



RF - TEST REPORT

- FCC Part 15.407, 5470-5725 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>
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<p>Test Report No. : 80091012-05 Rev_2</p>	<p>06. July 2022 Date of issue</p>
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Deutsche
Akkreditierungsstelle
D-PL-12030-01-03
D-PL-12030-01-04

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ATTACHMENT A as separate supplement

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1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (September 2021)

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 C - Intentional Radiators (September 2021)

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
Part 15, Subpart C, Section 15.212	Modular transmitters

FCC Rules and Regulations Part 15, Subpart E – Unlicensed National Information Infrastructure Devices (September 2021)

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 - 5.85 GHz
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ANSI C63.10: 2013	Testing Unlicensed Wireless Devices
ETSI TR 100 028 V1.3.1: 2001-03	Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Uncertainties in the Measurement of Mobile Radio Equipment Characteristics—Part 1 and Part 2
KDB 789033 D02 v02r01	Guidance for compliance Testing of U-NII devices, December 14, 2017.
KDB 662911 D01 v02r01	Emissions Testing of Transmitters with Multiple Outputs in the Same Band, October 31, 2013

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

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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 5470 MHz to 5725 MHz.

Channel plan:

WLAN Standard
802.11a, n HT20, ac VHT20

Channel	Frequency (MHz)
100	5500
104	5520
108	5540
112	5560
116	5580
120	5600
124	5620
128	5640
132	5660
136	5680
140	5700
144	5720

WLAN Standard
802.11n HT40, ac VHT40

Channel	Frequency (MHz)
102	5510
110	5550
118	5590
126	5630
134	5670
142	5710

WLAN Standard
802.11ac VHT80

Channel	Frequency (MHz)
106	5530
122	5610
138	5690

Note: The red marked channels are not supported by the firmware for ISED.

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

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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}

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: _____

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	100 – 144	100, 116, 140, 144	OFDM	BPSK	MCS7
802.11n HT40	102 – 142	102, 110, 134, 142	OFDM	BPSK	MCS7
802.11ac VHT80	106 – 138	106, 122, 138	OFDM	BPSK	MCS7

Power Settings:

Following power settings for maximum power output were used.

Radiated measurement:

802.11n HT20

Channel	Frequency	Power Setting
	MHz	
100	5500	q62
116	5580	q76
140	5700	q67
144	5720	q62

802.11n HT40

Channel	Frequency	Power Setting
	MHz	
CH102	5510	q52
CH110	5550	q74
CH134	5670	q69
CH142	5710	q71

802.11ac VHT80

Channel	Frequency	Power Setting
	MHz	
CH106	5530	q56
CH122	5610	q74
CH138	5690	q73

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Conducted measurement:

802.11n HT20

Channel	Frequency	Power Setting
	MHz	
100	5500	q56
116	5580	q51
140	5700	q67
144	5720	q54

802.11n HT40

Channel	Frequency	Power Setting
	MHz	
CH102	5510	q52
CH110	5550	q54
CH134	5670	q54
CH142	5710	q56

802.11ac VHT80

Channel	Frequency	Power Setting
	MHz	
CH106	5530	q53
CH122	5610	q51
CH138	5690	q52

2.12.1 Test jig

No test jig is used.

2.12.2 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.

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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3 TEST RESULT SUMMARY

FCC Rule Part	RSS Rule Part	Description	Result
15.407(b)(6)	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, 6.2.3.1	Maximum conducted output power	passed
15.407(a)(2)	RSS-247, 6.2.3.1	Maximum conducted PSD	passed
15.407(b)(3)	RSS-247, 6.2.3.2	Undesirable emissions	passed
15.407(b)(7)	RSS-Gen, 8.10	Emissions in restricted bands	passed
15.407(h)(1)	RSS-247, 6.2.3.1	TPC	not applicable
15.407(a)	RSS-Gen, 6.8	Antenna requirement	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
80091012-05	0	18 January 2022	Initial test report
80091012-05	1	22 February 2022	Added Power evaluation to RSS Limits.
80091012-05	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

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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

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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".

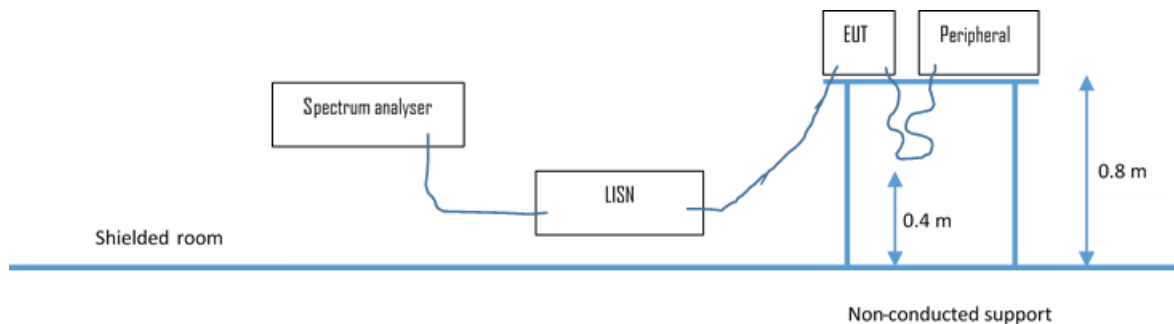
4.5.2.1 Justification

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 dB μ V, is arrived at by taking the reading directly from the Spectrum analyser. This level is compared to the limit.

To convert between dB μ V and μ V, 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 Ω / 50 μ 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.

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.

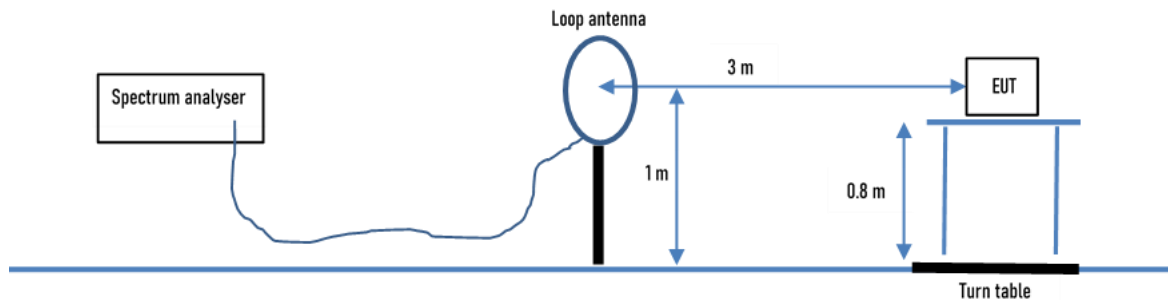
FCC ID: 2AHES-M2

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4.5.3.2 Radiated emission

4.5.3.2.1 OATS1 test site (9 kHz - 30 MHz):

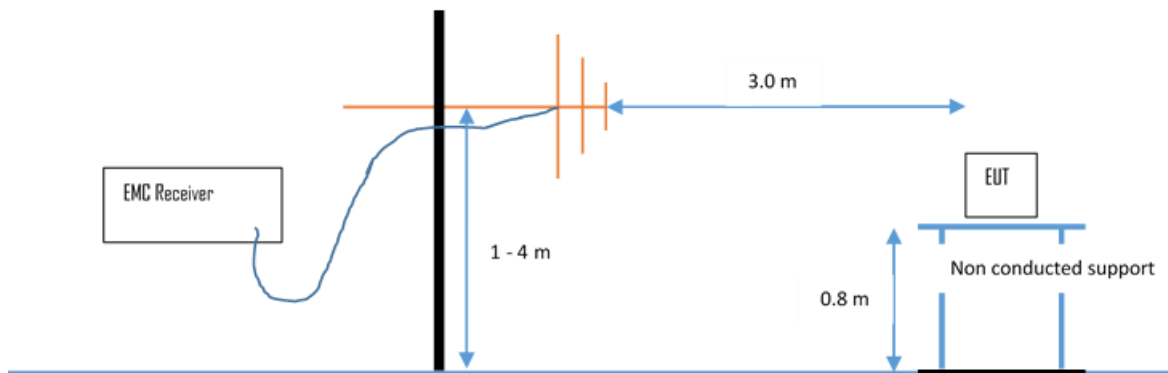
Test setup according ANSI C63.10



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:

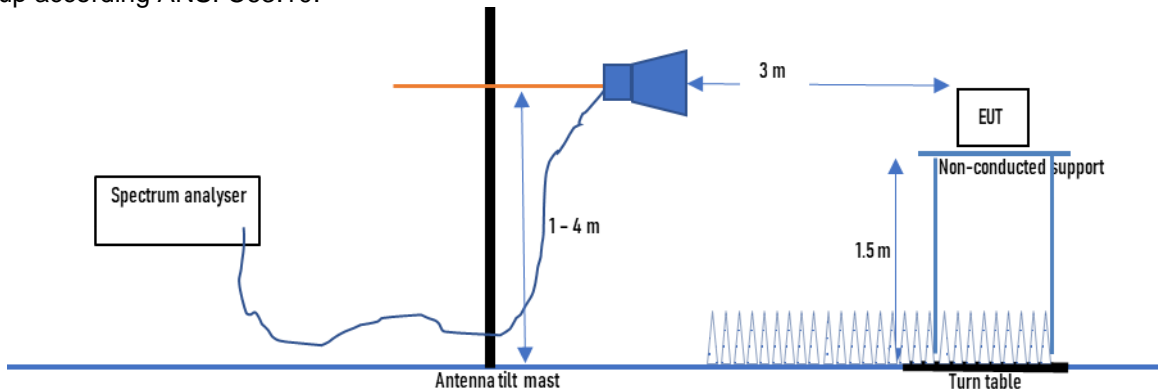
Frequency	Level	+	Factor	=	Level	-	Limit	=	Delta
(MHz)	(dBµV)		(dB)		(dBµV/m)		(dBµV/m)		(dB)
719.0	75.0	+	32.6	=	107.6	-	110.0	=	-2.4

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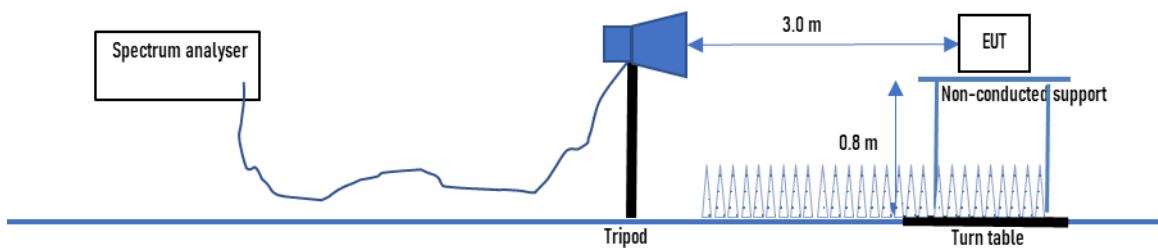
4.5.3.2.3 Anechoic chamber 1 (1000 MHz – 18000 MHz)

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 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.

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5 TEST CONDITIONS AND RESULTS

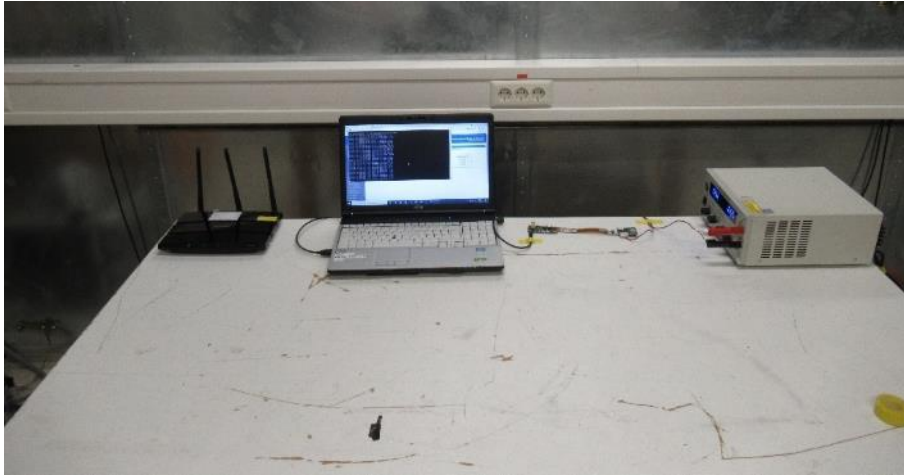
5.1 AC power line conducted emissions

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.

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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.

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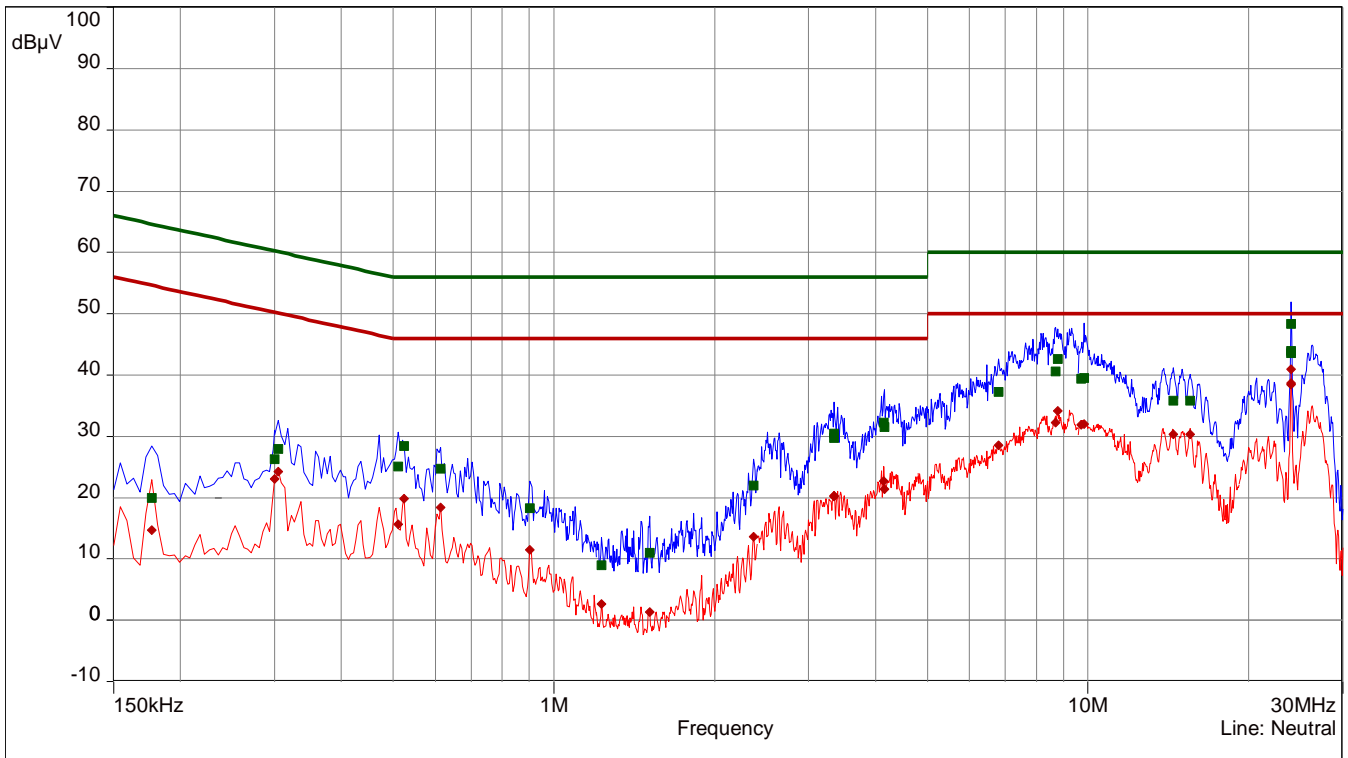
IC ID: 21152-M2

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.

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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.

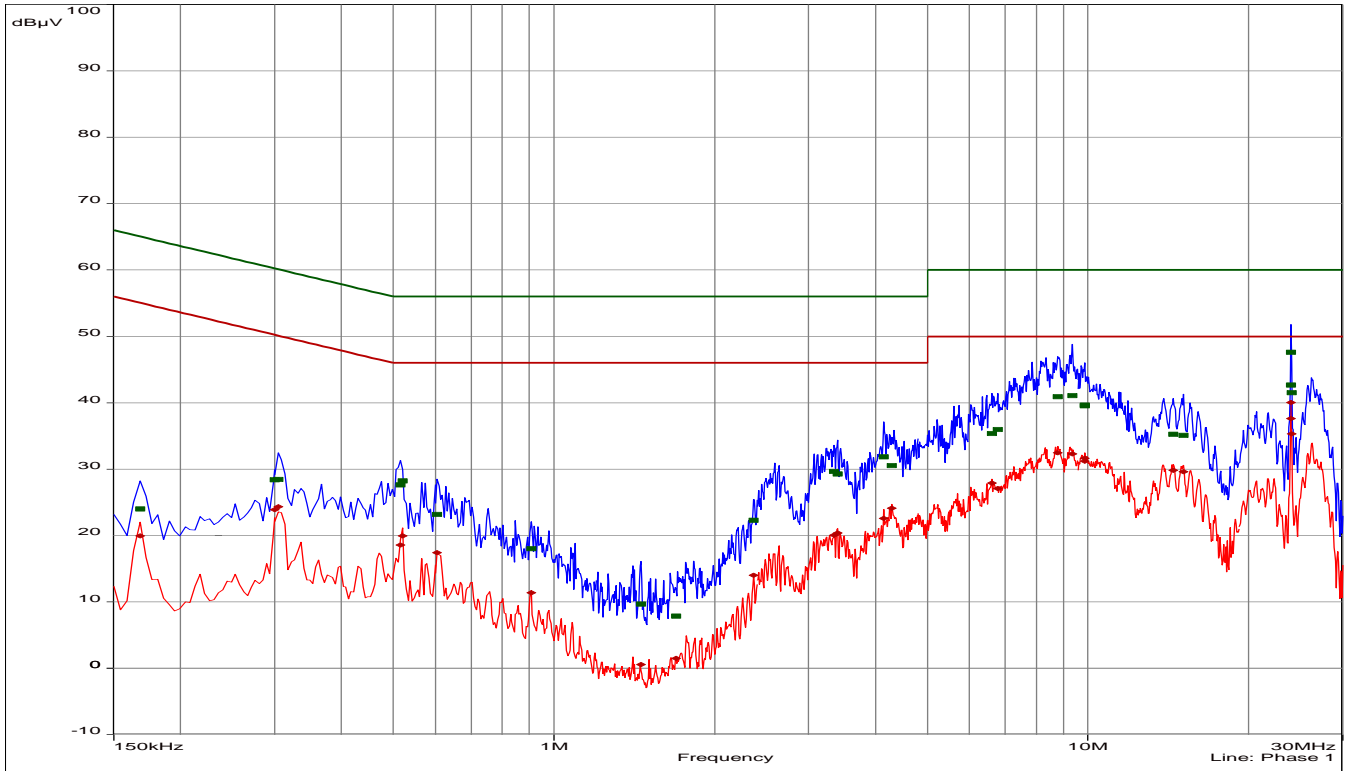
FCC ID: 2AHES-M2

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

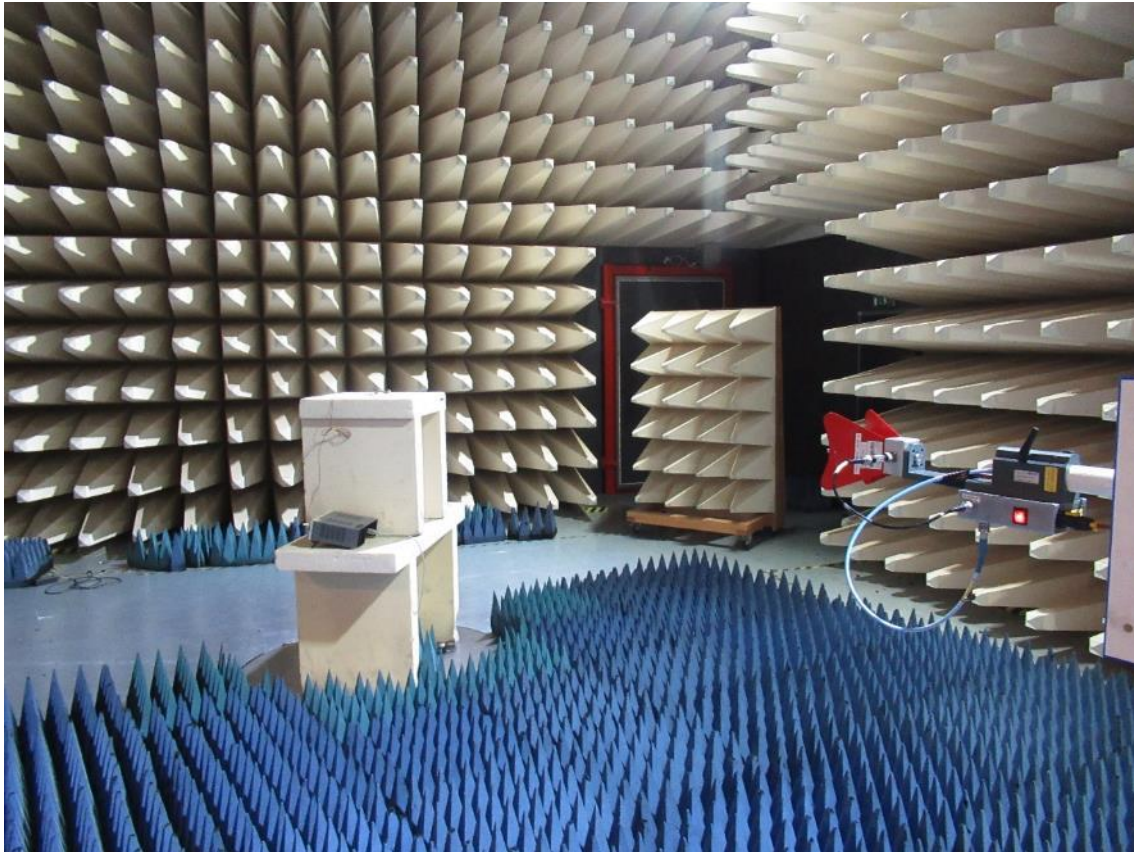
5.2 EBW and OBW

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 $11 \text{ dBm} + 10 \log B$, where B is the 26 dB emission bandwidth in megahertz.

According to RSS-247 6.2.1.1:

The maximum conducted output power shall not exceed 250 mW or $11 + 10 \log_{10} B$, dBm, whichever is less. The maximum e.i.r.p. shall not exceed 1.0 W or $17 + 10 \log_{10} B$, dBm, whichever is less. B is the 99% emission bandwidth in megahertz.

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-2C; FCC §15.407 (a)(2)					
Modulation	Channel	Frequency	EBW	Max. EIRP	Max. Cond. TX-Power
					11 + 10*log(EBW) or 24
		MHz	MHz	dBm	dBm
802.11n, HT20, MCS7	CH100	5500	21.14	30.0	24.0
	CH116	5580	25.93	30.0	24.0
	CH140	5700	21.54	30.0	24.0
	CH144	5720	23.18	30.0	24.0
802.11n, HT40, MCS7	CH102	5510	39.96	30.0	24.0
	CH110	5550	60.66	30.0	24.0
	CH134	5670	49.95	30.0	24.0
	CH142	5710	58.02	30.0	24.0
802.11n, VHT80, MCS7	CH106	5530	80.72	30.0	24.0
	CH122	5610	93.03	30.0	24.0
	CH138	5690	111.41	30.0	24.0

5.2.5.2 Table for RSS

UNII-2C; RSS-247 6.2.3.1					
Modulation	Channel	Frequency	OBW	Max. EIRP	Max. Cond. TX-Power
				17 + 10*log(OBW) or 30	11 + 10*log(OBW) or 24
		MHz	MHz	dBm	dBm
802.11n, HT20, MCS7	CH100	5500	17.79	29.5	23.5
	CH116	5580	18.05	29.6	23.6
	CH140	5700	17.82	29.5	23.5
	CH144	5720	18.01	29.6	23.6
802.11n, HT40, MCS7	CH102	5510	36.46	30.0	24.0
	CH110	5550	37.67	30.0	24.0
	CH134	5670	36.85	30.0	24.0
	CH142	5710	37.59	30.0	24.0
802.11n, VHT80, MCS7	CH106	5530	75.80	30.0	24.0
	CH122	5610	76.55	30.0	24.0
	CH138	5690	76.61	30.0	24.0

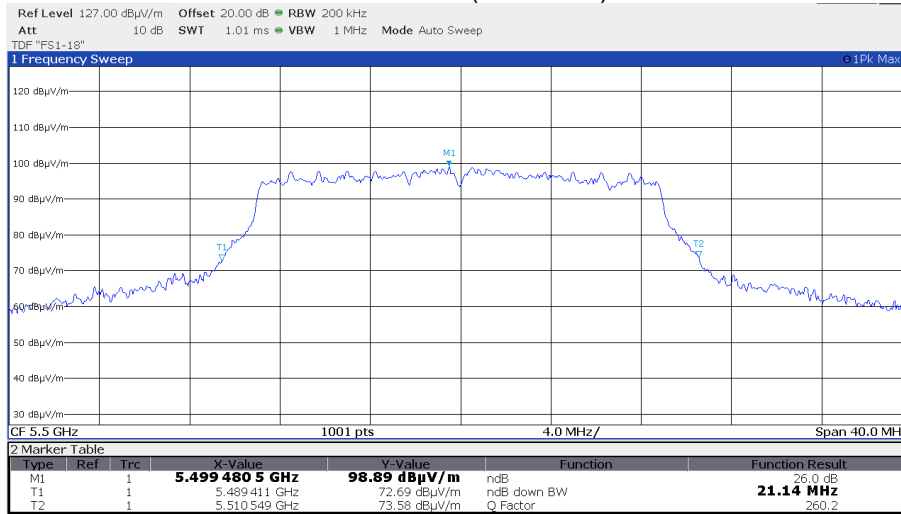
Remarks: For detailed test results please see the following test protocols. No limit is defined for EBW and OBW.

