

TEST REPORT

Application No.: SZEM2007006017CR
Applicant: Navico Auckland Ltd.
Address of Applicant: 44 Arrenway Drive, Rosedale, Auckland 0632, New Zealand
Manufacturer: Navico Auckland Ltd.
Address of Manufacturer: 44 Arrenway Drive, Rosedale, Auckland 0632, New Zealand
Factory: Shenzhen Fastrain Technology Co., Ltd.
Address of Factory: No.3 Baolong 4th Rd., Baolong Industrial Area, Longgang District, Shenzhen, China

Equipment Under Test (EUT):

EUT Name: MARINE BLACK BOX DSC/AIS VHF RADIO SYSTEM
Model No.: NRS-1, NRS-2 ♣
 ♣ Please refer to section 2 of this report which indicates which model was actually tested and which were electrically identical.

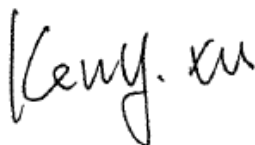
Trade mark: NAVICO
Standard(s) : EN 60945:2002
 IEC 60945:2002

Date of Receipt: 2020-07-29
Date of Test: 2020-07-29 to 2020-09-18
Date of Issue: 2020-09-19

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards specified above.

The CE mark as shown below can be used, under the responsibility of the manufacturer, after completion of an EU Declaration of Conformity and compliance with all relevant EU Directives.



Keny Xu
 EMC Laboratory Manager



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<i>Revision Record</i>				
<i>Version</i>	<i>Chapter</i>	<i>Date</i>	<i>Modifier</i>	<i>Remark</i>
01		2020-09-19		Original

Authorized for issue by:			
			
		<hr/> Edison Li /Project Engineer	
			
		<hr/> Eric Fu /Reviewer	



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2 Test Summary

EN 60945:2002/IEC 60945:2002 Section 9, Electromagnetic Emission				
Item	Standard	Method	Requirement	Result
Conducted Emissions at DC Power Input Port (150kHz-30MHz)	EN 60945:2002 IEC 60945:2002 Section 9.2	EN 60945:2002	EN 60945 clause 9.2.3	Pass
Radiated Emissions (Below 1GHz)	EN 60945:2002 IEC 60945:2002 Section 9.3	EN 60945:2002	EN 60945 clause 9.3.3	Pass
Radiated Emissions (Above 1GHz)	EN 60945:2002 IEC 60945:2002 Section 9.3	EN 60945:2002	EN 60945 clause 9.3.3	Pass

EN 60945:2002/IEC 60945:2002 Section 10, Immunity to electromagnetic environment				
Item	Standard	Method	Requirement	Result
Electrostatic Discharge	EN 60945:2002 IEC 60945:2002 Section 10.9	EN 61000-4-2:2009	6kV Contact Discharge 8kV Air Discharge	Pass
Radiated Immunity (80MHz-2.7GHz)	EN 60945:2002 IEC 60945:2002 Section 10.4	EN 61000-4-3:2006 +A1:2008+A2:2010	10V/m, 80%, 400Hz Amp. Mod.	Pass
Electrical Fast Transients/Burst at DC Power Port	EN 60945:2002 IEC 60945:2002 Section 10.5	EN 61000-4-4:2012	1kV 5/50ns Tr/Td 5kHz Repetition Frequency	Pass
Conducted Immunity at DC Power port (150kHz-80MHz)	EN 60945:2002 IEC 60945:2002 Section 10.3	EN 61000-4-6:2014	3Vrms (emf), 80%, 400Hz Amp. Mod. For 150KHz-80MHz 10Vrms (emf), 80%, 400Hz Amp. Mod. For 2MHz, 3MHz, 4MHz, 6.2MHz, 8.2MHz, 12.2MHz, 16.5MHz, 18.8MHz, 22MHz, 25MHz	Pass
Power Supply Failure	EN 60945:2002 IEC 60945:2002 Section 10.8	EN 61000-4-11:2004 +A1:2017	The EUT shall be subjected to three breaks in power supply of duration 60 s each.	Pass



EN 60945:2002/IEC 60945:2002 Section 11, Special purpose tests				
Item	Standard	Method	Requirement	Result
Compass Safe Distance	EN 60945:2002 IEC 60945:2002 Section 11.2	EN 61000-4-8:2010 & ISO 694:2001	The greatest distance obtained under all these conditions is the safe distance. Distances are to be rounded up to the nearest 50 mm or 100 mm.	Pass

EN 60945:2002/IEC 60945:2002 Section 12, Safety precautions				
Item	Standard	Method	Requirement	Result
Protection against accidental access to dangerous voltages	EN 60945:2002 IEC 60945:2002 Section 12.1	IEC 60529:1989+AMD2:2013+COR1:2019	Adequate clearance shall be found between the access probe and the hazardous parts. For the low voltage test, the lamp shall not light. For the high voltage test, the EUT shall be capable of withstanding the dielectric test.	N/A

Remark:

Model No.: NRS-1, NRS-2

The model and NRS-1 NRS-2 was tested fully, since according to the declaration from the applicant, the electrical circuit design, layout, components used, internal wiring and functions were identical for all the above models, with only differences are the trade name, model no. and AIS board(NRS2 has AIS board inside the main unit and while NRS-1 not).



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4 General Information

4.1 Details of E.U.T.

Power supply:	12 VDC battery system
Sample Type:	Mobile device
Internal Source:	More than 108MHz
Transmitter Frequency Range:	VHF:156.025MHz-157.425MHz 802.11b/g/n HT20: 2412MHz-2472MHz
Receiver Frequency Range:	156.05MHz-163.275MHz
AIS Transmitter Frequency Range:	161.975MHz(CH87), 162.025MHz(CH88)
DSC Transmitter Frequency Range:	156.525MHz(CH70)
GNSS Receiver Frequency Range:	1559MHz-1610MHz(GLONASS:G1, GPS:L1)
Modulation Type:	VHF:FM for Analog; DSC: FSK; AIS: GMSK; GNSS: BPSK; 802.11b: DSSS (CCK, DQPSK, DBPSK) 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK) 802.11n(HT20): OFDM (BPSK, QPSK, 16QAM, 64QAM)
Frequency Spacing:	VHF: 25KHz 802.11b/g/n HT20: 5MHz
Channel Numbers:	802.11b/g/n HT20: 13 Channels
Emission Type:	16K0G3E for VHF; 16K0G2B for DSC;
Rated Output Power:	25W/1W for VHF/DSC; 2W for AIS;
VHF/DSC Antenna Connectors:	SO-239(50ohm, External Antenna)
AIS Antenna Connectors:	SO-239(50ohm, External Antenna)
VHF/DSC Antenna Gain:	6dBi
AIS Antenna Gain:	6dBi
GNSS Antenna Connector:	SMA for External antenna;
GNSS Antenna Gain:	1.5dBi
WiFi Antenna Type:	External
WiFi Antenna Gain:	5.3dBi

4.2 Cable

Cable	Length	Shielding	Core
DC cable	longer than 300cm	Unshielded	Non-Core

4.3 Description of Support Units

Description	Manufacturer/ Trade mark	Model No.	Serial No.
DC power	ZHAOXIN	RXN-305D	REF. No.SEA2700
Coaxial Attenuator	Provided by client	TS4	HYT168793
Cell Site Test Set	HP	8921A	3633A04615
Audio Analyzer	Rohde & Schwarz	UPV	SEM008-03
Wired Handset	SIMRAD	HS100	/
Wired Speaker	/	SP100	/
Wired Handset	B&G	H100	/
Wired Speaker	/	SP100	/

4.4 Measurement Uncertainty

Test Item	Measurement Uncertainty
Conducted Emissions at DC Power Input Port (150kHz-30MHz)	± 3.0dB
Radiated Emissions (Below 1GHz)	± 4.5dB
Radiated Emissions (Above 1GHz)	± 4.8
Radiated Emissions (Below 30MHz)	± 3.1dB
Electrostatic Discharge	± 6 %
Radiated Immunity (80MHz-2GHz)	± 1.64dB
Electrical Fast Transients-Burst at Power Port	± 5 %
Conducted Immunity at Power port (150kHz-80MHz)	± 0.96dB
Power Supply Failure	± 4 %
Compass Safe Distance	± 5 %
Protection against accidental access to dangerous voltages	± 5 %

Remark:

The U_{lab} (lab Uncertainty) is less than U_{CISPR} (CISPR Uncertainty), so the test results

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.



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4.5 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch

No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China. 518057.

Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

No tests were sub-contracted.

4.6 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **A2LA (Certificate No. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

- **VCCI**

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

- **FCC –Designation Number: CN1178**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

- **Innovation, Science and Economic Development Canada**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

4.7 Deviation from Standards

None

4.8 Abnormalities from Standard Conditions

None

4.9 EMS Monitor

Visual: Monitored the display of the EUT

Audio: Monitored the Sound of the EUT



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5 Equipment List

Conducted Emissions at DC Power Input Port (150kHz-30MHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Shielding Room	ZhongYu Electron	GB-88	SEM001-06	2019-06-13	2022-06-12
EMI Test Receiver	Rohde&Schwarz	ESCI	SEM004-02	2020-03-24	2021-03-23
Switch	WEINSCHEL ENGINEERING	1506A	SEN009-01	N/A	N/A
Matching Pad	anzac	PT-75	SEN009-02	N/A	N/A
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM024-01	2020-07-10	2021-07-09
LISN	Schwarzebck	NNBM8124	SEM007-08	2019-09-24	2020-09-23
LISN	Schwarzebck	NNBM8124	SEM007-09	2019-09-24	2020-09-23
Current Sensor Probe	TESEQ	CSP9160A	SEM009-12	2019-09-24	2020-09-23

Radiated Emissions (Below 30MHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
10m Semi-Anechoic Chamber	SAEMC	FSAC1018	SEM001-03	2018-03-31	2021-03-30
MXE EMI receiver	KEYSIGHT	N9038A	SEM004-16	2019-12-16	2020-12-15
Trilog-Broadband Antenna	Schwarzbeck	VULB9168	SEM003-18	2019-08-08	2022-08-07
Pre-amplifier	Sonoma Instrument Co	310N	SEM005-04	2020-04-09	2021-04-08
Loop Antenna	ETS-Lindgren	6502	SEM003-08	2017-08-22	2020-08-21
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM029-01	2020-07-10	2021-07-09

Radiated Emissions (Below 1GHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001-01	2020-07-19	2023-07-18
MXE EMI Receiver	Agilent Technologies	N9038A	SEM004-15	2019-12-16	2020-12-15
BiConiLog Antenna	ETS-LINDGREN	3142C	SEM003-02	2019-05-24	2022-05-23
Pre-Amplifier	Agilent Technologies	8447D	SEM005-01	2020-04-01	2021-03-31
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM025-01	2020-07-10	2021-07-09



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Radiated Emissions (Above 1GHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2018-03-13	2021-03-12
EXA Signal Analyzer	Agilent Technologies Inc	N9010A	SEM004-12	2020-04-09	2021-04-08
Horn Antenna	Rohde&Schwarz	HF907	SEM003-07	2018-04-13	2021-04-12
Pre-Amplifier	Compliance Directions Systems Inc.	PAP-0126	SEM004-11	2019-09-24	2020-09-23
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM026-01	2020-07-10	2021-07-09
Horn Antenna	Schwarzbeck	BBHA 9170	SEM003-15	2017-10-17	2020-10-16
Pre-Amplifier	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2020-04-01	2021-03-31

Electrostatic Discharge					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
ESD Ground Plane	SGS(3m*3m)	N/A	SEN006-01	N/A	N/A
ESD Generator	TESEQ AG	NSG 437	SEM019-02	2020-04-16	2021-04-15

Electrical Fast Transients-Burst at Power Port					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Ultra Compact Simulator	EM Test	UCS 500N7	SEM018-02	2020-03-26	2021-03-25
Measurement Software	EM TEST	IEC CONTROL V6.0.1	N/A	N/A	N/A

Conducted Immunity at Power port (150kHz-80MHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Shielding Room	AUDIX	N/A	SEM001-08	2019-06-13	2022-06-12
RF-Generator	SCHAFFNER	NSG 2070	SEM006-01	2019-09-24	2020-09-23
Coupling/Decoupling Network	SCHAFFNER	CDN M016	SEM007-03	2020-04-09	2021-04-08
EM Clamp	SCHAFFNER	KEMZ 801	SEM013-01	2019-09-25	2020-09-24
Conditioning Amplifier	Brüel & Kjaer	2690-OS2	SEM005-10	2020-04-20	2021-04-19
Audio Analyzer	Rohde & Schwarz	UPV	SEM008-03	2019-09-25	2020-09-24



