

TEST REPORT

Of

JAPAN MIC

Product : TPMS

Brand: MOBILETRON

Model: TX-T003; TX-T004

Model Difference: The enclosure and Gas nozzle are different.

Applicant: Mobiletron Electronics Co., Ltd.

Address: 85, Sec.4, Chung-Ching Rd., Ta-Ya District,
Taichung 428, Taiwan

Test Performed by:
International Standards Laboratory

<LT Lab.>

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Report No.: ISL-23LR0047JAP

Issue Date : 2023/04/17

Test results given in this report apply only to the specific sample(s) tested and are traceable to national or international standard through calibration of the equipment and evaluating measurement uncertainty herein.

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VERIFICATION OF COMPLIANCE

Applicant: Mobiletron Electronics Co., Ltd.
Product Name: TPMS
Brand Name: MOBILETRON
Model No.: TX-T003;TX-T004
Model Difference: The enclosure and Gas nozzle are different.
Date of Test: 2023/03/16 ~ 2023/04/14
Date of EUT Received: 2023/03/16

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
ARIB STD-T93	Complied

The above equipment was tested by ISL Taiwan Ltd. for compliance with the requirements in the Radio equipment stipulated in the certification ordinance Article 2, Clause 1, Item 8. The results of testing in this report apply to the product system that was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

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Prepared By:	<u> Gigi yeh </u>	Date:	<u> 2023/04/17 </u>
	<i>Gigi Yeh / Senior Engineer</i>		
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Version

Version No.	Date	Description
00	2023/04/17	Initial creation of document

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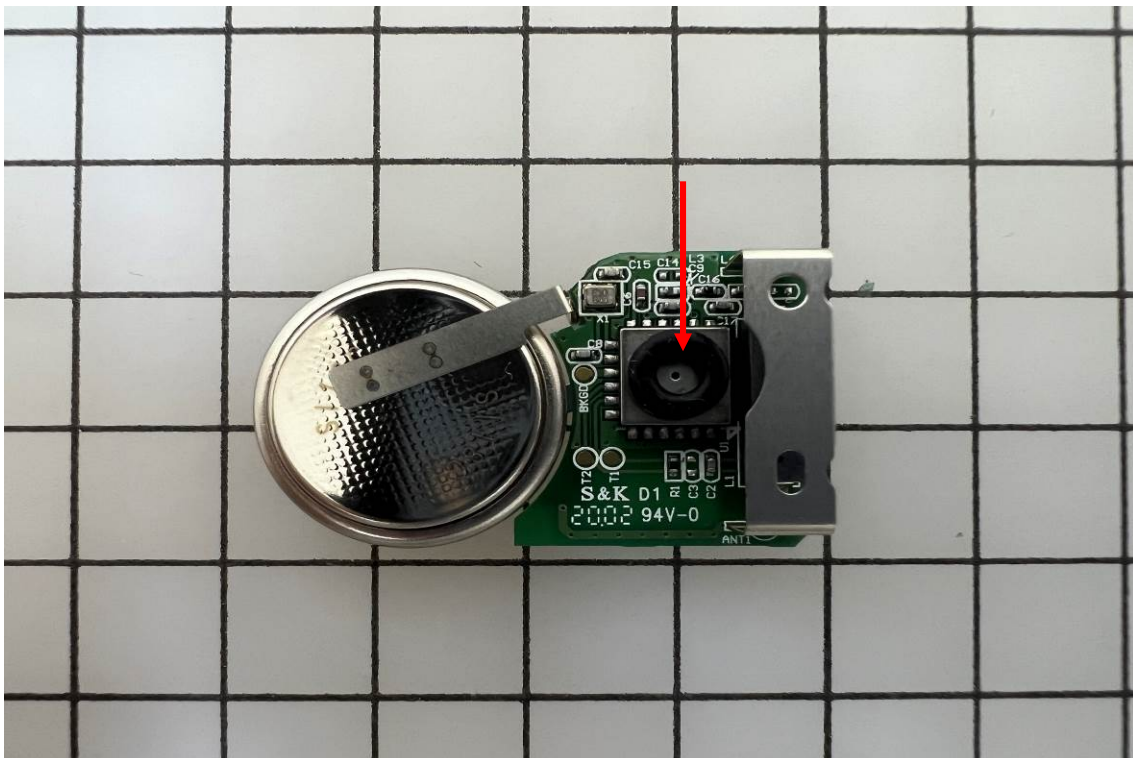
1. Description of Equipment under Test (EUT)

1.1 General information

Product Name:	TPMS
Brand Name:	MOBILETRON
Model Name:	TX-T003; TX-T004
Model Difference:	The enclosure and Gas nozzle are different.
Operation Frequency:	315 MHz Tx
Channel number:	1 channels
Rated Transmit Power	0.0000005 mW (ASK) 0.0000005 mW (FSK)
Modulation Type:	FSK, ASK
Power Supply:	3.3V dc form button cell battery
Antenna type	Loop Antenna

1.2 Assemble

The RF circuit is designed as chip on board, it can't be considered to access/modified by user, please refer to the internal photo for below.



2. Description of Test Modes

The EUT has been tested under at TX modes. And software was used to control the EUT for staying in above description test modes.

Test conditions

Temperature & humidity	Normal
Normal voltage	3.3 Vdc
Lower extreme voltage	2.97 Vdc
Higher extreme voltage	3.63 Vdc

3. General Description of Applied Standards

The EUT According to the Specifications, it must comply with the requirements of the following standards:

Radio equipment stipulated in the certification ordinance Article 2, Clause 1, Item8.

4. Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of **International Standards Laboratory Corp.** <LT Lab.> No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist., Tao Yuan City 325, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 2014. FCC Registration Number is: TW0997, Canada Registration Number: 4067B-4.

5. MEASUREMENT UNCERTAINTY

ISO/IEC 17025 requires that an estimate of measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)).

