

Test Report

Product	Non-Directional Beacon Transmitter		
Name and address of the applicant	Tele Supply AS Fetveien 300 1900 Fetsund, Norway		
Name and address of the manufacturer	Same as above		
Model	JTM-30C		
Rating	24V DC or 85 - 265 V AC		
Trademark	JACOTRON		
Serial number	09274		
Additional information	/		
Tested according to	FCC Part 87 Aviation Services Industry Canada RSS-117, Issue 3 Land and Coast Station Transmitters Operating in Band 200–535 kHz		
Order number	300202		
Tested in period	2016.01.14 to 2016.03.15 and 2016.08.23 to 2016.08.26		
Issue date	2016.08.26		
Name and address of the testing laboratory	<div style="display: flex; align-items: center;">  <div> FCC No: 994405 IC OATS: 2040D-1 TEL: +47 22 96 03 30 FAX: +47 22 96 05 50 </div> </div> <div style="margin-top: 10px;"> Instituttveien 6 Kjeller, Norway </div>		
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%; text-align: center;">  Prepared by [Frode Sveinsen] </div> <div style="width: 45%; text-align: center;">  Approved by [Jan G. Eriksen] </div> </div>			
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1 INFORMATION

1.1 Test Item

Name :	JACOTRON
FCC ID :	2AHVBJTM-30C
Industry Canada ID :	/
Model/version :	JTM-30C
Serial number :	09274
Hardware identity and/or version:	/
Software identity and/or version :	/
Frequency Range :	190 – 535 kHz
Tunable Bands :	190 – 535 kHz
Type of Modulation :	NON and A2A
Occupied bandwidth (99%) :	2.11 kHz
Emission Designator :	2K11A2A
Type of Power Supply :	24V DC or 85 - 265 V AC
Antenna Information :	The EUT uses a unique antenna coupling via ATU (antenna tuning unit)

Product description and theory of operation

The EUT is a radio beacon transmitter that automatically transmits specific beacon identification signals at preselected repetition rates. Special codes may also be transmitted when commanded from an external source. Provision is made for local or remote operation of the transmitter as well as antenna fine-tuning through controls on the transmitters' front panel. Emission is continuous carrier (NON), beacon keyed identification tone (A2A) and beacon.

The EUT has two transmitter modules with different Output Power. Most test have been performed on both modules.

1.2 Test Environment

1.2.1 *Normal test condition*

Temperature:	20 - 24 °C
Relative humidity:	20 - 50 %
Normal test voltage:	24 V DC

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.

2 TEST REPORT SUMMARY

2.1 General

All measurements are traceable to national standards.

The tests were conducted for the purpose of demonstrating compliance with FCC CFR 47 Part 87 and Industry Canada RSS-117 Issue 3.

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

Radiated tests were made in a semi-anechoic chamber at measuring distances of 3m and 10m.

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

☒ New Submission

☒ Production Unit

☐ Class II Permissive Change

☐ Pre-production Unit

TNB 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".

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2.2 Test Summary

Name of test	FCC Part	RSS-117, Issue 3 reference	Result
Output power	87.131 2.1046	3.2, 4.2	Complies
Bandwidth of emissions	87.135 2.1049	4.1	Complies
Emission limitations	87.139 2.1051 2.1053 2.1057	3.3, 4.4	Complies
Frequency stability	87.133 2.1055	3.4, 4.5	Complies
Beacon Transmitters	N/A	4.3	Complies

2.3 Description of modification for Modification Filing

Not applicable.

2.4 Comments

The tested equipment does not have any mechanism for frequency selection. The frequency is changed by programming the unit and by tuning the antenna.

The measurements were done with the EUT powered by 24 V DC. It was checked that power variations between 85% and 115% did not have any influence on the measurements.

All ports were populated during spurious emission measurements.

2.5 Family List Rational

Not Applicable.

3 TEST RESULTS

3.1 Output Power

FCC Part 87.131, 2.1046

Industry Canada RSS-117, Issue 3

Test Results: Complies

Measurement Data:

Carrier Power

Without Modulation, Measured values

Module A	Measured Carrier Power Watts		
	190 kHz	410 kHz	535 kHz
Normal Voltage	62.4	65.0	64.0
Module B	Measured Carrier Power Watts		
	190 kHz	410 kHz	535 kHz
Normal Voltage	23.4	24.2	23.8

Peak Envelope Power (PEP)

1020 Hz, 100% Modulation, Measured values

Module A	Measured Peak Envelope Power (PEP) Watts		
	190 kHz	410 kHz	535 kHz
Normal Voltage	237.1	240.4	248.9
Module B	Measured Peak Envelope Power (PEP) Watts		
	190 kHz	410 kHz	535 kHz
Normal Voltage	83.6	85.7	84.5

Average Power (RMS), Modulated Carrier

1020 Hz, 100% Modulation, Measured values

Module A	Measured Average Output Power (RMS) Watts		
	190 kHz	410 kHz	535 kHz
Normal Voltage (24V DC)	92.5	96.8	96.2
Max. Voltage (21.6V DC)	81.7	85.9	83.2
Min. Voltage (28.6V DC)	92.5	97.9	97.3
Module B	Measured Average Output Power (RMS) Watts		
	190 kHz	410 kHz	535 kHz
Normal Voltage (24V DC)	35.2	36.7	36.4
Max. Voltage (21.6V DC)	35.2	36.7	36.1
Min. Voltage (28.6V DC)	35.2	36.7	36.1

Measured with Spectrum Analyzer in Zero-Span mode and with AM Modulated signal.

FCC Part 87.131:

Frequency, emission, and maximum power will be determined by appropriate standards during the certification process. See FCC Part 87.131 Note 7.

IC RSS-117, Issue 3, clause 4.2:

The output power shall be within ± 1 dB of the manufacturer's rated power listed in the equipment specifications which comply with the limits in Section 3.2.

3.2 Bandwidth of emissions

FCC Part 87.135, 2.1049

Test Results: Complies

Measurement Data:

	Occupied Bandwidth 99%	
	Hz	
Modulation Frequency	400 Hz	1020 Hz
Module A	884	2108
Module B	879	2112

Modulation Index was 100% for this test

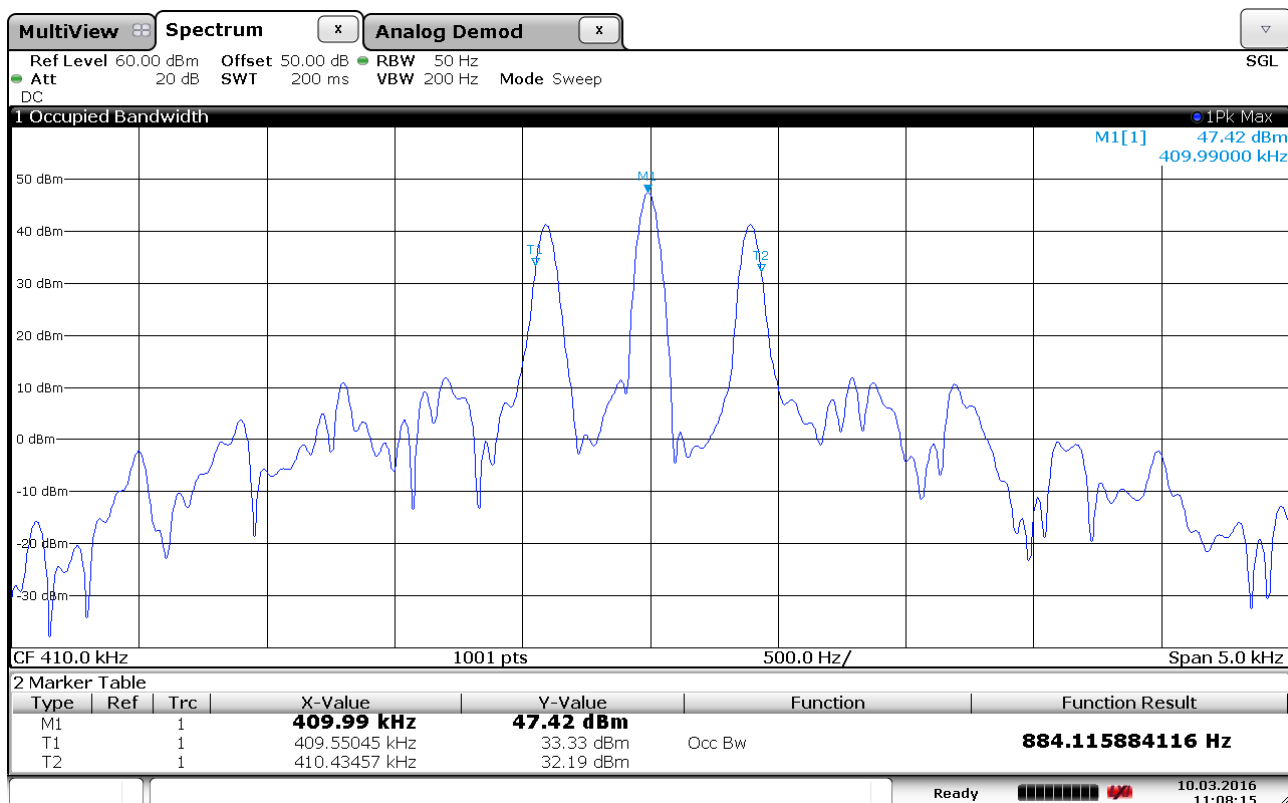
See attached graph.

