



Compliance Certification Services (Kunshan) Inc.
Shenzhen Branch

Report No.: FYCR220600023403

Page: 1 of 56

TEST REPORT

Application No.: FYCR2206000234AT
Applicant: Navico Inc.
Address of Applicant: 4500 S. 129th East Avenue, Ste. 200 Tulsa Oklahoma United States 74134
Manufacturer: Navico Auckland Limited
Address of Manufacturer: Arrenway Drive, Rosedale, Auckland, 0632 New Zealand
Factory: Shenzhen Fastrain Technology Co., Ltd.
Address of Factory: No.3 Baolong 4th Rd., Baolong Industrial Area, Longgang District, Shenzhen, China
Equipment Under Test (EUT):
EUT Name: Marin VHF Radio
Model No.: V60-B, RS40-B ♣
♣ Please refer to section 2 of this report which indicates which model was actually tested and which were electrically identical.
Trade mark: B&G, SIMRAD
FCC ID: RAYVHFERS40BA
Standards: 47 CFR Part 80
Date of Receipt: 2022-06-14
Date of Test: 2022-07-13 to 2022-07-22
Date of Issue: 2022-07-28

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

Winkey Wang

Winkey Wang
EMC Technical Manager





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Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2022-05-20		Original

Authorized for issue by:				
				
		Tree Zhan/Project Engineer		
				
		Winkey Wang/Reviewer		



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1 Test Summary

Radio Spectrum Technical Requirement				
Item	Standard	Method	Requirement	Result
Antenna Requirement	47 CFR Part 80	N/A	47 CFR Part 80.3(e),	Pass

Item	Standard	Method	Requirement	Result
Bandwidths	47 CFR Part 80	ANSI/TIA-603-E-2016 ANSI C63.26:2015	47 CFR Part 2.1049, 80.205(a)	Pass
Transmitter frequency tolerances	47 CFR Part 80		47 CFR Part 2.1055, 80.209(a)	Pass
Emission Mask	47 CFR Part 80		47 CFR Part 2.1047, 80.211(f)(1)(2)	Pass
Spurious Emissions at antenna Terminals	47 CFR Part 80		47 CFR Part 2.1047, 80.211(f)(3)	Pass
Modulation requirements	47 CFR Part 80		47 CFR Part 2.1047, 80.213	Pass
Transmitter frequency Deviation	47 CFR Part 80		47 CFR Part .1047, 80.213	Pass
Transmitter power	47 CFR Part 80		47 CFR Part 2.1046, 80.215	Pass
Transmitter Carrier Power Reduction	47 CFR Part 80		47 CFR Part 80.215(e)(f)	N/A
Suppression of interference aboard ships	47 CFR Part 80		47 CFR Part 80.217	Pass

Note:

N/A: Not Applicable, Hand-held portable transmitters are not required to comply with the automatic reduction of carrier power.

Remark:

Model No.: V60-B, RS40-B

Only the model V60-B was tested, since the electrical circuit design, layout, components used, internal wiring and functions were identical for all the above models, with only differences are the trade name and model no. for trading purpose.



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3 General Information

3.1 Details of E.U.T.

Power supply:	12 VDC battery system
Cable:	DC cable: longer than 300cm unshielded
Sample Type:	Mobile device
Internal Source:	More than 108MHz
Transmitter Frequency Range:	VHF:156.025MHz-157.425MHz
AIS Transmitter Frequency Range:	161.975MHz(CH87), 162.025MHz(CH88)
DSC Transmitter Frequency Range:	156.525MHz(CH70)
Modulation Type:	VHF:FM for Analog; DSC:FSK AIS:GMSK
Frequency Spacing:	VHF: 25KHz
Emission Type:	16K0G3E for VHF; 16K0G2B for DSC;
Rated Output Power:	25W/1W for VHF/DSC; 2W for AIS;
VHF/DSC Antenna Connectors:	SO-239(50 ohm, External Antenna)
AIS Antenna Connectors:	SO-239(50 ohm, External Antenna)
VHF/DSC Antenna Gain:	6dBi
AIS Antenna Gain:	6dBi

3.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
DC power	NOISEKEN	BP-4610	9105713
Coaxial Attenuator	Provided by client	TS4	HYT168793



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3.3 Measurement Uncertainty

Test Item	Measurement Uncertainty
99% Bandwidth	± 0.3%
Conducted Band Edges Measurement	± 2.7dB
Conducted Emissions at AC Power Line (150kHz-30MHz)	± 2.1 dB (9kHz to 30MHz)
Maximum Conducted Output Power	± 0.8dB
Conducted Spurious Emissions	± 2.7dB
Minimum 6dB Bandwidth	± 0.3%
Power Spectrum Density	± 0.4dB
Radiated Emissions below 1GHz	± 3.1dB (Below 1GHz)
Radiated Emissions which fall in the restricted bands	± 4.4dB (Above 1GHz)
Frequency Stability	± 5.4 x 10-8
Radiated Emissions Above 1GHz	± 4.4dB (Above 1GHz)



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3.4 Test Location

All tests were performed at:

Compliance Certification Services (Kunshan) Inc. Shenzhen branch.

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Tel: +86 755 8866 3988 Fax: +86 755 2671 0594

No tests were sub-contracted.

3.5 Test Facility

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

• **A2LA (Certificate No. 6606.01)**

Compliance Certification Services (Kunshan) Inc. Shenzhen branch is accredited by the American Association for Laboratory Accreditation (A2LA). Certificate No. 6606.01.

• **FCC –Designation Number: CN1322**

Compliance Certification Services (Kunshan) Inc. Shenzhen branch has been recognized as an accredited testing laboratory.

Designation Number: CN1322. Test Firm Registration Number: 718073

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

Compliance Certification Services (Kunshan) Inc. Shenzhen branch has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0129.

IC#: 28189.

3.6 Deviation from Standards

None

3.7 Abnormalities from Standard Conditions

None



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4 Equipment List

RF Conducted Test					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Programmable Temperature & Humidity Chamber	Votsch Industrietechnik GmbH	VT 4002	SEM002-15	2022/7/12	2023/7/11
MXA Signal Analyzer	Agilent	N9020A	SEM004-20	2022/7/12	2023/7/11
Signal Generator	Agilent	N5173B	SEM006-05	2022/7/12	2023/7/11
ESG Vector Signal Generator	Agilent	E4438C	SEM006-15	2022/7/12	2023/7/11
Power Sensor	Agilent	U2021XA	SEM009-15	2022/7/12	2023/7/11
Power Sensor	Agilent	U2021XA	SEM009-16	2022/7/12	2023/7/11
Wideband Radio Communication Tester	Rohde & Schwarz	CMW 500	SEM010-08	2022/7/12	2023/7/11
Programmable DC Source	Chroma	62024P-80-60	SEM011-09	2022/7/12	2023/7/11
Attenuator	Huber+Suhner	6620_SMA-50-1	SEM021-09	2022/7/12	2023/7/11
Audio Generator	LONGWEI ELECTRIC	TAG-101	SEM008-08	2021/9/23	2022/9/22
FSV-Signal Analyzer 10Hz-40GHz	Rohde & Schwarz	FSV40	SEM008-04	2022/3/23	2023/3/22

Radiated Spurious Emissions Below 1GHz					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
3m Anechoic Chamber	CRT	N/A	SEM001-13	2021/7/13	2024/7/12
Trilog-Broadband Antenna	Schwarzbeck	VULB9168	SEM003-33	2021/9/25	2024/9/24
Biconical Antenna	Schwarzbeck	VUBA9117	SEM003-35	2021/12/26	2024/12/25
Loop Antenna	ETS-LINDGREN	6502	SEM003-36	2021/9/26	2024/9/25
MXE EMI receiver	Agilent	N9038A	SEM004-05	2022/7/12	2023/7/11
Pre-amplifier	HP	8447D	SEM005-02	2022/7/12	2023/7/11
Substitution antenna	Schwarzbeck	VULB9168	SEM003-26	2021/10/19	2023/10/18



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Radiated Spurious Emissions Above 1GHz					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
3m Anechoic Chamber	CRT	N/A	SEM001-13	2021/7/13	2024/7/12
MXE EMI receiver	Agilent	N9038A	SEM004-05	2022/7/12	2023/7/11
Pre-amplifier	HP	8447D	SEM005-02	2022/7/12	2023/7/11
Broad-Band Horn Antenna	Schwarzbeck	BBHA 9170	SEM003-15	2021/7/11	2024/7/10
Broad-Band Horn Antenna	Schwarzbeck	BBHA 9120D	SEM003-32	2021/9/26	2024/9/25
Double-ridged waveguide horn	ETS-LINDGREN	3117	SEM003-34	2021/9/25	2024/9/24
Spectrum Analyzer	Rohde & Schwarz	101288	SEM004-08	2022/7/12	2023/7/11
Low Noise Amplifier	CLAVIO	BDLNA-0118-352810	SEM005-05	2022/7/12	2023/7/11
Pre-amplifier	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2022/7/12	2023/7/11
Pre-amplifier	Rohde & Schwarz	CH14-H052	SEM005-17	2022/7/12	2023/7/11
Pre-amplifier	TST PASS	LNA04080G30	SEM005-27	2022/4/15	2023/4/14
Pre-amplifier	TST PASS	LNA10180G45	SEM005-28	2022/4/15	2023/4/14
Substitution antenna	Schwarzbeck	VULB9168	SEM003-26	2021/10/19	2023/10/18

General used equipment					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Humidity/ Temperature Indicator	Mingle	TH607	SEM002-22	2021-07-13	2022-07-12
Humidity/ Temperature Indicator	Mingle	TH607	SEM002-23	2021-07-13	2022-07-12
Barometer	DUMAI	DYM3	SEM002-24	2021-07-13	2022-07-12



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5 Radio Spectrum Technical Requirement

5.1 Antenna Requirement

5.1.1 Test Requirement:

47 CFR Part Part 80.81

5.1.2 Conclusion

80.81 Requirements:

All telephony emissions of a ship station or a marine utility station on board ship within the frequency band 30-200 MHz must be vertically polarized.

EUT Antenna:

Antenna location: Refer to appendix - External Photos for FYCR2206000234AT.

6 Radio Spectrum Matter Test Results

6.1 Bandwidths

Test Requirement: 47 CFR FCC Part2.1049 & FCC Part 80.205(a)
Test Method: ANSI/TIA-603-E:2016
Limit:

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

6.1.1 E.U.T. Operation

Operating Environment:

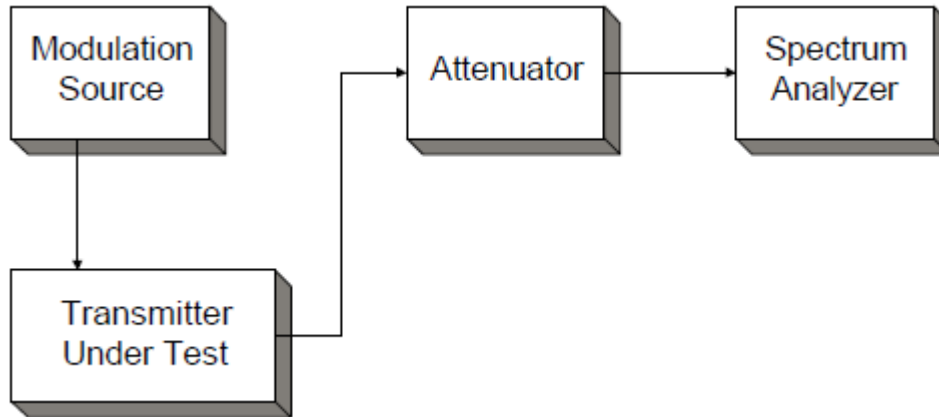
Temperature: 23.2 °C Humidity: 56.5 % RH Atmospheric Pressure: 1020 mbar
Test mode: 02: TX mode, Keep the EUT in transmitting mode.



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6.1.2 E.U.T. Operation



6.1.3 Measurement Data

The detailed test data see: Appendix FCC data.



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6.2 Transmitter Frequency Tolerances.

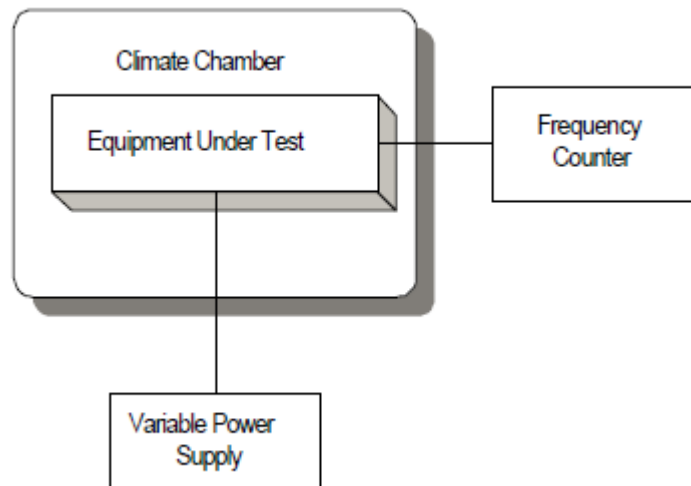
Test Requirement 47 CFR FCC Part2.1055 & FCC Part 80.209(a)
Test Method: ANSI/TIA-603-E:2016
Limit: $\pm 10\text{ppm}$

6.2.1 E.U.T. Operation

Operating Environment:

Temperature: 23.2 °C Humidity: 56.5 % RH Atmospheric Pressure: 1020 mbar
Test mode: 02: TX mode, Keep the EUT in transmitting mode.

6.2.2 E.U.T. Operation



6.2.3 Measurement Data

The detailed test data see: Appendix FCC data.

6.3 Emissions Mask

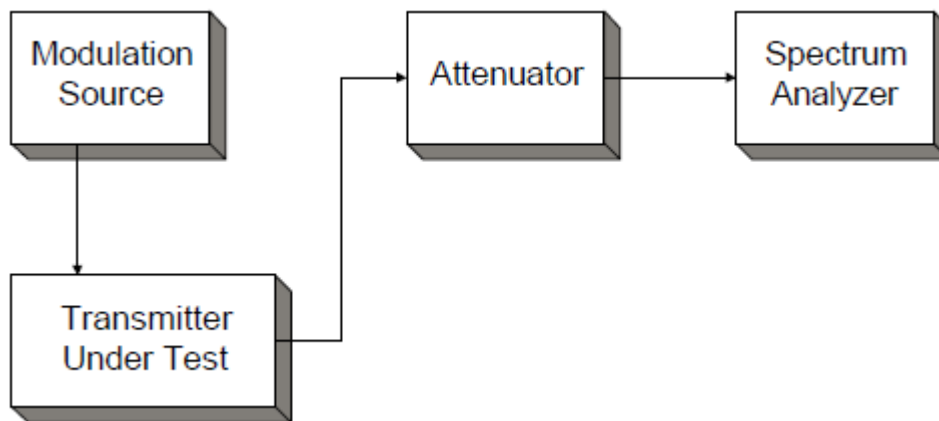
Test Requirement: 47 CFR FCC Part2.1047 & FCC Part 80.211(f) (1) (2)
 Test Method: ANSI/TIA-603-E:2016
 Limit: (f) The mean power when using emissions other than those in paragraphs (a), (b), (c) and (d) of this section:
 (1) On any frequency removed from the assigned frequency by more than 50 percent 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;

Note: As required by FCC part 80.211(f), the limit value of the Emission Mask is calculated based on the measured maximum carrier power minus the corresponding value defined by the standard.

