



ISED LISTED
REGISTRATION NUMBER
4621A-4

Test report No:
NIE: 56848RRF.012

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 HIGH.
Other identification of the product	HW Version: D4. SW Version: E412.007. FCC ID: T8GNTG6NH. IC: 6434A-NTG6NH. S/N: HBM249JB002144.
Features	FM, AM, DAB, TV, USB, HDD, 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	2019-06-07
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 FCC-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report.

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

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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, TV, USB, HDD, Bluetooth, WLAN, 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 Nº	Description	Model	Serial Nº	Reception
56848G/059	Automotive infotainment System	NTG6N HIGH	HBM249JB002144	2019/01/11
56848G/132	HMI-CAN box	--	H0034722	2019/01/11
56848G/087	Ethernet Cable	--		2019/01/11
56848G/118	Harness	--	--	2019/01/11
56848G/106	BT/WLAN antenna	--	--	2019/01/11
56848G/107	BT/WLAN antenna	--	--	2019/01/11
56848G/108	BT/WLAN antenna	--	--	2019/01/11
56848G/109	BT/WLAN antenna	--	--	2019/01/11
56848G/021	BT/WLAN antenna	--	--	2019/01/10

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 max length [m]	Attached during test	Shielded	Coupled to patient ⁽³⁾		
	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: T8GNTG6NH / IC: 6434A-NTG6NH						
Software version	E412.007						
Hardware version.....	D4 / Serial Product						
Dimensions in cm (W x H 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
	n/a		
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)	2019-03-15
Date (finish)	2019-03-25

Document history

Report number	Date	Description
56848RRF.012	2019-06-07	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, 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 40 dB, 10 MHz - 6 GHz BONN ELEKTRONIK BLNA 0160-01N	2019/02	2020/08
4.	Biconical/Log Antenna 30MHz - 6GHz ETS LINDGREN 3142E	2017/09	2020/09
5.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2018/02	2020/02
6.	RF Pre-amplifier G>30dB, 1-18GHz BONN ELEKTRONIK BLMA 0118-3A	2019/04	2020/04
7.	RF Pre-amplifier, G>48dB, 18-40GHz NARDA JS44-18004000-33-8P	2018/02	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.	Low Noise Amplifier G>30dB, 18 - 40 GHz BONN ELEKTRONIK BLMA 1840-1M	2018/02	2020/02
11.	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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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)16

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:

Antenna Port 3 Gain: +0.7 dBi

Maximum Declared Gain for 2.4 GHz WLAN:

Antenna Port 2 Gain: +2.2 dBi

Maximum Declared Gain for 5 GHz WLAN:

Antenna Port 1 Gain: +3.2 dBi

Antenna Port 4 Gain: +2.3 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)
	6	2437

	WLAN (IEEE 802.11 n) / U-NII	
Mode:	802.11n HT20: MCS0 (WLAN0 CORE0) (SISO) / 802.11n HT20: MCS0 (WLAN1 CORE2 (CORE0+CORE1)) (MIMO)	
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)
	Middle: 157	5785

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 four signals at maximum output power: Wi-Fi 5GHz in 802.11n HT20 (WLAN1 CORE0) (SISO), Wi-Fi 5GHz in 802.11n HT20 (WLAN0 CORE2 (CORE0+CORE1)) (MIMO), Wi-Fi 2.4GHz in 802.11b (WLAN1 CORE1) and the Bluetooth EDR in GFSK.

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 (SISO): 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.

* 5 GHz WLAN (MIMO): Transmitter radiated spurious emissions tests were performed with the EUT transmitting in 802.11n / HT20 / MCS8 / 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 four signals at maximum output power, 2.4GHz WLAN (WLAN1 CORE1) in 802.11b / 1 Mbps / SISO, 5GHz WLAN (WLAN 1 CORE 0) in 802.11n / HT20 / MCS0 / SISO, 5GHz WLAN0 CORE2 (CORE0+CORE1) in 802.11n / HT20 / MCS0 / MIMO and the Bluetooth Basic Rate with DH5.

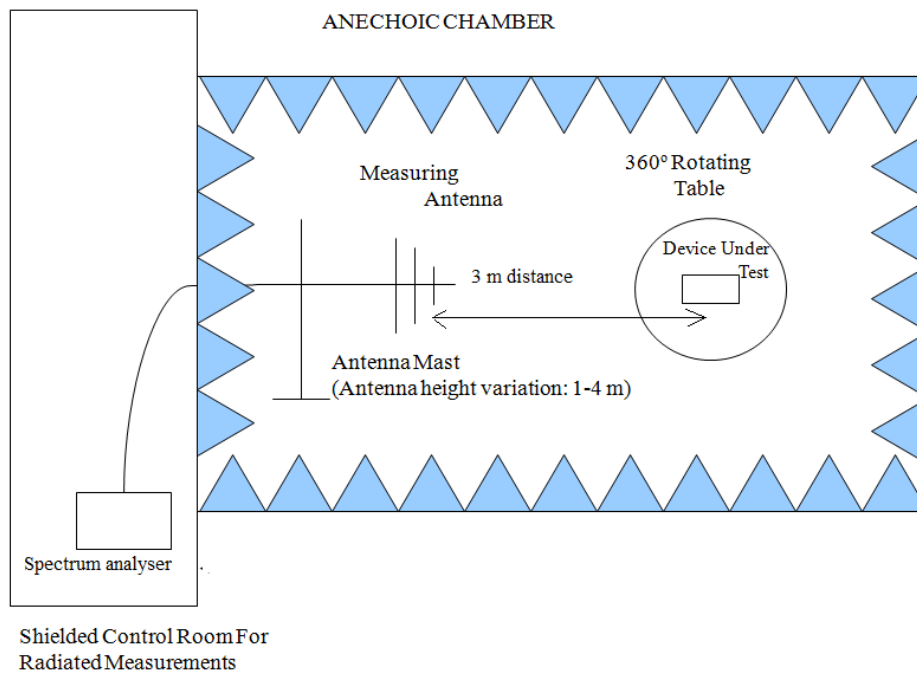
RADIATED MEASUREMENTS

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.

