




# TEST REPORT

**Report No.** ..... : **CHEW22110035** Report verification :   
**Project No.** ..... : **SHT2204124301EW**  
**FCC ID**..... : **K6630683X30**  
**Applicant's name** ..... : **Yaesu Musen Co., Ltd.**  
 Address ..... : Tennozu Parkside Building 2-5-8 Higashi-Shinagawa,  
 Shinagawa-ku, Tokyo 140-0002 JAPAN  
**Test item description** ..... : **VHF FM Marine Transceiver**  
 Trade Mark ..... : Standard Horizon  
 Model/Type reference ..... : HX320  
 Listed Model(s) ..... : -  
**Standard**..... : **FCC CFR Title 47 Part 2**  
**FCC CFR Title 47 Part 80**  
 Date of receipt of test sample ..... : Oct. 31, 2022  
 Date of testing ..... : Nov. 01, 2022- Feb. 01, 2023  
 Date of issue ..... : Feb. 06, 2023  
**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:

[FCC Rules Part 2](#): Frequency allocations and radio treaty matters; General rules and regulations

[FCC Rules Part 80](#): STATIONS IN THE MARITIME SERVICES

[ANSI C63.26-2015](#): American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

[ANSI/TIA-603-E\(2016\)](#): Land Mobile FM or PM Communications Equipment and Performance Standards

## **1.2. Report revised information**

Revised No.	Date of issued	Description
N/A	2023-02-06	Original

## 2 TEST DESCRIPTION

Test Item	Section in CFR 47	Result	Test Engineer
Conducted Carrier Output Power	Part 80.215 Part 2.1046(a)	Pass	Chunshui Gu
99% Occupied Bandwidth & 26dB bandwidth	Part 80.205 Part 2.1049	Pass	Chunshui Gu
Emission Mask	Part 80.211(f) Part 2.1049	Pass	Chunshui Gu
Modulation Limit	Part 2.1047(b) Part 80.213	Pass	Chunshui Gu
Audio Frequency Response	Part 2.1047(a) Part 80.213(e)	Pass	Chunshui Gu
Frequency Stability V.S. Temperature	Part 80.209 Part 2.1055	Pass	Chunshui Gu
Frequency Stability V.S. Voltage	Part 80.209 Part 2.1055	Pass	Chunshui Gu
Transmit Conducted Spurious Emission	Part 80.211(f)(3) Part 2.1051	Pass	Yifan Wang
Transmit Radiated Spurious Emission	Part 80.211(f)(3) Part 2.1053	Pass	Yifan Wang

### 3 SUMMARY

#### 3.1 Client Information

Applicant:	Yaesu Musen Co., Ltd.
Address:	Tennozu Parkside Building 2-5-8 Higashi-Shinagawa, Shinagawa-ku, Tokyo 140-0002 JAPAN
Manufacturer:	Qixian Electron Science & Technology Co., Ltd.
Address:	Qixiang Building, Tangxi Industrial Zone, Luojiang District, Quanzhou, Fujian, China

#### 3.2 Product Description

Name of EUT:	VHF FM Marine Transceiver
Trade mark:	Standard Horizon
Model/Type reference:	HX320
Listed model(s):	-
Power supply:	DC 7.4V from Battery
Battery information:	7.4Vdc, 2100mAh
Adapter information:	Model:W&T-AD06C050100KU Input: AC100-240V, 50/60Hz, 0.3A Output: 5.0Vdc, 1.0A 5.0W
Hardware version:	V3.1
Software version:	V1.100

#### 3.3 Radio Specification Description

Operation Frequency Range:	TX:156.025MHz to 161.600MHz RX:156.300MHz to 162.000MHz
Rated Output Power:	6W (37.78dBm)
Modulation Type:	FM
Channel Separation:	25kHz
Emission Designator: * <sup>1</sup>	16K0G3E
Antenna Type:	1/4λ Helical whip

Note:

(1) \*<sup>1</sup> According to FCC Part 2.202 requirements, the Necessary Bandwidth is calculated as follows:

- For FM Voice Modulation

Channel Spacing = 25 KHz, D = 5 KHz max, K = 1, M = 3 KHz

$B_n = 2M + 2DK = 2 \times 3 + 2 \times 5 \times 1 = 16 \text{ KHz}$

Emission designation: 16K0G3E

### 3.4 Testing Laboratory Information

Laboratory Name	Shenzhen Huatongwei International Inspection Co., Ltd.	
Laboratory Location	1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China	
Connect information:	Phone: 86-755-26715499 E-mail: <a href="mailto:cs@szhtw.com.cn">cs@szhtw.com.cn</a> <a href="http://www.szhtw.com.cn">http://www.szhtw.com.cn</a>	
Qualifications	Type	Accreditation Number
	FCC	762235

## 4 TEST CONFIGURATION

### 4.1 Test frequency list

According to ANSI C63.26 section 5.1.2.1:

Measurements of transmitters shall be performed and, if required, reported for each frequency band in which the EUT can be operated with the device transmitting at the number of frequencies in each band specified in Table 2.

Frequency range over which EUT operates	Number of frequencies	Location in frequency range of operation
1 MHz or less	1	Middle
1 MHz to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle, and 1 near bottom

Frequency Bands (MHz)	Test Channel	Test Frequency (MHz)	
		TX	RX
TX:156.025MHz to 161.600MHz RX:156.300MHz to 162.000MHz	CH <sub>L</sub> (CH60)	156.025	160.625
	CH <sub>M</sub> (CH16)	156.800	156.800
	CH <sub>H</sub> (CH88)	157.425	157.425
	CH <sub>2020</sub>	161.600	161.600

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

Channel	TX Frequency (MHz)	RX Frequency (MHz)	Channel	TX Frequency (MHz)	RX Frequency (MHz)
1	156.050	160.650	60	156.025	160.625
2	156.100	160.700	61	156.075	160.675
3	156.150	160.750	62	156.125	160.725
4	156.200	160.800	63	156.175	160.775
5	156.250	160.850	64	156.225	160.825
6	156.300	156.300	65	156.275	160.875
7	156.350	160.950	66	156.325	160.925
8	156.400	156.400	67	156.375	156.375
9	156.450	156.450	68	156.425	156.425
10	156.500	156.500	69	156.475	156.475
11	156.550	156.550	71	156.575	156.575
12	156.600	156.600	72	156.625	156.625
13	156.650	156.650	73	156.675	156.675
14	156.700	156.700	74	156.725	156.725
15	156.750	156.750	75	156.775	156.775
16	156.800	156.800	76	156.825	156.825
17	156.850	156.850	77	156.875	156.875
18	156.900	161.500	78	156.925	161.525
19	156.950	161.550	79	156.975	161.575
20	157.000	161.600	80	157.025	161.625
21	157.050	161.650	81	157.075	161.675
22	157.100	161.700	82	157.125	161.725
23	157.150	161.750	83	157.175	161.775
24	157.200	161.800	84	157.225	161.825
25	157.250	161.850	85	157.275	161.875
26	157.300	161.900	86	157.325	161.925
27	157.350	161.950	87	157.375	157.375
28	157.400	162.000	88	157.425	157.425
2020	161.600	161.600			

## 4.2 Operation mode

Test mode	Transmitting	Receiving	Power level	Analog Voice/PM
			High	25kHz
TX-AWH	√		√	√

Note:

√: is operation mode.

Modulation Type	Description
UM	Un-modulation
AM2	Apply a 1000 Hz tone and adjust the audio frequency generator to produce 20% of the rated system deviation.
AM6	Apply a 1000 Hz modulating signal to the transmitter from the audio frequency generator, and adjust the level to obtain 60% of full rated system deviation, then increase the level from the audio generator by 20 dB
AM5	Modulate the transmitter with a 2500 Hz sine wave at an input level 16 dB greater than that necessary to produce 50% of rated system deviation.

Pre-scan above all test mode, found below test mode which it was worse case mode, so only show the test data for worse case mode on the test report.