Parameters	Uncertainty
Field Strength of Spurious Radiation	≤ 30MHz: ± 2.96dB 30-1GHz: ± 4.22 dB 1-40 GHz: ± 4.08 dB
Frequency Error	± 727.3 Hz
Conducted Power	± 1.55 dB
Power Density	± 1.67 dB
Conducted Spurious Emission	± 1.55 dB
Adjacent Channel Power	± 1.55 dB
Time	± 0.01 %
DC Voltage	± 1 %

6. Support Equipment

Fig. 5-1 Configuration of Tested System



Table 5-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/ Type No.	Series No.	Data Cable	Power Cord
1	N/A					

7. Summary of Tests

Parameter	Status
Output Power (EIRP) and Output Power Tolerance	Pass
Frequency Tolerance	Pass
Occupied Bandwidth	Pass
Transmitter spurious emission	Pass
Receiver spurious emission	N/A
Restriction function of transmission time	Pass

6.1. Output Power (EIRP) and Power tolerance

6.1.1. Limit:

Output power (EIRP):

312MHz - 315.05MHz <0.25mW

315.05MHz - 315.25MHz <0.025mW

Power tolerance:

< +20% of rated power

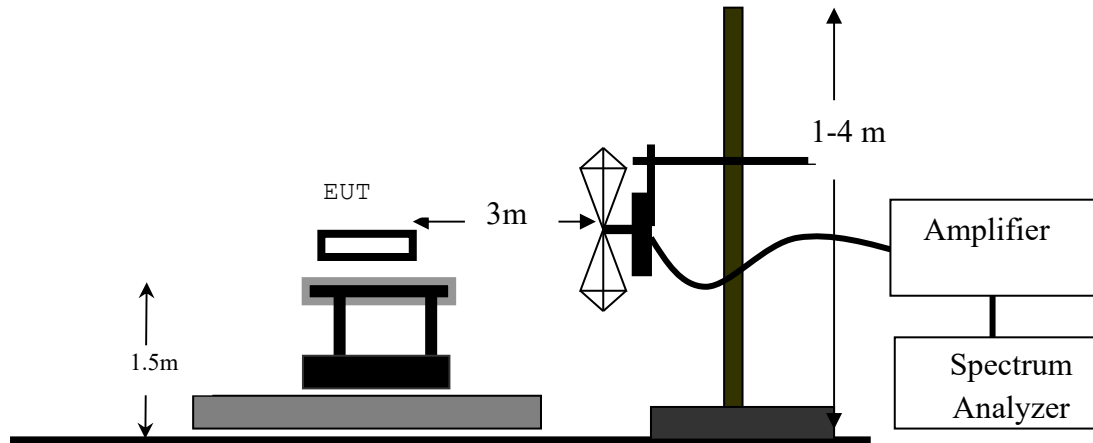
6.1.2. Measurement Equipment Used:

Location Conducted	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date	Calibration Body	Calibration Method
Chamber 19	Signal analyzer	R&S	FSV40	101919	08/17/2022	08/17/2023	ETC	c
Chamber 19	EMI Receiver	R&S	ESR3	102461	05/10/2022	05/10/2023	ETC	c
Chamber 19	Loop Antenna	EM	EM-6879	271	10/05/2022	10/05/2023	ETC	c
Chamber 19	Bilog Antenna (30MHz-1GHz)	Schwarzbeck	VULB9168 w 6dB Att.	9168-736	03/09/2023	03/09/2024	ETC	c
Chamber 19	Horn antenna (1GHz-18GHz)	ETS	3117	00218718	10/12/2022	10/12/2023	ETC	c
Chamber 19	Horn antenna (18GHz-26GHz)	Com-power	AH-826	081001	11/24/2022	11/24/2023	ETC	c
Chamber 19	Horn antenna (26GHz-40GHz)	Com-power	AH-640	100A	03/18/2023	03/18/2024	ETC	c
Chamber 19	Preamplifier (9kHz-1GHz)	HP	8447F	3113A04621	06/24/2022	06/24/2023	ETC	c
Chamber 19	Preamplifier (1GHz - 26GHz)	HP	8449B	3008A02471	06/24/2022	06/24/2023	ETC	c
Chamber 19	Preamplifier (26GHz-40GHz)	MITEQ	JS4-26004000-27-5A	818471	05/12/2022	05/12/2023	ETC	c
Chamber 19	RF Cable (100kHz-26.5GHz)	Huber Suhner	Sucoflex 104A	MY1394/4A & 50886/4A	09/02/2022	09/02/2023	ETC	c
Chamber 19	RF Cable (18GHz-40GHz)	HUBER SUHNER	Sucoflex 102	27963/2&37421/2	11/23/2022	11/23/2023	ETC	c
Chamber 19	Signal Generator	Anritsu	MG3692A	20311	12/29/2022	12/29/2023	ETC	c
Chamber 19	Test Software	Audix	E3 Ver:6.120203b	N/A	N/A	N/A	N/A	N/A

Calibration Method:

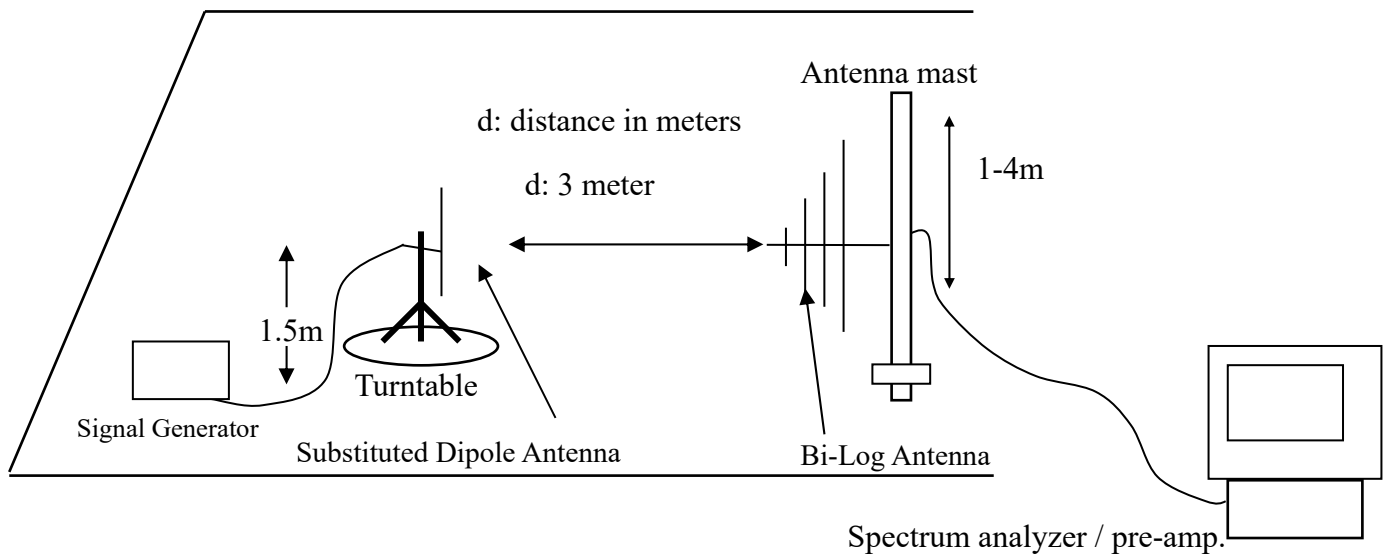
- Calibration conducted by the National Institute of Information and Communications Technology (NICT) (hereinafter referred to as "NICT") or a designated calibration agency under Article 102-18 paragraph (1)
- Correction conducted pursuant to the provisions of Article 135 or Article 144 of the Measurement Law (Law No. 51 of 1992)
- Calibration conducted in foreign countries, which shall be equivalent to the calibration conducted by the NICT or a designated calibration agency under Article 102-18 paragraph (1)
- Calibration conducted by using measuring instruments and other equipment listed in the right column of Table No. 3 attached hereto, which shall have been given any of calibration, etc. listed above from a) to c)