FCC ID: 2AHES-M2

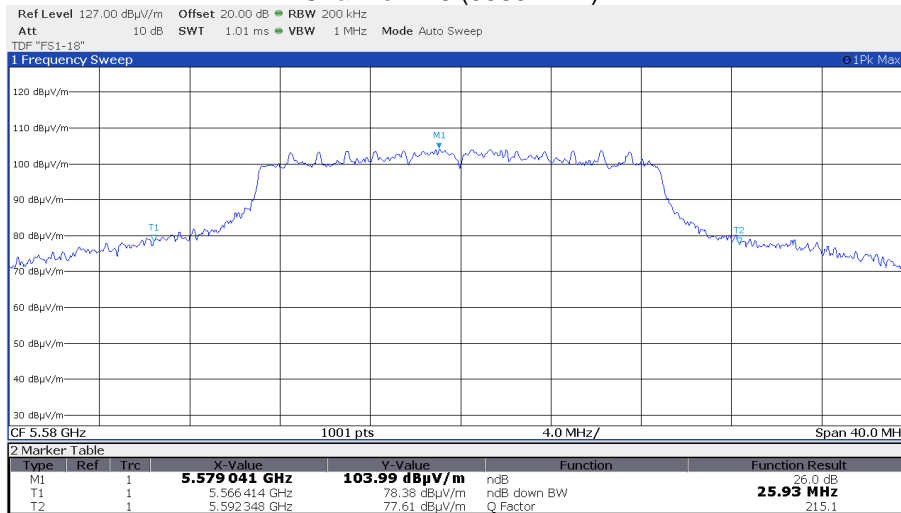
IC ID: 21152-M2

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

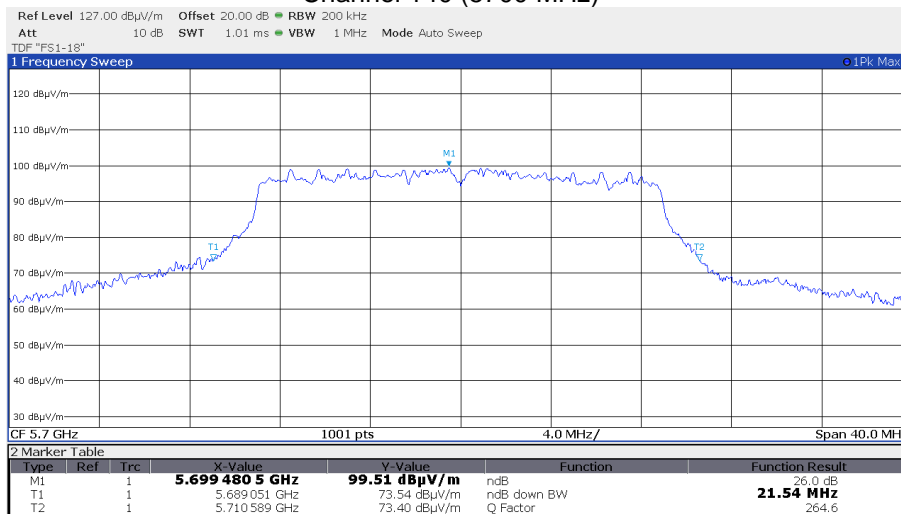
Channel 100 (5500 MHz)



Channel 116 (5580 MHz)



Channel 140 (5700 MHz)

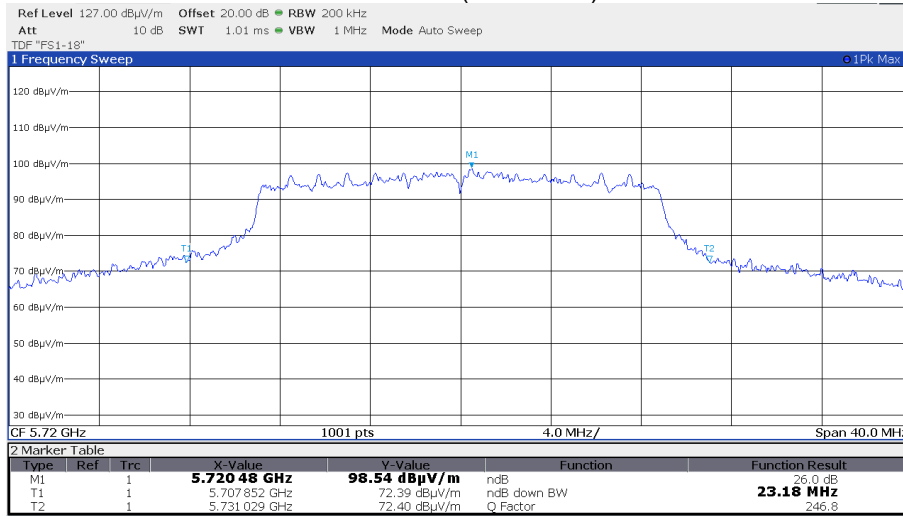


The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: 2AHES-M2

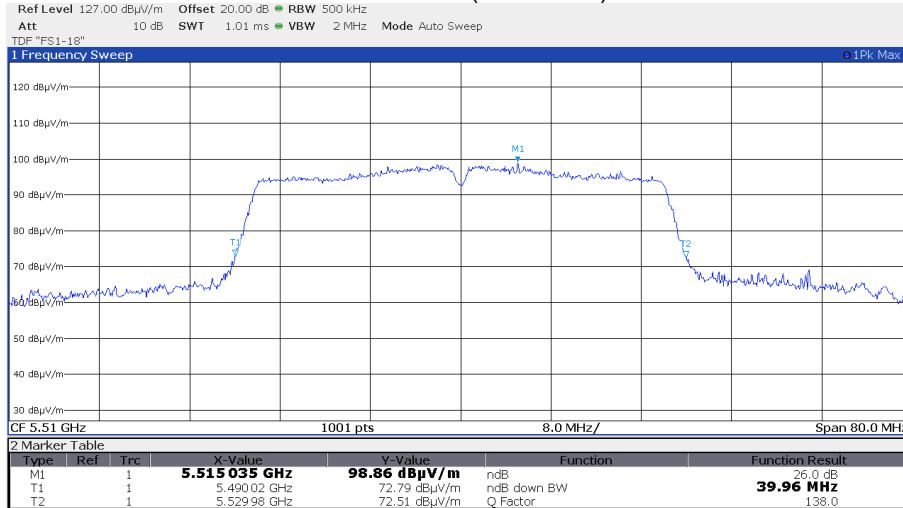
IC ID: 21152-M2

Channel 144 (5720 MHz)

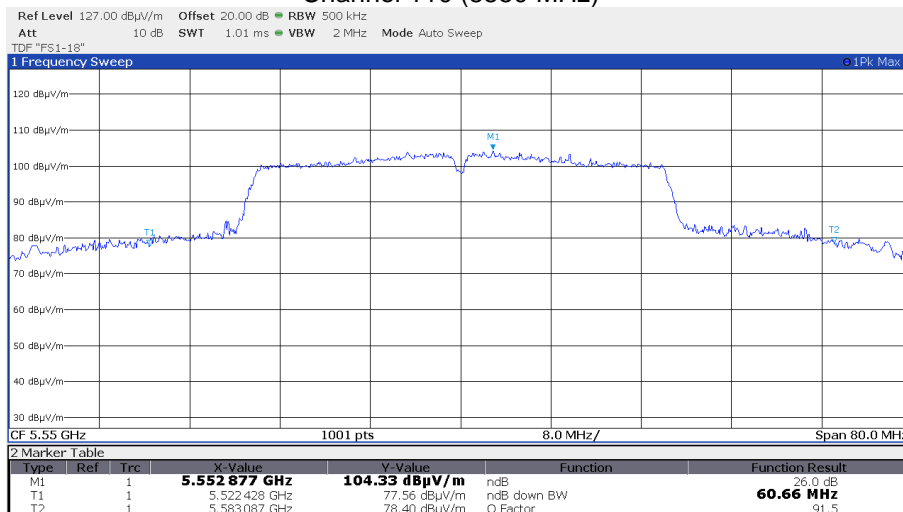


802.11n HT40:

Channel 102 (5510 MHz)



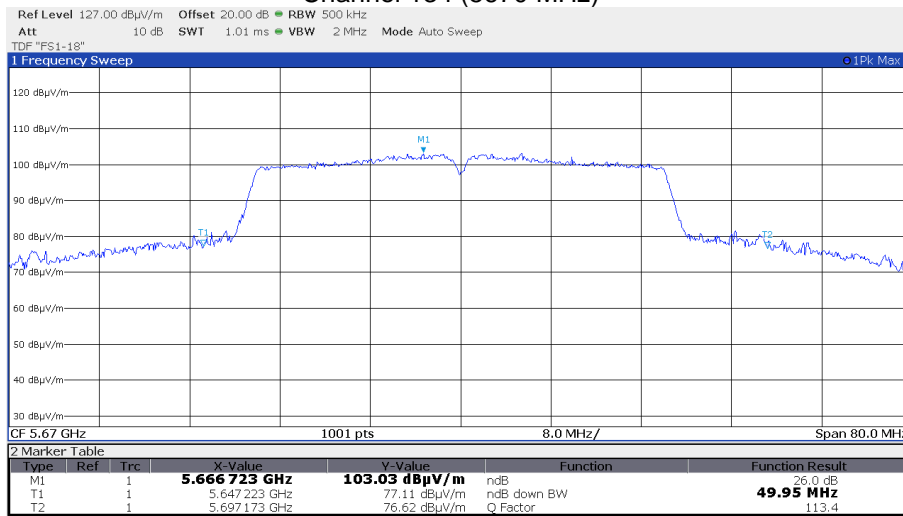
Channel 110 (5550 MHz)



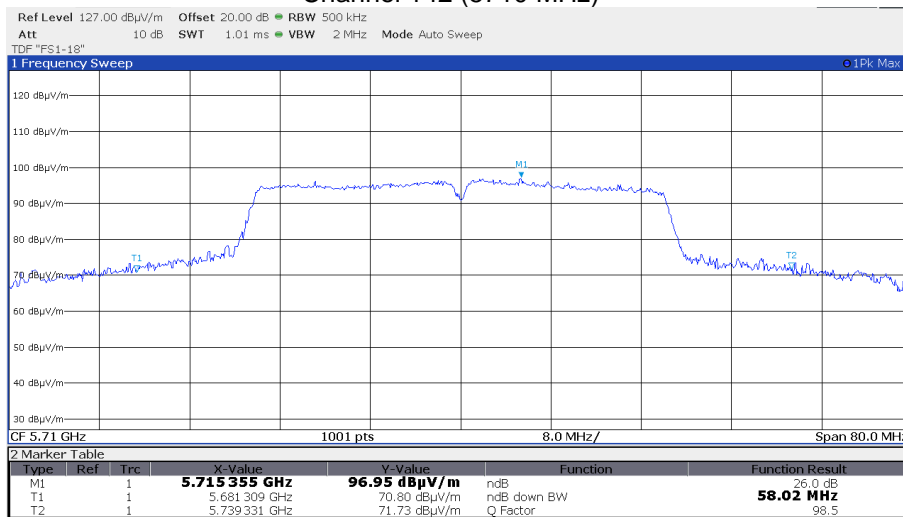
FCC ID: 2AHES-M2

IC ID: 21152-M2

Channel 134 (5670 MHz)

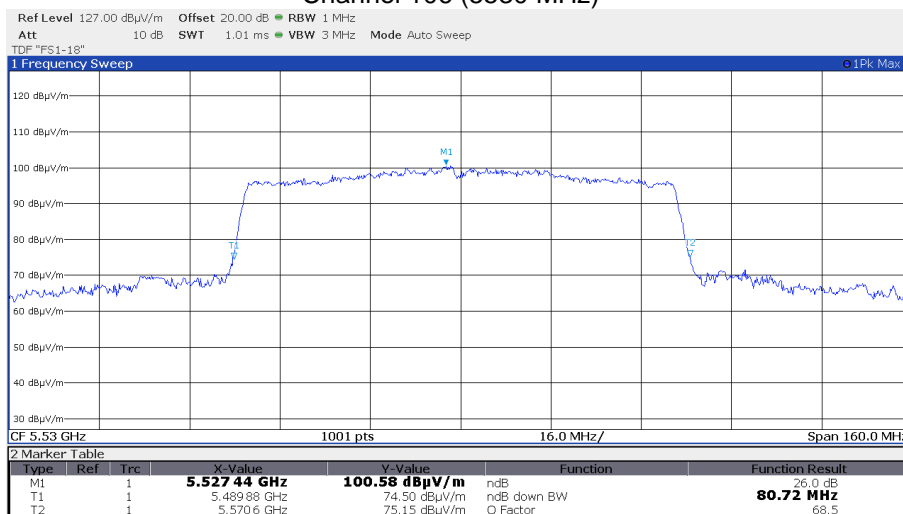


Channel 142 (5710 MHz)



802.11ac VHT80:

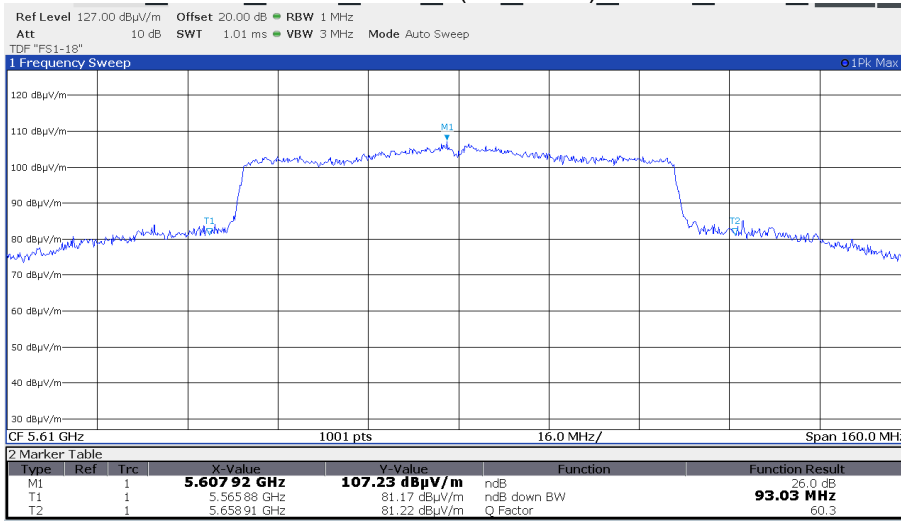
Channel 106 (5530 MHz)



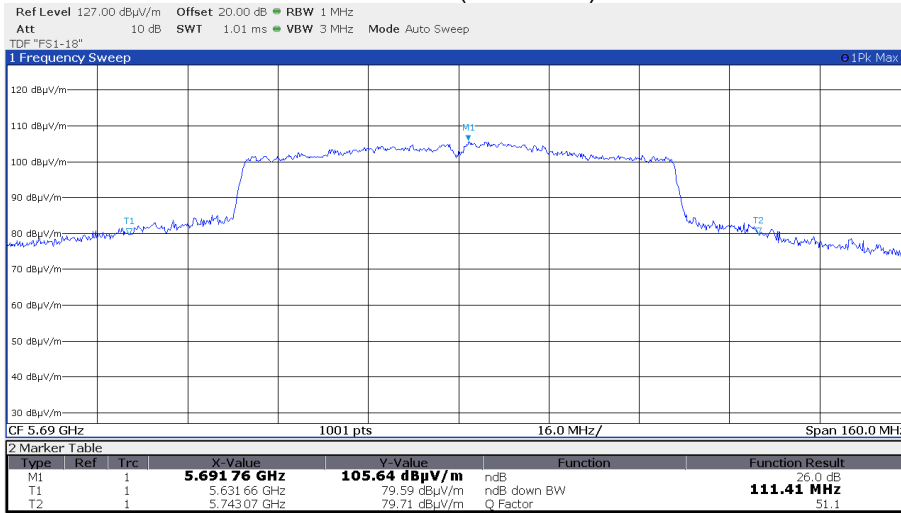
FCC ID: 2AHES-M2

IC ID: 21152-M2

Channel 122 (5610 MHz)



Channel 138 (5690 MHz)



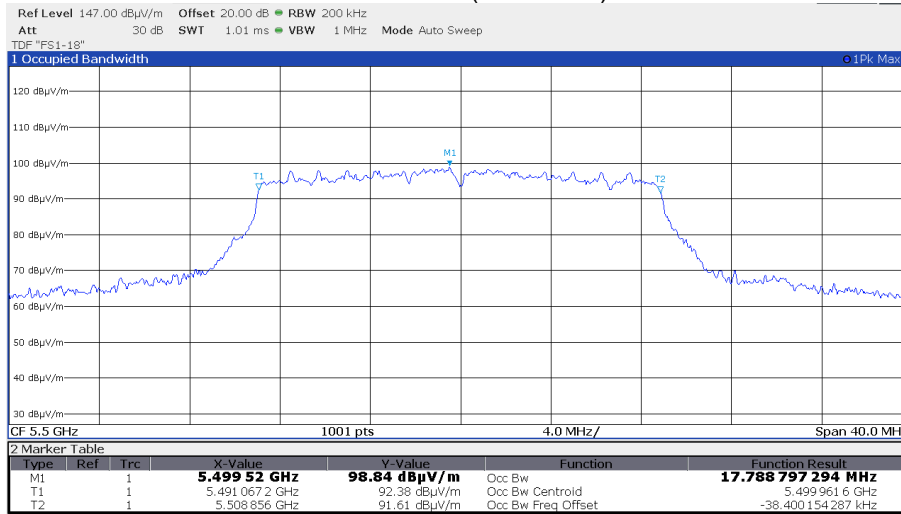
The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: 2AHES-M2

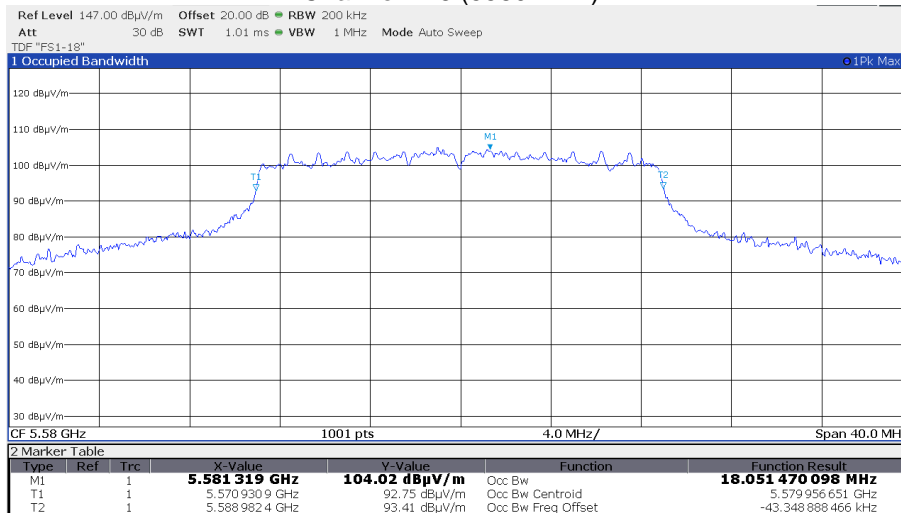
IC ID: 21152-M2

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

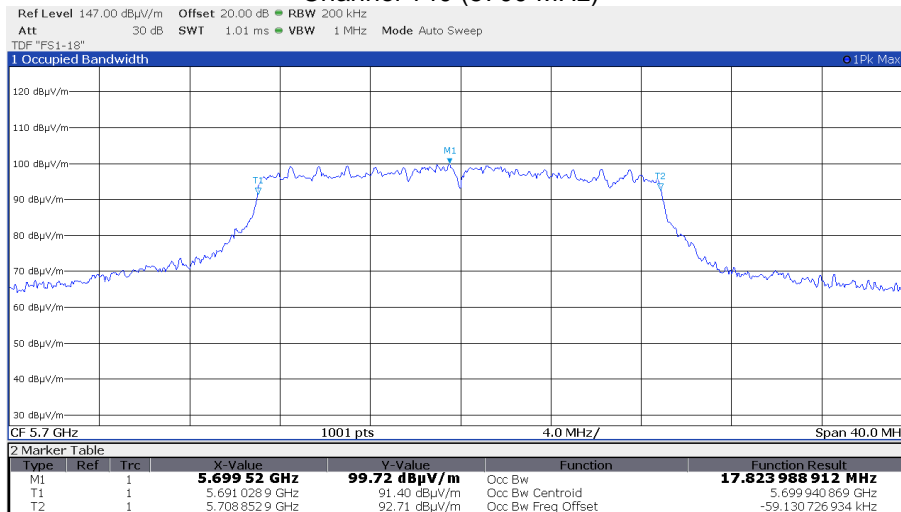
Channel 100 (5500 MHz)



Channel 116 (5580 MHz)



Channel 140 (5700 MHz)

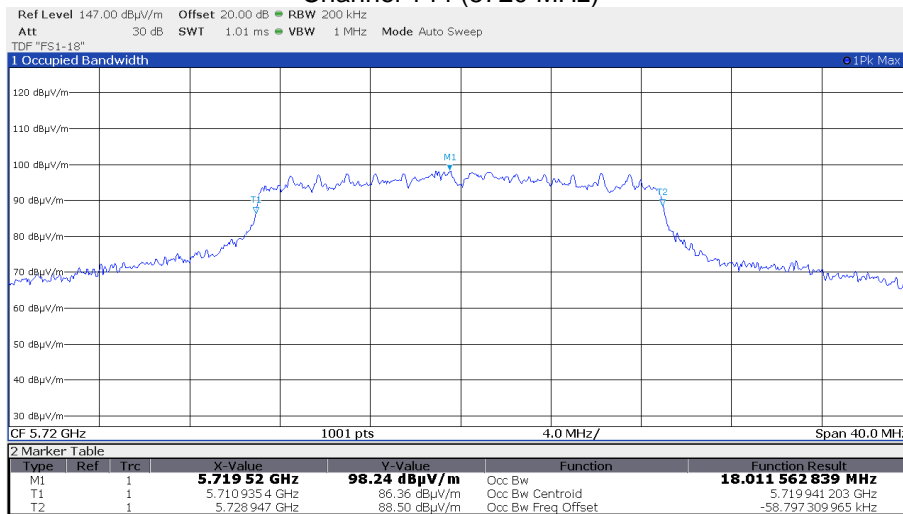


The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: 2AHES-M2

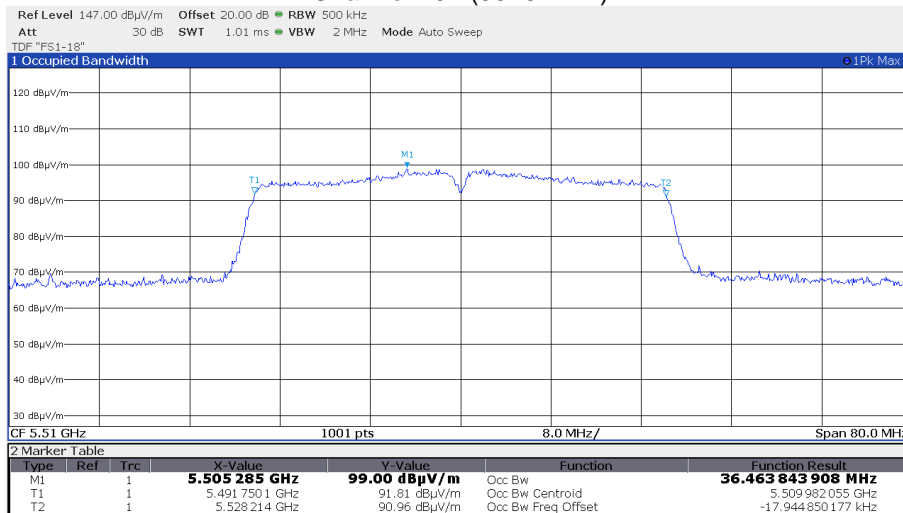
IC ID: 21152-M2

Channel 144 (5720 MHz)

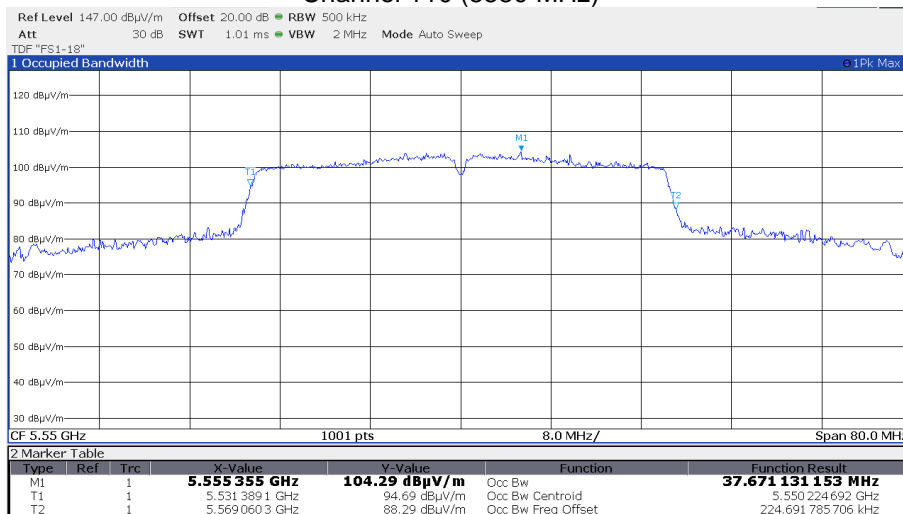


802.11n HT40:

Channel 102 (5510 MHz)



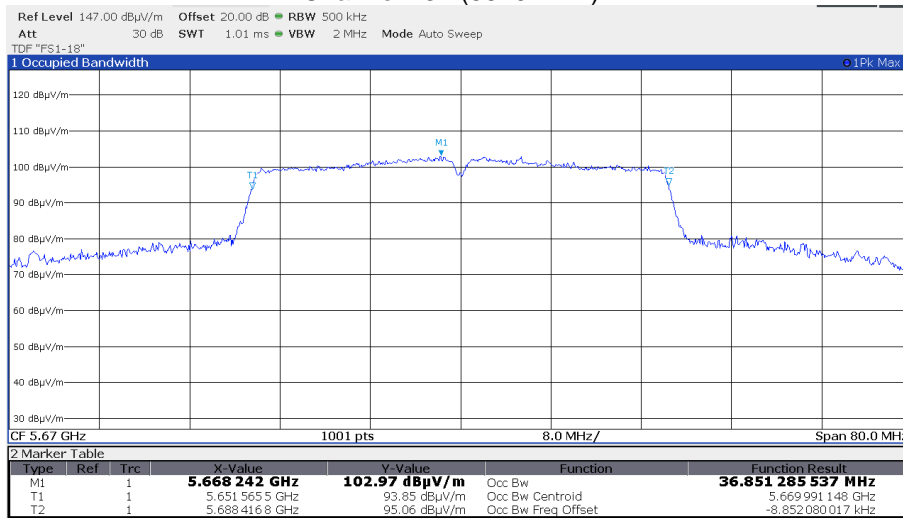
Channel 110 (5550 MHz)



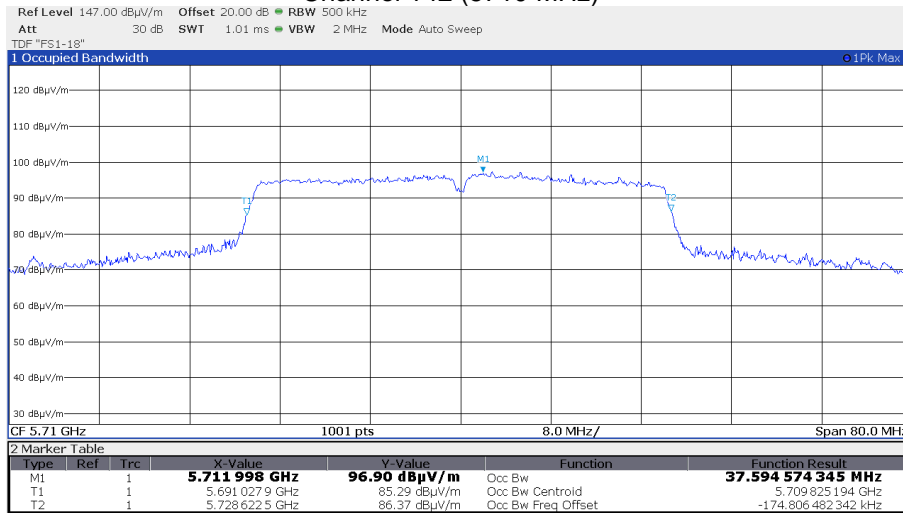
FCC ID: 2AHES-M2

IC ID: 21152-M2

Channel 134 (5670 MHz)

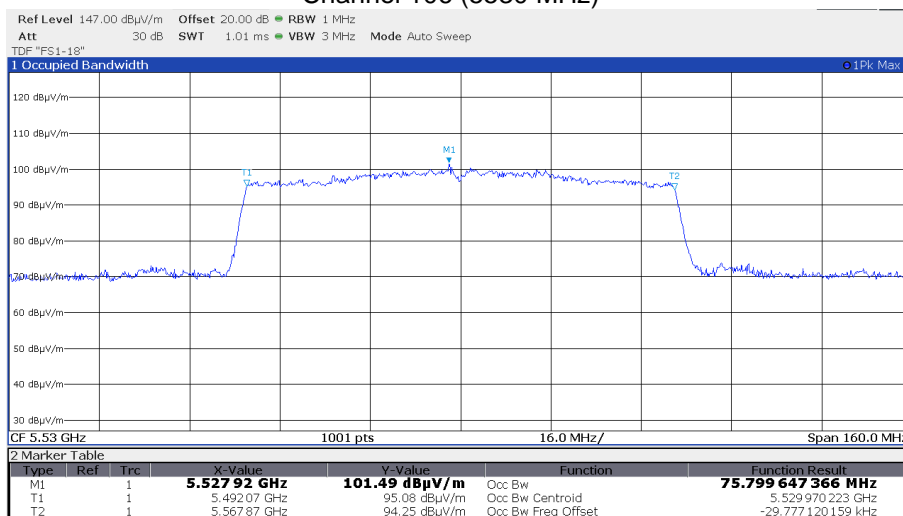


Channel 142 (5710 MHz)



802.11ac VHT80:

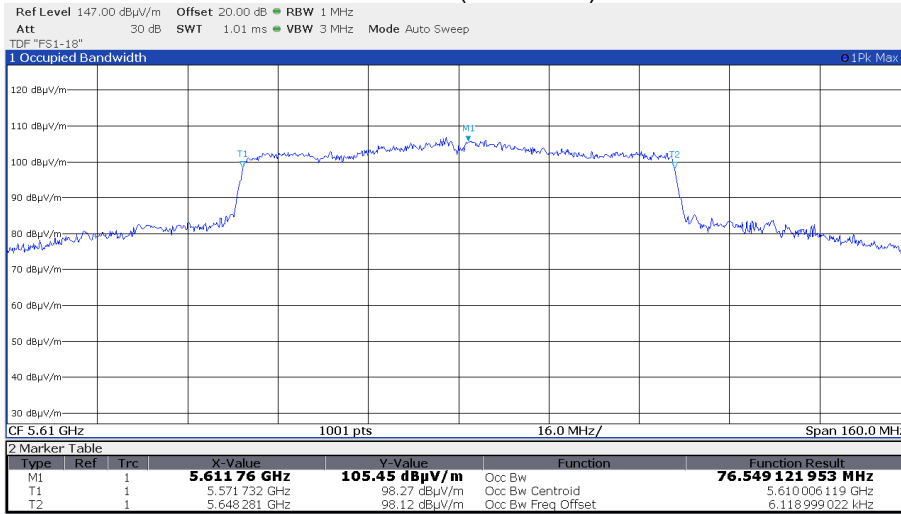
Channel 106 (5530 MHz)



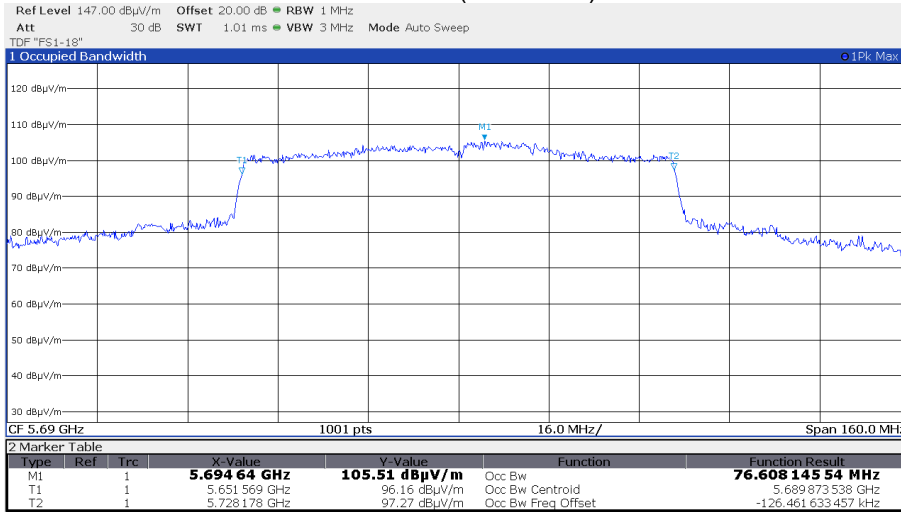
FCC ID: 2AHES-M2

IC ID: 21152-M2

Channel 122 (5610 MHz)



Channel 138 (5690 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

5.3 Maximum conducted output power

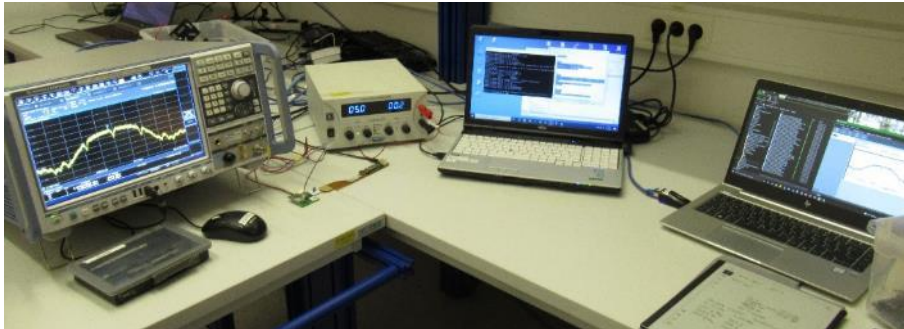
For test instruments and accessories used see section 6 Part **CPC 3**.