FCC Part 87.135:

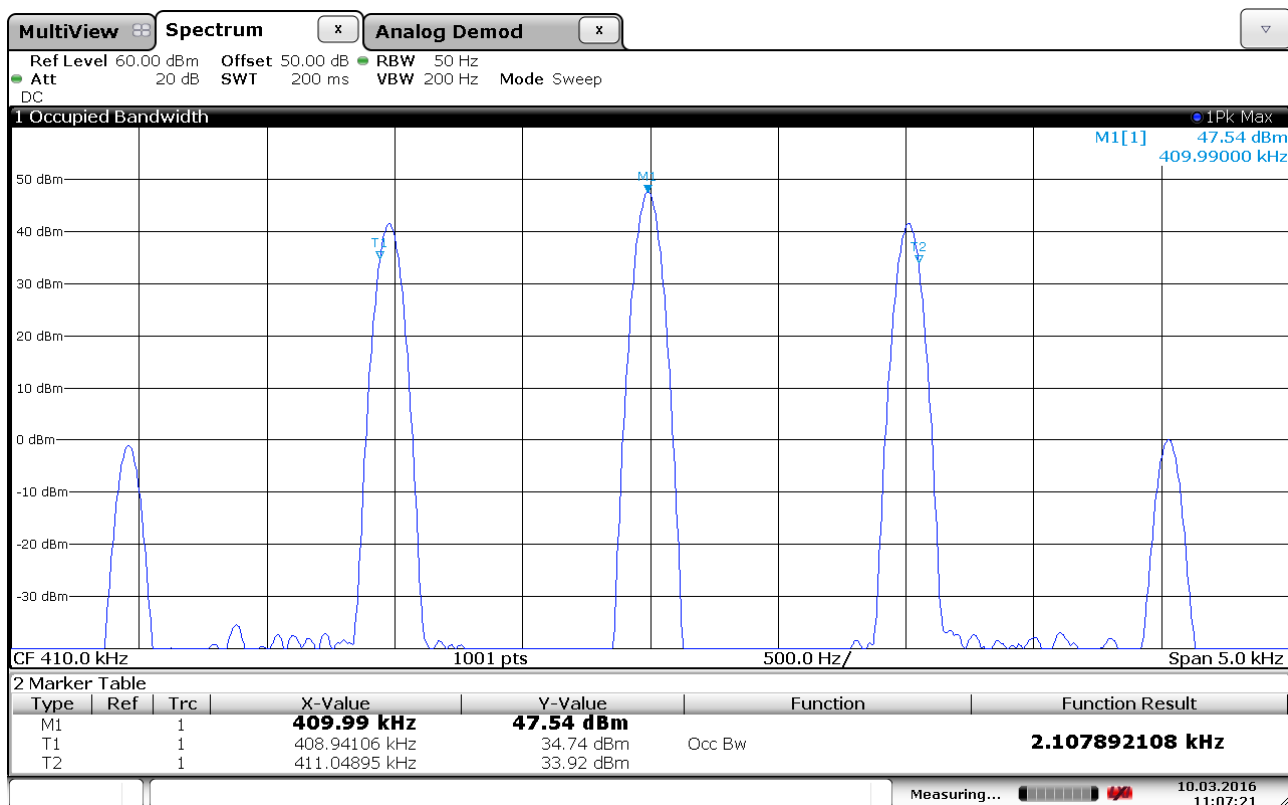
(a) Occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0.5 percent of the total mean power of a given emission.

(b) The authorized bandwidth is the maximum occupied bandwidth authorized to be used by a station.

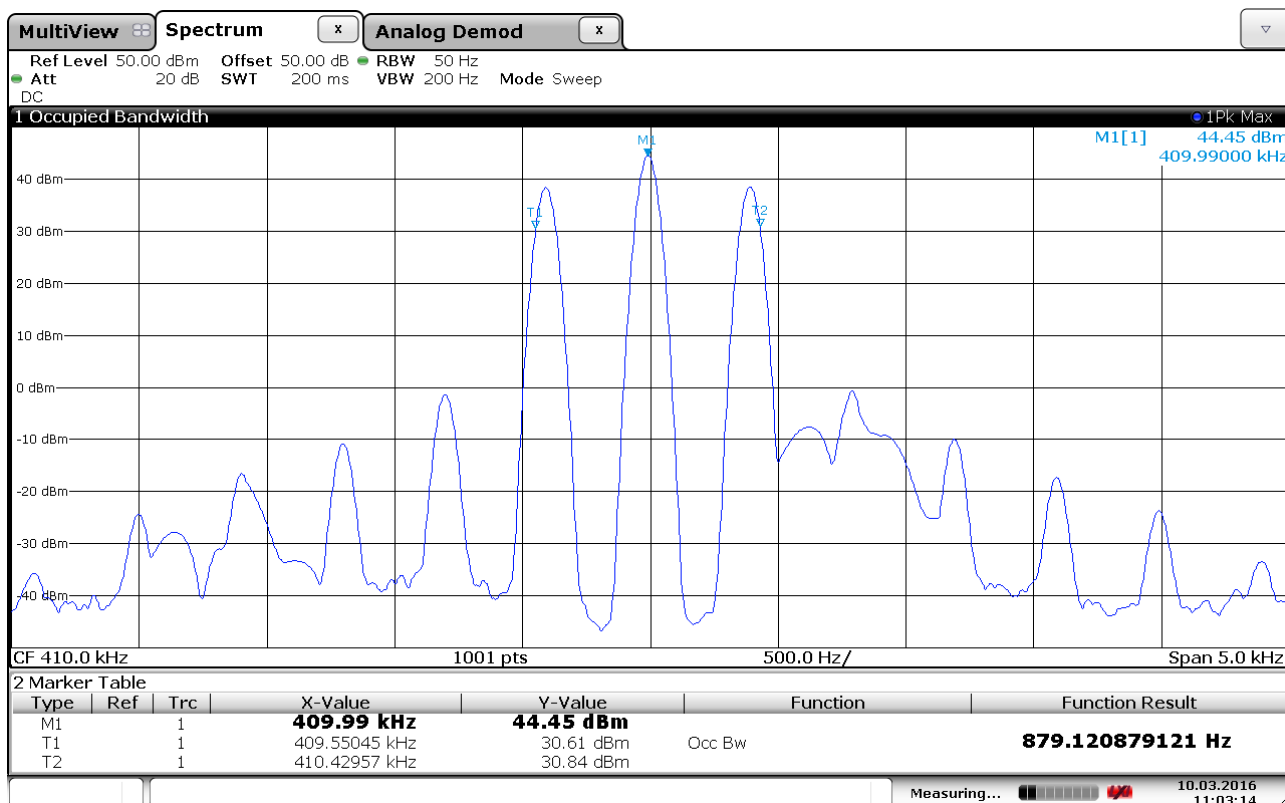
(c) The necessary bandwidth for a given class of emission is the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions.



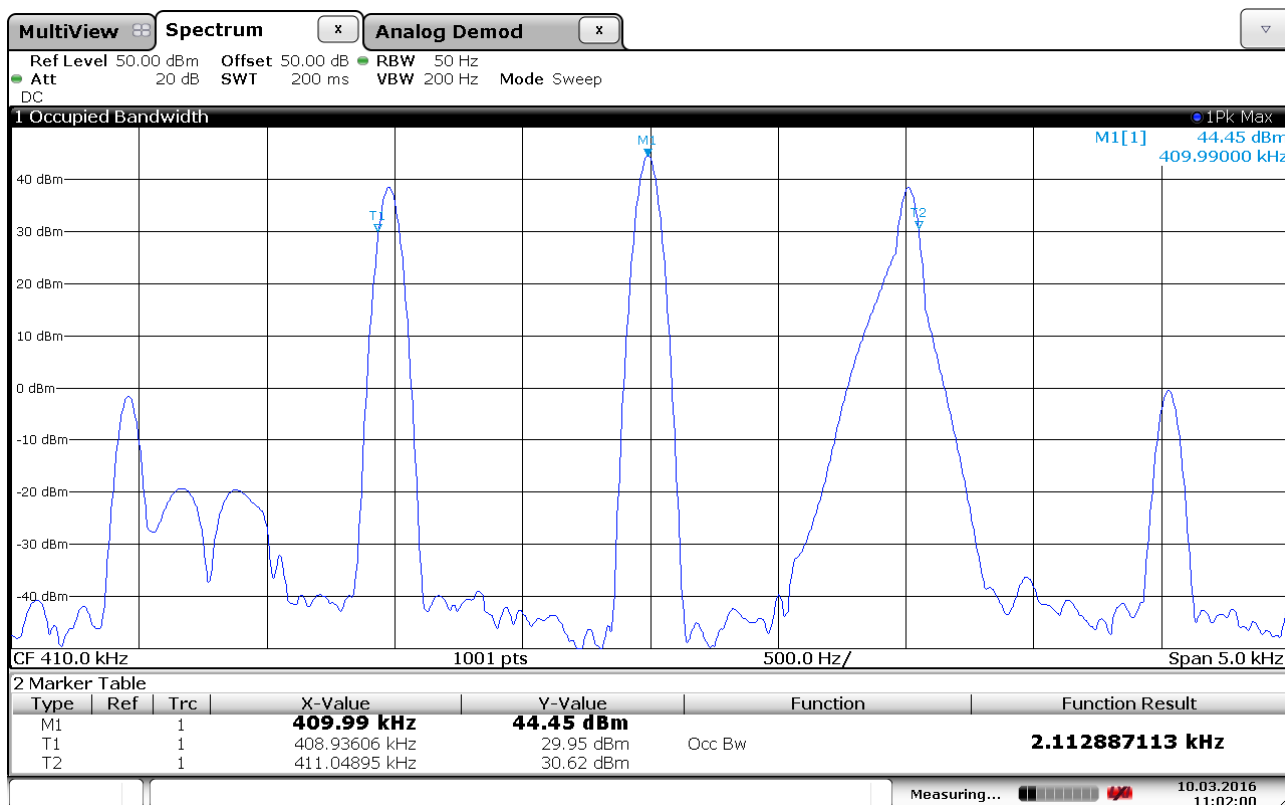
Occupied Bandwidth, 410 kHz, Module A, 400 Hz



Occupied Bandwidth, 410 kHz, Module A, 1020 Hz



Occupied Bandwidth, 410 kHz, Module B, 400 Hz



Occupied Bandwidth, 410 kHz, Module B, 1020 Hz

3.3 Beacon transmitters

Industry Canada RSS-117, clause 4.3

Test Results: Complies

Measurement Data:

	Measured Modulation Tone Hz	
	400 Hz	1020 Hz
Module A – 410 kHz	398.7	1016.6
Module B – 410 kHz	398.7	1016.6

The modulation tone is the same for all frequencies and voltages.

