DEKRA Certification, Inc.
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DEKRA

Test Lab
Cert 2764.01

FCC LISTED, REGISTRATION NUMBER: 2764.01

ISED LISTED REGISTRATION NUMBER: 23595-1

Test report No:

NIE: 2118ERM.006

Test report

USA FCC Part 15.249 & 15.209

CANADA RSS-210, RSS-Gen

Radio Frequency Devices. Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, 5725 - 5875 MHz, and 24.0 – 24.25 GHz.

Identification of item tested ..... :	Wireless rechargeable hearing instrument
Trademark ..... :	ReSound / Beltone / Interton / GN Hearing
Model and /or type reference ..... :	LXR45
Other identification of the product ..... :	FCC ID:X26LXR45 IC : 6941C-LXR45
Final HW version ..... :	PCBA,LUXOR RHI, V1.B, C5.0 Rev. F
Final SW version ..... :	Dooku1
Features ..... :	Audio amplification, Wireless recharging, proprietary 2.4GHz wireless functionality(Proximity) and Bluetooth 5.0
Manufacturer ..... :	GN Hearing A/S Lautrupbjerg 7, 2750 Ballerup, Denmark.
Test method requested, standard……..:	USA FCC Part 15.249 10-1-17 Edition: Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, 5725 - 5875 MHz, and 24.0 – 24.25 GHz. USA FCC Part 15.209 10-1-17 Edition: Radiated emission limits; general requirements. CANADA RSS-210 Issue 9 (August 2016). CANADA RSS-Gen Issue 4 (November 2014). ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Summary ..... :	IN COMPLIANCE
Approved by (name / position & signature) ..... :	Domingo Galvez EMC & RF Lab. Manager Digitally signed by Domingo Galvez DN: cn=Domingo Galvez, o=DEKRA, ou=EMC-RF Lab Manager, email=domingo.galvez@dekra.com, c=US Date: 2018.07.06 07:56:00 -04'00'
Date of issue ..... :	04/06/2018
Report template No. ..... :	FDT08_20

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Competences and guarantees

DEKRA Certification Inc. is a testing laboratory accredited by A2LA (The American Association for Laboratory Accreditation), to perform the tests indicated in the Certificate 2764.01.

DEKRA Certification Inc. 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: 2764.01.

DEKRA Certification Inc. 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:23595-1.

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

DEKRA Certification Inc. 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 Certification Inc. at the time of performance of the test.

DEKRA Certification Inc. 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 Certification Inc.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Certification Inc. and the Accreditation Bodies.

Uncertainty

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

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
2118.046	Hearing Aid/ EU RF	NA	NA	04/23/2018

Auxiliary elements used with the sample S/01:

Control Nº	Description	Model	Serial Nº	Date of reception
2118.016	Audio Extension	NA	NA	04/23/2018
2118.018	Banana Plug Cable	NA	NA	04/23/2018
2118.039	SpeedLink	NA	1581007547	04/23/2018

1. Sample S/01 has undergone following test(s).
   All Condcuted tests indicated in appendix A.

Sample S/02 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
2118.006	Hearing Aid/ Radiated	NA	NA	04/23/2018

Auxiliary elements used with the sample S/02:

Control Nº	Description	Model	Serial Nº	Date of reception
2118.016	Audio Extension	NA	NA	04/23/2018
2118.018	Banana Plug Cable	NA	NA	04/23/2018
2118.039	SpeedLink	NA	1581007547	04/23/2018

1. Sample S/02 has undergone following test(s).
   All Radiated tests indicated in appendix A.

Test sample description

Wireless rechargeable hearing instrument, which is capable of being recharged through magnetic induction.

Identification of the client

GN HEARING A/S

Lautrupbjerg 7, 2750 Ballerup, Denmark.

Testing period

The performed test started on 04/26/2018 and finished on 05/06/2018.

The tests have been performed at DEKRA Certification, Inc.

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

In the chamber for conducted measurements, 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

1; The tests have been performed by the technical personnel: Divya Adusumilli, Koji Nishimoto and Victor Acedo Rubio.

2: Used instrumentation:

Conducted Measurements

Test system Rohde & Schwarz TS 8997:

No.	Description	Last Cal. Date	Cal. Due date
1.	Signal analyzer Rohde & Schwarz FSV40	2017/03	2019/03
2.	Switch unit Rohde & Schwarz with power detector OSP120 / OSP-B157	2017/03	2019/03
3.	RF generator Rohde & Schwarz SMB100A	2017/04	2019/04
4.	RF generator Rohde & Schwarz SMBV100A	2018/01	2019/01
5.	Climatic chamber Espec	2017/12	2018/12

Radiated Measurements

No.	Description	Last Cal. date	Cal. due date
1.	Semi anechoic Absorber Lined Chamber Frankonia SAC 3 plus "L"	N/A	N/A
2.	BiconicalLog antenna ETS LINDGREN 3142E	2017/03	2020/03
3.	Double-ridge Waveguide Horn antenna 1-18 GHz	2017/03	2019/03
4.	Spectrum analyzer Rohde & Schwarz FSV40	2017/03	2019/03
5.	Double Ridge Horn Antenna 10 – 40 GHz	2016/12	2018/12
6.	RF pre-amplifier 30 MHz-6 GHz Bonn Elektronik BLMA 0360-01N	2017/05	2019/05
7.	RF pre-amplifier 1-18 GHz Bonn Elektronik BLMA 0118-2A	2017/05	2019/05
8.	RF Pre-amplifier 18-40 GHz Bonn Elektronik BLMA1840-1M	2017/05	2019/05
9.	Rohde & Schwarz EMC32 software	N/A	N/A

Testing verdicts

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

1. BTLE

FCC PART 15 PARAGRAPH / RSS-210		VERDICT			
		NA	P	F	NM
FCC 15.249 Subclause (a) / RSS-210 B.10. (a)	Field strength of fundamental and harmonics emissions		P		
FCC 15.249 Subclause (d) / RSS-210 B.10. (b)	Emissions radiated outside of the specific frequency bands		P		

1. Proximity Protocol

FCC PART 15 PARAGRAPH / RSS-210		VERDICT			
		NA	P	F	NM
FCC 15.249 Subclause (a) / RSS-210 B.10. (a)	Field strength of fundamental and harmonics emissions		P		
FCC 15.249 Subclause (d) / RSS-210 B.10. (b)	Emissions radiated outside of the specific frequency bands		P		

Appendix A – Test result (Bluetooth Low Energy)

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TEST CONDITIONS

Power supply (V):

$V_{nominal}$ = 3.8 Vdc

Type of power supply = DC voltage from internal battery.

Type of antenna = Integral antenna

Declared Gain for antenna (maximum) = +0.82 dBi

Temperature (ºC):

T_n = +15 to +35

T_{min} = 0 (*)

T_{max} = +45 (*)

The subscript n indicates normal test conditions.

The subscripts min and max indicates extreme test conditions (minimum and maximum respectively).

(*): Declared by applicant.

TEST FREQUENCIES:

Lowest channel: 2402 MHz

Middle channel: 2440 MHz

Highest channel: 2480 MHz

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is directly connected to the Test System TS8997.

RADIATED MEASUREMENTS

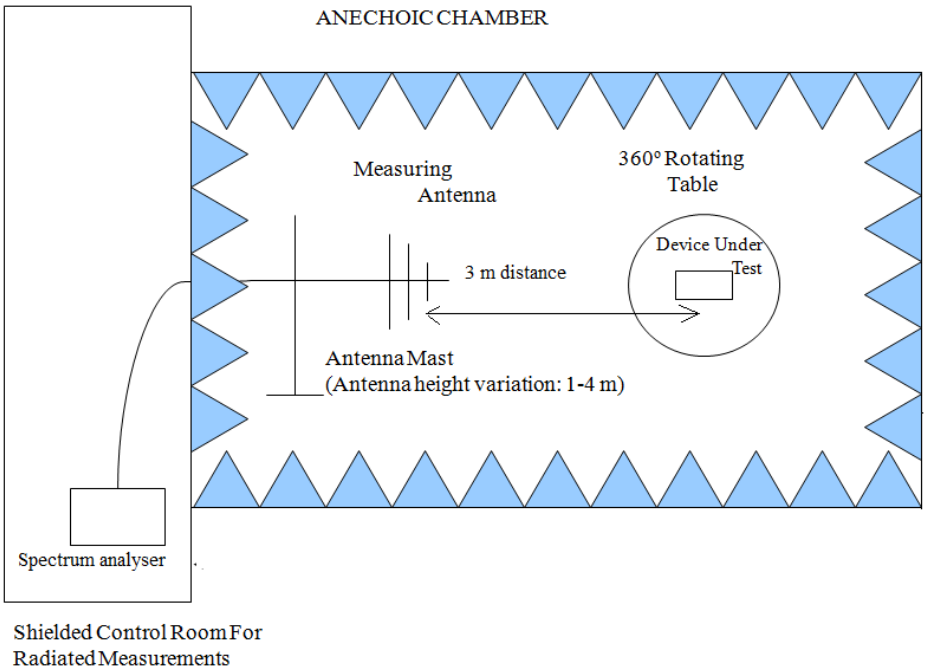
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1m for the frequency range 1 GHz-25 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

For radiated emissions in the range 1 GHz-25 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.

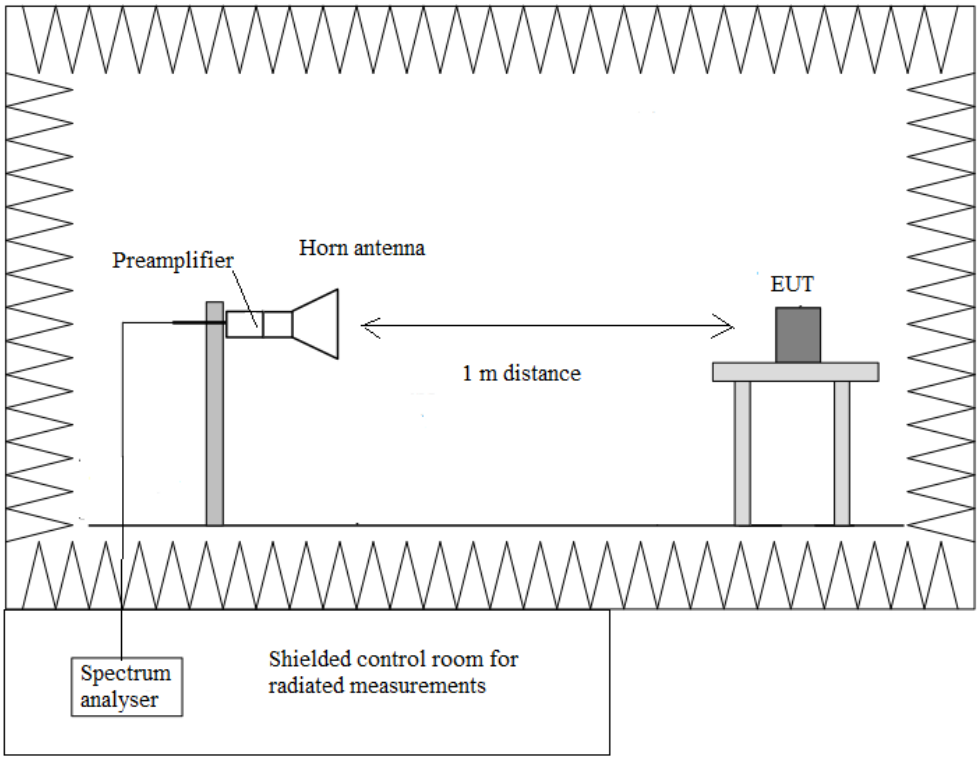
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

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

Radiated measurements setup f < 1 GHz



Radiated measurements setup f > 1 GHz



Occupied Bandwidth

RESULTS

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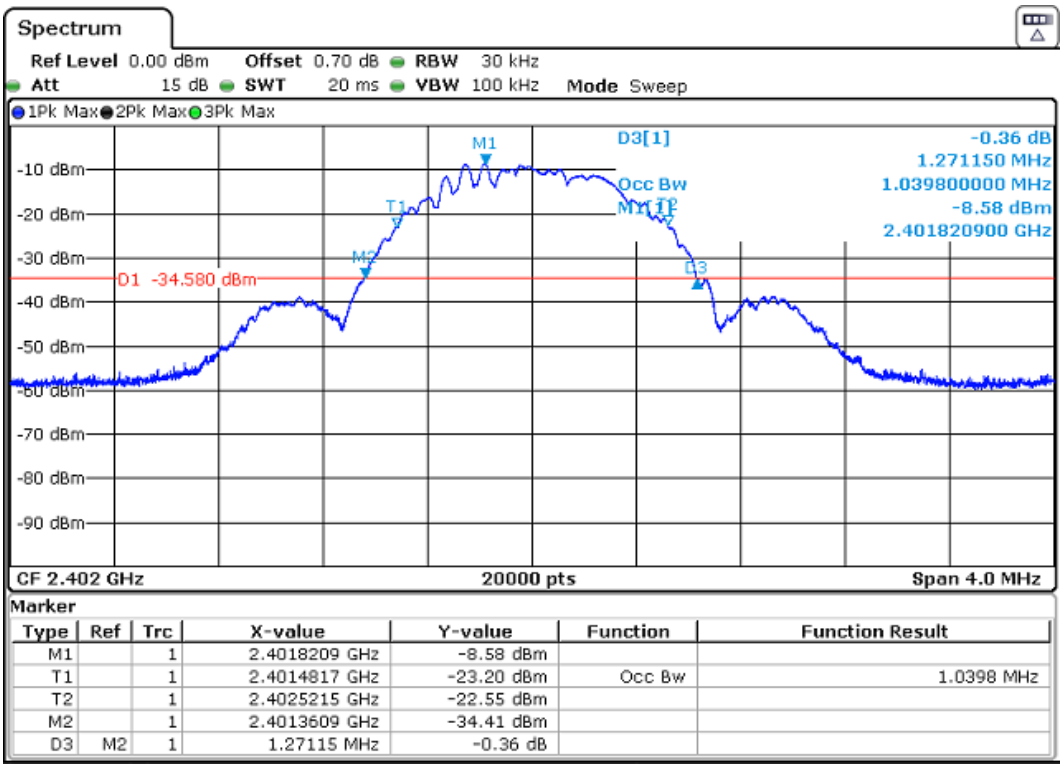
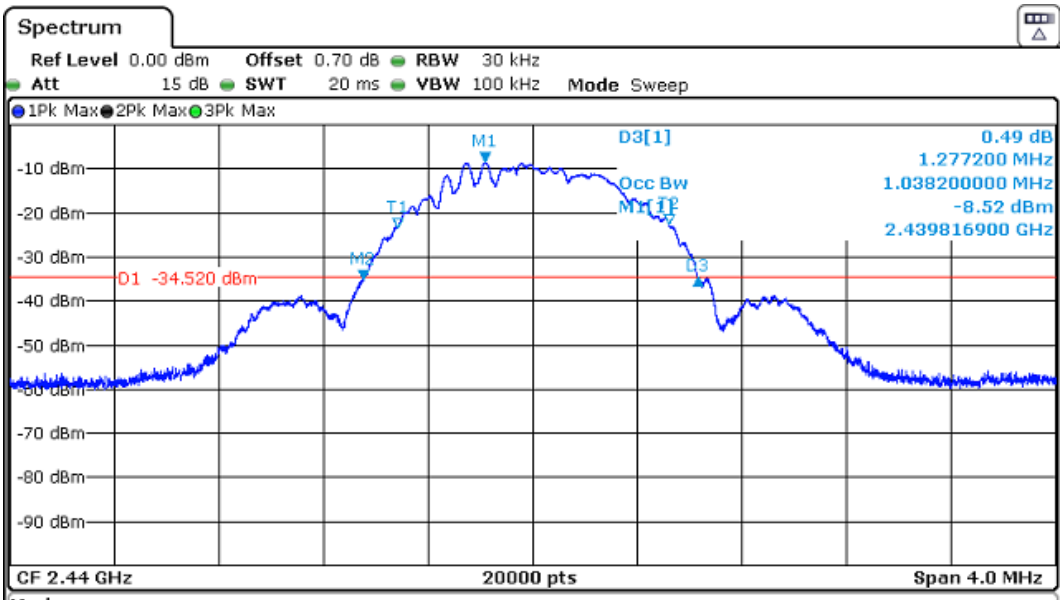
(see next plots).

	Lowest frequency 2402 MHz	Middle frequency 2440 MHz	Highest frequency 2480 MHz
99% dB bandwidth (MHz)	1.04	1.038	1.04
-26 dBc bandwidth (MHz)	1.27	1.27	1.27
Measurement uncertainty (kHz)	<± 8.33		

Lowest Channel



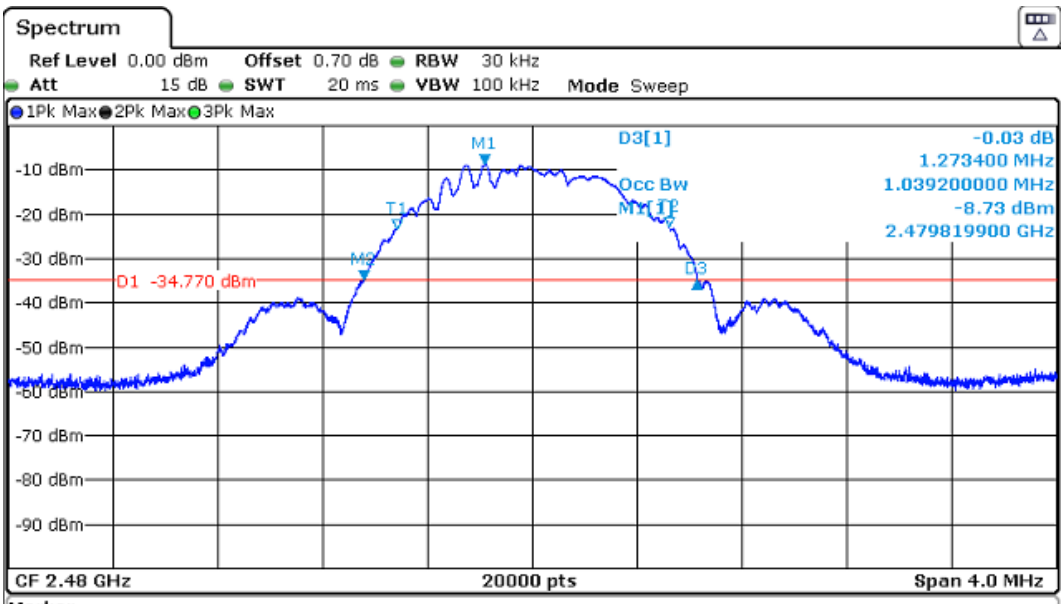
Middle Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4398169 GHz	-8.52 dBm		
T1		1	2.4394823 GHz	-23.33 dBm	Occ Bw	1.0382 MHz
T2		1	2.4405205 GHz	-22.47 dBm		
M2		1	2.4393533 GHz	-34.99 dBm		
D3	M2	1	1.2772 MHz	0.49 dB		

Highest channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4798199 GHz	-8.73 dBm		
T1		1	2.4794819 GHz	-23.36 dBm	Occ Bw	1.0392 MHz
T2		1	2.4805211 GHz	-22.70 dBm		
M2		1	2.4793553 GHz	-34.73 dBm		
D3	M2	1	1.2734 MHz	-0.03 dB		

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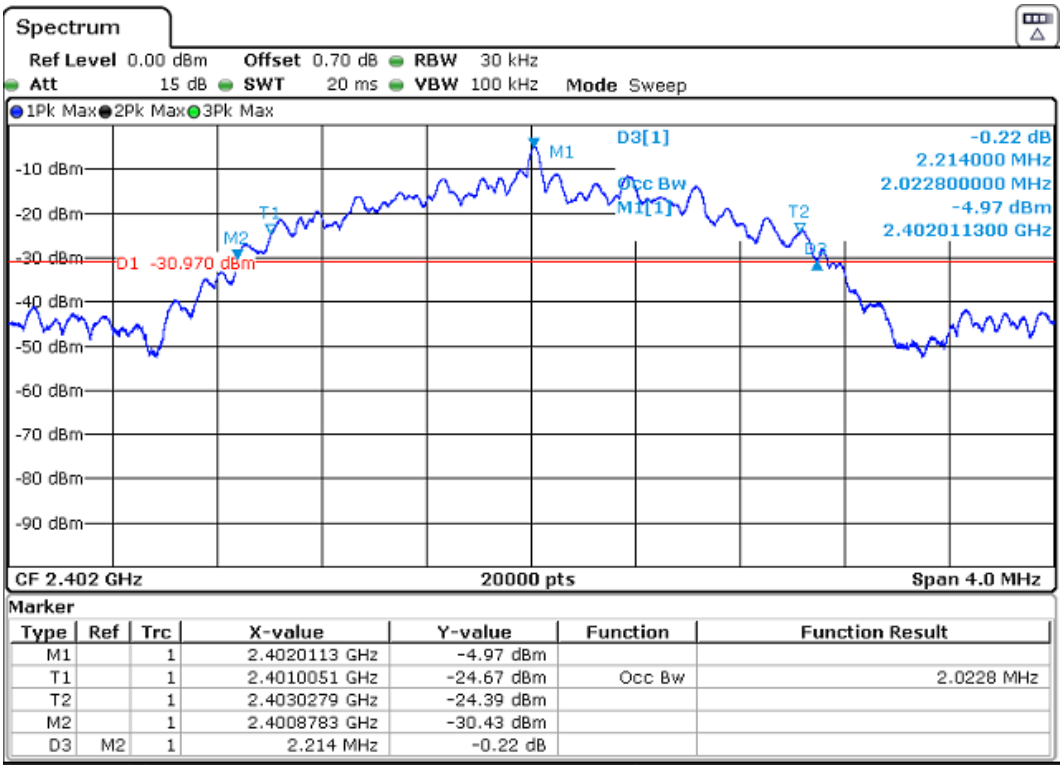
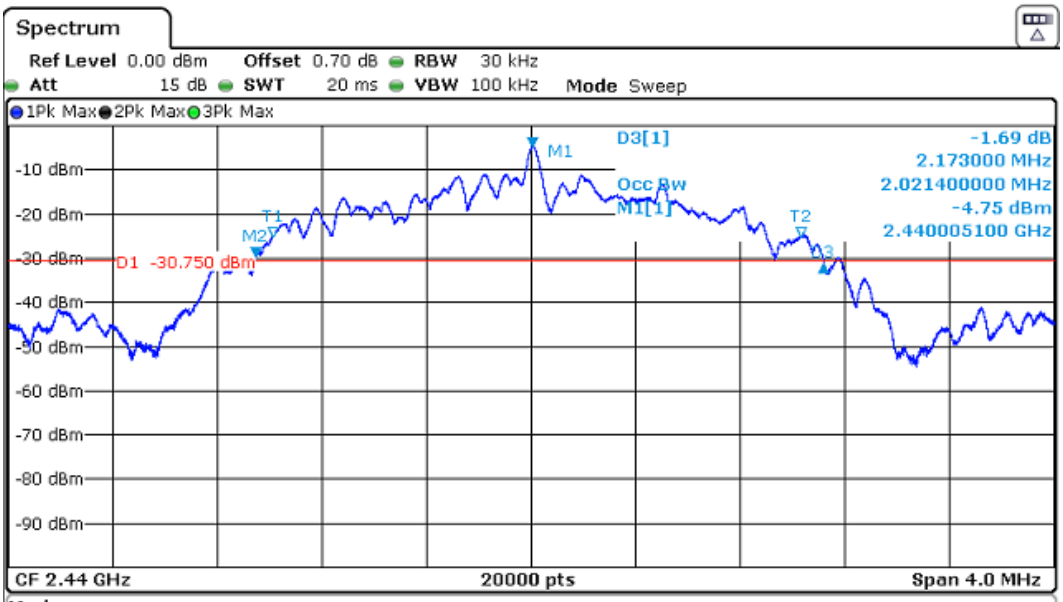
(see next plots).

