




## TEST REPORT

<b>APPLICANT:</b>	CARLO GAVAZZI CONTROLS SPA 32100 Belluno (Italy) – Via Safforze, 8 Tel. 0437 355811	
<b>APPLICANT REFEREE:</b>	ING. BORGHI <a href="mailto:claudio.borghia@gavazziacbu.it">claudio.borghia@gavazziacbu.it</a>	
<b>EUT DESCRIPTION</b>	PC CONVERTER BY EXCHANGE INFORMATION	
<b>EUT MODEL</b>	OptoProg	
<b>EUT FCC ID</b>	SNJOPT	
<b>EUT TRADEMARK</b>		
<b>MANUFACTURER</b>	CARLO GAVAZZI CONTROLS SPA	
<b>REFERENCE STANDARDS</b>	47 CFR FCC part 15.247; Subpart B - §15.107 §15.109	
<b>TEST REPORT NUMBER</b>	FCCTR_161683-3	
<b>TEST REPORT ISSUE DATE</b>	07/09/2018	
<b>TESTING LABORATORY</b>	PRSLAB S.r.l. Unipersonale Via Campagna, 92 -22020 Faloppio (Co) – Italy FCC test registration number: 177269	
<b>TESTING LOCATION</b>	As Above	
<b>DATE OF TEST SAMPLE RECEIPT</b>	Jun 2017	
<b>DATE OF TEST</b>	Jun 2017- September 2017	
<b>TESTED BY</b>	Daniele AOSANI Tecnico Laboratorio EMC & RADIO / EMC & RADIO Laboratory Technician	
<b>APPROVED BY</b>	Riccardo PFEIFFER Responsabile Laboratori / Laboratory Manager	

The test results reported in this test report shall refer only to the sample actually tested and shall not refer or be deemed to refer to bulk from which such a sample may be said to have been obtained.

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## 1. RELEASE CONTROL RECORD

TEST REPORT NUMBER	REASON OF CHANGE	DATE OF ISSUE
FCCTR_161683-0	Original release	21/09/2017
FCCTR_161683-1	Editorial change	02/05/2018
FCCTR_161683-2	Editorial change	02/08/2018
FCCTR_161683-2	Added explanation about modulation	07/09/2018

## 2. TECHNICAL INFORMATION OF EQUIPMENT UNDER TEST (EUT)

### 2.1 Identification

Trademark:	
Manufacturer:	CARLO GAVAZZI CONTROLS SPA
Type of Equipment :	PC CONVERTER BY EXCHANGE INFORMATION
Model name:	OptoProg
Serial number :	Prototype
FCC ID :	SNJOPT
Country of manufacturer:	Italy

## 2.2 Technical data

<b>Product type:</b>	Radio Equipment – Bluetooth 4.1*
<b>Radio type:</b>	Intentional radiators
<b>Product description / application</b>	PC converter by exchange information
<b>Power supply requirements :</b>	3,7V 1200mAh (internal battery rechargeable)
<b>Operating Frequency range</b>	2400-2483.5MHz
<b>Operating Frequency:</b>	From 2402MHz to 2480MHz
<b>Channel bandwidth</b>	1MHz
<b>Channel spacing</b>	1MHz
<b>Number of Channel</b>	0-78 [79]
<b>Type of modulation :</b>	BT: BR GFSK (Tested as worst case) EDR $\pi/4$ -DQPSK, EDR 8-DPSK
<b>Antenna Type</b>	Integrated antenna

\*The Chip is a BT 4.1 + LE dual mode, but the LE function has been disabled by the Manufacturer and will not be used.

### 2.3 Ports identification

This section contains descriptions of all signal ports and AC/DC power input/output ports, the length and the type of the cable provided by manufacturer needed for the tests. Moreover it is specified if the ports are ever or optionally connected.

Port		Description	Connection
1	Enclosure	Plastic	---
2	AC Power Supply	Port not present	---
3	DC power supply	5 V powered by Micro USB	Micro USB from Host
4	Signal lines	USB	Micro USB
5	Telecomm. Lines	Port not present	---
6	Antenna port	Integrated antenna	---

*Note: During the tests all cables must be what provided the manufacturer or the same that used in the real employment of the EUT.*

### 2.4 Auxiliary equipment

- Host PC

### 3. OPERATING TEST MODES AND CONDITIONS

In the following table there are the operating conditions adopted during tests identified by an indicator (#..) at which has been referred the item "Operating condition of the equipment under test"

<i>Operating condition</i>	<i>Description</i>
<b>#1</b>	Continuous transmission, modulated carrier, on channel 0 BR GFSK modulation (worst case)* Data Rate: 1Mbps
<b>#2</b>	Continuous transmission, modulated carrier, on channel 39 BR GFSK modulation (worst case)* Data Rate: 1Mbps
<b>#3</b>	Continuous transmission, modulated carrier, on channel 78 BR GFSK modulation (worst case)* Data Rate: 1Mbps
<b>#4</b>	Standard operating, Hopping mode

\*GFSK has been evaluated as worst modulation case after OBW and Radiated Output Power Measurements. Only the data about GFSK modulation has been recorded in this Report.

**Special Test Software:** Special software by the Applicant to operate the EUT at each channel frequency continuously. For example, the transmitter will be operated at each of the lowest, middle and highest frequencies individually continuously during testing.

**Special Hardware Used:** None

**Transmitter Test Antenna:** The EUT has been tested with the antenna fitted in a manner typical of normal intended use as integral antenna equipment as described with the test results.

#### 4. REFERENCE STANDARD / DOCUMENT FOR PERFORMED TESTS

<b>Cfr 47 Part 15 subpart C par. 15.247</b>	Radio Frequency Devices – Intentional Radiators Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz
<b>Title 47 Part 15 Subpart B</b>	Radio frequency devices - General
<b>Title 47 Part 15 Subpart B § 15.107</b>	Radio frequency devices – Unintentional Radiators Conducted Limits
<b>Title 47 Part 15 Subpart B § 15.109</b>	Radio frequency devices – Unintentional Radiators Radiated Emissions Limits
<b>FCC Public notice DA 00-705</b>	Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
<b>ANSI C63.10:2013</b>	American National Standard for Testing Unlicensed Wireless Devices

## 5. SUMMARY OF TEST RESULTS

Port	Phenomena	Basic standard	Operating condition <sup>1</sup>	Result
Antenna port	Antenna requirement	FCC Part 15 §15.203	---	Compliant
	Conducted Output Power	FCC Part 15 §15.247 (b) (1)	#1, #2, #3	Within the limit
	Radiated Emission	FCC Part 15 § 15.247 (d) § 15.209	#1,#2, #3	Within the limit
	Number of hopping channels	FCC Part 15 §15.247 (a) (1) (iii)	#4	Within the limit
	Hopping Channel Separation	FCC Part 15 §15.247 (e)	#4	Within the limit
	Band-Edge	FCC Part 15 § 15.247 (a) (1)	#1,#3, #4	Within the limit
	Dwell Time	FCC Part 15 §15.247 (a) (1) (iii)	#4	Within the limit
Enclosure	Radiated Emissions	Title 47 Part 15 Subpart B § 15.109	#4	Within the limit



## 6. TEST RESULTS

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**TEST  
1.**

**ANTENNA REQUIREMENTS**

**REFERENCE  
DOCUMENT**

According to §15.203 / 15.204

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sec. 15.211, Sec. 15.213, Sec. 15.217, Sec. 15.219, or Sec. 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Sec. 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded

Antenna requirement
The EUT has an integrated PCB Printed antenna
<b>RESULT: COMPLIANT</b>

**TEST  
2.**
**CONDUCTED OUTPUT POWER**
**REFERENCE  
DOCUMENT**

**According to §15.247(b) (3), (b)** The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

<b>TEST SETUP</b>	In according to ref std
<b>TEST LOCATION</b>	Semi Anechoic Chamber / Radio test Area
<b>TEST METHOD</b>	FCC Public notice DA 00-705 ANSI C63.10:2013
<b>TYPE OF MEASUREMENT</b>	RADIATED
<b>TEST EQUIPMENT</b>	Emi Receiver / Spectrum Analyzer Rohde&Schwarz mod. ESU40
<b>TEST PERFORMED BY</b>	Daniele Aosani
<b>TESTING DATE</b>	September 2017

<b>TEST CONDITIONS:</b>	<b>MEASURED</b>
Ambient temperature : 23°C ± 5°C	24°C
Ambient humidity : 25 – 75 %rH	45%
Pressure : 85 – 106 kPa (860 mbar – 1060 mbar)	960mbar

<b>OPERATING CONDITION</b>	#1, #2, #3 DUTY CYCLE 100%
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<b>TEST RESULT</b>	<b>WITHIN THE LIMITS</b>
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MEASUREMENT PARAMETER	
Resolution bandwidth:	RBW $\geq$ DTS bandwidth
Video bandwidth:	VBW $\geq$ 3 x RBW
Span:	span $\geq$ 3 x RBW
Sweep time	Auto couple
Detector:	Peak
Trace-Mode:	Max. hold

**TEST DESCRIPTION**

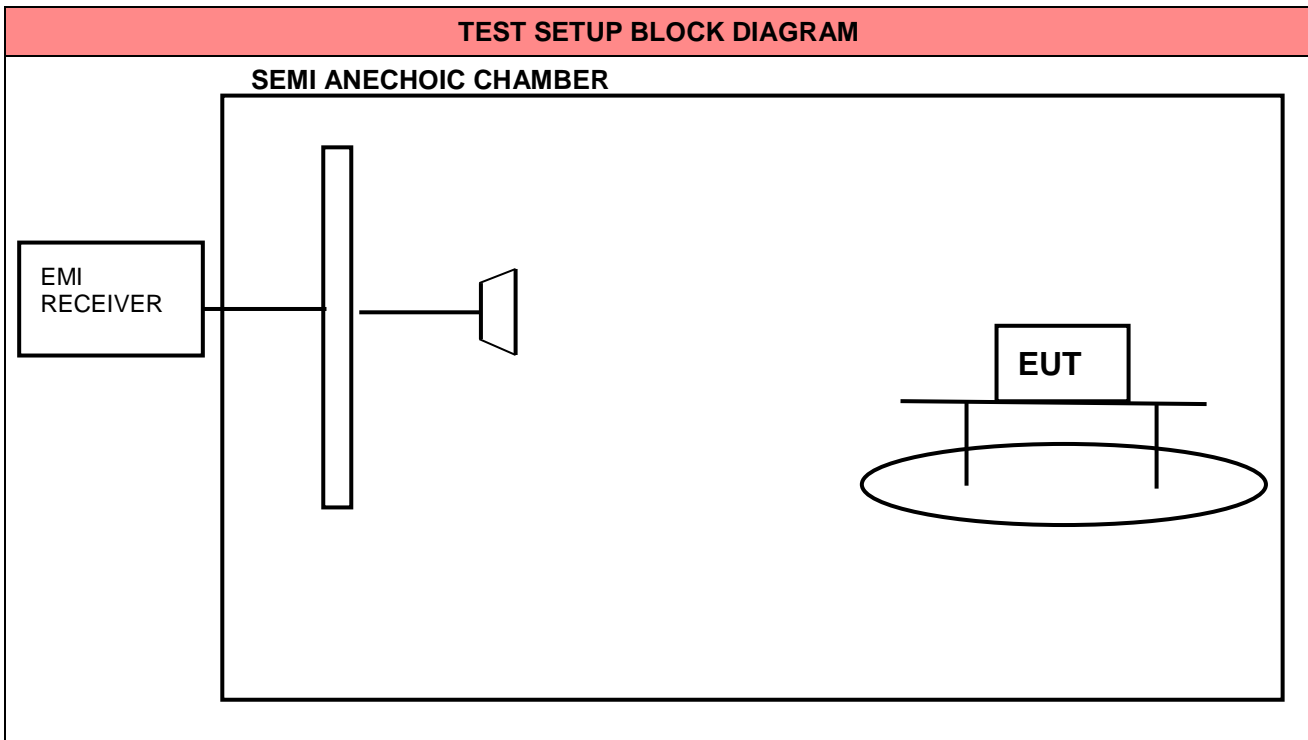
Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously - rotating, remotely - controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. The EUT is placed at test table.

For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height is 1.5 m

Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m~4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3m.

This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

The power of the EUT is measured on all three axis and only the worst case is recorded in the Test Report.



Channel	Frequency (MHz)	Max Radiated output power (dBm)	Antenna Gain (dBi)	Max Conducted Output power (dBm)	Max Conducted Output power (mW)	Limit (mW)	Result
0	2402	2.8	+1.5	+1,3	1,34	125	<b>WITHIN THE LIMITS</b>
39	2441	-3.2	+1.5	-4,7	0,33		
78	2480	-5,7	+1.5	-7.2	0,19		
Incertezza di misura / Measurement Uncertainty : $\pm 3$ dB							
Note: none							

Channel	Frequency (MHz)	AV Radiated Output power (dBm)	Antenna Gain (dBi)	AV Conducted Output power (dBm)	AV Conducted Output power (mW)
0	2402	2.5	+1.5	+1,0	1,25
39	2441	-3.5	+1.5	-5,0	0,31
78	2480	-5,9	+1.5	-7.4	0,18

**TEST  
3.**
**20dB CHANNEL BANDWIDTH and OCCUPIED BANDWIDTH**
**REFERENCE DOCUMENT**

According to §15,247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

<b>TEST SETUP</b>	In according to ref std
<b>TEST LOCATION</b>	Radio test area
<b>TEST METHOD</b>	FCC Public notice DA 00-705 ANSI C63.10:2013
<b>TYPE OF MEASUREMENT</b>	RADIATED
<b>TEST EQUIPMENT</b>	Spectrum Analyzer Rohde&Schwarz mod. FSP40 SYSTEM DC POWER SUPPLY HP mod. 6623A
<b>TEST PERFORMED BY</b>	Daniele Aosani
<b>TESTING DATE</b>	September 2017

<b>TEST CONDITIONS:</b>	<b>MEASURED</b>
Ambient temperature : 23°C ± 5°C	24°C
Ambient humidity : 25 - 75 %rH	45%
Pressure : 85 - 106 kPa (860 mbar - 1060 mbar)	960mbar

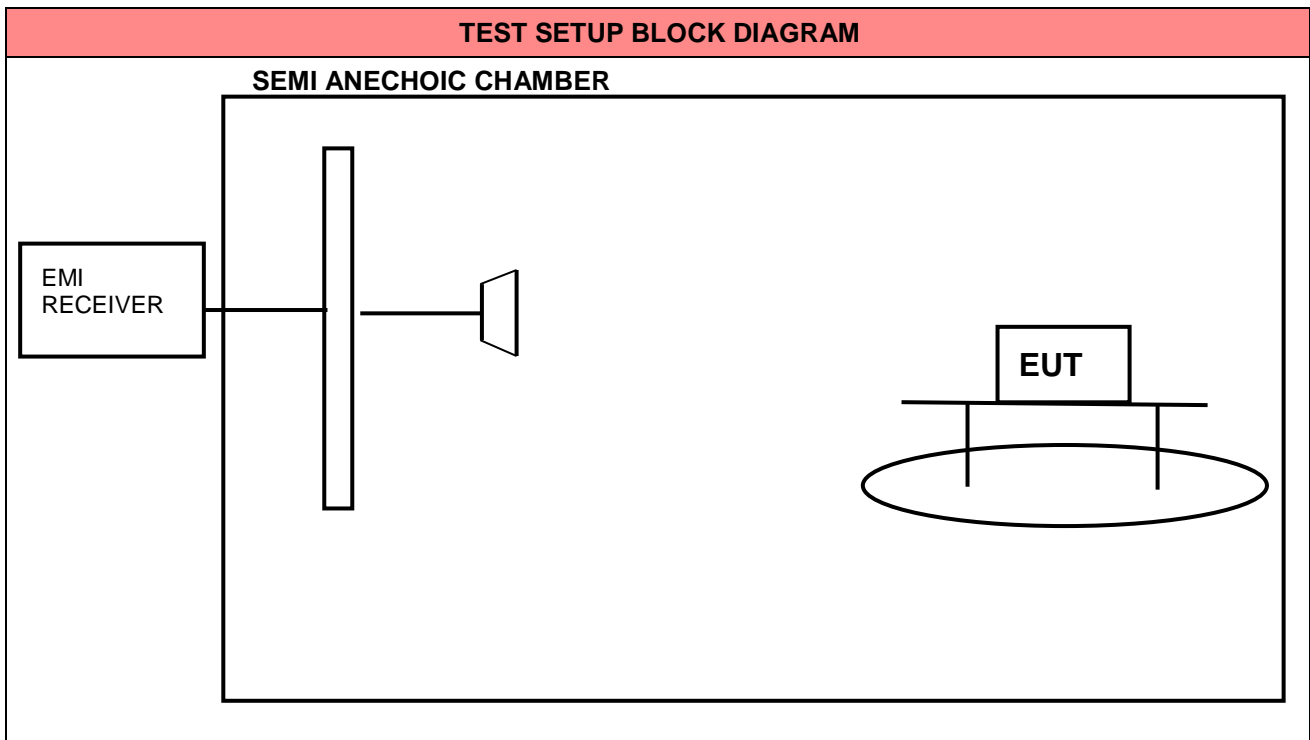
<b>OPERATING CONDITION</b>	#1, #2, #3, DUTY CYCLE 100%
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<b>TEST RESULT</b>	<b>WITHIN THE LIMITS</b>
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MEASUREMENT PARAMETER	
Resolution bandwidth:	100kHz
Video bandwidth:	300kHz
Span:	3MHz
Sweep time	Auto couple
Detector:	Peak
Trace-Mode:	Max. hold

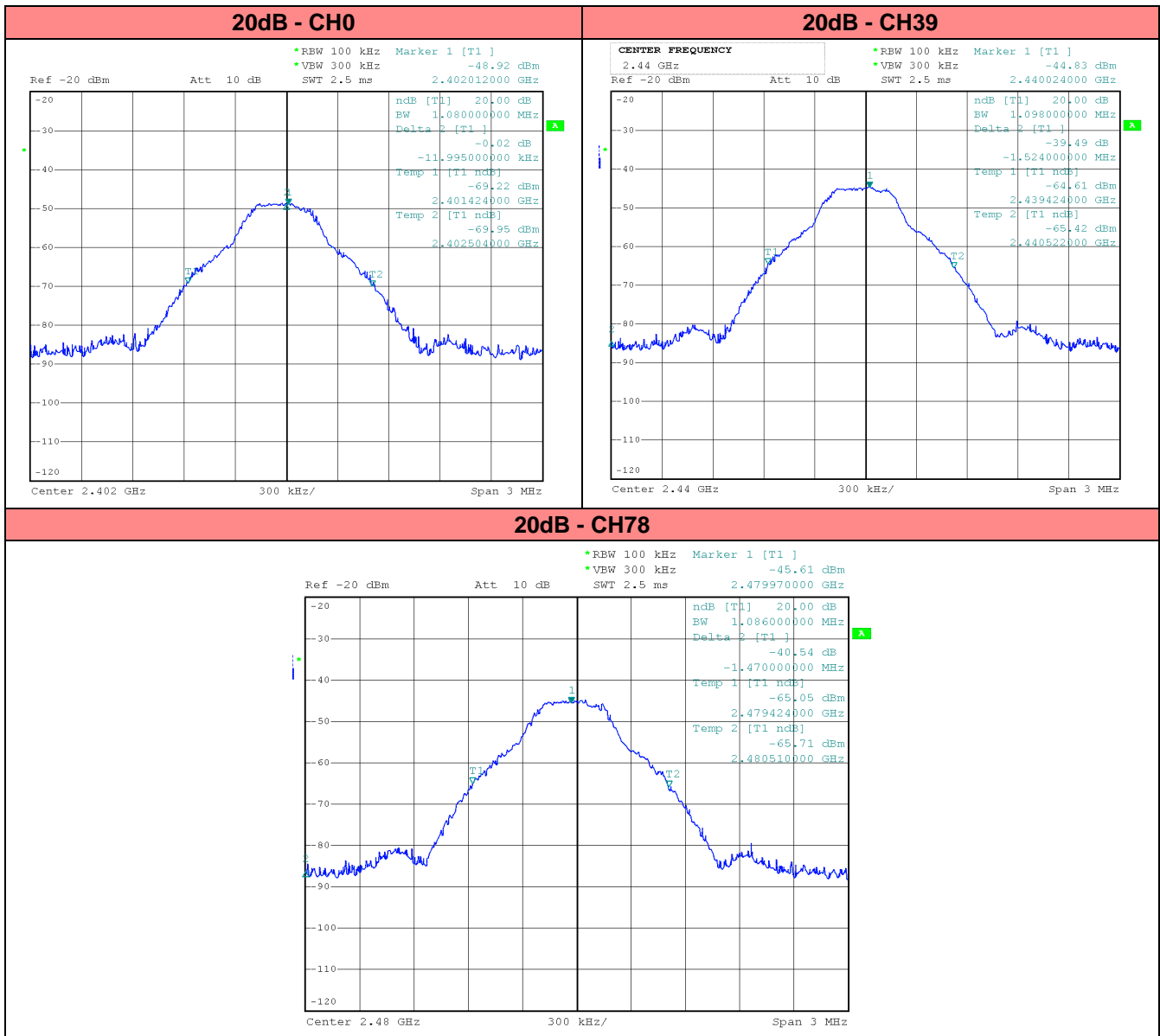
**TEST DESCRIPTION**

Allow the trace to stabilize.  
 Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission

