Certificate #7130.01

FCC Radio Test Report

FCC ID: G95OWM7111

This report concerns: Original Grant

Project No.	:	2406C089B
Equipment	:	IoT gateway
Brand Name	:	Vantiva
Test Model	:	OWM7111IOT
Series Model	:	OWM7111IOT1
Applicant	:	Vantiva USA LLC
Address	:	4855 Peachtree Industrial Blvd. Suite 200 Norcross, Georgia 30092
Manufacturer	:	Vantiva USA LLC
Address	:	4855 Peachtree Industrial Blvd. Suite 200 Norcross, Georgia 30092
Factory	:	FUHONG PRECISION COMPONENT (BAC GIANG) COMPANY LIMITED
Address	:	Dinh Tram Industrial Zone.Nenh Ward Viet Yen Town.Bac Giang Province. Vietnam
Date of Receipt	:	Jun. 25, 2024
Date of Test	:	Jun. 25, 2024 ~ Aug. 28, 2024
Issued Date	:	Sep. 27, 2024
Report Version	:	R00
Test Sample	:	Engineering Sample No.: DG2024062512 and DG2024081298 for radiated, DG2024062512 for AC conducted power line emission, DG2024062515 for power and conducted
Standard(s)	:	FCC CFR Title 47, Part 15, Subpart C

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc.

Prepared by : Antony Liang

Approved by : Chay Cai

Room 108, Building 2, No.1, Yile Road, Songshan Lake Zone, Dongguan City, Guangdong, People's Republic of China

Tel: +86-769-8318-3000 Web: www.newbtl.com Service mail: btl_qa@newbtl.com

Declaration

BTL represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with standards traceable to international standard(s) and/or national standard(s).

BTL's reports apply only to the specific samples tested under conditions. It is manufacture's responsibility to ensure that additional production units of this model are manufactured with the identical electrical and mechanical components. BTL assumes no responsibility for the data provided by the customer, any statements, inferences or generalizations drawn by the customer or others from the reports issued by BTL.

The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the U.S. Government.

This report is the confidential property of the client. As a mutual protection to the clients, the public and ourselves, the test report shall not be reproduced, except in full, without our written approval.

BTL's laboratory quality assurance procedures are in compliance with the ISO/IEC 17025: 2017 requirements, and accredited by the conformity assessment authorities listed in this test report.

BTL is not responsible for the sampling stage, so the results only apply to the sample as received.

The information, data and test plan are provided by manufacturer which may affect the validity of results, so it is manufacturer's responsibility to ensure that the apparatus meets the essential requirements of applied standards and in all the possible configurations as representative of its intended use.

Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective. Please note that the measurement uncertainty is provided for informational purpose only and are not use in determining the Pass/Fail results.

Table of Contents Page

Table of Contents Page

Table of Contents Page

REPORT ISSUED HISTORY

Report No.	Version	Description	Issued Date	Note
BTL-FCCP-8-2406C089B	R00	Original Report.	Sep. 27, 2024	Valid

1. APPLICABLE STANDARDS

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:
ANSI C63.10-2013
The following reference test guidance is not within the scope of accreditation of A2LA:
KDB 558074 D01 15.247 Meas Guidance v05r02

2. SUMMARY OF TEST RESULTS

Test procedures according to the technical standard(s):

FCC CFR Title 47, Part 15, Subpart C				
Standard(s) Section	**Test Item**	**Test Result**	**Judgment**	**Remark**
15.207	AC Power Line Conducted Emissions	APPENDIX A	PASS	------
15.247(d) 15.205(a) 15.209(a)	Radiated Emission	APPENDIX B APPENDIX C APPENDIX D	PASS	------
15.247 (a)(1)(i)	Number of Hopping Frequency	APPENDIX E	PASS	------
15.247 (f)	Average Time of Occupancy	APPENDIX F	PASS	------
15.247(a)(1)	Hopping Channel Separation	APPENDIX G	PASS	------
15.247(a)(1)	20dB Bandwidth	APPENDIX H	PASS	------
15.247(b)(3)	Maximum Output Power	APPENDIX I	PASS	------
15.247(d)	Conducted Spurious Emission	APPENDIX J	PASS	------
15.203	Antenna Requirement	------	PASS	**Note(2)**

Note:

(1) “N/A” denotes test is not applicable in this test report

(2) The device what use a permanently attached antenna were considered sufficient to comply with the provisions of 15.203.

2.1 TEST FACILITY

The test facilities used to collect the test data in this report is at the location of No.3, Jinshagang 1st Road, Dalang, Dongguan City, Guangdong People's Republic of China.
BTL's Registration Number for FCC: 747969
BTL's Designation Number for FCC: CN1377

2.2 MEASUREMENT UNCERTAINTY

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95.45% confidence level (based on a coverage factor (k=2))
The BTL measurement uncertainty as below table:

A. AC power line conducted emissions Measurement:

Test Site	Method	Measurement Frequency Range	*U*,(dB)
DG-C02	CISPR	150kHz ~ 30MHz	2.88

B. Radiated emissions Measurement:

Test Site	Method	Measurement Frequency Range	*U*,(dB)
DG-CB01	CISPR	9kHz ~ 30MHz	2.36

Test Site	Method	Measurement Frequency Range	Ant. H / V	*U*,(dB)
DG-CB03 (3m)	CISPR	30MHz ~ 200MHz	V	4.40
		30MHz ~ 200MHz	H	3.62
		200MHz ~ 1,000MHz	V	4.58
		200MHz ~ 1,000MHz	H	3.98

Test Site	Method	Measurement Frequency Range	*U*,(dB)
DG-CB03 (3m)	CISPR	1GHz ~ 6GHz	4.08
		6GHz ~ 18GHz	4.62

C. Other Measurement:

Test Item	Uncertainty
Conducted Spurious Emission	1.9 dB
Maximum Output Power	1.3 dB
Bandwidth	0.90 %
Temperature	0.8 °C
Humidity	2.2 %

Note: Unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.

2.3 TEST ENVIRONMENT CONDITIONS

Test Item	Temperature	Humidity	Test Voltage	Tested By	Test Date
AC Power Line Conducted Emissions	25°C	60%	AC 120V/60Hz	Hayden Chen	Jul. 17, 2024
Radiated Emissions-9 kHz to 30 MHz	23°C	46%	AC 120V/60Hz	Hayden Chen	Aug. 05, 2024
Radiated Emissions-30 MHz to 1000 MHz	23°C	54%	AC 120V/60Hz	Jensen Zhou	Aug. 17, 2024
Radiated Emissions-Above 1000 MHz	24°C	53%	AC 120V/60Hz	Allen Tong	Aug. 23, 2024
Number of Hopping Frequency	23°C	58%	PoE 54V	Parker Yang	Aug. 23, 2024
Average Time of Occupancy	23°C	58%	PoE 54V	Parker Yang	Aug. 23, 2024
Hopping Channel Separation	23°C	58%	PoE 54V	Parker Yang	Aug. 23, 2024
Bandwidth	23°C	58%	PoE 54V	Parker Yang	Aug. 23, 2024
Maximum Output Power	23°C	58%	PoE 54V	Parker Yang	Aug. 23, 2024
Conducted Spurious Emission	23°C	58%	PoE 54V	Parker Yang	Aug. 23, 2024

3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

Equipment	IoT gateway
Brand Name	Vantiva
Test Model	OWM7111IOT
Series Model	OWM7111IOT1
Model Difference(s)	Indoor access point device model: OWM7111IOT Outdoor access point device model : OWM7111IOT1
Software Version	5043_OWM7111IOT_FSW_V07
Hardware Version	FGR
Power Source	DC Voltage supplied from PoE Power Supply. Model: ADP-46PH-54-2- 54046EPCU
Power Rating	INPUT: 100-240V~ 50/60Hz OUTPUT: 54.0V⎓0.85A
Operation Frequency	902.3 MHz ~ 914.9 MHz
Channel Number	64
Modulation Type	LoRa
Bit Rate of Transmitter	125Kbps
Max. Output Power	125Kbps: 21.46 dBm (0.1400 W)

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

2. Channel List:

Channel	Frequency (MHz)
00	902.3
32	908.7
63	914.9

3. Table for Filed Antenna:

Ant.	Brand	IPN	Antenna Type	Connector	Gain (dBi)
1	Vantiva	6338358D	PCB	N/A	2.40

3.2 DESCRIPTION OF TEST MODES

The test system was pre-tested based on the consideration of all possible combinations of EUT operation mode.

Pretest Mode	Description
Mode 1	TX Mode_125Kbps Channel 00/32/63
Mode 2	TX Mode_125Kbps Channel 00

Following mode(s) was (were) found to be the worst case(s) and selected for the final test.

AC power line conducted emissions test	
Final Test Mode	Description
Mode 2	TX Mode_125Kbps Channel 00

Radiated emissions test - Below 1GHz	
Final Test Mode	Description
Mode 2	TX Mode_125Kbps Channel 00

Radiated emissions test - Above 1GHz	
Final Test Mode	Description
Mode 1	TX Mode_125Kbps Channel 00/32/63

Maximum Output Power	
Final Test Mode	Description
Mode 1	TX Mode_125Kbps Channel 00/32/63

Other Conducted test	
Final Test Mode	Description
Mode 1	TX Mode_125Kbps Channel 00/32/63

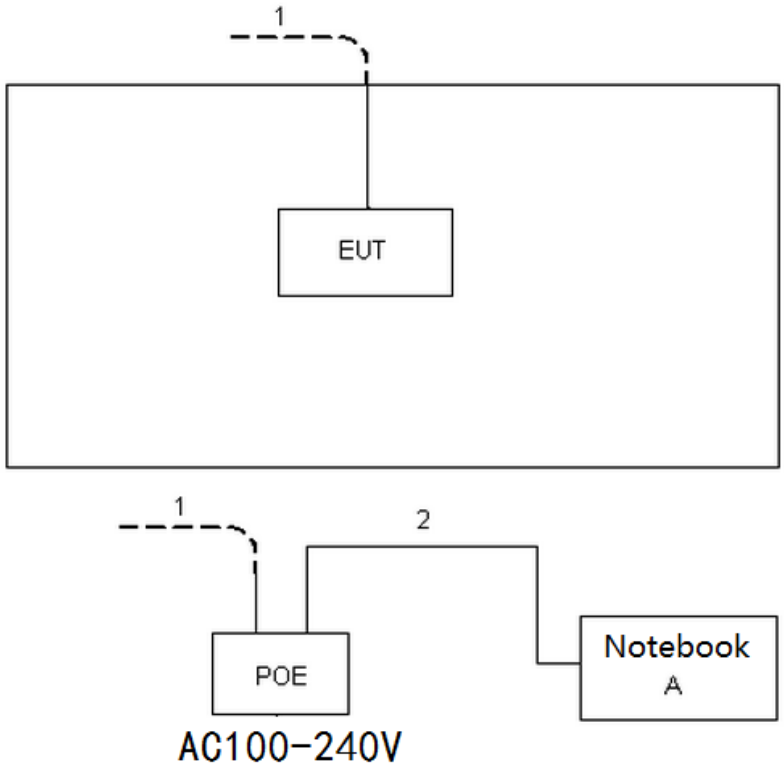
Note:
(1) For radiated emission above 1 GHz test, the spurious points of 1GHz~26.5GHz have been pre-tested and in this report only recorded the worst case. The remaining spurious points are all below the limit value of 20dB.
(2) For AC power line conducted emissions and radiated emissions below 1 GHz test, the TX Mode_125Kbps Channel 00 is found to be the worst case and recorded.
(3) For radiated emission above 1 GHz test: The polarization of Vertical and Horizontal are evaluated, the worst case is recorded.

3.3 PARAMETERS OF TEST SOFTWARE

During testing, channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level.

Test Software Version	IPOP V4.1		
Frequency (MHz)	902.3	908.7	914.9
125Kbps	N	M	M

3.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



3.5 SUPPORT UNITS

Item	Equipment	Brand	Model No.	Series No.
A	Notebook	Dell	Inspiron 15-7559	N/A

Item	Cable Type	Shielded Type	Ferrite Core	Length
1	RJ45 Cable	NO	NO	10m
2	RJ45 Cable	NO	NO	1m

3.6 CUSTOMER INFORMATION DESCRIPTION

1) The antenna gain is provided by the manufacturer.
2) Except for AC power line conducted emissions and radiated emissions, the results of all test items include cable losses. All cable losses are provided by the testing laboratory.

4. AC POWER LINE CONDUCTED EMISSIONS

4.1 LIMIT

Frequency of Emission (MHz)	Limit (dBμV)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56*	56 to 46*
0.5 - 5.0	56	46
5.0 - 30.0	60	50

Note:

(1) The tighter limit applies at the band edges.
(2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.
(3) The test result calculated as following:
Measurement Value = Reading Level + Correct Factor
Correct Factor = Insertion Loss + Cable Loss + Attenuator Factor (if use)
Margin Level = Measurement Value – Limit Value

4.2 TEST PROCEDURE

a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipment powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
d. LISN at least 80 cm from nearest part of EUT chassis.
e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

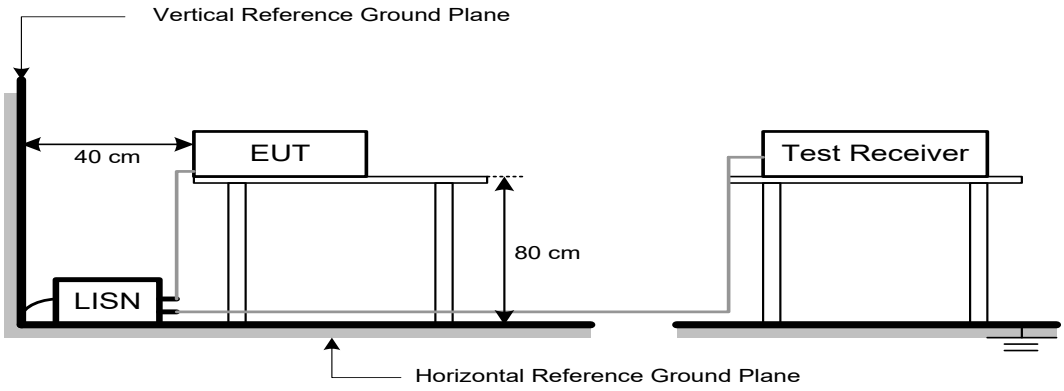
The following table is the setting of the receiver:

Receiver Parameters	Setting
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

4.3 DEVIATION FROM TEST STANDARD

No deviation.

4.4 TEST SETUP



4.5 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical function (as a customer would normally use it), EUT was programmed to be in continuously transmitting data or hopping on mode.

