



SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch

SZEMC-TRF-01 Rev. A/0 Aug01,2022

Report No.: SZCR230300089101

Page: 1 of 65

TEST REPORT

Application No.: SZCR2303000891AT
Applicant: SHENZHEN SATLEAD TECHNOLOGY CO., LTD.
Address of Applicant: TCL Science Park, NO.1001 Zhongshanyuan Road Shenzhen China
Manufacturer: SHENZHEN SATLEAD TECHNOLOGY CO., LTD.
Address of Manufacturer: TCL Science Park, NO.1001 Zhongshanyuan Road Shenzhen China
Equipment Under Test (EUT):
EUT Name: Wireless data transceiver
Model No.: HX-DU1022D
FCC ID: 2BA39HX-DU1022D
Standard(s) : 47 CFR Part 90
Date of Receipt: 2023-03-30
Date of Test: 2023-05-01 to 2023-06-01
Date of Issue: 2023-06-02

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

Keny Xu

Keny Xu
EMC Laboratory Manager



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Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2023-06-02		Original

Authorized for issue by:				
		Darren Yuan		
		Darren Yuan/Project Engineer		
		Eric Fu		
		Eric Fu/Reviewer		



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1 Test Summary

Radio Spectrum Technical Requirement				
Item	Standard	Method	Requirement	Result
Antenna Requirement	47 CFR Part 90	N/A	47 CFR Part 90.205(d)	Pass

Radio Spectrum Matter Part				
Item	Standard	Method	Requirement	Result
RF Power Output	47 CFR FCC Part 2, Part90	ANSI/TIA-102.CAAA-E-2016, ANSI/TIA-603-E (2016), ANSI C63.26-2015	47 CFR FCC Part 2.1046, Part90.205	Pass
Frequency Stability	47 CFR FCC Part 2, Part90		47 CFR FCC Part 2.1055, Part90.213	Pass
Occupied Bandwidth	47 CFR FCC Part 2, Part90		47 CFR FCC Part 2.1049, FCC Part90.209	Pass
Emission Mask	47 CFR FCC Part 2, Part90		47 CFR FCC Part 2.1049, FCC Part90.210	Pass
Transient Frequency Behaviour	47 FCC CFR Part90		47 CFR FCC Part90.214	Pass
Conducted Spurious Emission	47 CFR FCC Part 2, Part90		47 CFR FCC Part 2.1051, Part90.210	Pass
Radiated Spurious Emission	47 CFR FCC Part 2, Part90		47 CFR FCC Part 2.1053, Part90.210	Pass

N/A: Not Applicable.

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3 General Information

3.1 Details of E.U.T.

Power supply:	DC 3.3V
Internal source:	More than 108MHz
Frequency Range:	421MHz to 470MHz
Modulation Type:	GMSK, 4FSK
Channel Separation:	25KHz
Number of Channels:	The equipment is able to operate on any designated channel within the specified frequency range.
Antenna Type:	IPEX Antenna Connector
Antenna Gain:	4dBi

3.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
Laptop	Lenovo	T430u	REF. No.SEA18B00
Test board	SHENZHEN SATLEAD TECHNOLOGY CO., LTD.	HX-DU2017D-Baseboard	N/A



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3.3 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	$\pm 7.25 \times 10^{-8}$
2	Duty cycle	$\pm 0.37\%$
3	Occupied Bandwidth	$\pm 3\%$
4	RF conducted power	$\pm 0.75\text{Db}$
5	RF power density	$\pm 2.84\text{Db}$
6	Conducted Spurious emissions	$\pm 0.75\text{Db}$
7	RF Radiated power	$\pm 4.5\text{Db}$ (below 1GHz)
		$\pm 4.8\text{Db}$ (above 1GHz)
8	Radiated Spurious emission test	$\pm 4.5\text{Db}$ (Below 1GHz)
		$\pm 4.8\text{Db}$ (Above 1GHz)
9	Temperature test	$\pm 1^\circ\text{C}$
10	Humidity test	$\pm 3\%$
11	Supply voltages	$\pm 1.5\%$
12	Audio frequency response	± 0.5
13	Modulation limiting	± 0.5
14	Transient frequency behaviour	± 0.5

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3.4 Test Location

All tests were performed at:

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Tel: +86 755 2601 2053

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. 3816.01)

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• VCCI (Member No. 1937)

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen EMC laboratory have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

• FCC –Designation Number: CN1336

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1336. Test Firm Registration Number: 787754.

• Innovation, Science and Economic Development Canada

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

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
DC Power Supply	Chroma	62012P-80-60	SEM011-11	2022-10-20	2023-10-19
MXA Signal Analyzer	KEYSIGHT	N9020A	SEM004-19	2023-03-21	2024-03-20
Power Sensor	TST PASS	TSPS2023R	SEM009-22	2022-09-21	2023-09-20
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2022-09-29	2023-09-28
Measurement Software	TST PASS	TST PASS V2.0	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM031-01	2022-07-08	2023-07-07
Attenuator	Huber+Suhner	6620_SMA-50-1	SEM021-09	2023-03-31	2024-03-30
Oscilloscope	Tektronix	MSO 4104	SEM022-02	2022-09-20	2023-09-19
Programmable Temperature & Humidity Chamber	Votsch Industrietechnik GmbH	VT 4002	SEM002-15	2023-03-21	2024-03-20

Radiated Spurious Emissions Below 1GHz					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Loop Antenna	ETS-Lindgren	6502	SEM003-08	2021-11-30	2023-11-29
3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001-01	2020-07-19	2023-07-18
MXE EMI Receiver	Agilent Technologies	N9038A	SEM004-15	2022-10-20	2023-10-19
BiConiLog Antenna	ETS-LINDGREN	3142C	SEM003-01	2021-09-17	2023-09-16
Pre-Amplifier	Agilent Technologies	8447D	SEM005-01	2023-03-20	2024-03-19
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM025-01	2022-07-08	2023-07-07



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Radiated Spurious Emissions (Above 1GHz)					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2022-04-02	2025-04-01
Signal Analyzer	Rohde & Schwarz	FSV40	SEM008-04	2023-03-20	2024-03-19
Horn Antenna	Rohde&Schwarz	HF907	SEM003-07	2022-07-24	2024-07-23
Microwave system amplifier	Agilent	83017A	SEM005-25	2022-09-21	2023-09-20
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM026-01	2022-07-08	2023-07-07

General used equipment					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Humidity/ Temperature Indicator	Mingle	N/A	SEM002-08	2022-09-04	2023-09-03
Humidity/ Temperature Indicator	Anymetre	TH101B	SEM002-09	2022-09-04	2023-09-03
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2023-03-23	2024-03-22



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5 Radio Spectrum Technical Requirement

5.1 Antenna Requirement

5.1.1 Test Requirement:

47 CFR Part90.205

5.1.2 Conclusion

90.205 Requirement:

(g) 421-430 MHz. Limitations on power and antenna heights are specified in §90.279.

(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.

Table 2—450-470MHz—Maximum ERP/Reference HAAT for a Specific Service Area Radius

	Service area radius (km)									
	3	8	13	16	24	32	40 ⁴	48 ⁴	64 ⁴	80 ⁴
Maximum ERP (w) ¹	2	100	² 500	² 500	² 500	² 500	500	² 500	² 500	² 500
Up to reference HAAT (m) ³	15	15	15	27	63	125	250	410	950	2700

¹Maximum ERP indicated provides for a 39 dBu signal strength at the edge of the service area per FCC Report R-6602, Fig. 29 (See §73.699, Fig. 10 b).

²Maximum ERP of 500 watts allowed. Signal strength at the service area contour may be less than 39 dBu.

³When the actual antenna HAAT is greater than the reference HAAT, the allowable ERP will be reduced in accordance with the following equation: $ERP_{allow} = ERP_{max} \times (HAAT_{ref} / HAAT_{actual})^2$.

⁴Applications for this service area radius may be granted upon specific request with justification and must include a technical demonstration that the signal strength at the edge of the service area does not exceed 39 dBu.

EUT Antenna:

Antenna location: Refer to Appendix(External photos)

6 Radio Spectrum Matter Test Results

6.1 RF Power Output

Test Requirement 47 CFR FCC Part2.1046 & FCC Part90.205

Test Method: ANSI/TIA-102.CAAA-E-2016, ANSI/TIA-603-E (2016), ANSI C63.26-2015

Limit:

For FCC Part 90.205:

(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.

TABLE 2—450-470 MHz—MAXIMUM ERP/REFERENCE HAAT FOR A SPECIFIC SERVICE AREA RADIUS

	Service area radius (km)									
	3	8	13	16	24	32	40 ⁴	48 ⁴	64 ⁴	80 ⁴
Maximum ERP (w) ¹	2	100	² 500	² 500	² 500	² 500	² 500	² 500	² 500	² 500
Up to reference HAAT (m) ³	15	15	15	27	63	125	250	410	950	2700

¹Maximum ERP indicated provides for a 39 dBu signal strength at the edge of the service area per FCC Report R-6602, Fig. 29 (See §73.699, Fig. 10 b).

²Maximum ERP of 500 watts allowed. Signal strength at the service area contour may be less than 39 dBu.

³When the actual antenna HAAT is greater than the reference HAAT, the allowable ERP will be reduced in accordance with the following equation: $ERP_{allow} = ERP_{max} \times (HAAT_{ref} / HAAT_{actual})^2$.

⁴Applications for this service area radius may be granted upon specific request with justification and must include a technical demonstration that the signal strength at the edge of the service area does not exceed 39 dBu.

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For FCC part 90.279

Power limitations applicable to the 421–430 MHz band.

- (a) Base station authorizations in the 421–430 MHz band will be subject to Effective Radiated Power (ERP) and Effective Antenna Height (EAH) limitations as shown in the table below. ERP is defined as the product of the power supplied to the antenna and its gain relative to a half-wave dipole in a given direction. EAH is calculated by subtracting the Assumed Average Terrain Elevation (AATE) as listed in table 7 of § 90.619 from the antenna height above mean sea level.

Limits of Effective Radiated Power (ERP) Corresponding to Effective Antenna Heights (EAH) of Base Stations in the 421–430 MHz Band

Effective antenna height (EAH) in meters (feet)	Maximum effective radiated power (ERP) (watts)
0–152 (0–500)	250
Above 152–305 (above 500–1000)	150
Above 305–457 (above 1000–1500)	75
Above 457–610 (above 1500–2000)	40
Above 610–762 (above 2000–2500)	20
Above 762–914 (above 2500–3000)	15
Above 914–1219 (above 3000–4000)	10
Above 1219 (above 4000)	5

- (b) The maximum transmitter power output that will be authorized for control stations is 20 watts.

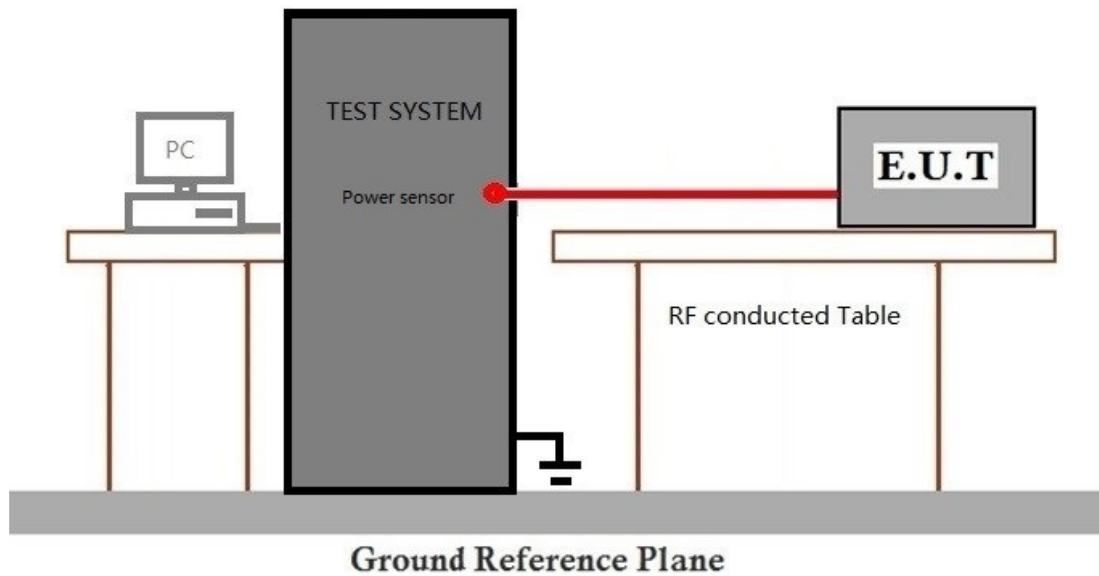
6.1.1 E.U.T. Operation

Operating Environment:

Temperature: 20.8 °C Humidity: 50.2 % RH Atmospheric Pressure: 1010 mbar

Test mode: 00: Tx mode_Keep the EUT in transmitting mode.

6.1.2 Test Setup Diagram



6.1.3 Measurement Procedure and Data

The detailed test data see: Appendix FCC data.

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6.2 Frequency Stability

Test Requirement

47 CFR FCC Part2.1055 & FCC Part90.213;

Test Method:

ANSI/TIA-102.CAAA-E-2016, ANSI/TIA-603-E (2016), ANSI C63.26-2015

Limit:

For FCC Part 90.213:

Frequency range (MHz)	Fixed and base stations	Mobile stations	
		Over 2 watts output power	2 watts or less output power
Below 25	^{1 2 3} 100	100	200
25-50	20	20	50
72-76	5		50
150-174	^{5 11} 5	⁶ 5	^{4 6} 50
216-220	1.0		1.0
220-222 ¹²	0.1	1.5	1.5
421-512	^{7 11 14} 2.5	⁸ 5	⁸ 5
806-809	¹⁴ 1.0	1.5	1.5
809-824	¹⁴ 1.5	2.5	2.5
851-854	1.0	1.5	1.5
854-869	1.5	2.5	2.5
896-901	¹⁴ 0.1	1.5	1.5
902-928	2.5	2.5	2.5
902-928 ¹³	2.5	2.5	2.5
929-930	1.5		
935-940	0.1	1.5	1.5
1427-1435	⁹ 300	300	300
Above 2450 ¹⁰			



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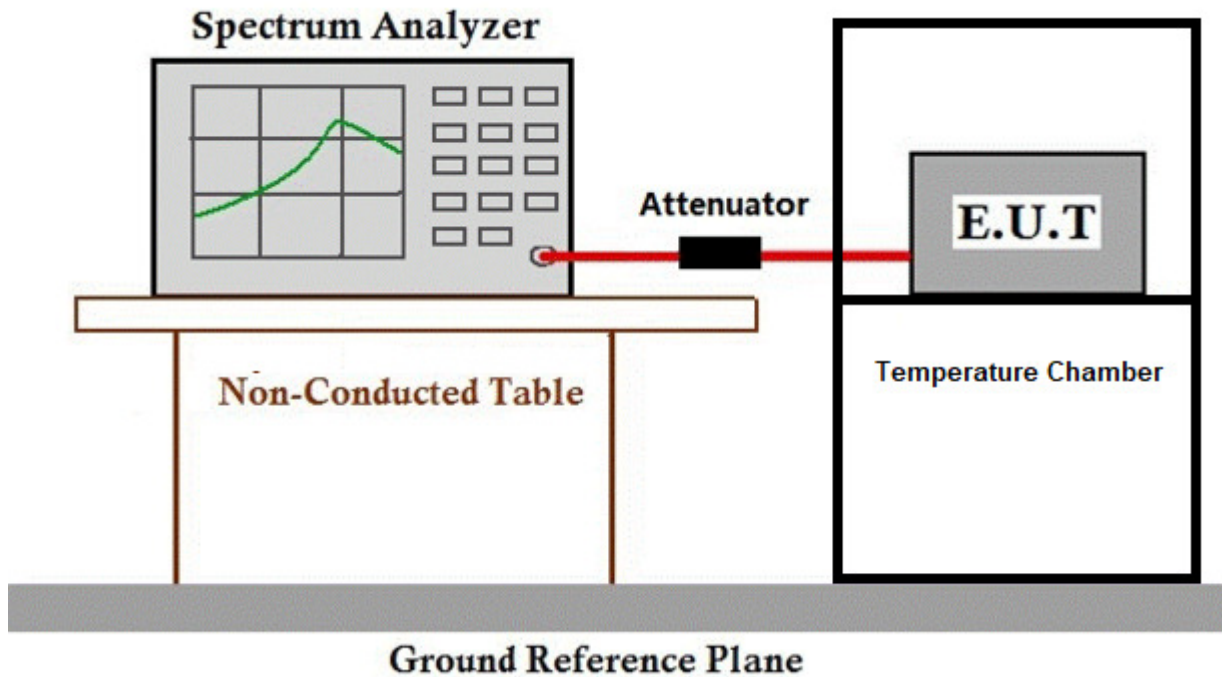
6.2.1 E.U.T. Operation

Operating Environment:

Temperature: 20.8 °C Humidity: 50.2 % RH Atmospheric Pressure: 1010 mbar

Test mode: 00: Tx mode_Keep the EUT in transmitting mode.

6.2.2 Test Setup Diagram



6.2.3 Measurement Procedure and Data

The detailed test data see: Appendix FCC data.

6.3 Occupied Bandwidth

Test Requirement

47 CFR FCC Part2.1049 & FCC Part90.209;

Test Method:

ANSI/TIA-102.CAAA-E-2016, ANSI/TIA-603-E (2016), ANSI C63.26-2015

Limit:

For FCC Part 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) The maximum authorized single channel bandwidth of emission corresponding to the type of emission specified in §90.207 is as follows:

(1) For A1A or A1B emissions, the maximum authorized bandwidth is 0.25 kHz. The maximum authorized bandwidth for type A3E emission is 8 kHz.

(2) For operations below 25 MHz utilizing J3E emission, the bandwidth occupied by the emission shall not exceed 3000 Hz. The assigned frequency will be specified in the authorization. The authorized carrier frequency will be 1400 Hz lower in frequency than the assigned frequency. Only upper sideband emission may be used. In the case of regularly available double sideband radiotelephone channels, an assigned frequency for J3E emissions is available either 1600 Hz below or 1400 Hz above the double sideband radiotelephone assigned frequency.

(3) For all other types of emissions, the maximum authorized bandwidth shall not be more than that normally authorized for voice operations.

(4) Where a frequency is assigned exclusively to a single licensee, more than a single emission may be used within the authorized bandwidth. In such cases, the frequency stability requirements of §90.213 must be met for each emission.

