

Prüfbericht-Nr.: <i>Test report no.:</i>	CN23S9B0 (P15C-433.92M) 001	Auftrags-Nr.: <i>Order no.:</i>	48219165	Seite 1 von 26 Page 1 of 26
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	2023-03-09	
Auftraggeber: <i>Client:</i>	Microchip Technology Inc. 2355 West Chandler Blvd. Chandler, Arizona 85224-6199, United States			
Prüfgegenstand: <i>Test item:</i>	EV77V90A			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	ATAB8510B-V2.0			
Auftrags-Inhalt: <i>Order content:</i>	FCC Part 15C Test report			
Prüfgrundlage: <i>Test specification:</i>	FCC CFR47 Part 15: Subpart C Section 15.231			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2023-05-22			
Prüfmuster-Nr.: <i>Test sample no.:</i>	A003480465-001 A003480465-002			
Prüfzeitraum: <i>Testing period:</i>	2023-05-29 - 2023-08-23			
Ort der Prüfung: <i>Place of testing:</i>	EMC/RF Taipei Testing Site			
Prüflaboratorium: <i>Testing laboratory:</i>	Taipei Testing Laboratories			
Prüfergebnis*: <i>Test result*:</i>	Pass			
zusammengestellt von: <i>compiled by:</i>	 Ryan Chen Senior Project Manager		genehmigt von: <i>authorized by:</i>	 Brenda Chen Senior Project Manager
Datum: <i>Date:</i>	2023-08-25		Ausstellungsdatum: <i>Issue date:</i>	2023-08-25
Stellung / Position:	Senior Project Manager		Stellung / Position:	Senior Project Manager
Sonstiges / Other:				
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
<p>* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet</p> <p>* Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested</p>				
<p>Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i></p>				

TEST SUMMARY

Report Section	FCC Clause	Test Item	Result
5.1.1	15.203	Antenna Requirement	Pass
5.1.2	15.231(c)	20 dB Bandwidth and Occupied Bandwidth	Pass
5.1.3	15.231(a)	Pulse Width / TX Gap	Pass
5.1.4	15.231(b)	Field Strength of Fundamental Emissions	Pass
5.1.5	15.231(b) & 15.205 & 15.209	Radiated Spurious Emissions	Pass
-	15.207	Mains Conducted Emission	Not Applicable

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

Contents

HISTORY OF THIS TEST REPORT	5
1. GENERAL REMARKS	6
1.1 COMPLEMENTARY MATERIALS.....	6
1.2 DECISION RULE OF CONFORMITY	6
2. TEST SITES	7
2.1 TEST LABORATORY	7
2.2 TEST FACILITY.....	7
2.3 TRACEABILITY	8
2.4 CALIBRATION	8
2.5 MEASUREMENT UNCERTAINTY	8
3. GENERAL PRODUCT INFORMATION.....	9
3.1 PRODUCT FUNCTION AND INTENDED USE	9
3.2 SYSTEM DETAILS AND RATINGS.....	9
3.3 NOISE GENERATING AND NOISE SUPPRESSING PARTS	10
3.4 SUBMITTED DOCUMENTS.....	10
4. TEST SET-UP AND OPERATION MODES.....	11
4.1 PRINCIPLE OF CONFIGURATION SELECTION	11
4.2 TEST OPERATION AND TEST SOFTWARE.....	11
4.3 SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT	12
4.4 TEST SETUP DIAGRAM	12
4.5 DUTY CYCLE OF TEST SIGNAL	13
5. TEST RESULTS	14
5.1 TRANSMITTER REQUIREMENT & TEST SUITES.....	14
5.1.1 Antenna Requirement	14
5.1.2 20 dB Bandwidth and Occupied Bandwidth.....	15
5.1.3 Pulse Width/TX Gap.....	18
5.1.4 Field Strength of Fundamental Emissions	20
5.1.5 Radiated Spurious Emissions	23

Prüfbericht - Nr.: CN23S9B0 (P15C-433.92M) 001
Test Report No.

Seite 4 von 26
Page 4 of 26

APPENDIX A - TEST RESULT OF RADIATED EMISSIONS EMISSION

APPENDIX SP - PHOTOGRAPHS OF TEST SETUP

APPENDIX EP - PHOTOGRAPHS OF EUT

Prüfbericht - Nr.: CN23S9B0 (P15C-433.92M) 001
Test Report No.

Seite 5 von 26
Page 5 of 26

HISTORY OF THIS TEST REPORT

Report No.	Description	Date Issued
CN23S9B0 (P15C-433.92M) 001	Original Release	2023-08-25

1. General Remarks

1.1 Complementary Materials

The following attachments are integral parts of this test report:

Appendix A - Test Result of Radiated Emissions Emission

Appendix SP - Photographs of Test Setup

Appendix EP - Photographs of EUT

Test Specifications

The following standards were applied.

