Testing Laboratory
3023

Test Report No:
2490236R-RFUSV02S-C

TEST REPORT
FCC Rules & Regulations

Product Name	Rugged Controller
Brand Name	Trimble
Model No.	140000
FCC ID	S9E-140000
Applicant´s Name / Address	Trimble Inc. 5475 Kellenburger Rd., Dayton, Ohio 45424, United States
Manufacturer's Name	Sysgration Ltd.
Test Method Requested, Standard	FCC CFR Title 47 Part 15 Subpart C Section 15.247 ANSI C63.10-2013
Verdict Summary	IN COMPLIANCE
Documented by Genie Chang	Genie Chang
Tested by Ivan Chuang	Ivan Chuang
Approved by Alan Chen	Alan Chen
Date of Receipt	2024/09/09
Date of Issue	2024/11/06
Report Version	V1.0

INDEX

page

Competences and Guarantees 4
General Conditions 4
Revision History 5
Summary of Test Result 6
1. General Information 7
1.1. EUT Description 7
1.2. EUT Information 8
1.3. Testing Location Information 8
1.4. Measurement Uncertainty 9
1.5. List of Test Equipment 10
2. Test Configuration of EUT 11
2.1. Test Condition 11
2.2. Test Frequency Mode 11
2.3. Duty Cycle 12
2.4. Measurement Configuration 14
2.5. Tested System Details 15
2.6. Configuration of Tested System 15
2.7. EUT Operating Procedures 15
3. AC Power Line Conducted Emission 16
3.1. Test Setup 16
3.2. Test Limit 16
3.3. Test Procedure 16
3.4. Test Result of AC Power Line Conducted Emission 16
4. 6 dB Bandwidth 17
4.1. Test Setup 17
4.2. Test Limit 17
4.3. Test Procedures 17
4.4. Test Result of 6dB Bandwidth 17
5. Maximum Conducted Output Power 18
5.1. Test Setup 18
5.2. Test Limit 18
5.3. Test Procedures 18
5.4. Test Result of Maximum Conducted Output Power 18
6. Power Spectral Density 19
6.1. Test Setup 19
6.2. Test Limit 19

6.3. Test Procedures 19
6.4. Test Result of Power Spectral Density 19
7. Antenna Port Conducted Emission 20
7.1. Test Setup 20
7.2. Test Limit 20
7.3. Test Procedure 20
7.4. Test Result of Antenna Port Conducted Emission 20
8. Radiated Emission 21
8.1. Test Setup 21
8.2. Test Limit 22
8.3. Test Procedure 22
8.4. Test Result of Radiated Emission 22
Appendix A. Test Result of AC Power Line Conducted Emission
Appendix B. Test Result of 6 dB Bandwidth
Appendix C. Test Result of Maximum Conducted Output Power
Appendix D. Test Result of Power Spectral Density
Appendix E. Test Result of Antenna Port Conducted Emission
Appendix F. Test Result of Radiated Emission
Appendix G. Test Result of Radiated Emissions Co-location
Appendix H. Test Setup Photograph

Competences and Guarantees

DEKRA is a testing laboratory competent to carry out the tests described in this report.
In order to assure the traceability to other national and international laboratories, DEKRA has a calibration and maintenance program for its measurement equipment.

DEKRA guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated in the report and it is based on the knowledge and technical facilities available at DEKRA at the time of performance of the test.

DEKRA is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

General Conditions

1. The test results relate only to the samples tested.
2. The test results shown in the test report are traceable to the national/international standard through the calibration report of the equipment and evaluated measurement uncertainty herein.
3. This report must not be used to claim product endorsement by TAF or any agency of the government.

without the written approval of DEKRA Testing and Certification Co., Ltd.

5. Measurement uncertainties evaluated for each testing system and associated connections are given here to provide the system information for reference. Compliance determinations do not take into account measurement uncertainties for each testing system, but are based on the results of the compliance measurement.

Revision History

Version	Description	Issued Date
V1.0	Initial issue of report	2024/11/06

Summary of Test Result

Report Clause	Test Items	Result (PASS/FAIL)	Remark
3	AC Power Line Conducted Emission	PASS	-
4	6 dB Bandwidth	PASS	-
5	Maximum Conducted Output Power	PASS	-
6	Power Spectral Density	PASS	-
7	Antenna Port Conducted Emission	PASS	-
8	Radiated Emission	PASS	-

Comments and Explanations
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

1. General Information

1.1. EUT Description

Frequency Range	2400 ~ 2483.5 MHz	
Operating Frequency / Channel Number	IEEE 802.11b/g IEEE 802.11n/ac/ax (20 MHz)	2412 ~ 2462 MHz / 11 Channels
	IEEE 802.11n/ac/ax (40 MHz)	2422 ~ 2452 MHz / 7 Channels
Type of Modulation	IEEE 802.11b	DSSS-DBPSK, DQPSK, CCK
	IEEE 802.11g/n	OFDM-BPSK, QPSK, 16QAM, 64QAM
	IEEE 802.11ac	OFDM-BPSK, QPSK, 16QAM, 64QAM, 256QAM
	IEEE 802.11ax	OFDMA-BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM

Accessories Information		
No.	Equipment Name	Description
1	USB-C cable	Shielded, 2.1m

Antenna Information					
Item.	Brand Name	Part No.	Type	Gain (dBi)	Directional Gain (dBi)
1	AWAN	ALL00-000013 (Main)	PIFA	2.05	5.69
		ALL00-000015 (Aux)		3.26	

Note: The antenna of EUT conforms to FCC 15.203.