(5) Unless specified elsewhere, channel spacings and bandwidths that will be authorized in the following frequency bands are given in the following table.

band (MHz)	Channel spacing (kHz)	Authorized bandwidth (kHz)
Below 25 ²		
25-50	20	20
72-76	20	20
150-174	¹ 7.5	^{1 3} 20/11.25/6
216-220 ⁵	6.25	20/11.25/6
220-222	5	4
406-512 ²	¹ 6.25	¹³⁶ 20/11.25/6
806-809/851-854	12.5	20
809-824/854-869	25	⁶ 20



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896-901/935-940	12.5	13.6
902-928 ⁴		
929-930	25	20
1427-1432 ⁵	12.5	12.5
³ 2450-2483.5 ²		
Above 2500 ²		

¹For stations authorized on or after August 18, 1995.

²Bandwidths for radiolocation stations in the 420-450 MHz band and for stations operating in bands subject to this footnote will be reviewed and authorized on a case-by-case basis.

³Operations using equipment designed to operate with a 25 kHz channel bandwidth will be authorized a 20 kHz bandwidth. Operations using equipment designed to operate with a 12.5 kHz channel bandwidth will be authorized a 11.25 kHz bandwidth. Operations using equipment designed to operate with a 6.25 kHz channel bandwidth will be authorized a 6 kHz bandwidth. All stations must operate on channels with a bandwidth of 12.5 kHz or less beginning January 1, 2013, unless the operations meet the efficiency standard of §90.203(j)(3).

⁴The maximum authorized bandwidth shall be 12 MHz for non-multilateration LMS operations in the band 909.75-921.75 MHz and 2 MHz in the band 902.00-904.00 MHz. The maximum authorized bandwidth for multilateration LMS operations shall be 5.75 MHz in the 904.00-909.75 MHz band; 2 MHz in the 919.75-921.75 MHz band; 5.75 MHz in the 921.75-927.25 MHz band and its associated 927.25-927.50 MHz narrowband forward link; and 8.00 MHz if the 919.75-921.75 MHz and 921.75-927.25 MHz bands and their associated 927.25-927.50 MHz and 927.50-927.75 MHz narrowband forward links are aggregated.

⁵See §90.259.

⁶Operations using equipment designed to operate with a 25 kHz channel bandwidth may be authorized up to a 22 kHz bandwidth if the equipment meets the Adjacent Channel Power limits of §90.221.

(6)(i) Beginning January 1, 2011, no new applications for the 150-174 MHz and/or 421-512 MHz bands will be acceptable for filing if the applicant utilizes channels with an authorized bandwidth exceeding 11.25 kHz, unless specified elsewhere or the operations meet the efficiency standards of §90.203(j)(3).

(ii) Beginning January 1, 2011, no modification applications for stations in the 150-174 MHz and/or 421-512 MHz bands that increase the station's authorized interference contour, will be acceptable for filing if the applicant utilizes channels with an authorized bandwidth exceeding 11.25 kHz, unless specified elsewhere or the operations meet the efficiency standards of §90.203(j)(3). See §90.187(b)(2)(iii) and (iv) for interference contour designations and calculations. Applications submitted pursuant to this paragraph must comply with frequency coordination requirements of §90.175.

(7) Economic Area (EA)-based licensees in frequencies 817-824/862-869 MHz (813.5-824/858.5-869 MHz in the counties listed in §90.614(c)) may exceed the standard channel spacing and authorized bandwidth listed in paragraph (b)(5) of this section in any National Public Safety Planning Advisory Committee Region when all 800 MHz public safety licensees in the Region have completed band reconfiguration consistent with this part. In any National Public Safety Planning Advisory Committee Region where the 800 MHz band reconfiguration is incomplete, EA-based licensees in frequencies 817-821/862-866 MHz (813.5-821/858.5-866 MHz in the counties listed in §90.614(c)) may exceed the standard channel spacing and authorized bandwidth listed in paragraph (b)(5) of this section. Upon all 800 MHz public safety licensees in a National Public Safety Planning Advisory Committee Region completing band reconfiguration, EA-based 800 MHz SMR licensees in the 821-824/866-869 MHz band may exceed the channel spacing and authorized



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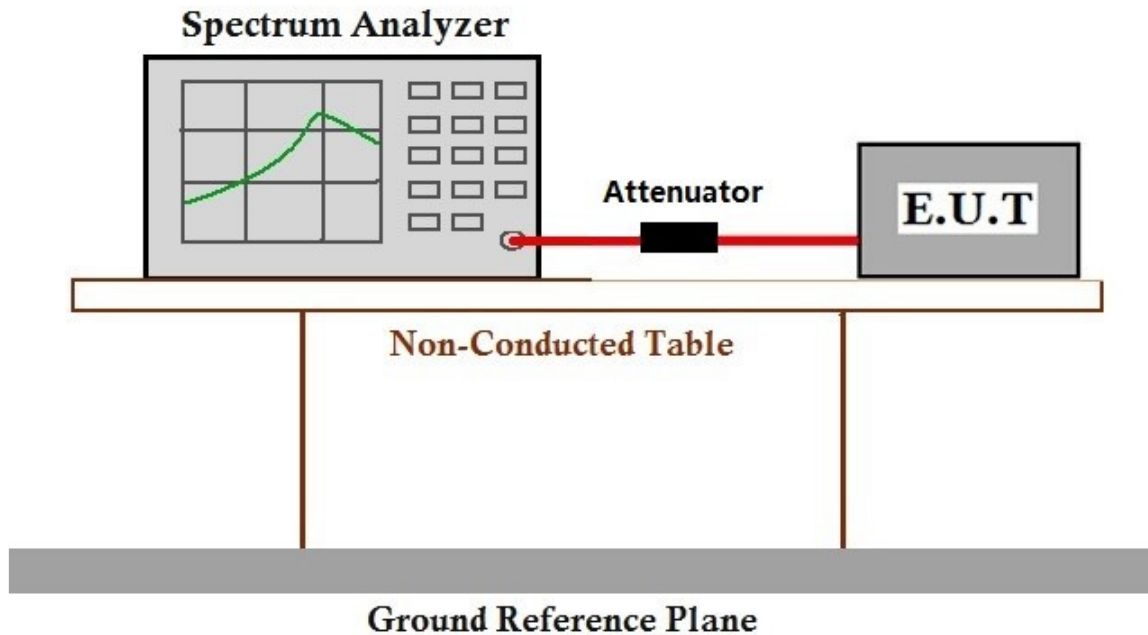
bandwidth in paragraph (b)(5) of this section. Licensees authorized to exceed the standard channel spacing and authorized bandwidth under this paragraph must provide at least 30 days written notice prior to initiating such service in the bands listed herein to every 800 MHz public safety licensee with a base station in an affected National Public Safety Planning Advisory Committee Region, and every 800 MHz public safety licensee with a base station within 113 kilometers (70 miles) of an affected National Public Safety Planning Advisory Committee Region. Such notice shall include the estimated date upon which the EA-based 800 MHz SMR licensee intends to begin operations that exceed the channel spacing and authorized bandwidth in paragraph (b)(5) of this section.

6.3.1 E.U.T. Operation

Operating Environment:

Temperature: 20. °C Humidity: 50. % RH Atmospheric Pressure: 1010 mbar
8 °C 2 % RH
Test mode: 00: Tx mode_Keep the EUT in transmitting mode.

6.3.2 Test Setup Diagram



6.3.3 Measurement Procedure and Data

The detailed test data see: Appendix FCC data.

6.4 Emission Mask

Test Requirement

47 CFR FCC Part2.1049 & FCC Part90.210;

Test Method:

ANSI/TIA-102.CAAA-E-2016, ANSI/TIA-603-E (2016), ANSI C63.26-2015

Limit:

For FCC Part 90.210:

(a) Emission Mask A. For transmitters utilizing J3E emission, the carrier must be at least 40 dB below the peak envelope power and the power of emissions must be reduced below the output power (P in watts) of the transmitter as follows:

(1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 150 percent of the authorized bandwidth: At least 25 dB.

(2) On any frequency removed from the assigned frequency by more than 150 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.

(b) 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.

(c) Emission Mask C. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier output power (P) as follows:

(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5 kHz, but not more than 10 kHz: At least $83 \log (fd/5)$ dB;

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 10 kHz, but not more than 250 percent of the authorized bandwidth: At least $29 \log (fd/11)$ dB or 50 dB, whichever is the lesser attenuation;

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

(4) In the 1427-1432 MHz band, licensees are encouraged to take all reasonable steps to ensure that unwanted emissions power does not exceed the following levels in the 1400-1427 MHz band:

(i) For stations of point-to-point systems in the fixed service: -45 dBW/27 MHz.

(ii) For stations in the mobile service: -60 dBW/27 MHz.

(d) 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 $7.27(fd-2.88 \text{ kHz})$ dB.



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- (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.
- (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 instrument resolution 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.
- (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.

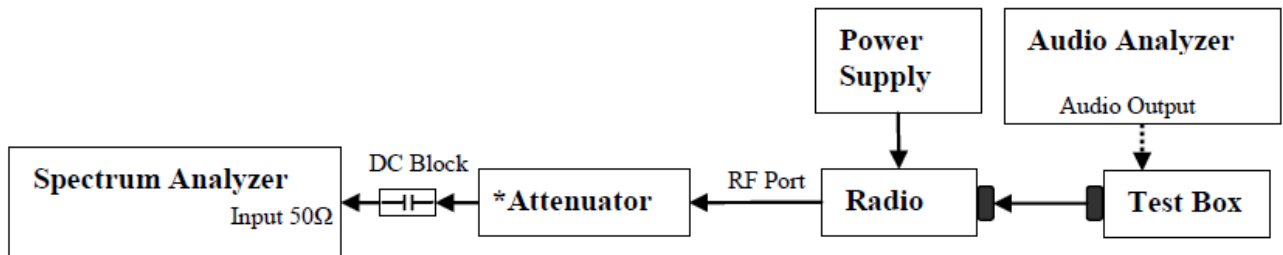
6.4.1 E.U.T. Operation

Operating Environment:

Temperature: 20.8 °C Humidity: 50.2 % RH Atmospheric Pressure: 1010 mbar

Test mode: 00: Tx mode_Keep the EUT in transmitting mode.

6.4.2 Test Setup Diagram



6.4.3 Measurement Procedure and Data

The detailed test data see: Appendix FCC data.

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6.5 Transient Frequency Behaviour

Test Requirement 47 CFR FCC Part 90.214

Test Method: ANSI/TIA-102.CAAA-E-2016, ANSI/TIA-603-E (2016), ANSI C63.26-2015

Limit:

For FCC Part 90.214:

Time intervals ^{1 2}	Maximum frequency difference ³	All equipment	
		150 to 174 MHz	421 to 512 MHz
Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels			
t ₁ ⁴	±25.0 kHz	5.0 ms	10.0 ms
t ₂	±12.5 kHz	20.0 ms	25.0 ms
t ₃ ⁴	±25.0 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels			
t ₁ ⁴	±12.5 kHz	5.0 ms	10.0 ms
t ₂	±6.25 kHz	20.0 ms	25.0 ms
t ₃ ⁴	±12.5 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 6.25 kHz Channels			
t ₁ ⁴	±6.25 kHz	5.0 ms	10.0 ms
t ₂	±3.125 kHz	20.0 ms	25.0 ms
t ₃ ⁴	±6.25 kHz	5.0 ms	10.0 ms



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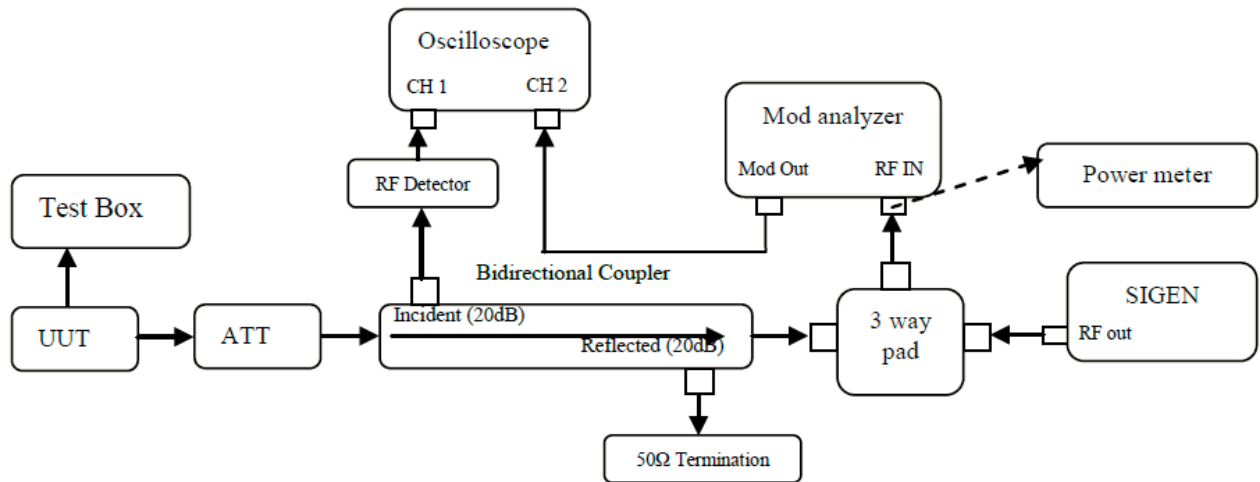
6.5.1 E.U.T. Operation

Operating Environment:

Temperature: 20.8 °C Humidity: 50.2 % RH Atmospheric Pressure: 1010 mbar

Test mode: 00: Tx mode_Keep the EUT in transmitting mode.

6.5.2 Test Setup Diagram



6.5.3 Measurement Procedure and Data

The detailed test data see: Appendix FCC data.

6.6 Conducted Spurious Emissions

Test Requirement

47 CFR FCC Part2.1051 & FCC Part90.210;

Test Method:

ANSI/TIA-102.CAAA-E-2016, ANSI/TIA-603-E (2016), ANSI C63.26-2015

Limit:

For FCC Part 90.210:

Frequency band (MHz)	Mask for equipment with audio low pass filter	Mask for equipment without audio low pass filter
Below 25 ¹	A or B	A or C
25-50	B	C
72-76	B	C
150-174 ²	B, D, or E	C, D or E
150 paging only	B	C
220-222	F	F
421-512 ^{2 5}	B, D, or E	C, D, or E
450 paging only	B	G
806-809/851-854 ⁶	B	H
809-824/854-869 ^{3 5}	B	G
896-901/935-940	I	J
902-928	K	K
929-930	B	G
4940-4990 MHz	L or M	L or M

5850-5925 ⁴		
All other bands	B	C

(b) 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.

(c) Emission Mask C. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier output power (P) as follows:

- (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5 kHz, but not more than 10 kHz: At least 83 log (fd/5) dB;



- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 10 kHz, but not more than 250 percent of the authorized bandwidth: At least 29 log (fd/11) dB or 50 dB, whichever is the lesser attenuation;
- (3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log (P)$ dB.
- (4) In the 1427-1432 MHz band, licensees are encouraged to take all reasonable steps to ensure that unwanted emissions power does not exceed the following levels in the 1400-1427 MHz band:
- (i) For stations of point-to-point systems in the fixed service: -45 dBW/27 MHz.
- (ii) For stations in the mobile service: -60 dBW/27 MHz.
- (d) 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 $7.27(fd - 2.88 \text{ kHz})$ 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 instrument resolution 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.
- (e) Emission Mask E—6.25 kHz or less channel bandwidth equipment. For transmitters designed to operate with a 6.25 kHz or less 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 3.0 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 3.0 kHz but no more than 4.6 kHz: At least $30 + 16.67(fd - 3 \text{ kHz})$ or $55 + 10 \log (P)$ or 65 dB, whichever is the lesser attenuation.
- (3) On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least $55 + 10 \log (P)$ or 65 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 instrument resolution 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.



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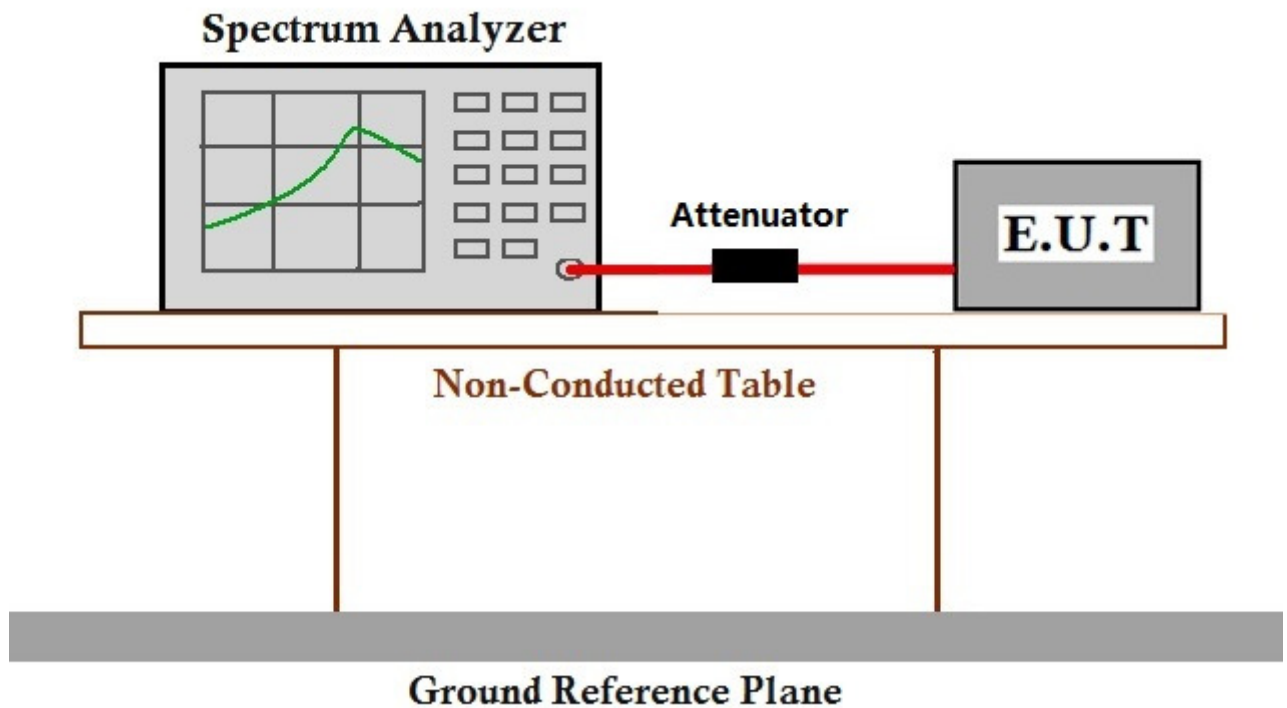
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6.6.1 E.U.T. Operation

Operating Environment:

Temperature: 20.8 °C Humidity: 50.2 % RH Atmospheric Pressure: 1010 mbar
Test mode: 00: Tx mode_Keep the EUT in transmitting mode.

