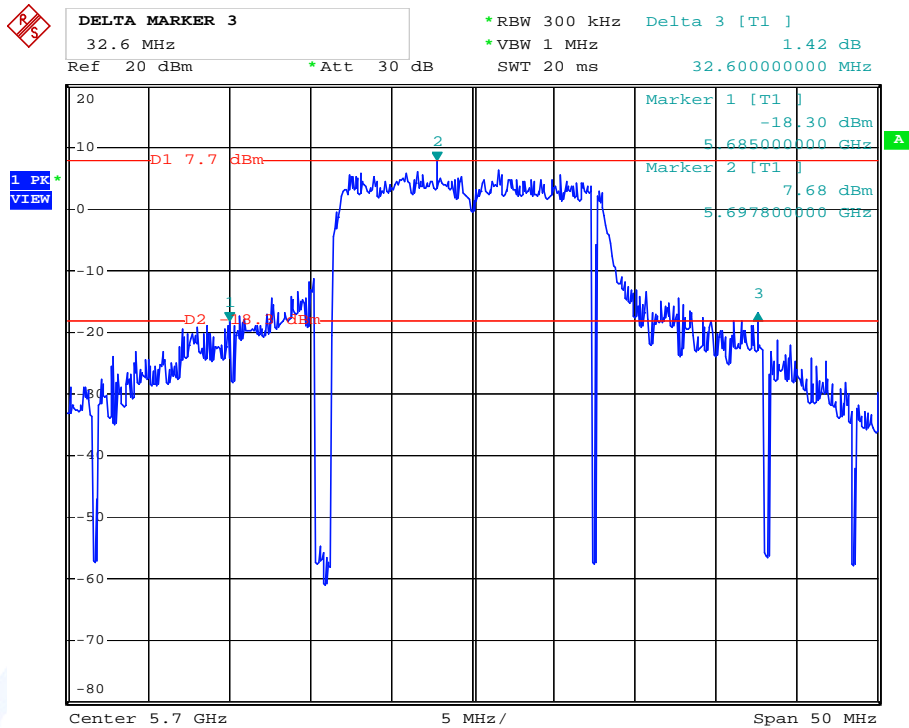


802.11h, Channel 120 (5600 MHz)



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802.11h, Channel 140 (5700 MHz)



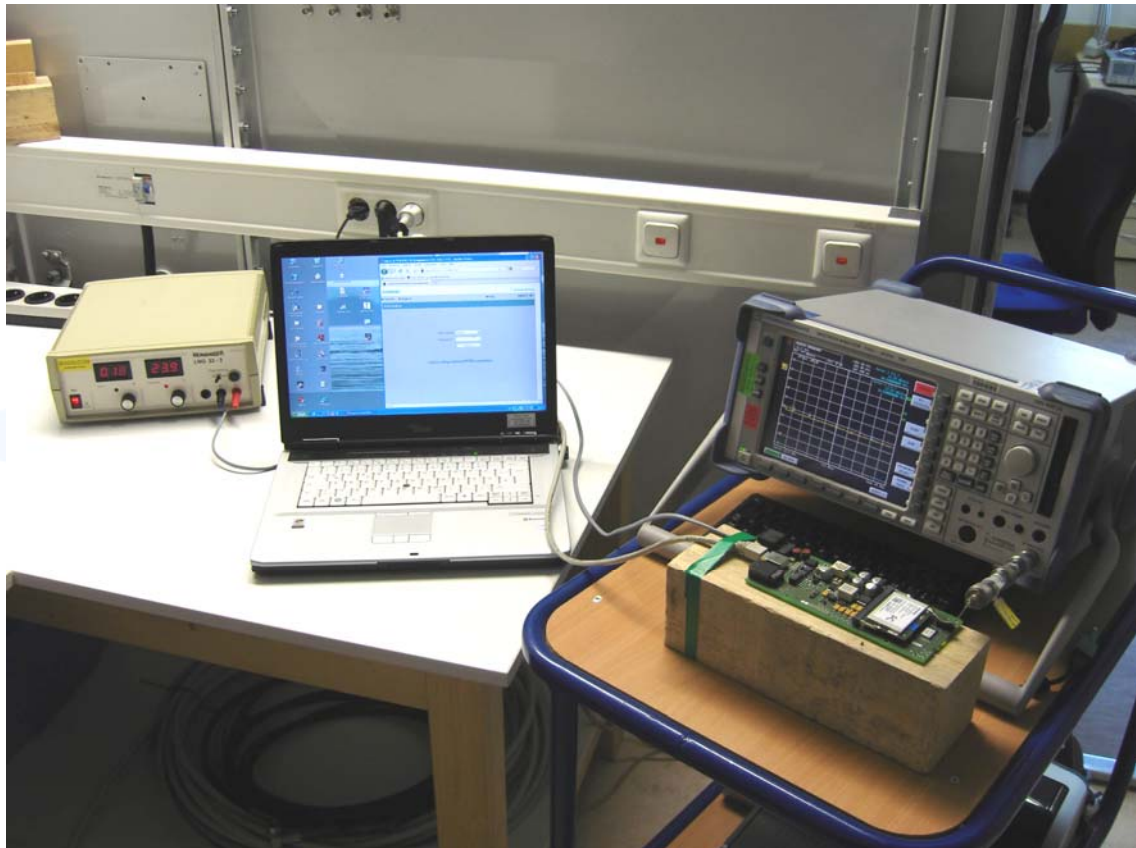
mikes

FCC ID:U9A277IWLAN-V211**5.3 Maximum conducted output power**

For test instruments and accessories used see section 6 Part **CPC 3**.

5.3.1 Description of the test location

Test location: AREA4

5.3.2 Photo documentation of the test set-up**5.3.3 Applicable standard**

According to FCC Part 15E, Section 15.407(a):

The maximum conducted output power over the frequency band of operation shall not exceed the effective values. If transmitting antennas of directional gain are greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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5.3.4 Description of Measurement

The transmitter output was connected to the spectrum analyzer through an attenuator. The center frequency of the spectrum analyzer is set to the fundamental frequency using RBW = 1 MHz and VBW = 300 kHz. The span of the spectrum analyser should be larger than the Emission Band Width (EBW). To get the total power of the occupied bandwidth the function "Channel Power Measurement" of the analyzer is used. The channel bandwidth is set to 20 MHz. With AV detector and Power Mode "Max Hold" the result is the summed maximum output power.

5.3.5 Test result

Channel	f (MHz)	SW settings (dBm)	Power conducted (dBm)	Antenna gain (dBi)	EIRP (dBm)	EIRP limit (dBm)	Delta (dB)
52	5260	20.0	15.8	5.0	20.8	30.0	-9.2
56	5280	20.0	15.8	5.0	20.8	30.0	-9.2
64	5320	20.0	13.9	5.0	18.9	30.0	-11.1
100	5500	20.0	15.4	5.0	20.4	30.0	-9.6
120	5600	20.0	17.7	5.0	21.3	30.0	-8.7
140	5700	20.0	14.3	5.0	22.7	30.0	-7.3

Note: The calculated EIRP includes the maximum gain of the applicable antenna.

Peak power limit according to FCC Part 15E, Section 15.407(a):

Frequency (MHz)	Conducted power limit (dBm)	EIRP limit (dBm)
5250 - 5350	24.0 or $11 + (10 \log_{10} B_{Ch})$	30.0 or $17 + (10 \log_{10} B_{Ch})$
5470 - 5725	24.0 or $11 + (10 \log_{10} B_{Ch})$	30.0 or $17 + (10 \log_{10} B_{Ch})$

The requirements are **FULFILLED**.

Remarks: This test has been performed conducted at antenna cable on WLAN module.

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5.4 Undesirable emissions

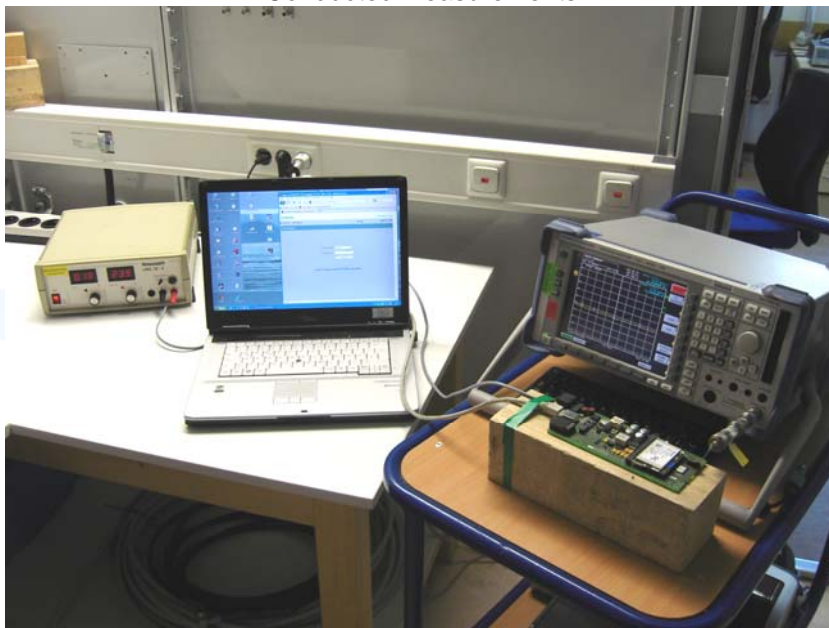
For test instruments and accessories used see section 6 Part **SEC 1-3, SER 1, SER 2 and SER 3.**

5.4.1 Description of the test location

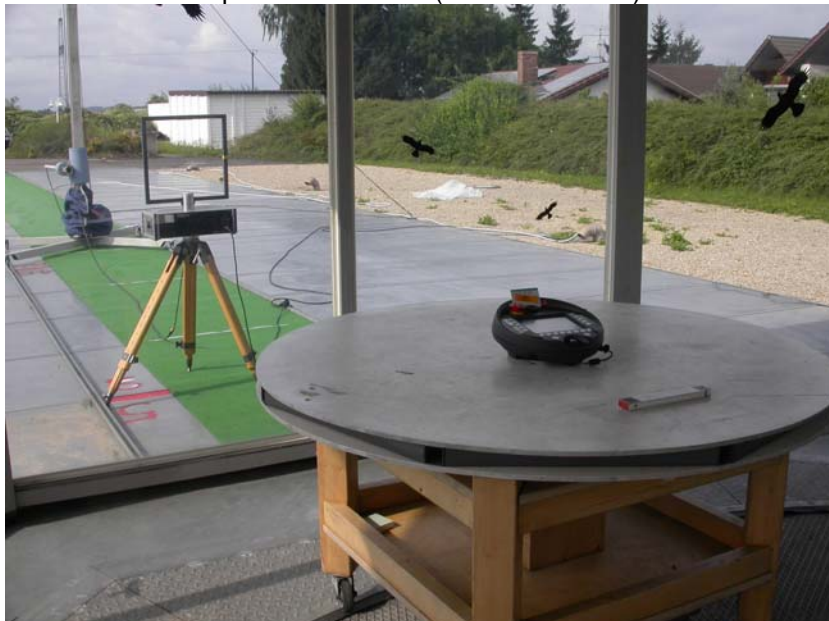
Test location: AREA 4
Test location: OATS1
Anechoic Chamber A2
Test distance: 3 metres

5.4.2 Photo documentation of the test set-up

Conducted measurements



Open area test site (9 kHz – 30 MHz)



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Open area test site (30 MHz – 1000 MHz)

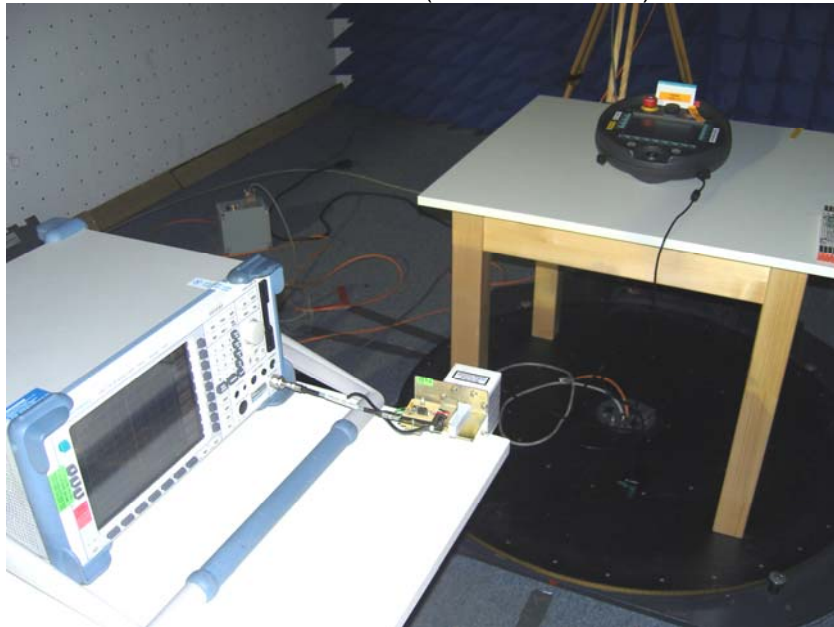


Anechoic chamber (960 MHz – 18 GHz)

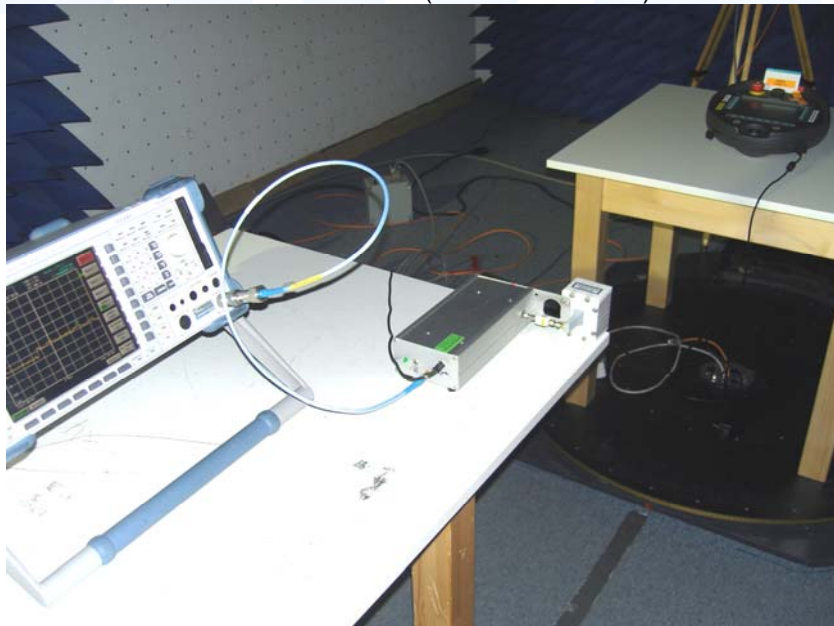


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Anechoic chamber (18 GHz – 30 GHz)



Anechoic chamber (30 GHz – 40 GHz)



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5.4.3 Applicable standard

According to FCC Part 15E, Section 15.407(b):

- (2) For transmitters operating in the 5.25 - 5.35 GHz band:
All emissions outside of the 5.15 - 5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5.25 - 5.35 GHz band that generate emissions in the 5.15 - 5.25 GHz band must meet all applicable technical requirements for operation in the 5.15 - 5.25 GHz or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15 - 5.25 GHz band.
- (3) For transmitters operating in the 5.47 - 5.725 GHz band:
All emissions outside of the 5.47 - 5.725 GHz band shall not exceed an EIRP of -27 dBm/MHz.

In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limit specified in §15.209(a) (see §15.205(c)).

5.4.4 Description of Measurement

Spurious emissions from the EUT are measured with the procedure set out under ANSI C63.4-2003. According to Part 15.407 (b)(5) the emission measurements have been performed using a minimum RBW of 1 MHz.

Spectrum analyzer settings:

Peak values: RBW: 1 MHz, VBW: 3 MHz, Sweep: Auto;
Average values: RBW: 1 MHz, VBW: 10 Hz, Sweep: Auto;

5.4.5 Test result

5.4.5.1 Conducted spurious emissions

Frequency band: 5.25 GHz to 5.35 GHz

Channel 52 (5260 MHz)				Channel 64 (5320 MHz)			
Frequency (MHz)	Peak Power (dBm)	AV-Limit (dBm)	Delta (dB)	Frequency (MHz)	Peak Power (dBm)	AV-Limit (dBm)	Delta (dB)
9 - 150 kHz	<-60	-27	> -20	9 - 150 kHz	<-60	-27	> -20
150 kHz - 30	<-60	-27	> -20	150 kHz - 30	<-60	-27	> -20
30 - 1000	<-60	-27	> -20	30 - 1000	<-60	-27	> -20
1 - 5.15 GHz	<-47	-27	> -20	1 - 5.15 GHz	-46.2	-27	-19.8
5.15 - 5.25 GHz	0.2	10	-9.8	5.15 - 5.25 GHz	<-10	10	> -20
5.35 - 40 GHz	-36.6	-27	-9.6	5.35 - 40 GHz	-32.9	-27	-5.9

Frequency band: 5.47 GHz to 5.725 GHz

Channel 100 (5500 MHz)				Channel 140 (5700 MHz)			
Frequency (MHz)	Peak power (dBm)	AV-Limit (dBm)	Delta (dB)	Frequency (MHz)	Peak power (dBm)	AV-Limit (dBm)	Delta (dB)
9 - 150 kHz	<-60	-27	> -20	9 - 150 kHz	<-60	-27	> -20
150 kHz - 30	<-60	-27	> -20	150 kHz - 30	<-60	-27	> -20
30 - 1000	<-60	-27	> -20	30 - 1000	<-60	-27	> -20
1 - 5.47 GHz	-25.6	-27	1.4	1 - 5.47 GHz	-47.3	-27	> -20
5.725 - 40 GHz	-42.8	-27	-15.8	5.725 - 40 GHz	-23.2	-27	3.8

Note: All spurious emissions falling in restricted bands have been measured radiated.

