RF - TEST REPORT

Report Number	:	**68.950.17.020.01**	Date of Issue:	**April 14, 2017**
Model	:	**MRHH600FLTGPSBT, MRHH600WFLTGPSBT**		
Product Type	:	MR HH600 GPS BT		
Applicant/man	:	Cobra Electronics Corporation		
Address	:	6500 West Cortland Street Chicago, IL		
Manufacturer	:	XIN XING GREAT SUCCESS PLASTIC PRODUCTS LIMITED		
Address	:	Building A, District 1, B2-02, Xincheng Industrial Park, Xinxing, YunFu, Guangdong, P.R.C		
Test Result	:	■ **Positive** ☐ **Negative**		
Total pages including Appendices	:	**69**		

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1 Report Version

Revision	Release Date	History/Memo.
1.0	April 14, 2017	Initial Release

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2 General Information

2.1 Notes

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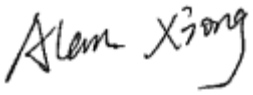
Prepared by	2017-04-14	Alan Xiong	
Project Engineer	Date	Name	Signature
Approved by	2017-04-14	John Zhi	
Section Manager	Date	Name	Signature

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2.2 Testing Laboratory

Test Site 1:

TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
Address: Building 12&13, Zhiheng Wisdomland Business Park,
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Shenzhen City, 518052,
P. R. China,
Phone: +86-755-8828 6998
Fax: +86-755-8828 5299

Test Site 2:

SHENZHEN HUATONGWEI INTERNATIONAL INSPECTIONAL CO.，LTD.
Address: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao,
Gongming, Shenzhen, China
Phone: +86-755-26748019
Fax: +86-755-26748089

Remark: All test items were performed at site 2.

2.3 Details of Applicant

Client:	Cobra Electronics Corporation
Address:	6500 West Cortland Street Chicago, IL
Product Description:	MR HH600 GPS BT
Submitted Model No.:	MRHH600FLTGPSBT, MRHH600WFLTGPSBT
Brand Name:	Cobra MARINE

2.4 Application Details

Date of receipt of order:	November 24, 2016
Date of receipt of test item:	November 24, 2016
Date of test:	November 24, 2016 – December 26, 2016

2.5 Test Item

Refer to table 1

2.6 Applied Standard

IEC 61097-3:1996	Global maritime distress and safety system (GMDSS) Part 3: Digital selective calling (DSC) equipment Operational and performance requirements, methods of testing and required testing results
IEC 61097-8:1998	Global maritime distress and safety system (GMDSS) Part 8: Shipborne watch keeping receivers for the reception of digital selective calling (DSC) in the maritime MF, MF/HF and VHF bands –Operational and performance requirements, methods of testing and required test results

2.7 Test Summary

Table 1. Summary of results

Technical requirements			
Transmitter Requirement			
Test item	**Standards requirement IEC 61097-3**	**Result**	
		Pass	**N/A**
Frequency error	Sub-clause5.4.1	☒	☐
Calling Sensitivity	Sub-clause5.4.2	☒	☐
Nominal modulation rate	Sub-clause5.4.3	☒	☐
Residual modulation	Sub-clause5.4.4	☒	☐
Unwanted spectral components of the output signal of non-integrated equipment	Sub-clause5.4.5	☒	☐
Test item	**Standards requirement IEC 61097-3**	**Result**	
		Pass	**Pass**
Durability and resistance to environmental conditions	Sub-clause5.1	☒	☐
Protection of the antenna input circuit	Sub-clause5.2	☒	☐
Frequency bands and channels	Sub-clause5.3	☒	☐
Mode of reception	Sub-clause5.4	☒	☐
Scanning receivers	Sub-clause5.5	☒	☐
Calling sensitivity	Sub-clause5.6	☒	☐
Adjacent channel selectivity	Sub-clause5.7	☒	☐
Co-channel rejection	Sub-clause5.8	☒	☐
Intermodulation response .	Sub-clause5.9	☒	☐
Interference rejection, spurious response and blocking immunity	Sub-clause5.10	☒	☐
Dynamic range	Sub-clause5.11	☒	☐
Conducted spurious emissions into the antenna	Sub-clause5.12	☒	☐
Frequency stability	Sub-clause5.13	☒	☐

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Environmental Test Requirement			
Test item	Standards requirement (IEC 61097-8)	Result	
		Pass	N/A
Vibration tests	Sub-clause 7.3	☒	☐
Temperature tests	Sub-clause 7.4	☒	☐
Corrosion test	Sub-clause 7.5	☒	☐
EMC Test Requirement			
Test item	Standards requirement EN60945 (IEC 61097-8)	☒	☐
Conducted Emissions	Clause 9.2	☒	☐
Radiated Emissions Enclosure Port	Clause 9.3	☒	☐
Immunity To Continuous Conducted Interference	Clause 10.3	☒	☐
Immunity To Radiated Electromagnetic Fields	Clause 10.4	☒	☐
Immunity To Electrical Fast Transient Bursts	Clause 10.5	☒	☐
Immunity To Surges (all equipment categories except portable)	Clause 10.6	☐	☒
Immunity to power supply short-term variation (all equipment categories except portable)	Clause 10.7	☐	☒
Immunity to power supply failure (all equipment categories except portable)	Clause 10.8	☐	☒
Immunity To Electrostatic Discharge	Clause 10.9	☒	☐

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3 Equipment Specification

3.1 General Description

The Equipment Under Test (EUT) is a VHF transceiver for the maritime mobile service with buletooth and GPS receive function.

3.2 Technical Data

Name of EUT:	MR HH600 GPS BT			
Trade mark:	Cobra MARINE			
Model/Type reference:	For Radio: MRHH600FLTGPSBT, MRHH600WFLTGPSBT For Charging Cradle: CM 110-032			
Power supply:	7.4Vdc 2000mAh supplied by rechargeable battery			
Battery information:	Model: FT704159P			
Adapter information:	Model: ASSA55W-120100 Input: 100-240Va.c., 50/60Hz, 0.45A Output:12Vd.c.,1.0A			
Car Charger:	Input: 12Vdc, 1.0A Output:12Vdc.,1.0A			
Hardware version:	V2.0			
Software version:	0.27			
Marine Radio				
Operation Frequency Range:	TX:156.050MHz to 157.425MHz			
	RX:156.050MHz to 162.000MHz			
Rated Output Power:	☒ High Power:	5W (36.98dBm)	☒ Low Power	1W (30.00dBm)
Modulation Type:	Analog Voice:	PM		
	Digital Data(DSC):	FSK		
Channel Separation:	Analog Voice:	25kHz		
	Digital Data(DSC):	25kHz		
Emission Designator:	Analog Voice:	16K0G3E		
	Digital Data(DSC):	16K0G2B		
Maximum Transmitter Power:	Analog Voice:	5.77W		
	Digital Data(DSC):	5.42W		
Antenna Type:	External			

Remark 1: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
Remark 2: As per Client Declaration, MRHH600FLTGPSBT and MRHH600WFLTGPSBT are identical, only the cosmetics have different color, so we use MRHH600FLTGPSBT as a representative to perform all testing.

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3.3 Test frequency list

Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	
			TX	RX
Analog Voice/PM	25kHz	CH_L (CH60)	156.025	160.625
		CH_M(CH16)	156.800	156.800
		CH_H(CH88)	157.425	157.425

Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	
			TX	RX
Digital Data(DSC) / FSK	25kHz	CH_{M1} (CH70)	156.525	156.525

Note: The Product channel frequency table: International Marine VHF Channels and Frequencies:

Channel	TX Frequency (MHz)	RX Frequency (MHz)	Channel	TX Frequency (MHz)	RX Frequency (MHz)
1	156.05	160.65	60	156.025	160.625
2	156.1	160.7	61	156.075	160.675
3	156.15	160.75	62	156.125	160.725
4	156.2	160.8	63	156.175	160.775
5	156.25	160.85	64	156.225	160.825
6	156.3	156.3	65	156.275	160.875
7	156.35	160.95	66	156.325	160.925
8	156.4	156.4	67	156.375	156.375
9	156.45	156.45	68	156.425	156.425
10	156.5	156.5	69	156.475	156.475
11	156.55	156.55	71	156.575	156.575
12	156.6	156.6	72	156.625	156.625
13	156.65	156.65	73	156.675	156.675
14	156.7	156.7	74	156.725	156.725
15	156.75	156.75	75	156.775	156.775
16	156.8	156.8	76	156.825	156.825
17	156.85	156.85	77	156.875	156.875
18	156.9	161.5	78	156.925	161.525
19	156.95	161.55	79	156.975	161.575
20	157	161.6	80	157.025	161.625
21	157.05	161.65	81	157.075	161.675
22	157.1	161.7	82	157.125	161.725
23	157.15	161.75	83	157.175	161.775
24	157.2	161.8	84	157.225	161.825
25	157.25	161.85	85	157.275	161.875
26	157.3	161.9	86	157.325	161.925
27	157.35	161.95	87	157.375	157.375
28	157.4	162	88	157.425	157.425
70	156.525	156.525	-	-	-

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3.4 EUT operation mode

Test mode	Transmitting	Receiving	Power level		Analog Voice/PM
			High	Low	25kHz
TX1	√		√		√
TX2	√			√	√
RX1		√			√

Test mode	Transmitting	Receiving	States			Digital Data(DSC)/FSK
			B	Y	B+Y	25kHz
TX3	√		√			√
TX4	√			√		√
TX5	√				√	√
RX2		√				√

√: is operation mode.

3.5 Environmental conditions

Normal Condition	Temperature	15 °C to 35 °C	
	Relative humidity	20 % to 75 %.	
	Voltage	☐Mains voltage	Nominal mains voltage
		☐Lead-acid battery	1.1 * the nominal voltage of the battery
		☒Other	the normal test voltage shall be that declared by the equipment provider
Extreme Condition	Temperature	☒ -20°C to +55 °C	
	Voltage	☐Mains voltage	±10 %* the nominal mains voltage
		☐Lead-acid battery	1,3 and 0,9 multiplied by the nominal voltage of the battery
		☒Leclanché or the lithium battery	Lower extreme voltage: 0.85*the nominal voltage upper extreme voltage: the terminal voltage of the battery (fresh primary battery or fully charged secondary battery) when loaded by the equipment at normal temperature in the receive condition with the squelch operated to mute the audio.
		☐Nickel-cadmium battery	Lower extreme voltage: 0.9*the nominal voltage upper extreme voltage: declared by the equipment provider
		☐Other	the normal test voltage shall be that declared by the equipment provider

power supply	**DC 7.4V**	
Normal Condition	Vn=nominal Voltage	DC 7.40V
	Tn=normal Temperature	25°C
Extreme Condition	V_L=lower Voltage	DC 6.29V
	T_L=lower Temperature	-20°C
	V_H=higher Voltage	DC 8.40V
	T_H=higher Temperature	55°C

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4 Technical Requirements and Results

4.1 Transmitter Requirements of IEC61097-3

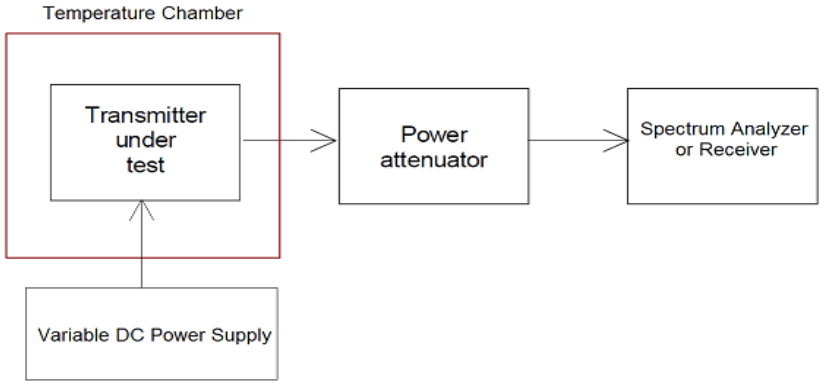
4.1.1 Frequency Error

The frequency error is the difference between the measured carrier frequency and its nominal value.

Limit

IEC 61097-3 Sub-clause 5.4.1.3
The frequency error shall be within ±10 Hz of 1.3 kHz and 2.1kHz respectively.

Test configuration



Test procedure

1. The test conditions.
☒ normal condition ☒ Extreme conditions
2. Please refer to IEC 61097-3 Sub-clause 5.4.1.2 for the measurement method.

Test mode

Please reference to the section 3.4

Test results

☒ Passed ☐ Not Applicable
Please refer to the below test data:

Operation Mode	Test conditions		Frequency Error (kHz)			Limit (kHz)	Result
	Temperature (℃)	Voltage (V)	CH_L(KHz)	CH_M(KHz)	CH_H(KHz)		
TX1	Tn	Vn	0.119	0.061	0.059	1.29 to 1.310	Pass
	V_L	V_H	0.018	0.058	0.057		
		V_L	0.019	0.015	0.016		
	T_H	V_H	0.017	0.014	0.018		
		V_L	0.018	0.017	0.016		

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Operation Mode	Test conditions		Frequency Error (kHz)			Limit (kHz)	Result
	Temperature (℃)	Voltage (V)	CH_L(KHz)	CH_M(KHz)	CH_H(KHz)		
TX2	Tn	Vn	0.115	0.053	0.054	1.29 to 1.310	Pass
	V_L	V_H	0.110	0.051	0.052		
		V_L	0.106	0.049	0.050		
	T_H	V_H	0.101	0.047	0.048		
		V_L	0.097	0.045	0.046		

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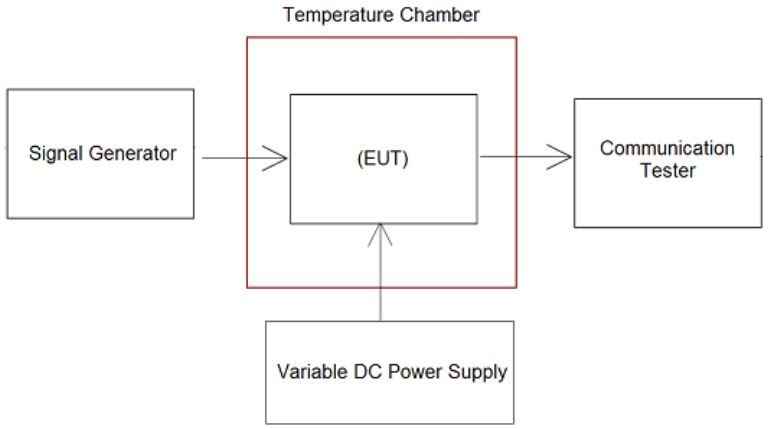
4.1.2 Calling Sensitivity

The sensitivity of the receiver shall be such as to obtain an output character error rate of 10^{-2} or less for an input signal of +5 dBμV(e.m.f.) on MF and 0 dBμV (e.m.f.) on HF and VHF (A.804/C.3, A.806/C.3).
To determine the maximum usable sensitivity as the minimum level of the signal (e.m.f.) at the nominal frequency of the receiver which, when applied to the receiver input with a standard test signal, will produce a specified BER.

Limit

The sensitivity shall be less than or equal to 10dB S/N.
For integrated equipment the sensitivity shall be less than 0 dBμV EMF.

Test configuration



Test procedure

1. The test conditions.
☒ normal condition ☒ Extreme conditions
2. Please refer to IEC 61097-3 Sub-clause 5.4.2.2 for the measurement method.

Test mode
Please reference to the section 3.4

Test results

☒ Passed ☐ Not Applicable
Please refer to the below test data:

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Operation Mode	Temperature (℃)	Voltage (V)	Test Channel	Measured (dBuV)	Limit (dB)	Result
RX1	Tn	Vn	CH_L	-3.70	≤ 0	Pass
			CH_M	-4.70		
			CH_H	-3.00		
	T_L	V_H	CH_L	-3.59	≤ 0	
			CH_M	-4.56		
			CH_H	-2.91		
		V_L	CH_L	-3.63		
			CH_M	-4.61		
			CH_H	-2.94		
	T_H	V_H	CH_L	-3.66		
			CH_M	-4.65		
			CH_H	-2.97		
		V_L	CH_L	-3.64		
			CH_M	-4.32		
			CH_H	-3.24		

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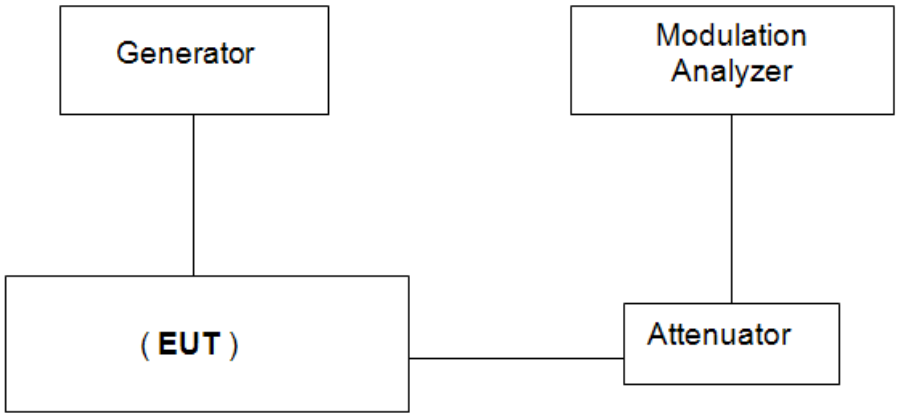
4.1.3 Nominal modulation rate

The modulation rate is the bit stream speed measured in bit/s.

