TEST REPORT

Applicant Name :	Shenzhen Ysair Technology Co., LTD
Address :	6/F, building 6, Yunli intelligent park, No. 3, Changfa, Middle Road, Yangmei community, Bantian street, Longgang District, Shenzhen, Guangdong China
Report Number :	SZNS220425-16366E-RF-00A
FCC ID:	2A3OORT55

Test Standard (s)

FCC PART 80

Sample Description

Product Type:	VHF MARINE TWO WAY RADIO
Model No.:	RT55
Multiple Model(s) No.:	RA26(Please refer to DOS for Model difference)
Trade Mark:	RETEVIS
Date Received:	2022/04/25
Report Date:	2022/06/20

Test Result:	Pass*

* In the configuration tested, the EUT complied with the standards above.

Prepared and Checked By:

Nick Fang

EMC Engineer

Approved By:

Robert Li

EMC Engineer

Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★ ".
Shenzhen Accurate Technology Co., Ltd. is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk '*'. Customer model name, addresses, names, trademarks etc. are not considered data.
This report cannot be reproduced except in full, without prior written approval of the Company. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested. This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Frequency Range	Transitter:156.025-157.425MHz Receiver: 156.05-163.275MHz
Maximum conducted Peak output power(rated)	High Power Level:5W Low Power Level:1W
Modulation Technique	FM
Antenna Specification*	3dBi (provided by the applicant)
Product category	Portable device
DCS function	Receive only
AIS Class	Class B, receive only
Voltage Range	DC 7.4V from battery or DC 12.0V from adapter
Sample serial number	SZNS220425-16366E-RF-S1 for Radiated Emissions SZNS220425-16366E-RF-S2 for RF Conducted Test (Assigned by ATC)
Sample/EUT Status	Good condition
Adapter information	Model: CG-D120050 Input: AC 100-240V, 50/60Hz, 0.6A, Max Output: DC 12V, 500mA

Objective

This test report is in accordance with Part 2 and Part 80 of the Federal Communication Commissions rules.

Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of federal Regulations Title 47 Part 2, Sub-part J as well as the following individual parts:

Part 80 –Stations in the Maritime Services

Applicable Standards: TIA 603-E.

All emissions measurement was performed at Shenzhen Accurate Technology Co., Ltd. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Each test item follows test standards and with no deviation.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		5%
RF Frequency		$0.082*10^{-7}$
RF output power, conducted		0.73dB
Unwanted Emission, conducted		1.6dB
AC Power Lines Conducted Emissions		2.72dB
Emissions, Radiated	9kHz - 30MHz	2.66dB
	30MHz - 1GHz	4.28dB
	1GHz - 18GHz	4.98dB
	18GHz - 26.5GHz	5.06dB
	26.5GHz - 40GHz	4.72dB
Temperature		1℃
Humidity		6%
Supply voltages		0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The test site used by Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358, the FCC Designation No.: CN1189. Accredited by American Association for Laboratory Accreditation (A2LA) The Certificate Number is 429 7.01.

Listed by Innovation, Science and Economic Development Canada (ISEDC), the Registration Number is 5077A.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in a test mode which has been done in the factory.

EUT Exercise Software

No exercise software was used.

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

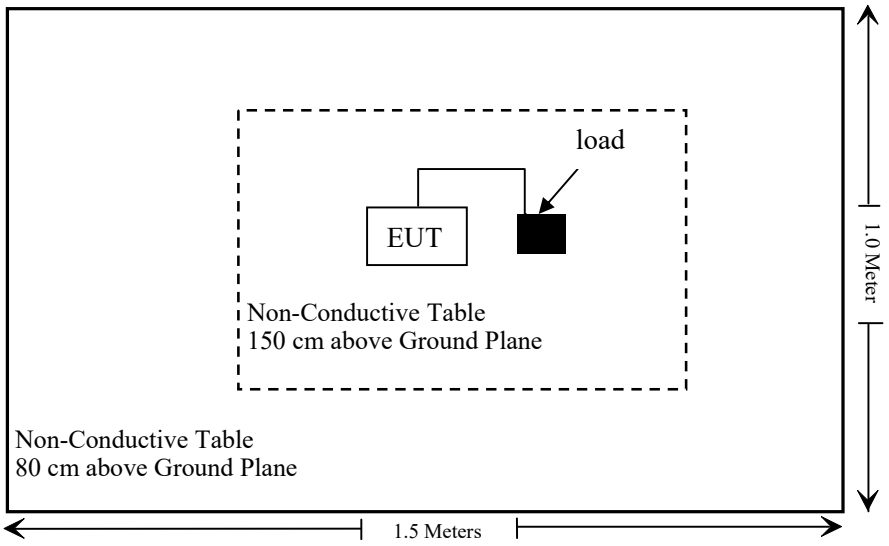
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Unknown	Load	Unknown	Unknown

External I/O Cable

Cable Description	Length (m)	From/Port	To
/	/	/	/

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§2.1093	RF EXPOSURE	Compliant
FCC Part §2.1046,§80.215	RF Output Power	Compliant
FCC Part §2.1047,§80.213	Modulation requirements	Compliant
FCC Part §2.1049,§80.205	Bandwidth	Compliant
FCC Part §2.1051,§80.211 (f)	Emission limitations	Compliant
FCC Part §80.217	Suppression of Interference Aboard Ships	Compliant
FCC Part § 80.211	Spurious Emission at Antenna Terminal	Compliant
FCC Part §2.1051,§80.211	Radiated Spurious Emissions	Compliant
FCC Part §2.1055,§80.209 (a) (5) (ii)	Transmitter Frequency Tolerances	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emissions Test					
Rohde& Schwarz	Test Receiver	ESR	102725	2021/12/13	2022/12/12
SONOMA INSTRUMENT	Amplifier	310 N	186131	2021/11/09	2022/11/08
A.H. Systems, inc.	Preamplifier	PAM-0118P	135	2021/11/09	2022/11/08
Radiated Emission Test Software: e3 19821b (V9)					
Unknown	RF Coaxial Cable	No.10	N050	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.11	N1000	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.12	N040	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.13	N300	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.14	N800	2021/12/14	2022/12/13
Schwarzbeck	Bilog Antenna	VULB9163	9163-194	2020/01/05	2023/01/04
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2021/07/06	2024/07/05
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-655	2020/01/05	2023/01/04
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2020/01/05	2023/01/04
Unknown	RFCoaxialCable	No.16	N200	2021/12/14	2022/12/13
Agilent	Signal Generator	N5183A	MY51040755	2021/12/13	2022/12/12

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
SPECTRUM ANALYZER	Rohde & Schwarz	FSU26	200982	2021/07/06	2022/07/05
HP Agilent	RF Communication test set	8920B	3325U00859	2021/12/14	2022/12/13
Aeroflex/Weinschel	30dB Attenuator (Input 250W/Output 50W)	58-30-33	PS467	2021/12/14	2022/12/13
Gongwen	Temp. & Humid. Chamber	HSD-500	109	2021/10/14	2022/10/13
Manson	DC Power Source	KPS-6604	ATCS-205	NCR	NCR
Fluke	Digital Multimeter	287	19000011	2022/02/21	2023/02/20
Unknown	RF Cable	Unknown	Unknown	Each time	

*** Statement of Traceability:** Shenzhen Accurate Technology Co., Ltd. attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §2.1093 – RF EXPOSURE

Applicable Standard

According to FCC §2.1093 and §1.1307(b) (1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

Measurement Result

Please refer to SAR test report: CR22040050-SA.

FCC §2.1046 & §80.215 - RF OUTPUT POWER

Applicable Standard

FCC §2.1046, §80.215

Ship station: 156-162MHz - 25W
Marine utility stationss and hand-held portable transmitters: 156-162 MHz - 10W
Reducible to 1 watt or less, except for transmitters limited to public correspondence channels and used in an automated system.

Test Procedure

Conducted RF Output Power:

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

Spectrum Analyzer Setting:

R B/W	Video B/W
100 kHz	300 kHz

Test Data

Environmental Conditions

Temperature:	27 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Nick Fang on 2022-06-16.

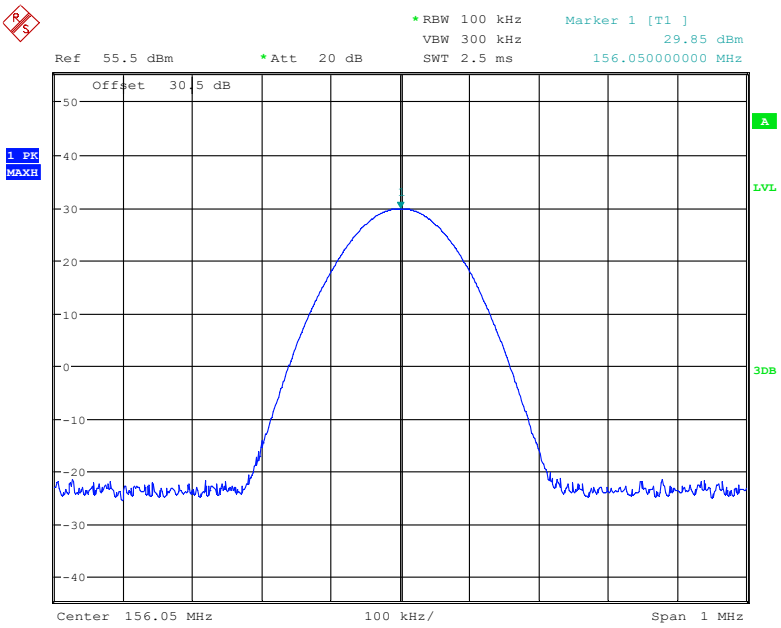
Test Mode: Transmitting

Test Result: Compliance. Please refer to following table.

Mode	Frequency Spacing (kHz)	Frequency (MHz)	Power level	Output Power(dBm)	Output Power(W)	Limit (W)
Analog	25	156.05	L	29.85	0.97	1
			H	36.84	4.83	10
		156.8	L	29.80	0.95	1
			H	36.84	4.83	10
		157.425	L	29.44	0.88	1
			H	36.83	4.82	10
		156.65	Low power only	29.87	0.97	1
		156.75	Low power only	29.86	0.97	1
		156.85	Low power only	29.82	0.96	1
		156.375	Low power only	29.80	0.95	1
		156.775	Low power only	29.82	0.96	1
		156.825	Low power only	29.79	0.95	1
		156.875	Low power only	29.77	0.95	1

Note: Maximum Rated Power is 5 Watts, Low Rated Power is 1 Watts

156.05 MHz, Low Power



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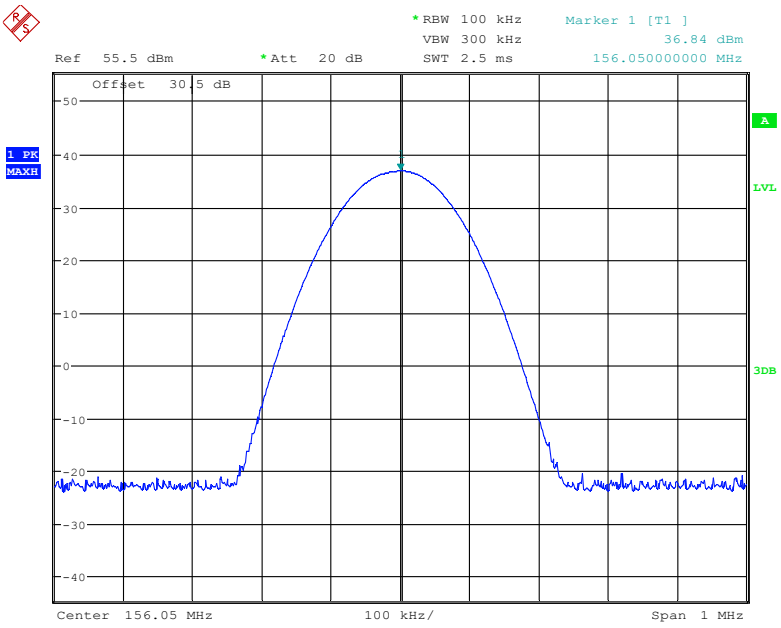
156.05 MHz, High Power



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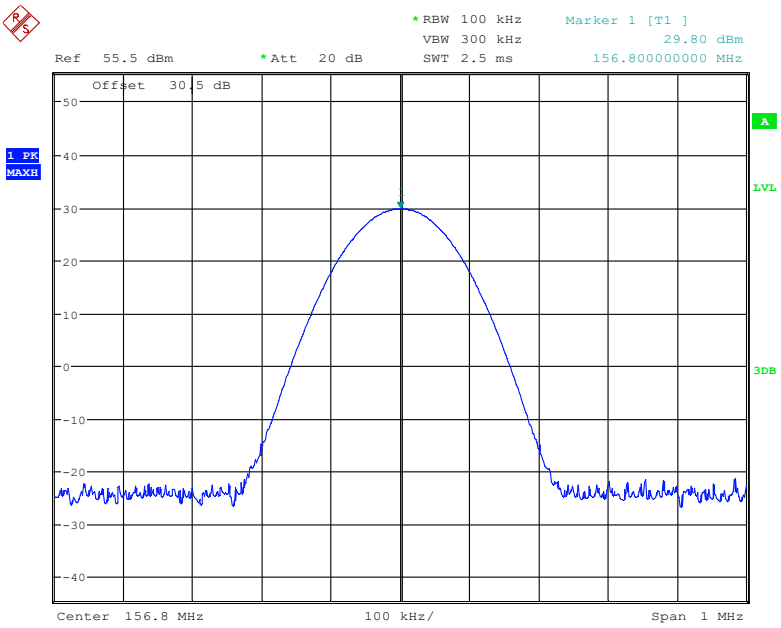
156.8 MHz, Low Power



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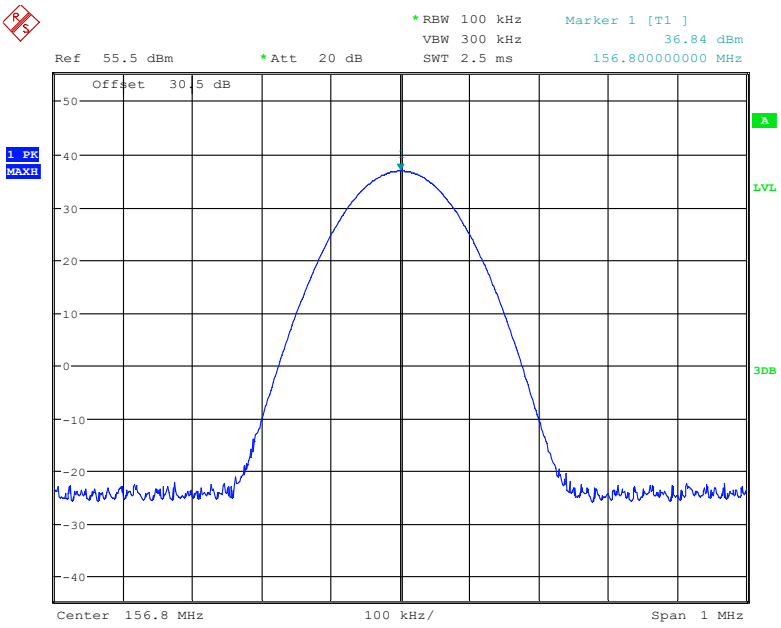
156.8 MHz, High Power



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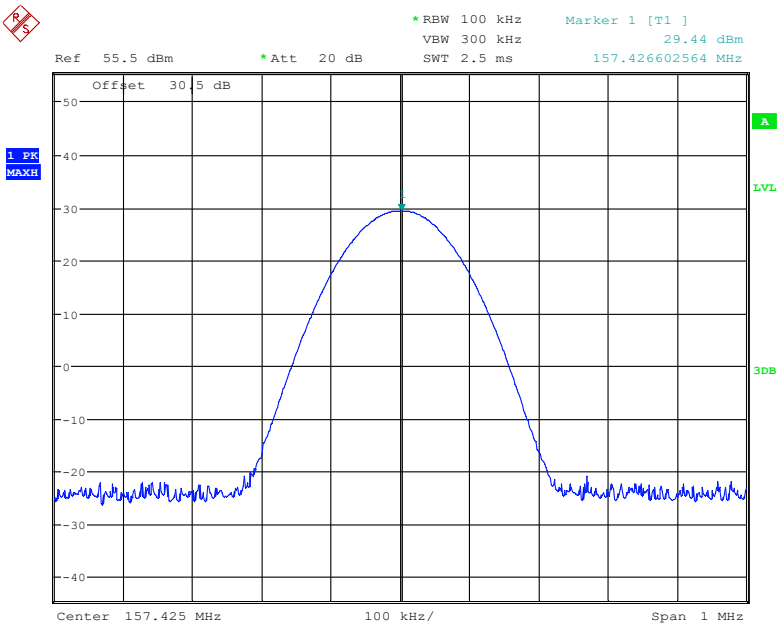
157.425 MHz, Low Power



