R F – T E S T R E P O R T

- FCC Part 15.407, RSS-247 -

Type / Model Name	:	SPB228-D
Product Description	:	Combined WLAN/BT module
Applicant	:	H&D Wireless AB
Address	:	Färögatan 33
		164 51 KISTA, SWEDEN
Manufacturer	:	H&D Wireless AB
Address	:	Färögatan 33
		164 51 KISTA, SWEDEN

Test Result according to the standards listed in clause 1 test standards:	**POSITIVE**

Test Report No. : 80113315-01 Rev_0	20. January 2022 Date of issue

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

FCC ID: XO2-SPB228D IC: 8713A-SPB228D

Contents

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (September 2020)

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 2020)

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 2020)

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
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	Guidelines for compliance testing of UNII-Devices Part 15, Subpart E, December 14, 2017.

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

According to the customer the WLAN/BT5 module SPB228 (FCC ID: XO2-SPB228D, IC ID: 8713A-SPB228D) is fully tested and approved according the FCC 15407. This test report shows the further compliance to the FCC 15407 after integration. Therefore, the re-test is partly done to the following requirements, only.

- **RF output power (radiated)**
- **Emission bandwidth (radiated)**
- **Transmitter unwanted emissions (radiated)**

2.5 Equipment category

WLAN - Client

2.6 Short description of the equipment under test (EUT)

The EUT is a combined WLAN/BT5 2x2 MU-MIMO module SPB228-D (802.11 ac/a/b/g/n, BLE 5.0). It is integrated into a mobile handheld computer M2SmartSE for mobile acquisition and transmission of data with WLAN/BT. The M2SmartSE can be charged in a docking station.

Number of tested samples:	1
Serial number:	1911 01 (M2SmartSE: 193600000151)
Firmware version WLAN:	16.68.10.p16

2.7 Variants of the EUT

There are no variants.

2.8 Operation frequency and channel plan

The operating frequency is 5150 MHz to 5850 MHz.

Channel plan:

a, n HT20, ac VHT20 mode:

Channel	Frequency (MHz)
36	5180
40	5200
44	5220
48	5240

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

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

Channel	Frequency (MHz)
149	5745
153	5765
157	5785
161	5805
165	5825

a, n HT40, ac VHT40 mode:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
36up	5190	40down	5190
44up	5230	48down	5230

Channel	Frequency (MHz)	Channel	Frequency (MHz)
52up	5270	56down	5270
60up	5310	64down	5310

Channel	Frequency (MHz)	Channel	Frequency (MHz)
100up	5510	104down	5510
108up	5550	112down	5550
132up	5670	136down	5670
140up	5710	142down	5710

Channel	Frequency (MHz)	Channel	Frequency (MHz)
149up	5755	153down	5755
161up	5815	165down	5815

ac VT80 mode:

Channel	Frequency (MHz)
42	5210

Channel	Frequency (MHz)
58	5290

Channel	Frequency (MHz)
106	5530
122	5610
138	5690

Channel	Frequency (MHz)
155	5775

Note: The marked frequencies are determined for final testing.

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 VT20, MCS 0 - 9
- 802.11ac VT40, MCS 0 - 9
- 802.11ac VT80, MCS 0 - 9

2.10 Antenna

The following antenna shall be used with the EUT:

Number	Characteristic	Model number	Plug	Frequency range (MHz)	Gain (dBi)
A	omnidirectional	W3006 Pulse LarsenAntenna	MHF4L	2400-2485 5150-5850	1.8 4.5
B	omnidirectional	1001932PT AVX ethertronics	MHF4L	2400-2485 5150-5825	2.5 4.4

2.11 Power supply system utilised

Power supply voltage : 3.8 V/DC (battery pack)
Power supply voltage (alternative) : 15.0 V/DC (docking station)

2.12 Peripheral devices and interface cables

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

- Docking station Model : DS2Smart, ACD Elektronik GmbH
- Notebook EPC-0776 Model : Latitude E6400, DELL

2.13 Determination of worst case conditions for final measurement

Measurements have been made in all three orthogonal axes and the settings of the EUT were changed to locate at which position and at what setting of the EUT produce the maximum of the emissions.

Preliminary tests were performed to find the worst case mode from all possible combinations between available modulations, data rates. The maximum output power depends on used data rate.

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

Path A (antenna A):

WLAN	Available channel	Tested channels	Power setting	Modulation	Modulation type	Data rate
802.11n HT20	36 - 165	36, 64, 100, 165	14	OFDM	BPSK	MCS7 (BW=20 MHz)
802.11ac VHT40	36up – 161up	36up, 60up, 100up, 161up	8	OFDM	BPSK	MCS9 (BW=40 MHz)
802.11ac VHT80	42 - 155	42, 56, 106, 155	6	OFDM	BPSK	MCS9 (BW=80 MHz)

Path B (antenna B):

WLAN	Available channel	Tested channels	Power setting	Modulation	Modulation type	Data rate
802.11n HT20	36 - 165	36, 64, 100, 165	14	OFDM	BPSK	MCS7 (BW=20 MHz)
802.11ac VHT40	36up – 161up	36up, 60up, 100up, 161up	8	OFDM	BPSK	MCS9 (BW=40 MHz)
802.11ac VHT80	42 - 155	42, 56, 106, 155	6	OFDM	BPSK	MCS9 (BW=80 MHz)

Path A+B:

WLAN	Available channel	Tested channels	Power setting	Modulation	Modulation type	Data rate
802.11n HT20	36 - 165	64	11	OFDM	BPSK	MCS7 (BW=20 MHz)
802.11ac VHT40	36up – 161up	60up	5	OFDM	BPSK	MCS9 (BW=40 MHz)
802.11ac VHT80	42 - 155	58	3	OFDM	BPSK	MCS9 (BW=80 MHz)

- TX continuous mode, 802.11n
- TX continuous mode, 802.11ac

2.13.1 Test jig

No test jig used.

2.13.2 Test software

The test software for the EUT provides free power setting, the special test mode TX continuous mode, modulated. The EUT was set with test modulation to transmit data during the tests with a maximum duty cycle (x) from an internal packet generator.

Test software scripts:

802.11n, ch36, MCS7, 20MHz, 14dBm path A only
35
10 1 1
30 1
112 0
12 36
22 0 36 14 2
35 1 22 1 100 F00

802.11n, ch36, MCS7, 20MHz, 14dBm path B only
35
10 2 2
30 1
112 0
12 36
22 1 36 14 2
35 1 22 1 100 F00

802.11n, ch64, MCS7, 20MHz, 11dBm path A+B
35
10 3 3
30 1
112 0
12 64
22 3 64 11 2
35 1 22 1 100 F00

802.11ac, ch36+40, MCS9, 40MHz, 8dBm, path A only
35
10 1 1
30 1

112 1
12 36
22 0 36 8 2
35 1 110 1 100 F04

802.11ac, ch36+40, MCS9, 40MHz, 8dBm, path B only
35
10 2 2
30 1
112 1
12 36
22 1 36 8 2
35 1 110 1 100 F04

802.11ac, ch60+64, MCS9, 40MHz, 5dBm, path A+B
35
10 3 3
30 1
112 1
12 60
22 3 60 5 2
35 1 120 1 100 F04

802.11ac, ch36+40+44+48, MCS9, 80MHz, 6dBm, path A only
35
10 1 1
30 1
112 4
12 36
22 0 36 6 2
35 1 110 1 100 F04

802.11ac, ch36+40+44+48, MCS9, 80MHz, 6dBm, path B only
35
10 2 2
30 1
112 4
12 36
22 1 36 6 2
35 1 110 1 100 F04

802.11ac, ch52+56+60+64, MCS9, 80MHz, 3dBm, path A+B
35
10 3 3
30 1
112 4
12 52
22 3 52 3 2
35 1 120 1 100 F04

3 TEST RESULT SUMMARY

UNII device uses the operating band 5150 MHz - 5850 MHz:

FCC Rule Part	RSS Rule Part	Description	Result
15.207(a)	RSS Gen, 8.8	AC power line conducted emissions	passed
15.407(a)	RSS-247, 6.2.1.1	Output power	passed
15.407(e)	RSS-247, 5.2(a)	-6 dB EBW	passed
15.407(b)	RSS-247, 6.2.1.2	Undesirable emissions	passed
15.205(a)	RSS-Gen, 8.10	Emissions in restricted bands	passed
15.407(a)	-	Antenna requirement	passed

The mentioned RSS Rule Parts in the above table are related to:
RSS-Gen, Issue 5 + Amendment 1 + Amendment 2, February 2021
RSS-247, Issue 2, February 2017

3.1 Final assessment

The equipment under test fulfils the requirements cited in clause 1 test standards.

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

Testing commenced on : 10 December 2020

Testing concluded on : 18 January 2022

Checked by:

Klaus Gegenfurtner
2022.01.20 14:07:37
+01'00'

Klaus Gegenfurtner
Teamleader Radio

Tested by:

Sabine Kugler
2022.01.20 13:23:46
+01'00'

Sabine Kugler
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 acc. to CISPR 16-4-2 / 2011 + A1 / 2014 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements“ and is documented in the quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, CSA Group Bayern GmbH, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component 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%	± 2.5 x 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

4.4 Conformity Decision Rule

The conformity decision rule is based on the ILAC G8 published at the time of reporting.

4.5 Measurement protocol for FCC and IC

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".

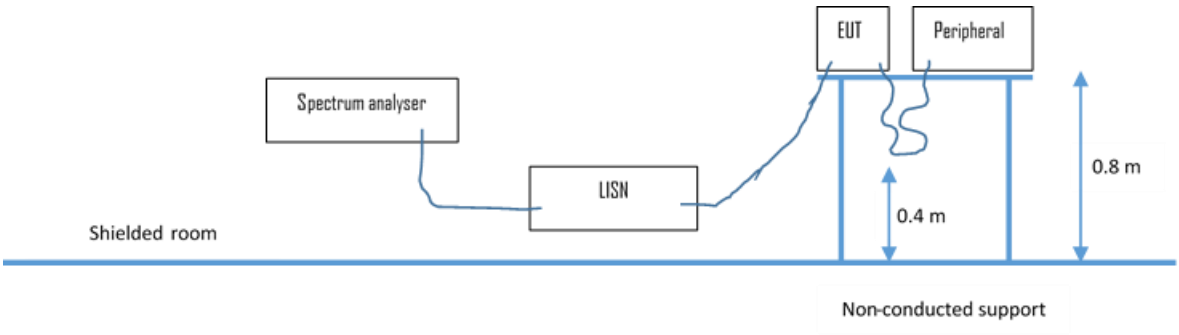
4.5.2.1 Justification

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

4.5.3 Details of test procedures

4.5.3.1 Conducted emission

Test setup according ANSI C63.10



The final level, expressed in dBµV, is arrived at by taking the reading directly from the Spectrum analyser. This level is compared to the limit.

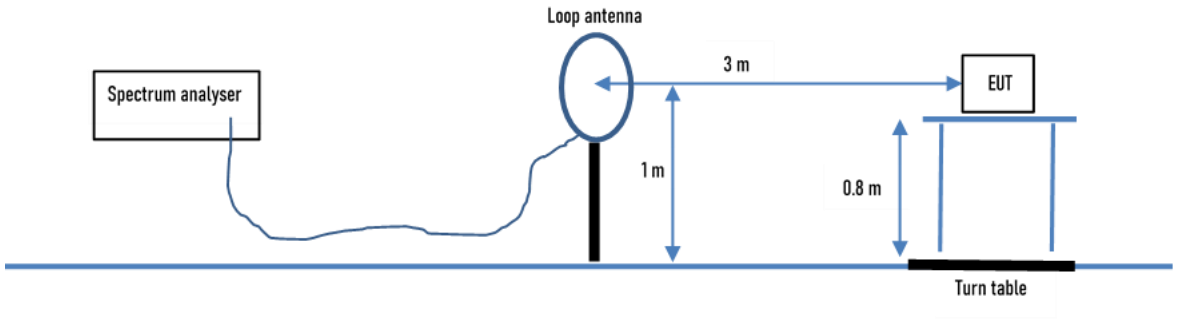
To convert between dBµV and µV, the following conversions apply:

dBµV = 20(log µV)
µV = Inverse log(dBµV/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 µH (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.

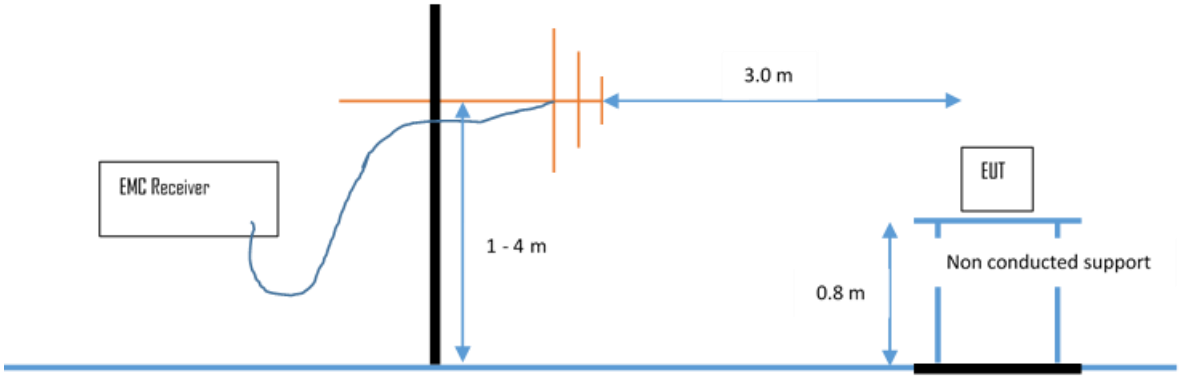
4.5.3.2 Radiated emission

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 center 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 center 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.

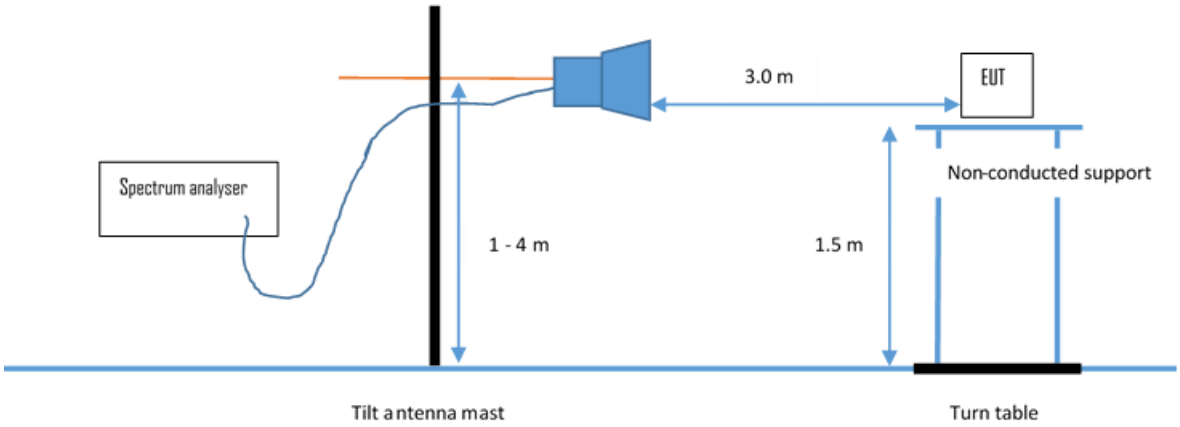
The resolution bandwidth setting:
30 MHz – 1000 MHz: RBW: 120 kHz

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

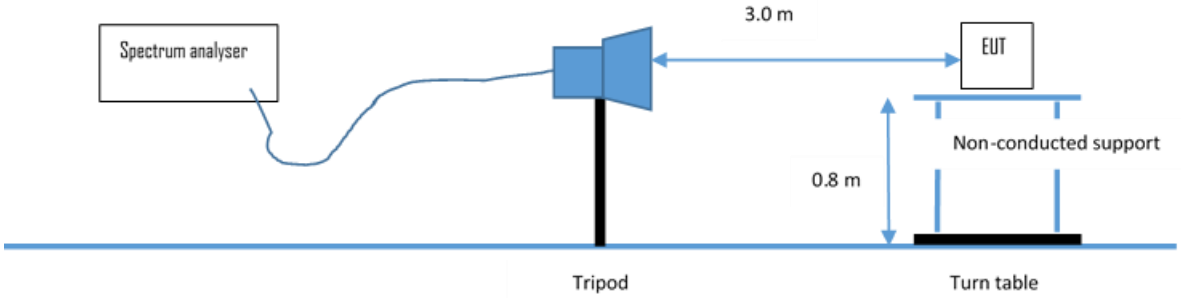
4.5.3.2.3 Anechoic chamber 1 (1000 MHz – 18000 MHz)

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 center, 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.

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 are adopted.

5 TEST CONDITIONS AND RESULTS

5.1 Conducted emissions

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

5.1.1 Description of the test location

Test location: Shielded Room S2

5.1.2 Photo documentation of the test set-up

5.1.3 Applicable standard

According to FCC Part 15C, Section 15.207(a):
Except as shown in paragraphs (b) and (c) of this Section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	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

5.1.4 Description of Measurement

The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection and a line impedance stabilization network (LISN) with 50Ω/50 μH (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimetres above the floor and is positioned 40 centimetres from the vertical ground plane (wall) of the screen room. If the minimum limit margin 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.

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

dBμV = 20 log μV

μV = 10^(dBμV/20)

5.1.5 Test result

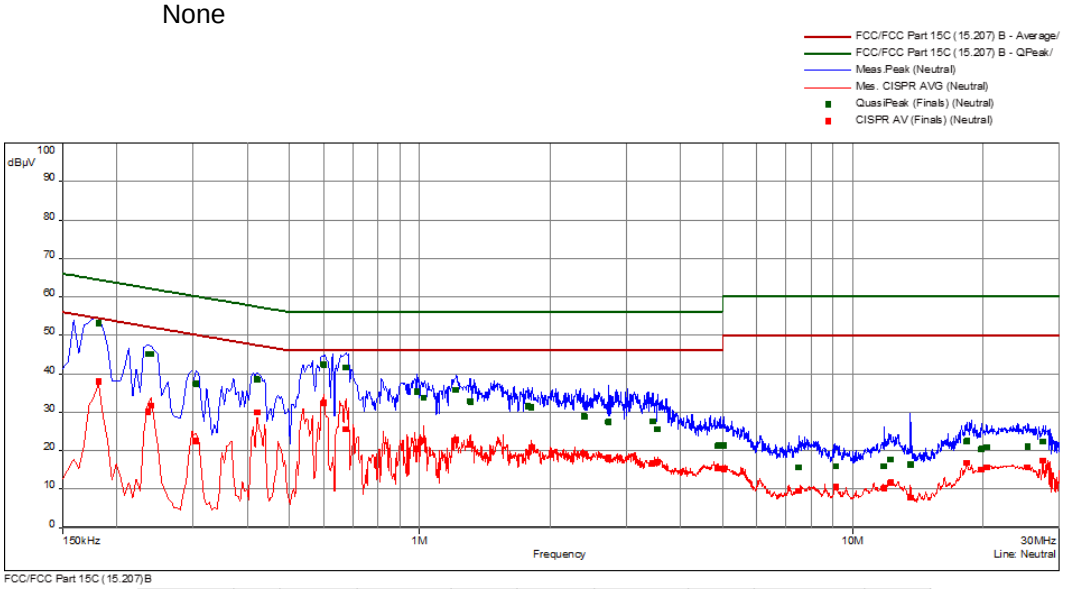
Frequency range:	0.15 MHz - 30 MHz
Min. limit margin	-13.6 dB at 0.6 MHz

The requirements are **FULFILLED.**

Remarks: For detailed test result please see following test protocols.

5.1.6 Test protocol

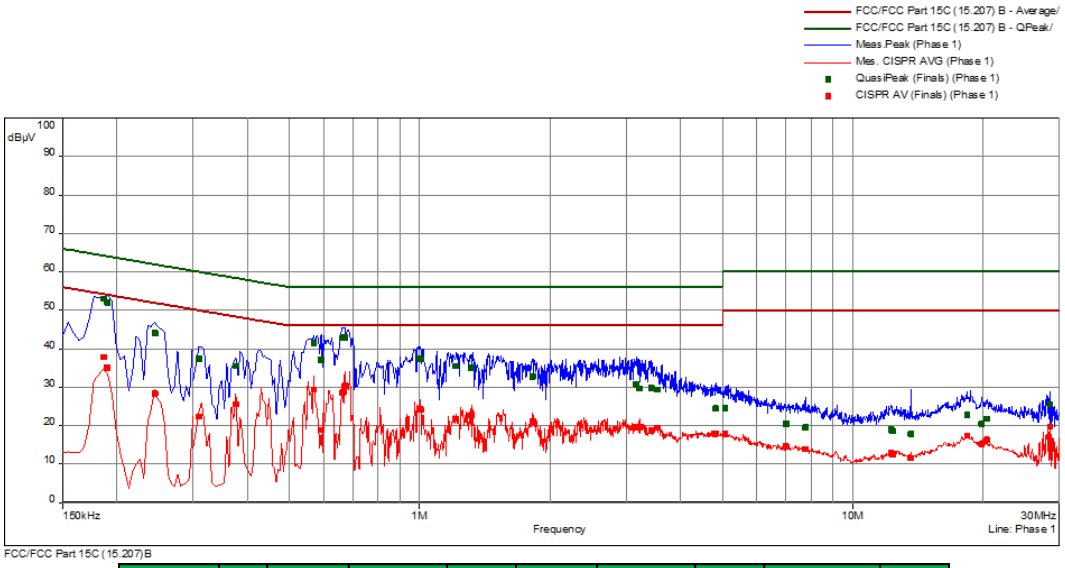
Test point N Result: passed
Operation mode: WLAN 5 GHz TX continuous
Remarks: None



freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
0.182	9	53.2	-11.3	64.4	37.9	-16.5	54.4	Neutral	10.1
0.236	9	45.2	-17.0	62.3	30.2	-22.1	52.3	Neutral	10.1
0.240	9	45.2	-16.9	62.1	31.9	-20.3	52.1	Neutral	10.1
0.305	10	37.4	-22.7	60.1	22.5	-27.6	50.1	Neutral	10.1
0.422	10	38.5	-18.9	57.4	29.9	-17.5	47.4	Neutral	10.2
0.600	10	42.4	-13.6	56.0	32.3	-13.7	46.0	Neutral	10.2
0.600	11	42.5	-13.5	56.0	32.4	-13.6	46.0	Neutral	10.2
0.677	11	41.7	-14.3	56.0	25.5	-20.5	46.0	Neutral	10.2
0.987	11	35.3	-20.7	56.0	20.6	-25.4	46.0	Neutral	10.2
1.023	11	33.9	-22.1	56.0	22.7	-23.3	46.0	Neutral	10.2
1.214	12	35.8	-20.2	56.0	22.8	-23.2	46.0	Neutral	10.2
1.308	12	32.9	-23.1	56.0	21.7	-24.3	46.0	Neutral	10.3
1.776	12	31.6	-24.4	56.0	19.4	-26.6	46.0	Neutral	10.3
1.812	12	31.3	-24.7	56.0	21.0	-25.0	46.0	Neutral	10.3
2.400	13	29.0	-27.1	56.0	19.3	-26.7	46.0	Neutral	10.3
2.729	13	27.5	-28.5	56.0	18.1	-27.9	46.0	Neutral	10.3
3.453	13	27.6	-28.4	56.0	16.8	-29.2	46.0	Neutral	10.4
3.539	13	25.7	-30.3	56.0	17.1	-28.9	46.0	Neutral	10.4
4.877	14	21.4	-34.6	56.0	15.4	-30.6	46.0	Neutral	10.4
5.043	14	21.4	-38.6	60.0	15.2	-34.8	50.0	Neutral	10.4
7.500	14	15.8	-44.2	60.0	9.7	-40.4	50.0	Neutral	10.6
9.125	14	16.0	-44.0	60.0	10.5	-39.5	50.0	Neutral	10.7
11.801	15	16.0	-44.0	60.0	10.3	-39.7	50.0	Neutral	10.8
12.215	15	17.8	-42.2	60.0	11.8	-38.2	50.0	Neutral	10.8
13.596	15	16.5	-43.6	60.0	7.9	-42.1	50.0	Neutral	10.9
18.321	15	22.5	-37.5	60.0	16.8	-33.2	50.0	Neutral	11.2
19.835	16	20.5	-39.5	60.0	15.2	-34.8	50.0	Neutral	11.2
20.388	16	21.0	-39.0	60.0	15.7	-34.3	50.0	Neutral	11.3
25.370	16	21.0	-39.0	60.0	15.7	-34.3	50.0	Neutral	11.2
27.467	16	22.5	-37.6	60.0	17.5	-32.5	50.0	Neutral	11.2

FCC ID: XO2-SPB228D **IC: 8713A-SPB228D**

Test point L1 Result: passed
Operation mode: WLAN 5 GHz TX continuous
Remarks: None



freq	SR	QP	margin	limit	AV	margin	limit	line	corr
MHz		dB(µV)	dB	dB	dB(µV)	dB	dB		dB
0.186	1	53.1	-11.1	64.2	37.9	-16.4	54.2	Phase 1	10.1
0.191	1	52.0	-12.0	64.0	35.2	-18.8	54.0	Phase 1	10.1
0.245	1	44.1	-17.9	61.9	28.5	-23.5	51.9	Phase 1	10.1
0.309	2	37.4	-22.6	60.0	22.4	-27.6	50.0	Phase 1	10.1
0.377	2	35.5	-22.9	58.4	25.5	-22.8	48.4	Phase 1	10.2
0.570	2	41.5	-14.5	56.0	29.5	-16.5	46.0	Phase 1	10.2
0.593	2	37.1	-18.9	56.0	18.9	-27.1	46.0	Phase 1	10.2
0.663	3	42.9	-13.1	56.0	28.7	-17.4	46.0	Phase 1	10.2
0.672	3	43.0	-13.0	56.0	30.4	-15.6	46.0	Phase 1	10.2
1.001	3	37.6	-18.4	56.0	24.4	-21.6	46.0	Phase 1	10.2
1.005	3	37.4	-18.6	56.0	24.2	-21.8	46.0	Phase 1	10.2
1.214	4	35.5	-20.5	56.0	21.8	-24.2	46.0	Phase 1	10.2
1.317	4	35.1	-20.9	56.0	22.9	-23.1	46.0	Phase 1	10.3
1.826	4	32.9	-23.1	56.0	21.3	-24.7	46.0	Phase 1	10.3
3.161	5	30.8	-25.2	56.0	19.7	-26.3	46.0	Phase 1	10.4
3.215	5	29.6	-26.4	56.0	19.6	-26.4	46.0	Phase 1	10.4
3.431	5	29.9	-26.2	56.0	18.8	-27.2	46.0	Phase 1	10.4
3.534	5	29.3	-26.7	56.0	19.4	-26.6	46.0	Phase 1	10.4
4.827	6	24.6	-31.4	56.0	17.9	-28.1	46.0	Phase 1	10.4
5.070	6	24.5	-35.5	60.0	17.9	-32.1	50.0	Phase 1	10.5
7.010	6	20.5	-39.5	60.0	14.6	-35.4	50.0	Phase 1	10.6
7.766	6	19.6	-40.4	60.0	13.9	-36.1	50.0	Phase 1	10.6
12.264	7	19.1	-40.9	60.0	12.9	-37.1	50.0	Phase 1	11.0
12.372	7	18.7	-41.3	60.0	12.6	-37.4	50.0	Phase 1	11.0
13.605	7	17.9	-42.1	60.0	11.7	-38.3	50.0	Phase 1	11.1
18.375	7	22.8	-37.2	60.0	17.4	-32.6	50.0	Phase 1	11.4
19.812	8	20.6	-39.4	60.0	15.2	-34.8	50.0	Phase 1	11.5
20.361	8	21.8	-38.2	60.0	16.4	-33.6	50.0	Phase 1	11.5
28.479	8	25.6	-34.4	60.0	19.9	-30.2	50.0	Phase 1	11.7

5.2 Maximum conducted output power

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

5.2.1 Description of the test location

Test location: Anechoic chamber 1

5.2.2 Photo documentation of the test set-up

X Y Z

5.2.3 Applicable standard

According to FCC Part 15E, Section 15.407(a):
The maximum conducted output power over the frequency band of operation shall not exceed the effective values. If transmitting antennas of directional gain are greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.2.4 Description of Measurement

The output power is measured conducted using a spectrum analyser. The EUT has no constant duty cycle and may be smaller than 98% therefore the procedure according the KDB 789033; item E g) Method SA-3 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 OBW 99 alternatively.

Spectrum analyser settings:
Channel power measurement function, TX channel bandwidth equal to OBW;

N HT20:	RBW: 30 MHz,	VBW: 80 MHz,	Sweep time: auto,	Detector: PK,	Trace: max hold;
ac VT40:	RBW: 50 MHz,	VBW: 80 MHz,	Sweep time: auto,	Detector: PK,	Trace: max hold;
ac VT80:	RBW: 80 MHz,	VBW: 80 MHz,	Sweep time: auto,	Detector: PK,	Trace: max hold;

5.2.5 Test result

Measurement of radiated output power:

802.11n HT20, MCS7, P14		Test results radiated			
Path A (Ant A)		Fieldstrength E (dBµV/m)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
CH36					
T_{nom}	V_{nom}	115.6	20.3	30.0	-9.7
CH64					
T_{nom}	V_{nom}	115.9	20.7	30.0	-9.3
CH100					
T_{nom}	V_{nom}	117.4	22.1	30.0	-7.9
CH165					
T_{nom}	V_{nom}	117.4	22.1	36.0	-13.9

802.11n HT20, MCS7, P14		Test results radiated			
Path B (Ant B)		Fieldstrength E (dBµV/m)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
CH36					
T_{nom}	V_{nom}	114.5	19.3	30.0	-10.7
CH64					
T_{nom}	V_{nom}	117.9	22.7	30.0	-7.3
CH100					
T_{nom}	V_{nom}	117.0	21.7	30.0	-8.3
CH165					
T_{nom}	V_{nom}	117.0	21.7	36.0	-14.3

802.11n HT20, MCS7, P11		Test results radiated			
Path A+B		Fieldstrength E (dBµV/m)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
CH34					
T_{nom}	V_{nom}	117.0	21.7	30.0	-8.3

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802.11ac VT40, MCS9, P8		Test results radiated			
Path A (Ant A)		Fieldstrength E (dBµV/m)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
CH36up					
T_{nom}	V_{nom}	111.4	16.1	30.0	-13.9
CH60up					
T_{nom}	V_{nom}	111.6	16.3	30.0	-13.7
CH100up					
T_{nom}	V_{nom}	114.7	19.4	30.0	-10.6
CH161up					
T_{nom}	V_{nom}	114.1	18.8	36.0	-17.2

802.11ac VT40, MCS9, P8		Test results radiated			
Path A (Ant A)		Fieldstrength E (dBµV/m)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
CH36up					
T_{nom}	V_{nom}	110.6	15.3	30.0	-14.7
CH60up					
T_{nom}	V_{nom}	112.9	17.7	30.0	-12.3
CH100up					
T_{nom}	V_{nom}	114.2	19.0	30.0	-11.0
CH161up					
T_{nom}	V_{nom}	113.2	17.9	36.0	-18.1

802.11ac VT40, MCS9, P5		Test results radiated			
Path A+B		Fieldstrength E (dBµV/m)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
CH60up					
T_{nom}	V_{nom}	110.3	15.0	30.0	-15.0

802.11ac VT80, MCS9, P6		Test results radiated			
Path A (Ant A)		Fieldstrength E (dBµV/m)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
CH42					
T_{nom}	V_{nom}	111.4	16.2	30.0	-13.8
CH58					
T_{nom}	V_{nom}	111.5	16.3	30.0	-13.7
CH106					
T_{nom}	V_{nom}	113.7	18.4	30.0	-11.6
CH155					
T_{nom}	V_{nom}	113.3	18.1	36.0	-17.9

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802.11ac VT80, MCS9, P6		Test results radiated			
Path B (Ant B)		Fieldstrength E (dBµV/m)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
CH42					
T_{nom}	V_{nom}	110.9	15.6	30.0	-14.4
CH58					
T_{nom}	V_{nom}	112.0	16.8	30.0	-13.2
CH106					
T_{nom}	V_{nom}	112.8	17.6	30.0	-12.4
CH155					
T_{nom}	V_{nom}	113.7	18.4	36.0	-17.6

802.11ac VT80, MCS9, P3		Test results radiated			
Path A+B		Fieldstrength E (dBµV/m)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
CH58					
T_{nom}	V_{nom}	110.4	15.1	30.0	-14.9

Calculated peak conducted output power:

For calculation the following formula is used: A = P – G;
Where:
A is peak conducted output power
P is the output power as EIRP
G is the antenna gain

802.11n HT20, MCS7, P14		Test results conducted				
Path A (Ant A)		P (dBm)	G (dBi)	A (dBm)	Limit (dBm)	Margin (dB)
CH36						
T_{nom}	V_{nom}	20.3	4.5	15.8	24.0	-8.2
CH64						
T_{nom}	V_{nom}	20.7	4.5	16.2	24.0	-7.8
CH100						
T_{nom}	V_{nom}	22.1	4.5	17.6	24.0	-6.4
CH165						
T_{nom}	V_{nom}	22.1	4.5	17.6	30.0	-12.4

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802.11n HT20, MCS7, P14		Test results conducted				
Path B (Ant B)		P (dBm)	G (dBi)	A (dBm)	Limit (dBm)	Margin (dB)
CH36						
T_{nom}	V_{nom}	19.3	4.4	14.9	24.0	-9.1
CH64						
T_{nom}	V_{nom}	22.7	4.4	18.3	24.0	-5.7
CH100						
T_{nom}	V_{nom}	21.7	4.4	17.3	24.0	-6.7
CH165						
T_{nom}	V_{nom}	21.7	4.4	17.3	30.0	-12.7

