NVLAP LAB CODE 600341-0

TEST REPORT

Applicant:	**Kirisun Communication Co., Ltd.**
Address:	**3rd Floor, Building A, Tongfang Information Habour, No.11 Langshan Road Nanshan District, Shenzhen 518057 China**
Product Name:	**DMR Two Way Radio**
FCC ID:	**Q5EDP68502**
Standard(s):	**47 CFR Part 2 47 CFR Part 90 ANSI C63.26-2015 ANSI/TIA 603-E-2016**
Report Number:	**2402S45679-RF-00A**
Report Date:	**2024/5/20**

The above device has been tested and found compliant with the requirement of the relative standards by Bay Area Compliance Laboratories Corp. (Dongguan).

Reviewed By: Gavin Xu
Title: RF Engineer

Approved By: Ivan Cao
Title: EMC Manager

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CONTENTS

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
1.0	2402S45679-RF-00A	Original Report	2024/5/20

1. GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

EUT Name:	DMR Two Way Radio
EUT Model:	DP685
Operation Frequency:	400-470 MHz
Modulation Type:	FM, 4FSK
Channel Spacing:	12.5 kHz
Rated Output Power: (Conducted)	High Power Level: 4W Low Power Level: 1W
Rated Input Voltage:	DC 7.4V from battery or DC 12V from Charger
Serial Number:	2JLO-2
EUT Received Date:	2024/4/9
EUT Received Status:	Good

1.2 Accessory Information

Accessory Description	Manufacturer	Model	Parameters
Adapter	SHENZHEN TIANYIN ELECTRONICS CO.,LTD.	TPQ-236A120100UW01	Input: 100-240Vac 50/60Hz 0.4A Output: 12Vdc 1A
Charger	Kirisun Communication Co., Ltd.	Unknown	Input: 12Vdc 1A OUtput: 12Vdc 1A

1.3 Antenna Information Detail▲

Antenna Manufacturer	Antenna Type	input impedance (Ohm)	Frequency Range	Antenna Gain
Kirisun Communication Co., Ltd.	Helical	50	400-470MHz	0 dBi

1.4 Equipment Modifications

No modifications are made to the EUT during all test items.

3. SUMMARY OF TEST RESULTS

Standard/Rule(s)	Description of Test	Results
§2.1055; §90.213	Transmitter Frequency Stability	Compliant
§2.1046; §90.205	Transmitter Output Power	Compliant
§2.1049; §90.209; §90.210	Occupied Bandwidth & Emission Mask	Compliant
§2.1051;§90.210	Transmitter Unwanted Emissions at Antenna Terminal	Compliant
§2.1053;§90.210	Transmitter Unwanted Emissions-Radiated	Compliant
§90.214	Transient Frequency Behavior	Compliant
§2.1047	Modulation Characteristic	Compliant

3. DESCRIPTION OF TEST CONFIGURATION

3.1 Test Frequency Detail

Per C63.26-2015, section 5.1, the lowest frequency, middle frequency, and highest frequency was performed the test as below:

Modulation/ Channel Bandwidth	Test Channel	Frequency (MHz)	Rule Part
FM 12.5kHz	Lowest	400.0125	For Federal
	Middle	453.2125	For Part 90
	Highest	469.9875	For Part 90
4FSK 12.5kHz	Lowest	400.0125	For Federal
	Middle	453.2125	For Part 90
	Highest	469.9875	For Part 90

3.2 EUT Operation Condition

The system was configured for testing in Engineering Mode, which was provided by the manufacturer.

3.3 EUT Exercise Software

No software was used during test.

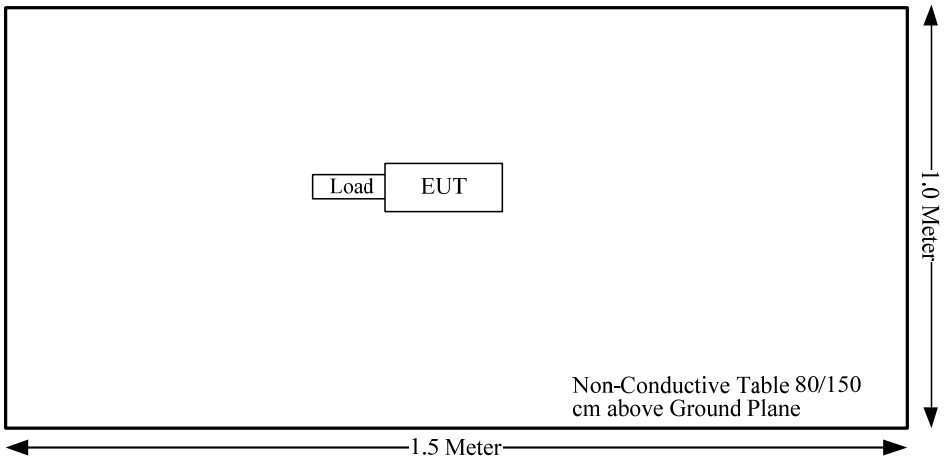
3.4 Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Fenfei	Load	N-J-2W	S1

3.5 Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
/	/	/	/	/	/

3.6 Block Diagram of Test Setup



3.7 Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.12, Pulong East 1st Road, Tangxia Town, Dongguan, Guangdong, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 829273, the FCC Designation No. : CN5044.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0022.

