

Test Report

(FCC Rules 47 CFR,
2.1046, 2.1049, 2.1051, 2.1053, 2.1055, 80.209, 80.211, 80.215 and 80.217)

For

Trade name: Furuno
Model: U-AIS TRANSPONDER
Type: FA-170

Report no.: LIC 12-15-116

Date of issue: 6 November 2015

Labotech International Co., Ltd.

1-16, Fukazu-cho, Nishinomiya-shi, Hyogo, 663-8203 Japan

Tel: +81-798-63-1094 Fax: +81-798-63-1098

URL: <http://www.furuno-labotech.co.jp>

Report Summary

LIC project number:	LIC 04-15-0217		
Test report number of initial issue:	LIC 12-15-116	Date of initial issue	6 November 2015
Test report number of revised/replaced issue:	---	Date of revised/replaced issue	---
Test report revision/ replacement history:	---		
Test standard(s)/ Test specifications:	FCC Rules 47 CFR, Sections: 2.1046 - RF Power Output, 2.1049 - Occupied Bandwidth, 2.1051 - Spurious Emissions at Antenna Terminal, 2.1055 - Frequency Stability, 2.1053 - Field Strength of Spurious Radiation, 80.209 -Transmitter frequency tolerances. 80.211 -Emission limitations. 80.215 -Transmitter power. 80.217 - Suppression of Interference Aboard Ships. (Date of issue: 1 October 2014)		
Customer:	Furuno Electric Co., Ltd. 9-52 Ashihara-Cho, Nishinomiya-City, 662-8580 Japan		
Manufacturer:	Furuno Electric Co., Ltd. 9-52 Ashihara-Cho, Nishinomiya-City, 662-8580 Japan		
Trade name:	FURUNO		
Model:	U-AIS TRANSPONDER		
Type:	FA-170		
Product function and intended use:	Universal automatic identification system equipment (AIS)		
Number of samples tested:	One		
Serial number:	1000-4200-0005		
Power rating:	12 - 24 VDC, 6 - 3 A		
Product status:	Pre-production model		
Modifications made to samples during testing:	None.		
Date of receipt of samples:	31 August 2015		
Test period:	From 1 September 2015 to 8 September 2015		
Place of test:	Labotech International Co., Ltd. - Nishinomiya Lab. 9-52, Ashihara-cho, Nishinomiya-shi, Hyogo, 662-8580 Japan - Nishinomiya-Hama Lab. 2-20, Nishinomiya-Hama, Nishinomiya-shi, Hyogo, 662-0934 Japan Anechoic Chamber used for the test has also been registered by FCC. (FCC File number: 90607) FCC Test firm Designation Number: JP2007, FCC Test firm Registration #: 838049		
Test results/ Compliance:	Passed. The test results of this report relate only to the samples tested.		
Tested by:	Yasuharu Nakamura, Akira Inoue and Nobuyuki Shimada		
Written by:	Akiko Inoue		
Verified by:	Yoshihiro Ishii		

Approved by:	Date: 6 November 2015 Name: Yoshihiro Ishii Title: Senior Manager, Technical Department Labotech International Co., Ltd. Signature: 
---------------------	---

Testing Laboratory Status

Labotech International Co., Ltd. (hereafter called "LIC") has been holding the following status after having been assessed according to the provisions of ISO/IEC 17025 and/or the relevant rules:

(1) JAB Accredited Testing Laboratory:

- accredited by Japan Accreditation Board (JAB),
- Laboratory accreditation number: RTL03220
- Date of initial accreditation: 14 January 2011 (*)
- Scope of accreditation: Electrical testing - EMC testing

(2) Telefication Listed Testing Laboratory:

- listed by Telefication B. V., (The Netherlands)
- Laboratory assignment number: L116
- Date of initial listing: 26 July 1999 (*)
- for testing the following product categories/test standards: EN 60945, IEC 61162-1/-2, IEC/EN 61162-450 and IEC 62288

(3) BSH Recognized Testing Laboratory:

- recognized by Bundesamt für Seeschifffahrt und Hydrographie (BSH), (Germany)
- Recognition certificate number: BSH/4613/06202/1864/11
- Date of initial recognition: 4 April 2003 (*)
- for testing the following product categories/ test standards:
 - IEC/EN 60945, IEC 62388, IEC 61162-1/-2, and IEC 62288

(4) TÜV Appointed EMC Test Laboratory:

- appointed by TÜV Rheinland Japan Ltd.,
- Laboratory assignment number: UA 50046428
- Date of initial appointment: 21 December 1998 (*)
- for carrying out the tests of: EN 55011, CISPR 11, EN 55022, CISPR 22, EN 55024, CISPR 24, EN 55025, CISPR 25, EN/IEC 61000-3-2/-3, EN/IEC 61000-4-2/-3/-4/-5/-6/-8/-11, EN/IEC 61000-6-1/-2/-3/-4, EN/IEC 60945, EN/IEC 61326-1, EN/IEC 61326-2-6, EN/IEC 60601-1-2, JIS T 0601-1-2, JIS C 1806-1, and ISO 11452-1/-2/-4.

(5) RMRS Recognized Testing Laboratory:

- recognized by Russian Maritime Register of Shipping (RMRS), (Russia)
- Laboratory recognition number: 11.02594.011
- Date of initial recognition: 27 January 2009 (*)
- for carrying out testing in the field of:
 - Electrical measurements and tests, EMC tests, Mechanical measurements and tests, Equipment protection degree tests, and Climatic tests for Ship's radio and navigational equipment and IEC 60945: 2002

(6) RRR Recognized Test Laboratory:

- recognized by Russian River Register (RRR), (Russia)
- Recognition certificate number: 154262
- Date of initial recognition: 31 May 2013 (*)
- for carrying out of tests of ships radio and navigation equipment

(7) DNV Recognized Environmental Test Laboratory:

- recognized by Det Norske Veritas AS (DNV), (Norway)
- Recognition certificate number: 262.1-015854-J-12
- Date of initial recognition: 12 July 2013 (*)
- Scope of recognition: Testing according to the standards IEC 60945, IEC 61162-1/-2/-450, IEC 62288, IEC 62388 and IEC 62252 Annex E
- Application: Provisions of Environmental, interface and safety testing.

(8) CCS Recognized Test Agency :

- recognized by China Classification Society
- Recognition certificate number : DB13A00001
- Date of initial recognition : 29 January 2014 (*)
- Scope of recognition : Performance/Environmental/EMC/Special purpose/Safety precautions tests for Electrical & Electronic Product including Maritime Navigation and Radio-communication Equipment & Systems

Note: (*) – The current certificates may be found in the LIC web site (<http://www.furuno-labotech.co.jp>).

TABLE OF CONTENTS

Report Summary	2
Testing Laboratory Status	4
1 Principal Information	6
1.1 Equipment under test (EUT)	6
1.2 Observation and comments	9
2 Test Results Summary	9
3 Test Results	10
3.1 RF Power Output (FCC Rule 47 CFR, 2.1046 and 80.215)	10
3.2 Modulation Characteristics (FCC Rule 47 CFR, 2.1047) (Not applicable)	11
3.3 Occupied Bandwidth (FCC Rule 47 CFR, 2.1049, 80.209 (b), 80.211 (f))	11
3.4 Frequency Stability (FCC Rule 47 CFR, 2.1055, 80.209 (b))	12
3.5 Spurious Emissions	14
3.5.1 Spurious Emissions at Antenna Terminal (FCC Rule 47 CFR, 2.1051, 80.211 (f))	14
3.5.2 Field Strength of Spurious Radiation (FCC Rule 47 CFR, 2.1053, 80.211 (f))	16
3.6 Suppression of Interference Aboard Ships (FCC Rule 47 CFR, 80.217)	17
4 Test Setup for Measurements	18
5 Measuring Equipment List:	19
6 Photograph of Test Setup/Arrangement	20
7 Occupied Band Width Plots	21
8 Spurious Emission Plots measured at Antenna Terminal	23
9 Field Strength Plots of Spurious Radiation	29
10 Field Strength Plots for Suppression of Interference Aboard Ships	41

1 Principal Information

1.1 Equipment under test (EUT)

1.1.1 General

- (a) Brand name: Furuno
- (b) Manufacturer: Furuno Electric Co., Ltd.
Ashihara-cho 9-52, Nishinomiya-city, 662-8580 Japan
- (c) Model: FA-170
- (d) EUT configuration:

No.	Unit	Type	Serial Number	Remarks
1	Transponder unit	FA-1701	4200-0005	
2	Monitor unit	FA-1702	000002	
3	Pilot plug unit	FA-1703	000002	
4	GPS Antenna	GPA-017S	000422	Either Selectable
	VHF Antenna	FAB-151D	4-110718-00	
5	GPS/VHF Combined Antenna	GVA-100	013032	
	Distributor unit	DB-1	012834	

- (e) Certification number: FCC ID: ADB9ZWFA170
- (f) Classification: Class A U-AIS equipment
- (g) Equipment designator: A
- (h) Communication capacity: 2250 reports/min/1 channel
4500 reports/min/2 channels
- (i) Communication system: Self-Organized Time Division Multiple Access (TDMA),
Simultaneous reception of 2 channels
- (j) Occupied bandwidth: 25 kHz (Depending on Channel spacing setting.)
- (k) Frame synchronization: UTC Direct synchronization by built-in GPS receiver or UTC
Indirect synchronization by using other station
- (l) Operating mode: Autonomous, Assigned and Polled
- (m) Channel selection: Automatically, by external equipment and manually
- (n) Prevention of abnormal TDMA-transmitting: Automatic transmission stops when detecting 1 second or more continuous transmission
- (o) ANT Impedance: 50 ohms
- (p) Regulations/Standards: IMO MSC. 74(69) ANNEX 3, A.694(17), MSC.191(79) ,
ITU-R M.1371-5, DSC: ITU-R M.825-3, IEC 61993-2 Ed.2,
IEC 60945 ed. 4 + CORR.1, IEC 62288 Ed.2,
IEC 61162-1 Ed.4, IEC 61162-2 Ed.1, IEC 61162-450 Ed.1

1.1.2 TRANSPONDER UNIT

TDMA TX

- (a) Frequency range: 156.025 MHz to 162.025 MHz
- (b) Output Power: 1 W/12.5 W (± 1.5 dB), selectable
- (c) Type of emission: F1D
- (d) Emission designator: 25K0F1D
- (e) Type of modulation: GMSK
- (f) Channel interval: 25 kHz

- (g) Frequency deviation: within ± 500 Hz
- (h) Transmit speed: within 9600 bps $\pm$ 50 ppm
- (i) Spurious emissions: 9 kHz to 1 GHz, less than -36 dBm (0.25 μ W)
1 GHz to 4 GHz, less than -30 dBm (1 μ W)

TDMA RX

- (a) Frequency range: 156.025 MHz to 162.025 MHz
- (b) Oscillator frequency: 1st LO: $f_0 + (38.325 \text{ MHz}/57.525 \text{ MHz})$,
2nd LO: 38.4 MHz/57.6 MHz
Note f_0 : TDMA frequency
- (c) Intermediate frequency: 1st IF: 38.325 MHz/57.525 MHz
2nd IF: 75 kHz
- (d) RX System: Double super-heterodyne
- (e) Sensitivity: -107 dBm (PER < 20%)
- (f) Error at high input level: -7 dBm (PER < 20%)
-77 dBm (PER < 20%)
- (g) Co-channel rejection: >-10 dB (PER < 20%)
- (h) Adjacent channel selectivity: >70 dB (PER < 20%)
- (i) Spurious response rejection: >70 dB (PER < 20%)
- (j) Intermodulation response rejection and blocking: Wanted Signal: -101 dBm
Unwanted Signal1: ± 500 kHz, -27 dBm. Mod 400 Hz/Dev ± 3 kHz
Unwanted Signal2: ± 1 MHz, -27 dBm
Unwanted Signal3: ± 5.725 MHz, -15 dBm
PER < 20%
- (k) Spurious emissions: 9 kHz to 1 GHz, less than -57 dBm (2 nW)
1 GHz to 4 GHz, less than -47 dBm (20 nW)

DSC RX

- (a) Receiving Frequency: CH 70 (fixed), 156.525 MHz
- (b) Oscillator frequency: 1st LO: 192 MHz,
2nd LO: 35.525 MHz
- (c) Intermediate frequency: 1st IF: 35.475 MHz
2nd IF: 50 kHz
- (d) RX system: Double super-heterodyne
- (e) Sensitivity: -107 dBm (BER < 1%)
- (f) Error at high input level: -7 dBm (BER < 1%)
- (g) Co-channel rejection: >-10 dB (BER < 1%)
- (h) Adjacent channel selectivity: >70 dB (BER < 1%)

- (i) Spurious response rejection: >70 dB (BER < 1%)
- (j) Intermodulation response:
 - Wanted Signal: -104 dBm
 - Unwanted Signal1: ± 50 kHz, -39 dBm
 - Unwanted Signal2: ± 100 kHz, -39 dBm. Mod400 Hz/Dev ± 3 kHz
 - BER < 1%
- (k) Blocking or desensitization:
 - Wanted Signal: -104 dBm
 - Unwanted Signal: -20 dBm
 - BER < 1%
- (l) Spurious emissions:
 - 9 kHz to 1 GHz, less than -57 dBm (2 nW)
 - 1 GHz to 4 GHz, less than -47 dBm (20 nW)

1.1.3 MONITOR UNIT

- (a) Display: 4.3-inch Color LCD
- (b) Display Size: 53.8 (H) x 95.0 (W) mm
- (c) Number of Dots: 480 x 272 dots
- (d) Menu:
 - MSG / STATUS / USER SET / INITIAL SET / CH INFO
 - DIAGNOSTICS / SERVICE

1.1.4 GPS RECEIVER

- (a) Receiving frequency: 1575.42 MHz
- (b) Tracking code: C/A code
- (c) Number of channel: 12 channels parallel, 12 satellites
- (d) Position fixing method: All in view, 8-state Kalman filter
- (e) Position accuracy:
 - GPS: 13 m max. (2DRMS, HDOP < 4)
 - DGPS: 5 m max. (2DRMS, HDOP < 4)
- (f) Tracking velocity: 1000 kn
- (g) Position fixing time: Warm start: 12 seconds typical, Cold start: 90 seconds typical
- (h) Geoids: WGS-84
- (i) Position update interval: 1 second (Typ.), 0.1 second (Min.)
- (j) DGPS data receiving: RTCM SC104 Ver 2.1 formatted by AIS information

1.1.5 POWER SUPPLY

- (a) Monitor Unit: 12 VDC, 0.3 A MAX (supplied from transponder unit)
- (b) Transponder Unit: 12 - 24 VDC, 6 - 3 A

1.1.6 ENVIRONMENTAL CONDITIONS

- (a) Ambient Temperature:
- GPS Antenna: -30°C to +70°C
- Other units: -15°C to +55°C
- (b) Relative Humidity: 93% at +40°C
- (c) Degree of protection (IEC 60529):
- GPS Antenna: IP56
- Other units: IP22
- (d) Bearing vibration: IEC 60945 edition 4

1.1.7 DIMENSIONS AND MASS

- (a) Monitor Unit: 172 (W) x 146 (H) x 88 (D) mm, 0.6 kg
- (b) Transponder unit: 250 (W) x 390 (H) x 63 (D) mm, 3.0 kg

1.2 Observation and comments

None.

2 Test Results Summary

Clause no. of this report	47 CFR Section	Item	Result	Test Engineer
3.1	2.1046 80.215	RF Power Output	Passed.	A. Inoue Y. Nakamura N. Shimada
3.2	2.1047	Modulation Characteristics	Not applicable.	---
3.3	2.1049 80.209(b) 80.211(f)	Occupied Bandwidth	Passed.	A. Inoue Y. Nakamura N. Shimada
3.4	2.1055 80.209(b)	Frequency Stability	Passed.	A. Inoue Y. Nakamura N. Shimada
3.5		Spurious Emissions	---	---
3.5.1	2.1051 2.1057 80.211(f)	- Spurious Emissions at Antenna Terminal	Passed.	A. Inoue Y. Nakamura N. Shimada
3.5.2	2.1053 2.1057 80.211(f)	- Field Strength of Spurious Radiation	Passed.	A. Inoue N. Shimada
3.6	80.217	Suppression of Interference Aboard Ships	Passed.	A. Inoue Y. Nakamura N. Shimada

3 Test Results

3.1 RF Power Output (FCC Rule 47 CFR, 2.1046 and 80.215)

(1) Test conditions:

AIS Transmitter Setting: 156.025 MHz (CH 1060) and 162.025 MHz (CH 2088)

High power (12.5 W) and Low Power (1 W)

For the transmitter, output power was measured at the antenna port with unmodulated.

(2) Test setup:

See Clause 4.

(3) Test Results:

RF Power Output (Temperature)

Test Conditions		RF Power Output (dBm)			
		156.025 MHz (CH1060)		162.025 MHz (CH 2088)	
Temperature	Voltage	High Power	Low Power	High Power	Low Power
Tmin (-20°C)	Vnom (24 V)	41.1	29.8	41.3	29.8
(-10°C)	Vnom (24 V)	41.0	29.6	41.2	29.8
(0°C)	Vnom (24 V)	41.0	29.5	41.2	29.5
(+10°C)	Vnom (24 V)	40.8	29.3	41.0	29.4
Tnom (+20°C)	Vnom (24 V)	40.7	29.1	40.9	29.0
(+30°C)	Vnom (24 V)	40.7	29.3	40.8	29.4
(+40°C)	Vnom (24 V)	40.5	29.0	40.7	29.0
Tmax (+50°C)	Vnom (24 V)	40.4	29.1	40.6	29.0
Limits		High Power: 8 W (Min.) to 25 W (Max.) Low Power: 1 W or less			

High Power = Output carrier power set at its nominal High: 41 dBm (12.5 W)

Low Power = Output carrier power set at its nominal Low: 30 dBm (1 W)

Time after startup of each measurement: 30 minutes.

RF Power Output (Voltage)

Test Conditions		RF Power Output (dBm)			
		156.025 MHz		162.025 MHz	
Temperature	Voltage	High Power	Low Power	High Power	Low Power
Tnom (+20°C)	Vnom-10% (10.2 V)	40.8	29.1	40.9	29.0
Tnom (+20°C)	Vnom (24 V)	40.7	29.1	40.9	29.0
Tnom (+20°C)	Vnom+15% (27.6 V)	40.7	29.1	40.9	29.0
Limits		High Power: 8 W (Min.) to 25 W (Max.) Low Power: 1 W or less			

High Power = Output carrier power set at its nominal High: 41 dBm (12.5 W)

Low Power = Output carrier power set at its nominal Low: 30 dBm (1 W)

Time after startup of each measurement: 30 minutes.

Current and Voltage measurements

Test Conditions		Current and Voltage measurements			
		156.025 MHz		162.025 MHz	
Temperature	Voltage	High Power	Low Power	High Power	Low Power
Tnom (+20°C)	Vnom-10% (10.2 V)	11.9 (VDC) 3.41 (A)	11.9 (VDC) 0.78 (A)	11.9 (VDC) 3.74 (A)	11.9 (VDC) 0.83 (A)
Tnom (+20°C)	Vnom (24 V)	11.9 (VDC) 3.41 (A)	11.9 (VDC) 0.78 (A)	11.9 (VDC) 3.72 (A)	11.9 (VDC) 0.84 (A)
Tnom (+20°C)	Vnom+15% (27.6 V)	11.9 (VDC) 3.41 (A)	11.9 (VDC) 0.78 (A)	11.9 (VDC) 3.74 (A)	11.9 (VDC) 0.83 (A)

High Power = Output carrier power set at its nominal High: 41 dBm (12.5 W)

Low Power = Output carrier power set at its nominal Low: 30 dBm (1 W)

Time after startup of each measurement: 30 minutes.

The DC voltage applied to and DC current into the several elements of the final radio frequency amplifying device for normal operation over the power range.

Environmental conditions observed: On 1 September 2015, 25°C to 25°C, 61%RH to 54%RH

Power supply voltage measured: 24.0 VDC to 24.0 VDC, 10.2 VDC to 10.2 VDC, 27.6 VDC to 27.6 VDC

3.2 Modulation Characteristics (FCC Rule 47 CFR, 2.1047) (Not applicable)

Not applicable.