5.3.1 Description of the test location

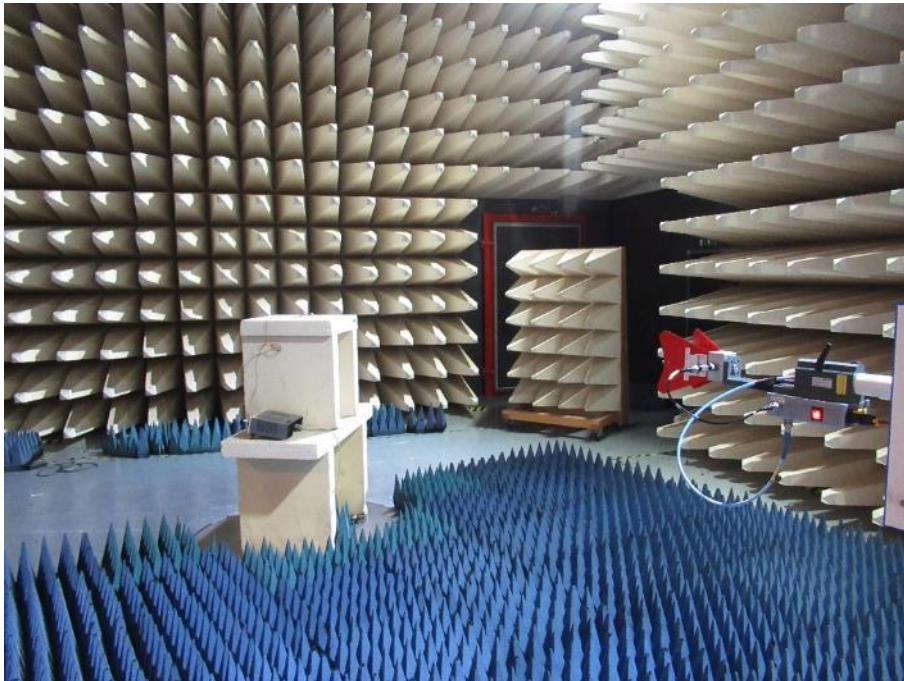
Test location: Shielded Room S6
 Test location: Anechoic chamber 1
 Test distance: 3 m

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 6.2.1.1:

The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. 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

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

5.3.5 Test result

5.3.5.1 Tables for FCC

Radiated Measurement with maximum power setting						
UNII-2C; 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	CH100	5500	108.11	12.9	30	-17.1
	CH116	5580	113.74	18.5	30	-11.5
	CH140	5700	109.13	13.9	30	-16.1
	CH144	5720	106.38	11.2	30	-18.8
n HT40, MCS7	CH102	5510	109.11	13.9	30	-16.1
	CH110	5550	114.42	19.2	30	-10.8
	CH134	5670	111.80	16.6	30	-13.4
	CH142	5710	105.97	10.8	30	-19.2
ac VHT80, MCS7	CH106	5530	108.21	13.0	30	-17.0
	CH122	5610	114.88	19.7	30	-10.3
	CH138	5690	113.74	18.5	30	-11.5

Conducted Measurement with maximum power setting					
UNII-2C; FCC §15.407 (a)(2)					
Modulation	Channel	Frequency	Measured Conducted TX Power	Conducted Tx-Power Limit	Margin
		MHz	dBm	dBm	dB
n HT20, MCS7	CH100	5500	12.2	24.0	-11.8
	CH116	5580	12.1	24.0	-11.9
	CH140	5700	12.0	24.0	-12.0
	CH144	5720	12.2	24.0	-11.8
n HT40, MCS7	CH102	5510	11.7	24.0	-12.3
	CH110	5550	12.6	24.0	-11.4
	CH134	5670	12.5	24.0	-11.5
	CH142	5710	12.6	24.0	-11.4
ac VHT80, MCS7	CH106	5530	12.7	24.0	-11.3
	CH122	5610	12.7	24.0	-11.3
	CH138	5690	12.7	24.0	-11.3

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 final power setting					
UNII-2C; FCC §15.407 (a)(2)					
Modulation	Channel	Frequency	Measured Conducted TX Power	Conducted Tx-Power Limit	Margin
		MHz	dBm	dBm	dB
n HT20	CH100	5500	8.9	24.0	-15.1
	CH116	5580	9.3	24.0	-14.7
	CH140	5700	10.8	24.0	-13.2
	CH144	5720	10.0	24.0	-14.0
n HT40	CH102	5510	9.2	24.0	-14.8
	CH110	5550	10.0	24.0	-14.0
	CH134	5670	10.3	24.0	-13.7
	CH142	5710	10.6	24.0	-13.4
ac VHT80	CH106	5530	8.3	24.0	-15.7
	CH122	5610	8.4	24.0	-15.6
	CH138	5690	8.2	24.0	-15.8

5.3.5.2 Tables for RSS

Radiated Measurement with maximum power setting						
UNII-2C; RSS-247 6.2.3.1						
Modulation	Channel	Frequency	Measured fieldstrength	Calculated EIRP	EIRP Limit	Margin
		MHz	dB(μV/m)	dBm	dBm	dB
n HT20, MCS7	CH100	5500	108.11	12.9	29.5	-16.6
	CH116	5580	113.74	18.5	29.6	-11.0
	CH140	5700	109.13	13.9	29.5	-15.6
	CH144	5720	106.38	11.2	29.6	-18.4
n HT40, MCS7	CH102	5510	109.11	13.9	30.0	-16.1
	CH110	5550	114.42	19.2	30.0	-10.8
	CH134	5670	111.80	16.6	30.0	-13.4
	CH142	5710	105.97	10.8	30.0	-19.2
ac VHT80, MCS7	CH106	5530	108.21	13.0	30.0	-17.0
	CH122	5610	114.88	19.7	30.0	-10.3
	CH138	5690	113.74	18.5	30.0	-11.5

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.

Conducted Measurement with maximum power setting					
UNII-2C; RSS-247 6.2.3.1					
Modulation	Channel	Frequency	Measured Conducted TX Power	Conducted Tx-Power Limit	Margin
		MHz	dBm	dBm	dB
n HT20, MCS7	CH100	5500	12.2	23.5	-11.3
	CH116	5580	12.1	23.6	-11.5
	CH140	5700	12.0	23.5	-11.5
	CH144	5720	12.2	23.6	-11.3
n HT40, MCS7	CH102	5510	11.7	24.0	-12.3
	CH110	5550	12.6	24.0	-11.4
	CH134	5670	12.5	24.0	-11.5
	CH142	5710	12.6	24.0	-11.4
ac VHT80, MCS7	CH106	5530	12.7	24.0	-11.3
	CH122	5610	12.7	24.0	-11.3
	CH138	5690	12.7	24.0	-11.3

Conducted Measurement with final power setting					
UNII-2C; RSS-247 6.2.3.1					
Modulation	Channel	Frequency	Measured Conducted TX Power	Conducted Tx-Power Limit	Margin
		MHz	dBm	dBm	dB
n HT20	CH100	5500	8.9	23.5	-14.6
	CH116	5580	9.3	23.6	-14.2
	CH140	5700	10.8	23.5	-12.7
	CH144	5720	10.0	23.6	-13.6
n HT40	CH102	5510	9.2	24.0	-14.8
	CH110	5550	10.0	24.0	-14.0
	CH134	5670	10.3	24.0	-13.7
	CH142	5710	10.6	24.0	-13.4
ac VHT80	CH106	5530	8.3	24.0	-15.7
	CH122	5610	8.4	24.0	-15.6
	CH138	5690	8.2	24.0	-15.8

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

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 6.2.3.1:

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.

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 Maximum power spectral density

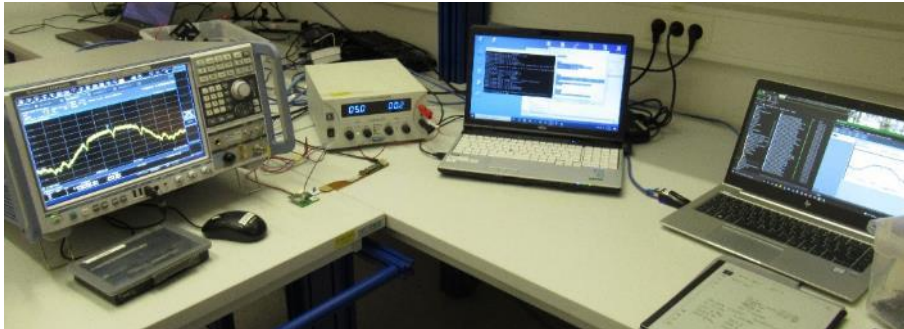
For test instruments and accessories used see section 6 Part **CPC 3**.

5.4.1 Description of the test location

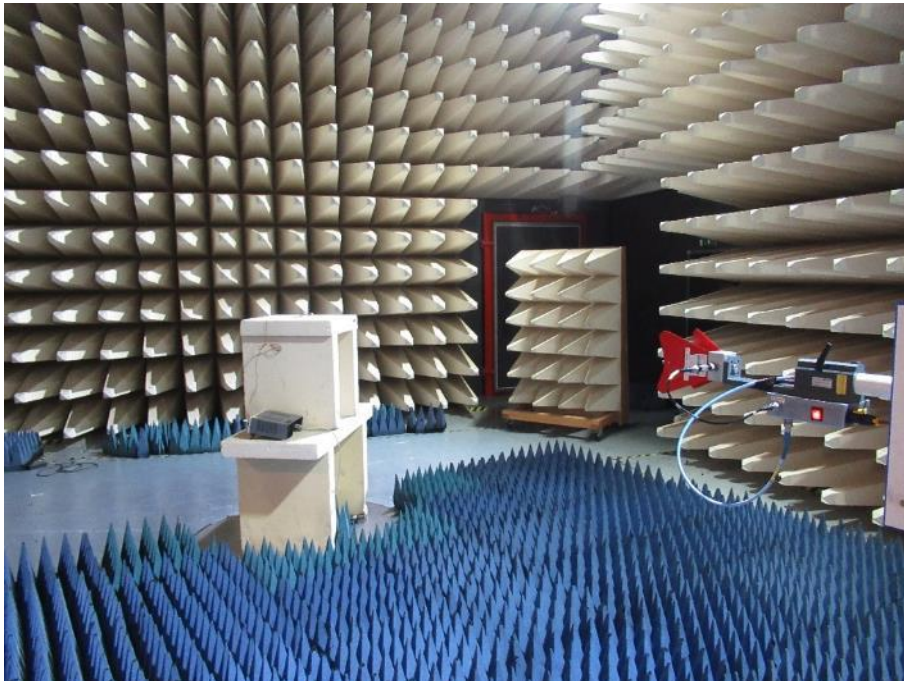
Test location: Shielded Room S6
 Test location: Anechoic chamber 1
 Test distance: 3 m

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 6.2.3.1:
 The power spectral density shall not exceed 11 dBm in any 1.0 MHz band

FCC ID: 2AHES-M2

IC ID: 21152-M2

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

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.

5.4.5 Test result

Radiated Measurement						
UNII-2C ; FCC §15.407 (a)(2); RSS-247 6.2.3.1						
Modulation	Channel	Frequency	Measured fieldstrength	Radiated PSD	Radiated PSD Limit	Margin
		MHz	dB(µV/m)	dBm	dBm	dB
n HT20, MCS7	CH100	5500	98.54	3.3	17.0	-13.7
	CH116	5580	103.77	8.6	17.0	-8.4
	CH140	5700	99.03	3.8	17.0	-13.2
	CH144	5720	95.26	0.1	17.0	-16.9
n HT40, MCS7	CH102	5510	96.12	0.9	17.0	-16.1
	CH110	5550	100.98	5.8	17.0	-11.2
	CH134	5670	98.09	2.9	17.0	-14.1
	CH142	5710	92.02	-3.2	17.0	-20.2
ac VHT80, MCS7	CH106	5530	92.56	-2.6	17.0	-19.6
	CH122	5610	98.41	3.2	17.0	-13.8
	CH138	5690	97.89	2.7	17.0	-14.3

Conducted Measurement					
UNII-2C ; FCC §15.407 (a)(2); RSS-247 6.2.3.1					
Modulation	Channel	Frequency	Measured Conducted PSD	Conducted PSD Limit	Margin
		MHz	dBm	dBm	dB
n HT20, MCS7	CH100	5500	2.2	11.0	-8.8
	CH116	5580	2.1	11.0	-8.9
	CH140	5700	2.0	11.0	-9.0
	CH144	5720	2.1	11.0	-8.9
n HT40, MCS7	CH102	5510	-1.5	11.0	-12.5
	CH110	5550	-0.4	11.0	-11.4
	CH134	5670	-1.3	11.0	-12.3
	CH142	5710	-0.4	11.0	-11.4
ac VHT80, MCS7	CH106	5530	-3.0	11.0	-14.0
	CH122	5610	-3.5	11.0	-14.5
	CH138	5690	-3.6	11.0	-14.6

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**

Peak power limit according to FCC Part 15E, Section 15.407(a)(2) & RSS-247 6.2.3.1:

Frequency (GHz)	Radiated PSD limit (dBm/MHz)	Conducted PSD limit (dBm/MHz)
5470 – 5725	17	11

The requirements are **FULFILLED**.**Remarks:** For detailed test results please see the following test protocols.

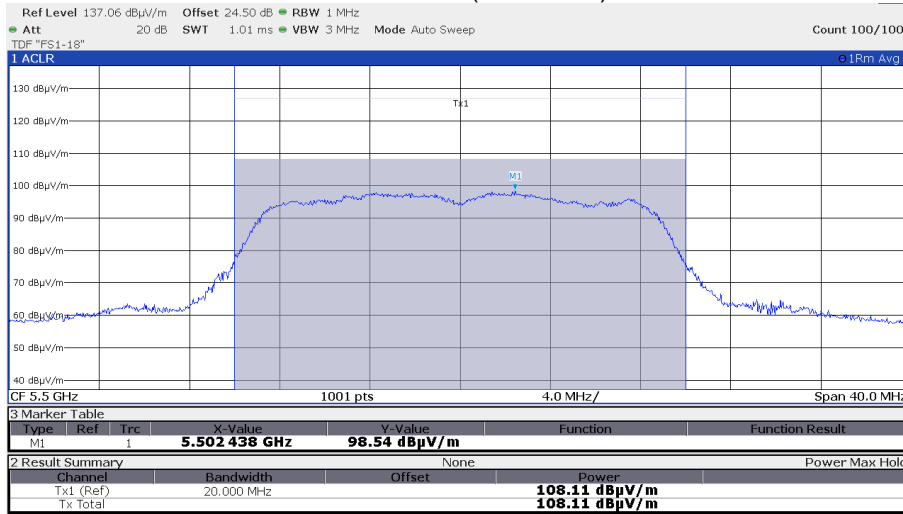
The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: 2AHES-M2

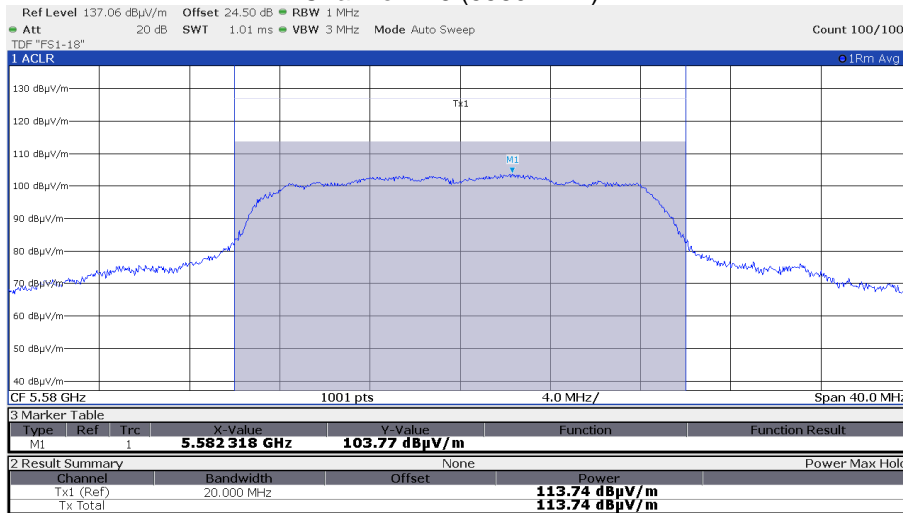
IC ID: 21152-M2

5.4.6 Peak Power spectral density plots
Radiated Measurement
802.11n HT20:

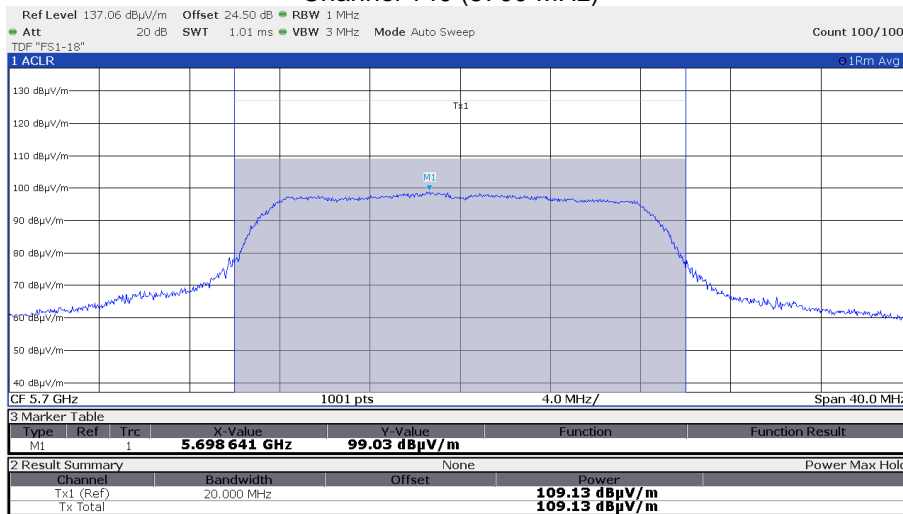
Channel 100 (5500 MHz)



Channel 116 (5580 MHz)



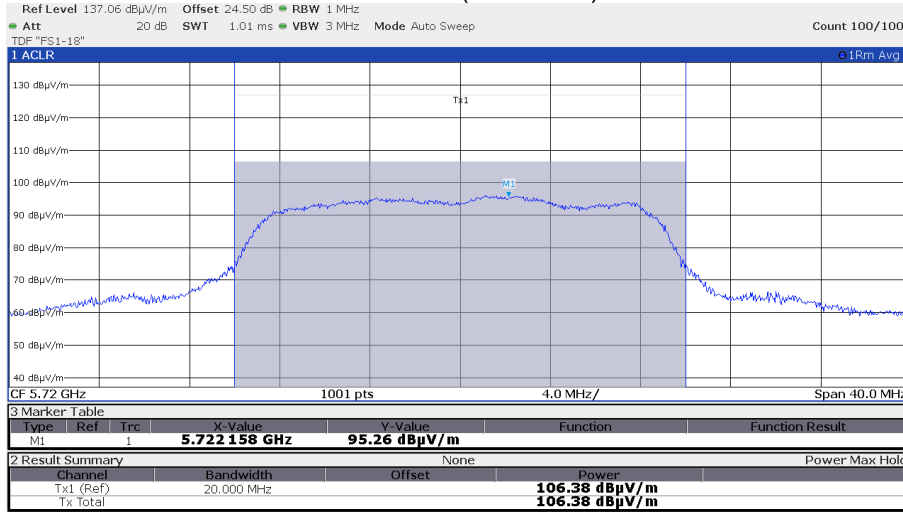
Channel 140 (5700 MHz)



FCC ID: 2AHES-M2

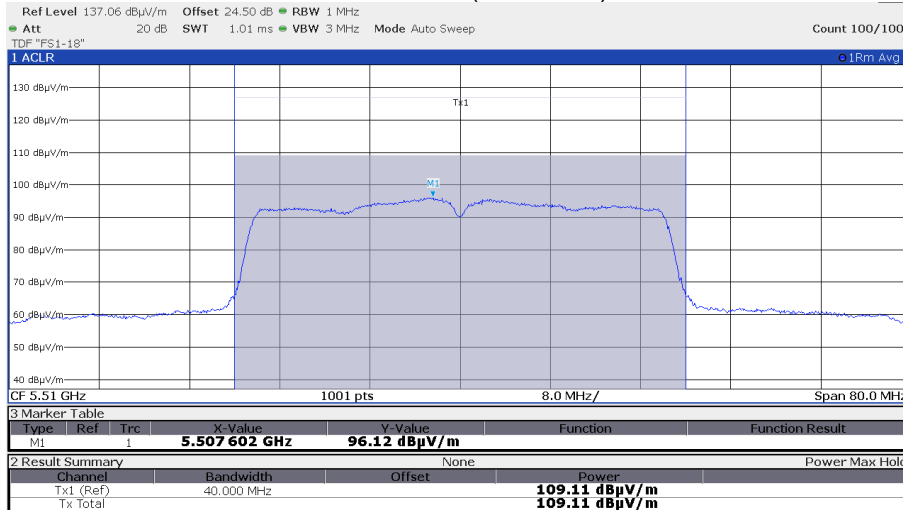
IC ID: 21152-M2

Channel 144 (5720 MHz)

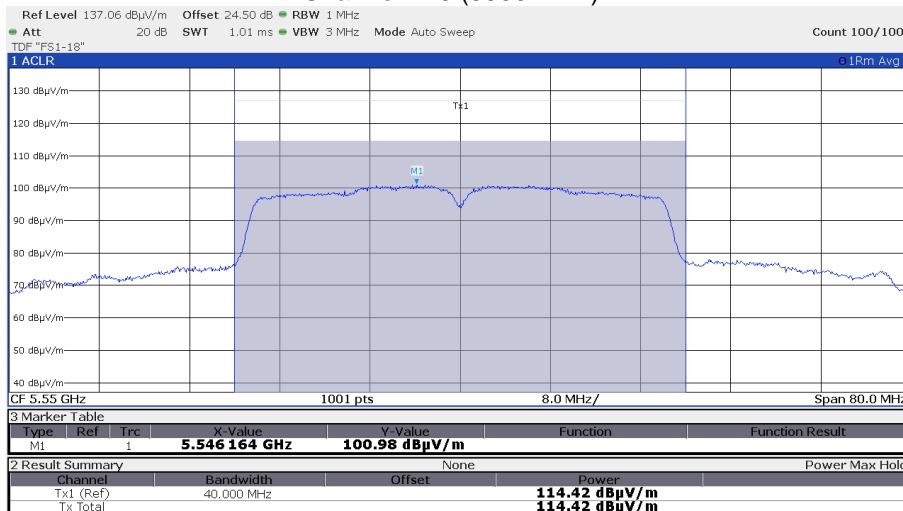


802.11n HT40:

Channel 102 (5510 MHz)



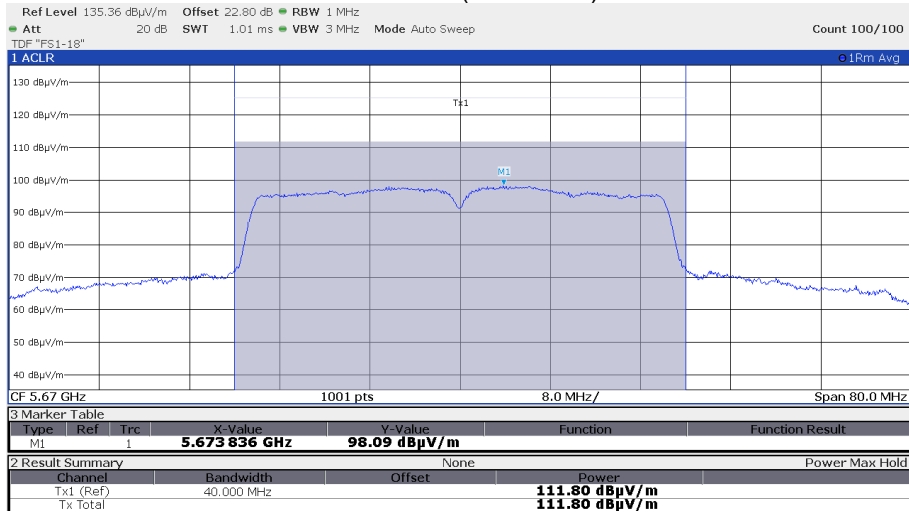
Channel 110 (5550 MHz)