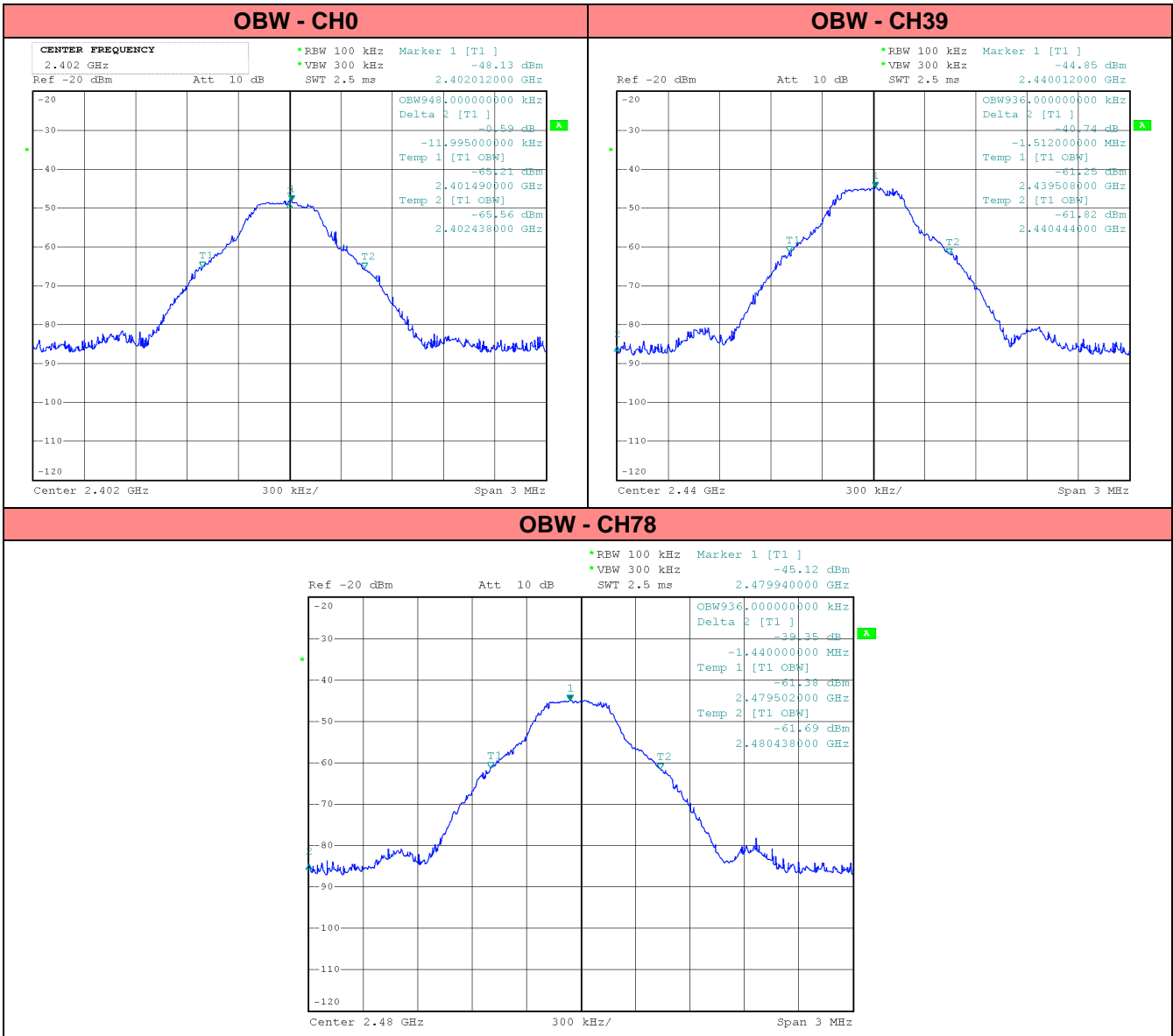


**Measurement Result**

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Occupied Bandwidth (MHz)	Result
0	2402	1,080	0,948	<b>WITHIN THE LIMITS</b>
39	2441	1,098	0,936	
78	2480	1,086	0,936	







**TEST  
4.**
**Band-Edge**
**REFERENCE  
DOCUMENT**

According to §15,247(d), In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB, Attenuation below the general limits specified in Sec, 15,209(a) is not required, In addition, radiated emissions which fall in the restricted bands, as defined in Sec, 15,205(a), must also comply with the radiated emission limits specified in Sec, 15,209(a) (see Sec, 15,205(c)),

<b>TEST SETUP</b>	In according to ref std
<b>TEST LOCATION</b>	Radio test area
<b>TYPE OF MEASUREMENT</b>	RADIATED
<b>TEST EQUIPMENT</b>	Spectrum Analyzer Rohde&Schwarz mod. FSP40 SYSTEM DC POWER SUPPLY HP mod. 6623A
<b>TEST PERFORMED BY</b>	Daniele Aosani
<b>TESTING DATE</b>	September 2017

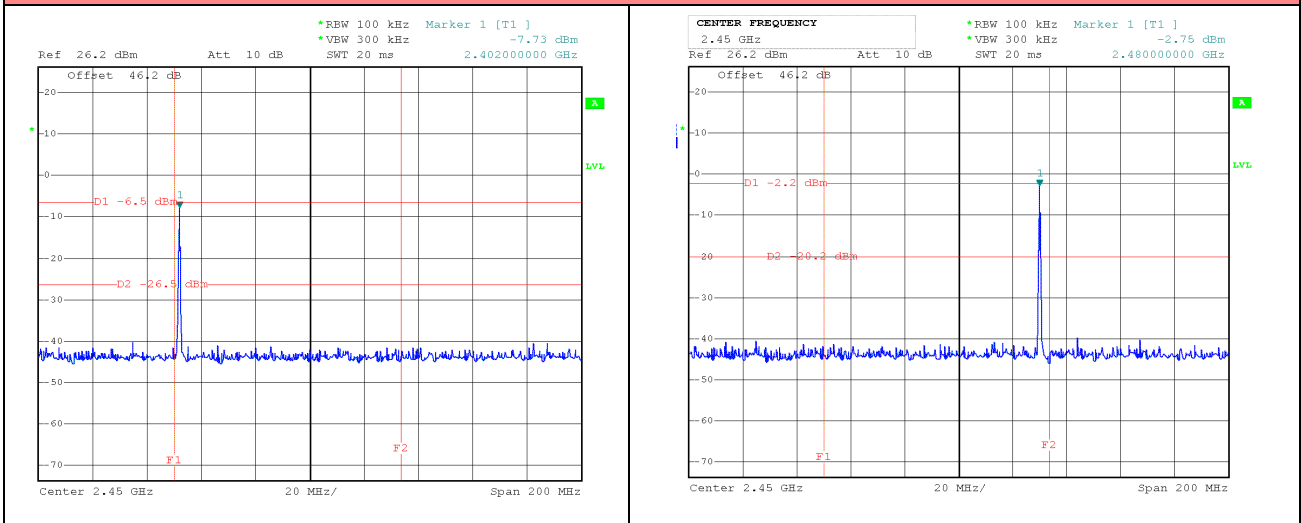
<b>TEST CONDITIONS:</b>	<b>MEASURED</b>
Ambient temperature : 23°C ± 5°C	24°C
Ambient humidity : 25 - 75 %rH	45%
Pressure : 85 - 106 kPa (860 mbar - 1060 mbar)	960mbar

<b>OPERATING CONDITION</b>	#1, #3, #4
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<b>TEST RESULT</b>	<b>WITHIN THE LIMITS</b>
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**Hopping off**



**TEST  
5.**
**NUMBER OF HOPPING FREQUENCY**
**REFERENCE  
DOCUMENT**

According to §15,247) (a) (iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used,

<b>TEST SETUP</b>	In according to ref std
<b>TEST LOCATION</b>	Radio test area
<b>TYPE OF MEASUREMENT</b>	RADIATED
	FCC Public notice DA 00-705 ANSI C63.10:2013
<b>TEST EQUIPMENT</b>	Spectrum Analyzer Rohde&Schwarz mod. FSP40 SYSTEM DC POWER SUPPLY HP mod. 6623A
<b>TEST PERFORMED BY</b>	Daniele Aosani
<b>TESTING DATE</b>	September 2017

<b>TEST CONDITIONS:</b>	<b>MEASURED</b>
Ambient temperature : 23°C ± 5°C	24°C
Ambient humidity : 25 - 75 %rH	45%
Pressure : 85 - 106 kPa (860 mbar - 1060 mbar)	960mbar

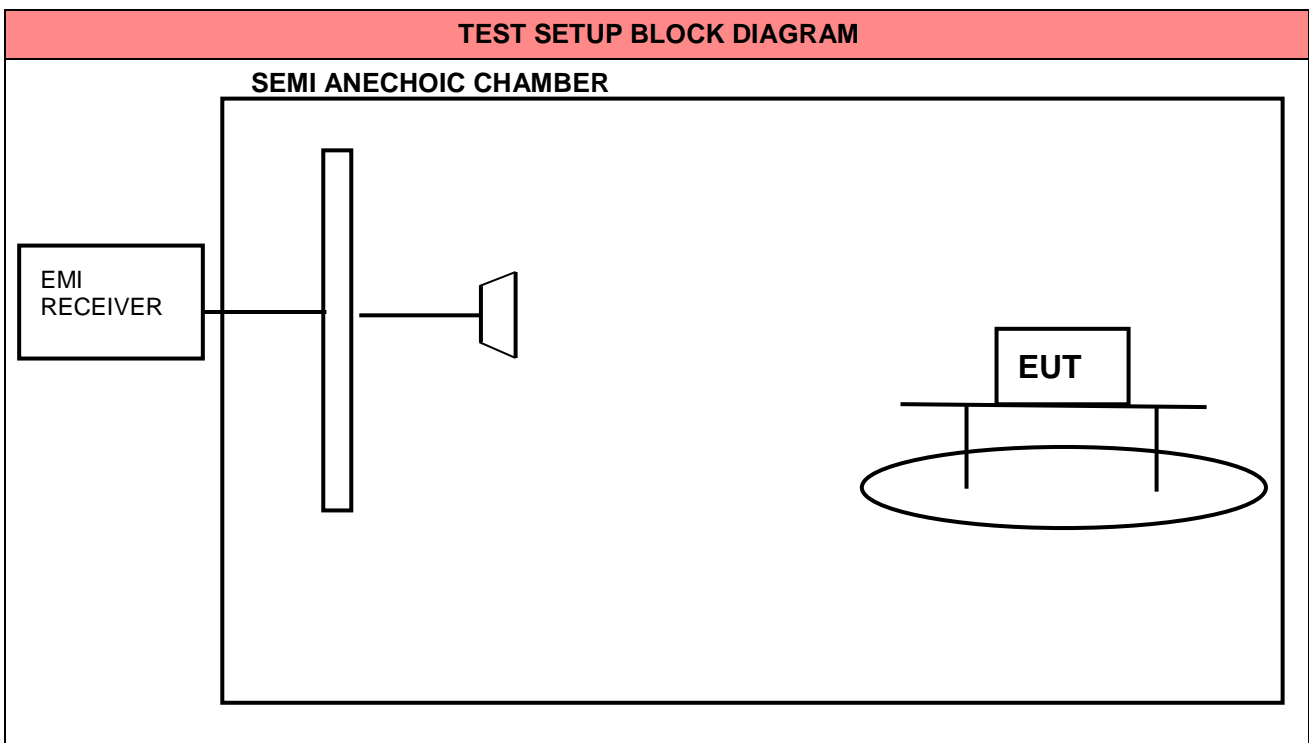
<b>OPERATING CONDITION</b>	#4
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<b>TEST RESULT</b>	<b>WITHIN THE LIMITS</b>
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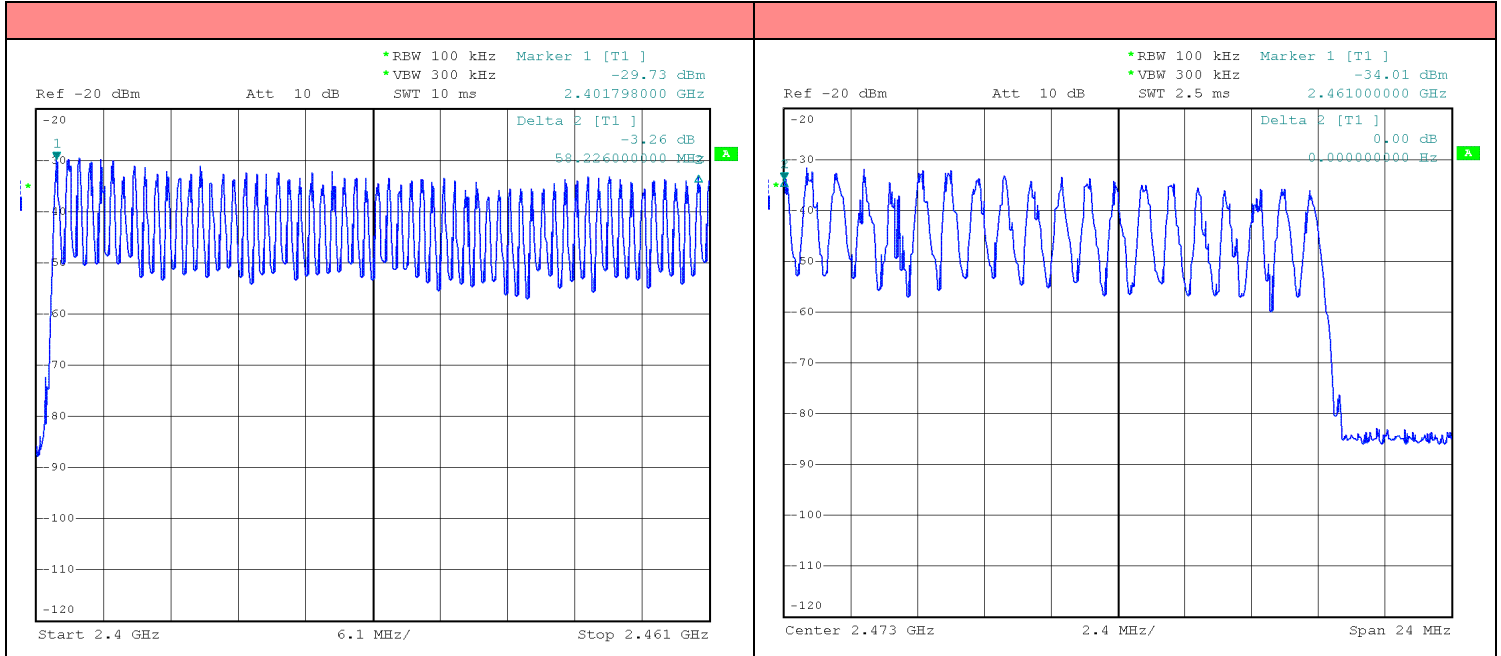
MEASUREMENT PARAMETER	
Resolution bandwidth:	100kHz
Video bandwidth:	300kHz
Sweep time	Auto couple
Detector:	Peak
Trace-Mode:	Max. hold

**TEST DESCRIPTION**

Allow trace to fully stabilize.  
Use the peak marker function to determine the maximum amplitude level within the RBW.



**GRAPHICS**



**TEST  
6.**
**CHANNEL SEPARATION**
**REFERENCE  
DOCUMENT**

According to §15,247) (a) (1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

<b>TEST SETUP</b>	In according to ref std
<b>TEST LOCATION</b>	Radio test area
<b>TYPE OF MEASUREMENT</b>	RADIATED
	FCC Public notice DA 00-705 ANSI C63.10:2013
<b>TEST EQUIPMENT</b>	Spectrum Analyzer Rohde&Schwarz mod. FSP40 SYSTEM DC POWER SUPPLY HP mod. 6623A
<b>TEST PERFORMED BY</b>	Daniele Aosani
<b>TESTING DATE</b>	September 2017

<b>TEST CONDITIONS:</b>	<b>MEASURED</b>
Ambient temperature : 23°C ± 5°C	24°C
Ambient humidity : 25 - 75 %rH	45%
Pressure : 85 - 106 kPa (860 mbar - 1060 mbar)	960mbar

<b>OPERATING CONDITION</b>	#4
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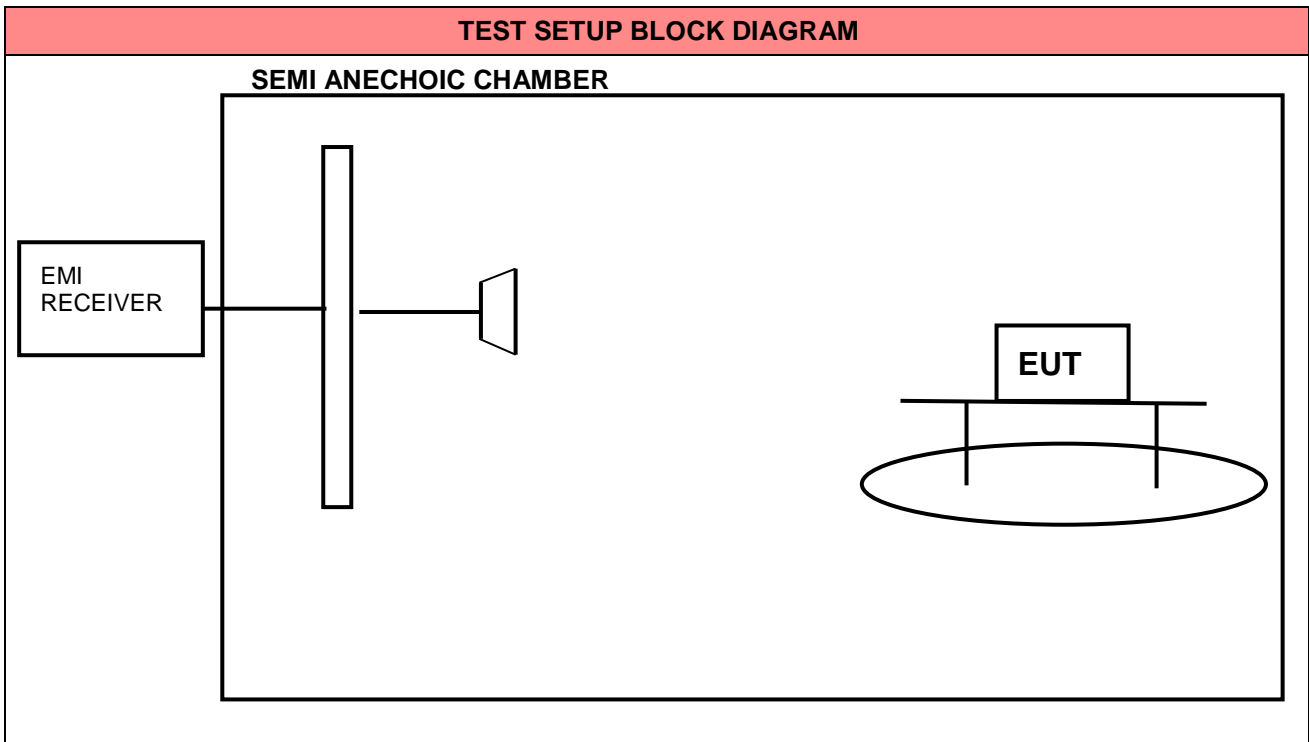
<b>TEST RESULT</b>	<b>WITHIN THE LIMITS</b>
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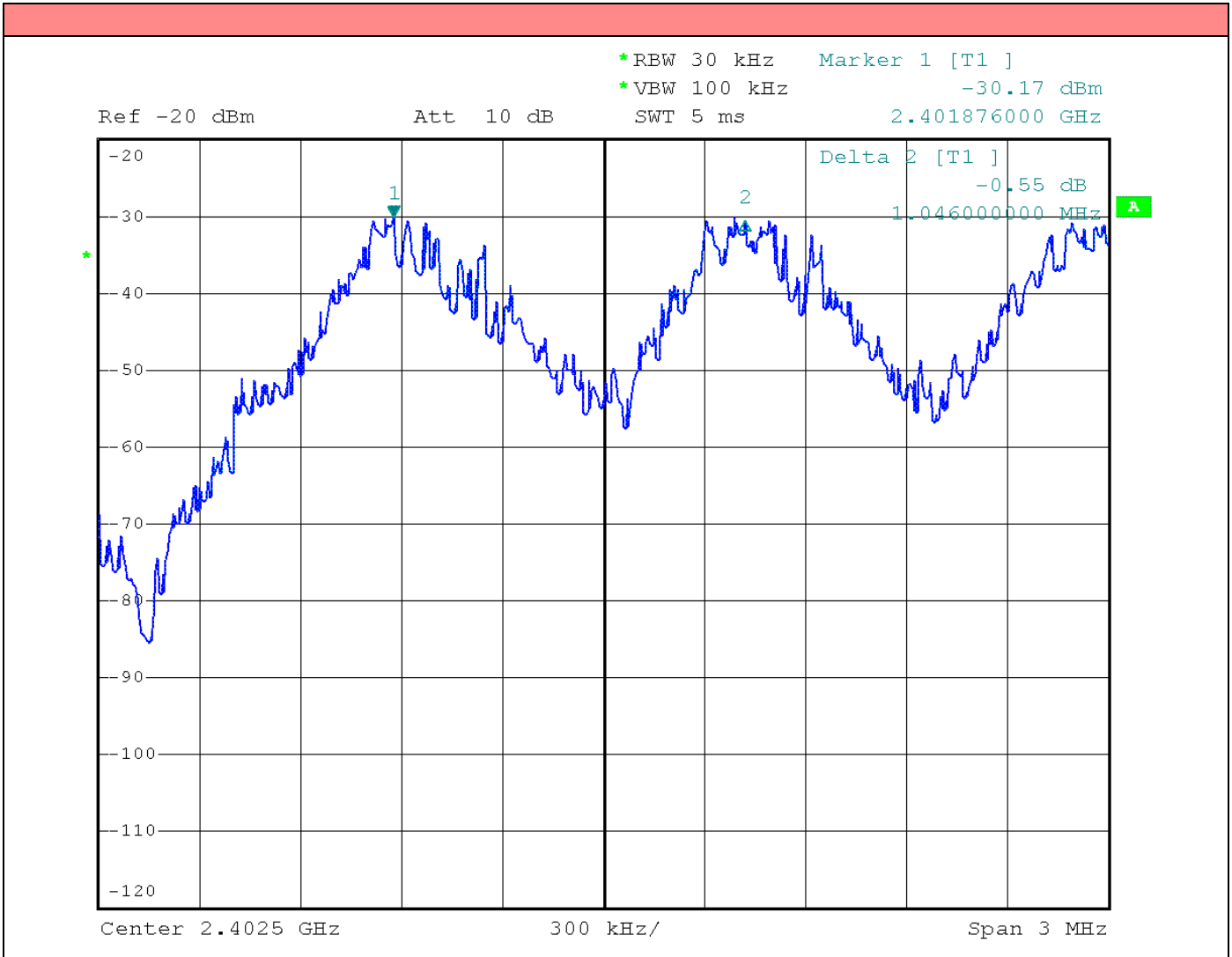
MEASUREMENT PARAMETER	
Resolution bandwidth:	30kHz
Video bandwidth:	100kHz
Span:	3MHz
Sweep time	Auto couple
Detector:	Peak
Trace-Mode:	Max. hold

**TEST DESCRIPTION**

Allow trace to fully stabilize.  
Use the peak marker function to determine the maximum amplitude level within the RBW.