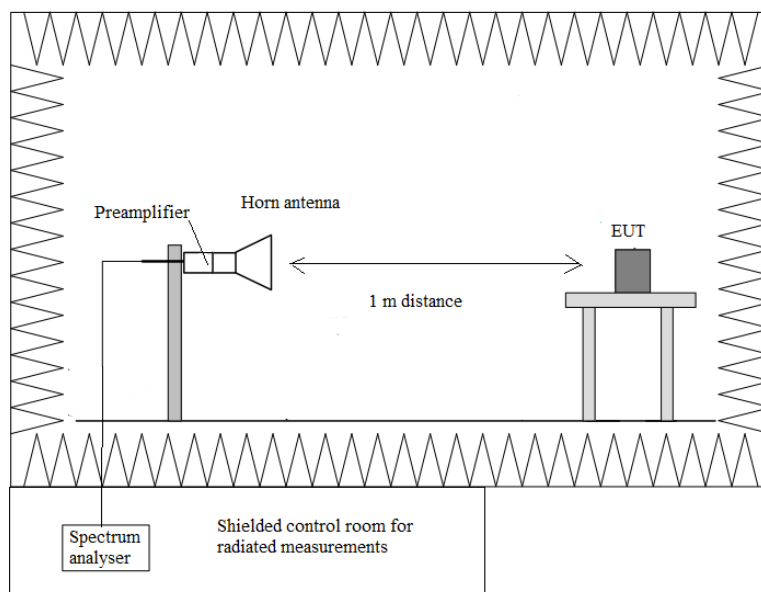
Measurements were made in both horizontal and vertical planes of polarization.

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

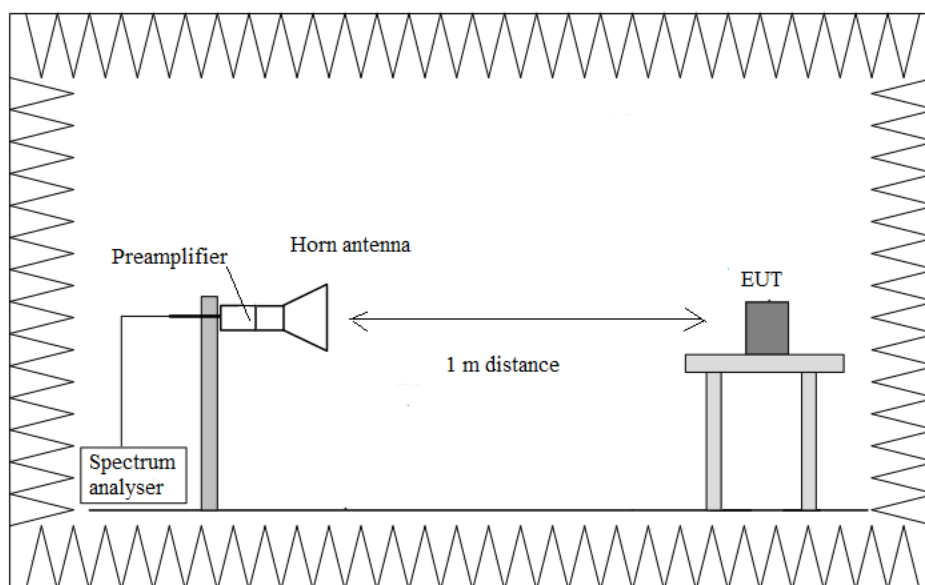
Radiated measurements setup $f < 1$ GHz



Radiated measurements setup $f > 1$ 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 – WLAN1 CORE 1 (2437MHz), 802.11n HT20 – 20MHz – SISO – WLAN1 CORE 0 (5200MHz), 802.11n HT20 – 20MHz – MIMO – WLAN0 CORE 2 (CORE0+CORE1) (5200MHz) and Bluetooth Basic Rate with DH5 (2441).
- Mode: 802.11b – 20MHz – SISO – WLAN1 CORE 1 (2437MHz), 802.11n HT20 – 20MHz – SISO – WLAN1 CORE 0 (5785MHz), 802.11n HT20 – 20MHz – MIMO – WLAN0 CORE 2 (CORE0+CORE1)(5785MHz) and Bluetooth Basic Rate with DH5 (2441).

Mode: 802.11b – 20MHz – SISO – WLAN1 CORE 1 (2437MHz), 802.11n HT20 – 20MHz – SISO – WLAN1 CORE 0 (5200MHz), 802.11n HT20 – 20MHz – MIMO – WLAN0 CORE 2 (CORE0+CORE1)(5200MHz) and Bluetooth Basic Rate with DH5 (2441).