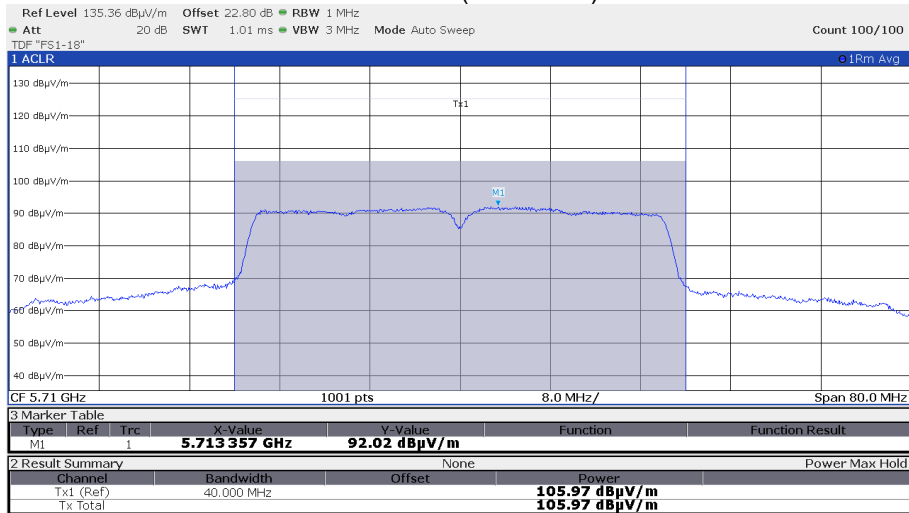
FCC ID: 2AHES-M2

IC ID: 21152-M2

Channel 134 (5670 MHz)

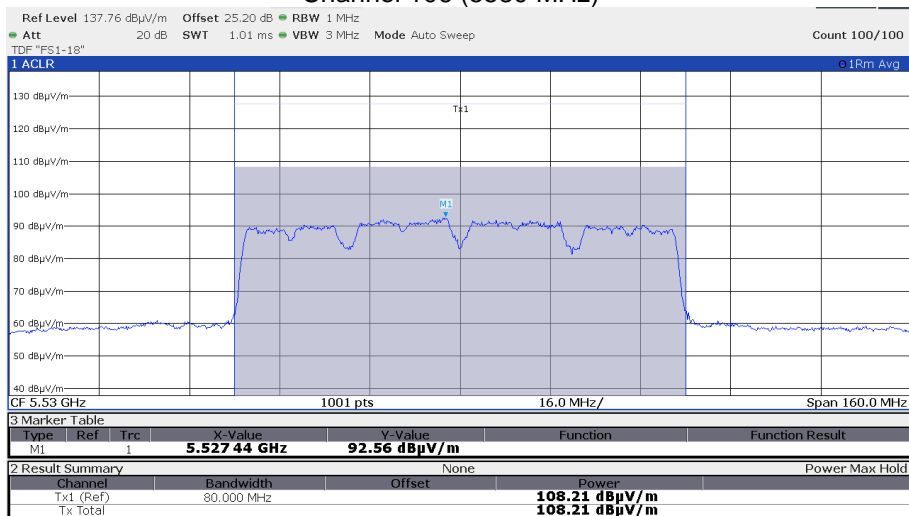


Channel 142 (5710 MHz)



802.11ac VHT80:

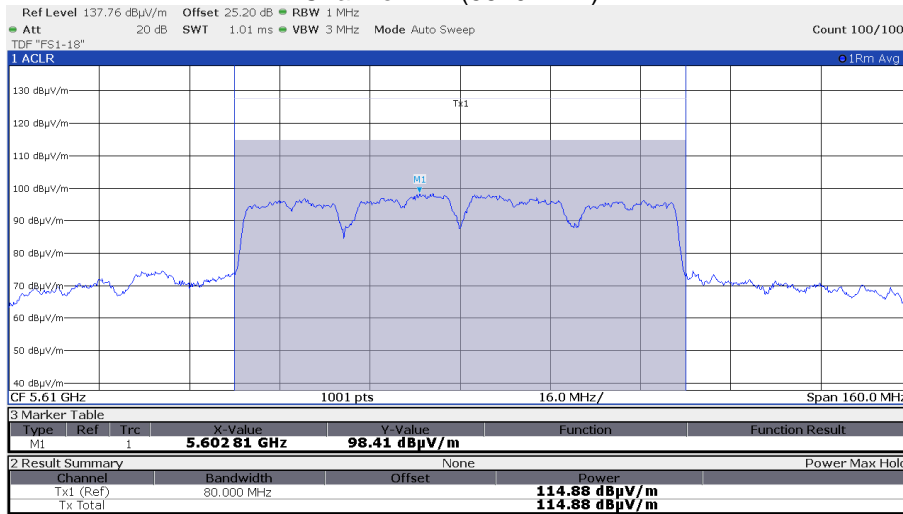
Channel 106 (5530 MHz)



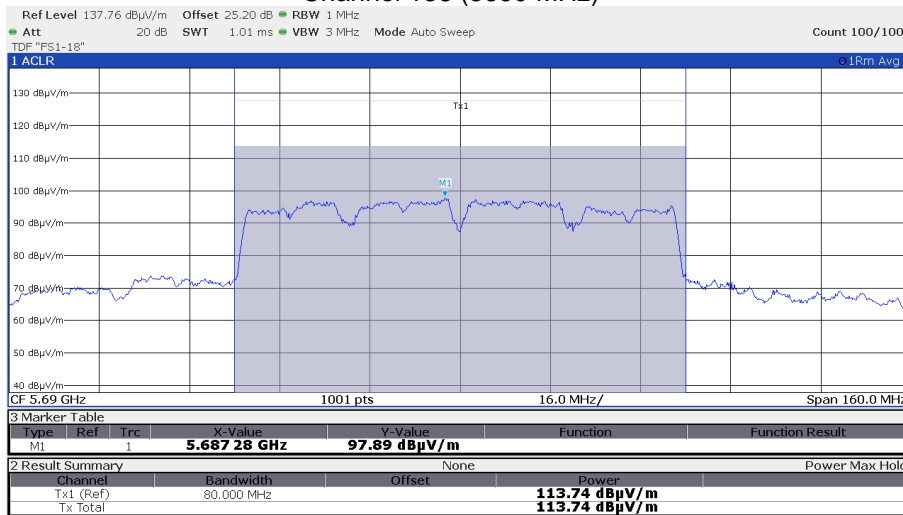
FCC ID: 2AHES-M2

IC ID: 21152-M2

Channel 122 (5610 MHz)



Channel 138 (5690 MHz)



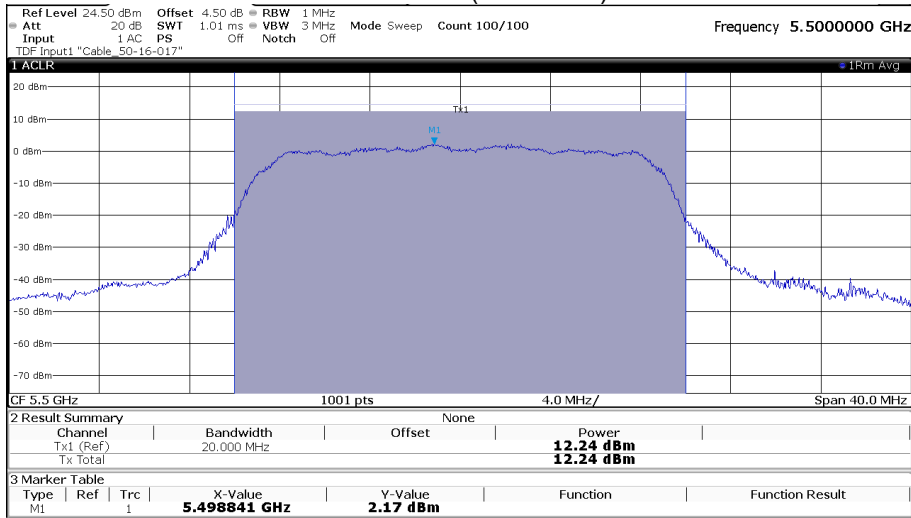
The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: 2AHES-M2

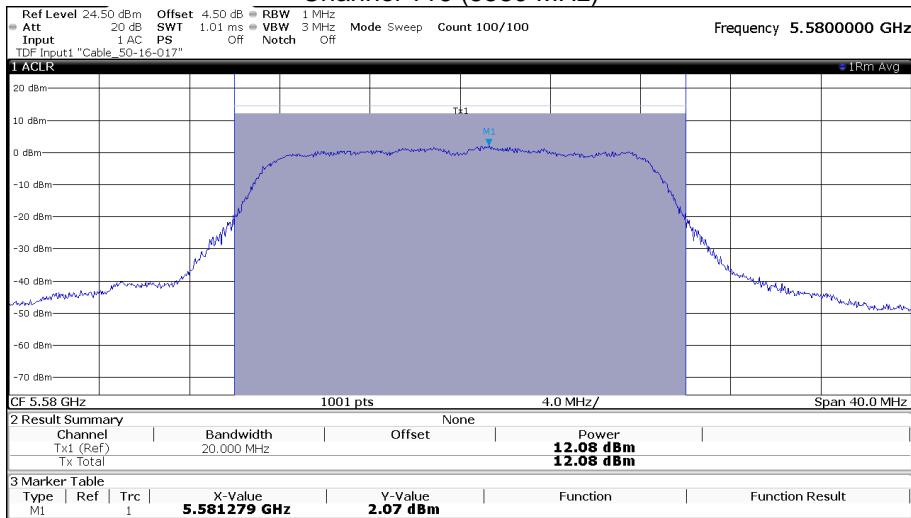
IC ID: 21152-M2

Conducted Measurement with maximum power settings
802.11n HT20:

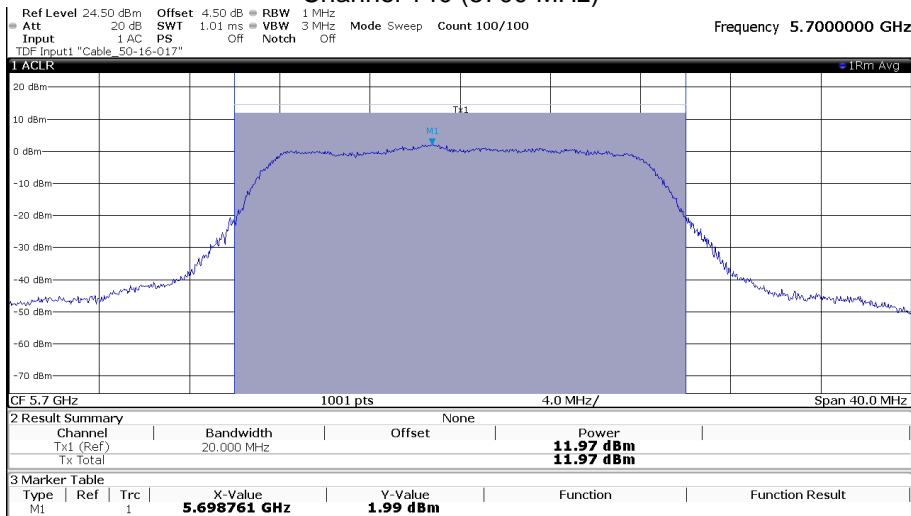
Channel 100 (5500 MHz)



Channel 116 (5580 MHz)



Channel 140 (5700 MHz)

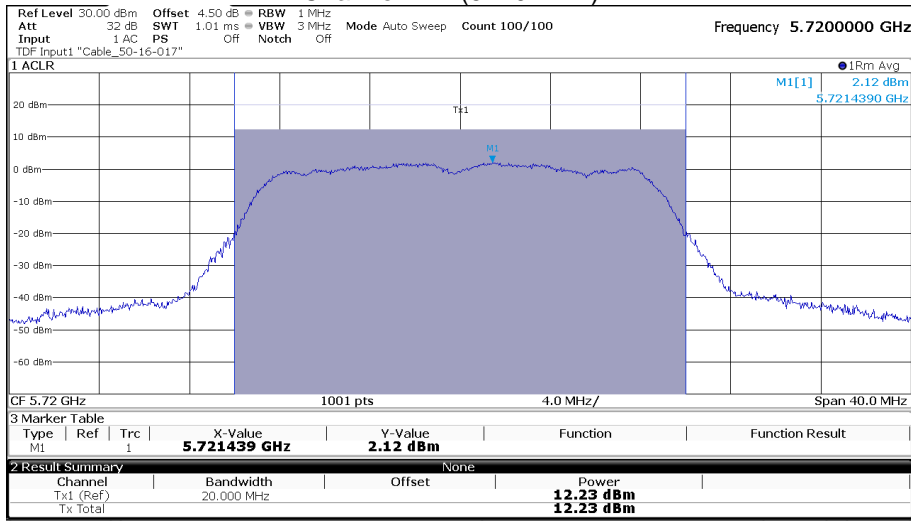


The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: 2AHES-M2

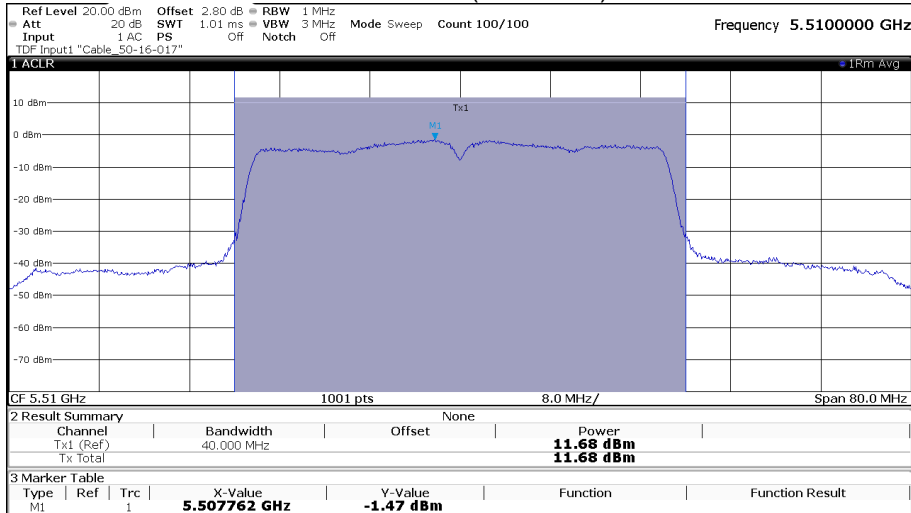
IC ID: 21152-M2

Channel 144 (5720 MHz)

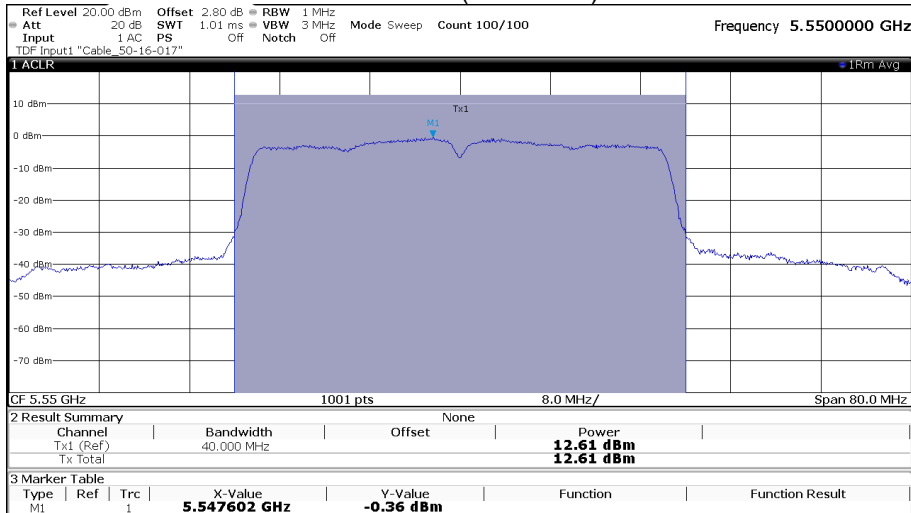


802.11n HT40:

Channel 102 (5510 MHz)



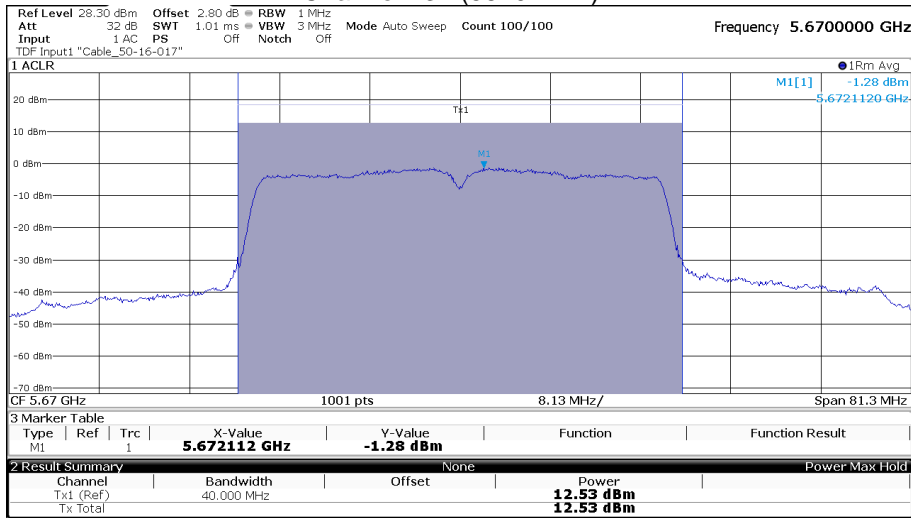
Channel 110 (5550 MHz)



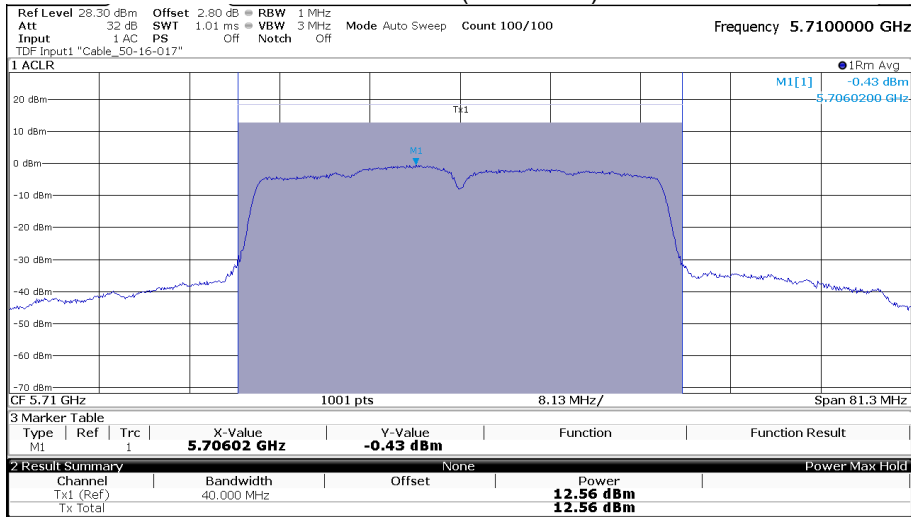
FCC ID: 2AHES-M2

IC ID: 21152-M2

Channel 134 (5670 MHz)

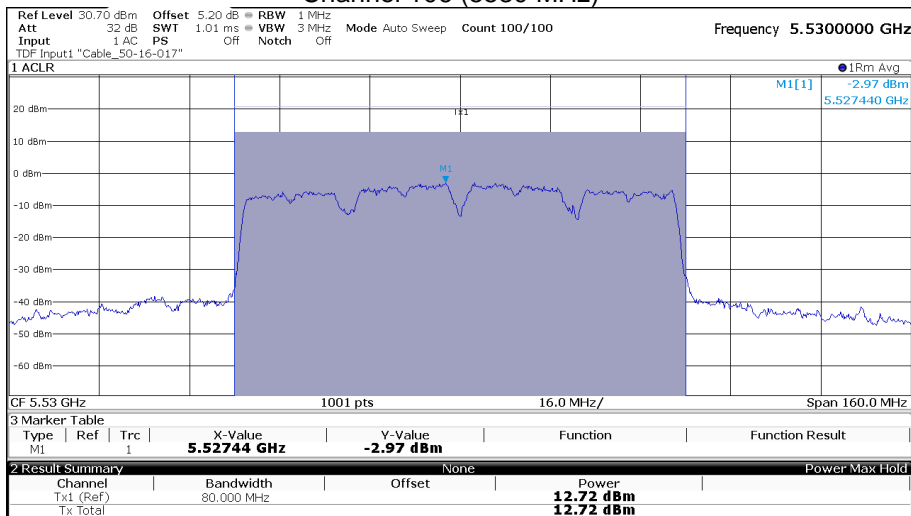


Channel 142 (5710 MHz)



802.11ac VHT80:

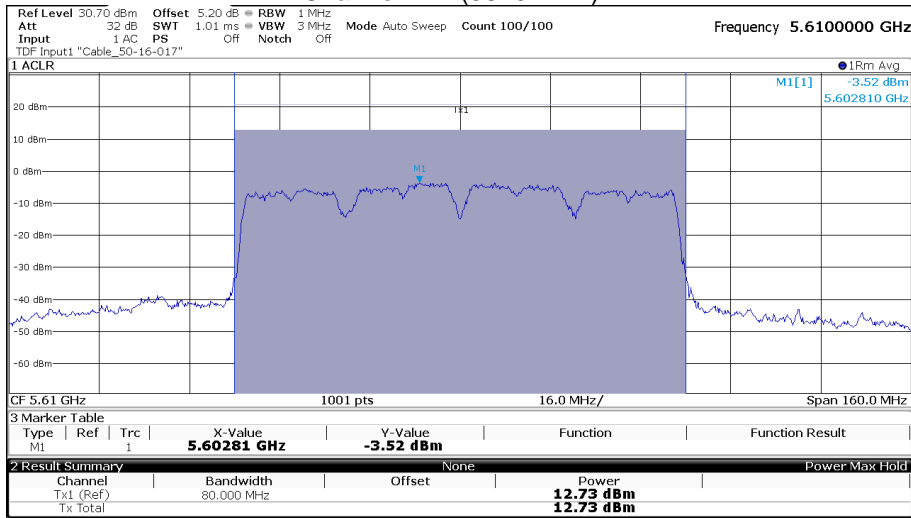
Channel 106 (5530 MHz)



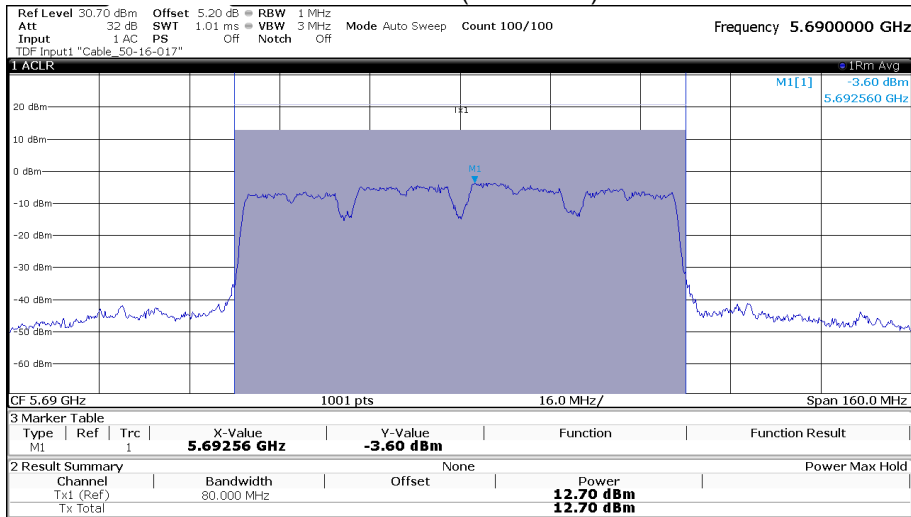
FCC ID: 2AHES-M2

IC ID: 21152-M2

Channel 122 (5610 MHz)



Channel 138 (5690 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

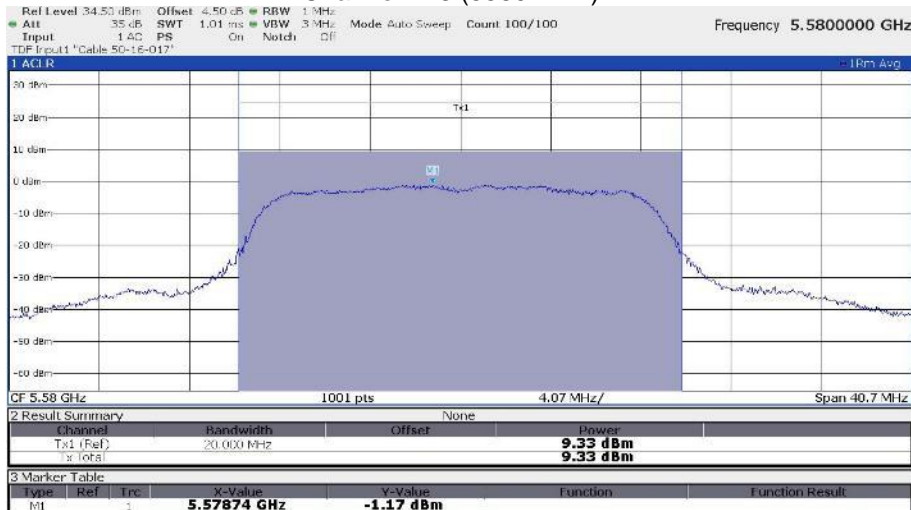
IC ID: 21152-M2

Conducted Measurement with final power settings
802.11n HT20:

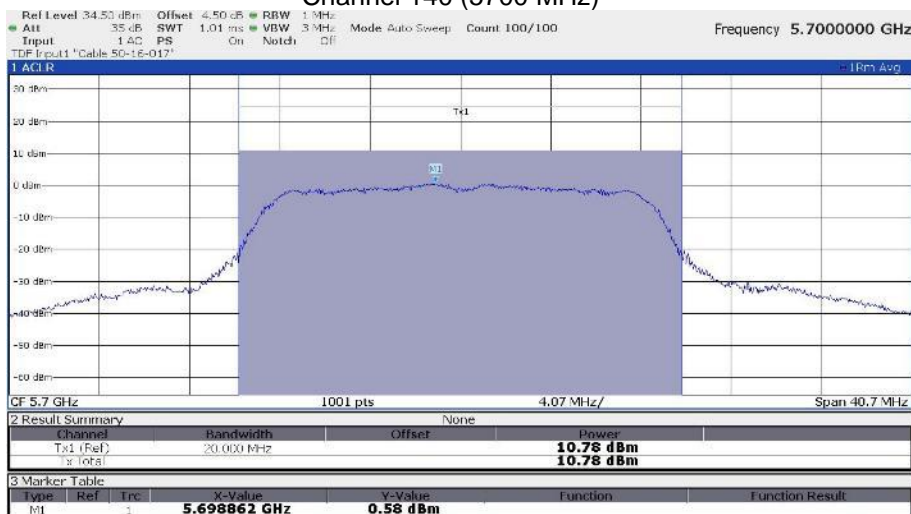
Channel 100 (5500 MHz)



Channel 116 (5580 MHz)



Channel 140 (5700 MHz)

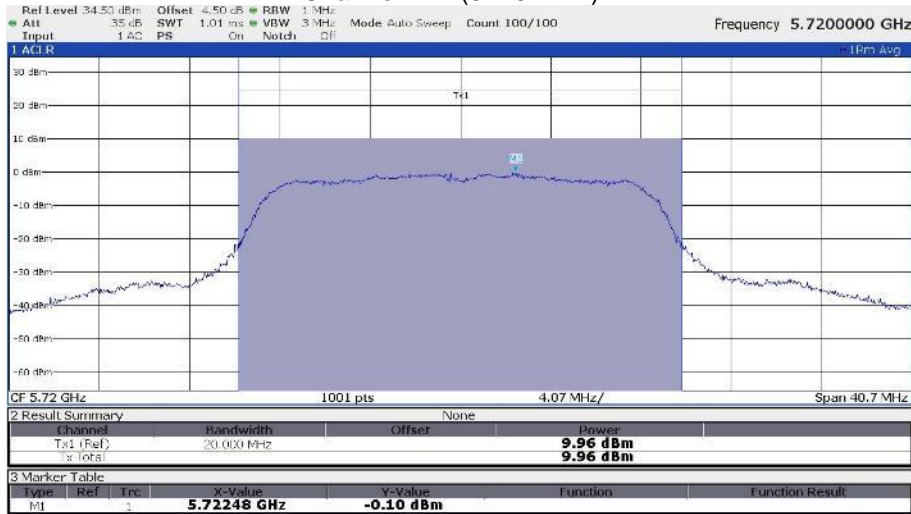


The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: 2AHES-M2

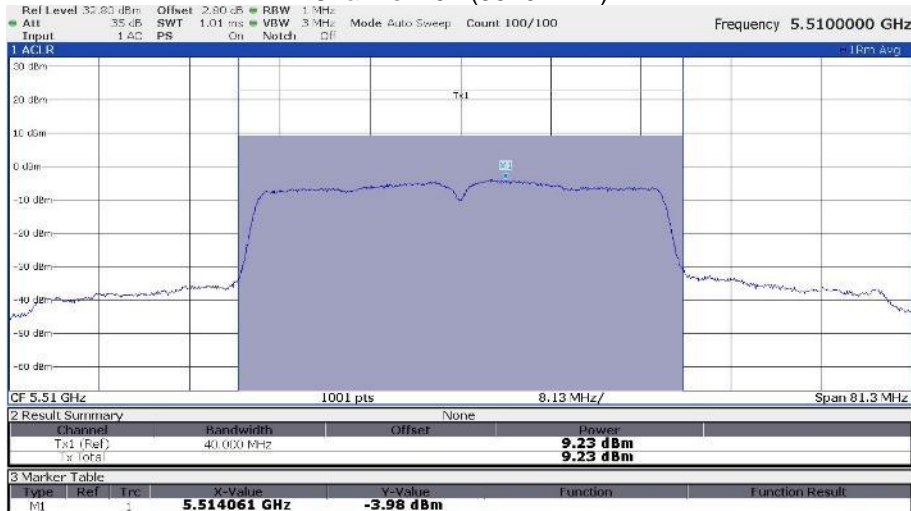
IC ID: 21152-M2

Channel 144 (5720 MHz)

