FCC / ISED – TEST REPORT

Report Number	:	**60.790.23.096.01R02**	Date of Issue:	**November 16, 2023**
Model/HVIN	:	**SBC-D09**		
Product Type	:	MasterMind T3		
Applicant	:	Dayton Industrial Co., Ltd		
Address	:	2-12 Kwai Fat Road, 11-A Kwai Chung, New Territories, Hong Kong.		
Production Facility	:	KENDY ELECRTONICS (DONGGUAN) CO., LTD.		
Address	:	XIN SI HUANG TANG VILLAGE HENG LI TOWN, DONGGUAN CITY, GUANGDONG, CHINA.		
Test Result	:	**n Positive** o Negative		
Total pages including Appendices	:	**25**		

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1 Table of Contents

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2 Details about the Test Laboratory

Details about the Test Laboratory
Test Site 1

Company name:	TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch Building 12 & 13, Zhiheng Wisdomland Business Park, Guankou Erlu, Nantou, Nanshan District Shenzhen 518052 P.R. China
Telephone:	86 755 8828 6998
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FCC Registration No.:	514049
FCC Deignation No.:	CN5009
IC Registration No.:	10320A
ISED CAB Identifier:	CN0077

3 Description of the Equipment Under Test

Product:	MasterMind T3
Model no.:	SBC-D09
Hardware Version Identification No. (HVIN)	SBC-D09
Product Marketing Name (PMN)	MasterMind T3
Brand name:	N/A
FCC ID:	O4GT3
IC:	7666A-T3
Rating:	12.0 VDC (Powered by Bike Battery) Or 5.0 VDC (Powered by USB Port)
RF Transmission Frequency:	2457MHz
No. of Operated Channel:	1
Modulation:	GFSK
Antenna Type:	Rod Antenna
Antenna	Gain: 0 dBi
Description of the EUT:	The Equipment Under Test (EUT) is a MasterMind T3 which support Bluetooth (BLE) function and Ant+ function. Only ANT+ Function included in this report.

NOTE:

1. The above EUT's information is declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2021 Edition	**PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators**
RSS-Gen Issue 5 April 2018 + Amendment 1 March 2019 + Amendment 2 February 2021	**General Requirements for Compliance of Radio Apparatus**
RSS-210 Issue 10 December 2019 + Amendment April 2020	**Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment**

All the test methods were according to ANSI C63.10-2020.

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5 Summary of Test Results

Technical Requirements						
FCC Part 15 Subpart C/ RSS-210 Issue 10 + AMD / RSS-Gen Issue 5 + A1 + A2						
Test Condition		Test Site	Test Result			Test Environment
			Pass	Fail	N/A	
§15.207 & RSS-GEN 8.8	Conducted emission AC power port	Site 1	☒	☐	☐	T: 24.8℃ H: 53.7%
§15.215 & RSS-GEN 6.7	20dB bandwidth and 99% Occupied Bandwidth	Site 1	☒	☐	☐	T: 24.8℃ H: 53.7%
§15.249 & §15.209 & §15.205 & RSS-210 B.10 & RSS-Gen 6.13	Radiated Emissions	Site 1	☒	☐	☐	T: 24.7℃ H: 49.3%
§15.203 & RSS-Gen 6.8	Antenna requirement	See note 2	☒	☐	☐	--

Note 1: N/A=Not Applicable.
Note 2: The EUT uses a rod antenna, which gain is 0 dBi. In accordance to §15.203 & RSS-Gen 6.8, it is considered sufficiently to comply with the provisions of this section.
Note 3: T :Temperature, H: Humidity

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6 General Remarks

Remarks

This submittal(s) (test report) is intended for **FCC ID: O4GT3**,
IC: 7666A-T3, complies with Section 15.207, 15.209, 15.249 of the FCC Part 15, Subpart C rules and RSS-210, RSS-GEN.

SUMMARY:

All tests according to the regulations cited on page 5 were

n - Performed

o - **Not** Performed

The Equipment under Test

n - **Fulfills** the general approval requirements.

o - **Does not** fulfill the general approval requirements.

Sample Received Date:	October 25, 2023
Testing Start Date:	October 26, 2023
Testing End Date:	November 14, 2023

- TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch -

Reviewed by:	Prepared by:	Tested by:
Eric LI	Kevin DU	Louise LIU
Section Manager	EMC Project Engineer	EMC Test Engineer