6.1.3. Test Setup:

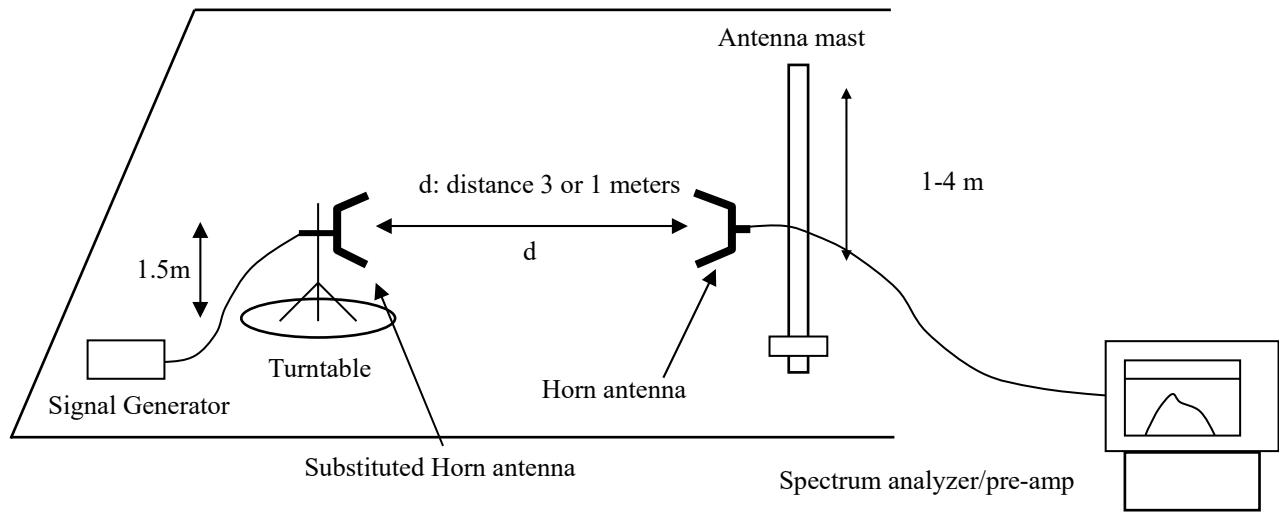


Substitution Method: (Radiated Emissions)

Radiated Below 1GHz



Radiated Above 1 GHz



6.1.4. Test Procedure:

EUT was placed on an 1.5m wooden table. The search antenna is placed at 3m distance from the EUT and search antenna height is from 1 -4m. With the transmitter operating at continuously mode, the turntable was slowly rotated to locate the direction of maximum emission. Once maximum direction is determined, the search antenna was raised and lowered in both vertical and horizontal polarizations.

The EUT was removed from the turntable and replaced with a linearly polarized antenna connected to a calibrated RF signal generator. The RF generator was set to a measured emission frequency and the search antenna was raised and lowered to produce a maximum received reading. The generator output was increased to match the radiated emission reading measured previously, and the result expressed in dB EIRP or ERP, correcting for substitution antenna gain at each frequency.

6.1.5. Test results:

Ambient temperature: 25 °C Relative humidity: 65 % Test Date: 2023/04/11

FSK:

EIRP Rated Power 0.0000005 mW

		Reading	Limit
Normal Voltage 3.3 V	EIRP Ver (dBm)	-64.380	NA
	EIRP Hor (dBm)	-68.230	NA
	EIRP Ver (mW)	0.000000365	0.025mW
	EIRP Hor (mW)	0.000000150	0.025mW
	Power Tolerance Ver	-27.049	< 20%
	Power Tolerance Hor	-69.937	< 20%
Upper Voltage 3.63 V	EIRP Ver (dBm)	-62.810	NA
	EIRP Hor (dBm)	-70.840	NA
	EIRP Ver (mW)	0.000000524	0.025mW
	EIRP Hor (mW)	0.000000082	0.025mW
	Power Tolerance Ver	4.720	< 20%
	Power Tolerance Hor	-83.517	< 20%
Lower Voltage 2.97 V	EIRP Ver (dBm)	-63.130	NA
	EIRP Hor (dBm)	-70.360	NA
	EIRP Ver (mW)	0.000000486	0.025mW
	EIRP Hor (mW)	0.000000092	0.025mW
	Power Tolerance Ver	-2.719	< 20%
	Power Tolerance Hor	-81.591	< 20%

ASK:

EIRP Rated Power

0.0000005 mW

		Reading	Limit
Normal Voltage 3.3 V	EIRP Ver (dBm)	-65.180	NA
	EIRP Hor (dBm)	-69.540	NA
	EIRP Ver (mW)	0.000000303	0.025mW
	EIRP Hor (mW)	0.000000111	0.025mW
	Power Tolerance Ver	-39.322	< 20%
	Power Tolerance Hor	-77.765	< 20%
Upper Voltage 3.63 V	EIRP Ver (dBm)	-62.840	NA
	EIRP Hor (dBm)	-69.760	NA
	EIRP Ver (mW)	0.000000520	0.025mW
	EIRP Hor (mW)	0.000000106	0.025mW
	Power Tolerance Ver	3.999	< 20%
	Power Tolerance Hor	-78.864	< 20%
Lower Voltage 2.97 V	EIRP Ver (dBm)	-63.340	NA
	EIRP Hor (dBm)	-71.140	NA
	EIRP Ver (mW)	0.000000463	0.025mW
	EIRP Hor (mW)	0.000000077	0.025mW
	Power Tolerance Ver	-7.311	< 20%
	Power Tolerance Hor	-84.617	< 20%

6.2. Frequency tolerance

6.2.1. Limit:

Within 312MHz - 315.25MHz

6.2.2. Measurement Equipment Used:

Refer to section 6.1.2 for detail.

6.2.3. Test Setup:

Refer to section 6.1.3 for detail.

6.2.4. Test Procedure:

1. Set the EUT modulation off.
2. Set the ETU operates at channel low, mid and high and normal voltage.
3. Set the spectrum analyzer RBW = 10kHz, VBW=10kHz and Span = 3MHz
4. Max hold, View, Peak High, Mark and snap the screen and record the mark.
5. Varied input voltage to + 10% and - 10% normal voltage and repeat procedure 1 to 4 again.