802.11n HT20, MCS7, P11		Test results conducted				
Path A+B		P (dBm)	G (dBi)	A (dBm)	Limit (dBm)	Margin (dB)
CH34						
T_{nom}	V_{nom}	21.7	8.9	12.8	24.0	-11.2

802.11ac VT40, MCS9, P8		Test results conducted				
Path A (Ant A)		P (dBm)	G (dBi)	A (dBm)	Limit (dBm)	Margin (dB)
CH36up						
T_{nom}	V_{nom}	16.1	4.5	11.6	24.0	-12.4
CH60up						
T_{nom}	V_{nom}	16.3	4.5	11.8	24.0	-12.2
CH100up						
T_{nom}	V_{nom}	19.4	4.5	14.9	24.0	-9.1
CH161up						
T_{nom}	V_{nom}	18.8	4.5	14.3	30.0	-15.7

802.11ac VT40, MCS9, P8		Test results conducted				
Path A (Ant A)		P (dBm)	G (dBi)	A (dBm)	Limit (dBm)	Margin (dB)
CH36up						
T_{nom}	V_{nom}	15.3	4.4	10.9	24.0	-13.1
CH60up						
T_{nom}	V_{nom}	17.7	4.4	13.3	24.0	-10.7
CH100up						
T_{nom}	V_{nom}	19.0	4.4	14.6	24.0	-9.4
CH161up						
T_{nom}	V_{nom}	17.9	4.4	13.5	30.0	-16.5

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802.11ac VT40, MCS9, P5		Test results conducted				
Path A+B		P (dBm)	G (dBi)	A (dBm)	Limit (dBm)	Margin (dB)
CH60up						
T_{nom}	V_{nom}	15.0	8.9	6.1	24.0	-17.9

802.11ac VT80, MCS9, P6		Test results conducted				
Path A (Ant A)		P (dBm)	G (dBi)	A (dBm)	Limit (dBm)	Margin (dB)
CH42						
T_{nom}	V_{nom}	16.2	4.5	11.7	24.0	-12.3
CH58						
T_{nom}	V_{nom}	16.3	4.5	11.8	24.0	-12.2
CH106						
T_{nom}	V_{nom}	18.4	4.5	13.9	24.0	-10.1
CH155						
T_{nom}	V_{nom}	18.1	4.5	13.6	30.0	-16.4

802.11ac VT80, MCS9, P6		Test results conducted				
Path B (Ant B)		P (dBm)	G (dBi)	A (dBm)	Limit (dBm)	Margin (dB)
CH42						
T_{nom}	V_{nom}	15.6	4.4	11.2	24.0	-12.8
CH58						
T_{nom}	V_{nom}	16.8	4.4	12.4	24.0	-11.6
CH106						
T_{nom}	V_{nom}	17.6	4.4	13.2	24.0	-10.8
CH155						
T_{nom}	V_{nom}	18.4	4.4	14.0	30.0	-16.0

802.11ac VT80, MCS9, P3		Test results conducted				
Path A+B		P (dBm)	G (dBi)	A (dBm)	Limit (dBm)	Margin (dB)
CH58						
T_{nom}	V_{nom}	15.1	8.9	6.2	24.0	-17.8

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

Frequency (MHz)	Conducted Power Limit	
	(dBm)	(Watt)
5150-5350	24	0.25
5470-5725	24	0.25
5725-5850	30	1

Frequency (MHz)	Radiated Limit (EIRP)	
	(dBm)	(Watt)
5150-5350	30	1
5470-5725	30	1
5725-5850	36	4

The requirements are **FULFILLED.**

Remarks: None

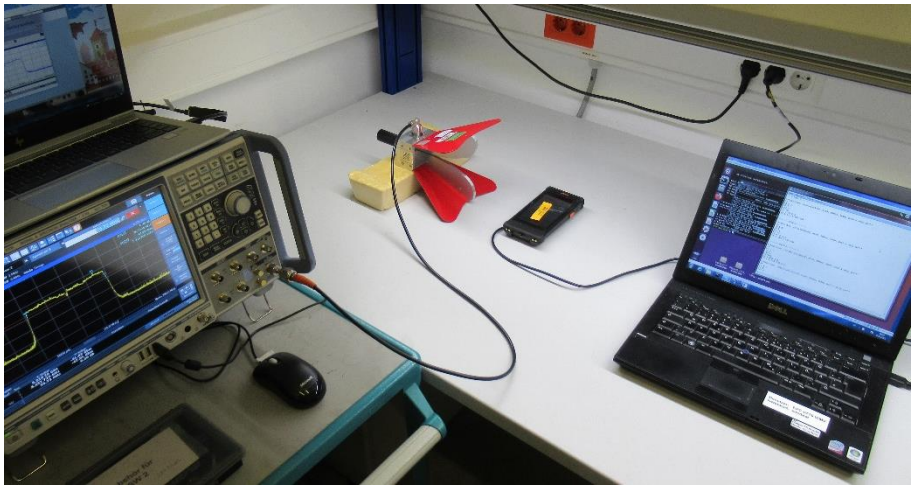
5.3 Emission bandwidth

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

5.3.1 Description of the test location

Test location: Shielded Room S6

5.3.2 Photo documentation of the test set-up



5.3.3 Applicable standard

According to FCC Part 15, Section 15.407(e):
Within the 5.725-5.850 GHz and 5.850-5.895 GHz bands, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

5.3.4 Description of Measurement

The bandwidth was measured at an amplitude level reduced from the reference level of a modulated channel by a ratio of -6 dB. The reference level is the level of the highest signal amplitude observed at the transmitter at either the fundamental frequency or the first order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical. An alternative is to use the bandwidth measurement of the analyser.

Spectrum analyser settings:
RBW: approx. 1% of EBW, VBW: > RBW, Detector: Max peak, Sweep time: auto, Span: approx.. 2 EBW;

5.3.5 Test result

6dB bandwidth

Path	Modulation	Power set	Channel	Centre frequency (MHz)	6 dB EBW (MHz)
A	*n HT20, MCS-7*	*14*	*CH64*	5320	17.800
A	*ac VHT40, MCS-9*	*8*	*CH60up*	5310	36.400
A	*ac VHT80, MCS-9*	*6*	*CH58*	5290	76.720
B	*n HT20, MCS-7*	*14*	*CH64*	5320	17.810
B	*ac VHT40, MCS-9*	*8*	*CH60up*	5310	36.240
B	*ac VHT80, MCS-9*	*6*	*CH58*	5290	76.080
A+B	*n HT20, MCS-7*	*11*	*CH64*	5320	17.620
A+B	*ac VHT40, MCS-9*	*5*	*CH60up*	5310	36.320
A+B	*ac VHT80, MCS-9*	*3*	*CH58*	5290	76.320

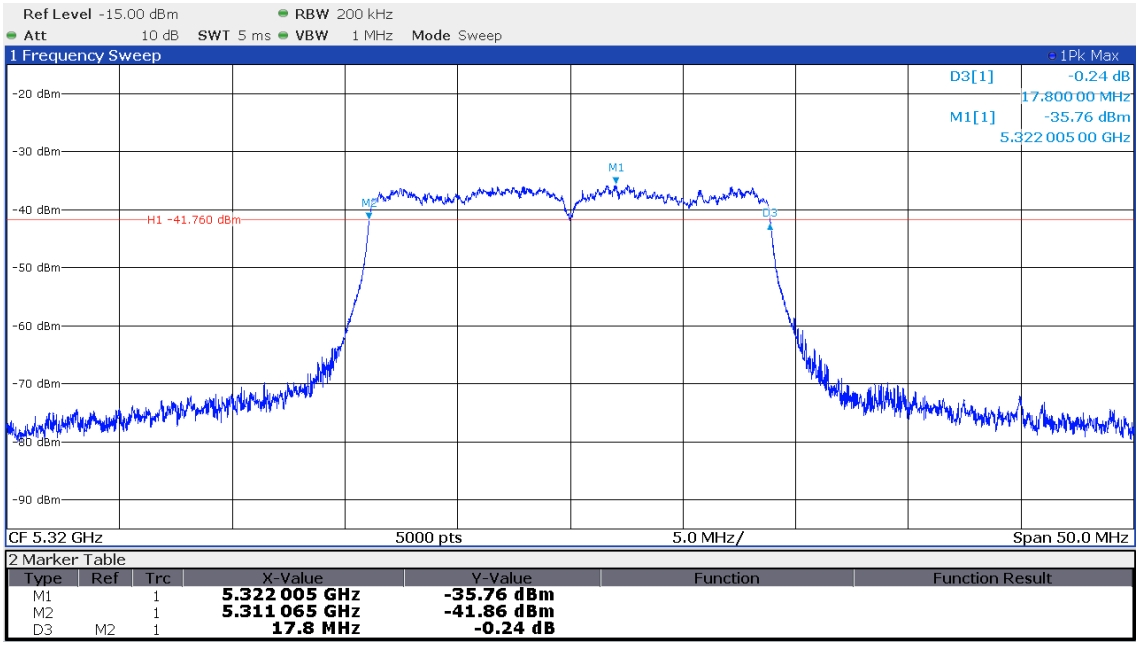
Limit according to FCC Part 15, Section 15.407(e):
Within the 5.725-5.850 GHz and 5.850-5.895 GHz bands, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

The requirements are **FULFILLED.**

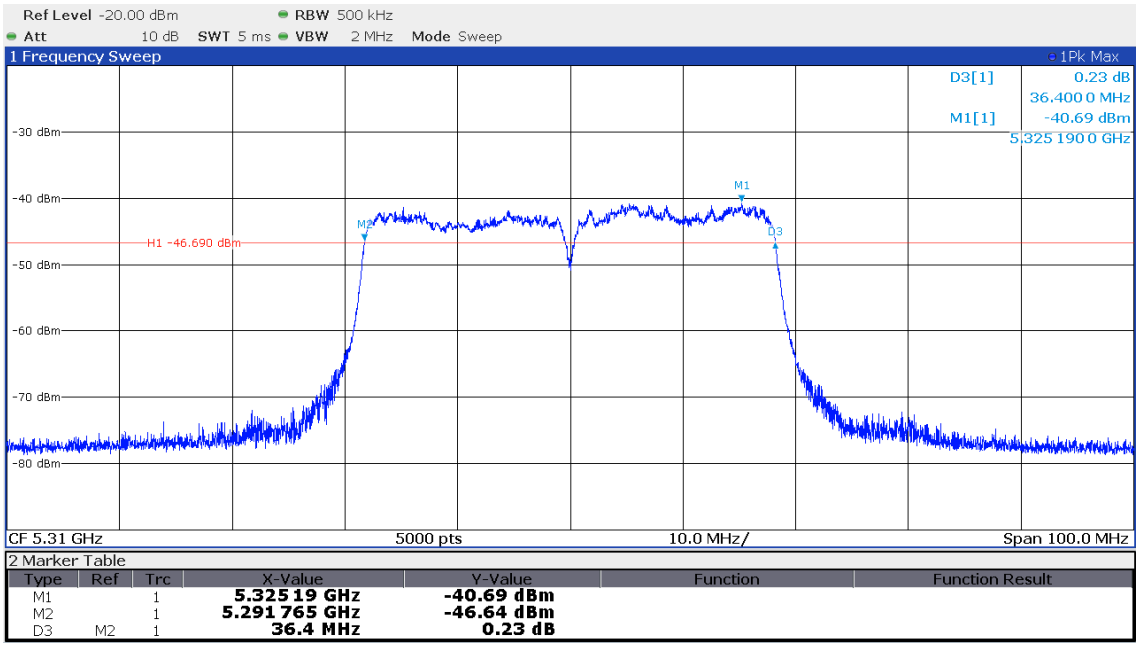
Remarks: For detailed test result please see the following test protocols

5.3.6 Test protocols

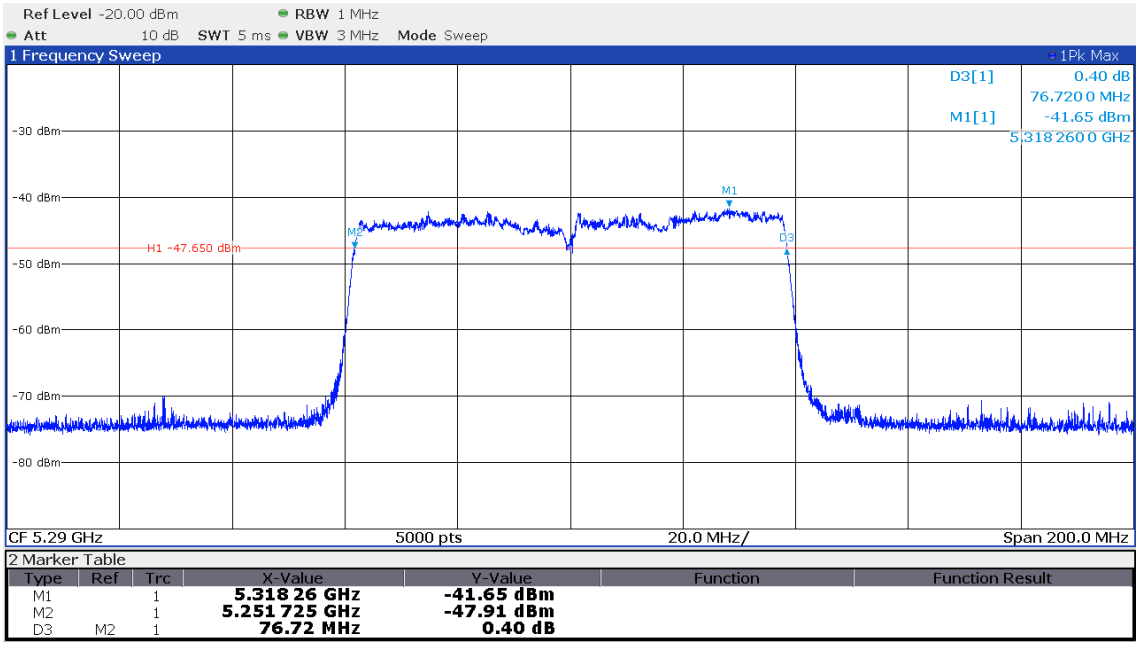
WLAN Standard 802. 11n HT20, MCS-7, P14, Path A - Ant A, CH64



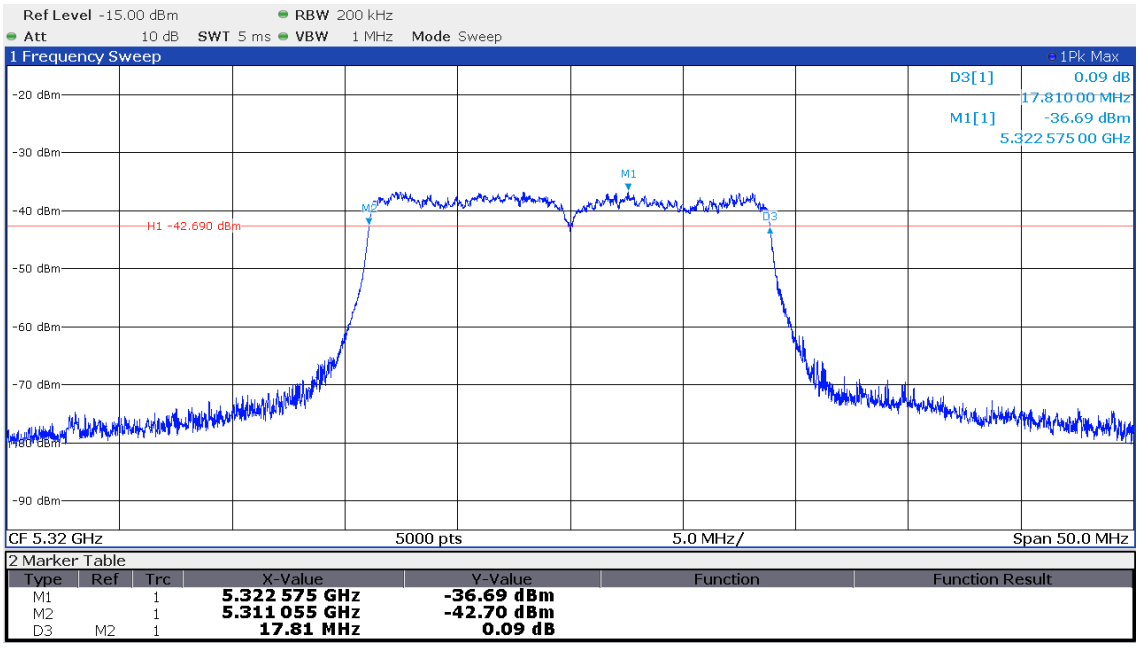
WLAN Standard 802.11ac VHT40, MCS-9, P8, Path A - Ant A, CH60up



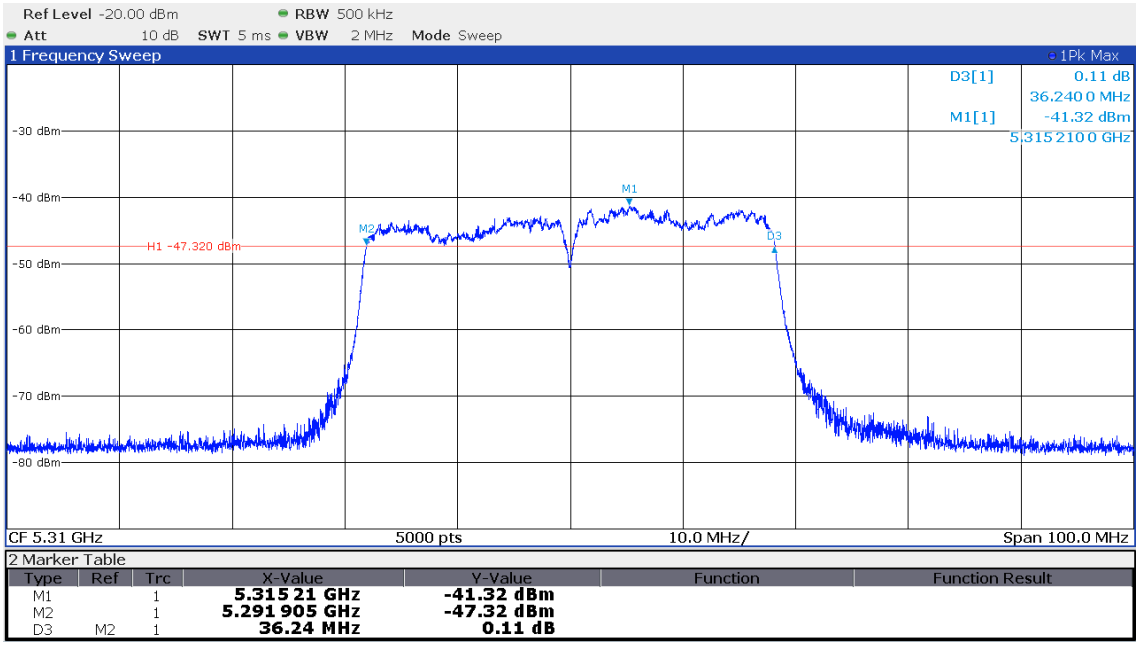
WLAN Standard 802.11ac VHT80, MCS-9, P6, Path A - Ant A, CH58



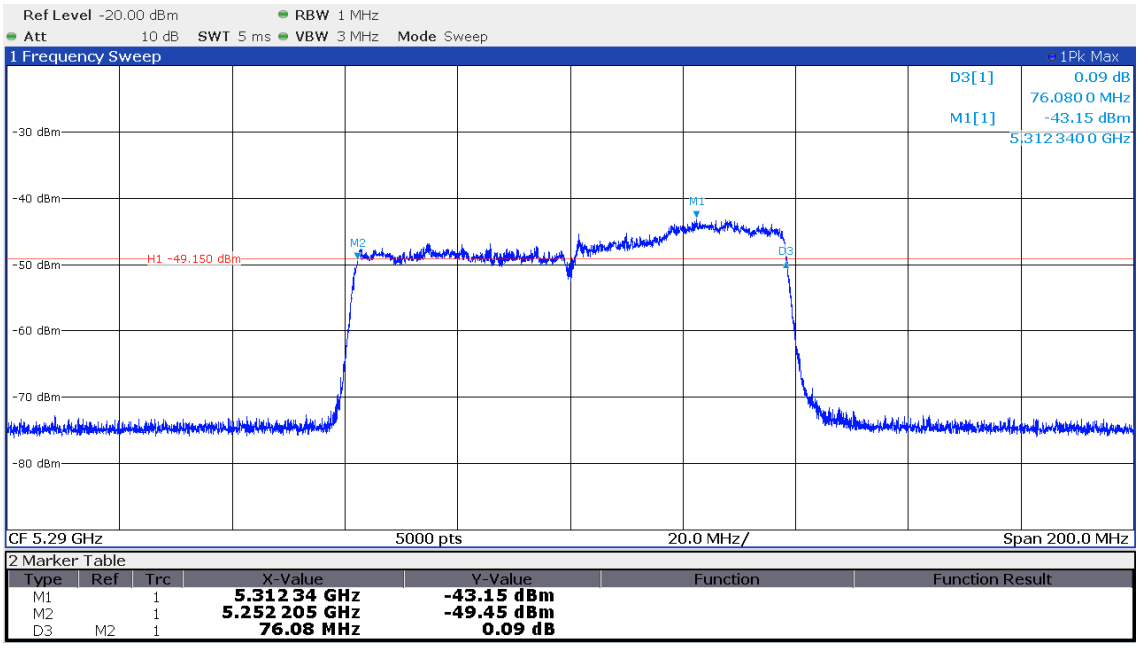
WLAN Standard 802. 11n HT20, MCS-7, P14, Path B - Ant B, CH64



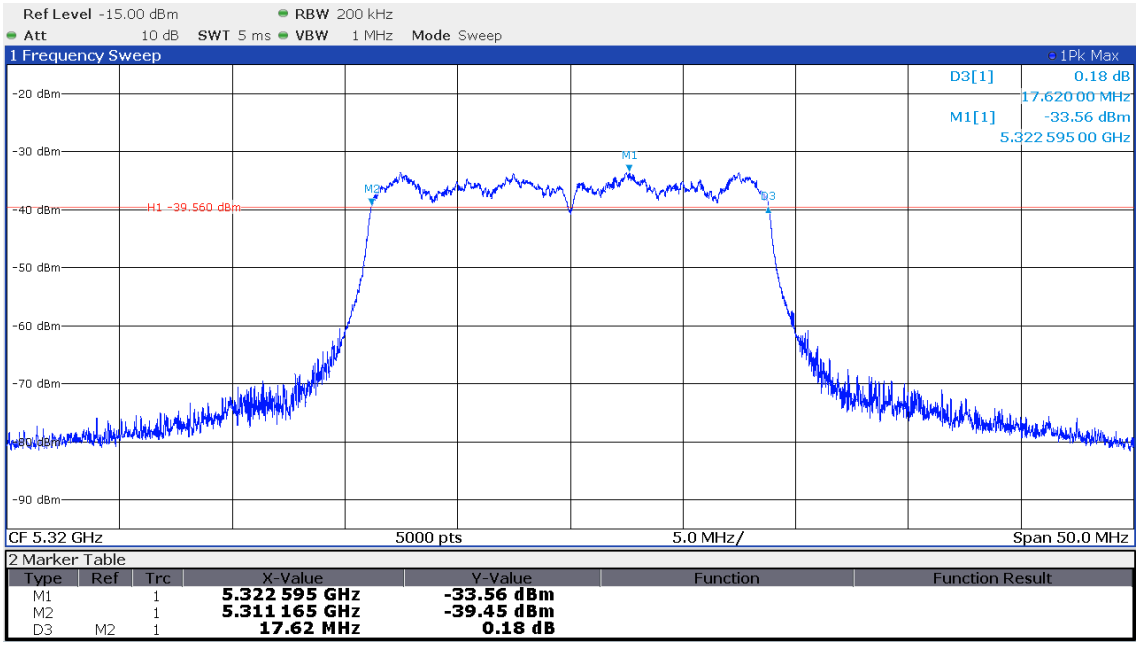
WLAN Standard 802.11ac VHT40, MCS-9, P8, Path B - Ant B, CH60up



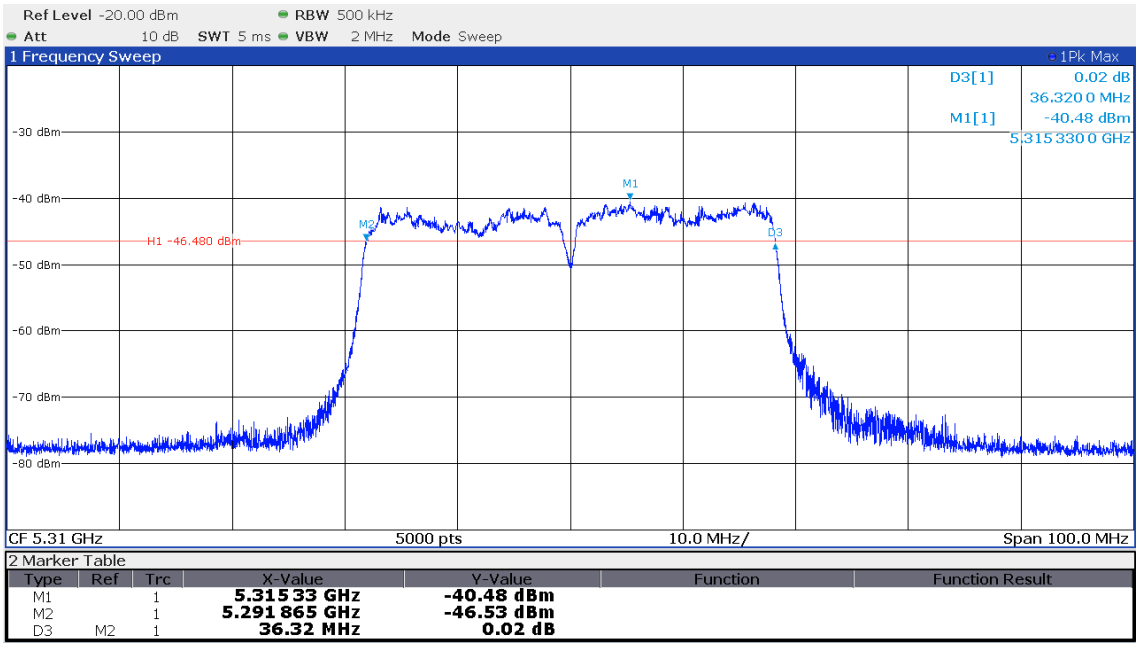
WLAN Standard 802.11ac VHT80, MCS-9, P6, Path B - Ant B, CH58



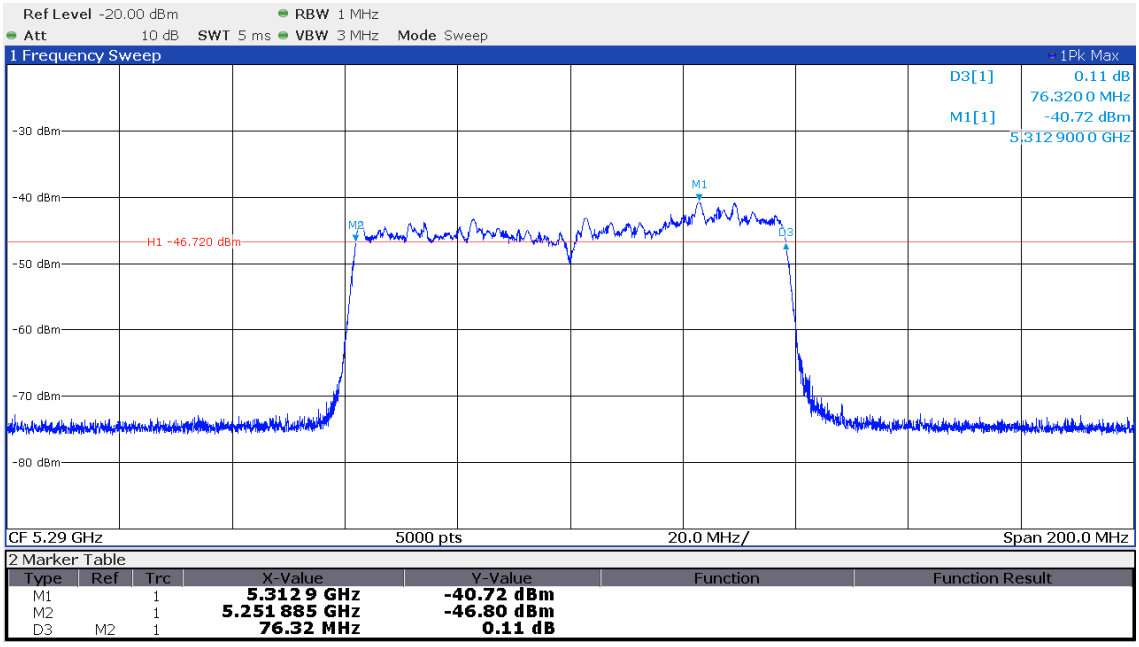
WLAN Standard 802.11n HT20, MCS-7, P11, Path A+B - Ant A+B, CH64



WLAN Standard 802.11ac VHT40, MCS-9, P5, Path A+B - Ant A+B, CH60up



WLAN Standard 802.11ac VHT80, MCS-9, P3, Path A+B - Ant A+B, CH58



5.4 Undesirable emissions

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

5.4.1 Description of the test location

Test location: OATS 1
Test location: Anechoic chamber 1

Test distance: 3 m

5.4.2 Photo documentation of the test set-up

30 MHz – 1 GHz:

1 GHz – 18 GHz:

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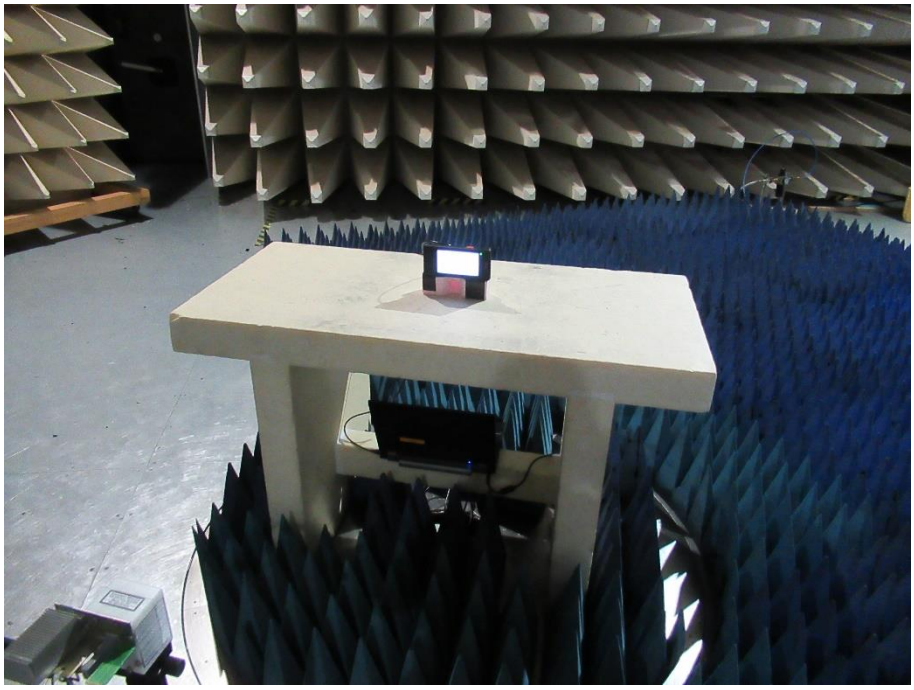
18 GHz – 25 GHz:



5.4.3 Applicable standard

According to FCC Part 15E, Section 15.407(b):
For transmitters operating in the defined bands shall not exceed the appropriate emission limit outside of the operating bands.
In addition, radiated emissions which fall in the restricted bands, as defined in Section15.205(a), must also comply with the radiated emission limit specified in Section15.209(a) (see Section15.205(c)).

5.4.4 Description of Measurement

Undesirable emissions are measured using a spectrum analyser and following the procedures according the KDB 789033, item H. 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.