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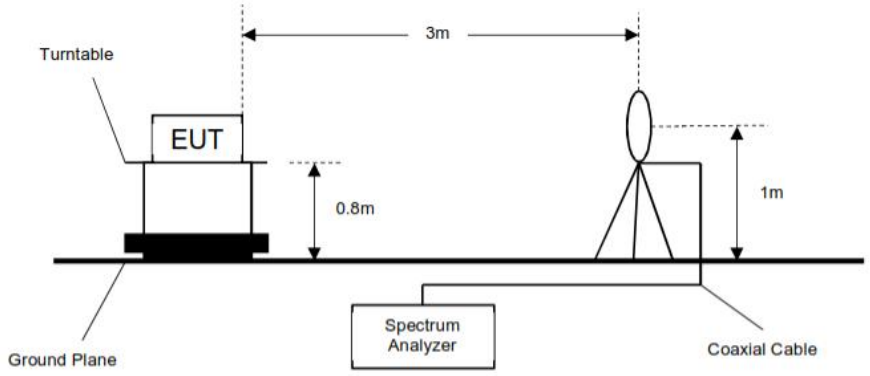
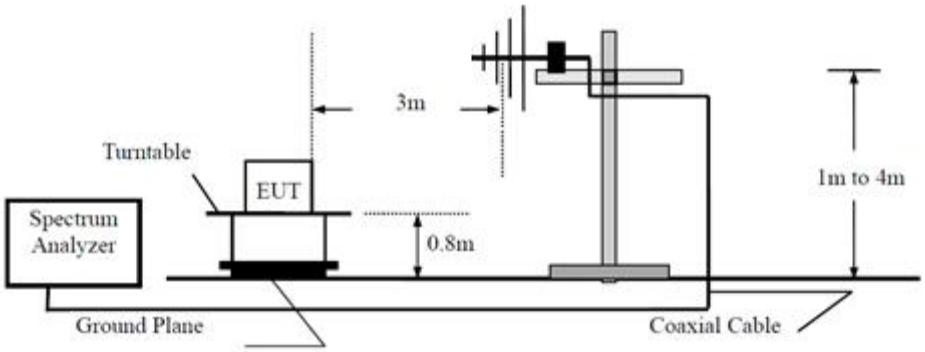
7 Test Setups

7.1 Radiated test setups

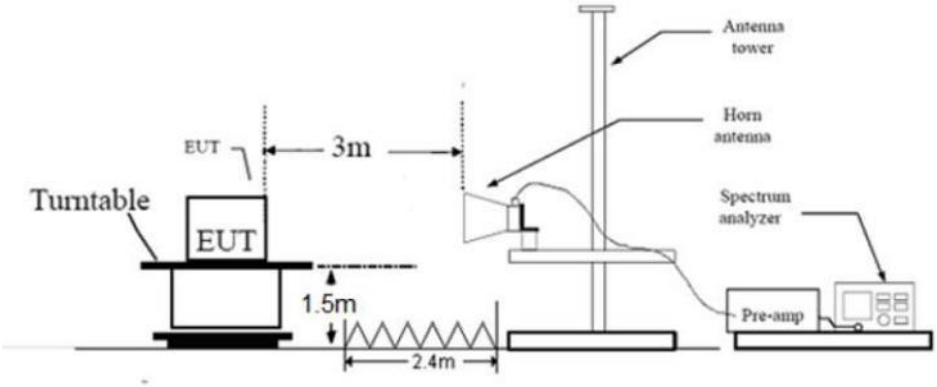
9kHz - 30MHz



30MHz - 1GHz



Above 1GHz



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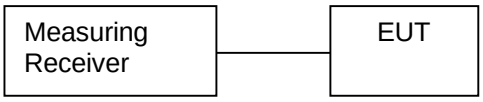
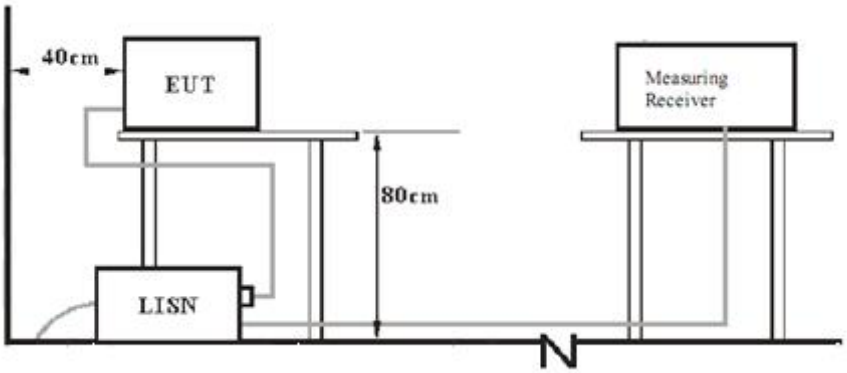
7.2 Conducted RF test setups



7.3 AC Power Line Conducted Emission test setups



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8 Systems Test Configuration

Auxiliary Equipment Used during Test:

Description	Manufacturer	Model NO.	Remark
Laptop	Lenovo	X220	0A72168
Adaptor	Apple	A1357	--
RF Test Mode Software	nRFgo	1.16	Provided by applicant

Cables Used During Test:

Cable	Length	Shielded/unshielded	With / without ferrite
---	---	---	---

The system was configured to non-hopping mode, testing with the Single Channel.

