



# TEST REPORT

**Report Reference No.....:** TRE1811020703 R/C.....: 87587

**FCC ID.....:** BBOMRF77B

**Applicant's name.....:** Cobra Electronics Corporation

Address .....: 6500 West Cortland Street Chicago, IL 60707

Manufacturer.....: Cobra Electronics Corporation

Address.....: 6500 West Cortland Street Chicago, IL 60707

**Test item description .....** **VHF Marine Radio**

Trade Mark .....: Cobra

Model/Type reference .....: MR F77W GPS

Listed Model(s).....: MR F77B GPS, MR F57B, MR F57W

**Standard.....:** **IEC 62238**

Date of receipt of test sample.....: Nov.27, 2018

Date of testing.....: Nov.27, 2018- Jan.28, 2019

Date of issue.....: Jan.28, 2019

**Result .....** **PASS**

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**Testing Laboratory Name .....** **Shenzhen Huatongwei International Inspection Co., Ltd**

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*The test report merely correspond to the test sample.*

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## 1. TEST STANDARDS AND REPORT VERSION

### 1.1. Test Standards

The tests were performed according to following standards:

[IEC 62238:2003](#)-Maritime navigation and radiocommunication equipment and systems –VHF radiotelephone equipment incorporating Class "D" Digital Selective Calling (DSC) – Methods of testing and required test results

### 1.2. Report version information

Revision No.	Date of issue	Description
N/A	2019-01-28	Original

## 2. Test Description

Environmental Requirement			
Test item	Standards requirement (IEC62238)	Result	Test Engineer
Vibration test	Sub-clause 7.4	Pass	Gaosheng Pan
Temperature tests	Dry heat	Gaoshe ng Pan	Gaosheng Pan
	Damp heat	Gaoshe ng Pan	Gaosheng Pan
	Low temperature	Gaoshe ng Pan	Gaosheng Pan
Transmitter Requirement			
Test item	Standards requirement (IEC62238)	Result	Test Engineer
Frequency error	Sub-clause 8.1	Pass	Gaosheng Pan
Carrier power	Sub-clause 8.2	Pass	Gaosheng Pan
Frequency deviation	Sub-clause 8.3	Pass	Gaosheng Pan
Sensitivity of the modulator, including microphone	Sub-clause 8.4	Pass	Gaosheng Pan
Audio frequency response	Sub-clause 8.5	Pass	Gaosheng Pan
Audio frequency harmonic distortion of the emission	Sub-clause 8.6	Pass	Gaosheng Pan
Adjacent channel power	Sub-clause 8.7	Pass	Gaosheng Pan
Conducted spurious emissions conveyed to the antenna	Sub-clause 8.8	Pass	Gaosheng Pan
Transient frequency behaviour of the transmitter	Sub-clause 8.9	Pass	Gaosheng Pan
Residual modulation of the transmitter	Sub-clause 8.10	Pass	Gaosheng Pan
Frequency error (DSC signal)	Sub-clause 8.11	Pass	Gaosheng Pan
Modulation index for DSC	Sub-clause 8.12	Pass	Gaosheng Pan
Modulation rate for DSC	Sub-clause 8.13	Pass	Gaosheng Pan
Testing of generated call sequences	Sub-clause 8.14	Pass	Gaosheng Pan
Receiver for Radiotelephone Requirement			
Test item	Standards requirement (IEC62238)	Result	Test Engineer
Harmonic distortion and rated audio frequency output power	Sub-clause 9.1	Pass	Gaosheng Pan
Audio frequency response	Sub-clause 9.2	Pass	Gaosheng Pan
Maximum usable sensitivity	Sub-clause 9.3	Pass	Gaosheng Pan
Co-channel rejection	Sub-clause 9.4	Pass	Gaosheng Pan
Adjacent channel selectivity	Sub-clause 9.5	Pass	Gaosheng Pan
Spurious response rejection	Sub-clause 9.6	Pass	Gaosheng Pan
Intermodulation response	Sub-clause 9.7	Pass	Gaosheng Pan
Blocking or desensitization	Sub-clause 9.8	Pass	Gaosheng Pan
Spurious emissions	Sub-clause 9.9	Pass	Gaosheng Pan
Receiver residual noise level	Sub-clause 9.10	Pass	Gaosheng Pan
Squelch operation	Sub-clause 9.11	Pass	Gaosheng Pan
Squelch hysteresis	Sub-clause 9.12	Pass	Gaosheng Pan
Multiple watch characteristic	Sub-clause 9.13	Pass	Gaosheng Pan

<b>Receiver for DSC decoder Requirement</b>			
Test item	Standards requirement (IEC62238)	Result	Test Engineer
Maximum usable sensitivity	Sub-clause 10.1	Pass	Gaosheng Pan
Co-channel rejection	Sub-clause 10.2	Pass	Gaosheng Pan
Adjacent channel selectivity	Sub-clause 10.3	Pass	Gaosheng Pan
Spurious response and blocking immunity	Sub-clause 10.4	Pass	Gaosheng Pan
Intermodulation response	Sub-clause 10.5	Pass	Gaosheng Pan
Dynamic range	Sub-clause 10.6	Pass	Gaosheng Pan
Spurious emissions	Sub-clause 10.7	Pass	Gaosheng Pan
Verification of correct decoding of various types of DSC calls	Sub-clause 10.8	Pass	Gaosheng Pan
Reaction to VTS and AIS channel management DSC transmissions	Sub-clause 10.9	Pass	Gaosheng Pan
Simultaneous reception	Sub-clause 10.10	Pass	Gaosheng Pan

### 3. SUMMARY

#### 3.1. Client Information

Applicant:	Cobra Electronics Corporation
Address:	6500 West Cortland Street Chicago, IL 60707
Manufacturer:	Cobra Electronics Corporation
Address:	6500 West Cortland Street Chicago, IL 60707

#### 3.2. Product Description

Name of EUT:	VHF Marine Radio	
Trade mark:	Cobra	
Model/Type reference:	MR F77W GPS	
Listed mode(s):	MR F77B GPS, MR F57B, MR F57W	
Power supply:	DC 12V	
Hardware Version:	V0.4	
Software Version:	V0.12.05	
Marine Radio		
Operation Frequency Range:	TX:156.025MHz to 157.425MHz	
	RX:156.05MHz to 157.425MHz	
Rated Output Power:	<input checked="" type="checkbox"/> High Power: 22W (43.98dBm) <input checked="" type="checkbox"/> Low Power 1W (30.00dBm)	
Modulation Type:	Analog Voice:	FM
	Digital Data(DSC):	AFSK
Channel Separation:	Analog Voice:	25kHz
	Digital Data(DSC):	25kHz
Emission Designator:	Analog Voice:	16K0G3E
	Digital Data(DSC):	16K0G2B
Antenna Type:	External	

### 3.3. Test frequency list

Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)	
			TX	RX
Analog Voice	25kHz	CH <sub>L</sub> (CH60)	156.025	160.625
		CH <sub>M1</sub> (CH16)	156.800	156.800
		CH <sub>H</sub> (CH88)	157.425	157.425
Digital Data(DSC)	25kHz	CH <sub>M2</sub> (CH70)	156.525	156.525

### 3.4. EUT operation mode

Test mode	Transmitting	Receiving	Power level		Analog Voice 25kHz
			High	Low	
TX-AWH	√		√		√
TX-AWL	√			√	√
RX-AW		√			√

Test mode	Transmitting	Receiving	States			Digital Data(DSC) 25kHz
			B	Y	B+Y	
TX-B	√		√			√
TX-Y	√			√		√
TX-(B+Y)	√				√	√
RX-DSC		√				√

√ : is operation mode.

### 3.5. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

● - supplied by the manufacturer

○ - supplied by the lab

○ Power Cable	Length (m) :	/
	Shield :	Unshielded
	Detachable :	Undetachable
○ Multimeter	Manufacturer :	/
	Model No. :	/



## **4. TEST ENVIRONMENT**

### **4.1. Address of the test laboratory**

Laboratory: Shenzhen Huatongwei International Inspection 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

### **4.2. Test Facility**

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

#### **CNAS-Lab Code: L1225**

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

#### **A2LA-Lab Cert. No.: 3902.01**

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

#### **FCC-Registration No.: 762235**

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration 762235.

#### **IC-Registration No.: 5377B-1**

Two 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 5377B-1.

#### **ACA**

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

### 4.3. Environmental conditions

<b>Normal Conditon</b>	Temperature	15 °C to 35 °C		
	Relative humidity	20 % to 75 %.		
	Voltage	<input checked="" type="checkbox"/> Mains voltage	Nominal mains voltage	
		<input type="checkbox"/> Lead-acid battery	1.1 * the nominal voltage of the battery	
<input type="checkbox"/> Other		the normal test voltage shall be that declared by the equipment provider		
<b>Extreme Conditon</b>	Temperature	<input type="checkbox"/> -15 °C and +55 °C for equipment intended for mounting below deck		
		<input checked="" type="checkbox"/> -20 °C and +55 °C for equipment intended for mounting above deck.		
		<input type="checkbox"/> -10 °C to +55 °C for Base stations for indoor/controlled climate conditions		
	Voltage	<input type="checkbox"/> Mains voltage	± 10 %* the nominal mains voltage	
		<input type="checkbox"/> Secondary battery power sources	1,3 and 0,9 multiplied by the nominal voltage of the battery	
<input checked="" type="checkbox"/> Other		For equipment using other power sources, the extreme test voltages shall be as stated by the manufacturer.		

Normal Conditon	V <sub>N</sub> =nominal Voltage	DC 12V
	T <sub>N</sub> =normal Temperature	25 °C
Extreme Conditon	V <sub>L</sub> =lower Voltage	DC 10.2V
	T <sub>L</sub> =lower Temperature	-20 °C
	V <sub>H</sub> =higher Voltage	DC 13.8V
	T <sub>H</sub> =higher Temperature	55 °C

#### 4.4. 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 CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ 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
Frequency stability & Occupied Bandwidth	18Hz for <1GHz 69Hz for >1GHz	(1)
Conducted Output Power	0.63dB	(1)
ERP / EIRP / RSE	2.38dB for <1GHz 3.45dB for >1GHz	(1)
Conducted Emission 9KHz-30MHz	3.35 dB	(1)
Radiated Emission 30~1000MHz	4.80 dB	(1)
Radiated Emission 1~18GHz	5.16 dB	(1)
Radiated Emission 18-40GHz	5.54 dB	(1)
FM deviation	25 Hz	(1)
Audio level	0.62 dB	(1)
Low Pass Filter Response	0.76 dB	(1)
Modulation Limiting	0.42 %	(1)
Transient Frequency Behavior	6.8 %	(1)
Radiated Emission30~1000MHz	4.28 dB	(1)
Radiated Emission1~18GHz	5.16 dB	(1)
Conducted Disturbance0.15~30MHz	3.35 dB	(1)

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

#### 4.5. Equipments Used during the Test

● TS8613 Test system						
Used	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Spectrum Analyzer	Agilent	N9020A	MY50510187	2018/09/29	2019/09/28
●	Signal & Spectrum Analyzer	R&S	FSW26	103440	2018/10/28	2019/10/27
●	RF Communication Test Set	HP	8920A	3813A10206	2018/10/28	2019/10/27
●	Digital intercom communication tester	Aeroflex	3920B	1001682041	2018/10/28	2019/10/27
●	Signal Generator	R&S	SML02	100507	2018/10/27	2019/10/26
●	Signal Generator	IFR	2032	203002\100	2018/11/11	2019/11/10
●	RF Control Unit	Tonscend	JS0806-2	N/A	N/A	N/A
●	Fliter-VHF	Microwave	N26460M1	498702	2018/03/19	2019/03/18
○	Fliter-UHF	Microwave	N25155M2	498704	2018/03/19	2019/03/18
○	Power Divider	Microwave	OPD1040-N-4	N/A	2018/11/15	2019/11/14
○	Attenuator	JFW	50FH-030-100	N/A	2018/11/15	2019/11/14
○	Attenuator	JFW	50-A-MFN-20	0322	2018/11/15	2019/11/14
●	Test software	HTW	Radio ATE	N/A	N/A	N/A

● Auxiliary Equipment						
Used	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Climate chamber	ESPEC	GPL-2	N/A	2018/11/08	2019/11/07
●	DC Power Supply	Gwinstek	SPS-2415	GER835793	2018/10/28	2019/10/27

## 5. TEST CONDITIONS AND RESULTS

### 5.1. Environmental Requirement

#### 5.1.1. Vibration test

##### TEST RESULTS:

Complies

Please refer to the below test data:

Frequency Error:

Operation Mode	Test conditions			Frequency Error(kHz)	Limit (KHz)	Result
	Temperature (°C)	Voltage (V)	Vibration Frequency (Hz)	CH <sub>M</sub>		
TX-AWH	T <sub>N</sub>	V <sub>N</sub>	2.5~100	0.082	±1.5	Pass

Carrier power:

Operation Mode	Temperature (°C)	Voltage (V)	Vibration Frequency (Hz)	Test Channel	Measured power (dBm)	Limit (dB)	Result
TX-AWH	T <sub>N</sub>	V <sub>N</sub>	2.5~100	CH <sub>M</sub>	42.94	37.78~43.98	Pass

Maximum usable sensitivity:

Operation Mode	Temperature (°C)	Voltage (V)	Vibration Frequency (Hz)	Test Channel	Measured SINAD (dB)	Limit (dB)	Result
RX-AW	T <sub>N</sub>	V <sub>N</sub>	2.5~100	CH <sub>L</sub>	30.58	≥20	Pass
				CH <sub>M</sub>	31.41		
				CH <sub>H</sub>	30.29		

DSC receiver:

Operation Mode	Temperature (°C)	Voltage (V)	Vibration Frequency (Hz)	Test Channel	Measured (error ratio)	Limit (error ratio)	Result
RX-DSC	T <sub>N</sub>	V <sub>N</sub>	2.5~100	CH <sub>M1</sub>	0.005	≤10 <sup>-2</sup>	Pass

**5.1.2. Dry heat****TEST RESULTS:**

Complies

Please refer to the below test data:

Frequency Error:

Operation Mode	Test conditions		Frequency Error(kHz)	Limit (kHz)	Result
	Temperature(°C )	Voltage (V)	CH <sub>M</sub>		
TX-AWH	55	V <sub>N</sub>	0.167	±1.5	Pass

Carrier power:

Operation Mode	Temperature (°C )	Voltage (V)	Test Channel	Measured power (dBm)	Limit (dB)	Result
TX-AWH	55	V <sub>N</sub>	CH <sub>M</sub>	43.15	37.78~43.98	Pass

Maximum usable sensitivity:

Operation Mode	Temperature (°C )	Voltage (V)	Test Channel	Measured SINAD (dB)	Limit (dB)	Result
RX-AW	55	V <sub>N</sub>	CH <sub>L</sub>	31.88	≥20	Pass
			CH <sub>M</sub>	31.12		
			CH <sub>H</sub>	30.97		

DSC receiver:

Operation Mode	Temperature (°C )	Voltage (V)	Test Channel	Measured (error ratio)	Limit (error ratio)	Result
RX-DSC	55	V <sub>N</sub>	CH <sub>M1</sub>	0.004	≤10 <sup>-2</sup>	Pass

**5.1.3. Damp heat****TEST RESULTS:**

Complies

Please refer to the below test data:

Frequency Error:

Operation Mode	Test conditions			Frequency Error(kHz)	Limit (kHz)	Result
	Temperature(°C )	Humidity(%)	Voltage (V)	CH <sub>M</sub>		
TX-AWH	40	93	V <sub>N</sub>	0.159	±1.5	Pass

Carrier power:

Operation Mode	Temperature(°C )	Humidity(%)	Voltage (V)	Test Channel	Measured power (dBm)	Limit (dB)	Result
TX-AWH	40	93	V <sub>N</sub>	CH <sub>M</sub>	43.11	37.78~43.98	Pass

Maximum usable sensitivity:

Operation Mode	Humidity(%)	Voltage (V)	Voltage (V)	Test Channel	Measured SINAD (dB)	Limit (dB)	Result
RX-AW	40	93	V <sub>N</sub>	CH <sub>L</sub>	31.22	≥20	Pass
				CH <sub>M</sub>	30.99		
				CH <sub>H</sub>	31.01		

DSC receiver:

Operation Mode	Temperature(°C )	Humidity(%)	Voltage (V)	Test Channel	Measured (error ratio)	Limit (error ratio)	Result
RX-DSC	40	93	V <sub>N</sub>	CH <sub>M1</sub>	0.008	≤10 <sup>-2</sup>	Pass

**5.1.4. Low temperature****TEST RESULTS:**

Complies

Please refer to the below test data:

Frequency Error:

Operation Mode	Test conditions		Frequency Error(kHz)	Limit (kHz)	Result
	Temperature(°C )	Voltage (V)	CH <sub>M</sub>		
TX-AWH	-15	V <sub>N</sub>	0.177	±1.5	Pass

Carrier power:

Operation Mode	Temperature (°C )	Voltage (V)	Test Channel	Measured power (dBm)	Limit (dB)	Result
TX-AWH	-15	V <sub>N</sub>	CH <sub>M</sub>	42.97	37.78~43.98	Pass

Maximum usable sensitivity:

Operation Mode	Temperature (°C )	Voltage (V)	Test Channel	Measured SINAD (dB)	Limit (dB)	Result
RX-AW	-15	V <sub>N</sub>	CH <sub>L</sub>	31.22	≥20	Pass
			CH <sub>M</sub>	33.14		
			CH <sub>H</sub>	32.58		

DSC receiver:

Operation Mode	Temperature (°C )	Voltage (V)	Test Channel	Measured (error ratio)	Limit (error ratio)
RX-DSC	-15	V <sub>N</sub>	CH <sub>M1</sub>	0.006	≤10 <sup>-2</sup>



## 5.2. Transmitter Requirement

### 5.2.1. Frequency error

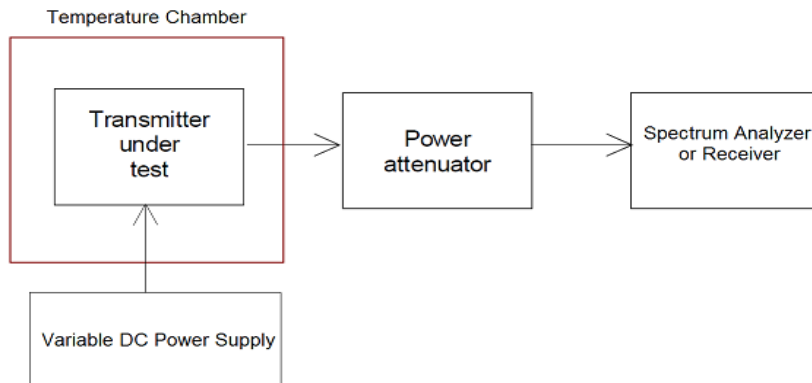
The frequency error is the difference between the measured carrier frequency and its nominal value.