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Radiated Immunity (80MHz-2GHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Fully-Anechoic Chamber 2	Chang Zhou Zhong Shuo	854	SEM001-05	2020-07-10	2021-07-09
Power Sensor	Rohde&Schwarz	NRP-Z91	SEM009-09	2020-03-23	2021-03-22
Stacked Log.-Per.-Broadband Antenna	Schwarzbeck	STLP 9129	SEM003-25	N/A	N/A
Signal Generator	Rohde&Schwarz	SMB100A	SEM006-11	2020-03-23	2021-03-22
Broadband Amplifier	Rohde&Schwarz	BBA150-BC250	SEM005-12	2019-09-24	2020-09-23
Broadband Amplifier	Rohde&Schwarz	BBA150-D110	SEM005-13	2020-04-01	2021-03-31
Broadband Amplifier	Rohde&Schwarz	BBA150-E60	SEM005-16	2020-05-21	2021-05-20
Measurement Software	Rohde&Schwarz	EMC32 V9.25.00	N/A	N/A	N/A
Amplifier	Amplifier Research	75A250A	SEM005-11	2020-04-01	2021-03-31
Wire ISN	Rohde&Schwarz	ENY 22	EMC0114	2019-09-24	2020-09-23
Audio Analyzer	Rohde&Schwarz	UPL	SEM008-01	2019-09-24	2020-09-23
Conditioning Amplifier	Brüel&Kjaer	2690-OS2	SEM005-10	2020-04-14	2021-04-13
Mouth Simulator	Brüel&Kjaer	4227	SEM017-01	2020-04-14	2021-04-13
Signal Source	Brüel&Kjaer	4231	SEM017-02	2020-03-25	2021-03-24
Coupling/Decoupling Network	SCHLODER	CDN-M2+3	SEM007-10	2019-09-24	2020-09-23
Universal Radio Communication Tester	Rohde&Schwarz	CMU 200	SEM010-06	2019-09-24	2020-09-23

Power Supply Failure					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Ultra Compact Simulator	EM Test	UCS 500N7	SEM018-02	2020-03-26	2021-03-25
Measurement Software	EM TEST	IEC CONTROL V6.0.1	N/A	N/A	N/A

Compass Safe Distance					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Magnetic Field Test	EM TEST	MS100N	SEM018-04	2020-05-07	2021-05-06
Electric and Magnetic Field Analyzer	Narda	EHP-50F	EMC092	2020-02-06	2021-02-05
Measurement Software	EM TEST	IEC CONTROL V6.0.1	N/A	N/A	N/A



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General used equipment					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-03	2019-09-26	2020-09-25
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-04	2019-09-26	2020-09-25
Humidity/ Temperature Indicator	Mingle	N/A	SEM002-08	2019-09-26	2020-09-25
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2020-04-07	2021-04-06



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6 Emission Test Results

6.1 Conducted Emissions at DC Power Input Port (150kHz-30MHz)

Test Requirement: IEC/EN 60945:2002 clause 9.2
 Test Method: EN 60945 clause 9.2.2
 Limit:
 0.01MHz-0.15MHz 96dB(μV)-50dB(μV) quasi-peak
 0.15MHz-0.35MHz 60dB(μV)-50dB(μV) quasi-peak
 0.35MHz-30MHz 50dB(μV) quasi-peak
 Detector: Peak for pre-scan (200Hz resolution bandwidth) 0.01MHz to 0.15MHz and (9kHz resolution bandwidth) 0.15MHz to 30MHz

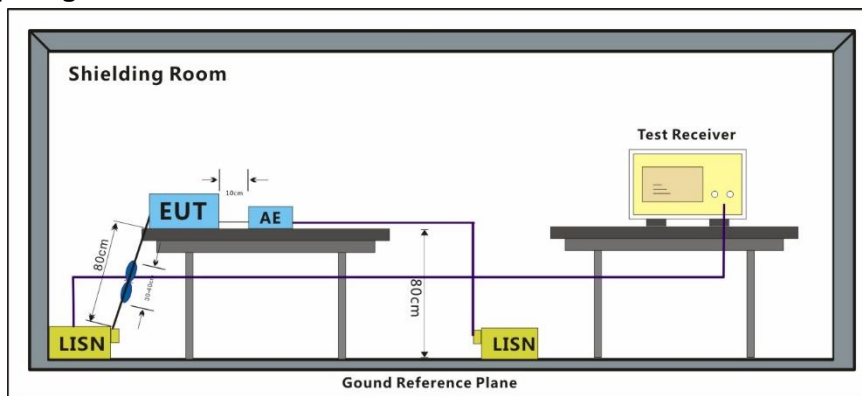
6.1.1 E.U.T. Operation

Operating Environment:
 Temperature: 23 °C Humidity: 56 % RH Atmospheric Pressure: 1010 mbar

6.1.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	05	On mode, keep EUT working normally.
Pre-scan	06	Idle mode, Keep the EUT at standby mode.

6.1.3 Test Setup Diagram

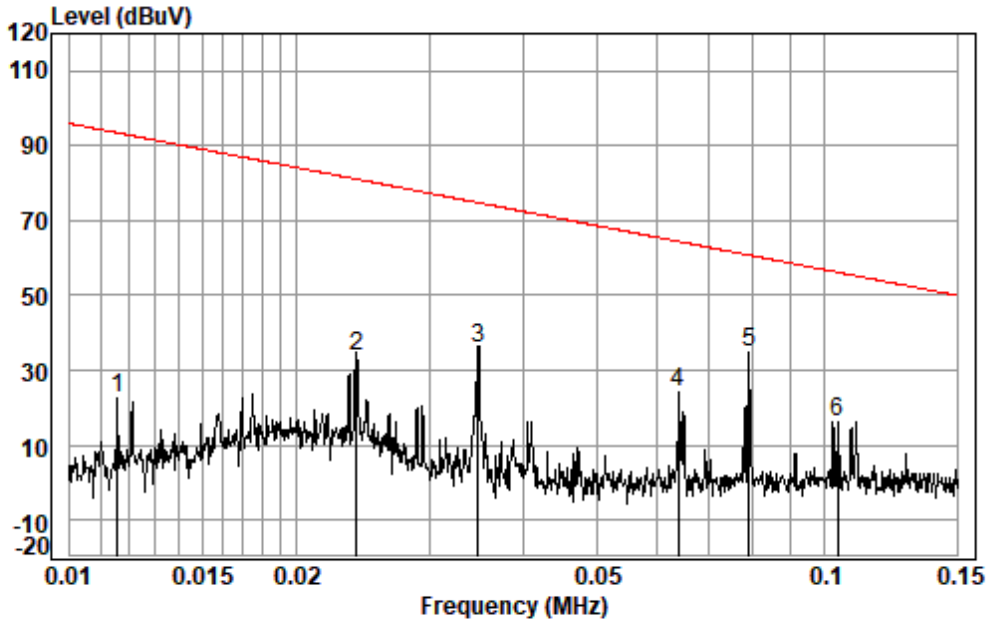


6.1.4 Measurement Procedure and Data

An initial pre-scan was performed with peak detector. Quasi-Peak measurement were performed at the frequencies with maximized peak emission were detected.

Test data for NRS2

Test Mode: 05; Line: Live line



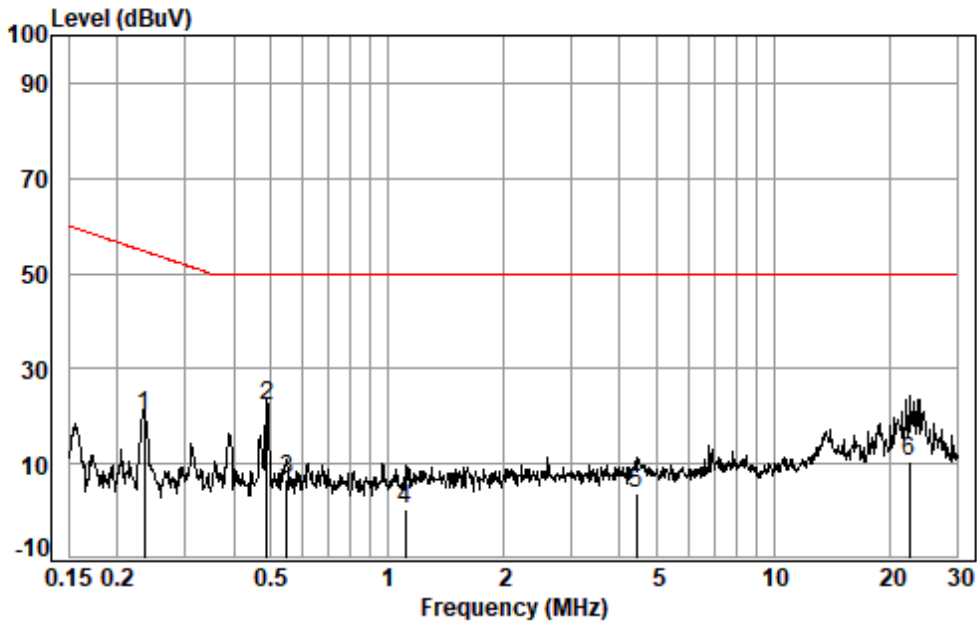
Site : Shielding Room
 Condition: Line
 Job No. : 06017CR
 Test mode: 05

	Freq	Cable Loss	LISN Factor	Read Level	Limit Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.0116	0.01	10.44	12.16	22.61	93.52	-70.91	QP
2	0.0240	0.01	9.92	23.77	33.70	81.14	-47.44	QP
3	0.0348	0.01	9.77	26.24	36.02	74.84	-38.82	QP
4	0.0641	0.01	9.63	14.55	24.19	64.44	-40.25	QP
5	0.0794	0.01	9.61	25.35	34.97	60.81	-25.84	QP
6	0.1041	0.02	9.60	6.77	16.39	56.21	-39.82	QP



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Test Mode: 05; Line: Live line



Site : Shielding Room
 Condition: Line
 Job No. : 06017CR
 Test mode: 05

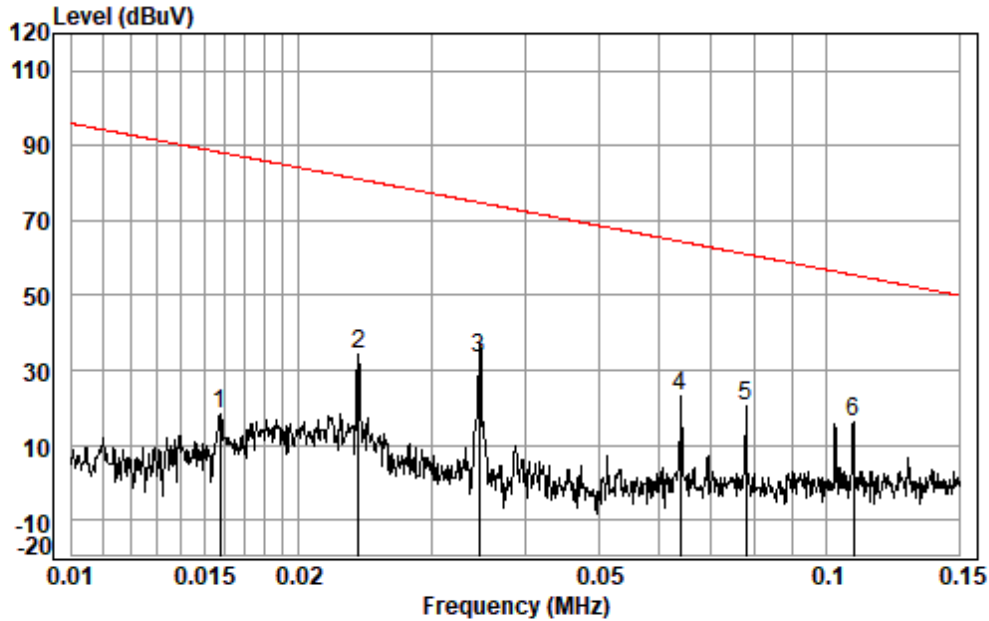
	Cable	LISN	Read	Limit	Over		
Freq	Loss	Factor	Level	Level	Line	Limit	Remark
MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.2353	0.03	9.68	10.46	20.17	54.68	-34.51 QP
2	0.4889	0.06	9.69	12.59	22.34	50.00	-27.66 QP
3	0.5493	0.06	9.69	-2.84	6.91	50.00	-43.09 QP
4	1.1114	0.10	9.71	-9.47	0.34	50.00	-49.66 QP
5	4.4071	0.16	9.80	-6.06	3.90	50.00	-46.10 QP
6	22.5354	0.25	10.96	-0.51	10.70	50.00	-39.30 QP



