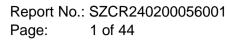




SZEMC-TRF-01 Rev. A/1



# TEST REPORT

Application No.:	SZCR2402000560AT		
Applicant:	SHENZHEN MINEWSEMI CO., LTD		
Address of Applicant:	3rd Floor,I Building, Gangzhilong Science Park, NO.6, Qinglong Road, Longhua District, Shenzhen, China		
Manufacturer:	SHENZHEN MINEWSEMI CO., LTD		
Address of Manufacturer:	3rd Floor,I Building, Gangzhilong Science Park, NO.6, Qinglong Road, Longhua District, Shenzhen, China		
Equipment Under Test (EUT	):		
EUT Name:	Radio Module(60GHZ Millimeter wave radar)		
Model No.:	MS72SF11		
Trade Mark:	MINEWSEMI		
FCC ID:	2BDJ6-MS72SF11		
Standard(s) :	FCC 47 CFR Part 15, Subpart C		
Date of Receipt:	2024-02-22		
Date of Test:	2024-03-14 to 2024-03-18		
Date of Issue:	2024-04-24		
Test Result:	Pass*		

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

Keny. XM

Keny Xu EMC Laboratory Manager



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Revision Record					
Version Chapter Date Modifier Rem					
01		2024-04-24		Original	

Authorized for issue by:		
	Lerdai	
	Leo Lai/Project Engineer	
	Eric Fu	
	Eric Fu/Reviewer	



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# 2 Test Summary

Test Item	FCC Rule No.	Test Method	Result	
Antenna Requirement	15.203		PASS	
Transmitter power	15.255(c)(2)(iii)(A)	ANSI C63.10-2020 Section 9.2.1/9.2.2	PASS	
Occupied heredwidth	15.215 (c),	ANSI C63.10-2020	PASS	
Occupied bandwidth	15.255 (c2)	Section 9.4	PASS	
Radiated spurious emissions below 40	15 255 (d)/2)	ANSI C63.10-2020		
GHz	15.255 (d)(2)	Section 9.11	PASS	
Radiated emissions outside assigned	15 255 (d)/2)	ANSI C63.10-2020	DASS	
band and above 40 GHz up to 200 GHz	15.255 (d)(3)	Section 9.10	PASS	
	15 255 (f)	ANSI C63.10-2020	DASS	
Frequency stability	15.255 (f)	Section 9.5	PASS	



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# 4 General Information

### 4.1 Details of E.U.T.

Power supply:	DC 3.3V
Operation Frequency:	57GHz-64GHz
Modulation Type:	FMCW
Antenna Type:	Integrated Patch Antenna
Antenna Gain:	5dBi

Remark: The information in this section is provided by the applicant or manufacturer, SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.

#### 4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
DC power supply	ZHAOXIN	PS-3005D	REF. No.SEA27B01

#### 4.3 Test Environment

Environment Parameter		Selected Values During Tests		
Relative Humidity		Ambient		
Value		Temperatu	ure(°C)	Voltage(V)
NTNV		25		3.3
LTHV		-40		3.6
LTLV		-40		3.0
HTHV		85		3.6
HTLV		85		3.0
Note:				
NV:Normal Voltage LV:Low Extreme Test Vo		oltage	HV:High Extre	me Test Voltage
NT:Normal Temperature	LT:Low Extreme Test Te	t Temperature HT:High Extreme Test Te		me Test Temperature

#### 4.4 Measurement Uncertainty

Test Item	Measurement Uncertainty
Conducted Emissions at AC Power Line (150kHz-30MHz)	± 3.1dB
Transmitter power and power spectral density	± 4.8dB
Occupied bandwidth	± 3%
Radiated Spurious Emissions Below 1GHz	$\pm$ 6.0dB for 3m; $\pm$ 5.0dB for 10m
Radiated Spurious Emissions Above 1GHz	± 4.6dB (1-18GHz);± 4.8dB (Above 18GHz)



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#### Remark:

The U<sub>lab</sub> (lab Uncertainty) is less than U<sub>cispr/ETSI</sub> (CISPR/ETSI Uncertainty), so the test results – compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;

- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

### 4.5 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Nanshan District, Shenzhen, Guangdong, China. 518057. Tel: +86 755 2601 2053 Fax: +86 755 2671 0594 No tests were sub-contracted.

#### 4.6 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.

### 4.7 Deviation from Standards

None

### 4.8 Abnormalities from Standard Conditions

None



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#### 5 **Equipment List**

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
EXA Signal Analyzer(10Hz-44GHz)	Keysight	N9010A	SEM004-20	2023-03-31	2024-03-30
Horn Antenna(800MHz- 18GHz)	Rohde&Schwarz	HF907	SEM003-07	2022-07-24	2024-07-23
Microwave system amplifier (0.5GHz- 26.5GHz)	Agilent	83017A	SEM005-25	2023-09-19	2024-09-18
Broad-Band Horn Antenna(15GHz-40GHz)	SCHWARZBECK	BBHA 9170	SEM003-15	2022-11-13	2024-11-12
Programmable Temperature&Humidity Chamber	Votsch Industrietechnik GmbH	VT 4002	SEM002-15	2024-03-19	2025-03-18
Pre-amplifier (26GHz-40GHz)	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2023-03-31	2024-03-30
Coaxial Cable	SGS	N/A	SEM026-01	2023-07-07	2024-07-06
Waveguide(40-60GHz)	REBES	SWG-19025-FB	06303-01	2023-02-19	2025-02-18
Waveguide(50-75GHz)	REBES	SWG-15025-FB	01525-09	2023-02-19	2025-02-18
Waveguide(75-110GHz)	REBES	SWG-10025-FB	01509-01	2023-02-19	2025-02-18
Waveguide(110- 170GHz)	REBES	SWG-06025-FB	06302-01	2023-02-19	2025-02-18
Waveguide Harmonic Mixer(40-60GHz)	REBES	STH-19SF-S1	06937-01	2023-02-19	2025-02-18
Waveguide Harmonic Mixer(50-75GHz)	KEYSIGHT	M1970V	MY51390966	2023-02-19	2025-02-18
Waveguide Harmonic Mixer(75-110GHz)	KEYSIGHT	M1970W	MY51430883	2023-02-19	2025-02-18
Waveguide Harmonic Mixer(110-170GHz)	REBES	STH-06SF-S1	06110-01	2023-02-19	2025-02-18
Spectrum Analyzer	Rohde&Schwarz	FSU43	SEM004-08	2023-03-30	2024-03-29
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A