6.3.1 E.U.T. Operation

Operating Environment:
 Temperature: 23.2 °C Humidity: 56.5 % RH Atmospheric Pressure: 1020 mbar
 Test mode: 02: TX mode, Keep the EUT in transmitting mode.

6.3.2 E.U.T. Operation



6.3.3 Measurement Data

The detailed test data see: Appendix FCC data.



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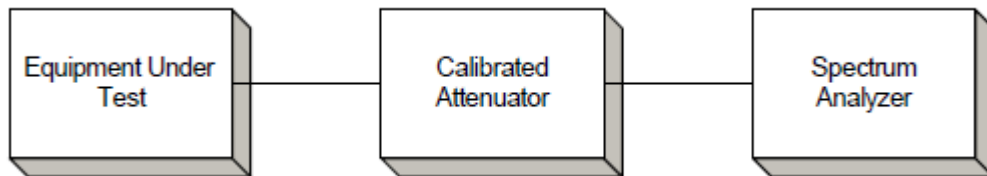
6.4 Spurious Emissions at Antenna Terminals

Test Requirement: 47 CFR FCC Part2.1047 & FCC Part 80.211(f) (3)
 Test Method: ANSI/TIA-603-E:2016
 Limit: (f) The mean power when using emissions other than those in paragraphs (a), (b), (c) and (d) of this section:
 (3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus 10log10 (mean power in watts) dB.

6.4.1 E.U.T. Operation

Operating Environment:
 Temperature: 23.2 °C Humidity: 56.5 % RH Atmospheric Pressure: 1020 mbar
 Test mode: 02: TX mode, Keep the EUT in transmitting mode.

6.4.2 E.U.T. Operation



6.4.3 Measurement Data

The detailed test data see: Appendix FCC data.

6.5 Transmitter Unwanted Emissions(Radiated)

Test Requirement:	47 CFR FCC Part2.1047 & FCC Part 80.211(f)
Test Method:	ANSI/TIA-603-E:2016
Limit:	(f) The mean power when using emissions other than those in paragraphs (a), (b), (c) and (d) of this section: (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 10log10 (mean power in watts) dB.

6.5.1 E.U.T. Operation

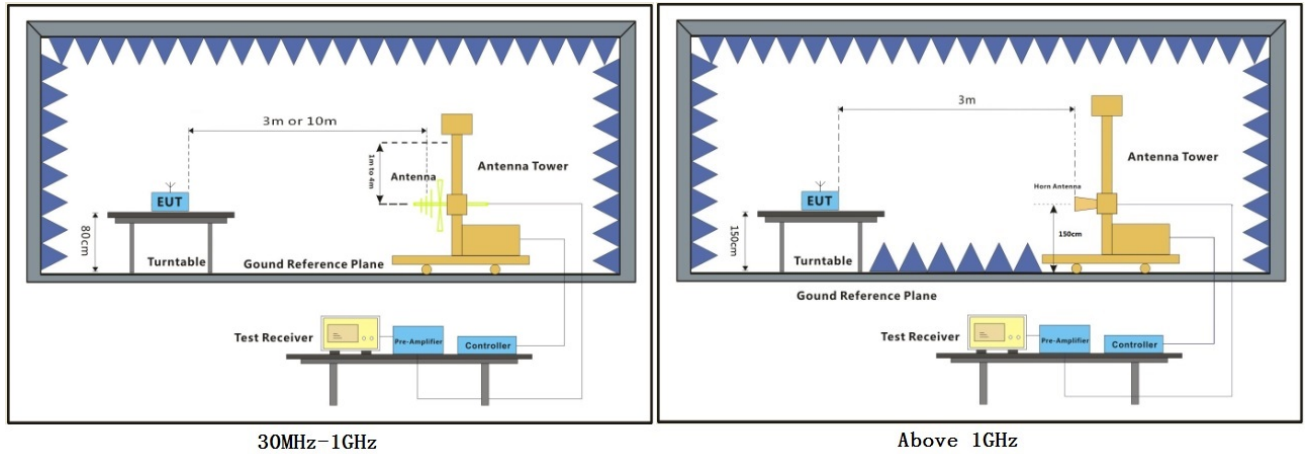
Operating Environment:					
Temperature:	23.2 °C	Humidity:	56.5 % RH	Atmospheric Pressure:	1020 mbar
Test mode:	02: TX mode, Keep the EUT in transmitting mode.				



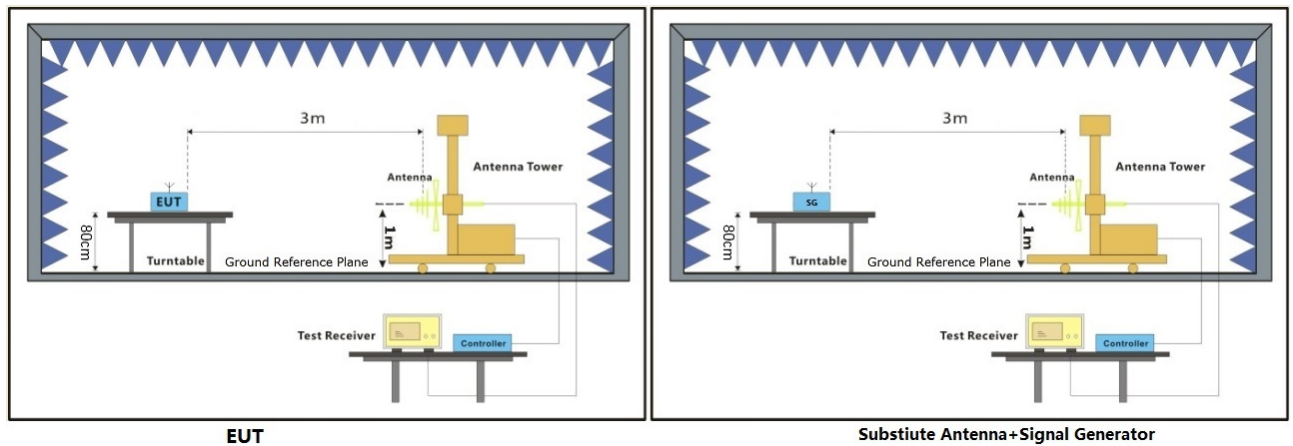
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6.5.2 E.U.T. Operation



Radiation Emission Test Setup



Substitution Test Setup

6.5.3 Measurement Data

Test Procedure:

- (1) On a test site, the EUT shall be placed on a turntable and in the position closest to the normal use as declared by the user.
- (2) The test antenna shall be oriented initially for vertical polarization located 3m from the EUT to correspond to the transmitter.
- (3) The output of the antenna shall be connected to the measuring receiver and either a peak or quasi-peak detector was used for the measurement as indicated on the report. The detector selection is based on how close the emission level was approaching the limit.
- (4) The transmitter shall be switched on; if possible, without the modulation and the measurement receiver shall be tuned to the frequency of the transmitter under test.
- (5) The test antenna shall be raised and lowered through the specified range of height until the measuring receiver detects a maximum signal level.
- (6) The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
- (7) The test antenna shall be raised and lowered again through the specified range of height until the measuring receiver detects a maximum signal level.
- (8) The maximum signal level detected by the measuring receiver shall be noted.
- (9) The measurement shall be repeated with the test antenna set to horizontal polarization.
- (10) Replace the antenna with a proper Antenna (substitution antenna).
- (11) The substitution antenna shall be oriented for vertical polarization and, if necessary, the length of the substitution antenna shall be adjusted to correspond to the frequency of transmitting.
- (12) The substitution antenna shall be connected to a calibrated signal generator.
- (13) If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
- (14) The test antenna shall be raised and lowered through the specified range of the height to ensure that the maximum signal is received.
- (15) The input signal to substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuation setting of the measuring receiver.
- (16) The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
- (17) The measurement shall be repeated with the test antenna and the substitution antenna oriented for horizontal polarization.

The detailed test data see: Appendix FCC data.

Note: The disturbance below 1GHz was very low and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed.



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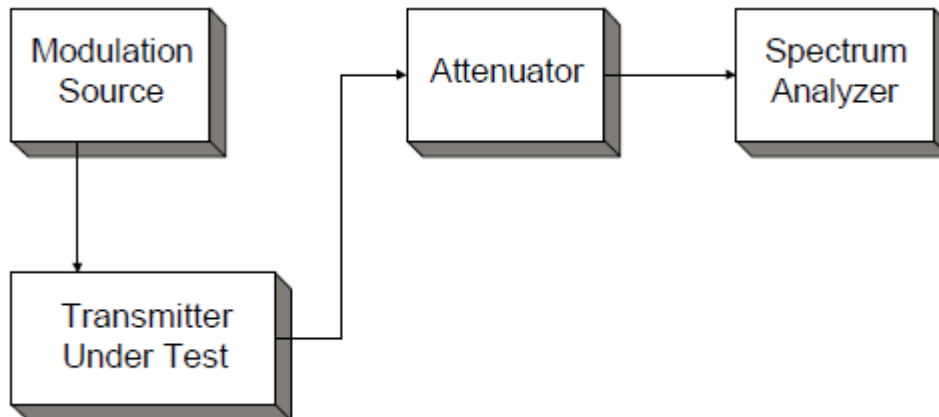
6.6 Modulation Requirements

Test Requirement: 47 CFR FCC Part2.1047 & FCC Part 80.213(a)
 Test Method: ANSI/TIA-603-E:2016
 Limit: (a) Transmitters must meet the following modulation requirements:
 (1) When double sideband emission is used the peak modulation must be maintained between 75 and 100 percent;
 (2) When phase or frequency modulation is used in the 156-162 MHz band the peak modulation must be maintained between 75 and 100 percent. A frequency deviation of ± 5 kHz is defined as 100 percent peak modulation; and
 (3) In single sideband operation the upper sideband must be transmitted. Single sideband transmitters must automatically limit the peak envelope power to their authorized operating power and meet the requirements in § 80.207(c).

6.6.1 E.U.T. Operation

Operating Environment:
 Temperature: 23.2 °C Humidity: 56.5 % RH Atmospheric Pressure: 1020 mbar
 Test mode: 02: TX mode, Keep the EUT in transmitting mode.

6.6.2 Test Setup Diagram



6.6.3 Measurement Data

The detailed test data see: Appendix FCC data.

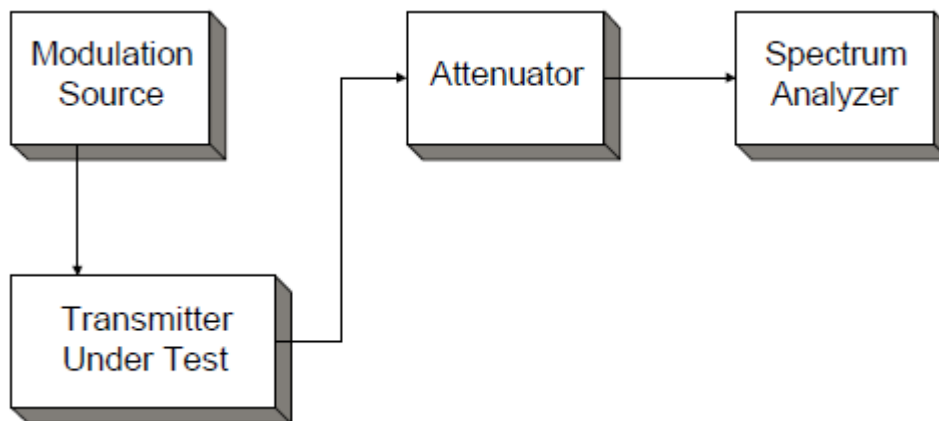
6.7 Transmitter Frequency Deviation

Test Requirement: 47 CFR FCC Part2.1047 & FCC Part 80.213(d)
 Test Method: ANSI/TIA-603-E:2016
 Limit: (d) 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.

6.7.1 E.U.T. Operation

Operating Environment:
 Temperature: 23.2 °C Humidity: 56.5 % RH Atmospheric Pressure: 1020 mbar
 Test mode: 02: TX mode, Keep the EUT in transmitting mode.

6.7.2 Test Setup Diagram



6.7.3 Measurement Data

The detailed test data see: Appendix FCC data.

6.8 Transmitter Power

Test Requirement: 47 CFR FCC Part2.1046 & FCC Part 80.215

Test Method: ANSI/TIA-603-E:2016

Limit:

e) Ship stations frequencies above 27500 kHz. The maximum power must not exceed the values listed below.

(1) Ship stations 156-162 MHz—25W⁶

⁶Reducible to 1 watt or less, except for transmitters limited to public correspondence channels and used in an automated system.

(g) The carrier power of ship station radiotelephone transmitters, except portable transmitters, operating in the 156-162 MHz band must be at least 8 but not more than 25 watts. Transmitters that use 12 volt lead acid storage batteries as a primary power source must be measured with a primary voltage between 12.2 and 13.7 volts DC. Additionally, unless otherwise indicated, equipment in radiotelephone ship stations operating in the 156-162 MHz band must meet the following requirements:

(1) All transmitters and remote control units must be capable of reducing the carrier power to one watt or less;

(2) Except as indicated in (g)(4) of this section, all transmitters manufactured after January 21, 1987, or in use after January 21, 1997, must automatically reduce the carrier power to one watt or less when the transmitter is tuned to 156.375 MHz or 156.650 MHz, and must be provided with a manual override switch which when held by an operator will permit full carrier power operation on 156.375 MHz and 156.650 MHz;

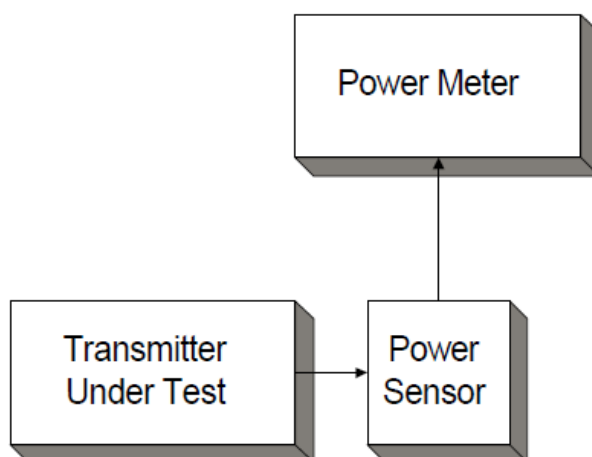
6.8.1 E.U.T. Operation

Operating Environment:

Temperature: 23.2 °C Humidity: 56.5 % RH Atmospheric Pressure: 1020 mbar

Test mode: 02: TX mode, Keep the EUT in transmitting mode.

6.8.2 Test Setup Diagram





6.8.3 Measurement Data

The detailed test data see: Appendix FCC data.