RSS-117, Issue 3, clause 4.3:

Transmitters used as radio beacons shall have an output modulated at 1 020 Hz or 400 Hz as specified by the manufacturer. The tolerance on these tones shall be $\pm 5\%$.

3.4 Spurious emissions at antenna terminal

FCC Part 2.1051, 87.139

Industry Canada RSS-117, Issue 3

Test Results: Complies

Measurement Data:

The spectrum was scanned from 9 kHz to 10th harmonic

The EUT was modulated with 1020 Hz and Modulation Index 100%

The ATU was tuned for each frequency to maximize performance and for optimal VSWR

The measurement was performed with an artificial load at the antenna (10 Ohm, 250 pF)

Radiated measurements were performed at a distance of 10m

Conducted limit of -62.7 dBc was calculated to be equivalent to -13 dBm ($49.7\text{dBm} - 62.7\text{ dBc} = -13.0\text{ dBm}$)

Radiated limit of 73.9 dBμV/m @10m was calculated from -13 dBm as radiated by a half wave dipole antenna

Module A

Carrier Frequency kHz	Spurious Frequency kHz	Spurious Level dBc	Limit dBc
190 kHz	380	-70.3	-62.7
	570	-71.8	-62.7
	All others	< -70	-62.7
410 kHz	820	-68.9	-62.9
	1230	-74.9	-62.9
	4510	-73.2	-62.9
	All others	< -70	-62.9
535 kHz	1070	-69.7	-62.8
	1605	-63.6	-62.8
	2675	-69.8	-62.8
	All others	< -70	-62.8

Module B

Carrier Frequency kHz	Spurious Frequency kHz	Spurious Level dBc	Limit dBc
190 kHz	380	-71.4	-58.5
	570	-74.4	-58.5
	All others	< -75	-58.5
410 kHz	820	-71.4	-58.7
	1230	-72.0	-58.7
	2050	-77.0	-58.7
	All others	< -75	-58.7
535 kHz	1070	-68.9	-58.6
	1605	-71.5	-58.6
	2140	-75.5	-58.6
	All others	< -75	-58.6

Requirements:

FCC Part 87.139(a):

The mean power of any emissions must be attenuated below the mean power of the transmitter (pY) as follows:

- (1) When the frequency is removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth the attenuation must be at least 25 dB;
- (2) When the frequency is removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth the attenuation must be at least 35 dB.
- (3) When the frequency is removed from the assigned frequency by more than 250 percent of the authorized bandwidth the attenuation for aeronautical station transmitters must be at least $43 + 10 \log_{10} pY$ dB.

IC RSS-117, Issue 3, clause 4.4:

Under the test described in the preceding Section 3.3.2, the land and coast stations' transmitter unwanted emissions shall be attenuated below the unmodulated carrier as follows:

- (1) When the frequency is removed from the assigned frequency by more than 50 percent up to and including 150 percent of necessary bandwidth the attenuation below the unmodulated carrier must be at least 26 dB;
 - (2) When the frequency is removed from the assigned frequency by more than 150 percent up to and including 250 percent of the authorized bandwidth the attenuation below the unmodulated carrier must be at least 32 dB.
 - (3) When the frequency is removed from the assigned frequency by more than 250 percent of the authorized bandwidth the attenuation below the unmodulated carrier must be at least 40 dB or 25 mW (whichever is more stringent).
- (NOTE: Since the unmodulated output power is below 250 W, it means that 40 dB is the more stringent requirement).



MARKER 1

190 kHz

*RBW 100 Hz

Marker 1 [T1]