3.3 Occupied Bandwidth (FCC Rule 47 CFR, 2.1049, 80.209 (b), 80.211 (f))

(1) Test conditions:

AIS Transmitter Setting: 156.025 MHz (CH 1060) and 162.025 MHz (CH 2088)

High power (12.5 W) and Low Power (1 W)

For the Occupied bandwidth was measured at the antenna port with test signal number 4 and maximum symbol rate (2 sec)

(2) Test setup:

See Clause 4.

(3) OoB Emission Limits (FCC Rule 47 CFR, 80.211 (f)):

Frequency removed from the carrier frequency	Emission limits (output power, dBc)
50 - 100% (of the authorized bandwidth)	At least 25 dBc
100 - 250% (of the authorized bandwidth)	At least 35 dBc
more than 250% (of the authorized bandwidth)	At least $43 + 10 \log_{10} p(\text{watts})$ = At least 54 dBc for 12.5 W setting = At least 43 dBc for 1 W setting

Authorized bandwidth = 25 kHz

Reference level = RF Power Output (Mean Power, in dBW)

(4) Test Results:

Complied.

Spectrum plots: See Clause 7.

Environmental conditions observed: On 4 September 2015, 24°C to 24°C, 60%RH to 60%RH

Power supply voltage measured : 24.0 VDC to 24.0 VDC.

3.4 Frequency Stability (FCC Rule 47 CFR, 2.1055, 80.209 (b))

(1) Test Conditions:

- (1) AIS Transmitter Setting: 156.025 MHz (CH 1060) and 162.025 MHz (CH 2088)
High power (12.5 W) and Low Power (1 W)
- (2) Ambient Temperature settings: - 20°C to + 50°C (10°C interval)
- (3) Power Supply Voltage settings: 85 /100/115 % of nominal voltage (10.2/24.0/27.6 VDC)

For the Frequency Stability was measured at the antenna port with the unmodulated.

(2) Test setup:

See Clause 4.

(3) Frequency Tolerance Limits (FCC Rule 47 CFR, 80.209(b)):

±10 ppm

(4) Test Results:

Complied.

Frequency Stability (Temperature)

Test Conditions		Frequency Stability (MHz)			
		156.025 MHz (CH1060)		162.025 MHz (CH 2088)	
Temperature	Voltage	High Power	Low Power	High Power	Low Power
Tmin (-20°C)	Vnom (24 V)	156.025056 (+56 Hz)	156.025056 (+56 Hz)	162.025058 (+58 Hz)	162.025058 (+58 Hz)
(-10°C)	Vnom (24 V)	156.025026 (+26 Hz)	156.025026 (+26 Hz)	162.025027 (+27 Hz)	162.025027 (+27 Hz)
(0°C)	Vnom (24 V)	156.025010 (+10 Hz)	156.025011 (+11 Hz)	162.025011 (+11 Hz)	162.025011 (+11 Hz)
(+10°C)	Vnom (24 V)	156.024981 (-19 Hz)	156.024981 (-19 Hz)	162.024980 (-20 Hz)	162.024980 (-20 Hz)
Tnom (+20°C)	Vnom (24 V)	156.024951 (-49 Hz)	156.024946 (-54 Hz)	162.024948 (-52 Hz)	162.024945 (-55 Hz)
(+30°C)	Vnom (24 V)	156.024874 (-126 Hz)	156.024875 (-125 Hz)	162.024870 (-130 Hz)	162.024870 (-130 Hz)
(+40°C)	Vnom (24 V)	156.024828 (-172 Hz)	156.024828 (-172 Hz)	162.024821 (-179 Hz)	162.024821 (-179 Hz)
Tmax (+50°C)	Vnom (24 V)	156.024845 (-155 Hz)	156.024845 (-155 Hz)	162.024839 (-161 Hz)	162.024839 (-161 Hz)
Deviation max.		-172 Hz	-172 Hz	-179 Hz	-179 Hz
Limits		± 1620 Hz for CH2088 (162.025 MHz) ± 1560 Hz for CH1060 (156.025 MHz)			

High Power = Output carrier power set at its nominal High: 41 dBm (12.5 W)

Low Power = Output carrier power set at its nominal Low: 30 dBm (1 W)

Time after startup of each measurement: 30 minutes.

Frequency Stability (Voltage)

Test Conditions		Frequency Stability (Hz)			
		156.025 MHz		162.025 MHz	
Temperature	Voltage	High Power	Low Power	High Power	Low Power
Tnom (+20°C)	Vnom-10% (10.2 V)	156.024949 (-51 Hz)	156.024946 (-54 Hz)	162.024947 (-53 Hz)	162.024946 (-54 Hz)
Tnom (+20°C)	Vnom (24 V)	156.024951 (-49 Hz)	156.024946 (-54 Hz)	162.024948 (-52 Hz)	162.024945 (-55 Hz)
Tnom (+20°C)	Vnom+15% (27.6 V)	156.024950 (-50 Hz)	156.024946 (-54 Hz)	162.024948 (-52 Hz)	162.024945 (-55 Hz)
Deviation max. (ppm)		-51 Hz	-54 Hz	-53 Hz	-55 Hz
Limits		± 1620 Hz for CH2088 (162.025 MHz) ± 1560 Hz for CH1060 (156.025 MHz)			

High Power = Output carrier power set at its nominal High: 41 dBm (12.5 W)

Low Power = Output carrier power set at its nominal Low: 30 dBm (1 W)

Time after startup of each measurement: 30 minutes.

Environmental conditions observed: On 2 September 2015, 24°C to 24°C, 68%RH to 60%RH

Power supply voltage measured: 24.0 VDC to 24.0 VDC, 10.2 VDC to 10.2 VDC, 27.6 VDC to 27.6 VDC

3.5 Spurious Emissions

3.5.1 Spurious Emissions at Antenna Terminal (FCC Rule 47 CFR, 2.1051, 2.1057, 80.211 (f))

(1) Test Conditions:

AIS Transmitter Setting: 156.025 MHz (CH 1060) and 162.025 MHz (CH 2088)

High power (12.5 W) and Low Power (1 W)

For the Spurious Emissions at Antenna Terminal was measured at the antenna port with test signal number 4 and maximum symbol rate (2 sec)

(2) Test setup:

See Clause 4.

(3) Emission Limits (FCC Rule 47 CFR, 80.211 (f)):

Frequency	Emission limits (dB)
9 kHz to the 10th harmonic of the highest fundamental frequency (Except OoB)	At least $43 + 10 \log_{10} p$ (watts) dB =At least 54 dBc for 12.5 W setting or -13dBm

Note: Reference level = Transmit output power (P, in dBW)

(4) Test Results:

Complied.

Spectrum Plots: See Clause 8.

Spurious emissions at Antenna Terminal of 156.025 MHz (*1) (CH 1060), High Power

Spurious frequency	Spurious Emissions power (dBm)	Emission limits (dBm)	Margin (dB)
$1/2 \times F_c$ (*1)	-44.01	-13	31.01
$2 \times F_c$	-33.15	-13	20.15
$3 \times F_c$	-42.04	-13	29.04
$4 \times F_c$	-41.67	-13	28.67
$5 \times F_c$	-41.50	-13	28.50
$6 \times F_c$	-41.47	-13	28.47
$7 \times F_c$	-42.83	-13	29.83
$8 \times F_c$	-43.54	-13	30.54
$9 \times F_c$	-42.18	-13	29.18
$10 \times F_c$	-43.39	-13	30.39

Spurious emissions at Antenna Terminal of 156.025 MHz (*1) (CH 1060), Low Power

Spurious frequency	Spurious Emissions power (dBm)	Emission limits (dBm)	Margin (dB)
$1/2 \times F_c$ (*1)	-43.07	-13	30.07
$2 \times F_c$	-42.73	-13	29.73
$3 \times F_c$	-41.17	-13	28.17
$4 \times F_c$	-40.85	-13	27.85
$5 \times F_c$	-41.19	-13	28.19
$6 \times F_c$	-39.87	-13	26.87
$7 \times F_c$	-42.89	-13	29.89
$8 \times F_c$	-42.61	-13	29.61
$9 \times F_c$	-41.91	-13	28.91
$10 \times F_c$	-41.50	-13	28.50

Spurious emissions at Antenna Terminal of 162.025 MHz (*1) (CH 2088), High Power

Spurious frequency	Spurious Emissions power (dBm)	Emission limits (dBm)	Margin (dB)
$1/2 \times F_c$ (*1)	-42.94	-13	29.94
$2 \times F_c$	-32.78	-13	19.78
$3 \times F_c$	-42.71	-13	29.71
$4 \times F_c$	-41.32	-13	28.32
$5 \times F_c$	-40.55	-13	27.55
$6 \times F_c$	-41.92	-13	28.92
$7 \times F_c$	-41.70	-13	28.70
$8 \times F_c$	-43.18	-13	30.18
$9 \times F_c$	-43.61	-13	30.61
$10 \times F_c$	-42.32	-13	29.32

Spurious emissions at Antenna Terminal of 162.025 MHz (*1) (CH 2088), Low Power

Spurious frequency	Spurious Emissions power (dBm)	Emission limits (dBm)	Margin (dB)
$1/2 \times F_c$ (*1)	-43.75	-13	30.75
$2 \times F_c$	-43.36	-13	30.36
$3 \times F_c$	-42.08	-13	29.08
$4 \times F_c$	-42.58	-13	29.58
$5 \times F_c$	-42.72	-13	29.72
$6 \times F_c$	-39.88	-13	26.88
$7 \times F_c$	-42.32	-13	29.32
$8 \times F_c$	-42.62	-13	29.62
$9 \times F_c$	-43.07	-13	30.07
$10 \times F_c$	-42.98	-13	29.98

Environmental conditions observed: On 4 September 2015, 24°C to 24°C, 60%RH to 60%RH
Power supply voltage measured: 24.0 VDC to 24.0 VDC.

3.5.2 Field Strength of Spurious Radiation (FCC Rule 47 CFR, 2.1053, 2.1057, 80.211 (f))**(1) Test Conditions:**

AIS Transmitter Setting: 156.025 MHz, 162.025 MHz

High power (12.5 W) and Low Power (1 W)

DSC Transmitter Setting: 156.525 MHz

High power (12.5 W) and Low Power (1 W)

For the Field Strength of Spurious Radiation was measured with test signal number 4 and maximum symbol rate (2 sec)

(2) Test Site: LIC Nishinomiya-Hama Laboratory, Semi-Anechoic Chamber
(FCC file number: 90607)

(3) Distance between the radar set and measuring antenna: 3 m

(4) Test setup:**Measuring (Receiving) Antenna height and polarization:**

- (a) 1 m to 4 m for the test frequency range of 30 MHz to 1700 MHz,
- (b) Antenna polarization: vertical and horizontal.

EUT height:

- (a) 1.5 m for the test frequency range of 30 MHz to 1700 MHz,

See Clauses 4 and 6.

(5) Field Strength Limits (FCC Rule 47 CFR, 80.211 (f)):

Radiation limit: ≤ 86.2 dB μ V/m (at 3m : 30 MHz to 1000 MHz)
 ≤ 82.2 dB μ V/m (at 3m : 1000 MHz to 1700 MHz)

(6) Test Results:

Complied.

Spectrum plots: See Clause 9.

Spurious emission levels measured were found to be attenuated more than 20 dB below the limits.

Environmental conditions observed: On 7 September 2015, 25°C to 25°C, 68%RH to 68%RH

On 8 September 2015, 25°C to 25°C, 68%RH to 68%RH

Power supply voltage measured : 24.0 VDC to 24.0 VDC.

3.6 Suppression of Interference Aboard Ships (FCC Rule 47 CFR, 80.217)

(1) Test Conditions:

AIS Receiver Setting: 156.025 MHz, 162.025 MHz

DSC Receiver Setting: 156.525 MHz

For the Receiver conducted emissions was measured with the antenna disconnected and with receiver antenna terminals connected to a measuring instrument.

(2) Test frequency range: 9 kHz to 2 GHz

(3) Test setup: See clause 4

(4) Receiver Conducted Emissions Limits:

Frequency	Power to artificial antenna in		Resolution bandwidth of Spectrum analyzer
	(μW)	(dBm)	
9 kHz - 150 kHz	400	-4	1 kHz
150 kHz - 30 MHz			10 kHz
30 MHz - 100 MHz	4,000	6	100 kHz
100 MHz - 300 kHz	40,000	16	
300 MHz - 1 GHz	400,000	26	
1 GHz - 2 GHz			1 MHz

(5) Test Results:

Complied.

Tests were performed with the EUT receive only mode.

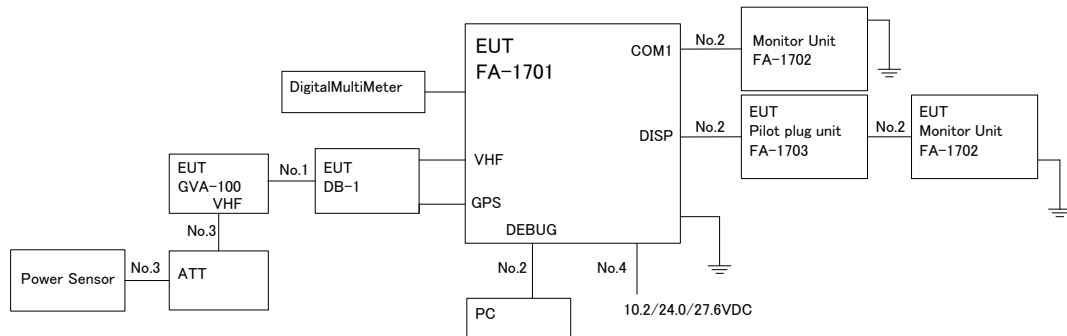
Spurious emission levels measured were found to be attenuated more than 20 dB below the limits.

Spectrum plots: See Clause 10.

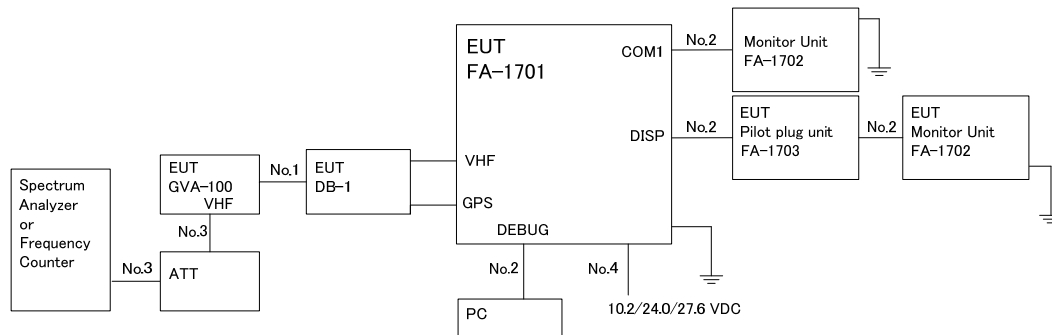
Environmental conditions observed: On 4 September 2015, 24°C to 24°C, 60%RH to 60%RH
Power supply voltage measured: 24.0 VDC to 24.0 VDC.

4 Test Setup for Measurements

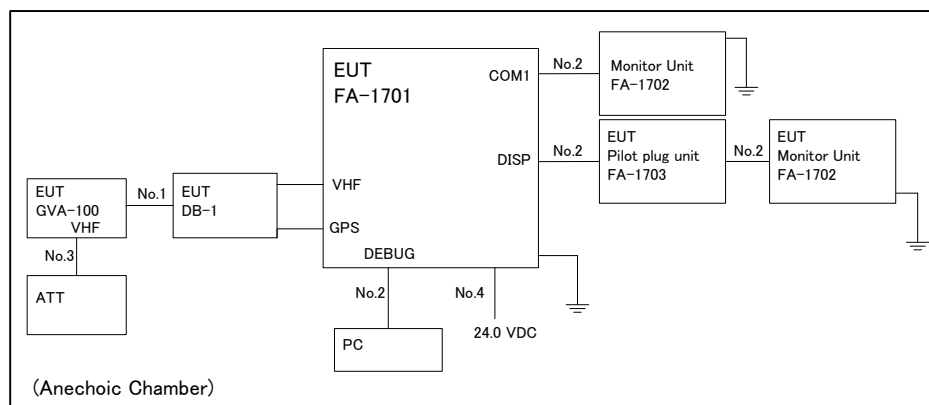
(1) Test Setup for Clause 3.1



(2) Test Setup for Clauses 3.3, 3.4, 3.5.1, and 3.6



(2) Test Setup for Clause 3.5.2



Cable designations:

No.	Name	Length (m)
1	RG-10/UJY	20
2	AWG25	5
3	RG-55/U	3
4	DPYC-2.5	20

5 Measuring Equipment List

(1) For 3.1 RF Power Output:

C/N	Instrument	Type	S/N	Manufacturer	Date of calibration	Calibration interval
HT415	Climatic chamber (S)	PL-4KP	14004204	Tabai Espec	18 May 2015	1 year
HT831	Digital Multimeter	115	15540244	FLUKE	18 June 2015	1 year
736295	DC Power Supply	ZX-400L	428700060086	Takasago	----	----
736557	Digital Multimeter	2110-100	1421478	KEITHLEY	15 January 2015	1 year
736553	Power Sensor	NRP-Z11	100722	ROHDE & SCHWARTZ	15 January 2015	1 year
----	ATT (30dB, 50W)	24-30-34-LIM	CF8277	Aeroflex / Weinschel	----	----

(2) For 3.2 Modulation Characteristics:

Not applicable.

