

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: K44475400

Report Type: CIIPC		Product Model: TK-D240/D240V
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1802159-80	CIIPC	-

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: *TK-D240/D240V*, *FCC ID: K44475400*, 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 154-162.0375 MHz." 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-45L	138.05	KRA-26M3
		150.05	KRA-26M
		162.05	KRA-26M2
		173.95	KRA-26M2

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. ANSI C63.10-2013, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9kHz to 40GHz.

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

BACL's 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):
 - o BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
 - o NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
 - o EMC Directive 2014/30/EU US-EU EMC & Telecom MRA CAB (NB)
 - o Radio Equipment (RE) Directive 2014/53/EU US-EU EMC & Telecom MRA CAB (NB)
 - o 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:
 - o ENERGY STAR Recognized Test Laboratory – US EPA
 - o Telecommunications Certification Body (TCB) – US FCC;
 - o 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 Corporation	Dummy MIC	PTT JIG No.2

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)	Operating 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—25W⁶

⁶Reducible 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 °C
Relative Humidity:	46 %
ATM Pressure:	101.4 kPa

The testing was performed by Vincent Licata on 2018-02-23 and 2018-04-03 at RF site.

4.5 Test Results

Conducted output power:

Channel	Frequency (MHz)	Device Power Setting	Conducted Output Power (dBm)	Limits (dBm)
Low	138.05	High	36.99	43.98
		Low	30.37	43.98
Middle	150.05	High	36.96	43.98
		Low	30.31	43.98
Middle	162.05	High	36.84	43.98
		Low	30.25	43.98
High	173.95	High	36.83	43.98
		Low	30.16	43.98

5 FCC §2.1049, §80.205 (a) – Operating 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

⁸Applicable 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
Agilent	Analyzer, Spectrum	E4446A	US44300386	2017-04-20	1 year
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 °C
Relative Humidity:	46 %
ATM Pressure:	101.4 kPa

The testing was performed by Vincent Licata on 2018-02-26 and 2018-04-03 at RF site.

5.5 Test Results

99% Bandwidth High Power

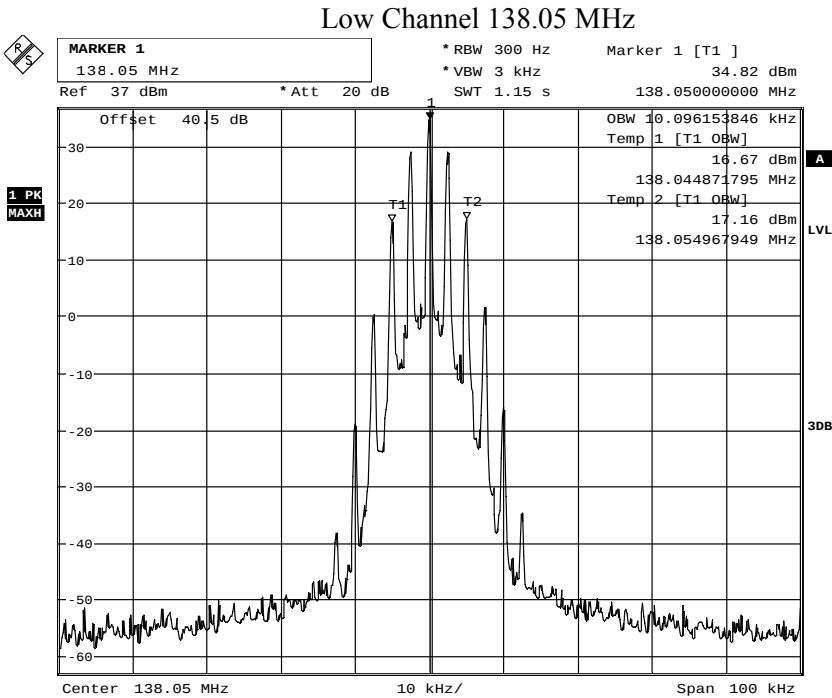
Channel	Frequency (MHz)	99% OBW (kHz)	Limit (kHz)
Low	138.05	10.0961	20
Middle	150.05	10.0961	20
Middle	162.05	10.0961	20
High	173.95	10.0961	20

99% Bandwidth Low Power

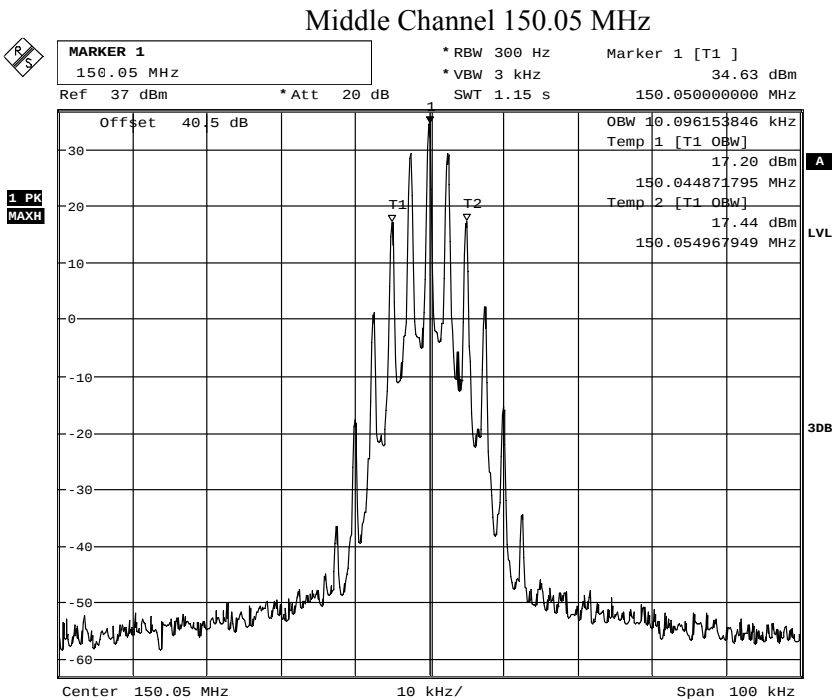
Channel	Frequency (MHz)	99% OBW (kHz)	Limit (kHz)
Low	138.05	10.5400	20
Middle	150.05	10.4400	20
Middle	162.05	10.4300	20
High	173.95	10.4200	20

Please refer to the following plots for detailed test results.

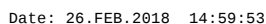
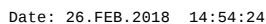
High Power



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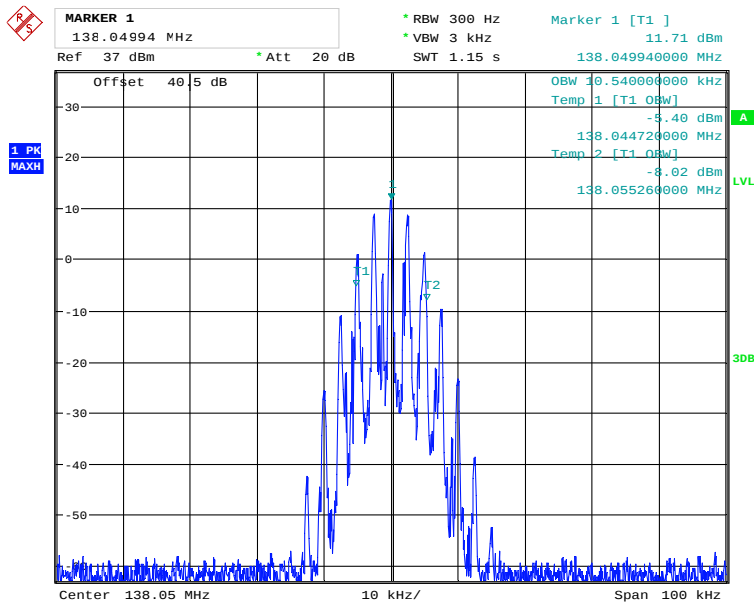