4.6 TEST RESULTS

Please refer to the APPENDIX A.

Remark:

(1) All readings are QP Mode value unless otherwise stated AVG in column of『Note』. If the QP Mode Measured value compliance with the QP Limits and lower than AVG Limits, the EUT shall be deemed to meet both QP & AVG Limits and then only QP Mode was measured, but AVG Mode didn't perform in this case, a "*" marked in AVG Mode column of Interference Voltage Measured.

(2) Measuring frequency range from 150 kHz to 30 MHz.

5. RADIATED EMISSIONS

5.1 LIMIT

In case the emission fall within the restricted band specified on 15.205(a) & RSS-Gen 8.10, then the 15.209(a) & RSS-Gen 8.9 limit in the table below has to be followed.

LIMITS OF RADIATED EMISSION MEASUREMENT (9 kHz-1000 MHz)

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000 MHz)

Frequency (MHz)	(dBuV/m at 3 m)	
	Peak	Average
Above 1000	74	54

Note:
(1) The limit for radiated test was performed according to FCC CFR Title 47, Part 15, Subpart C.
(2) The tighter limit applies at the band edges.
(3) Emission level (dBuV/m)=20log Emission level (uV/m).
(4) The test result calculated as following:
Measurement Value = Reading Level + Correct Factor
Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain(if use)
Margin Level = Measurement Value - Limit Value

5.2 TEST PROCEDURE

a. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1 GHz)
b. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 1.5 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(above 1 GHz)
c. The height of the equipment or of the substitution antenna shall be 0.8m or 1.5m; the height of the test antenna shall vary between 1 m to 4 m. 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 find the maximum reading (used Bore sight function).
e. The receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.
f. The initial step in collecting radiated emission data is a receiver peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
g. All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn‘t perform. (below 1 GHz)
h. All readings are Peak Mode value unless otherwise stated AVG in column of Note. If the Peak Mode Measured value compliance with the Peak Limits and lower than AVG Limits, the EUT shall be deemed to meet both Peak & AVG Limits and then only Peak Mode was measured, but AVG Mode didn‘t perform. (above 1 GHz)
i. For the actual test configuration, please refer to the related Item –EUT Test Photos.

The following table is the setting of the receiver:

Spectrum Parameters	Setting
Start ~ Stop Frequency	9 kHz~150 kHz for RBW 200 Hz
Start ~ Stop Frequency	0.15 MHz~30 MHz for RBW 9 kHz
Start ~ Stop Frequency	30 MHz~1000 MHz for RBW 100 kHz

Spectrum Parameters	Setting
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RBW / VBW (Emission in restricted band)	1 MHz / 3 MHz for PK value 1 MHz / 1/T Hz for AVG value

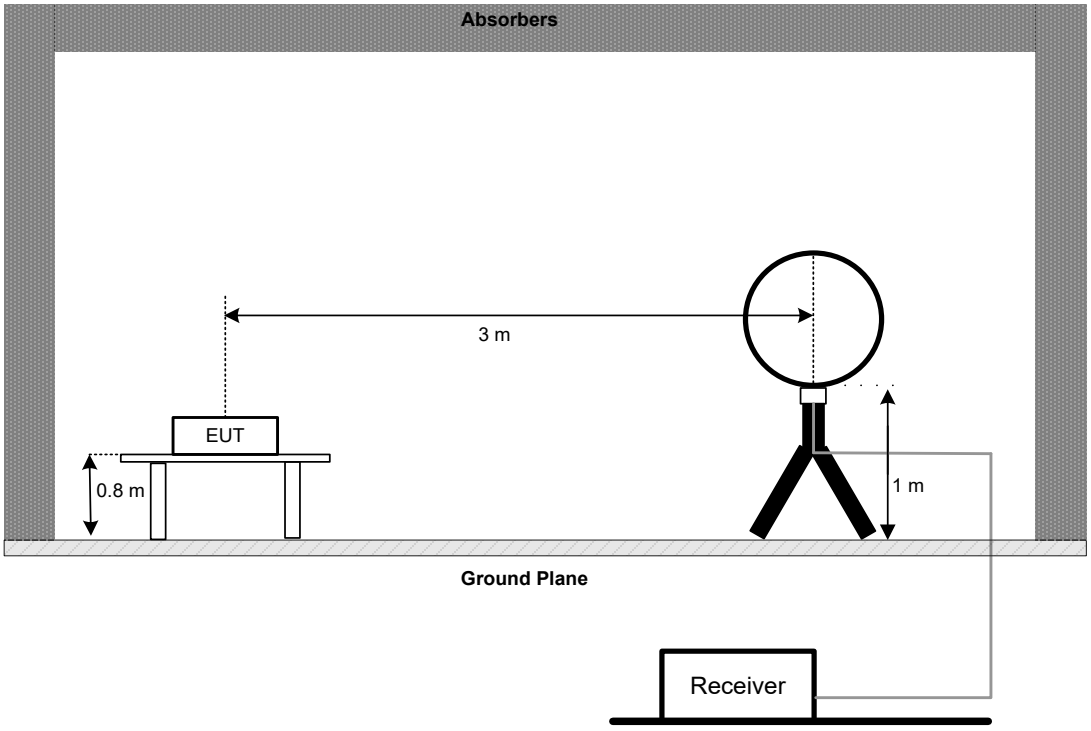
Spectrum Parameters	Setting
Start ~ Stop Frequency	9 kHz~90 kHz for PK/AVG detector
Start ~ Stop Frequency	90 kHz~110 kHz for QP detector
Start ~ Stop Frequency	110 kHz~490 kHz for PK/AVG detector
Start ~ Stop Frequency	490 kHz~30 MHz for QP detector
Start ~ Stop Frequency	30 MHz~1000 MHz for QP detector
Start ~ Stop Frequency	1 GHz~26.5 GHz for PK/AVG detector

5.3 DEVIATION FROM TEST STANDARD

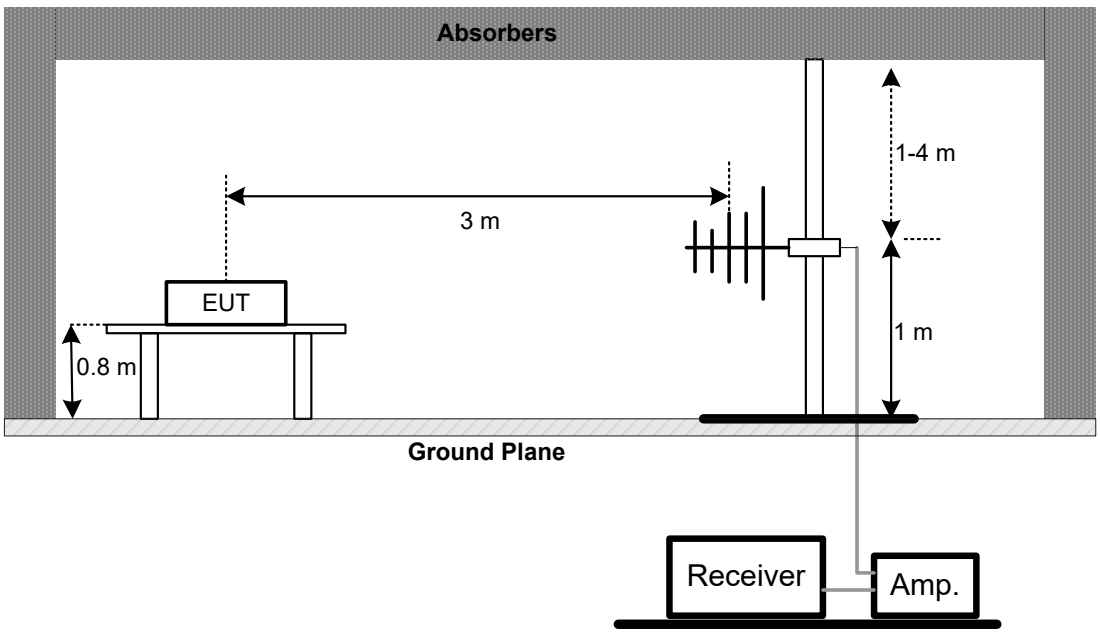
No deviation.

5.4 TEST SETUP

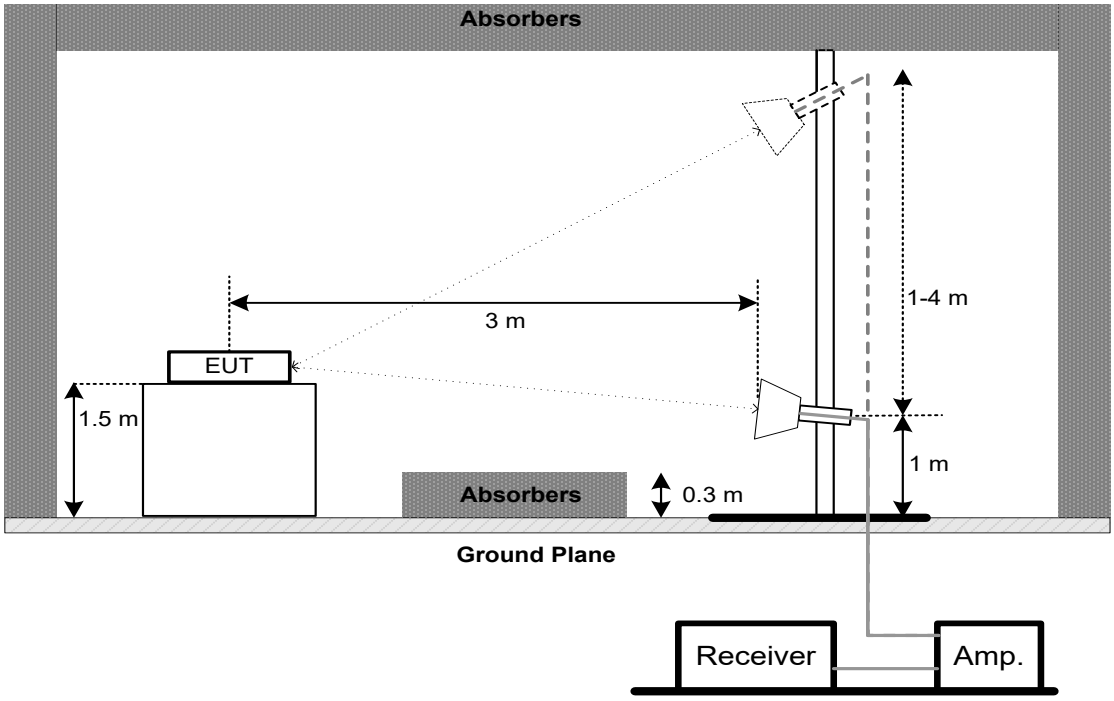
9 kHz to 30 MHz



30 MHz to 1 GHz



Above 1 GHz



5.5 EUT OPERATING CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

5.6 TEST RESULTS - 9 kHz TO 30 MHz

Please refer to the APPENDIX B.

Remark:

(1) Distance extrapolation factor = 40 log (specific distance / test distance) (dB).
(2) Limit line = specific limits (dBuV) + distance extrapolation factor.

5.7 TEST RESULTS - 30 MHz TO 1000 MHz

Please refer to the APPENDIX C.

5.8 TEST RESULTS - ABOVE 1000 MHz

Please refer to the APPENDIX D.

Remark:

(1) No limit: This is fundamental signal, the judgment is not applicable.
For fundamental signal judgment was referred to Peak output test.

6. NUMBER OF HOPPING FREQUENCY

6.1 LIMIT

(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

6.2 TEST PROCEDURE

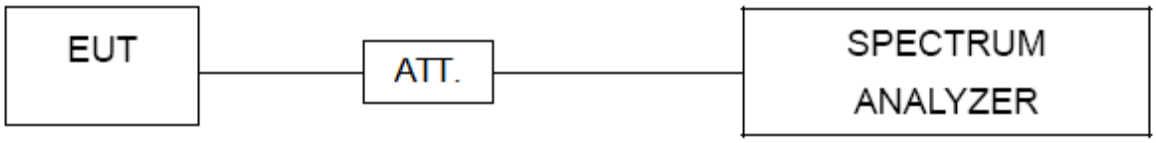
a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
b. The following table is the setting of the spectrum analyzer:

Spectrum Parameters	Setting
Span Frequency	> Operating Frequency Range
RBW	100 kHz
VBW	300 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

6.3 DEVIATION FROM STANDARD

No deviation.

6.4 TEST SETUP



6.5 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

6.6 TEST RESULTS

Please refer to the APPENDIX E.

7. AVERAGE TIME OF OCCUPANCY

7.1 LIMIT

(f) For the purposes of this section, hybrid systems are those that employ a combination of both frequency hopping and digital modulation techniques. The frequency hopping operation of the hybrid system, with the direct sequence or digital modulation operation turned-off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4. The power spectral density conducted from the intentional radiator to the antenna due to the digital modulation operation of the hybrid system, with the frequency hopping operation turned off, shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

7.2 TEST PROCEDURE

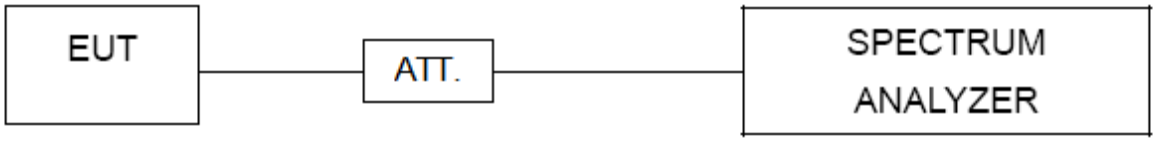
The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

a Span: Zero span, centered on a hopping channel.
b RBW shall be ≤ channel spacing and where possible RBW should be set ≥ 1 / T, where T is the expected dwell time per channel.
c Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
d Detector function: Peak.
e Trace: Max hold.

7.3 DEVIATION FROM STANDARD

No deviation.

7.4 TEST SETUP



7.5 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

7.6 TEST RESULTS

Please refer to the APPENDIX F.

8. HOPPING CHANNEL SEPARATION

8.1 LIMIT

(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

8.2 TEST PROCEDURE

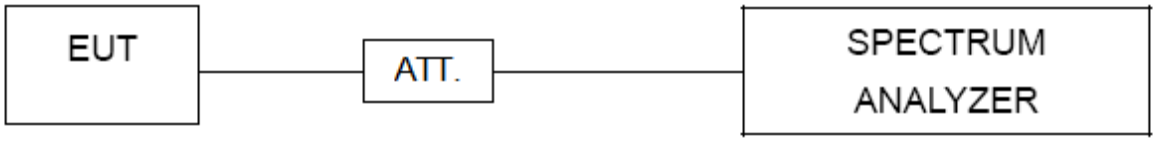
a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
b. The following table is the setting of the spectrum analyzer:

Spectrum Parameters	Setting
Span Frequency	Wide enough to capture the peaks of two adjacent channels
RBW	30 kHz
VBW	100 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

8.3 DEVIATION FROM STANDARD

No deviation.

