



RF - TEST REPORT

- FCC Part 15.407, 5250-5350 MHz -

Type / Model Name : M2

Product Description : Radio Module 802.11a/b/n/ac & BLE

Applicant : BSH Hausgeräte GmbH

Address : Carl-Wery-Straße 34
81739 München

Manufacturer : BSH Hausgeräte GmbH

Address : Carl-Wery-Straße 34
81739 München

<p>Test Result according to the standards listed in clause 1 test standards:</p>	<p>POSITIVE</p>
---	------------------------

<p>Test Report No. : 80091012-04 Rev_2</p>	<p>03. June 2022 Date of issue</p>
---	--



Deutsche
Akkreditierungsstelle
D-PL-12030-01-03
D-PL-12030-01-04

Contents

1	<u>TEST STANDARDS</u>	3
2	<u>EQUIPMENT UNDER TEST</u>	4
2.1	Information provided by the Client	4
2.2	Sampling	4
2.3	Photo documentation of the EUT – Detailed photos see attachment A	4
2.4	General remarks	4
2.5	Equipment category	4
2.6	Short description of the equipment under test (EUT)	4
2.7	Variants of the EUT	5
2.8	Operation frequency and channel plan	5
2.9	Transmit operating modes	5
2.10	Antenna	5
2.11	Power supply system utilised	5
2.12	Peripheral devices and interface cables	6
2.13	Determination of worst case conditions for final measurement	6
3	<u>TEST RESULT SUMMARY</u>	7
3.1	Revision history of test report	7
3.2	Final assessment	7
4	<u>TEST ENVIRONMENT</u>	8
4.1	Address of the test laboratory	8
4.2	Environmental conditions	8
4.3	Statement of the measurement uncertainty	8
4.4	Conformity Decision Rule	9
4.5	Measurement protocol for FCC and ISED	9
5	<u>TEST CONDITIONS AND RESULTS</u>	12
5.1	AC power line conducted emissions	12
5.2	EBW and OBW	18
5.3	Maximum conducted output power	24
5.4	Maximum power spectral density	28
5.5	Undesirable emission	37
5.6	Frequency stability	52
5.7	Antenna application	54
6	<u>USED TEST EQUIPMENT AND ACCESSORIES</u>	55

ATTACHMENT A as separate supplement

2 EQUIPMENT UNDER TEST

2.1 Information provided by the Client

Please note, we do not take any responsibility for information provided by the client or his representative which may have an influence on the validity of the test results.

2.2 Sampling

The customer is responsible for the choice of sample. Sample configuration, start-up and operation is carried out by the customer or according his/her instructions.

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

2.4 General remarks

As requested by the manufacturer all tests were performed with the highest possible power setting to still comply with the applying regulations and limits. Used power settings are listed under 2.13. of this test report.

Maximum peak conducted output power is additionally measured with power settings as applied in the final product.

2.5 Equipment category

WLAN - Client

2.6 Short description of the equipment under test (EUT)

The EUT is a communication module for assembling into household devices. The firmware does not support ad-hoc modes and gives the user no possibility to choose the data transmission or power setting. The EUT is compatible with IEEE 802.11b, g, n, a, ac Standard and 802.15. It supports the 2.4 GHz and 5 GHz frequency band and supports no beam forming.

Tested samples	:	1 (radiated)
Serial number	:	80012117280000440335000001789
SW	:	BSH Embedded Linux Platform (SMM M2 default) - debug [HWTEST] 40.0.0-204-g45fedbf \n \l
Firmware	:	1.28 RC0.0 wI0: Apr 15 2021 03:04:08 version 7.45.234 (4ca95bb CY WLTEST) FWID 01-67595eaa
Tested samples	:	1 (conducted) with maximum power setting
Serial number	:	80012117280000440335000001793
SW	:	BSH Embedded Linux Platform (SMM M2 default) - debug [HWTEST] 40.0.0-204-g45fedbf \n \l
Firmware	:	1.28 RC0.0 wI0: Apr 15 2021 03:04:08 version 7.45.234 (4ca95bb CY WLTEST) FWID 01-67595eaa

FCC ID: 2AHES-M2

IC ID: 21152-M2

Tested samples : 1 (conducted) with final power setting
 Serial number : 80012117280000440335000001781
 SW : BSH Embedded Linux Platform (SMM M2 default) - debug [HWTEST] 51.0.2-166-g265f5d5 bsh-smm-m2 ttyxc3
 Firmware : 1.28 RC0.0 wI0: Apr 15 2021 03:04:08 version 7.45.234 (4ca95bb CY WLTEST) FWID 01-67595eaa

2.7 Variants of the EUT

There are no variants.

2.8 Operation frequency and channel plan

The operating frequency is 5250 MHz to 5350 MHz.

Channel plan:

WLAN Standard
802.11a, n HT20, ac VHT20

Channel	Frequency (MHz)
52	5260
56	5280
60	5300
64	5320

WLAN Standard
802.11n HT40, ac VHT40

Channel	Frequency (MHz)
54	5270
62	5310

WLAN Standard
802.11ac VHT80

Channel	Frequency (MHz)
58	5290

2.9 Transmit operating modes

The module uses OFDM modulation and is capable to provide following data rates:
 - 802.11a 54, 48, 36, 24, 18, 12, 9, 6 Mbps (Mbps = megabits per second)
 - 802.11n HT20, MCS 0 – 7
 - 802.11n HT40, MCS 0 – 7
 - 802.11ac VHT20, MCS 0 – 9
 - 802.11ac VHT40, MCS 0 – 9
 - 802.11ac VHT80, MCS 0 – 9

2.10 Antenna

The following antennas shall be used with the EUT:

Number	Characteristic	Model number	Plug	Frequency range (GHz)	Gain (dBi)
1	Omni	PCB antenna	-	5	4.3

The EUT has only an integrated PCB antenna, no temporary connector and no external antenna to be connected.

2.11 Power supply system utilised

Power supply voltage, V_{nom} : 5 V_{DC}

FCC ID: 2AHES-M2

IC ID: 21152-M2

2.12 Peripheral devices and interface cables

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

- Debug Adapter Model: _____
- Micro USB cable Model: _____
- Laptop Model: _____

2.13 Determination of worst case conditions for final measurement

Preliminary tests are performed in all three orthogonal axes of the EUT to locate at which position and at what setting of the EUT produce the maximum of the emissions. For the further measurement the EUT is set in this position.

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

WLAN	Available channel	Tested channels	Modulation	Modulation type	Data rate
802.11n HT20	52 – 64	52, 56, 64	OFDM	BPSK	MCS7
802.11n HT40	54, 62	54, 62	OFDM	BPSK	MCS7
802.11ac VHT80	58	58	OFDM	BPSK	MCS7

Power Settings:

Following power settings for maximum power output were used.

Radiated measurement:

802.11n HT20

Channel	Frequency	Power Setting
	MHz	
CH52	5260	q70
CH56	5280	q70
CH64	5320	q70

802.11n HT40

Channel	Frequency	Power Setting
	MHz	
CH54	5270	q78
CH62	5310	q52

802.11ac VHT80

Channel	Frequency	Power Setting
	MHz	
CH58	5290	q59

Conducted measurement:

802.11n HT20

Channel	Frequency	Power Setting
	MHz	
CH52	5260	q70
CH56	5280	q70
CH64	5320	q70

802.11n HT40

Channel	Frequency	Power Setting
	MHz	
CH54	5270	q77
CH62	5310	q52

802.11ac VHT80

Channel	Frequency	Power Setting
	MHz	
CH58	5290	q54

2.13.1 Test jig

No test jig is used.

2.13.2 Test software

The test software is controlled by a terminal program (PuTTY). The test software allows to set the EUT into RX and TX continuous modulated mode and set different channel by command.

FCC ID: 2AHES-M2

IC ID: 21152-M2

3 TEST RESULT SUMMARY

FCC Rule Part	RSS Rule Part	Description	Result
15.407(b)(9)	RSS-Gen, 8.8	AC power line conducted emissions	passed
15.407(a)(5)	RSS-Gen, 6.7	EBW 26 dB, OBW	passed
15.407(a)(2)	RSS-247, 6.2.2.1a	Maximum conducted output power	passed
15.407(a)(2)	RSS-247, 6.2.2.1a	Maximum conducted PSD	passed
15.407(b)(3)	RSS-247, 6.2.2.2	Undesirable emissions	passed
15.407(b)(10)	RSS-Gen, 8.10	Emissions in restricted bands	passed
15.407(h)(1)	RSS-247, 6.2.2.1b	TPC	not applicable
15.407(a)(2)	RSS-247, 6.2.2.1a	Antenna requirement (Defacto limit)	passed
15.407(g)	RSS-Gen, 8.11	Frequency stability	passed

TPC is not applicable because the EUT has an output power < 500 mW.

The mentioned RSS Rule Parts in the above table are related to:
 RSS-Gen, Issue 5 + Amendment 1 + Amendment 2, March 2019
 RSS-247, Issue 2, February 2017

3.1 Revision history of test report

Test report No	Rev.	Issue Date	Changes
80091012-04	0	18 January 2022	Initial test report
80091012-04	1	22 February 2022	Added Power evaluation to RSS Limits.
80091012-04	2	03 June 2022	Added conducted output power measurement with final power settings

The test report with the highest revision number replaces the previous test reports.

3.2 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 : 24 August 2021

Testing concluded on : 24 May 2022

Checked by:

Tested by:

 Klaus Gegenfurtner
 Teamleader Radio

 Lukas Scheuermann
 Radio Team

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

**CSA Group Bayern GmbH
Ohmstrasse 1-4
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. It is noted that the expanded measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor $k = 2$. The true value is located in the corresponding interval with a probability of 95 %. The measurement uncertainty was calculated for all measurements listed in this test report on basis of the ETSI Technical Report TR 100 028 Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1 and Part 2. The results are documented in the quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Measurement Type	Range	Confidence Level	Calculated Uncertainty
AC power line conducted emissions	0.15 MHz to 30 MHz	95%	± 3.29 dB
EBW and OBW	2400 MHz to 30000 MHz	95%	$\pm 2.5 \times 10^{-7}$
Output power ERP, radiated	1000 MHz to 7000 MHz	95%	± 2.71 dB
Field strength of the fundamental	1000 MHz to 7000 MHz	95%	± 2.71 dB
Power spectral density	2400 MHz to 3000 MHz	95%	± 0.62 dB
Spurious Emissions, conducted	9 kHz to 10000 MHz	95%	± 2.15 dB
Spurious Emissions, conducted	10000 MHz to 40000 MHz	95%	± 3.47 dB
Spurious Emissions, radiated	9 kHz to 30 MHz	95%	± 3.53 dB
Spurious Emissions, radiated	30 MHz to 1000 MHz	95%	± 4.44 dB
Spurious Emissions, radiated	1000 MHz to 30000 MHz	95%	± 2.34 dB
Spurious Emissions, radiated	30000 MHz to 40000 MHz	95%	± 5.13 dB

FCC ID: 2AHES-M2

IC ID: 21152-M2

4.4 Conformity Decision Rule

The applied conformity decision rule is based on ILAC G8:09/2019 clause 4.2.1 Binary Statement for Simple Acceptance Rule ($w = 0$).
 Details can be found in the procedure CSA_B_V50_29.

4.5 Measurement protocol for FCC and ISED

4.5.1 General information

CSA Group Bayern GmbH is recognized as wireless testing laboratory under the CAB identifier:

FCC: DE 0011
ISED: DE0009

4.5.2 General Standard information

The test methods used comply with ANSI C63.10 - "Testing Unlicensed Wireless Devices".

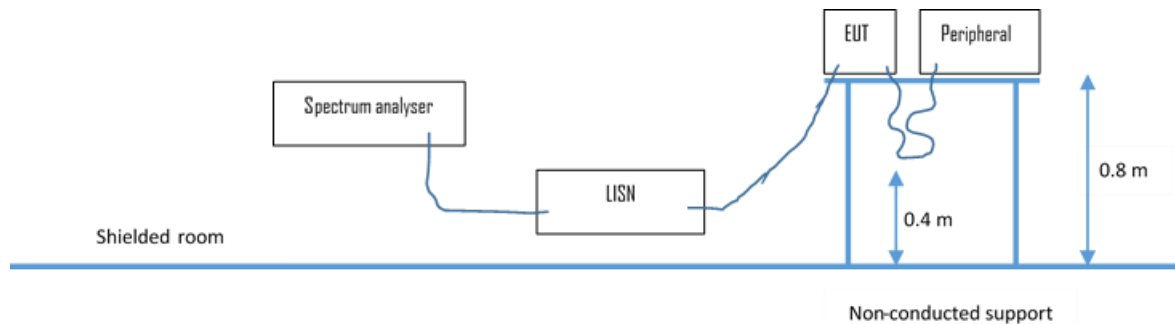
4.5.2.1 Justification

The equipment under test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions.

4.5.3 Details of test procedures

4.5.3.1 Conducted emission

Test setup according ANSI C63.10



The final level, expressed in $\text{dB}\mu\text{V}$, is arrived at by taking the reading directly from the Spectrum analyser. This level is compared to the limit.

To convert between $\text{dB}\mu\text{V}$ and μV , the following conversions apply:

$$\text{dB}\mu\text{V} = 20(\log \mu\text{V})$$

$$\mu\text{V} = \text{Inverse log}(\text{dB}\mu\text{V}/20)$$

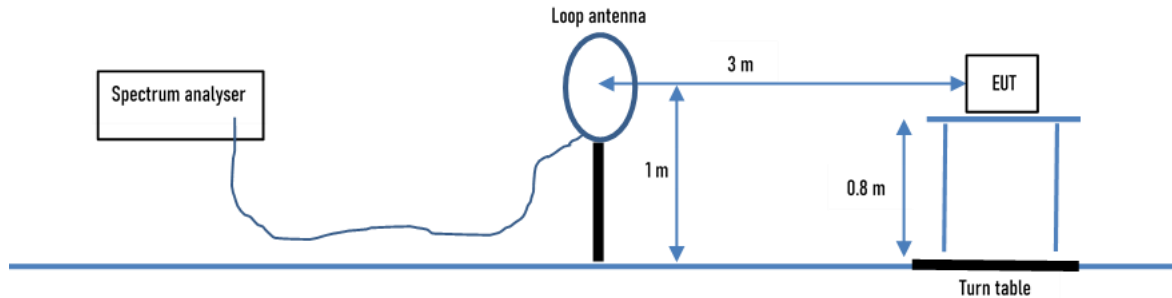
Conducted emissions on the 50 Hz and/or 60 Hz power interface of the EUT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection and a Line Impedance Stabilization Network (LISN) with $50 \Omega / 50 \mu\text{H}$ (CISPR 16) characteristics. The receiver is protected by means of an impedance matched pulse limiter connected directly to the RF input. 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 appears to be less than 20 dB with a peak mode measurement, the emission is re-measured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

FCC ID: 2AHES-M2

IC ID: 21152-M2

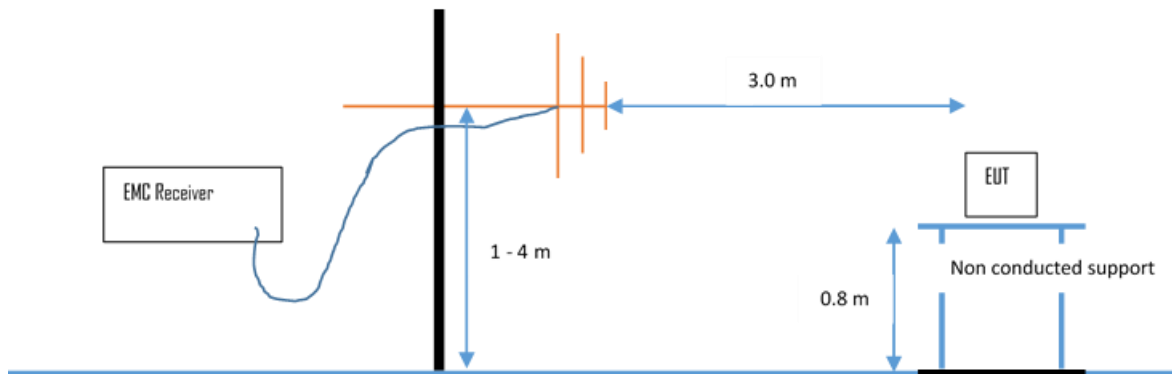
4.5.3.2 Radiated emission

4.5.3.2.1 OATS1 test site (9 kHz - 30 MHz):
Test setup according ANSI C63.10



Emissions from the EUT are measured in the frequency range of 9 MHz to 30 MHz using a tuned receiver and a calibrated loop antenna. Table top equipment is placed on a 1.0 X 1.5 m non-conducting table 80 centimetres above the ground plane. Cables to simulators/testers (if used in this test) are routed through the centre of the table and to a screened room located outside the test area. The antenna is positioned 3, 10 or 30 metres horizontally from the EUT and is repeated vertically. To locate maximum emissions from the test sample the antenna is varied along the site axis and the EUT is rotated 360 degrees.

4.5.3.2.2 OATS1 test site (30 MHz - 1 GHz):
Test setup according ANSI C63.10.



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. Cables to simulators/testers (if used in this test) are routed through the centre of the table and to a screened room located outside the test area. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 metres 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 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:

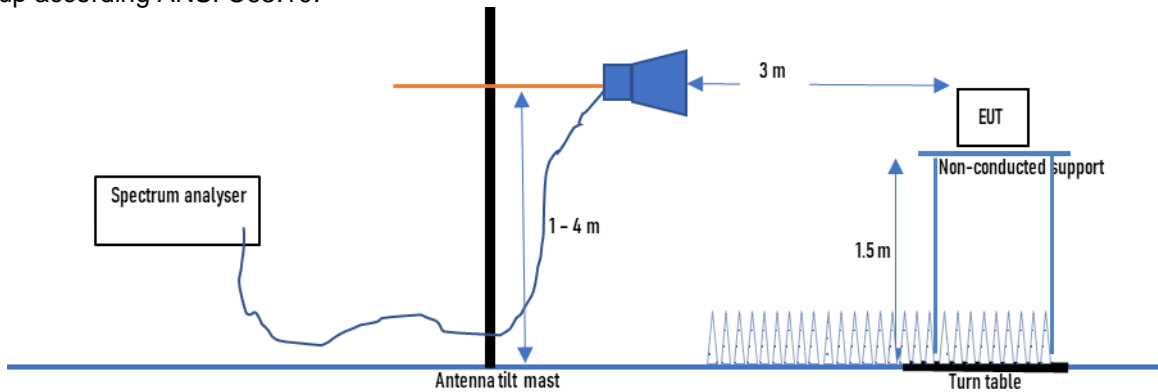
Frequency (MHz)	Level (dBµV)	+	Factor (dB)	=	Level (dBµV/m)	-	Limit (dBµV/m)	=	Delta (dB)
719.0	75.0	+	32.6	=	107.6	-	110.0	=	-2.4

FCC ID: 2AHES-M2

IC ID: 21152-M2

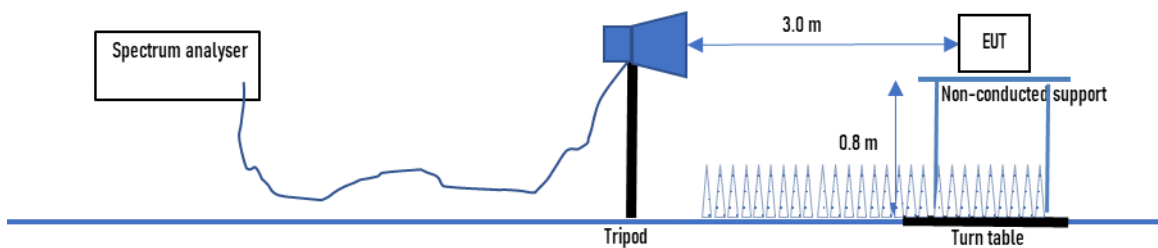
4.5.3.2.3 Anechoic chamber 1 (1000 MHz – 18000 MHz)

Test setup according ANSI C63.10.



Radiated emissions from the EUT are measured in the frequency range 1 GHz up to 18 GHz 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 non-conducting table, 1.5 metre above the ground plane. The turntable is fully covered with the appropriate absorber (Type VHP-12). Any controlling device is positioned such that it does not significantly influence the measurement results. Interconnecting cables that hang closer than 40 cm to the ground plane are folded back and forth in the centre, forming a bundle 30 cm to 40 cm long. Measurements are made in three orientations of the EUT and the horizontal and vertical polarization planes of measurement antenna in a fully anechoic room. The measurement antenna is adjusted and the EUT orientated to permit the measurement of the maximum emission from the EUT. The conditions determined as worst-case will then be used for the final measurements.

4.5.3.2.4 Anechoic chamber 1 (18 GHz – 40 GHz)



Emissions from the EUT are measured in the frequency range 18 GHz up to 40 GHz 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 non-conducting table, 0.8 metre above the ground plane. The turntable is fully covered with the appropriate absorber (Type VHP-12). Any controlling device is positioned such that it does not significantly influence the measurement results. Interconnecting cables that hang closer than 40 cm to the ground plane are folded back and forth in the centre, forming a bundle 30 cm to 40 cm long. Measurements are made in in three orientations of the EUT and the horizontal and vertical polarization planes of measurement antenna in a fully anechoic room. The measurement antenna is adjusted and the EUT orientated to permit the measurement of the maximum emission from the EUT. The conditions determined as worst-case will then be used for the final measurements. Where appropriate, the test distance may be reduced in order to detect emissions under better uncertainty. The limit is adopted.

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.