### GRAPHICS



**TEST  
7.**
**NUMBER OF DWELL TIME**
**REFERENCE  
DOCUMENT**

According to §15,247) (a) (1) (iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

<b>TEST SETUP</b>	In according to ref std
<b>TEST LOCATION</b>	Radio test area
<b>TYPE OF MEASUREMENT</b>	RADIATED
	FCC Public notice DA 00-705 ANSI C63.10:2013
<b>TEST EQUIPMENT</b>	Spectrum Analyzer Rohde&Schwarz mod. FSP40 SYSTEM DC POWER SUPPLY HP mod. 6623A
<b>TEST PERFORMED BY</b>	Daniele Aosani
<b>TESTING DATE</b>	September 2017

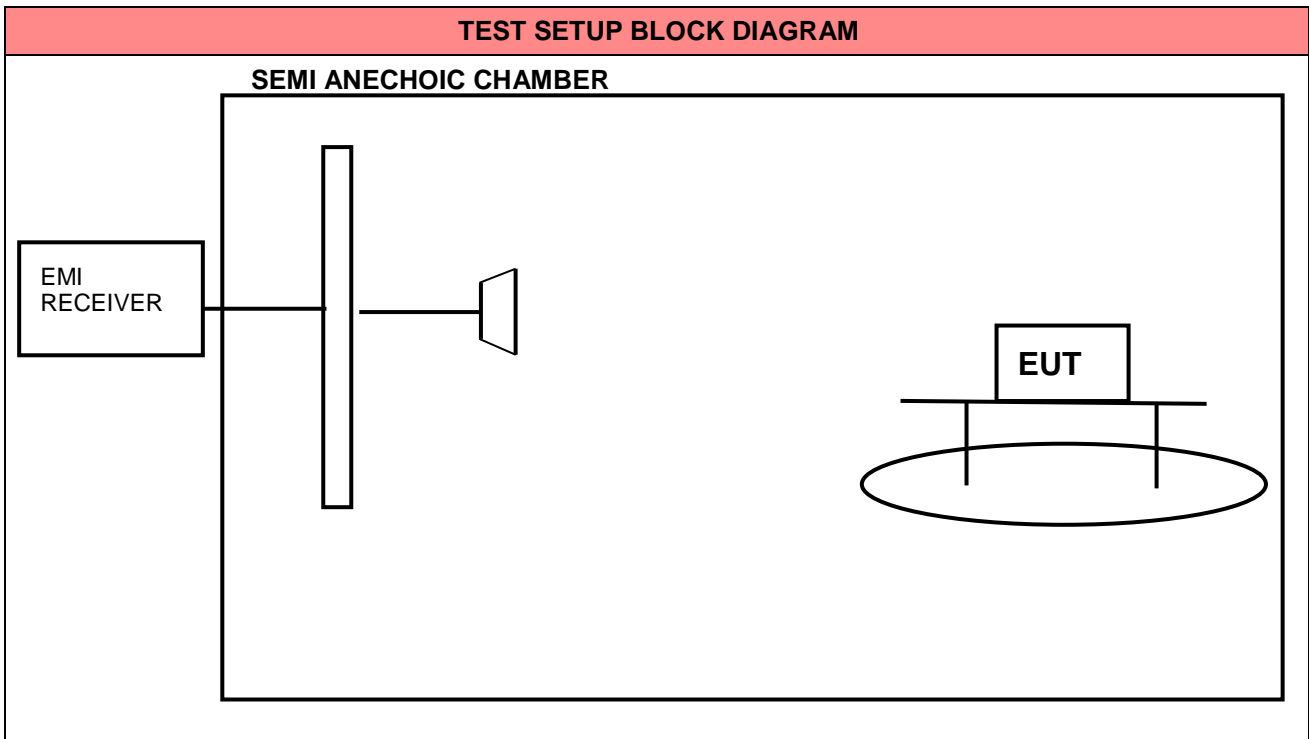
<b>TEST CONDITIONS:</b>	<b>MEASURED</b>
Ambient temperature : 23°C ± 5°C	24°C
Ambient humidity : 25 - 75 %rH	45%
Pressure : 85 - 106 kPa (860 mbar - 1060 mbar)	960mbar

<b>OPERATING CONDITION</b>	#4
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<b>TEST RESULT</b>	<b>WITHIN THE LIMITS</b>
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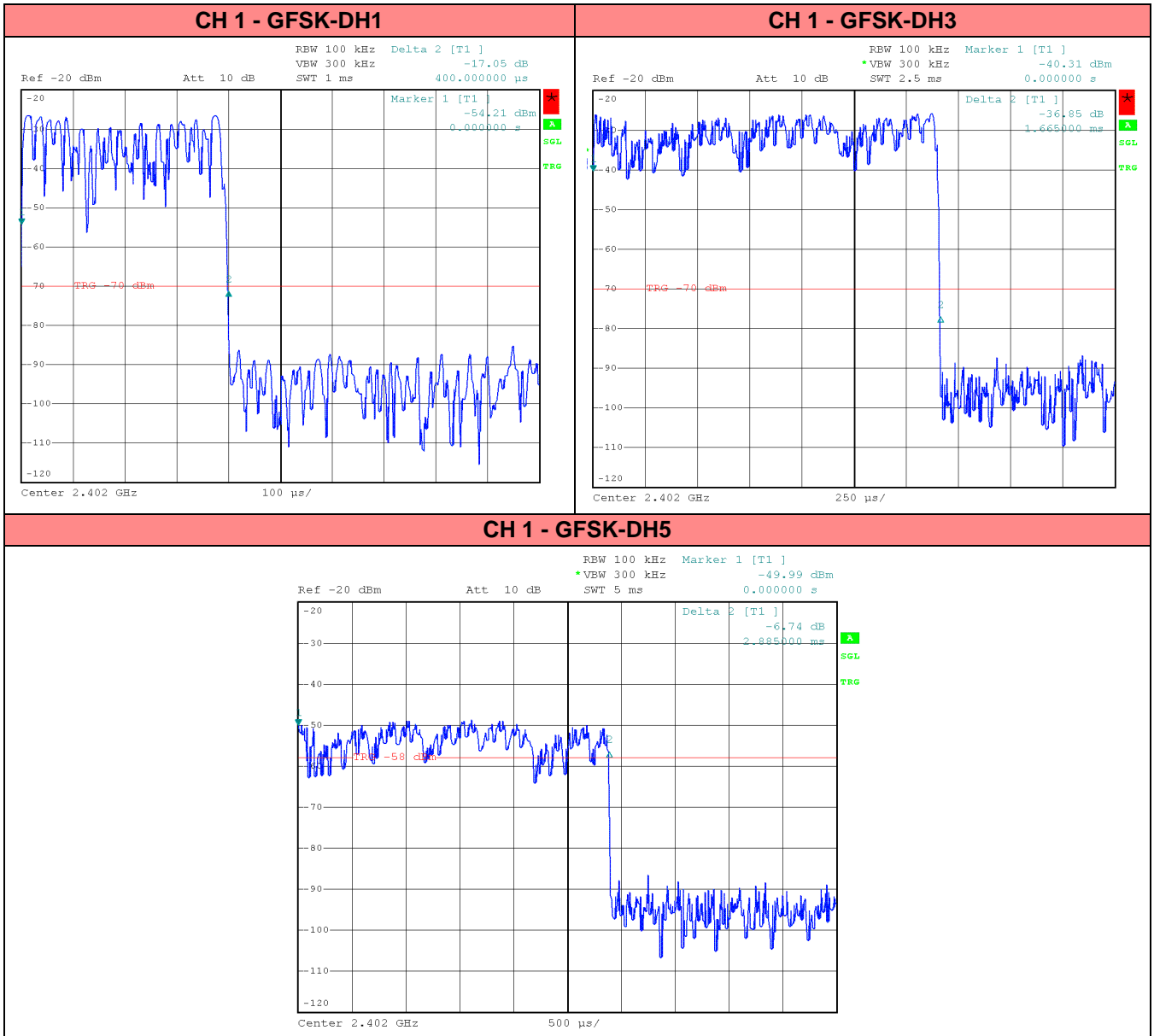
MEASUREMENT PARAMETER	
Resolution bandwidth:	30kHz
Video bandwidth:	100kHz
Span:	Zero
Sweep time	Auto couple
Detector:	Peak
Trace-Mode:	Max. hold

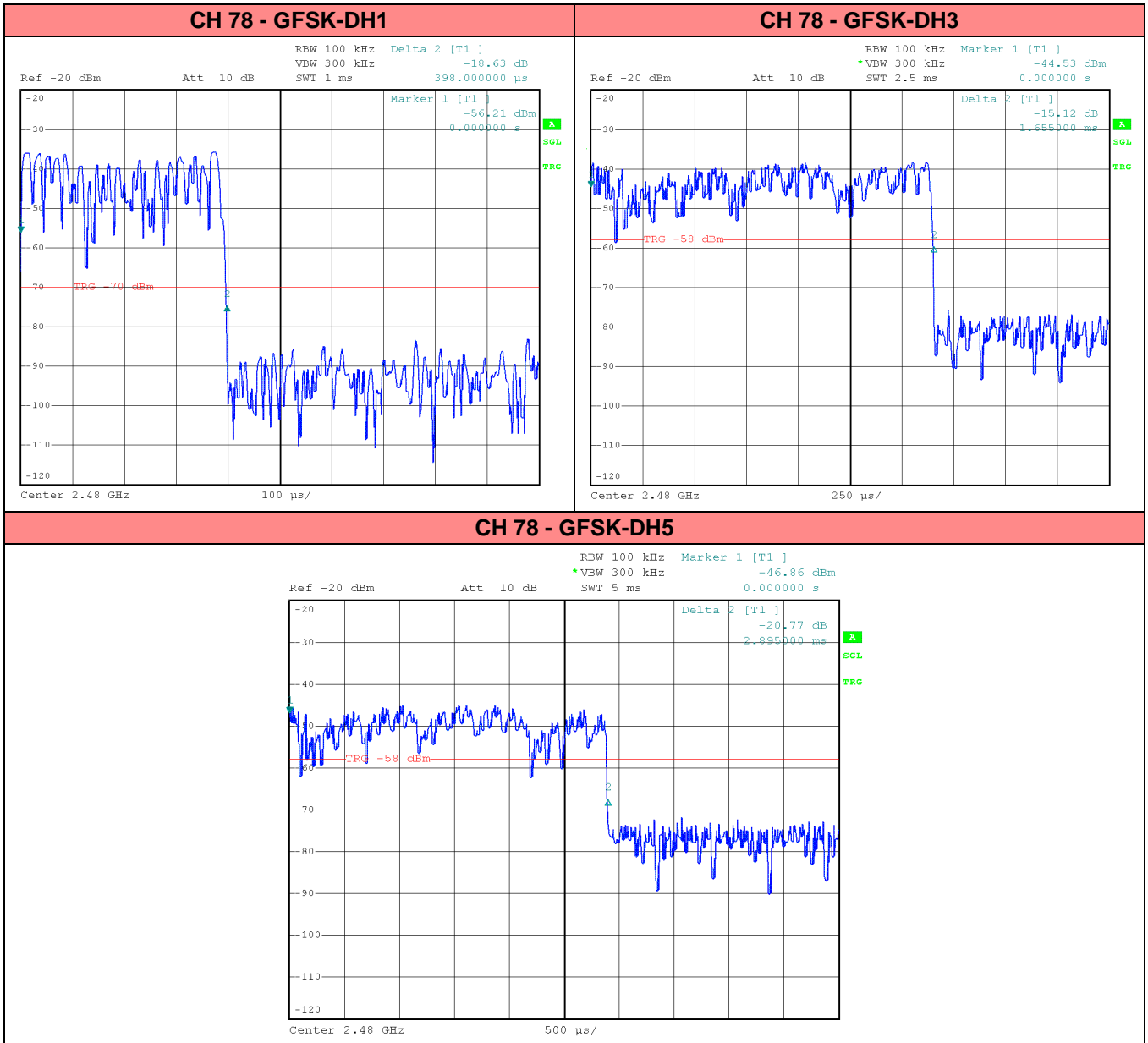
TEST DESCRIPTION
<p>Enable gating and trigger function of spectrum analyzer to measure burst on time.</p> <p>DH1 packet permit maximum <math>1600/79/2=10,12</math> hops per second in each channel. So, the dwell time is the time duration of the pulse times <math>10,12 \times 31,6 = 320</math> within 31,6 seconds.</p> <p>DH3 packet permit maximum <math>1600/79/4=5,06</math> hops per second in each channel. So, the dwell time is the time duration of the pulse times <math>5,06 \times 31,6 = 160</math> within 31,6 seconds.</p> <p>DH5 packet permit maximum <math>1600/79/6=3,37</math> hops per second in each channel. So, the dwell time is the time duration of the pulse times <math>3,37 \times 31,6 = 106,6</math> within 31,6 seconds.</p>



### Measurement Result

Channel	Modulation Mode	Frequency (MHz)	Length of Transmission Time (msec)	Number of Transmission in a 31.6 (79 Hopping*0,4)	Results (s)	Limit (s)
0	GFSK-DH1	2402	0,40	320	0,128	<b>0,4</b>
0	GFSK-DH3	2402	1,66	160	0,265	0,4
0	GFSK-DH5	2402	2,88	106,6	0,307	0,4
78	GFSK-DH1	2480	0,39	320	0,125	0,4
78	GFSK-DH3	2480	1,65	160	0,264	0,4
78	GFSK-DH5	2480	2,89	106,6	0,308	0,4





**TEST  
8.**
**RADIATED EMISSION 9KHZ ÷10<sup>TH</sup> HARMONIC**
**REFERENCE  
DOCUMENT**

According to §15,247) d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 Db instead of 20 Db. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

<b>TEST SETUP</b>	In according to ref std
<b>TEST LOCATION</b>	Semi Anechoic Chamber
<b>TYPE OF MEASUREMENT</b>	RADIATED
	KDB 558074 D01 par. 11.0
<b>TEST EQUIPMENT</b>	EMI receiver Rohde & Schwarz Mod, ESU 40 Chase Antenna Mod, CBL 6111 C Antenna Rohde & Schwarz mod, HBL050 Tunable notch filter Wainwright mod, WRCT2200/2500-5/40-10SK High pass filter Wainwright WHNX 2,8/18G-10SS
<b>TEST PERFORMED BY</b>	Daniele Aosani
<b>TESTING DATE</b>	September 2017
<b>UNCERTAINTY OF MEASURE:</b>	Combined uncertainty = $\pm 1,75$ dB Total uncertainty = (k=2) $\pm 3,5$ dB

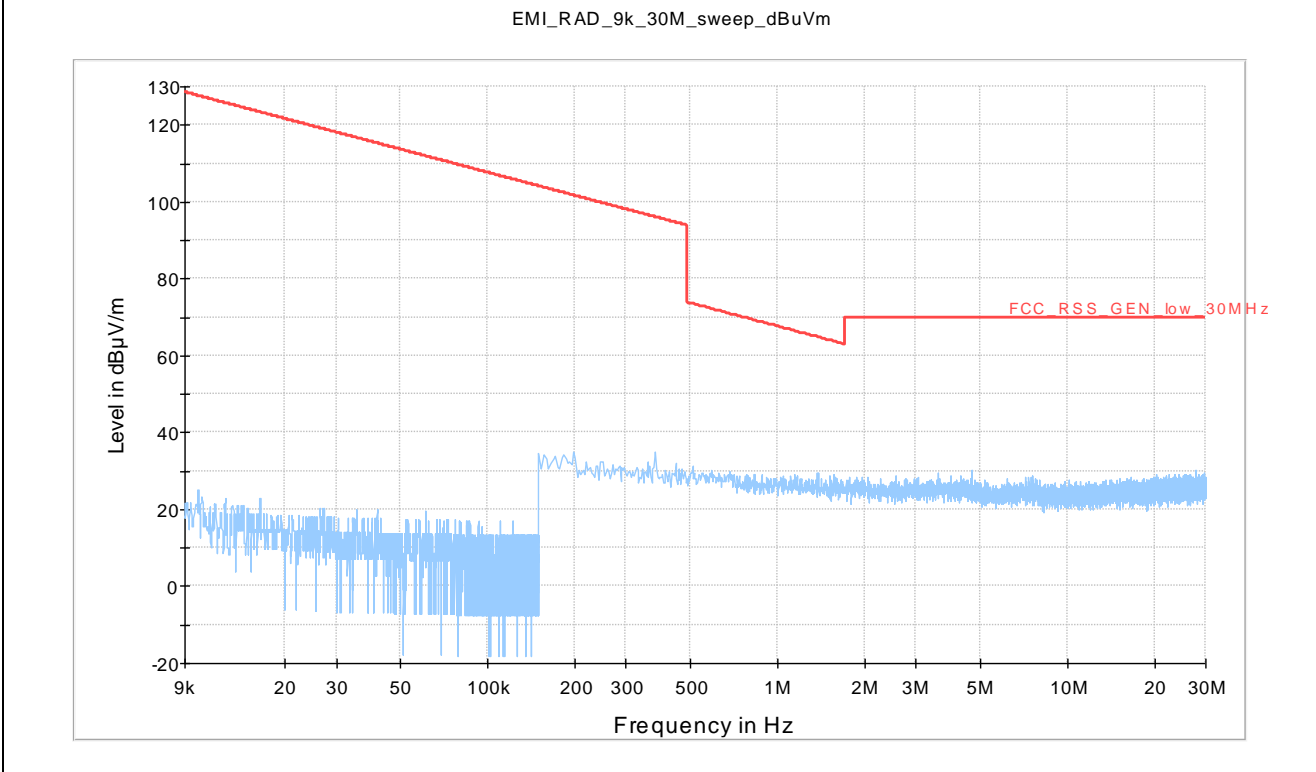
TEST CONDITIONS:	MEASURED
Ambient temperature : 23°C $\pm$ 5°C	24°C
Ambient humidity : 25 - 75 %rH	45%
Pressure : 85 - 106 kPa (860 mbar - 1060 mbar)	960mbar

<b>OPERATING CONDITION</b>	#1, #2, #3, DUTY CYCLE 100%
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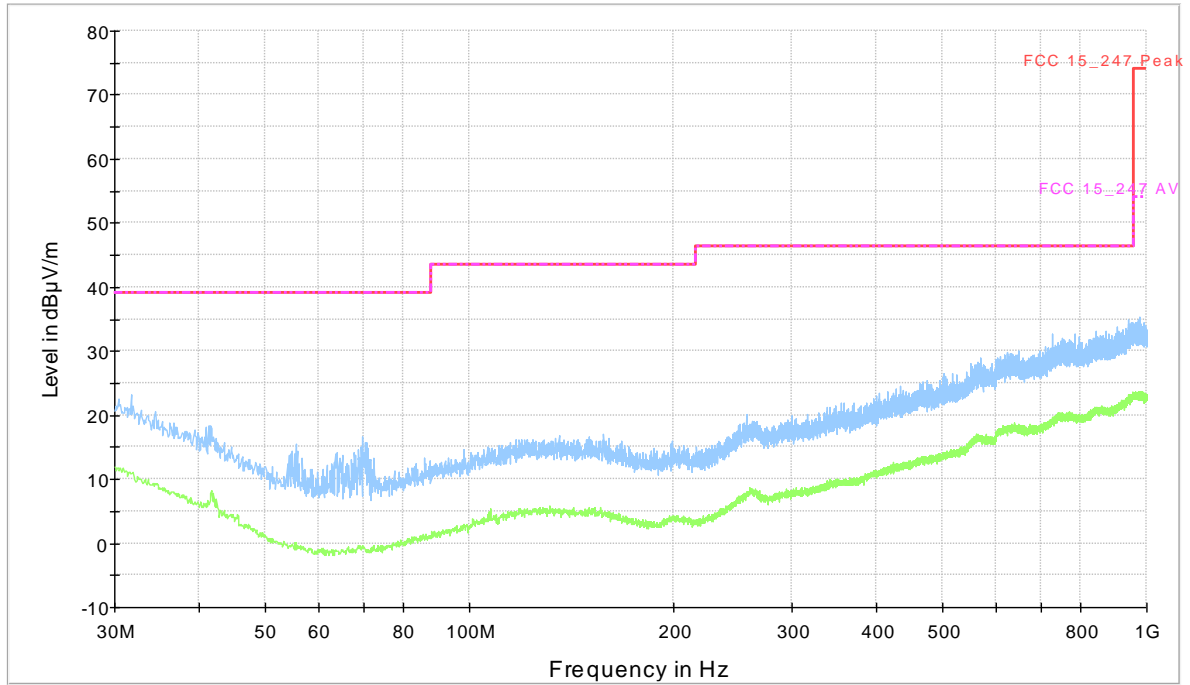
<b>TEST RESULT</b>	<b>WITHIN THE LIMITS</b>
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<b>CHANNEL</b>	0
<b>FREQUENCY RANGE</b>	9kHz - 30MHz
<b>POLARIZATION</b>	VERTICAL