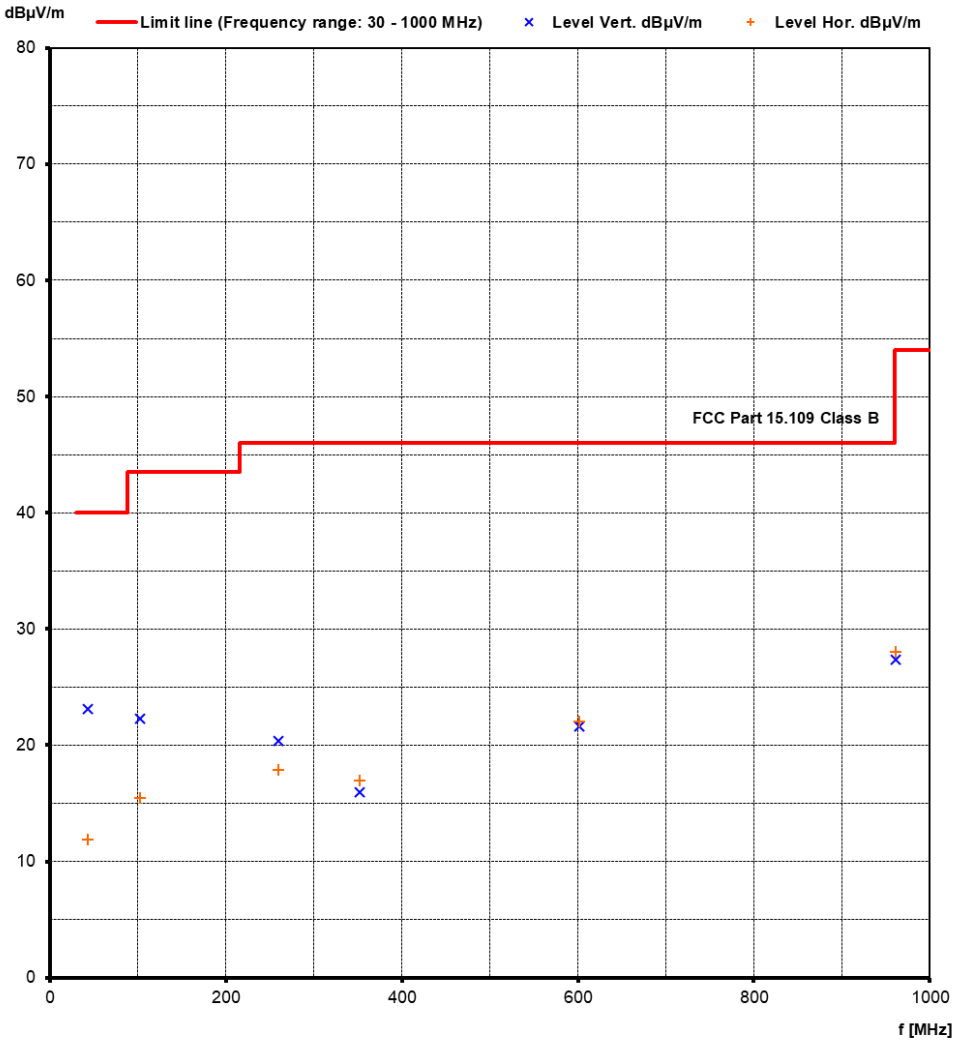
Spectrum analyser settings for peak values:
RBW: 1 MHz, VBW: 3 MHz, Sweep: Auto, Trace mode: max hold;
Spectrum analyser settings for average values:
RBW: 1 MHz VBW: 10 Hz Sweep: Auto, Trace mode: max hold;

5.4.5 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)
43.00	8.6	-3.4	14.5	15.3	23.1	11.9	40.0	-16.9
102.60	9.6	4.0	12.7	11.5	22.3	15.5	43.5	-21.2
260.00	4.4	1.8	16.0	16.1	20.4	17.9	46.0	-25.6
351.80	-2.8	-2.1	18.8	19.0	16.0	16.9	46.0	-29.1
602.00	-3.5	-3.3	25.1	25.4	21.6	22.1	46.0	-23.9
961.50	-2.7	-2.6	30.1	30.6	27.4	28.0	54.0	-26.0

Note: No emissions from the EUT could be detected in this frequency range. The recorded values are noise values from the OATS.



f > 1000 MHz:

WLAN Standard 802.11n HT20, MSC7, P14, Path A - Ant A

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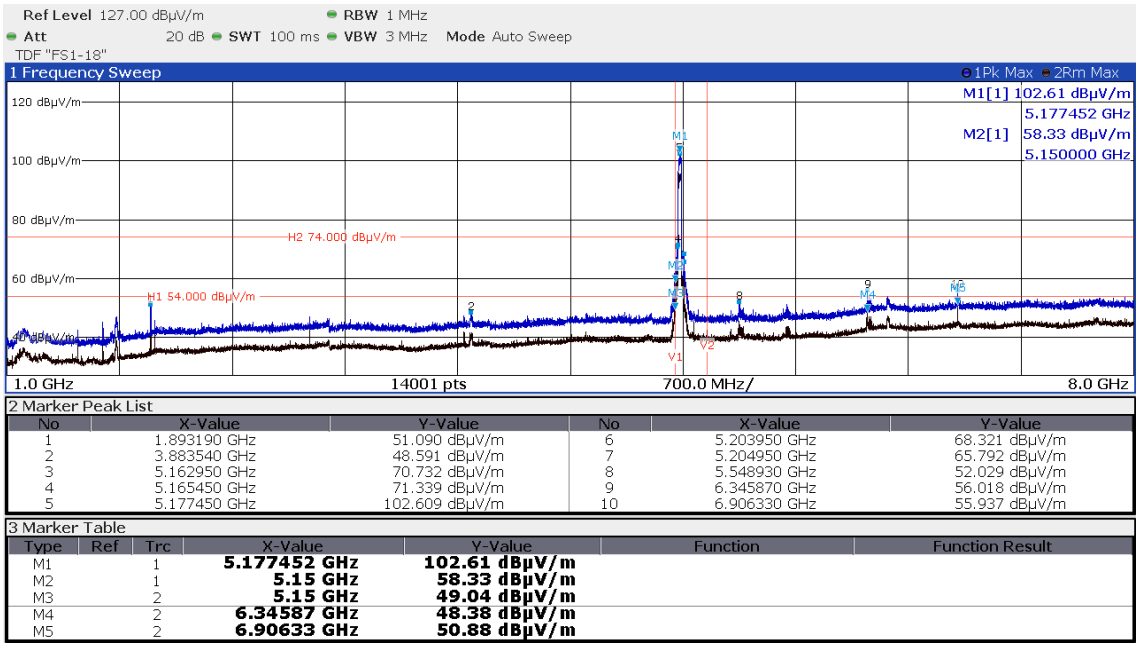
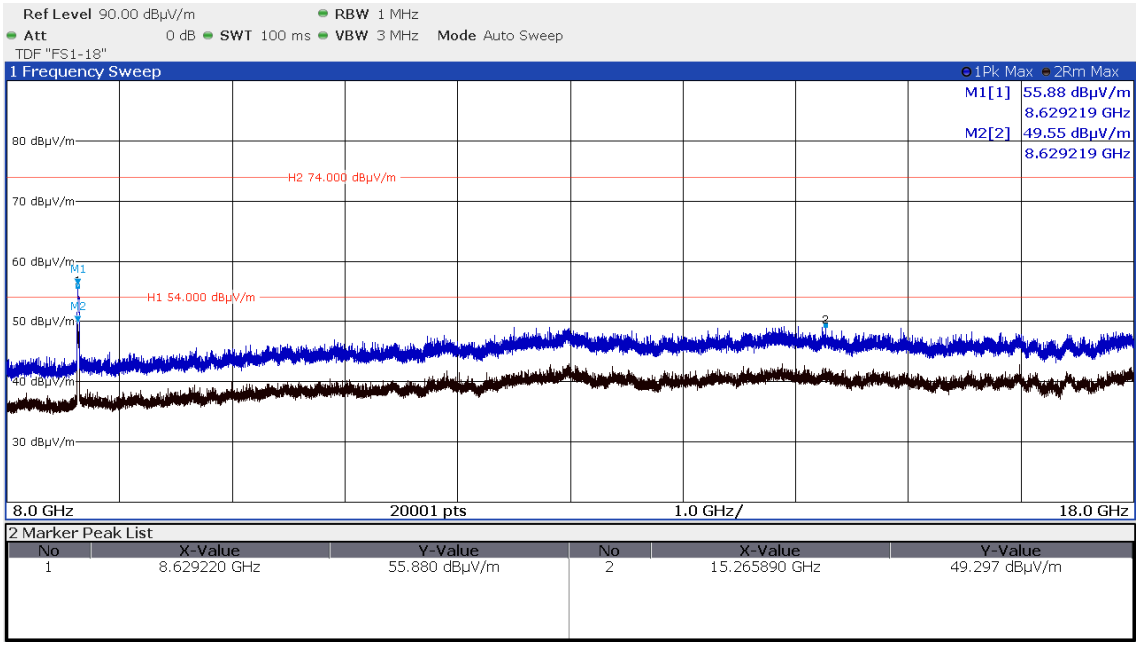


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.893190 GHz	51.090 dBµV/m	6	5.203950 GHz	68.321 dBµV/m
2	3.883540 GHz	48.591 dBµV/m	7	5.204950 GHz	65.792 dBµV/m
3	5.162950 GHz	70.732 dBµV/m	8	5.548930 GHz	52.029 dBµV/m
4	5.165450 GHz	71.339 dBµV/m	9	6.345870 GHz	56.018 dBµV/m
5	5.177450 GHz	102.609 dBµV/m	10	6.906330 GHz	55.937 dBµV/m

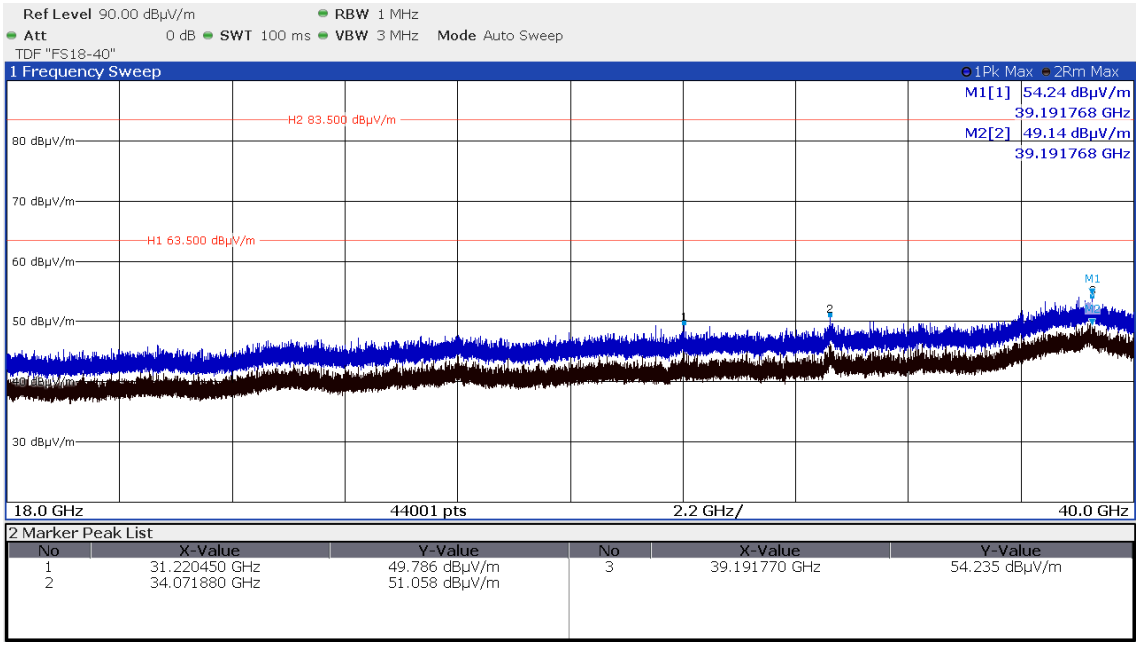
3 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**5.177452 GHz**	**102.61 dBµV/m**		
M2		1	**5.15 GHz**	**58.33 dBµV/m**		
M3		2	**5.15 GHz**	**49.04 dBµV/m**		
M4		2	**6.34587 GHz**	**48.38 dBµV/m**		
M5		2	**6.90633 GHz**	**50.88 dBµV/m**		



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	8.629220 GHz	55.880 dBµV/m	2	15.265890 GHz	49.297 dBµV/m

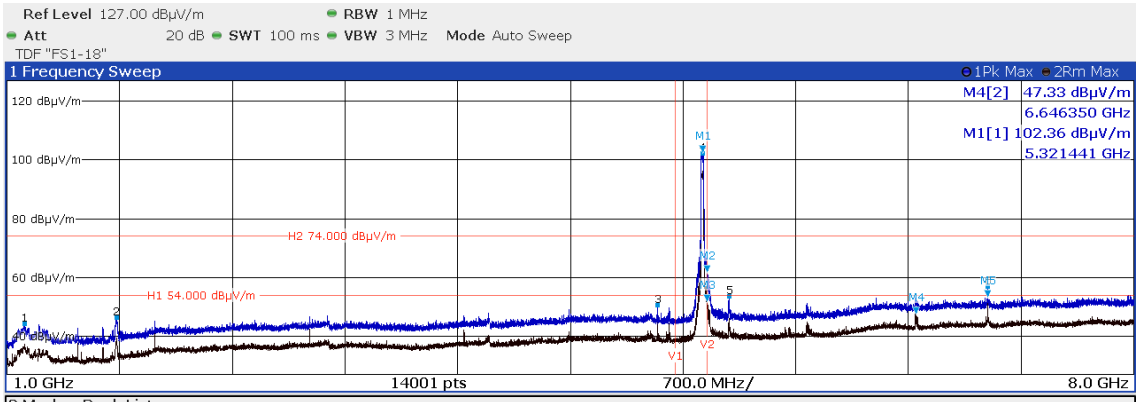


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	31.220450 GHz	49.786 dBµV/m	3	39.191770 GHz	54.235 dBµV/m
2	34.071880 GHz	51.058 dBµV/m			

Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

CH64



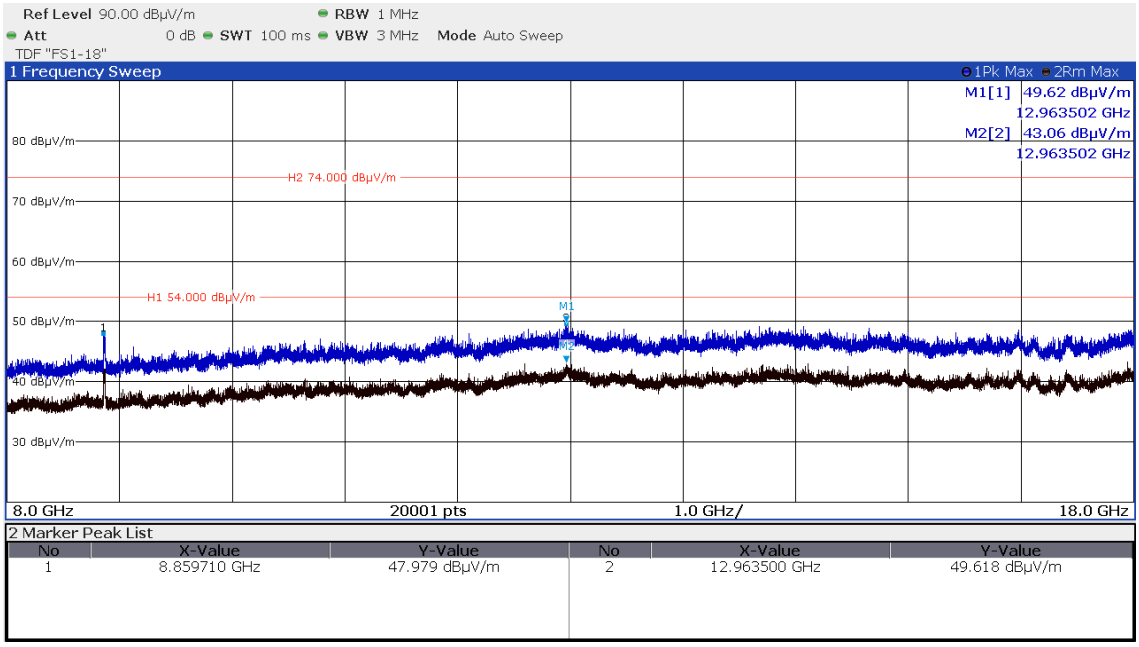
2 Marker Peak List

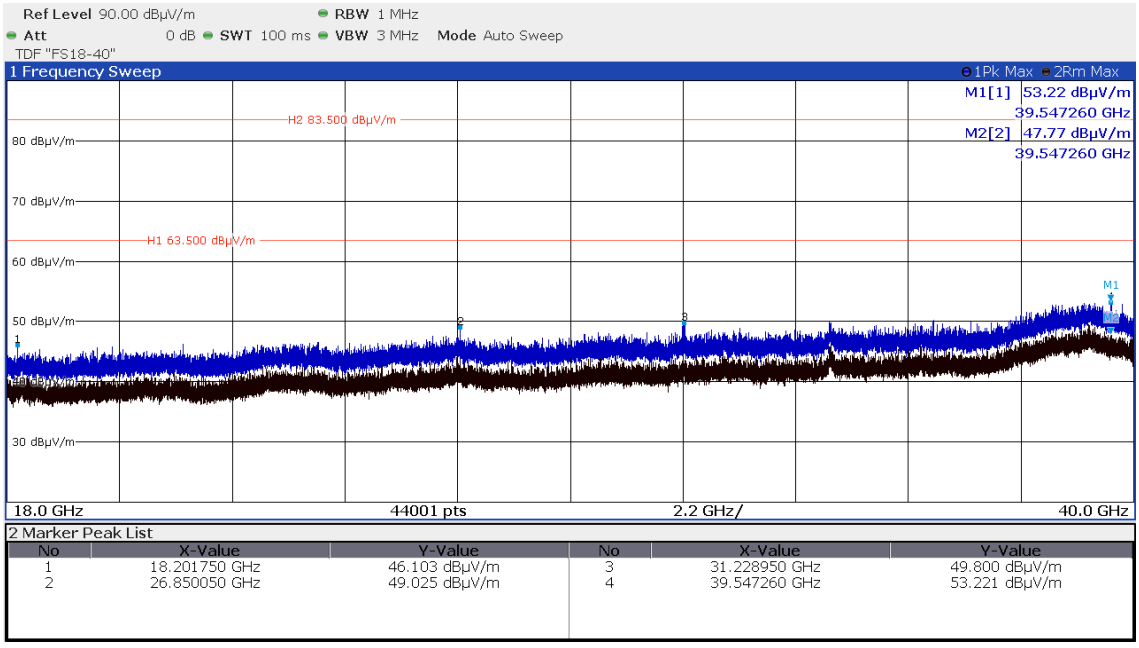
No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.111740 GHz	44.173 dBµV/m	4	5.321440 GHz	102.361 dBµV/m
2	1.679200 GHz	46.393 dBµV/m	5	5.487930 GHz	53.701 dBµV/m
3	5.042960 GHz	50.673 dBµV/m	6	7.093310 GHz	56.896 dBµV/m

3 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**5.321441 GHz**	**102.36 dBµV/m**		
M2		1	**5.35 GHz**	**61.55 dBµV/m**		
M3		2	**5.35 GHz**	**51.41 dBµV/m**		
M4		2	**6.64635 GHz**	**47.33 dBµV/m**		
M5		2	**7.09331 GHz**	**52.89 dBµV/m**		

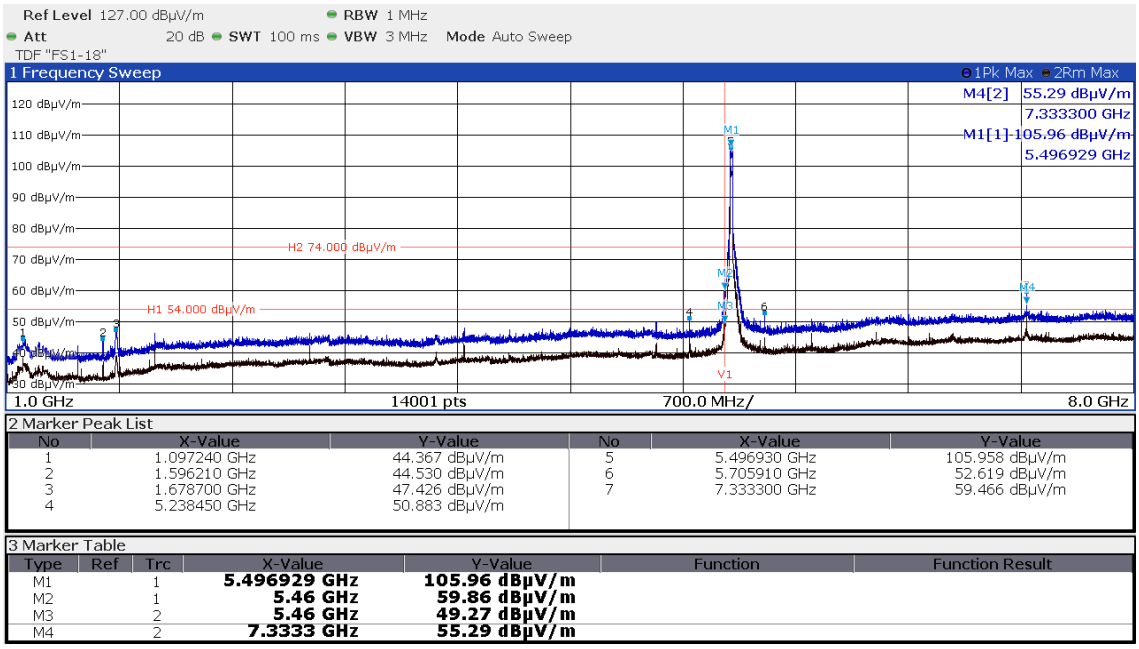
FCC ID: XO2-SPB228D **IC: 8713A-SPB228D**





Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

CH100

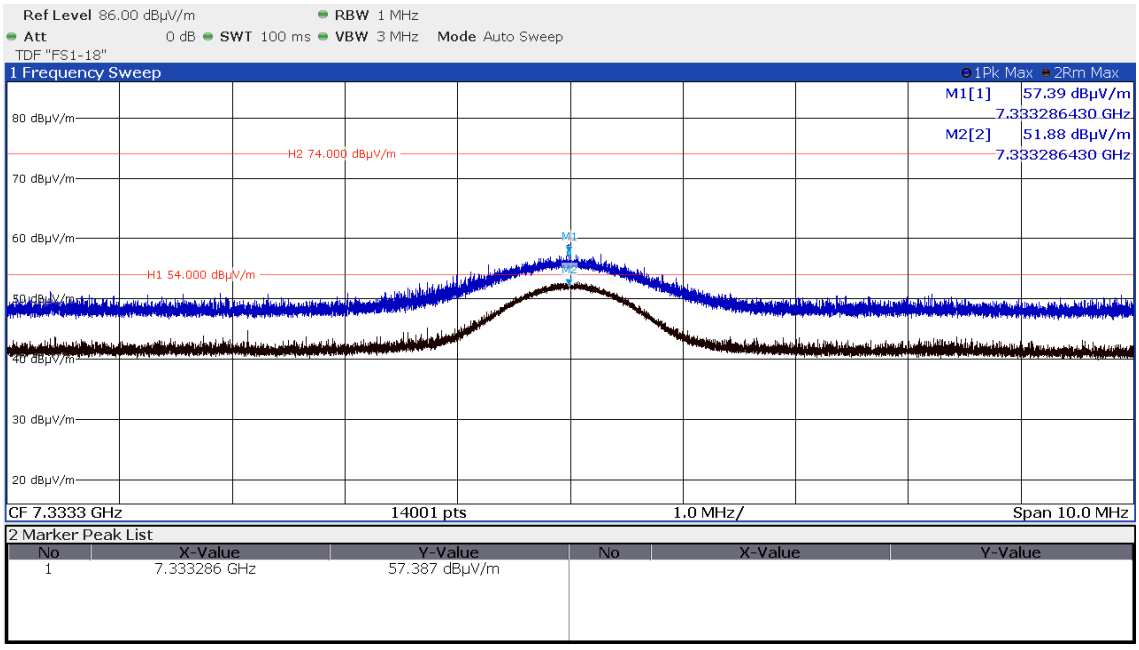


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.097240 GHz	44.367 dBµV/m	5	5.496930 GHz	105.958 dBµV/m
2	1.596210 GHz	44.530 dBµV/m	6	5.705910 GHz	52.619 dBµV/m
3	1.678700 GHz	47.426 dBµV/m	7	7.333300 GHz	59.466 dBµV/m
4	5.238450 GHz	50.883 dBµV/m			

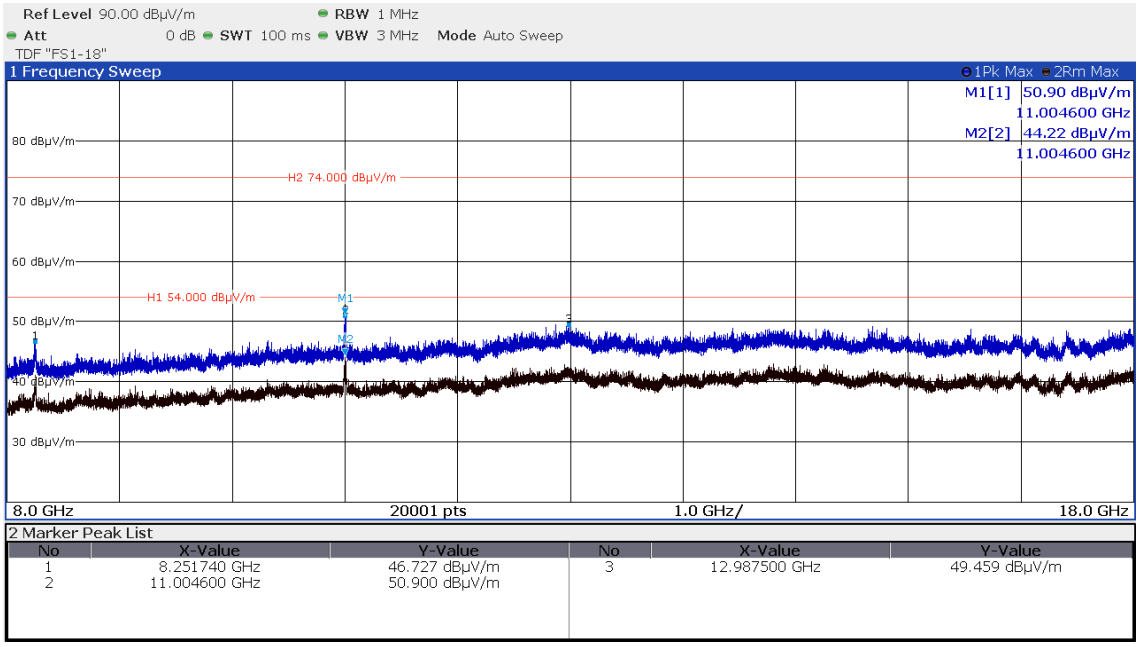
3 Marker Table

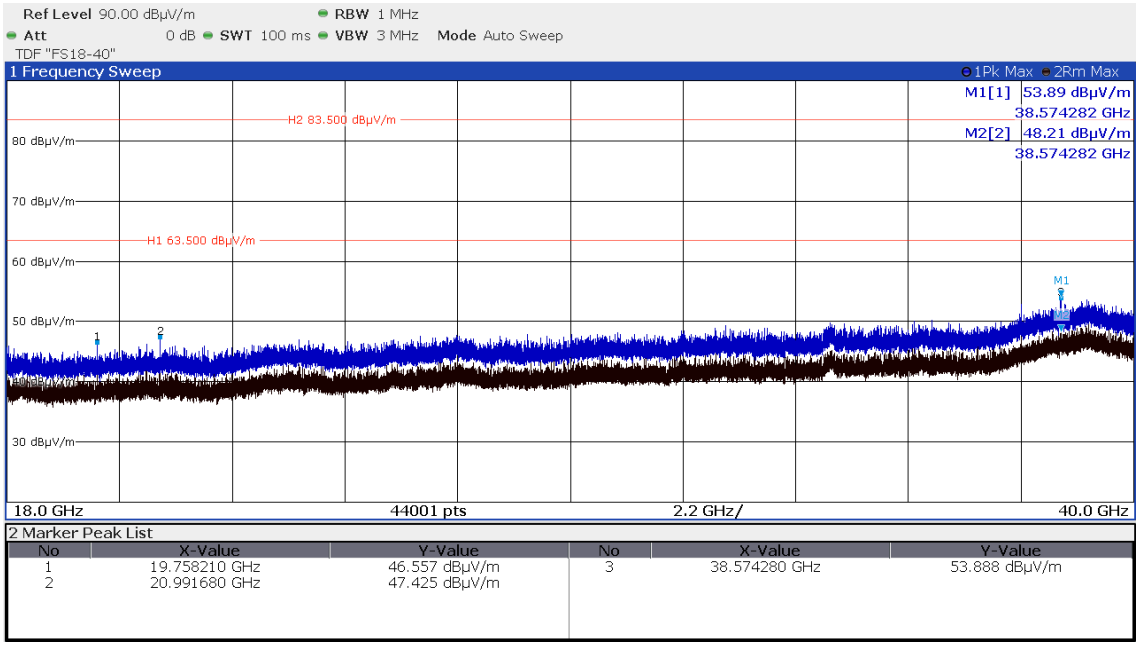
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**5.496929 GHz**	**105.96 dBµV/m**		
M2		1	**5.46 GHz**	**59.86 dBµV/m**		
M3		2	**5.46 GHz**	**49.27 dBµV/m**		
M4		2	**7.3333 GHz**	**55.29 dBµV/m**		



2 Marker Peak List

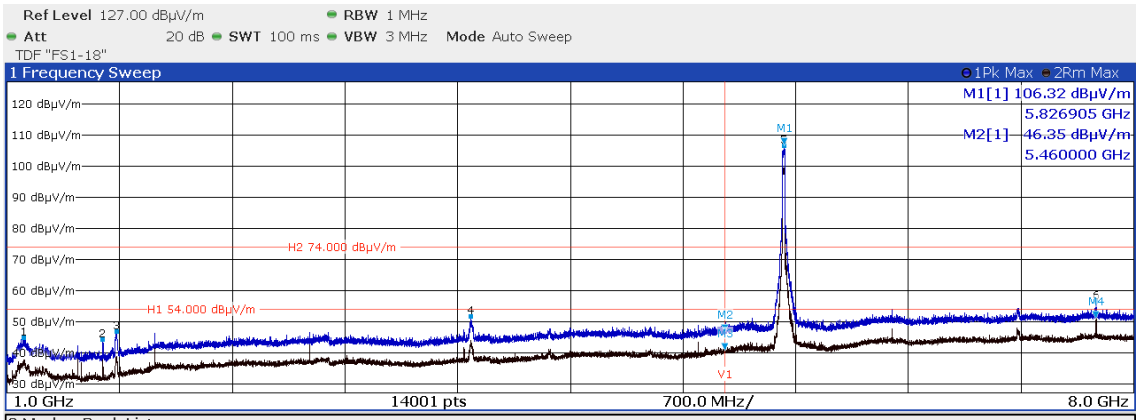
No	X-Value	Y-Value	No	X-Value	Y-Value
1	7.333286 GHz	57.387 dBµV/m			





Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

CH165

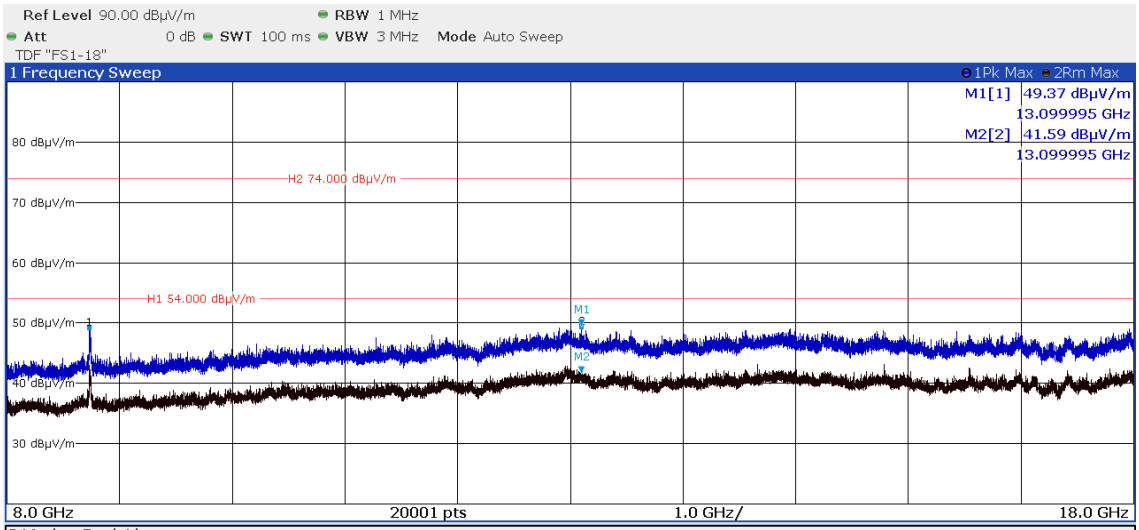


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.104740 GHz	44.644 dBµV/m	4	3.883040 GHz	51.484 dBµV/m
2	1.593710 GHz	44.142 dBµV/m	5	5.826910 GHz	106.318 dBµV/m
3	1.679200 GHz	46.731 dBµV/m	6	7.766270 GHz	56.419 dBµV/m

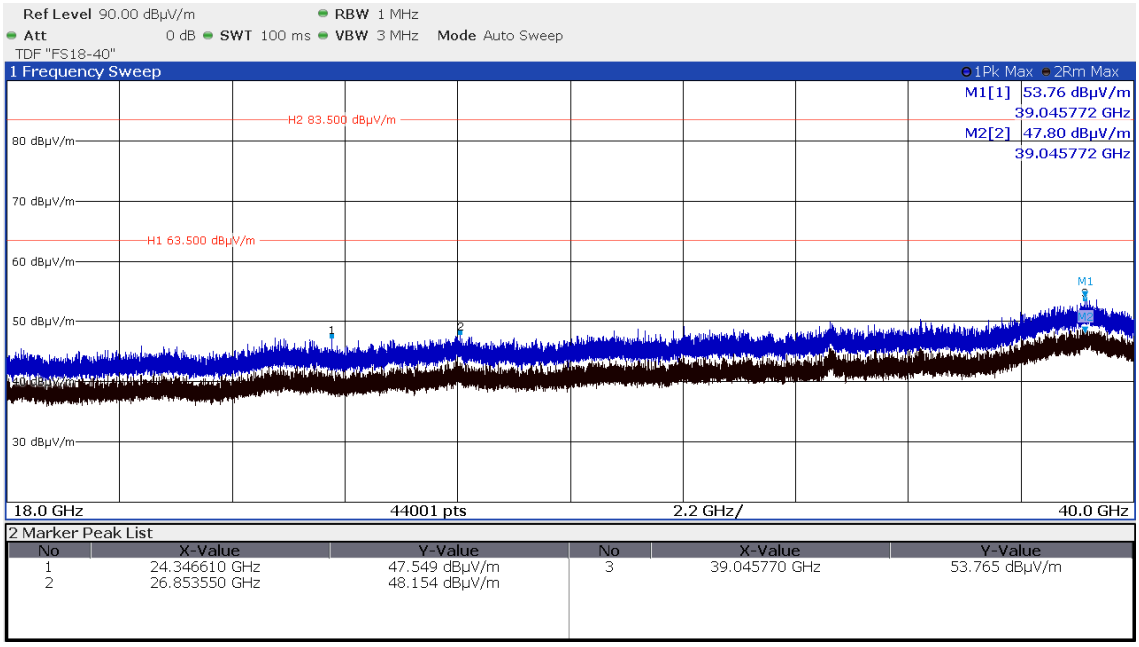
3 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**5.826905 GHz**	**106.32 dBµV/m**		
M2		1	**5.46 GHz**	**46.35 dBµV/m**		
M3		2	**5.46 GHz**	**40.47 dBµV/m**		
M4		2	**7.76627 GHz**	**50.69 dBµV/m**		