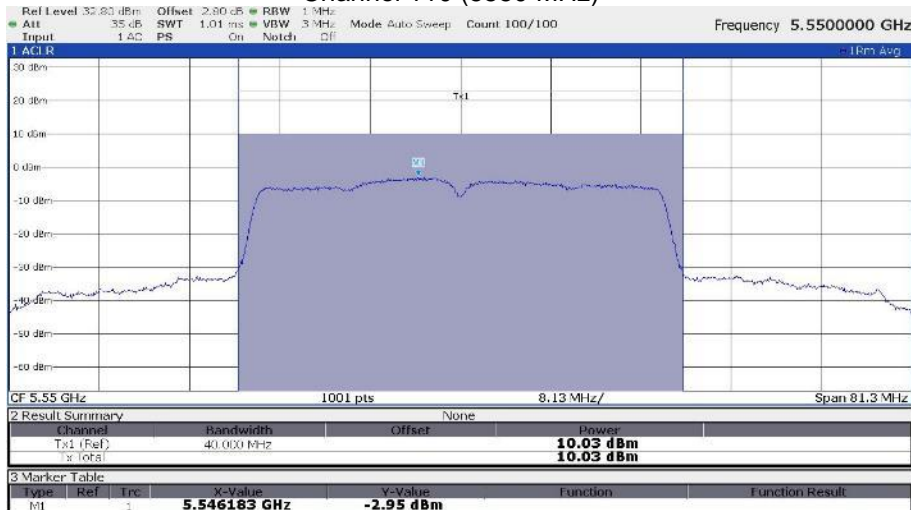


802.11n HT40:

Channel 102 (5510 MHz)



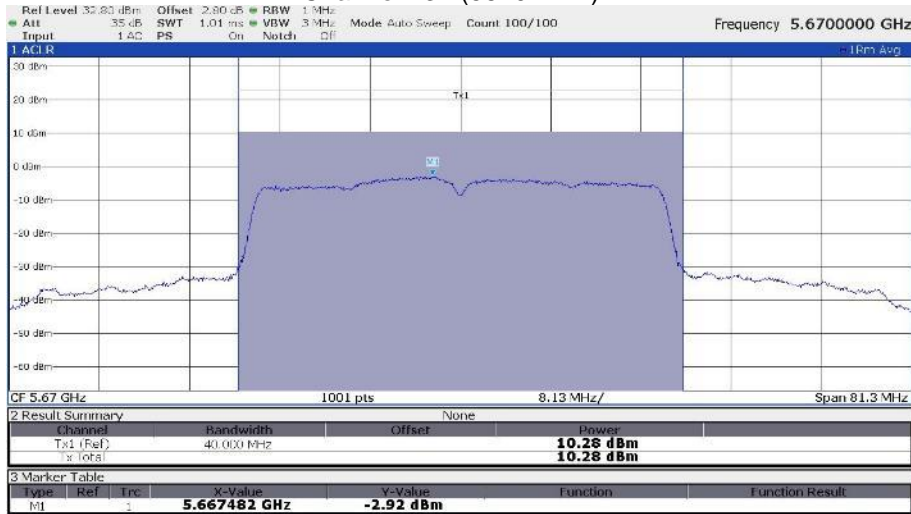
Channel 110 (5550 MHz)



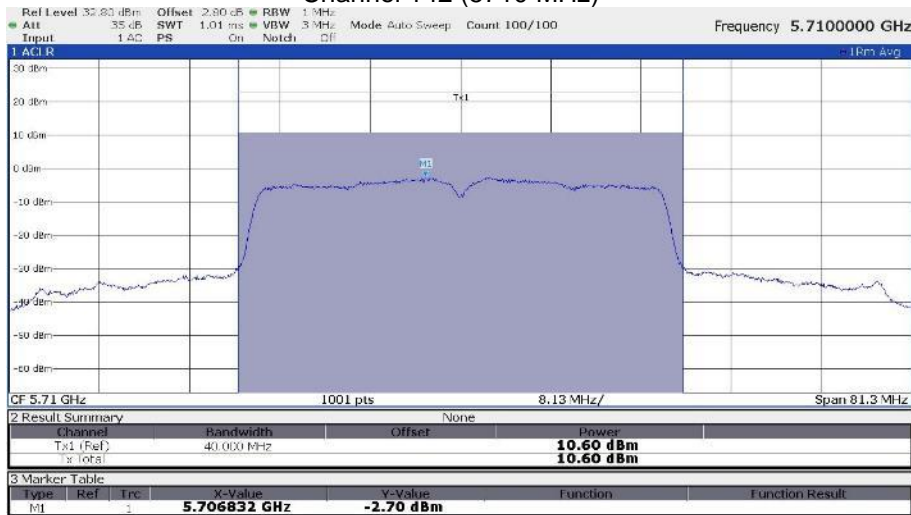
FCC ID: 2AHES-M2

IC ID: 21152-M2

Channel 134 (5670 MHz)



Channel 142 (5710 MHz)



802.11ac VHT80:

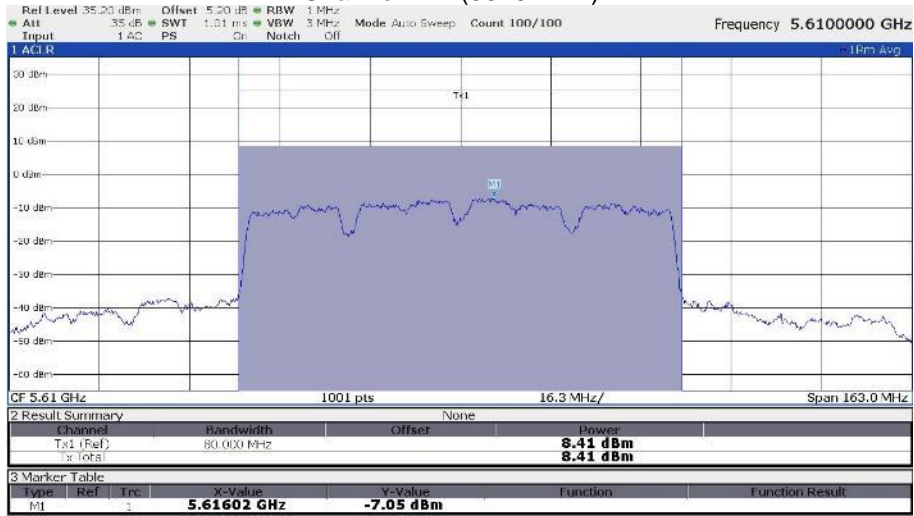
Channel 106 (5530 MHz)



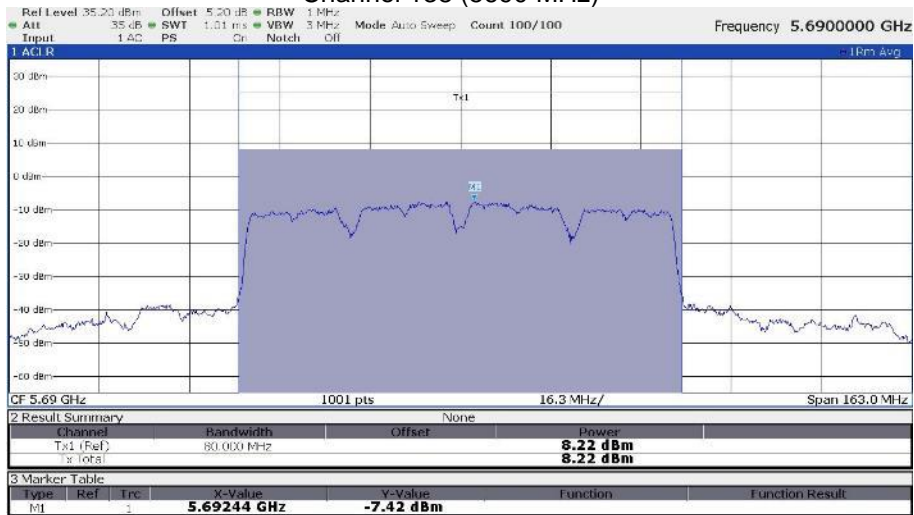
FCC ID: 2AHES-M2

IC ID: 21152-M2

Channel 122 (5610 MHz)



Channel 138 (5690 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

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

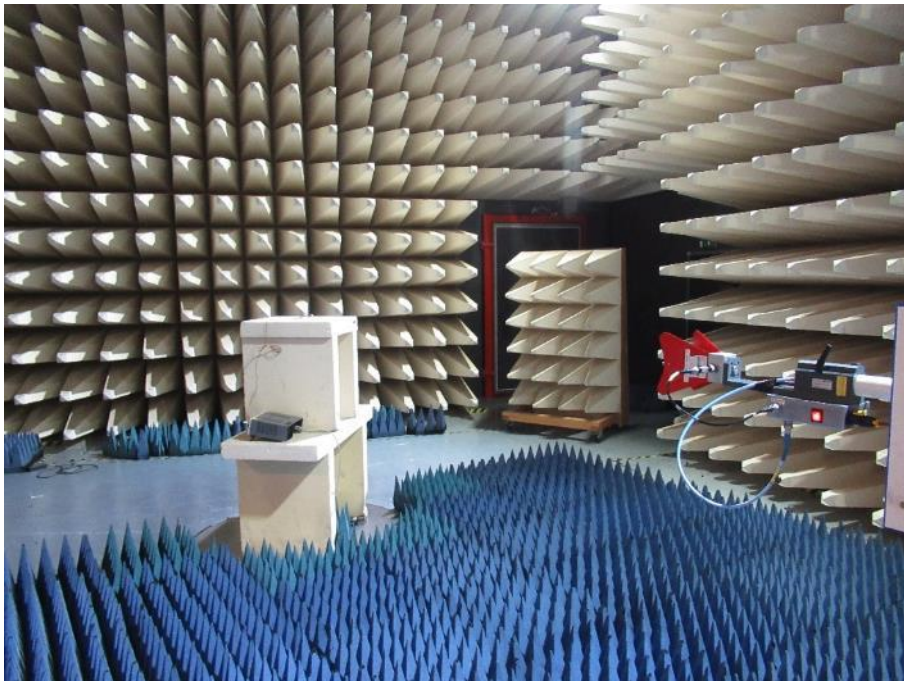
Test location: OATS 1
Test location: Anechoic chamber 1
Test distance: 3 m

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.

FCC ID: 2AHES-M2

IC ID: 21152-M2

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

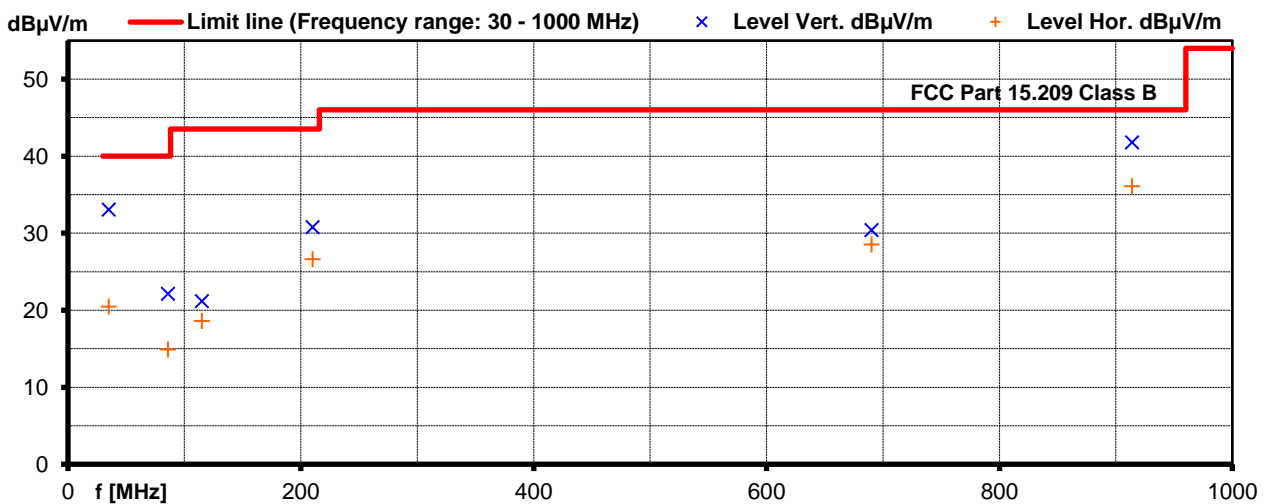
f > 1000 MHz

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

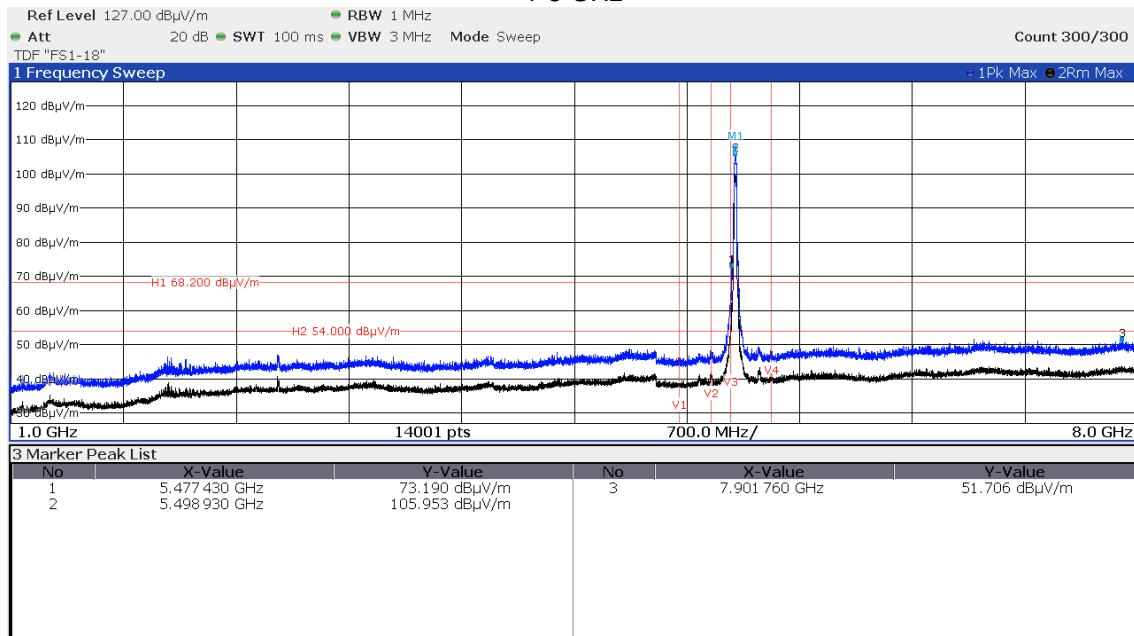
IC ID: 21152-M2

f > 1000 MHz
CH100, 802.11n HT20

Band Edges



1-8 GHz

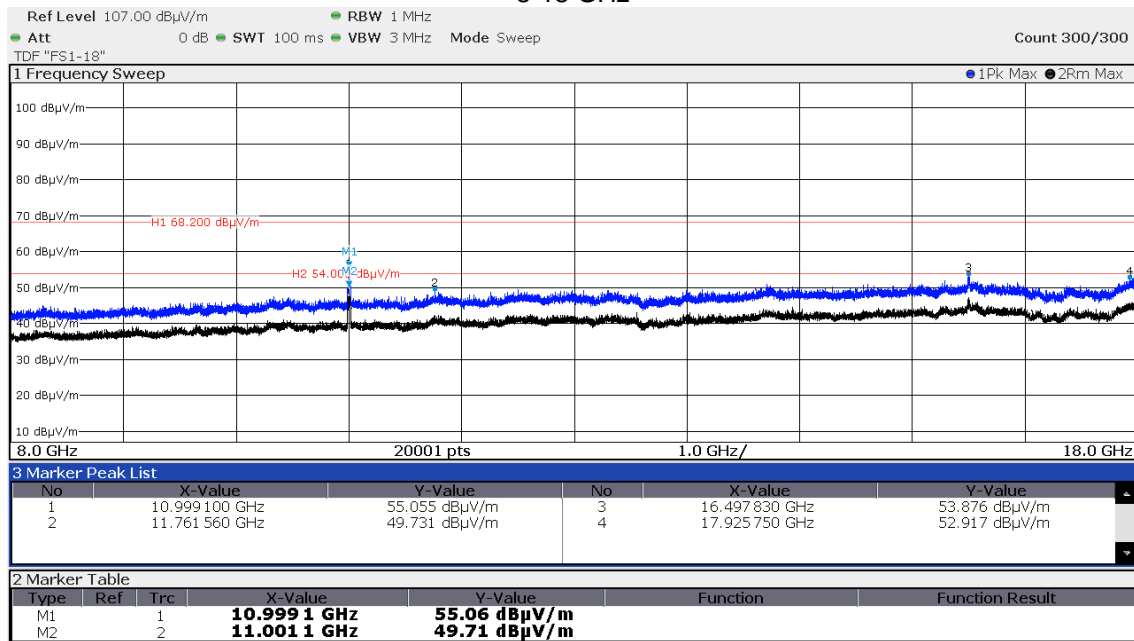


The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

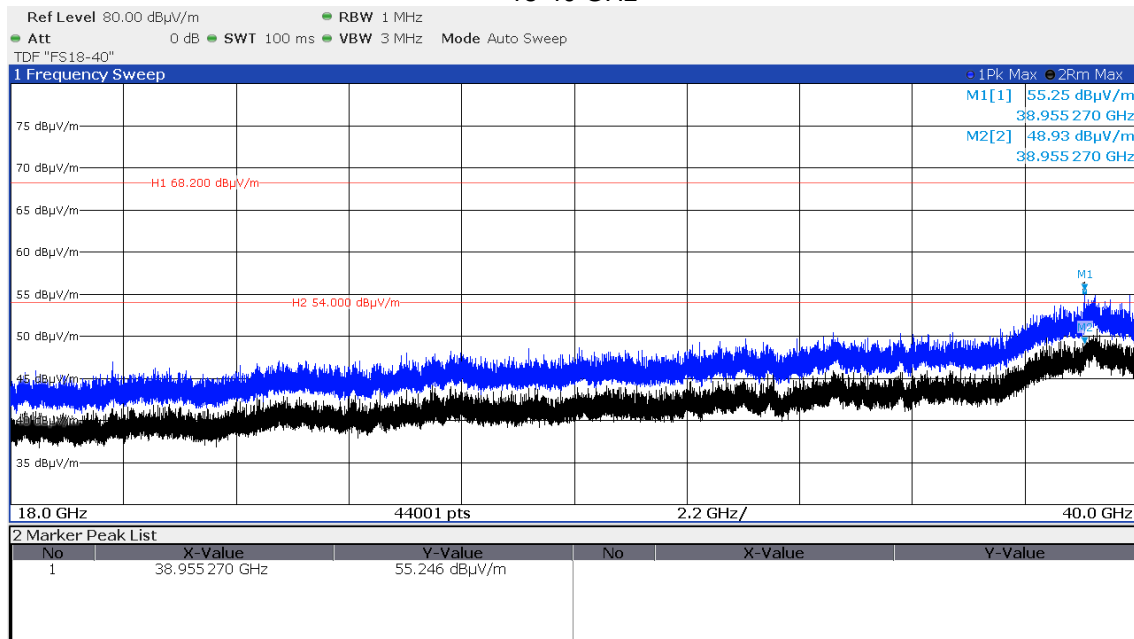
FCC ID: 2AHES-M2

IC ID: 21152-M2

8-18 GHz



18-40 GHz



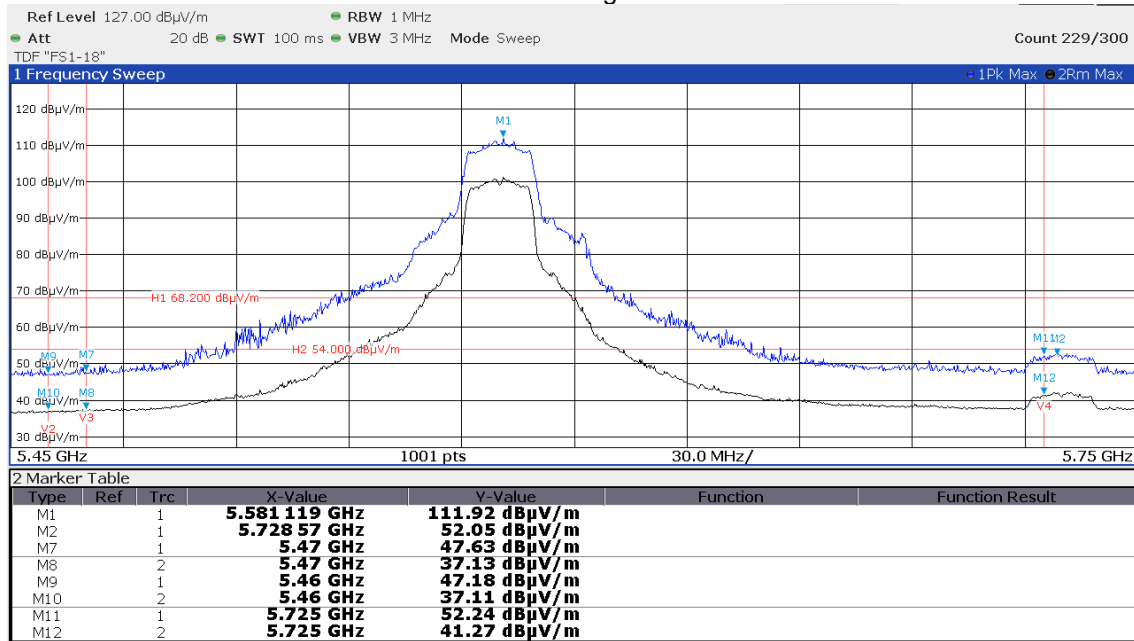
The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: 2AHES-M2

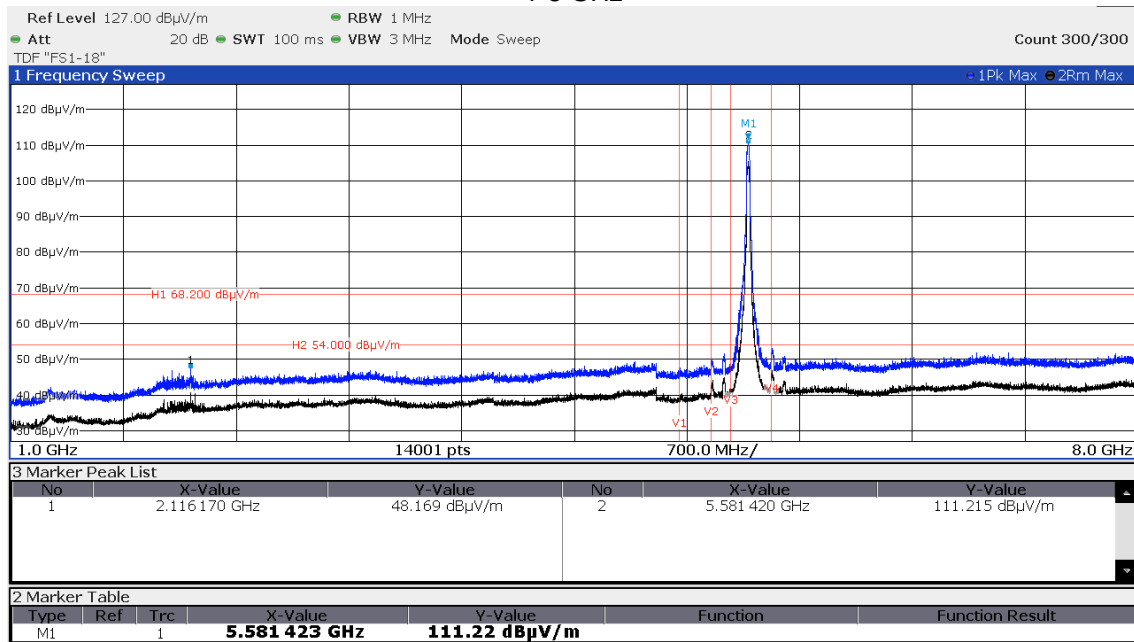
IC ID: 21152-M2

CH116, 802.11n HT20

Band Edges



1-8 GHz

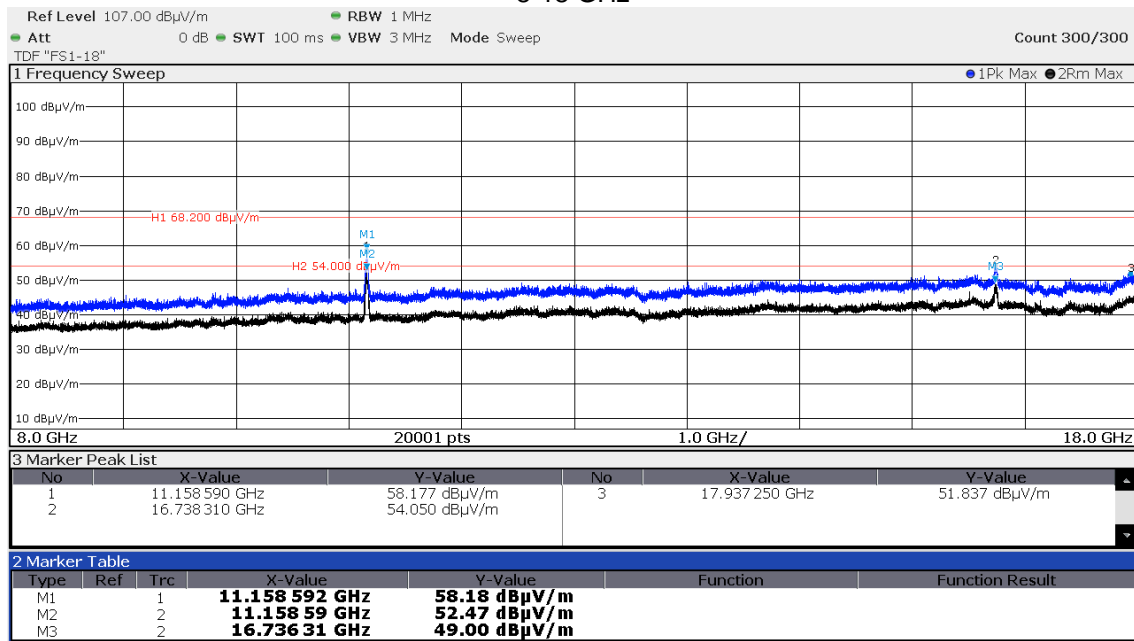


The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

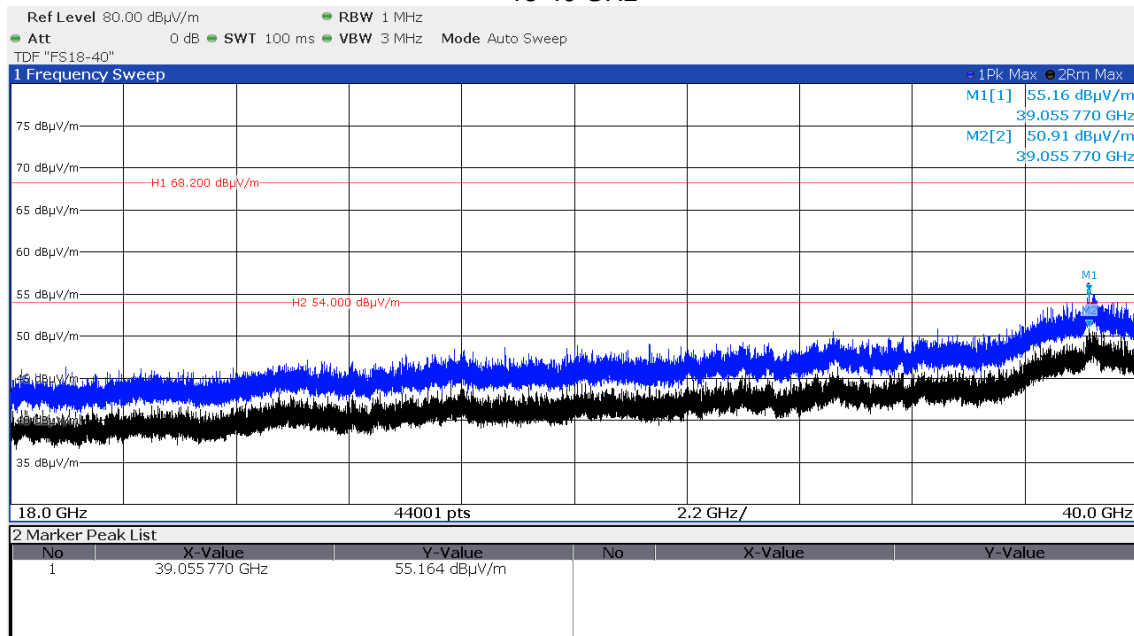
FCC ID: 2AHES-M2

IC ID: 21152-M2

8-18 GHz



18-40 GHz



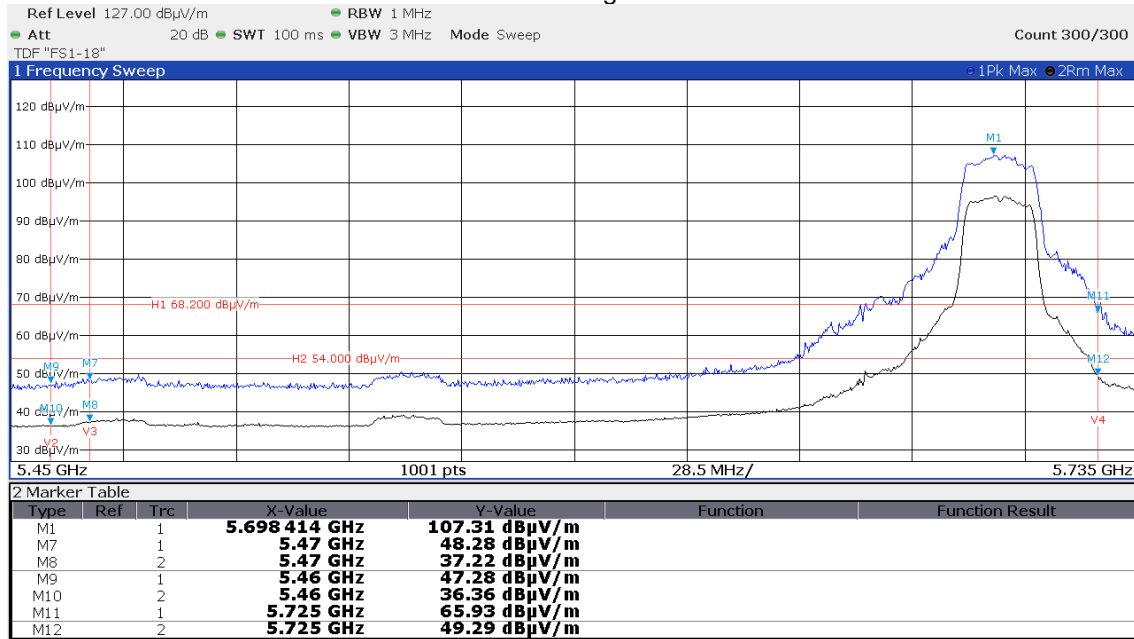
The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: 2AHES-M2