	Lowest frequency 2402 MHz	Middle frequency 2440 MHz	Highest frequency 2480 MHz
99% dB bandwidth (MHz)	2.02	2.02	2.0
-26 dBc bandwidth (MHz)	2.21	2.17	2.22
Measurement uncertainty (kHz)	<± 8.33		

Lowest Channel



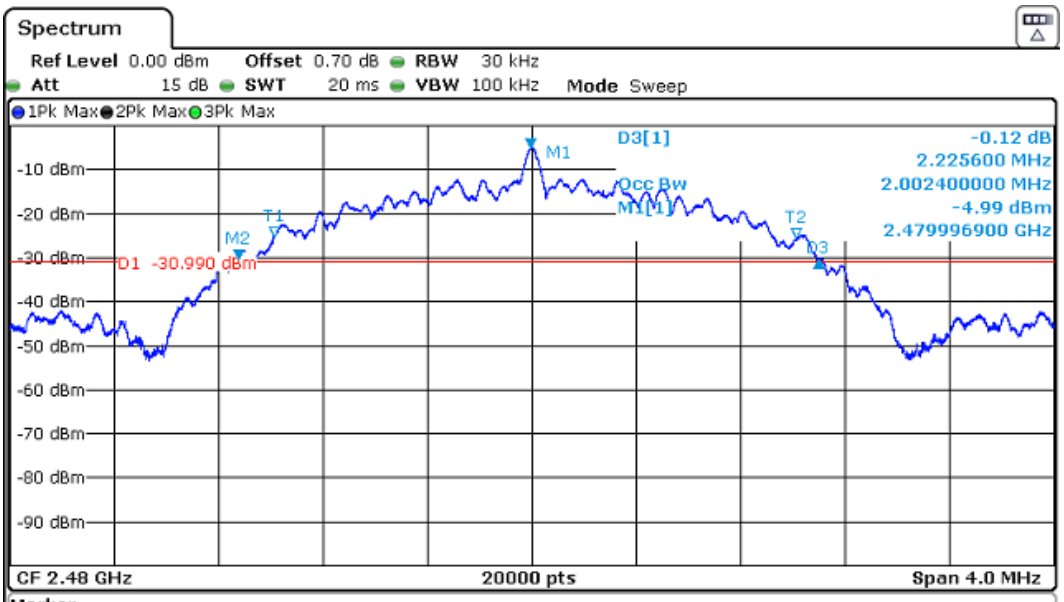
Middle Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4400051 GHz	-4.75 dBm		
T1		1	2.4390127 GHz	-25.11 dBm	Occ Bw	2.0214 MHz
T2		1	2.4410341 GHz	-25.11 dBm		
M2		1	2.4389477 GHz	-29.64 dBm		
D3	M2	1	2.173 MHz	-1.69 dB		

Highest channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4799969 GHz	-4.99 dBm		
T1		1	2.4790125 GHz	-25.12 dBm	Occ Bw	2.0024 MHz
T2		1	2.4810149 GHz	-25.59 dBm		
M2		1	2.4788743 GHz	-30.31 dBm		
D3	M2	1	2.2256 MHz	-0.12 dB		

Section 15.249 Subclause (a) / RSS-210 B.10. (a) Field strength of Fundamental

SPECIFICATION

The field strength of emissions from intentional radiators shall comply with the following

Fundamental frequency (MHz)	Field strength of fundamental (mV/m)	Field strength (dBµV/m)	Measurement distance (m)
902 - 928	50	93.98	3
2400 – 2483.5	50	93.98	3
5725 - 5875	50	93.98	3
24000-24250	250	107.96	3

For frequencies above 1000 MHz, the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

RESULTS:

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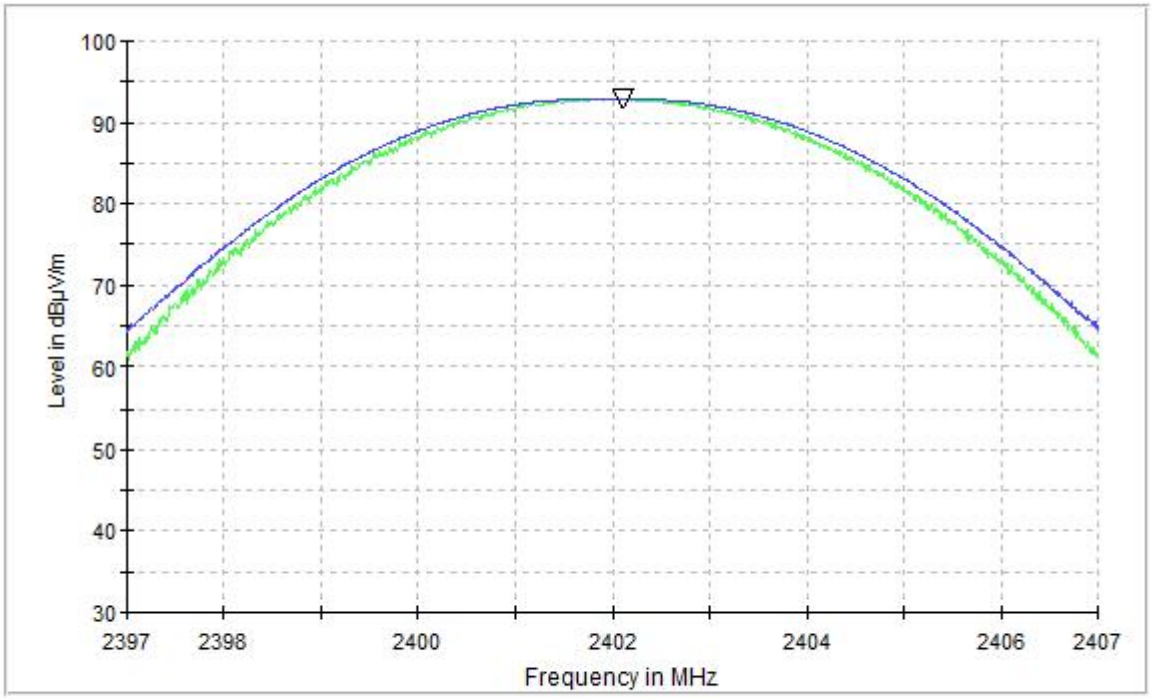
	Lowest frequency 2402 MHz	Middle frequency 2440 MHz	Highest frequency 2480 MHz
Field strength (dBµV/m) average	92.78	91.17	90.30
Field strength (dBµV/m) peak	92.85	91.2	90.38
Measurement uncertainty (dB)	<±3.88		

Verdict: PASS

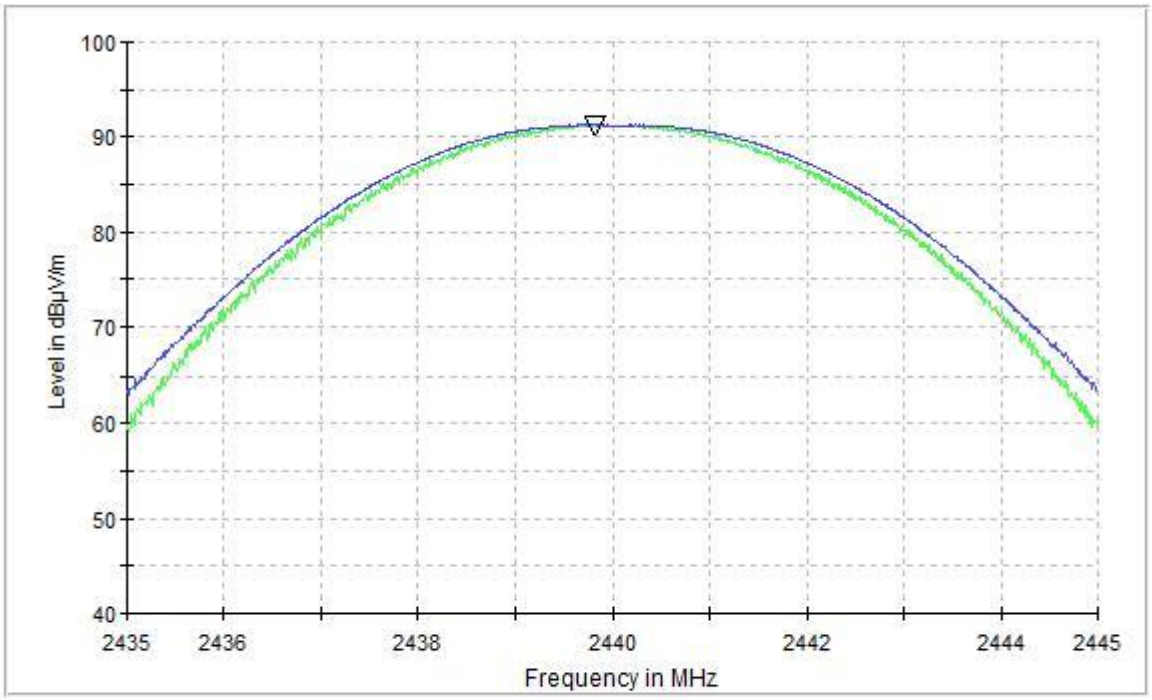
FIELD STRENGTH

LOWEST CHANNEL



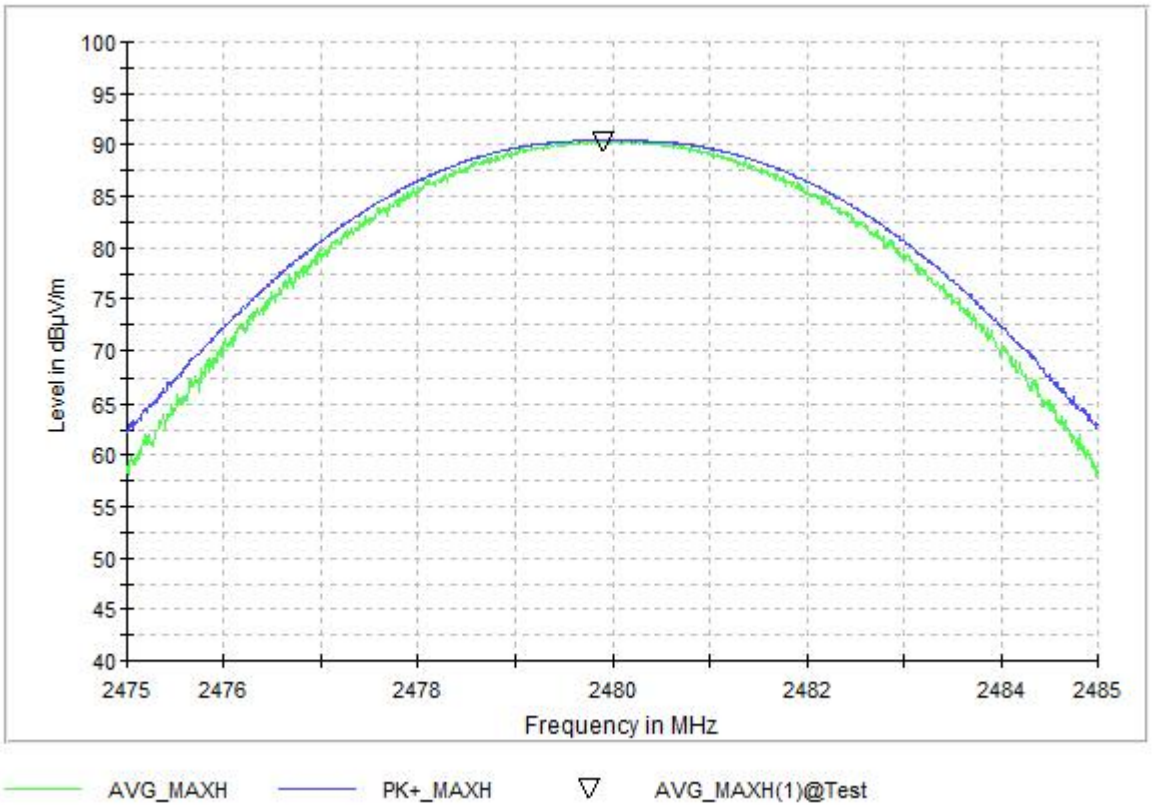
AVG_MAXH
PK+_MAXH
AVG_MAXH@Fundamental_Field_Strength_2402MHz_HPVP

MIDDLE CHANNEL



AVG_MAXH
PK+_MAXH
AVG_MAXH(1)@Fundamental_Field_Strength_2440MHz_HPVP

HIGHEST CHANNEL



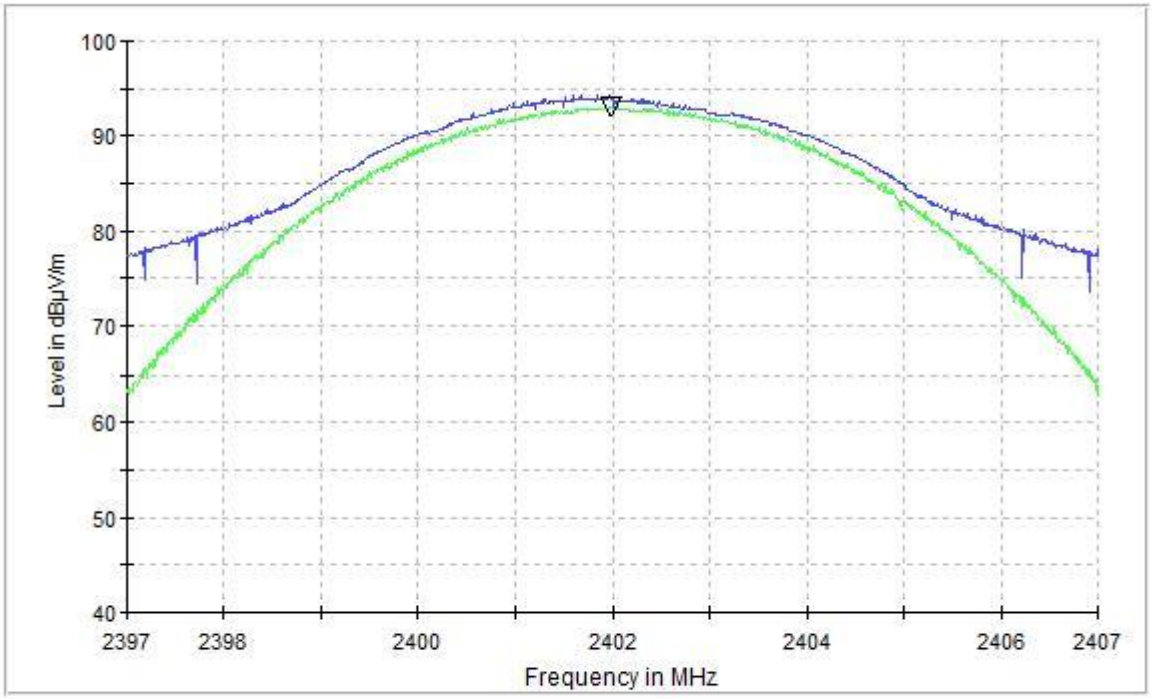
BTLE 2Mb

	Lowest frequency 2402 MHz	Middle frequency 2440 MHz	Highest frequency 2480 MHz
Field strength (dBµV/m) average	93.0	91.58	90.42
Field strength (dBµV/m) peak	93.8	92.71	91.55
Measurement uncertainty (dB)	<±3.88		

Verdict: PASS

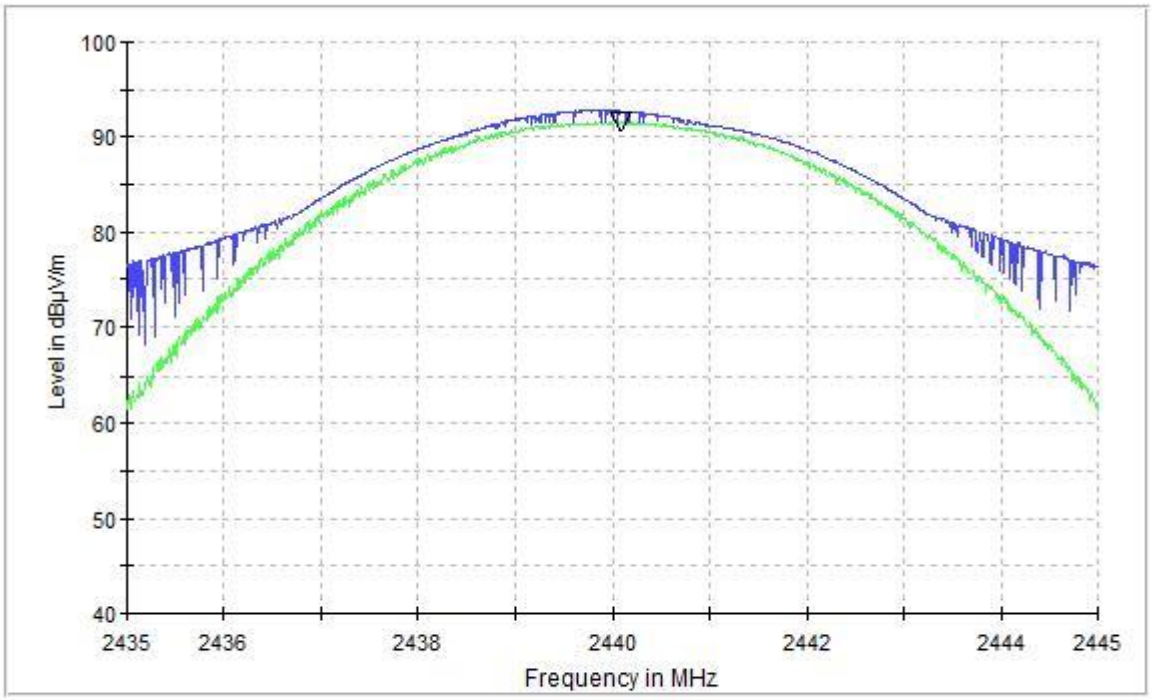
FIELD STRENGTH

LOWEST CHANNEL



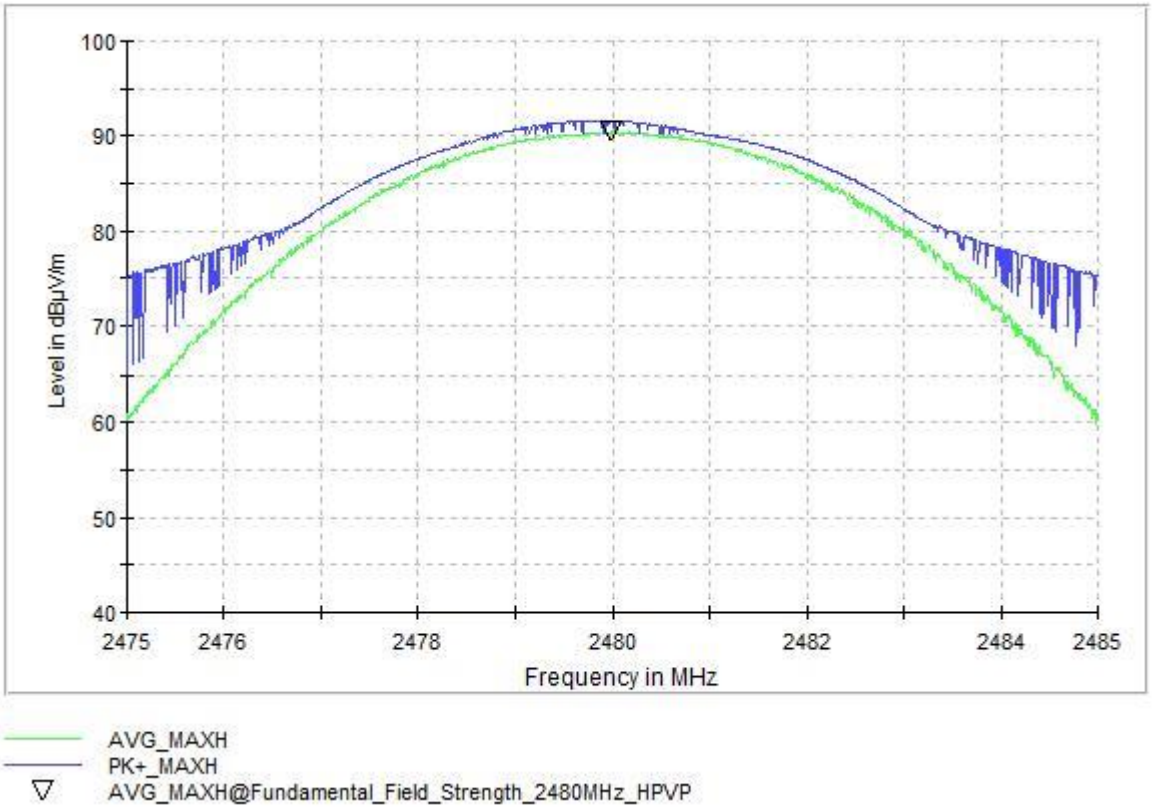
AVG_MAXH
PK+_MAXH
AVG_MAXH(1)@Fundamental_Field_Strength_2402MHz_HPVP

MIDDLE CHANNEL



AVG_MAXH
PK+_MAXH
AVG_MAXH(1)@Fundamental_Field_Strength_2440MHz_HPVP

HIGHEST CHANNEL



Section 15.249 Subclause (a) and (d) / RSS-210 B.10 (b) Emissions limitations radiated (Transmitter)

SPECIFICATION

The field strength of harmonics from intentional radiators shall comply with the following

Fundamental frequency (MHz)	Field strength of harmonics (µV/m)	Field strength of harmonics (dBµV/m)	Measurement distance (m)
902 - 928	500	54	3
2400 – 2483.5	500	54	3
5725 - 5875	500	54	3
24000-24250	2500	67.96	3

Emissions radiated outside of the specific frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of fundamental or to the general radiated emission limits specified in section 15.209:

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

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-1000 MHz and at distance of 1m for the frequency range 1 GHz-25 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.

BTLE 1Mb

Frequency range 30 MHz-1000 MHz.

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

No radiated spurious signals were detected at less than 20 dB respect to the limit for the lowest, middle and highest operating channels.

Frequency range 1 GHz-25 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 (see next plots).

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.

1. CHANNEL: LOWEST (2402 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
6.85423	V	Peak	51	± 4.87
		Average	47.7	± 4.87
6.9891	V	Peak	51.9	± 4.87
		Average	49.1	± 4.87
17.61863	V	Peak	47.4	± 4.87
		Average	44.4	± 4.87
7.2067	H	Peak	51	± 4.87
		Average	47.7	± 4.87
9.60936	H	Peak	51.9	± 4.87
		Average	49.1	± 4.87
17.9813	H	Peak	49.2	± 4.87
		Average	45.3	± 4.87

2. CHANNEL: MIDDLE (2440 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
6.84913	V	Peak	52.8	± 4.87
		Average	48.1	± 4.87
6.95283	V	Peak	50.9	± 4.87
		Average	47.9	± 4.87
17.89743	V	Peak	46.8	± 4.87
		Average	44.7	± 4.87
6.9517	H	Peak	52.8	± 4.87
		Average	48.7	± 4.87
7.31946	H	Peak	49.3	± 4.87
		Average	47.6	± 4.87
9.75953	H	Peak	50.8	± 4.87
		Average	48.4	± 4.87

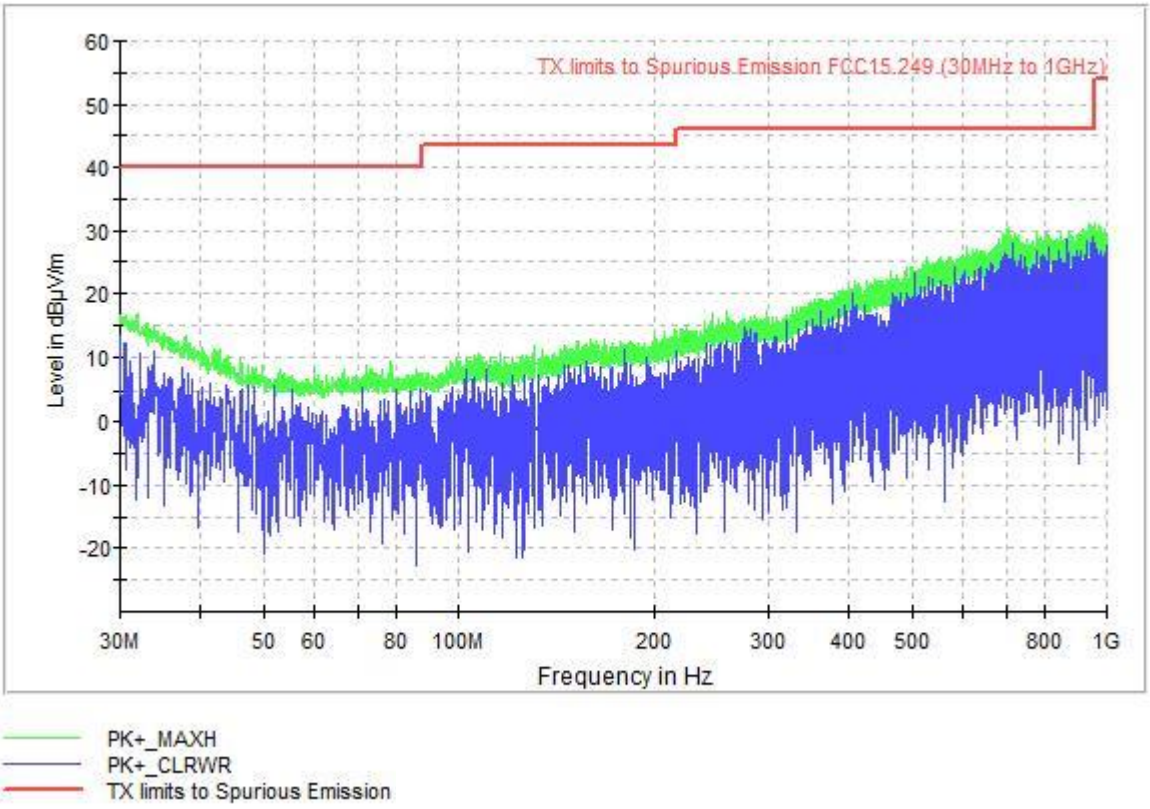
3. CHANNEL: HIGHEST (2480 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
4.96043	V	Peak	46.4	± 4.87
		Average	43.9	± 4.87
6.8888	V	Peak	51.4	± 4.87
		Average	47.7	± 4.87
9.92103	V	Peak	43.2	± 4.87
		Average	40.3	± 4.87
4.95986	H	Peak	49.6	± 4.87
		Average	46.5	± 4.87
6.94036	H	Peak	52.1	± 4.87
		Average	47.9	± 4.87
9.92103	H	Peak	49.8	± 4.87
		Average	47.9	± 4.87

Verdict: PASS

FREQUENCY RANGE 30 MHz-1000 MHz.