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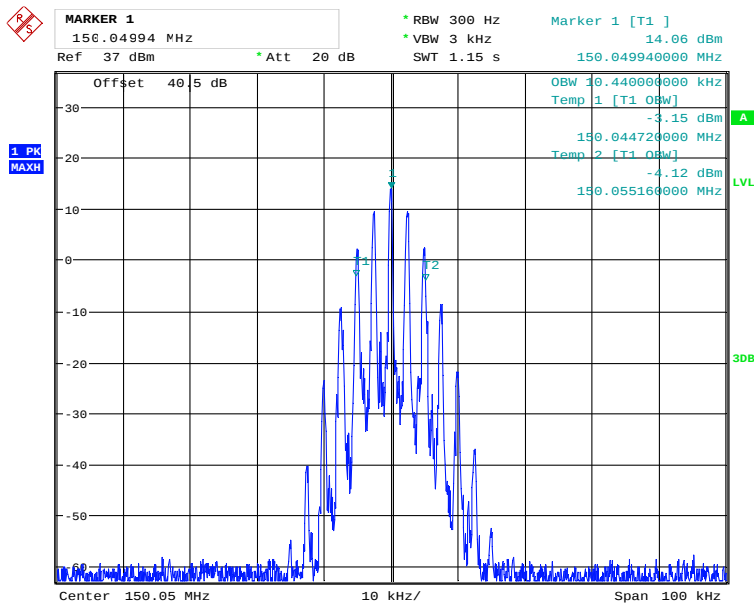
Low Power

Low Channel 138.05 MHz



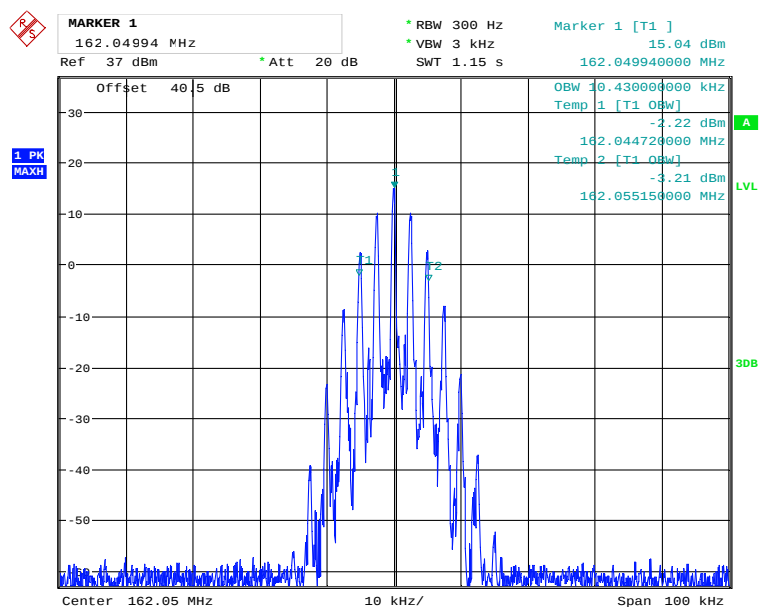
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Middle Channel 150.05 MHz



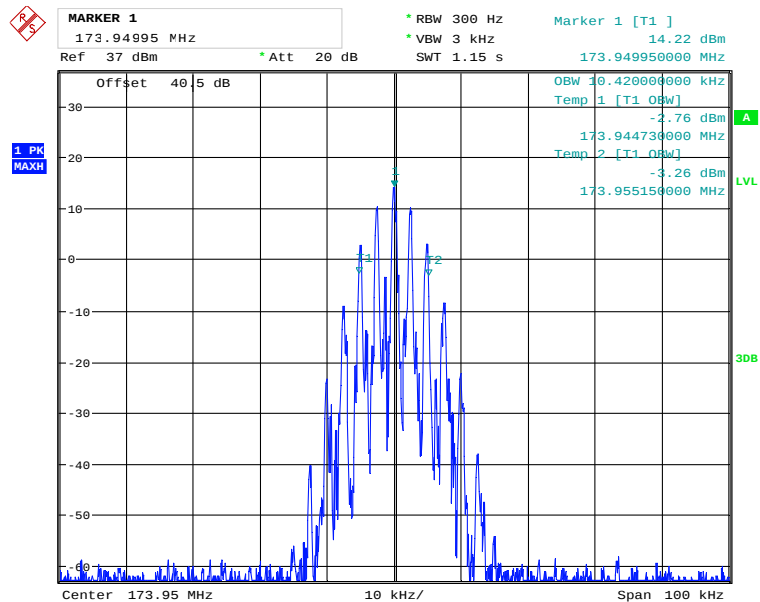
Date: 3.APR.2018 11:25:26

Middle Channel 162.05 MHz



Date: 3.APR.2018 11:23:32

High Channel 173.95 MHz



Date: 3.APR.2018 11:29:06

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

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 °C
Relative Humidity:	46 %
ATM Pressure:	101.4 kPa

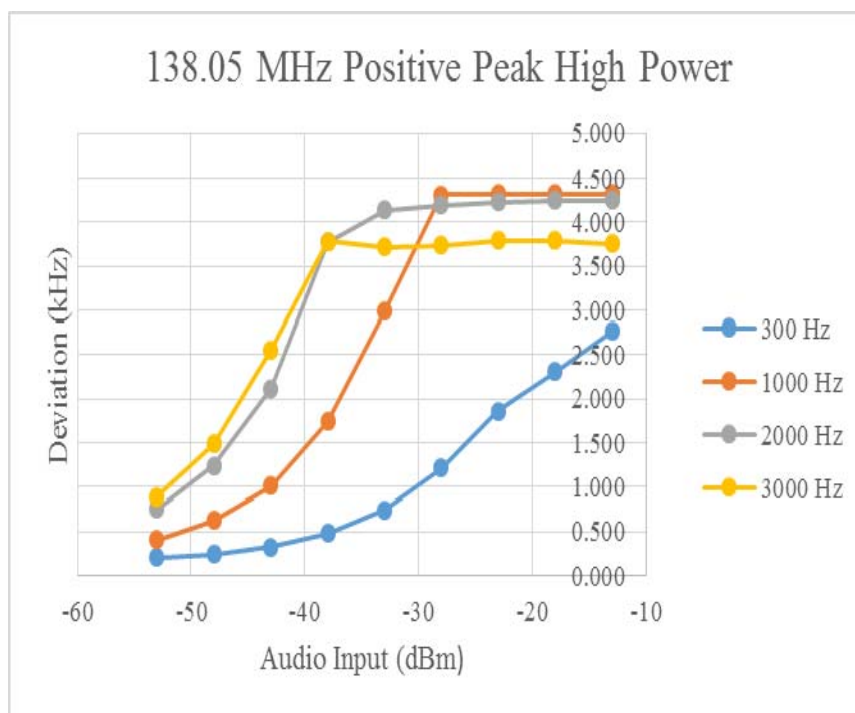
The testing was performed by Vincent Licata on 2018-02-26 and 2018-04-03 at RF site.

6.5 Test Results

Modulation Limiting

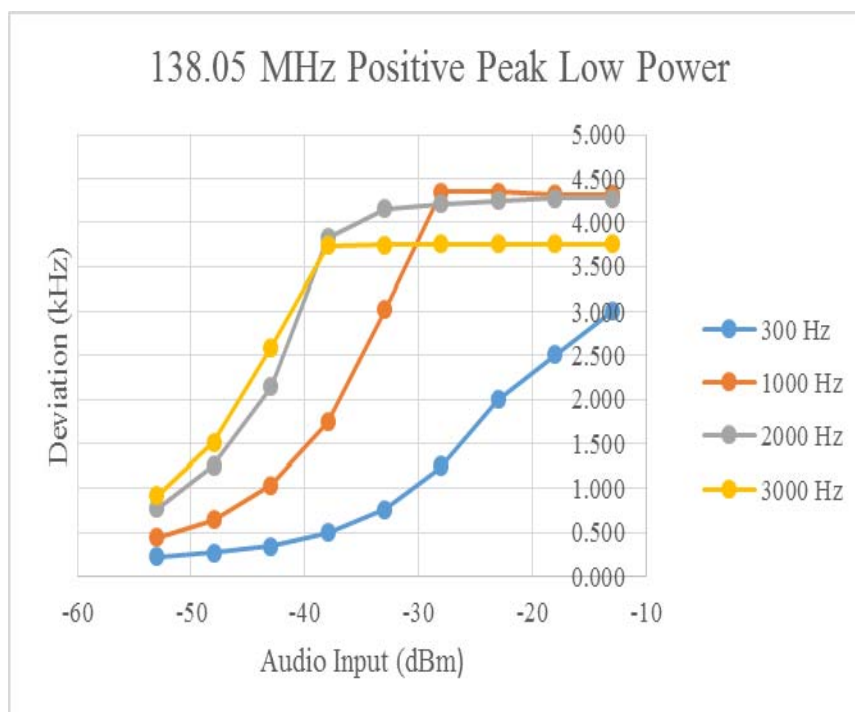
138.05 MHz Positive Peak High Power

AF Level (dB)	AF Frequency (Hz)/Peak Deviation (kHz)				Limit (kHz)
	300 Hz	1000 Hz	2000 Hz	3000 Hz	
20	2.771	4.320	4.250	3.760	±5
15	2.312	4.320	4.250	3.790	±5
10	1.867	4.320	4.230	3.790	±5
5	1.210	4.310	4.190	3.740	±5
0	0.743	3.001	4.140	3.720	±5
-5	0.485	1.743	3.774	3.780	±5
-10	0.326	1.017	2.118	2.561	±5
-15	0.248	0.628	1.237	1.486	±5
-20	0.207	0.412	0.758	0.896	±5



