



EMC Test Report

Issued Date : Aug. 04, 2011
Project No. : R1105011
Equipment : AIS Aids to Navigation (AtoN)
Model Name : MANDO-301; MANDO-302;
MANDO-303
Applicant : Alltek Marine Electronics Corp.
Address : 7F, NO. 605, Ruei Guang Rd., NeiHu,
Taipei, Taiwan, R.O.C. 114

Tested by: Neutron Engineering Inc. EMC Laboratory
Date of Receipt: May 24, 2011
Date of Test: May 24, 2011 ~ Jun. 13, 2011

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Declaration

Neutron represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with the standards traceable to National Measurement Laboratory (**NML**) of **R.O.C.**, or National Institute of Standards and Technology (**NIST**) of **U.S.A.**

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Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.



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1. CERTIFICATION

Equipment : AIS Aids to Navigation (AtoN)
Brand Name : AMEC
Model Name : MANDO-301; MANDO-302; MANDO-303
Applicant : Alltek Marine Electronics Corp.
Date of Test : May 24, 2011 ~ Jun. 13, 2011
Standards : EN 301 843-1 V1.2.1 (2004-06)
 EN 301 843-2 V1.2.1 (2004-06)
 IEC 61000-4-2: 2008
 IEC 61000-4-3: 2006 +A1: 2007 +A2: 2010
 IEC 61000-4-4: 2004 +A1: 2010
 IEC 61000-4-6: 2008

The above equipment has been tested and found compliance with the requirement of the relative standards by Neutron Engineering Inc. EMC Laboratory.
The test data, data evaluation, and equipment configuration contained in our test report (Ref No. NEI-ETSE-2-R1105011) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of NVLAP and TAF according to the ISO-17025 quality assessment standard and technical standard(s).



2. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

Emission EN 301 843-1 ; EN 301 843-2				
Standard	Test Item	Limit	Judgment	Remark
-----	Conducted Emission	---	PASS	
	Conducted Emission At Telecommunication Ports	---	N/A	
	Radiated Emission	---	PASS	
Immunity EN 301 843-1 ; EN 301 843-2				
Section	Test Item	Performance Criteria	Judgment	Remark
IEC 61000-4-2: 2008	Electrostatic Discharge	B	PASS	
IEC 61000-4-3: 2006 +A1: 2007 +A2: 2010	RF electromagnetic field	A	PASS	
IEC 61000-4-4: 2004 +A1: 2010	Fast transients	B	PASS	
IEC 61000-4-6: 2008	Injected Current	A	PASS	

NOTE:

(1) " N/A" denotes test is not applicable in this Test Report.



2.1 TEST FACILITY

The test facilities used to collect the test data in this report:

- C02:** (VCCI RN: C-3477; FCC RN: 614388; FCC DN: TW1054)
1F., No. 61, Ln. 77, Sing-ai Rd., Neihu Dist., Taipei City 114, Taiwan (R.O.C.)
- CB05:** B1, No. 37, Lane 365, YangGuang St., NeiHu District 114, Taipei, Taiwan.
- CB06:** B1, No. 37, Lane 365, YangGuang St., NeiHu District 114, Taipei, Taiwan.
- CB08:** (VCCI RN: G-91; FCC RN: 614388; FCC DN: TW1054;
IC Assigned Code: 4428C-1)
1F., No. 61, Ln. 77, Sing-ai Rd., Neihu Dist., Taipei City 114, Taiwan (R.O.C.)
- OS02:** (VCCI RN: R-2669; FCC RN: 95335; FCC DN: TW1010;
IC Assigned Code: 4428A-1)
No.132-1, Lane 329, Sec. 2, Palian Road, Shijr City, Taipei, Taiwan.

2.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95%.

The measurement instrumentation uncertainty considerations contained in CISPR 16-4-2.

A. Radiated Measurement :

Test Site	Method	Measurement Frequency Range	Ant. H / V	U , (dB)	NOTE
OS-02	ANSI	30MHz ~ 200MHz	V	2.48	
		30MHz ~ 200MHz	H	2.16	
		200MHz ~ 1,000MHz	V	2.50	
		200MHz ~ 1,000MHz	H	2.66	

Test Site	Item	Measurement Frequency Range	Uncertainty	NOTE	
CB08	Radiated Emission at 3m	Horizontal Polarization	30 - 200MHz	3.35 dB	
			200 - 1000MHz	3.11 dB	
			1 - 18GHz	3.97 dB	
			18 - 40GHz	4.01 dB	
		Vertical Polarization	30 - 200MHz	3.22 dB	
			200 - 1000MHz	3.24 dB	
			1 - 18GHz	4.05 dB	
			18 - 40GHz	4.04 dB	

B. EMS Measurement:

Item	Standard	Expanded Uncertainty		NOTE
ESD(CB06)	IEC 61000-4-2	Voltage	1.6 %	
		Timing	2.8 %	
RS(CB05)	IEC 61000-4-3	2.66 dB		80MHz - 2.5GHz, k=2

Our calculated Measurement Instrumentation Uncertainty is shown in the tables above. These are our U_{lab} values in CISPR 16-4-2 terminology.

Since Table 1 of CISPR 16-4-2 has values of measurement instrumentation uncertainty, called U_{CISPR} , as follows:

- Conducted Disturbance (mains port) – 150 kHz – 30 MHz : 3.6 dB
- Radiated Disturbance (electric field strength on an open area test site or alternative test site) – 30 MHz – 1000 MHz : 5.2 dB

It can be seen that our U_{lab} values are smaller than U_{CISPR} .



3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

Equipment	AIS Aids to Navigation (AtoN)		
Brand Name	AMEC		
Model Name	MANDO-301; MANDO-302; MANDO-303		
OEM Brand/Model Name	N/A		
Model Difference	All models are based on similar electrical circuit except the difference of list below:		
	Model Name	Transmitter(s)	Receiver(s)
	MANDO-301	1	0
	MANDO-302	1	1
	MANDO-303	1	2
Product Description	All the above models were tested, and the model: MANDO-301 was found to be the worst case during the pre-scanning test. This model of the worst case was used for final testing and collecting test data included in this report.		
	The EUT is an AIS Aids to Navigation (AtoN).		
	Operation Frequency:	156.025~162.025 MHz	
	Product Class:	Class 1	
	Receiver Class:	Class 3	
	Modulation Type:	GMSK (AIS)	
	Number Of Channel	2 Channels CH1: 161.975 MHz CH2: 162.025 MHz	
	Antenna Designation:	Please refer to the Note 2.	
	Antenna Gain(Peak)	Please refer to the Note 2.	
	Based on the application, features, or specification exhibited in User's Manual, the EUT is considered as an ITE/Computing Device. More details of EUT technical specification, please refer to the User's Manual.		
Power Source	DC Voltage supplied from DC Source.		
Power Rating	DC 12V		
Connecting I/O Port(s)	Please refer to the User's Manual		
Products Covered	N/A		
EUT Modification(s)	N/A		
Hardware	M-PCB-CTLNC3, M-PCB-RFNR2		
Software	Version: 1.4.3		

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
2. Table of Filed Antenna:

Antenn	Brand	Model Name	Type	Connector Type	Gain (dBi)
1	AMEC	ALT06-310510	Dipole	Type M	2.86



3.2 DESCRIPTION OF TEST MODES

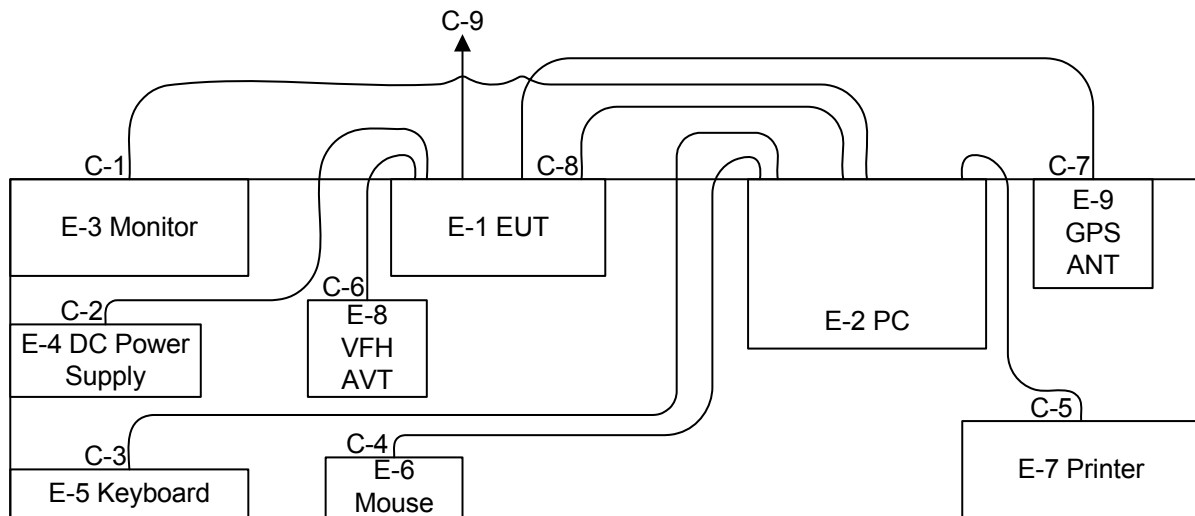
To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Test Mode	Description
Mode 1	FULL SYSTEM(MANDO-303)
Mode 2	FULL SYSTEM(MANDO-301)

For Radiated Test	
Final Test Mode	Description
Mode 2	FULL SYSTEM(MANDO-301)

For EMS Test	
Final Test Mode	Description
Mode 2	FULL SYSTEM(MANDO-301)

3.3 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



- C-1 D-SUB Cable
- C-2 Power Cable
- C-3 PS/2 Cable
- C-4 PS/2 Cable
- C-5 USB Cable
- C-6 ANT Cable
- C-7 ANT Cable
- C-8 Signal Cable
- C-9 Signal Cable



3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID	Series No.	Note
E-1	AIS Aids to Navigation (AtoN)	AMEC	MANDO-301	N/A	N/A	EUT
E-2	PC	DELL	MVT01	DOC	4GCTR18	
E-3	24" LCD Monitor	DELL	2408WFPb	DOC	071863-11	
E-4	DC Power Supply	GOOD WILL	GPC-3030D	N/A	B710591	
E-5	PS/2 K/B	Logitech	Y-SJ17(ACK260A)	DOC	SYU44664880	
E-6	PS/2 Mouse	Logitech	M-SBF69	DOC	HCA44601156	
E-7	Printer	HP	C9025A	DOC	TH4B013021	
E-8	VHF ANT	N/A	N/A	N/A	N/A	
E-9	GPS ANT	AMEC	N/A	N/A	N/A	

Item	Shielded Type	Ferrite Core	Length	Note
C-1	YES	YES	1.8M	
C-2	NO	NO	2.5M	
C-3	YES	NO	1.5M	
C-4	YES	NO	1.7M	
C-5	YES	NO	1.7M	
C-6	YES	NO	0.3M	
C-7	YES	NO	8.0M	
C-8	YES	NO	2.5M	
C-9	YES	NO	3.2M	

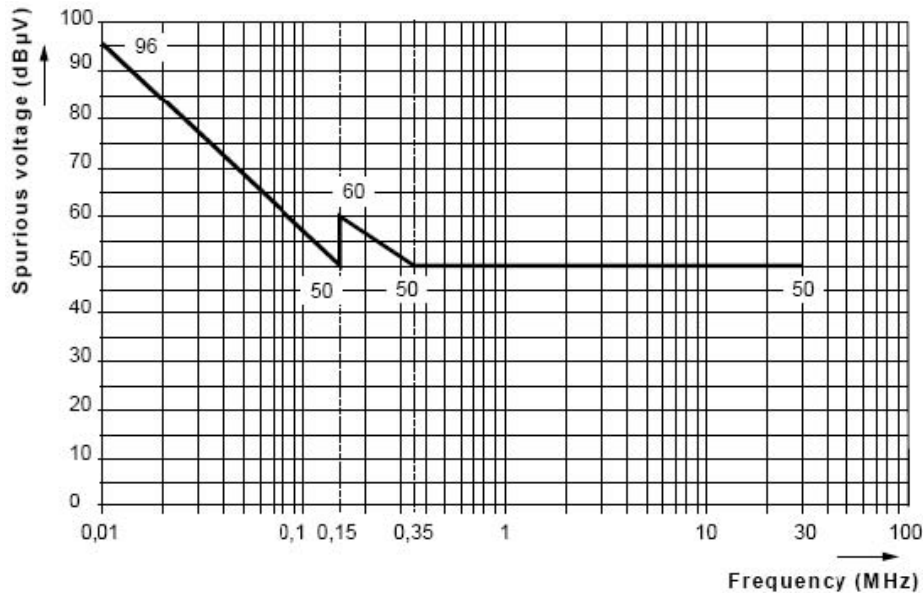
Note:

- (1) For detachable type I/O cable should be specified the length in cm in 『Length』 column

4. EMC EMISSION TEST

4.1 CONDUCTED EMISSION MEASUREMENT

4.1.1 POWER LINE CONDUCTED EMISSION (FREQUENCY RANGE 10 KHZ-30MHZ)



Maximum permissible level (quasi-peak) of conducted EMC emissions into the mains.