FCC ID: 2AHES-M2

IC ID: 21152-M2

5 TEST CONDITIONS AND RESULTS

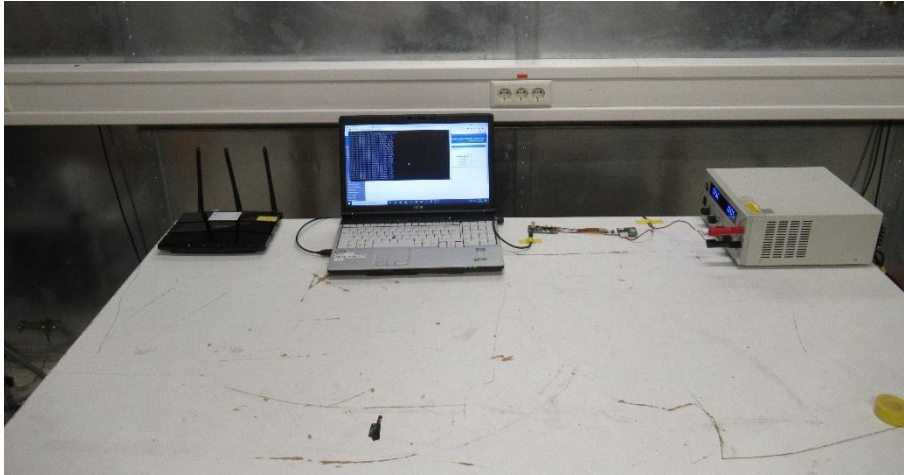
5.1 AC power line conducted emissions

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 15, 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 given limits.

5.1.4 Description of Measurement

The measurements are performed following the procedures set out in ANSI C63.10 described under item 4.4.3. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emissions are re-measured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

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.

FCC ID: 2AHES-M2
IC ID: 21152-M2
5.1.5 Test result

Frequency range: 0.15 MHz - 30 MHz
 Min. limit margin -9.06 dB at 23.988 MHz

Limit according to FCC Part 15, 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 following test protocols.

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.

FCC ID: 2AHES-M2

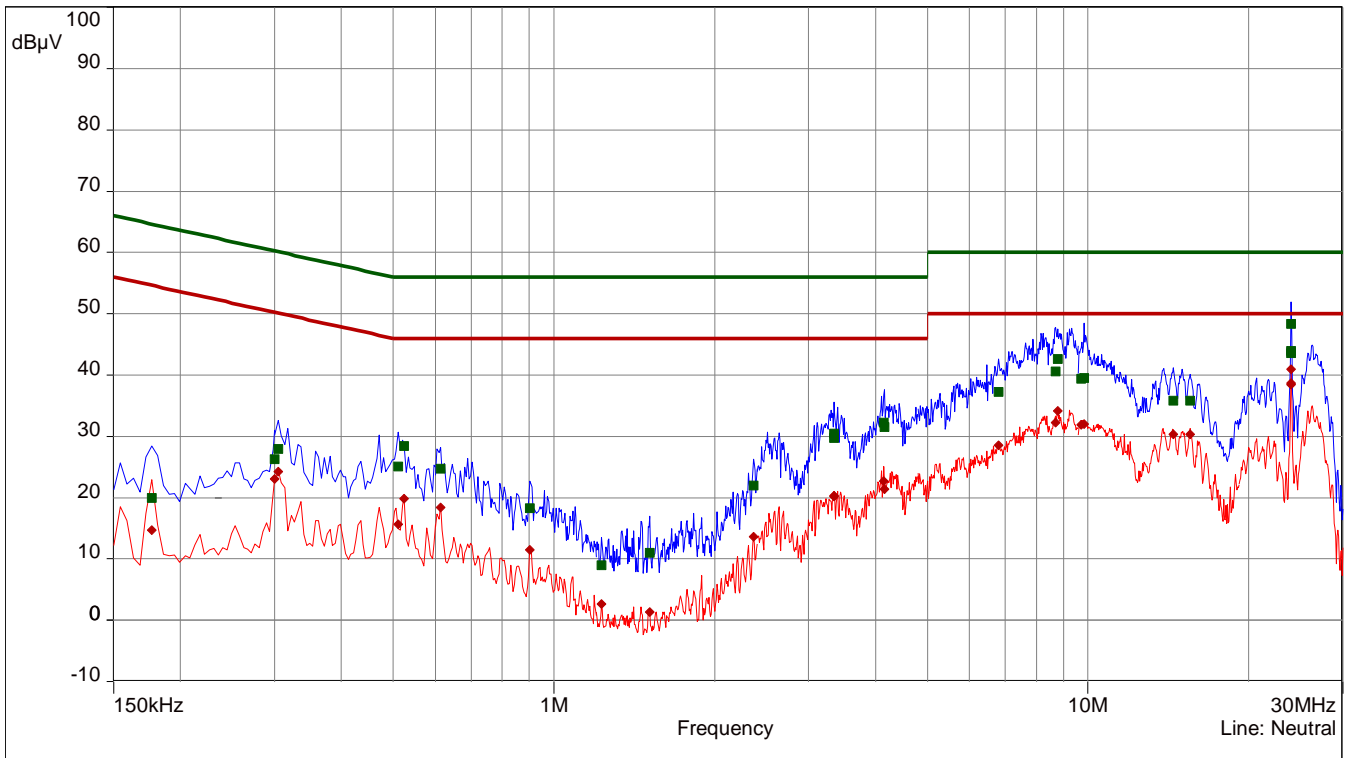
IC ID: 21152-M2

5.1.6 Test protocol

Test point: N
 Operation mode: WLAN 802.11n HT20 Connection
 Remarks:

Result: passed

- FCC/FCC Part 15C (15.207) B - Avg/
- FCC/FCC Part 15C (15.207) B - Q-Peak/
- Peak (Neutral)
- CISPR.AVG (Neutral)
- QuasiPeak (Finals) (Neutral)
- ◆ CISPR AV (Finals) (Neutral)



FCC/FCC Part 15C (15.207)B

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.

FCC ID: 2AHES-M2

IC ID: 21152-M2

freq	SR	QP	margin	limit	AV	margin	limit	line	RBW	Measure time	corr
MHz		dBµV	dB	dBµV	dBµV	dB	dBµV		Hz	sec	dB
0.177	9	19.90	-44.73	64.63	14.75	-39.87	54.63	Neutral	9k	1.00	10.11
0.3	9	26.24	-34.00	60.24	23.05	-27.20	50.24	Neutral	9k	1.00	10.14
0.3045	10	27.91	-32.20	60.12	24.25	-25.87	50.12	Neutral	9k	1.00	10.14
0.5115	10	25.07	-30.93	56.00	15.63	-30.37	46.00	Neutral	9k	1.00	10.16
0.525	10	28.45	-27.55	56.00	19.83	-26.17	46.00	Neutral	9k	1.00	10.16
0.6135	11	24.78	-31.22	56.00	18.39	-27.61	46.00	Neutral	9k	1.00	10.17
0.9015	11	18.26	-37.74	56.00	11.44	-34.56	46.00	Neutral	9k	1.00	10.20
1.227	12	8.95	-47.05	56.00	2.60	-43.40	46.00	Neutral	9k	1.00	10.23
1.5105	12	11.02	-44.98	56.00	1.30	-44.70	46.00	Neutral	9k	1.00	10.27
2.3655	12	22.03	-33.97	56.00	13.64	-32.36	46.00	Neutral	9k	1.00	10.31
3.345	13	29.69	-26.31	56.00	20.19	-25.81	46.00	Neutral	9k	1.00	10.35
3.3495	13	30.41	-25.59	56.00	20.35	-25.65	46.00	Neutral	9k	1.00	10.35
4.146	13	32.27	-23.73	56.00	22.72	-23.28	46.00	Neutral	9k	1.00	10.40
4.155	13	31.50	-24.50	56.00	21.36	-24.64	46.00	Neutral	9k	1.00	10.40
6.789	14	37.24	-22.76	60.00	28.54	-21.46	50.00	Neutral	9k	1.00	10.56
8.6925	14	40.64	-19.36	60.00	32.24	-17.76	50.00	Neutral	9k	1.00	10.63
8.7735	14	42.61	-17.39	60.00	34.20	-15.80	50.00	Neutral	9k	1.00	10.63
9.717	15	39.37	-20.63	60.00	31.93	-18.07	50.00	Neutral	9k	1.00	10.66
9.8205	15	39.53	-20.47	60.00	32.00	-18.00	50.00	Neutral	9k	1.00	10.66
14.46	15	35.88	-24.12	60.00	30.38	-19.62	50.00	Neutral	9k	1.00	10.97
15.5355	15	35.82	-24.18	60.00	30.30	-19.70	50.00	Neutral	9k	1.00	11.03
23.988	16	48.37	-11.63	60.00	40.94	-9.06	50.00	Neutral	9k	1.00	11.26
24.006	16	43.89	-16.11	60.00	38.67	-11.33	50.00	Neutral	9k	1.00	11.26
24.0105	16	43.54	-16.46	60.00	38.42	-11.58	50.00	Neutral	9k	1.00	11.26

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.

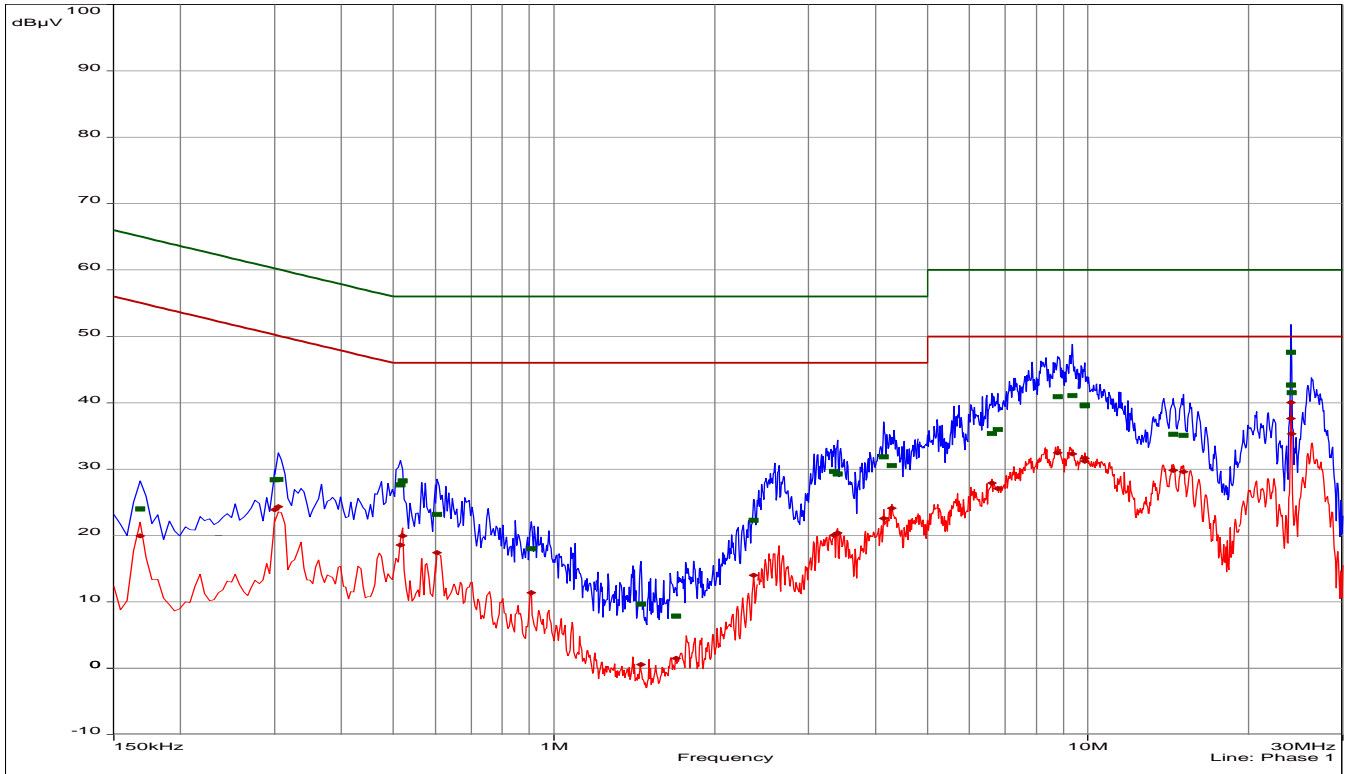
FCC ID: 2AHES-M2

IC ID: 21152-M2

Test point: L1
 Operation mode: WLAN 802.11n HT20 Connection
 Remarks:

Result: passed

- FCC/FCC Part 15C (15.207) B - Avg/
- FCC/FCC Part 15C (15.207) B - Q-Peak/
- Peak (Phase 1)
- CISPR.AVG (Phase 1)
- QuasiPeak (Finals) (Phase 1)
- ◆ CISPR AV (Finals) (Phase 1)



FCC/FCC Part 15C (15.207)B

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.

FCC ID: 2AHES-M2

IC ID: 21152-M2

freq	SR	QP	margin	limit	AV	margin	limit	line	RBW	Measure time	corr
MHz		dBµV	dB	dBµV	dBµV	dB	dBµV		Hz	sec	dB
0.168	1	24.03	-41.03	65.06	19.94	-35.12	55.06	Phase 1	9k	1.00	10.10
0.3	1	28.41	-31.83	60.24	23.86	-26.38	50.24	Phase 1	9k	1.00	10.14
0.3045	2	28.44	-31.68	60.12	24.34	-25.78	50.12	Phase 1	9k	1.00	10.14
0.516	2	27.62	-28.38	56.00	18.59	-27.41	46.00	Phase 1	9k	1.00	10.16
0.5205	2	28.24	-27.76	56.00	19.96	-26.04	46.00	Phase 1	9k	1.00	10.16
0.6045	3	23.17	-32.83	56.00	17.43	-28.57	46.00	Phase 1	9k	1.00	10.17
0.906	3	18.00	-38.00	56.00	11.38	-34.62	46.00	Phase 1	9k	1.00	10.20
1.4565	4	9.65	-46.35	56.00	0.54	-45.46	46.00	Phase 1	9k	1.00	10.26
1.695	4	7.86	-48.14	56.00	1.48	-44.52	46.00	Phase 1	9k	1.00	10.27
2.3655	4	22.31	-33.69	56.00	14.02	-31.98	46.00	Phase 1	9k	1.00	10.31
3.345	5	29.66	-26.34	56.00	20.03	-25.97	46.00	Phase 1	9k	1.00	10.35
3.3945	5	29.27	-26.73	56.00	20.36	-25.64	46.00	Phase 1	9k	1.00	10.35
4.146	5	31.84	-24.16	56.00	22.57	-23.43	46.00	Phase 1	9k	1.00	10.41
4.2945	5	30.55	-25.45	56.00	24.10	-21.90	46.00	Phase 1	9k	1.00	10.41
6.6	6	35.35	-24.65	60.00	27.91	-22.09	50.00	Phase 1	9k	1.00	10.57
6.7755	6	35.96	-24.04	60.00	27.05	-22.95	50.00	Phase 1	9k	1.00	10.59
8.7825	6	40.90	-19.10	60.00	32.44	-17.56	50.00	Phase 1	9k	1.00	10.69
9.3585	6	41.10	-18.90	60.00	32.29	-17.71	50.00	Phase 1	9k	1.00	10.71
9.852	7	39.66	-20.34	60.00	31.21	-18.79	50.00	Phase 1	9k	1.00	10.73
9.8565	7	39.53	-20.47	60.00	31.61	-18.39	50.00	Phase 1	9k	1.00	10.73
14.4465	7	35.25	-24.75	60.00	29.83	-20.17	50.00	Phase 1	9k	1.00	11.14
15.072	7	35.08	-24.92	60.00	29.62	-20.38	50.00	Phase 1	9k	1.00	11.19
23.988	8	47.60	-12.40	60.00	40.02	-9.98	50.00	Phase 1	9k	1.00	11.64
24.006	8	42.70	-17.30	60.00	37.59	-12.41	50.00	Phase 1	9k	1.00	11.64
24.0375	8	41.50	-18.50	60.00	35.32	-14.68	50.00	Phase 1	9k	1.00	11.64

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.

FCC ID: 2AHES-M2

IC ID: 21152-M2

5.2 EBW and OBW

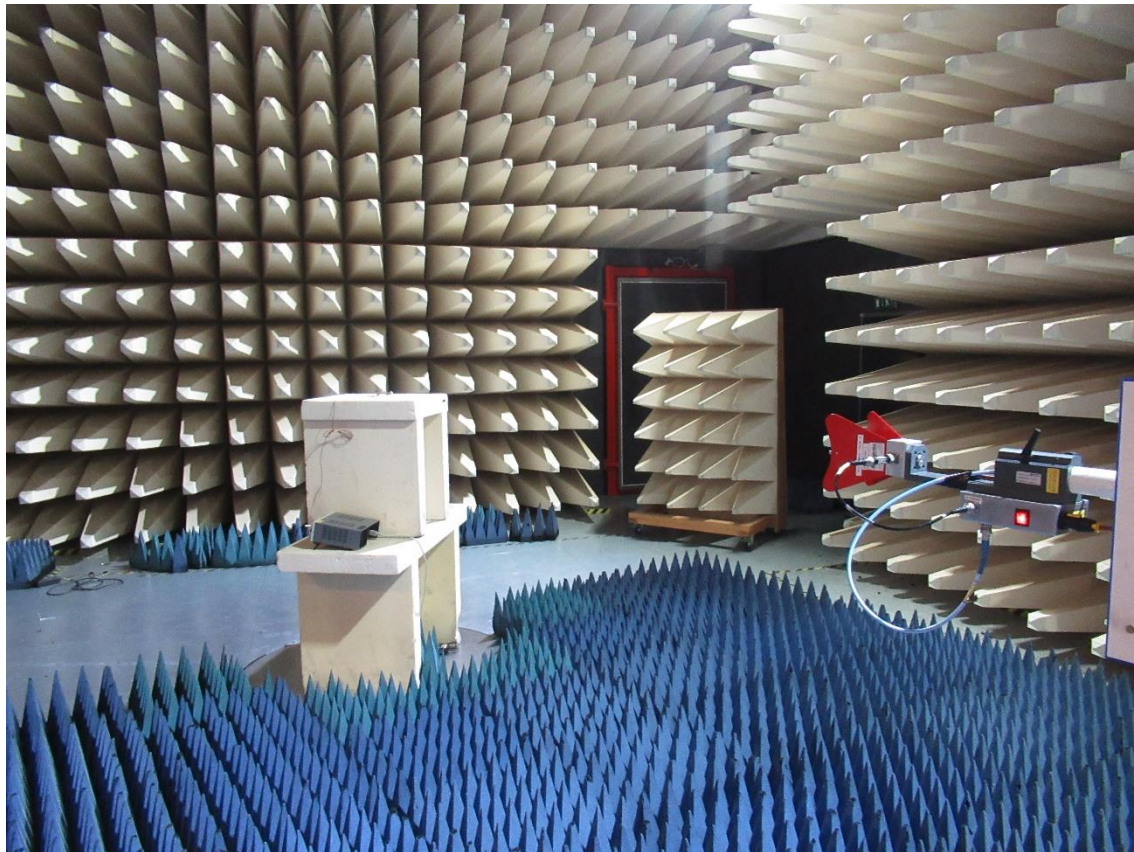
For test instruments and accessories used see section 6 Part MB.

5.2.1 Description of the test location

Test location: Anechoic chamber 1

Test distance: 3 m

5.2.2 Photo documentation of the test set-up



5.2.3 Applicable standard

According to FCC Part 15E, Section 15.407(a)(2):

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz.

According to RSS-247 6.2.1.1:

For other devices, the maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log10B, dBm, whichever power is less. B is the 99% emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

5.2.4 Description of Measurement

The bandwidth is measured conducted using a spectrum analyser and following the procedures according the KDB 789033, item C. The spectrum analyser function “n-dB-down” is used to determine the EBW. For the OBW the analyser function “OBW” is used to determine the bandwidth. The procedures according the KDB 789033, item D are followed in this case.

FCC ID: 2AHES-M2

IC ID: 21152-M2

5.2.5 Test result

5.2.5.1 Table for FCC

UNII-2A; FCC §15.407 (a)(2)					
Modulation	Channel	Frequency	EBW	Max. EIRP	Max. Cond. TX-Power
					$11 + 10 \cdot \log(\text{EBW})$ or 24
		MHz	MHz	dBm	dBm
802.11n, HT20, MCS7	CH52	5260	21.10	30.0	24.0
	CH56	5280	20.94	30.0	24.0
	CH64	5320	21.26	30.0	24.0
802.11n, HT40, MCS7	CH54	5270	54.11	30.0	24.0
	CH62	5310	39.88	30.0	24.0
802.11n, VHT80, MCS7	CH58	5290	81.04	30.0	24.0

5.2.5.2 Table for RSS

UNII-2A; RSS-247 6.2.2.1					
Modulation	Channel	Frequency	OBW	Max. EIRP	Max. Cond. TX-Power
				$17 + 10 \cdot \log(\text{OBW})$ or 30	$11 + 10 \cdot \log(\text{OBW})$ or 24
		MHz	MHz	dBm	dBm
802.11n, HT20, MCS7	CH52	5260	17.73	29.5	23.5
	CH56	5280	17.77	29.5	23.5
	CH64	5320	17.79	29.5	23.5
802.11n, HT40, MCS7	CH54	5270	37.21	30.0	24.0
	CH62	5310	36.46	30.0	24.0
802.11n, VHT80, MCS7	CH58	5290	75.77	30.0	24.0

Remarks: For detailed test results please see the following test protocols. No limit is defined for EBW and OBW.

