FCC PART 80

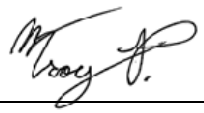
TEST AND MEASUREMENT REPORT

For

JVC Kenwood Corporation

Communications System Division
1-16-2, Hakusan, Midori-ku
Yokohama-shi, Kanagawa-ken, Japan

FCC ID: K44431400

Report Type: CIIPC		Product Model: NX-5200-K3
Prepared By:	Troy Pandhumsoporn Test Engineer	
Report Number:	R1802158-80 Rev A	
Report Date:	2018-03-16	
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1802158-80	CIIPC	2018-02-26
A	R1802158-80 Rev A	Revised frequency tolerance measurement results in Section 10.5 per customer request	2018-03-16

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report has been compiled on behalf of *JVC Kenwood Corporation* and their product model: *NX-5200-K3, FCC ID: K44431400,* which henceforth is referred to as the EUT (Equipment Under Test). The EUT is a VHF Digital Maritime Transceiver.

The Customer declares: "This device supports the frequency range 150-174 MHz. Only for Part80 Analog 25kHz, this device just allow to use the available channels within 154-162.0375MHz." The following test frequencies were requested by the customer:

EUT Type (Worst Case)	Battery (Worst Case)	Test Frequency (MHz)	Antenna (Worst Case)
Stand alone	KNB-L3	138.05	KRA-26(M3)
			KRA-22(M3)
			KRA-41(M3)
		143.95	KRA-26(M3)
			KRA-22(M3)
			KRA-41(M3)
			KRA-28
		148.05	KRA-26(M)
			KRA-26(M3)
			KRA-22(M)
			KRA-22(M3)
			KRA-41(M)
			KRA-41(M3)
			KRA-25
			KRA-28
		150.05	KRA-26(M)
			KRA-22(M)
			KRA-41(M)
			KRA-25
			KRA-28
		162.05	KRA-26(M2)
			KRA-22(M2)
			KRA-41(M2)
			KRA-28
		173.95	KRA-26(M2)
			KRA-22(M2)
			KRA-41(M2)

1.2 Objective

The following type approved report is prepared on behalf of *JVC Kenwood Corporation* in accordance with Part 80 of the Federal Communications Commission rules, Stations in the Maritime Services.

The objective is to determine compliance with Part 80 of the FCC Rules, limits for RF output power, Modulation requirements, Operating bandwidth, Field strength of spurious radiation, Frequency Tolerance, Emission Limitations, and Emissions at Antenna Terminals.

1.3 Related Submittal(s)/Grant(s)

N/A

1.4 Test Methodology

All measurements contained in this report were conducted in accordance with TIA 603-E Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

All tests were performed at Bay Area Compliance Laboratories Corp.

1.5 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR16-4-2:2011, The Treatment of Uncertainty in EMC Measurements, the values ranging from ±2.0 dB for Conducted Emissions tests and ±4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

1.6 Test Facility Registrations

BACLs test facilities that are used to perform Radiated and Conducted Emissions tests are currently recognized by the Federal Communications Commission as Accredited with NIST Designation Number US1129.

BACL's test facilities that are used to perform Radiated and Conducted Emissions tests are currently registered with Industry Canada under Registration Numbers: 3062A-1, 3062A-2, and 3062A-3.

BACL is a Chinese Taipei Bureau of Standards Metrology and Inspection (BSMI) validated Conformity Assessment Body (CAB), under Appendix B, Phase I Procedures of the APEC Mutual Recognition Arrangement (MRA). BACL's BSMI Lab Code Number is: SL2-IN-E-1002R

BACL's test facilities that are used to perform AC Line Conducted Emissions, Telecommunications Line Conducted Emissions, Radiated Emissions from 30 MHz to 1 GHz, and Radiated Emissions from 1 GHz to 6 GHz are currently recognized as Accredited in accordance with the Voluntary Control Council for Interference [VCCI] Article 15 procedures under Registration Number A-0027.

1.7 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- ***An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2005 by A2LA (Test Laboratory Accreditation Certificate Number 3279.02)*****,** in the fields of: Electromagnetic Compatibility and Telecommunications. Unless noted by an Asterisk (*) in the Compliance Matrix (See Section 3 of this Test Report), BACL's ISO/IEC 17025:2005 Scope of Accreditation includes all of the Test Method Standards and/or the Product Family Standards detailed in this Test Report..

BACL's ISO/IEC 17025:2005 Scope of Accreditation includes a comprehensive suite of EMC Emissions, EMC Immunity, Radio, RF Exposure, Safety and wireline Telecommunications test methods applicable to a wide range of product categories. These product categories include Central Office Telecommunications Equipment [including NEBS - Network Equipment Building Systems], Unlicensed and Licensed Wireless and RF devices, Information Technology Equipment (ITE); Telecommunications Terminal Equipment (TTE); Medical Electrical Equipment; Industrial, Scientific and Medical Test Equipment; Professional Audio and Video Equipment; Industrial and Scientific Instruments and Laboratory Apparatus; Cable Distribution Systems, and Energy Efficient Lighting.

B- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body***

- - For the USA (Federal Communications Commission):
  - 1- All Unlicensed radio frequency devices within FCC Scopes A1, A2, A3, and A4;
  - 2- All Licensed radio frequency devices within FCC Scopes B1, B2, B3, and B4;
  - 3- All Telephone Terminal Equipment within FCC Scope C.

- For the Canada (Industry Canada):
  - 1- All Scope 1-Licence-Exempt Radio Frequency Devices;
  - 2- All Scope 2-Licensed Personal Mobile Radio Services;
  - 3- All Scope 3-Licensed General Mobile & Fixed Radio Services;
  - 4- All Scope 4-Licensed Maritime & Aviation Radio Services;
  - 5- All Scope 5-Licensed Fixed Microwave Radio Services
  - 6- All Broadcasting Technical Standards (BETS) in the Category I Equipment Standards List.

For Singapore (Info-Communications Development Authority (IDA)):

  - 1 All Line Terminal Equipment: All Technical Specifications for Line Terminal Equipment – Table 1 of IDA MRA Recognition Scheme: 2011, Annex 2
  - 2. All Radio-Communication Equipment: All Technical Specifications for Radio-Communication Equipment – Table 2 of IDA MRA Recognition Scheme: 2011, Annex 2

- For the Hong Kong Special Administrative Region:
  - 1 All Radio Equipment, per KHCA 10XX-series Specifications;
  - 2 All GMDSS Marine Radio Equipment, per HKCA 12XX-series Specifications;
  - 3 All Fixed Network Equipment, per HKCA 20XX-series Specifications.

- For Japan:
  - 1 MIC Telecommunication Business Law (Terminal Equipment):
    - All Scope A1 - Terminal Equipment for the Purpose of Calls;
    - All Scope A2 - Other Terminal Equipment
  - 2 Radio Law (Radio Equipment):
    - All Scope B1 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 1 of the Radio Law
    - All Scope B2 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 2 of the Radio Law
    - All Scope B3 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 3 of the Radio Law

C- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3279.01)*** to certify Products to USA's Environmental Protection Agency (EPA) ENERGY STAR Product Specifications for:

1 Electronics and Office Equipment:
- for Telephony (ver. 3.0)
- for Audio/Video (ver. 3.0)
- for Battery Charging Systems (ver. 1.1)
- for Set-top Boxes & Cable Boxes (ver. 4.1)
- for Televisions (ver. 6.1)
- for Computers (ver. 6.0)
- for Displays (ver. 6.0)
- for Imaging Equipment (ver. 2.0)
- for Computer Servers (ver. 2.0)

2 Commercial Food Service Equipment
- for Commercial Dishwashers (ver. 2.0)
- for Commercial Ice Machines (ver. 2.0)
- for Commercial Ovens (ver. 2.1)
- for Commercial Refrigerators and Freezers

3 Lighting Products
- For Decorative Light Strings (ver. 1.5)
- For Luminaires (including sub-components) and Lamps (ver. 1.2)
- For Compact Fluorescent Lamps (CFLs) (ver. 4.3)
- For Integral LED Lamps (ver. 1.4)

4 Heating, Ventilation, and AC Products
- for Residential Ceiling Fans (ver. 3.0)
- for Residential Ventilating Fans (ver. 3.2)

5 Other
- For Water Coolers (ver. 3.0)

D. A NIST Designated Phase-I and Phase-II Conformity Assessment Body (CAB) for the following economies and regulatory authorities under the terms of the stated MRAs/Treaties:

- Australia: ACMA (Australian Communication and Media Authority) – APEC Tel MRA -Phase I;
- Canada: (Industry Canada - IC) Foreign Certification Body – FCB – APEC Tel MRA -Phase I & Phase II;
- Chinese Taipei (Republic of China – Taiwan):
    - BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
    - NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
    - EMC Directive 2014/30/EU US-EU EMC & Telecom MRA CAB (NB)
    - Radio & Teleterminal Equipment (R&TTE) Directive 1995/5/EC US -EU EMC & Telecom MRA CAB (NB)
    - Radio Equipment (RE) Directive 2014/53/EU US-EU EMC & Telecom MRA CAB (NB)
    - Low Voltage Directive (LVD) 2014/35/EU
- Hong Kong Special Administrative Region: (Office of the Telecommunications Authority – OFTA) APEC Tel MRA -Phase I & Phase II
- Israel – US-Israel MRA Phase I
- Republic of Korea (Ministry of Communications - Radio Research Laboratory) APEC Tel MRA -Phase I
- Singapore: (Infocomm Development Authority - IDA) APEC Tel MRA -Phase I & Phase II;
- Japan: VCCI - Voluntary Control Council for Interference US-Japan Telecom Treaty VCCI Side Letter
- USA:
    - ENERGY STAR Recognized Test Laboratory – US EPA
    - Telecommunications Certification Body (TCB) – US FCC;
    - Nationally Recognized Test Laboratory (NRTL) – US OSHA
- Vietnam: APEC Tel MRA -Phase I;

2 EUT Test Configuration

2.1 Justification

The EUT was configured for testing according to TIA 603-E Standards.

2.2 EUT Exercise Software

Testing firmware/software pre-loaded in the EUT, which was provided by the manufacturer.

2.3 Special Equipment

Manufacturer	Description	Model
JVC Kenwood	PTT JIG Board	-

2.4 Equipment Modifications

None

2.5 Local Support Equipment

None

2.6 Interface Ports and Cables

Cable Description	Length (m)	To	From
RF cable	<1 m	PSA	EUT

3 Summary of Test Results

FCC Rules	Descriptions of Test	Result (s)
FCC §2.1051, FCC §80.215 (e)(1)	RF output power	Compliant
FCC §2.1049, FCC §80.205 (a)	Occupied Bandwidth	Compliant
FCC §2.1051, FCC §80.213 (a)(2), (d)	Modulation Requirements	Compliant
FCC §80.211 (f)	Emission Limitations	Compliant
FCC §2.1051, FCC §80.211 (f)	Emissions at Antenna Terminals	Compliant
FCC §2.1053, FCC §80.211 (f)	Field strength of spurious radiation	Compliant
FCC §2.1055, FCC §80.209	Frequency Tolerance	Compliant

4 FCC §2.1046, §80.215 (e) (1) - RF Output Power

4.1 Applicable Standards

According to FCC §80.215 (e) (1): the power may not exceed the following values:

(e) Ship stations frequencies above 27500 kHz. The maximum power must not exceed the values listed below.

(1) Ship stations 156-162 MHz—25W[6]

[6]Reducible to 1 watt or less, except for transmitters limited to public correspondence channels and used in an automated system.

4.2 Test Procedure

According to TIA-603-E Section 2.2.1

4.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
ETS- Lindgren	Power Sensor	7002-006	160097	2016-12-05	2 years
-	Attenuator 30 dB	-	-	-	Each time
-	Attenuator 10 dB	-	-	-	Each time
-	RF Cable	-	-	-	Each time

Note: Cable and attenuators included in the test set-up were checked each time before testing.

Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 09 June 2016) "A2LA Policy on Metrological Traceability".*

4.4 Test Environmental Conditions

Temperature:	23 ºC
Relative Humidity:	46 %
ATM Pressure:	101.4 kPa

The testing was performed by Troy Pandhumsoporn on 2018-02-26 at RF site.

4.5 Test Results

Conducted output power:

Channel Frequency (MHz)	Device Power Setting	Conducted Output Power (dBm)	Limits (dBm)
138.05	High	37.27	43.98
	Low	29.42	43.98
143.95	High	37.32	43.98
	Low	29.47	43.98
148.05	High	37.4	43.98
	Low	29.49	43.98
150.05	High	37.44	43.98
	Low	29.5	43.98
162.05	High	37.43	43.98
	Low	29.2	43.98
173.95	High	37.37	43.98
	Low	29.31	43.98

5 FCC §2.1049, §80.205 (a) – Occupied Bandwidth

5.1 Applicable Standards

According to FCC §80.205 (a):

(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)
F3E[8]	16KOF3E	20.0

[8]Applicable only when maximum frequency deviation is 5 kHz. See also paragraph (b) of this section.

(b) For land stations the maximum authorized frequency deviation for F3E or G3E emission is as follows:

(1) 5 kHz in the 72.0-73.0 MHz, 75.4-76.0 MHz and 156-162 MHz bands;

5.2 Test Procedure

According to TIA-603-E Section 2.2.11

5.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Rohde & Schwarz	Signal Analyzer	FSQ26	200749	2016-04-24	2 years
HP	Analyzer, RF Communications Test Set	8920A	3438A05338	2018-01-09	2 years
HP	Analyzer, Modulation	8901A	2026A00847	2018-01-06	2 years
-	Attenuator 30 dB	-	-	-	Each time
-	Attenuator 10 dB	-	-	-	Each time
-	RF Cable	-	-	-	Each time

Note: Cable and attenuators included in the test set-up were checked each time before testing.

Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 09 June 2016) "A2LA Policy on Metrological Traceability".*

5.4 Test Environmental Conditions

Temperature:	23 ºC
Relative Humidity:	46 %
ATM Pressure:	101.4 kPa

The testing was performed by Troy Pandhumsoporn on 2018-02-22 at RF site.

