DEKRA Testing and Certification, S.A.U.
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C.I.F. A29 507 456

ENSAYOS Nº 51/LE147

Test report No:
NIE: 57478RRF.009

Partial test report

USA FCC Part 15.225,15.247,15.407, 15.209
CANADA RSS-210, RSS-247, RSS-Gen

Radio Frequency Devices.
Operation within the band 13.110-14.010 MHz.
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	Secure Smartphone
(*) Trademark	Bittium
(*) Model and /or type reference	Tough Mobile 2
Other identification of the product	HW version: 0302 SW version: 40.1 FCC ID: V27SD-61 IC: 3282B-SD61
(*) Features	LTE • 3GPP Rel12 • FDD/TDD Cat13/5, • DL 400Mbit/s, • UL 75 Mbit/s UMTS/HSPA • 3GPP rel8, HSPA+, • DL 42 Mbit/s, • UL 5.76 Mbit/s GSM/GPRS/EDGE Complementary Radios • Wi-Fi 802.11 a/b/g/n/ac (2.4 and 5 GHz), 2 x 2 MIMO • BT 5.0 • NFC

Applicant	BITTIUM WIRELESS OY Ritaharjuntie 1, 90590 Oulu, Finland
Test method requested, standard	USA FCC Part 15.225 (10–1–18 Edition): Operation within the band 13.110 -14.010. USA FCC Part 15.407 10-1-18 Edition: Unlicensed National Information Infrastructure (U-NII) Devices. General technical requirements. Band U-NII-3 (5725 MHz – 5850 MHz). 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-210 Issue 9 (August 2016). 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 v05r02 dated April 2, 2019. 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. Guidance for Emission Testing of Transmitters with Multiple Outputs in the Same Band 662911 D01 Multiple Transmitter Output v02r01 dated 10/31/2013 ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Jose Carlos Luque RF Lab. Supervisor 74841983Y JOSE CARLOS LUQUE (C:A29507456) Firmado digitalmente por 74841983Y JOSE CARLOS LUQUE (C:A29507456) Fecha: 2019.09.10 16:33:33 +02'00'
Date of issue	2019-09-10
Report template No	FDT08_22 (*) "Data provided by the client"

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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 an ISED-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report.

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.

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA Testing and Certification.

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.
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 and the Accreditation Bodies.

Uncertainty

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

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").

2. The sample of Tough Mobile 2 consists of a Secure Smartphone targeted for professional use where High Security is required.

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	Date of reception
57478/032	Secure Smartphone	Tough Mobile 2	---	2018-11-26
57478/033	USB cable	---	---	2018-11-26
57478/034	AC/DC power adapter	---	---	2018-11-26
57478/039	Headphones	---	---	2018-11-26

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		
	-			☐	☐		
Supplementary information to the ports…… :							
Rated power supply .. :	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	☐	AC:	☐	☐	☐	☐	☐
	☒	DC: 3.6 – 4.35 Vdc					
Rated Power ..... :	Not provided data						
Clock frequencies..... :	Not provided data						
Other parameters ..... :	Not provided data						
Software version ..... :	40.1						
Hardware version ..... :	0302						
Dimensions in cm (W x H x D) ..... :	-						
Mounting position ..... :	☐	Table top equipment					
	☐	Wall/Ceiling mounted equipment					
	☐	Floor standing equipment					
	☒	Hand-held equipment					
	☐	Other:					
Modules/parts..... :	Module/parts of test item		Type		Manufacturer		
	N/A						
Accessories (not part of the test item) ..... :	Description		Type		Manufacturer		
	N/A						
	N/A						
Documents as provided by the applicant..... :	Description		File name		Issue date		
	-						
	-						

Identification of the client

BITTIUM WIRELESS OY
Ritaharjuntie 1, 90590 Oulu, Finland

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2019-03-28
Date (finish)	2019-04-03

Document history

Report number	Date	Description
57478RRF.009	2019-09-10	First release

Environmental conditions

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

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

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

Remarks and comments

The tests have been performed by the technical personnel: Carolina Postigo, José Alberto Aranda, Nicolás Salguero, Jaime Barranquero, 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.	Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N.A.	N.A.
3.	Active Loop Antenna HEWLETT PACKARD 11966A	2018/06	2020/06
4.	EMI Test Receiver ROHDE AND SCHWARZ ESR7	2018/10	2020/10
5.	EMI Test Receiver R&S ESU26	2018/02	2020/02
6.	Biconical/Log Antenna ETS LINDGREN 3142E	2017/09	2020/09
7.	RF Pre-amplifier 40 dB, 10 MHz-6 GHz BONN ELEKTRONIK BLNA 0160-01N	2019/02	2020/08
8.	Spectrum Analyzer ROHDE AND SCHWARZ FSW50	2018/02	2020/02
9.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2018/02	2020/02
10.	RF Pre-amplifier, 40 dB ,1-18 GHz BONN ELEKTRONIK BLMA 0118-1M	2019/04	2020/04
11.	RF Pre-amplifier 30 dB, 1-18GHz BONN ELEKTRONIK BLMA 0118-3A	2019/04	2020/04
12.	RF Pre-amplifier 30 dB, 18 GHz-40 GHz BONN ELEKTRONIK BLMA 1840-1M	2019/02	2021/02
13.	Broadband Horn antenna 18-40 GHz SCHWARZBECK BBHA 9170	2018/07	2021/07
14.	Broadband Horn antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2018/01	2021/01
15.	Broadband Horn antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2016/11	2019/11
16.	Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500	2019/05	2020/05

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), 15.225 (d), 15.247 (d), 15.407 (b) / RSS-Gen 8.9, RSS-247 5.5, 6.2.1.2, 6.2.2.2, 6.2.3.2 & 6.2.4.2, RSS-210: - Emission limitations radiated (Transmitter)	P	1
Supplementary information and remarks: (1) Only co-location radiated spurious emission test was requested.		

Appendix A: Test results.

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TEST CONDITIONS.....12

FCC 15.209 (a), 15.225 (d), 15.247 (d), 15.407 (b) / RSS-Gen 8.9, RSS-247 5.5, 6.2.1.2, 6.2.2.2, 6.2.3.2 & 6.2.4.2, RSS-210 Emission limitations radiated (Transmitter).....17

TEST CONDITIONS

POWER SUPPLY (V):

V nonimal: 3.8 Vdc.

Type of Power Supply: DC voltage from a rechargeable battery.

ANTENNA:

Type of Antennas: Internal.

Maximum Declared Gain for NFC:

Gain: Not Applicable.