#### LIMIT

IEC 62238 Sub-clause 8.1.3

The frequency error shall be within  $\pm 1,5$  kHz.

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The test conditions.

normal condition                       Extreme conditions

2. Please refer to IEC 62238 Sub-clause 8.1.2 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(°C )	Voltage (V)	CH <sub>L</sub>	CH <sub>M</sub>	CH <sub>H</sub>		
TX-AWH	T <sub>N</sub>	V <sub>N</sub>	0.099	0.098	0.094	±1.5	Pass
	T <sub>L</sub>	V <sub>H</sub>	0.115	0.121	0.113		
		V <sub>L</sub>	0.214	0.221	0.210		
	T <sub>H</sub>	V <sub>H</sub>	0.119	0.128	0.117		
		V <sub>L</sub>	0.222	0.234	0.229		
	TX-AWL	T <sub>N</sub>	V <sub>N</sub>	0.101	0.097		
T <sub>L</sub>		V <sub>H</sub>	0.119	0.114	0.118		
		V <sub>L</sub>	0.223	0.229	0.231		
T <sub>H</sub>		V <sub>H</sub>	0.224	0.118	0.211		
		V <sub>L</sub>	0.235	0.231	0.238		

### 5.2.2. Carrier Power (Conducted)

The carrier power is the mean power delivered to the artificial antenna during one radio frequency cycle in the absence of modulation. The rated output power is the carrier power declared by the manufacturer.

#### LIMIT

IEC 62238 Sub-clause 8.2.3

Normal test conditions:

The rated output power of the equipment shall be between 6 W and 25 W.

With the output power switch set at maximum, the carrier power shall be within  $\pm 1,5$  dB of the rated output power under normal test conditions. The output power shall never however exceed 25 W.

With the output power switch set at minimum the carrier power shall remain between 0,1 W and 1 W.

The maximum continuous transmission time shall be between 5 min and 6 min.

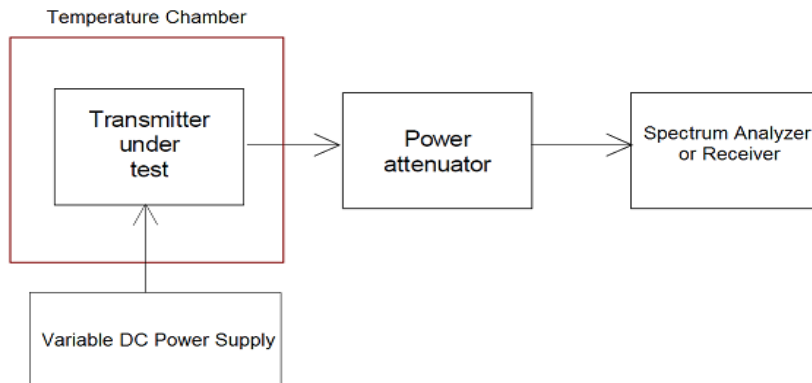
Extreme test conditions:

With the output power switch set at maximum, the carrier power shall remain between 6 W and 25 W and be within +2 dB, -3 dB of the rated output power under extreme conditions. The output power shall never however exceed 25 W.

With the output power switch set at minimum the carrier power shall remain between 0,1 W and 1 W.

The maximum continuous transmission time shall be between 5 min and 6 min.

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The test conditions.

normal condition

Extreme conditions

2. Please refer to IEC 62238 Sub-clause 8.2.2 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:

Operation Mode	Temperature (°C)	Voltage (V)	Test Channel	Measured power (dBm)	Limit (dBm)	Result
TX-AWH	T <sub>N</sub>	V <sub>N</sub>	CH <sub>L</sub>	43.88	42.48~43.98	Pass
			CH <sub>M</sub>	43.82		
			CH <sub>H</sub>	43.78		
	T <sub>L</sub>	V <sub>H</sub>	CH <sub>L</sub>	43.74	40.98~43.98	
			CH <sub>M</sub>	43.75		
			CH <sub>H</sub>	43.65		
		V <sub>L</sub>	CH <sub>L</sub>	43.99		
			CH <sub>M</sub>	43.96		
			CH <sub>H</sub>	43.87		
	T <sub>H</sub>	V <sub>H</sub>	CH <sub>L</sub>	42.39	40.98~43.98	
			CH <sub>M</sub>	42.50		
			CH <sub>H</sub>	42.35		
V <sub>L</sub>		CH <sub>L</sub>	43.78			
		CH <sub>M</sub>	43.68			
		CH <sub>H</sub>	43.67			
TX-AWL	T <sub>N</sub>	V <sub>N</sub>	CH <sub>L</sub>	29.88	20~30	Pass
			CH <sub>M</sub>	29.79		
			CH <sub>H</sub>	29.91		
	T <sub>L</sub>	V <sub>H</sub>	CH <sub>L</sub>	29.95	20~30	
			CH <sub>M</sub>	29.87		
			CH <sub>H</sub>	29.98		
		V <sub>L</sub>	CH <sub>L</sub>	29.79		
			CH <sub>M</sub>	29.73		
			CH <sub>H</sub>	29.81		
	T <sub>H</sub>	V <sub>H</sub>	CH <sub>L</sub>	29.78	20~30	
			CH <sub>M</sub>	29.71		
			CH <sub>H</sub>	29.82		
		V <sub>L</sub>	CH <sub>L</sub>	29.78		
			CH <sub>M</sub>	29.66		
			CH <sub>H</sub>	29.77		

### 5.2.3. Frequency Deviation

For the purpose of the present document, the frequency deviation is the difference between the instantaneous frequency of the modulated radio frequency signal and the carrier frequency.

#### LIMIT

IEC 62238 Sub-clause 8.3.3

The maximum permissible frequency deviation shall be:

25 kHz channels:  $\pm 5$  kHz.

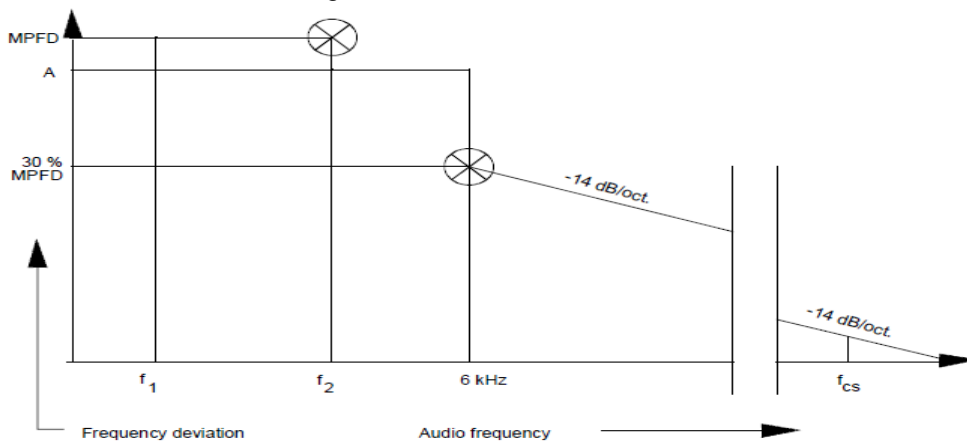
12,5 kHz channels:  $\pm 2,5$  kHz.

between 3,0 kHz/2,55 kHz and 6,0 kHz: shall not exceed the frequency deviation at a modulation frequency of 3,0 kHz/2,55 kHz.

At 6,0 kHz the deviation shall be not more than 30,0 % of the maximum permissible frequency deviation.

between 6,0 kHz and a frequency equal to the channel separation for which the equipment is intended shall not exceed that given by a linear representation of the frequency deviation (dB) relative to the modulation frequency, starting at the 6,0 kHz limit and having a slope of -14,0 dB per octave.

These limits are illustrated in figure 1.



NOTE:  
Abbreviations:  
f<sub>1</sub> lowest appropriate frequency  
f<sub>2</sub> 3,0 kHz (for 25 kHz channel separation), or  
2,55 kHz (for 12,5 kHz channel separation)  
MPFD Maximum Permissible Frequency Deviation, clause 8.3.2.1  
A measured frequency deviation at f<sub>2</sub>  
f<sub>cs</sub> frequency equal to channel separation

Figure 1: Frequency deviation

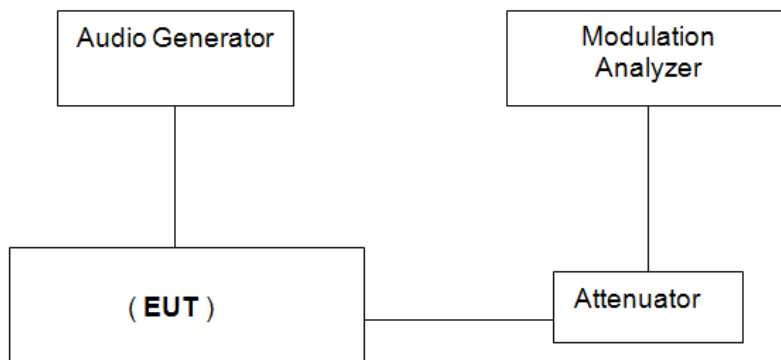
#### TEST PROCEDURE

1. The test conditions.

normal condition  Extreme conditions

2. Please refer to IEC 62238 Sub-clause 8.3.2 for the measurement method.

#### TEST CONFIGURATION



**TEST MODE:**

Please reference to the section 3.4

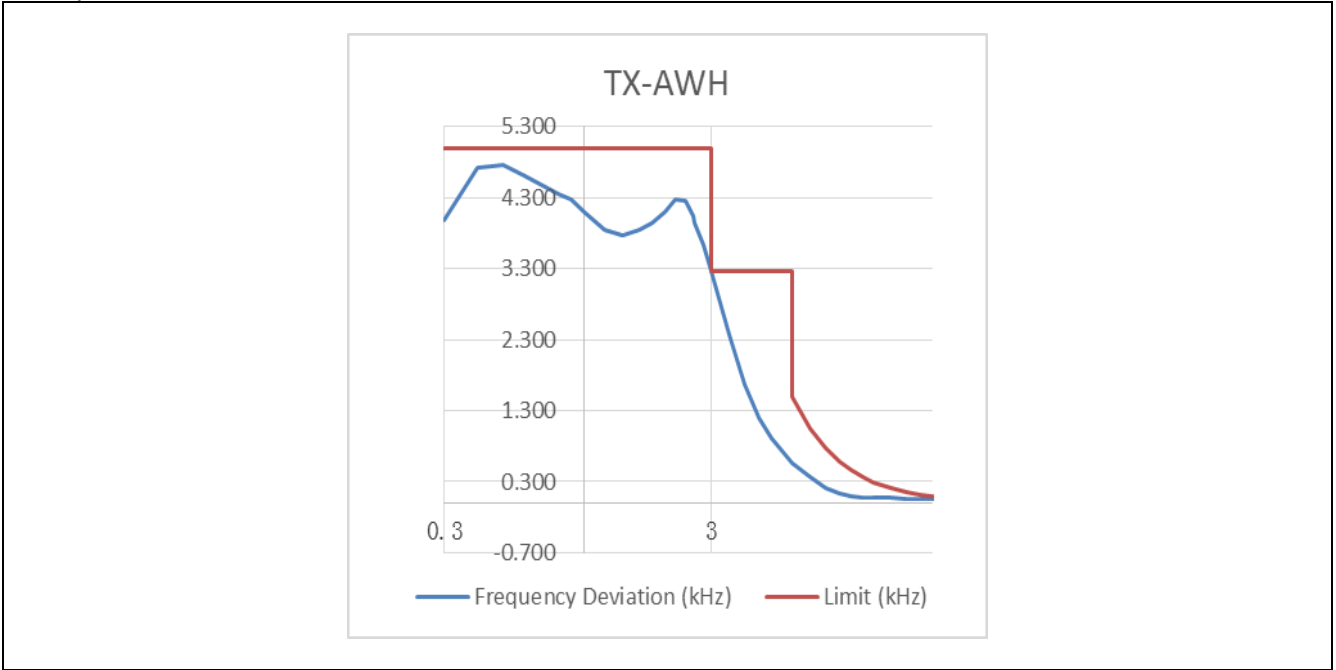
**TEST RESULTS** **Passed**       **Not Applicable**

Note:

We tested TX-AWH and TX-AWL all channel, recorded worst case TX-AWH for CH<sub>M</sub>.

TX-AWH:CH <sub>M</sub>			
Modulation Frequency (kHz)	Frequency Deviation (kHz)	Limit (kHz)	Result
0.3	3.979	5.00	Pass
0.4	4.718	5.00	Pass
0.5	4.761	5.00	Pass
0.6	4.608	5.00	Pass
0.7	4.461	5.00	Pass
0.8	4.359	5.00	Pass
0.9	4.278	5.00	Pass
1	4.101	5.00	Pass
1.2	3.845	5.00	Pass
1.4	3.768	5.00	Pass
1.6	3.850	5.00	Pass
1.8	3.935	5.00	Pass
2	4.096	5.00	Pass
2.2	4.272	5.00	Pass
2.4	4.254	5.00	Pass
2.55	4.044	5.00	Pass
2.6	3.948	5.00	Pass
2.8	3.622	5.00	Pass
3	3.257	5.00	Pass
3	3.257	3.26	Pass
3.5	2.377	3.26	Pass
4	1.672	3.26	Pass
4.5	1.210	3.26	Pass
5	0.915	3.26	Pass
6	0.552	3.26	Pass
6	0.552	1.50	Pass
7	0.359	1.05	Pass
8	0.218	0.77	Pass
9	0.139	0.58	Pass
10	0.099	0.46	Pass
11	0.072	0.37	Pass
12	0.068	0.30	Pass
14	0.072	0.21	Pass
16	0.064	0.15	Pass
18	0.062	0.12	Pass
20	0.057	0.09	Pass
22	0.059	0.07	Pass
24	0.058	0.06	Pass
25	0.049	0.05	Pass

Test plot as follow:



### 5.2.4. Sensitivity of the modulator, including microphone

This characteristic expresses the capability of the transmitter to produce sufficient modulation when an audio frequency signal corresponding to the normal mean speech level is applied to the microphone.

#### LIMIT

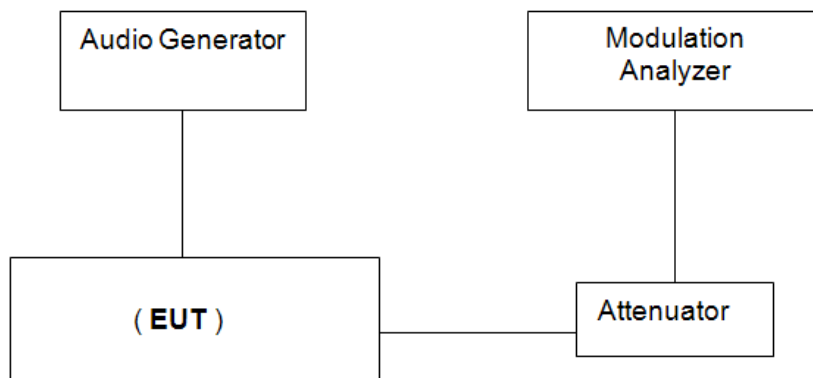
IEC 62238 Sub-clause 8.4.3

The resulting frequency deviation shall be between  $\pm 1,5$  kHz and  $\pm 3$  kHz.

