


## Test Report

<b>Product</b>	Maritime Aeromobile Emergency Radio		
<b>Name and address of the applicant</b>	Jotron AS Østbyveien 1 3280 Tjodalyng, Norway		
<b>Name and address of the manufacturer</b>	Jotron AS Østbyveien 1 3280 Tjodalyng, Norway		
<b>Model</b>	TR30 AIR		
<b>Rating</b>	6.0 V <sub>DC</sub> (2900 mAh, Primary Battery, Lithium Iron Disulphide)		
<b>Trademark</b>	TRON		
<b>Serial number</b>	314		
<b>Additional information</b>	-		
<b>Tested according to</b>	<b>FCC Part 80</b> Stations in the Maritime Services <b>Industry Canada RSS-141, Issue 12</b> Aeronautical Radiocommunication Equipment in the Frequency Band 117.975-137 MHz		
<b>Order number</b>	356984		
<b>Tested in period</b>	2019-03-19 to 2019-04-29		
<b>Issue date</b>	2019-06-04		
<b>Name and address of the testing laboratory</b>	 Instituttveien 6 Kjeller, Norway www.nemko.com	CAB Number: FCC: NO0001 ISED: NO0470  TEL: +47 22 96 03 30 FAX: +47 22 96 05 50	 
An accredited technical test executed under the Norwegian accreditation scheme			
 Prepared by [Frode Sveinsen]		 Approved by [Jan G Eriksen]	
This report shall not be reproduced except in full without the written approval of Nemko. Opinions and interpretations expressed within this report are not part of the current accreditation. This report was originally distributed electronically with digital signatures. For more information contact Nemko.			

Template version: B

**Nemko Norway**

 Nemko AS, Instituttveien 6, P.O. Box 96 Kjeller, 2027 Kjeller, Norway  
 TEL +47 22 96 03 30 FAX +47 22 96 05 50 EMAIL info@nemko.com  
 ENTERPRISE NUMBER NO974404532

## CONTENTS

<b>1</b>	<b>INFORMATION .....</b>	<b>3</b>
1.1	Test Item .....	3
1.2	Normal test condition .....	4
1.3	Test Engineer(s) .....	4
1.4	Test Equipment .....	4
1.5	Comments .....	4
<b>2</b>	<b>TEST REPORT SUMMARY .....</b>	<b>5</b>
2.1	General .....	5
2.2	Test Summary .....	6
<b>3</b>	<b>TEST RESULTS.....</b>	<b>7</b>
3.1	RF Output Power, Conducted.....	7
3.2	Modulation Characteristics .....	8
3.3	Occupied Bandwidth.....	11
3.4	Spurious Emissions at Antenna Terminals .....	13
3.5	Field Strength of Spurious Radiations .....	20
3.6	Frequency Stability .....	32
<b>4</b>	<b>LIST OF TEST EQUIPMENT .....</b>	<b>33</b>
<b>5</b>	<b>BLOCK DIAGRAM .....</b>	<b>34</b>
5.1	Conducted Tests .....	34
5.2	Test Site Radiated Emission.....	34

## 1 INFORMATION

### 1.1 Test Item

<b>Name</b>	TRON
<b>FCC ID</b>	VRVTRONTR30AIR
<b>Model/version</b>	TR30 AIR
<b>Serial number</b>	314
<b>Hardware identity and/or version</b>	R1844
<b>Software identity and/or version</b>	3.2.0 AIR
<b>Frequency Range</b>	121.5 MHz / 123.1 MHz
<b>Number of Channels</b>	2
<b>Type of Modulation</b>	A3E (Amplitude Modulation)
<b>User Frequency Adjustment</b>	Selectable 121.5 MHz or 123.1 MHz
<b>Type of Power Supply</b>	Primary Battery (Lithium Iron Disulphide Battery, 6V <sub>DC</sub> , 2900 mAh)
<b>Antenna Connector</b>	SMA
<b>Antenna</b>	Antenna TR30 AIR
<b>Desktop Charger</b>	N/A

### Theory of Operation

The EUT is a Maritime Aeromobile Emergency Radio with 121.5 MHz and 123.1 MHz.

## 1.2 Normal test condition

Temperature:	20 - 25 °C
Relative humidity:	30 - 50 %
Normal test voltage:	6.0 V <sub>DC</sub> (Nominal Voltage)

The values are the limit registered during the test period. All tests except the Frequency Stability Test, were performed with a fully charged battery. The Frequency stability test was performed with a regulated DC Power Supply.

## 1.3 Test Engineer(s)

Frode Sveinsen

## 1.4 Test Equipment

See list of test equipment in clause 5.

## 1.5 Comments

The EUT is pre-programmed with 121.5 MHz and 123.1 MHz, it's not possible to select any other frequencies.  
All ports were populated during spurious emission measurements.

## 2 TEST REPORT SUMMARY

### 2.1 General

All measurements are traceable to national standards.

The tests were conducted for demonstrating compliance with FCC CFR 47 Part 80 and ISED Canada RSS-141 Issue 2 and RSS-GEN Issue 5.

Radiated tests were conducted in accordance with ANSI C63.4-2014.

Radiated tests were made in a semi-anechoic chamber at measuring distance of 3m.

A description of the test facility is on file with the FCC and ISED Canada.

New Submission

Production Unit

Class II Permissive Change

Pre-production Unit

**TNF** Equipment Code

Family Listing



#### **THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.**

Deviations from, additions to, or exclusions from the test specifications are described in "Summary of Test Data".

Nemko Group authorizes the above named company to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only. Any reproduction of parts of this report requires approval in writing from Nemko Group.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Nemko Group accepts no responsibility for damages suffered by any third party as a result of decisions made or actions based on this report.

## 2.2 Test Summary

Name of test	FCC Part 2, FCC Part 80 Reference	ISED Canada RSS-141 Issue 2, RSS-GEN Issue 5 Reference	Result
RF Power Output	2.1046 80.215	4.1	Complies
Modulation Characteristics, - Audio Frequency Response - Audio Low Pass Filter - Modulation Limiting	2.1047	5.1	Complies
Occupied Bandwidth	2.1049 80.205	5.1 6.7 (RSS-GEN)	Complies
Spurious Emissions at antenna terminals	2.1051, 2.1057 80.211	4.2, 5.2.2	Complies
Field Strength of Transmitter Spurious Radiations	2.1053, 2.1057 80.211	5.2.2 8.9 (RSS-GEN)	Complies
Frequency Stability	2.1055 80.209	5.1 8.11 (RSS-GEN)	Complies

<sup>1</sup> The tested equipment transmits voice

<sup>2</sup> The tested equipment has a 50 ohm antenna connector

## Revision history

Version	Date	Comment	Sign
1.0	2019-05-28	First edition	FS
1.1	2019-06-04	Corrections after TCB review	FS

### 3 TEST RESULTS

#### 3.1 RF Output Power, Conducted

FCC §2.1046, 80.215

Test Results: Complies

Measurement Data:

Frequency (MHz)	Measured Value (dBm)	Measured Value (Watts)
121.500	24.7	0.295
123.100	24.8	0.302

The EUT always transmits at maximum output power.

This measurement was performed with an Average Power Meter.

The measurement is performed with the the EUT transmitting continuously modulated with a 2.5 kHz audio signal at input level 16 dB above the level that produce modulation index 50%.

#### Requirements:

**§2.1046** (a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in §2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

(b) For single sideband, independent sideband, and single channel, controlled carrier radiotelephone transmitters the procedure specified in paragraph (a) of this section shall be employed and, in addition, the transmitter shall be modulated during the test as follows. In all tests, the input level of the modulating signal shall be such as to develop rated peak envelope power or carrier power, as appropriate, for the transmitter.

(6) Single-channel controlled-carrier transmitters in the A3 emission mode—by a 2500 Hz tone.

(c) For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

**§80.215** (a) Transmitter power shown on the radio station authorization is the maximum power the licensee is authorized to use. Power is expressed in the following terms:

(5) For all other emissions: the carrier power multiplied by 1.67.

### 3.2 Modulation Characteristics

#### 3.2.1 Audio Frequency Response

FCC §2.1047, §80.213

Test Results: Complies

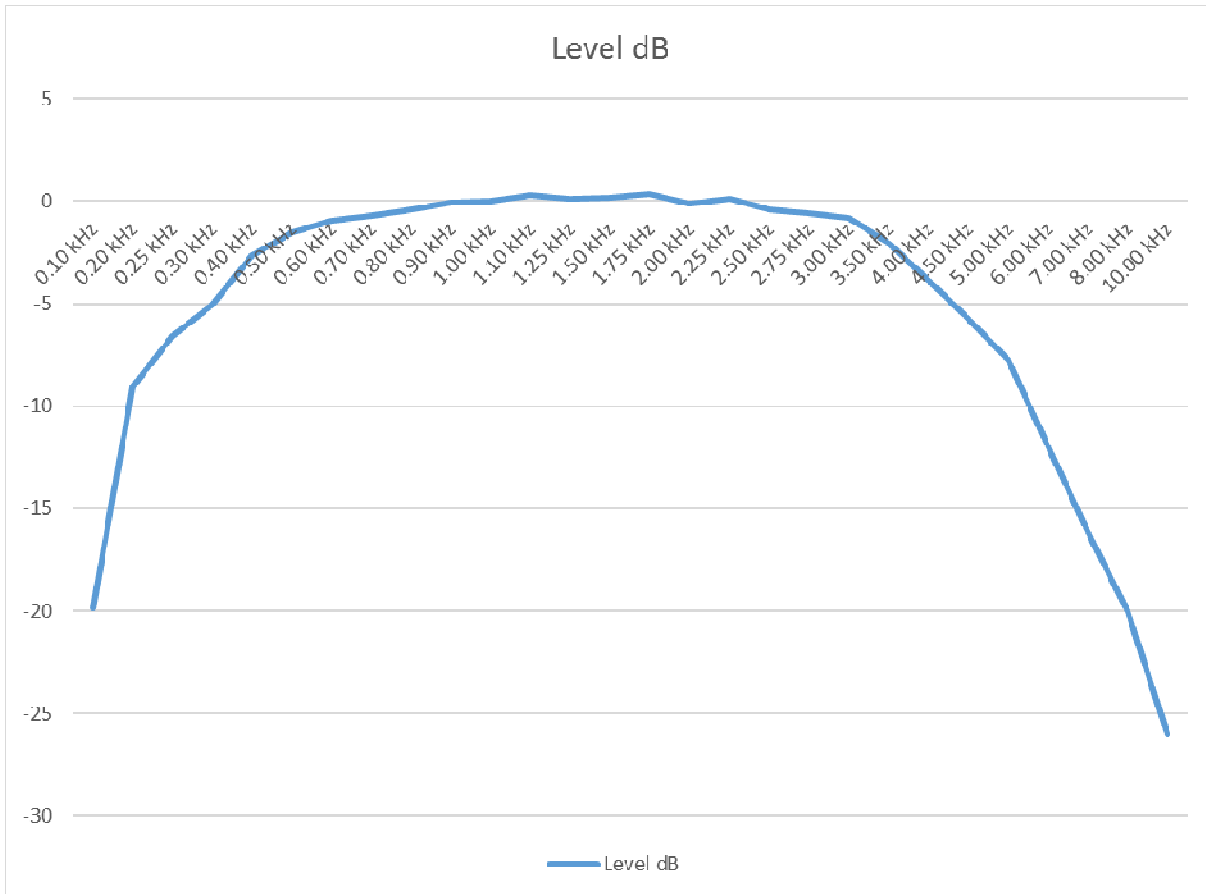
Measurement Data:

See attached graph.

Reference Level is 1000 Hz tone at 50% Modulation

#### Requirements:

§2.1047 (a) *Voice modulated communication equipment.* A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.



#### Audio Frequency Response



### 3.2.2 Modulation Limiting

FCC §2.1047, 80.213

Test Results: Complies

Measurement Data:

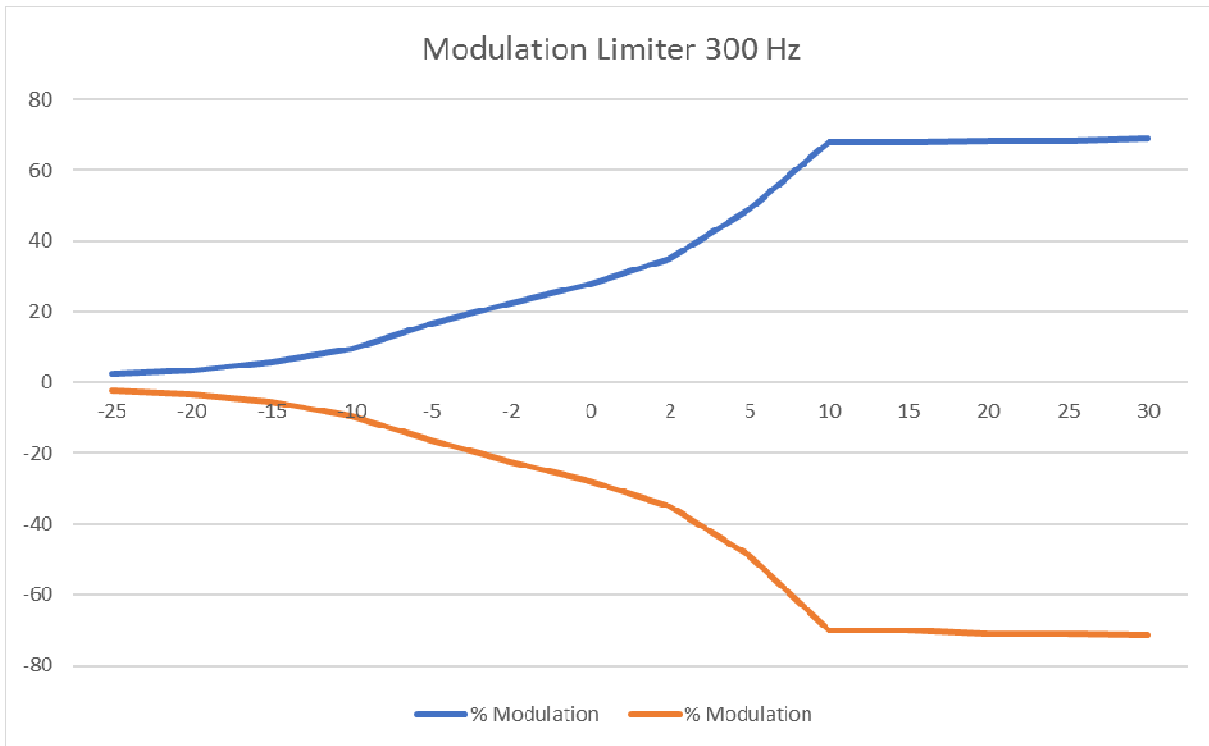
See attached graph.