Applied Standard and Test Levels

Radio
FCC 47CFR Part 15: Subpart C Section 15.231
ANSI C63.10:2013

1.2 Decision Rule of Conformity

The decision rule of conformity of this test report is following the requirements of the requested standard in the quotation, and agreed among testing laboratory and manufacturer (applicant) to exclude the consideration of Measurement Uncertainty, unless it is required by the specific standard.

2. Test Sites

2.1 Test Laboratory

Taipei Testing Laboratories

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.
Taipei City 105
Taiwan (R.O.C.)

2.2 Test Facility

Taipei Testing Laboratories

No.458-18, Sec. 2, Fenliao Rd., Linkou Dist.,
New Taipei City 244
Taiwan (R.O.C.)
FCC Registration No.: 180491
ISED Registration No.: 25563

2.3 Traceability

All measurement equipment calibrations are traceable to NML(Taiwan)/NIST(USA) or where calibration is performed outside Taiwan, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically in a suitably accredited Calibration Lab. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

All measurement uncertainty values are shown with a coverage factor of $k=2$ to indicate a 95% level of confidence.

Emission Measurement Uncertainty

Parameter	Uncertainty
Radiated Emission (9 kHz ~ 30 MHz)	± 1.15 dB
Radiated Emission (30 MHz ~ 200 MHz)	± 1.32 dB
Radiated Emission (200 MHz ~ 1 GHz)	± 1.31 dB
Radiated Emission (1 GHz ~ 18 GHz)	± 1.53 dB
Radiated Emission (18 GHz ~ 40 GHz)	± 2.50 dB
Mains Conducted Emission	± 1.65 dB

3. General Product Information

3.1 Product Function and Intended Use

The EUT is an EV77V90A working at 433.92 MHz.
For details refer to the User Guide, Data Sheet and Circuit Diagram.

3.2 System Details and Ratings

Basic Information of EUT

Item	EUT information
Kind of Equipment/Test Item	EV77V90A
Type Identification	ATAB8510B-V2.0
FCC ID	2ADHK77V90

Technical Specification of EUT

Item	EUT information
Operating Frequency	433.92 MHz
Operation Voltage	3 Vdc
Modulation	FSK
Transmission Mode	Automatically / Manual
Antenna Information	Refer to 5.1.1
Accessory Device	Refer to 4.3

Note:

- All models are listed as below.

Model Type	Type Identification	Difference
Main	ATA8510B-V2.0	TRX device (20kByte user flash memory) The whole product family is based on the same silicon. They differ only in numbering and features that are enabled for customer. To support the industrial segment additional product numbering was defined for the same products.
Series	ATA5831-XPRO	identical to ATA8510B-V2.0
	ATA5833	TRX device without user flash memory
	ATA8515	identical to ATA5833
	ATA8710	TX only device (20kByte user flash memory)

- The automatic and manual modes are operating at the same RF characteristics.

3.3 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.4 Submitted Documents

- Circuit Diagram
- Instruction Manual
- Rating Label
- Technical Description

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The equipment under test (EUT) was configured to measure its maximum emission level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Setup for testing: Test samples are modified to continuous transmitter mode which makes it possible to transmit when press the button.

Test Software	N/A
---------------	-----

The samples were used as follows:

A003480465-001

A003480465-002

Full test was applied on all test modes, but only worst case was shown.

EUT Configure Mode	Applicable To					Description
	20 dB Bandwidth	Pulse Width / TX Gap	Field Strength of Fundamental Emissions	Radiated Spurious Emissions	Mains Conducted Emission	
-	√	√	√	√	-	-

Note:

- The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when position on Z-plane.
- The series model has been evaluated but only the worst case was shown.
- "-" means no effect.