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6.9 Transmitter Carrier Power Reduction

Test Requirement 47 CFR FCC Part 80.215

Test Method: ANSI/TIA-603-E:2016

Limit:

e) Ship stations frequencies above 27500 kHz. The maximum power must not exceed the values listed below.

(1) Ship stations 156-162 MHz—25W6

6Reducible to 1 watt or less, except for transmitters limited to public correspondence channels and used in an automated system.

(g) The carrier power of ship station radiotelephone transmitters, except portable transmitters, operating in the 156-162 MHz band must be at least 8 but not more than 25 watts. Transmitters that use 12 volt lead acid storage batteries as a primary power source must be measured with a primary voltage between 12.2 and 13.7 volts DC. Additionally, unless otherwise indicated, equipment in radiotelephone ship stations operating in the 156-162 MHz band must meet the following requirements:

(1) All transmitters and remote control units must be capable of reducing the carrier power to one watt or less;

(2) Except as indicated in (g)(4) of this section, all transmitters manufactured after January 21, 1987, or in use after January 21, 1997, must automatically reduce the carrier power to one watt or less when the transmitter is tuned to 156.375 MHz or 156.650 MHz, and must be provided with a manual override switch which when held by an operator will permit full carrier power operation on 156.375 MHz and 156.650 MHz;

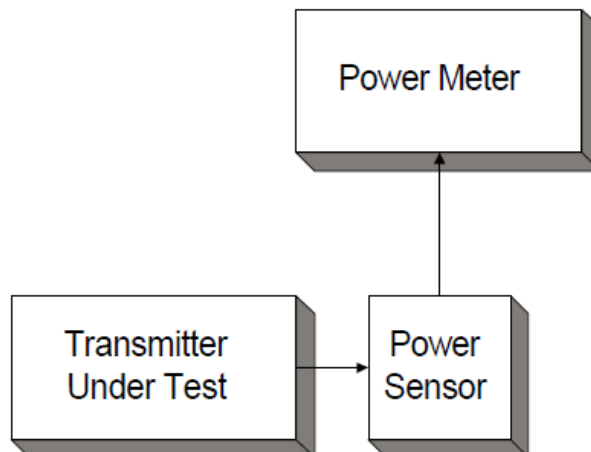
6.9.1 E.U.T. Operation

Operating Environment:

Temperature: 23.2 °C Humidity: 56.5 % RH Atmospheric Pressure: 1020 mbar

Test mode: 02: TX mode, Keep the EUT in transmitting mode.

6.9.2 Test Setup Diagram





6.9.3 Measurement Data

The detailed test data see: Appendix FCC data.



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6.10 Suppression of interference aboard ships

Test Requirement 47 CFR FCC Part 80.217
Test Method: ANSI/TIA-603-E:2016
Limit:

- (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:

Frequency of interfering emissions	Field intensity in microvolts per meter
Below 30 MHz	0.1
30 to 100 MHz	0.3
100 to 300 MHz	1.0
Over 300 MHz	3.0

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:

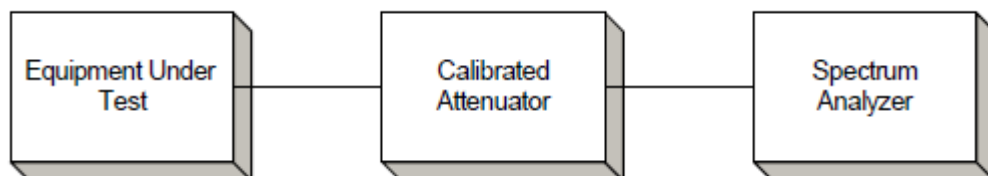
Frequency of interfering emissions	Power to artificial antenna in microwatts
Below 30 MHz	400(-3.98dBm)
30 to 100 MHz	4,000(6.02dBm)
100 to 300 MHz	40,000(16.02dBm)
Over 300 MHz	400,000(36.02dBm)

6.10.1 E.U.T. Operation

Operating Environment:

Temperature: 23.2 °C Humidity: 56.5 % RH Atmospheric Pressure: 1020 mbar
Test mode: 02: TX mode, Keep the EUT in transmitting mode.

6.10.2 E.U.T. Operation



6.10.3 Measurement Data

The detailed test data see: Appendix FCC data.



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7 Photographs

7.1 Test Setup

Refer to appendix - Test Setup Photos for FYCR2206000234AT.

7.2 EUT Constructional Details

Refer to appendix - External and Internal Photos for FYCR2206000234AT.



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8 Appendix FCC data.

1.Occupied Bandwidth

Test Frequency (MHz)	Modulation Type	Power Level	99% Occupied Bandwidth (kHz)	26dB Bandwidth (kHz)	Limit (kHz)
156.025	FM/G3E	Max	10.446	13.22	20
		Low	10.459	13.22	20
156.3		Max	10.482	13.21	20
		Low	10.457	13.23	20
156.8		Max	10.408	13.33	20
		Low	10.451	13.23	20
156.65		Max	10.433	13.31	20
		Low	10.464	13.22	20
157.425		Max	10.629	13.24	20
		Low	10.462	13.22	20
162.025	GMSK/GXW	/	8.972	11.577	20
156.525	FSK/G2B (dsc-1300Hz)	/	8.031	10.347	20
	FSK/G2B dsc-2100Hz	/	12.879	16.859	20

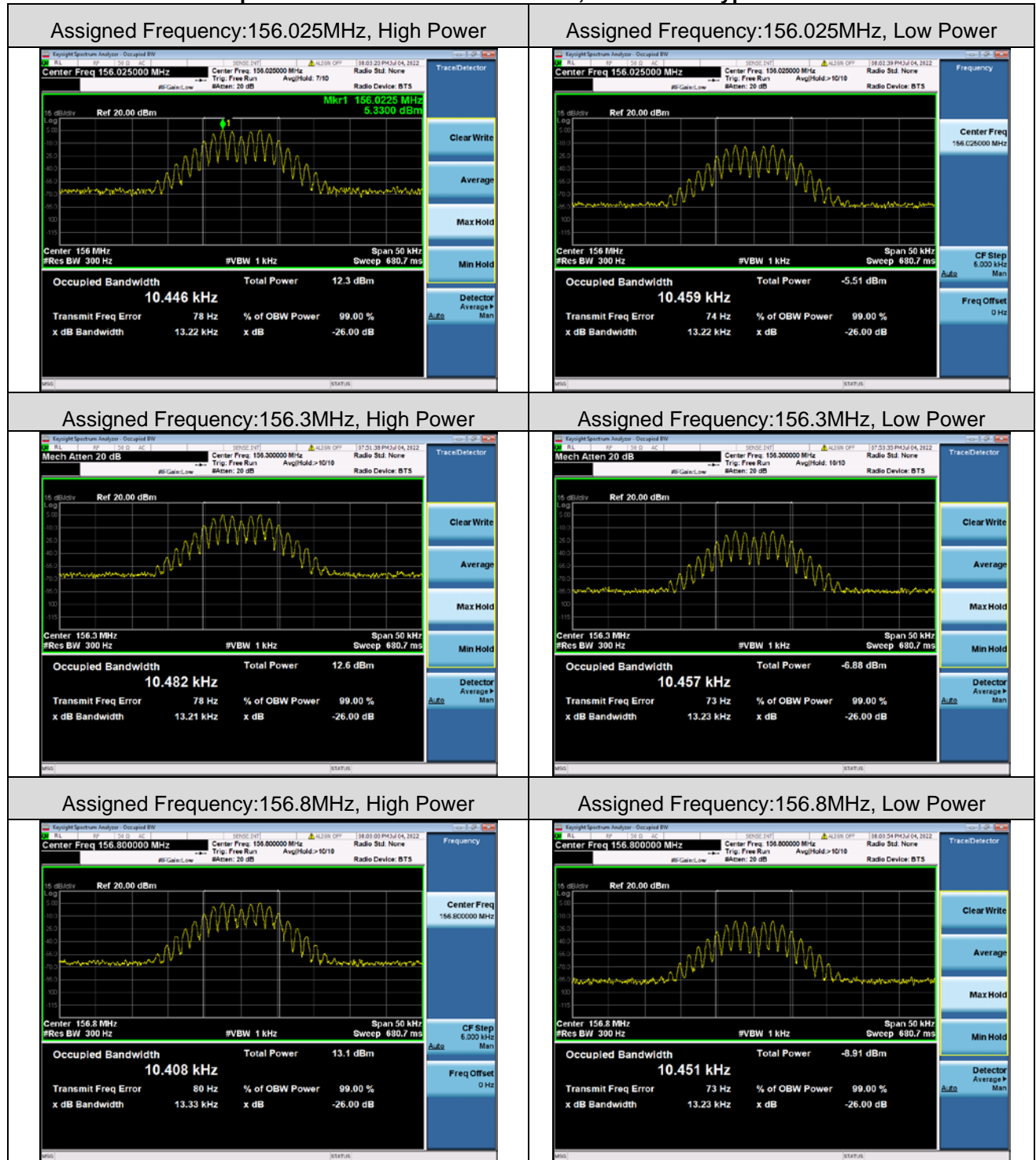


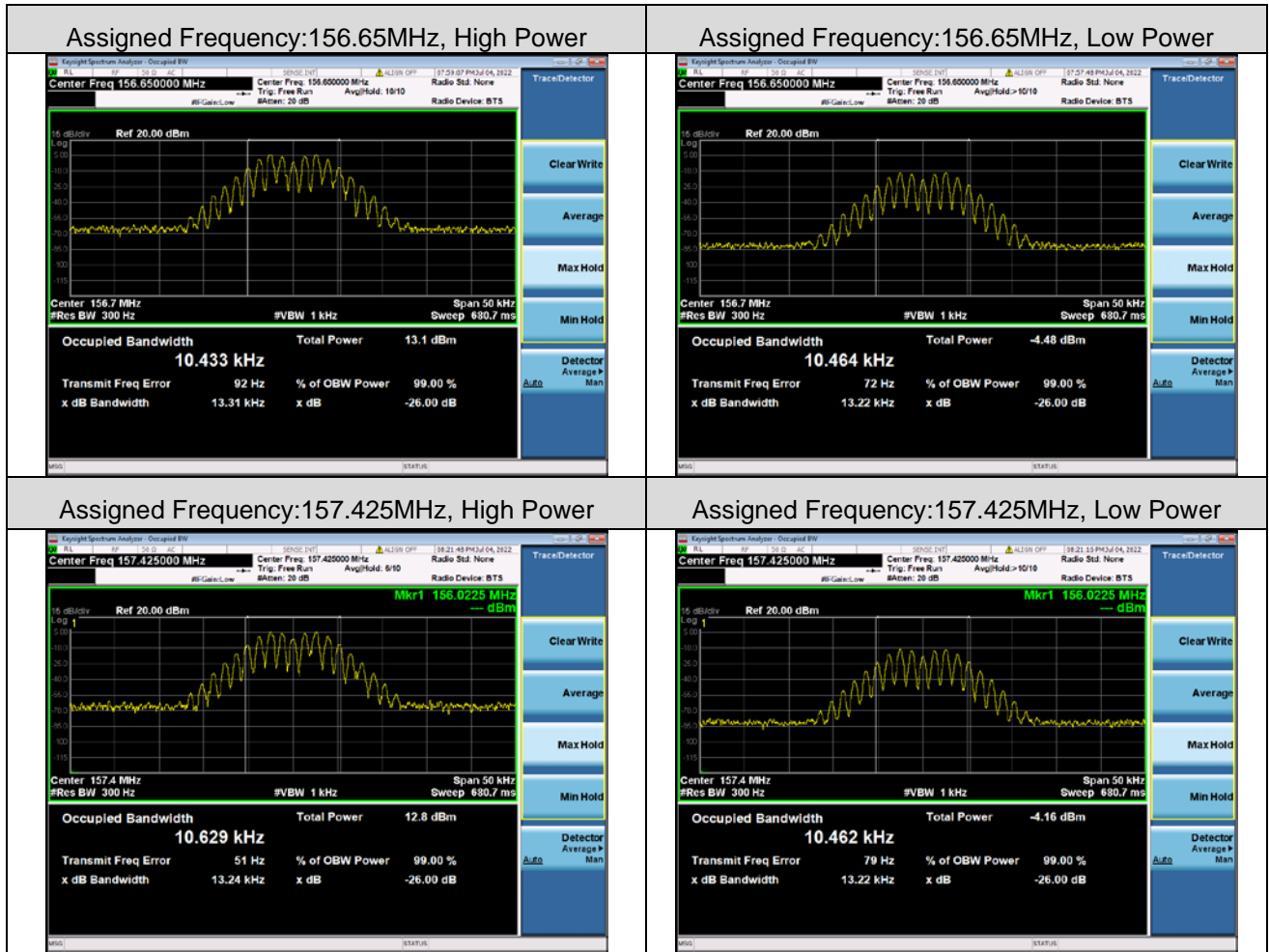
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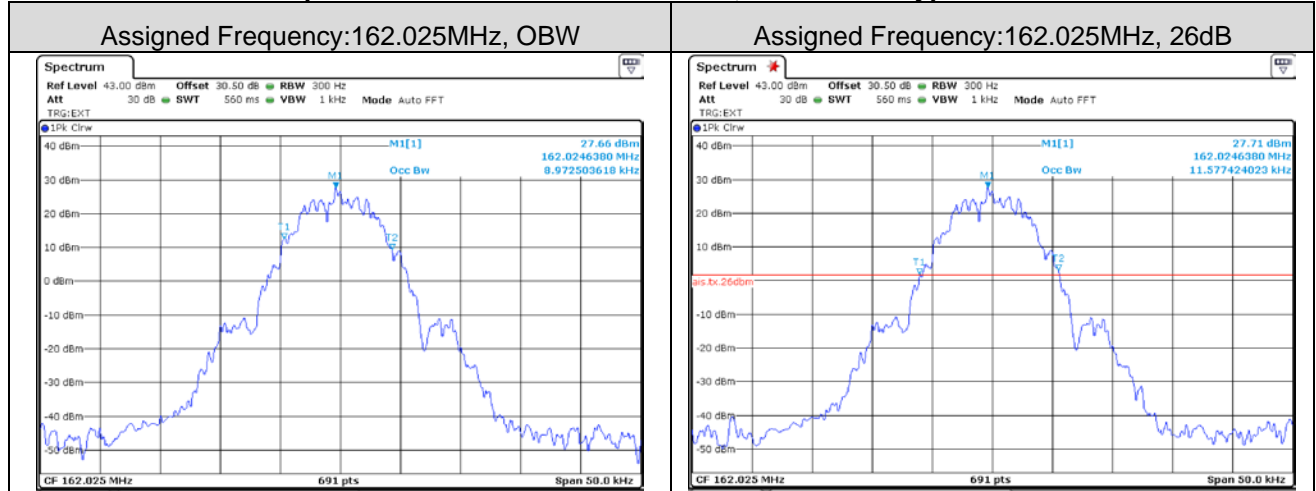
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Test data for 99% Occupied Bandwidth / 26dB Bandwidth, Modulation Type: FM