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Test data for NRS1

Test Mode: 05; Line: Neutral Line



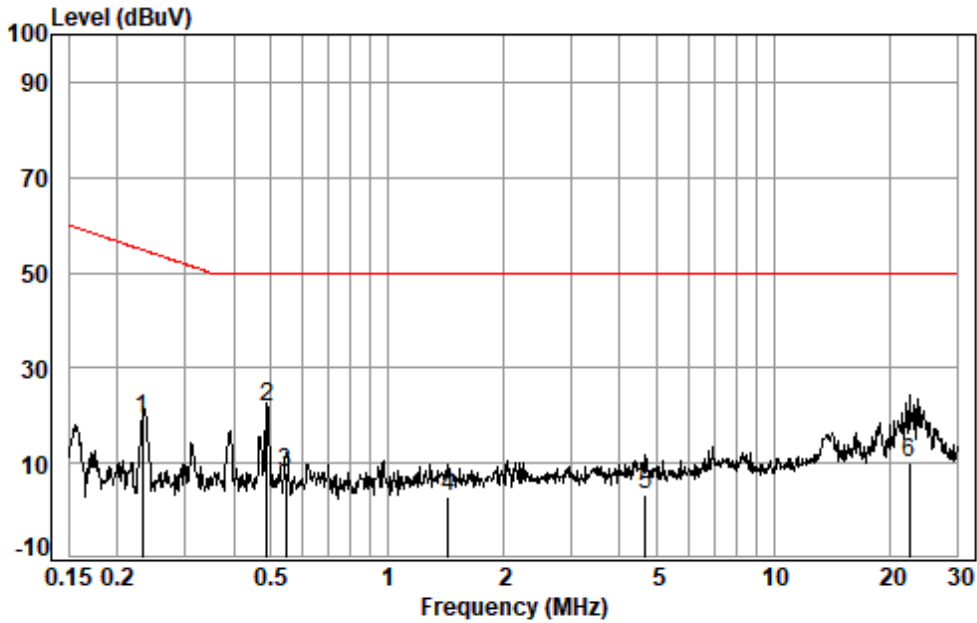
Site : Shielding Room
 Condition: Neutral
 Job No. : 06017CR
 Test mode: 05

	Cable	LISN	Read	Limit	Over		
Freq	Loss	Factor	Level	Level	Line	Limit	Remark
MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.0158	0.01	10.09	7.98	18.08	88.27	-70.19 QP
2	0.0240	0.01	9.85	24.68	34.54	81.14	-46.60 QP
3	0.0347	0.01	9.71	23.69	33.41	74.89	-41.48 QP
4	0.0641	0.01	9.60	13.74	23.35	64.44	-41.09 QP
5	0.0783	0.01	9.58	11.05	20.64	61.04	-40.40 QP
6	0.1084	0.02	9.56	6.55	16.13	55.52	-39.39 QP



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Test Mode: 05; Line: Neutral Line



Site : Shielding Room
 Condition: Neutral
 Job No. : 06017CR
 Test mode: 05

	Freq	Cable Loss	LISN Factor	Read Level	Limit Level	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dB	
1	0.2329	0.03	9.66	9.58	19.27	54.81 -35.54	QP
2	0.4889	0.06	9.67	12.02	21.75	50.00 -28.25	QP
3	0.5464	0.06	9.67	-1.73	8.00	50.00 -42.00	QP
4	1.4409	0.13	9.71	-6.67	3.17	50.00 -46.83	QP
5	4.6715	0.17	9.83	-6.67	3.33	50.00 -46.67	QP
6	22.5354	0.25	10.82	-0.80	10.27	50.00 -39.73	QP



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6.2 Radiated Emissions (Below 30MHz)

Test Requirement: IEC/EN 60945 :2002 clause 9.3
 Test Method: EN 60945 clause 9.3.2
 Measurement Distance: 3m
 Limit:
 150KHz-300KHz 80 dB(μV/m) to 52 dB(μV/m) quasi-peak
 300KHz-30MHz 52 dB(μV/m) to 34 dB(μV/m) quasi-peak
 Detector: Peak for pre-scan (9KHz resolution bandwidth) 150KHz to 30MHz.

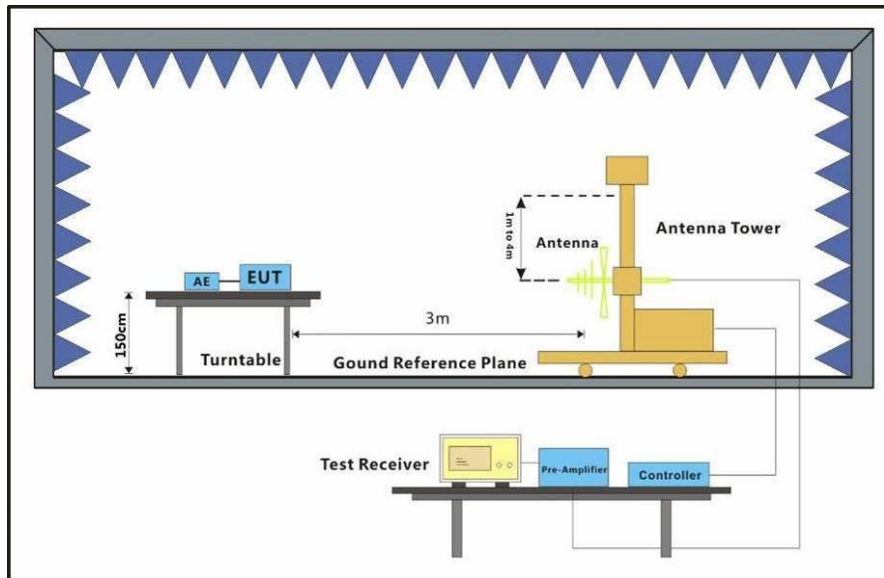
6.2.1 E.U.T. Operation

Operating Environment:
 Temperature: 25 °C Humidity: 45 % RH Atmospheric Pressure: 1010 mbar

6.2.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	05	On mode, keep EUT working normally.
Pre-scan	06	Idle mode, Keep the EUT at standby mode.

6.2.3 Test Setup Diagram



6.2.4 Measurement Procedure and Data

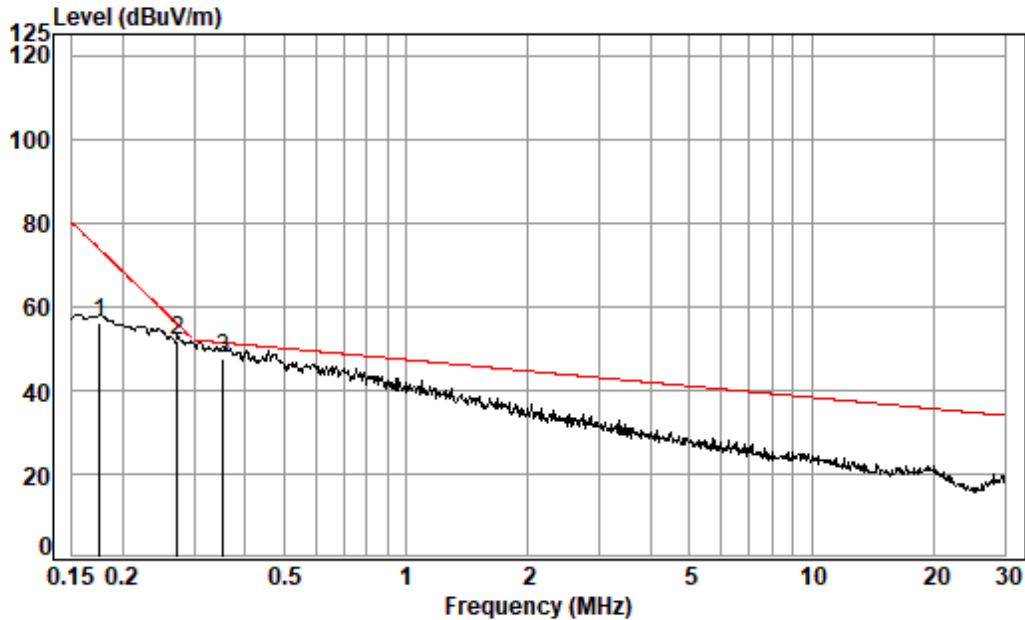
An initial pre-scan was performed in the chamber using the spectrum analyser in peak detection mode. Quasi-peak measurements were conducted based on the peak sweep graph. The EUT was measured by BiConiLog antenna with 2 orthogonal polarities.



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Test data for NRS2

Test Mode: 05



Condition: 3m

Job No. : 06017CR

Test Mode: 05

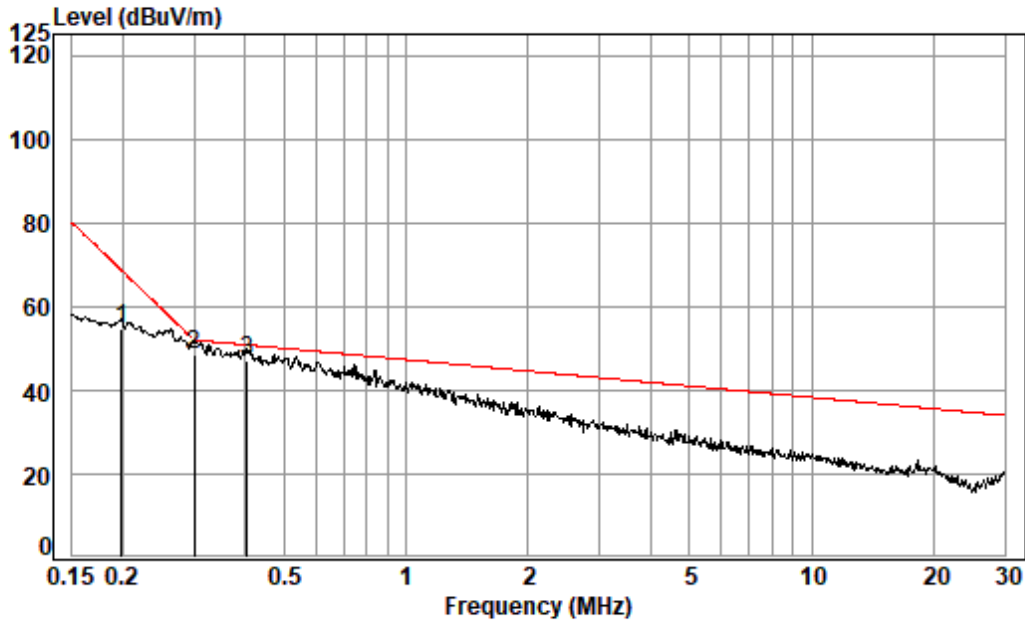
	Ant Freq	Preamp Factor	Cable Factor	Cable Loss	Read Level	Limit Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dB	dB	dBuV	dBuV/m	dBuV/m	dB	
1	0.176	13.92	32.21	0.02	74.14	55.87	73.58	-17.71	QP
2	0.273	13.82	32.22	0.03	70.11	51.74	55.81	-4.07	QP
3 pp	0.354	13.80	32.23	0.04	66.05	47.66	51.35	-3.69	QP



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Test data for NRS1

Test Mode: 05



Condition: 3m

Job No. : 06017CR

Test Mode: 05 Difference

	Freq	Ant Factor	Preamp Factor	Cable Loss	Read Level	Limit Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dB	dB	dBuV	dBuV/m	dBuV/m	dB	
1	0.199	13.90	32.21	0.03	73.14	54.86	68.66	-13.80	QP
2	0.300	13.80	32.23	0.04	66.99	48.60	52.00	-3.40	QP
3	0.406	13.80	32.24	0.04	65.23	46.83	50.82	-3.99	QP



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6.3 Radiated Emissions (Below 1GHz)

Test Requirement: IEC/EN 60945 :2002 clause 9.3
 Test Method: EN 60945 clause 9.3.2
 Measurement Distance: 3m
 Limit:
 30MHz-1GHz 54 dB(μV/m) quasi-peak
 156MHz-165MHz 24 dB(μV/m) quasi-peak, 30 dB(μV/m) peak
 Detector: Peak for pre-scan (9KHz resolution bandwidth) 156MHz to 165MHz,
 (120kHz resolution bandwidth) 30MHz to 1000MHz.