5.5 Test Results

99% Bandwidth High Power

Channel Frequency (MHz)	99% OBW (kHz)	Limit (kHz)
138.05	14.67	20
143.95	14.67	20
148.05	14.67	20
150.05	14.83	20
162.05	14.83	20
173.95	14.67	20

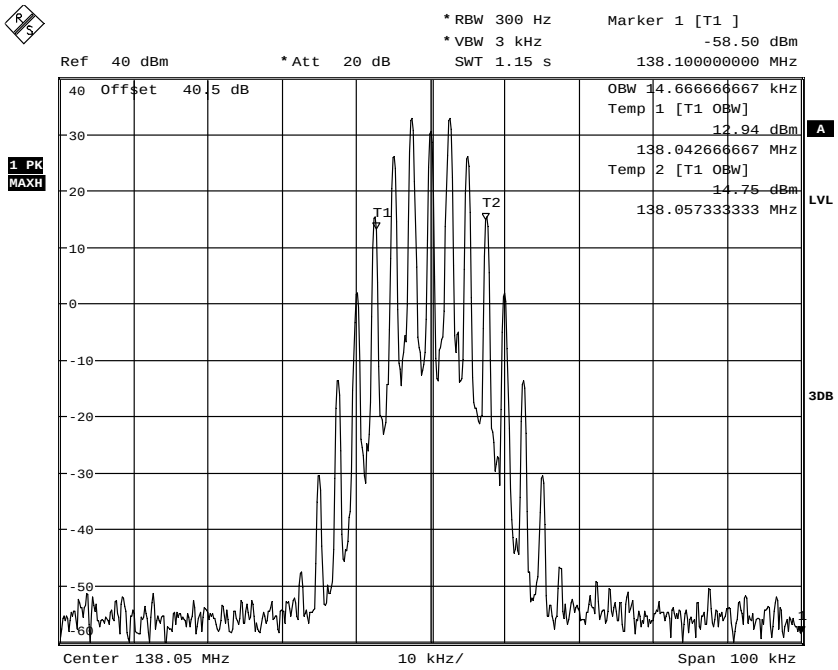
99% Bandwidth Low Power

Channel Frequency (MHz)	99% OBW (kHz)	Limit (kHz)
138.05	14.67	20
143.95	14.67	20
148.05	14.67	20
150.05	14.83	20
162.05	14.83	20
173.95	14.67	20

Please refer to the following plots for detailed test results.

99% Bandwidth
High Power

Low Channel 138.05 MHz



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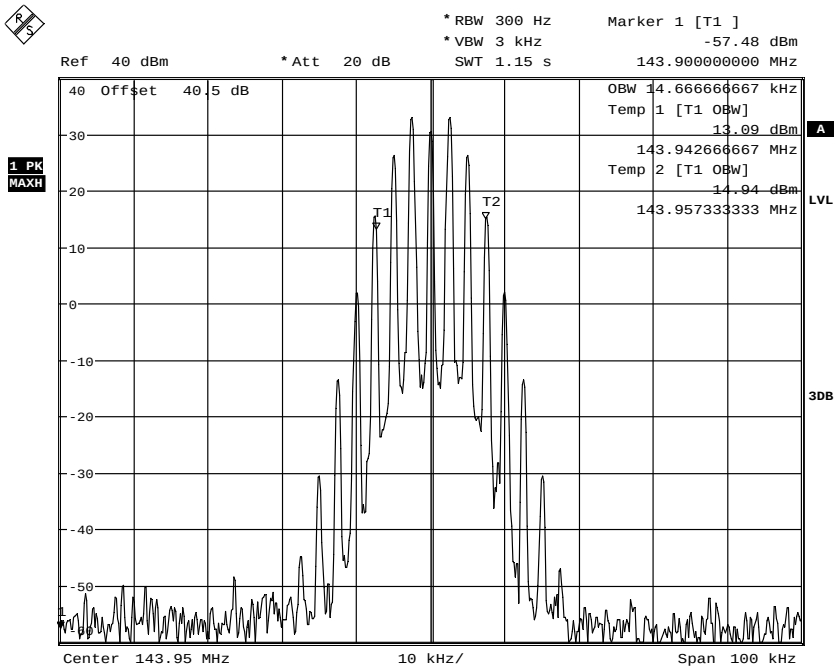
Middle Channel 143.95 MHz



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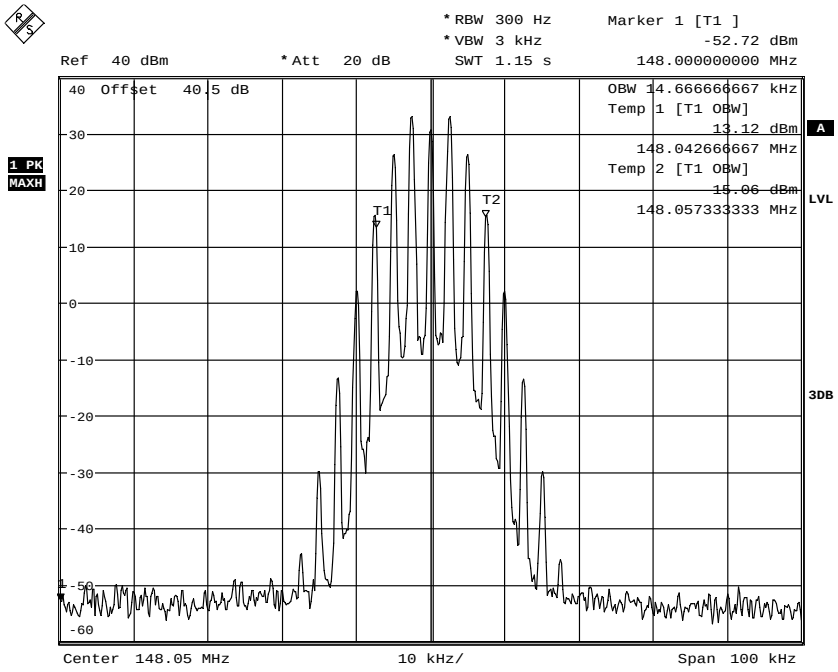

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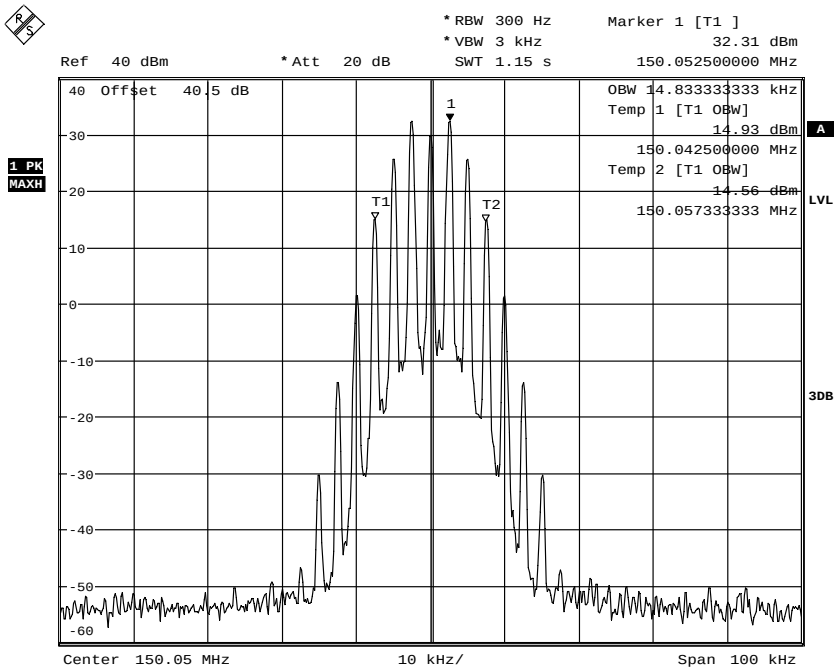

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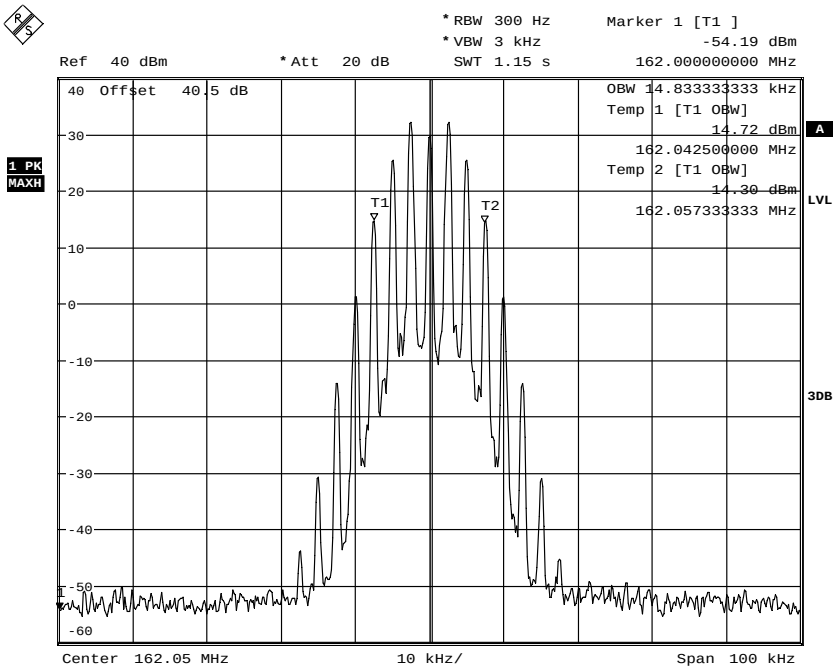
Middle Channel 162.05 MHz



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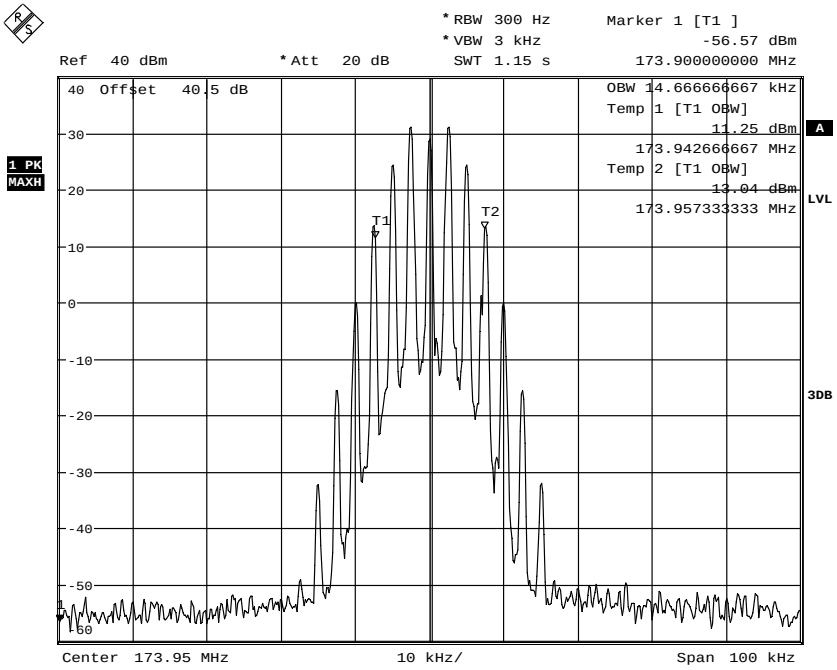
Middle Channel 173.95 MHz



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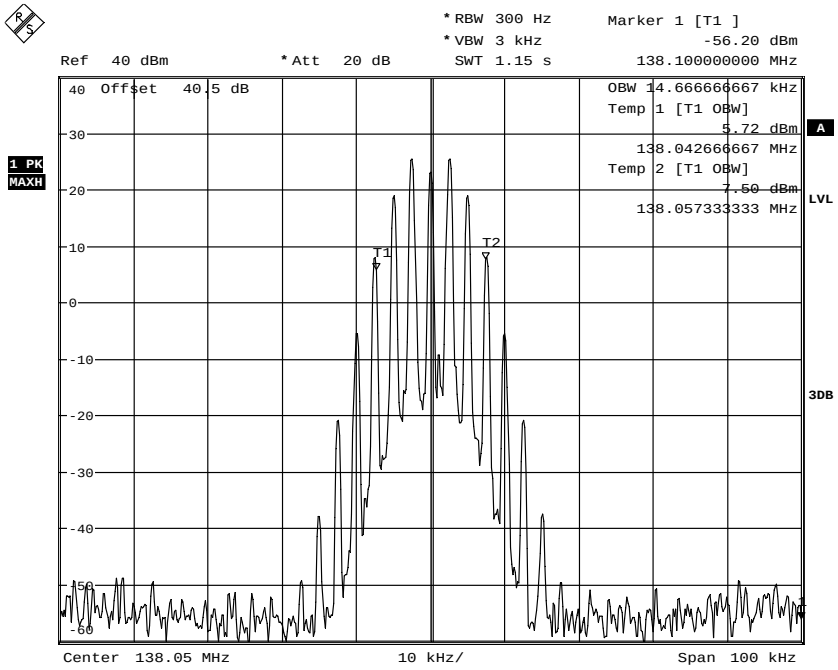
Low Power

Low Channel 138.05 MHz



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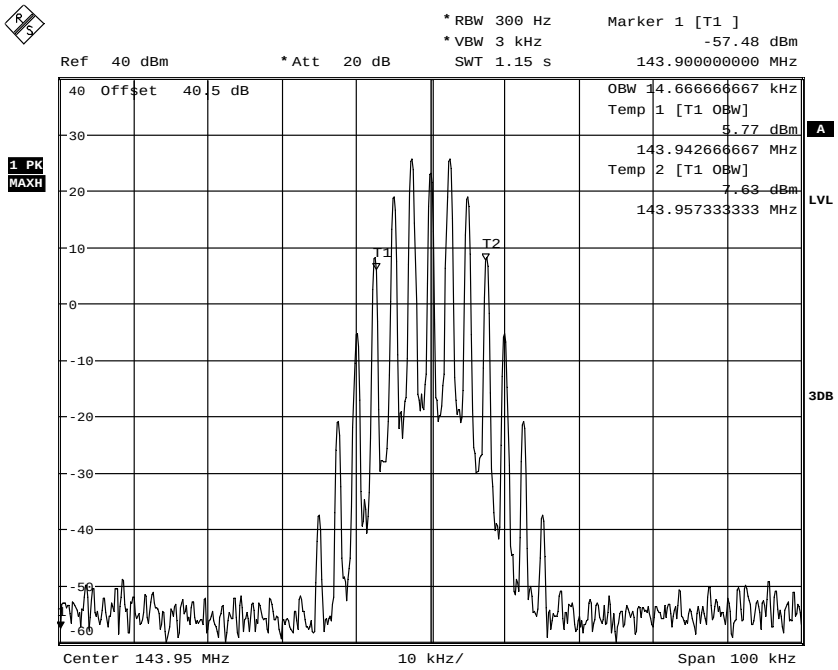
Middle Channel 143.95 MHz



