



ISED LISTED
REGISTRATION
NUMBER 4621A-4

Test report No:
NIE: 57720RRF.001

Test report

USA FCC Part 15.247, 15.209, 15.207

CANADA RSS-247, RSS-Gen

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

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	Martial arts wearable tracker
Trademark	Kick-AI
Model and /or type reference	Kick sensor
Other identification of the product	FCC ID: 2AQTI-KICKAI IC: 24196-KICKAI HW Version: 1.0 SW Version: 1.0
Features	Accelerometer/gyroscope sensor, BT 5.0.
Applicant	Kick AI Ltd Oy Mikonkatu 17 A, 00100 Helsinki, Finland
Test method requested, standard	USA FCC Part 15.247 10-1-17 Edition: Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 10-1-17 Edition: Radiated emission limits; general requirements. USA FCC Part 15.207 10-1-17 Edition: Conducted emission limits. CANADA RSS-247 Issue 2 (February 2017). CANADA RSS-Gen Issue 5 (April 2018). 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. 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	2019-03-21
Report template No	FDT08_21

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Competences and guarantees

DEKRA Testing and Certification S.A.U. 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 S.A.U. 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 S.A.U. has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification S.A.U. 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 S.A.U. at the time of performance of the test.

DEKRA Testing and Certification S.A.U. 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.
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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 a Martial arts wearable tracker.

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
57720B/007	Martial arts wearable tracker	Kick sensor	--	2018/10/03

Sample S/01 has undergone the following test(s): All CONDUCTED tests indicated in Appendixes A, B.

- Sample S/02 is composed of the following elements:

Control N°	Description	Model	Serial N°	Reception
57720B/014	Martial arts wearable tracker	Kick sensor	--	2018/11/05

Sample S/02 has undergone the following test(s): All RADIATED tests indicated in Appendixes A, B.

Sample S/03 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
57720B/001	Martial arts wearable tracker	Kick sensor	---	2018-08-27

Auxiliary elements used with the sample S/03:

Control N°	Description	Model	Serial N°	Date of reception
---	USB Cable	---	---	---
57720B/004	AC/DC Adaptor	CEUL502100	--	2018-08-27

Sample S/03 has undergone the following test(s): Conducted emissions tests indicated in Appendix C.

Test sample description

Ports..... :	Port name and description	Cable				
		Specified max length [m]	Attached during test	Shielded	Coupled to patient ⁽³⁾	
			☐	☐	☐	
Supplementary information to the ports..... :						
Rated power supply	Voltage and Frequency		Reference poles			
			L1	L2	L3	N
	☒	DC: 3,7 V battery				
	☒	DC: 5,0 V USB				
Rated Power						
Clock frequencies	32 MHz, 32.768 KHz					
Other parameters..... :						
Software version	1.0					
Hardware version..... :	1.0					
Dimensions in cm (W x H x D)..... :	2,3 cm x 0,6 cm x 1,7 cm					
Mounting position..... :	☒	Other: Angle wearable equipment.				
Modules/parts	Module/parts of test item		Type		Manufacturer	
Accessories (not part of the test item)	Description		Type		Manufacturer	
	USB charger cable		Dual USB Micro		ETERENALS TAR TECH	
Documents as provided by the applicant..... :	Description		File name		Issue date	

⁽³⁾ Only for Medical Equipment

Identification of the client

Kick AI Ltd Oy
Mikonkatu 17 A, 00100 Helsinki, Finland

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2018-11-14
Date (finish)	2019-03-19

Document history

Report number	Date	Description
57720RRF.001	2019-03-21	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 %
Shielding effectiveness	> 100 dB
Electric insulation	> 10 k Ω
Reference resistance to earth	< 1 Ω

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 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 k Ω
Reference resistance to earth	< 1 Ω
Normal site attenuation (NSA)	< ± 4 dB at 10 m distance between item under test and receiver antenna, (30 MHz to 1000 MHz)
Field homogeneity	More than 75% of illuminated surface is between 0 and 6 dB (26 MHz to 1000 MHz).

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 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω

Remarks and comments

The tests have been performed by the technical personnel: José Alberto Aranda, Ignacio Cabra, Miguel Ángel Torres and Jorge Mora.

Used instrumentation:

Conducted RF Measurements:

	Last Calibration	Due Calibration
1. Spectrum Analyzer PSA 3Hz-26.5 GHz AGILENT TECHNOLOGIES E4440A	2017/10	2019/10
2. DC Power Supply 40V/40A Rohde & Schwarz NGPE40	2018/02	2021/02

Radiated RF Measurements:

	Last Calibration	Due Calibration
1. Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N.A.	N.A.
2. EMI Test Receiver ROHDE AND SCHWARZ ESR7	2017/08	2019/08
3. RF Pre-amplifier, 38 dB, 30 MHz-6 GHz BONN ELEKTRONIK BLNA 0360-01N	2018/07	2019/07
4. Biconical/Log Antenna 30 MHz-6 GHz ETS LINDGREN 3142E	2018/07	2021/07
5. Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV 40	2018/02	2020/02
6. Pre-amplifier G>30dB, 1-18GHz BONN ELEKTRONIK BLMA 0118-3A	2018/03	2019/03
7. Broadband Horn antenna 1-18GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2018/01	2021/01
8. Broadband Horn antenna 18-40 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9170	2018/07	2021/07

Conducted emissions Measurements:

CONTROL NUMBER	DESCRIPTION	MANUFACTURER	MODEL	LAST CALIBRATION	NEXT CALIBRATION
4526	EMI TEST Receiver	ROHDE & SCHWARZ	ESU26	2018-02-21	2020-02-21
4522	EMC measurement software	ROHDE & SCHWARZ	EMC32 V9.01	---	---
1650	Artificial network	SCHWARZBECK	NNLK8121	2017-09-20	2019-09-20

Testing verdicts

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

Summary

FCC PART 15 PARAGRAPH			
Requirement – Test case		Verdict	Remark
Section 15.247 Subclause (a) (2) / RSS-247 5.2. (a)	6 dB Bandwidth	P	
Section 15.247 Subclause (b) / RSS-247 5.4. (d)	Maximum output power and antenna gain	P	
Section 15.247 Subclause (d) / RSS-247 5.5	Emission limitations conducted (Transmitter)	P	
Section 15.247 Subclause (d) / RSS-247 5.5.	Band-edge emissions compliance (Transmitter)	P	
Section 15.247 Subclause (e) / RSS-247 5.2. (b)	Power spectral density	P	
Section 15.247 Subclause (d) / RSS-247 5.5.	Emission limitations radiated (Transmitter)	P	
Section 15.207 / RSS-Gen 8.8.	Conducted limits	P	
<u>Supplementary information and remarks:</u>			
None.			

Appendix A: Test results. Bluetooth Low Energy 5.0 2M

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TEST CONDITIONS

POWER SUPPLY (V):

V nominal: 5 Vdc / 3.7 Vdc
Type of power supply: 5 Vdc from USB / 3.7 Vdc from battery.
Type of Antenna: PulseLarsen Antenna W3008C Ceramic Chip Antenna.
Declared maximum antenna Gain: 2.2 dBi (peak).

TEST FREQUENCIES:

Low Channel: 2402 MHz
Middle Channel: 2440 MHz
High Channel: 2480 MHz

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is directly connected to the spectrum analyzer.



RADIATED MEASUREMENTS

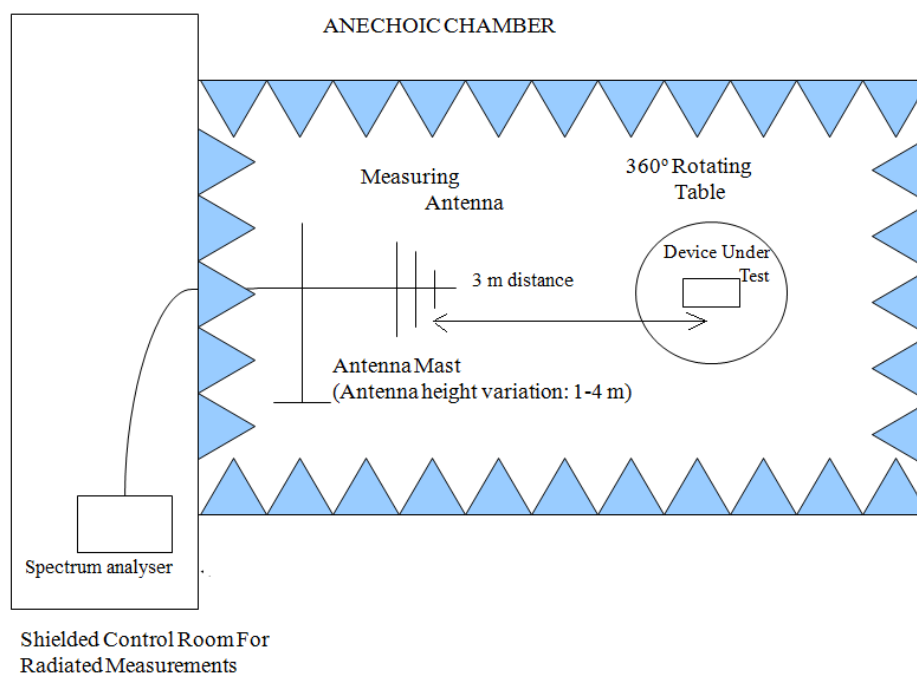
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz) is situated at a distance of 3 m and at a distance of 1m for the frequency range 1 GHz-26 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

For radiated emissions in the range 1 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

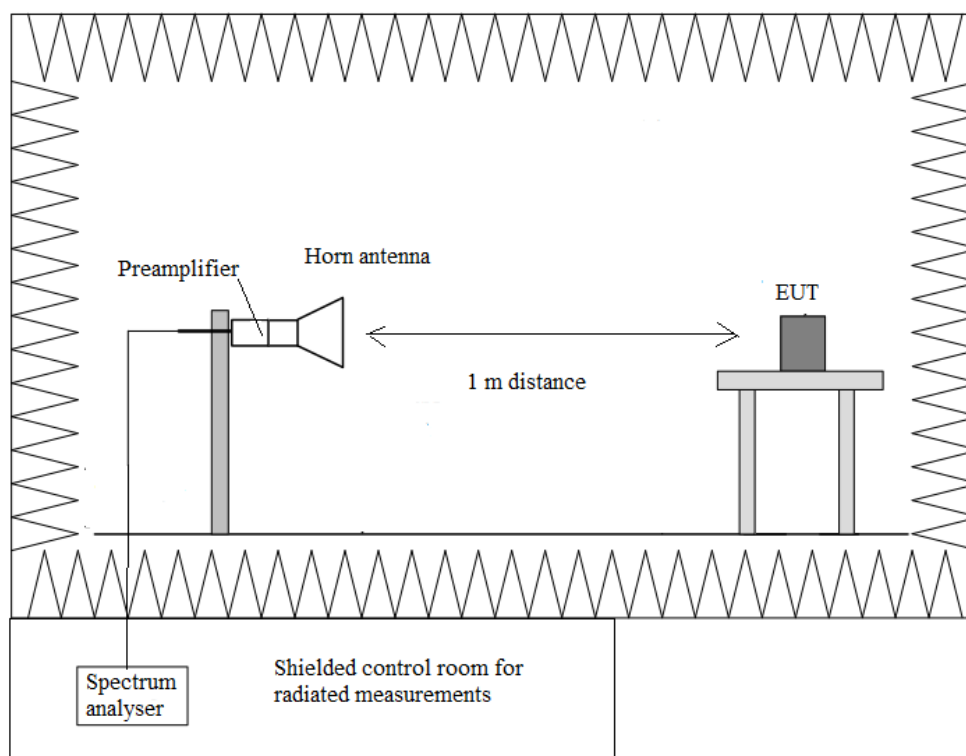
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find the maximum radiated emission.

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

Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup $f > 1$ GHz:

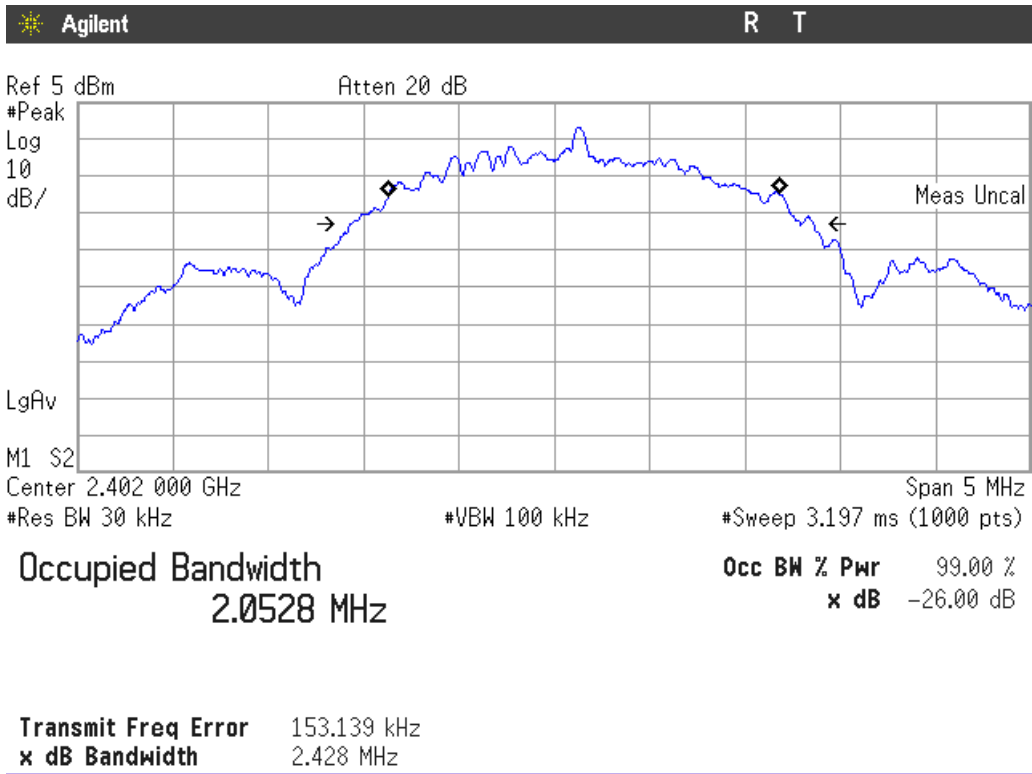


Occupied Bandwidth

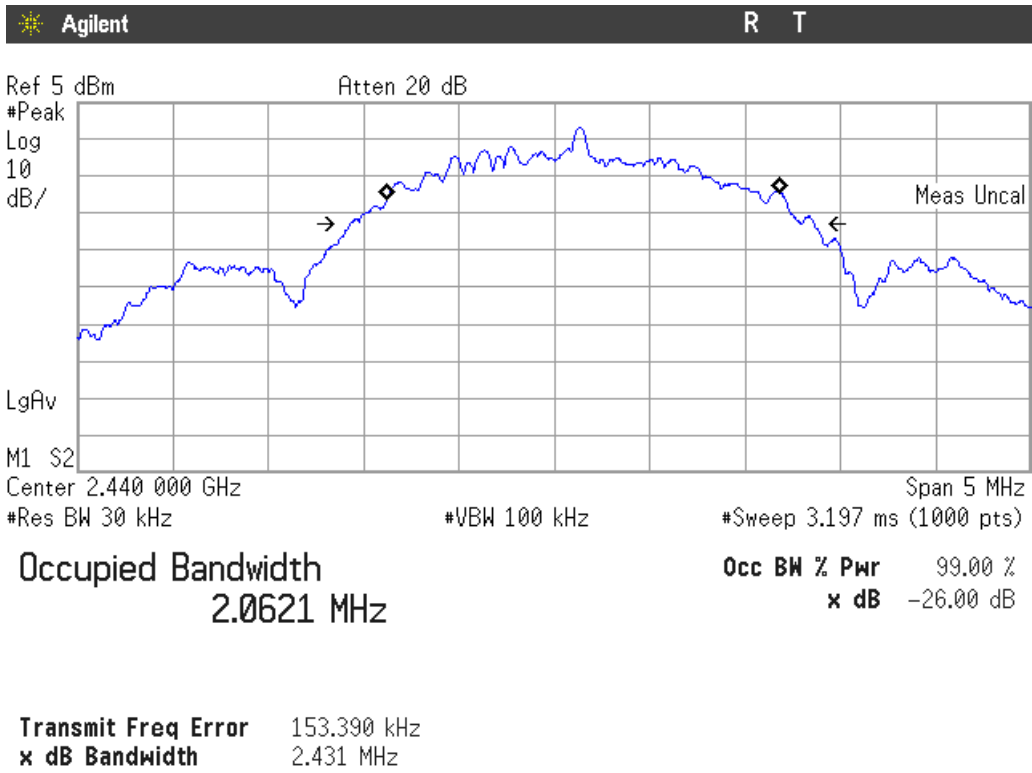
RESULTS:

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
99% bandwidth (MHz)	2.0528	2.0621	2.0606
Measurement uncertainty (kHz)	<± 5.00		

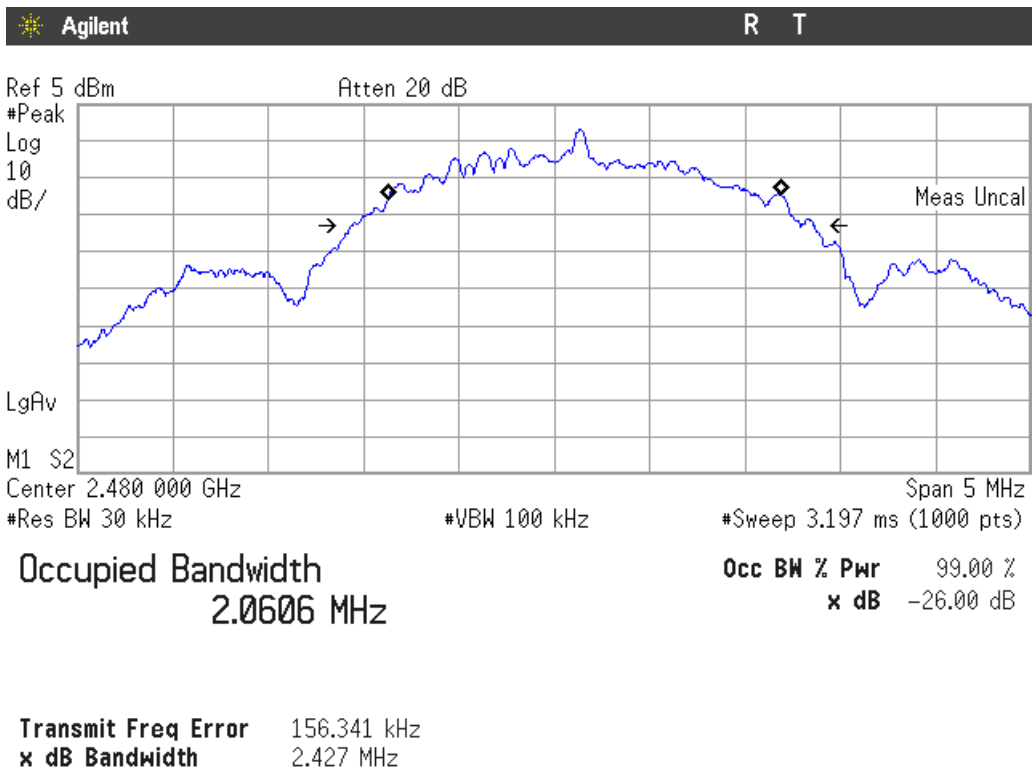
- Low Channel:



- Middle Channel:



- High Channel:



FCC Section 15.247 Subclause (a) (2) / RSS-247 Clause 5.2 (a) 6 dB Bandwidth.

SPECIFICATION:

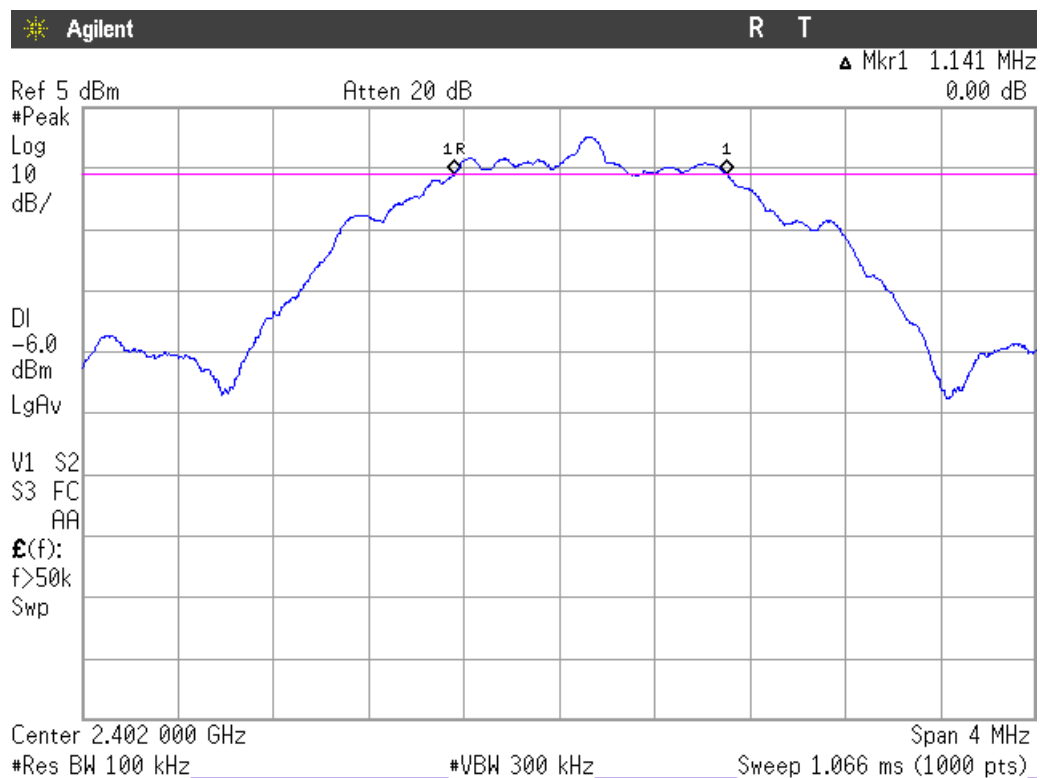
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS:

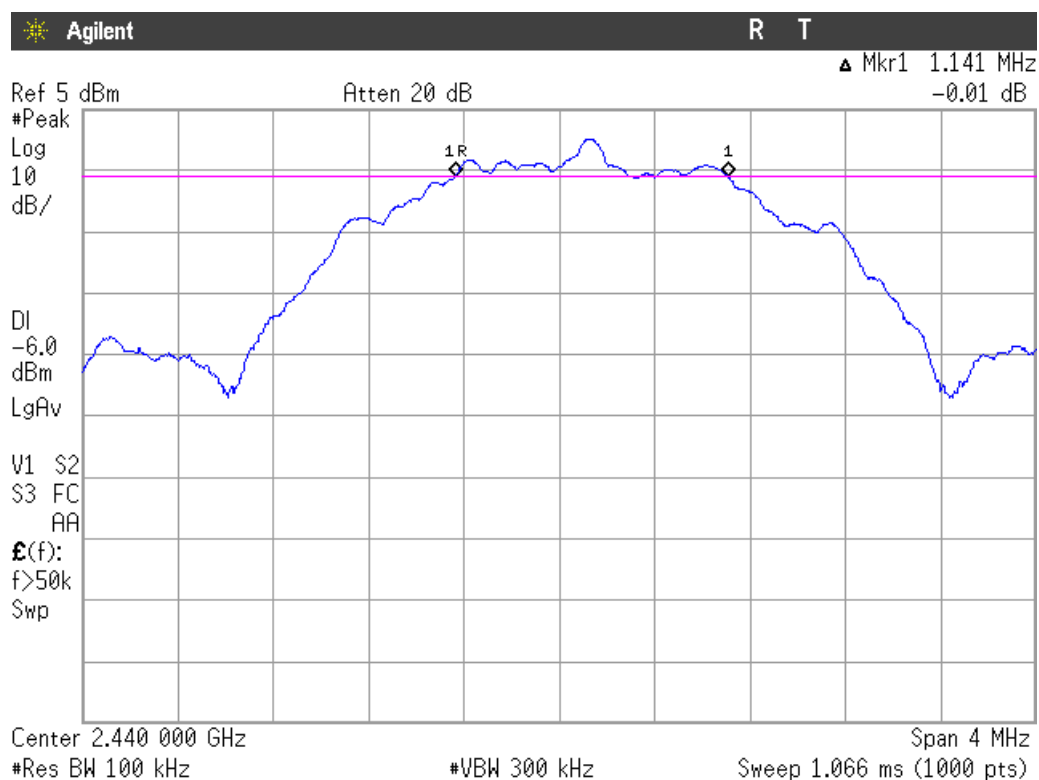
	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
6 dB Spectrum bandwidth (MHz)	1.141	1.141	1.149
Measurement uncertainty (kHz)	<±17.0		

Verdict: PASS

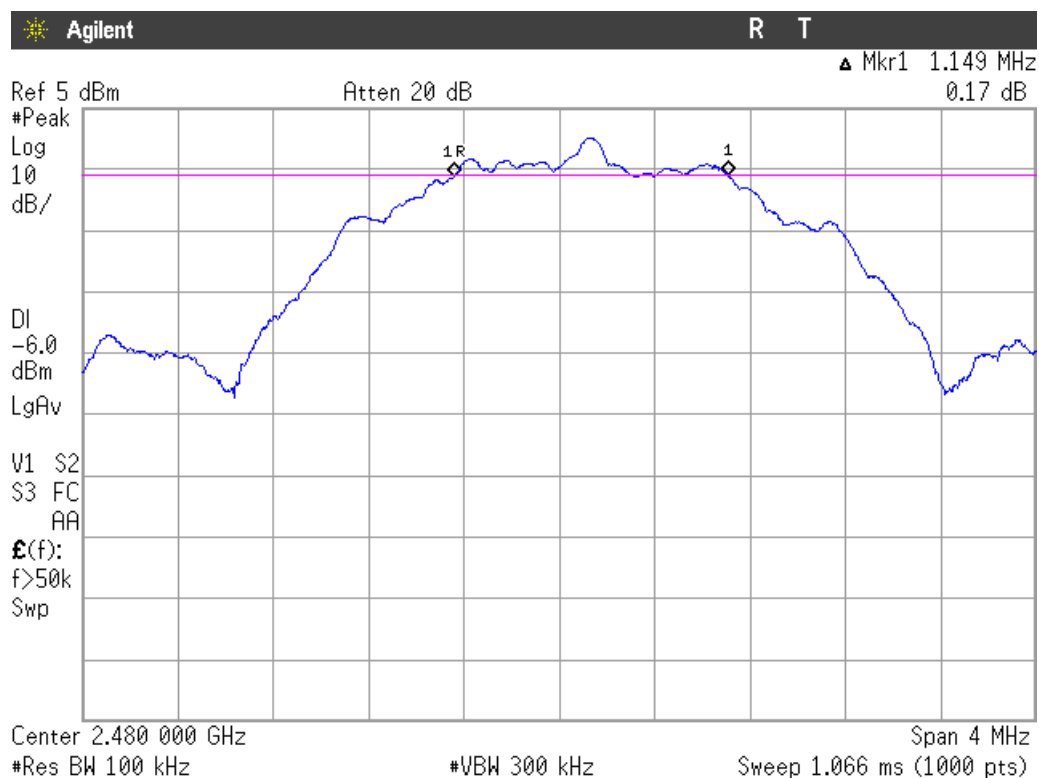
- Low Channel:



- Middle Channel:



- High Channel:



FCC Section 15.247 Subclause (b) / RSS-247 Clause 5.4 (d) Maximum output power and antenna gain

SPECIFICATION:

For systems using digital modulation in the 2400-2483.5 MHz band: 1 watt (30 dBm).