Non-hopping mode: The system was configured to operate at a signal channel transmitting. The test software allows the configuration and operation at the worst-case duty and the highest transmit power.

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9 Technical Requirement

9.1 Conducted Emission

Test Method

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. Both sides of AC line were checked for maximum conducted interference.
6. The frequency range from 150 kHz to 30 MHz was searched.
7. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

Limit

According to §15.207 & RSS-GEN 8.8, conducted emissions limit as below:

Frequency MHz	QP Limit dBµV	AV Limit dBµV
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

*Decreasing linearly with logarithm of the frequency

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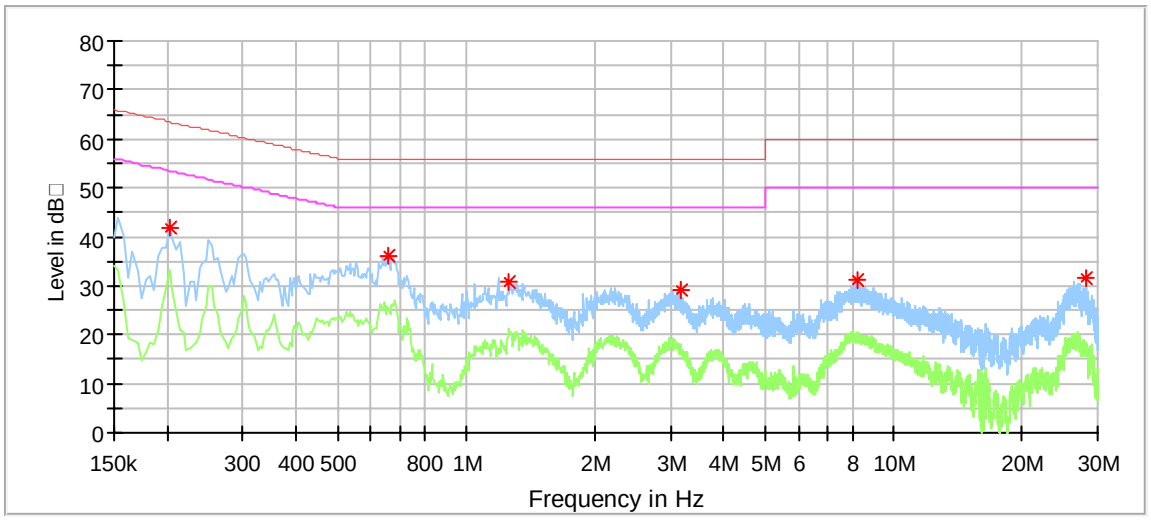
Conducted Emission

Product Type	:	MasterMind T3
M/N	:	SBC-D09
Operating Condition	:	Normal Working
Test Specification	:	Line
Comment	:	AC 120V/60Hz



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.202000	41.76	---	63.53	21.77	L1	9.55
0.658000	36.25	---	56.00	19.75	L1	9.60
1.262000	30.83	---	56.00	25.17	L1	9.60
3.178000	29.02	---	56.00	26.98	L1	9.66
8.194000	31.18	---	60.00	28.82	L1	9.89
28.214000	31.66	---	60.00	28.34	L1	10.03

Remark:
Max Peak= Read level + Corrector factor
Correct factor=cable loss + LISN factor
(The Reading Level is recorded by software which is not shown in the sheet)

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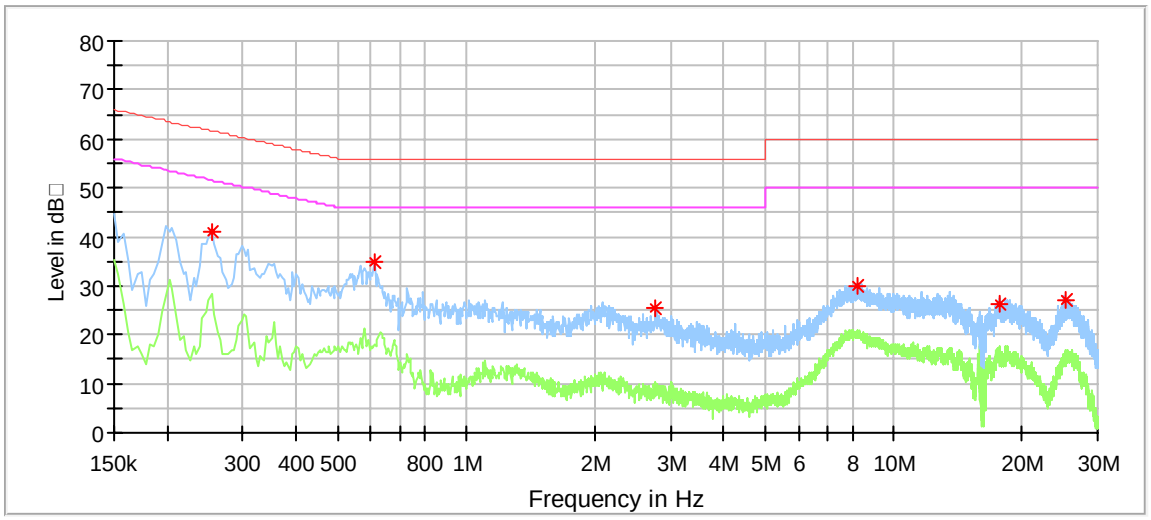
Conducted Emission