6.2.5. Test results:

Ambient temperature: 25 °C

Relative humidity: 65 %

Test Date: 2023/04/11

FSK Mode		Reading MHz	Limit
Normal Voltage 3.3 V	Measured Frequency (MHz)	315.08	within 312-315.25MHz
Upper Voltage 3.63 V	Measured Frequency (MHz)	315.08	within 312-315.25MHz
Lower Voltage 2.97 V	Measured Frequency (MHz)	315.08	within 312-315.25MHz

ASK Mode		Reading MHz	Limit
Normal Voltage 3.3 V	Measured Frequency (MHz)	315.08	within 312-315.25MHz
Upper Voltage 3.63 V	Measured Frequency (MHz)	315.08	within 312-315.25MHz
Lower Voltage 2.97 V	Measured Frequency (MHz)	315.08	within 312-315.25MHz

6.3. Occupied bandwidth

6.3.1. Limit:

< 1MHz

6.3.2. Measurement Equipment Used:

Refer to section 6.1.2 for detail.

6.3.3. Test Setup:

Refer to section 6.1.3 for detail.

6.3.4. Test Procedure:

1. Set the EUT modulation on.
2. Set the ETU operate at channel low, mid and high and normal voltage.
3. Set the spectrum analyzer RBW = 10kHz, VBW=30kHz, and Span = 200kHz
4. Turn on 99% spectrum OBW function on, Max hold, View, and snap the screen and record the mark.
5. Varied input voltage to + 10% and - 10% normal voltage and repeat procedure 1 to 4 again.

6.3.5. Test results:

Ambient temperature: 25 °C

Relative humidity: 65 %

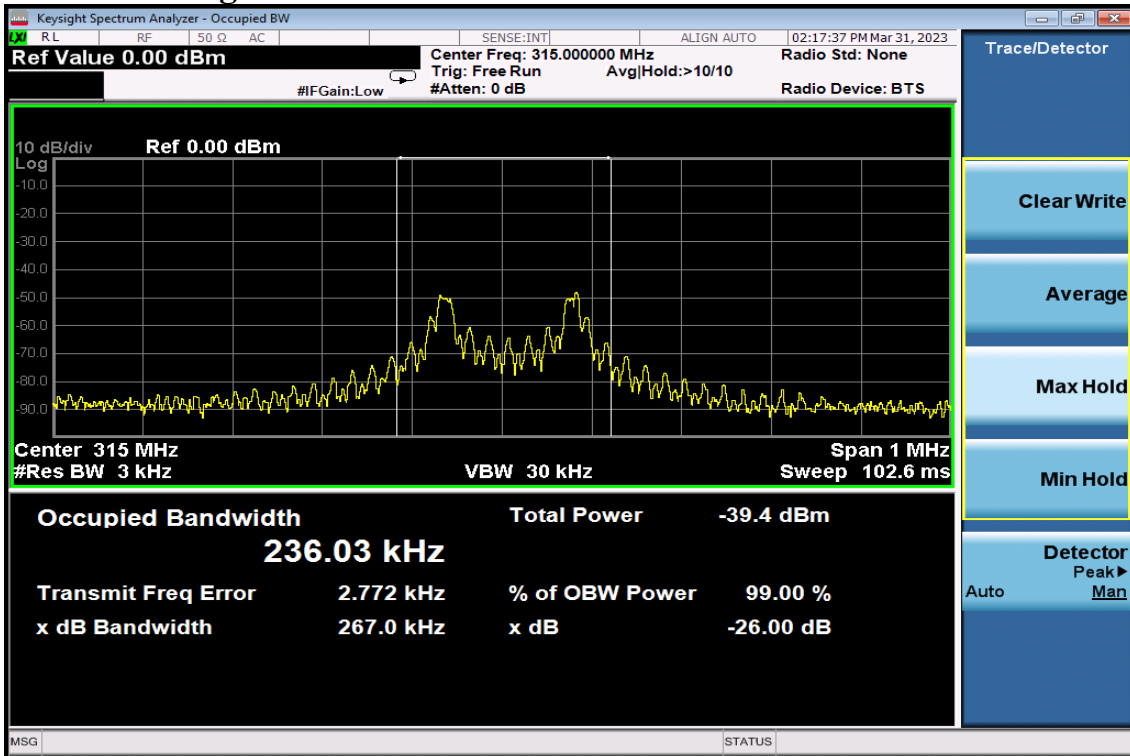
Test Date: 2023/04/11

FSK Mode	Reading(MHz)	Limit
Normal Voltage 3.3 V	0.23603	<1MHz
Upper Voltage 3.63 V	0.23270	<1MHz
Lower Voltage 2.97 V	0.22903	<1MHz

ASK Mode	Reading(MHz)	Limit
Normal Voltage 3.3 V	0.094433	<1MHz
Upper Voltage 3.63 V	0.079157	<1MHz
Lower Voltage 2.97 V	0.086528	<1MHz

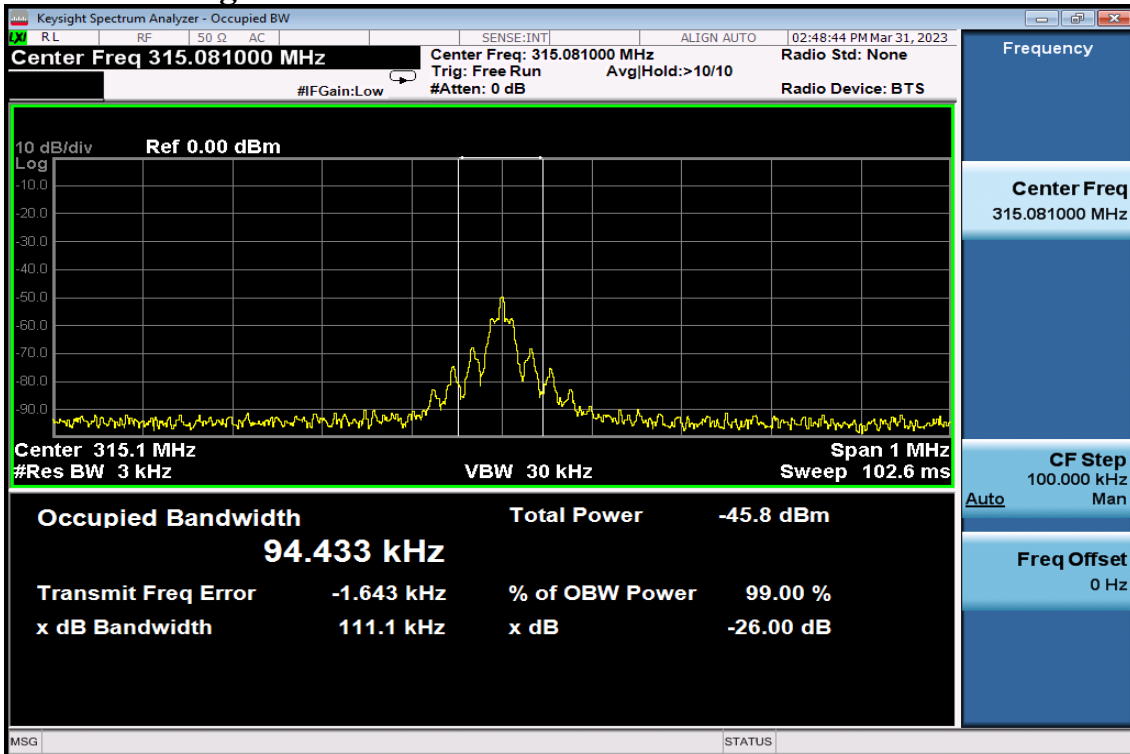
FSK Mode:

Normal Voltage: Channel Low



ASK Mode:

Normal Voltage: Channel Low



6.4. Transmitter Spurious Emissions

6.4.1. Limit:

Below 1GHz < 250nW/100kHz (-36dBm/kHz)

Above 1GHz < 1uW/MHz (-30dBm/MHz)

6.4.2. Measurement Equipment Used:

Refer to section 6.1.2 for detail.

6.4.3. Test Setup:

Refer to section 6.1.3 for detail.

6.4.4. Test Procedure:

Refer to 6.1.4 and RBW setting 100kHz for below 1GHz, 1MHz for above 1GHz

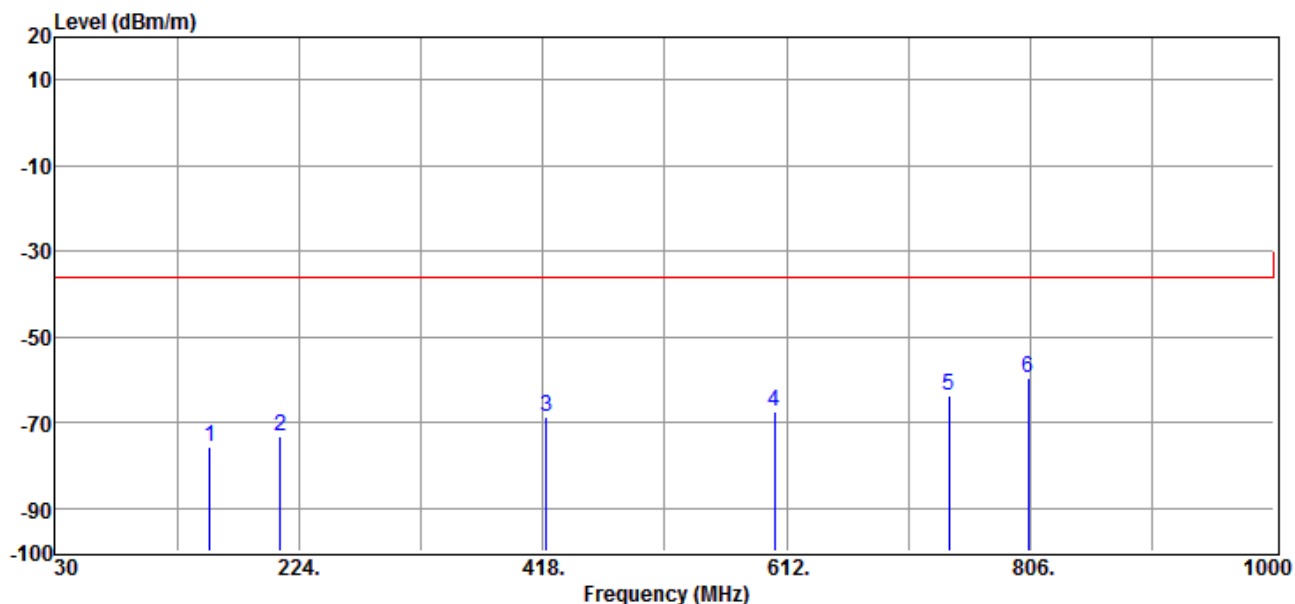
6.4.5. Test Results:

Ambient temperature: 25 °C

Relative humidity: 65 %

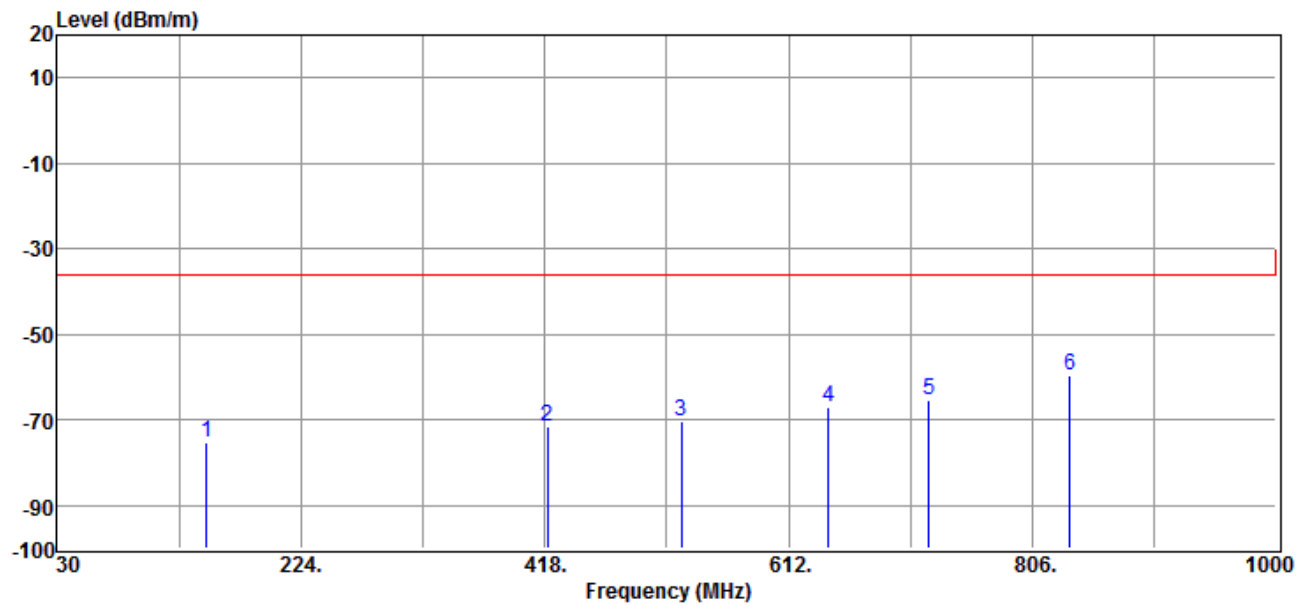
Test Date: 2023/04/11

FSK Mode, Normal voltage: below 1GHz, Vertical



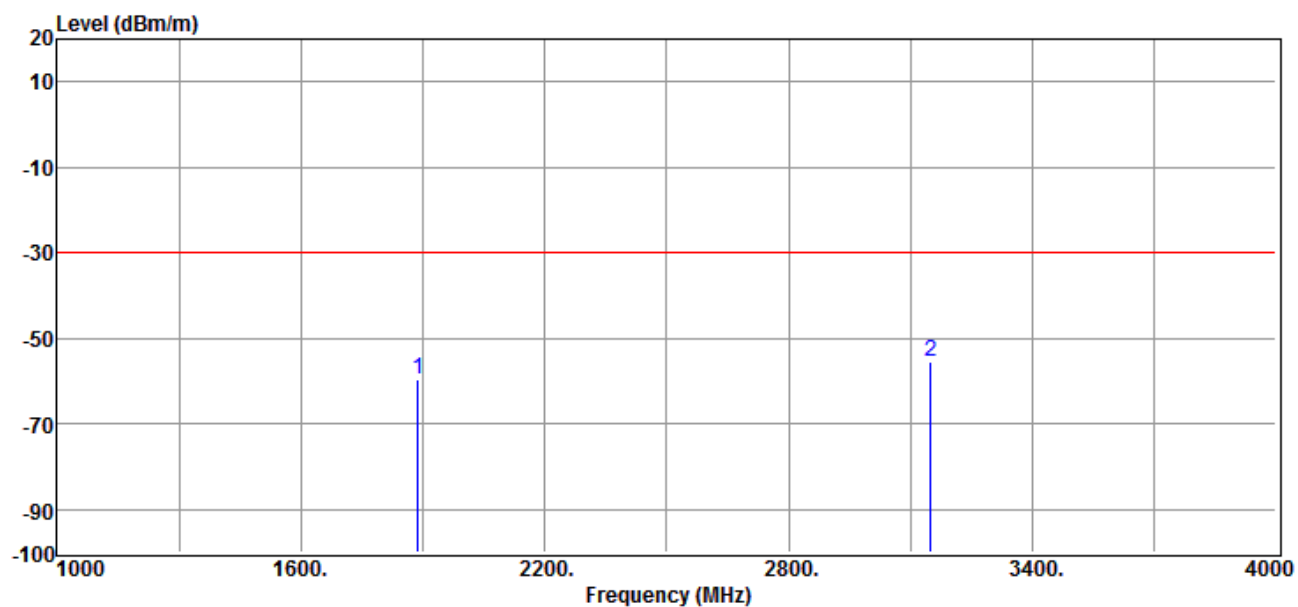
No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	153.19	-75.12	-0.51	-75.63	-36.00	-39.63	VERTICAL
2	209.45	-69.80	-3.27	-73.07	-36.00	-37.07	VERTICAL
3	420.91	-72.45	3.71	-68.74	-36.00	-32.74	VERTICAL
4	602.30	-75.57	8.10	-67.47	-36.00	-31.47	VERTICAL
5	741.01	-74.15	10.43	-63.72	-36.00	-27.72	VERTICAL
6	804.06	-70.74	11.19	-59.55	-36.00	-23.55	VERTICAL

FSK Mode, Normal voltage: below 1GHz, Horizontal



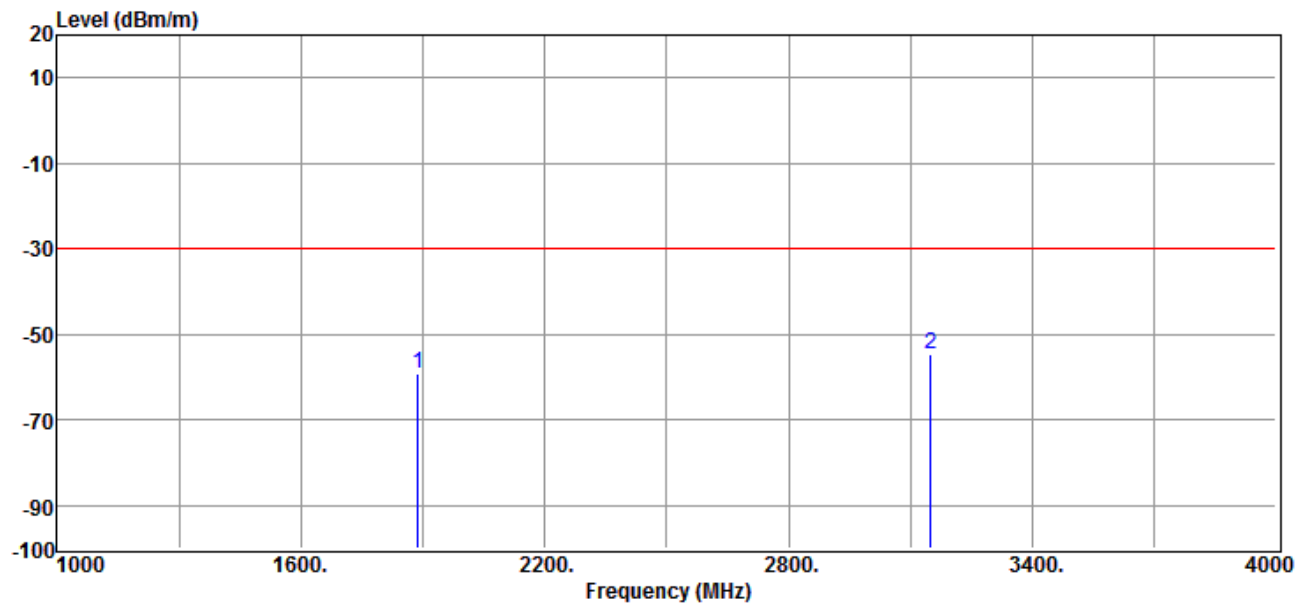
No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	149.31	-74.83	-0.32	-75.15	-36.00	-39.15	HORIZONTAL
2	419.94	-75.10	3.68	-71.42	-36.00	-35.42	HORIZONTAL
3	526.64	-76.29	5.84	-70.45	-36.00	-34.45	HORIZONTAL
4	644.01	-75.64	8.52	-67.12	-36.00	-31.12	HORIZONTAL
5	723.55	-75.28	10.00	-65.28	-36.00	-29.28	HORIZONTAL
6	836.07	-71.01	11.63	-59.38	-36.00	-23.38	HORIZONTAL