The e.i.r.p. shall not exceed 4 W (36 dBm) (Canada).

RESULTS:

The maximum peak conducted output power was measured using the method according to point 9.1.1. of Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under Section 15.247 558074 D01 DTS Meas Guidance v04 dated 04/05/2017.

The EIRP power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power.

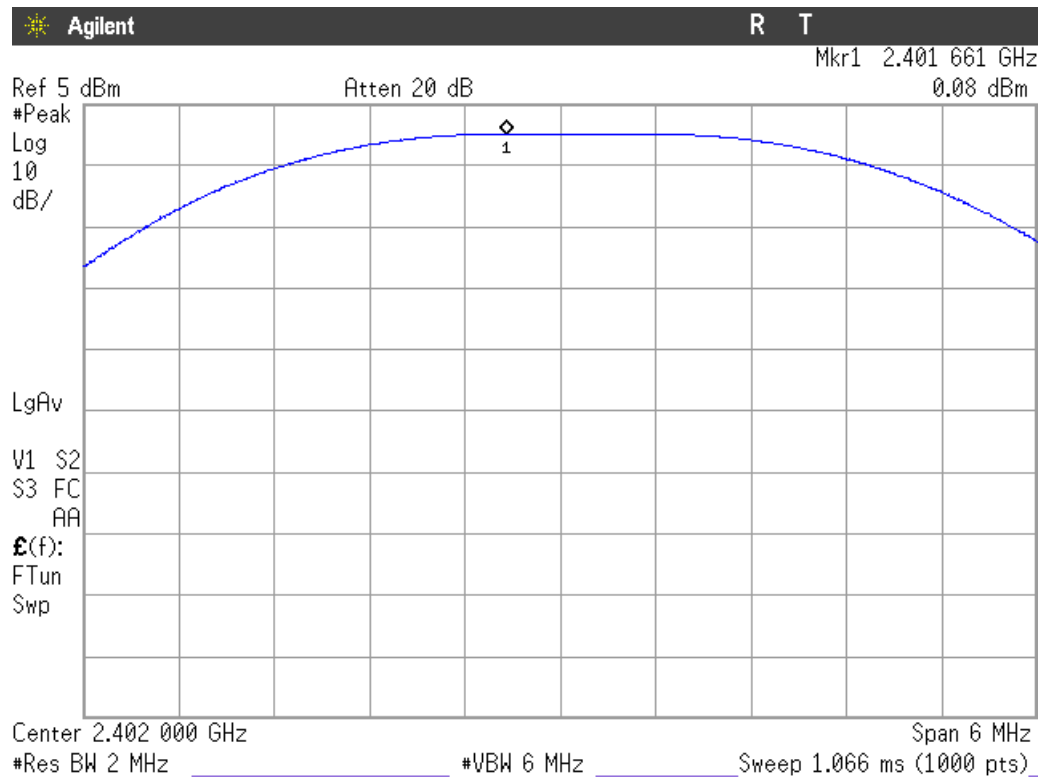
Maximum declared antenna gain: 2.2 dBi.

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Maximum Conducted Power (dBm)	0.08	0.08	0.06
Maximum EIRP Power (dBm)	2.28	2.28	2.26
Measurement uncertainty (dB)	<±0.78		

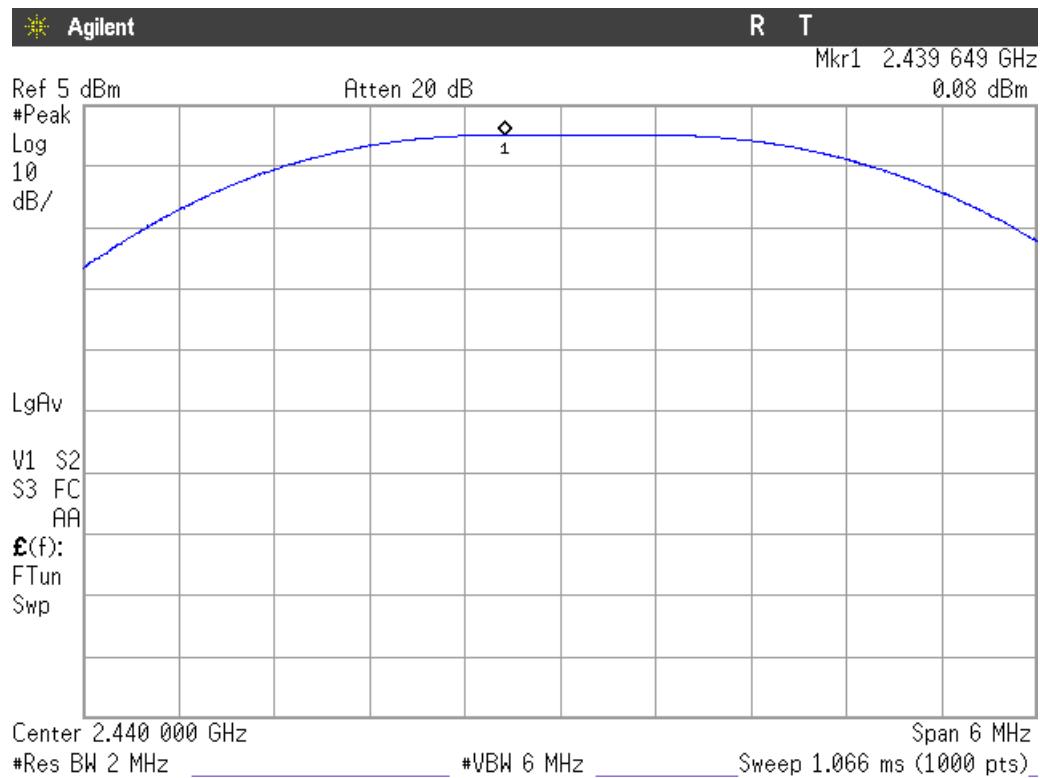
The maximum directional gain of the antenna is less than 6 dBi and therefore the maximum output power is not required to be reduced from the stated values.

Verdict: PASS

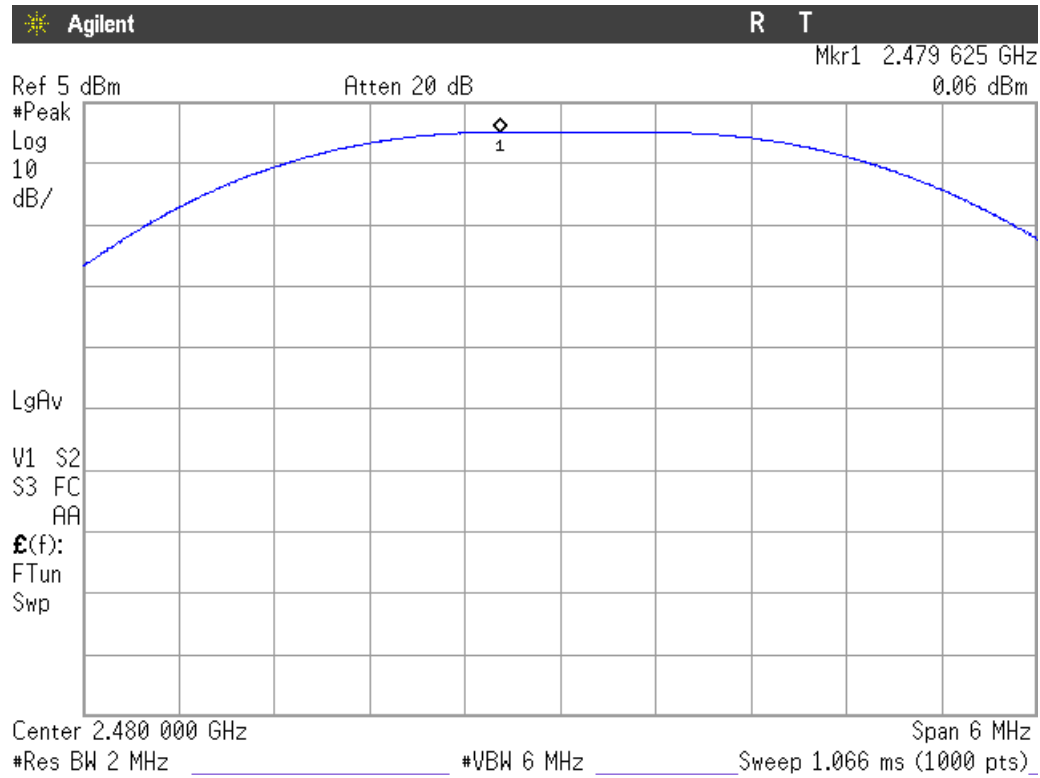
- Low Channel:



- Middle Channel:



- High Channel:



FCC Section 15.247 Subclause (d) / RSS-247 Clause 5.5. Emission limitations conducted (Transmitter)

SPECIFICATION:

In any 100 kHz bandwidths outside the frequency band in which the intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

RESULTS:

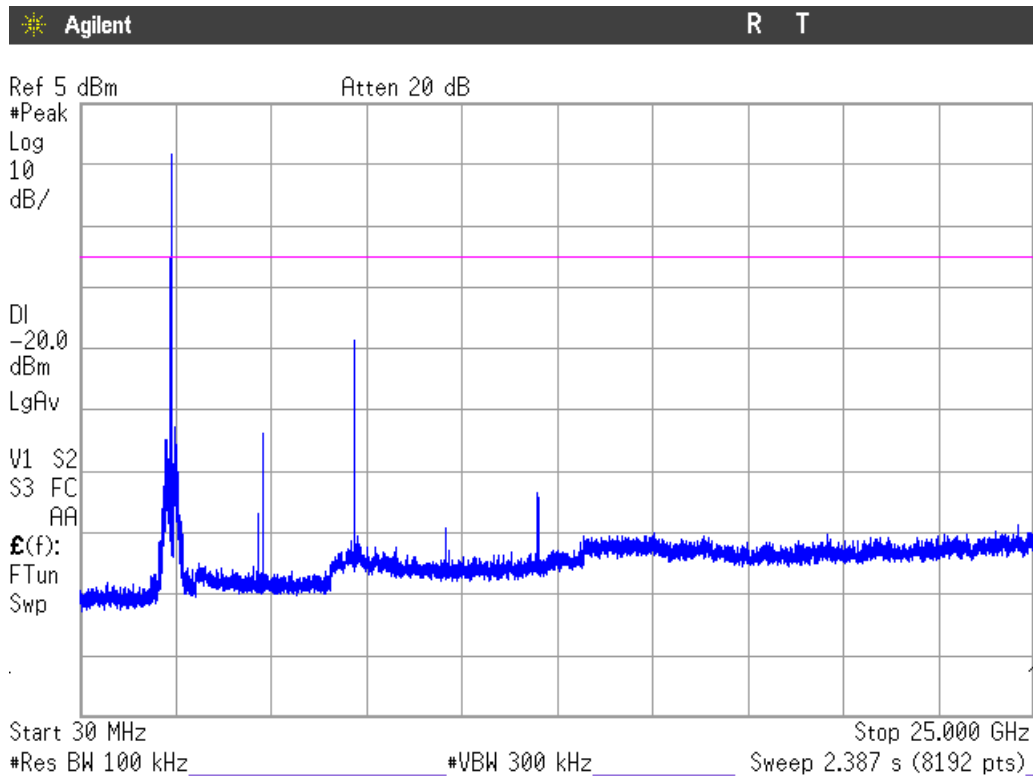
	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Reference Level Measurement (dBm)	0.03	0.04	0.02
Measurement uncertainty (dB)	<±0.78		

Spurious peaks at less than 20 dB below the limit:

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Spurious frequency (MHz)	7206	7319	7438
Emission level (dBm)	-33.69	-34.78	-33.49
Measurement uncertainty (dB)	<±2.03		

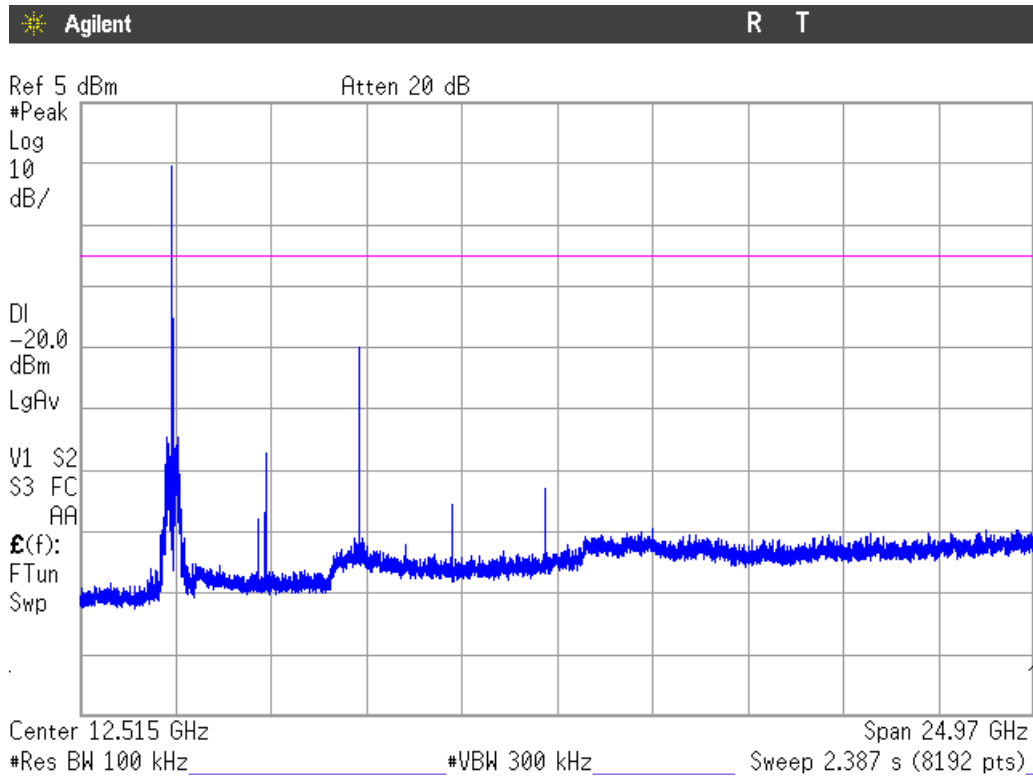
Verdict: PASS

- Low Channel:



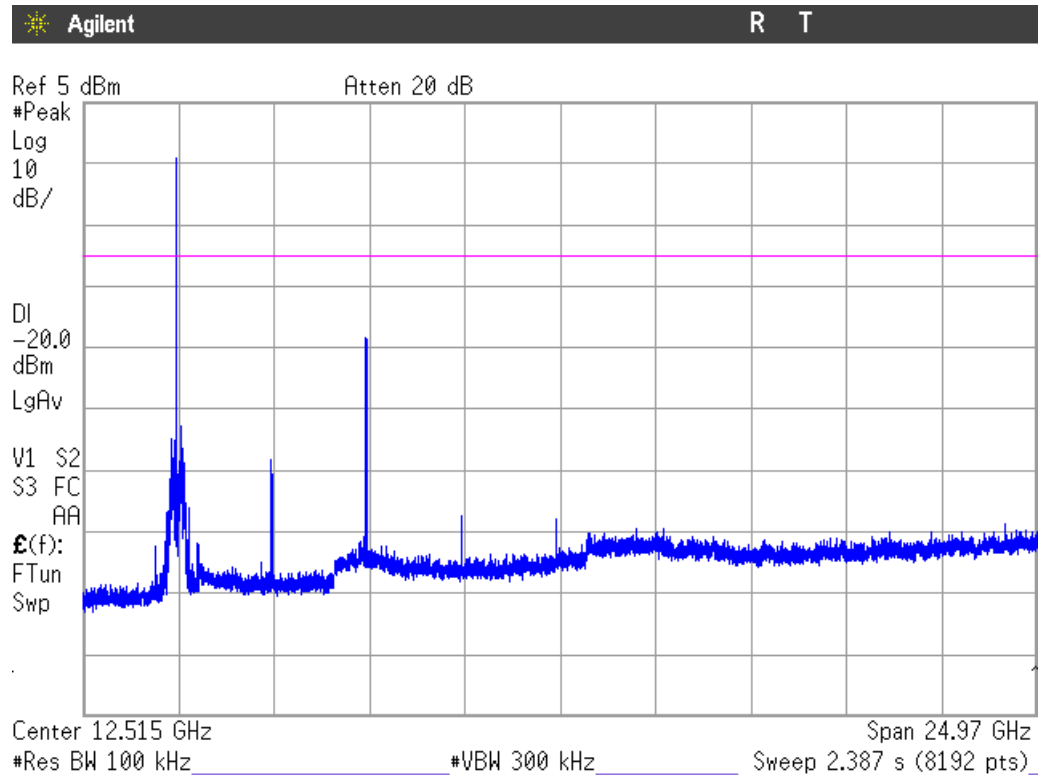
The peak shown in the plot above the limit is the carrier frequency.

- Middle Channel:



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

- High Channel:



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

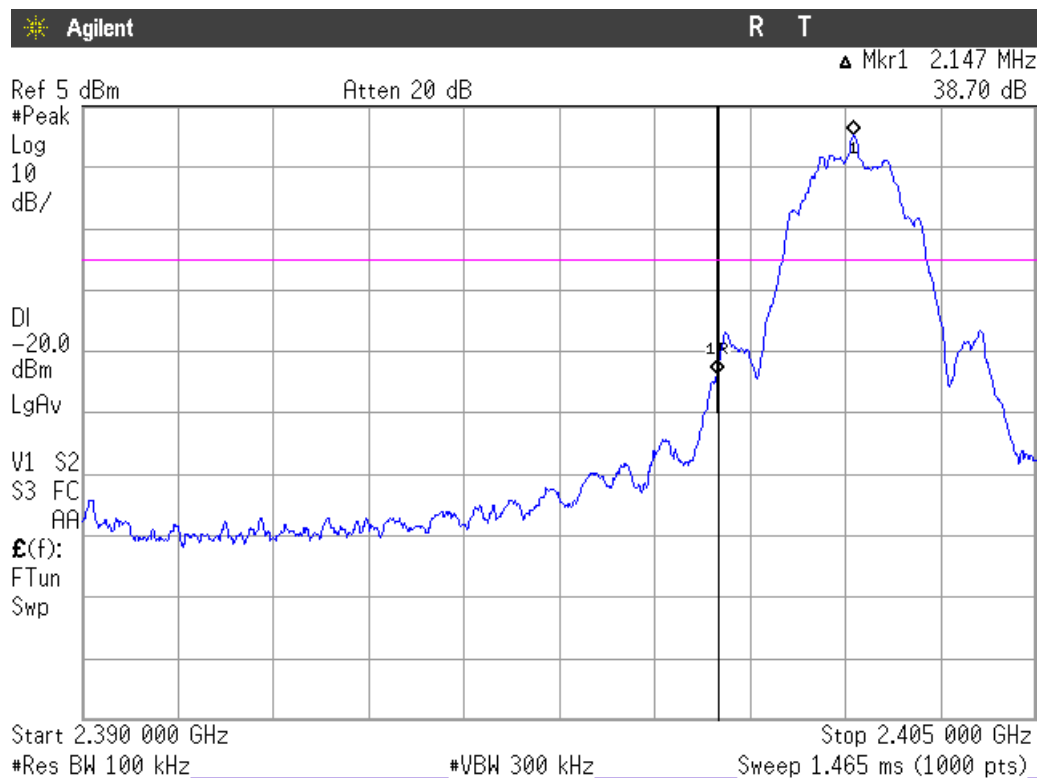
FCC Section 15.247 Subclause (d) / RSS-247 Clause 5.5. Band-edge emissions compliance (Transmitter)

SPECIFICATION:

In any 100 kHz bandwidths outside the frequency band in which the intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

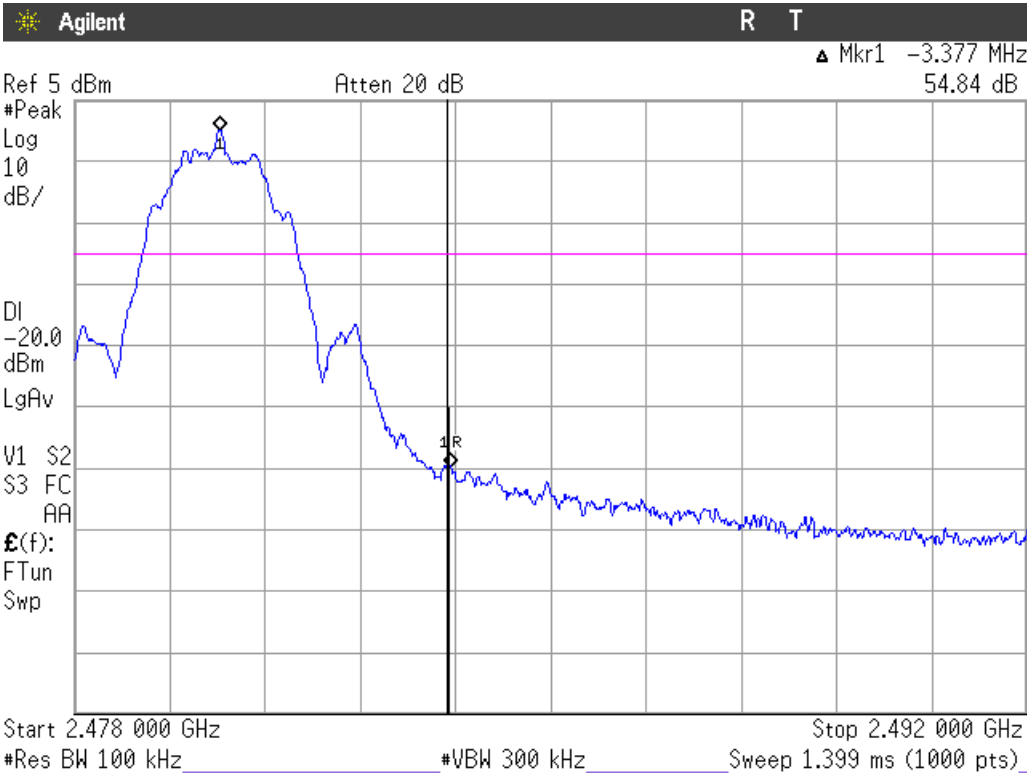
RESULTS:

- Low Channel:



Verdict: PASS

- High Channel:



Verdict: PASS

Measurement uncertainty (dB)	<±2.03
------------------------------	--------

FCC Section 15.247 Subclause (e) / RSS-247 5.2. (b) Power spectral density

SPECIFICATION:

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

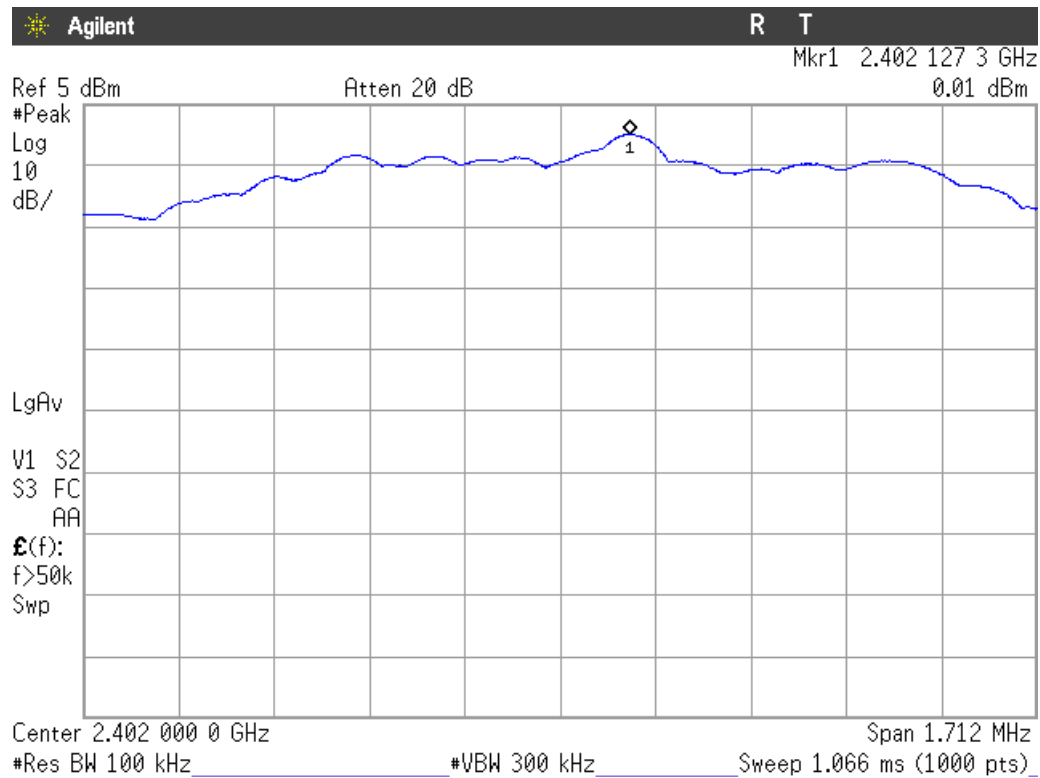
RESULTS:

The maximum power spectral density level in the fundamental emission was measured using the method PKPSD (Peak PSD) according to point 10.2. of Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under Section 15.247 558074 D01 DTS Meas Guidance v04 dated 04/05/2017.