(3) For 3.3 Occupied Bandwidth, for 3.5.1 Spurious Emissions at Antenna Terminal and For 3.6 Suppression of Interference Aboard Ships:

C/N	Instrument	Type	S/N	Manufacturer	Date of calibration	Calibration interval
HT415	Climatic chamber (S)	PL-4KP	14004204	Tabai Espec	18 May 2015	1 year
HT831	Digital Multimeter	115	15540244	FLUKE	18 June 2015	1 year
736295	DC Power Supply	ZX-400L	428700060086	Takasago	----	----
1304001	SIGNAL & SPECTRUM ANALYZER	FSW26	101356	ROHDE & SCHWARTZ	25 May 2015	1 year
----	ATT (30dB, 50W)	24-30-34-LIM	CF8277	Aeroflex / Weinschel	----	----

(4) For 3.4 Frequency Stability:

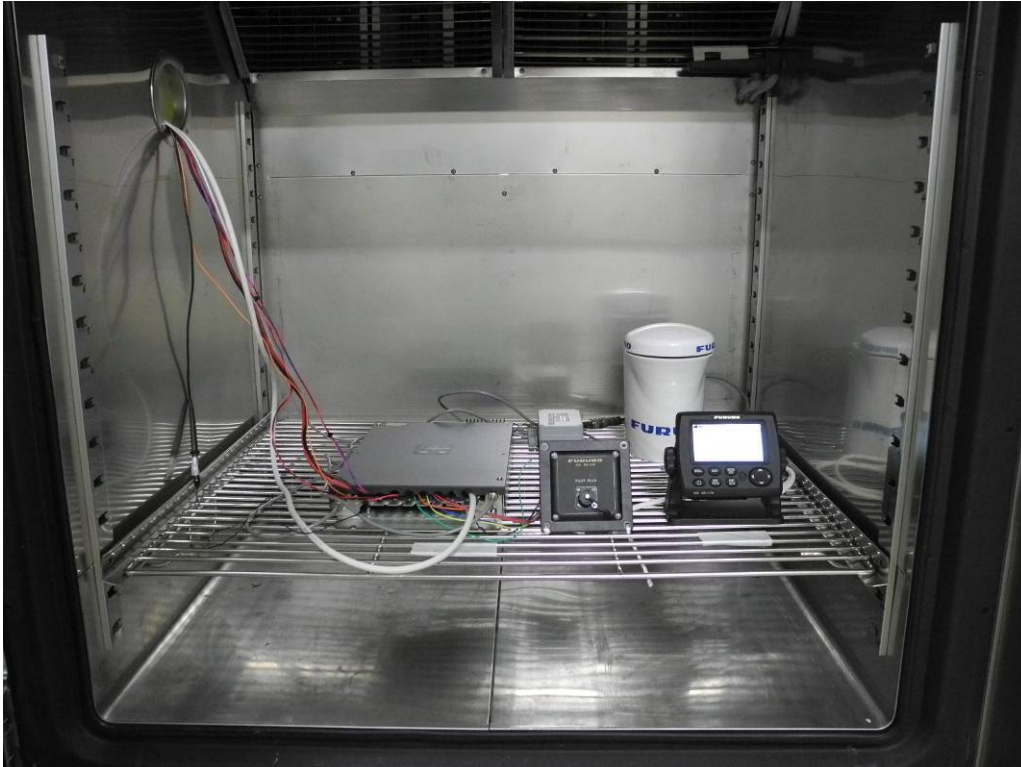
C/N	Instrument	Type	S/N	Manufacturer	Date of calibration	Calibration interval
HT415	Climatic chamber (S)	PL-4KP	14004204	Tabai Espec	18 May 2015	1 year
HT831	Digital Multimeter	115	15540244	FLUKE	18 June 2015	1 year
736295	DC Power Supply	ZX-400L	428700060086	Takasago	----	----
9107057	Frequency Counter	R5362A	13720092	ADVANTEST	15 January 2015	1 year
----	ATT (30dB, 50W)	24-30-34-LIM	CF8277	Aeroflex / Weinschel	----	----

(5) For 3.5.2 Field Strength of Spurious Radiation:

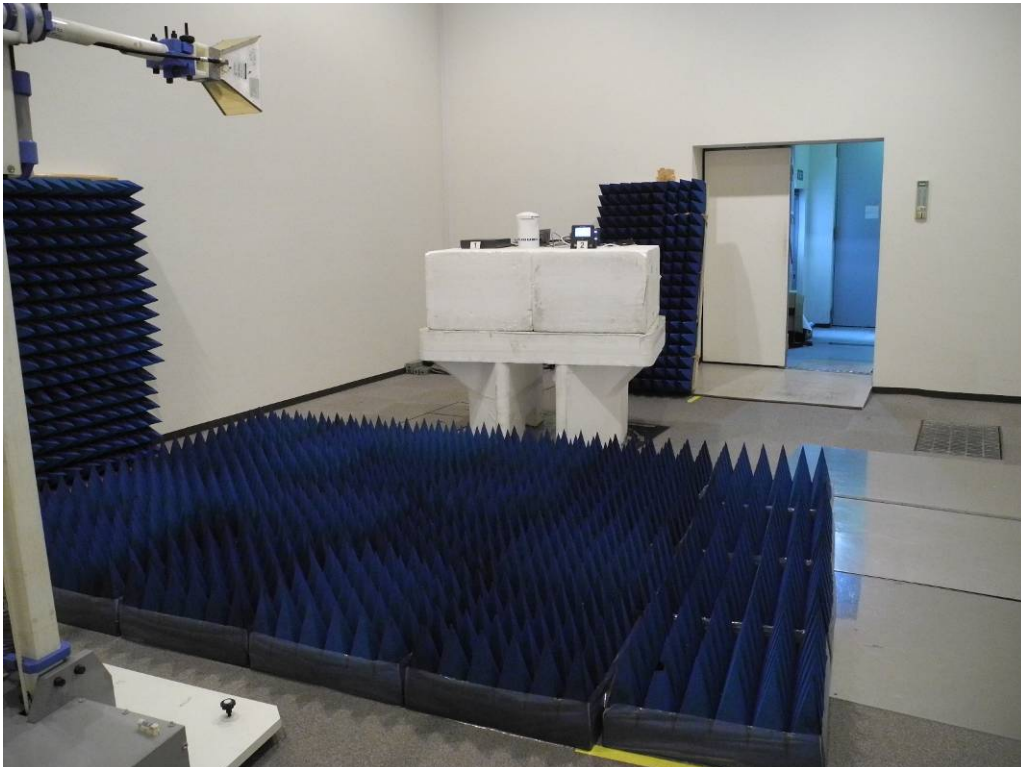
C/N	Instrument	Type	S/N	Manufacturer	Date of calibration	Calibration interval
HT199	EMI receiver (9 kHz to 2.75 GHz)	ESCS30	826547/021	Rohde & Schwarz	8 August 2015	1 year
HT463	Spectrum analyzer (9 kHz to 3 GHz)	R3132	110401654	Advantest	27 August 2015	1 year
HT459	Biconical antenna (30 MHz to 300 MHz)	VBA6106A	1296	Schaffner	12 August 2015	1 year
HT331	Log periodic antenna (300 MHz to 1000 MHz)	UHALP9107	91071214	Schwarzbeck	12 August 2015	1 year
HT467	Double-ridged waveguide horn antenna (1 GHz to 2 GHz)	3115	6520	EMCO	13 August 2015	1 year
HT518	Pre-amplifier (30 MHz to 2 GHz)	87405A	3207A01643	Agilent	18 June 2015	1 year
HT498	Measurement software	TEPTO-DV/RE	Ver.1.4.0016	TSJ	----	----
HT365	Semi-anechoic Chamber	3mSAC	D-002	Riken	29 August 2015	1 year
HT156	DC power supply	GP035-30	1014396080	Takasago	----	----
HT885	Test table	W1500-D1000-H800	No.03	JSE	----	----
HT688	Digital Multimeter	115	10821184	FLUKE	20 November 2014	1 year
----	ATT (30dB, 50W)	24-30-34-LIM	CF8277	Aeroflex / Weinschel	----	----

6 Photograph of Test Setup/Arrangement

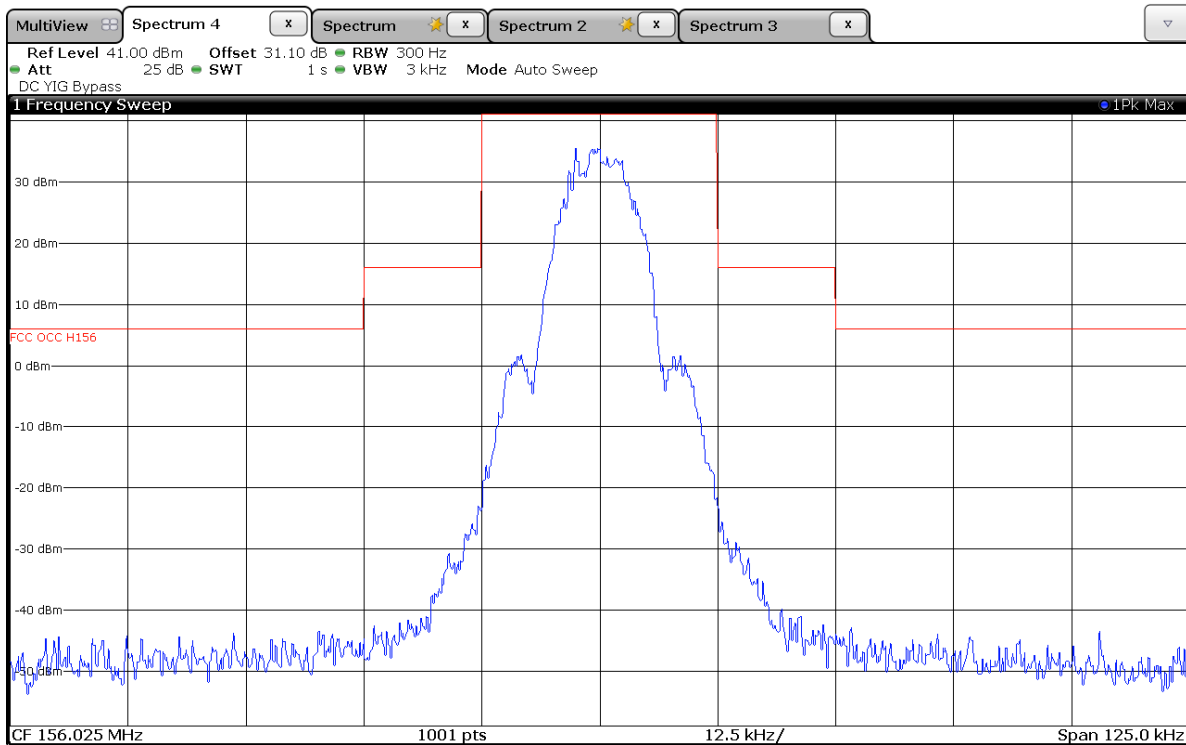
(1) For Temperature (TX frequency stability) tests,



(2) For Spurious Radiation measurements,

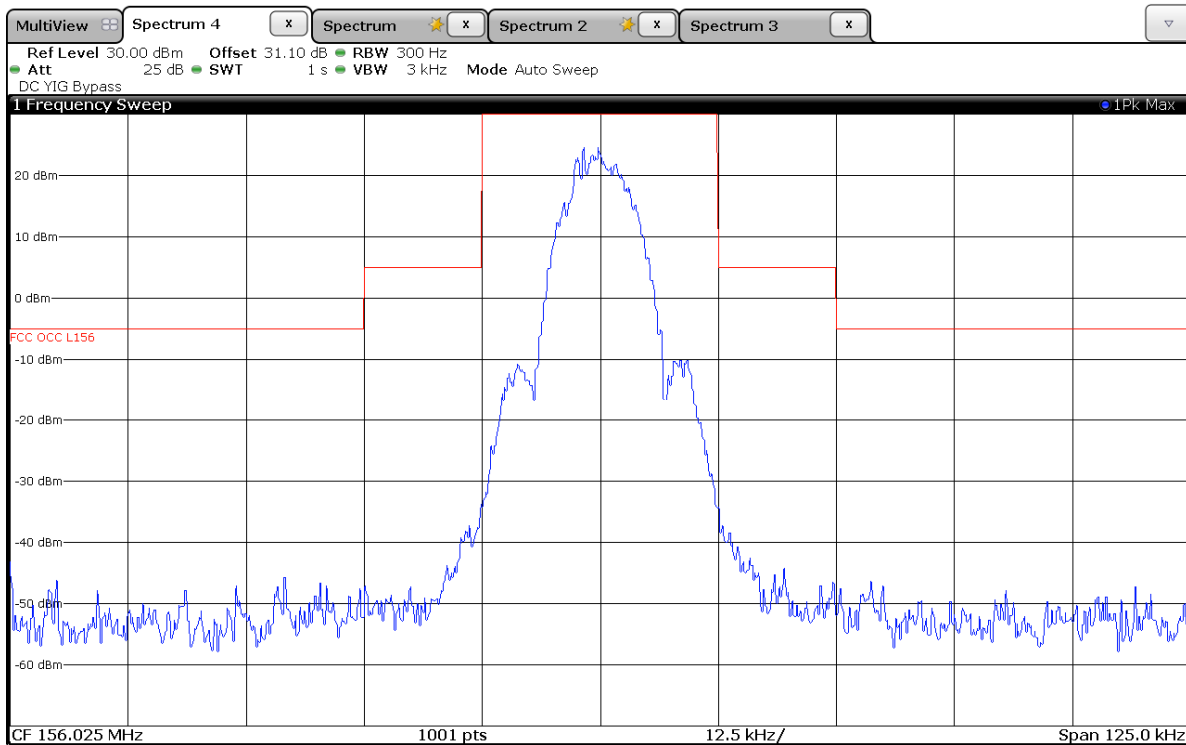


7 Occupied Band Width Plots



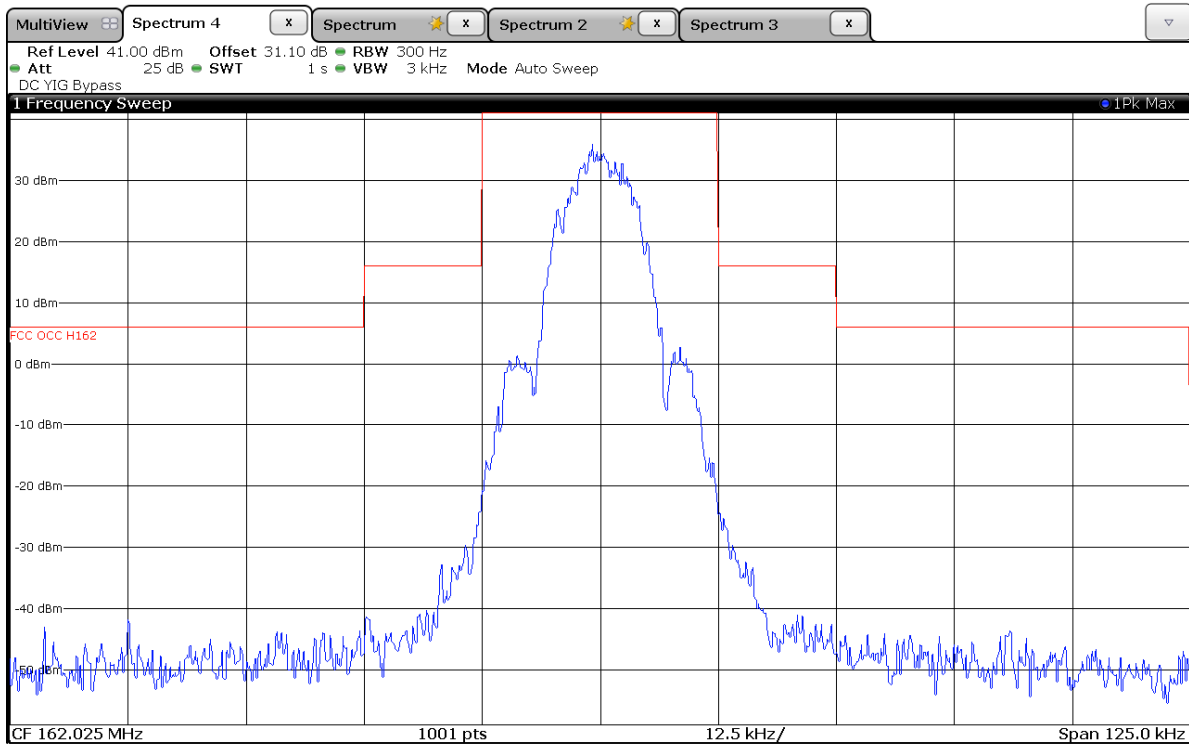
Date: 4.SEP.2015 13:17:38

Fig. 7.1 156.025 MHz (CH 1060), High power (12.5 W) Occupied Band Width



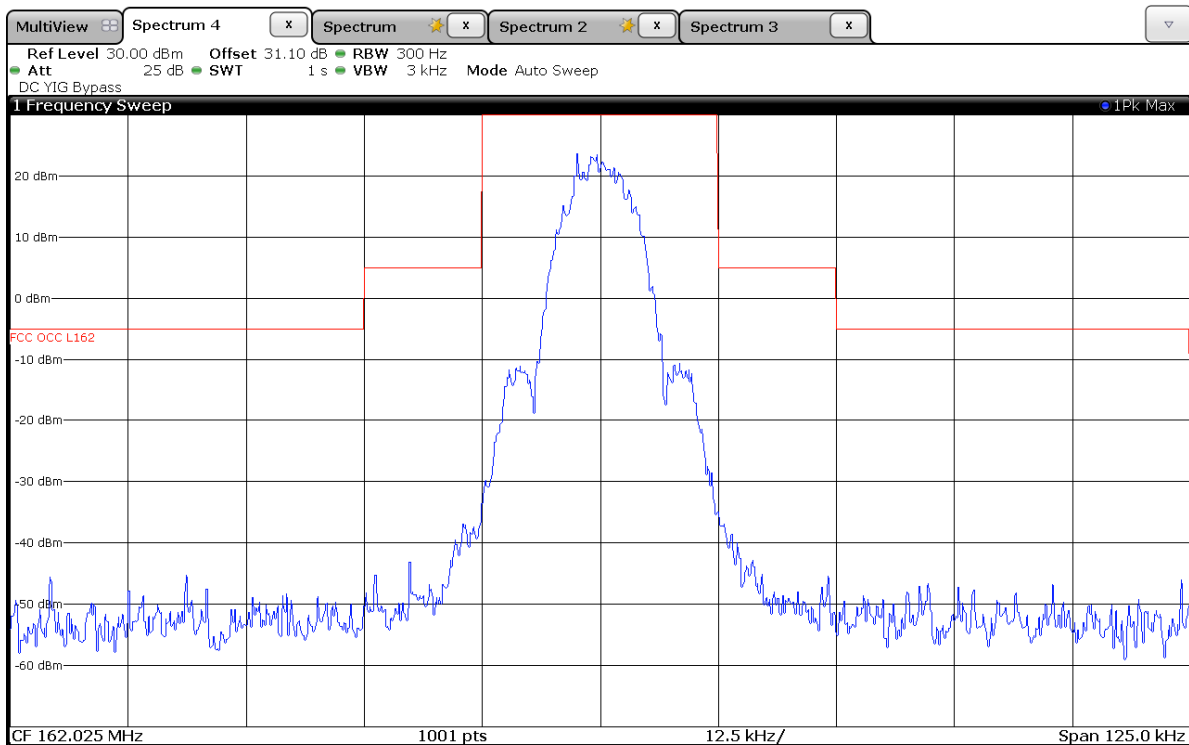
Date: 4.SEP.2015 13:26:06

Fig. 7.2 156.025 MHz (CH 1060), Low power (1 W) Occupied Band Width



Date: 4.SEP.2015 13:36:20

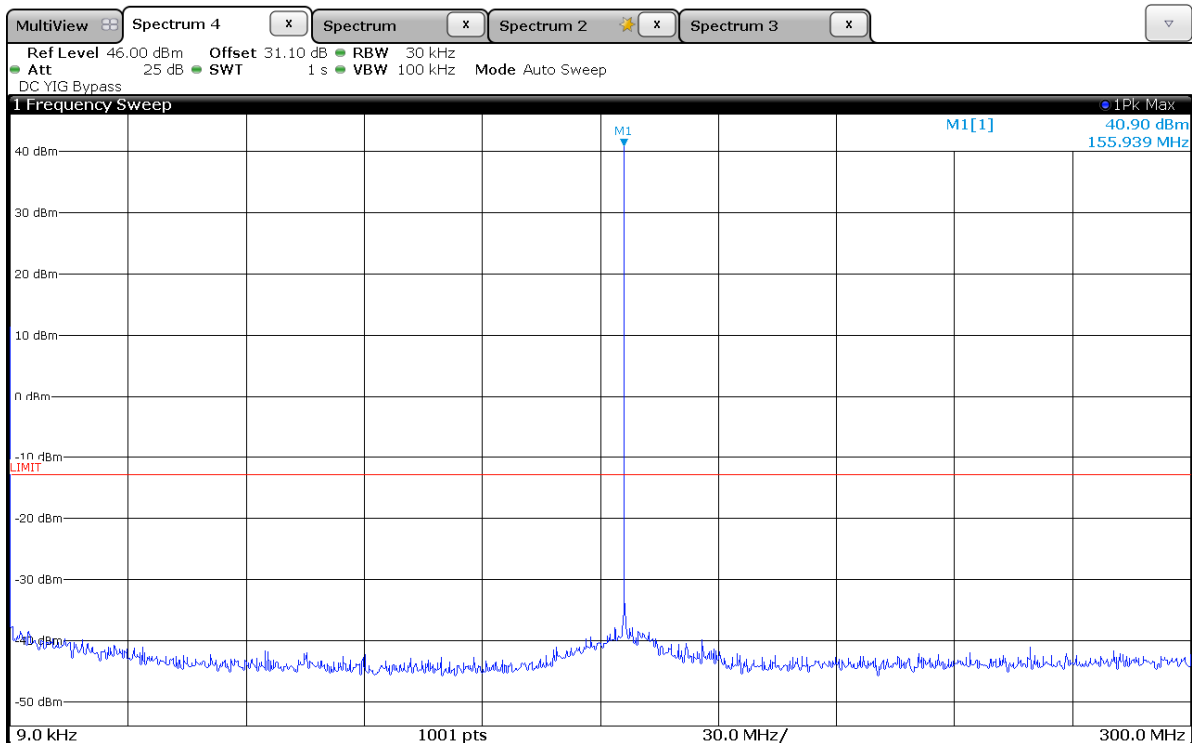
Fig. 7.3 162.025 MHz (CH 2088), High power (12.5 W) Occupied Band Width