1.2. EUT Information

EUT Power Type	From DC 5V by USB			
EUT Function	☒	Point-to-multipoint	☐	Point-to-point
Beamforming Function	☐	With beamforming	☒	Without beamforming
Resource Unit of 802.11ax	☒	Full RU	☐	Partial RU

1.3. Testing Location Information

USA	FCC Designation Number: TW0033
Canada	CAB Identifier Number: TW3023 / Company Number: 26930

Site Description	Accredited by TAF
	Accredited Number: 3023

Test Laboratory	DEKRA Testing and Certification Co., Ltd.
	Linkou Laboratory
Address	No.5-22, Ruishukeng Linkou District, New Taipei City, 24451, Taiwan, R.O.C.
Performed Location	No. 26, Huaya 1st Rd., Guishan Dist.,Taoyuan City 333411, Taiwan, R.O.C.
Phone Number	+886-3-275-7255
Fax Number	+886-3-327-8031

Ambient conditions in the laboratory:

Performed Item	Items	Required	Actual	Test Date
AC Power Line Conducted Emission	Temperature (°C)	10~40 °C	24.3 °C	2024/10/09
	Humidity (%RH)	10~90 %	59.0 %	
Radiated Emission	Temperature (°C)	10~40 °C	23.0 °C	2024/09/26
	Humidity (%RH)	10~90 %	48.0 %	
RF Conducted Emission	Temperature (°C)	10~40 °C	25.1 °C	2024/9/20~2024/9/24
	Humidity (%RH)	10~90 %	65.7 %	

1.4. Measurement Uncertainty

Uncertainties have been calculated according to the DEKRA internal document.

The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

Measurement uncertainties evaluated for each testing system and associated connections are given here to provide the system information for reference. Compliance determinations do not take into account measurement uncertainties for each testing system, but are based on the results of the compliance measurement.

Test Item	Uncertainty
AC Power Line Conducted Emission	±3.50 dB
6 dB Bandwidth	±1580.61 Hz
Maximum Conducted Output Power	Spectrum Analyzer: ±2.13 dB Power Meter: ±1.07 dB
Power Spectral Density	±2.13 dB
Antenna Port Conducted Emission	±2.13 dB
Radiated Emission	9 kHz~30 MHz: ±3.30 dB 30 MHz~1 GHz: ±4.79 dB 1 GHz~18 GHz: ±4.17 dB 18 GHz~40 GHz: ±3.32 dB

1.5. List of Test Equipment

For Conduction Measurements / HY-SR01

	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
V	EMI Test Receiver	R&S	ESR7	101601	2024/06/24	2025/06/23
V	Two-Line V-Network	R&S	ENV216	101306	2024/04/01	2026/03/31
V	Two-Line V-Network	R&S	ENV216	101307	2023/08/17	2025/08/16
V	Coaxial Cable	SUHNER	RG400_BNC	RF001	2024/01/10	2025/01/09

Note:
1. Two-Line V-Network is calibrated every two years, the other equipments are calibrated every one year.
2. The test instruments marked with “V” are used to measure the final test results.
3. Test Software Version: e3 230303 dekra V9.

For Conducted Measurements / HY-SR02

	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
V	Spectrum Analyzer	R&S	FSV30	103466	2024/01/05	2025/01/04
V	Spectrum Analyzer	KEYSIGHT	N9010A	MY53470892	2023/11/09	2024/11/08
V	Peak Power Analyzer	KEYSIGHT	8990B	MY51000539	2024/05/07	2025/05/06
V	Wideband Power Sensor	KEYSIGHT	N1923A	MY59240002	2024/05/08	2025/05/07
V	Wideband Power Sensor	KEYSIGHT	N1923A	MY59240003	2024/05/08	2025/05/07

Note:
1. All equipments are calibrated every one year.
2. The test instruments marked with “V” are used to measure the final test results.
3. Test Software Version: DTC_RF_Tool_Release V100