2 Marker Peak List

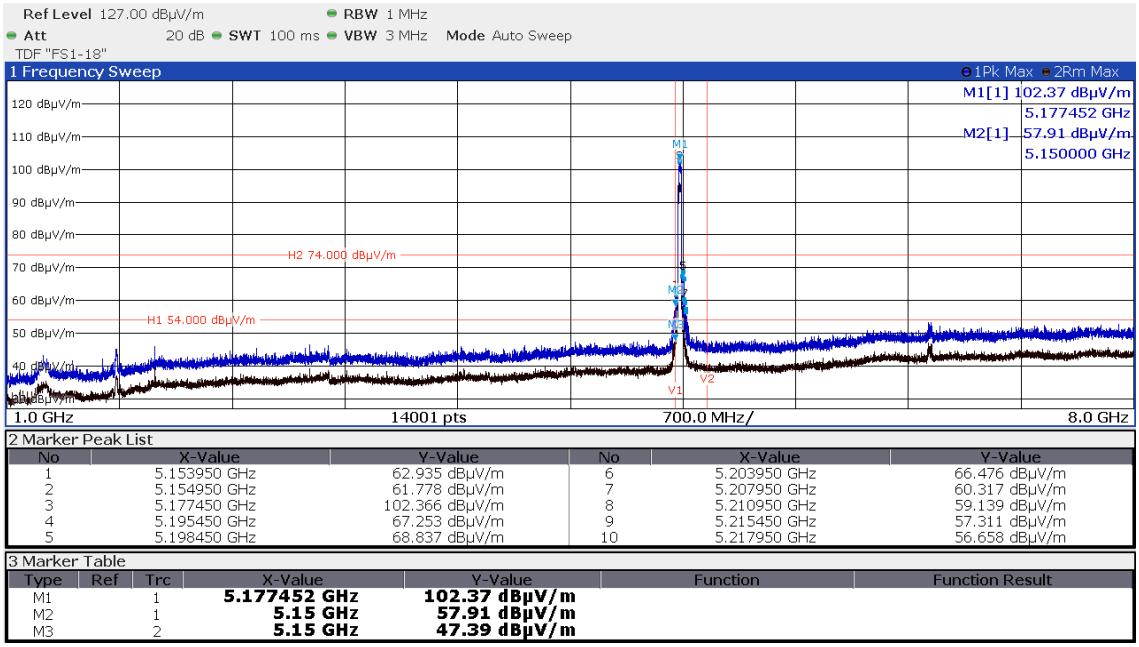
No	X-Value	Y-Value	No	X-Value	Y-Value
1	8.730210 GHz	49.219 dBµV/m	2	13.100000 GHz	49.374 dBµV/m



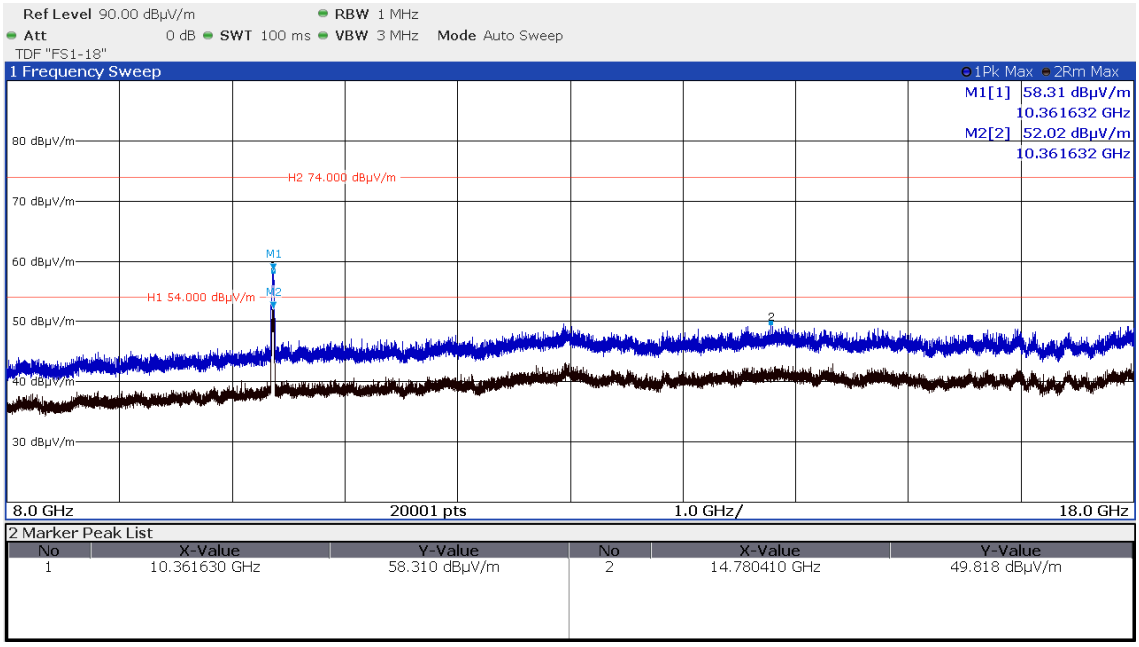
Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

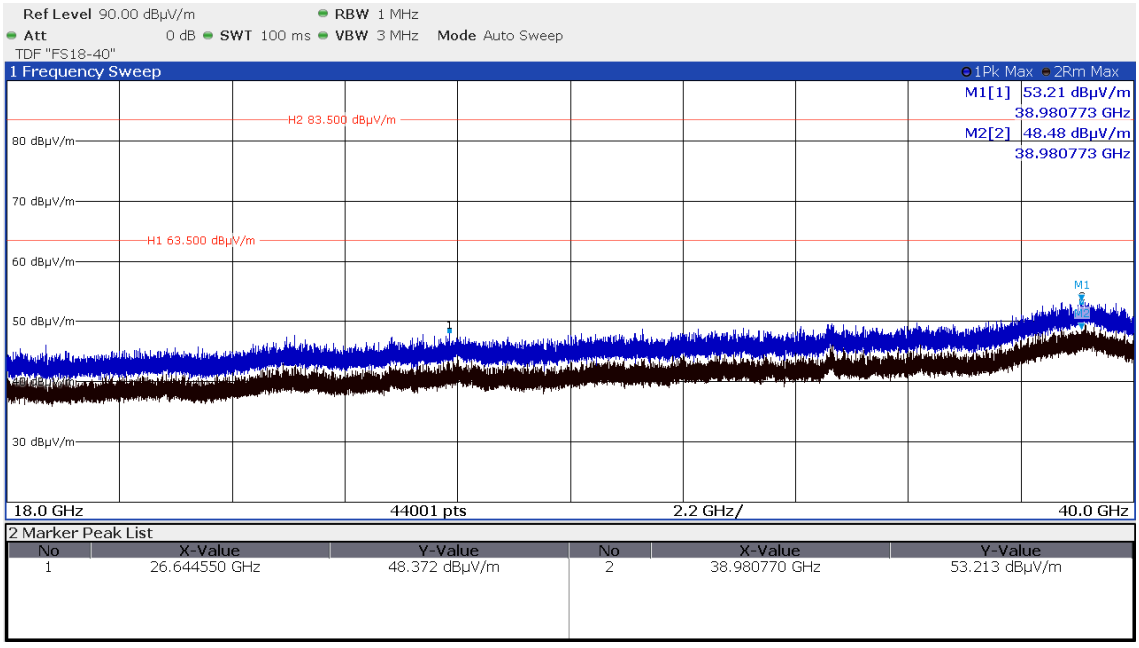
WLAN Standard 802.11n HT20, MSC7, P14, Path B - Ant B

CH36



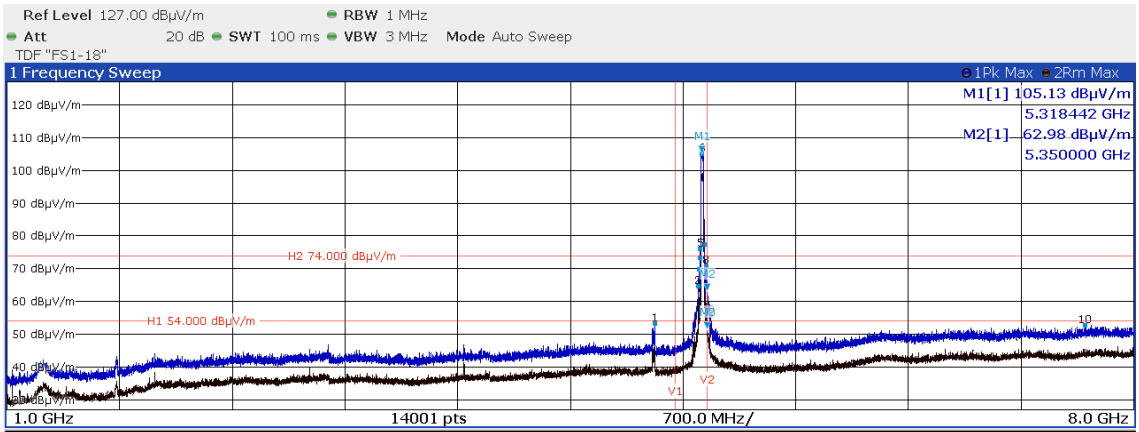
FCC ID: XO2-SPB228D **IC: 8713A-SPB228D**





Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

CH64

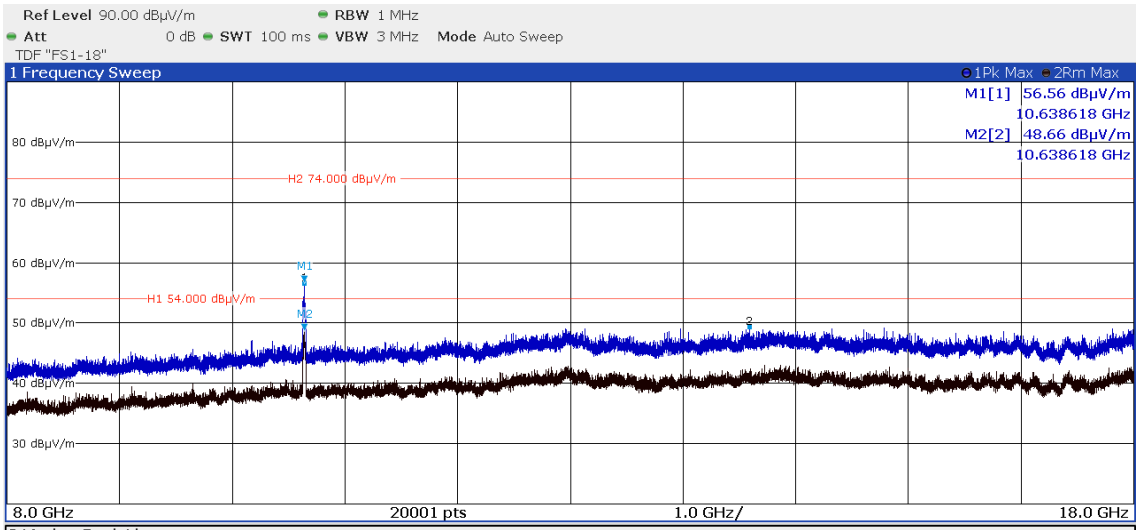


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	5.027460 GHz	53.241 dBµV/m	6	5.318440 GHz	105.131 dBµV/m
2	5.294440 GHz	64.636 dBµV/m	7	5.332440 GHz	77.397 dBµV/m
3	5.297940 GHz	69.687 dBµV/m	8	5.342440 GHz	70.802 dBµV/m
4	5.303940 GHz	73.454 dBµV/m	9	5.372940 GHz	55.645 dBµV/m
5	5.307440 GHz	76.086 dBµV/m	10	7.700270 GHz	52.783 dBµV/m

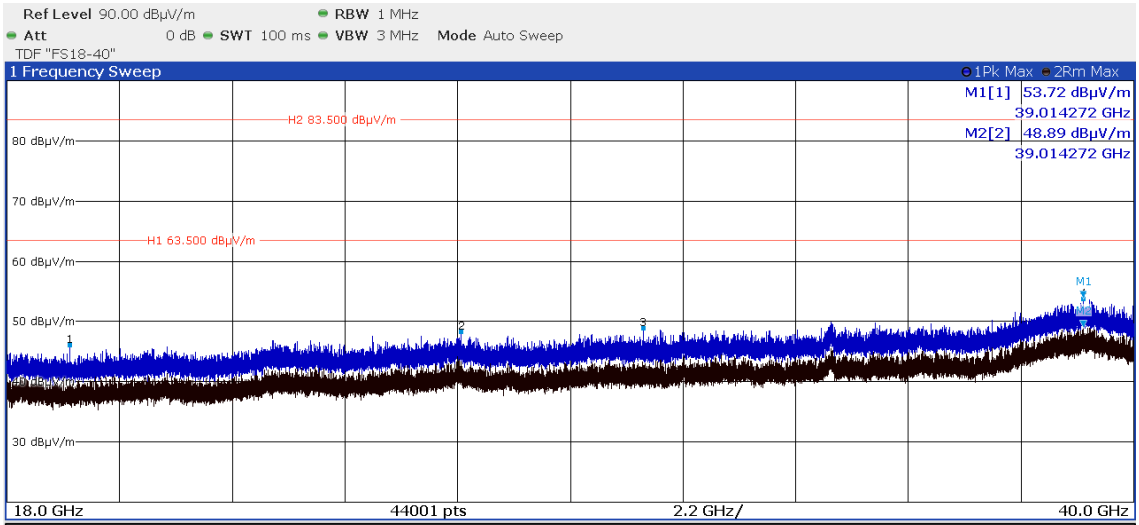
3 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**5.318442 GHz**	**105.13 dBµV/m**		
M2		1	**5.35 GHz**	**62.98 dBµV/m**		
M3		2	**5.35 GHz**	**51.43 dBµV/m**		



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	10.638620 GHz	56.560 dBµV/m	2	14.588920 GHz	49.307 dBµV/m

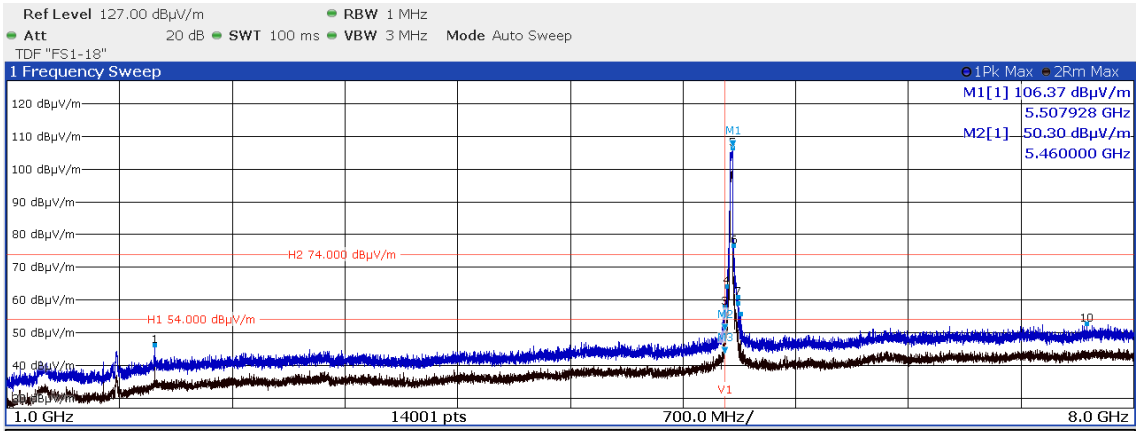


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	19.231220 GHz	46.012 dBµV/m	3	30.420470 GHz	48.880 dBµV/m
2	26.866550 GHz	48.304 dBµV/m	4	39.014270 GHz	53.718 dBµV/m

Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

CH100

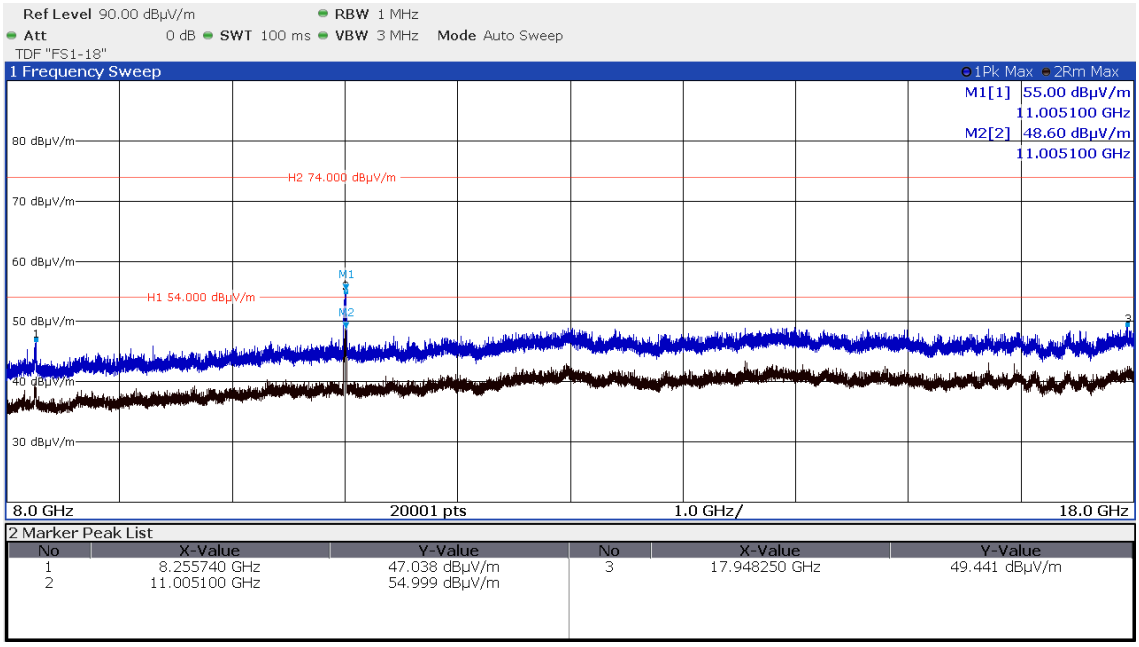


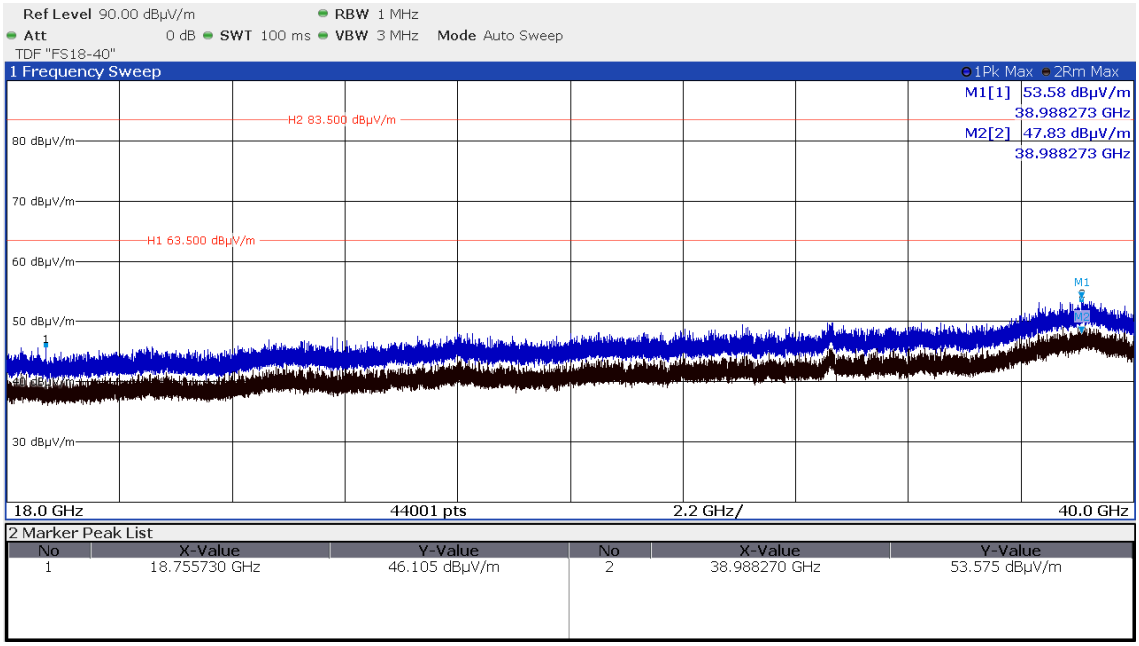
2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.920180 GHz	46.240 dBµV/m	6	5.515930 GHz	76.621 dBµV/m
2	5.448430 GHz	55.384 dBµV/m	7	5.541430 GHz	60.855 dBµV/m
3	5.457430 GHz	57.972 dBµV/m	8	5.542930 GHz	59.026 dBµV/m
4	5.472430 GHz	64.165 dBµV/m	9	5.555920 GHz	55.741 dBµV/m
5	5.507930 GHz	106.370 dBµV/m	10	7.708270 GHz	52.765 dBµV/m

3 Marker Table

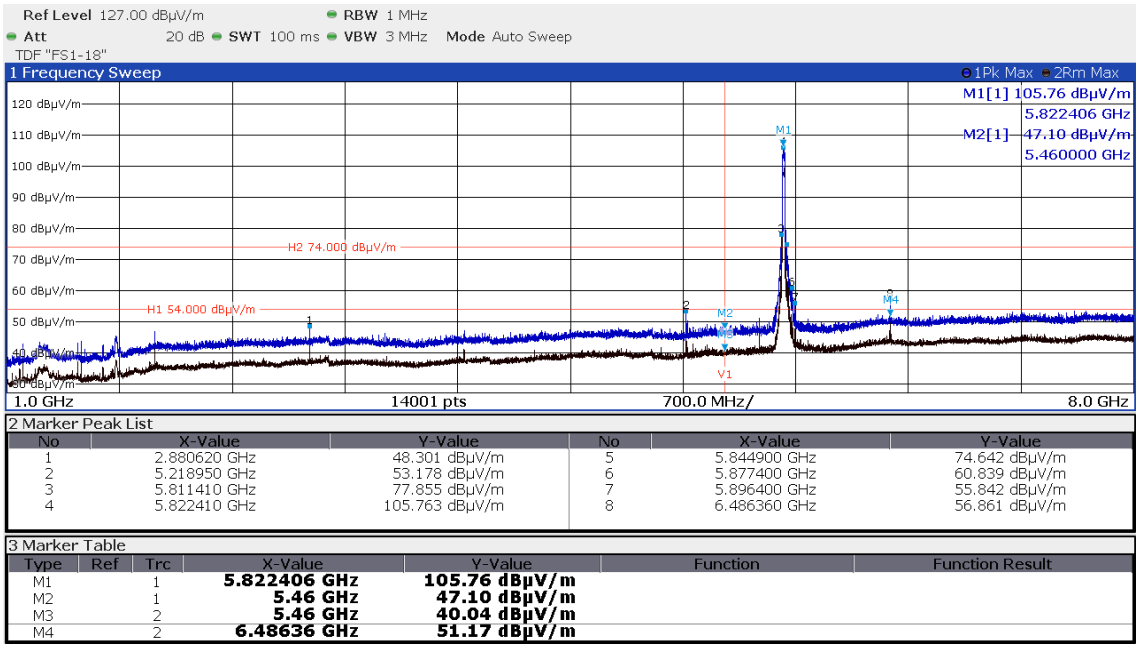
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**5.507928 GHz**	**106.37 dBµV/m**		
M2		1	**5.46 GHz**	**50.30 dBµV/m**		
M3		2	**5.46 GHz**	**43.34 dBµV/m**		





Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

CH165

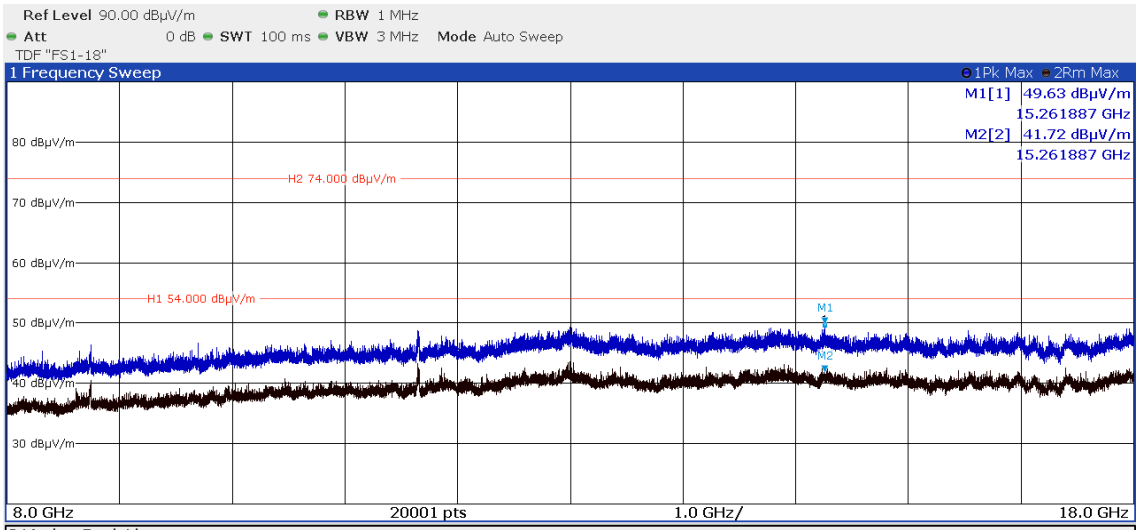


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	2.880620 GHz	48.301 dBµV/m	5	5.844900 GHz	74.642 dBµV/m
2	5.218950 GHz	53.178 dBµV/m	6	5.877400 GHz	60.839 dBµV/m
3	5.811410 GHz	77.855 dBµV/m	7	5.896400 GHz	55.842 dBµV/m
4	5.822410 GHz	105.763 dBµV/m	8	6.486360 GHz	56.861 dBµV/m

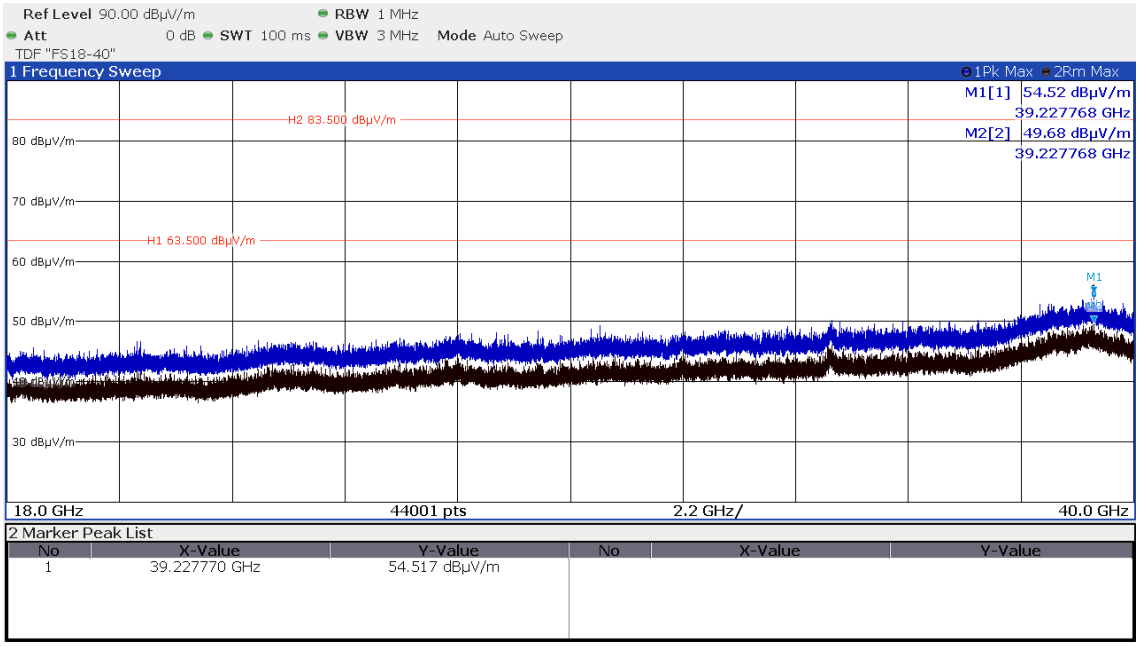
3 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**5.822406 GHz**	**105.76 dBµV/m**		
M2		1	**5.46 GHz**	**47.10 dBµV/m**		
M3		2	**5.46 GHz**	**40.04 dBµV/m**		
M4		2	**6.48636 GHz**	**51.17 dBµV/m**		



2 Marker Peak List

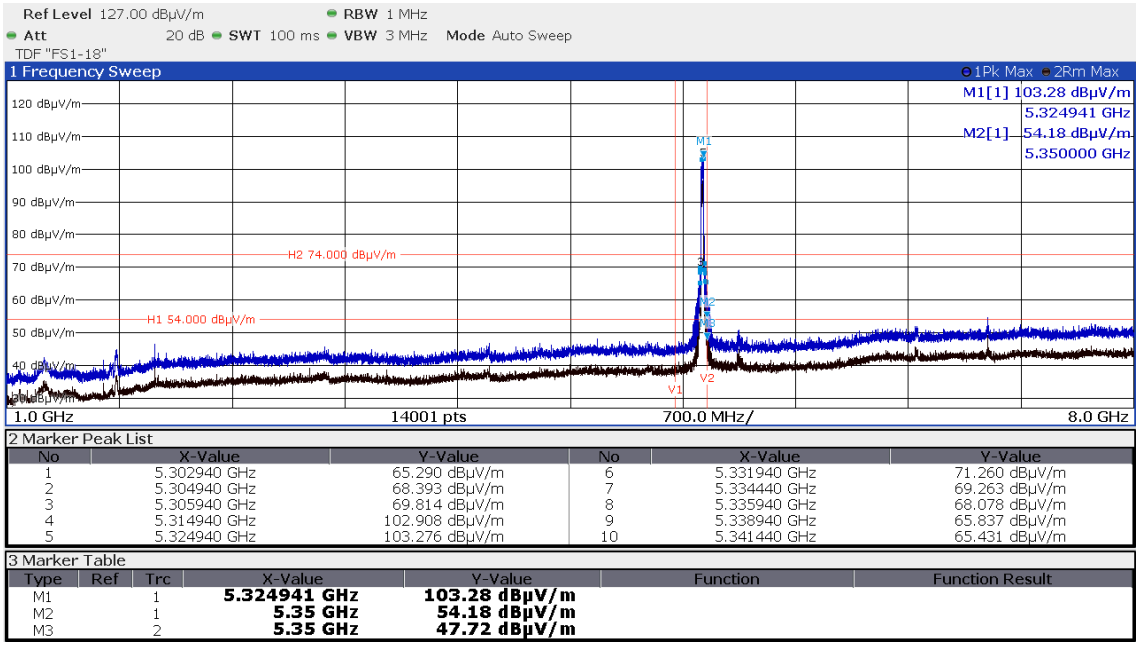
No	X-Value	Y-Value	No	X-Value	Y-Value
1	15.261890 GHz	49.630 dBµV/m			