20 dB Bandwidth

☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Frequency (MHz)	Tested Frequency (MHz)
-	433.92	433.92

Pulse Width / TX Gap

☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Frequency (MHz)	Tested Frequency (MHz)
-	433.92	433.92

Field Strength of Fundamental

☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Frequency (MHz)	Tested Frequency (MHz)
-	433.92	433.92

Prüfbericht - Nr.: CN23S9B0 (P15C-433.92M) 001
Test Report No.
Seite 12 von 26
Page 12 of 26
Radiated Spurious Emissions

- ☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Frequency (MHz)	Tested Frequency (MHz)
-	433.92	433.92

Test Condition

Test Item	Ambient Temperature	Relative Humidity	Tested by
20 dB Bandwidth	18-23 °C	55-68 %	Nick Hsu
Pulse Width / TX Gap	18-23 °C	55-68 %	Nick Hsu
Field Strength of Fundamental	23.7-24.6 °C	52-55 %	Ray Huang
Radiated Spurious Emissions	23.7-24.6 °C	52-55 %	Ray Huang

4.3 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

Accessory of EUT

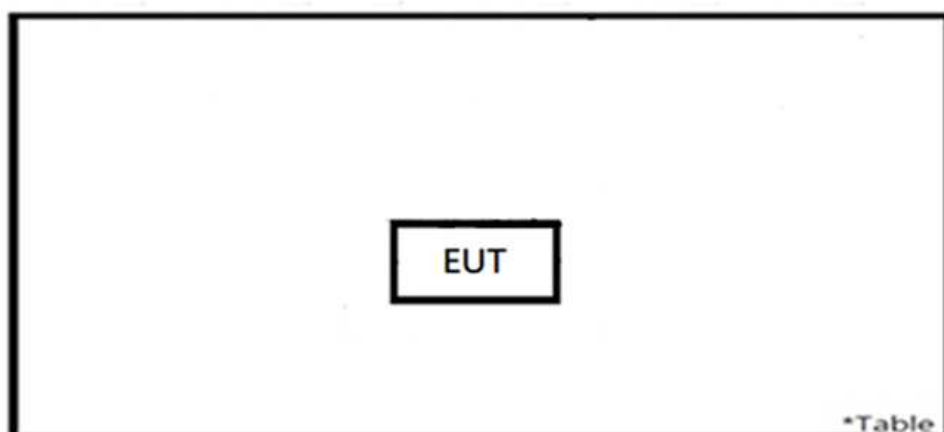
None.

Support Unit

No.	Description	Brand	Model	S/N	Remark
Conducted Test					
-	Power Supply	Radio Tek	KEITHLEY	002	--

4.4 Test Setup Diagram

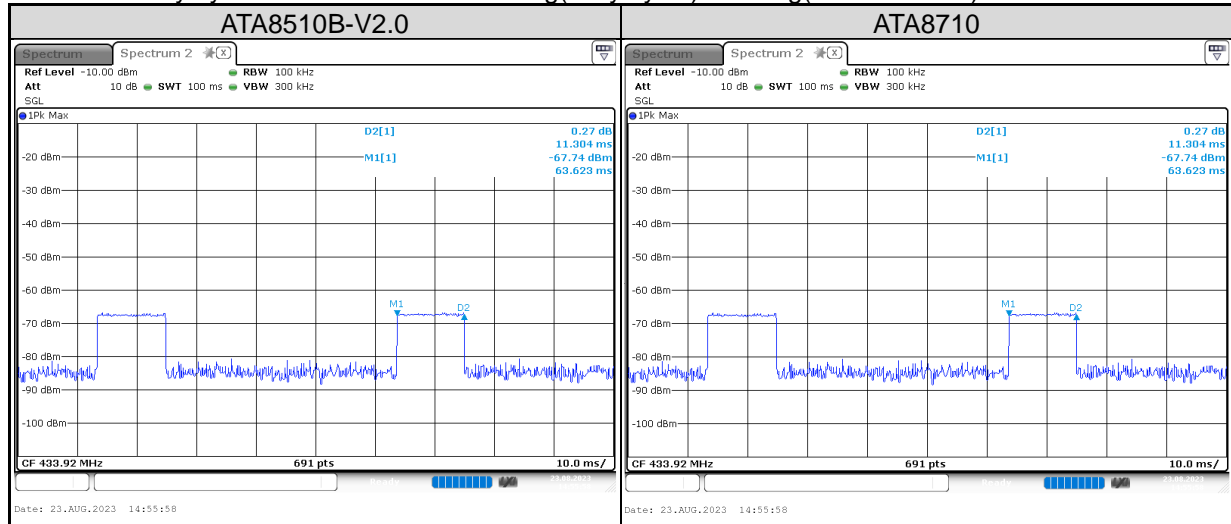
<Radiated Spurious Emissions Mode>



4.5 Duty Cycle of Test Signal

ATA8510B-V2.0: Duty cycle correction factor = $20 \log(\text{Duty cycle}) = 20 \log(11.304 \cdot 2/100) = -12.91$

ATA8710: Duty cycle correction factor = $20 \log(\text{Duty cycle}) = 20 \log(11.304 \cdot 2/100) = -12.91$



5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

Requirement Use of approved antennas only

According to the manufacturer declaration, the EUT has an antenna with a directional gain of -23.85 dBi. The antenna is a PCB with a printed magnetic loop antenna with no possibility of replacement with a non-approved antenna by the end-user. Therefore, the EUT is considered to comply with this provision.