#### TEST PROCEDURE

- The test conditions.
  - normal condition       Extreme conditions
- Please refer to IEC 62238 Sub-clause 8.4.2 for the measurement method.

#### TEST CONFIGURATION



#### TEST MODE:

Please reference to the section 3.4

#### TEST RESULTS

Passed       Not Applicable

Operation Mode	Test Channel	Measured (kHz)	Limit (kHz)	Result
TX-AWH	CH <sub>L</sub>	3.1	$\pm 2.5 \sim \pm 4.5$	Pass
	CH <sub>M</sub>	3.1		
	CH <sub>H</sub>	3.1		

Operation Mode	Test Channel	Measured (kHz)	Limit (kHz)	Result
TX-AWL	CH <sub>L</sub>	3.1	$\pm 2.5 \sim \pm 4.5$	Pass
	CH <sub>M</sub>	3.1		
	CH <sub>H</sub>	3.1		

### 5.2.5. Audio frequency response

The audio frequency response is the frequency deviation of the transmitter as a function of the modulating frequency.

#### LIMIT

IEC 62238 Sub-clause 8.5.3

The audio frequency response shall be within +1 dB and -3 dB of a 6 dB/octave line passing through the reference point (see figure 2). The upper limit frequency shall be 2,55 kHz for 12,5 kHz channels.

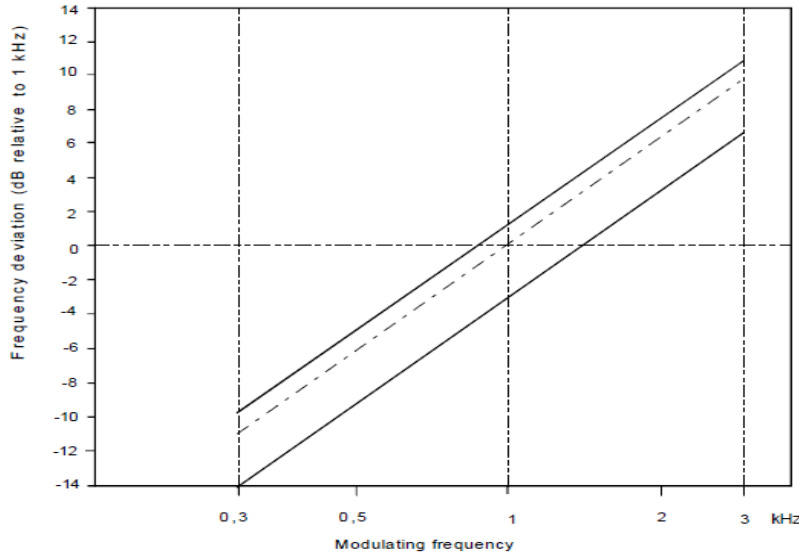
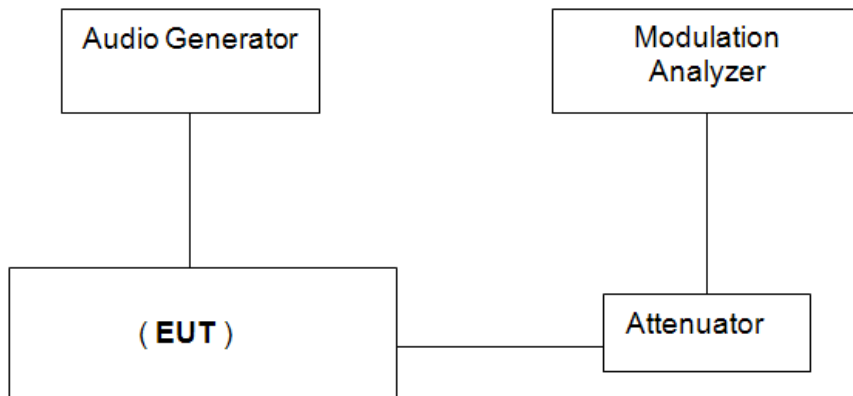


Figure 2: Audio frequency response

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The test conditions.

normal condition                       Extreme conditions

2. Please refer to IEC 62238 Sub-clause 8.5.2 for the measurement method.

#### TEST MODE:

Please reference to the section 3.4

#### TEST RESULTS

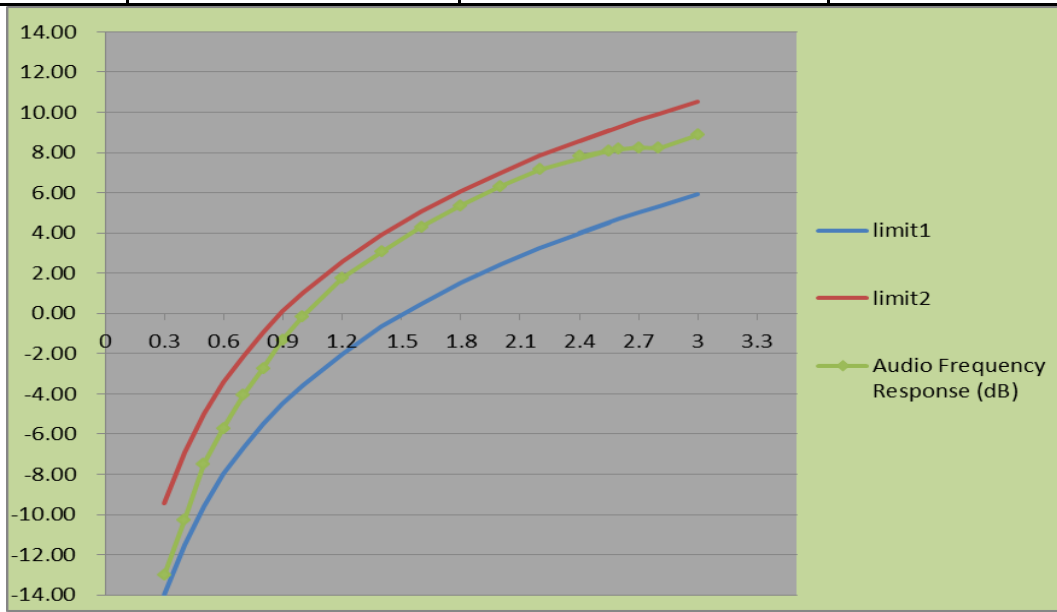
Passed                       Not Applicable

Note:

We tested TX-AWH and TX-AWL all channel, recorded worst case TX-AWH for CH<sub>M</sub>.



TX-AWH:CH <sub>M</sub>			
Frequency (kHz)	Frequency Deviation (kHz)	1kHz Reference Deviation (kHz)	Audio Frequency Response (dB)
0.3	0.252	1.000	-13.02
0.4	0.369	1.000	-10.27
0.5	0.477	1.000	-7.49
0.6	0.578	1.000	-5.72
0.7	0.672	1.000	-4.04
0.8	0.768	1.000	-2.72
0.9	0.865	1.000	-1.31
1	1.000	1.000	-0.15
1.2	1.165	1.000	1.76
1.4	1.372	1.000	3.06
1.6	1.585	1.000	4.29
1.8	1.797	1.000	5.37
2	2.005	1.000	6.32
2.2	2.201	1.000	7.15
2.55	2.456	1.000	8.09
2.4	2.369	1.000	7.82
2.6	2.492	1.000	8.17
2.7	2.527	1.000	8.23
2.8	2.555	1.000	8.21
3	2.575	1.000	8.88



### 5.2.6. Audio frequency harmonic distortion of the emission

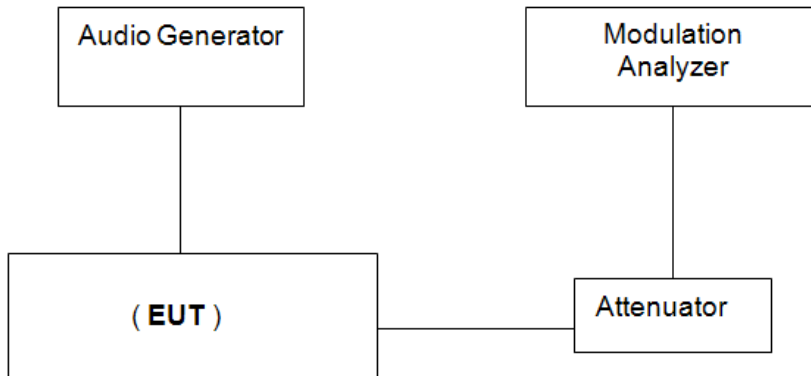
The harmonic distortion of the emission modulated by an audio frequency signal is defined as the ratio, expressed as a percentage, of the root mean square (rms) voltage of all the harmonic components of the fundamental modulation frequency to the total rms voltage of the modulation signal after linear demodulation

#### LIMIT

IEC 62238 Sub-clause 8.6.3

The harmonic distortion shall not exceed 10 %.

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The test conditions.

normal condition

Extreme conditions

2. Please refer to IEC 62238 Sub-clause 8.6.2 for the measurement method.

#### TEST MODE:

Please reference to the section 3.4

#### TEST RESULTS

Passed

Not Applicable

Operation Mode	Temperature (°C)	Voltage (V)	Modulated Frequency (kHz)	Test Channel	Measured (%)	Limit (%)	Result
TX-AWH	T <sub>N</sub>	V <sub>N</sub>	0.3	CH <sub>L</sub>	4.0	≤ 10	Pass
				CH <sub>M</sub>	4.0		
				CH <sub>H</sub>	3.9		
			0.5	CH <sub>L</sub>	2.2		
				CH <sub>M</sub>	2.2		
				CH <sub>H</sub>	2.2		
			1.0	CH <sub>L</sub>	4.6		
				CH <sub>M</sub>	4.7		
				CH <sub>H</sub>	4.5		
	T <sub>L</sub>	V <sub>H</sub>	1.0	CH <sub>L</sub>	4.2	≤ 10	
				CH <sub>M</sub>	4.3		
				CH <sub>H</sub>	4.5		
		V <sub>L</sub>	1.0	CH <sub>L</sub>	4.1		
				CH <sub>M</sub>	4.2		
				CH <sub>H</sub>	4.6		
T <sub>H</sub>	V <sub>H</sub>	1.0	CH <sub>L</sub>	4.1			
			CH <sub>M</sub>	4.9			
			CH <sub>H</sub>	5.1			
	V <sub>L</sub>	1.0	CH <sub>L</sub>	5.0			
			CH <sub>M</sub>	4.7			
			CH <sub>H</sub>	4.6			
TX-AWL	T <sub>N</sub>	V <sub>N</sub>	0.3	CH <sub>L</sub>	4.1	≤ 10	Pass
				CH <sub>M</sub>	3.9		
				CH <sub>H</sub>	4.0		
			0.5	CH <sub>L</sub>	2.2		
				CH <sub>M</sub>	2.2		
				CH <sub>H</sub>	2.3		
			1.0	CH <sub>L</sub>	4.9		
				CH <sub>M</sub>	4.5		
				CH <sub>H</sub>	4.4		
	T <sub>L</sub>	V <sub>H</sub>	1.0	CH <sub>L</sub>	5.2	≤ 10	
				CH <sub>M</sub>	5.1		
				CH <sub>H</sub>	4.2		
		V <sub>L</sub>	1.0	CH <sub>L</sub>	5.6		
				CH <sub>M</sub>	5.1		
				CH <sub>H</sub>	5.2		
	T <sub>H</sub>	V <sub>H</sub>	1.0	CH <sub>L</sub>	4.8		
				CH <sub>M</sub>	4.9		
				CH <sub>H</sub>	5.4		
V <sub>L</sub>		1.0	CH <sub>L</sub>	5.6			
			CH <sub>M</sub>	4.7			
			CH <sub>H</sub>	4.9			

### 5.2.7. Adjacent Channel Power

The adjacent channel power is that part of the total power output of a transmitter under defined conditions of modulation, which falls within a specified passband centred on the nominal frequency of either of the adjacent channels. This power is the sum of the mean power produced by the modulation, hum and noise of the transmitter.

#### LIMIT

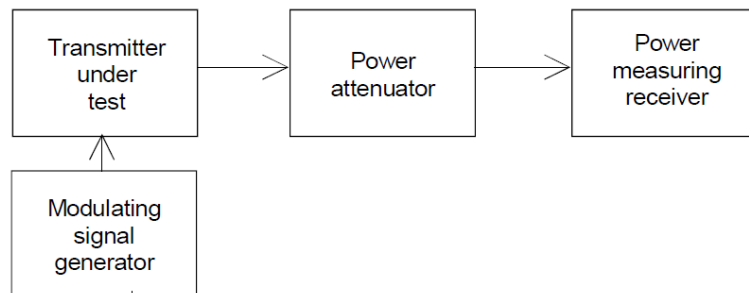
IEC 62238 Sub-clause 8.7.3

The adjacent channel power shall not exceed a value of:

25 kHz channel: 70 dB below the carrier power of the transmitter without any need to be below 0,2  $\mu$ W.

12 kHz channel: 60 dB below the carrier power of the transmitter without any need to be below 0,2  $\mu$ W.

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The test conditions.

normal condition                       Extreme conditions

2. Please refer to IEC 62238 Sub-clause 8.7.2 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:

TX-AWH				
Test Channel	Test Channel	Measurement Power (dBc)	Limit (dB)	Result
CH <sub>L</sub>	Lower adjacent	-71.41	≤-70	Pass
	Upper adjacent	-71.04		
CH <sub>M</sub>	Lower adjacent	-71.88	≤-70	Pass
	Upper adjacent	-71.69		
CH <sub>H</sub>	Lower adjacent	-71.3	≤-70	Pass
	Upper adjacent	-71.05		

TX-AWL				
Test Channel	Test Channel	Measurement Power (dBc)	Limit (dB)	Result
CH <sub>L</sub>	Lower adjacent	-70.96	≤-70	Pass
	Upper adjacent	-71.32		
CH <sub>M</sub>	Lower adjacent	-70.86	≤-70	Pass
	Upper adjacent	-71.29		
CH <sub>H</sub>	Lower adjacent	-71.05	≤-70	Pass
	Upper adjacent	-71.44		

### 5.2.8. Conducted spurious emissions conveyed to the antenna

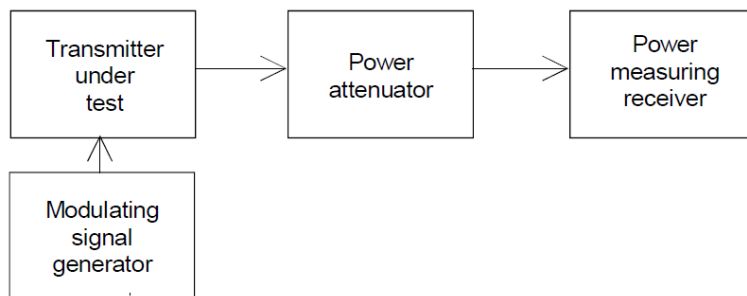
Conducted spurious emissions are emissions on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out of band emissions.

#### **LIMIT**

IEC 62238 Sub-clause 8.8.3

The power of any conducted spurious emission on any discrete frequency shall not exceed 0,25 $\mu$ W(-36dBm).