FCC ID:U9A277IWLAN-V211

Re-measurement AV:

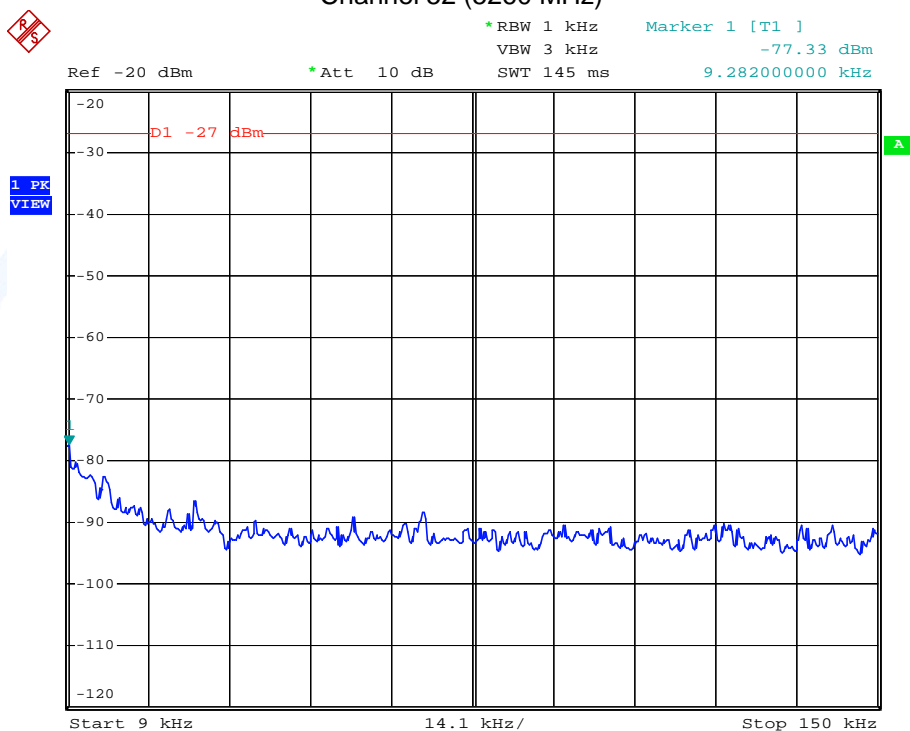
Channel 100 (5500 MHz)				Channel 140 (5700 MHz)			
Frequency (MHz)	AV Power (dBm)	AV-Limit (dBm)	Delta (dB)	Frequency (MHz)	AV Power (dBm)	AV-Limit (dBm)	Delta (dB)
5469	-44.7	-27	-17.7	5725	-40.2	-27	-13.2

For detailed test results please see to test plots below.

5.4.5.2 Test plots spurious emissions, conducted:

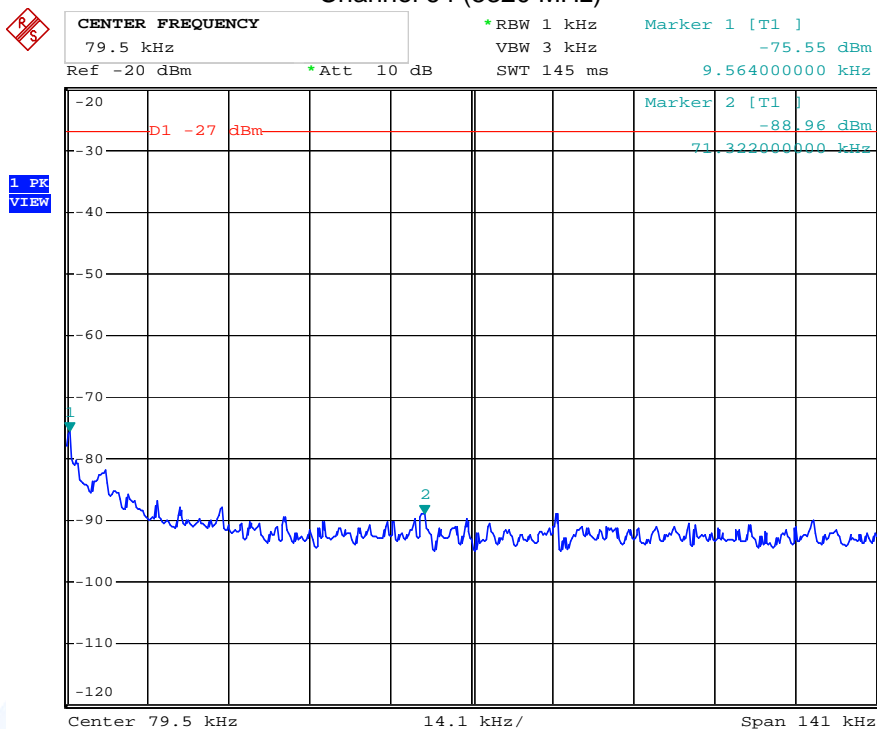
Spurious emissions from 9 kHz to 150 kHz

Channel 52 (5260 MHz)

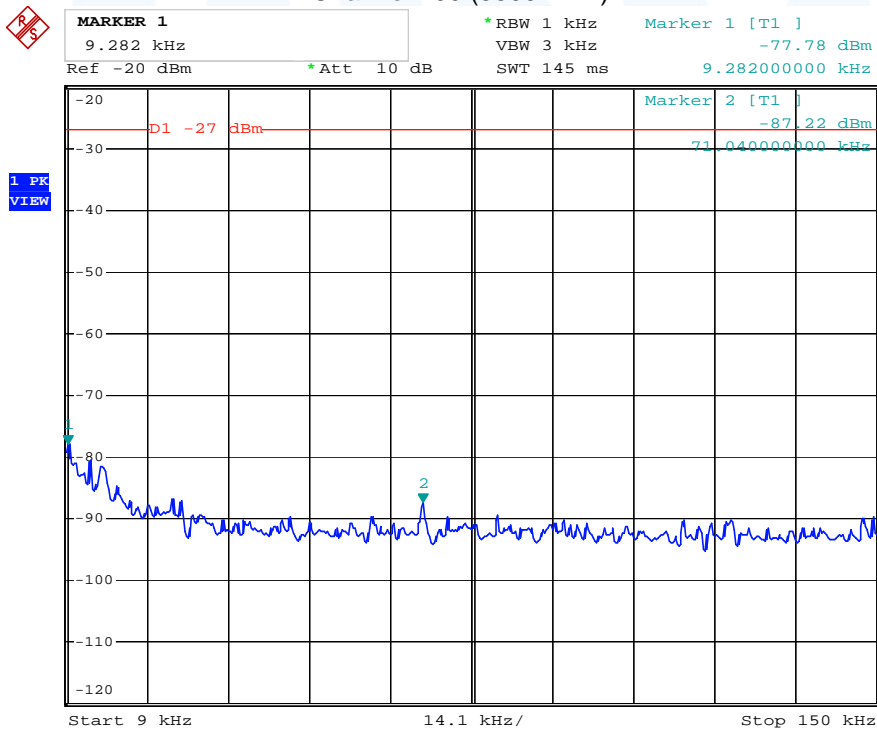


FCC ID:U9A277IWLAN-V211

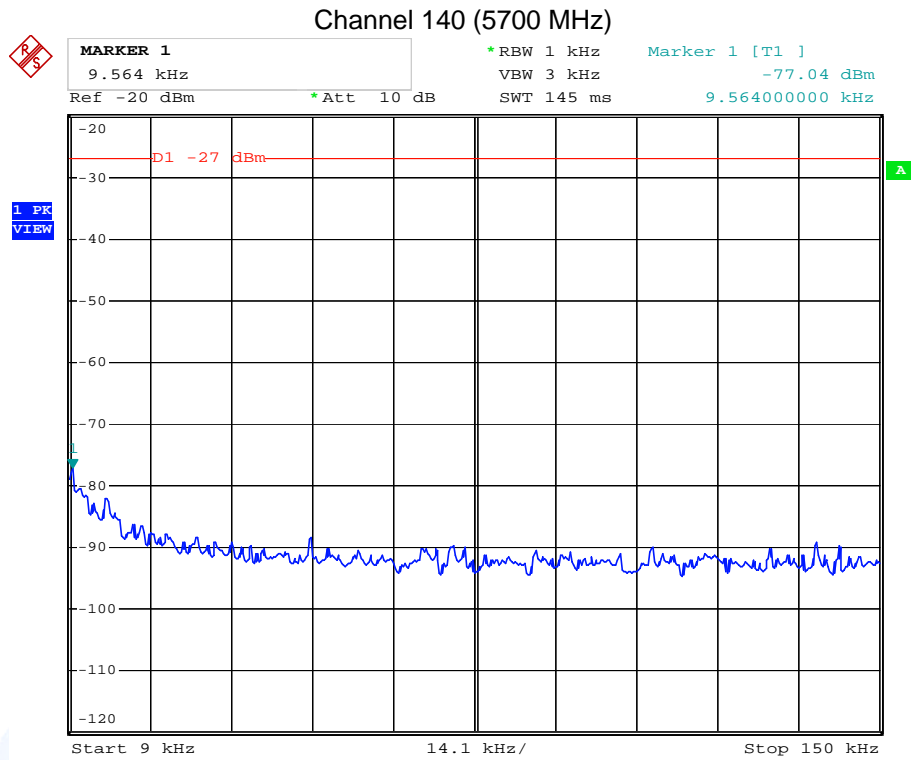
Channel 64 (5320 MHz)



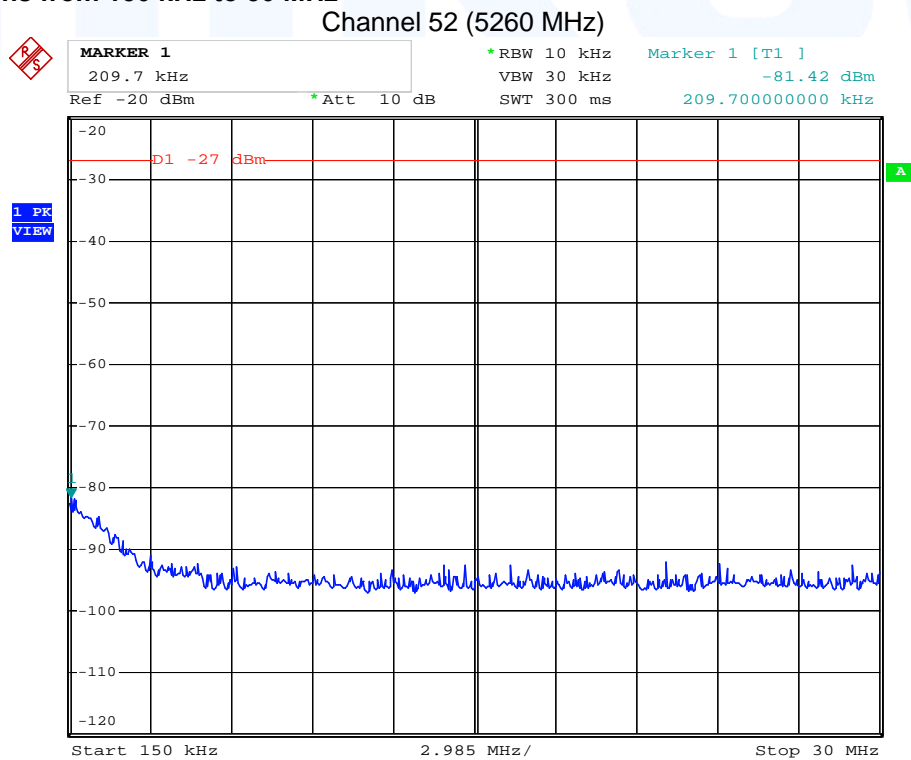
Channel 100 (5500 MHz)



FCC ID:U9A277IWLAN-V211

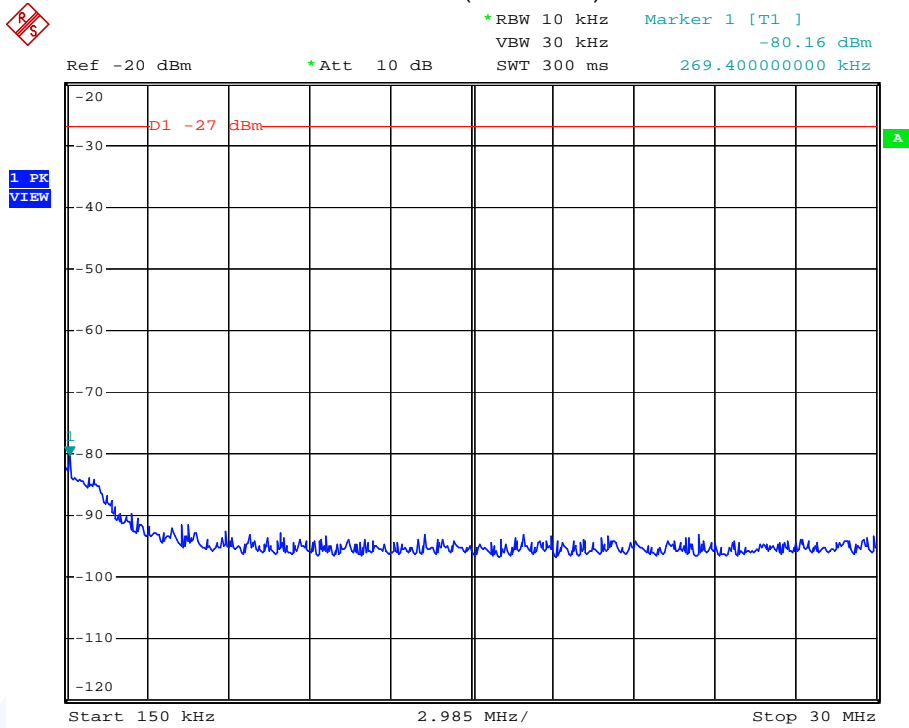


Spurious emissions from 150 kHz to 30 MHz

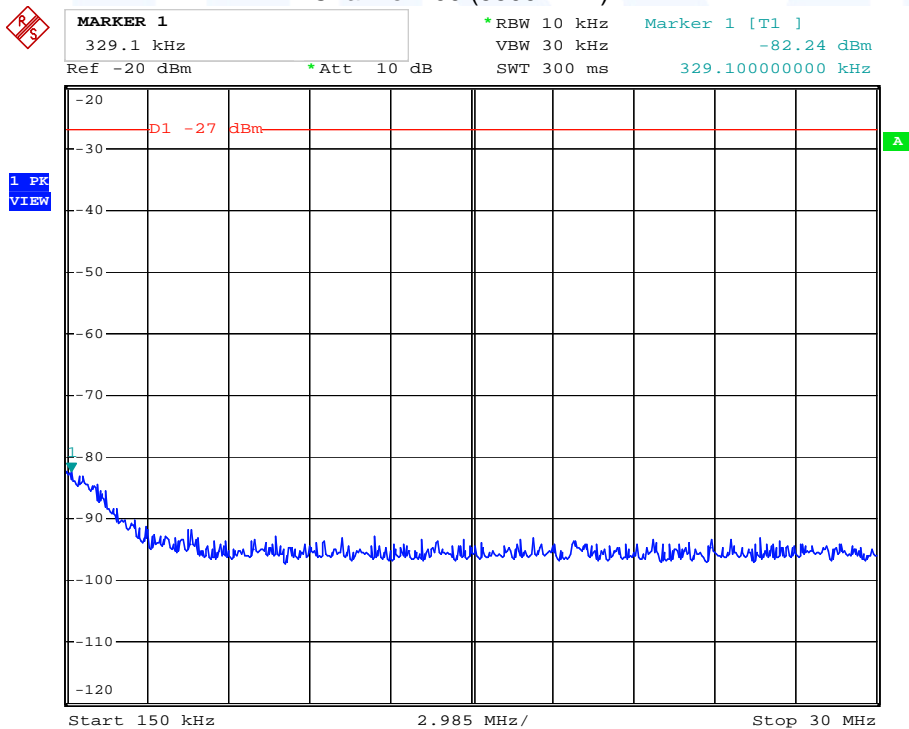


FCC ID:U9A277IWLAN-V211

Channel 64 (5320 MHz)

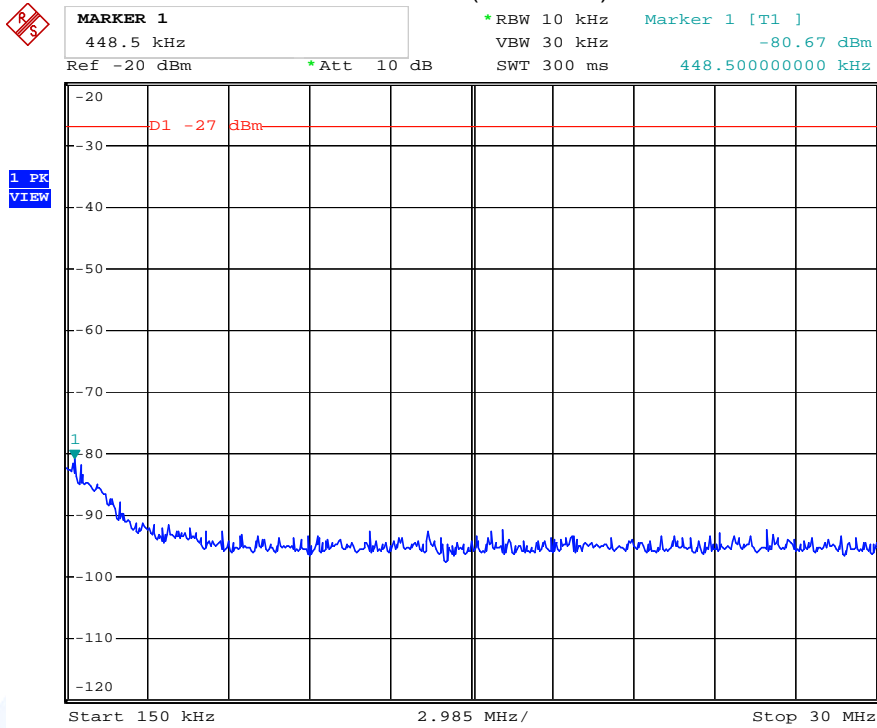


Channel 100 (5500 MHz)