For Radiated Measurements /HY-CB03

	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
V	Loop Antenna	TESEQ	HLA6121	49611	2024/02/23	2025/02/22
V	Bi-Log Antenna	SCHWARZBECK	VULB9168	9168-0675	2023/08/09	2025/08/08
V	Horn Antenna	RF SPIN	DRH18-E	210802A18ES	2024/03/28	2025/03/27
V	Horn Antenna	Com-Power	AH-840	101101	2023/12/04	2025/12/03
V	Pre-Amplifier	SGH	0301-9	20211007-11	2024/01/10	2025/01/09
V	Pre-Amplifier	SGH	PRAMP118	20200701	2024/01/10	2025/01/09
V	Pre-Amplifier	EMCI	EMC05820SE	980362	2024/01/10	2025/01/09
V	Pre-Amplifier	EMCI	EMC184045SE	980369	2024/01/10	2025/01/09
V	Coaxial Cable	EMCI	EMC102-KM-KM-600	1160314	2024/01/10	2025/01/09
V	Coaxial Cable	EMCI	EMC102-KM-KM-7000	170242	2024/01/10	2025/01/09
V	Filter	MICRO TRONICS	BRM50702	G251	2024/01/05	2025/01/04
	Filter	MICRO TRONICS	BRM50716	067	2024/01/05	2025/01/04
V	EMI Test Receiver	R&S	ESR3	102792	2024/01/05	2025/01/04
V	Spectrum Analyzer	R&S	FSV3044	101115	2024/01/11	2025/01/10
V	Coaxial Cable	SGH	SGH18	2021005-1	2024/01/10	2025/01/09
V	Coaxial Cable	SGH	SGH18	202108-4	2024/01/10	2025/01/09
V	Coaxial Cable	SGH	HA800	GD20110223-1	2024/01/10	2025/01/09
V	Coaxial Cable	SGH	HA800	GD20110222-3	2024/01/10	2025/01/09

Note:
1. Bi-Log Antenna and Horn Antenna(AH-840) is calibrated every two years, the other equipments are calibrated every one year.
2. The test instruments marked with “V” are used to measure the final test results.
3. Test Software Version: e3 230303 dekra V9.

2. Test Configuration of EUT

2.1. Test Condition

EUT Operational Condition	
Testing Voltage	DC 5V by USB

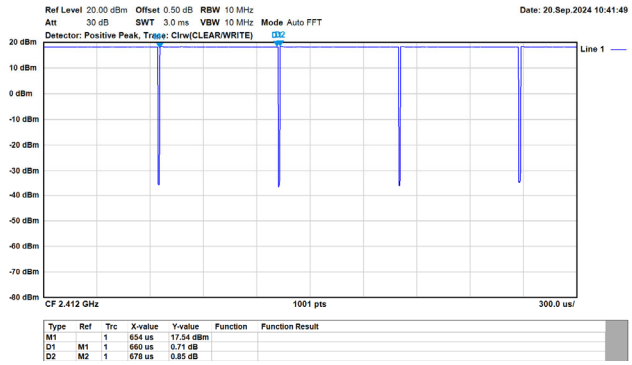
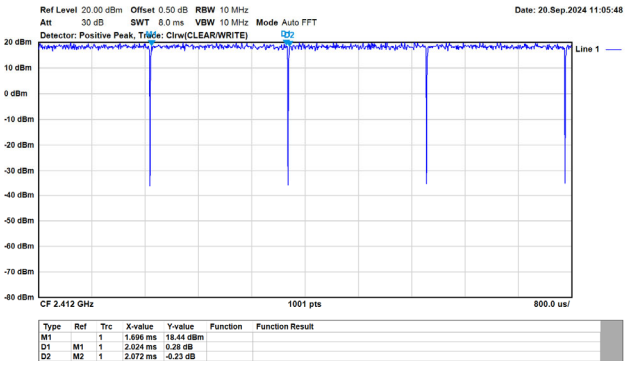
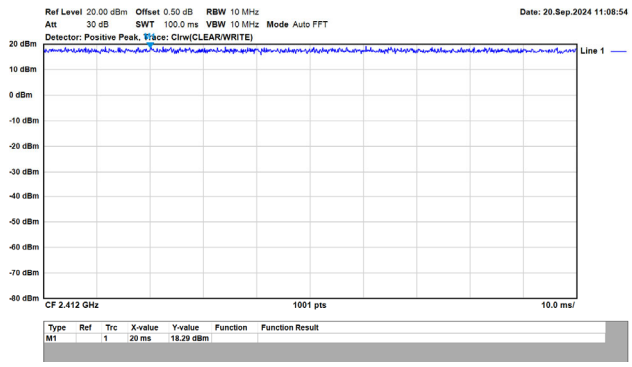
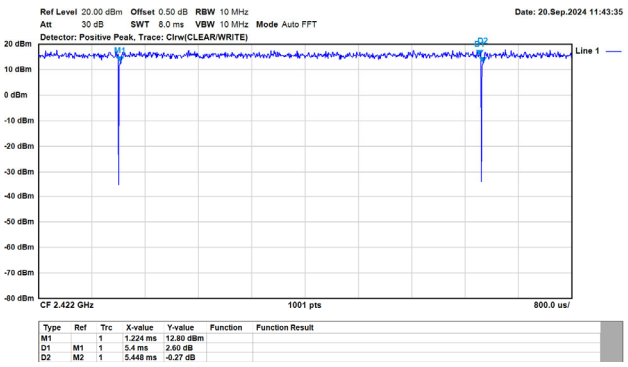
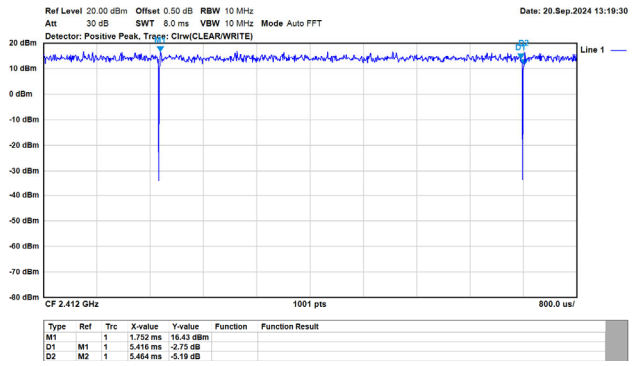
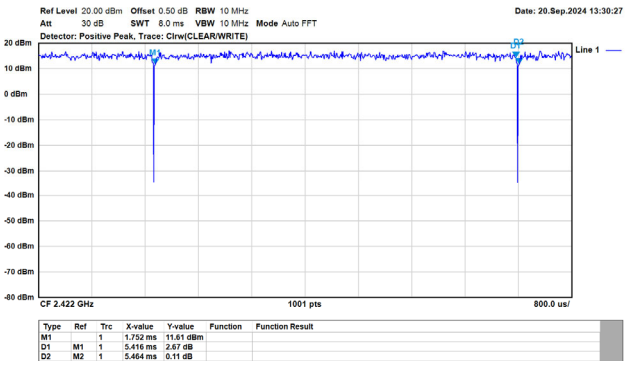
2.2. Test Frequency Mode