Notes:

- (1) The test result calculated as following:
 Measurement Value = Reading Level + Correct Factor
 Correct Factor = Insertion Loss + Cable Loss + Attenuator Factor(if use)
 Margin Level = Measurement Value – Limit Value

4.1.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	TWO-LINE V-NETWORK	R&S	ENV216	101050	Jun. 06, 2012
2	TWO-LINE V-NETWORK	R&S	ENV216	101051	Jun. 06, 2012
3	Test Cable	TIMES	CFD300-NL	130	Jun. 17, 2011
4	EMI Test Receiver	R&S	ESCI	100080	Mar. 15, 2012
5	50Ω BNC TYPE Terminator	N/A	N/A	01	May. 24, 2013

Remark: " N/A" denotes No Model Name , Serial No. or No Calibration specified.

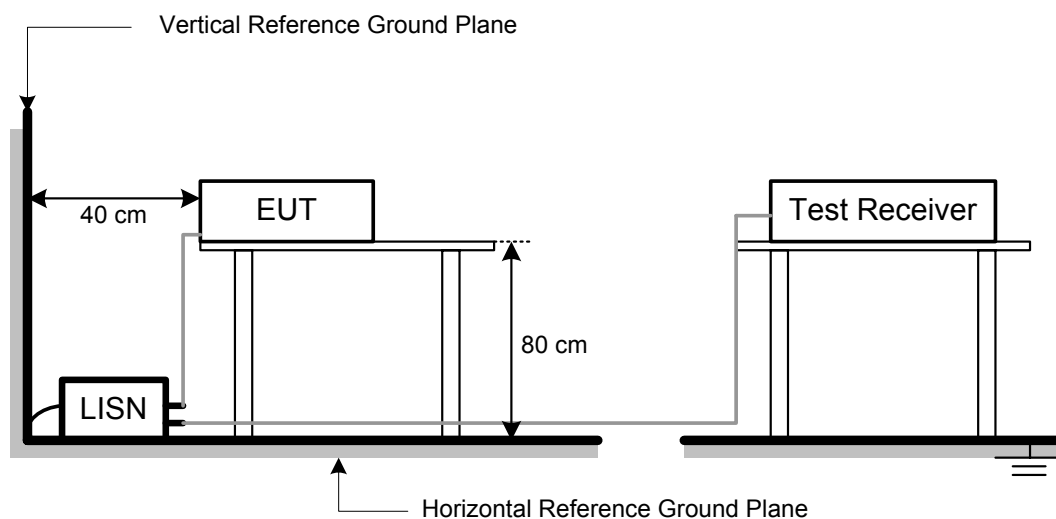
4.1.3 TEST PROCEDURE

- a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- d. LISN at least 80 cm from nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

4.1.4 DEVIATION FROM TEST STANDARD

No deviation

4.1.5 TEST SETUP





4.1.6 EUT OPERATING CONDITIONS

The EUT exercise program (EMC.exe) used during radiated and/or conducted emission measurement was designed to exercise the various system components in a manner similar to a typical use. The program contained on a Notebook PC hard disk and is auto-starting on power-up. Once loaded, the program sequentially exercises each system component in turn. The sequence used is:

1. Read (write) from (to) mass storage device (Disk).
2. Send "H" pattern to video port device (LCD Monitor).
3. Send " H " pattern to USB port device (Printer).
4. The EUT send/receive data to/from data port (Automatic Identification System).
5. Repeated from 2 to 4 continuously.



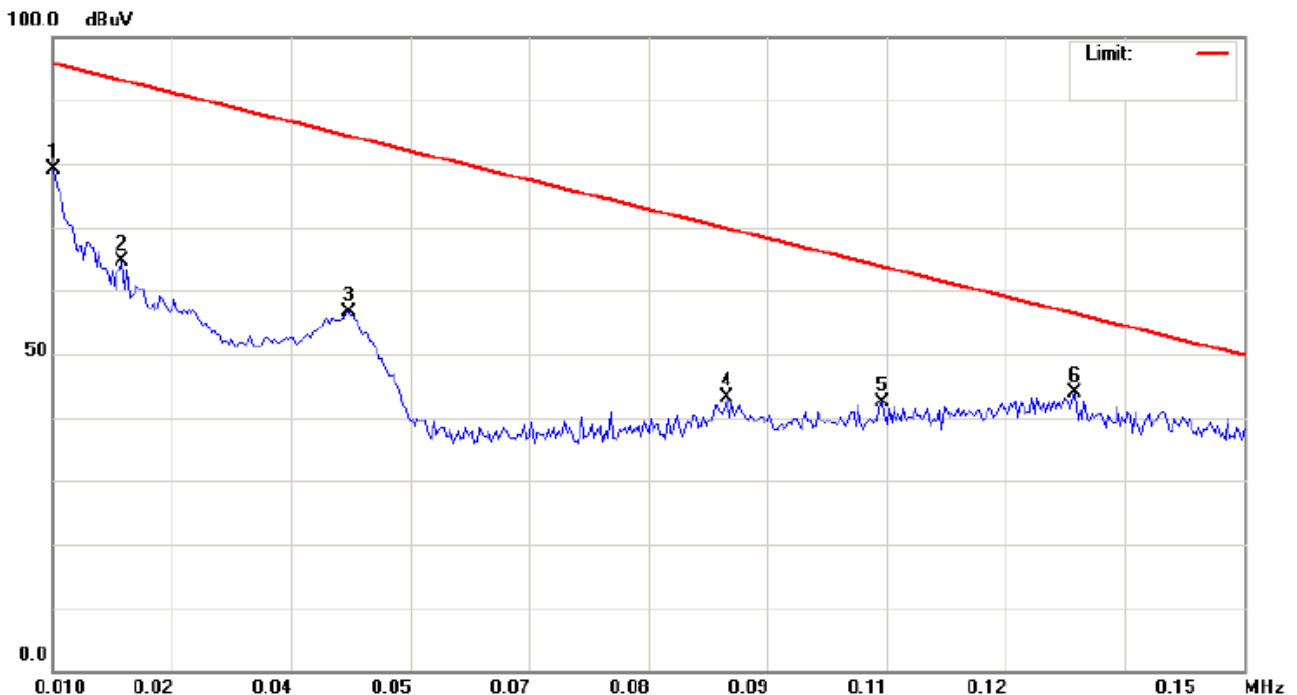
4.1.7 TEST RESULTS-BETWEEN 0.01MHZ AND 0.15MHZ

E.U.T :	AIS Aids to Navigation (AtoN)	Model Name :	MANDO-301
Temperature :	20°C	Relative Humidity :	86%
Test Voltage :	DC 12V		
Test Mode :	FULL SYSTEM(MANDO-301)		

Freq. (MHz)	Terminal P/N	Reading Level(dBuV)		Correct Factor(dB)	Measurement(dBuV)		Limit(dBuV)		Margin (dB)	Note
		QP-Mode	AV-Mode		QP-Mode	AV-Mode	QP-Mode	AV-Mode		
0.0100	Postive	68.96	*	10.27	79.23	*	95.97	-	-16.74	(QP)
0.0181	Postive	54.71	*	9.96	64.67	*	93.31	-	-28.64	(QP)
0.0447	Postive	46.89	*	9.74	56.63	*	84.31	-	-27.68	(QP)
0.0892	Postive	33.50	*	9.70	43.20	*	69.96	-	-26.76	(QP)
0.1074	Postive	32.57	*	9.70	42.27	*	63.99	-	-21.72	(QP)
0.1301	Postive	34.21	*	9.69	43.90	*	56.53	-	-12.63	(QP)

Remark:

- (1) Reading in which marked as QP means measurements by using are Quasi-Peak Mode with Detector BW=9 kHz; SPA setting in RBW=10 kHz, VBW =10 kHz, Swp. Time = 0.2 sec./ MHz. Reading in which marked as AV means measurements by using are Average Mode with instrument setting in RBW=10 kHz, VBW=10 kHz, Swp. Time =0.2 sec./ MHz.
- (2) All readings are QP Mode value unless otherwise stated AVG in column of Note. If the QP Mode Measured value compliance with the QP Limits and lower than AVG Limits, the EUT shall be deemed to meet both QP & AVG Limits and then only QP Mode was measured, but AVG Mode didn't perform. In this case, a "*" marked in AVG Mode column of Interference Voltage Measured.
- (3) In the "Note" column, QP means the margin value of QP is higher than Average and the "Margin" column shows the margin value of QP; AV means the margin value of Average is higher than QP and the "Margin" column shows the margin value of Average.



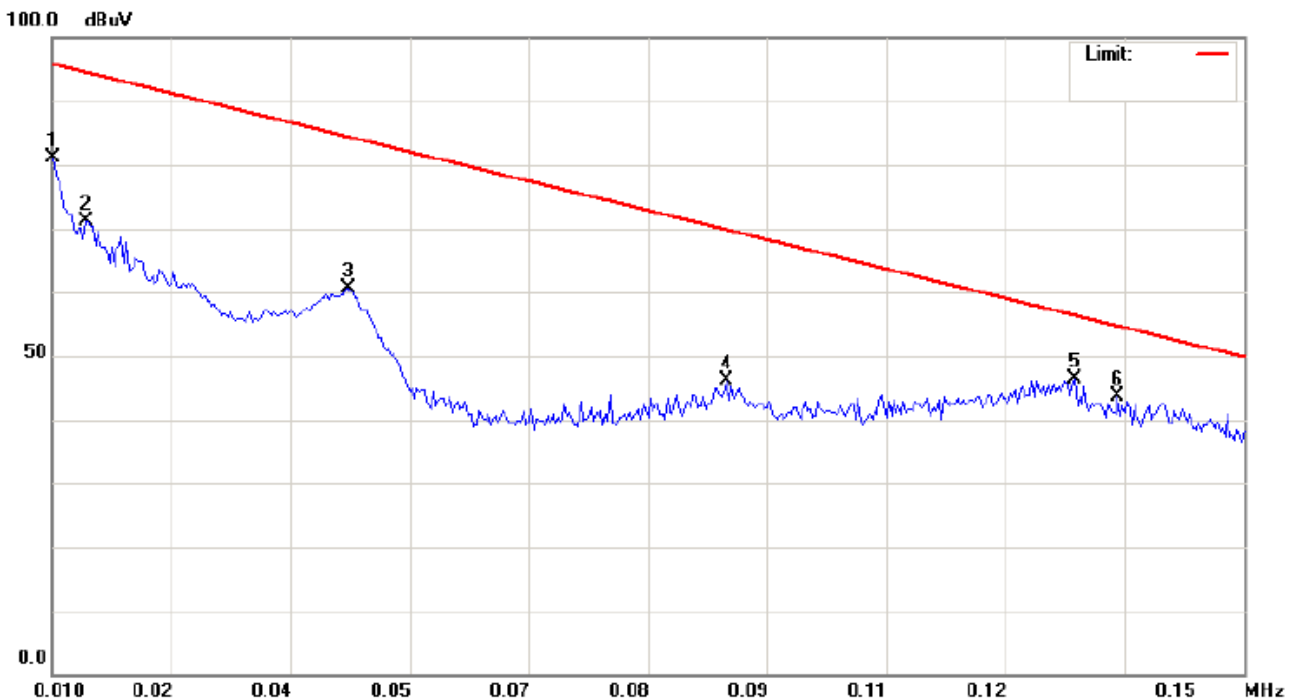


E.U.T :	AIS Aids to Navigation (AtoN)	Model Name :	MANDO-301
Temperature :	20°C	Relative Humidity :	86%
Test Voltage :	DC 12V		
Test Mode :	FULL SYSTEM(MANDO-301)		