Date: 4.SEP.2015 13:38:29

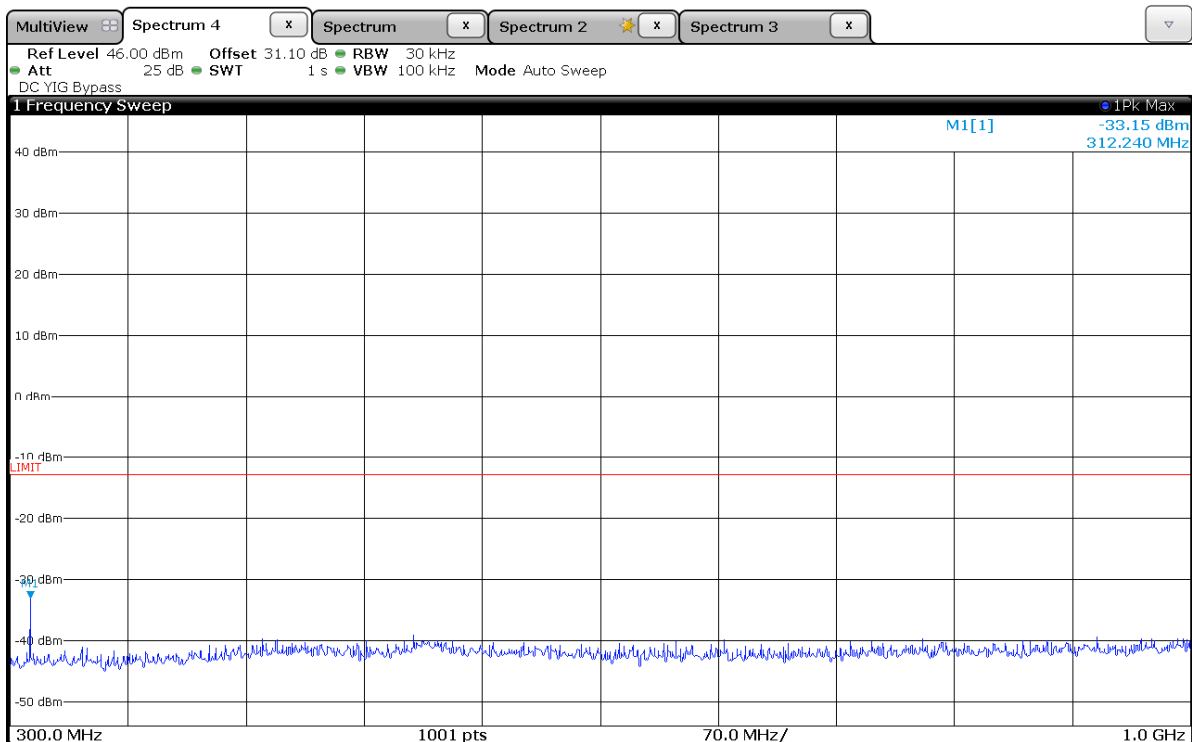
Fig. 7.4 162.025 MHz (CH 2088), Low power (1 W) Occupied Band Width

8 Spurious Emission Plots measured at Antenna Terminal



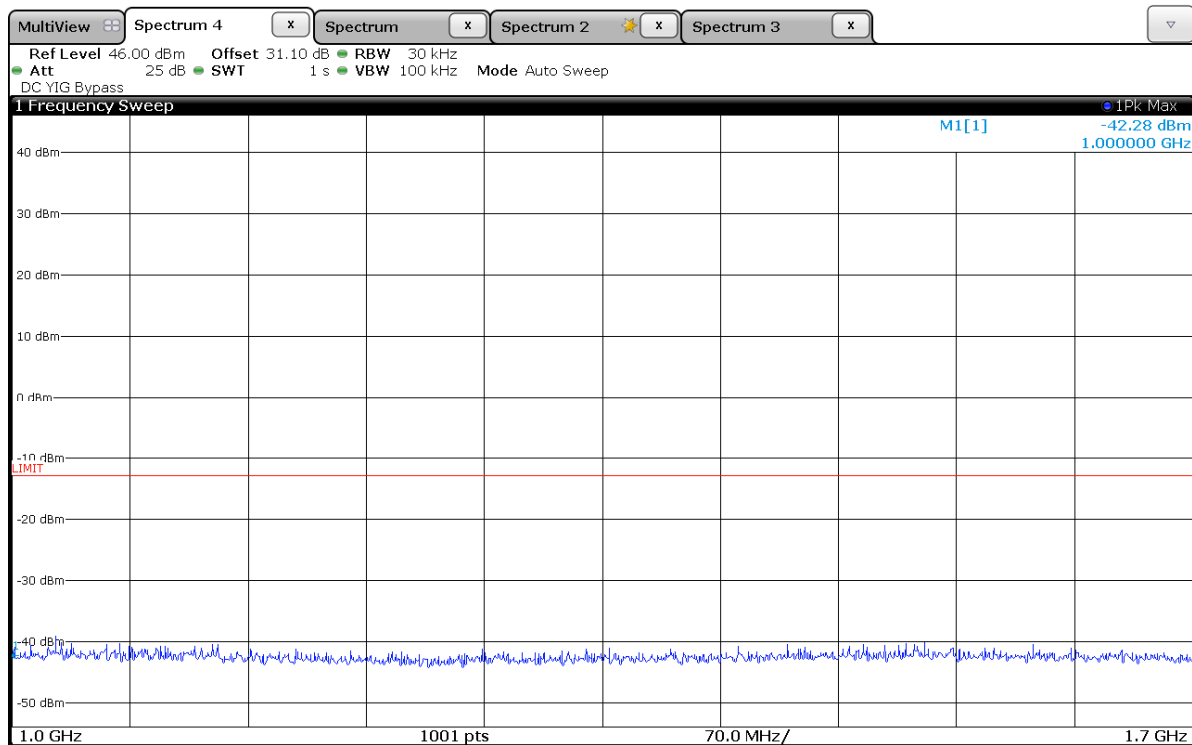
Date: 4.SEP.2015 18:40:16

Fig. 8.1 156.025 MHz, 12.5 W Spurious Emission at Antenna Terminal (9 kHz to 300 MHz)



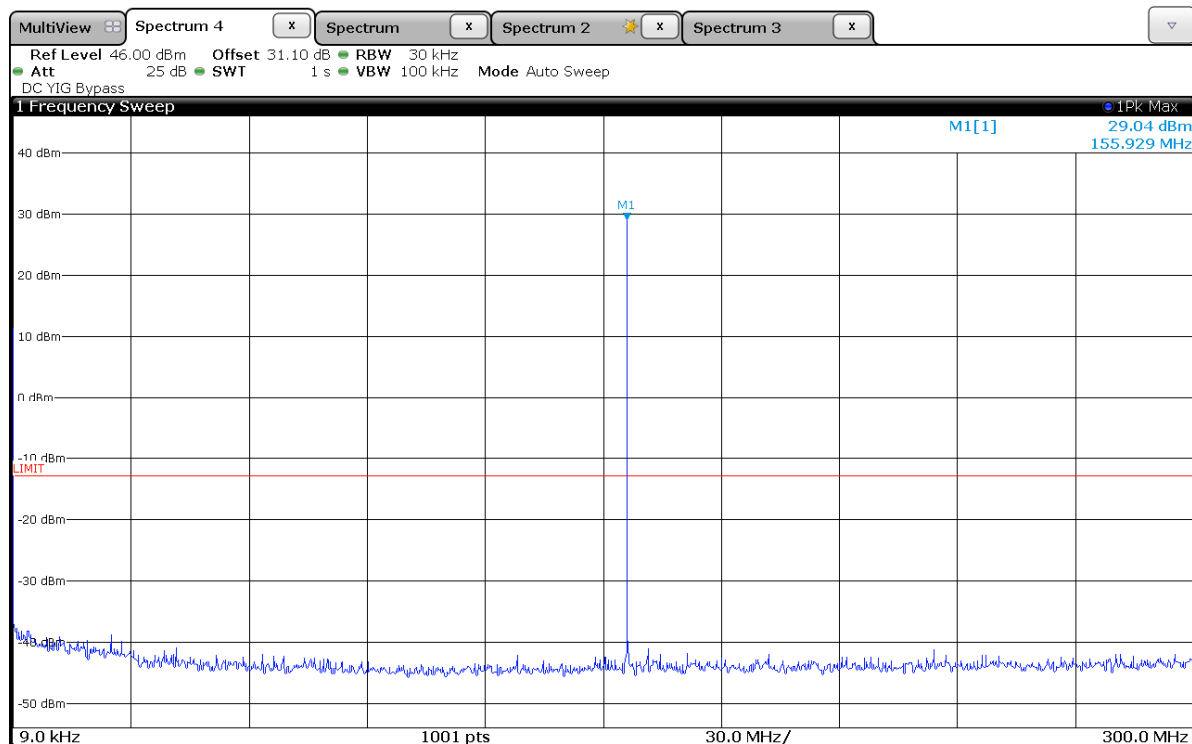
Date: 4.SEP.2015 14:53:33

Fig. 8.2 156.025 MHz, 12.5 W Spurious Emission at Antenna Terminal (300 MHz to 1 GHz)



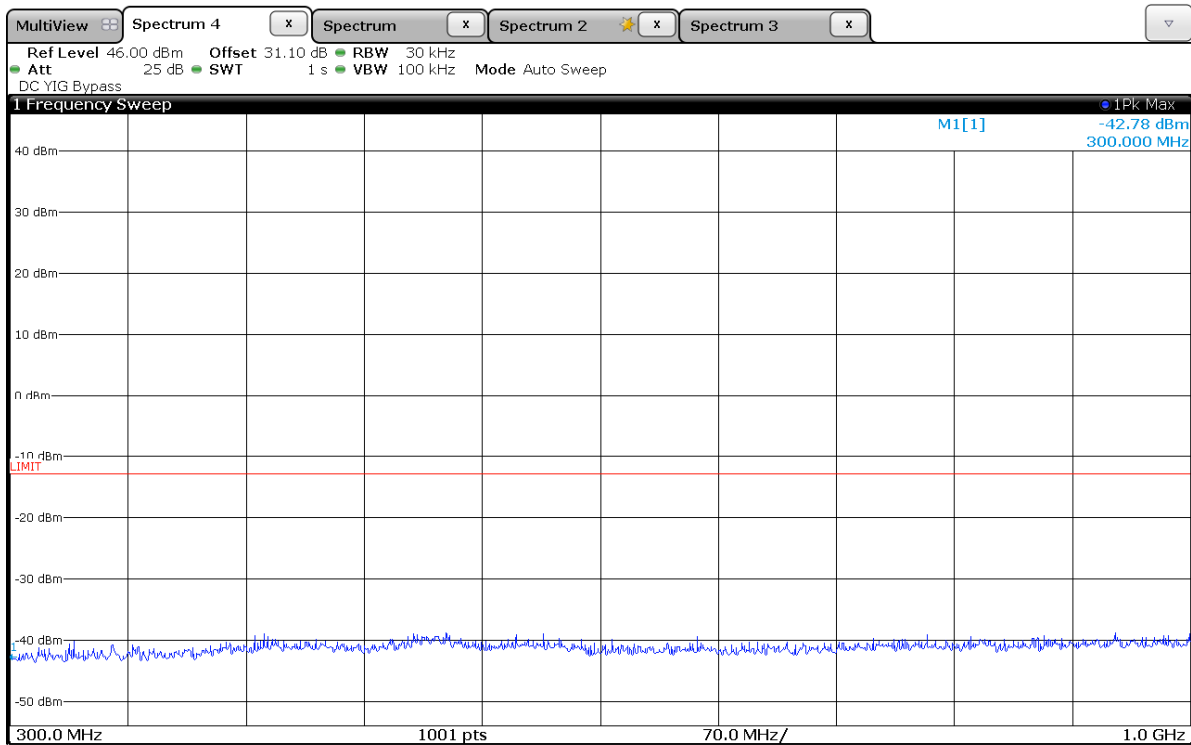
Date: 4.SEP.2015 14:56:35

Fig. 8.3 156.025 MHz, 12.5 W Spurious Emission at Antenna Terminal (1 GHz to 1.7 GHz)



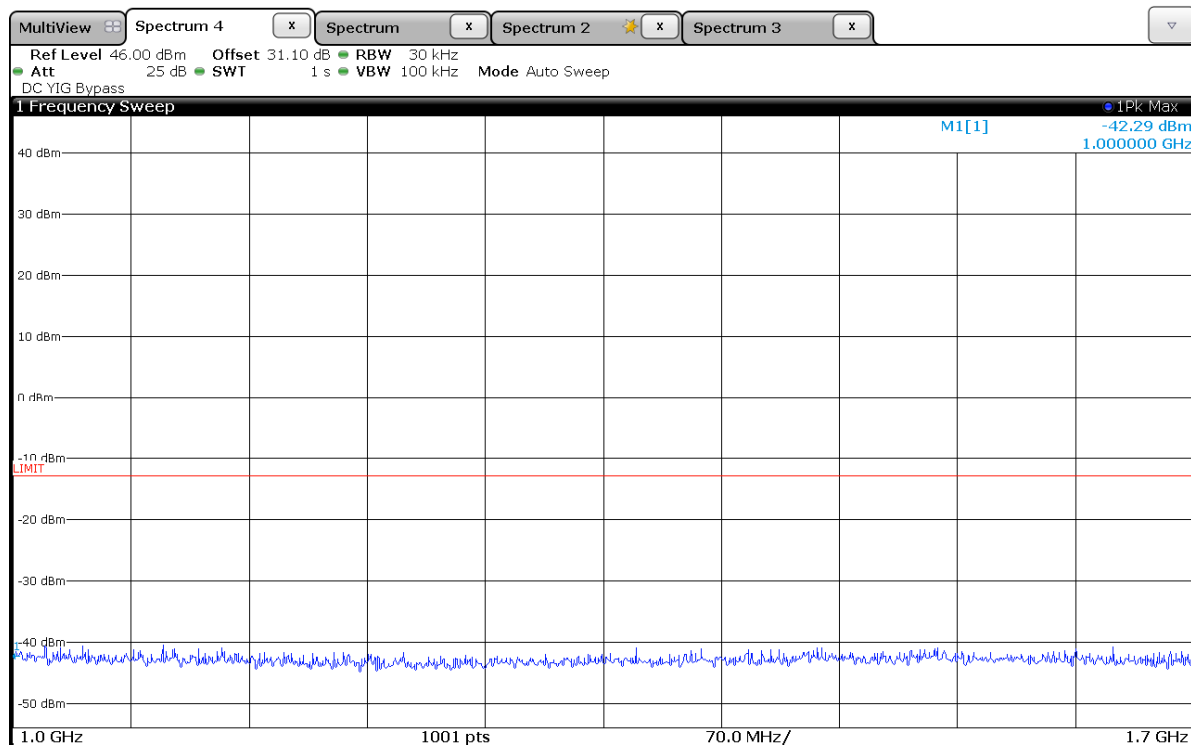
Date: 4.SEP.2015 18:42:41

Fig. 8.4 156.025 MHz, 1 W Spurious Emission at Antenna Terminal (9 kHz to 300 MHz)



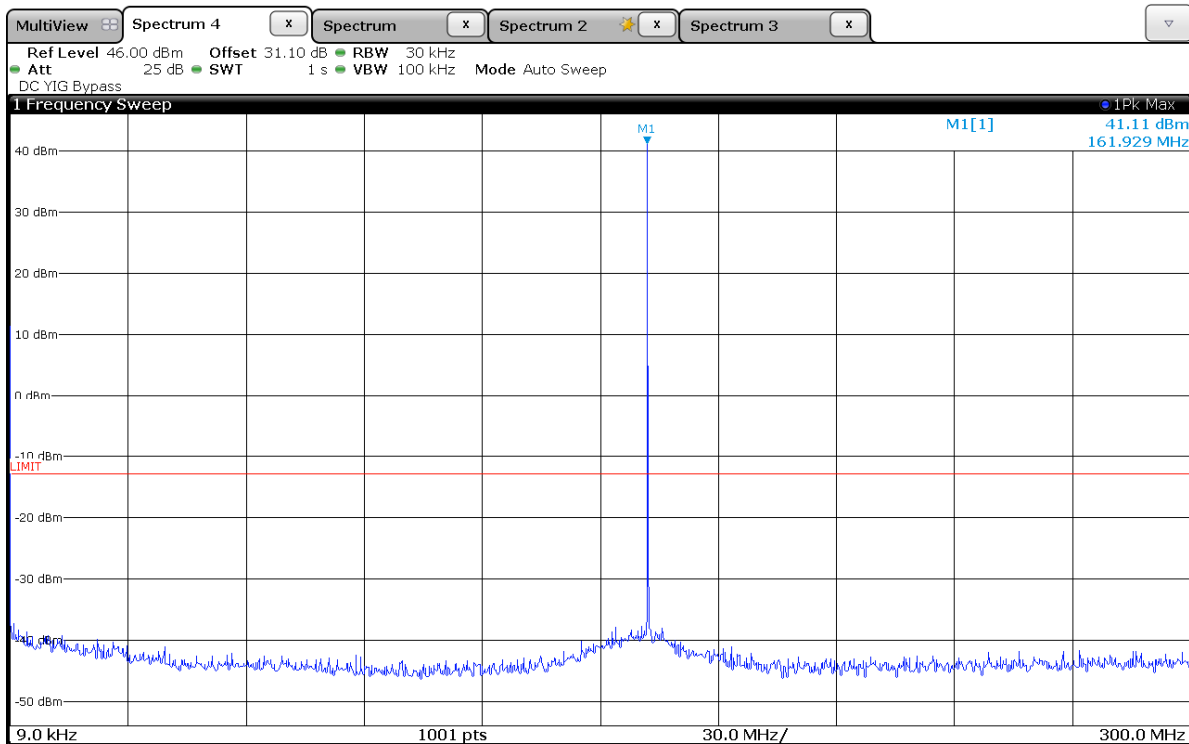
Date: 4.SEP.2015 15:03:40

Fig. 8.5 156.025 MHz, 1 W Spurious Emission at Antenna Terminal (300 MHz to 1 GHz)



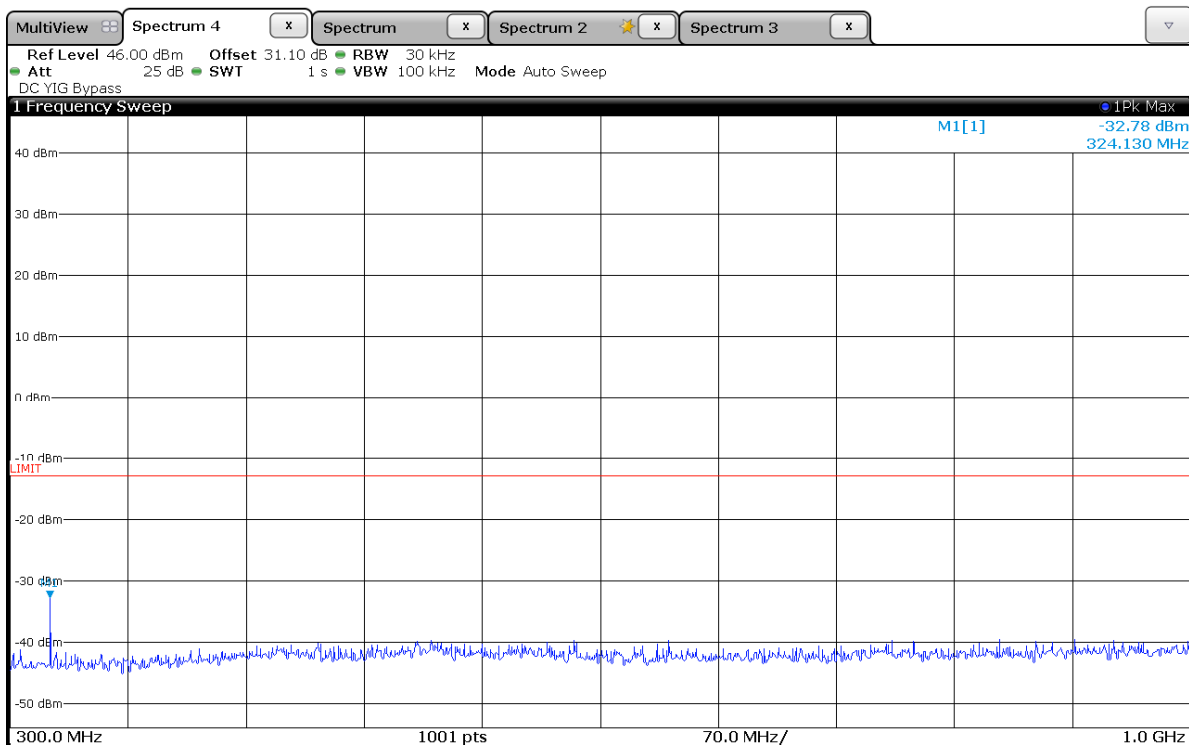
Date: 4.SEP.2015 15:05:29

Fig. 8.6 156.025 MHz, 1 W Spurious Emission at Antenna Terminal (1 GHz to 1.7 GHz)