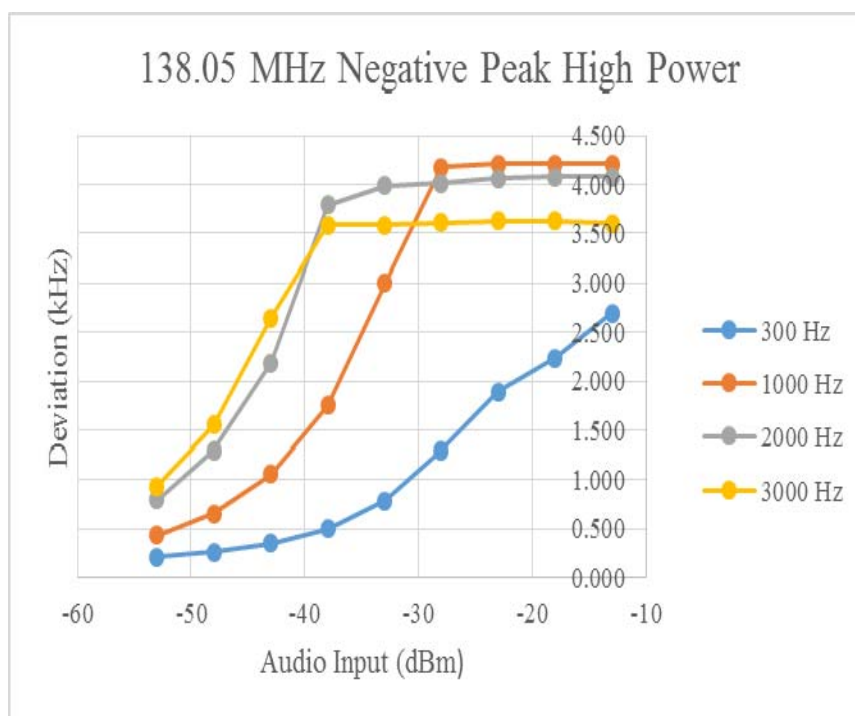
138.05 MHz Positive Peak Low Power

AF Level (dB)	AF Frequency (Hz)/Peak Deviation (kHz)				Limit (kHz)
	300 Hz	1000 Hz	2000 Hz	3000 Hz	
20	3.002	4.320	4.280	3.757	±5
15	2.512	4.320	4.280	3.754	±5
10	2.001	4.350	4.250	3.753	±5
5	1.247	4.350	4.210	3.752	±5
0	0.767	3.028	4.160	3.744	±5
-5	0.501	1.741	3.830	3.738	±5
-10	0.343	1.036	2.145	2.590	±5
-15	0.271	0.650	1.260	1.512	±5
-20	0.224	0.441	0.776	0.918	±5



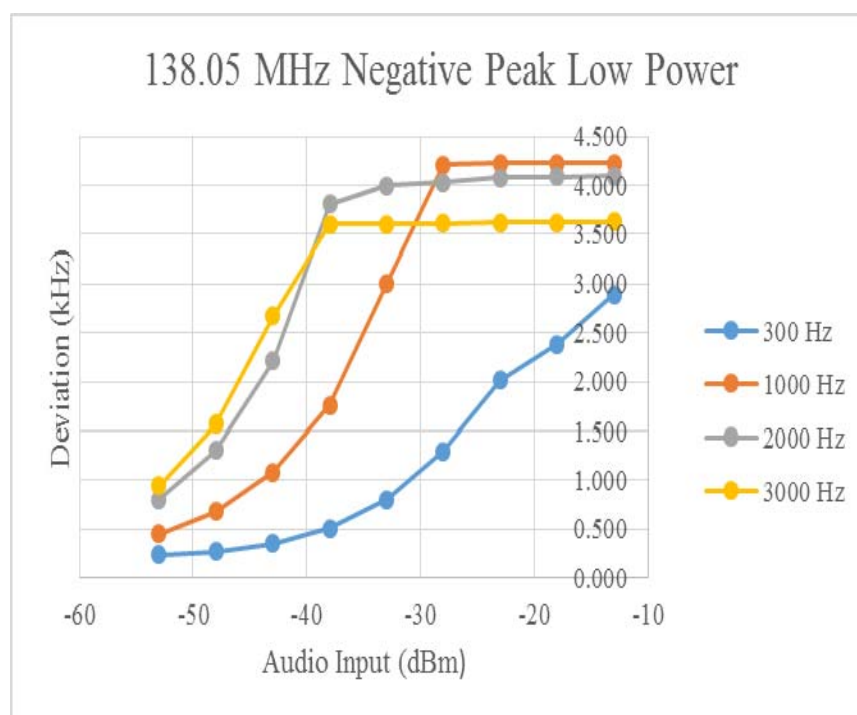
138.05 MHz Negative Peak High Power

AF Level (dB)	AF Frequency (Hz)/Peak Deviation (kHz)				Limit (kHz)
	300 Hz	1000 Hz	2000 Hz	3000 Hz	
20	2.700	4.210	4.080	3.601	±5
15	2.234	4.210	4.080	3.626	±5
10	1.888	4.210	4.060	3.629	±5
5	1.297	4.180	4.010	3.608	±5
0	0.784	3.005	3.990	3.589	±5
-5	0.499	1.754	3.790	3.585	±5
-10	0.351	1.057	2.190	2.645	±5
-15	0.260	0.659	1.297	1.553	±5
-20	0.214	0.435	0.799	0.937	±5



138.05 MHz Negative Peak Low Power

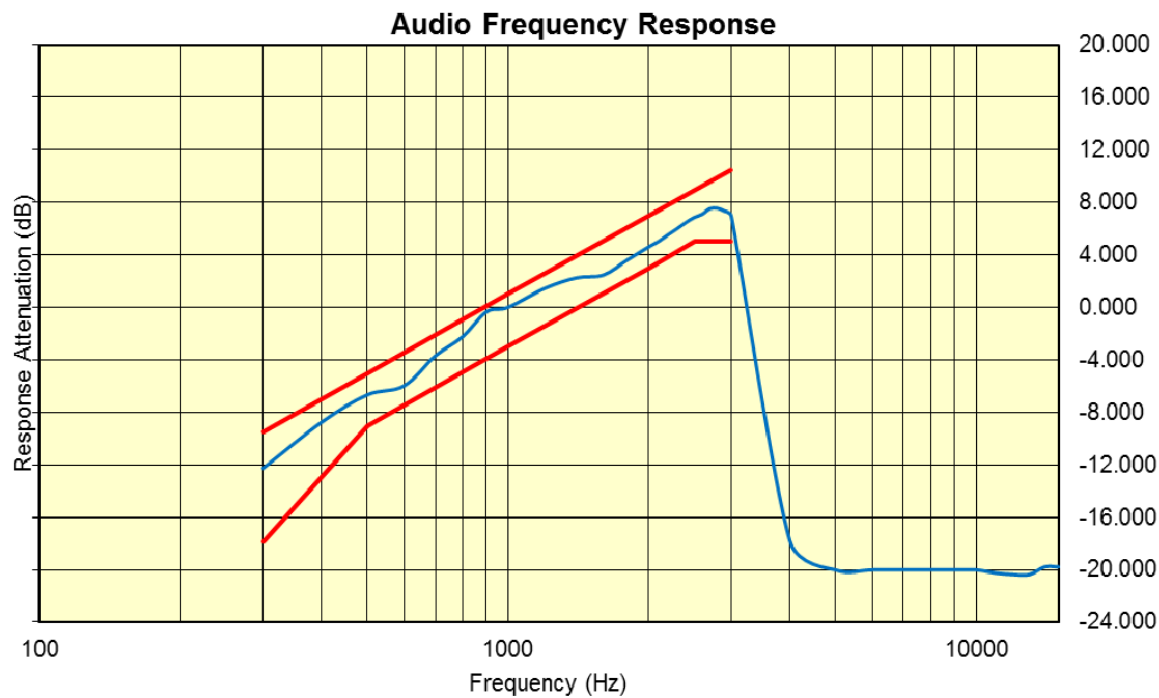
AF Level (dB)	AF Frequency (Hz)/Peak Deviation (kHz)				Limit (kHz)
	300 Hz	1000 Hz	2000 Hz	3000 Hz	
20	2.895	4.230	4.100	3.624	±5
15	2.386	4.230	4.090	3.621	±5
10	2.014	4.230	4.080	3.618	±5
5	1.296	4.210	4.030	3.614	±5
0	0.801	3.007	4.000	3.605	±5
-5	0.510	1.760	3.810	3.604	±5
-10	0.350	1.080	2.209	2.670	±5
-15	0.272	0.680	1.309	1.569	±5
-20	0.240	0.449	0.806	0.948	±5



Note: Only worst case channel (138.05 MHz) was tested to show compliance.