FSK Mode, Normal voltage: above 1GHz, Vertical



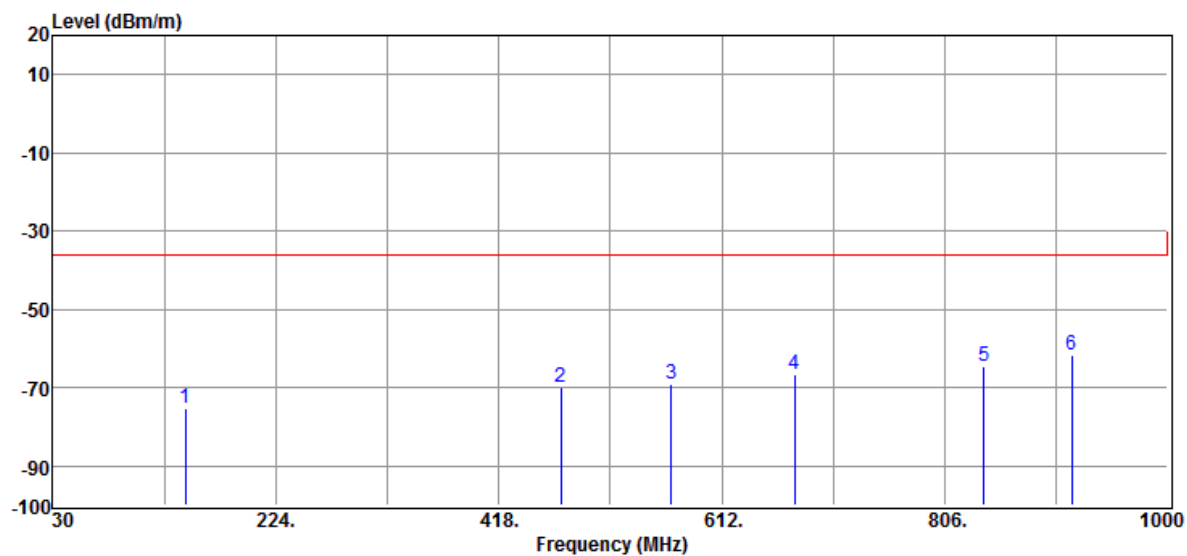
No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	1888.00	-67.22	7.68	-59.54	-30.00	-29.54	VERTICAL
2	3151.00	-68.36	13.03	-55.33	-30.00	-25.33	VERTICAL

FSK Mode, Normal voltage: above 1GHz, Horizontal



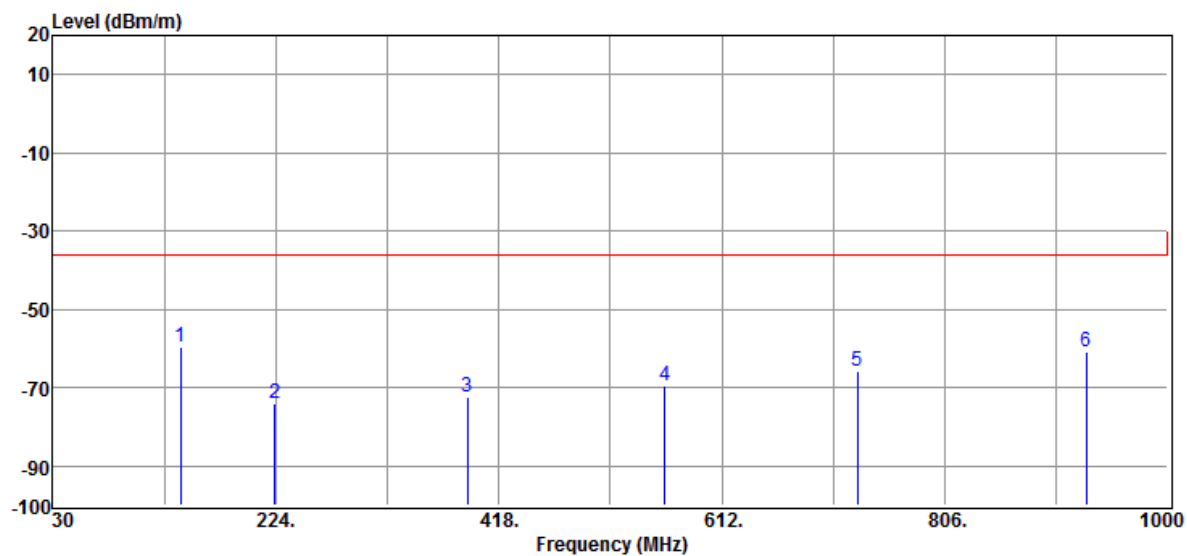
No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	1888.00	-66.79	7.68	-59.11	-30.00	-29.11	HORIZONTAL
2	3151.00	-67.59	13.03	-54.56	-30.00	-24.56	HORIZONTAL

ASK Mode, Normal voltage: below 1GHz, Vertical



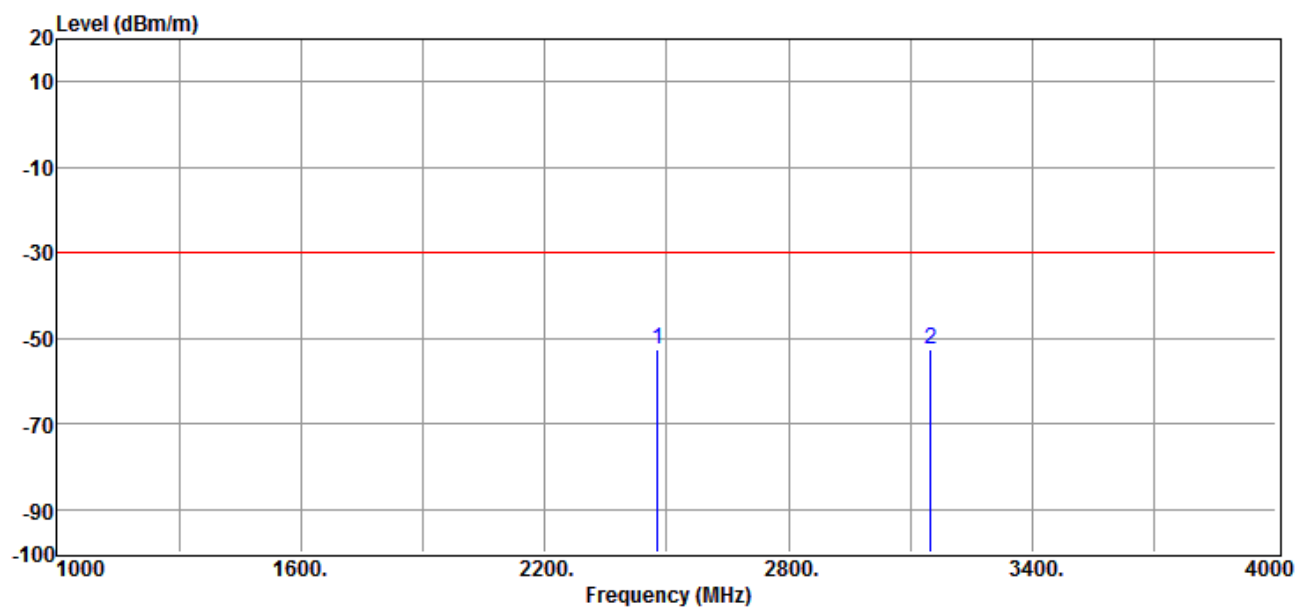
No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	145.43	-74.82	-0.64	-75.46	-36.00	-39.46	VERTICAL
2	472.32	-74.90	4.92	-69.98	-36.00	-33.98	VERTICAL
3	568.35	-76.09	6.91	-69.18	-36.00	-33.18	VERTICAL
4	675.05	-75.67	9.00	-66.67	-36.00	-30.67	VERTICAL
5	839.95	-76.08	11.68	-64.40	-36.00	-28.40	VERTICAL
6	916.58	-74.46	12.92	-61.54	-36.00	-25.54	VERTICAL