Maximum Declared Gain for Bluetooth EDR and Bluetooth LE:

Gain: -3 dBi

Maximum Declared Gain for 2.4 GHz WLAN:

CHAIN 0 Antenna Port Gain : -3 dBi

CHAIN 1 Antenna Port Gain : +2.2 dBi

Maximum Declared Gain for 5 GHz WLAN:

CHAIN 0 Antenna Port Gain : -1.1 dBi

CHAIN 1 Antenna Port Gain : -1.1 dBi

RADIOS AND CHANNELS TESTED:

	NFC
Mode:	Type B
Bitrate:	106
Nominal Operating frequency:	13.56 MHz

	Bluetooth EDR (FHSS)	
Mode:	Basic Rate (GFSK - DH5)	
Channel Spacing:	1 MHz	
Frequency Range:	2402 MHz to 2480 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	78	2480

	WLAN (IEEE 802.11 bgn) / Digital Transmission System (DTS)	
Modes:	802.11b: 1, 2, 5.5 & 11 Mbps (SISO)	
Channel Spacing:	20 MHz	
Frequency Range:	2412 MHz to 2472 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	1	2412

	WLAN (IEEE 802.11 anac) / U-NII	
Mode:	802.11a: 6, 9, 12, 18, 24, 36, 48 & 54 Mbps (SISO)	
Frequency Range:	5150 MHz to 5725 MHz	
Channel Spacing:	20 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	Middle: 40	5200

The test set-up was made in accordance to the general provisions of FCC DTS Measurement 558074 D01 DTS Meas Guidance v05r2 dated April 2, 2019 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.

The following configurations were selected based on preliminary testing that identified those corresponding to the worst cases:

Transmission modes selected with each radio:

* NFC: Transmitter radiated spurious emissions tests were performed with the EUT transmitting in B mode (106 bps) because its power is higher than the other modulations and bitrates.

* 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 / 1Mbps / SISO (port 1) mode configuration as this mode was found to transmit higher EIRP than all the other 2.4 GHz WLAN modes.

* 5 GHz WLAN: Transmitter radiated spurious emissions tests were performed with the EUT transmitting in 802.11a / 6Mbps / SISO (port 0) mode configuration as these modes were found to transmit higher EIRP than all the other 5 GHz WLAN modes.

Simultaneous transmission modes selected:

*** NFC, 2.4 GHz WLAN and 5 GHz WLAN co-location**, with the EUT configured to simultaneously transmit three signals at maximum output power, NFC (B – 106 Kbps), 2.4GHz WLAN (Wi-Fi Chain 1) in 802.11b / 1 Mbps / SISO and 5GHz WLAN (Wi-Fi Chain 0) in 802.11a / 6 Mbps / SISO.

*** NFC, Bluetooth Basic Rate and 5 GHz WLAN co-location**, with the EUT configured to simultaneously transmit three signals at maximum output power, NFC (B – 106 Kbps), Bluetooth Basic Rate in DH5 mode and 5GHz WLAN (Wi-Fi Chain 0) in 802.11a / 6 Mbps / SISO.

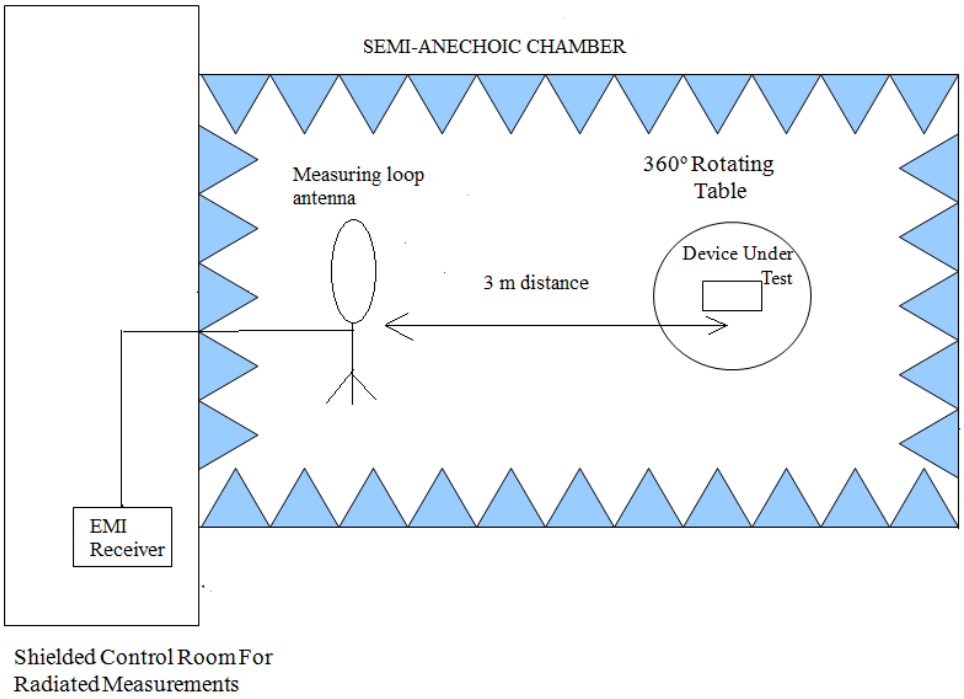
RADIATED MEASUREMENTS

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 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

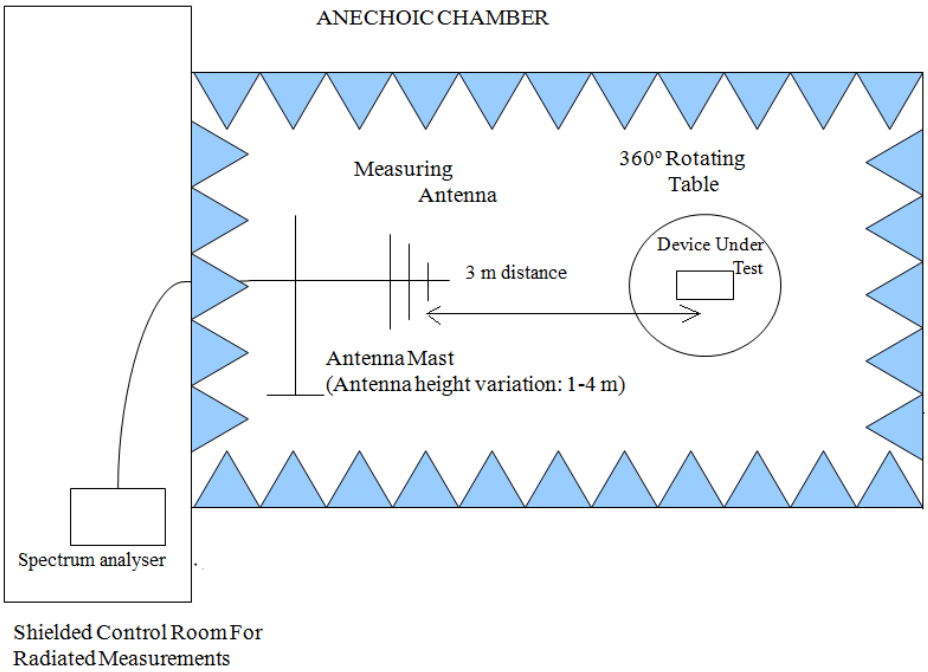
Measurements were made in both horizontal and vertical planes of polarization.