Refer to EUT photo for details.

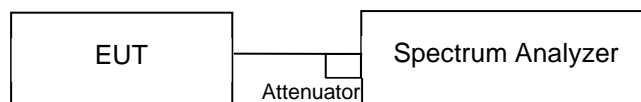
5.1.2 20 dB Bandwidth and Occupied Bandwidth

Limit

The bandwidth of the emission shall be no wider than 0.25 % of the center frequency for devices operating above 70 MHz and below 900 MHz.

Kind of Test Site Shielded room

Test Setup



Test Instruments

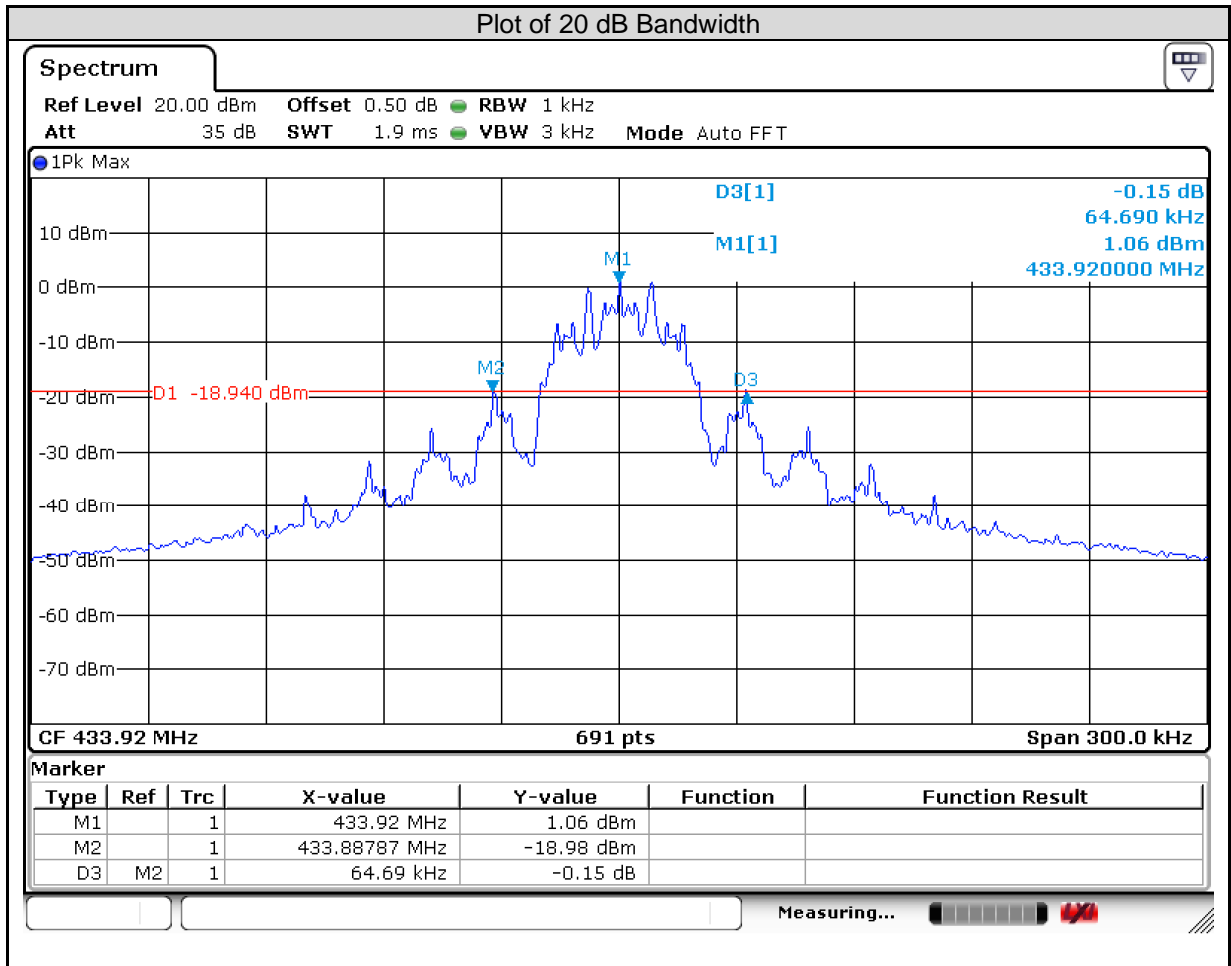
Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	ESR	102109	2023/3/24	2024/3/22	2023/6/27	2023/7/05