General used equipmen	t				
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Humidity/ Temperature Indicator	deli	8838	SEM002-32	2023-07-28	2024-07-27
Humidity/ Temperature Indicator	deli	8838	SEM002-33	2023-07-28	2024-07-27



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Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2023-03-23	2024-03-22



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# 6 Radio Spectrum Technical Requirement

### 6.1 Antenna Requirement

#### 6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203

#### 6.1.2 Conclusion

#### 15.203 requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

#### EUT Antenna:

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 5dBi.

Antenna location: Refer to internal photos



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#### **Radio Spectrum Matter Test Results** 7

#### 7.1 Transmitter power

Test Requirement	47 CFR Part 15C Section 15.255 (c)(2)(iii)(A)
Test Method:	ANSI C63.10-2020 Section 9.2.1, 9.2.2

Limit:

The peak EIRP shall not exceed 14 dBm, and the sum of continuous transmitter off-times of at least two milliseconds shall equal at least 25.5 milliseconds within any contiguous interval of 33 milliseconds.

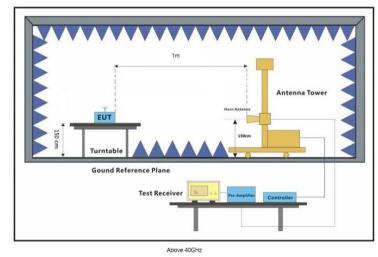
#### 7.1.1 E.U.T. Operation

Operating Enviro	nment:					
Temperature:	19.8 °C	Humidity:	46.1 % RH	Atmospheric Pressure:	1000	mbar

#### 7.1.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode _ Keep the EUT in continuously transmitting mode

#### 7.1.3 Test Setup Diagram





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#### 7.1.4 Measurement Procedure and Data

a. For transmitter power test, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 1 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation

b. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

c. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to the same hight and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

d. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

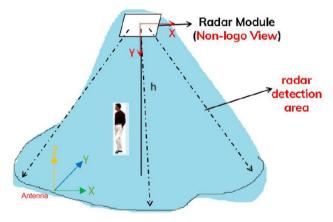
e. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

g. Repeat above procedures until all frequencies measured was complete.

Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor

Spectrum analyser setting during test.

- 1. Place the EUT on the table and set it in the transmitting mode.
- 2. SA set RBW=1MHz, VBW=3\*RBW, Detector=Peak Trace: Max Hold, Peak Search.
- 3. During test, the module will be rotate for 0 degrees to 360 degrees in X, Y, Z axis to find the maximum reading base on the previous test in different host-specific condition and the worst data was record in the report.



Please Refer to Appendix for Details



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#### 7.2 Occupied Bandwidth

Test Requirement	47 CFR Part 15C Section 15.215(c), 15.255 (c)(2)
Test Method:	ANSI C63.10-2020 Section 9.4

Limit:

57-64GHz

#### 7.2.1 E.U.T. Operation

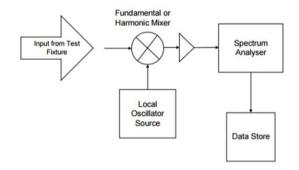
Operating Environment:

Temperature: 19.8 °C Humidity: 46.1 % RH Atmospheric Pressure: 1000 ml	Temperature:	19.8 °C	Humidity:	46.1 % RH	Atmospheric Pressure:	1000	mbar
--	--------------	---------	-----------	-----------	-----------------------	------	------

#### 7.2.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode _ Keep the EUT in continuously transmitting mode

#### 7.2.3 Test Setup Diagram



#### 7.2.4 Measurement Procedure and Data

- 1. Place the EUT on the table and set it in the transmitting mode.
- 2. SA set RBW=1%~5% OBW, or a minimum of 1 MHz if this is not possible due to a large OBW, VBW=3\*RBW and Detector=Peak.
- 3. Measure and record the result of 20dB and 99% bandwidth.

Please Refer to Appendix for Details



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#### 7.3 Radiated spurious emissions below 40 GHz

Test Requirement	47 CFR Part 15C Section 15.255 (d)(2)
Test Method:	ANSI C63.10-2020 Section 9.11

Limit:

Below 30MHz:

Frequency	Field Strength (µV/m)	Measurement Distance (metres)
9 - 490 kHz	2,400/F (kHz)	300
490 - 1,705 kHz	24,000/F (kHz)	30
1.705-30 MHz	30	30

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

#### Above 30MHz:

Frequency (MHz)	Field Strength (µV/m)	Measurement Distance (metres)
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

\*\* Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.

Frequency (MHz)	Field strength at 3 m, dB(uV/m)* Within restricted bands		
	Peak	Quasi Peak	Average
0.009 - 0.090	148.5 - 128.5	NA	128.5 - 108.5**
0.090 - 0.110	NA	108.5 - 106.8**	NA
0.110 - 0.490	126.8 - 113.8	NA	106.8 - 93.8**
0.490 - 1.705		73.8 - 63.0**	
1.705 - 30.0*	NA	69.5	NA
30 - 88	NA	40.0	
88 - 216		43.5	



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		. age.	
216 - 960		46.0	
Above 960		54.0	
1000 - 200000	74.0	N/A	54.0

\*- The limit for 3 m test distance was calculated using the inverse square distance extrapolation factor as follows:

 $LimS2 = LimS1 + 20 \log (S1/S2)$ ,

where S1 and S2 - standard defined and test distance respectively in meters.