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

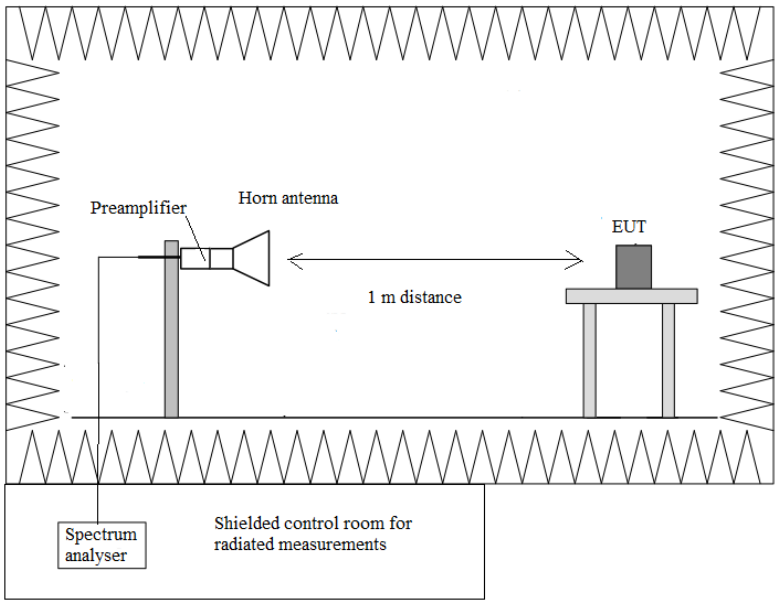
Radiated measurements setup 9 kHz < f < 30 MHz:



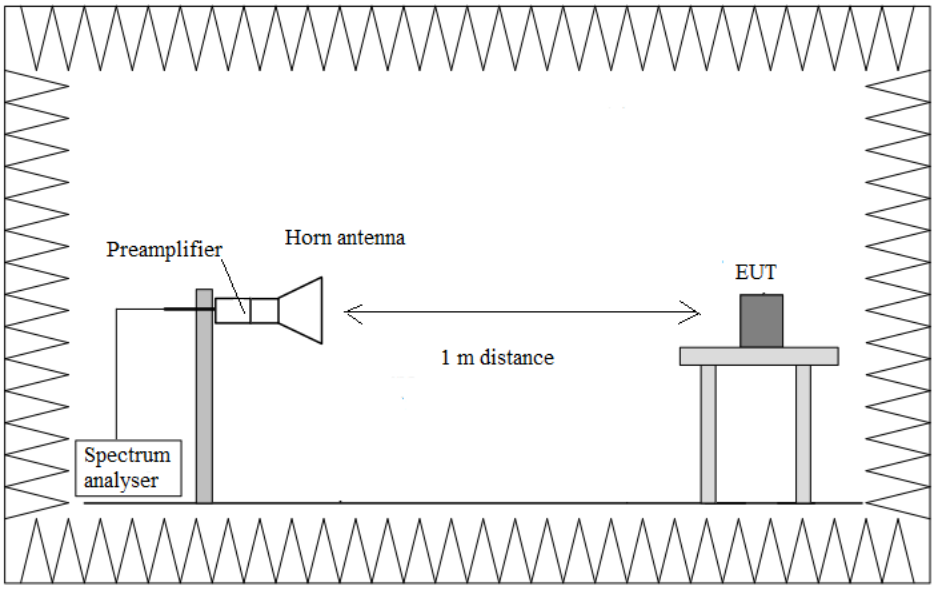
Radiated measurements setup 30 MHz < f < 1 GHz:



Radiated measurements setup f > 1 GHz up to 18 GHz:



Radiated measurements setup f > 18 GHz up to 40 GHz:



FCC 15.209 (a), 15.225 (d), 15.247 (d), 15.407 (b) / RSS-Gen 8.9, RSS-247 5.5, 6.2.1.2, 6.2.2.2, 6.2.3.2 & 6.2.4.2, RSS-210 Emission limitations radiated (Transmitter)

SPECIFICATION:

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), appearing outside of the band 13.110 MHz - 14.010 MHz band 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	29.54	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 40000	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 360º 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 3 m for the frequency range 30 MHz-40 GHz.

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 cases in all relevant tests channels:

- **Mode NFC B, 802.11b, 802.11a.**

NFC ISO 14443B:	106Kbps (13.56 MHz).
802.11b:	1Mbps, 20MHz, SISO, Port 1 (2440 MHz).
802.11a:	6Mbps, 20MHz, SISO, Port 0 (5200 MHz).

Frequency range 9 KHz - 30 MHz

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

No spurious frequencies at less than 20 dB below the limit.