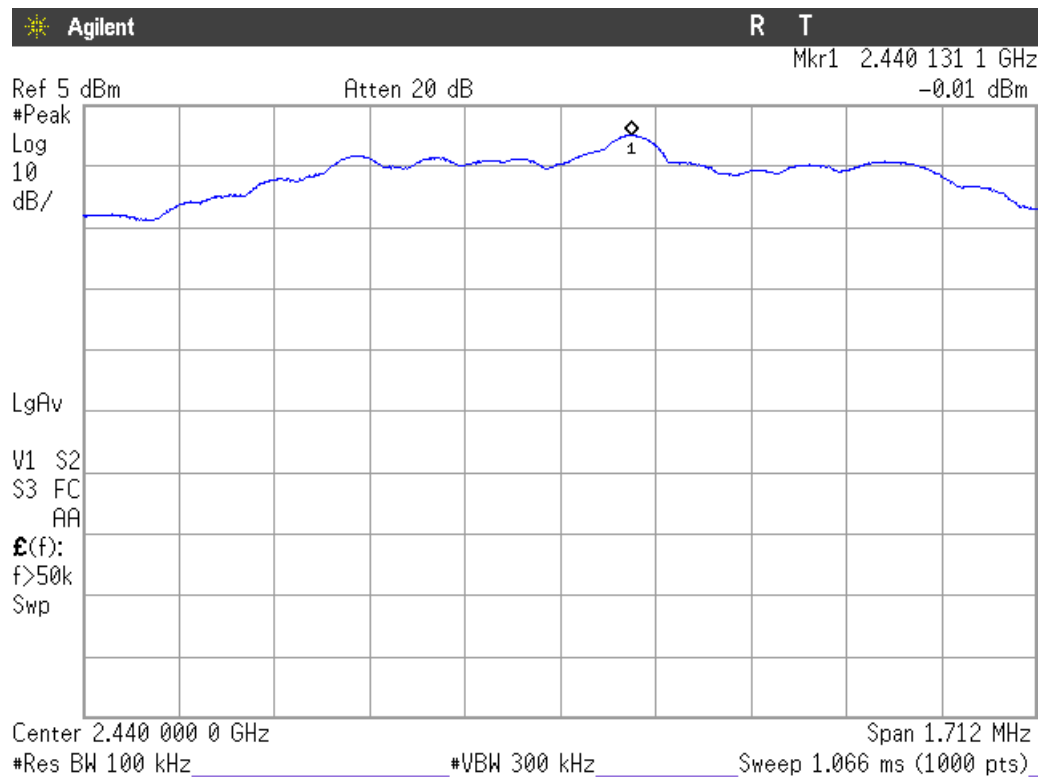
	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Power Spectral Density (dBm)	0.01	-0.01	-0.05
Measurement uncertainty (dB)	<±0.78		

Verdict: PASS

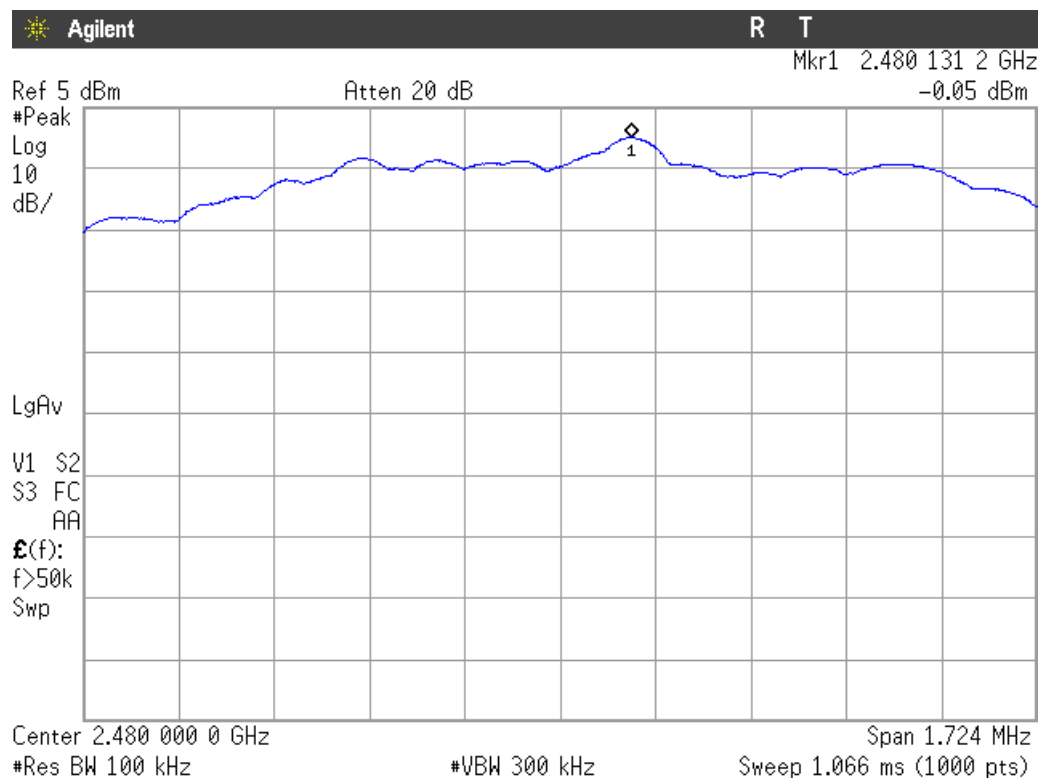
- Low Channel:



- Middle Channel:



- High Channel:



FCC Section 15.247 Subclause (d) / RSS-247 Clause 5.5. Emission limitations radiated (Transmitter)

SPECIFICATION:

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

Frequency Range (MHz)	Field strength ($\mu\text{V/m}$)	Field strength ($\text{dB}\mu\text{V/m}$)	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 - 10000	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 3 m for the frequency range 30 MHz-1000 MHz and at distance of 1m for the frequency range 1 GHz-26 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.

Frequency range 30 MHz - 1 GHz:

The spurious signals detected do not depend on the operating channel.

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

Frequency range 1 - 26 GHz:

The results in the next tables show the maximum measured levels in the 1-26 GHz range including the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

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

- LOW CHANNEL. Spurious signals closest to the limit:

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
7.20770	Peak	55.14	V	< $\pm$ 3.70
	Average	49.07		< $\pm$ 3.70

- MIDDLE CHANNEL. Spurious signals closest to the limit:

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
7.31877	Peak	54.37	V	< $\pm$ 3.70
	Average	48.90		< $\pm$ 3.70

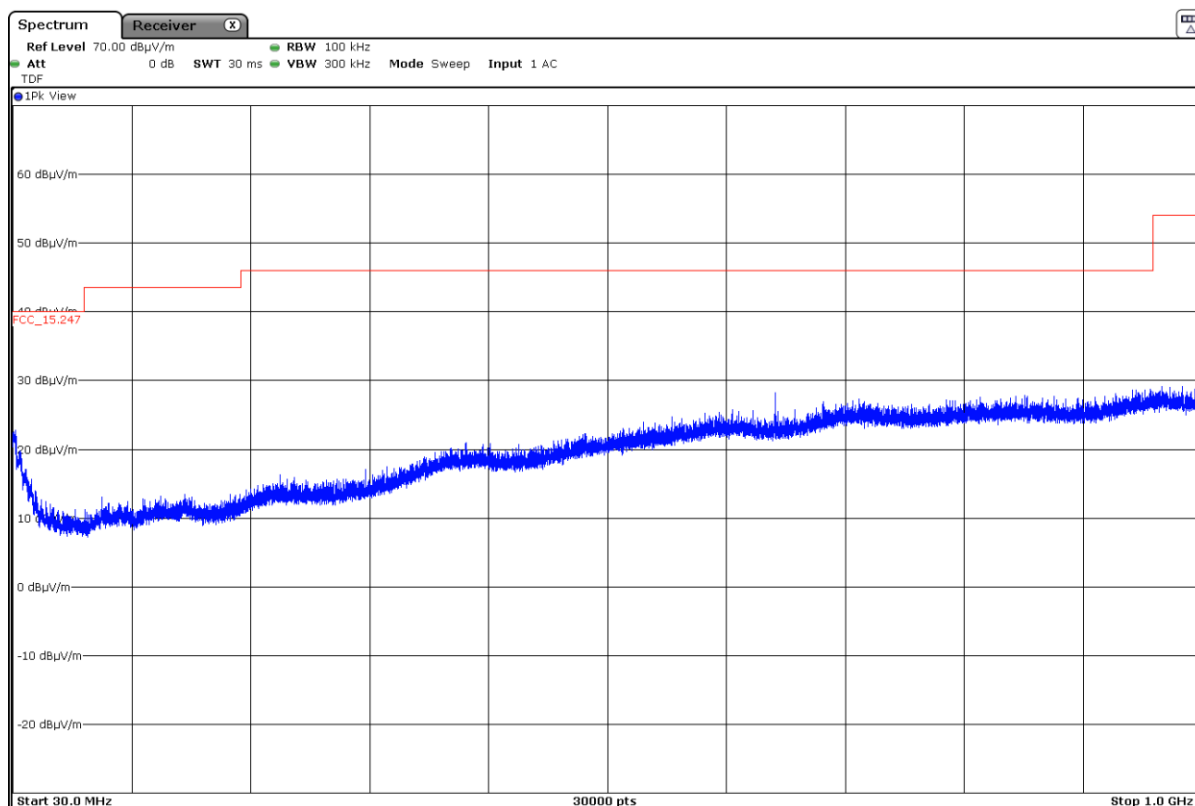
- HIGH CHANNEL. Spurious signals closest to the limit:

Spurious frequency (MHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
7.44150	Peak	52.68	V	< $\pm$ 3.70

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz:

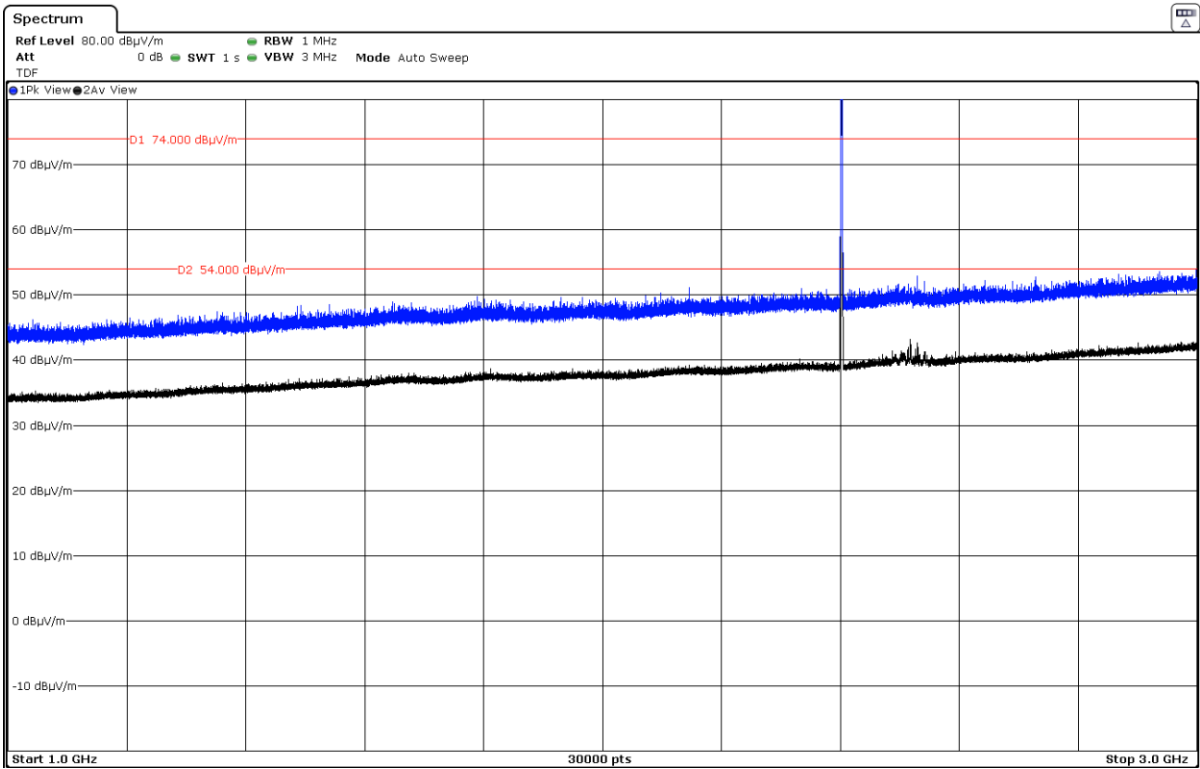
The spurious signals detected do not depend on the operating channel.



Note: This plot is valid for all three channels.

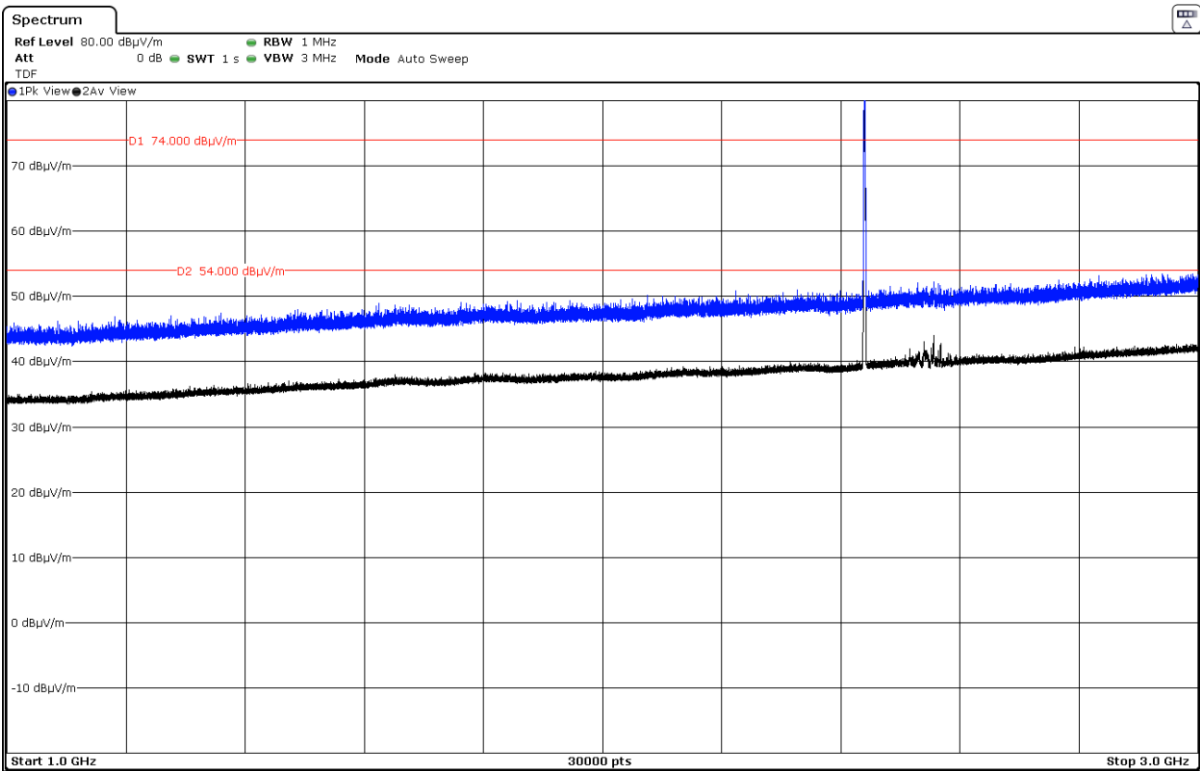
FREQUENCY RANGE 1 - 3 GHz:

- Low Channel:



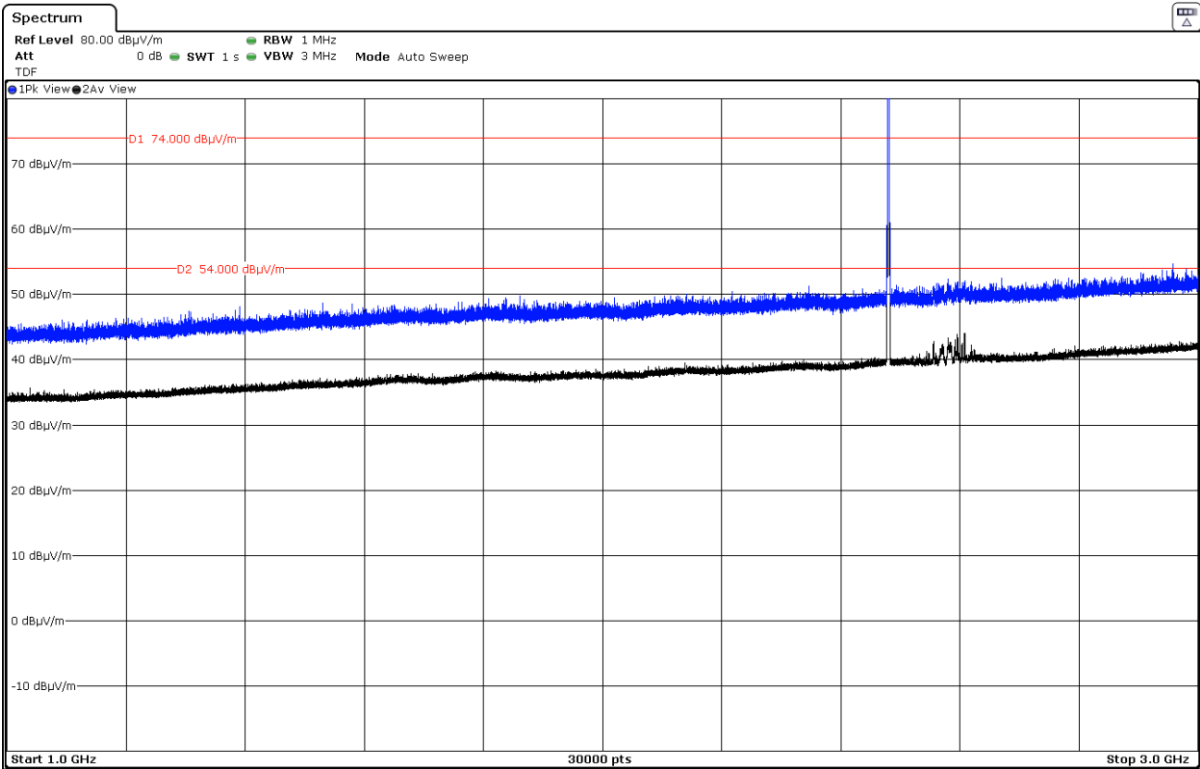
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

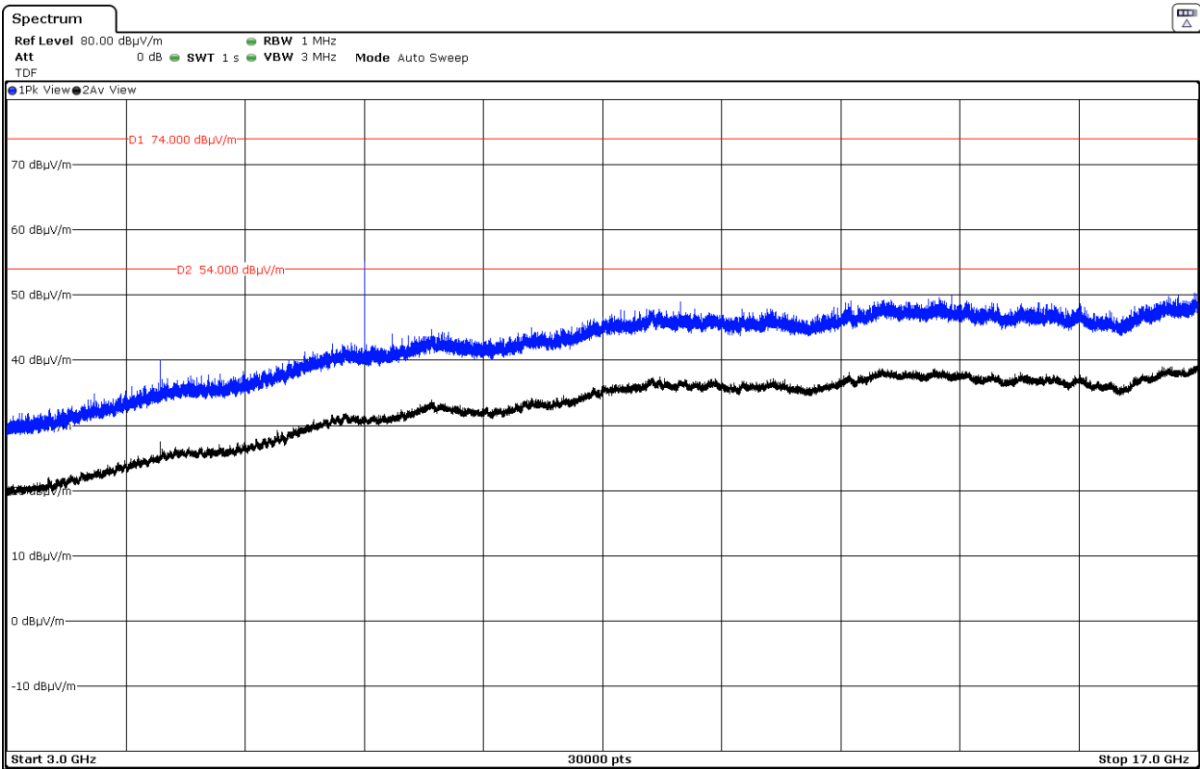
- High Channel:



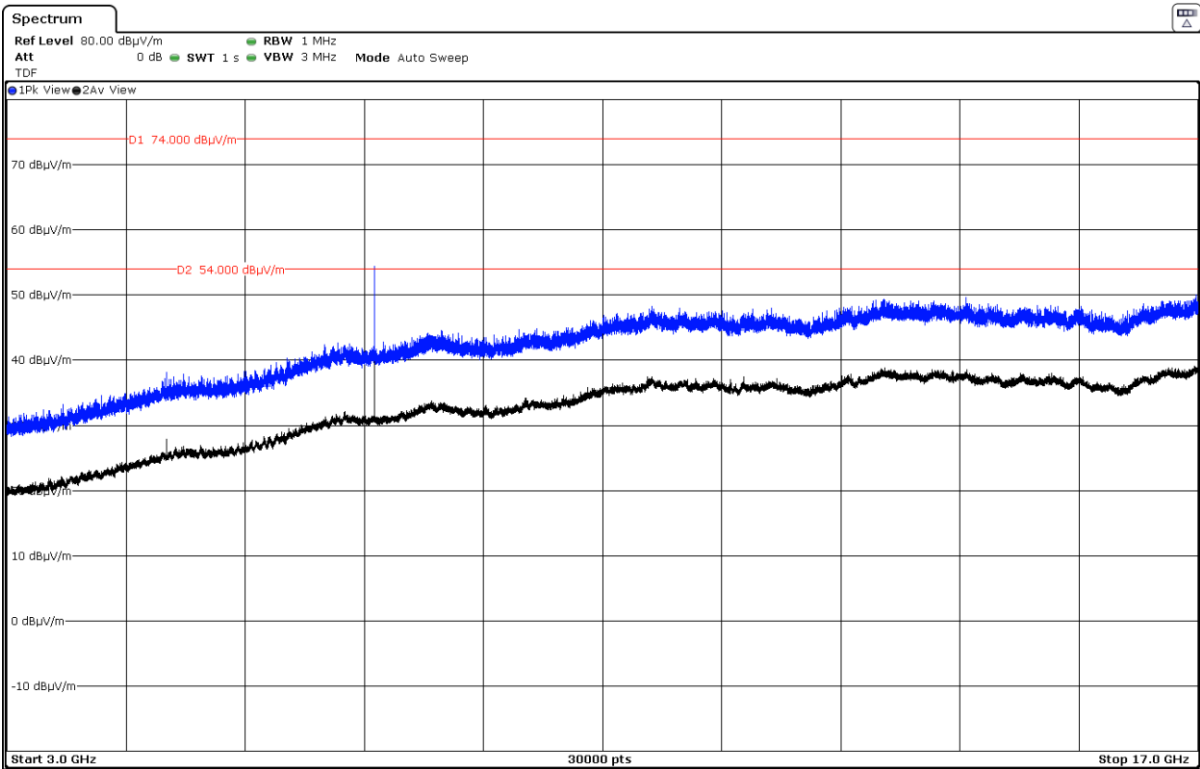
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 17 GHz:

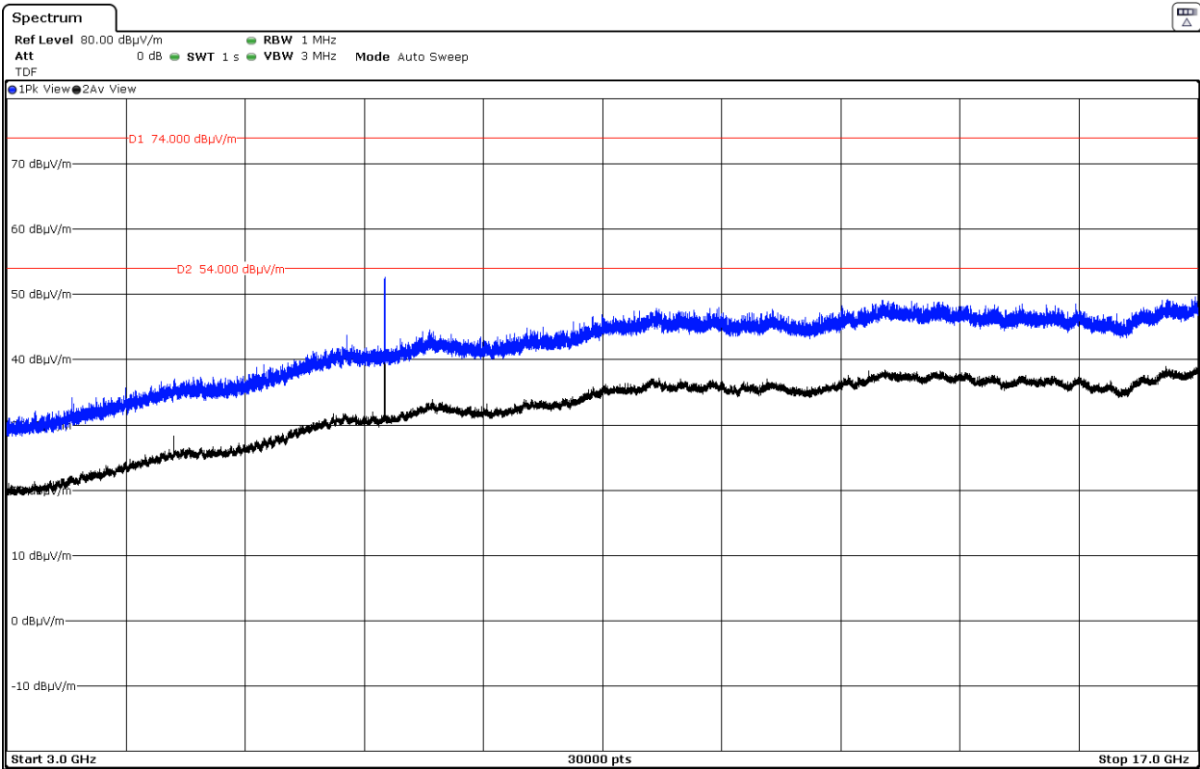
- Low Channel:



- Middle Channel:

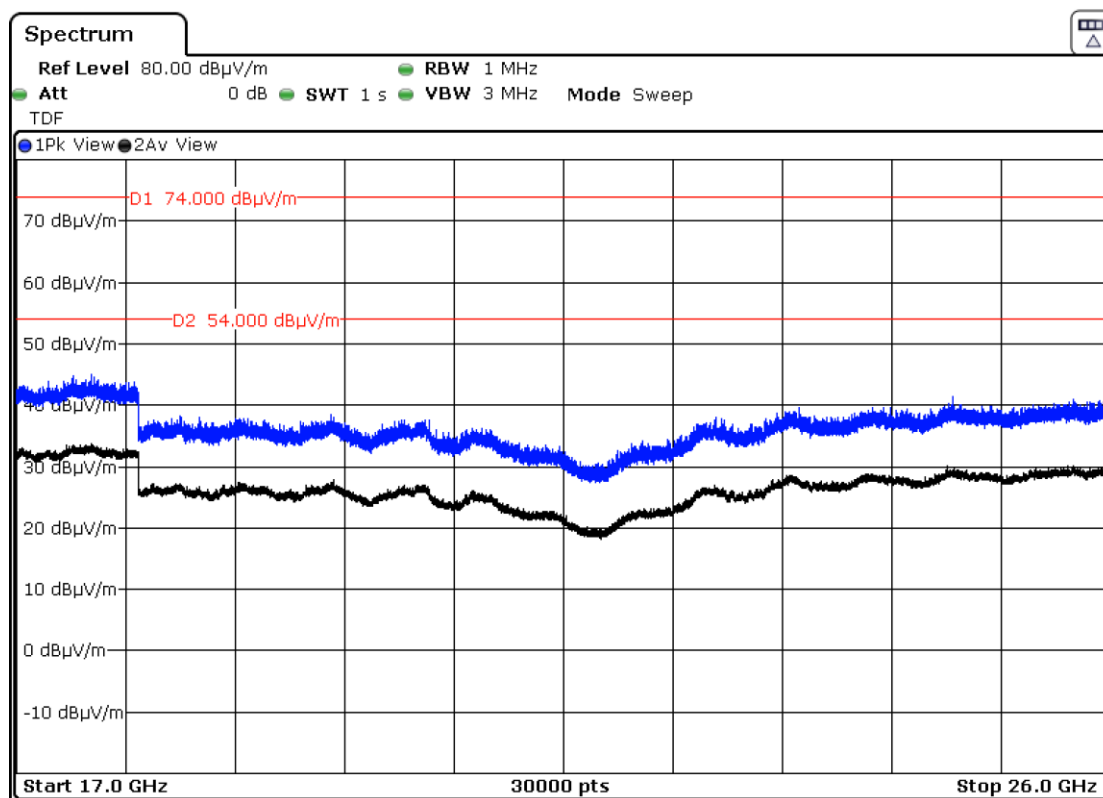


- High Channel:



FREQUENCY RANGE 17 - 26 GHz:

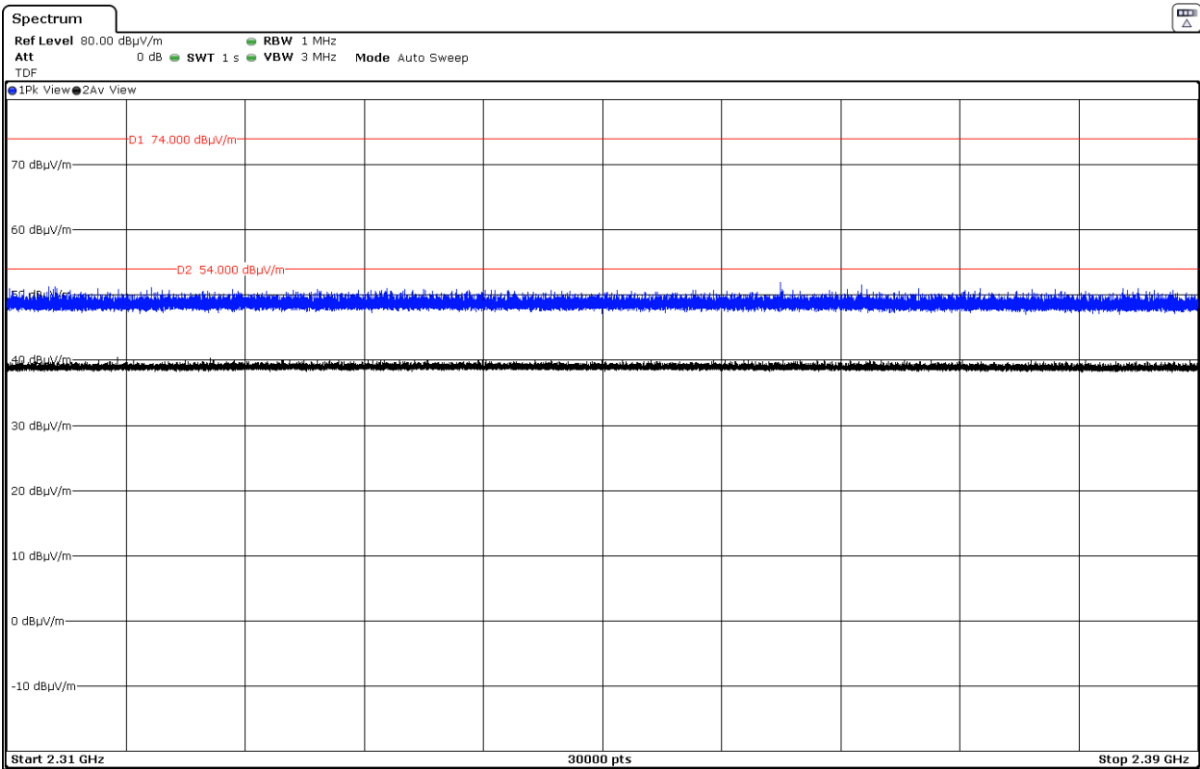
The spurious signals detected do not depend on the operating channel.



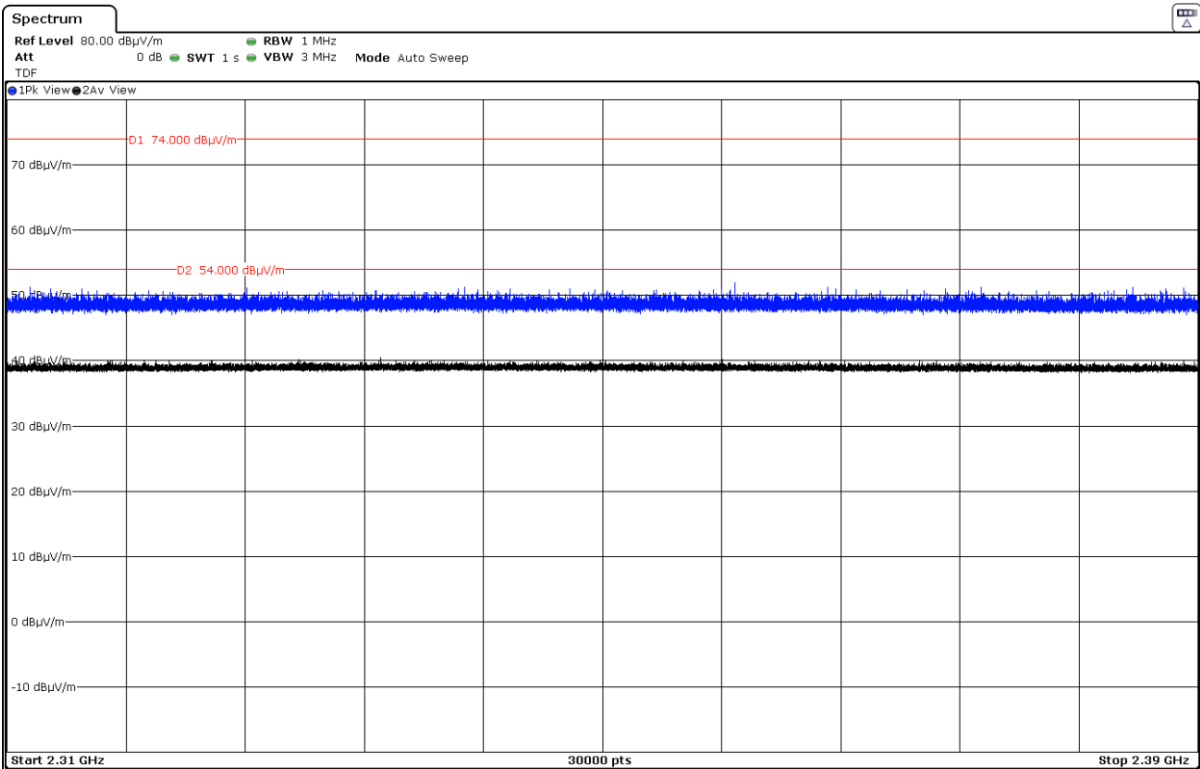
Note: This plot is valid for all three channels.

FREQUENCY RANGE 2.31-2.39 GHz (Restricted Band 1):

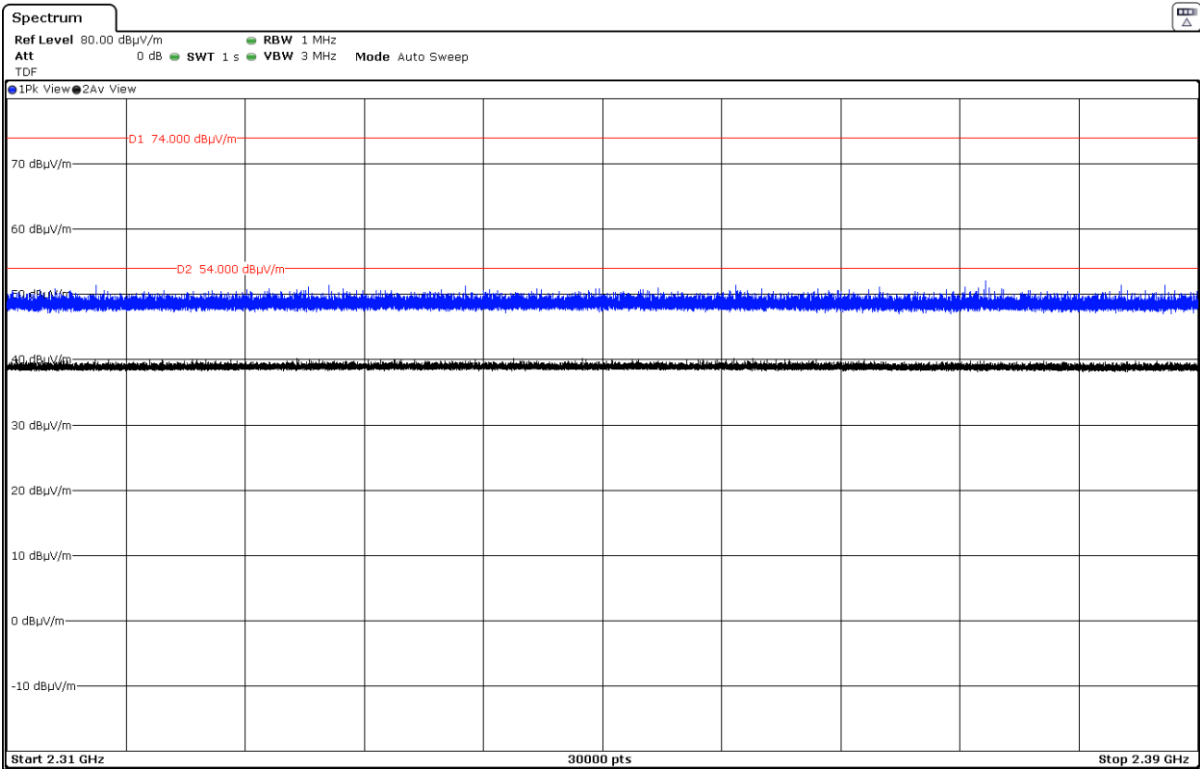
- Low Channel:



- Middle Channel:

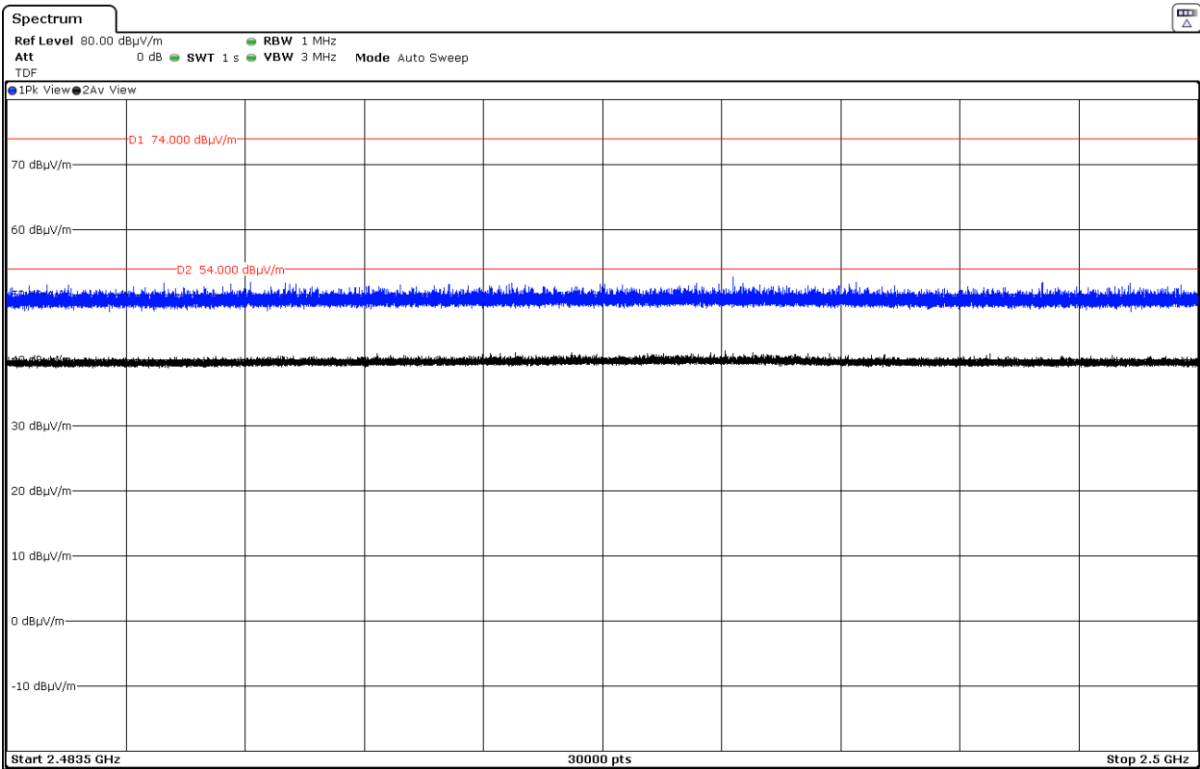


- High Channel:

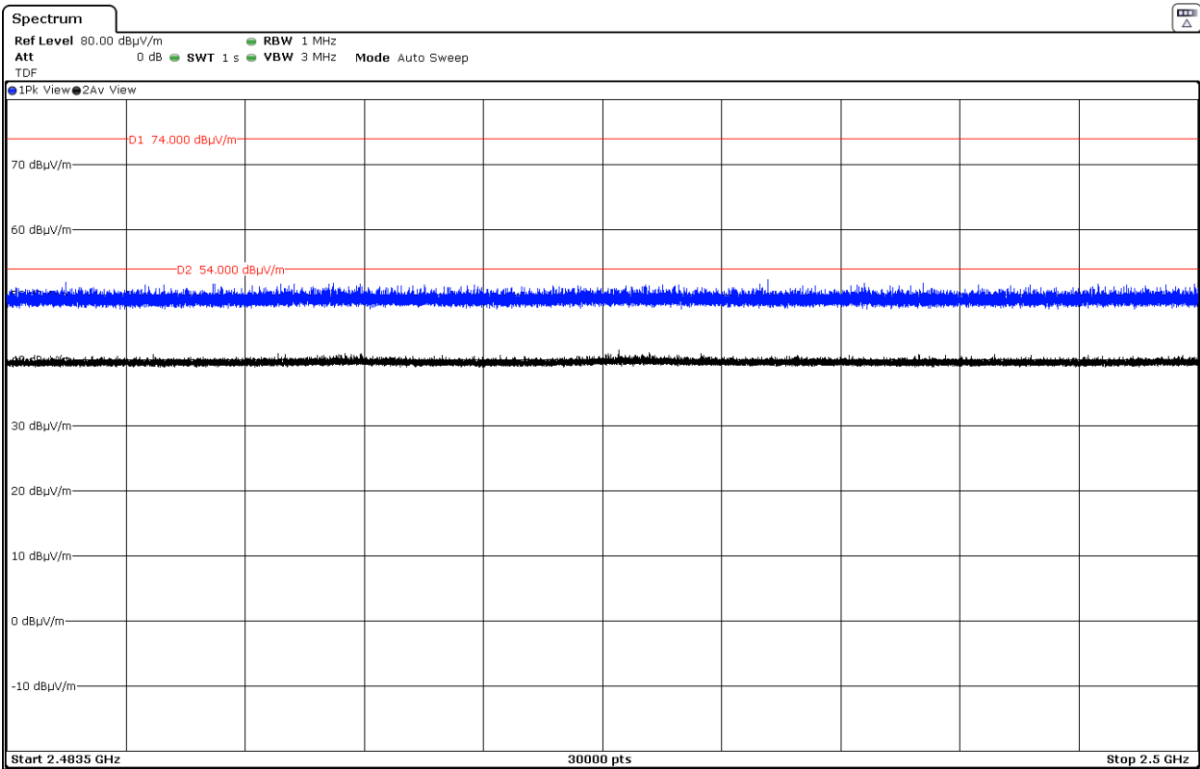


FREQUENCY RANGE 2.4835-2.5 GHz (Restricted Band 2):

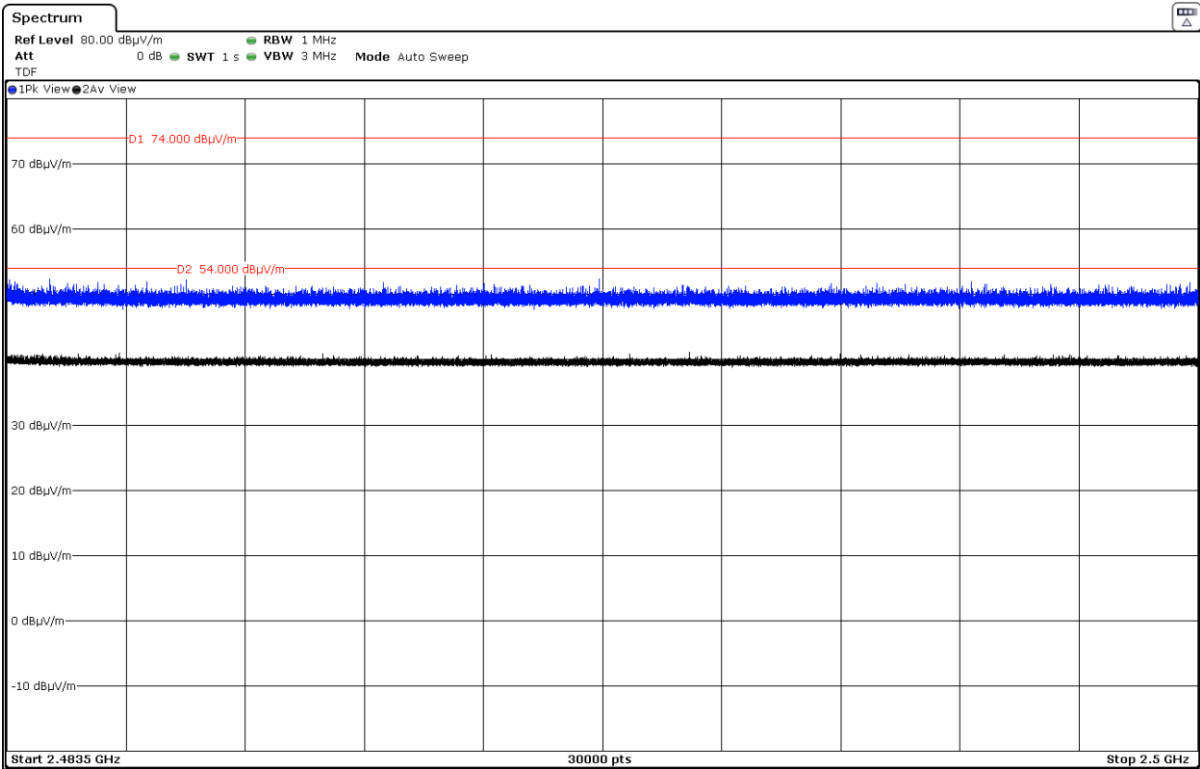
- Low Channel:



- Middle Channel:



- High Channel:



Appendix B: Test results. Bluetooth Low Energy 5.0 1M

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TEST CONDITIONS

POWER SUPPLY (V):

V nominal: 5 Vdc / 3.7 Vdc
Type of power supply: 5 Vdc from USB / 3.7 Vdc from battery.
Type of Antenna: PulseLarsen Antenna W3008C Ceramic Chip Antenna.
Declared maximum antenna Gain: 2.2 dBi (peak).

TEST FREQUENCIES:

Low Channel: 2402 MHz
Middle Channel: 2440 MHz
High Channel: 2480 MHz

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is directly connected to the spectrum analyzer.