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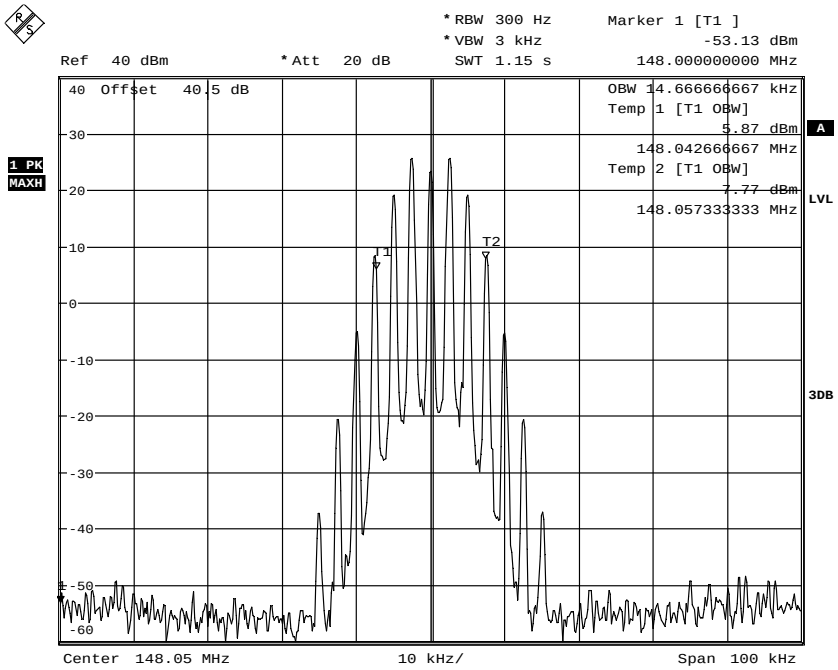
Middle Channel 148.05 MHz



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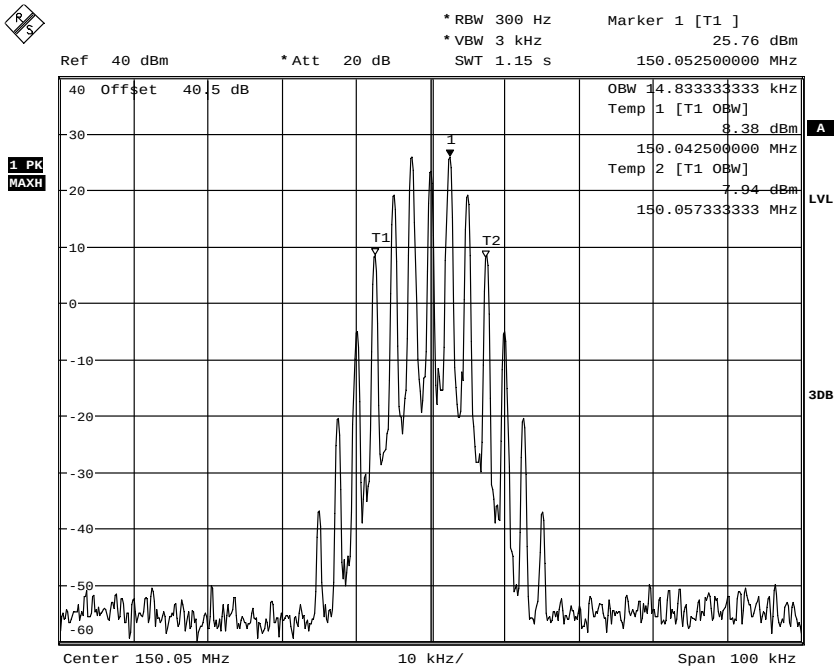

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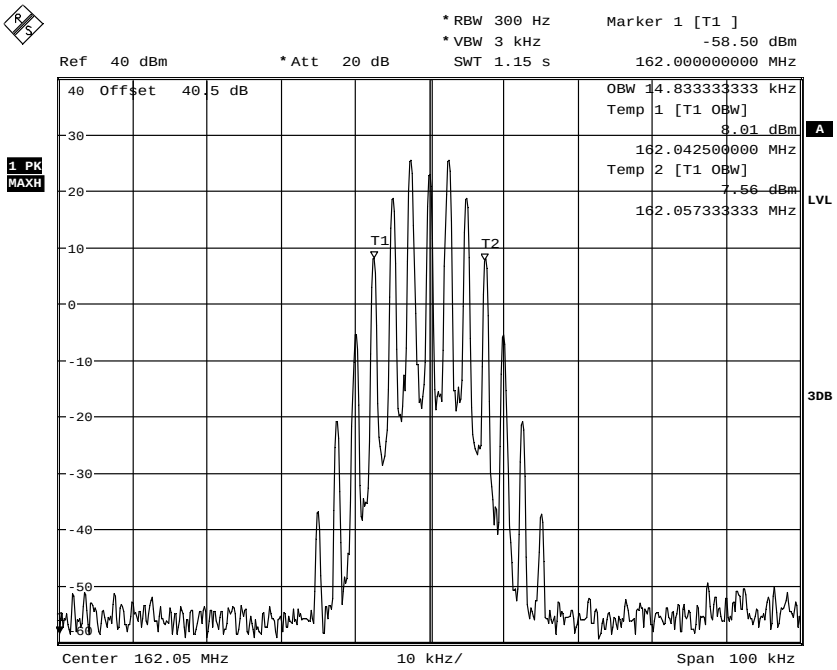
Middle Channel 162.05 MHz



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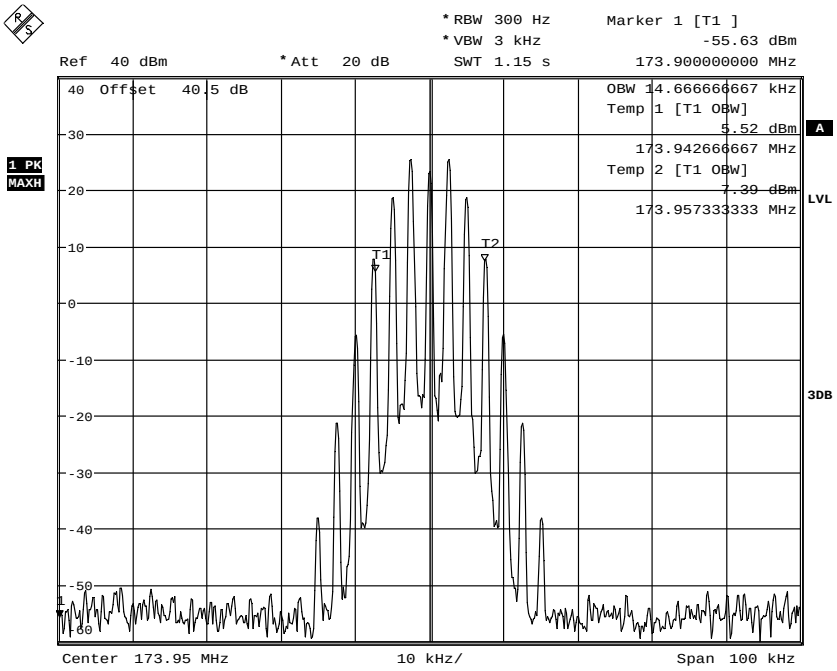
High Channel 173.95 MHz



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6 FCC §2.1051, §80.213 (a) (2), (d) - Modulation Requirements

6.1 Applicable Standards

According to FCC §80.213 (a) (2), (d):

(a) Transmitters must meet the following modulation requirements:

(2) When phase or frequency modulation is used in the 156-162 MHz band the peak modulation must be maintained between 75 and 100 percent. A frequency deviation of ±5 kHz is defined as 100 percent peak modulation;

(d) Ship and coast station transmitters operating in the 156-162 MHz and 216-220 bands must be capable of proper operation with a frequency deviation that does not exceed ±5 kHz when using any emission authorized by §80.207.

6.2 Test Procedure

According to TIA-603-E Section 2.2.3 and 2.2.6

6.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
HP	Analyzer, RF Communications Test Set	8920A	3438A05338	2018-01-09	2 years
HP	Analyzer, Modulation	8901A	2026A00847	2018-01-06	2 years
-	Attenuator 30 dB	-	-	-	Each time
-	Attenuator 10 dB	-	-	-	Each time
-	RF Cable	-	-	-	Each time

Note: Cable and attenuators included in the test set-up were checked each time before testing.

Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 09 June 2016) "A2LA Policy on Metrological Traceability".*

6.4 Test Environmental Conditions

Temperature:	23 ºC
Relative Humidity:	46 %
ATM Pressure:	101.4 kPa

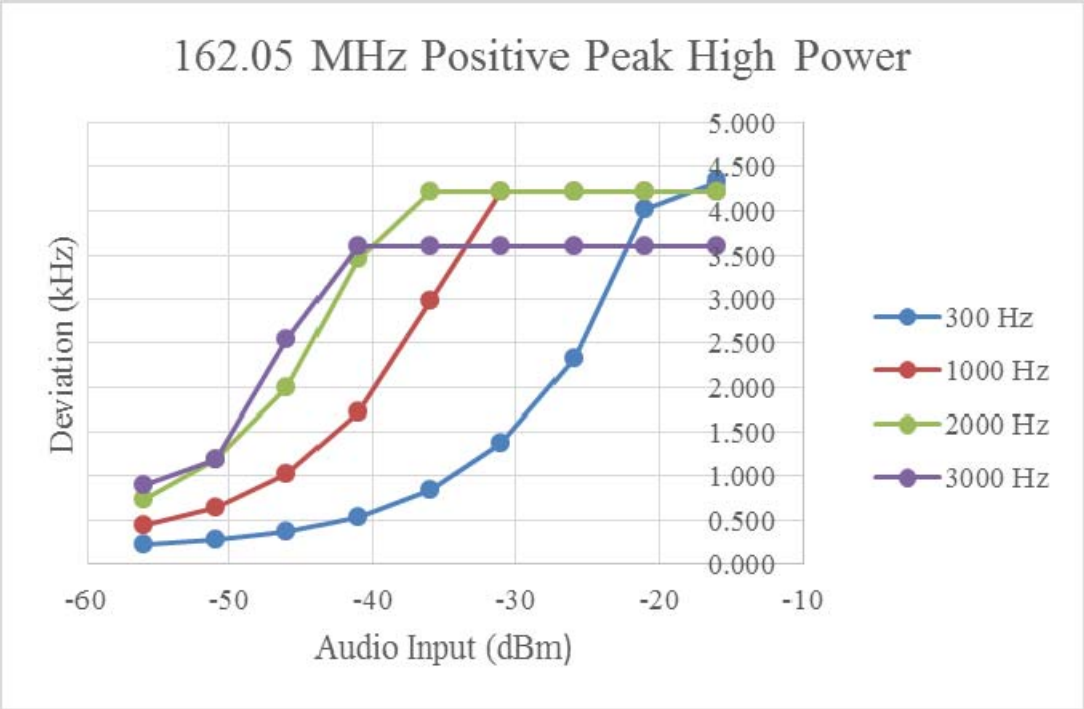
The testing was performed by Troy Pandhumsoporn on 2018-02-21 to 2018-02-22 at RF site.

6.5 Test Results

Modulation Limiting

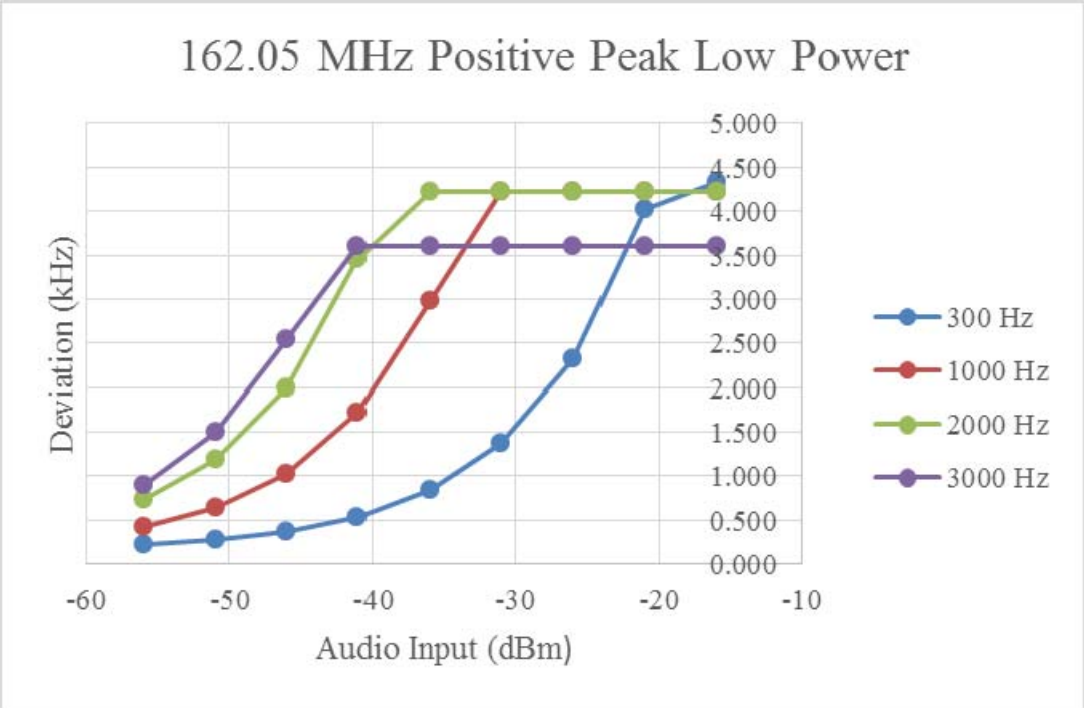
162.05 MHz Positive Peak High Power

Audio Input Level (dB)	AF Frequency (Hz)/Peak Deviation (kHz)				Limit (kHz)
	300 Hz	1000 Hz	2000 Hz	3000 Hz	
20	4.330	4.230	4.230	3.606	±5
15	4.020	4.230	4.230	3.606	±5
10	2.320	4.230	4.230	3.606	±5
5	1.371	4.230	4.230	3.606	±5
0	0.844	2.980	4.230	3.606	±5
-5	0.539	1.720	3.451	3.606	±5
-10	0.376	1.031	2.005	2.546	±5
-15	0.282	0.648	1.192	1.196	±5
-20	0.231	0.433	0.737	0.906	±5