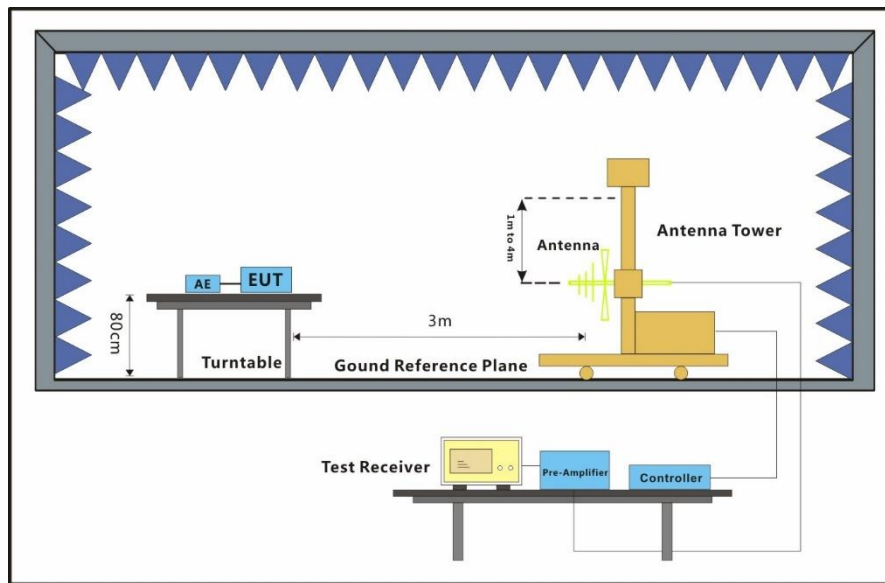
6.3.1 E.U.T. Operation

Operating Environment:
 Temperature: 25 °C Humidity: 51 % RH Atmospheric Pressure: 1010 mbar

6.3.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	05	On mode, keep EUT working normally.
Pre-scan	06	Idle mode, Keep the EUT at standby mode.

6.3.3 Test Setup Diagram



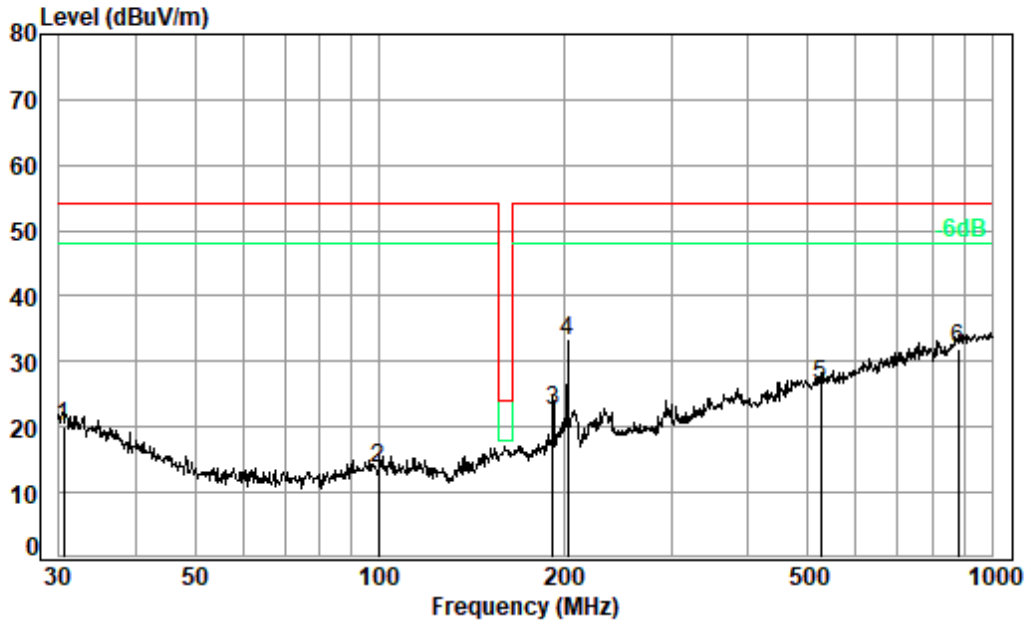
6.3.4 Measurement Procedure and Data

An initial pre-scan was performed in the chamber using the spectrum analyser in peak detection mode. Quasi-peak measurements were conducted based on the peak sweep graph. The EUT was measured by BiConiLog antenna with 2 orthogonal polarities.



Test data for NRS2

Test Mode: 05; Polarity: Horizontal



Condition: 3m HORIZONTAL

Job No. : 06017CR

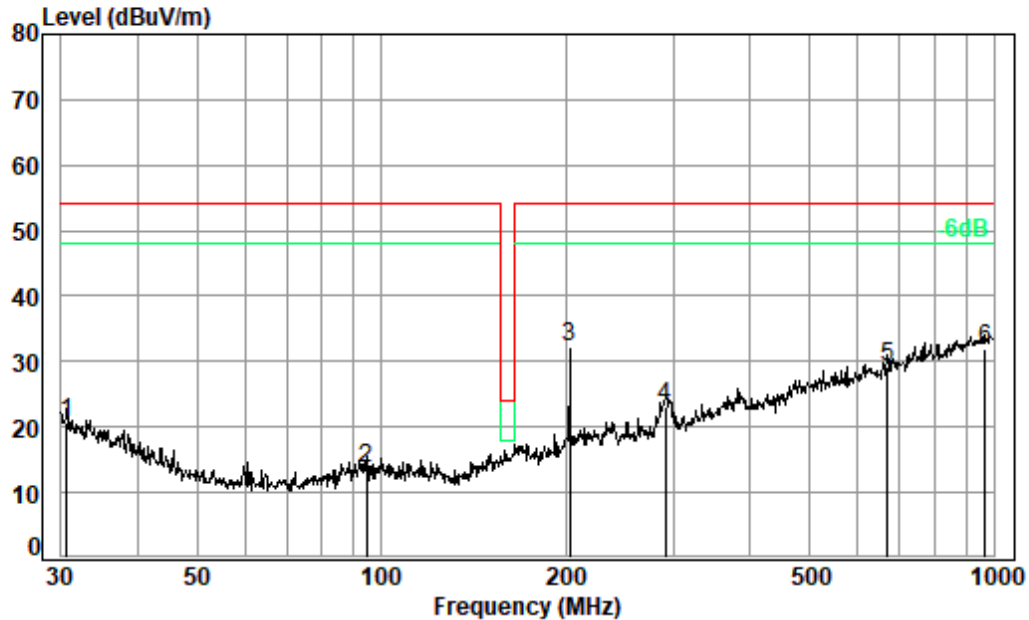
Test Mode: 05

: 1#

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Over Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	30.53	0.61	22.59	27.73	24.72	20.19	54.00	-33.81	QP
2	99.88	1.10	13.99	27.61	26.30	13.78	54.00	-40.22	QP
3	191.75	1.19	15.55	27.17	32.94	22.51	54.00	-31.49	QP
4 pp	202.81	1.23	15.66	27.13	43.34	33.10	54.00	-20.90	QP
5	526.40	2.56	24.66	27.89	27.07	26.40	54.00	-27.60	QP
6	881.41	3.46	29.09	27.27	26.80	32.08	54.00	-21.92	QP



Test Mode: 05; Polarity: Vertical



Condition: 3m VERTICAL

Job No. : 06017CR

Test Mode: 05

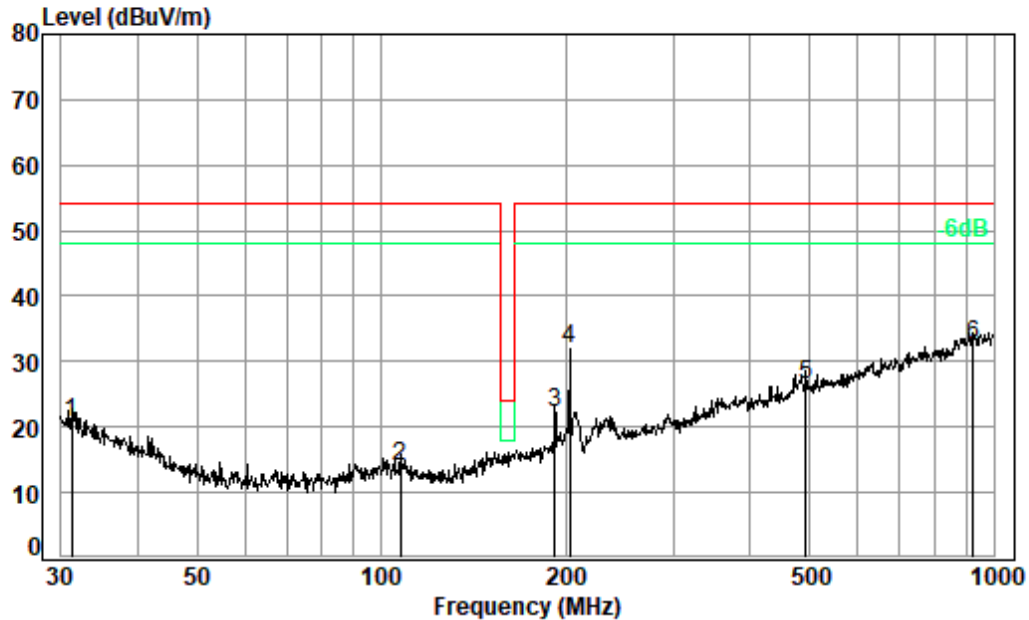
: 1#

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Over Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	30.64	0.61	22.51	27.73	25.31	20.70	54.00	-33.30	QP
2	94.76	1.20	13.61	27.62	26.41	13.60	54.00	-40.40	QP
3 pp	202.81	1.23	15.66	27.13	42.59	32.35	54.00	-21.65	QP
4	291.04	1.94	18.38	26.89	29.61	23.04	54.00	-30.96	QP
5	670.49	2.84	27.10	27.98	27.13	29.09	54.00	-24.91	QP
6	968.93	3.57	29.50	26.81	25.73	31.99	54.00	-22.01	QP



Test data for NRS1

Test Mode: 05; Polarity: Horizontal



Condition: 3m HORIZONTAL

Job No. : 06017CR

Test Mode: 05

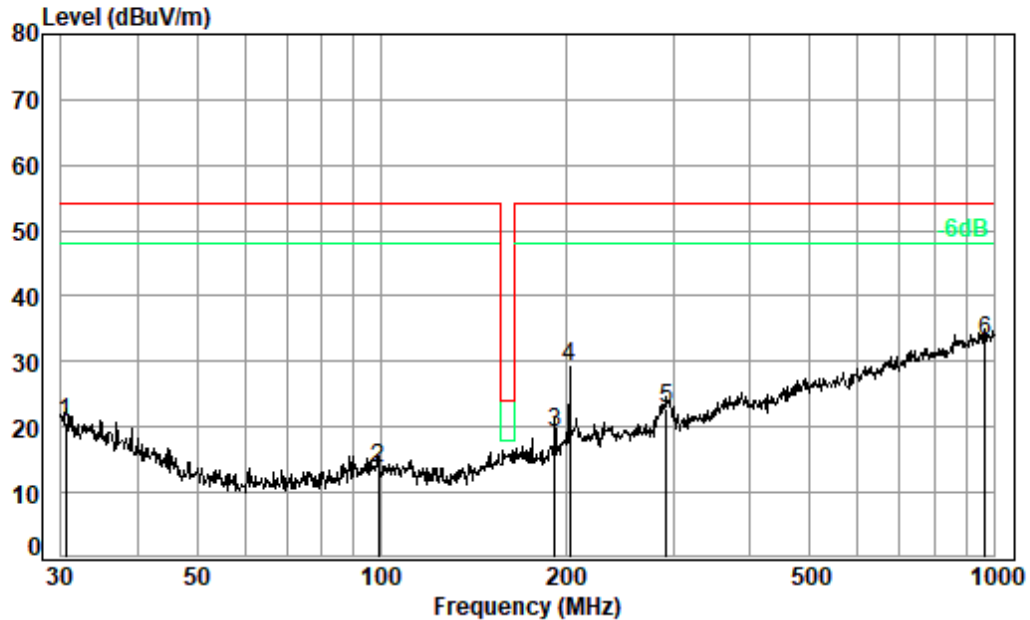
: 2#

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Over Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	31.29	0.61	22.02	27.73	25.91	20.81	54.00	-33.19	QP
2	107.51	1.11	13.77	27.56	26.56	13.88	54.00	-40.12	QP
3	191.75	1.19	15.55	27.17	32.78	22.35	54.00	-31.65	QP
4	202.81	1.23	15.66	27.13	42.16	31.92	54.00	-22.08	QP
5	492.47	2.49	24.25	27.77	27.57	26.54	54.00	-27.46	QP
6 pp	925.76	3.53	29.20	27.03	26.77	32.47	54.00	-21.53	QP



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Test Mode: 05; Polarity: Vertical



Condition: 3m VERTICAL
 Job No. : 06017CR
 Test Mode: 05
 : 2#

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Over Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	30.53	0.61	22.59	27.73	25.22	20.69	54.00	-33.31	QP
2	98.83	1.12	13.88	27.61	26.20	13.59	54.00	-40.41	QP
3	191.75	1.19	15.55	27.17	29.68	19.25	54.00	-34.75	QP
4	202.81	1.23	15.66	27.13	39.57	29.33	54.00	-24.67	QP
5	292.06	1.95	18.47	26.89	29.22	22.75	54.00	-31.25	QP
6 pp	968.93	3.57	29.50	26.81	26.75	33.01	54.00	-20.99	QP