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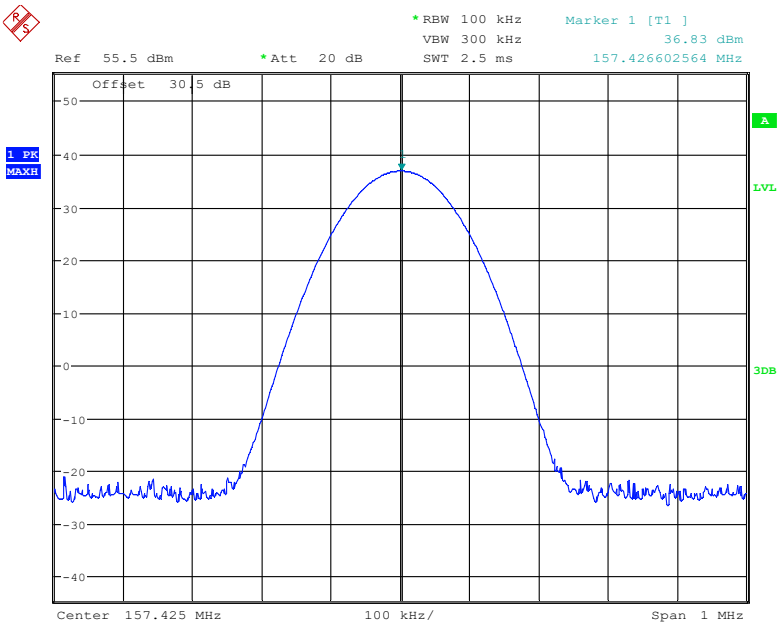
157.425 MHz, High Power



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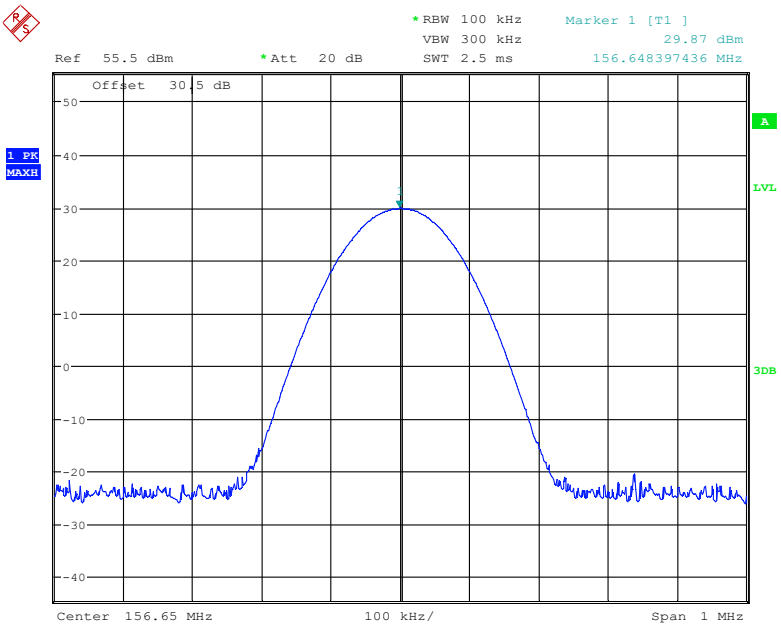
156.65 MHz, Low Power



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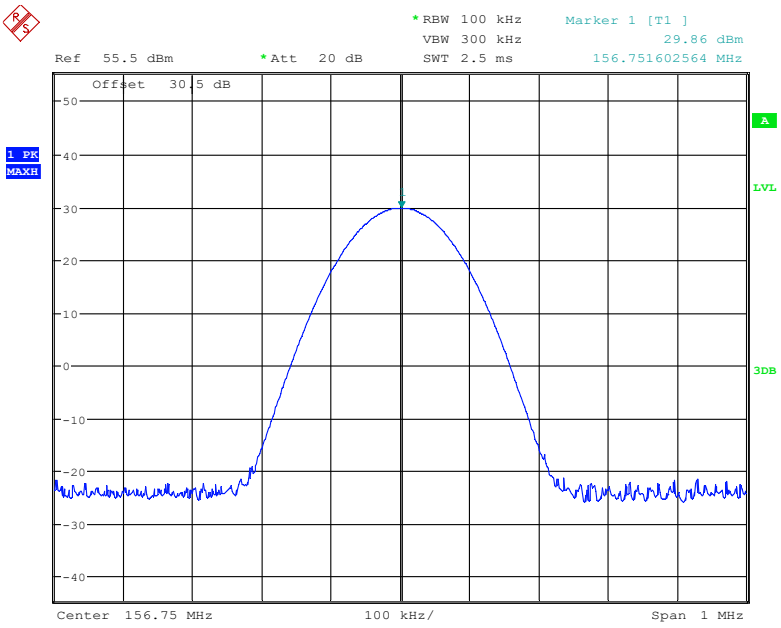
156.75 MHz, Low Power



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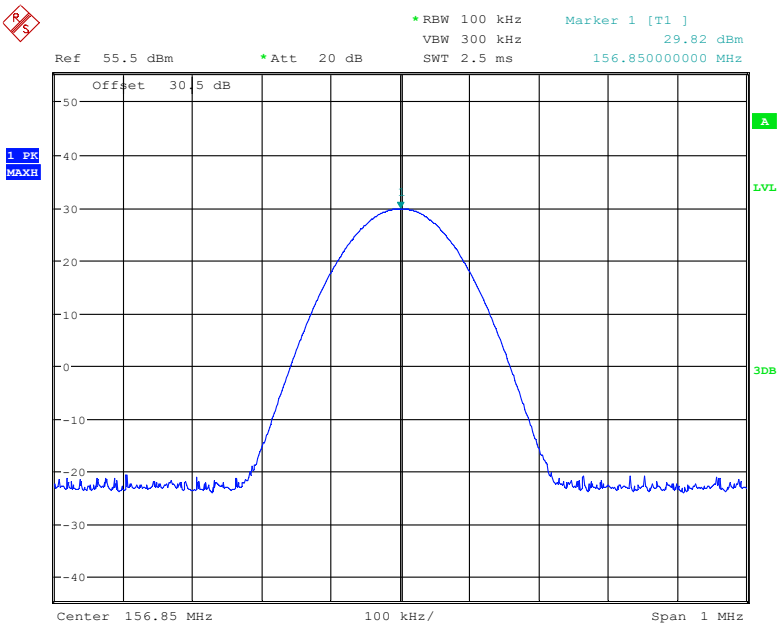
156.85 MHz, Low Power



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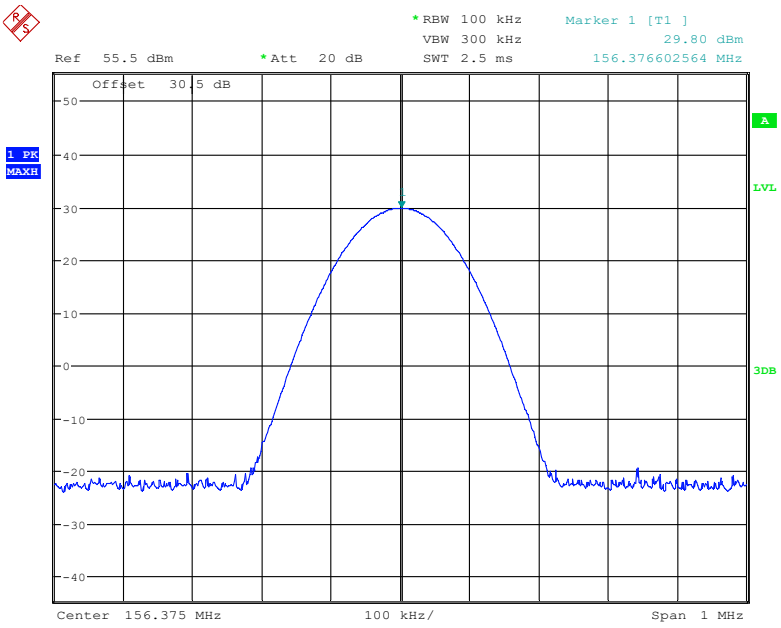
156.375 MHz, Low Power



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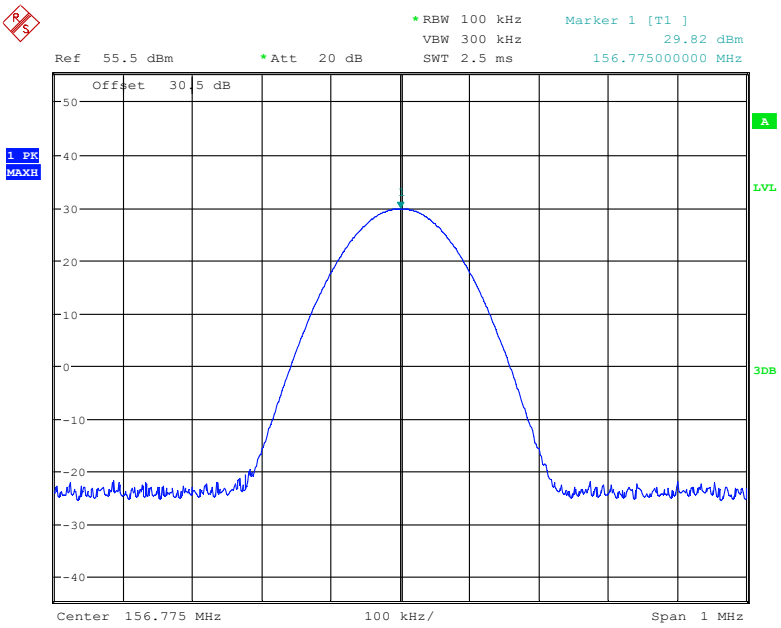
156.775 MHz, Low Power



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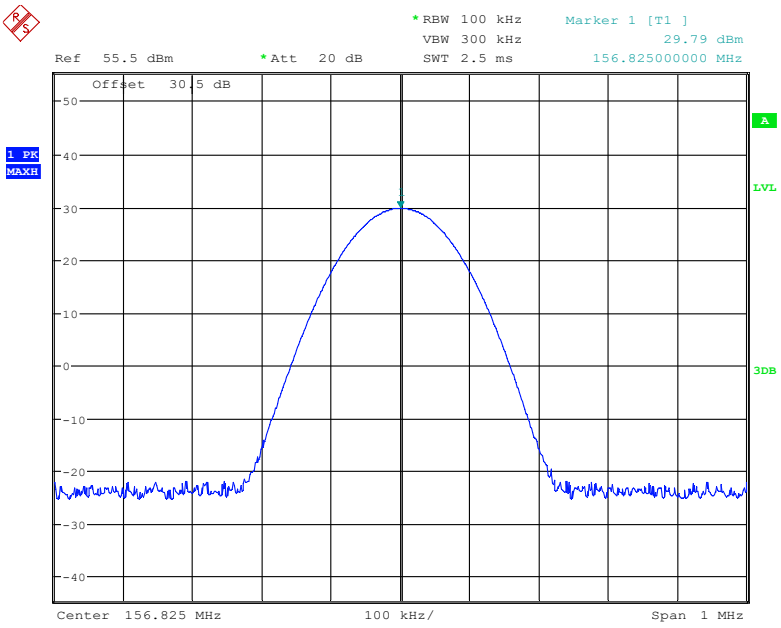
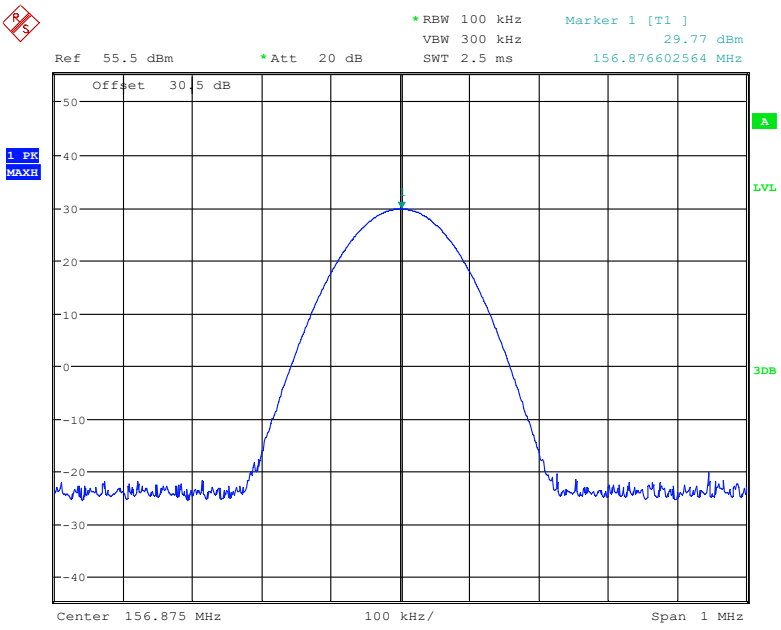
156.825 MHz, Low Power



Date: 16.JUN.2022 16:52:17

156.875 MHz, Low Power



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FCC §2.1047 §80.213 - MODULATION REQUIREMENTS

Applicable Standard

FCC §2.1047 and §80.213

Ship and coast station transmitters operating in the 156-162 MHz and 216-220 bands must be capable of proper operation with a frequency deviation that does not exceed ±5 kHz when using any emission authorized by § 80.207.

Test Procedure

Test Method: TIA/EIA-603E 2.2.3

Test Data

Environmental Conditions

Temperature:	27 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Nick Fang on 2022-06-16.

Test Mode: Transmitting

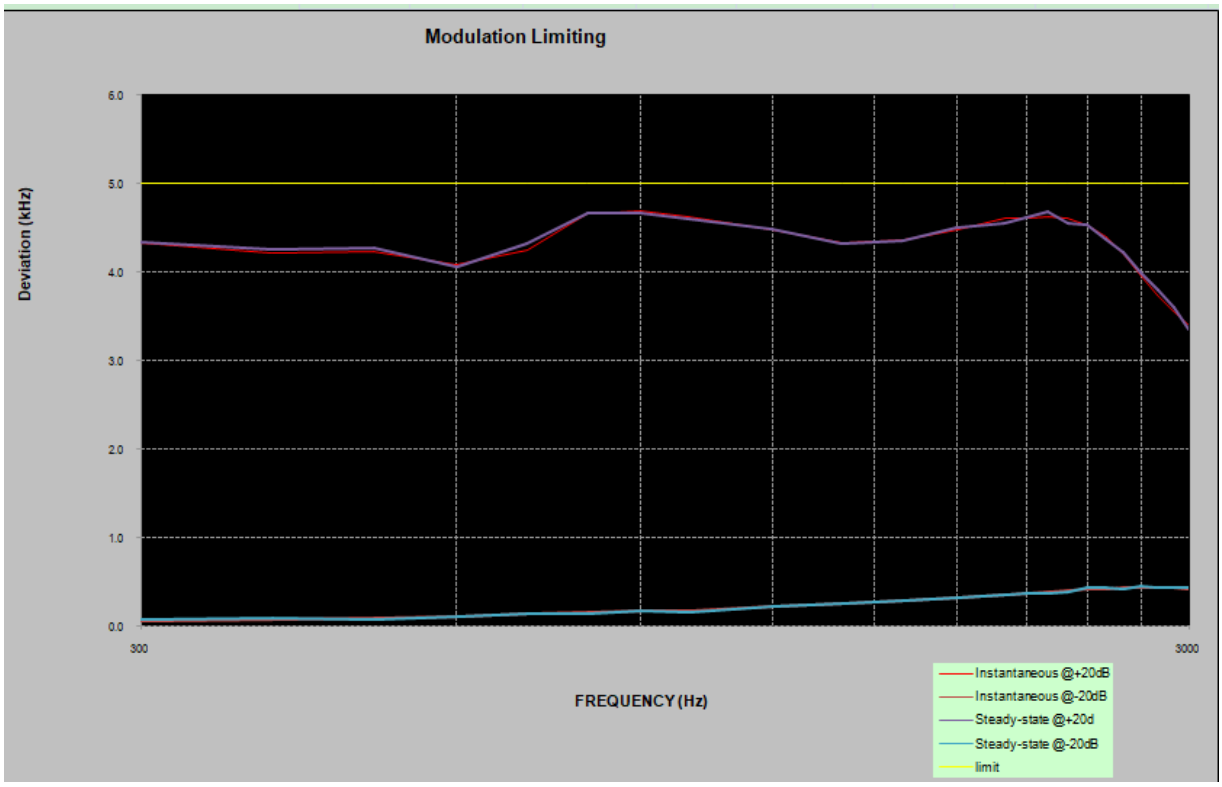
Result: Compliance.