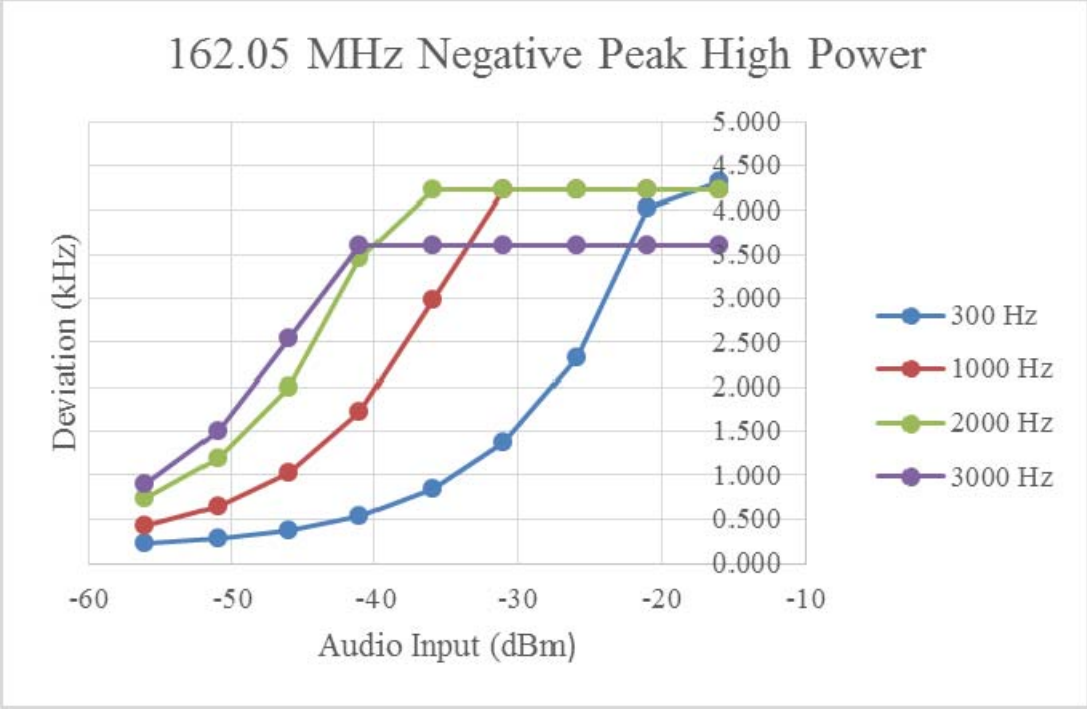
162.05 MHz Positive Peak Low Power

Audio Input Level (dB)	AF Frequency (Hz)/Peak Deviation (kHz)				Limit (kHz)
	300 Hz	1000 Hz	2000 Hz	3000 Hz	
20	4.330	4.230	4.230	3.606	±5
15	4.030	4.230	4.230	3.606	±5
10	2.321	4.230	4.230	3.606	±5
5	1.372	4.230	4.230	3.606	±5
0	0.841	2.982	4.230	3.606	±5
-5	0.537	1.721	3.453	3.606	±5
-10	0.371	1.032	2.005	2.546	±5
-15	0.276	0.649	1.194	1.499	±5
-20	0.230	0.432	0.739	0.907	±5



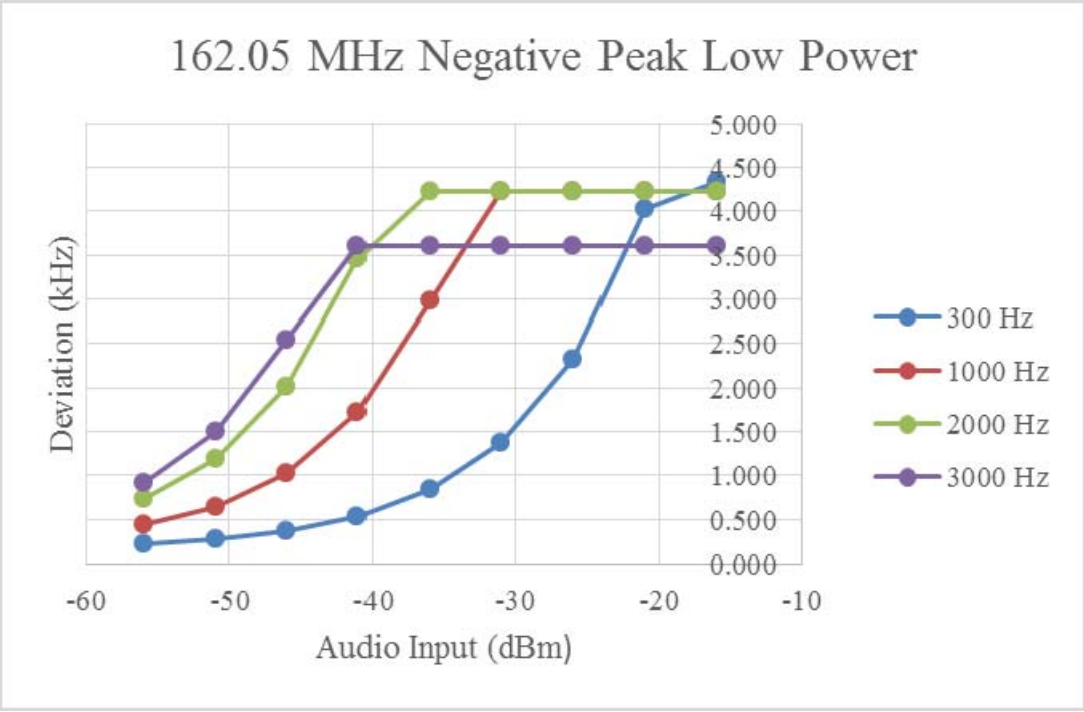
162.05 MHz Negative Peak High Power

Audio Input Level (dB)	AF Frequency (Hz)/Peak Deviation (kHz)				Limit (kHz)
	300 Hz	1000 Hz	2000 Hz	3000 Hz	
20	4.320	4.230	4.230	3.606	±5
15	4.020	4.230	4.230	3.606	±5
10	2.320	4.230	4.230	3.606	±5
5	1.370	4.230	4.230	3.606	±5
0	0.845	2.981	4.230	3.606	±5
-5	0.532	1.721	3.450	3.606	±5
-10	0.366	1.032	2.005	2.546	±5
-15	0.272	0.650	1.193	1.496	±5
-20	0.230	0.432	0.738	0.906	±5



162.05 MHz Negative Peak Low Power

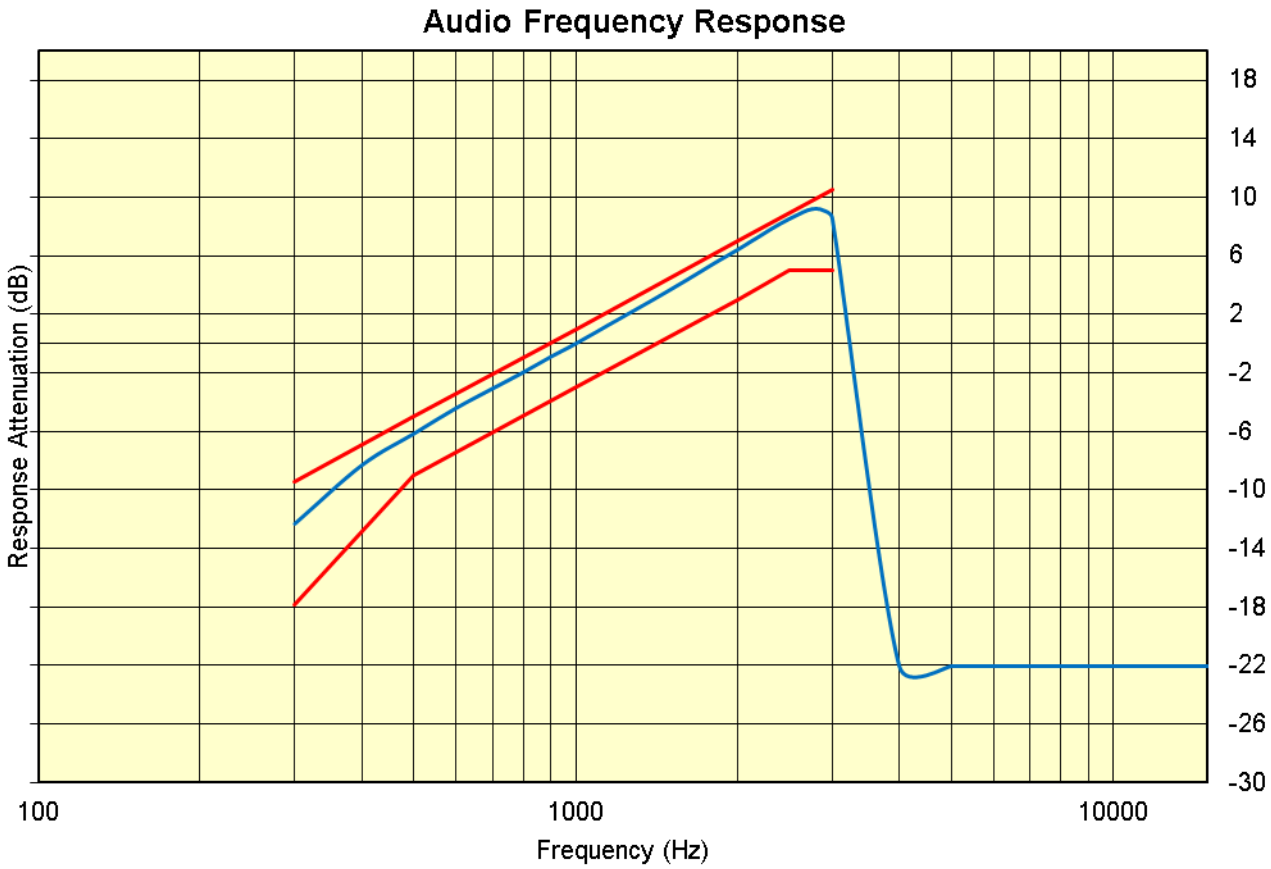
Audio Input Level (dB)	AF Frequency (Hz)/Peak Deviation (kHz)				Limit (kHz)
	300 Hz	1000 Hz	2000 Hz	3000 Hz	
20	4.330	4.230	4.230	3.606	±5
15	4.030	4.230	4.230	3.606	±5
10	2.322	4.230	4.230	3.606	±5
5	1.372	4.230	4.230	3.606	±5
0	0.840	2.984	4.230	3.606	±5
-5	0.536	1.722	3.454	3.606	±5
-10	0.372	1.035	2.006	2.546	±5
-15	0.276	0.650	1.196	1.498	±5
-20	0.230	0.435	0.738	0.909	±5



Audio Frequency Response

162.05 MHz High Power

Tone (Hz)	Deviation (kHz)	Response Attenuation (dB)
300	0.147	-12.3174
400	0.233	-8.31666
500	0.299	-6.15035
600	0.366	-4.39415
700	0.426	-3.07558
800	0.485	-1.94894
900	0.548	-0.88816
1000	0.607	0
1200	0.734	1.650147
1400	0.862	3.046371
1600	0.995	4.292688
1800	1.135	5.436143
2000	1.27	6.412301
2100	1.342	6.891276
2200	1.414	7.345214
2300	1.488	7.788285
2400	1.557	8.181998
2500	1.621	8.531886
2600	1.68	8.842412
2700	1.733	9.112197
2800	1.755	9.221769
2900	1.726	9.077042
3000	1.634	8.601267
4000	0.048	-22.0389
5000	0.048	-22.0389
6000	0.048	-22.0389
7000	0.048	-22.0389
8000	0.048	-22.0389
9000	0.048	-22.0389
10000	0.048	-22.0389
11000	0.048	-22.0389
12000	0.048	-22.0389
13000	0.048	-22.0389
14000	0.048	-22.0389
15000	0.048	-22.0389

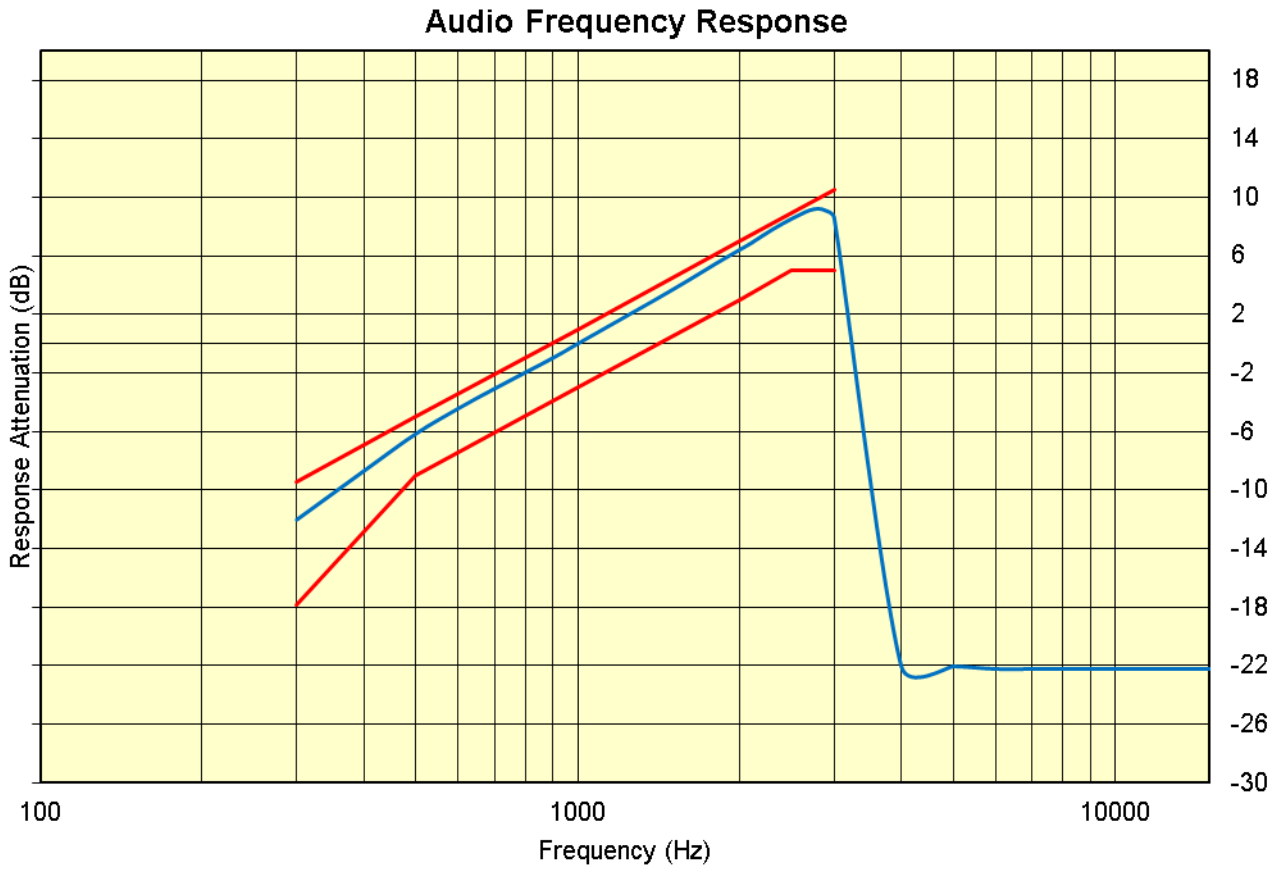

Audio Frequency Response
Response Attenuation (dB)
18
14
10
6
2
-2
-6
-10
-14
-18
-22
-26
-30
100
1000
10000
Frequency (Hz)

Result: Pass

Audio Frequency Response

162.05 MHz Low Power

Tone (Hz)	Deviation (kHz)	Response Attenuation (dB)
300	0.152	-12.0269
400	0.223	-8.69768
500	0.299	-6.15035
600	0.365	-4.41792
700	0.426	-3.07558
800	0.485	-1.94894
900	0.543	-0.96778
1000	0.607	0
1200	0.734	1.650147
1400	0.862	3.046371
1600	0.995	4.292688
1800	1.135	5.436143
2000	1.27	6.412301
2100	1.337	6.858854
2200	1.414	7.345214
2300	1.488	7.788285
2400	1.557	8.181998
2500	1.621	8.531886
2600	1.681	8.84758
2700	1.733	9.112197
2800	1.755	9.221769
2900	1.726	9.077042
3000	1.635	8.606581
4000	0.048	-22.0389
5000	0.048	-22.0389
6000	0.047	-22.2218
7000	0.047	-22.2218
8000	0.047	-22.2218
9000	0.047	-22.2218
10000	0.047	-22.2218
11000	0.047	-22.2218
12000	0.047	-22.2218
13000	0.047	-22.2218
14000	0.047	-22.2218
15000	0.047	-22.2218



Result: Pass

Note: audio filter of the above result is substituted with the same structure as audio frequency response. On the transmission condition below 3 kHz, transceiver shows pre-emphasis condition of transmission function.
On the transmission condition above 3 kHz, transceiver shows audio low pass filter.
The worst case channel frequency was recorded.