VBW 300 Hz

47.84 dBm

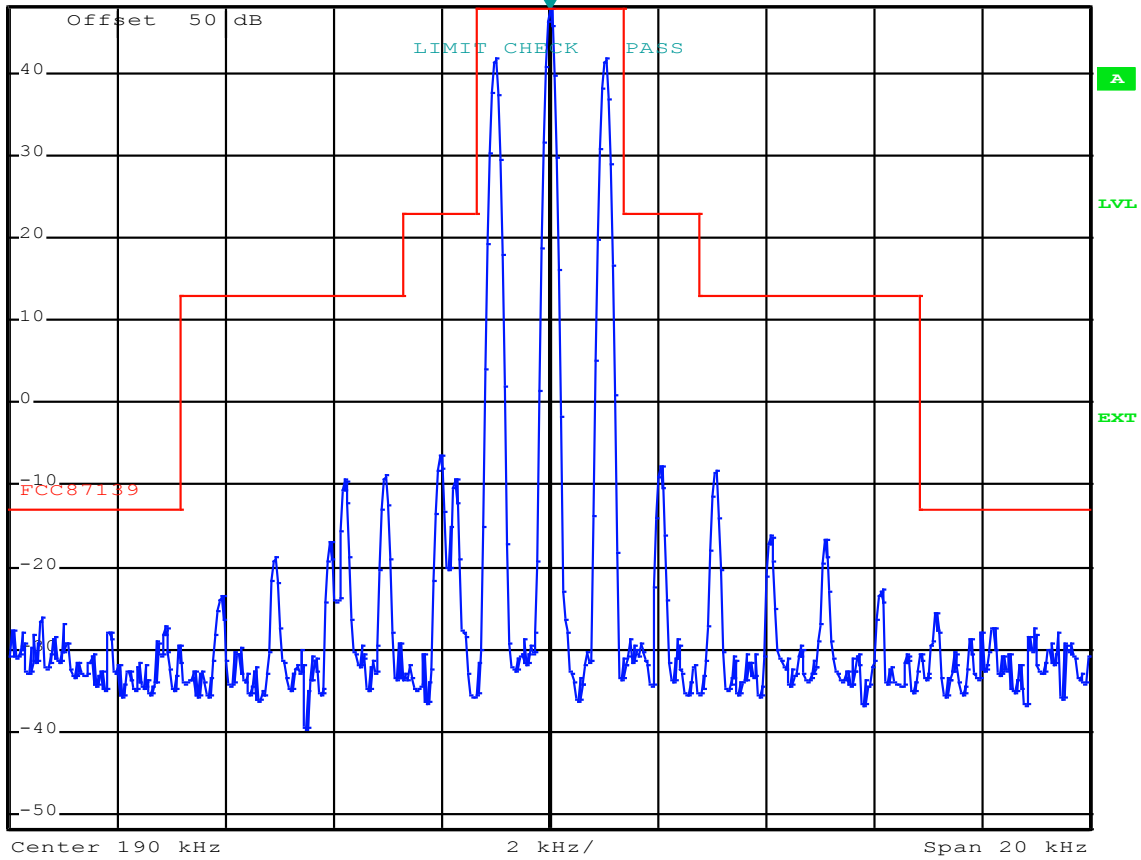
Ref 48 dBm

*Att 30 dB

1 SWT 2.4 s

190.000000000 kHz

1 PK
MAXH



Date: 14.JAN.2016 14:41:43

Emission Mask, 190 kHz, Module A, 1020 Hz

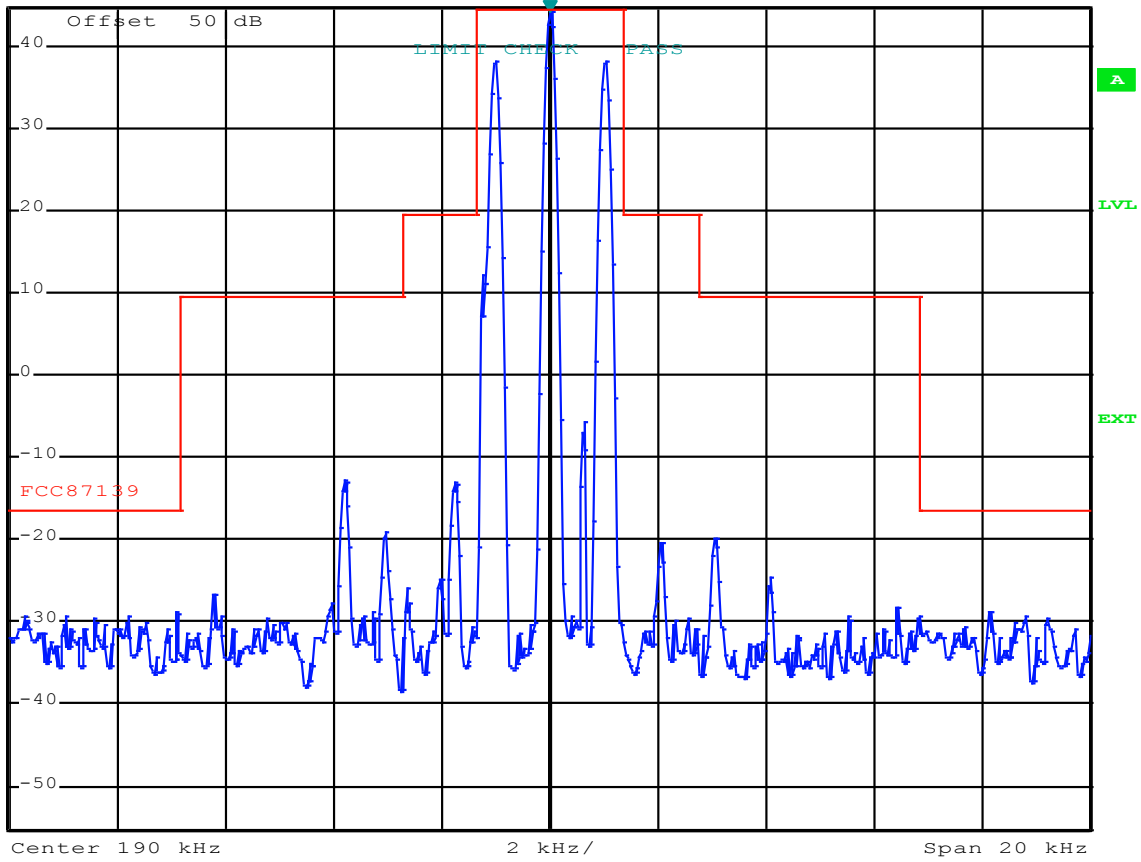


MARKER 1
190 kHz

*RBW 100 Hz Marker 1 [T1]
VBW 300 Hz 44.23 dBm

Ref 44.5 dBm *Att 30 dB 1 SWT 2.4 s 190.000000000 kHz

1 PK
MAXH



Date: 14.JAN.2016 14:50:08

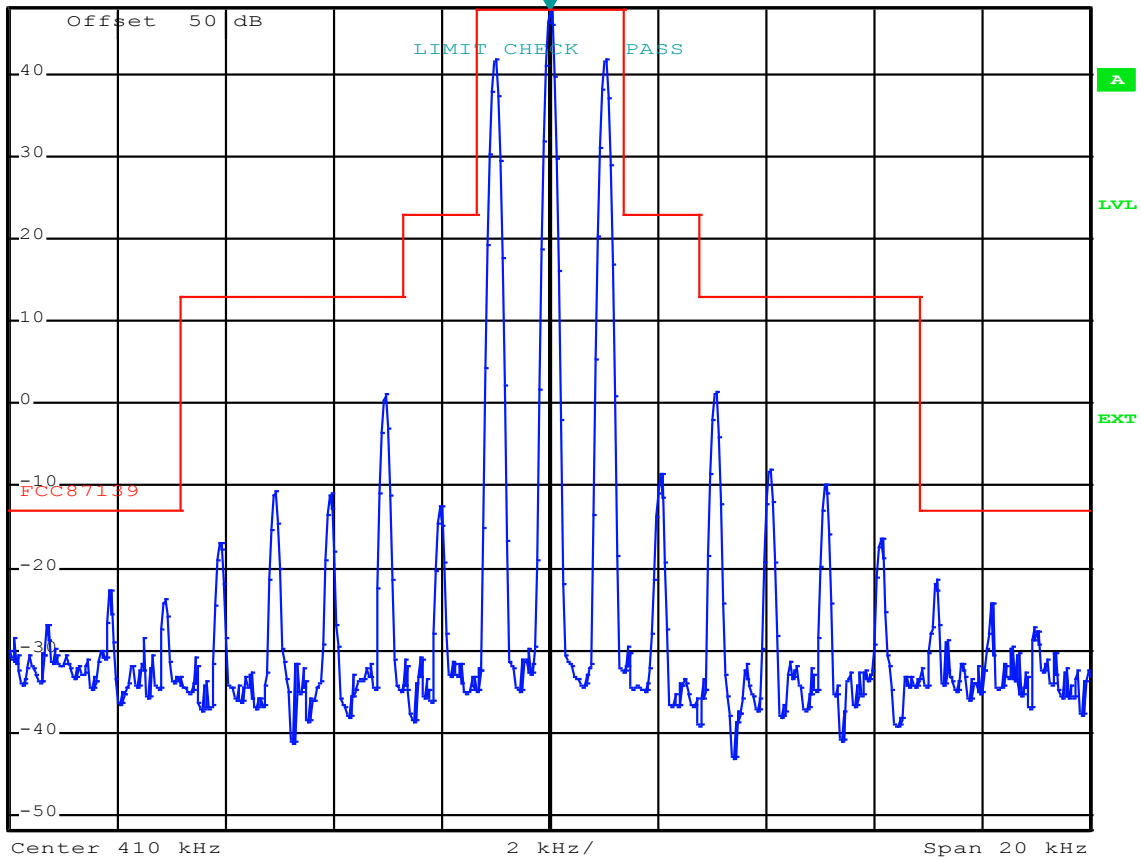
Emission Mask, 190 kHz, Module B, 1020 Hz



MARKER 1
410 kHz

*RBW 100 Hz Marker 1 [T1]
VBW 300 Hz 47.95 dBm
Ref 48 dBm *Att 30 dB 1 SWT 2.4 s 410.000000000 kHz

1 PK
MAXH



Date: 14.JAN.2016 14:39:24

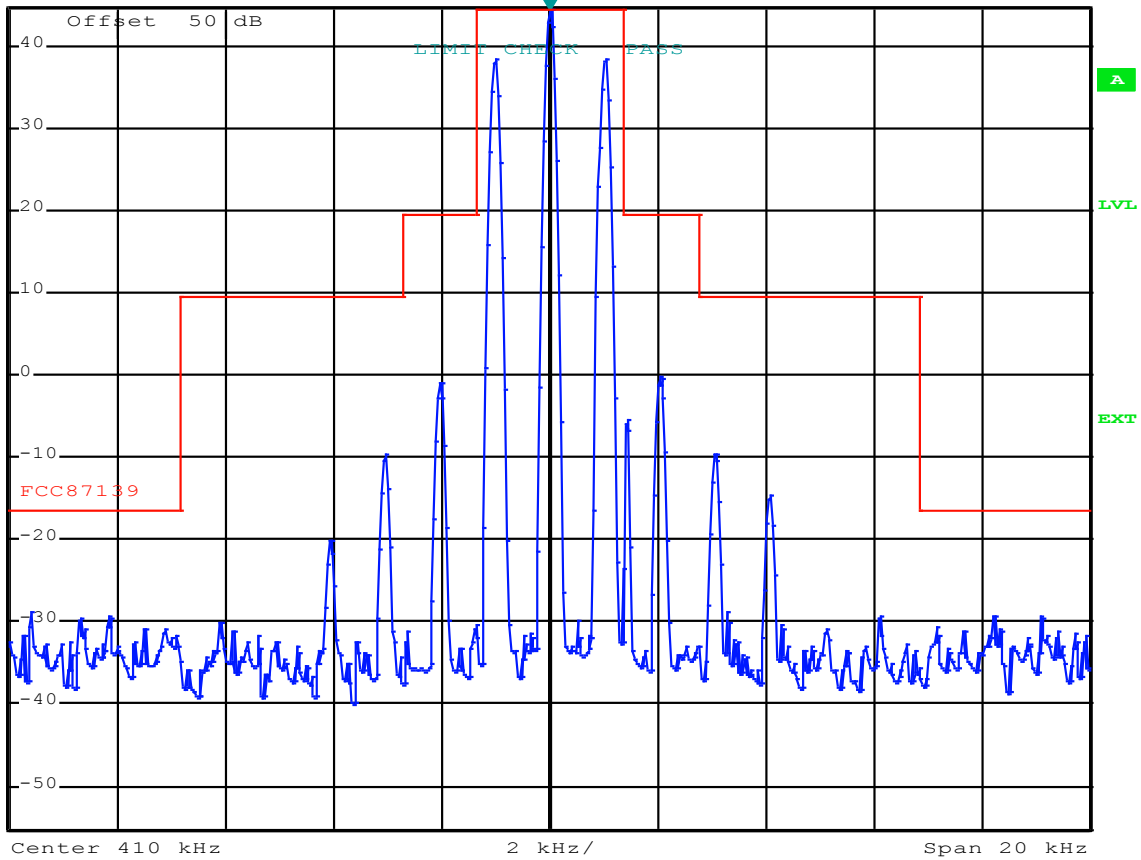
Emission Mask, 410 kHz, Module A, 1020 Hz



MARKER 1
410 kHz

*RBW 100 Hz Marker 1 [T1]
VBW 300 Hz 44.32 dBm
Ref 44.5 dBm *Att 30 dB 1 SWT 2.4 s 410.000000000 kHz

1 PK
MAXH



Date: 14.JAN.2016 14:48:30

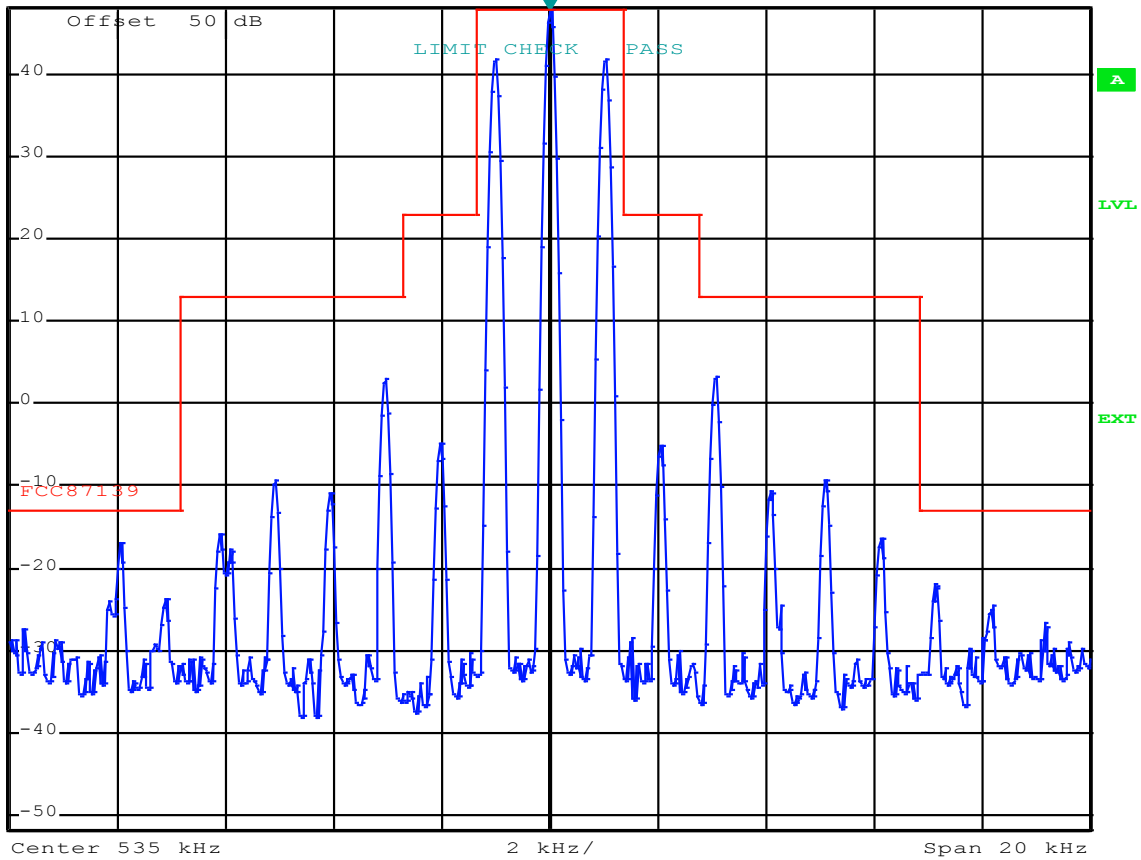
Emission Mask, 410 kHz, Module B, 1020 Hz