Analog Modulation:

Maximum Deviation

Carrier Frequency: 156.8 MHz, high power

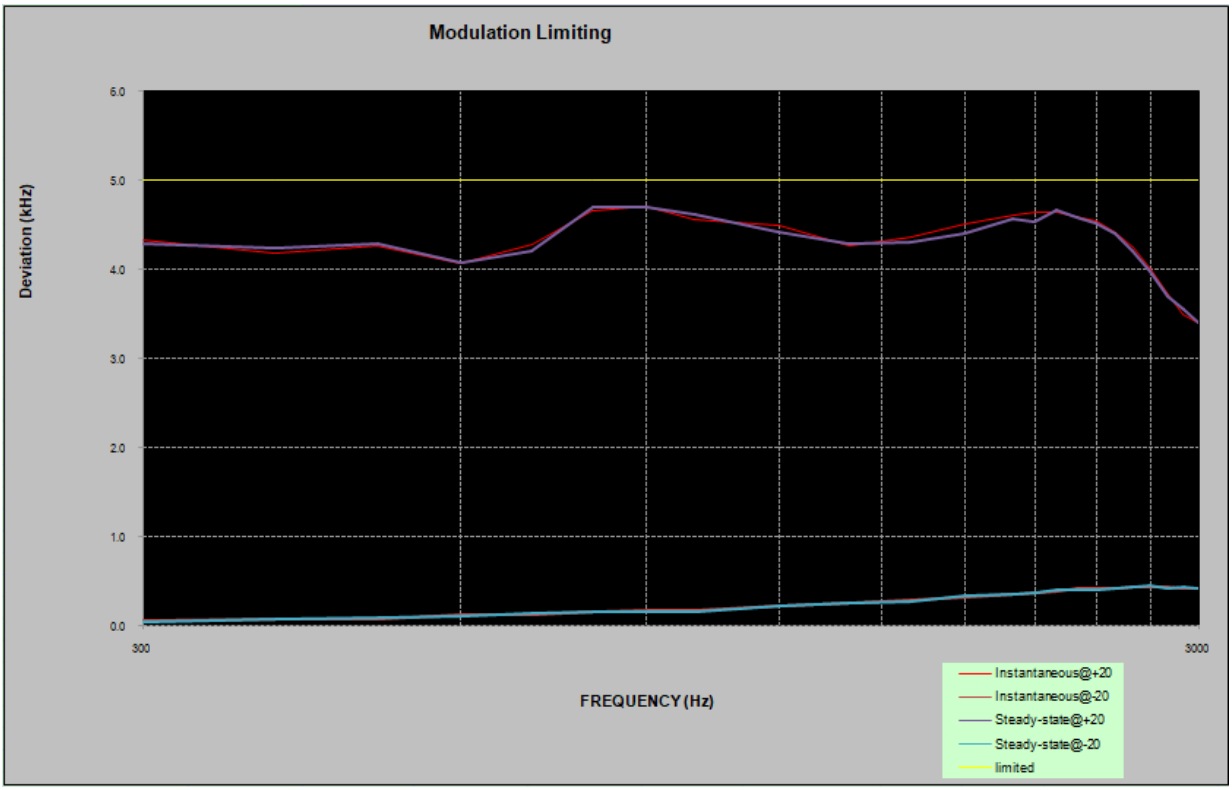
Audio Frequency (Hz)	Instantaneous		Steady-state		FCC Limit [kHz]
	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	
300	4.325	0.057	4.333	0.070	5.000
400	4.225	0.076	4.262	0.084	5.000
500	4.228	0.088	4.269	0.081	5.000
600	4.089	0.110	4.058	0.112	5.000
700	4.256	0.133	4.324	0.136	5.000
800	4.655	0.150	4.675	0.139	5.000
900	4.685	0.165	4.667	0.166	5.000
1000	4.631	0.175	4.610	0.162	5.000
1200	4.477	0.220	4.480	0.225	5.000
1400	4.333	0.251	4.316	0.248	5.000
1600	4.365	0.287	4.363	0.285	5.000
1800	4.477	0.321	4.497	0.322	5.000
2000	4.608	0.352	4.556	0.346	5.000
2100	4.610	0.372	4.617	0.369	5.000
2200	4.626	0.387	4.683	0.372	5.000
2300	4.612	0.401	4.551	0.393	5.000
2400	4.536	0.415	4.530	0.432	5.000
2500	4.395	0.421	4.366	0.427	5.000
2600	4.203	0.429	4.232	0.426	5.000
2700	3.957	0.435	3.996	0.448	5.000
2800	3.743	0.431	3.805	0.427	5.000
2900	3.557	0.429	3.597	0.429	5.000
3000	3.389	0.422	3.348	0.435	5.000


Modulation Limiting
Deviation (kHz)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
300
3000
FREQUENCY (Hz)
Instantaneous @+20dB
Instantaneous @-20dB
Steady-state @+20d
Steady-state @-20dB
limit

Maximum Deviation

Carrier Frequency: 156.875 MHz, low power only

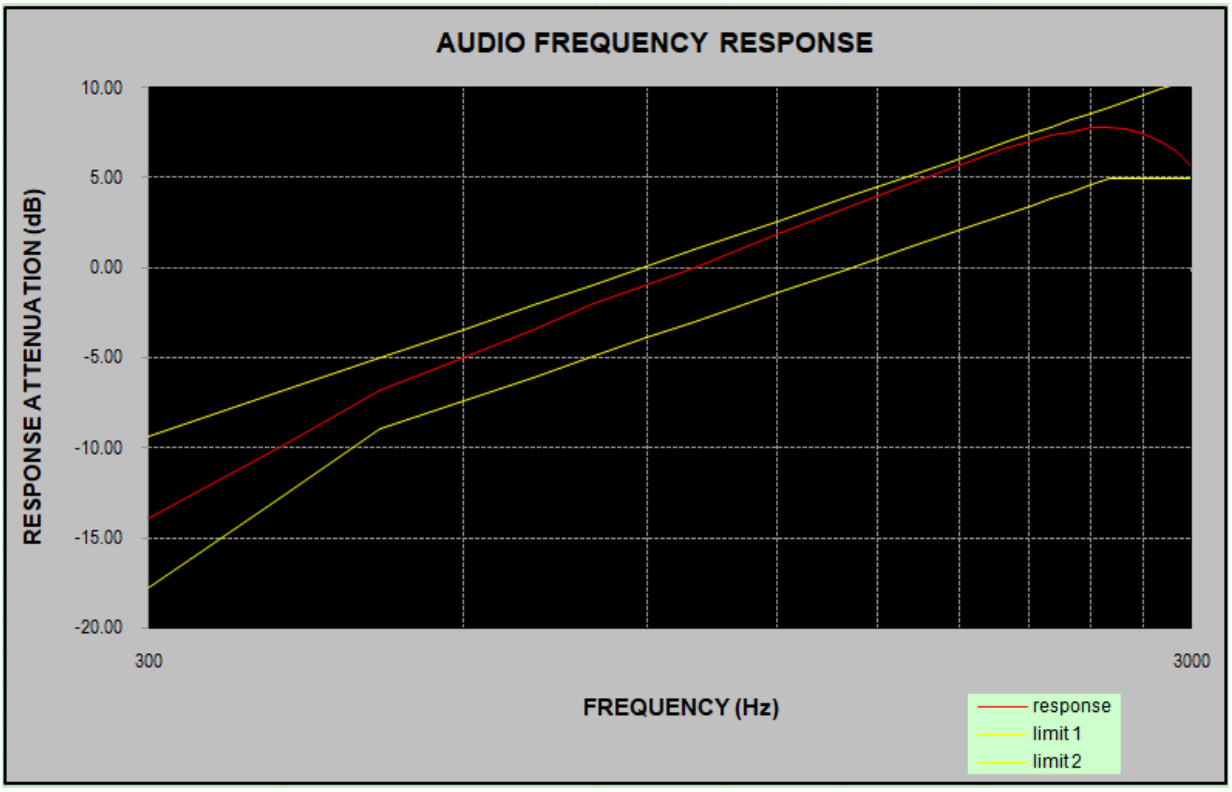
Audio Frequency (Hz)	Instantaneous		Steady-state		FCC Limit [kHz]
	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	
300	4.340	0.060	4.285	0.048	5.000
400	4.191	0.066	4.241	0.069	5.000
500	4.261	0.079	4.286	0.098	5.000
600	4.062	0.117	4.072	0.106	5.000
700	4.283	0.122	4.211	0.144	5.000
800	4.667	0.162	4.695	0.160	5.000
900	4.715	0.167	4.706	0.158	5.000
1000	4.566	0.168	4.617	0.159	5.000
1200	4.502	0.228	4.423	0.213	5.000
1400	4.273	0.250	4.283	0.248	5.000
1600	4.370	0.293	4.304	0.277	5.000
1800	4.517	0.313	4.414	0.334	5.000
2000	4.616	0.355	4.572	0.351	5.000
2100	4.645	0.373	4.544	0.365	5.000
2200	4.646	0.385	4.667	0.398	5.000
2300	4.596	0.415	4.590	0.401	5.000
2400	4.548	0.425	4.522	0.401	5.000
2500	4.409	0.422	4.399	0.419	5.000
2600	4.250	0.427	4.213	0.428	5.000
2700	4.008	0.442	3.974	0.444	5.000
2800	3.744	0.428	3.708	0.413	5.000
2900	3.499	0.424	3.560	0.438	5.000
3000	3.395	0.411	3.410	0.420	5.000


Modulation Limiting
Deviation (kHz)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
300
3000
FREQUENCY (Hz)
Instantaneous@+20
Instantaneous@-20
Steady-state@+20
Steady-state@-20
limited

Audio Frequency Response

Carrier Frequency: 156.8 MHz, high power

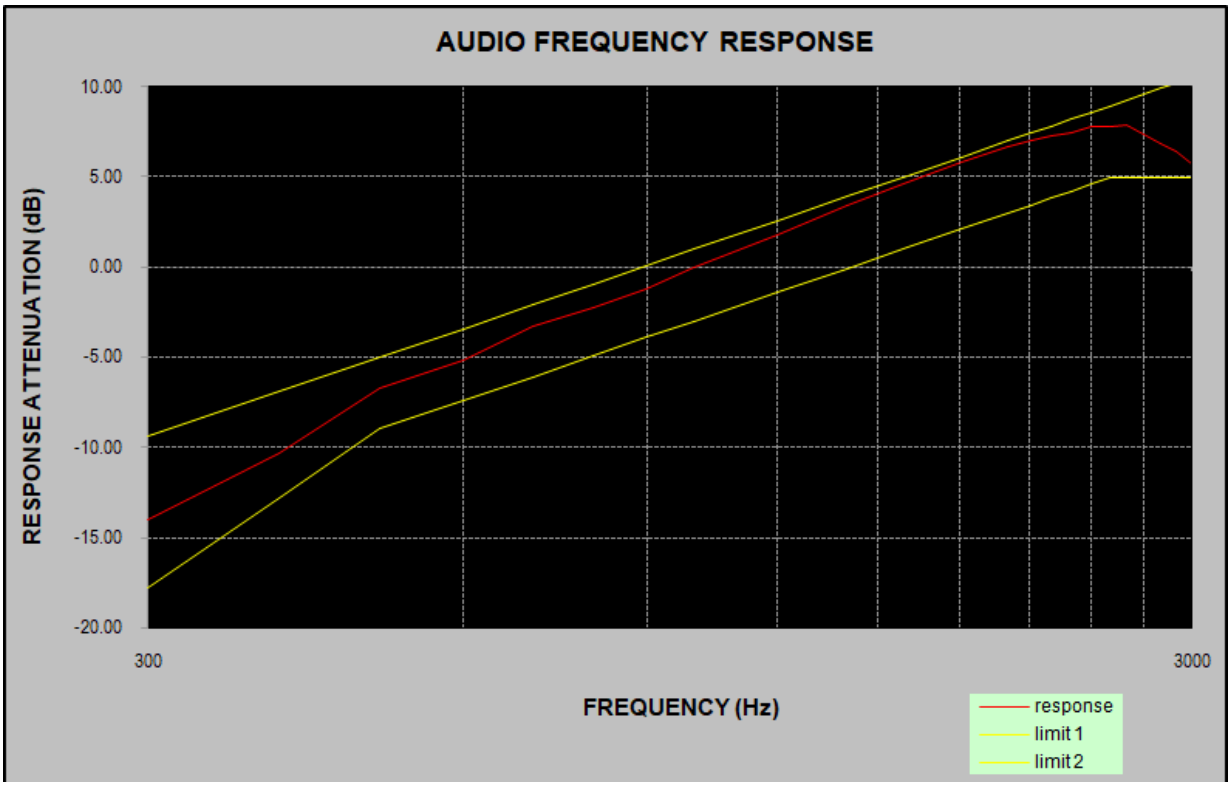
Audio Frequency (Hz)	Response Attenuation (dB)
300	-13.98
400	-10.01
500	-6.78
600	-5.04
700	-3.48
800	-1.98
900	-0.99
1000	0.00
1200	1.90
1400	3.31
1600	4.64
1800	5.73
2000	6.69
2100	7.02
2200	7.35
2300	7.52
2400	7.75
2500	7.80
2600	7.69
2700	7.42
2800	7.03
2900	6.48
3000	5.67


AUDIO FREQUENCY RESPONSE
RESPONSE ATTENUATION (dB)
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00
300
3000
FREQUENCY (Hz)
response
limit 1
limit 2

Audio Frequency Response

Carrier Frequency: 156.875 MHz, low power only

Audio Frequency (Hz)	Response Attenuation (dB)
300	-14.07
400	-10.34
500	-6.71
600	-5.19
700	-3.30
800	-2.27
900	-1.25
1000	0.00
1200	1.76
1400	3.42
1600	4.73
1800	5.80
2000	6.66
2100	7.05
2200	7.26
2300	7.41
2400	7.83
2500	7.80
2600	7.84
2700	7.35
2800	6.87
2900	6.39
3000	5.71


AUDIO FREQUENCY RESPONSE
RESPONSE ATTENUATION (dB)
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00
300
3000
FREQUENCY (Hz)
response
limit 1
limit 2

FCC §2.1049 & §80.205 –BANDWIDTH

Applicable Standard

FCC §2.1049 and §80.205

(a) An emission designator shows the necessary bandwidth for each class of emission of a station except that in ship earth stations it shows the occupied or necessary bandwidth, whichever is greater. The class of emission and corresponding emission designator and authorized bandwidth can refer to §80.205

Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 300 Hz and the spectrum was recorded in the frequency band ±30 kHz from the carrier frequency.

Test Data

Environmental Conditions

Temperature:	27 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Nick Fang on 2022-06-16.

Test Mode: Transmitting

Modulation	Channel Separation (kHz)	Frequency (MHz)	Power Level	99% Occupied Bandwidth (kHz)	26 dB Emissions Bandwidth (kHz)
Analog	25	156.05	L	14.904	15.673
	25		H	15.00.	15.769

Modulation	Channel Separation (kHz)	Frequency (MHz)	Power Level	99% Occupied Bandwidth (kHz)	26 dB Emissions Bandwidth (kHz)
Analog	25	156.8	L	14.904	15.673
	25		H	15.000	15.769

Modulation	Channel Separation (kHz)	Frequency (MHz)	Power Level	99% Occupied Bandwidth (kHz)	26 dB Emissions Bandwidth (kHz)
Analog	25	157.425	L	15.000	15.769
	25		H	14.904	15.769

Low power only：

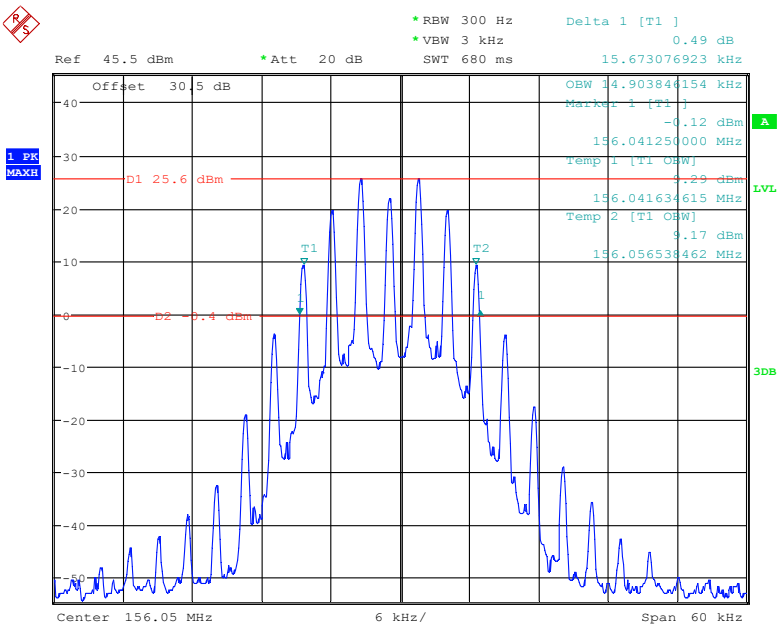
Modulation	Channel Separation (kHz)	Frequency (MHz)	99% Occupied Bandwidth (kHz)	26 dB Emissions Bandwidth (kHz)
Analog	25	156.85	15.000	15.673
	25	156.875	15.000	15.769

Note: Emission designator is base on calculation instead of measurement.