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6.4 Radiated Emissions (Above 1GHz)

Test Requirement: IEC/EN 60945 :2002 clause 9.3
 Test Method: EN 60945 clause 9.3.2
 Measurement Distance: 3m
 Limit:
 1GHz-2GHz 54 dB(μ V/m) peak
 Detector: Peak for pre-scan (120KHz resolution bandwidth) 1GHz to 2GHz

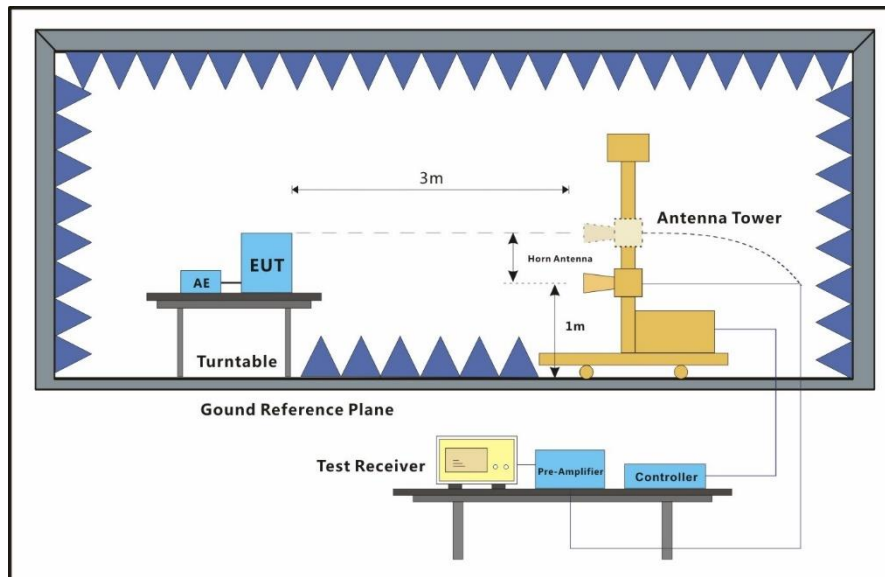
6.4.1 E.U.T. Operation

Operating Environment:
 Temperature: 23.5 °C Humidity: 55.4 % RH Atmospheric Pressure: 1010 mbar

6.4.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	05	On mode, keep EUT working normally.
Pre-scan	06	Idle mode, Keep the EUT at standby mode.

6.4.3 Test Setup Diagram

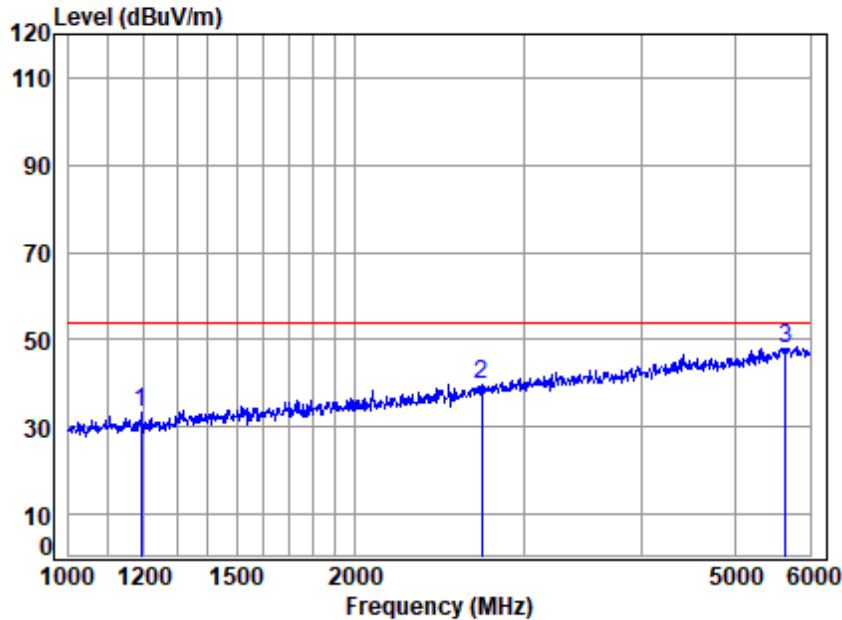


6.4.4 Measurement Procedure and Data

An initial pre-scan was performed in the chamber using the spectrum analyser in peak detection mode. The EUT was measured by Horn antenna with 2 orthogonal polarities.

Test data for NRS2

Test Mode: 05; Polarity: Horizontal



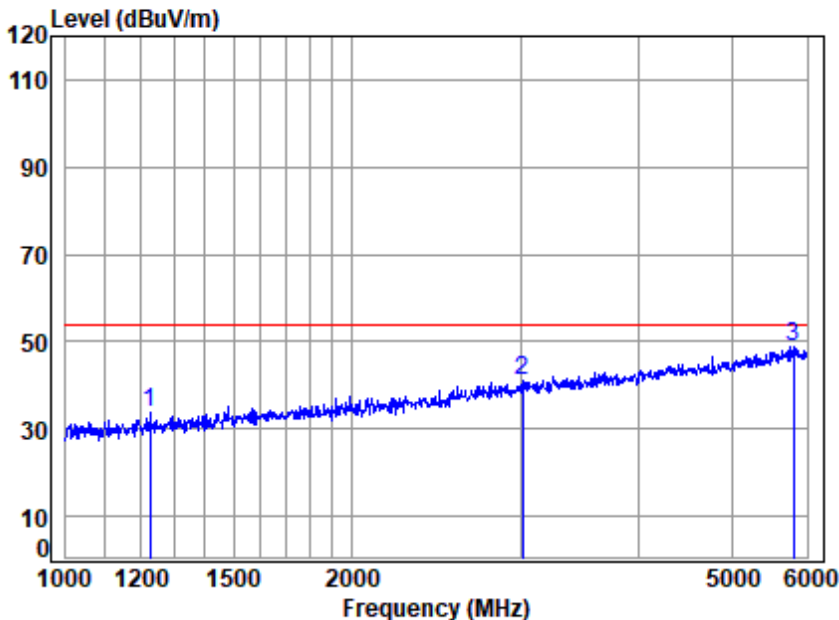
Site : chamber
 Condition: 3m HORIZONTAL
 Job No : 06017CR
 Mode : 05
 Note :

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1191.952	2.75	24.55	40.28	46.06	33.08	54.00	-20.92	Peak
2	2712.878	4.67	29.69	41.10	46.60	39.86	54.00	-14.14	Peak
3	5655.516	8.21	34.76	42.45	47.59	48.11	54.00	-5.89	Peak



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Test Mode: 05; Polarity: Vertical



Site : chamber
 Condition: 3m VERTICAL
 Job No : 06017CR
 Mode : 05
 Note :

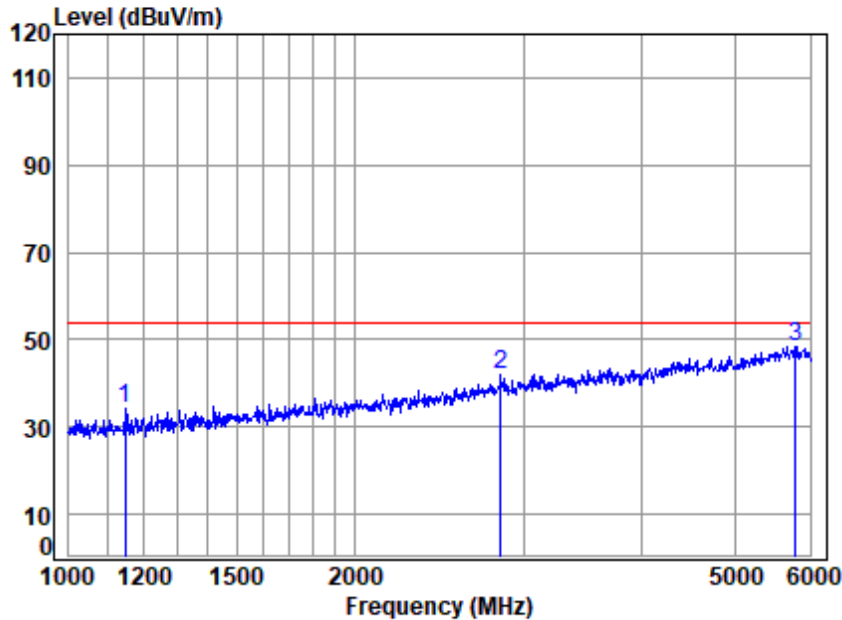
	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1226.618	2.81	24.71	40.30	46.72	33.94	54.00	-20.06	Peak
2	3015.374	4.88	30.93	41.22	46.28	40.87	54.00	-13.13	Peak
3	5809.577	8.23	34.91	42.36	47.94	48.72	54.00	-5.28	Peak



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Test data for NRS1

Test Mode: 05; Polarity: Horizontal



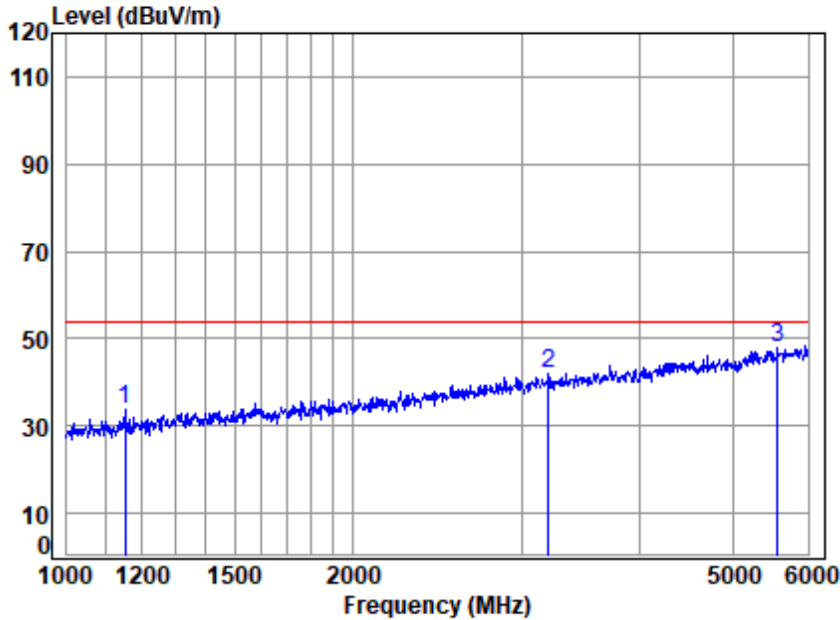
Site : chamber
Condition: 3m HORIZONTAL
Job No : 06017CR
Mode : 05
Note :

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1145.881	2.66	24.34	40.24	47.55	34.31	54.00	-19.69	Peak
2	2837.161	4.76	30.23	41.14	47.92	41.77	54.00	-12.23	Peak
3	5799.177	8.23	34.90	42.36	47.79	48.56	54.00	-5.44	Peak



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Test Mode: 05; Polarity: Vertical



Site : chamber
 Condition: 3m VERTICAL
 Job No : 06017CR
 Mode : 05
 Note :

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	1152.057	2.67	24.37	40.24	46.84	33.64	54.00	-20.36 Peak
2	3204.781	5.14	31.24	41.42	47.11	42.07	54.00	-11.93 Peak
3	5575.028	8.19	34.68	42.51	47.52	47.88	54.00	-6.12 Peak



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7 Immunity Test Results

7.1 General Performance Criteria Description in EN 60945

- Performance criteria A the EUT shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed, as defined in the relevant equipment standard and in the technical specification published by the manufacturer;
- Performance criteria B the EUT shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed, as defined in the relevant equipment standard and in the technical specification published by the manufacturer.
 During the test, degradation or loss of function or performance which is self-recoverable is however, allowed, but no change of actual operating state or stored data is allowed.
- Performance criteria C temporary degradation or loss of function or performance is allowed during the test, provided the function is self-recoverable, or can be restored at the end of the test by the operation of the controls, as defined in the relevant equipment standard and in the technical specification published by the manufacturer.