Freq. (MHz)	Terminal P/N	Reading Level(dBuV)		Correct Factor(dB)	Measurement(dBuV)		Limit(dBuV)		Margin (dB)	Note
		QP-Mode	AV-Mode		QP-Mode	AV-Mode	QP-Mode	AV-Mode		
0.0100	Negative	70.96	*	10.25	81.21	*	95.97	-	-14.76	(QP)
0.0138	Negative	60.97	*	10.11	71.08	*	94.72	-	-23.64	(QP)
0.0447	Negative	50.89	*	9.72	60.61	*	84.57	-	-23.96	(QP)
0.0891	Negative	36.50	*	9.69	46.19	*	70.00	-	-23.81	(QP)
0.1300	Negative	36.71	*	9.68	46.39	*	56.57	-	-10.18	(QP)
0.1351	Negative	33.95	*	9.68	43.63	*	54.89	-	-11.26	(QP)

Remark:

- (1) Reading in which marked as QP means measurements by using are Quasi-Peak Mode with Detector BW=9 kHz; SPA setting in RBW=10 kHz, VBW =10 kHz, Swp. Time = 0.2 sec./ MHz. Reading in which marked as AV means measurements by using are Average Mode with instrument setting in RBW=10 kHz, VBW=10 kHz, Swp. Time =0.2 sec./ MHz.
- (2) All readings are QP Mode value unless otherwise stated AVG in column of Note. If the QP Mode Measured value compliance with the QP Limits and lower than AVG Limits, the EUT shall be deemed to meet both QP & AVG Limits and then only QP Mode was measured, but AVG Mode didn't perform. In this case, a " * " marked in AVG Mode column of Interference Voltage Measured.
- (3) In the "Note" column, QP means the margin value of QP is higher than Average and the "Margin" column shows the margin value of QP; AV means the margin value of Average is higher than QP and the "Margin" column shows the margin value of Average.





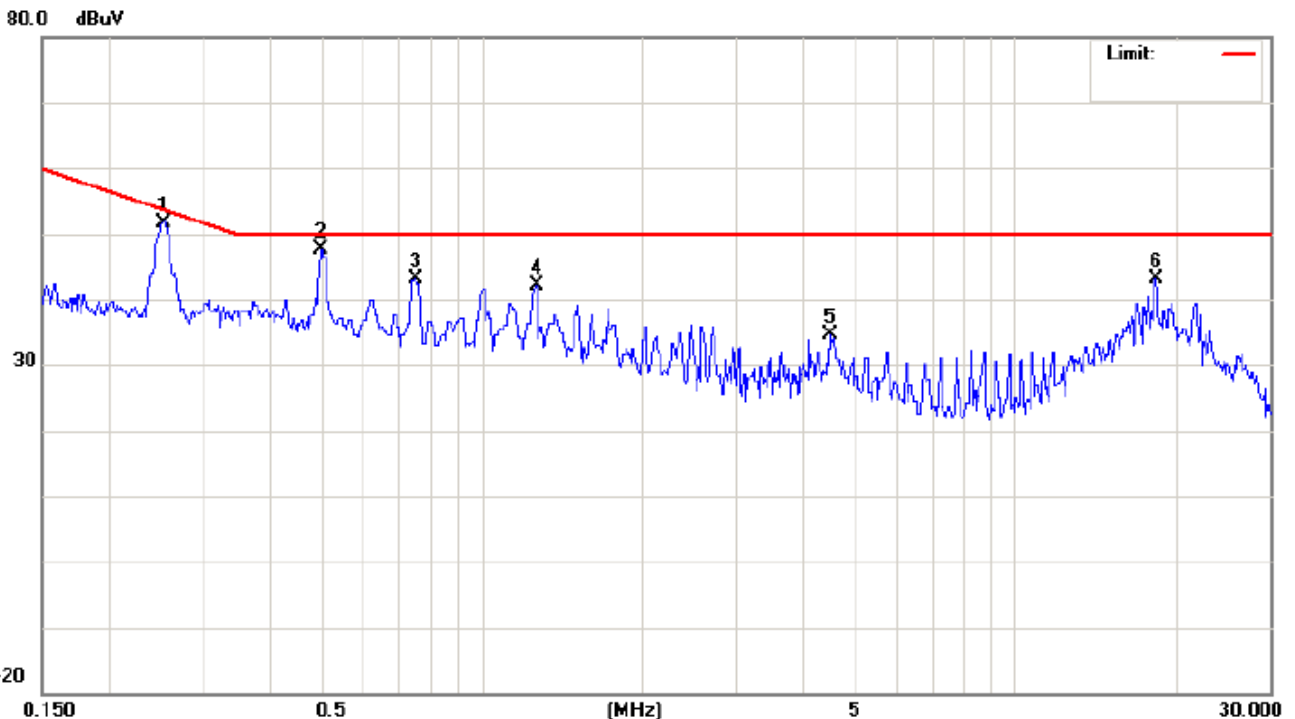
4.1.8 TEST RESULTS-BETWEEN 0.15MHZ AND 30MHZ

E.U.T :	AIS Aids to Navigation (AtoN)	Model Name :	MANDO-301
Temperature :	20°C	Relative Humidity :	86%
Test Voltage :	DC 12V		
Test Mode :	FULL SYSTEM(MANDO-301)		

Freq. (MHz)	Terminal P/N	Reading Level(dBuV)		Correct Factor(dB)	Measurement(dBuV)		Limit(dBuV)		Margin (dB)	Note
		QP-Mode	AV-Mode		QP-Mode	AV-Mode	QP-Mode	AV-Mode		
0.2535	Postive	42.01	*	9.69	51.70	*	53.80	-	-2.10	(QP)
0.4993	Postive	37.83	*	9.69	47.52	*	50.00	-	-2.48	(QP)
0.7520	Postive	33.39	*	9.74	43.13	*	50.00	-	-6.87	(QP)
1.2649	Postive	32.35	*	9.77	42.12	*	50.00	-	-7.88	(QP)
4.4959	Postive	25.00	*	9.72	34.72	*	50.00	-	-15.28	(QP)
18.2500	Postive	33.15	*	9.88	43.03	*	50.00	-	-6.97	(QP)

Remark:

- (1) Reading in which marked as QP means measurements by using are Quasi-Peak Mode with Detector BW=9 kHz; SPA setting in RBW=10 kHz, VBW =10 kHz, Swp. Time = 0.2 sec./ MHz. Reading in which marked as AV means measurements by using are Average Mode with instrument setting in RBW=10 kHz, VBW=10 kHz, Swp. Time =0.2 sec./ MHz.
- (2) All readings are QP Mode value unless otherwise stated AVG in column of Note. If the QP Mode Measured value compliance with the QP Limits and lower than AVG Limits, the EUT shall be deemed to meet both QP & AVG Limits and then only QP Mode was measured, but AVG Mode didn't perform. In this case, a "*" marked in AVG Mode column of Interference Voltage Measured.
- (3) In the "Note" column, QP means the margin value of QP is higher than Average and the "Margin" column shows the margin value of QP; AV means the margin value of Average is higher than QP and the "Margin" column shows the margin value of Average.



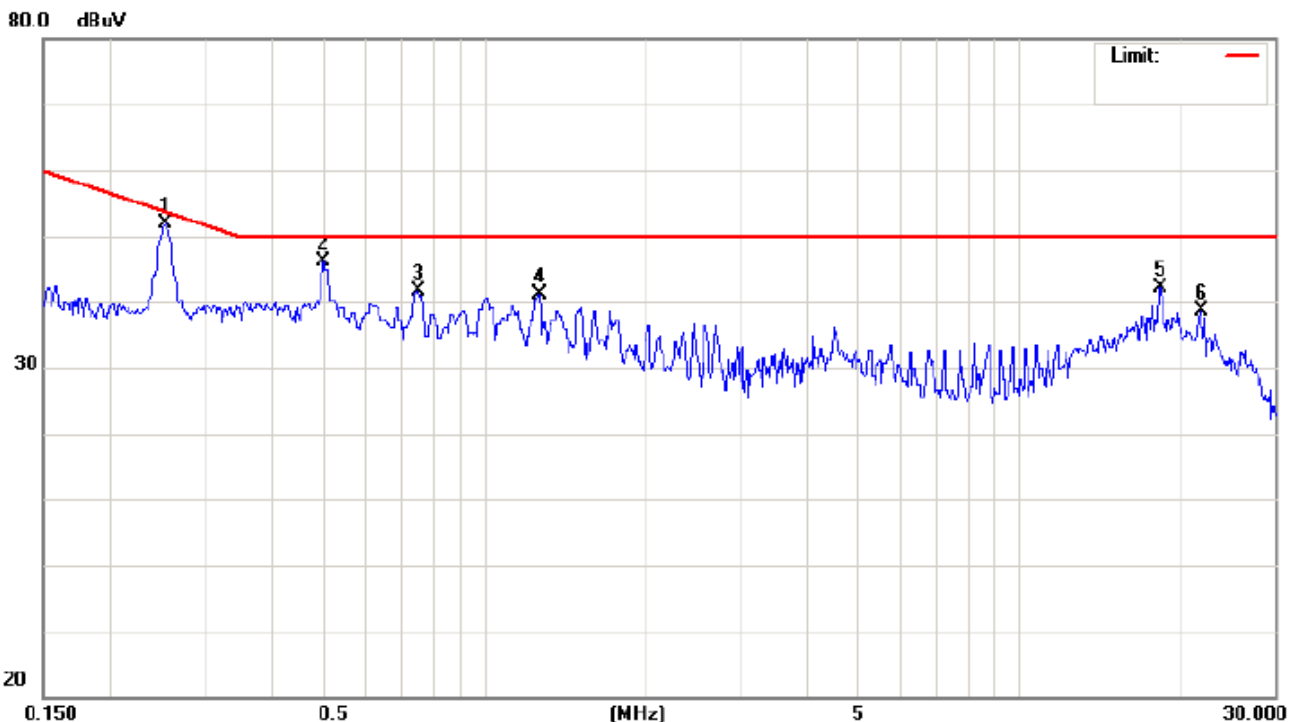


E.U.T :	AIS Aids to Navigation (AtoN)	Model Name :	MANDO-301
Temperature :	20°C	Relative Humidity :	86%
Test Voltage :	DC 12V		
Test Mode :	FULL SYSTEM(MANDO-301)		

Freq. (MHz)	Terminal P/N	Reading Level(dBuV)		Correct Factor(dB)	Measurement(dBuV)		Limit(dBuV)		Margin (dB)	Note
		QP-Mode	AV-Mode		QP-Mode	AV-Mode	QP-Mode	AV-Mode		
0.2535	Negative	42.12	*	9.68	51.80	*	53.80	-	-2.00	(QP)
0.4993	Negative	36.33	*	9.68	46.01	*	50.00	-	-3.99	(QP)
0.7519	Negative	31.89	*	9.73	41.62	*	50.00	-	-8.38	(QP)
1.2647	Negative	31.35	*	9.76	41.11	*	50.00	-	-8.89	(QP)
18.2500	Negative	32.15	*	9.92	42.07	*	50.00	-	-7.93	(QP)
21.7400	Negative	28.58	*	9.94	38.52	*	50.00	-	-11.48	(QP)

Remark:

- (1) Reading in which marked as QP means measurements by using are Quasi-Peak Mode with Detector BW=9 kHz; SPA setting in RBW=10 kHz, VBW =10 kHz, Swp. Time = 0.2 sec./ MHz. Reading in which marked as AV means measurements by using are Average Mode with instrument setting in RBW=10 kHz, VBW=10 kHz, Swp. Time =0.2 sec./ MHz.
- (2) All readings are QP Mode value unless otherwise stated AVG in column of Note. If the QP Mode Measured value compliance with the QP Limits and lower than AVG Limits, the EUT shall be deemed to meet both QP & AVG Limits and then only QP Mode was measured, but AVG Mode didn't perform. In this case, a " * " marked in AVG Mode column of Interference Voltage Measured.
- (3) In the "Note" column, QP means the margin value of QP is higher than Average and the "Margin" column shows the margin value of QP; AV means the margin value of Average is higher than QP and the "Margin" column shows the margin value of Average.