\*\*- The limit decreases linearly with the logarithm of frequency.

Note: The above field strength limits applied from the lowest radio frequency generated in the device. without going below 9 kHz up to the tenth harmonic of the highest fundamental frequency but not exceeding 40 GHz for intentional radiators operated below 10 GHz and up to the fifth harmonic of the highest fundamental frequency but not exceeding 200 GHz for intentional radiators operated above 30 GHz.

	Field strength at 1 m, dB(uV/m)*				
Frequency (MHz)	Within restricted bands				
	Peak	Quasi Peak	Average		
1000 - 200000	83.5	N/A	63.5		

#### 7.3.1 E.U.T. Operation

Operating Environment:									
Temperature:	19.8 °C	Humidity:	46.1 % RH	Atmospheric Pressure:	1000	mbar			

#### 7.3.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode _ Keep the EUT in continuously transmitting mode



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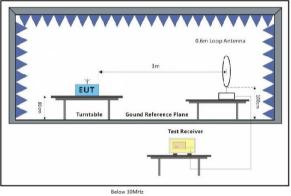
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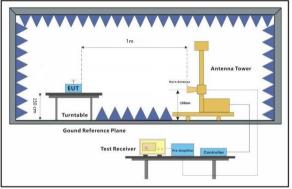
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# 7.3.3 Test Setup Diagram Antenna Towe EUT Turntal Test Receiver 30MHz-1GH



EUT Turnete Gound Reference Pla Test Receiver 1GHz-18GHz



18GHz-40GHz



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#### 7.3.4 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. For 1-18GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

c. For 18-40GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 1 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was t tuned to the same hight (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

i. Repeat above procedures until all frequencies measured was complete.

Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

Remark 3: Scan from 9kHz to 40GHz, the disturbance below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.



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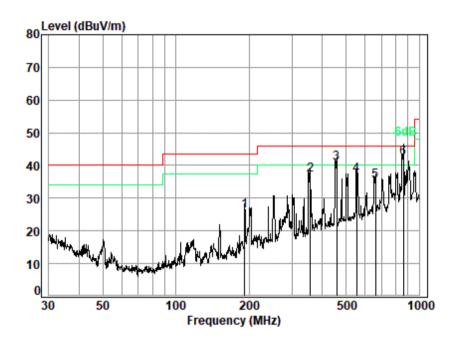
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Test Mode: 01; Polarity: Horizontal



Site :	chamber				
Condition:	3m HORIZONTAL				
Job No. :	00016AT				
Test Mode:	03				

		Ant	Cable	Preamp	Read		Limit	0ver	
	Freq	Factor	Loss	Factor	Level	Level	Line	Limit	Remark
	MHz	dB/m	dB	dB	dBuV	dBuV/m	dBuV/m	dB	
1	191.75	14.26	1.69	27.28	37.55	26.22	43.50	-17.28	QP
2	356.68	20.13	2.39	27.14	41.69	37.07	46.00	-8.93	QP
3	457.51	21.28	2.75	27.59	44.28	40.72	46.00	-5.28	QP
4	552.88	23.71	3.06	28.02	38.49	37.24	46.00	-8.76	QP
5	661.15	25.22	3.39	28.04	34.81	35.38	46.00	-10.62	QP
6 q									-
									-



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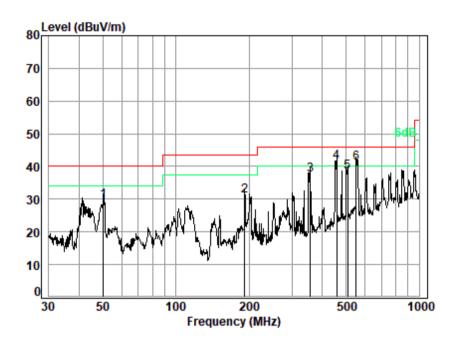
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Test Mode: 01; Polarity: Vertical



Site : chamber Condition: 3m VERTICAL Job No. : 00016AT Test Mode: 03

		Ant	Cable	Preamp	Read		Limit	0ver	
	Freq	Factor	Loss	Factor	Level	Level	Line	Limit	Remark
_									
	MHz	dB/m	dB	dB	dBuV	dBuV/m	dBuV/m	dB	
1	50.23	12.73	0.83	27.75	43.72	29.53	40.00	-10.47	QP
2	191.75	14.26	1.69	27.28	42.48	31.15	43.50	-12.35	QP
3	356.68	20.13	2.39	27.14	42.07	37.45	46.00	-8.55	QP
4 q	457.51	21.28	2.75	27.59	45.01	41.45	46.00	-4.55	QP
5	508.26	23.13	2.92	27.82	39.98	38.21	46.00	-7.79	QP
6	550.95								-
									-



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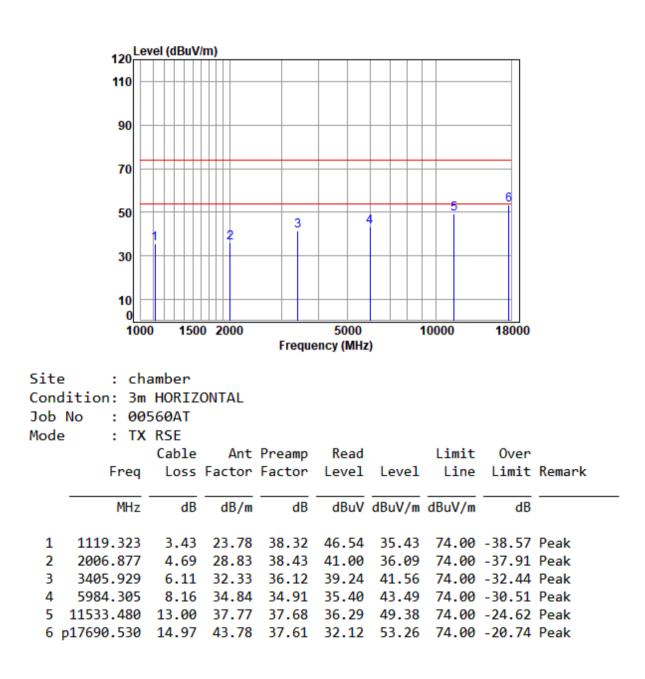
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Test Mode: 01; Polarity: Horizontal