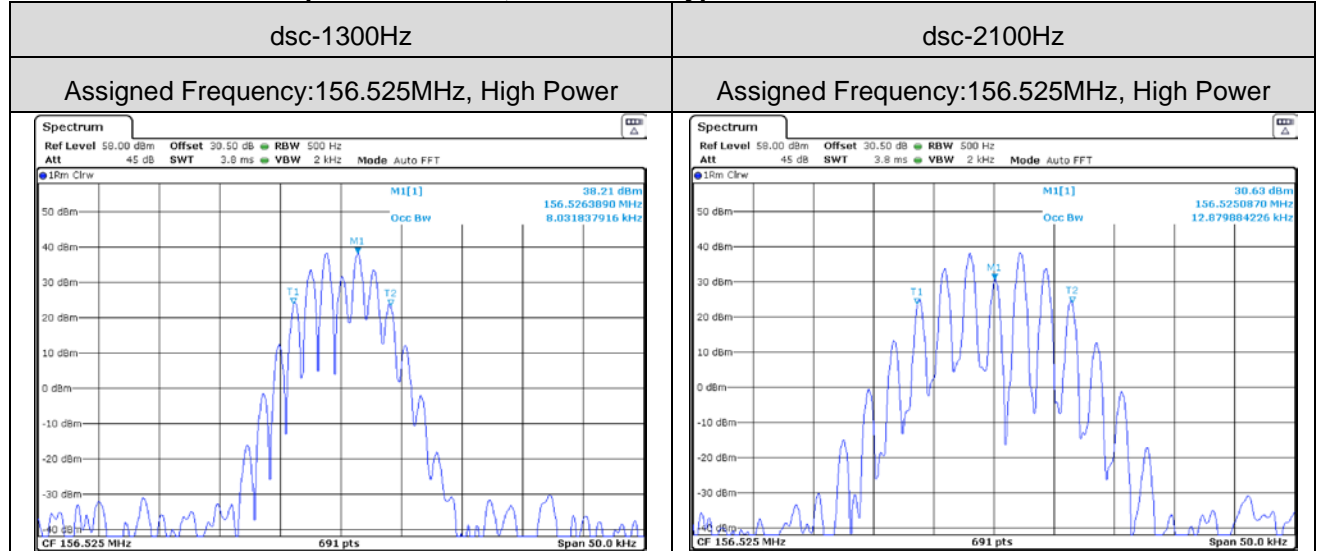




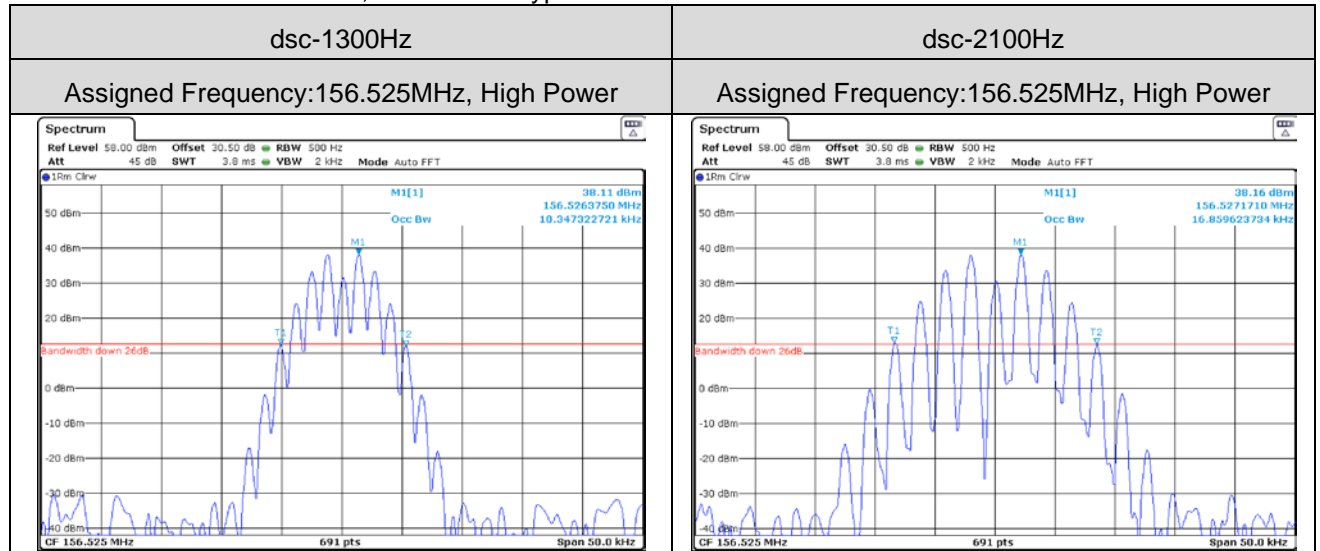
Test data for 99% Occupied Bandwidth / 26dB Bandwidth, Modulation Type: GMSK



Test data for 99% Occupied Bandwidth, Modulation Type: FSK



Test data for 26dB Bandwidth, Modulation Type: FSK



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2. Transmitter Frequency Tolerances.

Unmodulated, Assigned Frequency:156.025MHz					
Voltage(V)	Temperature (°C)	Measured Frequency(MHz)	Frequency Error(ppm)	FCC Limit (ppm)	Result
12	-30	156.025008	-0.0513	±10	Pass
	-20	156.025013	-0.0833		
	-15	156.025024	-0.1538		
	-10	156.025026	-0.1666		
	0	156.025021	-0.1346		
	10	156.025022	-0.1410		
	20	156.025016	-0.1025		
	30	156.025015	-0.0961		
	40	156.025024	-0.1538		
	50	156.025013	-0.0833		
	55	156.025015	-0.0961		
10.2	25	156.025006	-0.0385		
13.8	25	156.025017	-0.1090		

Unmodulated, Assigned Frequency:162.025MHz					
Voltage(V)	Temperature (°C)	Measured Frequency(MHz)	Frequency Error(ppm)	FCC Limit (ppm)	Result
12	-30	162.025019	-0.1173	±10	Pass
	-20	162.025026	-0.1605		
	-15	162.025027	-0.1666		
	-10	162.025016	-0.0988		
	0	162.025024	-0.1481		
	10	162.025017	-0.1049		
	20	162.025012	-0.0741		
	30	162.025023	-0.1420		
	40	162.025009	-0.0555		
	50	162.025044	-0.2716		
	55	162.025032	-0.1975		



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10.2	25	162.025026	-0.1605		
13.8	25	162.025014	-0.0864		

Unmodulated, Assigned Frequency:156.525MHz					
Voltage(V)	Temperature (°C)	Measured Frequency(MHz)	Frequency Error(ppm)	FCC Limit (ppm)	Result
12	-30	156.525022	-0.1406	±10	Pass
	-20	156.525016	-0.1022		
	-15	156.525017	-0.1086		
	-10	156.525023	-0.1469		
	0	156.525004	-0.0256		
	10	156.525027	-0.1725		
	20	156.525015	-0.0958		
	30	156.525036	-0.2300		
	40	156.525027	-0.1725		
	50	156.525016	-0.1022		
	55	156.525015	-0.0958		
10.2	25	156.525009	-0.0575		
13.8	25	156.525024	-0.1533		

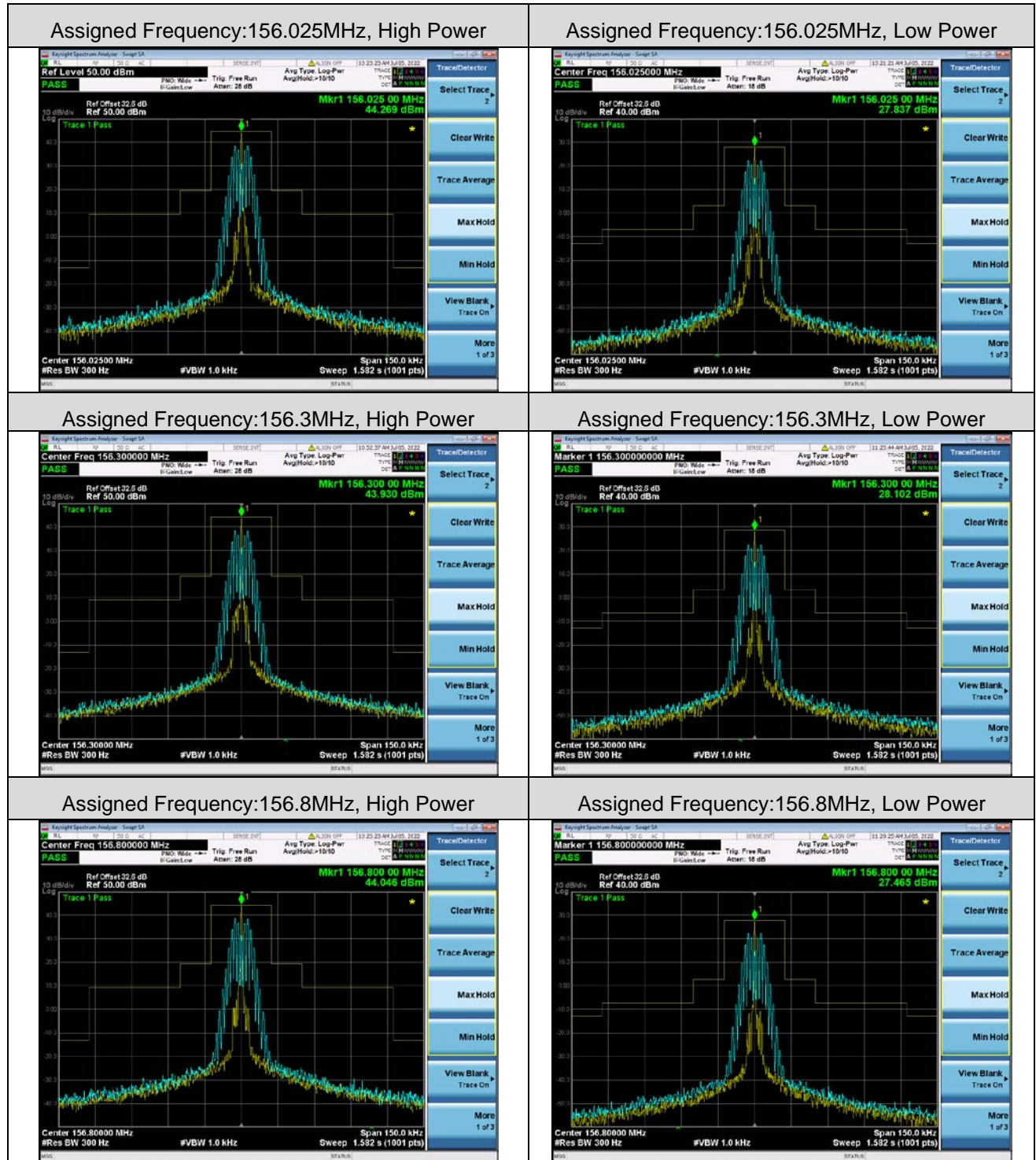


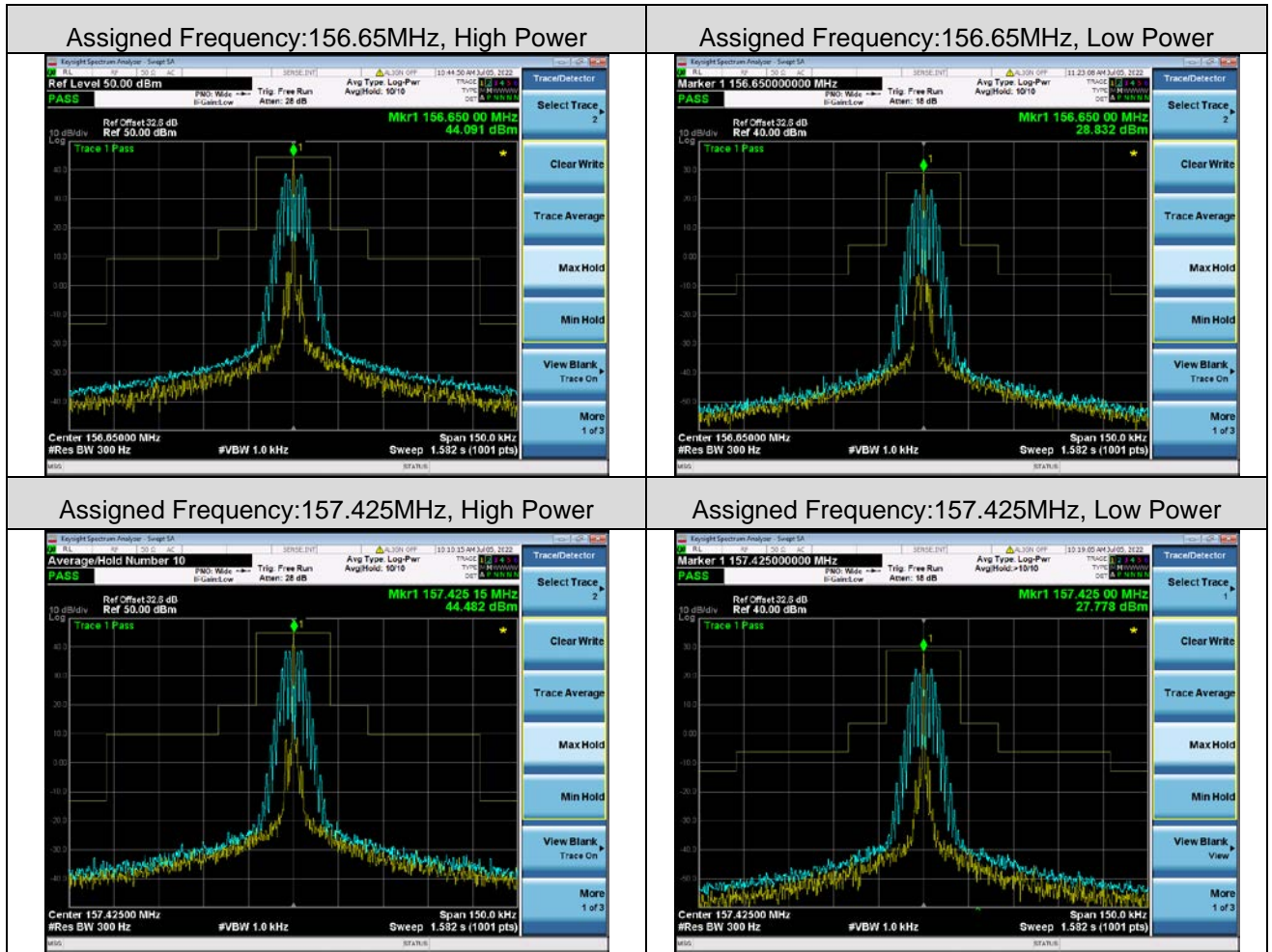
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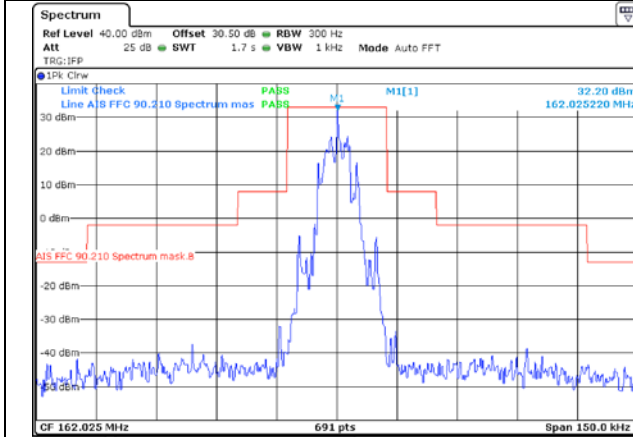
Member of the SGS Group (SGS SA)