Emission Designator Per CFR 47 §2.201& §2.202&, Bn = 2M + 2D

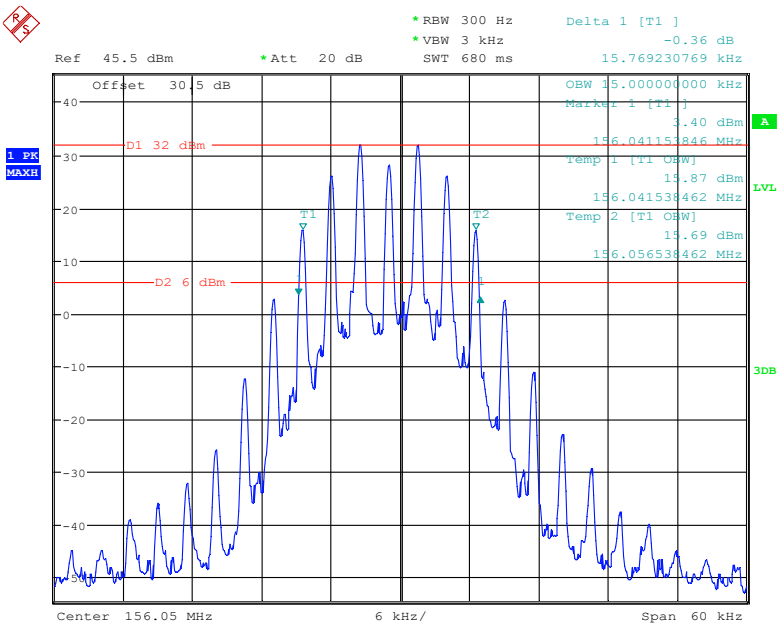
For FM Mode (Channel Spacing: 25 kHz)
Emission Designator 16K0G3E. In this case, the maximum modulating frequency is 3.0 kHz with a 5 kHz deviation. BW = 2(M+D) = 2(3.0 kHz + 5 kHz) = 16 kHz → 16K0*
G3E portion of the designator represents an voice transmission
Therefore, the entire designator for 25 kHz channel spacing FM mode is 16K0G3E.

99% Occupied Bandwidth & 26 dB Emissions Bandwidth (156.05 MHz, Low Power)



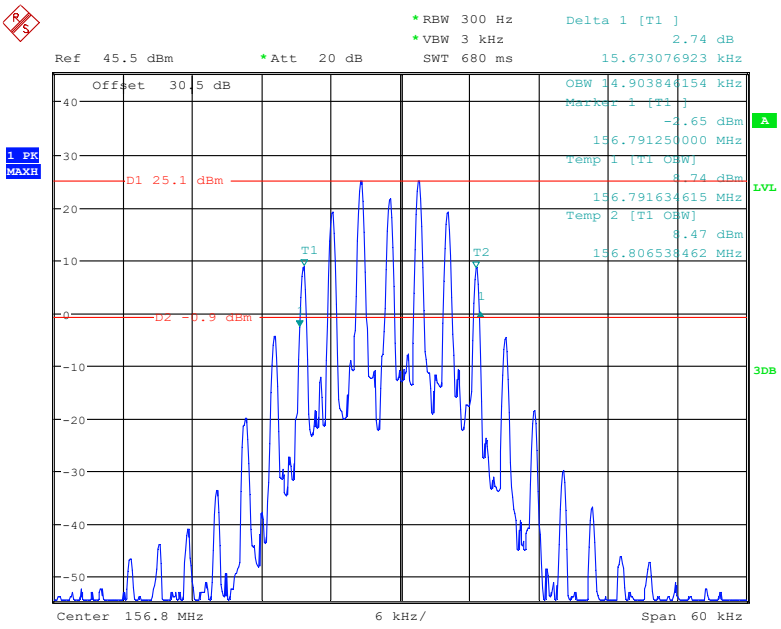
Date: 16.JUN.2022 17:20:49

99% Occupied Bandwidth & 26 dB Emissions Bandwidth (156.05 MHz, High Power)



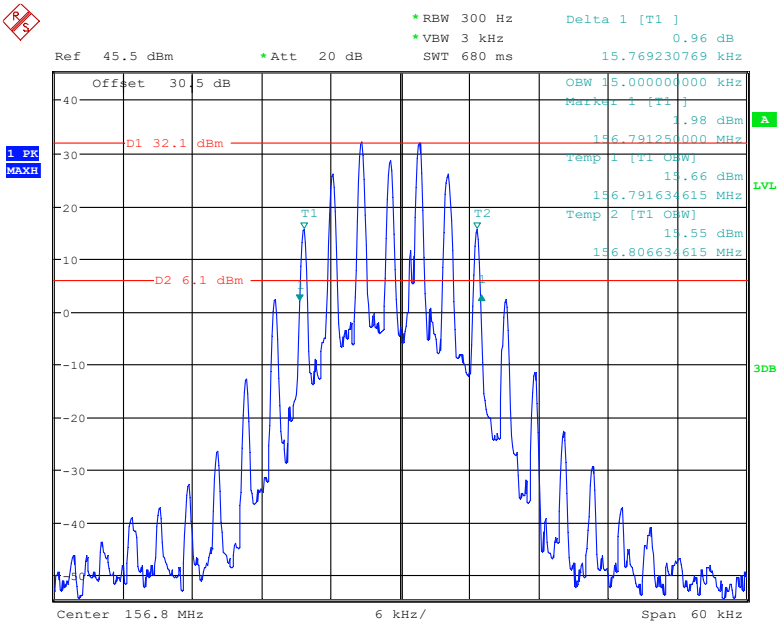
Date: 16.JUN.2022 17:22:42

99% Occupied Bandwidth & 26 dB Emissions Bandwidth (156.8 MHz, Low Power)



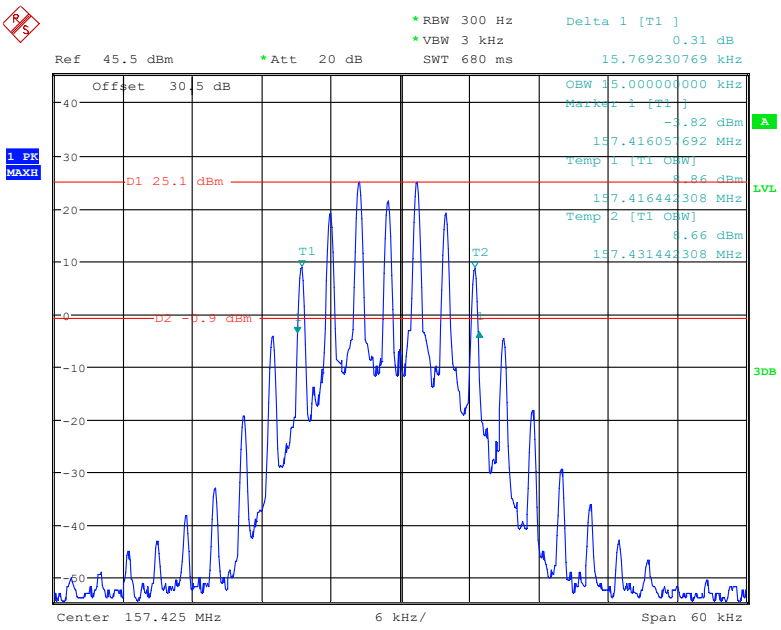
Date: 16.JUN.2022 17:18:24

99% Occupied Bandwidth & 26 dB Emissions Bandwidth (156.8 MHz, High Power)



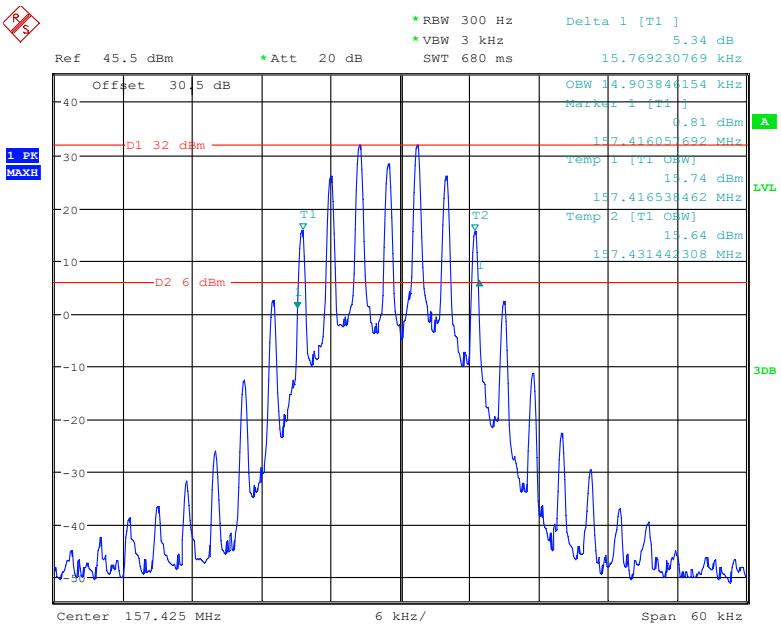
Date: 16.JUN.2022 17:16:18

99% Occupied Bandwidth & 26 dB Emissions Bandwidth (157.425 MHz, Low Power)



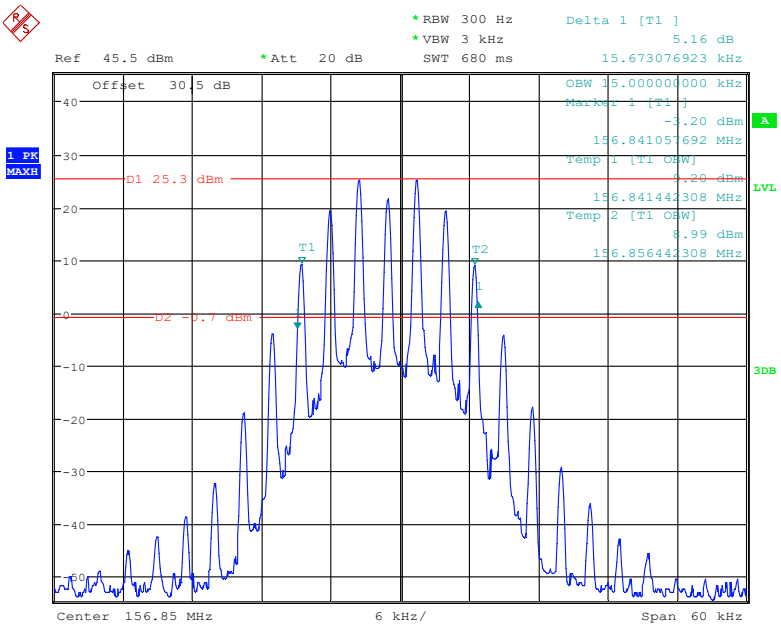
Date: 16.JUN.2022 17:24:58

99% Occupied Bandwidth & 26 dB Emissions Bandwidth (157.425 MHz, High Power)



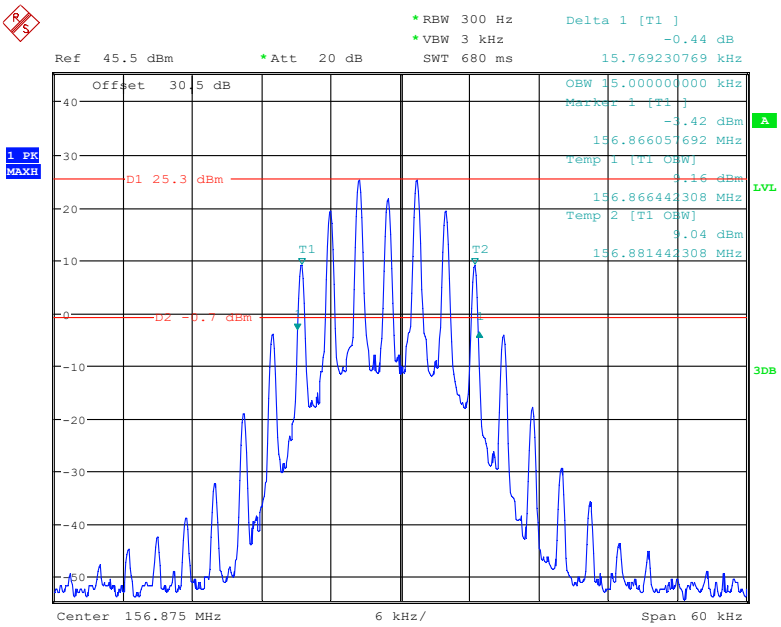
Date: 16.JUN.2022 17:24:01

99% Occupied Bandwidth & 26 dB Emissions Bandwidth (157.85 MHz, Low Power)



Date: 16.JUN.2022 17:29:00

99% Occupied Bandwidth & 26 dB Emissions Bandwidth (157.875 MHz, Low Power)



Date: 16.JUN.2022 17:27:17

§2.1051 & §80.211 (f) - EMISSION LIMITATIONS

Applicable Standard

According to FCC§80.211 (f):

(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 Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz for below 1GHz, and 1MHz for above 1GHz. sufficient scans were taken to show any out of band emissions up to 10^{th} harmonic.

Test Data

Environmental Conditions

Temperature:	27 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

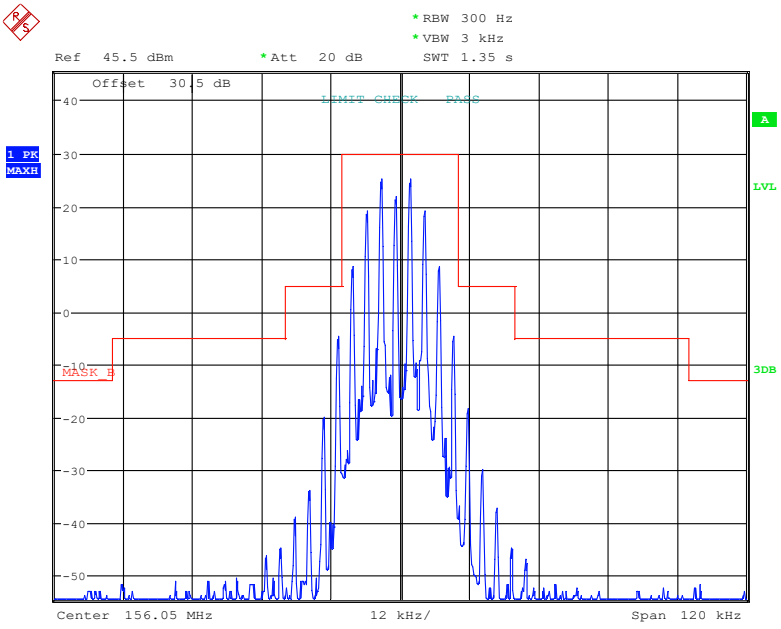
The testing was performed by Nick Fang on 2022-06-16.

Test Mode: Transmitting

Please refer to the following plots.