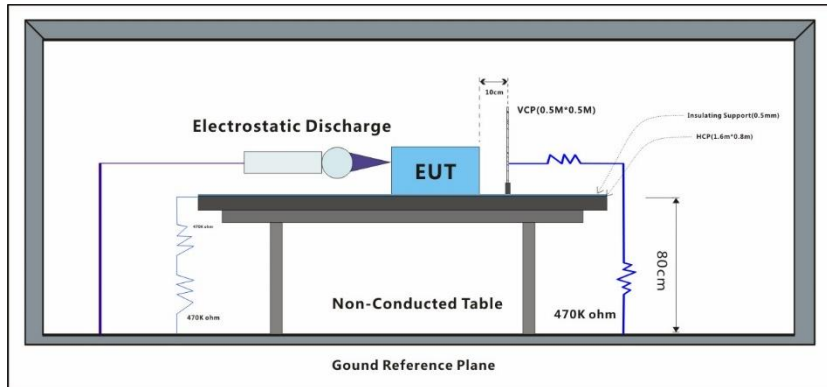


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7.2 Electrostatic Discharge

Test Requirement: IEC/EN 60945 :2002 clause 10.9
 Test Method: EN 61000-4-2:2009

7.2.1 Test Setup Diagram



7.2.2 E.U.T. Operation

Operating Environment:

Temperature: 25 °C Humidity: 51 % RH Atmospheric Pressure: 1000 mbar

7.2.3 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	05	On mode, keep EUT working normally.
Final test	06	Idle mode, Keep the EUT at standby mode.

7.2.4 Test Condition and Results:

Performance Criterion: B

Discharge Impedance: 330Ω/150pF

Number of Discharge: Minimum 10 times at each test point

Discharge Mode: Single Discharge

Discharge Period: 1 second minimum

Test Point: 1. All insulated enclosure and seams.

2. All accessible metal parts of the enclosure.

3. All side



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Discharge type	Level (kV)	Polarity	Test Point	Result / Observations
Air Discharge	2,4,8	+	1	A
Air Discharge	2,4,8	-	1	A
Contact Discharge	6	+	2	A
Contact Discharge	6	-	2	A
Horizontal Coupling	4	+	3	A
Horizontal Coupling	4	-	3	A
Vertical Coupling	4	+	3	A
Vertical Coupling	4	-	3	A

Results:

A: No degradation in the performance of the EUT was observed.

No false alarms or other malfunctions were observed during or after the test.

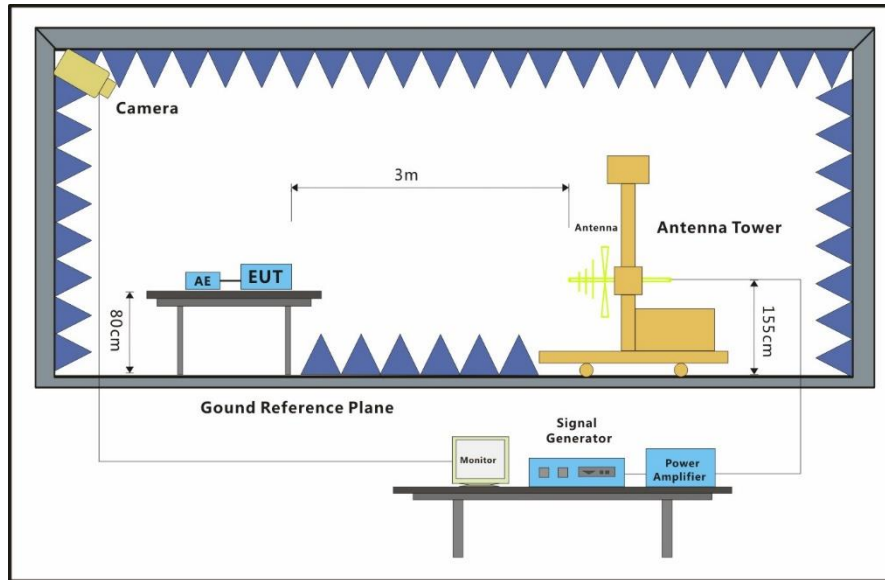


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7.3 Radiated Immunity (80MHz-2GHz)

Test Requirement: IEC/EN 60945 :2002 clause 10.4
 Test Method: EN 61000-4-3:2006+A1:2008+A2:2010

7.3.1 Test Setup Diagram



7.3.2 E.U.T. Operation

Operating Environment:
 Temperature: 25 °C Humidity: 51 % RH Atmospheric Pressure: 1000 mbar

7.3.3 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	05	On mode, keep EUT working normally.
Final test	06	Idle mode, Keep the EUT at standby mode.

7.3.4 Test Condition and Results:

Performance Criterion: A
 Frequency Range: 80MHz to 2GHz
 Antenna Polarisation: Vertical and Horizontal
 Modulation: 400Hz,80% Amp. Mod,10% increment



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Frequency	Level (V/m)	EUT Face	Dwell time	Result / Observations
80MHz-2GHz	10	Front	2s	A
80MHz-2GHz	10	Back	2s	A
80MHz-2GHz	10	Left	2s	A
80MHz-2GHz	10	Right	2s	A
80MHz-2GHz	10	Top	2s	A
80MHz-2GHz	10	Underside	2s	A

A: No degradation in the performance of the EUT was observed
 No false alarms or other malfunctions were observed during or after the test.

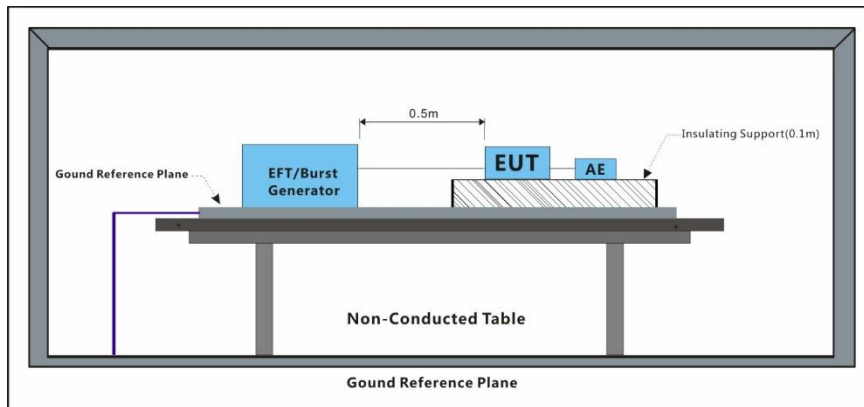


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7.4 Electrical Fast Transients-Burst at Power Port

Test Requirement: IEC/EN 60945 :2002 clause 10.5
 Test Method: EN 61000-4-4:2012

7.4.1 Test Setup Diagram



7.4.2 E.U.T. Operation

Operating Environment:
 Temperature: 21.7 °C Humidity: 76.9 % RH Atmospheric Pressure: 1000 mbar

7.4.3 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	05	On mode, keep EUT working normally.
Final test	06	Idle mode, Keep the EUT at standby mode.

7.4.4 Test Condition and Results:

Performance Criterion: B
 Repetition Frequency: 5kHz
 Burst Period: 300ms
 Test Duration: 3 minute per level & polarity

Test Line	Level (kV)	Polarity	CDN/Clamp	Result / Observations
DC power port	1	+	CDN	A
DC power port	1	-	CDN	A

A: No degradation in the performance of the EUT was observed
 No false alarms or other malfunctions were observed during or after the test.

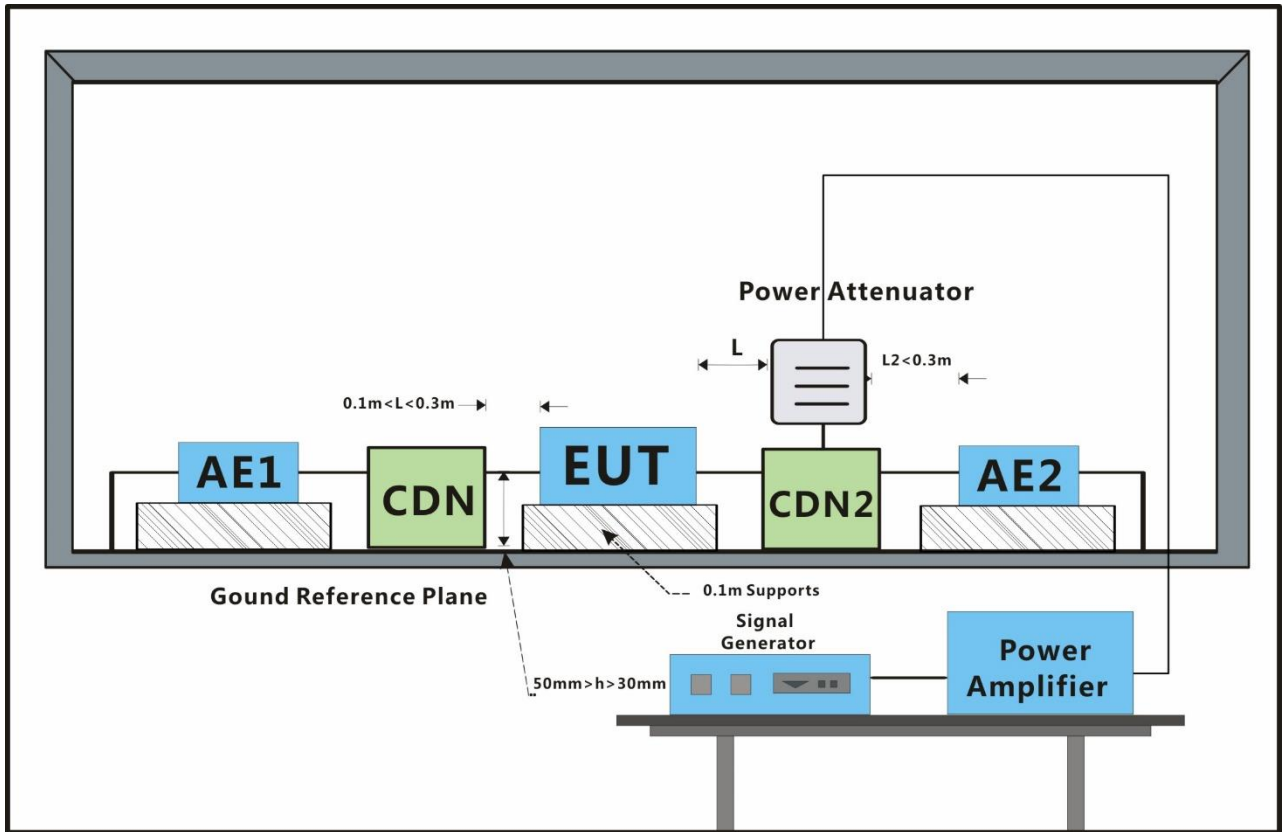


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7.5 Conducted Immunity at Power port (150kHz-80MHz)

Test Requirement: IEC/EN 60945 :2002 clause 10.3
 Test Method: EN 61000-4-6:2014

7.5.1 Test Setup Diagram



7.5.2 E.U.T. Operation

Operating Environment:
 Temperature: 21.7 °C Humidity: 76.9 % RH Atmospheric Pressure: 1000 mbar

7.5.3 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	05	On mode, keep EUT working normally.
Final test	06	Idle mode, Keep the EUT at standby mode.

7.5.4 Test Condition and Results:

Performance Criterion: A
 Frequency Range: 0.15MHz to 80MHz
 Modulation: 80%, 400Hz Amplitude Modulation
 Step Size: 1%



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Frequency Range	Level (Vrms)	CDN/Clamp	Dwell time	Result / Observations
150KHz to 80MHz	3	CDN	2s	A
2MHz	10	CDN	2s	A
3MHz	10	CDN	2s	A
4MHz	10	CDN	2s	A
6.2MHz	10	CDN	2s	A
8.2MHz	10	CDN	2s	A
12.6MHz	10	CDN	2s	A
16.5MHz	10	CDN	2s	A
18.8MHz	10	CDN	2s	A
22MHz	10	CDN	2s	A
25MHz	10	CDN	2s	A

A: No degradation in the performance of the EUT was observed
 No false alarms or other malfunctions were observed during or after the test.

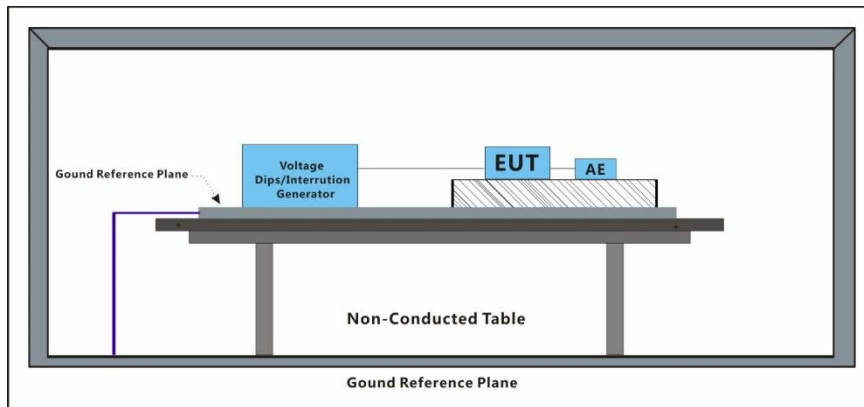


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7.6 Power Supply Failure

Test Requirement: IEC/EN 60945 :2002 clause 10.3
 Test Method: EN 61000-4-11:2004 +A1:2017

7.6.1 Test Setup Diagram



7.6.2 E.U.T. Operation

Operating Environment:
 Temperature: 21.8 °C Humidity: 76.8 % RH Atmospheric Pressure: 1000 mbar

7.6.3 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	05	On mode, keep EUT working normally.
Final test	06	Idle mode, Keep the EUT at standby mode.