CHANNEL: Lowest (2402 MHz):

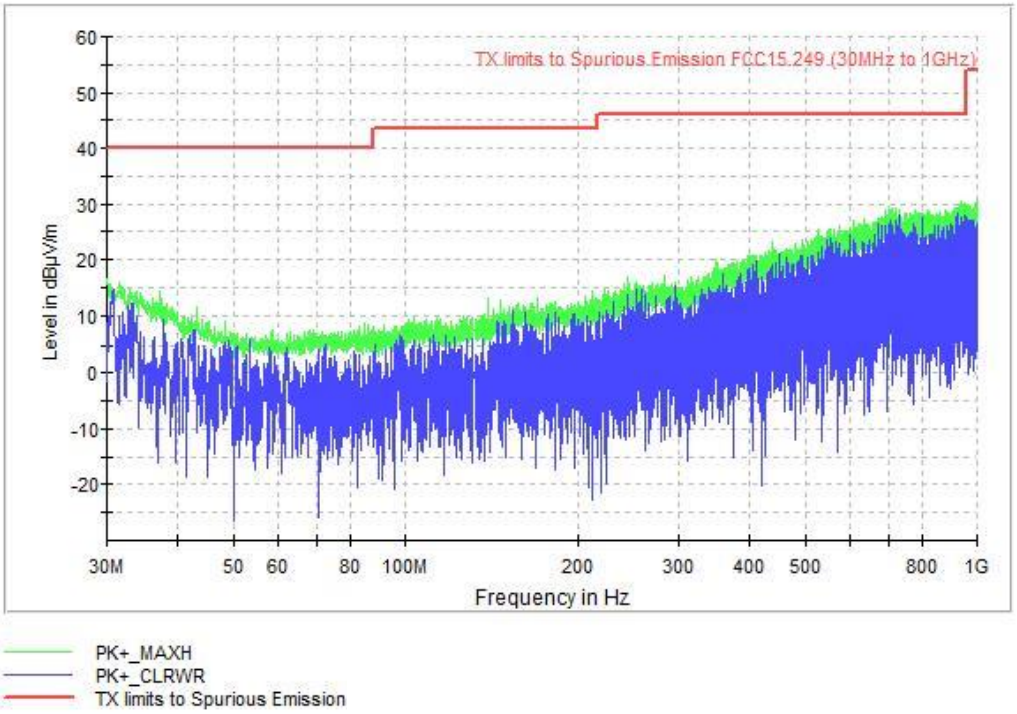


30MHz_1GHz_CH Low

CHANNEL: Middle (2440 MHz):

30MHz_1GHz_CH Mid

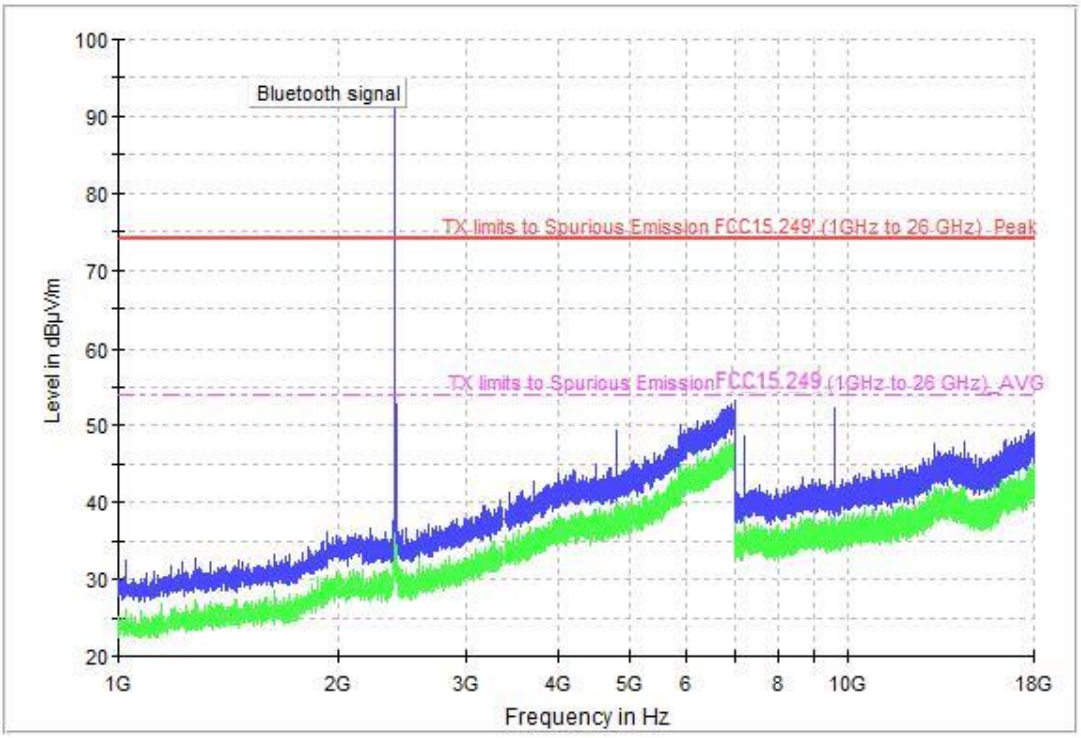
CHANNEL: Highest (2480 MHz) :



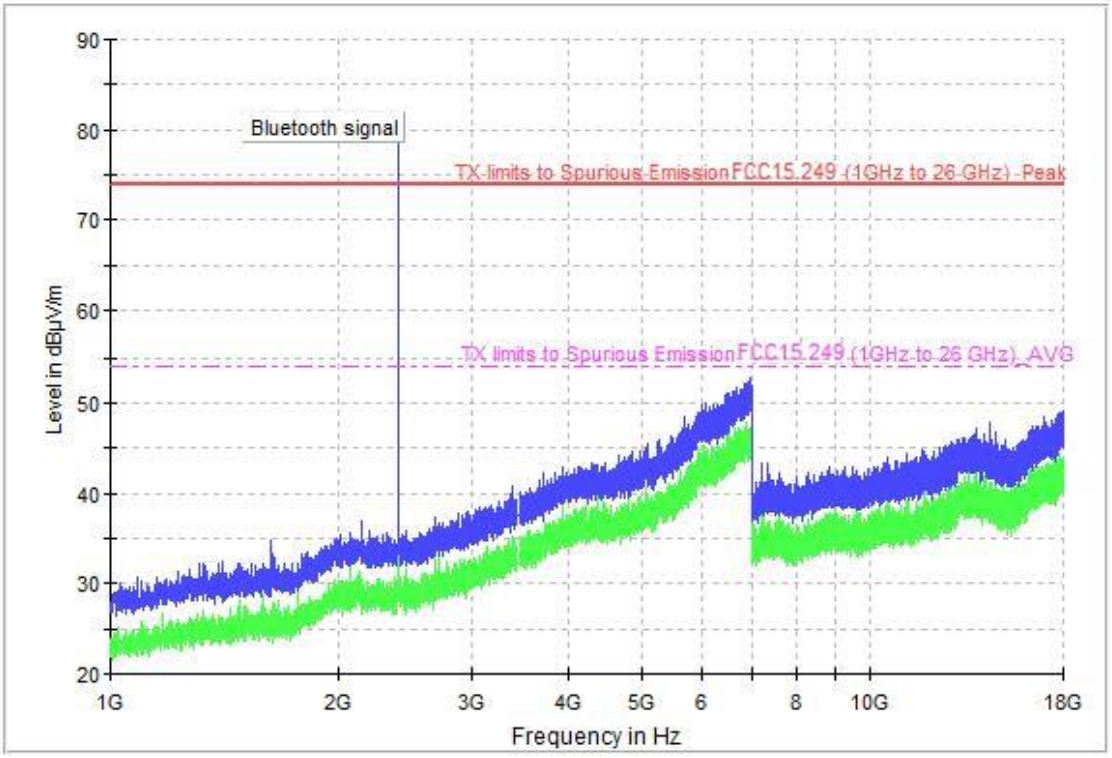
30MHz_1GHz_CH High

FREQUENCY RANGE 1 GHz to 18 GHz.

CHANNEL: Lowest (2402 MHz).

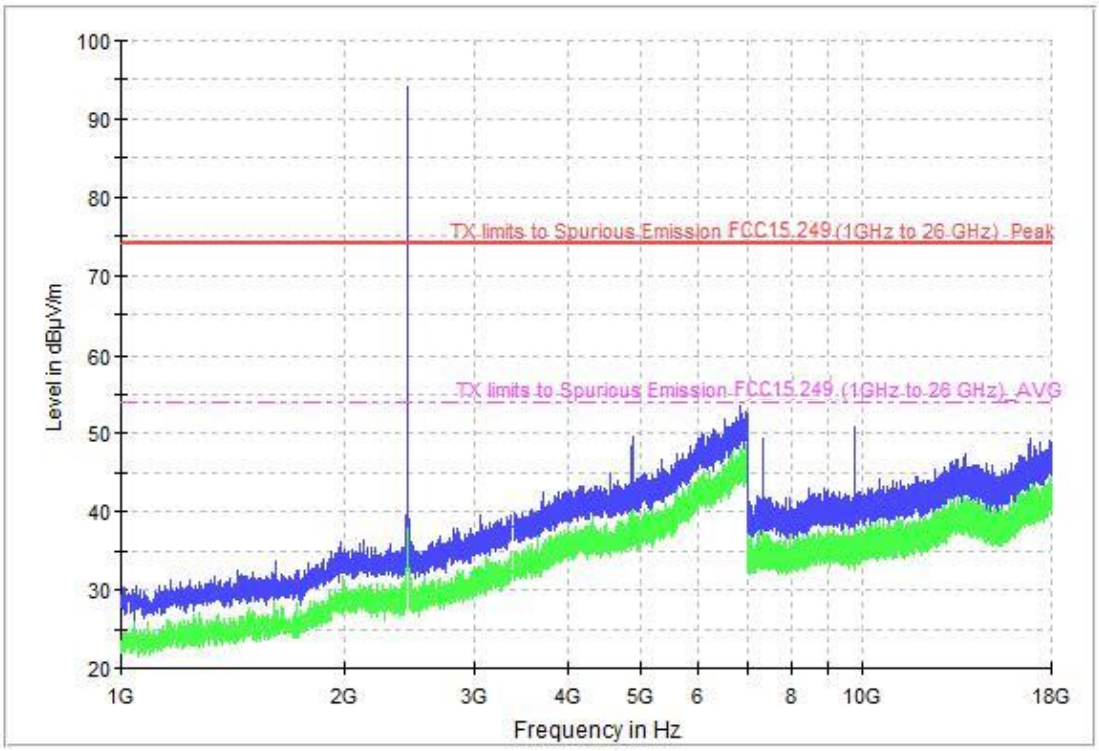


1GHz_18GHz_ HP_CH Low

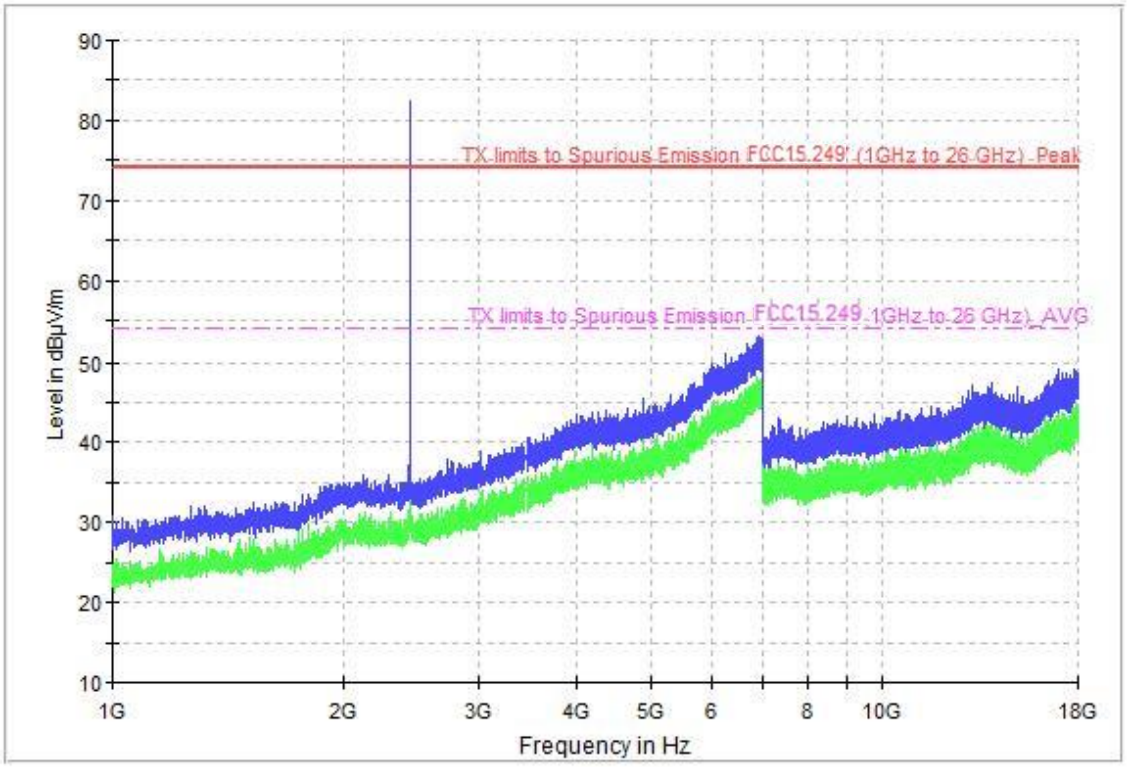


1GHz_18GHz_VP_CH Low

CHANNEL: Middle (2440 MHz).

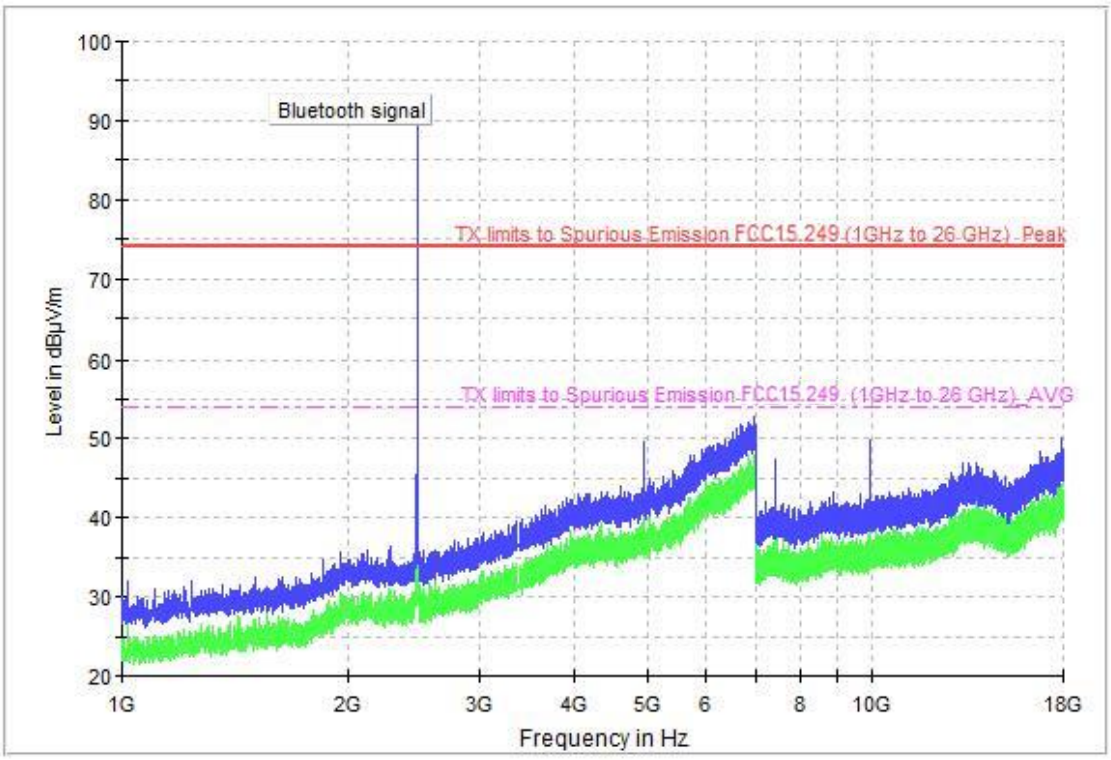


1GHz_18GHz_HP_CH Mid

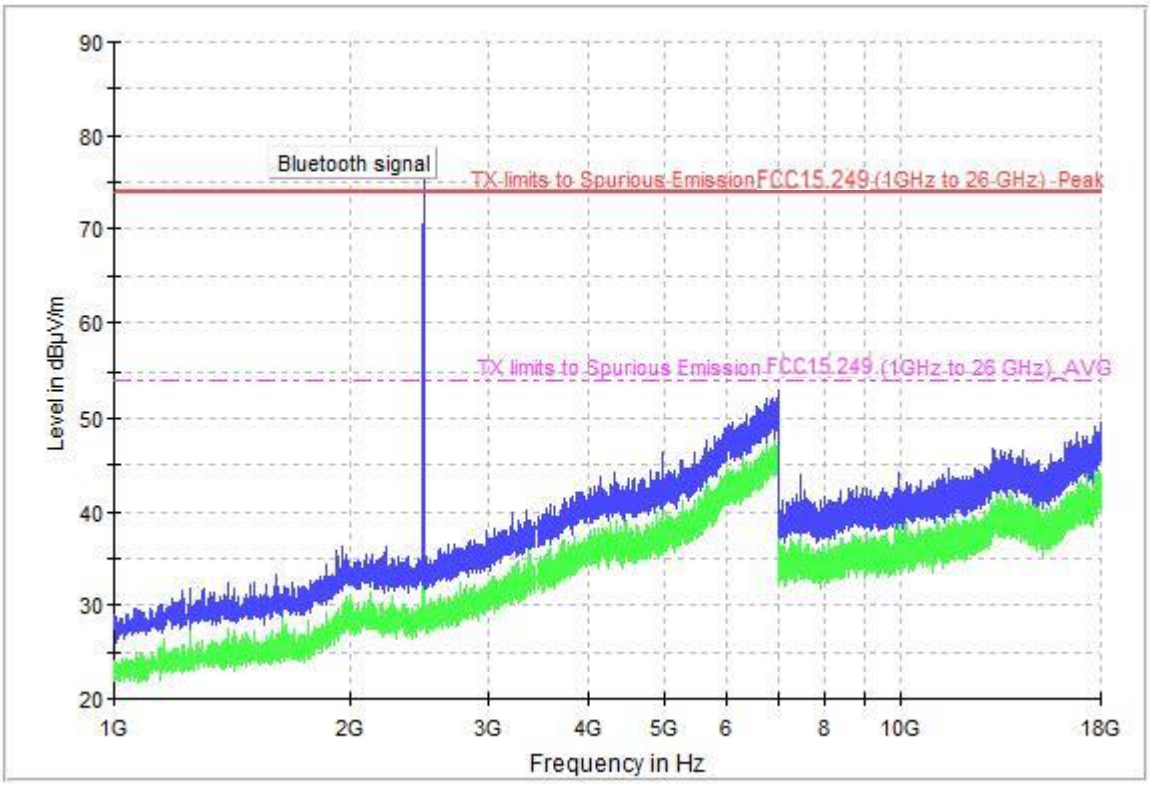


1GHz_18GHz_VP_CH Mid

CHANNEL: Highest (2480 MHz).



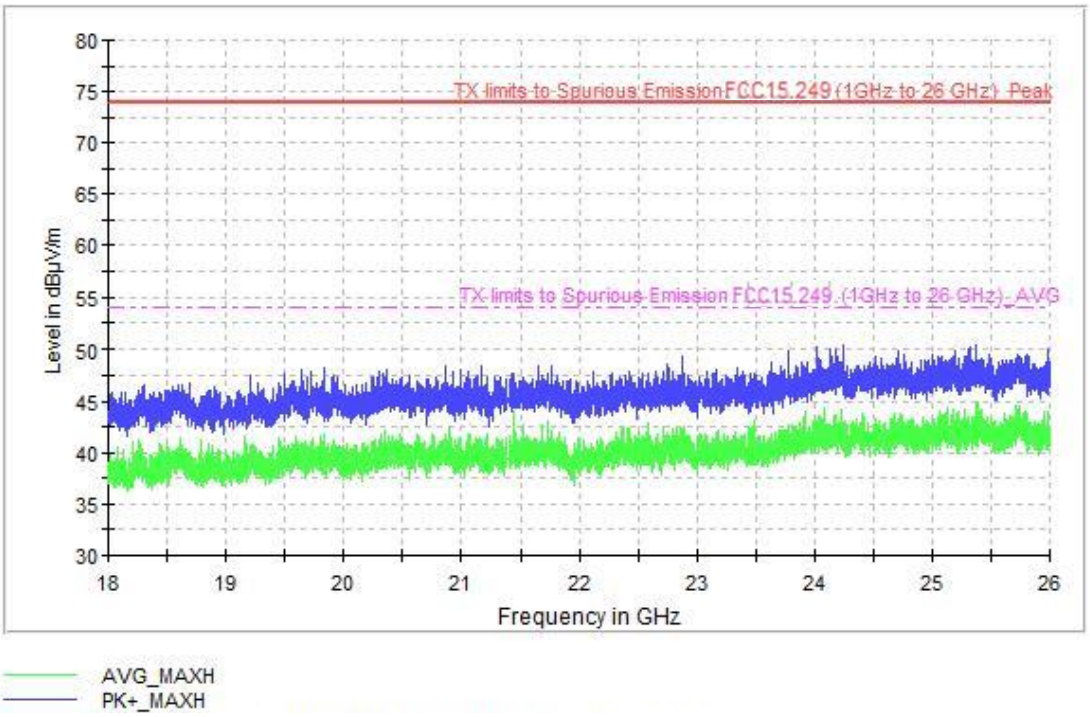
1GHz_18GHz_HP_CH High



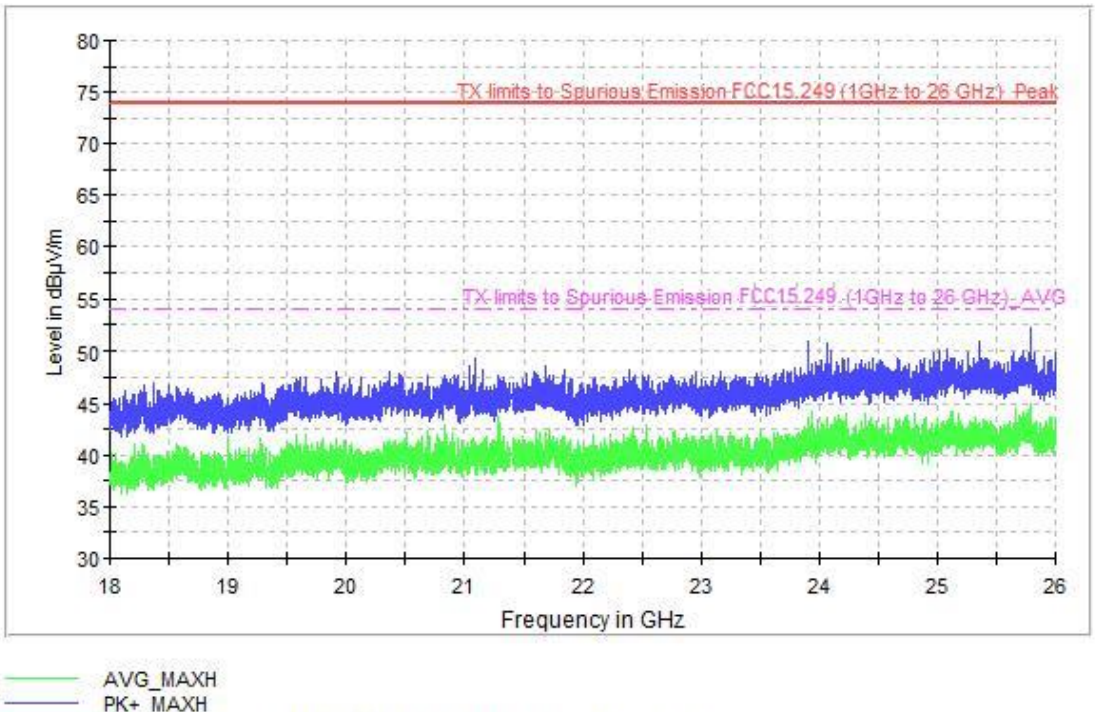
1GHz_18GHz_VP_CH High

FREQUENCY RANGE 18 GHz to 26 GHz.

