



FCC LISTED,
REGISTRATION NUMBER:
720267

ISED LISTED
REGISTRATION NUMBER
4621A-4

Test report No:
NIE: 56848RRF.011

Partial test report

USA FCC Part 15.247,15.407, 15.209

CANADA RSS-247, RSS-Gen

Radio Frequency Devices. Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz.

Unlicensed National Information Infrastructure (U-NII) Devices. General technical requirements.

Radiated emission limits; general requirements.

Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices.

General Requirements and Information for the Certification of Radio Apparatus.

Identification of item tested	Automotive Infotainment System.
Trademark	Mercedes-Benz.
Model and /or type reference	NTG6N ENTRY/MID.
Other identification of the product	HW version: D4. SW version: E412.007. FCC ID: T8GNTG6NEM. IC: 6434A-NTG6NEM. S/N: HBM245JB004716.
Features	FM, AM, DAB, USB, Bluetooth, WLAN, GPS.
Applicant	HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH BECKER-GOERING-STR. 16; 76307 KARLSBAD GERMANY
Test method requested, standard	USA FCC Part 15.407 10-1-18 Edition: Unlicensed National Information Infrastructure (U-NII) Devices. General technical requirements. USA FCC Part 15.247 10-1-18 Edition: Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 10-1-18 Edition: Radiated emission limits; general requirements. CANADA RSS-247 Issue 2 (February 2017). CANADA RSS-Gen Issue 5 (April 2018). -Transmitter out of band radiated emissions with simultaneous transmissions. Guidance for Performing Compliance Measurements on Digital Transmission System, Frequency Hopping Spread

	Spectrum System, and Hybrid Systems Devices Operating Under Section 15.247 of the FCC Rules. 558074 D01 Meas Guidance v05 dated August 24, 2018. Guidance for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices 789033 D02 General U-NII Test Procedures New Rules v02r01 dated Dec 14, 2017. ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	A. Llamas RF Lab. Manager
Date of issue	2019-06-05
Report template No	FDT08_21

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Competences and guarantees

DEKRA Testing and Certification is a testing laboratory accredited by the National Accreditation Body (ENAC - Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

DEKRA Testing and Certification is a laboratory with a measurement facility in compliance with the requirements of Section 2.948 of the FCC rules and has been added to the list of facilities whose measurements data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Registration Number: 720267.

DEKRA Testing and Certification is a laboratory with a measurement site in compliance with the requirements of RSS 212, Issue 1 (Provisional) and has been added to the list of filed sites of the Canadian Certification and Engineering Bureau. Reference File Number: ISED 4621A-4.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification has a calibration and maintenance program for its measurement equipment.

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

DEKRA Testing and Certification is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

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General conditions

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

Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

Data provided by the client

The sample consists of an automotive head unit to be installed in cars with the following features: FM, AM, DAB, USB, Bluetooth, WLAN and GPS.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples undergoing test have been selected by: The client.

- Sample S/01 is composed of the following elements:

Control N°	Description	Model	Serial N°	Reception
56848G/079	Automotive Infotainment System	NTG6N ENTRY/MID	HBM246JB000724	2019/01/11
54022/058	CAN Box	--	H0034761	2017/09/26
56848G/088	Ethernet Harness	--	--	2019/01/11
56848G/117	Harness	--	--	2019/01/11
56848G/020	Dual BT/WLAN antenna	---	---	2019/01/10
56848G/103	BT/WLAN antenna	---	---	2019/01/11

Sample S/01 has undergone the following test(s): All RADIATED tests indicated in Appendix A.

Test sample description

Ports..... :	Port name and description	Cable					
		Specified length [m]	Attached during test	Shielded			
	Car Connector A	>3m ^(x1)	☒	☐			
	Car Connector B	>3m ^(x1)	☒	☐			
	Display Connector CID/PIP / RVC	>3m ^(x1)	☒	☒			
	USB Connector	<3m ^(x2)	☒	☒			
	Eth Connector	>3m ^(x1)	☒	☒			
	BT/WLAN-Antenna	>3m ^(x1)	☒	☒			
	FM/AM, TV/SDARS Ant	>3m ^(x1)	☒	☒			
GPS Antenna	>3m ^(x1)	☒	☒				
Supplementary information to the ports..... :	For EMC-Testing all cables should be connected to the connectors						
Rated power supply	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	☐	AC:	☐	☐	☐	☐	☐
	☐	AC:	☐	☐	☐	☐	☐
	☒	DC: 12V Car battery / attenuator (9,5-15,5V normal operation)					
	☐	DC:					
Rated Power	9,5-15,5V normal operation						
Clock frequencies	see schematics						
Other parameters..... :	FCC ID: T8GNTG6NEM IC: 6434A-NTG6NEM						
Software version	E412.007						
Hardware version..... :	D4 / Serial Product						
Dimensions in cm (L x W x D)	182 x 78 x 160 mm						
Mounting position..... :	☐	Table top equipment					
	☐	Wall/Ceiling mounted equipment					
	☐	Floor standing equipment					
	☐	Hand-held equipment					
	☒	Other: automotive headunit					

Modules/parts	Module/parts of test item	Type	Manufacturer
	Not Applicable		
Accessories (not part of the test item)	Description	Type	Manufacturer
	Display	A247 905 69	Daimler OEM Displ.
	CAN-Box	-	HBAS
	Cable harness	-	HBAS
	BT/WLAN-Antenna	A247 905 83	Hirschmann
Documents as provided by the applicant.....	Description	File name	Issue date
	Technical Description		

Identification of the client

HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH
BECKER-GOERING-STR. 16; 76307 KARLSBAD GERMANY

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2019-01-22
Date (finish)	2019-01-23

Document history

Report number	Date	Description
56848RRF.011	2019-06-05	First release

Environmental conditions

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

Temperature	Min. = 15 °C
	Max. = 35 °C
Relative humidity	Min. = 20 %
	Max. = 75 %

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 °C
	Max. = 35 °C
Relative humidity	Min. = 20 %
	Max. = 75 %

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

Temperature	Min. = 15 °C
	Max. = 35 °C
Relative humidity	Min. = 20 %
	Max. = 35 %

Remarks and comments

The tests have been performed by the technical personnel: Miguel Ángel Torres, Juan Carlos Fuentes, Ignacio Cabra.

Used instrumentation:

Radiated Measurements:

		Last Calibration	Due Calibration
1.	Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N.A.	N.A.
2.	EMI Test Receiver 7 GHz ROHDE AND SCHWARZ ESR7	2018/10	2020/10
3.	RF Pre-amplifier, 38 dB, 30 MHz-6 GHz BONN ELEKTRONIK BLNA 0360-01N	2018/07	2019/07
4.	Biconical/Log Antenna 30MHz - 6GHz ETS LINDGREN 3142E	2017/09	2020/09
5.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2017/07	2019/07
6.	RF Pre-amplifier G>30dB, 1-18GHz BONN ELEKTRONIK BLMA 0118-3A	2019/04	2020/04
7.	RF pre-amplifier 18-40 GHz NARDA JS44-18004000-33-8P	2019/02	2020/02
8.	Broadband Horn antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2018/01	2021/01
9.	Broadband Horn antenna 18 - 40 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9170	2018/07	2021/07
10.	DC Power Supply Rohde and Schwarz NGPE 40/40	2018/02	2021/02

Testing verdicts

Not applicable:	N/A
Pass:	P
Fail:	F
Not measured:	N/M

Summary

FCC PART 15 PARAGRAPH / RSS-247		
Requirement – Test case	Verdict	Remark
FCC 15.209 (a), FCC 15.247 Subclause (d), FCC 15.407 (b) / RSS-Gen 8.9, RSS-247 5.5, RSS-247 6.2.1.2, 6.2.2.2, 6.2.3.2 & 6.2.4.2 Emission limitations radiated (Transmitter)	P	
<u>Supplementary information and remarks:</u> (1) The Equipment Under Test supports Simultaneous-Dual-Band (SDB) and Simultaneous-In-Band (CoTx) transmission.		

Appendix A: Test results.

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TEST CONDITIONS13

FCC 15.209 (a), FCC 15.247 Subclause (d), FCC 15.407 (b) / RSS-Gen 8.9, RSS-247 5.5, RSS-247 6.2.1.2,
6.2.2.2, 6.2.3.2 & 6.2.4.2 Emission limitations radiated (Transmitter)18

TEST CONDITIONS

POWER SUPPLY (V):

V nominal: 12.6 Vdc.
Type of Power Supply: External power supply (Battery).

ANTENNA:

Type of Antenna: External.