6.6.2 Test Setup Diagram



6.6.3 Measurement Procedure and Data

The detailed test data see: Appendix FCC data.

6.7 Radiated Spurious Emissions

Test Requirement: 47 CFR FCC Part2.1051 & FCC Part90.210;
 Test Method: ANSI/TIA-102.CAAA-E-2016, ANSI/TIA-603-E (2016), ANSI C63.26-2015
 Measurement Distance: 3m
 Limit:
For FCC Part 90.210:

Frequency band (MHz)	Mask for equipment with audio low pass filter	Mask for equipment without audio low pass filter
Below 25 ¹	A or B	A or C
25-50	B	C
72-76	B	C
150-174 ²	B, D, or E	C, D or E
150 paging only	B	C
220-222	F	F
421-512 ^{2 5}	B, D, or E	C, D, or E
450 paging only	B	G
806-809/851-854 ⁶	B	H
809-824/854-869 ^{3 5}	B	G
896-901/935-940	I	J
902-928	K	K
929-930	B	G
4940-4990 MHz	L or M	L or M

5850-5925 ⁴		
All other bands	B	C

(b) 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.

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(c) Emission Mask C. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier output power (P) as follows:

(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5 kHz, but not more than 10 kHz: At least 83 log (fd/5) dB;

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 10 kHz, but not more than 250 percent of the authorized bandwidth: At least 29 log (fd/11) dB or 50 dB, whichever is the lesser attenuation;

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

(4) In the 1427-1432 MHz band, licensees are encouraged to take all reasonable steps to ensure that unwanted emissions power does not exceed the following levels in the 1400-1427 MHz band:

(i) For stations of point-to-point systems in the fixed service: -45 dBW/27 MHz.

(ii) For stations in the mobile service: -60 dBW/27 MHz.

(d) 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 instrument resolution 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.

(e) Emission Mask E—6.25 kHz or less channel bandwidth equipment. For transmitters designed to operate with a 6.25 kHz or less 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 3.0 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 3.0 kHz but no more than 4.6 kHz: At least 30 + 16.67(fd-3 kHz) or 55 + 10 log (P) or 65 dB, whichever is the lesser attenuation.

(3) On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least 55 + 10 log (P) or 65 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

instrument resolution 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



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accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

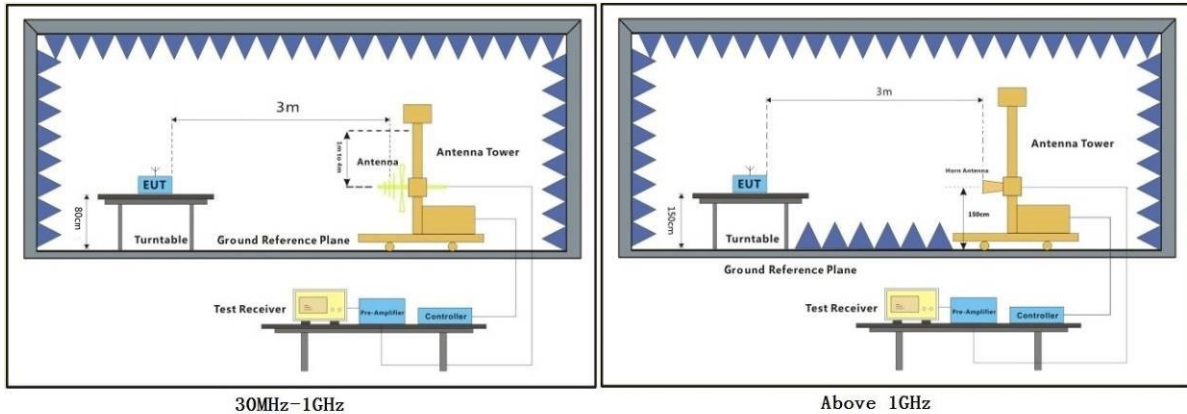
6.7.1 E.U.T. Operation

Operating Environment:

Temperature: 20.2 °C Humidity: 51.1 % RH Atmospheric Pressure: 1010 mbar

Test mode: 00: Tx mode_Keep the EUT in transmitting mode.

6.7.2 Test Setup Diagram



6.7.3 Measurement Procedure and 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.



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7 EUT Constructional Details

7.1 EUT Constructional Details (EUT Photos)

Please Refer to external and internal photos for details.



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8 Appendix

1. RF Output Power

Modulation Type	Channel Separation	Frequency (MHz)	Power Level	RF Output Power(dBm)	RF Output Power(W)	ERP (dBm)
GMSK	25KHz	421.025	High	29.505	0.892	31.355
			Low	26.232	0.420	28.082
		429.975	High	30.027	1.006	31.877
			Low	27.194	0.524	29.044
		450.025	High	30.289	1.069	32.139
			Low	27.774	0.599	29.624
4FSK	25KHz	469.025	High	29.697	0.933	31.547
			Low	26.846	0.484	28.696
		421.025	High	29.822	0.960	31.672
			Low	27.058	0.508	28.908
		429.975	High	29.840	0.964	31.690
			Low	26.854	0.485	28.704
		450.025	High	30.037	1.009	31.887
			Low	27.011	0.502	28.861
		469.025	High	30.368	1.088	32.218
			Low	26.796	0.478	28.646

2. Frequency Stability

25KHz, GMSK modulation, Assigned Frequency:421.025MHz					
Voltage(V)	Temperature (°C)	Measured Frequency(MHz)	Frequency Deviation(ppm)	FCC Limit (ppm)	Result
3.3	-30	421.02512	0.29	±1.5	Pass
	-20	421.02525	0.59		
	-10	421.02522	0.52		
	0	421.02531	0.74		
	10	421.02523	0.55		
	20	421.02494	-0.14		
	30	421.02525	0.59		
	40	421.02508	0.19		
	50	421.02533	0.78		
3.6	25	421.02524	0.57		
2.97	25	421.02520	0.48		

25KHz, GMSK modulation, Assigned Frequency:429.975MHz					
Voltage(V)	Temperature (°C)	Measured Frequency(MHz)	Frequency Deviation(ppm)	FCC Limit (ppm)	Result
3.3	-30	429.97528	0.65	±1.5	Pass
	-20	429.97522	0.51		
	-10	429.97517	0.40		
	0	429.97511	0.26		
	10	429.97509	0.21		
	20	429.97508	0.19		
	30	429.97508	0.19		
	40	429.97514	0.33		
	50	429.97524	0.56		
3.6	25	429.97518	0.42		
2.97	25	429.97514	0.33		



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25KHz, GMSK modulation, Assigned Frequency:450.025MHz					
Voltage(V)	Temperature (°C)	Measured Frequency(MHz)	Frequency Deviation(ppm)	FCC Limit (ppm)	Result
3.3	-30	450.02531	0.69	±1.5	Pass
	-20	450.02524	0.53		
	-10	450.02518	0.40		
	0	450.02515	0.33		
	10	450.02513	0.29		
	20	450.02509	0.20		
	30	450.02508	0.18		
	40	450.02511	0.24		
	50	450.02512	0.27		
3.6	25	450.02515	0.33		
2.97	25	450.02518	0.40		

25KHz, GMSK modulation, Assigned Frequency:469.025MHz					
Voltage(V)	Temperature (°C)	Measured Frequency(MHz)	Frequency Deviation(ppm)	FCC Limit (ppm)	Result
3.3	-30	469.02530	0.64	±1.5	Pass
	-20	469.02507	0.15		
	-10	469.02515	0.32		
	0	469.02527	0.58		
	10	469.02539	0.83		
	20	469.02522	0.47		
	30	469.02520	0.43		
	40	469.02525	0.53		
	50	469.02510	0.21		
3.6	25	469.02511	0.23		
2.97	25	469.02512	0.26		



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25KHz, 4FSK modulation, Assigned Frequency:421.025MHz					
Voltage(V)	Temperature (°C)	Measured Frequency(MHz)	Frequency Deviation(ppm)	FCC Limit (ppm)	Result
3.3	-30	421.02538	0.90	±1.5	Pass
	-20	421.02501	0.02		
	-10	421.02504	0.10		
	0	421.02499	-0.02		
	10	421.02537	0.88		
	20	421.02516	0.38		
	30	421.02514	0.33		
	40	421.02539	0.93		
	50	421.02519	0.45		
3.6	25	421.02504	0.10		
2.97	25	421.02517	0.40		

25KHz, 4FSK modulation, Assigned Frequency:429.975MHz					
Voltage(V)	Temperature (°C)	Measured Frequency(MHz)	Frequency Deviation(ppm)	FCC Limit (ppm)	Result
3.3	-30	429.97534	0.79	±1.5	Pass
	-20	429.9753	0.70		
	-10	429.97527	0.63		
	0	429.97522	0.51		
	10	429.97517	0.40		
	20	429.97511	0.26		
	30	429.9751	0.23		
	40	429.97507	0.16		
	50	429.97518	0.42		
3.6	25	429.97524	0.56		
2.97	25	429.97519	0.44		



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25KHz, 4FSK modulation, Assigned Frequency:450.025MHz					
Voltage(V)	Temperature (°C)	Measured Frequency(MHz)	Frequency Deviation(ppm)	FCC Limit (ppm)	Result
3.3	-30	450.02539	0.87	±1.5	Pass
	-20	450.02535	0.78		
	-10	450.02533	0.73		
	0	450.02525	0.56		
	10	450.02522	0.49		
	20	450.02515	0.33		
	30	450.02514	0.31		
	40	450.0251	0.22		
	50	450.02515	0.33		
3.6	25	450.02512	0.27		
2.97	25	450.0252	0.44		

25KHz, 4FSK modulation, Assigned Frequency:469.025MHz					
Voltage(V)	Temperature (°C)	Measured Frequency(MHz)	Frequency Deviation(ppm)	FCC Limit (ppm)	Result
3.3	-30	469.02536	0.77	±1.5	Pass
	-20	469.02499	-0.02		
	-10	469.02492	-0.17		
	0	469.02530	0.64		
	10	469.02514	0.30		
	20	469.02503	0.06		
	30	469.02503	0.06		
	40	469.02520	0.43		
	50	469.02521	0.45		
3.6	25	469.02504	0.09		
2.97	25	469.02495	-0.11		



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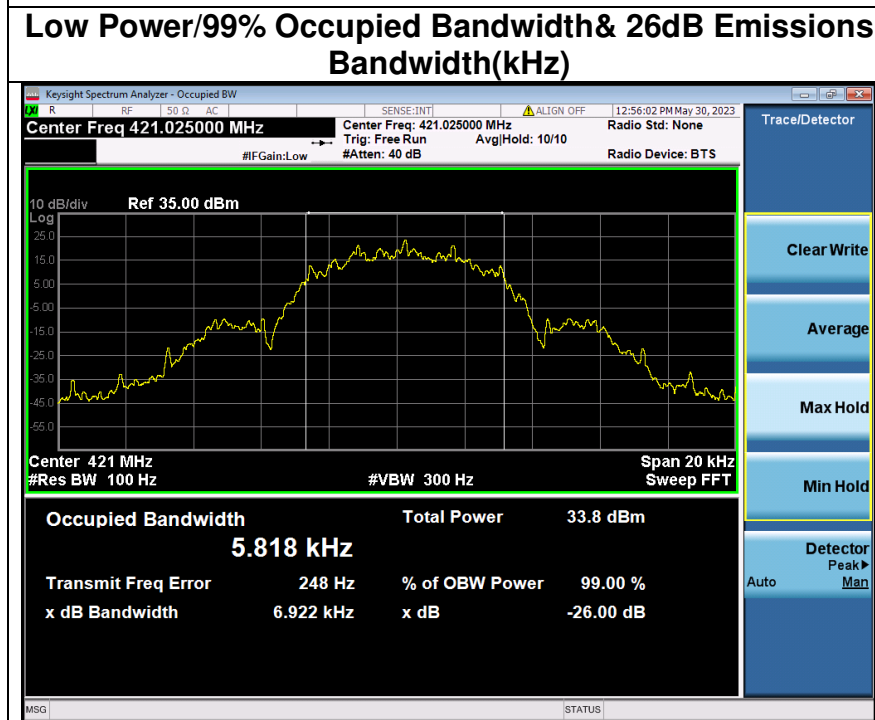
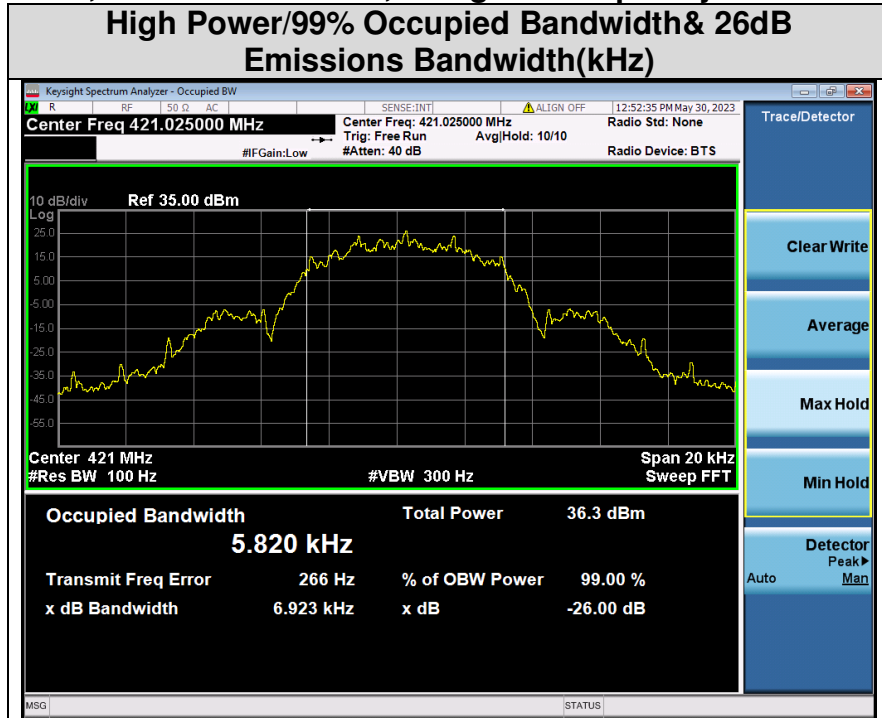
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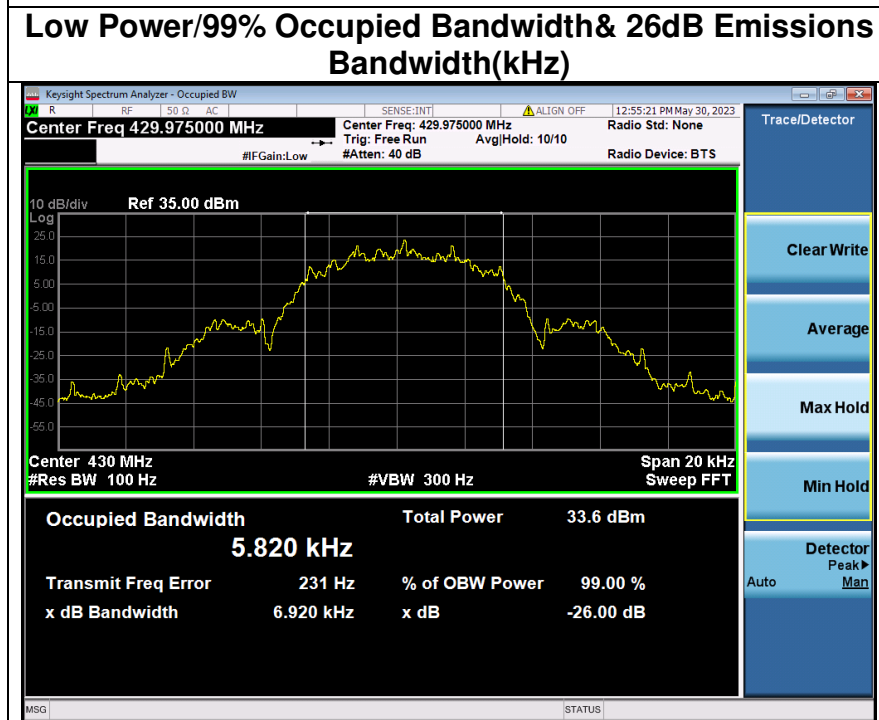
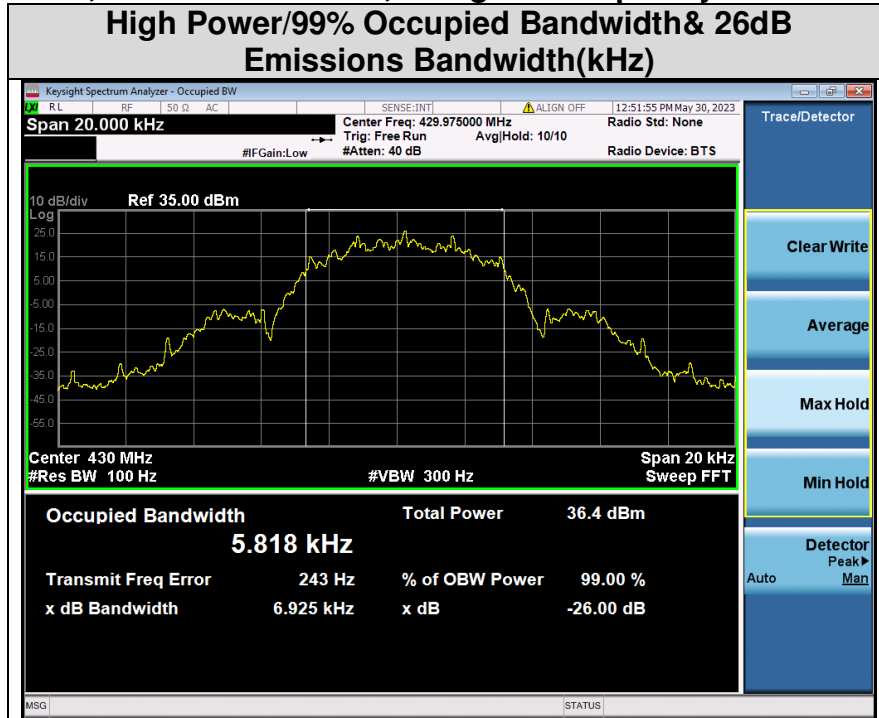
3. Occupied Bandwidth