Limit

IEC 61097-3 Sub-clause 5.4.3.3
The frequency shall be 600 Hz ± 30 ppm corresponding to a modulation rate of 1 200 baud.

Test configuration



Test procedure

1. The test conditions.
☒ normal condition ☐ Extreme conditions

2. Please refer to IEC 61097-3 Sub-clause 5.4.3.2 for the measurement method.

Test mode
Please reference to the section 3.4

Test results

☒ **Passed** ☐ **Not Applicable**

Operation Mode	Test Channel	Modulation rate (Hz)	Limit	Result
TX5	CH_{M1}	454.320	600Hz ± 30 ppm	Pass

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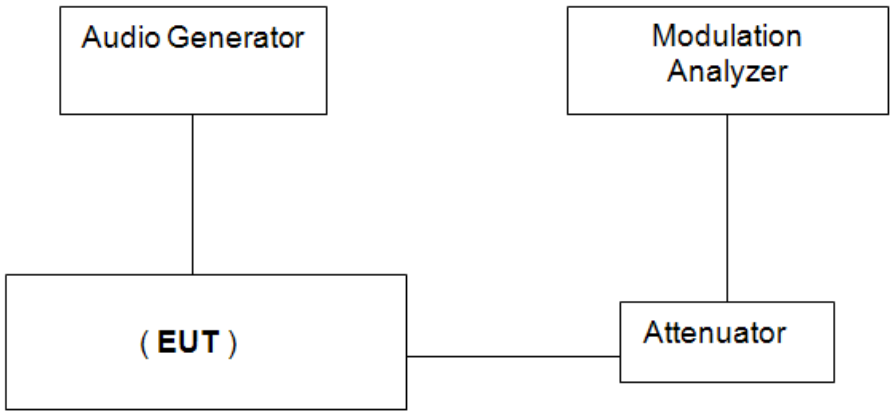
4.1.4 Residual modulation of the transmitter

The residual modulation of the transmitter is the ratio, in dB, of the demodulated RF signal in the absence of wanted modulation, to the demodulated RF signal produced when the normal test modulation is applied.

Limit

IEC 61097-3 Sub-clause 5.4.4
The residual modulation shall not exceed -36 dB(non-integrated equipment) and -26 dB(integrated equipment) on either 25 kHz or 12,5 kHz channels.

Test configuration



Test procedure

1. The test conditions.
☒ normal condition ☐ Extreme conditions

2. Please refer to IEC 61097-3 Sub-clause 5.4.4.2 for the measurement method.

Test mode
Please reference to the section 3.4

Test results

☒ Passed ☐ Not Applicable

Operation Mode	Test Channel	Measured (dB)	Limit (dB)	Result
TX1	CH_L	-43.12	⩽-36	Pass
	CH_M	-43.35		
	CH_H	-43.61		

Operation Mode	Test Channel	Measured (dB)	Limit (dB)	Result
TX2	CH_L	-43.75	⩽-36	Pass
	CH_M	-43.41		
	CH_H	-43.59		

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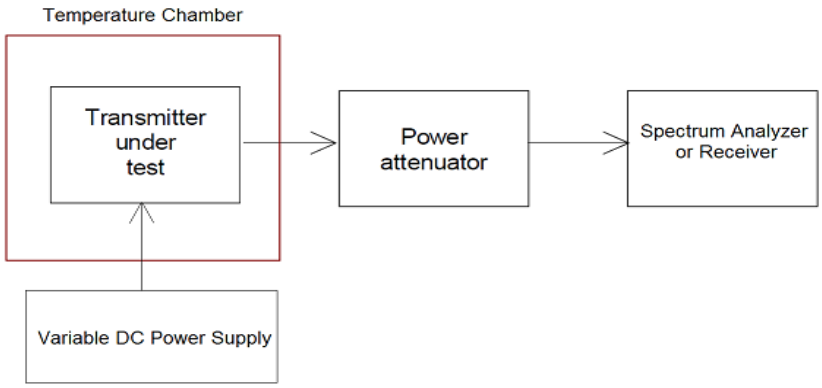
4.1.5 Unwanted spectral components of the output signal of non-integrated equipment

Unwanted spectral components are emissions on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Unwanted spectral components include harmonic spectral components and intermodulation products.

Limit
IEC 61097-3 Sub-clause 5.4.5.3 figure 2

Test configuration



Test procedure

1. The test conditions.
☒ normal condition ☐ Extreme conditions
2. Please refer to IEC 61097-3 Sub-clause 5.4.5.2 for the measurement method.

Test mode:
Please reference to the section 3.4

Test results

☒ **Passed** ☐ **Not Applicable**

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Building 12&13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District,
Shenzhen City, 518052, P. R. China Tel. +86 755 8828 6998, Fax: +86 755 8828 5299

Please refer to the below test data:

Unwanted Frequency (KHz)	Spurious emission level(dB)	Limit
0.5	-0.51	0.5kHz to2.9kHz: 0dB 2.9kHz to 4.1kHz:-9dB to -25dB 4.1kHz to 6.9kHz:-25dB to -47dB 6.9kHz to 11.3kHz:-47dB to -60dB
1.5	-0.50	
2.9	-0.53	
3.0	-16.70	
4.0	-26.32	
4.1	-27.23	
5.0	-45.33	
6.0	-46.34	
6.9	-48.13	
7.0	-52.1	
8.0	-54.34	
9.0	-56.43	
10.0	-57.32	
11.0	-59.12	
11.3	61.32	

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4.2 Transmitter Requirements of IEC61097-8

4.2.1 Durability and resistance to environmental conditions

Test results:
Complies
Remark: Manufacturer declared the equipment is capable of continuous operation under the conditions of various sea states, vibration, humidity and of temperature likely to be experienced in ships (A.694/5).

4.2.2 Protection of the antenna input circuit

The receiver shall not suffer damage when an unmodulated radiofrequency signal at an input level of 30 V r.m.s. at any frequency in the range 100 kHz to 27,5 MHz is applied to its antenna input terminal for a period of 15 min.

Test results:
Complies

4.2.3 Frequency bands and channels

The equipment can be designed as a single-frequency receiver, as a multiple-frequency receiver or as a scanning receiver in one or more of the frequency bands:
MF: 1 605 kHz to 4 000 kHz;
HF: 4 MHz to 27,5 MHz;
VHF: 156 MHz to 174 MHz.
Test results:
Complies VHF 156MHz to 174 MHz.

4.2.4 Mode of reception

Equipment for reception of MF and HF DSC transmissions shall provide for classes of emission F1B or J2B (A.804/C.1.3, A.806/C.1.3).
Equipment for reception of VHF DSC transmissions shall provide for class of emission G2B (see RR appendix 19) (A. 803/3.4).

Test results:
Complies

4.2.5 Scanning receivers

The scanning receiver shall be provided with means for stop and start of the scanning under the control of an external DSC equipment. Such control may be provided by either:
- a stop/start signal in accordance with recommendation ITU-T V.11. The stop signal shall be logic 0 and the start signal shall be logic 1; or
- by direct frequency commands in accordance with IEC 61162-1, or both.

The selected receiver frequency shall be clearly identifiable

Test results:
Complies

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4.2.6 Calling sensitivity

The sensitivity of the receiver shall be such as to obtain an output character error rate of 10–2 or less for an input signal of +5 dBµV (e.m.f.) on MF and 0 dBµV (e.m.f.) on HF and VHF (A.804/C.3, A.806/C.3).

Test results:
Complies

Remark: the result same with IEC61097-3 sub-clause 5.4.2

4.2.7 Adjacent channel selectivity

The adjacent channel selectivity is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal which differs in frequency from the wanted signal by the nominal channel spacing.

The adjacent channel selectivity shall be 40 dB for MF/HF and 70 dB for VHF.

Test results:
Complies VHF 156MHz to 174 MHz.

Please refer to the below test data:

RX1						
Test Condition		Test Channel	Measurement Position	SG B – SG A (dB)	Limit (dB)	Result
Temperature (℃)	Voltage (V)					
Tn	Vn	CH_L	Lower adjacent	77.10	≥70	Pass
			Upper adjacent	76.35		
		CH_M	Lower adjacent	77.15		
			Upper adjacent	76.61		
		CH_H	Lower adjacent	77.04		
			Upper adjacent	76.40		
T_L	V_H	CH_L	Lower adjacent	75.56	≥60	Pass
			Upper adjacent	74.82		
		CH_M	Lower adjacent	75.61		
			Upper adjacent	75.08		
		CH_H	Lower adjacent	75.50		
			Upper adjacent	74.87		
	V_L	CH_L	Lower adjacent	74.79	≥60	Pass
			Upper adjacent	74.06		
		CH_M	Lower adjacent	74.84		
			Upper adjacent	74.31		

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		CH_H	Lower adjacent	74.73		
			Upper adjacent	74.11		
T_H	V_H	CH_L	Lower adjacent	76.33	≥60	Pass
			Upper adjacent	75.58		
		CH_M	Lower adjacent	76.38		
			Upper adjacent	75.84		
		CH_H	Lower adjacent	76.27		
			Upper adjacent	75.63		
	V_L	CH_L	Lower adjacent	75.68	≥60	Pass
			Upper adjacent	74.94		
		CH_M	Lower adjacent	75.72		
			Upper adjacent	75.19		
		CH_H	Lower adjacent	75.62		
			Upper adjacent	74.99		

4.2.8 Co-channel rejection

The co-channel rejection is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal, both signals being at the nominal frequency of the receiver.

The co-channel rejection ratio shall be between –10 dB and 0 dB.

Test results:
Complies VHF 156MHz to 174 MHz

Please refer to the below test data:

RX1				
Test Channel	Measurement Offset (kHz)	SG B – SG A (dB)	Limit (dB)	Result
CH_L	-3	-8.20	-10～0	Pass
	0	-8.31		
	3	-8.15		
CH_M	-3	-8.23	-10～0	Pass
	0	-8.52		
	3	-8.22		
CH_H	-3	-7.59	-10～0	Pass
	0	-8.42		
	3	-7.96		

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4.2.9 Intermodulation response

The intermodulation response is a measure of the capability of a receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of two or more unwanted signals with a specific frequency relationship to the wanted signal frequency.

The intermodulation response for MF and HF equipment shall be such as to obtain a specified BER at a level of +70 dBµV for each of the two unwanted input signals.
The intermodulation response ratio for VHF equipment shall be 65 dB (M.489/1.3.4).

Test results:
Complies VHF

Please refer to the below test data:

RX1					
Test Channel	Measurement Offset (kHz)		SG B/C – SG A (dB)	Limit (dB)	Result
	SG B	SG C			
CH_L	-50	-100	72.24	≥68	Pass
	50	100	72.30		
CH_M	-50	-100	73.07	≥68	Pass
	50	100	72.80		
CH_H	-50	-100	72.77	≥68	Pass

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4.2.10 Interference rejection, spurious response and blocking immunity

The interference rejection for MF and HF equipment shall be such as to obtain a specified BER at a level of the unwanted input signal of +60 dBµV.
The spurious response immunity for VHF equipment shall be 70 dB (M.489/1.3.3).
The blocking level shall be not less than +90 dBµV for MF/HF equipment and +93 dBµV for VHF equipment.

Test results:
Complies
Please refer to the below test data
For Interference rejection

RX1					
Test Channel	Relationship	Spurious Frequency (MHz)	SG B – SG A (dB)	Limit (dB)	Result
CH_L	f_{RF1}-f_{LO}/2	149.95	85.03	≥70	Pass
	f_{RF1}-2*f_{LO}	117.85	84.30		
	f_{LO}	21.4	84.49		
	2*f_{I1}-f_{LO}	257.1	84.89		
CH_M	f_{RF2}-f_{LO}/2	146.1	84.70	≥70	Pass
	f_{RF2}-2*f_{LO}	114	85.15		
	f_{LO}	21.4	84.96		
	2*f_{I2}-f_{LO}	249.4	85.13		
CH_H	f_{RF3}-f_{LO}/2	146.725	85.47	≥70	Pass
	f_{RF3}-2*f_{LO}	114.625	84.91		
	f_{LO}	21.4	85.06		
	2*f_{I3}-f_{LO}	250.65	85.15		

1) f_{RF1}=160.65MHz, f_{RF2}=156.8MHz, f_{RF3}=157.425MHz, f_{LO}=21.4MHz, f_{I1}=160.65MHz-21.4MHz=139.25MHz, f_{I2}=156.8MHz-21.4MHz=135.4MHz f_{I3}=157.425MHz-21.4MHz=136.025MHz
2) An increment sweep was made between 100 kHz - 2000 MHz with no other significant responses detected.

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For Blocking immunity

RX1				
Test Channel	Measurement Offset (MHz)	SG B (dBμV)	Limit (dBμV)	Result
CH_L	-10	98.04	≥90	Pass
	-5	95.60		
	-2	95.41		
	-1	93.24		
	1	93.45		
	2	94.75		
	5	95.48		
	10	98.31		
CH_M	-10	98.16	≥90	Pass
	-5	95.72		
	-2	95.53		
	-1	93.35		
	1	93.57		
	2	94.86		
	5	95.60		
	10	98.43		
CH_H	-10	98.36	≥90	Pass
	-5	95.91		
	-2	95.72		
	-1	93.54		
	1	93.75		
	2	95.05		
	5	95.79		
	10	98.63		

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4.2.11 Dynamic range

The dynamic range shall be 80 dB for MF/HF equipment and 100 dB for VHF equipment.

Test results:
Complies

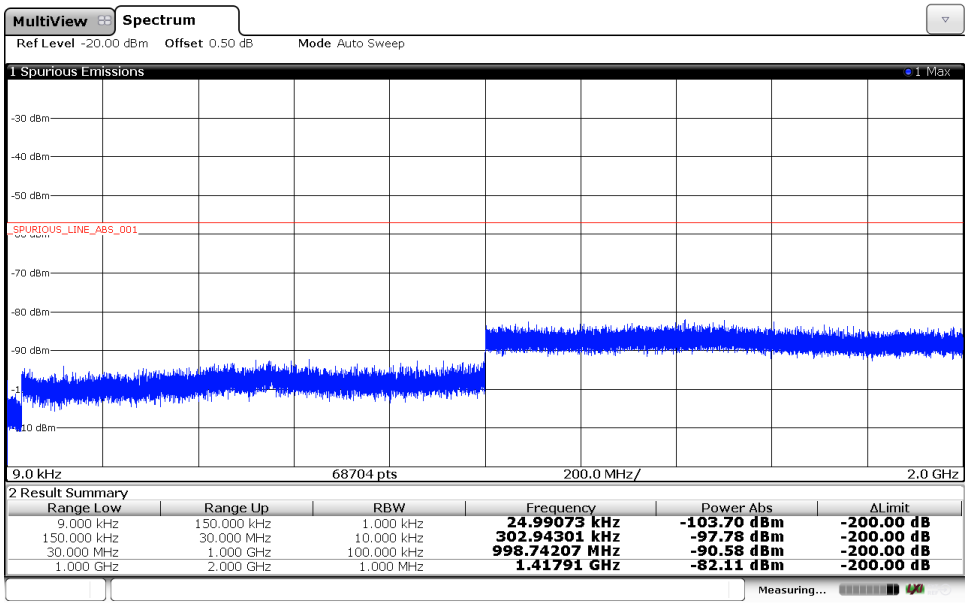
4.2.12 Conducted spurious emissions into the antenna

Conducted spurious emissions into the antenna shall not exceed 2 nW (M.489/1.3.5).