Test item	Modulation Type	Test mode (Worse case mode)
Conducted Output Power	UM	TX-AWH
99% Occupied Bandwidth & 26dB bandwidth	AM6	TX-AWH
Emission Mask	AM5	TX-AWH
Modulation Limit	AM6	TX-AWH
Audio Frequency Response	AM2	TX-AWH
Frequency Stability VS Temperature	UM	TX-AWH
Frequency Stability VS Voltage	UM	TX-AWH
Transmit Conducted Spurious Emission	AM5	TX-AWH
Transmit Radiated Spurious Emission	AM5	TX-AWH

## 4.3 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. :	/



#### 4.4 Environmental conditions

Atmospheric Contions	
Temperature:	21°C to 25°C
Relative Humidity:	20 % to 75 %.
Atmospheric Pressure:	860 mbar to 1060 mbar
Norminal Test Voltage:	$V_N = DC 7.4V$
Extrem Test Voltage @115% $V_N$ :	$V_H = DC 8.4V$
Extrem Test Voltage @85% $V_N$ :	$V_L = DC 6.3V$

#### 4.5 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 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
Conducted Carrier Output Power	0.63	(1)
99% Occupied Bandwidth & 26dB bandwidth	0.002%	(1)
Emission Mask	0.92dB	(1)
Frequency Stability	0.06ppm	(1)
Transmit Conducted Spurious Emission	1.68dB	(1)
Transmit Radiated Spurious Emission	4.54dB for 30MHz-1GHz	(1)
	5.10dB for above 1GHz	(1)

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

## 4.6 Equipments Used during the Test

● TS8613 Test system							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Spectrum Analyzer	Agilent	HTWE0286	N9020A	MY50510187	2022/08/25	2023/08/24
●	Signal & Spectrum Analyzer	R&S	HTWE0262	FSW26	103440	2022/08/25	2023/08/24
●	RF Communication Test Set	HP	HTWE0038	8920A	3813A10206	2022/08/25	2023/08/24
●	Digital intercom communication tester	Aeroflex	HTWE0255	3920B	1001682041	2022/08/25	2023/08/24
●	Signal Generator	R&S	HTWE0191	SML02	100507	2022/08/25	2023/08/24
●	Signal Generator	R&S	HTWE0337	SMC100A	107268	2022/08/25	2023/08/24
●	RF Control Unit	Tonscend	HTWE0294	JS0806-2	N/A	N/A	N/A
●	Filter-VHF	Microwave	HTWE0309	N26460M1	498702	N/A	N/A
●	Filter-UHF	Microwave	HTWE0311	N25155M2	498704	N/A	N/A
●	Power Divider	Microwave	HTWE0043	OPD1040-N-4	N/A	2022/05/16	2023/05/15
●	Attenuator	JFW	HTWE0292	50FH-030-100	N/A	2022/05/16	2023/05/15
●	Attenuator	JFW	HTWE0293	50-A-MFN-20	0322	2022/05/16	2023/05/15
●	Test software	HTW	N/A	Radio ATE	N/A	N/A	N/A
● Auxiliary Equipment							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Climate chamber	ESPEC	HTWE0254	GPL-2	N/A	2022/08/29	2023/08/28
●	DC Power Supply	Gwinstek	HTWE0274	SPS-2415	GER835793	N/A	N/A
● Radiated Spurious Emission							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	HTWE0122	SAC-3m-01	C11121	2018/09/27	2023/09/26
●	Spectrum Analyzer	R&S	HTWE0098	FSP40	100597	2022/08/25	2023/08/24
●	Loop Antenna	R&S	HTWE0170	HFH2-Z2	100020	2021/04/06	2024/04/05
●	Broadband Horn Antenna	SCHWARZBECK	HTWE0103	BBHA9170	BBHA9170472	2020/04/27	2023/04/26
●	Ultra-Broadband Antenna	SCHWARZBECK	HTWE0123	VULB9163	538	2021/04/06	2024/04/05
●	Horn Antenna	SCHWARZBECK	HTWE0126	9120D	1011	2020/04/01	2023/03/31
●	Pre-amplifier	CD	HTWE0071	PAP-0102	12004	2022/11/04	2023/11/03
●	Broadband Preamplifier	SCHWARZBECK	HTWE0201	BBV 9718	9718-248	2022/02/28	2023/02/27
●	RF Connection Cable	HUBER+SUHNER	HTWE0120-01	6m 18GHz S Serisa	N/A	2022/02/25	2023/02/24
●	RF Connection Cable	HUBER+SUHNER	HTWE0120-02	6m 3GHz RG Serisa	N/A	2022/02/25	2023/02/24
●	RF Connection Cable	HUBER+SUHNER	HTWE0119-05	6m 3GHz RG Serisa	N/A	2022/02/25	2023/02/24
●	RF Connection Cable	HUBER+SUHNER	HTWE0120-04	6m 3GHz RG Serisa	N/A	2022/02/25	2023/02/24
●	EMI Test Software	Audix	N/A	E3	N/A	N/A	N/A

### ● Conducted Emission

Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Shielded Room	Albatross projects	HTWE0114	N/A	N/A	2018/09/28	2023/09/27
●	EMI Test Receiver	R&S	HTWE0111	ESCI	101247	2022/08/30	2023/08/29
●	Artificial Mains	SCHWARZBECK	HTWE0113	NNLK 8121	573	2022/08/29	2023/08/28
●	Pulse Limiter	R&S	HTWE0193	ESH3-Z2	101447	2022/08/29	2023/08/28
●	RF Connection Cable	HUBER+SUHNER	HTWE0113-02	ENVIROFLEX_142	EF-NM-BNCM-2M	2022/09/17	2023/09/16
●	Test Software	R&S	N/A	ES-K1	N/A	N/A	N/A

### ● Radiated Emission-6th test site

Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	HTWE0127	SAC-3m-02	C11121	2018/09/30	2023/09/29
●	EMI Test Receiver	R&S	HTWE0099	ESCI	100900	2022/08/30	2023/08/29
●	Ultra-Broadband Antenna	SCHWARZBECK	HTWE0119	VULB9163	546	2020/04/28	2023/04/27
●	Pre-Amplifier	SCHWARZBECK	HTWE0295	BBV 9742	N/A	2022/11/04	2023/11/03
●	RF Connection Cable	HUBER+SUHNER	HTWE0062-01	N/A	N/A	2022/02/25	2023/02/24
●	RF Connection Cable	HUBER+SUHNER	HTWE0062-02	SUCOFLEX104	501184/4	2022/02/25	2023/02/24
●	Test Software	R&S	N/A	ES-K1	N/A	N/A	N/A

### ● Radiated emission-7th test site

Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	HTWE0122	SAC-3m-01	C11121	2018/09/27	2023/09/26
●	Spectrum Analyzer	R&S	HTWE0098	FSP40	100597	2022/08/25	2023/08/24
●	Horn Antenna	SCHWARZBECK	HTWE0126	9120D	1011	2020/04/01	2023/03/31
●	Broadband Pre-amplifier	SCHWARZBECK	HTWE0201	BBV 9718	9718-248	2022/02/28	2023/02/27
●	RF Connection Cable	HUBER+SUHNER	HTWE0126-01	RE-7-FH	N/A	2022/03/04	2023/03/03
●	Test Software	Audix	N/A	E3	N/A	N/A	N/A

## **5 TEST CONDITIONS AND RESULTS**

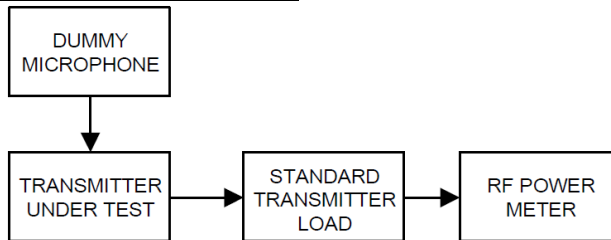
### **5.1 Conducted Carrier Output Power**

#### **LIMIT**

FCC Part 80.215, FCC Part 2.1046

Applicants for licenses must request and use no more power than the actual power necessary for satisfactory operation.

#### **TEST CONFIGURATION**



#### **TEST PROCEDURE**

- (1) Connect the equipment as illustrated
- (2) Correct for all losses in the RF path
- (3) Measure the transmitter output power
- (4) If the power output is adjustable, measurements shall be made for the highest and lowest power levels.

#### **TEST MODE**

Please reference to the section 3.4

#### **TEST RESULTS**

**Passed**       **Not Applicable**

Please refer to appendix A on the section 8 appendix report

## 5.2 99% Occupied Bandwidth & 26dB Bandwidth

### LIMIT

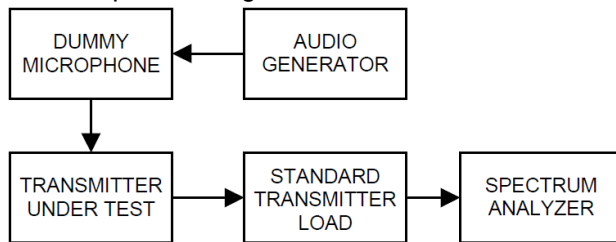
FCC Part 80.205, FCC Part 2.1049

Class of emission	Emission designator	Authorized bandwidth (kHz)
A1A	160HA1A	0.4
A1B <sup>1</sup>	160HA1B	0.4
A1D <sup>12</sup>	16K0A1D	20.0
A2A	2K66A2A	2.8
A2B <sup>1</sup>	2K66A2B	2.8
A2D <sup>12</sup>	16K0A2D	20.0
A3E	6K00A3E	8.0
A3N <sup>2</sup>	2K66A3N	2.8
A3X <sup>3</sup>	3K20A3X	25.0
F1B <sup>4</sup>	280HF1B	0.3
F1B <sup>5</sup>	300HF1B	0.5
F1B <sup>6</sup>	16K0F1B	20.0
F1C	2K80F1C	3.0
F1D <sup>12</sup>	16K0F1D	20.0
F2B <sup>6</sup>	16K0F2B	20.0
F2C <sup>7</sup>	16K0F2C	20.0
F2D <sup>12</sup>	16K0F2D	20.0
F3C	2K80F3C	3.0
F3C <sup>7</sup>	16K0F3C	20.0
F3E <sup>8</sup>	16K0F3E	20.0

<sup>8</sup> Applicable only when maximum frequency deviation is 5 kHz. See also paragraph (b) of this section.