Frequency range 30 MHz - 1 GHz

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

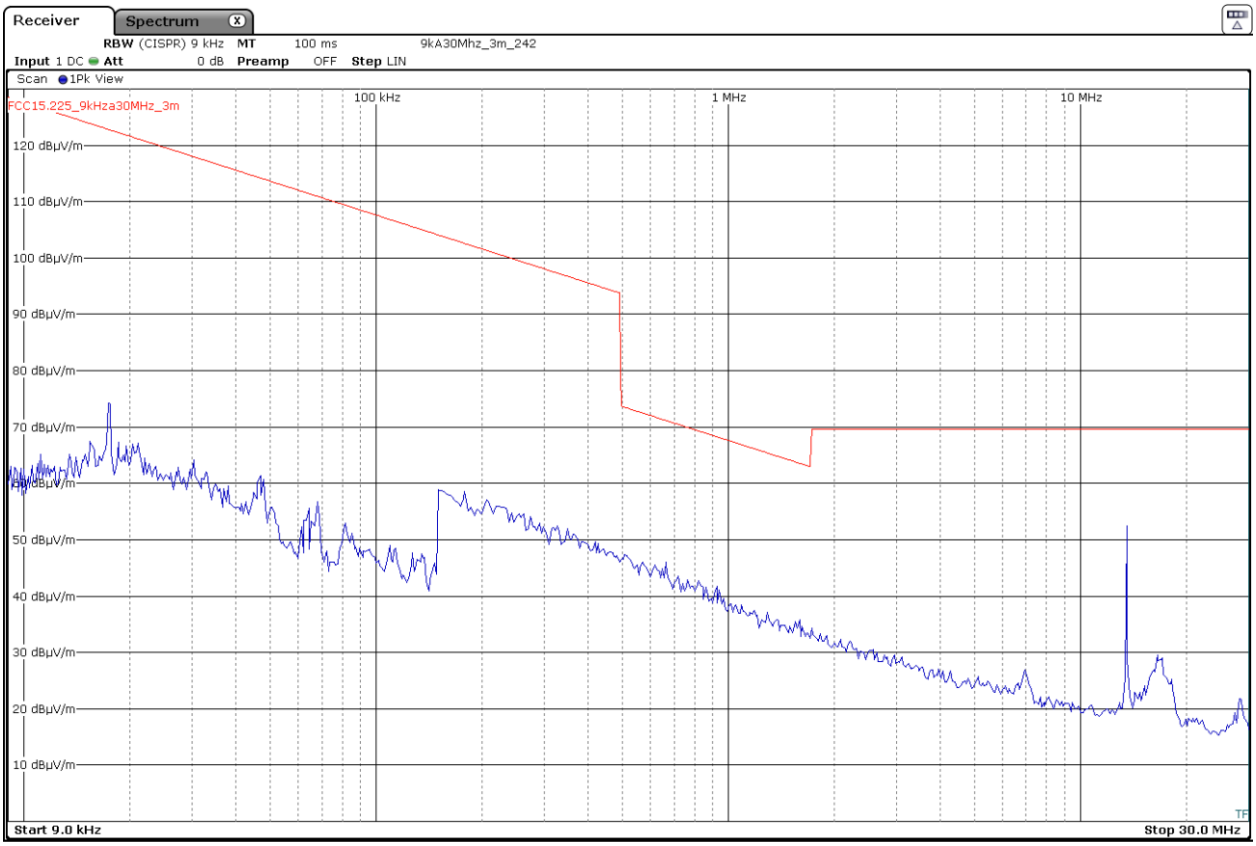
No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 40 GHz

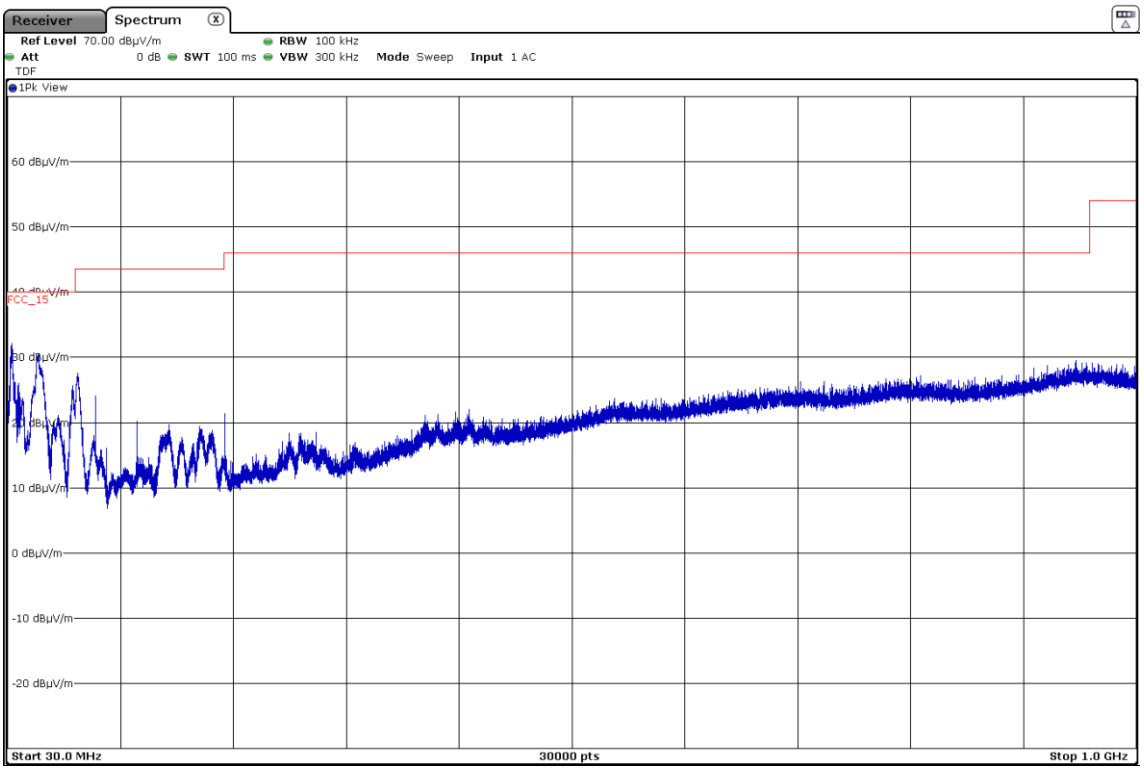
No spurious frequencies at less than 20 dB below the limit.