4.2 RADIATED EMISSION MEASUREMENT

4.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT

Frequency range	Limit (Quasi Peak)	Limit (Peak)	Measuring distance
150kHz to 300kHz	80dBuV/m to 52dBuV/m	--	3m
300kHz to 30MHz	52dBuV/m to 34dBuV/m	--	3m
30MHz to 1GHz	54dBuV/m	Not defined	3m
1GHz to 2GHz	Not defined	54dBuV/m	3m
156MHz to 165MHz	24dBuV/m	30dBuV/m	3m

Notes:

- (4) The test result calculated as following:
Measurement Value = Reading Level + Correct Factor
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain(if use)
Margin Level = Measurement Value – Limit Value



4.2.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Log-Bicon Antenna	Schwarzbeck	VULB 9160	3173	Nov. 04, 2011
2	Pre-Amplifier	Anritsu	MH648A	M98457	Dec. 13, 2011
3	Test Cable	TIMES	LMR-400	10M-OS01	Jun. 17, 2011
4	Test Cable	TIMES	LMR-400	OS02	Jun. 17, 2011
5	EMI Test Receiver	R&S	ESCI	100082	Mar. 15, 2012
6	System Controller (OS02)	CT	SC100	N/A	N/A
7	Turn Table	Chance Most	CMTB-1.5	N/A	N/A
8	Loop Ant.	EMCO	6502	00042960	Jan. 12,2012

Remark: " N/A" denotes No Model Name / Serial No. and No Calibration specified.

4.2.3 TEST PROCEDURE

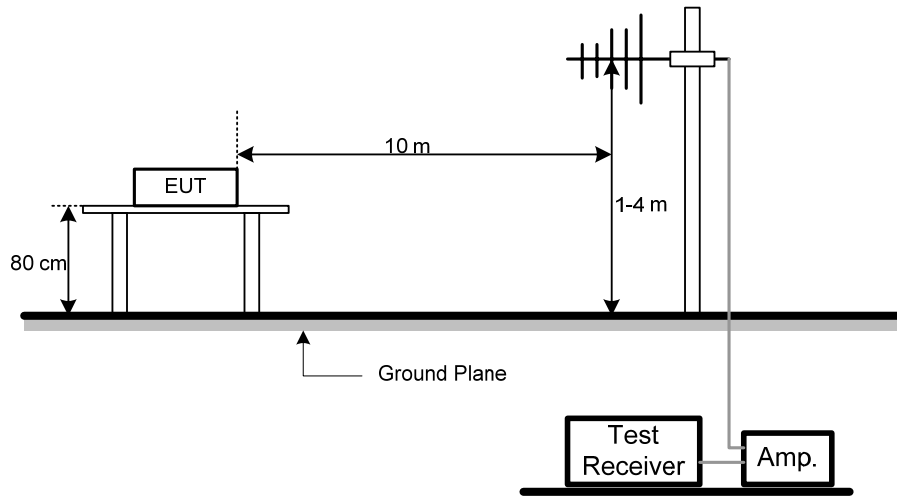
- a. The measuring distance of at 10 m shall be used for measurements at frequency up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
- b. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3m or 10 meter open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The height of the equipment or of the substitution antenna shall be 0.8 m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. The initial step in collecting radiated emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

4.2.4 DEVIATION FROM TEST STANDARD

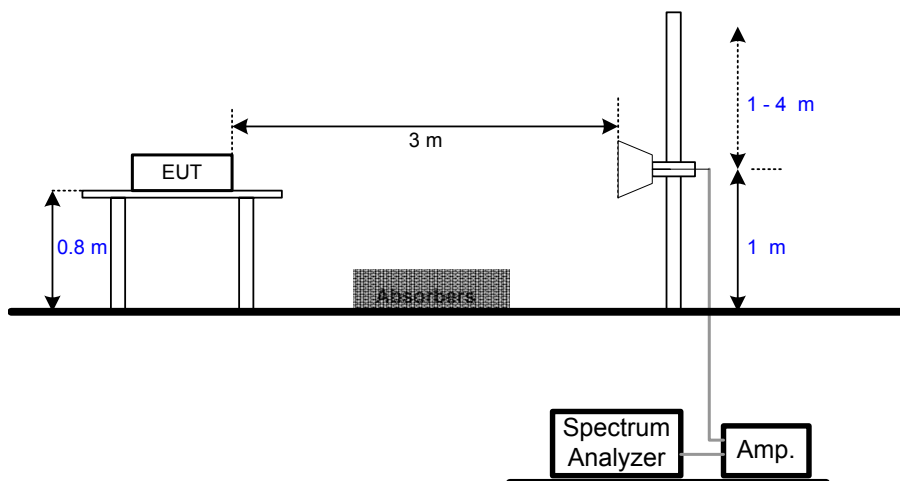
No deviation

4.2.5 TEST SETUP

Radiated Emission Test Set-Up Frequency 30 - 1000MHz



Radiated Emission Test Set-Up Frequency Above 1 GHz



4.2.6 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 4.1.6 Unless otherwise a special operating condition is specified in the follows during the testing.



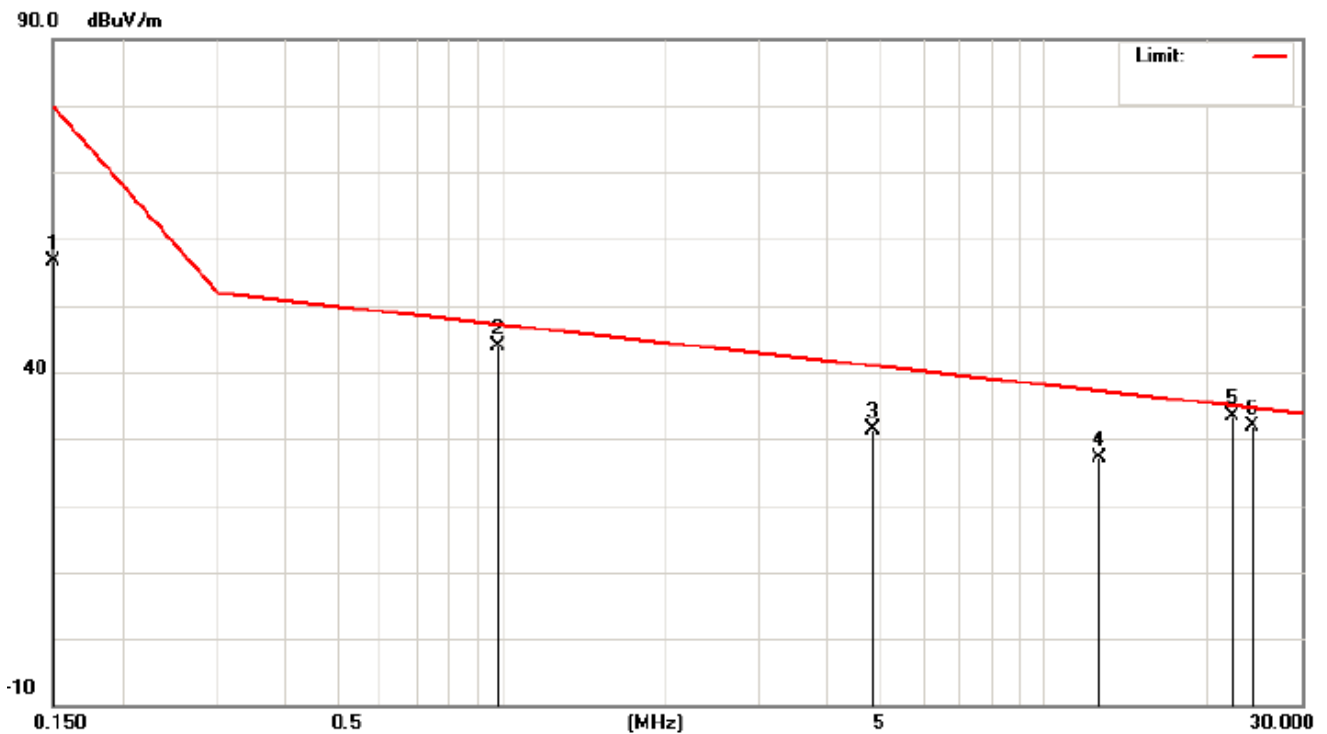
4.2.7 TEST RESULTS-BETWEEN 0.15MHZ AND 30MHZ

E.U.T :	AIS Aids to Navigation (AtoN)	Model Name :	MANDO-301
Temperature :	20°C	Relative Humidity :	86%
Test Voltage :	DC 12V		
Test Mode :	FULL SYSTEM(MANDO-301)		

Freq. (MHz)	Polarization H/V	Reading Level (dBuV)	Correct Factor(dB)	Measurement (dBuV/m)	Limit(Quasi-Peak) (dBuV/m)	Margin (dB)	Note
0.1500	-	44.59	12.10	56.69	80.00	- 23.31	(QP)
0.9858	-	31.69	12.10	43.79	47.35	- 3.56	(QP)
4.8066	-	19.58	11.80	31.38	41.16	- 9.78	(QP)
12.6870	-	15.97	11.08	27.05	37.36	- 10.31	(QP)
22.1196	-	23.10	10.24	33.34	35.19	- 1.85	(QP)
24.0897	-	22.01	9.91	31.92	34.86	- 2.94	(QP)

Remark :

- (1) Reading in which marked as QP or Peak means measurements by using are Quasi-Peak Mode or Peak Mode with Detector BW=9 kHz
- (2) All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform.
- (3) Measuring frequency range from 0.15 MHz to 30 MHz.
- (4) If the peak scan value is under the limit for more than 20dB, the signal will not show in table.





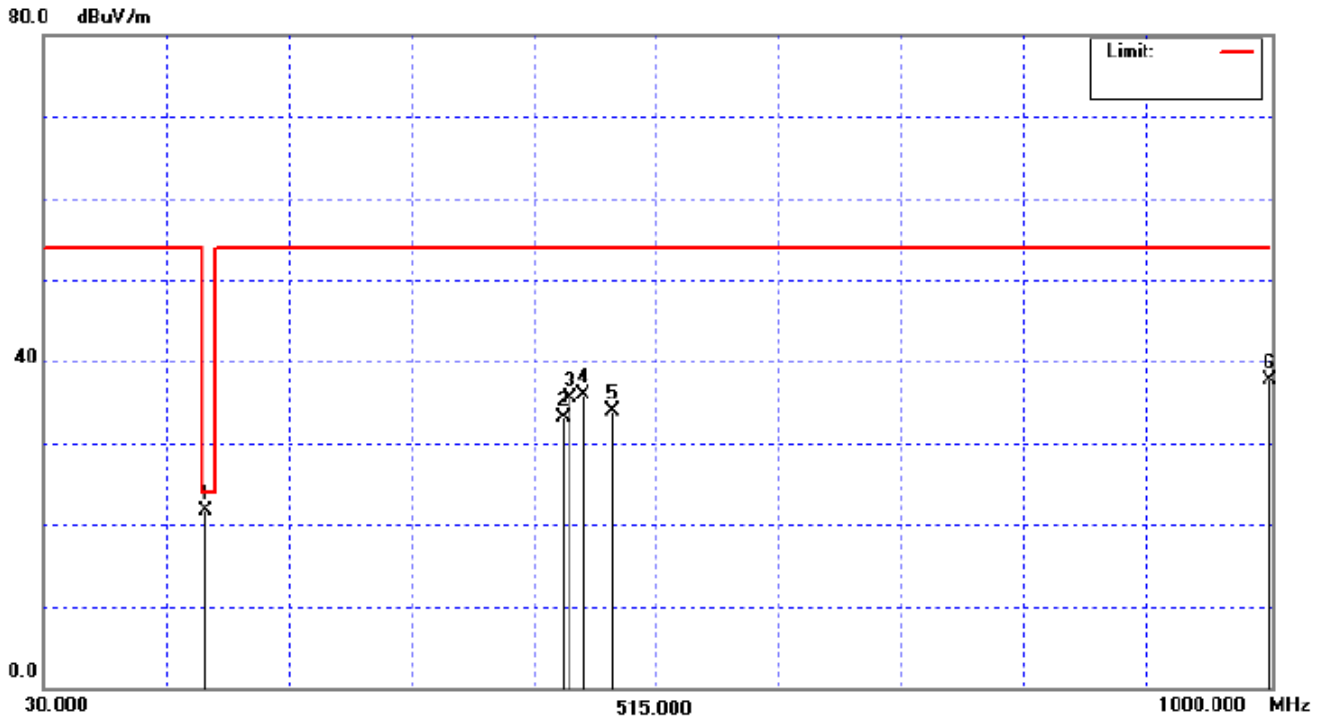
4.2.8 TEST RESULTS-BETWEEN 30MHZ AND 1000MHZ