RADIATED MEASUREMENTS

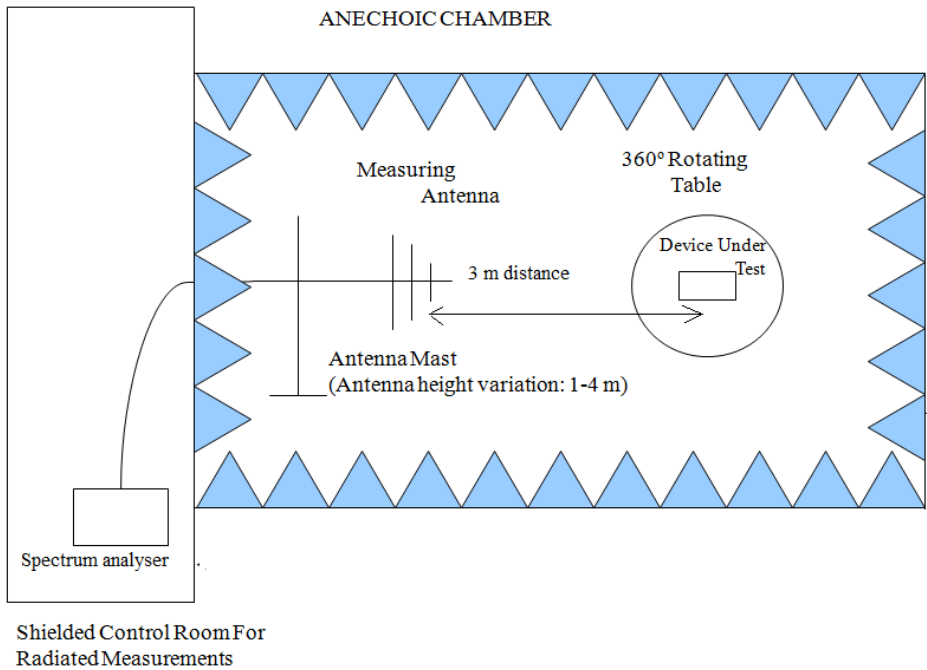
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz) is situated at a distance of 3 m and at a distance of 1m for the frequency range 1 GHz-26 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

For radiated emissions in the range 1 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

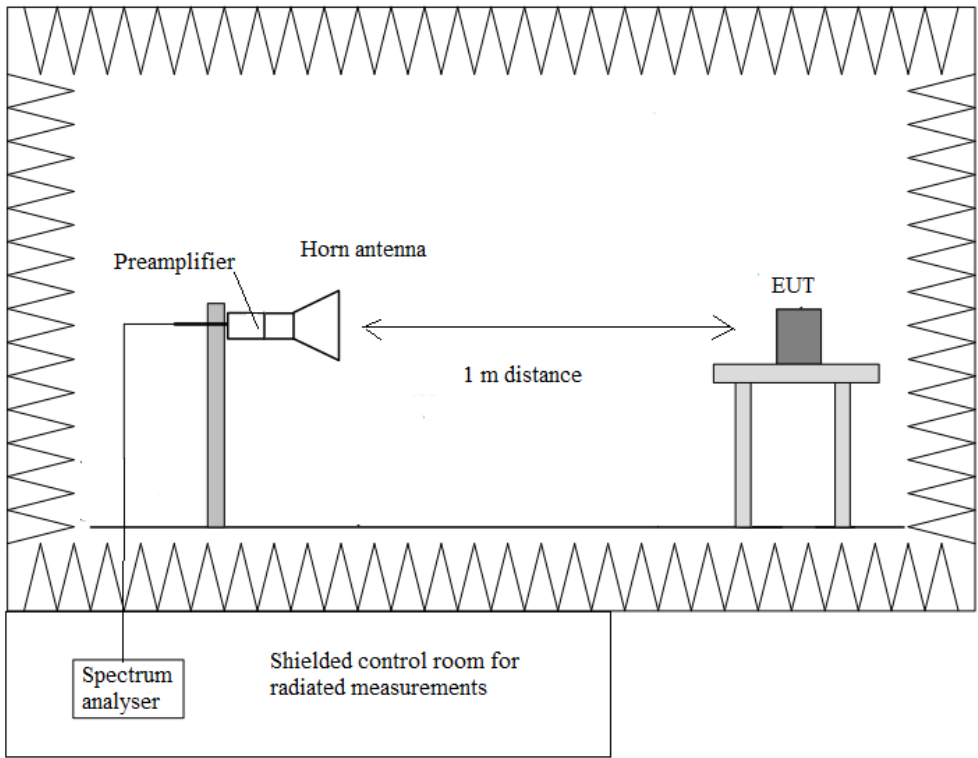
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find the maximum radiated emission.

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

Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup $f > 1$ GHz:

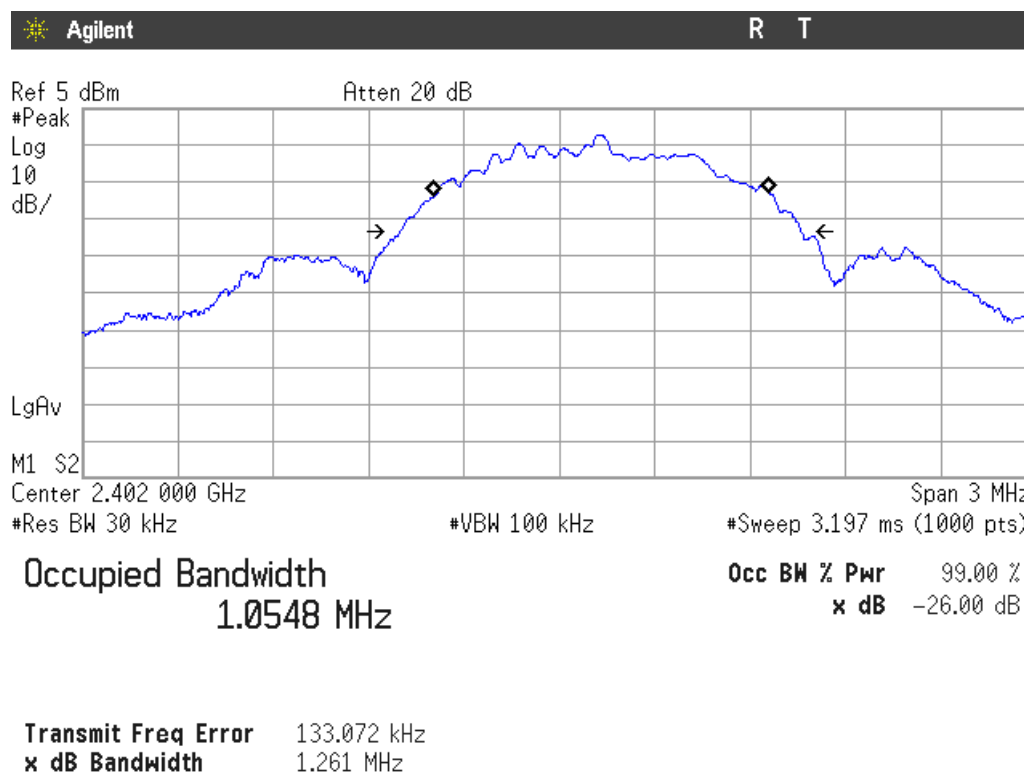


Occupied Bandwidth

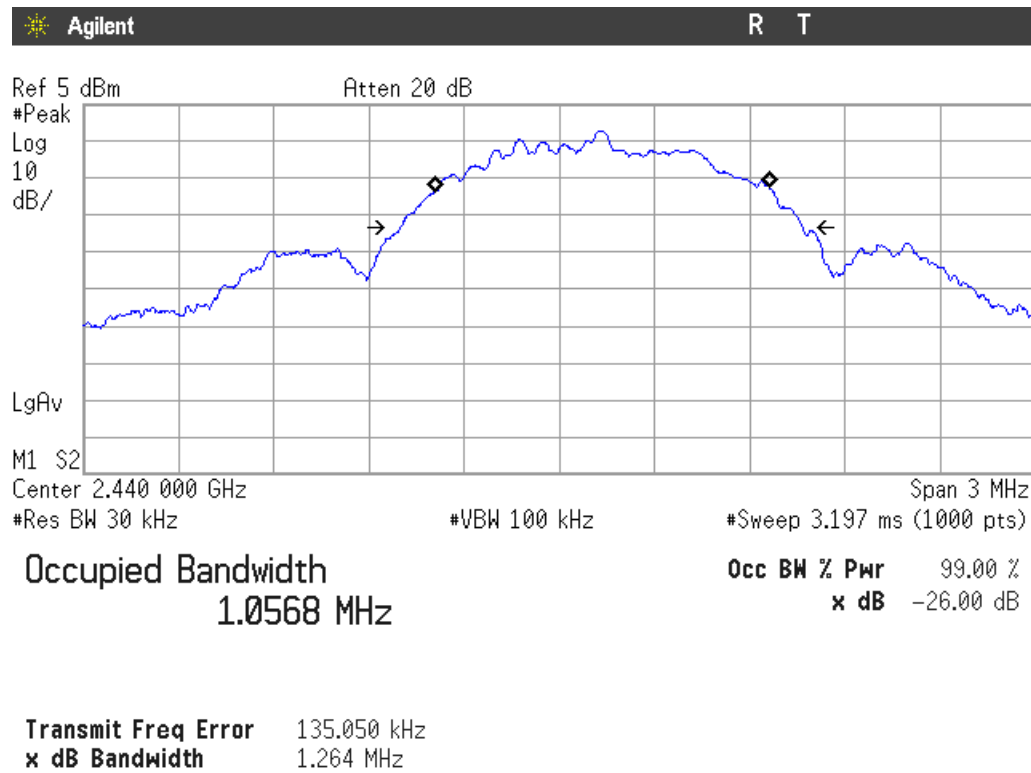
RESULTS:

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
99% bandwidth (MHz)	1.0548	1.0568	1.0588
Measurement uncertainty (kHz)	<± 5.00		

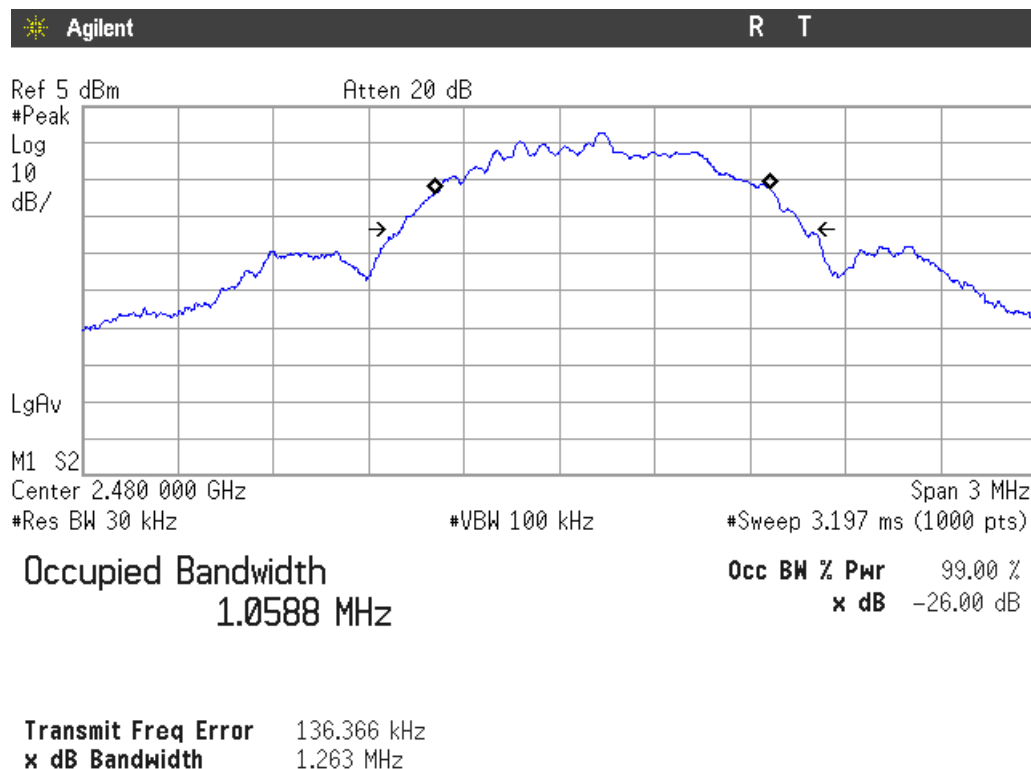
- Low Channel:



- Middle Channel:



- High Channel:



FCC Section 15.247 Subclause (a) (2) / RSS-247 Clause 5.2 (a) 6 dB Bandwidth.

SPECIFICATION:

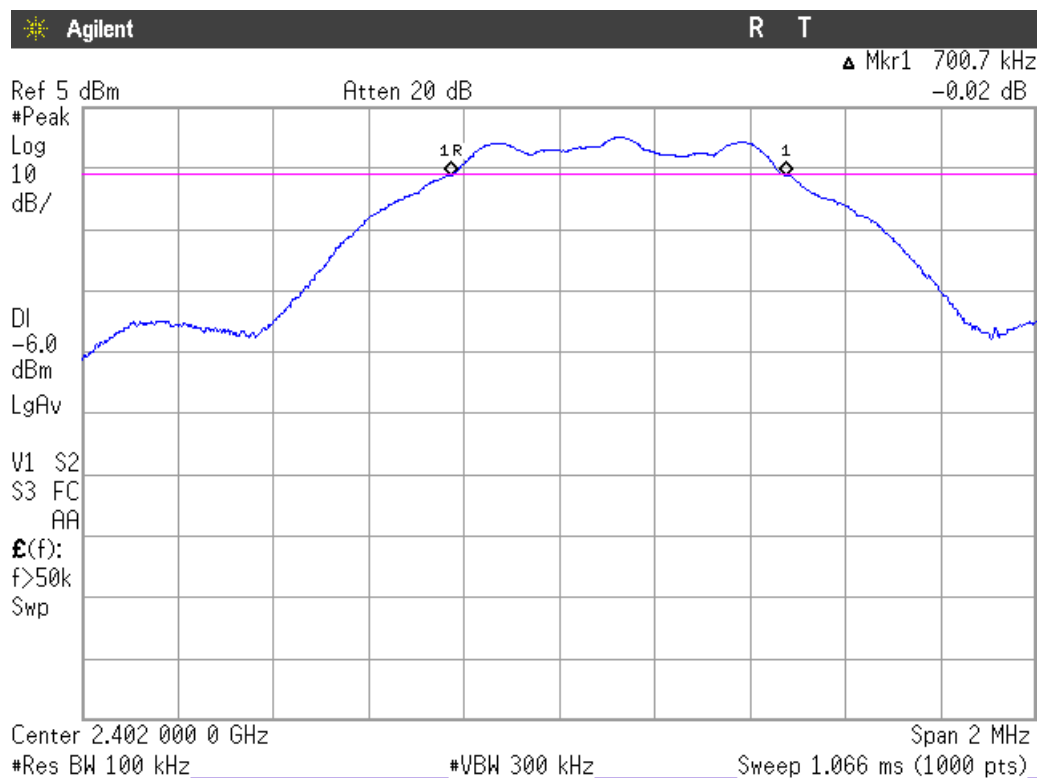
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS:

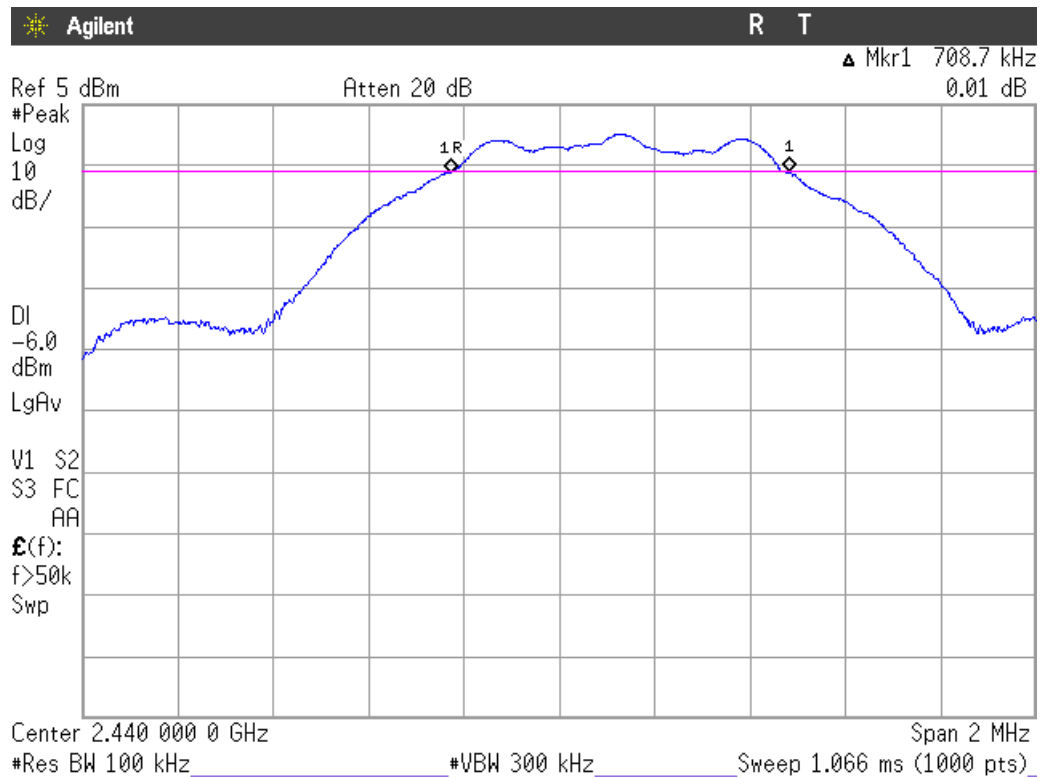
	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
6 dB Spectrum bandwidth (kHz)	700.7	708.7	720.7
Measurement uncertainty (kHz)	<±11.0		

Verdict: PASS

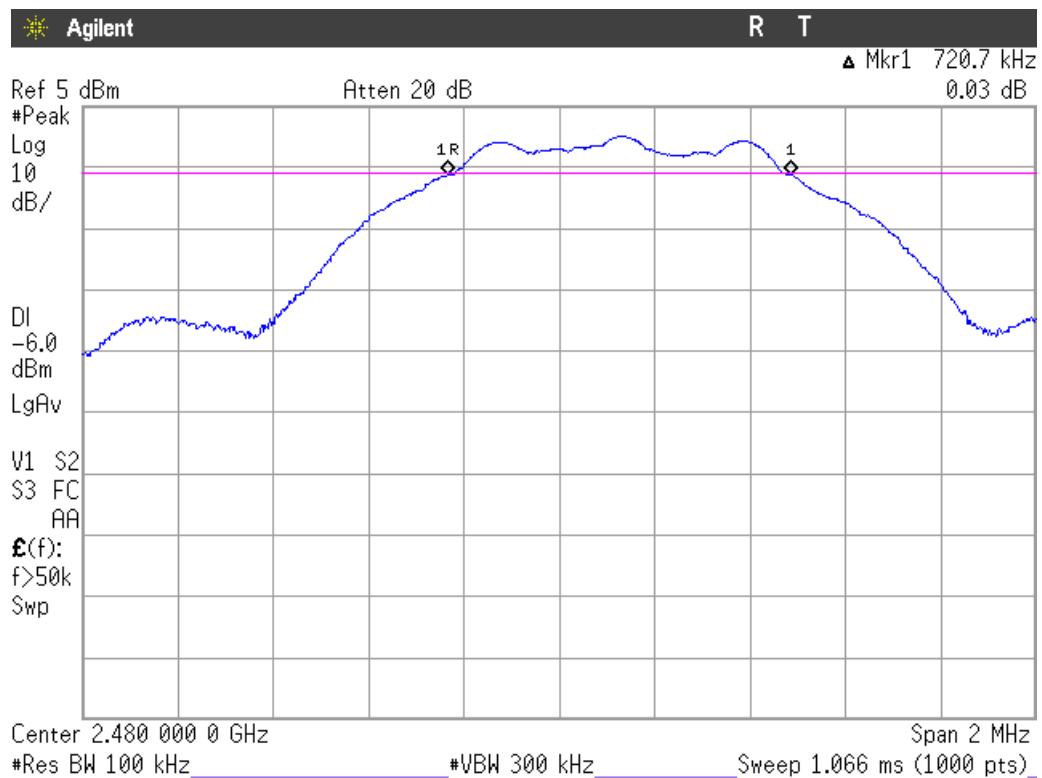
- Low Channel:



- Middle Channel:



- High Channel:



FCC Section 15.247 Subclause (b) / RSS-247 Clause 5.4 (d) Maximum output power and antenna gain

SPECIFICATION:

For systems using digital modulation in the 2400-2483.5 MHz band: 1 watt (30 dBm).

The e.i.r.p. shall not exceed 4 W (36 dBm) (Canada).

RESULTS:

The maximum peak conducted output power was measured using the method according to point 9.1.1. of Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under Section 15.247 558074 D01 DTS Meas Guidance v04 dated 04/05/2017.

The EIRP power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power.

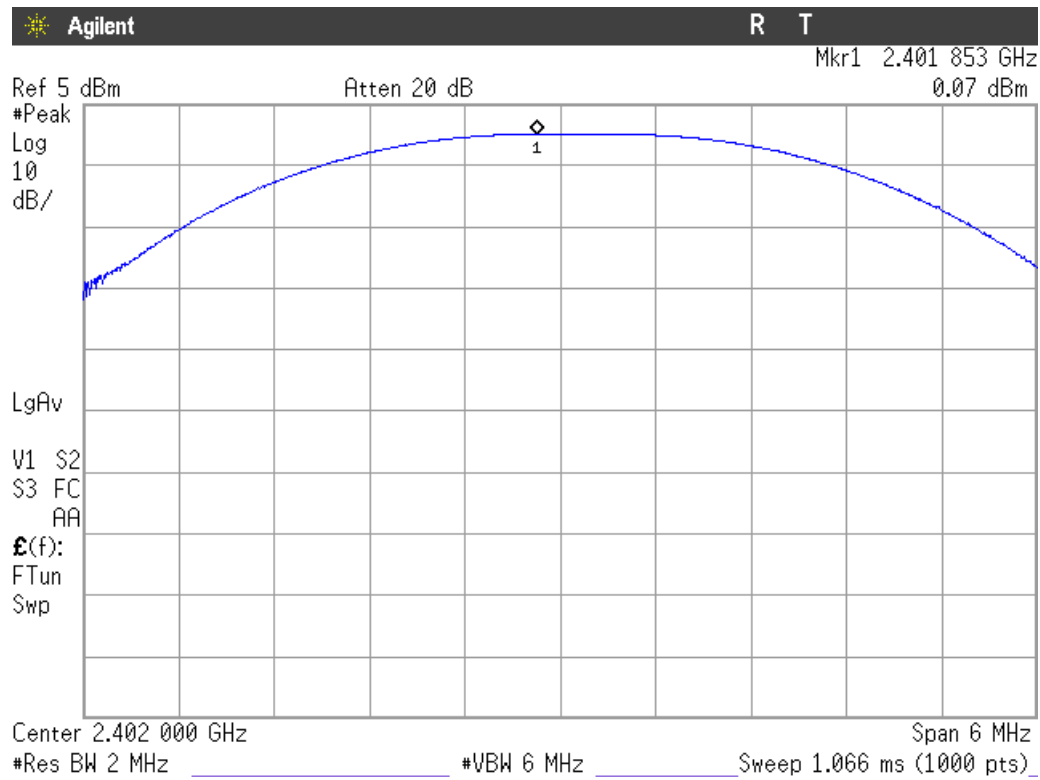
Maximum declared antenna gain: 2.2 dBi.

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Maximum Conducted Power (dBm)	0.07	0.06	0.05
Maximum EIRP Power (dBm)	2.27	2.26	2.25
Measurement uncertainty (dB)	<±0.78		

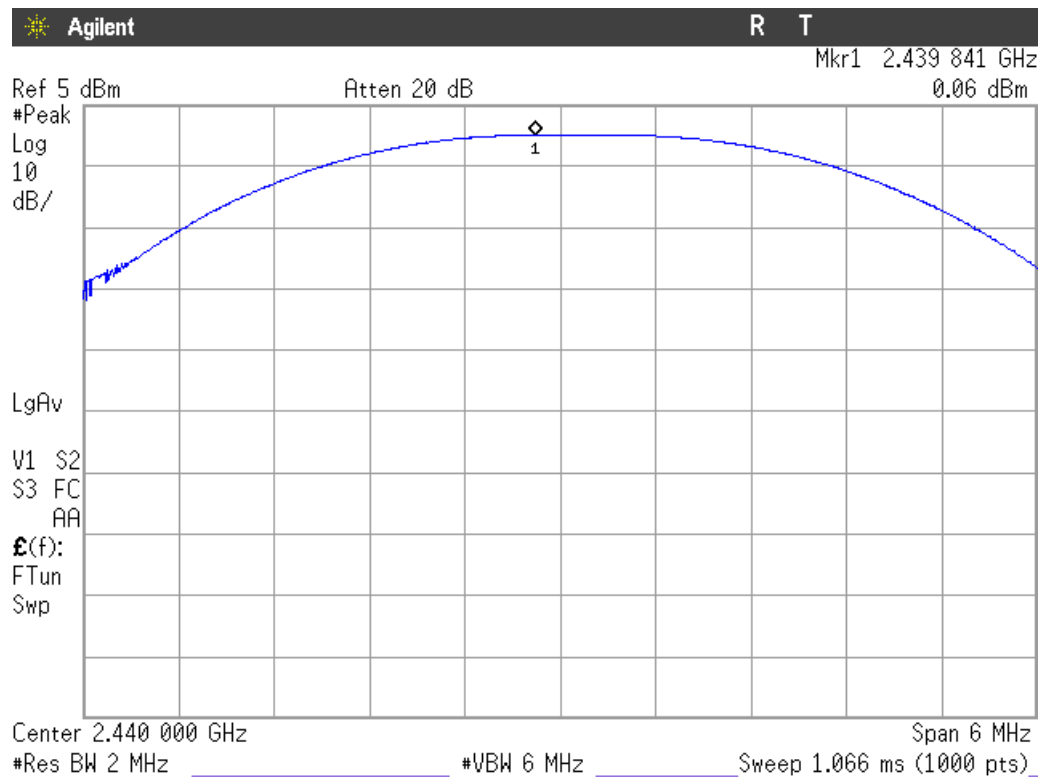
The maximum directional gain of the antenna is less than 6 dBi and therefore the maximum output power is not required to be reduced from the stated values.