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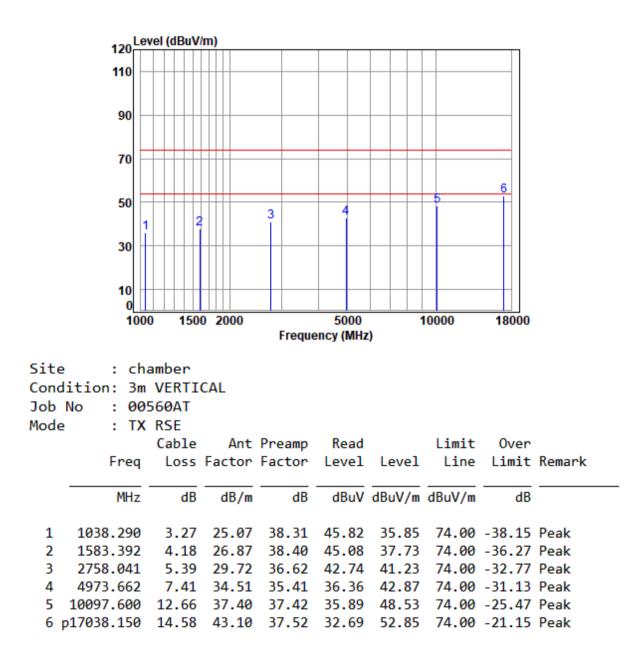
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Test Mode: 01; Polarity: Vertical





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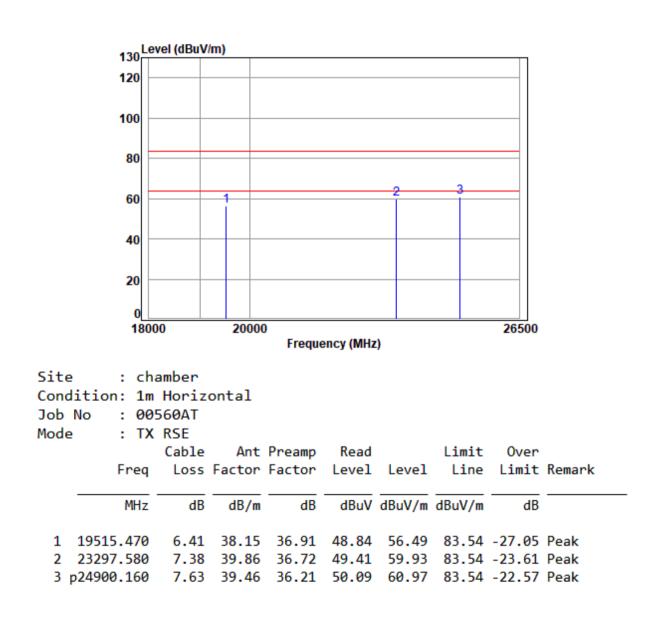
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Test Mode: 01; Polarity: Horizontal





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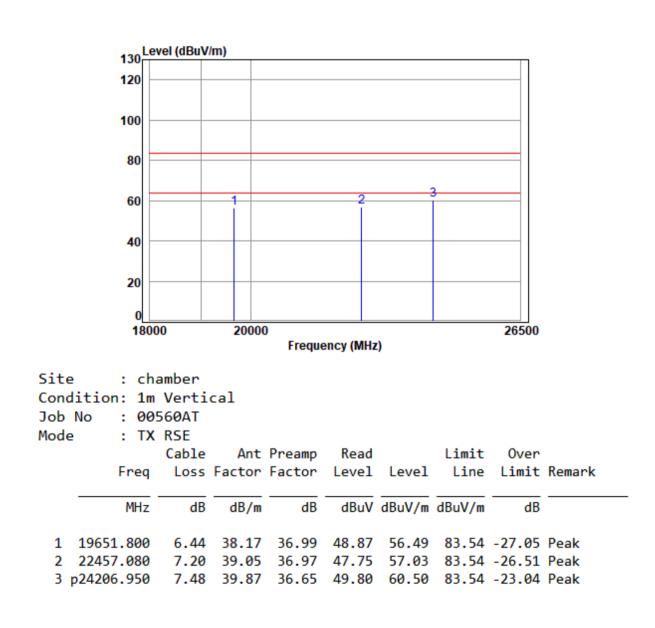
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Test Mode: 01; Polarity: Vertical