CHANNEL: Lowest (2402 MHz).

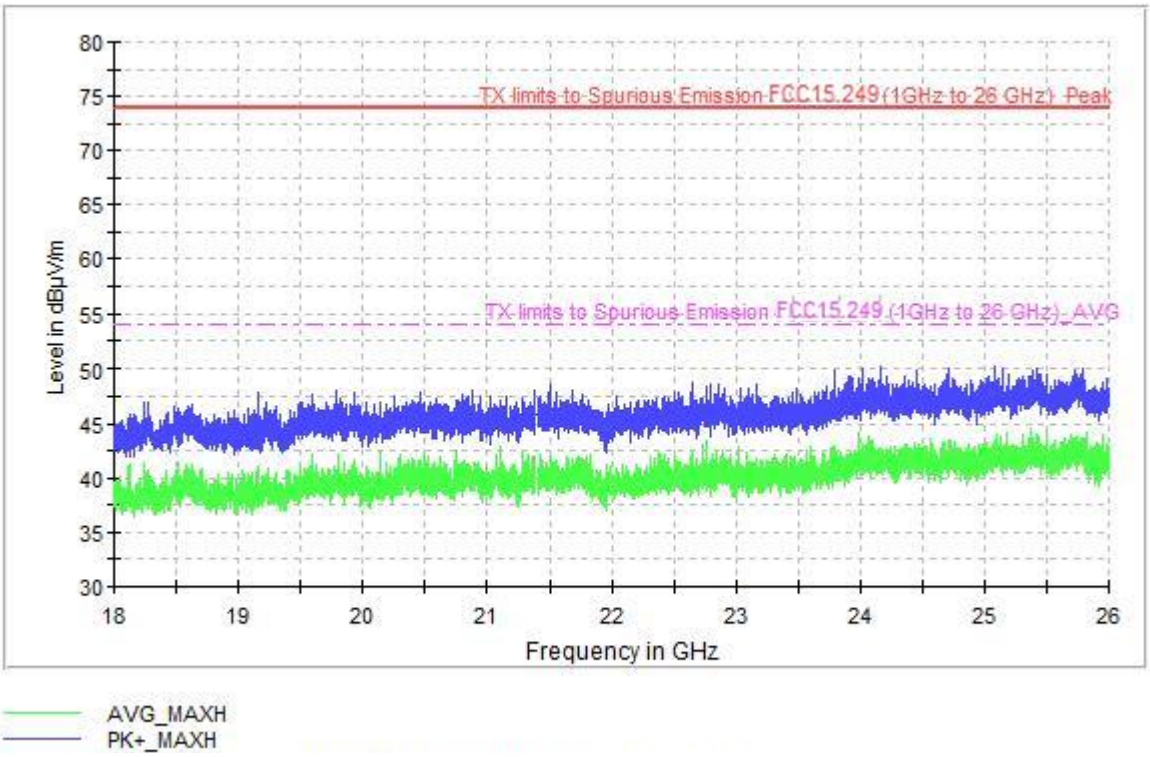


18GHz_26GHz_HP_CH Low

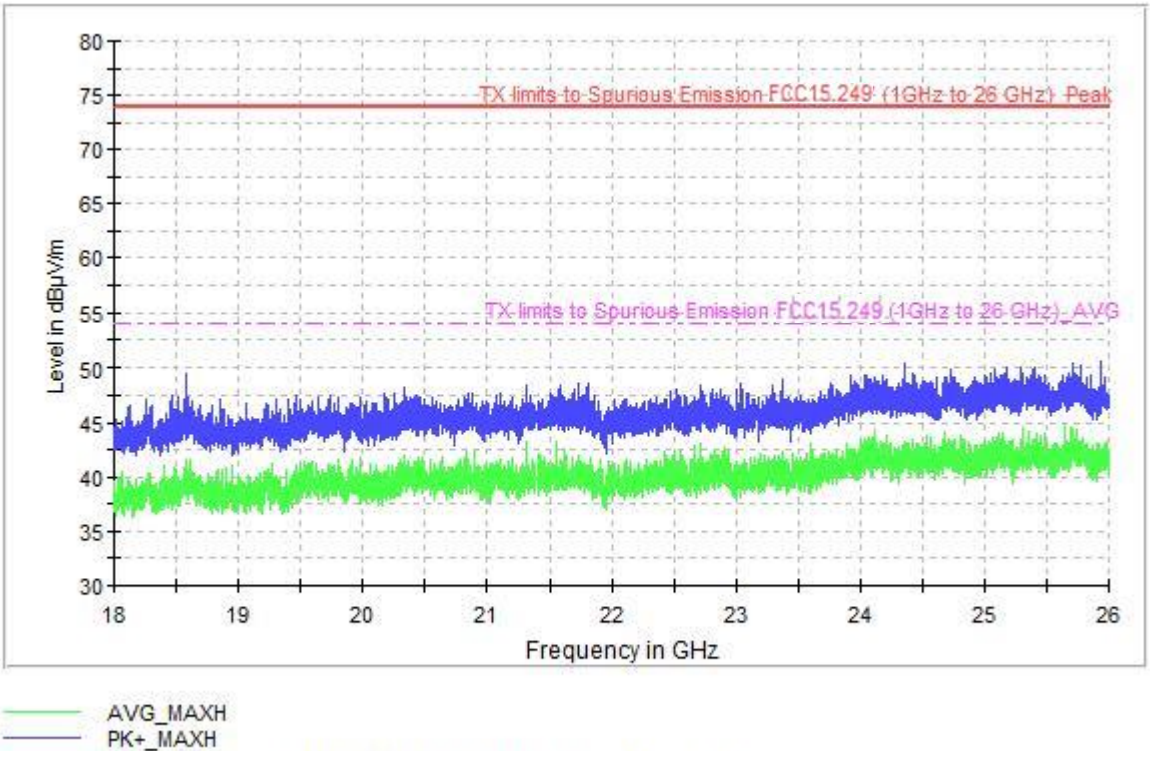


18GHz_26GHz_VP_CH Low

CHANNEL: Middle (2440 MHz).

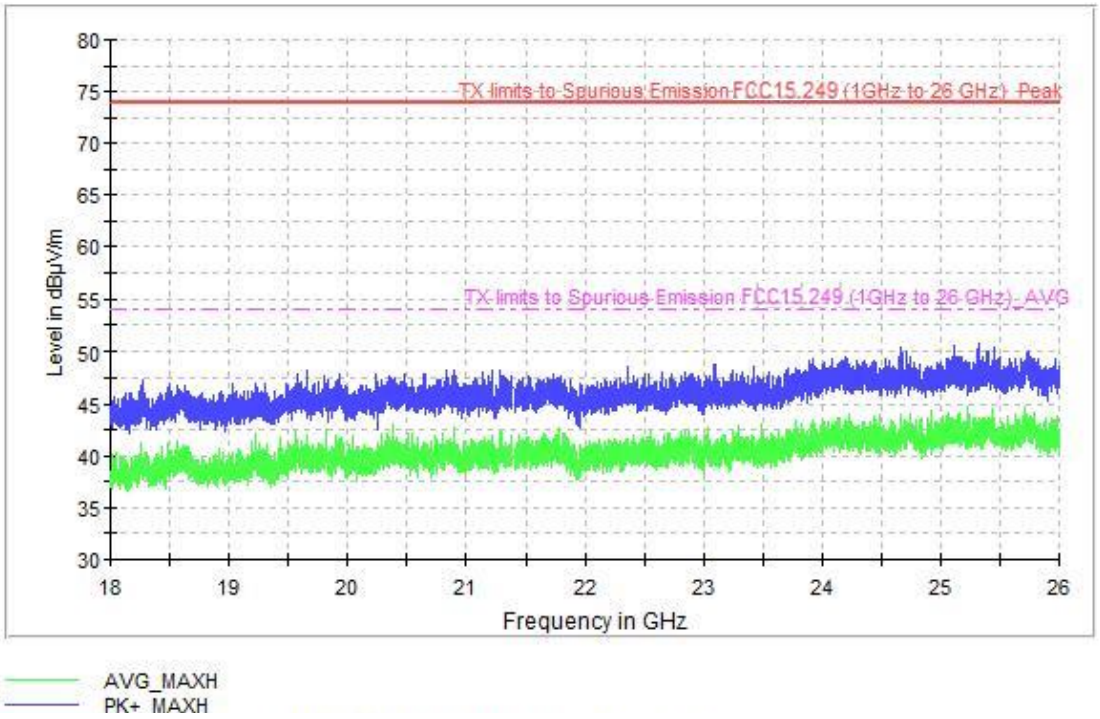


18GHz_26GHz_HP_CH Mid

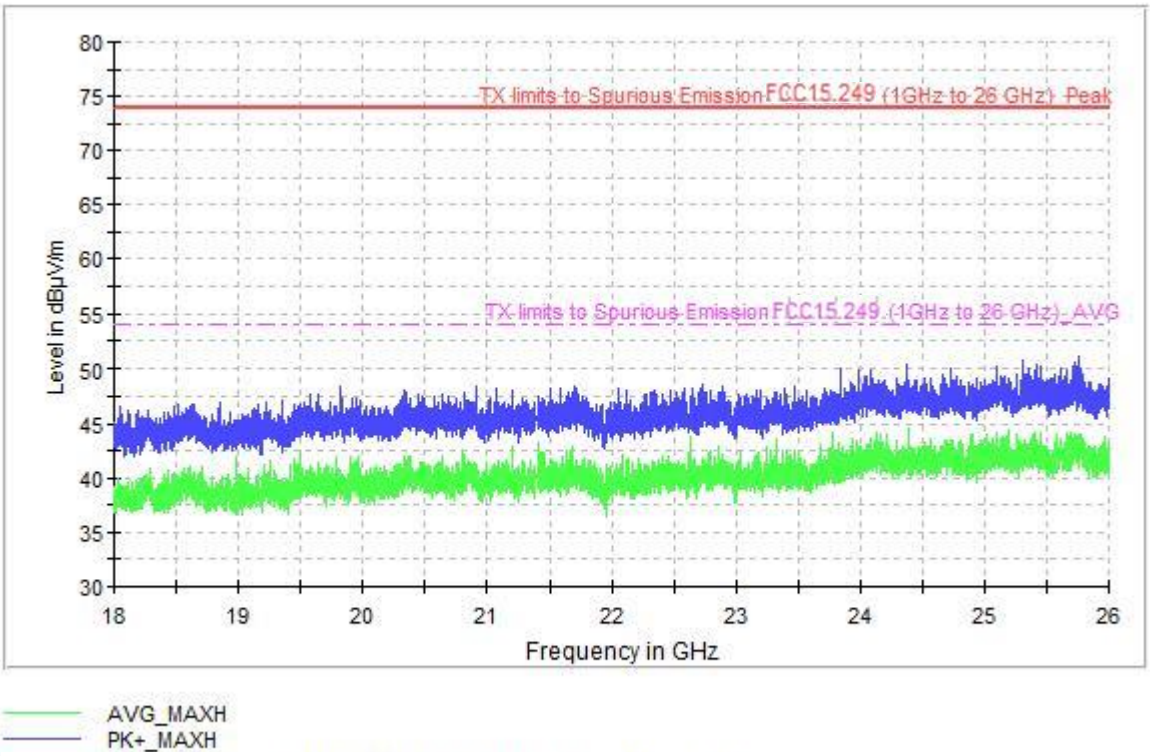


18GHz_26GHz_VP_CH Mid

CHANNEL: Highest (2480 MHz).



18GHz_26GHz_HP_CH High



18GHz_26GHz_HP_CH High

BTLE 2Mb

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-1000 MHz and at distance of 1m for the frequency range 1 GHz-25 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-1000 MHz.

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

No radiated spurious signals were detected at less than 20 dB respect to the limit for the lowest, middle and highest operating channels.

Frequency range 1 GHz-25 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 (see next plots).

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.

1. CHANNEL: LOWEST (2402 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
6.84913	V	Peak	50.3	± 4.87
		Average	48.0	± 4.87
17.69286	V	Peak	46.6	± 4.87
		Average	43.9	± 4.87
25.39840	V	Peak	48.5	± 4.87
		Average	45.3	± 4.87
6.82193	H	Peak	52.5	± 4.87
		Average	45.3	± 4.87
9.60936	H	Peak	52.3	± 4.87
		Average	51.1	± 4.87
25.72240	H	Peak	49.5	± 4.87
		Average	45.0	± 4.87

2. CHANNEL: MIDDLE (2440 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
6.83156	V	Peak	50.8	± 4.87
		Average	48.6	± 4.87
17.17550	V	Peak	46.3	± 4.87
		Average	43.7	± 4.87
25.11360	V	Peak	49.3	± 4.87
		Average	45.2	± 4.87
6.99646	H	Peak	52.7	± 4.87
		Average	46.8	± 4.87
9.75896	H	Peak	51	± 4.87
		Average	48.3	± 4.87
24.22720	H	Peak	49.2	± 4.87
		Average	44.7	± 4.87

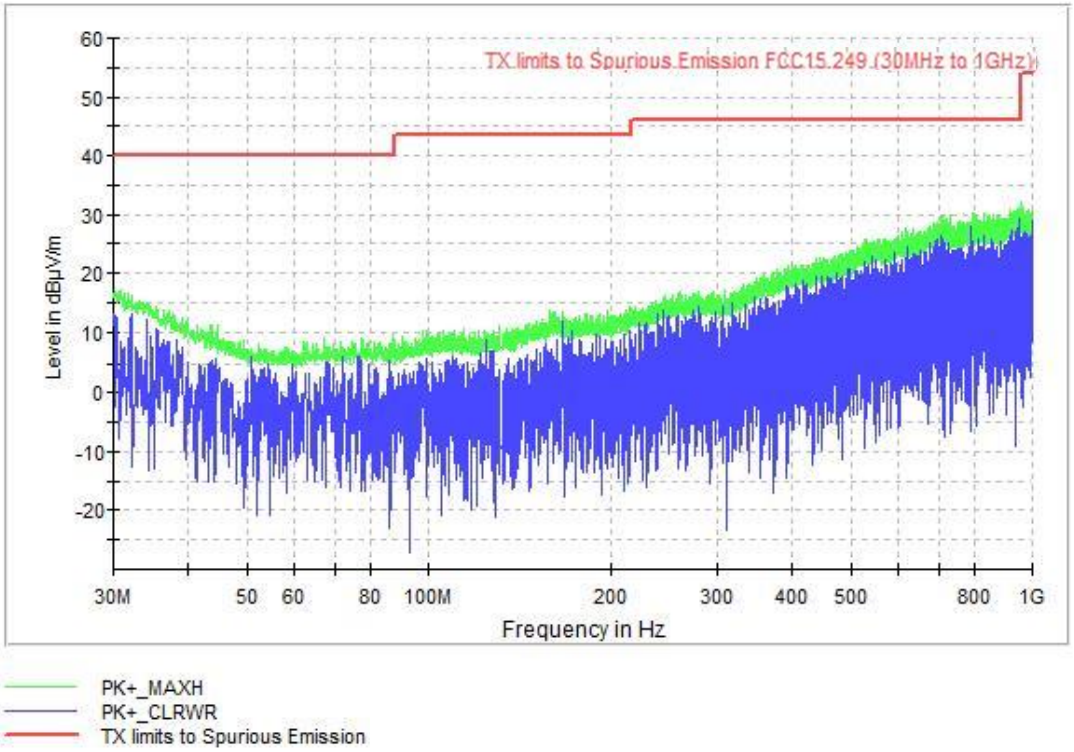
3. CHANNEL: HIGHEST (2480 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
6.8718	V	Peak	52.8	± 4.87
		Average	48.1	± 4.87
17.93653	V	Peak	48.3	± 4.87
		Average	44.7	± 4.87
24.99760	V	Peak	47.2	± 4.87
		Average	44.8	± 4.87
6.86953	H	Peak	52.5	± 4.87
		Average	44.7	± 4.87
9.921033	H	Peak	49.7	± 4.87
		Average	46.9	± 4.87
25.46160	H	Peak	47.7	± 4.87
		Average	44.6	± 4.87

Verdict: PASS

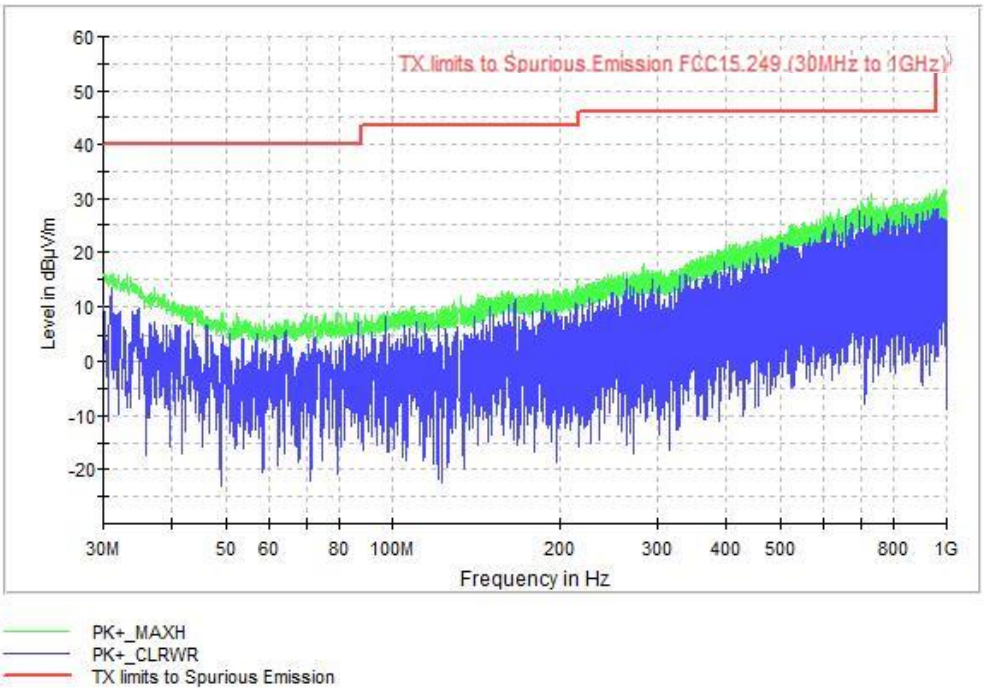
FREQUENCY RANGE 30 MHz-1000 MHz.