7.6.4 Test Condition and Results:

Performance Criterion: C
 Test duration time: 60s
 Requirement: 3Times

Voltage (& Reduction)	Duration(Sec)	Performance Criterion	Observation	Test Result
100	60	C	Note1	A

Note1: During power supply failure tests, EUT operates automatically and normally each time after power is restored.

A: No degradation in the performance of the EUT was observed

No false alarms or other malfunctions were observed during or after the test.

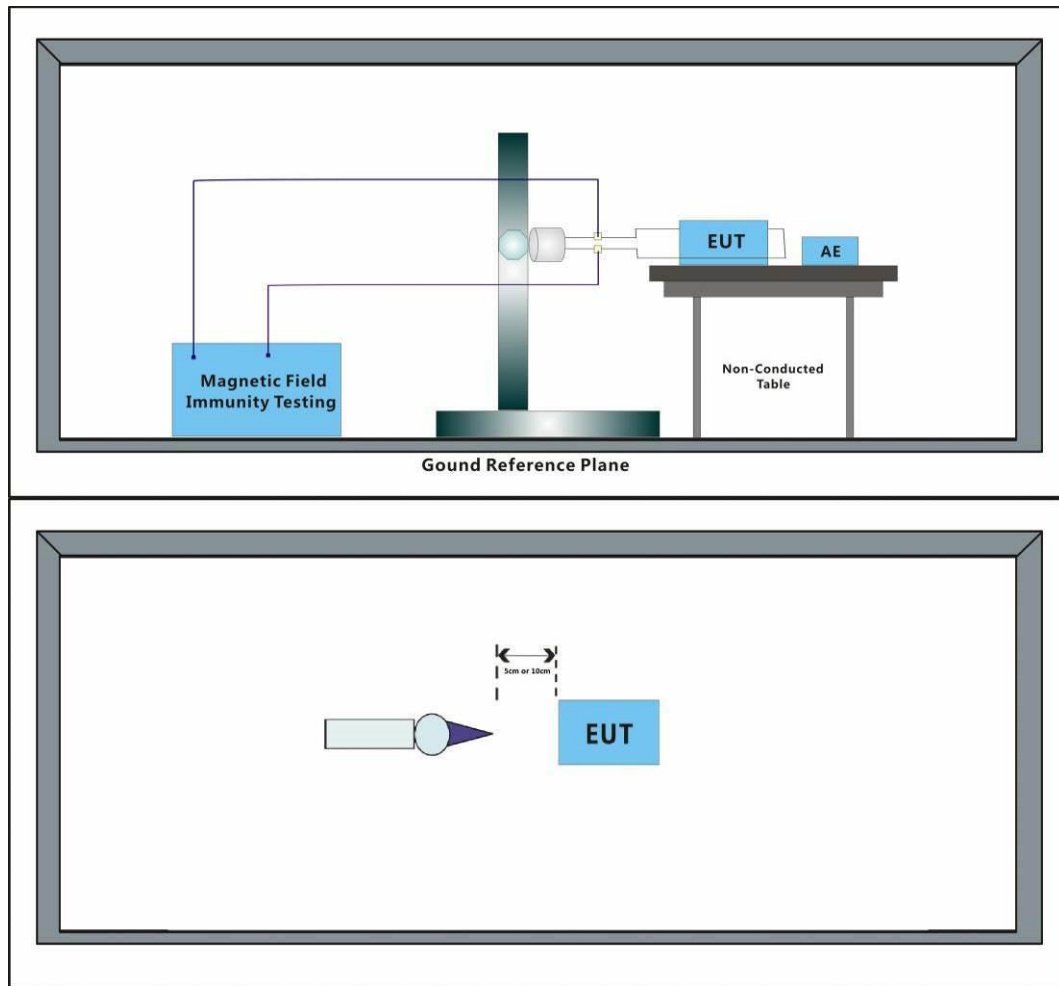


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7.7 Compass Safe Distance

Test Requirement: IEC/EN 60945 :2002 clause 11.2
 Test Method: EN 61000-4-8:2010 & ISO 694:2001

7.7.1 Test Setup Diagram



7.7.2 E.U.T. Operation

Operating Environment:

Temperature: 21.8 °C Humidity: 76.8 % RH Atmospheric Pressure: 1000 mbar

7.7.1 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	06	Idle mode, Keep the EUT at standby mode.
Final test	07	Power Off, keep the EUT unpowered.
Final test	08	Power On, Keep the EUT powered.



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7.7.2 Test Condition and Results:

Compass safe distance is the distance between the nearest point of the EUT and the subject compass, where an unacceptable compass deviation occur.

For a standard compass, the horizontal magnetic flux shall be less than 0.942 mGauss (compass deviation of 5.4°/H).

For a steering/standby/emergency compass, the horizontal magnetic flux shall be less than 3.142 mGauss (compass deviation of 18°/H).

The compass safe distance is measured with a DC milligaussmeter. The EUT is first rotated to determine the worst case direction. Secondly the EUT is moved towards/away from the measurement probe until the required field is measured. The distance is then measured.

EUT mode	Front	Rear	Left	Right	Top	Bottom
Power Off	5cm	5cm	5cm	5cm	10cm	5cm
Power On	5cm	5cm	5cm	5cm	10cm	5cm
Normalised	5cm	5cm	5cm	5cm	10cm	5cm

Note:

All distances rounded up to the nearest 5cm or 10cm.

The EUT was measured before after being normalized, it was normalised by placing it in a Helmholtz coil and applying a a d.c. field of $1 \times 1\,000 / 4\pi$ A/m with a superimposed stabilizing a.c. field of 50 Hz of $18 \times 1\,000 / 4\pi$ A/m r.m.s.



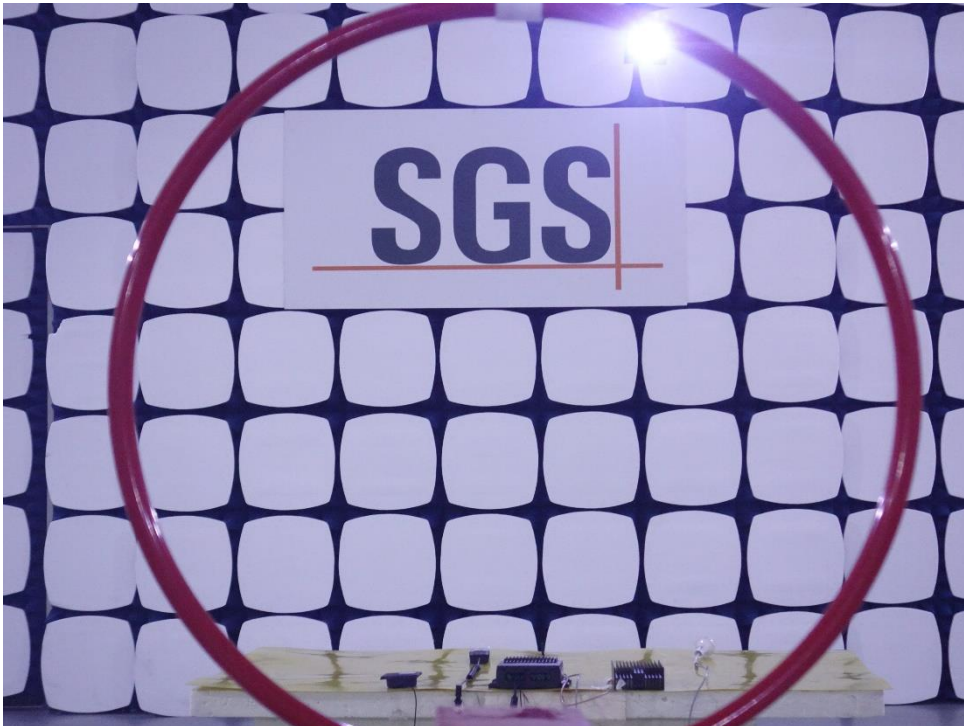
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8 Test Setup Photo

Conducted Emissions at DC Power Input Port (150kHz-30MHz)

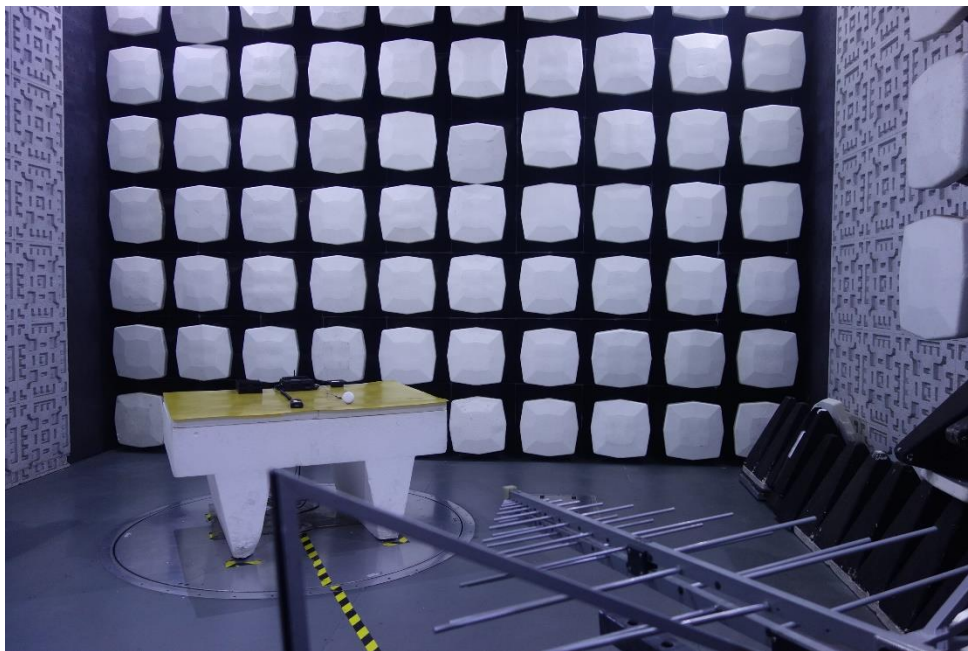


Radiated Emissions (Below 30MHz)

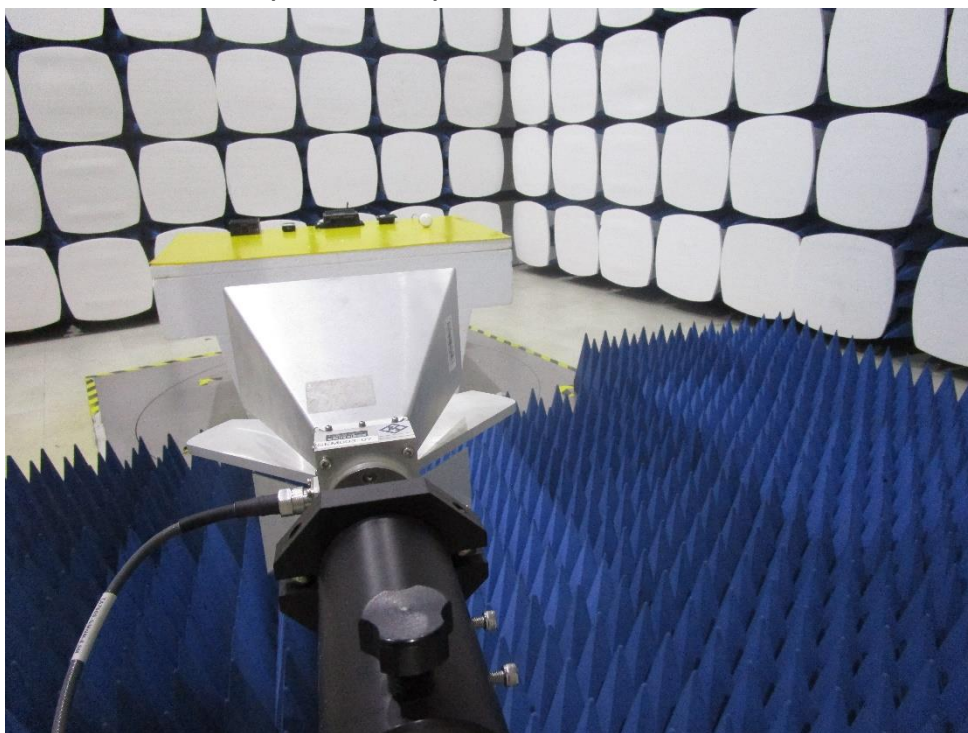


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Radiated Emissions (Below 1GHz)