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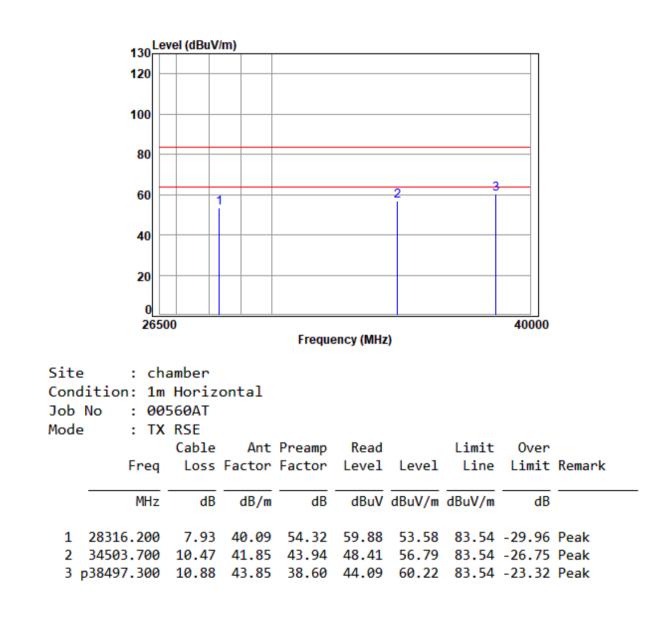
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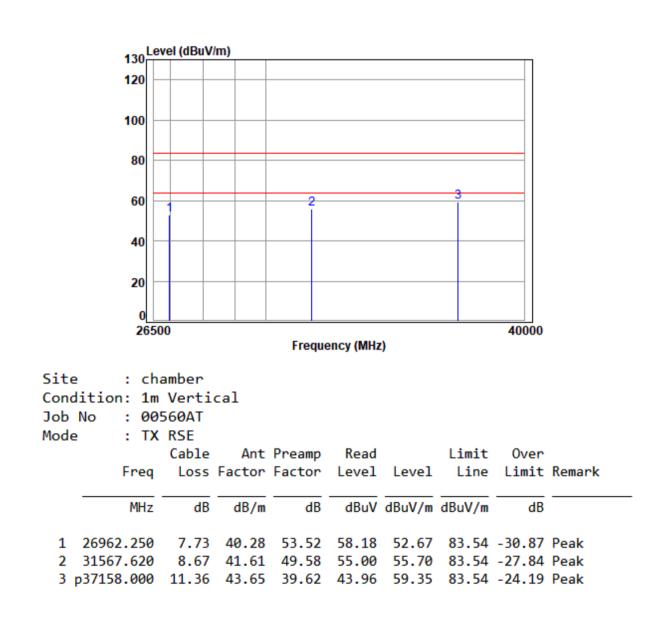
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Test Mode: 01; Polarity: Vertical





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### 7.4 Radiated emissions outside assigned band and above 40 GHz up to 200 GHz

Test Requirement	47 CFR Part 15C Section 15.255 (d)(3)
Test Method:	ANSI C63.10-2020 Section 9.10

Limit:

#### Above 40GHz:

Frequency (GHz)	Power density at 3 m distance (pW/cm2)	Distance (m)	Field strength (dBuV/m)*, peak	Field strength (dBuV/m)*, average
40 - 200	90	3.0	105.31	85.31
40 - 200	90	1.0	114.85**	94.85**

\* - Field strength was calculated per equation (26) of ANSI C63.10-2013 section 9 as follows: E=sqrt(PDx377), where PD is the power density at the distance specified by the limit in W/m2, Efield strength in V/m.

\*\*- The limit for other test distance was calculated using the inverse distance extrapolation factor as follows:

LimS2 = LimS1 + 20 log (S1/S2), where S1 and S2 - standard defined and test distance respectively in meters.

#### 7.4.1 E.U.T. Operation

Operating Enviro	nment:					
Temperature:	23.2 °C	Humidity:	45.8 % RH	Atmospheric Pressure:	1000	mbar

#### 7.4.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode _ Keep the EUT in continuously transmitting mode



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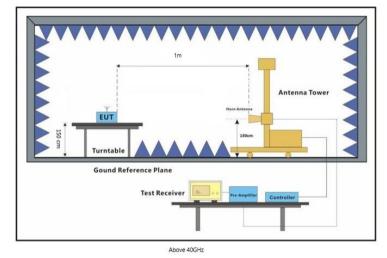
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#### 7.4.3 Test Setup Diagram



#### 7.4.4 Measurement Procedure and Data

a. For above 40GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 1 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation

b. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

c. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to the same hight (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

d. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

e. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

f. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

g. Repeat above procedures until all frequencies measured was complete.

Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

Remark 2: For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.



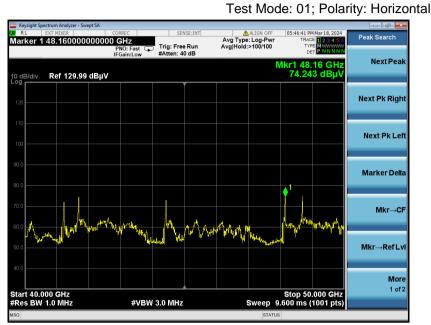
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Test Mode: 01; Polarity: Vertical



Frequency (GHz)	Distance (M)	PK Value (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
48.16	1	74.243	114.85	94.85	Н	PASS
48.80	1	84.949	114.85	94.85	V	PASS



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Test Mode: 01; Polarity: Horizontal

#### Test Mode: 01; Polarity: Vertical

	ectrum Analyzer - Swept S					
LXI RL Markor 1	EXT MIXER 56.84600000		SENSE:INT	ALIGN OFF	05:37:07 PM Mar 18, 2024 TRACE 1 2 3 4 5 6	Peak Search
Marker	50.84000000	PNO: Fast	Trig: Free Run #Atten: 40 dB	Avg Hold: 81/100	TYPE MWWWWW DET P N N N N N	
		IFGain:Low	#Atten: 40 dB			Next Peak
	D-6 400 00 dl	<b>D</b> )/		IVI	kr1 56.846 GHz 72.732 dBµV	
10 dB/div	Ref 129.99 di	ομν	•		12.102 0000	
						New Di Dialet
120						Next Pk Right
110						
						Next Pk Left
100						
90.0						
50.0						Marker Delta
80.0						
					1 1	
70.0	durant mettikadiskoa (Al	Jk. fr. ft. and M. and Markeda	d . hear the desider the second	hay his trade to a manufacture of the sector	Auropa high mark and particular	Mkr→CF
- Freihouth	AND A CONTRACT OF	a de la constant de la constant e la	official completion of the			WIKI→CF
60.0						
50.0						Mkr→RefLvl
40.0						
						More 1 of 2
Start 50.0					Stop 57.000 GHz	1 07 2
#Res BW	1.0 MHz	#VBW	3.0 MHz	Sweep 6	5.733 ms (1001 pts)	
MSG				STATU	5	

Frequency (GHz)	Distance (M)	PK Value (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
56.902	1	72.459	114.85	94.85	н	PASS
56.846	1	72.732	114.85	94.85	V	PASS