CHANNEL: Lowest (2402 MHz):



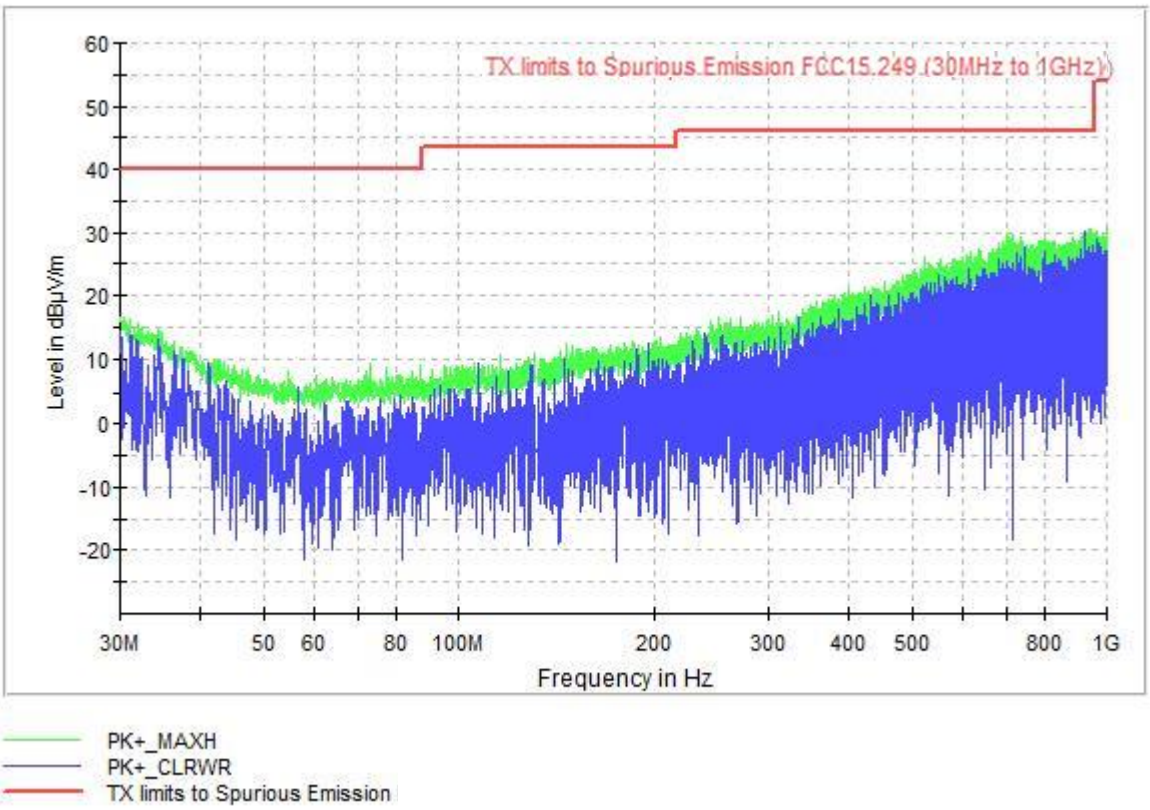
30MHz_1GHz_CH Low

CHANNEL: Middle (2440 MHz):



30MHz_1GHz_CH Mid

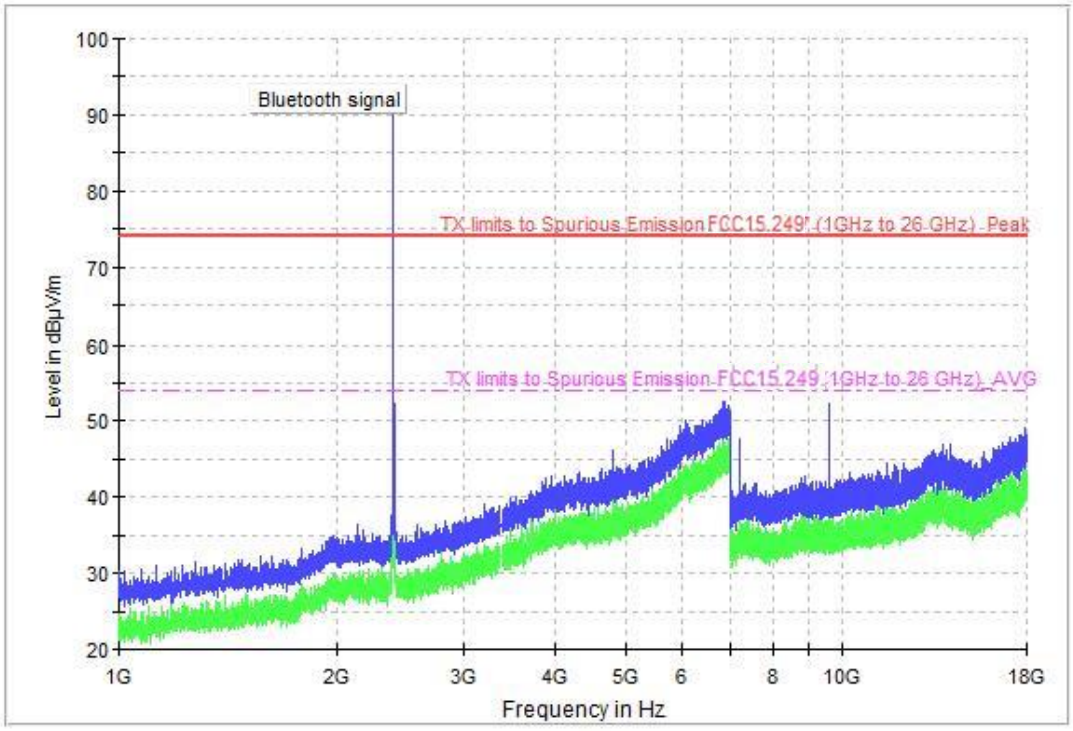
CHANNEL: Highest (2480 MHz):



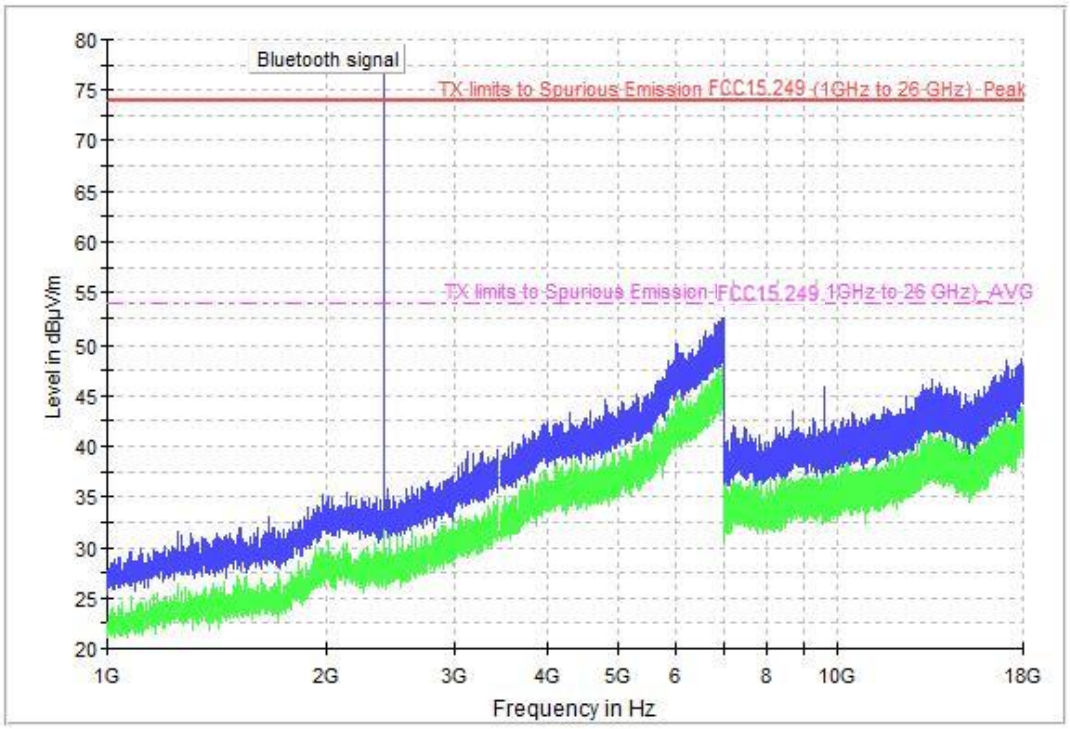
30MHz_1GHz_CH High

FREQUENCY RANGE 1 GHz to 18 GHz.

CHANNEL: Lowest (2402 MHz).

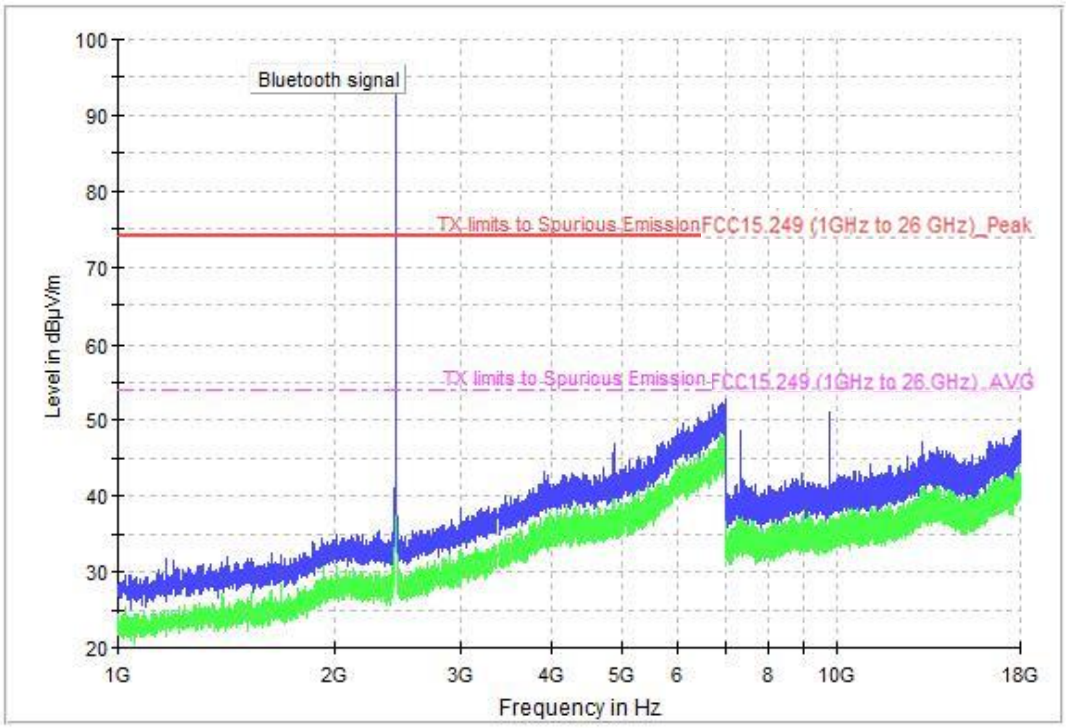


1GHz_18GHz_ HP_CH Low

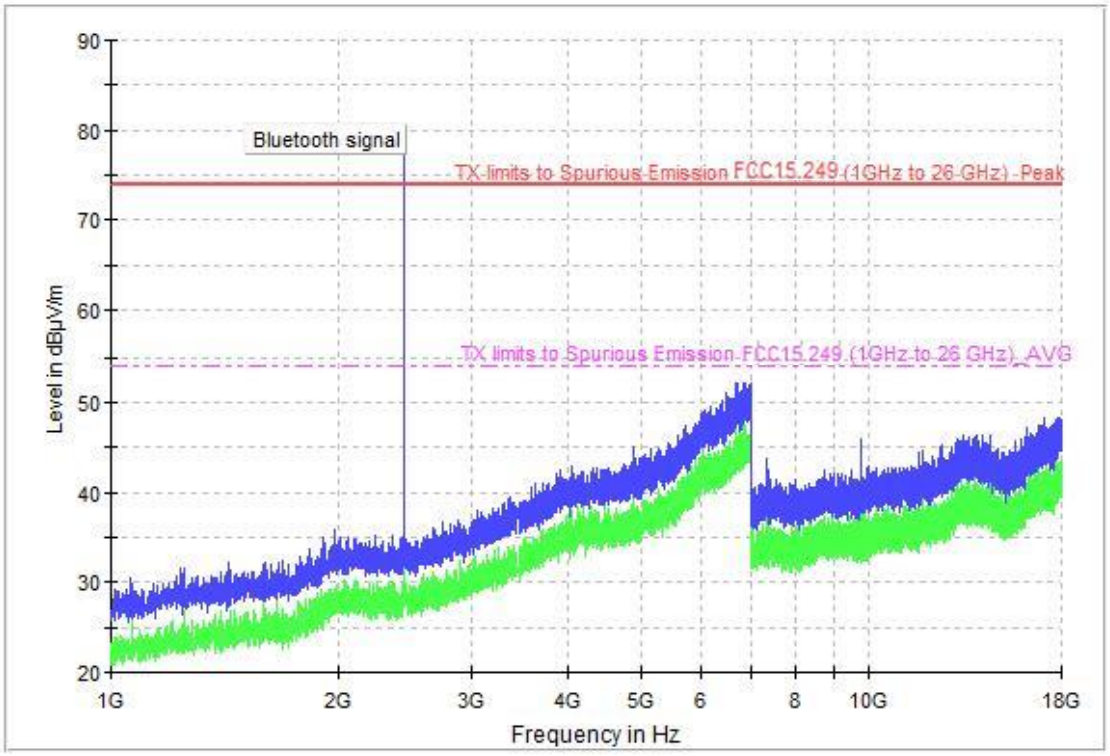


1GHz_18GHz_VP_CH Low

CHANNEL: Middle (2440 MHz).

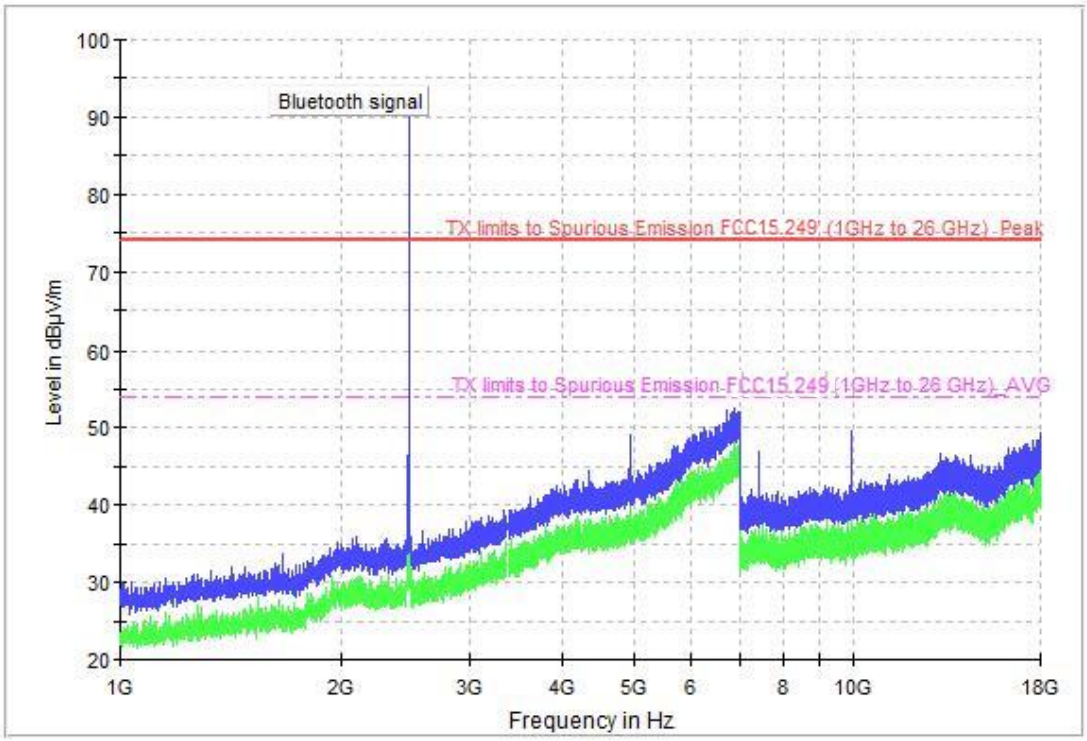


1GHz_18GHz_HP_CH Mid

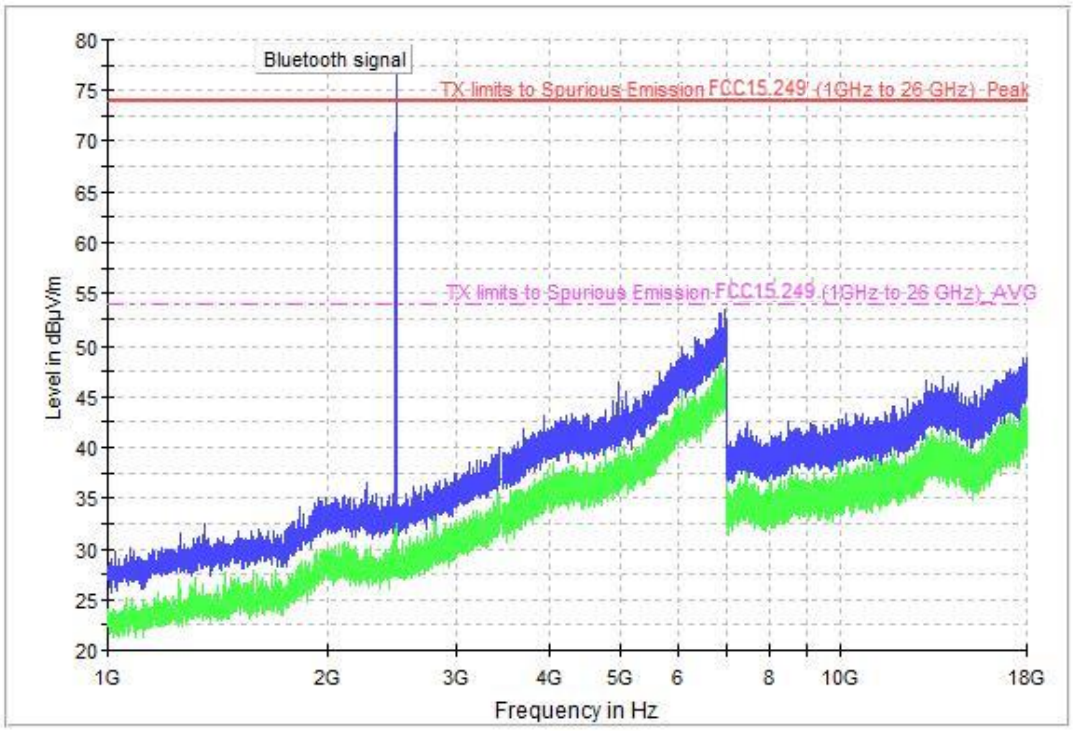


1GHz_18GHz_VP_CH Mid

CHANNEL: Highest (2480 MHz).



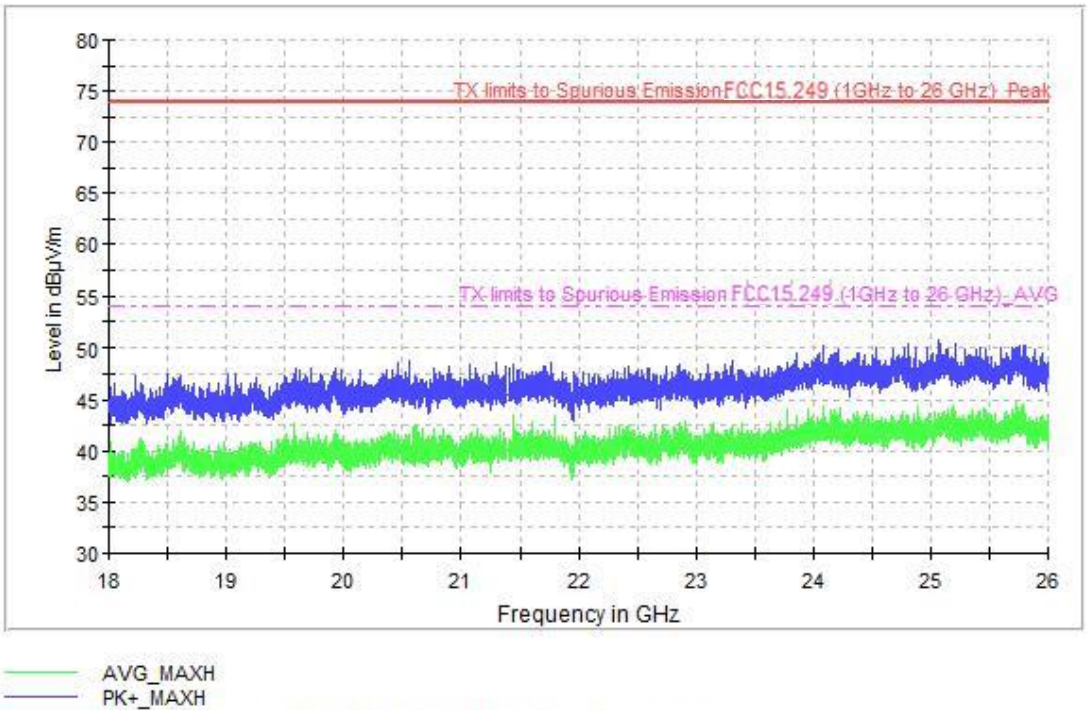
1GHz_18GHz_HP_CH High



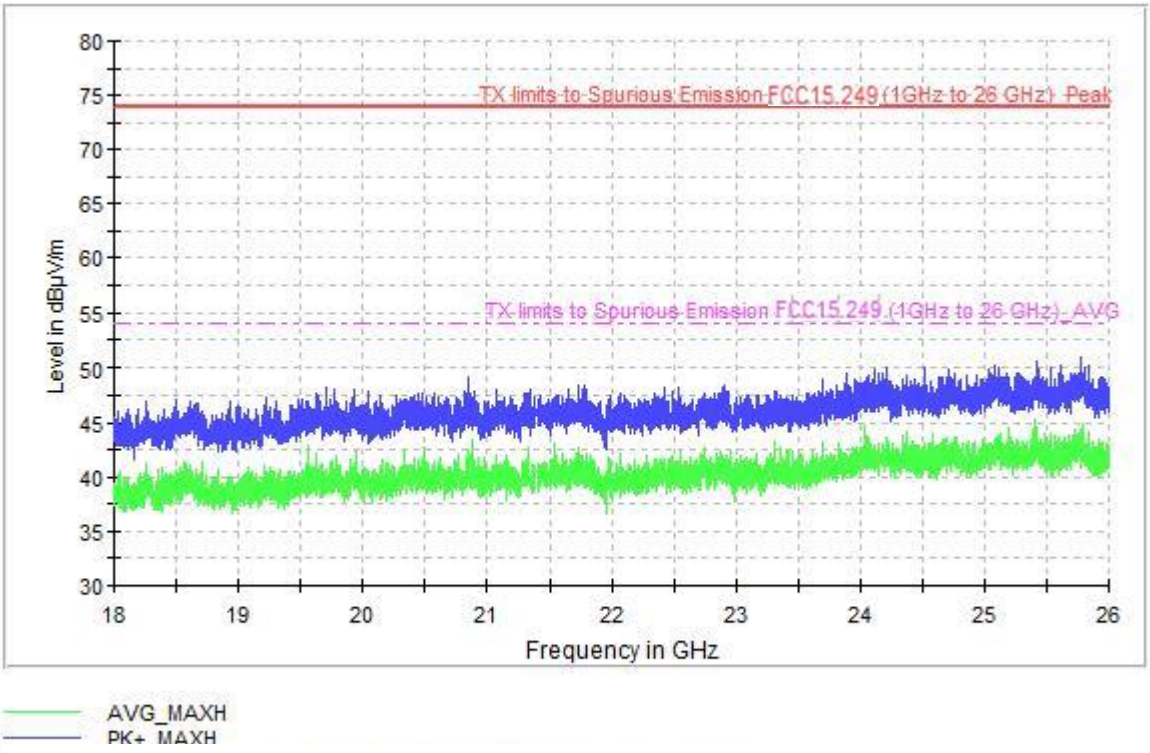
1GHz_18GHz_VP_CH High

FREQUENCY RANGE 18 GHz to 26 GHz.

CHANNEL: Lowest (2402 MHz).

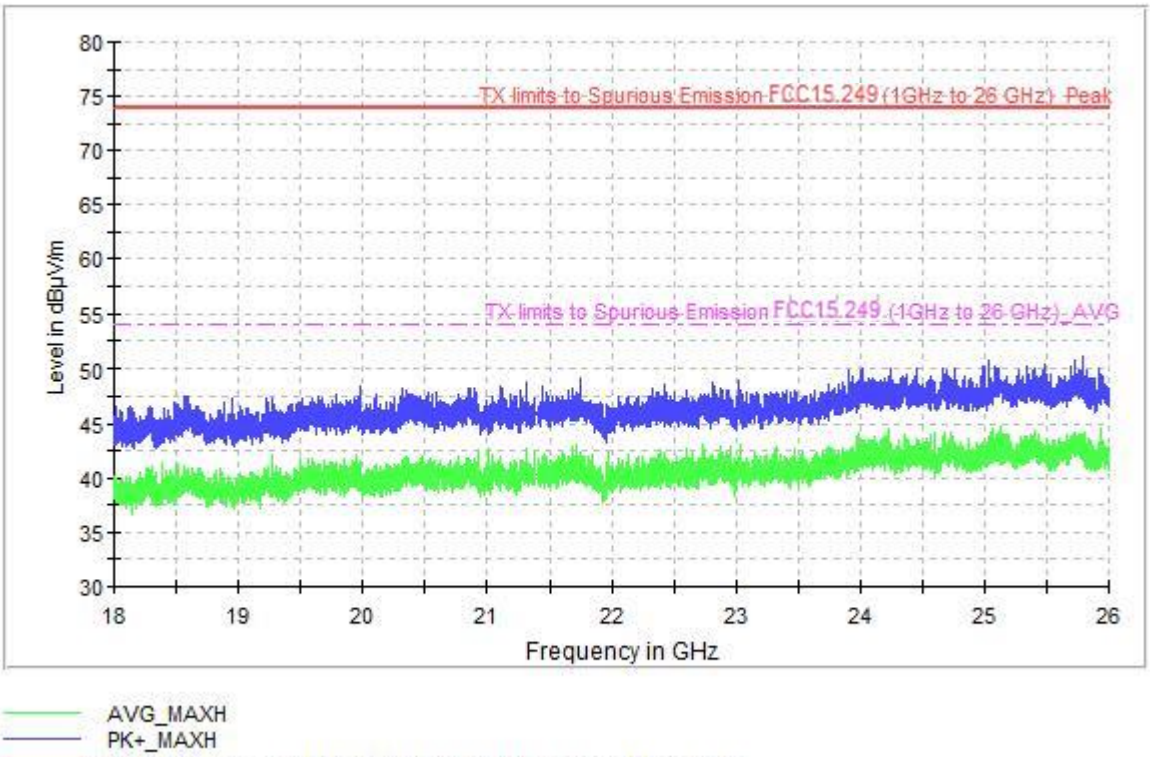


18GHz_26GHz_HP_CH Low

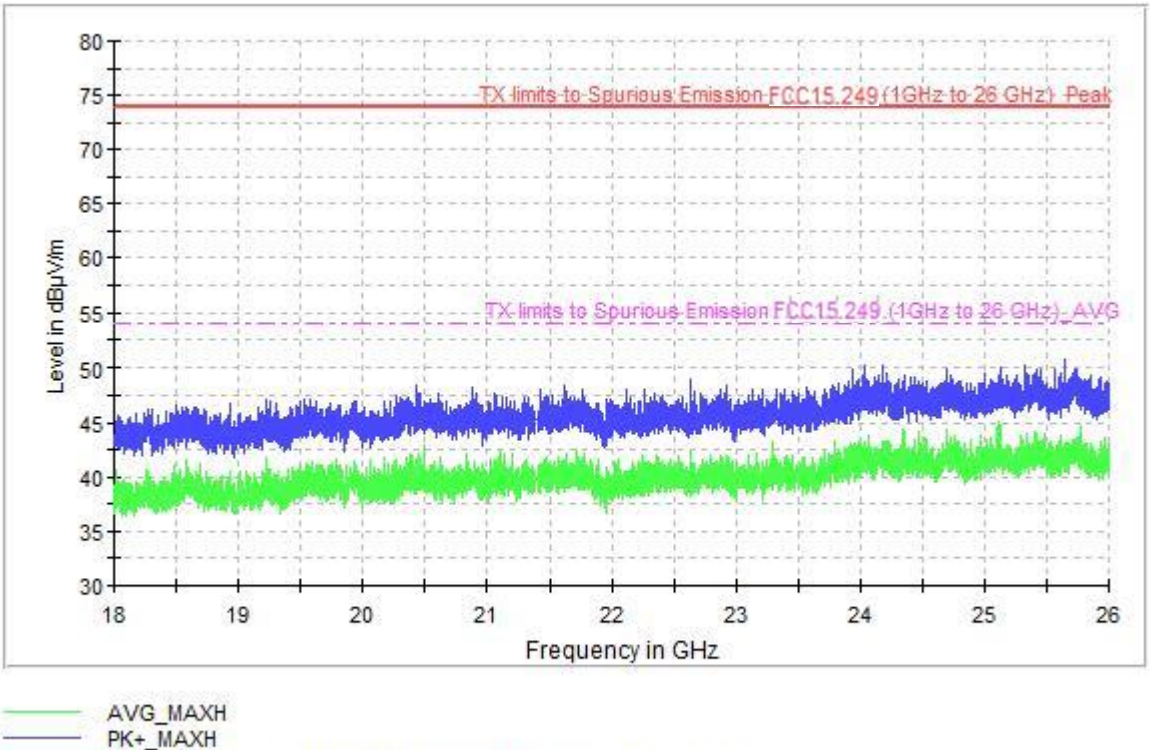


18GHz_26GHz_VP_CH Low

CHANNEL: Middle (2440 MHz).

