

RADIO PERFORMANCE TEST REPORT

Test Report No. : OT-237-RWD-044
Reception No. : 2306001870
Applicant : Westcom Wireless Inc.
Address : 2773 Leechburg Road, Lower Burrell, Pennsylvania, 15068, United States
Manufacturer : Westcom Wireless Inc.
Address : 2773 Leechburg Road, Lower Burrell, Pennsylvania, 15068, United States
Type of Equipment : ProCom
FCC ID. : 2AO37ATLASLOUD
Model Name : ATLAS LM
Multiple Model Name : N/A
Serial number : N/A
Total page of Report : 35 pages (including this page)
Date of Incoming : July 17, 2023
Date of issue : July 25, 2023

SUMMARY

The equipment complies with the regulation; *FCC PART 15 SUBPART C Section 15.247*

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

This report is not correlated with the "KS Q ISO/IEC 17025 and KOLAS accreditation" of Korean Laboratory Accreditation Scheme.





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Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-237-RWD-044	July 25, 2023	Initial Release	All

1. VERIFICATION OF COMPLIANCE

Applicant : Westcom Wireless Inc.
 Address : 2773 Leechburg Road, Lower Burrell, Pennsylvania, 15068, United States
 Manufacturer : Westcom Wireless Inc.
 Address : 2773 Leechburg Road, Lower Burrell, Pennsylvania, 15068, United States
 Contact Person : Frank Girardi / President
 Telephone No. : +1-724-337-1400
 FCC ID : 2AO37ATLASLOUD
 Model Name : ATLAS LM
 Brand Name : -
 Serial Number : N/A
 Date : July 25, 2023

EQUIPMENT CLASS	DSS – PART 15 SPREAD SPECTRUM TRANSMITTER
E.U.T. DESCRIPTION	ProCom
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC PART 15 SUBPART C Section 15.247 558074 D01 15.247 Meas Guidance v05r02
Modifications on the Equipment to Achieve Compliance	None
Final Test was Conducted On	3 m, Semi Anechoic Chamber

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

2. TEST SUMMARY

2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
15.247(a)(1)(i)	20 dB Bandwidth	Met the Limit / PASS
15.247(b)(2)	Conducted Maximum Peak Output Power	Met the Limit / PASS
15.247(a)(1)	Carrier Frequency Separation	Met the Limit / PASS
15.247(a)(1)(i)	Number of Hopping Frequencies	Met the Limit / PASS
15.247(a)(1)(i)	Time of Occupancy	Met the Limit / PASS
15.247(d)	100 kHz Bandwidth Outside the Frequency Band	Met the Limit / PASS
15.207	Conducted Limits	Met the Limit / PASS
15.209	Radiated Emission Limits, General Requirement	Met the Limit / PASS
15.203	Antenna Requirement	Met requirement / PASS

Note.: All test items have been performed for each Normal (CH 20 ~ CH 220), Long (CH12 ~ CH 138) and Repeat (CH 20 ~ CH 220) Mode. And the conducted Emissions and Radiated Spurious Emissions have been performed for Transmitting mode.

2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

2.3 Related Submittal(s) / Grant(s)

Original submittal only

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC PART 15 SUBPART C Section 15.247.

2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea.

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-20122/ C-14617/ G-10666/ T-11842

ISED (Innovation, Science and Economic Development Canada) – Registration No. Site# 3736A-3

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

3. GENERAL INFORMATION

3.1 Product Description

The Westcom Wireless Inc., Model ATLAS LM(referred to as the EUT in this report) is a ProCom. Product specification information described herein was obtained from product data sheet or user’s manual.

DEVICE TYPE	ProCom	
Temperature Range	-10 °C ~ 50 °C	
OPERATING FREQUENCY	902 MHz ~ 928 MHz	
MODULATION TYPE	GFSK	
RF OUTPUT POWER	Mode 1_Normal	22.73 dBm
	Mode 2_Long	28.73 dBm
	Mode 3_Repeat	28.17 dBm
ANTENNA TYPE	Helical Antenna	
ANTENNA GAIN	-0.65 dBi	
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)	48 MHz	

3.2 Alternative type(s)/model(s); also covered by this test report.

-. None

4. EUT MODIFICATIONS

-. None

5. SYSTEM TEST CONFIGURATION

5.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
Main Board	Westcom Wireless Inc.	ATLAS LM	N/A
Battery	Mirim Technology	MS35E-M	N/A

5.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

Model	Manufacturer	Description	Connected to
ATLAS LM	Westcom Wireless Inc.	ProCom (EUT)	-
Battery	Mirim Technology	Battery	EUT

5.3 Mode of operation during the test

For the testing, software used to control the EUT for staying in continuous transmitting is programmed.