Test results:
Complies

Please refer to the below test data

Test mode:	RX1	Test Frequency:	CH_L



9kHz-2GHz

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Building 12&13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District,
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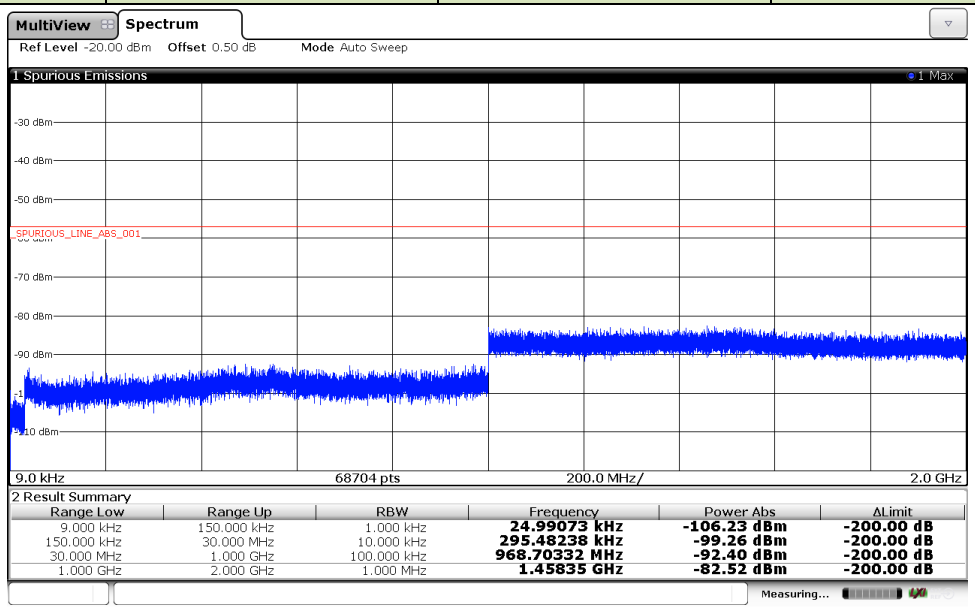
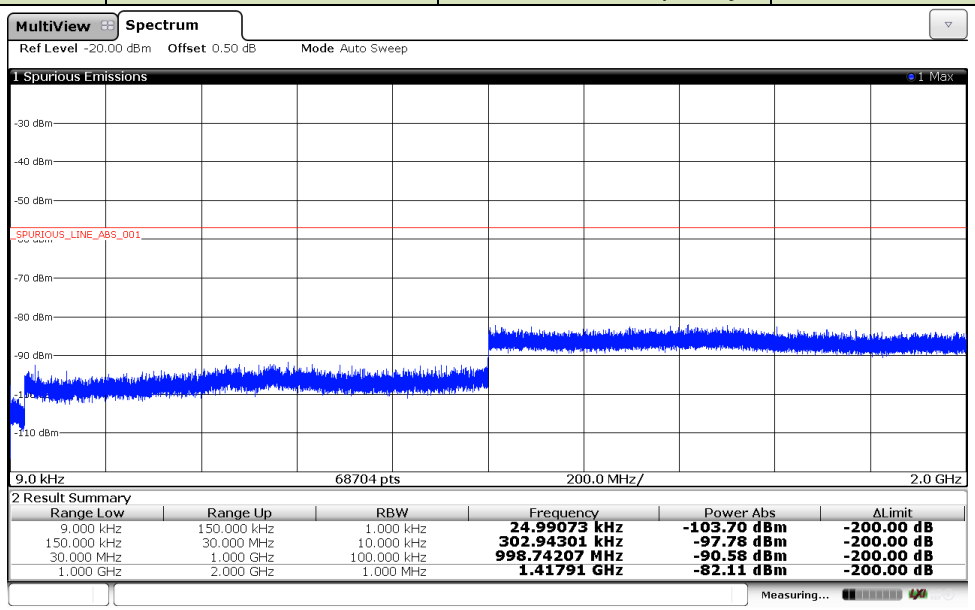
Test mode:	RX1	Test Frequency:	CH_M



9kHz-2GHz

Test mode:	RX1	Test Frequency:	CH_H



9kHz-2GHz

4.2.13 Frequency stability

For MF/HF equipment, the receiver frequency shall at all times remain within 10 Hz of the required frequency following the warming-up period (A.804/C.2, A.806/C.2).

Test results:

Not applicable

4.3 IEC 61097-8 Environmental tests

4.3.1 Vibration Tests

These tests determine the ability of equipment to withstand vibration without resulting in mechanical weakness or degradation in performance. They simulate the effect of vibration induced in a ship's hull by its propeller and machinery. This is generally at frequencies of up to 13 Hz and predominantly vertical. The tests at higher frequencies simulate the effect of slamming which occurs in irregular stormy seas and is predominantly horizontal. The tests do not simulate the effect of regular seas giving the translational components of surging, swaying and heaving, and the corresponding rotational components of rolling, pitching and yawing which generally produce accelerations too small to be of consequence to electronic equipment.

Test Method:

The EUT, complete with any shock and vibration absorbers with which it is provided, shall be clamped to the vibration table by its normal means of support and in its normal attitude. The EUT may be resiliently suspended to compensate for weight not capable of being withstood by the vibration table. Provision may be made to reduce or nullify any adverse effect on EUT performance which could be caused by the presence of an electromagnetic field due to the vibration unit.
The equipment shall be subjected to sinusoidal vertical vibration at all frequencies between:

- 2 Hz to 5 Hz and up to 13,2 Hz with an excursion of ±1 mm ± 10 % (7 m/s^2 maximumacceleration at 13,2 Hz);
- above 13,2 Hz and up to 100 Hz with a constant maximum acceleration of 7 m/s^2.

The frequency sweep rate shall be slow enough to allow the detection of resonances in any part of the EUT.
A resonance search shall be carried out throughout the test. If any resonance of the EUT has Q ≥ 5 measured relative to the base of the vibration table, the EUT shall be subjected to a vibration endurance test at each resonant frequency at the vibration level specified in the test with a duration of 2 h. If no resonance with Q ≥ 5 occurs, the endurance test shall be carried out at one single observed frequency. If no resonance occurred, the endurance test shall be carried out at a frequency of 30 Hz.
Performance check(s) (see 7.2) shall be carried out at least once during each endurance test period, and once before the end of each endurance test period.
The procedure shall be repeated with vibration in each of two mutually perpendicular directions in the horizontal plane.
After conducting the vibration tests, the equipment shall be inspected for any mechanical deterioration.

Test results:

Meet clause 7.2 performance requirement, no visible harmful deterioration.

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Building 12&13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District,
Shenzhen City, 518052, P. R. China Tel. +86 755 8828 6998, Fax: +86 755 8828 5299

4.3.2 Temperature tests

The immunity against the effects of temperature is the ability of the equipment to maintain the specified mechanical and electrical performance after the following tests have been carried out.
The maximum rate of raising or reducing the temperature of the chamber in which the equipment is tested shall be 1 °C/min.

Test Method:
For Dry heat functional test:
The EUT shall be placed in a chamber at normal room temperature and relative humidity. The EUT and, if appropriate, any climatic control devices with which it is provided shall then be switched on. The temperature shall then be raised to and maintained at +55 °C ± 3 °C.
At the end of a soak period of 10 h to 16 h at +55 °C ± 3 °C, the EUT shall be subjected to the performance check of 8.2 or 9.1 as applicable.
The temperature of the chamber shall be maintained at +55 °C ± 3 °C during the whole test period.
At the end of the test, the EUT shall be returned to normal environmental conditions or to those required at the start of the next test.

For Damp heat:
The EUT shall be placed in a chamber at normal room temperature and relative humidity.
The temperature shall then be raised to +40 °C ± 2 °C, and the relative humidity raised to 93 % ± 3 % over a period of 3 h ± 0,5 h. These conditions shall be maintained for a period of 10 h to 16 h.
Any climatic control devices provided in the EUT may be switched on at the conclusion of this period.
The EUT shall be switched on 30 min later, or after such period as agreed by the manufacturer, and shall be kept operational for at least 2 h during which period the EUT shall be subjected to the performance check.
The temperature and relative humidity of the chamber shall be maintained as specified during the whole test period.
At the end of the test period and with the EUT still in the chamber, the chamber shall be brought to room temperature in not less than 1 h.
At the end of the test the EUT shall be returned to normal environmental conditions, or to those required at the start of the next test.

For Low temperature
The EUT shall be placed in a chamber at normal room temperature and relative humidity. The temperature shall then be reduced to and maintained at –15 °C ± 3 °C, for a period of 10 h to 16 h. Any climatic control devices provided in the EUT may be switched on at the conclusion of this period.
The EUT shall be switched on 30 min later, or after such a period as agreed by the manufacturer, and shall be kept operational for at least 2 h, during which period the EUT shall be subjected to the performance check of 8.2 or 9.1 as applicable.
The temperature of the chamber shall be maintained at –15 °C ± 3 °C during the whole test period.
At the end of the test the EUT shall be returned to normal environmental conditions, or to those required at the start of the next test.

Test results:

Meet clause 8.2 BER less than 10^{-2}

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4.3.3 Corrosion test

This test shall be waived where the manufacturer is able to produce evidence that the components, materials and finishes employed in the equipment satisfy the requirements of this subclause.

Test Method:

The EUT shall be placed in a chamber and sprayed with a salt solution for 2 h at normal temperature. The salt solution shall be prepared by dissolving 5 ± 1 parts by weight of sodium chloride (NaCl) in 95 parts by weight of distilled or de-mineralized water.
At the end of the spraying period the EUT shall be placed in a chamber, which shall be maintained at a temperature of 40 °C ± 2 °C and a relative humidity between 90 % and 95 % for a period of seven days.
The EUT shall be subjected to a test comprising four spraying periods, each of 2 h duration, with a storage period of seven days after each.
At the conclusion of the test the EUT shall be inspected with the naked eye without magnification. The EUT shall then be subjected to the performance check.

Test results:

No undue deterioration. Meet clause 7.2 performance requirement, no visible harmful deterioration.

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Building 12&13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District,
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4.4 IEC 61097-8 VHF watchkeeping receiver

4.4.1 Calling sensitivity

To determine the maximum usable sensitivity which is the minimum level of the signal (e.m.f.) at the nominal frequency of the receiver which, when applied to the receiver input with a standard test signal, will produce a specified BER.

Test Method:

The arrangements for applying the test signals shall be in accordance with cluase 6.5.
Standard test signal No. 2 shall be applied at an input level of 0 dBµV under normal test conditions and +6 dBµV under extreme test conditions.
The measurement shall be carried out under normal test conditions (see 6.3) and under extreme test conditions (6.4.1 and 6.4.2 applied simultaneously).
Measurements under extreme conditions may be carried out during environmental tests (see 7.4.1 and 7.4.3).
The measurement shall be repeated at the nominal carrier frequency ±1,5 kHz under normal test conditions.

Limit:

The BER shall be equal to or less than 10^{-2}**.**

Test results:

Please refer to the below test data:

Operation Mode	Test Condition		Test Frequency (MHz)	Measured (error ratio)	Limit (error ratio)	Result
	Temperature (℃)	Voltage (V)				
RX	25	7.4	156.525	0.0071	≤10^{-2}	Pass
				0.0074		
	-10	7.4	156.525	0.0072	≤10^{-2}	Pass
				0.0075		
		6.29	156.525	0.0085	≤10^{-2}	Pass
				0.0083		
	55	7.4	156.525	0.0078	≤10^{-2}	Pass
				0.0082		
		6.29	156.525	0.0084	≤10^{-2}	Pass
				0.0084		

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4.4.2 Adjacent channel selectivity

The adjacent channel selectivity is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal which differs in frequency from the wanted signal by 25 kHz.

Test Method:

The arrangements for applying the test signals shall be in accordance with clause 6.5.
The wanted signal shall be standard test signal No. 2 at an input level of +3 dBµV.
The unwanted signal shall be modulated by 400 Hz with a deviation of ±3 kHz. The unwanted signal shall be tuned to the centre frequency of the upper adjacent channels. The level of the unwanted signal shall be +73 dBµV.
The BER at the output of the receiver shall be determined as described in 6.8.
The measurement shall be repeated with the unwanted signal tuned to the centre frequency of the lower adjacent channel.

Limit
The bit error ratio shall be equal to or less than 10^{-2}

Test results:
Complies

Please refer to the below test data:

Frequency Error:

Operation Mode	Test conditions		Frequency Error(kHz)			Limit (kHz)	Result
	Temperature(℃)	Voltage (V)	CH_L (KHz)	CH_M (KHz)	CH_H (KHz)		
TX1	Tn	Vn	0.026	0.021	0.017	±1.5	Pass

Operation Mode	Test conditions		Frequency Error(kHz)			Limit (kHz)	Result
	Temperature(℃)	Voltage (V)	CH_L (KHz)	CH_M (KHz)	CH_H (KHz)		
TX2	Tn	Vn	0.021	0.017	0.019	±1.5	Pass

Carrier power:

Operation Mode	Temperature (℃)	Voltage (V)	Test Channel	Measured power (dBm)	Limit (dB)	Result
TX1	Tn	Vn	CH_L	37.49	34.77~37.78	Pass
			CH_M	37.42		
			CH_H	37.43		

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Operation Mode	Temperature (℃)	Voltage (V)	Test Channel	Measured power (dBm)	Limit (dB)	Result
TX2	Tn	Vn	CH_L	29.93	20~30	Pass
			CH_M	29.86		
			CH_H	29.83		

Maximum usable sensitivity:

Operation Mode	Temperature (℃)	Voltage (V)	Test Channel	Measured (dBuV)	Limit (dB)	Result
RX1	Tn	Vn	CH_L	-3.15	⩽+6.0	Pass
			CH_M	-2.97		
			CH_H	-3.07		

4.4.3 Co-channel rejection

The co-channel rejection is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal, both signals being at the nominal frequency of the receiver.

Test Method:
The arrangements for applying the test signals shall be in accordance with clause 6.5.
The unwanted signal shall be modulated by 400 Hz with a deviation of ±3 kHz. The input level of the unwanted signal shall be –7 dBµV.
Both input signals shall be at the nominal frequency of the receiver and the measurement shall be repeated for displacements of the unwanted signal of up to ±3 kHz.
The BER at the output of the receiver shall be determined as described in 6.8.

Limit

The bit error ratio shall be equal to or less than 10^{-2}

Test results:
Complies
Please refer to the below test data:

Operation Mode	Test Frequency (MHz)	Measurement Offset (kHz)	Measured (error ratio)	Limit (error ratio)	Result
RX	156.525	-3	0.0048	≤10^{-2}	Pass
		0	0.0051		
		3	0.0063		

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4.4.4 Intermodulation response

The intermodulation response is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of two or more unwanted signals with a specific frequency relationship to the wanted signal frequency.

Test Method:

The arrangements for applying the test signals shall be in accordance with 6.5.
The wanted signal represented by signal generator A shall be at the nominal frequency of the receiver and shall be standard test signal No. 2 at an input level of +3 dBµV.
The two unwanted signals shall be applied, both at the same level of +68 dBµV.
The first unwanted signal from signal generator B shall be unmodulated and adjusted to a frequency 50 kHz above (or below) the nominal frequency of the receiver.
The second unwanted signal from signal generator C shall be modulated by 400 Hz with a deviation of ±3 kHz and adjusted to a frequency 100 kHz above (or below) the nominal frequency of the receiver.
The BER at the output of the receiver shall be determined as described in 6.8.

Limit

The bit error ratio shall be equal to or less than 10^{-2}

Test results:

Complies

Please refer to the below test data:

Operation Mode	Test Frequency (MHz)	Measurement Offset (kHz)		Measured (error ratio)	Limit (error ratio)	Result
		SG B	SG C			
RX	156.525	-50	-100	0.0072	≤10^{-2}	Pass
		50	100	0.0064		

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4.4.5 Spurious response and blocking immunity

To determine the ability to receive a wanted modulated signal without exceeding a specified BER due to the presence of an unwanted unmodulated signal at frequencies outside the passband of the receiver.

Test Method:
The arrangements for applying the test signals shall be in accordance with 6.5.
The wanted signal shall be standard test signal No. 2 at an input level of +3 dBµV.

For the spurious response test the unwanted signal shall be unmodulated and at an input level of +73 dBµV. The frequency shall be varied over the range 9 kHz to 2 GHz except for the channel of the wanted signal and its adjacent channels.
For the blocking immunity test the unwanted signal shall be unmodulated and at an input level of +93 dBµV. The frequency shall be varied between –10 MHz and –1 MHz and also between +1 MHz and +10 MHz relative to the nominal frequency of the wanted signal.

Limit

The bit error ratio shall be equal to or less than 10^{-2}

Test results:
Complies

Please refer to the below test data:

Operation Mode	Test Frequency (MHz)	Relationship	Spurious Frequency (MHz)	Measured (error ratio)	Limit (error ratio)	Result
RX	156.525	f_{RF1}-f_{LO}/2	145.825	0.0065	≤10^{-2}	Pass
		f_{RF1}-2*f_{LO}	113.725	0.0059		
		f_{LO}	21.4	0.0044		
		2*f_{I1}-f_{LO}	248.85	0.0062		

Operation Mode	Test Frequency (MHz)	Measurement Offset (MHz)	Measured (error ratio)	Limit (error ratio)	Result
RX	156.525	-10	0.0074	≤10^{-2}	Pass
		-5	0.0069		
		-2	0.0063		
		-1	0.0055		
		1	0.0053		
		2	0.0066		
		5	0.0075		
		10	0.0079		

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4.4.6 Dynamic range

The dynamic range of the equipment is the range from the minimum to the maximum level of a radio frequency input signal at which the bit error ratio in the output of the decoder does not exceed a specified value.

Test Method:
The arrangements for applying the test signals shall be in accordance with 6.5.
Standard test signal No. 2 shall be applied at an input level of +100 dBµV.
The BER at the output shall be determined as described in 6.8.