8.4 TEST SETUP



8.5 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

8.6 TEST RESULTS

Please refer to the APPENDIX G.

9. 20DB EMISSION BANDWIDTH

9.1 LIMIT

(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

9.2 TEST PROCEDURE

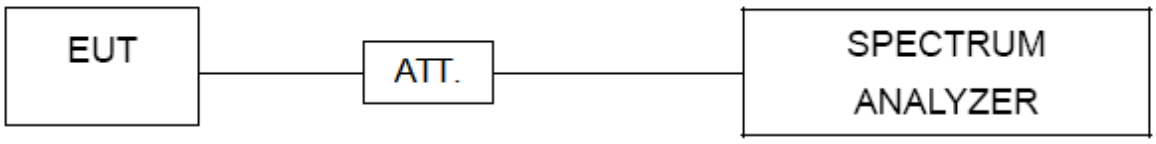
a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
b. The following table is the setting of the spectrum analyzer:

Spectrum Parameters	Setting
Span Frequency	> Measurement Bandwidth
RBW	3 kHz
VBW	10 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

9.3 DEVIATION FROM STANDARD

No deviation.

9.4 TEST SETUP



9.5 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

9.6 TEST RESULTS

Please refer to the APPENDIX H.

10. MAXIMUM OUTPUT POWER

10.1 LIMIT

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, Compliant with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

10.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.

b. The following table is the setting of the spectrum analyzer:

Spectrum Parameters	Setting
Span Frequency	Approximately five times the 20 dB bandwidth, centered on a hopping channel.
RBW	10 KHz
VBW	100 KHz
Detector	RMS
Trace	AVG
Sweep Time	Auto

10.3 DEVIATION FROM STANDARD

No deviation.

10.4 TEST SETUP

10.5 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

10.6 TEST RESULTS

Please refer to the APPENDIX I.

11. CONDUCTED SPURIOUS EMISSION

11.1 LIMIT

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 Output Power limits. If the transmitter complies with the Output Power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required.

11.2 TEST PROCEDURE

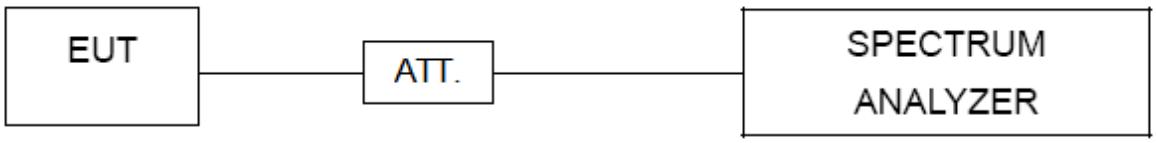
a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
b. The following table is the setting of the spectrum analyzer:

Spectrum Parameters	Setting
Start Frequency	30 MHz
Stop Frequency	10 GHz
RBW	100 kHz
VBW	300 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

11.3 DEVIATION FROM STANDARD

No deviation.

11.4 TEST SETUP



11.5 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

11.6 TEST RESULTS

Please refer to the APPENDIX J.

12. MEASUREMENT INSTRUMENTS LIST

AC Power Line Conducted Emissions					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	EMI TEST RECEIVER	R&S	ESCI	100382	Dec. 22, 2024
2	TWO-LINE V-NETWORK	R&S	ENV216	101447	Dec. 22, 2024
3	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A
4	Cable	N/A	SFT205-NMNM-9M -001	9M	Nov. 27, 2024
5	643 Shield Room	ETS	6*4*3	N/A	N/A

Radiated Emissions - 9 kHz to 30 MHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Active Loop Antenna	Schwarzbeck	FMZB 1513-60B	1513-60 B-034	Mar. 30, 2025
2	MXE EMI Receiver	Keysight	N9038A	MY56400091	Dec. 22, 2024
3	Cable	N/A	RW2350-3.8A-NMB M-1.5M	N/A	Jun. 09, 2025
4	Cable	N/A	RG 213/U	N/A	Jun. 09, 2025
5	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A
6	966 Chamber room	ETS	9*6*6	N/A	May 16, 2025

Radiated Emissions - 30 MHz to 1 GHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Trilog-Broadband Antenna	Schwarzbeck	VULB 9168	1462	Dec. 13, 2024
2	Attenuator	EMC INSTRUMENT	EMCI-N-6-06	AT-06009	Dec. 13, 2024
3	Preamplifier	EMC NSTRUMENT	EMC001330	980998	Nov. 17, 2024
4	Cable	RegalWay	LMR400-NMNM-12 .5m	N/A	Jun. 06, 2025
5	Cable	RegalWay	LMR400-NMNM-3 m	N/A	Jun. 06, 2025
6	Cable	RegalWay	LMR400-NMNM-0. 5m	N/A	Jun. 06, 2025
7	Receiver	Agilent	N9038A	MY52130039	Dec. 22, 2024
8	Attenuator	Talent Microwave	TA10A2-S-18	N/A	N/A
9	Positioning Controller	MF	MF-7802	N/A	N/A
10	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A
11	966 Chamber room	CM	9*6*6	N/A	May 16, 2025

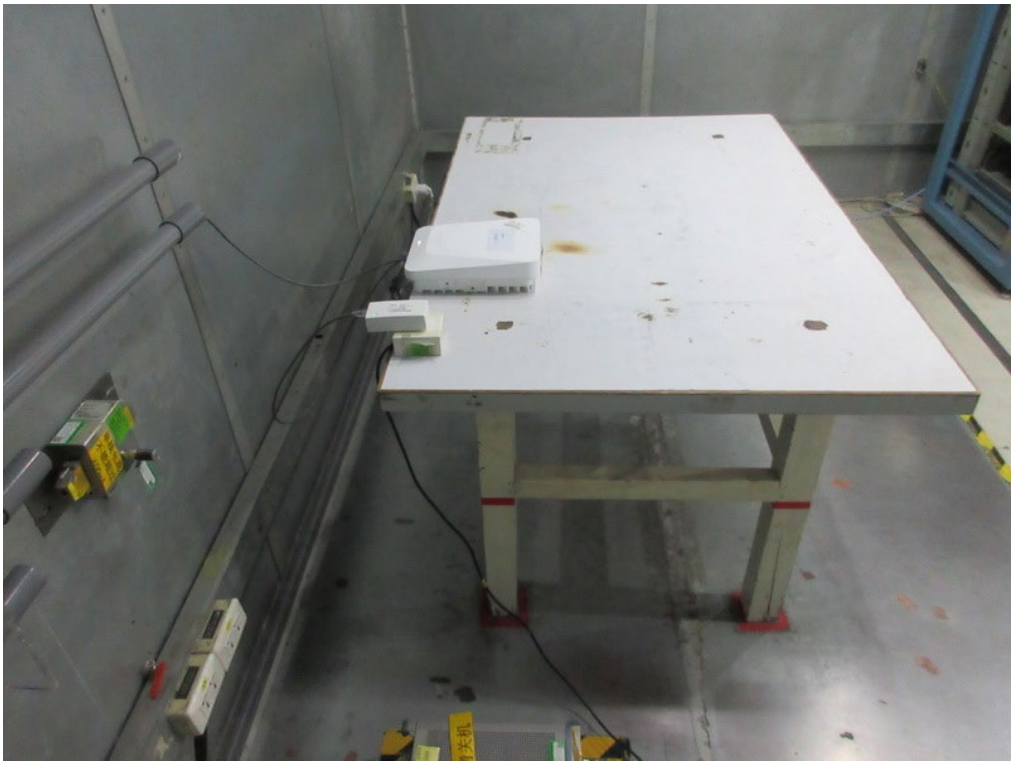
Radiated Emissions - Above 1 GHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Receiver	Agilent	N9038A	MY52130039	Dec. 22, 2024
2	Preamplifier	EMC INSTRUMENT	EMC118A45SE	980888	Nov. 17, 2024
3	Double Ridged Guide Antenna	ETS	3115	75789	Jun. 15, 2025
4	Cable	RegalWay	RWLP50-4.0A-SMSM-12.5M	N/A	Jul. 03, 2025
5	Cable	RegalWay	RWLP50-4.0A-NMRASM-2.5M	N/A	Jul. 03, 2025
6	Cable	RegalWay	RWLP50-4.0A-NMRASMRA-0.8M	N/A	Jul. 03, 2025
7	966 Chamber room	CM	9*6*6	N/A	May 19, 2025
8	Filter	Wairrwright Instruments Gmbh	WHK 1.5/15G-10ST	N/A	Dec. 22, 2024
9	Positioning Controller	MF	MF-7802	N/A	N/A
10	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A

Number of Hopping Frequency & Average Time of Occupancy & Hopping Channel Separation & Bandwidth & Maximum Output Power & e.i.r.p. & Conducted Spurious Emission					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP38	100852	May 31, 2025
2	Measurement Software	BTL	BTL Conducted Test	N/A	N/A
3	Isolation attenuator	Z-Link	ASMA-16-18-2W	N/A	N/A

Remark “N/A” denotes no model name, serial no. or calibration specified.
All calibration period of equipment list is one year.

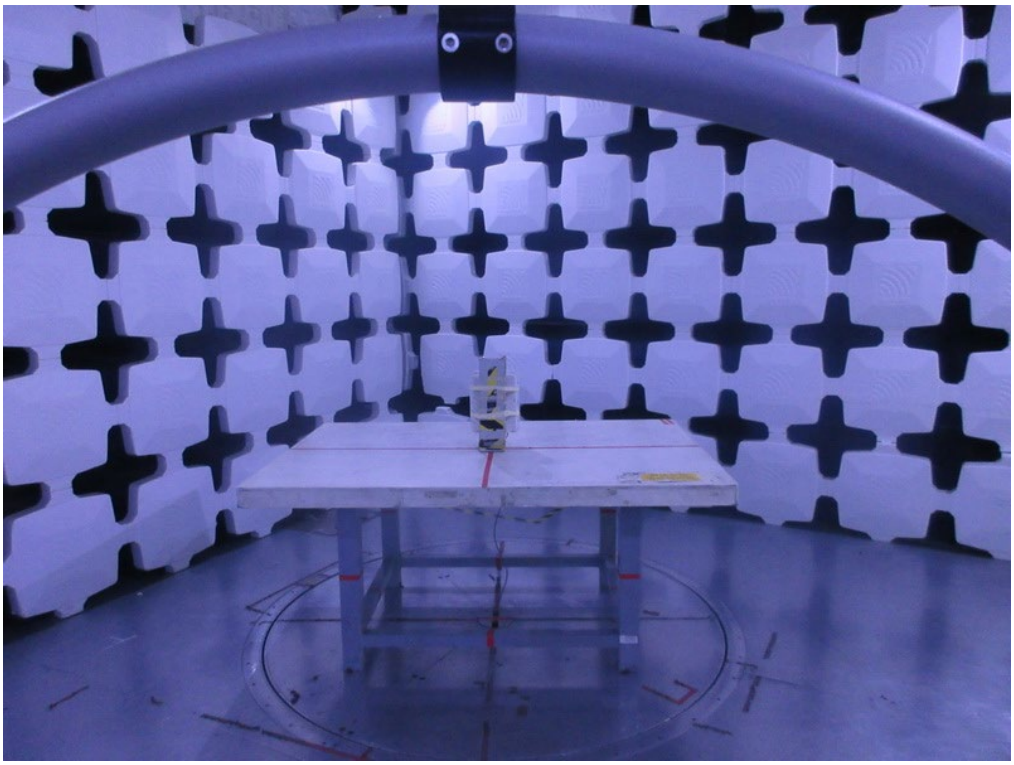
13. EUT TEST PHOTO

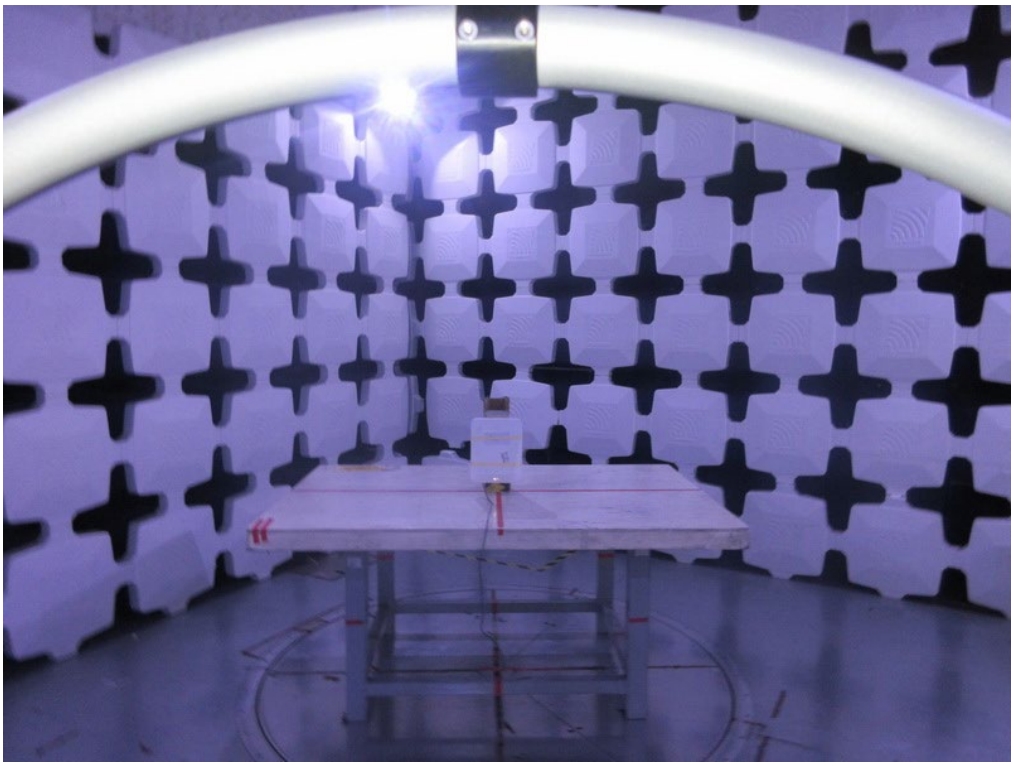
AC Power Line Conducted Emissions Test Photos