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Measurement Uncertainty (dB)
42.529	Vertical	Quasi-Peak	28.80	40	11.20	± 3.88
525.072	Vertical	Quasi-Peak	29.40	46	16.60	± 3.88
675.002	Horizontal	Quasi-Peak	33.60	46	12.40	± 3.88
890.245	Vertical	Quasi-Peak	30.70	46	15.30	± 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.

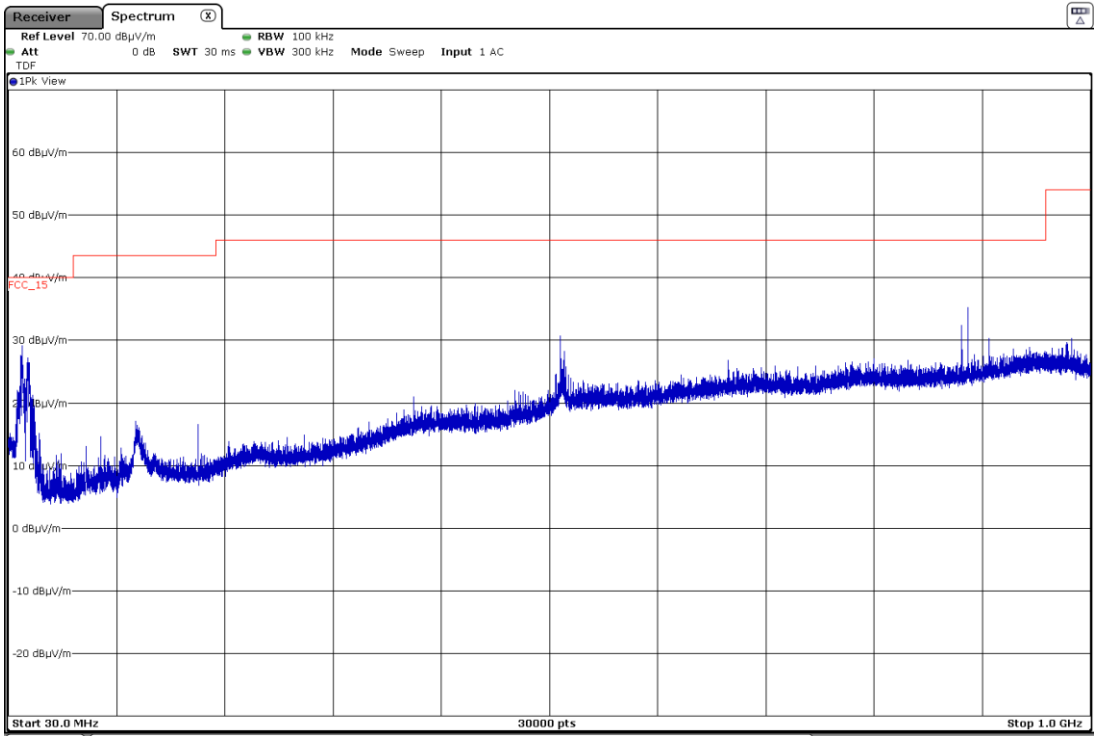
Spurious signals with peak levels above the average limit (54 dBμV/m at 3 m) are measured with average detector for checking compliance with the average limit.

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBμV/m)	Measurement Uncertainty (dB)
5.08865	Vertical	Peak	52.03	± 3.88
		Average	42.43	± 3.88
10.47917 (*)	Horizontal	Peak	72.25	± 3.88

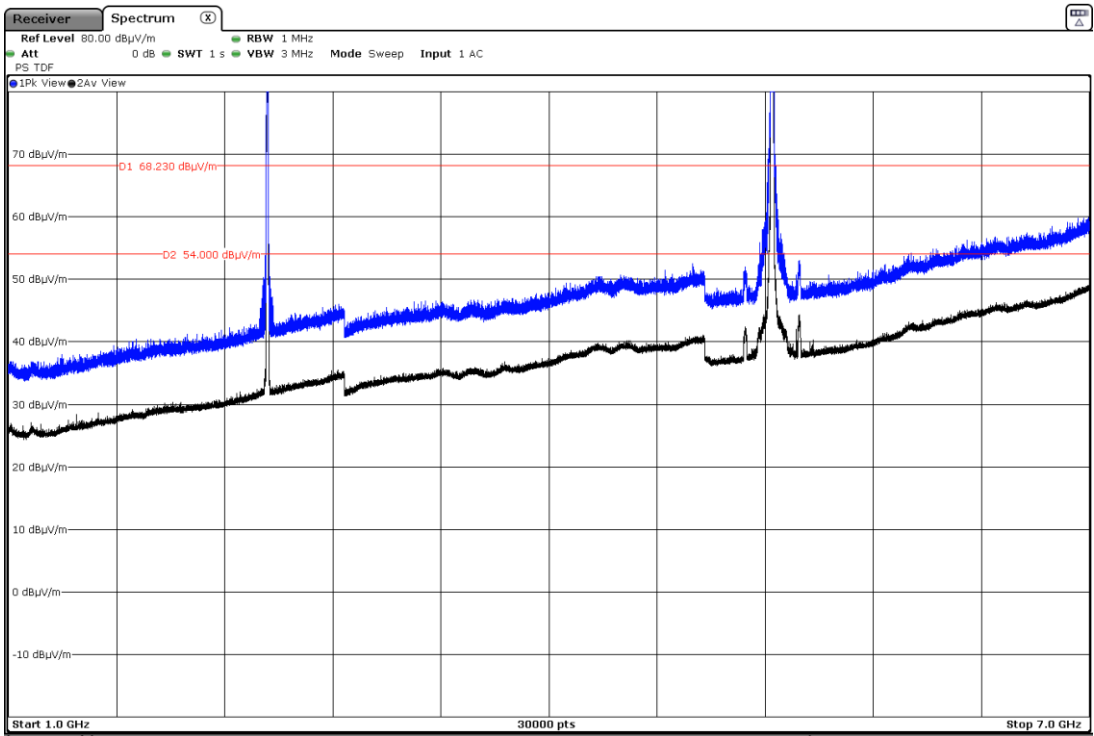
(*): This spurious frequency is outside the restricted bands as defined in §15.205(a). The measured maximum carrier level at 3 m was 93.36 dBμV/m (Peak) so the spurious level is more than 20 dB below the carrier level.