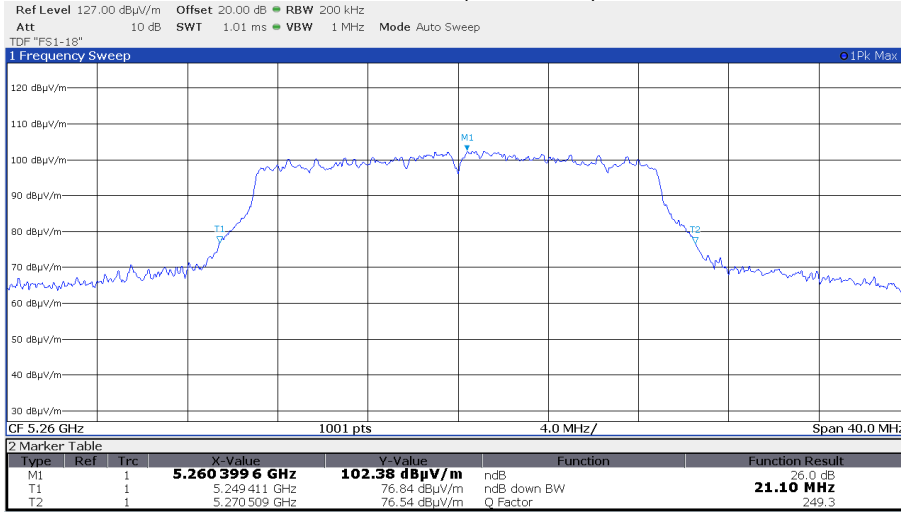
The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: 2AHES-M2

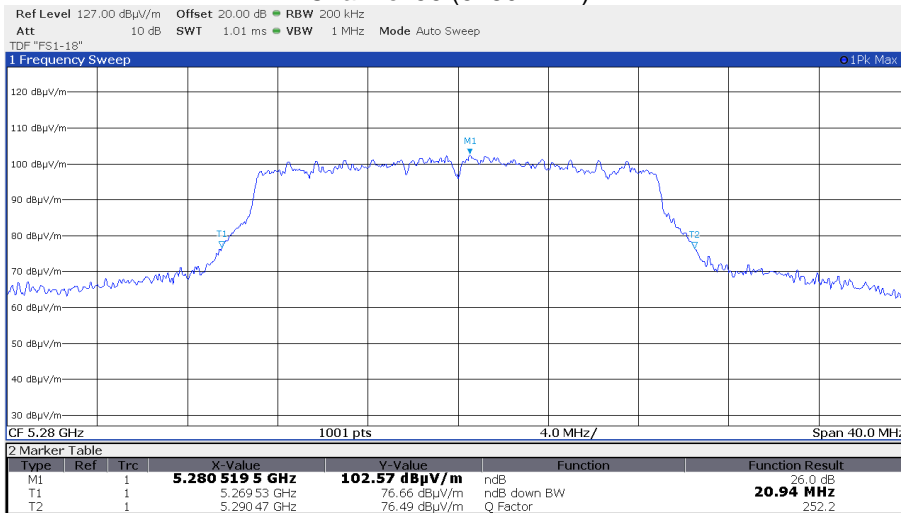
IC ID: 21152-M2

5.2.6 Test protocol EBW (26-dB-down bandwidth measurement)
802.11n HT20:

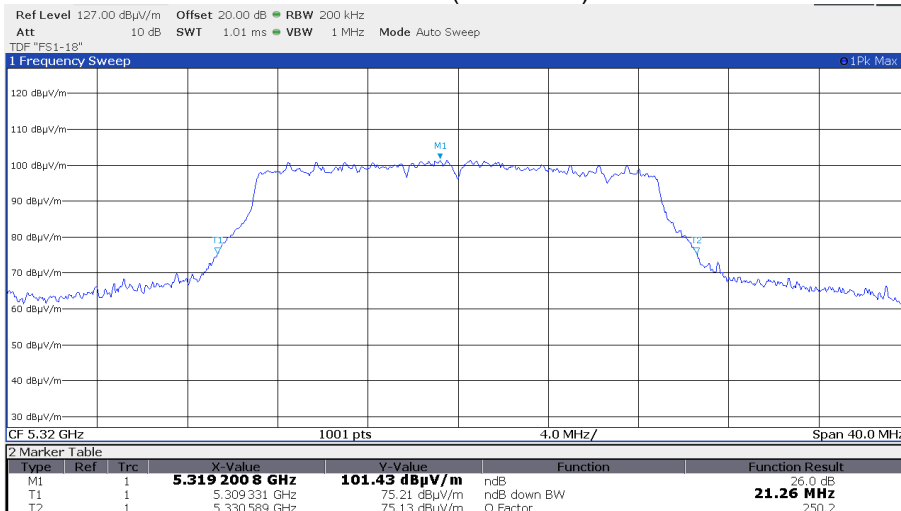
Channel 52 (5260 MHz)



Channel 56 (5280 MHz)



Channel 64 (5320 MHz)

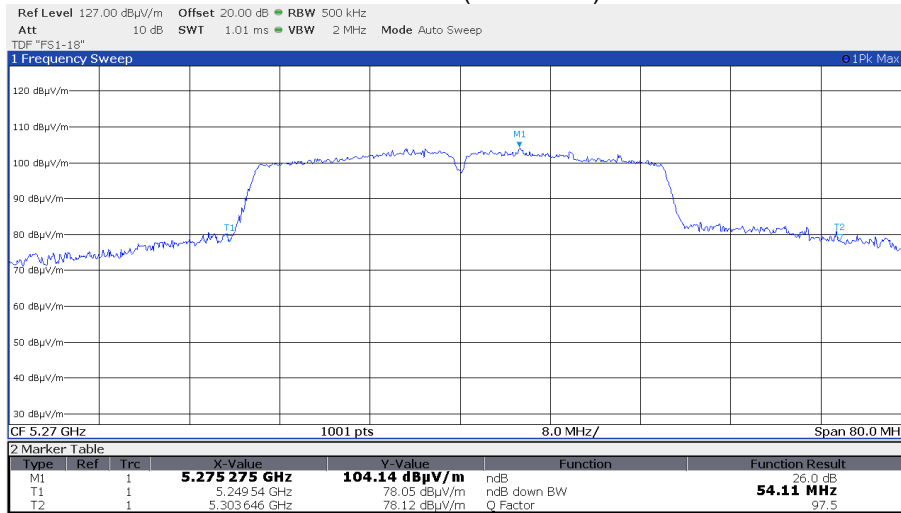


FCC ID: 2AHES-M2

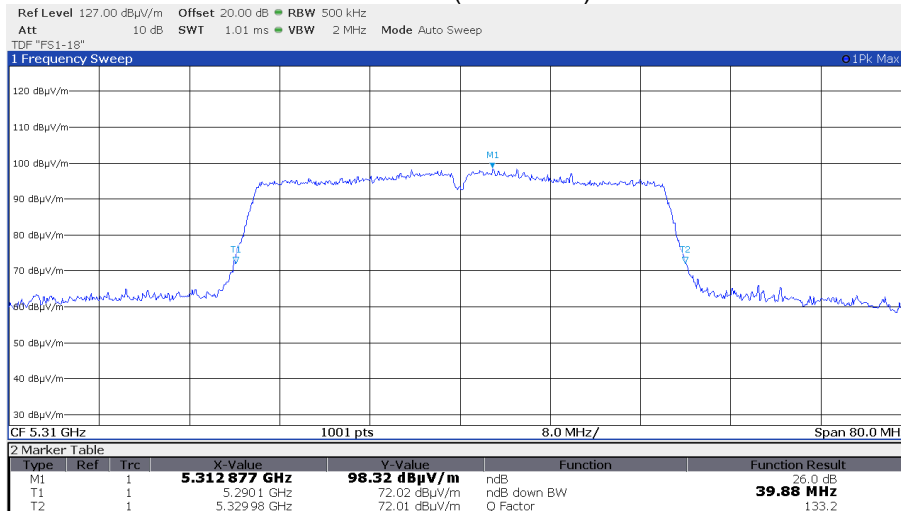
IC ID: 21152-M2

802.11n HT40:

Channel 54 (5270 MHz)

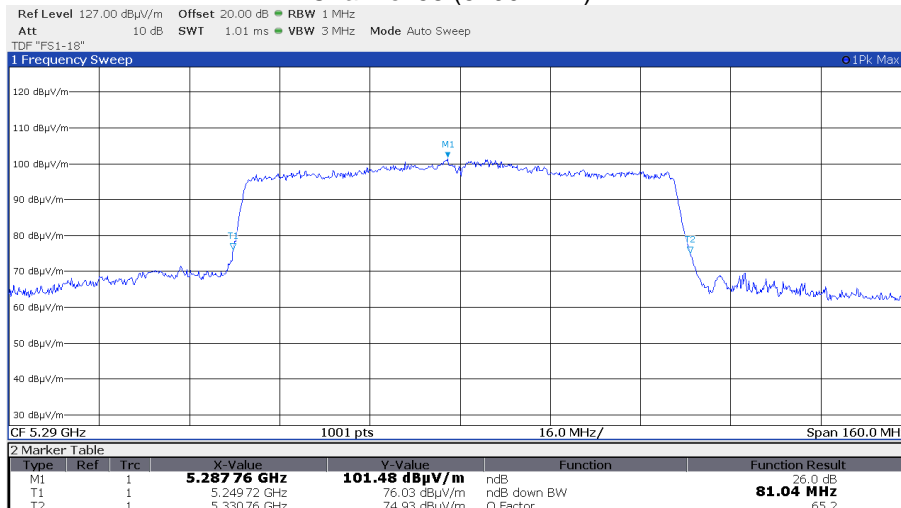


Channel 62 (5310 MHz)



802.11ac VHT80:

Channel 58 (5290 MHz)

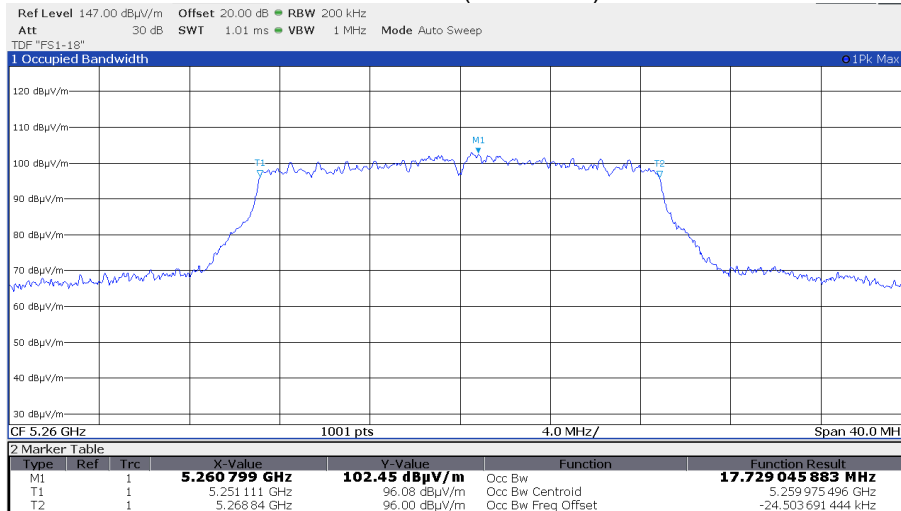


FCC ID: 2AHES-M2

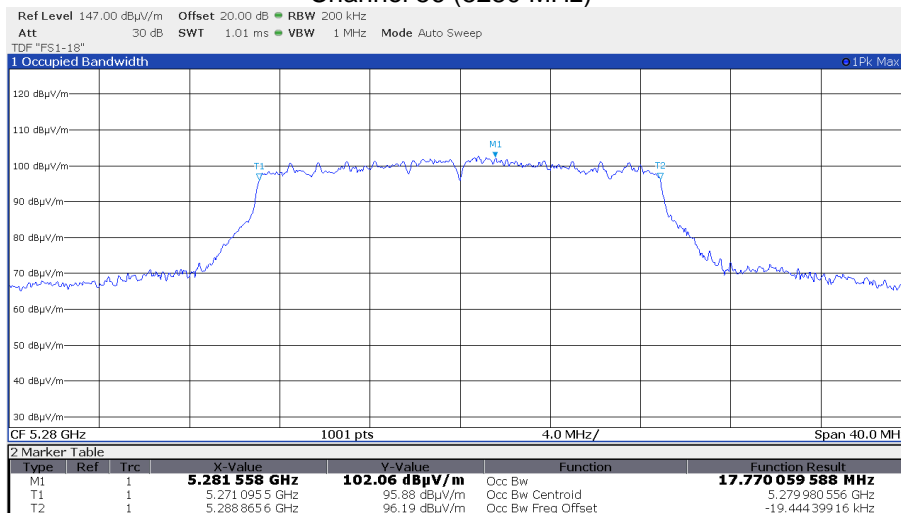
IC ID: 21152-M2

5.2.7 Test protocol OBW (99% Power bandwidth measurement)
802.11n HT20:

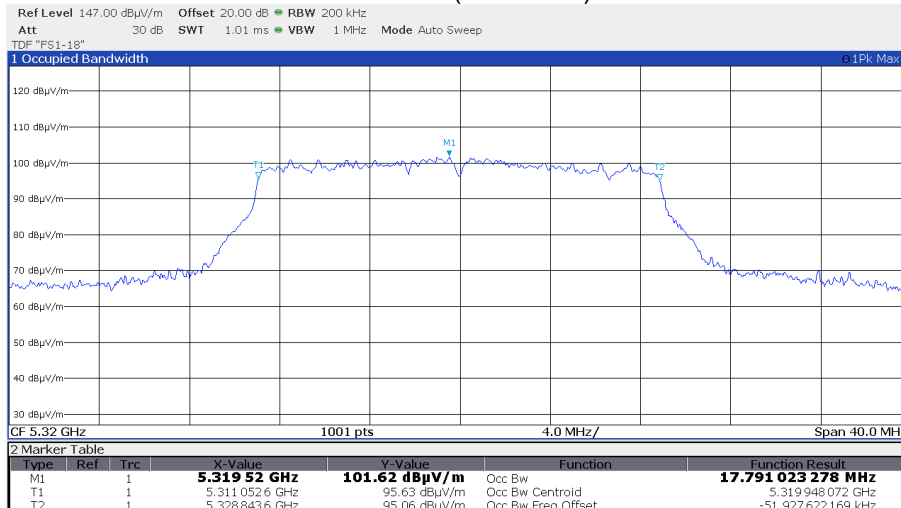
Channel 52 (5260 MHz)



Channel 56 (5280 MHz)



Channel 64 (5320 MHz)

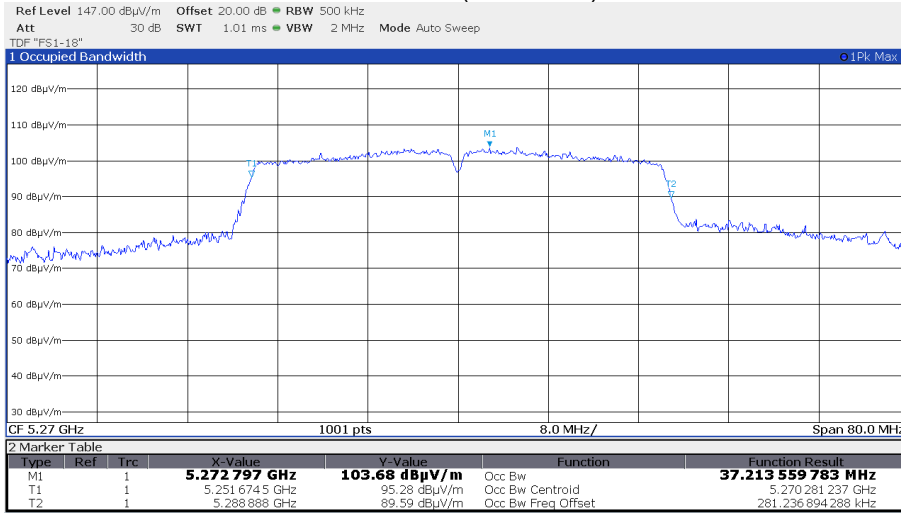


FCC ID: 2AHES-M2

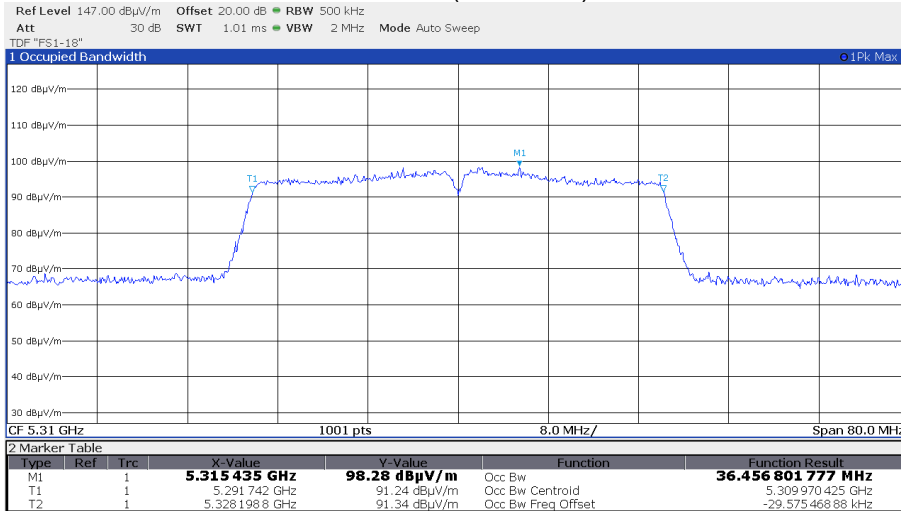
IC ID: 21152-M2

802.11n HT40:

Channel 54 (5270 MHz)

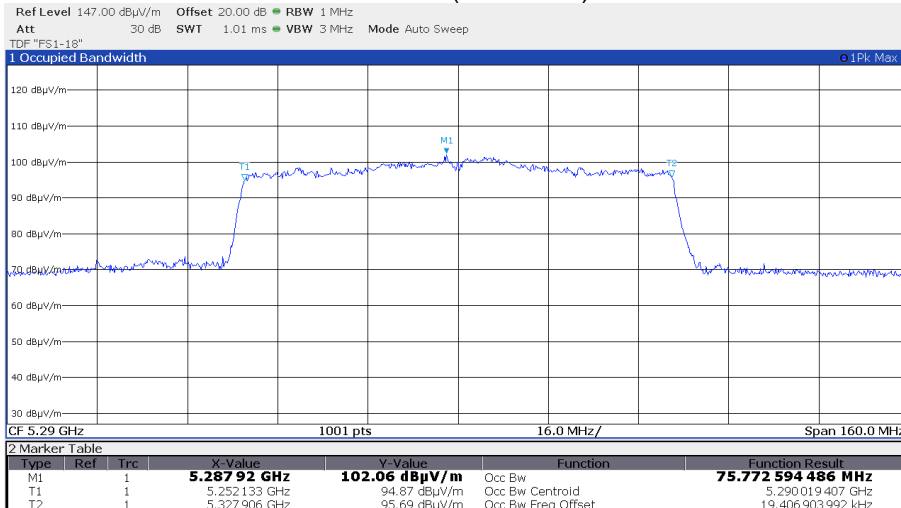


Channel 62 (5310 MHz)



802.11ac VHT80:

Channel 58 (5290 MHz)



FCC ID: 2AHES-M2

IC ID: 21152-M2

5.3 Maximum conducted output power

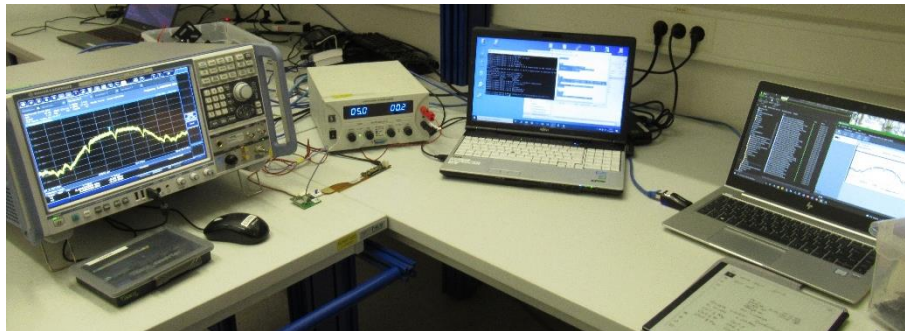
For test instruments and accessories used see section 6 Part **CPC 3**.

5.3.1 Description of the test location

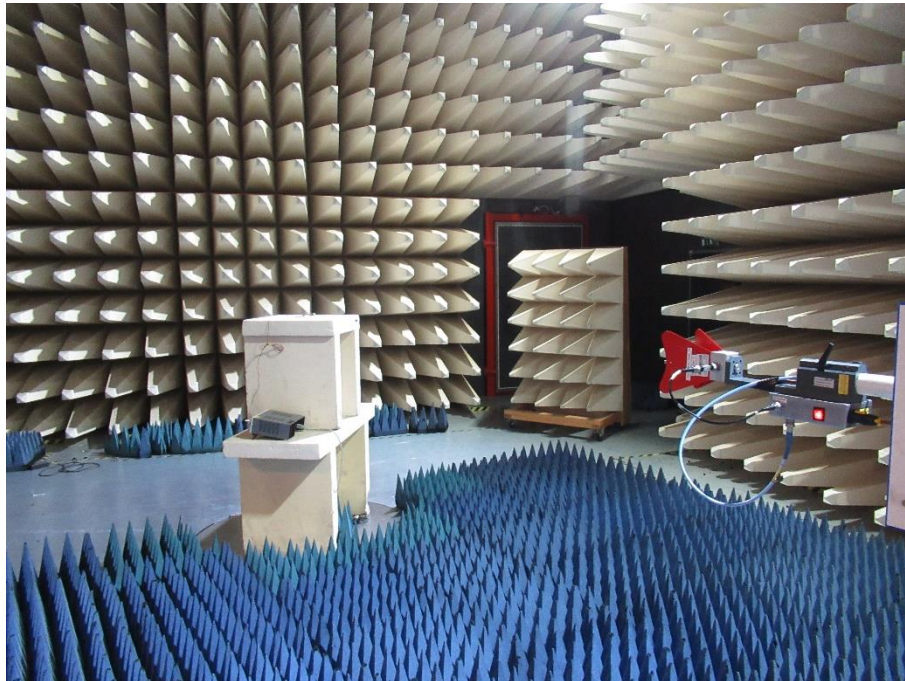
Test location: Shielded Room S6
 Test location: Anechoic chamber 1
 Test distance: 3 m

5.3.2 Photo documentation of the test set-up

Conducted Setup



Radiated Setup



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.

5.3.3 Applicable standard

According to FCC Part 15E, Section 15.407(a)(2):

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz.

According to RSS-247 6.2.2.1:

- a. The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less.
- b. The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz.

5.3.4 Description of Measurement

The output power is measured conducted using a spectrum analyser. The EUT has a constant duty cycle and may be smaller than 98% therefore the procedure according the KDB 789033 D02; item E d) Method SA-2 Alternative is followed. The EUT is set while measuring in TX continuous mode with a maximum duty cycle. The insertion loss of the measurement cable is taken into account with amplitude offset while measuring. The output power is integrated across the channel bandwidth.