7 FCC §80.211 (f): Emission Limitations

7.1 Applicable Standards

According to FCC §80.211 (f):

(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 10log10 (mean power in watts) dB.

7.2 Test Procedure

According to TIA-603-E Section 2.2.11

7.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Rohde & Schwarz	Signal Analyzer	FSQ26	200749	2017-06-08	2 years
HP	Analyzer, RF Communications Test Set	8920A	3438A05338	2018-01-09	2 years
HP	Analyzer, Modulation	8901A	2026A00847	2018-01-06	2 years
-	Attenuator 30 dB	-	-	-	Each time
-	Attenuator 10 dB	-	-	-	Each time
-	RF Cable	-	-	-	Each time

Cable and attenuators included in the test set-up were checked each time before testing.

Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 09 June 2016) "A2LA Policy on Metrological Traceability".*

7.4 Test Environmental Conditions

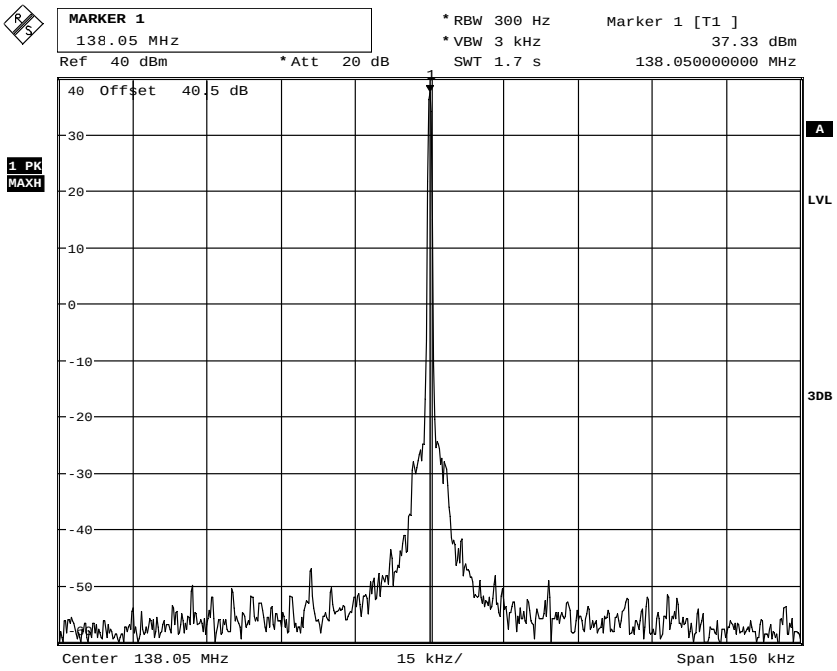
Temperature:	23 ºC
Relative Humidity:	46 %
ATM Pressure:	101.4 kPa

The testing was performed by Troy Pandhumsoporn on 2018-02-22 at RF site.

7.5 Test Results

Please refer to the following table plots for detailed test results

138.05 MHz High Power



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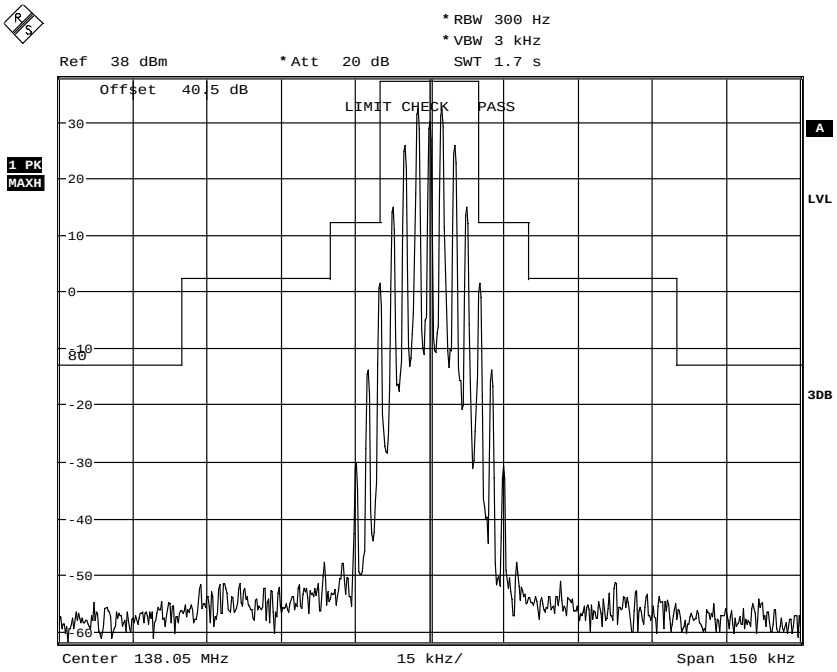
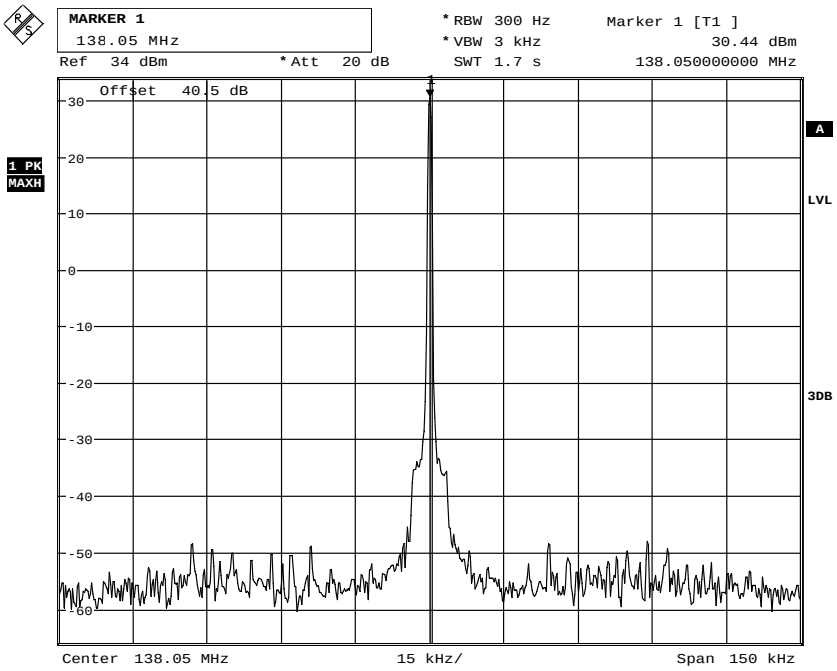


Date: 22.FEB.2018 17:37:19

138.05 MHz Low Power



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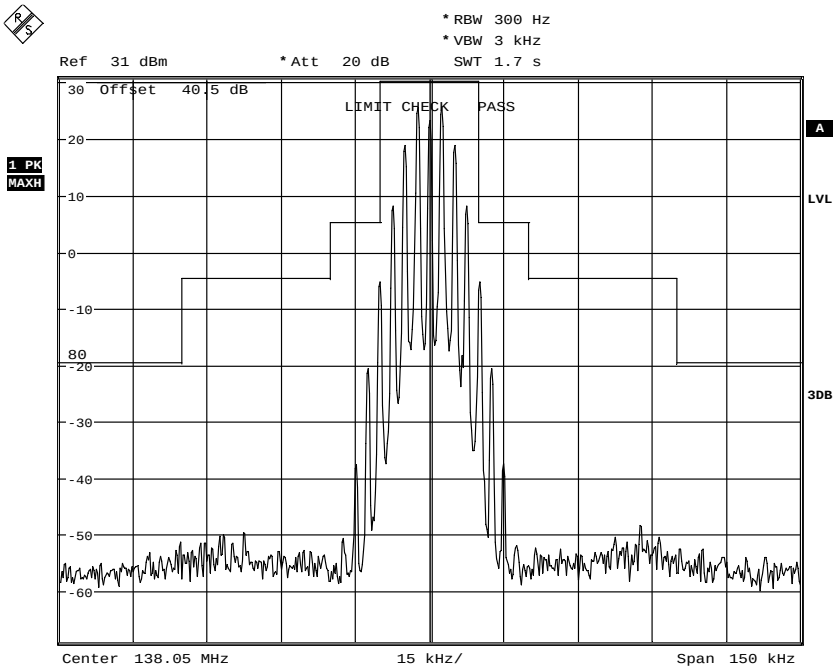
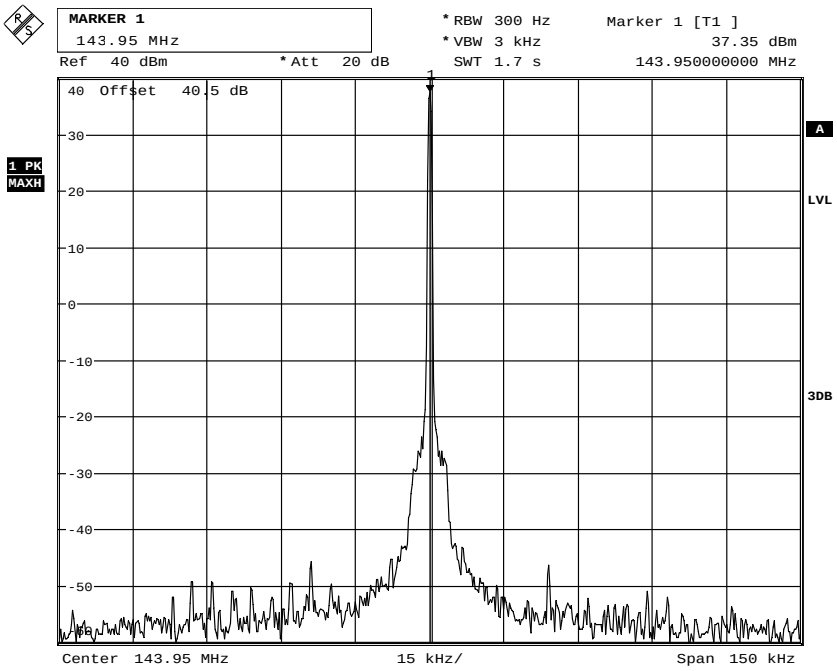


Date: 22.FEB.2018 17:44:14

143.95 MHz High Power



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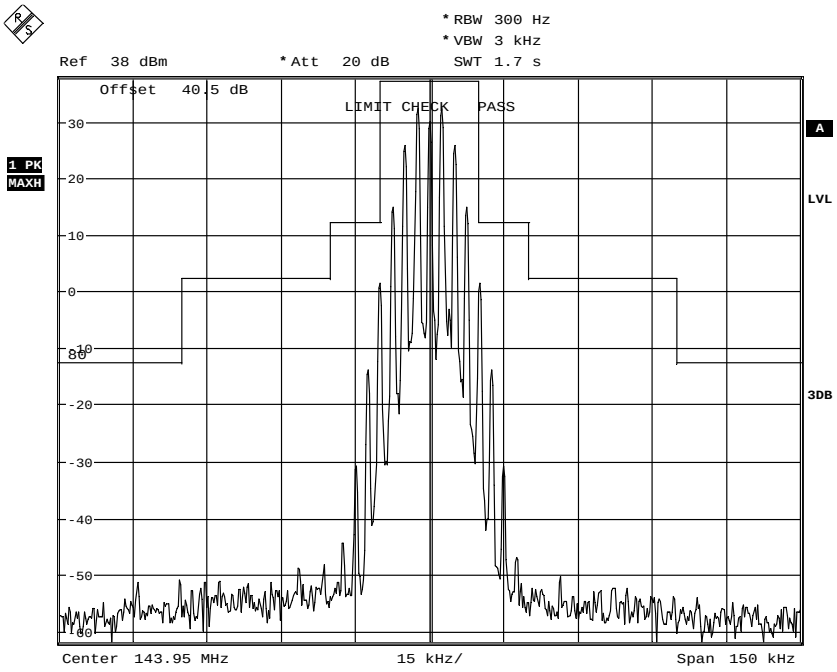

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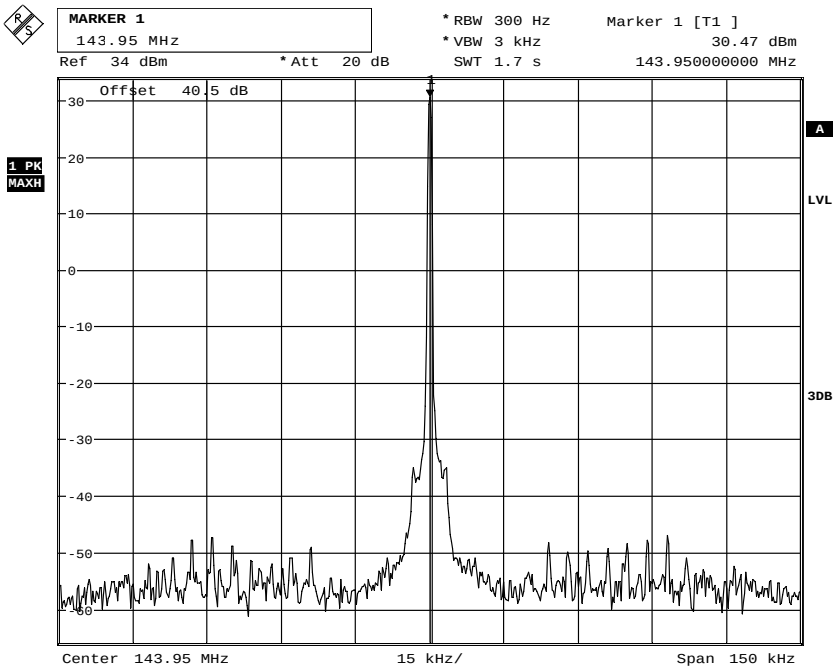
143.95 MHz Low Power