#### **TEST CONFIGURATION**



#### **TEST PROCEDURE**

1. The test conditions.

normal condition

Extreme conditions

2. Please refer to IEC 62238 Sub-clause 8.8.2 for the measurement method.

#### **TEST MODE:**

Please reference to the section 3.4

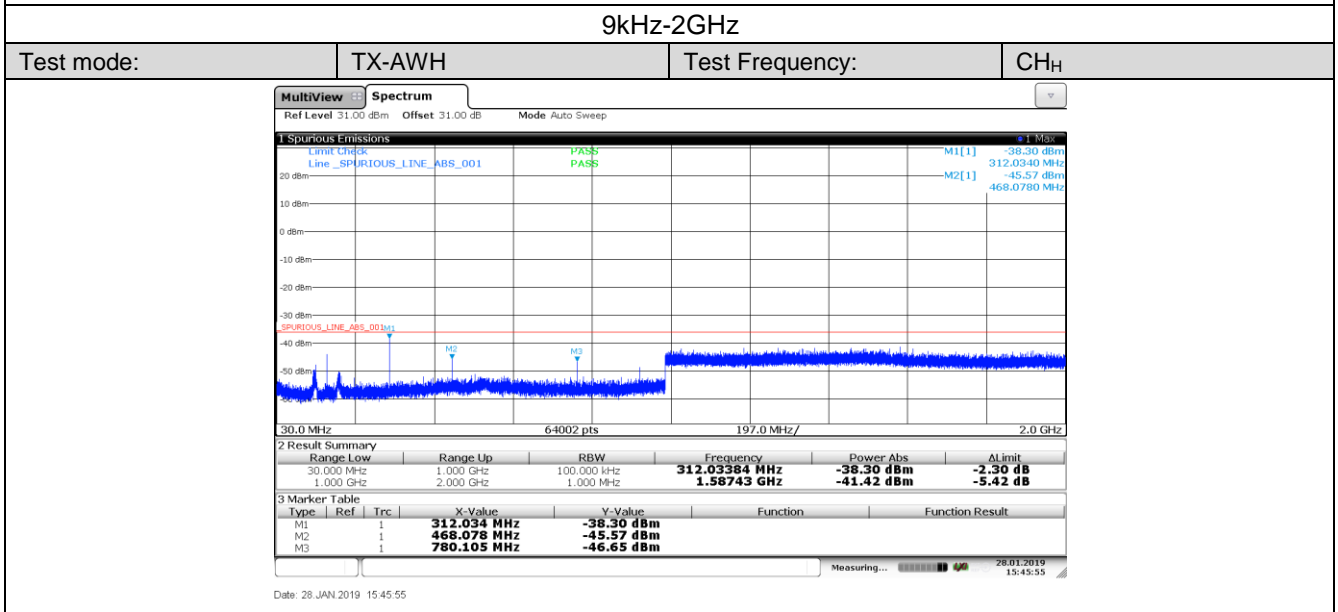
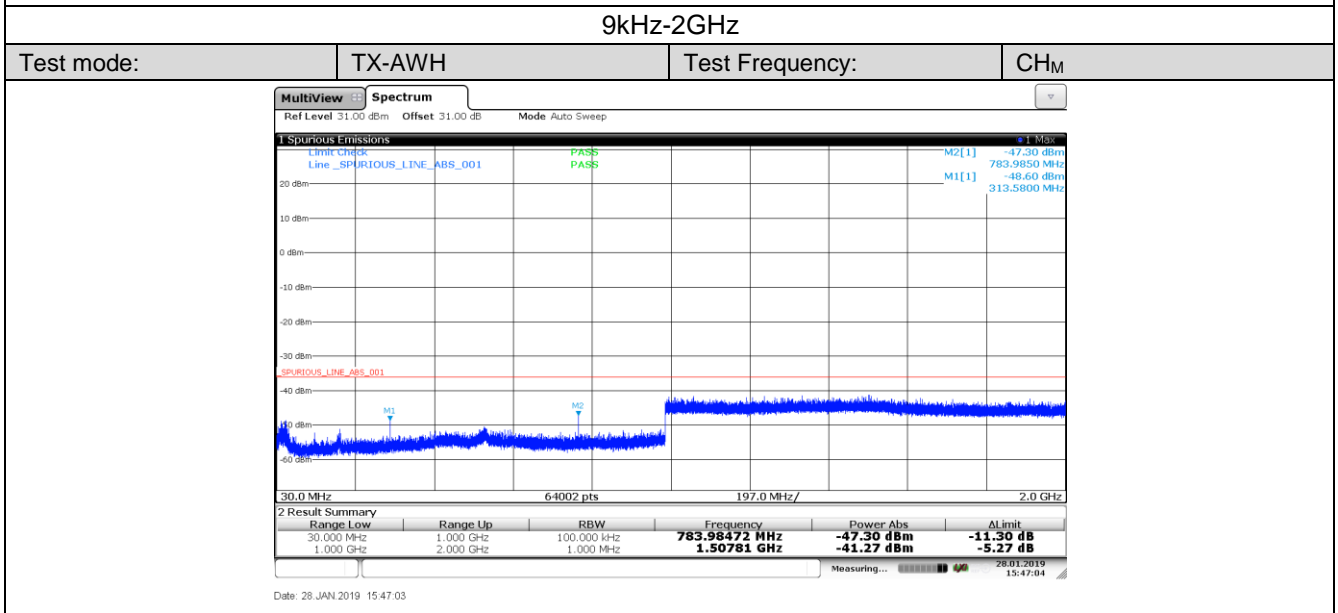
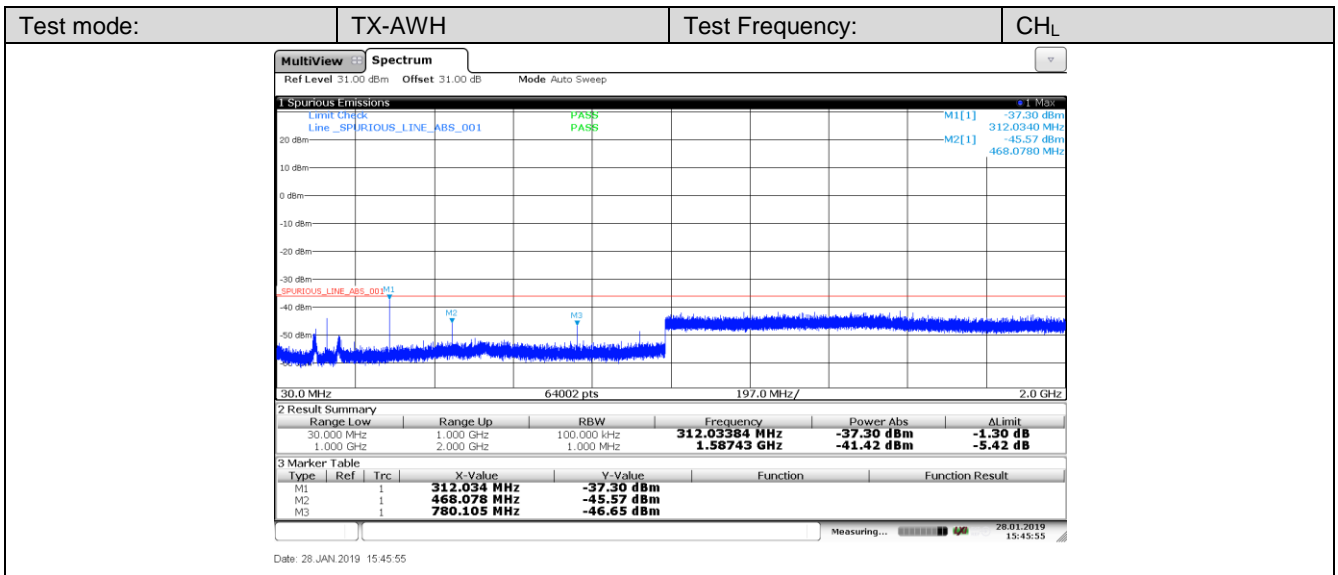
#### **TEST RESULTS**

Passed

Not Applicable

Note:

We tested TX-AWH to TX-AWL, recorded worst case for TX-AWH.



### 5.2.9. Transient frequency behaviour of the transmitter

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

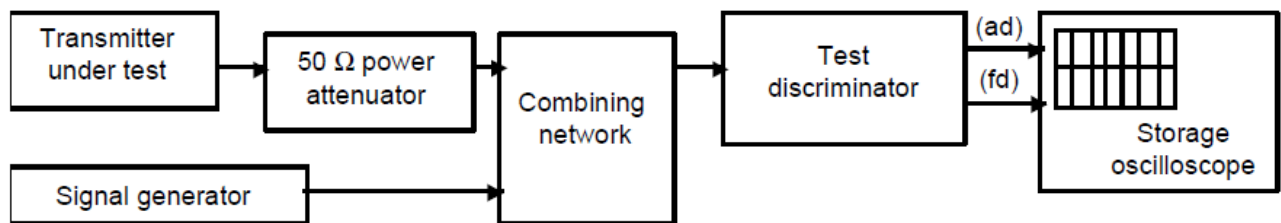
#### LIMIT

IEC 62238 Sub-clause 8.9.3

During the period of time  $t_1$  and  $t_3$  the frequency difference shall not exceed the value of one channel separation. The frequency difference, after the end of  $t_2$ , shall be within the limit of the frequency error of  $\pm 1,5$  kHz.

During the period of time  $t_2$  the frequency difference shall not exceed the value of half a channel separation. Before the start of  $t_3$  the frequency difference shall be within the limit of the frequency error of  $\pm 1,5$  kHz.

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The test conditions.

normal condition                       Extreme conditions

2. Please refer to IEC 62238 Sub-clause 8.9.2 for the measurement method.

#### TEST MODE:

Please reference to the section 3.4

#### TEST RESULTS

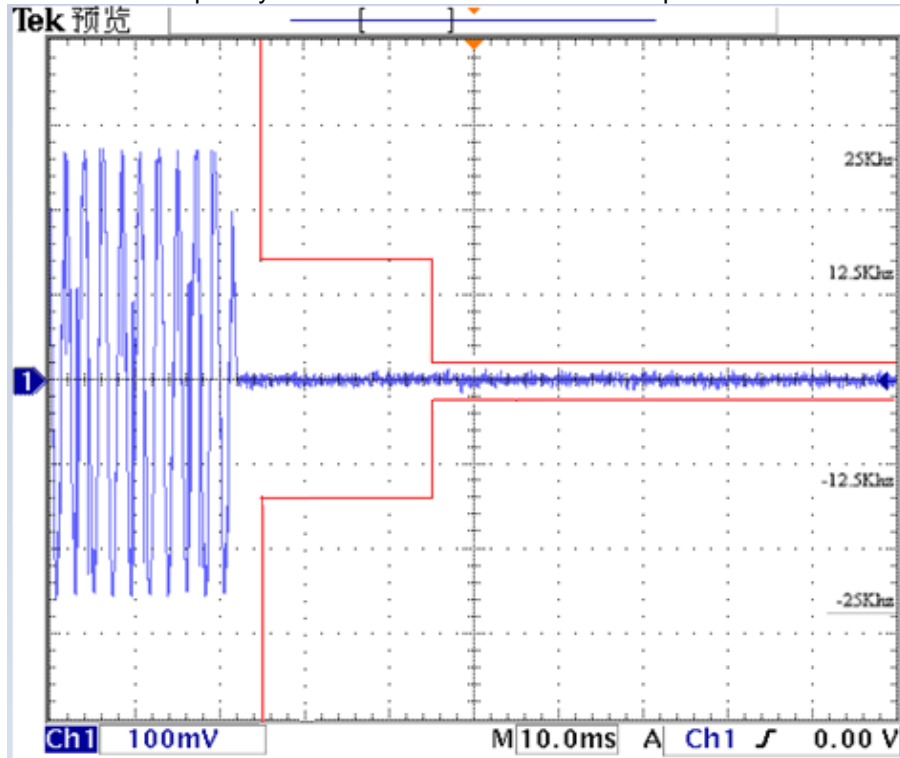
Passed                       Not Applicable

*Please refer to the below test data:*

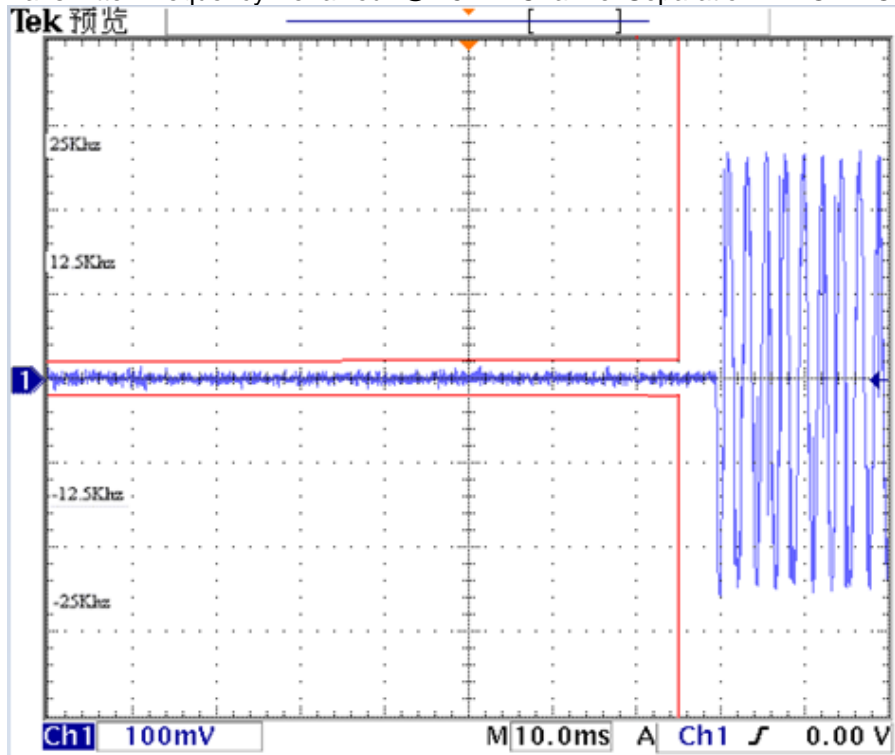
Note:

We tested TX-AWH to TX-AWL, recorded worst case at TX-AWH for  $CH_M$ .

Transmitter Frequency Behaviour @ 25kHz Channel Separation-----Off – On



Transmitter Frequency Behaviour @ 25kHz Channel Separation-----On – Off





### 5.2.10. Residual modulation of the transmitter

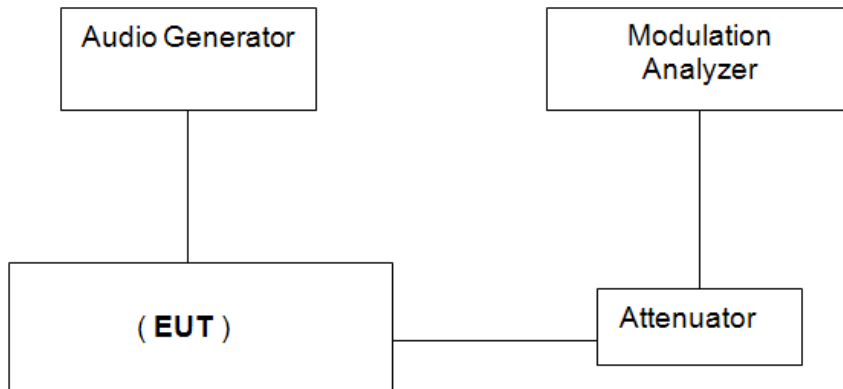
The residual modulation of the transmitter is the ratio, in dB, of the demodulated RF signal in the absence of wanted modulation, to the demodulated RF signal produced when the normal test modulation is applied.

#### LIMIT

IEC 62238 Sub-clause 8.10.3

The residual modulation shall not exceed -40 dB 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 62238 Sub-clause 8.10.2 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
TX-AWH	CH <sub>L</sub>	-40.49	≤ -40	Pass
	CH <sub>M</sub>	-40.61		
	CH <sub>H</sub>	-40.51		
TX-AWL	CH <sub>L</sub>	-40.52	≤ -40	Pass
	CH <sub>M</sub>	-40.38		
	CH <sub>H</sub>	-40.15		

### 5.2.11. Frequency error (demodulated DSC signal)

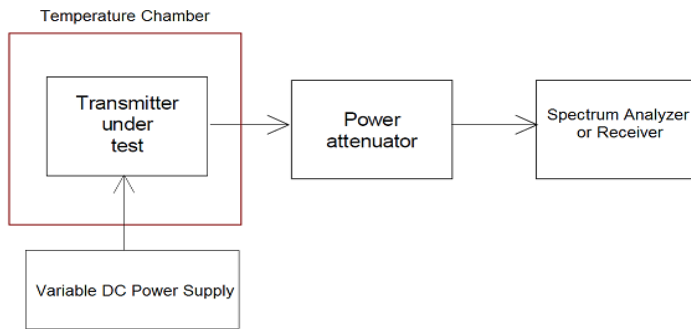
The frequency error for the B- and the Y-state is the difference between the measured frequency from the demodulator and the nominal values.

#### LIMIT

IEC 62238 Sub-clause 8.11.3

The measured frequency from the demodulator at any time for the B-state shall be within 2 100 Hz  $\pm$ 10 Hz and for the Y-state within 1 300 Hz  $\pm$  10 Hz.

#### TEST CONFIGURATION



#### TEST PROCEDURE

- The test conditions.  
 normal condition                       Extreme conditions
- Please refer to IEC 62238 Sub-clause 8.11.2 for the measurement method.