### TEST CONFIGURATION

Test setup for Analog:



### TEST PROCEDURE

- (1) Connect the equipment as illustrated
- (2) Spectrum set as follow:
  - Centre frequency = the nominal EUT channel center frequency,
  - The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (typically a span of  $1.5 \times \text{OBW}$  is sufficient)
  - RBW = 1% to 5% of the anticipated OBW, VBW  $\geq 3 \times \text{RBW}$ , Sweep = auto,
  - Detector function = peak, Trace = max hold
- (3) Set 99% Occupied Bandwidth and 26dB Bandwidth
- (4) Measure and record the results in the test report.

### TEST MODE

Please reference to the section 3.4

### TEST RESULTS

Passed       Not Applicable

Please refer to appendix B on the section 8 appendix report

### 5.3 Emission Mask

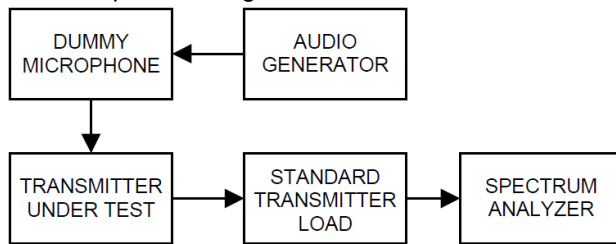
#### LIMIT

FCC Part 80.211(f), FCC Part 2.1049

- (1) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 dB;
- (2) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 dB; and
- (3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus  $10\log_{10}$  (mean power in watts) dB.

#### TEST CONFIGURATION

Test setup for Analog:



#### TEST PROCEDURE

- 1) Connect the equipment as illustrated.
- 2) Spectrum set as follow:  
Centre frequency = fundamental frequency, span=120kHz for 12.5kHz channel spacing,  
RBW=100Hz, VBW=1000Hz, Sweep = auto,  
Detector function = peak, Trace = max hold
- 3) Key the transmitter, and set the level of the unmodulated carrier to a full scale reference line. This is the 0dB reference for the measurement.
- 4) Apply Input Modulation Signal to EUT according to Section 3.4
- 5) Measure and record the results in the test report.

#### TEST MODE

Please reference to the section 3.4

#### TEST RESULTS

Passed       Not Applicable

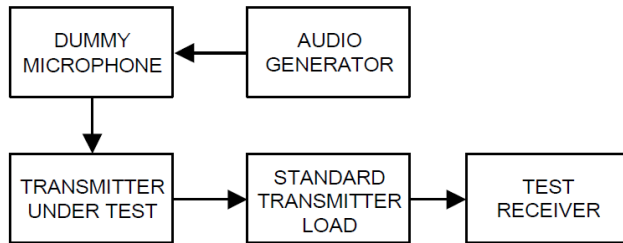
Please refer to appendix C on the section 8 appendix report

## 5.4 Modulation Limit

### LIMIT

FCC Part 80.213, FCC Part 2.1047(b)  
5kHz for 25 KHz Channel Spacing System

### TEST CONFIGURATION



### TEST PROCEDURE

- 1) Connect the equipment as illustrated.
- 2) Adjust the transmitter per the manufacturer's procedure for full rated system deviation.
- 3) Set the test receiver to measure peak positive deviation. Set the audio bandwidth for  $\leq 0.25$  Hz to  $\geq 15,000$  Hz. Turn the de-emphasis function off.
- 4) Apply Input Modulation Signal to EUT according to Section 3.4 and vary the input level from  $-20$  to  $+20$ dB.
- 5) Measure both the instantaneous and steady-state deviation at and after the time of increasing the audio input level
- 6) Repeat step 4-5 with input frequency changing to 300Hz, 1004Hz, 1500Hz and 2500Hz in sequence.

### TEST MODE

Please reference to the section 3.4

### TEST RESULTS

Passed       Not Applicable

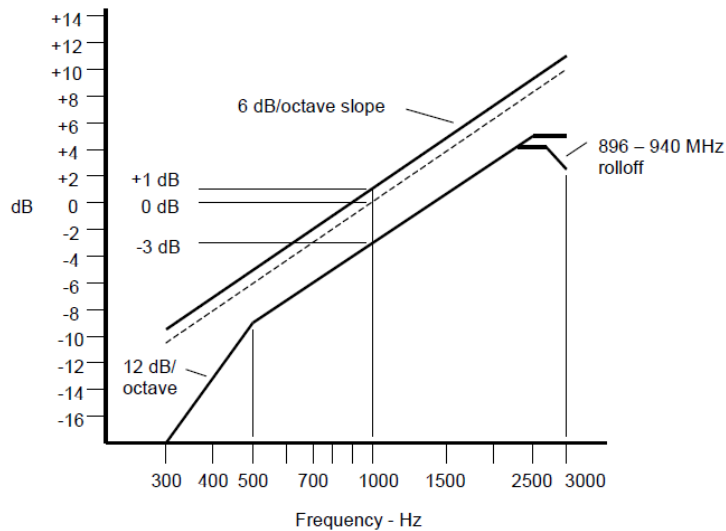
Please refer to appendix D on the section 8 appendix report

## 5.5 Audio Frequency Response

### LIMIT

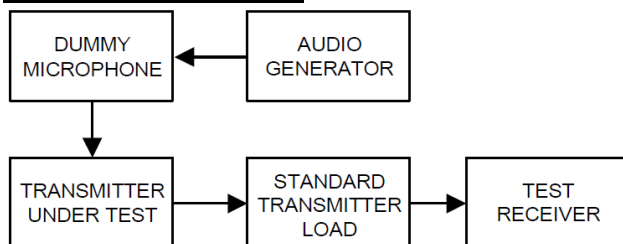
FCC Part 80.213(e), FCC Part 2.1047(a):

Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.



An additional 6 dB per octave attenuation is allowed from 2500 Hz to 3000 Hz in equipment operating in the 25 MHz to 869 MHz range.

### TEST CONFIGURATION



### TEST PROCEDURE

- 1) Connect the equipment as illustrated.
- 2) Set the test receiver to measure peak positive deviation. Set the audio bandwidth for 50 Hz to 15,000 Hz. Turn the de-emphasis function off.
- 3) Set the DMM to measure rms voltage.
- 4) Adjust the transmitter per the manufacturer's procedure for full rated system deviation.
- 5) Apply Input Modulation Signal to EUT according to Section 3.4
- 6) Set the test receiver to measure rms deviation and record the deviation reading.
- 7) Record the DMM reading as  $V_{REF}$ .
- 8) Set the audio frequency generator to the desired test frequency between 300 Hz and 3000 Hz.
- 9) Vary the audio frequency generator output level until the deviation reading that was recorded in step 6) is obtained.
- 10) Record the DMM reading as  $V_{FREQ}$
- 11) Calculate the audio frequency response at the present frequency as:  
audio frequency response =  $20 \log_{10} (V_{FREQ}/V_{REF})$ .
- 12) Repeat steps 8) through 11) for all the desired test frequencies