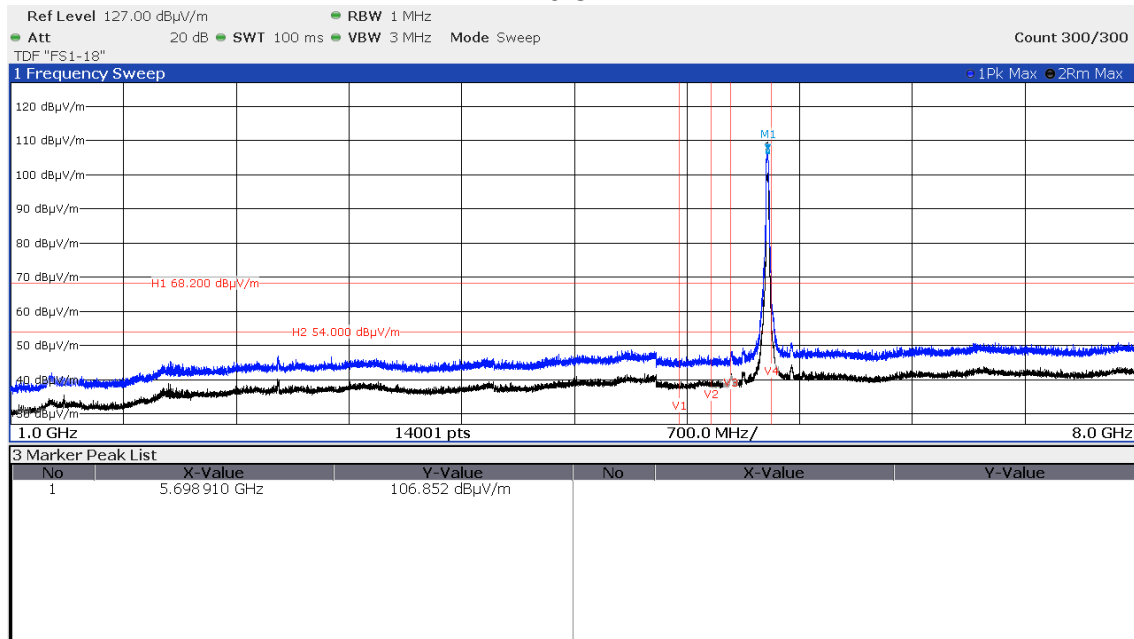
IC ID: 21152-M2

CH140, 802.11n HT20

Band Edges



1-8 GHz

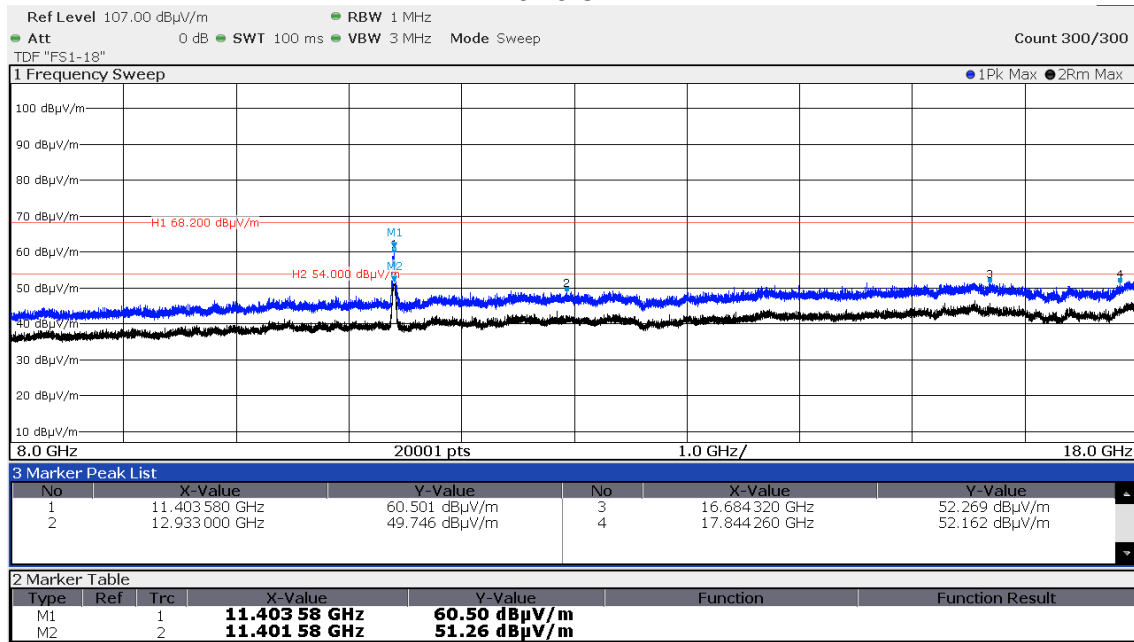


The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

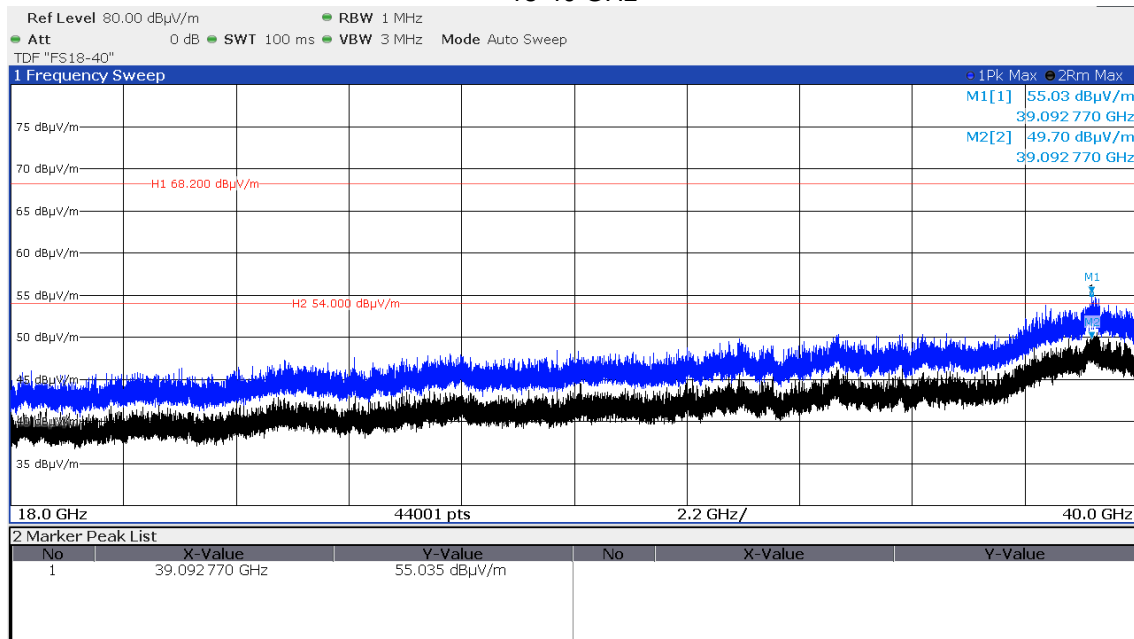
FCC ID: 2AHES-M2

IC ID: 21152-M2

8-18 GHz



18-40 GHz



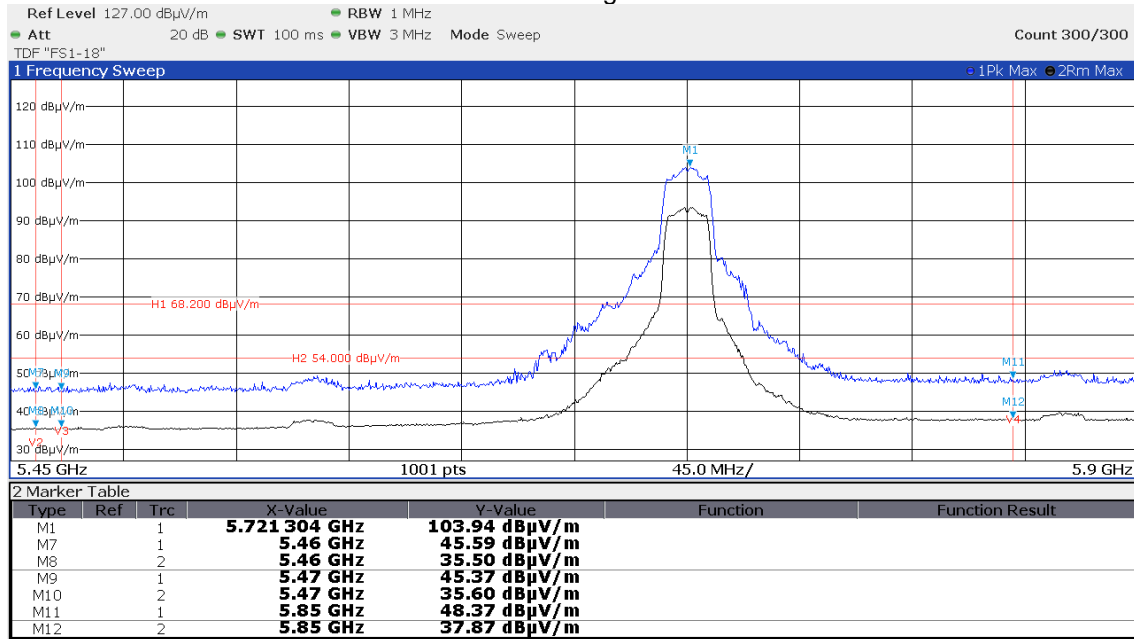
The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: 2AHES-M2

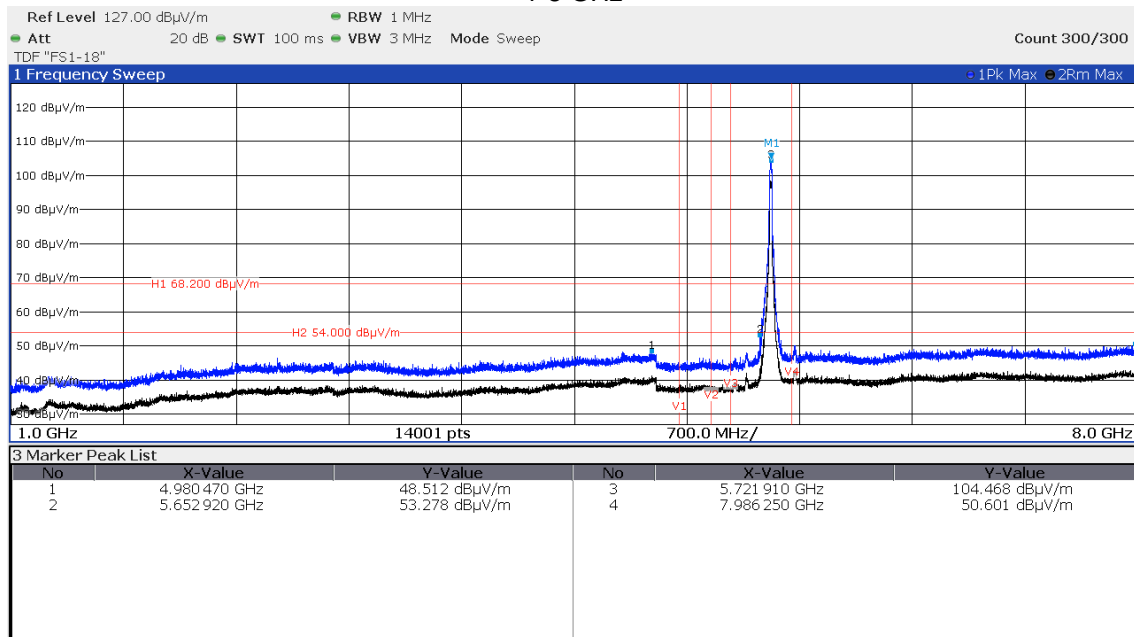
IC ID: 21152-M2

CH144, 802.11n HT20

Band Edges



1-8 GHz

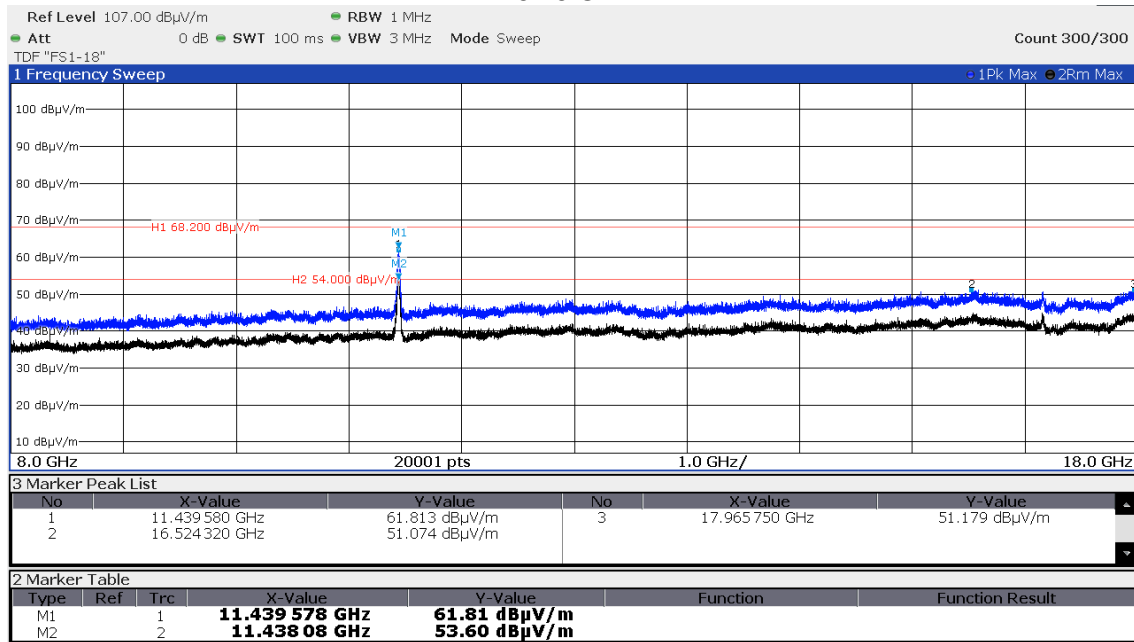


The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

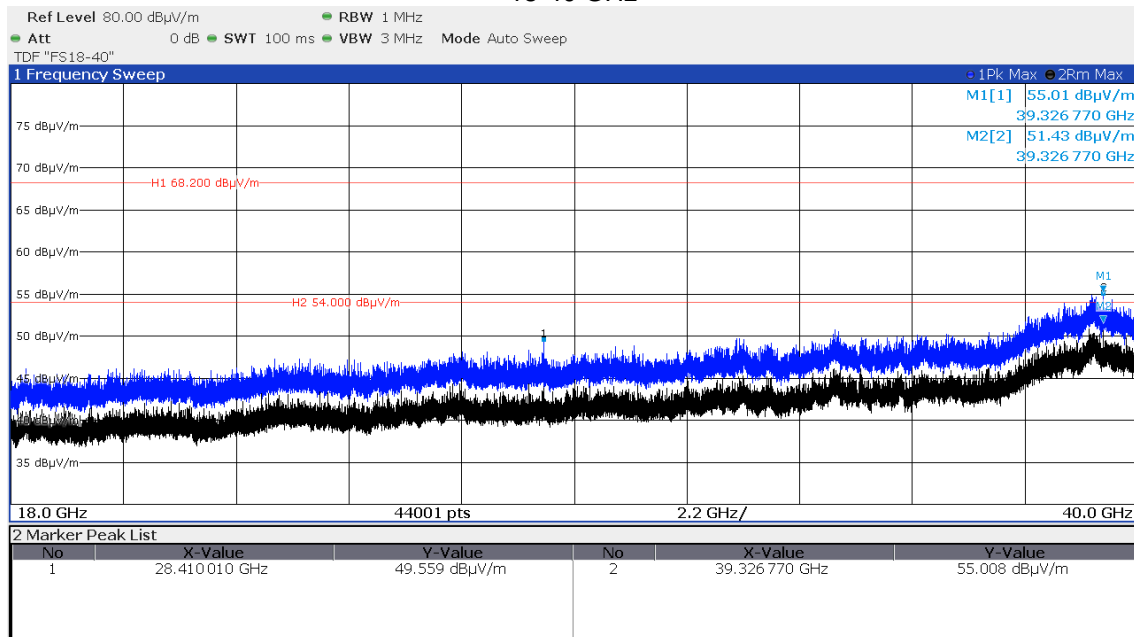
FCC ID: 2AHES-M2

IC ID: 21152-M2

8-18 GHz



18-40 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

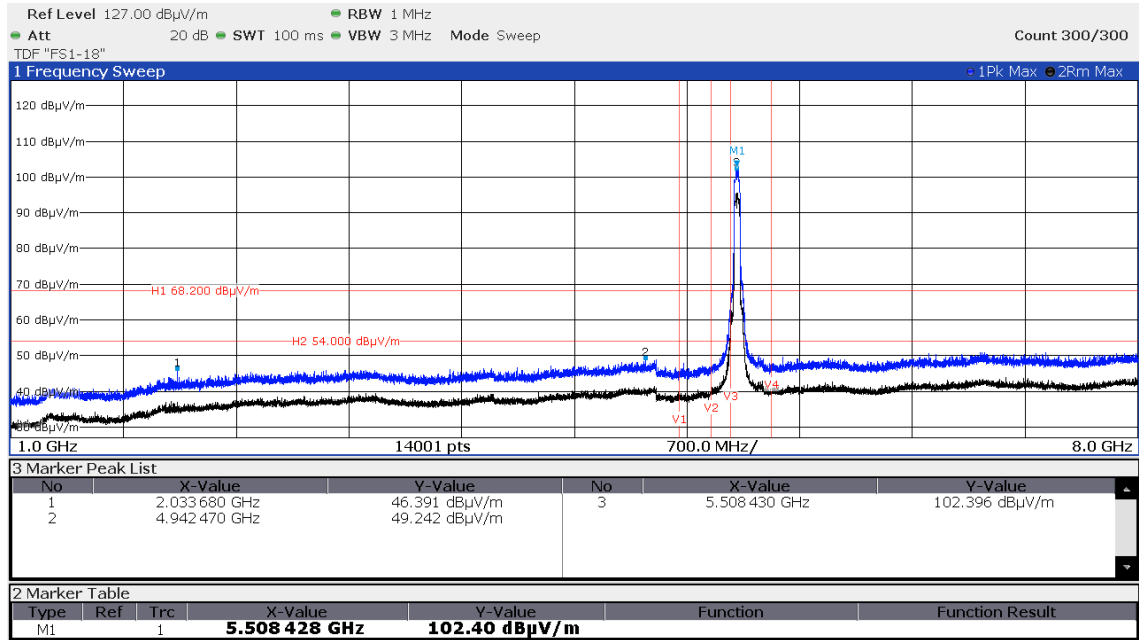
IC ID: 21152-M2

CH102, 802.11n HT40

Band Edges



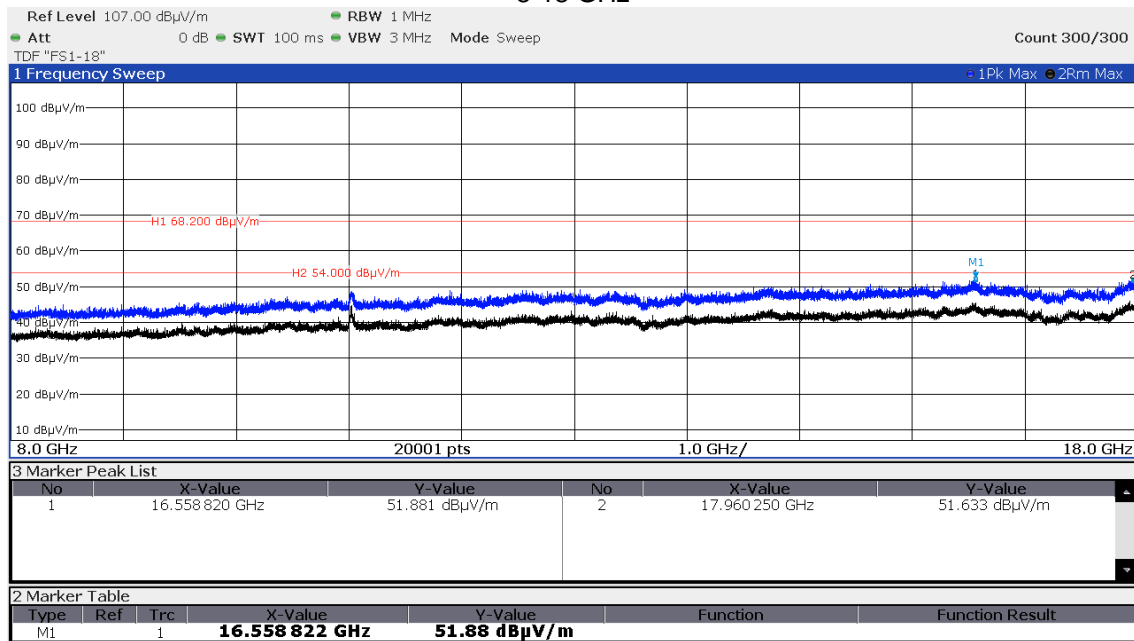
1-8 GHz



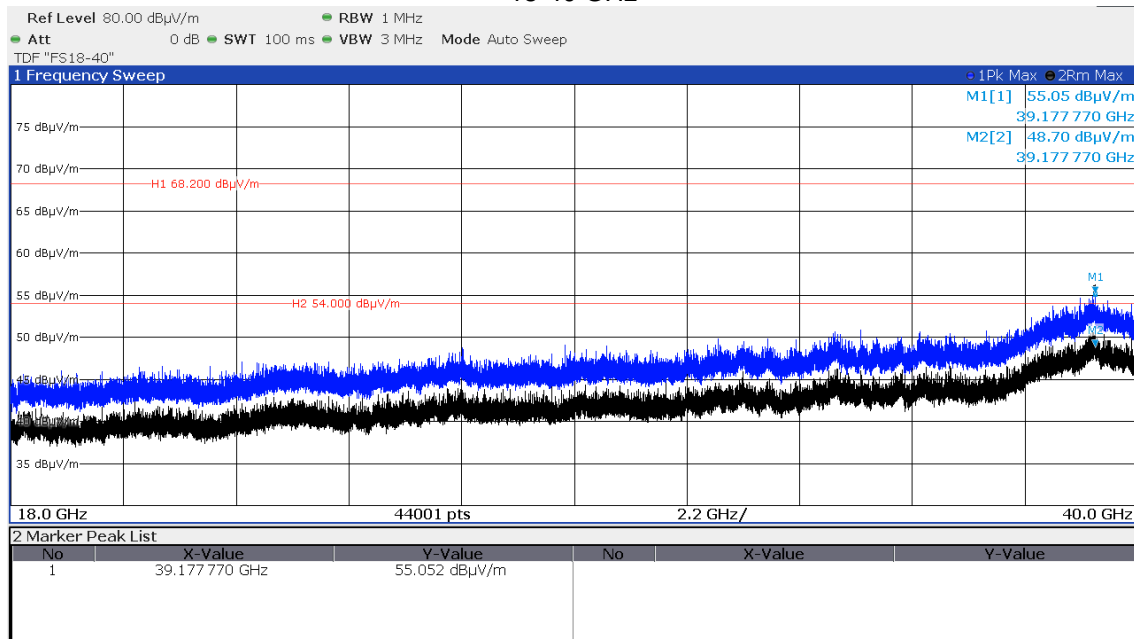
FCC ID: 2AHES-M2

IC ID: 21152-M2

8-18 GHz



18-40 GHz



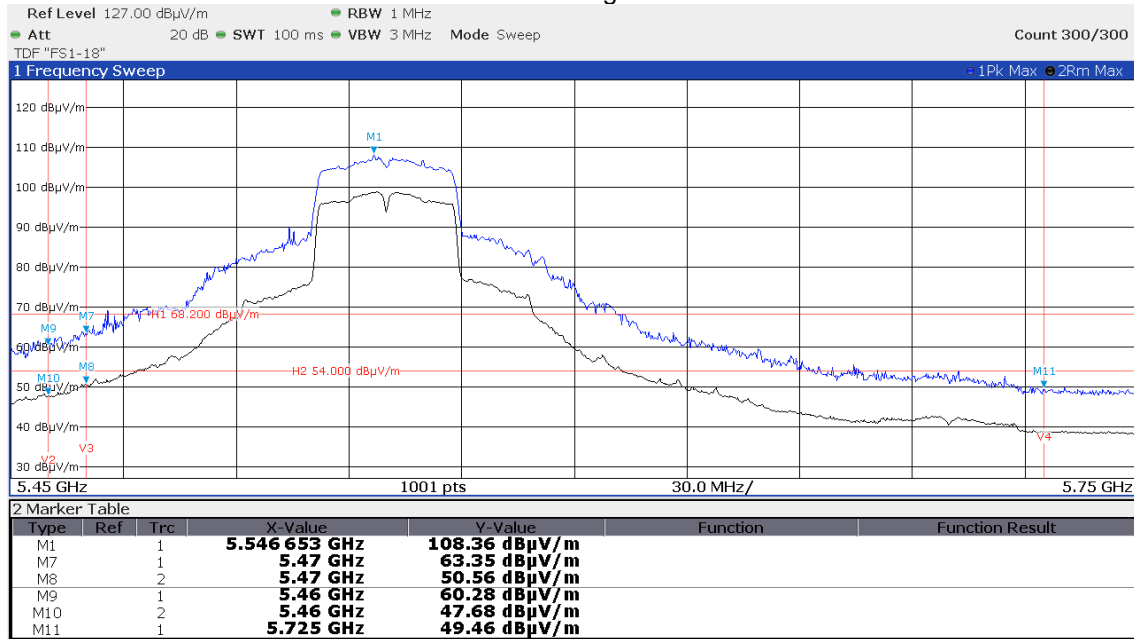
The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: 2AHES-M2