E.U.T :	AIS Aids to Navigation (AtoN)	Model Name :	MANDO-301
Temperature :	20°C	Relative Humidity :	86%
Test Voltage :	DC 12V		
Test Mode :	FULL SYSTEM(MANDO-301)		

Freq. (MHz)	Polarization H/V	Reading Level (dBuV)	Correct Factor(dB)	Measurement (dBuV/m)	Limit(Quasi-Peak) (dBuV/m)	Margin (dB)	Note
156.5000	V	25.50	-3.79	21.71	24.00	- 2.29	(QP)
440.6500	V	32.85	0.27	33.12	54.00	- 20.88	
445.4900	V	35.11	0.41	35.52	54.00	- 18.48	
455.0600	V	35.38	0.61	35.99	54.00	- 18.01	
479.2100	V	32.94	0.97	33.91	54.00	- 20.09	
1000.0000	V	27.50	10.27	37.77	54.00	- 16.23	

Remark :

- (1) Reading in which marked as QP or Peak means measurements by using are Quasi-Peak Mode or Peak Mode with Detector BW=120 kHz;
- (2) All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform.
- (3) Measuring frequency range from 30 MHz to 1000 MHz.
- (4) If the peak scan value is under the limit for more than 20dB, the signal will not show in table.



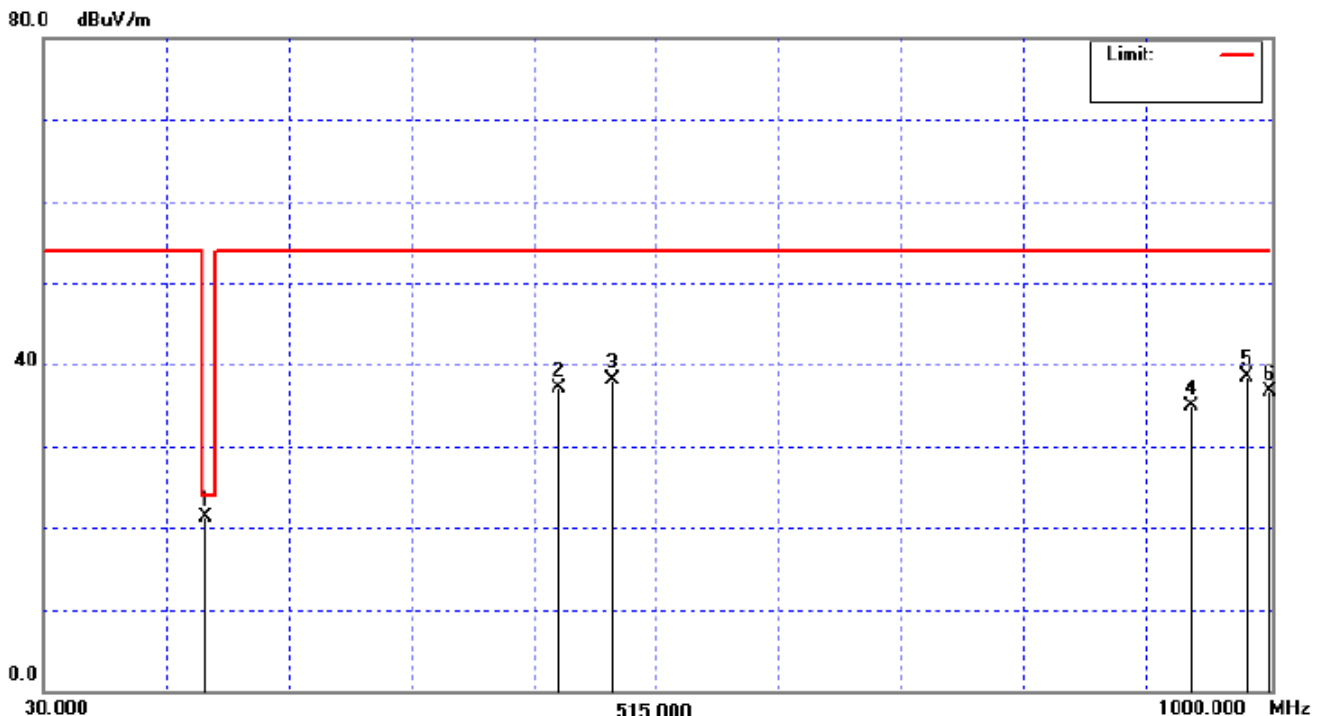


E.U.T :	AIS Aids to Navigation (AtoN)	Model Name :	MANDO-301
Temperature :	20°C	Relative Humidity :	86%
Test Voltage :	DC 12V		
Test Mode :	FULL SYSTEM(MANDO-301)		

Freq. (MHz)	Polarization H/V	Reading Level (dBuV)	Correct Factor(dB)	Measurement (dBuV/m)	Limit(Quasi-Peak) (dBuV/m)	Margin (dB)	Note
156.4640	H	25.10	-3.79	21.31	24.00	- 2.69	(QP)
435.9360	H	36.88	0.14	37.02	54.00	- 16.98	
479.1680	H	37.05	0.97	38.02	54.00	- 15.98	
936.4000	H	25.78	9.15	34.93	54.00	- 19.07	
981.0240	H	28.48	9.98	38.46	54.00	- 15.54	
1000.0000	H	26.51	10.27	36.78	54.00	- 17.22	

Remark :

- (1) Reading in which marked as QP or Peak means measurements by using are Quasi-Peak Mode or Peak Mode with Detector BW=120 kHz
- (2) All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform.
- (3) Measuring frequency range from 30 MHz to 1000 MHz.
- (4) If the peak scan value is under the limit for more than 20dB, the signal will not show in table.





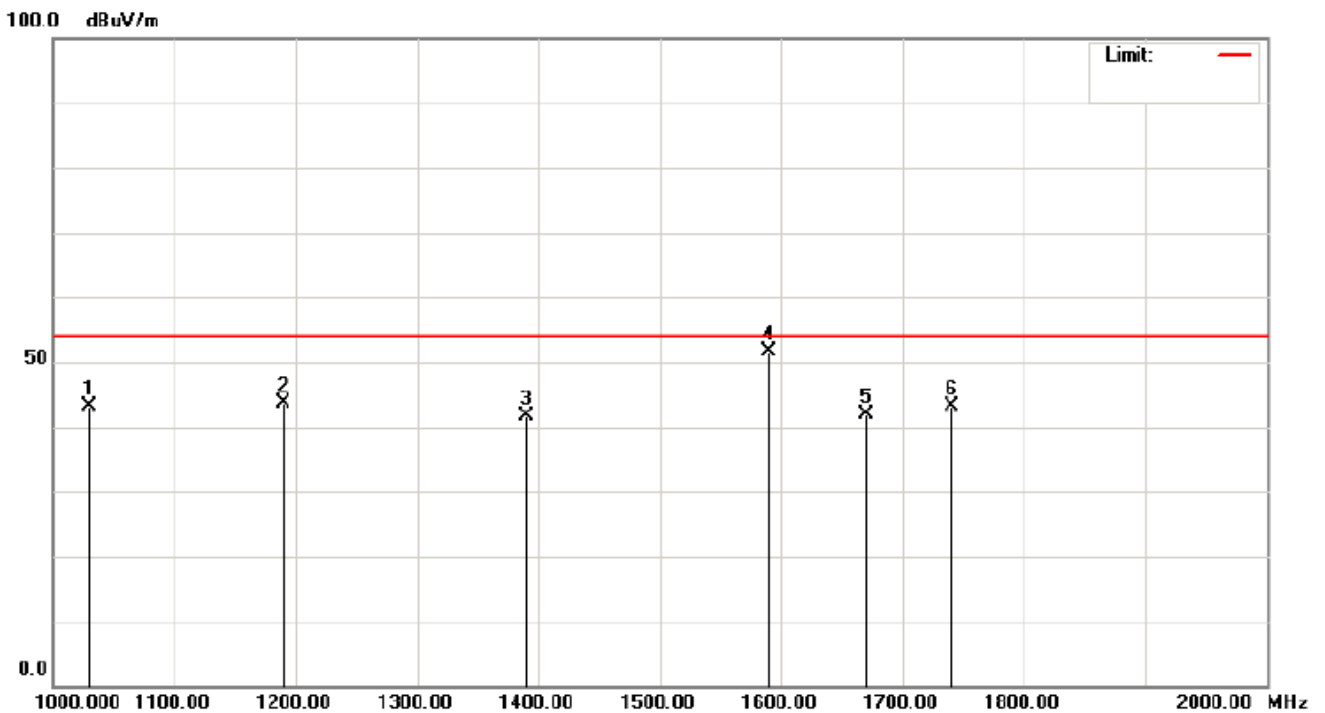
4.2.9 TEST RESULTS- ABOVE 1000MHZ

E.U.T :	AIS Aids to Navigation (AtoN)	Model Name :	MANDO-301
Temperature :	20°C	Relative Humidity :	86%
Test Voltage :	DC 12V		
Test Mode :	FULL SYSTEM(MANDO-301)		

Freq. (MHz)	Polarization H/V	Reading Level(dBuV)		Correct Factor(dB)	Measurement(dBuV/m)		Limit(dBuV/m)		Margin (dB)	Note
		Peak	AV		Peak	AV	Peak	AV		
1030.000	V	51.64	*	-8.45	43.19	*	54.00	-	- 10.81	Peak
1190.000	V	51.47	*	-7.85	43.62	*	54.00	-	- 10.38	Peak
1390.000	V	48.63	*	-7.09	41.54	*	54.00	-	- 12.46	Peak
1590.000	V	57.95	*	-6.41	51.54	*	54.00	-	- 2.46	Peak
1670.000	V	48.00	*	-6.17	41.83	*	54.00	-	- 12.17	Peak
1740.000	V	49.11	*	-5.96	43.15	*	54.00	-	- 10.85	Peak

Remark :

- (1) Reading in which marked as QP or Peak means measurements by using are Quasi-Peak Mode or Peak Mode with Detector BW=120 kHz; SPA setting in RBW=120 kHz, VBW =120 kHz, Swp. Time = 0.3 sec./ MHz.
- (2) All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform.
- (3) Measuring frequency range from 30 MHz to 1000 MHz.
- (4) If the peak scan value is under the limit for more than 20dB, the signal will not show in table.