Limit

The bit error ratio shall be equal to or less than 10^{-2}

Test results:
Complies

Please refer to the below test data:

Operation Mode	Test Frequency (MHz)	Measured (error ratio)	Limit (error ratio)	Result
RX	156.525	0.0069	≤10^{-2}	Pass

4.4.7 Conducted spurious emissions into the antenna

To determine internally generated signals conducted to the antenna terminal and which may be radiated.

Test Method:
The receiver antenna terminal shall be connected to a 50 Ω artificial antenna and the spurious emissions shall be measured using a selective measuring instrument. The r.m.s. value of any component of the spurious emission shall then be evaluated.
The measurement shall be made over the frequency range from 9 kHz to 2 GHz.
The bandwidth of the selective measuring instrument shall be:
- 200 kHz in the frequency range from 9 kHz to 150 kHz;
- 9 kHz to 10 kHz in the frequency range from 150 kHz to 30 MHz;
- 100 kHz to 120 kHz in the frequency range from 30 MHz to 1 GHz; and
- 1 MHz above 1 GHz.

The detector shall be a peak detector.

Limit

The power of any discrete frequency component shall not exceed 2 nW.

Test results:
Complies

Please refer to the below test data:

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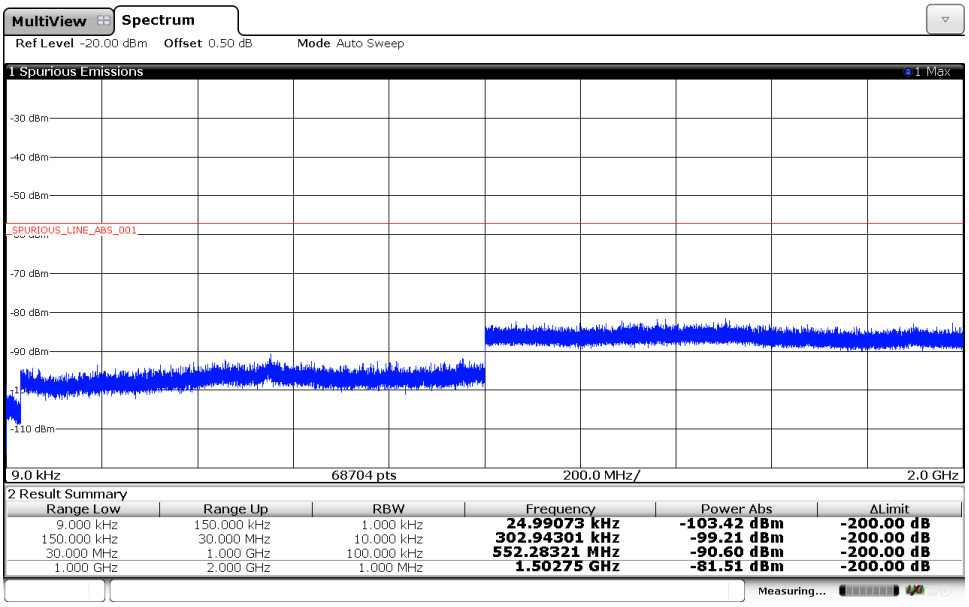
Test mode:	RX1	Test Frequency:	CH_M



Operation Mode	Test conditions		Frequency Error (kHz)	Limit (Hz)	Result
	Temperature (℃)	Voltage(V)	CH_{M1}		
TX4	Tn	Vn	1300.084	1300±10	Pass
	T_L	T_H	1300.068		
		V_L	1300.066		
	T_H	T_H	1300.075		
		V_L	1300.079		

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5 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01" Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 2 " and is documented in the Shenzhen Huatongwei International Inspection Co., Ltd quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen Huatongwei laboratory is reported:

Test Items	Measurement Uncertainty	Notes
RF frequency	25 Hz	(1)
Maximum frequency deviation: within 300 Hz to 6 kHz of modulation frequency	2.6 %	(1)
Maximum frequency deviation: within 6 kHz to 25 kHz of modulation frequency	2.20 dB	(1)
Deviation limitation	3.5 %	(1)
Adjacent channel power	1.20 dB	(1)
Conducted spurious emission of transmitter	0.57 dB	(1)
Amplitude characteristics of receiver limiter	1.20 dB	(1)
Sensitivity at 20 dB SINAD	2.60 dB	(1)
Conducted emission of receiver	1.60 dB	(1)
Two-signal measurement	2.80 dB	(1)
Three-signal measurement	2.20 dB	(1)
Radiated emission of transmitter	2.20 dB	(1)
Radiated emission of receiver	2.20 dB	(1)
Transmitter transient time	6.8 %	(1)
Transmitter transient frequency	75 Hz	(1)
Receiver desensitization (duplex operation)	0.25 dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

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6 IEC 61097-8 EMC test according EN60945 Electromagnetic Compatibility (EMC)

6.1 Radiated Disturbance 150kHz to 2GHz

6.1.1 Test Procedure

The quasi-peak measuring receivers specified in CISPR 16-1 shall be used. The receiver bandwidth in the frequency ranges 150 kHz to 30 MHz shall be 9 kHz and in the frequency ranges 30 MHz to 2 GHz shall be 120 kHz.

For frequencies from 150 kHz to 30 MHz measurements shall be made of the magnetic H field. The measuring antenna shall be an electrically screened loop antenna of dimension so that the antenna can be completely enclosed by a square having sides of 60 cm in length, or an appropriate ferrite rod as described in CISPR 16-1.

The correction factor for the antenna shall include the factor +51,5 dB to convert the magnetic field strength to equivalent electric field strength.

For frequencies above 30 MHz measurements shall be made of the electric E field. The measuring antenna shall be a balanced dipole of resonant length, or alternate shortened dipole or higher gain antenna as described in CISPR 16-1. The dimension of the measuring antenna in the direction of the EUT shall not exceed 20 % of its distance from the EUT. At frequencies above 80 MHz it shall be possible to vary the height of the centre of the measuring antenna above the ground over a range of 1 m to 4 m.

The test site shall be compliant with CISPR 16-1, using a metal ground plane and of dimensions to allow a measurement distance of 3 m.

The EUT shall be fully assembled, complete with its associated interconnecting cables and mounted in its normal plane of operation.

When the EUT consists of more than one unit, the interconnecting cables (other than antenna feeders) between the main unit and all other units shall be the maximum length as specified by the manufacturer or 20 m whichever is shorter. Available input and output ports shall be connected to the maximum length of cable as specified by the manufacturer or 20 m whichever is shorter, and terminated to simulate the impedance of the ancillary equipment to which they are normally connected.

The excess length of these cables shall be bundled at the approximate centre of the cable with bundles 30 cm to 40 cm in length running in the horizontal plane from the port to which they are connected. If it is impractical to do so because of cable bulk or stiffness, the disposition of the excess cable shall be as close as possible to that required, and shall be precisely described in the test report.

The test antenna shall be placed at a distance of 3 m from the EUT. The centre of the antenna shall be at least 1,5 m above the ground plane. The E-field antenna only shall be adjusted in height and rotated to give horizontal and vertical polarization, one being parallel to the ground, in order to determine the maximum emission level. Finally the antenna shall either be moved around the EUT, again in order to determine the maximum emission level, or alternatively, the EUT may be placed on a plane orthogonal to the test antenna at its mid-point and rotated to achieve the same effect.

b) In addition, for the frequency band 156 MHz to 165 MHz, the measurement shall be repeated with a receiver bandwidth of 9 kHz, all other conditions of a) hereinbefore remaining unchanged.

c) Alternatively, for the frequency band 156 MHz to165 MHz, a peak receiver or a frequency analyzer may be used, in accordance with the agreement between the manufacturer and the test house.

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6.1.2 Test Setup

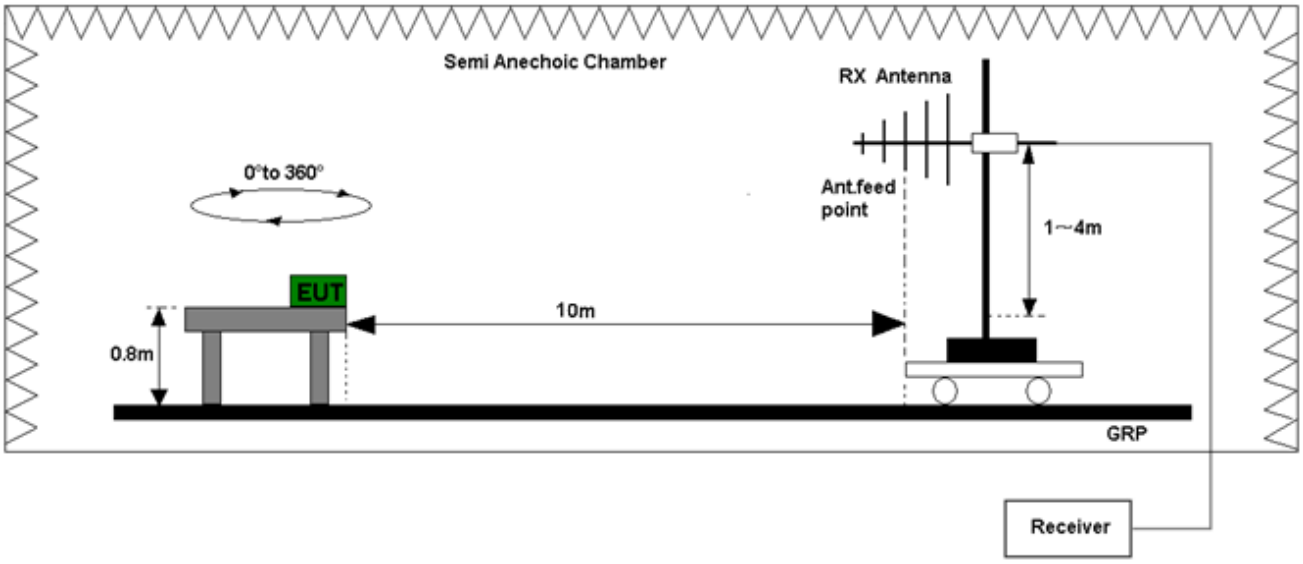

Figure 1. Test set-up of radiated disturbance(30Hz-1GHz)

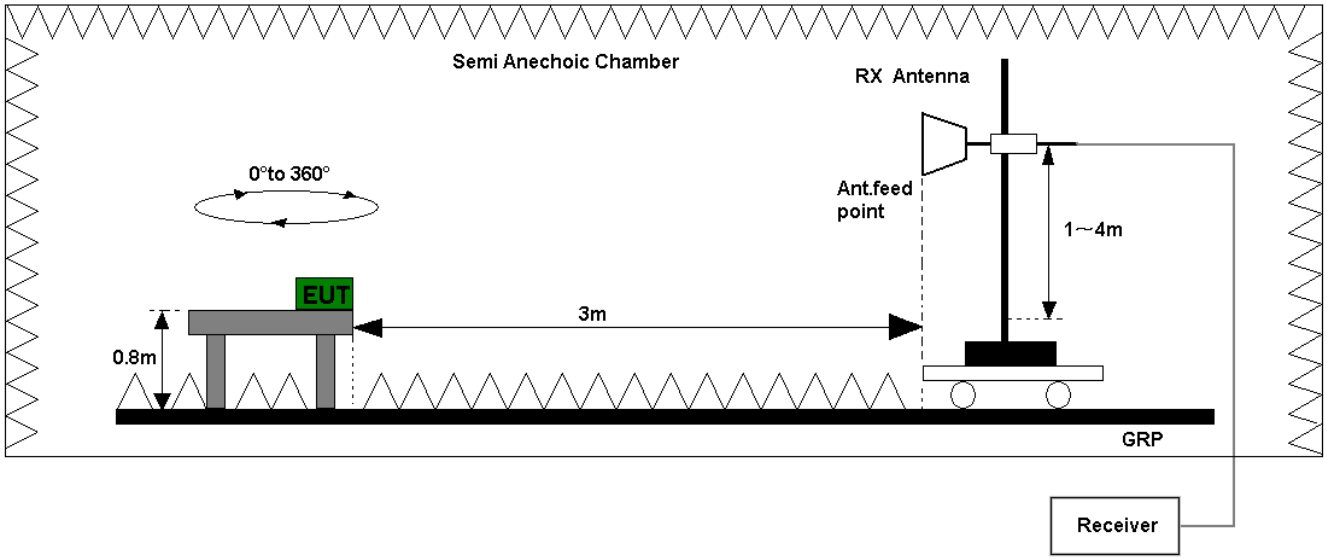

Figure 2. Test set-up of radiated disturbance(above 1GHz)

6.1.3 Test Results

Frequency (MHz)	Result (dBm)	Limit (dBm)	Margin (dB)	Polar H/V
0.358	35.06	52.0	16.94	H
0.797	29.63	51.7	22.07	H
5.351	31.52	48.9	17.38	H
21.384	32.05	39.2	7.15	H
27.400	29.73	35.6	5.87	H
29.769	30.88	34.1	3.22	H
0.281	34.92	55.5	20.58	V
0.480	30.29	51.9	21.61	V

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0.742	31.92	51.7	19.78	V
6.649	33.03	48.2	15.17	V
23.514	30.82	37.9	7.08	V
28.924	31.76	34.7	2.94	V
69.224375	43.12	54.00	10.88	H
134.335625	42.80	54.00	11.20	H
155.918125	28.76	54.00	25.24	H
164.345000	27.66	30.00	2.34	H
36.183750	50.60	54.00	3.40	V
69.891250	44.94	54.00	9.06	V
140.519375	39.76	54.00	14.24	V
1030.750000	50.07	54.00	3.93	H
1107.562500	48.80	54.00	5.20	H
1451.937500	48.36	54.00	5.64	H
1097.625000	48.93	54.00	5.07	V
1446.000000	49.08	54.00	4.92	V

Test environment condition:

Performed Item	Item	Required	Actual
Radiated Emission	Ambient temperature	15°C～35°C	25°C
	Relative humidity	25%～75%	55%
	Atmospheric pressure	86 kPa～106kPa	989kPa

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6.2 Conducted Disturbance 0.10 MHz to 30MHz

6.2.1 Test Procedure

The emission shall be measured by means of the quasi-peak measuring receivers specified in CISPR 16-1. An artificial mains V-network (figure 3) in accordance with CISPR 16-1 shall be used to provide a defined impedance at high frequencies across the terminals of the EUT, and to isolate the test circuit from unwanted radio frequency signals on the supply mains. The measuring bandwidth in the frequency range 10 kHz to 150 kHz shall be 200 Hz, and in the frequency range 150 kHz to 30 MHz shall be 9 kHz.
The power input cables between the a.c. and the d.c. power ports of the EUT and the artificial mains network shall be screened and not exceed 0,8 m in length. If the EUT consists of more than one unit with individual a.c. and/or d.c. power ports, power ports of identical nominal supply voltage may be connected in parallel to the artificial mains supply network.
Measurements shall be made with all measuring equipment and the EUT mounted on, and bonded to, an earth plane. Where provision of an earth plane is not practicable, equivalent arrangements shall be made using the metallic frame or mass of the EUT as the earth reference.

6.2.2 Test Setup

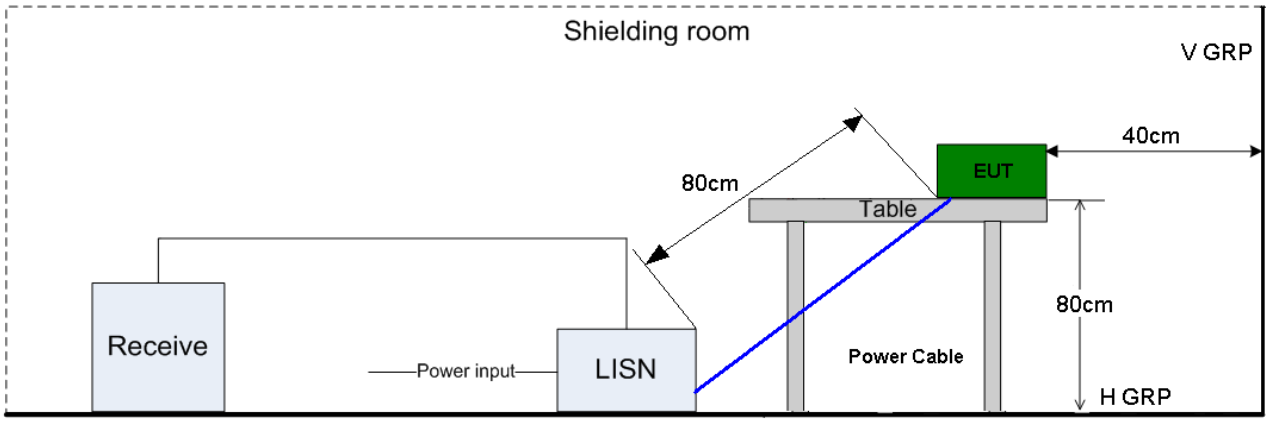

Figure 3. Test set-up of conducted disturbance for power port

6.2.3 Test Results

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.076343	---	46.36	---	---	N	9.9
0.076343	46.15	---	61.47	15.32	N	9.9
0.611662	---	45.86	---	---	N	10.0
0.611662	45.77	---	50.00	4.23	N	10.0
0.689813	---	46.16	---	---	N	9.9
0.689813	46.05	---	50.00	3.95	N	9.9
0.725277	---	49.16	---	---	N	9.9
0.725277	49.06	---	50.00	0.94	N	9.9
0.762503	---	47.76	---	---	N	9.9
0.762503	47.84	---	50.00	2.16	N	9.9
14.302679	---	33.70	---	---	N	9.7
14.302679	39.17	---	50.00	10.83	N	9.7

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Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.076343	---	48.23	---	---	L	9.9
0.076343	48.12	---	61.47	13.35	L	9.9
0.536893	---	42.60	---	---	L	10.1
0.536893	42.53	---	50.00	7.47	L	10.1
0.611662	---	45.40	---	---	L	10.0
0.611662	45.30	---	50.00	4.70	L	10.0
0.689813	---	44.54	---	---	L	10.0
0.689813	44.43	---	50.00	5.57	L	10.0
0.762503	---	48.53	---	---	L	9.9
0.762503	48.60	---	50.00	1.40	L	9.9
0.801627	---	47.67	---	---	L	9.9
0.801627	48.02	---	50.00	1.98	L	9.9
14.445661	---	34.10	---	---	L	10.0
14.445661	39.67	---	50.00	10.33	L	10.0

Test environment condition:

Performed Item	Item	Required	Actual
Conducted Emission	Ambient temperature	15°C～35°C	25°C
	Relative humidity	25%～75%	55%
	Atmospheric pressure	86 kPa～106kPa	989kPa

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6.3 Immunity to Continuous Conducted Interference 0.15MHz to 80MHz

6.3.1 Test Procedure

The EUT was configured as described in section 5 for this test. The applied level was Amplitude Modulated by a 1 kHz sinusoidal signal to a modulation depth of 80%. The set-up and test methods were according to IEC 61000-4-6.