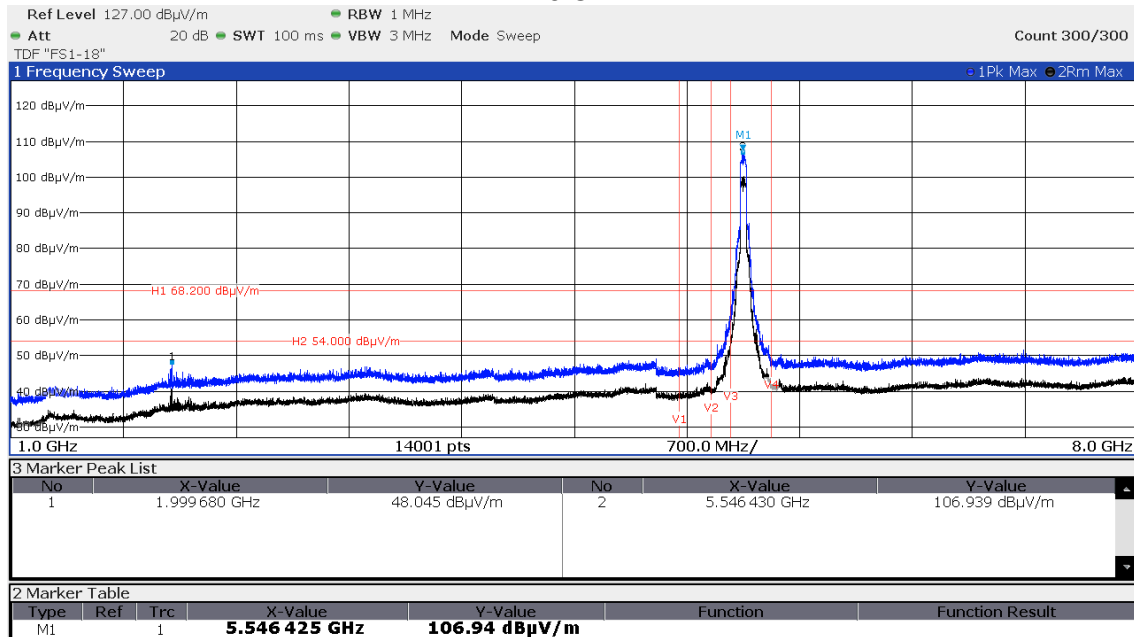
IC ID: 21152-M2

CH110, 802.11n HT40

Band Edges



1-8 GHz

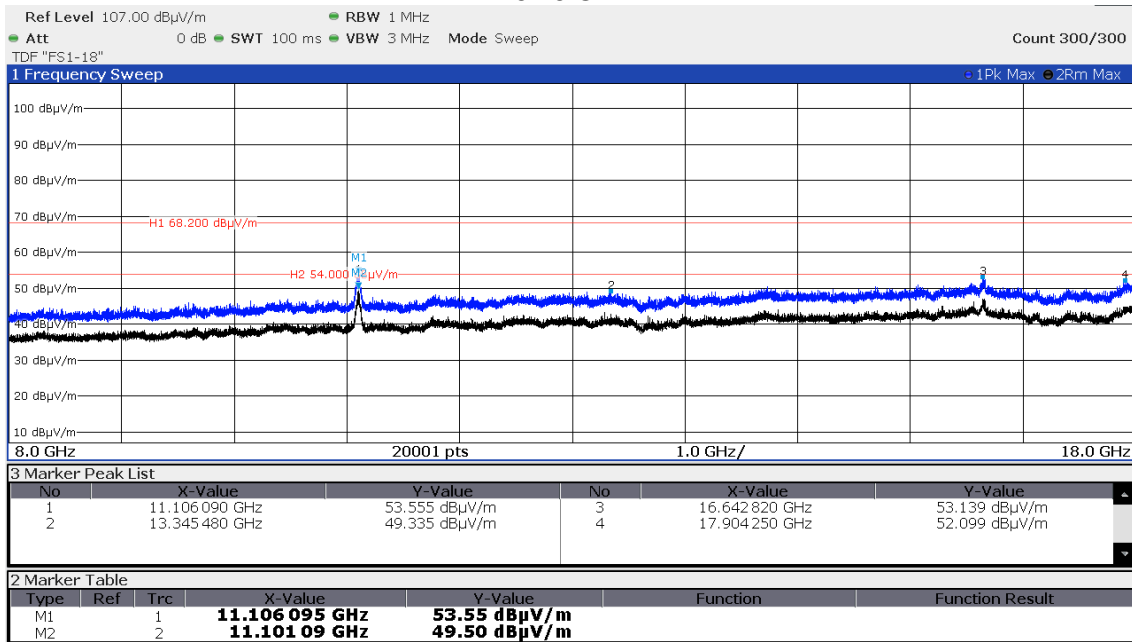


The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

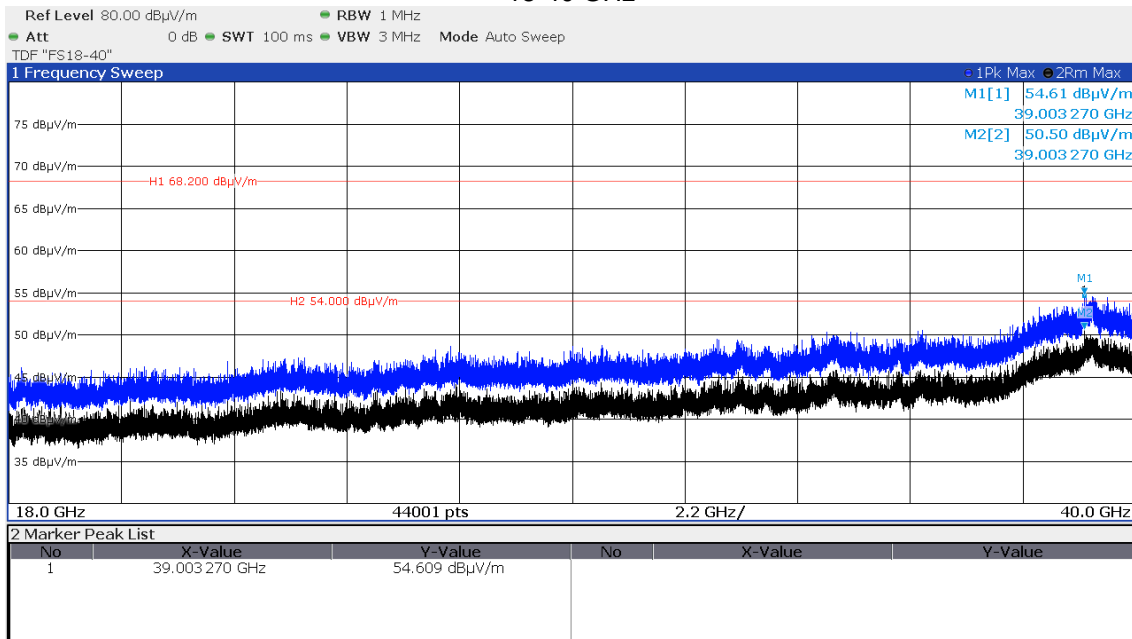
FCC ID: 2AHES-M2

IC ID: 21152-M2

8-18 GHz



18-40 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

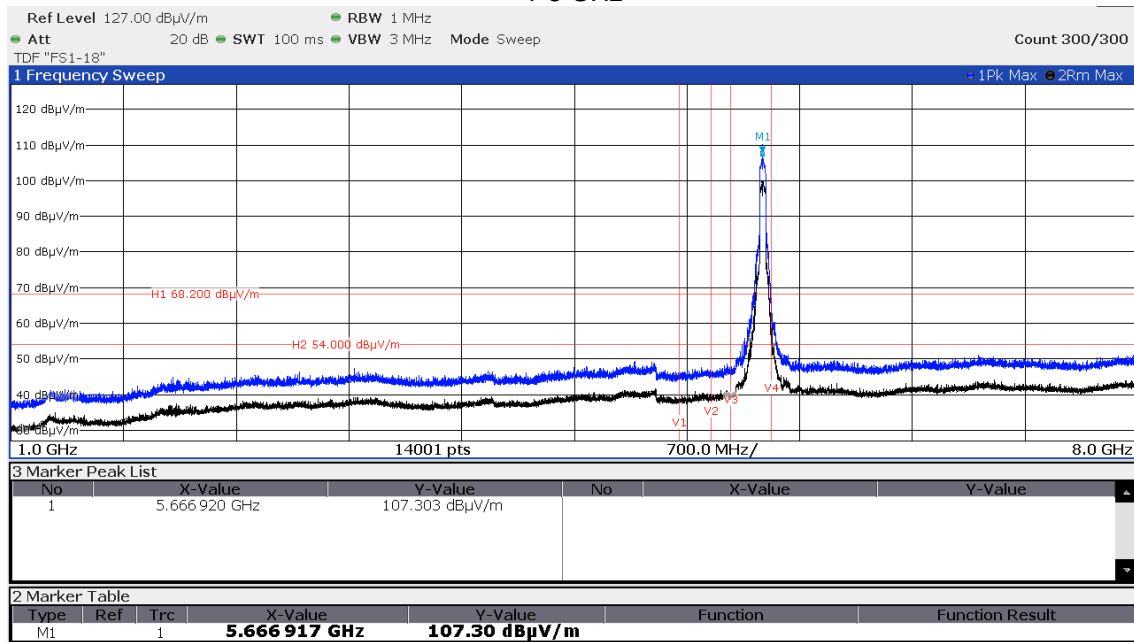
IC ID: 21152-M2

CH134, 802.11n HT40

Band Edges



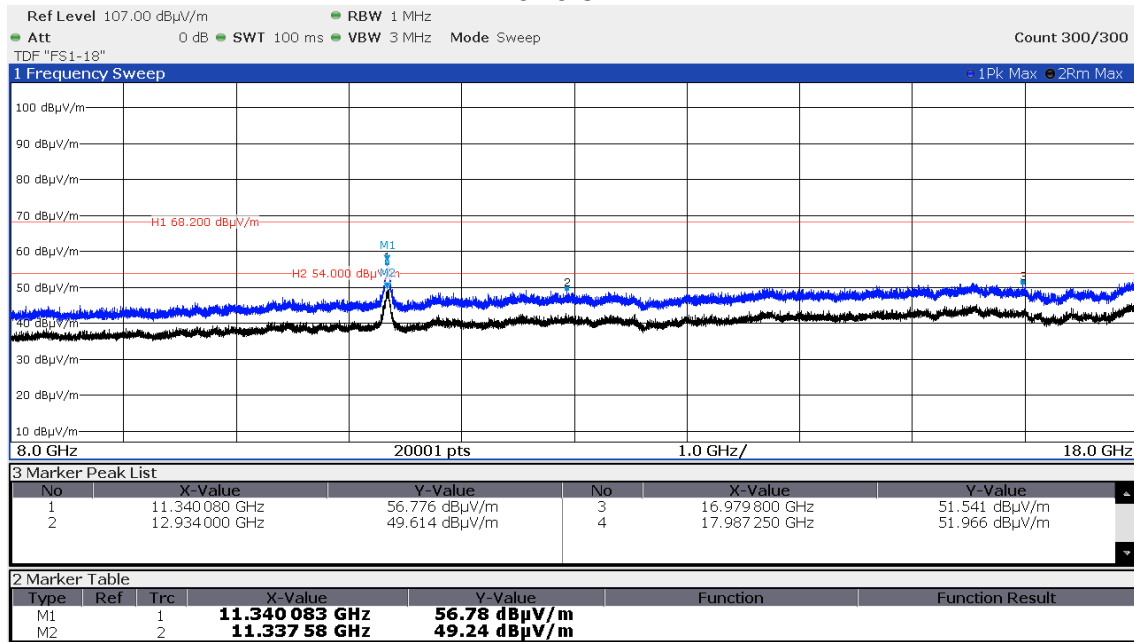
1-8 GHz



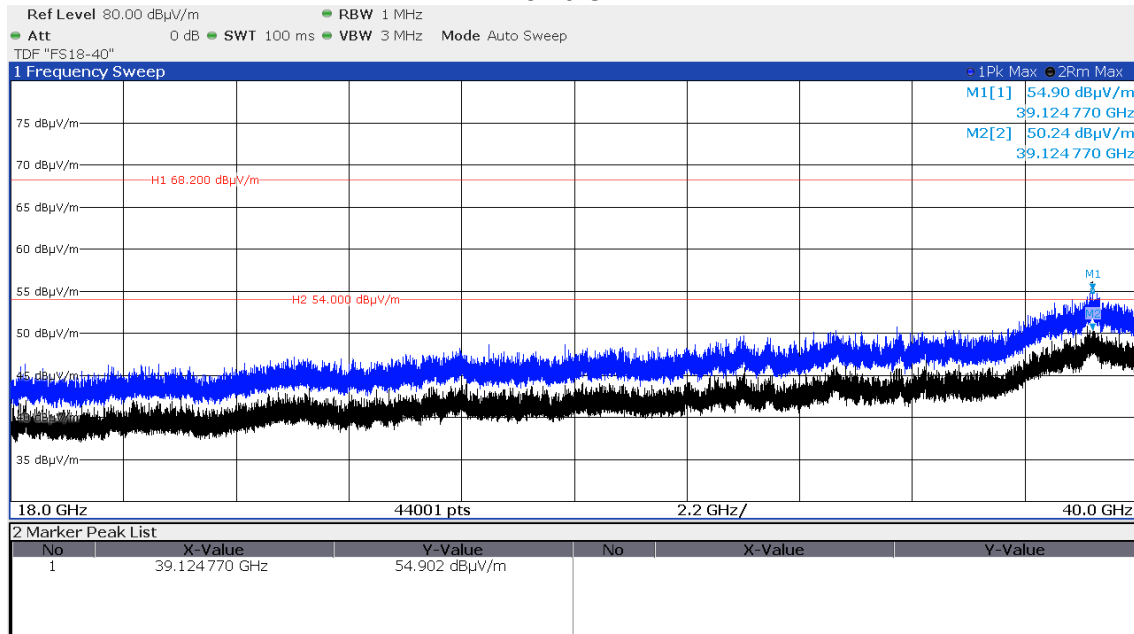
FCC ID: 2AHES-M2

IC ID: 21152-M2

8-18 GHz



18-40 GHz



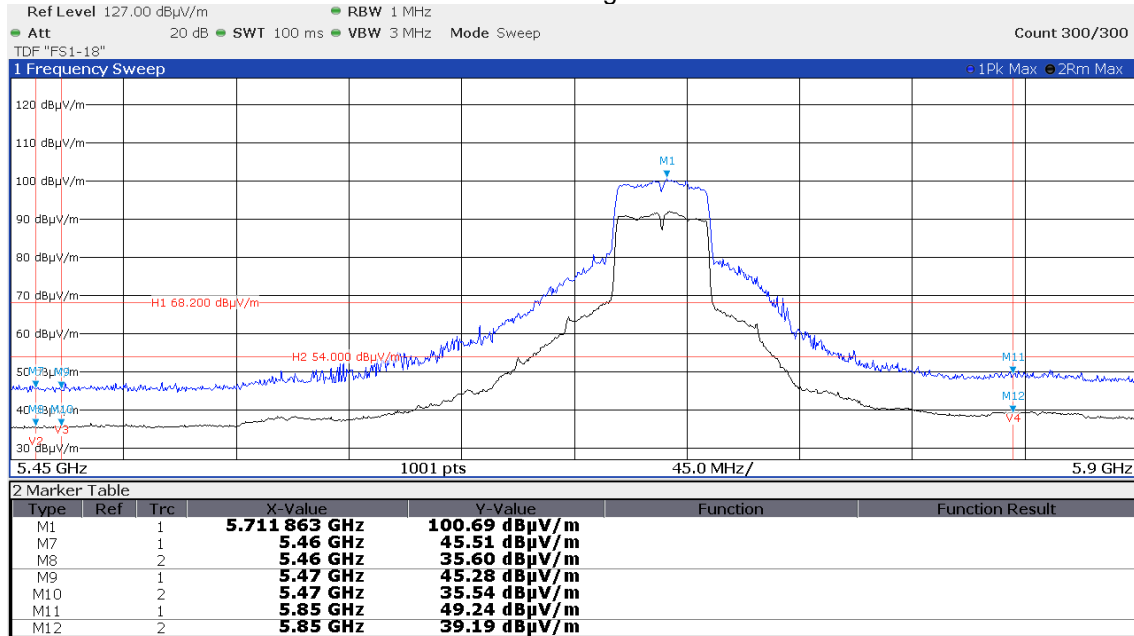
The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: 2AHES-M2