Modulation Type	Channel Separation	Frequency (MHz)	Power Level	99% Occupied Bandwidth(kHz)	26dB Emissions Bandwidth(kHz)
GMSK	25KHz	421.025	High	5.820	6.923
			Low	5.818	6.922
		429.975	High	5.818	6.925
			Low	5.820	6.920
		450.025	High	5.825	6.916
			Low	5.822	6.917
		469.025	High	5.816	6.920
			Low	5.820	6.915
4FSK	25KHz	421.025	High	7.601	9.637
			Low	7.609	9.640
		429.975	High	7.607	9.657
			Low	7.619	9.678
		450.025	High	7.605	9.694
			Low	7.604	9.665
		469.025	High	7.570	9.642
			Low	7.574	9.648

25KHz, GMSK modulation, Assigned Frequency:421.025MHz

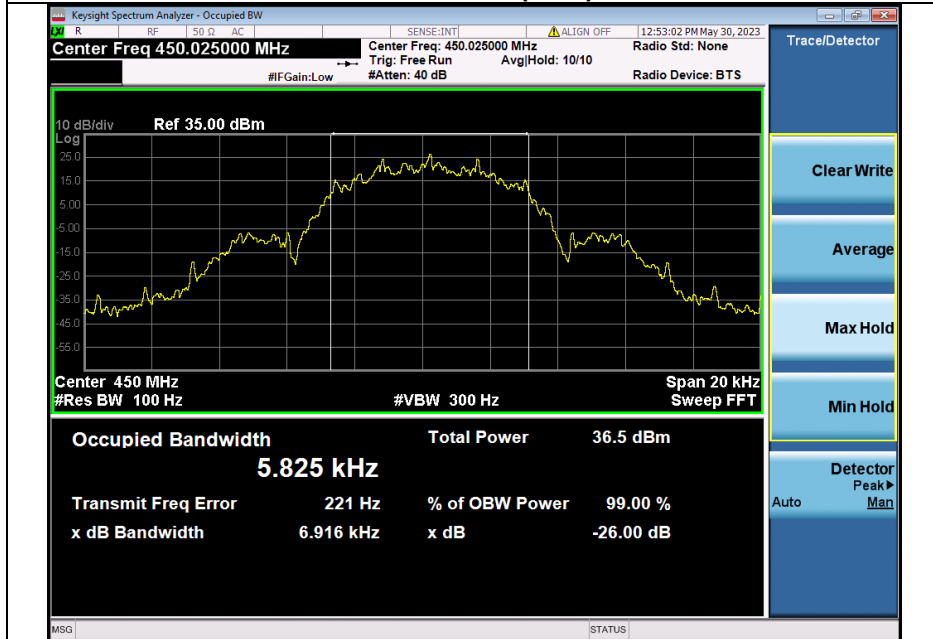


25KHz, GMSK modulation, Assigned Frequency:429.975MHz

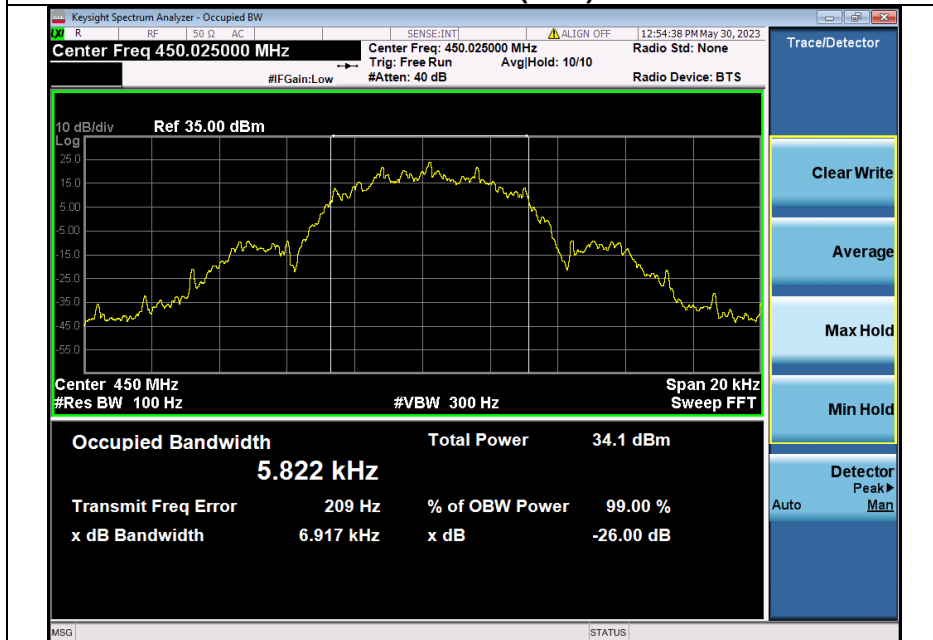


25KHz, GMSK modulation, Assigned Frequency:450.025MHz

High Power/99% Occupied Bandwidth& 26dB Emissions Bandwidth(kHz)

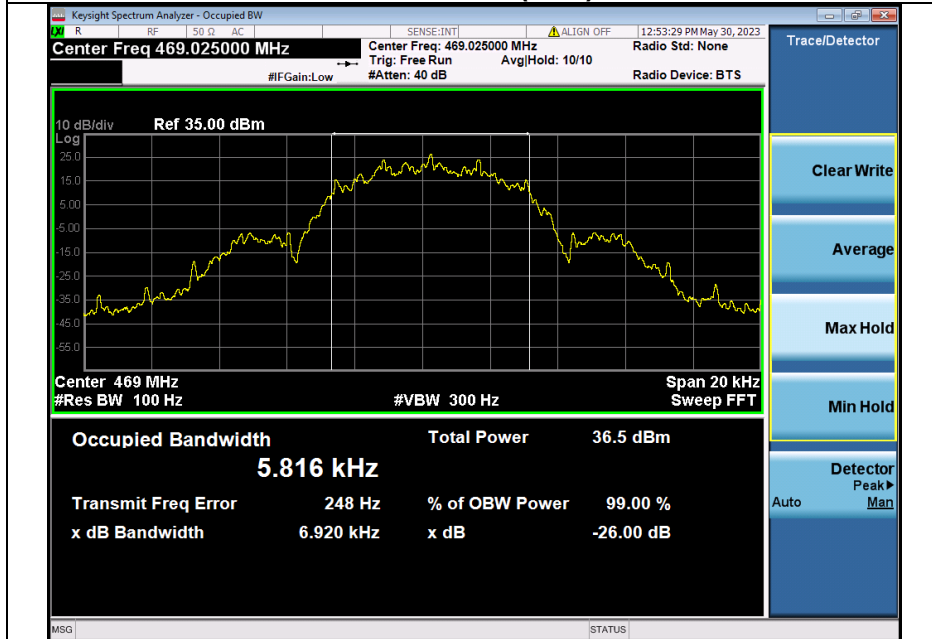


Low Power/99% Occupied Bandwidth& 26dB Emissions Bandwidth(kHz)

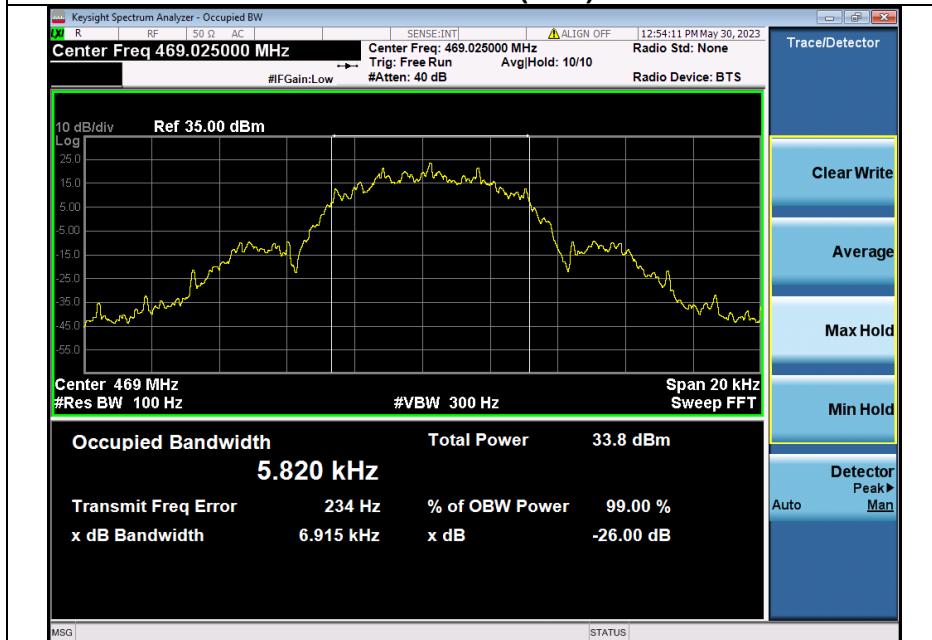


25KHz, GMSK modulation, Assigned Frequency:469.025MHz

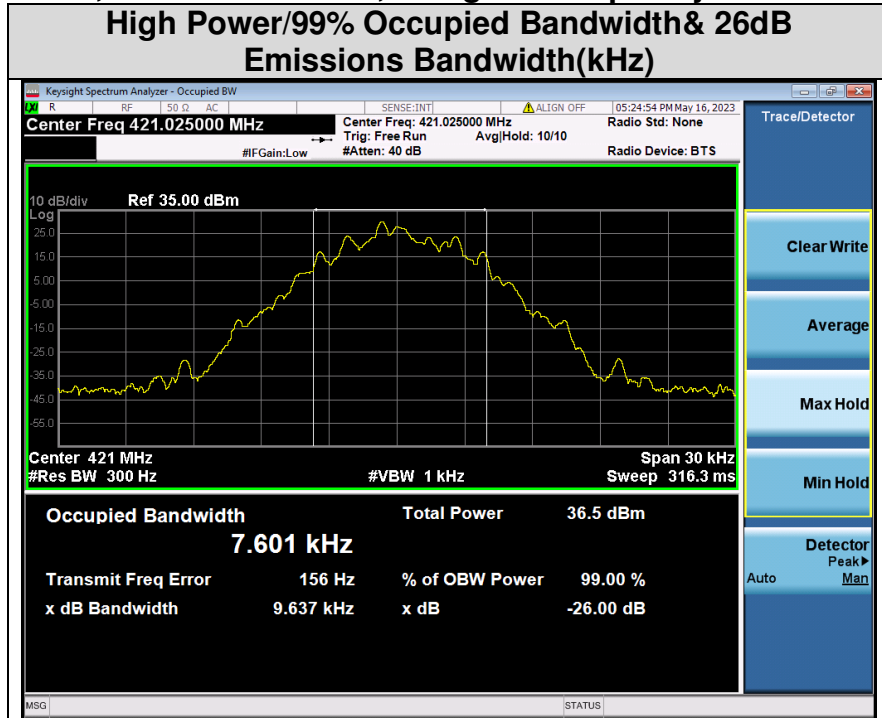
High Power/99% Occupied Bandwidth& 26dB Emissions Bandwidth(kHz)



Low Power/99% Occupied Bandwidth& 26dB Emissions Bandwidth(kHz)



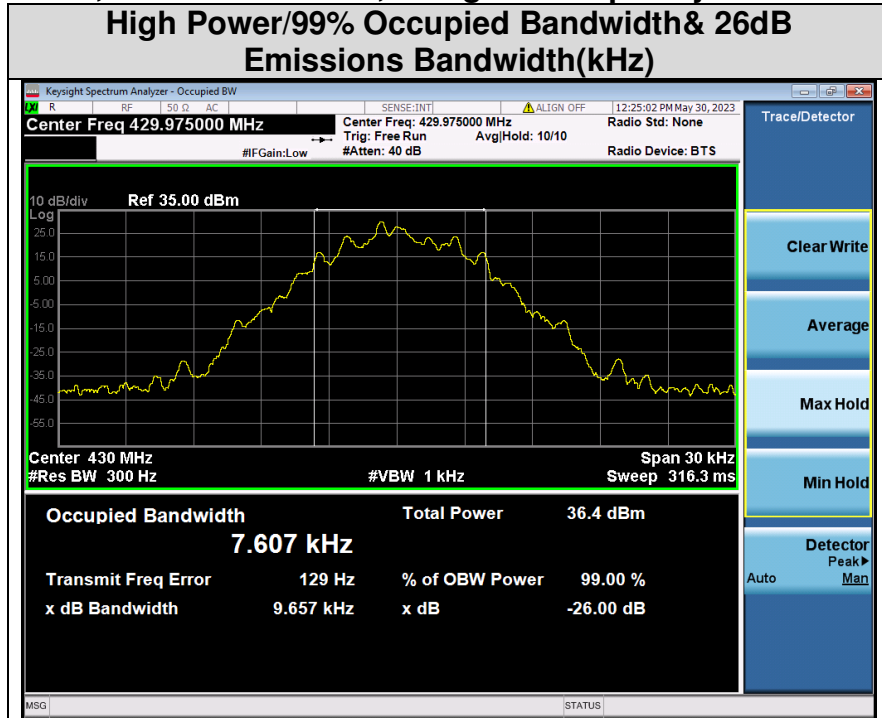
25KHz, 4FSK modulation, Assigned Frequency:421.025MHz



Low Power/99% Occupied Bandwidth& 26dB Emissions Bandwidth(kHz)



25KHz, 4FSK modulation, Assigned Frequency:429.975MHz



Low Power/99% Occupied Bandwidth& 26dB Emissions Bandwidth(kHz)



25KHz, 4FSK modulation, Assigned Frequency:450.025MHz High Power/99% Occupied Bandwidth& 26dB Emissions Bandwidth(kHz)



Low Power/99% Occupied Bandwidth& 26dB Emissions Bandwidth(kHz)



25KHz, 4FSK modulation, Assigned Frequency:469.025MHz High Power/99% Occupied Bandwidth& 26dB Emissions Bandwidth(kHz)

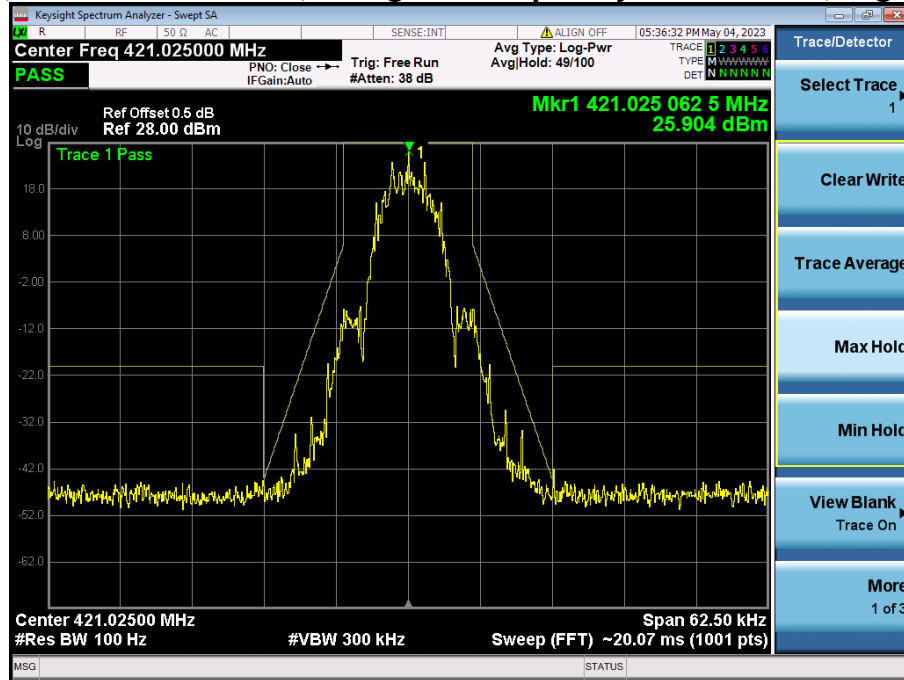


Low Power/99% Occupied Bandwidth& 26dB Emissions Bandwidth(kHz)

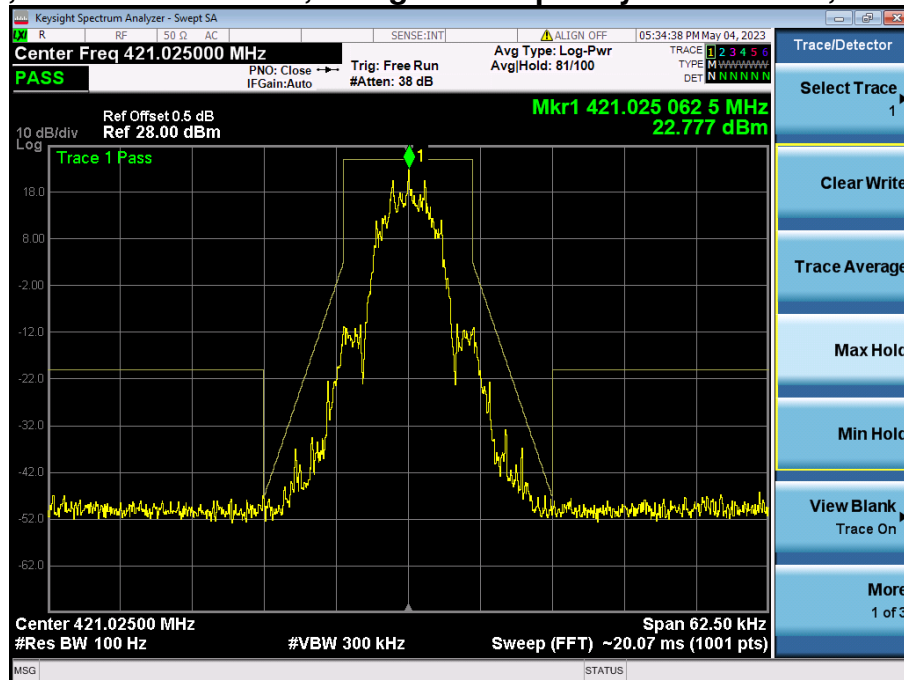


4. Emission Mask

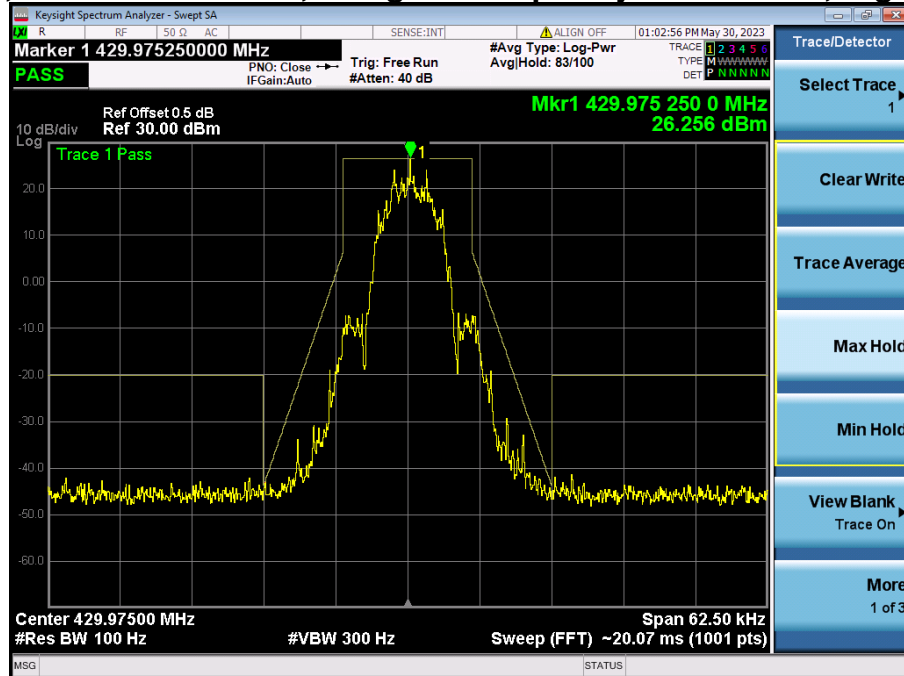
25KHz, GMSK modulation, Assigned Frequency:421.025MHz, High Power