Test Procedures

- Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
- Repeat above procedures until all frequencies measured were complete.
- For occupied bandwidth, the transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with resolution bandwidth in the range of 1 % to 5 % of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth and set the detector to Sampling. The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

Test Results

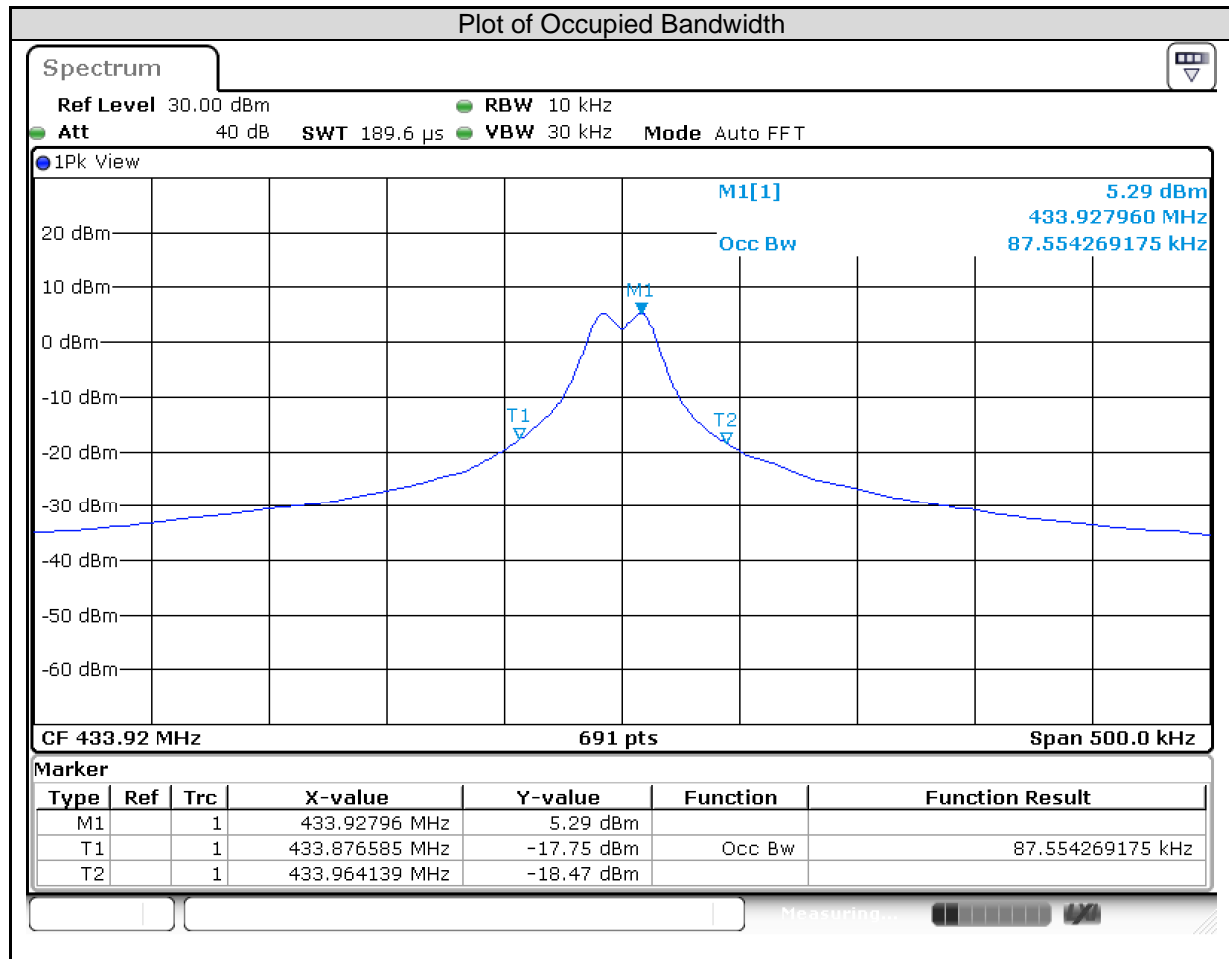
Channel Frequency (MHz)	20 dB Bandwidth (kHz)	Limit (kHz)
433.92	64.69	1085



Prüfbericht - Nr.: CN23S9B0 (P15C-433.92M) 001
Test Report No.