3.8 Measurement Uncertainty

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

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.61dB
RF Frequency	0.082×10^{-6}
Unwanted Emissions, radiated	±3.62 dB
Unwanted Emissions, conducted	±2.47 dB
Temperature	±1℃
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%

4. REQUIREMENTS AND TEST PROCEDURES

4.1 Transmitter Frequency Stability

4.1.1 Applicable Standard

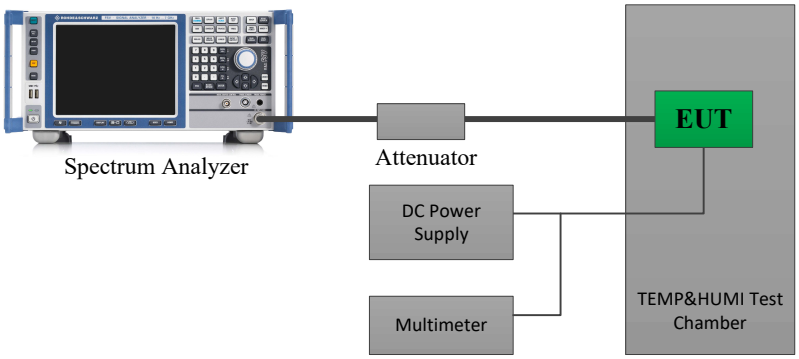
FCC §90.213

In the 150-174 MHz band, fixed and base stations with a 12.5 kHz channel bandwidth must have a frequency stability of 2.5 ppm. Fixed and base stations with a 6.25 kHz channel bandwidth must have a frequency stability of 1.0 ppm.

In the 150-174 MHz band, mobile stations designed to operate with a 12.5 kHz channel bandwidth or designed to operate on a frequency specifically designated for itinerant use or designed for low-power operation of two watts or less, must have a frequency stability of 5.0 ppm. Mobile stations designed to operate with a 6.25 kHz channel bandwidth must have a frequency stability of 2.0 ppm.

In the 421-512 MHz band, mobile stations designed to operate with a 12.5 kHz channel bandwidth must have a frequency stability of 2.5 ppm. Mobile stations designed to operate with a 6.25 kHz channel bandwidth must have a frequency stability of 1.0 ppm.

4.1.2 EUT Setup Block Diagram



4.1.3 Test Procedure

According to ANSI C63.26-2015 Section 5.6:

Frequency stability is a measure of the frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at +20 °C and rated supply voltage.

The operating carrier frequency shall be set up in accordance with the manufacturer's published operation and instruction manual prior to the commencement of these tests. No adjustment of any frequency determining circuit element shall be made subsequent to this initial set-up. Frequency stability is tested:

a) At 10 °C intervals of temperatures between −30 °C and +50 °C at the manufacturer's rated supply voltage, and

b) At +20 °C temperature and ±15% supply voltage variations. If a product is specified to operate over a range of input voltage then the −15% variation is applied to the lowermost voltage and the +15% is applied to the uppermost voltage.

During the test all necessary settings, adjustments and control of the EUT have to be performed without disturbing the test environment, i.e., without opening the environmental chamber. The frequency stabilities can be maintained to a lesser temperature range provided that the transmitter is automatically inhibited from operating outside the lesser temperature range. For handheld equipment that is only capable of operating from internal batteries and the supply voltage cannot be varied, the frequency stability tests shall be performed at the nominal battery voltage and the battery end point voltage specified by the manufacturer. An external supply voltage can be used and set at the internal battery nominal voltage, and again at the battery operating end point voltage which shall be specified by the equipment manufacturer.

If an unmodulated carrier is not available, the mean frequency of a modulated carrier can be obtained by using a frequency counter with gating time set to an appropriately large multiple of bit periods (gating time depending on the required accuracy). Full details on the choice of values shall be included in the test report.

4.1.4 Test Data And Result

Serial Number:	2JLO-2	Test Date:	2024/5/17
Test Site:	RF	Test Mode:	Transmitting
Tester:	Stu Song	Test Result:	Pass

Environmental Conditions:					
Temperature: (℃)	25.3	Relative Humidity: (%)	46	ATM Pressure: (kPa)	100.6

Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSV40	101947	2023/10/18	2024/10/17
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-03	2023/9/2	2024/9/1
Huaxiang	Coaxial Attenuator	DTS250-30	11022109	2024/3/1	2025/3/1
BACL	TEMP&HUMI Test Chamber	BTH-150-40	30173	2023/10/18	2024/10/17
All-sun	Clamp Meter	EM305A	8348897	2023/8/3	2024/8/2
TDK-Lambda	DC Power Supply	Z+60-14	F-08-EM038-1	N/A	N/A

** Statement of Traceability: Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

Test Data:

Un-modulation, f_c = 453.2125MHz, High power				
Temperature	**Voltage**	**Measured**	**Frequency Error**	**Limit**
℃	**V_{DC}**	**MHz**	**ppm**	**ppm**
-30	7.4	453.2126817	0.40	2.5
-20		453.2126601	0.35	
-10		453.2126378	0.30	
0		453.2126105	0.24	
10		453.2125842	0.19	
20		453.2125579	0.13	
30		453.2125354	0.08	
40		453.2125080	0.02	
50		453.2124835	-0.04	
20	6.7	453.2125983	0.22	
20	8.4	453.2125142	0.03	

4.2 Transmitter Output Power

4.2.1 Applicable Standard

FCC §90.205

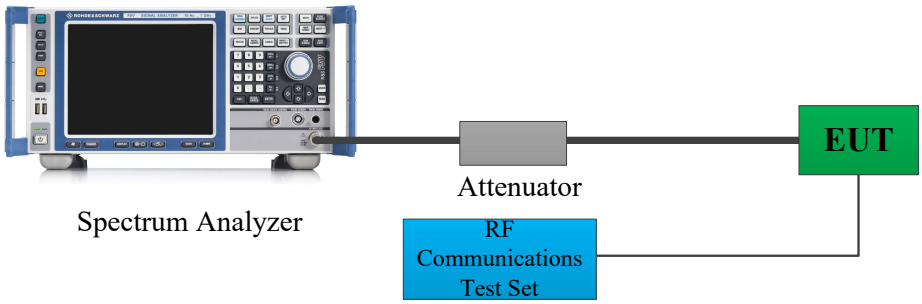
(d) 150-174 MHz. (1) The maximum allowable station ERP is dependent upon the station's antenna HAAT and required service area and will be authorized in accordance with table 1. Applicants requesting an ERP in excess of that listed in table 1 must submit an engineering analysis based upon generally accepted engineering practices and standards that includes coverage contours to demonstrate that the requested station parameters will not produce coverage in excess of that which the applicant requires.

(h) 450-470 MHz.
(1) The maximum allowable station effective radiated power (ERP) is dependent upon the station's antenna HAAT and required service area and will be authorized in accordance with table 2. Applicants requesting an ERP in excess of that listed in table 2 must submit an engineering analysis based upon generally accepted engineering practices and standards that includes coverage contours to demonstrate that the requested station parameters will not produce coverage in excess of that which the applicant requires.

(2) Applications for stations where special circumstances exist that make it necessary to deviate from the ERP and antenna heights in Table 2 will be submitted to the frequency coordinator accompanied by a technical analysis, based upon generally accepted engineering practices and standards, that demonstrates that the requested station parameters will not produce a signal strength in excess of 39 dBu at any point along the edge of the requested service area. The coordinator may then recommend any ERP appropriate to meet this condition.

(3) An applicant for a station with a service area radius greater than 32 km (20 mi) must justify the requested service area radius, which may be authorized only in accordance with table 2, note 4. For base stations with service areas greater than 80 km, all operations 80 km or less from the base station will be on a primary basis and all operations outside of 80 km from the base station will be on a secondary basis and will be entitled to no protection from primary operations.

4.2.2 EUT Setup Block Diagram



Note: The Insertion loss of the RF cable, Attenuators was offset into the Spectrum Analyzer.

4.2.3 Test Procedure

C63.26-2015, Clause 5.2.3.3

This procedure can be used to measure the peak power in either a CW-like or noise-like narrowband RF signal. The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW ≥ 3 × RBW.
a) Set the RBW ≥ OBW.
b) Set VBW ≥ 3 × RBW.
c) Set span ≥ 2 × OBW.
d) Sweep time ≥ 10 × (number of points in sweep) × (transmission symbol period).
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the peak marker function to determine the peak amplitude level

4.2.4 Test Data And Result

Serial Number:	2JLO-2	Test Date:	2024/5/17
Test Site:	RF	Test Mode:	Transmitting
Tester:	Stu Song	Test Result:	Pass

Environmental Conditions:					
Temperature: (℃)	25.3	Relative Humidity: (%)	46	ATM Pressure: (kPa)	100.6

Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSV40	101947	2023/10/18	2024/10/17
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-03	2023/9/2	2024/9/1
Huaxiang	Coaxial Attenuator	DTS250-30	11022109	2024/3/1	2025/3/1
HP	RF Communications Test Set	8920A	3438A05201	2023/10/18	2024/10/17

** Statement of Traceability: Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

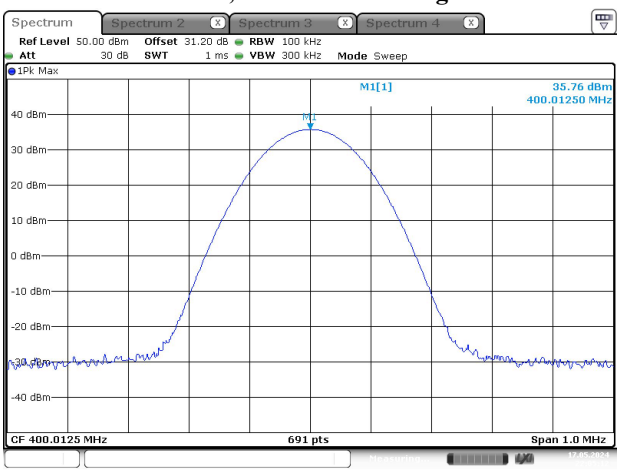
Test Data:

Channel Separation	Test Modulation	Test Channel	Test Frequency (MHz)	Conducted Output Power (dBm)		Limit (dBm)	
				High Power Level	Low Power Level	High Power Level	Low Power Level
12.5kHz	FM	Low	400.0125	35.76	30.16	36.81	30.79
		Middle	453.2125	36.02	30.49	36.81	30.79
		High	469.9875	36.06	30.23	36.81	30.79
12.5kHz	4FSK	Low	400.0125	35.89	30.22	36.81	30.79
		Middle	453.2125	36.11	30.51	36.81	30.79
		High	469.9875	36.17	30.30	36.81	30.79

Note:
The high rated power level is 4W(36dBm), and low rated power level is 1W(30dBm).
The output power shall not exceed by more than 20 percent the manufacturer's rated output power for the particular transmitter specifically listed on the authorization.

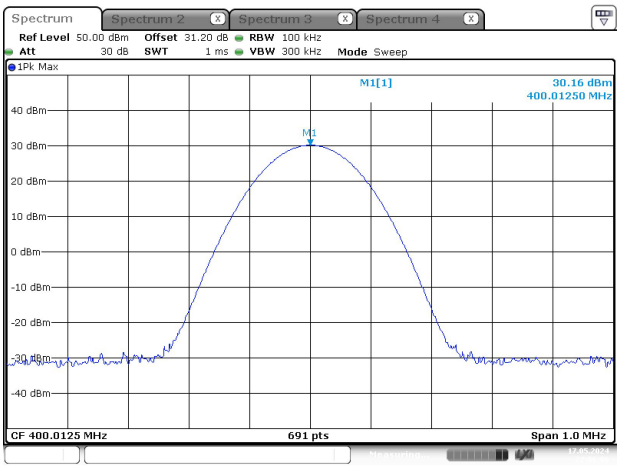
FM, 12.5kHz:

Low Channel, 400.0125 MHz High Power



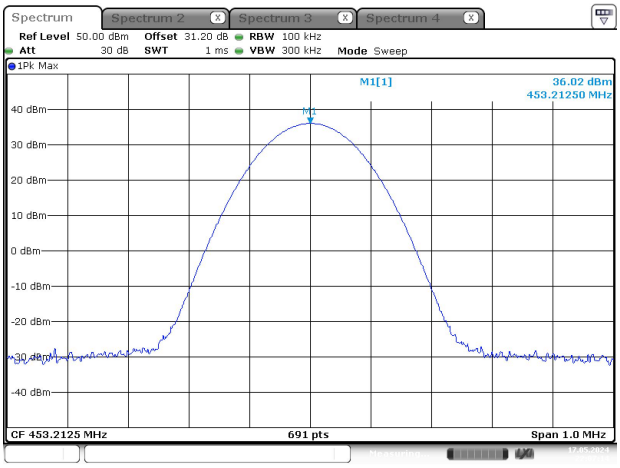
ProjectNo.:2402S45679-RF Tester:Stu Song
Date: 17.MAY.2024 22:05:12

Low Channel, 400.0125 MHz Low Power



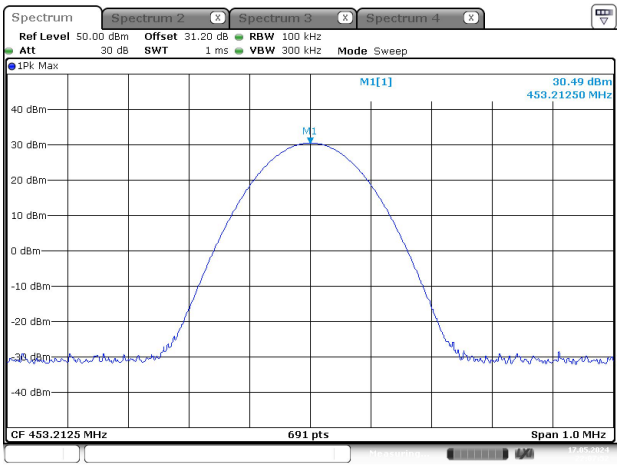
ProjectNo.:2402S45679-RF Tester:Stu Song
Date: 17.MAY.2024 22:06:06

Middle Channel, 453.2125 MHz High Power



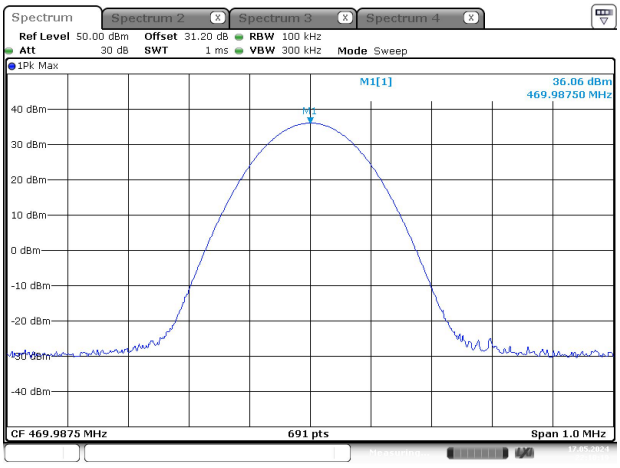
ProjectNo.:2402S45679-RF Tester:Stu Song
Date: 17.MAY.2024 22:07:14