Verdict: PASS

FREQUENCY RANGE 30 MHz-1000 MHz.

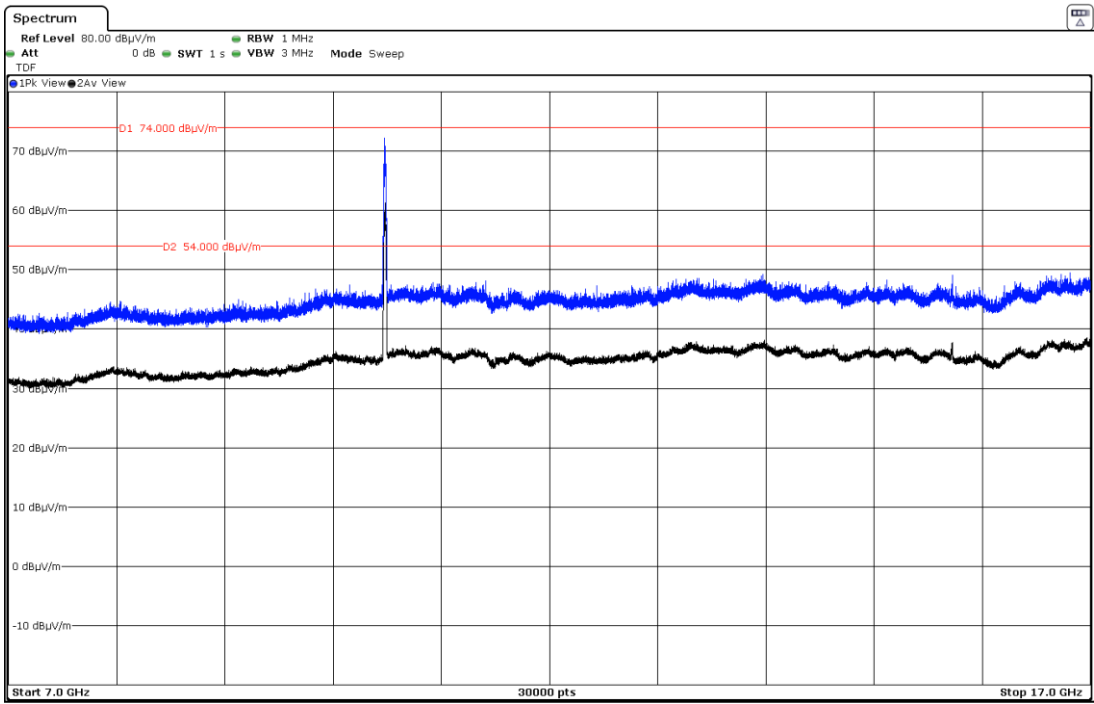


FREQUENCY RANGE 1 – 7 GHz.