Product Type	:	MasterMind T3
M/N	:	SBC-D09
Operating Condition	:	Normal Working
Test Specification	:	Neutral
Comment	:	AC 120V/60Hz



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.254000	40.95	---	61.63	20.67	N	9.59
0.610000	35.03	---	56.00	20.97	N	9.63
2.770000	25.23	---	56.00	30.77	N	9.67
8.262000	30.15	---	60.00	29.85	N	9.91
17.610000	26.43	---	60.00	33.57	N	9.97
25.222000	27.07	---	60.00	32.93	N	9.93

Remark:
Max Peak= Read level + Corrector factor
Correct factor=cable loss + LISN factor
(The Reading Level is recorded by software which is not shown in the sheet)

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9.2 20 dB Bandwidth

Test Method

Test Method

1. The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Use the following test receiver settings:
   Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
   RBW ≥ 1% to 5% of the 20 dB bandwidth, VBW≥3RBW,
   Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth. Record the results.
5. Repeat above procedures until all frequencies measured were complete.

Limit

Limit [kHz]

Test result

Frequency MHz	Mode	20dB bandwidth MHz	Result
2457 MHz	Transmitting	1.221	Pass

Test Graphs as below:

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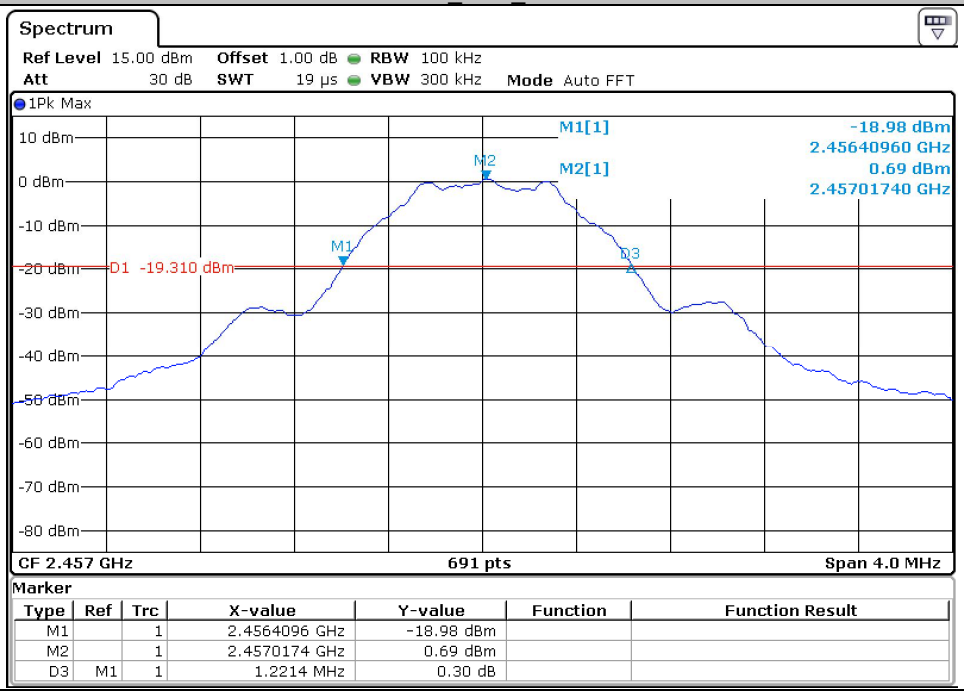
ANT+_Ant0_2457



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9.3 99% bandwidth

Test Method of 99% Bandwidth

1. Set center frequency to the nominal EUT channel center frequency.
2. Set span = 1.5 times to 5.0 times the OBW.
3. Set RBW = 1 % to 5 % of the OBW
4. Set VBW ≥ 3 RBW
5. Trace mode = max hold.
6. Sweep = auto couple.
7. Allow the trace to stabilize.
8. Use the 99 % power bandwidth function of the instrument.
9. Record the results in the test report.