MARKER 1
535 kHz

*RBW 100 Hz Marker 1 [T1]
VBW 300 Hz 47.90 dBm
Ref 48 dBm *Att 30 dB 1 SWT 2.4 s 535.000000000 kHz

1 PK
MAXH



Date: 14.JAN.2016 14:36:49

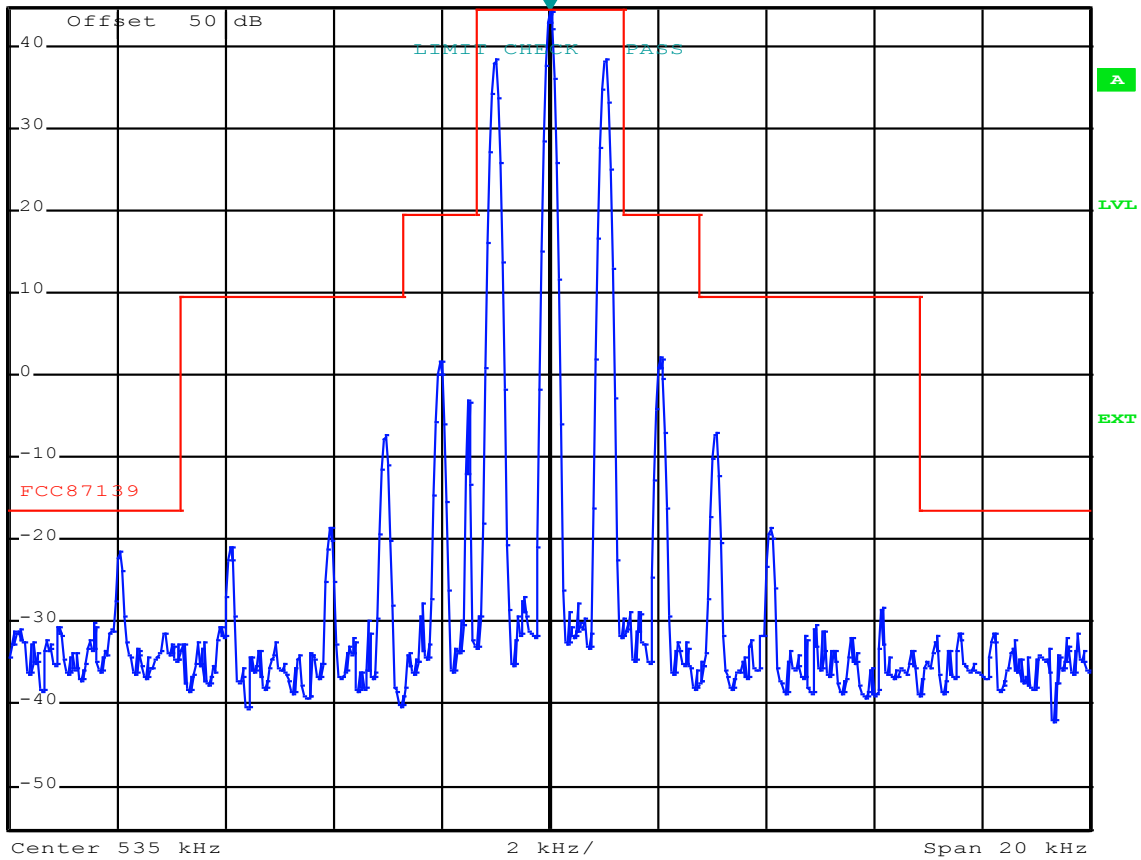
Emission Mask, 535 kHz, Module A, 1020 Hz



MARKER 1
535 kHz

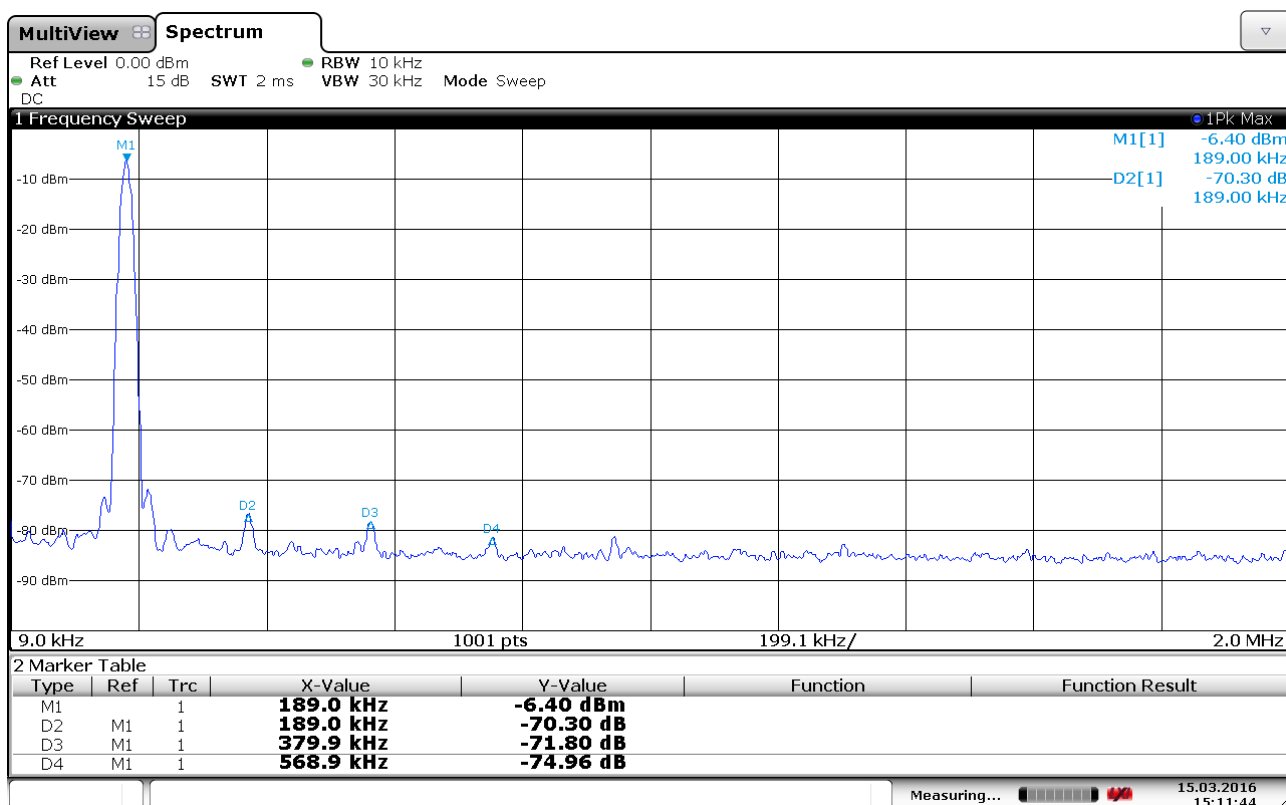
*RBW 100 Hz Marker 1 [T1]
VBW 300 Hz 44.25 dBm
Ref 44.5 dBm *Att 30 dB 1 SWT 2.4 s 535.000000000 kHz