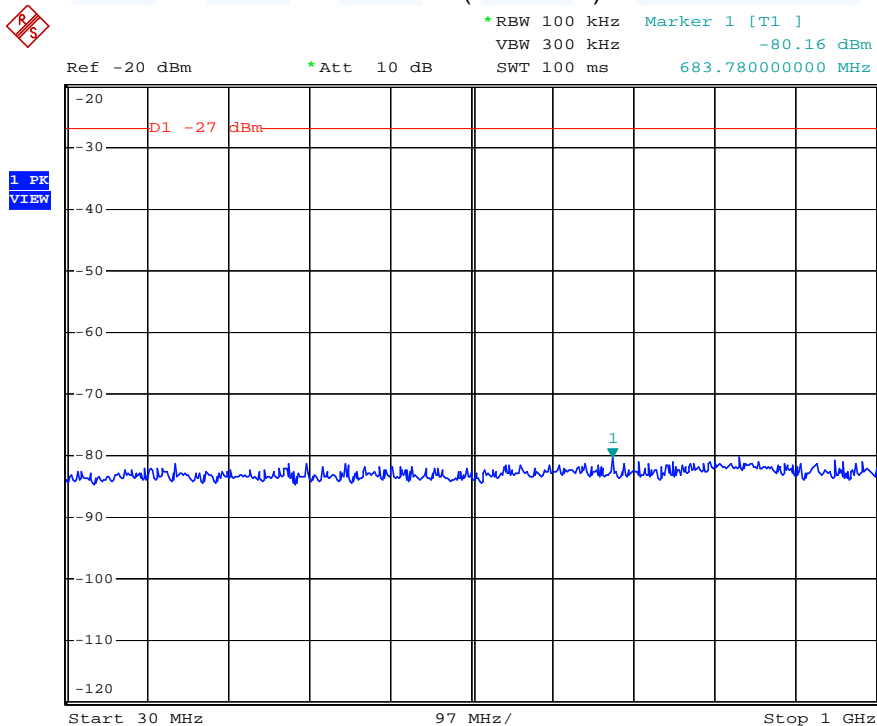
FCC ID:U9A277IWLAN-V211

Channel 140 (5700 MHz)



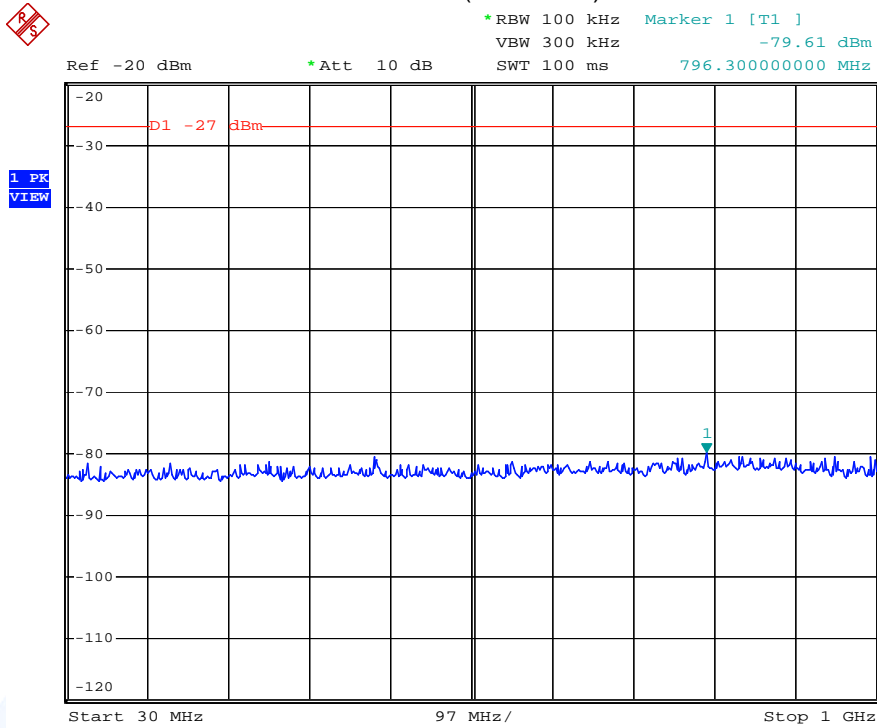
Spurious emissions from 30 MHz to 1000 MHz

Channel 52 (5260 MHz)

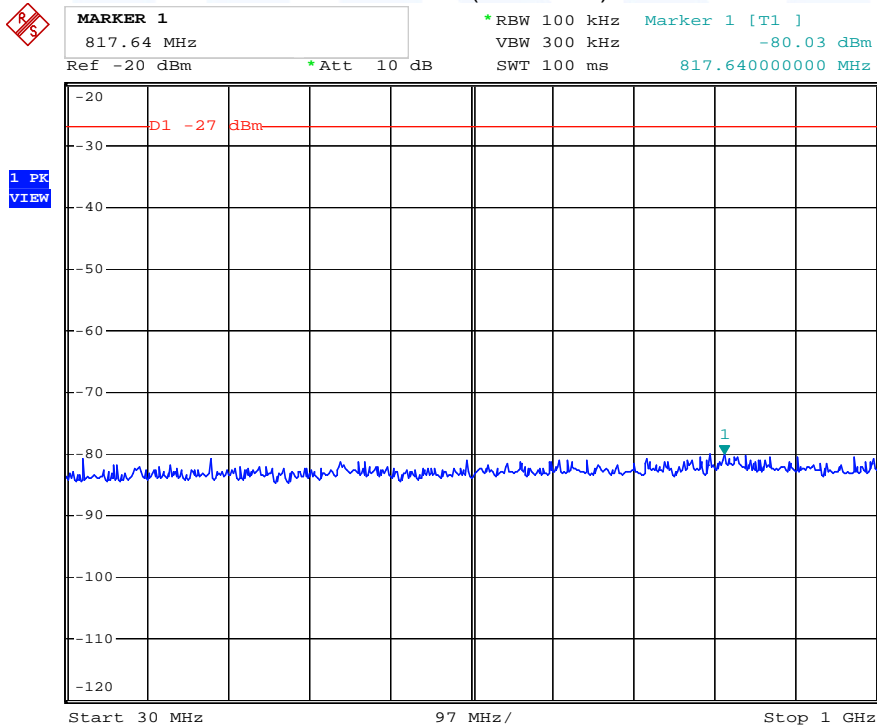


FCC ID:U9A277IWLAN-V211

Channel 64 (5320 MHz)

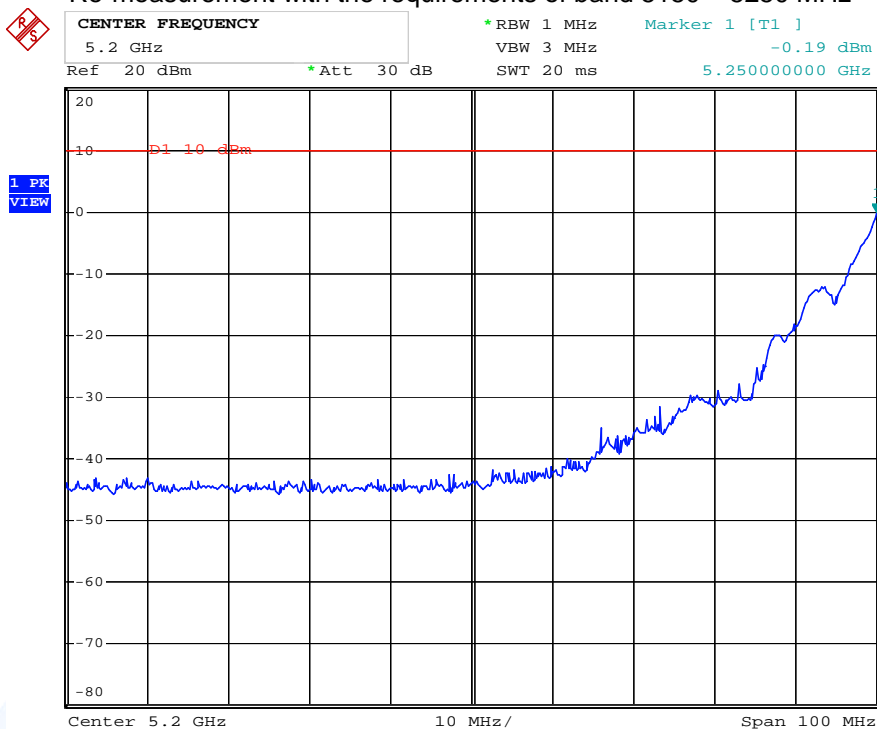


Channel 100 (5500 MHz)

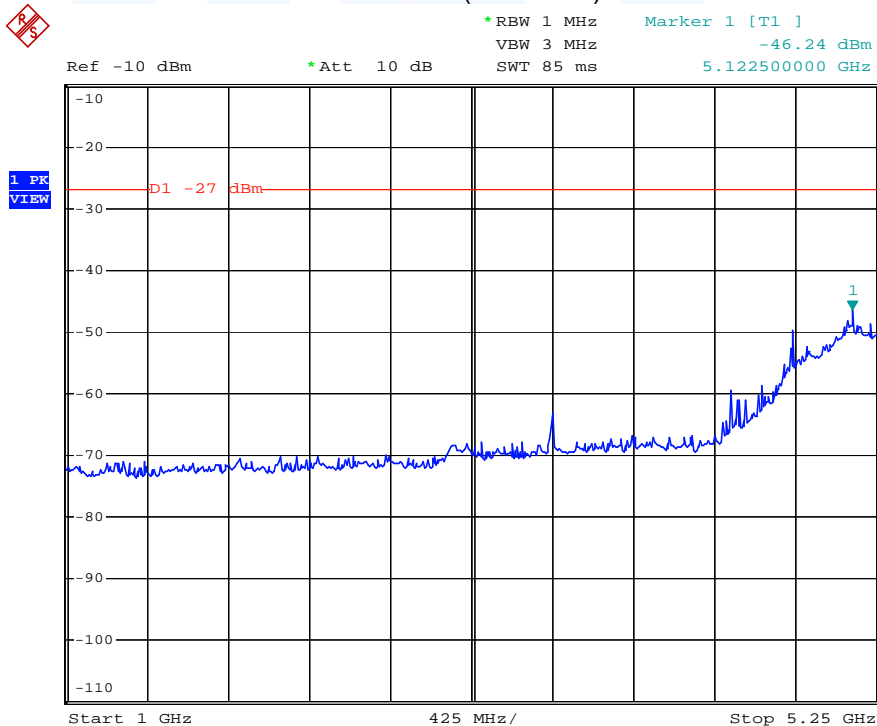


FCC ID:U9A277IWLAN-V211

Re-measurement with the requirements of band 5150 – 5250 MHz



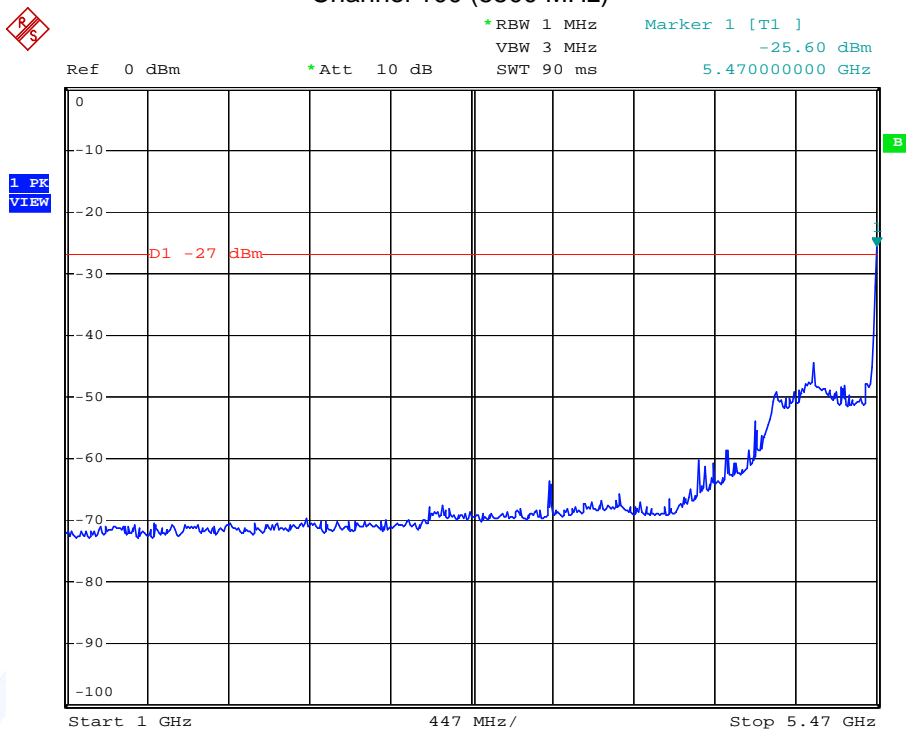
Channel 64 (5320 MHz)



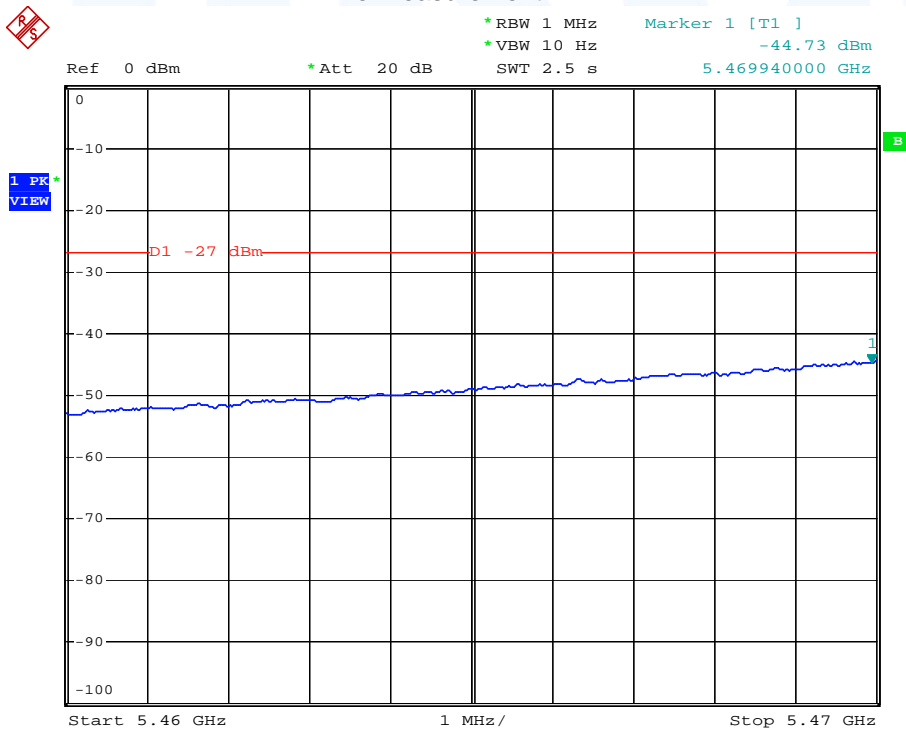
FCC ID:U9A277IWLAN-V211

Spurious emissions from 1 GHz to 5.47 GHz

Channel 100 (5500 MHz)

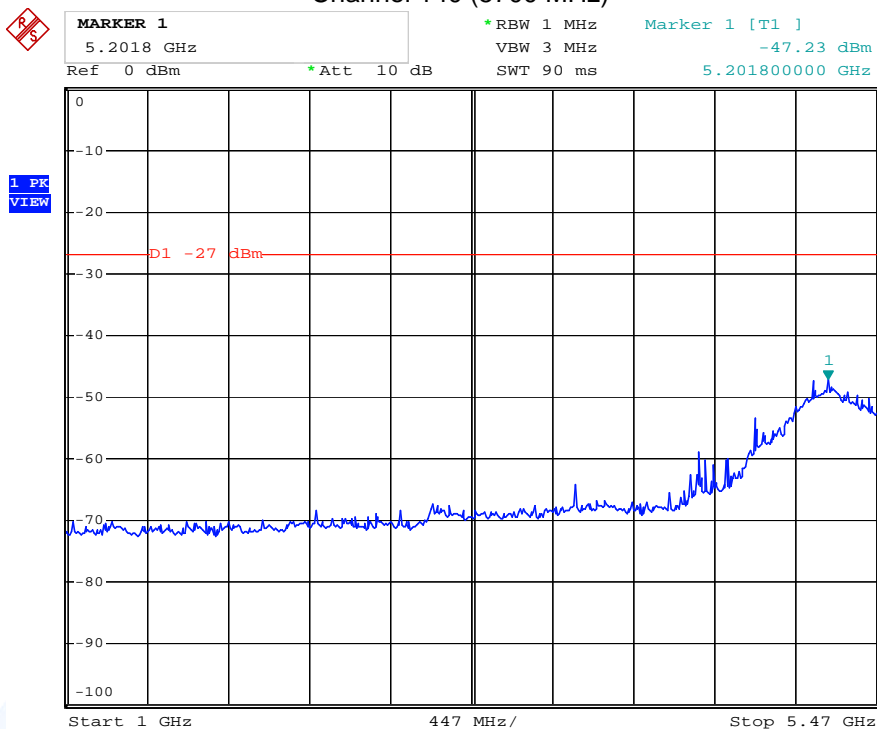


Re-measurement AV



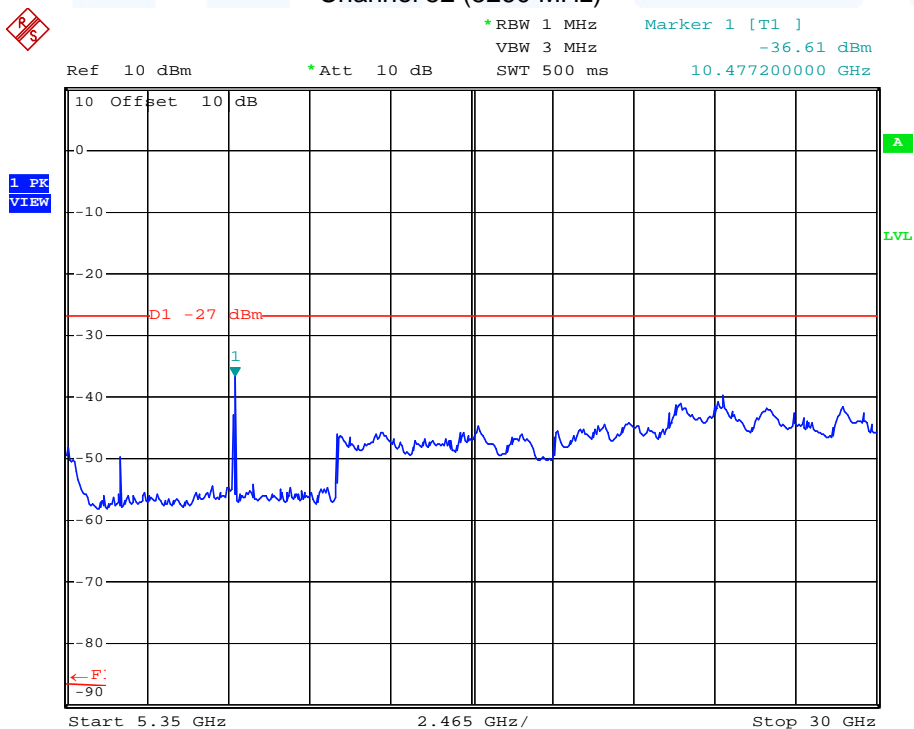
FCC ID:U9A277IWLAN-V211

Channel 140 (5700 MHz)