Limit

Limit [kHz]
--

Test result

Frequency MHz	Mode	99% bandwidth MHz	Result
2457 MHz	Transmitting	1.077	Pass

Test Graphs as below:

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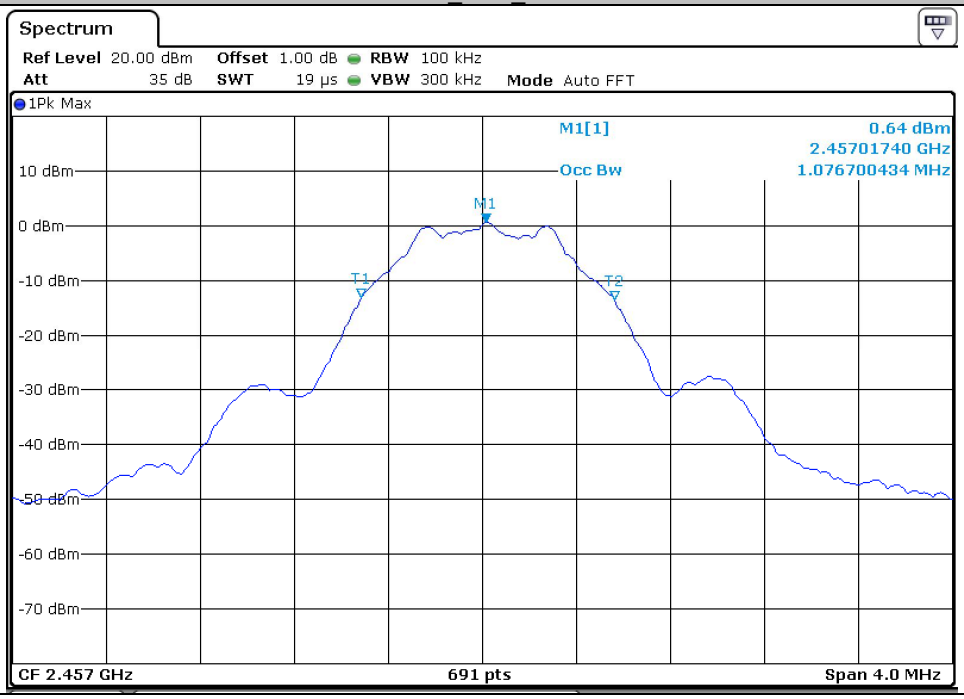
ANT+_Ant0_2457



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9.4 Radiated Emissions

Test Method

1: The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2: The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
3: The height of antenna 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.
4: For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5: Use the following spectrum analyzer settings According to C63.10:
For Below 1GHz
Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 100kHz to 120kHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

For Peak unwanted emissions Above 1GHz:

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 1MHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

Procedures for average unwanted emissions measurements above 1000 MHz

a) RBW = 1MHz.
b) VBW \ [3 × RBW].
c) Detector = RMS (power averaging), if [span / (# of points in sweep)] \ RBW / 2. Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.
d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)
e) Sweep time = auto.
f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of 1 / D, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)
g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:
1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is [10 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.
2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is [20 log (1 / D)], where D is the duty cycle. For example, if the transmit duty

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cycle was 50%, then 6 dB shall be added to the measured emission levels.
3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission (AV) at frequency above 1GHz.

Limit

According to §15.249 (a) & RSS-210 B.10, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

According to §15.249 (c) & RSS-GEN 8.9, Field strength limits are specified at 3 meters distance. According to §15.249 (d) & RSS-GEN, Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209 & RSS-GEN 8.9, whichever is the lesser attenuation.

According to §15.205 Unwanted emissions falling into restricted bands in §15.205 (a) & RSS-GEN 8.10 shall comply with the limits specified in §15.209 & RSS-GEN 8.9.

Frequency MHz	Field Strength uV/m	Field Strength dBµV/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

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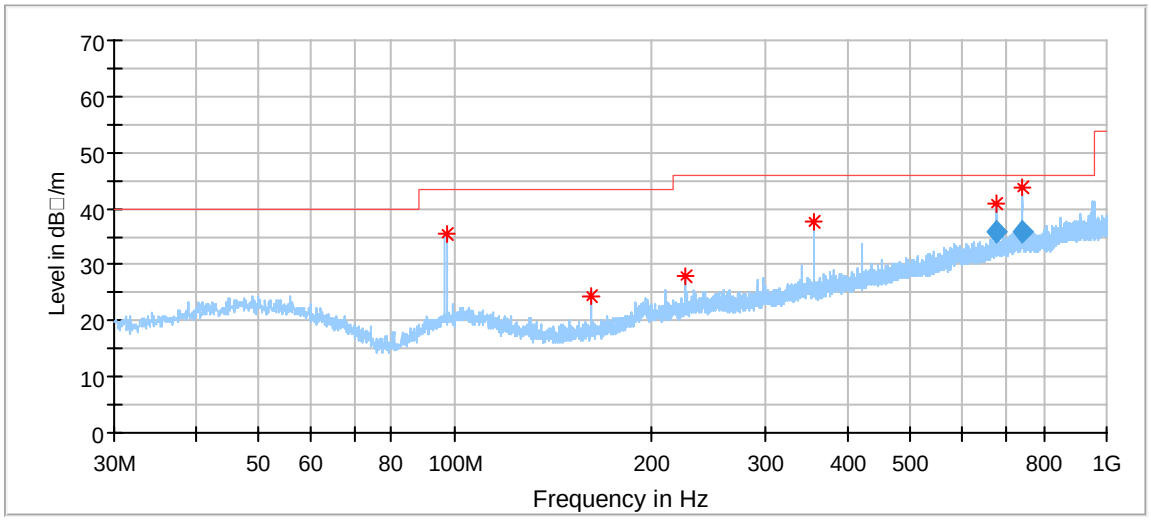
Spurious radiated emissions for transmitter

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

The only worse case test result is listed in the report.