Verdict: PASS

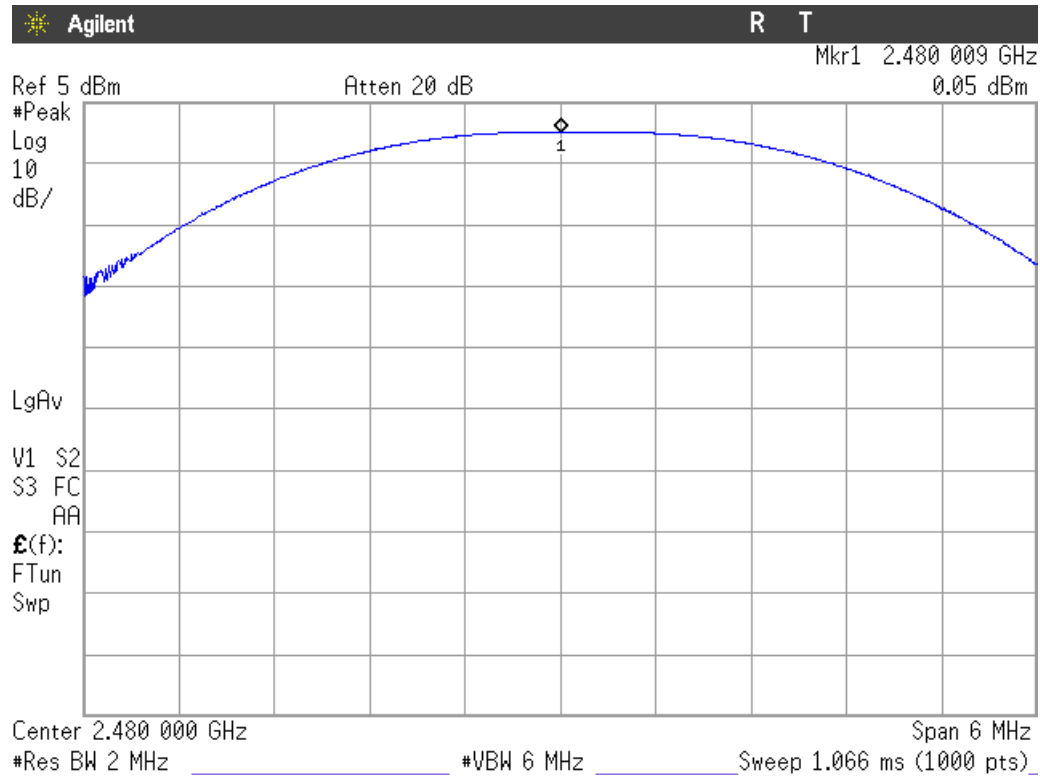
- Low Channel:



- Middle Channel:



- High Channel:



FCC Section 15.247 Subclause (d) / RSS-247 Clause 5.5. Emission limitations conducted (Transmitter)

SPECIFICATION:

In any 100 kHz bandwidths outside the frequency band in which the intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

RESULTS:

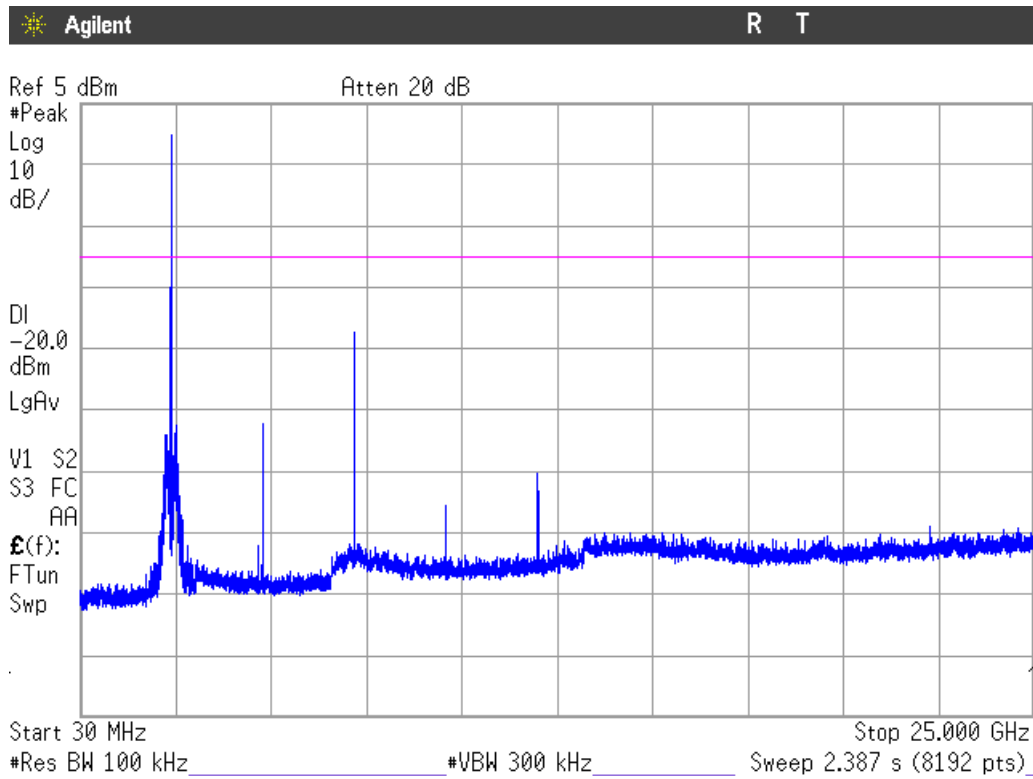
	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Reference Level Measurement (dBm)	0.01	0.01	-0.01
Measurement uncertainty (dB)	<±0.78		

Spurious peaks at less than 20 dB below the limit:

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Spurious frequency (MHz)	7206	7322	7441
Emission level (dBm)	-32.28	-30.31	-28.08
Measurement uncertainty (dB)	<±2.03		

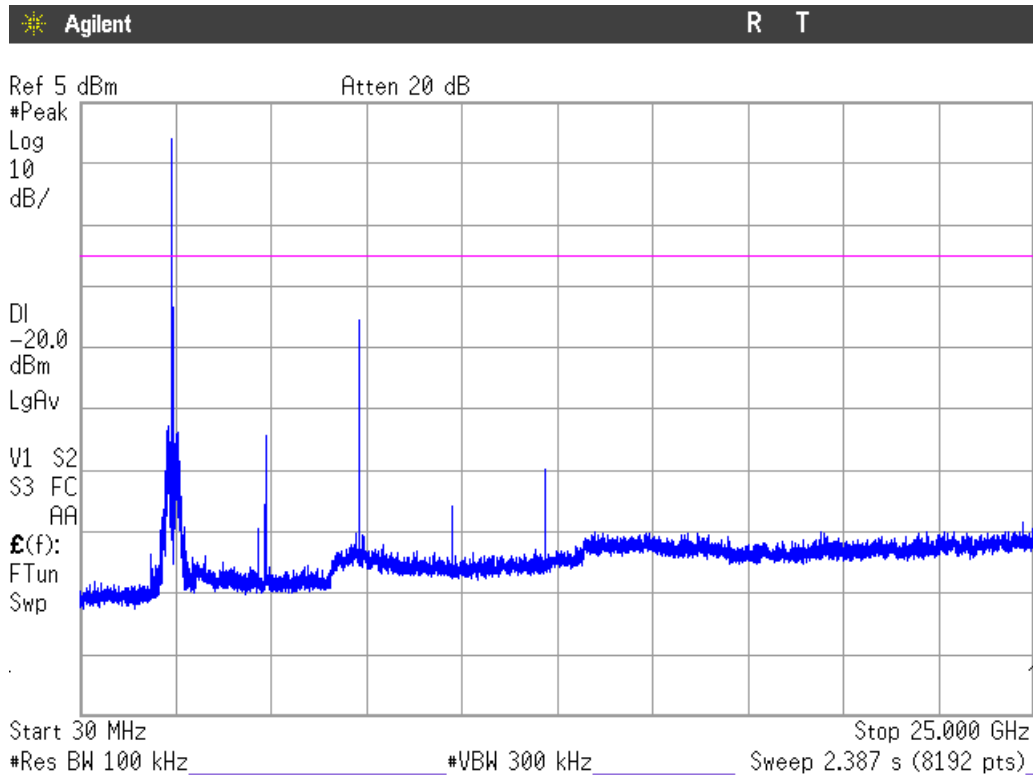
Verdict: PASS

- Low Channel:



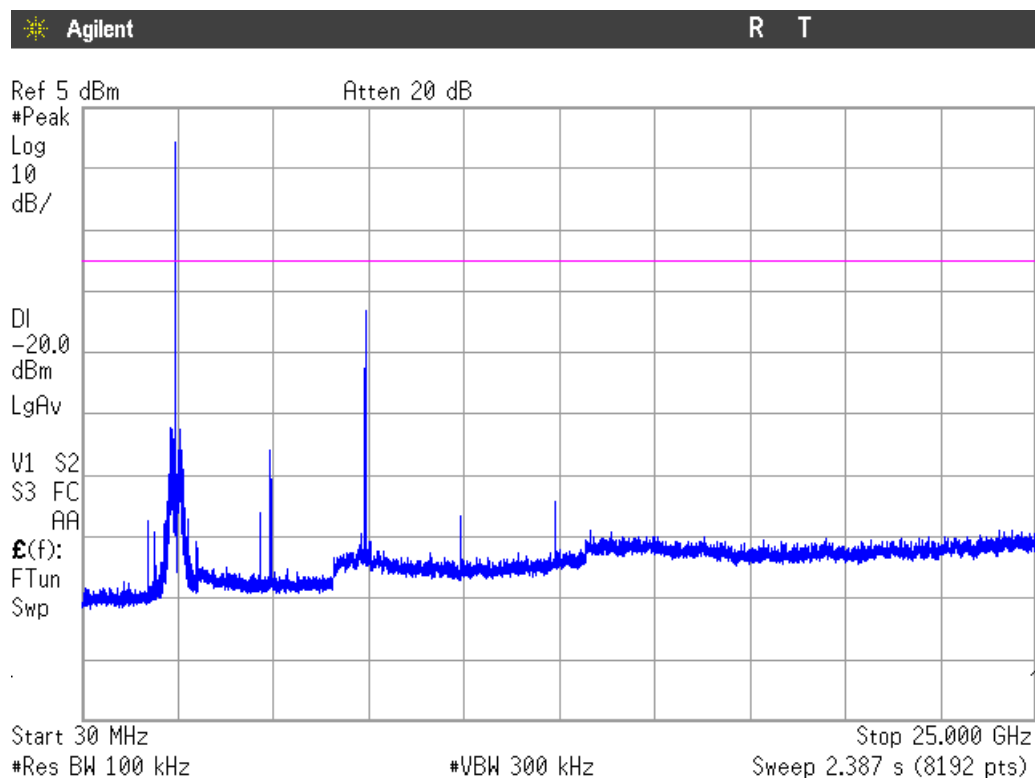
The peak shown in the plot above the limit is the carrier frequency.

- Middle Channel:



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

- High Channel:



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

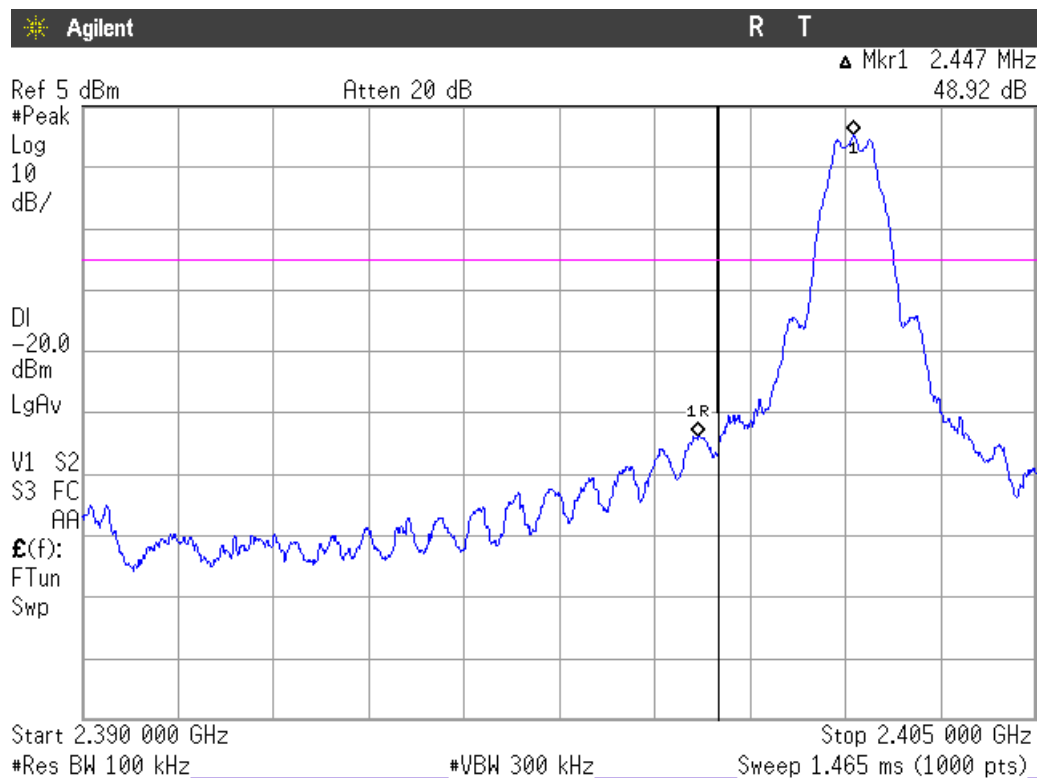
FCC Section 15.247 Subclause (d) / RSS-247 Clause 5.5. Band-edge emissions compliance (Transmitter)

SPECIFICATION:

In any 100 kHz bandwidths outside the frequency band in which the intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

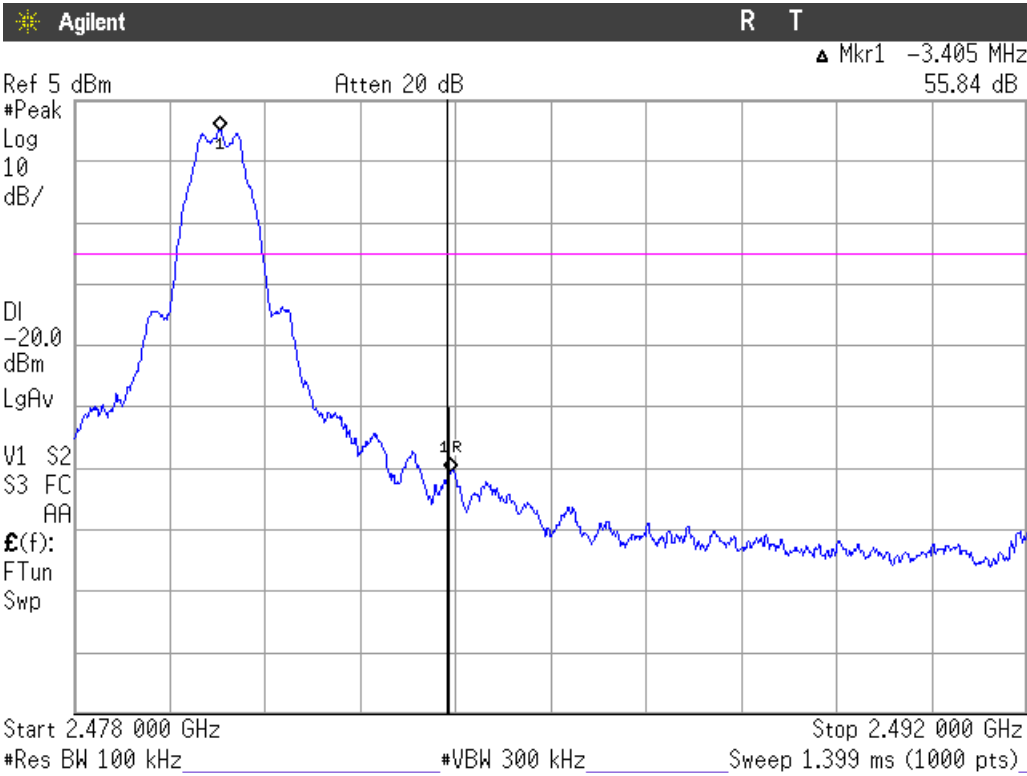
RESULTS:

- Low Channel:



Verdict: PASS

- High Channel:



Verdict: PASS

Measurement uncertainty (dB)	<±2.03
------------------------------	--------

FCC Section 15.247 Subclause (e) / RSS-247 5.2. (b) Power spectral density

SPECIFICATION:

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

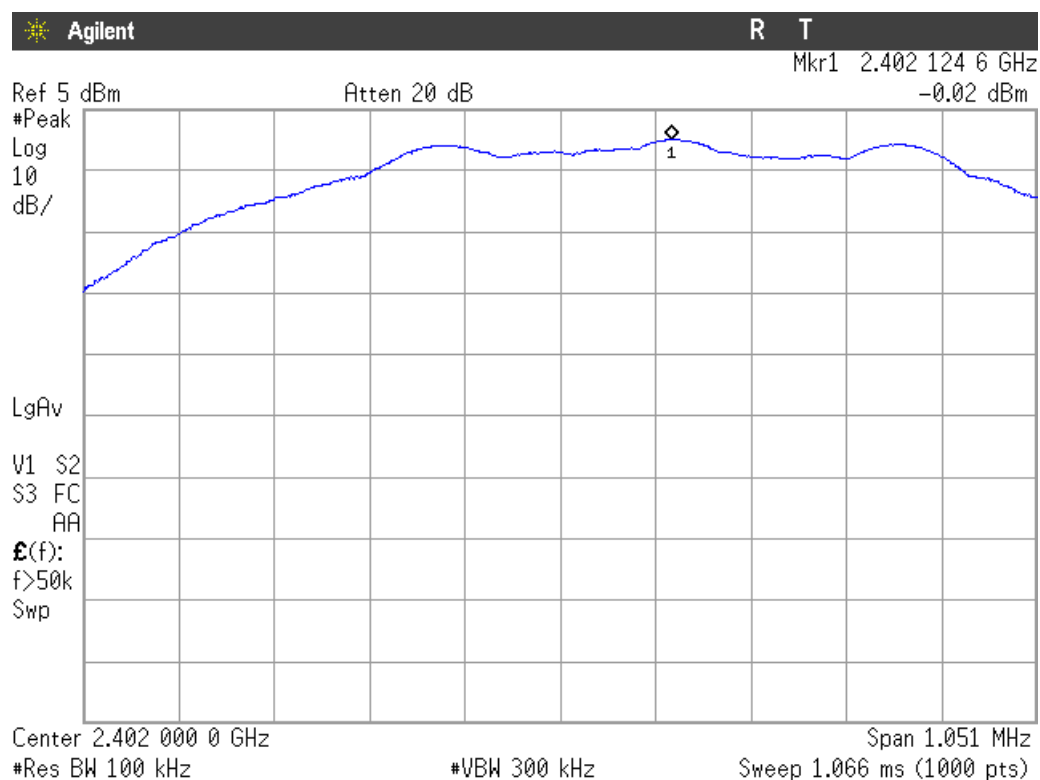
RESULTS:

The maximum power spectral density level in the fundamental emission was measured using the method PKPSD (Peak PSD) according to point 10.2. of Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under Section 15.247 558074 D01 DTS Meas Guidance v04 dated 04/05/2017.

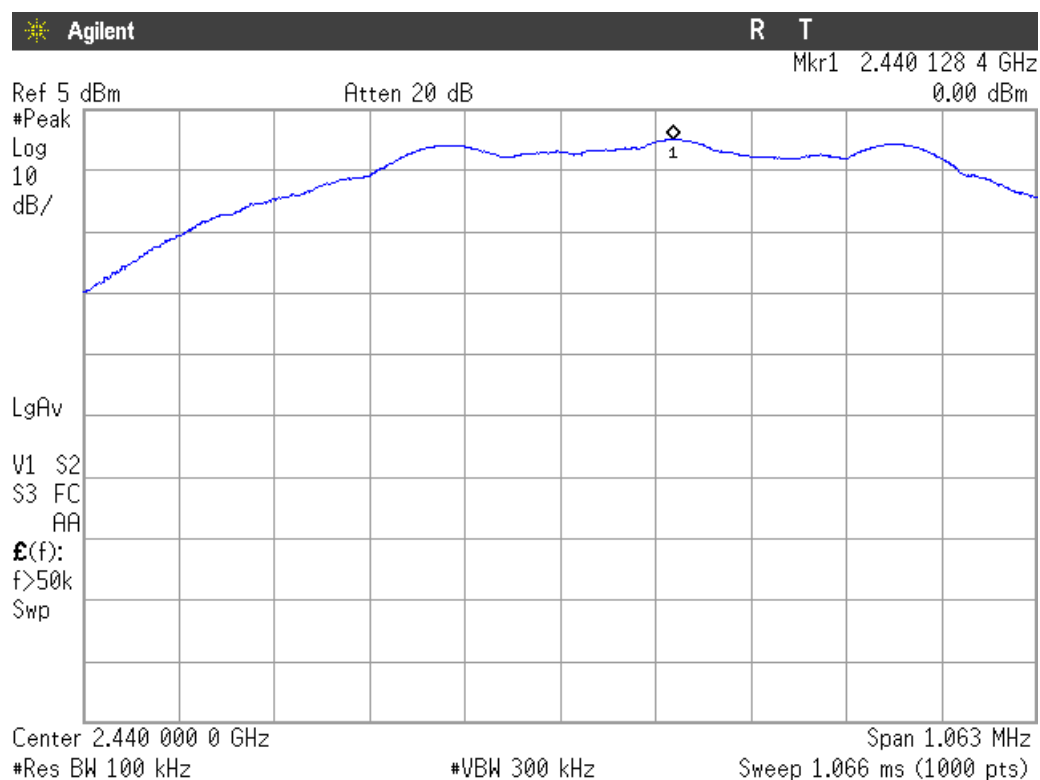
	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Power Spectral Density (dBm)	-0.02	0.00	-0.05
Measurement uncertainty (dB)	<±0.78		

Verdict: PASS

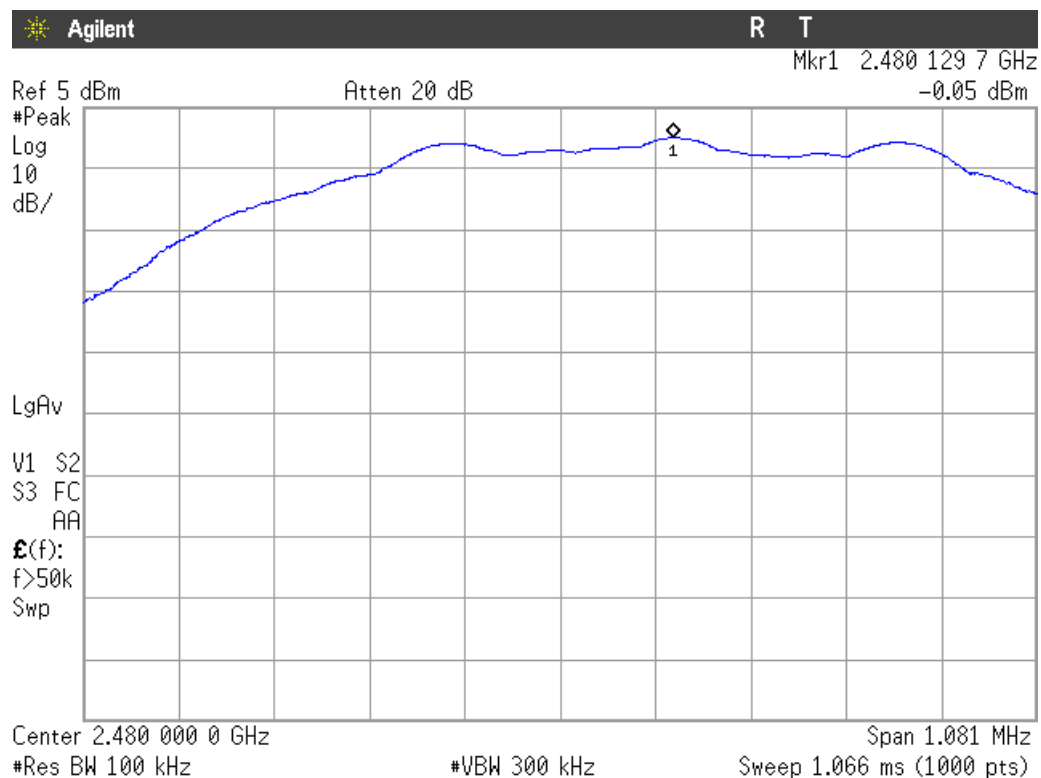
- Low Channel:



- Middle Channel:



- High Channel:



FCC Section 15.247 Subclause (d) / RSS-247 Clause 5.5. Emission limitations radiated (Transmitter)

SPECIFICATION:

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

Frequency Range (MHz)	Field strength ($\mu\text{V/m}$)	Field strength ($\text{dB}\mu\text{V/m}$)	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 - 10000	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 3 m for the frequency range 30 MHz-1000 MHz and at distance of 1m for the frequency range 1 GHz-26 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.