#### Requirements:

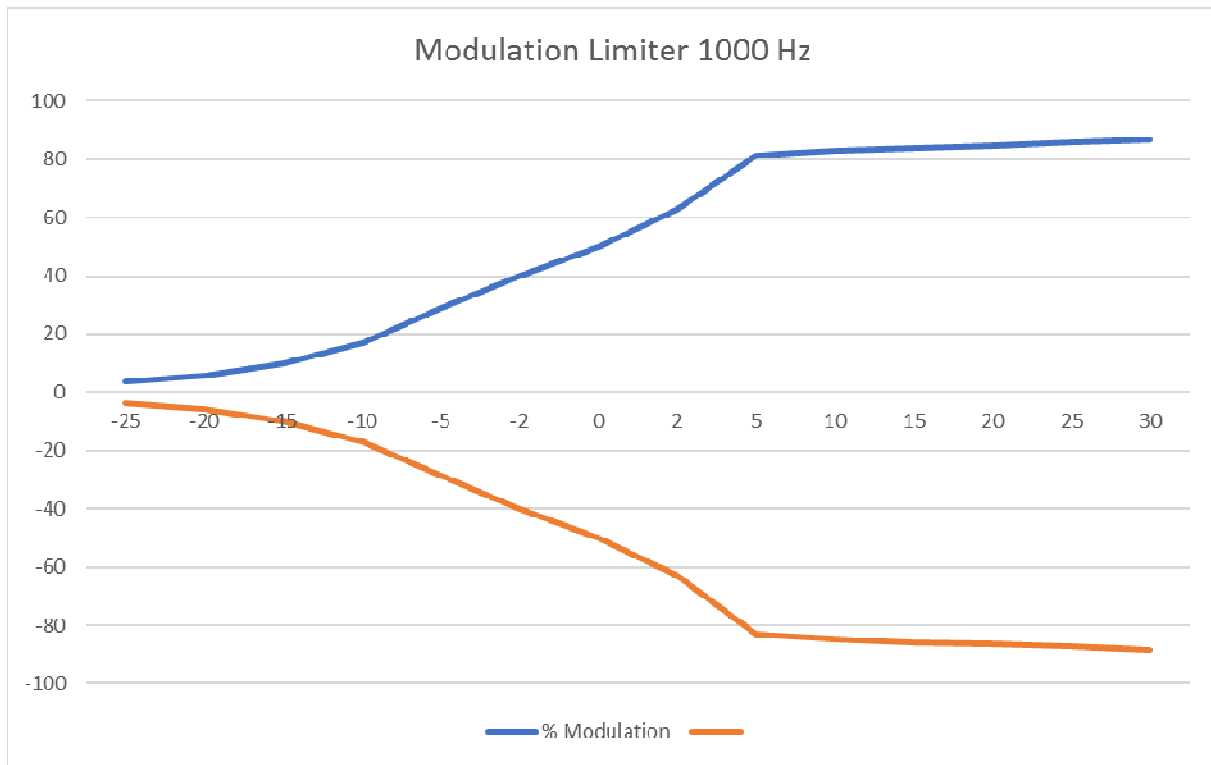
§2.1047 (b) *Equipment which employs modulation limiting.* A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.

§80.213 (a) Transmitters must meet the following modulation requirements:

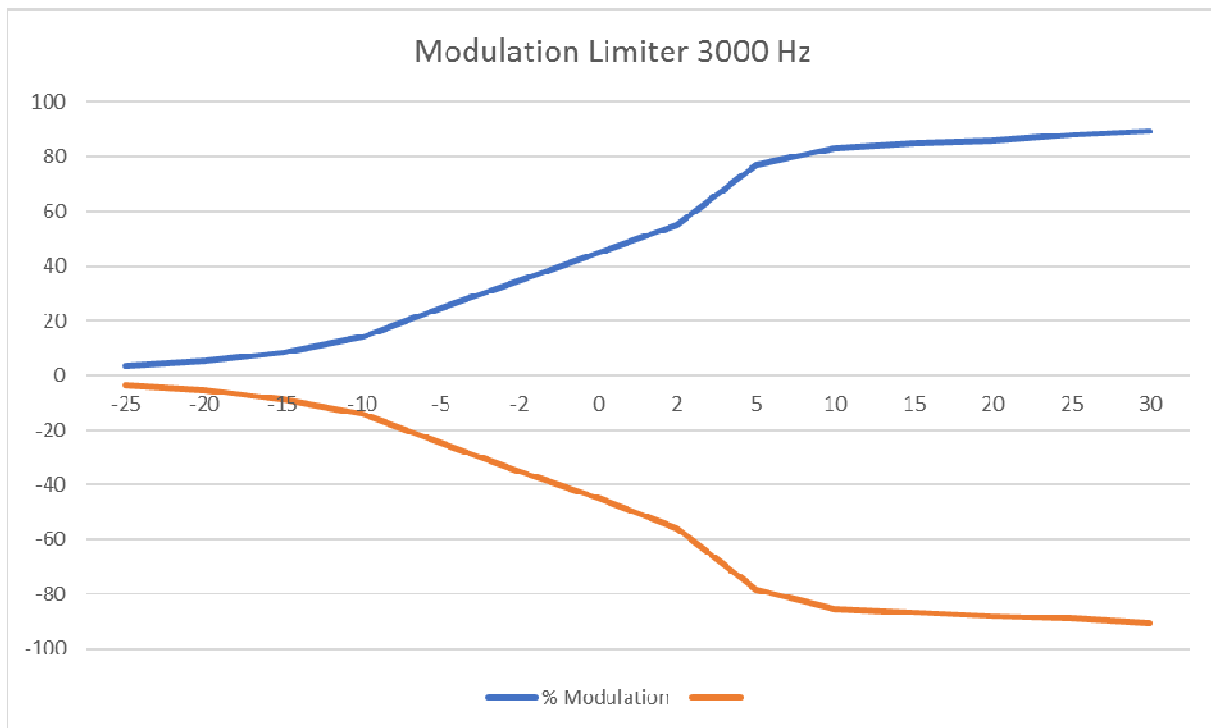
- (1) When double sideband emission is used the peak modulation must be maintained between 75 and 100 percent



Modulation Limiter, 300 Hz (x-axis: Voltage, dB)



Modulation Limiter, 1000 Hz (x-axis: Voltage, dB)



Modulation Limiter, 3000 Hz (x-axis: Voltage, dB)

### 3.3 Occupied Bandwidth

FCC §2.1049, §80.205

Test Results: Complies

Measurement Data:

Transmit Frequency	Occupied Bandwidth (kHz)
121.500 MHz	5.18
123.100 MHz	5.18

See plots

For this test the EUT was transmitting continuously.

The EUT was modulated by a 2.5 kHz signal and the input level was adjusted to 16 dB above the level that produced 50% modulation.

#### Requirements:

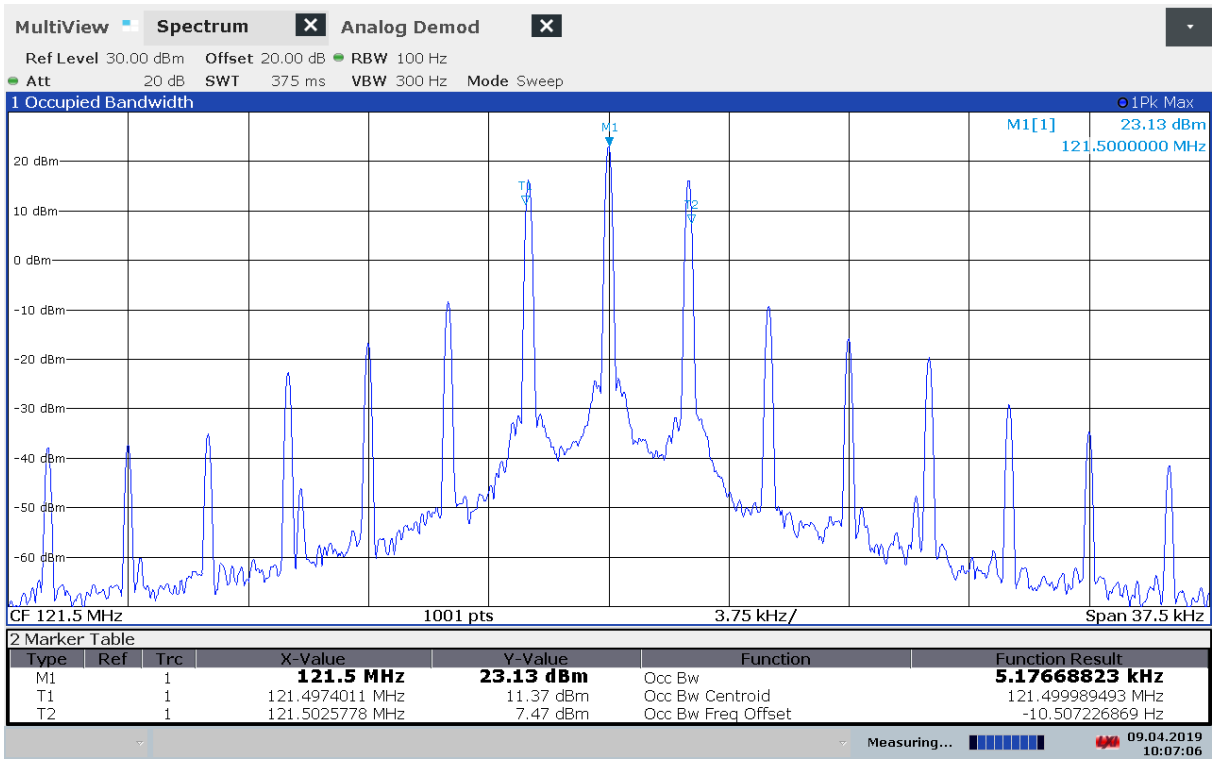
**§2.1049** The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable:

(c) Radiotelephone transmitters equipped with a device to limit modulation or peak envelope power shall be modulated as follows.

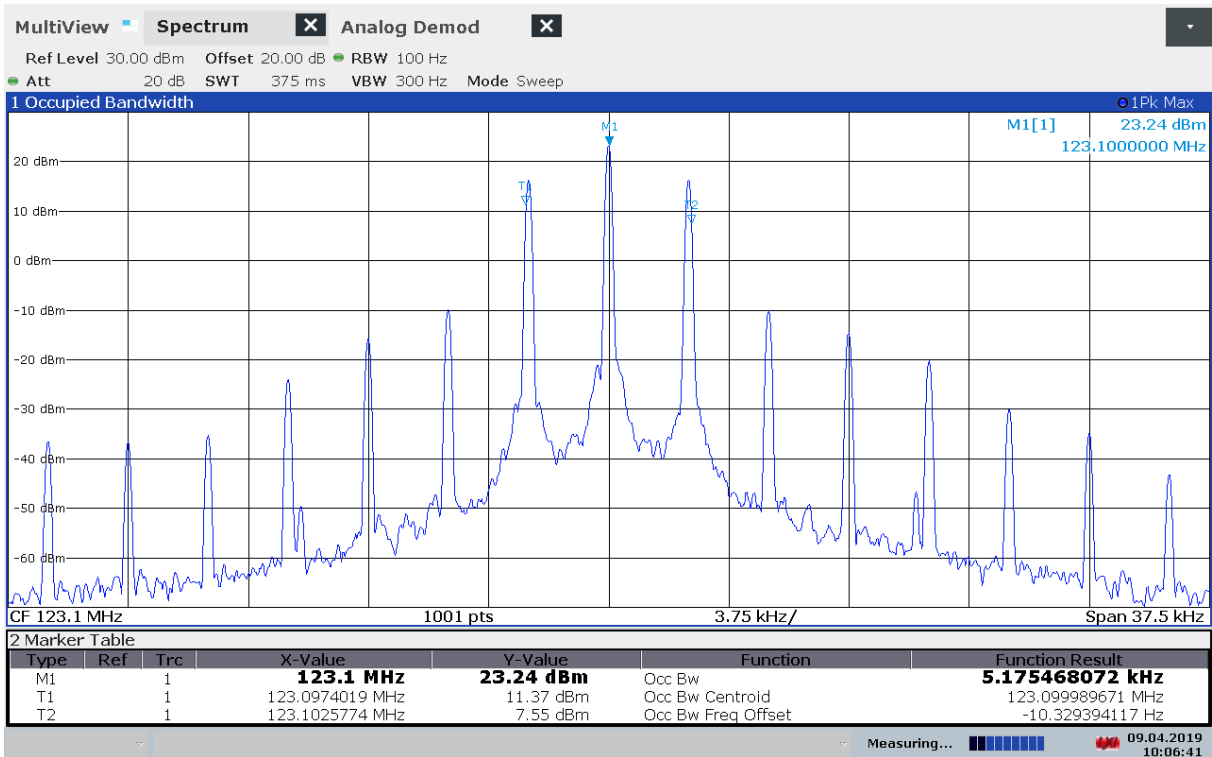
(1) Other than single sideband or independent sideband transmitters—when modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation. The input level shall be established at the frequency of maximum response of the audio modulating circuit.

**§80.205** (a) An emission designator shows the necessary bandwidth for each class of emission of a station except that in ship earth stations it shows the occupied or necessary bandwidth, whichever is greater. The following table gives the class of emission and corresponding emission designator and authorized bandwidth:

Class of emission	Emission designator	Authorized bandwidth (kHz)
A3E	6K00A3E	8.0



99% Bandwidth, 121.5 MHz, Audio Freq: 2500Hz, Modulation 16dB above 50%



99% Bandwidth, 123.1 MHz, Audio Freq: 2500Hz, Modulation 16dB above 50%

### 3.4 Spurious Emissions at Antenna Terminals

FCC §2.1051, 80.211(f), 2.1057

**Test Results: Complies**

**Measurement Data:**

See plots

Authorized Bandwidth = 8 kHz

For this test the EUT was transmitting continuously.

The EUT was modulated by a 2.5 kHz signal and the input level was adjusted to 16 dB above the level that produced 50% modulation.

**Requirements:**

**§2.1051** The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

**§2.1057** (a) In all of the measurements set forth in §§2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:

(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

(b) Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.