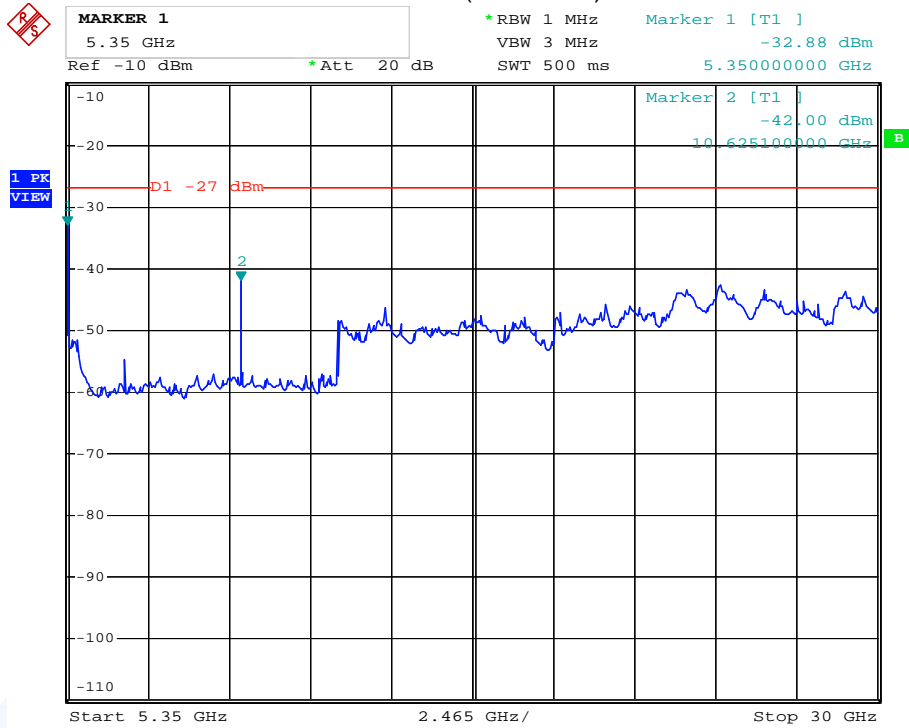
Spurious emissions from 5.35 GHz to 30 GHz

Channel 52 (5260 MHz)



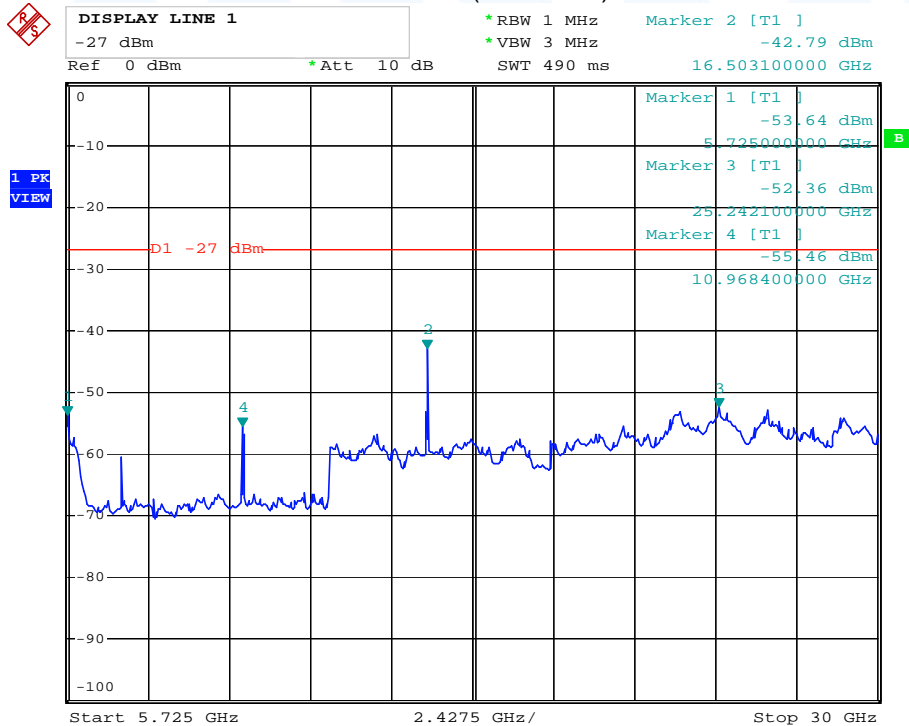
FCC ID:U9A277IWLAN-V211

Channel 64 (5320 MHz)



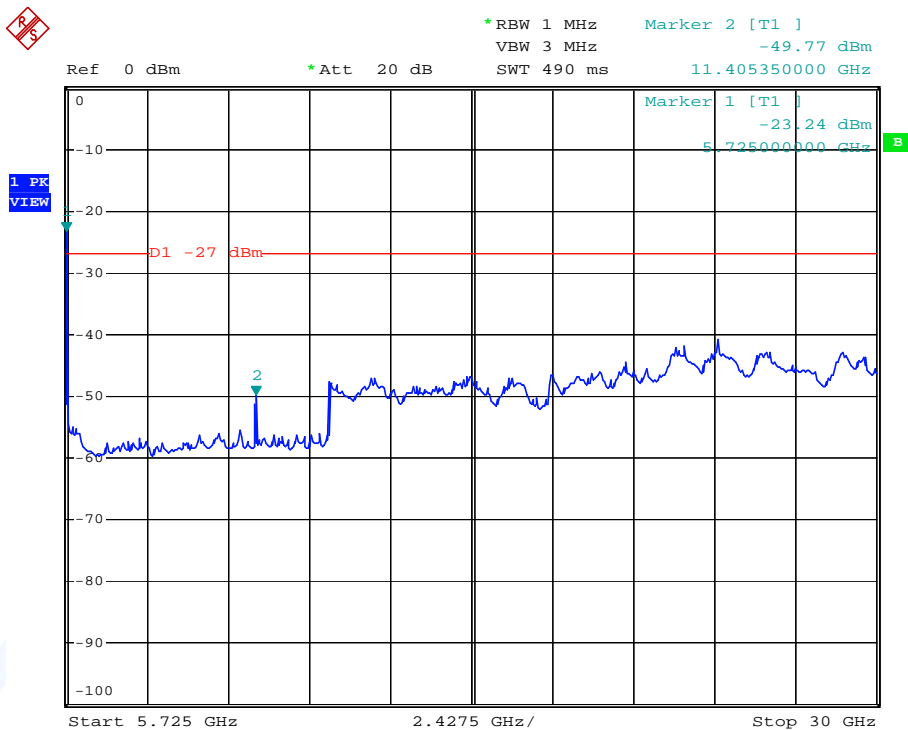
Spurious emissions from 5.725 GHz to 30 GHz

Channel 100 (5500 MHz)

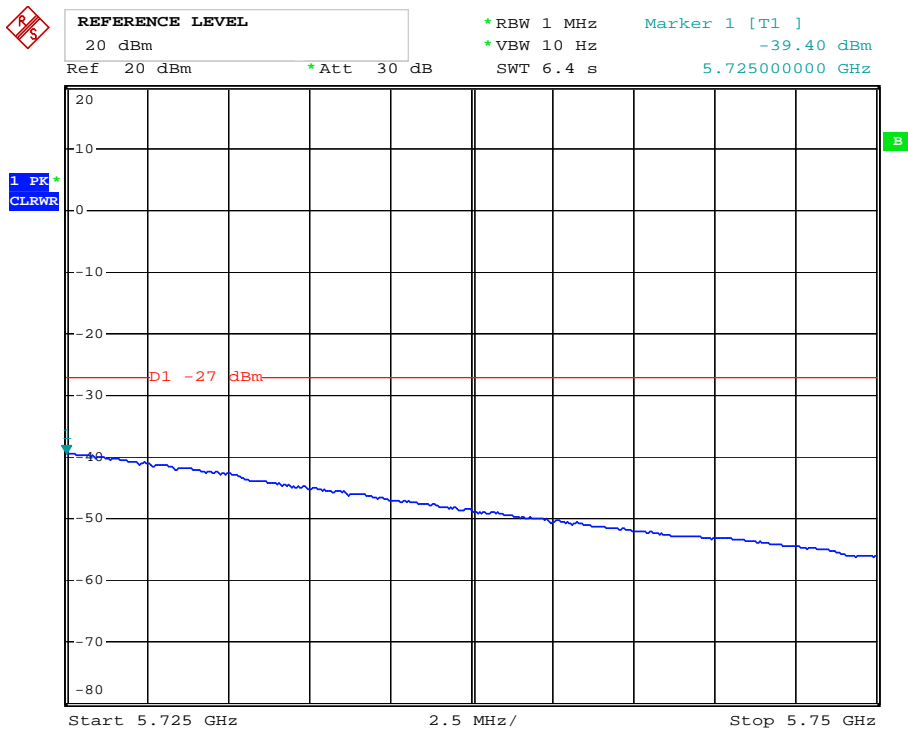


FCC ID:U9A277IWLAN-V211

Channel 140 (5700 MHz)



Re-measurement AV



FCC ID:U9A277IWLAN-V211

5.4.5.3 Radiated emissions and harmonics in restricted bands

Channel 52 (5260 MHz)

Nearest restricted band: 4500 to 5150 MHz and band 10.6 to 12.7 GHz

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit (dBµV/m)	Delta (dB)
		hor (dBµV/m)	vert (dBµV/m)		hor (dBµV/m)	vert (dBµV/m)		
4875	Pk	---	---	---	54.4	57.2	74	-16.8
	AV	---	---	---	---	50.4	54	-3.6
10516	Pk	---	---	---	55.6	61.5	74	-12.5
	AV	---	---	---	---	35.3	54	-18.7

Channel 64 (5320 MHz)

Nearest restricted band: 5350 to 5460 MHz and band 10.6 to 12.7 GHz

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit (dBµV/m)	Delta (dB)
		hor (dBµV/m)	vert (dBµV/m)		hor (dBµV/m)	vert (dBµV/m)		
5353	Pk	---	---	---	54.6	57.3	74	-16.7
	AV	---	---	---	---	30.1	54	-23.9
10641	Pk	---	---	---	54.6	57.1	74	-16.9
	AV	---	---	---	---	33.9	54	-20.1

Channel 100 (5500 MHz)

Nearest restricted band: 5350 to 5460 MHz

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit (dBµV/m)	Delta (dB)
		hor (dBµV/m)	vert (dBµV/m)		hor (dBµV/m)	vert (dBµV/m)		
5459	Pk	---	---	---	---	60.5	74	-13.5
	AV	---	---	---	---	29.6	54	-24.4

Remark: No radiated harmonics in restricted band 10.6 to 12.7 GHz could be measured.

Channel 120 (5500 MHz)

Restricted band: 10.6 to 12.7 GHz

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit (dBµV/m)	Delta (dB)
		hor (dBµV/m)	vert (dBµV/m)		hor (dBµV/m)	vert (dBµV/m)		
11200	Pk	---	---	---	---	57.1	74	-16.9
	AV	---	---	---	---	34.7	54	-19.3

Channel 140 (5700 MHz)

Nearest restricted band: 5350 to 5460 MHz and band 10.6 to 12.7 GHz

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit (dBµV/m)	Delta (dB)
		hor (dBµV/m)	vert (dBµV/m)		hor (dBµV/m)	vert (dBµV/m)		
5350-5460	Pk	---	---	---	<54	<54	74	<-20.0
	AV	---	---	---	---	---	54	---
11407	Pk	---	---	---	---	57.8	74	-16.2
	AV	---	---	---	---	35.2	54	-18.8

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Radiated limits according to FCC Part 15C, Section 15.209(a) for spurious emissions which fall in restricted bands:

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (metres)
	(μ V/m)	dB(μ V/m)	
0.009 - 0.490	2400/F(kHz)		300
0.490 - 1.705	24000/F(kHz)		30
1.705 - 30	30	29,5	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
Above 960	500	54	3

Restricted bands of operation:

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209.

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	399.9 – 410	4.5 – 5.15
0.495 – 0.505	16.69475 – 16.69525	608 – 614	5.35 – 5.46
2.1735 – 2.1905	16.80425 – 16.80475	960 – 1240	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1300 – 1427	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1435 – 1626.5	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1645.5 – 1646.5	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	1660 – 1710	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	1718.8 – 1722.2	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2200 – 2300	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2310 – 2390	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	2483.5 – 2500	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	2690 – 2900	22.01 – 23.12
8.41425 – 8.41475	162.0125 – 167.17	3260 – 3267	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3332 – 3339	31.2 – 31.8
12.51975 – 12.52025	240 – 285	3345.8 – 3358	36.43 – 36.5
12.57675 – 12.57725	322 – 335.4	3600 – 4400	Above 38.6

The requirements are **FULFILLED**.

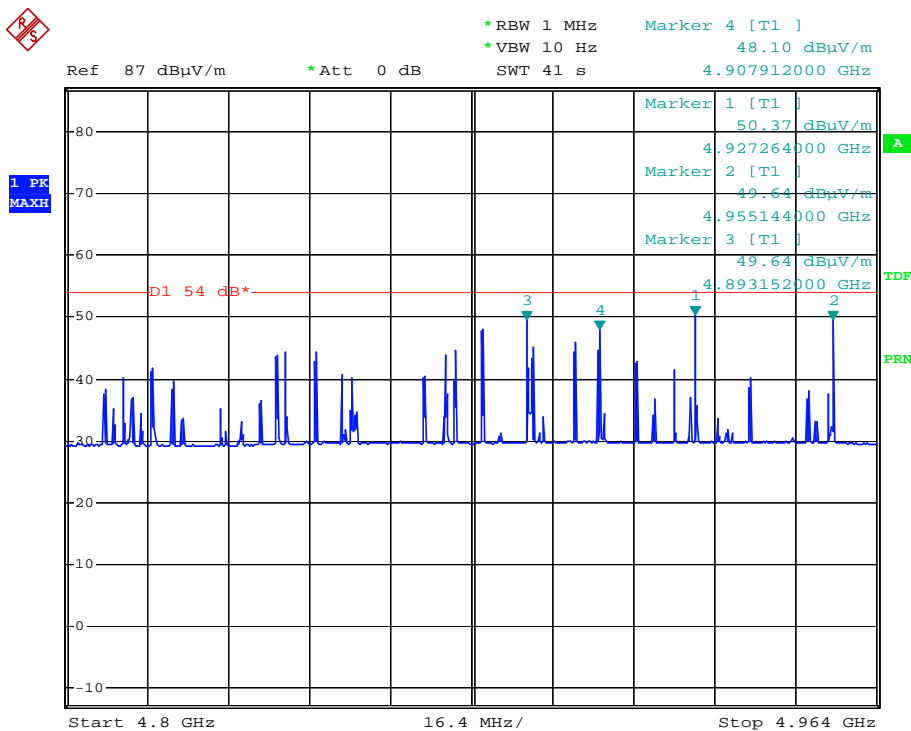
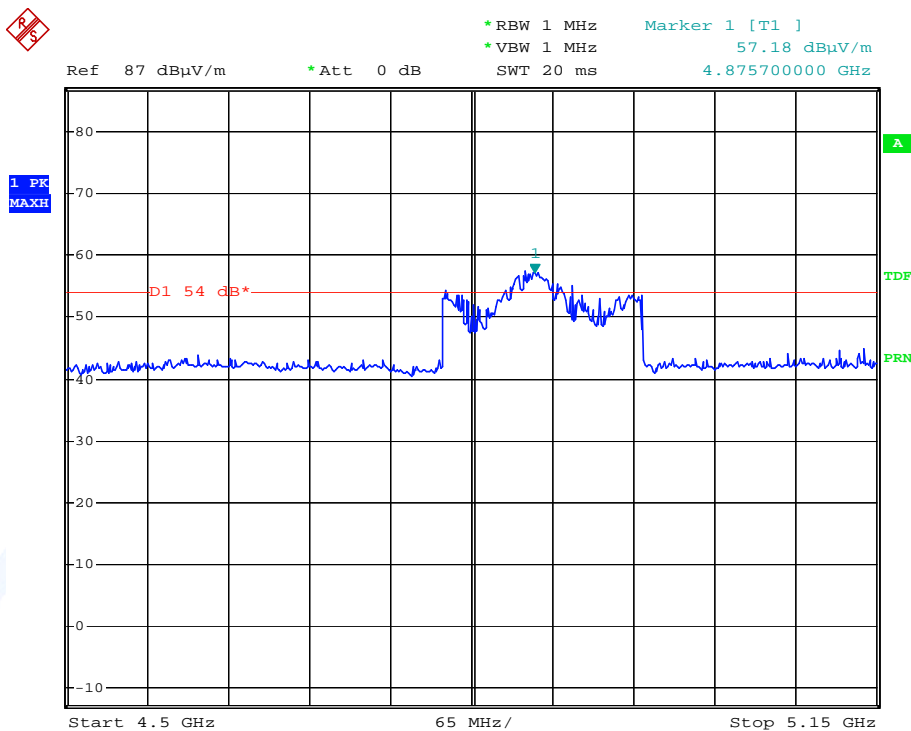
Remarks: The measurement was performed up to 40 GHz. All radiated peak emissions from 9 kHz to 1000 MHz were below the limits of part 15.209. For detailed test results please see to following test protocols.