Audio Frequency Response**138.05 MHz High Power**

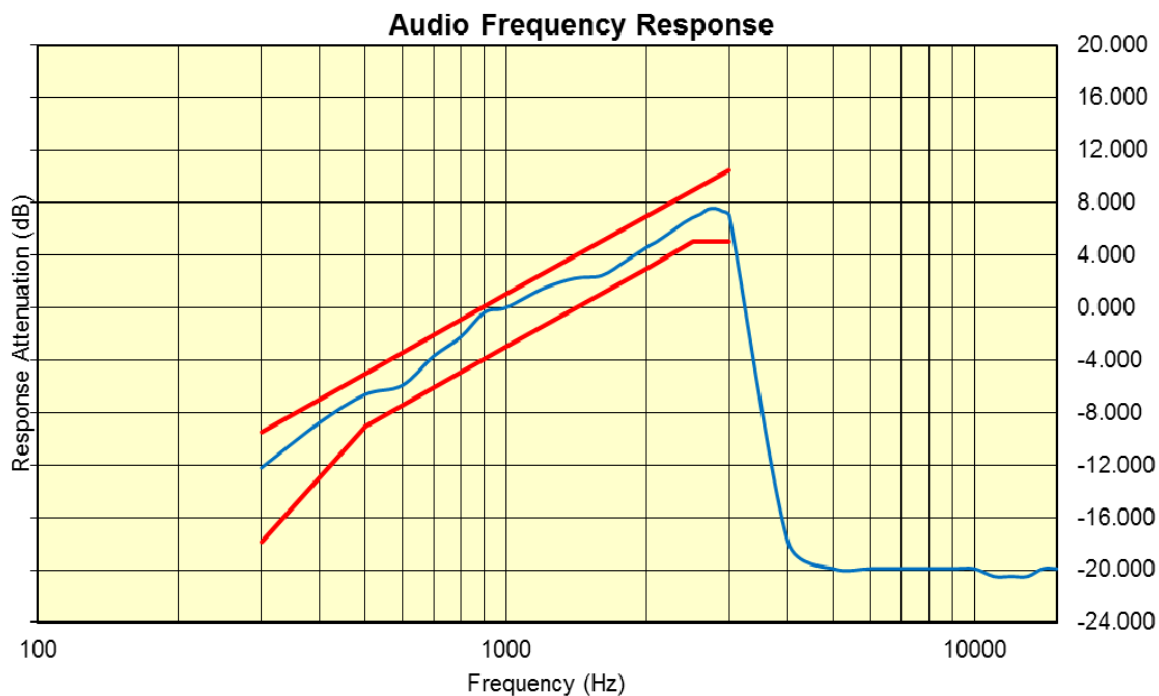
Tone (Hz)	Deviation (kHz)	Response Attenuation (dB)
300	0.183	-12.264
400	0.274	-8.758
500	0.348	-6.681
600	0.377	-5.986
700	0.491	-3.691
800	0.580	-2.244
900	0.722	-0.342
1000	0.751	0.000
1200	0.888	1.455
1400	0.973	2.249
1600	0.998	2.470
1800	1.139	3.618
2000	1.278	4.618
2100	1.342	5.042
2200	1.422	5.545
2300	1.499	6.003
2400	1.582	6.471
2500	1.653	6.853
2600	1.701	7.101
2700	1.784	7.515
2800	1.792	7.554
2900	1.748	7.338
3000	1.673	6.957
4000	0.097	-17.777
5000	0.075	-20.012
6000	0.075	-20.012
7000	0.075	-20.012
8000	0.075	-20.012
9000	0.075	-20.012
10000	0.075	-20.012
11000	0.073	-20.246
12000	0.072	-20.366
13000	0.072	-20.366
14000	0.077	-19.783
15000	0.077	-19.783



Result: Pass

Audio Frequency Response**138.05 MHz Low Power**

Tone (Hz)	Deviation (kHz)	Response Attenuation (dB)
300	0.184	-12.216
400	0.274	-8.758
500	0.350	-6.631
600	0.379	-5.940
700	0.490	-3.709
800	0.580	-2.244
900	0.721	-0.354
1000	0.751	0.000
1200	0.888	1.455
1400	0.970	2.223
1600	0.994	2.435
1800	1.130	3.549
2000	1.277	4.611
2100	1.341	5.036
2200	1.420	5.533
2300	1.500	6.009
2400	1.584	6.482
2500	1.653	6.853
2600	1.704	7.117
2700	1.782	7.505
2800	1.793	7.559
2900	1.748	7.338
3000	1.679	6.988
4000	0.096	-17.867
5000	0.076	-19.897
6000	0.076	-19.897
7000	0.076	-19.897
8000	0.076	-19.897
9000	0.076	-19.897
10000	0.076	-19.897
11000	0.071	-20.488
12000	0.071	-20.488
13000	0.071	-20.488
14000	0.076	-19.897
15000	0.076	-19.897

**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 $10\log_{10}$ (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.

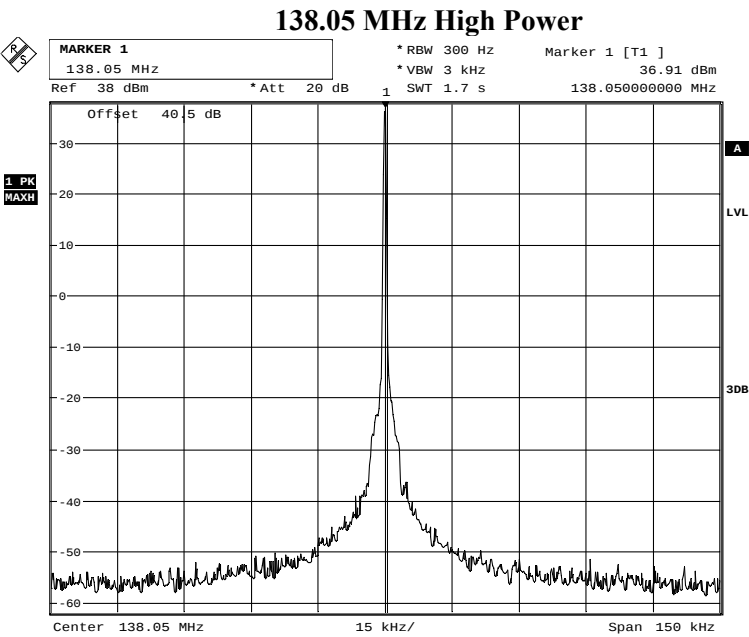
Statement of Traceability: BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 09 June 2016) "A2LA Policy on Metrological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

7.4 Test Environmental Conditions

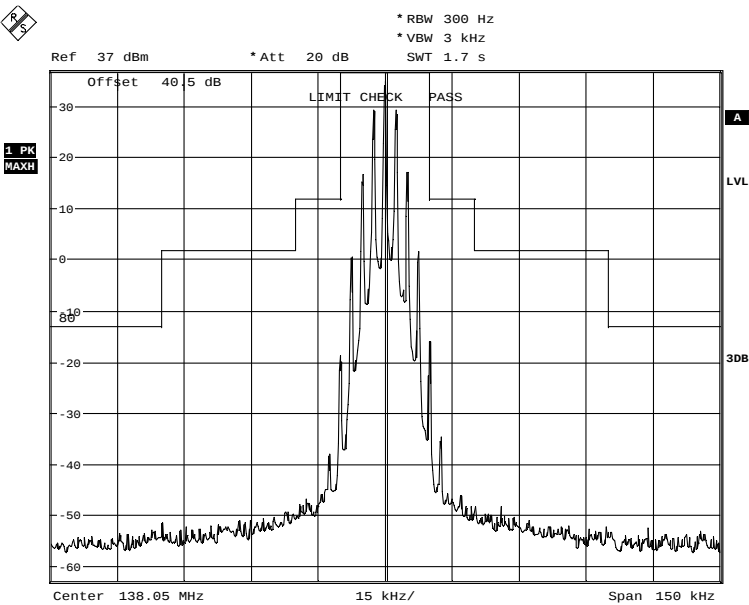
Temperature:	23 °C
Relative Humidity:	46 %
ATM Pressure:	101.4 kPa

The testing was performed by Vincent Licata on 2018-02-26 and 2018-04-03 at RF site.