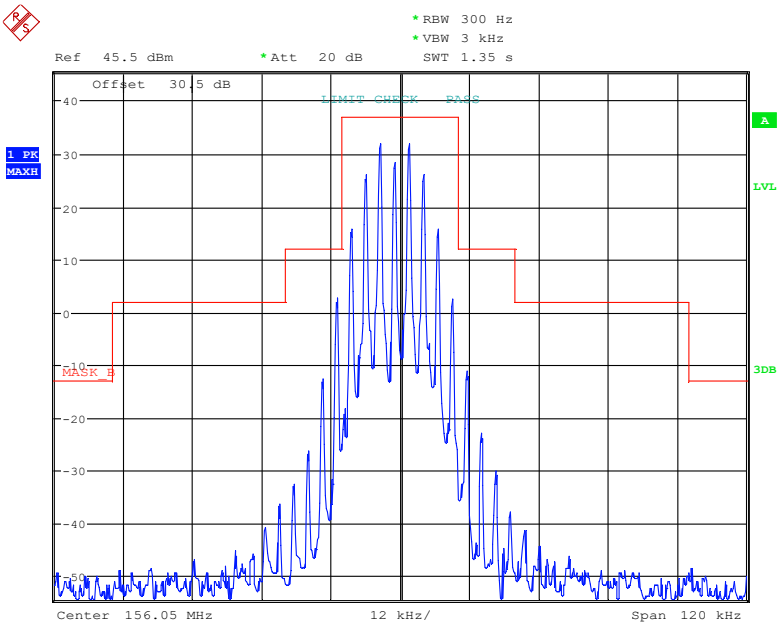
Radio Telephony (156.05 MHz):

Emission Mask, High Power



Date: 16.JUN.2022 17:54:45

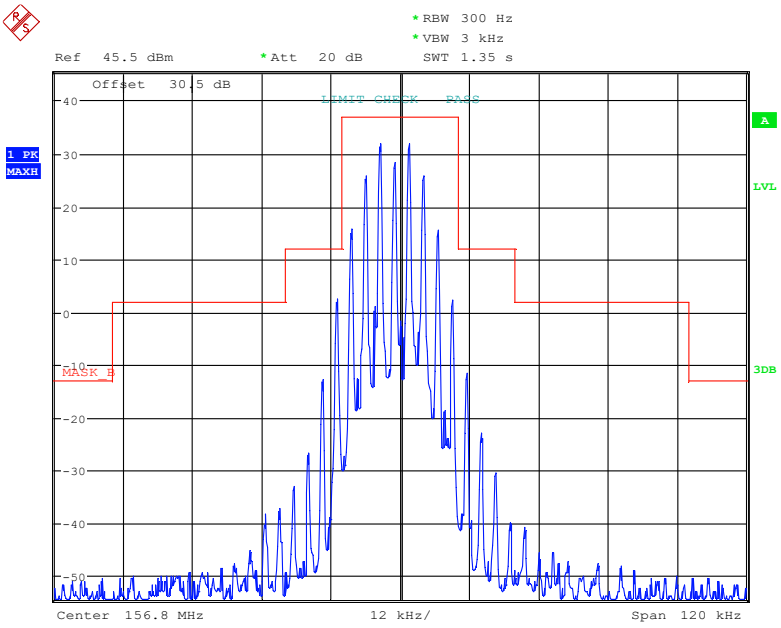
Emission Mask, Low Power



Date: 16.JUN.2022 17:37:53

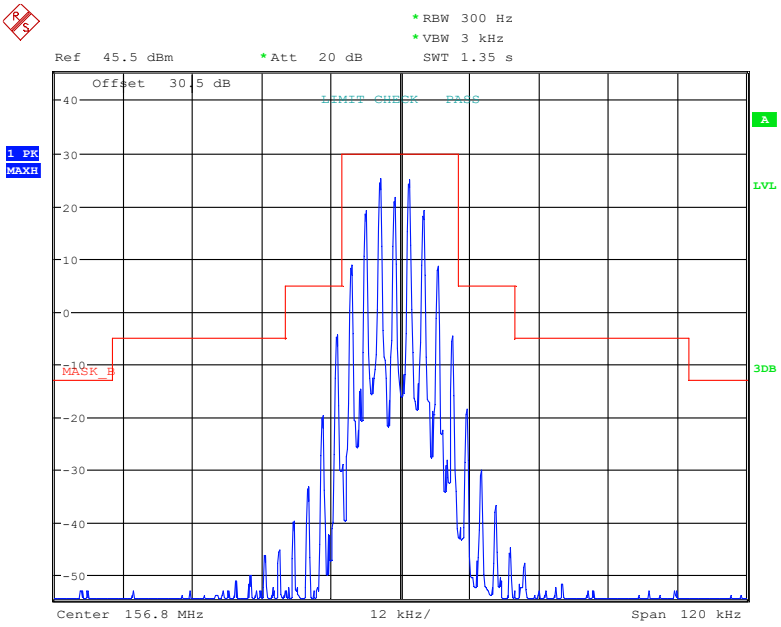
Radio Telephony (156.8 MHz):

Emission Mask, High Power



Date: 16.JUN.2022 17:36:52

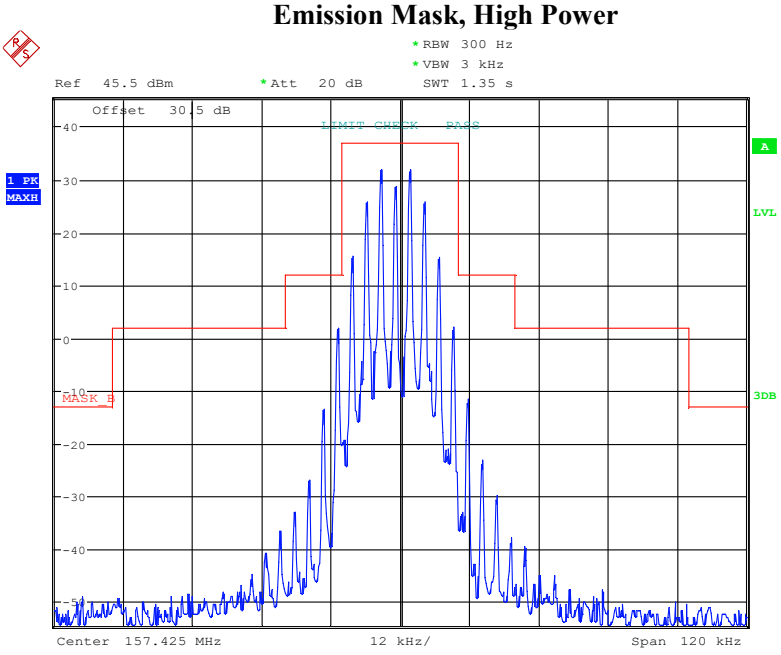
Emission Mask, Low Power



Date: 16.JUN.2022 17:35:58

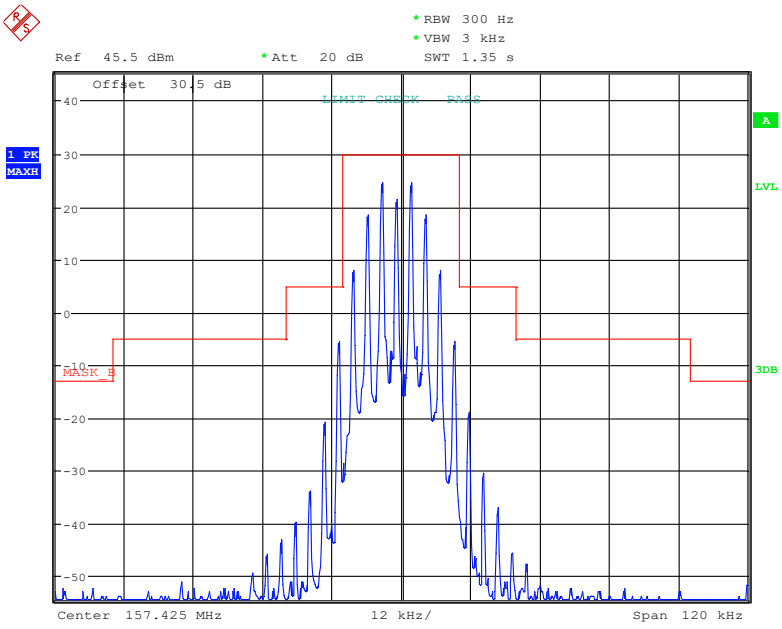
Radio Telephony (157.425 MHz):

Emission Mask, High Power



Date: 16.JUN.2022 17:57:58

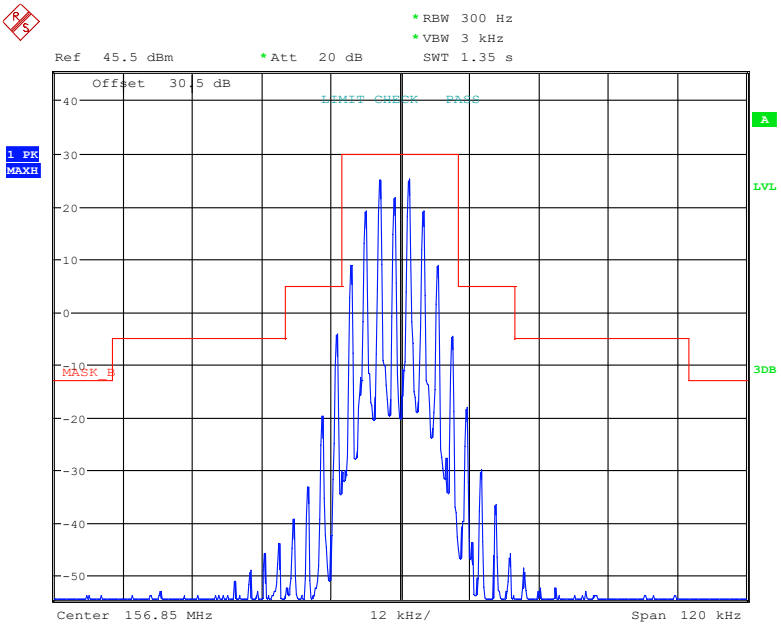
Emission Mask, Low Power



Date: 16.JUN.2022 17:57:05

Radio Telephony (156.85 MHz):

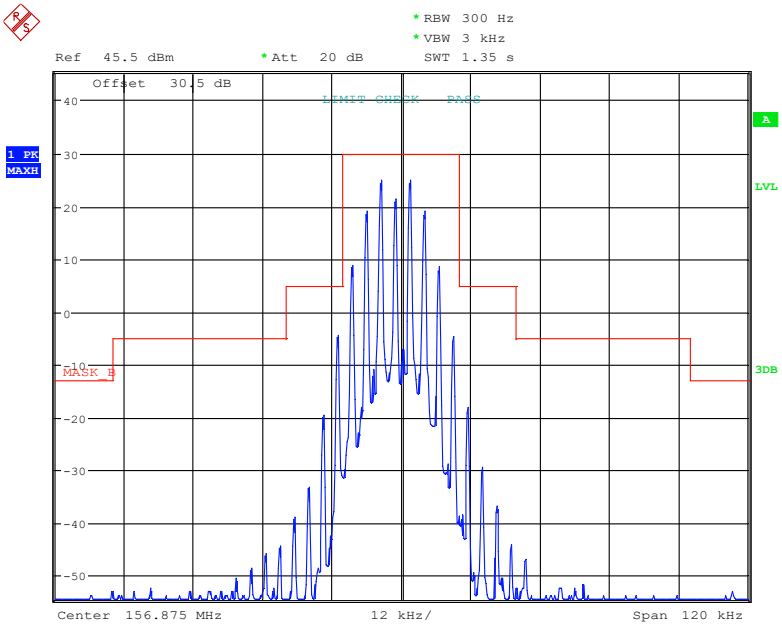
Emission Mask, Low Power



Date: 16.JUN.2022 17:31:27

Radio Telephony (156.875 MHz):

Emission Mask, Low Power



Date: 16.JUN.2022 17:35:05

FCC§80.217 - SUPPRESSION OF INTERFERENCE ABOARD SHIPS

Applicable Standard

FCC §80.217

(a) A voluntarily equipped ship station receiver must not cause harmful interference to any receiver required by statute or treaty.
(b) The electromagnetic field from receivers required by statute or treaty must not exceed the following value at a distance over sea water of one nautical mile from the receiver or Deliver not more than the following amounts of power, to an artificial antenna having electrical characteristics equivalent to those of the average receiving antenna(s) use on shipboard:

Frequency of interfering emissions	Power to artificial antenna in microwatts	Power to artificial antenna in dBm
Below 30 MHz	400	-3.98
30 to 100 MHz	4000	6.02
100 to 300 MHz	40000	16.02
Over 300 MHz	400000	26.02

Test Procedure

The EUT was connected to a spectrum analyser via a 30 dB attenuator. The spectrum was measured between 9 kHz to 2 GHz. The traces were recorded as shown on the following pages.

Test Data

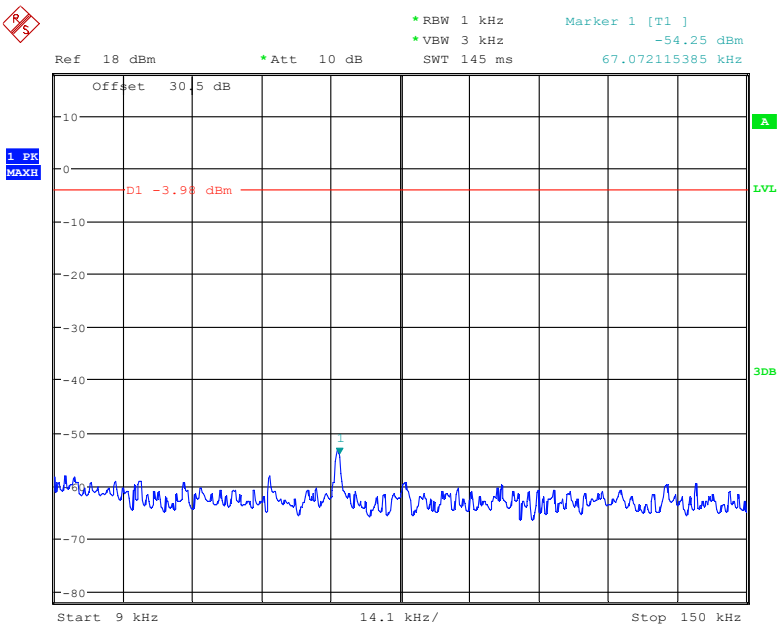
Environmental Conditions

Temperature:	27 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Nick Fang on 2022-06-16.