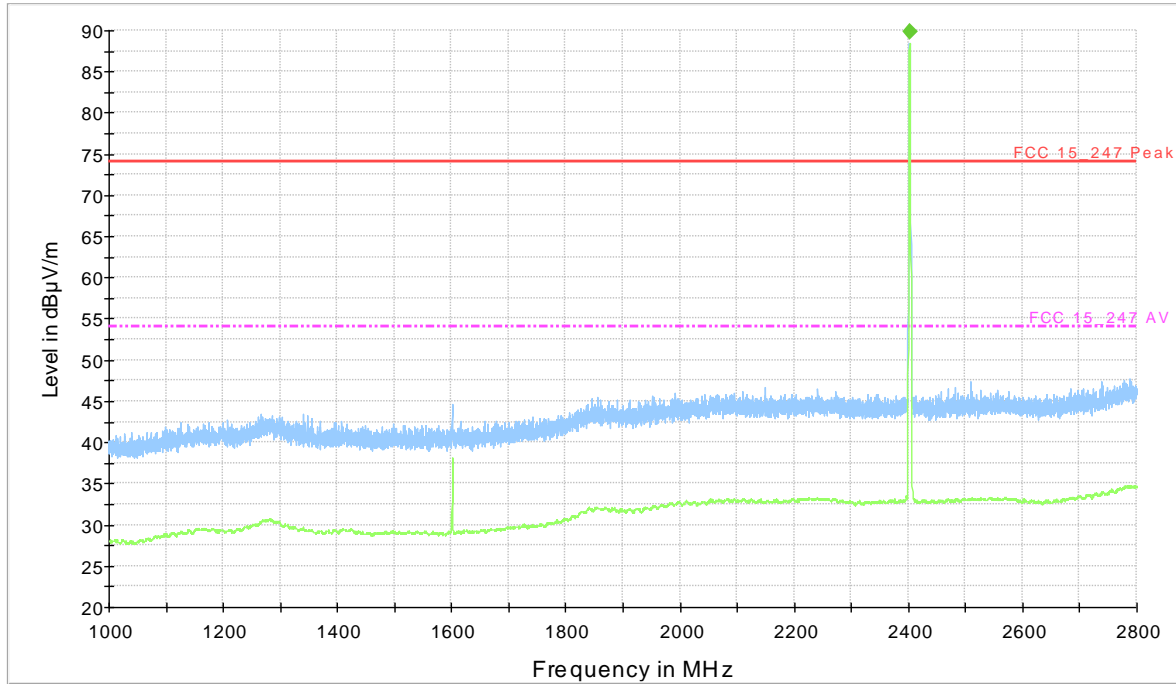


<b>CHANNEL</b>	0
<b>FREQUENCY RANGE</b>	30MHz – 1GHz
<b>POLARIZATION</b>	VERTICAL



<b>CHANNEL</b>	0
<b>FREQUENCY RANGE</b>	1-2.8GHz
<b>POLARIZATION</b>	VERTICAL

FCC\_15\_247\_RADIATED\_SPURIOUS\_VERTICAL



**Final Result Peak**

Frequency (MHz)	Peak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Limit (dBµV/m)
2402.020000	87.3	104.9	V	270.0	74.00

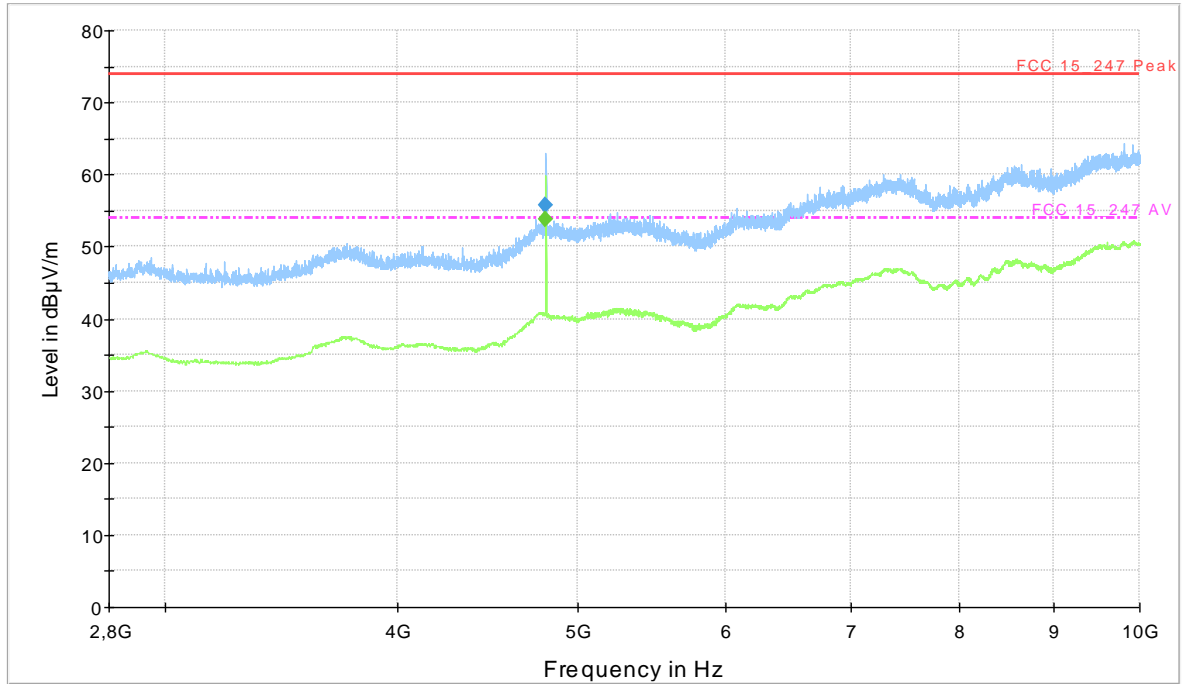
**Final Result Average**

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
2402.020000	89.8	104.9	V	270.0	-35.80	54.00

NOTE: Peak out of limits is related to the BT carrier and it is not evaluated

<b>CHANNEL</b>	0
<b>FREQUENCY RANGE</b>	2.8-10GHz
<b>POLARIZATION</b>	VERTICAL

FCC\_15\_247\_RADIATED\_SPURIOUS\_VERTICAL

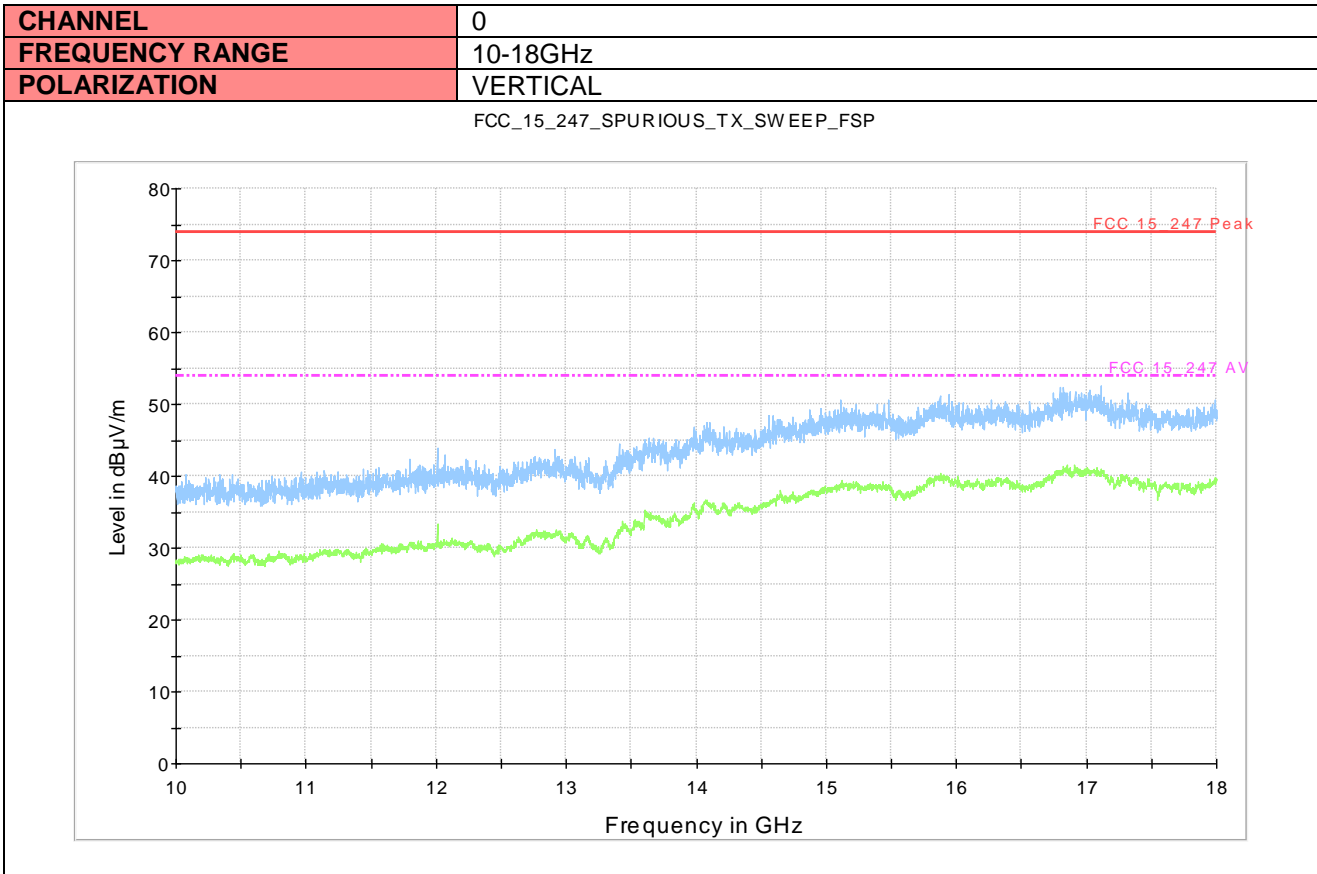


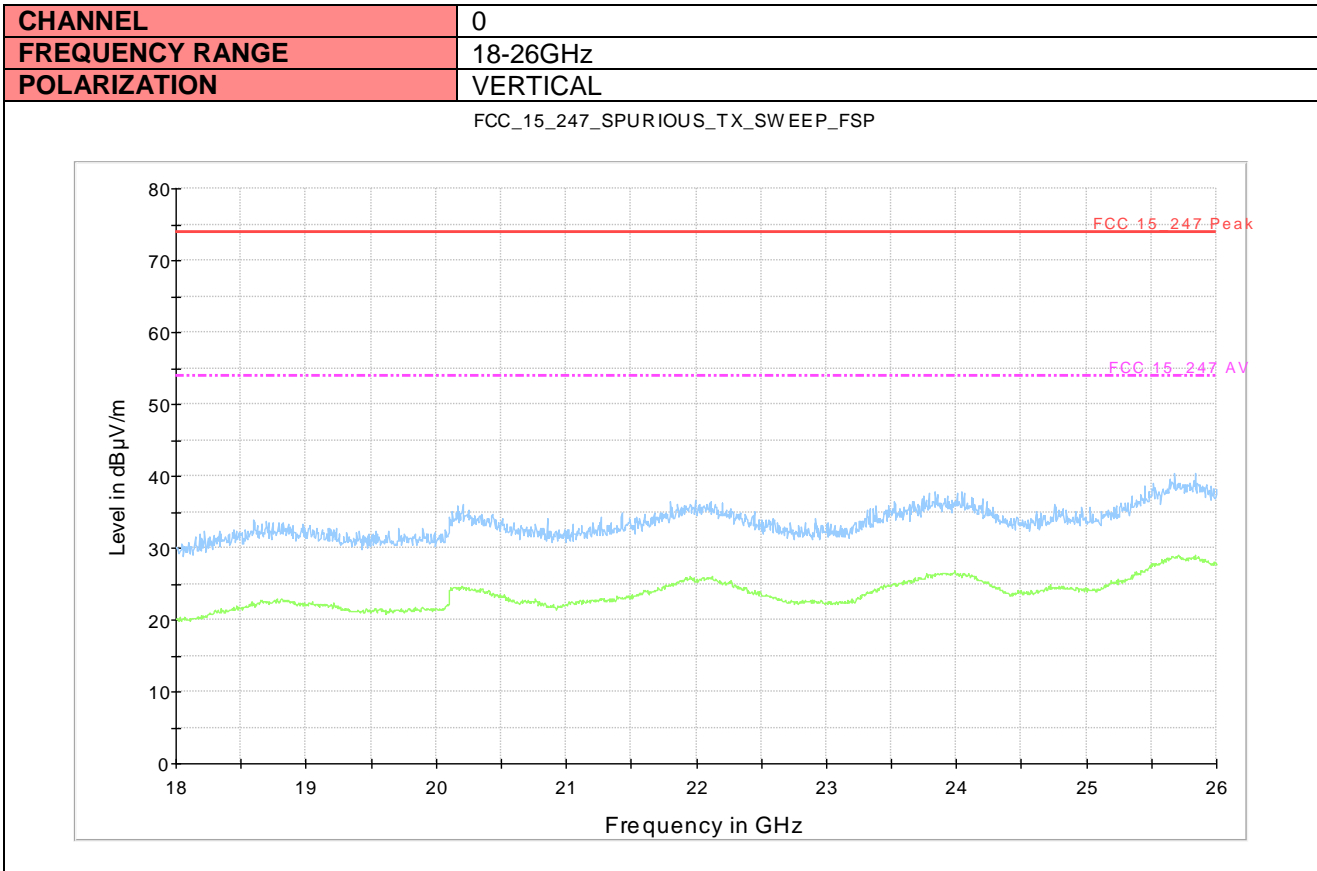
**Final Result Peak**

Frequency (MHz)	Peak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
4803.760000	55.8	104.9	V	0.0	18.20	74.00

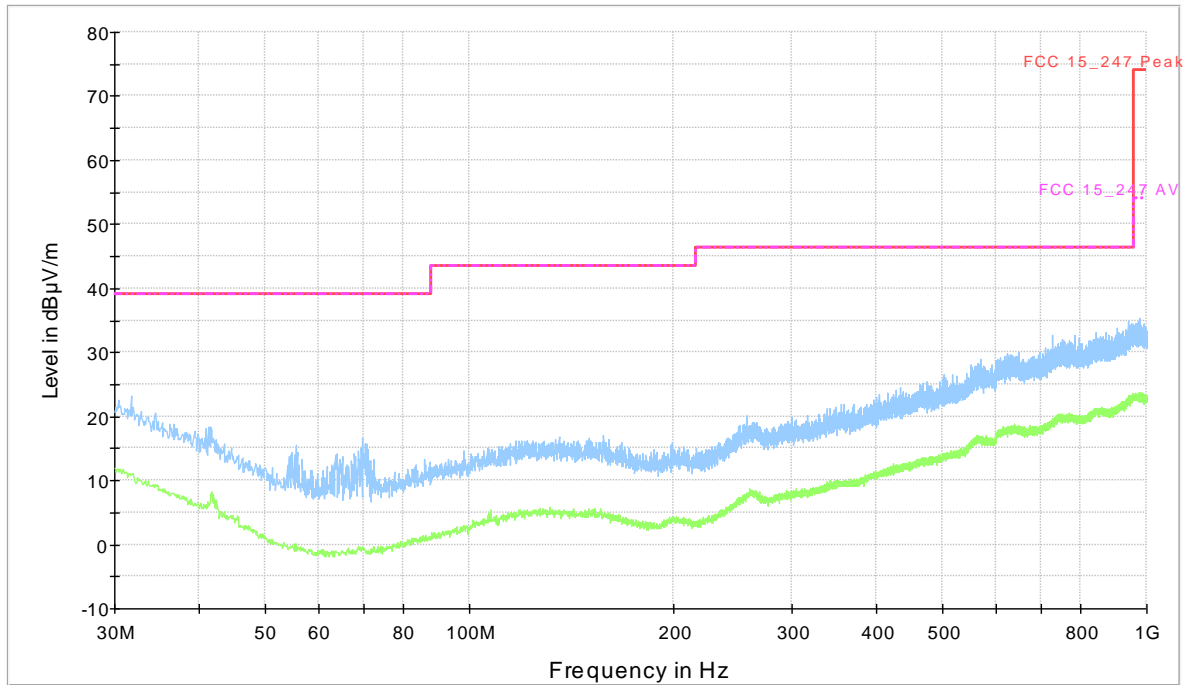
**Final Result Average**

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
4803.760000	53.9	104.9	V	0.0	0.1	54.00



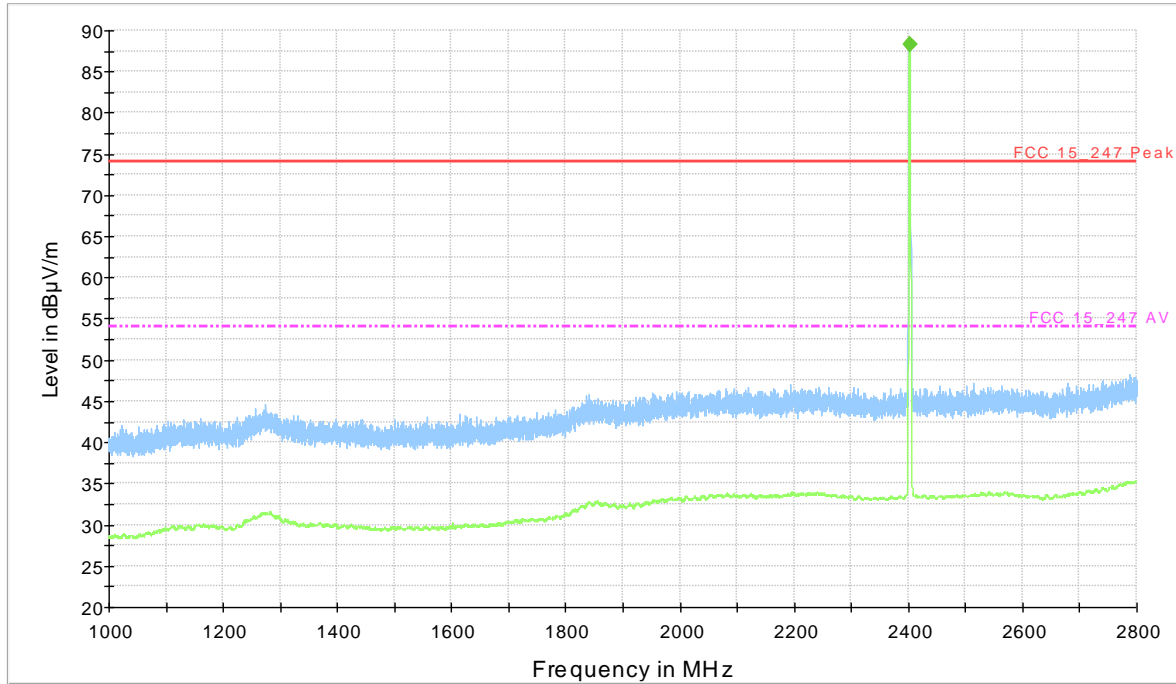


<b>CHANNEL</b>	0
<b>FREQUENCY RANGE</b>	30MHz – 1GHz
<b>POLARIZATION</b>	HORIZONTAL



<b>CHANNEL</b>	0
<b>FREQUENCY RANGE</b>	1-2.8GHz
<b>POLARIZATION</b>	HORIZONTAL

FCC\_15\_247\_RADIATED\_SPURIOUS\_HORIZONTAL



**Final Result Peak**

Frequency (MHz)	Peak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Limit (dBµV/m)
2402.020000	88.5	255.2	H	270.0	-10.50

**Final Result 2**

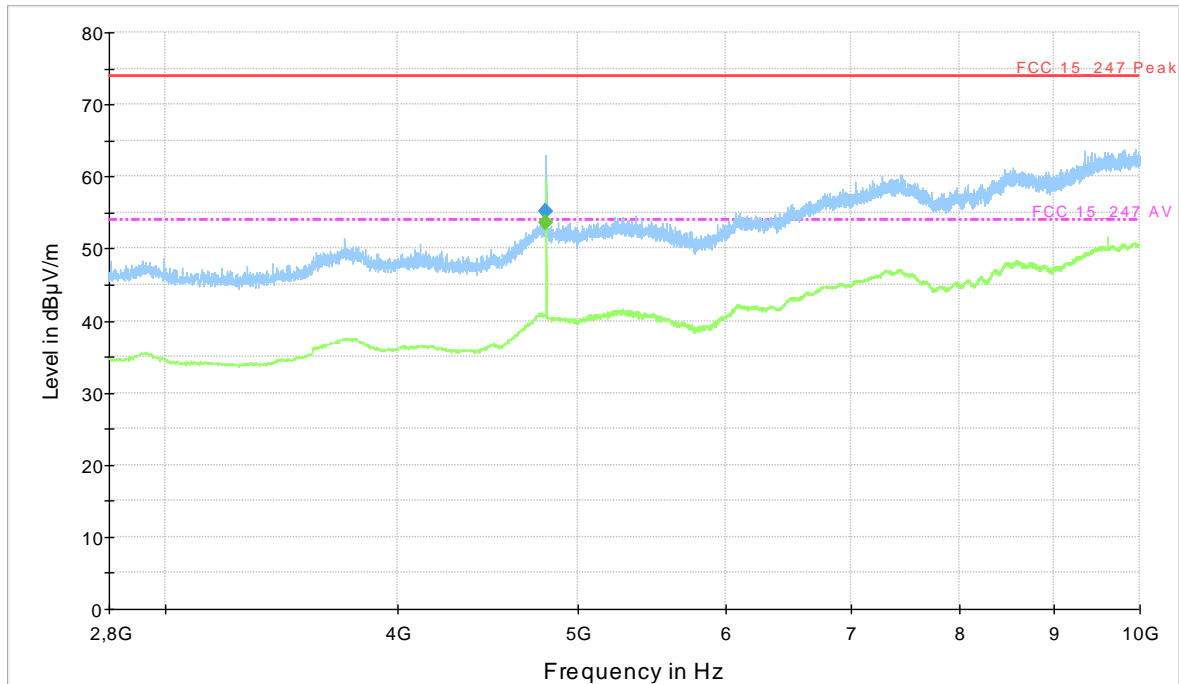
Frequency (MHz)	Average (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
2402.020000	88.2	255.2	H	270.0	-34.20	54.00