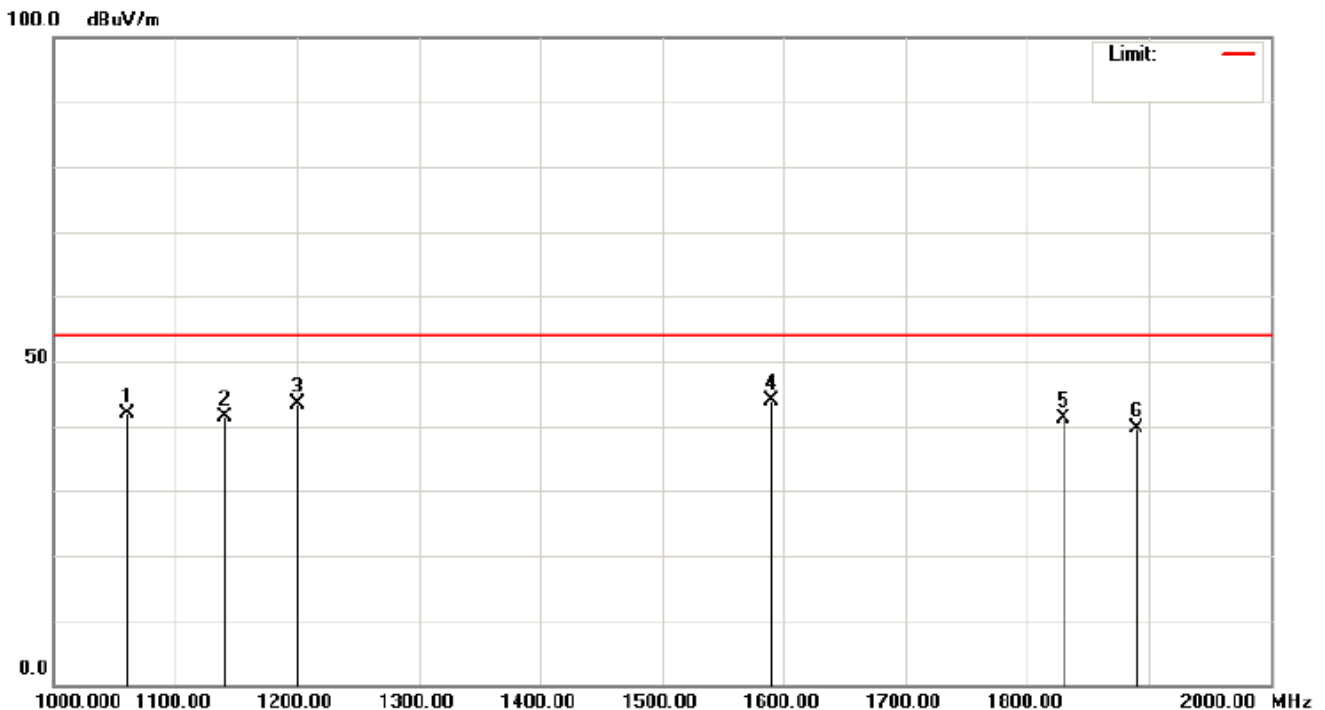


E.U.T :	AIS Aids to Navigation (AtoN)	Model Name :	MANDO-301
Temperature :	20°C	Relative Humidity :	86%
Test Voltage :	DC 12V		
Test Mode :	FULL SYSTEM(MANDO-301)		

Freq. (MHz)	Polarization H/V	Reading Level(dBuV)		Correct Factor(dB)	Measurement(dBuV/m)		Limit(dBuV/m)		Margin (dB)	Note
		Peak	AV		Peak	AV	Peak	AV		
1060.000	H	50.24	*	-8.33	41.91	*	54.00	-	- 12.09	Peak
1140.000	H	49.48	*	-8.03	41.45	*	54.00	-	- 12.55	Peak
1200.000	H	51.27	*	-7.81	43.46	*	54.00	-	- 10.54	Peak
1590.000	H	50.33	*	-6.41	43.92	*	54.00	-	- 10.08	Peak
1830.000	H	46.76	*	-5.70	41.06	*	54.00	-	- 12.94	Peak
1890.000	H	45.09	*	-5.52	39.57	*	54.00	-	- 14.43	Peak

Remark :

- (1) Reading in which marked as QP or Peak means measurements by using are Quasi-Peak Mode or Peak Mode with Detector BW=120 kHz; SPA setting in RBW=120 kHz, VBW =120 kHz, Swp. Time = 0.3 sec./ MHz.
- (2) All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform.
- (3) Measuring frequency range from 30 MHz to 1000 MHz.
- (4) If the peak scan value is under the limit for more than 20dB, the signal will not show in table.





5. EMC IMMUNITY TEST

5.1 STANDARD COMPLIANCE/SERVIRITY LEVEL/CRITERIA

Tests Standard No.	TEST SPECIFICATION Level	Test Mode Test Ports	Perform. Criteria	Remark
1. ESD IEC/EN 61000-4-2	8 kV air discharge 6 kV contact discharge	Direct Mode	B	
	6 kV HCP discharge 6 kV VCP discharge	Indirect Mode	B	
2. RS IEC/EN 61000-4-3	80 MHz - 2000 MHz 10 V/m(rms), 400Hz, 80%, AM modulated	Enclosure	A	
3. EFT/Burst IEC/EN 61000-4-4	2.0kV(peak) 5/50ns Tr/Th 5 kHz Repetition Freq.	Power Supply Port	B	
	1.0 kV(peak) 5/50ns Tr/Th 5 kHz Repetition Freq.	CTL/Signal Data Line Port	B	
4 Injected Current IEC/EN 61000-4-6	0.15 MHz to 80 MHz 3V(rms),and 2 / 3 / 4 / 6.2 / 8.2 / 12.2 / 16.5 / 18.8 / 22 / 25 MHz 10V(rms), 400Hz 80%, AM Modulated 150Ω source impedance	CTL/Signal Port	A	
		AC Power Port	A	N/A
		DC Power Port	A	

* Remark:

N/A : denotes test is not applicable in this Test Report

5.2 GENERAL PERFORMANCE CRITERIA TEST SETUP

The EUT tested system was configured as the statements of 4.1.6 Unless otherwise a special operating condition is specified in the follows during the testing.



5.3 ESD TESTING

5.3.1 TEST SPECIFICATION

Basic Standard:	IEC/EN 61000-4-2
Discharge Impedance:	330 ohm / 150 pF
Required Performance	B
Discharge Voltage:	Air Discharge : 2 kV / 4 kV / 8 kV (Direct) Contact Discharge : 2 kV / 4 kV/ 6 kV (Direct/Indirect)
Polarity:	Positive & Negative
Number of Discharge:	Air Discharge: min. 20 times at each test point Contact Discharge: min. 200 times in total
Discharge Mode:	Single Discharge
Discharge Period:	1 second minimum

5.3.2 MEASUREMENT INSTRUMENTS

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	ESD Simulator	TESEQ	NSG 437	429	Apr. 05. 2012

Remark: " N/A" denotes No Model Name / Serial No. and No Calibration specified.

5.3.3 TEST PROCEDURE

The test generator necessary to perform direct and indirect application of discharges to the EUT in the following manner:

- a. Contact discharge was applied to conductive surfaces (Direct) and coupling planes (Indirect) of the EUT.

During the test, it was performed with single discharges. For the single discharge time between successive single discharges was at least 1 second. The EUT shall be exposed to at least 200 discharges, 100 each at negative and positive polarity, at a minimum of four test points. One of the test points shall be subjected to at least 50 indirect discharges to the center of the front edge of the horizontal coupling plane. The remaining three test points shall each receive at least 50 direct contact discharges.

If no direct contact test points are available, then at least 200 indirect discharges shall be applied in the indirect mode. Test shall be performed at a maximum repetition rate of one discharge per second.

Vertical Coupling Plane (VCP):

The coupling plane, of dimensions 0.5m x 0.5m, is placed parallel to, and positioned at a distance 0.1m from, the EUT, with the Discharge Electrode touching the coupling plane.

The four faces of the EUT will be performed with electrostatic discharge.

Horizontal Coupling Plane (HCP):

The coupling plane is placed under to the EUT. The generator shall be positioned vertically at a distance of 0.1m from the EUT, with the Discharge Electrode touching the coupling plane.

The four faces of the EUT will be performed with electrostatic discharge.

- b. Air discharges at insulation surfaces of the EUT.

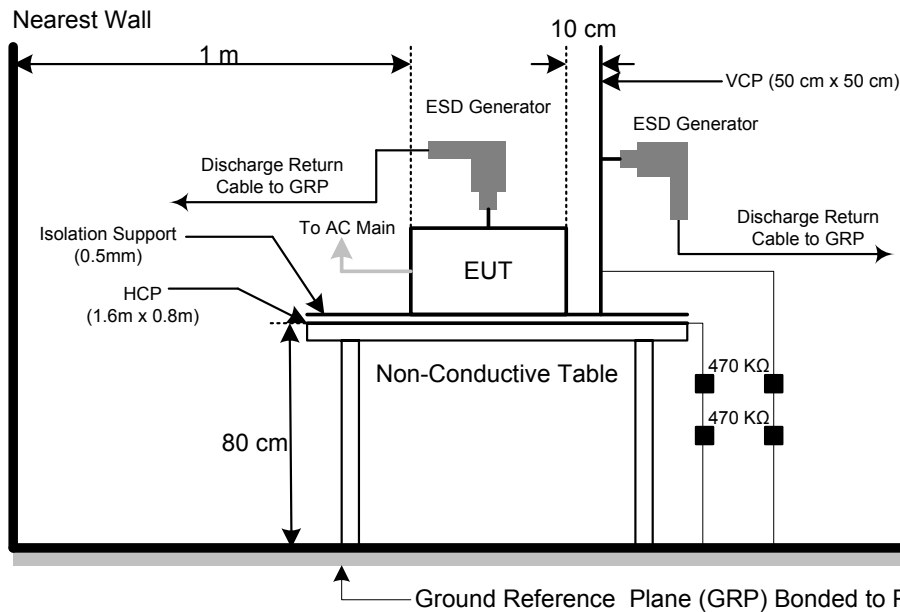
It was at least ten single discharges with positive and negative at the same selected point.

- c. For the actual test configuration, please refer to the related Item –EUT Test Photos.

5.3.4 DEVIATION FROM TEST STANDARD

No deviation

5.3.5 TEST SETUP



Note:

TABLE-TOP EQUIPMENT

The configuration consisted of a wooden table 0.8 meters high standing on the Ground Reference Plane. The GRP consisted of a sheet of aluminum at least 0.25mm thick, and 2.5 meters square connected to the protective grounding system. A Horizontal Coupling Plane (1.6m x 0.8m) was placed on the table and attached to the GRP by means of a cable with 940k total impedance. The equipment under test, was installed in a representative system as described in section 7 of IEC /EN 61000-4-2, and its cables were placed on the HCP and isolated by an insulating support of 0.5mm thickness. A distance of 1-meter minimum was provided between the EUT and the walls of the laboratory and any other metallic structure.

FLOOR-STANDING EQUIPMENT

The equipment under test was installed in a representative system as described in section 7 of IEC/EN 61000-4-2, and its cables were isolated from the Ground Reference Plane by an insulating support of 0.1-meter thickness. The GRP consisted of a sheet of aluminum that is at least 0.25mm thick, and 2.5 meters square connected to the protective grounding system and extended at least 0.5 meters from the EUT on all sides.



5.3.6 TEST RESULTS

E.U.T :	AIS Aids to Navigation (AtoN)	Model Name :	MANDO-301
Temperature :	22°C	Relative Humidity :	45%
Pressure :	1025 hPa	Test Voltage :	DC 12V
Test Mode :	FULL SYSTEM(MANDO-301)		

Mode	Air Discharge								Contact Discharge							
	2 kV		4 kV		8 kV		15 kV		2 kV		4 kV		6 kV		8 kV	
Location	P	N	P	N	P	N	P	N	P	N	P	N	P	N	P	N
1	A	A	A	A	A	A			A	A	A	A	A	A		
2	A	A	A	A	A	A			A	A	A	A	A	A		
3	A	A	A	A	A	A			A	A	A	A	A	A		
4									A	A	A	A	A	A		
5									A	A	A	A	A	A		
6									A	A	A	A	A	A		
7									A	A	A	A	A	A		
8									A	A	A	A	A	A		
9									A	A	A	A	A	A		
10									A	A	A	A	A	A		
11									A	A	A	A	A	A		
12									A	A	A	A	A	A		
13									A	A	A	A	A	A		
14									A	A	A	A	A	A		
15									A	A	A	A	A	A		
16									A	A	A	A	A	A		
17									A	A	A	A	A	A		
18									A	A	A	A	A	A		
19									A	A	A	A	A	A		
20									A	A	A	A	A	A		
21									A	A	A	A	A	A		
22									A	A	A	A	A	A		
23									A	A	A	A	A	A		
24									A	A	A	A	A	A		
Criteria	B								B							
Result	A								A							
Judgment	PASS								PASS							