Middle Channel, 453.2125 MHz Low Power



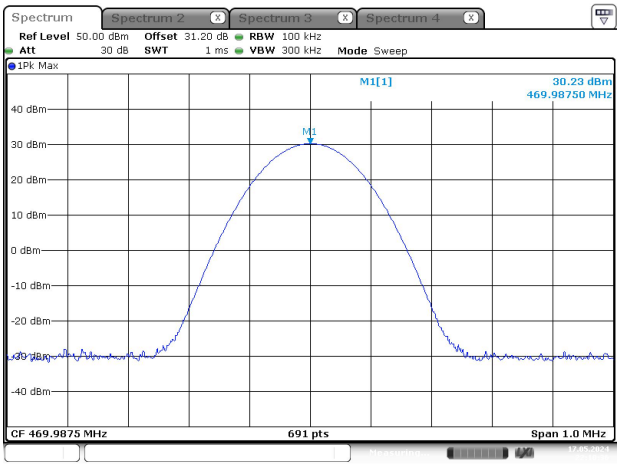
ProjectNo.:2402S45679-RF Tester:Stu Song
Date: 17.MAY.2024 22:07:52

High Channel, 469.9875MHz High Power



ProjectNo.:2402S45679-RF Tester:Stu Song
Date: 17.MAY.2024 22:10:19

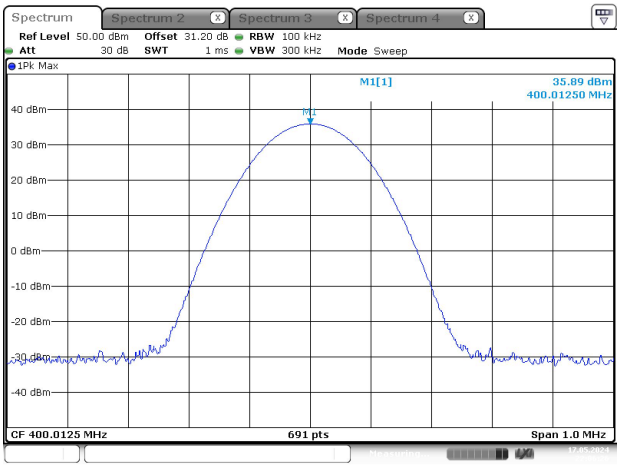
High Channel, 469.9875 MHz Low Power



ProjectNo.:2402S45679-RF Tester:Stu Song
Date: 17.MAY.2024 22:10:36

4FSK, 12.5kHz:

Low Channel, 400.0125 MHz High Power



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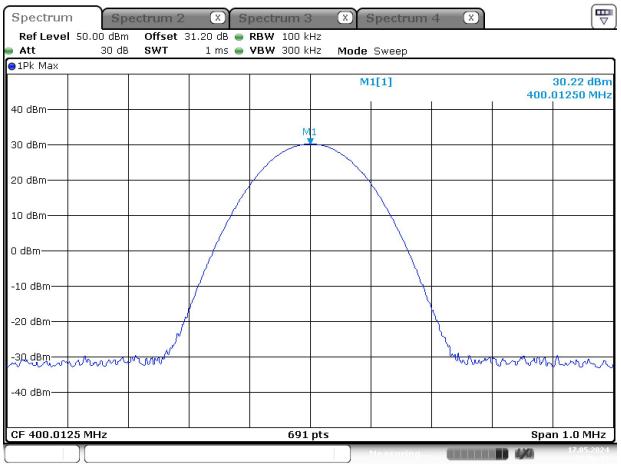
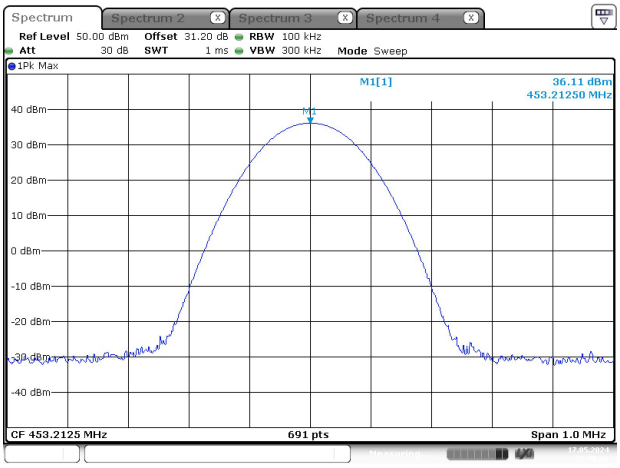
Date: 17.MAY.2024 22:06:26