FCC ID:U9A277IWLAN-V211

5.4.5.4 Test protocols spurious emissions, radiated:

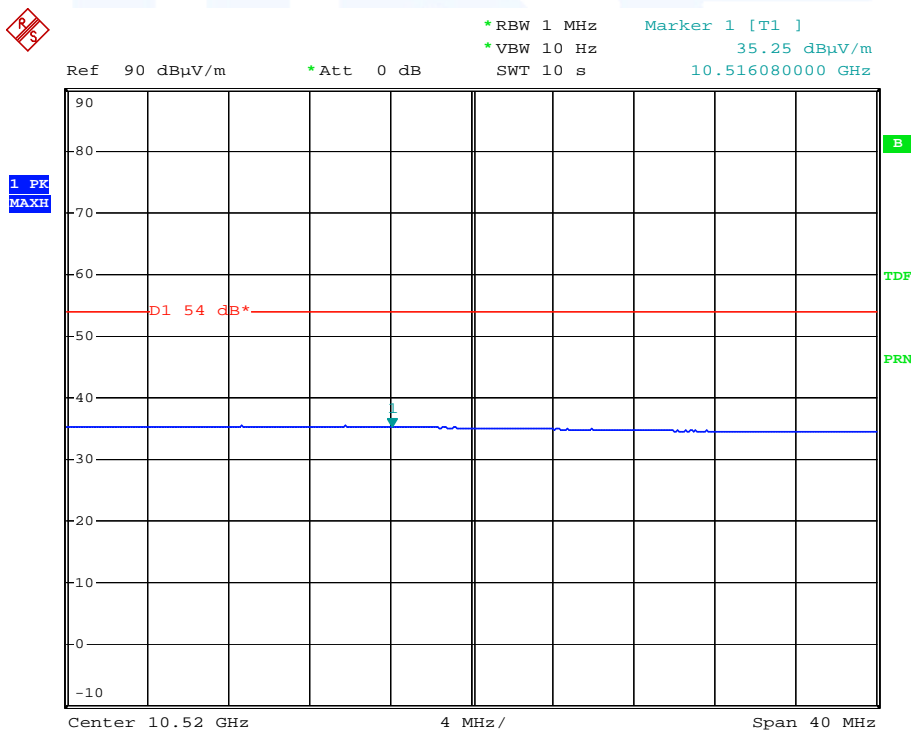
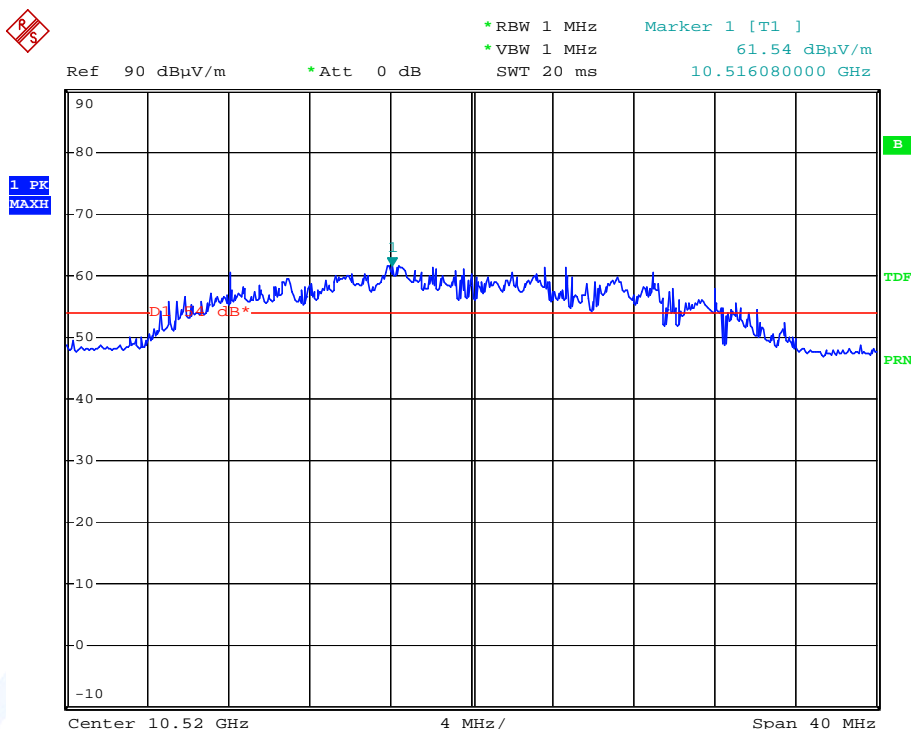
Carrier frequency at channel 52 (5260 MHz)

Peak and AV plot has been taken to show the restricted band emission levels near the lower authorized band edge.
(Restricted band from 4500 to 5150 MHz)



FCC ID:U9A277IWLAN-V211

Pk and AV value of harmonics in restricted band from 10.6 – 12.7 GHz.

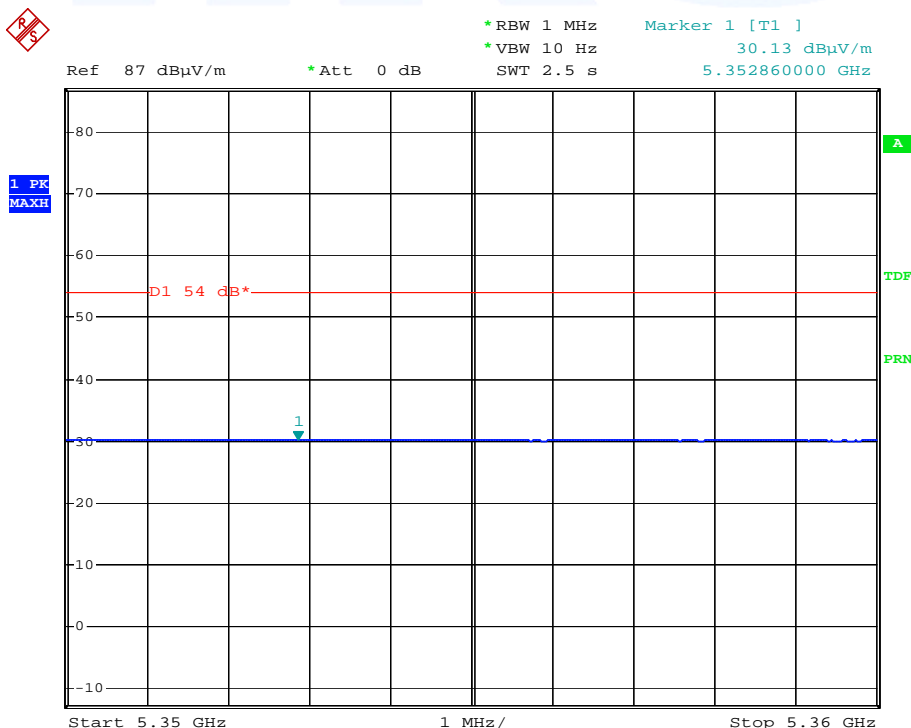
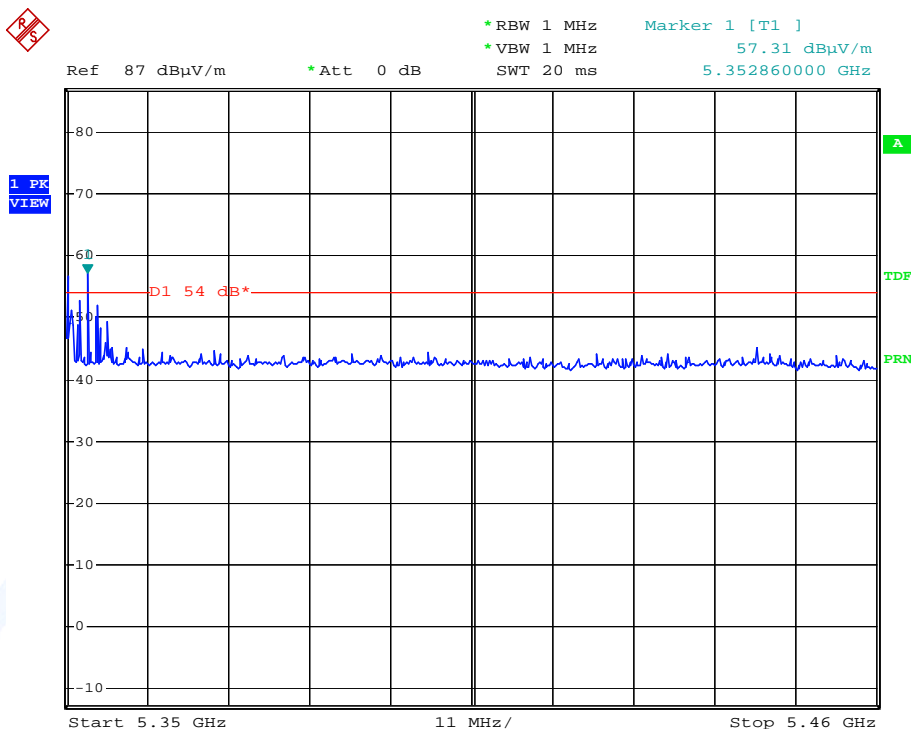


Remark: No harmonics in restricted band from 15.35 – 16.2 GHz.

FCC ID:U9A277IWLAN-V211

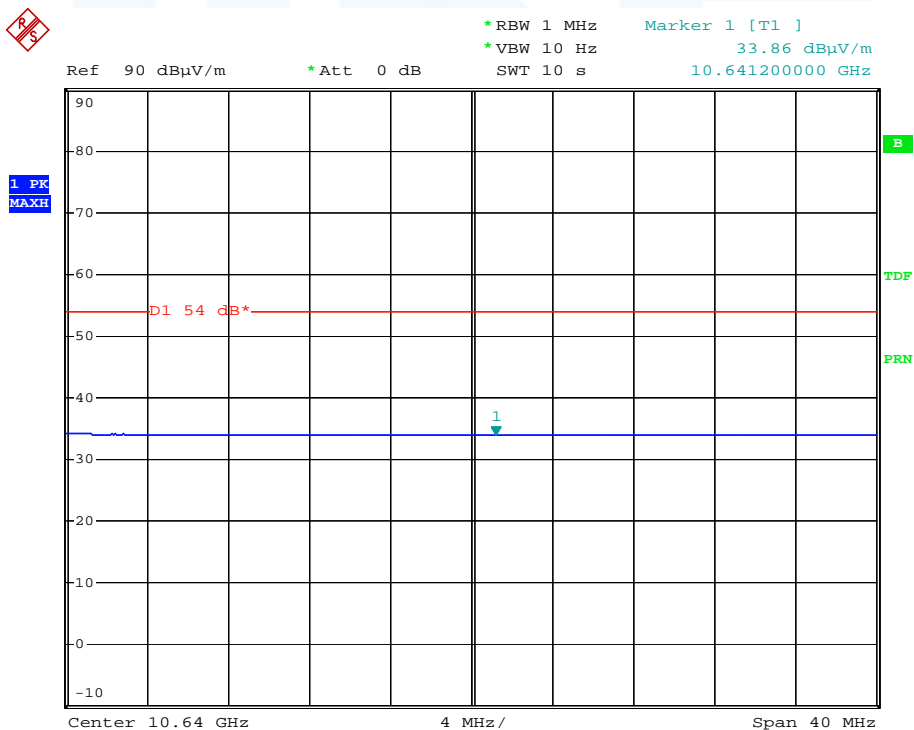
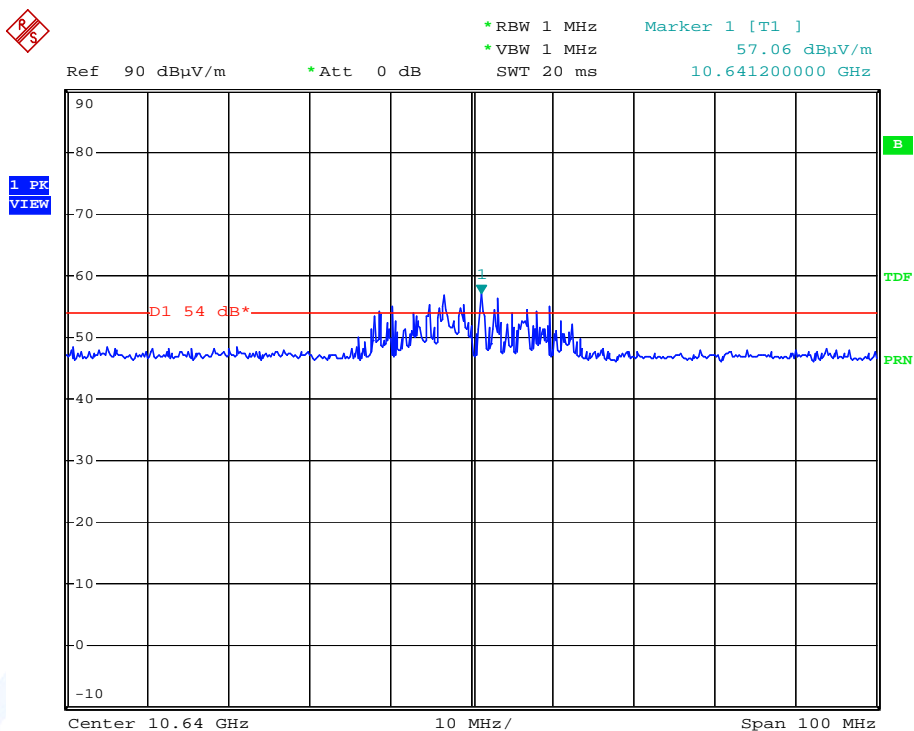
Carrier frequency at channel 64 (5320 MHz)

Peak and AV plot has been taken to show the restricted band emission levels near the upper authorized band edge.
(Restricted band from 5350 to 5460 MHz)



FCC ID:U9A277IWLAN-V211

Pk and AV value of harmonics in restricted band from 10.6 – 12.7 GHz.

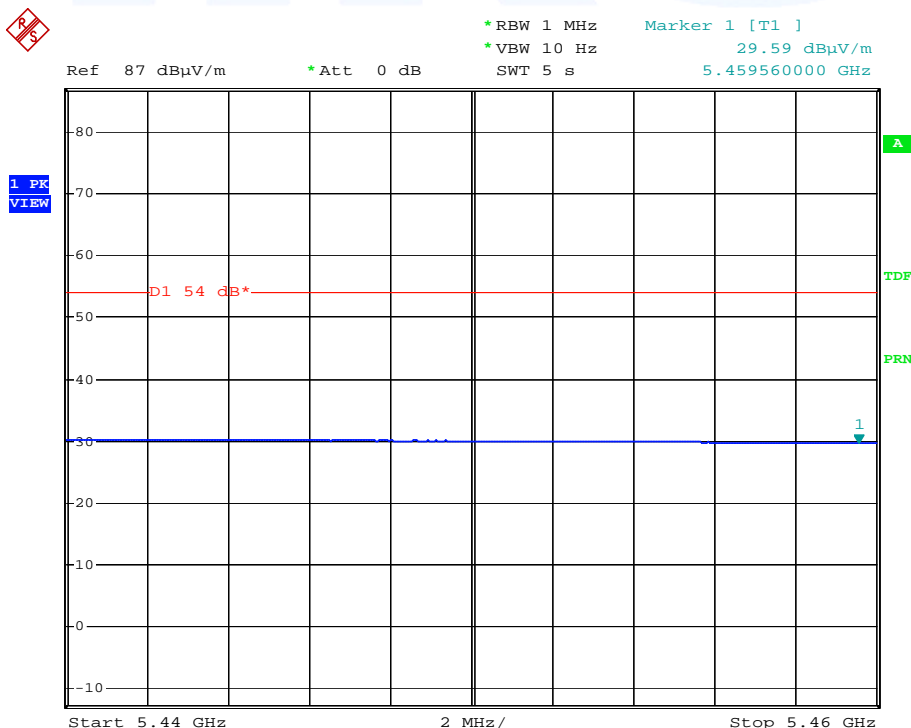
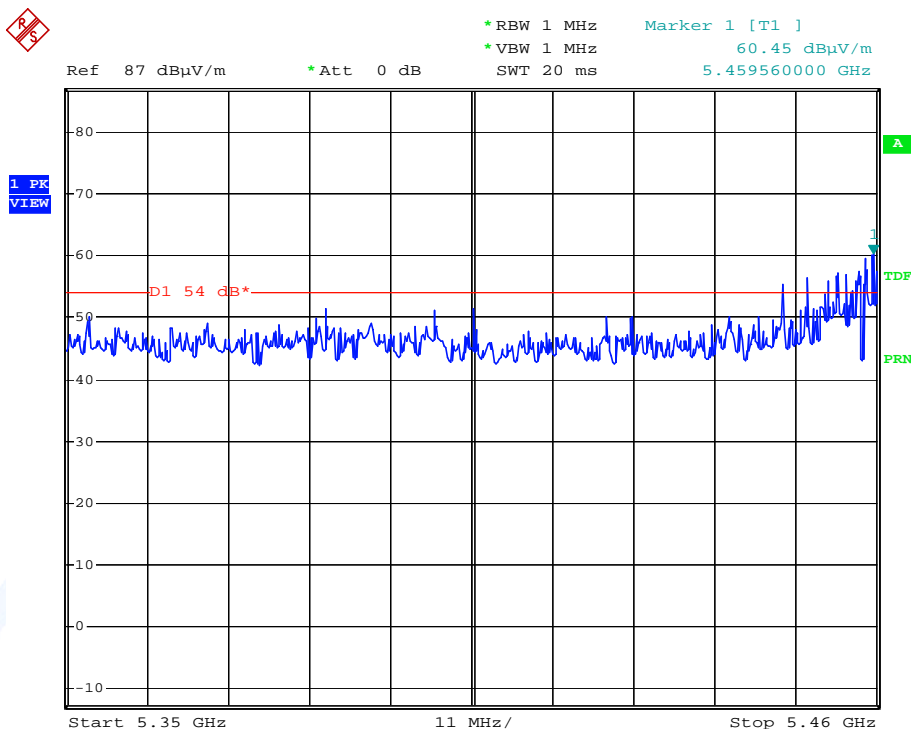


Remark: No harmonics in restricted band from 15.35 – 16.2 GHz.