1 PK
MAXH

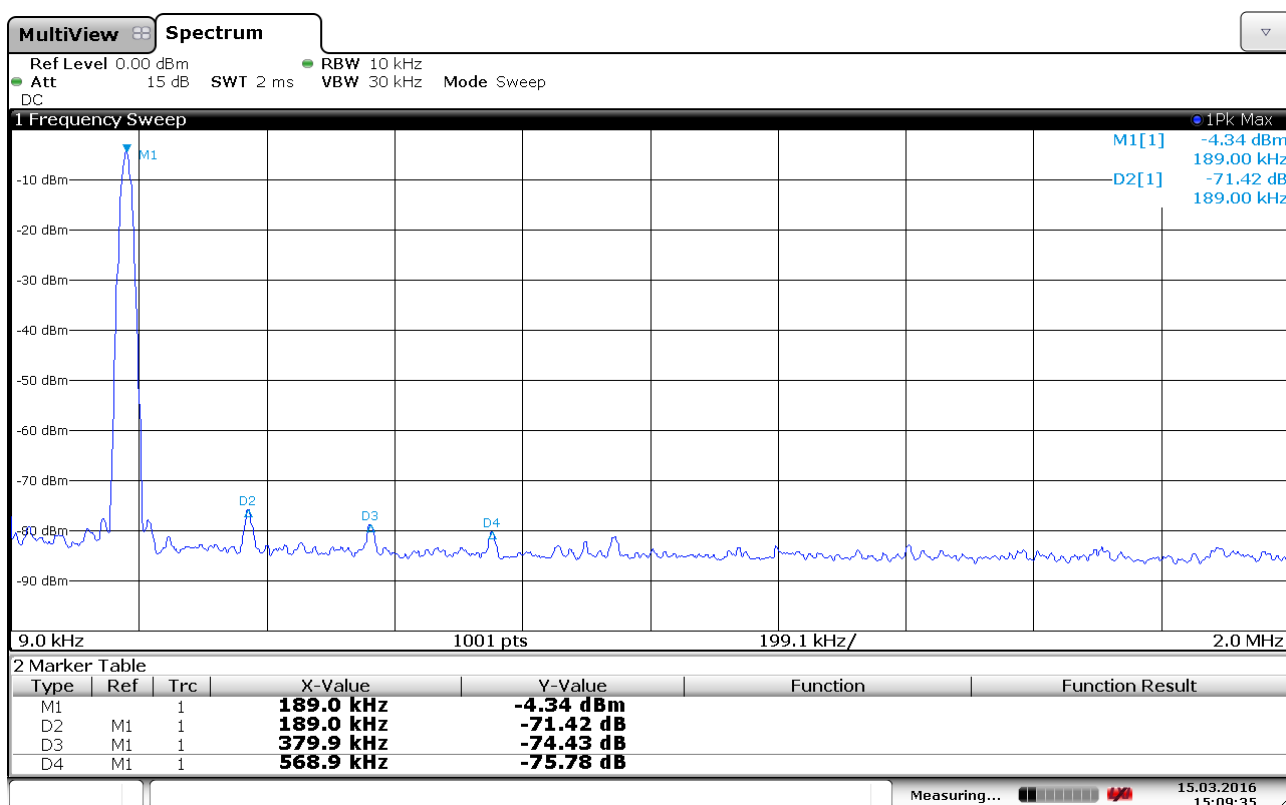


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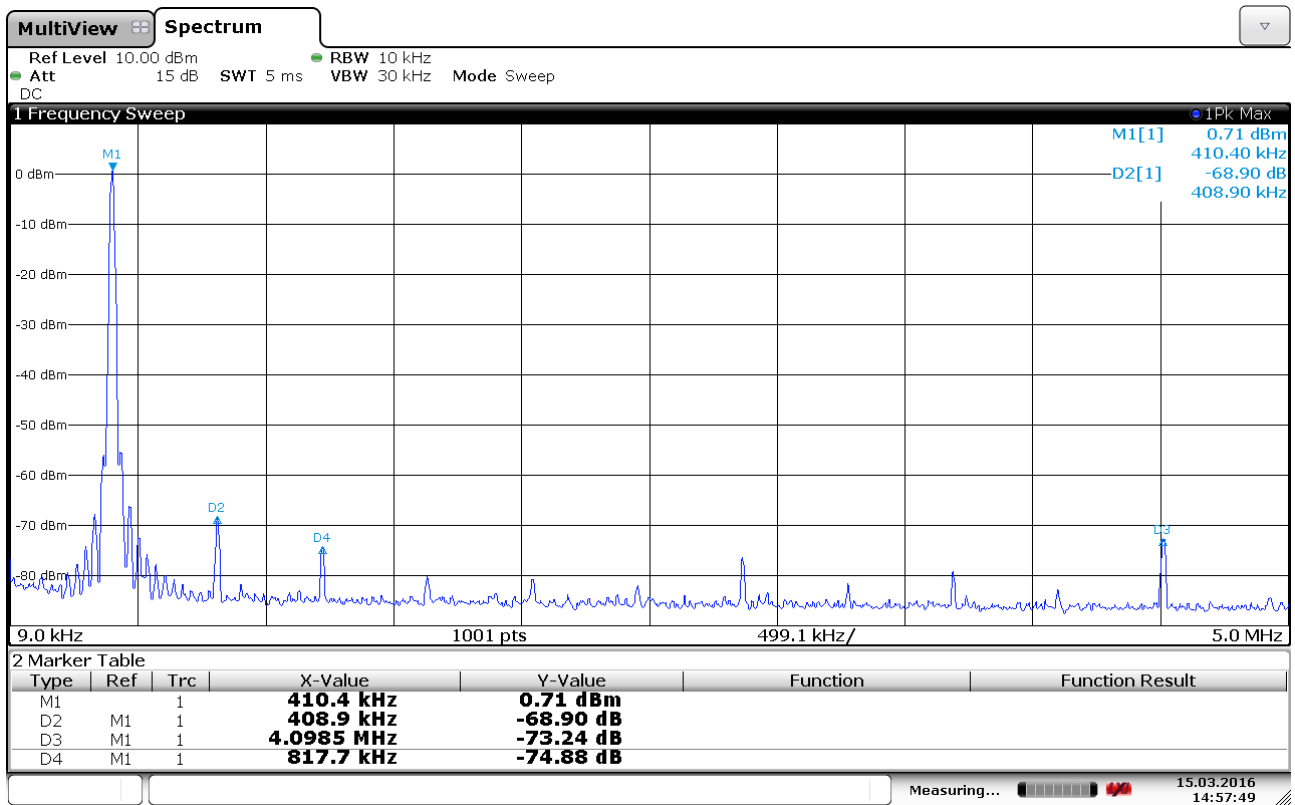
Emission Mask, 535 kHz, Module B, 1020 Hz



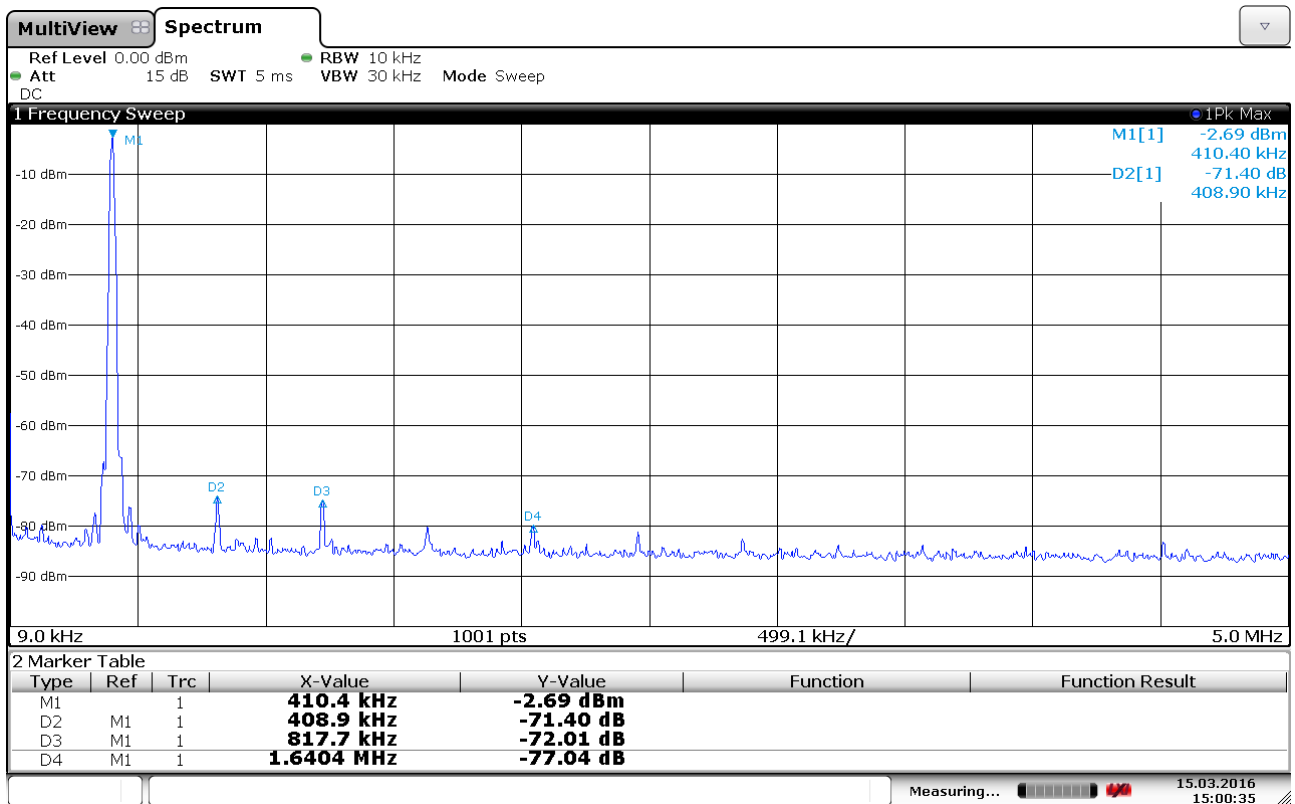
Out-of-Band Emissions, 9 kHz – 2 MHz, 190 kHz, Module A



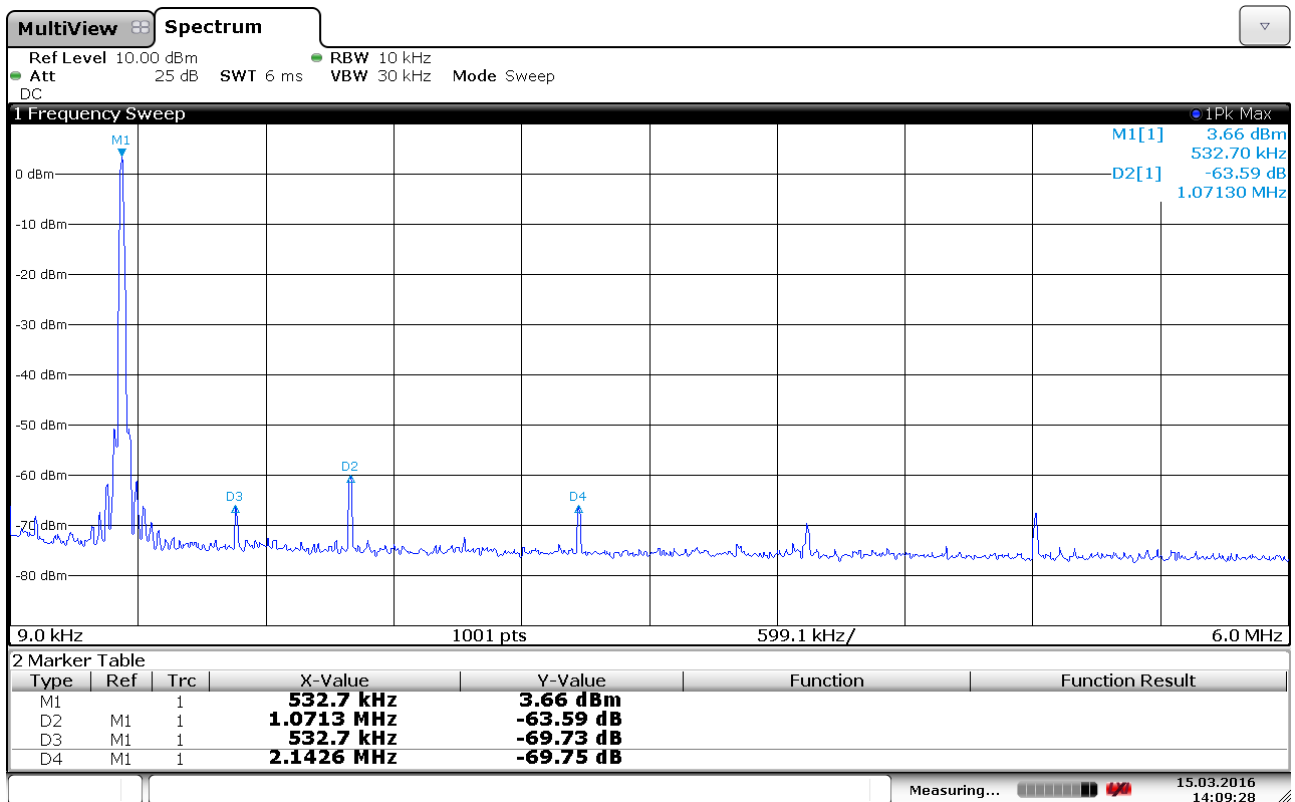
Out-of-Band Emissions, 9 kHz – 2 MHz, 190 kHz, Module B