Determination of the Duty Cycle:

Modulation	n HT20	nHT40	ac VHT80
Unit	µs	µs	µs
T _{ON}	56.00	114.92	43.70
T _{period duration}	157.00	217.14	145.54
Duty Cycle (x)	0.36	0.53	0.30
Offset in dB	4.5	2.8	5.2

Spectrum analyser settings:

RBW: 1 MHz, VBW: 3 MHz,
Power mode: max hold;

Detector: RMS (power averaging),
Band power function: OBW, Span: >OBW

5.3.5 Test result

5.3.5.1 Tables for FCC

Radiated Measurement with maximum power setting						
UNII-2A; FCC §15.407 (a)(2)						
Modulation	Channel	Frequency	Measured fieldstrength	Calculated EIRP	EIRP Limit	Margin
		MHz	dB(µV/m)	dBm	dBm	dB
n HT20, MCS7	CH52	5260	111.73	16.5	30	-13.5
	CH56	5280	111.81	16.6	30	-13.4
	CH64	5320	110.93	15.7	30	-14.3
n HT40, MCS7	CH54	5270	112.21	17.0	30	-13.0
	CH62	5310	108.37	13.2	30	-16.8
ac VHT80, MCS7	CH58	5290	109.64	14.4	30	-15.6

FCC ID: 2AHES-M2

IC ID: 21152-M2

Conducted Measurement with maximum power setting					
UNII-2A; FCC §15.407 (a)(2)					
Modulation	Channel	Frequency	Measured Conducted TX Power	Conducted Tx-Power Limit	Margin
		MHz	dBm	dBm	dB
n HT20, MCS7	CH52	5260	10.8	24.0	-13.2
	CH56	5280	10.5	24.0	-13.5
	CH64	5320	10.7	24.0	-13.3
n HT40, MCS7	CH54	5270	12.3	24.0	-11.7
	CH62	5310	6.5	24.0	-17.5
ac VHT80, MCS7	CH58	5290	12.8	24.0	-11.2

Conducted Measurement with final power setting					
UNII-2A; FCC §15.407 (a)(2)					
Modulation	Channel	Frequency	Measured Conducted TX Power	Conducted Tx-Power Limit	Margin
		MHz	dBm	dBm	dB
n HT20	CH52	5260	8.0	24.0	-16.0
	CH56	5280	7.8	24.0	-16.2
	CH64	5320	7.6	24.0	-16.4
n HT40	CH54	5270	10.2	24.0	-13.8
	CH62	5310	6.4	24.0	-17.6
ac VHT80	CH58	5290	4.7	24.0	-19.4

5.3.5.2 Tables for RSS

Radiated Measurement with maximum power setting						
UNII-2A; RSS-247 6.2.2.1						
Modulation	Channel	Frequency	Measured fieldstrength	Calculated EIRP	EIRP Limit	Margin
		MHz	dB(μV/m)	dBm	dBm	dB
n HT20, MCS7	CH52	5260	111.73	16.5	29.5	-13.0
	CH56	5280	111.81	16.6	29.5	-12.9
	CH64	5320	110.93	15.7	29.5	-13.8
n HT40, MCS7	CH54	5270	112.21	17.0	30.0	-13.0
	CH62	5310	108.37	13.2	30.0	-16.8
ac VHT80, MCS7	CH58	5290	109.64	14.4	30.0	-15.6

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.

FCC ID: 2AHES-M2

IC ID: 21152-M2

Conducted Measurement with maximum power setting					
UNII-2A; RSS-247 6.2.2.1					
Modulation	Channel	Frequency	Measured Conducted TX Power	Conducted Tx-Power Limit	Margin
		MHz	dBm	dBm	dB
n HT20, MCS7	CH52	5260	10.8	23.5	-12.7
	CH56	5280	10.5	23.5	-13.0
	CH64	5320	10.7	23.5	-12.8
n HT40, MCS7	CH54	5270	12.3	24.0	-11.7
	CH62	5310	6.5	24.0	-17.5
ac VHT80, MCS7	CH58	5290	12.8	24.0	-11.2

Conducted Measurement with final power setting					
UNII-2A; RSS-247 6.2.2.1					
Modulation	Channel	Frequency	Measured Conducted TX Power	Conducted Tx-Power Limit	Margin
		MHz	dBm	dBm	dB
n HT20	CH52	5260	8.0	23.5	-15.4
	CH56	5280	7.8	23.5	-15.7
	CH64	5320	7.6	23.5	-15.9
n HT40	CH54	5270	10.2	24.0	-13.8
	CH62	5310	6.4	24.0	-17.6
ac VHT80	CH58	5290	4.7	24.0	-19.4

Peak power limit according to FCC Part 15E, Section 15.407(a)(2):

Frequency	Radiated Power Limit	Conducted Power Limit
GHz	dBm	dBm
5.250 – 5.350	30	11 + 10*log(EBW) or 24

Whichever is the lesser applies.

Peak power limit according to RSS-247 6.2.2.1:

Frequency	Radiated Power Limit	Conducted Power Limit
GHz	dBm	dBm
5.250 – 5.350	17 + 10*log(OBW) or 30	11 + 10*log(OBW) or 24

Whichever is the lesser applies.

The requirements are **FULFILLED**.

Remarks: For detailed test results please refer to test protocols in 5.4.6 of this test report.

FCC ID: 2AHES-M2

IC ID: 21152-M2

5.4 Maximum power spectral density

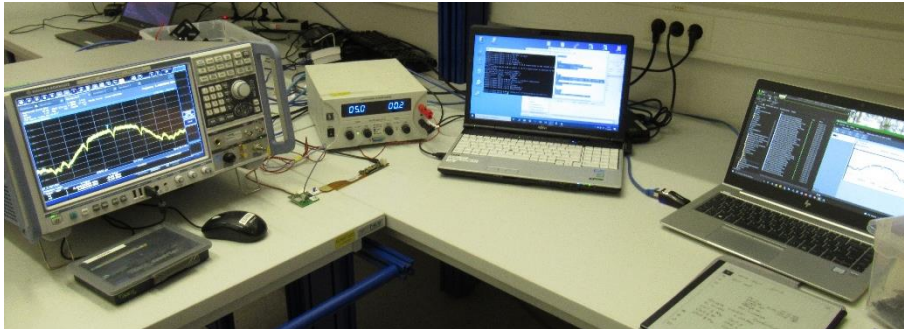
For test instruments and accessories used see section 6 Part **CPC 3**.

5.4.1 Description of the test location

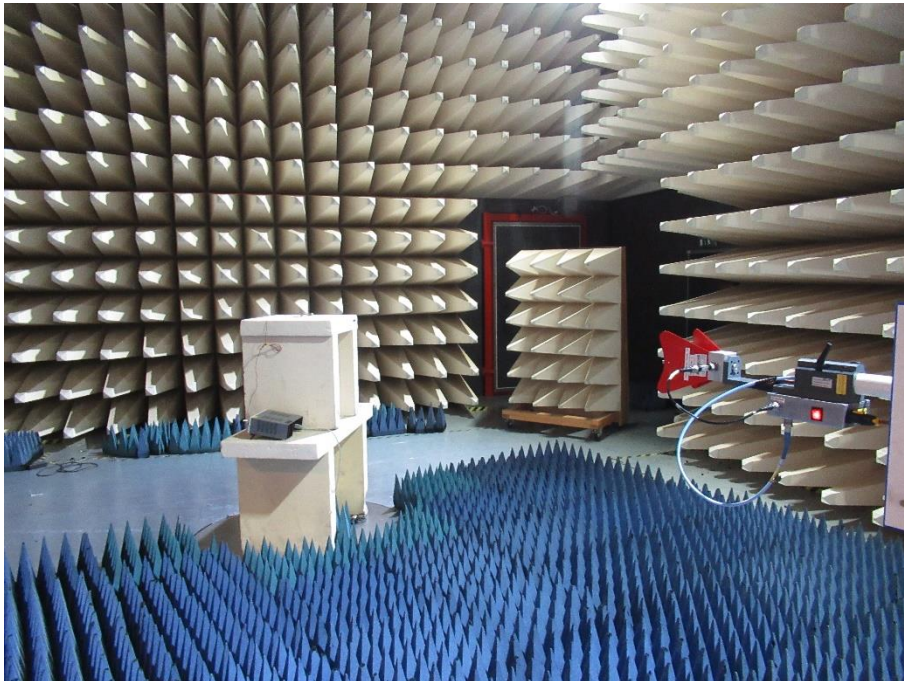
Test location: Shielded Room S6
Test location: Anechoic chamber 1
Test distance: 3 m

5.4.2 Photo documentation of the test set-up

Conducted Setup



Radiated Setup



5.4.3 Applicable standard

According to FCC Part 15E, Section 15.407(a)(2):

In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

According to RSS-247 6.2.2.1:

The power spectral density shall not exceed 11 dBm in any 1.0 MHz band

5.4.4 Description of Measurement

The bandwidth is measured conducted using a spectrum analyser and following the procedures according the KDB 789033, item F. Since the method SA-2 Alternative was used for channel power the spectrum analyser settings are the same as under item E) d). The marker function “Marker to max” is used to set at peak power spectral density. An attenuator or cable loss is taken into account with an amplitude offset.

Spectrum analyser settings:

RBW: 1 MHz, VBW: 3 MHz,
Power mode: max hold;

Detector: RMS (power averaging),
Band power function: OBW, Span: >OBW

5.4.5 Test result

Radiated Measurement						
UNII-2A; FCC §15.407 (a)(2) ; RSS-247 6.2.2.1						
Modulation	Channel	Frequency	Measured fieldstrength	Radiated PSD	Radiated PSD Limit	Margin
		MHz	dB(µV/m)	dBm	dBm	dB
n HT20, MCS7	CH52	5260	102.17	7.0	17.0	-10.0
	CH56	5280	101.01	5.8	17.0	-11.2
	CH64	5320	101.24	6.0	17.0	-11.0
n HT40, MCS7	CH54	5270	98.76	3.6	17.0	-13.4
	CH62	5310	95.35	0.1	17.0	-16.9
ac VHT80, MCS7	CH58	5290	93.60	-1.6	17.0	-18.6

Conducted Measurement					
UNII-2A; FCC §15.407 (a)(2) ; RSS-247 6.2.2.1					
Modulation	Channel	Frequency	Measured Conducted PSD	Conducted PSD Limit	Margin
		MHz	dBm	dBm	dB
n HT20, MCS7	CH52	5260	0.9	11.0	-10.1
	CH56	5280	1.2	11.0	-9.8
	CH64	5320	0.5	11.0	-10.5
n HT40, MCS7	CH54	5270	-1.2	11.0	-12.2
	CH62	5310	-6.9	11.0	-17.9
ac VHT80, MCS7	CH58	5290	-4.6	11.0	-15.6

FCC ID: 2AHES-M2

IC ID: 21152-M2

Peak power limit according to FCC Part 15E, Section 15.407(a)(2) & RSS-247 6.2.2.1:

Frequency (GHz)	Radiated PSD limit (dBm/MHz)	Conducted PSD limit (dBm/MHz)
5.250 - 5.350	17	11

The requirements are **FULFILLED**.

Remarks: For detailed test results please see the following test protocols.

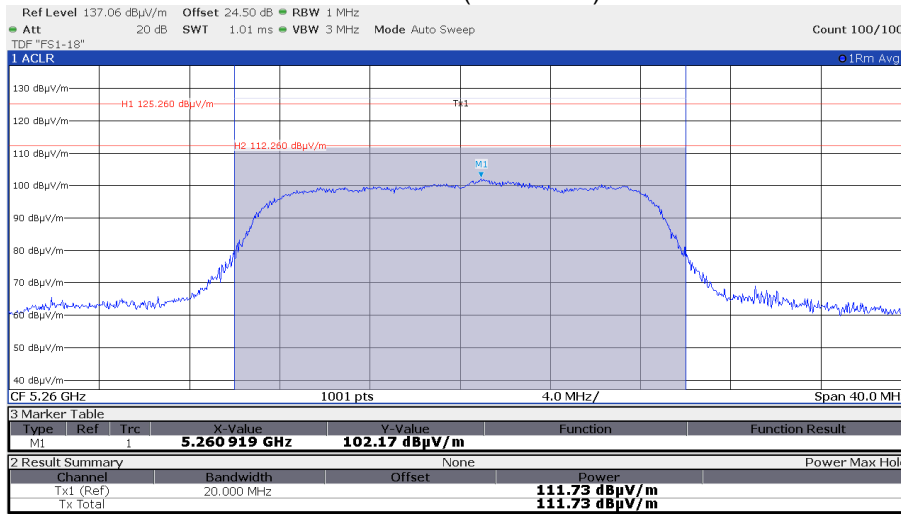
The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: 2AHES-M2

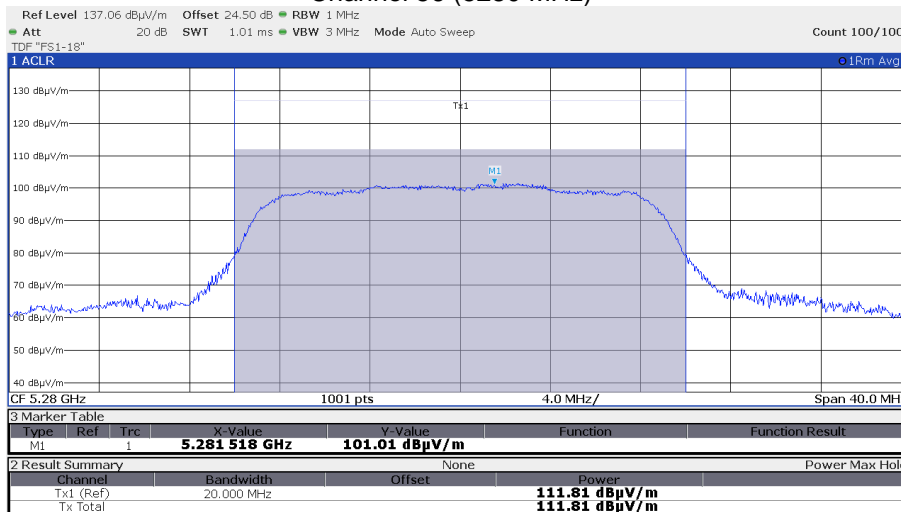
IC ID: 21152-M2

5.4.6 Power spectral density plots
Radiated Measurement
802.11n HT20:

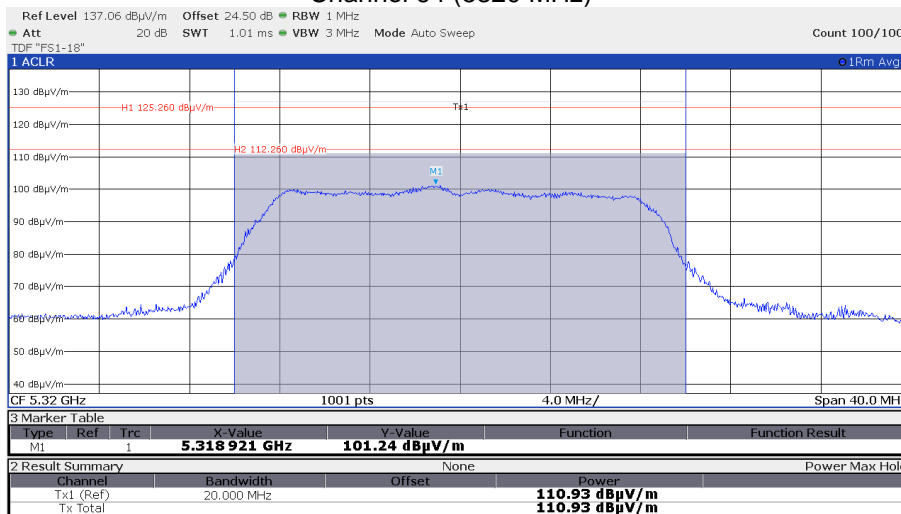
Channel 52 (5260 MHz)



Channel 56 (5280 MHz)



Channel 64 (5320 MHz)



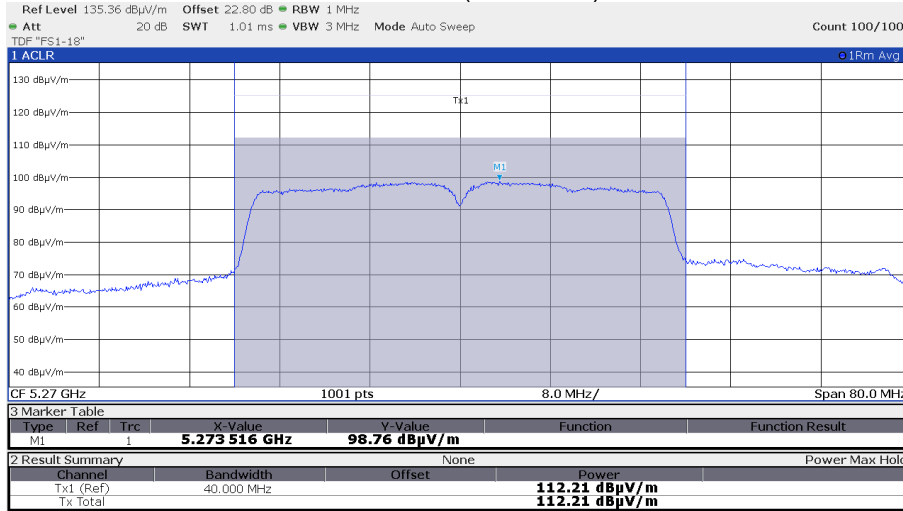
The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: 2AHES-M2

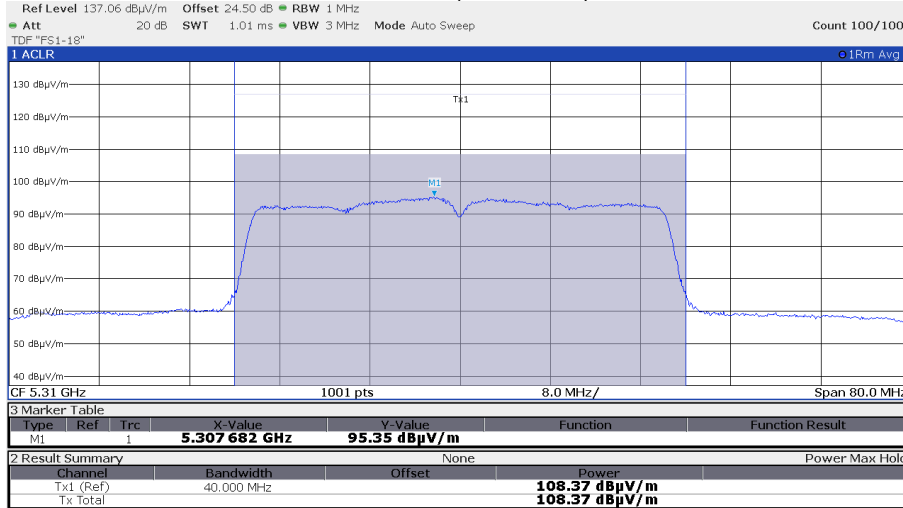
IC ID: 21152-M2

802.11n HT40:

Channel 54 (5270 MHz)

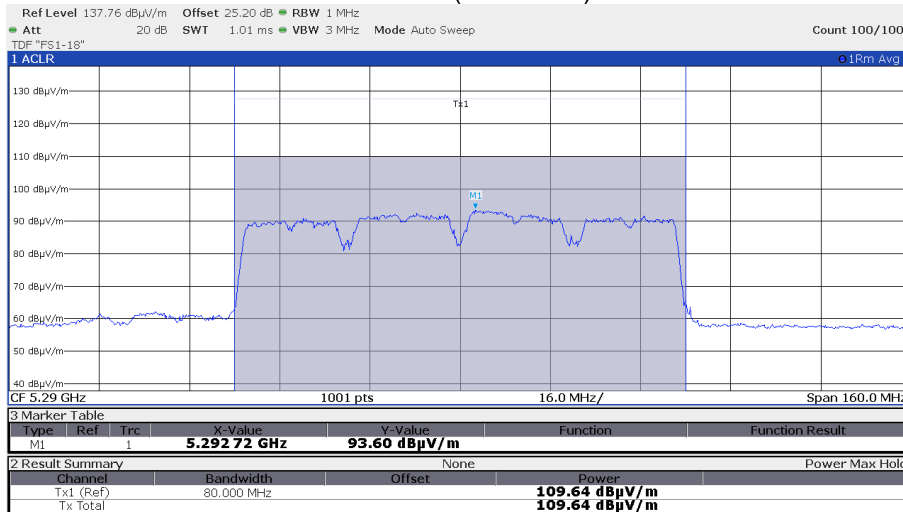


Channel 62 (5310 MHz)



802.11ac VHT80:

Channel 58 (5290 MHz)



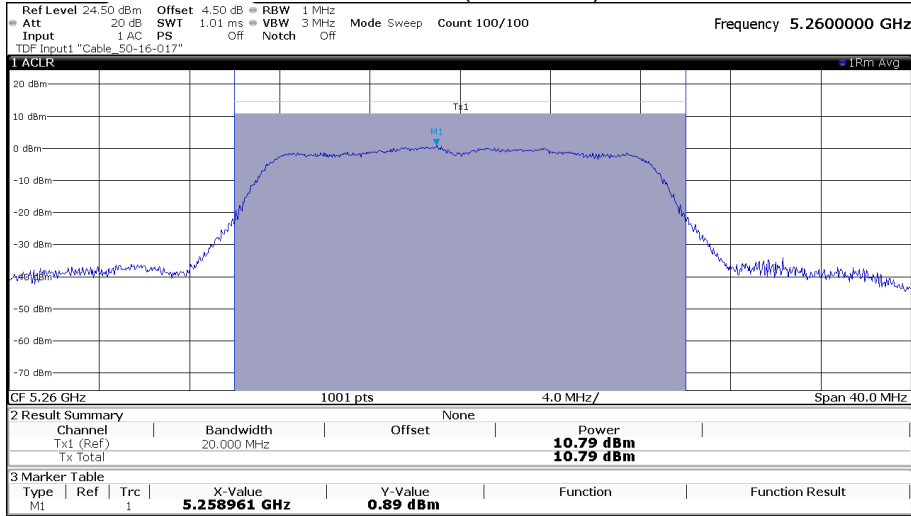
The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: 2AHES-M2