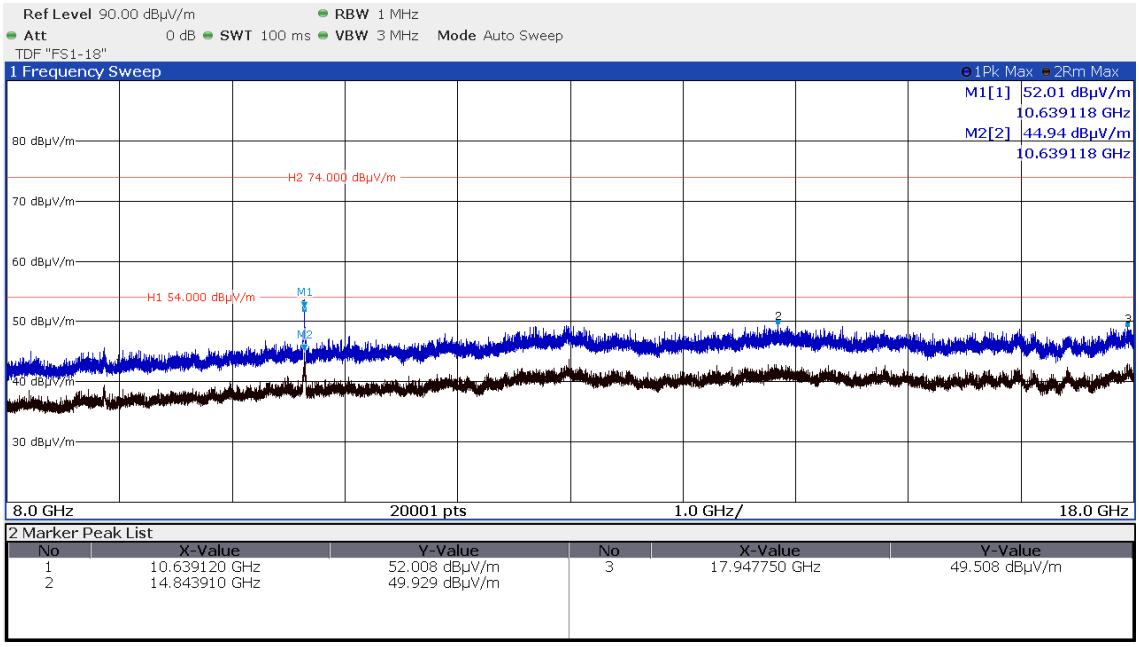


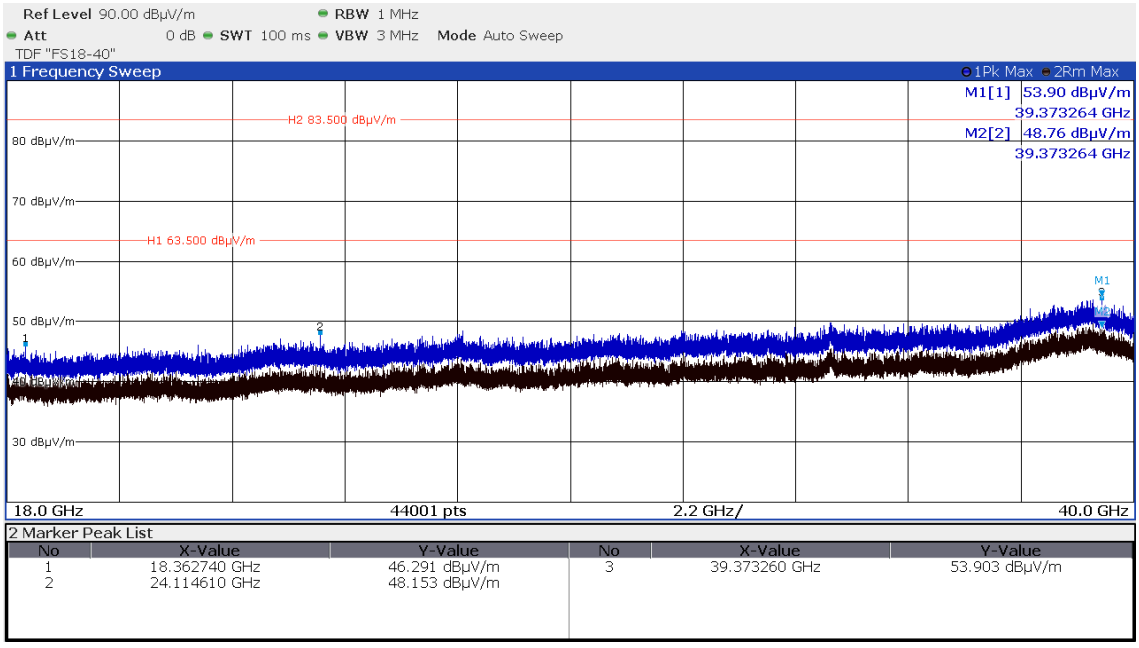
Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

WLAN Standard 802.11n HT20, MSC7, P11, Path A + B

CH64



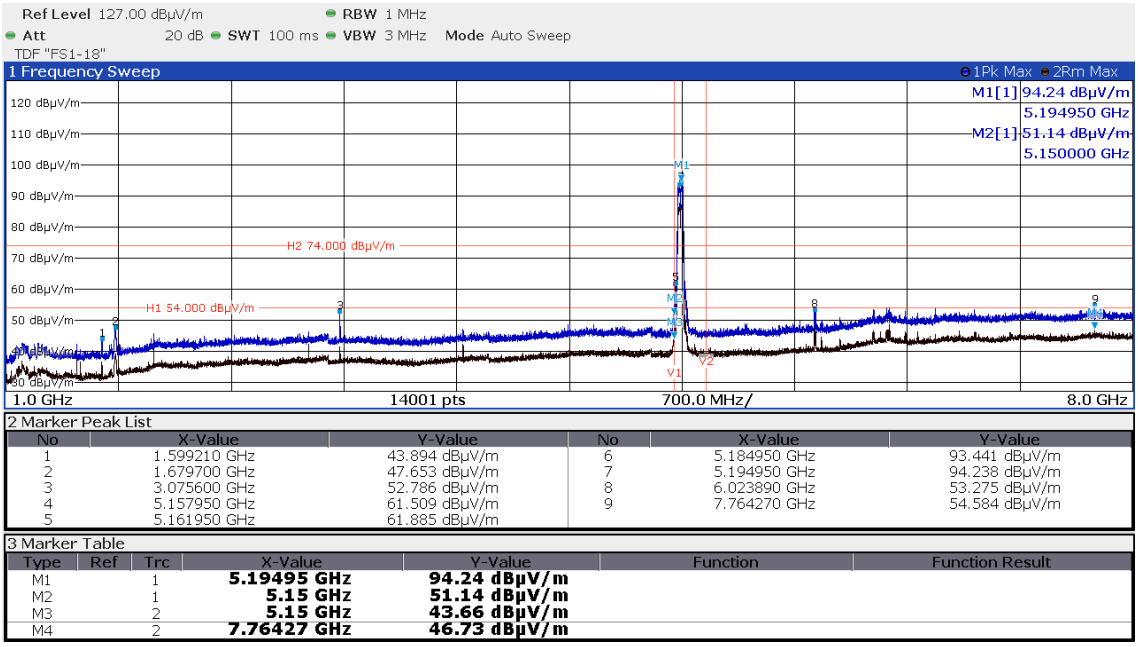




Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

WLAN Standard 802.11ac VT40, MSC7, P8, Path A - Ant A

CH36up

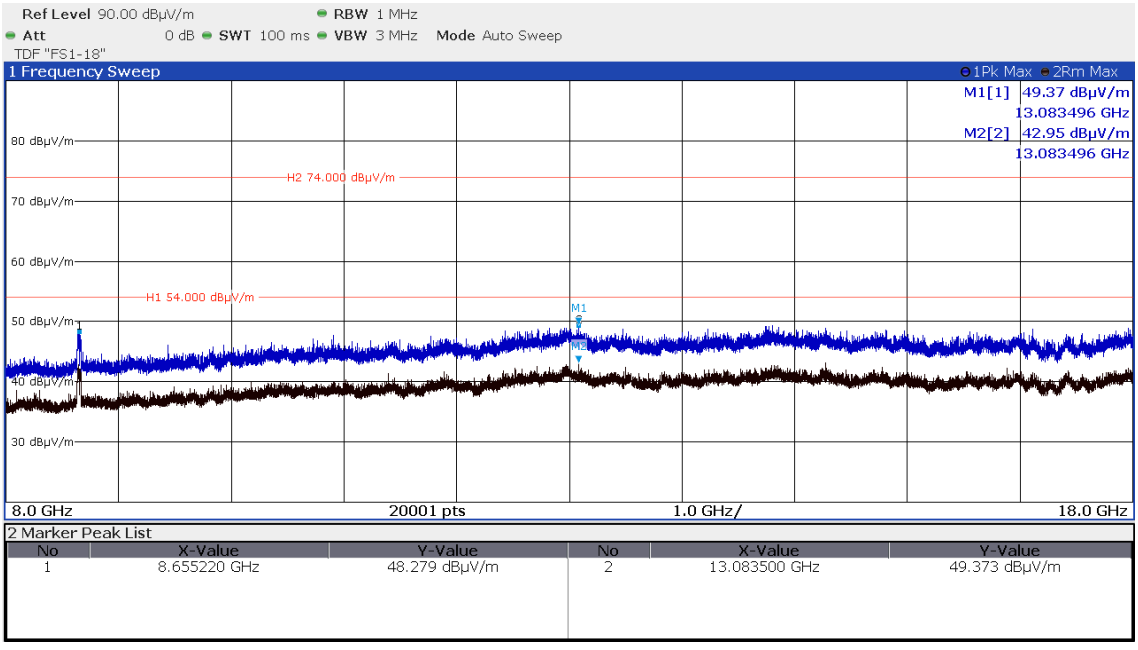


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.599210 GHz	43.894 dBµV/m	6	5.184950 GHz	93.441 dBµV/m
2	1.679700 GHz	47.653 dBµV/m	7	5.194950 GHz	94.238 dBµV/m
3	3.075600 GHz	52.786 dBµV/m	8	6.023890 GHz	53.275 dBµV/m
4	5.157950 GHz	61.509 dBµV/m	9	7.764270 GHz	54.584 dBµV/m
5	5.161950 GHz	61.885 dBµV/m			

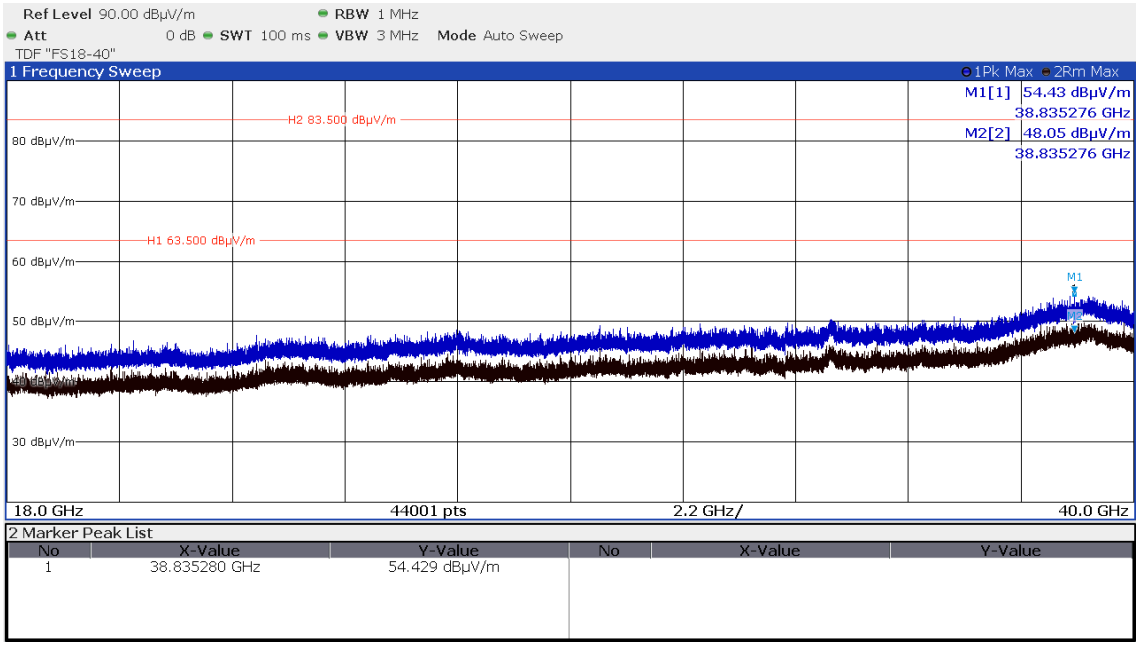
3 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**5.19495 GHz**	**94.24 dBµV/m**		
M2		1	**5.15 GHz**	**51.14 dBµV/m**		
M3		2	**5.15 GHz**	**43.66 dBµV/m**		
M4		2	**7.76427 GHz**	**46.73 dBµV/m**		



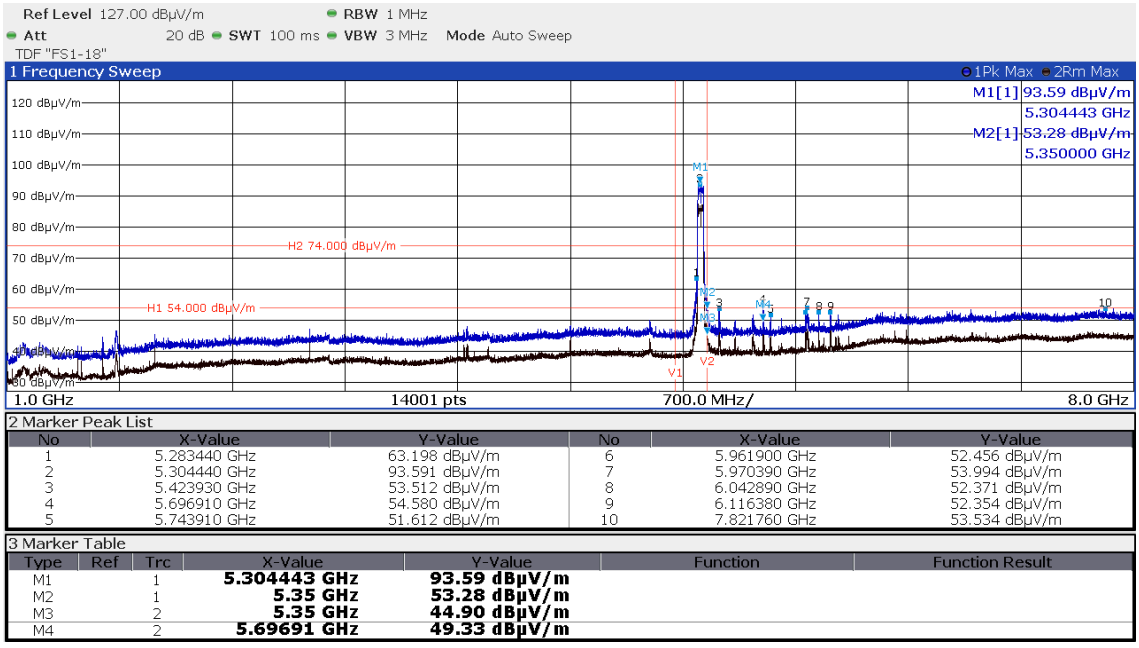
2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	8.655220 GHz	48.279 dBµV/m	2	13.083500 GHz	49.373 dBµV/m

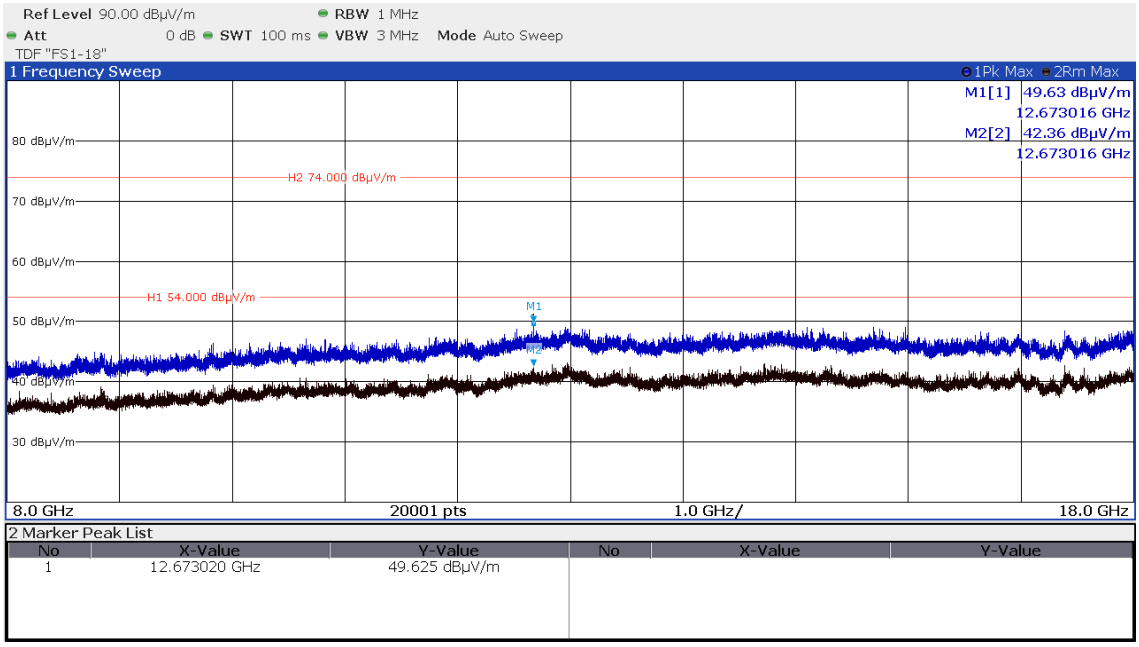


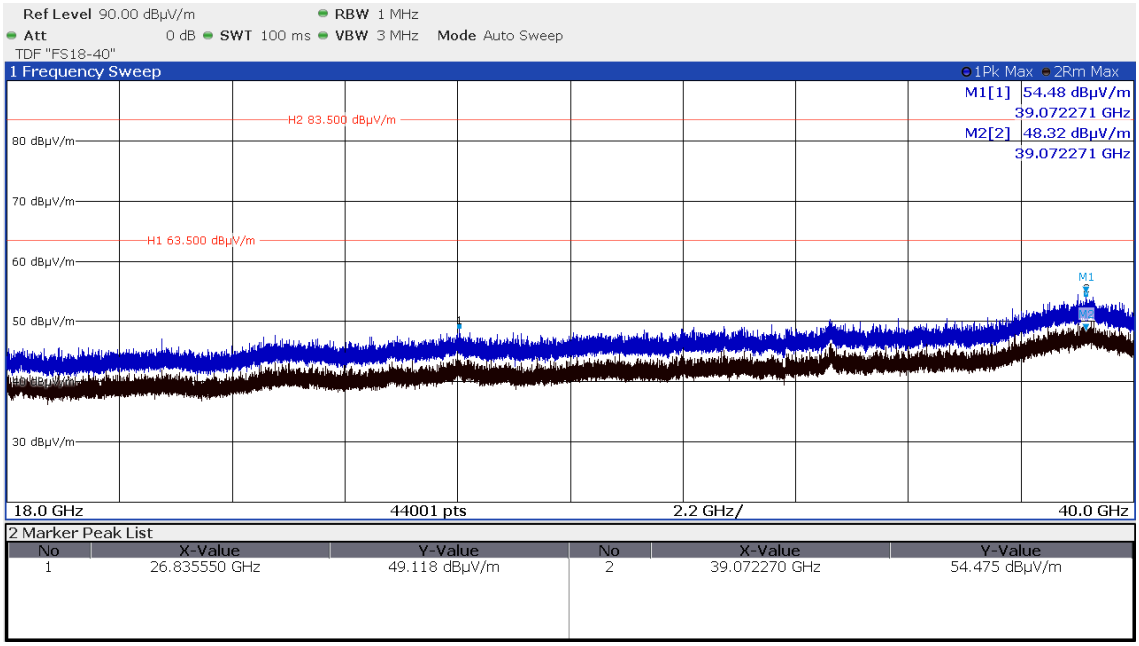
Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

CH60up



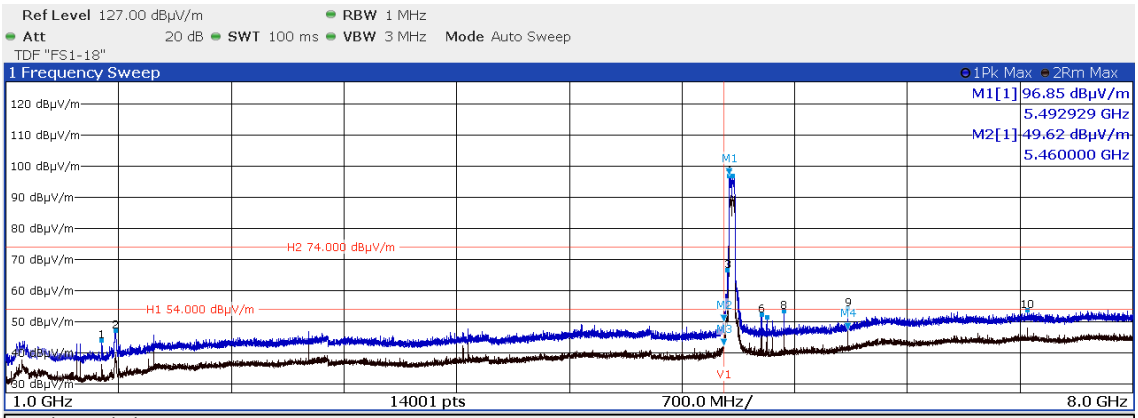
FCC ID: XO2-SPB228D **IC: 8713A-SPB228D**





Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

CH100up

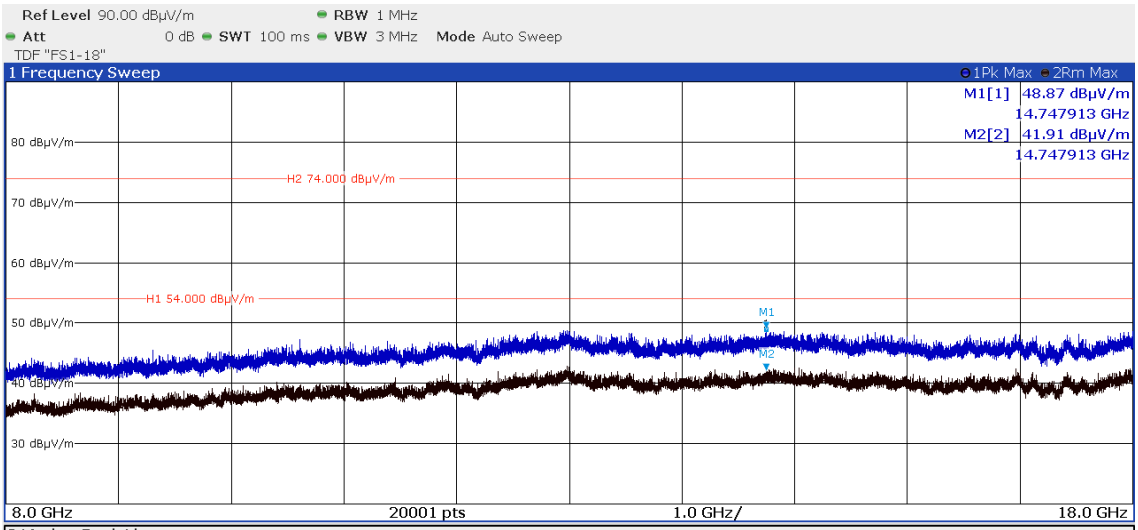


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.595710 GHz	43.847 dBµV/m	6	5.693410 GHz	52.134 dBµV/m
2	1.681200 GHz	46.892 dBµV/m	7	5.726410 GHz	51.176 dBµV/m
3	5.482930 GHz	66.430 dBµV/m	8	5.831900 GHz	53.313 dBµV/m
4	5.492930 GHz	96.851 dBµV/m	9	6.229380 GHz	54.119 dBµV/m
5	5.514430 GHz	96.823 dBµV/m	10	7.346800 GHz	53.567 dBµV/m

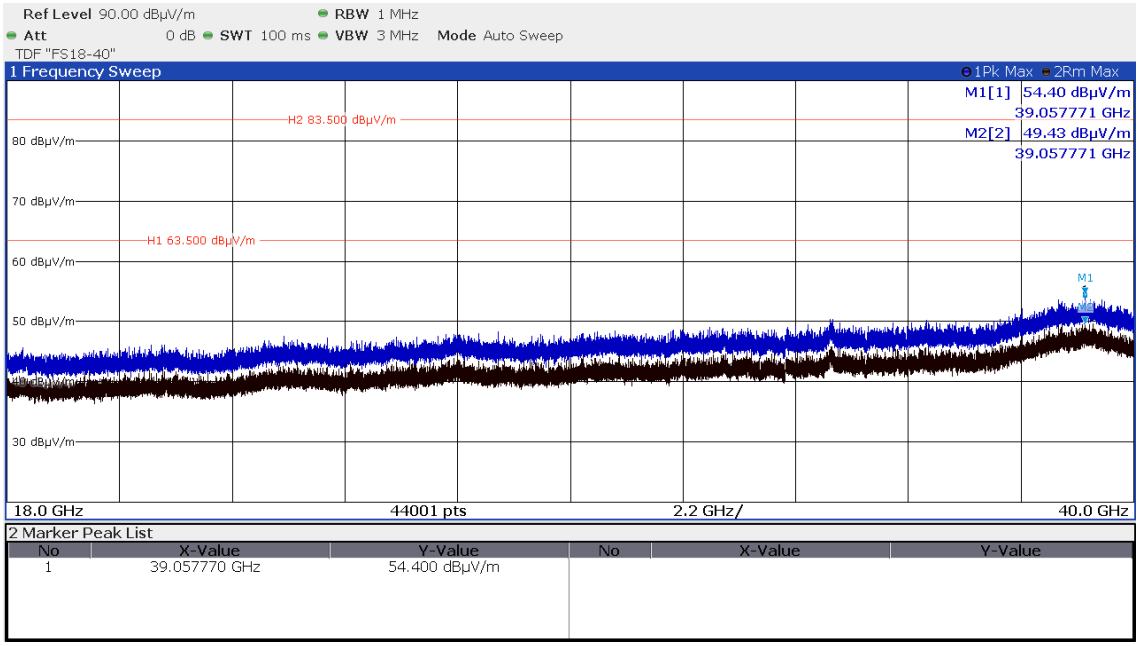
3 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**5.492929 GHz**	**96.85 dBµV/m**		
M2		1	**5.46 GHz**	**49.62 dBµV/m**		
M3		2	**5.46 GHz**	**41.89 dBµV/m**		
M4		2	**6.22938 GHz**	**47.07 dBµV/m**		



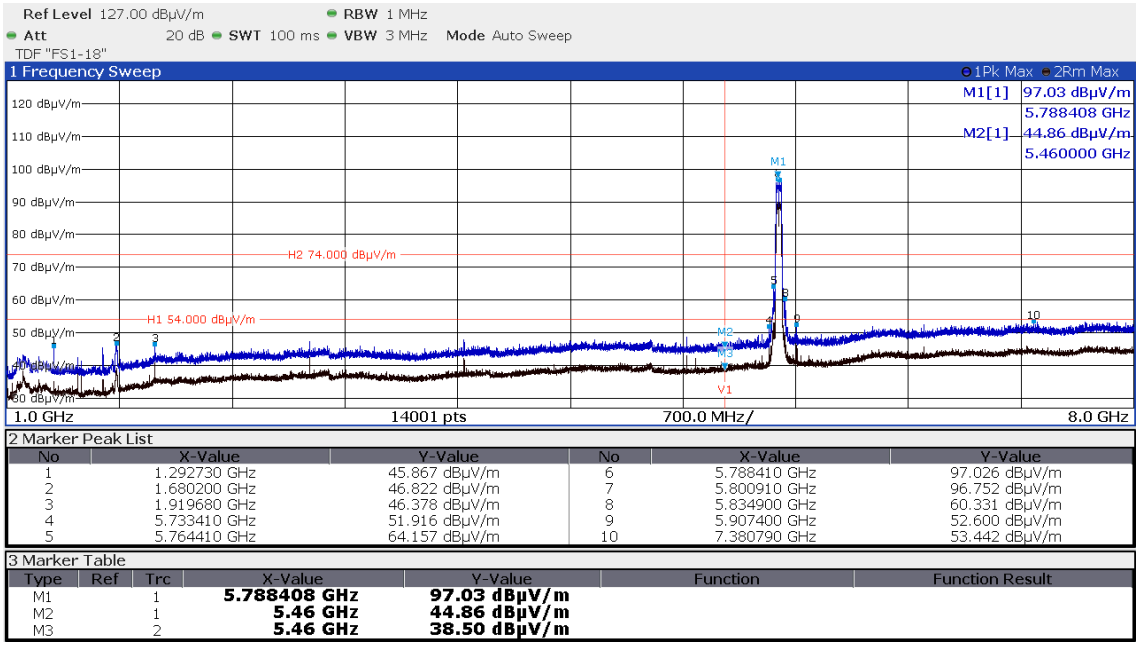
2 Marker Peak List

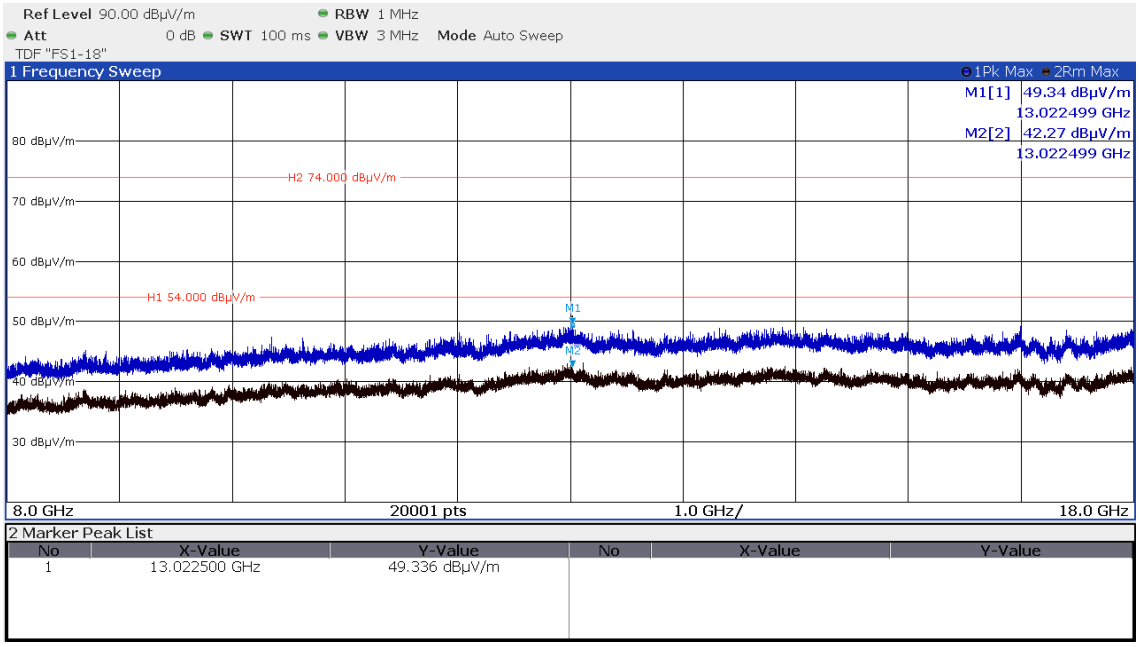
No	X-Value	Y-Value	No	X-Value	Y-Value
1	14.747910 GHz	48.873 dBµV/m			