Test Software Version	QRCT / Version 4.0.115.1

Modulation	Frequency (MHz)	Power Setting
802.11b	2412	23
	2437	23
	2462	24.5
802.11g	2412	22
	2437	26
	2462	20.5
802.11ac (20 MHz)	2412	22
	2437	25
	2462	20.5
802.11ac (40 MHz)	2422	20.5
	2437	22
	2452	19.5
802.11ax (20 MHz)	2412	21
	2437	25
	2462	19.5
802.11ax (40 MHz)	2422	20.5
	2437	22
	2452	19

2.3. Duty Cycle

Modulation	On Times (ms)	On+Off Times (ms)	Duty Cycle (%)	Duty Factor (dB)	VBW (Hz)
802.11 b	0.6600	0.6780	97.35	0.12	2000
802.11 g	2.0240	2.0720	97.68	0.10	500
802.11 ac20	20.0000	20.0000	100.00	0.00	10
802.11 ac40	5.4000	5.4480	99.12	0.04	10
802.11 ax20	5.4160	5.4640	99.12	0.04	10
802.11 ax40	5.4160	5.4640	99.12	0.04	10

802.11b	802.11g
	
802.11ac (20 MHz)	**802.11ac (40 MHz)**
	
802.11ac (20 MHz)	**802.11ac (40 MHz)**
	

2.4. Measurement Configuration

Test Mode	Mode 1 (Transmit)	802.11b
		802.11g
		802.11ac (20 MHz)
		802.11ac (40 MHz)
		802.11ax (20 MHz)
		802.11ax (40 MHz)

Note:

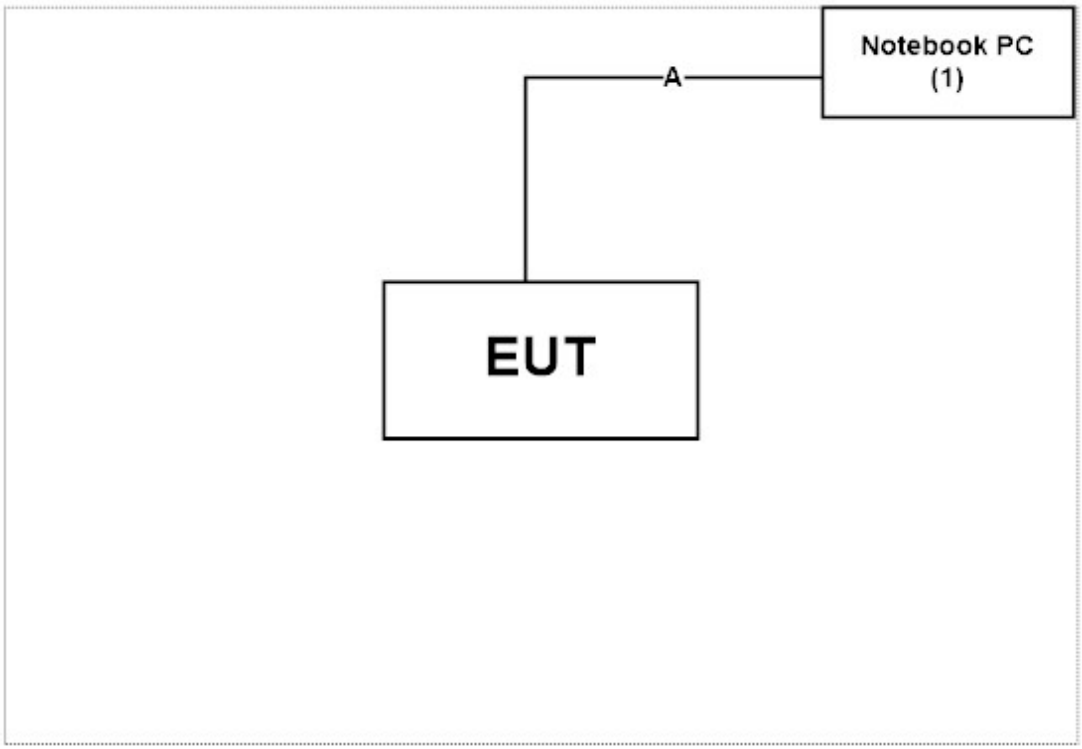
1. Determining compliance shall be based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
2. For radiated emission below 1 GHz and AC power line conducted emission have performed all modes of operation were investigated and the worst-case emissions are reported.
3. Lowest data rates are tested in each mode. Only worst case is shown in the report. (802.11b is 1Mbps, 802.11g is 6Mbps, 802.11ac/ax 20MHz/40MHz is MCS0)
4. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.