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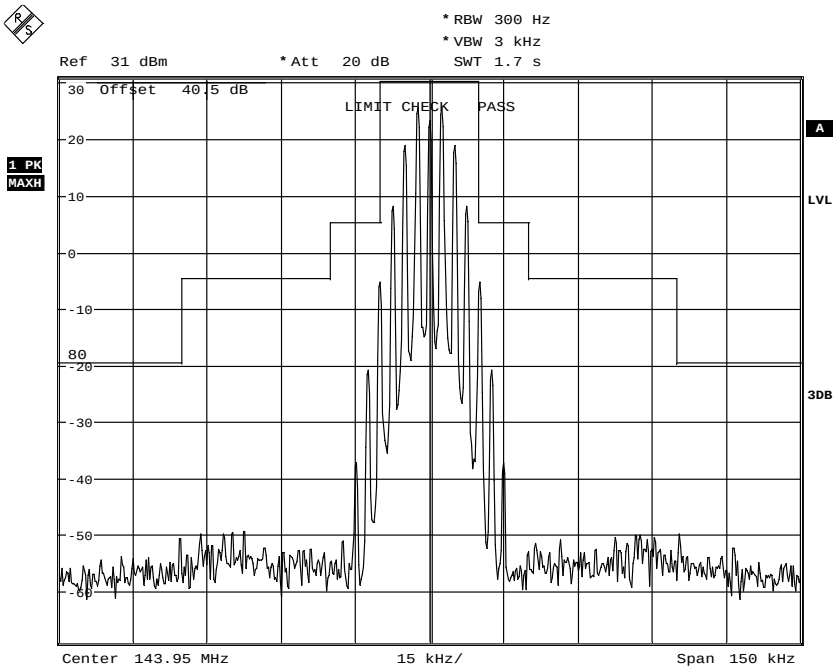

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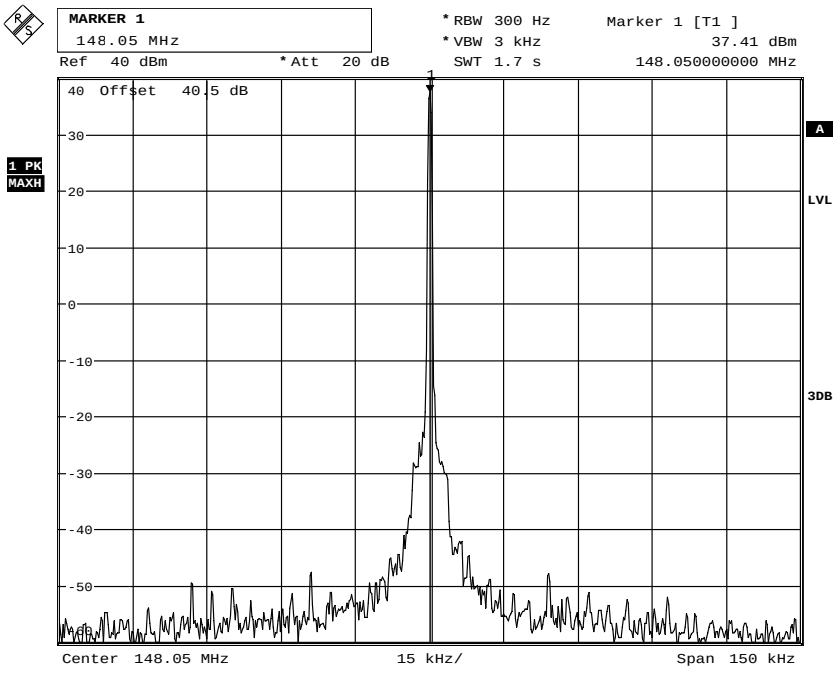
148.05 MHz High Power



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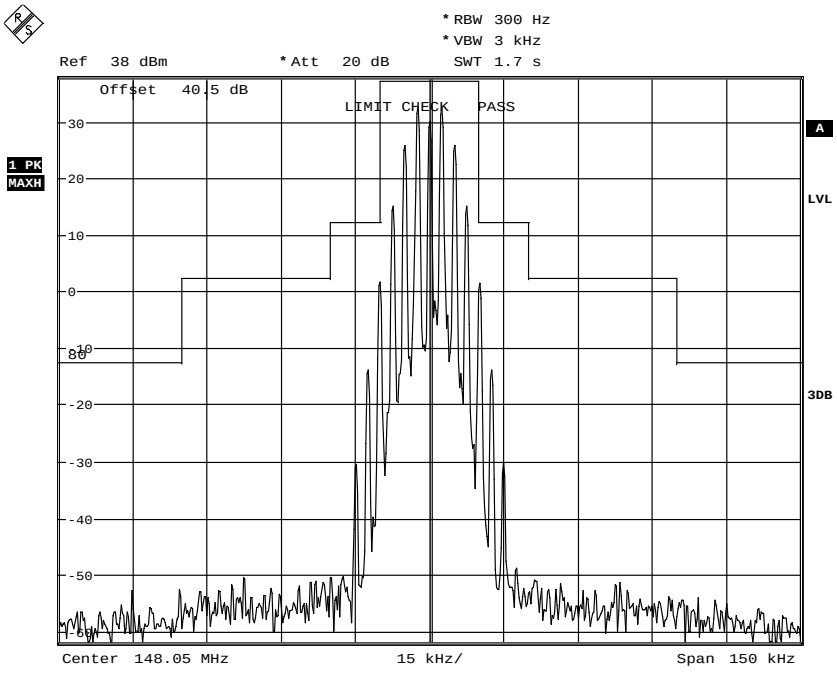

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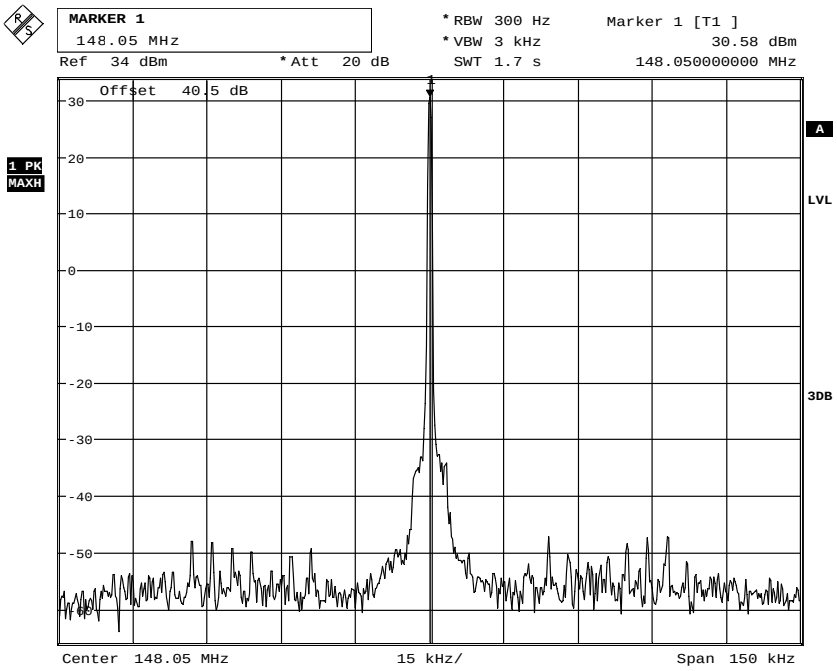
148.05 MHz Low Power



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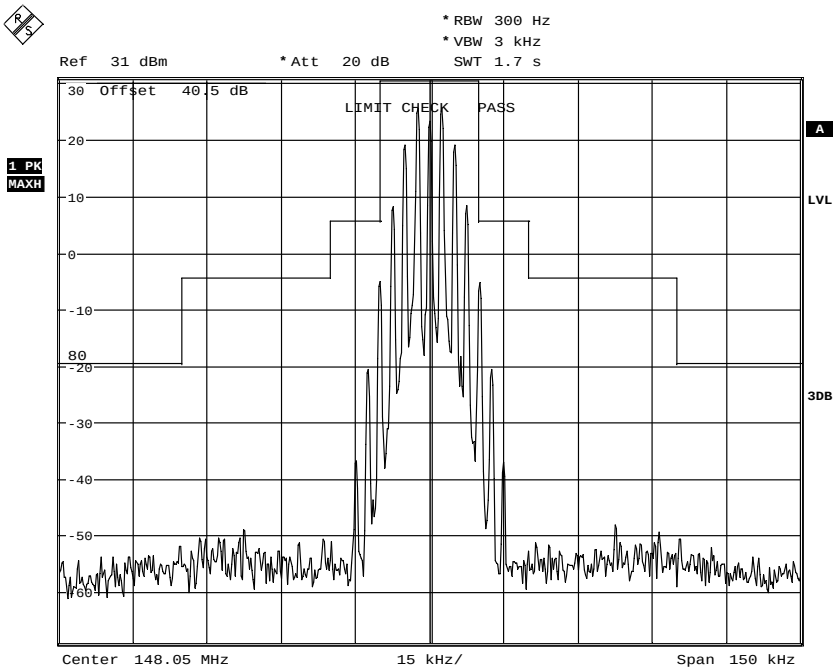
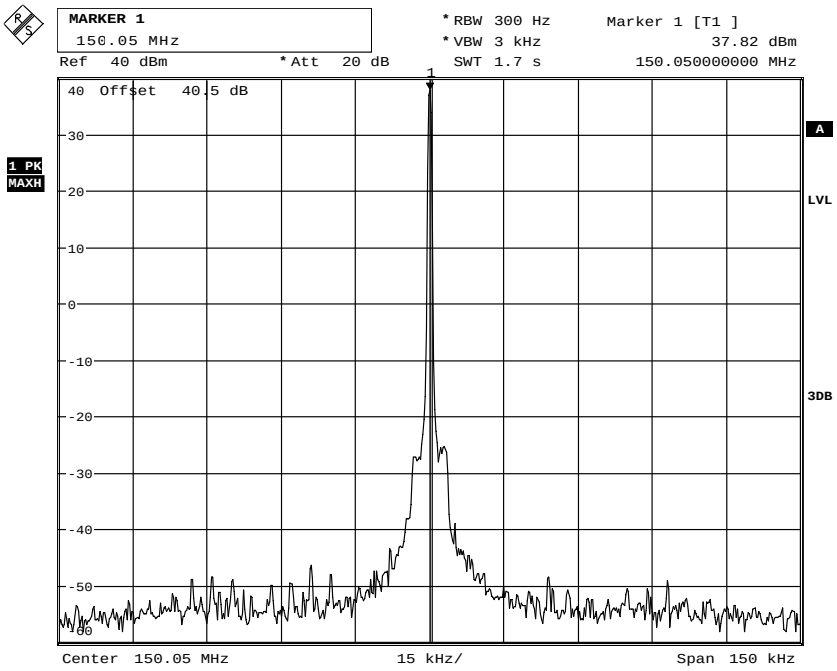


Date: 22.FEB.2018 18:10:18

150.05 MHz High Power



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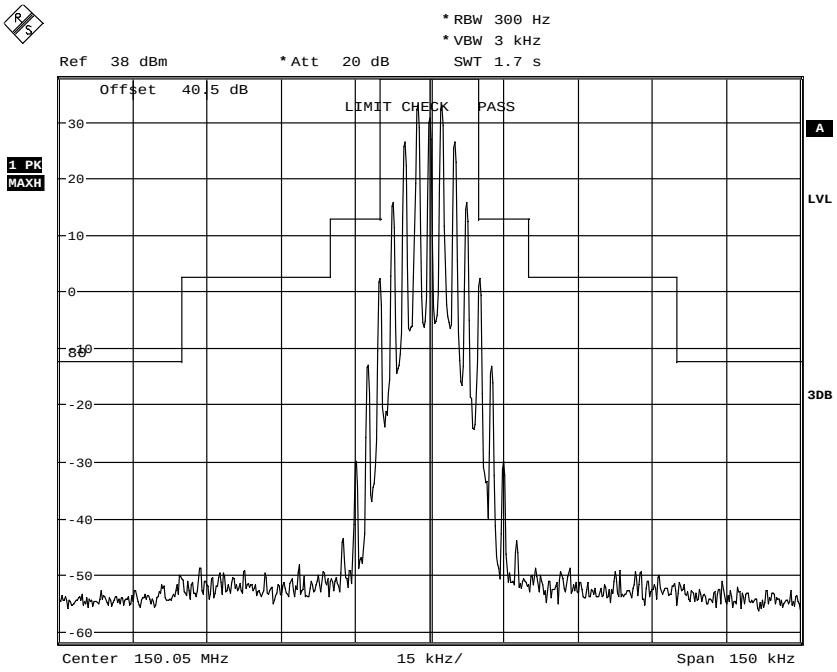

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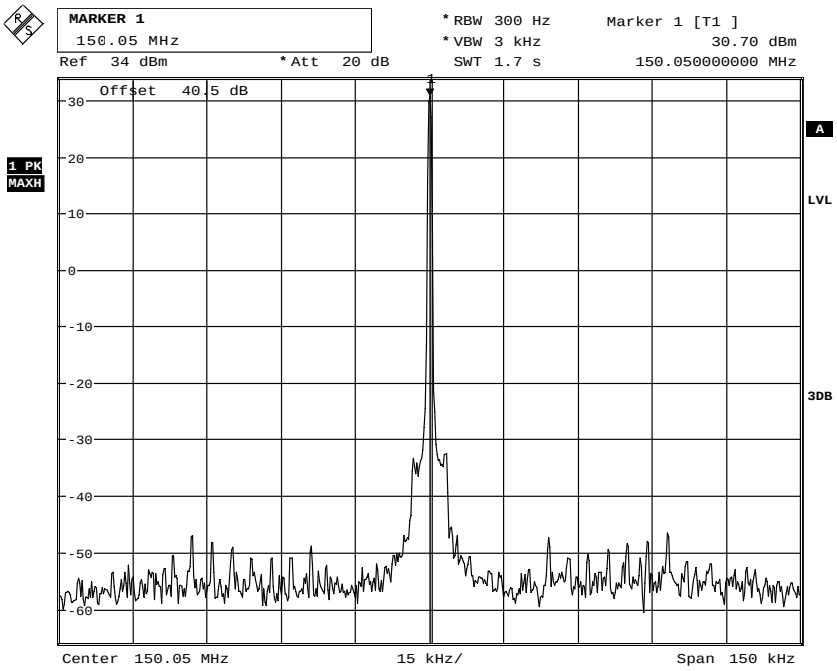
150.05 MHz Low Power