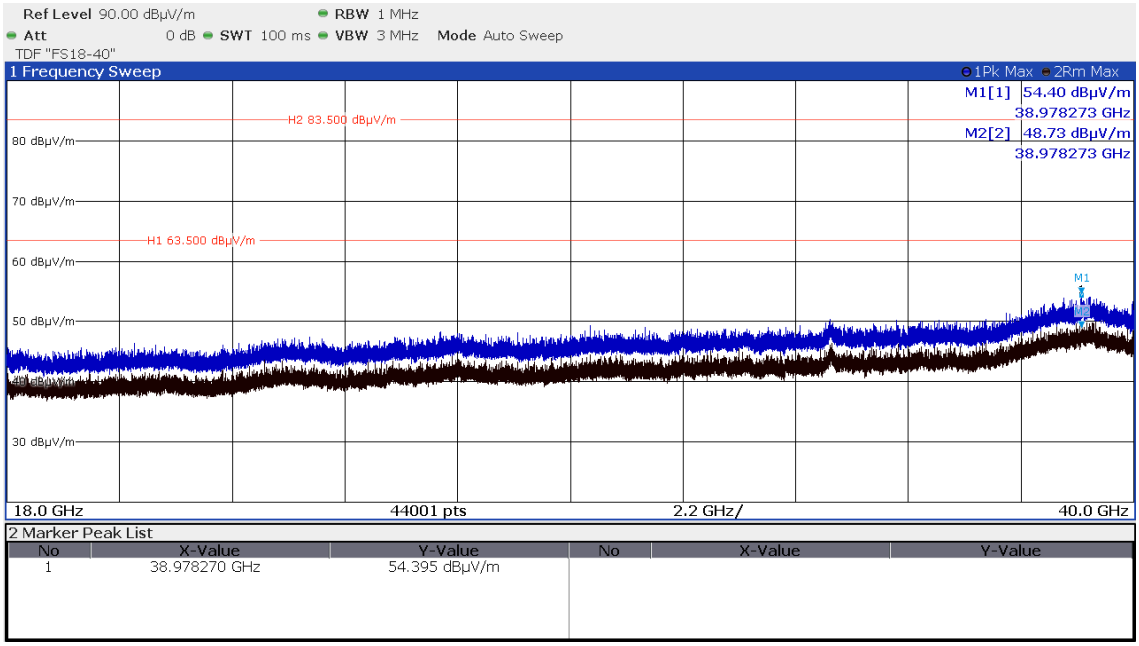


Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

CH161up



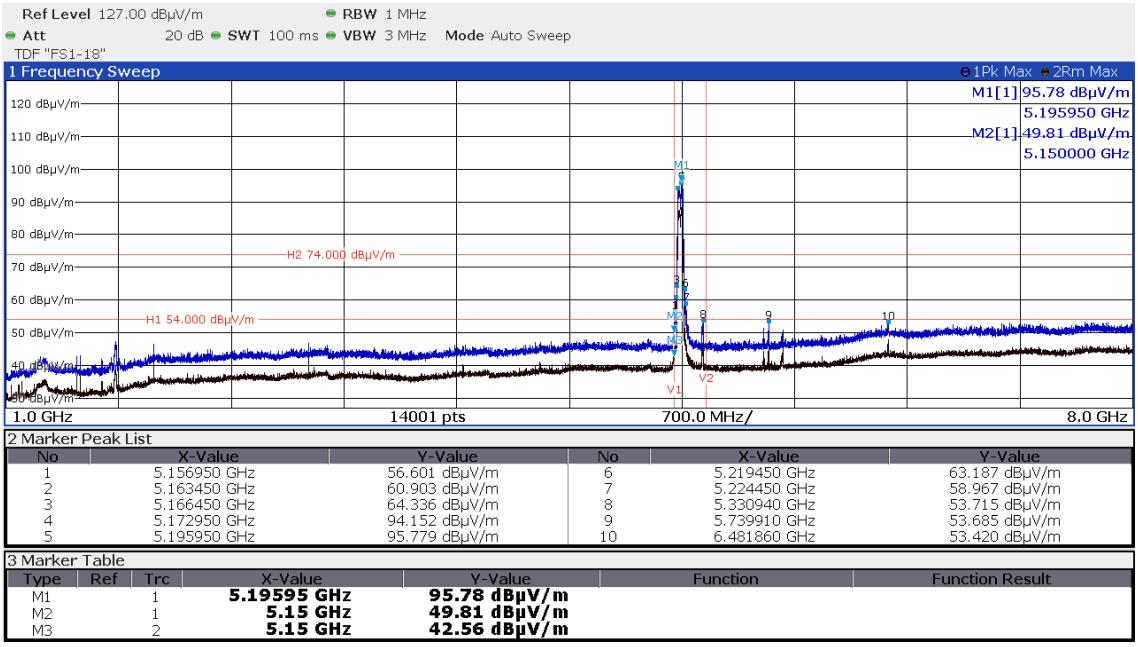




Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

WLAN Standard 802.11ac VT40, MSC7, P8, Path B - Ant B

CH36up

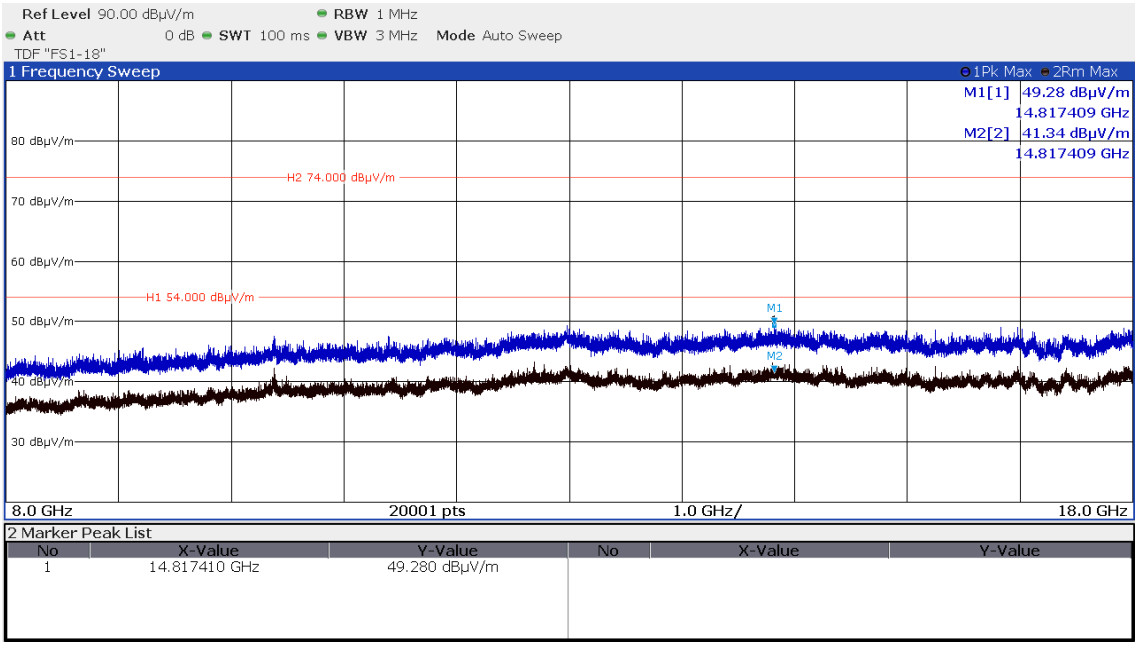


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	5.156950 GHz	56.601 dBµV/m	6	5.219450 GHz	63.187 dBµV/m
2	5.163450 GHz	60.903 dBµV/m	7	5.224450 GHz	58.967 dBµV/m
3	5.166450 GHz	64.336 dBµV/m	8	5.330940 GHz	53.715 dBµV/m
4	5.172950 GHz	94.152 dBµV/m	9	5.739910 GHz	53.685 dBµV/m
5	5.195950 GHz	95.779 dBµV/m	10	6.481860 GHz	53.420 dBµV/m

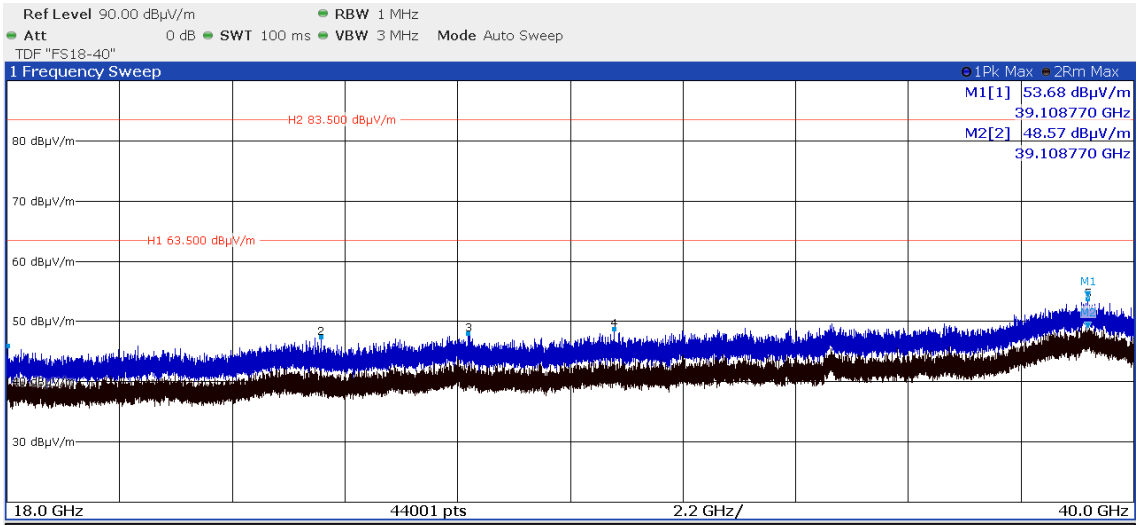
3 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**5.19595 GHz**	**95.78 dBµV/m**		
M2		1	**5.15 GHz**	**49.81 dBµV/m**		
M3		2	**5.15 GHz**	**42.56 dBµV/m**		



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	14.817410 GHz	49.280 dBµV/m			

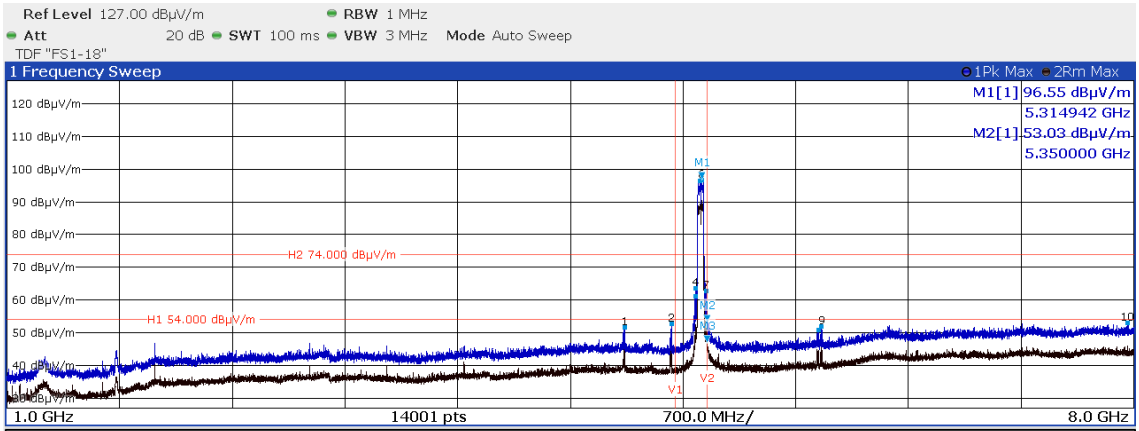


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	18.010750 GHz	46.000 dBµV/m	4	29.850480 GHz	48.777 dBµV/m
2	24.129110 GHz	47.436 dBµV/m	5	39.108770 GHz	53.676 dBµV/m
3	27.004550 GHz	47.941 dBµV/m			

Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

CH60up



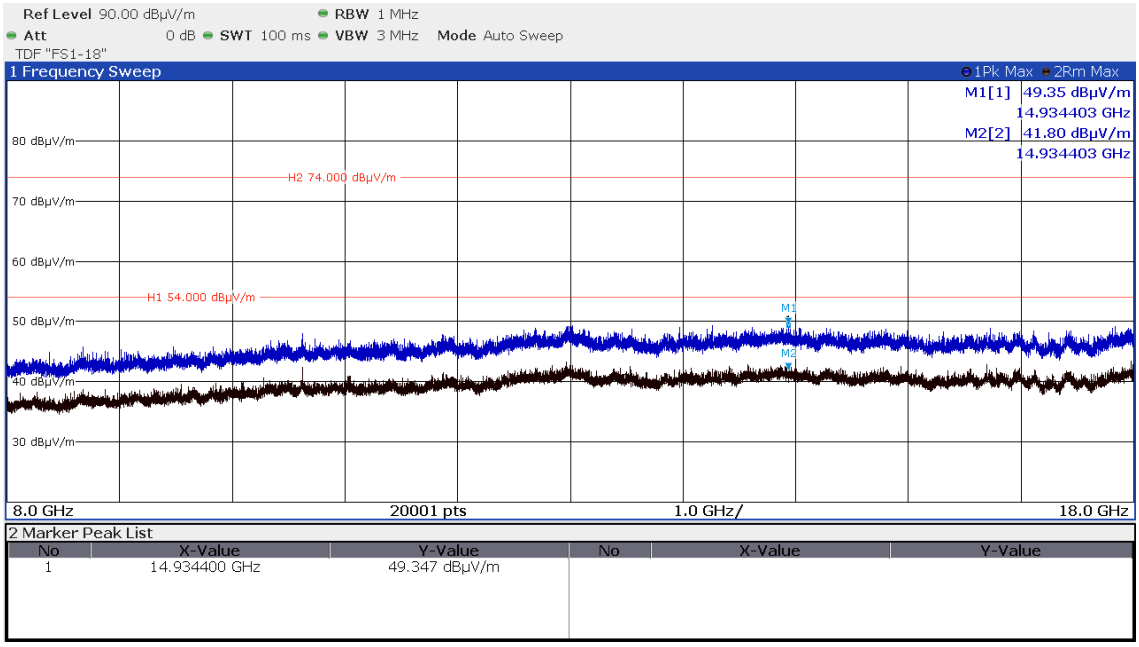
2 Marker Peak List

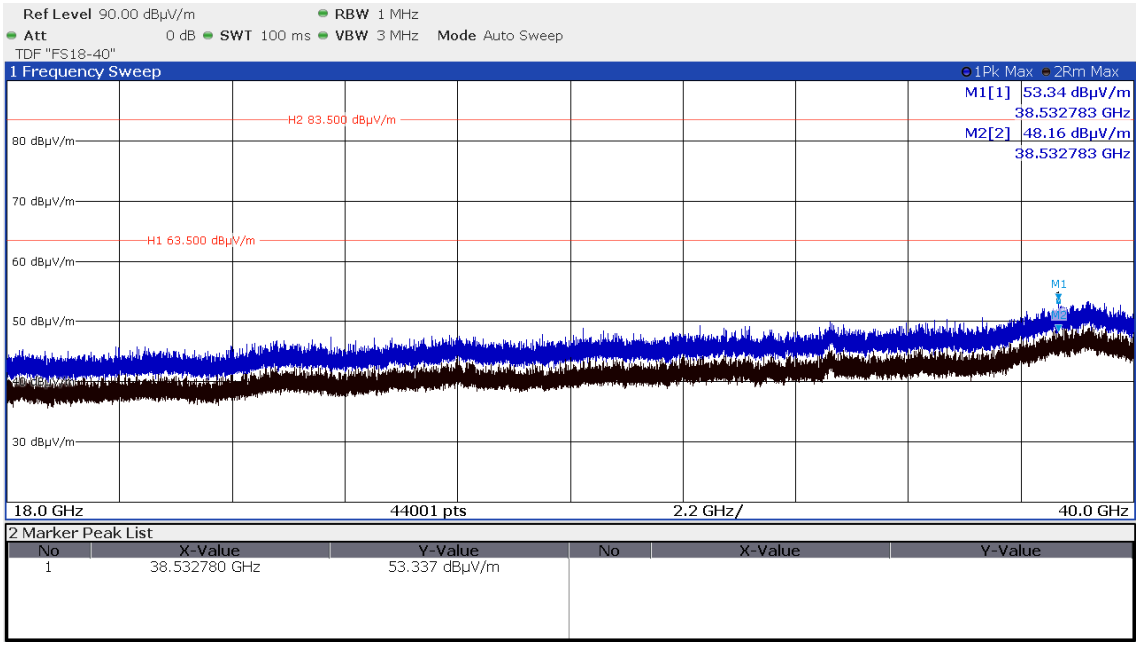
No	X-Value	Y-Value	No	X-Value	Y-Value
1	4.835480 GHz	51.544 dBµV/m	6	5.314940 GHz	96.546 dBµV/m
2	5.127960 GHz	52.754 dBµV/m	7	5.342440 GHz	62.651 dBµV/m
3	5.275440 GHz	61.242 dBµV/m	8	6.041390 GHz	50.918 dBµV/m
4	5.279440 GHz	63.568 dBµV/m	9	6.061390 GHz	51.835 dBµV/m
5	5.303940 GHz	96.368 dBµV/m	10	7.959250 GHz	53.073 dBµV/m

3 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**5.314942 GHz**	**96.55 dBµV/m**		
M2		1	**5.35 GHz**	**53.03 dBµV/m**		
M3		2	**5.35 GHz**	**46.85 dBµV/m**		

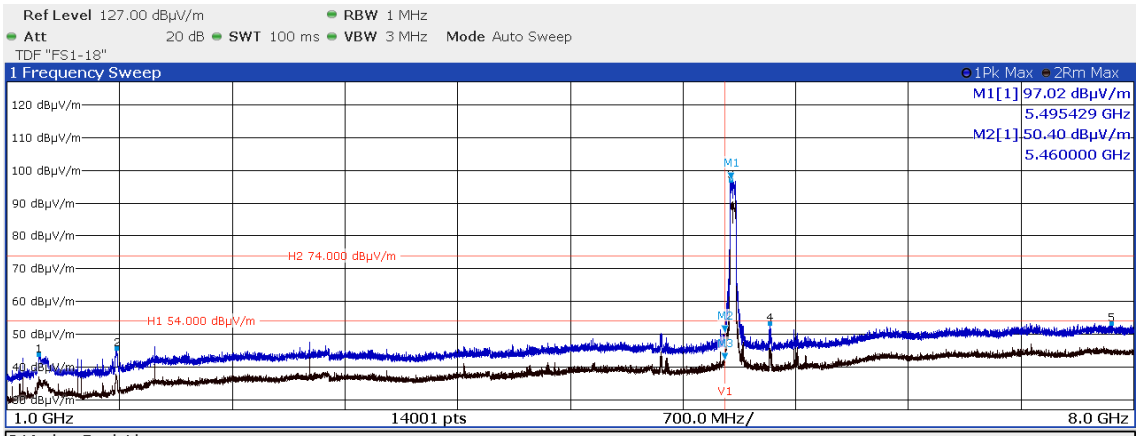
FCC ID: XO2-SPB228D **IC: 8713A-SPB228D**





Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

CH100up

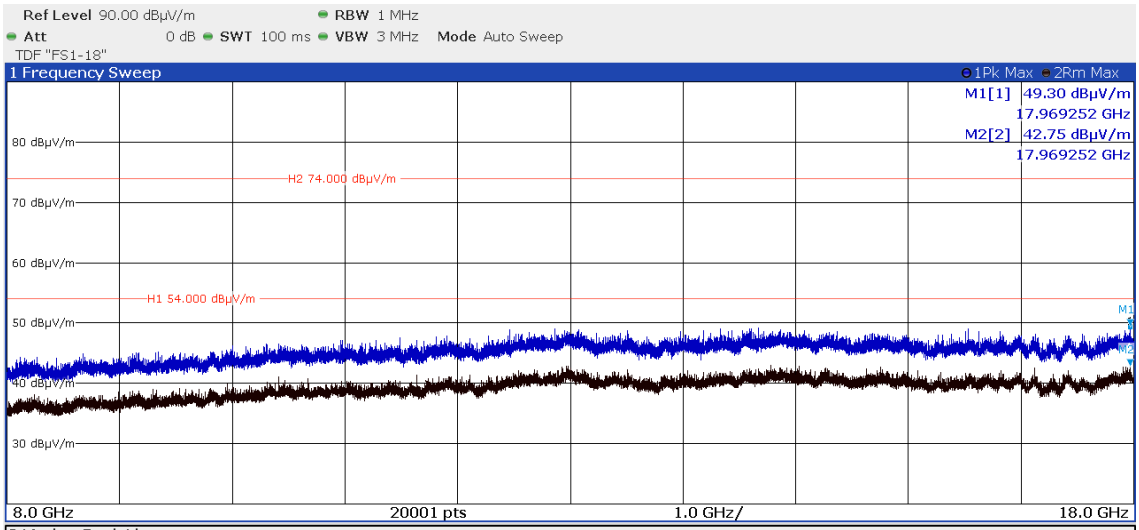


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.198740 GHz	43.717 dBµV/m	4	5.737910 GHz	53.153 dBµV/m
2	1.682200 GHz	45.690 dBµV/m	5	7.860260 GHz	53.298 dBµV/m
3	5.495430 GHz	97.021 dBµV/m			

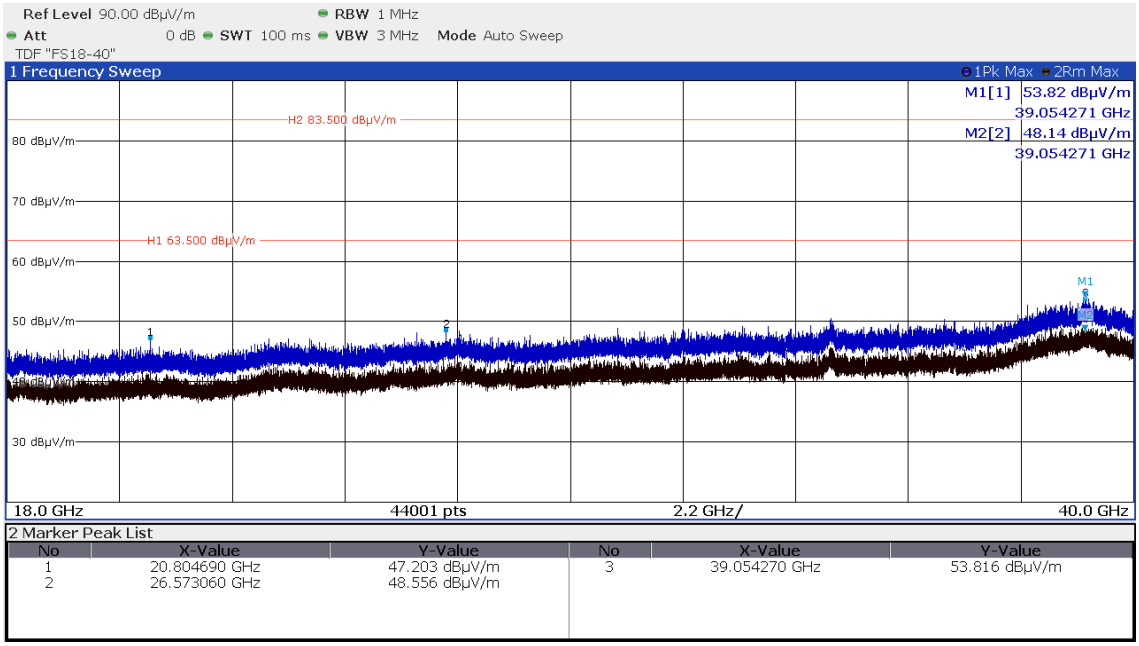
3 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**5.495429 GHz**	**97.02 dBµV/m**		
M2		1	**5.46 GHz**	**50.40 dBµV/m**		
M3		2	**5.46 GHz**	**41.93 dBµV/m**		



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	17.969250 GHz	49.297 dBµV/m			

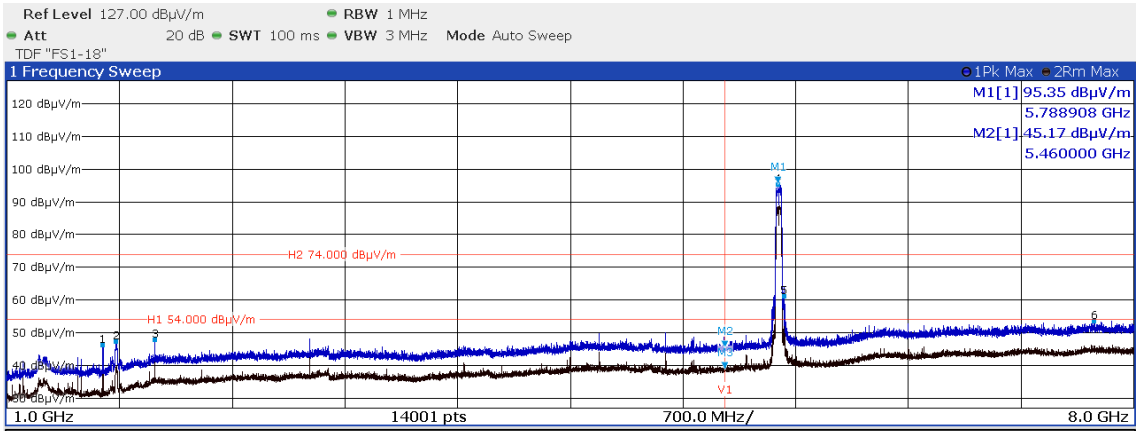


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	20.804690 GHz	47.203 dBµV/m	3	39.054270 GHz	53.816 dBµV/m
2	26.573060 GHz	48.556 dBµV/m			

Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

CH161up

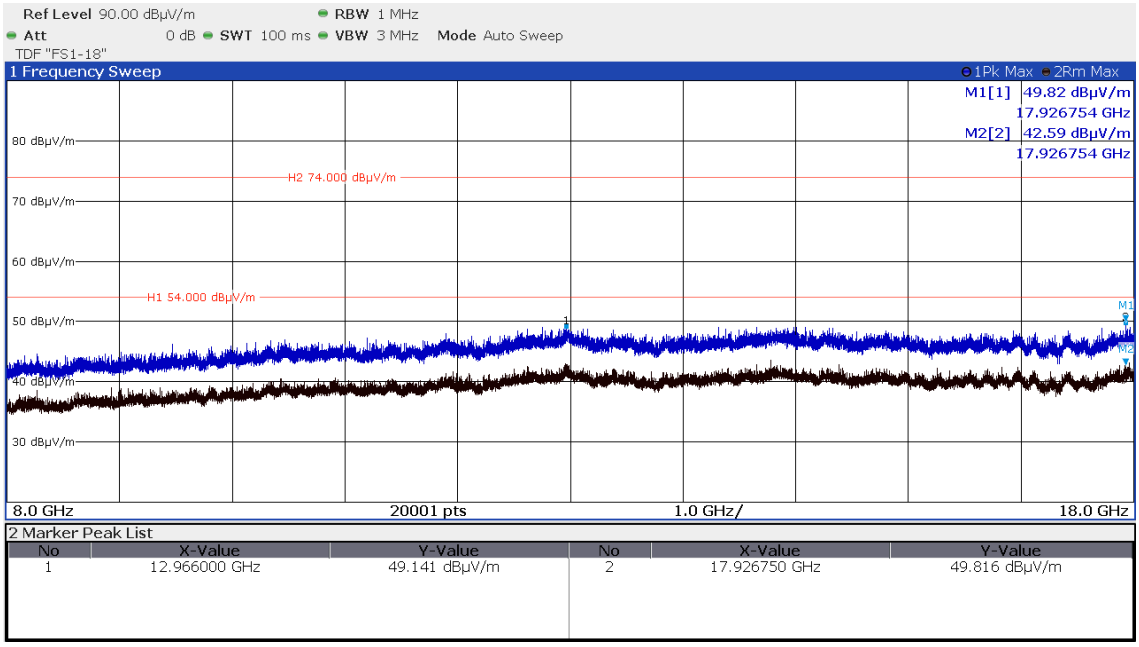


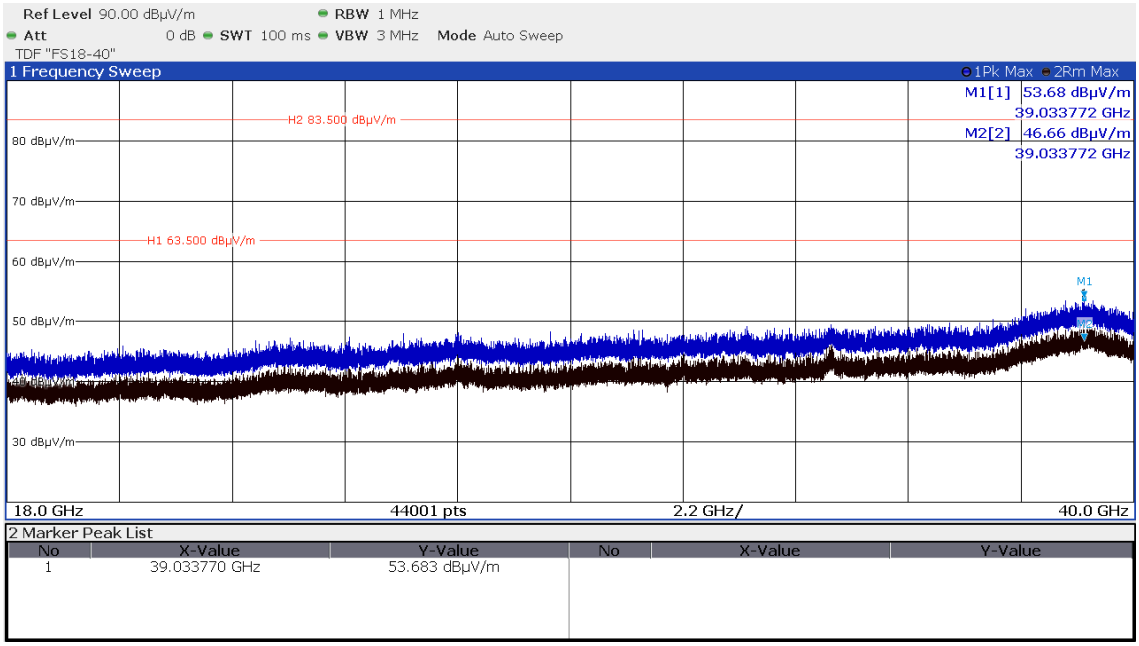
2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.593710 GHz	46.269 dBµV/m	4	5.788910 GHz	95.350 dBµV/m
2	1.678200 GHz	47.391 dBµV/m	5	5.827410 GHz	61.033 dBµV/m
3	1.919680 GHz	47.878 dBµV/m	6	7.755270 GHz	53.488 dBµV/m

3 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**5.788908 GHz**	**95.35 dBµV/m**		
M2		1	**5.46 GHz**	**45.17 dBµV/m**		
M3		2	**5.46 GHz**	**38.63 dBµV/m**		

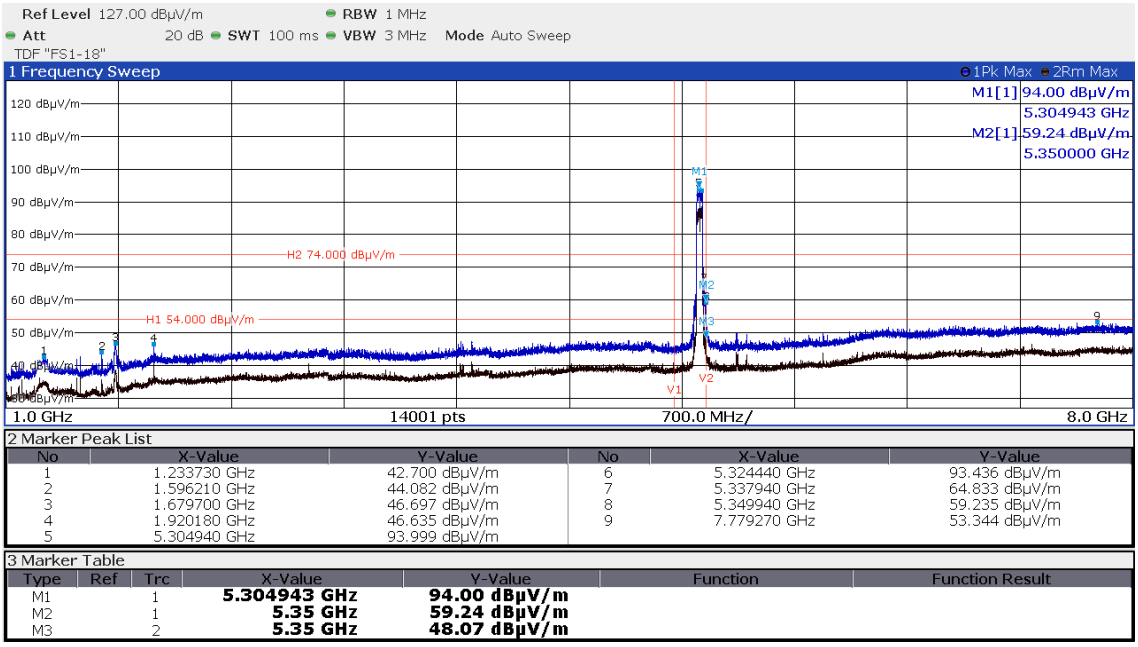




Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

WLAN Standard 802.11ac VT40, MSC7, P5, Path A + B

CH60up

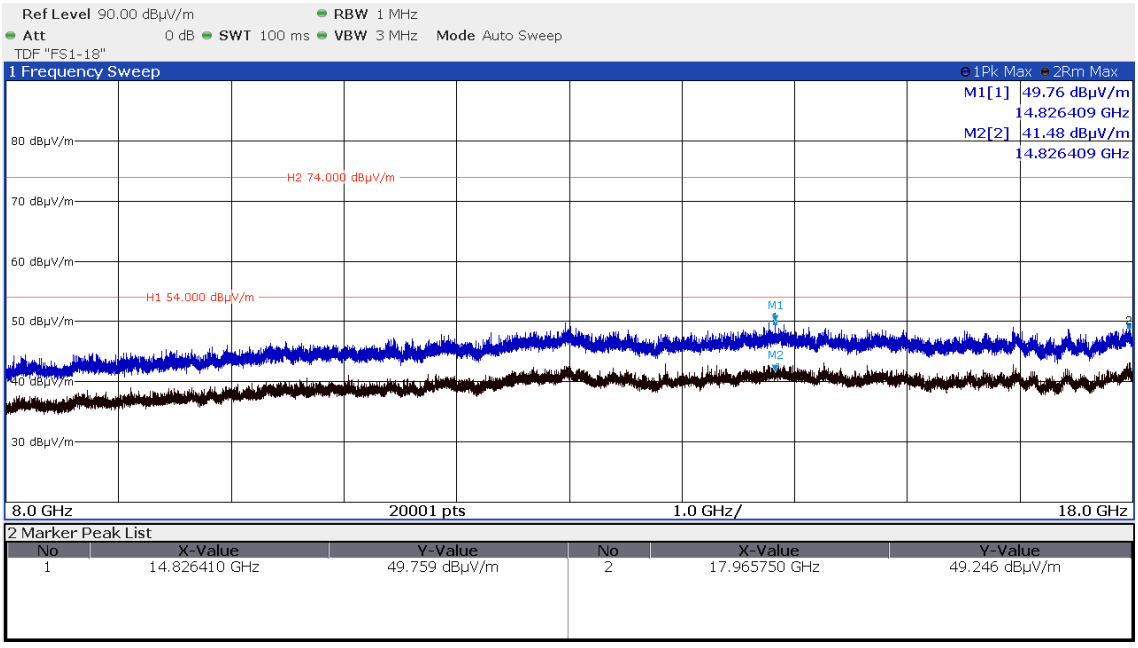


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.233730 GHz	42.700 dBµV/m	6	5.324440 GHz	93.436 dBµV/m
2	1.596210 GHz	44.082 dBµV/m	7	5.337940 GHz	64.833 dBµV/m
3	1.679700 GHz	46.697 dBµV/m	8	5.349940 GHz	59.235 dBµV/m
4	1.920180 GHz	46.635 dBµV/m	9	7.779270 GHz	53.344 dBµV/m
5	5.304940 GHz	93.999 dBµV/m			