7.5 Test Results

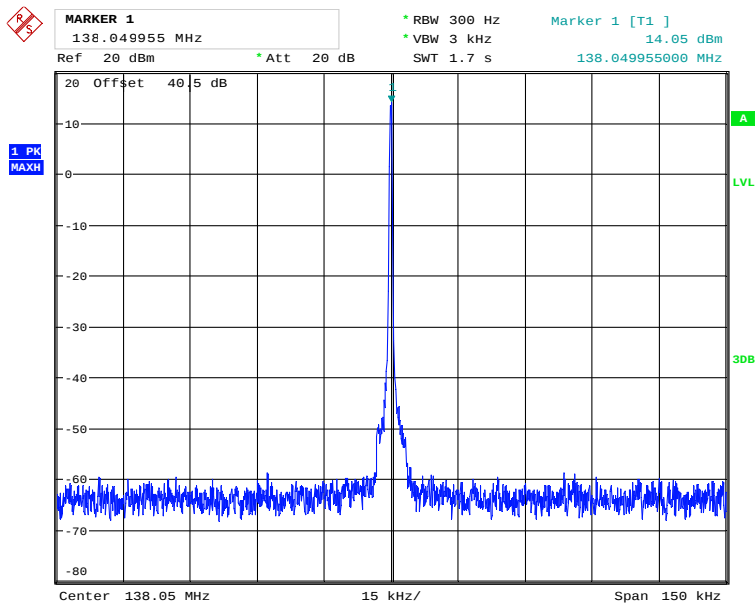


Date: 26.FEB.2018 14:39:55

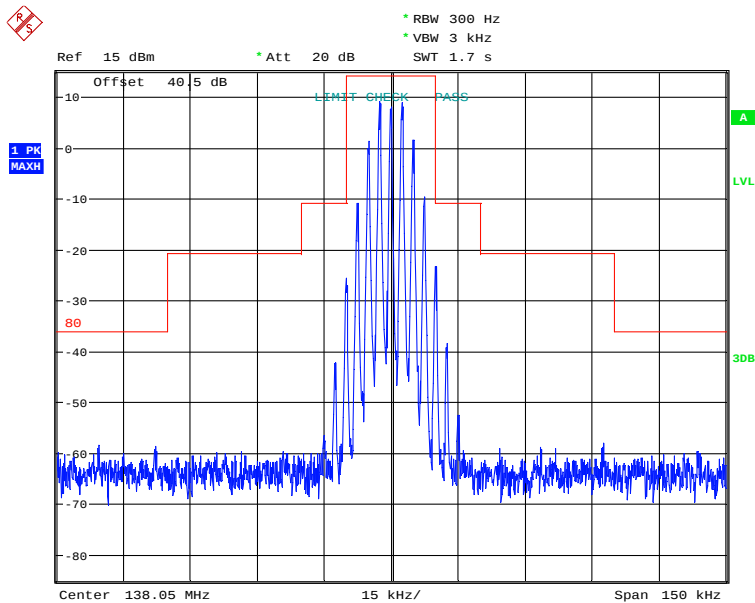


Date: 26.FEB.2018 14:43:54

138.05 MHz Low Power

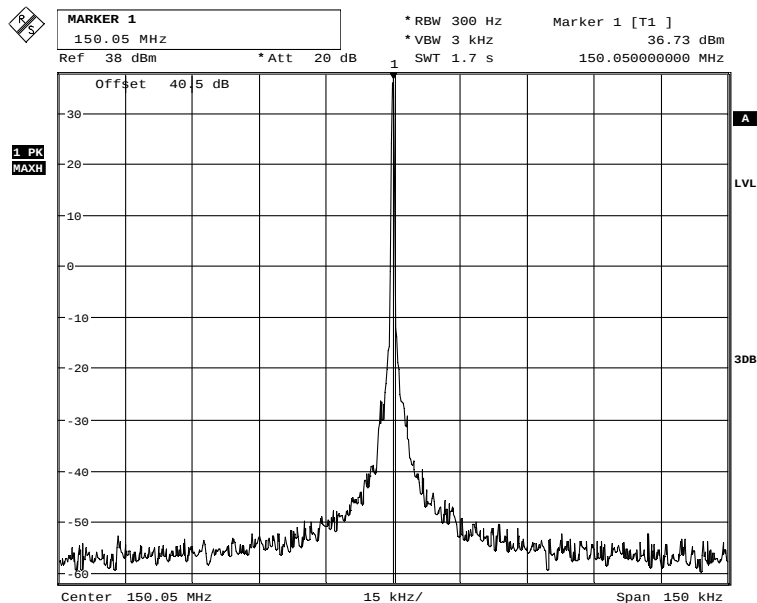


Date: 3.APR.2018 11:43:06

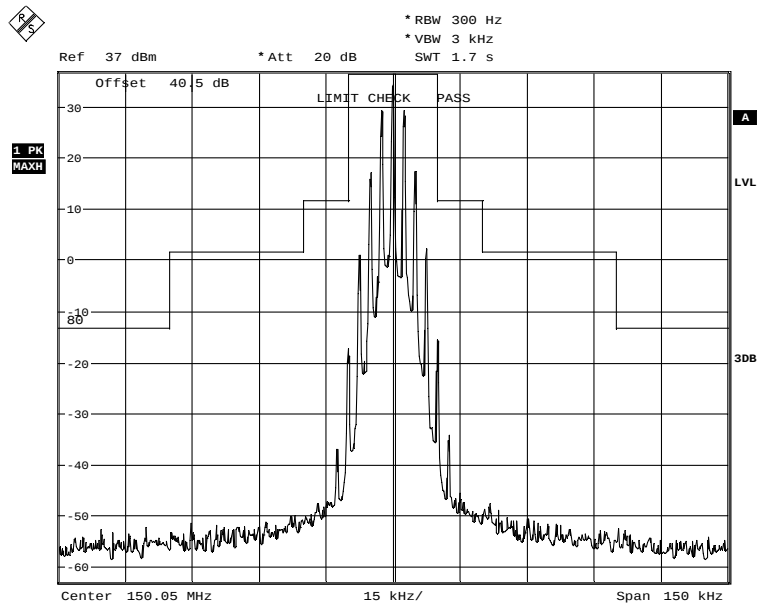


Date: 3.APR.2018 11:44:53

150.05 MHz High Power

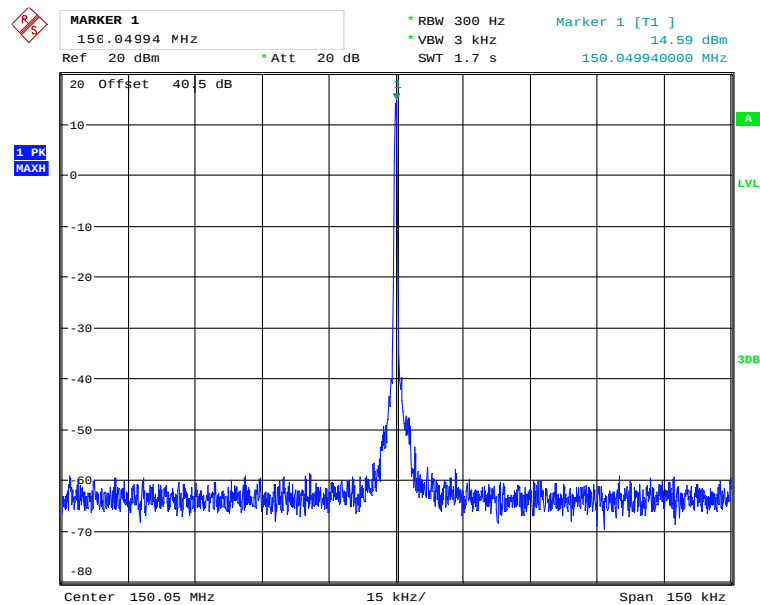


Date: 26.FEB.2018 14:49:56

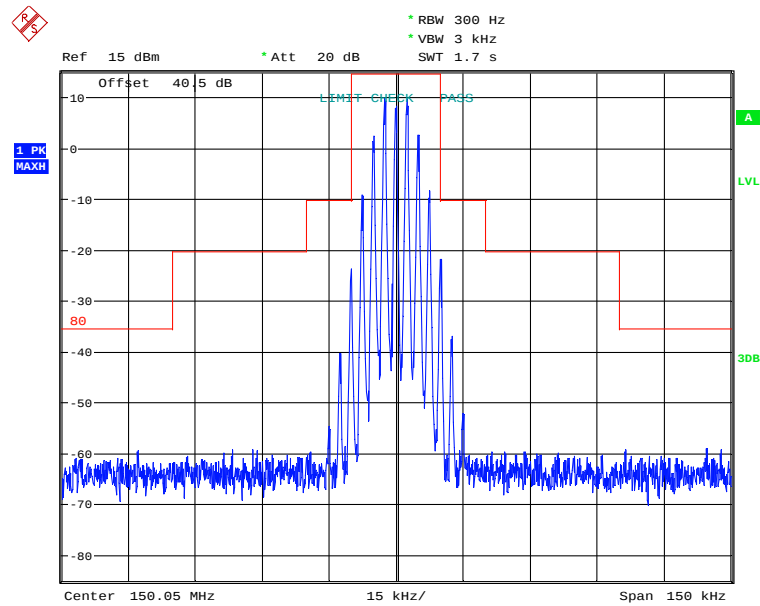


Date: 26.FEB.2018 14:51:30

150.05 MHz Low Power