#### TEST MODE:

Please reference to the section 3.4

#### TEST RESULTS

Passed                       Not Applicable

Operation Mode	Test conditions		Frequency Error (kHz)	Limit (Hz)	Result
	Temperature(°C )	Voltage(V)	CH <sub>M1</sub>		
TX-B	T <sub>N</sub>	V <sub>N</sub>	2099.98	2100 $\pm$ 10	Pass
	T <sub>L</sub>	V <sub>H</sub>	2099.54		
		V <sub>L</sub>	2099.56		
	T <sub>H</sub>	V <sub>H</sub>	2099.81		
V <sub>L</sub>		2099.79			
TX-Y	T <sub>N</sub>	V <sub>N</sub>	1300.03	1300 $\pm$ 10	Pass
	T <sub>L</sub>	V <sub>H</sub>	1299.78		
		V <sub>L</sub>	1299.81		
	T <sub>H</sub>	V <sub>H</sub>	1299.86		
V <sub>L</sub>		1299.83			

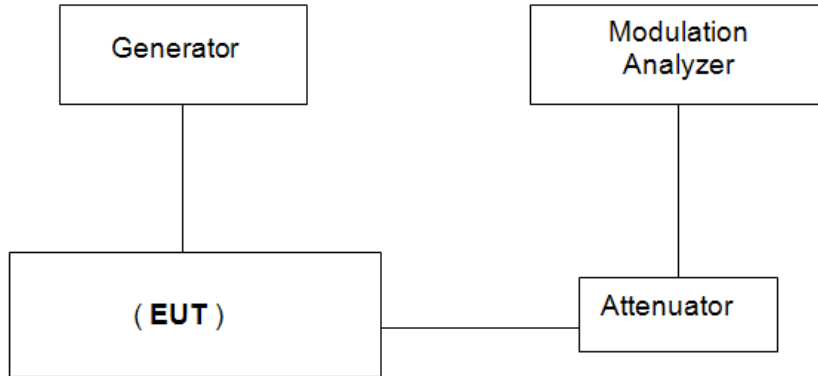
**5.2.12. Modulation index for DSC**

This test measures the modulation index in the B and Y states.

**LIMIT**

IEC 62238 Sub-clause 8.12.3

The modulation index shall be  $2.0 \pm 10\%$ .

**TEST CONFIGURATION****TEST PROCEDURE**

1. The test conditions.

normal condition

Extreme conditions

2. Please refer to IEC 62238 Sub-clause 8.12.2 for the measurement method.

**TEST MODE:**

Please reference to the section 3.4

**TEST RESULTS**

Passed

Not Applicable

Operation Mode	Test Channel	Modulation index	Limit	Result
TX-B	CH <sub>M1</sub>	2.11	$2.0 \pm 10\%$	Pass
TX-Y	CH <sub>M1</sub>	2.07	$2.0 \pm 10\%$	Pass

**5.2.13. Modulation rate for DSC**

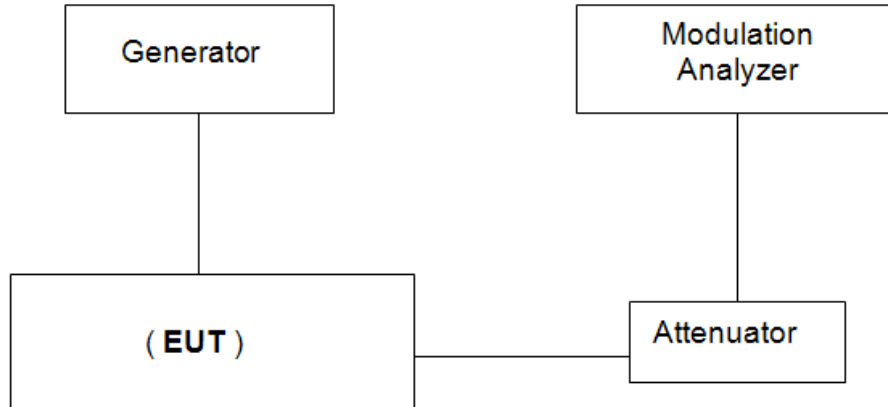
The modulation rate is the bit stream speed measured in bit/s.

**LIMIT**

IEC 62238 Sub-clause 8.13.3

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 62238 Sub-clause 8.13.2 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
TX-(B+Y)	CH <sub>M1</sub>	599.999	600Hz ± 30 ppm	Pass

### 5.2.14. Testing of generated call sequences

Generated call sequences are call which comply with the requirements of ITU-R. Recommendation M.493-10.

#### **Requirement**

IEC 62238 Sub-clause 8.14.3

The requirements of ITU-R Recommendation M.493-14 regarding message composition and content shall be met.

The generated calls shall be analyzed with the calibrated apparatus for correct configuration of the signal format, including time diversity. It shall be verified that, after transmission of a DSC call, the transmitter re-tunes to the original channel. However, in the case of a distress call, the transmitter shall tune to channel 16 and automatically select the maximum power. The telecommands used and the channels tested for switching shall be stated in the test report.

#### **TEST RESULTS**

**Passed**       **Not Applicable**

*Please refer to the below test data:*

Call Sent	Received without error	Telecommand 1	Telecommand 2
Distress	Yes	100	126
All Ships Urgency	Yes	100	126
All Ships Safety	Yes	100	126
Individual Routine	Yes	100	126
Group Routine	Yes	100	126

### 5.3. Receiver for Radiotelephone Requirement

#### 5.3.1. Harmonic distortion and rated audio frequency output power

The harmonic distortion at the receiver output is defined as the ratio, expressed as a percentage, of the total rms voltage of all the harmonic components of the modulation audio frequency to the total rms voltage of the signal delivered by the receiver.

The rated audio frequency output power is the value stated by the manufacturer to be the maximum power available at the output, for which all the requirements of the present document are met.

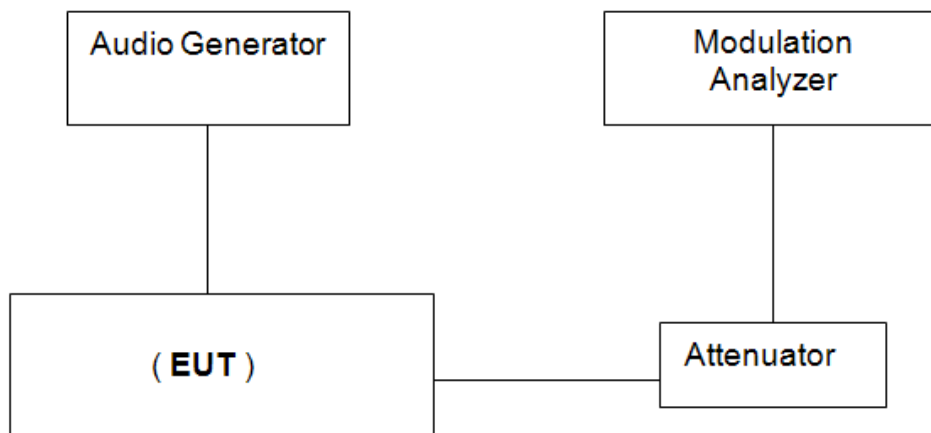
#### LIMIT

IEC 62238 Sub-clause 9.1.3

- 2 W in a loudspeaker;
- 1 mW in the handset earphone.

The harmonic distortion shall not exceed 10 %.

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The test conditions.

- normal condition                       Extreme conditions

2. Please refer to IEC 62238 Sub-clause 9.1.2 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:

Harmonic distortion:

RX-AW					
Signals Level (dB $\mu$ V)	Modulated Frequency (kHz)	Test Frequency (MHz)	Measured (%)	Limit (%)	Result
60	0.3	CH <sub>L</sub>	4.2	$\leq 10$	Pass
		CH <sub>M</sub>	4.2		
		CH <sub>H</sub>	4.2		
	0.5	CH <sub>L</sub>	2.7		
		CH <sub>M</sub>	2.7		
		CH <sub>H</sub>	2.6		
	1.0	CH <sub>L</sub>	2.6		
		CH <sub>M</sub>	2.6		
		CH <sub>H</sub>	2.6		
100	0.3	CH <sub>L</sub>	4.3	$\leq 10$	Pass
		CH <sub>M</sub>	4.2		
		CH <sub>H</sub>	4.2		
	0.5	CH <sub>L</sub>	2.7		
		CH <sub>M</sub>	2.6		
		CH <sub>H</sub>	2.6		
	1.0	CH <sub>L</sub>	2.5		
		CH <sub>M</sub>	2.6		
		CH <sub>H</sub>	2.5		

rated audio frequency output power:

RX-AW			
Test Channel	Measured (W)	Limit (W)	Result
CH <sub>L</sub>	2.15	$\geq 2.0$	Pass
CH <sub>M</sub>	2.24		
CH <sub>H</sub>	2.31		

### 5.3.2. Audio frequency response

The audio frequency response is the variation in the receiver's audio frequency output level as a function of the modulating frequency of a received radio frequency signal modulated with constant deviation.

#### LIMIT

IEC 62238 Sub-clause 9.2.3

The audio frequency response shall not deviate by more than +1 dB or -3 dB from a characteristic giving the output level as a function of the audio frequency, decreasing by 6 dB per octave and passing through the measured point at 1 kHz (figure 5).

Certified Intrinsically Safe equipment need not comply with the limits below 700 Hz.

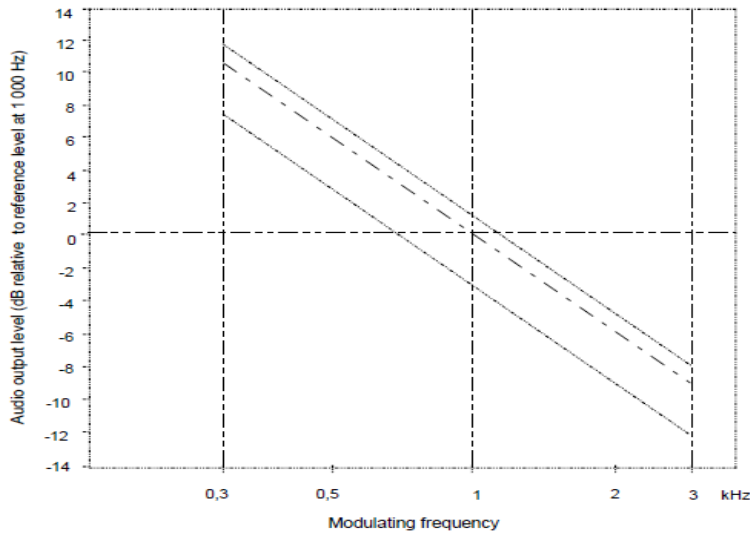
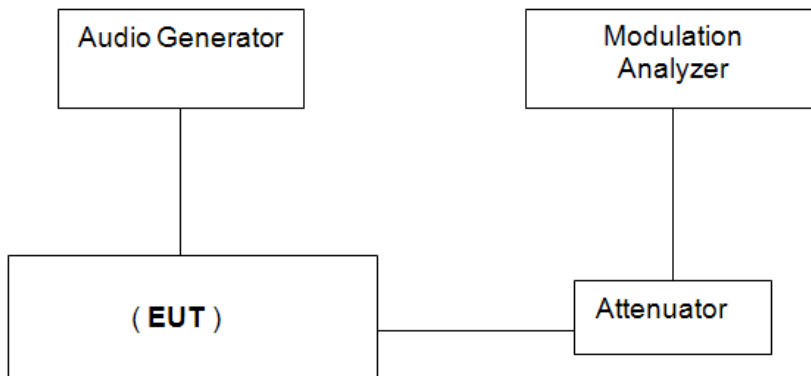


Figure 5: Audio frequency response

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The test conditions.

- normal condition                       Extreme conditions

2. Please refer to IEC 62238 Sub-clause 9.2.2 for the measurement method.

#### TEST MODE:

Please reference to the section 3.4

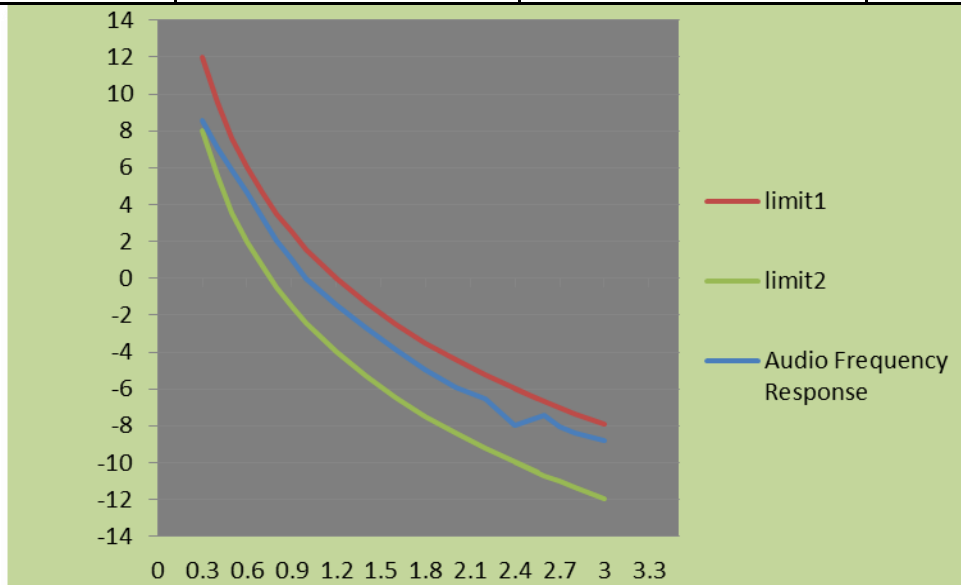
#### TEST RESULTS

- Passed                       Not Applicable



Please refer to the below test data:

RX-AW			
Frequency (kHz)	Frequency Deviation (kHz)	1kHz Reference Deviation (kHz)	Audio Frequency Response (dB)
0.3	2.125	8.56	8.56
0.4	2.899	7.03	7.03
0.5	3.4	5.85	5.85
0.6	3.923	4.62	4.62
0.7	4.36	3.28	3.28
0.8	4.518	2.06	2.06
0.9	4.345	0.98	0.98
1	3.928	0	0
1.2	3.038	-1.46	-1.46
1.4	2.356	-2.7	-2.7
1.6	1.848	-3.88	-3.88
1.8	1.506	-4.99	-4.99
2	1.247	-5.9	-5.9
2.2	1.048	-6.57	-6.57
2.4	0.8665	-7.95	-7.95
2.6	0.694	-7.4	-7.4
2.7	0.6089	-8.05	-8.05
2.8	0.5288	-8.38	-8.38
3	0.3866	-8.81	-8.81



### 5.3.3. Maximum Usable Sensitivity

The maximum usable sensitivity of the receiver is the minimum level of the signal (emf) at the nominal frequency of the receiver which, when applied to the receiver input with normal test modulation (clause 6.4), will produce:

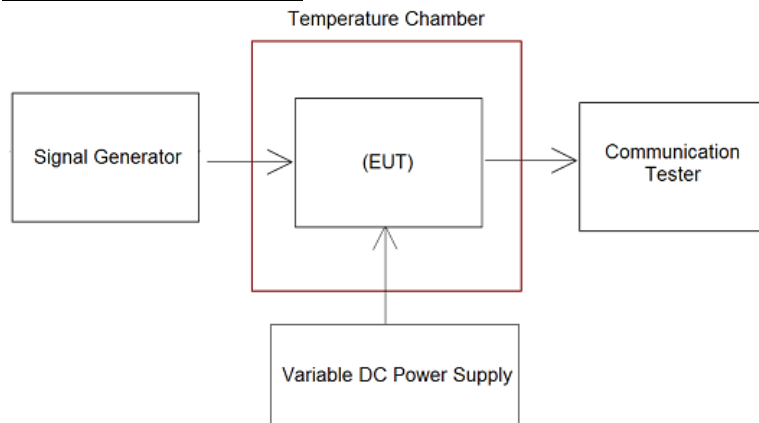
- in all cases, an audio frequency output power of at least 50 % of the rated output power (clause 9.1); and
- a SINAD ratio of 20 dB, measured at the receiver output through a psophometric telephone filtering network such as described in ITU-T Recommendation O.41 [6].

#### LIMIT

IEC 62238 Sub-clause 9.3.3

The maximum usable sensitivity for either 25 kHz or 12,5 kHz channels shall not exceed +6 dB $\mu$ V (emf) under normal test conditions and +12 dB $\mu$ V (emf) under extreme test conditions.

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The test conditions.

- normal condition                       Extreme conditions

2. Please refer to IEC 62238 Sub-clause 9.3.2 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	Temperature (°C)	Voltage (V)	Test Channel	Measured (dBμV)	Limit (dB)	Result
RX-AW	T <sub>N</sub>	V <sub>N</sub>	CH <sub>L</sub>	-8.9	≤+6.0	Pass
			CH <sub>M</sub>	-8.7		
			CH <sub>H</sub>	-6.9		
	T <sub>L</sub>	V <sub>H</sub>	CH <sub>L</sub>	-8.5	≤+12.0	
			CH <sub>M</sub>	-8.4		
			CH <sub>H</sub>	-6.6		
		V <sub>L</sub>	CH <sub>L</sub>	-8.3		
			CH <sub>M</sub>	-8.1		
			CH <sub>H</sub>	-6.2		
	T <sub>H</sub>	V <sub>H</sub>	CH <sub>L</sub>	-8.4		
			CH <sub>M</sub>	-8.4		
			CH <sub>H</sub>	-6.6		
		V <sub>L</sub>	CH <sub>L</sub>	-8.2		
			CH <sub>M</sub>	-7.8		
			CH <sub>H</sub>	-6.1		

### 5.3.4. Co-channel rejection

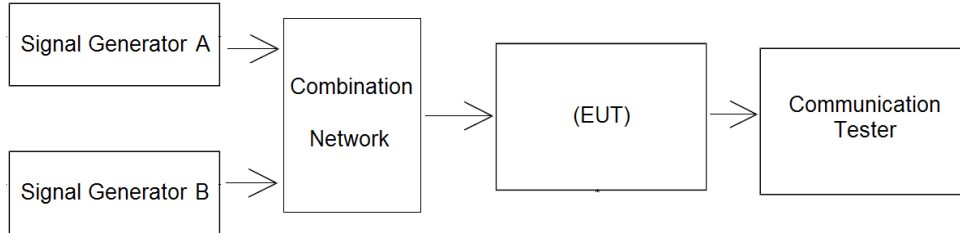
The co-channel rejection is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal, both signals being at the nominal frequency of the receiver.