FCC ID:U9A277IWLAN-V211

Carrier frequency at channel 100 (5500 MHz)

Peak plot has been taken to show the restricted band emission levels near the lower authorised band edge.
(Restricted band from 5350 to 5460 MHz)

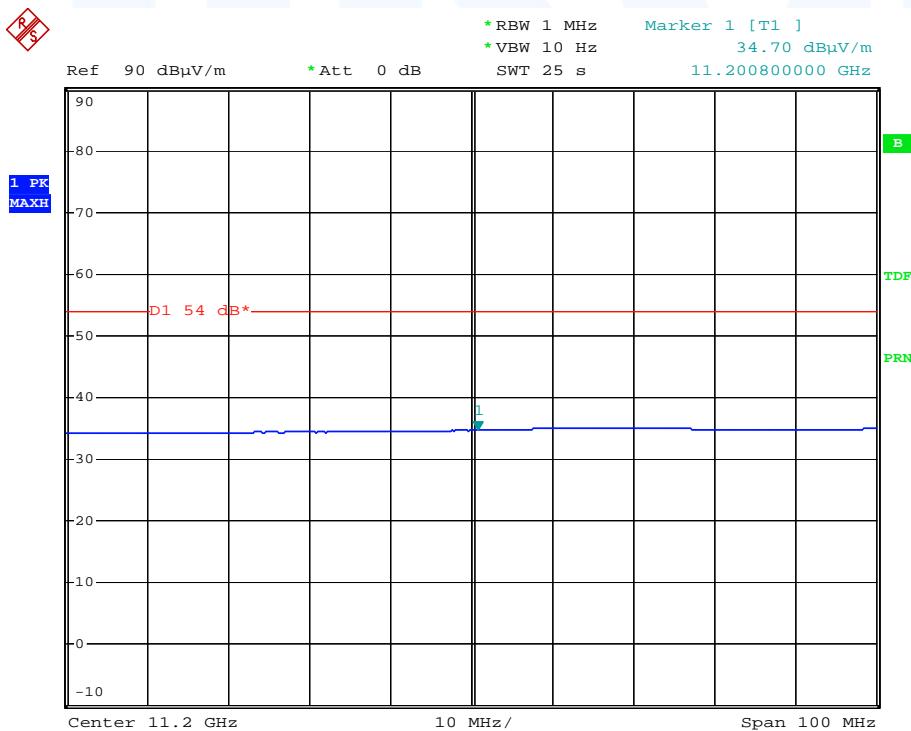
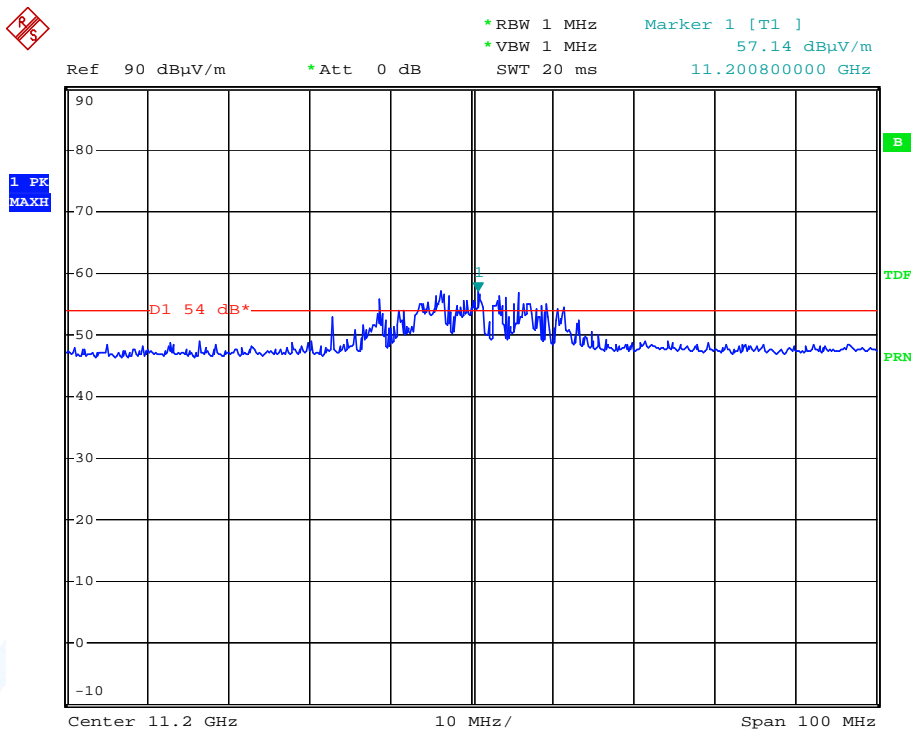


Remark: No harmonics in restricted band from 10.6 – 12.7 GHz.

FCC ID:U9A277IWLAN-V211

Carrier frequency at channel 120 (5600 MHz)

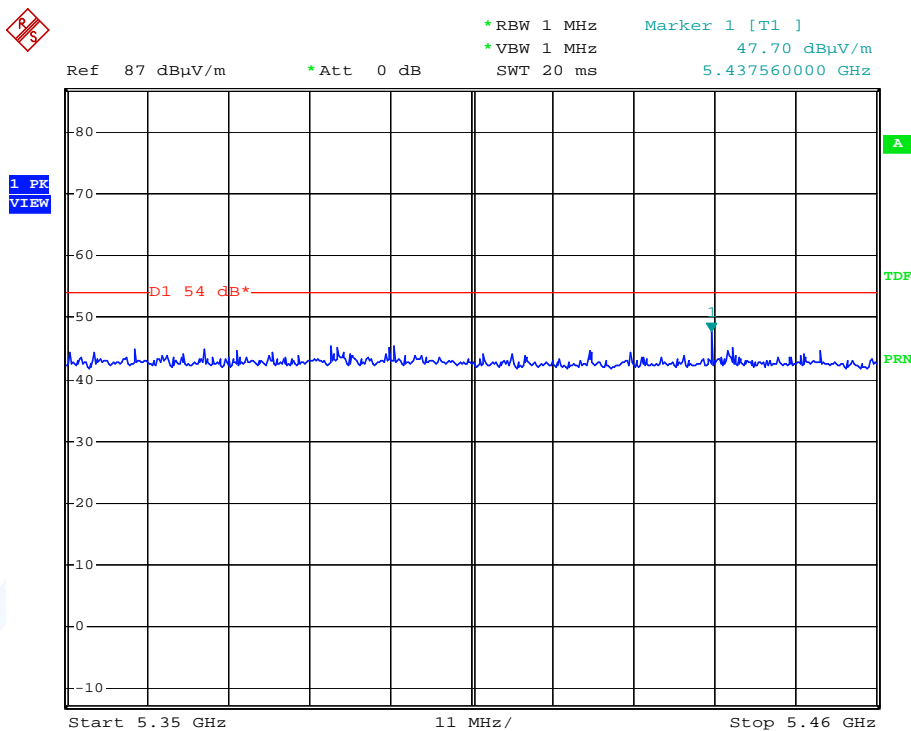
Pk and AV value of harmonics in restricted band from 10.6 – 12.7 GHz.



FCC ID:U9A277IWLAN-V211

Carrier frequency at channel 140 (5700 MHz)

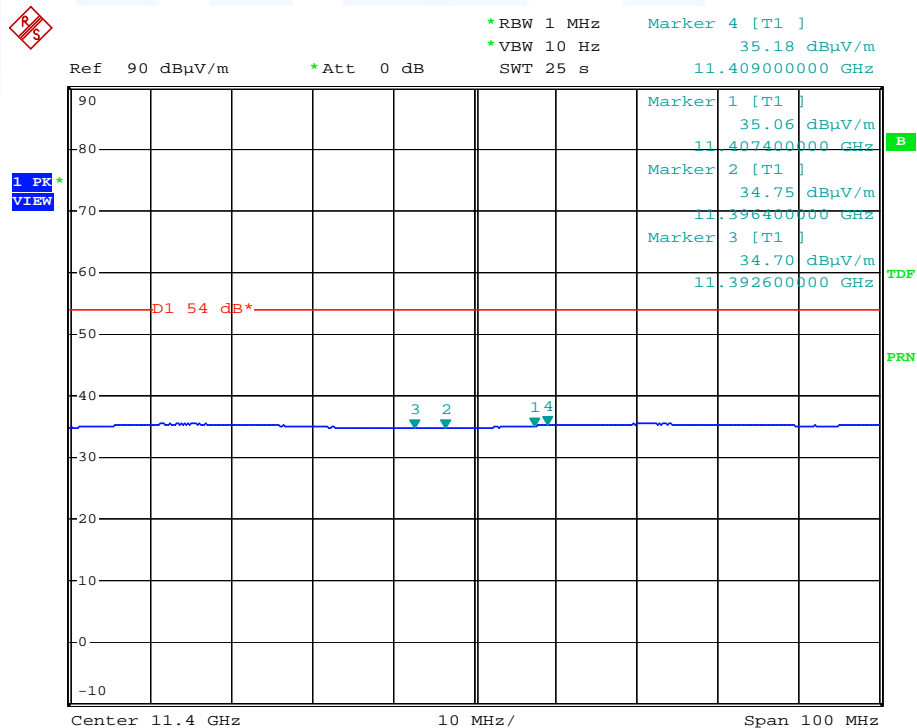
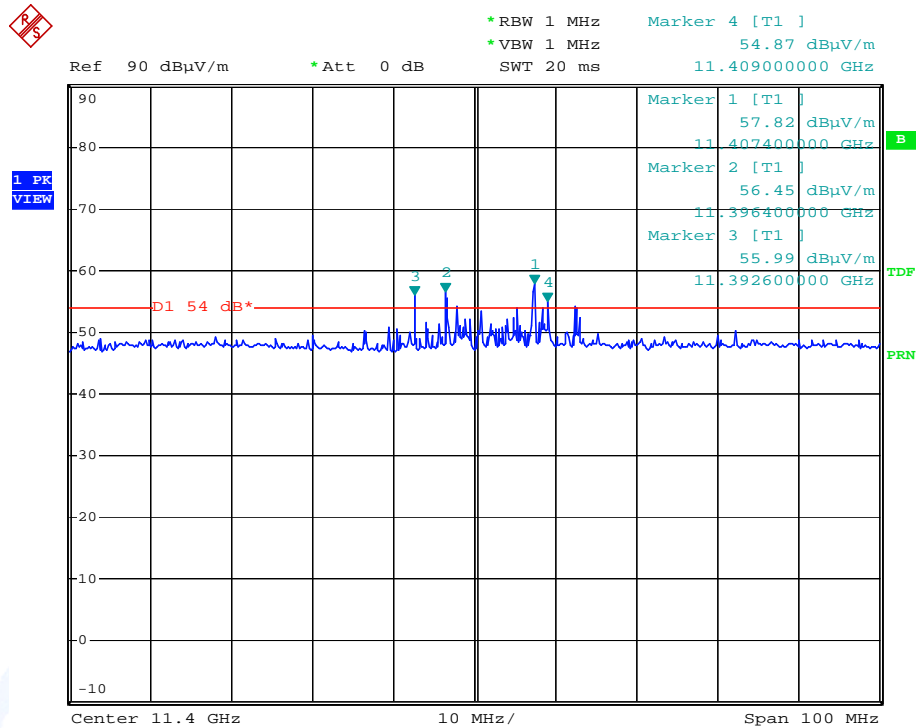
Peak plot has been taken to show the restricted band emission levels near the lower authorized band edge.
(Restricted band from 5350 to 5460 MHz)



Remark: Pk Value is below average limit.

FCC ID:U9A277IWLAN-V211

Pk and AV value of harmonics in restricted band from 10.6 – 12.7 GHz.



FCC ID:U9A277IWLAN-V211

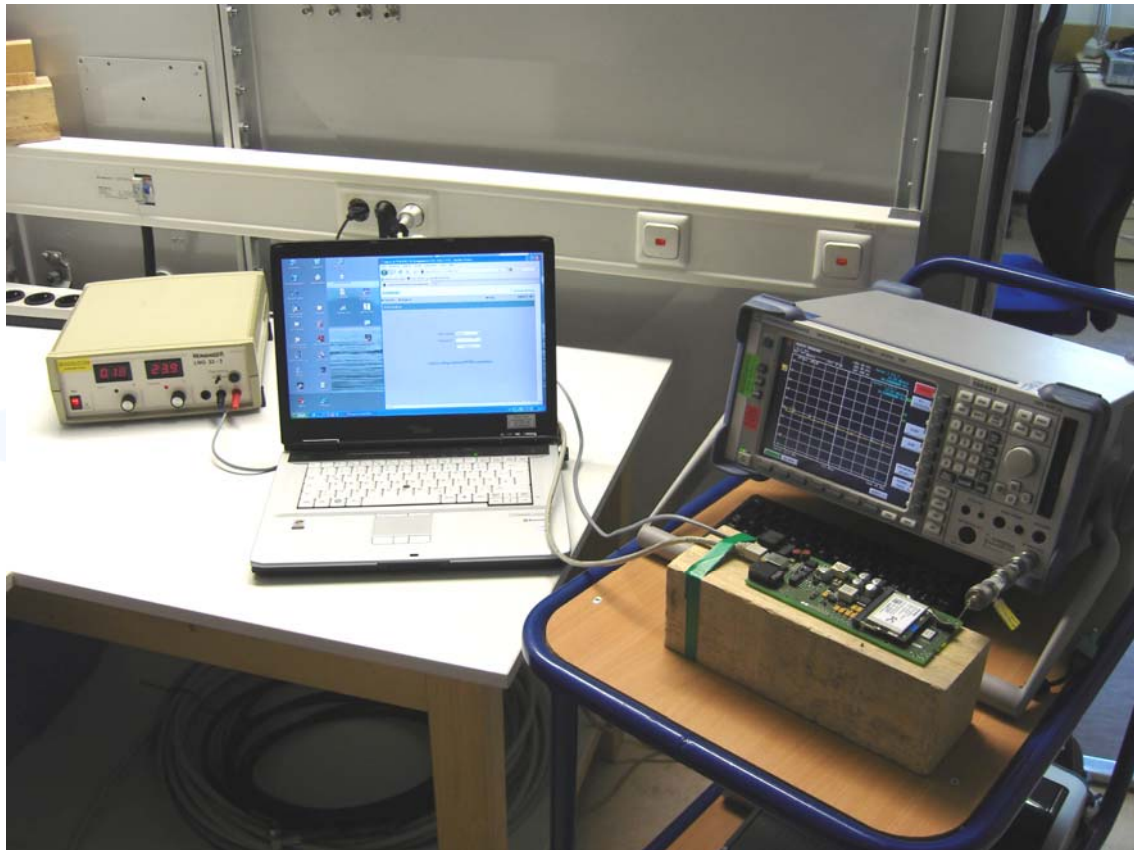
5.5 Peak power spectral density

For test instruments and accessories used see section 6 Part CPC 3.

5.5.1 Description of the test location

Test location: AREA 4

5.5.2 Photo documentation of the test set-up



5.5.3 Applicable standard

According to FCC Part 15E, Section 15.407(a):

For the 5.25 – 5.35 GHz and 5.47 – 5.725 GHz bands, the maximum conducted peak power spectral density shall not exceed 11 dBm in any 1 MHz band.

5.5.4 Description of Measurement

The EUT was connected to the spectrum analyzer through a suitable attenuator. The peak power spectral density was measured using the analyser function of measuring the power of the emission band (dBm/Hz) and the same settings like the power measuring. The result is calculated by adding a bandwidth correction factor of 60 dB (10 log 1 MHz/Hz) to the analyser reading.

Spectrum analyser settings:

RBW: 1 MHz, VBW: 3 MHz, Sweep: auto, Detector function: AV

FCC ID:U9A277IWLAN-V211

5.5.5 Test result

Channel	Frequency (MHz)	Reading (dBm/Hz)	Correction to 1 MHz (dB)	PSD (dBm/MHz)	Limit (dBm)
52	5260	-56.9	60	3.1	11
56	5280	-56.7	60	3.3	11
64	5320	-58.8	60	1.2	11
100	5500	-57.5	60	2.5	11
120	5600	-55.3	60	4.7	11
140	5700	-58.6	60	1.4	11

PSD Limit according to FCC Subpart 15.407(a)(2):

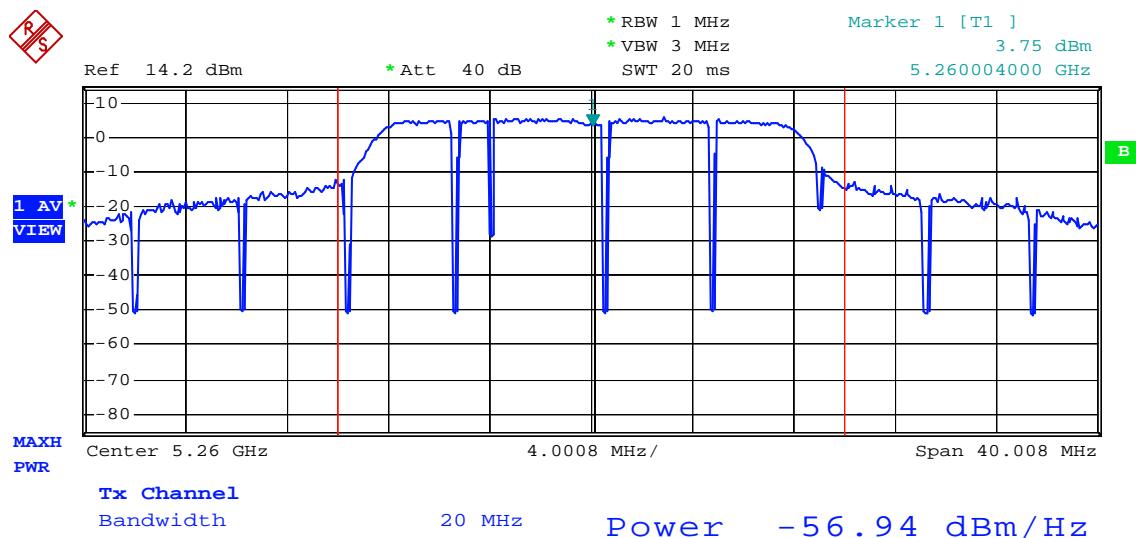
For the 5.25 – 5.35 GHz and 5.47 – 5.725 GHz bands, the maximum conducted peak power spectral density shall not exceed 11 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The requirements are **FULFILLED**.

Remarks: For detailed test results please refer to following test protocols.