Low Channel, 400.0125 MHz Low Power



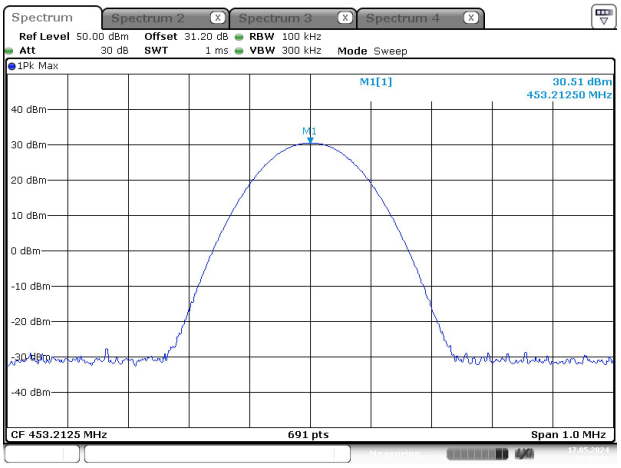
ProjectNo.:2402S45679-RF Tester:Stu Song
Date: 17.MAY.2024 22:06:44

Middle Channel, 453.2125 MHz High Power



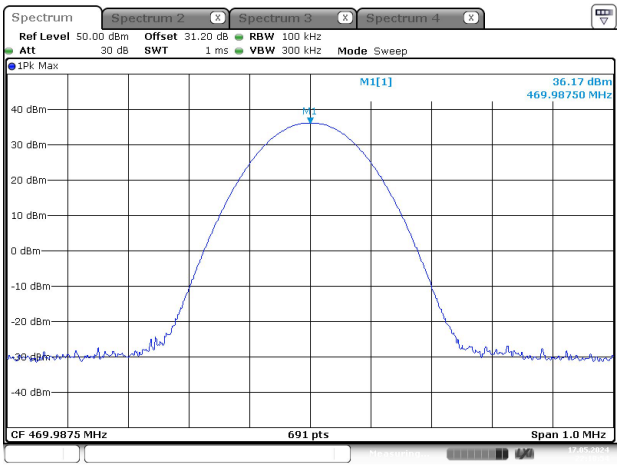
ProjectNo.:2402S45679-RF Tester:Stu Song
Date: 17.MAY.2024 22:08:08

Middle Channel, 453.2125 MHz Low Power



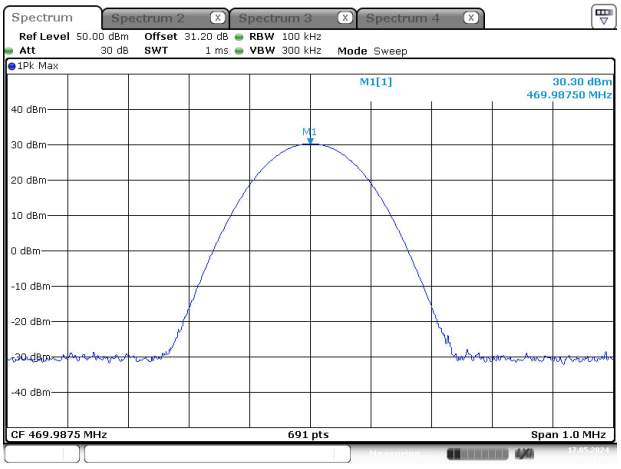
ProjectNo.:2402S45679-RF Tester:Stu Song
Date: 17.MAY.2024 22:08:32

High Channel, 469.9875MHz High Power



ProjectNo.:2402S45679-RF Tester:Stu Song
Date: 17.MAY.2024 22:10:54

High Channel, 469.9875 MHz Low Power



ProjectNo.:2402S45679-RF Tester:Stu Song
Date: 17.MAY.2024 22:11:17

4.3 Occupied Bandwidth & Emission Mask

4.3.1 Applicable Standard

FCC §90.209

(a) Each authorization issued to a station licensed under this part will show an emission designator representing the class of emission authorized. The designator will be prefixed by a specified necessary bandwidth. This number does not necessarily indicate the bandwidth occupied by the emission at any instant. In those cases where §2.202 of this chapter does not provide a formula for the computation of necessary bandwidth, the occupied bandwidth, as defined in part 2 of this chapter, may be used in lieu of the necessary bandwidth.

(b) (5)Unless specified elsewhere, channel spacings and bandwidths that will be authorized in the following frequency bands are given in the following table: STANDARD CHANNEL SPACING/BANDWIDTH

FCC §90.210

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:

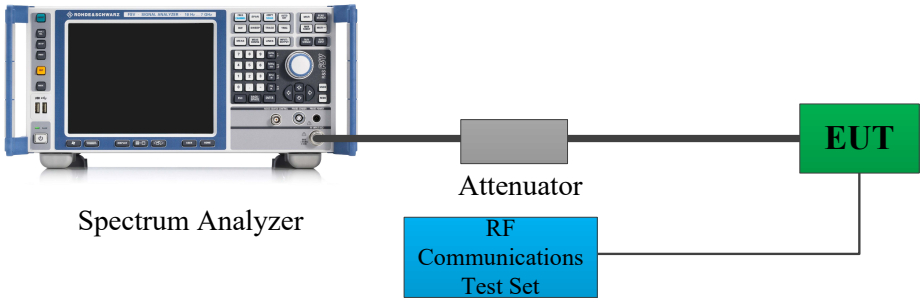
(1) On any frequency from the center of the authorized bandwidth f0 to 5.625 kHz removed from f0: Zero dB.