NOTE: Peak out of limits is related to the BT carrier and it is not evaluated



<b>CHANNEL</b>	0
<b>FREQUENCY RANGE</b>	2.8-10GHz
<b>POLARIZATION</b>	HORIZONTAL

FCC\_15\_247\_RADIATED\_SPURIOUS\_HORIZONTAL

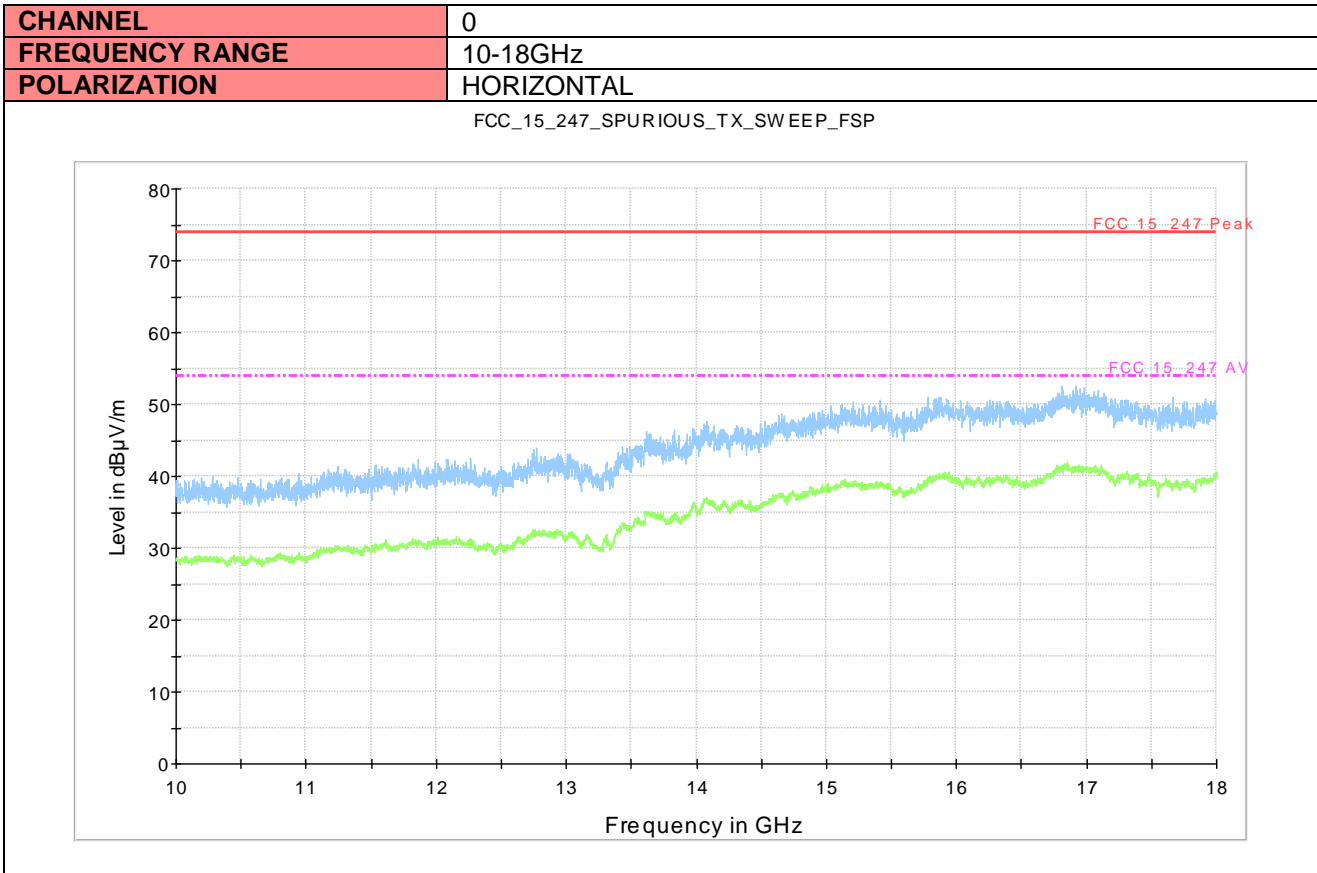


**Final Result Peak**

Frequency (MHz)	Peak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
4803.760000	55.2	104.7	H	180.0	18.80	74.00

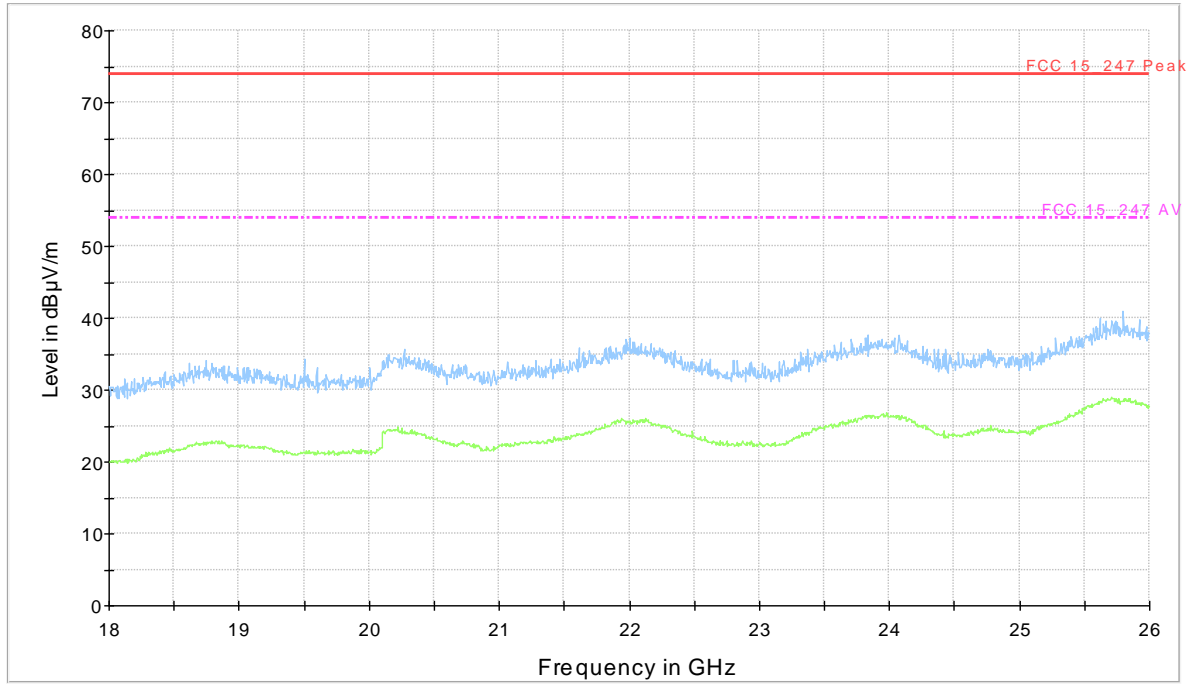
**Final Result Average**

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
4803.760000	53.6	104.7	H	180.0	0.4	54.00

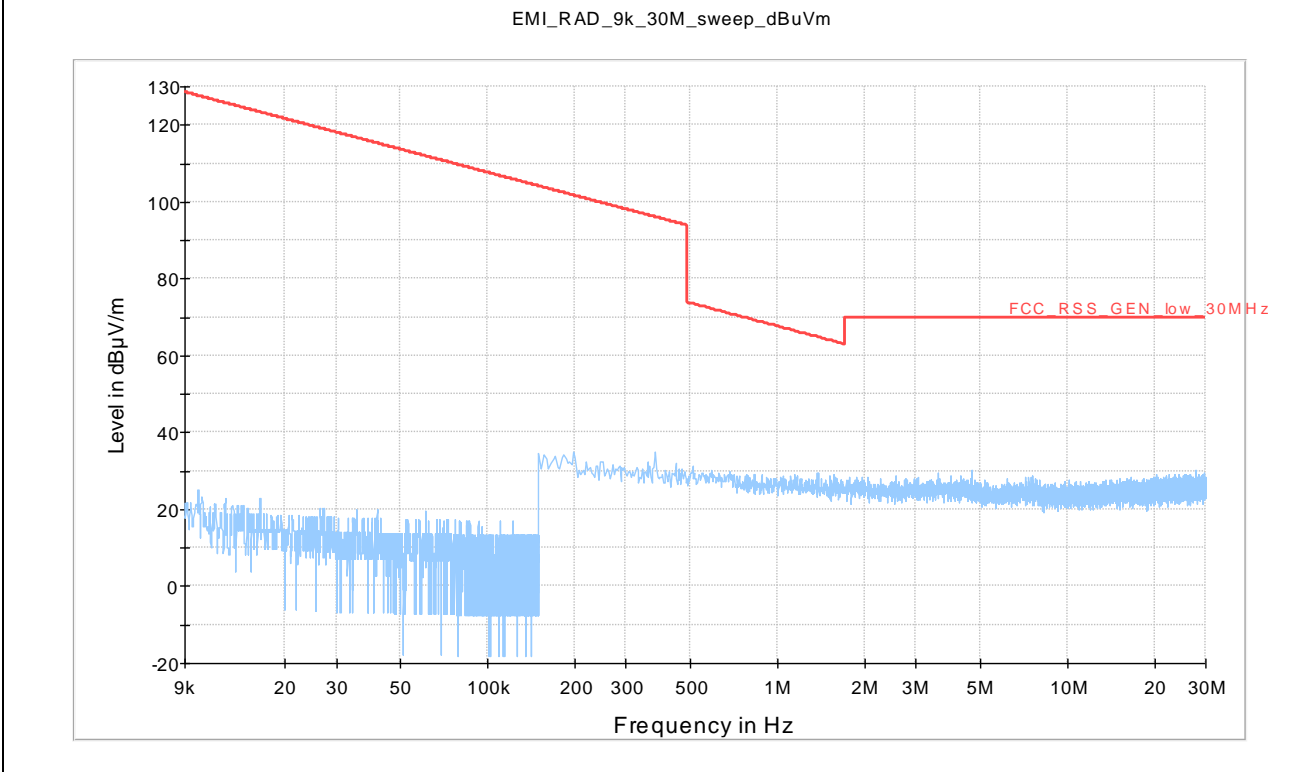


<b>CHANNEL</b>	0
<b>FREQUENCY RANGE</b>	18-26GHz
<b>POLARIZATION</b>	HORIZONTAL

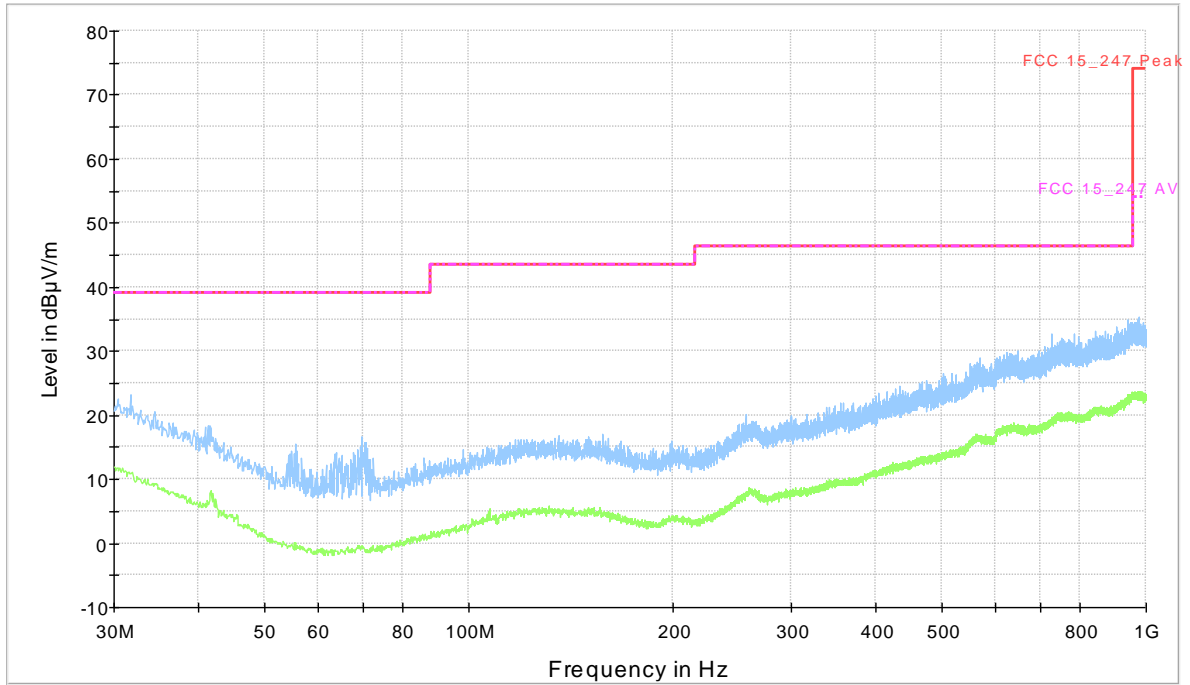
FCC\_15\_247\_SPURIOUS\_TX\_SWEEP\_FSP



<b>CHANNEL</b>	39
<b>FREQUENCY RANGE</b>	9kHz - 30MHz
<b>POLARIZATION</b>	VERTICAL

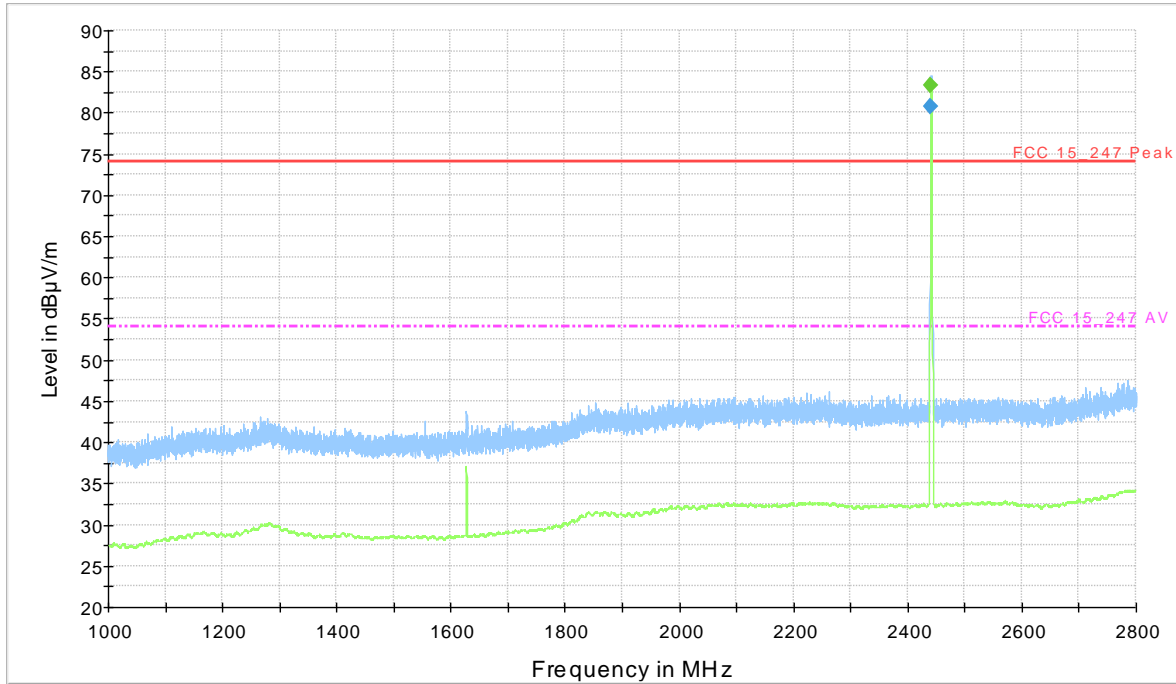


<b>CHANNEL</b>	39
<b>FREQUENCY RANGE</b>	30MHz – 1GHz
<b>POLARIZATION</b>	VERTICAL



<b>CHANNEL</b>	39
<b>FREQUENCY RANGE</b>	1-2.8GHz
<b>POLARIZATION</b>	VERTICAL

FCC\_15\_247\_RADIATED\_SPURIOUS\_VERTICAL



**Final Result Peak**

Frequency (MHz)	Peak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
2441.080000	80.8	104.9	V	90.0	-6.80	74.00

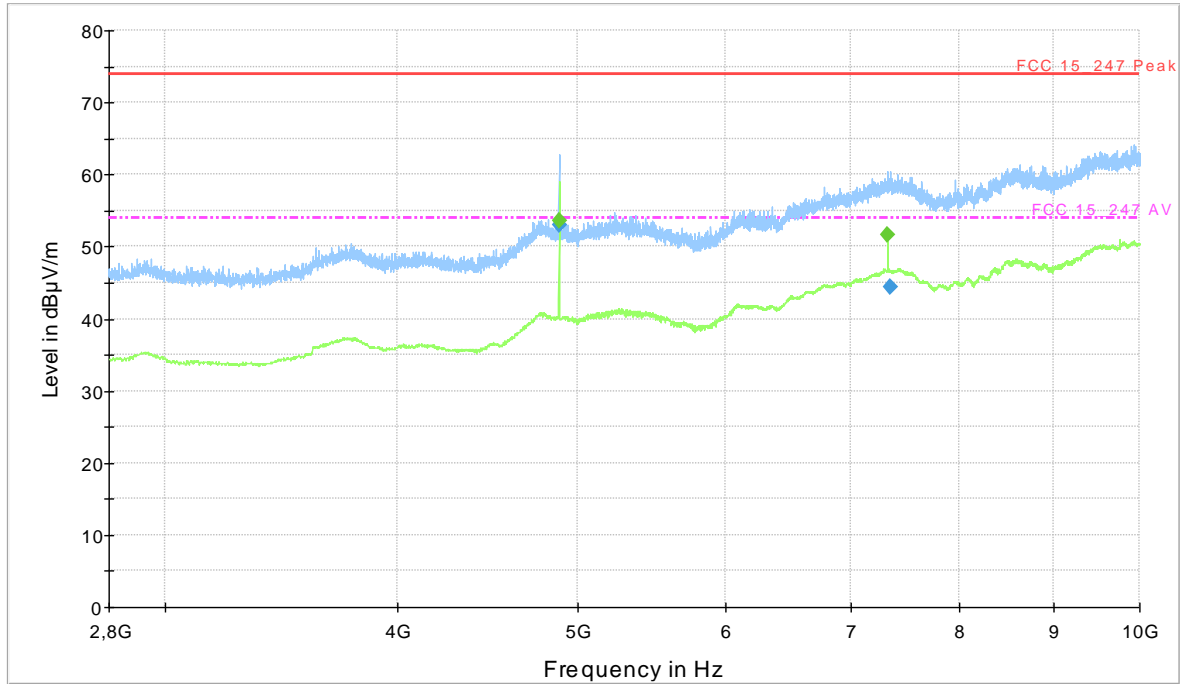
**Final Result Average**

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
2441.080000	83.3	104.9	V	90.0	-29.30	54.00

NOTE: Peak out of limits is related to the BT carrier and it is not evaluated

<b>CHANNEL</b>	39
<b>FREQUENCY RANGE</b>	2.8-10GHz
<b>POLARIZATION</b>	VERTICAL

FCC\_15\_247\_RADIATED\_SPURIOUS\_VERTICAL



**Final Result Peak**

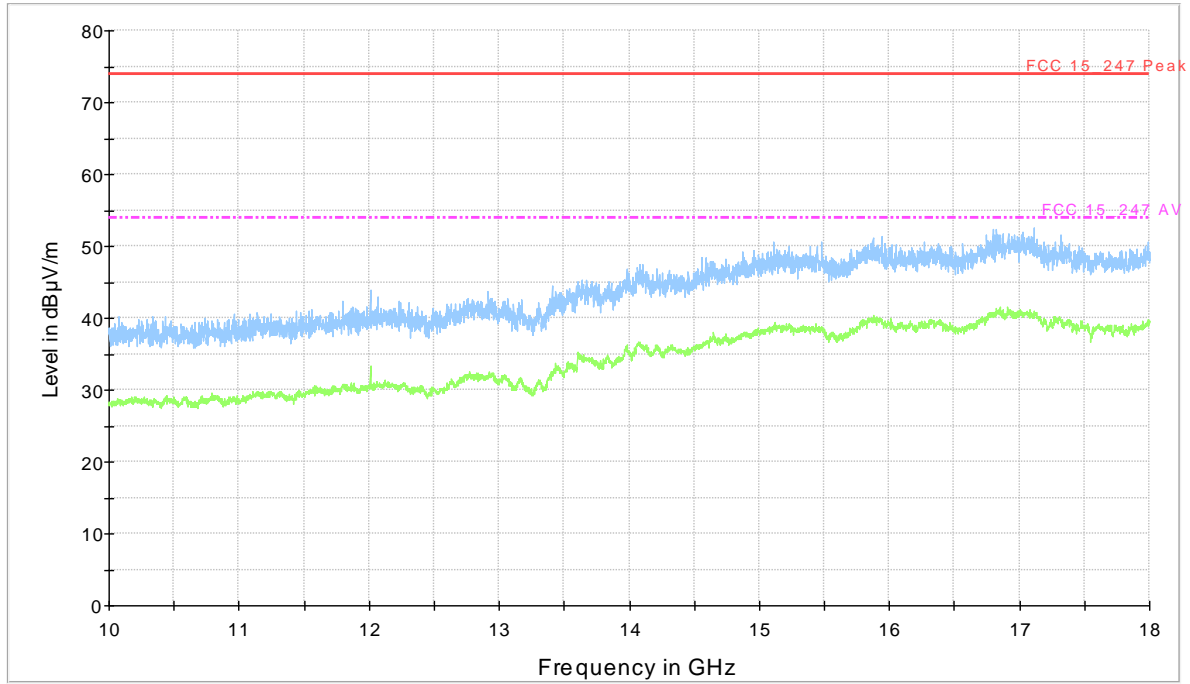
Frequency (MHz)	Peak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
4881.520000	53.1	104.8	V	180.0	20.90	74.00
7346.080000	44.4	255.3	V	0.0	29.60	74.00

**Final Result Average**

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
4881.520000	53.6	104.8	V	180.0	0.4	54.00
7323.040000	51.7	104.8	V	0.0	2.30	54.00