2.5. Tested System Details

No.	Equipment	Brand Name	Model No.	Serial No.	Power Cord
1	Notebook PC	DELL	Latitude 5501	4H94P13	N/A

2.6. Configuration of Tested System

Connection Diagram



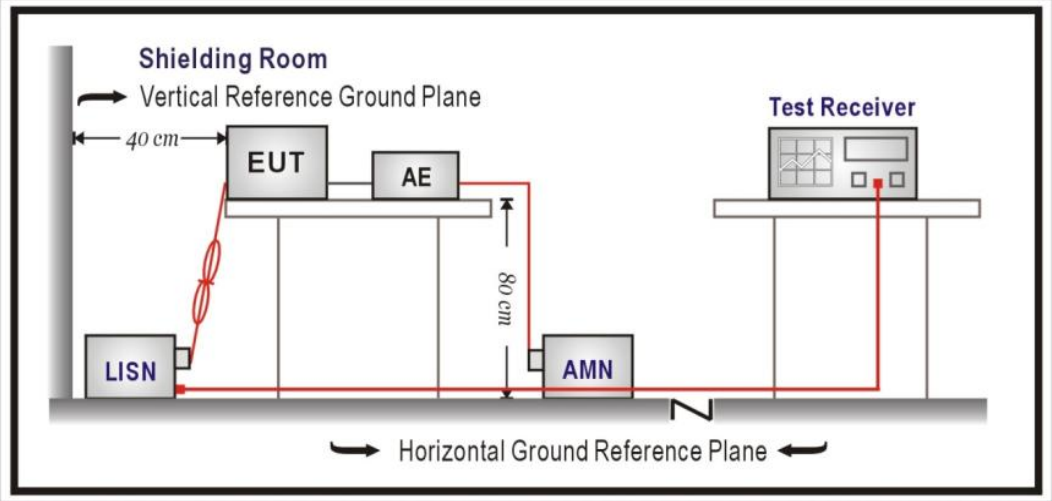
Signal Cable Type		Signal cable Description
A	USB-C cable	Shielded, 2.1m

2.7. EUT Operating Procedures

1	Setup the EUT as shown in Section 2.6.
2	Execute software “QRCT / Version 4.0.115.1” on the Notebook PC.
3	Configure the test mode, the test channel, and the data rate.
4	Verify that the EUT works properly.

3. AC Power Line Conducted Emission

3.1. Test Setup



3.2. Test Limit

Frequency (MHz)	QP (dBuV)	AV (dBuV)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Remarks: In the above table, the tighter limit applies at the band edges.