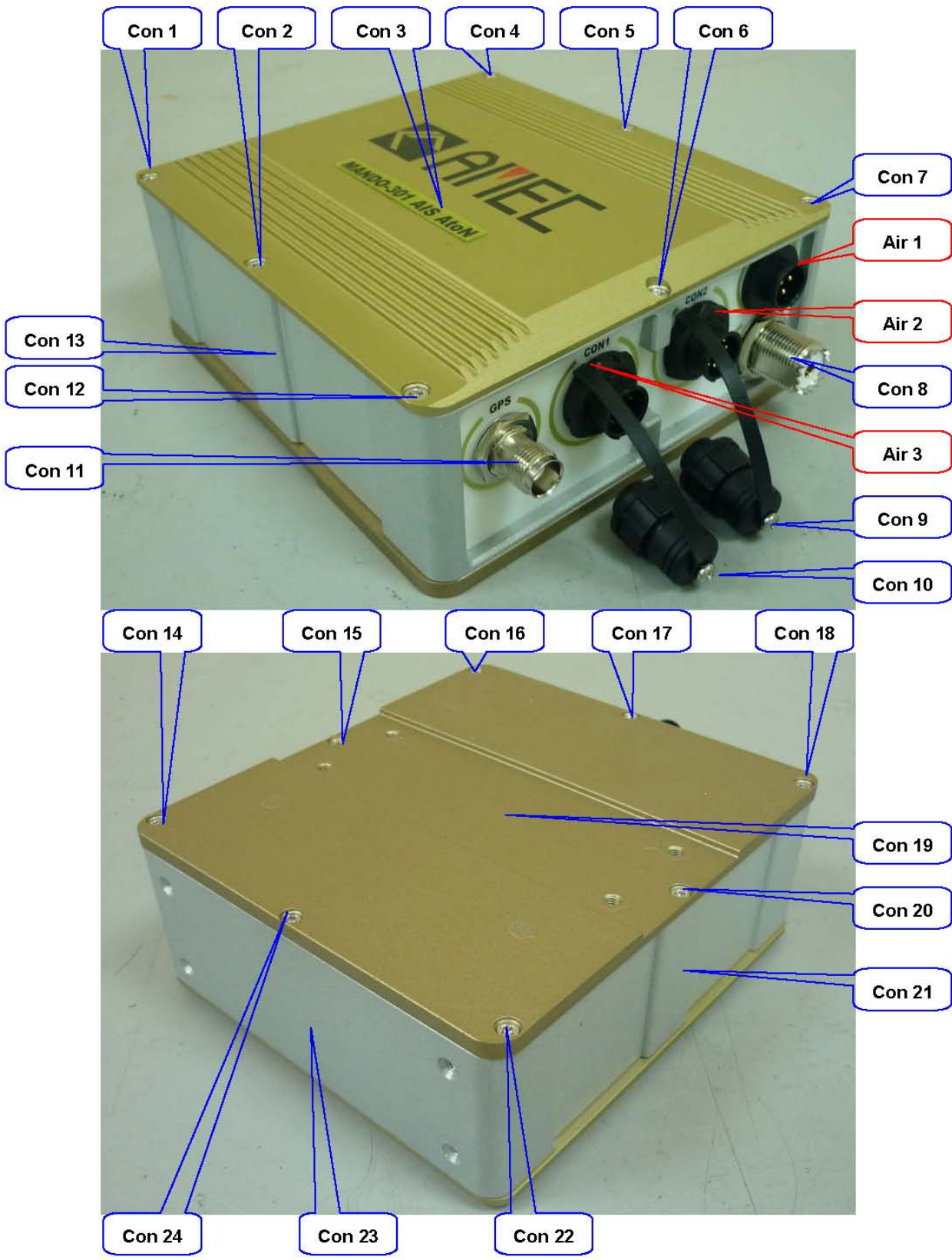


Mode	HCP Discharge								VCP Discharge							
	2 kV		4 kV		6 kV		8 kV		2 kV		4 kV		6 kV		8 kV	
Location	P	N	P	N	P	N	P	N	P	N	P	N	P	N	P	N
1	A	A	A	A	A	A			A	A	A	A	A	A		
2	A	A	A	A	A	A			A	A	A	A	A	A		
3	A	A	A	A	A	A			A	A	A	A	A	A		
4	A	A	A	A	A	A			A	A	A	A	A	A		
Criteria	B								B							
Result	A								A							
Judgment	PASS								PASS							

Note:

- 1) P/N denotes the Positive/Negative polarity of the output voltage.
- 2) Test condition:
Direct / Indirect (HCP/VCP) discharges: Minimum 25 times (Positive/Negative) at each point. Air discharges: Minimum 10 times (Positive/Negative) at each point.
- 3) Test location(s) in which discharge (Air and contact discharge) to be applied illustrated by photos shown in next page(s)
- 4) The Indirect (HCP/VCP) discharges description of test point as following:
1.left side 2.right side 3.front side 4.rear side
- 5) N/A - denotes test is not applicable in this test report
- 6) Criteria A: There was no change operated with initial operating during the test.
- 7) Criteria B: The EUT function loss during the test, but self-recoverable after the test.
- 8) Criteria C: The system shut down during the test.
- 9) The level of wanted RF signal for EUT in RF input port is 40 dBuV(emf) during the test.

5.3.7 PHOTO(S) SHOWN THE LOCATION(S) OF ESD EVALUATED





5.4 RS TESTING

5.4.1 TEST SPECIFICATION

Basic Standard:	IEC/EN 61000-4-3
Required Performance	A
Frequency Range:	80 MHz - 1000 MHz
Field Strength:	10 V/m
Modulation:	400Hz Sine Wave, 80%, AM Modulation
Frequency Step:	1% of fundamental
Polarity of Antenna:	Horizontal and Vertical
Test Distance:	3 m
Antenna Height:	1.5 m
Dwell Time:	at least 3 seconds

5.4.2 MEASUREMENT INSTRUMENTS

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Signal Generator	R&S	SMT06	832080/007	Aug. 2, 2011
2	Log-Bicon Antenna	Schwarzbeck	VULB 9161	4022	Jun. 03, 2012
3	Power Amplifier	AR	150W1000M1	320946	Jun. 03, 2012
4	Microwave Horn Antenna	AR	AT4002A	321467	Jun. 03, 2012
5	Power Amplifier	AR	25S1G4A	308598	Jun. 03, 2012
6	Measurement Software	AR	SW1006 (Version 1.22)	321779	N/A

Remark: " N/A" denotes No Model Name / Serial No. and No Calibration specified.

5.4.3 TEST PROCEDURE

The EUT and support equipment, which are placed on a table that is 0.8 meter above ground and the testing was performed in a fully-anechoic chamber.

The testing distance from antenna to the EUT was 3 meters.

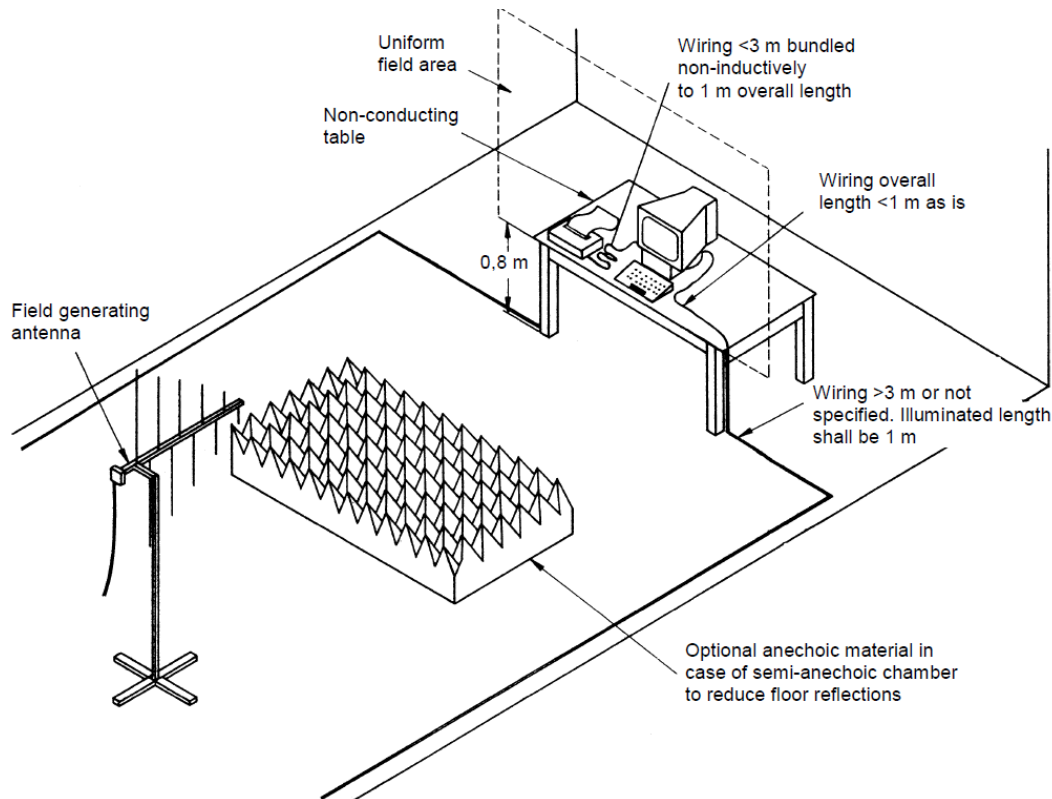
The other condition as following manner:

- a. The field strength level was 3 V/m.
- b. The frequency range is swept from 80 MHz to 1000 MHz and 1400MHz - 2700MHz, with the signal 80%amplitude modulated with a 1kHz sine wave. The rate of sweep did not exceed 1.5x 10⁻³ decade/s. Where the frequency range is swept incrementally, the step size was 1% of fundamental.
- c. Sweep Frequency 900 MHz, with the Duty Cycle:1/8 and Modulation: Pulse 217 Hz(if applicable)
- d. The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.
- e. The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.
- f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

5.4.4 DEVIATION FROM TEST STANDARD

No deviation

5.4.5 TEST SETUP



Note:

TABLE-TOP EQUIPMENT

The EUT installed in a representative system as described in section 7 of IEC/EN 61000-4-3 was placed on a non-conductive table 0.8 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

FLOOR-STANDING EQUIPMENT

The EUT installed in a representative system as described in section 7 of IEC/EN 61000-4-3 was placed on a non-conductive wood support 0.1 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.



5.4.6 TEST RESULTS

E.U.T :	AIS Aids to Navigation (AtoN)	Model Name :	MANDO-301
Temperature :	22°C	Relative Humidity :	45%
Test Voltage :	DC 12V		
Test Mode :	FULL SYSTEM(MANDO-301)		

Frequency Range (MHz)	RF Field Position	R.F. Field Strength	Azimuth	Perform . Criteria	Results	Judgme nt
80 - 1000	H / V	10 V/m (rms) AM Modulated 400Hz, 80%	0	A	A	PASS
			90			
			180			
			270			

Note:

- 1) P/N denotes the Positive/Negative polarity of the output voltage.
- 2) N/A - denotes test is not applicable in this test report.
- 3) Criteria A: There was no change operated with initial operating during the test.
- 4) Criteria B: The EUT function loss during the test, but self-recoverable after the test.
- 5) Criteria C: The system shut down during the test.
- 6) The level of wanted RF signal for EUT in RF input port is 40 dBuV(emf) during the test.



5.5 EFT/BURST TESTING

5.5.1 TEST SPECIFICATION

Basic Standard:	IEC/EN 61000-4-4
Required Performance	B
Test Voltage :	Power Line: 2.0 kV Signal/Control Line: 1.0 kV
Polarity:	Positive & Negative
Impulse Frequency:	5 kHz
Impulse Wave shape :	5/50 ns
Burst Duration:	15 ms
Burst Period:	300 ms
Test Duration:	Not less than 1 min.

5.5.2 MEASUREMENT INSTRUMENTS

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	EMC Immunity Test System	Thermo	EMCPRO PLUS	0502176	Mar. 9, 2012
2	Capacitive Clamp	Thermo	CCL	0502218	N/A
3	Measurement Software	KeyTek	CEWare32 (Version 4.00)	N/A	N/A

Remark: " N/A" denotes No Model Name / Serial No. and No Calibration specified.

5.5.3 TEST PROCEDURE

The EUT and support equipment(s) are placed on a table that is 0.8 meter high above a metal ground plane and should be located 0.1 m+/- 0.01m high above the Ground Reference Plane (1m*1m min. and 0.65mm thick min).