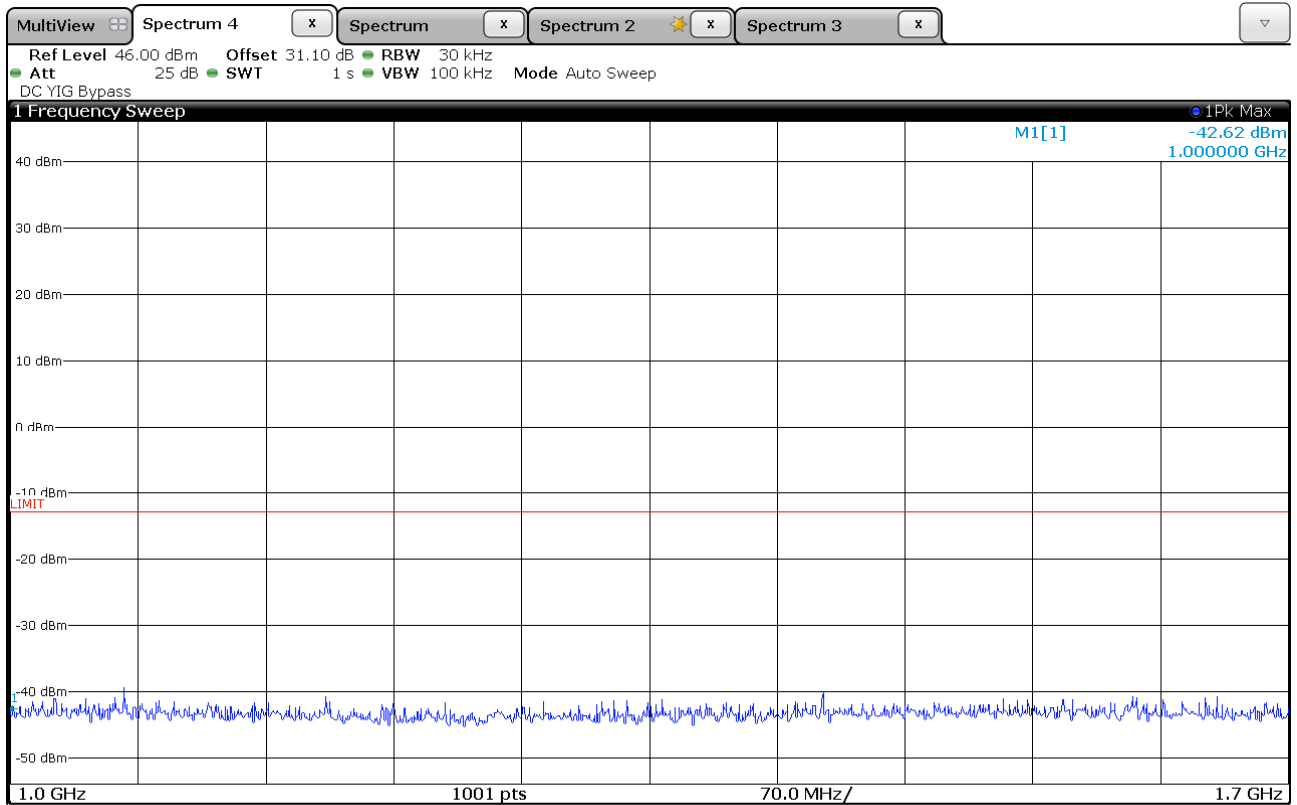
Date: 4.SEP.2015 18:32:26

Fig. 8.7 162.025 MHz, 12.5 W Spurious Emission at Antenna Terminal (9 kHz to 300 MHz)



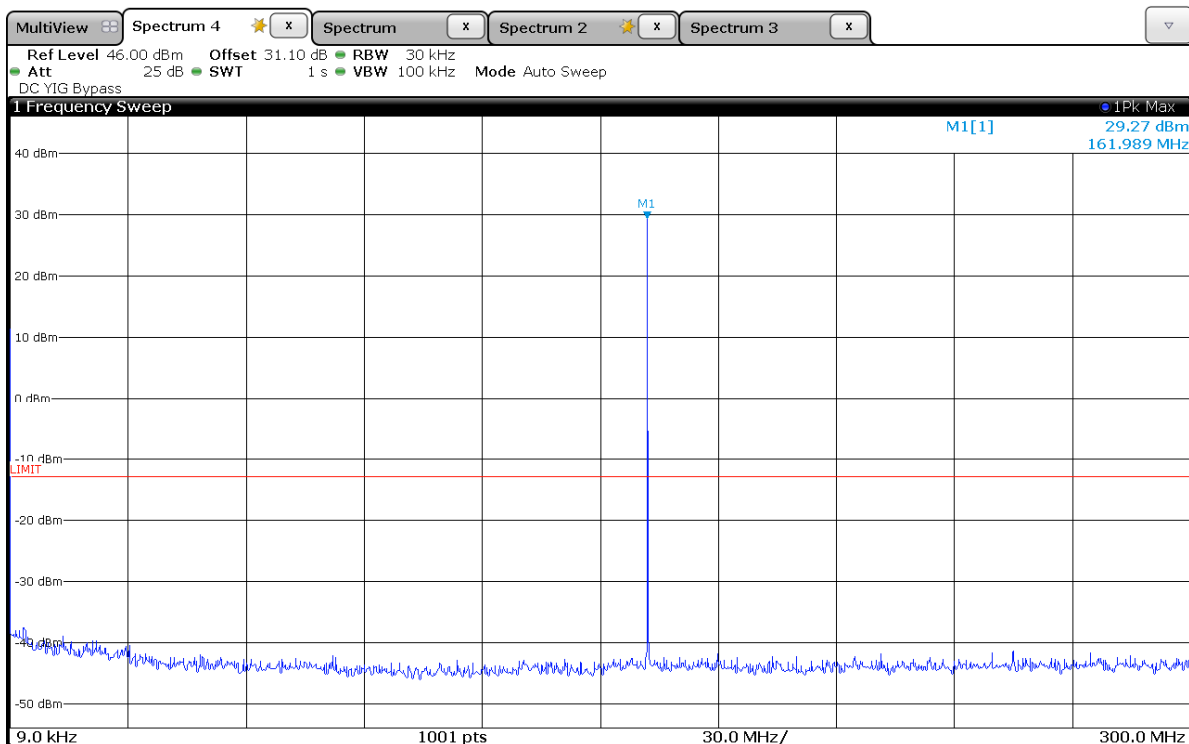
Date: 4.SEP.2015 16:29:41

Fig. 8.8 162.025 MHz, 12.5 W Spurious Emission at Antenna Terminal (300 MHz to 1 GHz)



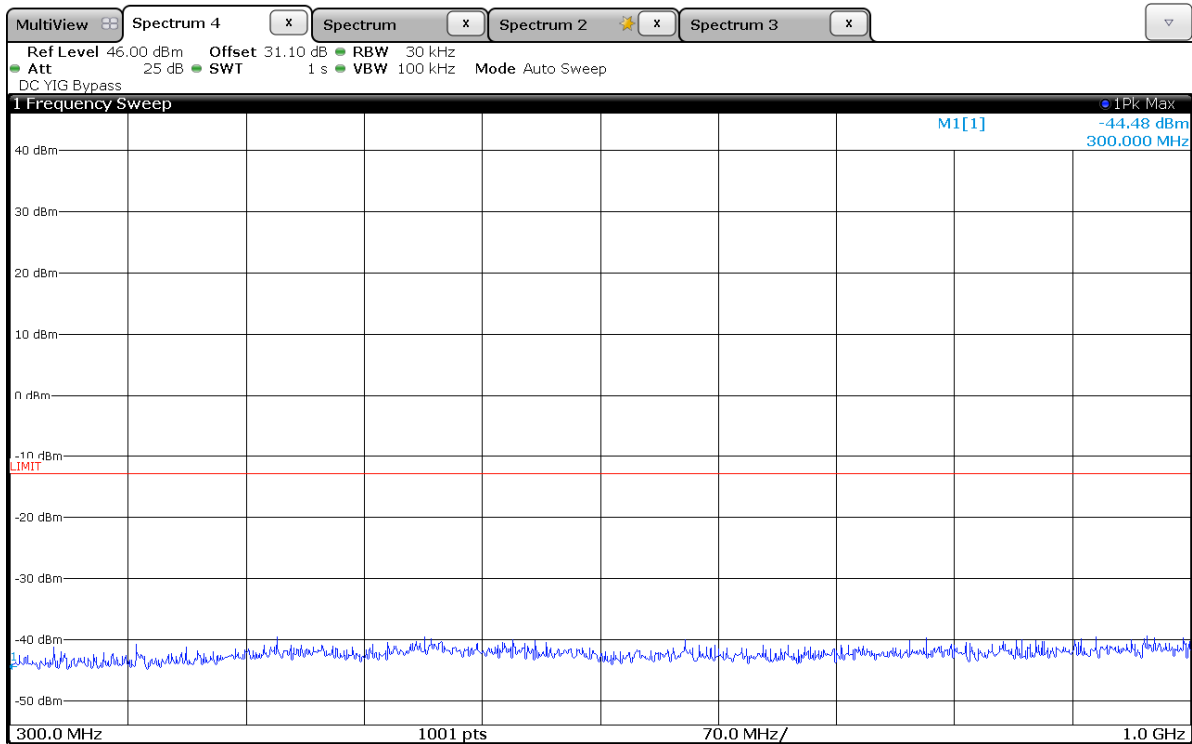
Date: 4.SEP.2015 16:30:56

Fig. 8.9 162.025 MHz, 12.5 W Spurious Emission at Antenna Terminal (1 GHz to 1.7 GHz)



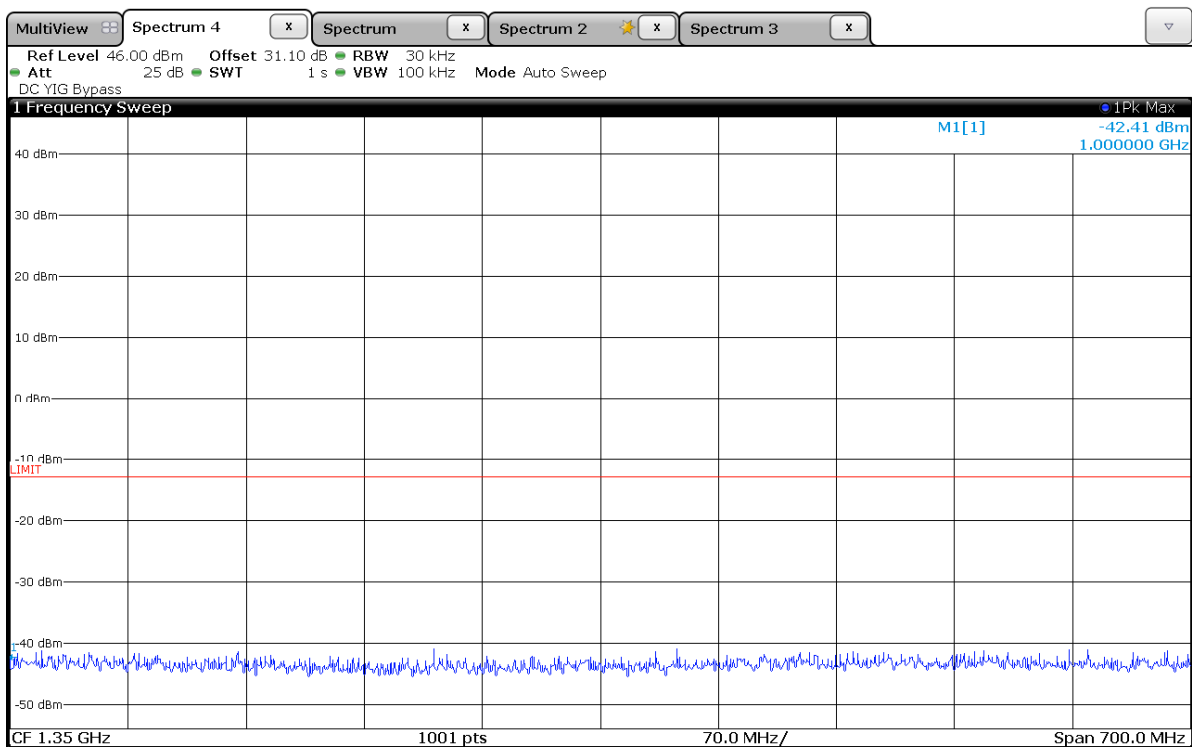
Date: 4.SEP.2015 18:29:45

Fig. 8.10 162.025 MHz, 1 W Spurious Emission at Antenna Terminal (9 kHz to 300 MHz)



Date: 4.SEP.2015 16:33:47

Fig. 8.11 162.025 MHz, 1 W Spurious Emission at Antenna Terminal (300 MHz to 1 GHz)



Date: 4.SEP.2015 16:35:06

Fig. 8.12 162.025 MHz, 1 W Spurious Emission at Antenna Terminal (1 GHz to 1.7 GHz)

9 Field Strength Plots of Spurious Radiation

(1) 156.025 MHz, 12.5 W Field Strength of Spurious Radiation (30 MHz to 1 GHz)

Results of Radiated Emission

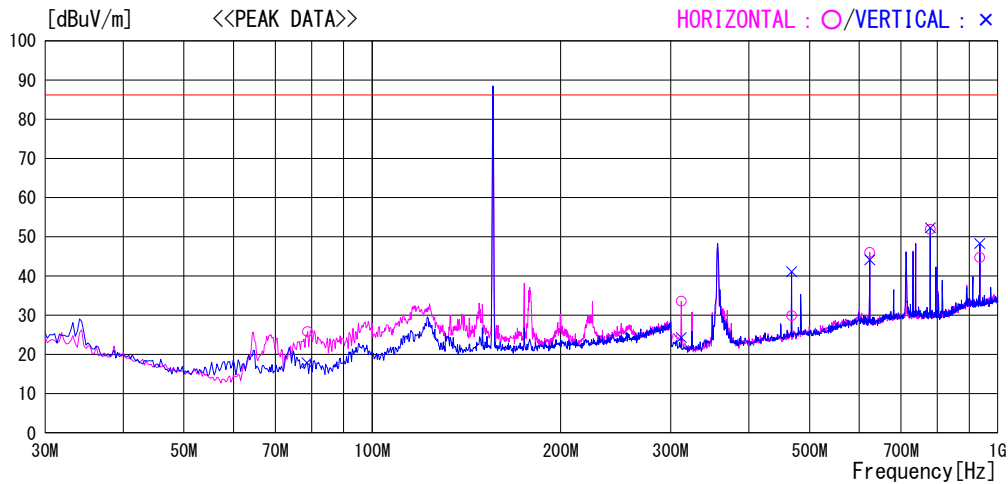
Labotech International CO., LTD.
Date : 2015/09/07 15:39:54

Model_Name : U-AIS TRANSPONDER
Type_Name : FA-170
Serial_No. : 1000-4200-0005
Test_Mode : Autonomous mode

Test_Site : Nishinomiya-hama Site
Regulation : FCC
Power_Supply : 24 VDC
Operator : A. Inoue, N. Shimada

Memo : Temp (deg)/Humid(%RH) : 25/68

LIMIT : FCC



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB/m]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	78.870	35.3	6.9	-16.4	0.0	25.8	86.2	60.4	200	204
2	311.900	35.1	15.9	-17.4	0.0	33.6	86.2	52.6	200	271
3	468.003	28.1	18.4	-16.6	0.0	29.9	86.2	56.3	100	54
4	624.106	40.7	21.2	-15.9	0.0	46.0	86.2	40.2	400	259
5	780.208	44.6	22.7	-15.4	0.0	51.9	86.2	34.3	200	16
6	935.611	34.8	24.7	-14.8	0.0	44.7	86.2	41.5	300	222
----- Vertical -----										
7	78.600	27.5	6.9	-16.5	0.0	17.9	86.2	68.3	100	287
8	311.900	25.8	15.9	-17.4	0.0	24.3	86.2	61.9	100	9
9	468.003	39.3	18.4	-16.6	0.0	41.1	86.2	45.1	200	101
10	624.106	38.8	21.2	-15.9	0.0	44.1	86.2	42.1	200	339
11	780.208	45.0	22.7	-15.4	0.0	52.3	86.2	33.9	200	127
12	935.611	38.4	24.7	-14.8	0.0	48.3	86.2	37.9	100	225

TEPT-DV Ver 1.4.0016

(2) 156.025 MHz, 12.5 W Field Strength of Spurious Radiation (1 GHz to 1.7 GHz)

Results of Radiated Emission

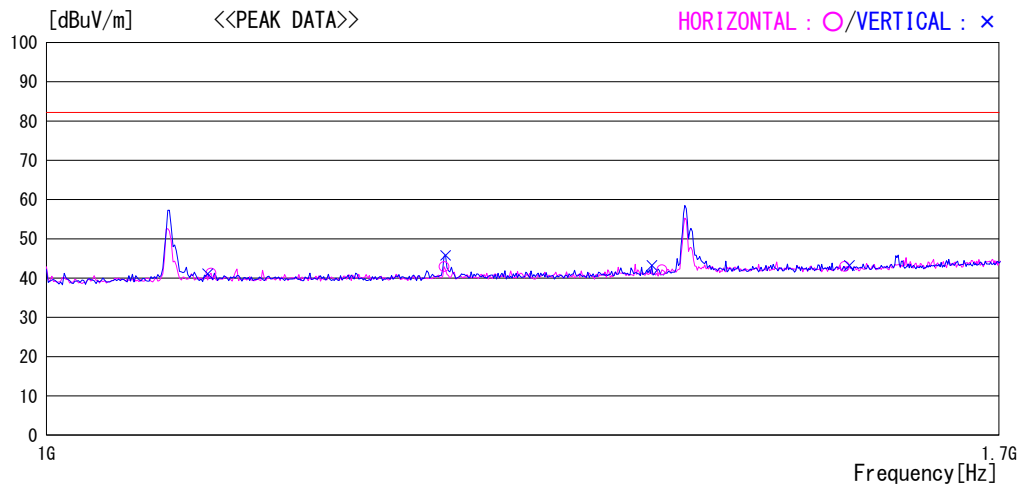
Labotech International CO., LTD.
Date : 2015/09/08 10:46:27

Model Name : U-AIS TRANSPONDER
Type Name : FA-170
Serial No. : 1000-4200-0005
Test Mode : Autonomous mode

Test Site : Nishinomiya-hama Site
Regulation : FCC
Power Supply : 24 VDC
Operator : A. Inoue, N. Shimada

Memo : Temp (deg)/Humid (%RH) : 25/68

LIMIT : FCC



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB/m]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	1096.000	34.1	24.6	-17.4	0.0	41.3	82.2	40.9	200	246
2	1248.000	34.9	25.1	-17.1	0.0	42.9	82.2	39.3	100	206
3	1409.000	33.7	25.1	-16.7	0.0	42.1	82.2	40.1	150	18
4	1560.000	34.1	25.3	-16.4	0.0	43.0	82.2	39.2	200	78
----- Vertical -----										
5	1094.000	33.9	24.6	-17.4	0.0	41.1	82.2	41.1	200	206
6	1249.000	37.8	25.1	-17.1	0.0	45.8	82.2	36.4	150	230
7	1401.000	34.8	25.1	-16.7	0.0	43.2	82.2	39.0	200	350
8	1564.000	34.2	25.3	-16.3	0.0	43.2	82.2	39.0	100	106

TEPT-DV Ver 1.4.0016

(3) 156.025 MHz, 1 W Field Strength of Spurious Radiation (30 MHz to 1 GHz)