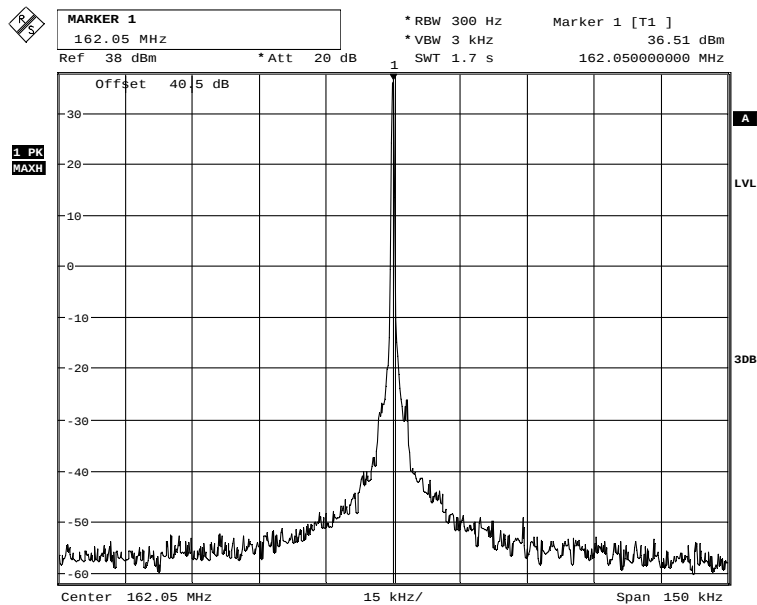


Date: 3.APR.2018 11:39:41

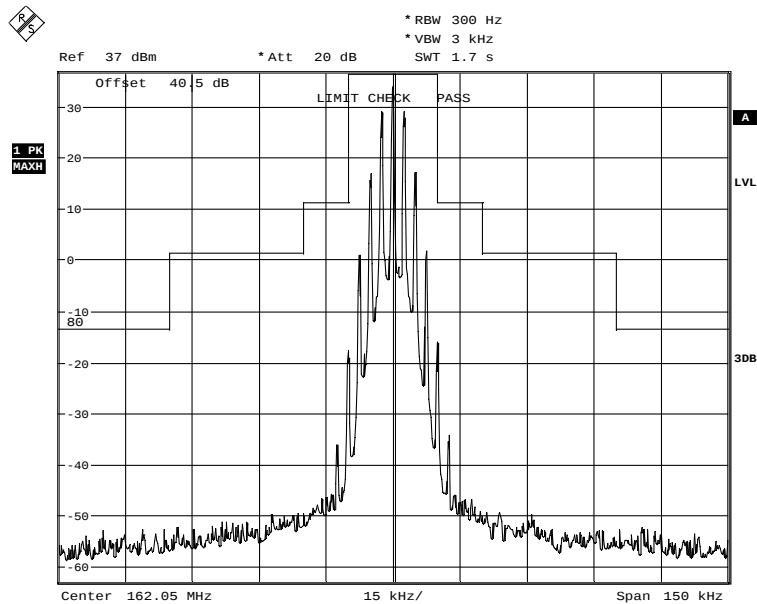


Date: 3.APR.2018 11:41:21

162.05 MHz High Power

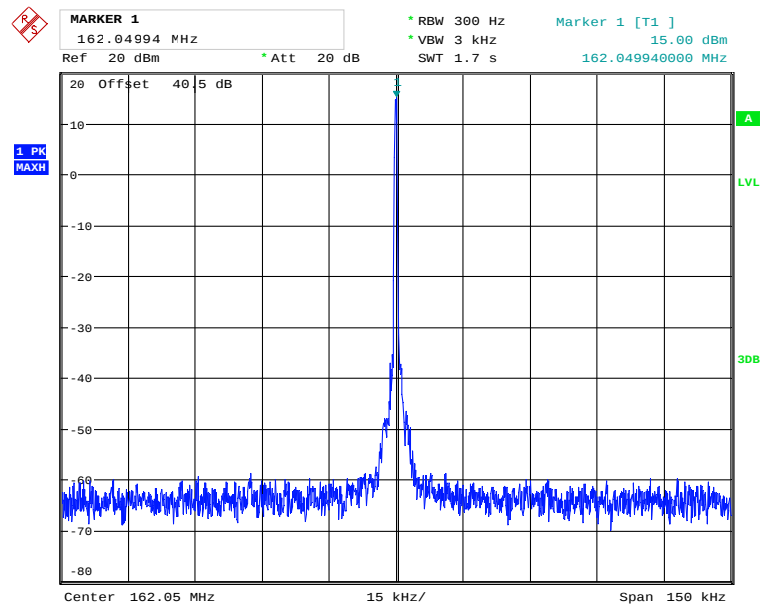


Date: 26.FEB.2018 14:55:45

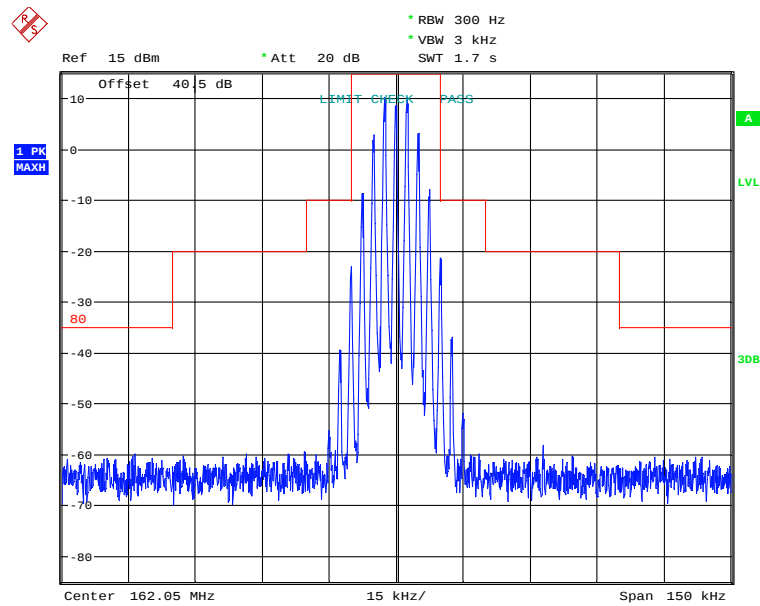


Date: 26.FEB.2018 14:57:35

162.05 MHz Low Power

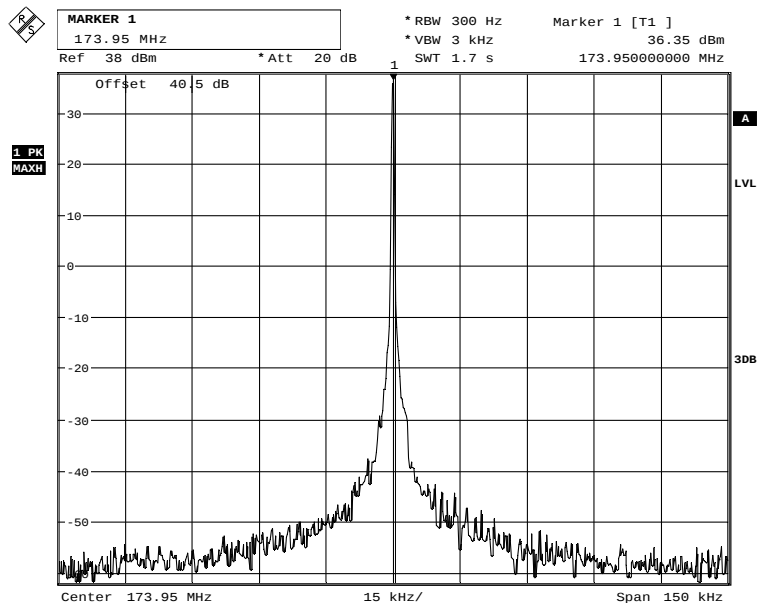


Date: 3.APR.2018 11:36:53

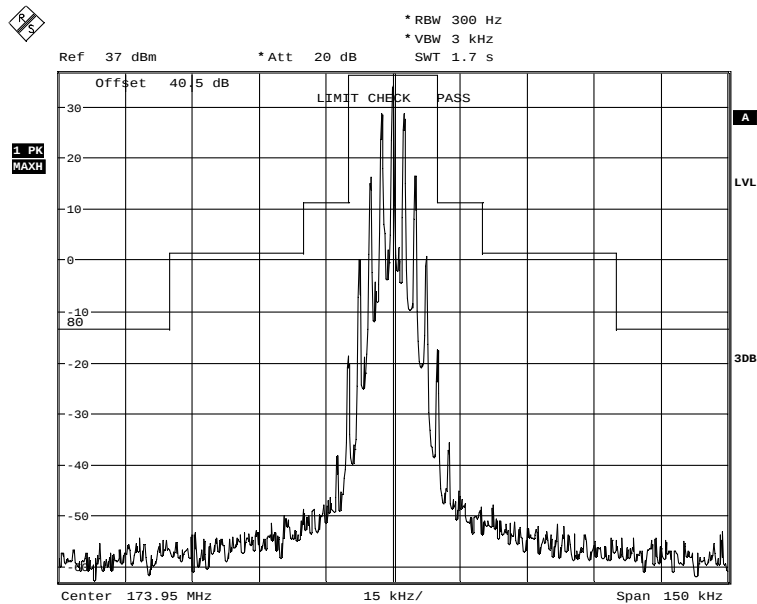


Date: 3.APR.2018 11:38:13

173.95 MHz High Power