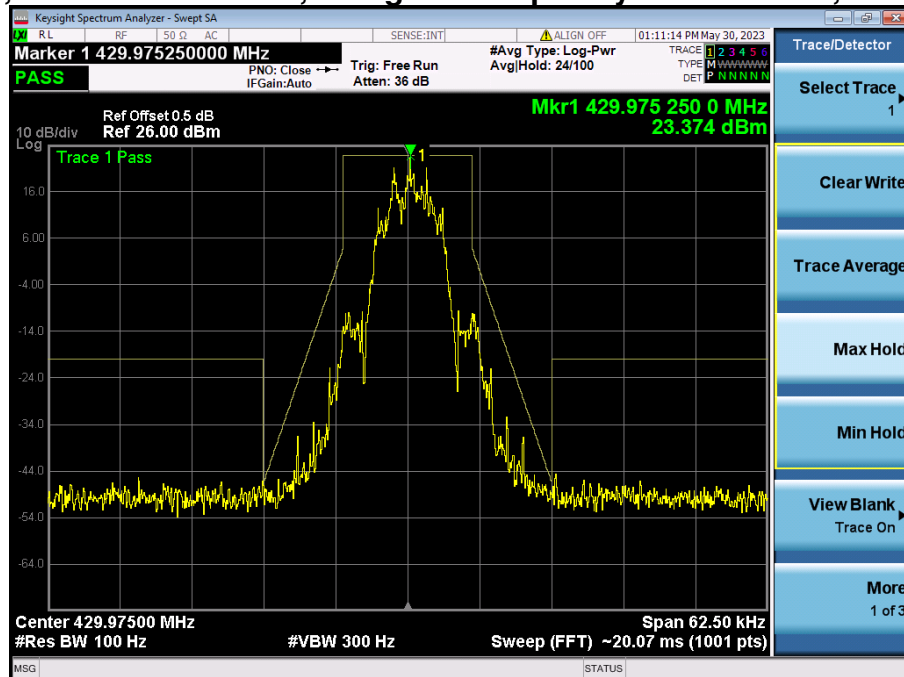
25KHz, GMSK modulation, Assigned Frequency:421.025MHz, Low Power



25KHz, GMSK modulation, Assigned Frequency:429.975MHz, High Power



25KHz, GMSK modulation, Assigned Frequency: 429.975MHz, Low Power





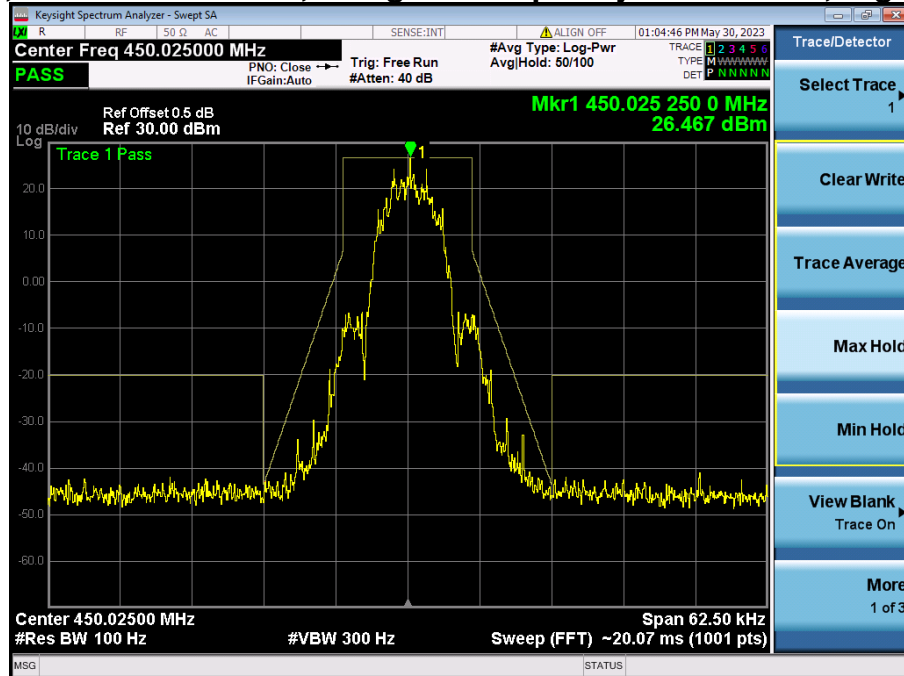
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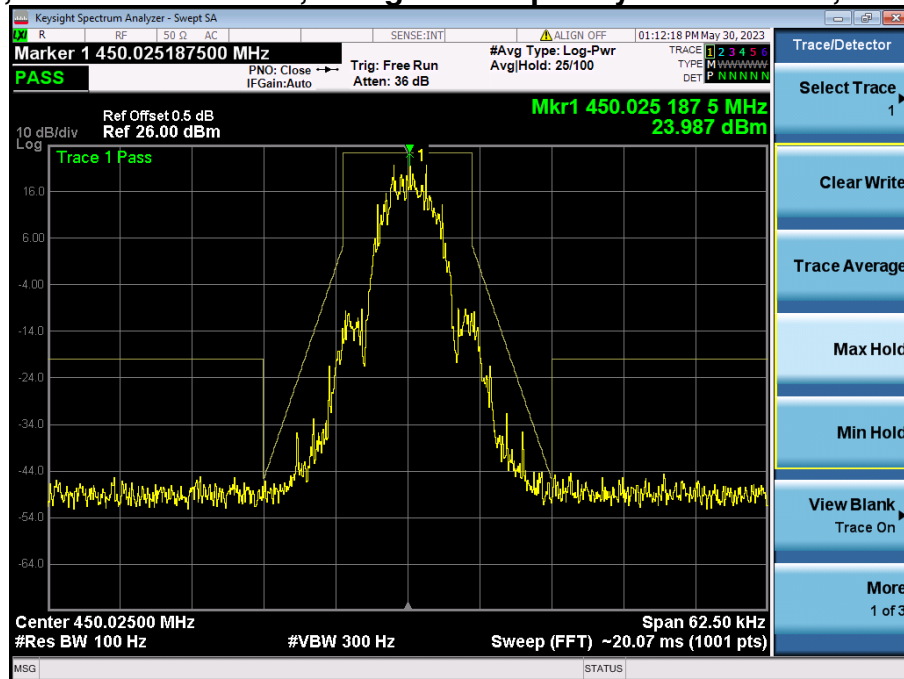
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25KHz, GMSK modulation, Assigned Frequency:450.025MHz, High Power



25KHz, GMSK modulation, Assigned Frequency: 450.025MHz, Low Power



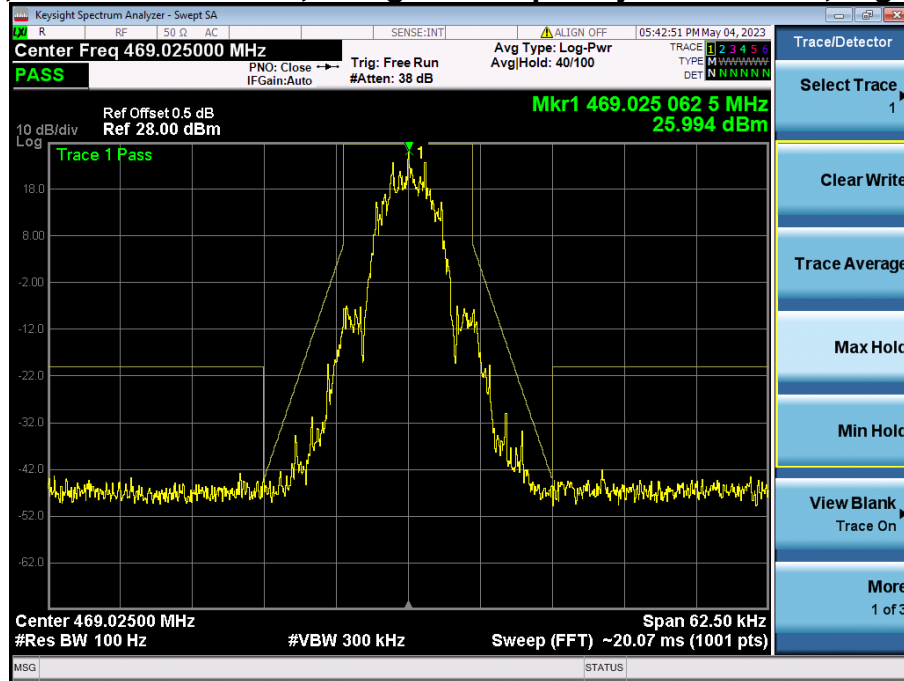
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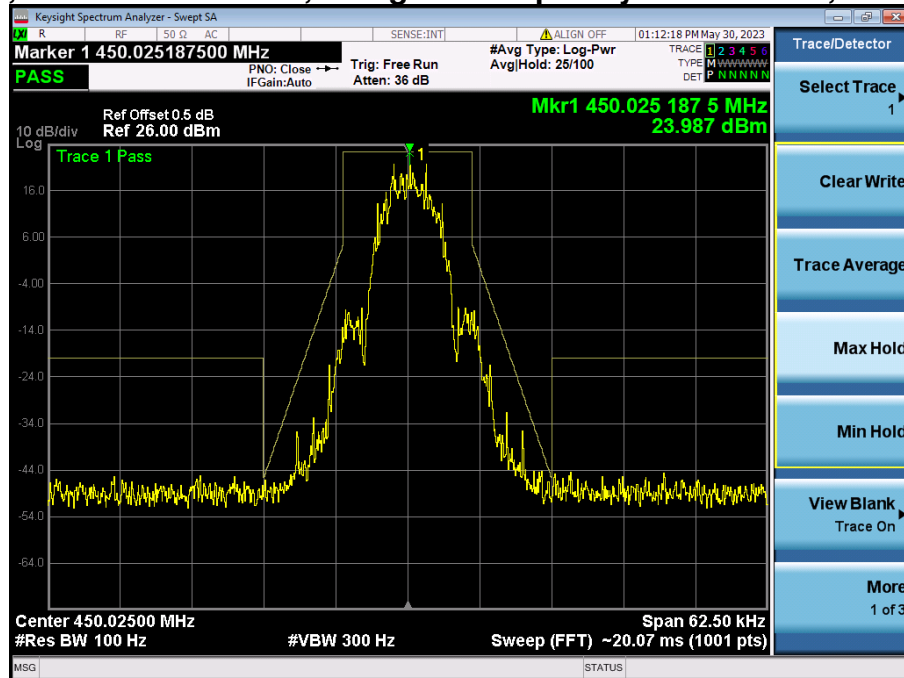
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25KHz, GMSK modulation, Assigned Frequency:469.025MHz, High Power



25KHz, GMSK modulation, Assigned Frequency:469.025MHz, Low Power





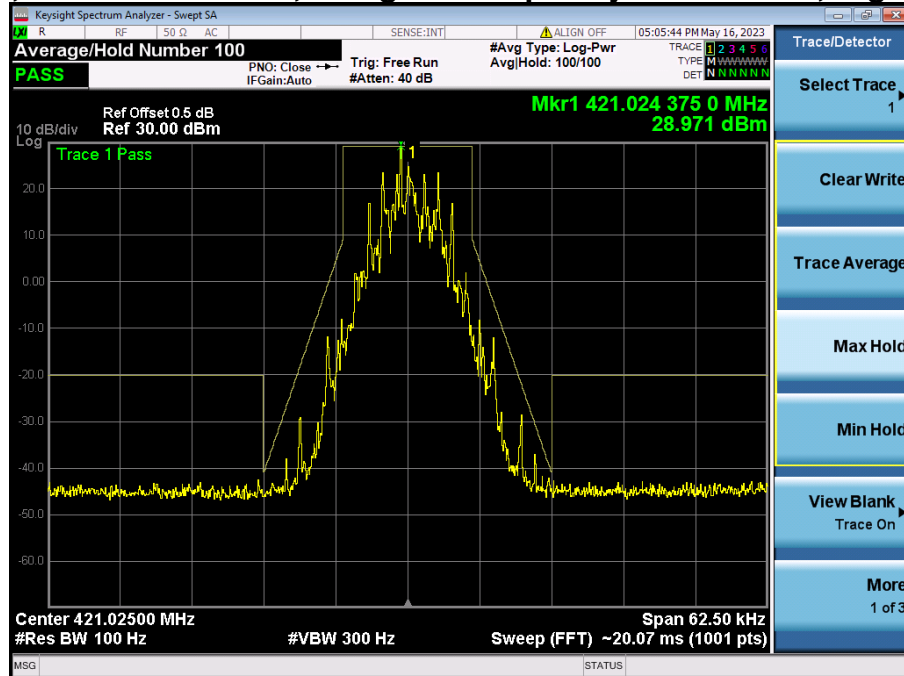
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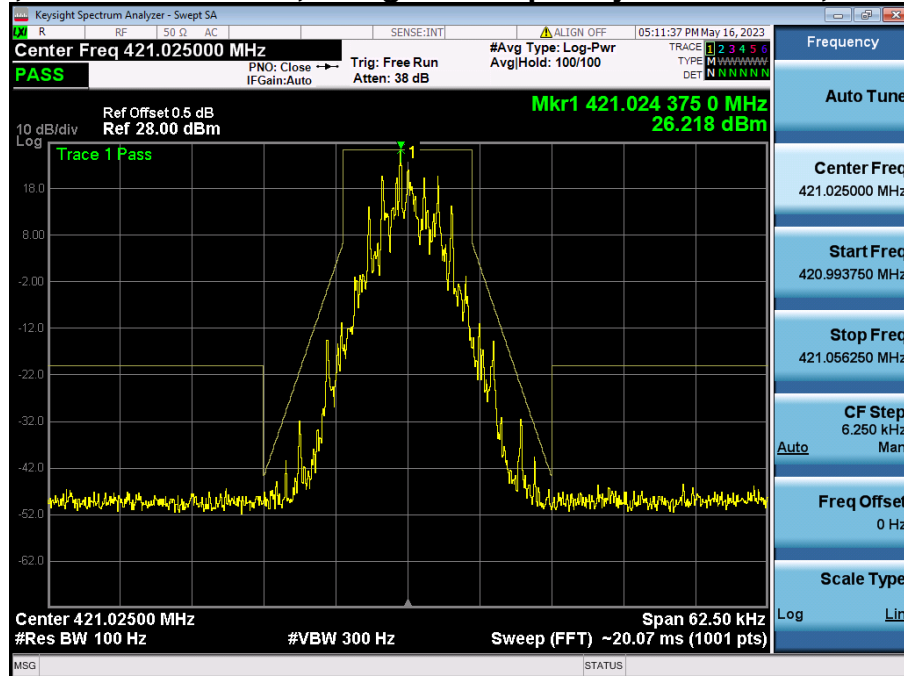
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25KHz, 4FSK modulation, Assigned Frequency:421.025MHz, High Power



25KHz, 4FSK modulation, Assigned Frequency:421.025MHz, Low Power



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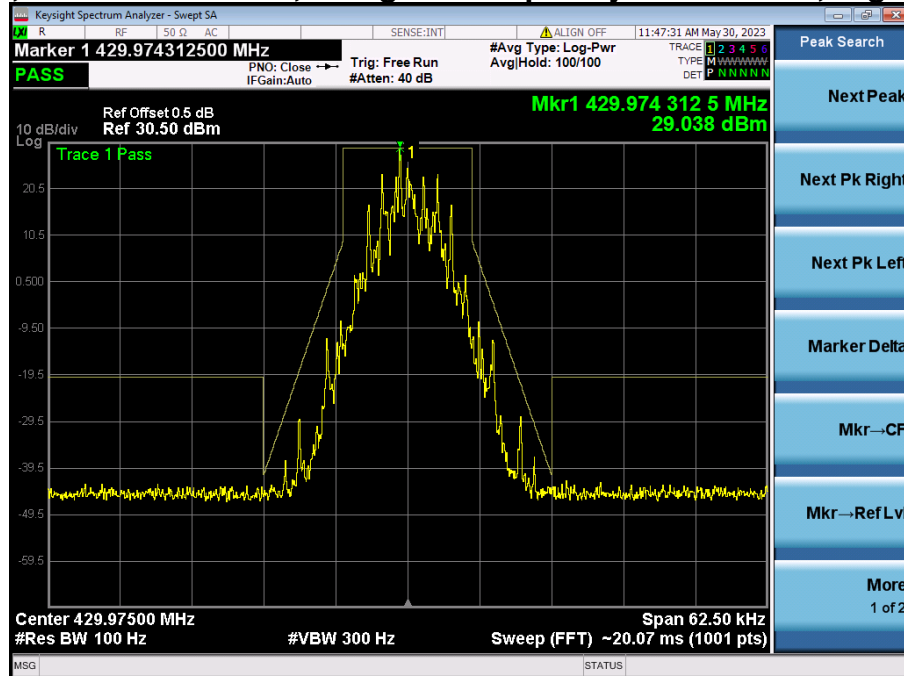
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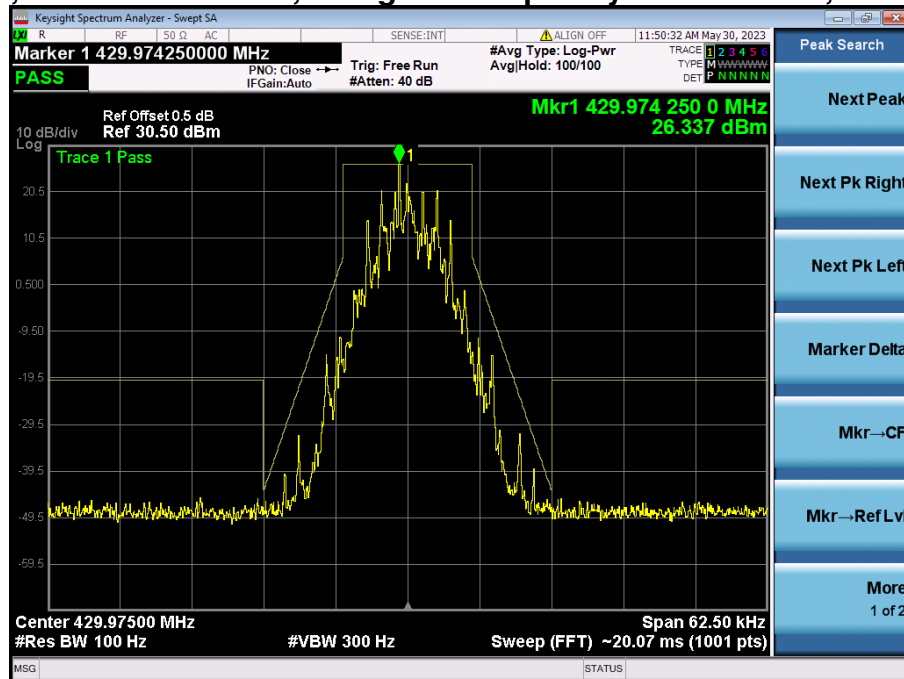
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25KHz, 4FSK modulation, Assigned Frequency:429.975MHz, High Power