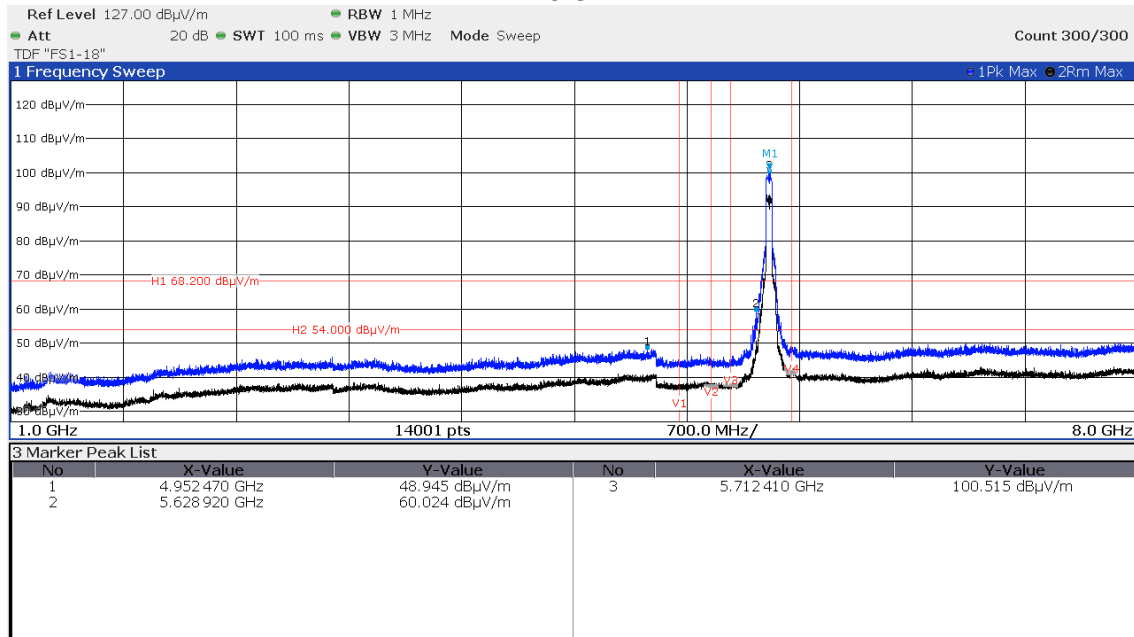
IC ID: 21152-M2

CH142, 802.11n HT40

Band Edges



1-8 GHz

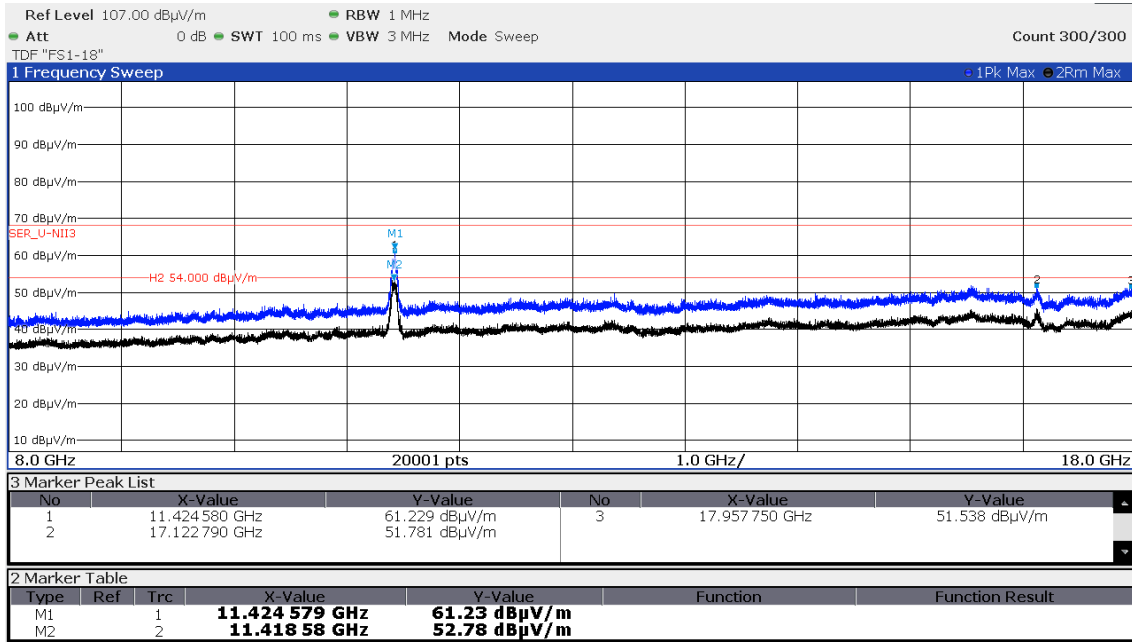


The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

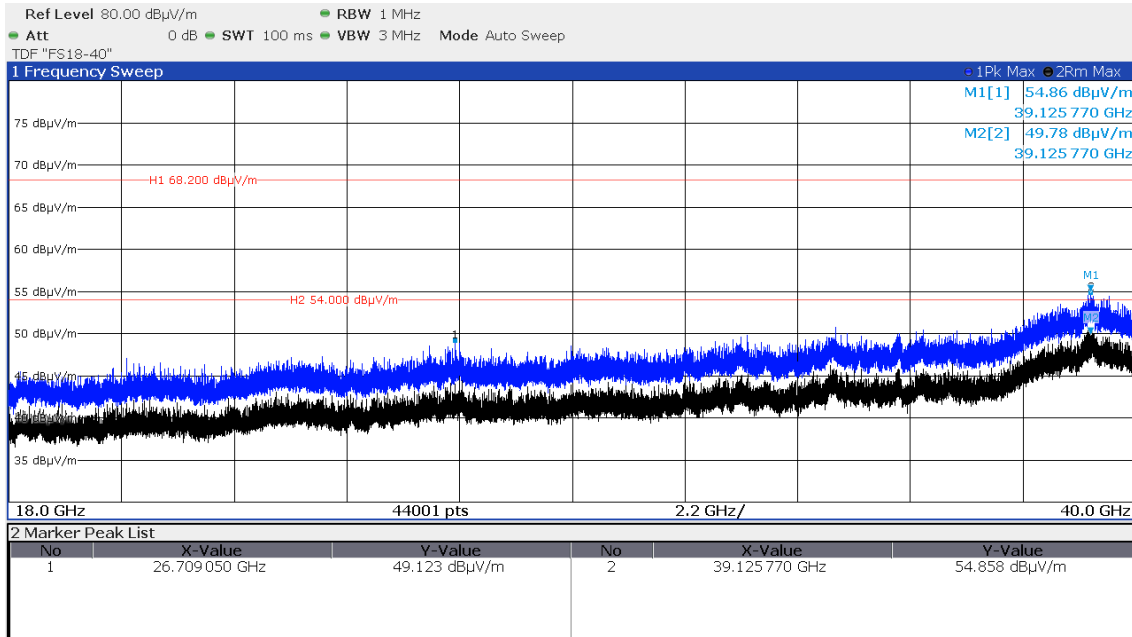
FCC ID: 2AHES-M2

IC ID: 21152-M2

8-18 GHz



18-40 GHz

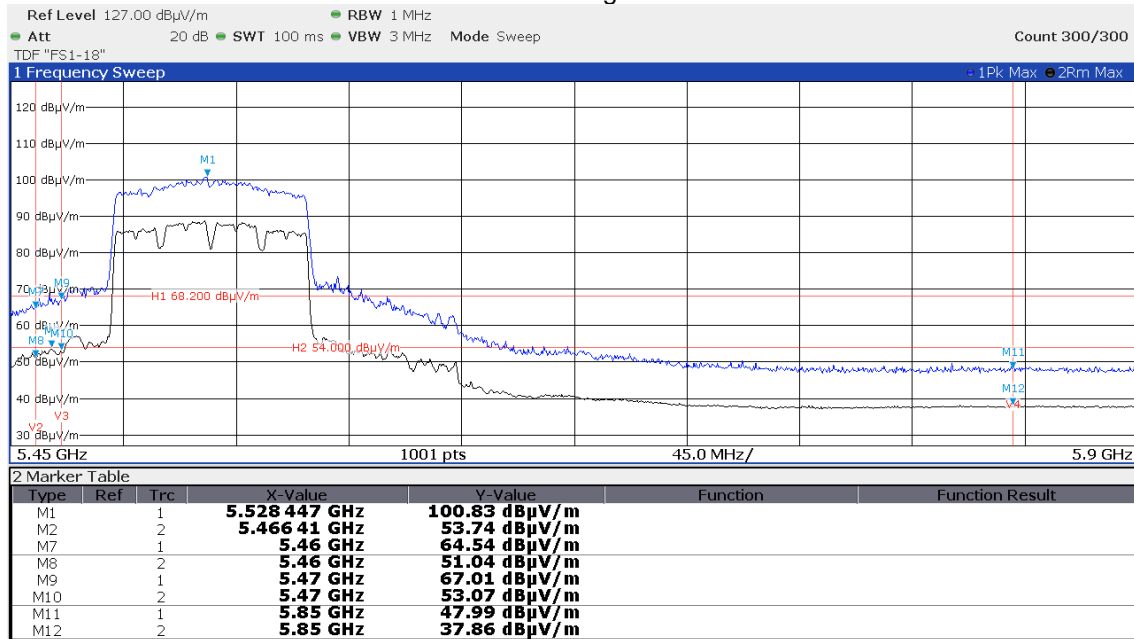


FCC ID: 2AHES-M2

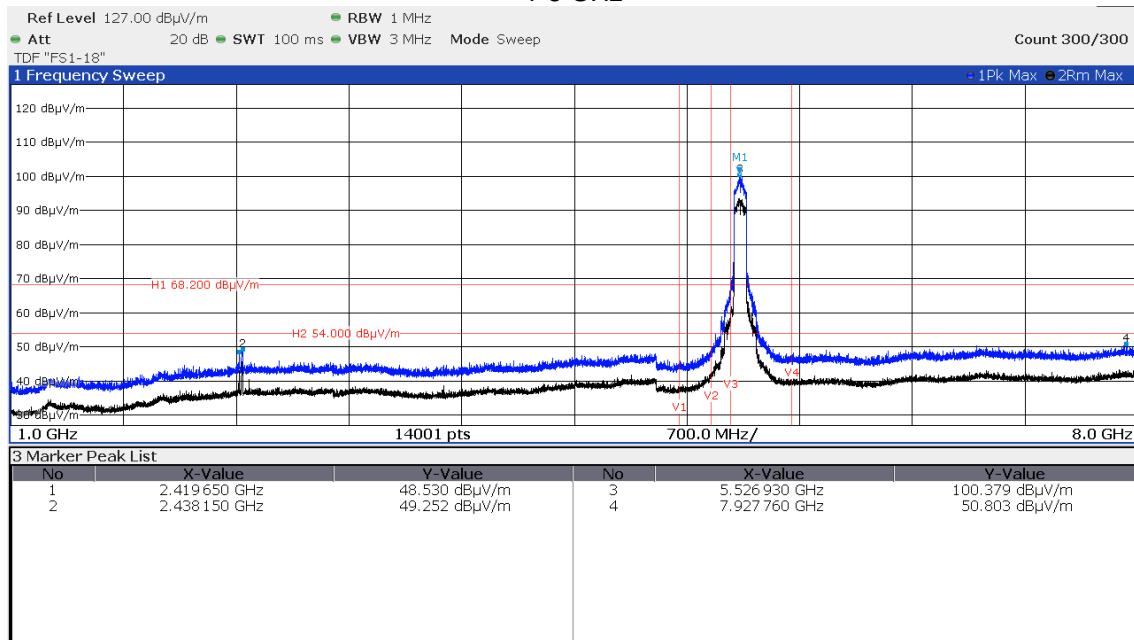
IC ID: 21152-M2

CH106, 802.11ac VHT80

Band Edges



1-8 GHz

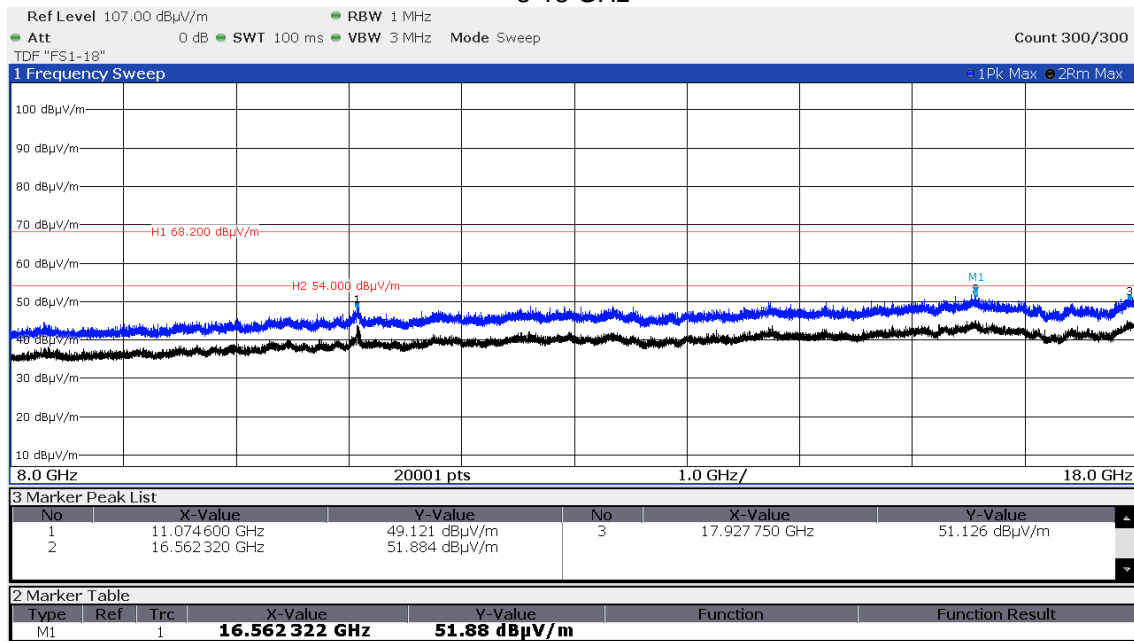


The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

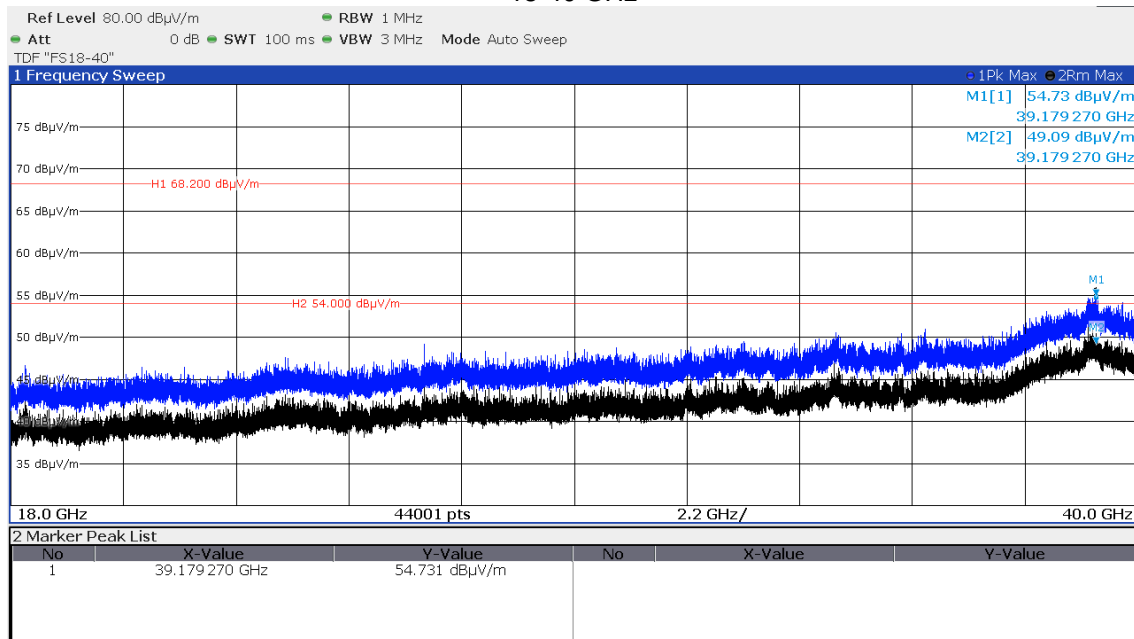
FCC ID: 2AHES-M2

IC ID: 21152-M2

8-18 GHz



18-40 GHz



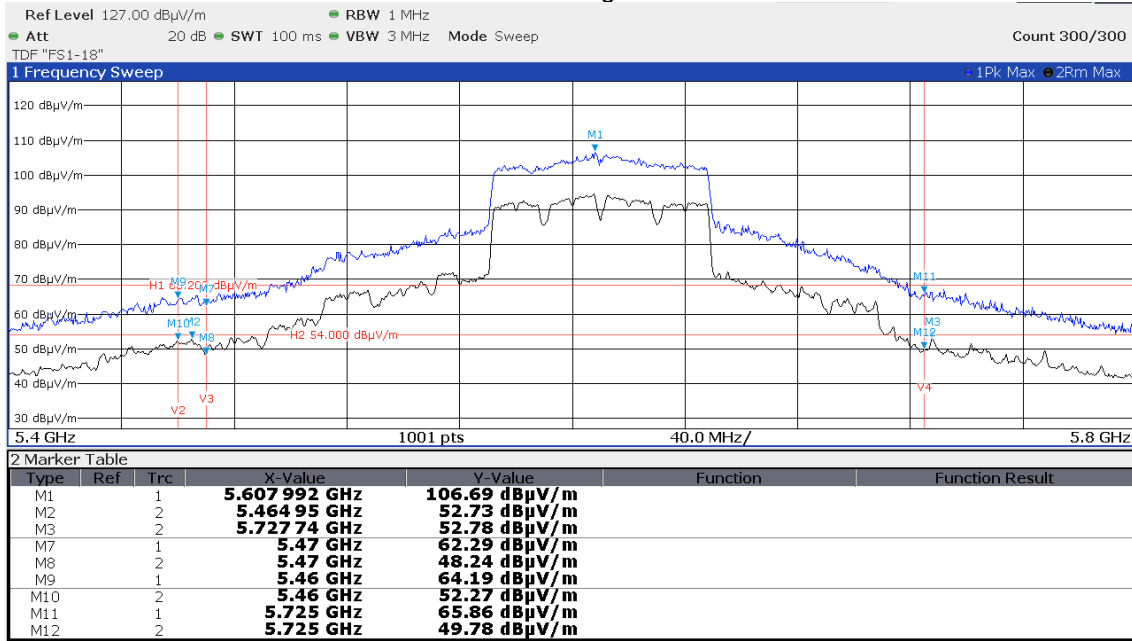
The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: 2AHES-M2

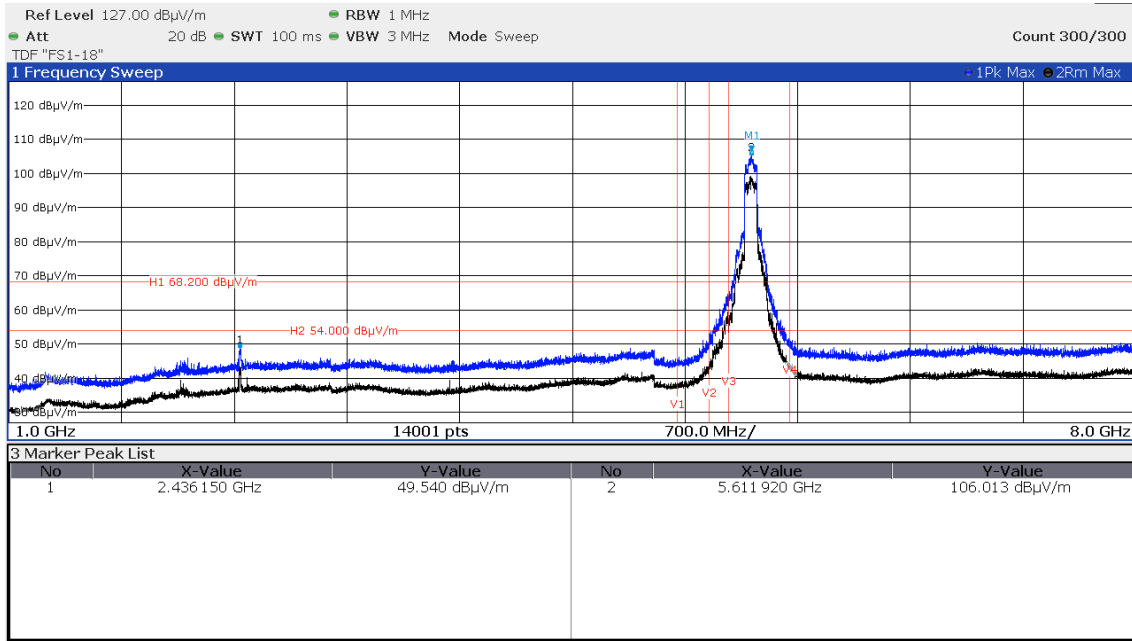
IC ID: 21152-M2

CH122, 802.11ac VHT80

Band Edges



1-8 GHz

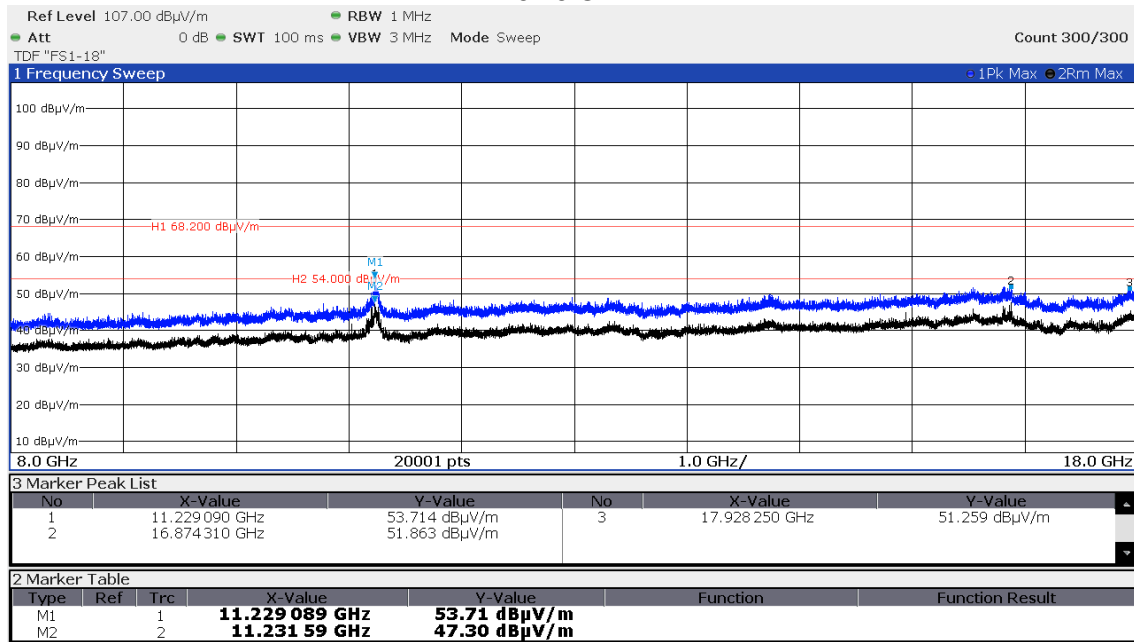


The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

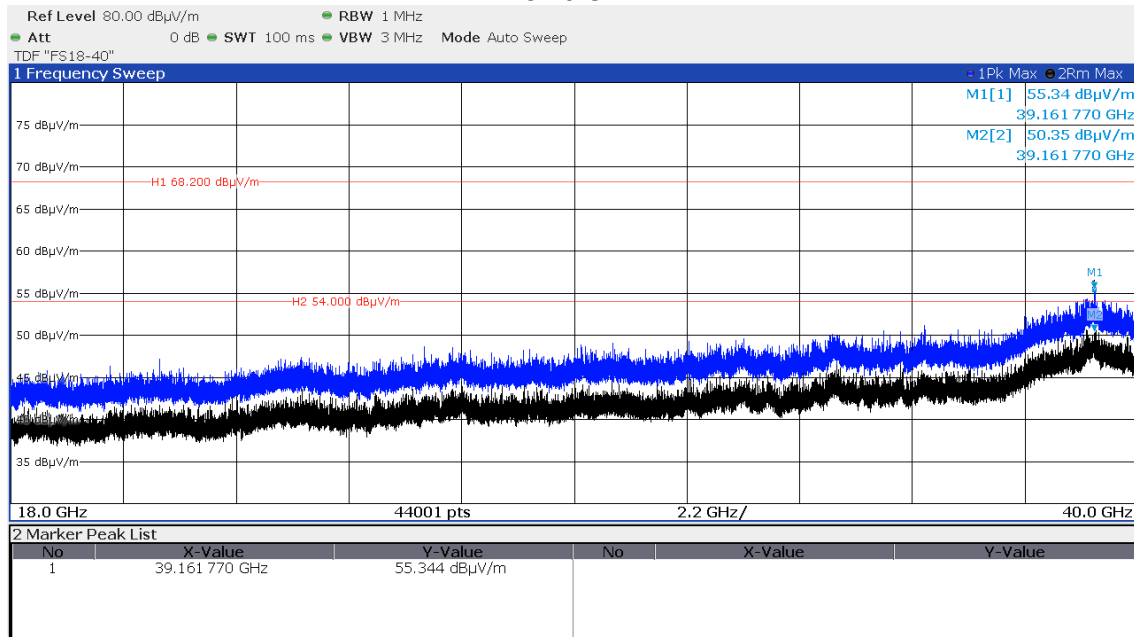
FCC ID: 2AHES-M2

IC ID: 21152-M2

8-18 GHz



18-40 GHz



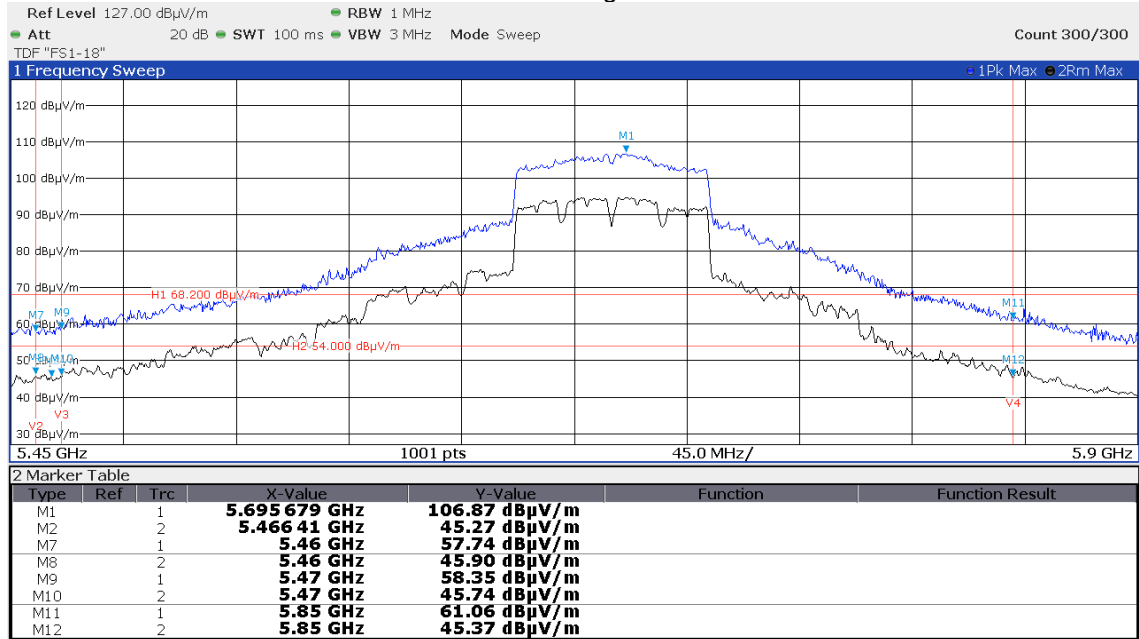
The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: 2AHES-M2

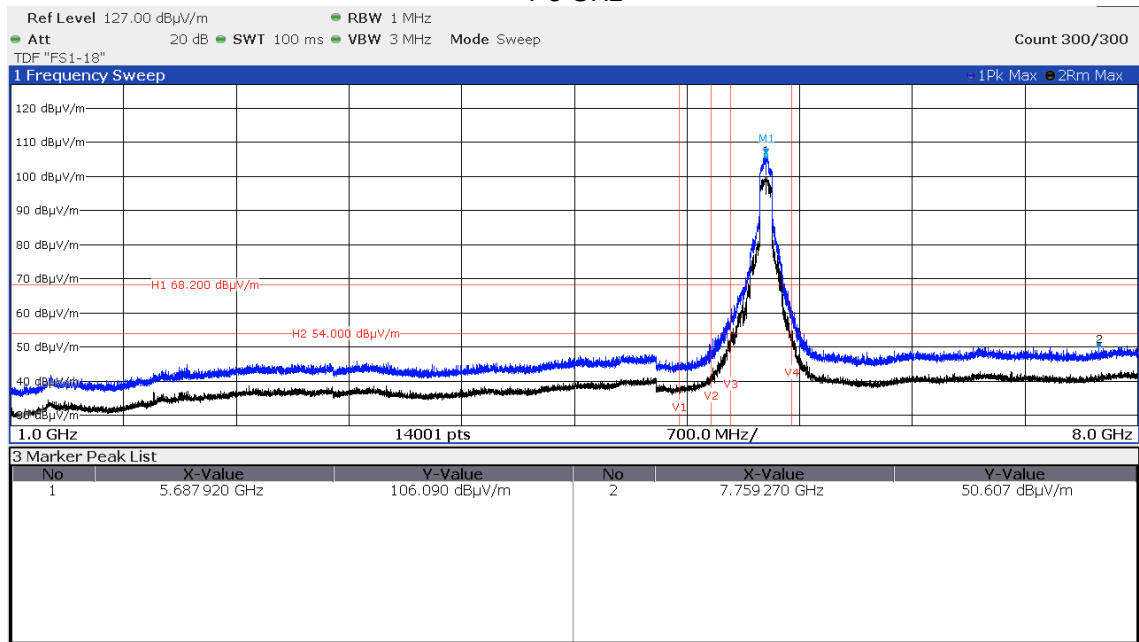
IC ID: 21152-M2

CH138, 802.11ac VHT80

Band Edges



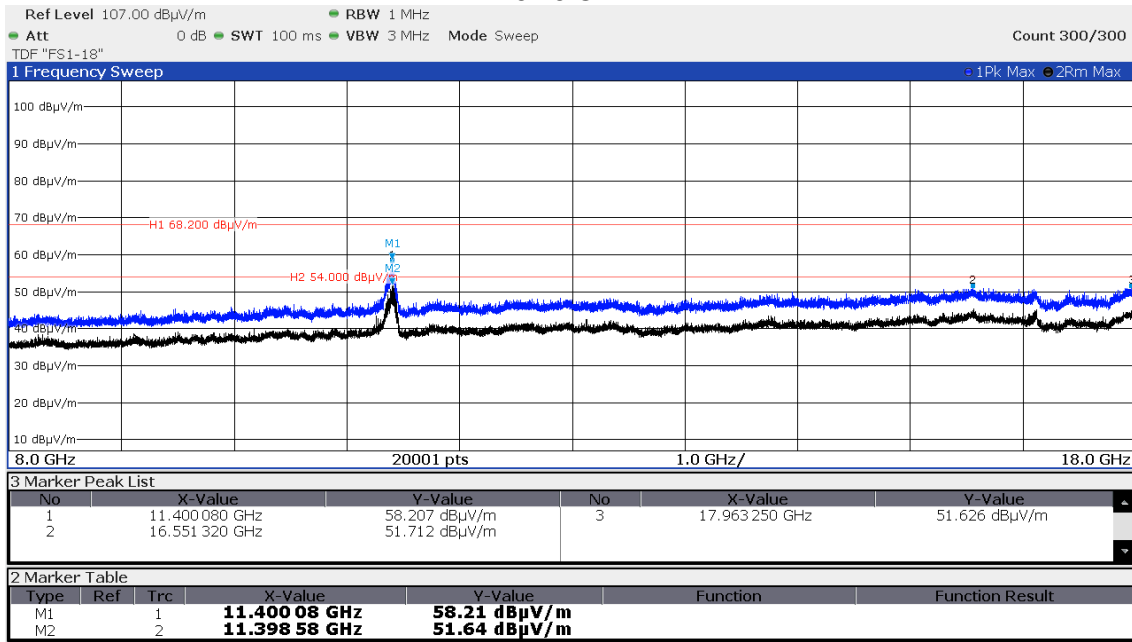
1-8 GHz



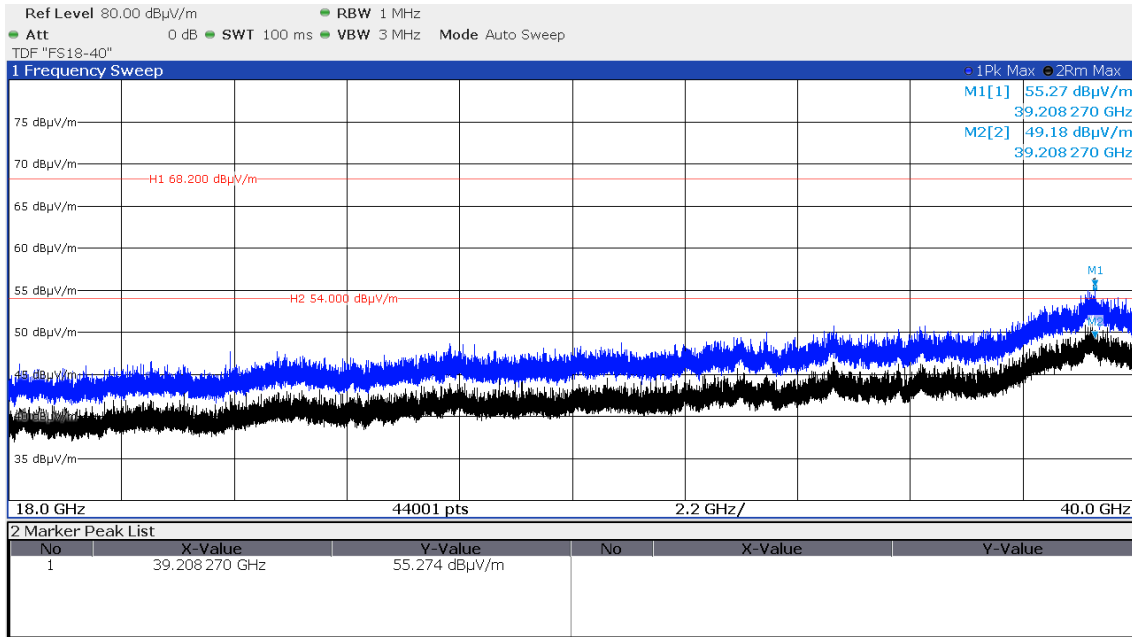
FCC ID: 2AHES-M2

IC ID: 21152-M2

8-18 GHz



18-40 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)
5470 – 5725	-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.

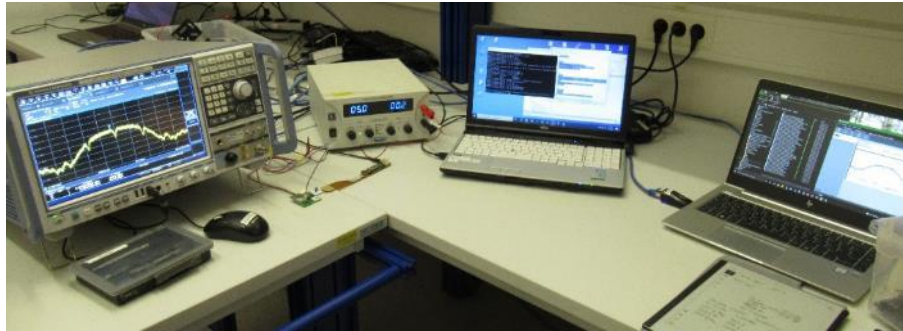
5.6 Frequency stability

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
CH100	5500
Temperature	Frequency Offset
°C	kHz
50	-19.9
40	-15.1
30	-2.9
20	10.2
10	18.8
0	26.9
-10	23.7
-20	19.9

Channel	Channel Frequency
	MHz
CH100	5500
Supply Voltage	Frequency Offset
V _{DC}	kHz
4.25	-
5.00	10.2
5.75	5.3

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:

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

5.7 Antenna application - Detailed photos see attachment A

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.

5.7.1 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.

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	02-02/03-17-002	10/02/2022	10/02/2021		
	minibend KR-16	02-02/50-16-014				
	EA-PS 3032-05 B	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	02-02/11-15-001	06/04/2022	06/04/2021		
	AMF-6D-01002000-22-10P	02-02/17-15-004				
	3117	02-02/24-05-009	28/06/2022	28/06/2021		
	BAM 4.5-P	02-02/50-17-024				
	NCD	02-02/50-17-025				
	KK-SF106-2X11N-6,5M	02-02/50-18-016				
	EA-PS 3032-05 B	02-02/50-20-008				
	18N-20	02-02/50-21-009				
BAT-EMC 3.21.0.24	02-02/68-13-001					
MB	FSW43 Spectrum Analyser	02-02/11-15-001	06/04/2022	06/04/2021		
	WK-340/40	02-02/45-05-001	05/08/2022	05/08/2021		
	KK-SF104-11SMA-11N-2M	02-02/50-14-003				
minibend KR-16	02-02/50-16-014					
SER 2	FSP 30 Spectrum Analyser	02-02/11-05-001				
	VULB 9168	02-02/24-05-005	20/12/2022	20/12/2021	07/07/2022	07/07/2021
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
	KK-SD_7/8-2X21N-33,0M	02-02/50-15-028				
	EA-PS 3032-05 B	02-02/50-20-008				
50F-003 N 3 dB	02-02/50-21-010					
SER 3	FSW43	02-02/11-15-001	06/04/2022	06/04/2021		
	AMF-6D-01002000-22-10P	02-02/17-15-004				
	LNA-40-18004000-33-5P	02-02/17-20-002				
	3117	02-02/24-05-009	28/06/2022	28/06/2021		
	BBHA 9170	02-02/24-05-013	19/05/2023	19/05/2020	04/02/2022	04/02/2021
	WHKX 7.5/18G-8SS	02-02/50-07-010				
	BAM 4.5-P	02-02/50-17-024				
	NCD	02-02/50-17-025				
	KK-SF106-2X11N-6,5M	02-02/50-18-016				
	EA-PS 3032-05 B	02-02/50-20-008				
	KMS116-GL140SE-KMS116	02-02/50-20-026				
BAT-EMC 3.21.0.24	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.