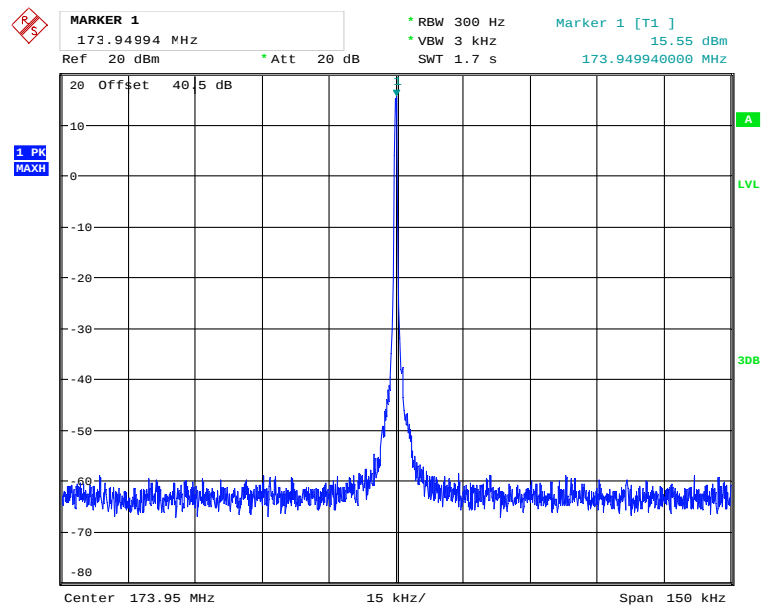


Date: 26.FEB.2018 15:01:03

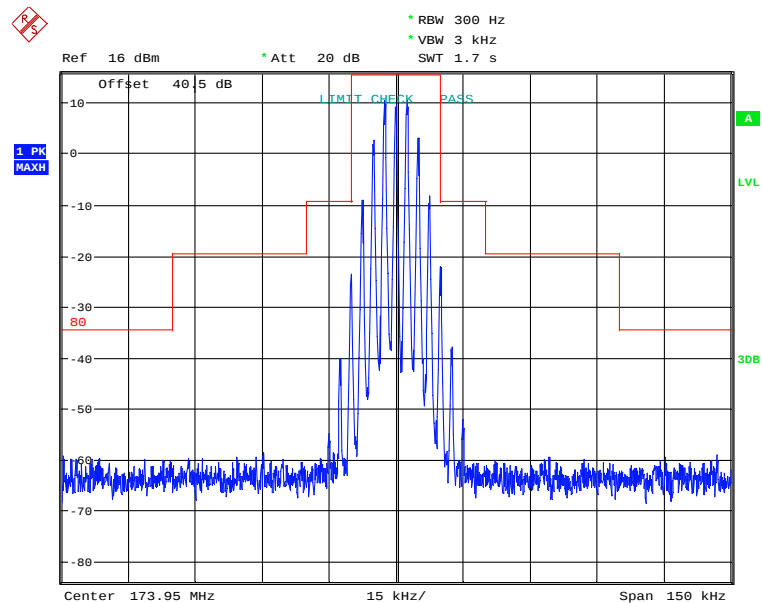


Date: 26.FEB.2018 15:02:42

173.95 MHz Low Power



Date: 3.APR.2018 11:31:39



Date: 3.APR.2018 11:34:34

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 $10\log_{10}$ (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

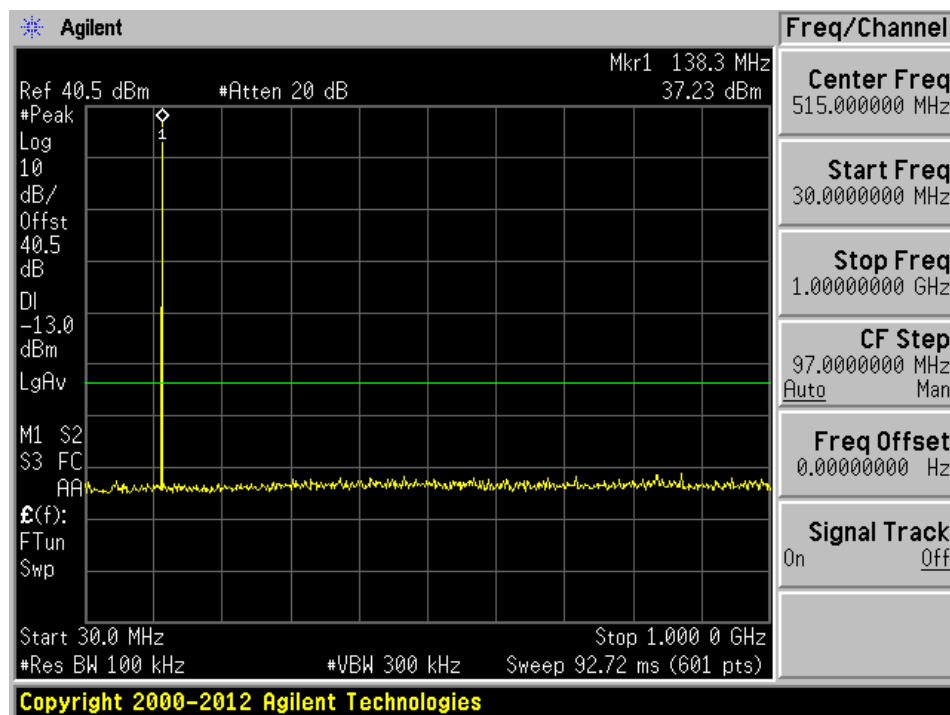
Temperature:	23 °C
Relative Humidity:	46 %
ATM Pressure:	101.4 kPa

The testing was performed by Vincent Licata on 2018-02-26 at RF site.