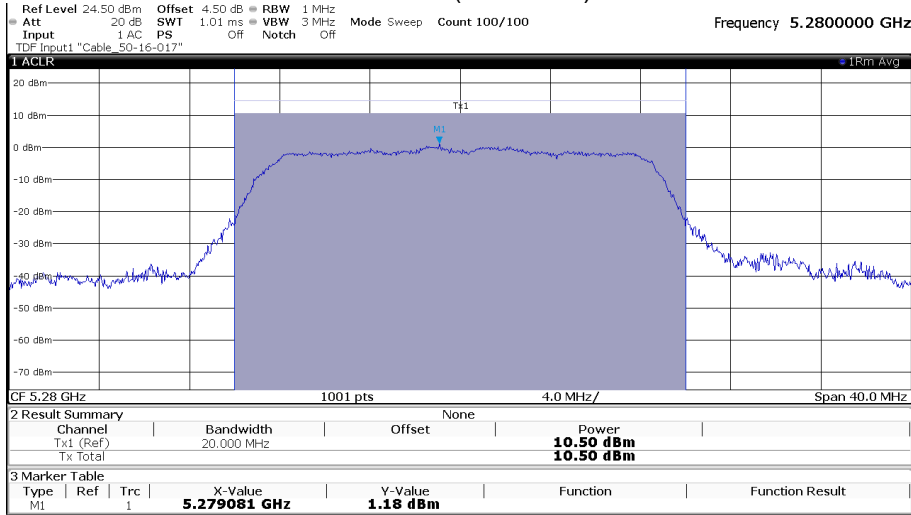
IC ID: 21152-M2

Conducted Measurement with maximum power setting
802.11n HT20:

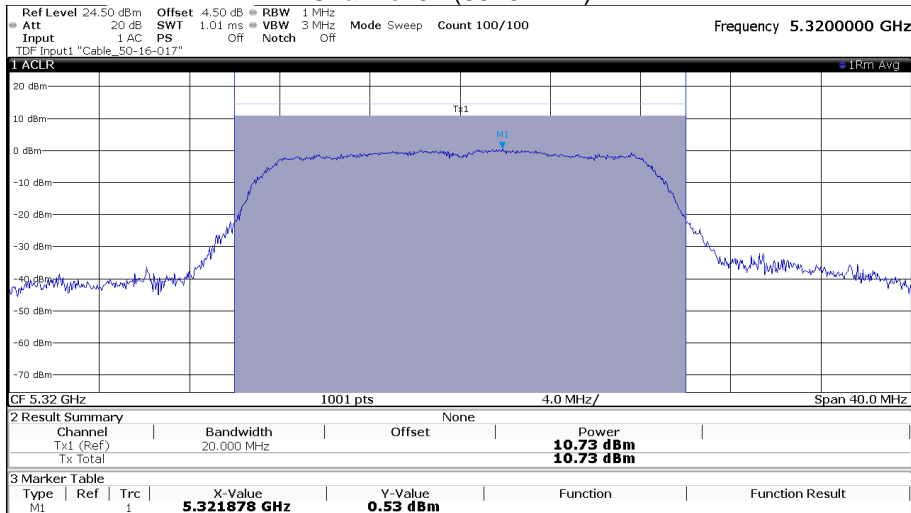
Channel 52 (5260 MHz)



Channel 56 (5280 MHz)



Channel 64 (5320 MHz)

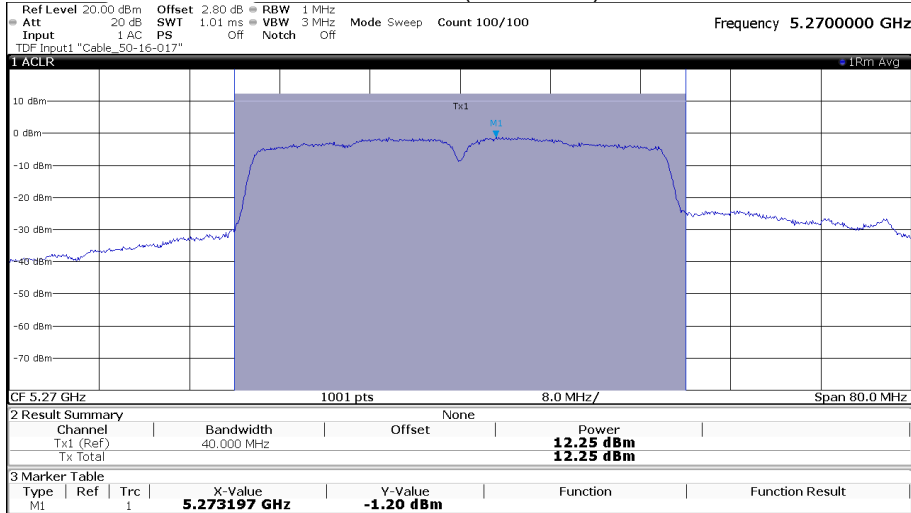


FCC ID: 2AHES-M2

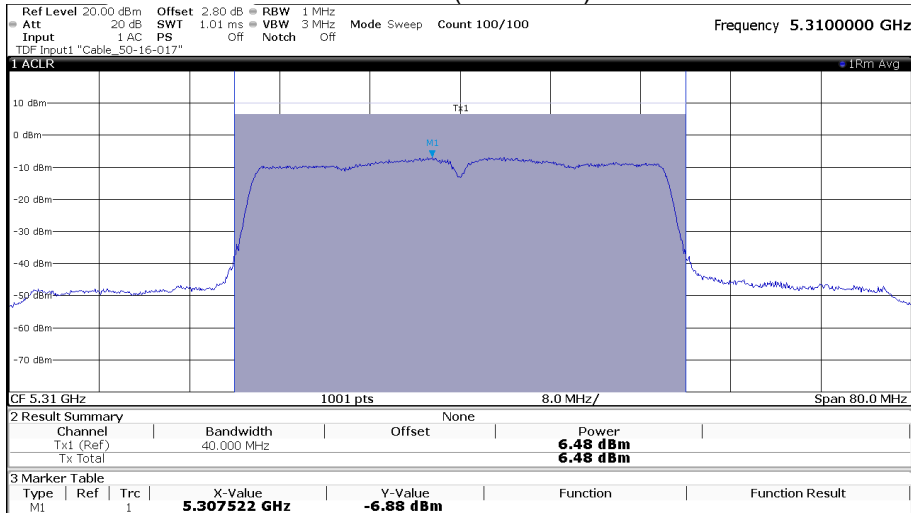
IC ID: 21152-M2

802.11n HT40:

Channel 54 (5270 MHz)

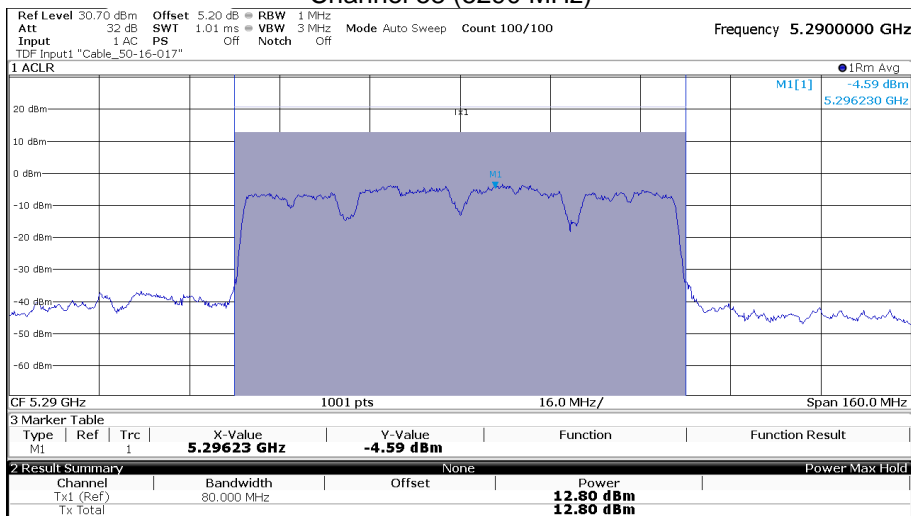


Channel 62 (5310 MHz)



802.11ac VHT80:

Channel 58 (5290 MHz)



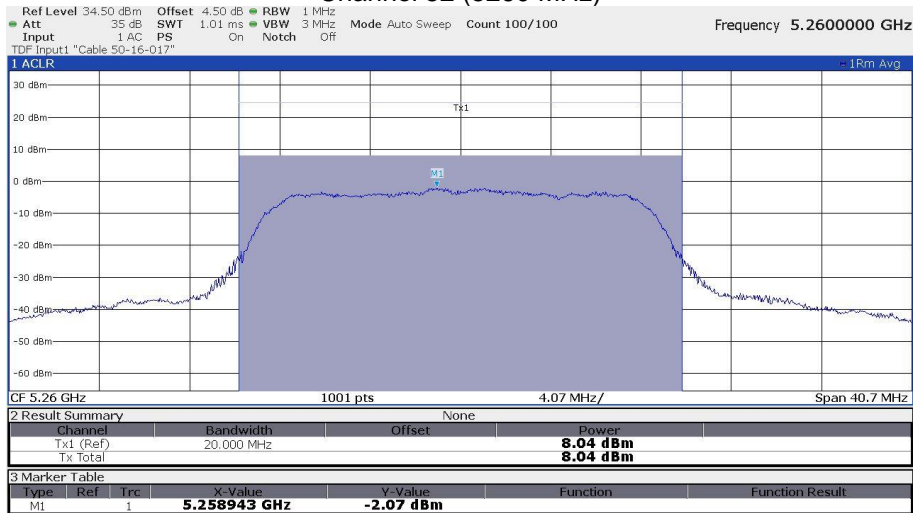
The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: 2AHES-M2

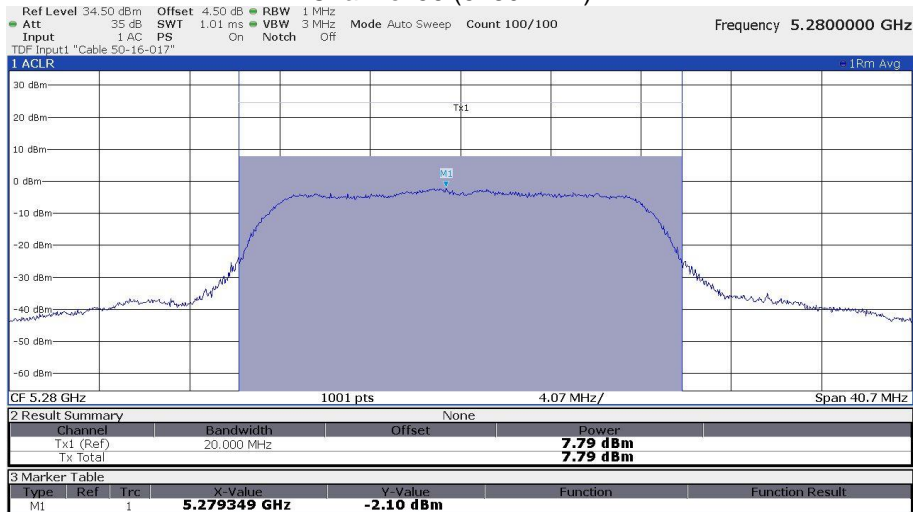
IC ID: 21152-M2

Conducted Measurement with maximum power setting
802.11n HT20:

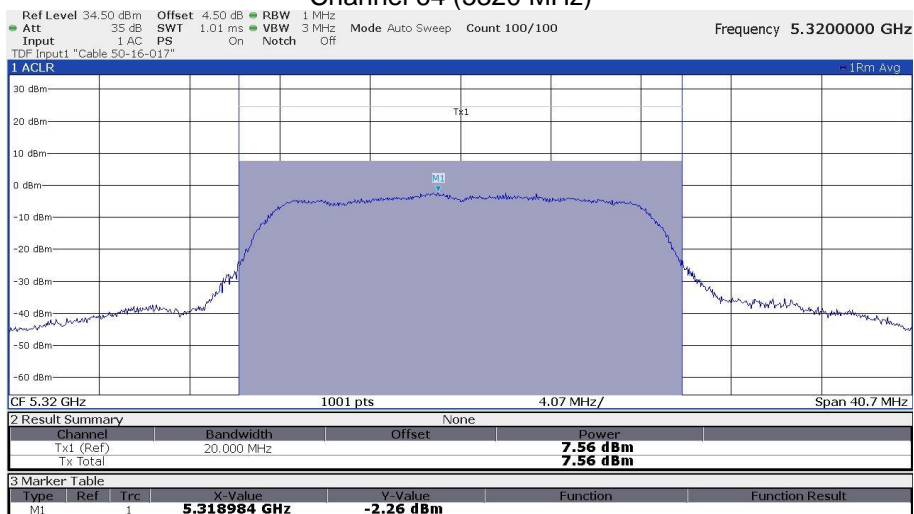
Channel 52 (5260 MHz)



Channel 56 (5280 MHz)



Channel 64 (5320 MHz)

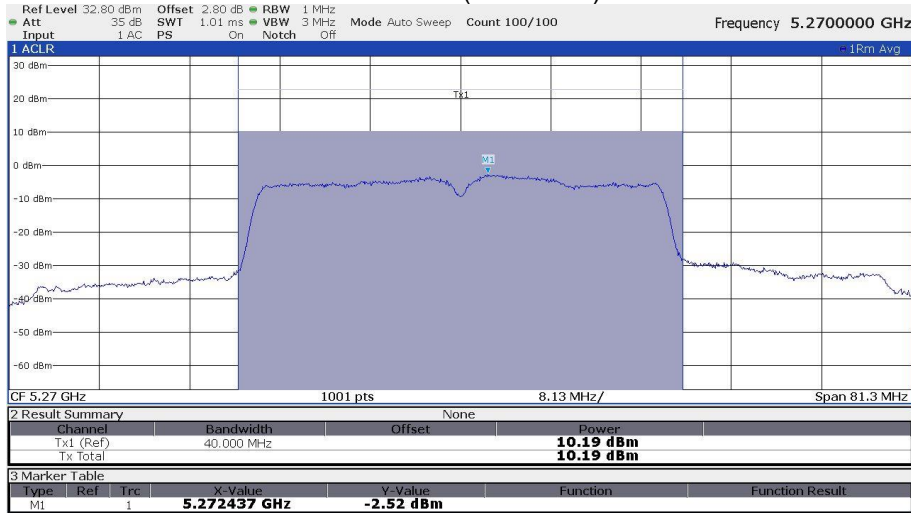


FCC ID: 2AHES-M2

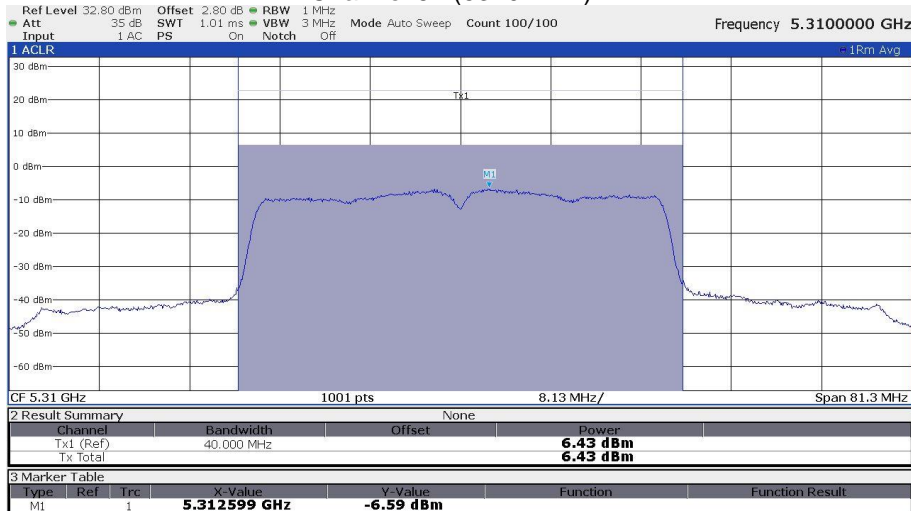
IC ID: 21152-M2

802.11n HT40:

Channel 54 (5270 MHz)

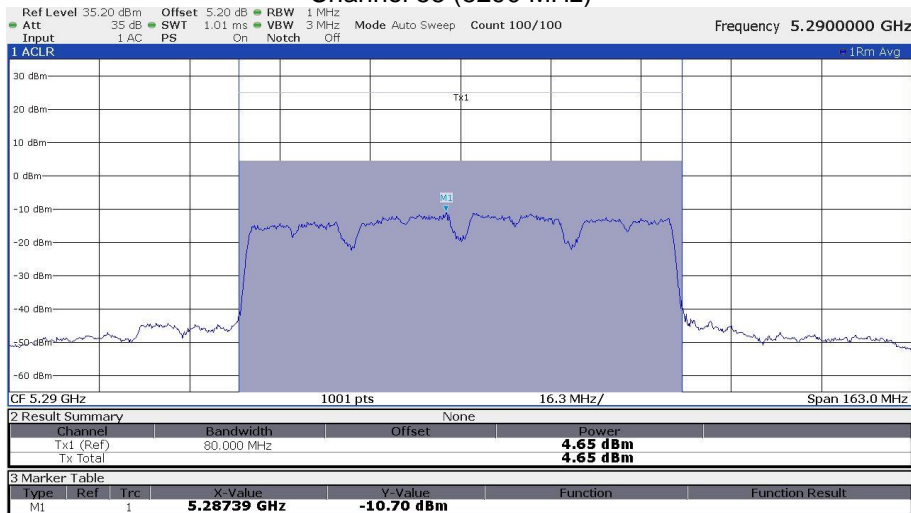


Channel 62 (5310 MHz)



802.11ac VHT80:

Channel 58 (5290 MHz)



FCC ID: 2AHES-M2

IC ID: 21152-M2

5.5 Undesirable emission

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

5.5.1 Description of the test location

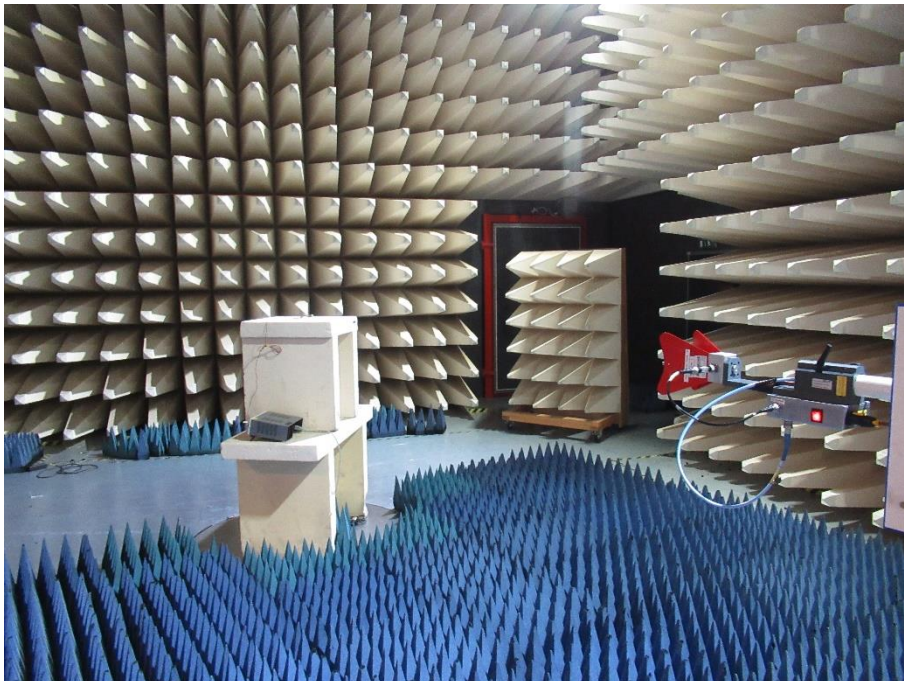
Test location: OATS 1
 Test location: Anechoic chamber 1
 Test distance: 3 m

5.5.2 Photo documentation of the test set-up

Setup $f < 1000$ MHz



Setup $f > 1000$ MHz



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.

5.5.3 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 e.i.r.p. of -27 dBm/MHz.

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

5.5.4 Description of Measurement

Unwanted emission is measured with the setup set out in ANSI C63.10, item 12.7. The plots show the general limit average 54 dBµV/m and the peak limit for out of band emission -27 dBm/MHz (68.2 dBµV/m). This way we are able to verify the undesirable limit and the general limit within the restricted bands in one plot.