Results of Radiated Emission

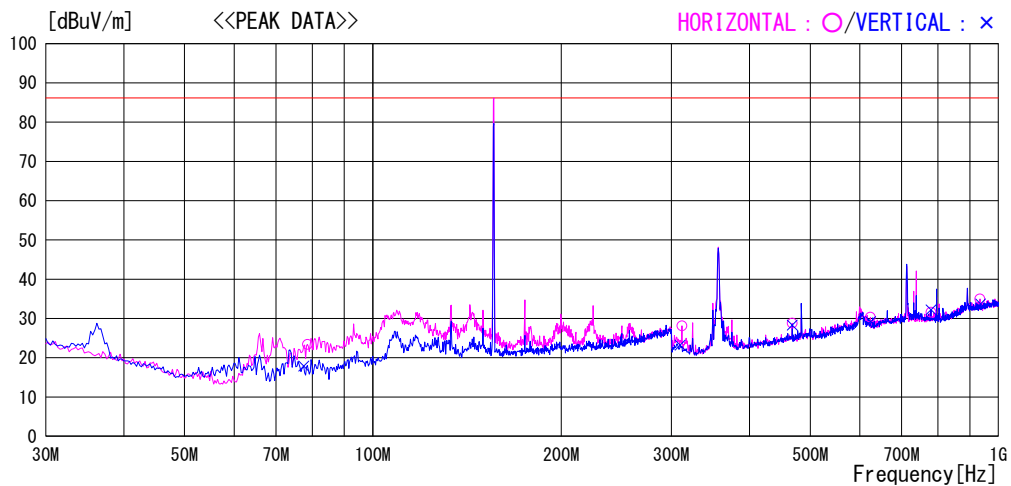
Labotech International CO., LTD.
Date : 2015/09/07 16:20:06

Model_Name : U-AIS TRANSPONDER
Type_Name : FA-170
Serial.No. : 1000-4200-0005
Test_Mode : Autonomous mode

Test_Site : Nishinomiya-hama Site
Regulation : FCC
Power_Supply : 24 VDC
Operator : A. Inoue, N. Shimada

Memo : Temp (deg)/Humid(%RH) : 25/68

LIMIT : FCC



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB/m]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	78.600	33.0	6.9	-16.5	0.0	23.4	86.2	62.8	200	199
2	311.900	29.6	15.9	-17.4	0.0	28.1	86.2	58.1	200	310
3	468.003	27.0	18.4	-16.6	0.0	28.8	86.2	57.4	100	192
4	624.106	25.0	21.2	-15.9	0.0	30.3	86.2	55.9	100	18
5	780.208	24.3	22.7	-15.4	0.0	31.6	86.2	54.6	200	333
6	934.211	25.2	24.6	-14.8	0.0	35.0	86.2	51.2	400	76
----- Vertical -----										
7	77.520	27.7	6.7	-16.5	0.0	17.9	86.2	68.3	175	134
8	309.800	24.6	16.0	-17.4	0.0	23.2	86.2	63.0	300	162
9	468.003	26.5	18.4	-16.6	0.0	28.3	86.2	57.9	100	343
10	624.806	23.9	21.2	-15.9	0.0	29.2	86.2	57.0	100	209
11	780.208	24.9	22.7	-15.4	0.0	32.2	86.2	54.0	100	355
12	936.311	23.8	24.7	-14.8	0.0	33.7	86.2	52.5	300	131

TEPT-DV Ver 1.4.0016

(4) 156.025 MHz, 1 W Field Strength of Spurious Radiation (1 GHz to 1.7 GHz)

Results of Radiated Emission

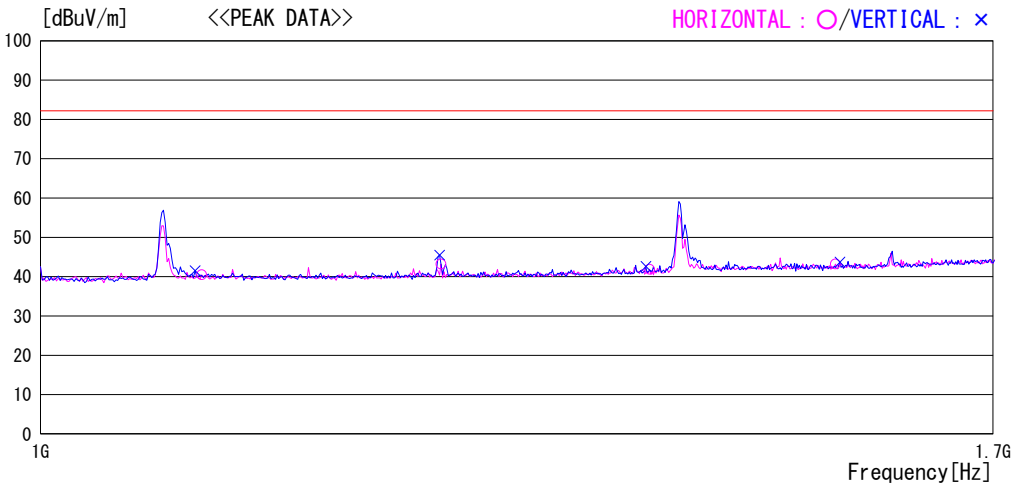
Labotech International CO., LTD.
Date : 2015/09/07 19:05:13

Model_Name : U-AIS TRANSPONDER
Type_Name : FA-170
Serial.No. : 1000-4200-0005
Test_Mode : Autonomous mode

Memo : Temp (deg)/Humid(%RH) : 25/68

LIMIT : FCC

Test_Site : Nishinomiya-hama Site
Regulation : FCC
Power_Supply : 24 VDC
Operator : A. Inoue, N. Shimada



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB/m]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	1094.000	33.3	24.6	-17.4	0.0	40.5	82.2	41.7	150	11
2	1250.000	35.2	25.1	-17.1	0.0	43.2	82.2	39.0	100	206
3	1404.000	33.5	25.1	-16.7	0.0	41.9	82.2	40.3	200	289
4	1557.000	34.3	25.3	-16.4	0.0	43.2	82.2	39.0	150	280
----- Vertical -----										
5	1090.000	34.4	24.5	-17.4	0.0	41.5	82.2	40.7	125	181
6	1249.000	37.5	25.1	-17.1	0.0	45.5	82.2	36.7	200	192
7	1401.000	34.2	25.1	-16.7	0.0	42.6	82.2	39.6	175	182
8	1561.000	34.7	25.3	-16.3	0.0	43.7	82.2	38.5	125	172

(5) 156.525 MHz, 12.5 W Field Strength of Spurious Radiation (30 MHz to 1 GHz)

Results of Radiated Emission

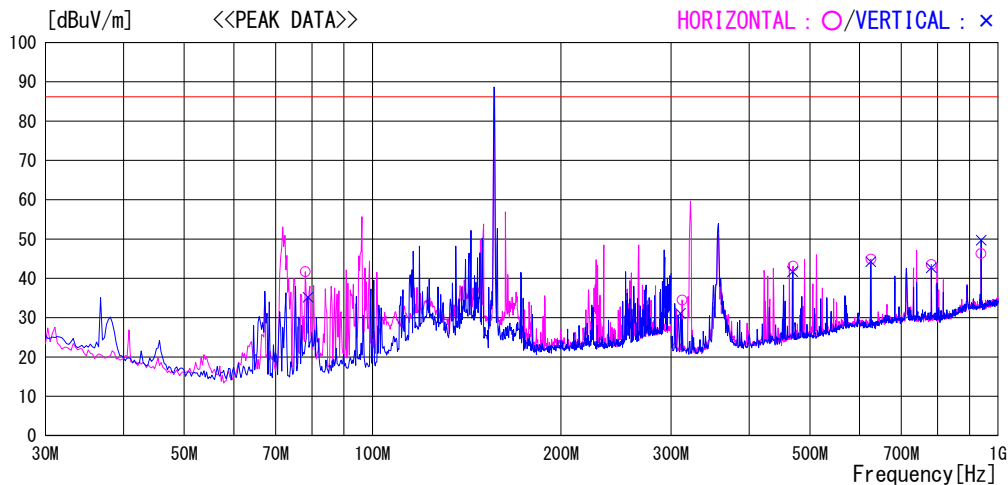
Labotech International CO., LTD.
Date : 2015/09/07 17:20:36

Model_Name : U-AIS TRANSPONDER
Type_Name : FA-170
Serial_No. : 1000-4200-0005
Test_Mode : Autonomous mode

Test_Site : Nishinomiya-hama Site
Regulation : FCC
Power_Supply : 24 VDC
Operator : A. Inoue, N. Shimada

Memo : Temp (deg)/Humid(%RH) : 25/68

LIMIT : FCC



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB/m]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	78.060	51.4	6.8	-16.5	0.0	41.7	86.2	44.5	150	332
2	312.600	36.0	15.9	-17.4	0.0	34.5	86.2	51.7	200	267
3	470.103	41.3	18.4	-16.6	0.0	43.1	86.2	43.1	200	158
4	626.206	39.6	21.2	-15.9	0.0	44.9	86.2	41.3	200	348
5	782.308	36.2	22.7	-15.4	0.0	43.5	86.2	42.7	100	164
6	939.111	36.4	24.7	-14.8	0.0	46.3	86.2	39.9	100	269
----- Vertical -----										
7	78.870	44.7	6.9	-16.4	0.0	35.2	86.2	51.0	150	112
8	310.500	32.5	16.0	-17.4	0.0	31.1	86.2	55.1	300	46
9	469.403	39.9	18.4	-16.6	0.0	41.7	86.2	44.5	200	18
10	625.506	38.9	21.2	-15.9	0.0	44.2	86.2	42.0	300	342
11	782.308	35.4	22.7	-15.4	0.0	42.7	86.2	43.5	300	311
12	939.111	39.8	24.7	-14.8	0.0	49.7	86.2	36.5	300	175

TEPT-DV Ver 1.4.0016

(6) 156.525 MHz, 12.5 W Field Strength of Spurious Radiation (1 GHz to 1.7 GHz)

Results of Radiated Emission

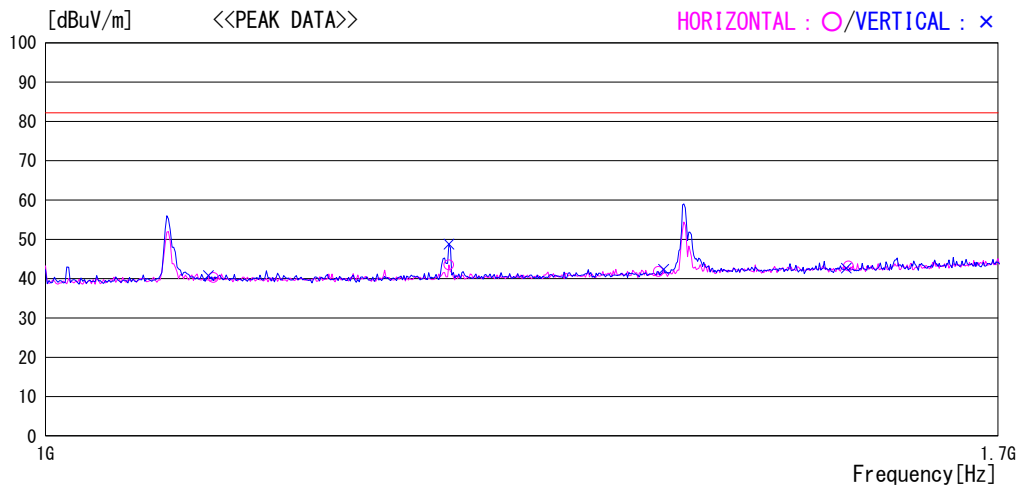
Labotech International CO., LTD.
Date : 2015/09/07 19:55:23

Model_Name : U-AIS TRANSPONDER
Type_Name : FA-170
Serial_No. : 1000-4200-0005
Test_Mode : Autonomous mode

Test_Site : Nishinomiya-hama Site
Regulation : FCC
Power_Supply : 24 VDC
Operator : A. Inoue, N. Shimada

Memo : Temp (deg)/Humid(%RH) : 25/68

LIMIT : FCC



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB/m]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	1098.000	33.1	24.6	-17.4	0.0	40.3	82.2	41.9	175	190
2	1252.000	35.5	25.1	-17.1	0.0	43.5	82.2	38.7	200	315
3	1407.000	33.4	25.1	-16.7	0.0	41.8	82.2	40.4	200	39
4	1564.000	34.2	25.3	-16.3	0.0	43.2	82.2	39.0	200	246
----- Vertical -----										
5	1095.000	33.6	24.6	-17.4	0.0	40.8	82.2	41.4	125	287
6	1252.000	40.8	25.1	-17.1	0.0	48.8	82.2	33.4	175	165
7	1411.000	34.0	25.1	-16.7	0.0	42.4	82.2	39.8	150	189
8	1562.000	33.7	25.3	-16.3	0.0	42.7	82.2	39.5	150	296

TEPT-DV Ver 1.4.0016

(7) 156.525 MHz, 1 W Field Strength of Spurious Radiation (30 MHz to 1 GHz)

Results of Radiated Emission

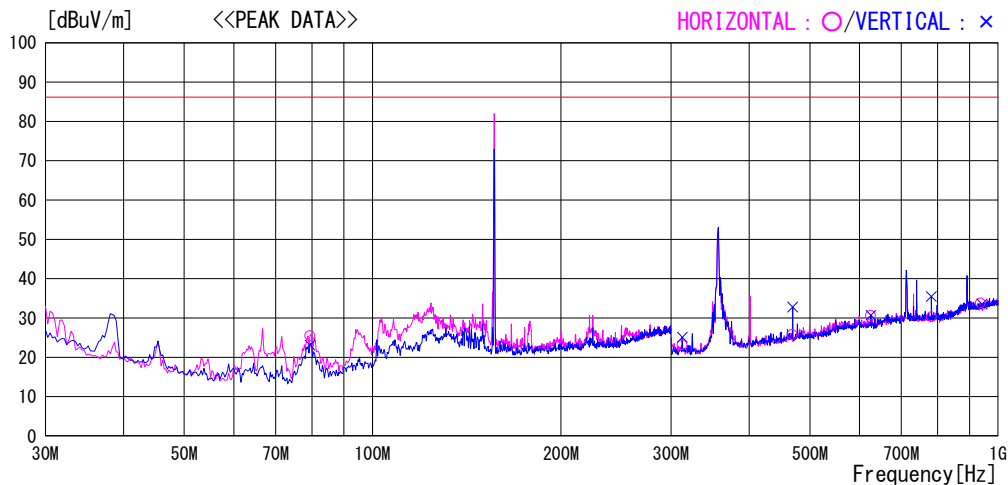
Labotech International CO., LTD.
Date : 2015/09/07 16:57:42

Model_Name : U-AIS TRANSPONDER
Type_Name : FA-170
Serial.No. : 1000-4200-0005
Test_Mode : Autonomous mode

Test_Site : Nishinomiya-hama Site
Regulation : FCC
Power_Supply : 24 VDC
Operator : A. Inoue, N. Shimada

Memo : Temp (deg)/Humid(%RH) : 25/68

LIMIT : FCC



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB/m]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	79.410	34.9	7.0	-16.4	0.0	25.5	86.2	60.7	200	13
2	312.600	24.7	15.9	-17.4	0.0	23.2	86.2	63.0	100	192
3	468.703	24.0	18.4	-16.6	0.0	25.8	86.2	60.4	300	13
4	625.506	25.4	21.2	-15.9	0.0	30.7	86.2	55.5	100	276
5	782.308	23.0	22.7	-15.4	0.0	30.3	86.2	55.9	100	300
6	937.011	23.9	24.7	-14.8	0.0	33.8	86.2	52.4	100	58
----- Vertical -----										
7	79.410	32.5	7.0	-16.4	0.0	23.1	86.2	63.1	125	165
8	312.600	26.6	15.9	-17.4	0.0	25.1	86.2	61.1	100	352
9	469.403	31.0	18.4	-16.6	0.0	32.8	86.2	53.4	200	8
10	626.206	25.4	21.2	-15.9	0.0	30.7	86.2	55.5	300	339
11	782.308	28.2	22.7	-15.4	0.0	35.5	86.2	50.7	100	152
12	941.911	23.6	24.7	-14.8	0.0	33.5	86.2	52.7	400	164

TEPT-DV Ver 1.4.0016

(8) 156.525 MHz, 1 W Field Strength of Spurious Radiation (1 GHz to 1.7 GHz)

Results of Radiated Emission

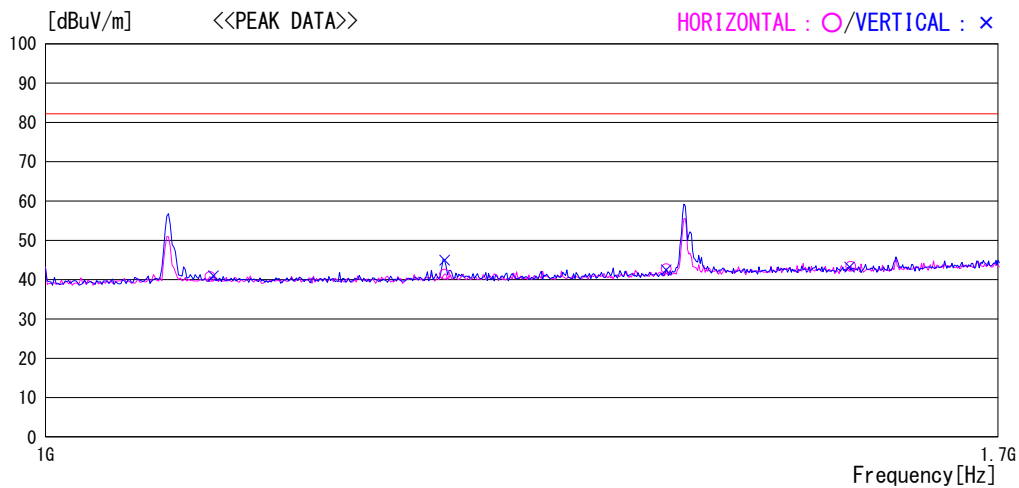
Labotech International CO., LTD.
Date : 2015/09/07 18:54:04

Model_Name : U-AIS TRANSPONDER
Type_Name : FA-170
Serial.No. : 1000-4200-0005
Test_Mode : Autonomous mode

Test_Site : Nishinomiya-hama Site
Regulation : FCC
Power_Supply : 24 VDC
Operator : A. Inoue, N. Shimada

Memo : Temp (deg)/Humid(%RH) : 25/68

LIMIT : FCC



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB/m]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	1096.000	33.6	24.6	-17.4	0.0	40.8	82.2	41.4	175	301
2	1249.000	33.4	25.1	-17.1	0.0	41.4	82.2	40.8	175	323
3	1413.000	34.4	25.1	-16.7	0.0	42.8	82.2	39.4	150	25
4	1566.000	34.4	25.3	-16.3	0.0	43.4	82.2	38.8	125	340
----- Vertical -----										
5	1098.000	33.8	24.6	-17.4	0.0	41.0	82.2	41.2	150	123
6	1249.000	37.0	25.1	-17.1	0.0	45.0	82.2	37.2	200	192
7	1413.000	34.1	25.1	-16.7	0.0	42.5	82.2	39.7	125	166
8	1565.000	34.2	25.3	-16.3	0.0	43.2	82.2	39.0	125	223

TEPT-DV Ver 1.4.0016

(9) 162.025 MHz, 12.5 W Field Strength of Spurious Radiation (30 MHz to 1 GHz)