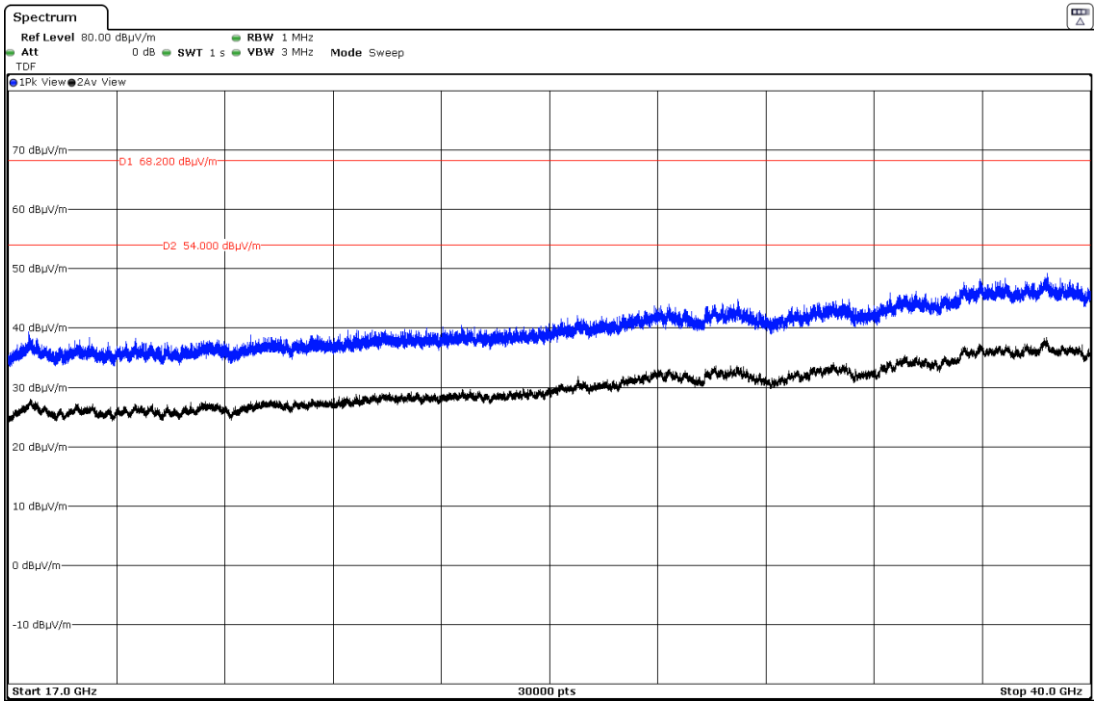


Note: The peaks shown in the plot above the limit are the carrier frequencies.

FREQUENCY RANGE 7 - 17 GHz.



FREQUENCY RANGE 17 - 40 GHz.



Mode: 802.11b – 20MHz – SISO – WLAN1 CORE 1 (2437MHz), 802.11n HT20 – 20MHz – SISO – WLAN1 CORE 0 (5785MHz), 802.11n HT20 – 20MHz – MIMO – WLAN0 CORE 2 (CORE 0+CORE1) (5785MHz) 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)
47.767	Vertical	Quasi-Peak	28.40	40	11.60	± 3.88
675.002	Horizontal	Quasi-Peak	33.10	46	12.90	± 3.88
884.780	Vertical	Quasi-Peak	27.60	46	18.40	± 3.88

Frequency range 1 GHz-40 GHz

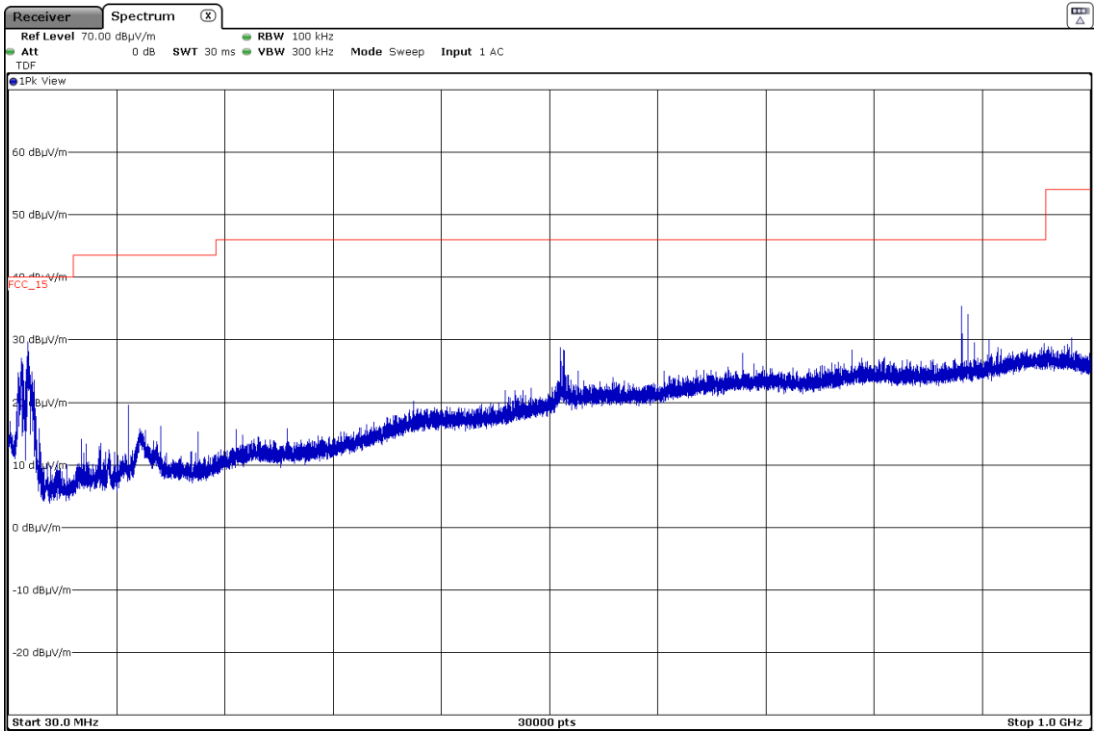
The results in the next tables show the maximum measured levels in the 1-40 GHz range.

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.