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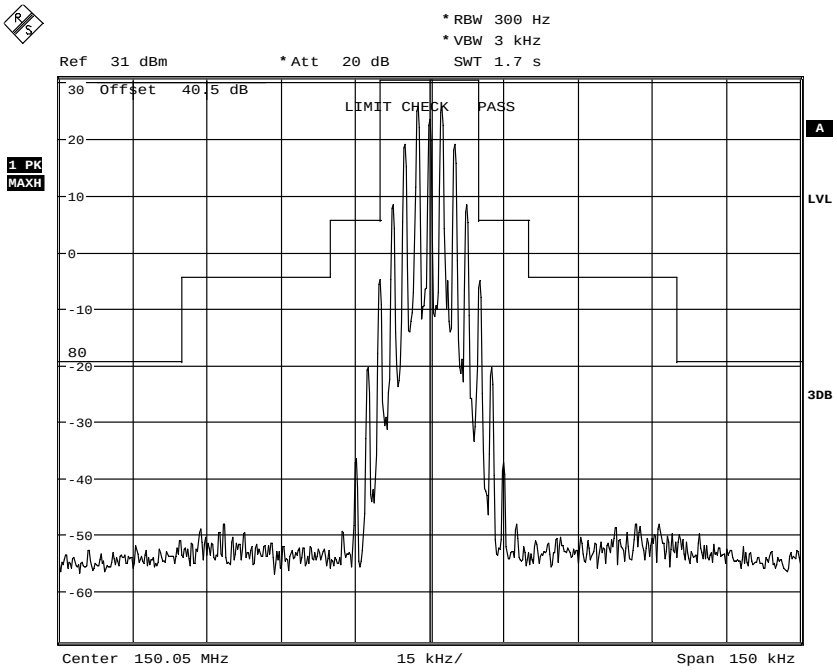
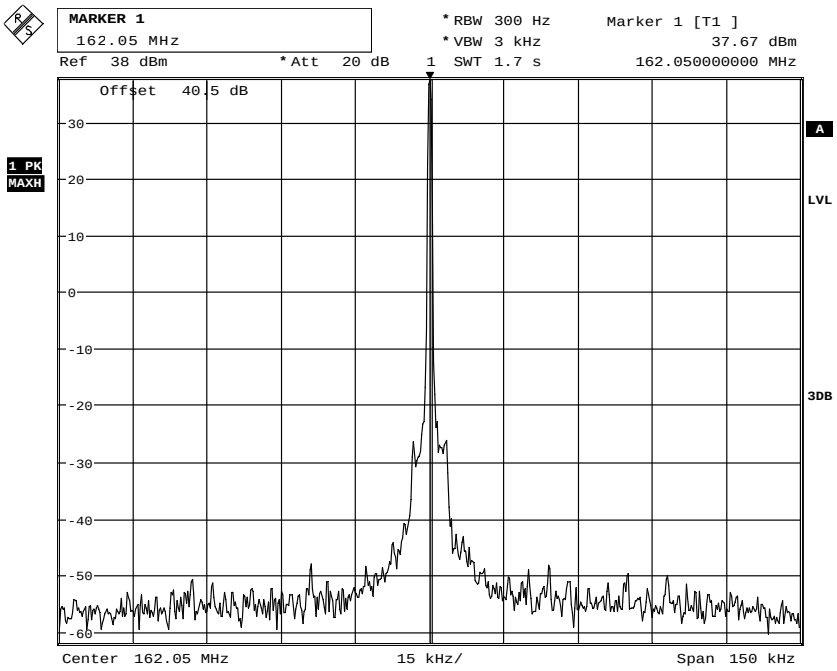


Date: 22.FEB.2018 17:08:28

162.05 MHz High Power



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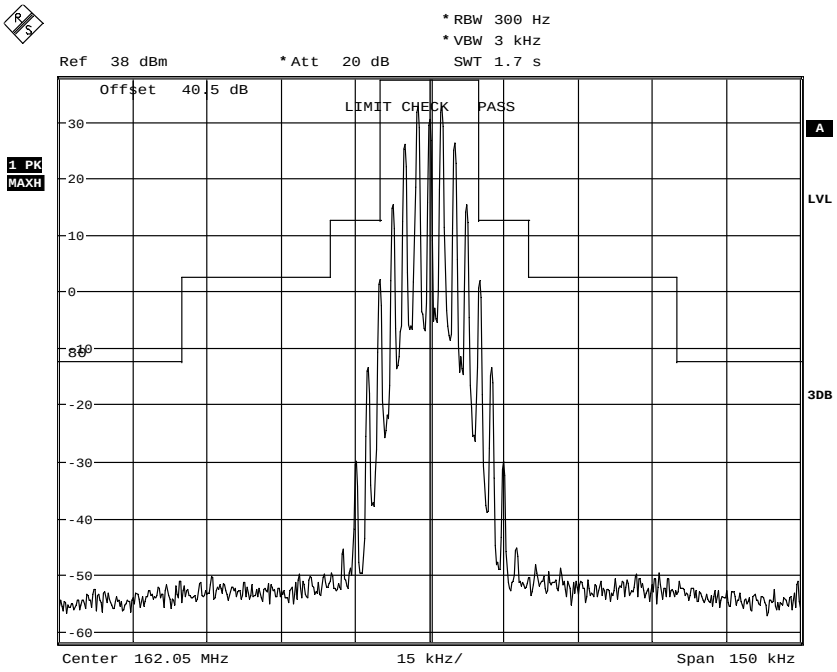
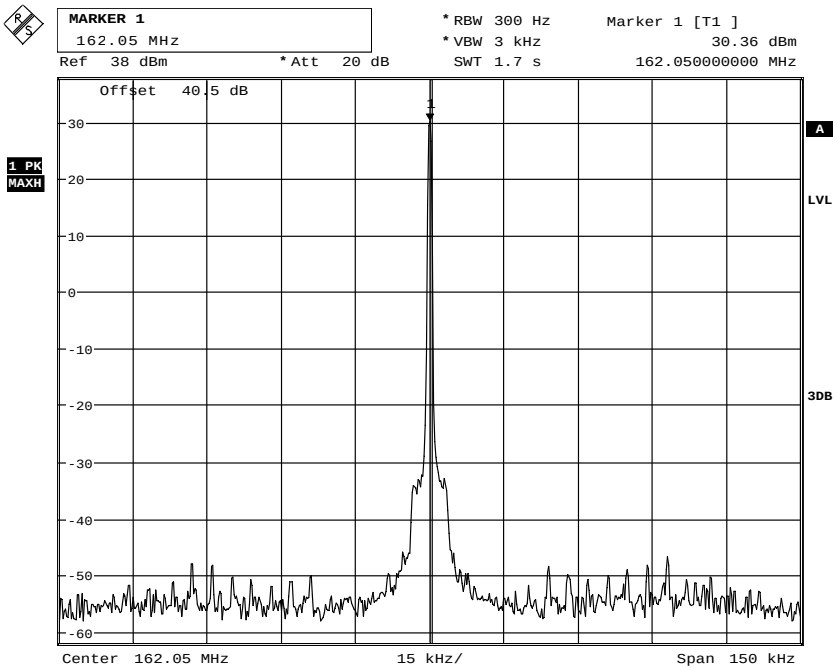


Date: 22.FEB.2018 16:30:59

162.05 MHz Low Power



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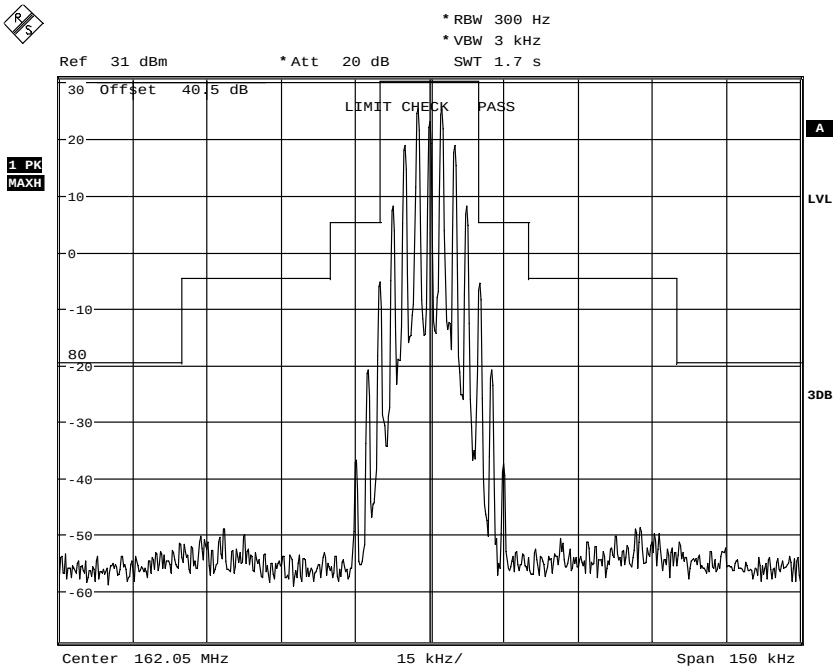

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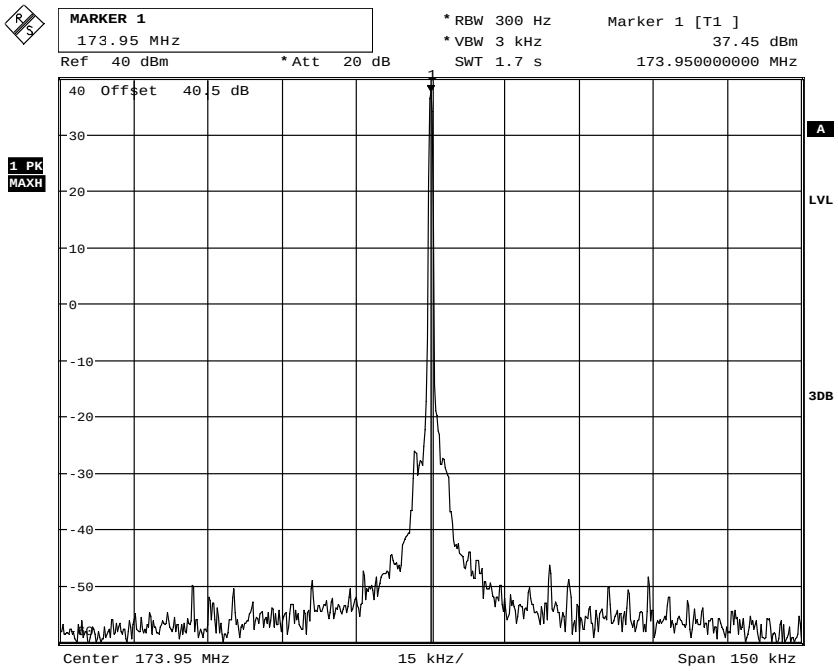
173.95 MHz High Power



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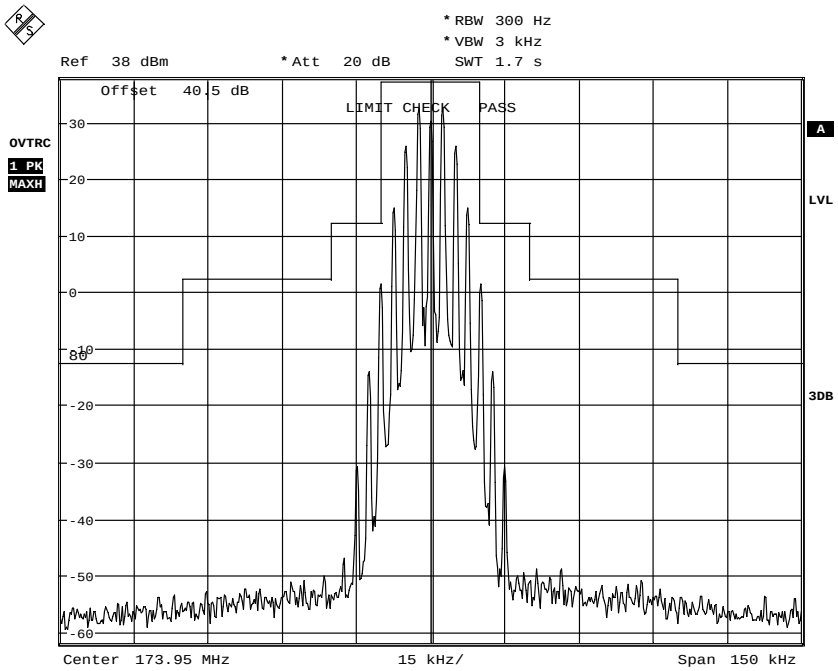
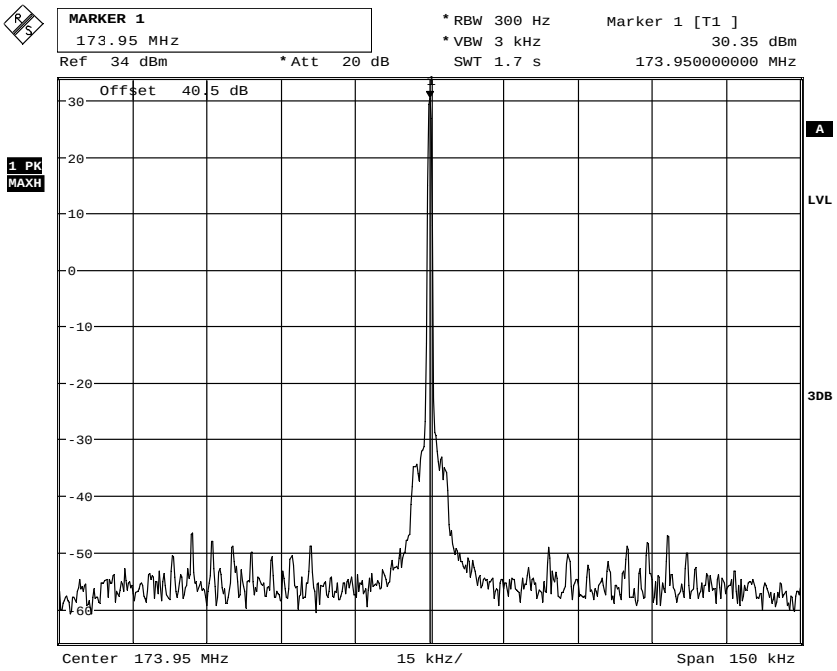