Verdict: PASS

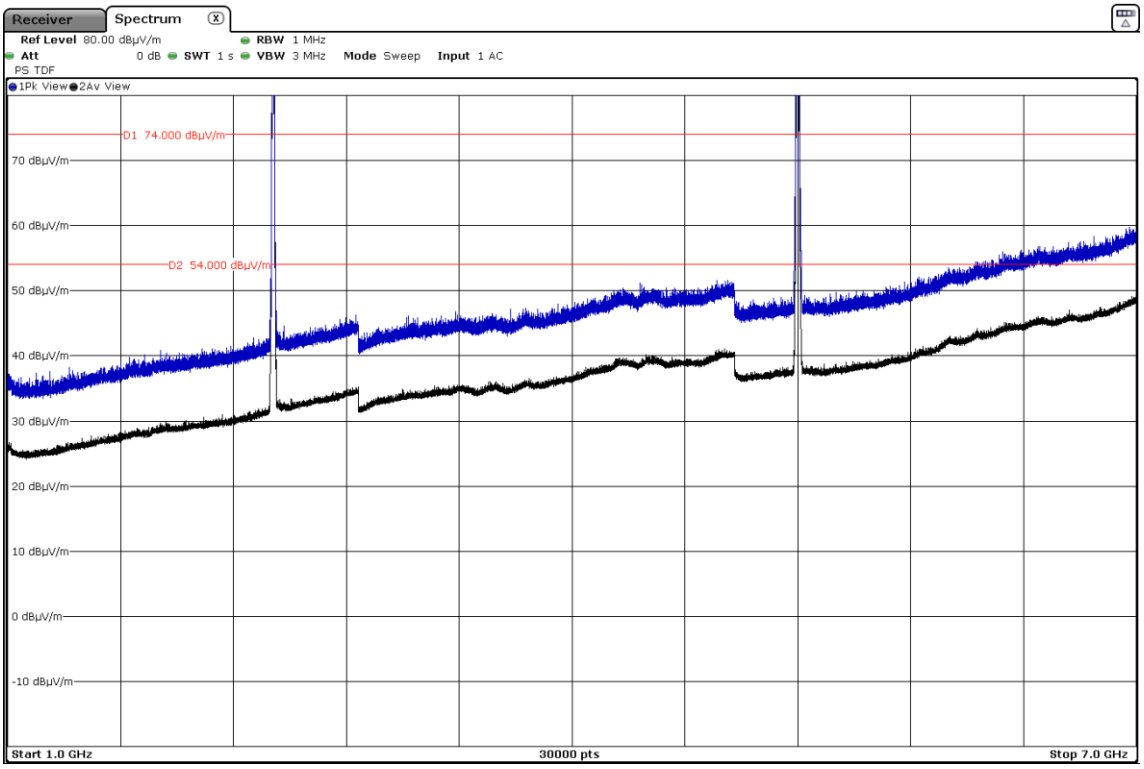
FREQUENCY RANGE 9 KHz - 30 MHz



FREQUENCY RANGE 30 MHz - 1 GHz

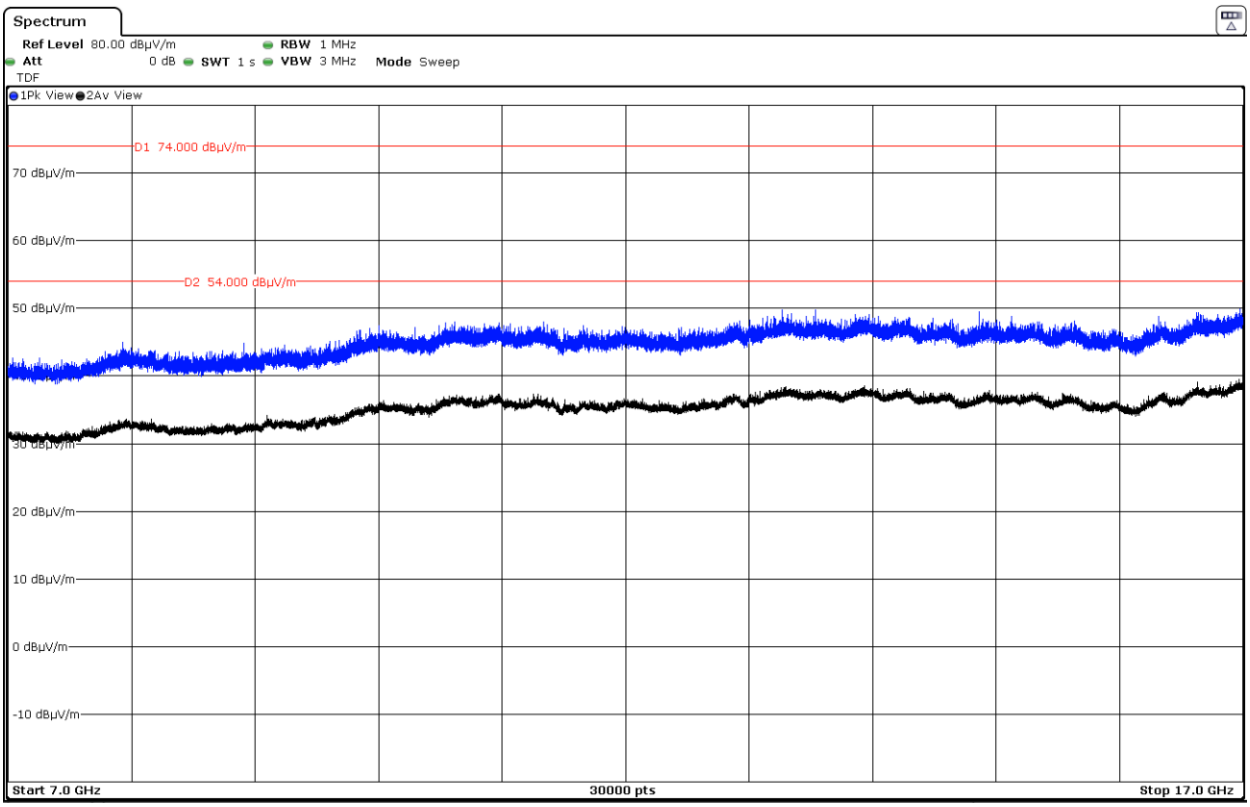


FREQUENCY RANGE 1 - 7 GHz

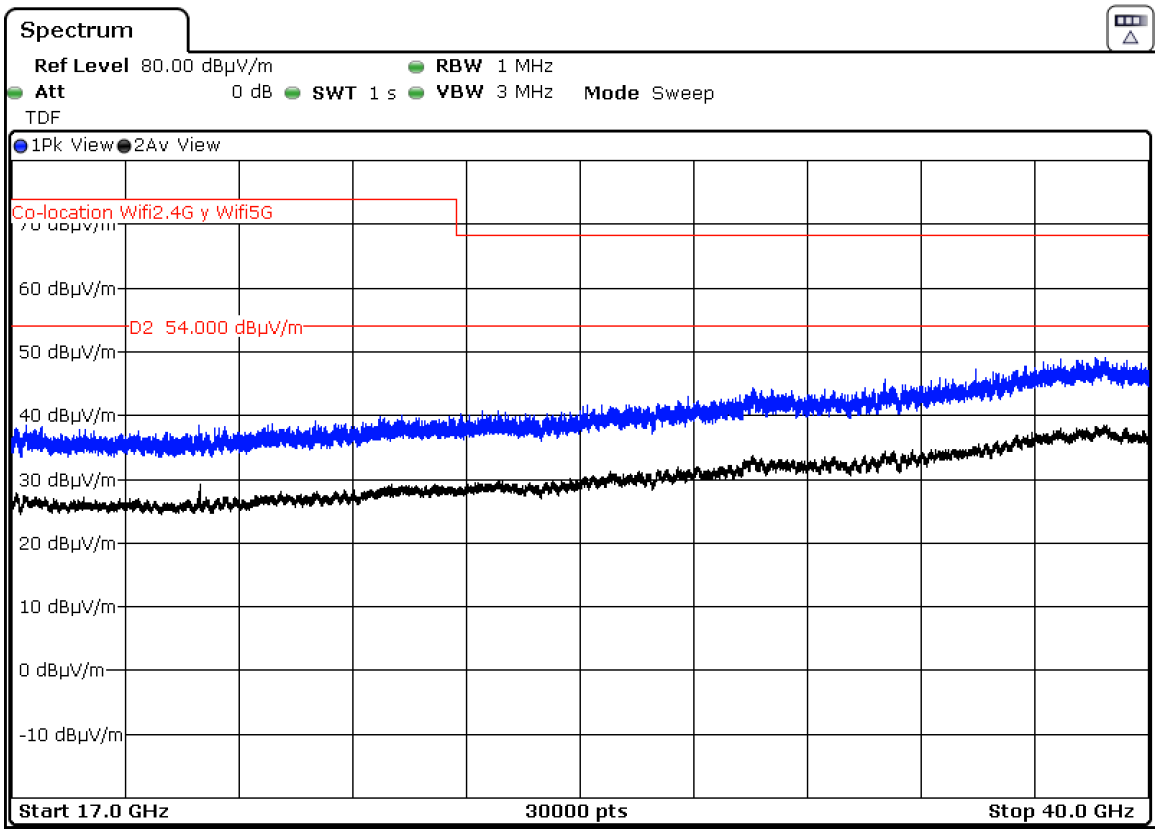


Note: The peaks shown in the plot above the limit are the carrier frequencies.

FREQUENCY RANGE 7 - 17 GHz



FREQUENCY RANGE 17 - 40 GHz



- **Mode NFC B, Bluetooth Basic Rate, 802.11a.**

NFC ISO 14443B:	106Kbps (13.56 MHz).
Bluetooth Basic Rate:	1-DH5 (2480 MHz).
802.11a:	6Mbps, 20MHz, SISO, Port 0 (5200 MHz).