(c) The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

**§80.211** The emissions must be attenuated according to the following schedule.

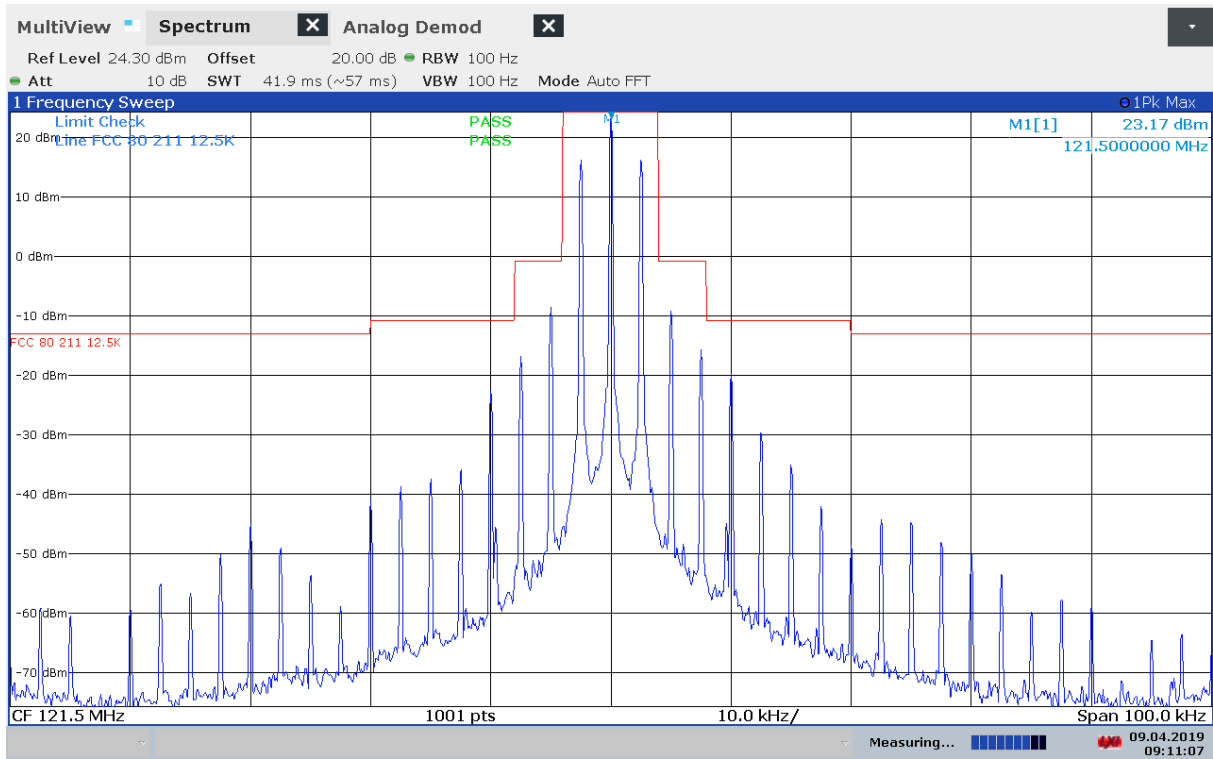
(f) The mean power when using emissions other than those in paragraphs (a), (b), (c) and (d) of this section:

(1) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 dB;

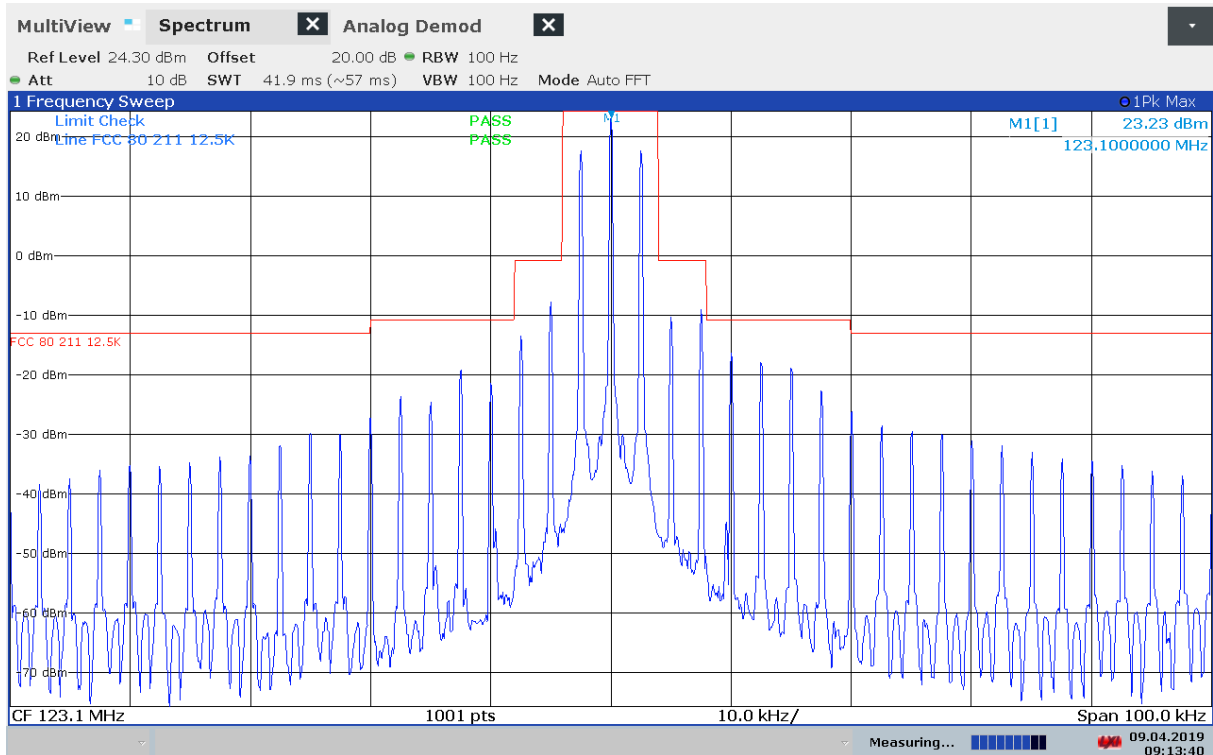
(2) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 dB; and

(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus  $10\log_{10}$  (mean power in watts) dB.

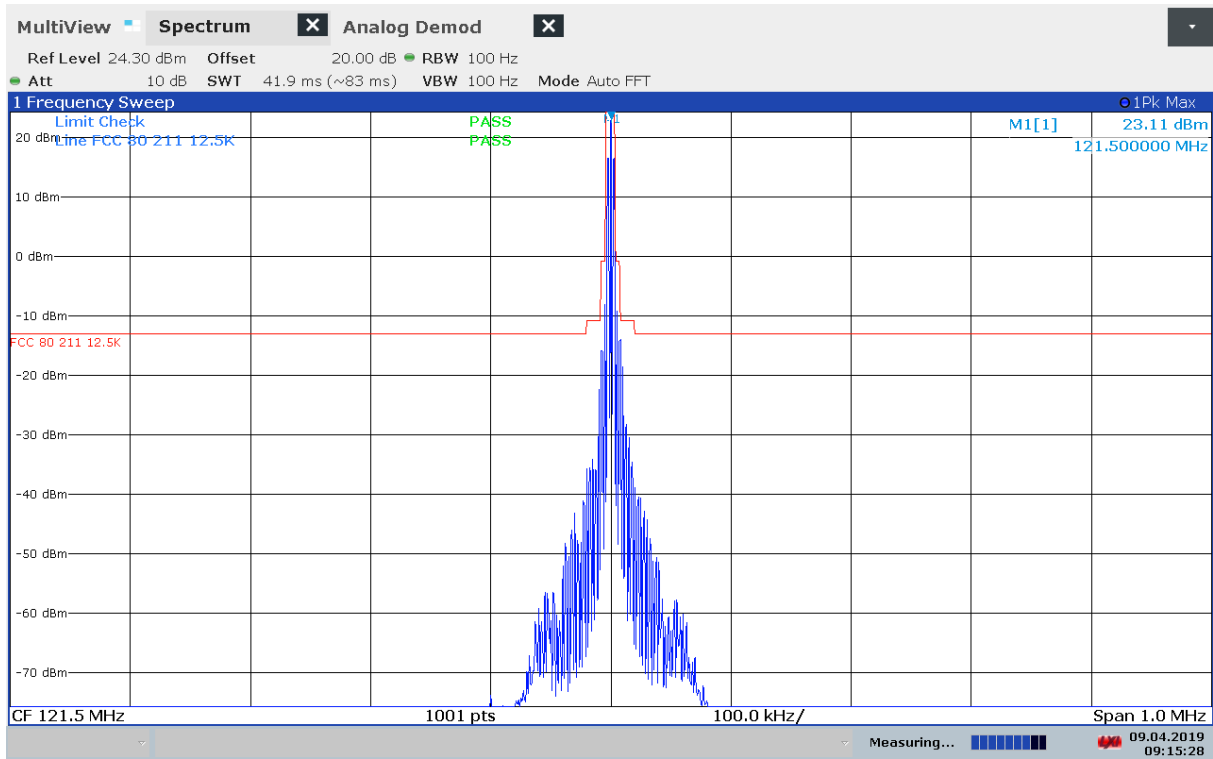
Frequency Range	Limit, §80.211(f)
More than 4 kHz and less than 8 kHz from Nominal Frequency	At least 25 dB below carrier
More than 8 kHz and less than 20 kHz from Nominal Frequency	At least 35 dB below carrier
More than 20 kHz from Nominal Frequency	At least $43 + 10 \log_{10}(\text{Mean Power in Watts})$ dB below carrier



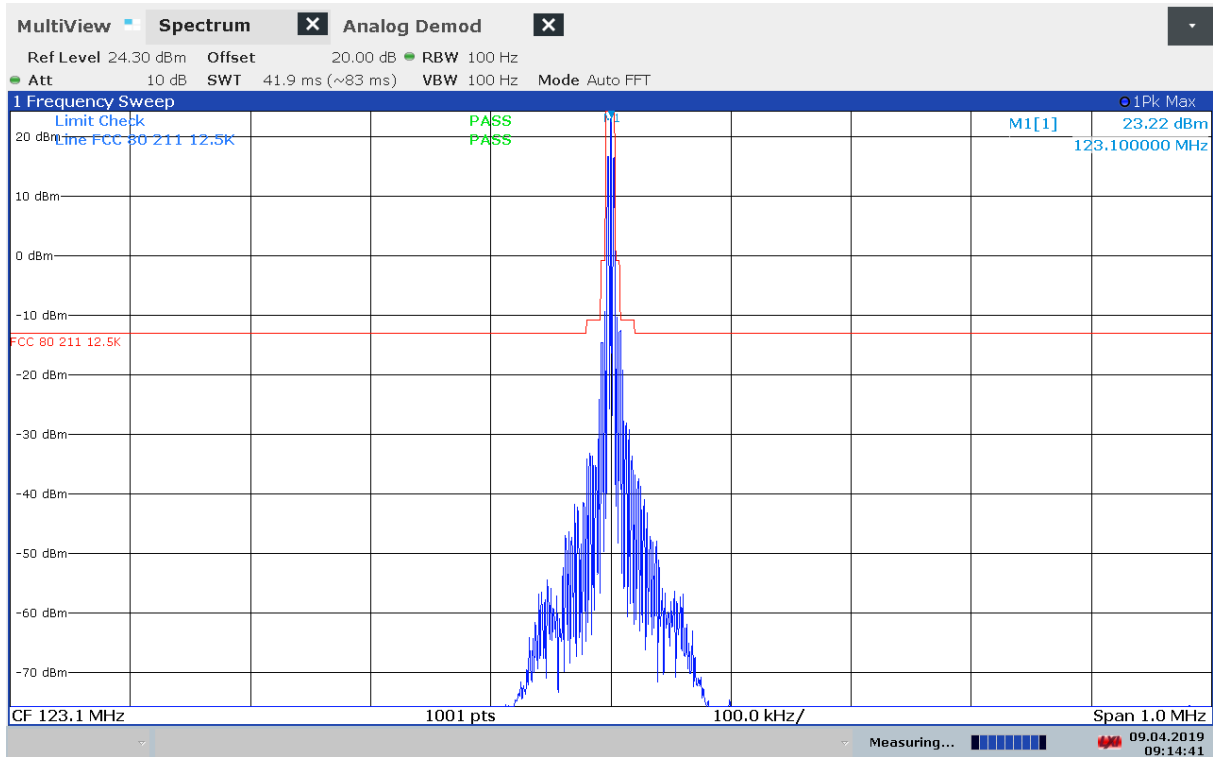
Conducted Emissions, 121.45 – 121.55 MHz, TX Freq: 121.5MHz



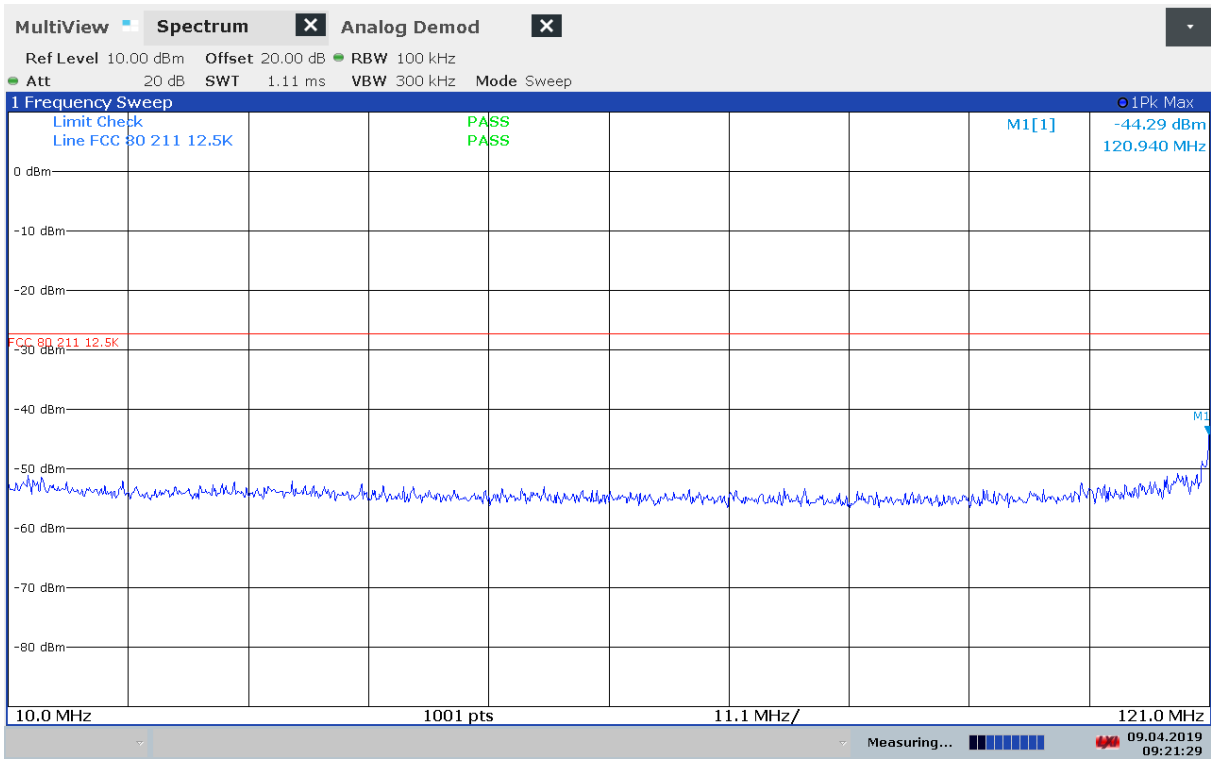
Conducted Emissions, 123.05 – 123.15 MHz, TX Freq: 123.1MHz