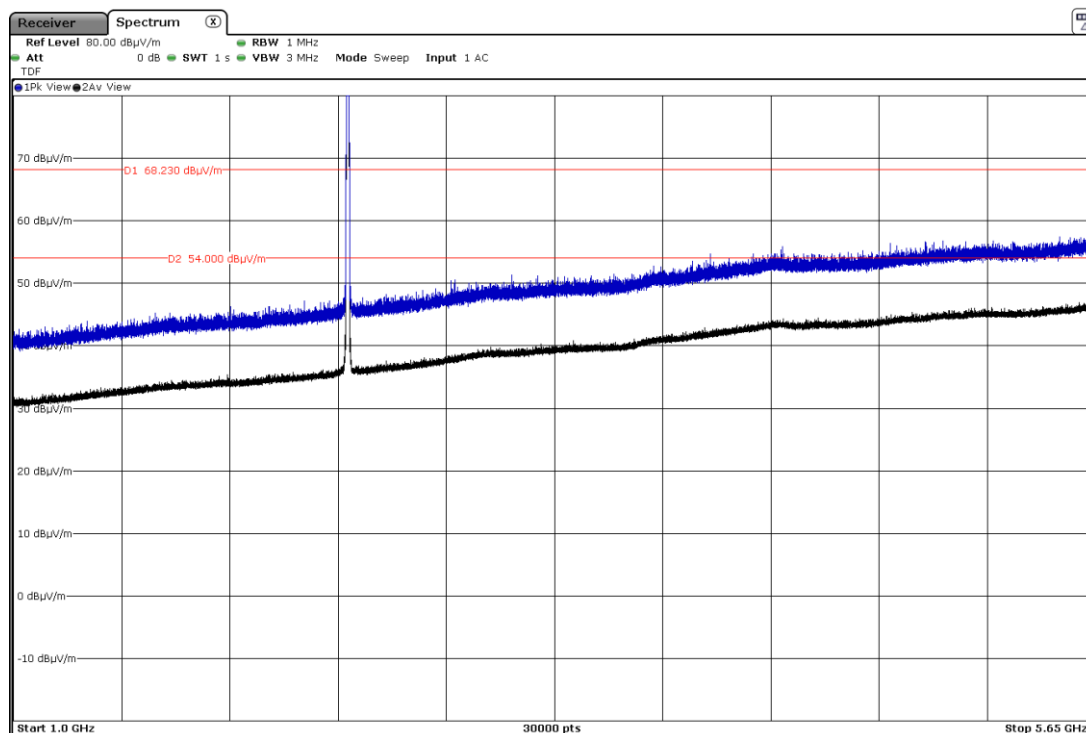
Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Measurement Uncertainty (dB)
11.56963	Horizontal	Peak	55.56	74	18.44	± 3.88
		Average	44.03	54	9.97	± 3.88

Verdict: PASS

FREQUENCY RANGE 30 MHz-1000 MHz.

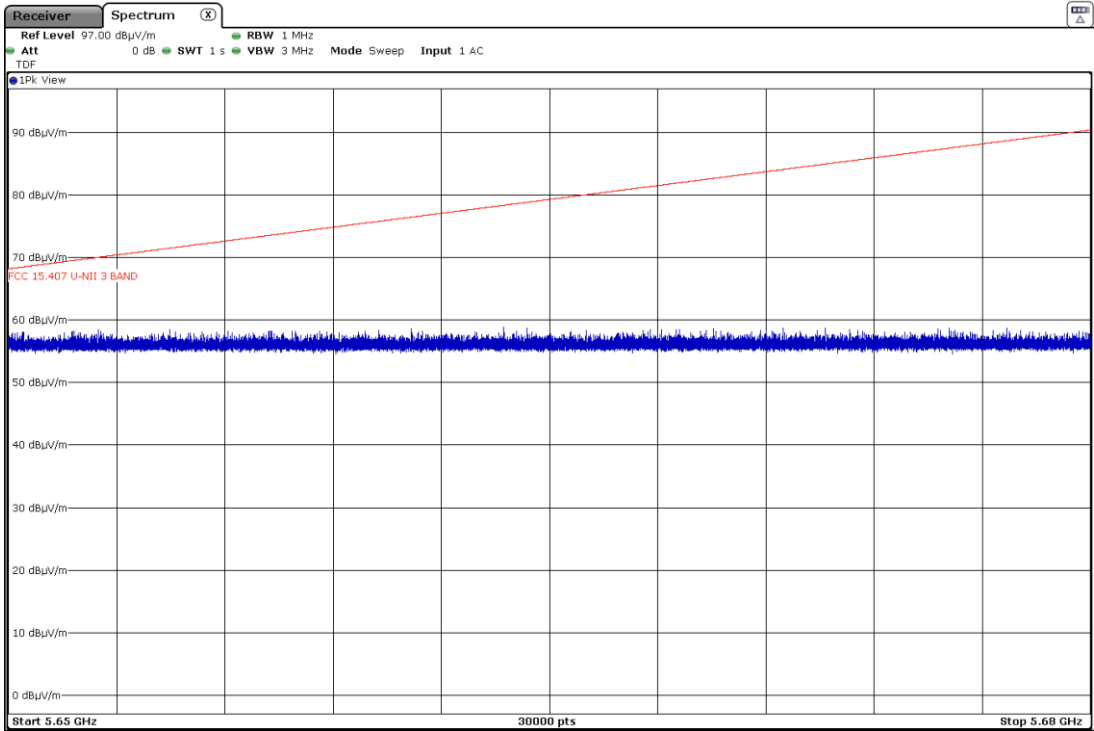


FREQUENCY RANGE 1 – 5.65 GHz.