Frequency range 30 MHz - 1 GHz:

The spurious signals detected do not depend on the operating channel.

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

Frequency range 1 - 26 GHz:

The results in the next tables show the maximum measured levels in the 1-25 GHz range including the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

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

- LOW CHANNEL. Spurious signals closest to the limit:

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
4.80437	Peak	41.15	H	< $\pm$ 3.70
7.20583	Peak	57.14	H	< $\pm$ 3.70
	Average	53.10		< $\pm$ 3.70

- MIDDLE CHANNEL. Spurious signals closest to the limit:

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
4.88043	Peak	40.86	H	< $\pm$ 3.70
7.31970	Peak	55.08	V	< $\pm$ 3.70
	Average	50.12		< $\pm$ 3.70

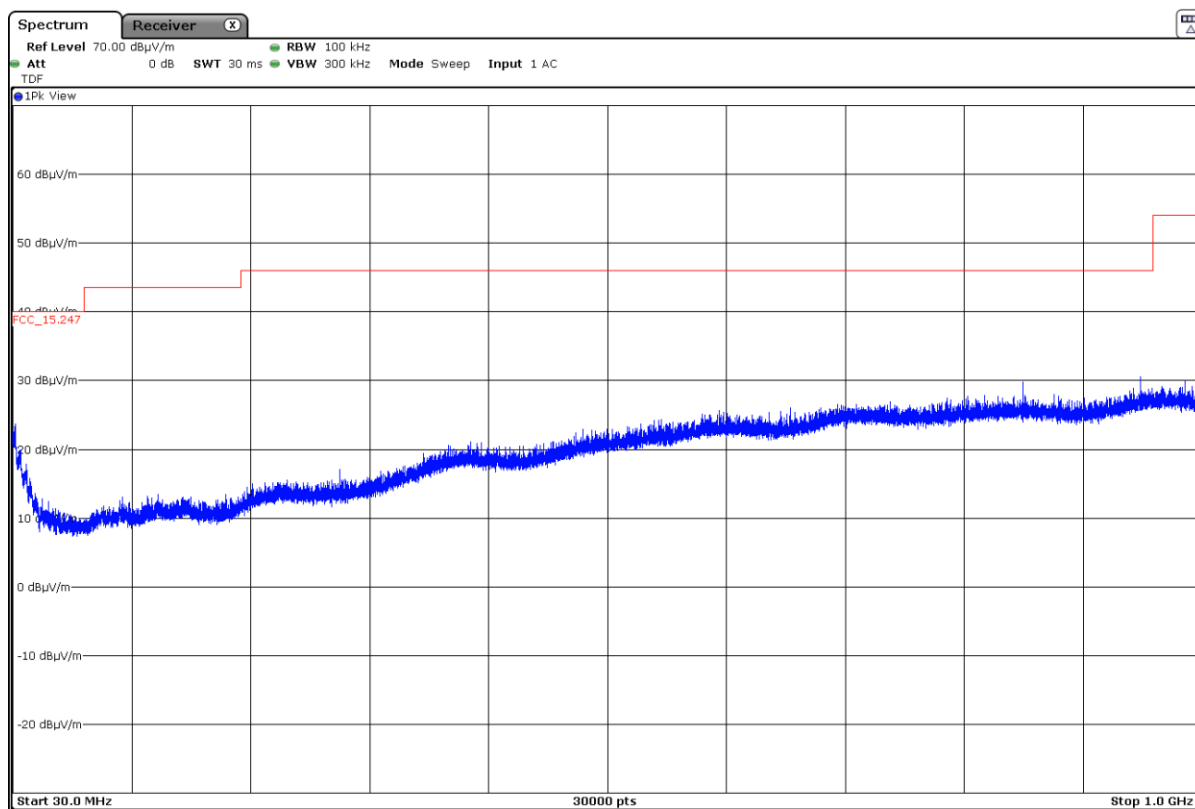
- HIGH CHANNEL. Spurious signals closest to the limit:

Spurious frequency (MHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
4.95977	Peak	44.36	H	< $\pm$ 3.70
7.44057	Peak	53.85	V	< $\pm$ 3.70

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz:

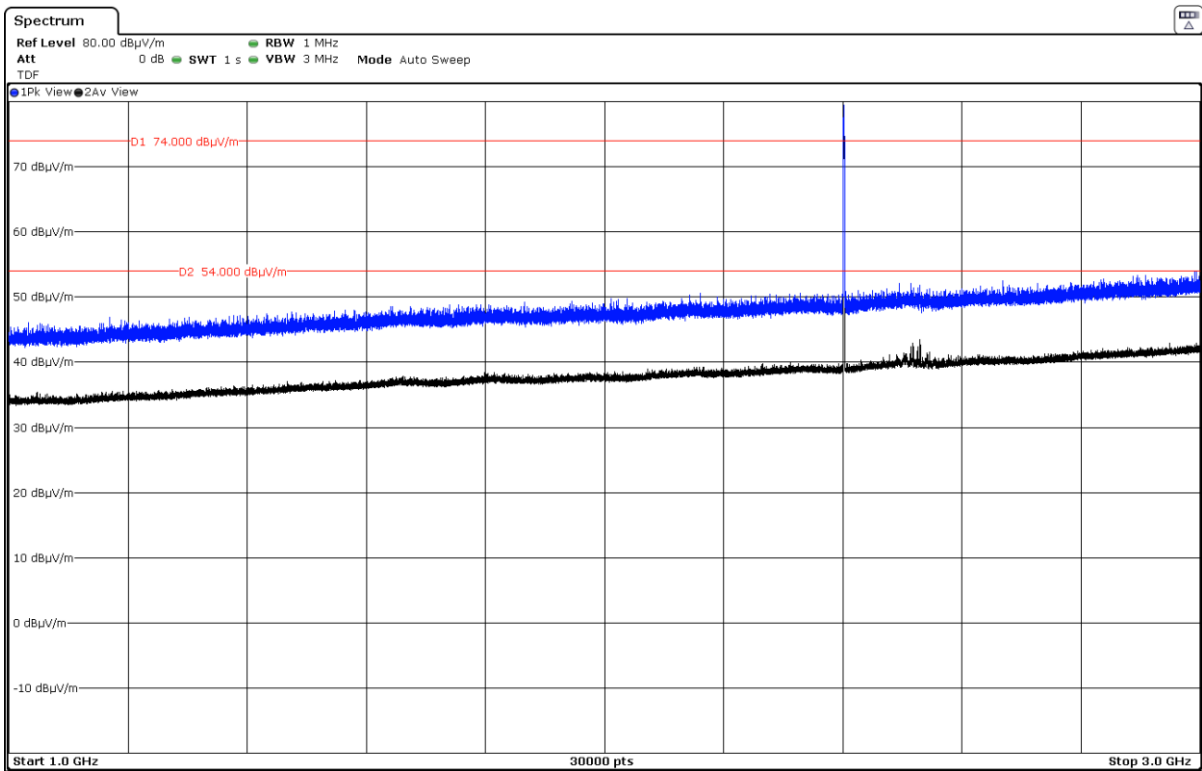
The spurious signals detected do not depend on the operating channel.



Note: This plot is valid for all three channels.

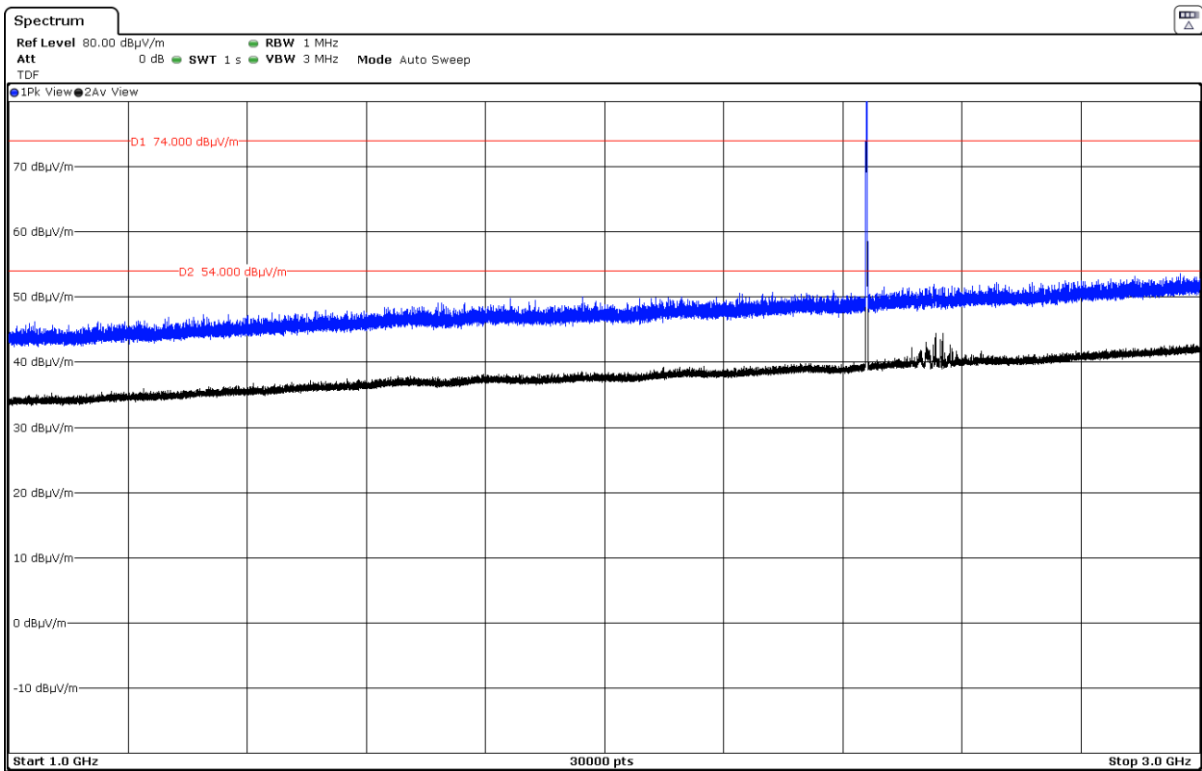
FREQUENCY RANGE 1 - 3 GHz:

- Low Channel:



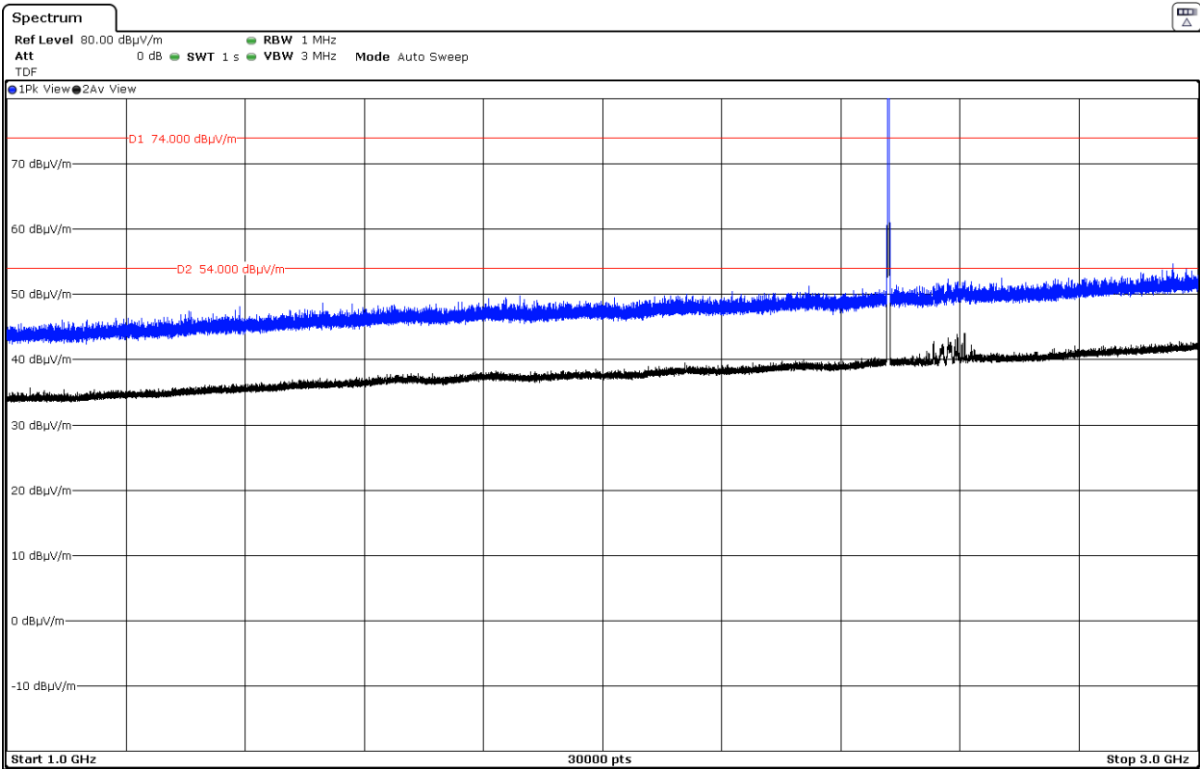
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

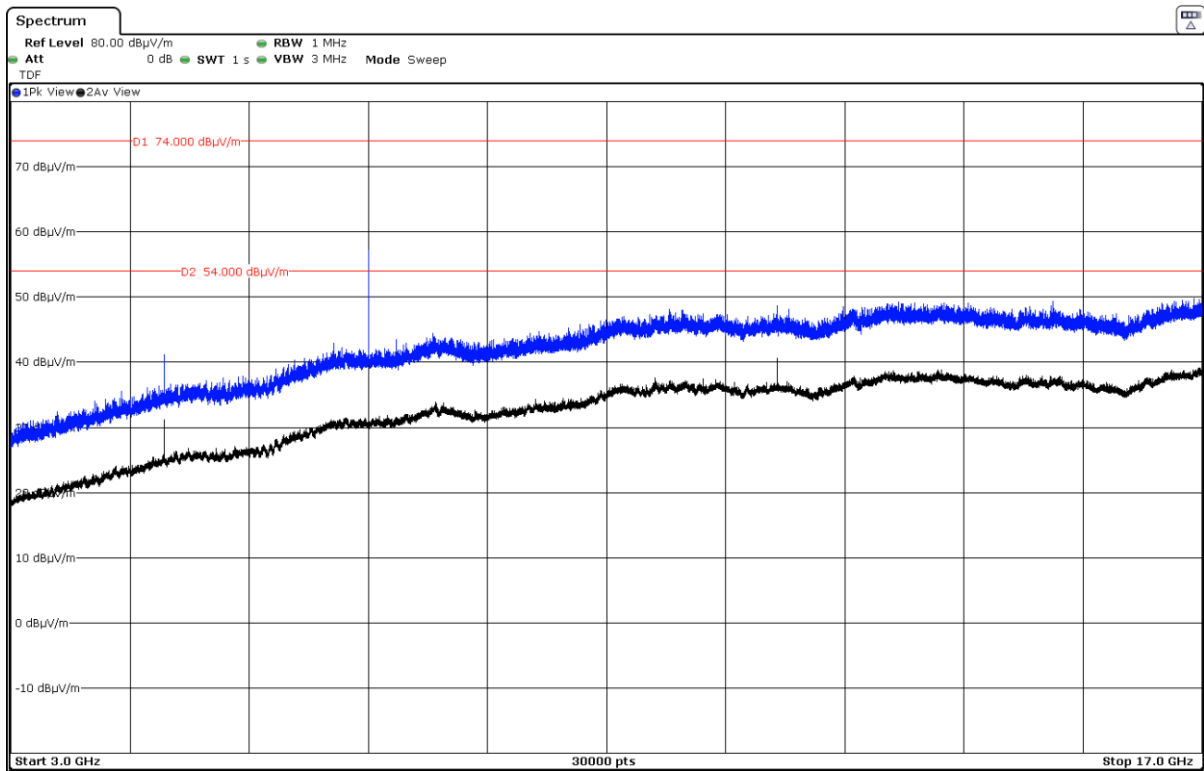
- High Channel:



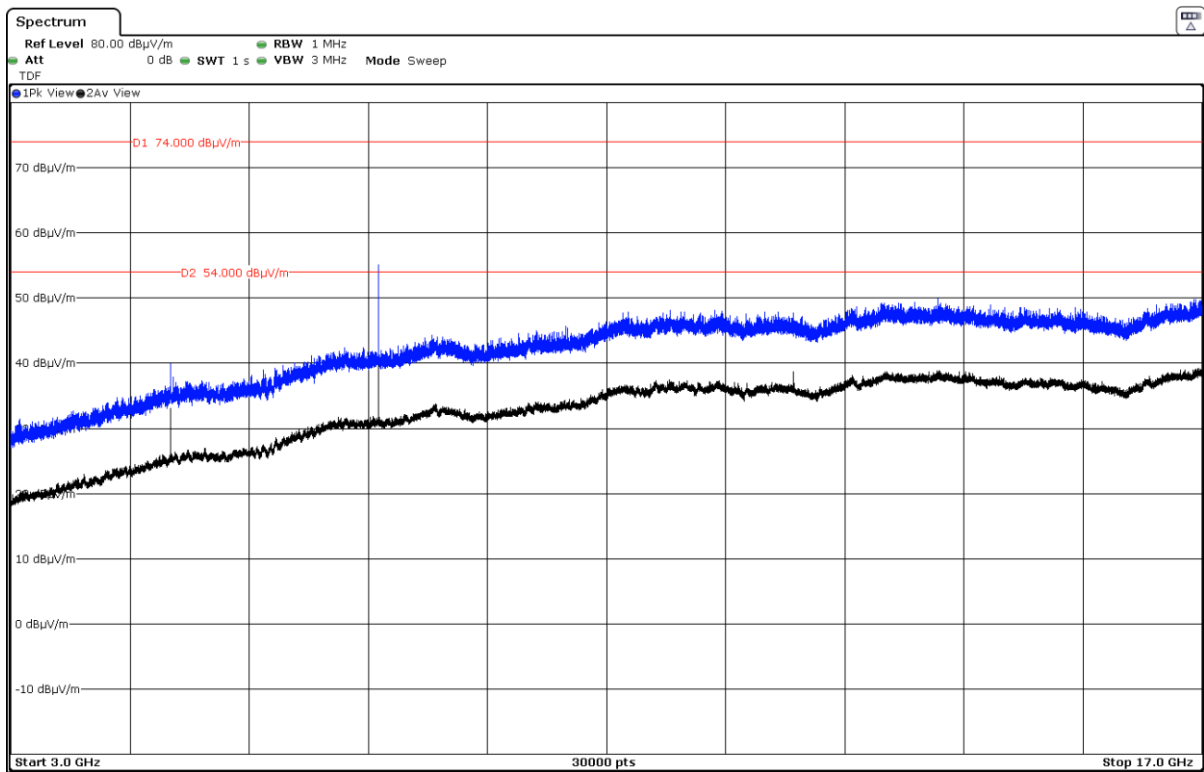
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 17 GHz:

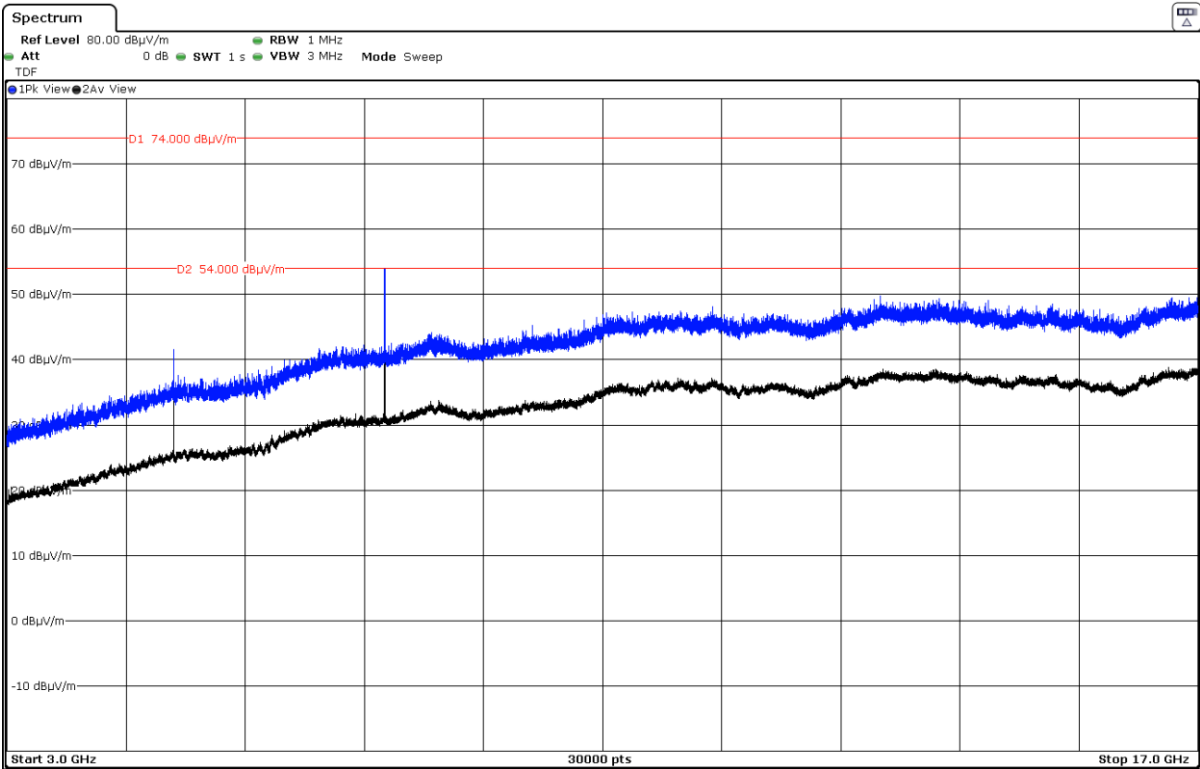
- Low Channel:



- Middle Channel:

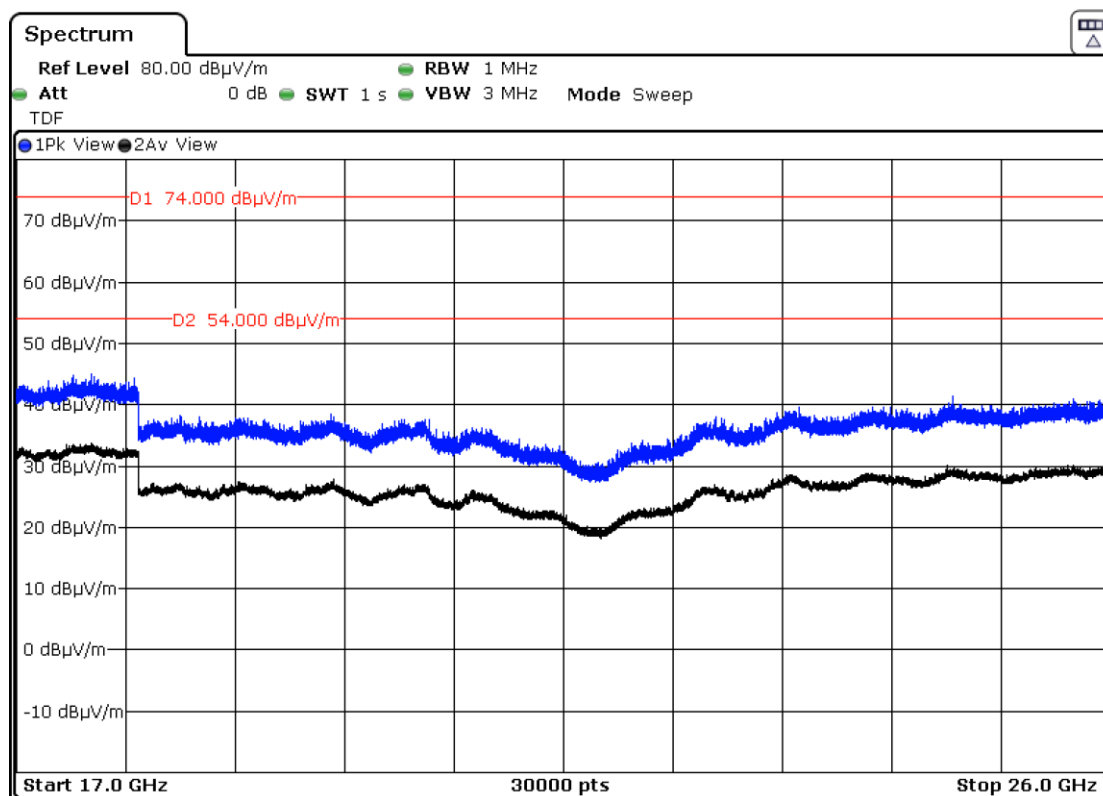


- High Channel:



FREQUENCY RANGE 17 - 26 GHz:

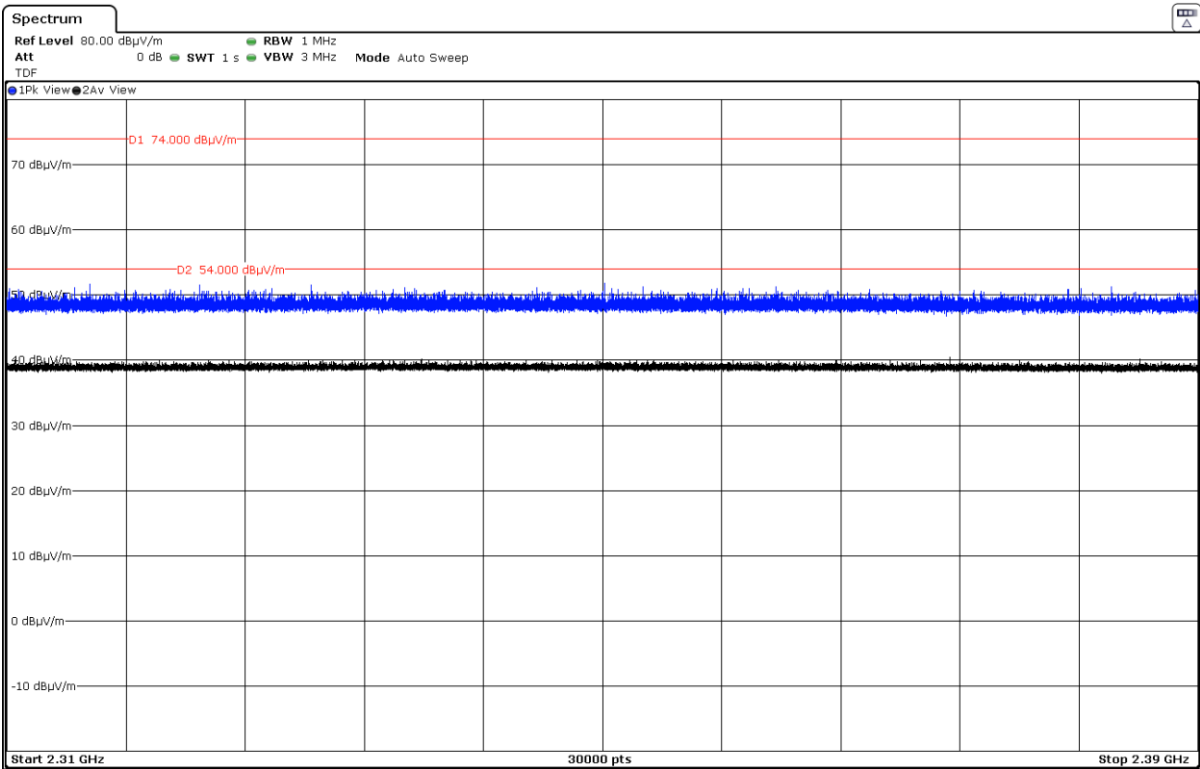
The spurious signals detected do not depend on the operating channel.