Results of Radiated Emission

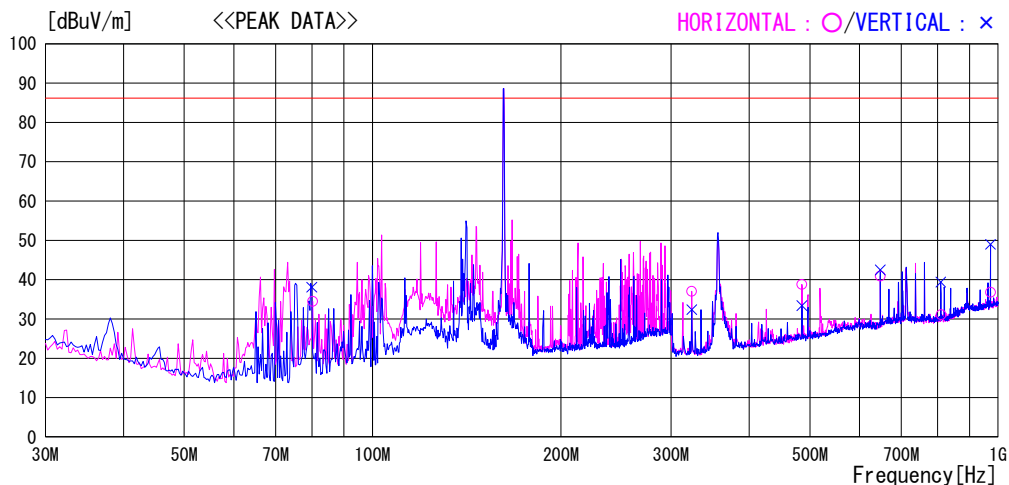
Labotech International CO., LTD.
Date : 2015/09/07 17:42:51

Model Name : U-AIS TRANSPONDER
Type Name : FA-170
Serial No. : 1000-4200-0005
Test Mode : Autonomous mode

Test Site : Nishinomiya-hama Site
Regulation : FCC
Power Supply : 24 VDC
Operator : A. Inoue, N. Shimada

Memo : Temp (deg)/Humid(%RH) : 25/68

LIMIT : FCC



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB/m]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	80.220	43.7	7.2	-16.4	0.0	34.5	86.2	51.7	125	128
2	323.800	38.5	15.8	-17.3	0.0	37.0	86.2	49.2	100	61
3	485.503	36.1	19.2	-16.5	0.0	38.8	86.2	47.4	100	16
4	647.906	34.8	21.9	-15.8	0.0	40.9	86.2	45.3	100	305
5	811.009	23.6	22.8	-15.3	0.0	31.1	86.2	55.1	400	29
6	972.012	26.3	25.2	-14.7	0.0	36.8	86.2	49.4	100	201
----- Vertical -----										
7	79.950	47.3	7.2	-16.4	0.0	38.1	86.2	48.1	200	303
8	323.800	33.9	15.8	-17.3	0.0	32.4	86.2	53.8	100	313
9	485.503	30.7	19.2	-16.5	0.0	33.4	86.2	52.8	200	44
10	647.906	36.4	21.9	-15.8	0.0	42.5	86.2	43.7	200	206
11	809.609	31.9	22.8	-15.3	0.0	39.4	86.2	46.8	100	352
12	972.012	38.5	25.2	-14.7	0.0	49.0	86.2	37.2	100	205

TEPT-DV Ver 1.4.0016

(10) 162.025 MHz, 12.5 W Field Strength of Spurious Radiation (1 GHz to 1.7 GHz)

Results of Radiated Emission

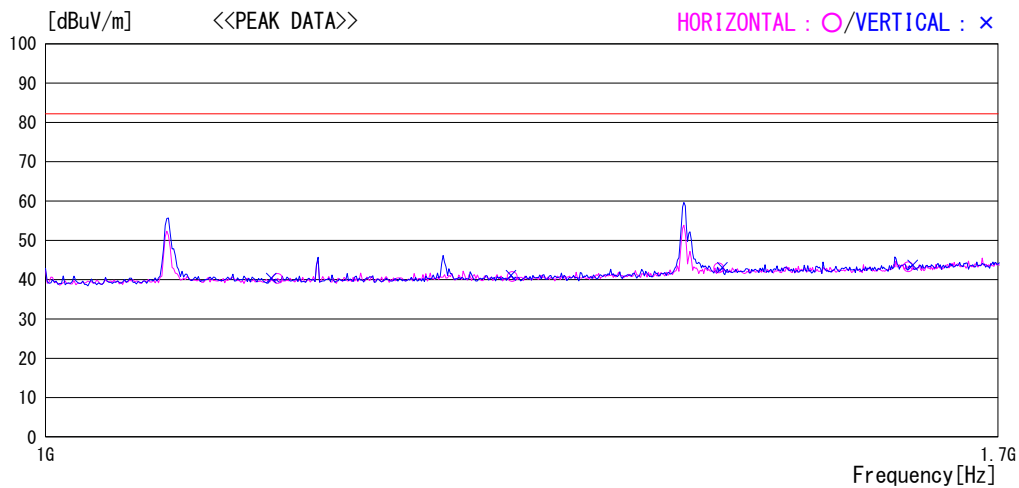
Labotech International CO., LTD.
Date : 2015/09/07 20:25:07

Model_Name : U-AIS TRANSPONDER
Type_Name : FA-170
Serial.No. : 1000-4200-0005
Test_Mode : Autonomous mode

Test_Site : Nishinomiya-hama Site
Regulation : FCC
Power_Supply : 24 VDC
Operator : A. Inoue, N. Shimada

Memo : Temp (deg)/Humid(%RH) : 25/68

LIMIT : FCC



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB/m]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	1138.000	32.9	24.7	-17.3	0.0	40.3	82.2	41.9	100	298
2	1297.000	32.7	25.1	-17.0	0.0	40.8	82.2	41.4	200	106
3	1455.000	34.5	25.1	-16.6	0.0	43.0	82.2	39.2	100	197
4	1617.000	34.0	25.5	-16.2	0.0	43.3	82.2	38.9	200	315
----- Vertical -----										
5	1134.000	33.1	24.7	-17.4	0.0	40.4	82.2	41.8	200	343
6	1296.000	33.0	25.1	-17.0	0.0	41.1	82.2	41.1	125	17
7	1458.000	34.6	25.1	-16.6	0.0	43.1	82.2	39.1	150	349
8	1621.000	34.4	25.5	-16.2	0.0	43.7	82.2	38.5	175	211

TEPT-DV Ver 1.4.0016

(11) 162.025 MHz, 1 W Field Strength of Spurious Radiation (30 MHz to 1 GHz)

Results of Radiated Emission

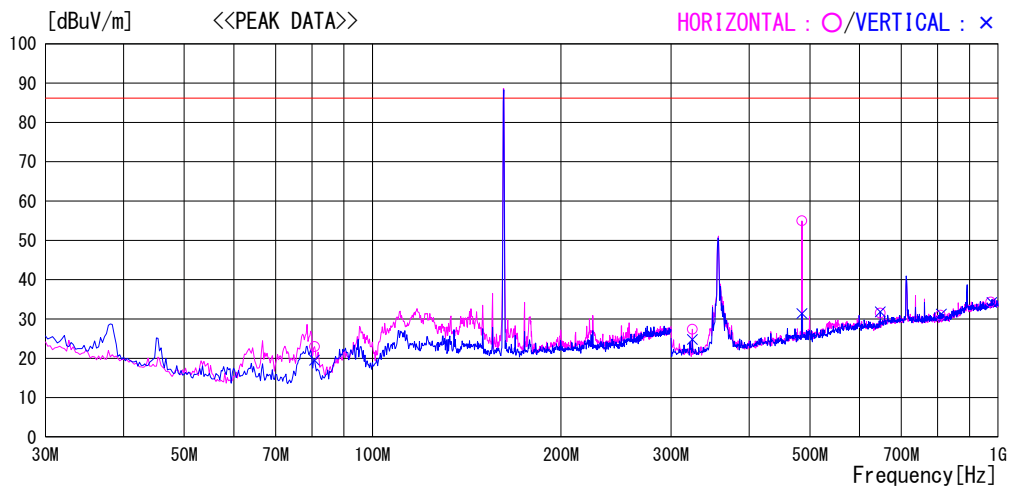
Labotech International CO., LTD.
Date : 2015/09/07 18:08:09

Model_Name : U-AIS TRANSPONDER
Type_Name : FA-170
Serial_No. : 1000-4200-0005
Test_Mode : Autonomous mode

Test_Site : Nishinomiya-hama Site
Regulation : FCC
Power_Supply : 24 VDC
Operator : A. Inoue, N. Shimada

Memo : Temp (deg)/Humid(%RH) : 25/68

LIMIT : FCC



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB/m]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	80.760	32.1	7.3	-16.4	0.0	23.0	86.2	63.2	200	179
2	324.500	28.9	15.8	-17.3	0.0	27.4	86.2	58.8	200	278
3	485.503	52.3	19.2	-16.5	0.0	55.0	86.2	31.2	200	22
4	647.906	25.4	21.9	-15.8	0.0	31.5	86.2	54.7	400	344
5	808.209	23.6	22.7	-15.3	0.0	31.0	86.2	55.2	300	188
6	973.412	23.8	25.2	-14.7	0.0	34.3	86.2	51.9	400	264
----- Vertical -----										
7	80.760	28.6	7.3	-16.4	0.0	19.5	86.2	66.7	100	157
8	324.500	26.3	15.8	-17.3	0.0	24.8	86.2	61.4	100	245
9	485.503	28.7	19.2	-16.5	0.0	31.4	86.2	54.8	400	32
10	647.906	25.7	21.9	-15.8	0.0	31.8	86.2	54.4	400	6
11	811.709	23.8	22.8	-15.3	0.0	31.3	86.2	54.9	300	350
12	976.912	23.6	25.3	-14.7	0.0	34.2	86.2	52.0	200	11

TEPT-DV Ver 1.4.0016

(12) 162.025 MHz, 1 W Field Strength of Spurious Radiation (1 GHz to 1.7 GHz)

Results of Radiated Emission

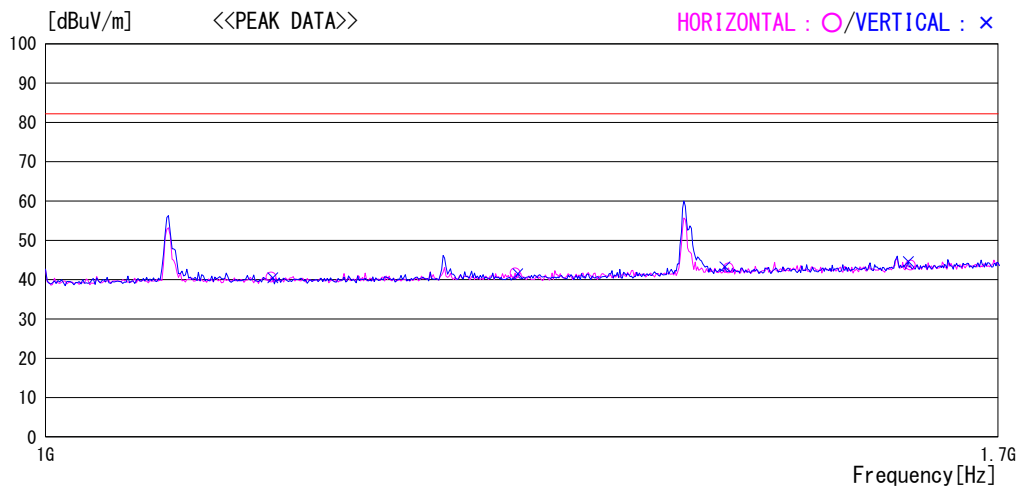
Labotech International CO., LTD.
Date : 2015/09/07 18:42:33

Model_Name : U-AIS TRANSPONDER
Type_Name : FA-170
Serial_No. : 1000-4200-0005
Test_Mode : Autonomous mode

Test_Site : Nishinomiya-hama Site
Regulation : FCC
Power_Supply : 24 VDC
Operator : A. Inoue, N. Shimada

Memo : Temp (deg)/Humid(%RH) : 25/68

LIMIT : FCC

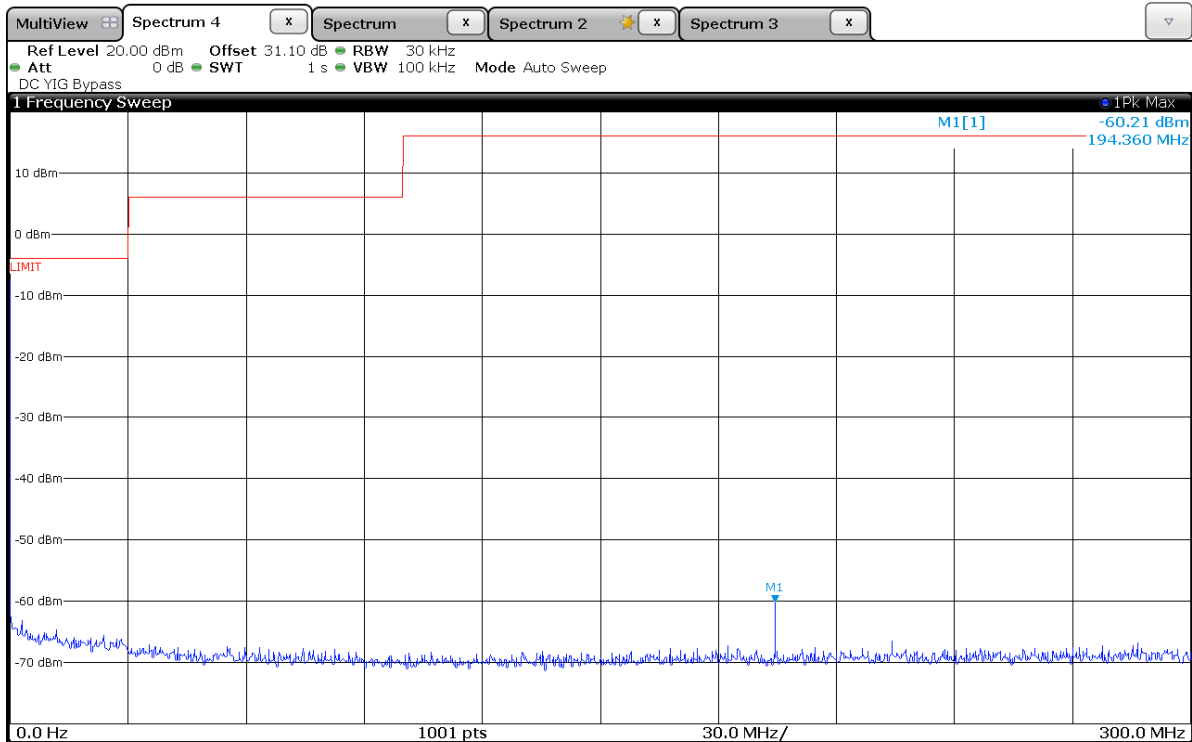


No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB/m]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	1134.000	33.4	24.7	-17.4	0.0	40.7	82.2	41.5	100	5
2	1299.000	33.6	25.1	-17.0	0.0	41.7	82.2	40.5	125	273
3	1463.000	34.5	25.1	-16.6	0.0	43.0	82.2	39.2	150	283
4	1619.000	34.4	25.5	-16.2	0.0	43.7	82.2	38.5	200	39
----- Vertical -----										
5	1135.000	33.2	24.7	-17.4	0.0	40.5	82.2	41.7	125	11
6	1301.000	33.4	25.1	-17.0	0.0	41.5	82.2	40.7	175	188
7	1460.000	34.8	25.1	-16.6	0.0	43.3	82.2	38.9	150	123
8	1617.000	35.3	25.5	-16.2	0.0	44.6	82.2	37.6	125	223

TEPT-DV Ver 1.4.0016

10 Field Strength Plots for Suppression of Interference Aboard Ships

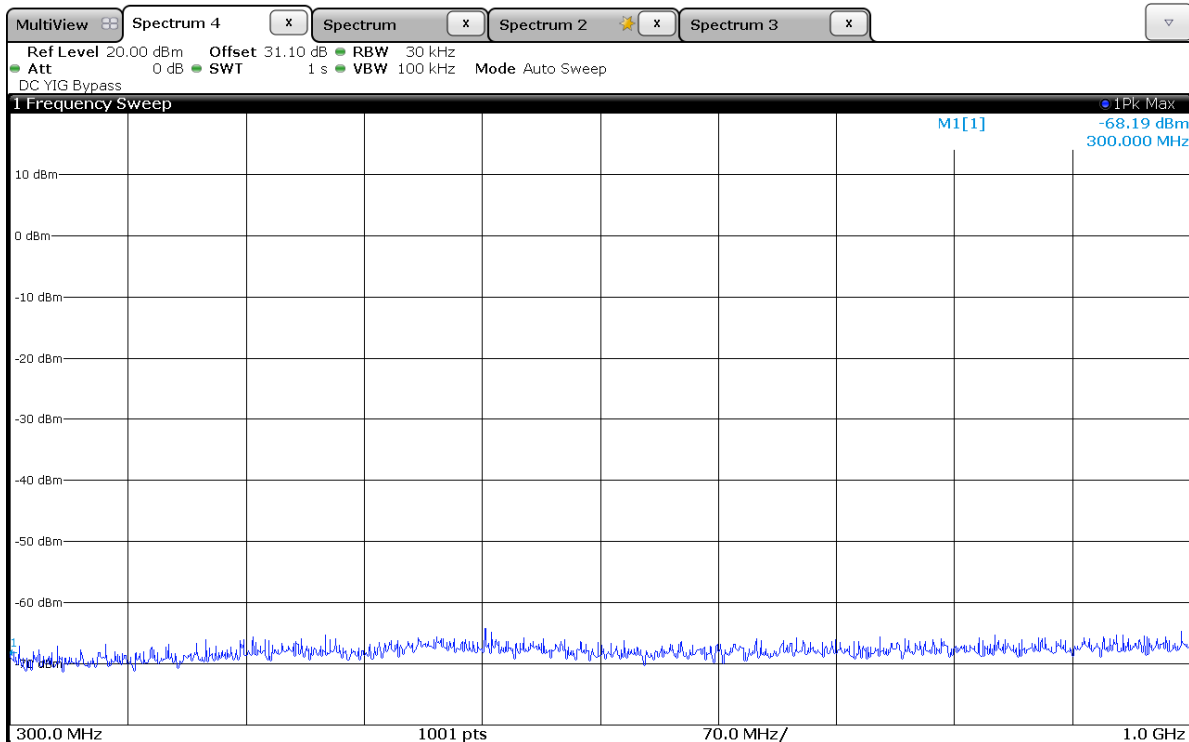
(1) 156.025 MHz, Suppression of Interference Aboard Ships (9 kHz to 300 MHz)



Date: 4.SEP.2015 17:47:44

9 kHz – 30 MHz: Limit = 400 μ W (-4 dBm)
30 MHz – 100 MHz: Limit = 4,000 μ W (+6 dBm)
100 MHz – 300 MHz: Limit = 40,000 μ W (+16 dBm)

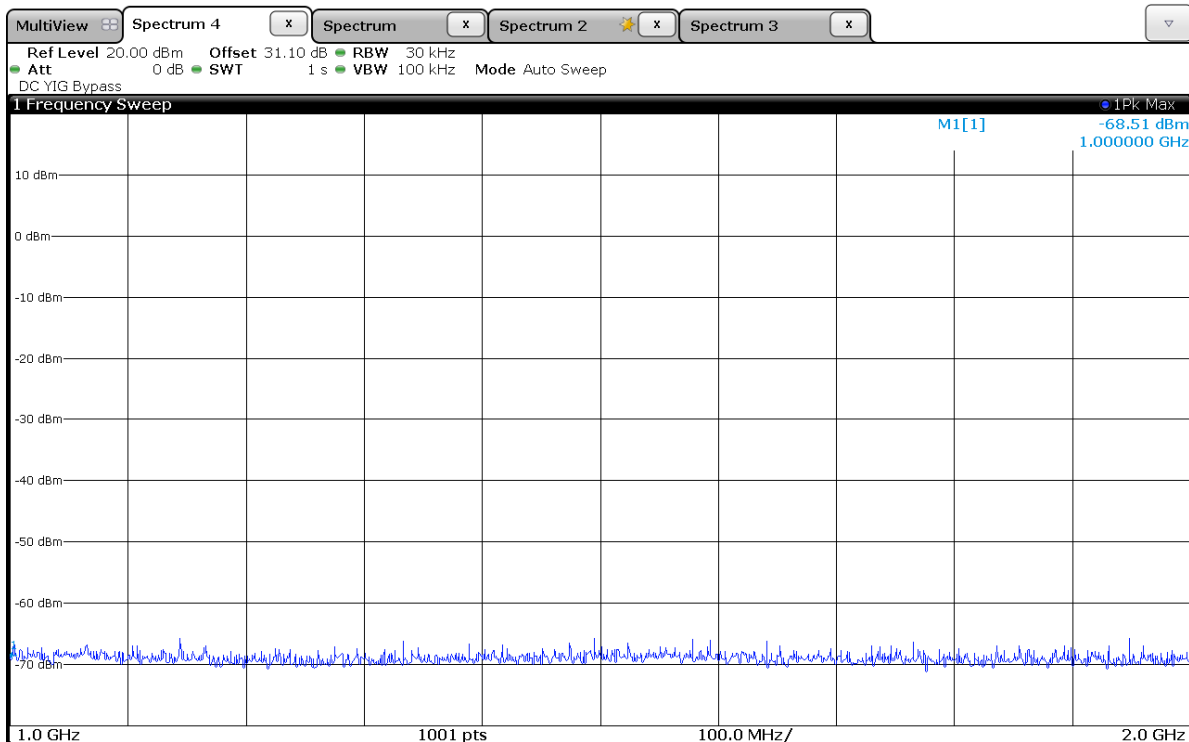
(2) 156.025 MHz, Suppression of Interference Aboard Ships (300 MHz to 1 GHz)