Radiated Emissions (Above 1GHz)



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Electrostatic Discharge



Radiated Immunity (80MHz-2GHz)



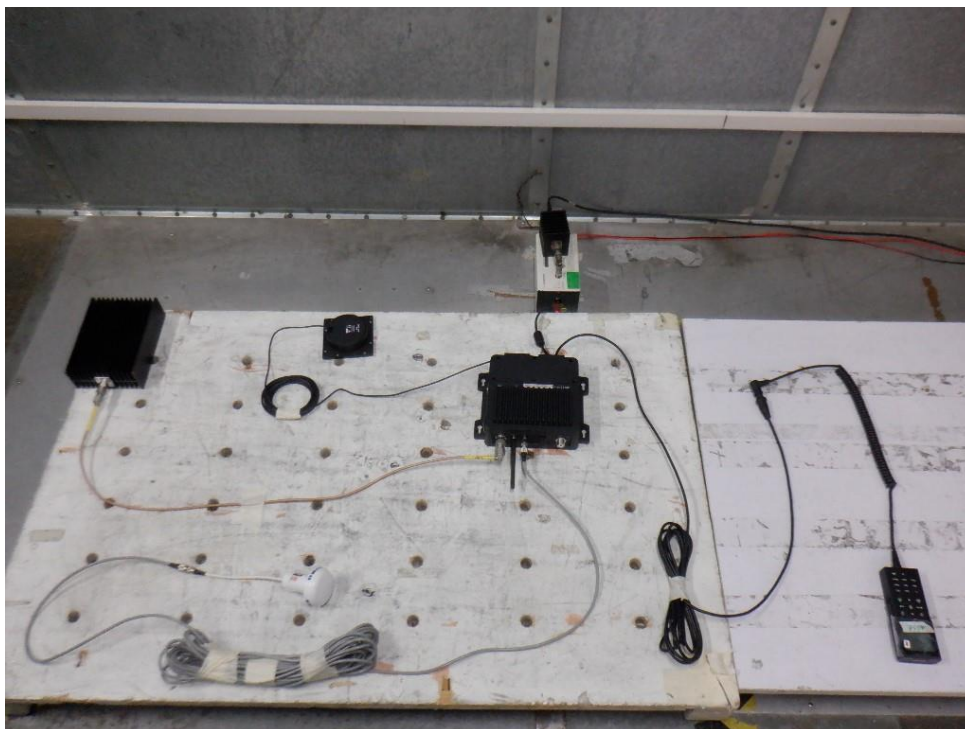
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Electrical Fast Transients-Burst at Power Port



Conducted Immunity at Power port (150kHz-80MHz)



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Power Supply Failure

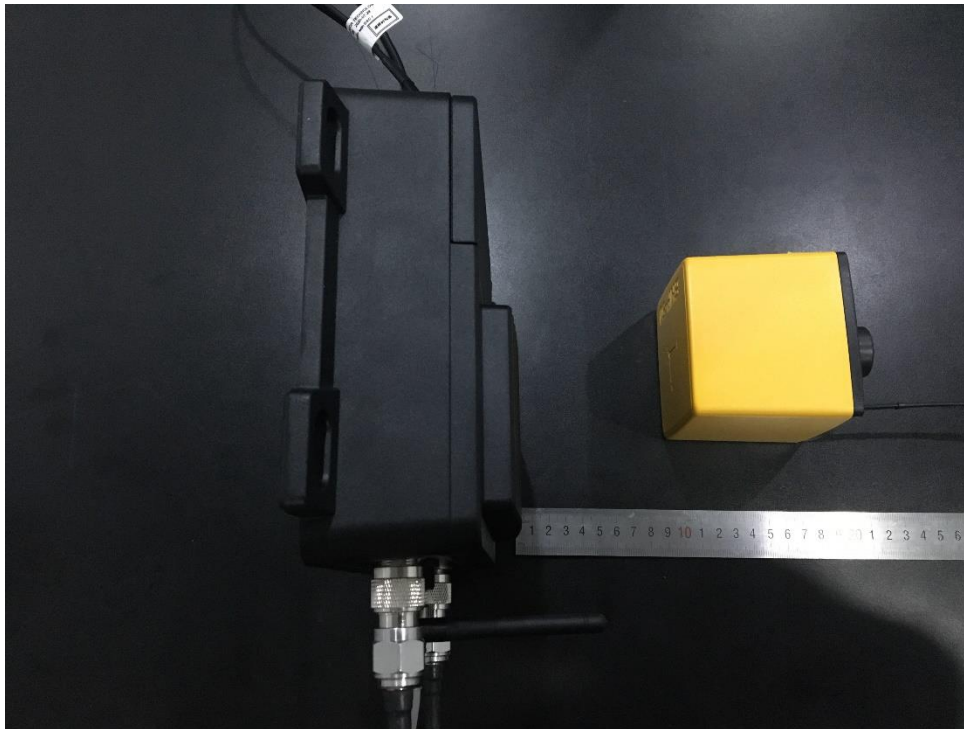


Compass Safe Distance—General Setup

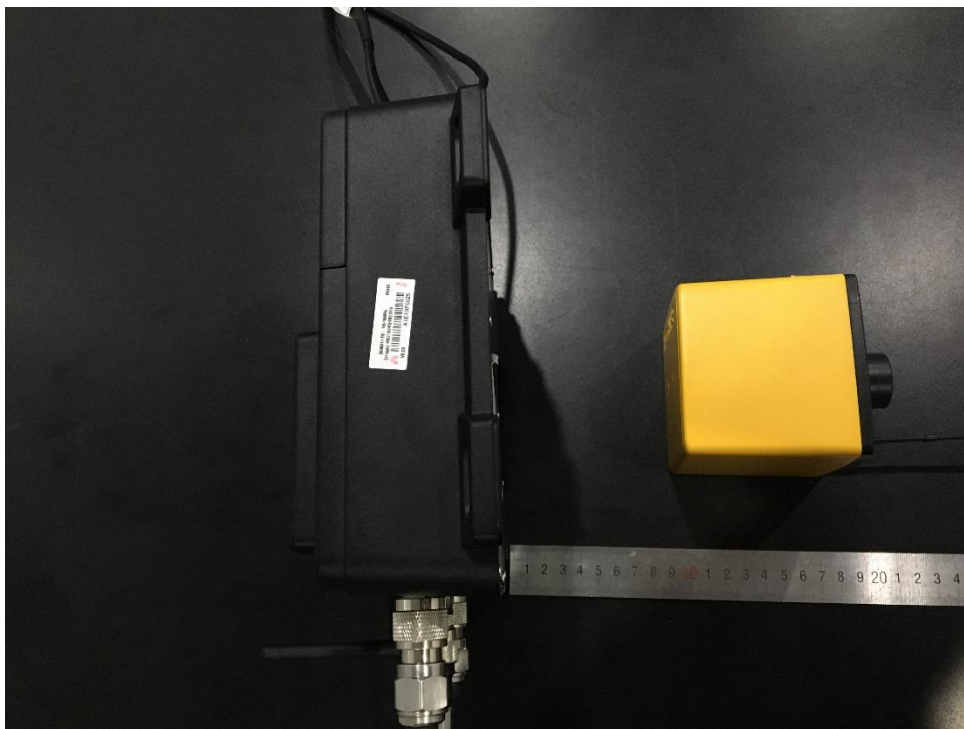


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Compass Safe Distance—Front Setup



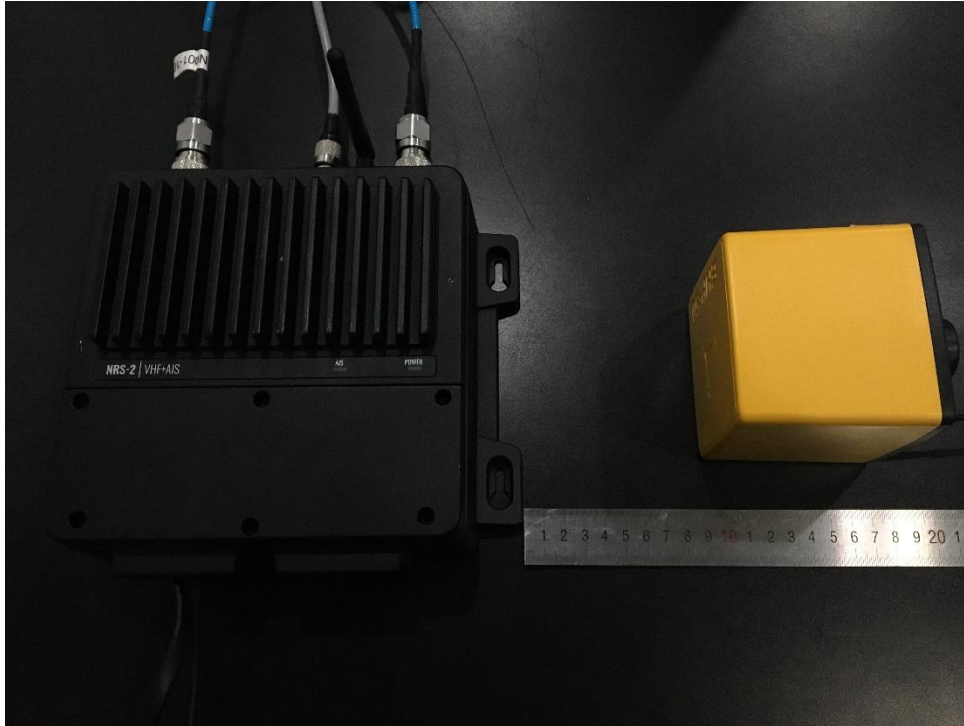
Compass Safe Distance—Rear Setup



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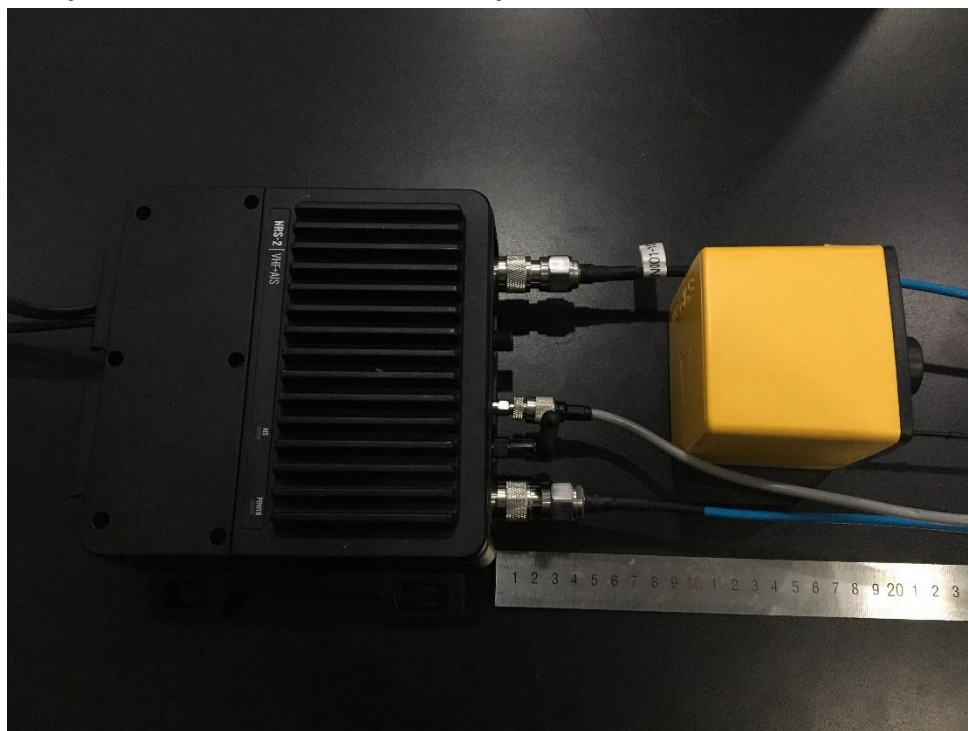
Compass Safe Distance—Left Setup



Compass Safe Distance—Right Setup



Compass Safe Distance—Bottom Setup



9 EUT Constructional Details (EUT Photos)

Refer to Appendix A - Photographs of EUT Constructional Details for SZEM2007006017CR.

- End of the Report -