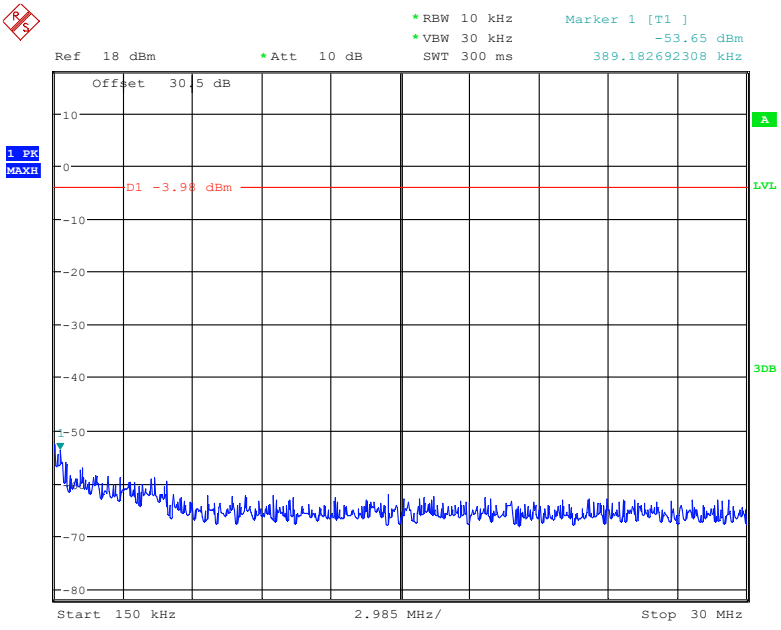
Test Mode: Transmitting

9 kHz – 150kHz, 156.8 MHz



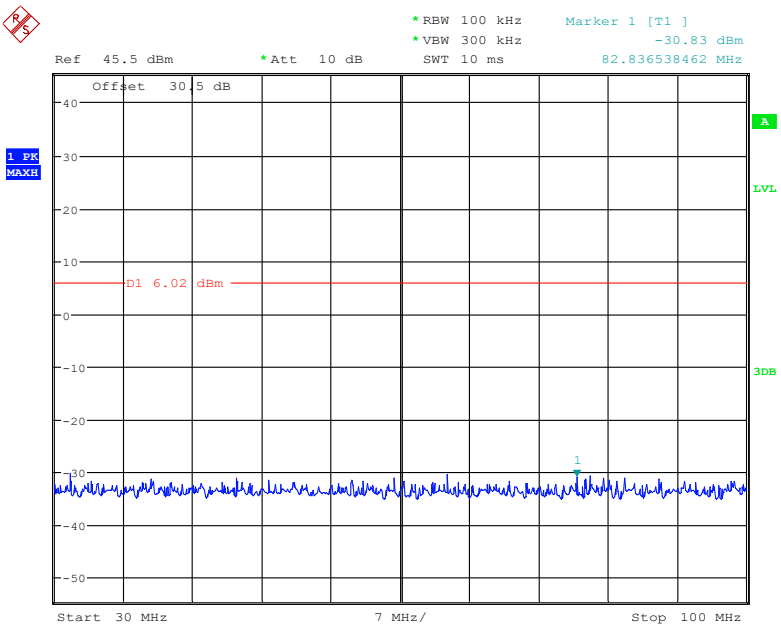
Date: 16.JUN.2022 19:08:29

150kHz – 30MHz, 156.8 MHz



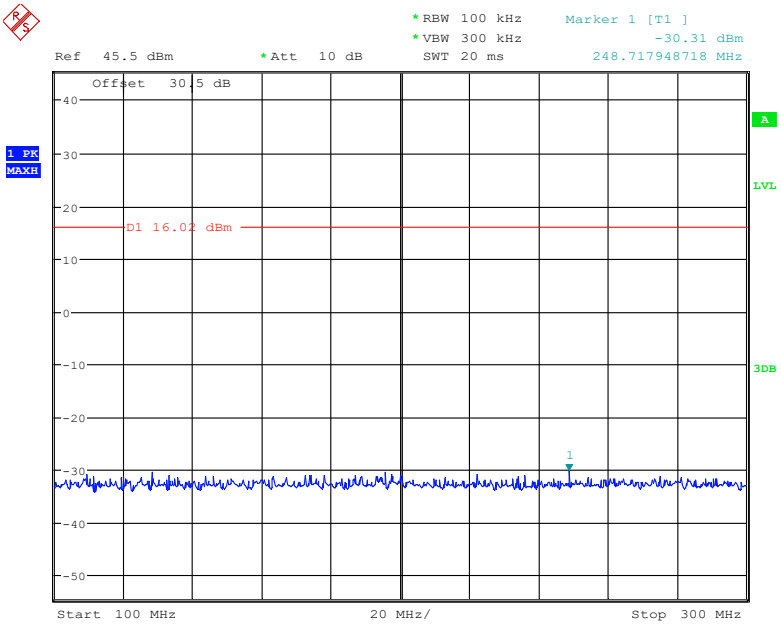
Date: 16.JUN.2022 19:08:49

30MHz – 100MHz, 156.8 MHz



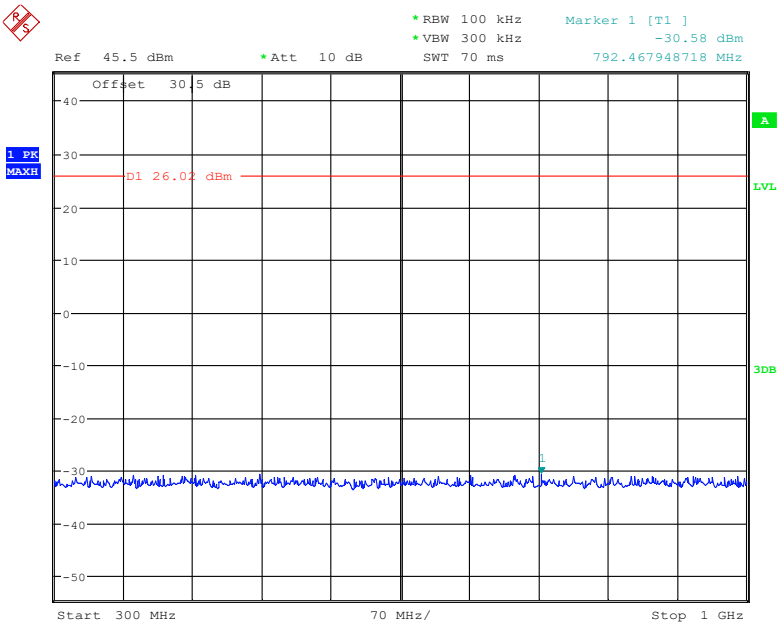
Date: 16.JUN.2022 19:09:40

100MGHz – 300MHz, 156.8 MHz



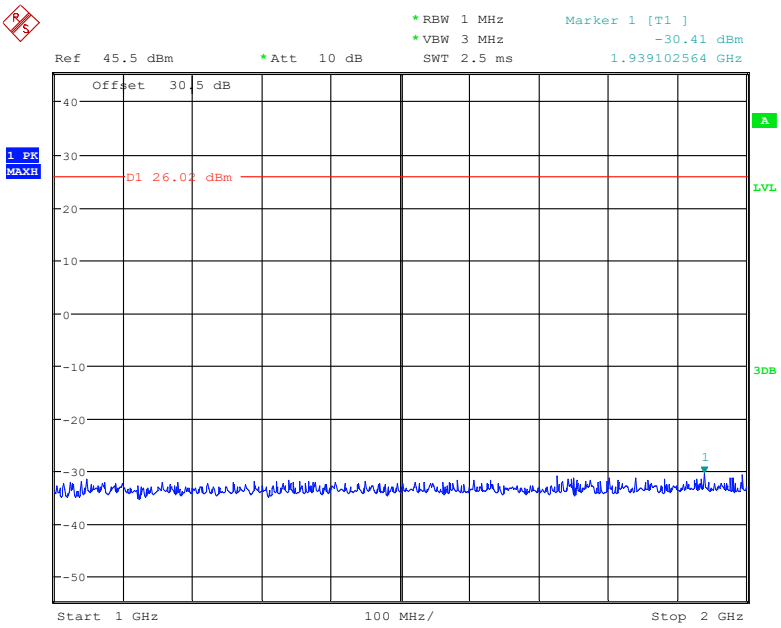
Date: 16.JUN.2022 19:10:09

300MHz – 1GHz, 156.8 MHz



Date: 16.JUN.2022 19:10:55

1 GHz – 2 GHz, 156.8 MHz



Date: 16.JUN.2022 19:11:30

FCC § 80.211 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Applicable Standard

Emission Mask D—12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

1) For any frequency removed from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0, 0 dB.

2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.626 kHz but no more than 12.5 kHz, at least 7.27 (f_d –2.88 kHz) dB.

3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

Emission Mask B. For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

(1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.

(2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.

(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

Test Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100kHz for below 1GHz, and 1MHz for above 1GHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

Test Data

Environmental Conditions

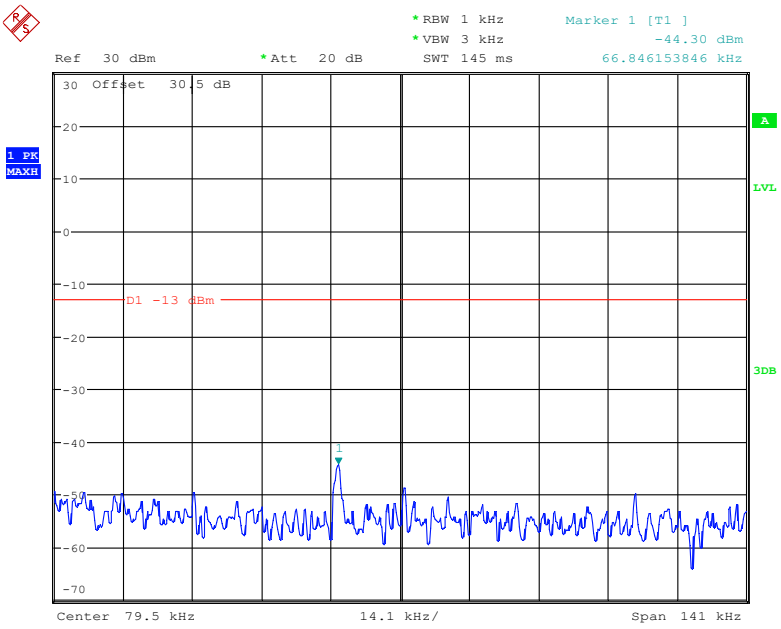
Temperature:	27 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Nick Fang on 2022-06-16.

Test Mode: Transmitting, worst case for High power level, please refer to the following plots.