Radiated Emissions Test Photos

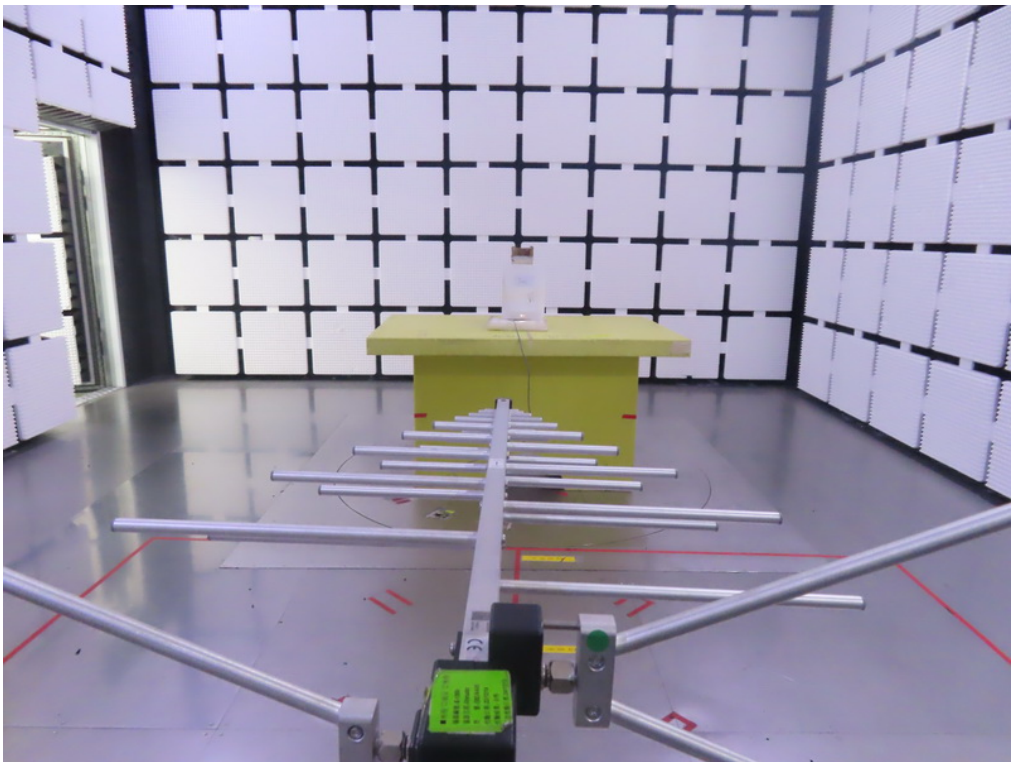
9 kHz to 30 MHz

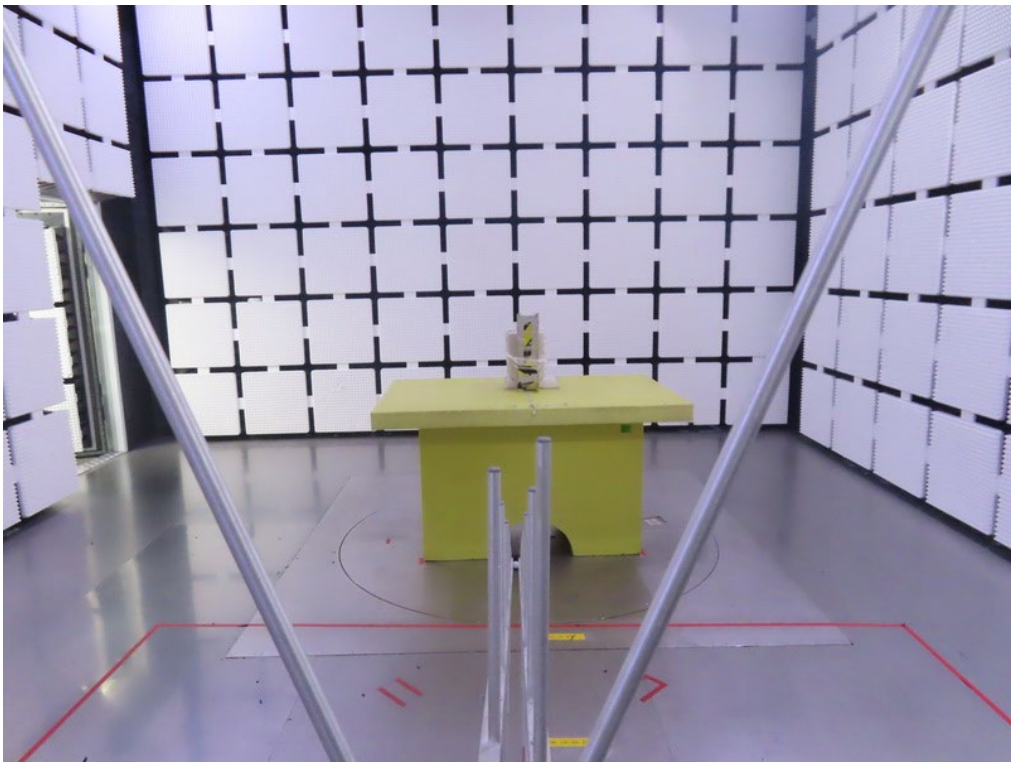




Radiated Emissions Test Photos

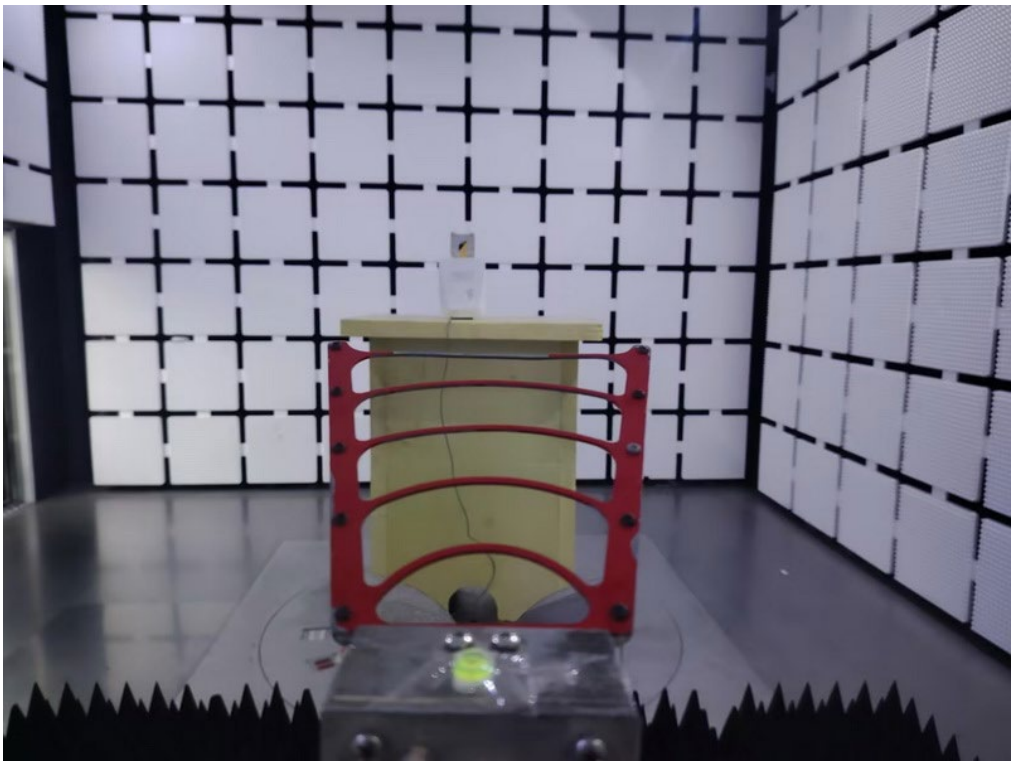
30 MHz to 1000 MHz

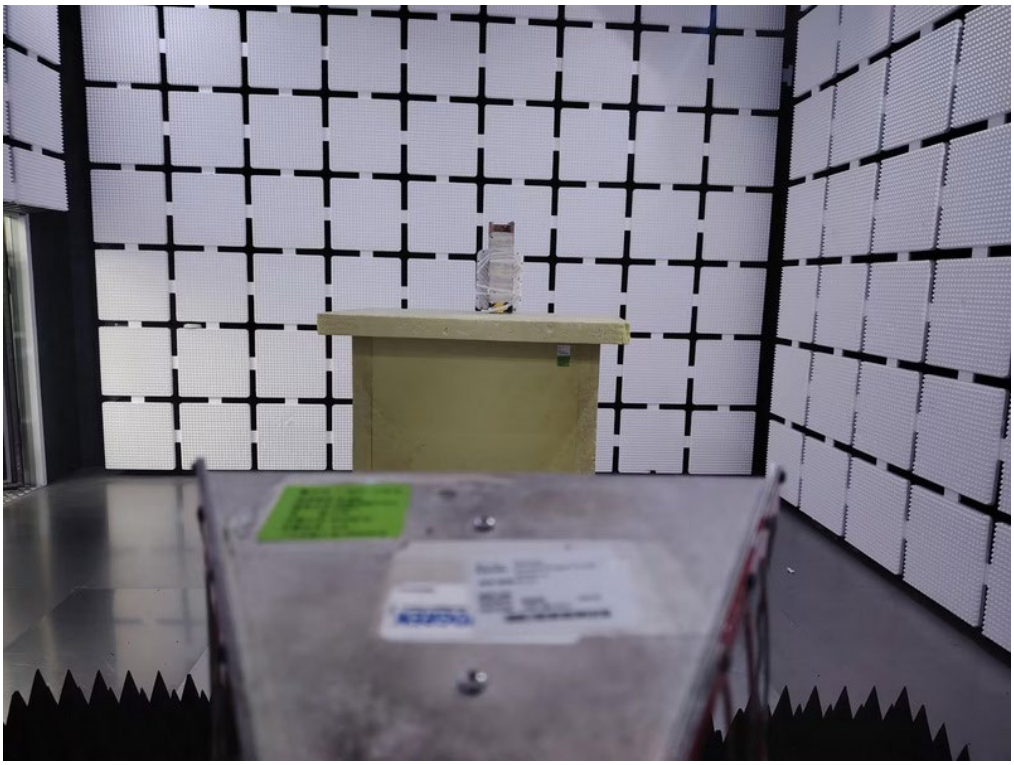




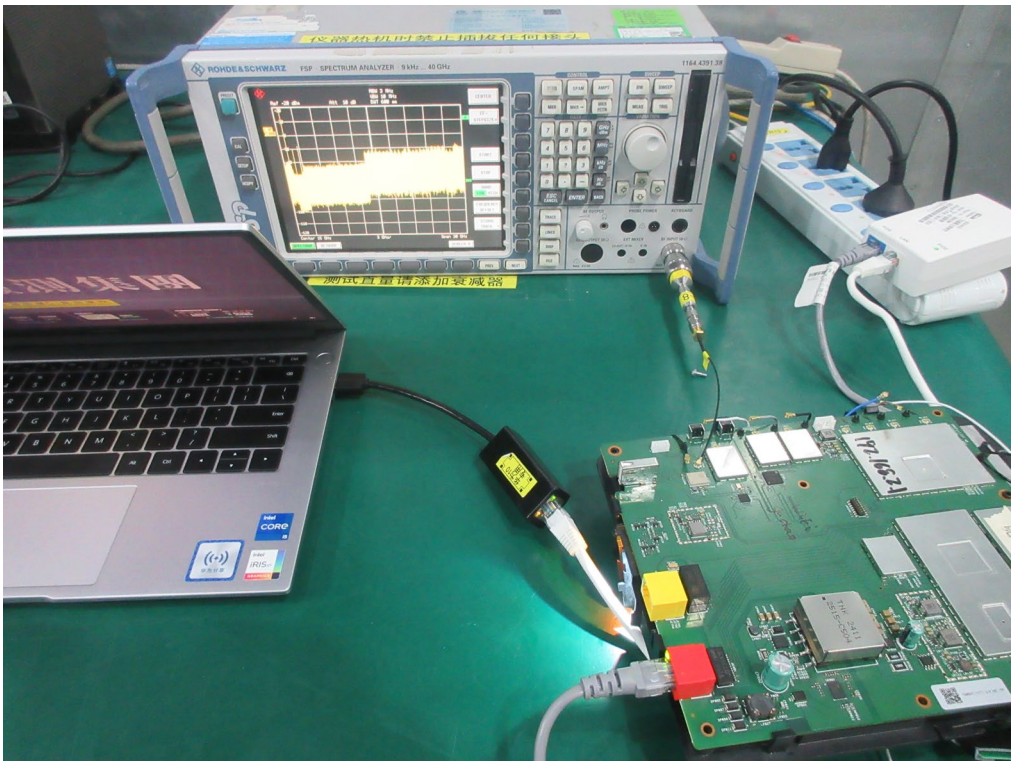
Radiated Emissions Test Photos

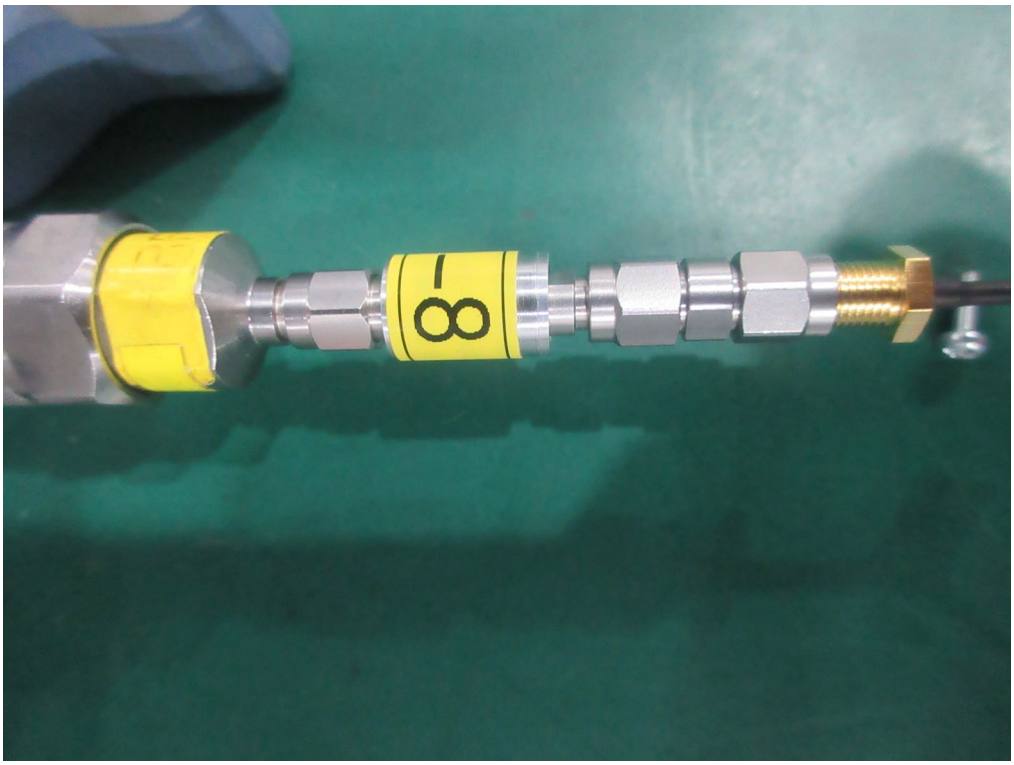
Above 1 GHz





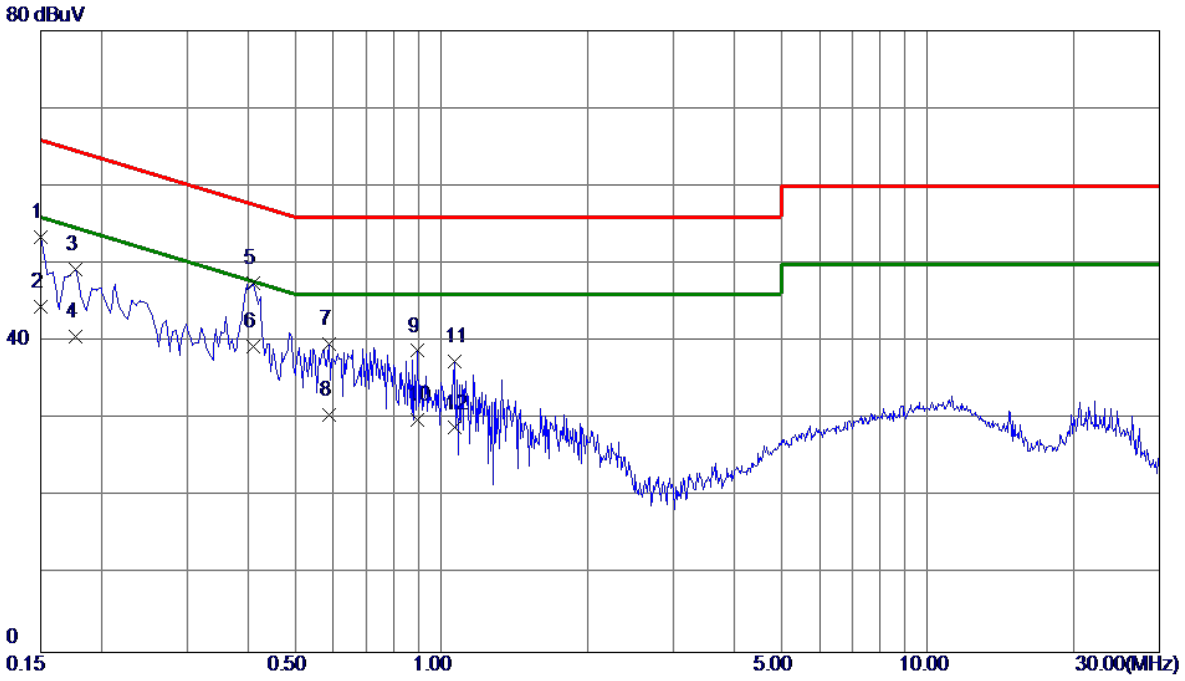
Conducted Test Photos





APPENDIX A - AC POWER LINE CONDUCTED EMISSIONS

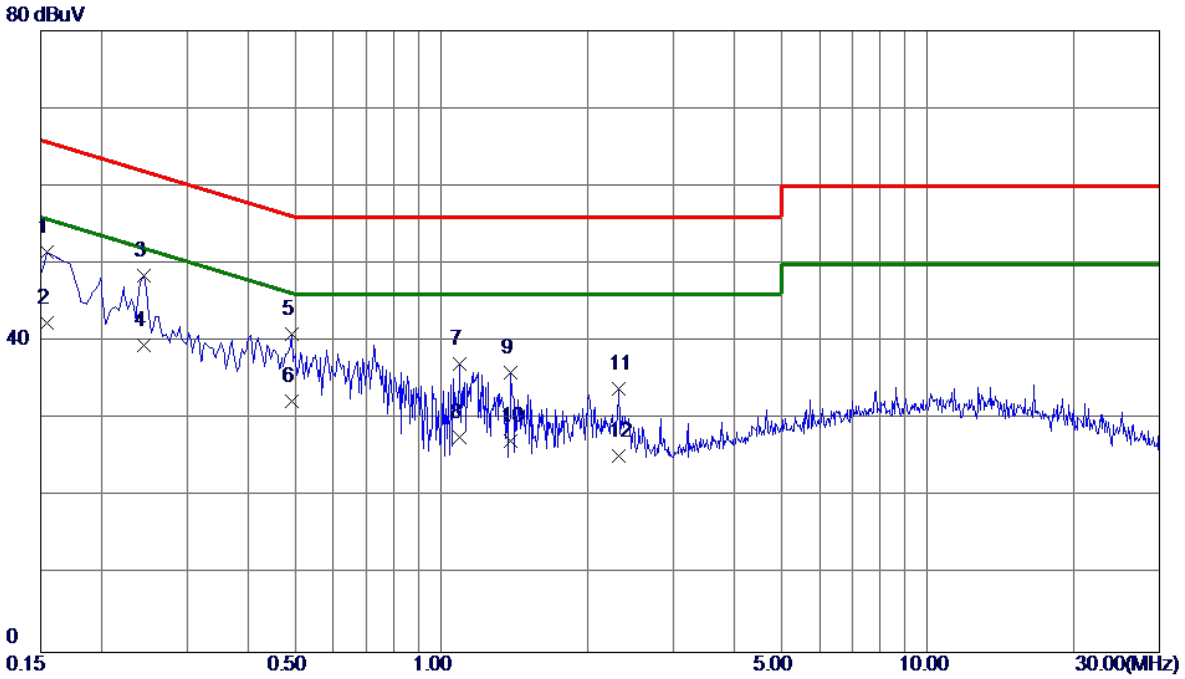
Test Mode	TX Mode_125Kbps Channel 00	Phase	Line



No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	0.1500	43.55	9.96	53.51	66.00	-12.49	QP	
2	0.1500	34.50	9.96	44.46	56.00	-11.54	AVG	
3	0.1770	39.30	9.97	49.27	64.63	-15.36	QP	
4	0.1770	30.60	9.97	40.57	54.63	-14.06	AVG	
5	0.4110	37.04	10.43	47.47	57.63	-10.16	QP	
6 *	0.4110	28.89	10.43	39.32	47.63	-8.31	AVG	
7	0.5865	28.95	10.80	39.75	56.00	-16.25	QP	
8	0.5865	19.80	10.80	30.60	46.00	-15.40	AVG	
9	0.8925	27.61	11.19	38.80	56.00	-17.20	QP	
10	0.8925	18.70	11.19	29.89	46.00	-16.11	AVG	
11	1.0635	26.21	11.28	37.49	56.00	-18.51	QP	
12	1.0635	17.60	11.28	28.88	46.00	-17.12	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

Test Mode	TX Mode_125Kbps Channel 00	Phase	Neutral

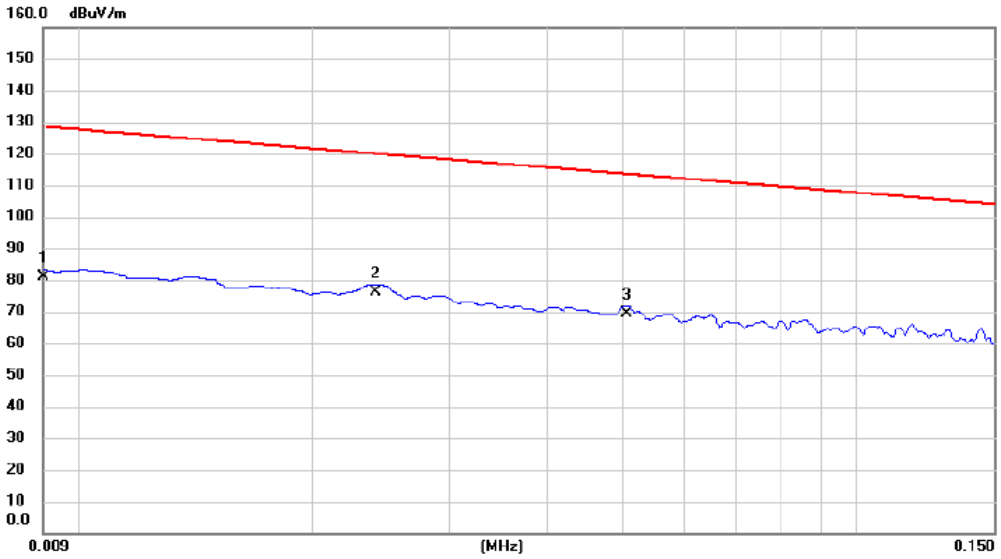