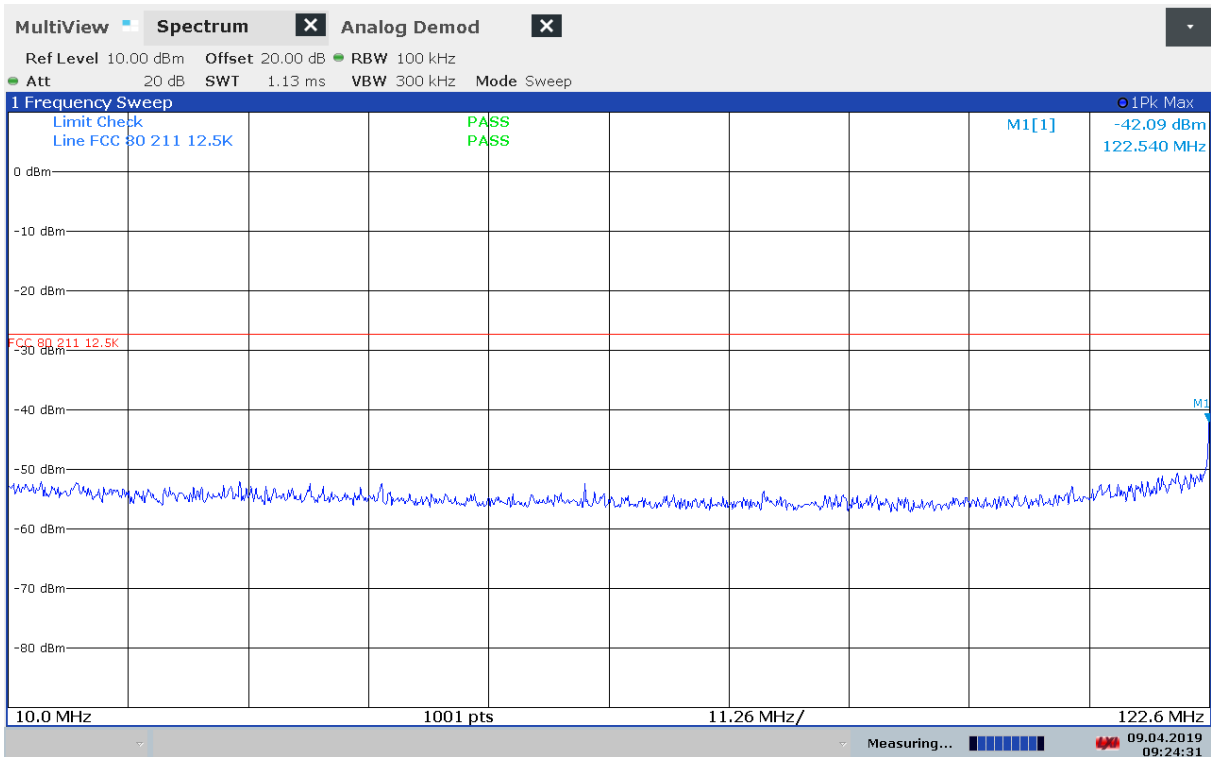
Conducted Emissions, 121.00 – 122.00 MHz, TX Freq: 121.5MHz



Conducted Emissions, 122.60 – 123.60 MHz, TX Freq: 123.1MHz

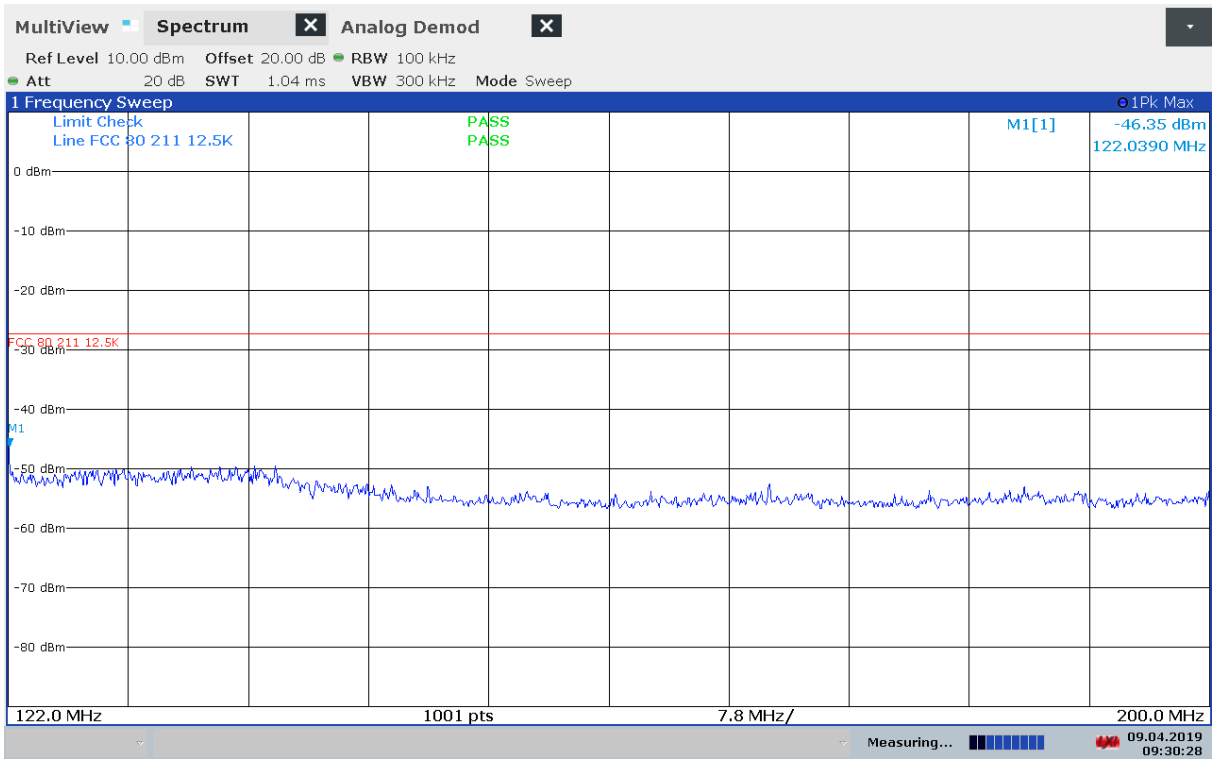


Conducted Emissions, 10 – 121 MHz, TX Freq: 121.5MHz

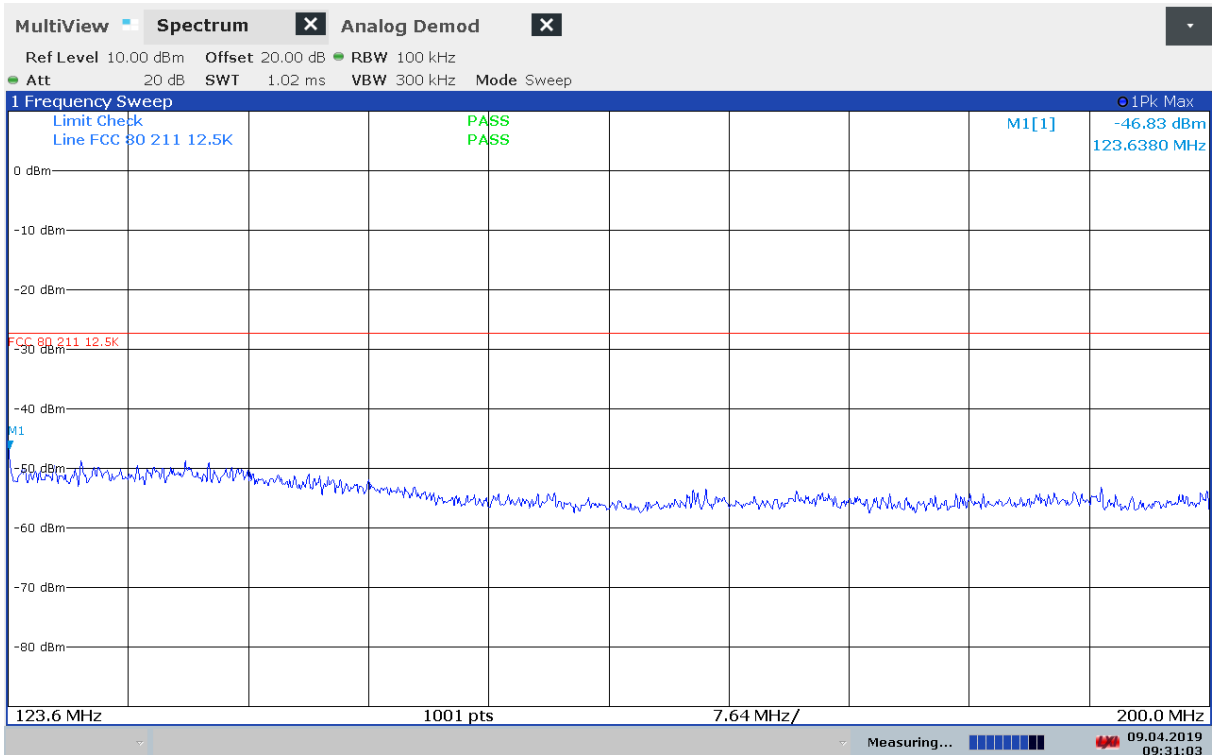


Conducted Emissions, 10 – 122.6 MHz, TX Freq: 123.1MHz

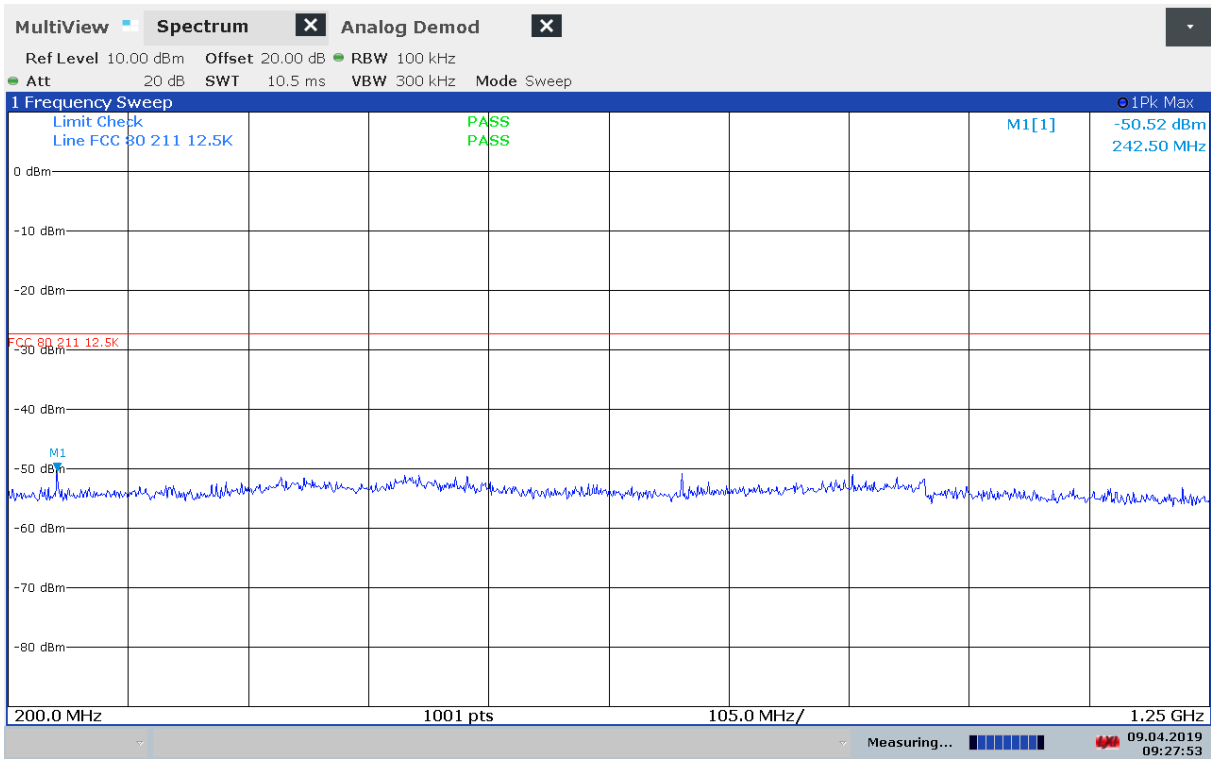




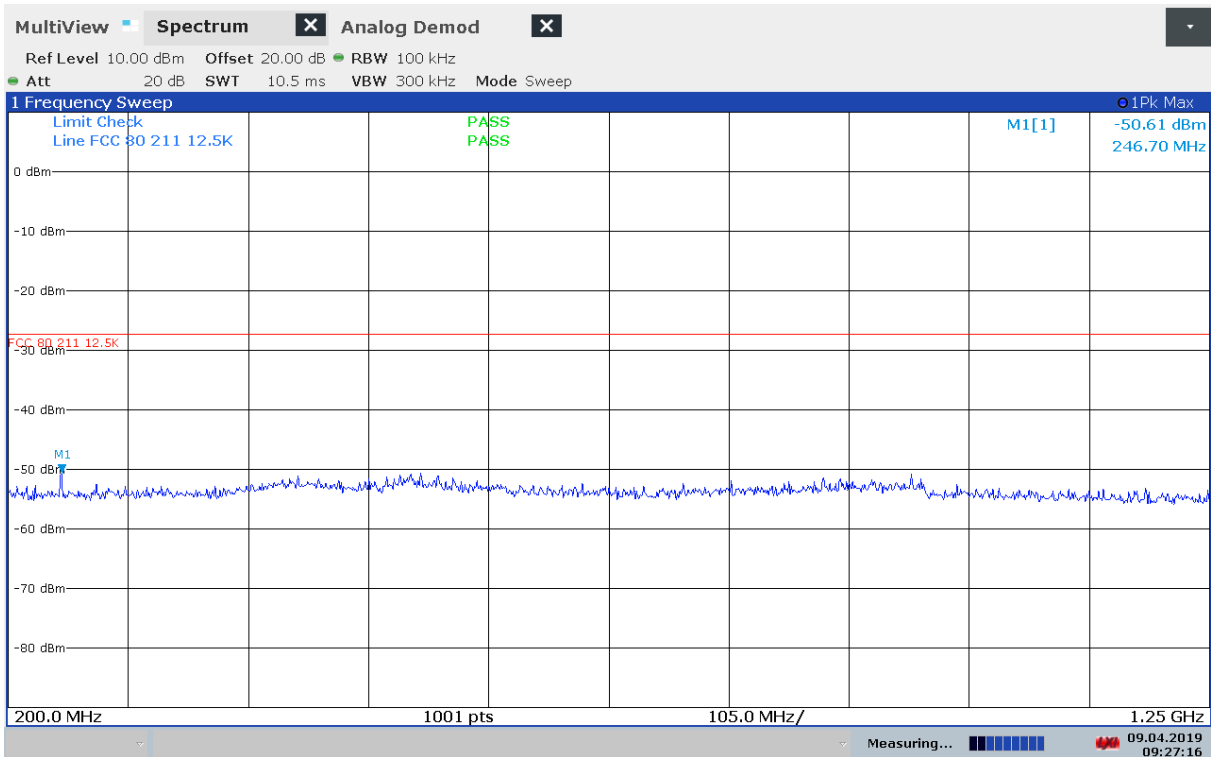
Conducted Emissions, 122 – 200 MHz, TX Freq: 121.5MHz