3. Emission Mask



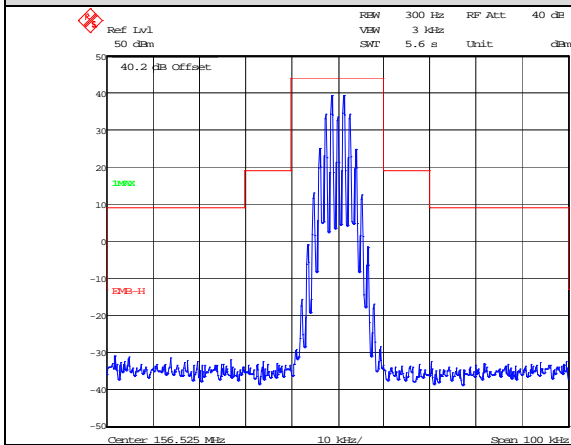


Assigned Frequency:162.025MHz, Low Power



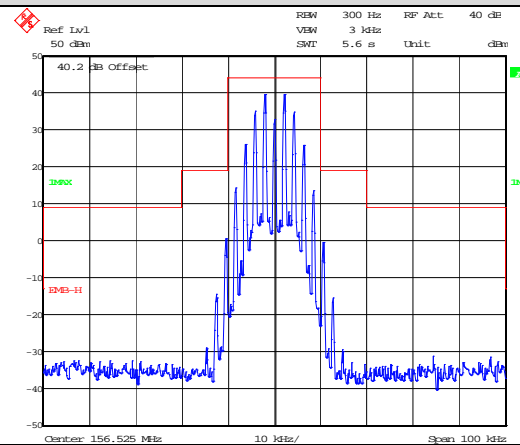
dsc-1300Hz

Assigned Frequency:156.525MHz, High Power



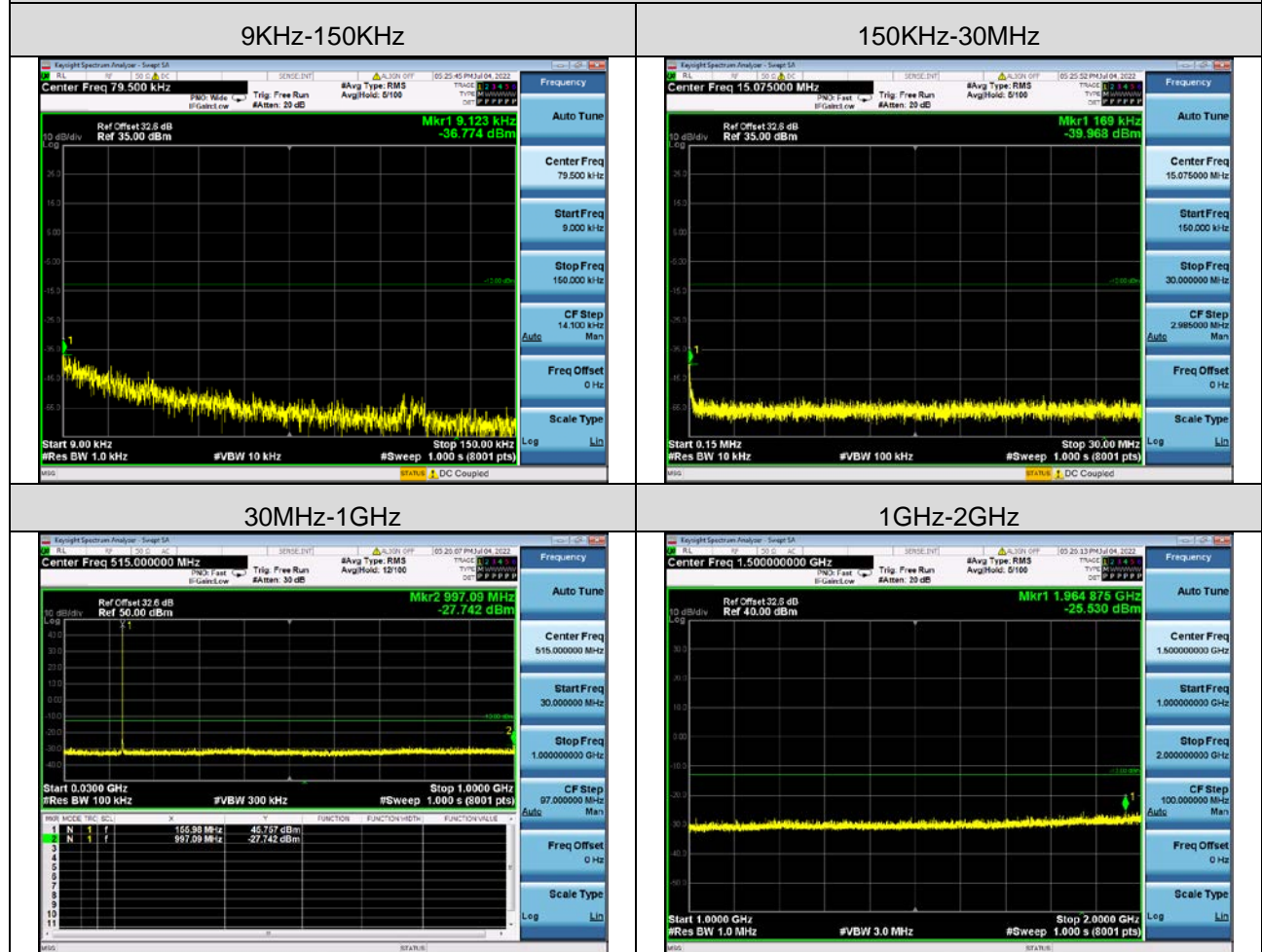
dsc-2100Hz

Assigned Frequency:156.525MHz, High Power



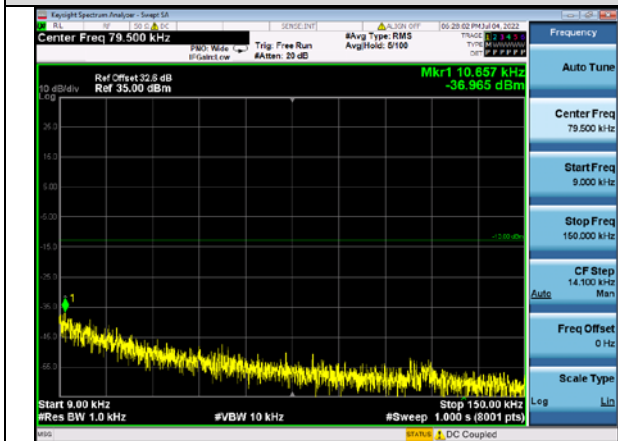
4. Conducted Spurious Emission

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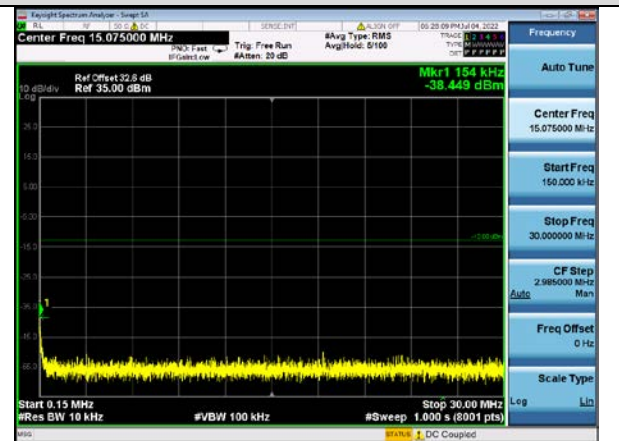


Assigned Frequency: 156.300MHz, High Power, Modulation Type: FM,

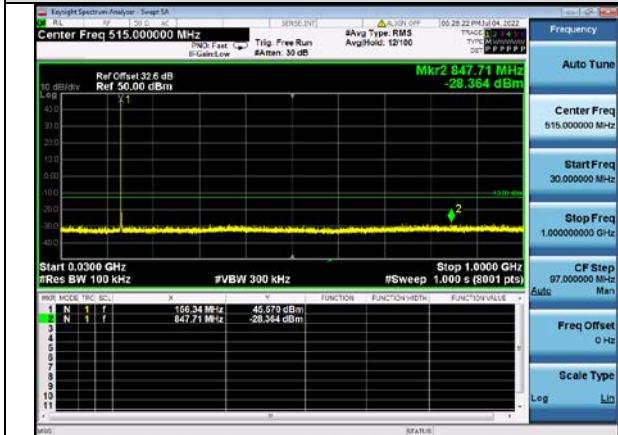
9KHz-150KHz



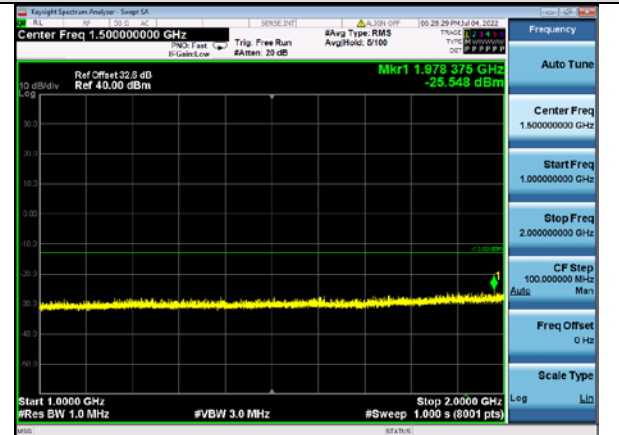
150KHz-30MHz



30MHz-1GHz



1GHz-2GHz

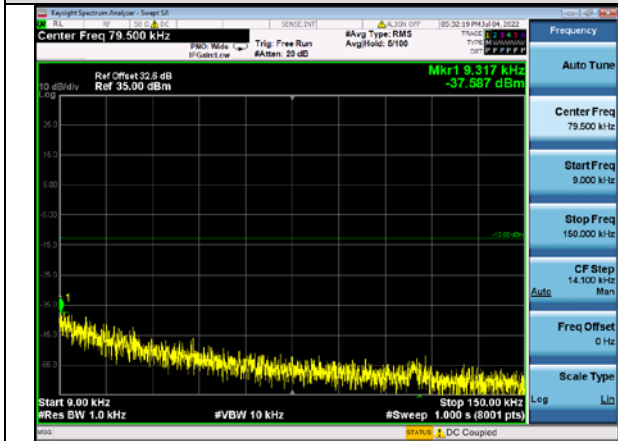


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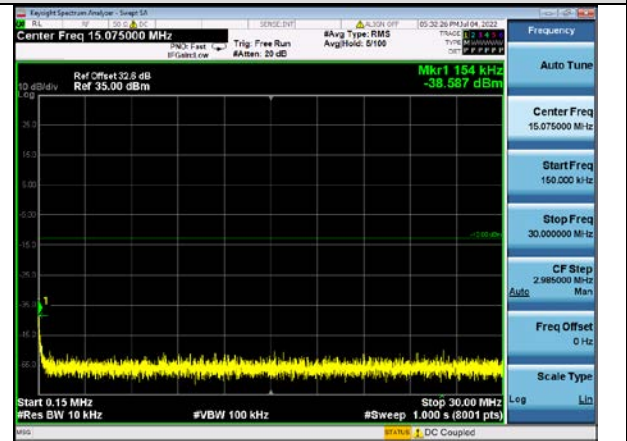
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Assigned Frequency: 156.650MHz, High Power, Modulation Type: FM,

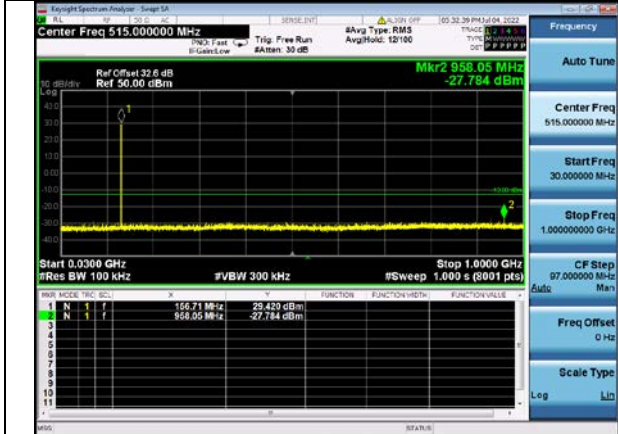
9KHz-150KHz



150KHz-30MHz



30MHz-1GHz

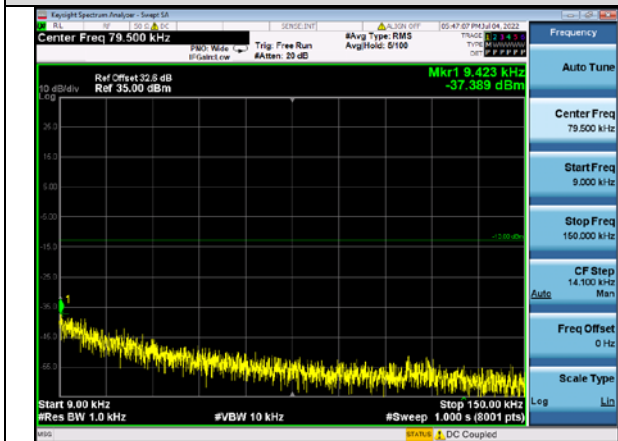


1GHz-2GHz

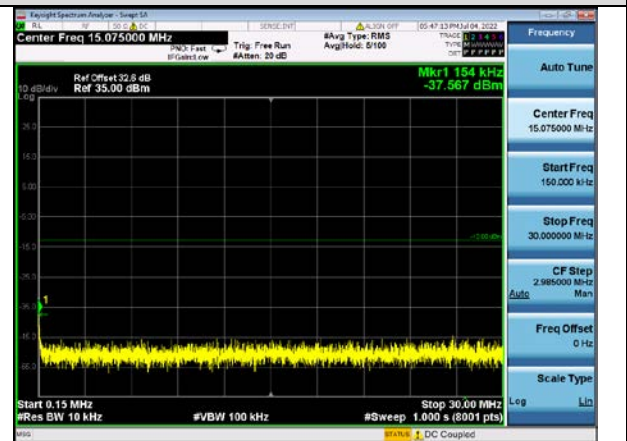


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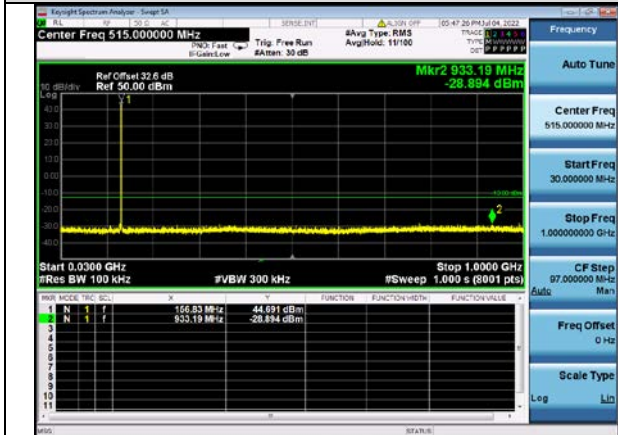
9KHz-150KHz