25KHz, 4FSK modulation, Assigned Frequency: 429.975MHz, Low Power



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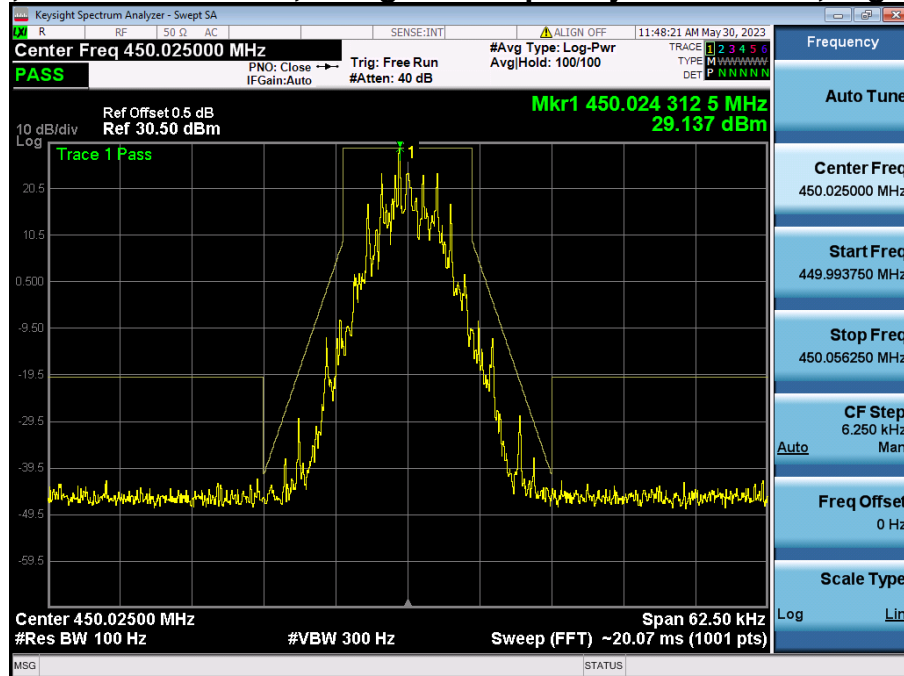
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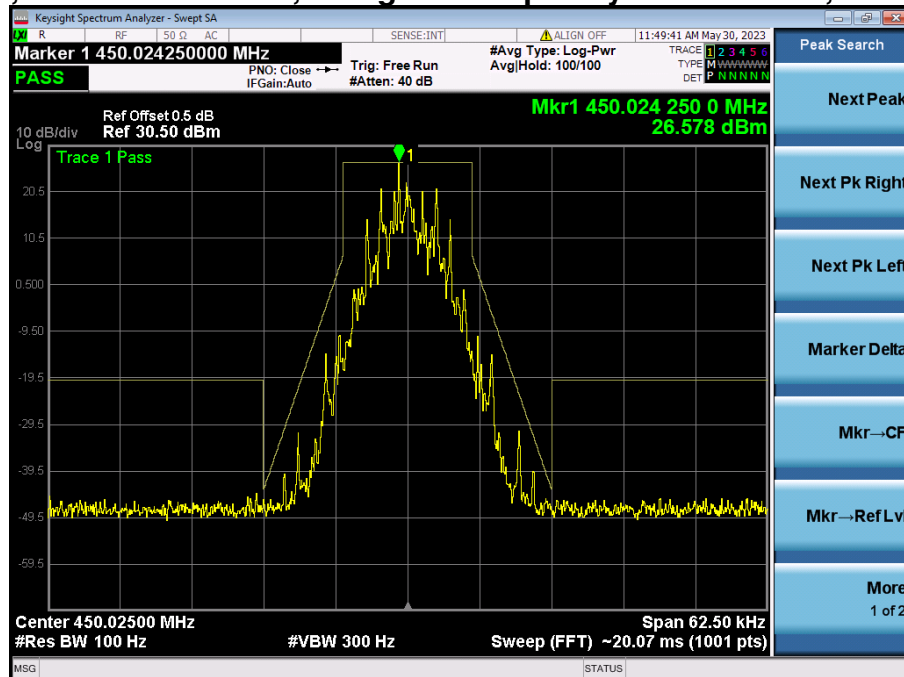
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25KHz, 4FSK modulation, Assigned Frequency:450.025MHz, High Power



25KHz, 4FSK modulation, Assigned Frequency: 450.025MHz, Low Power



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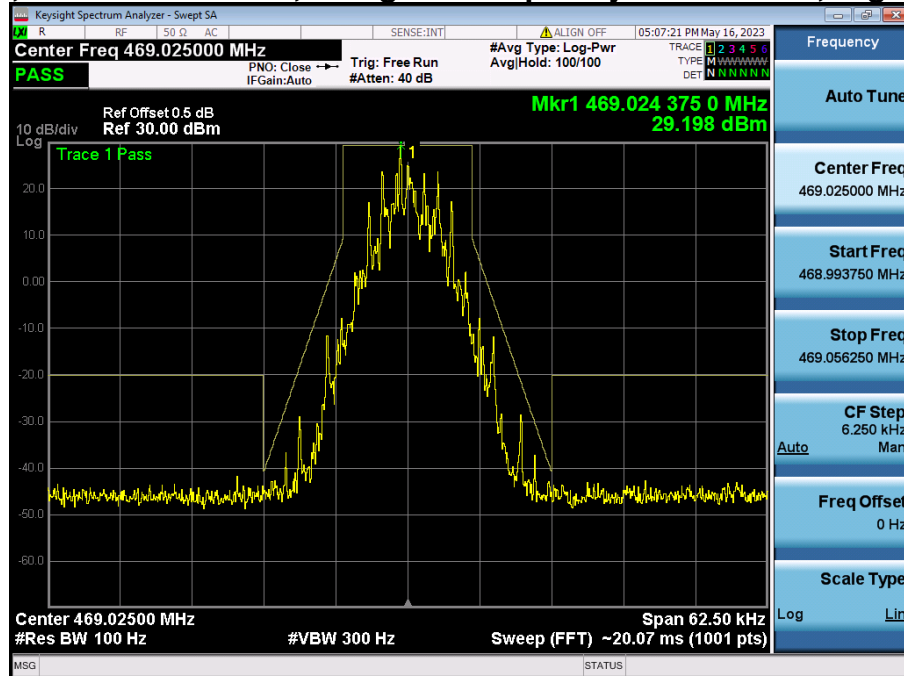
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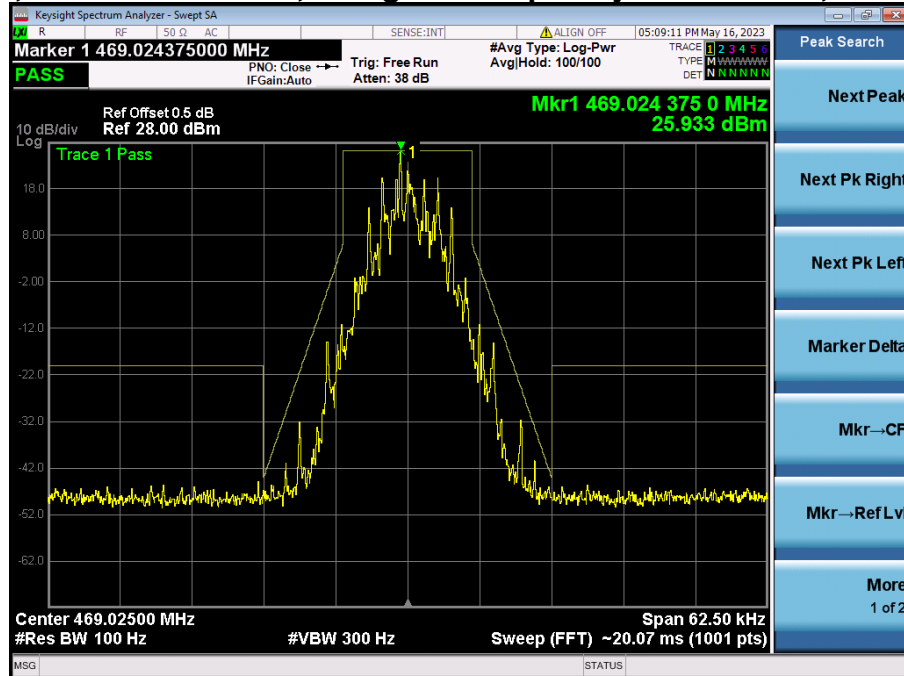
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25KHz, 4FSK modulation, Assigned Frequency:469.025MHz, High Power



25KHz, 4FSK modulation, Assigned Frequency:469.025MHz, Low Power



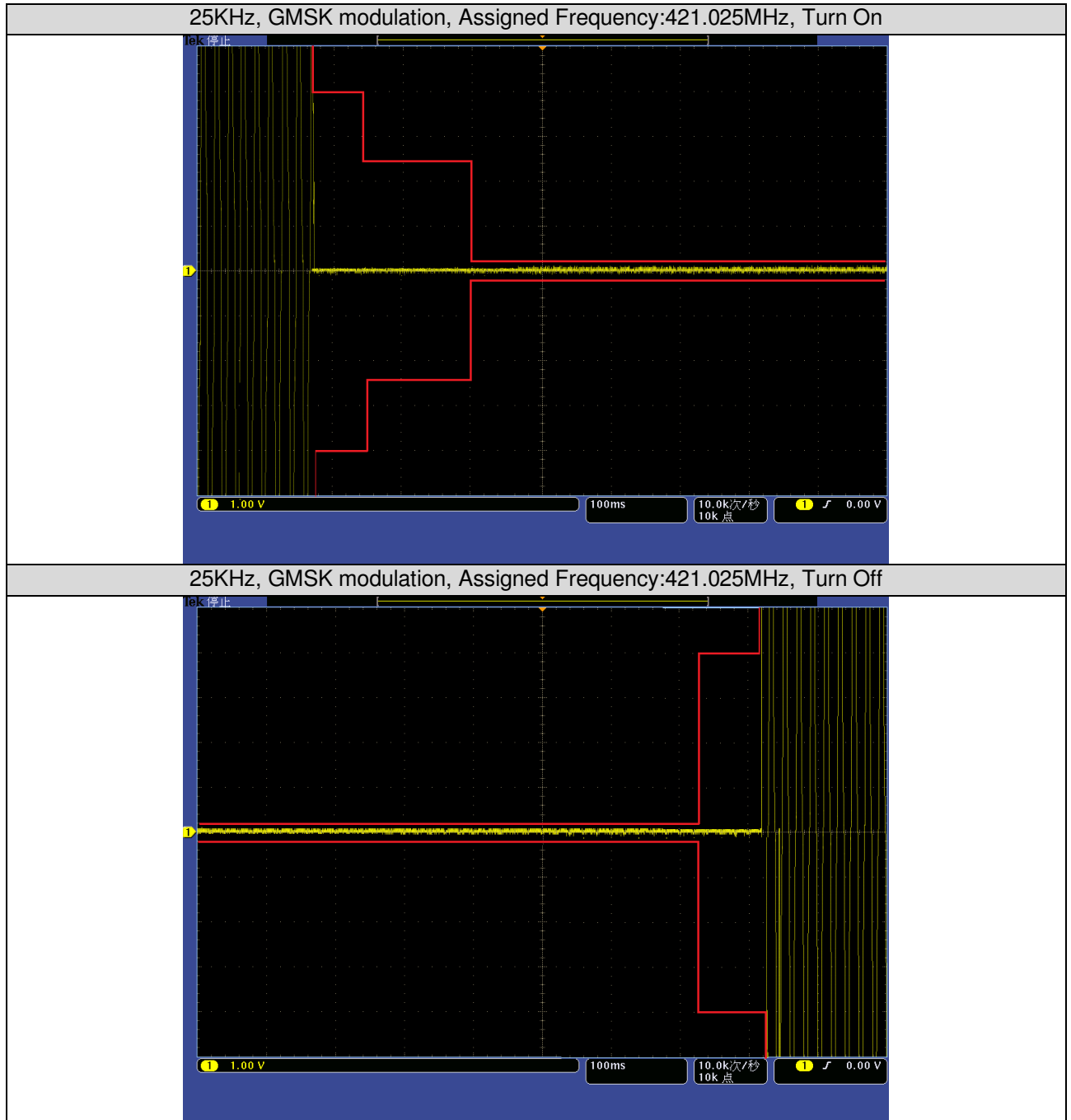
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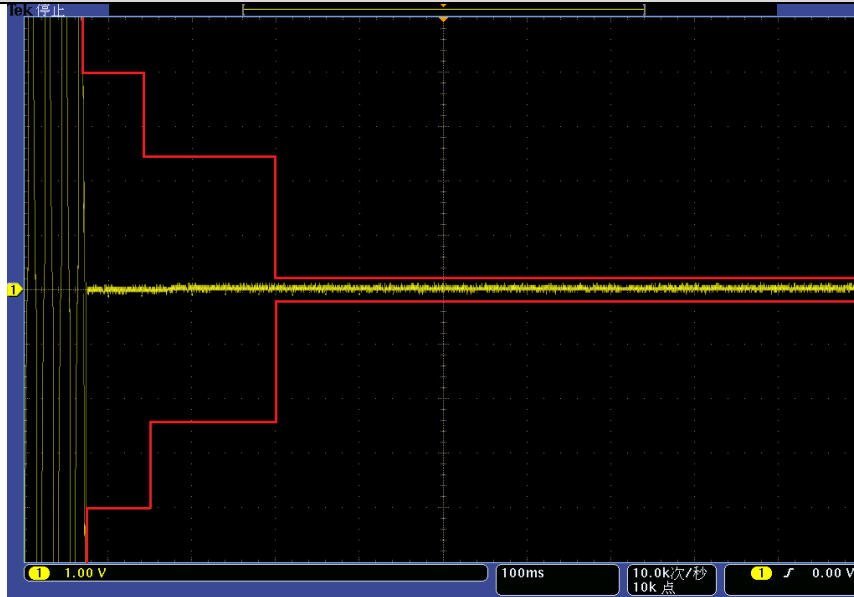
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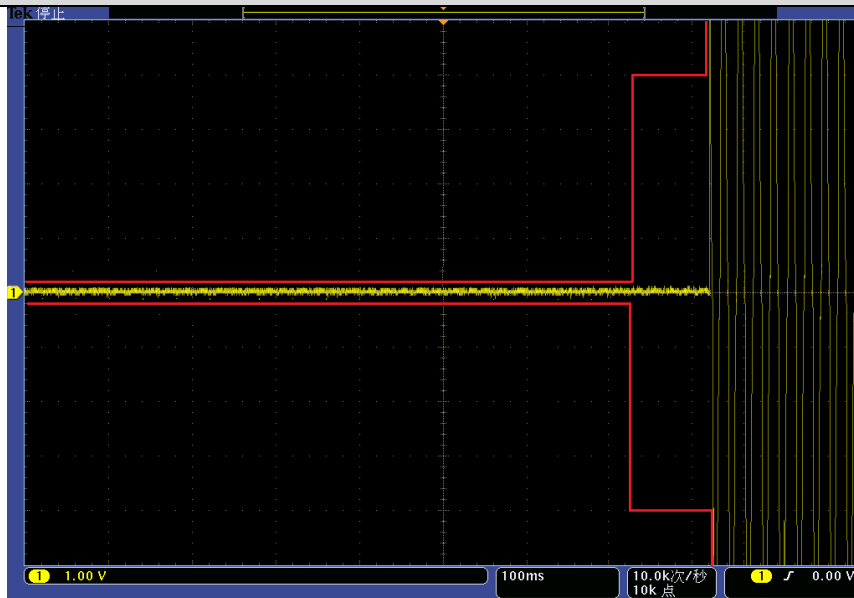
5. Transient Frequency Behavior