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27(fd−2.88 kHz) dB.

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

(4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrumentresolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

4.3.2 EUT Setup Block Diagram



Note: The Insertion loss of the RF cable, Attenuators was offset into the Spectrum Analyzer.

4.3.3 Test Procedure

According to ANSI C63.26-2015 Section 5.4.4:

The OBW is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.

The following procedure shall be used for measuring (99%) power bandwidth:

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (typically a span of 1.5 × OBW is sufficient).

b) The nominal IF filter 3 dB bandwidth (RBW) shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.

c) Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3. NOTE—Step a), step b), and step c) may require iteration to adjust within the specified tolerances.

d) Set the detection mode to peak, and the trace mode to max-hold.

e) If the instrument does not have a 99% OBW function, recover the trace data points and sum directly in linear power terms. Place the recovered amplitude data points, beginning at the lowest frequency, in a running sum until 0.5% of the total is reached. Record that frequency as the lower OBW frequency. Repeat the process until 99.5% of the total is reached and record that frequency as the upper OBW frequency. The 99% power OBW can be determined by computing the difference these two frequencies.

f) The OBW shall be reported and plot(s) of the measuring instrument display shall be provided with the test report. The frequency and amplitude axis and scale shall be clearly labeled. Tabular data can be reported in addition to the plot(s).

According to ANSI C63.26-2015 Section 5.7.3:

f) See Annex I for example emission mask plots.

4.3.4 Test Data And Result

Serial Number:	2JLO-2	Test Date:	2024/5/17
Test Site:	RF	Test Mode:	Transmitting
Tester:	Stu Song	Test Result:	Pass

Environmental Conditions:					
Temperature: (℃)	25.3	Relative Humidity: (%)	46	ATM Pressure: (kPa)	100.6

Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSV40	101947	2023/10/18	2024/10/17
E-Microwave	Coaxial DC Block	EMDCB-00033	OE01203218	2024/3/1	2025/3/1
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-03	2023/9/2	2024/9/1
Huaxiang	Coaxial Attenuator	DTS250-30	11022109	2024/3/1	2025/3/1
HP	RF Communications Test Set	8920A	3438A05201	2023/10/18	2024/10/17

** Statement of Traceability: Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

Test Data:

Bandwidth:

Test Mode	Test Channel	Test Frequency (MHz)	High Power Level		Low Power Level	
			99% Occupied Bandwidth (kHz)	26dB Emission Bandwidth (kHz)	99% Occupied Bandwidth (kHz)	26dB Emission Bandwidth (kHz)
FM 12.5kHz	Low	400.0125	9.913	10.275	9.913	10.275
	Middle	453.2125	9.841	10.275	9.841	10.275
	High	469.9875	5.210	10.275	5.210	10.275
4FSK 12.5kHz	Low	400.0125	7.598	9.841	7.598	9.479
	Middle	453.2125	7.381	9.624	7.308	9.479
	High	469.9875	7.525	9.696	7.308	9.334

Emission Mask please refer to the plots.

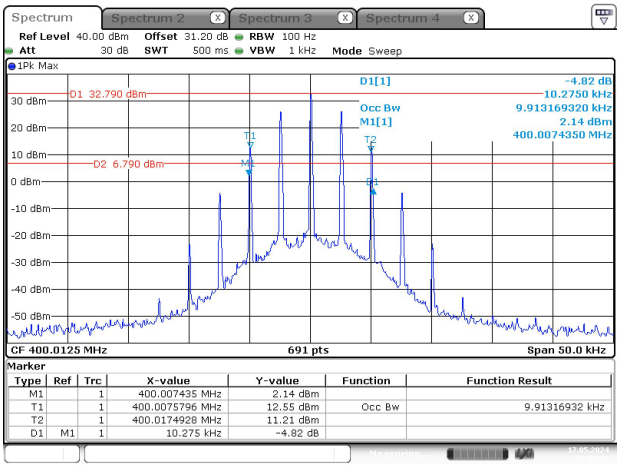
Note:
Emission bandwidth was based on calculation method instead of measurement.
Emission Designator: Per CFR 47 §2.201& §2.202, BW = 2M + 2D

For FM Mode (Channel Spacing: 12.5 kHz)
Emission Designator: 11K0F3E
In this case, the maximum modulating frequency is 3.0 kHz with a 2.5 kHz deviation.
BW = 2(M+D) = 2(3.0 kHz + 2.5 kHz) = 11 kHz = 11K0*
F3E portion of the designator represents an FM voice transmission
Therefore, the entire designator for 12.5 kHz channel spacing FM mode is 11K0F3E.

For Digital Mode (Channel Spacing: 12.5 kHz)
Emission Designator: 7K60F1D and 7K60F1E
The 99% energy rule (title 47CFR 2.1049) was used for digital mode. It basically states that 99% of the modulation energy falls within X kHz, in this case, 7.60 kHz. The emission mask was obtained from 47CFR 90.210(d).
F1D and F1E portion of the designator indicates digital information.
Therefore, the entire designator for 12.5 kHz channel spacing digital mode is 7K60F1D and 7K60F1E.