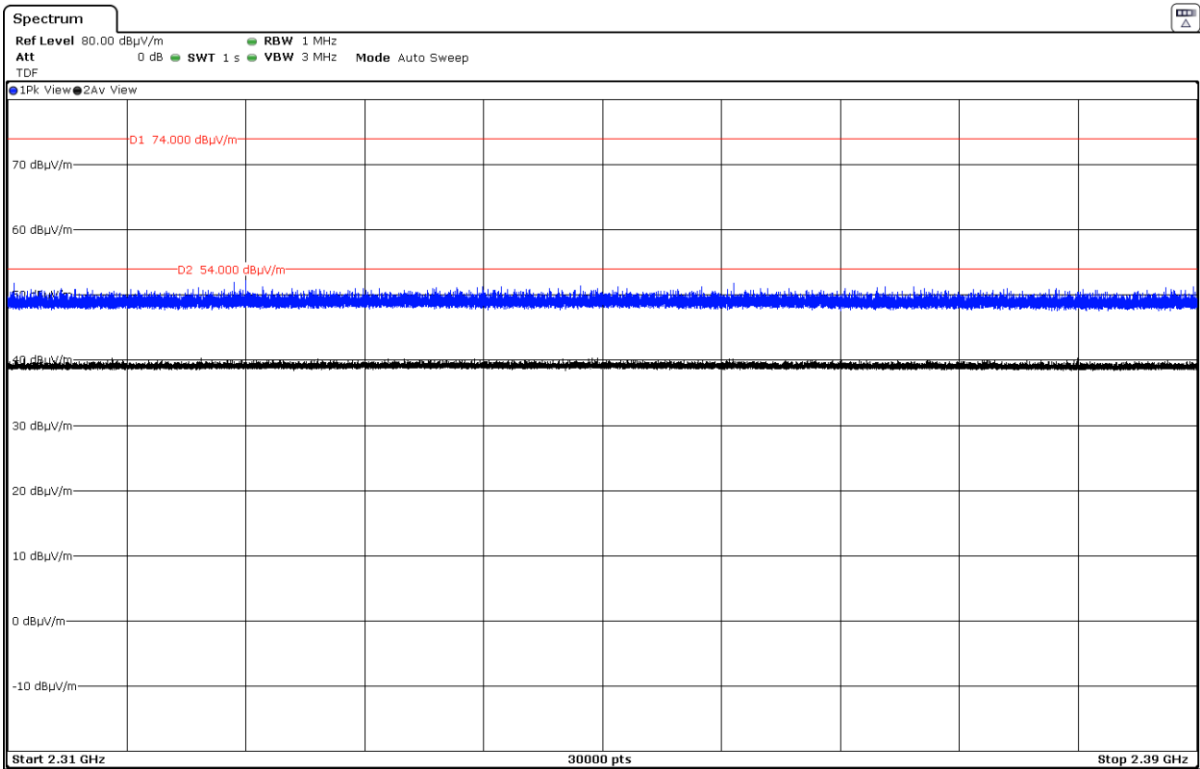
Note: This plot is valid for all three channels.

FREQUENCY RANGE 2.31-2.39 GHz (Restricted Band 1):

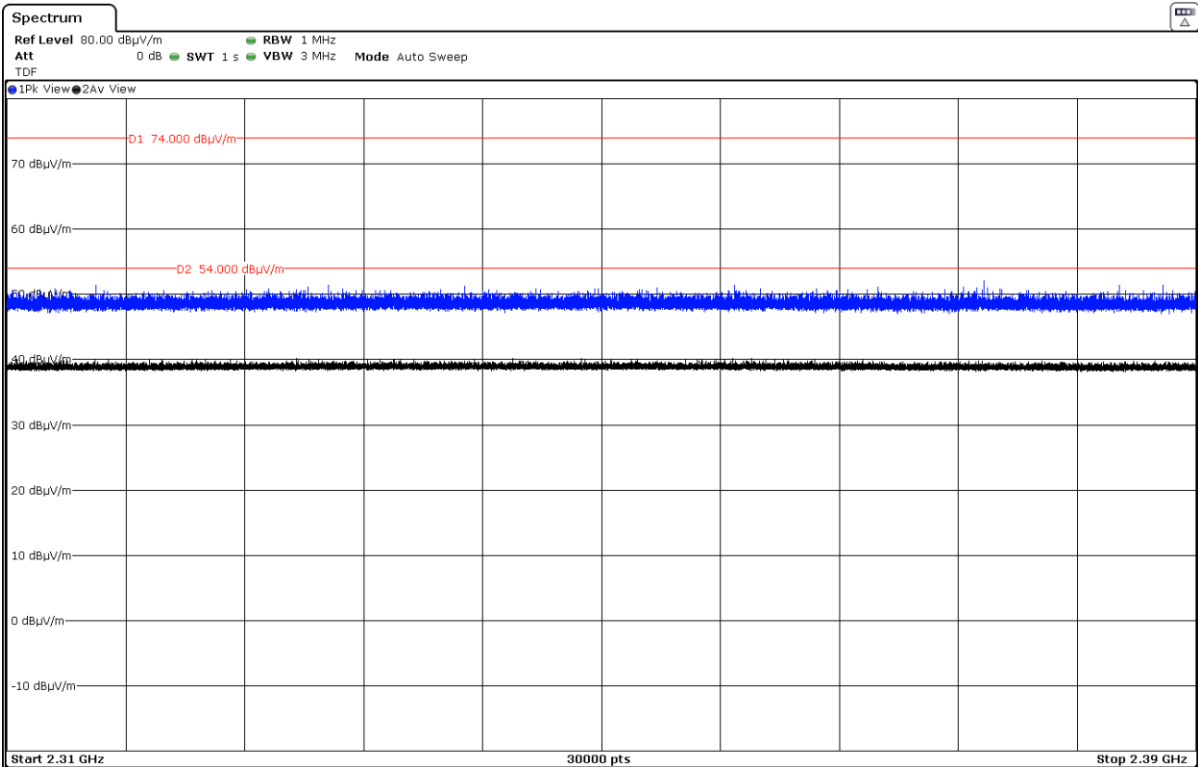
- Low Channel:



- Middle Channel:

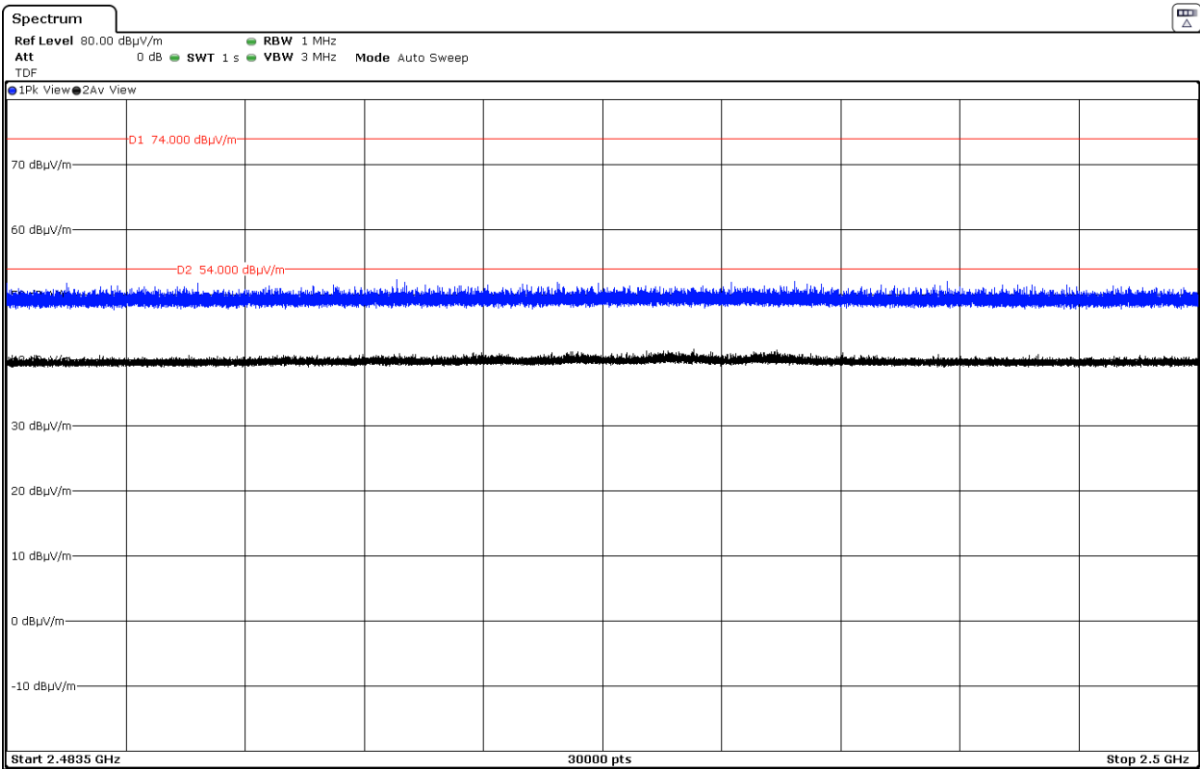


- High Channel:

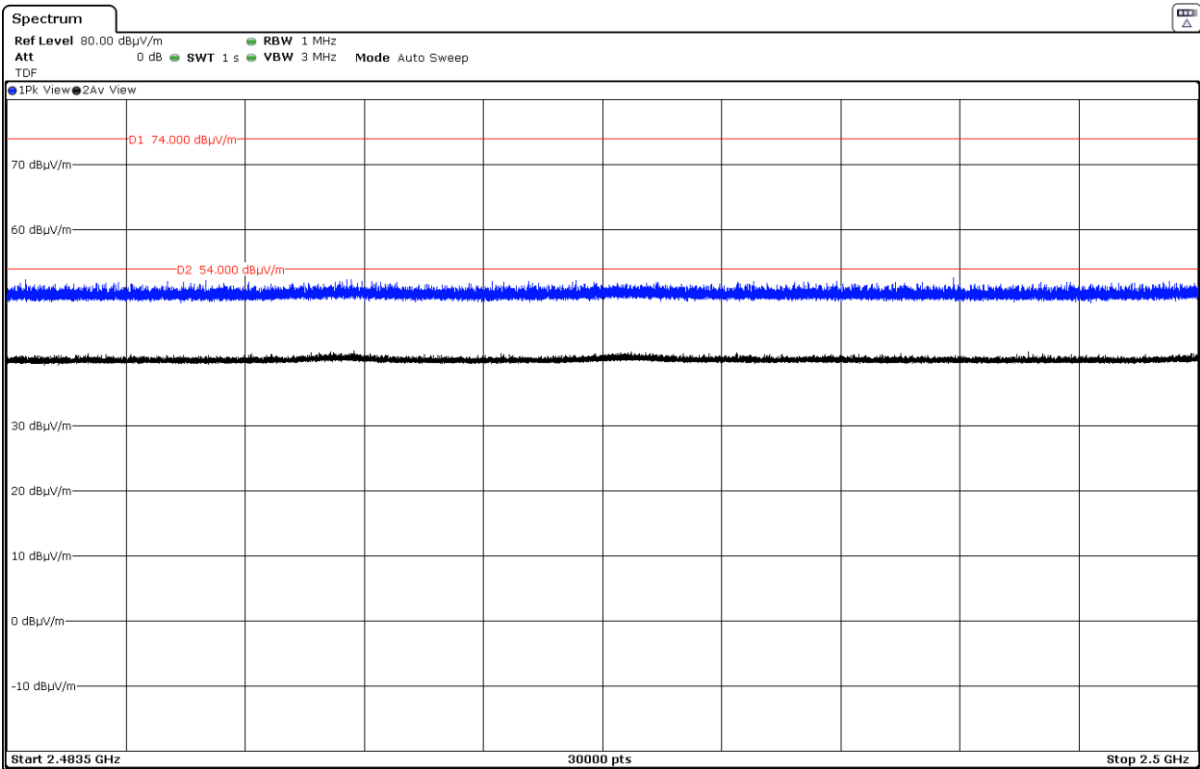


FREQUENCY RANGE 2.4835-2.5 GHz (Restricted Band 2):

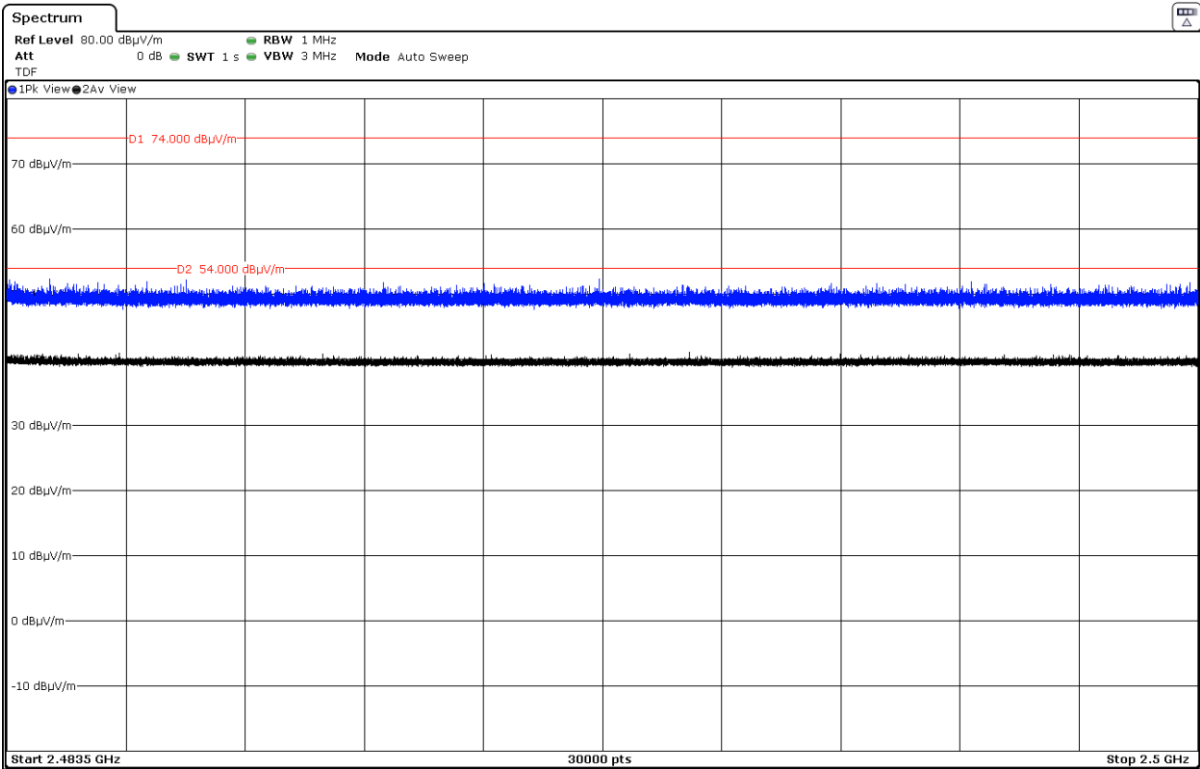
- Low Channel:



- Middle Channel:



- High Channel:



Appendix C: Test results. Conducted emissions limit

CONTINUOUS CONDUCTED EMISSION 75

DESCRIPTION OF THE OPERATION MODES

The operation modes described in this paragraph constitute a functionality of the sample under test for itself. The operation modes used by the samples to which the present report refers, are shown in the following table:

OPERATION MODE	DESCRIPTION
OM#01	EUT ON. Charging Mode, Bluetooth linked with ancillary equipment. Power Supply: 115 VAC.

The total uncertainty of the measurement system for the measured conducted disturbance characteristics of EUT from 150 kHz to 30 MHz is $I = \pm 3,9$ dB for quasi-peak measurements, $I = \pm 3,2$ dB for average measurements ($k = 2$).

CONTINUOUS CONDUCTED EMISSION

LIMITS:	Product standard :	FCC CFR 47, Part 15, Subpart C (10-1-16 Edition), Secs. 15.207
	Test standard :	FCC CFR 47, Part 15, Subpart C (10-1-16 Edition), Secs. 15.207

CLASS B

The applied limit for continuous conducted emissions in power leads, according with the requirements of FCC Rules and Regulations 47 CFR Part 15, Subpart C (10-1-16 Edition), Secs. 15.207 in the frequency range 0,15 to 30 MHz, for Class B equipment was:

Frequency range (MHz)	Limit (dB μ V)	
	Quasi-peak	Average
0,15 to 0,5	66-56*	56-46*
0,5 to 5	56	46
5 to 30	60	50

*Decreases with the logarithm of the frequency.

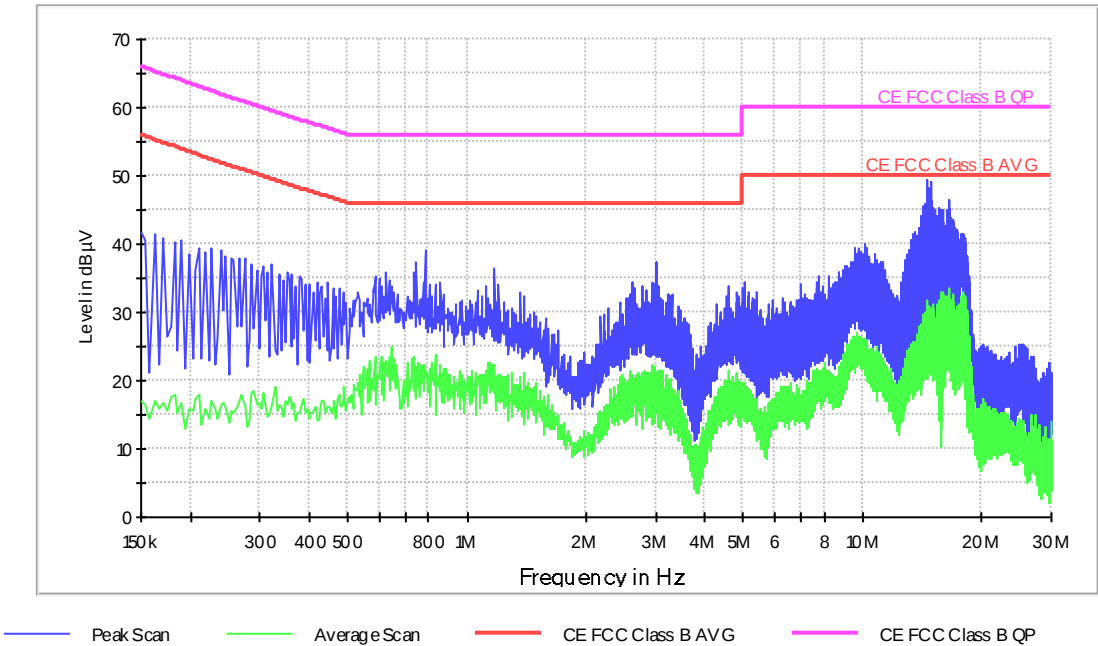
TESTED SAMPLES:	S/03
TESTED OPERATION MODES:	OM#01
TEST RESULTS:	CCmmnnhh: CC, Conducted Condition; mm: Sample number; nn: Operation mode; hh: wire

CCmmnnhh	DESCRIPTION	RESULT
CC03010N	Range: 150kHz – 30MHz. Neutral wire noise.	P
CC0301L1	Range: 150kHz – 30MHz. Phase wire noise.	P

Conducted Emission. CC03010N

Project: 57720RRF.001
Company: Kick AI Ltd Oy
Sample: S/03
Operation mode: OM#01
Description: EUT ON. Charging Mode, Bluetooth linked with ancillary equipment.
Power Supply: 115 VAC. Neutral Wire Noise.

EC FCC Class B



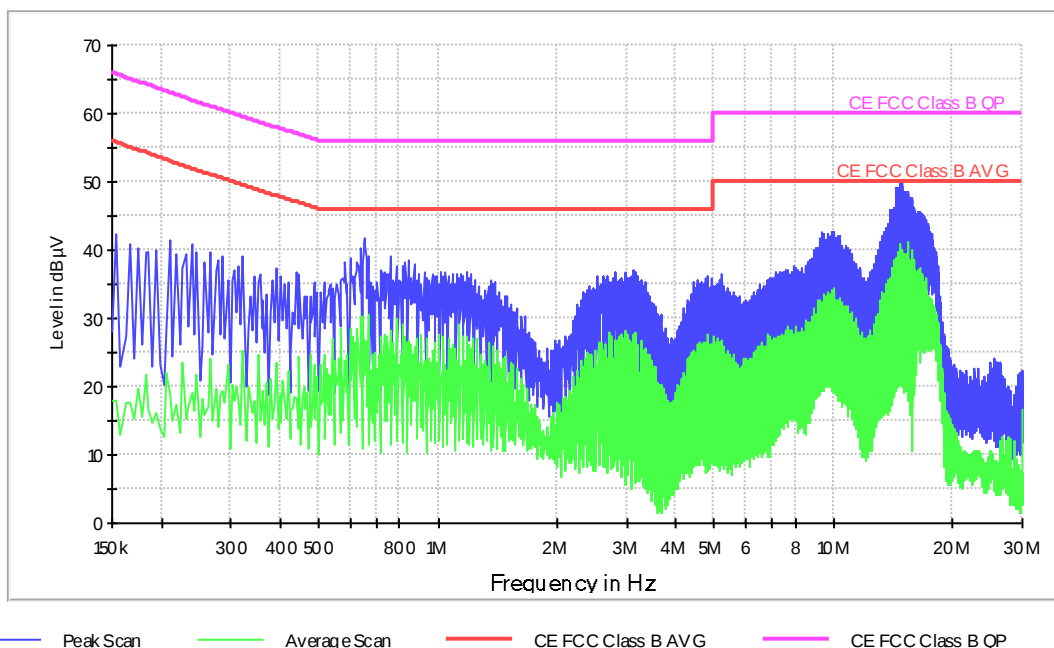
Subrange Maxima

Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)
0.150000	41.8	17.1
0.266000	38.0	17.0
0.734000	35.8	23.4
0.786000	39.2	21.2
1.366000	33.0	20.7
3.002000	37.5	19.1
5.054000	34.4	18.3
10.086000	40.0	26.3
14.602000	49.5	29.2
18.014000	41.5	32.8

Conducted Emission. CC0301L1

Project: 57720RRF.001
 Company: Kick AI Ltd Oy
 Sample: S/03
 Operation mode: OM#01
 Description: EUT ON. Charging Mode, Bluetooth linked with ancillary equipment.
 Power Supply: 115 VAC. Phase Wire Noise.

EC FCC Class B



Subrange Maxima

Frequency (MHz)	MaxPeak-ClearWrite (dBµV)	Average-ClearWrite (dBµV)
0.154000	42.5	17.9
0.266000	39.6	24.2
0.650000	41.9	21.7
0.758000	39.0	28.1
1.366000	35.5	19.8
3.130000	37.0	19.7
5.210000	36.3	26.8
9.866000	42.7	34.1
14.814000	49.9	34.4
17.674000	42.3	31.2