Date: 4.SEP.2015 17:48:08

300 MHz – 1 GHz: Limit = 400,000 μ W (+26 dBm)

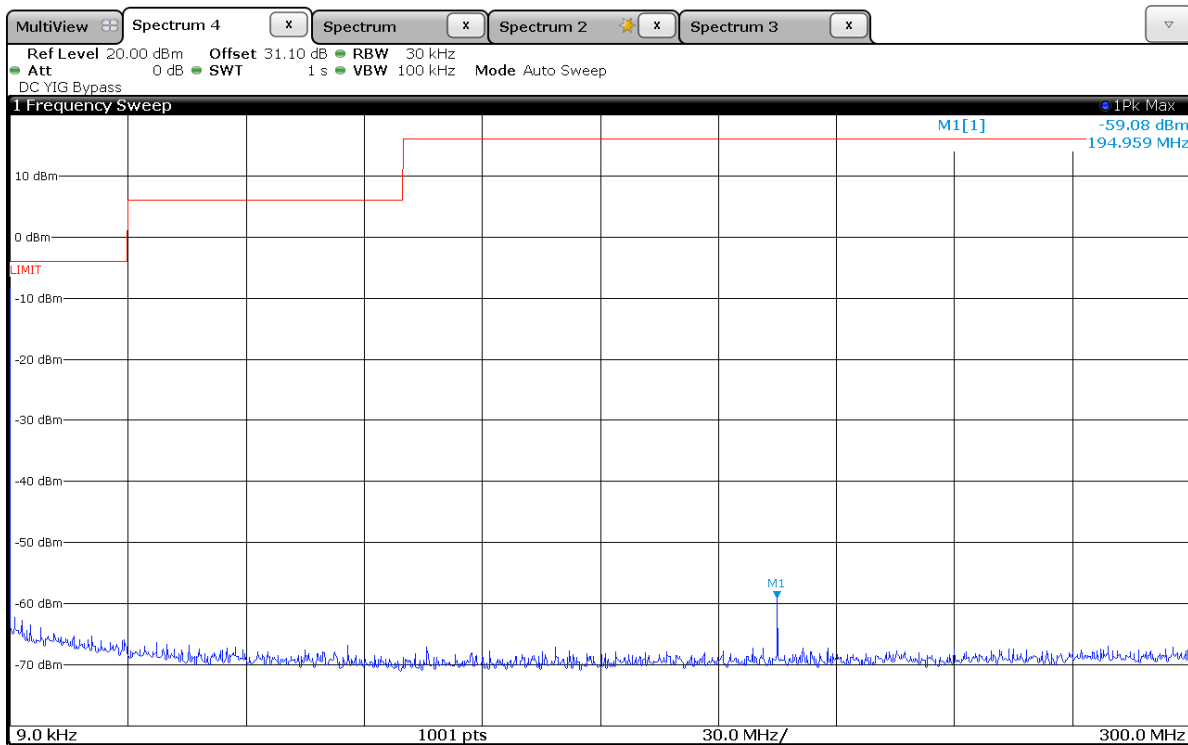
(3) 156.025 MHz, Suppression of Interference Aboard Ships (1 GHz to 2 GHz)



Date: 4.SEP.2015 17:48:21

1 GHz – 2 GHz: Limit = 400,000 μ W (+26 dBm)

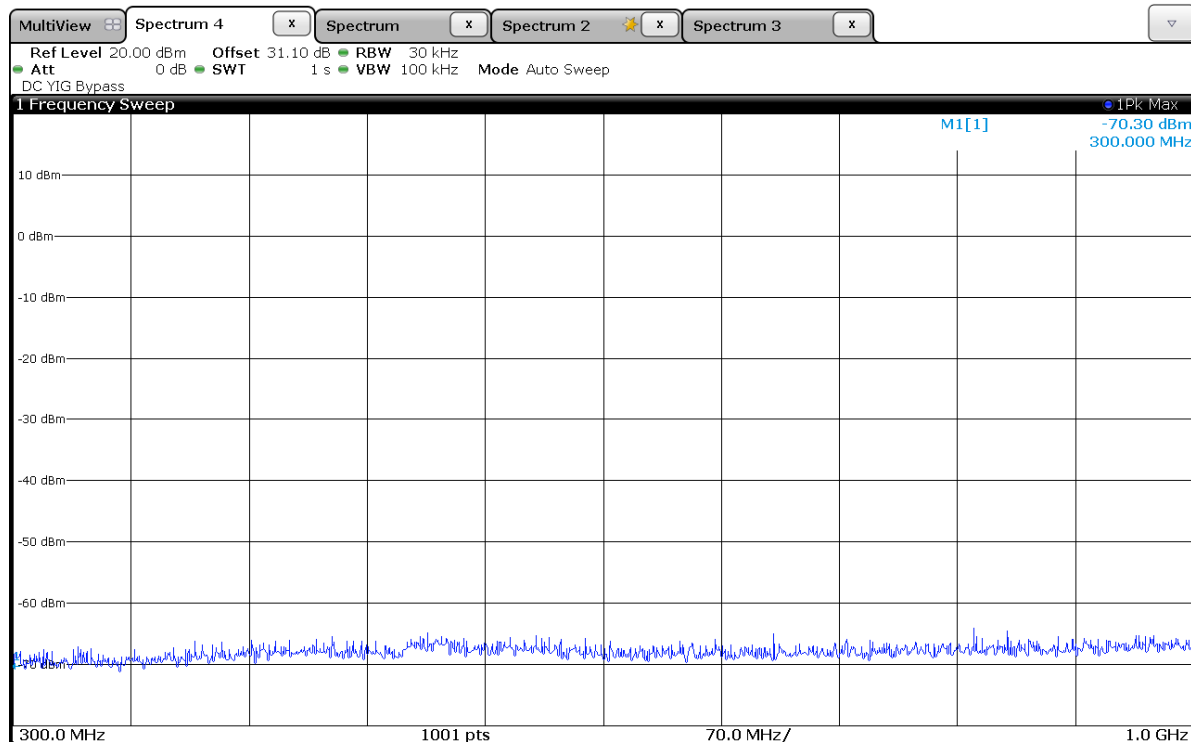
(4) 156.525 MHz, Suppression of Interference Aboard Ships (9 kHz to 300 MHz)



Date: 4.SEP.2015 17:45:39

9 kHz – 30 MHz: Limit = 400 μ W (-4 dBm)
30 MHz – 100 MHz: Limit = 4,000 μ W (+6 dBm)
100 MHz – 300 MHz: Limit = 40,000 μ W (+16 dBm)

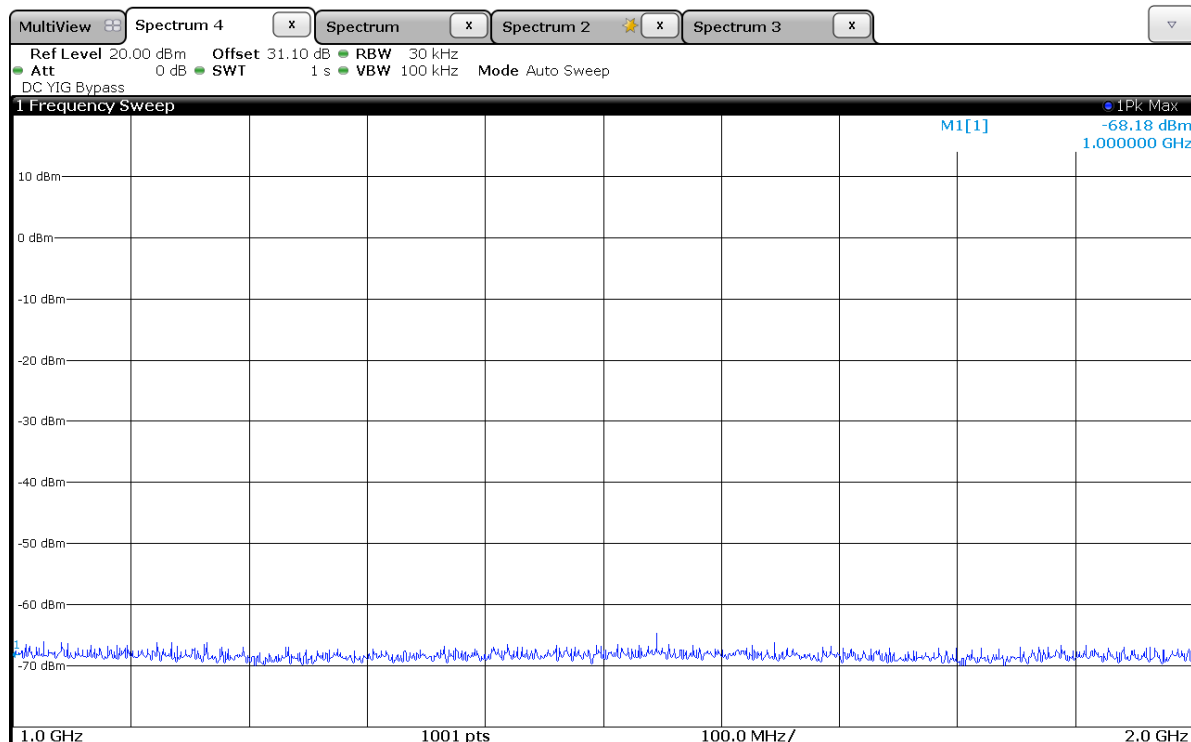
(5) 156.525 MHz, Suppression of Interference Aboard Ships (300 MHz to 1 GHz)



Date: 4.SEP.2015 17:46:07

300 MHz – 1 GHz: Limit = 400,000 μ W (+26 dBm)

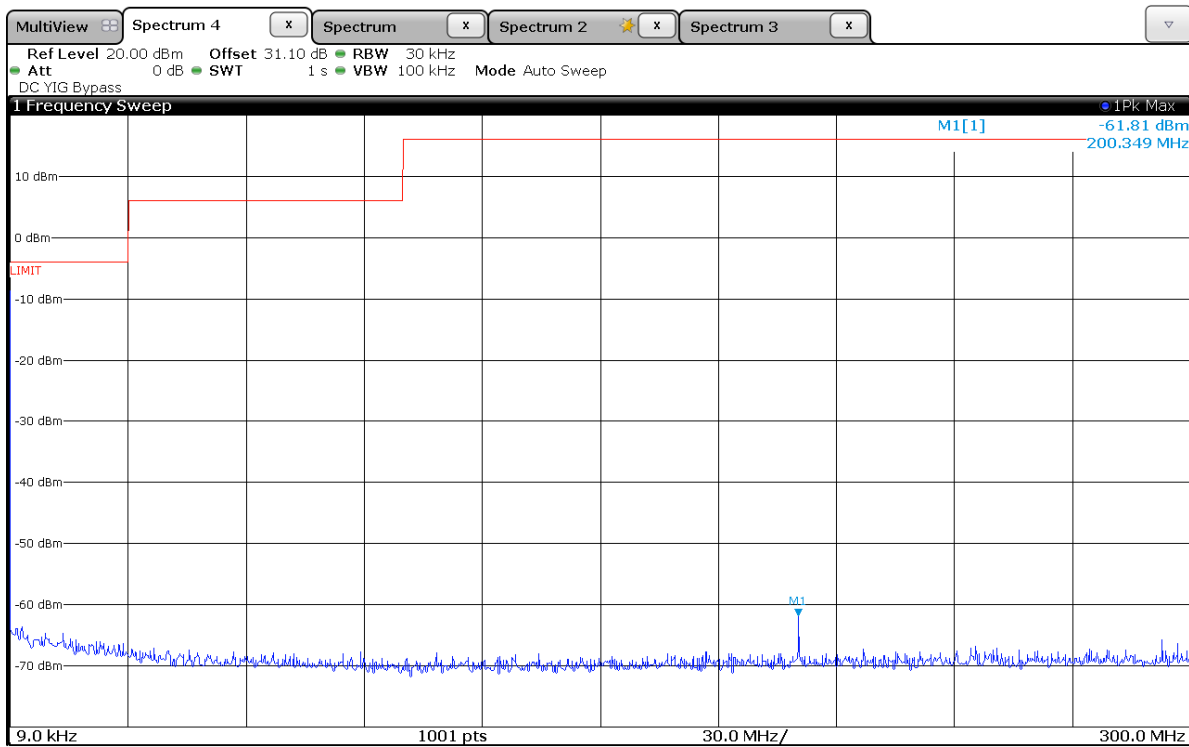
(6) 156.525 MHz, Suppression of Interference Aboard Ships (1 GHz to 2 GHz)



Date: 4.SEP.2015 17:46:30

1 GHz – 2 GHz: Limit = 400,000 μ W (+26 dBm)

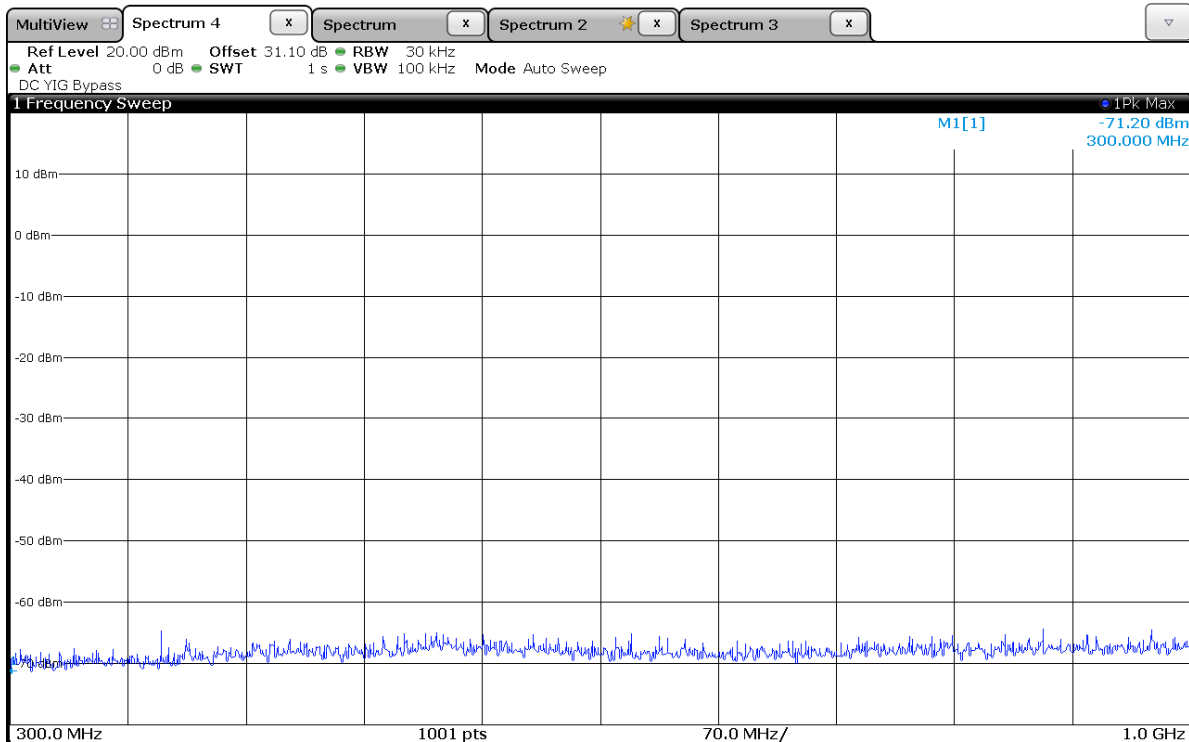
(7) 162.025 MHz, Suppression of Interference Aboard Ships (9 kHz to 300 MHz)



Date: 4.SEP.2015 17:49:56

9 kHz – 30 MHz: Limit = 400 μ W (-4 dBm)
30 MHz – 100 MHz: Limit = 4,000 μ W (+6 dBm)
100 MHz – 300 MHz: Limit = 40,000 μ W (+16 dBm)

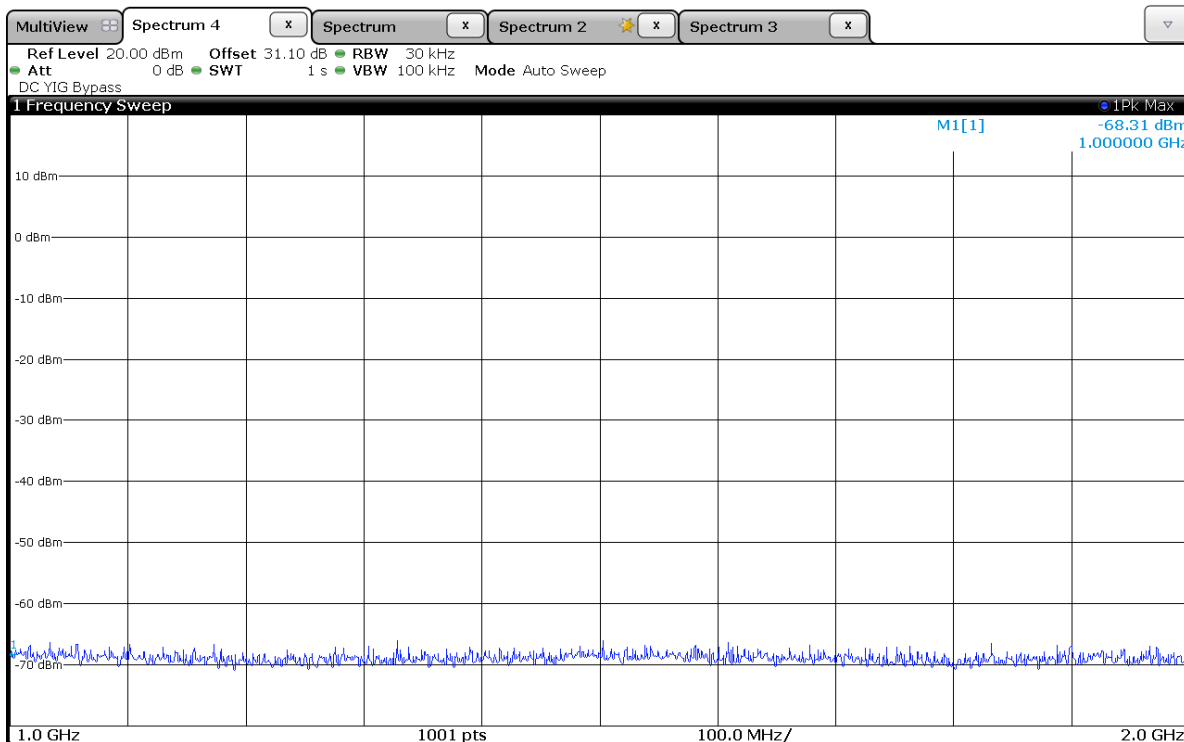
(8) 162.025 MHz, Suppression of Interference Aboard Ships (300 MHz to 1 GHz)



Date: 4.SEP.2015 17:50:16

300 MHz – 1 GHz: Limit = 400,000 μ W (+26 dBm)

(9) 162.025 MHz, Suppression of Interference Aboard Ships (1 GHz to 2 GHz)



Date: 4.SEP.2015 17:50:31

1 GHz – 2 GHz: Limit = 400,000 μ W (+26 dBm)