If the emission level of the EUT in peak mode complies with the average limit then testing will be stopped and peak values of the EUT will be reported, otherwise, the emission will be measured in average mode again and reported. Up from 8 GHz a HP filter is used. A conversion EIRP to Field strength is done with the formula which applies at 3 m measurement distance only.

$$\frac{EIRP}{dBm} = \frac{FS}{dB(\frac{\mu V}{m})} + 95.2$$

Spectrum analyser settings:

f < 1000 MHz

RBW: 120 kHz Detector: Peak

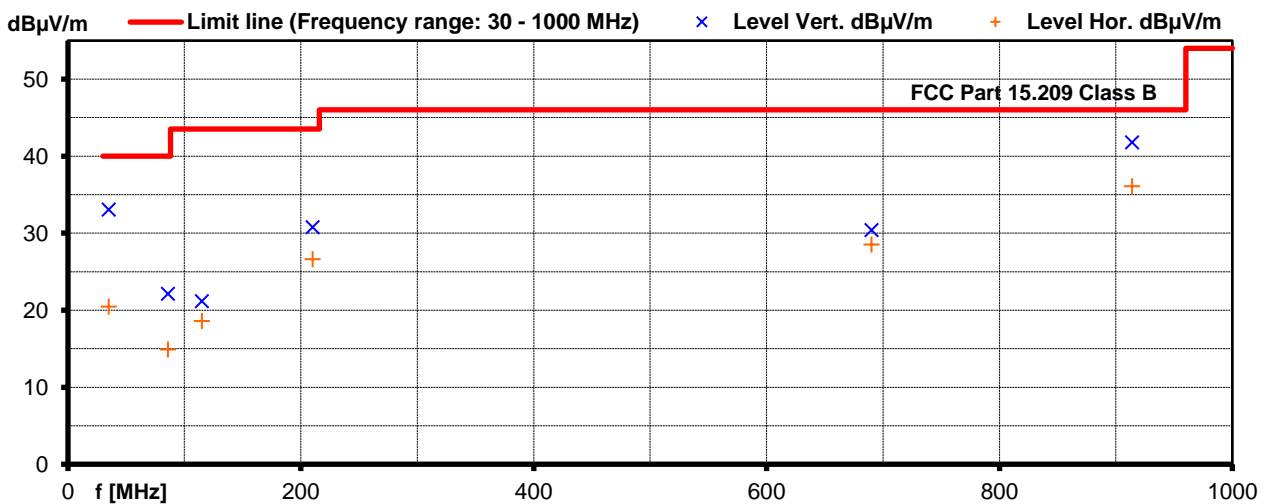
f > 1000 MHz

RBW: 1 MHz VBW: 3 MHz Detector: Peak Sweep time: Auto Trace mode: max. hold

5.5.5 Test result

f < 1000 MHz

Frequency (MHz)	Reading Vert. (dBµV)	Reading Hor. (dBµV)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level Vert. (dBµV/m)	Level Hor. (dBµV/m)	Limit (dBµV/m)	Dlimit (dB)
35.00	16.8	3.3	16.2	17.2	33.0	20.5	40.0	-7.0
86.00	8.3	1.6	13.8	13.3	22.1	14.9	40.0	-17.9
115.00	4.3	2.5	16.9	16.1	21.2	18.6	43.5	-22.3
210.00	13.5	9.8	17.3	16.8	30.8	26.6	43.5	-12.7
690.00	0.9	-1.6	29.5	30.1	30.4	28.5	46.0	-15.6
914.00	8.8	2.7	33.0	33.4	41.8	36.1	46.0	-4.2

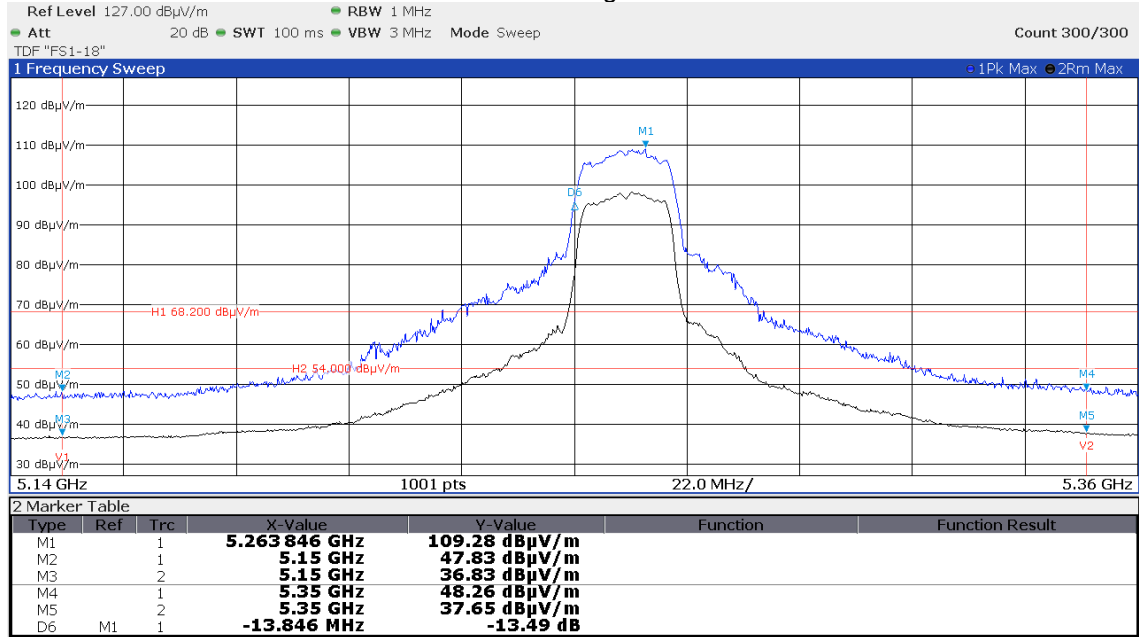


FCC ID: 2AHES-M2

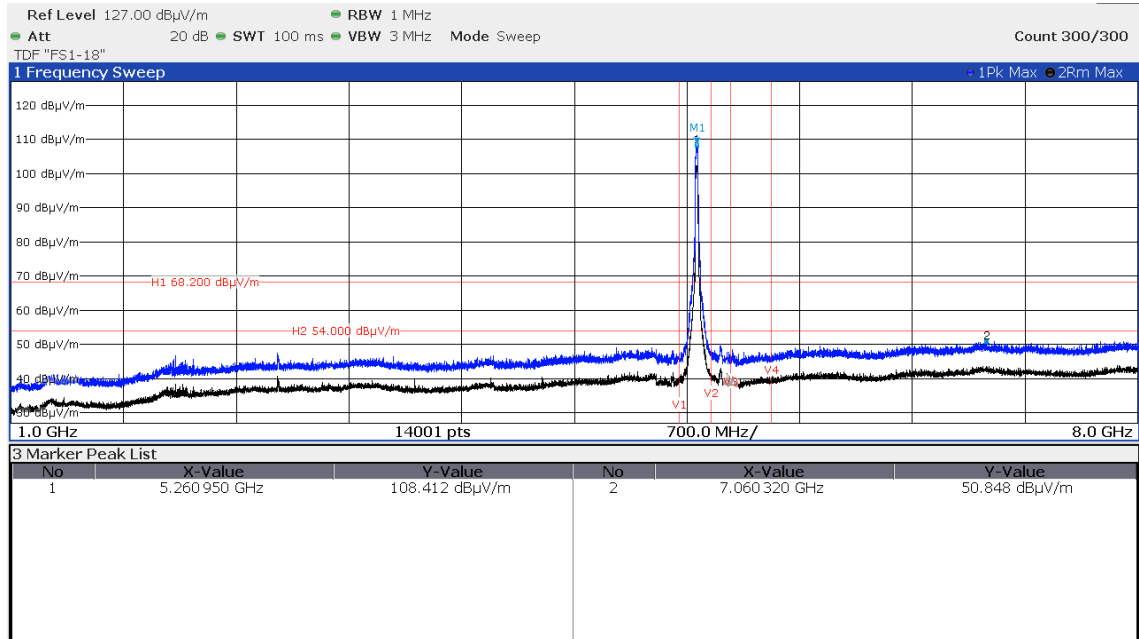
IC ID: 21152-M2

f > 1000 MHz
CH52, 802.11n HT20:

Band Edges



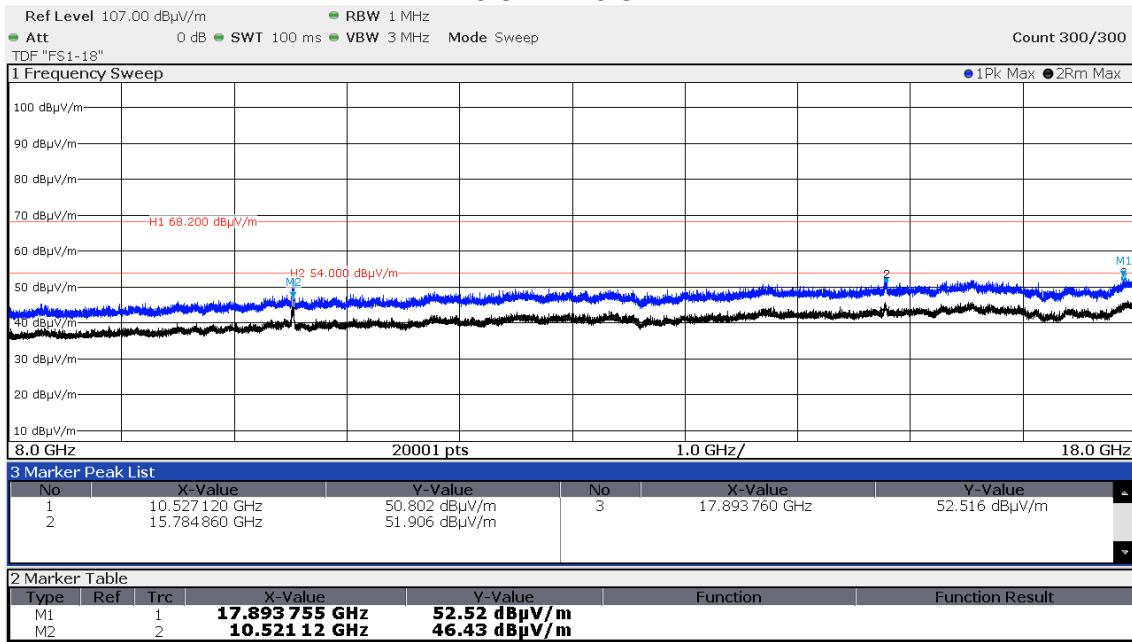
1 GHz – 8 GHz



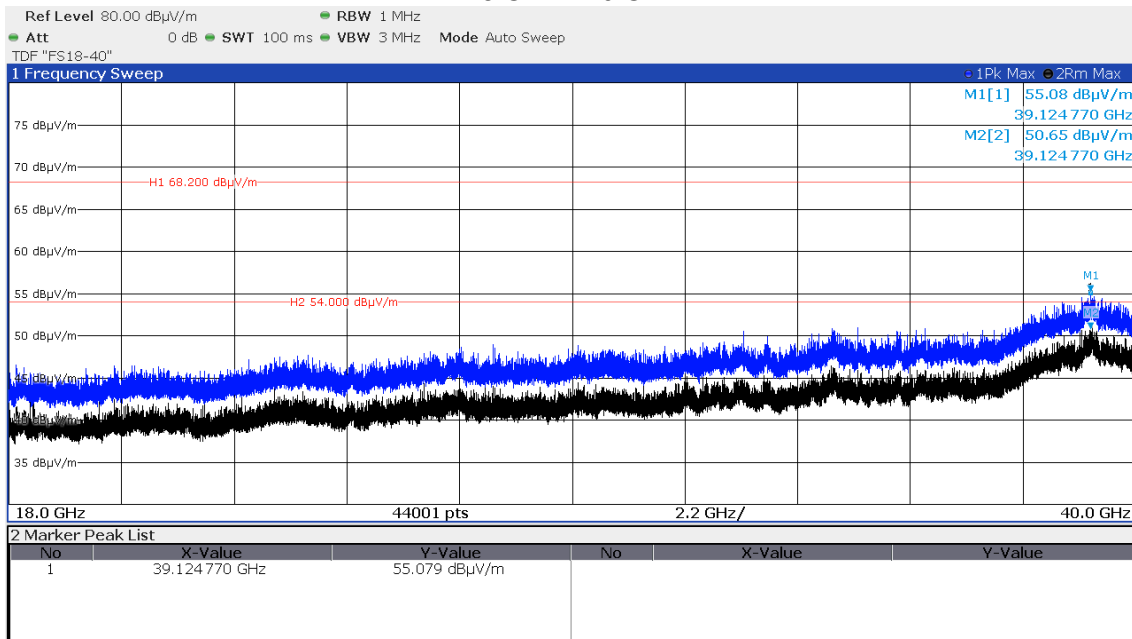
FCC ID: 2AHES-M2

IC ID: 21152-M2

8 GHz – 18 GHz



18 GHz – 40 GHz



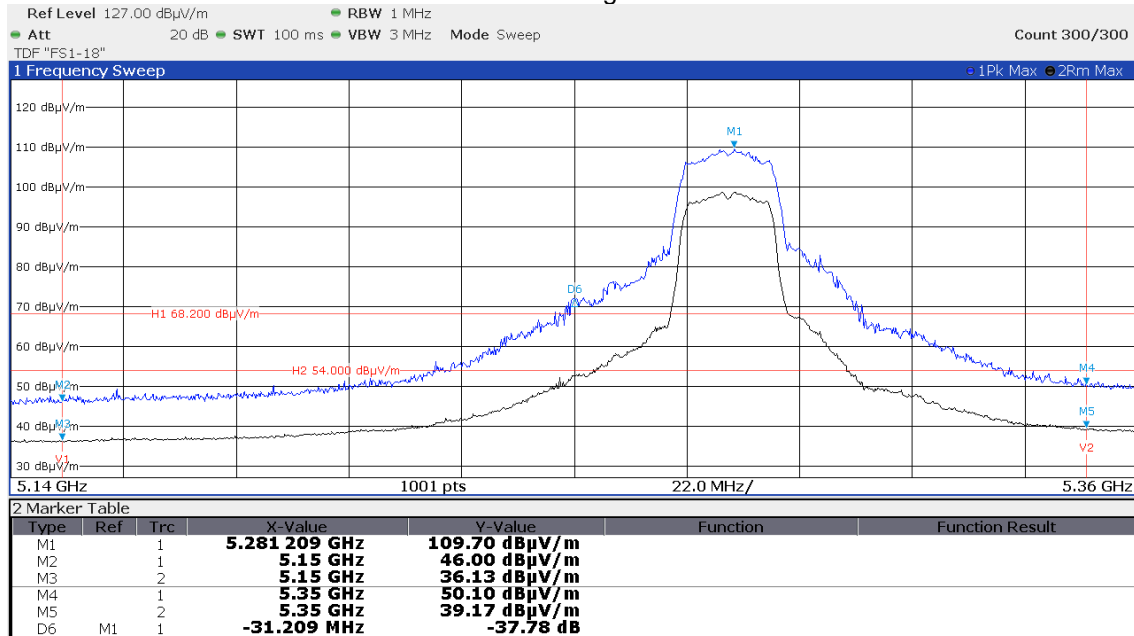
The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: 2AHES-M2

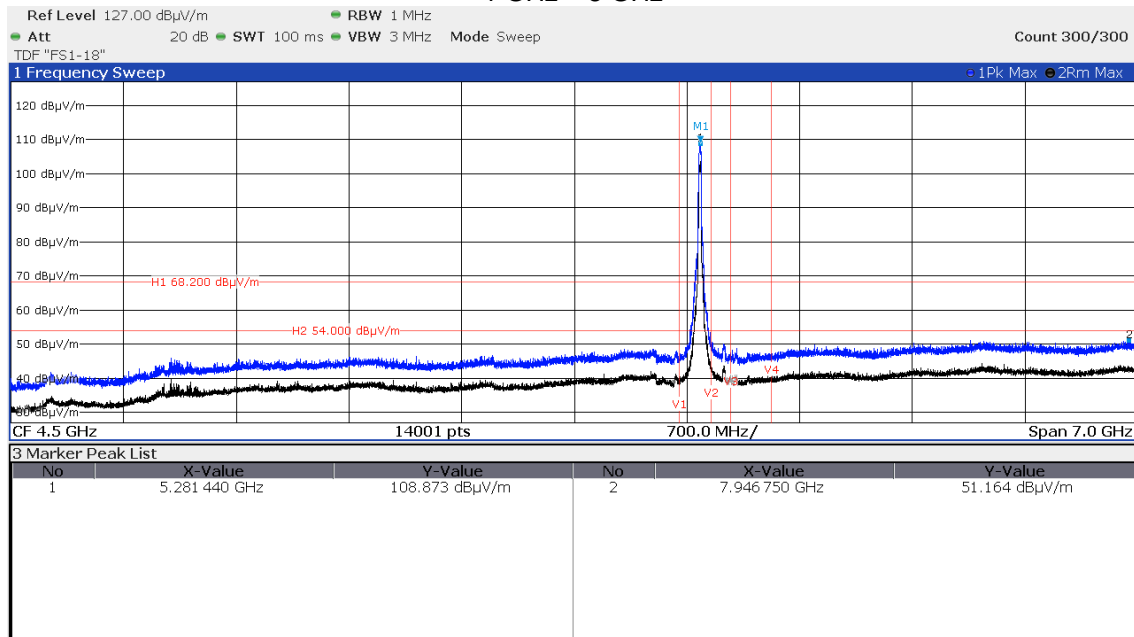
IC ID: 21152-M2

CH56, 802.11n HT20:

Band Edges



1 GHz – 8 GHz

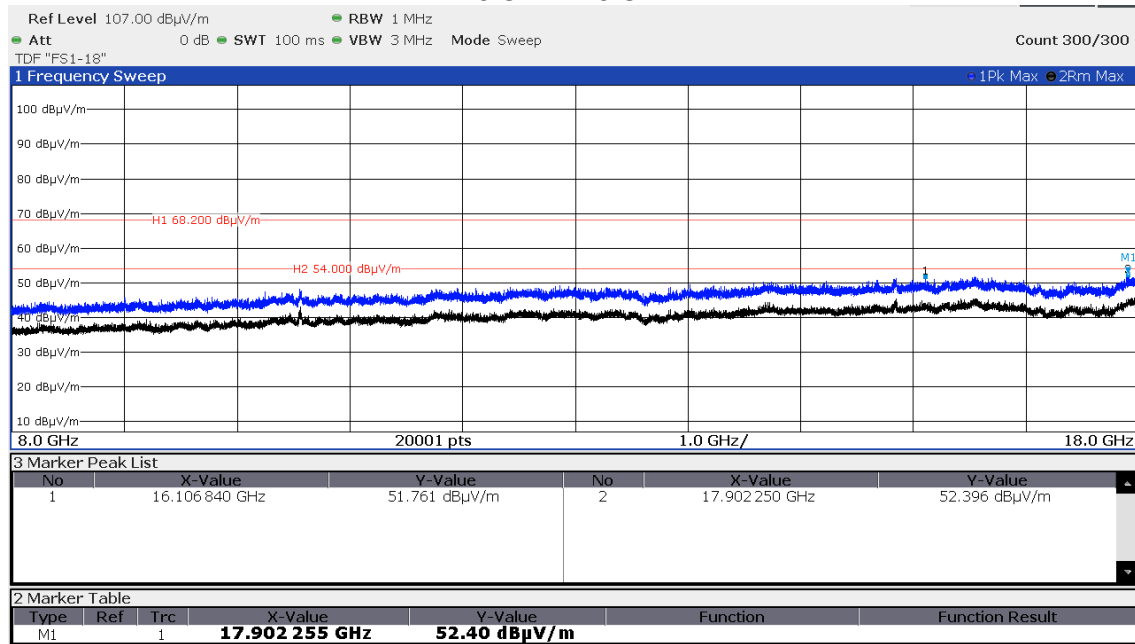


The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

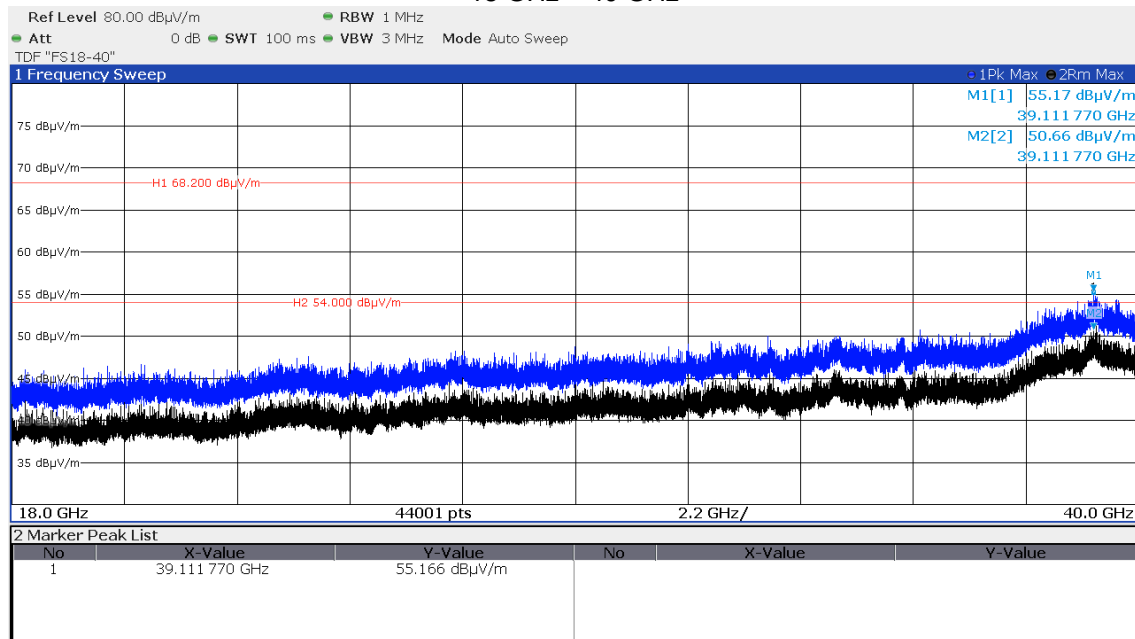
FCC ID: 2AHES-M2

IC ID: 21152-M2

8 GHz – 18 GHz



18 GHz – 40 GHz



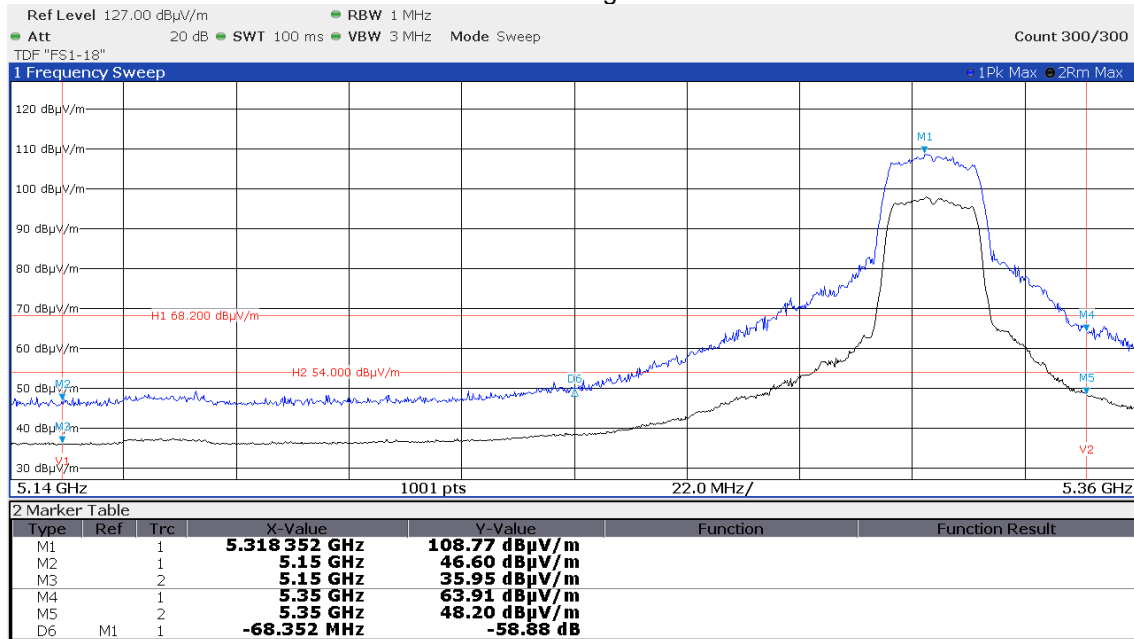
The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: 2AHES-M2