Date: 22.FEB.2018 17:28:12

173.95 MHz Low Power



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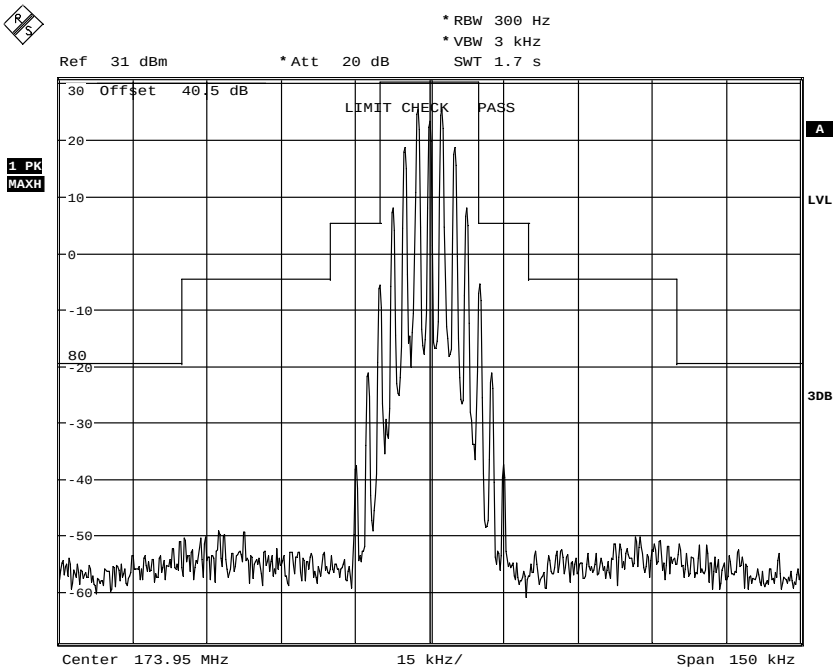


Date: 22.FEB.2018 17:19:12

8 FCC §2.1051, §80.211 (f) - Emissions at Antenna Terminals

8.1 Applicable Standards

According to FCC §80.211 (f):

(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 10log10 (mean power in watts) dB.

8.2 Test Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

8.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2017-04-20	1 year
-	Attenuator 30 dB	-	-	-	Each time
-	Attenuator 10 dB	-	-	-	Each time
-	RF Cable	-	-	-	Each time

Cable and attenuators included in the test set-up were checked each time before testing.

Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 09 June 2016) "A2LA Policy on Metrological Traceability".*

8.4 Test Environmental Conditions

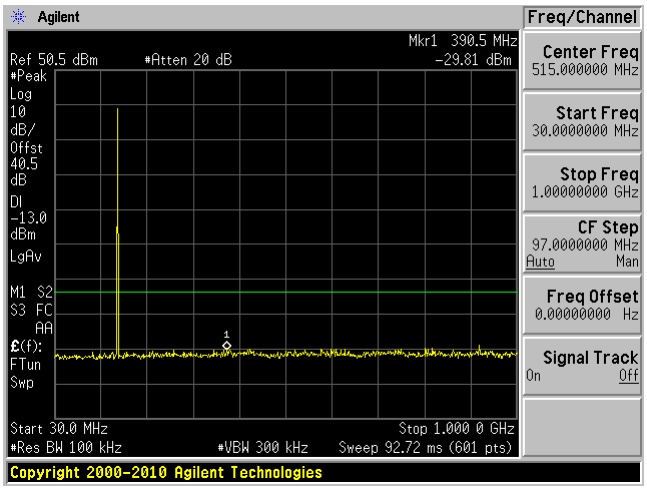
Temperature:	23 ºC
Relative Humidity:	46 %
ATM Pressure:	101.4 kPa

The testing was performed by Troy Pandhumsoporn on 2018-02-24 at RF site.

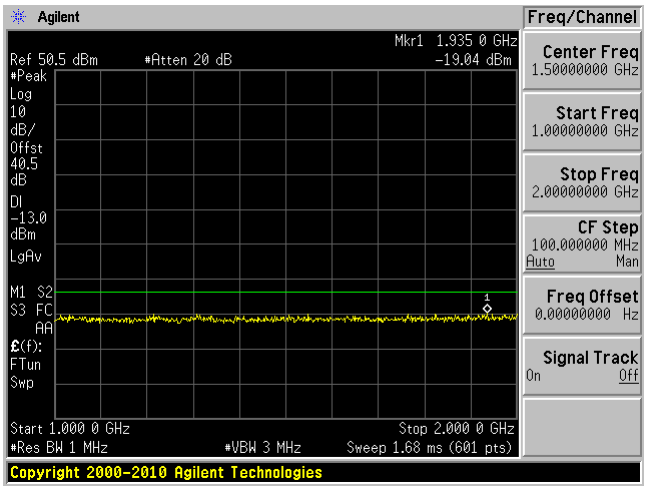
8.5 Test Results

The worst case channel frequency 162.05 MHz and high power setting

30 MHz to 1 GHz



1 GHz to 2 GHz



9 FCC §2.1053, §80.211 (f) - Field Strength of Spurious Radiation

9.1 Applicable Standards

According to FCC §80.211 (f):

(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 10log10 (mean power in watts) dB.

9.2 Test Procedure

According to TIA-603-E Section 2.2.12

9.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Rohde & Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100044	2017-09-19	2 years
Agilent	PSA	E4446A	MY48250238	2018-01-29	1 year
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
COM-POWER	Antenna, Dipole	AD-100	721033DB1, 2, 3, 4	2017-02-13	2 years
HP	Amplifier, Pre	8447D	2944A07030	2017-04-17	1 year
Keysight Technologies	Vector Signal Generator	N5182B	MY51350070	2018-01-06	1 year
Sunol Sciences	Antenna, Biconi-Log	JB3	A020106-2	2018-01-25	2 years
-	SMA Cable	-	C0003	-	Each time
-	N-Type Cable	-	-	-	Each time
EMCO	Antenna, Horn	3115	9511-4627	01/28/2016	26 months
Sunol Sciences	Antenna, Horn	DRH-118	A052704	03/27/2017	2 year
Agilent	Analyzer, Spectrum	E4446A	US44300386	04/20/2017	1 year
HP	Amplifier, Pre	8449B	3147A00400	06/15/2017	1 year

Cables included in the test set-up were checked each time before testing.

Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 09 June 2016) "A2LA Policy on Metrological Traceability".*

9.4 Test Environmental Conditions

Temperature:	24 ºC
Relative Humidity:	43 %
ATM Pressure:	101.2 kPa

The testing was performed by Troy Pandhumsoporn on 2018-02-23 at 5 meter chamber 3.

9.5 Test Results

Test mode: the worst case channel frequency 162.05 MHz and high power setting

Please refer to the following table

Freq. (MHz)	S.A. Amp. (dBmV)	Table Azimuth (Degrees)	Test Antenna		Substitution				Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (cm)	Polar (H/V)	Freq. (MHz)	S.G. Level (dBm)	Antenna Gain (dB)	Cable Loss (dB)			
162.05 MHz High Power											
324.1	31.74	85	167	H	324.1	-67.58	0	0.227	-67.807	-13	-54.807
324.1	33.13	0	100	V	324.1	-64.98	0	0.227	-65.207	-13	-52.207
486.15	40.59	84	175	H	486.15	-56.78	0	0.227	-57.007	-13	-44.007
486.16	41.36	0	144	V	486.16	-56.2	0	0.227	-56.427	-13	-43.427
648.2	37.71	80	124	H	648.2	-61.09	0	0.227	-61.317	-13	-48.317
648.2	37.88	0	100	V	648.2	-58.94	0	0.227	-59.167	-13	-46.167
1782	52.35	0	158	H	1782	-53.7	8.424	0.591	-45.867	-13	-32.867
1782	49.82	0	158	V	1782	-56.19	8.586	0.591	-48.195	-13	-35.195
1300	48.94	0	100	H	1300	-60.31	7.135	0.423	-53.598	-13	-40.598
1300	50.57	191	188	V	1300	-58.78	7.51	0.423	-51.693	-13	-38.693

10 FCC §2.1055, §80.209 - Frequency Tolerance

10.1 Applicable Standards

FCC §80.209 also:

According to FCC §2.1055:

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

(1) From −30° to + 50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(2) From −20° to + 50° centigrade for equipment to be licensed for use in the Maritime Services under part 80 of this chapter, except for Class A, B, and S Emergency Position Indicating Radiobeacons (EPIRBS), and equipment to be licensed for use above 952 MHz at operational fixed stations in all services, stations in the Local Television Transmission Service and Point-to-Point Microwave Radio Service under part 21 of this chapter, equipment licensed for use aboard aircraft in the Aviation Services under part 87 of this chapter, and equipment authorized for use in the Family Radio Service under part 95 of this chapter.

(3) From 0° to + 50° centigrade for equipment to be licensed for use in the Radio Broadcast Services under part 73 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.

(c) In addition to all other requirements of this section, the following information is required for equipment incorporating heater type crystal oscillators to be used in mobile stations, for which type acceptance is first requested after March 25, 1974, except for battery powered, hand carried, and portable equipment having less than 3 watts mean output power.

(1) Measurement data showing variation in transmitter output frequency from a cold start and the elapsed time necessary for the frequency to stabilize within the applicable tolerance. Tests shall be made after temperature stabilization at each of the ambient temperature levels; the lower temperature limit, 0° centigrade and + 30° centigrade with no primary power applied.

(2) Beginning at each temperature level specified in paragraph (c)(1) of this section, the frequency shall be measured within one minute after application of primary power to the transmitter and at intervals of no more than one minute thereafter until ten minutes have elapsed or until sufficient measurements are obtained to indicate clearly that the frequency has stabilized within the applicable tolerance, whichever time period is greater. During each test, the ambient temperature shall not be allowed to rise more than 10° centigrade above the respective beginning ambient temperature level.

(3) The elapsed time necessary for the frequency to stabilize within the applicable tolerance from each beginning ambient temperature level as determined from the tests specified in this paragraph shall be specified in the instruction book for the transmitter furnished to the user.

(4) When it is impracticable to subject the complete transmitter to this test because of its physical dimensions or power rating, only its frequency determining and stabilizing portions need be tested.

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

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(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.

(e) When deemed necessary, the Commission may require tests of frequency stability under conditions in addition to those specifically set out in paragraphs (a), (b), (c), and (d) of this section. (For example measurements showing the effect of proximity to large metal objects, or of various types of antennas, may be required for portable equipment.)

10.2 Test Procedure

According to ANSI/TIA-603-D 2010 section 2.2.2, the carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

The measurement method is as following:

- Operate the equipment in standby conditions for 15 minutes before proceeding.
- Record the carrier frequency of the transmitter as MCF MHz.
- Calculate the ppm frequency error by the following:

  Ppm error = ((MCF-ACF) / (ACF)) * 10^6

  Where

  MCF is the Measured Carrier Frequency in MHz
  ACF is the Assigned Carrier Frequency in MHz

- The value recorded above is the carrier frequency stability.
- At temperature of -30°C, +20°C and +50°C, and at the manufacturer's rated supply voltage; and
- At a temperature of +20°C and at ±15 percent of the manufacturer's rated supply voltage

10.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Rohde & Schwarz	Signal Analyzer	FSQ26	200749	2016-04-24	2 years
Tenney	Chamber, Environmental	TUJR	27445-06	2017-10-02	1 year
KEPCO	Source, DC	25-10M	H1334526	Cal. Not Required	N/A
Fluke	Digital Multi-meter	189	89920092	2017-03-22	1 year
-	Attenuator 30 dB	-	-	-	Each time
-	Attenuator 20 dB	-	-	-	Each time
-	RF Cable	-	-	-	Each time

Cable and attenuators included in the test set-up were checked each time before testing.

Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 09 June 2016) "A2LA Policy on Metrological Traceability".*

10.4 Test Environmental Conditions

Temperature:	21 ºC
Relative Humidity:	35 %
ATM Pressure:	101.1 kPa

The testing was performed by Troy Pandhumsoporn on 2018-03-12 at RF site.

10.5 Test Results

162.05 MHz High Power

Varying temperature:

Temperature (℃)	Measured Frequency (MHz)	Channel Frequency (MHz)	Frequency Tolerance (ppm)
-30	162.049971	162.050	-0.179
-20	162.049972	162.050	-0.173
-10	162.049972	162.050	-0.173
0	162.049974	162.050	-0.160
10	162.049978	162.050	-0.136
20	162.049962	162.050	-0.234
30	162.049958	162.050	-0.259
40	162.049964	162.050	-0.222
50	162.049965	162.050	-0.216

Varying supply voltage:

Voltage Condition	Measured Frequency (MHz)	Channel Frequency (MHz)	Frequency Tolerance (ppm)
Low Voltage	162.049957	162.050	-0.265
High Voltage	162.049959	162.050	-0.253

11 Exhibit A - FCC Equipment Labeling Requirements

11.1 FCC ID Label Requirements

As per FCC §2.925,

(a) Each equipment covered in an application for equipment authorization shall bear a nameplate or label listing the following:

(1) FCC Identifier consisting of the two elements in the exact order specified in §2.926. The FCC Identifier shall be preceded by the term FCC ID in capital letters on a single line, and shall be of a type size large enough to be legible without the aid of magnification.

Example: FCC ID: XXX123

Where: XXX—Grantee Code, 123—Equipment Product Code

As per FCC §15.19,

(a) In addition to the requirements in part 2 of this chapter, a device subject to certification, or verification shall be labeled as follows:

(3) All other devices shall bear the following statement in a conspicuous location on the device:
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

(4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified above is required to be affixed only to the main control unit. If the EUT is integrated within another device then a label affixed to the host shall also state, "Contains FCC ID: XXXXXX"

(5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

11.2 FCC ID Label Contents and Location

12 Appendix

The following exhibits can be found in R1802157 Photo Reports:

1. Exhibit B – EUT Test Setup Photographs
2. Exhibit C – EUT External Photographs
3. Exhibit D – EUT Internal Photographs

13 Annex A (Informative) - A2LA Electrical Testing Certificate

Accredited Laboratory

A2LA has accredited

BAY AREA COMPLIANCE LABORATORIES CORP.

Sunnyvale, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of A2LA *R222 - Specific Requirements - EPA ENERGY STAR Accreditation Program*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

Presented this 30th day of August 2016.

Senior Director of Quality & Communications
For the Accreditation Council
Certificate Number 3297.02
Valid to September 30, 2018

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

---END OF REPORT ---