**TEST MODE**

Please reference to the section 3.4

**TEST RESULTS**

**Passed**       **Not Applicable**

Please refer to appendix E on the section 8 appendix report

## 5.6 Frequency stability VS Temperature

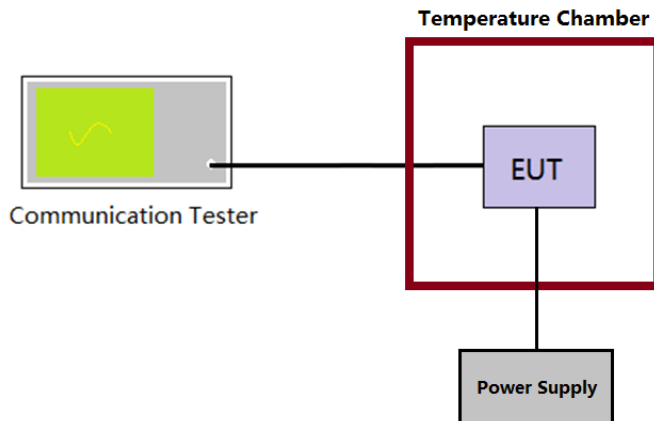
### LIMIT

FCC Part 80.209, FCC Part 2.1055

Frequency bands and categories of stations	Tolerances <sup>1</sup>
(5) Band 156-162 MHz:	
(i) Coast stations:	
For carriers licensed to operate with a carrier power:	
Below 3 watts	10.
3 to 100 watts	5. <sup>7</sup>
(ii) Ship stations	10. <sup>4</sup>
(iii) Survival craft stations operating on 121.500 MHz	50.
(iv) EPIRBs:	
Operating on 121.500 and 243.000 MHz	50.
Operating on 156.750 and 156.800 MHz. <sup>6</sup>	10.
(6) Band 216-220 MHz:	
(i) Coast stations:	
For all emissions	5.
(ii) Ship stations:	
For all emissions	5.
(7) Band 400-466 MHz:	
(i) EPIRBs operating on 406-406.1 MHz	5.
(ii) On-board stations	5.
(iii) Radiolocation and telecommand stations.	5.
(8) Band 1626.5-1646.5 MHz:	
(i) Ship earth stations	5.

<sup>7</sup>For transmitters operated at private coast stations with antenna heights less than 6 meters (20 feet) above ground and output power of 25 watts or less the frequency tolerance is 10 parts in 10<sup>6</sup>.

### TEST CONFIGURATION



### TEST PROCEDURE

- 1) The EUT output port was connected to communication tester.
- 2) The EUT was placed inside the temperature chamber.
- 3) Turn EUT off and set the chamber temperature to  $-30^{\circ}\text{C}$ . After the temperature stabilized for approximately 30 minutes recorded the frequency as  $MCF_{\text{MHz}}$ .
- 4) Calculate the ppm frequency error by the following:  

$$\text{ppm error} = (MCF_{\text{MHz}} / ACF_{\text{MHz}} - 1) * 10^6$$
 where  
 $MCF_{\text{MHz}}$  is the Measured Carrier Frequency in MHz  
 $ACF_{\text{MHz}}$  is the Assigned Carrier Frequency in MHz
- 5) Repeat step 3 measure with  $10^{\circ}\text{C}$  increased per stage until the highest temperature of  $+50^{\circ}\text{C}$  reached.

**TEST MODE**

Please reference to the section 3.4

**TEST RESULTS**

**Passed**       **Not Applicable**

Please refer to appendix F on the section 8 appendix report

## 5.7 Frequency stability VS Voltage

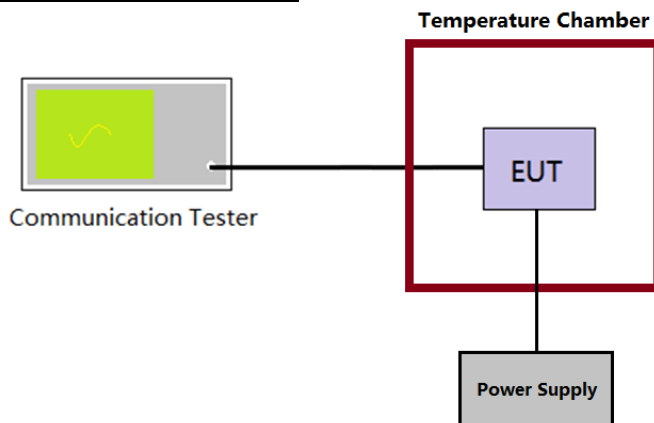
### LIMIT

FCC Part 80.209, FCC Part 2.1055

Frequency bands and categories of stations	Tolerances <sup>1</sup>
(5) Band 156-162 MHz:	
(i) Coast stations:	
For carriers licensed to operate with a carrier power:	
Below 3 watts	10.
3 to 100 watts	5. <sup>7</sup>
(ii) Ship stations	10. <sup>4</sup>
(iii) Survival craft stations operating on 121.500 MHz	50.
(iv) EPIRBs:	
Operating on 121.500 and 243.000 MHz	50.
Operating on 156.750 and 156.800 MHz. <sup>6</sup>	10.
(6) Band 216-220 MHz:	
(i) Coast stations:	
For all emissions	5.
(ii) Ship stations:	
For all emissions	5.
(7) Band 400-466 MHz:	
(i) EPIRBs operating on 406-406.1 MHz	5.
(ii) On-board stations	5.
(iii) Radiolocation and telecommand stations.	5.
(8) Band 1626.5-1646.5 MHz:	
(i) Ship earth stations	5.

<sup>7</sup>For transmitters operated at private coast stations with antenna heights less than 6 meters (20 feet) above ground and output power of 25 watts or less the frequency tolerance is 10 parts in 10<sup>6</sup>.

### TEST CONFIGURATION



### TEST PROCEDURE

- 1) The EUT output port was connected to communication tester.
- 2) The EUT was placed inside the temperature chamber at 25°C
- 3) Record the carrier frequency of the transmitter as  $MCF_{MHz}$
- 4) Calculate the ppm frequency error by the following:  

$$ppm\ error = (MCF_{MHz} / ACF_{MHz} - 1) * 10^6$$

where  
 $MCF_{MHz}$  is the Measured Carrier Frequency in MHz  
 $ACF_{MHz}$  is the Assigned Carrier Frequency in MHz
- 5) Repeat step 3 measure with varied  $\pm 15\%$  of the nominal value measured at the input to the EUT

**TEST MODE**

Please reference to the section 3.4

**TEST RESULTS**

**Passed**       **Not Applicable**

Please refer to appendix G on the section 8 appendix report

## 5.8 Transmit Conducted Spurious Emission

### LIMIT

FCC Part 80.211(f)(3), FCC Part 2.1051

FCC Rules	Attenuation Limit (dBc)
§ 80.211(f)(3)	At least 43 +10log10 (mean power in watts) dB

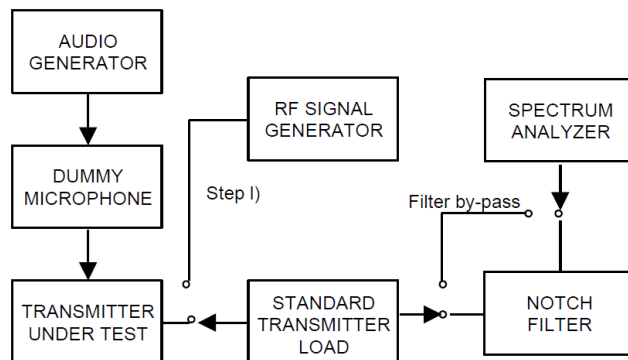
$43 + 10 \log (P_{\text{watts}})$

Calculation:  $\text{Limit (dBm)} = EL - 43 - 10 \log_{10} (TP)$

Notes: *EL is the emission level of the Output Power expressed in dBm,  
In this application, the EL is P( dBm).*

$\text{Limit (dBm)} = P(\text{dBm}) - 43 - 10 \log (P_{\text{watts}}) = -13 \text{ dBm}$

### TEST CONFIGURATION



### TEST PROCEDURE

1. Connect the equipment as illustrated, with the notch filter by-passed.
2. Apply Input Modulation Signal to EUT according to Section 3.4
3. Adjust the spectrum analyzer for the following settings:  
Below 1GHz: RBW=100kHz, VBW=300kHz  
Above 1GHz: RBW=1MHz, VBW=3MHz  
Detector=Peak, Sweep time=Auto, Trace=Max hold
4. Scan frequency range up to 10<sup>th</sup> harmonic.
5. Record the frequencies and levels of spurious emissions

### TEST MODE

Please reference to the section 3.4

### TEST RESULTS

Passed       Not Applicable

Please refer to appendix H on the section 8 appendix report

### 5.9 Transmitter Radiated Spurious Emission

Radiated spurious emissions are emissions from the equipment when transmitting into a nonradiating load on a frequency or frequencies that are outside an occupied band sufficient to ensure transmission of information of required quality for the class of communications desired.