#### LIMIT

IEC 62238 Sub-clause 9.4.3

The co-channel rejection ratio, at any frequency of the unwanted signal within the specified range, shall be between: -10 dB and 0 dB.

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The test conditions.

normal condition                       Extreme conditions

2. Please refer to IEC 62238 Sub-clause 9.4.2 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:

RX-AW				
Test Channel	Measurement Offset (kHz)	SG B – SG A (dB)	Limit (dB)	Result
CH <sub>L</sub>	-3	-5.7	-10~0	Pass
	0	-7.5		
	3	-7.6		
CH <sub>M</sub>	-3	-5.5	-10~0	Pass
	0	-7.4		
	3	-7.6		
CH <sub>H</sub>	-3	-5.8	-10~0	Pass
	0	-7.7		
	3	-7.9		

### 5.3.5. Adjacent channel selectivity

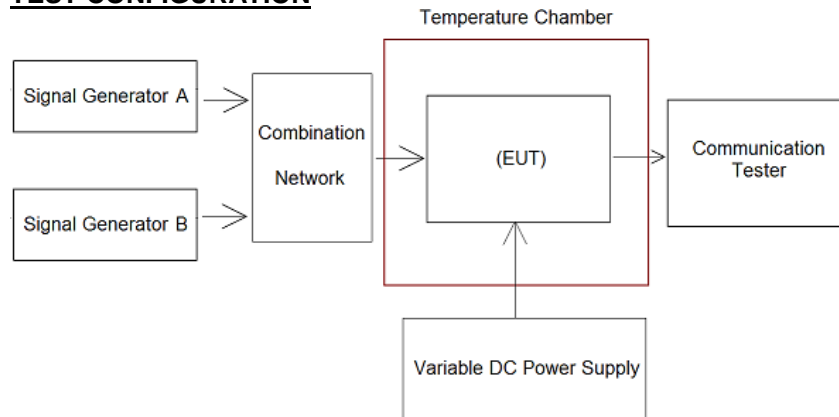
The adjacent channel selectivity is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal which differs in frequency from the wanted signal by the nominal channel spacing.

#### LIMIT

IEC 62238 Sub-clause 9.5.3

The adjacent channel selectivity shall be not less than 70 dB under normal test conditions and not less than 60 dB under extreme test conditions.

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The test conditions.

normal condition                       Extreme conditions

2. Please refer to IEC 62238 Sub-clause 9.5.2 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:

RX-AW						
Test Condition		Test Channel	Measurement Position	SG B – SG A (dB)	Limit (dB)	Result
Temperature (°C)	Voltage (V)					
T <sub>N</sub>	V <sub>N</sub>	CH <sub>L</sub>	Lower adjacent	73.1	≥70	Pass
			Upper adjacent	71.6		
		CH <sub>M</sub>	Lower adjacent	73.8		
			Upper adjacent	71.8		
		CH <sub>H</sub>	Lower adjacent	73.6		
			Upper adjacent	71.4		
T <sub>L</sub>	V <sub>H</sub>	CH <sub>L</sub>	Lower adjacent	72.0	≥60	Pass
			Upper adjacent	70.4		
		CH <sub>M</sub>	Lower adjacent	72.0		
			Upper adjacent	70.1		
		CH <sub>H</sub>	Lower adjacent	71.7		
			Upper adjacent	70.3		
	V <sub>L</sub>	CH <sub>L</sub>	Lower adjacent	71.9	≥60	Pass
			Upper adjacent	69.8		
		CH <sub>M</sub>	Lower adjacent	72.5		
			Upper adjacent	70.5		
		CH <sub>H</sub>	Lower adjacent	72.2		
			Upper adjacent	69.9		
T <sub>H</sub>	V <sub>H</sub>	CH <sub>L</sub>	Lower adjacent	71.2	≥60	Pass
			Upper adjacent	69.9		
		CH <sub>M</sub>	Lower adjacent	72.4		
			Upper adjacent	70.0		
		CH <sub>H</sub>	Lower adjacent	71.8		
			Upper adjacent	70.1		
	V <sub>L</sub>	CH <sub>L</sub>	Lower adjacent	71.9	≥60	Pass
			Upper adjacent	70.6		
		CH <sub>M</sub>	Lower adjacent	72.0		
			Upper adjacent	70.3		
		CH <sub>H</sub>	Lower adjacent	71.9		
			Upper adjacent	69.8		

### 5.3.6. Spurious Response Rejection

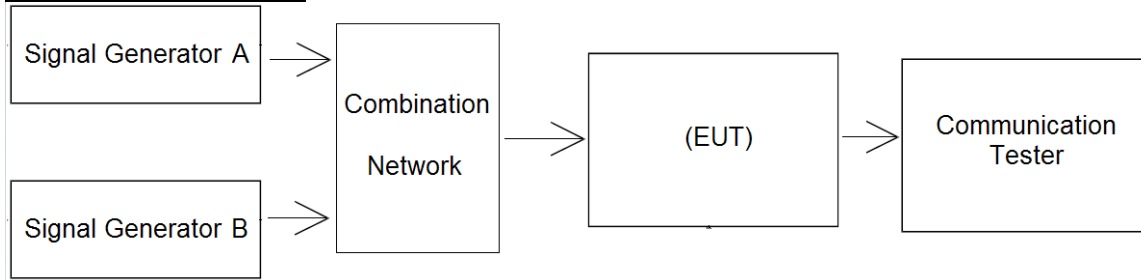
The spurious response rejection is a measure of the capability of the receiver to discriminate between the wanted modulated signal at the nominal frequency and an unwanted signal at any other frequency at which a response is obtained.

#### LIMIT

IEC 62238 Sub-clause 9.6.3

At any frequency separated from the nominal frequency of the receiver by more than 25 kHz, the spurious response rejection ratio shall be not less than 70 dB.

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The test conditions.

normal condition                       Extreme conditions

2. Please refer to IEC 62238 Sub-clause 9.6.2 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:

RX-AW				
Test Channel	Spurious Frequency (MHz)	SG B – SG A (dB)	Limit (dB)	Result
CH <sub>L</sub>	156.075	114.6	≥70	Pass
	156.525	105.5		
	134.900	106.3		
	177.700	107.2		
CH <sub>M</sub>	156.575	114.1	≥70	Pass
	157.025	105.9		
	135.400	105.7		
	178.200	106.9		
CH <sub>H</sub>	161.775	111.0	≥70	Pass
	162.225	106.6		
	140.600	107.0		
	183.400	107.4		

An increment sweep was made between 100 kHz - 2000 MHz with no other significant responses detected.

### 5.3.7. Intermodulation response

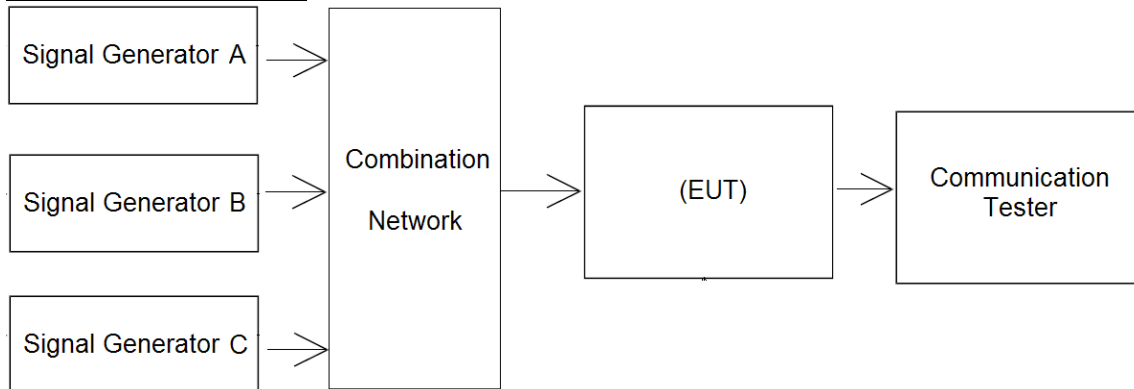
The intermodulation response is a measure of the capability of a receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of two or more unwanted signals with a specific frequency relationship to the wanted signal frequency.

#### LIMIT

IEC 62238 Sub-clause 9.7.3

The intermodulation response ratio shall not be less than 68 dB.

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The test conditions.

normal condition

Extreme conditions

2. Please refer to IEC 62238 Sub-clause 9.7.2 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:

RX-AW					
Test Channel	Measurement Offset (kHz)		SG B/C – SG A (dB)	Limit (dB)	Result
	SG B	SG C			
CH <sub>L</sub>	-50	-100	72.3	≥68	Pass
	50	100	72.1		
CH <sub>M</sub>	-50	-100	73.5	≥68	Pass
	50	100	73.2		
CH <sub>H</sub>	-50	-100	72.9	≥68	Pass
	50	100	72.7		



### 5.3.8. Blocking or Desensitization

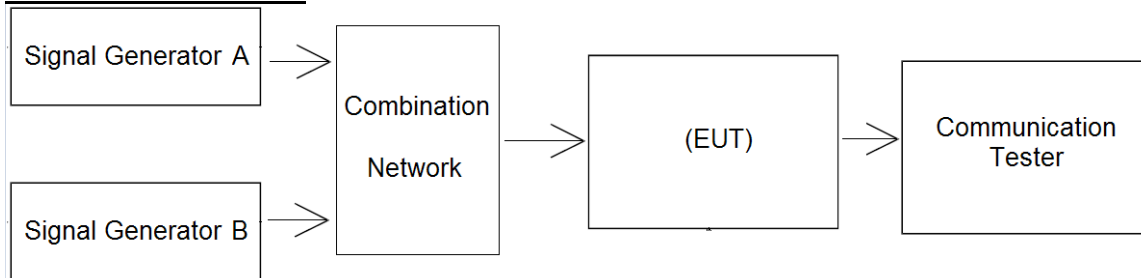
Blocking is a change (generally a reduction) in the wanted output power of the receiver or a reduction of the SINAD ratio due to an unwanted signal on another frequency.

#### LIMIT

IEC 62238 Sub-clause 9.8.3

The blocking level for any frequency within the specified ranges, shall be not less than 90 dB $\mu$ V (emf), except at frequencies on which spurious responses are found

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The test conditions.

normal condition

Extreme conditions

2. Please refer to IEC 62238 Sub-clause 9.8.2 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:

RX-AW				
Test Channel	Measurement Offset (MHz)	SG B (dB $\mu$ V)	Limit (dB $\mu$ V)	Result
CH <sub>L</sub>	-10	104.7	$\geq 90$	Pass
	-5	104.3		
	-2	104.9		
	-1	103.4		
	1	102.9		
	2	104.3		
	5	105.8		
	10	105.3		
CH <sub>M</sub>	-10	104.3	$\geq 90$	Pass
	-5	105.1		
	-2	104.2		
	-1	98.9		
	1	99.5		
	2	104.4		
	5	104.1		
	10	105.4		
CH <sub>H</sub>	-10	104.3	$\geq 90$	Pass
	-5	105.5		
	-2	102.9		
	-1	101.1		
	1	103.0		
	2	103.3		
	5	104.3		
	10	105.2		

### 5.3.9. Conducted spurious emissions

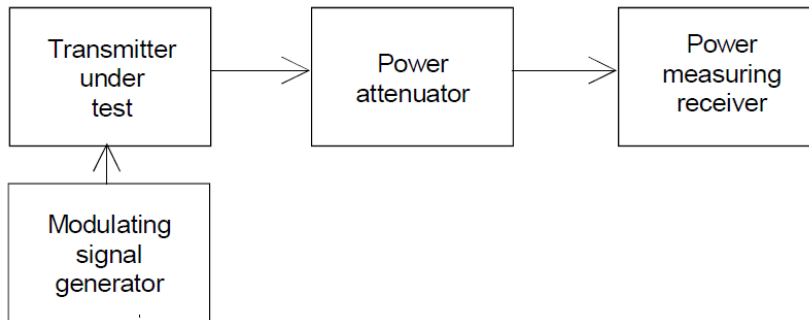
Conducted spurious emissions from the receiver are components at any frequency, present at the receiver input port.

#### LIMIT

IEC 62238 Sub-clause 9.9.3

The power of any spurious radiation shall not exceed 2 nw(-57dBm) at any frequency in the range between 9 kHz and 2 GHz.

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The test conditions.