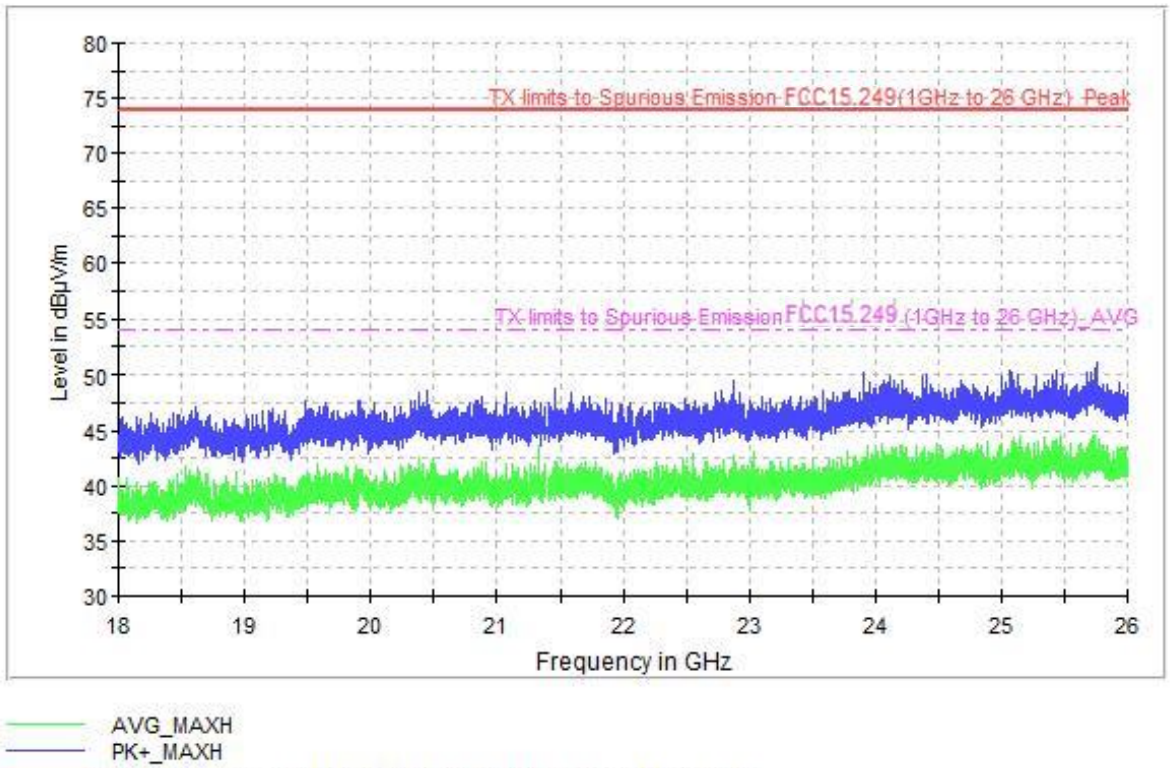


18GHz_26GHz_HP_CH Mid

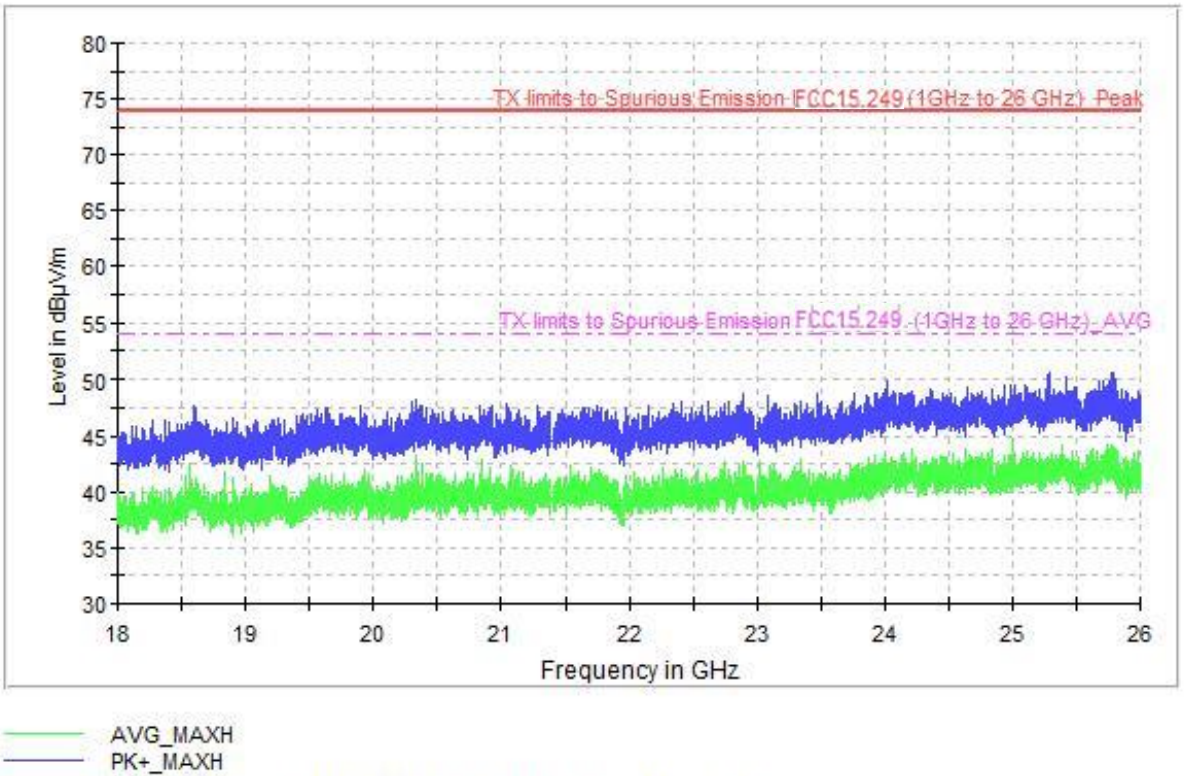


18GHz_26GHz_VP_CH Mid

CHANNEL: Highest (2480 MHz).



18GHz_26GHz_HP_CH High



18GHz_26GHz_HP_CH High

Appendix B – Test result (Proximity Protocol)

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Section 15.249 Subclause (d) / RSS-210 B.10 (b). Emissions Limitations Radiated (Transmitter) 60

TEST CONDITIONS

Power supply (V):

$V_{nominal}$ = 3.8 Vdc

Type of power supply = DC voltage from internal battery.

Type of antenna = Integral antenna

Declared Gain for antenna (maximum) = +0.82 dBi

Temperature (ºC):

T_n = +15 to +35

T_{min} = 0 (*)

T_{max} = +45 (*)

The subscript n indicates normal test conditions.

The subscripts min and max indicates extreme test conditions (minimum and maximum respectively).

(*): Declared by applicant.

TEST FREQUENCIES:

Lowest channel: 2402 MHz

Middle channel: 2440 MHz

Highest channel: 2480 MHz

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is directly connected to the Test System TS8997.

RADIATED MEASUREMENTS

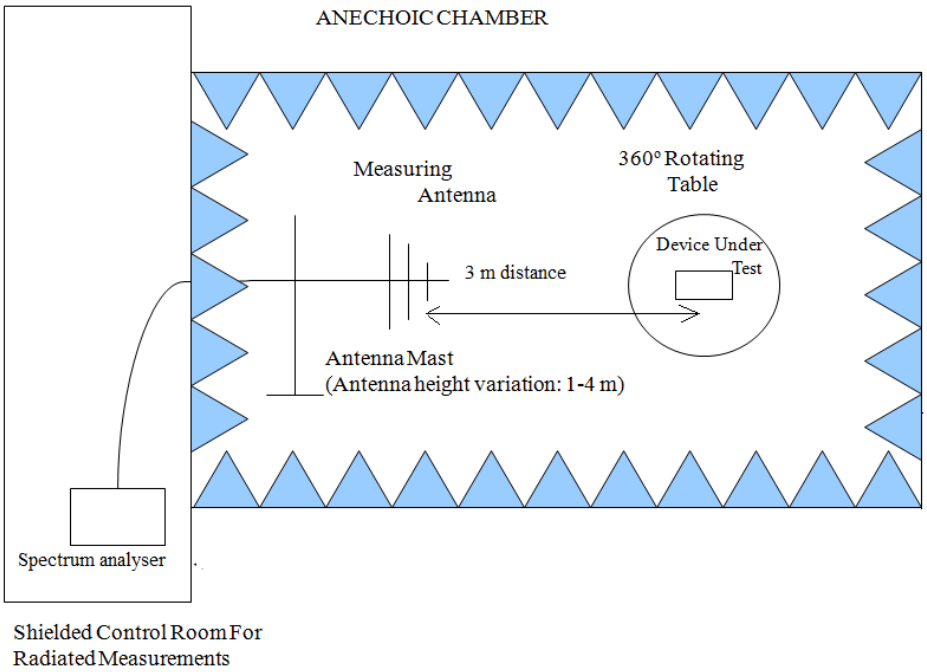
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1m for the frequency range 1 GHz-25 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

For radiated emissions in the range 1 GHz-25 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.

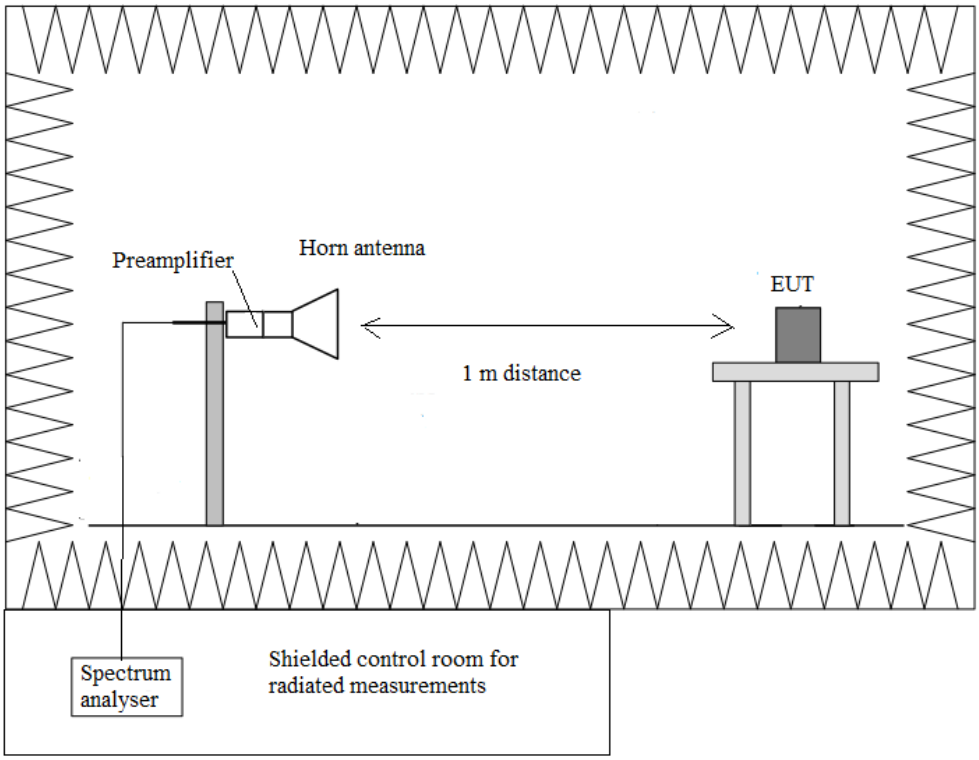
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

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

Radiated measurements setup f < 1 GHz



Radiated measurements setup f > 1 GHz



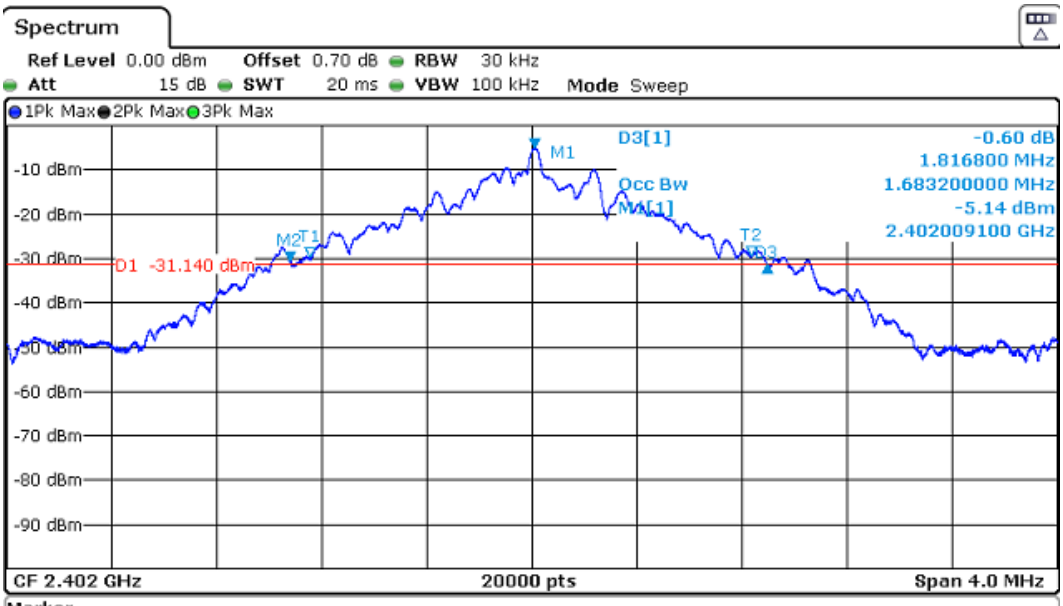
Occupied Bandwidth

RESULTS

(see next plots).

	Lowest frequency 2402 MHz	Middle frequency 2440 MHz	Highest frequency 2480 MHz
99% dB bandwidth (MHz)	1.68	1.66	1.67
-26 dBc bandwidth (MHz)	1.82	1.87	1.87
Measurement uncertainty (kHz)	<± 8.33		

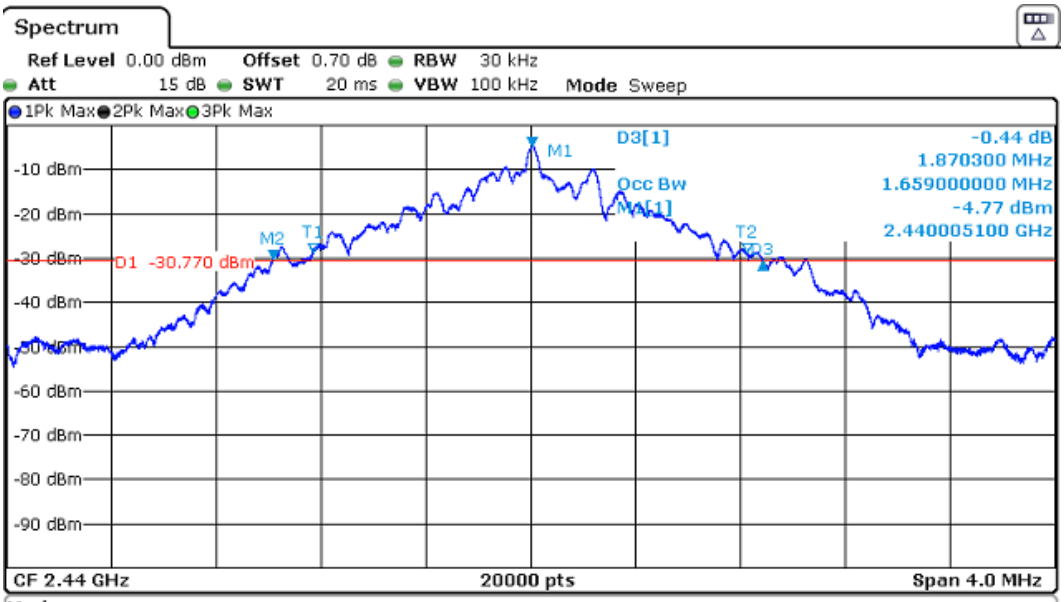
Lowest Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4020091 GHz	-5.14 dBm		
T1		1	2.4011543 GHz	-29.85 dBm	Occ Bw	1.6832 MHz
T2		1	2.4028375 GHz	-29.43 dBm		
M2		1	2.4010779 GHz	-30.74 dBm		
D3	M2	1	1.8168 MHz	-0.60 dB		

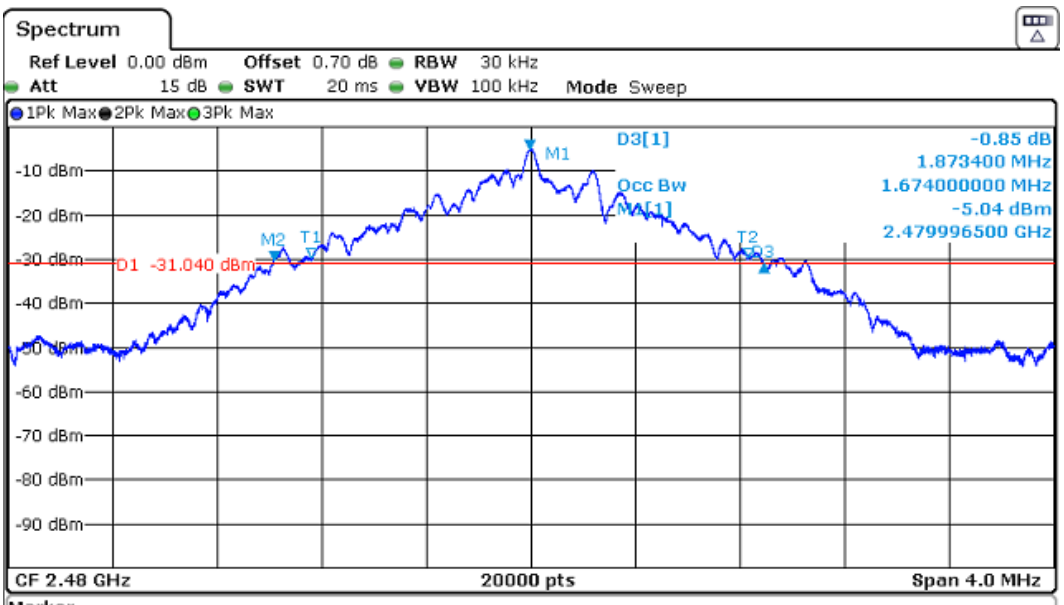
Middle Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4400051 GHz	-4.77 dBm		
T1		1	2.4391675 GHz	-28.95 dBm	Occ Bw	1.659 MHz
T2		1	2.4408265 GHz	-28.92 dBm		
M2		1	2.4390166 GHz	-30.27 dBm		
D3	M2	1	1.8703 MHz	-0.44 dB		

Highest channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4799965 GHz	-5.04 dBm		
T1		1	2.4791573 GHz	-29.72 dBm	Occ Bw	1.674 MHz
T2		1	2.4808313 GHz	-29.60 dBm		
M2		1	2.4790161 GHz	-30.20 dBm		
D3	M2	1	1.8734 MHz	-0.85 dB		

Section 15.249 Subclause (a) / RSS-210 B.10. (a) Field strength of Fundamental

SPECIFICATION

The field strength of emissions from intentional radiators shall comply with the following

Fundamental frequency (MHz)	Field strength of fundamental (mV/m)	Field strength (dBµV/m)	Measurement distance (m)
902 - 928	50	93.98	3
2400 – 2483.5	50	93.98	3
5725 - 5875	50	93.98	3
24000-24250	250	107.96	3

For frequencies above 1000 MHz, the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

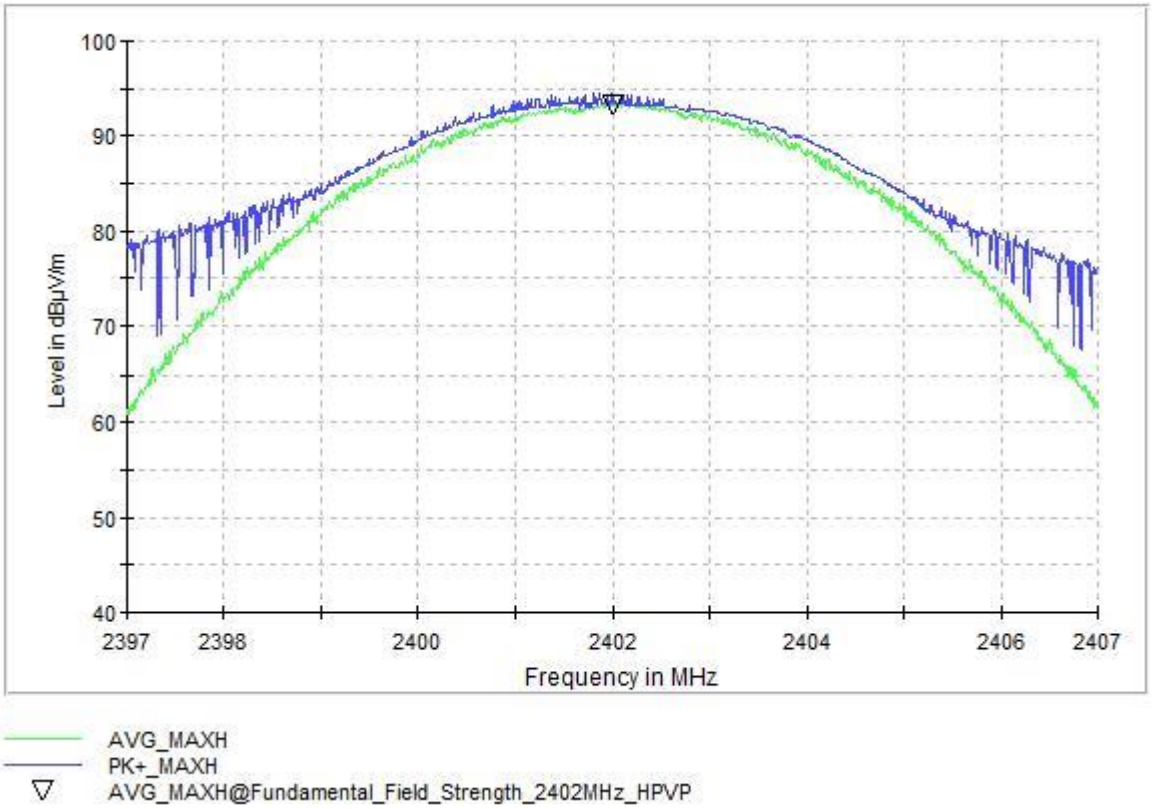
RESULTS:

	Lowest frequency 2402 MHz	Middle frequency 2440 MHz	Highest frequency 2480 MHz
Field strength (dBµV/m) average	93.23	91.56	90.18
Field strength (dBµV/m) peak	94.39	92.74	91.38
Measurement uncertainty (dB)	<±3.88		

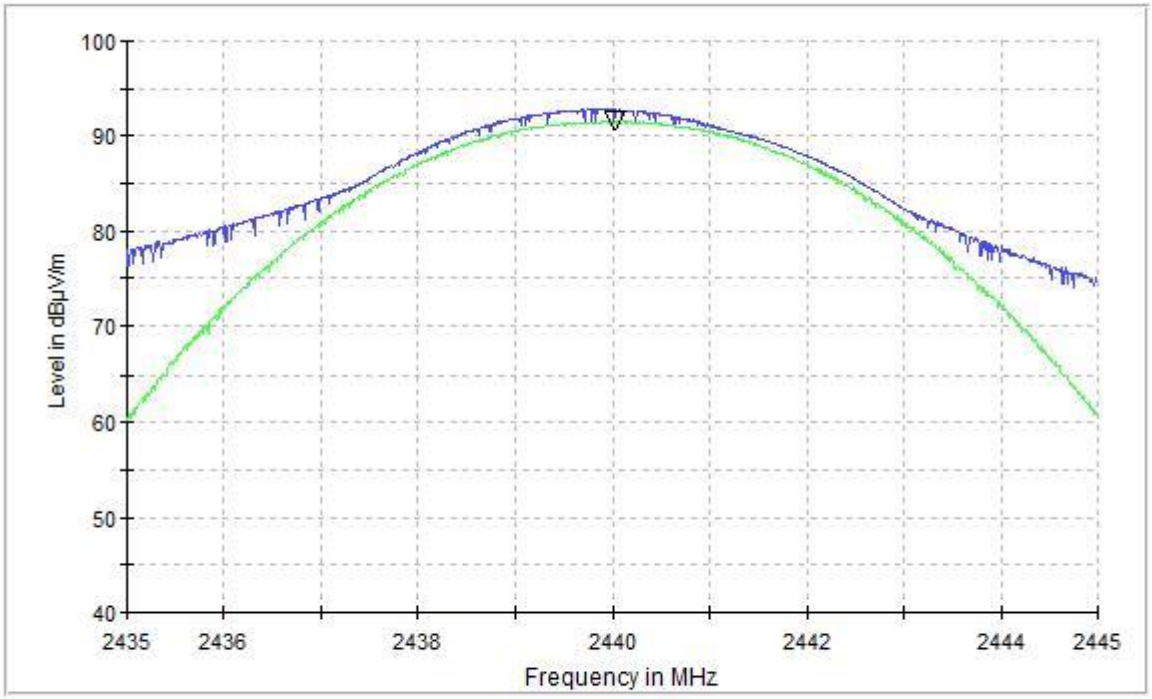
Verdict: PASS

FIELD STRENGTH

LOWEST CHANNEL

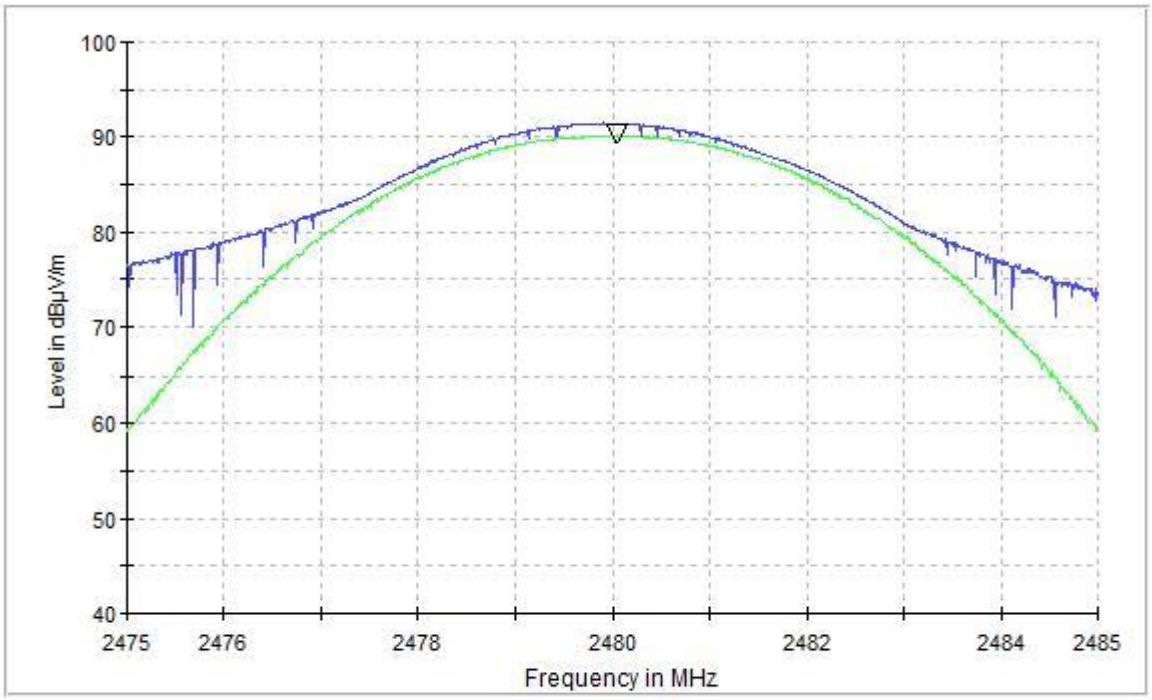


MIDDLE CHANNEL



AVG_MAXH
PK+_MAXH
AVG_MAXH@Fundamental_Field_Strength_2440MHz_HPVP

HIGHEST CHANNEL



AVG_MAXH
PK+_MAXH
AVG_MAXH(1)@Fundamental_Field_Strength_2480MHz_HPVP

Section 15.249 Subclause (a) and (d) / RSS-210 B.10 (b) Emissions limitations radiated (Transmitter)

SPECIFICATION

The field strength of harmonics from intentional radiators shall comply with the following

Fundamental frequency (MHz)	Field strength of harmonics (µV/m)	Field strength of harmonics (dBµV/m)	Measurement distance (m)
902 - 928	500	54	3
2400 – 2483.5	500	54	3
5725 - 5875	500	54	3
24000-24250	2500	67.96	3

Emissions radiated outside of the specific frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of fundamental or to the general radiated emission limits specified in section 15.209:

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

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-1000 MHz and at distance of 1m for the frequency range 1 GHz-25 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-1000 MHz.
The spurious signals detected do not depend on the operating channel.

No radiated spurious signals were detected at less than 20 dB respect to the limit for the lowest, middle and highest operating channels.

Frequency range 1 GHz-25 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 (see next plots).

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.

1. CHANNEL: LOWEST (2402 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
6.99476	V	Peak	52.7	± 4.87
		Average	46.9	± 4.87
17.9320	V	Peak	49.7	± 4.87
		Average	43.8	± 4.87
25.41760	V	Peak	49.6	± 4.87
		Average	45.1	± 4.87
2.384366	H	Peak	60.6	± 4.87
		Average	48.9	± 4.87
9.60993	H	Peak	51.3	± 4.87
		Average	48.4	± 4.87
25.71040	H	Peak	49.1	± 4.87
		Average	45.3	± 4.87

2. CHANNEL: MIDDLE (2440 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
6.99193	V	Peak	52.7	± 4.87
		Average	45.3	± 4.87
17.96373	V	Peak	49.7	± 4.87
		Average	41.6	± 4.87
25.7360	V	Peak	47.2	± 4.87
		Average	44.8	± 4.87
9.76010	H	Peak	48.8	± 4.87
		Average	47.6	± 4.87
17.84926	H	Peak	49.6	± 4.87
		Average	42.3	± 4.87
25.75440	H	Peak	48.8	± 4.87
		Average	44.9	± 4.87

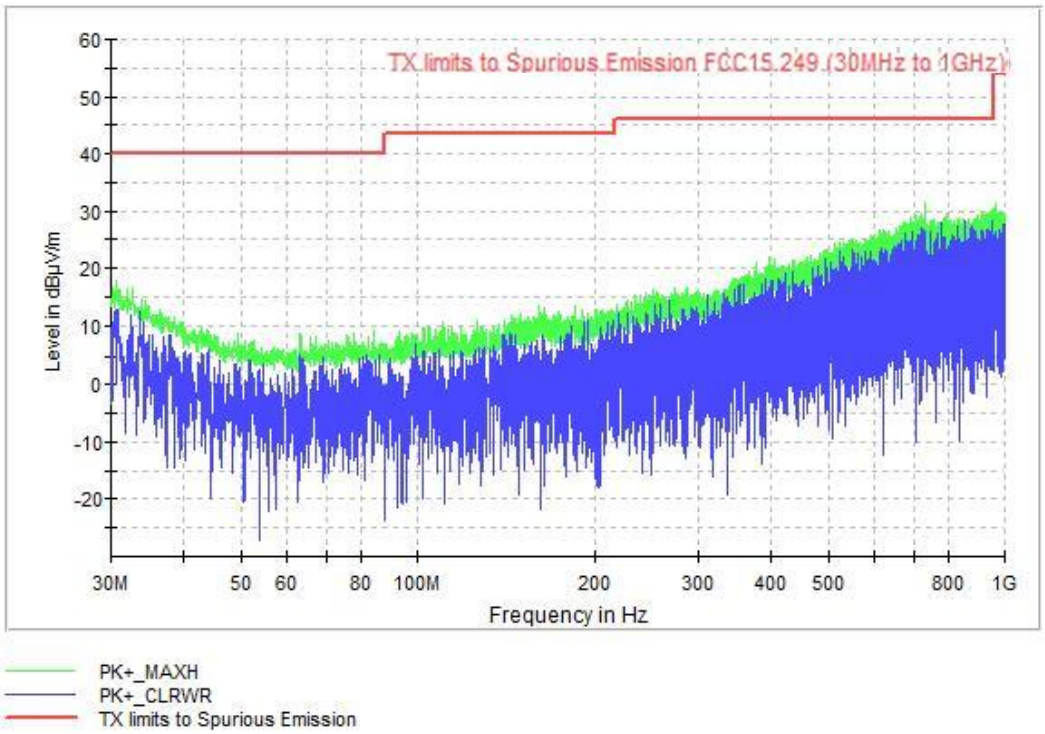
3. CHANNEL: HIGHEST (2480 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
6.99873	V	Peak	52.7	± 4.87
		Average	45.1	± 4.87
17.89233	V	Peak	50.3	± 4.87
		Average	41.1	± 4.87
25.72560	V	Peak	47.9	± 4.87
		Average	45.2	± 4.87
6.68933	H	Peak	52.3	± 4.87
		Average	45.7	± 4.87
9.9193	H	Peak	48.9	± 4.87
		Average	45.8	± 4.87
24.13520	H	Peak	50.7	± 4.87
		Average	45.2	± 4.87

Verdict: PASS

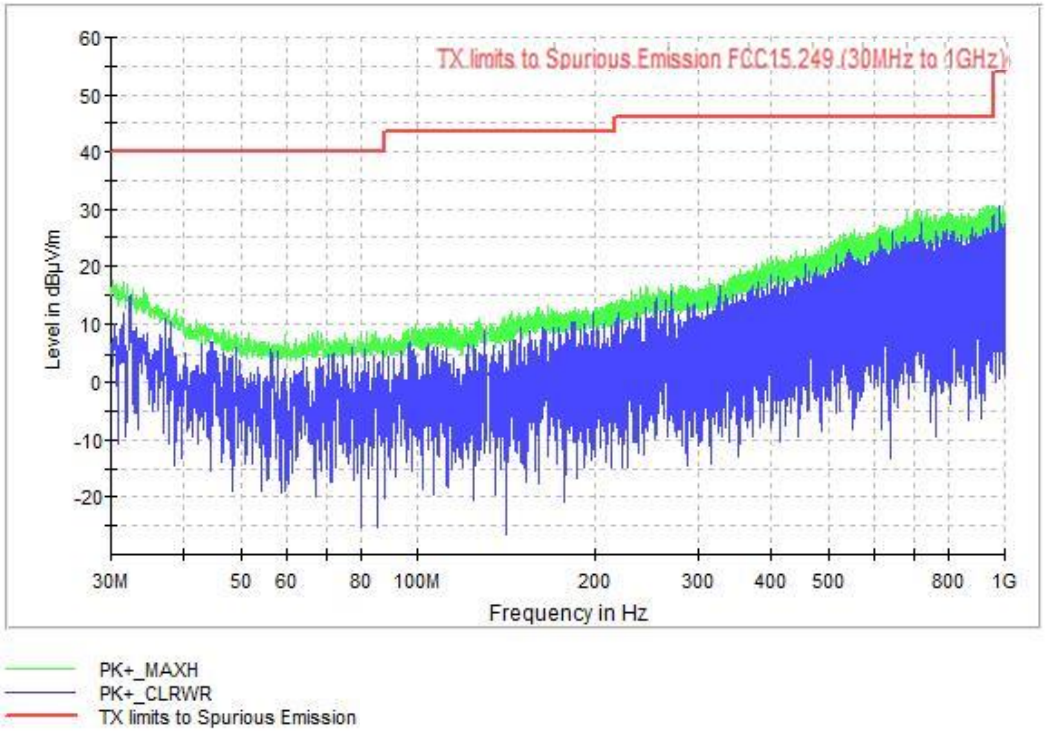
FREQUENCY RANGE 30 MHz-1000 MHz.

CHANNEL: Lowest (2402 MHz):



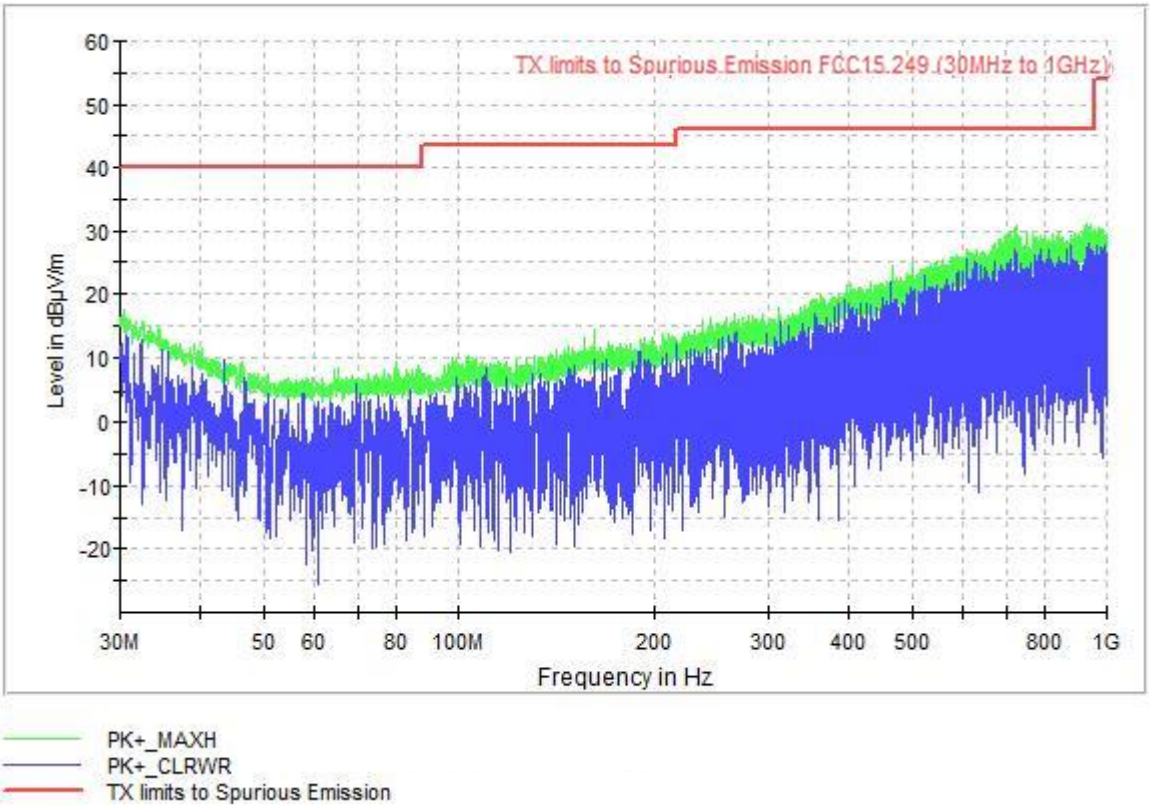
30MHz_1GHz_CH Low

CHANNEL: Middle (2440 MHz):



30MHz_1GHz_CH Mid

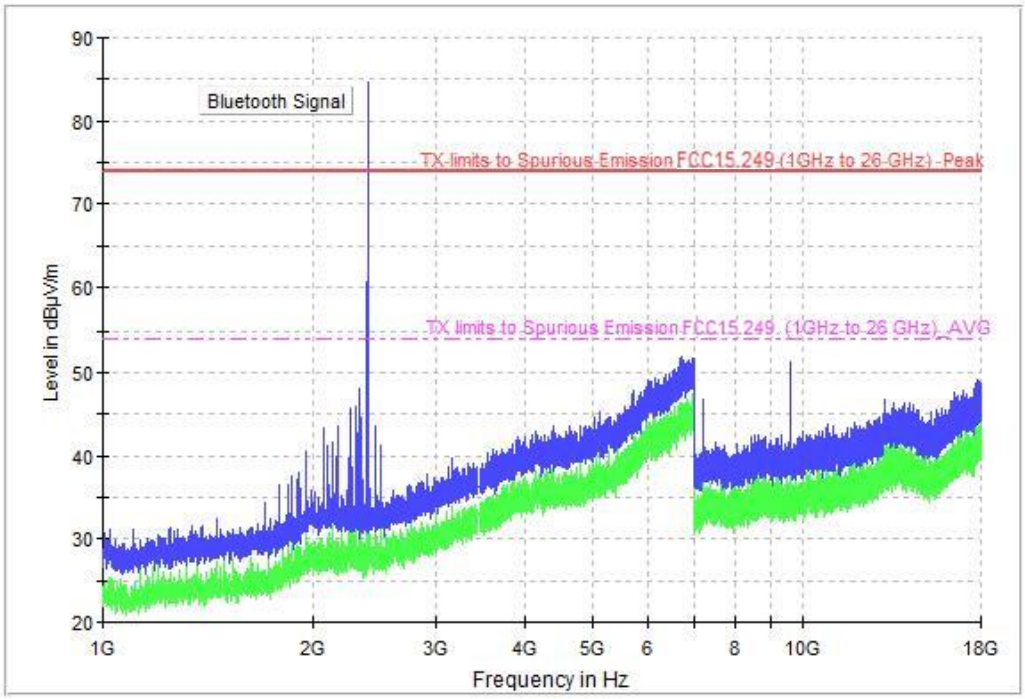
CHANNEL: Highest (2480 MHz:



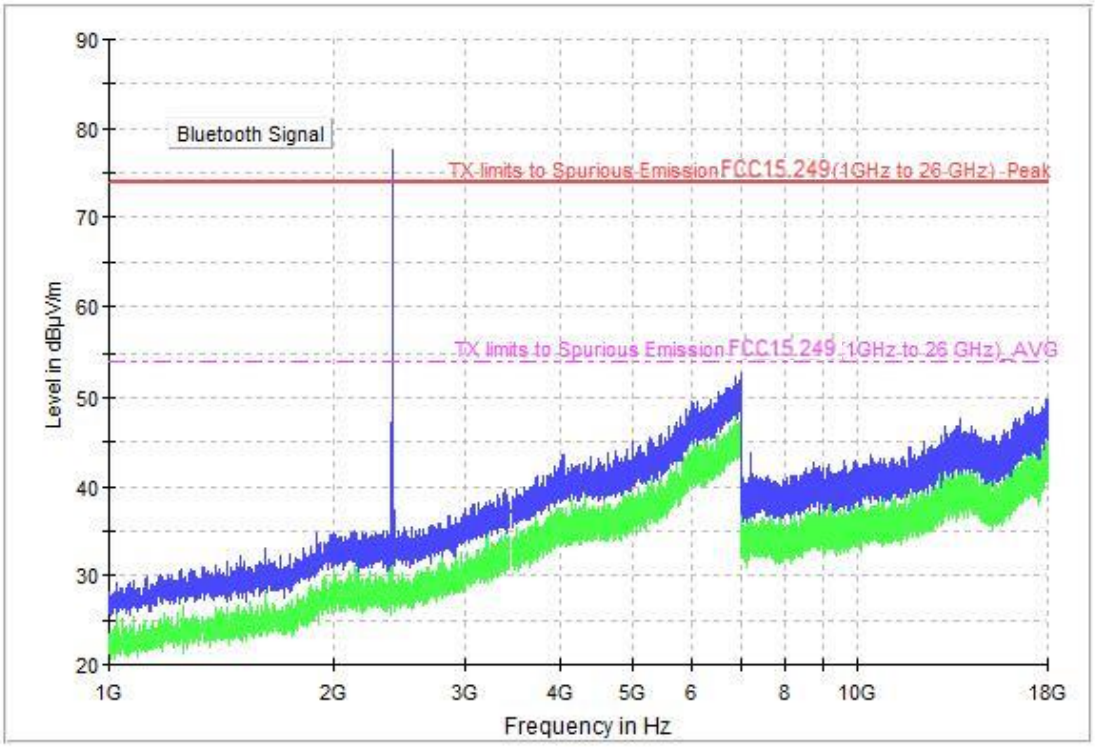
30MHz_1GHz_CH High

FREQUENCY RANGE 1 GHz to 18 GHz.

CHANNEL: Lowest (2402 MHz).