No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	0.1545	41.64	9.93	51.57	65.75	-14.18	QP	
2	0.1545	32.51	9.93	42.44	55.75	-13.31	AVG	
3	0.2445	38.41	10.02	48.43	61.94	-13.51	QP	
4 *	0.2445	29.49	10.02	39.51	51.94	-12.43	AVG	
5	0.4920	30.34	10.57	40.91	56.13	-15.22	QP	
6	0.4920	21.80	10.57	32.37	46.13	-13.76	AVG	
7	1.0905	25.84	11.24	37.08	56.00	-18.92	QP	
8	1.0905	16.40	11.24	27.64	46.00	-18.36	AVG	
9	1.3920	24.81	11.24	36.05	56.00	-19.95	QP	
10	1.3920	15.90	11.24	27.14	46.00	-18.86	AVG	
11	2.3190	23.25	10.68	33.93	56.00	-22.07	QP	
12	2.3190	14.61	10.68	25.29	46.00	-20.71	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

APPENDIX B - RADIATED EMISSION - 9 KHZ TO 30 MHZ

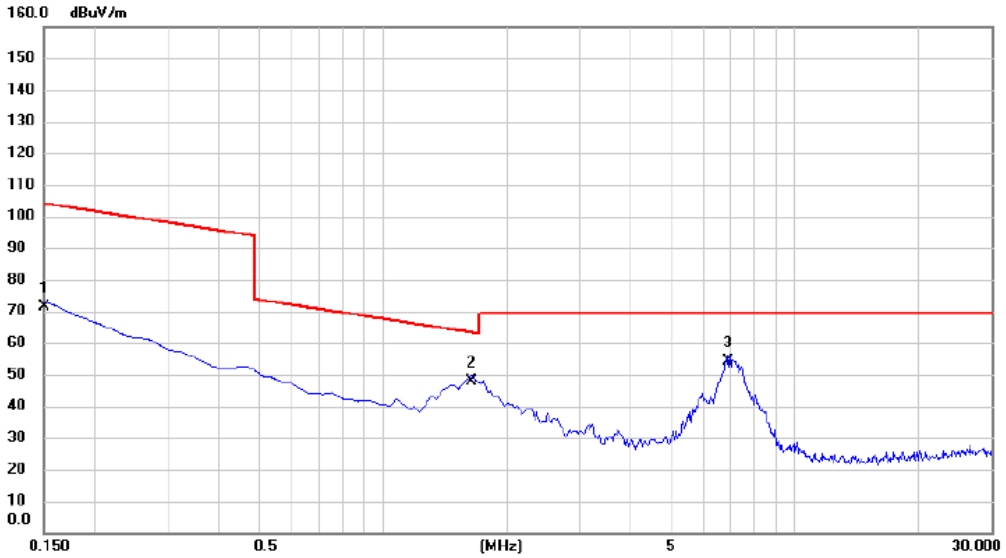
Test Mode	TX Mode_125Kbps Channel 00	Polarization	Ant 0°



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		0.0090	60.78	20.40	81.18	128.52	-47.34	AVG	
2	*	0.0241	55.12	20.92	76.04	119.96	-43.92	AVG	
3		0.0507	48.26	21.20	69.46	113.50	-44.04	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

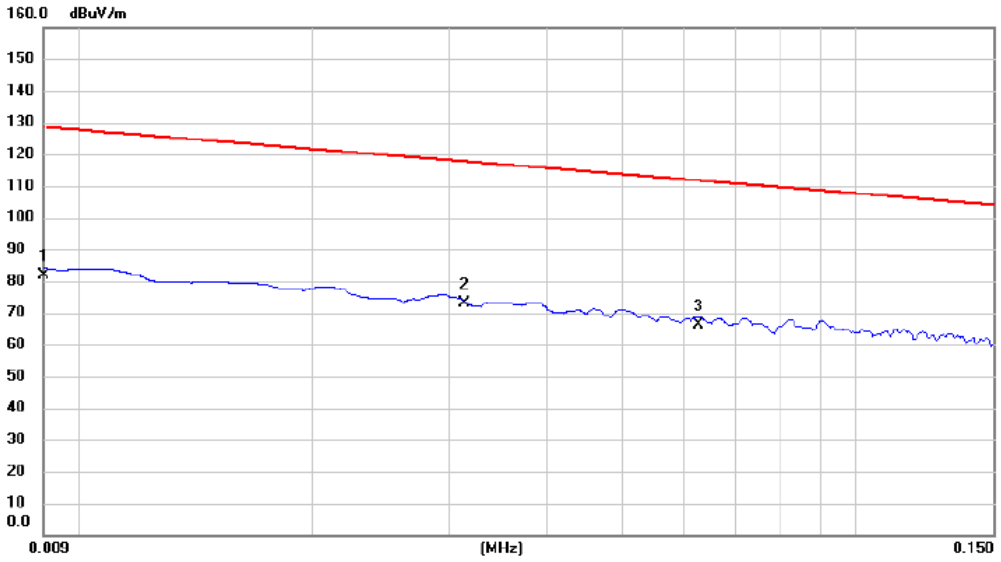
Test Mode	TX Mode_125Kbps Channel 00	Polarization	Ant 0°



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		0.1500	50.32	21.27	71.59	104.09	-32.50	AVG	
2		1.6425	26.78	21.14	47.92	63.29	-15.37	QP	
3	*	6.8662	33.12	21.19	54.31	69.54	-15.23	QP	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