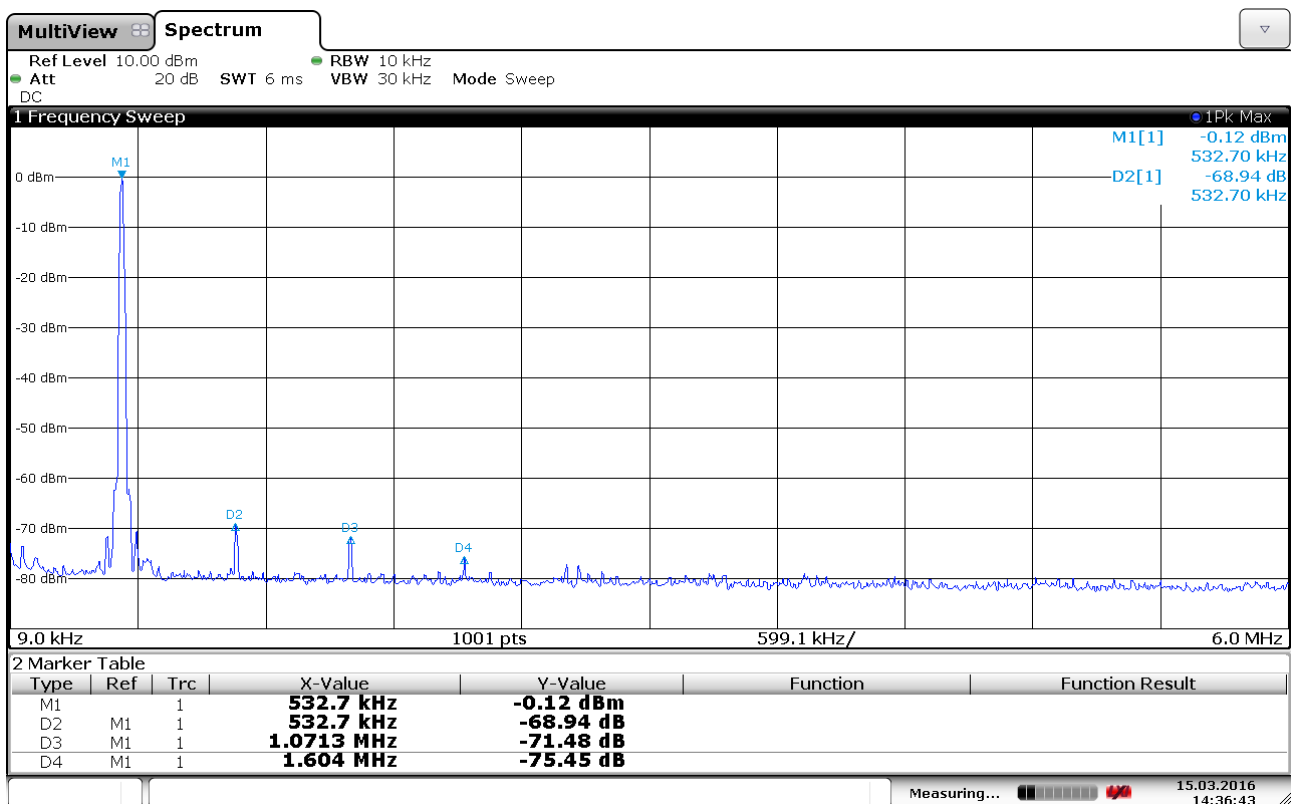
Out-of-Band Emissions, 9 kHz – 5 MHz, 410 kHz, Module A



Out-of-Band Emissions, 9 kHz – 5 MHz, 410 kHz, Module B



Out-of-Band Emissions, 9 kHz – 6 MHz, 535 kHz, Module A



Out-of-Band Emissions, 9 kHz – 6 MHz, 535 kHz, Module B



DELTA MARKER 2

190.625 kHz

Ref 100 dBµV/m

*Att 0 dB

*RBW 10 kHz

VBW 30 kHz

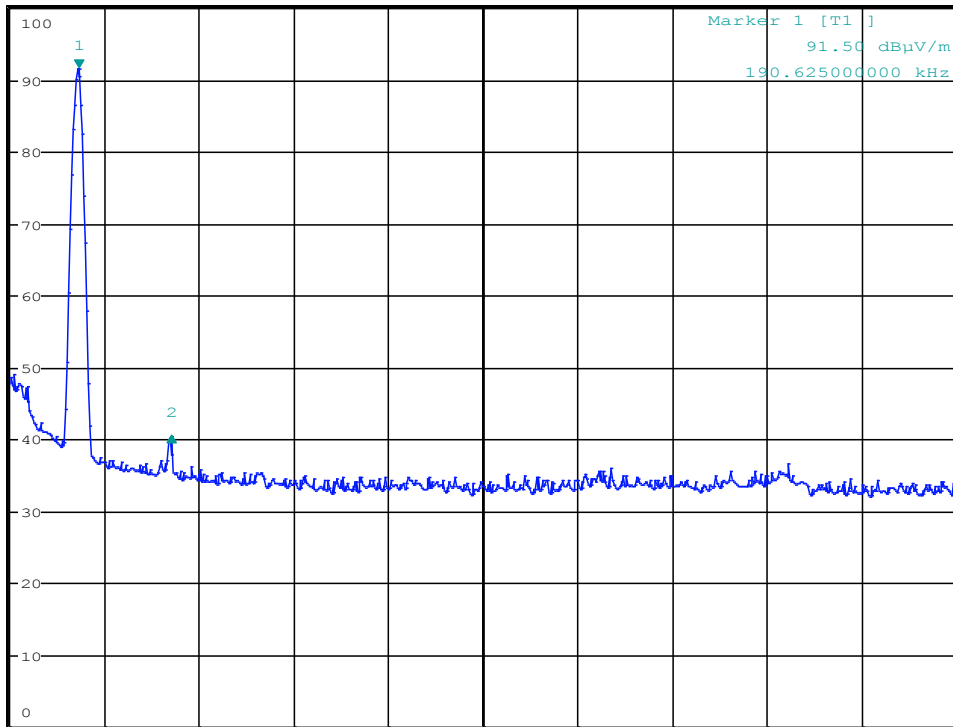
SWT 80 ms

Delta 2 [T1]

-51.14 dB

190.62500000 kHz

1 PK
MAXH



Start 50 kHz

195 kHz/

Stop 2 MHz

Date: 15.JAN.2016 14:49:49

Radiated emissions, 50 -2000 kHz, 190 kHz

Limit: 73.9 dBµV/m



MARKER 2

1.639102564 MHz

Ref 100 dBμV/m

*Att 0 dB

*RBW 10 kHz

VBW 30 kHz

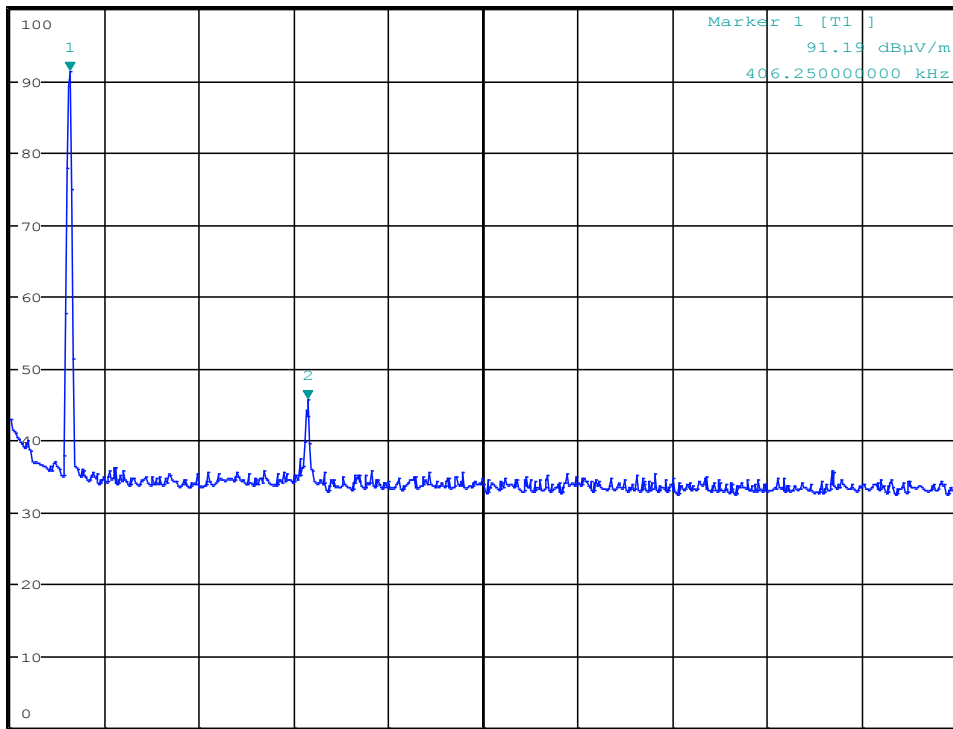
SWT 80 ms

Marker 2 [T1]