<b>CHANNEL</b>	39
<b>FREQUENCY RANGE</b>	10-18GHz
<b>POLARIZATION</b>	VERTICAL

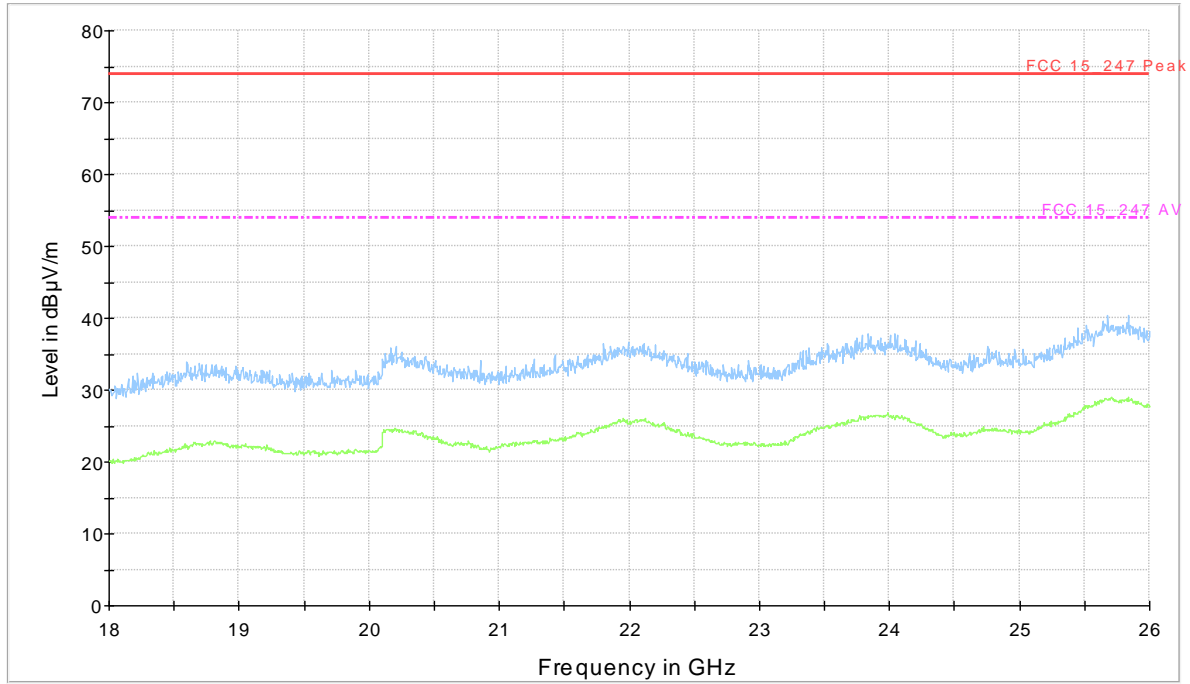
FCC\_15\_247\_SPURIOUS\_TX\_SWEEP\_FSP



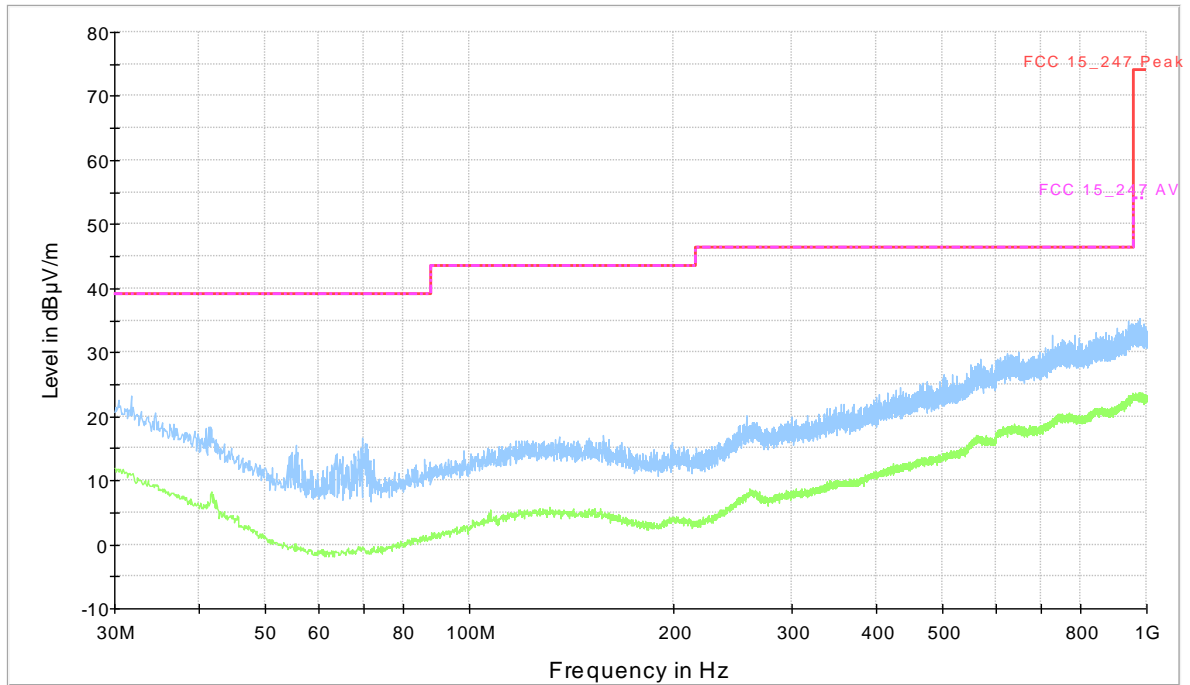


<b>CHANNEL</b>	39
<b>FREQUENCY RANGE</b>	18-26GHz
<b>POLARIZATION</b>	VERTICAL

FCC\_15\_247\_SPURIOUS\_TX\_SWEEP\_FSP

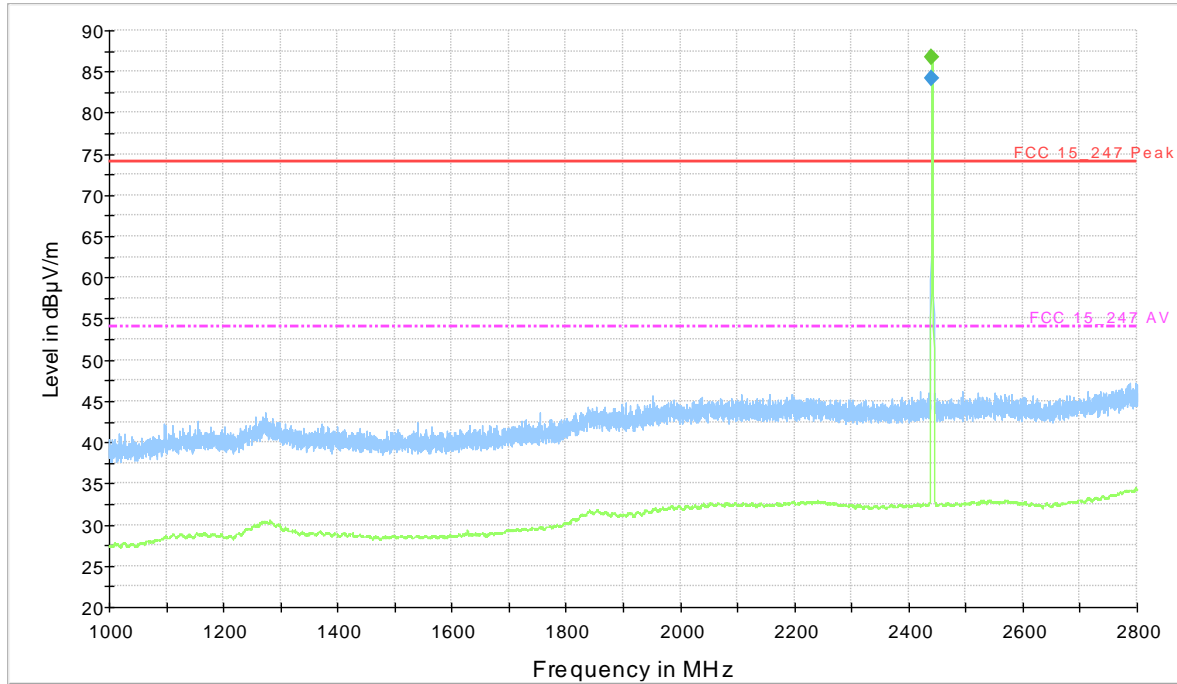


<b>CHANNEL</b>	39
<b>FREQUENCY RANGE</b>	30MHz – 1GHz
<b>POLARIZATION</b>	HORIZONTAL



<b>CHANNEL</b>	39
<b>FREQUENCY RANGE</b>	1-2.8GHz
<b>POLARIZATION</b>	HORIZONTAL

FCC\_15\_247\_RADIATED\_SPURIOUS\_HORIZONTAL



**Final Result Peak**

Frequency (MHz)	Peak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
2441.080000	84.2	255.1	H	90.0	-10.20	74.00

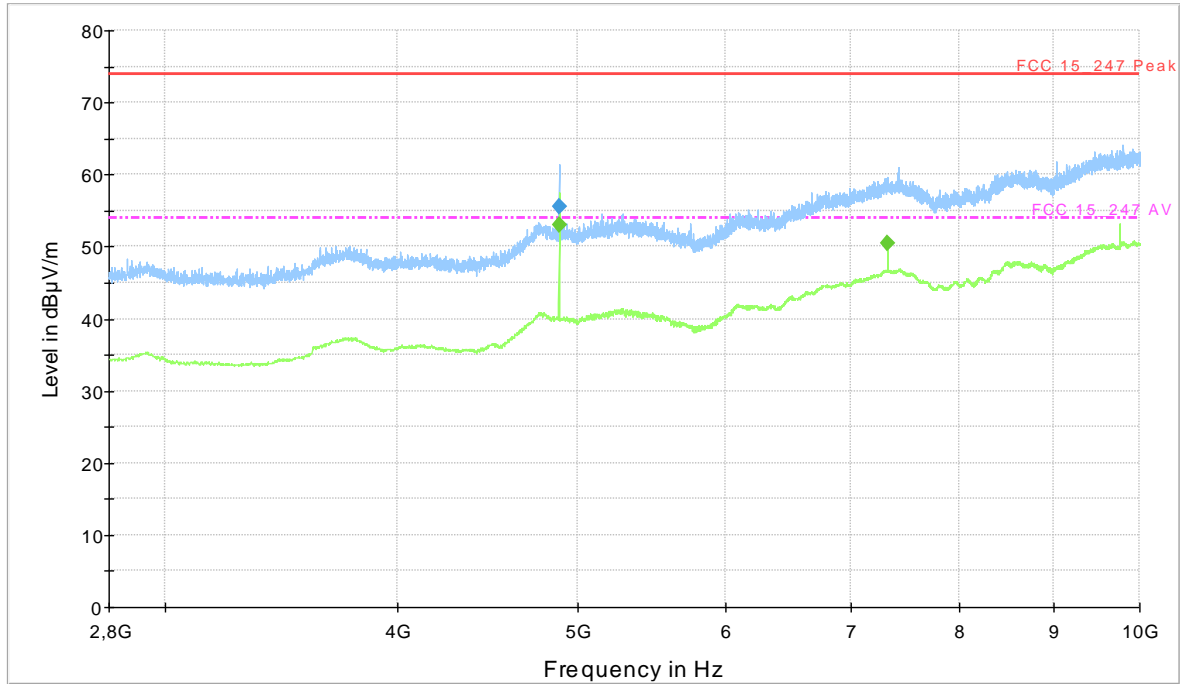
**Final Result Average**

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
2441.080000	86.8	255.1	H	90.0	-32.80	54.00

NOTE: Peak out of limits is related to the BT carrier and it is not evaluated

<b>CHANNEL</b>	39
<b>FREQUENCY RANGE</b>	2.8-10GHz
<b>POLARIZATION</b>	HORIZONTAL

FCC\_15\_247\_RADIATED\_SPURIOUS\_HORIZONTAL

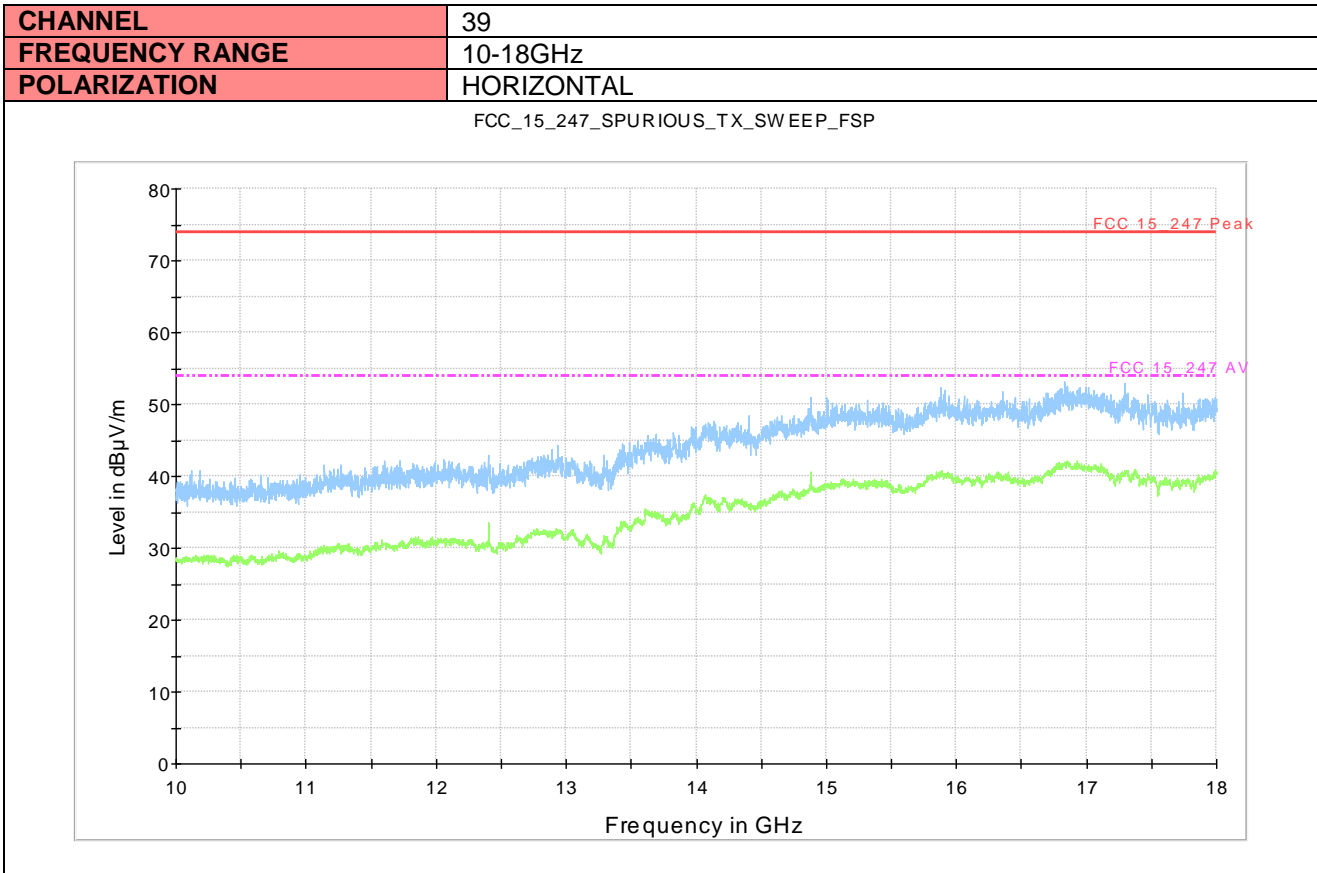


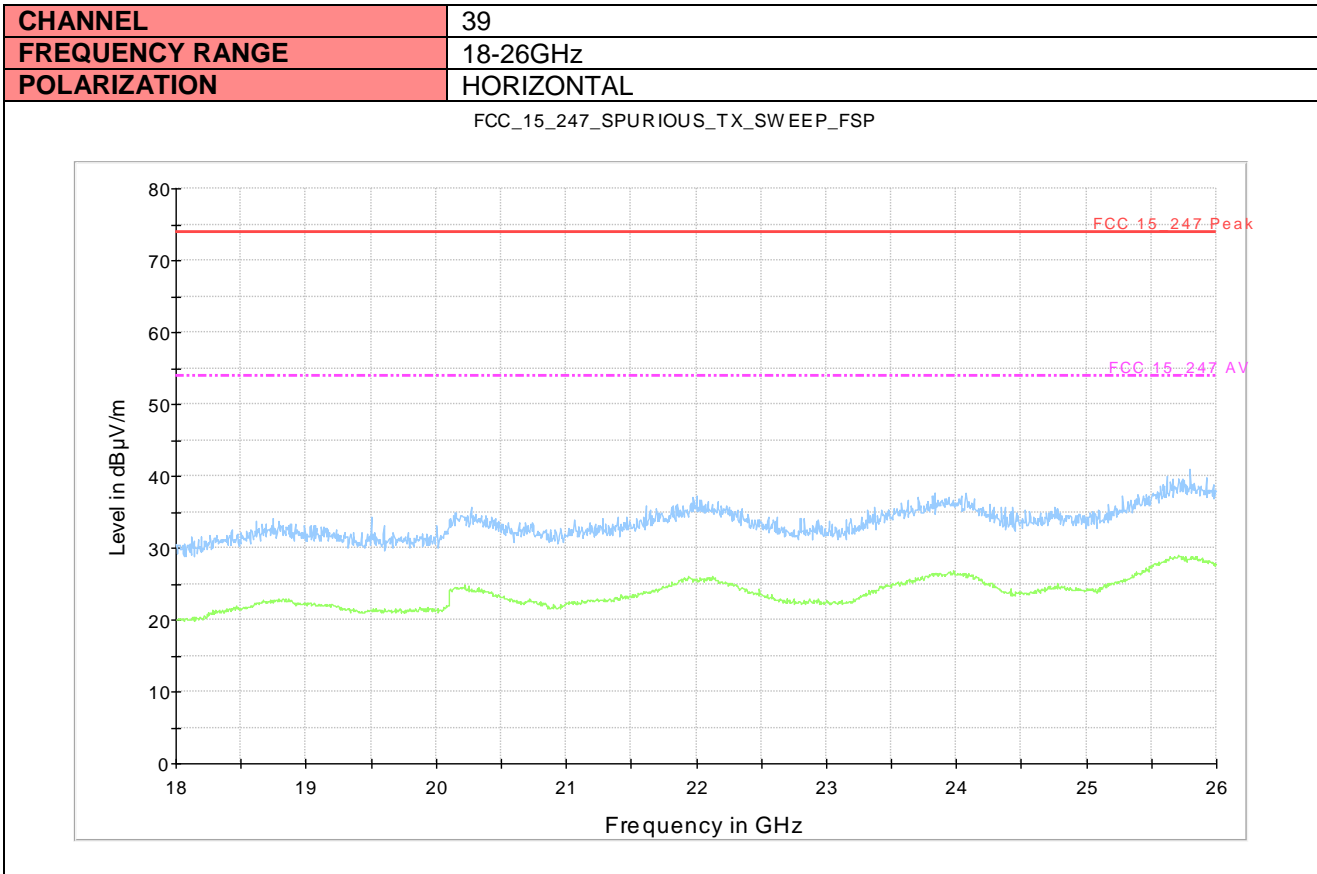
**Final Result Peak**

Frequency (MHz)	Peak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
4882.240000	55.5	104.8	H	180.0	18.50	74.00

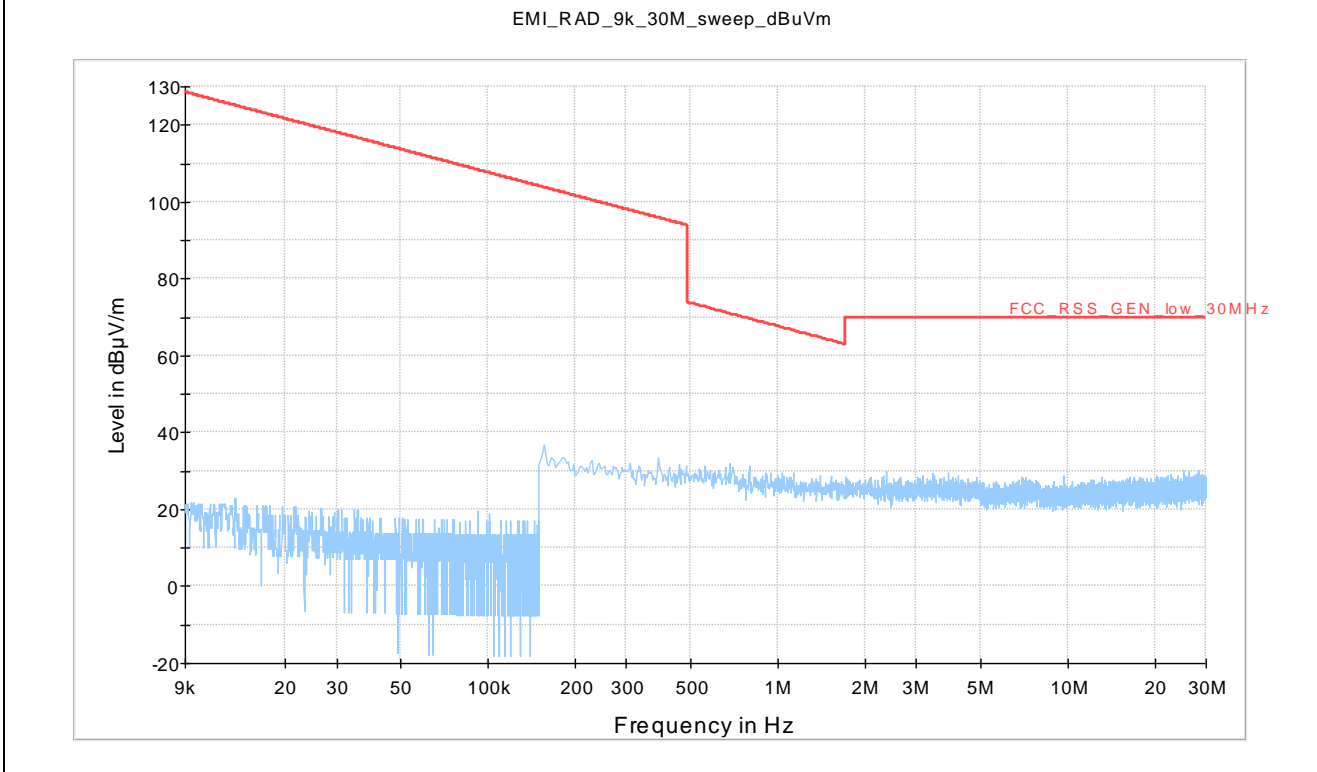
**Final Result Average**

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
4881.520000	53.1	104.8	H	180.0	0.9	54.00
7323.040000	50.5	104.8	H	90.0	3.50	54.00