Transmitting spurious emission test result as below:

Test data_30MHz to 1000MHz



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
96.930000	35.58	43.50	7.92	200.0	H	99.0	15.64
161.596667	24.45	43.50	19.05	200.0	H	99.0	13.14
226.425000	27.92	46.00	18.08	100.0	H	311.0	16.48
355.812222	37.60	46.00	8.40	100.0	H	220.0	19.74
679.361111	40.89	46.00	5.11	100.0	H	58.0	26.15
743.327222	43.85	46.00	2.15	100.0	H	58.0	27.36

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
679.361111	35.89	46.00	10.11	100.0	H	58.0	26.15
743.327222	35.85	46.00	10.15	100.0	H	58.0	27.36

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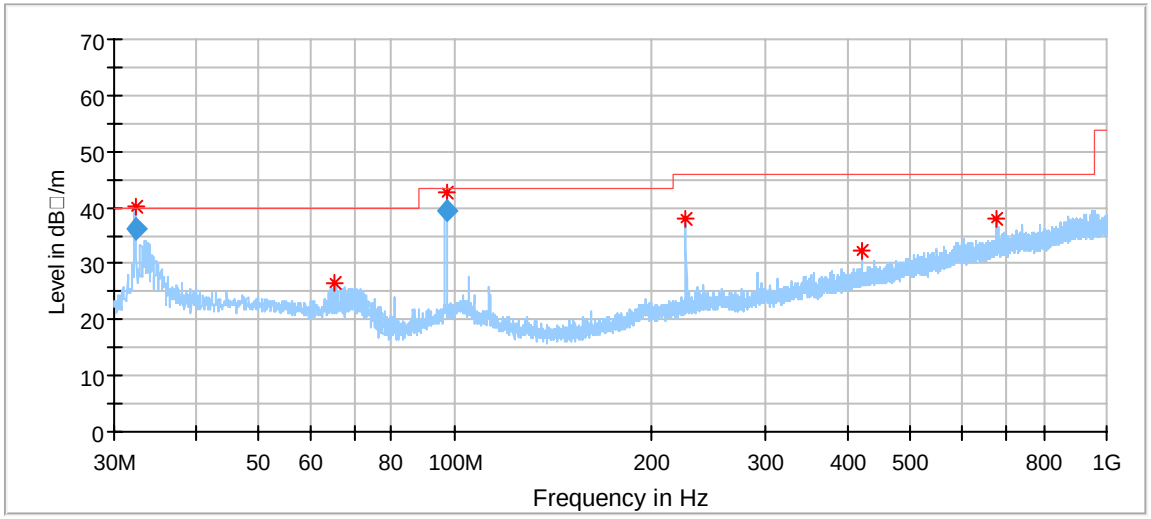
Test data_30MHz to 1000MHz



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
32.317222	40.13	40.00	-0.13	100.0	V	221.0	14.32
65.458889	26.74	40.00	13.26	100.0	V	282.0	15.30
97.037778	42.59	43.50	0.91	100.0	V	221.0	15.65
226.317222	37.88	46.00	8.12	100.0	V	50.0	16.47
420.101667	32.25	46.00	13.75	100.0	V	167.0	21.57
679.199444	38.07	46.00	7.93	200.0	V	271.0	26.15

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
32.317222	36.13	40.00	3.87	100.0	V	221.0	14.32
97.037778	39.59	43.50	3.91	100.0	V	221.0	15.65