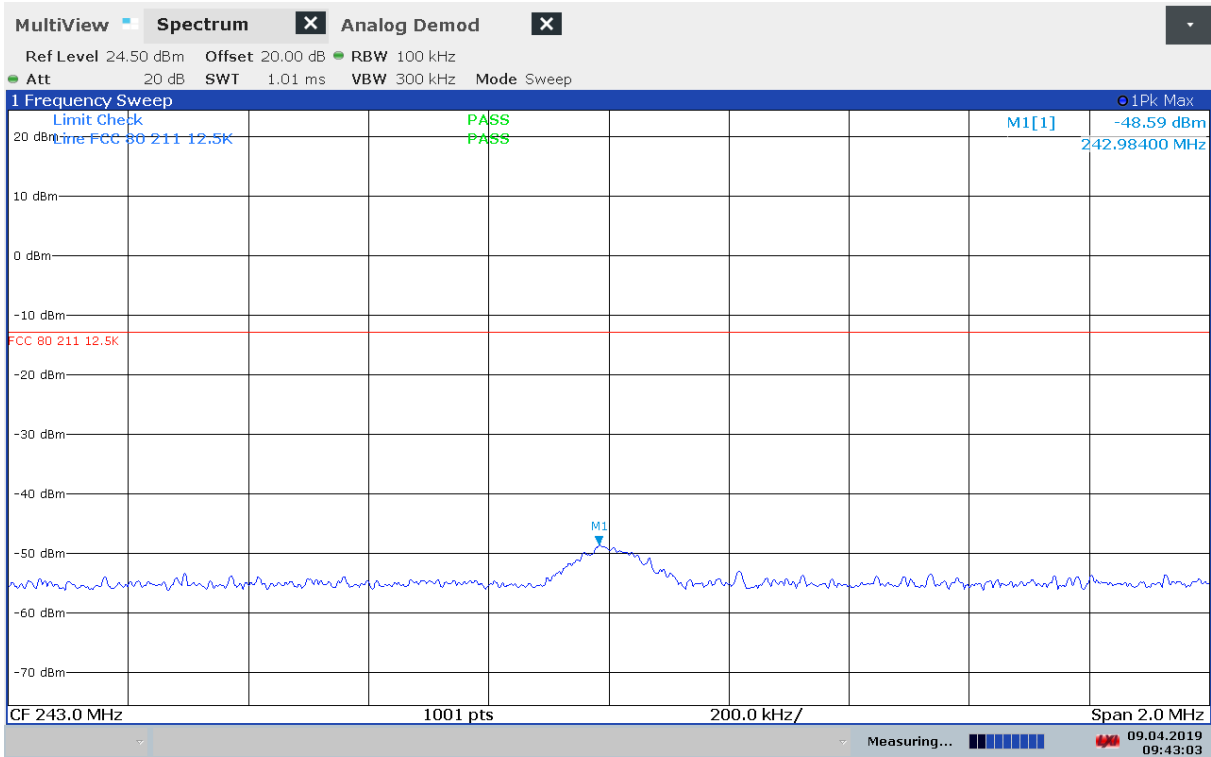
Conducted Emissions, 123.6 – 200 MHz, TX Freq: 123.1MHz



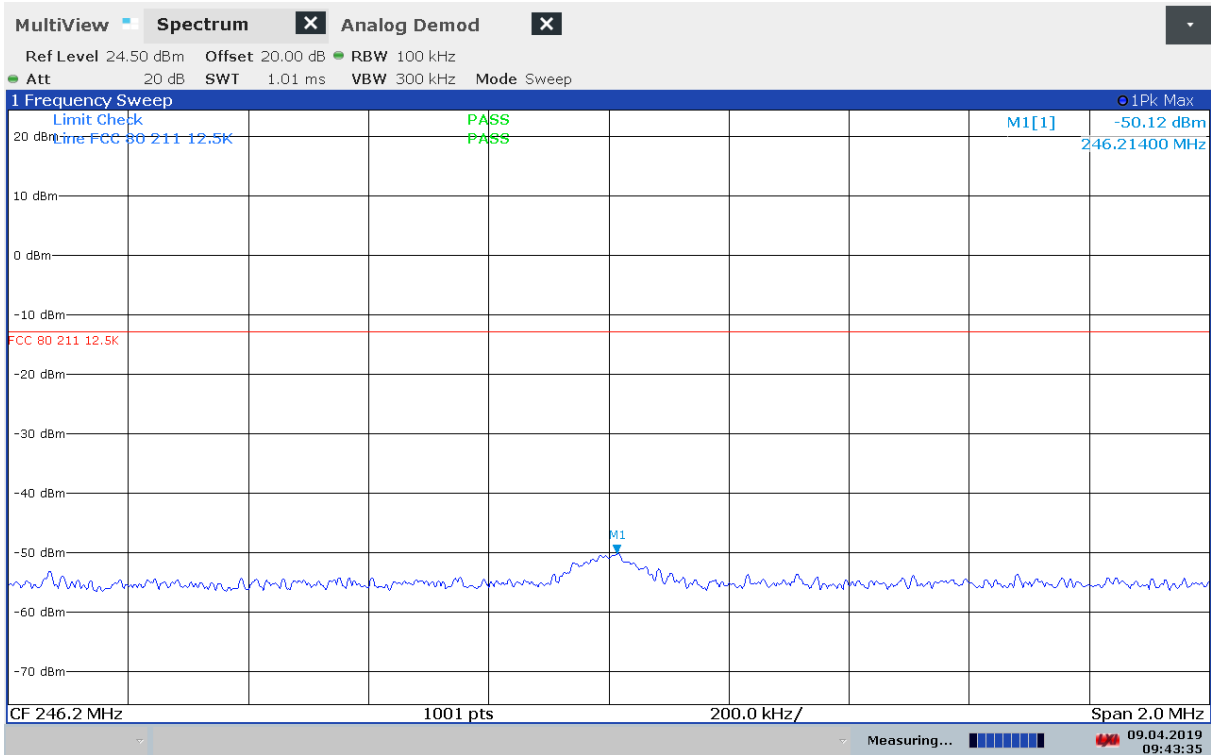
Conducted Emissions, 200 – 1250 MHz, TX Freq: 121.5MHz



Conducted Emissions, 200 – 1250 MHz, TX Freq: 123.1MHz



Conducted Emissions, 243 MHz, TX Freq: 121.5MHz



Conducted Emissions, 246.2 MHz, TX Freq: 123.1MHz

### 3.5 Field Strength of Spurious Radiations

FCC §2.1053, 2.1057, 80.211(f)

Test Results: Complies

Measurement Data:

Carrier Frequency (MHz)	Spurious Frequency (MHz)	Measured Field Strength (dBμV/m @3m)	Calculated Radiations (dBm)	Limit (dBm)	Margin (dB)
121.500	121.500	113.2	18.0	/	/
121.500	243.0	32.2	-63.0	-13	50.0
	486.0	32.2	-63.0	-13	50.0
	850.5	37.9	-57.3	-13	44.3
	972.0	42.8	-52.4	-13	39.4
123.100	123.100	114.9	19.7	/	/
123.100	246.2	32.4	-62.8	-13	49.8
	492.4	30.0	-65.2	-13	52.2
	861.7	39.1	-56.1	-13	43.1
	984.8	42.1	-53.1	-13	40.1
121.5 / 123.1	All other	< -40	-55.2	-13	42.2

All harmonic are checked with RBW of 100 kHz and Peak Detector. Harmonics from 1 to 1.25 GHz are measured with 1 MHz RBW and Peak Detector.

The measurement was performed at 3m with transducer factor programmed in the spectrum analyzer. All other harmonics were lower than the ones reported above.

EUT was transmitting continuously and modulated with a 2.5 kHz signal at maximum modulation index.

Field Strength values above are converted to dBm values using the method in KDB 412172.

**Requirements:**

**§2.1053** (a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:

(2) All equipment operating on frequencies higher than 25 MHz.

**§2.1057** (a) In all of the measurements set forth in §§2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:

(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

(b) Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.

(c) The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

**§80.211** The emissions must be attenuated according to the following schedule.

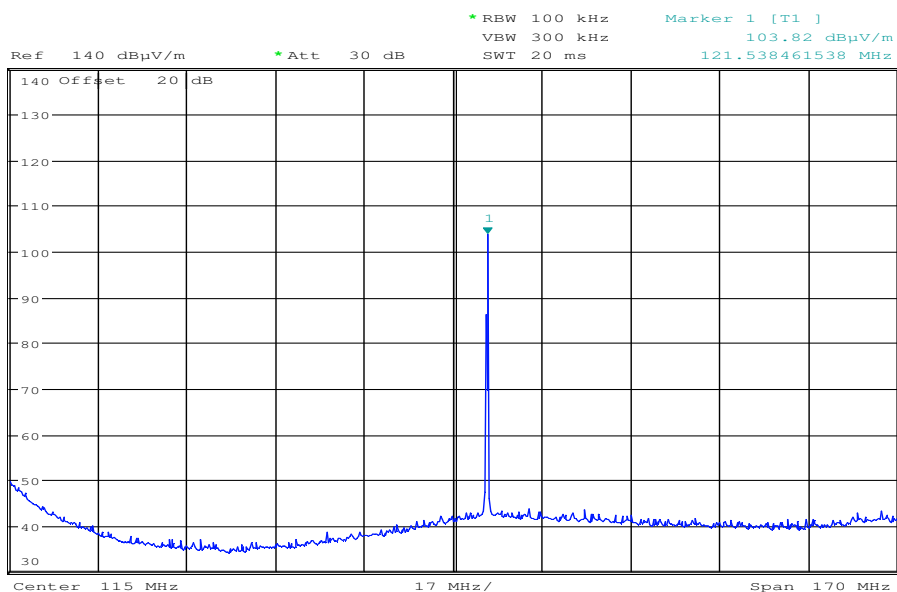
(f) The mean power when using emissions other than those in paragraphs (a), (b), (c) and (d) of this section:

(1) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 dB;

(2) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 dB; and

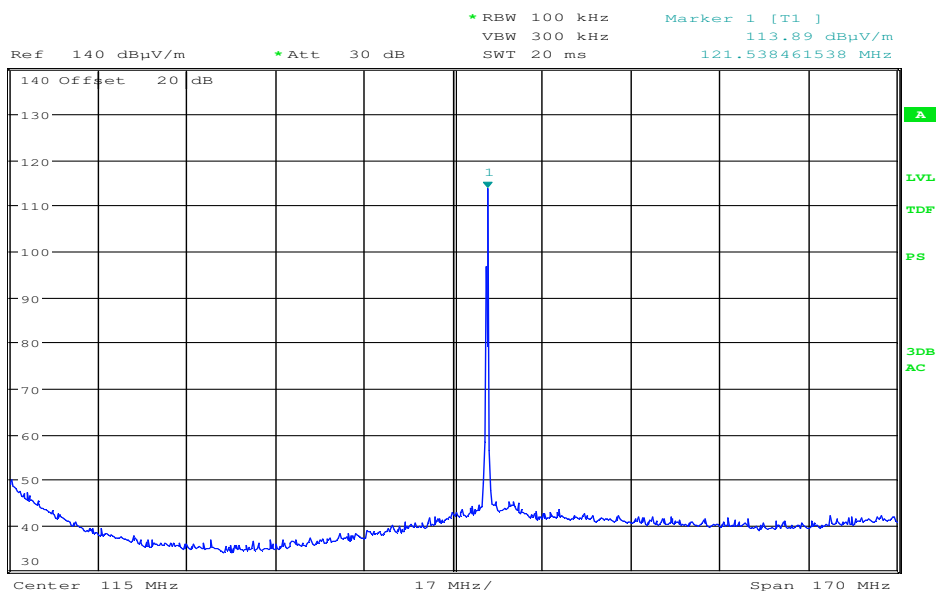
(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus  $10\log_{10}$  (mean power in watts) dB.