FM, 12.5kHz, High Power:

Low Channel



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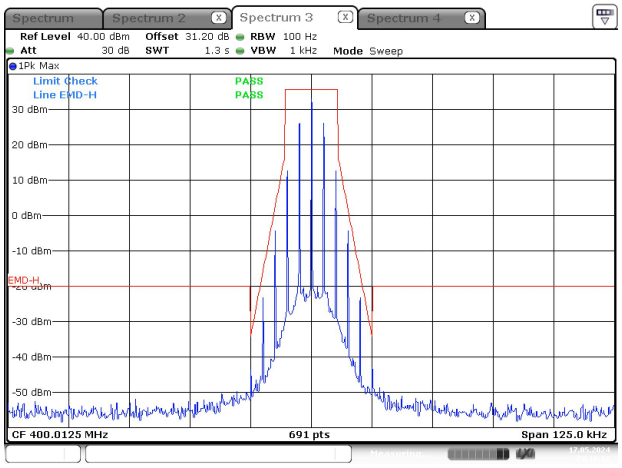

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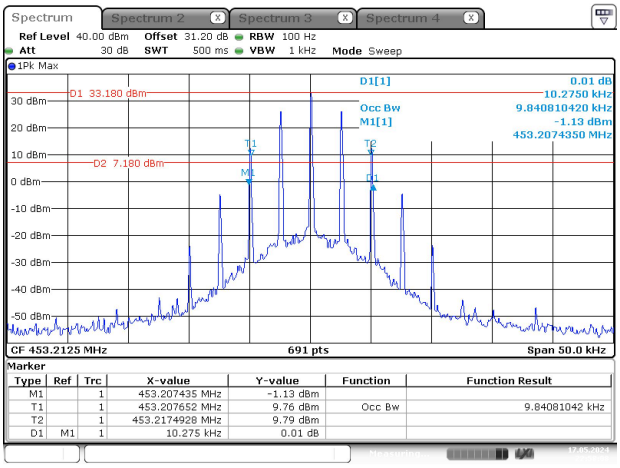
Middle Channel



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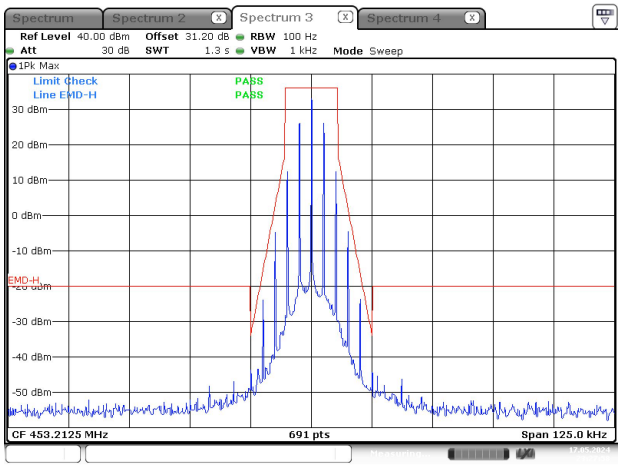
Date: 17.MAY.2024 22:58:08



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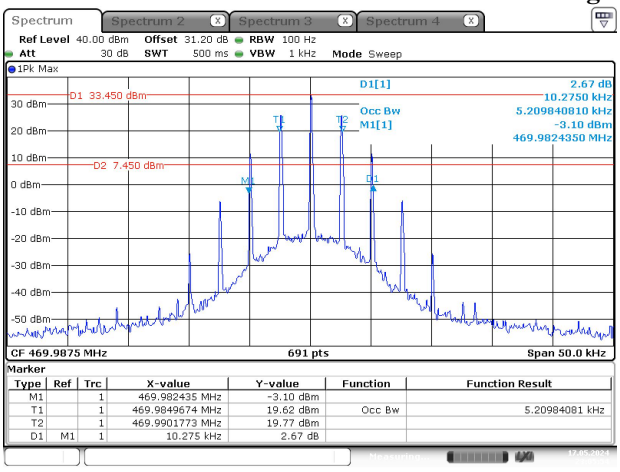
High Channel



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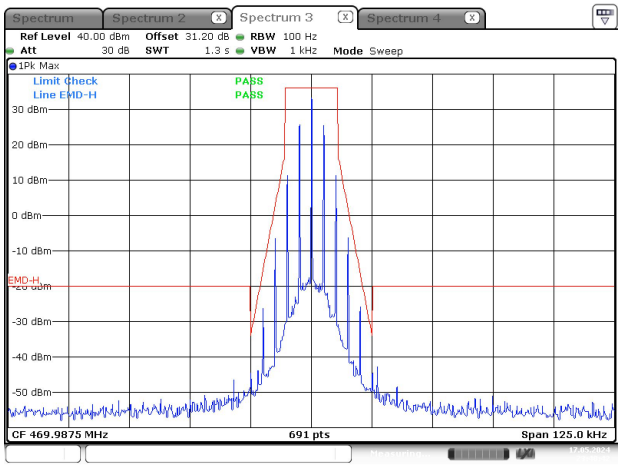
Date: 17.MAY.2024 23:05:54



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