150KHz-30MHz



30MHz-1GHz



1GHz-2GHz

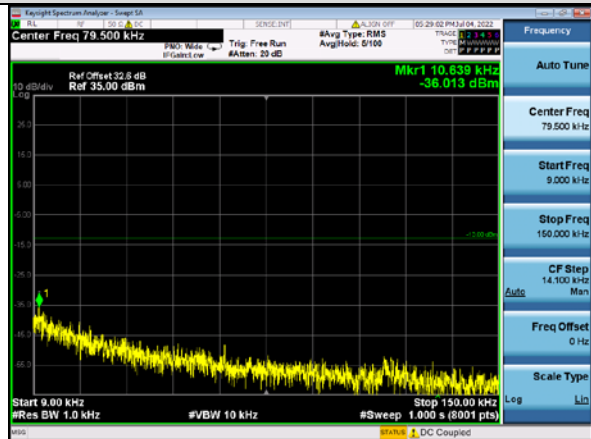


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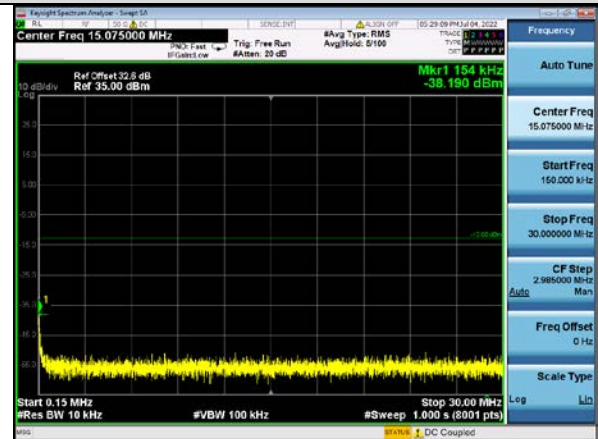
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Assigned Frequency: 157.425MHz, High Power, Modulation Type: FM,

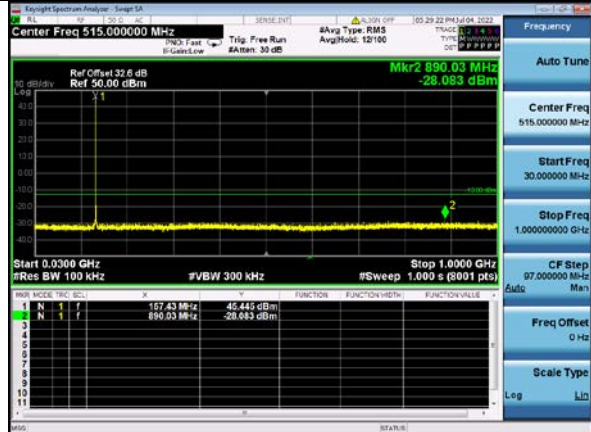
9KHz-150KHz



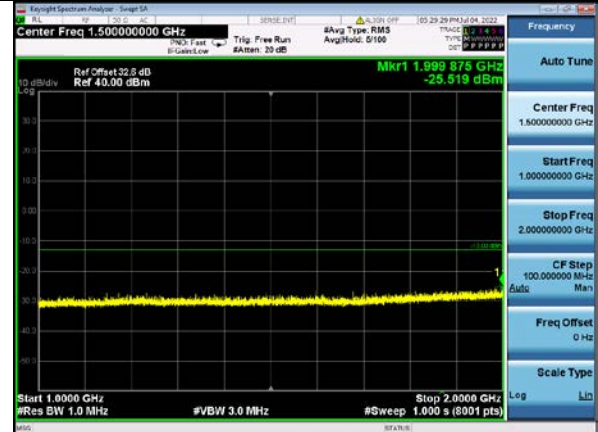
150KHz-30MHz



30MHz-1GHz



1GHz-2GHz



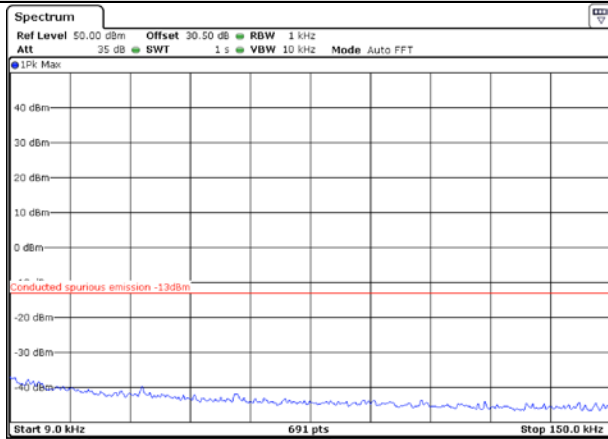
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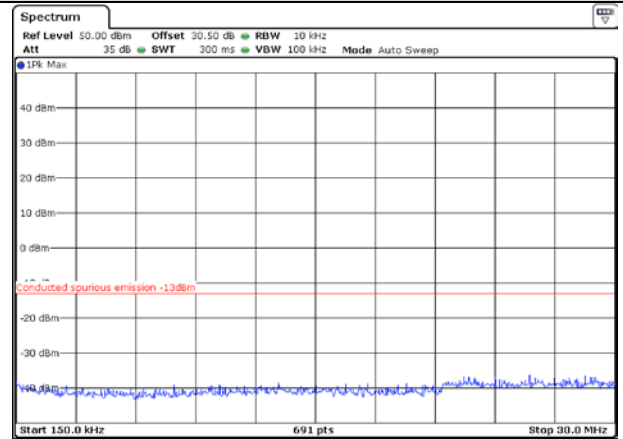
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Assigned Frequency: 162.025MHz, High Power, Modulation Type: GMSK,

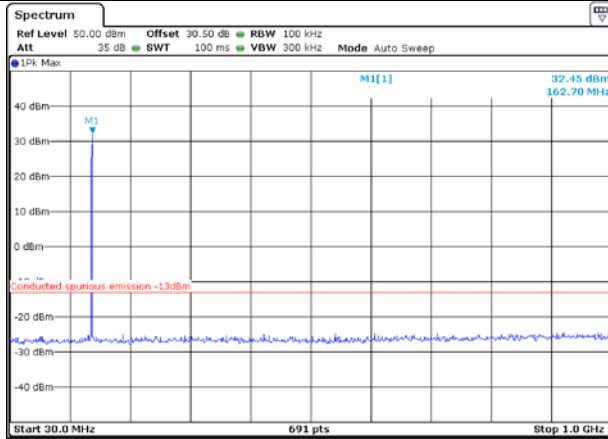
9KHz-150KHz



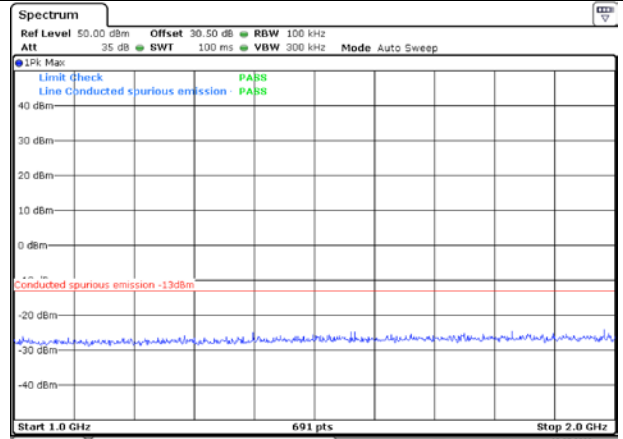
150KHz-30MHz



30MHz-1GHz

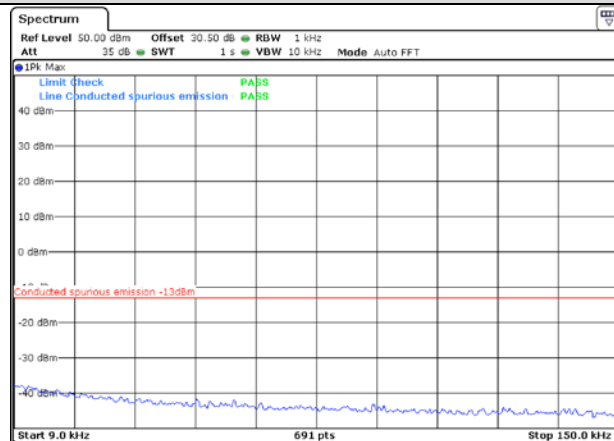


1GHz-2GHz

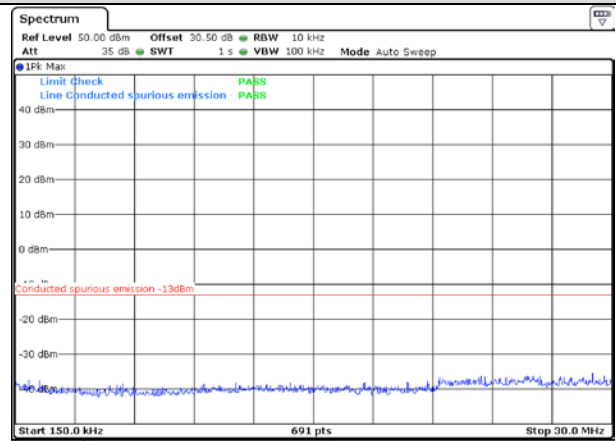


Assigned Frequency: 156.525MHz, High Power, Modulation Type: FSK,

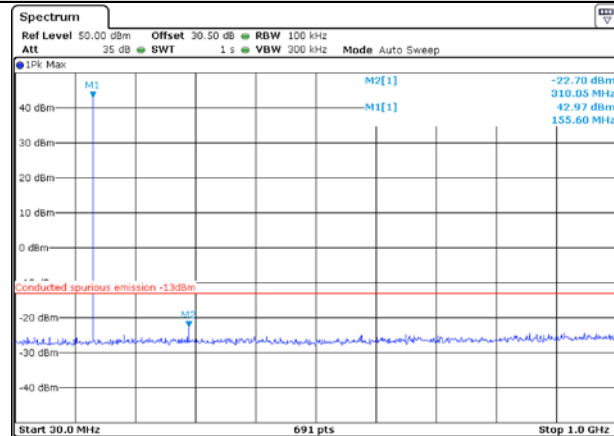
9KHz-150KHz



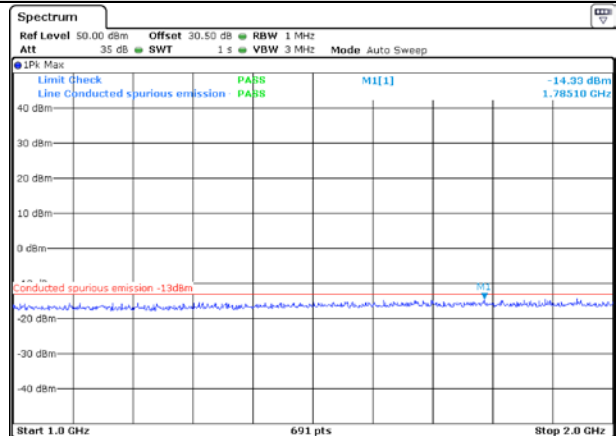
150KHz-30MHz



30MHz-1GHz



1GHz-2GHz



Only record the worst test result.



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Shenzhen Branch

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5. Transmitter Unwanted Emission(Radiated)

Assigned Frequency:156.025MHz, Modulation Type: FM								
Frequency (MHz)	S.G. Power (dBm)	Cable loss (dB)	Antenna Gain(dBi)	EIRP (dBm)	Limit (dBm)	Over Limit(dB)	Polarization (H/V)	Result
1003.472	-56.33	2.64	5.17	-55.95	-13	-42.95	Horizontal	Pass
1314.943	-53.8	2.64	5.17	-53.42	-13	-40.42	Horizontal	Pass
1968.368	-54.93	3.77	7.43	-53.42	-13	-40.42	Horizontal	Pass
1001.387	-56.81	2.64	5.17	-56.43	-13	-43.43	Vertical	Pass
1310.393	-54.39	2.64	5.17	-54.01	-13	-41.01	Vertical	Pass
1853.176	-56.4	3.77	7.43	-54.89	-13	-41.89	Vertical	Pass
Assigned Frequency:161.6MHz, Modulation Type: FM								
Frequency (MHz)	S.G. Power (dBm)	Cable loss (dB)	Antenna Gain(dBi)	EIRP (dBm)	Limit (dBm)	Over Limit(dB)	Polarization (H/V)	Result
1002.776	-56.15	2.64	5.17	-55.77	-13	-42.77	Horizontal	Pass
1310.393	-53.66	2.64	5.17	-53.28	-13	-40.28	Horizontal	Pass
1910.566	-56.09	3.77	7.43	-54.58	-13	-41.58	Horizontal	Pass
1005.561	-57.46	2.64	5.17	-57.08	-13	-44.08	Vertical	Pass
1517.819	-59.1	3.77	7.43	-57.59	-13	-44.59	Vertical	Pass
1994.463	-56.7	3.77	7.43	-55.19	-13	-42.19	Vertical	Pass
Assigned Frequency:156.525MHz, Modulation Type: FSK								
Frequency (MHz)	S.G. Power (dBm)	Cable loss (dB)	Antenna Gain(dBi)	EIRP (dBm)	Limit (dBm)	Over Limit(dB)	Polarization (H/V)	Result
1003.472	-56.3	2.64	5.17	-55.92	-13	-42.92	Horizontal	Pass
1398.616	-56.33	2.64	5.17	-55.95	-13	-42.95	Horizontal	Pass
1988.94	-56.32	3.77	7.43	-54.81	-13	-41.81	Horizontal	Pass
1002.776	-57.3	2.64	5.17	-56.92	-13	-43.92	Vertical	Pass
1373.636	-55.07	2.64	5.17	-54.69	-13	-41.69	Vertical	Pass
1863.481	-56.45	3.77	7.43	-54.94	-13	-41.94	Vertical	Pass

Note: All modes and modulation have been tested worst test result, All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit, Only record the worst test result.