3.3. Test Procedure

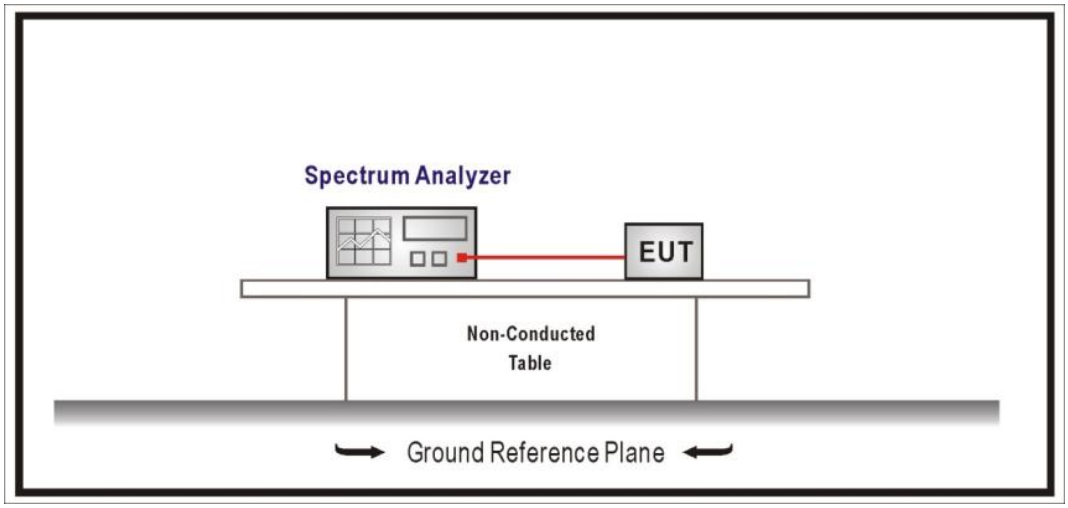
The EUT was setup according to ANSI C63.10: 2013 for AC Power Line Conducted Emissions.

3.4. Test Result of AC Power Line Conducted Emission

Refer as Appendix A

4. 6 dB Bandwidth

4.1. Test Setup



4.2. Test Limit

The 6 dB bandwidth: ≧ 500 kHz.

4.3. Test Procedures

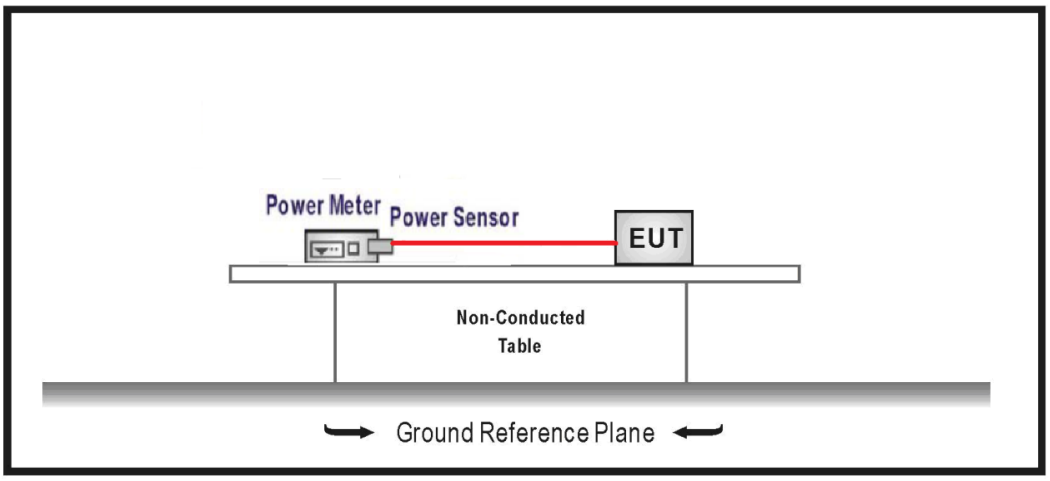
The EUT was setup according to ANSI C63.10: 2013; tested according to DTS test procedure of KDB 558074.

4.4. Test Result of 6dB Bandwidth

Refer as Appendix B

5. Maximum Conducted Output Power

5.1. Test Setup



5.2. Test Limit

The maximum conducted output power shall be less 30 dBm (1 Watt).

5.3. Test Procedures

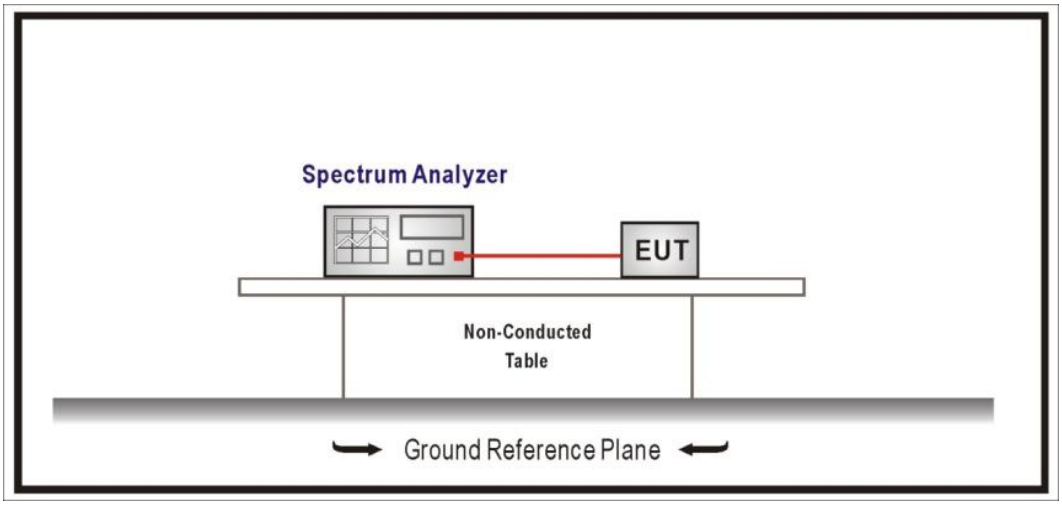
The EUT was setup according to ANSI C63.10: 2013; tested according to DTS test procedure of KDB 558074.