Maximum Declared Gain for Bluetooth EDR:

Gain: +0.7 dBi

Maximum Declared Gain for 2.4 GHz WLAN:

WLAN0 – CORE 1 Antenna Port 2 Gain : +2.2 dBi

Maximum Declared Gain for 5 GHz WLAN:

WLAN0 – CORE 0 Antenna Port 3 Gain : +0.9 dBi

RADIOS AND CHANNELS TESTED:

	Bluetooth EDR (FHSS)	
Mode:	8DPSK	
Channel Spacing:	1 MHz	
Frequency Range:	2400 MHz to 2483.5 MHz	
Transmit Channels:	Channel	Channel Frequency (MHz)
	39	2441

	Wi-Fi 2.4 GHz (IEEE 802.11 bgn20 1x1) (Digital Transmission System, DTS)	
Mode:	802.11b (WLAN0 CORE1)	
Channel Spacing:	20 MHz	
Frequency Range:	2412 MHz to 2472 MHz	
Transmit Channels:	Channel	Channel Frequency (MHz)
	11	2462

	WLAN (IEEE 802.11 n) / U-NII	
Mode:	802.11n HT20: MCS0 (WLAN0 CORE0)	
Frequency Range:	5150 MHz to 5250 MHz	
Channel Spacing:	20 MHz	
Transmit Channels:	Channel	Channel Frequency (MHz)
	Middle: 40	5200
Frequency Range:	5725 MHz to 5850 MHz	
Channel Spacing:	20 MHz	
Transmit Channels:	Channel	Channel Frequency (MHz)
	Highest: 165	5825

The test set-up was made in accordance to the general provisions of FCC DTS Measurement 558074 D01 DTS Meas Guidance v05 dated 24/08/2018 and FCC Unlicensed National Information Infrastructure (U-NII) Devices 789033 D02 General U-NII Test Procedures New Rules v02r01 dated Dec 14, 2017.

The EUT was tested in the following operating mode:

- Continuous transmission with a modulated carrier at maximum power in all required channels selecting the supported data rates/modulations types.

During transmitter test the EUT was being controlled by the SW tool to operate in a continuous transmit mode on the test channel as required and in each of the different modulation modes.

Simultaneous transmission modes selected:

The following configuration was selected based on preliminary testing that identified those corresponding to the worst case:

* Co-Location of Wi-Fi 5 GHz, Wi-Fi 2.4 GHz and Bluetooth EDR, with the EUT configured to simultaneously transmit three signals at maximum output power: Wi-Fi 5GHz in 802.11n HT20 (WLAN0 CORE0), Wi-Fi 2.4GHz in 802.11b (WLAN0 CORE1) and the Bluetooth EDR in 8DPSK.

RADIATED MEASUREMENTS

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m. The EUT was placed at a height of 80 cm above the reference ground plane in the center of the chamber turntable to perform the measurements below 1GHz and The EUT was placed at a height of 1.5 meters above the test chamber floor in the center of the chamber turntable to perform the measurements above 1GHz. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

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

The final measured value, for the given emission, in the tables below incorporates the calibrated antenna factor, preamplifier gain (if used) and cable losses.

Transmission modes selected with each radio:

* Bluetooth Basic Rate: Transmitter radiated spurious emissions tests were performed with the EUT transmitting in Basic Rate mode because its power is higher than EDR mode.

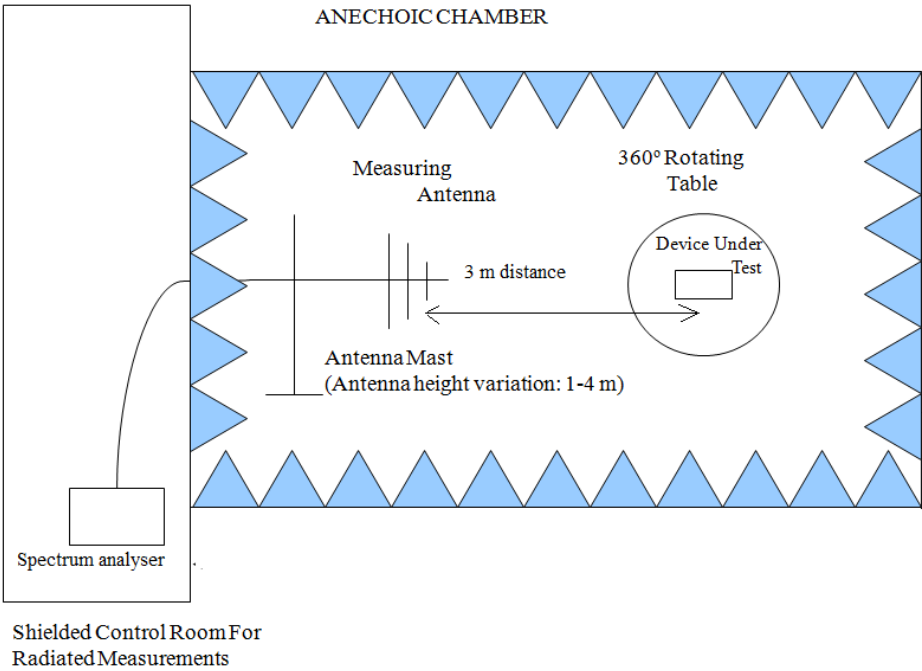
* 2.4 GHz WLAN: Transmitter radiated spurious emissions tests were performed with the EUT transmitting in 802.11b / 1 Mbps/ SISO mode configuration as that mode was found to transmit higher PSD than all the other 2.4 GHz WLAN modes.

* 5 GHz WLAN: Transmitter radiated spurious emissions tests were performed with the EUT transmitting in 802.11n / HT20 / MCS0 / SISO mode configuration as that mode was found to transmit higher PSD than than all the other 5 GHz WLAN modes.

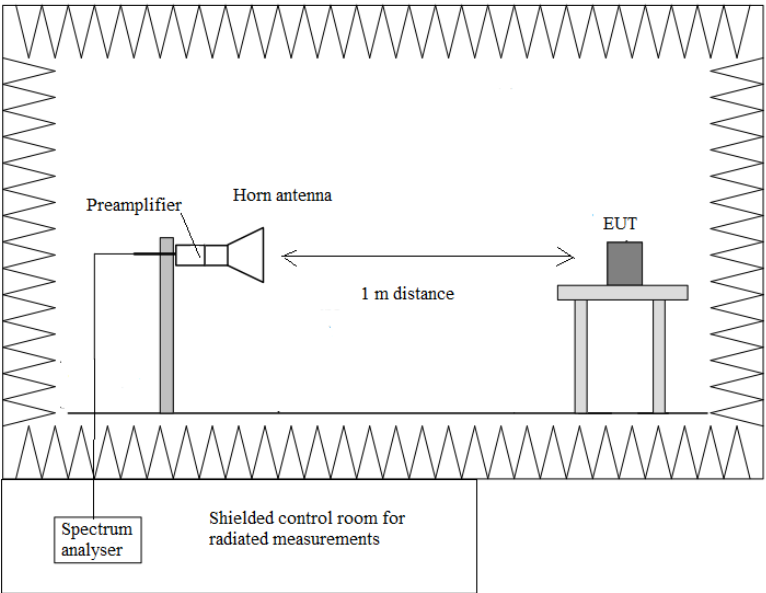
Simultaneous transmission modes selected:

* 2.4 GHz WLAN, 5 GHz WLAN and Bluetooth Basic Rate co-location, with the EUT configured to simultaneously transmit three signals at maximum output power, 2.4GHz WLAN (WLAN0 CORE1) in 802.11b / 1 Mbps / SISO, 5GHz WLAN (WLAN 0 CORE 0) in 802.11n / HT20 / MCS0 / SISO and the Bluetooth Basic Rate with DH5.

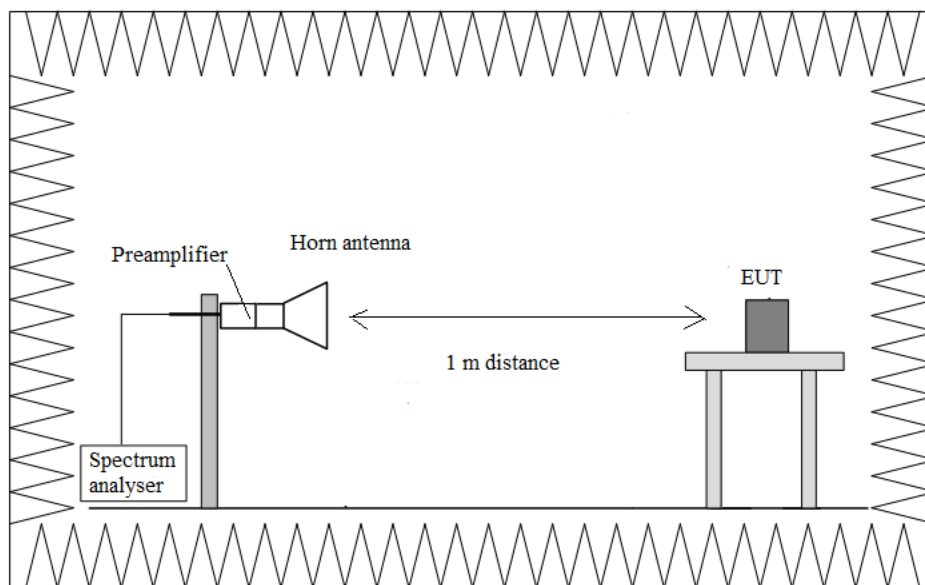
Radiated measurements setup $f < 1\text{ GHz}$



Radiated measurements setup $f > 1\text{ GHz}$ up to 18 GHz.



Radiated measurements setup $f > 18$ GHz up to 40 GHz.