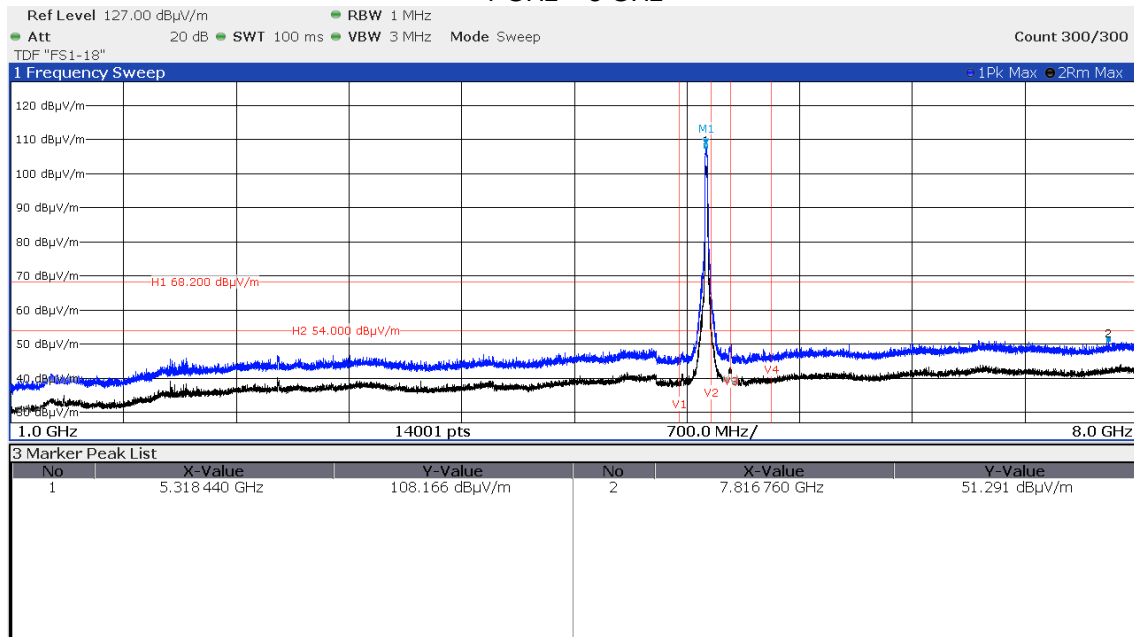
IC ID: 21152-M2

CH64, 802.11n HT20:

Band Edges



1 GHz – 8 GHz

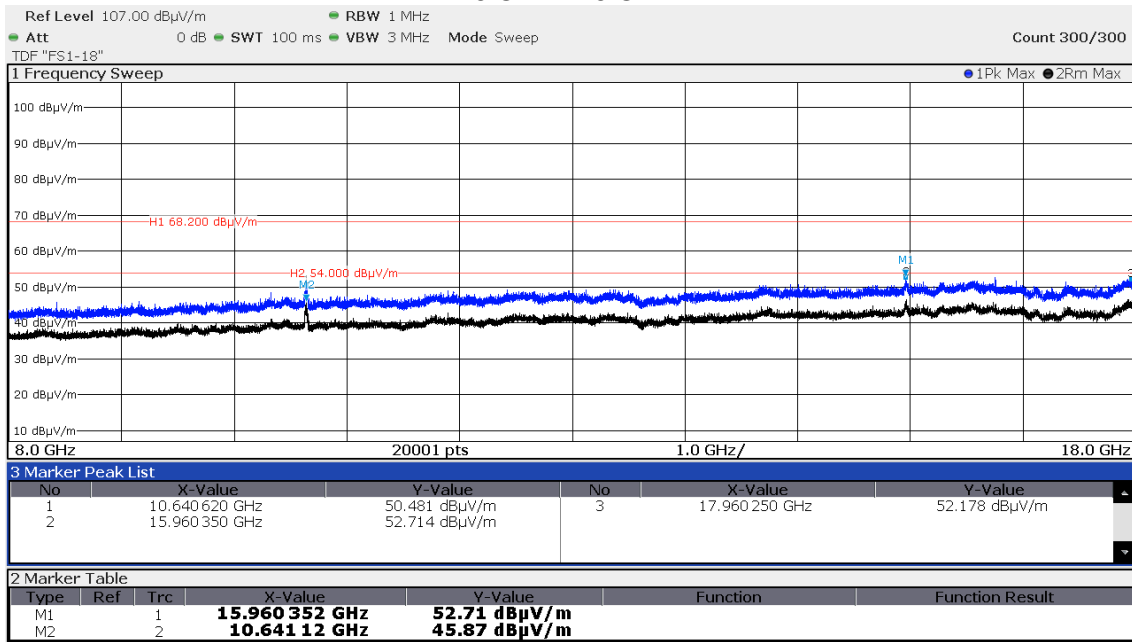


The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

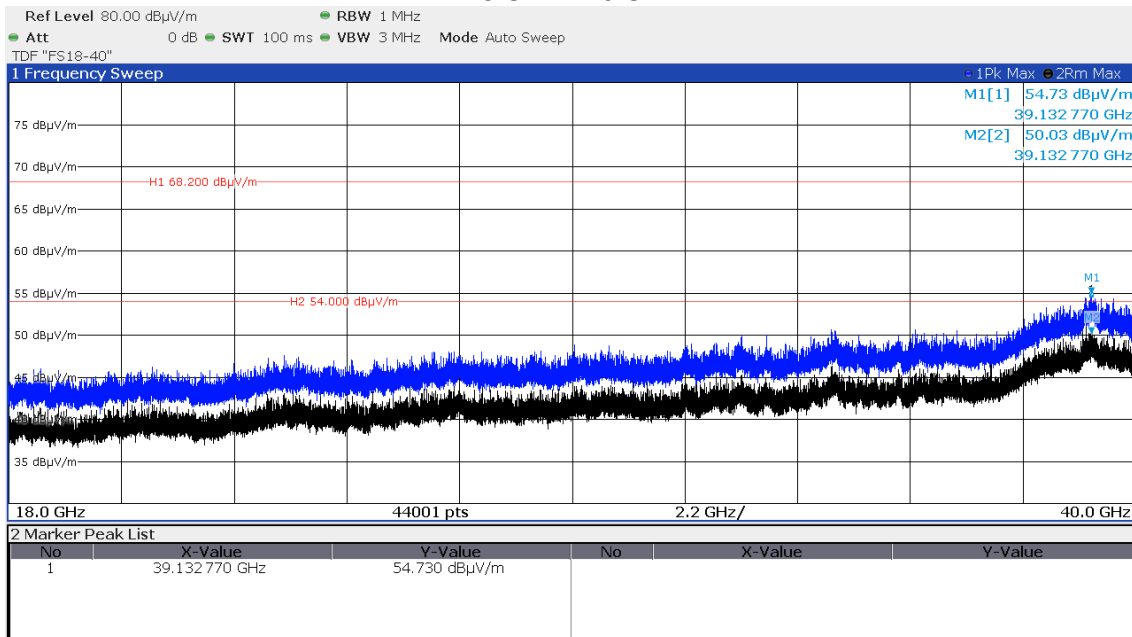
FCC ID: 2AHES-M2

IC ID: 21152-M2

8 GHz – 18 GHz



18 GHz – 40 GHz



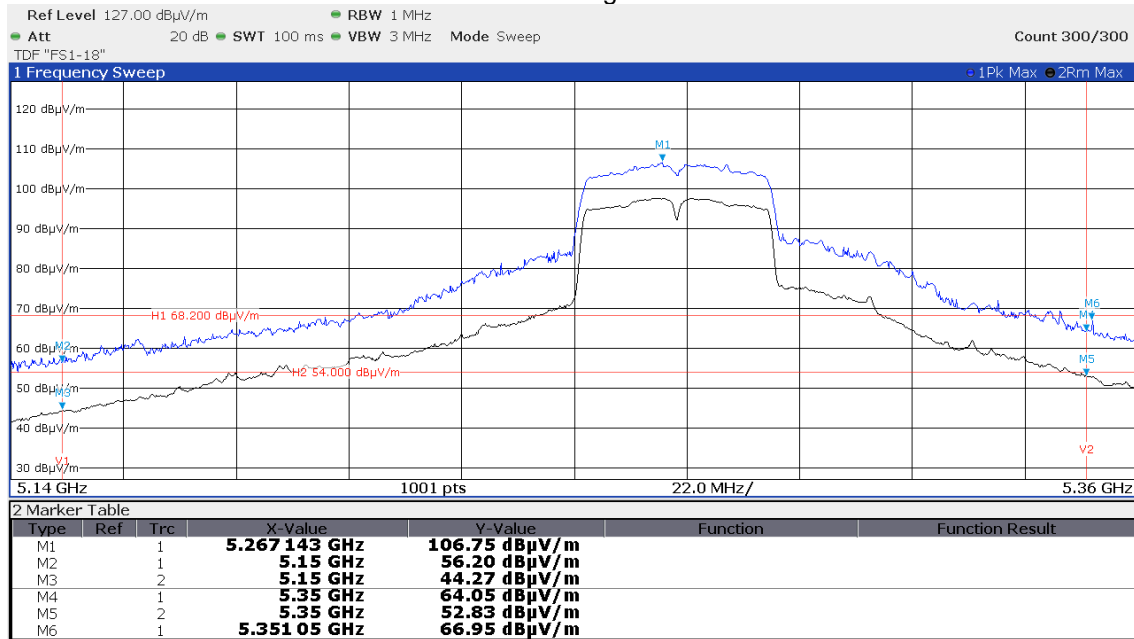
The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: 2AHES-M2

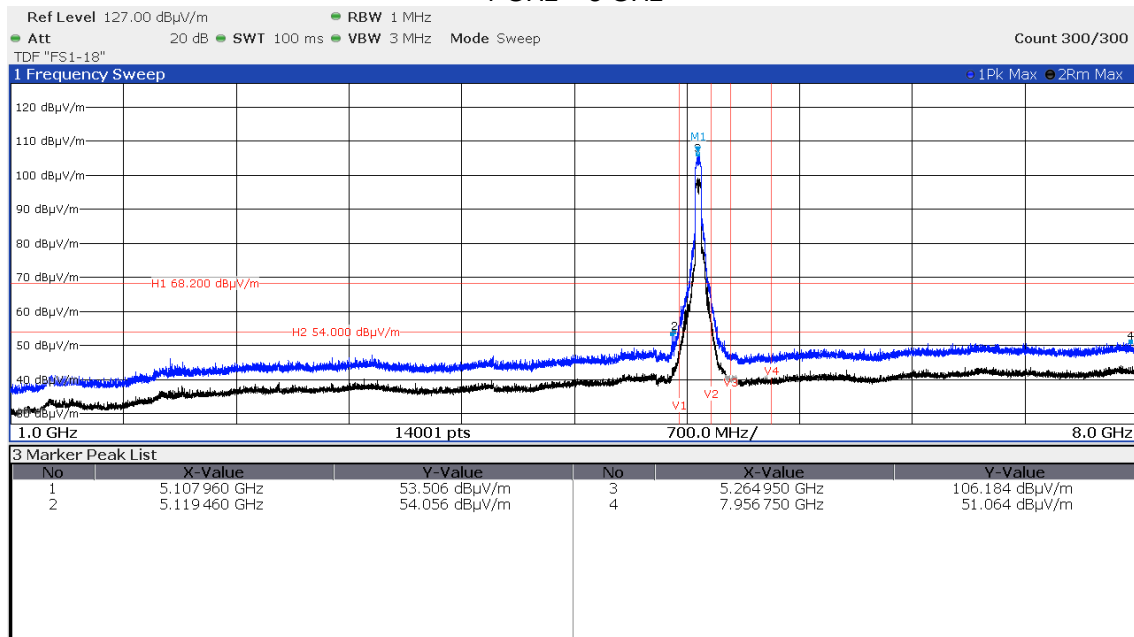
IC ID: 21152-M2

CH54, 802.11n HT40:

Band Edges



1 GHz – 8 GHz

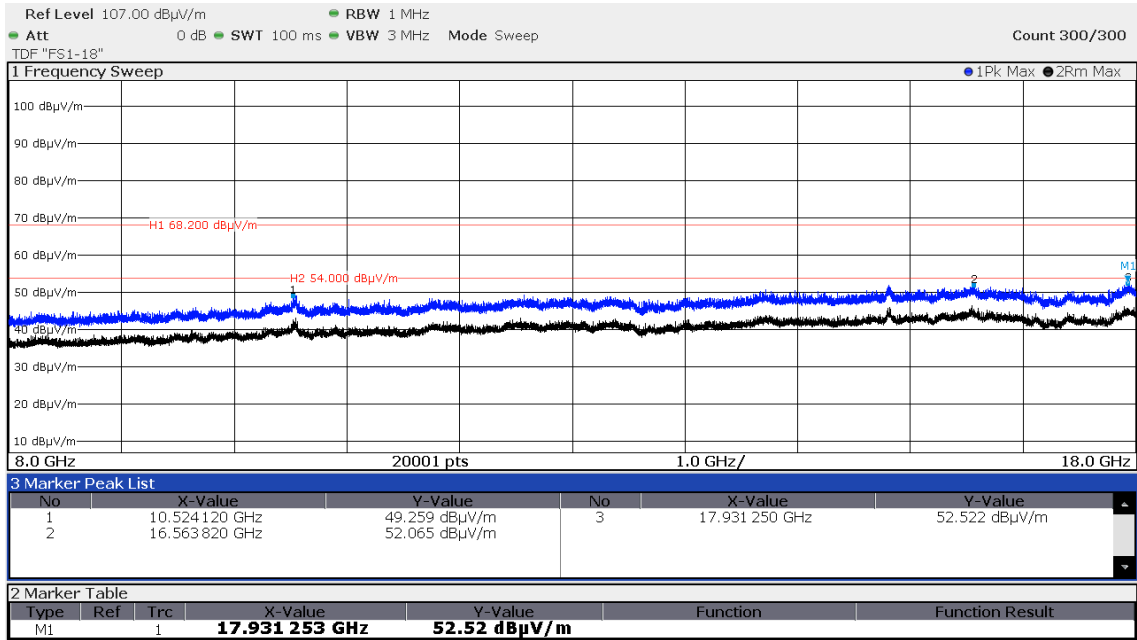


The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

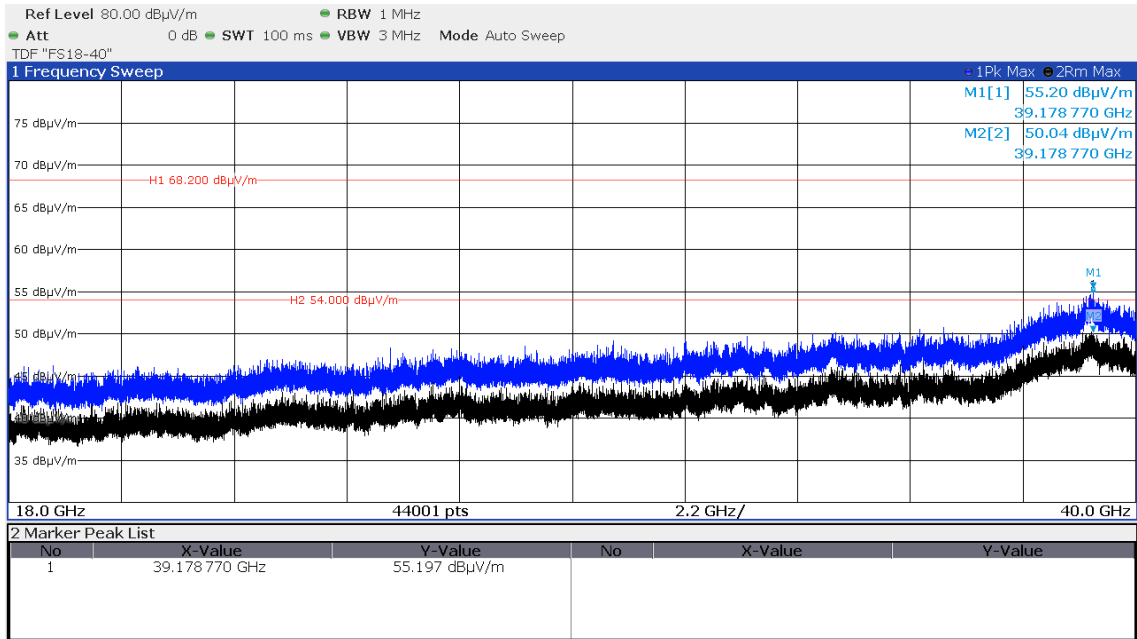
FCC ID: 2AHES-M2

IC ID: 21152-M2

8 GHz – 18 GHz



18 GHz – 40 GHz



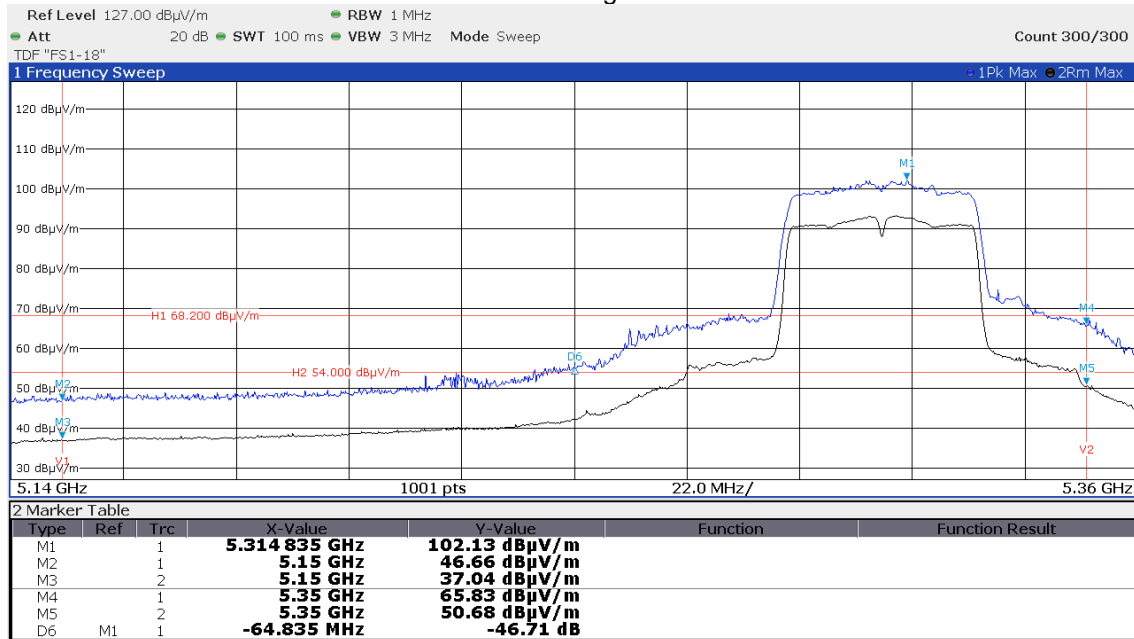
The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: 2AHES-M2

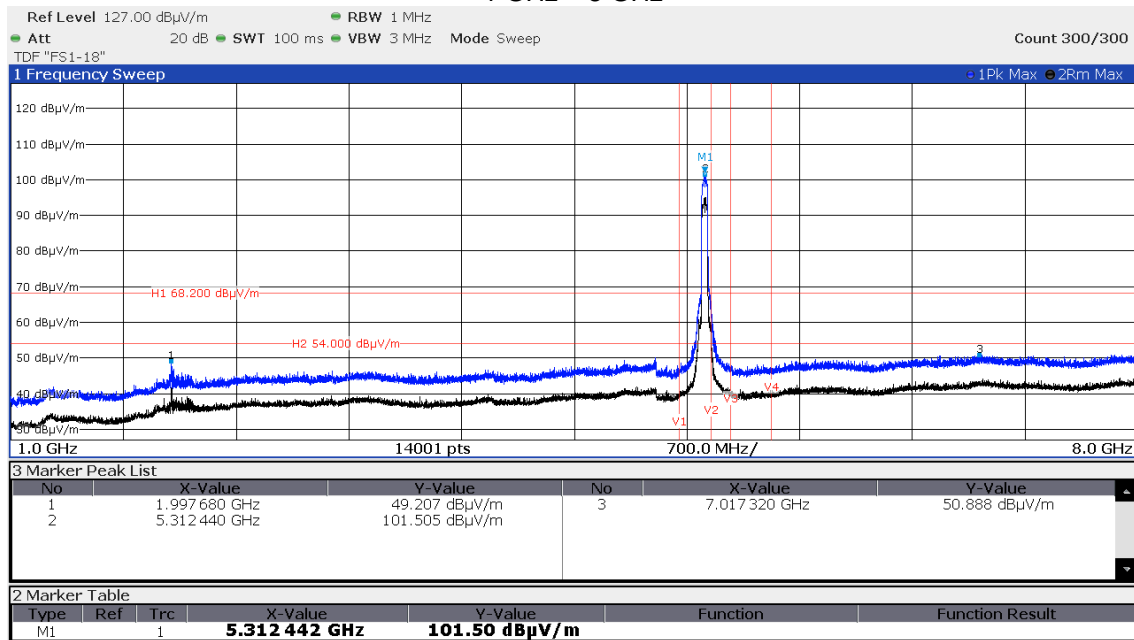
IC ID: 21152-M2

CH62, 802.11n HT40:

Band Edges



1 GHz – 8 GHz

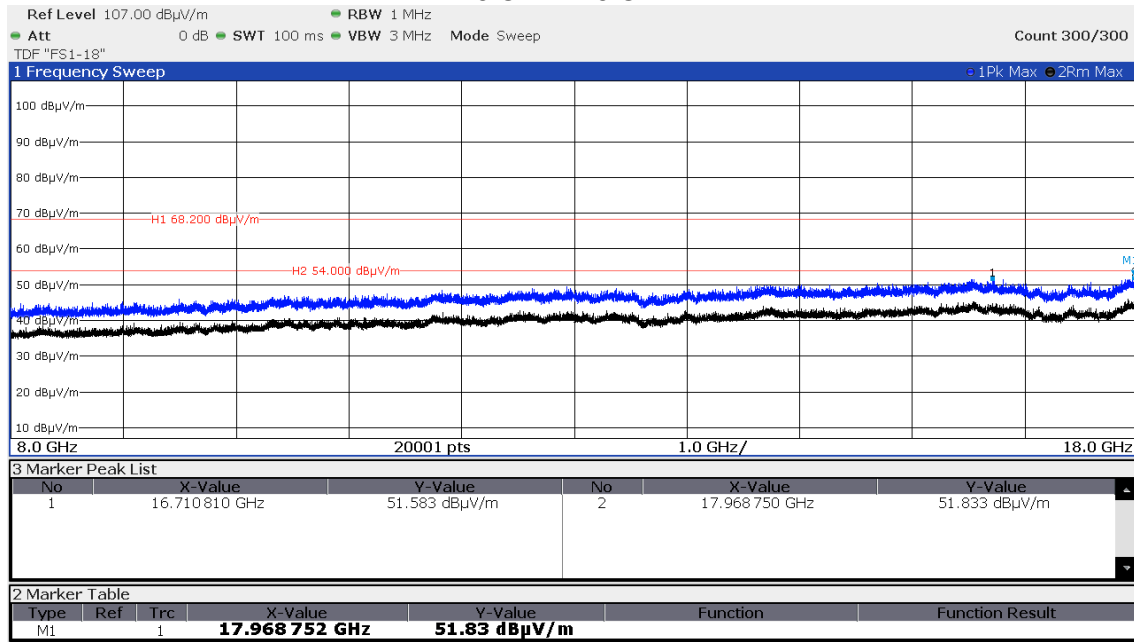


The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

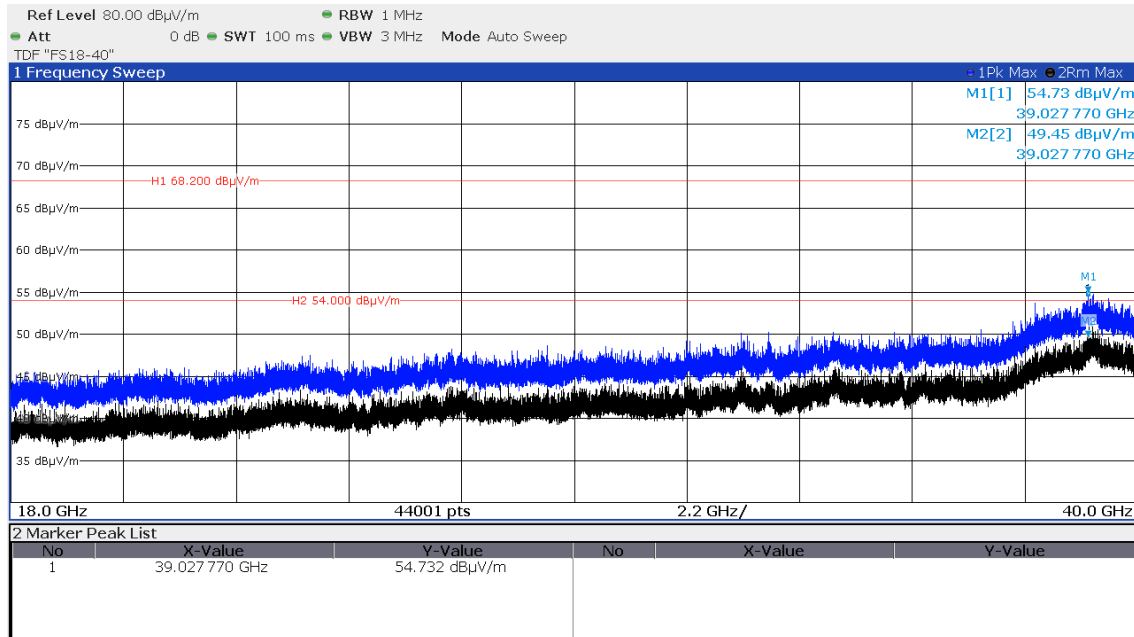
FCC ID: 2AHES-M2

IC ID: 21152-M2

8 GHz – 18 GHz



18 GHz – 40 GHz



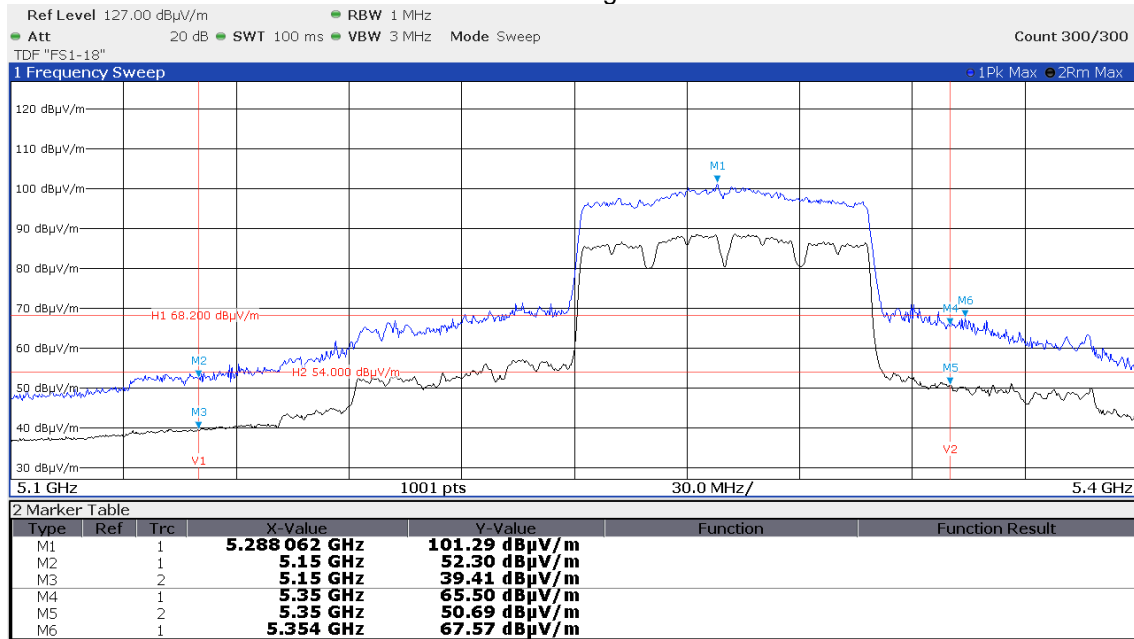
The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: 2AHES-M2

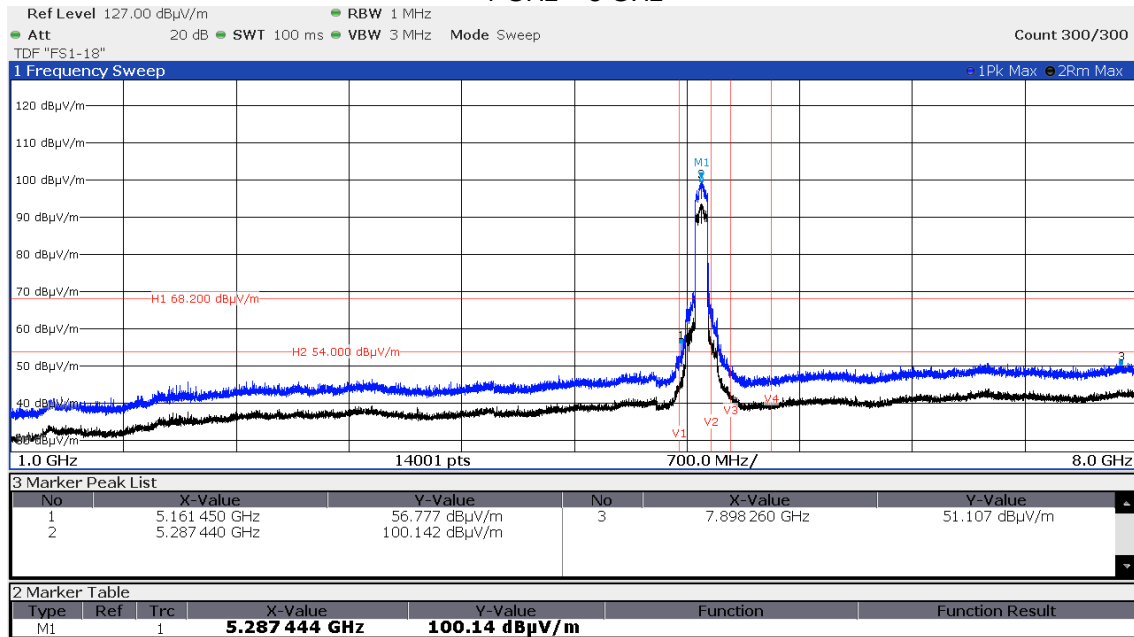
IC ID: 21152-M2

CH58, 802.11ac VHT80:

Band Edges



1 GHz – 8 GHz

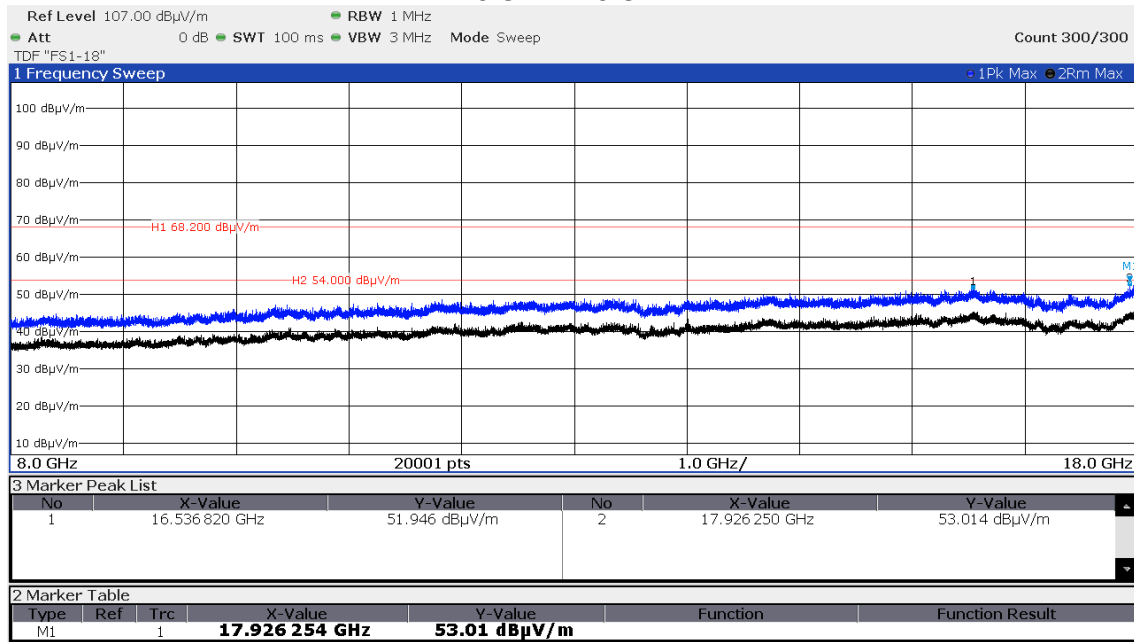


The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

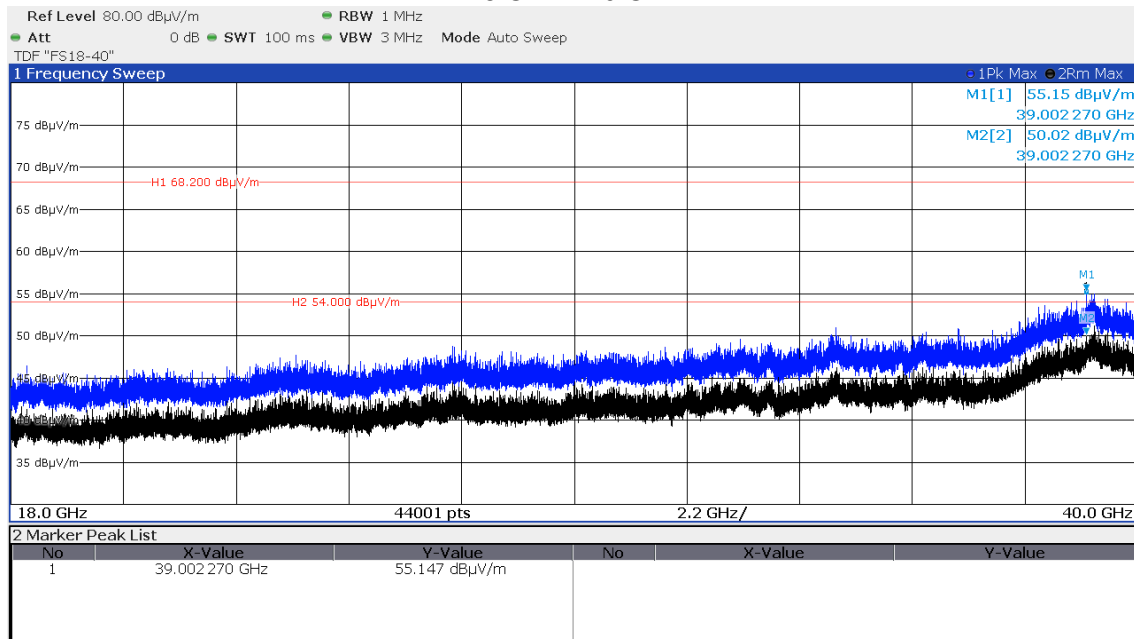
FCC ID: 2AHES-M2

IC ID: 21152-M2

8 GHz – 18 GHz



18 GHz – 40 GHz



Limit according to FCC Part 15E, Section 15.407(b)(2) for undesirable emissions:

Operating Frequency range	Limit Peak, EIRP	Limit Peak	Limit RMS
MHz	dBm/MHz	dB(µV/m)	dB(µV/m)
5250 – 5350	-27.0	68.2	54

FCC ID: 2AHES-M2

IC ID: 21152-M2

Limits according to FCC Part 15C, Section 15.209(a):

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 FCC Part 15C, Section 15.205:

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

Restricted frequency bands RSS-Gen, Table 6:

MHz	MHz	MHz	GHz
0.090 - 0.110	12.57675 - 12.57725	399.9 - 410	7.250 - 7.750
0.495 - 0.505	13.36 - 13.41	608 - 614	8.025 – 8.500
2.1735 - 2.1905	16.42 - 16.423	960 - 1427	9.0 - 9.2
3.020 - 3.026	16.69475 - 16.69525	1435 - 1626.5	9.3 - 9.5
4.125 - 4.128	16.80425 - 16.80475	1645.5 - 1646.5	10.6 - 12.7
4.17725 - 4.17775	25.5 - 25.67	1660 - 1710	13.25 - 13.4
4.20725 - 4.20775	37.5 - 38.25	1718.8 - 1722.2	14.47 - 14.5
5.677 - 5.683	73 - 74.6	2200 - 2300	15.35 - 16.2
6.215 - 6.218	74.8 - 75.2	2310 - 2390	17.7 - 21.4
6.26775 - 6.26825	108 - 138	2483.5 - 2500	22.01 - 23.12
6.31175 - 6.31225	149.9 - 150.05	2655 - 2900	23.6 - 24.0
8.291 - 8.294	156.52475 - 156.52525	3260 – 3267	31.2 - 31.8
8.362 - 8.366	156.7 - 156.9	3332 - 3339	36.43 - 36.5
8.37625 - 8.38675	162.0125 - 167.17	3345.8 - 3358	Above 38.6
8.41425 - 8.41475	167.72 - 173.2	3500 - 4400	
12.29 - 12.293	240 – 285	4500 - 5150	
12.51975 - 12.52025	322 - 335.4	5350 - 5460	

The requirements are **FULFILLED**.

Remarks: The measurement was performed from 9 kHz up to 40 GHz. Only the worst case of the plots are listed in horizontal antenna orientation.

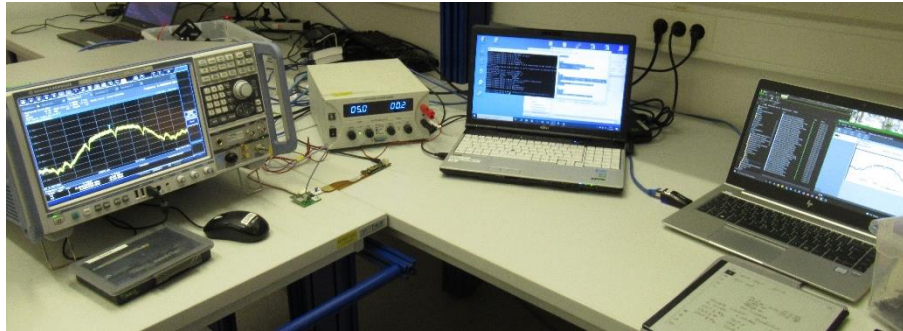
5.6 Frequency stability

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

5.6.1 Description of the test location

Test location: Shielded Room S6

5.6.2 Photo documentation of the test setup



5.6.3 Applicable standard

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

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user’s manual.

5.6.4 Description of Measurement

This test is performed over variations in temperature and voltage. The offset of the signal centre frequency from the nominal channel frequency is measured at one channel in the operating frequency bands under following conditions:

1. Supply voltage from 4.25 V_{DC} to 5.75 V_{DC} at normal temperature.
2. Extreme temperature from -20 °C to 50 °C at nominal voltage.

5.6.5 Test result

Channel	Channel Frequency
	MHz
CH64	5320
Temperature	Frequency Offset
°C	kHz
50	-23.8
40	-32.6
30	-25.1
20	-0.3
10	-0.4
0	15.3
-10	22.7
-20	9.8

Channel	Channel Frequency
	MHz
CH64	5320
Supply Voltage	Frequency Offset
V _{DC}	kHz
4.25	-
5.00	-0.3
5.75	-7.0

Note:

- Frequency offset is constant over time at respective temperatures.
- EUT performs instant restart when TX is started at 4.25 V.

FCC ID: 2AHES-M2

IC ID: 21152-M2

Limit according to FCC Part 15, Section 15.407(g):

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

The requirements are **FULFILLED**.

Remarks:

FCC ID: 2AHES-M2

IC ID: 21152-M2

5.7 Antenna application

5.7.1 Applicable standard

According to FCC Part 15C, Section 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. The manufacturer may design the unit that broken antennas can be replaced by the user, but the use of a standard antenna jack is prohibited.

5.7.2 Antenna requirements

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

The conducted output power limit specified in paragraph (a) of 15.407 is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from intentional radiator shall be reduced below the stated values in paragraph (a)(1), (a)(2) and (a)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds the effective value.

Remarks: No power reduction results using the listed antennas in combination with the mentioned power setting.

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.

FCC ID: 2AHES-M2

IC ID: 21152-M2

6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
A 4	BAT-EMC 3.21.0.24	01-02/68-13-001				
	ESCI	02-02/03-15-001	21/06/2022	21/06/2021		
	ESH 2 - Z 5	02-02/20-05-004	31/10/2022	31/10/2019	19/04/2022	19/10/2021
	N-4000-BNC	02-02/50-05-138				
	ESH 3 - Z 2	02-02/50-05-155	13/11/2022	13/11/2019	12/04/2022	12/10/2021
CPC 3	ESW26 EMI Test Receiver minibend KR-16 EA-PS 3032-05 B	02-02/03-17-002	10/02/2022	10/02/2021		
		02-02/50-16-014				
		02-02/50-20-008				
CPC 3	ESW26 minibend KR-16	02-02/03-17-002 02-02/50-16-017	10/02/2023	10/02/2022		
CPR 3	FSW43 AMF-6D-01002000-22-10P 3117 BAM 4.5-P NCD KK-SF106-2X11N-6,5M EA-PS 3032-05 B 18N-20 BAT-EMC 3.21.0.24	02-02/11-15-001	06/04/2022	06/04/2021		
		02-02/17-15-004				
		02-02/24-05-009	28/06/2022	28/06/2021		
		02-02/50-17-024				
		02-02/50-17-025				
		02-02/50-18-016				
		02-02/50-20-008				
		02-02/50-21-009				
MB	FSW43 Spectrum Analyser WK-340/40 KK-SF104-11SMA-11N-2M minibend KR-16	02-02/11-15-001	06/04/2022	06/04/2021		
		02-02/45-05-001	05/08/2022	05/08/2021		
		02-02/50-14-003				
SER 2	FSP 30 Spectrum Analyser VULB 9168 NW-2000-NB KK-EF393/U-16N-21N20 m KK-SD_7/8-2X21N-33,0M EA-PS 3032-05 B 50F-003 N 3 dB	02-02/11-05-001				
		02-02/24-05-005	20/12/2022	20/12/2021	07/07/2022	07/07/2021
		02-02/50-05-113				
		02-02/50-12-018				
		02-02/50-15-028				
		02-02/50-20-008				
SER 3	FSW43 AMF-6D-01002000-22-10P LNA-40-18004000-33-5P 3117 BBHA 9170 WHKX 7.5/18G-8SS BAM 4.5-P NCD KK-SF106-2X11N-6,5M EA-PS 3032-05 B KMS116-GL140SE-KMS116 BAT-EMC 3.21.0.24	02-02/11-15-001	06/04/2022	06/04/2021		
		02-02/17-15-004				
		02-02/17-20-002				
		02-02/24-05-009	28/06/2022	28/06/2021		
		02-02/24-05-013	19/05/2023	19/05/2020	04/02/2022	04/02/2021
		02-02/50-07-010				
		02-02/50-17-024				
		02-02/50-17-025				
		02-02/50-18-016				
		02-02/50-20-008				
		02-02/50-20-026				
02-02/68-13-001						

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.