5.4. Test Result of Maximum Conducted Output Power

Refer as Appendix C

6. Power Spectral Density

6.1. Test Setup



6.2. Test Limit

The power spectral density conducted from the intentional radiated to the antenna shall not be greater than +8 dBm in any 3 kHz band during any time interval of continuous transmission.

6.3. Test Procedures

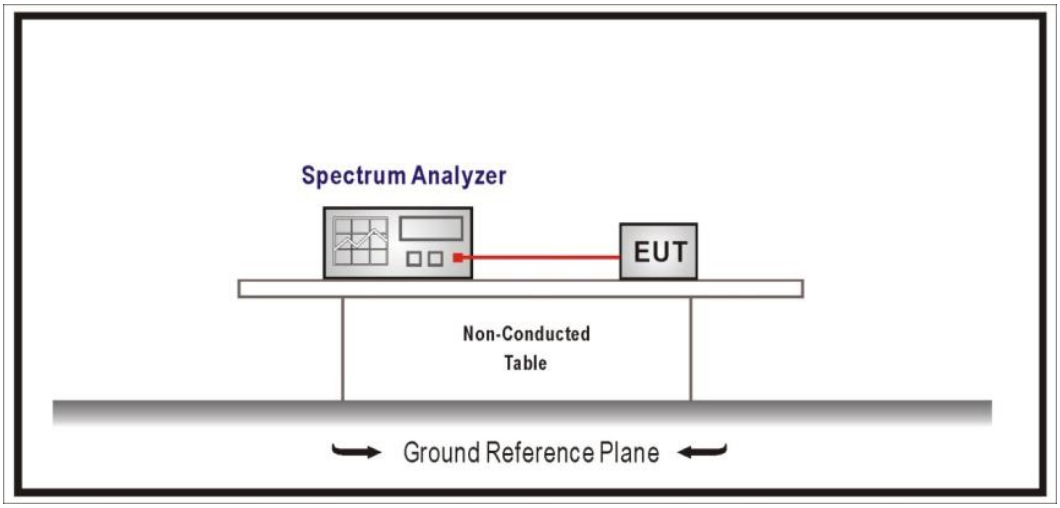
The EUT was setup according to ANSI C63.10: 2013; tested according to DTS test procedure of KDB 558074.

6.4. Test Result of Power Spectral Density

Refer as Appendix D

7. Antenna Port Conducted Emission

7.1. Test Setup



7.2. Test Limit

RF output power procedure	Limit (dBc)
Peak output power procedure	20
Average output power procedure	30

Remarks:

1. In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limit.
2. If the transmitter complies with the conducted power limit based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

7.3. Test Procedure

The EUT was setup according to ANSI C63.10: 2013 and tested according to DTS test procedure of KDB 558074.

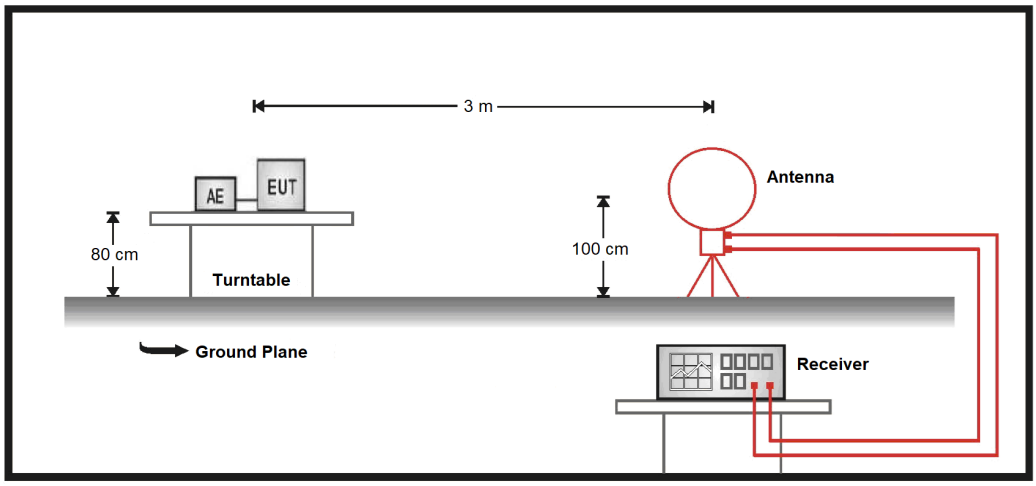
7.4. Test Result of Antenna Port Conducted Emission