normal condition

Extreme conditions

2. Please refer to IEC 62238 Sub-clause 9.9.2 for the measurement method.

#### TEST MODE:

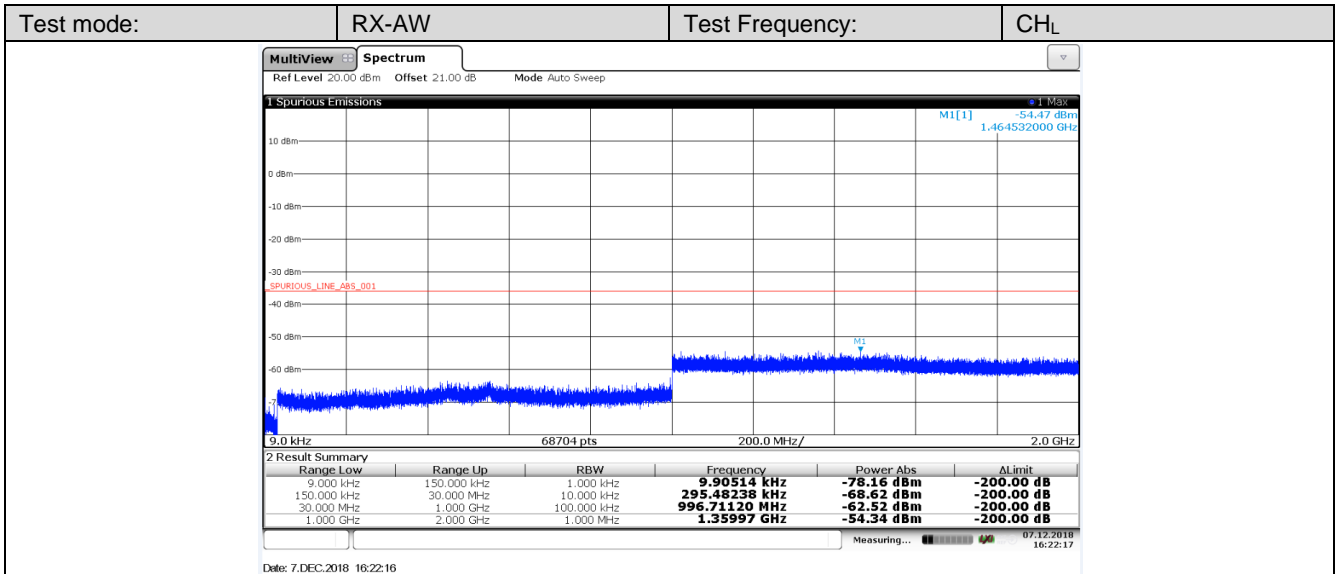
Please reference to the section 3.4

#### TEST RESULTS

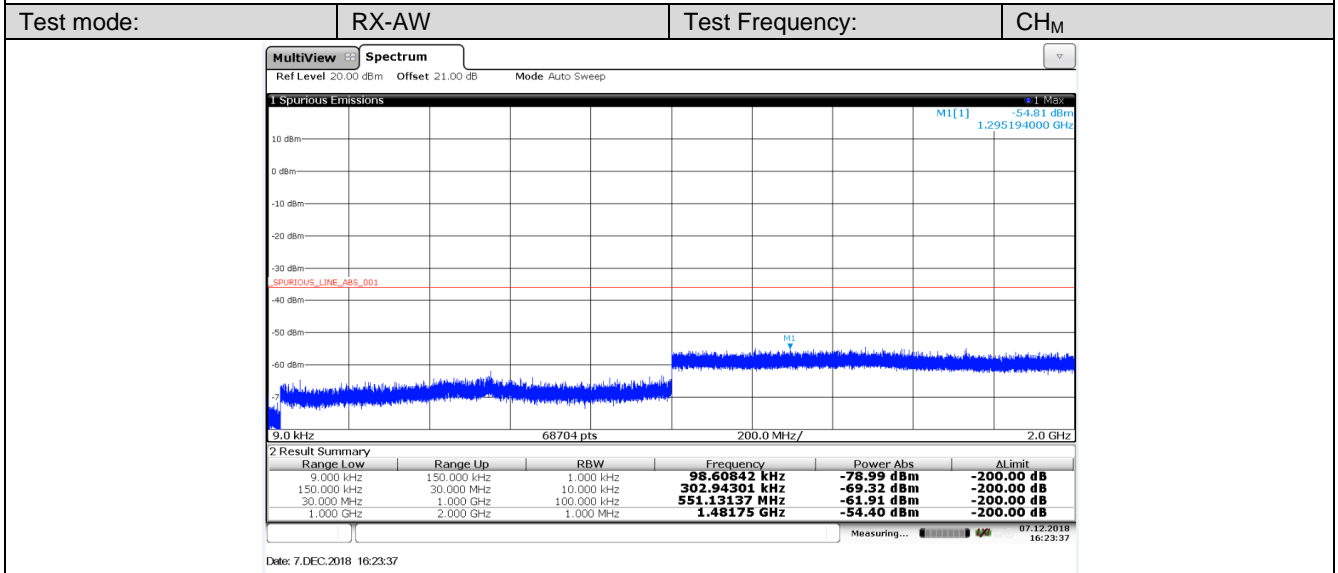
Passed

Not Applicable

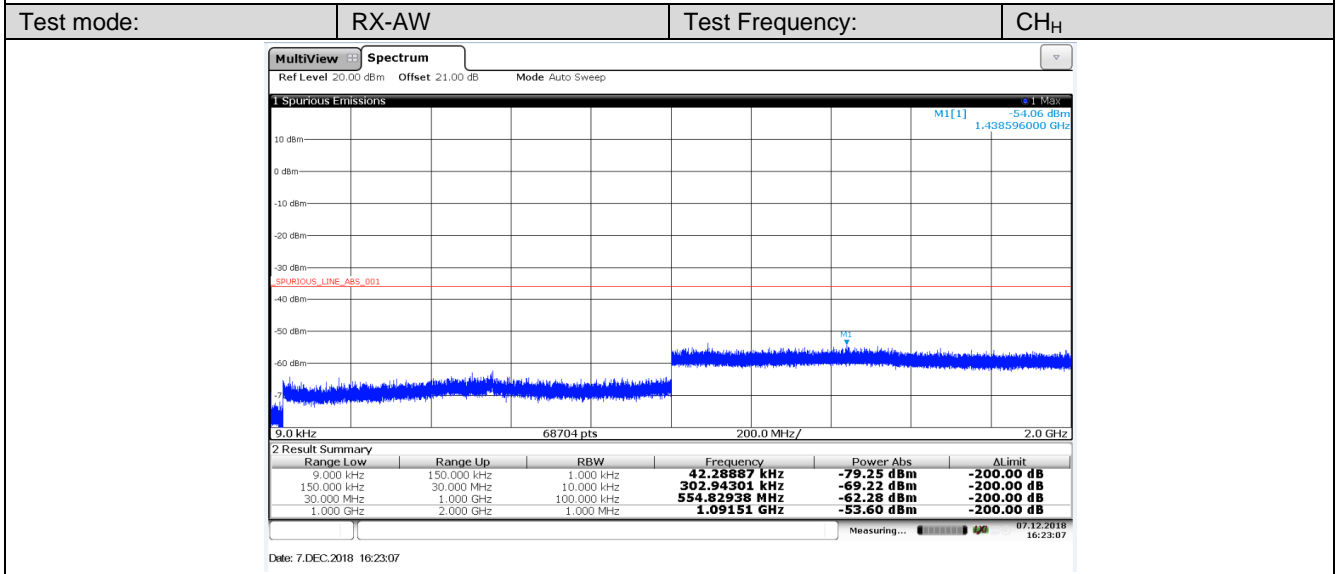
Please refer to the below test data:



9kHz-2GHz



9kHz-2GHz



9kHz-2GHz

**5.3.10. Receiver noise and hum level**

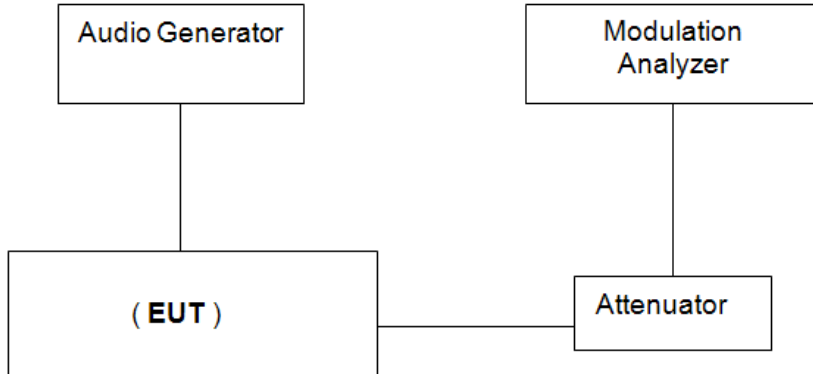
The receiver noise and hum level is defined as the ratio, in dB, of the audio frequency power of the noise and hum resulting from spurious effects of the power supply system or from other causes, to the audio frequency power produced by a high frequency signal of average level, modulated by the normal test modulation and applied to the receiver input.

**LIMIT**

IEC 62238 Sub-clause 9.10.3

The receiver noise and hum level shall not exceed -40 dB, relative to the modulated signal.

**TEST CONFIGURATION**



**TEST PROCEDURE**

1. The test conditions.

- normal condition                       Extreme conditions

2. Please refer to IEC 62238 Sub-clause 9.10.2 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 Channel	Measured (dB)	Limit (dB)	Result
RX-AW	CH <sub>L</sub>	-40.45	≤-40	Pass
	CH <sub>M</sub>	-40.37		
	CH <sub>H</sub>	-40.29		

### 5.3.11. Squelch operation

The purpose of the squelch facility is to mute the receiver audio output signal when the level of the signal at the receiver input is less than a given value.

#### LIMIT

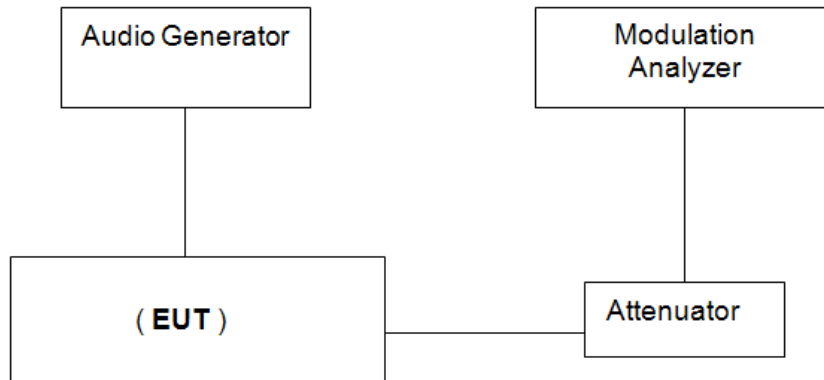
IEC 62238 Sub-clause 9.11.3

Under the conditions specified in a) clause 9.11.2, the audio frequency output power shall not exceed -40 dB relative to the rated output power.

Under the conditions specified in b) clause 9.11.2, the input level shall not exceed +6 dB $\mu$ V (emf) and the SINAD ratio shall be at least 20 dB.

Under the conditions specified in c) clause 9.11.2, the input signal shall not exceed +6 dB $\mu$ V (emf) when the control is set at maximum.

#### TEST CONFIGURATION



#### TEST PROCEDURE

- The test conditions.
  - normal condition
  - Extreme conditions
- Please refer to IEC 62238 Sub-clause 9.11.2 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:

Under the conditions specified in a):

RX-AW			
Test Channel	Measured (dB)	Limit (dB)	Result
CH <sub>L</sub>	-40.45	≤-40	Pass
CH <sub>M</sub>	-40.37		
CH <sub>H</sub>	-40.29		

Under the conditions specified in b):

RX-AW			
Test Channel	Measured (dBμV)	Limit (dBμV)	Result
CH <sub>L</sub>	-0.2	≤+6.0	Pass
CH <sub>M</sub>	-0.6		
CH <sub>H</sub>	0.1		

RX-AW			
Test Channel	Measured SINAD (dB)	Limit (dBμV)	Result
CH <sub>L</sub>	33.91	≥20	Pass
CH <sub>M</sub>	33.67		
CH <sub>H</sub>	32.45		

Under the conditions specified in c):

RX-AW			
Test Channel	Measured (dBμV)	Limit (dBμV)	Result
CH <sub>L</sub>	4.3	≤+6.0	Pass
CH <sub>M</sub>	4.8		
CH <sub>H</sub>	5.3		

**5.3.12. Squelch hysteresis**

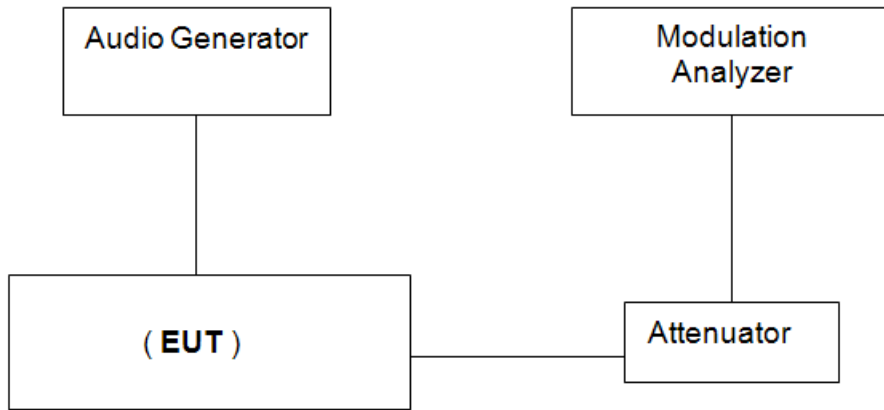
Squelch hysteresis is the difference in dB between the receiver input signal levels at which the squelch opens and closes.

**LIMIT**

IEC 62238 Sub-clause 9.12.3

The squelch hysteresis shall be between 3 dB and 6 dB.

**TEST CONFIGURATION**



**TEST PROCEDURE**

1. The test conditions.

normal condition

Extreme conditions

2. Please refer to IEC 62238 Sub-clause 9.12.2 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:

RX-AW			
Test Channel	Measured (dB)	Limit (dB)	Result
CH <sub>L</sub>	3.2	3~6	Pass
CH <sub>M</sub>	3.3		
CH <sub>H</sub>	3.4		



### 5.3.13. Multiple watch characteristic

The scanning period is the time between the start of two successive samples of the priority channel in the absence of a signal on that channel.

#### LIMIT

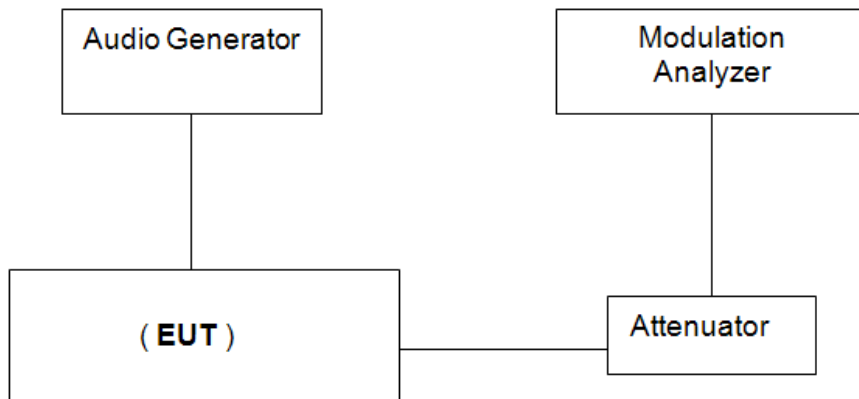
IEC 62238 Sub-clause 9.13.3

The scanning period shall not exceed 2 s.

The dwell time on the priority channel shall not exceed 150 ms.

The dwell time on the additional channel shall be between 850 ms and 2 s as indicated by the time of the gap between two output bursts.

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The test conditions.

normal condition

Extreme conditions

2. Please refer to IEC 62238 Sub-clause 9.13.2 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:

## Scanning Period:

RX-AW					
Test Condition		Test Channel	Measured Scanning Period (s)	Limit (s)	Result
Temperature (°C)	Voltage (V)				
T <sub>N</sub>	V <sub>N</sub>	CH <sub>L</sub>	1	≤2.0	Pass
		CH <sub>M</sub>	1		
		CH <sub>H</sub>	1		
T <sub>L</sub>	V <sub>H</sub>	CH <sub>L</sub>	1	≤2.0	Pass
		CH <sub>M</sub>	1		
		CH <sub>H</sub>	1		
	V <sub>L</sub>	CH <sub>L</sub>	1	≤2.0	Pass
		CH <sub>M</sub>	1		
		CH <sub>H</sub>	1		
T <sub>H</sub>	V <sub>H</sub>	CH <sub>L</sub>	1	≤2.0	Pass
		CH <sub>M</sub>	1		
		CH <sub>H</sub>	1		
	V <sub>L</sub>	CH <sub>L</sub>	1	≤2.0	Pass
		CH <sub>M</sub>	1		
		CH <sub>H</sub>	1		

## Dwell Time:

RX-AW					
Test Condition		Test Channel	Measured Dwell Time (ms)	Limit (ms)	Result
Temperature (°C)	Voltage (V)				
T <sub>N</sub>	V <sub>N</sub>	CH <sub>L</sub>	100	≤150	Pass
		CH <sub>M</sub>	100		
		CH <sub>H</sub>	100		
T <sub>L</sub>	V <sub>H</sub>	CH <sub>L</sub>	100	≤150	Pass
		CH <sub>M</sub>	100		
		CH <sub>H</sub>	100		
	V <sub>L</sub>	CH <sub>L</sub>	100	≤150	Pass
		CH <sub>M</sub>	101		
		CH <sub>H</sub>	100		
T <sub>H</sub>	V <sub>H</sub>	CH <sub>L</sub>	100	≤150	Pass
		CH <sub>M</sub>	100		
		CH <sub>H</sub>	100		
	V <sub>L</sub>	CH <sub>L</sub>	100	≤150	Pass
		CH <sub>M</sub>	100		
		CH <sub>H</sub>	101		

Dwell time on the additional channel:

RX-AW					
Test Condition		Test Channel	Measured (s)	Limit (s)	Result
Temperature (°C)	Voltage (V)				
T <sub>N</sub>	V <sub>N</sub>	CH <sub>L</sub>	1	0.85~2	Pass
		CH <sub>M</sub>	1		
		CH <sub>H</sub>	1		
T <sub>L</sub>	V <sub>H</sub>	CH <sub>L</sub>	1	0.85~2	Pass
		CH <sub>M</sub>	1		
		CH <sub>H</sub>	1		
	V <sub>L</sub>	CH <sub>L</sub>	1	0.85~2	Pass
		CH <sub>M</sub>	1		
		CH <sub>H</sub>	1		
T <sub>H</sub>	V <sub>H</sub>	CH <sub>L</sub>	1	0.85~2	Pass
		CH <sub>M</sub>	1		
		CH <sub>H</sub>	1		
	V <sub>L</sub>	CH <sub>L</sub>	1	0.85~2	Pass
		CH <sub>M</sub>	1		
		CH <sub>H</sub>	1		

### 5.4. Receiver for DSC decoder Requirement

#### 5.4.1. Maximum usable sensitivity

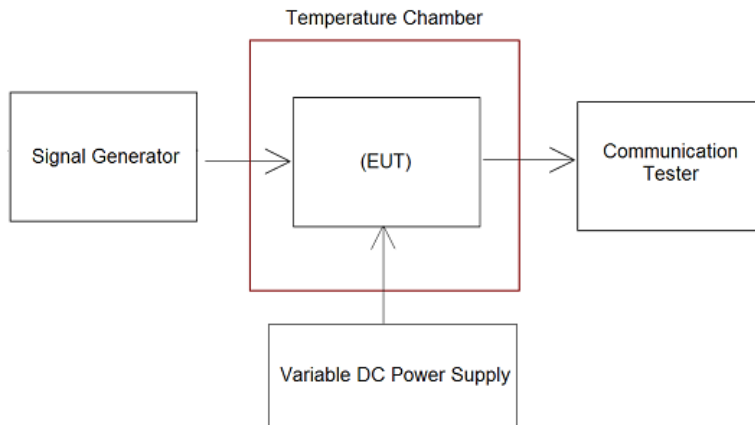
The maximum usable sensitivity of the receiver is the minimum level of the signal (e.m.f.) at the nominal frequency of the receiver which when applied to the receiver input with a test modulation will produce a bit error ratio of  $10^{-2}$

#### LIMIT

IEC 62238 Sub-clause 10.1.3

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

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The test conditions.

normal condition                       Extreme conditions

2. Please refer to IEC 62238 Sub-clause 10.1.2 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	Temperature (°C)	Voltage (V)	Test Channel	Measured (error ratio)	Limit (error ratio)	Result
RX-DSC	T <sub>N</sub>	V <sub>N</sub>	CH <sub>M1</sub>	0.004	≤ 10 <sup>-2</sup>	Pass
	T <sub>L</sub>	V <sub>H</sub>	CH <sub>M1</sub>	0.004		
		V <sub>L</sub>	CH <sub>M1</sub>	0.006		
	T <sub>H</sub>	V <sub>H</sub>	CH <sub>M1</sub>	0.005		
		V <sub>L</sub>	CH <sub>M1</sub>	0.007		

### 5.4.2. Co-channel rejection

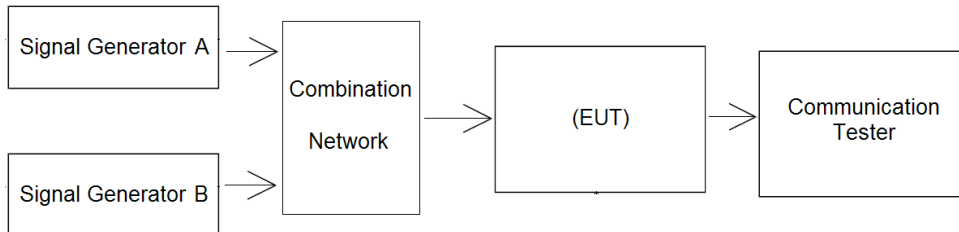
The co-channel rejection is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal, both signals being at the nominal frequency of the receiver.