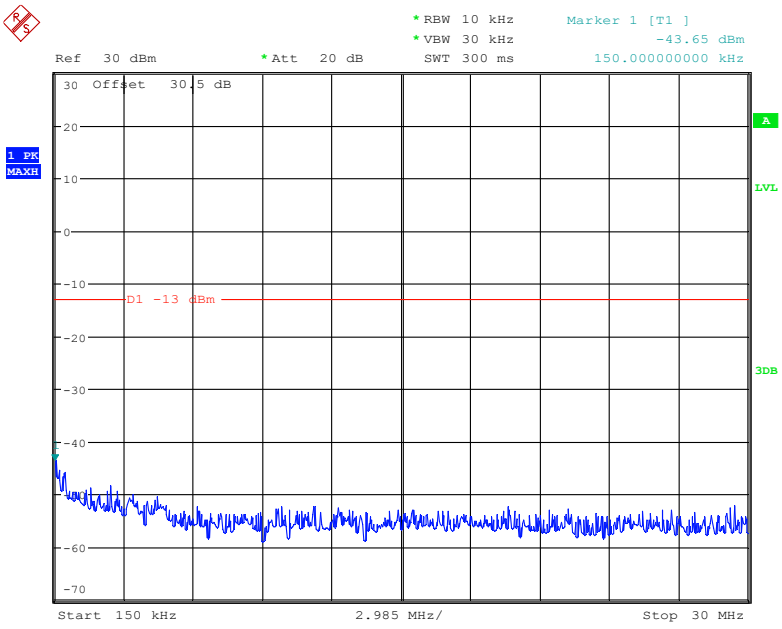
156.05 MHz

9KHz – 150MHz



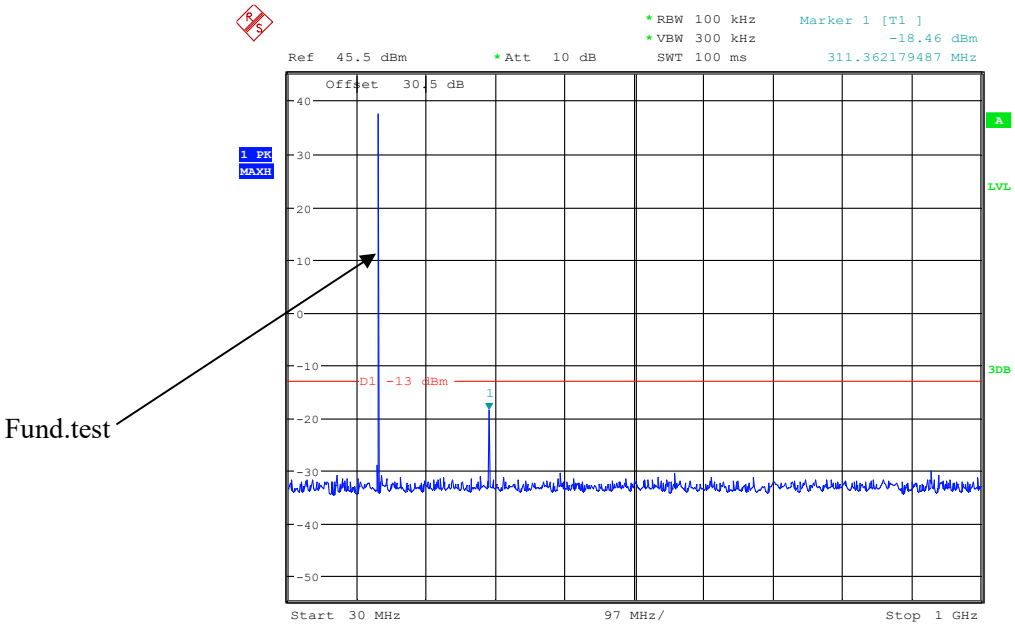
Date: 16.JUN.2022 18:45:08

150KHz – 30MHz



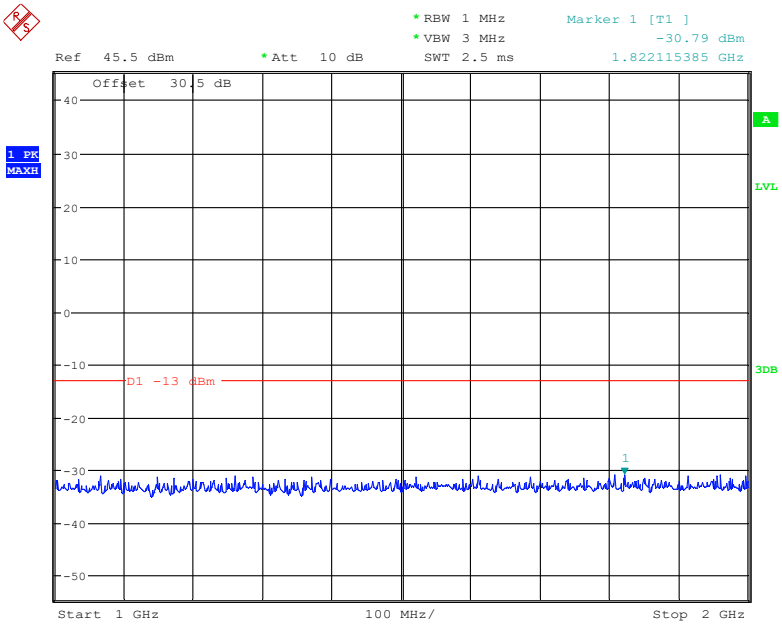
Date: 16.JUN.2022 18:47:20

30MHz – 1 GHz



Date: 16.JUN.2022 18:49:46

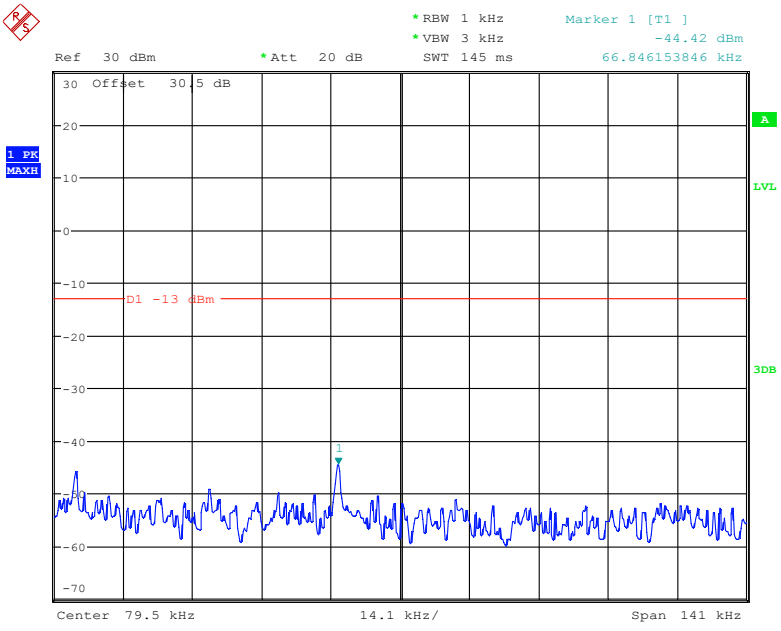
1 GHz – 2 GHz



Date: 16.JUN.2022 19:00:17

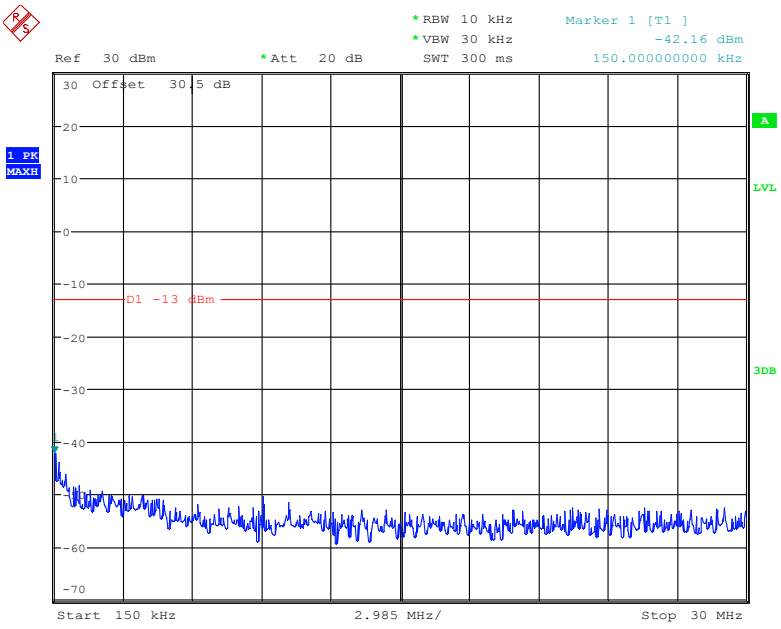
156.8 MHz

9KHz – 150MHz



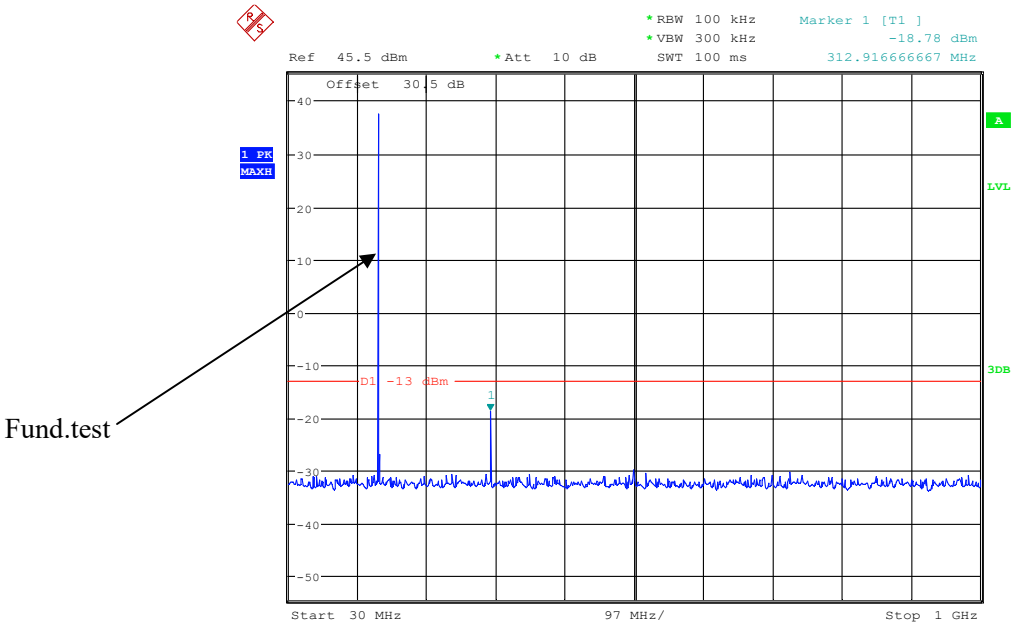
Date: 16.JUN.2022 18:44:53

150KHz – 30MHz



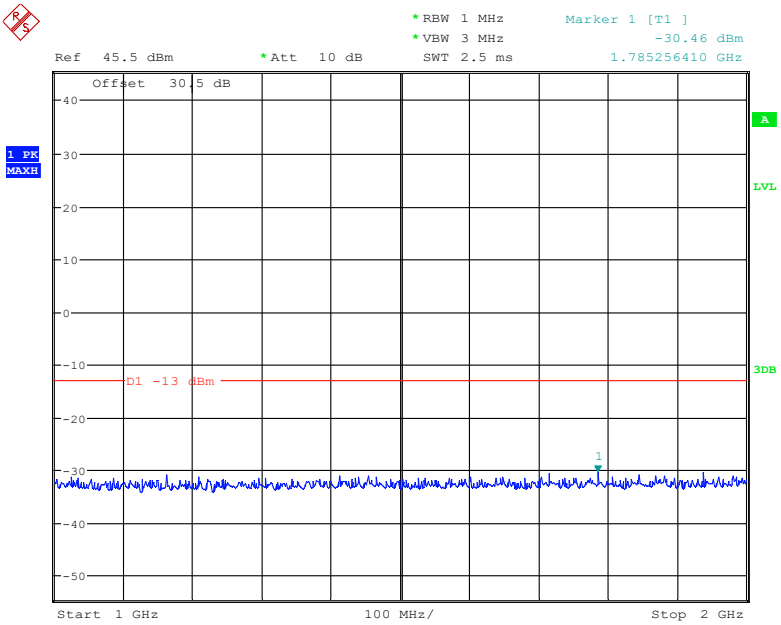
Date: 16.JUN.2022 18:47:10

30MHz – 1 GHz



Date: 16.JUN.2022 18:59:06

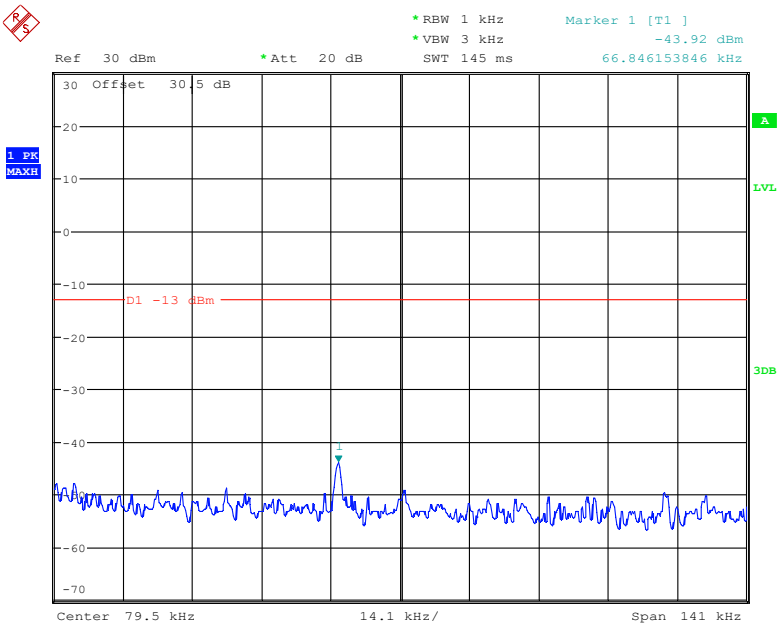
1 GHz – 2 GHz



Date: 16.JUN.2022 18:59:45

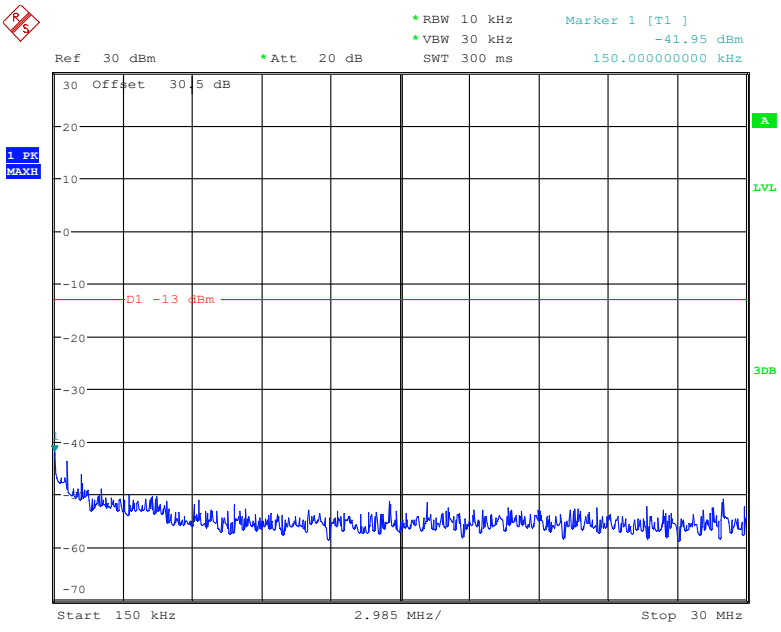
157.425 MHz

9KHz – 150MHz



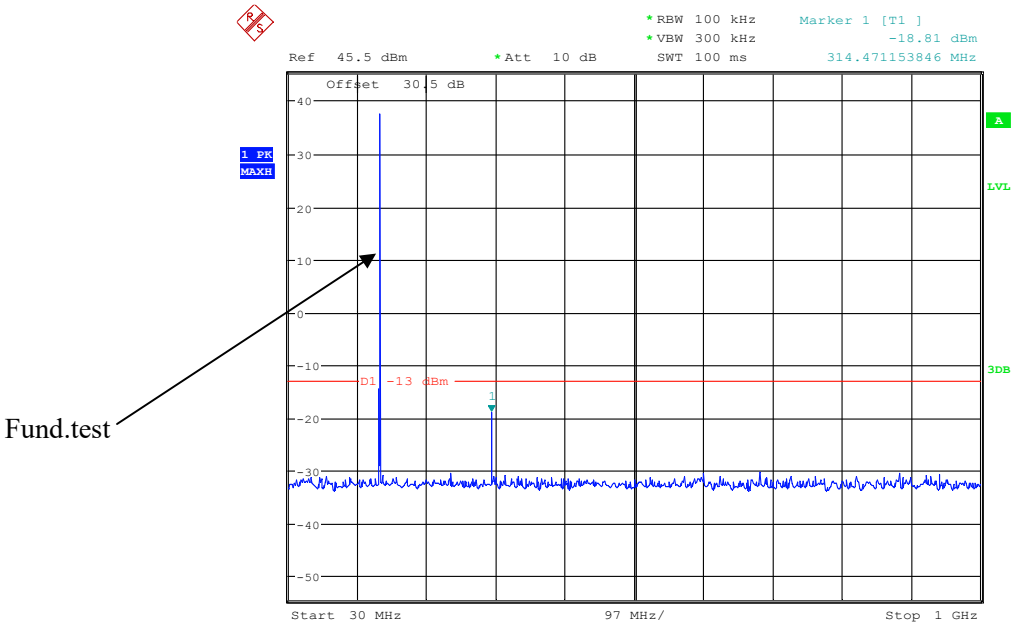
Date: 16.JUN.2022 18:44:41

150KHz – 30MHz



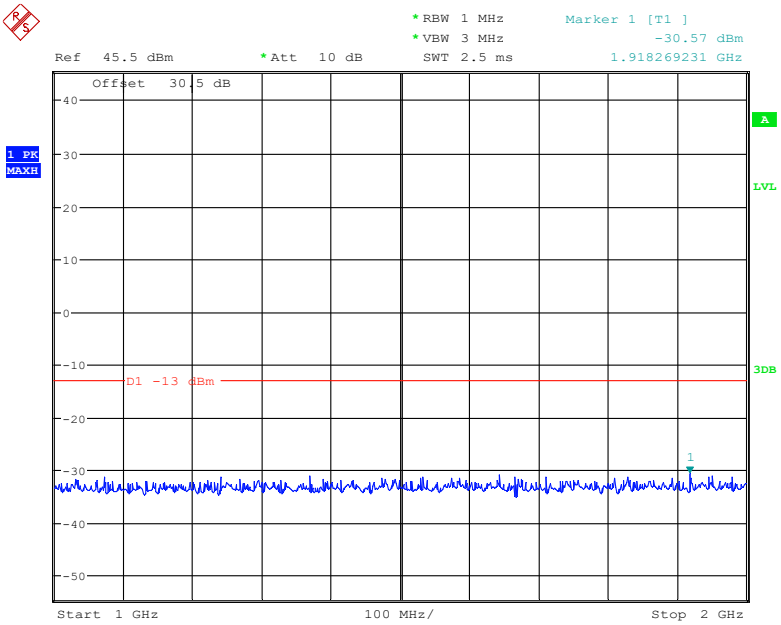
Date: 16.JUN.2022 18:47:40

30MHz – 1 GHz



Date: 16.JUN.2022 18:49:19

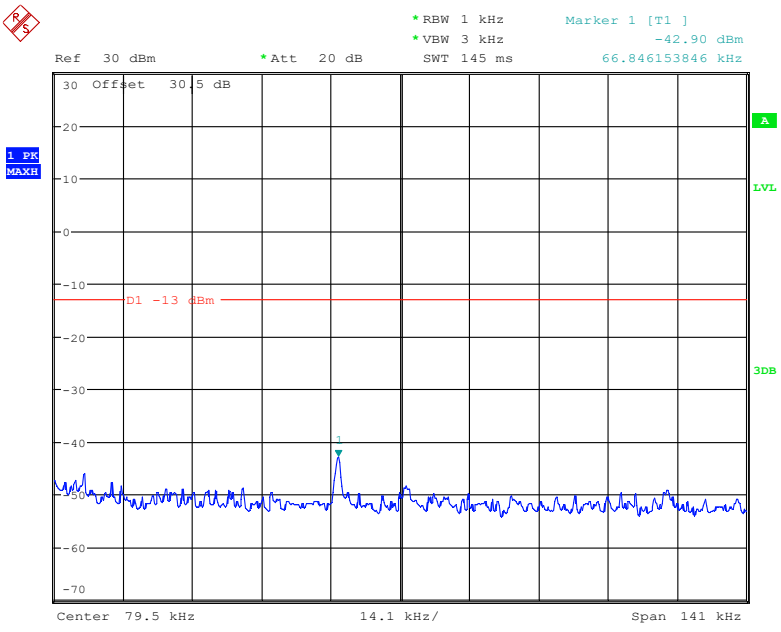
1 GHz – 2 GHz



Date: 16.JUN.2022 19:00:30

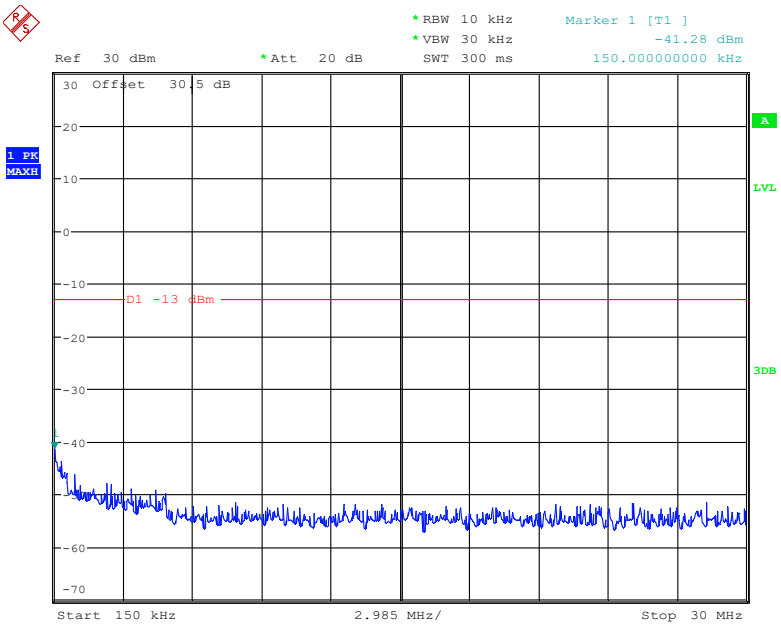
156.85 MHz

9KHz – 150MHz



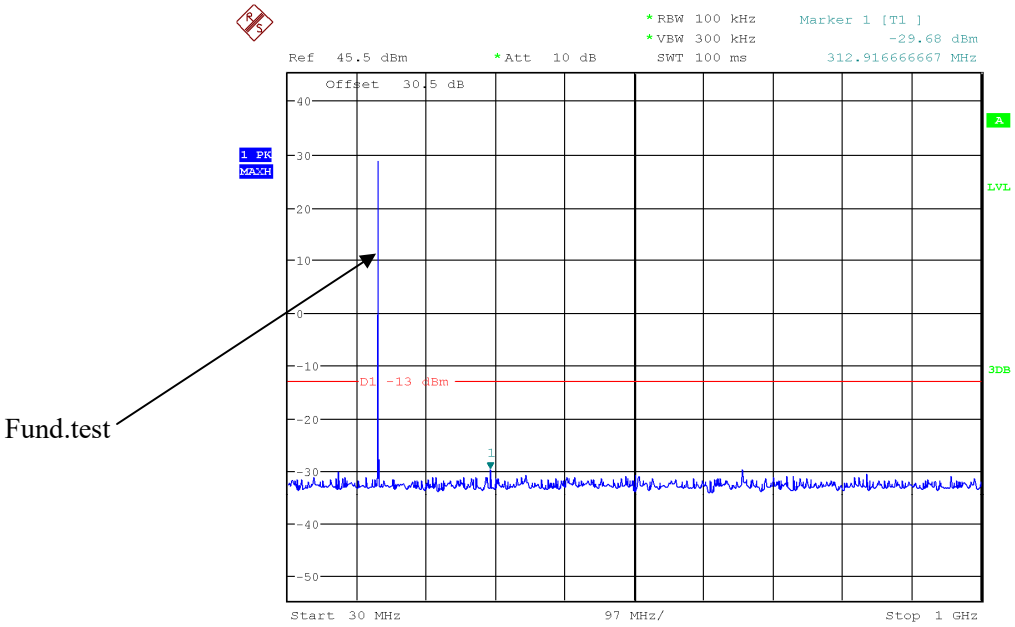
Date: 16.JUN.2022 18:45:30

150KHz – 30MHz



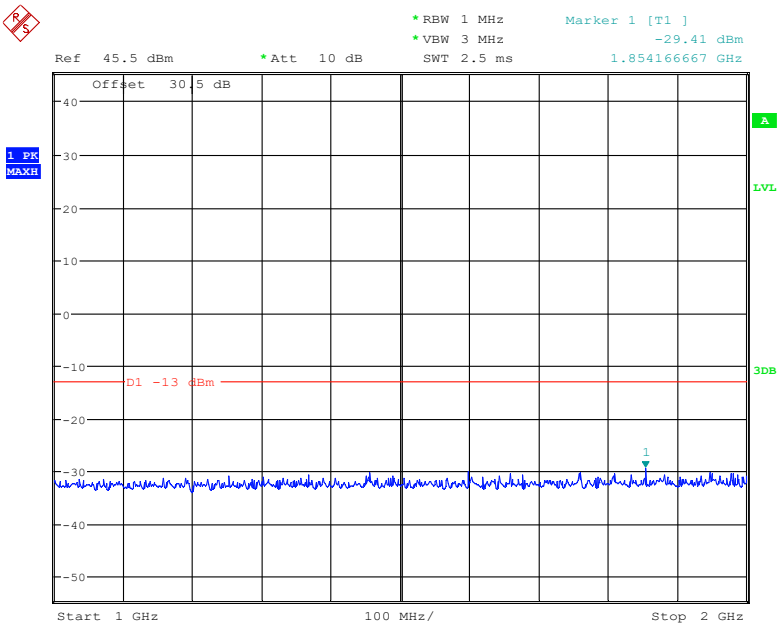
Date: 16.JUN.2022 18:46:58

30MHz – 1 GHz



Date: 16.JUN.2022 18:58:21

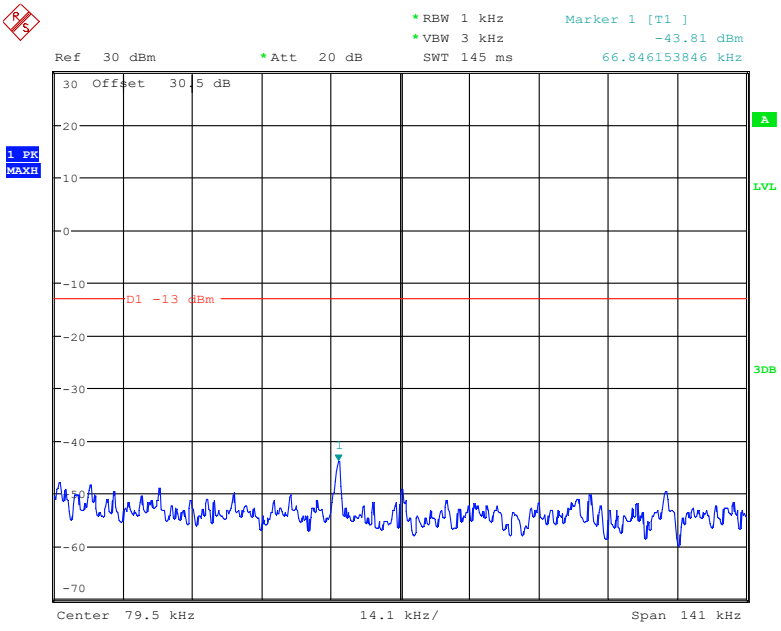
1 GHz – 2 GHz



Date: 16.JUN.2022 19:00:09

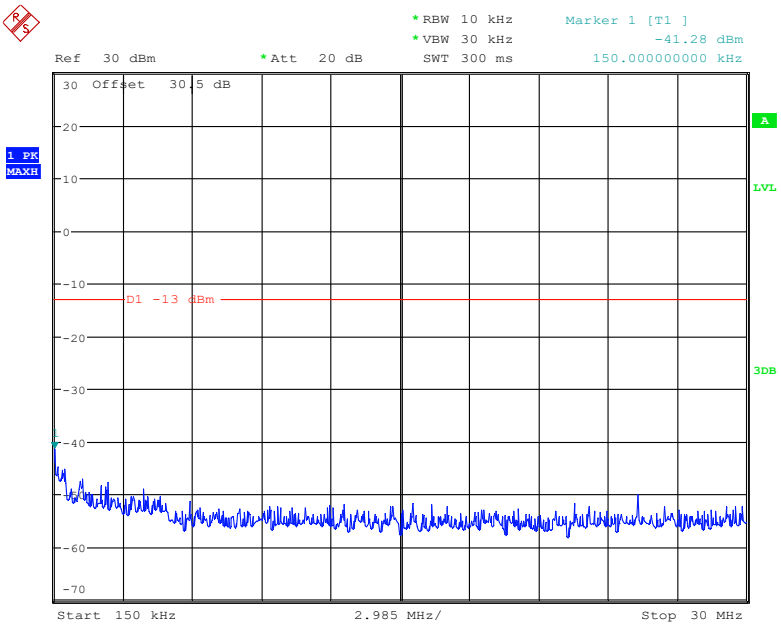
156.875 MHz

9KHz – 150MHz



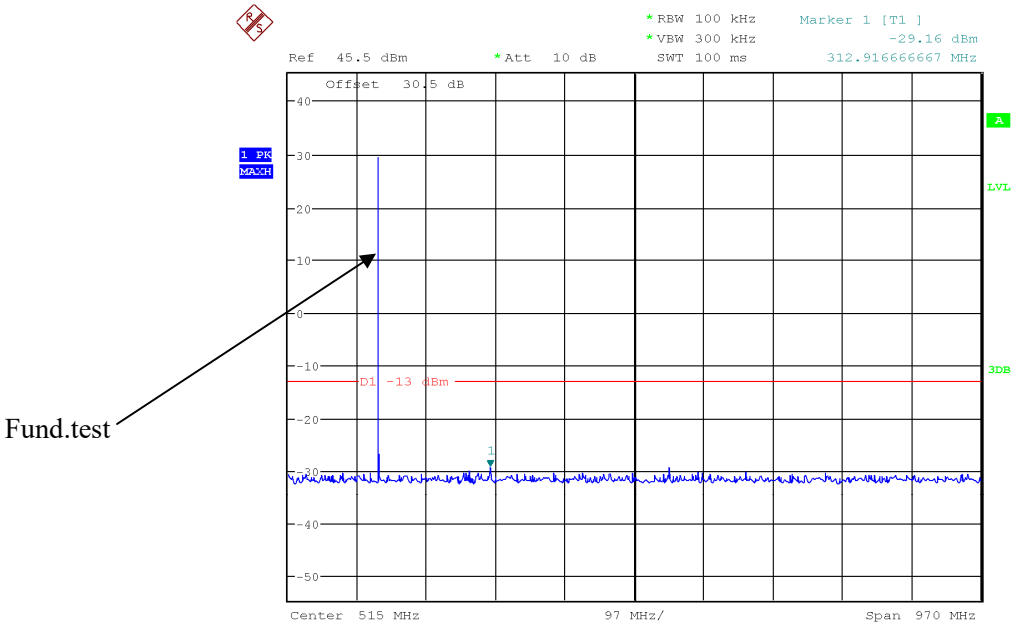
Date: 16.JUN.2022 18:45:50

150KHz – 30MHz



Date: 16.JUN.2022 18:46:39

30MHz – 1 GHz



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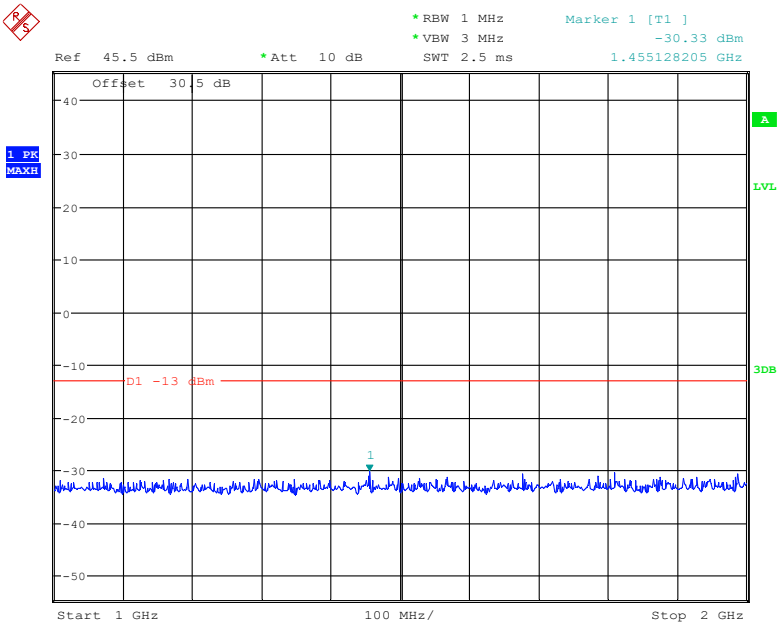
1 GHz – 2 GHz



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FCC §2.1053&§80.211 - RADIATED SPURIOUS EMISSIONS

Applicable Standard

FCC §2.1053, § 80.211

(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 Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load, which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT .The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to teeth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB =10 1g (TXpwr in Watts/0.001)-the absolute level

Spurious attenuation limit in dB =43+10 Log_{10} (power out in Watts)

Test Data

Environmental Conditions

Temperature:	24.9~25 ℃
Relative Humidity:	54~57 %
ATM Pressure:	101.0 kPa

The testing was performed by Cat Kang on 2012-06-16 for below 1GHz and Jeff Jiang on 2022-06-16 for above 1GHz.

Test Mode: Transmitting

30 MHz – 2 GHz:

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
CH01 156.05MHz, High power								
312.1	-57.99	112	2.1	H	-0.7	-58.69	-13	45.69
312.1	-58.67	192	1.6	V	2.8	-55.87	-13	42.87
468.15	-66.14	167	1.8	H	9.6	-56.54	-13	43.54
468.15	-59.73	29	2	V	4.8	-54.93	-13	41.93
1092.35	-56.5	265	1.9	H	4	-52.5	-13	39.5
1092.35	-49.4	94	1.4	V	2.6	-46.8	-13	33.8
1248.4	-61.4	196	1.3	H	5.7	-55.7	-13	42.7
1248.4	-59.9	285	1.5	V	4.9	-55	-13	42
1404.45	-60.4	129	1.7	H	5.9	-54.5	-13	41.5
1404.45	-52.7	299	1.6	V	5.9	-46.8	-13	33.8
1560.5	-53.6	168	1.7	H	4.2	-49.4	-13	36.4
1560.5	-50.4	254	1.7	V	3.3	-47.1	-13	34.1
CH16 156.8MHz, High power								
313.6	-60.11	222	1.6	H	-0.7	-60.81	-13	47.81
313.6	-58.33	241	1.2	V	2.8	-55.53	-13	42.53
470.4	-68.72	40	1.3	H	9.6	-59.12	-13	46.12
470.4	-59.95	278	2.1	V	4.8	-55.15	-13	42.15
1097.6	-53.7	181	1.1	H	4	-49.7	-13	36.7
1097.6	-52.4	259	1.4	V	2.6	-49.8	-13	36.8
1254.4	-62.8	40	2.1	H	5.7	-57.1	-13	44.1
1254.4	-58.9	175	2	V	4.9	-54	-13	41
1411.2	-59.3	234	1.1	H	5.9	-53.4	-13	40.4
1411.2	-60.1	313	1.3	V	5.9	-54.2	-13	41.2
1568	-55	118	1.2	H	4.2	-50.8	-13	37.8
1568	-52.8	255	2	V	3.3	-49.5	-13	36.5
CH88 157.425MHz, High power								
314.85	-58.83	143	1.9	H	-0.7	-59.53	-13	46.53
314.85	-58.67	52	1.2	V	2.8	-55.87	-13	42.87
472.275	-67.98	19	2.1	H	9.6	-58.38	-13	45.38
472.275	-60.54	130	1.4	V	4.8	-55.74	-13	42.74
1101.98	-52.1	177	1.3	H	4	-48.1	-13	35.1
1101.98	-50	230	2	V	2.6	-47.4	-13	34.4
1259.4	-62.7	28	2.1	H	5.7	-57	-13	44