Seite 17 von 26
Page 17 of 26

Channel Frequency (MHz)	Occupied Bandwidth (kHz)
433.92	87.55



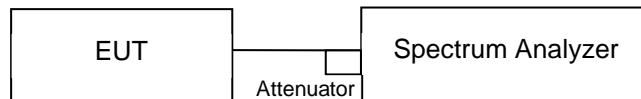
5.1.3 Pulse Width/TX Gap

Limit

For operation in 314-316 MHz and 433-435 MHz: A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds being released. A transmitter activated automatically shall cease transmission within 5 seconds after activation.

Kind of Test Site Shielded room

Test Setup



Test Instruments

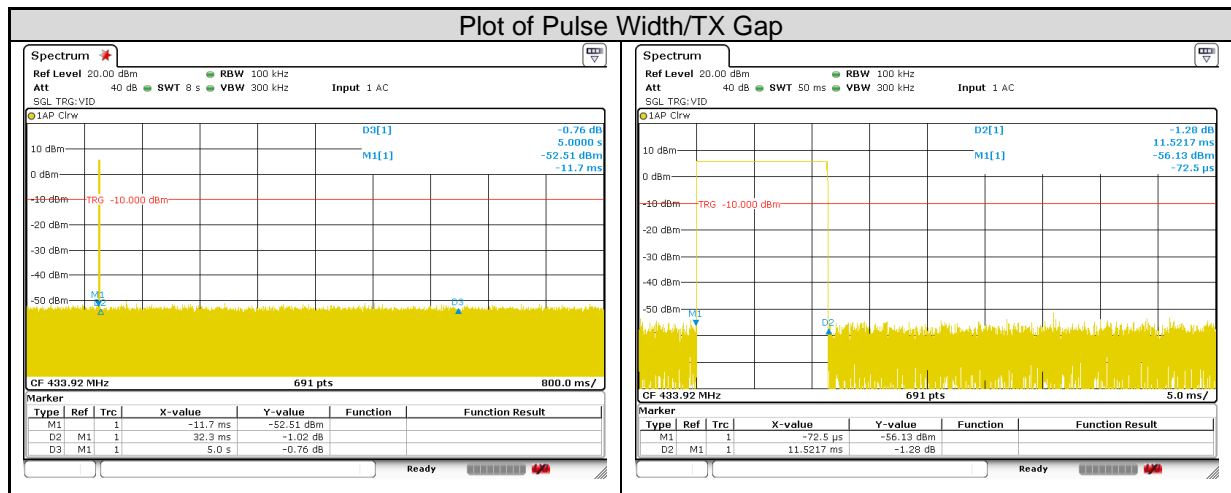
Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	ESR	102109	2023/3/24	2024/3/22	2023/6/27	2023/6/27

Test Procedures

- Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- Measure the transmission time (Pulse width) and stop duration of a transmission period (TX gap).
- Repeat above procedures until all frequencies measured were complete.

Test Results

Channel Frequency (MHz)	Pulse Width (ms)	Limit (ms)	Result
433.92	11.52	5000	Pass

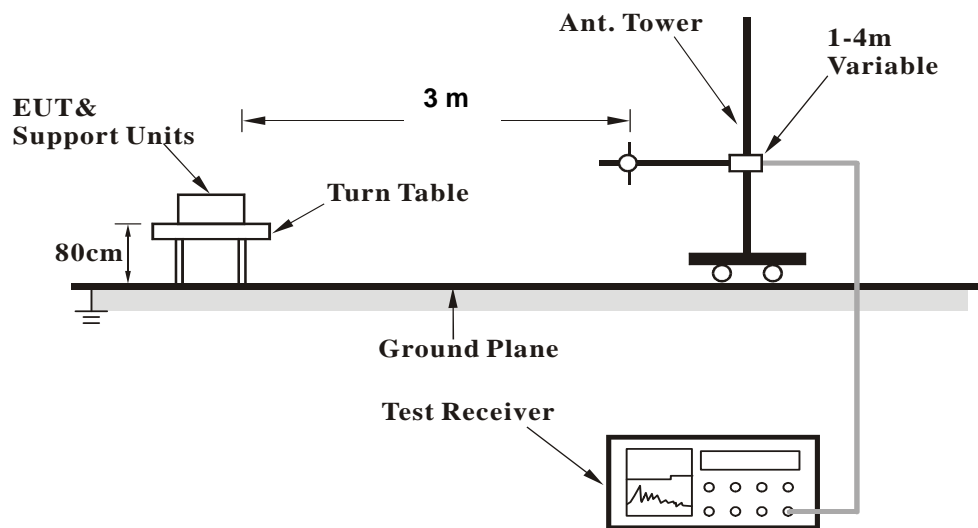


5.1.4 Field Strength of Fundamental Emissions

Limit Refer to §15.231(b) for reference

Kind of Test Site 3m Semi-Anechoic Chamber

Test Setup



For the actual test configuration, please refer to the attached file (Test Setup Photo).