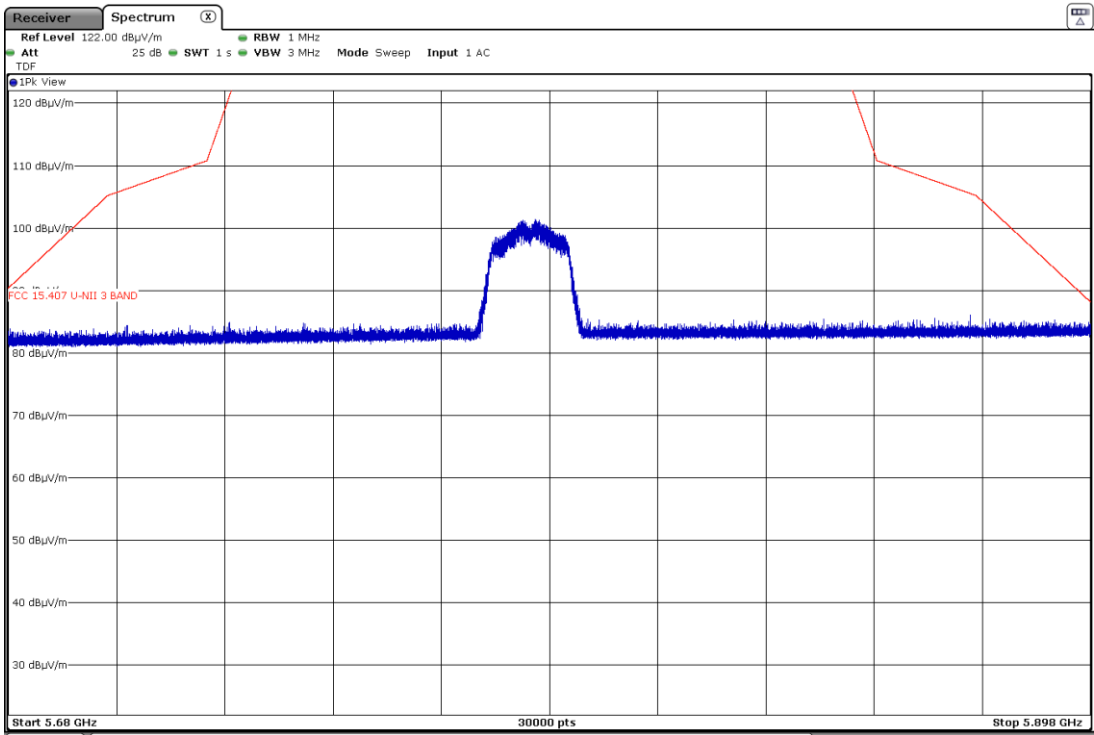


Note: The peak shown in the plot above the limit is the carrier frequency.

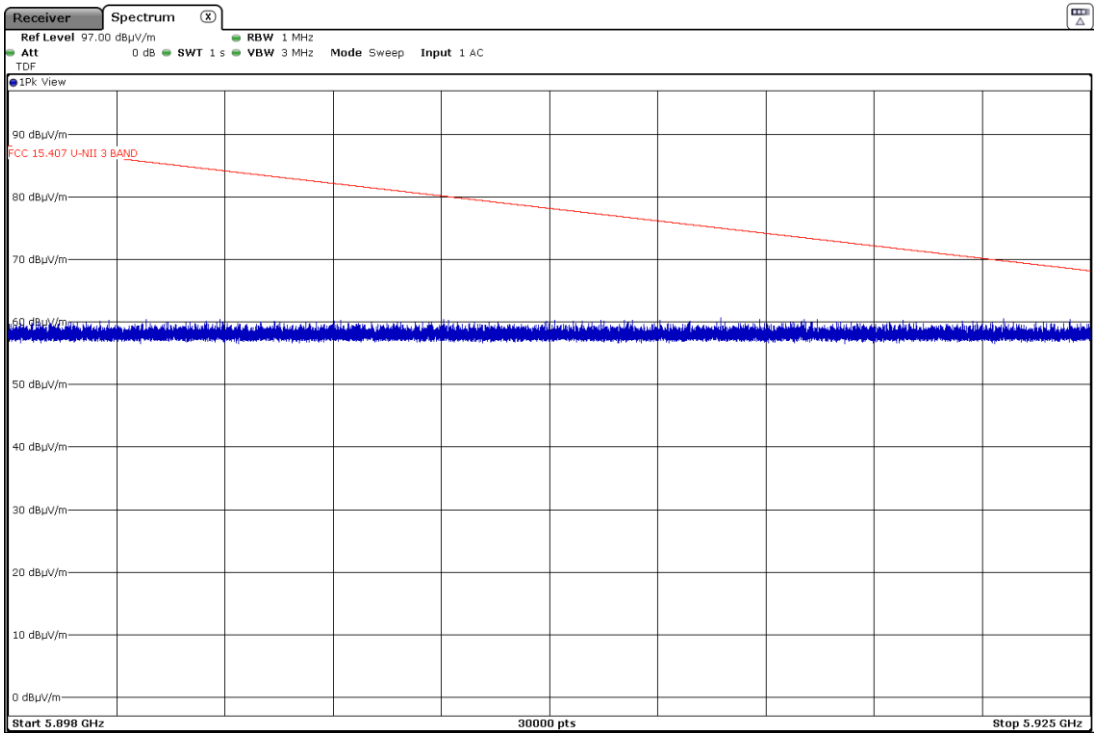
FREQUENCY RANGE 5.65 – 5.68 GHz.