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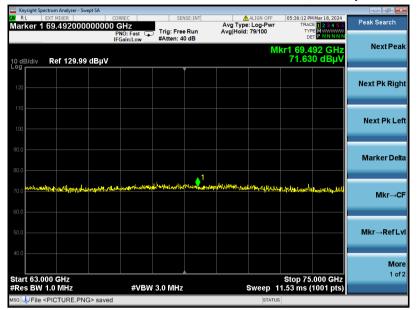
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Test Mode: 01; Polarity: Horizontal

#### Test Mode: 01; Polarity: Vertical

	oectrum Analyzer - Swe	pt SA							
L <mark>XI</mark> RL	EXT MIXER 69.4920000	CORREC	SEI	NSE:INT		ALIGN OFF		Mar 18, 2024	Peak Search
Marker	69.4920000	PNO: Fa IFGain:L	ow Trig: Free #Atten: 4		Avg Hold:	97/100	TYP DE		NextBack
10 dB/div Log	Ref 129.99	dBµV				MI	kr1 69.4 72.39	92 GHz 4 dBµV	Next Peak
120									Next Pk Right
110									Next Pk Left
90.0									Marker Delta
70.0 <b>***/***</b>	Manderski Turrovski ska sta sta sta sta sta sta sta sta sta st	www.www.hut	postorial Menorshawd	1 Muununahe	harildudiyida	hand sharen	panantangjan A	กังมีเป็นในสำนั	Mkr→CF
50.0									Mkr→RefLvl
40.0 Start 63.0								000 GHz	More 1 of 2
#Res BW			VBW 3.0 MHz			_	1.53 ms (	1001 pts)	
MSG VFIle	<picture.png< td=""><td>a&gt; saved</td><td></td><td></td><td></td><td>STATUS</td><td></td><td></td><td></td></picture.png<>	a> saved				STATUS			

Frequency (GHz)	Distance (M)	PK Value (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
69.492	1	71.630	114.85	94.85	н	PASS
69.492	1	72.394	114.85	94.85	V	PASS



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Test Mode: 01; Polarity: Horizontal

#### Test Mode: 01; Polarity: Vertical

	ectrum Analyzer - Swe					
Marker 1	EXT MIXER 104.365000	CORREC DOOOOOO GHz PNO: Fast	SENSE:INT	Avg Type: Log-Pwr Avg Hold:>100/100	05:57:03 PM Mar 18, 2024 TRACE 1 2 3 4 5 6 TYPE M WWWWW	Peak Search
		IFGain:Low	#Atten: 40 dB		DET PNNNN	Next Peak
10 dB/div Log	Ref 129.99	dBµV		MK	r1 104.365 GHz 86.029 dBµV	Nextr cur
			ľ			Next Pk Right
120						
110						Next Pk Left
100						
90.0					<b>↓</b> 1	Marker Delta
80.0	ocusio-docendations.	an a	gestand and see all and an and a second s	าลามู่ทระบ <sub>ิ</sub> สัมหาศักราชปฏิภูมิที่มีประเทศไข	haladd lannyda earllau ameilyn ddinia	
70.0						Mkr→CF
60.0						
50.0						Mkr→RefLvl
						WKI →KEI EVI
40.0						More
Start 75.0					Stop 110.00 GHz	1 of 2
Res BW 1	I.0 MHz	#VBW 3	.0 MHz		.667 ms (1001 pts)	
MSG				STATUS		

Frequency (GHz)	Distance (M)	PK Value (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
104.995	1	85.576	114.85	94.85	н	PASS
104.365	1	86.029	114.85	94.85	V	PASS



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Test Mode: 01; Polarity: Vertical



Frequency (GHz)	Distance (M)	PK Value (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
160.760	1	88.159	114.85	94.85	Н	PASS
156.740	1	88.225	114.85	94.85	V	PASS



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Test Mode: 01; Polarity: Horizontal

Test Mode: 01; Polarity: Vertical

								ept SA	rum Analyzer - Swe		Ke
Peak Search	M Mar 18, 2024 DE 1 2 3 4 5 6 PE M	TRAC	ALIGN OFF : Log-Pwr >100/100		NSE:INT			0000000	(T MIXER 94.990000		× Mar
Next Peak	.99 GHz 5 dBµV	₀ kr1 194				#Atten: 3	NO: Fast 🕞 Gain:Low	, IF	Ref 116.99	B/div	10 dE
Next Pk Right											Log 107
Next Pk Lef	samaara	1 martinetista	an south	an state and a manual	unigeness	ระจะสะประกาษไระ	newszykowe w termes	at ministry claras	neren and and the second		97.0 87.0
Marker Delta											77.0 67.0
Mkr→Cl											57.0 47.0
Mkr→RefLv											37.0 27.0
More 1 of 2	0.00 GHz (1001 pts)	Stop 20	Sweep 2			3.0 MHz	#VBW		0 GHz .0 MHz	t 170.0 s BW 1	Star
		0	STATUS								MSG

Frequency (GHz)	Distance (M)	PK Value (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
176.510	1	87.068	114.85	94.85	Н	PASS
194.990	1	88.055	114.85	94.85	V	PASS



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#### 7.5 Frequency Stability

Test Requirement	47 CFR Part 15C Section 15.255 (f)
Test Method:	ANSI C63.10-2020 Section 9.5

Limit:

Frequency (GHz)	Limit
57 - 64	The signal must be contained within assigned frequency band.