FCC 15.209 (a), FCC 15.247 Subclause (d), FCC 15.407 (b) / RSS-Gen 8.9, RSS-247 5.5, RSS-247 6.2.1.2, 6.2.2.2, 6.2.3.2 & 6.2.4.2 Emission limitations radiated (Transmitter)

SPECIFICATION:

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

Frequency Range (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 25000	500	54	3

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

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

RSS-247. Attenuation below the general field strength limits specified in RSS-Gen is not required.

RESULTS:

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

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

All tests were performed in a semi-anechoic chamber at a distance of 1m for the frequency range 1 GHz-40 GHz and a distance of 3m for frequency range 30MHz-1GHz.

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

Test performed on the following worst case in all relevant tests channels.

Simultaneous transmission modes selected:

- Mode: 802.11b – 20MHz – SISO – WLAN0 CORE 1 (2462MHz), 802.11n HT20 – 20MHz – SISO – WLAN0 CORE 0 (5200MHz) and Bluetooth Basic Rate with DH5 (2441).
- Mode: 802.11b – 20MHz – SISO – WLAN0 CORE 1 (2462MHz), 802.11n HT20 – 20MHz – SISO – WLAN0 CORE 0 (5825MHz) and Bluetooth Basic Rate with DH5 (2441).

Mode: 802.11b – 20MHz – SISO – WLAN0 CORE 1 (2462MHz), 802.11n HT20 – 20MHz – SISO – WLAN0 CORE 0 (5200MHz) and Bluetooth Basic Rate with DH5 (2441).

Frequency range 30 MHz - 1 GHz:

Note: The spurious emissions below 1 GHz do not depend on either the operating channel or the modulation mode selected in the EUT.

Spurious levels operating (radiated) closest to limit.

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Measurement Uncertainty (dB)
38.229	Vertical	Quasi-Peak	25.1	40	14.9	± 3.88
493.353	Horizontal	Quasi-Peak	29.6	46	16.4	± 3.88
688.161	Vertical	Quasi-Peak	30.4	46	15.6	± 3.88
786.455	Horizontal	Quasi-Peak	28.5	46	17.5	± 3.88
860.175	Vertical	Quasi-Peak	29.1	46	16.9	± 3.88
884.748	Vertical	Quasi-Peak	38.2	46	7.8	± 3.88

Frequency range 1 GHz-40 GHz

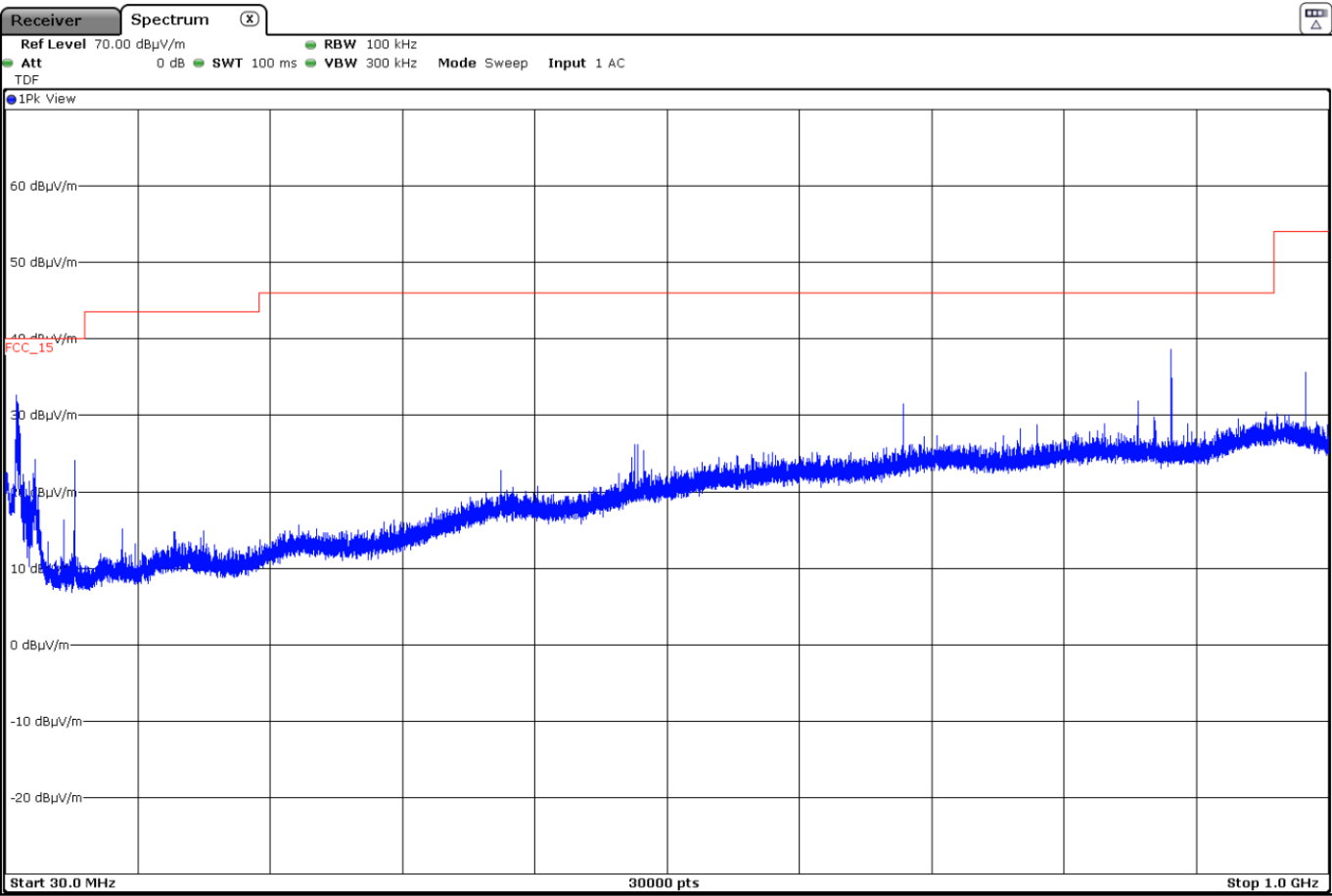
The results in the next tables show the maximum measured levels in the 1-40 GHz range.

Spurious signals with peak levels above the average limit (54 dBμV/m at 3 m) are measured with average detector for checking compliance with the average limit.

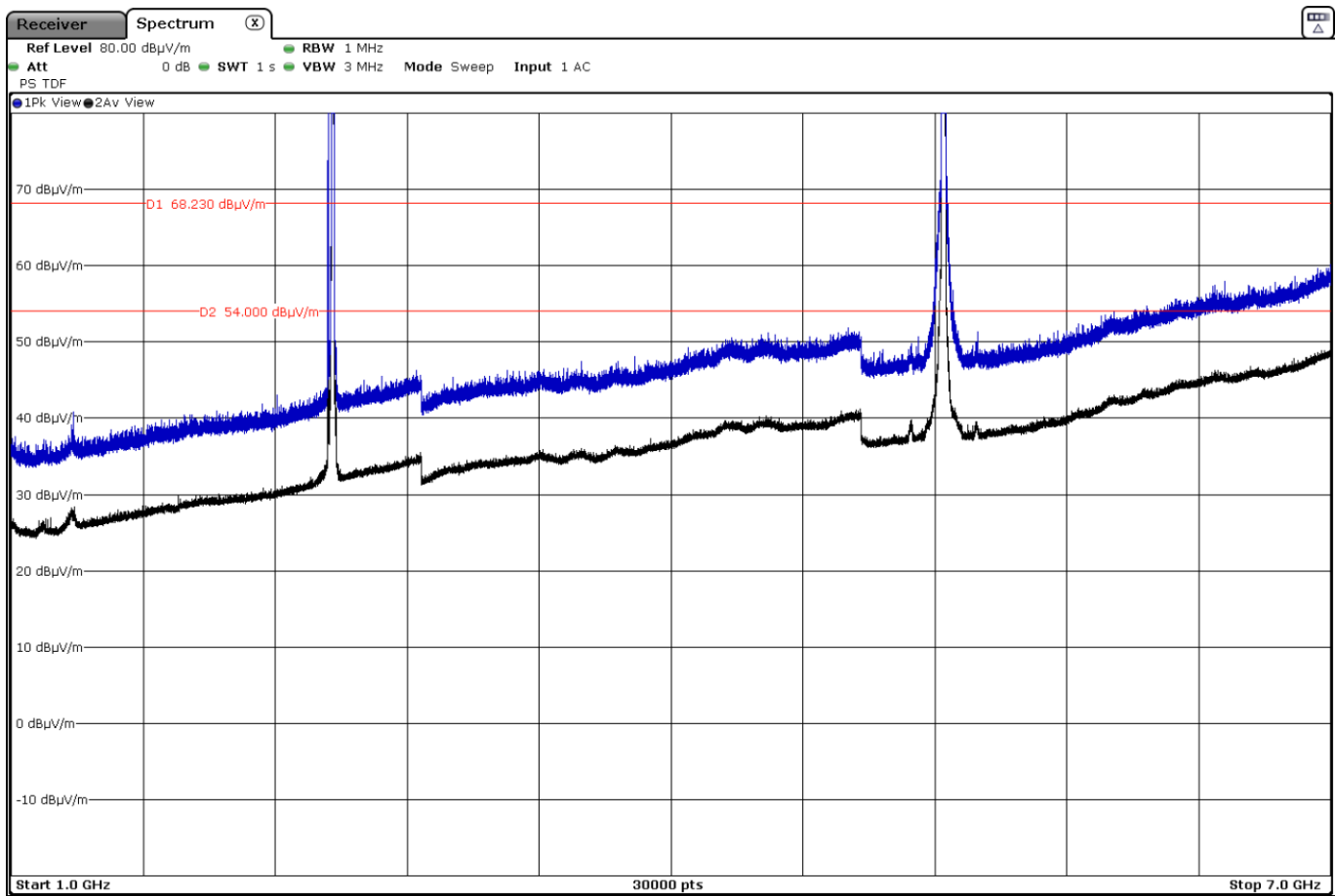
Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Measurement Uncertainty (dB)
10.48217	Vertical	Peak	59.47	74	14.53	± 3.70
		Average	49.69	54	4.86	± 3.70

Verdict: PASS

FREQUENCY RANGE 30 MHz-1000 MHz.