Prüfbericht - Nr.: CN23S9B0 (P15C-433.92M) 001
Test Report No.**Seite 21 von 26**
Page 21 of 26**Test Instruments**

Test Date: 2023/5/29, 2023/8/23

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
Above 1GHz					
Signal Analyzer	R&S	FSV40	101509	2023/4/26	2024/4/24
Horn Antenna	ETS-Lindgren	3117	00218930	2022/12/8	2023/12/7
HF-AMP + AC source	EMCI	EMC051845SE	980633	2023/2/22	2024/2/21
30MHz-1GHz					
Receiver	R&S	ESR7	102109	2023/2/24	2024/2/23
Bilog Antenna	SCHWARZBECK	VULB-9168	00951	2023/3/31	2024/3/29
LF-AMP	Agilent	8447D	2944A107722	2023/3/22	2024/3/20
Below 1GHz					
Receiver	R&S	ESR7	102109	2023/2/24	2024/2/23
Loop Antenna	SCHWARZBECK	FMZB 1519B	00215	2023/1/4	2024/1/3

Test Procedures

- The EUT was placed on the top of a rotating table 0.8 meters (for 30 MHz ~ 1 GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 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.
- 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.
- The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode.

Note:

- All modes of operation were investigated and the worst-case emissions are reported.
- The Radiated Emissions testing was performed in the X(E1), Y(H) and Z(E2) axis orientation. The worst-case Axis orientation is recorded in this test report.

Test Results

The EUT employs pulsed operation.

Duty Cycle Correction (dB) = $20\log(\text{pulse width} / 100\text{msec}) =$				-18.769
Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Antenna orientation	Detector or calculated value
433.92	85.71	100.83	Horizontal	Peak
433.92	66.94	80.83		Average
433.92	75.96	100.83	Vertical	Peak
433.92	57.19	80.83		Average

FCC 15.231(a), NCC LP0002 4.4.2.5(1)

Note: With linear interpolations, the formulas for calculating the maximum permitted fundamental field strengths is as follows:

$$433.92\text{MHz}, \mu\text{V/m at 3 meters} = 41.6667 \times (433.92\text{MHz}) - 7083.3333 = 10996.68 \mu\text{V/m}$$

$$20\log(10996.68) = 80.83 \text{ dB } \mu\text{V/m (Average Limit)}$$

$$80.83 + 20 = 100.83 \text{ dB } \mu\text{V/m (Peak Limit)}$$

5.1.5 Radiated Spurious Emissions

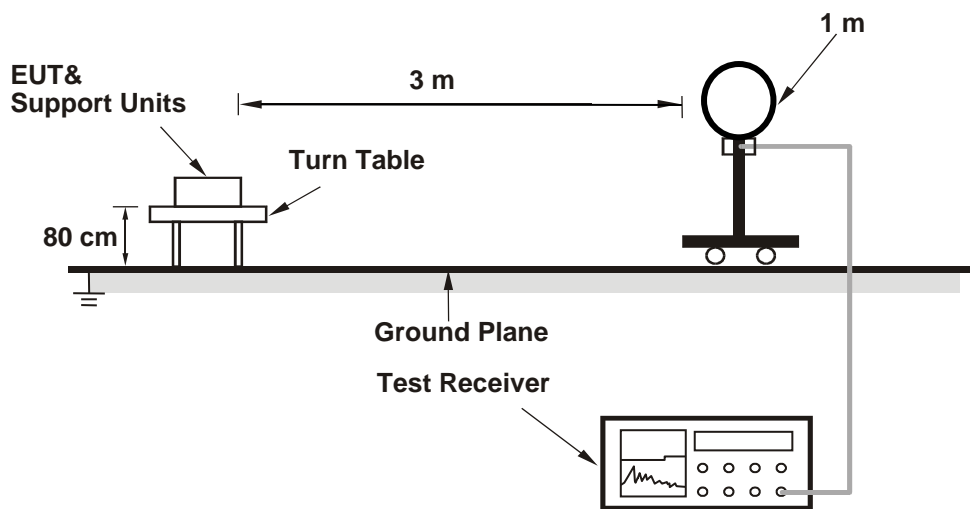
Limit

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a).