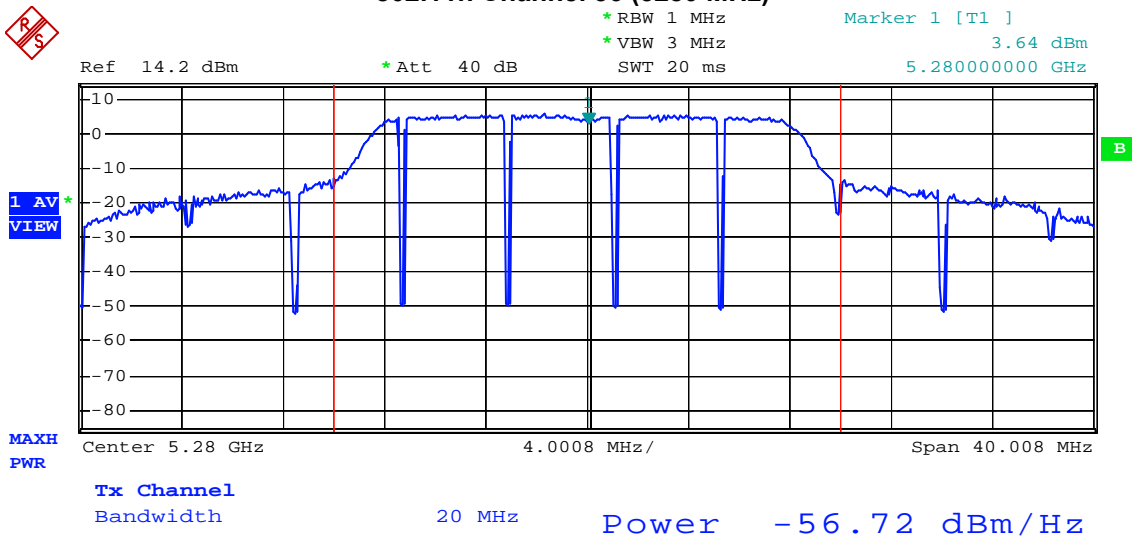
5.5.6 Peak power spectral density plots

802.11h Channel 52 (5260 MHz)

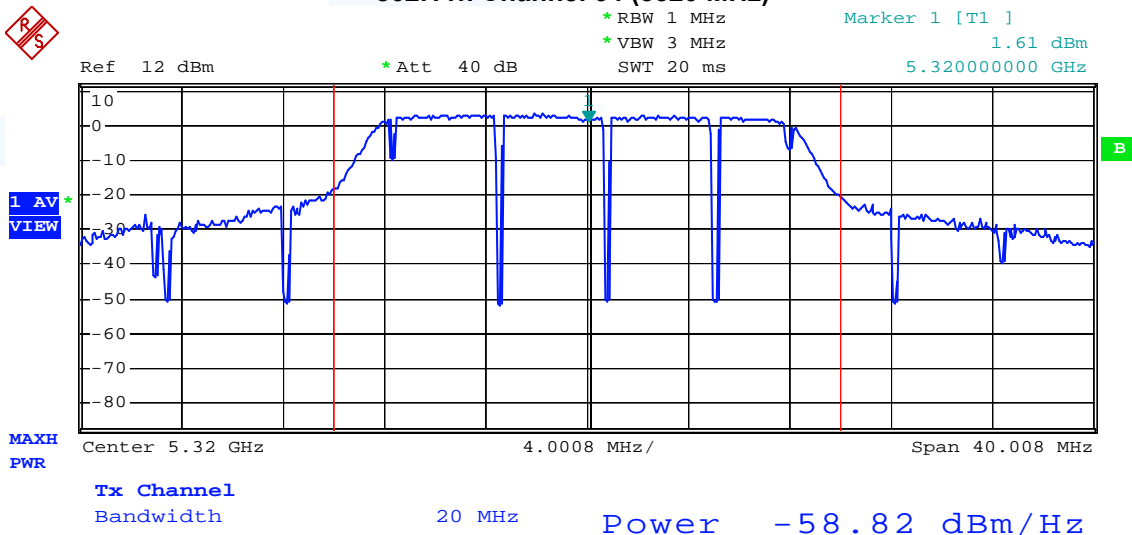


FCC ID:U9A277IWLAN-V211

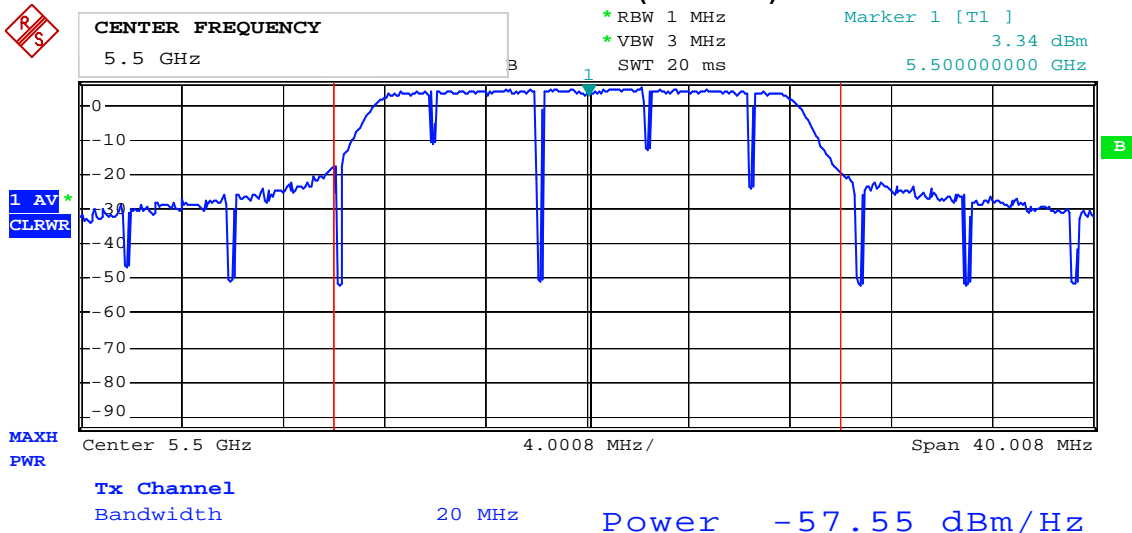
802.11h Channel 56 (5280 MHz)



802.11h Channel 64 (5320 MHz)

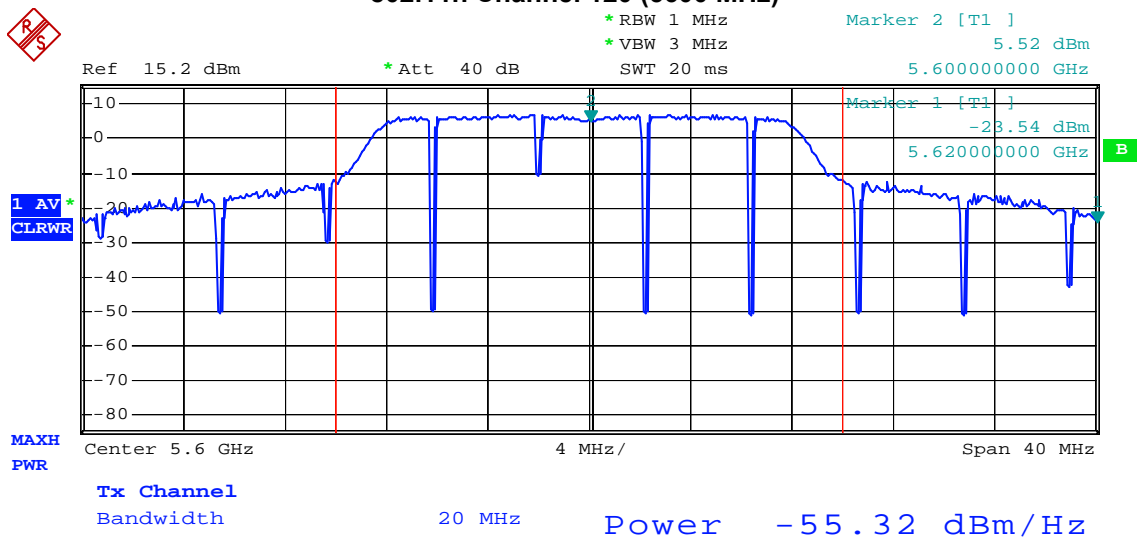


802.11h Channel 100 (5500 MHz)

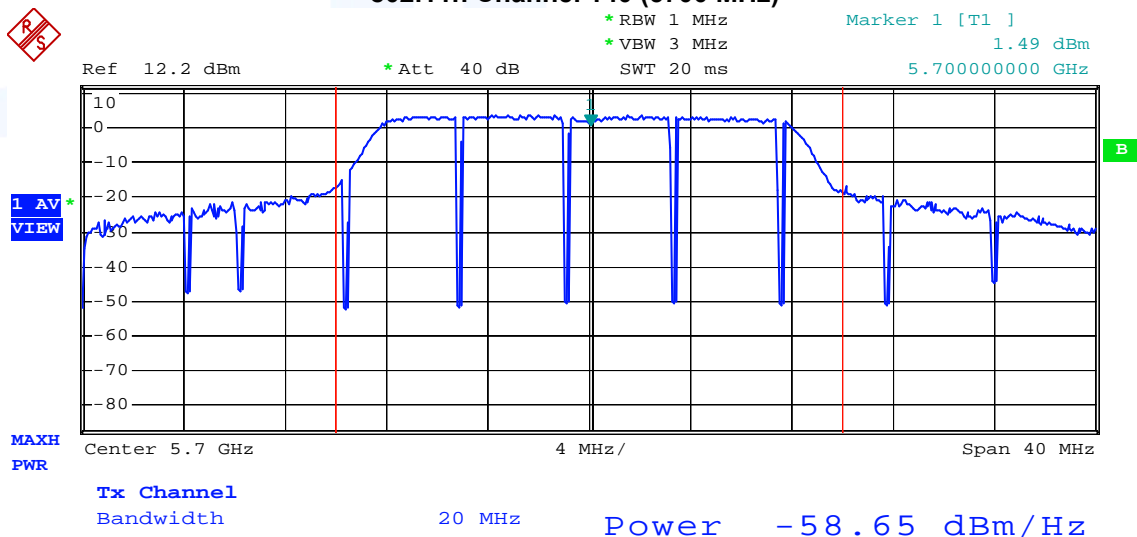


FCC ID:U9A277IWLAN-V211

802.11h Channel 120 (5600 MHz)



802.11h Channel 140 (5700 MHz)

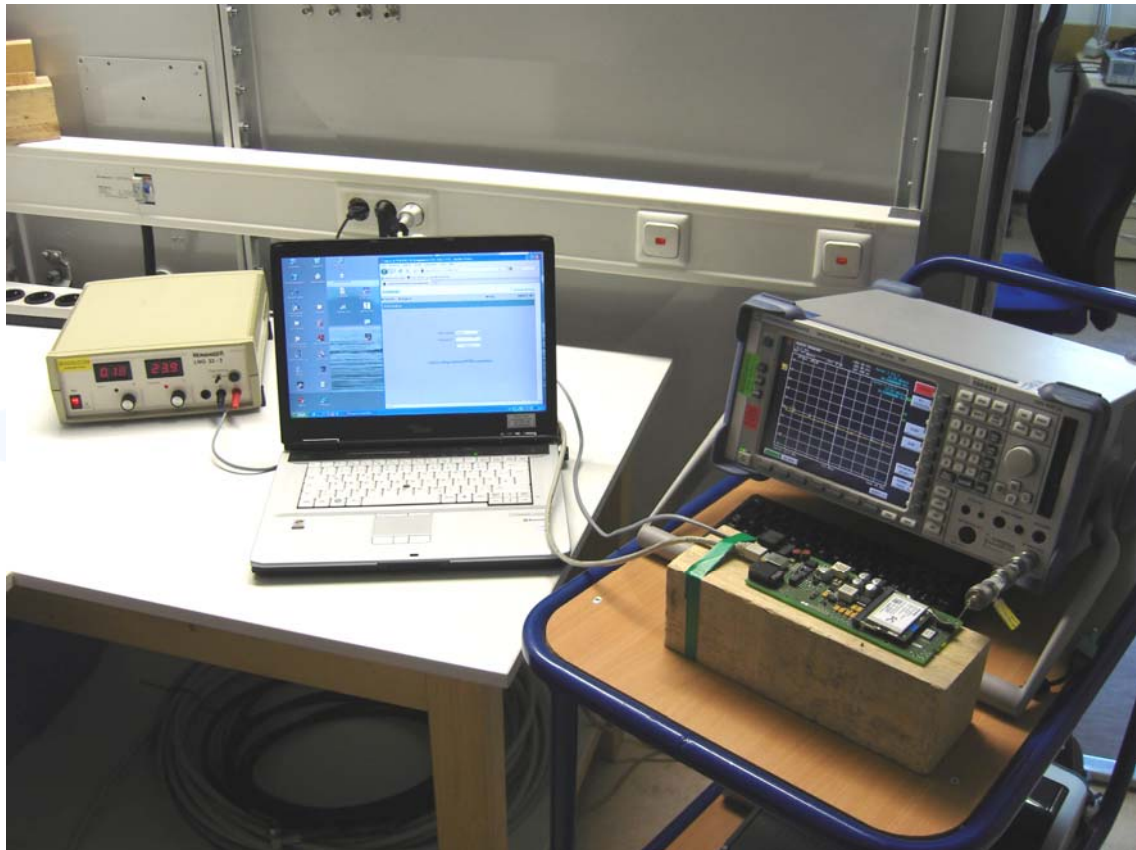


FCC ID:U9A277IWLAN-V211**5.6 Peak excursion**

For test instruments and accessories used see section 6 Part MB.

5.6.1 Description of the test location

Test location: AREA 4

5.6.2 Photo documentation of the test set-up**5.6.3 Applicable standard**

According to FCC Part 15E, Section 15.407(a)(6):

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured like before) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

5.6.4 Description of Measurement

The transmitter output was connected to the spectrum analyzer. Using peak detector and "MAX HOLD" function for Trace 1 with 1 MHz RBW and 3 MHz VBW and Trace 2 with 1 MHz RBW and 300 kHz VBW both traces were recorded. The largest difference between Trace 1 and Trace 2 in any 1 MHz band was noted as maximum *Peak Excursion* value.

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5.6.5 Test result

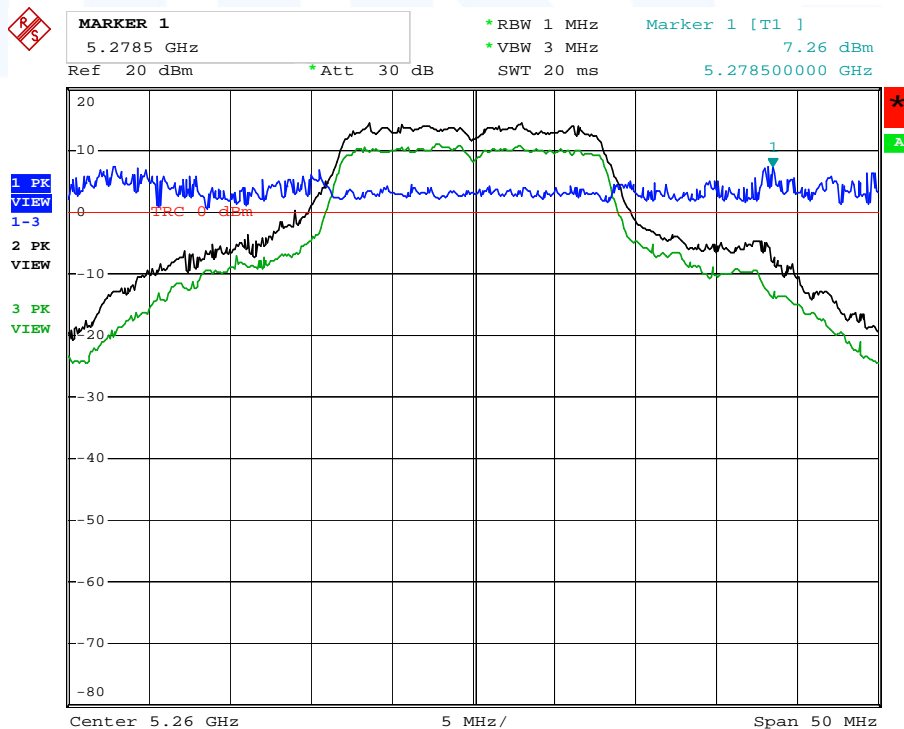
Channel	Frequency (MHz)	Peak power excursion (dBm)	Peak to average limit (dBm)	Delta (dB)
52	5260	7.3	13	-5.7
56	5280	9.0	13	-4.0
64	5320	8.9	13	-4.1
100	5500	9.8	13	-3.2
120	5600	12.5	13	-0.5
140	5700	8.7	13	-4.3

The requirements are **FULFILLED**.

Remarks: For detailed test results please refer to following test protocols.

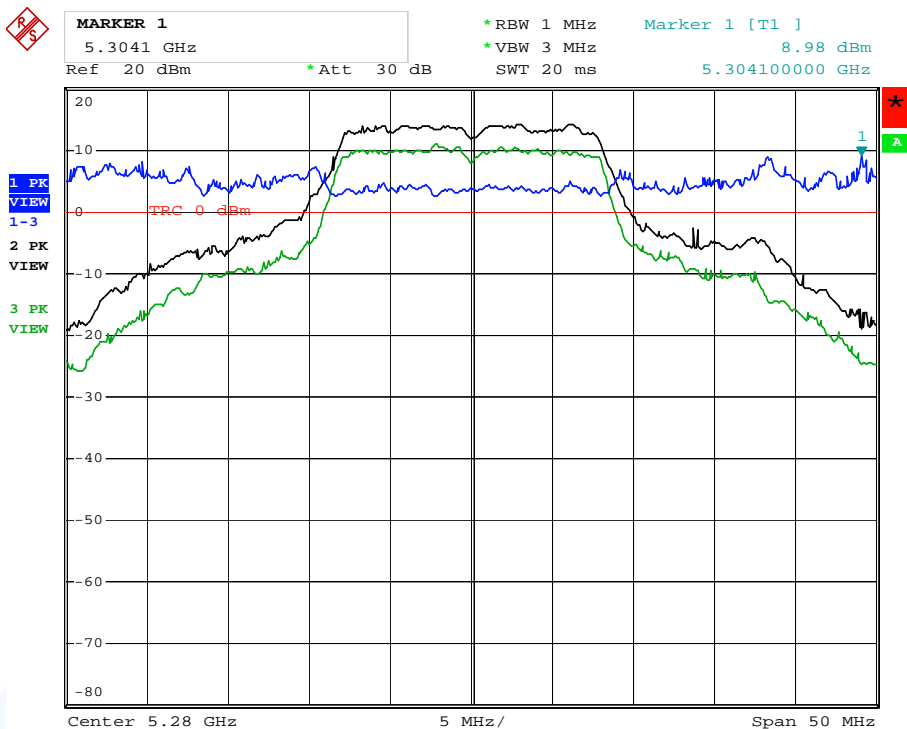
5.6.6 Test protocols Peak excursion

Channel 52 (5260 MHz)

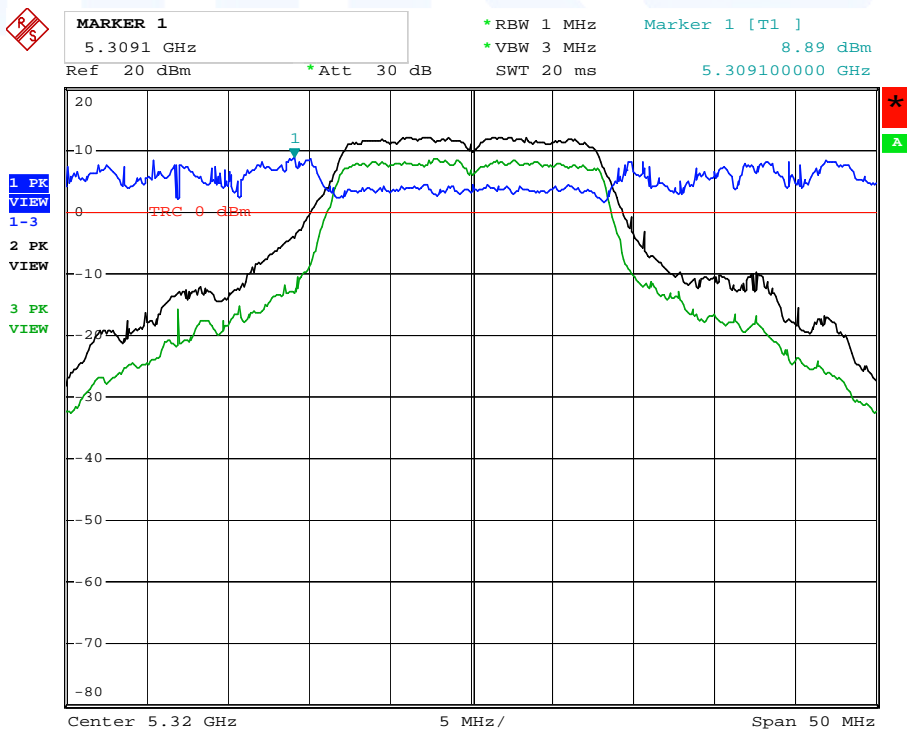


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Channel 56 (5280 MHz)