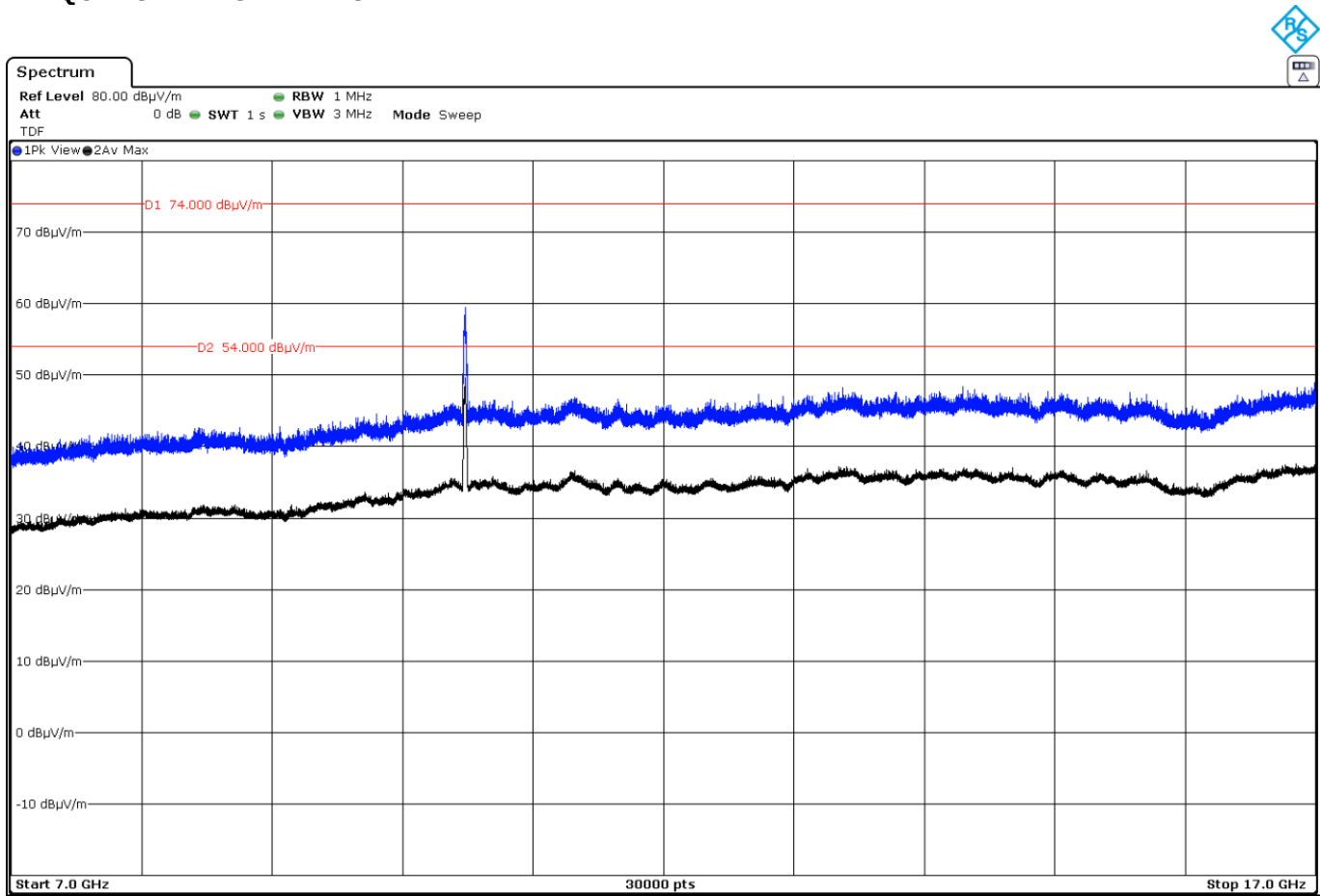


FREQUENCY RANGE 1 - 7 GHz.

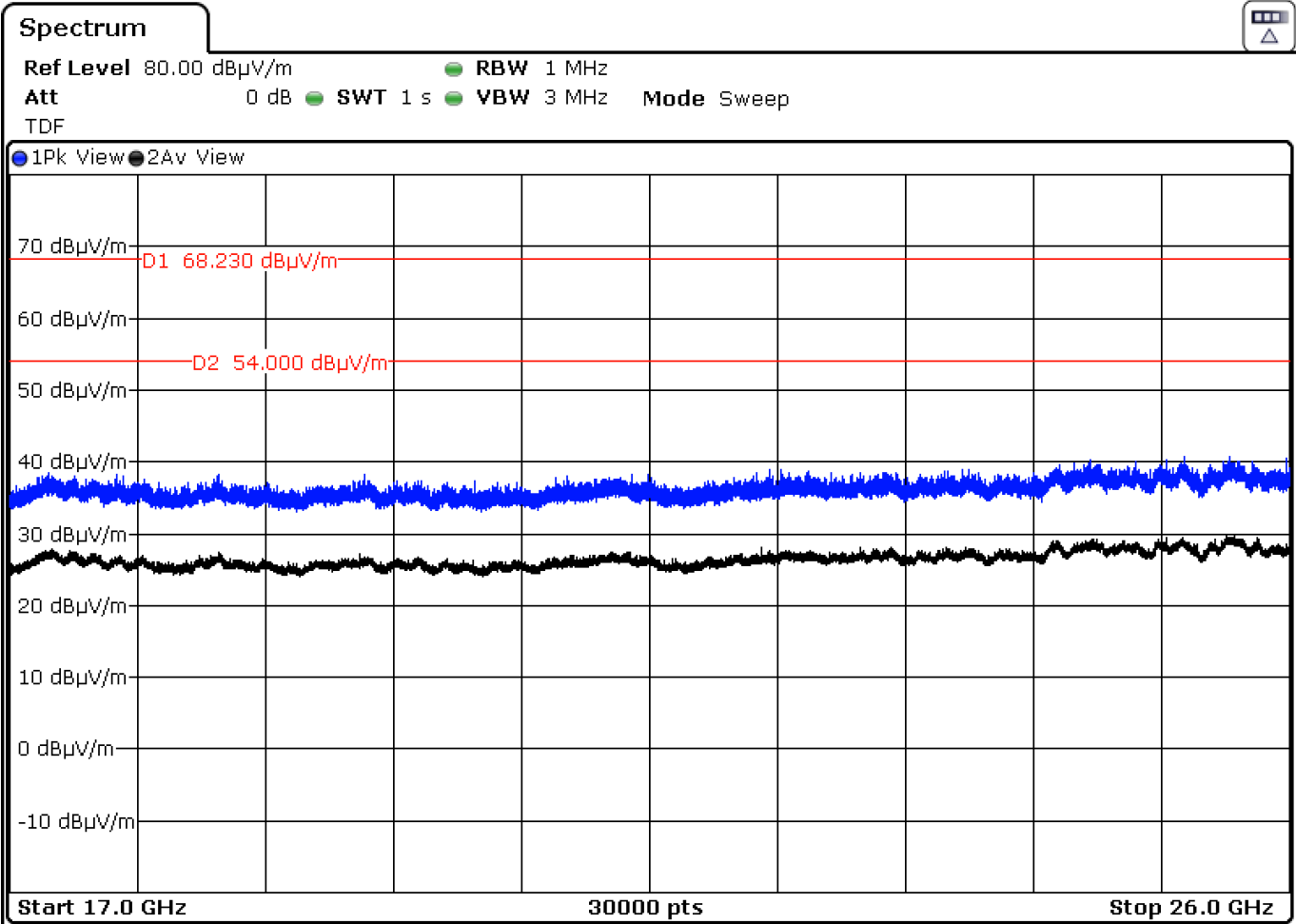


Note: The peaks shown in the plot above the limit are the carrier frequencies.