6.3.2 Test Setup

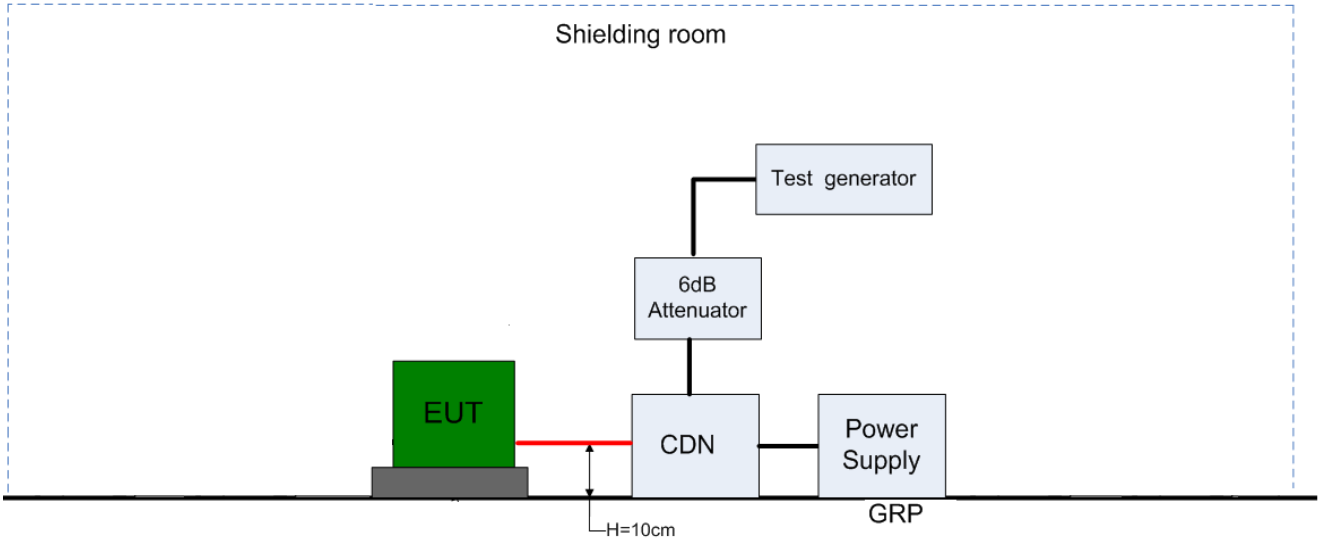

Figure 4. Test set-up of immunity to continuous conducted interference

6.3.3 Test Results

Test Results of Continuous Conducted Interference				
Ports	Measuring condition	Inject method	Description	Conclusion
AC Power Port	Frequency range: 0.15 MHz to 80 MHz Induced voltage :3 V (rms)	CDN M2	No fail detected	Pass
DC Power Port	Frequency range: 0.15 MHz to 80 MHz Induced voltage :3 V (rms)	CDN M2	No fail detected	Pass
Signal port	Frequency range: 0.15 MHz to 80 MHz Induced voltage :3 V (rms)	Clamp	N/A	N/A

Test environment condition:

Performed Item	Item	Required	Actual
Immunity to Continuous Conducted Interference	Ambient temperature	15°C～35°C	25°C
	Relative humidity	25%～75%	55%
	Atmospheric pressure	86 kPa～106kPa	989kPa

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6.4 Immunity to Radiated Electric Fields 80MHz to 2000MHz

6.4.1 Test Procedure

The EUT was configured as described in section 5 for this test. The set-up and test methods were according to EN/IEC 61000-4-3. All sides of the EUT (front, rear, left and right) were tested by antenna with vertical and horizontal polarization.

6.4.2 Test Setup

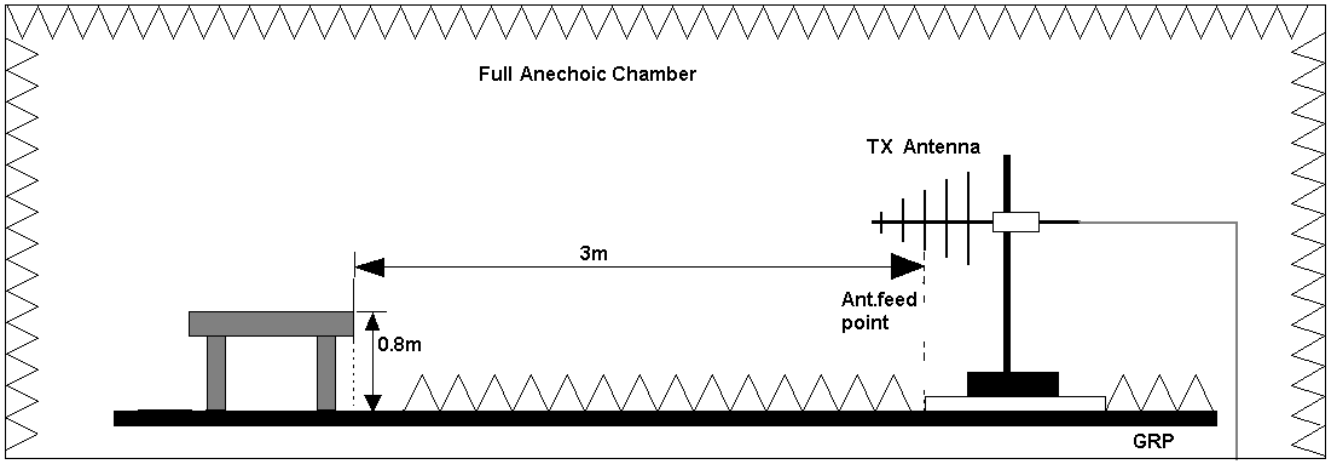

Figure 5. Test set-up of Immunity to Radiated Electric Fields

6.4.3 Test Results

Test Results of Radiated Electric Fields	
Test side of EUT	Front, Rear, Left, Right
Criterion	Performance criterion A
Frequency range & Test Level	80MHz –1000MHz test level：10 V/m(Unmodulated, rms) 1000MHz –2200MHz test level：10 V/m(Unmodulated, rms)
Modulation	80% AM, 0.4kHz
Conclusion	Pass

Test environment condition:

Performed Item	Item	Required	Actual
Immunity to Radiated Electric Fields	Ambient temperature	15°C～35°C	25°C
	Relative humidity	25%～75%	55%
	Atmospheric pressure	86 kPa～106kPa	989kPa

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6.5 Immunity to Electrical Fast Transient Bursts

6.5.1 Test Procedure

The EUT was configured as described in section 5 for this test. A series of Fast Transient Bursts meeting the specification were applied for a period of 120 seconds. The Transient Bursts were applied for both Positive and Negative Burst Trains to Power Port. The set-up and test methods were according to IEC 61000-4-4.

6.5.2 Test Setup

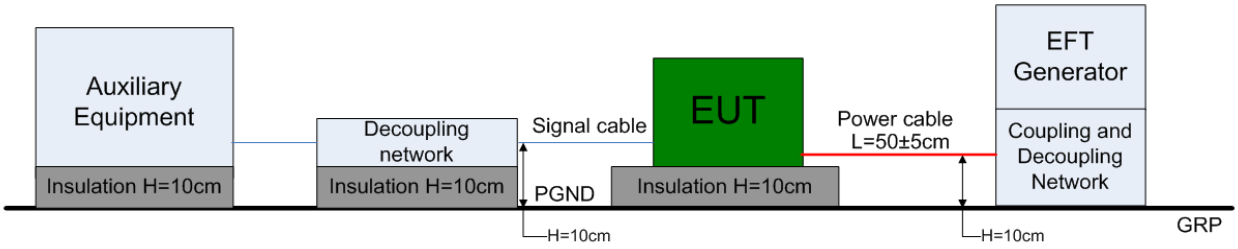

Figure 6. Test set-up of immunity to electrical fast transient bursts

6.5.3 Test Results

Test Results of Electrical Fast Transient Bursts			
Ports	Measuring condition Couple mode	Description	Conclusion
AC Power Port	Level:±2.0kV, Tr/Th: 5/50ns, 5kHz Interval: 120 seconds	No fail detected	Pass
Telecommunication Port	Level:±1.0kV, Tr/Th: 5/50ns, 100kHz Interval: 120 seconds	N/A	N/A

Remark: This test is not applicable to EUT intended for operation from battery power sources

Test environment condition:

Performed Item	Item	Required	Actual
Immunity to Electrical Fast Transient Bursts	Ambient temperature	15°C～35°C	25°C
	Relative humidity	25%～75%	55%
	Atmospheric pressure	86 kPa～106kPa	989kPa

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6.6 Immunity to Surges

6.6.1 Test Procedure

The EUT was configured as described in section 5 for this test. A series of High Energy Surges were applied to Power Port. The set-up and test methods were according to IEC 61000-4-5.

6.6.2 Test Setup

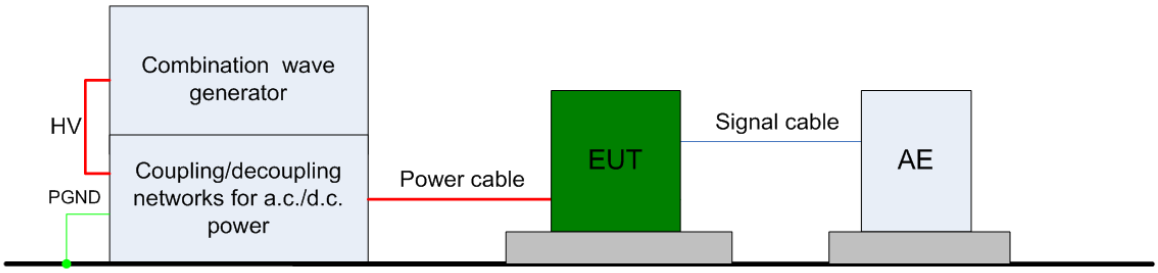

Figure 7. Test set-up of immunity to surge

6.6.3 Test Results

Test Results of Surges			
Ports	Measuring condition	Description	Conclusion
AC Power Port	Line to Line: L-N Level:±1.0kV, Tr/Th:1.2/50μs Interval: 60 seconds Phase: Sync	No fail detected	Pass
Signal Port	Level:±1.0kV, Tr/Th:1.2/50μs Interval: 60 seconds	N/A	N/A

Remark: This test is not applicable to EUT intended for operation from battery power sources

Test environment condition:

Performed Item	Item	Required	Actual
Immunity to Surges	Ambient temperature	15°C～35°C	25°C
	Relative humidity	25%～75%	55%
	Atmospheric pressure	86 kPa～106kPa	989kPa

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6.7 Immunity to power supply short-term variation (all equipment categories except portable

6.7.1 Test Procedure

This test is not applicable to d.c. powered equipment.

Power supply variations shall be applied using a programmable power supply.

The EUT shall be submitted to the following power supply variations relative to nominal value

1/min for 10 min (figure 10):

a) voltage: nominal + (20 ± 1) %, duration 1,5 s ± 0,2 s, frequency: nominal + (10 ± 0,5) %, duration 5 s ± 0,5 s, superimposed;

b) voltage: nominal – (20 ± 1) %, duration 1,5 s ± 0,2 s, frequency: nominal – (10 ± 0,5) %, duration 5 s ± 0,5 s, superimposed. Voltage and frequency variation rise and decay times are 0,2 s ± 0,1 s (from 10 % to 90 %). Further information is given in IEC 61000-4-11.

6.7.2 Test Setup

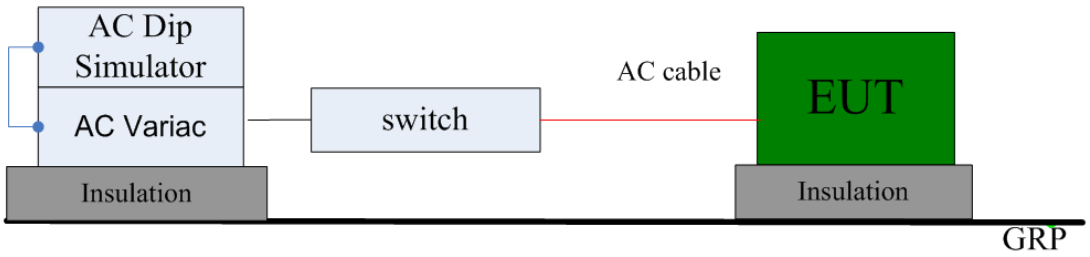

Figure 8. Test set-up of Voltage Dips and Short Interruption of AC Power Port

6.7.3 Test Results

In the case where the equipment is fitted with or connected to a battery back-up, the performance criteria for transient phenomena shall apply.
In the case where the equipment is powered solely from the AC mains supply (without the use of a parallel battery back-up) volatile user data may have been lost and if applicable the communication link need not to be maintained and lost functions should be recoverable by user or operator; no unintentional responses shall occur at the end of the test.

Test Results of Voltage Dips and Short Interruption				
Ports	Measuring condition	Performance Criterion	Description	Conclusion
Power Port	voltage: nominal + (20 ± 1) %, duration 1,5 s ± 0,2 s, frequency: nominal + (10 ± 0,5) %, duration 5 s ± 0,5 s, superimposed;	C	No fail detected	N/A
	voltage: nominal – (20 ± 1) %, duration 1,5 s ± 0,2 s, frequency: nominal – (10 ± 0,5) %, duration 5 s ± 0,5 s, superimposed.	C	No fail detected	N/A

Remark: This test is not applicable to EUT intended for operation from battery power sources

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Test environment condition:

Performed Item	Item	Required	Actual
Immunity to Voltage Dips and Short Interruption	Ambient temperature	15°C～35°C	25°C
	Relative humidity	25%～75%	55%
	Atmospheric pressure	86 kPa～106kPa	989kPa

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6.8 Immunity to power supply failure (all equipment categories except portable)

6.8.1 Test Procedure

This test is not applicable to EUT intended for operation from battery power sources or fitted with or connected to back-up batteries.

The EUT shall be subjected to three breaks in power supply of duration 60 s each.

Further information is in IEC 61000-4-11.

6.8.2 Test Setup

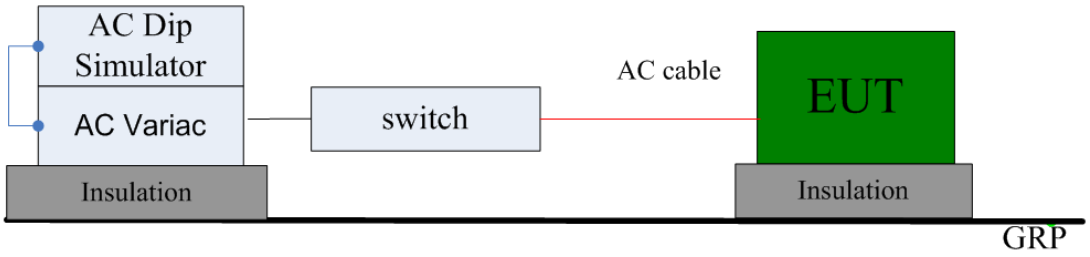

Figure 9. Test set-up of Voltage Dips and Short Interruption of AC Power Port

6.8.3 Test Results

In the case where the equipment is fitted with or connected to a battery back-up, the performance criteria for transient phenomena shall apply.
In the case where the equipment is powered solely from the AC mains supply (without the use of a parallel battery back-up) volatile user data may have been lost and if applicable the communication link need not to be maintained and lost functions should be recoverable by user or operator; no unintentional responses shall occur at the end of the test.