Frequency range 9 KHz - 30 MHz

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

No spurious frequencies at less than 20 dB below the limit.

Frequency range 30 MHz - 1 GHz

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

Spurious frequencies at less than 20 dB below the limit:

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Limit (dBµV/m)	Measurement Uncertainty (dB)
33.379	V	Quasi-Peak	29.3	40	± 3.88

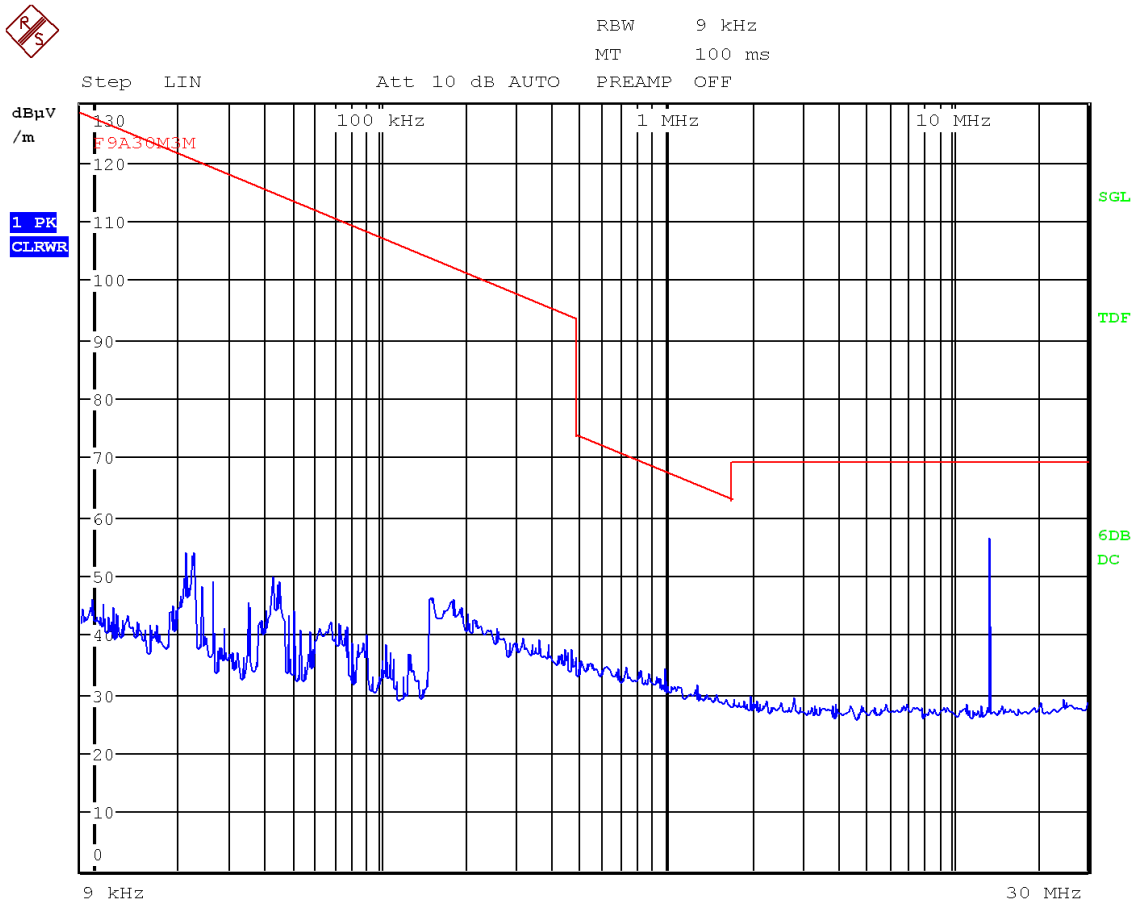
Frequency range 1 - 40 GHz

Spurious frequencies at less than 20 dB below the limit:

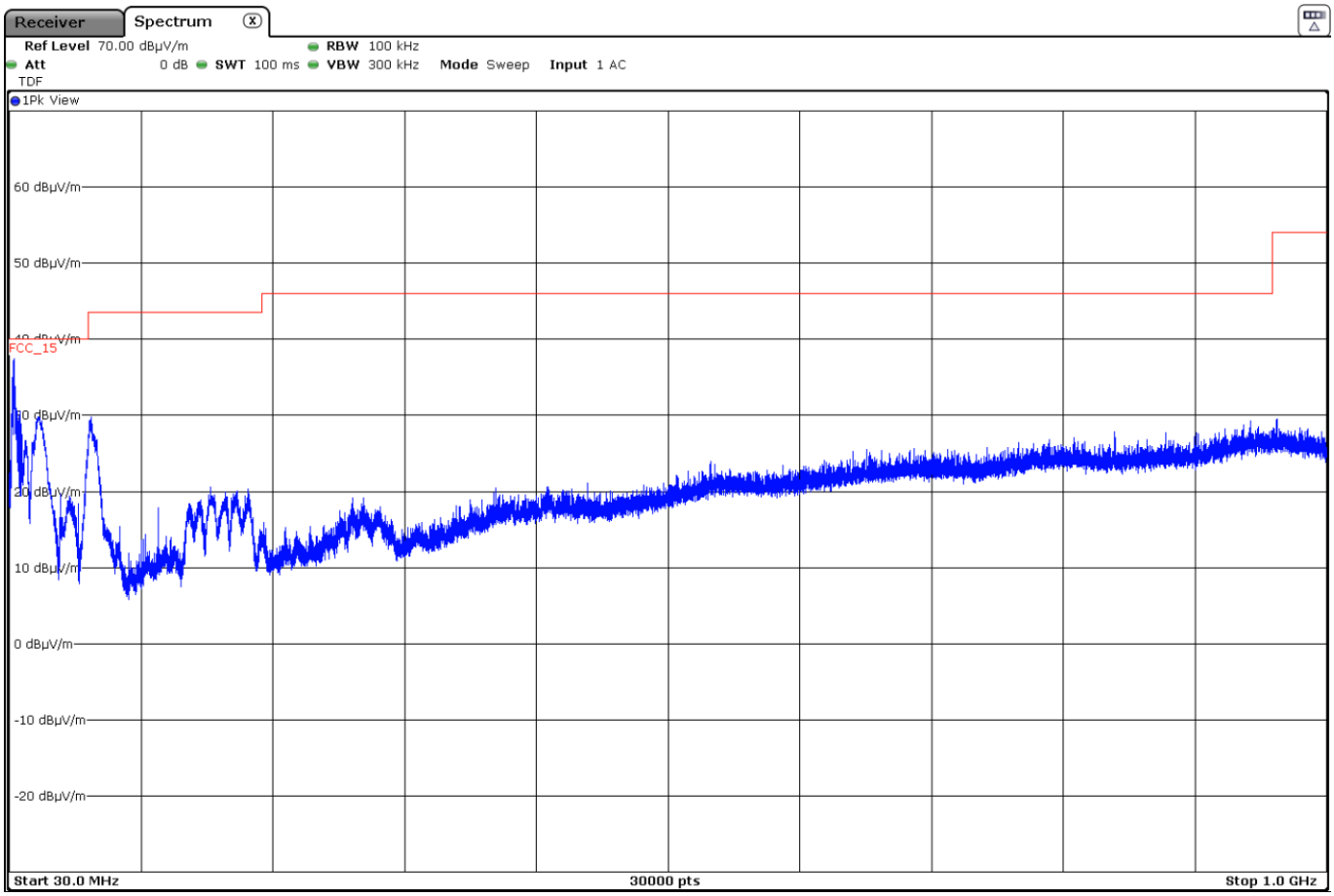
Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBµV/m)	Limit (dBµV/m)	Measurement Uncertainty (dB)
6.93312	H	Peak	45.69	74	± 3.88