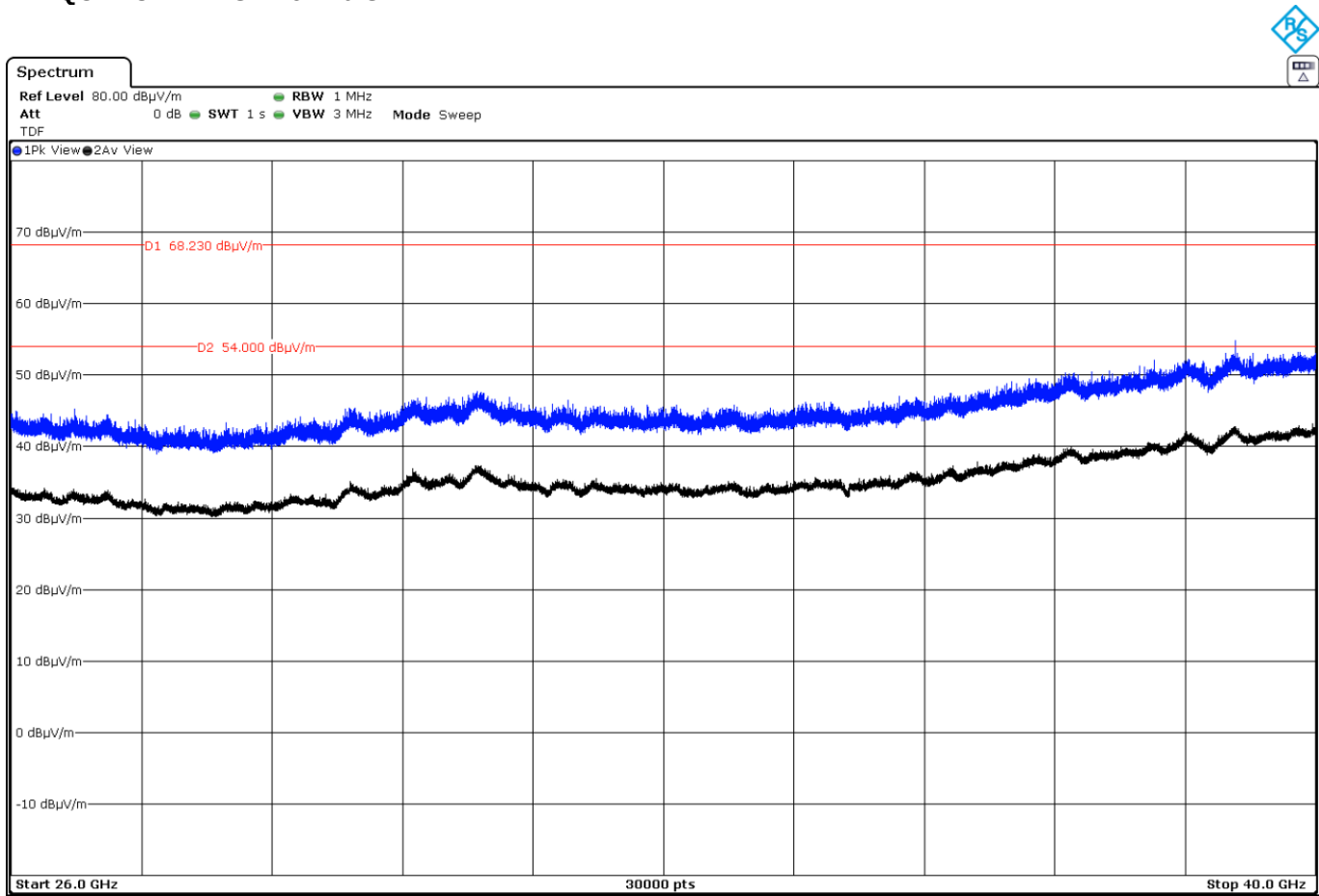
FREQUENCY RANGE 7 - 17 GHz.



FREQUENCY RANGE 17 - 26 GHz.



FREQUENCY RANGE 26 - 40 GHz.



Mode: 802.11b – 20MHz – SISO – WLAN0 CORE 1 (2462MHz), 802.11n HT20 – 20MHz – SISO – WLAN0 CORE 0 (5825MHz) and Bluetooth Basic Rate with DH5 (2441).

Frequency range 30 MHz - 1 GHz:

The spurious frequencies do not depend neither on the operating channel nor the modulation.

Spurious frequencies at less than 20 dB below the limit:

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Measurement Uncertainty (dB)
39.458	Vertical	Quasi-Peak	22.7	40	17.3	± 3.88
688.129	Vertical	Quasi-Peak	27	46	19	± 3.88
786.455	Horizontal	Quasi-Peak	26.5	46	19.5	± 3.88
884.78	Vertical	Quasi-Peak	32.8	46	13.2	± 3.88

Frequency range 1 GHz-40 GHz

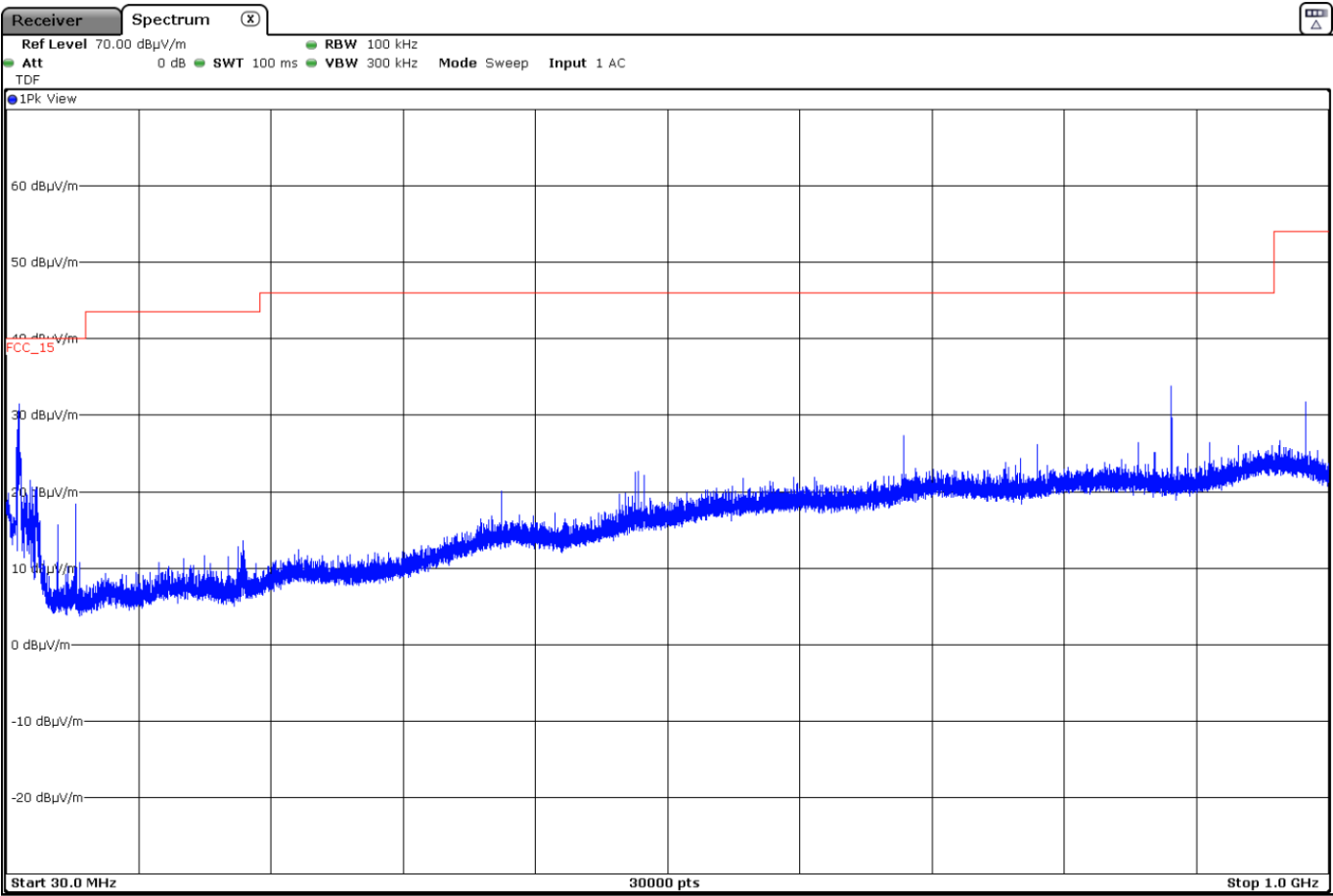
The results in the next tables show the maximum measured levels in the 1-40 GHz range.

Spurious signals with peak levels above the average limit (54 dBμV/m at 3 m) are measured with average detector for checking compliance with the average limit.