**LIMIT**

FCC Part 80.211(f)(3), FCC Part 2.1051

FCC Rules	Attenuation Limit (dBc)
§ 80.211(f)(3)	At least 43 +10log10 (mean power in watts) dB

$43 + 10 \log (P_{\text{watts}})$

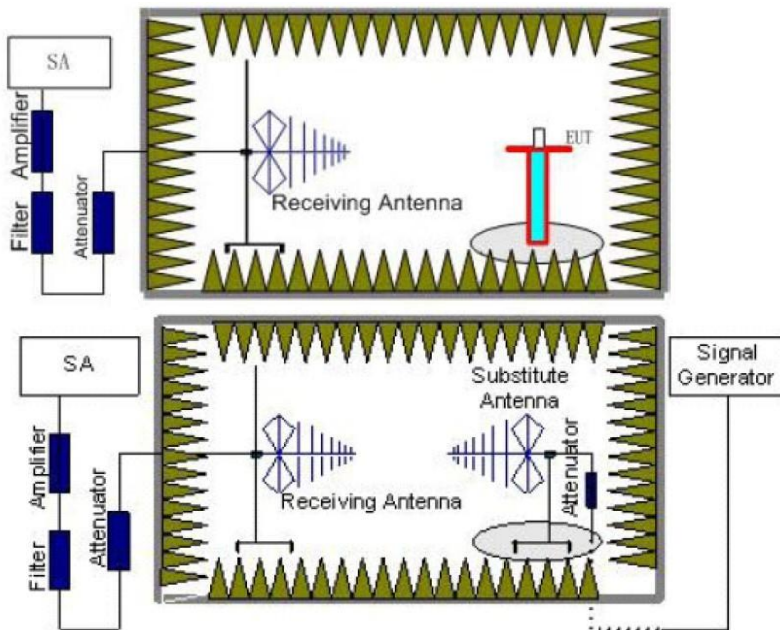
Calculation:  $\text{Limit (dBm)} = EL - 43 - 10 \log_{10} (TP)$

Notes: *EL is the emission level of the Output Power expressed in dBm, In this application, the EL is P( dBm).*

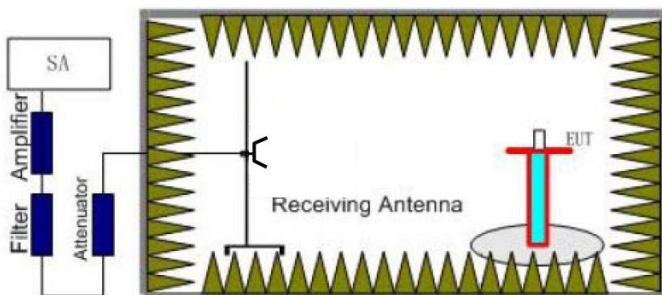
$\text{Limit (dBm)} = P (\text{dBm}) - 43 - 10 \log (P_{\text{watts}}) = -13 \text{ dBm}$

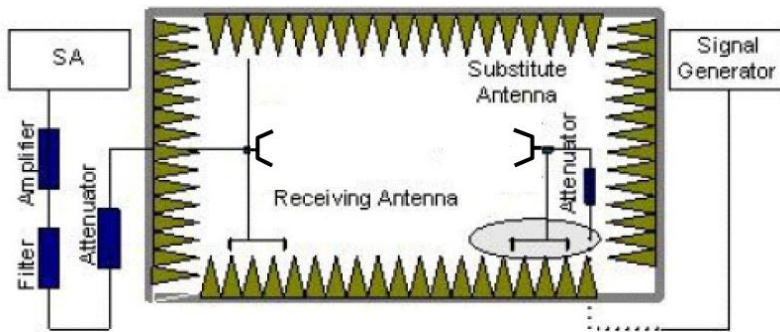
**TEST CONFIGURATION**

**Below 1GHz:**



**Above 1GHz:**





## TEST PROCEDURE

1. Place the EUT in the center of the turntable.
  - a) For radiated emissions measurements performed at frequencies less than or equal to 1 GHz, the EUT shall be placed on a RF-transparent table at a nominal height of 80 cm above the reference ground plane
  - b) For radiated measurements performed at frequencies above 1 GHz, the EUT shall be placed on an RF transparent table at a nominal height of 1.5 m above the ground plane.
2. Unless the EUT uses an integral antenna, the EUT shall be terminated with a non-radiating transmitter load. In cases where the EUT uses an adjustable antenna, the antenna shall be adjusted through typical positions and lengths to maximize emissions levels.
3. The EUT shall be tested while operating on the frequency per manufacturer specification. Set the transmitter to operate in continuous transmit mode.
4. Receiver or Spectrum set as follow:  
Below 1GHz, RBW=100kHz, VBW=300kHz, Detector=Peak, Sweep time=Auto  
Above 1GHz, RBW=1MHz, VBW=3MHz, Detector=Peck, Sweep time=Auto
5. Each emission under consideration shall be evaluated:
  - a) Raise and lower the measurement antenna from 1 m to 4 m, as necessary to enable detection of the maximum emission amplitude relative to measurement antenna height.
  - b) Rotate the EUT through 360° to determine the maximum emission level relative to the axial position.
  - c) Return the turntable to the azimuth where the highest emission amplitude level was observed.
  - d) Vary the measurement antenna height again through 1 m to 4 m again to find the height associated with the maximum emission amplitude.
  - e) Record the measured emission amplitude level and frequency
6. Repeat step 5 for each emission frequency with the measurement antenna oriented in both the horizontal and vertical polarizations to determine the orientation that gives the maximum emissions amplitude.
7. Set-up the substitution measurement with the reference point of the substitution antenna located as near as possible to where the center of the EUT radiating element was located during the initial EUT measurement.
8. Maintain the previous measurement instrument settings and test set-up, with the exception that the EUT is removed and replaced by the substitution antenna.
9. Connect a signal generator to the substitution antenna; locate the signal generator so as to minimize any potential influences on the measurement results. Set the signal generator to the frequency where emissions are detected, and set an output power level such that the radiated signal can be detected by the measurement instrument, with sufficient dynamic range relative to the noise floor.
10. For each emission that was detected and measured in the initial test
  - a) Vary the measurement antenna height between 1 m to 4 m to maximize the received (measured) signal amplitude.
  - b) Adjust the signal generator output power level until the amplitude detected by the measurement instrument equals the amplitude level of the emission previously measured directly in step 5 and step 6.
  - c) Record the output power level of the signal generator when equivalence is achieved in step b).
11. Repeat step 8 through step 10 with the measurement antenna oriented in the opposite polarization.
12. Calculate the emission power in dBm referenced to a half-wave dipole using the following equation:  

$$P_e = P_s(\text{dBm}) - \text{cable loss (dB)} + \text{antenna gain (dBd)}$$
 where  
 $P_e$  = equivalent emission power in dBm  
 $P_s$  = source (signal generator) power in dBm  
 NOTE—dBd refers to the measured antenna gain in decibels relative to a half-wave dipole.
13. Correct the antenna gain of the substitution antenna if necessary to reference the emission power to a half-wave dipole. When using measurement antennas with the gain specified in dBi, the equivalent dipole-referenced gain can be determined from:  

$$\text{gain (dBd)} = \text{gain (dBi)} - 2.15 \text{ dB.}$$
 If necessary, the antenna gain can be calculated from calibrated antenna factor information