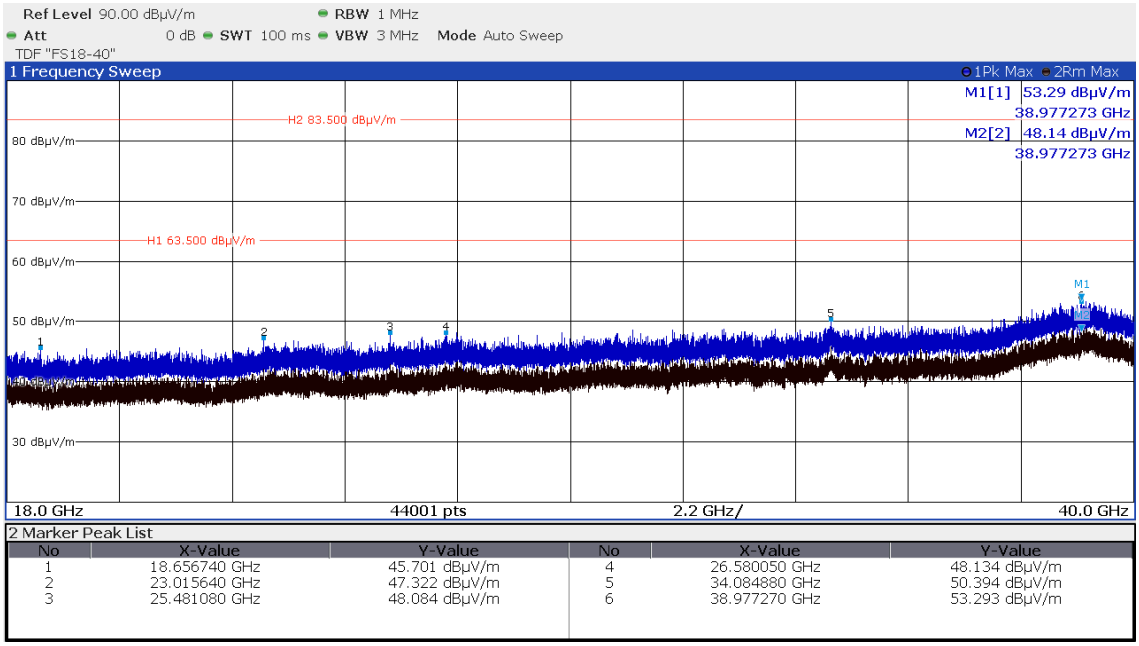
3 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**5.304943 GHz**	**94.00 dBµV/m**		
M2		1	**5.35 GHz**	**59.24 dBµV/m**		
M3		2	**5.35 GHz**	**48.07 dBµV/m**		



2 Marker Peak List

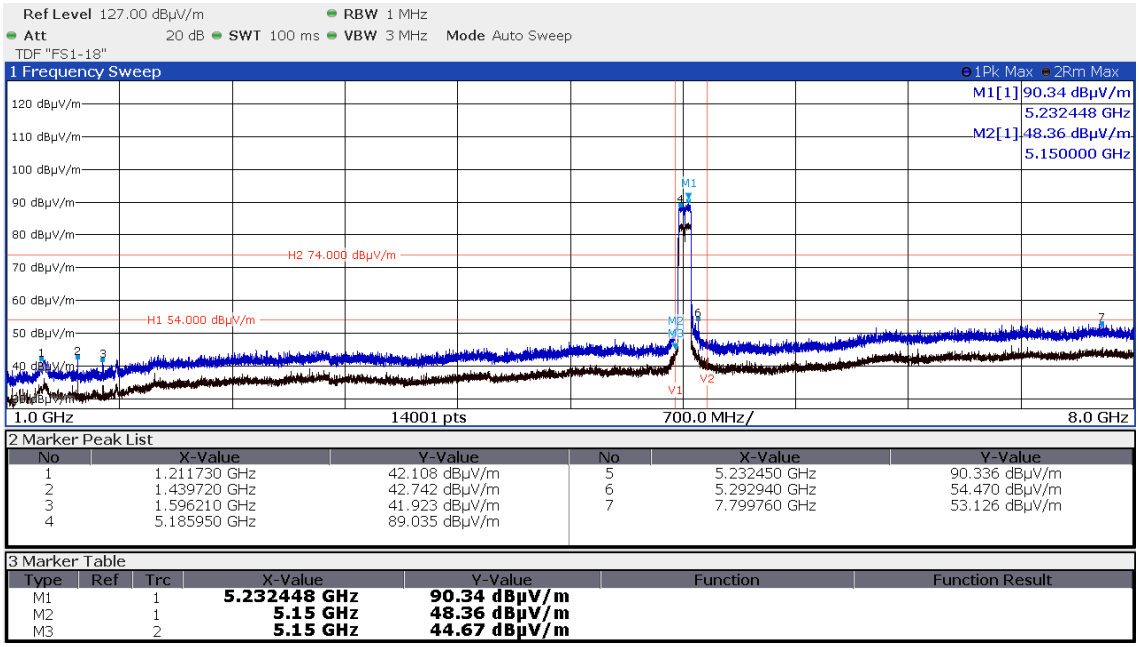
No	X-Value	Y-Value	No	X-Value	Y-Value
1	14.826410 GHz	49.759 dBµV/m	2	17.965750 GHz	49.246 dBµV/m

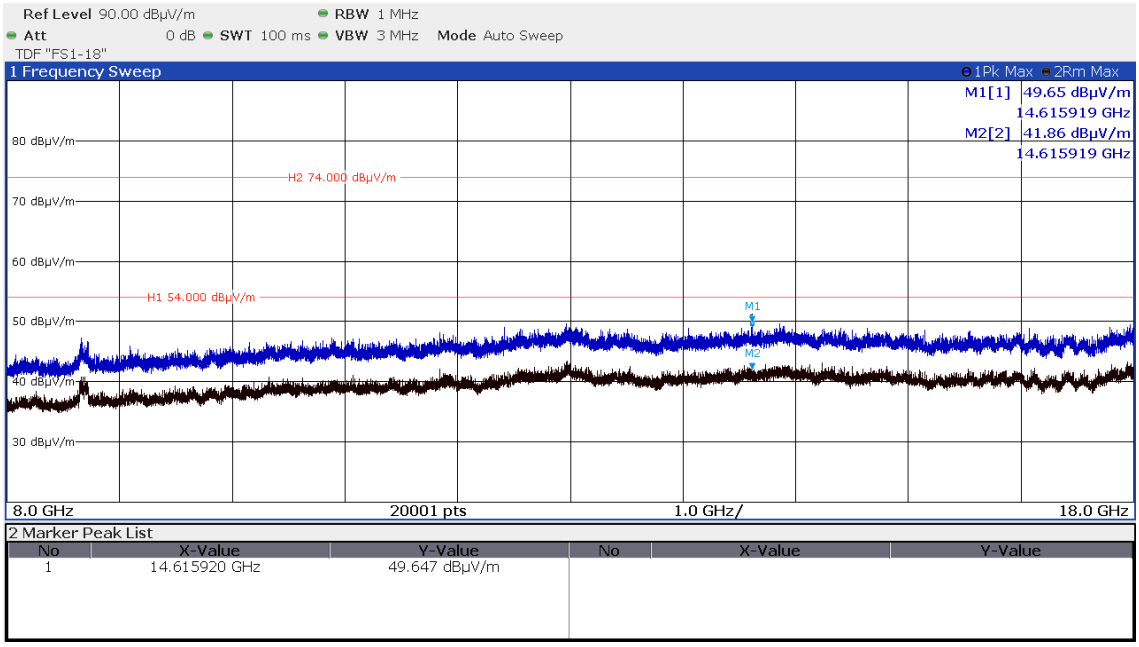


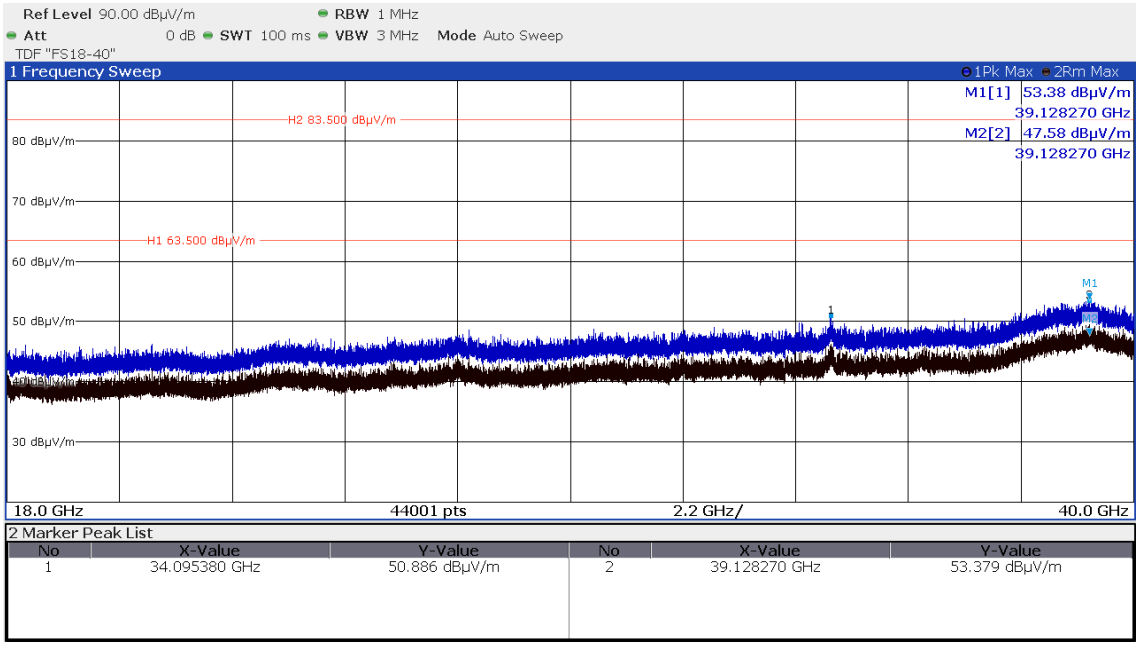
Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

WLAN Standard 802.11ac VT80, MSC7, P6, Path A - Ant A

CH42

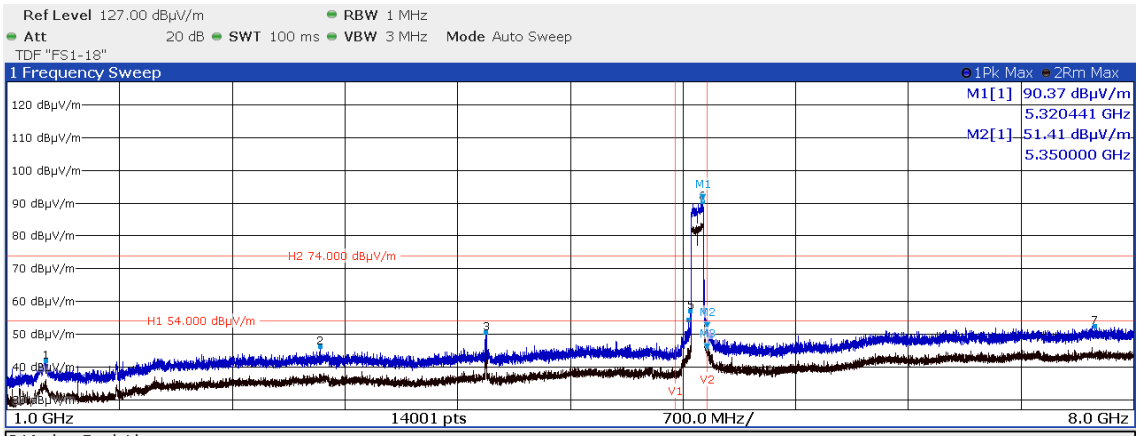






Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

CH56

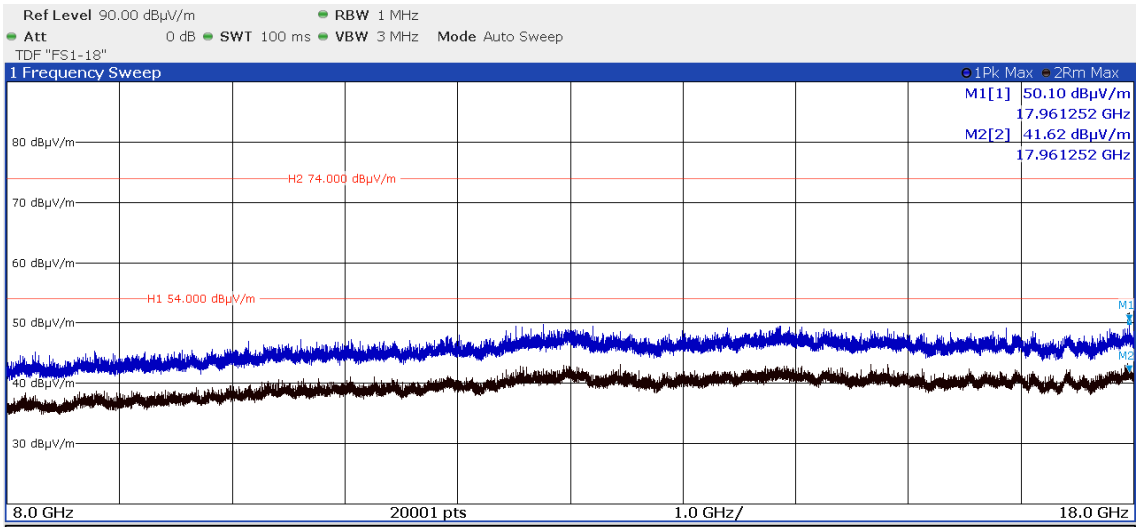


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.241730 GHz	41.789 dBµV/m	5	5.246450 GHz	57.105 dBµV/m
2	2.944110 GHz	46.126 dBµV/m	6	5.320440 GHz	90.369 dBµV/m
3	3.977540 GHz	50.510 dBµV/m	7	7.757770 GHz	52.593 dBµV/m
4	5.233950 GHz	54.473 dBµV/m			

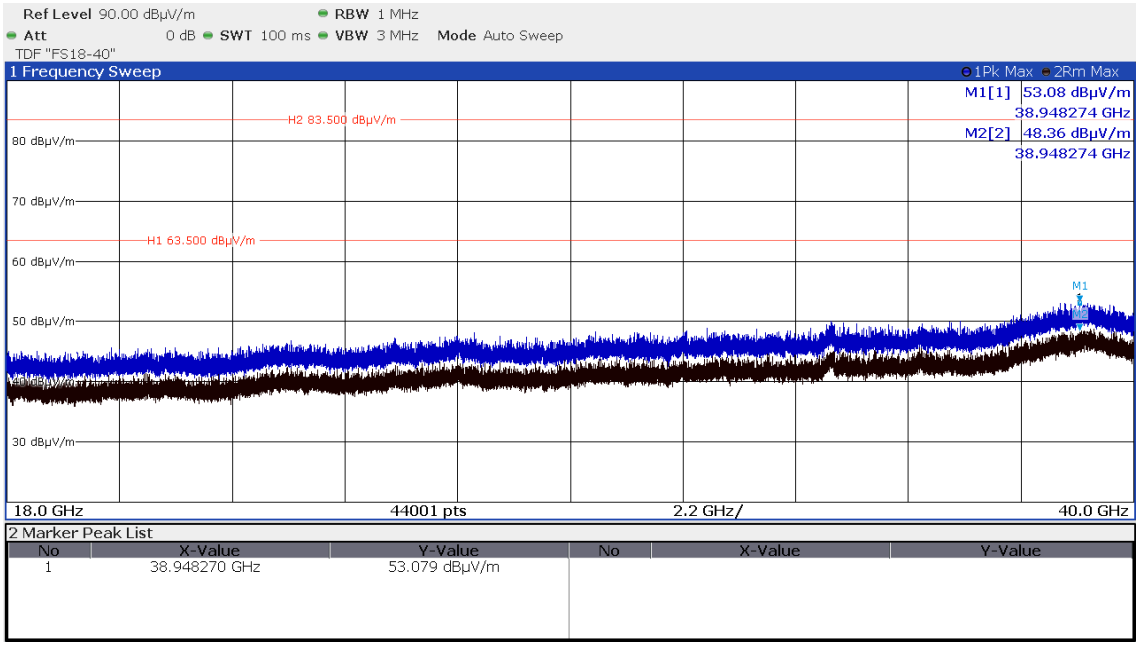
3 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**5.320441 GHz**	**90.37 dBµV/m**		
M2		1	**5.35 GHz**	**51.41 dBµV/m**		
M3		2	**5.35 GHz**	**44.93 dBµV/m**		



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	17.961250 GHz	50.103 dBµV/m			

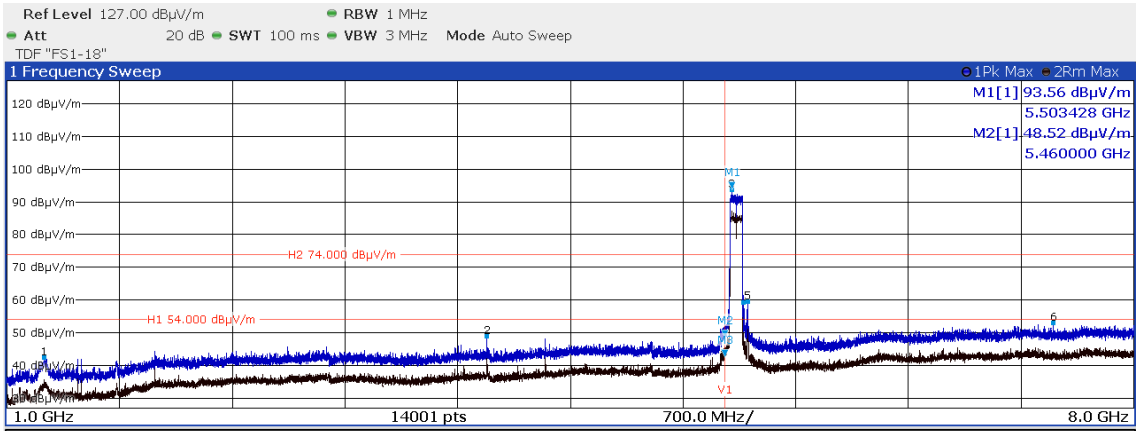


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	38.948270 GHz	53.079 dBµV/m			

Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

CH106



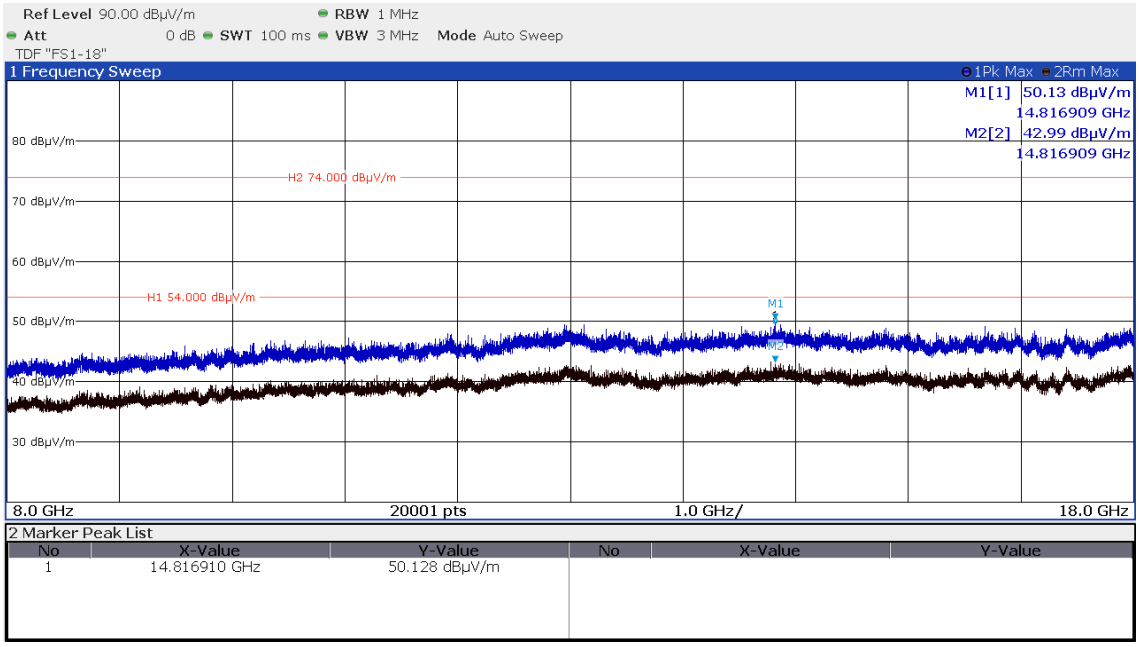
2 Marker Peak List

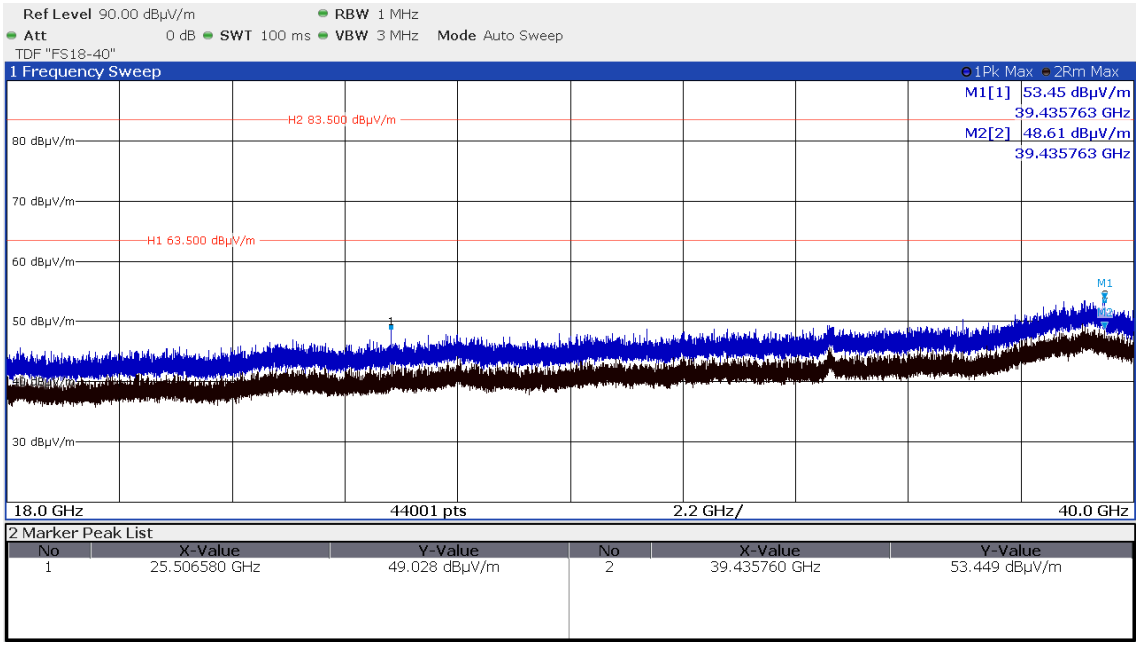
No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.229230 GHz	42.319 dBµV/m	4	5.576920 GHz	59.285 dBµV/m
2	3.982540 GHz	48.991 dBµV/m	5	5.600920 GHz	59.513 dBµV/m
3	5.503430 GHz	93.556 dBµV/m	6	7.499790 GHz	53.000 dBµV/m

3 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**5.503428 GHz**	**93.56 dBµV/m**		
M2		1	**5.46 GHz**	**48.52 dBµV/m**		
M3		2	**5.46 GHz**	**42.50 dBµV/m**		

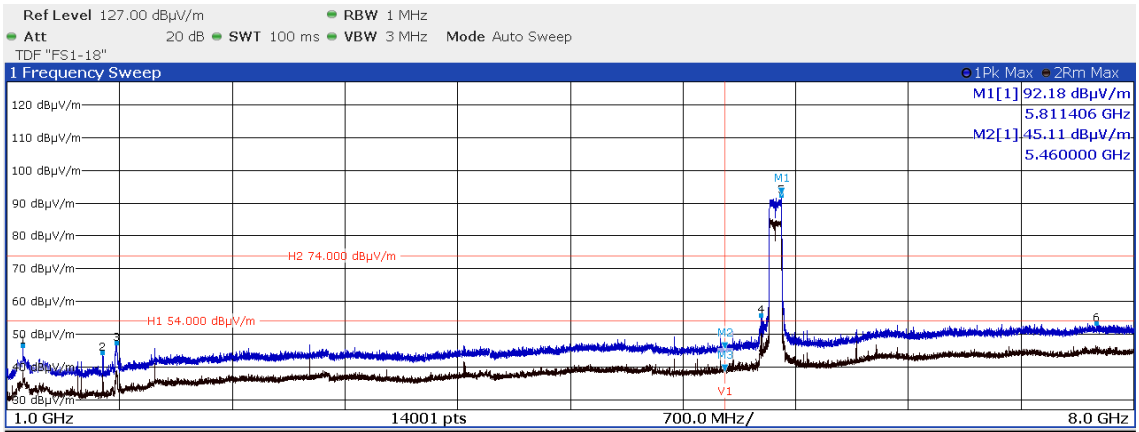
FCC ID: XO2-SPB228D **IC: 8713A-SPB228D**





Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

CH155

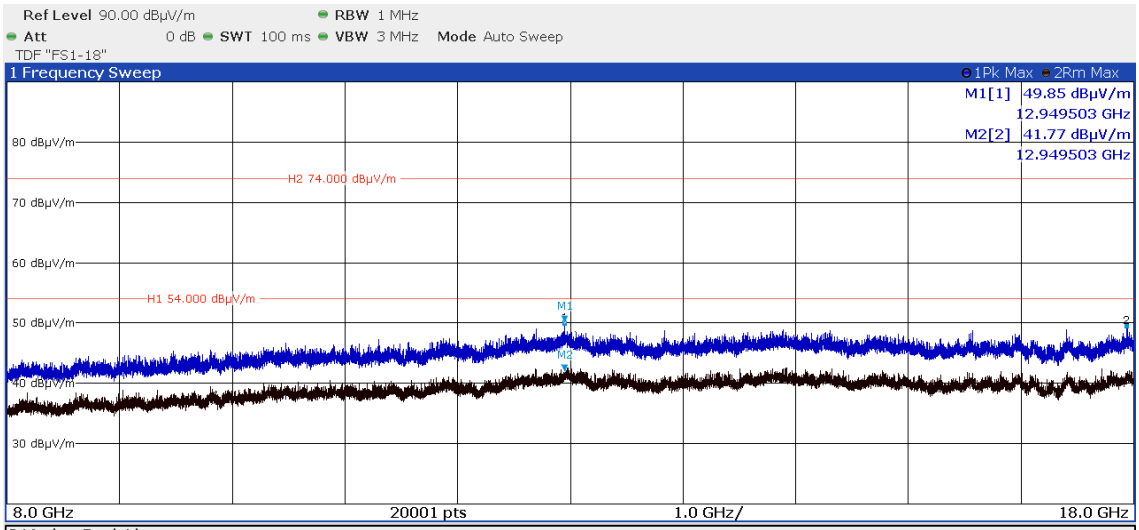


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.097240 GHz	46.377 dBµV/m	4	5.685920 GHz	55.836 dBµV/m
2	1.593710 GHz	44.395 dBµV/m	5	5.811410 GHz	92.177 dBµV/m
3	1.679700 GHz	47.290 dBµV/m	6	7.767770 GHz	53.196 dBµV/m

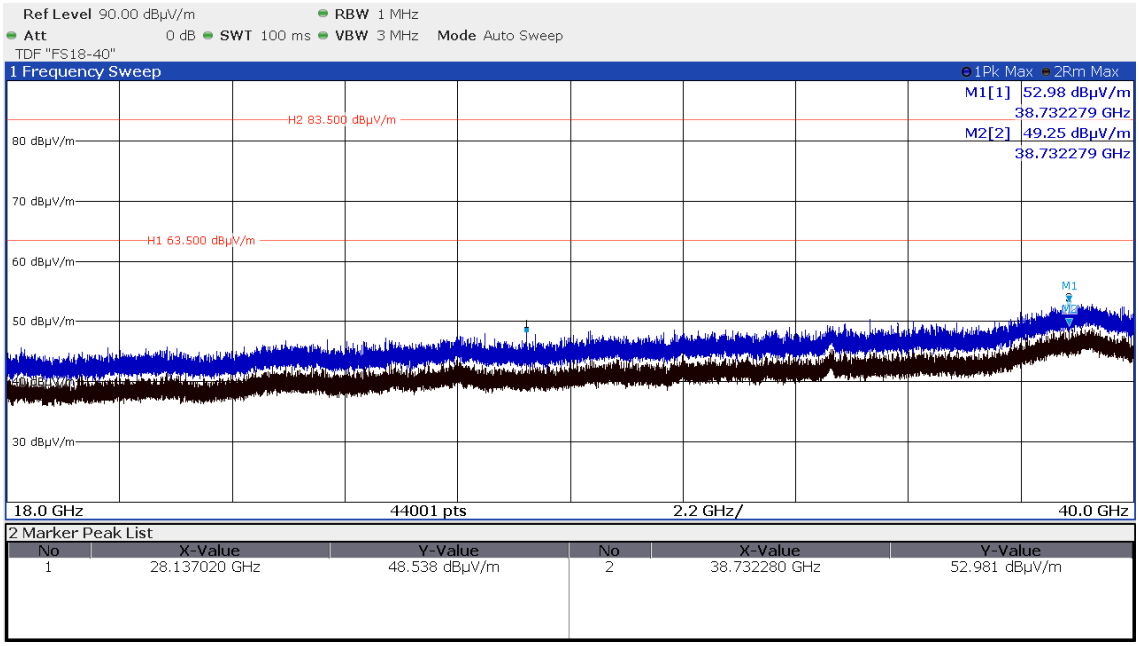
3 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**5.811406 GHz**	**92.18 dBµV/m**		
M2		1	**5.46 GHz**	**45.11 dBµV/m**		
M3		2	**5.46 GHz**	**38.37 dBµV/m**		



2 Marker Peak List

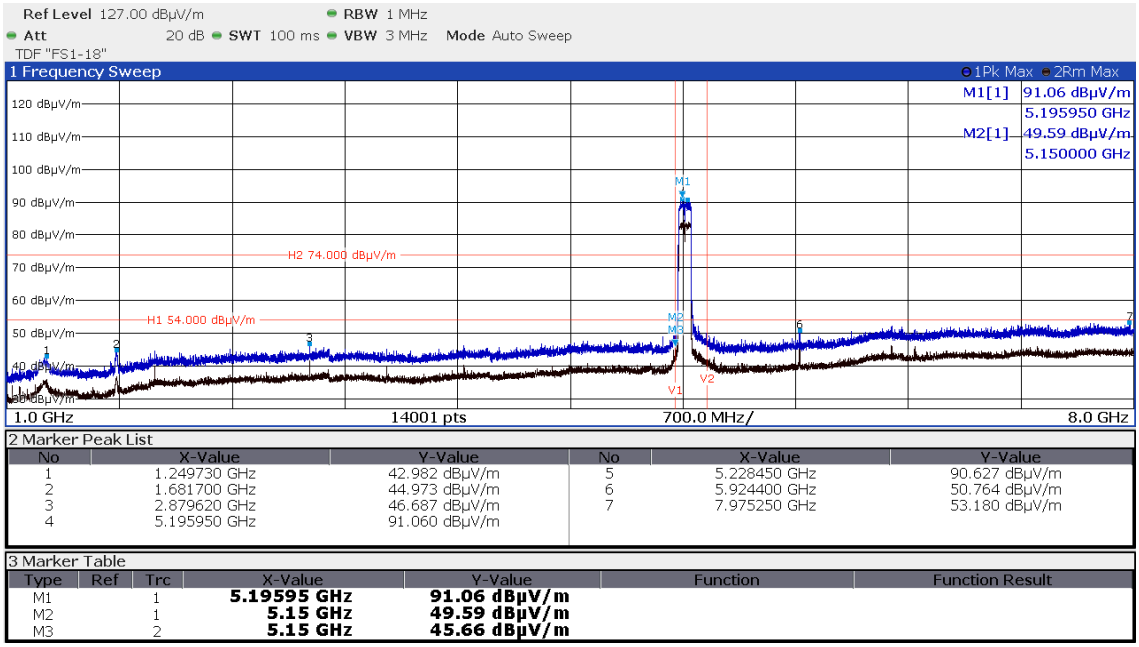
No	X-Value	Y-Value	No	X-Value	Y-Value
1	12.949500 GHz	49.848 dBµV/m	2	17.936750 GHz	49.413 dBµV/m