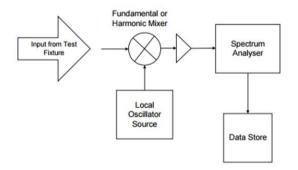
#### 7.5.1 E.U.T. Operation

Operating Enviro	nment:					
Temperature:	19.8 °C	Humidity:	47.4 % RH	Atmospheric Pressure:	1000	mbar

#### 7.5.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode _ Keep the EUT in continuously transmitting mode

#### 7.5.3 Test Setup Diagram





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#### 7.5.4 Measurement Procedure and Data

- 1. Temperature conditions:
- a) The RF output port of the EUT was connected to Frequency Meter;
- b) Set the working Frequency in the middle channel;
- c) record the 20°C and norminal voltage frequency value as reference point;
- d) vary the temperature from 0°C to 40°C with step 10°C

e) when reach a temperature point, keep the temperature banlance at least 1 hour to make the product working in this status;

f) read the frequency at the relative temperature.

- 2. Voltage conditions:
- a) record the 20°C and norminal voltage frequency value as reference point;
- b) vary the voltage from -15% norminal voltage to +15% voltage;

read the frequency at the relative voltage.

Remark: Manufacturer declared that the minimum temperature for normal operation of this product is  $0^\circ\!\mathbb{C}.$ 

Please Refer to Appendix for Details



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# 8 Test Setup Photo

Refer to Appendix - Test Setup Photo for SZCR2402000560AT

# 9 EUT Constructional Details (EUT Photos)

Refer to Appendix - External and Internal Photos for SZCR2402000560AT.



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# **10** Appendix

- 1. Transmitter power
- 1.1 Ant1
- 1.1.1 Test Result of duty cycle &

			Dui	y Cycle	
Keysight Spectrum Analyzer - S EXT MIXER	Swept SA CORREC	SENSE:INT	ALIGN OFF	12:02:56 AM Mar 18, 2024	
arker 3 Δ 99.9000	PNO: Fast ++	, Trig: Free Run #Atten: 30 dB	Avg Type: Log-Pwr	TRACE 1 2 3 4 5 6 TYPE WWWWWW DET P N N N N	Properties
0 dB/div Ref 126.9	IFGain:Low	#Atten: 30 dB	Δ	Mkr3 99.90 ms -0.01 dB	Select Marker 3
og 117 107	2Δ1	3∆1			Relative To 1
77.0 77.0 77.0 77.0 77.0 77.0		unitespottine.	ามกุรที่ แต่สิทธิ์แก่สำนาดเป็นการสี่งการสี่งการสี่งการสี่งการสี่งการสี่งการสี่งการสี่งการสี่งการสี่งการสี่งการส		X Axis Sca Time <u>Auto</u> Ma
57.0					<b>Marker Trace</b> [Trace1, Man Init]
enter 58.50000000 es BW 1.0 MHz		3.0 MHz	Sweep 30	Span 0 Hz 00.0 ms (1001 pts)	Line On <u>C</u>
	× 40.80 ms	۲ 105.15 dBµV	FUNCTION FUNCTION WIDTH	FUNCTION VALUE	-
2 Δ1 1 t (Δ) 3 Δ1 1 t (Δ) 4 5	<u>25.80 ms</u> (Δ) 99.90 ms (Δ)	0.33 dB -0.01 dB		=	
6 7 8 9					
10 11 11		m			
sg			STATUS		



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Keysight Spectrum Analyzer - Swept SA				
arker 3 Δ 99.7500 ms	CORREC SENS	Avg Type: Log-Pwr	12:04:39 AM Mar 18, 2024 TRACE 1 2 3 4 5 6	Marker
	PNO: Fast +++ Trig: Free F IFGain:Low #Atten: 30	dB	TYPE WWWW DET P NNNNN	Select Marker 3
0 dB/div Ref 126.99 dBµV	2Δ1		11.51 dB	Norm
97.0 97.0 77.0				De
67.0 		gerte for an and the party series of the formation of the party of the party of the party of the party of the p	yofaliytilanismyni	Fixe
37.0 Center 58.500000000 GHz tes BW 1.0 MHz	VBW 3.0 MHz	Sweep 1	Span 0 Hz 50.0 ms (1001 pts)	
KR  MODE  TRC  SCL  X    1  N  1  t	33.90 ms  93.86 dBμ²    25.65 ms  (Δ)  2.92 dl    99.75 ms  (Δ)  11.51 dl	B	FUNCTION VALUE	Propertie
6 7 8 9 0				<b>M</b> ( 1)
G	I III	STATU	5	

	ctrum Analyzer - Swep	pt SA						
	ext mixer Δ 25.7580 n	CORREC	SEI	NSE:INT	ALIGN OFF	12:06:07 AM Mar TRACE	23456	Marker
	A 23.7300 T	PNO: Fast IFGain:Lov		e Run		TYPE W DET P	NNNNN	Select Marker
10 dB/div	Ref 126.99	dBµV				ΔMkr2 25.7 -0.3	6 ms 2 dB	2
117 107		Nation Contractor	h à fhuile du du bh Dù	an in the initial state in the terms of the		والمرابعة والمراجعة المراجعة	2∆1	Norma
97.0 87.0 77.0 67.0	Pagnaha Jawa Makajikan J						hydrister	Delta
57.0 47.0 37.0								Fixed▷
Center 58 Res BW 1			W 3.0 MHz	FUNCTION		33.00 ms (100		Off
1 N 1 2 Δ1 1 3 4 5 6	t	<u>5.511 ms</u> 25.76 ms	105.37 dB	μV				Properties▶
7 8 9 10 11			m				-	More 1 of 2
MSG					STATI	JS		