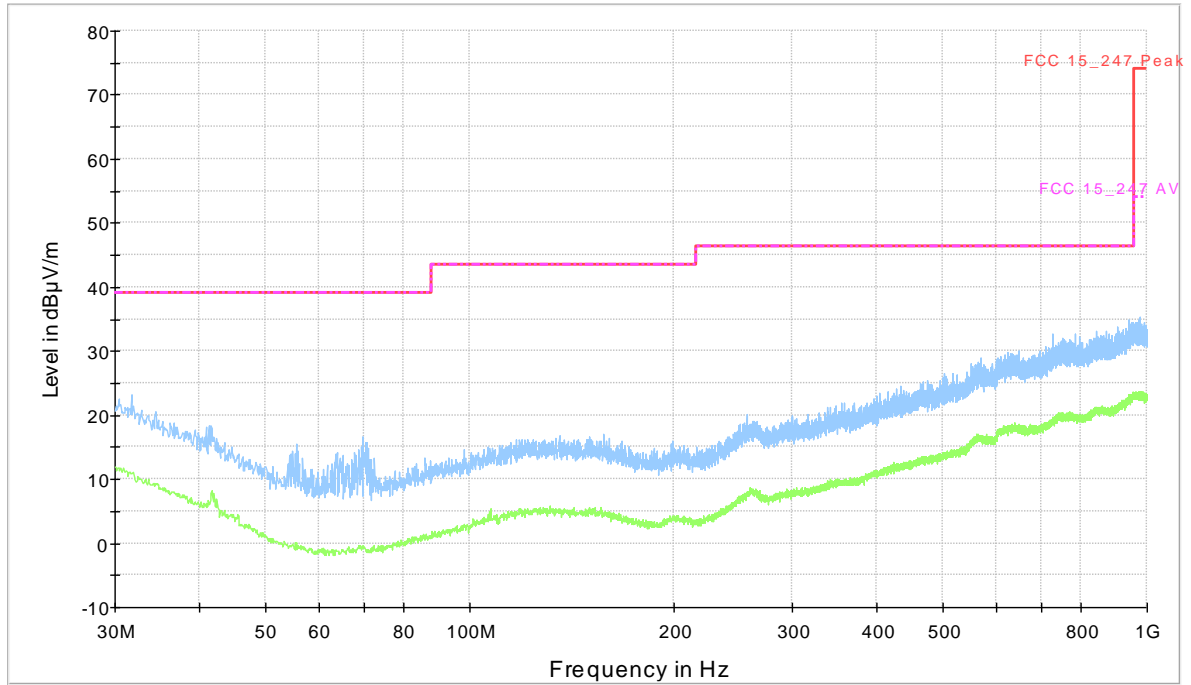




<b>CHANNEL</b>	78
<b>FREQUENCY RANGE</b>	9kHz - 30MHz
<b>POLARIZATION</b>	VERTICAL



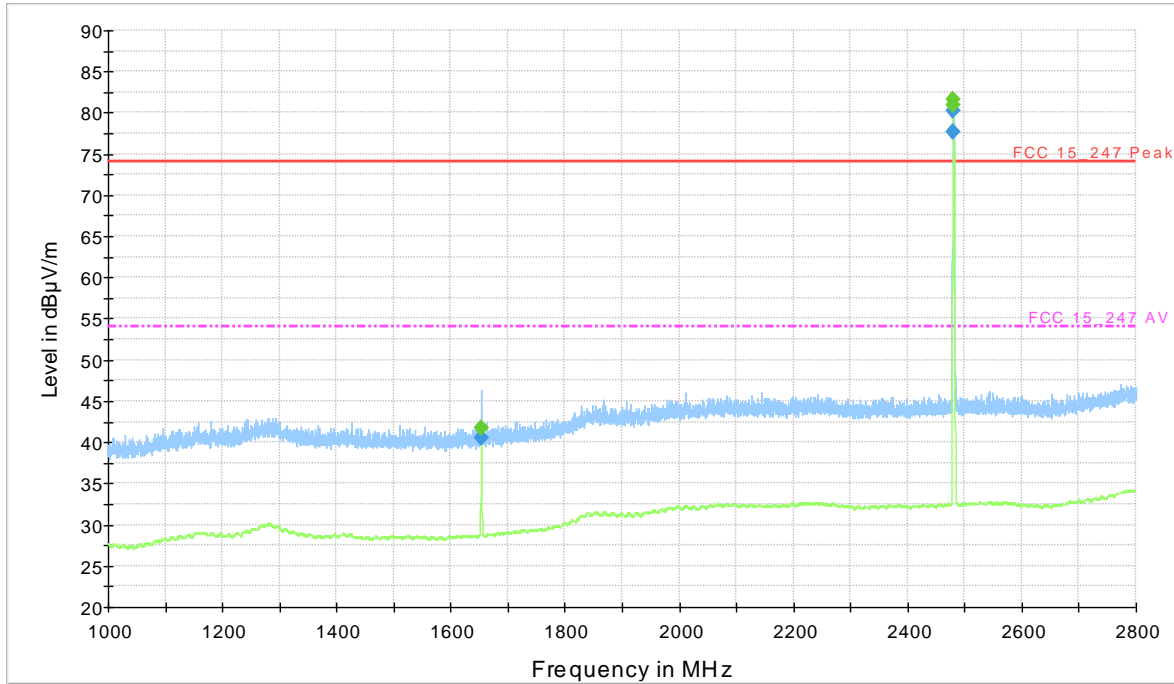
<b>CHANNEL</b>	78
<b>FREQUENCY RANGE</b>	30MHz – 1GHz
<b>POLARIZATION</b>	VERTICAL





<b>CHANNEL</b>	78
<b>FREQUENCY RANGE</b>	1-2.8GHz
<b>POLARIZATION</b>	VERTICAL

FCC\_15\_247\_RADIATED\_SPURIOUS\_VERTICAL



**Final Result Peak**

Frequency (MHz)	Peak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
1653.220000	40.5	104.8	V	270.0	33.50	74.00
2479.960000	80.3	255.2	V	180.0	-6.30	74.00
2480.140000	77.8	255.2	V	180.0	-3.80	74.00

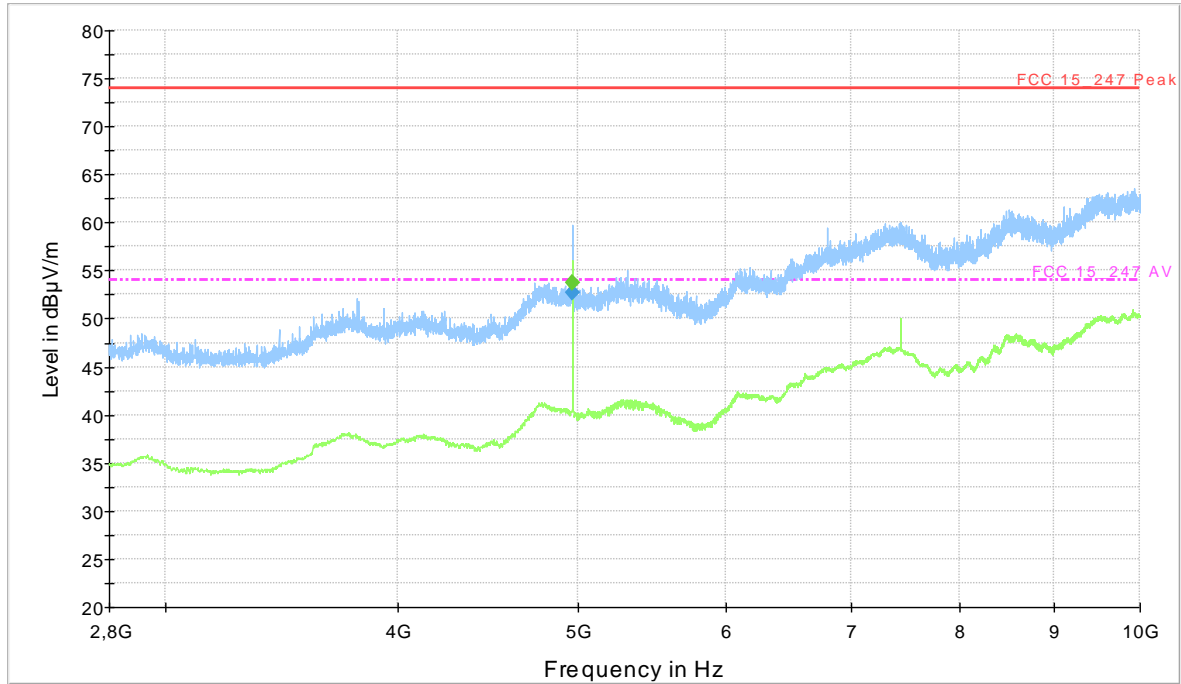
**Final Result Average**

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
1653.220000	41.8	104.8	V	270.0	12.20	54.00
2479.960000	81.6	255.2	V	180.0	-27.60	54.00
2480.140000	81.0	255.2	V	180.0	-27.00	54.00

NOTE: Peak out of limits is related to the BT carrier and it is not evaluated

<b>CHANNEL</b>	78
<b>FREQUENCY RANGE</b>	2.8-10GHz
<b>POLARIZATION</b>	VERTICAL

FCC\_15\_247\_RADIATED\_SPURIOUS\_VERTICAL



**Final Result Peak**

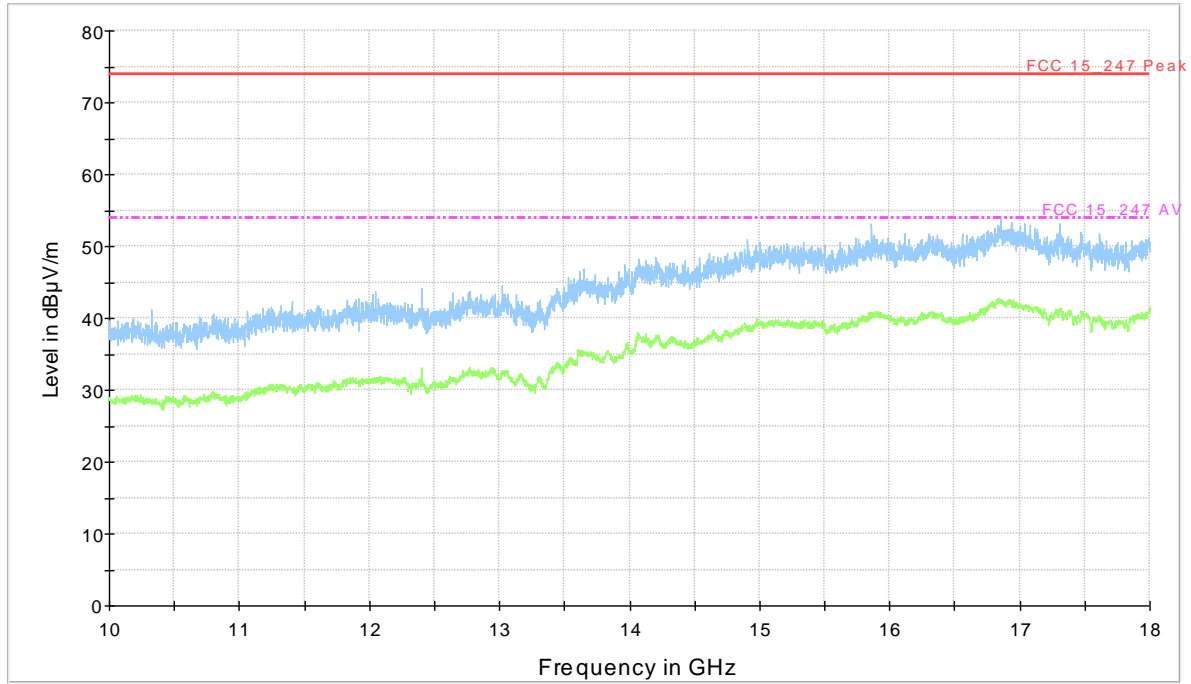
Frequency (MHz)	Peak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
4960.000000	52.7	104.8	V	270.0	21.30	74.00

**Final Result Average**

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
4960.000000	53.7	104.8	V	270.0	0.3	54.00

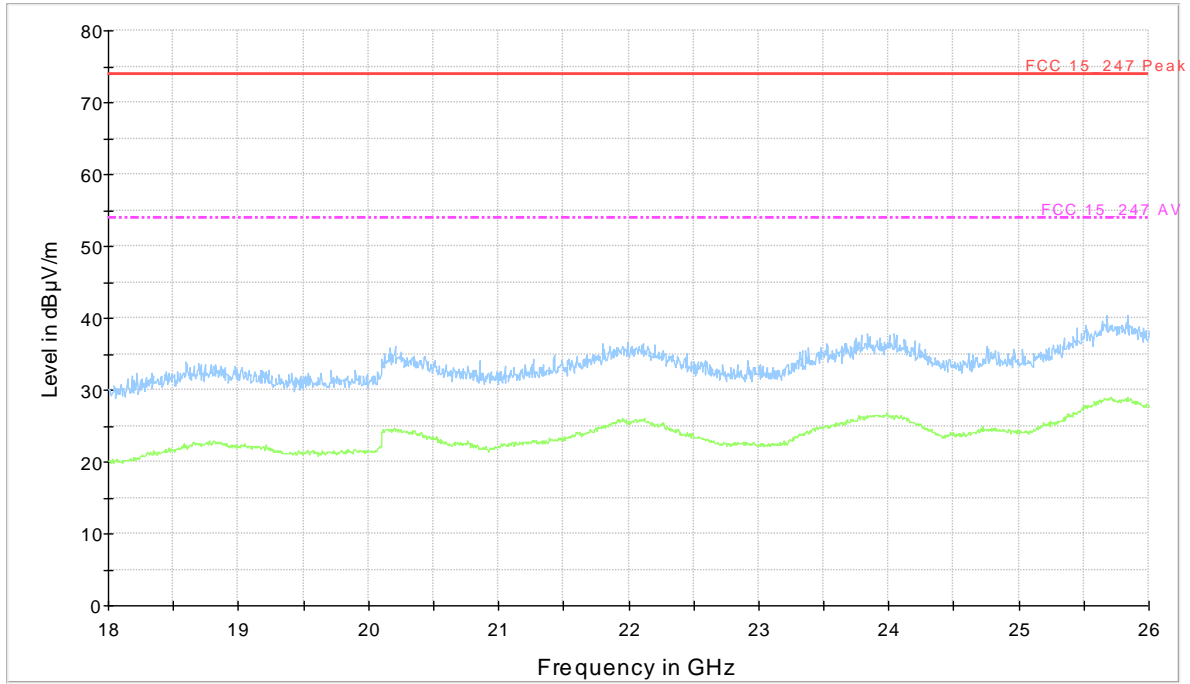
<b>CHANNEL</b>	78
<b>FREQUENCY RANGE</b>	10-18GHz
<b>POLARIZATION</b>	VERTICAL

FCC\_15\_247\_SPURIOUS\_TX\_SWEEP\_FSP

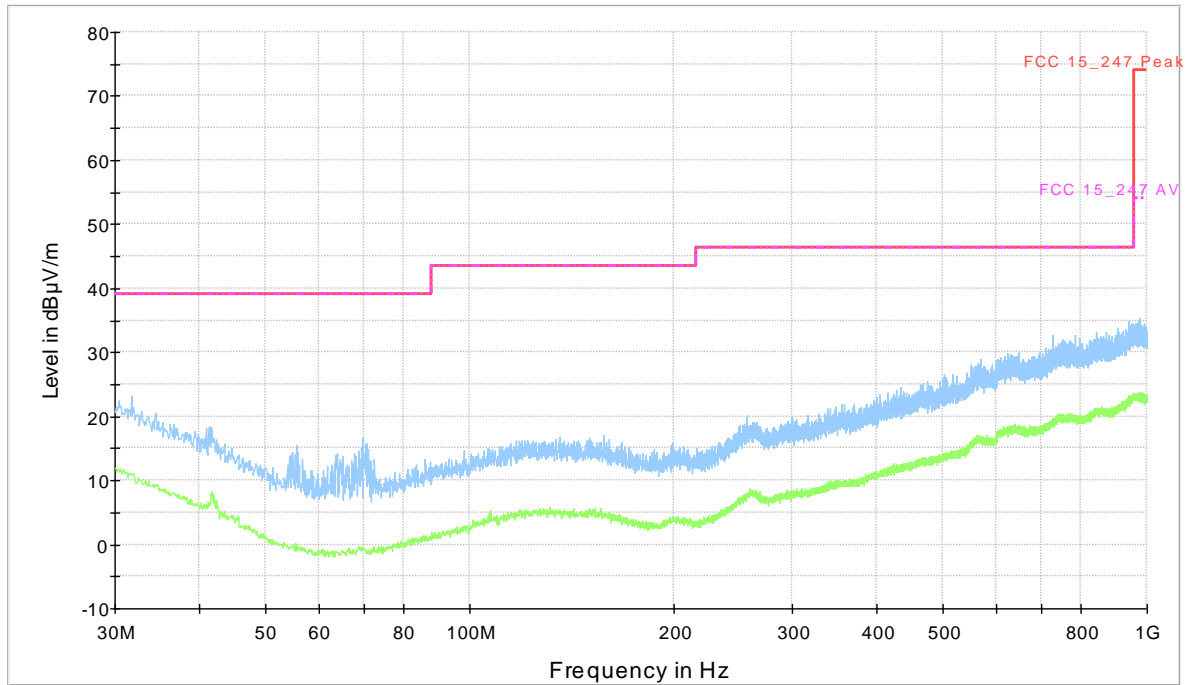


<b>CHANNEL</b>	78
<b>FREQUENCY RANGE</b>	18-26GHz
<b>POLARIZATION</b>	VERTICAL

FCC\_15\_247\_SPURIOUS\_TX\_SWEEP\_FSP

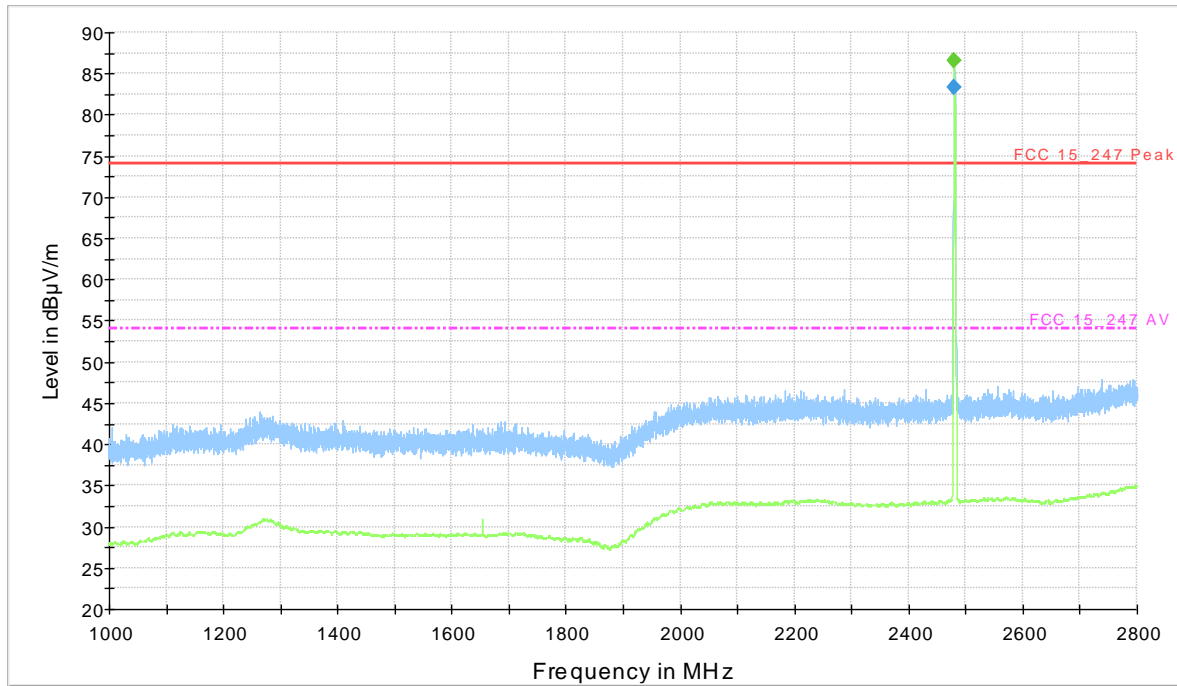


<b>CHANNEL</b>	78
<b>FREQUENCY RANGE</b>	30MHz – 1GHz
<b>POLARIZATION</b>	HORIZONTAL



<b>CHANNEL</b>	78
<b>FREQUENCY RANGE</b>	1-2.8GHz
<b>POLARIZATION</b>	HORIZONTAL

FCC\_15\_247\_RADIATED\_SPURIOUS\_HORIZONTAL



**Final Result Peak**

Frequency (MHz)	Peak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
2480.140000	83.4	255.2	H	90.0	-9.40	74.00

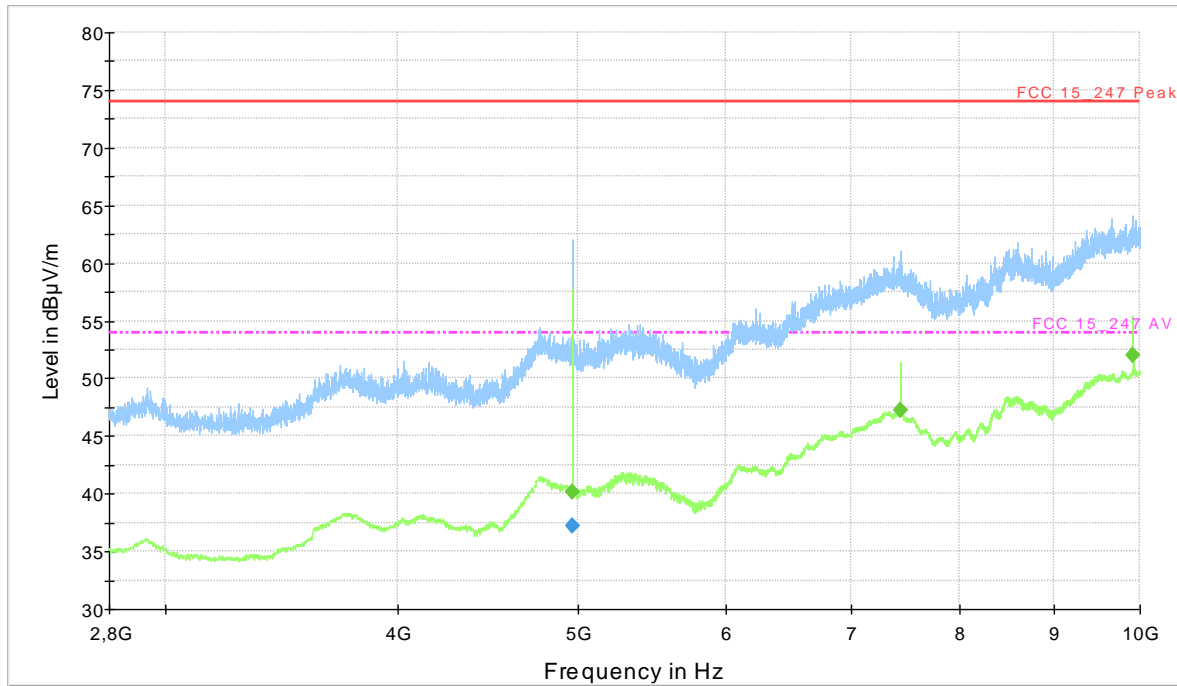
**Final Result Average**

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
2480.140000	86.6	255.2	H	90.0	-32.60	54.00