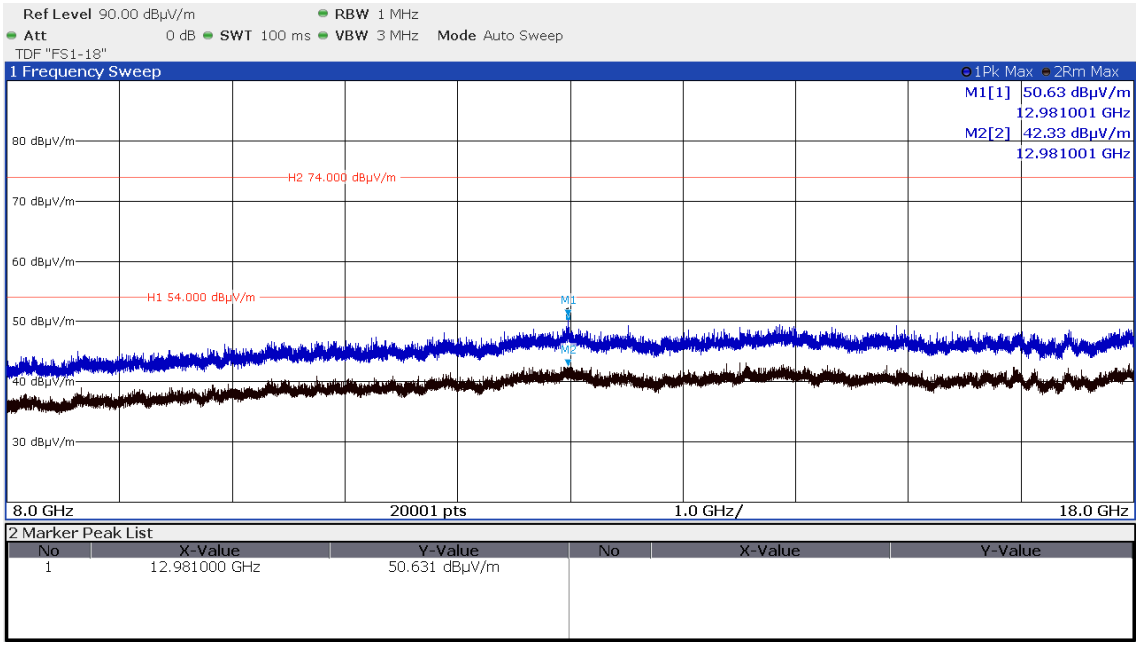


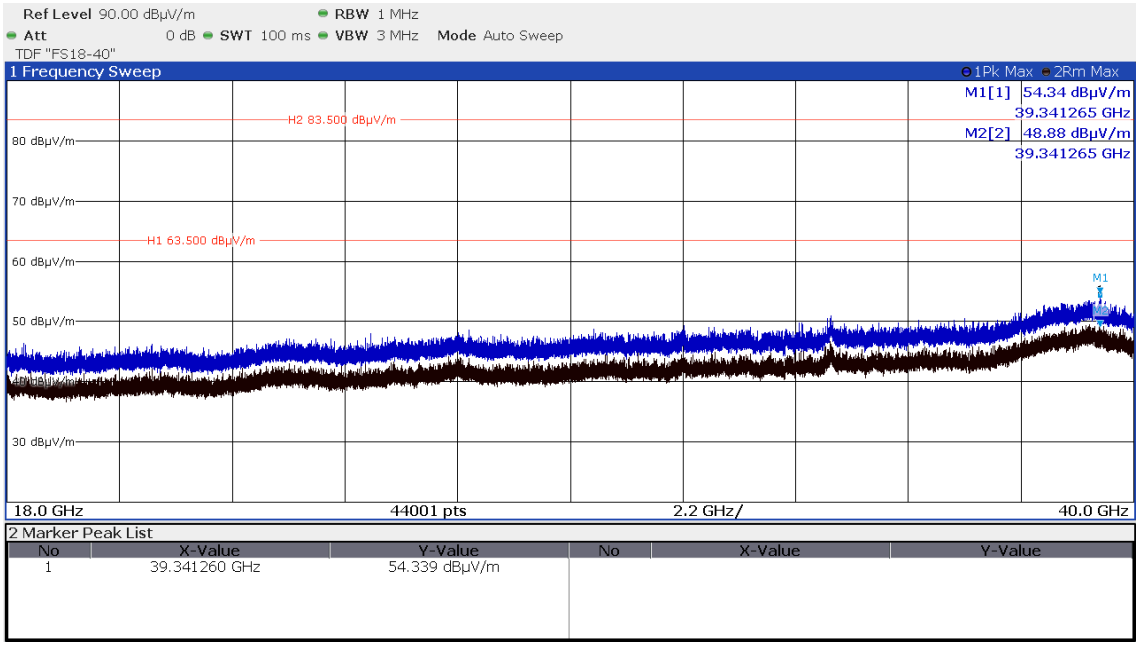
Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

WLAN Standard 802.11ac VT80, MSC7, P6, Path B - Ant B

CH42

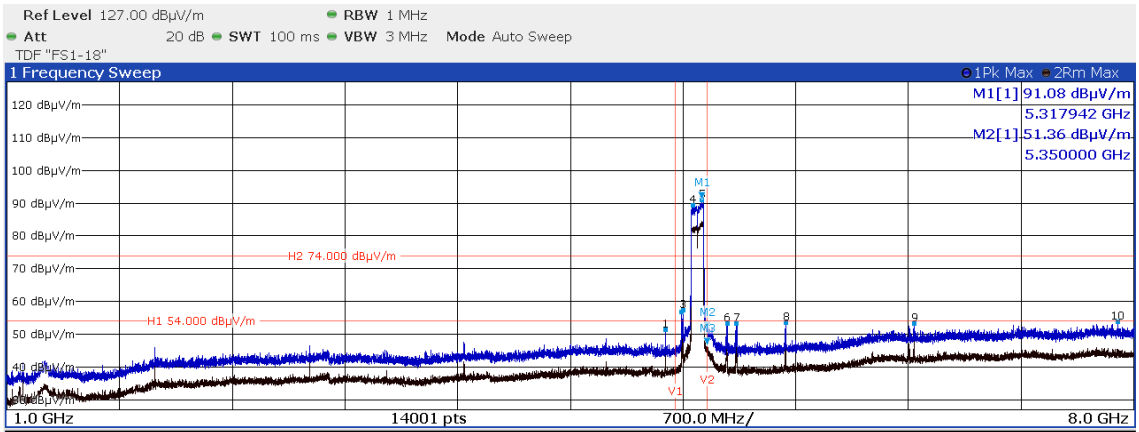






Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

CH56

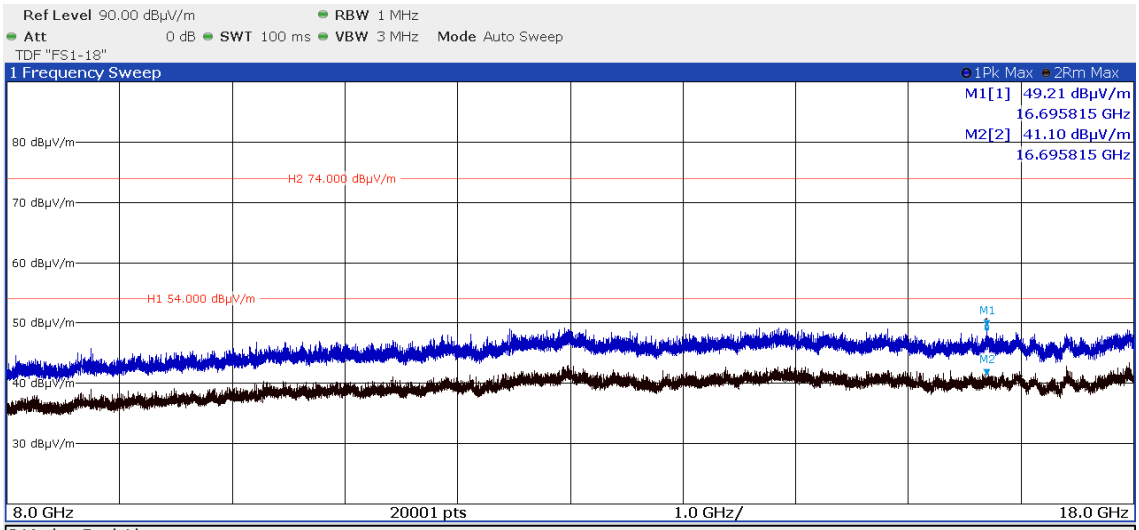


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	5.092960 GHz	51.402 dBµV/m	6	5.473430 GHz	53.263 dBµV/m
2	5.192450 GHz	56.750 dBµV/m	7	5.532930 GHz	53.306 dBµV/m
3	5.198950 GHz	57.290 dBµV/m	8	5.839400 GHz	53.579 dBµV/m
4	5.262450 GHz	89.217 dBµV/m	9	6.636850 GHz	53.222 dBµV/m
5	5.317940 GHz	91.077 dBµV/m	10	7.899760 GHz	53.737 dBµV/m

3 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**5.317942 GHz**	**91.08 dBµV/m**		
M2		1	**5.35 GHz**	**51.36 dBµV/m**		
M3		2	**5.35 GHz**	**46.52 dBµV/m**		



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	16.695820 GHz	49.207 dBµV/m			

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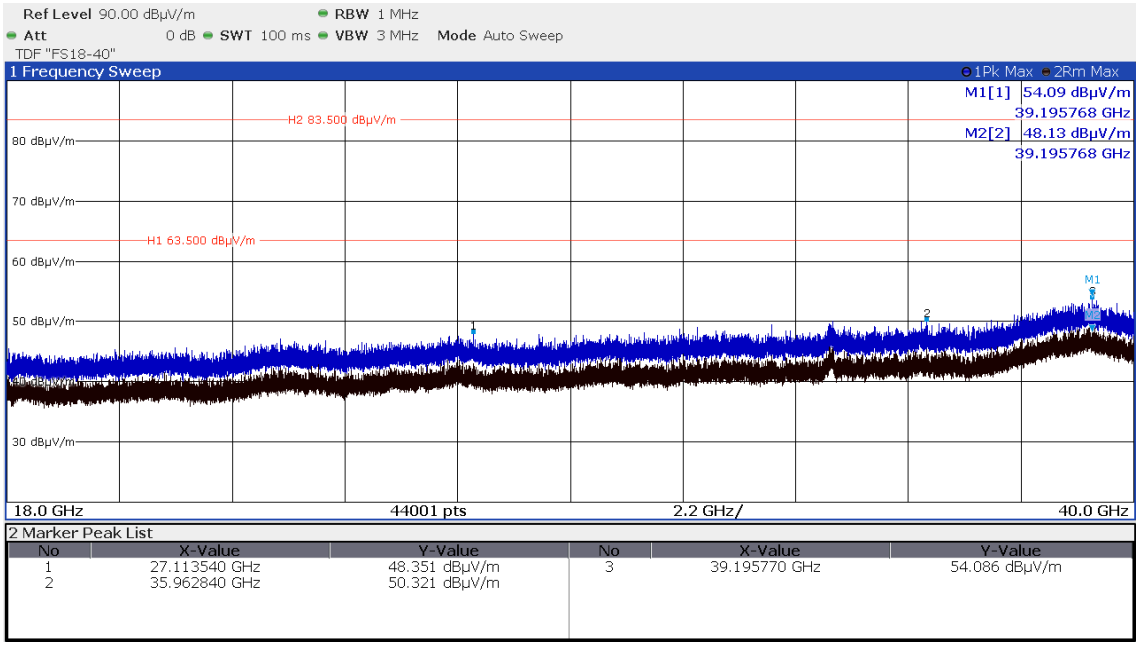
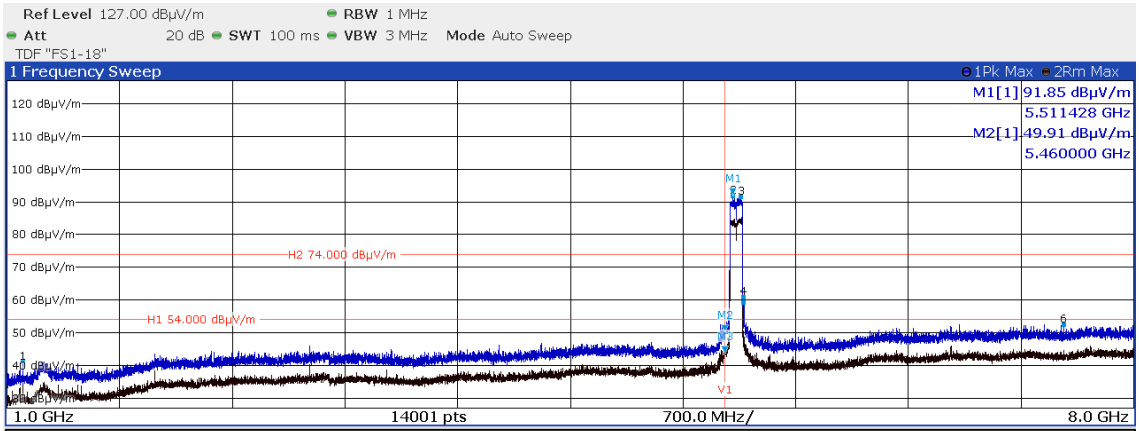


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	27.113540 GHz	48.351 dBµV/m	3	39.195770 GHz	54.086 dBµV/m
2	35.962840 GHz	50.321 dBµV/m			

Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

CH106

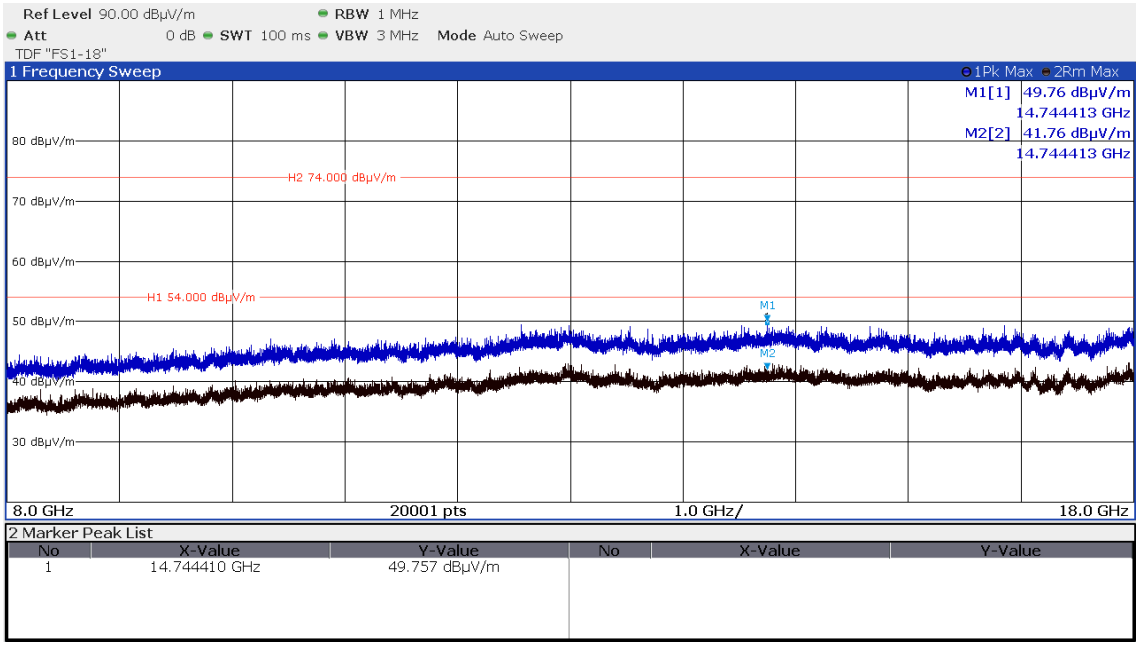


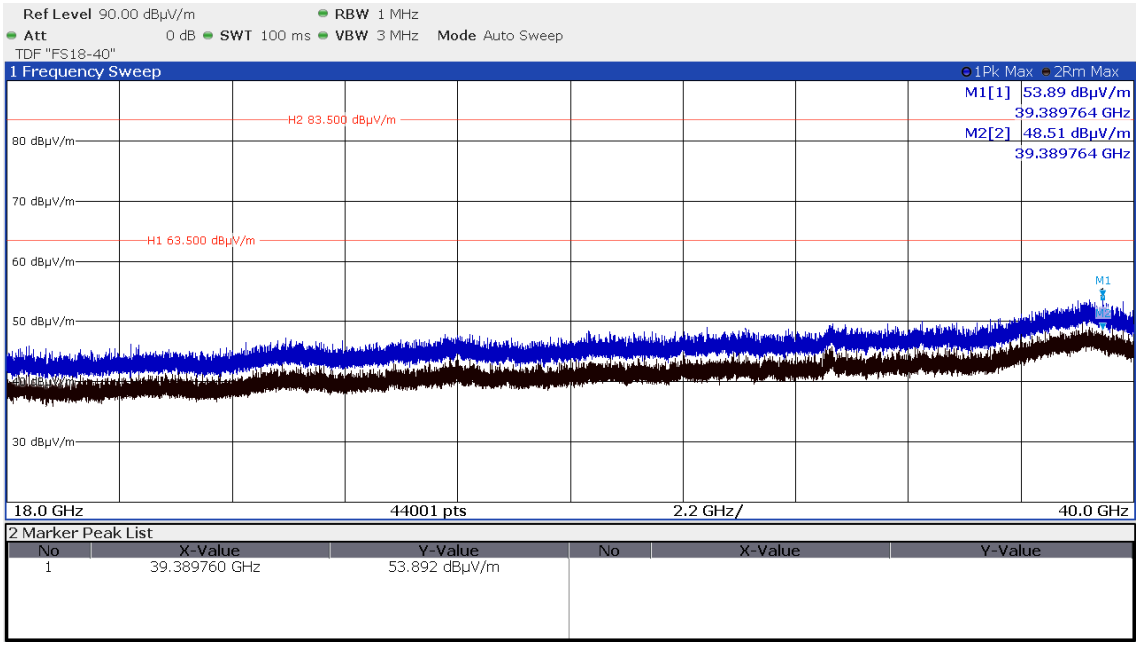
2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.097240 GHz	41.104 dBµV/m	4	5.573420 GHz	60.853 dBµV/m
2	5.511430 GHz	91.852 dBµV/m	5	5.576420 GHz	59.117 dBµV/m
3	5.560420 GHz	91.495 dBµV/m	6	7.564280 GHz	52.605 dBµV/m

3 Marker Table

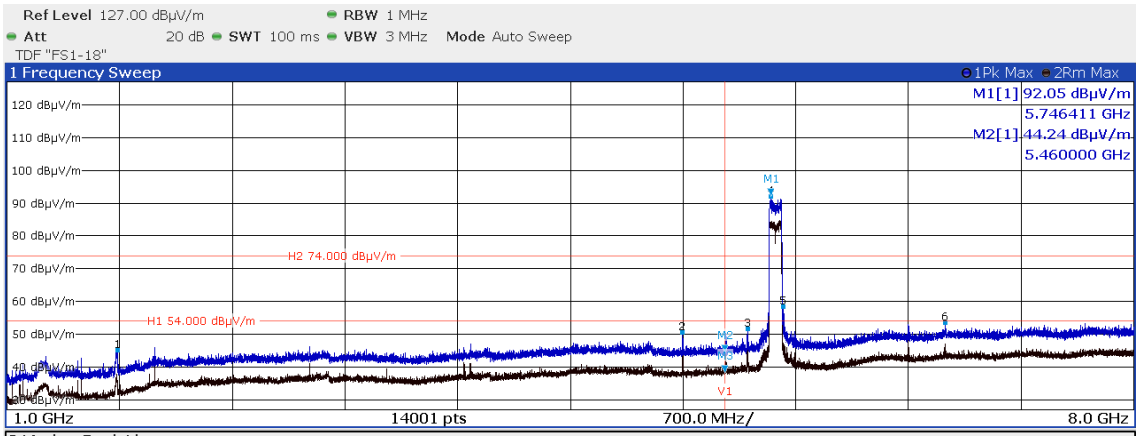
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**5.511428 GHz**	**91.85 dBµV/m**		
M2		1	**5.46 GHz**	**49.91 dBµV/m**		
M3		2	**5.46 GHz**	**43.45 dBµV/m**		





Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

CH155

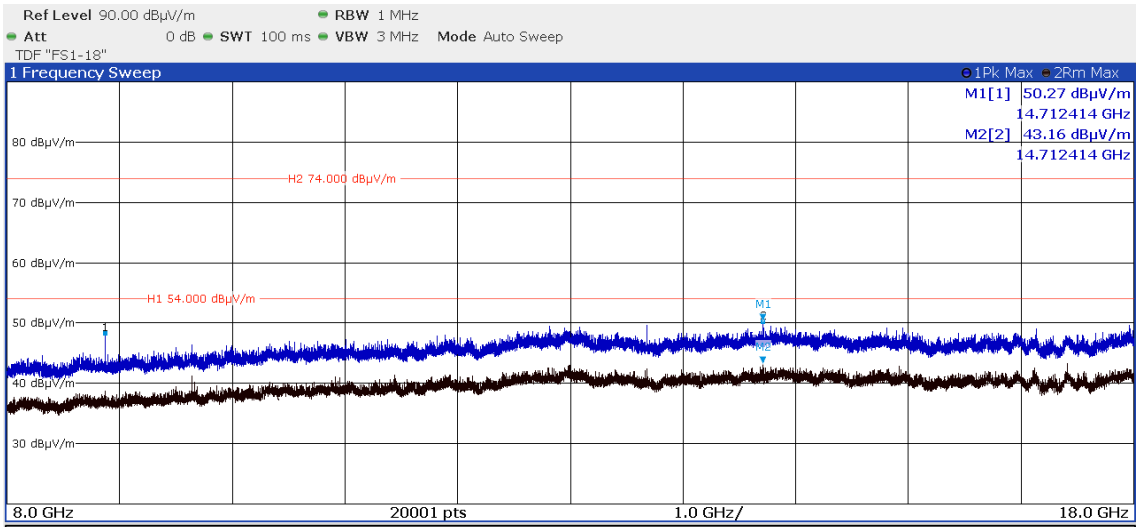


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.685700 GHz	45.074 dBµV/m	4	5.746410 GHz	92.055 dBµV/m
2	5.195450 GHz	50.599 dBµV/m	5	5.821910 GHz	58.544 dBµV/m
3	5.600420 GHz	51.712 dBµV/m	6	6.828330 GHz	53.437 dBµV/m

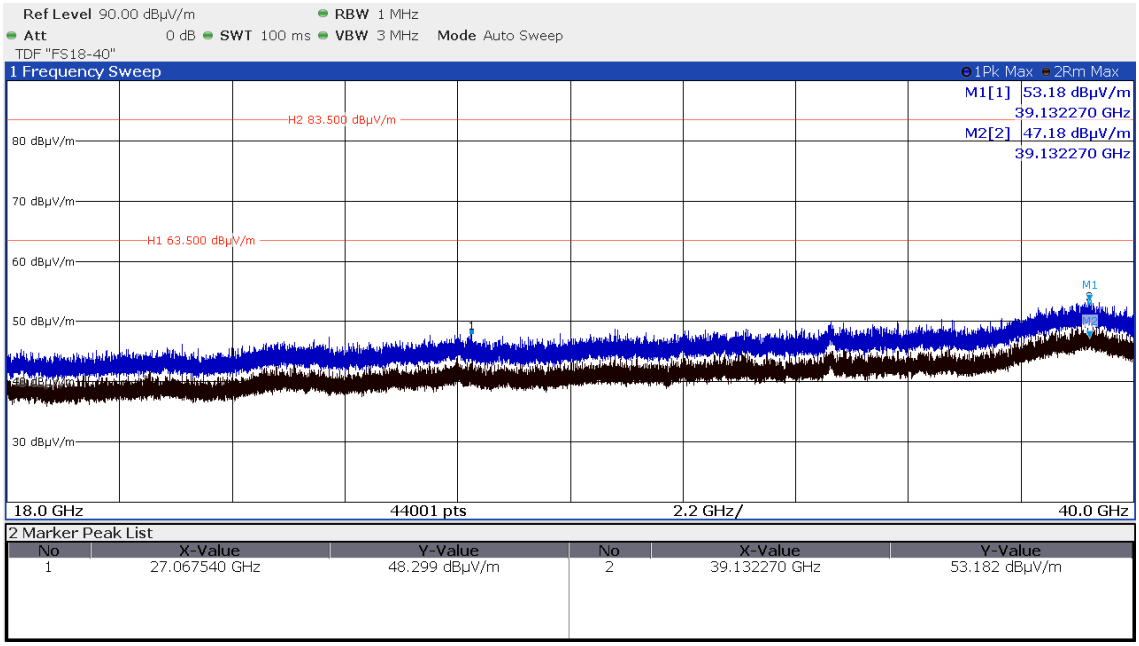
3 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**5.746411 GHz**	**92.05 dBµV/m**		
M2		1	**5.46 GHz**	**44.24 dBµV/m**		
M3		2	**5.46 GHz**	**38.13 dBµV/m**		



2 Marker Peak List

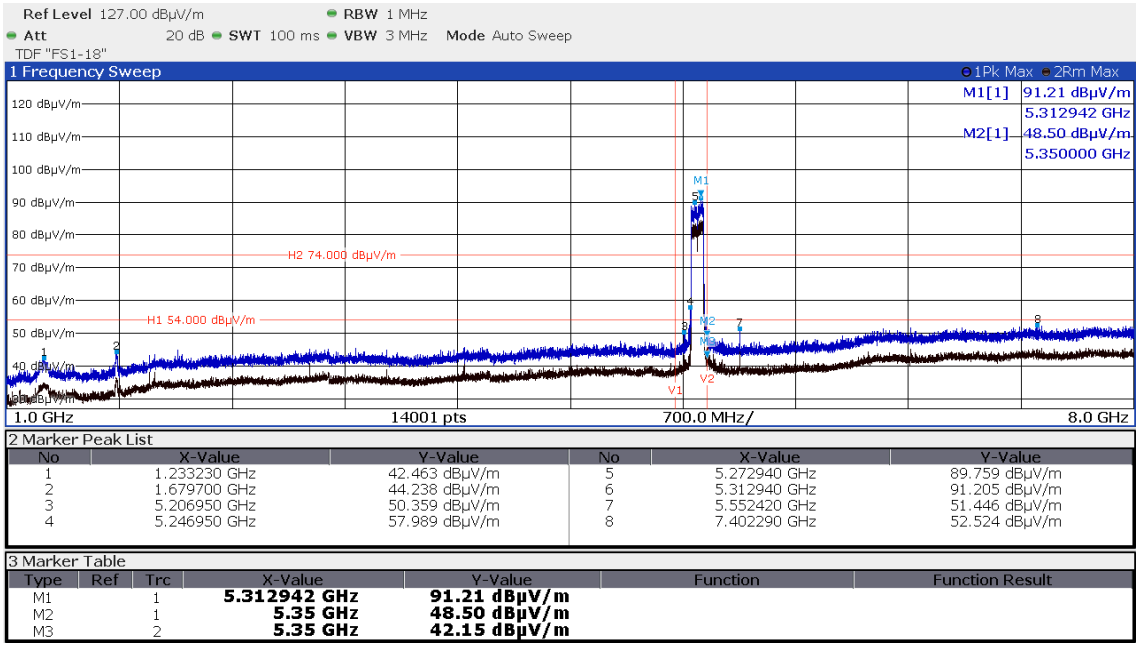
No	X-Value	Y-Value	No	X-Value	Y-Value
1	8.869210 GHz	48.277 dBµV/m	2	14.712410 GHz	50.265 dBµV/m



Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

WLAN Standard 802.11ac VT80, MSC7, P3, Path A + B

CH56



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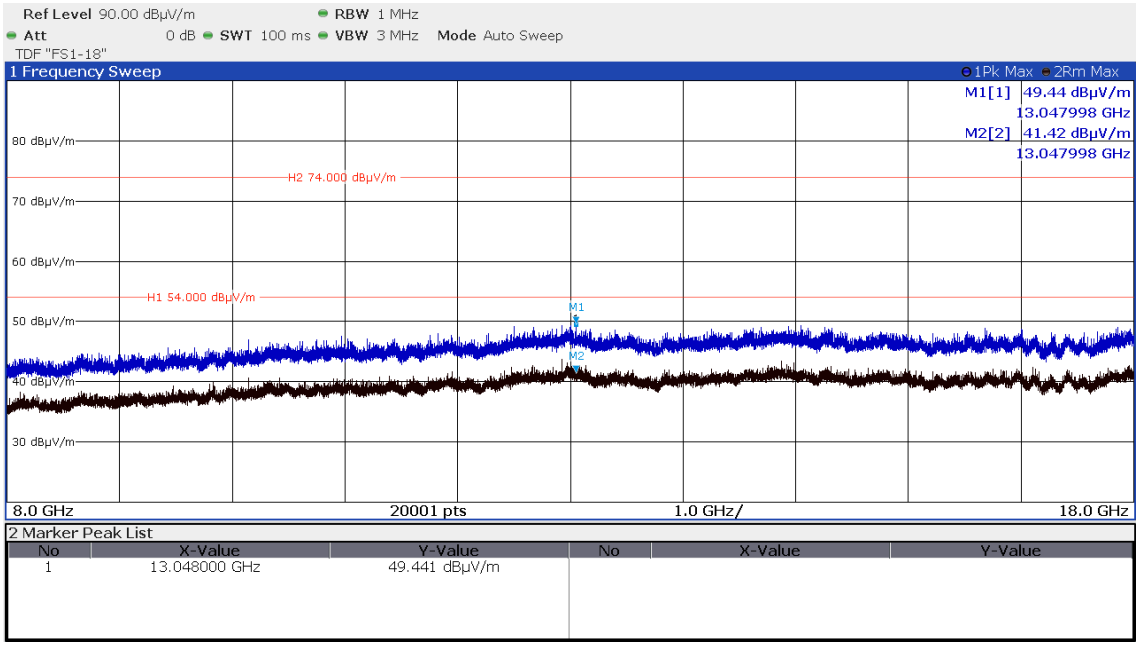

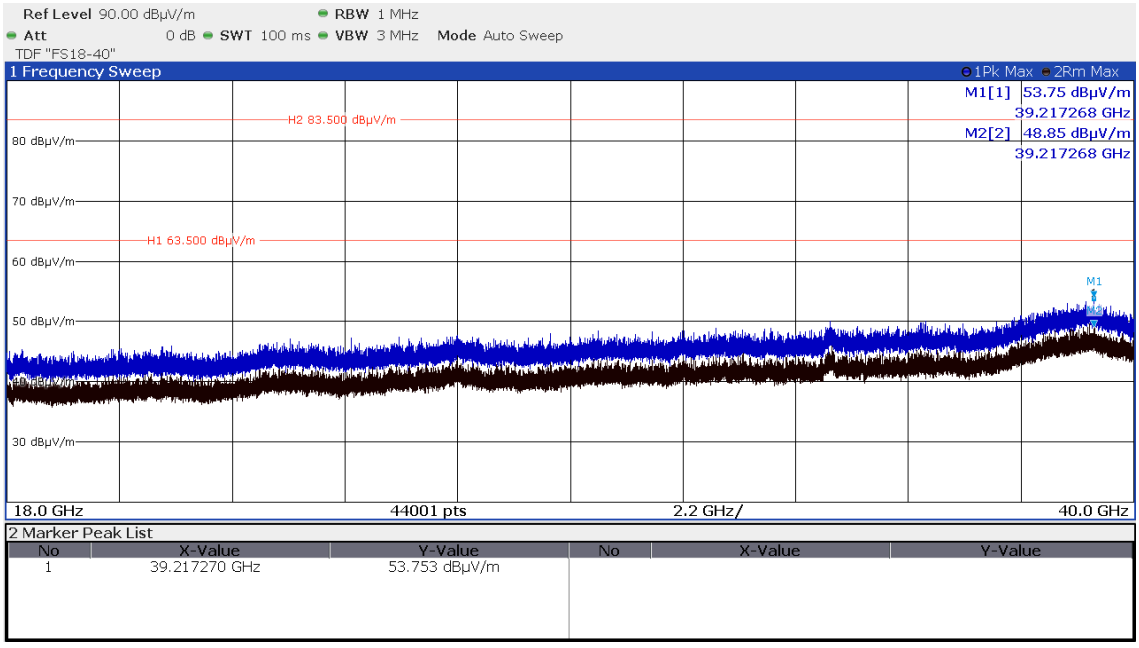

Note: The measurement distance for 18 – 40 GHz frequency range was changed to 1 m therefore the limit lines are adjusted and increased by 9.5 dB.

FCC ID: XO2-SPB228D **IC: 8713A-SPB228D**

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

Frequency	Field strength of spurious emissions		Measurement distance
(MHz)	(µV/m)	dB(µV/m)	(metres)
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

FCC Part 15C, Section 15.205, restricted bands of operation:

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

RSS-Gen, Table 6 – Restricted Frequency Bands

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	

FCC ID: XO2-SPB228D **IC: 8713A-SPB228D**

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

Operating Frequency range	Undesirable emission limit, EIRP
(MHz)	(dBm/MHz)
5150 - 5250	-27.0

The requirements are **FULFILLED.**

Remarks: The measurement was performed up to 40 GHz.

Only the worst case of the plots are listed.

5.5 Antenna application

5.5.1 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.

The EUT use the listed antennas for MIMO technique. The equipment connector is subject to the end product.

5.5.2 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.

5.5.3 Defacto EIRP-Limit:

For the output power reduction of the used antennas see the following table. The limit is calculated as using following formula, Pout = 30 – (Gx – 6);

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

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 3.19.1.24	01-02/68-13-001				
	ESCI	02-02/03-15-001	24/06/2021	24/06/2020		
	ESH 2 - Z 5	02-02/20-05-004	31/10/2021	31/10/2019	05/05/2021	05/11/2020
	N-4000-BNC	02-02/50-05-138				
	N-1500-N	02-02/50-05-140				
	ESH 3 - Z 2	02-02/50-05-155	13/11/2022	13/11/2019	10/05/2021	10/11/2020
	6430	02-02/50-13-014				
CPR 3	FSW43	02-02/11-15-001	02/04/2021	02/04/2020		
	AMF-6D-01002000-22-10P	02-02/17-15-004				
	3117	02-02/24-05-009	18/06/2021	18/06/2020		
	18N-20	02-02/50-17-003				
	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				
	BAT-EMC 3.19.1.24	02-02/68-13-001				
SER 2	ESVS 30	02-02/03-05-006	15/07/2021	15/07/2020		
	VULB 9168	02-02/24-05-005	18/12/2021	18/12/2020		
	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				
SER 3	FSW43	02-02/11-15-001	02/04/2021	02/04/2020		
	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	18/06/2021	18/06/2020		
	BBHA 9170	02-02/24-05-013	19/05/2023	19/05/2020	14/01/2021	14/01/2020
	18N-20	02-02/50-17-003				
	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				
	KMS116-GL140SE-KMS116-	02-02/50-20-026				
	BAT-EMC 3.19.1.24	02-02/68-13-001				
MB	FSW43	02-02/11-21-001	08/04/2022	08/04/2021		
	3117	02-02/24-20-007	09/11/2022	09/11/2021		

Note: A4, CPR3, SER2, SER3 performed between 10/12/2020 and 26/01/2021, MB performed on 18/01/2022.