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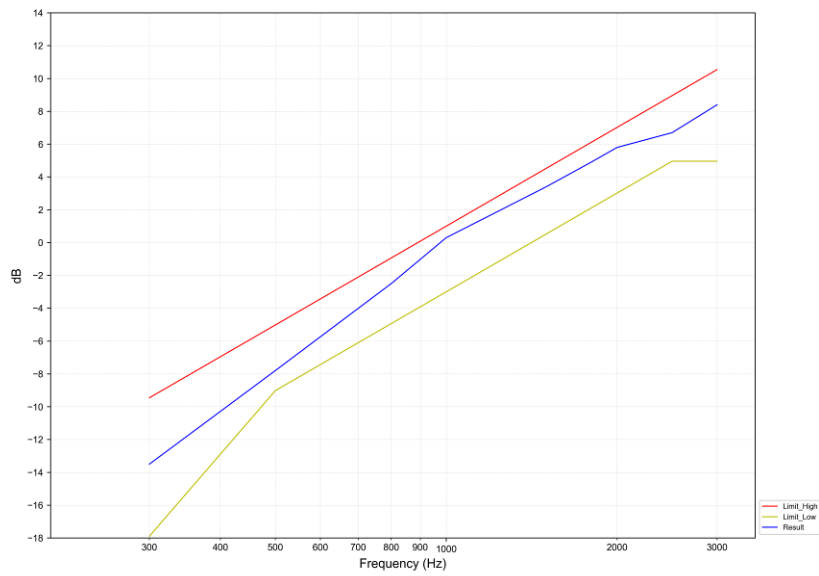
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6. Modulation Characteristics

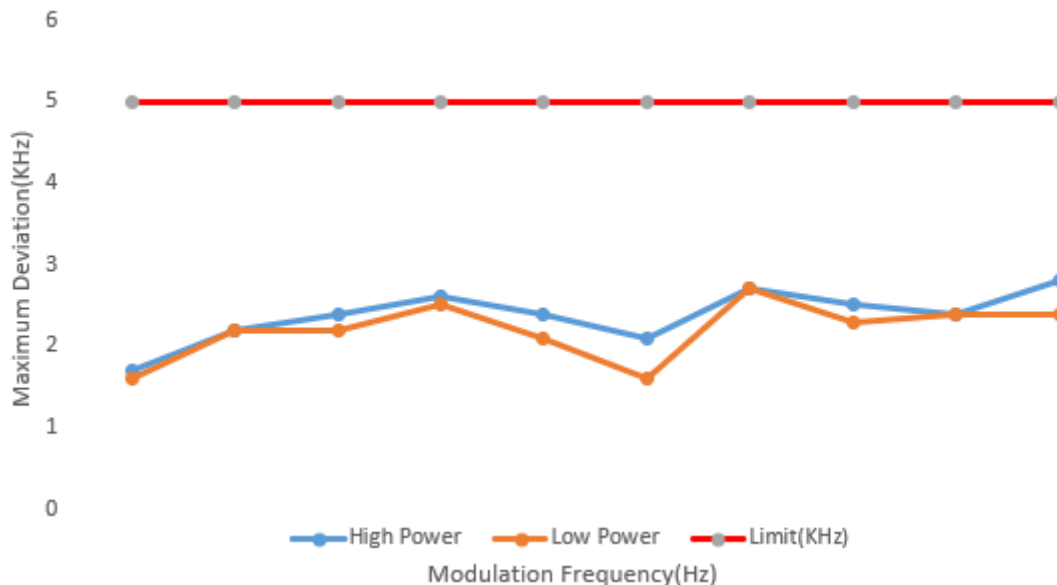
Test Frequency (MHz)	Modulation Frequency (Hz)	Upper Limit	Lower Limit	Modulation Index(dB) Relative. To 1KHz	Verdict
156.025	300	-9.5	-13.5	-12.52	Pass
	500	-5	-9	-7.76	Pass
	800	-0.9	-4.9	-2.55	Pass
	1000	1	-3	0.32	Pass
	1500	4.5	0.5	+3.35	Pass
	1800	6.1	2.1	+4.85	Pass
	2000	7	3	+5.80	Pass
	2500	9	5	+6.71	Pass
	3000	10.5	6.5	+8.33	Pass
156.525	300	-9.5	-13.5	-12.05	Pass
	500	-5	-9	-7.66	Pass
	800	-0.9	-4.9	-2.38	Pass
	1000	1	-3	0.72	Pass
	1500	4.5	0.5	+3.53	Pass
	1800	6.1	2.1	+4.88	Pass
	2000	7	3	+5.75	Pass
	2500	9	5	+8.13	Pass
	3000	10.5	6.5	+9.34	Pass

Test Frequency (MHz)	Modulation Frequency (Hz)	Input level	Maximum Deviation(KHz)		Limit (KHz)	Verdict
			High Power	Low Power		
156.025	100	20dB 3KHz	1.7	1.6	≤5.0	Pass
	200	20dB 3KHz	2.2	2.2	≤5.0	Pass
	300	20dB 3KHz	2.4	2.2	≤5.0	Pass
	400	20dB 3KHz	2.6	2.5	≤5.0	Pass
	500	20dB 3KHz	2.4	2.1	≤5.0	Pass
	1000	20dB 3KHz	2.1	1.6	≤5.0	Pass
	1500	20dB 3KHz	2.7	2.7	≤5.0	Pass
	2000	20dB 3KHz	2.5	2.3	≤5.0	Pass
	2500	20dB 3KHz	2.4	2.4	≤5.0	Pass
	3000	20dB 3KHz	2.8	2.4	≤5.0	Pass
156.525	100	20dB 3KHz	1.5	1.5	≤5.0	Pass
	200	20dB 3KHz	2.3	2.1	≤5.0	Pass
	300	20dB 3KHz	2.5	2.2	≤5.0	Pass
	400	20dB 3KHz	2.2	1.6	≤5.0	Pass
	500	20dB 3KHz	2.3	1.9	≤5.0	Pass
	1000	20dB 3KHz	2.6	2.3	≤5.0	Pass
	1500	20dB 3KHz	2.5	2.5	≤5.0	Pass
	2000	20dB 3KHz	2.1	1.4	≤5.0	Pass
	2500	20dB 3KHz	2.4	2.4	≤5.0	Pass
	3000	20dB 3KHz	2.7	2.6	≤5.0	Pass

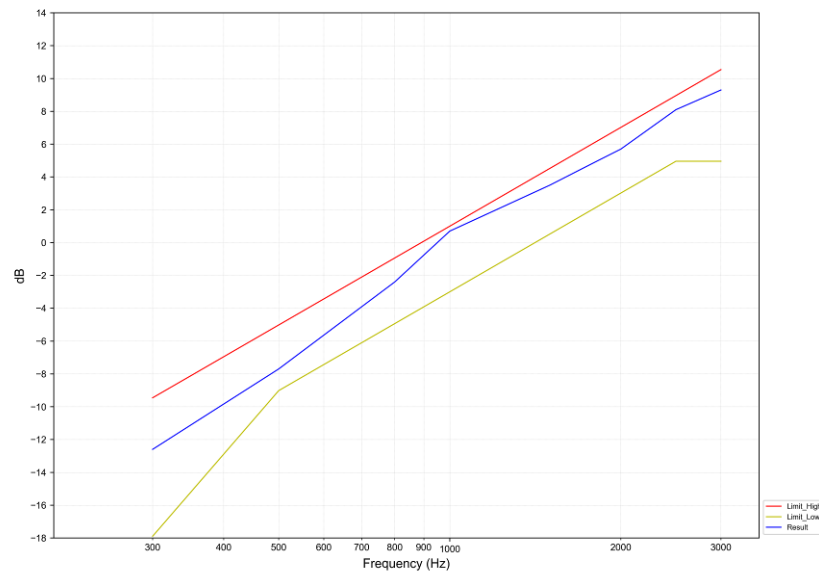
Assigned Frequency: 156.025MHz, High Power, Modulation Type: FM



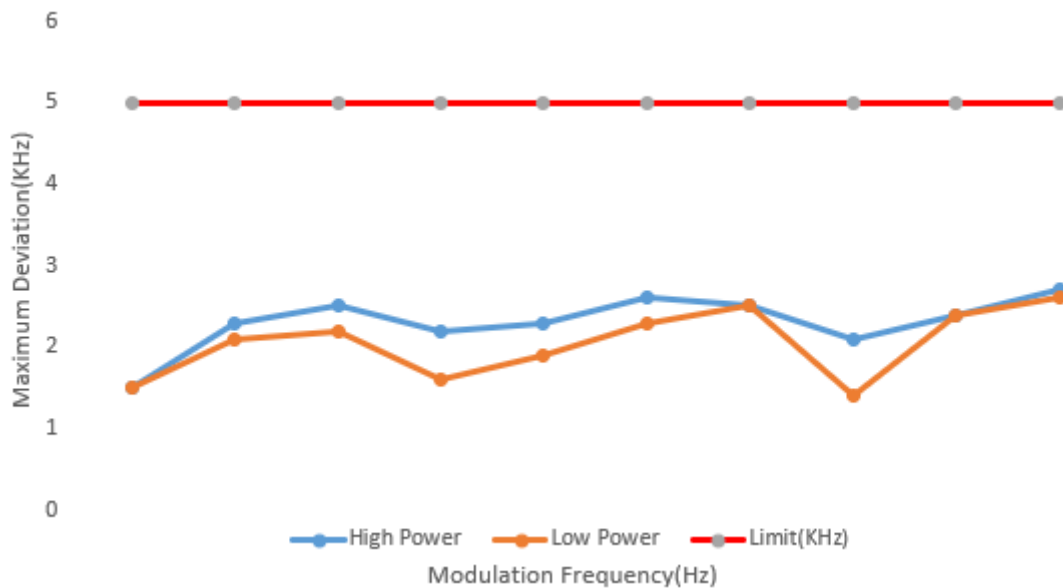
Assigned Frequency: 156.025MHz, High Power, Modulation Type: FM



Assigned Frequency:156.525MHz, Modulation Type: FSK

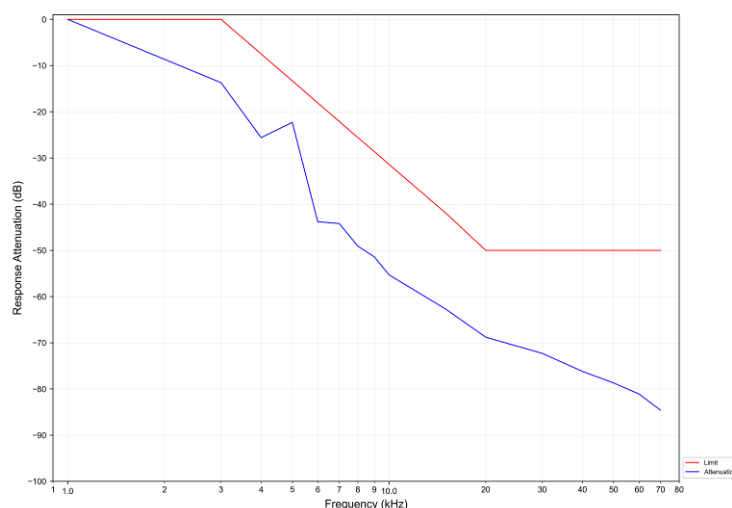


Assigned Frequency:156.525MHz, Modulation Type: FSK



Low Pass Filter Response

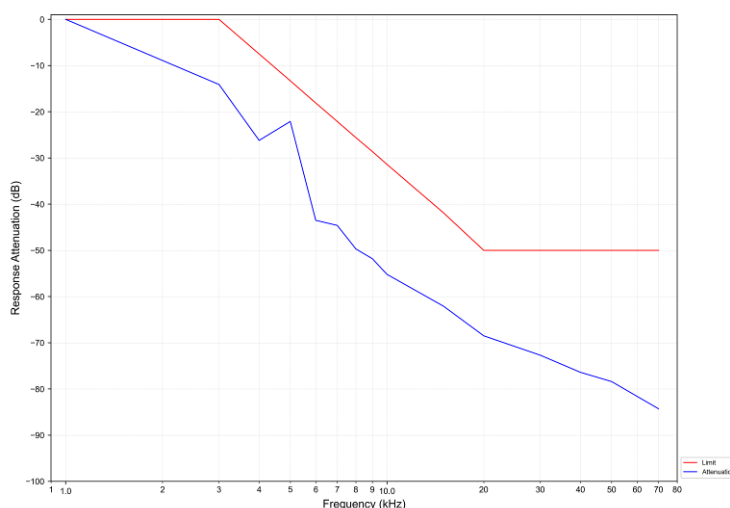
Assigned Frequency:156.025MHz, High Power, Modulation Type: FM		
Audio Frequency(KHz)	ResponseAttenuation(dB)	Limit (dB)
1	0	/
3	-13.9	0
4	-25.5	-7.5
5	-22.5	-13.3
6	-43.6	-18.1
7	-44.0	-22.1
8	-49.0	-25.6
9	-51.5	-28.6
10	-55.5	-31.4
15	-62.6	-41.9
20	-68.5	-50.0
30	-72.5	-50.0
40	-76.0	-50.0
50	-78.6	-50.0
60	-81.0	-50.0
70	-84.5	-50.0



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Assigned Frequency:156.525MHz, High Power, Modulation Type: FSK		
Audio Frequency(KHz)	ResponseAttenuation(dB)	Limit (dB)
1	0	/
3	-14.0	0
4	-26.0	-7.5
5	-22.3	-13.3
6	-43.3	-18.1
7	-44.3	-22.1
8	-49.5	-25.6
9	-51.7	-28.6
10	-55.1	-31.4
15	-62.3	-41.9
20	-68.2	-50.0
30	-72.5	-50.0
40	-76.5	-50.0
50	-78.5	-50.0
60	-81.5	-50.0
70	-84.5	-50.0



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7. Transmitter Power

Test Voltage (V Dc)	Test Frequency (MHz)	Power Level	Output Power(dBm)	Output Power(W)	Limit
12	156.025	Max	43.84	24.21	25W
		Low	29.33	0.86	1W
	156.300	Max	43.82	24.10	25W
		Low	29.16	0.82	1W
	156.650	Max	43.79	23.93	25W
		Low	29.07	0.81	1W
	156.800	Max	43.73	23.60	25W
		Low	29.24	0.84	1W
	157.425	Max	43.83	24.15	25W
		Low	29.25	0.84	1W
	156.525	Max	43.86	24.32	25W
	162.025	/	32.37	1.73	See Note
			ERP:38.37	ERP:6.87	See Note

Note:

- 1). The high power is 25W, the low power is 1W for VHF/DSC, and the nominal power of AIS is 2W that declared by manufacturer.
- 2). The transmitter output power not exceeding 25 watts and an ERP not exceeding 18 watts.
- 2). $ERP = EIRP - 2.15$, $EIRP = \text{Conducted Power} + \text{Antenna Gain(dBi)}$.