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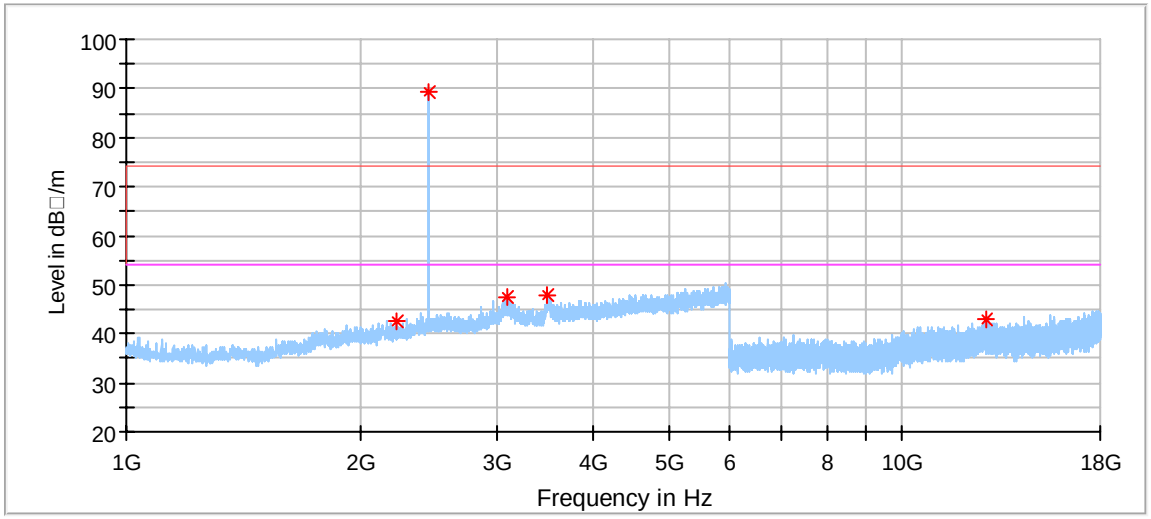
Test data 1GHz to 18GHz:



Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector PK/QP/AV	Corr. (dB)	Pol	RSE. or Fund.
2235.500000	42.50	74.00	31.50	Peak	-4.11	H	Spurious emission
2457.000000	**89.36**	**114.00**	**24.64**	**Peak**	**-2.47**	**H**	**Fundamental**
2457.000000	**75.45**	**94.00**	**18.55**	**AV**	**-2.47**	**H**	**Fundamental**
3093.000000	47.42	74.00	26.58	Peak	0.84	H	Spurious emission
3493.000000	47.92	74.00	26.08	Peak	2.96	H	Spurious emission
12830.500000	43.15	74.00	30.85	Peak	12.96	H	Spurious emission

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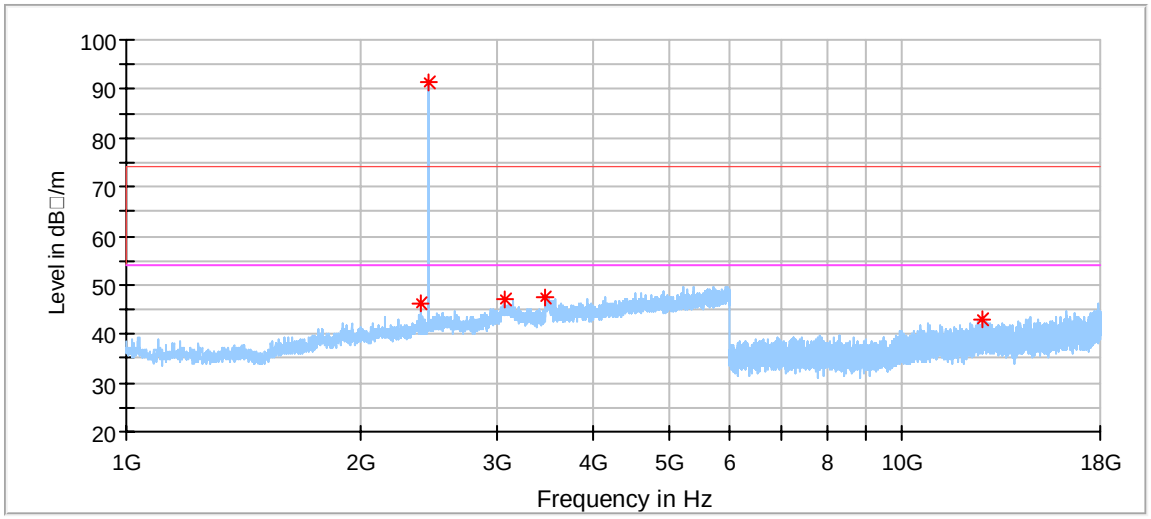
Test data 1GHz to 18GHz:



Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Detector PK/QP/AV	Corr. (dB)	Pol	RSE. or Fund.
2393.000000	46.33	74.00	27.67	Peak	-4.11	V	Spurious emission
2457.000000	**91.48**	**114.00**	**22.52**	**Peak**	**-2.47**	**V**	**Fundamental**
2457.000000	**80.32**	**94.00**	**10.68**	**AV**	**-2.47**	**V**	**Fundamental**
3082.500000	47.12	74.00	26.88	Peak	0.84	V	Spurious emission
3469.000000	47.35	74.00	26.65	Peak	2.96	V	Spurious emission
12669.000000	42.94	74.00	31.06	Peak	12.96	V	Spurious emission