Frequency Range	Limit, §80.211(f)
More than 4 kHz and less than 8 kHz from Nominal Frequency	At least 25 dB below carrier
More than 8 kHz and less than 20 kHz from Nominal Frequency	At least 35 dB below carrier
More than 20 kHz from Nominal Frequency	At least $(43 + 10 \log_{10}(\text{Mean Power in Watts}))$ dB below carrier



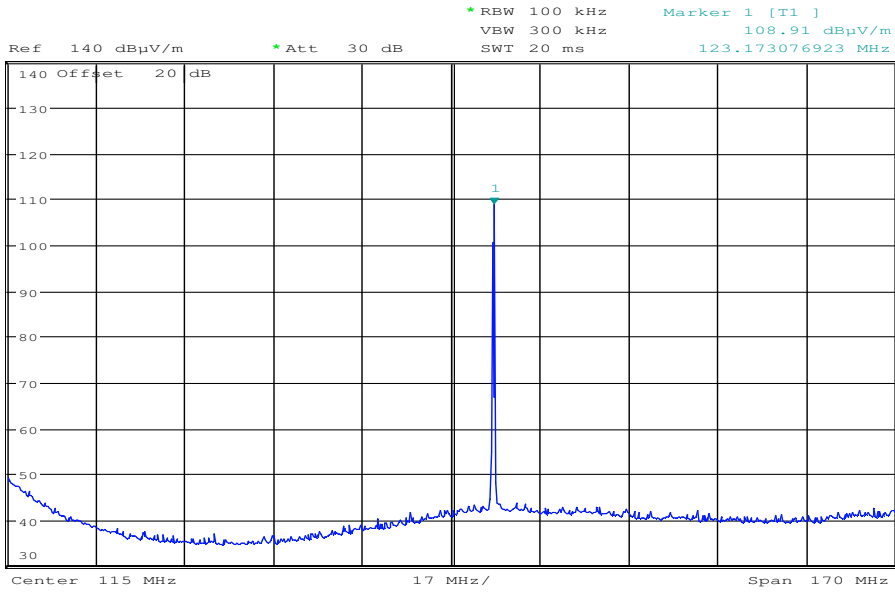
Date: 19.MAR.2019 12:19:15

**Field Strength, 30 – 200 MHz, CF=121.500 MHz, HP**



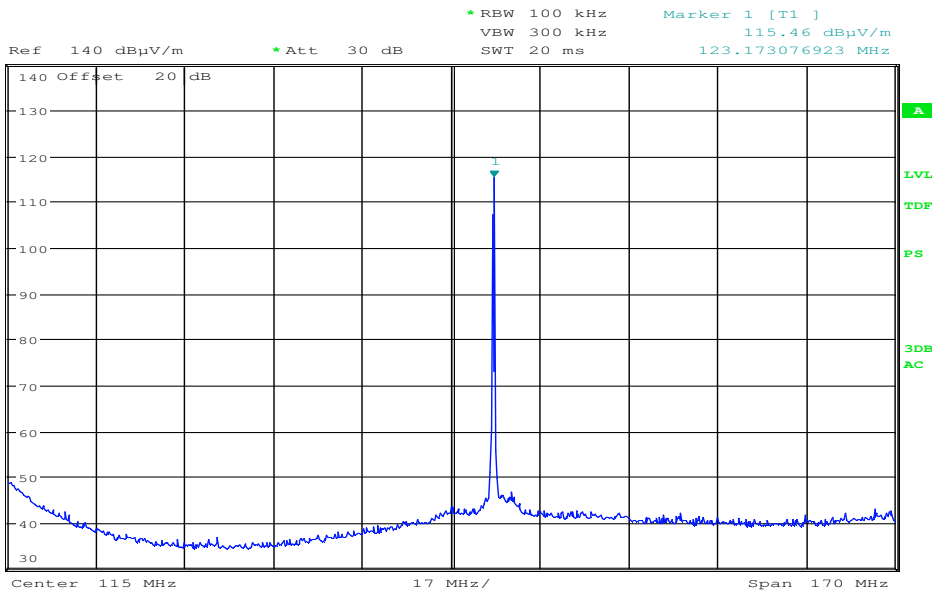
Date: 19.MAR.2019 12:16:36

**Field Strength, 30 – 200 MHz, CF=121.500 MHz, VP**



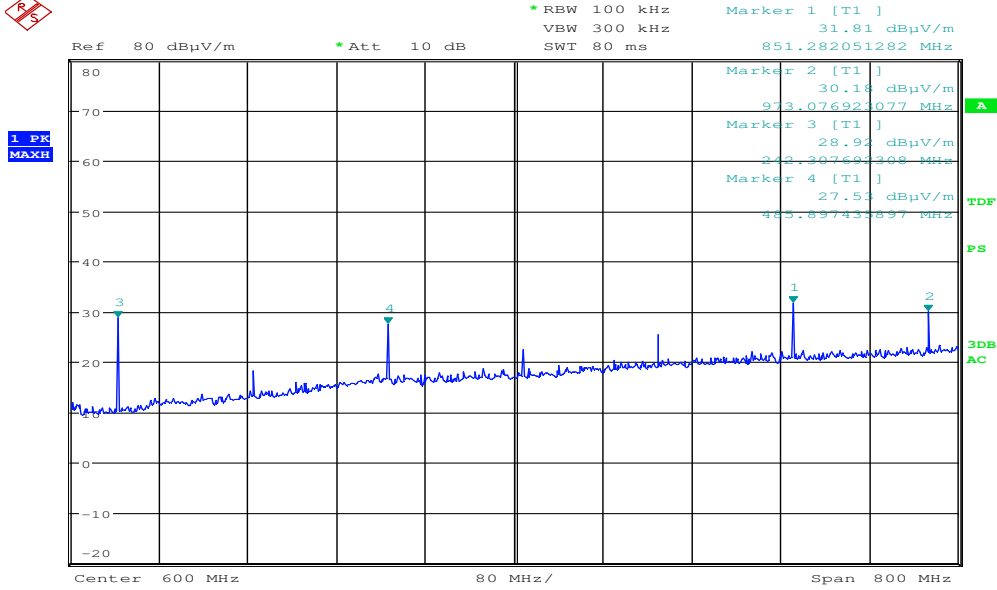
Date: 19.MAR.2019 12:22:37

**Field Strength, 30 – 200 MHz, CF=123.100 MHz, HP**



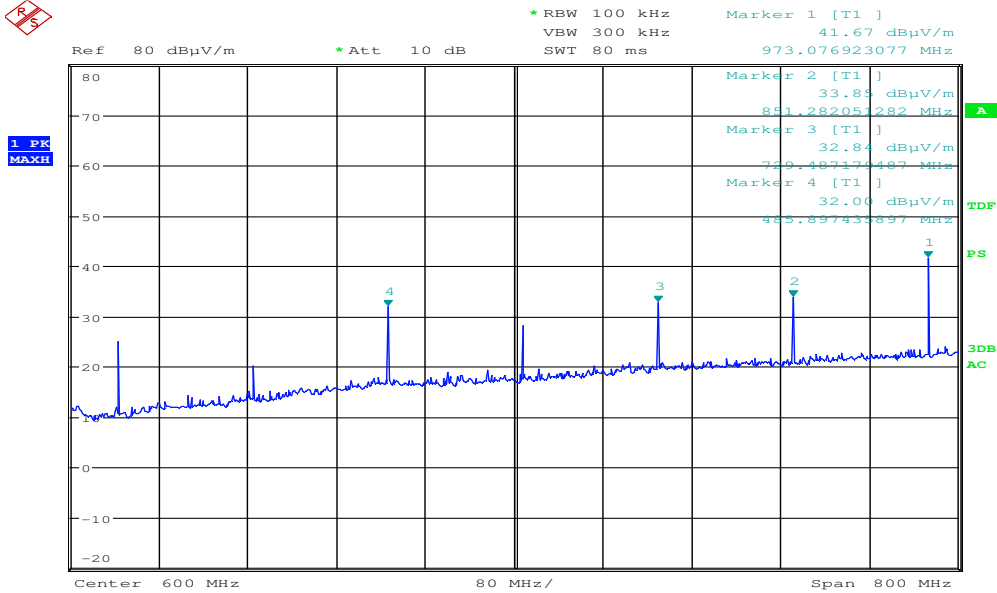
Date: 19.MAR.2019 12:24:49

**Field Strength, 30 – 200 MHz, CF=123.100 MHz, VP**



Date: 19.MAR.2019 15:02:20

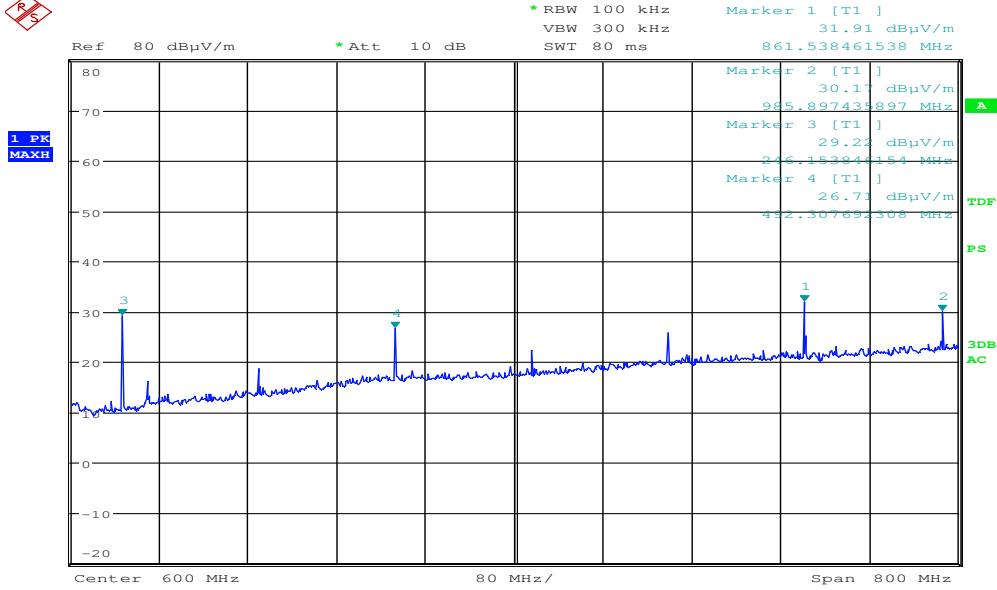
**Field Strength, 200 – 1000 MHz, CF=121.500 MHz, HP**



Date: 19.MAR.2019 14:59:26

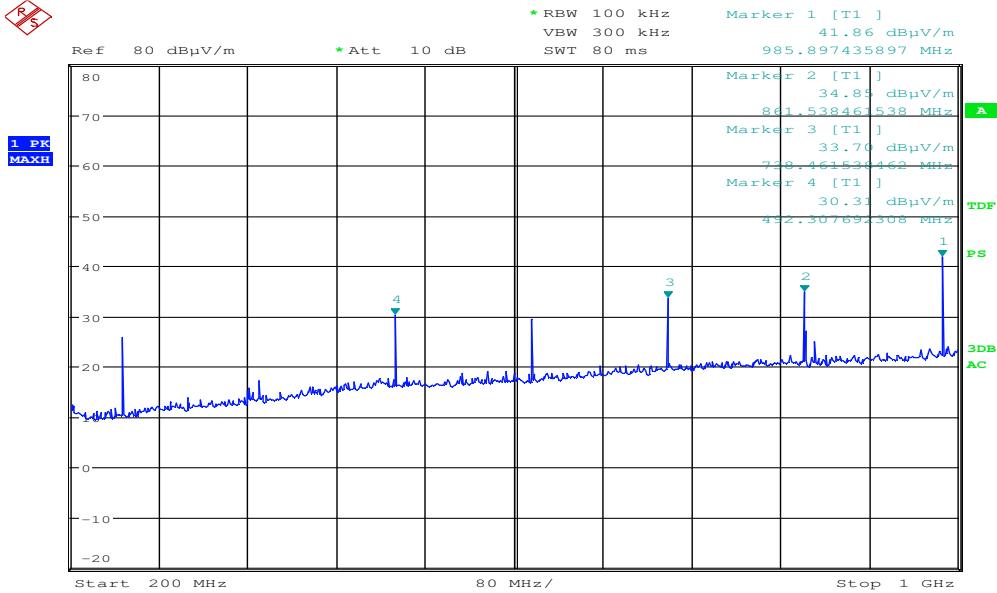
**Field Strength, 200 – 1000 MHz, CF=121.500 MHz, VP**





Date: 19.MAR.2019 15:07:40

Field Strength, 200 – 1000 MHz, CF=123.100 MHz, HP

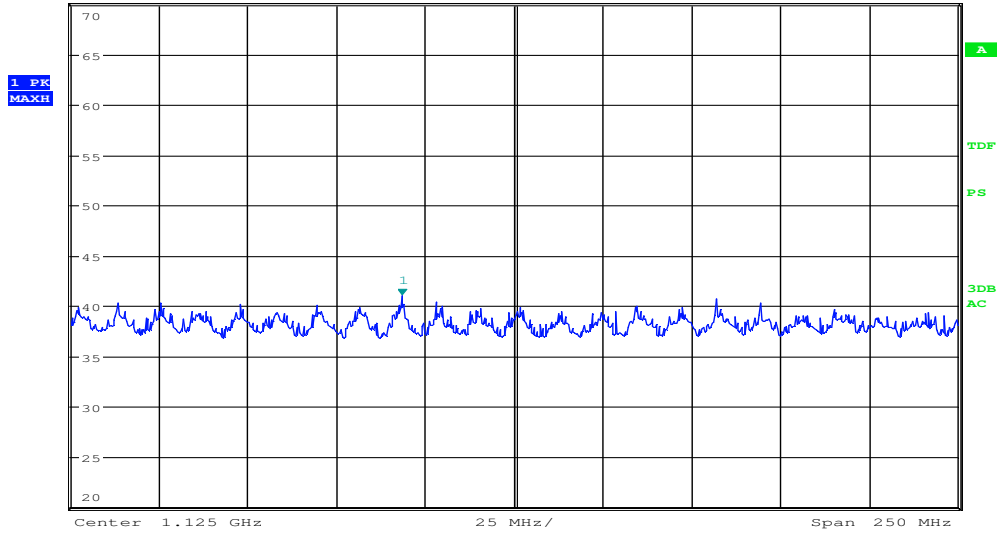


Date: 19.MAR.2019 15:10:40

Field Strength, 200 – 1000 MHz, CF=123.100 MHz, VP



Ref 70 dBµV/m      \* Att 10 dB      \* RBW 1 MHz      Marker 1 [T1 ]  
 VBW 3 MHz      41.10 dBµV/m  
 SWT 2.5 ms      1.093349359 GHz