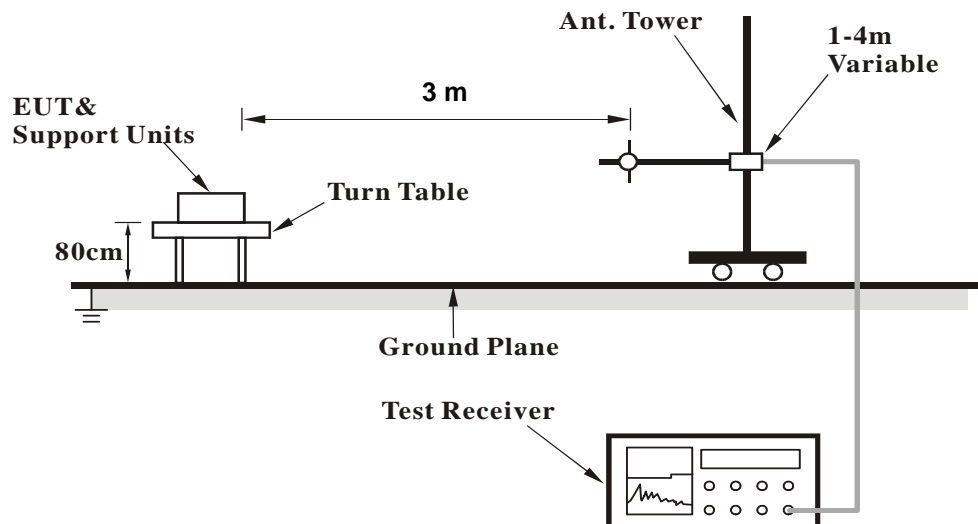
Kind of Test Site 3m Semi-Anechoic Chamber

Test Setup

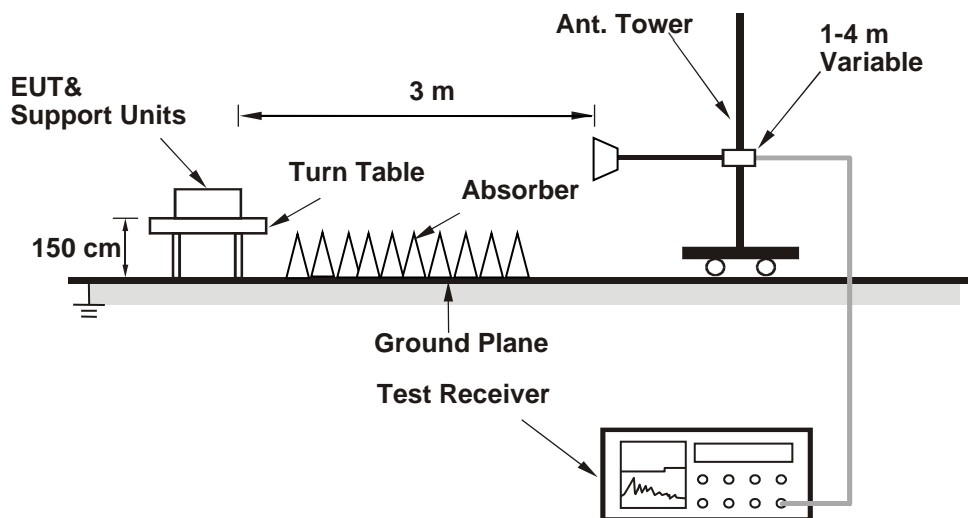
<Radiated Emissions below 30 MHz>



<Radiated Emissions 30 MHz to 1 GHz>



<Radiated Emissions above 1 GHz>



For the actual test configuration, please refer to the attached file (Test Setup Photo).

Test Instruments

Please refer to 5.1.4 Instruments

Test Procedures**For Radiated Emissions below 30 MHz**

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel (OPEN), perpendicular (CLOSE), and ground-parallel (GROUND) orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency are 9-90 kHz, 110-490 kHz and above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz at frequency below 30 MHz.
2. All modes of operation were investigated and the worst-case emissions are reported.

For Radiated Emissions above 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30 MHz ~ 1 GHz) / 1.5 meters (for above 1 GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. 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.
- d. 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.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
2. All modes of operation were investigated and the worst-case emissions are reported.
3. The Radiated Emissions testing was performed in the X(E1), Y(H) and Z(E2) axis orientation. The worst-case Axis orientation is recorded in this test report.
4. The emission levels of other frequencies (including the 10th harmonic of the highest fundamental frequency) are very lower than the limit and are not shown in the test report.

Prüfbericht - Nr.: CN23S9B0 (P15C-433.92M) 001
Test Report No.

Seite 26 von 26
Page 26 of 26

Test Results

Factor (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB)

Level (dBuV/m) = Reading (dBuV) + Factor (dB/m)

Please refer to Appendix A.