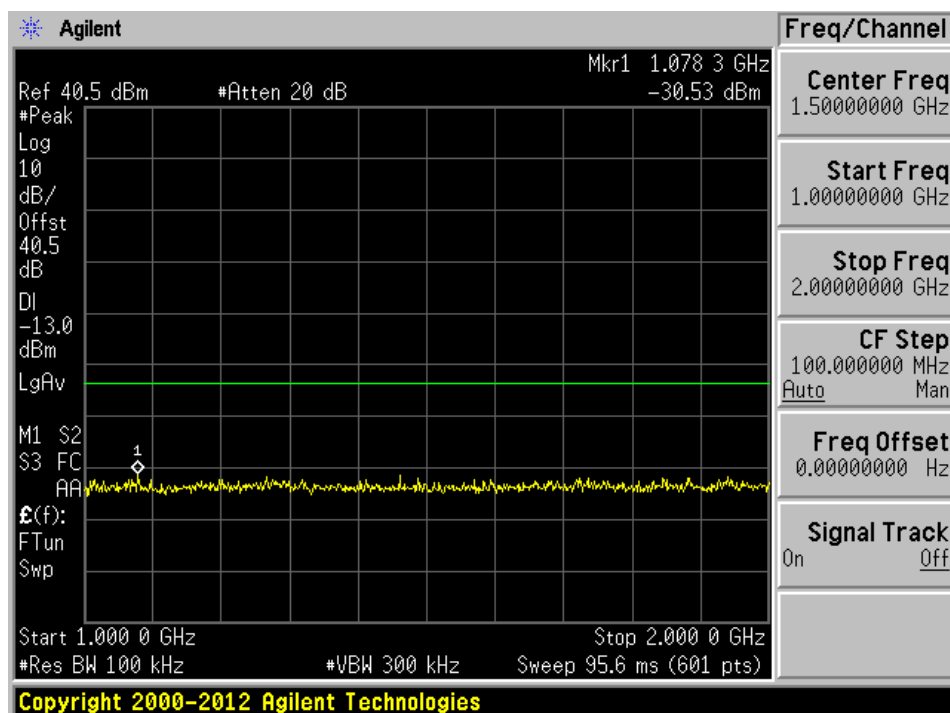
8.5 Test Results

The worst case channel frequency 138.05 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 $10\log_{10}$ (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
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	2016-01-28	26 months
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2017-03-27	2 year
Agilent	Analyzer, Spectrum	E4446A	US44300386	2017-04-20	1 year
HP	Amplifier, Pre	8449B	3147A00400	2017-06-15	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 °C
Relative Humidity:	43 %
ATM Pressure:	101.2 kPa

The testing was performed by Troy Pandhumsoporn on 2018-02-28 at 5 meter chamber 3.

9.5 Test Results

Test mode: the worst case channel frequency 138.05 MHz and high power setting

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)			
138.05 MHz High Power											
188	28.99	214	100	H	188	-80.55	0	0.227	-80.777	-13	-67.777
188	28.53	45	157	V	188	-78.07	0	0.227	-78.297	-13	-65.297
276.1	18.8	0	100	H	276.1	-84.81	0	0.227	-85.037	-13	-72.037
276.1	18.97	0	100	V	276.1	-84.46	0	0.227	-84.687	-13	-71.687
414.15	19.17	0	100	H	414.15	-82.07	0	0.227	-82.297	-13	-69.297
414.15	19.89	0	100	V	414.15	-78.53	0	0.227	-78.757	-13	-65.757
1500	47.93	0	100	H	1500	-61.03	8.168	0.423	-53.285	-13	-40.285
1500	48.1	0	100	V	1500	-61.15	8.206	0.423	-53.367	-13	-40.367
1300	48.71	0	100	H	1300	-61.37	7.135	0.335	-54.57	-13	-41.57
1300	48.7	0	100	V	1300	-61.38	7.51	0.335	-54.205	-13	-41.205

Note1: Any emissions above 1 GHz was due to noise floor.

Note2: Only worst case channel (138.05 MHz) was tested to show compliance.

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 $+50^{\circ}$ centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(2) From -20° to $+50^{\circ}$ 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 $+50^{\circ}$ 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 $+30^{\circ}$ 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:

$$\text{Ppm error} = ((\text{MCF} - \text{ACF}) / (\text{ACF})) * 10^6$$

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
Agilent	Analyzer, Spectrum	E4446A	US44300386	2017-04-20	1 year
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 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".

10.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	52 %
ATM Pressure:	101.1 kPa

The testing was performed by Vincent Licata on 2018-02-26 at RF site.

10.5 Test Results

138.05 MHz High Power

Varying temperature:

Temperature (°C)	Measured Frequency (MHz)	Channel Frequency (MHz)	Frequency Tolerance (ppm)
-30	138.050	138.050	0.000
-20	138.050	138.050	0.000
-10	138.050	138.050	0.000
0	138.050	138.050	0.000
10	138.050	138.050	0.000
20	138.050	138.050	0.000
30	138.050	138.050	0.000
40	138.050	138.050	0.000
50	138.050	138.050	0.000

Varying supply voltage:

Voltage (V _{DC})	Measured Frequency (MHz)	Channel Frequency (MHz)	Frequency Tolerance (ppm)
Low Voltage	138.050	138.05	0.000
High Voltage	138.050	138.05	0.000

Note: Only worst case channel (138.05 MHz) was tested to show compliance.

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:

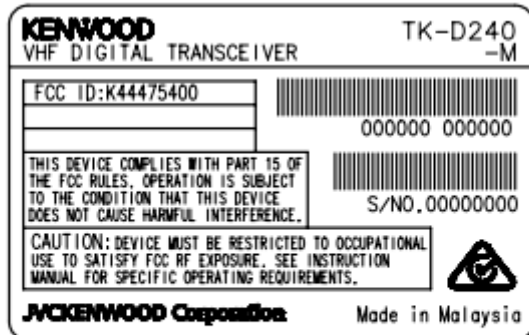
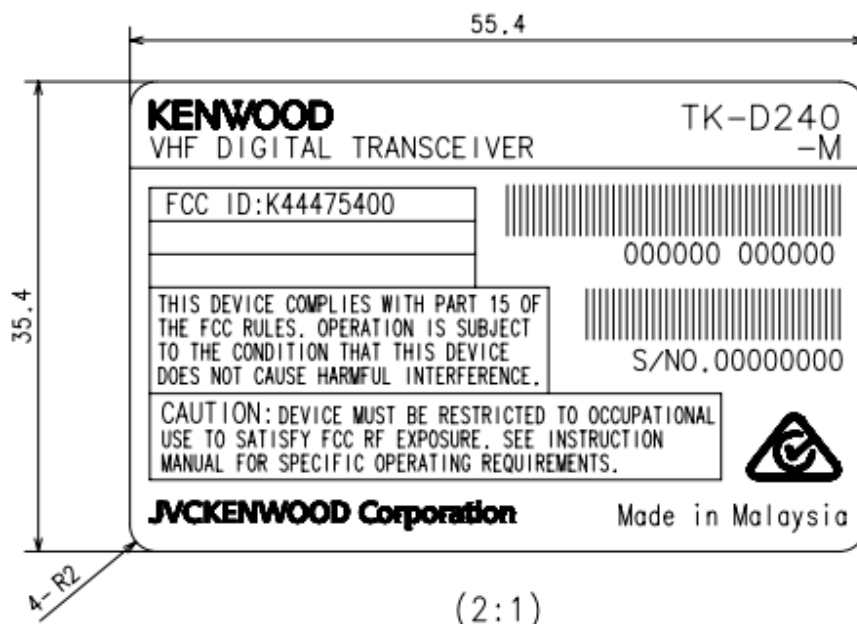
(3) All other devices shall bear the following statement in a conspicuous location on the device:

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



MATERIAL:PET(AL EVAPORATION PLATE)
THICKNESS:0.1mm
COLOR:FROSTED SILVER



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

---END OF REPORT ---