Test Results of Voltage Dips and Short Interruption				
Ports	Measuring condition	Performance Criterion	Description	Conclusion
Power Port	3 breaks in power supply of duration 60 s each	C	No fail detected	N/A

Remark: This test is not applicable to EUT intended for operation from battery power sources

Test environment condition:

Performed Item	Item	Required	Actual
Immunity to Voltage Dips and Short Interruption	Ambient temperature	15°C～35°C	25°C
	Relative humidity	25%～75%	55%
	Atmospheric pressure	86 kPa～106kPa	989kPa

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6.9 Immunity to Electrostatic Discharge

6.9.1 Test Set up

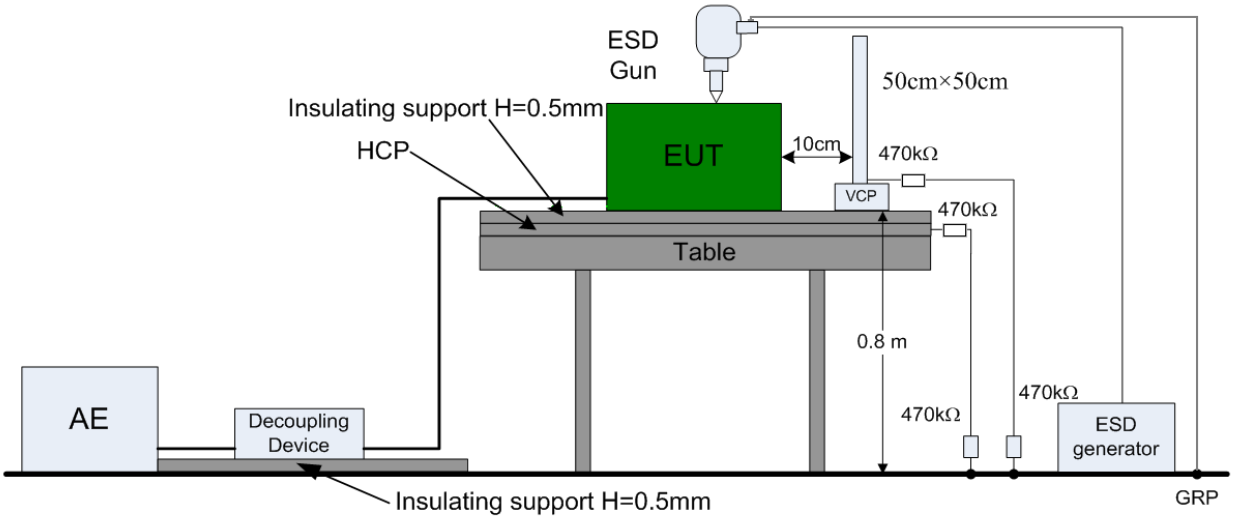

Figure 10. Test set-up of electrostatic discharge

6.9.2 Test Results

Details of the points tested were presented in below:

Test Results					
Test Points	Specification Level				Conclusion
	±6kV Contact Discharges		±8kV Air Discharges		
	Positive	Negative	Positive	Negative	
Indirect Contact					
Indirect Contact, HCP(left, right, front, rear)	√	√	N/A	N/A	Pass
Indirect Contact, VCP(left, right, front, rear)	√	√	N/A	N/A	Pass
Direct Contact/ Air Contact					
Slot	N/A	N/A	✓	✓	Pass
Surface	N/A	N/A	✓	✓	Pass
Screen	N/A	N/A	✓	✓	Pass
Button	N/A	N/A	✓	✓	Pass
Antenna	N/A	N/A	✓	✓	Pass

Test environment condition:

Performed Item	Item	Required	Actual
Immunity to Electrostatic Discharge	Ambient temperature	15°C～35°C	25°C
	Relative humidity	30%～60%	55%
	Atmospheric pressure	86 kPa～106kPa	989kPa

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6.10 Equipment Used during the Test

Frequency Deviation					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	RF COMMUNICATION TEST SET	HP	8920A	3813A10206	11/13/2016

Unwanted emissions in the spurious domain					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	EMI TEST RECEIVER	Rohde&Schwarz	ESI 26	100009	11/13/2016
2	EMI TEST SOFTWARE	Audix	E3	N/A	N/A
3	RF COMMUNICATION TEST SET	HP	8920A	3813A10206	11/13/2016
4	High-Pass Filter	Anritsu	MP526D	6220878392	11/13/2016
5	Ultra-Broadband Antenna	ShwarzBeck	VULB9163	538	11/13/2016
6	Ultra-Broadband Antenna	ShwarzBeck	VULB9163	539	11/13/2016
7	HORN ANTENNA	ShwarzBeck	9120D	1011	11/13/2016
8	HORN ANTENNA	ShwarzBeck	9120D	1012	11/13/2016
9	TURNTABLE	MATURO	TT2.0	----	N/A
10	ANTENNA MAST	MATURO	TAM-4.0-P	----	N/A
11	SPECTRUM ANALYZER	Agilent	E4407B	MY44210775	11/13/2016

Frequency Error & Carrier power (Conducted)					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Receiver	Rohde&Schwarz	ESIB26	100009	11/13/2016
2	Climate Chamber	ESPEC	EL-10KA	05107008	11/13/2016
3	RF COMMUNICATION TEST SET	HP	8920A	3813A10206	11/13/2016

Adjacent Channel Power					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Receiver	Rohde&Schwarz	ESI26	100009	11/13/2016
2	RF COMMUNICATION TEST SET	HP	8920A	3813A10206	11/13/2016

Maximum Usable Sensitivity					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Climate Chamber	ESPEC	EL-10KA	05107008	11/13/2016
2	RF COMMUNICATION TEST SET	HP	8920A	3813A10206	11/13/2016

Adjacent Channel Selectivity					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Signal Generator	Rohde&Schwarz	SMT03	100059	11/13/2016
2	Climate Chamber	ESPEC	EL-10KA	05107008	11/13/2016
3	RF COMMUNICATION TEST SET	HP	8920A	3813A10206	11/13/2016

Co-channel rejection & Spurious Response Rejection & Inter Modulation Response Rejection & Blocking or Desensitization					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Signal Generator	Rohde&Schwarz	SMT03	100059	11/13/2016
2	Signal Generator	IFR	2032	203002/100	11/13/2016
3	RF COMMUNICATION TEST SET	HP	8920A	3813A10206	11/13/2016

Transient Frequency Behavior				
Name of Equipment	Manufacturer	Model	Serial Number	Last Cal.
Signal Generator	Rohde&Schwarz	SMT03	100059	11/13/2016

Storage Oscilloscope	Tektronix	TDS3054B	B033027	11/13/2016
RF COMMUNICATION TEST SET	HP	8920A	3813A10206	11/13/2016

Radiated Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Ultar-Broadband Antenna	Rohde&Schwarz	HL562	100015	11/13/2016
2	EMI Test Receiver	Rohde&Schwarz	ESI 26	100009	11/13/2016
3	RF Test Panel	Rohde&Schwarz	TS / RSP	335015/0017	N/A
4	Turetable	ETS	2088	2149	N/A
5	Antenna Mast	ETS	2075	2346	N/A
6	EMI Test Software	Rohde&Schwarz	ESK1	N/A	N/A
7	Horn Antenna	Rohde&Schwarz	HF906	100039	11/13/2016
8	Ultra-Broadband Antenna	ShwarzBeck	VULB9163	538	11/13/2016
9	Ultra-Broadband Antenna	ShwarzBeck	VULB9163	539	11/13/2016
10	HORNANTENNA	ShwarzBeck	9120D	1011	11/13/2016
11	TURNTABLE	MATURO	TT2.0	----	N/A
12	ANTENNA MAST	MATURO	TAM-4.0-P	----	N/A
13	EMI Test Software	Audix	E3	N/A	N/A

Electrostatic Discharge					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	ESD Simulator	EM TEST	DITOC0103Z	0301-04	11/13/2016
2	ESD Simulator	EM TEST	P30	N/A	11/13/2016
3	ESD Simulator	EM TEST	ESD 30N	P1251107888	11/13/2016

Conducted Susceptibility Test					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Signal Generator	IFR	2023A	202304/060	11/13/2016
2	Amplifier	AR	75A250	302205	11/13/2016
3	Dual Directional Coupler	AR	DC2600	302389	11/13/2016
4	6db Attenuator	EMTEST	ATT6/75	0010230A	11/13/2016
5	EM Clamp	LÜTHI	EM101	335625	11/13/2016
6	CDN	EMTEST	CDN M3	0802-03	11/13/2016
7	Audio Analyzer	Rohde&Schwarz	UPL	SB3439	11/13/2016

RF Electromagnetic Field					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Signal Generator	IFR	2032	203002/100	11/13/2016
2	AMPLIFIER	AR	150W1000	301584	11/13/2016
3	DUAL DIRECTIONAL COUPLER	AR	DC6080	301508	11/13/2016
4	POWER HEAD	AR	PH2000	301193	11/13/2016
5	POWER METER	AR	PM2002	302799	11/13/2016
6	TRANSMITTING AERIAL	AR	AT1080	28570	11/13/2016
7	POWER AMPLIFIER	AR	25S1G4A	0325511	11/13/2016
8	DUAL DIRECTIONAL COUPLER	AR	DC7144A	0325100	11/13/2016
9	TRANSMITTING AERIAL	AR	AT4002A	0324848	11/13/2016
10	Audio Analyzer	Rohde&Schwarz	UPL	SB3439	11/13/2016

Voltage Fluctuation and Flicker &Harmonic Current					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.

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1	Purified Power Source	CALIFORNIA INSTRUMENTS	HFS500	54513	11/13/2016
2	Harmonic And Flicker Analyzer	EM TEST	DPA503S1	0500-10	11/13/2016

Electrical Fast Transient/Burst Test					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Ultra Compact Simulator	EM TEST	UCS500M6	0500-19	11/13/2016
2	Coupling Clamp	EM TEST	HFK	1501-14	11/13/2016

Conducted Disturbance					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	EMI Test Receiver	Rohde&Schwarz	ESCI	100106	11/13/2016
2	Artificial Mains	Rohde&Schwarz	ESH2-Z5	100028	11/13/2016
3	Pulse Limiter	Rohde&Schwarz	ESHSZ2	100044	11/13/2016
4	Artificial Mains	Rohde&Schwarz	ESH3-Z6	100210	11/13/2016
5	Artificial Mains	Rohde&Schwarz	ESH3-Z6	100211	11/13/2016
6	EMI Test Software	Rohde&Schwarz	ESK1	N/A	11/13/2016

Voltage Dips and Interruptions					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Ultra Compact Simulator	EM TEST	UCS500M6	0500-19	11/13/2016
2	Motor Driven Voltage Transformer	EM TEST	MV2616	0301-11	11/13/2016

Transients and surges in the vehicular environment					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Power supply	EM TEST	VDS200N100	V1242114003	11/13/2016
2	Test Control System	EM TEST	AUTOWAVE	V1242114005	11/13/2016
3	Pulse Generator	EM TEST	UC S200N100	V1242114002	11/13/2016
4	Impedance module	EM TEST	LD200N	V1242114001	11/13/2016

The Cal. Interval was one year.

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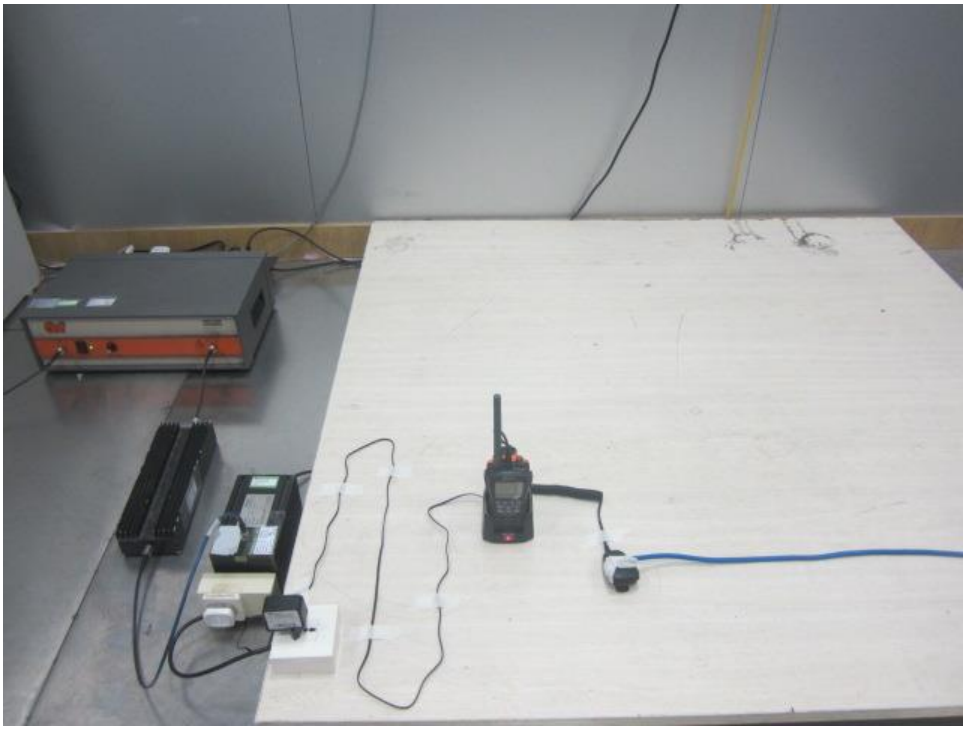
7 Photographs of Test Setup

External Photos: Conducted Emission for AC power port

RF- Common Mode - AC



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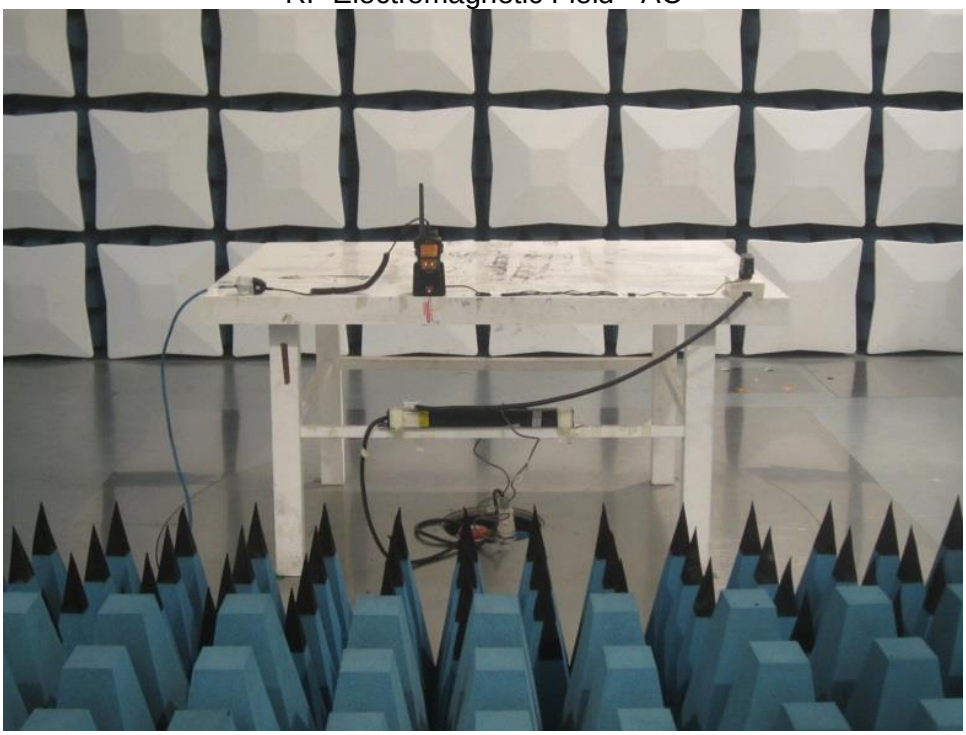
RF Electromagnetic Field - AC



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8 Photographs of EUT

External Photos:

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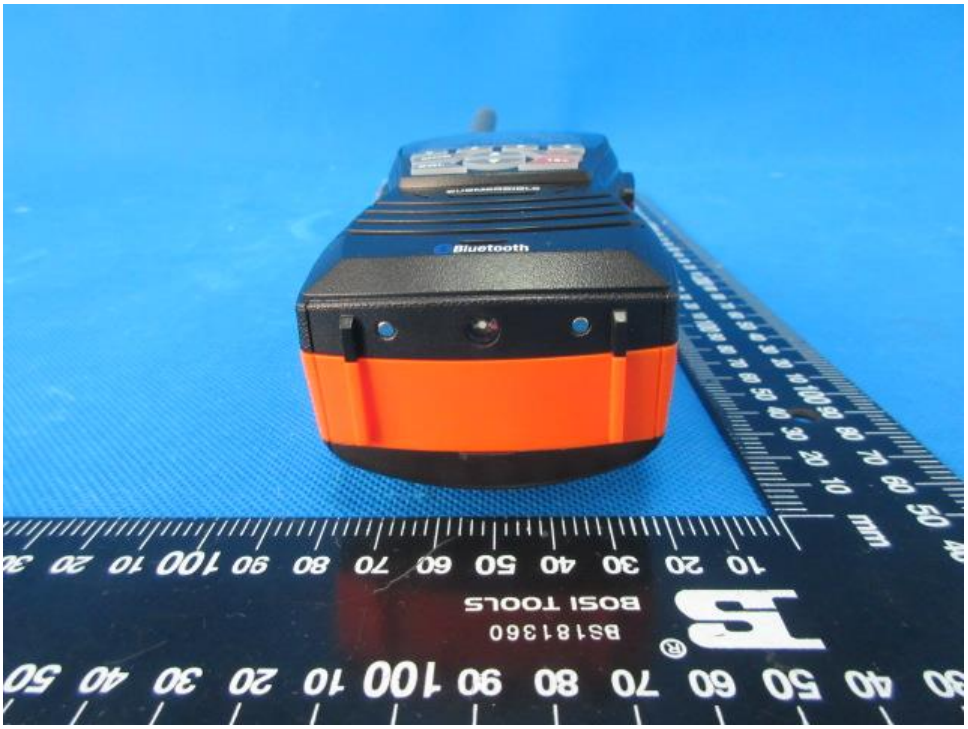

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Internal Photos:

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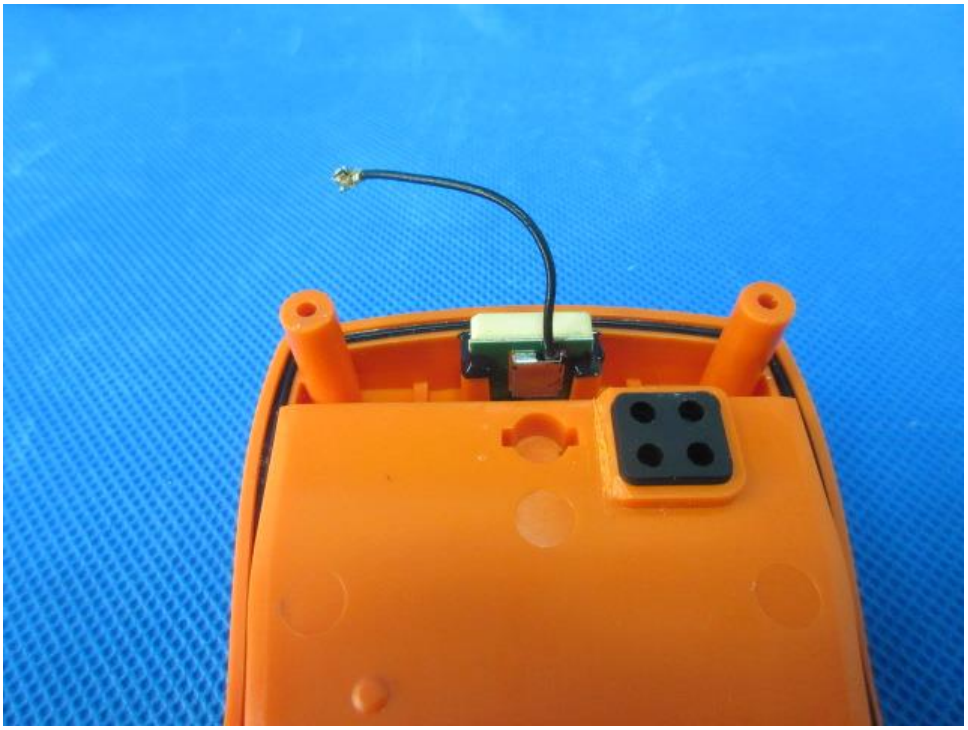

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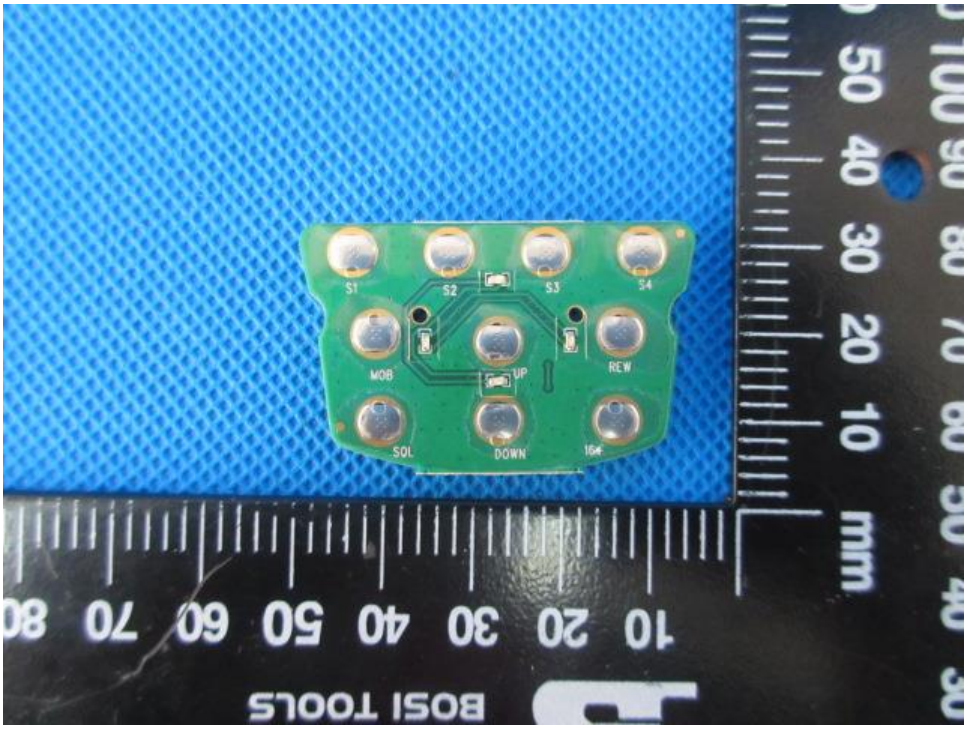

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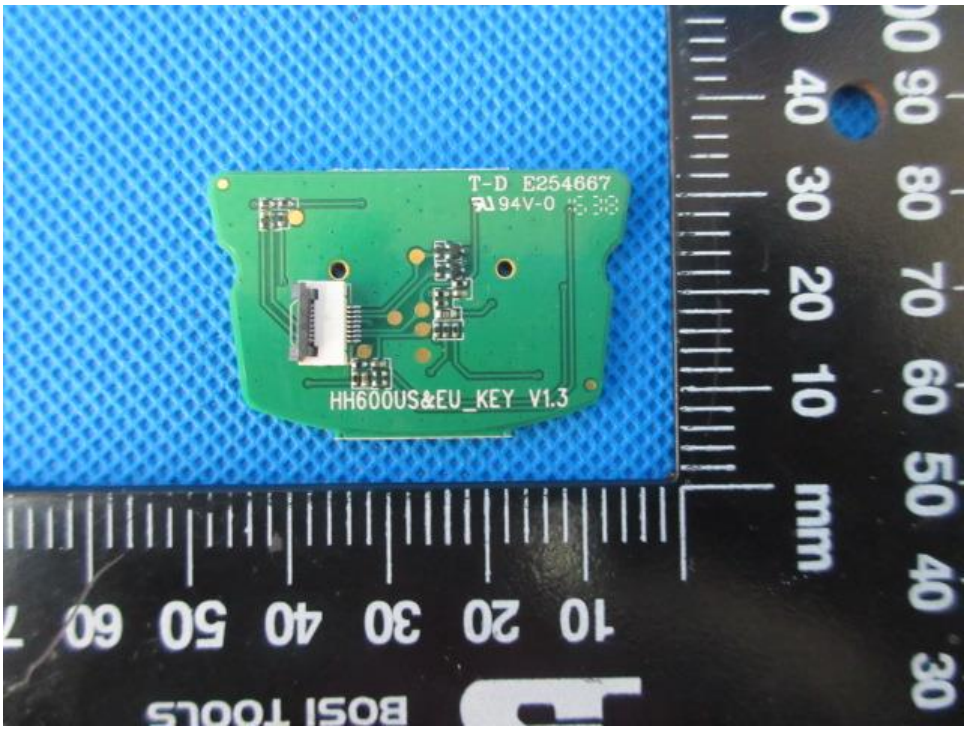

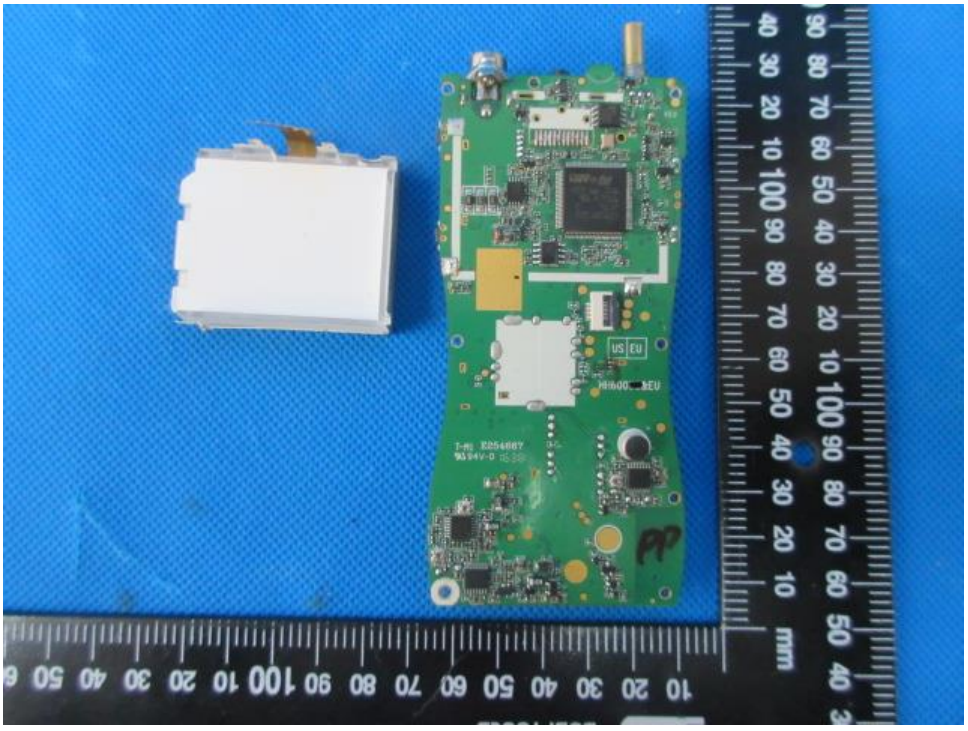

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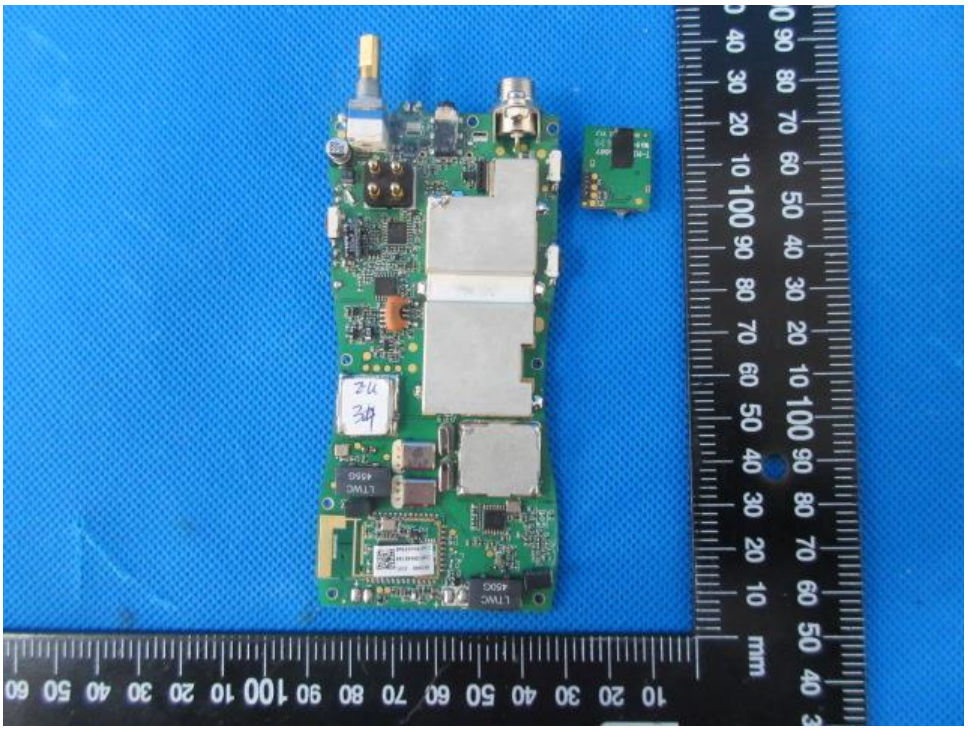

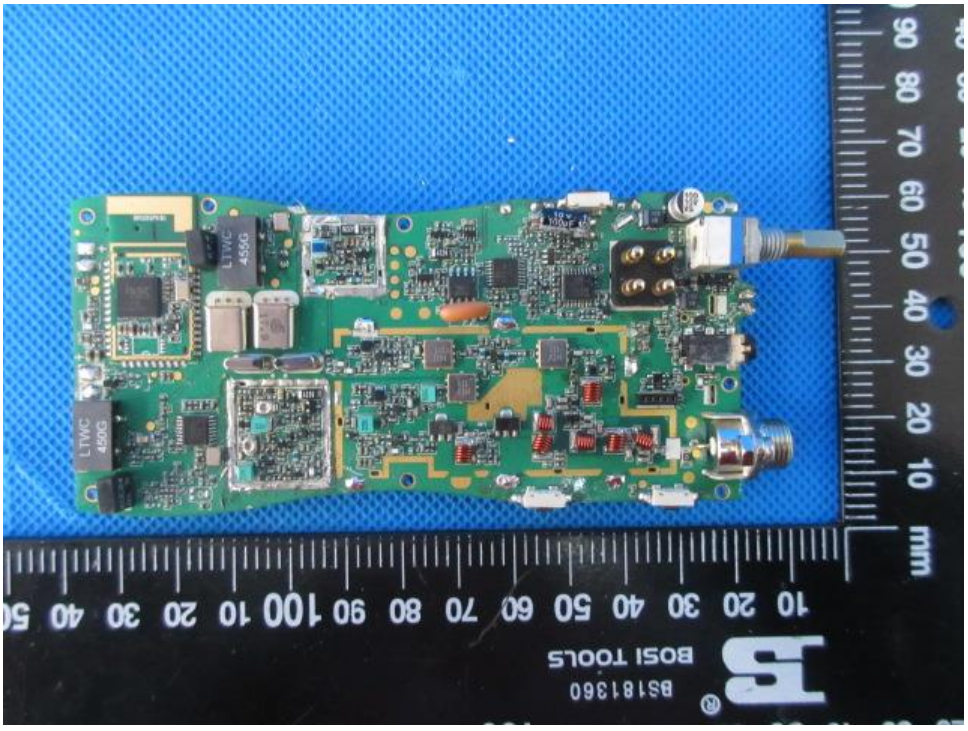

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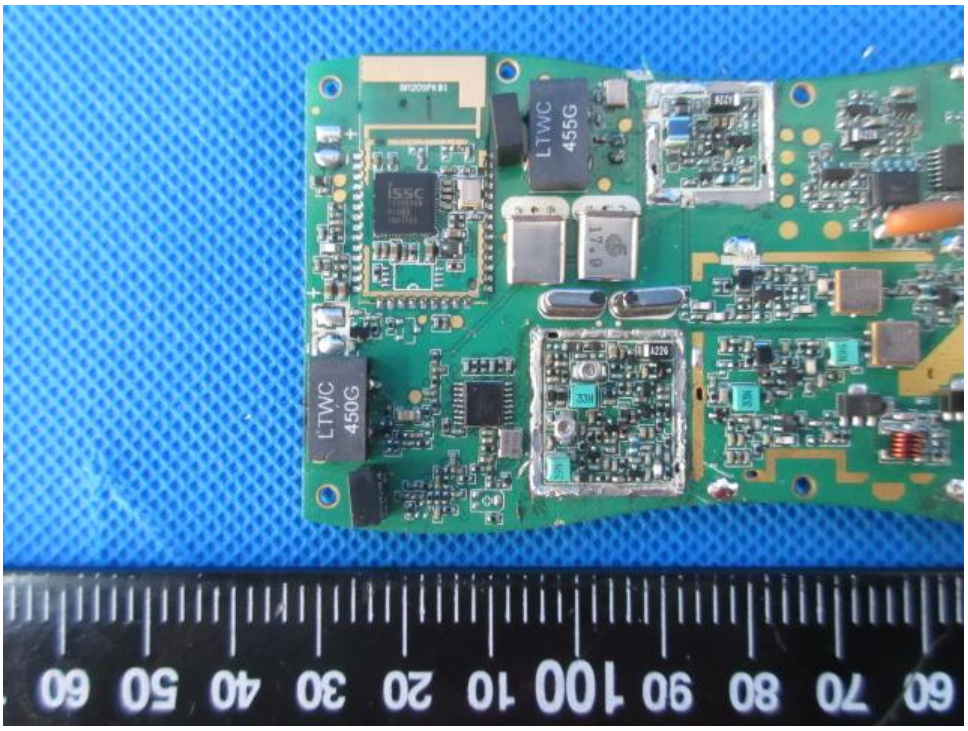