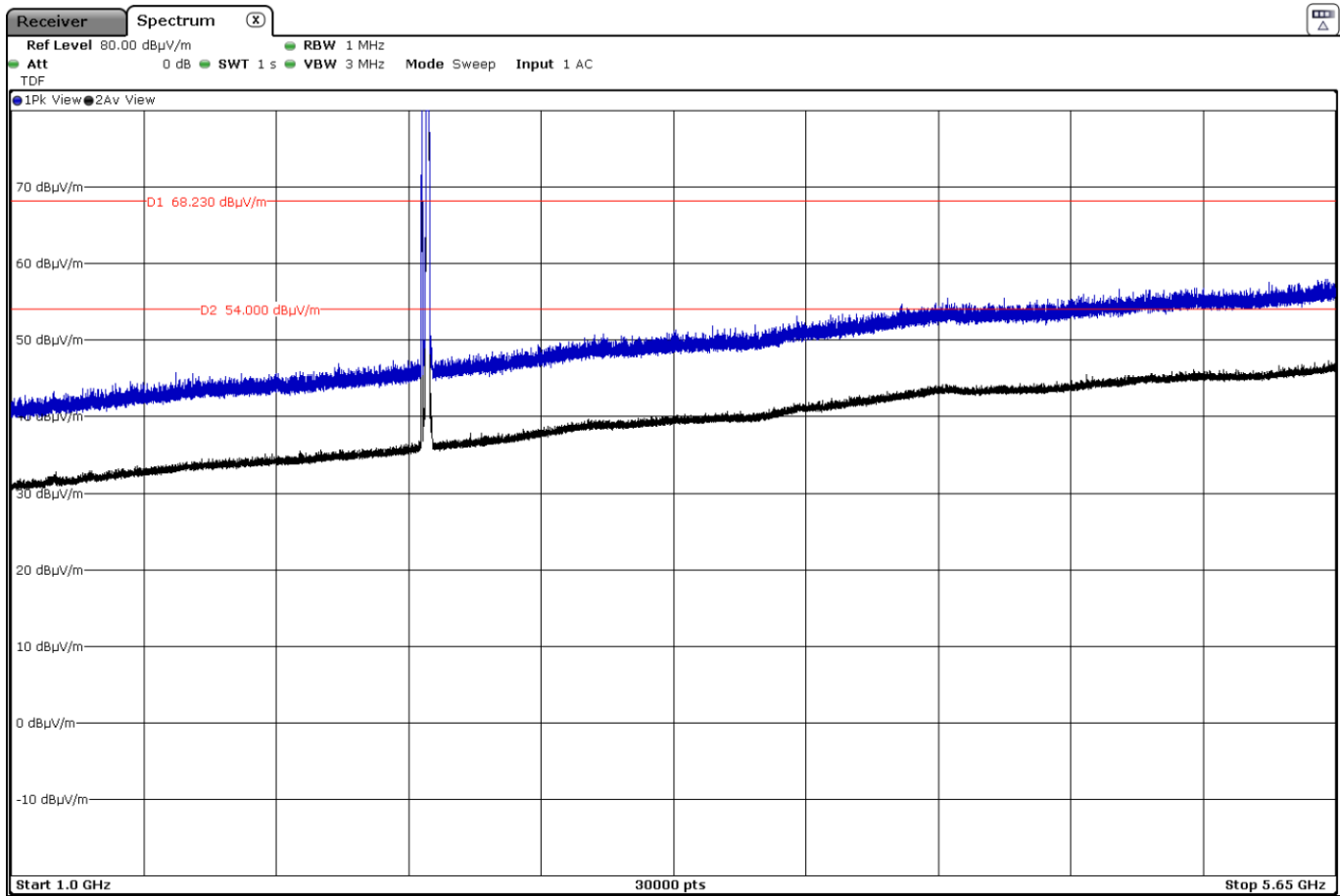
Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Measurement Uncertainty (dB)
10.48217	Horizontal	Peak	48.83	74	25.17	± 3.88

Verdict: PASS

FREQUENCY RANGE 30 MHz-1000 MHz.

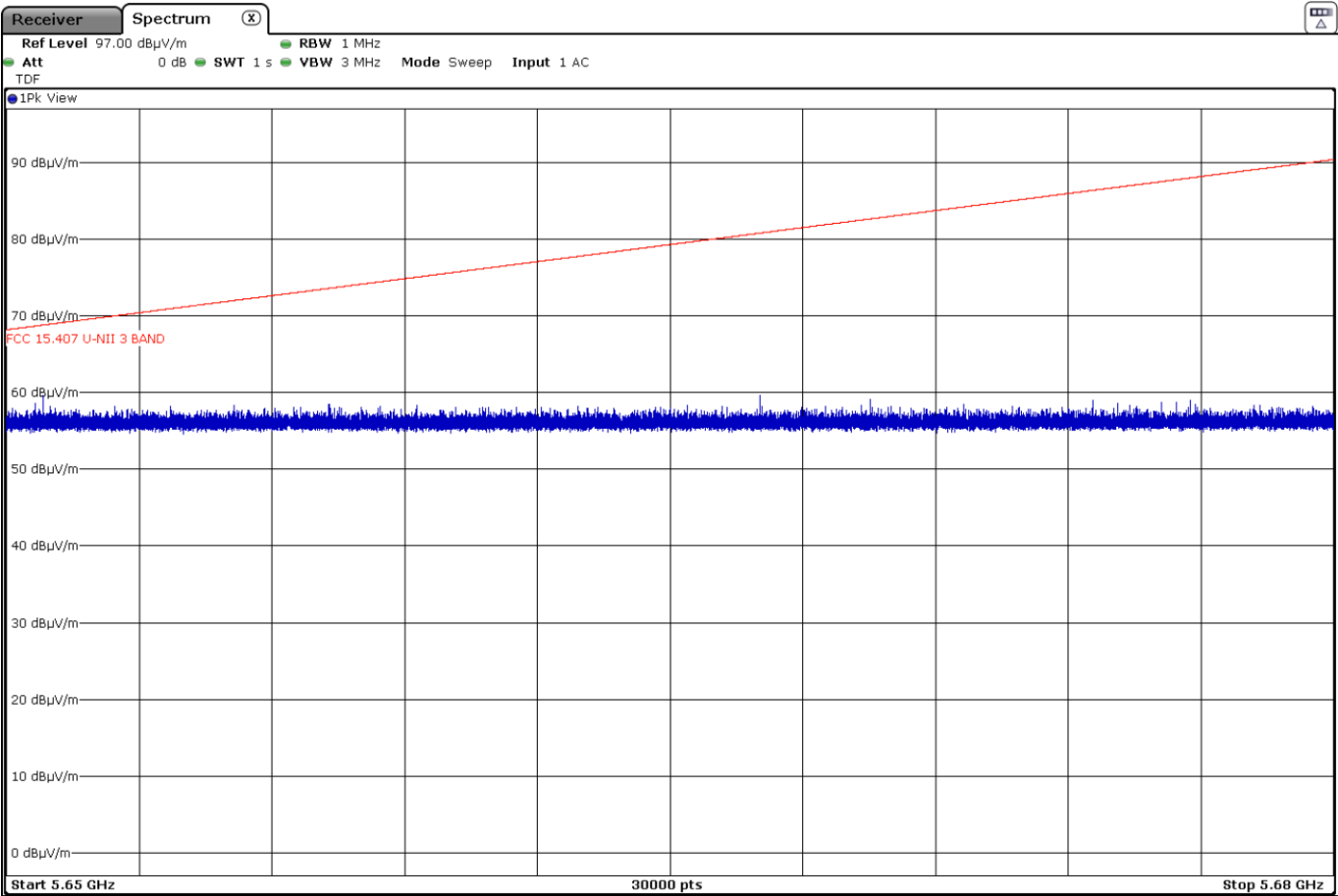


FREQUENCY RANGE 1 – 5.65 GHz.