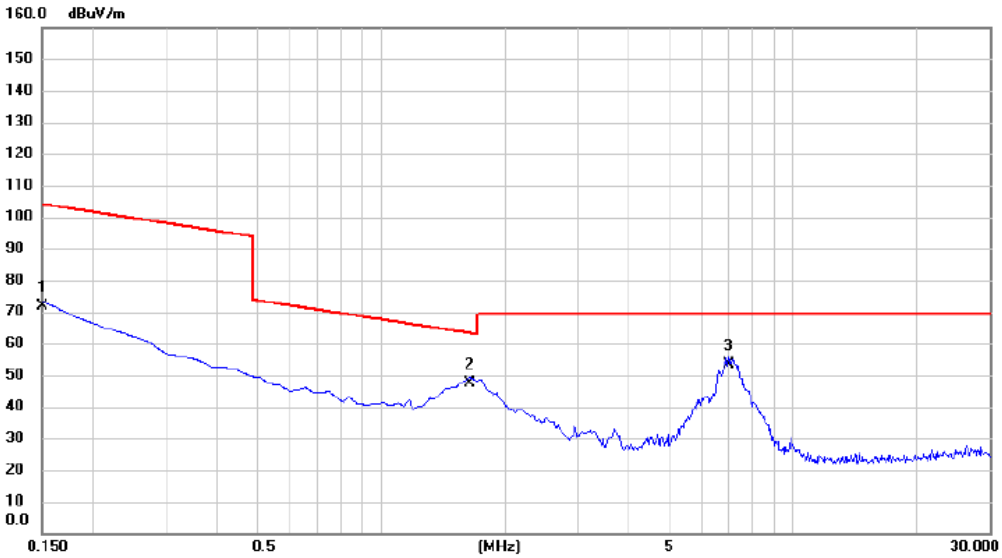
Test Mode	TX Mode_125Kbps Channel 00	Polarization	Ant 90°



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		0.0090	61.32	20.40	81.72	128.52	-46.80	AVG	
2	*	0.0313	51.79	21.11	72.90	117.69	-44.79	AVG	
3		0.0627	45.15	21.24	66.39	111.66	-45.27	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

Test Mode	TX Mode_125Kbps Channel 00	Polarization	Ant 90°

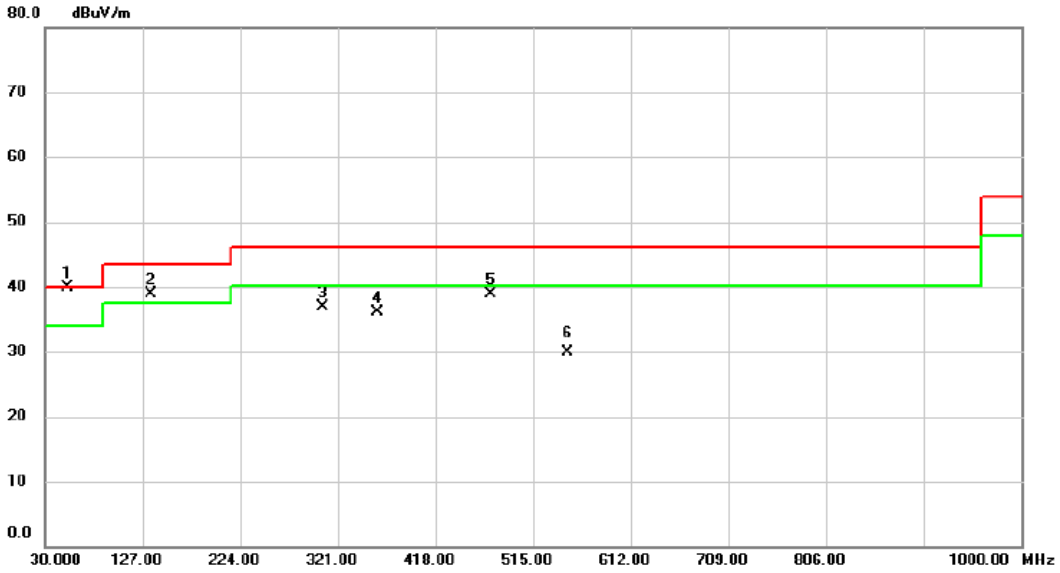


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		0.1500	50.36	21.27	71.63	104.09	-32.46	AVG	
2	*	1.6425	26.45	21.14	47.59	63.29	-15.70	QP	
3		6.9856	32.14	21.19	53.33	69.54	-16.21	QP	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

APPENDIX C - RADIATED EMISSION - 30 MHZ TO 1000 MHZ

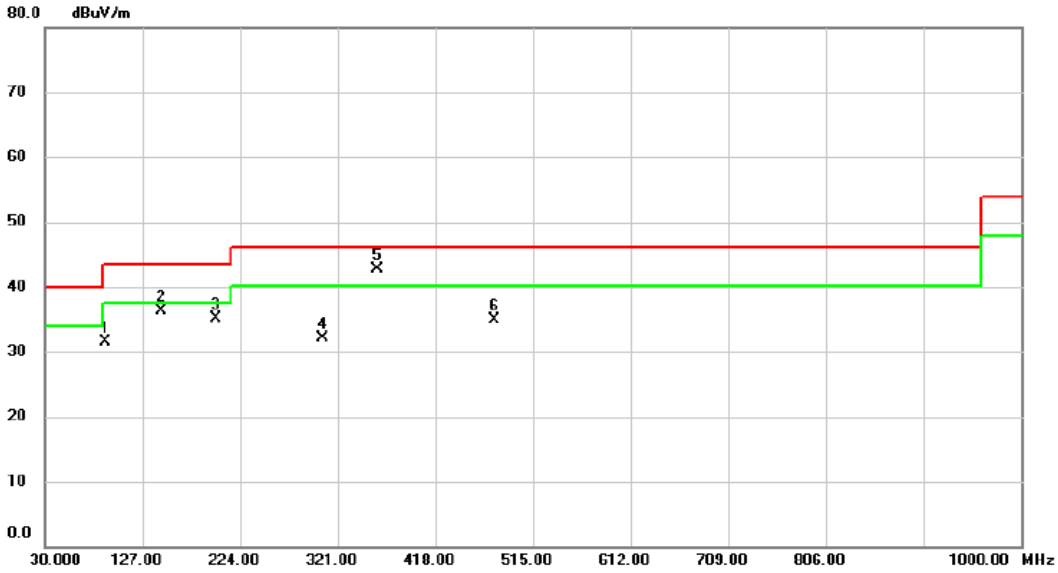
Test Mode	TX Mode_125Kbps Channel 00	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	52.7950	51.24	-11.35	39.89	40.00	-0.11	peak	
2	!	135.2450	50.93	-12.03	38.90	43.52	-4.62	peak	
3		305.9650	47.26	-10.44	36.82	46.02	-9.20	peak	
4		359.8000	45.57	-9.38	36.19	46.02	-9.83	peak	
5		473.2900	45.39	-6.42	38.97	46.02	-7.05	peak	
6		549.9200	34.97	-4.99	29.98	46.02	-16.04	QP	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

Test Mode	TX Mode_125Kbps Channel 00	Polarization	Horizontal

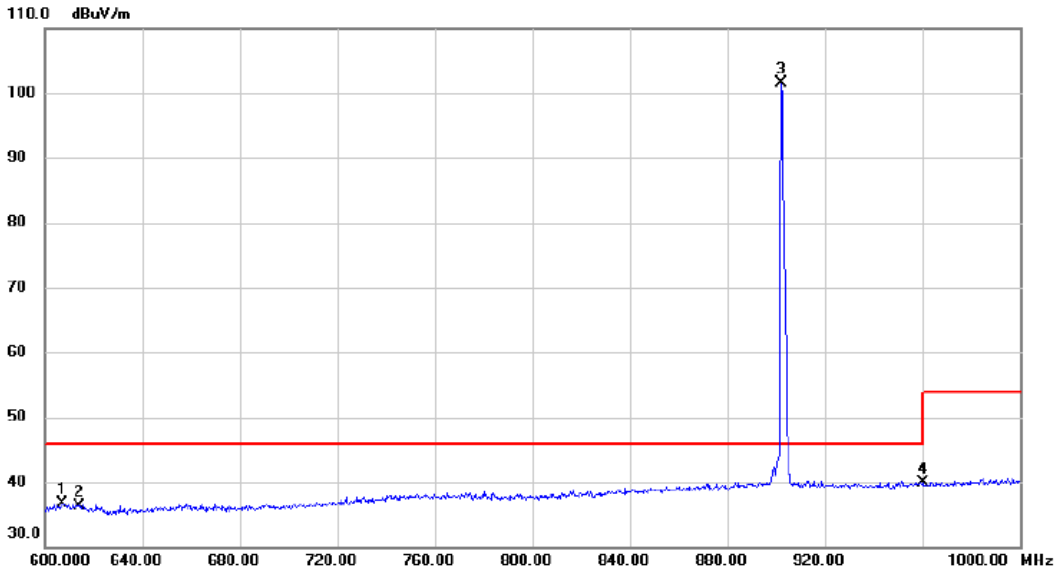


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		89.6550	48.46	-16.99	31.47	43.52	-12.05	peak	
2		145.9150	47.63	-11.38	36.25	43.52	-7.27	peak	
3		200.2350	49.48	-14.43	35.05	43.52	-8.47	peak	
4		306.4500	42.49	-10.42	32.07	46.02	-13.95	peak	
5	*	359.8000	52.16	-9.38	42.78	46.02	-3.24	peak	
6		476.2000	41.30	-6.38	34.92	46.02	-11.10	peak	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

APPENDIX D - RADIATED EMISSION - ABOVE 1000 MHZ

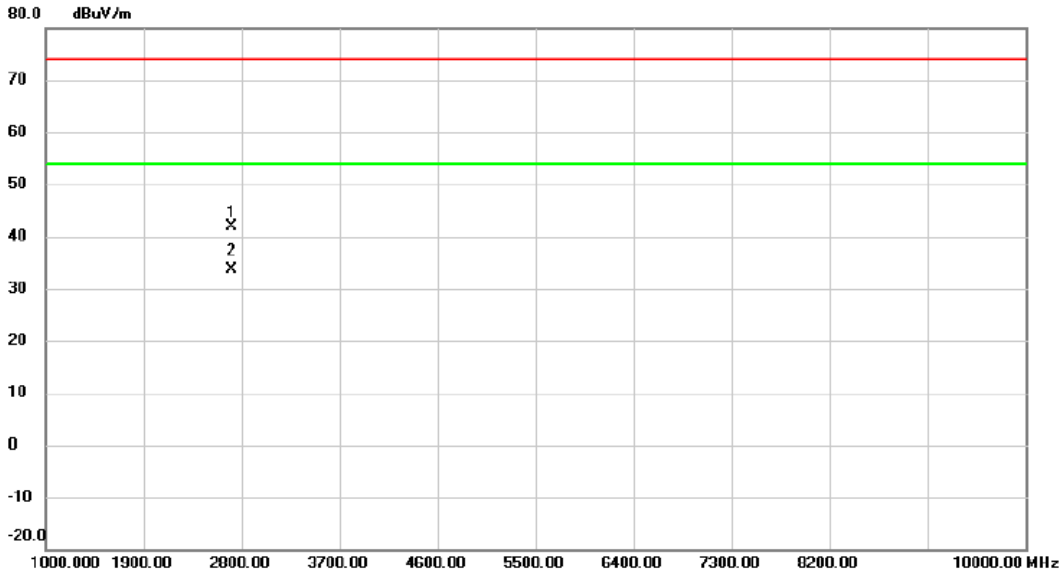
Test Mode	TX 902.3 MHz _CH00_125Kbps	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		607.2000	30.26	6.51	36.77	46.00	-9.23	peak	
2		614.0000	29.71	6.63	36.34	46.00	-9.66	peak	
3	*	902.2000	91.26	10.30	101.56	46.00	55.56	peak	No Limit
4		960.0000	29.30	10.63	39.93	46.00	-6.07	peak	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

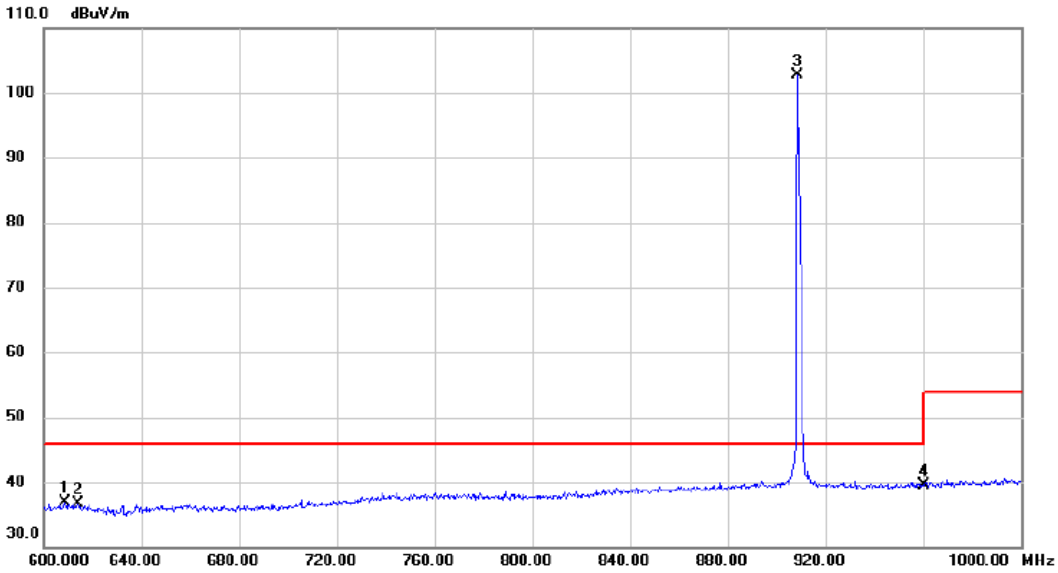
Test Mode	TX 902.3 MHz _CH00_125Kbps	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2705.500	43.39	-1.47	41.92	74.00	-32.08	peak	
2	*	2705.500	35.16	-1.47	33.69	54.00	-20.31	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