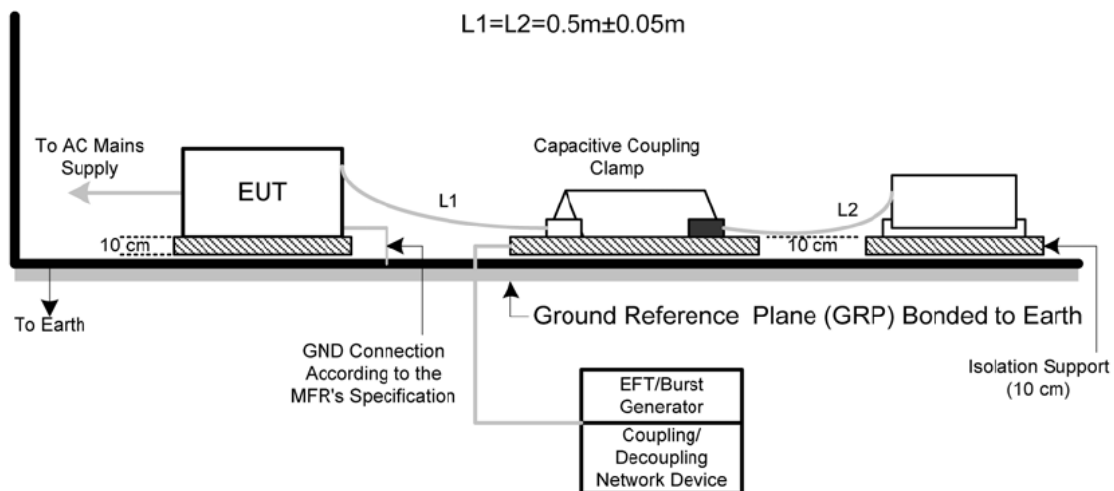
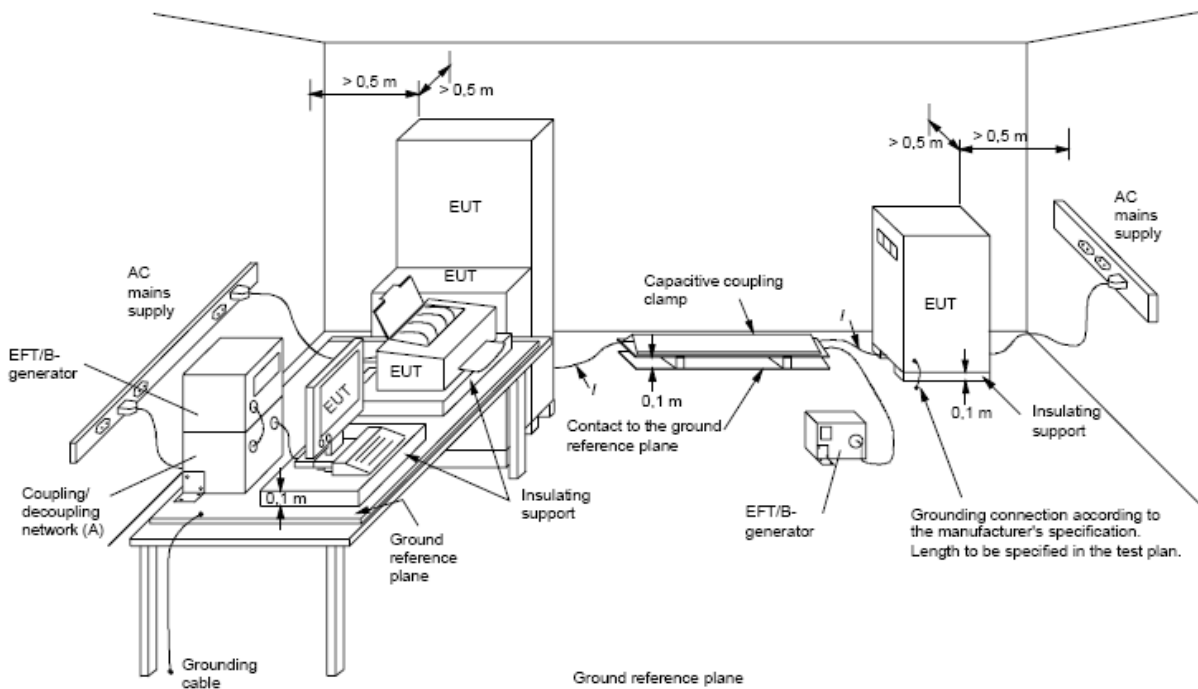
The other condition as following manner:

- a. The length of power cord between the coupling device and the EUT should not exceed 1 meter.
- b. Both positive and negative polarity discharges were applied.
- c. The duration time of each test sequential was 1 minute
- d. For the actual test configuration, please refer to the related Item –EUT Test Photos.

5.5.4 DEVIATION FROM TEST STANDARD

No deviation

5.5.5 TEST SETUP



Note:

TABLE-TOP EQUIPMENT

The configuration consisted of a wooden table (0.8m high) standing on the Ground Reference Plane and should be located 0.1 m+/- 0.01m above the Ground Reference Plane. The GRP consisted of a sheet of aluminum (at least 0.25mm thick and 2.5m square) connected to the protective grounding system. A minimum distance of 0.5m was provided between the EUT and the walls of the laboratory or any other metallic structure.

FLOOR-STANDING EQUIPMENT

The EUT installed in a representative system as described in section 7 of IEC/EN 61000-4-4 and its cables, were isolated from the Ground Reference Plane by an insulating support that is 0.1-meter thick. The GRP consisted of a sheet of aluminum (at least 0.25mm thick and 2.5m square) connected to the protective grounding system.



5.5.6 TEST RESULTS

E.U.T :	AIS Aids to Navigation (AtoN)	Model Name :	MANDO-301
Temperature :	22°C	Relative Humidity :	45%
Test Voltage :	DC 12V		
Test Mode :	FULL SYSTEM(MANDO-301)		

Mode	() AC Power Line		(X) DC Power Line		(X) Signal/Control Line	
Test Level	2kV		1kV		1kV	
Port(s)	Polarity	Results	Polarity	Results	Polarity	Results
Line (L)	P		P	A	P	
	N		N	A	N	
Neutral (N)	P		P	A	P	
	N		N	A	N	
Ground (PE)	P		P	N/A	P	
	N		N	N/A	N	
Signal/Control Line	P		P		P	A
	N		N		N	A
Criteria	B		B		B	
Result	N/A		A		A	
Judgment	N/A		PASS		PASS	

Note:

- 1) P/N denotes the Positive/Negative polarity of the output voltage.
- 2) N/A - denotes test is not applicable in this test report
- 3) Criteria A: There was no change operated with initial operating during the test.
- 4) Criteria B: The EUT function loss during the test, but self-recoverable after the test.
- 5) Criteria C: The system shut down during the test.
- 6) For DC input, L means positive pole & N means negative pole
- 7) The level of wanted RF signal for EUT in RF input port is 40 dBuV(emf) during the test.



5.6 INJECTION CURRENT TESTING

5.6.1 TEST SPECIFICATION

Basic Standard:	IEC/EN 61000-4-6
Required Performance	A
Frequency Range:	0.15 MHz - 80 MHz
Field Strength:	3 Vr.m.s.
Modulation:	400Hz Sine Wave, 80%, AM Modulation
Frequency Step:	1% of fundamental
Dwell Time:	at least 3 seconds

5.6.2 MEASUREMENT INSTRUMENTS

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Signal Generator	IFR	2023A	202301/368	Apr. 06, 2012
2	Power Amplifier	AR	75A250AM1	0320709	Sep. 22, 2011
3	EM Clamp	FCC	F-203I-23MM	504	Jun. 14, 2011
4	CDN(M2)	FCC	FCC-801-M2/M3-16A	100266	May. 18, 2013
5	50Ω BNC TYPE Terminator	N/A	N/A	08	Jun. 01, 2013
6	Measurement Software	AR	SW1006 (Version 1.13)	321778	N/A

Remark: " N/A" denotes No Model Name / Serial No. and No Calibration specified.

5.6.3 TEST PROCEDURE

The EUT and support equipment, are placed on a table that is 0.8 meter above a metal ground plane measured 1m*1m min. and 0.65mm thick min.

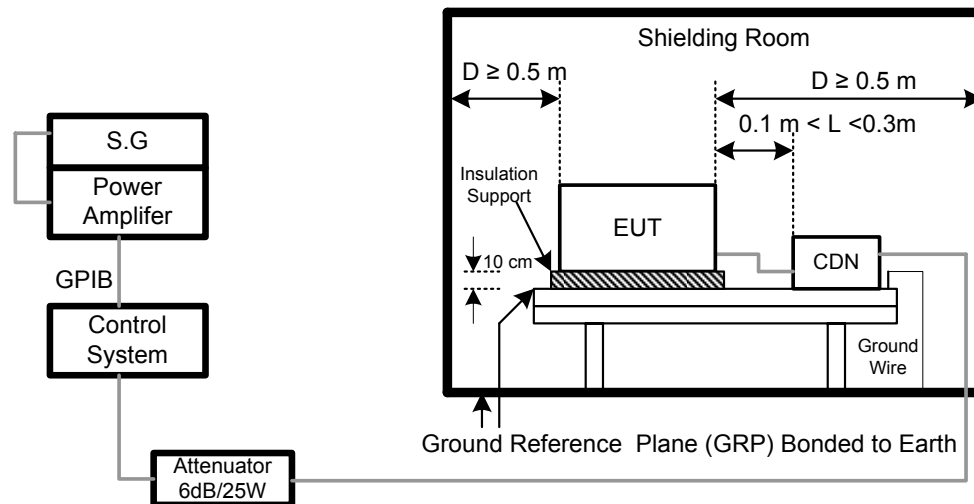
The other condition as following manner:

- a. The field strength level was 3V.
- b. The frequency range is swept from 150 kHz to 80 MHz, with the signal 80%amplitude modulated with a 1 kHz sine wave. The rate of sweep did not exceed 1.5x 10-3 decade/s. Where the frequency range is swept incrementally, the step size was 1% of fundamental.
- c. The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.
- d. For the actual test configuration, please refer to the related Item –EUT Test Photos.

5.6.4 DEVIATION FROM TEST STANDARD

No deviation

5.6.5 TEST SETUP



For the actual test configuration, please refer to the related Item –EUT Test Photos.

NOTE:

FLOOR-STANDING EQUIPMENT

The equipment to be tested is placed on an insulating support of 0.1 meters height above a ground reference plane. All relevant cables shall be provided with the appropriate coupling and decoupling devices at a distance between 0.1 meters and 0.3 meters from the projected geometry of the EUT on the ground reference plane.



5.6.6 TEST RESULTS

E.U.T :	AIS Aids to Navigation (AtoN)	Model Name :	MANDO-301
Temperature :	22°C	Relative Humidity :	45%
Test Voltage :	DC 12V		
Test Mode :	FULL SYSTEM(MANDO-301)		

Test Ports (Mode)	Freq. Range (MHz)	Field Strength	Perform. Criteria	Results	Judgment
Input/ Output AC. Power Port	0.15 - 80	3V(rms) AM Modulated 400Hz, 80%	A	N/A	N/A
Input/ Output DC. Power Port			A	A	PASS
Signal Line (Singal Cable (CON1))			A	A	PASS
Signal Line (Singal Cable (CON2))			A	A	PASS
Signal Line (VHF ANT Cable)			A	A	PASS
Signal Line (GPS ANT Cable)			A	A	PASS

Freq. Range (MHz)	Field Strength	Perform. Criteria	Results	Judgment
2 / 3 / 4 / 6.2 / 8.2 / 12.2 / 16.5 18.8 / 22 / 25	10V(rms) AM Modulated 400Hz, 80%	A	A	PASS

Note:

- 1) N/A - denotes test is not applicable in this Test Report.
- 2) Criteria A: There was no change operated with initial operating during the test.
- 3) Criteria B: The EUT function loss during the test, but self-recoverable after the test.
- 4) Criteria C: The system shut down during the test.
- 5) The level of wanted RF signal for EUT in RF input port is 40 dBuV(emf) during the test.

6. EUT TEST PHOTO

Conducted Measurement Photos



**Radiated Measurement Photos
BETWEEN 30MHZ AND 1000MHZ**



Radiated Measurement Photos

ABOVE 1000MHZ