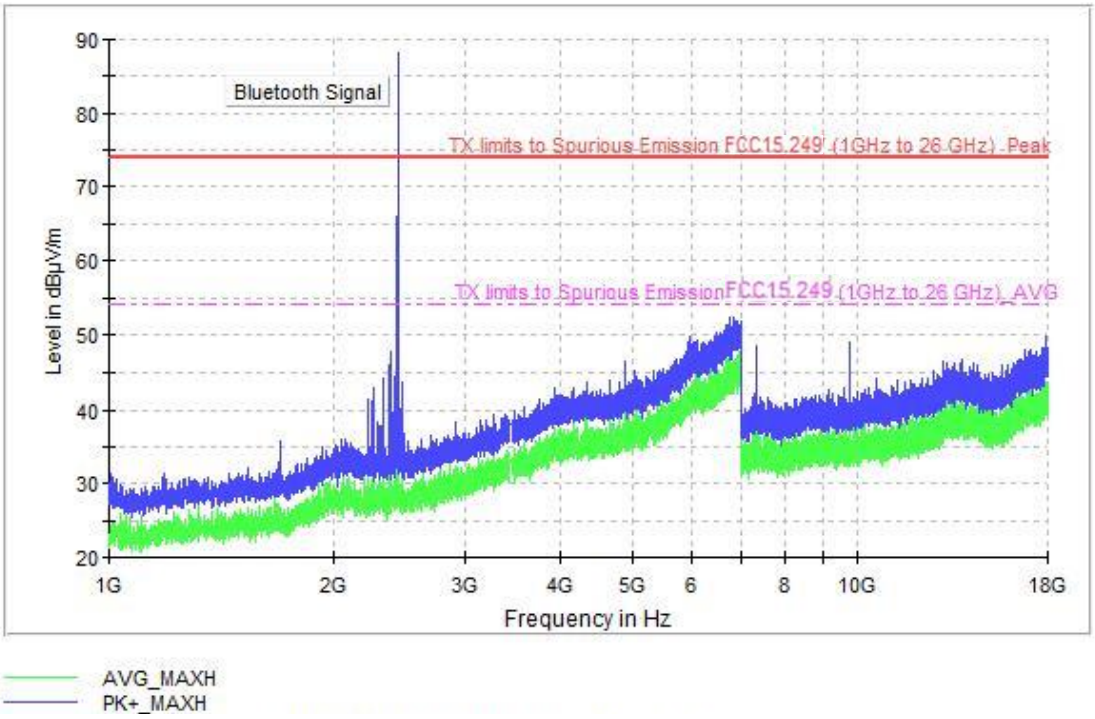


1GHz_18GHz_ HP_CH Low

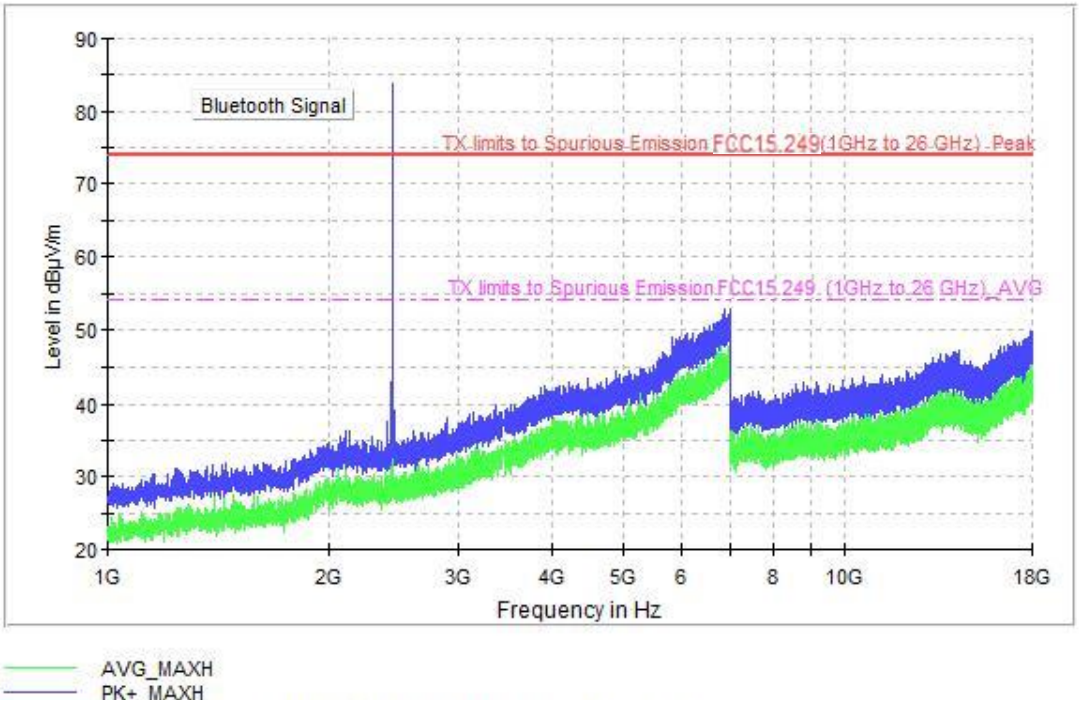


1GHz_18GHz_VP_CH Low

CHANNEL: Middle (2440 MHz).

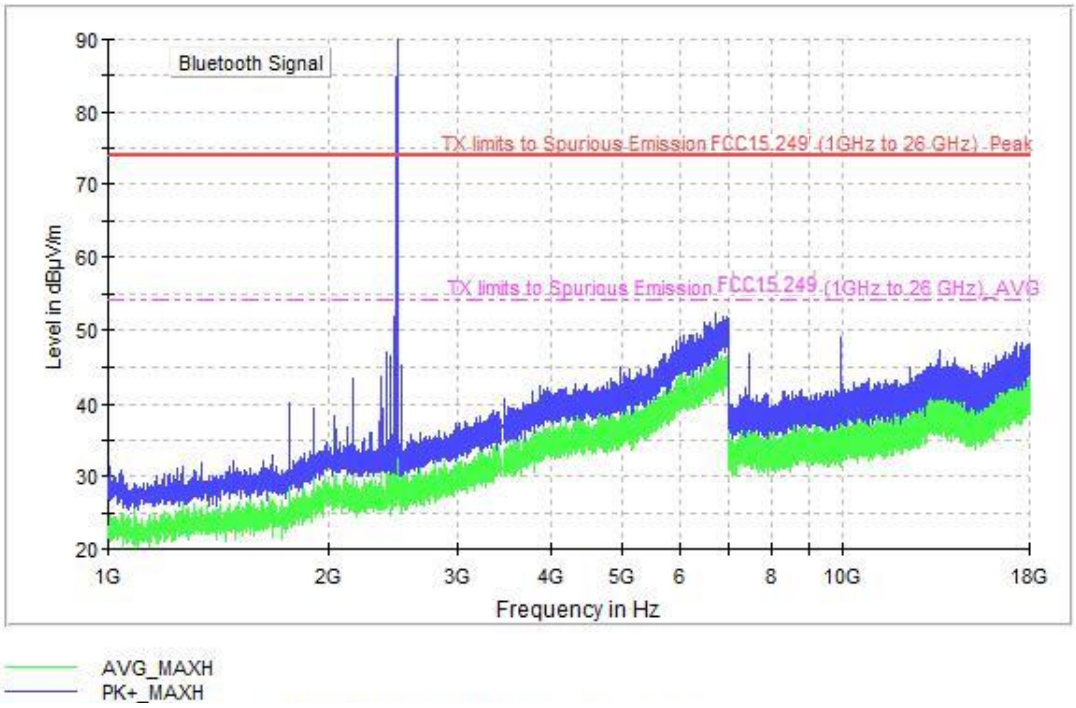


1GHz_18GHz_HP_CH Mid

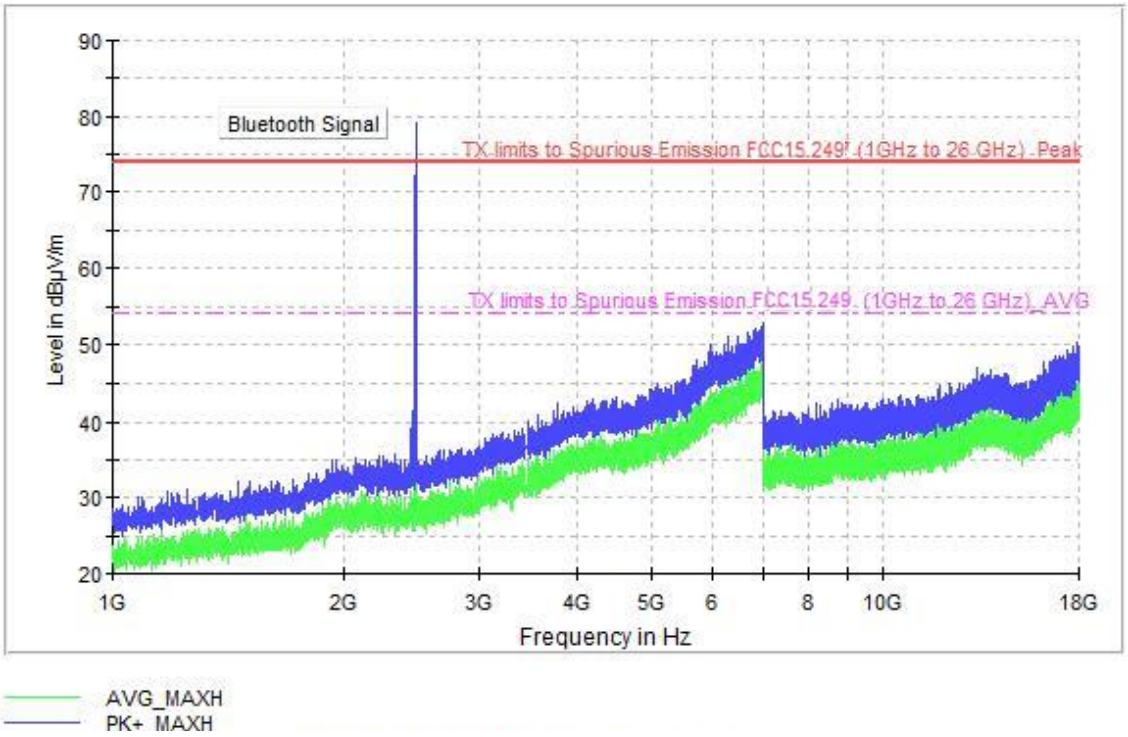


1GHz_18GHz_VP_CH Mid

CHANNEL: Highest (2480 MHz).



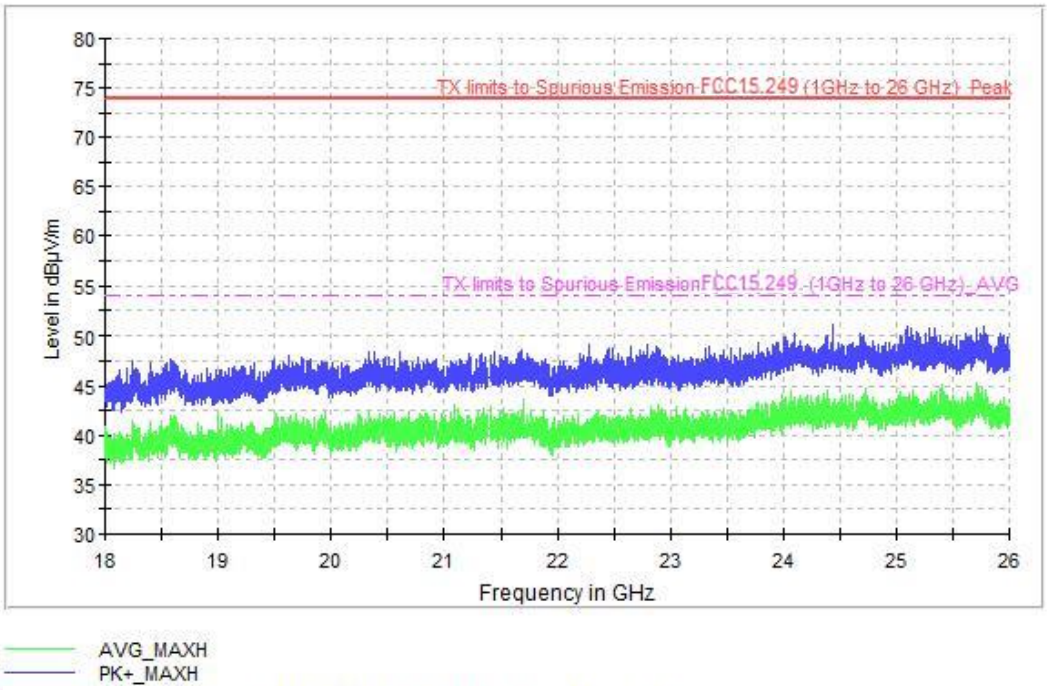
1GHz_18GHz_HP_CH High



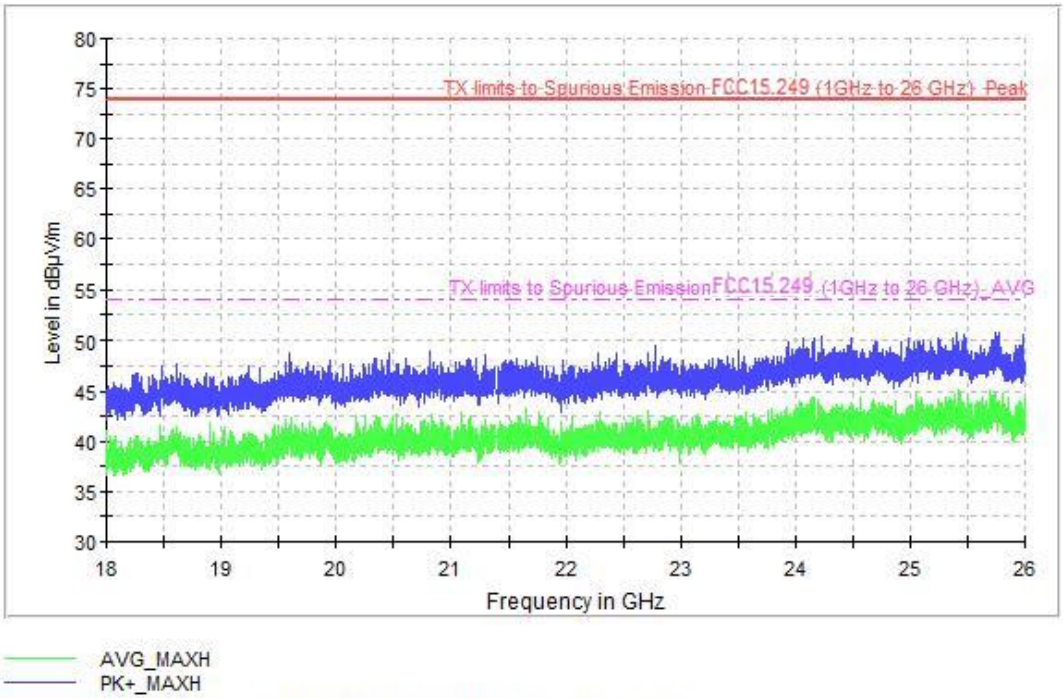
1GHz_18GHz_VP_CH High

FREQUENCY RANGE 18 GHz to 26 GHz.

CHANNEL: Lowest (2402 MHz).

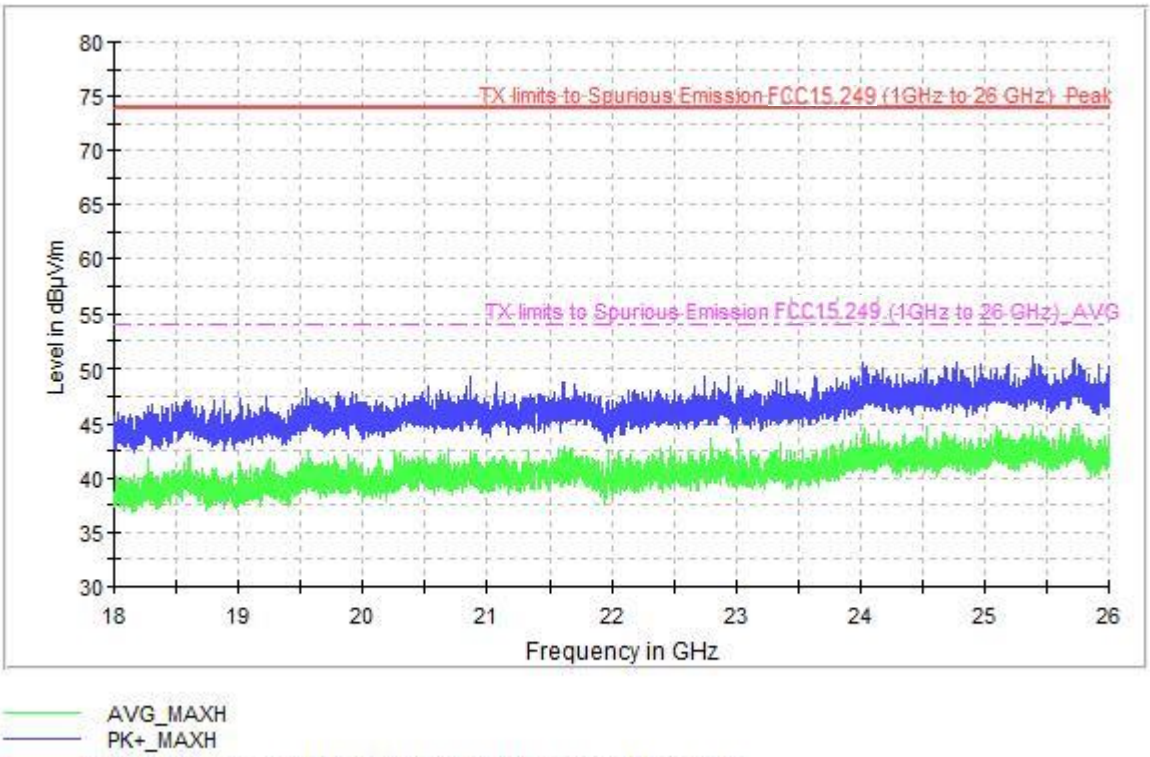


18GHz_26GHz_HP_CH Low

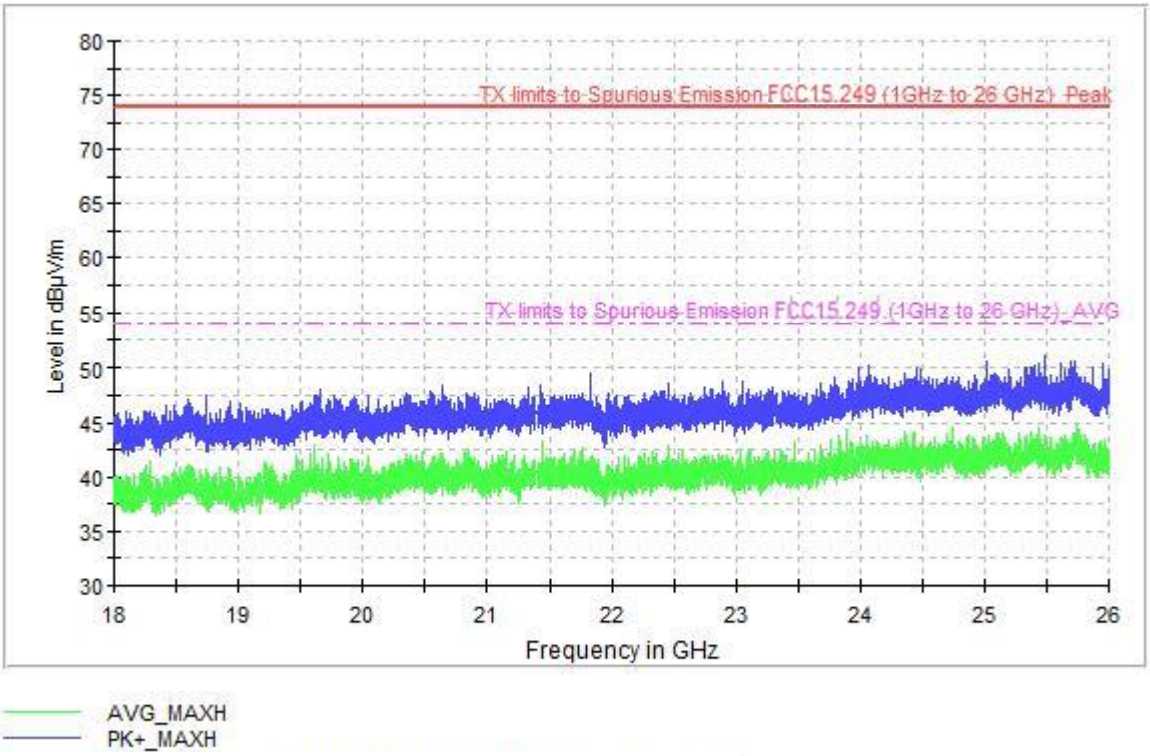


18GHz_26GHz_VP_CH Low

CHANNEL: Middle (2440 MHz).

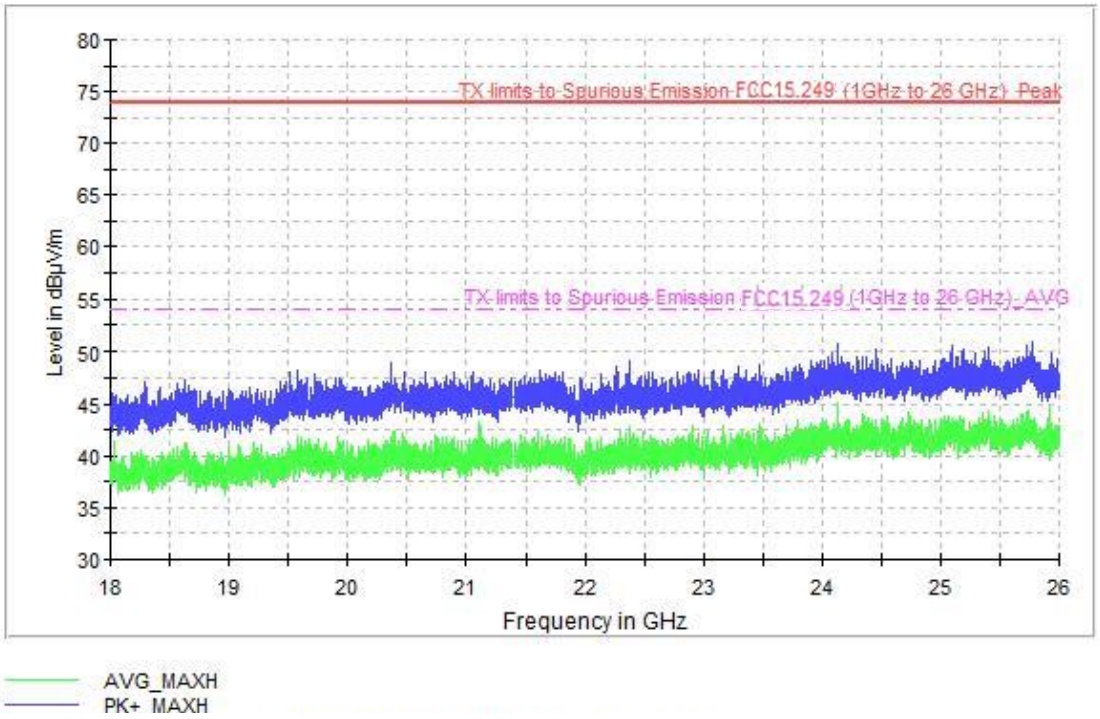


18GHz_26GHz_HP_CH Mid

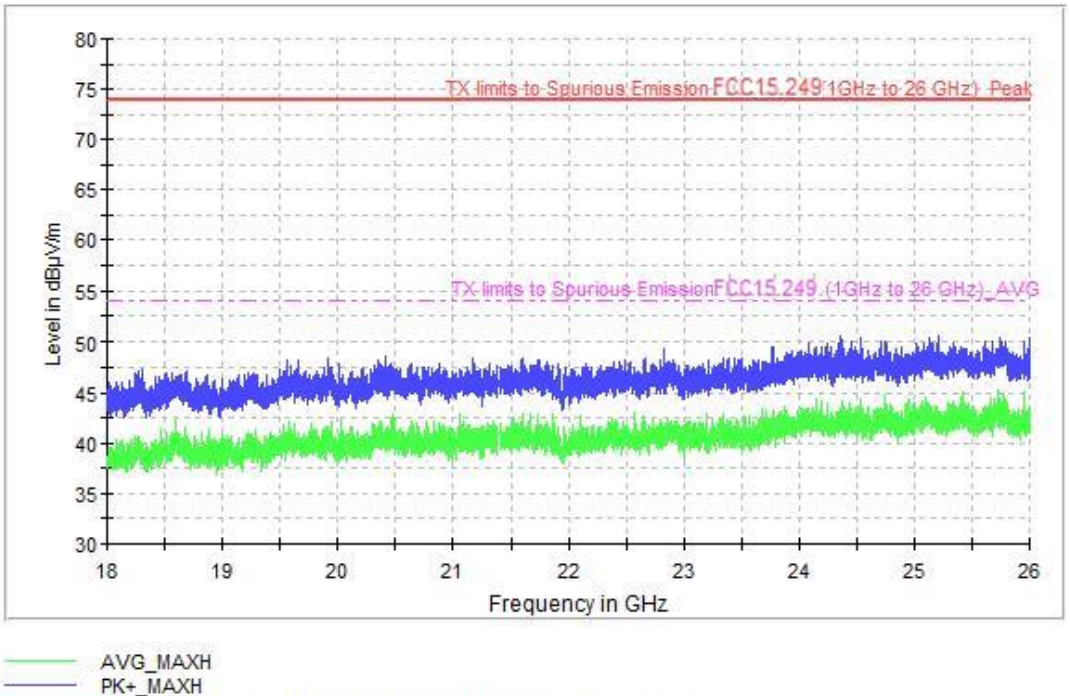


18GHz_26GHz_VP_CH Mid

CHANNEL: Highest (2480 MHz).



18GHz_26GHz_HP_CH High



18GHz_26GHz_VP_CH High