45.73 dBμV/m

1.639102564 MHz

1 PK
MAXH



Start 100 kHz

490 kHz/

Stop 5 MHz

Date: 15.JAN.2016 14:18:21

Radiated emissions, 100 -5000 kHz, 410 kHz

Limit: 73.9 dBμV/m



MARKER 2

1.603365385 MHz

Ref 107 dBµV/m

*Att 0 dB

*RBW 30 kHz

VBW 100 kHz

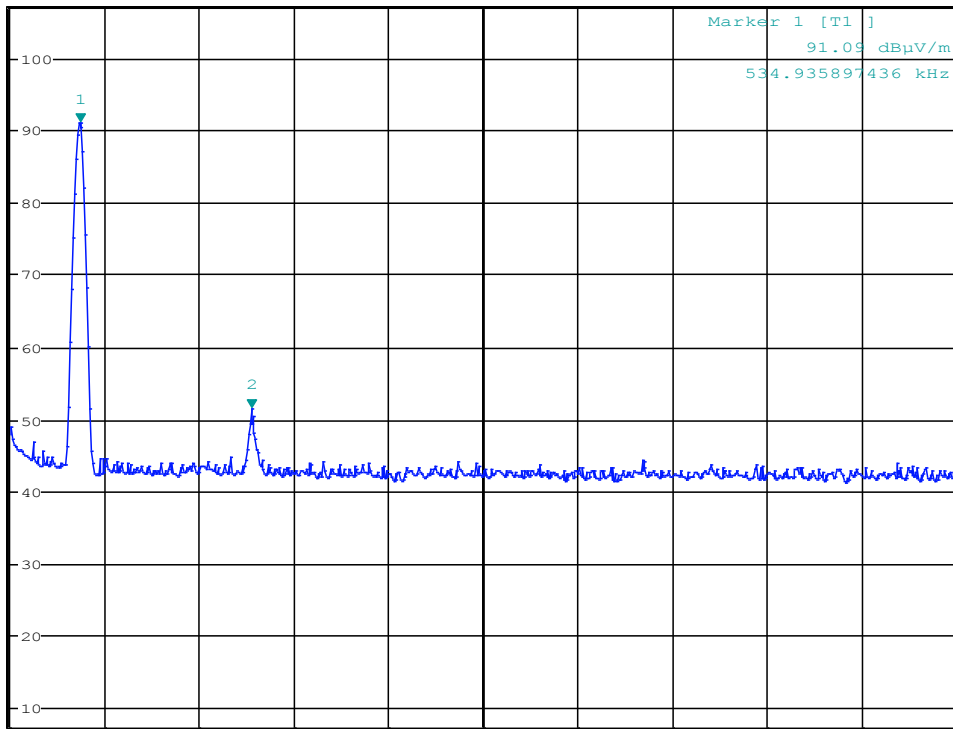
SWT 30 ms

Marker 2 [T1]

51.49 dBµV/m

1.603365385 MHz

1 PK
MAXH



Start 100 kHz

590 kHz/

Stop 6 MHz

Date: 15.JAN.2016 15:08:11

Radiated emissions, 100 -6000 kHz, 535 kHz

Limit: 73.9 dBµV/m

3.5 Frequency Stability

FCC Part 2.1055, 87.133

IC RSS-117, Issue 3

Test Results: Complies

Measurement Data:

Module A	Measured Frequency (kHz)	Deviation (Hz)	Deviation (ppm)
+50 °C	409.999629	-0.015	-0.04
+40 °C	409.999560	-0.085	-0.20
+30 °C	409.999620	-0.024	-0.06
+20 °C	409.999644	Reference	Reference
+10 °C	409.999655	0.011	0.03
0 °C	409.999585	-0.059	-0.14
-10 °C	409.999586	-0.058	-0.14
-20 °C	409.999524	-0.120	-0.29
-30 °C	409.999510	-0.134	-0.33
Module B	Measured Frequency (kHz)	Deviation (Hz)	Deviation (ppm)
+50 °C	409.999166	0.031	0.08
+40 °C	409.999157	0.022	0.05
+30 °C	409.999165	0.030	0.07
+20 °C	409.999135	Reference	Reference
+10 °C	409.999182	0.047	0.11
0 °C	409.999129	-0.006	-0.01
-10 °C	409.999134	-0.001	0.00
-20 °C	409.999151	0.016	0.04
-30 °C	409.999219	0.084	0.20

Module A	Measured Frequency (MHz)	Deviation (kHz)	Deviation (ppm)
27.6 Volts	409.999644	0.000	0.00
24.0 Volts DC	409.999644	Reference	Reference
20.4 Volts DC	409.999648	0.004	0.01
Module B	Measured Frequency (MHz)	Deviation (kHz)	Deviation (ppm)
27.6 Volts	409.999129	-0.006	-0.01
24.0 Volts DC	409.999135	Reference	Reference
20.4 Volts DC	409.999127	-0.008	-0.02

Requirements:

FCC Part 87.133:

(1) Band-9 to 535 kHz:

Radionavigation stations: 100 ppm

IC RSS-117, Issue 3, clause 4.5:

The maximum departure, under any environmental condition, of the measured frequency from the standard test frequency shall not exceed 0.01% (100 ppm).

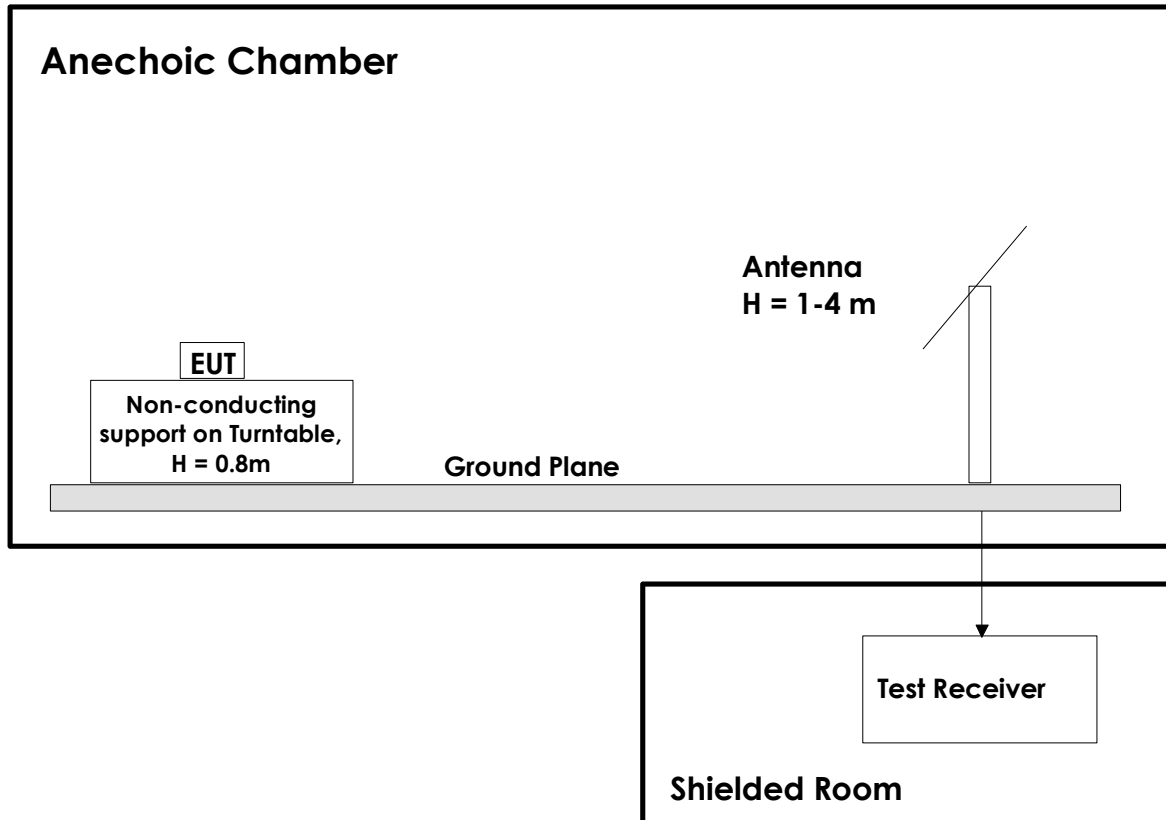
4 LIST OF TEST EQUIPMENT

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	2015.11	2016.11
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2015.11	2016.11
3	8321	Attenuator	Bird	LR 061	Cal b4 use	
4	768-20	Attenuator	Narda	LR 1202	2015.03	2017.03
5	HFH2-Z2	Loop Antenna	Rohde & Schwarz	LR 1660	2014.10	2016.10
6	Model 87V	Multimeter	Fluke	N-4669	2014.09	2016.09
7	6032A	Power Supply	Hewlett Packard	LR 1051	N/A	
8	/	Dummy load	Nemko	LR 1588	N/A	
9	/	250pF Capacitor	Nemko	LR 1588	N/A	
10	FSW43	Spectrum Analyzer	Rohde & Schwarz	LR 1690	2016.07	2017.07

5 BLOCK DIAGRAM

5.1 Test Site Radiated Emission



Revision history

Version	Date	Comment	Sign
1.0	2016.04.07	First edition	FS
2.0	2016.08.26	Output Power retested and some minor corrections	FS