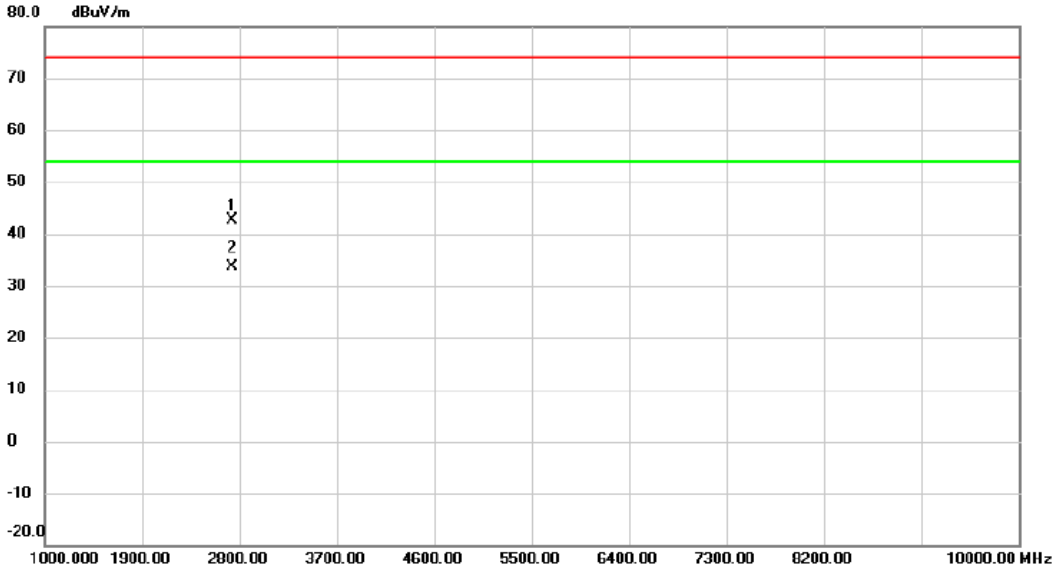
Test Mode	TX 908.7 MHz _CH32_125Kbps	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		608.8000	30.30	6.54	36.84	46.00	-9.16	peak	
2		614.0000	30.08	6.63	36.71	46.00	-9.29	peak	
3	*	908.6000	92.29	10.33	102.62	46.00	56.62	peak	No Limit
4		960.0000	28.90	10.63	39.53	46.00	-6.47	peak	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

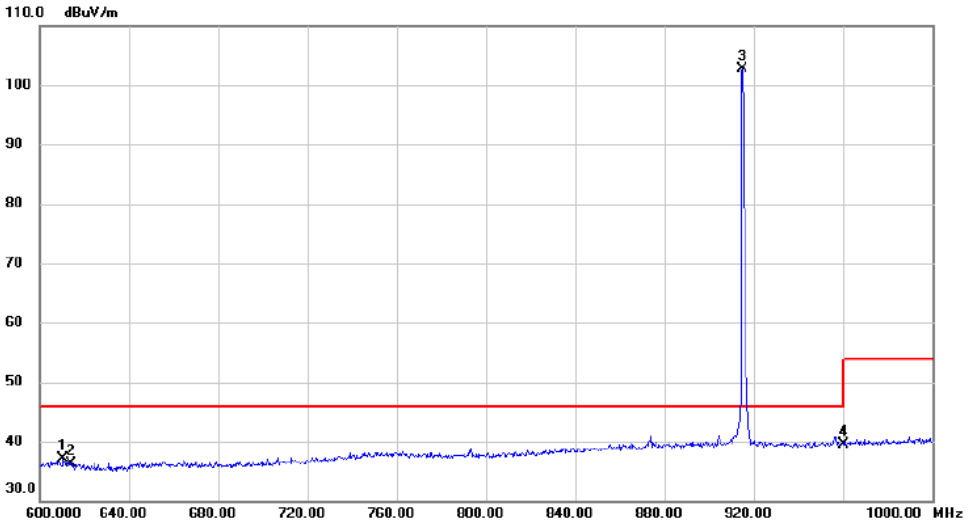
Test Mode	TX 908.7 MHz _CH32_125Kbps	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2728.000	44.03	-1.40	42.63	74.00	-31.37	peak	
2	*	2728.000	35.14	-1.40	33.74	54.00	-20.26	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

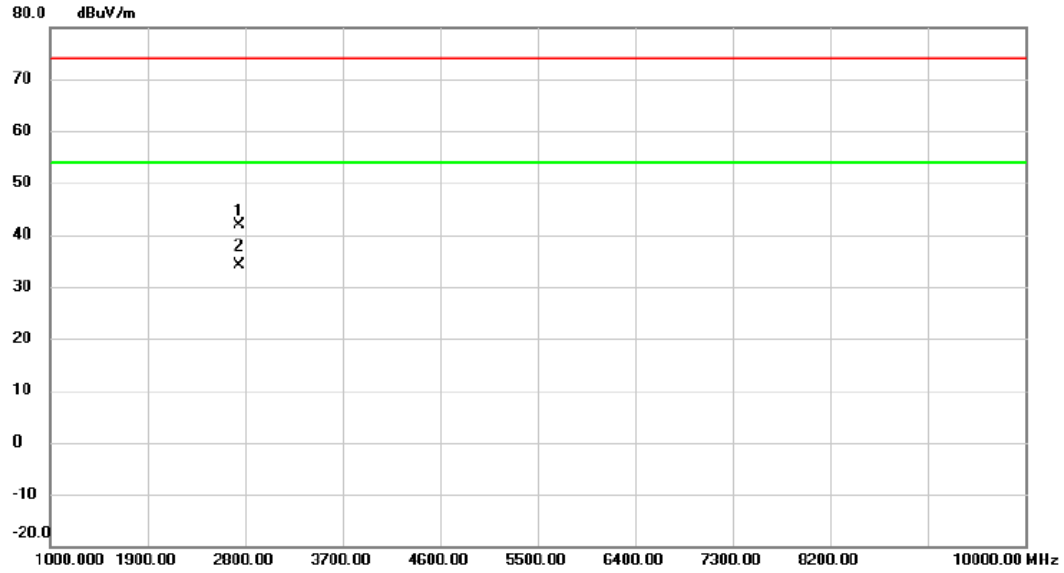
Test Mode	TX 914.9 MHz _CH63_125Kbps	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		610.6000	30.59	6.57	37.16	46.00	-8.84	peak	
2		614.0000	29.64	6.63	36.27	46.00	-9.73	peak	
3	*	914.8000	92.24	10.37	102.61	46.00	56.61	peak	No Limit
4		960.0000	28.93	10.63	39.56	46.00	-6.44	peak	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

Test Mode	TX 914.9 MHz _CH63_125Kbps	Polarization	Vertical



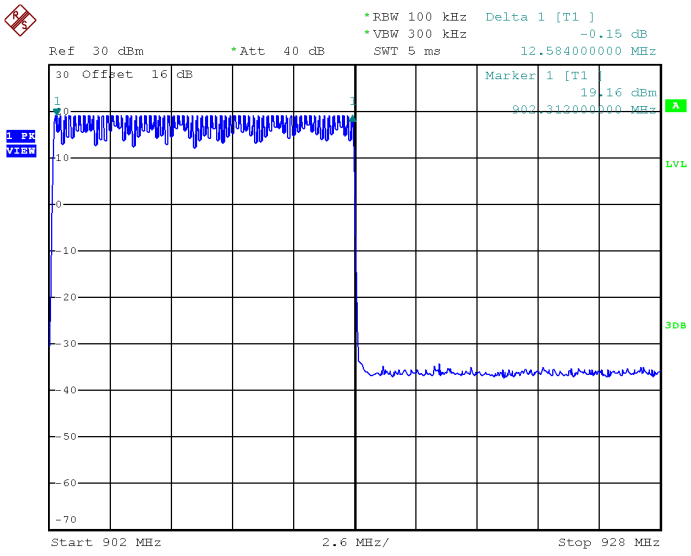
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2746.000	43.32	-1.33	41.99	74.00	-32.01	peak	
2	*	2746.000	35.34	-1.33	34.01	54.00	-19.99	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

APPENDIX E - NUMBER OF HOPPING FREQUENCY

Test Mode:	Number of Hopping Channels

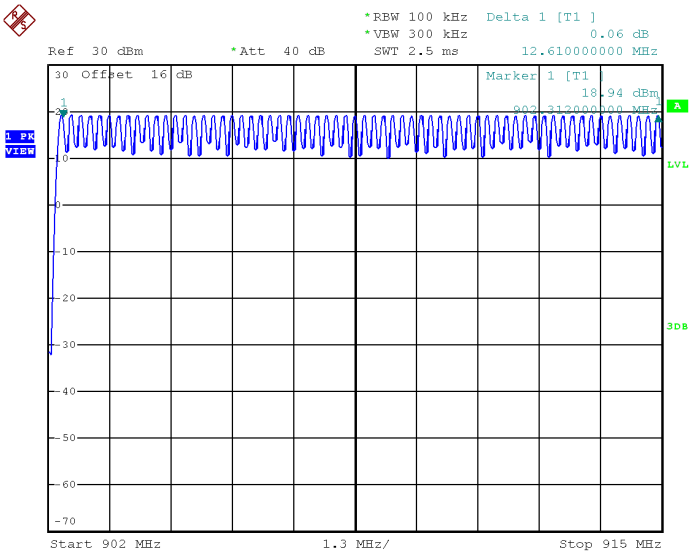
Test Mode	Hopping Mode_125Kbps	Limit	Test Result
Number of Hopping Frequency	64	50	Pass



Date: 23.AUG.2024 16:45:55

Test Mode:	TX 914.9 MHz _CH63_125Kbps

Test Mode	Hopping Mode_125Kbps	Limit	Test Result
Number of Hopping Frequency	64	50	Pass



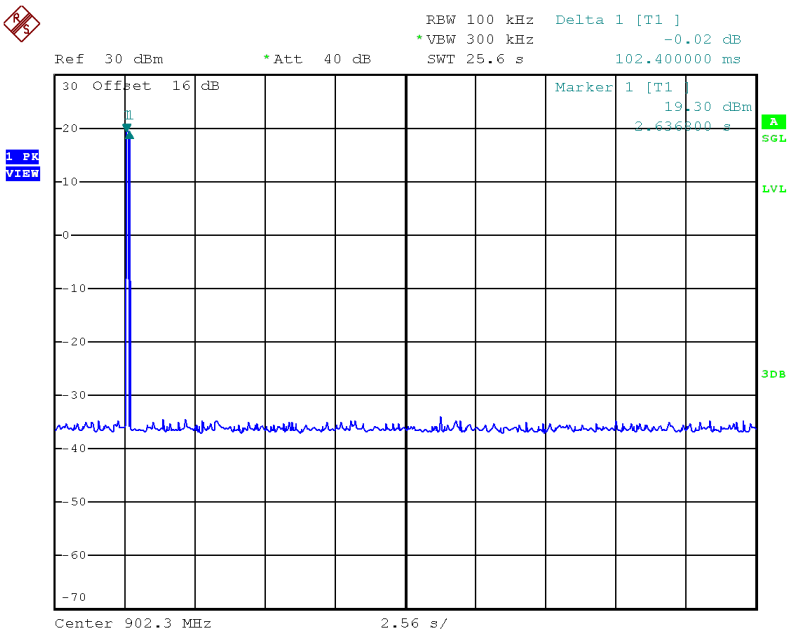
Date: 23.AUG.2024 16:48:06

APPENDIX F - AVERAGE TIME OF OCCUPANCY

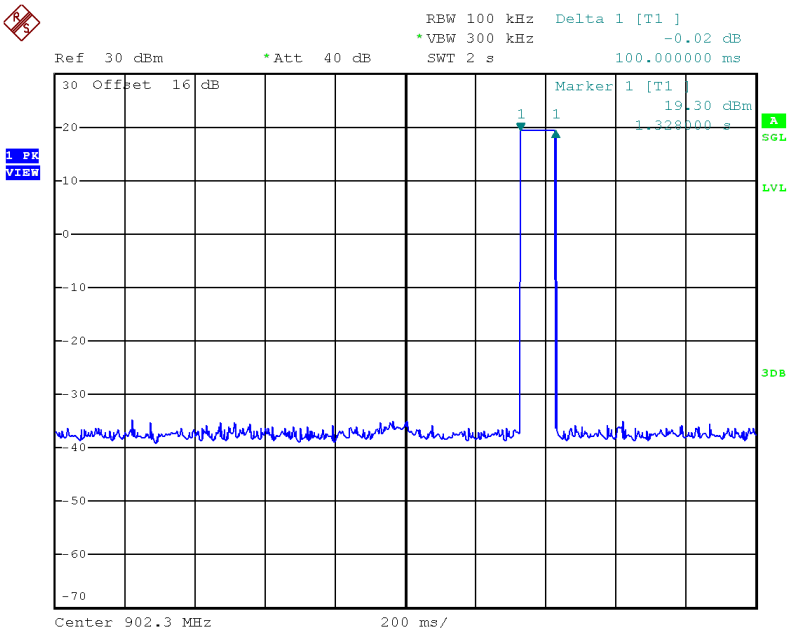
Test Mode	Hopping Mode_125Kbps

Frequency (MHz)	Dwell Time (s)	Limits (s)	Test Result
902.3	0.1024	0.4000	Pass
908.7	0.1024	0.4000	Pass
914.9	0.1044	0.4000	Pass