Remark:
(1) "*" means the emission(s) appear within the restrict bands shall follow the requirement RSS-GEN 8.10.
(2) Data of measurement within frequency range 9kHz-30MHz, 18-26GHz are the noise floor or attenuated more than 20dB below the permissible limits or the field strength is too small to be measured, so test data does not present in this report.
(3) We test the operated channel only and the worst case recorded in this report.
(4) Corrected Amplitude = Read level + Corrector factor
Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
Below 1GHz: Corrector factor = Antenna Factor + Cable Loss
(The Reading Level is recorded by software which is not shown in the sheet)

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10 Test Equipment List

List of Test Instruments

Radiated Emission Test 1# (9kHz – 1GHz)

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 26	68-4-74-14-002	101269	2024-5-20
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9162	68-4-80-19-003	284	2024-3-5
Loop Antenna	Rohde & Schwarz	HFH2-Z2	68-4-80-14-006	100398	2024-8-7
Pre-amplifier	Rohde & Schwarz	SCU 18F	68-4-29-19-001	100745	2024-5-19
Sideband Horn Antenna	Q-PAR	QWH-SL-18-40-K-SG	68-4-80-14-008	12827	2024-7-11
Pre-amplifier	Rohde & Schwarz	SCU 40A	68-4-29-14-002	100432	2024-8-1
Attenuator	Mini-circuits	UNAT-6+	68-4-81-21-002	15542	2024-5-19
3m Semi-anechoic chamber	TDK	SAC-3 #2	68-4-90-19-006	----	2024-5-28
Test software	Rohde & Schwarz	EMC32	68-4-90-19-006-A01	Version10.35.02	N/A

Radiated Emission 2# Test (1GHz – 40GHz)

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 26	68-4-74-14-002	101269	2024-5-20
Wave Guide Antenna	ETS	3117	68-4-80-19-001	00218954	2024-4-26
Pre-amplifier	Rohde & Schwarz	SCU 18F	68-4-29-19-002	100746	2024-5-19
Sideband Horn Antenna	Q-PAR	QWH-SL-18-40-K-SG	68-4-80-14-008	12827	2024-7-11
Pre-amplifier	Rohde & Schwarz	SCU 40A	68-4-29-14-002	100432	2024-8-1
Attenuator	Mini-circuits	UNAT-6+	68-4-81-21-002	15542	2024-5-19
3m Semi-anechoic chamber	TDK	SAC-3 #2	68-4-90-19-006	----	2024-5-28
Test software	Rohde & Schwarz	EMC32	68-4-90-19-006-A01	Version10.35.02	N/A

Conducted RF Test System

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL. DUE DATE
Signal Analyzer	Rohde & Schwarz	FSV40	68-4-74-14-004	101030	2024-5-19
RF Switch Module	Rohde & Schwarz	OSP120/OSP-B157W	68-4-93-14-003	101226/100929	2024-5-20
Power Splitter	Weinschel	1580	68-4-85-14-001	SC319	2024-5-20
10dB Attenuator	Weinschel	4M-10	68-4-81-14-003	43152	2024-5-19
10dB Attenuator	R&S	DNF	68-4-81-14-004	DNF-001	2024-5-19
10dB Attenuator	R&S	DNF	68-4-81-14-005	DNF-002	2024-5-19
10dB Attenuator	R&S	DNF	68-4-81-14-006	DNF-003	2024-5-19
10dB Attenuator	R&S	DNF	68-4-81-14-007	DNF-004	2024-5-19
Test software	Tonscend	System for BT/WIFI	68-4-74-14-006-A13	Version 2.6.77.0518	N/A
Shielding Room	TDK	TS8997	68-4-90-19-003	----	2025-10-15

Conducted Emission Test

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 3	68-4-74-14-001	101782	2024-5-20
LISN	Rohde & Schwarz	ENV432	68-4-87-16-001	101318	2024-5-20
Test software	Rohde & Schwarz	EMC32	68-4-90-14-003-A10	Version9.15.00	N/A
Shielding Room	TDK	CSR #1	68-4-90-19-004	----	2025-10-15

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11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

System Measurement Uncertainty	
Test Items	Extended Uncertainty
Uncertainty for Conducted Emission 150kHz-30MHz (for test using AMN ENV432 or ENV4200)	3.57dB
Uncertainty for Radiated Emission in 3m chamber 9kHz-30MHz	4.70dB
Uncertainty for Radiated Emission in new 3m chamber 30MHz-1000MHz	Horizontal: 4.59dB; Vertical: 4.75dB
Uncertainty for Radiated Emission in new 3m 1000MHz-18000MHz	Horizontal: 5.08dB; Vertical: 5.09dB;
Uncertainty for Radiated Emission 18000MHz-40000MHz	Horizontal: 4.52dB; Vertical: 4.51dB
Uncertainty for Conducted RF test	RF Power Conducted: 1.31dB Frequency test involved: 0.6×10^{-8} or 1%

Measurement Uncertainty Decision Rule:

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2023, clause 4.3.3 and 4.3.4.

---THE END OF REPORT---

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