NOTE: Peak out of limits is related to the BT carrier and it is not evaluated

<b>CHANNEL</b>	78
<b>FREQUENCY RANGE</b>	2.8-10GHz
<b>POLARIZATION</b>	HORIZONTAL

FCC\_15\_247\_RADIATED\_SPURIOUS\_HORIZONTAL

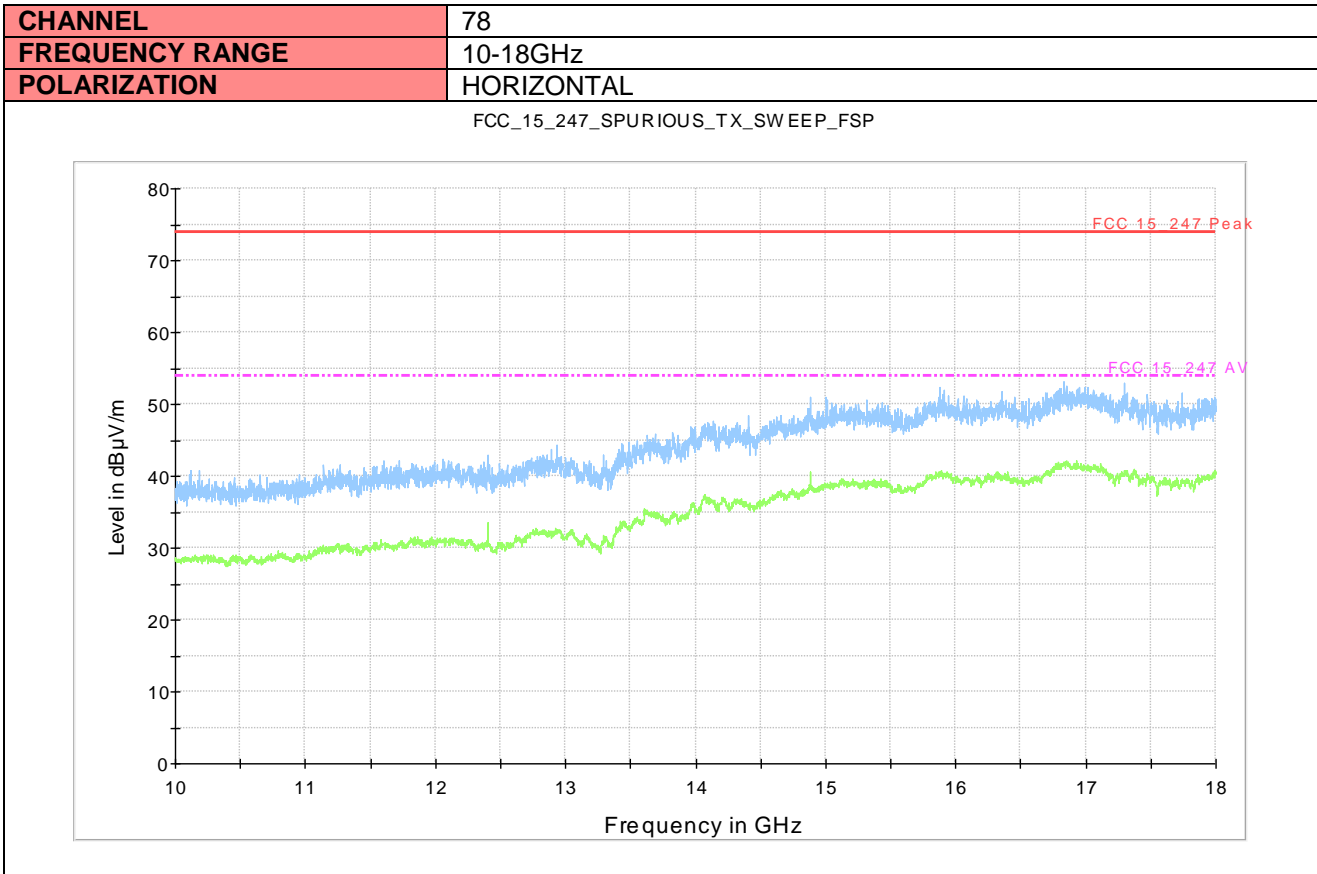


**Final Result Peak**

Frequency (MHz)	Peak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
4959.280000	37.2	104.9	H	180.0	36.80	74.00

**Final Result Average**

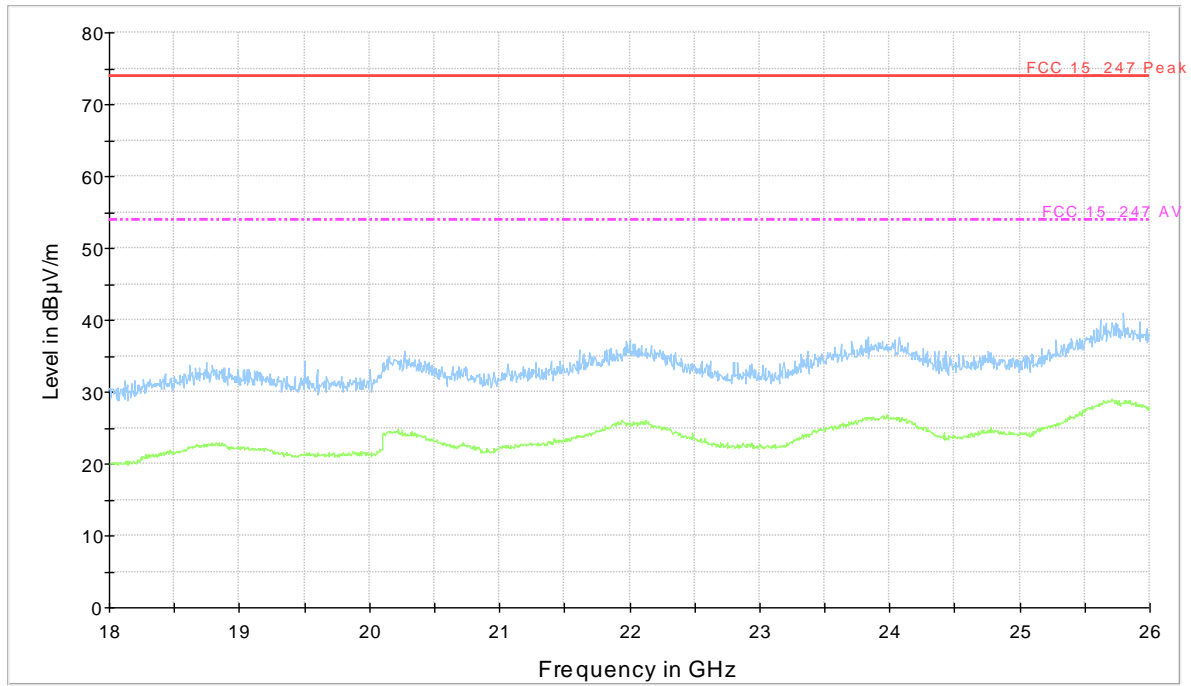
Frequency (MHz)	Average (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
4960.000000	40.2	104.9	H	180.0	13.80	54.00
7439.680000	47.3	104.9	H	90.0	6.70	54.00
9920.080000	52.0	104.9	H	90.0	2.00	54.00





<b>CHANNEL</b>	78
<b>FREQUENCY RANGE</b>	18-26GHz
<b>POLARIZATION</b>	HORIZONTAL

FCC\_15\_247\_SPURIOUS\_TX\_SWEEP\_FSP



**TEST  
9.**
**RADIATED EMISSIONS**

REFERENCE DOCUMENT FCC Cfr 47 part 15 - Subpart B - §15.109

<b>TEST SETUP</b>	In according to ref std
<b>TEST LOCATION</b>	Semi Anechoic Chamber
<b>TYPE OF MEASUREMENT</b>	RADIATED
<b>TEST EQUIPMENT</b>	EMI receiver Rohde & Schwarz Mod, ESU 40 Chase Antenna Mod, CBL 6111 C Antenna Rohde & Schwarz mod, HBL050 Tunable notch filter Wainwright mod, WRCT2200/2500-5/40-10SK High pass filter Wainwright WHNX 2,8/18G-10SS
<b>TEST PERFORMED BY</b>	Daniele Aosani
<b>TESTING DATE</b>	September 2017
<b>UNCERTAINTY OF MEASURE:</b>	Combined uncertainty = $\pm 1,75$ dB Total uncertainty = (k=2) $\pm 3,5$ dB

TEST CONDITIONS:	MEASURED
Ambient temperature : 23°C $\pm$ 5°C	24°C
Ambient humidity : 25 - 75 %rH	45%
Pressure : 85 - 106 kPa (860 mbar - 1060 mbar)	960mbar

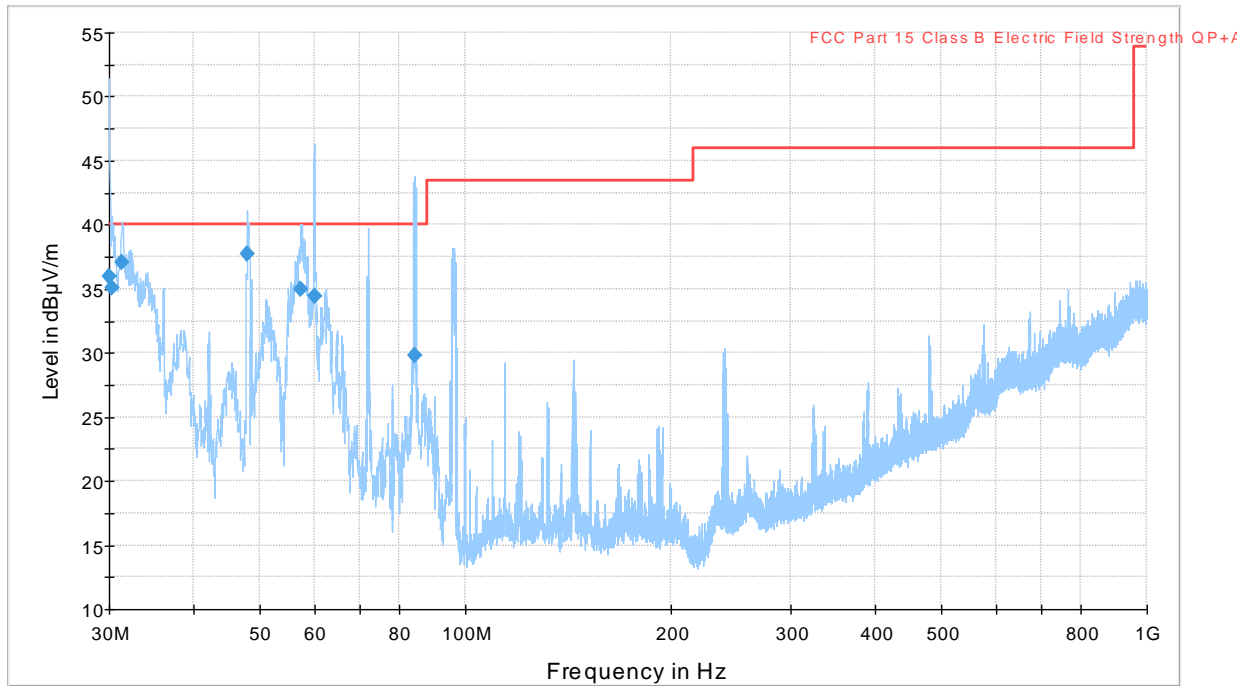
<b>OPERATING CONDITION</b>	#4
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<b>TEST RESULT</b>	<b>WITHIN THE LIMITS</b>
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**VERTICAL POLARIZATION**

**Frequency Range: 30 MHz – 1 GHz**

FCC\_15\_109\_RADIATED\_EMISSIONS\_VERTICAL

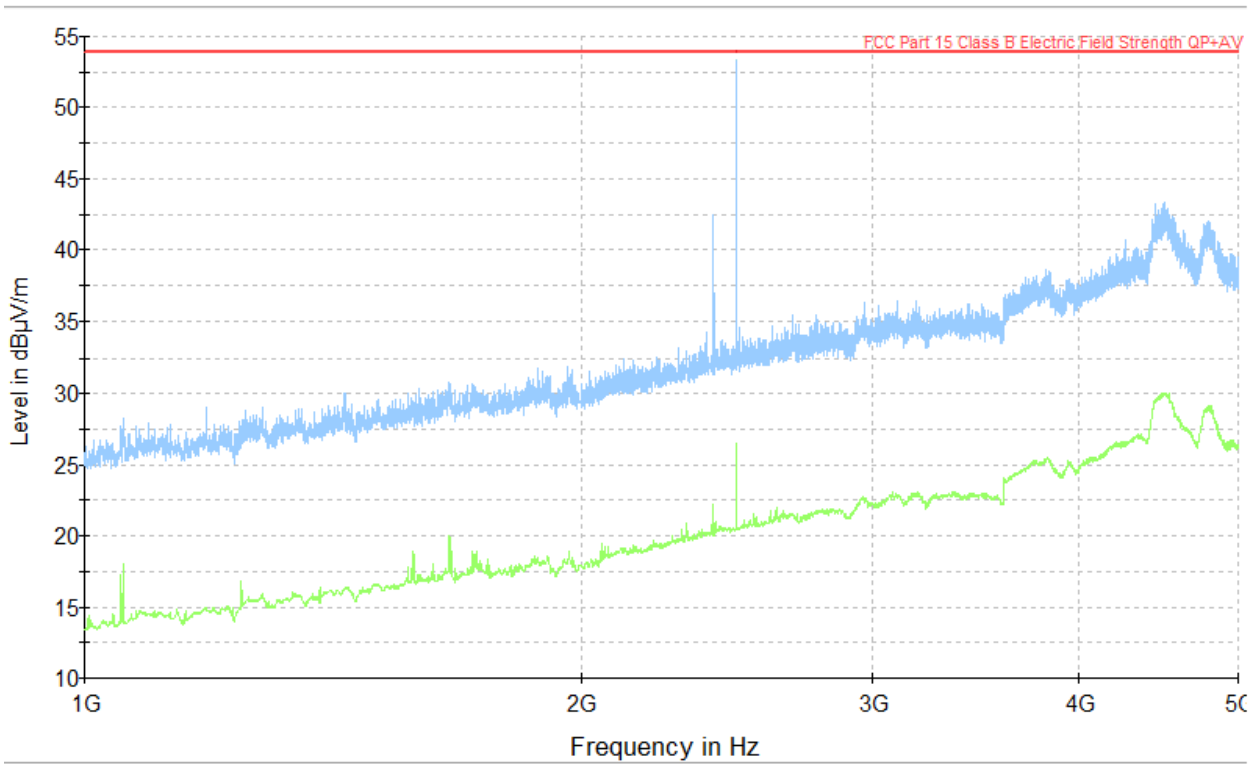


**Final Result QuasiPeak**

Frequency (MHz)	QuasiPeak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
30.000000	36.0	99.7	V	90.0	4.0	40.0
30.280000	35.1	99.9	V	0.0	4.9	40.0
31.360000	37.1	99.8	V	90.0	2.9	40.0
47.840000	37.7	99.7	V	90.0	2.3	40.0
57.240000	35.0	99.8	V	0.0	5.0	40.0
59.960000	34.4	99.8	V	270.0	5.6	40.0
84.120000	29.9	99.8	V	0.0	10.1	40.0

**Frequency Range: 1- 5 GHz**

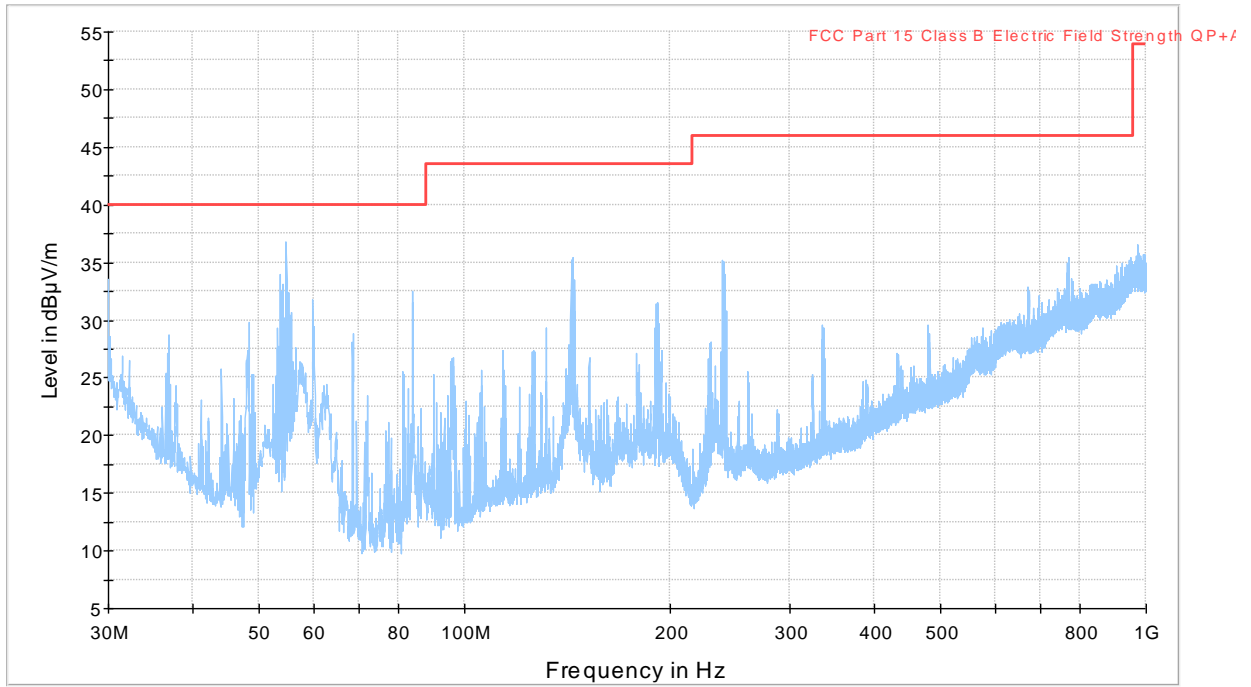
FCC\_15\_109\_RADIATED\_EMISSIONS\_VERTICAL



**HORIZONTAL POLARIZATION**

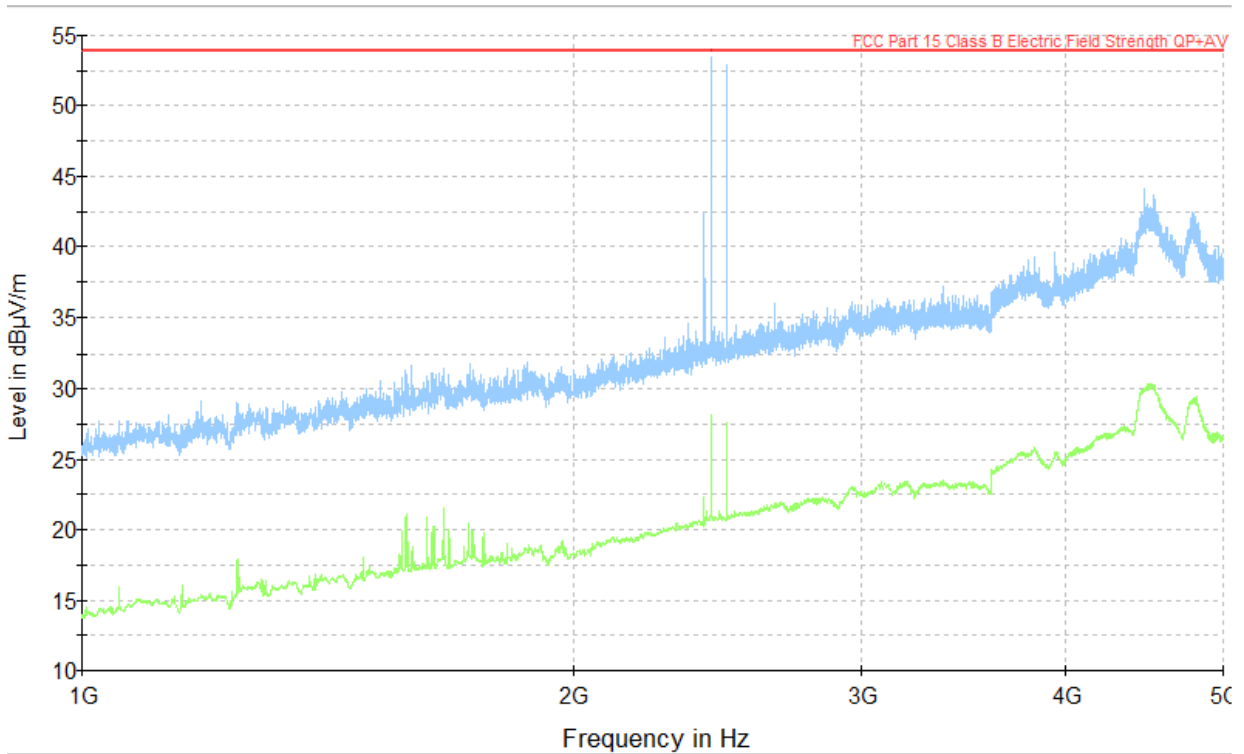
**Frequency Range: 30 MHz – 1 GHz**

FCC\_15\_109\_RADIATED\_EMISSIONS\_HORIZONTAL



**Frequency Range: 1- 5 GHz**

FCC\_15\_109\_RADIATED\_EMISSIONS\_HORIZONTAL



## 7. LIST OF EQUIPMENT USED

EQUIPMENT	MANUFACTURER	MODEL	SERIAL Nr.
EMI TEST RECEIVER	Rohde & Schwarz	ESU40	100111
RF SEMI-ANECHOIC CHAMBER (CSSA)	Siemens	B83117-D6019-T232	003-005-134/94C
BILOG ANTENNA	Chase	CBL6111C	2717
HORN ANTENNA 1-18GHz	Electrometrics	EN-6961	100437
HORN ANTENNA 18-26GHz	SCHWARZBECK MESS- ELEKTRONIK	BBHA 9170	9170-688
SPECTRUM ANALYZER	Rohde & Schwarz	FSP40	100038
SYSTEM DC POWER SUPPLY	HP	6623A	3448A04501
TUNABLE NOTCH FILTER	Wainwright	WRCT2200/2500-5/40-10SK	5
HIGH PASS FILTER	Wainwright	WHNX 2,8/18G-10SS	1