Refer as Appendix E

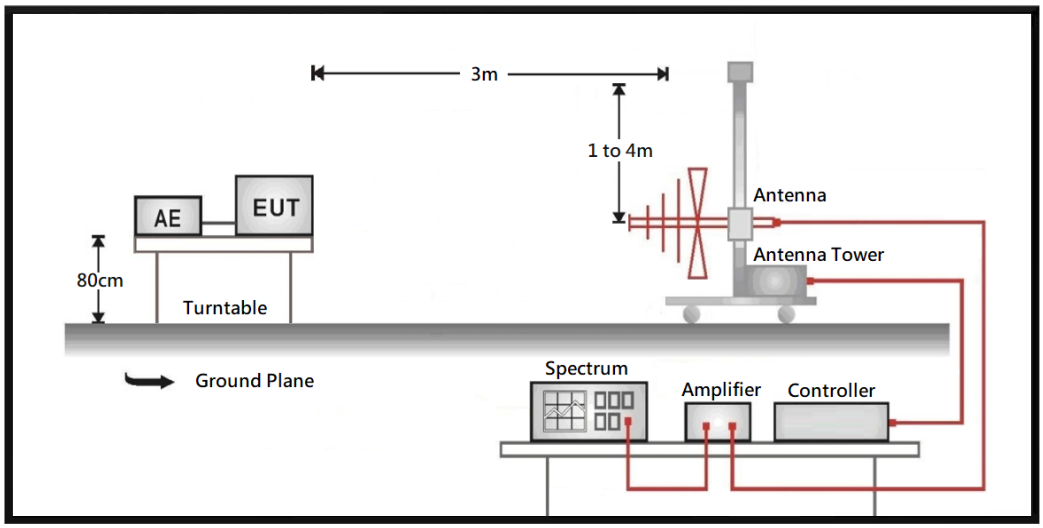
8. Radiated Emission

8.1. Test Setup

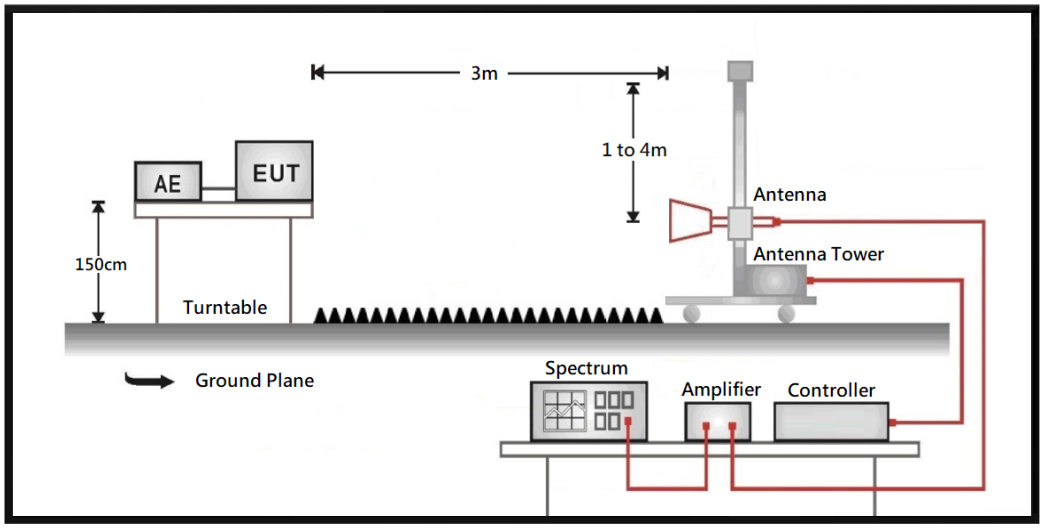
9 kHz ~ 30 MHz



30 MHz ~ 1 GHz



Above 1 GHz



8.2. Test Limit

Frequency (MHz)	Field strength (uV/m)	Field strength (dBuV/m)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	20 log (2400/F(kHz))	300
0.490 – 1.705	24000/F(kHz)	20 log (24000/F(kHz))	30
1.705 - 30	30	29.5	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
Above 960	500	54	3

Remarks:

1. Field strength (dBuV/m) = 20 log Field strength (uV/m)
2. In the Above Table, the tighter limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

8.3. Test Procedure

The EUT was setup according to ANSI C63.10: 2013 and tested according to DTS test procedure of KDB 558074.

The EUT and its simulators are placed on a turn table which is 0.8 or 1.5 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10: 2013 on radiated measurement.

On any frequency or frequencies form 9 kHz(inculde The the lowest oscillator frequency generated within the device up to the 10th harmonic) to 1000 MHz, the limit shown are based on measuring equipment employing a quasi-peak detector function and on any frequency or frequencies above 1000 MHz the radiated limit shown are based upon the use of measurement instrumentation employing an average detector function. When average radiated emission measurement are included emission measurement below 1000 MHz, there also is a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.

The bandwidth below 1 GHz setting on the field strength meter is 120 kHz and above 1 GHz is 1 MHz.

8.4. Test Result of Radiated Emission

Refer as Appendix F