25KHz, 4FSK modulation, Assigned Frequency:469.025MHz, Turn On

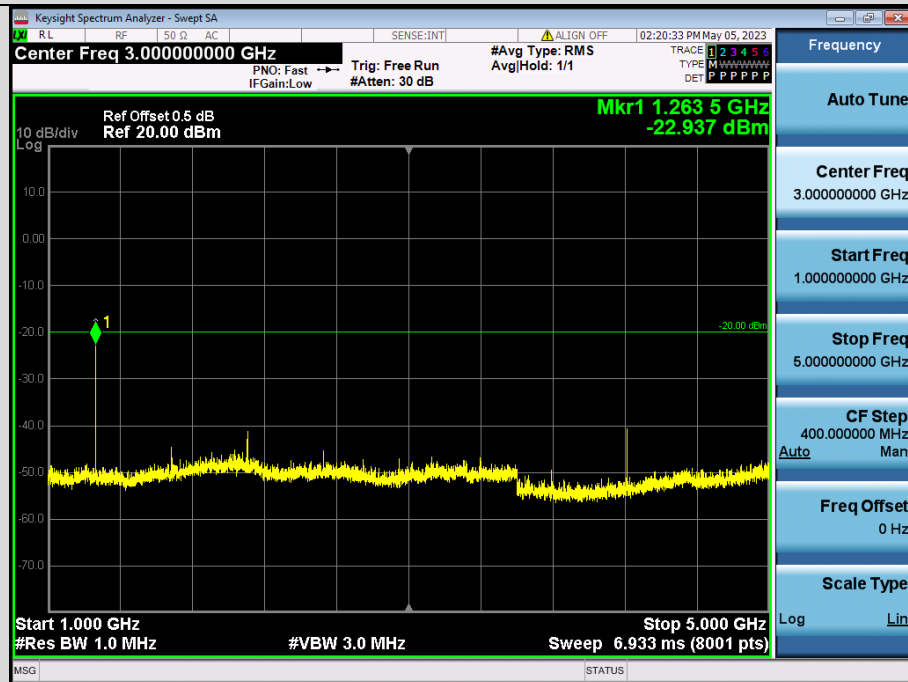
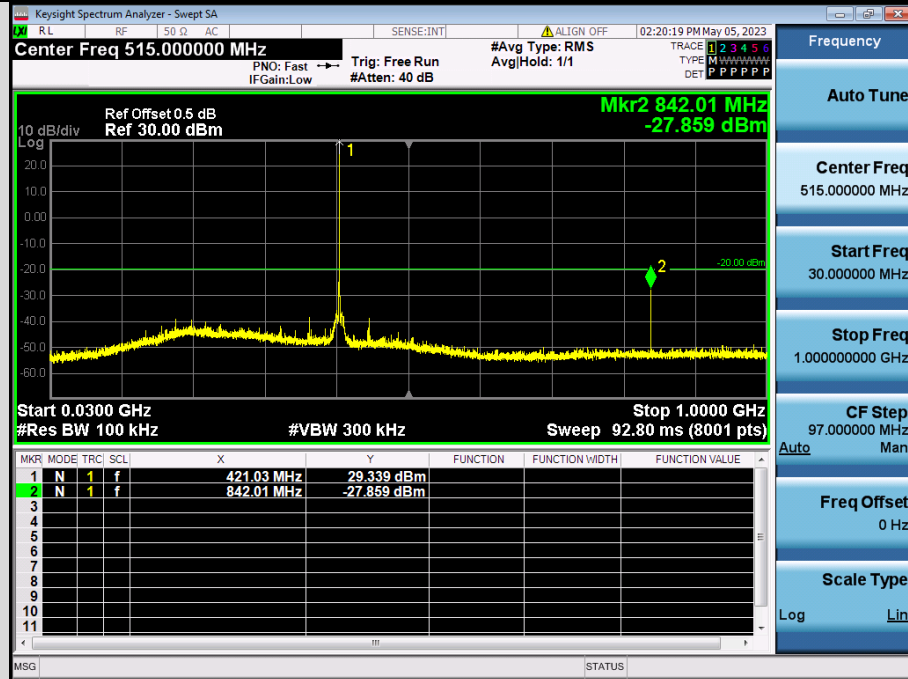


25KHz, 4FSK modulation, Assigned Frequency:469.025MHz, Turn Off

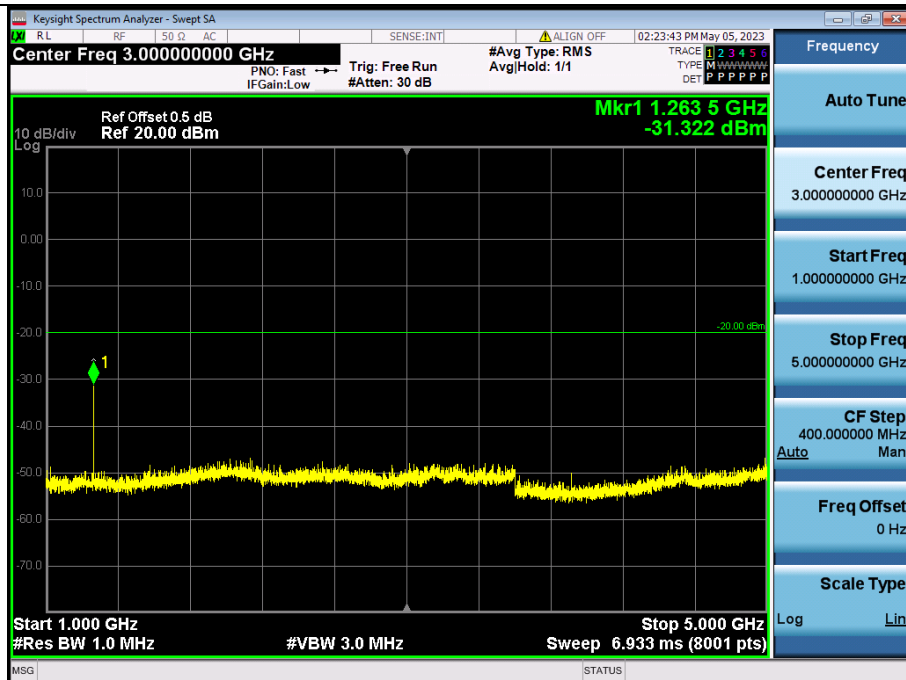
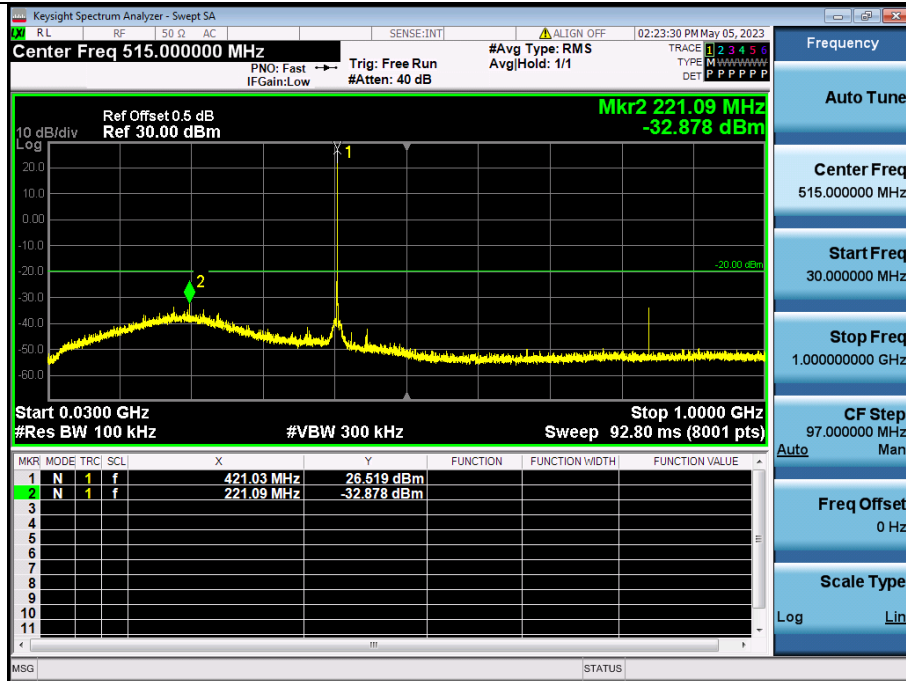


6. Conducted Spurious Emission

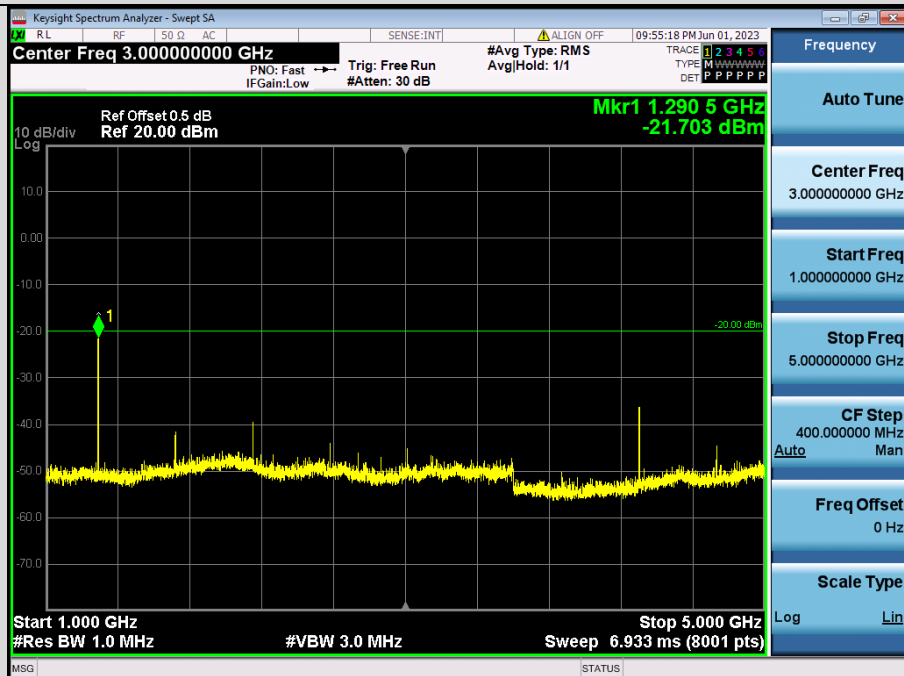
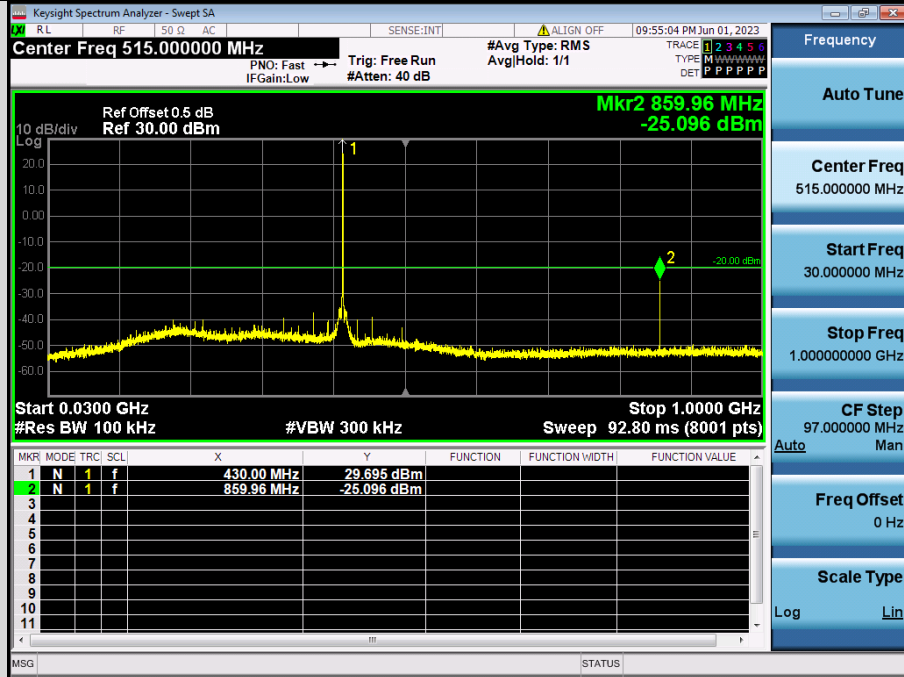
25KHz, GMSK modulation, Assigned Frequency:421.025MHz, High Power



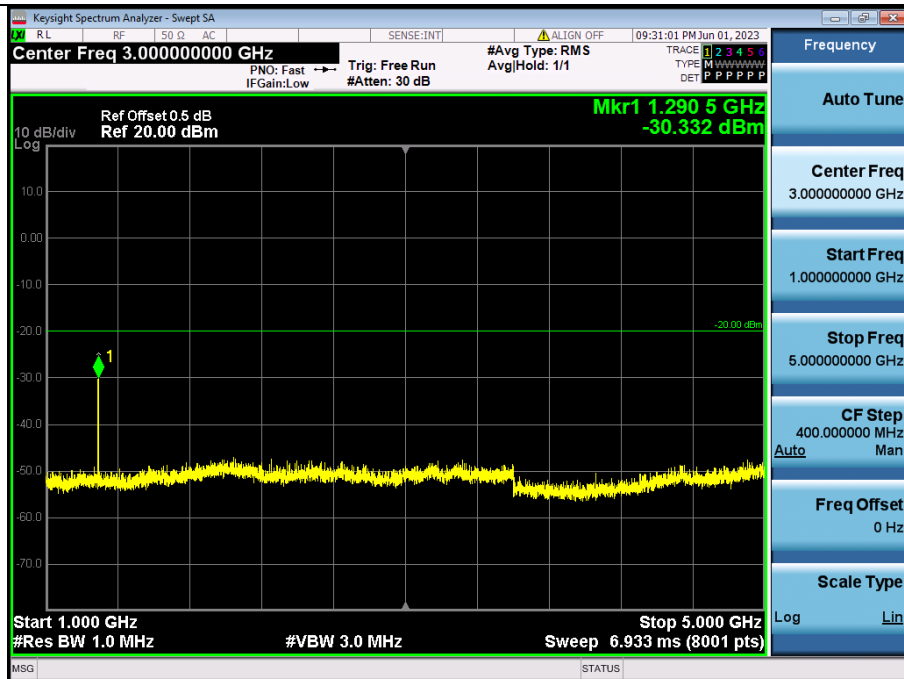
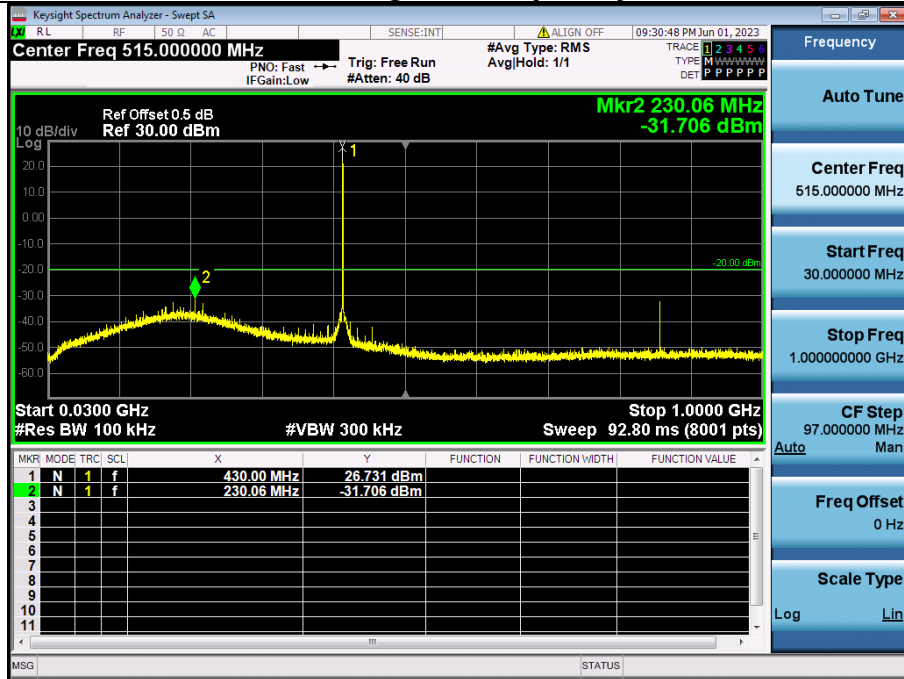
25KHz, GMSK modulation, Assigned Frequency: 421.025MHz Low Power



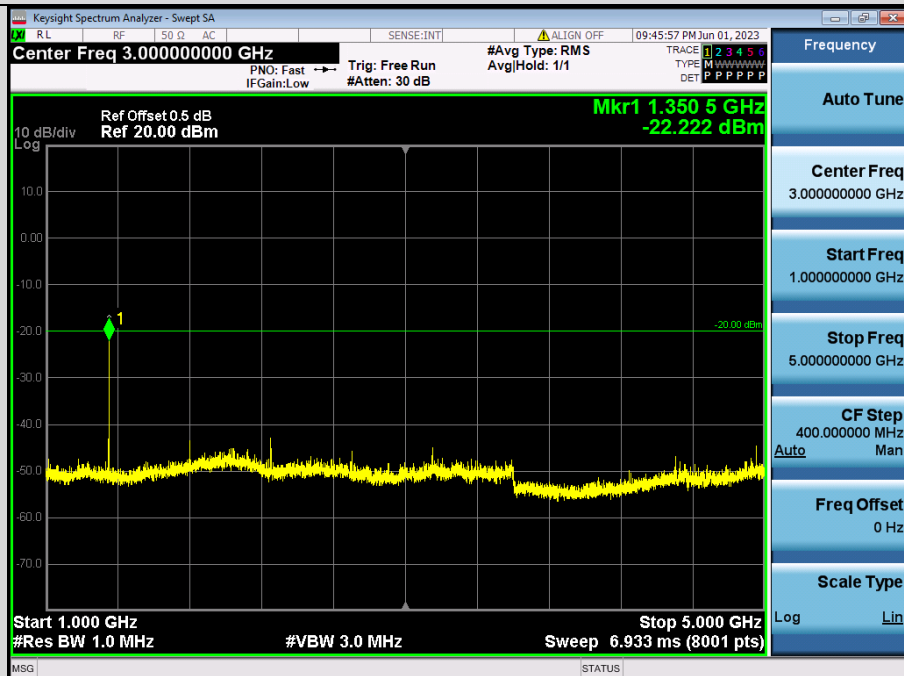
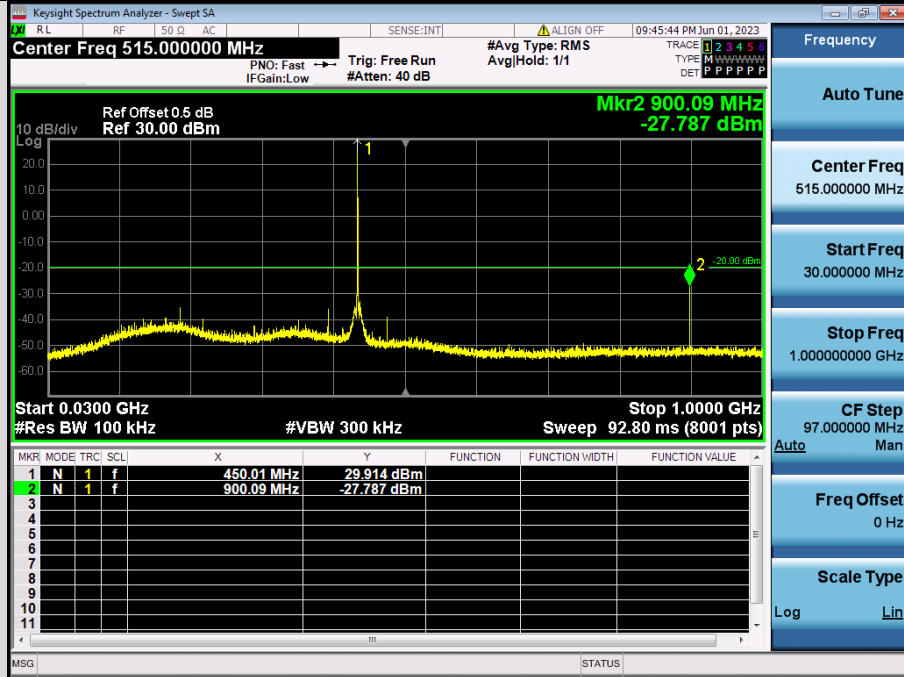
25KHz, GMSK modulation, Assigned Frequency: 429.975MHz, High Power