Test Mode	TX 902.3 MHz _CH00_125Kbps

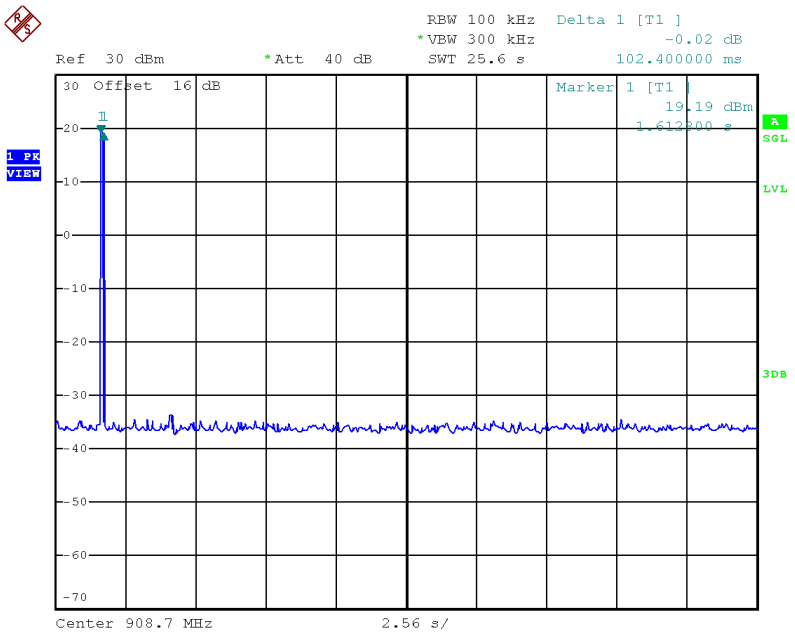


Date: 23.AUG.2024 17:01:34

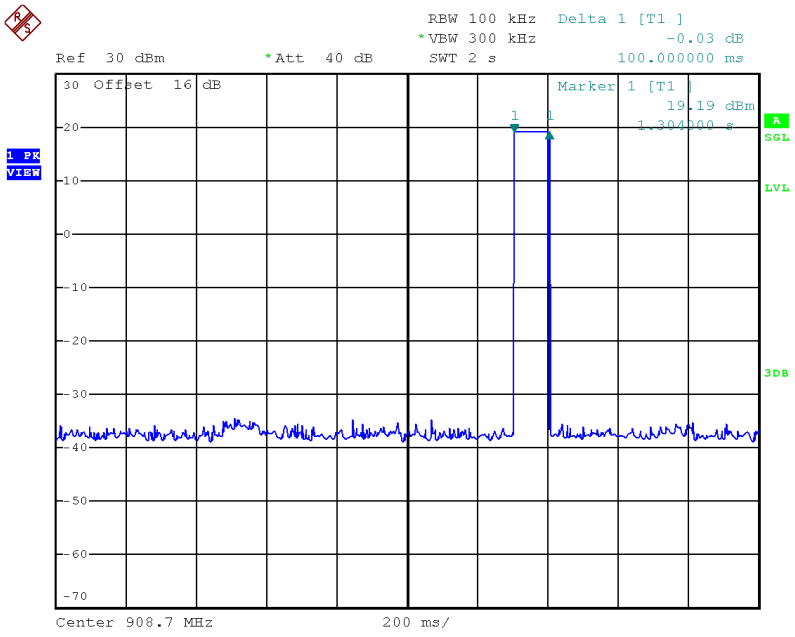


Date: 23.AUG.2024 17:04:03

Test Mode	TX 908.7 MHz _CH32_125Kbps

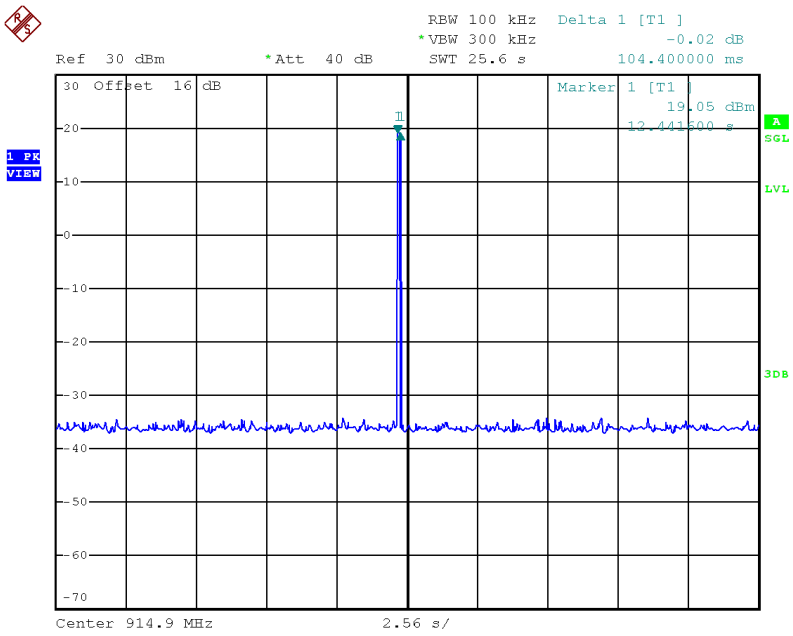


Date: 23.AUG.2024 16:59:12

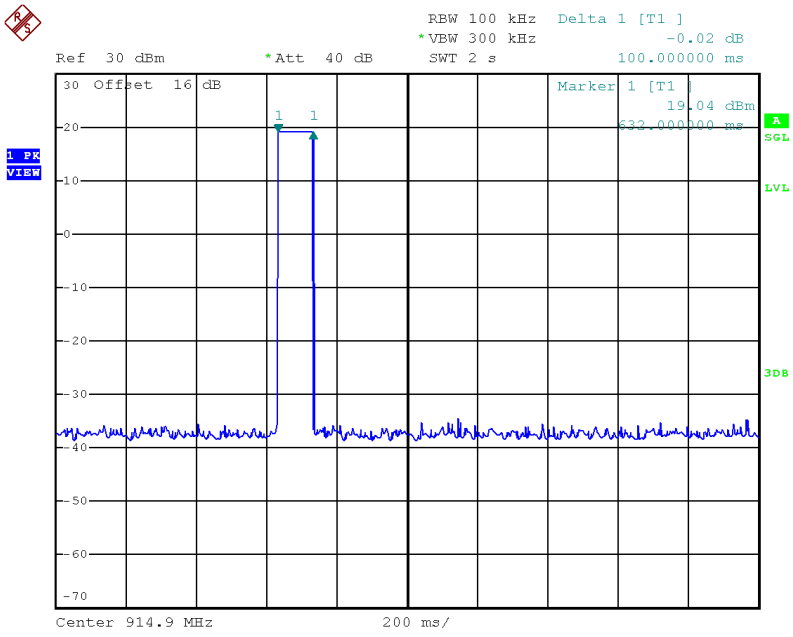


Date: 23.AUG.2024 17:03:27

Test Mode	TX 914.9 MHz _CH63_125Kbps



Date: 23.AUG.2024 17:11:08



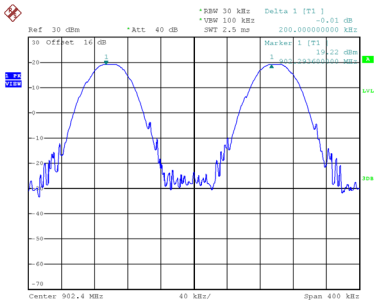
Date: 23.AUG.2024 17:05:05

APPENDIX G - HOPPING CHANNEL SEPARATION

Test Mode	Hopping Mode_125Kbps

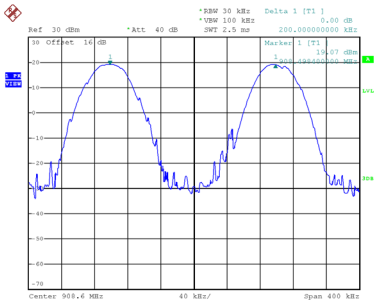
Channel	Frequency (MHz)	Channel Separation (MHz)	20 dB Bandwidth (MHz)	Test Result
00	902.3	0.2000	0.1368	Pass
32	908.7	0.2000	0.1368	Pass
63	914.9	0.2000	0.1386	Pass

CH00



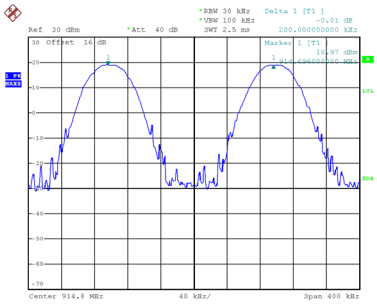
Date: 23.AUG.2024 16:28:12

CH32



Date: 23.AUG.2024 16:30:32

CH63



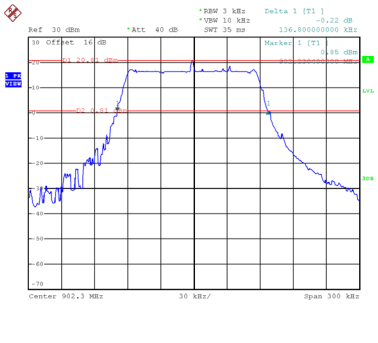
Date: 23.AUG.2024 16:32:33

APPENDIX H – 20DB BANDWIDTH

Test Mode	TX Mode _125Kbps

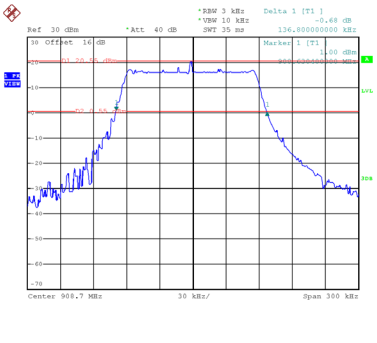
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
00	902.3	0.1368
32	908.7	0.1368
63	914.9	0.1386

CH00



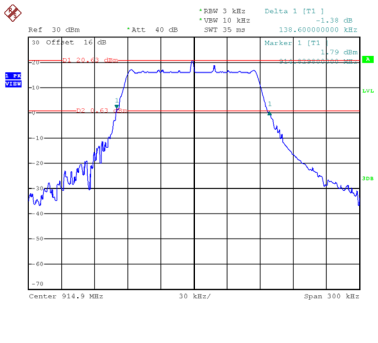
Date: 23.AUG.2024 16:39:30

CH39



Date: 23.AUG.2024 16:40:24

CH78



Date: 23.AUG.2024 16:41:34

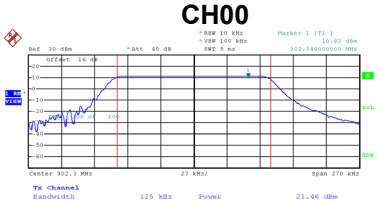
APPENDIX I - MAXIMUM OUTPUT POWER

Test Mode	TX Mode _125Kbps

Channel	Frequency (MHz)	Output Power (dBm)	Max. Limit (dBm)	Max. Limit (W)	Test Result
00	902.3	21.46	30.00	1.0000	Pass
32	908.7	21.28	30.00	1.0000	Pass
63	914.9	21.10	30.00	1.0000	Pass

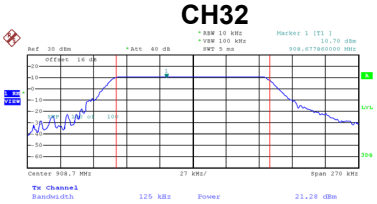
Note: Output power = Measure result + Cable loss

CH00



Date: 23.AUG.2024 10:04:57

CH32



Date: 23.AUG.2024 10:21:31

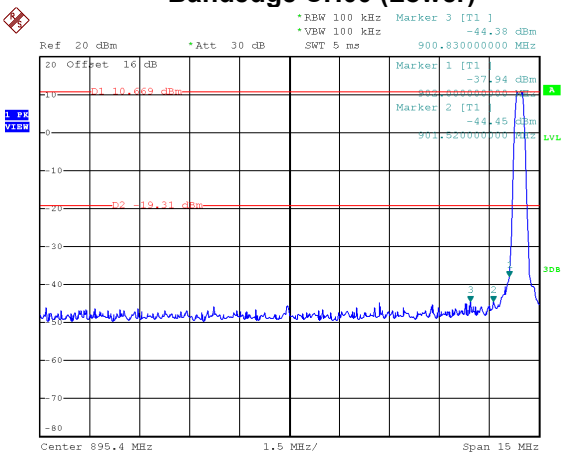
CH63

Date: 23.AUG.2024 10:34:26

APPENDIX J - CONDUCTED SPURIOUS EMISSION

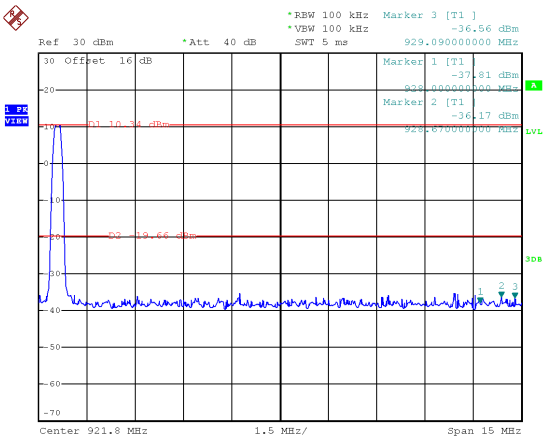
Test Mode	TX Mode _125Kbps

Bandedge CH00 (Lower)



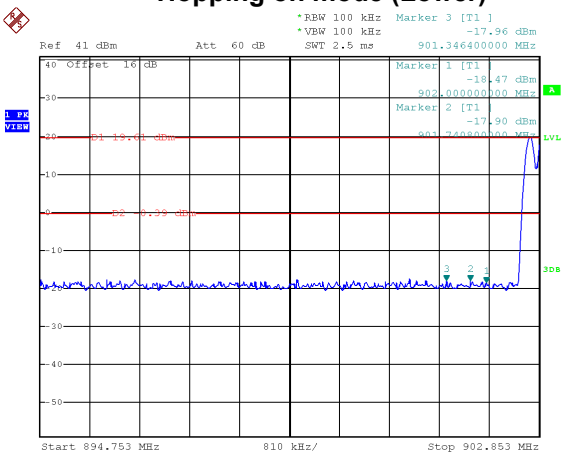
Date: 23.AUG.2024 10:09:39

Bandedge CH63 (Upper)



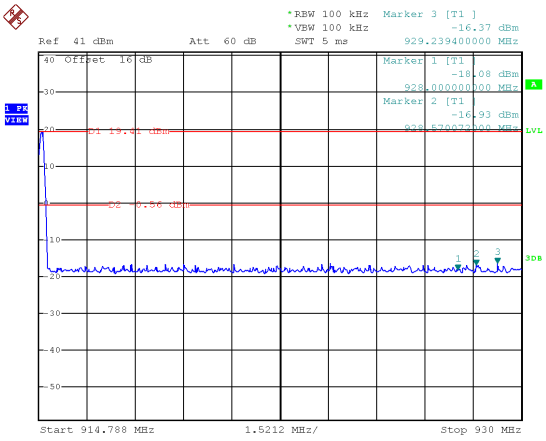
Date: 23.AUG.2024 10:37:21

Hopping on mode (Lower)



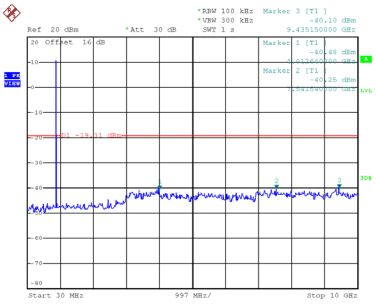
Date: 15.AUG.2024 15:19:17

Hopping on mode (Upper)



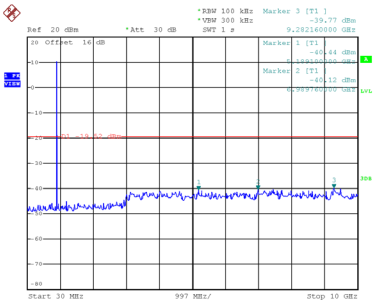
Date: 15.AUG.2024 16:00:57

CH00 – 10th Harmonic of the fundamental frequency



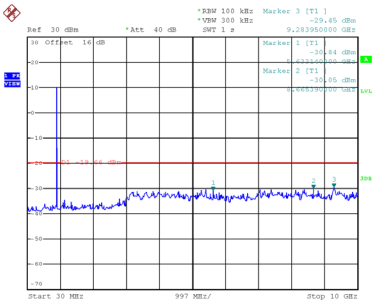
Date: 23.AUG.2024 10:12:07

CH32 – 10th Harmonic of the fundamental frequency



Date: 23.AUG.2024 10:24:49

CH63 – 10th Harmonic of the fundamental frequency



Date: 23.AUG.2024 10:38:44

End of Test Report