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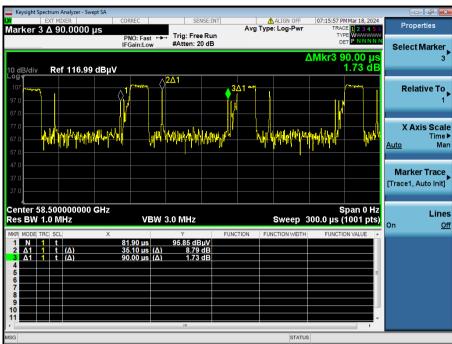
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🔤 Keysight Spectrum Analyzer - Swept SA	- 6 <b>-</b>
LX  EXT MIXER  CORREC  SENSE:INT  Allon OFF  10:35:36 AM Mar 18, 2024    Avg Type: Log-Pwr  TRACE  12 3 4 5 6	Marker
PNC: Fast → Trig: Free Run Trie: Viewwww. IFGain:Low #Atten: 20 dB DET	Select Marker 8
$\begin{array}{c} 4\Delta 3 \\ 86 0 \\ 86 0 \end{array}$	Normal
	Delta
48.0	Fixed⊳
Center 58.500000000 GHz  Span 0 Hz    Res BW 1.0 MHz  #VBW 3.0 MHz  Sweep 100.0 µs (1001 pts)    MKR MODE TRCISCLI  X  Y  Function  Function vidthi  Function vidthi	Off
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Properties►
7 7 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	More 1 of 2
MSG STATUS	



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Duty Cycle

Chirp Witdh(us)	Chirp Period(us)	Chirp Number (us)	Burst Period (ms)	Tx ON(ms)	Tx OFF(ms)	Tx OFF Rate(%)	Tx OFF Limit (%)	Verdict
21.3	90	287	25.76	6.11	26.89	81.47	77.27	Pass

Chirp numberin Burst Period = 25.76ms/90us

Transmission Time = Chirp number in Burst Period \* Chirp Width = 200ns+20.8us+300ns = 21.3us

OFFTime(ms) = Burst Period(ms)-ON Time (ms)

TX OFF Time Ratio = TX OFF Time(ms) /Burst Period(ms)

TX OFF Time Ratio Limit(%) =(25.50ms /33ms)"100% = 77.27%

The FMCW Desensitization factor

Star Freq(GHz)	Stop Freq(GHz)	FMCW Witdh(MHz)	Ramp Time(us)	RBW(MHz)	Desensitization Factor(lin)	Desensitization Factor(dB)
57	64	7000	90	1	0.17	15.36

FMCW desensitization factor =-20\*Log(α)=-20\*log(0.17)= 15.36dB

$$\alpha = \frac{1}{\sqrt[4]{1 + \left(\frac{2\ln(2)}{\pi}\right)^2 \left(\frac{F_s}{T_s B^2}\right)^2}}$$

where  $\alpha$  is the reduction in amplitude  $F_S$  is the FMCW Chirp Bandwidth  $T_S$  is the FMCW Chirp Time B is the 3 dB IF Bandwidth = RBW



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### 1.1.2 Test Result of EIRP



Peak Power- Horizontal



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**Peak Power- Vertical** 

Frequency (GHz)	Distance (m)	Polarity	dBuV/m@ 3m	E.I.R.P.P ower (dBm)	E.I.R.P Limit (dBm)	Remark	Duty Cycle	Duty Cycle Limit	Result
58.500	1	Horizontal	94.823	-9.947	14	peak	• • • • •		Pass
	1	Vertical	110.111	5.341	14	peak	9.0%	≤22.7%	Pass

Remark:

- 1. E[dBµV/m] = EIRP[dBm]-20 log(d[meters])+104.77, where E = field strength and d = distance at which field strength limit is specified in the rules
- 2. FMCW desensitization factor(15.36dB) was added in the test result.



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### 2. Occupied bandwidth

2.1 OBW

### 2.1.1 Test Result

Keysight Spectrum Analyzer - Occupied B					
Sweep Time 20.0 ms		SENSE:INT enter Freq: 60.00000		F 12:46:55 PM Ma Radio Std: No	
	#IFGain:Low	rig: Free Run	Avg Hold:>10/10	Radio Device	BTS
				Mkr1 58.5	GHZ
10 dB/div Ref 126.99 dE	βμV			110.73	dBµV
Log	1				
107			Martin Martin Street		
97.0				<u>/</u>	
87.0			<b>`</b>		
77.0					haran ala
67.0					
57.0					
47.0					
37.0					
Center 60 GHz					6 GHz
Res BW 3 MHz		VBW 50 MHz		Sweep	20 ms
Occupied Bandwidt	th	Total Po	wer 1	37 dBµV	
3.	7825 GHz				
Transmit Freq Error	-317.77 MHz	% of OB	W Power	99.00 %	
x dB Bandwidth	5.112 GHz	x dB	-7	20.00 dB	
MSG			ST	ATUS	

#### 99% & -20dB Occupied Channel Bandwidth

Centre Frequency (GHz)	-20dB OCW (GHz)	99% OCW (GHz)	F∟ (GHz)	Limit (GHz)	Fн (GHz)	Limit (GHz)	Result
58.500	5.112	3.7825	57.744	57	61.748	64	Pass

#### Remark:

FL: Frequency Low Band Edge, FH: Frequency High Band Edge



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### 3. Frequency stability

### 3.1 Frequency stability

### 3.1.1 Test Result

Frequency Stability vs temperature:

1. Test for 57GHz to 64GHz

Frequency (GHz)	Temperature (°C)	Voltage (V DC)	F∟ (GHz)	Limit (GHz)	Fн (GHz)	Limit (GHz)	Result
	40	3.3	57.7472	57	61.6622	64	Pass
	30	3.3	57.7468	57	61.6626	64	Pass
	20	3.3	57.7476	57	61.6629	64	Pass
57-64	10	3.3	57.7472	57	61.6632	64	Pass
	0	3.3	57.7466	57	61.6629	64	Pass
	-10	3.3	57.7462	57	61.6622	64	Pass
	-20	3.3	57.7452	57	61.6618	64	Pass

#### Frequency Stability vs voltage:

#### 1. Test for 57GHz to 64GHz

Frequency (GHz)	Voltage (V DC)	Temperature (°C)	F∟ (GHz)	Limit (GHz)	Fн (GHz)	Limit (GHz)	Result
	3.0	20	57.7473	57	61.6631	64	Pass
57-64	3.3	20	57.7479	57	61.6628	64	Pass
	3.6	20	57.7481	57	61.6643	64	Pass

Remark:

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- End of the Report -



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