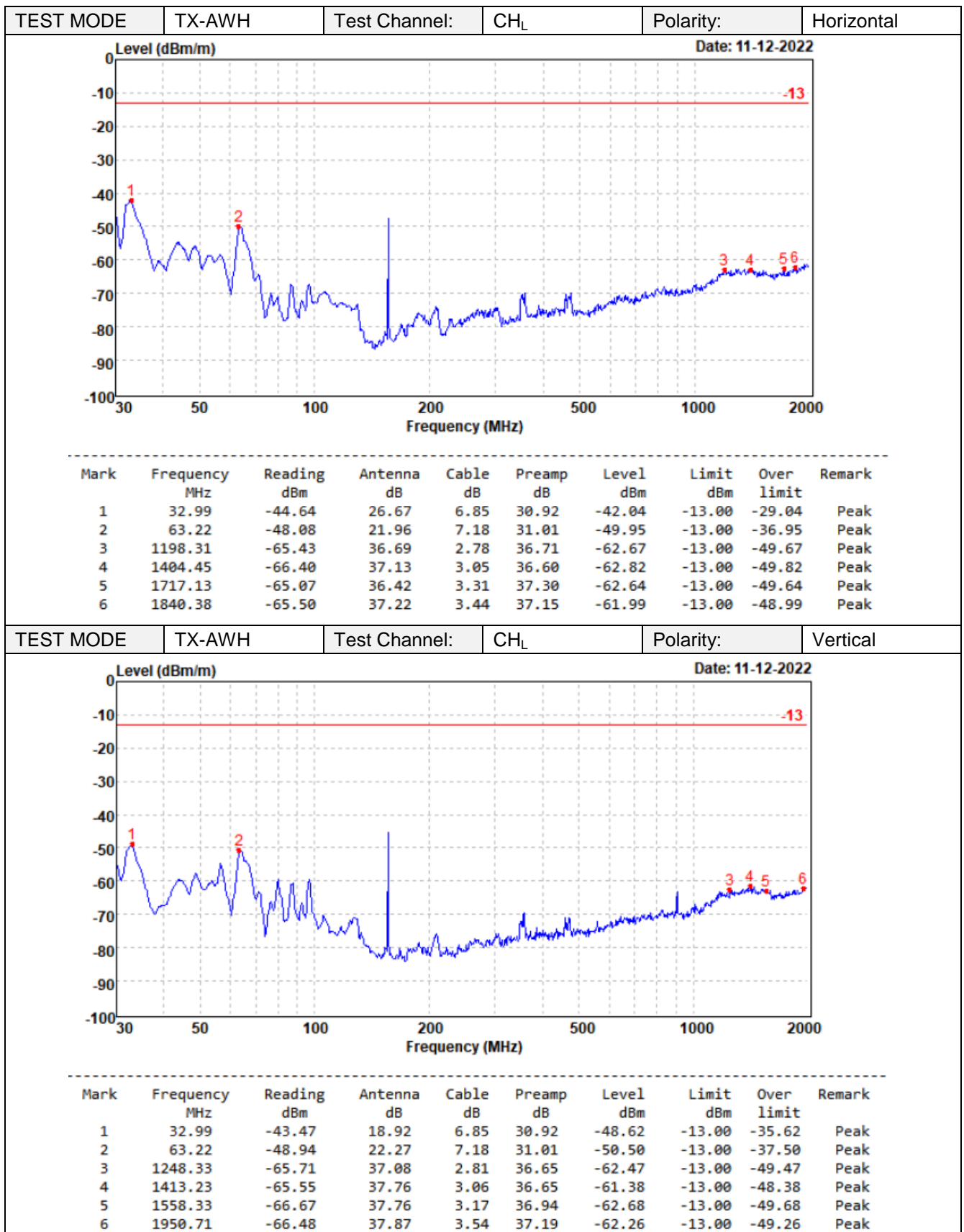
14. Provide the complete measurement results as a part of the test report.

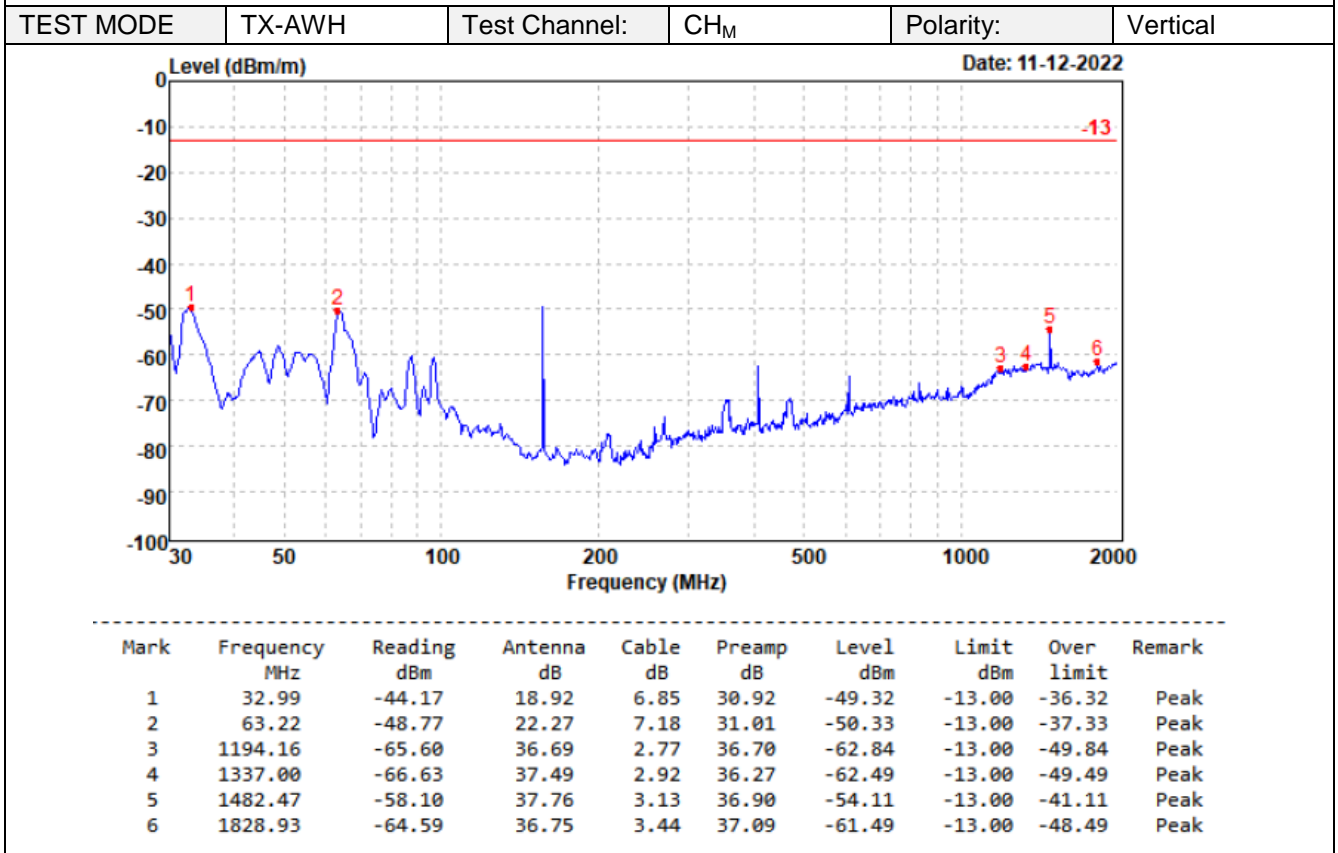
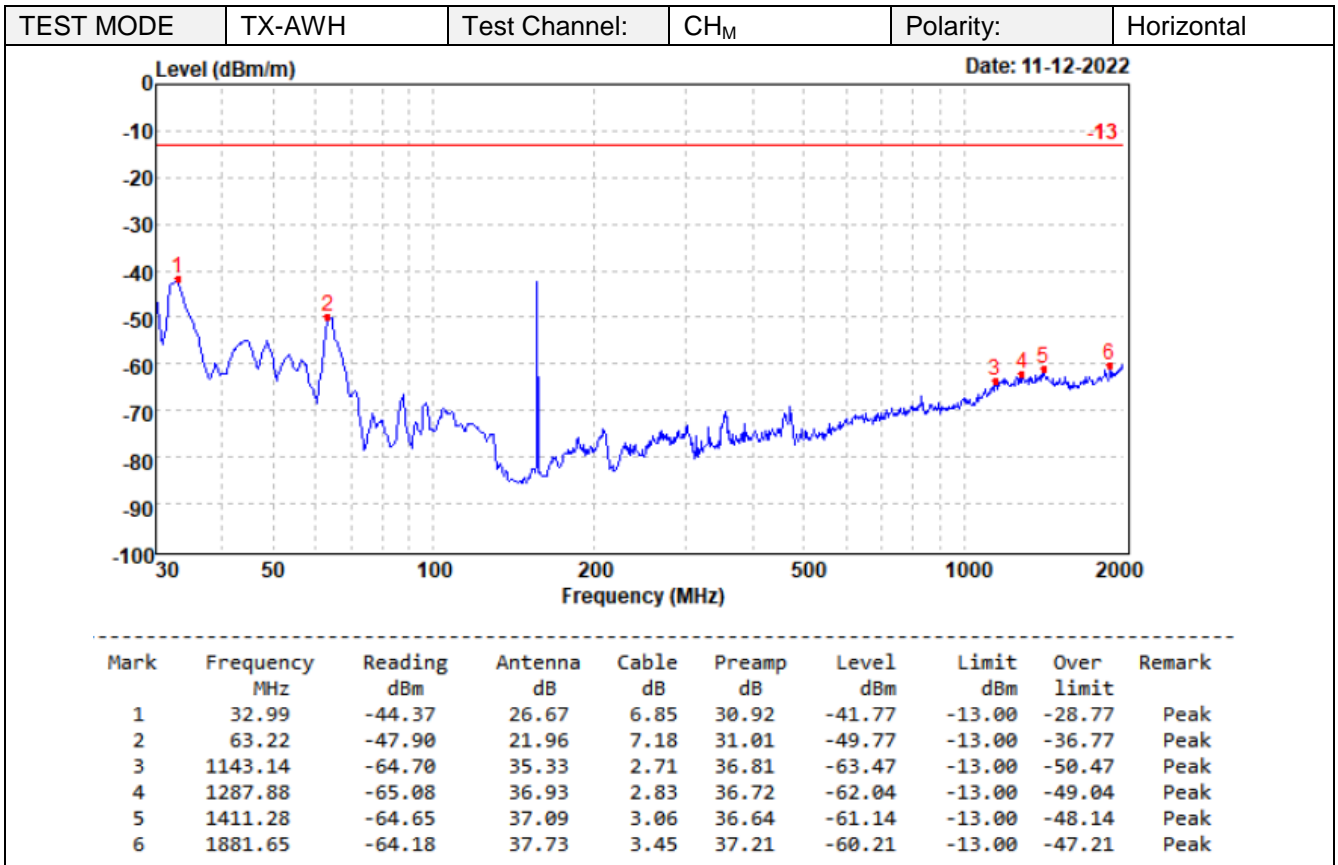
**TEST MODE**