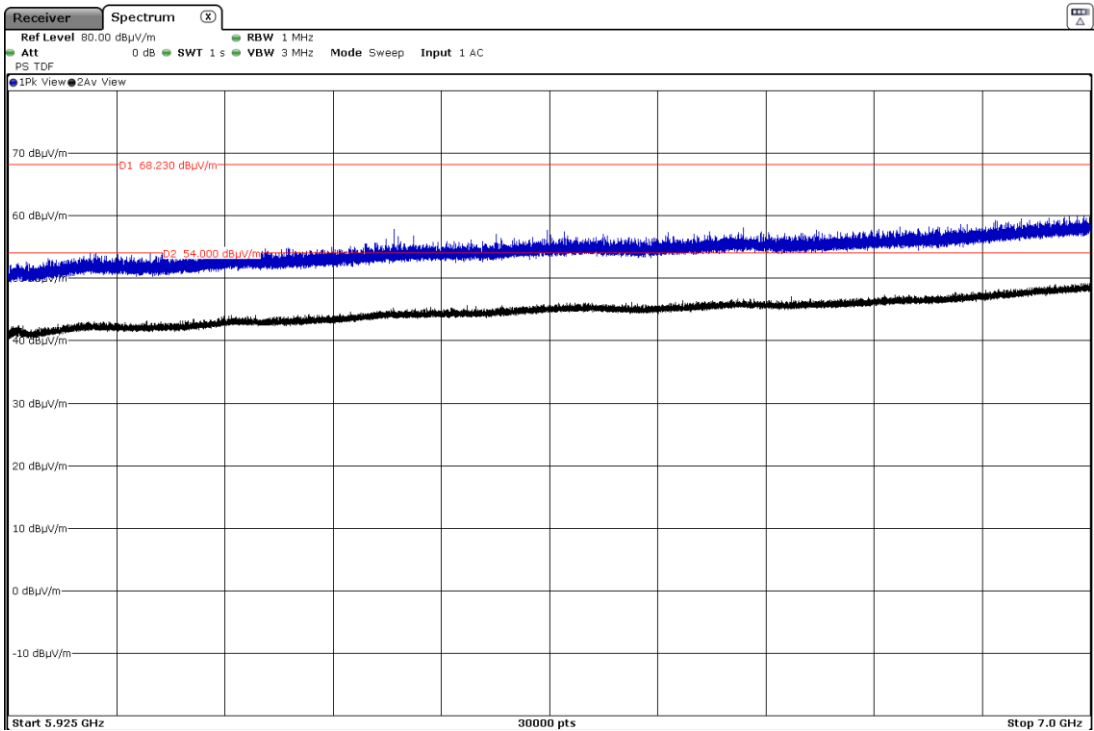
FREQUENCY RANGE 5.68 – 5.898 GHz.



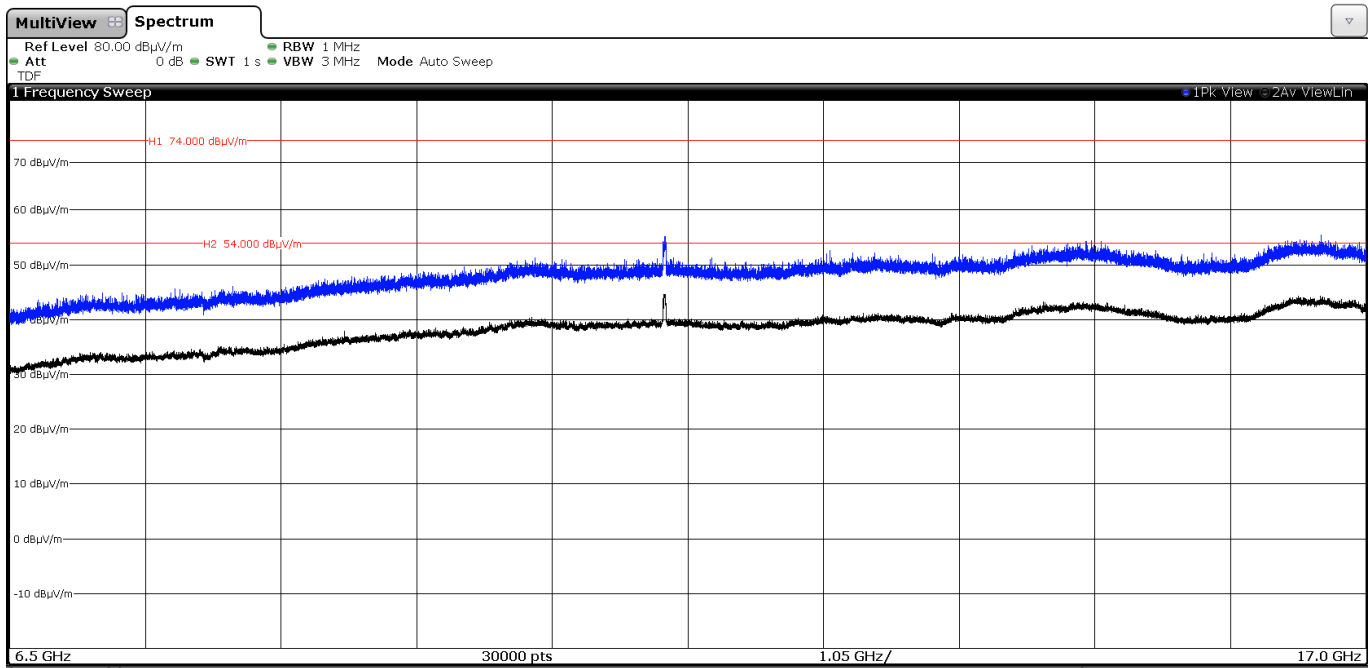
FREQUENCY RANGE 5.898 – 5.925 GHz.



FREQUENCY RANGE 5.925 - 7 GHz.



FREQUENCY RANGE 7 - 17 GHz.



FREQUENCY RANGE 17 - 40 GHz.