1259.4	-57.5	222	1.4	V	4.9	-52.6	-13	39.6
1416.83	-60	305	2	H	5.9	-54.1	-13	41.1
1416.83	-59.9	74	1.1	V	5.9	-54	-13	41
1574.25	-53.6	67	1.9	H	4.2	-49.4	-13	36.4
1574.25	-51.7	237	2	V	3.3	-48.4	-13	35.4

Low Power only:

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
CH17 156.85MHz								
313.7	-59.52	202	1.4	H	-0.7	-60.22	-13	47.22
313.7	-59.26	145	1.3	V	2.8	-56.46	-13	43.46
470.55	-67.96	312	1.1	H	9.6	-58.36	-13	45.36
470.55	-59.25	65	1.4	V	4.8	-54.45	-13	41.45
1097.95	-55.3	242	1.4	H	4	-51.3	-13	38.3
1097.95	-53.1	219	1.2	V	2.6	-50.5	-13	37.5
1254.8	-62.4	136	1.2	H	5.7	-56.7	-13	43.7
1254.8	-58.6	97	1.9	V	4.9	-53.7	-13	40.7
1411.65	-61	346	1.8	H	5.9	-55.1	-13	42.1
1411.65	-60.7	320	1.6	V	5.9	-54.8	-13	41.8
1568.5	-55.4	193	2.1	H	4.2	-51.2	-13	38.2
1568.5	-53.2	290	1.4	V	3.3	-49.9	-13	36.9
CH77 156.875MHz								
313.75	-59.11	296	1	H	-0.7	-59.81	-13	46.81
313.75	-58.13	82	1.3	V	2.8	-55.33	-13	42.33
470.625	-68.77	321	1.8	H	9.6	-59.17	-13	46.17
470.625	-58.49	311	1.6	V	4.8	-53.69	-13	40.69
1098.13	-54.2	191	2.1	H	4	-50.2	-13	37.2
1098.13	-52.6	209	1.6	V	2.6	-50	-13	37
1255	-62.4	139	2	H	5.7	-56.7	-13	43.7
1255	-59.4	71	1.8	V	4.9	-54.5	-13	41.5
1411.88	-61.1	45	1.8	H	5.9	-55.2	-13	42.2
1411.88	-61	270	1.8	V	5.9	-55.1	-13	42.1
1568.75	-55.8	45	1.2	H	4.2	-51.6	-13	38.6
1568.75	-54.1	293	1.5	V	3.3	-50.8	-13	37.8

Note:
Absolute Level = Reading Level + Substituted Factor
Substituted Factor contains: SG Level - Cable loss+ Antenna Gain
Margin = Limit- Absolute Level

FCC §2.1055 & §80.209 (a) (5) (ii) - TRANSMITTER FREQUENCY TOLERANCES

Applicable Standard

FCC §2.1055, §80.209 (a) (5) (ii)

Test Procedure

Frequency Stability vs. Temperature:

From −20° to +60° centigrade for equipment to be licensed for use in the Maritime Services under part 80 of this chapter, except for Class A, B, and S Emergency Position Indicating Radiobeacons (EPIRBS), and equipment to be licensed for use above 952 MHz at operational fixed stations in all services, stations in the Local Television Transmission Service and Point-to-Point Microwave Radio Service under part 21 of this chapter, equipment licensed for use aboard aircraft in the Aviation Services under part 87 of this chapter, and equipment authorized for use in the Family Radio Service under part 95 of this chapter.

The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

The frequency stability shall be measured with variation of primary supply voltage as follows

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.
(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.
(3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the counter.

Test Data

Environmental Conditions

Temperature:	27 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Nick Fang on 2022-06-16.

Test Mode: Transmitting

For Analog Modulation**:**

Reference Frequency: 156.8 MHz, Limit: ±10.0 ppm			
Test Environment		**Frequency Measure with Time Elapsed**	
Temperature (℃)	**Voltage Supplied (V_{DC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
Frequency Stability versus Input Temperature			
50	7.4	156.799307	-4.420
40	7.4	156.799261	-4.713
30	7.4	156.799234	-4.885
20	7.4	156.799273	-4.636
10	7.4	156.799288	-4.541
0	7.4	156.799317	-4.356
-10	7.4	156.799337	-4.228
-20	7.4	156.799283	-4.573
-30	7.4	156.799246	-4.809
Frequency Stability Versus Input Voltage			
20	6.2	156.799261	-4.713
20	8.4	156.799300	-4.464

Low power only

Reference Frequency: 156.8 MHz, Limit: ±10.0 ppm			
Test Environment		**Frequency Measure with Time Elapsed**	
Temperature (℃)	**Voltage Supplied (V_{DC})**	**Measured Frequency (MHz)**	**Frequency Error (ppm)**
Frequency Stability versus Input Temperature			
50	7.4	156.874428	-3.646
40	7.4	156.874314	-4.373
30	7.4	156.874369	-4.022
20	7.4	156.874358	-4.092
10	7.4	156.874316	-4.360
0	7.4	156.874371	-4.010
-10	7.4	156.874308	-4.411
-20	7.4	156.874377	-3.971
-30	7.4	156.874330	-4.271
Frequency Stability Versus Input Voltage			
20	6.2	156.874418	-3.710
20	8.4	156.874414	-3.735

******* END OF REPORT *******