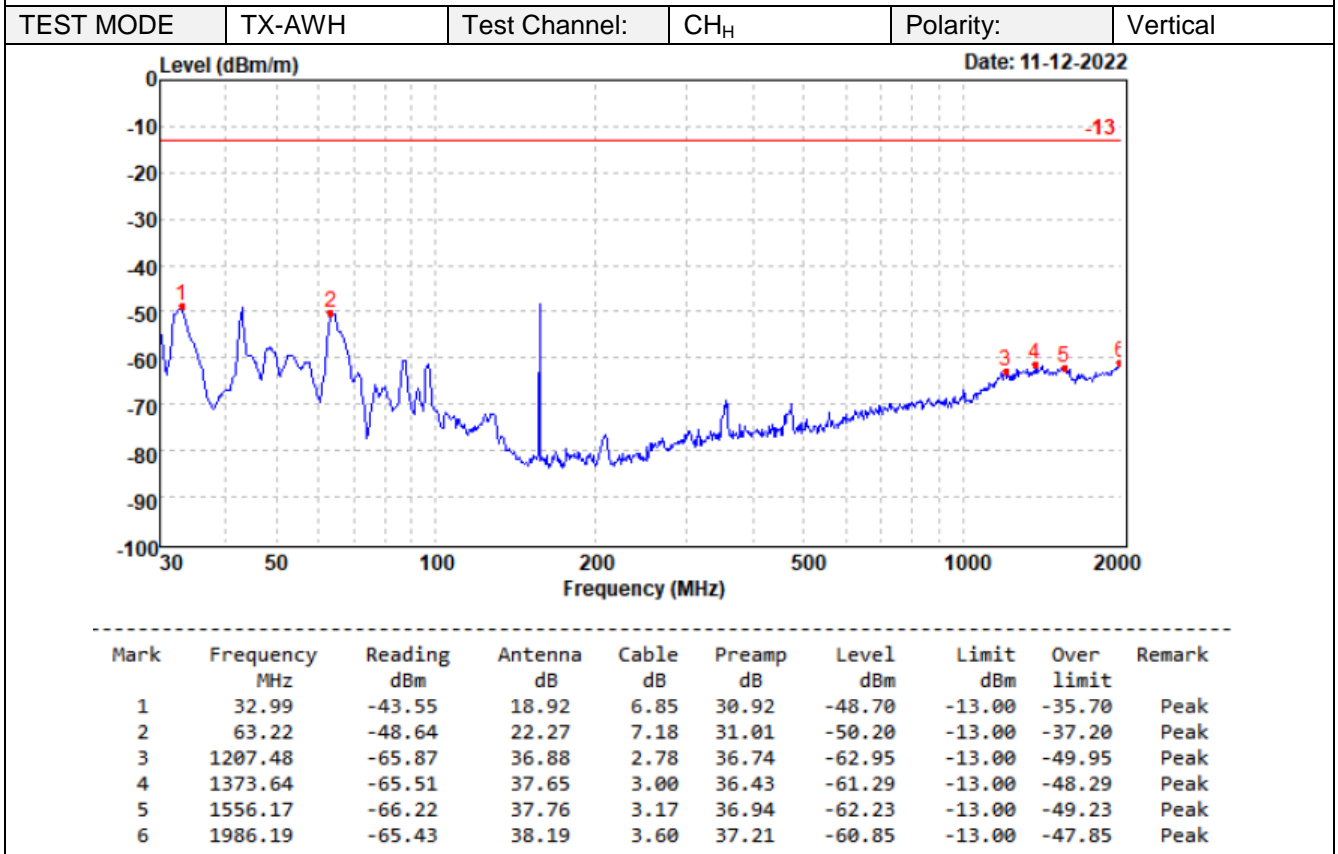
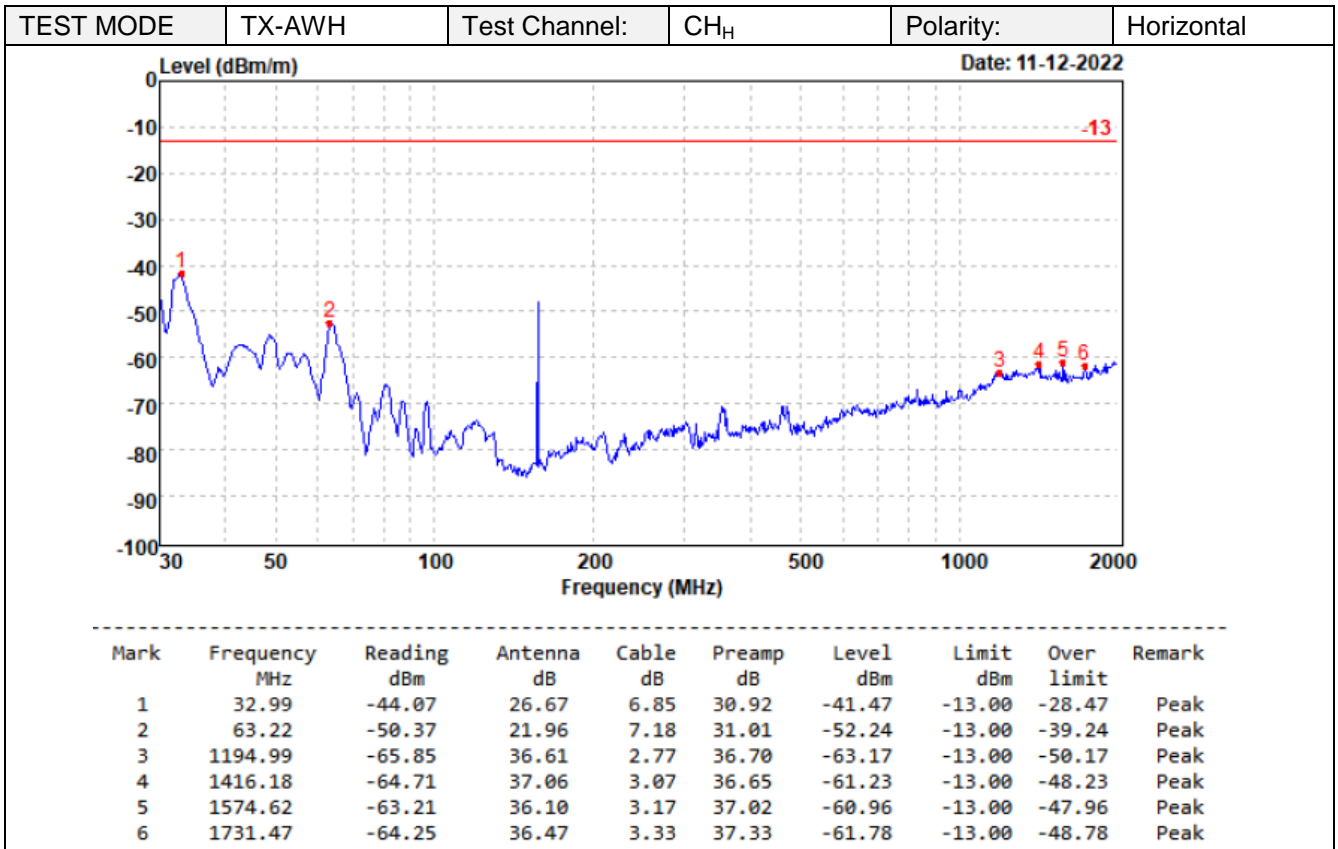
Please reference to the section 3.4