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8. Transmitter Carrier Power Reduction

Test Voltage (V Dc)	Test Frequency (MHz)	Power Level	Default Power (W)	Limit	Result
12	156.375	Low	0.78	one watt or less	Pass
	156.650	Low	0.82	one watt or less	Pass
	156.775	Low	0.81	one watt or less	Pass
	156.825	Low	0.85	one watt or less	Pass
	156.850	Low	0.82	one watt or less	Pass
	156.875	Low	0.77	one watt or less	Pass
	156.525	Low	0.79	one watt or less	Pass

Note:

- 1).All transmitters units must be capable of reducing the carrier power to one watt or less;
- 2).All transmitters must automatically reduce the carrier power to one watt or less when transmitting on 156.375 MHz or 156.650 MHz, and must be provided with a manual override switch which when held by an operator will permit full carrier power operation on 156.375 MHz and 156.650 MHz;
- 3).All transmitters must be capable of tuning to 156.775MHz and 156.825MHz and must automatically reduce the carrier power to one watt or less, with no manual override capability, when the transmitter is tuned to either 156.775MHz or 156.825MHz;

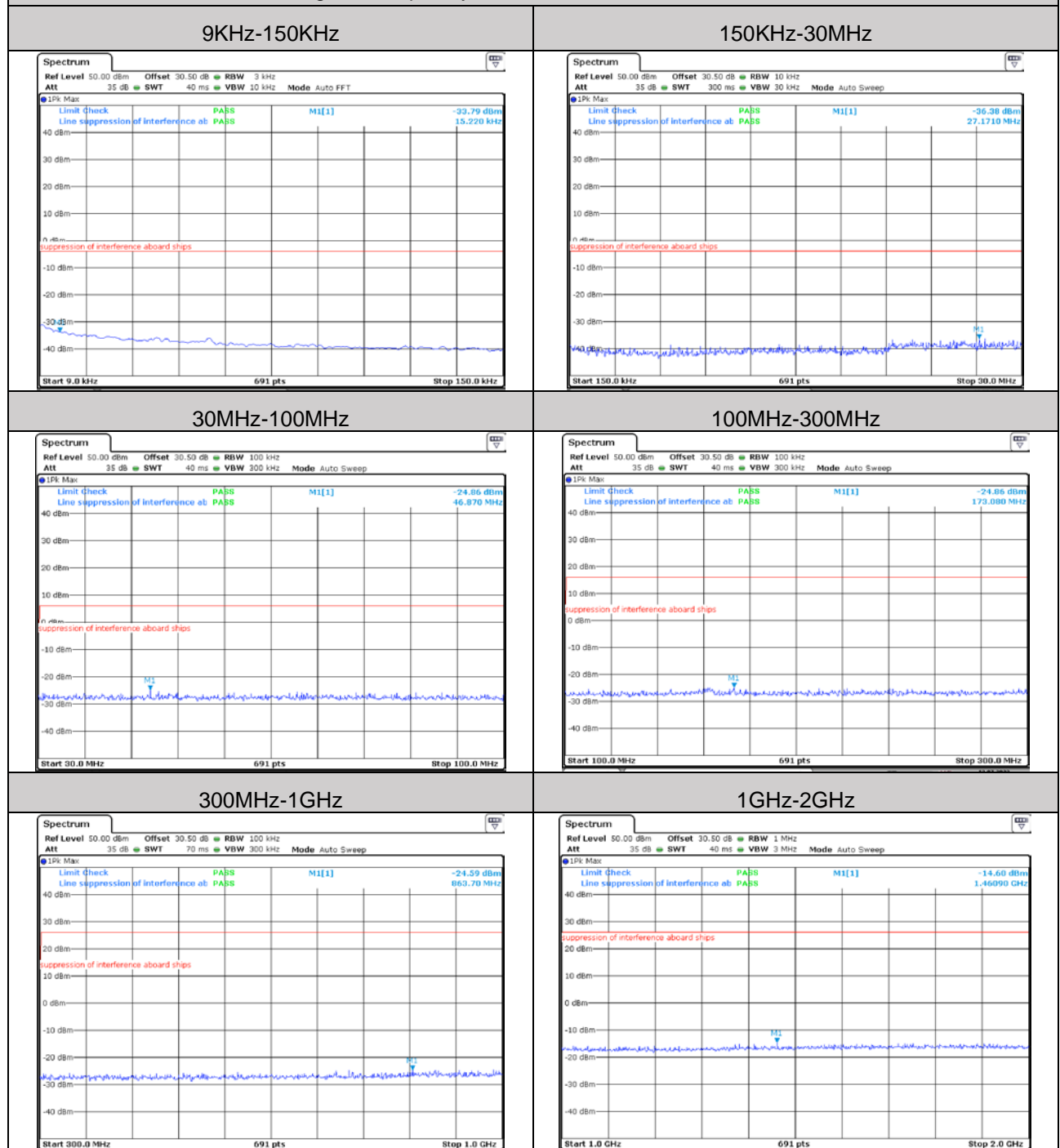


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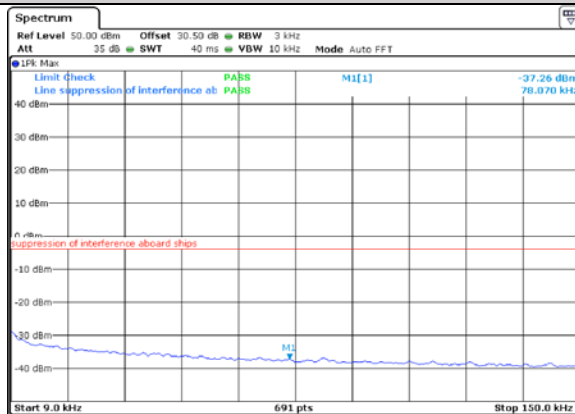
9. Suppression of interference aboard ships

Assigned Frequency: 161.975MHz, AIS receiver mode

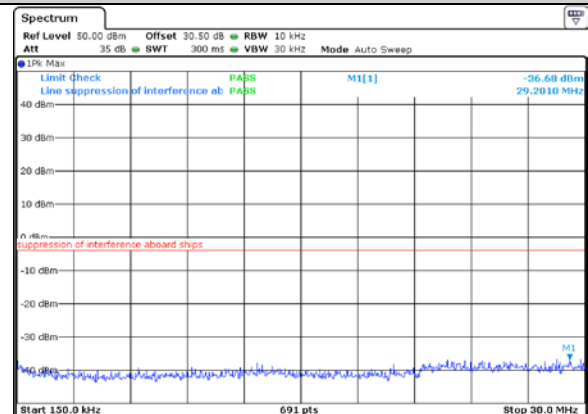


Assigned Frequency: 162.025MHz, AIS receiver mode

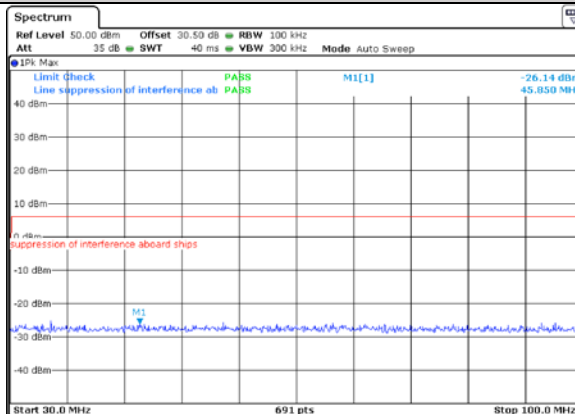
9KHz-150KHz



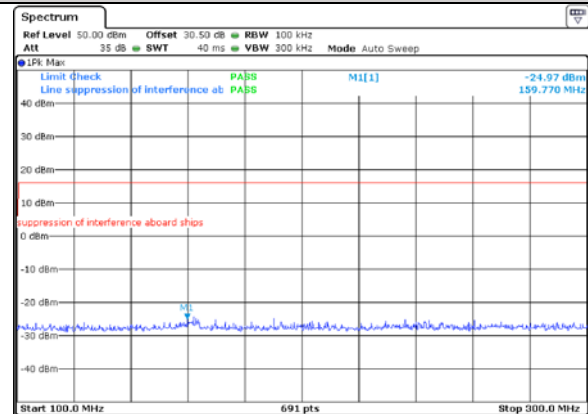
150KHz-30MHz



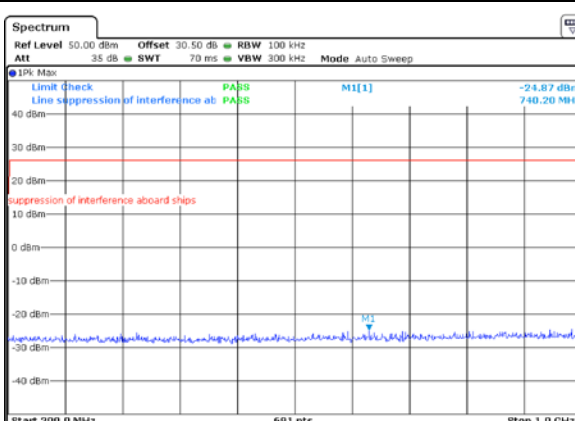
30MHz-100MHz



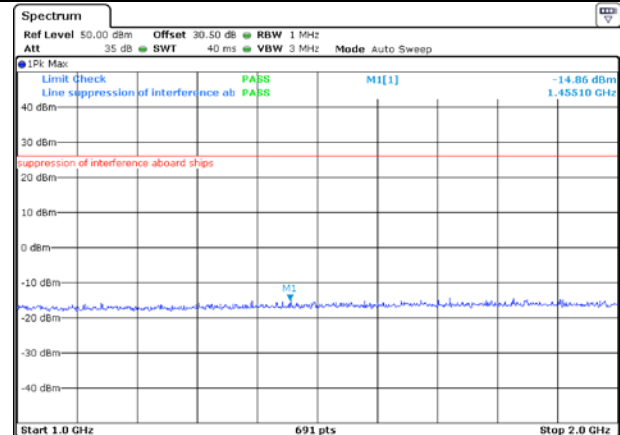
100MHz-300MHz



300MHz-1GHz



1GHz-2GHz

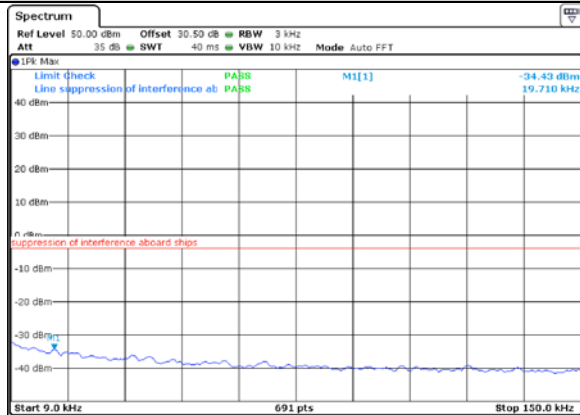


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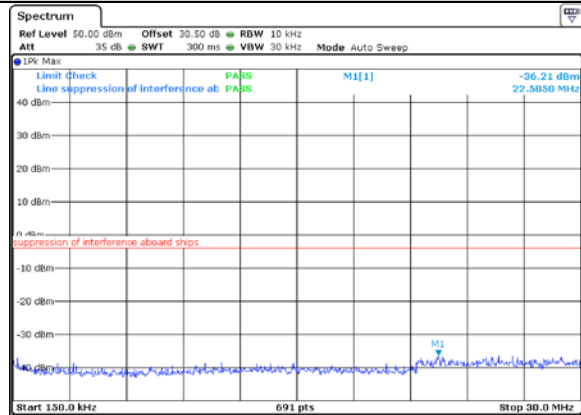
Fuyong lab, Xinlong TechnoPark, Fengtang Road, Fuyong Subdistrict, Bao'an, Shenzhen, China 518103 t (86-755) 88663988 f (86-755) 26710594 www.sgs.com.cn
中国·深圳·宝安区福永街道凤塘大道鑫龙科技园福永实验室 邮编: 518103 t (86-755) 88663988 f (86-755) 26710594 sgs.china@sgs.com

Assigned Frequency: 156.525MHz, DSC receiver mode

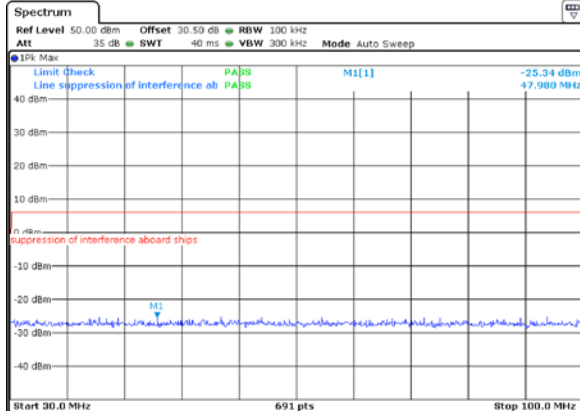
9KHz-150KHz



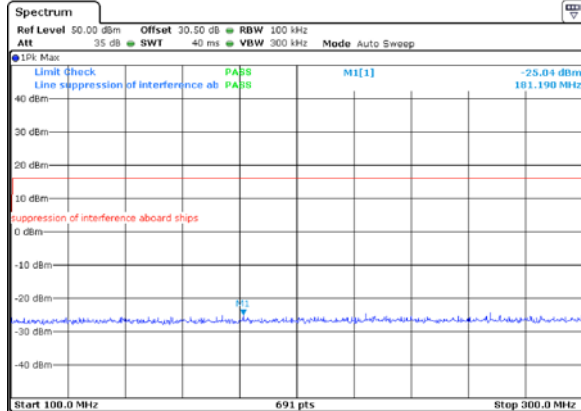
150KHz-30MHz



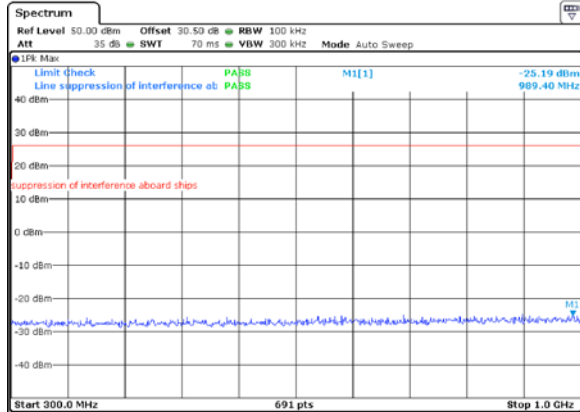
30MHz-100MHz



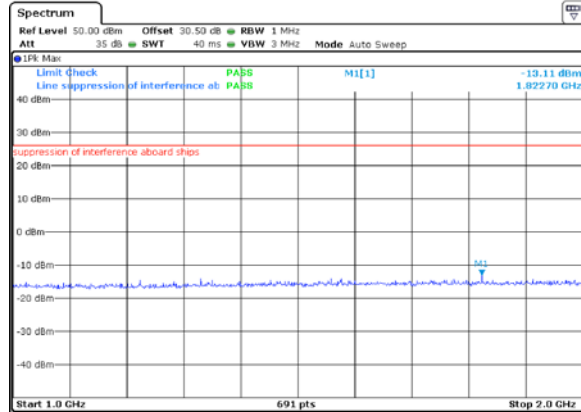
100MHz-300MHz



300MHz-1GHz



1GHz-2GHz



Only record the worst test result.

-End of Report-



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