ASK Mode, Normal voltage: below 1GHz, Horizontal



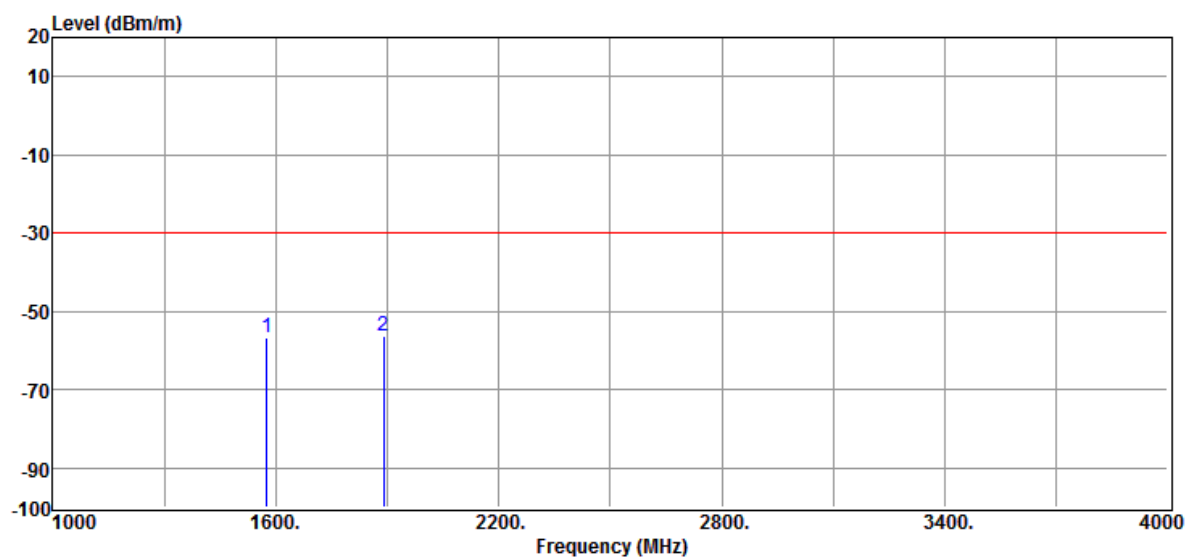
No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	141.55	-58.57	-0.97	-59.54	-36.00	-23.54	HORIZONTAL
2	223.03	-71.23	-2.68	-73.91	-36.00	-37.91	HORIZONTAL
3	390.84	-75.17	2.80	-72.37	-36.00	-36.37	HORIZONTAL
4	562.53	-76.23	6.69	-69.54	-36.00	-33.54	HORIZONTAL
5	730.34	-76.00	10.17	-65.83	-36.00	-29.83	HORIZONTAL
6	929.19	-73.98	13.12	-60.86	-36.00	-24.86	HORIZONTAL

ASK Mode, Normal voltage: above 1GHz, Vertical



No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	2479.00	-63.44	11.03	-52.41	-30.00	-22.41	VERTICAL
2	3151.00	-65.47	13.03	-52.44	-30.00	-22.44	VERTICAL

ASK Mode, Normal voltage: above 1GHz, Horizontal



No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	1576.00	-62.39	5.86	-56.53	-30.00	-26.53	HORIZONTAL
2	1891.00	-63.89	7.69	-56.20	-30.00	-26.20	HORIZONTAL

6.5. Receiver Spurious Emission

6.5.1. Limit:

Above 1GHz < 4nW/MHz
Below 1GHz < 4nW/100kHz

6.5.2. Measurement Equipment Used:

Refer to section 6.1.2 for detail.

6.5.3. Test Setup:

Refer to section 6.1.3 for detail.

6.5.4. Test Procedure:

Refer to 6.1.4 and RBW setting 100kHz for below 1GHz, 1MHz for above 1GHz

6.5.5. Test Results:

N/A, EUT is not Receiver device

6.6. Period Restriction Function of Transmitter Time

6.6.1. Limit:

Transmission time limit < 1 sec

Pause time limit > 10sec and 30 time of transmission time

6.6.2. Measurement Equipment Used:

Refer to section 6.1.2 for detail.

6.6.3. Test Setup:

Refer to section 6.1.3 for detail.

6.6.4. Test Procedure:

Refer to 6.1.4 and RBW setting RBW and VBW =100kHz Span 0Hz

6.6.5. Test Results:

FSK Mode	transmission time (s)	pause time(s)	transmission time limit (s)	pause time limit
Normal Voltage 3.3 V	230ms	61.0s	<1 sec	>10sec and 30 Time of transmission time
Upper Voltage 3.63 V	230ms	61.0s	<1 sec	>10sec and 30 Time of transmission time
Lower Voltage 2.97 V	230ms	60.9s	<1 sec	>10sec and 30 Time of transmission time

ASK Mode	transmission time (s)	pause time(s)	transmission time limit (s)	pause time limit
Normal Voltage 3.3 V	230ms	68.7	<1 sec	>10sec and 30 Time of transmission time
Upper Voltage 3.63 V	240ms	68.6s	<1 sec	>10sec and 30 Time of transmission time
Lower Voltage 2.97 V	240ms	68.5s	<1 sec	>10sec and 30 Time of transmission time