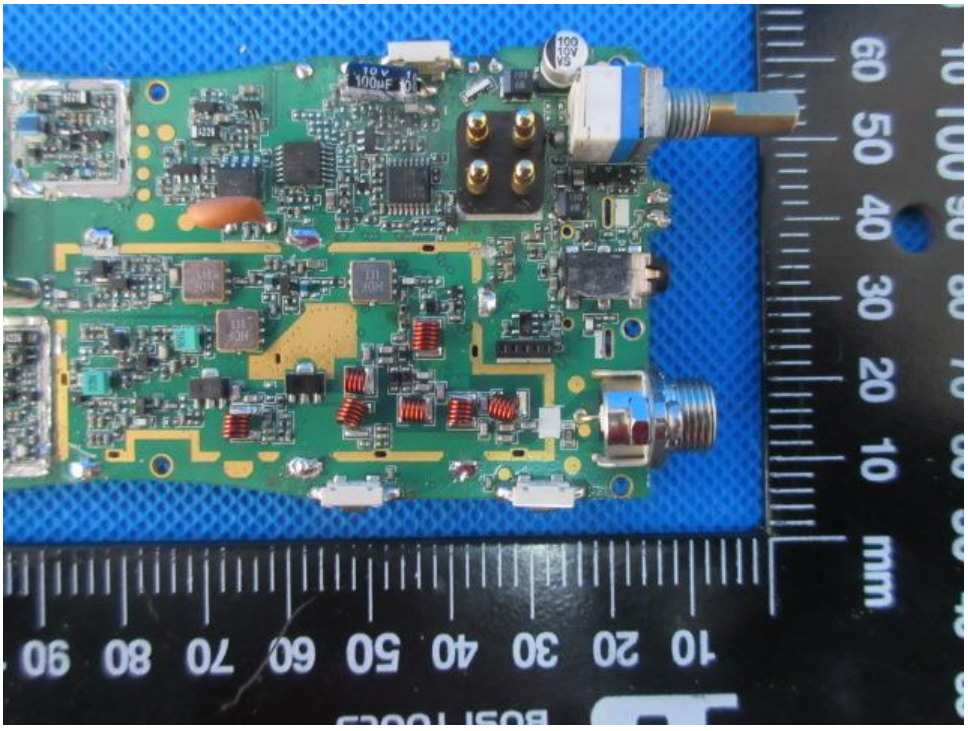

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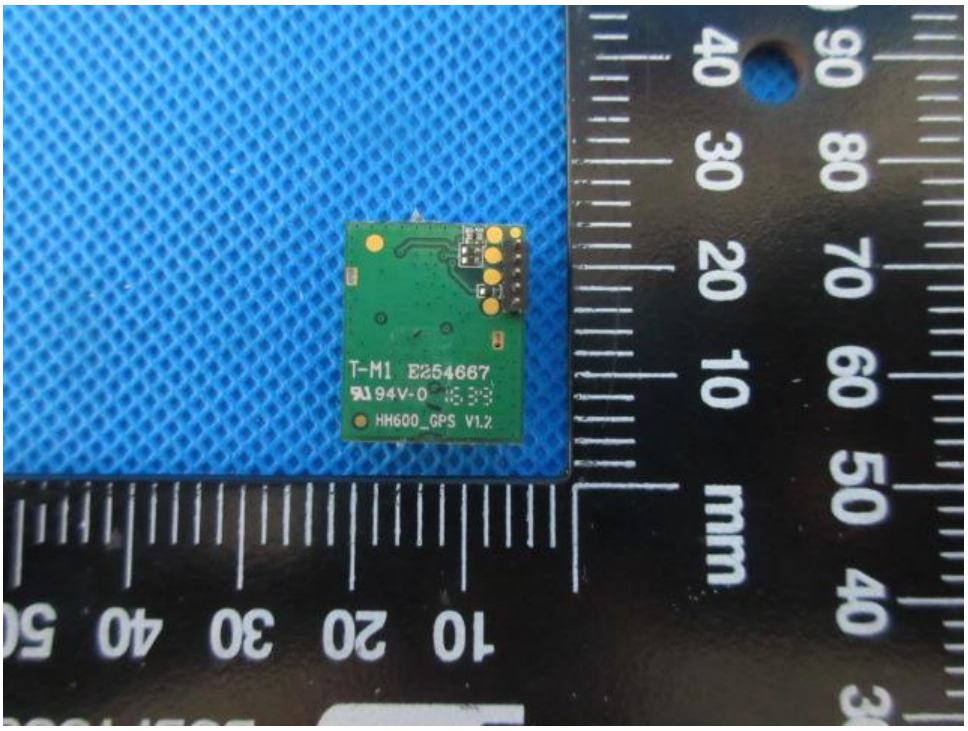

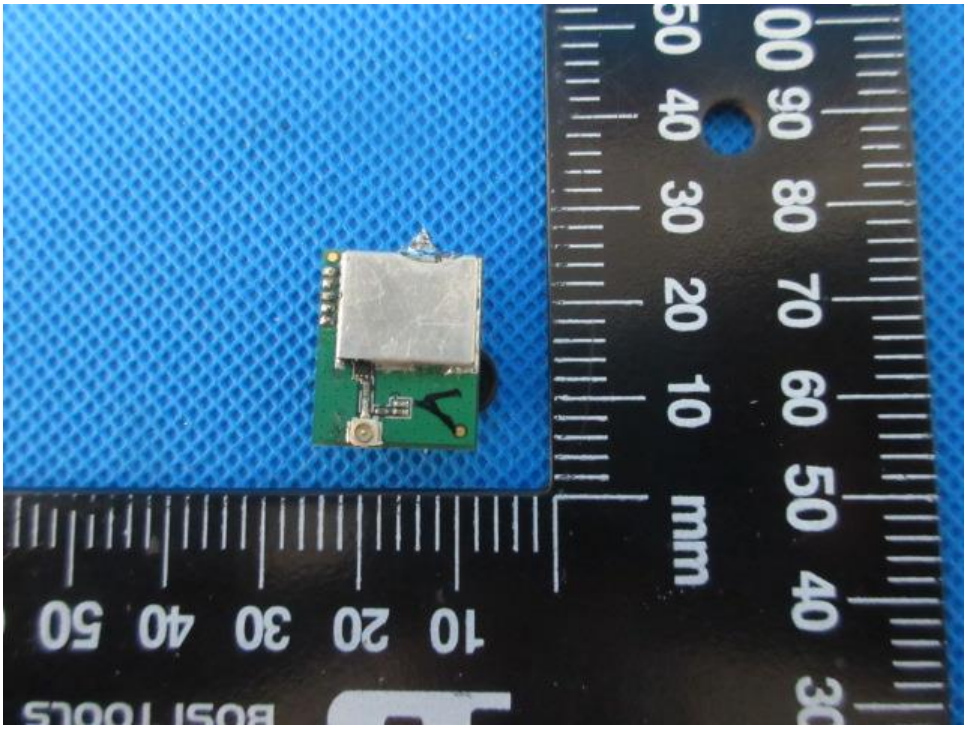

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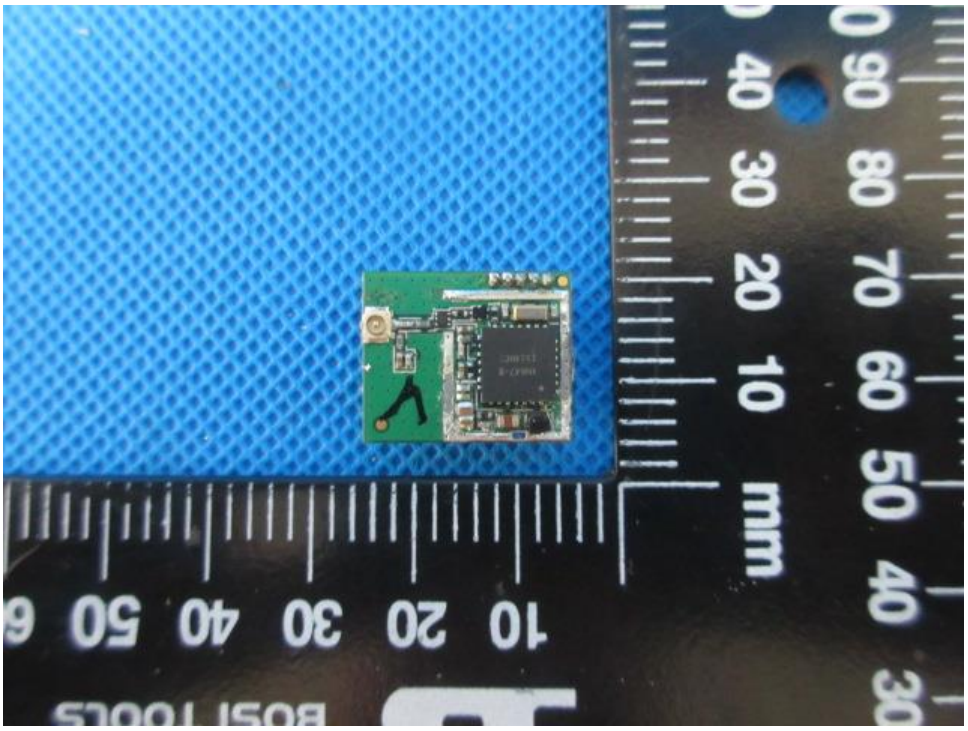
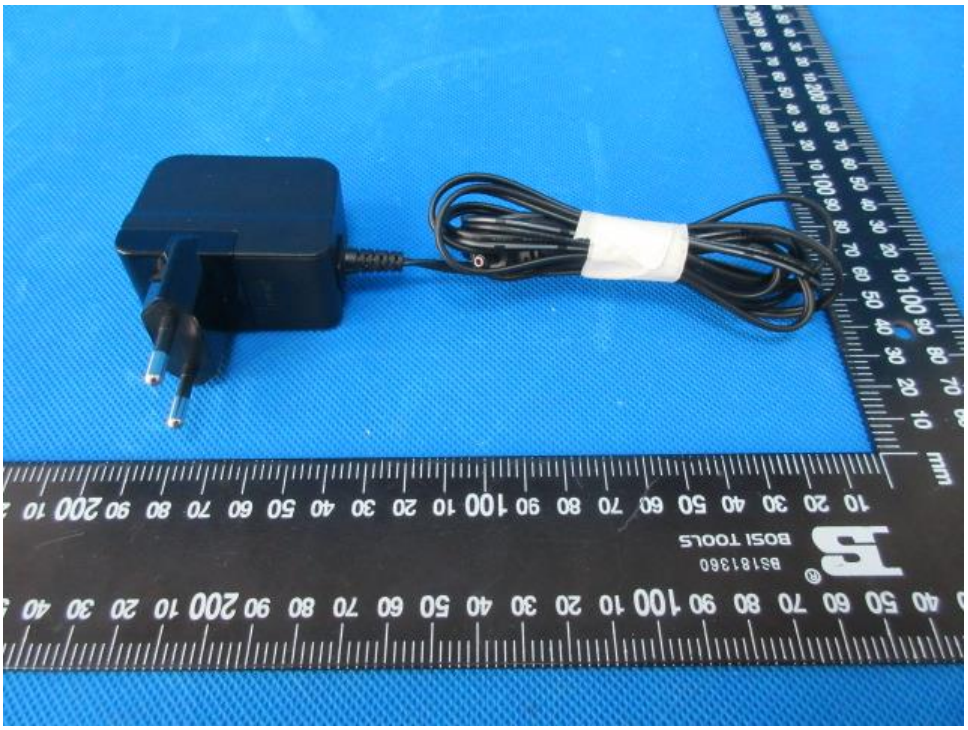


Adapter View:



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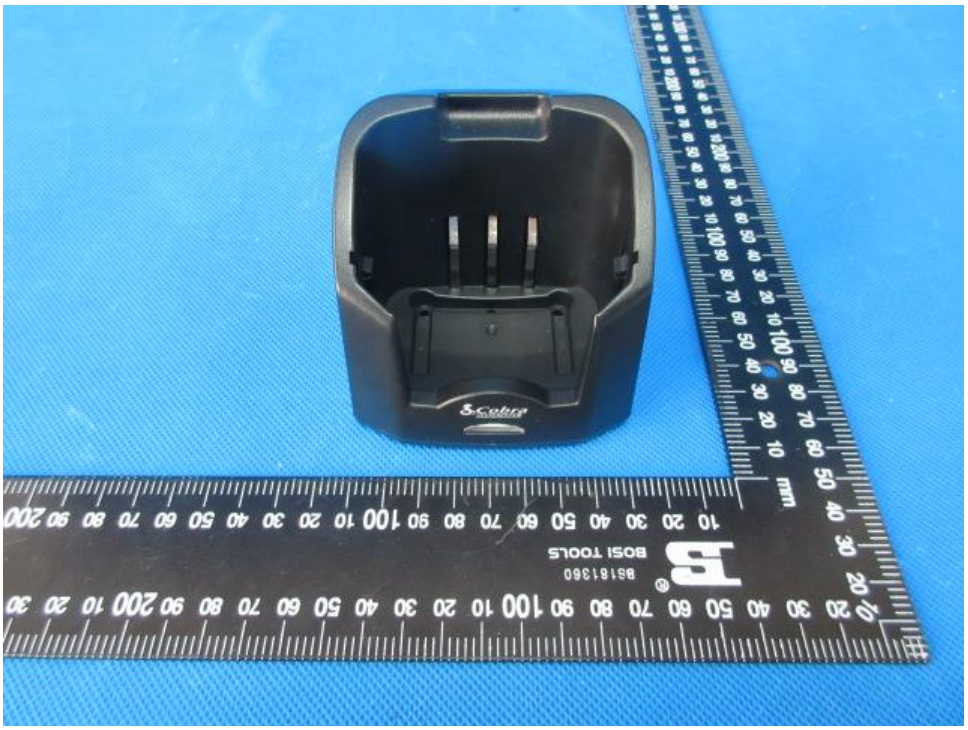
Charger View:



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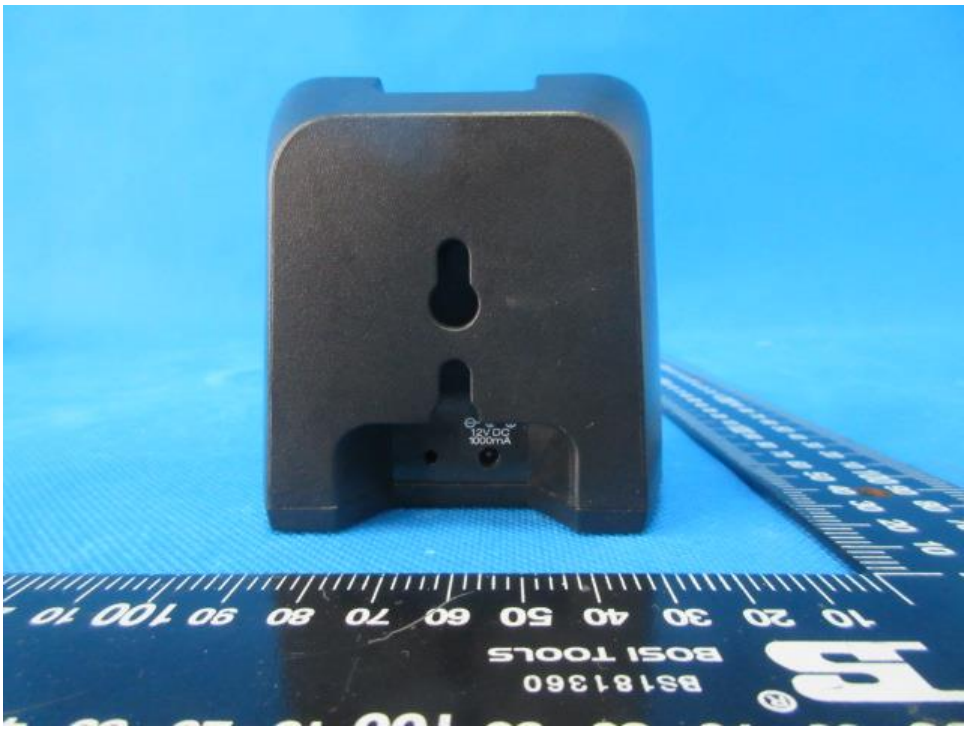

Speaker View:

THE END

TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
Building 12&13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District,
Shenzhen City, 518052, P. R. China Tel. +86 755 8828 6998, Fax: +86 755 8828 5299