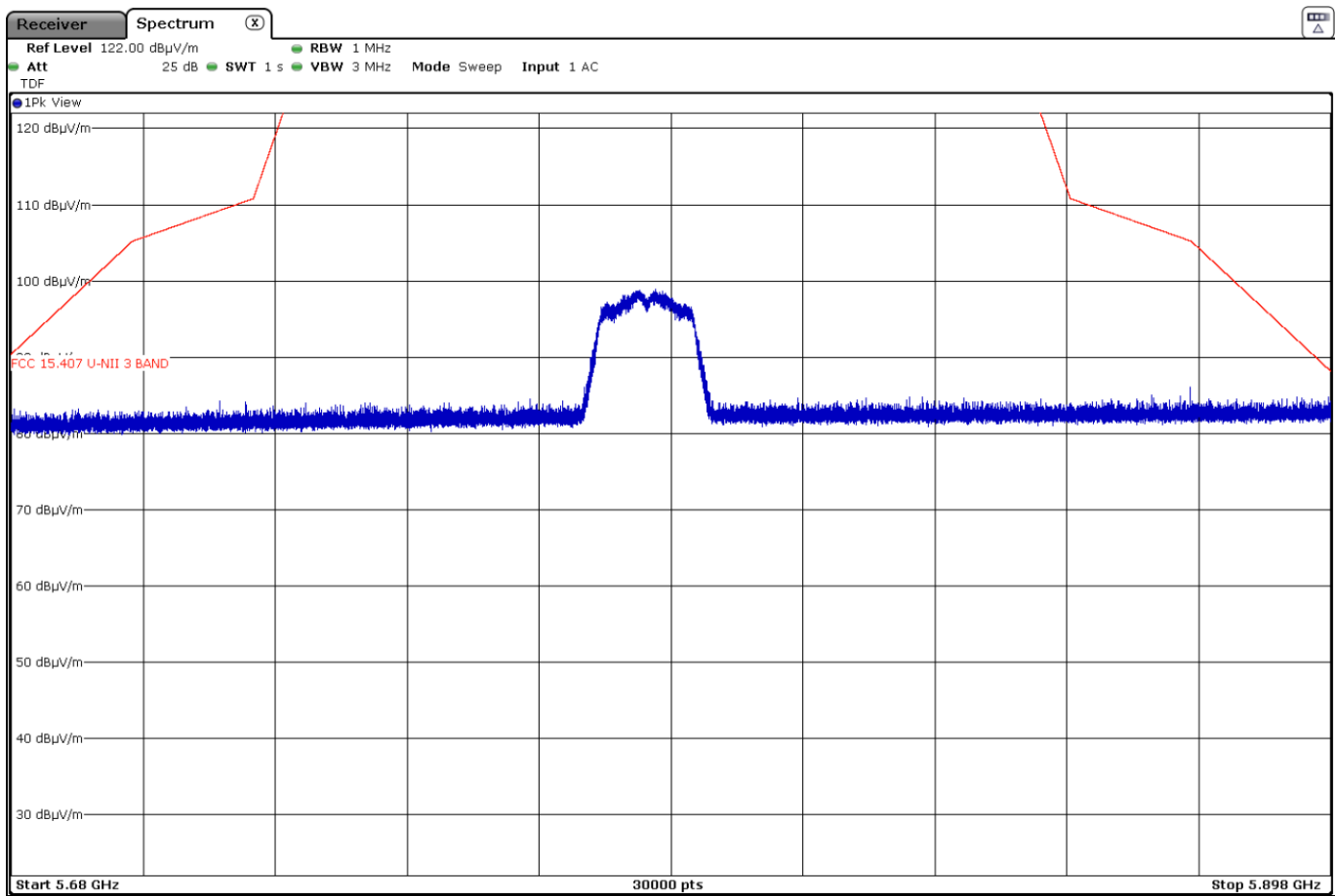
Note: The peaks shown in the plot above the limit are the carrier frequencies.

FREQUENCY RANGE 5.65 – 5.68 GHz.



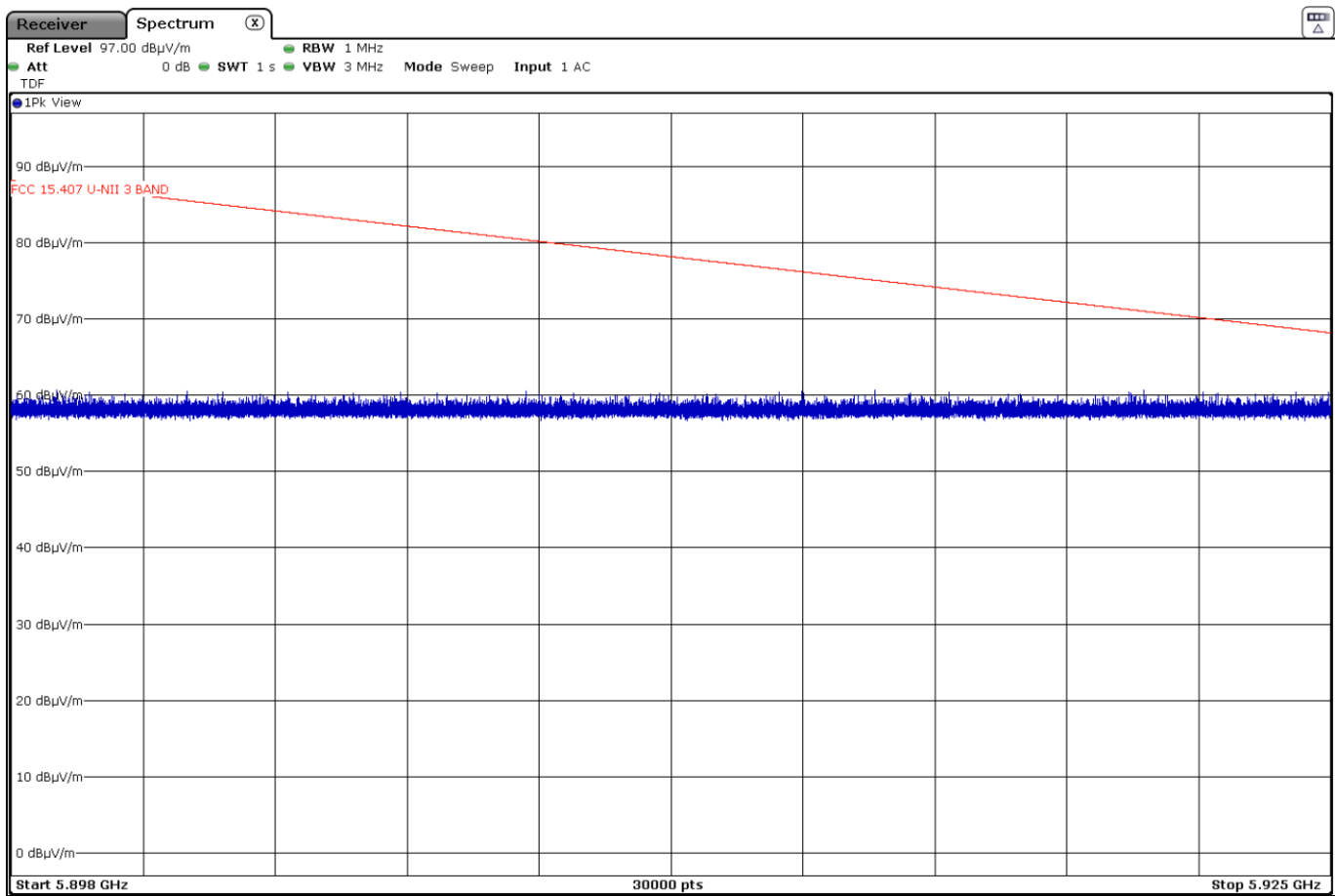
Note: The peaks shown in the plot above the limit are the carrier frequencies.

FREQUENCY RANGE 5.68 – 5.898 GHz.



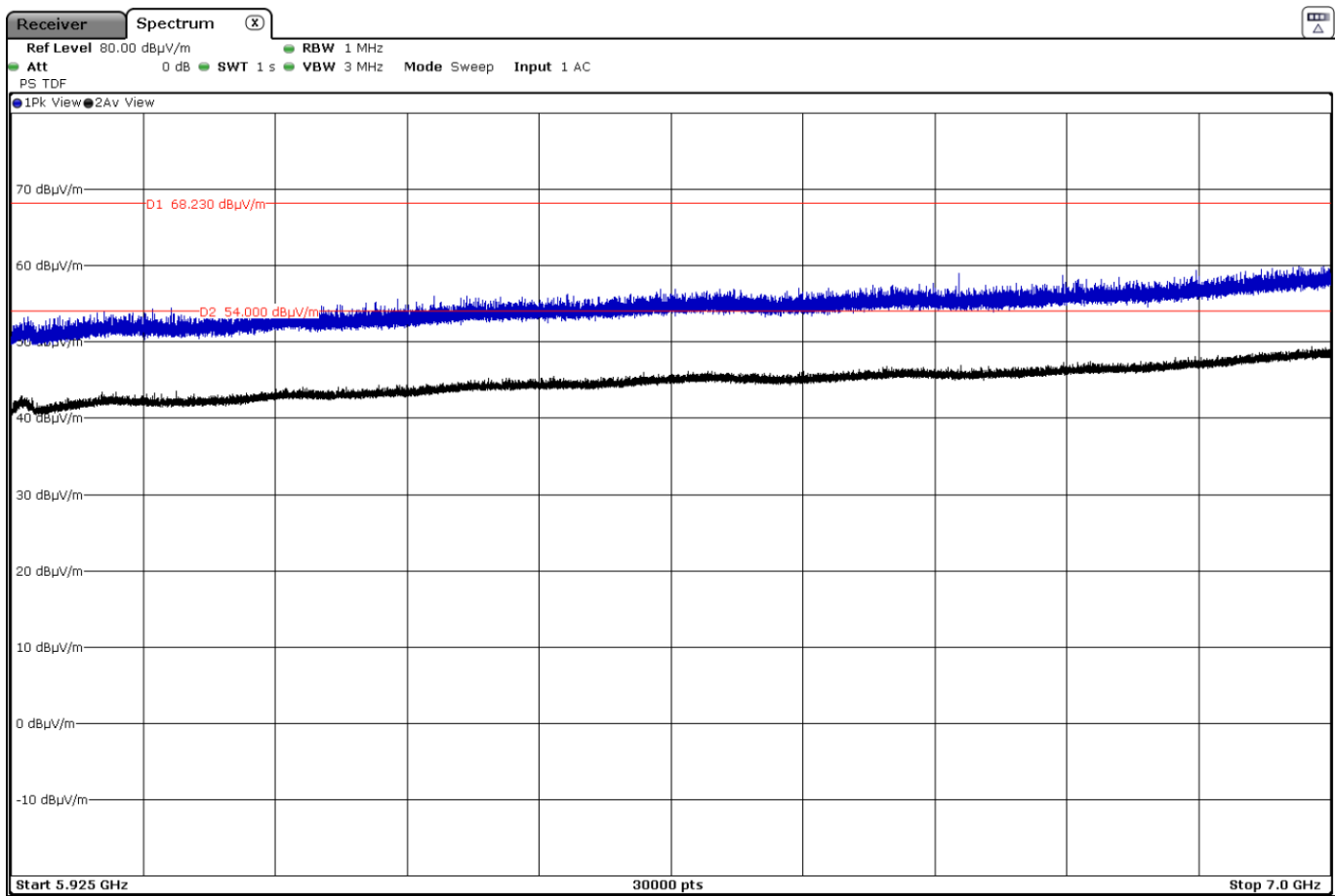
Note: The peaks shown in the plot above the limit are the carrier frequencies.