Verdict: PASS

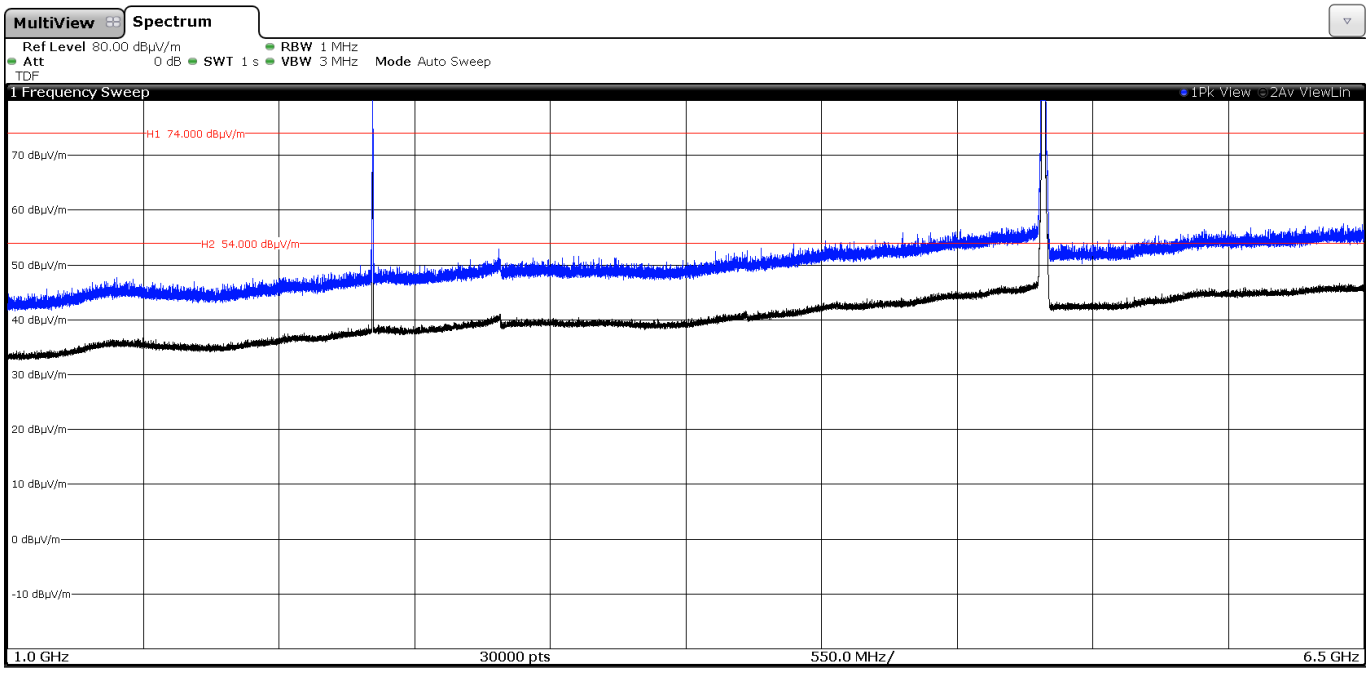
FREQUENCY RANGE 9 KHz - 30 MHz



FREQUENCY RANGE 30 MHz - 1 GHz

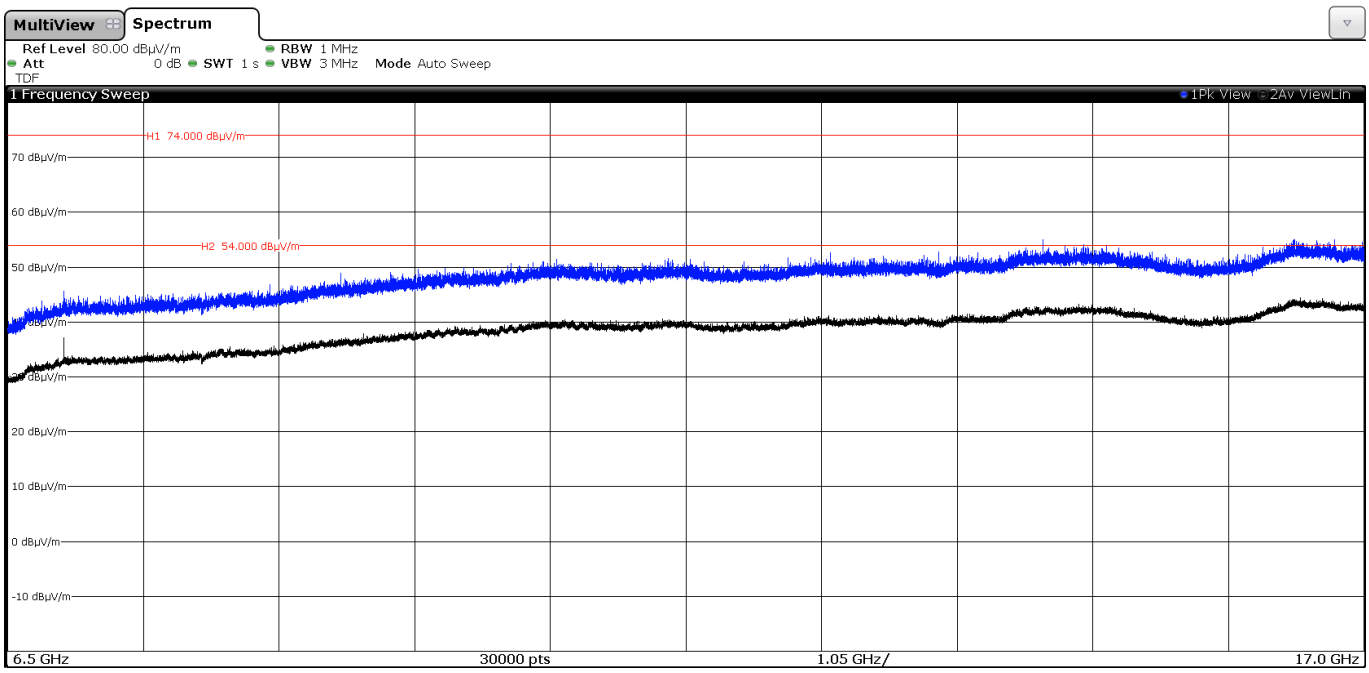
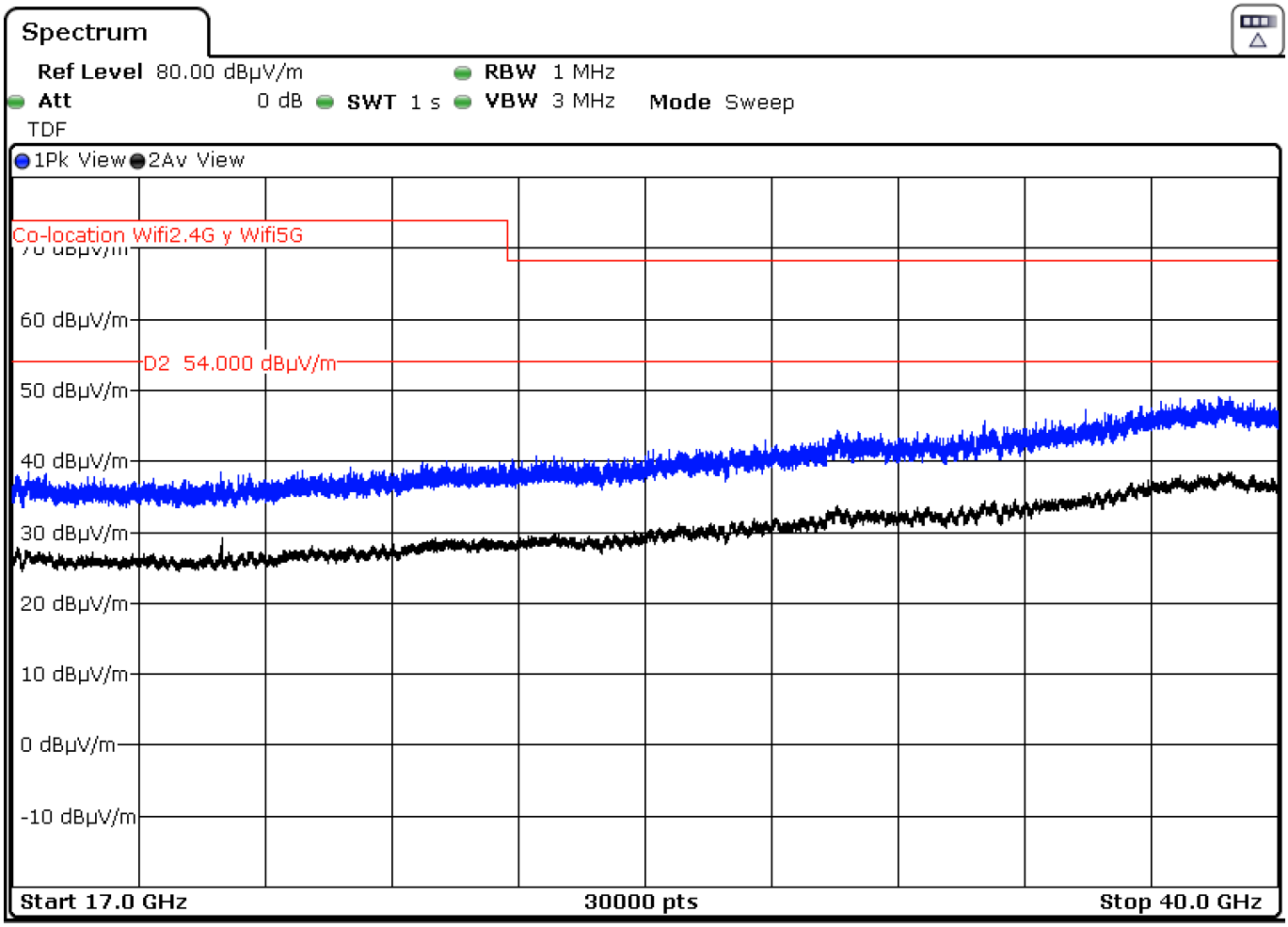


FREQUENCY RANGE 1 - 6.5 GHz



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

FREQUENCY RANGE 6.5 - 17 GHz



FREQUENCY RANGE 17 - 40 GHz