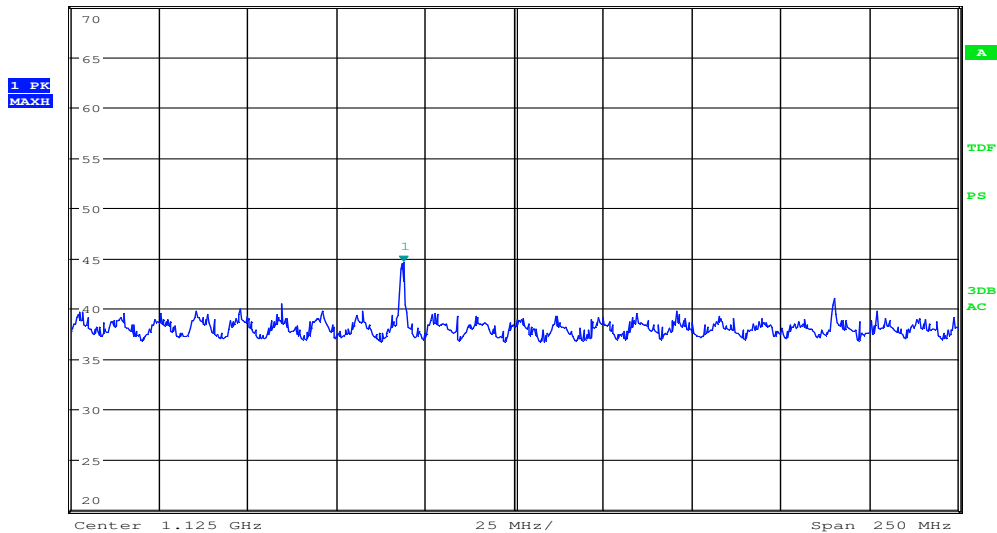


Date: 19.MAR.2019 14:46:10

**Field Strength, 1000 – 1250 MHz, CF=121.500 MHz, HP**

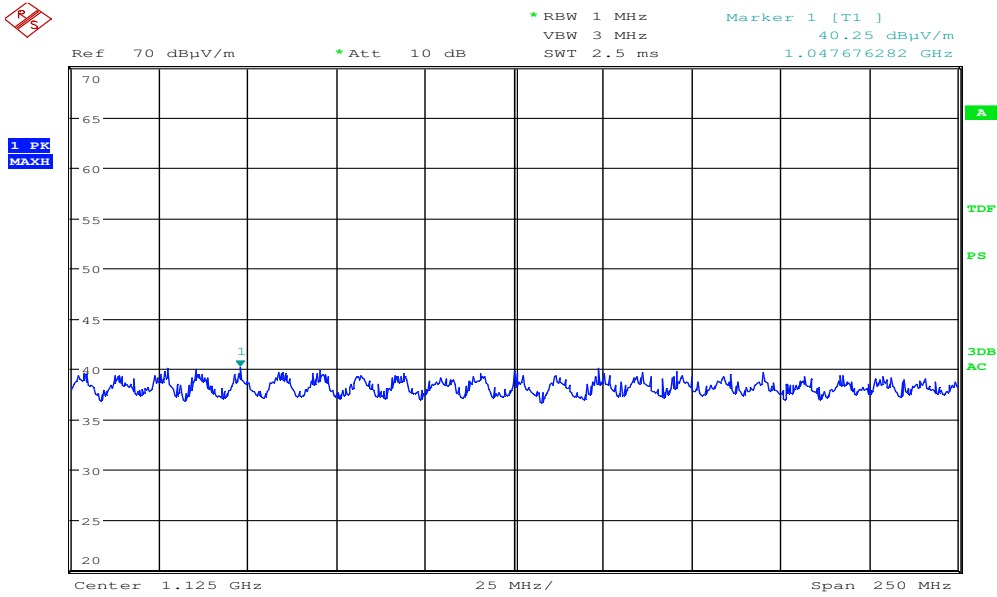


Ref 70 dBµV/m      \* Att 10 dB      \* RBW 1 MHz      Marker 1 [T1 ]  
 VBW 3 MHz      44.63 dBµV/m  
 SWT 2.5 ms      1.093750000 GHz



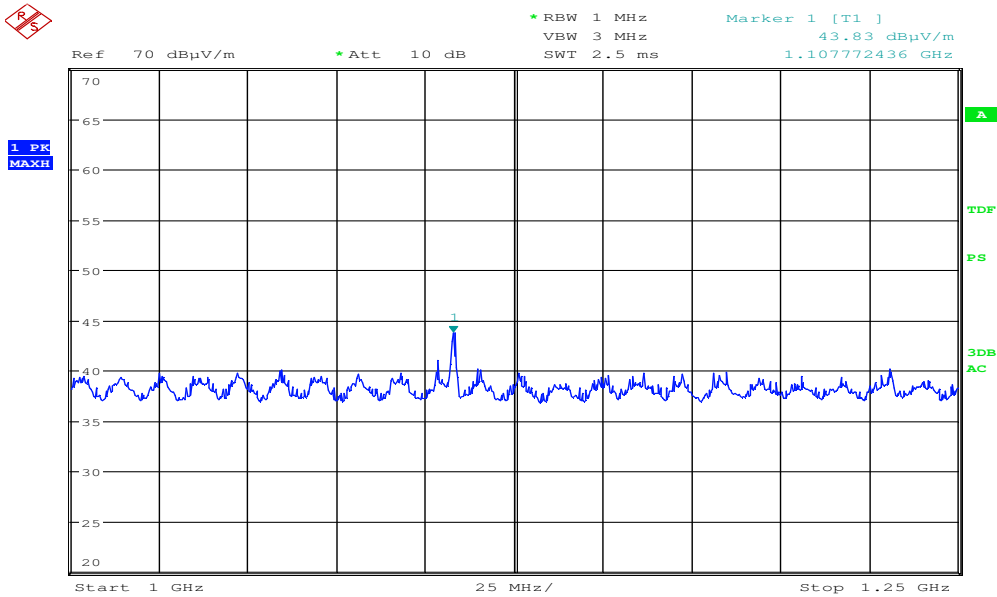
Date: 19.MAR.2019 14:48:13

**Field Strength, 1000 – 1250 MHz, CF=121.500 MHz, VP**



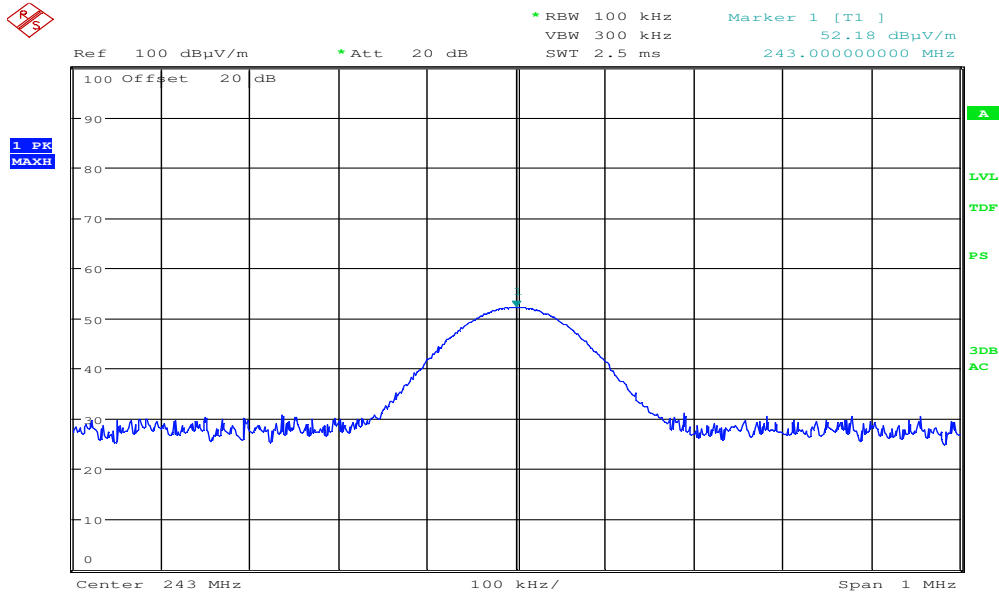
Date: 19.MAR.2019 14:43:04

**Field Strength, 1000 – 1250 MHz, CF=123.100 MHz, HP**



Date: 19.MAR.2019 14:39:12

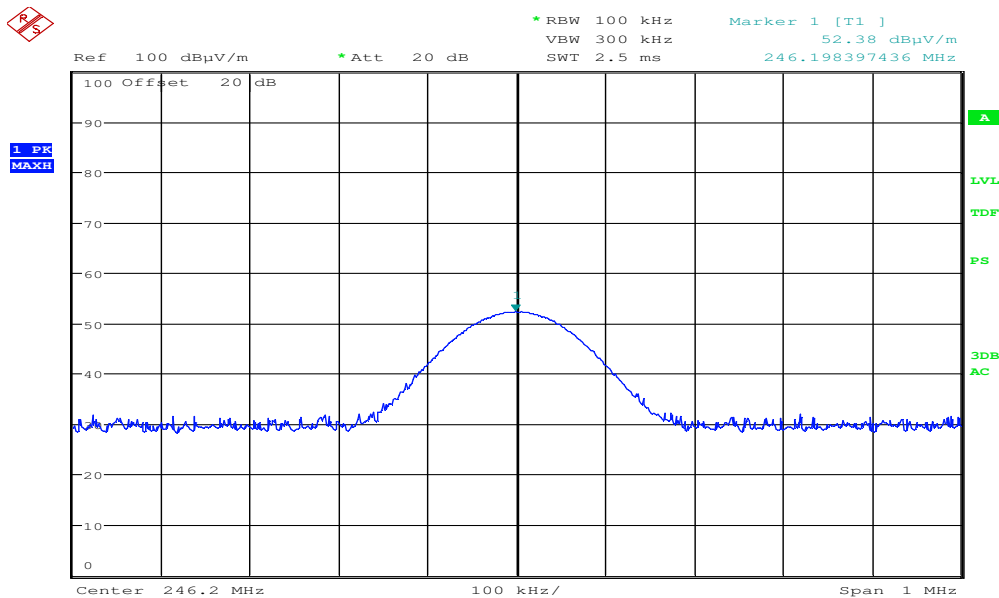
**Field Strength, 1000 – 1250 MHz, CF=123.100 MHz, VP**



Date: 19.MAR.2019 13:17:11

**Field Strength, 243.0 MHz, CF=121.500 MHz, VP**

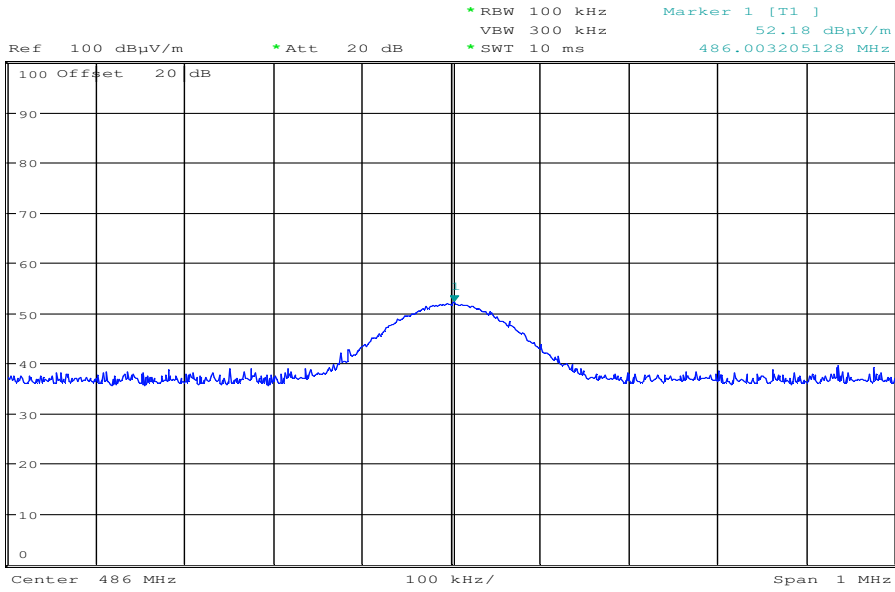
(plot is 20dB offset, actual value is 20 dB lower)



Date: 19.MAR.2019 13:13:12

**Field Strength, 246.2 MHz, CF=123.100 MHz, VP**

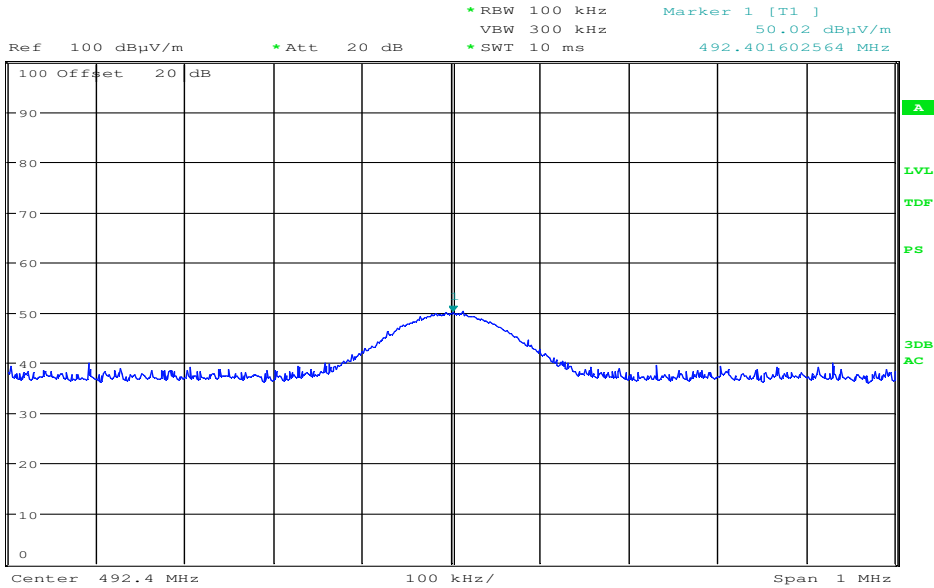
(plot is 20dB offset, actual value is 20 dB lower)



Date: 19.MAR.2019 14:05:23

**Field Strength, 486.0 MHz, CF=121.500 MHz, VP**

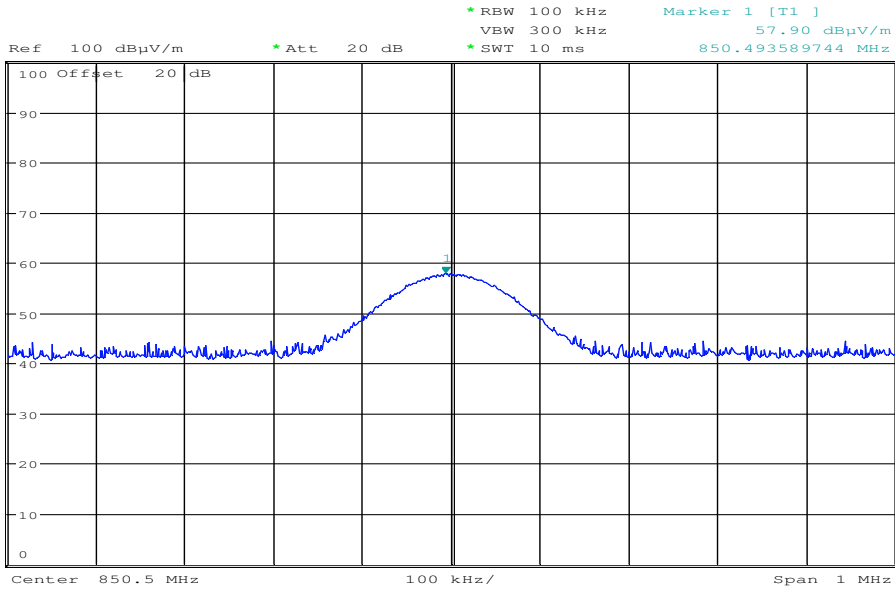
(plot is 20dB offset, actual value is 20 dB lower)