FREQUENCY RANGE 5.898 – 5.925 GHz.



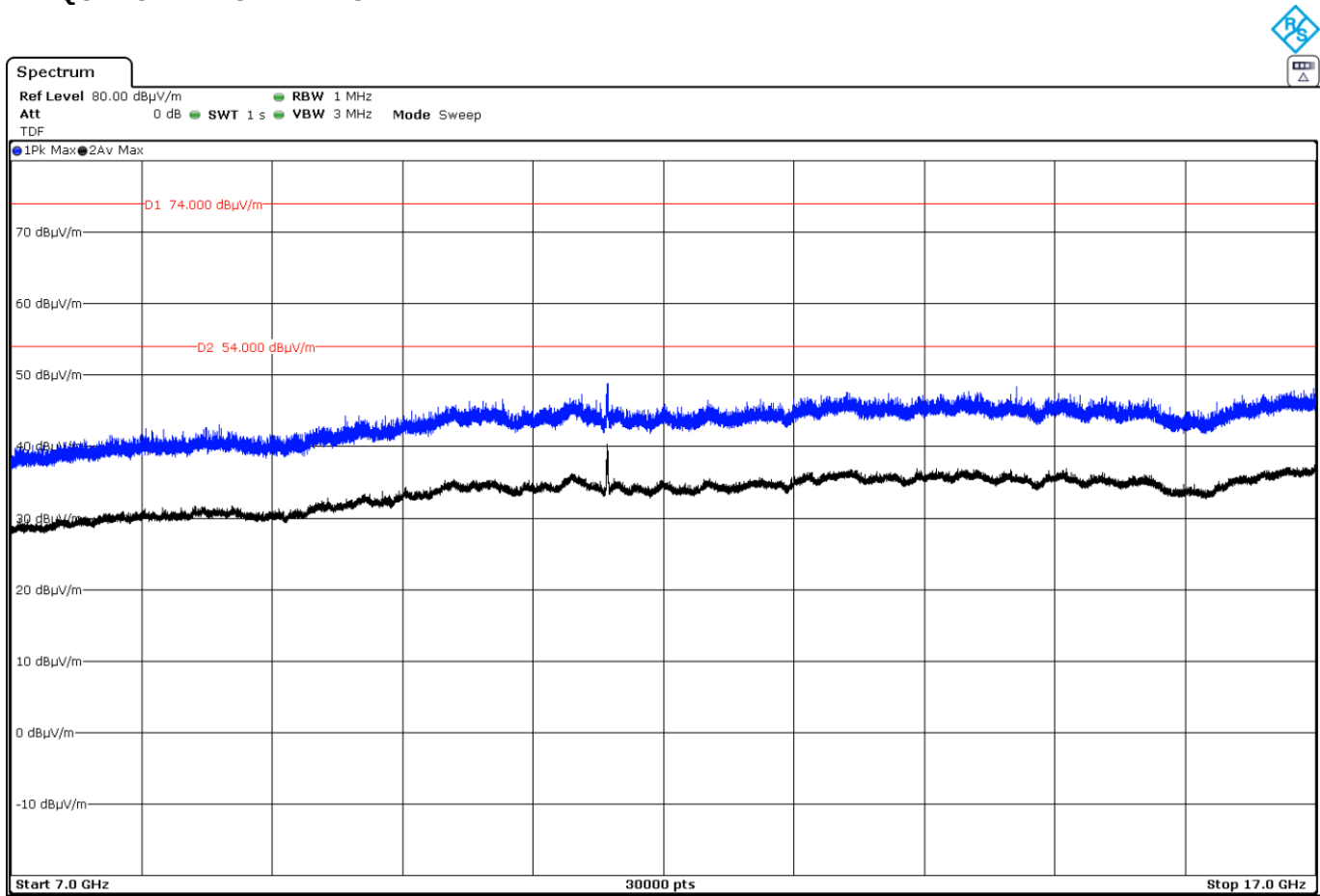
Note: The peaks shown in the plot above the limit are the carrier frequencies.

FREQUENCY RANGE 5.925 - 7 GHz.

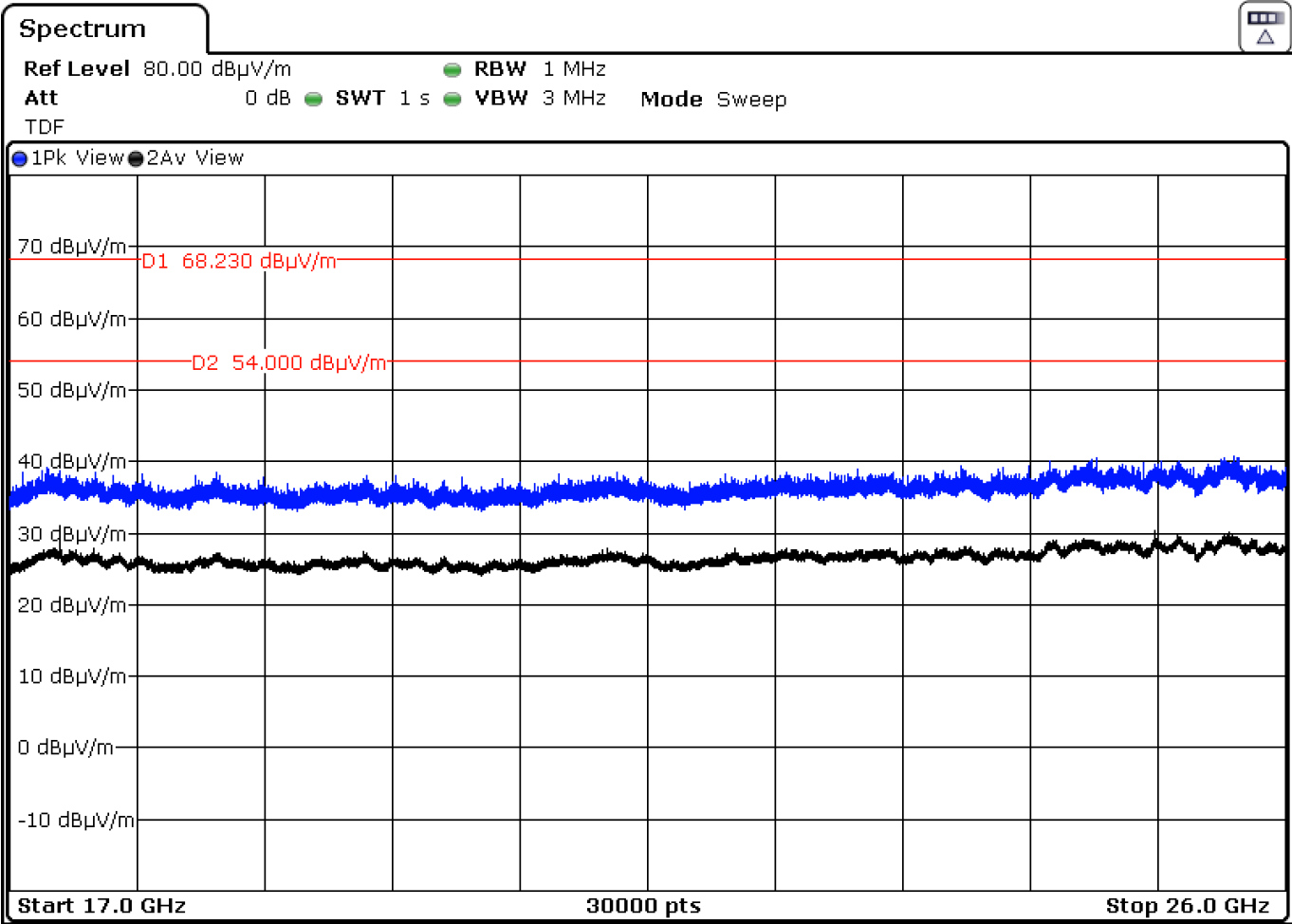


Note: The peaks shown in the plot above the limit are the carrier frequencies.

FREQUENCY RANGE 7 - 17 GHz.



FREQUENCY RANGE 17 - 26 GHz.



FREQUENCY RANGE 26 - 40 GHz.