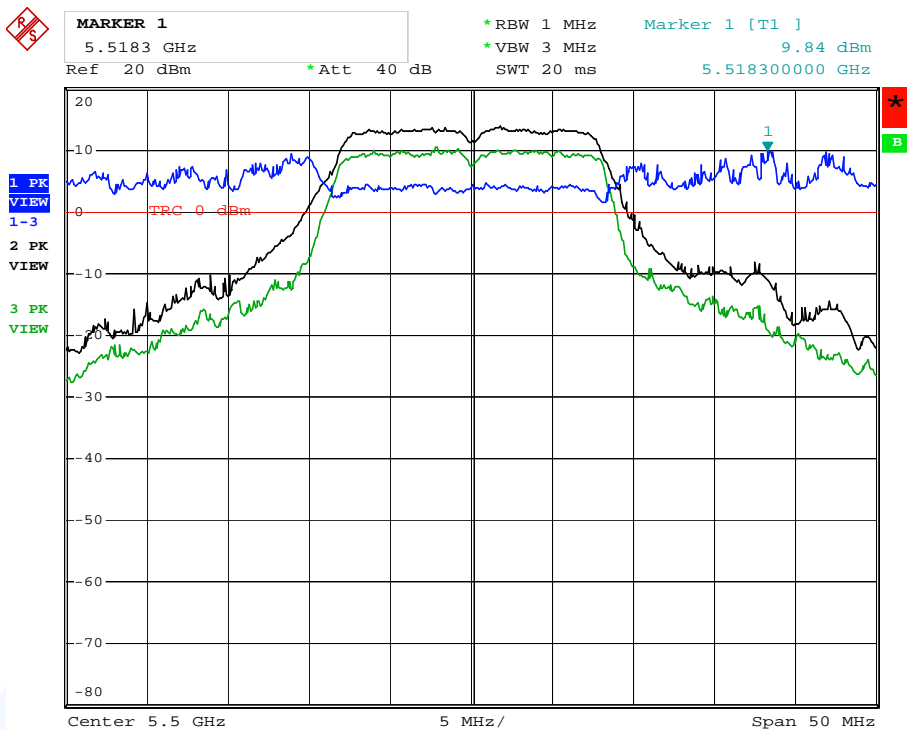


Channel 64 (5320 MHz)

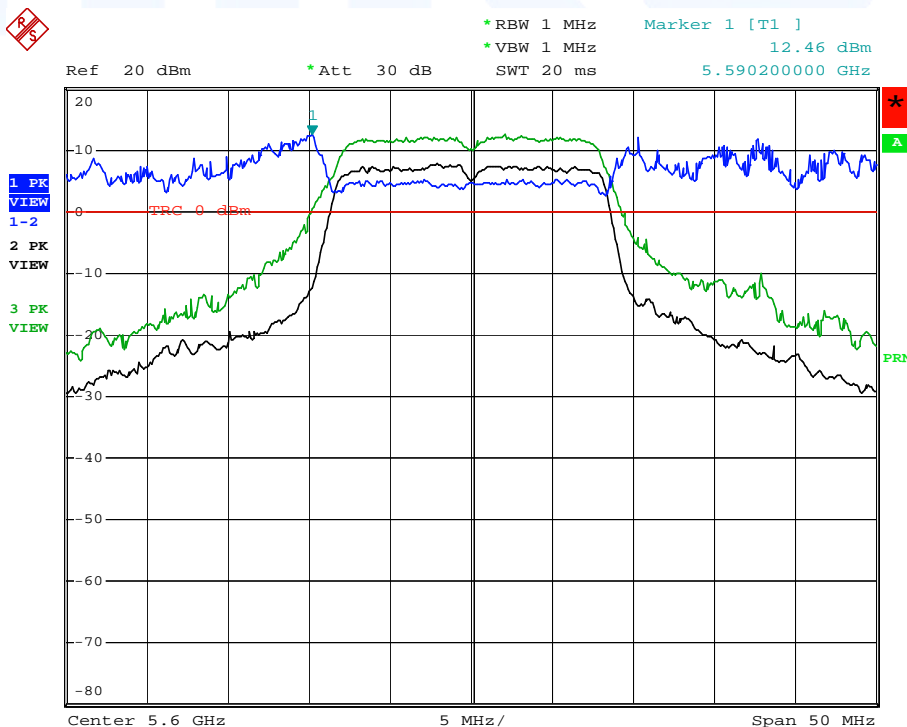


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802.11h Channel 100 (5500 MHz)

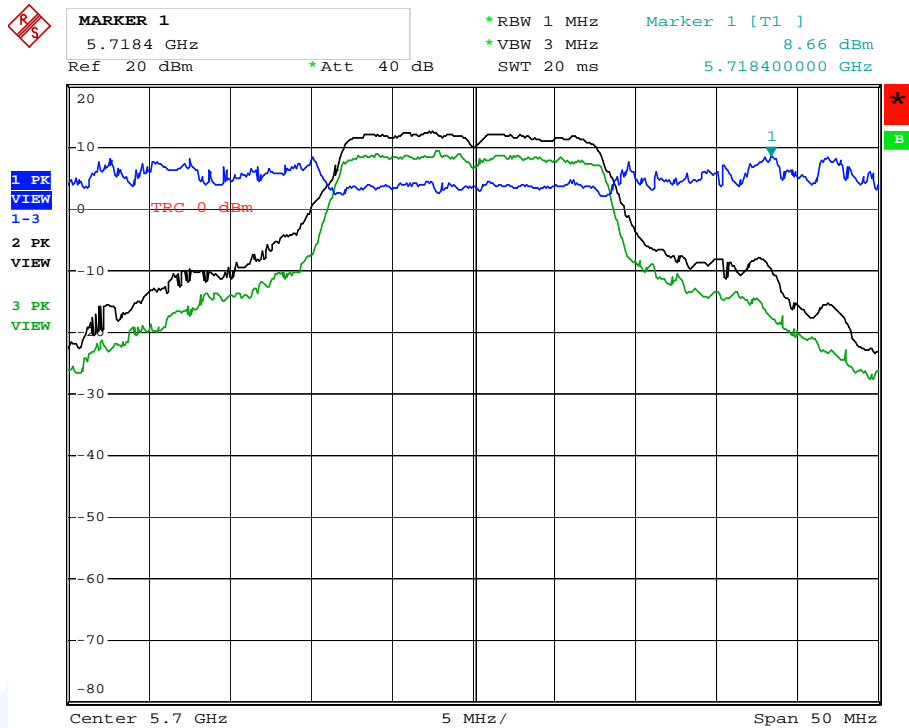


802.11h Channel 120 (5600 MHz)



FCC ID:U9A277IWLAN-V211

802.11h Channel 140 (5700 MHz)



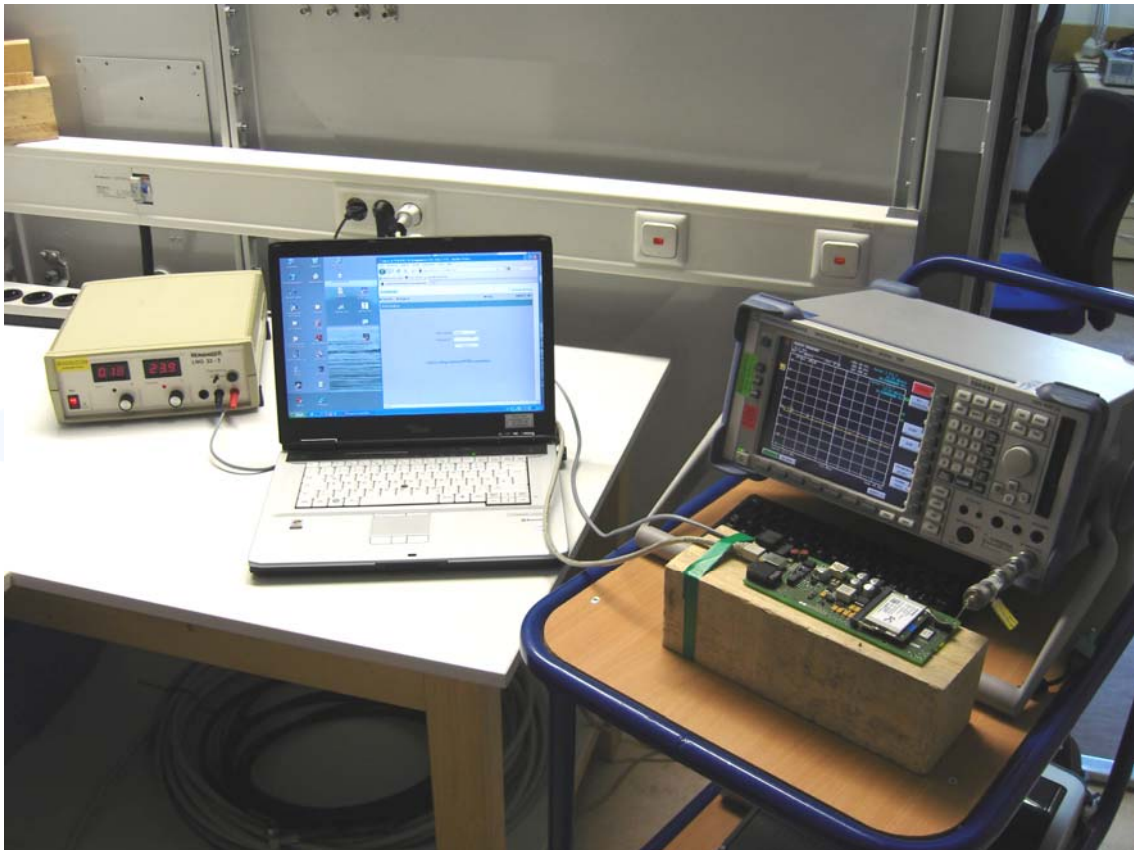
mikes

FCC ID:U9A277IWLAN-V211**5.7 Maximum permissible exposure (MPE)**

For test instruments and accessories used see section 6 Part **CPC 3**.

5.7.1 Description of the test location

Test location: AREA4

5.7.2 Photo documentation of the test set-up**5.7.3 Applicable standard**

According to FCC Part 15, Section 15.407(f):

U-NII devices are subject to the radio frequency radiation exposure requirements specified in Section 1.1307(b), 2.1091 and 2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment. The test methods used comply with ANSI/IEEE C95.1-1992, "IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz".

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5.7.4 Description of Measurement

The maximum total power input to the antenna has been measured conducted as described in clause 5.3 of this document. Through the Friis transmission formula, which is a far field assumption and the known maximum gain of the antenna, the maximum MPE at a defined distance away from the product, can be calculated.

Friis transmission formula:
$$P_d = \frac{P_{out} * G}{4 * \Pi * r^2};$$

where

- P_d =power density in mW/cm²
- P_{out} = output power to antenna in mW
- G = gain of antenna (linear scale)
- r = distance between antenna and observation point (cm)

5.7.5 Test result

Channel No.	Frequency (MHz)	Max power output to Antenna		Antenna gain (dBi)	Power density (mW/cm ²)	Limit of power density (mW/cm ²)
		(dBm)	(mW)			
52	5260	15.8	38.0	5	0.024	1.0
56	5280	15.8	38.0	5	0.024	1.0
64	5320	13.9	24.5	5	0.015	1.0
100	5500	15.4	34.7	5	0.022	1.0
120	5600	17.7	58.9	5	0.037	1.0
140	5700	14.3	26.9	5	0.017	1.0

Limits for maximum permissible exposure (MPE):

Frequency range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
(B) Limits for General Population / Uncontrolled Exposure				
0.3 – 3.0	614	1.63	100	30
3.0 – 30	824/f	2.19/f	180/ f ²	30
30 - 300	27.5	0.073	0.2	30
300-1500	---	---	f/1500	30
1500-100000	---	---	1.0	30

f = Frequency (MHz)

The requirements are **FULFILLED**.

Remarks: This test report shows the compliance with the limits for maximum permissible exposure (MPE) specified in FCC 1.1310 and the criteria to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in FCC 1.1307(b).

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5.8 Co-location and Co-transmission

Applicable standard: ANSI/IEEE C95.1-1999, "IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz", Clause 4.1.1. e):

For mixed or broadband fields at a number of frequencies for which there are different values of the MPE, the fraction of the MPE (in terms of E, H, or power density (S)) occurred within each frequency interval should be determined and the sum of all such fractions should not exceed unity (1.0, or 100 % in terms of percentage).

- 1. MPE of WLAN-Module: $P_d = 0.037 \text{ mW/cm}^2$
Limit: 1 mW/cm^2
Fraction of MPE: 1.5%
- 2. MPE of Effective Range Module: $P_d = 0.00006 \text{ mW/cm}^2$
Limit: 1 mW/cm^2
Fraction of MPE: 0.006 %

The requirements are **FULFILLED**.

Remarks: For the test result of Effective Range Module please refer to Test Report T33234-03-00AA
(mikes-testingpartners gmbh).

5.9 Antenna application - Detailed photos see attachment A

5.9.1 Applicable standard

According to FCC Part 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.

5.9.2 Result

The EUT is equipped with 3 integrated antennas (2 for WLAN, 1 for RFID) and have no external antenna connectors, which meets the requirement of FCC Part 15.203 and 15.204.

The requirements are **FULFILLED**.

Remarks: _____

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5.10 Receiver spurious emissions

For test instruments and accessories used see section 6 Part **SER 2** and **SER 3**.

5.10.1 Description of the test location

Test location: OATS1
Anechoic Chamber A2
Test distance: 3 metres

5.10.2 Photo documentation of the test set-up

Open area test site



Anechoic chamber (1 GHz – 18 GHz)



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Anechoic chamber (18 GHz – 30 GHz)



5.10.3 Applicable standard

According to FCC Part 15 Subpart 15.109:
Field strength of radiated emissions of unintentional radiator.

5.10.4 Description of Measurement

Radiated Spurious emissions from the EUT are measured with the procedure mentioned under item 4.4.3 and 4.4.4.

Spectrum analyser settings $f > 1$ GHz:

Peak measurement: RBW: 1 MHz, VBW: 1 MHz, Sweep: Auto;
AV measurement: RBW: 1 MHz, VBW: 10 Hz, Sweep: Auto;

5.10.5 Test result

Frequency (MHz)	Detector	Analyzer reading		Correction (dB)	Result		Limit (dB μ V/m)	Delta (dB)
		hor (dB μ V/m)	vert (dB μ V/m)		hor (dB μ V/m)	vert (dB μ V/m)		
30 - 960	QP				<30	<30	---	---
960 - 28500	Pk				<54	<54	74	---
	AV	---	---		---	---	54	---

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Limit according to FCC Subpart 15.109(a)

Frequency of emission (MHz)	Field strength Limits ($\mu\text{V/m}$)	Field strength Limits ($\text{dB}\mu\text{V/m}$)
0,009-0,490	2400/F(kHz)	
0,490-1,705	24000/F(kHz)	
1,705-30	30	
30-88	100	40
88-216	150	44
216-960	200	46
Above 960	500	54

The requirements are **FULFILLED**.

Remarks: The measurement was performed up to the 5th harmonic.



6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used, in addition to the test accessories, are calibrated and verified regularly.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
A 4	ESHS 30	02-02/03-05-002	18/06/2011	18/06/2010		
	ESH 2 - Z 5	02-02/20-05-004	13/03/2011	13/03/2008	11/12/2010	11/06/2010
	EMV D 30000/PAS	02-02/30-05-006				
	N-4000-BNC	02-02/50-05-138				
	N-1500-N	02-02/50-05-140				
	ESH 3 - Z 2	02-02/50-05-155	07/04/2011	07/10/2010		
CPC 3	FSP 30	02-02/11-05-001	04/05/2011	04/05/2010		
	LNG32-3	02-02/50-07-035				
MB	FSP 30	02-02/11-05-001	04/05/2011	04/05/2010		
	LNG32-3	02-02/50-07-035				
SEC 1-3	FSP 30	02-02/11-05-001	04/05/2011	04/05/2010		
	LNG32-3	02-02/50-07-035				
SER 1	FMZB 1516	01-02/24-01-018	15/02/2011	15/02/2010		
	ESCI	02-02/03-05-005	19/11/2011	19/11/2010		
	S10162-B	02-02/50-05-031				
	KK-EF393-21N-16	02-02/50-05-033				
	NW-2000-NB	02-02/50-05-113				
SER 2	ESVS 30	02-02/03-05-006	11/06/2011	11/06/2010		
	VULB 9168	02-02/24-05-005	06/05/2011	06/05/2008	16/03/2011	16/09/2010
	S10162-B	02-02/50-05-031				
	KK-EF393-21N-16	02-02/50-05-033				
	NW-2000-NB	02-02/50-05-113				
SER 3	FSP 30	02-02/11-05-001	04/05/2011	04/05/2010		
	AFS4-01000400-10-10P-4	02-02/17-05-003				
	AMF-4F-04001200-15-10P	02-02/17-05-004				
	AFS5-12001800-18-10P-6	02-02/17-06-002				
	3117	02-02/24-05-009	10/02/2011	10/02/2010		
	R2 _ 30 - 40 GHz	02-02/30-09-001	22/02/2011	22/02/2010		
	R1 _ 18 - 30 GHz	02-02/30-09-002	17/02/2011	17/02/2010		
	Sucoflex N-1000-SMA	02-02/50-05-072				
	Sucoflex N-1600-SMA	02-02/50-05-073				
	Sucoflex N-2000-SMA	02-02/50-05-075				
	WHKX 7.5/18G-8SS	02-02/50-07-010				
	H26G40G1	02-02/50-10-011				