Date: 19.MAR.2019 14:22:33

**Field Strength, 492.4 MHz, CF=123.100 MHz, VP**

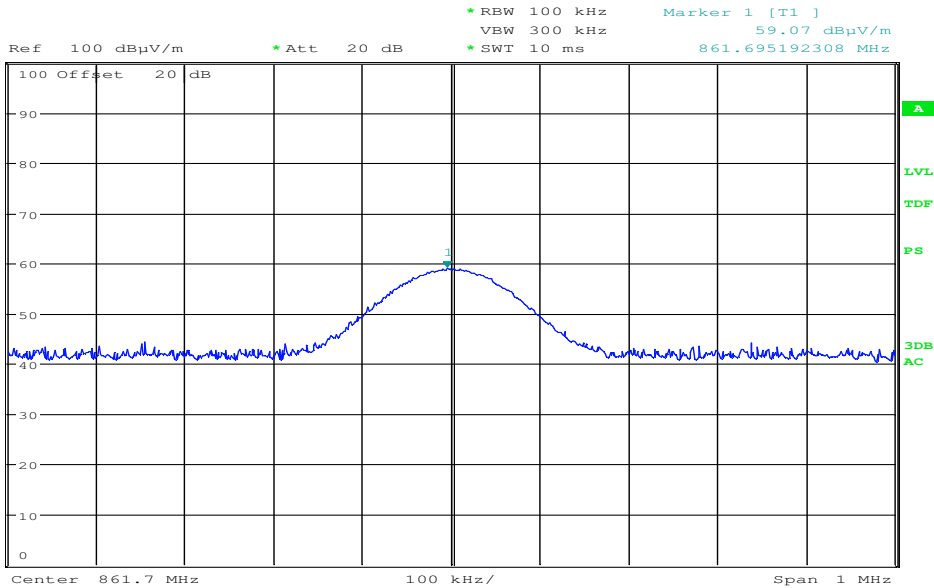
(plot is 20dB offset, actual value is 20 dB lower)



Date: 19.MAR.2019 13:50:03

**Field Strength, 850.5 MHz, CF=121.500 MHz, VP**

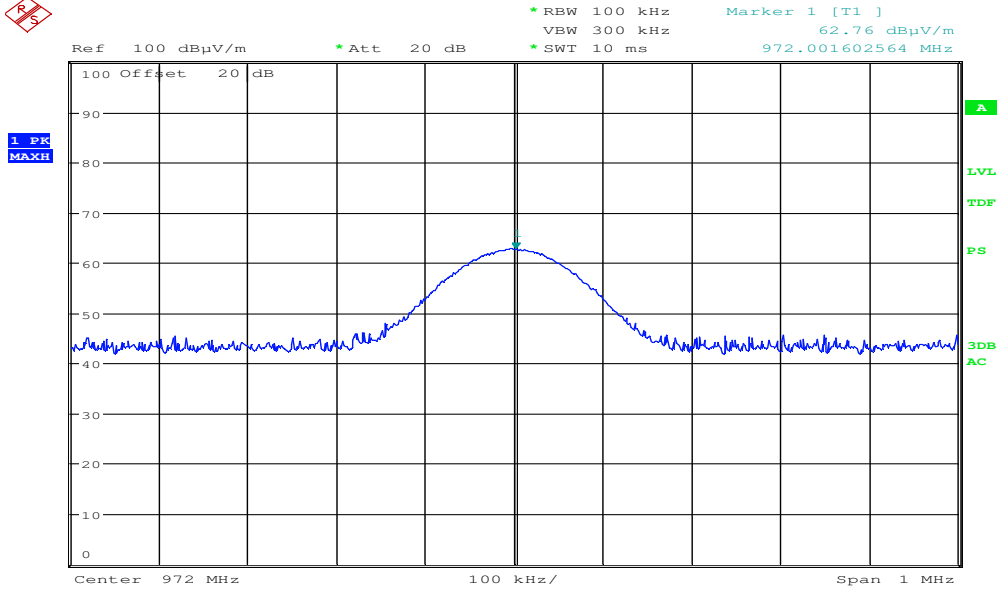
(plot is 20dB offset, actual value is 20dB lower)



Date: 19.MAR.2019 13:47:15

**Field Strength, 861.7 MHz, CF=123.100 MHz, VP**

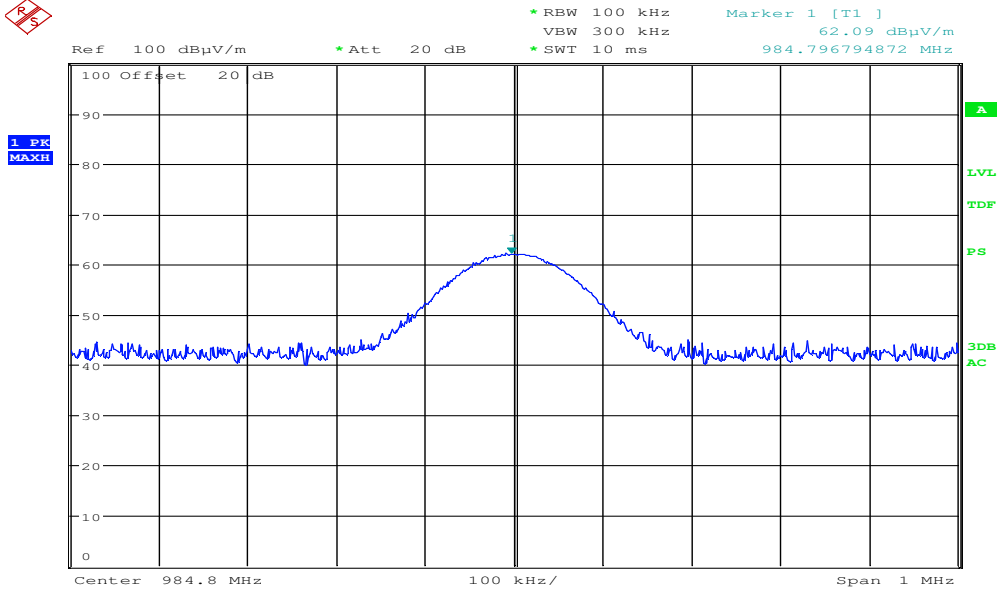
(plot is 20dB offset, actual value is 20dB lower)



Date: 19.MAR.2019 13:34:31

**Field Strength, 972.0 MHz, CF=121.500 MHz, VP**

(plot is 20dB offset, actual value is 20 dB lower than shown in plot)



Date: 19.MAR.2019 13:37:11

**Field Strength, 984.8 MHz, CF=123.100 MHz, VP**

(plot is 20dB offset, actual value is 20 dB lower than shown in plot)

### 3.6 Frequency Stability

FCC §2.1055, 80.209(a)(5)(iii)

Test Results: Complies

Measurement Data:

Temperature	Carrier Frequency 121.500 MHz			Carrier Frequency 123.100 MHz		
	Measured Frequency (MHz)	Deviation (kHz)	Deviation (ppm)	Measured Frequency (MHz)	Deviation (kHz)	Deviation (ppm)
-20 °C	121.5000233	0.0233	0.192	123.1000204	0.0204	0.166
-10 °C	121.4999954	-0.0046	-0.038	123.0999948	-0.0052	-0.042
0 °C	121.5000032	0.0032	0.026	123.1000037	0.0037	0.030
+10 °C	121.5000150	0.0150	0.123	123.1000152	0.0152	0.123
+20 °C	121.5000068	0.0068	0.056	123.1000068	0.0068	0.055
+30 °C	121.4999984	-0.0016	-0.013	123.0999980	-0.0020	-0.016
+40 °C	121.4999832	-0.0168	-0.138	123.0999817	-0.0183	-0.149
+50 °C	121.4999676	-0.0324	-0.267	123.0999674	-0.0326	-0.265

Voltage	Carrier Frequency 121.500 MHz			Carrier Frequency 123.100 MHz		
	Measured Frequency (MHz)	Deviation (kHz)	Deviation (ppm)	Measured Frequency (MHz)	Deviation (kHz)	Deviation (ppm)
6.2 Volts (Nominal)	121.5000060	0.0060	0.049	123.1000072	0.0072	0.058
5.1 Volts (lowest operating voltage)	121.5000071	0.0071	0.058	123.1000075	0.0075	0.061
7.2 Volts (20% above nominal voltage)	121.5000052	0.0052	0.043	123.1000060	0.0060	0.049

**Limit:**

§2.1055 (a) The frequency stability shall be measured with variation of ambient temperature as follows:

(2) From -20° to + 50° centigrade for equipment to be licensed for use in the Maritime Services under part 80 of this chapter.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

(3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

§80.209 (a) The frequency tolerance requirements applicable to transmitters in the maritime services are shown in the following table.

Frequency bands and categories of stations	Tolerances
(iii) Survival craft stations operating on 121.500 MHz	50 ppm



## 4 LIST OF TEST EQUIPMENT

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

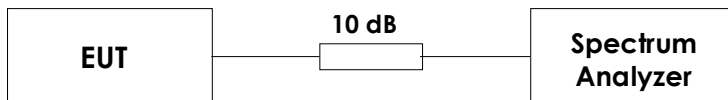
No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	FSW26	Spectrum Analyzer	Rohde & Schwarz	LR 1640	2019-01	2020-01
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2019-01	2020-01
3	6820.17A	Attenuator	Suhner	LR 1131	COU	
4	WHKS200-10SS	Highpass Filter	Wainwright Instruments	LR 1620	COU	
5	JB3	BiLog Antenna	Sunol Sciences	N-4525	2017-11	2020-11
6	Model 317	Preamplifier	Sonoma	LR 1687	2018-07	2019-07
7	3115	Horn Antenna	EMCO	LR 1330	2016-10	2021-10
8	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2018-07	2019-07
9	Model 87 V	Multimeter	Fluke	LR 1600	2018-02	2020-02
10	CPX400S	Power Supply	AimTTi	LR 1713	COU	
11	CMTA54	Radiocomm Analyzer	Rohde & Schwarz	LR 1066	2019-03	2021-03
12	RG223U	RF Cable	Suhner	Nemko	COU	
14	600 ohm	Transformer	Nemko	Nemko	N/A	
15	U2000A	USB Power Sensor	Agilent	LR 1523	2019-03	2020-03

The software listed below has been used for one or more tests in this report.

No.	Manufacturer	Name	Version	Comment
1	Rohde & Schwarz	EMC32	10.30.10	Radiated Emission test software
2	Rohde & Schwarz	GPIBShot	2.7	Screenshots from R&S Spectrum Analyzers
3				

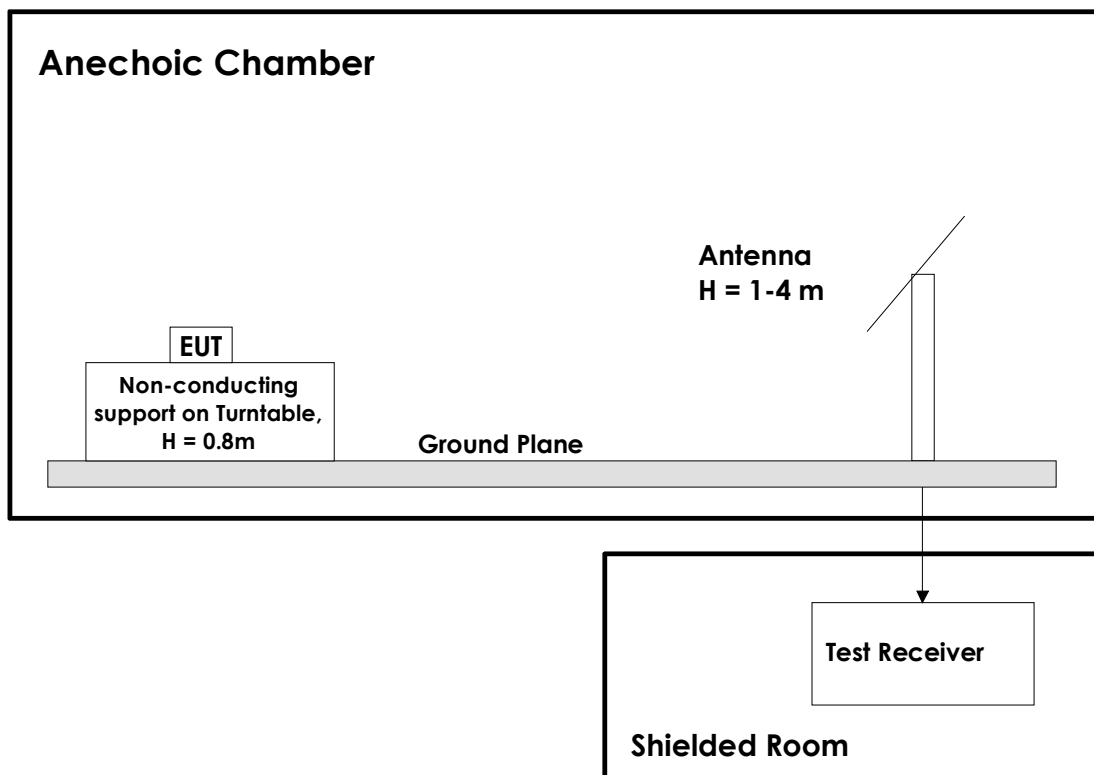
## 5 BLOCK DIAGRAM

### 5.1 Conducted Tests



This test set-up is used for all Conducted tests. A 20dB attenuator was used for all conducted tests.

### 5.2 Test Site Radiated Emission



This test setup is used for all radiated emissions tests. Measuring distance is 3m for all frequencies up to 18 GHz.

Emissions above 1 GHz are measured with a Spectrum Analyzer and Horn Antenna.

All measurements at 1 GHz and above were performed with turntable height 1.5m and with the ground plane covered by absorbers.

A pre-amplifier is used for all measurements and High-Pass filter is used for all harmonics.