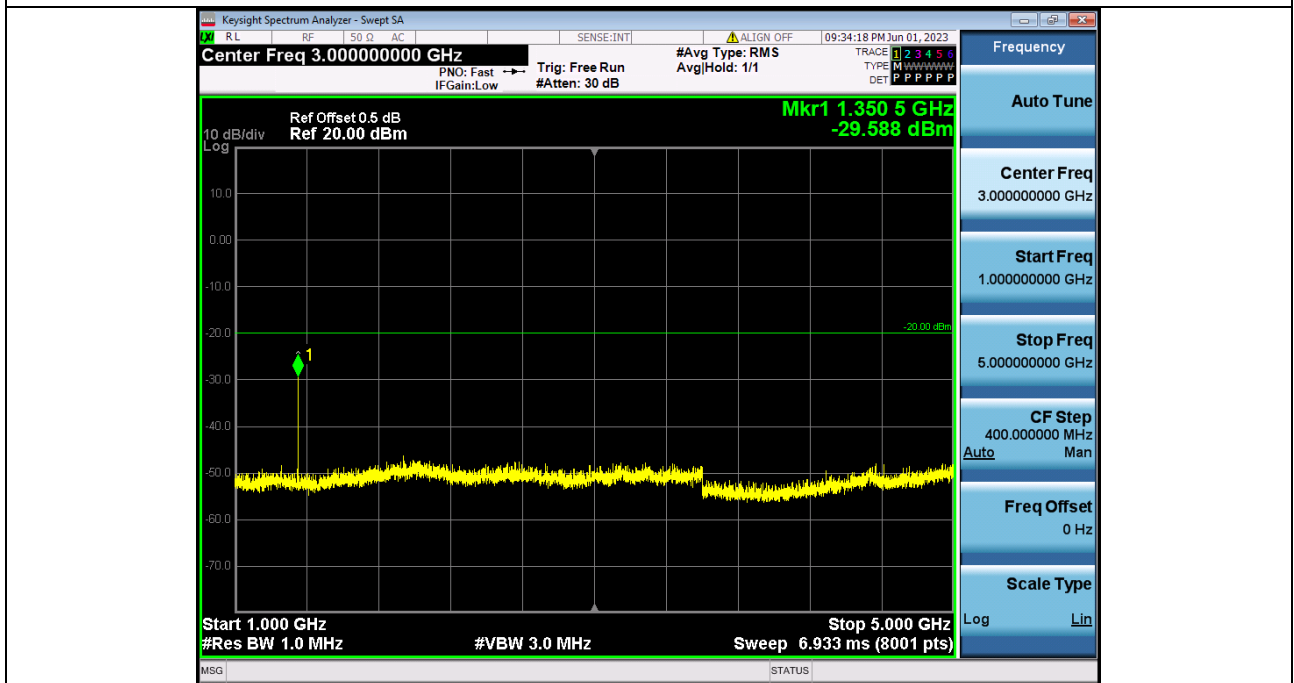
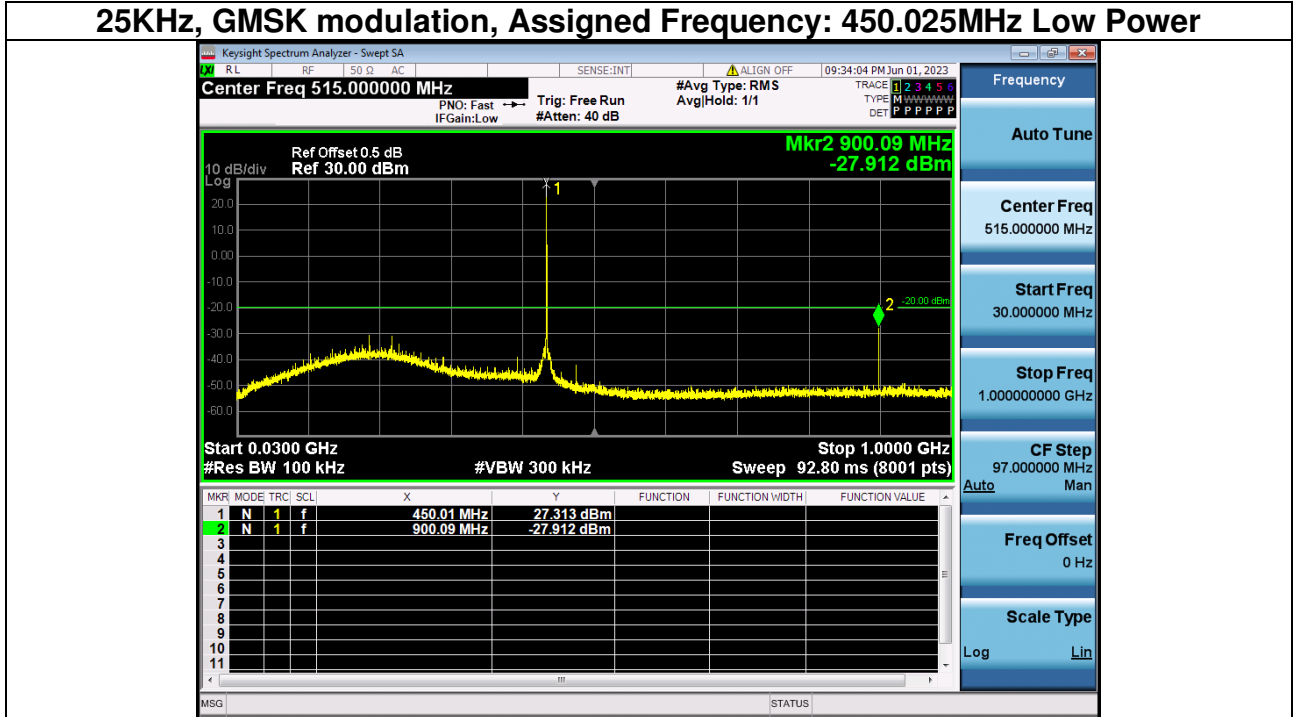
25KHz, GMSK modulation, Assigned Frequency: 429.975MHz Low Power



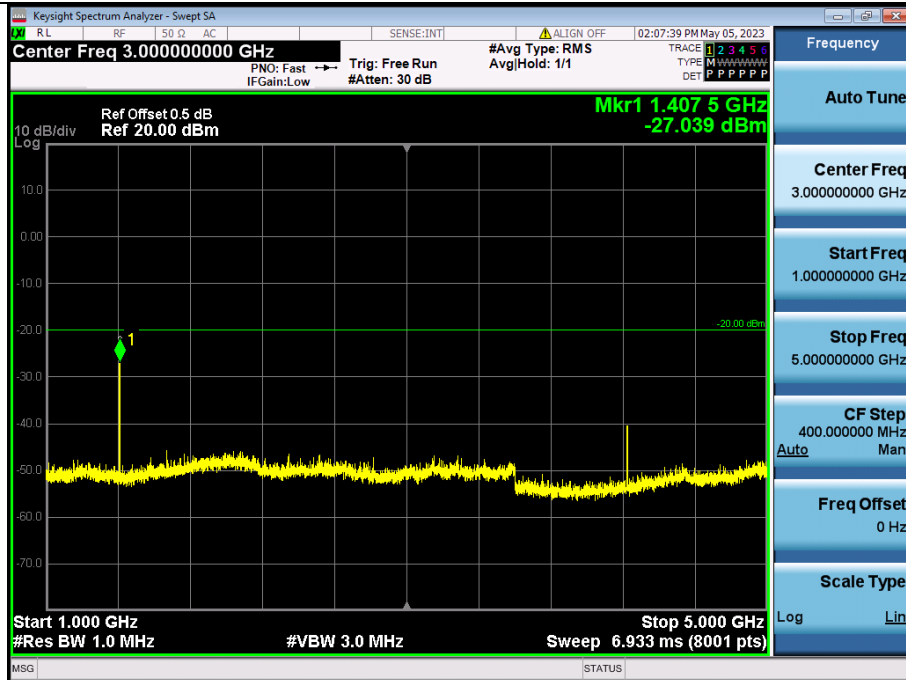
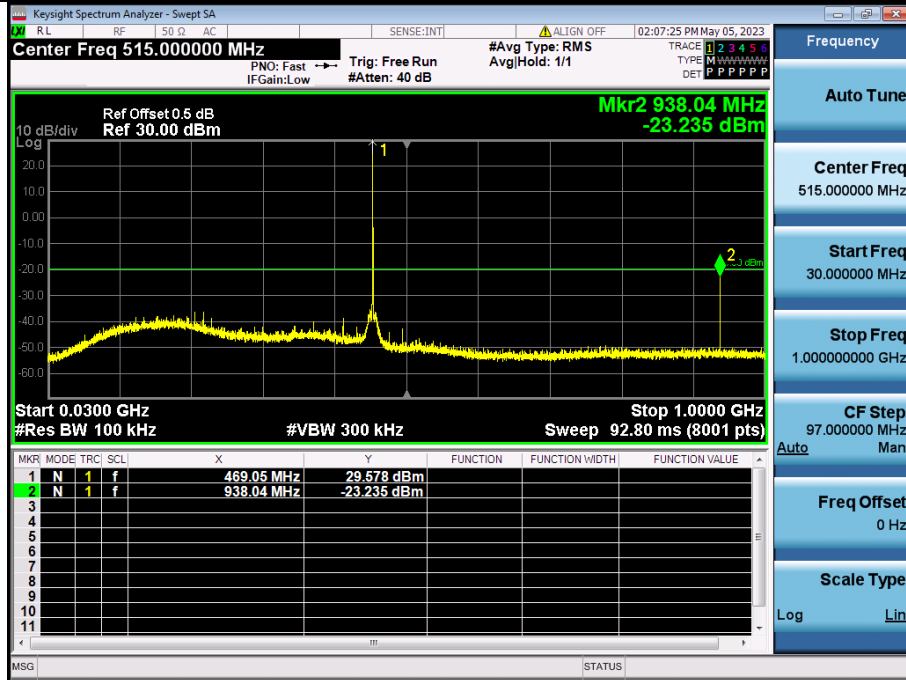
25KHz, GMSK modulation, Assigned Frequency: 450.025MHz, High Power



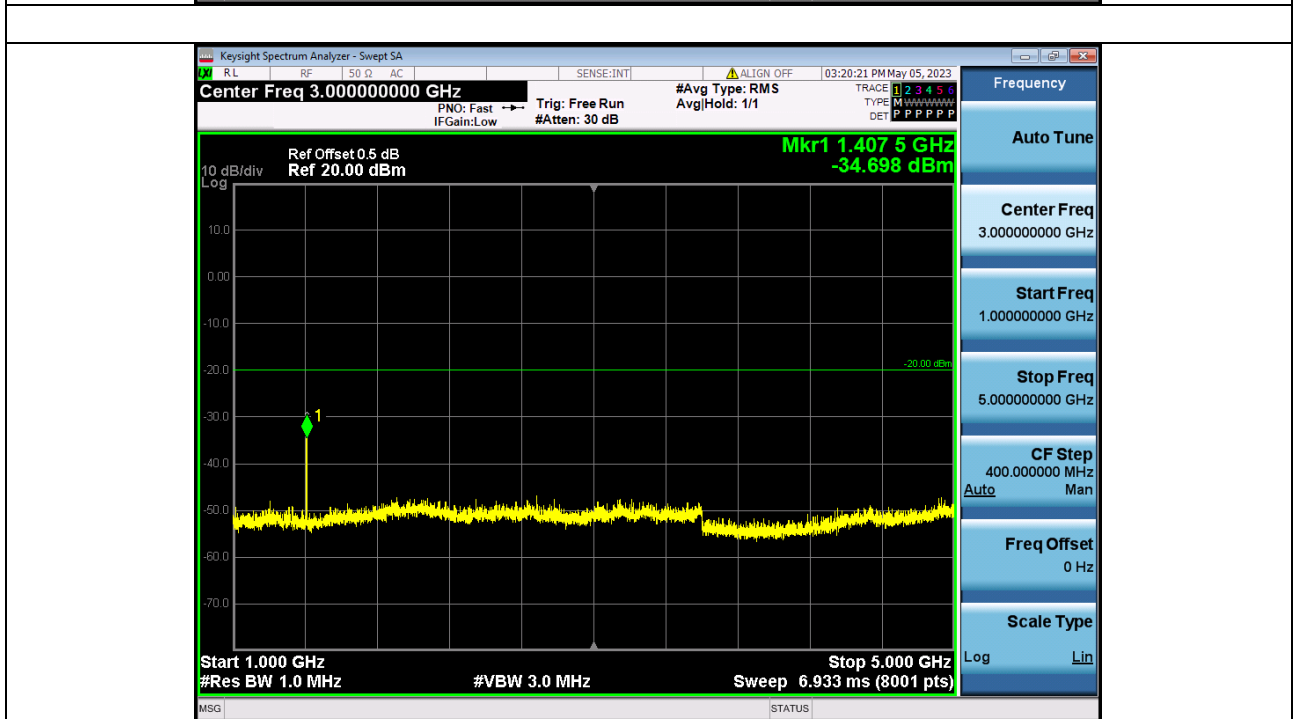
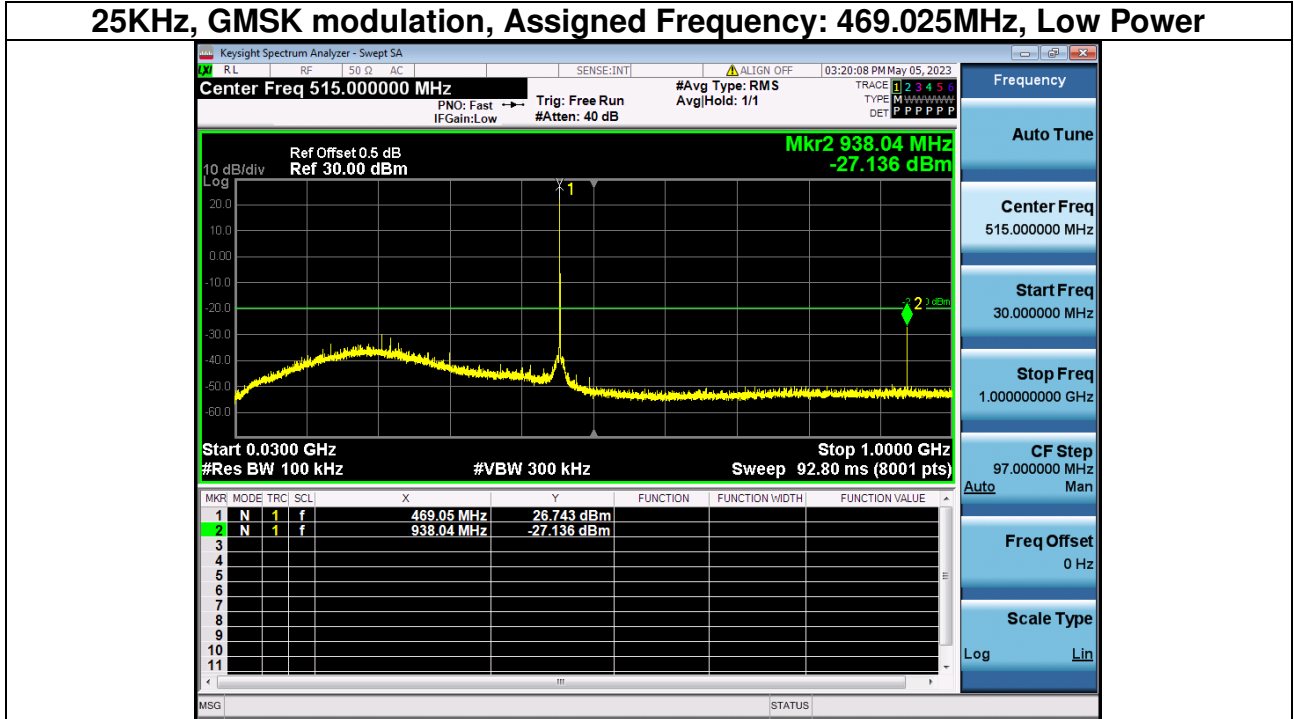
25KHz, GMSK modulation, Assigned Frequency: 450.025MHz Low Power



25KHz, GMSK modulation, Assigned Frequency:469.025MHz, High Power



25KHz, GMSK modulation, Assigned Frequency: 469.025MHz, Low Power



Note: All modes have been tested and we found 25KHz bandwidth, GMSK modulation has the worst test result. Only record the worst test result.

7. Radiated Spurious Emission

25KHz, GMSK modulation, Assigned Frequency:421.025MHz, High Power				
Frequency MHz	Polarity H/V	Emission Level dBm	Limit dBm	Over Limit dBm
842.050	H	-24.02	-20	-4.02
1263.075	H	-25.54	-20	-5.54
1263.075	H	-24.99	-20	-4.99
842.050	V	-23.71	-20	-3.71
1263.075	V	-24.08	-20	-4.08
1263.075	V	-24.49	-20	-4.49

25KHz, GMSK modulation, Assigned Frequency:429.975MHz, High Power				
Frequency MHz	Polarity H/V	Emission Level dBm	Limit dBm	Over Limit dBm
859.950	H	-23.96	-20	-3.96
1289.925	H	-25.61	-20	-5.61
1719.900	H	-25.02	-20	-5.02
859.950	V	-23.86	-20	-3.86
1289.925	V	-23.88	-20	-3.88
1719.900	V	-24.28	-20	-4.28

25KHz, GMSK modulation, Assigned Frequency:450.025MHz, High Power				
Frequency MHz	Polarity H/V	Emission Level dBm	Limit dBm	Over Limit dBm
900.050	H	-23.82	-20	-3.82
1350.075	H	-25.44	-20	-5.44
1800.100	H	-25.05	-20	-5.05
900.050	V	-23.62	-20	-3.62
1350.075	V	-23.87	-20	-3.87
1800.100	V	-24.32	-20	-4.32



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25KHz, GMSK modulation, Assigned Frequency:469.025MHz, High Power				
Frequency MHz	Polarity H/V	Emission Level dBm	Limit dBm	Over Limit dBm
938.050	H	-23.78	-20	-3.78
1407.075	H	-25.41	-20	-5.41
1407.075	H	-24.93	-20	-4.93
938.050	V	-23.89	-20	-3.89
1407.075	V	-24.20	-20	-4.20
1407.075	V	-24.43	-20	-4.43

Note: Margin = Emission level – Limit.

All modes have been tested, GMSK modulation has the worst test result.

- End of the Report -



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