#### LIMIT

IEC 62238 Sub-clause 10.2.3

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

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The test conditions.

normal condition  Extreme conditions

2. Please refer to IEC 62238 Sub-clause 10.2.2 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:

Operation Mode	Test Channel	Measurement Offset (kHz)	Measured (error ratio)	Limit(error ratio)	Result
RX-DSC	CH <sub>M1</sub>	-3	0.006	$\leq 10^{-2}$	Pass
		0	0.008		
		3	0.006		

### 5.4.3. Adjacent channel selectivity

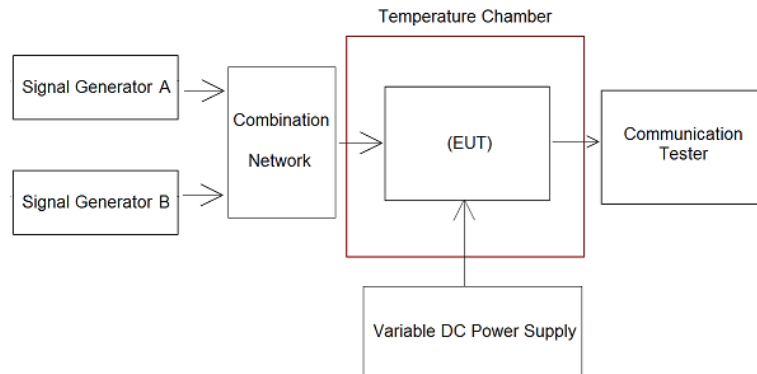
The adjacent channel selectivity is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal which differs in frequency from the wanted signal by 25 kHz.

#### LIMIT

IEC 62238 Sub-clause 10.3.3

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

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The test conditions.

normal condition       Extreme conditions

2. Please refer to IEC61138 Sub-clause 10.3.2 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 Condition		Test Channel	Measurement Position	Measured (error ratio)	Limit (error ratio)	Result
	Temperature (°C)	Voltage (V)					
RX-DSC	T <sub>N</sub>	V <sub>N</sub>	CH <sub>M1</sub>	Lower adjacent	0.004	≤10 <sup>-2</sup>	Pass
				Upper adjacent	0.005		
	T <sub>L</sub>	V <sub>H</sub>	CH <sub>M1</sub>	Lower adjacent	0.007	≤10 <sup>-2</sup>	Pass
				Upper adjacent	0.006		
		V <sub>L</sub>	CH <sub>M1</sub>	Lower adjacent	0.005	≤10 <sup>-2</sup>	Pass
				Upper adjacent	0.008		
	T <sub>L</sub>	V <sub>H</sub>	CH <sub>M1</sub>	Lower adjacent	0.006	≤10 <sup>-2</sup>	Pass
				Upper adjacent	0.007		
		V <sub>L</sub>	CH <sub>M1</sub>	Lower adjacent	0.007	≤10 <sup>-2</sup>	Pass
				Upper adjacent	0.006		

#### 5.4.4. Spurious response and blocking immunity

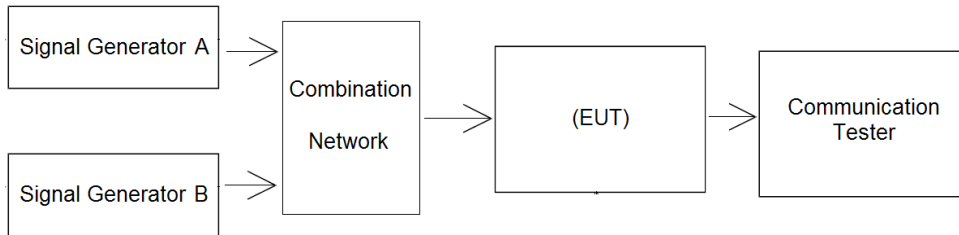
The spurious response and blocking immunity is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal with frequencies outside the pass band of the receiver.

##### LIMIT

IEC 62238 Sub-clause 10.4.3

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

##### TEST CONFIGURATION



##### TEST PROCEDURE

1. The test conditions.

normal condition  Extreme conditions

2. Please refer to IEC 62238 Sub-clause 10.4.2 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:

## Spurious response:

Operation Mode	Test Channel	Spurious Frequency (MHz)	Measured (error ratio)	Limit (error ratio)	Result
RX-DSC	CH <sub>M1</sub>	156.3	0.004	≤10 <sup>-2</sup>	Pass
		156.75	0.004		
		135.125	0.006		
		177.925	0.004		

## Blocking immunity:

Operation Mode	Test Channel	Measurement Offset (MHz)	Measured (error ratio)	Limit (error ratio)	Result
RX-DSC	CH <sub>M1</sub>	-10	0.004	≤10 <sup>-2</sup>	Pass
		-5	0.005		
		-2	0.005		
		-1	0.006		
		1	0.007		
		2	0.004		
		5	0.006		
		10	0.005		



### 5.4.5. Intermodulation response

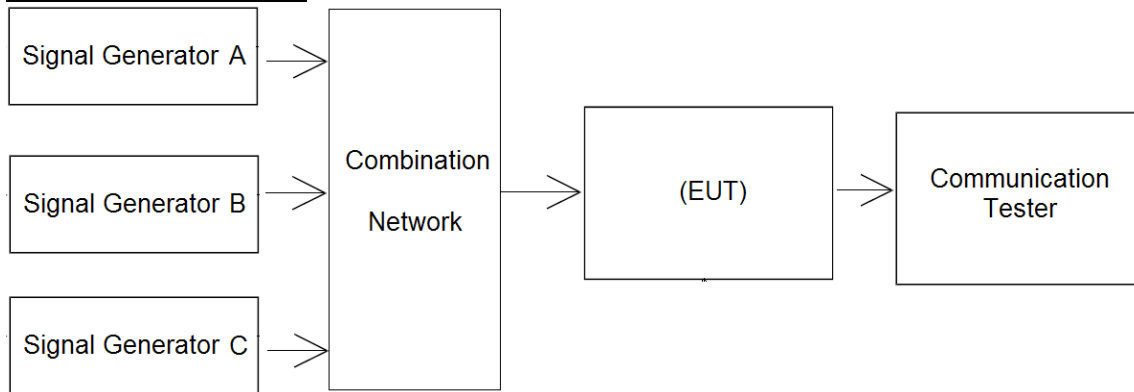
The intermodulation response is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of two or more unwanted signals with a specific frequency relationship to the wanted signal frequency.

#### LIMIT

IEC 62238 Sub-clause 10.5.3

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

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The test conditions.

normal condition

Extreme conditions

2. Please refer to IEC 62238 Sub-clause 10.5.2 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 Channel	Measurement Offset (kHz)		Measured (error ratio)	Limit (error ratio)	Result
		SG B	SG C			
RX-DSC	CH <sub>M1</sub>	-50	-100	0.004	$\leq 10^{-2}$	Pass
		50	100	0.006		

### 5.4.6. Dynamic range

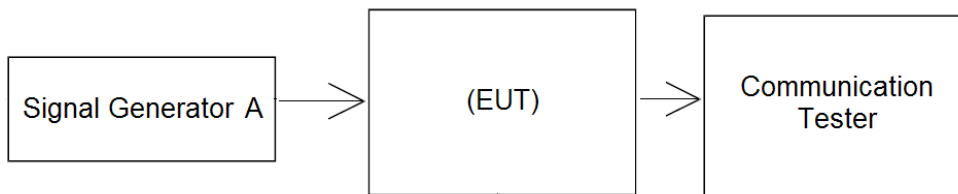
The dynamic range of the equipment is the range from the minimum to the maximum level of a radio frequency input signal at which the bit error ratio in the output of the decoder does not exceed a specified value.

#### Limit

IEC 62238 Sub-clause 10.6.3

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

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The test conditions.

normal condition                       Extreme conditions

2. Please refer to IEC 62238 Sub-clause 10.6.2 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 Channel	Measured (error ratio)	Limit (error ratio)	Result
RX-DSC	CH <sub>M1</sub>	0.004	$\leq 10^{-2}$	Pass

### 5.4.7. Spurious emissions

Spurious emissions from the receiver are components at any frequency, present at the receiver input port.

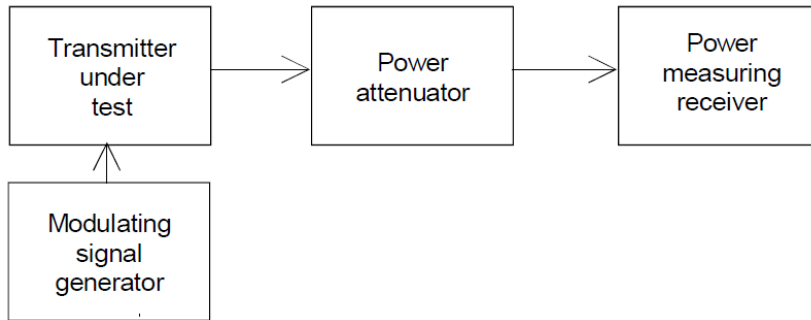
The level of spurious emissions shall be measured as the power level at the antenna.

**Limit**

IEC 62238 Sub-clause 10.7.3

The power of any spurious emission shall not exceed 2 nW at any frequency in the range between 9 kHz and 2 GHz.

**TEST CONFIGURATION**



**TEST PROCEDURE**

1. The test conditions.

- normal condition
- Extreme conditions

2. Please refer to IEC 62238 Sub-clause 10.7.2 for the measurement method.

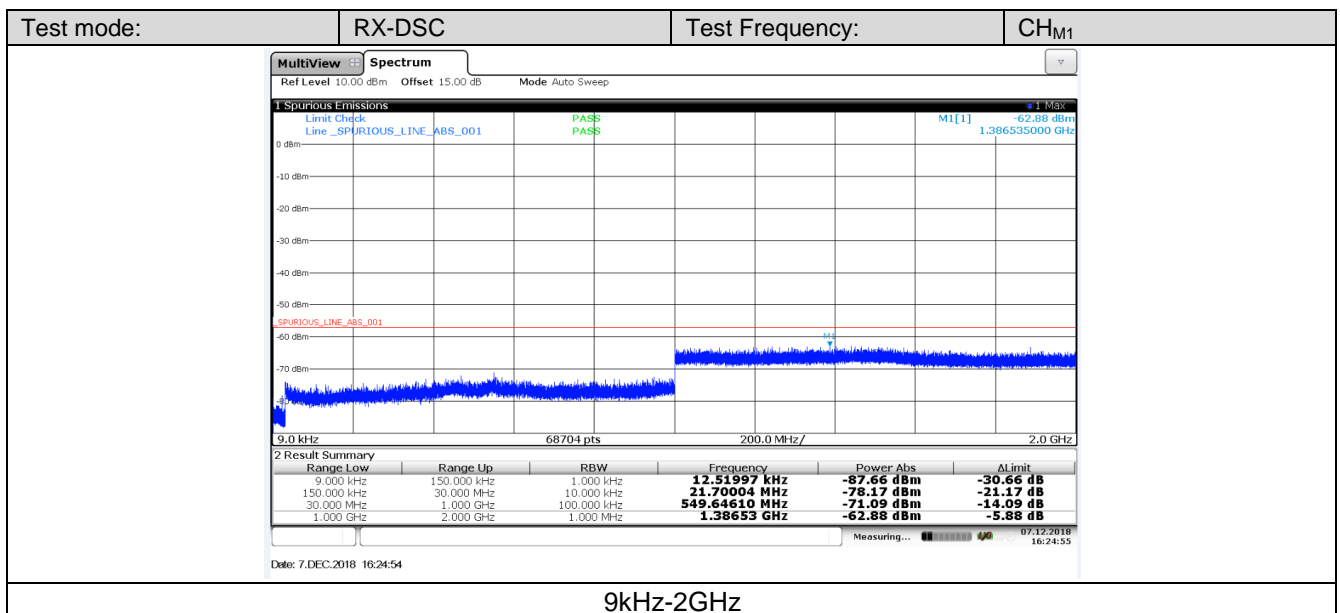
**TEST MODE:**

Please reference to the section 3.4

**TEST RESULTS**

- Passed
- Not Applicable

Please refer to the below test data:



### 5.4.8. Verification of correct decoding of various types of DSC calls

DSC call sequences are calls that comply with ITU-R Recommendation M.493-14.

#### Requirement

The requirements of ITU-R Recommendation M.493-14 regarding message composition and content shall be met.

The decoded call sequences at the output of the receiver shall be examined for correct technical format, including error-check characters.

When receiver measurements are made by use of a printer or a computer, a check shall be made to ensure accordance between printer output and display indication.

It shall be verified that the equipment is capable of switching to a channel identified in the DSC call.

#### TEST RESULTS

**Passed**       **Not Applicable**

Please refer to the below test data:

Call Sent	Received (Y or N)	Telecommand 1	Telecommand 2
Distress	Y	100	126
All Ships Distress Ack	Y	110	126
All Ships Distress Relay	Y	112	126
All Ships Urgency	Y	110	126
All Ships Safety	Y	100	126
Individual Urgency	Y	100	126
Individual Safety	Y	100	126
Individual Routine	Y	100	126
Group Routine	v	100	126

Function Check	Result
Confirm that the decoded call sequences at the output of the receiver have been examined for correct technical format, including error check characteristics.	Yes
Errors found:	No
Confirm that the checks have been made to ensure accordance between printer output and display	Yes
Errors found:	No
It has been verified that the equipment is capable of switching to a channel identified in the DSC call:	Yes

#### 5.4.9. Reaction to VTS and AIS channel management DSC transmissions

VTS and AIS channel management DSC transmissions are any DSC transmissions that are in accordance with Recommendation ITU-R M.825 or M.1371.

##### Requirement

The equipment shall not sound an alarm, display a message ( an accurate, imformative display is permissible but not required), transmit a response or suggest a transmitted response, lock up, or require operator intervention.

##### TEST RESULTS

**Passed**       **Not Applicable**

Please refer to the below test data:

Function Check	Received (Y or N)
Not sound an alarm	Y
Not display a message(An accurate informative display is permissible but not required)	Y
Not transmit a response	Y
Not suggest a transmitted response	Y
Not lock up	Y
Not require operator intervention	Y

**5.4.10. Simultaneous reception**

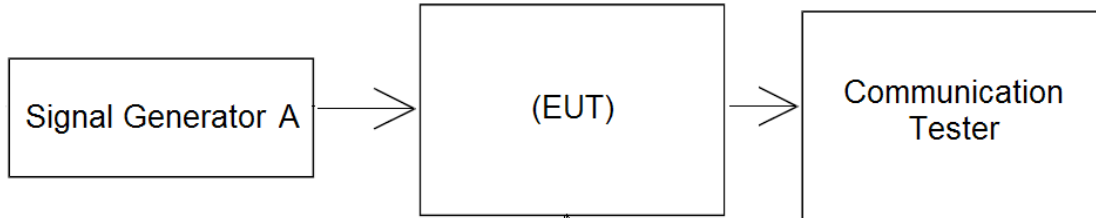
Simultaneous reception is the ability of the unit to correctly receive DSC traffic and radiotelephony traffic at the same time.

**Limit**

IEC 62238 Sub-clause 10.10.3

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

**TEST CONFIGURATION**



**TEST PROCEDURE**

1. The test conditions.

normal condition                       Extreme conditions

2. Please refer to IEC 62238 Sub-clause 10.10.2 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:

**TEST RESULTS**

Passed                       Not Applicable

Operation Mode	Test Channel	Measured SINAD (dB)	Limit (dB)	Result
RX-AW	CH <sub>M</sub>	24.86	≥20	Pass

Operation Mode	Test Channel	Measured (error ratio)	Limit (error ratio)	Result
RX-DSC	CH <sub>M1</sub>	0.004	≤10 <sup>-2</sup>	Pass

-----End of Report-----