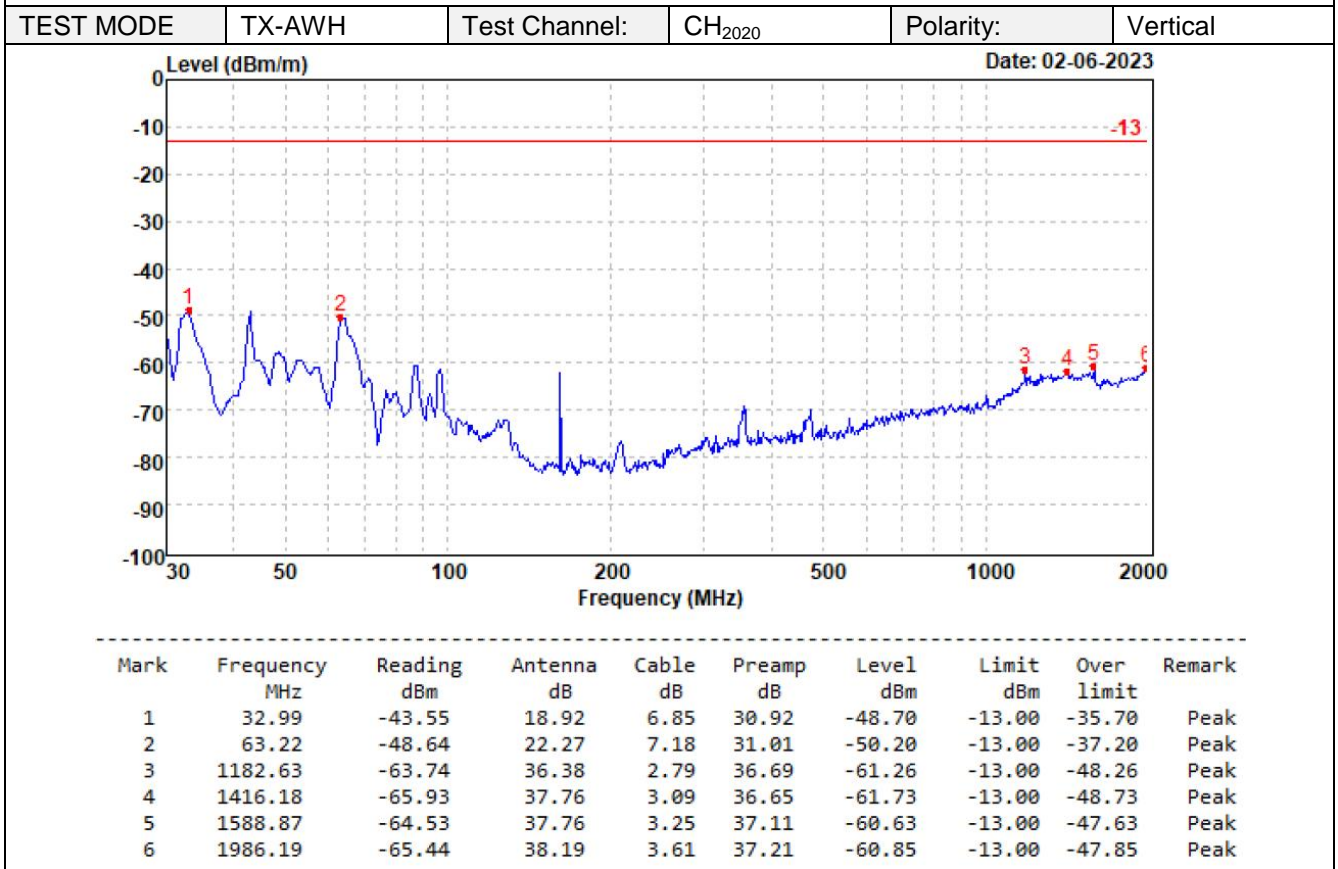
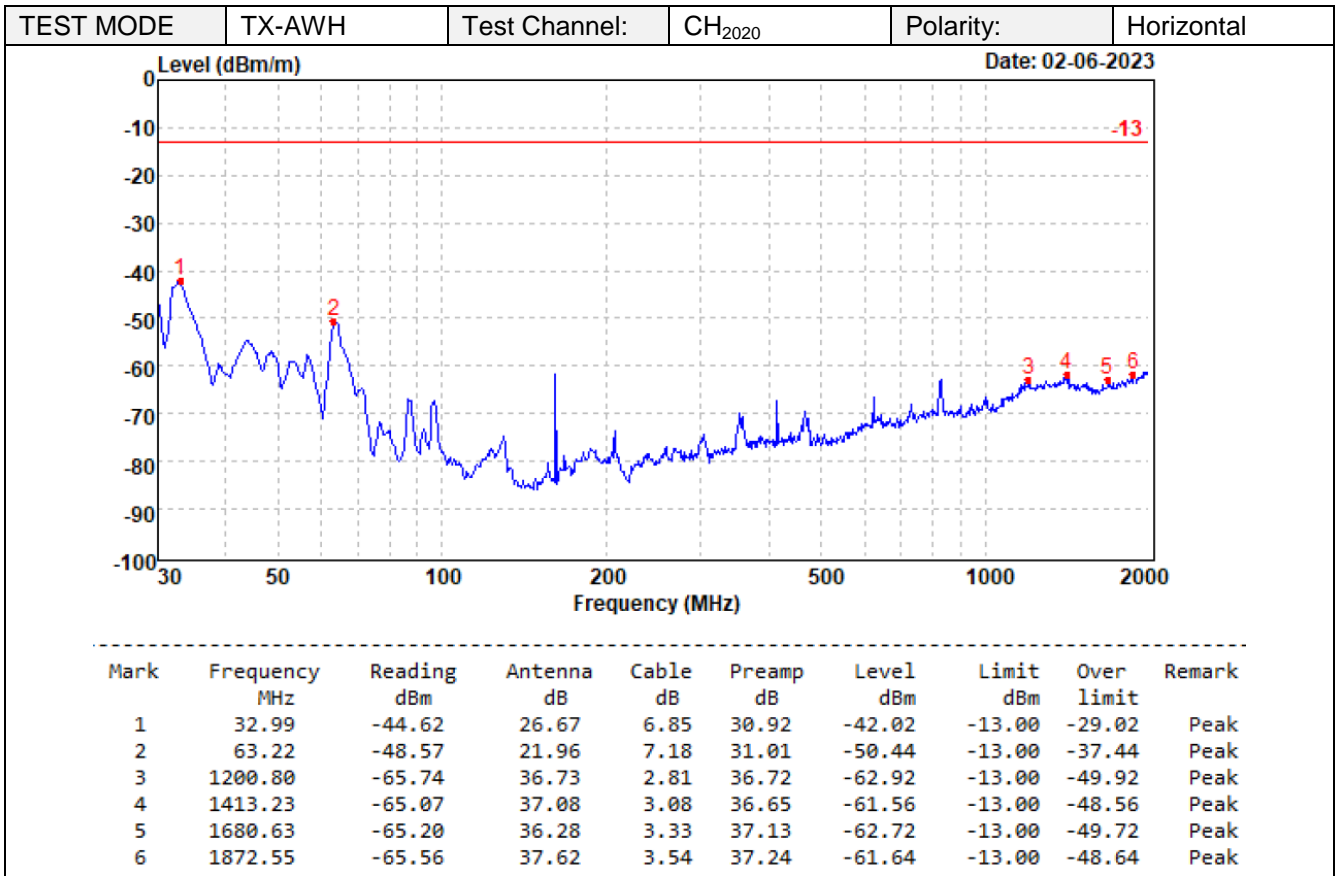
**TEST RESULTS**

**Passed**       **Not Applicable**

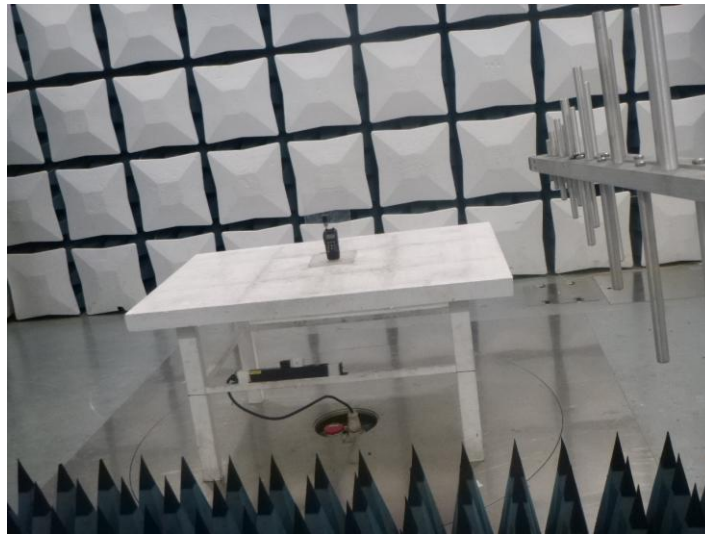








## 6 TEST SETUP PHOTOS OF THE EUT



## 7 EXTERNAL AND INTERNAL PHOTOS OF THE EUT

Reference to the test report No.: CHTEW22110033

## 8 APPENDIX REPORT