For final testing EUT was set as below to get a maximum emission levels from the EUT.

Mode 1 (Normal): 902.5 MHz, 915.0 MHz, and 927.5 MHz (Low/Middle/High)

Mode 2 (Long): 902.4 MHz, 914.8 MHz, and 927.6 MHz (Low/Middle/High)

Mode 3 (Repeat): 902.5 MHz, 915.0 MHz, and 927.5 MHz (Low/Middle/High)

The EUT was moved throughout the XY, XZ, and YZ planes and the worst case is “XY” axis, but the worst data was recorded in this report.

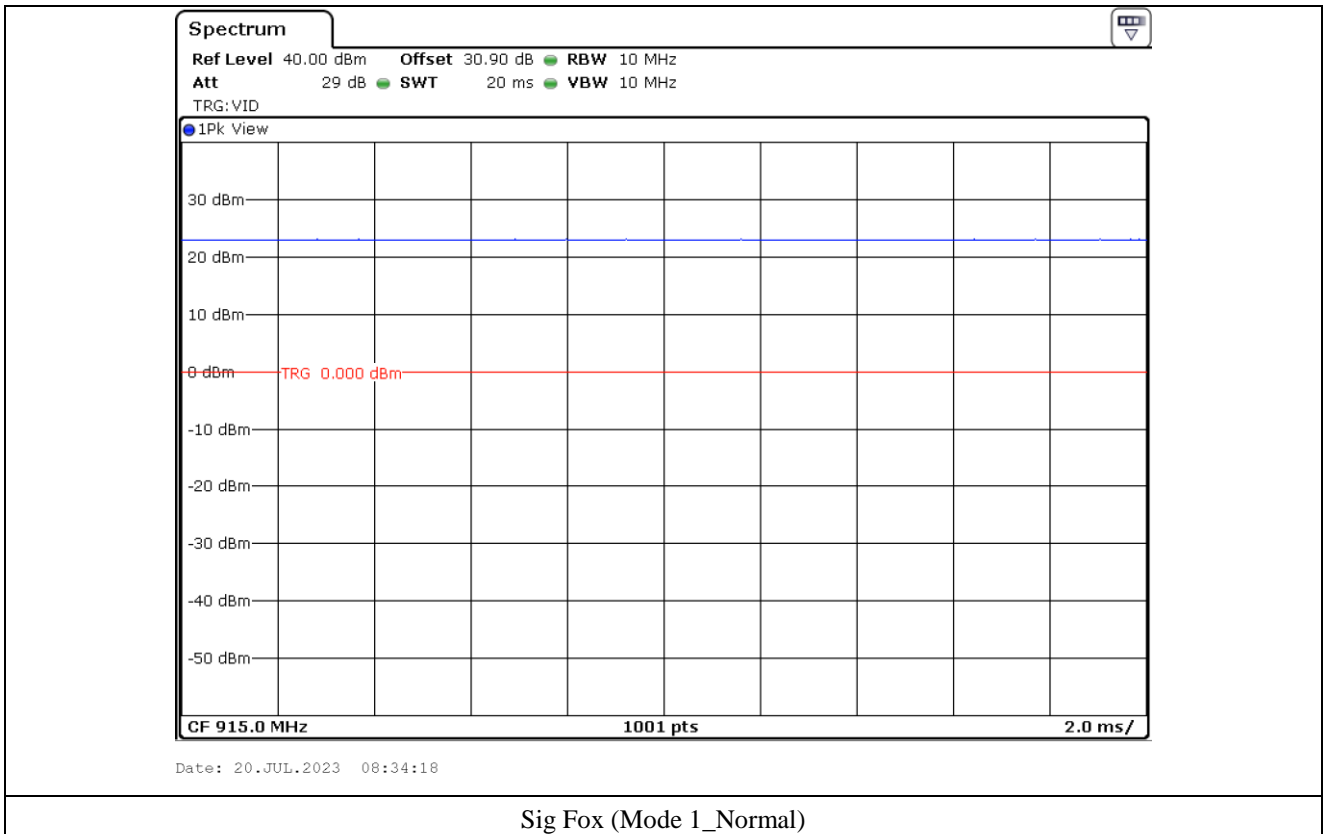
- Duty Cycle

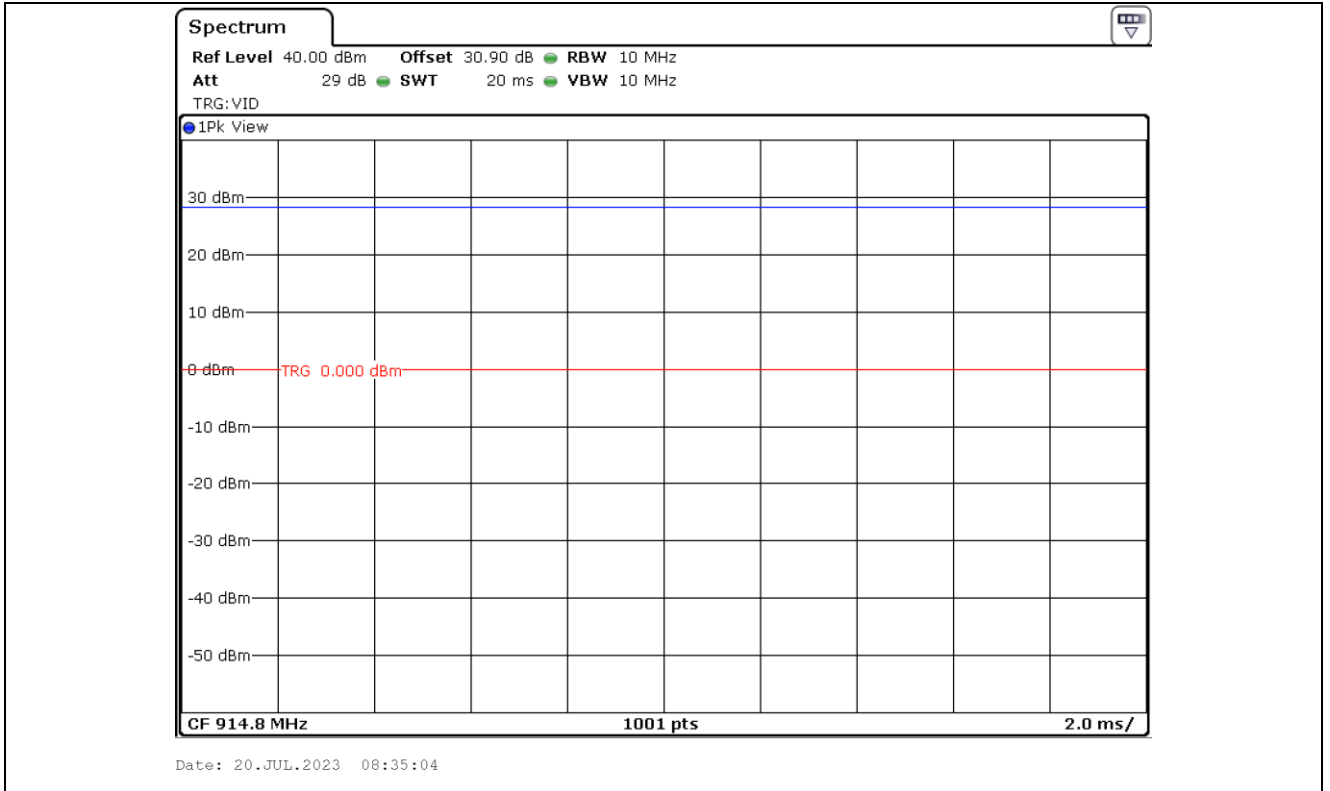
Mode	Tx On Time [ms]	Tx Off Time [ms]	Duty Cycle [%]	Correction Factor [dB]
GFSK (Mode 1_Normal)	-	-	100.00	0.00
GFSK (Mode 2_Long)	-	-	100.00	0.00
GFSK (Mode 3_Repeat)	-	-	100.00	0.00

Note – Duty Cycle : (Tx On Time / (Tx On Time + Tx Off Time)) * 100

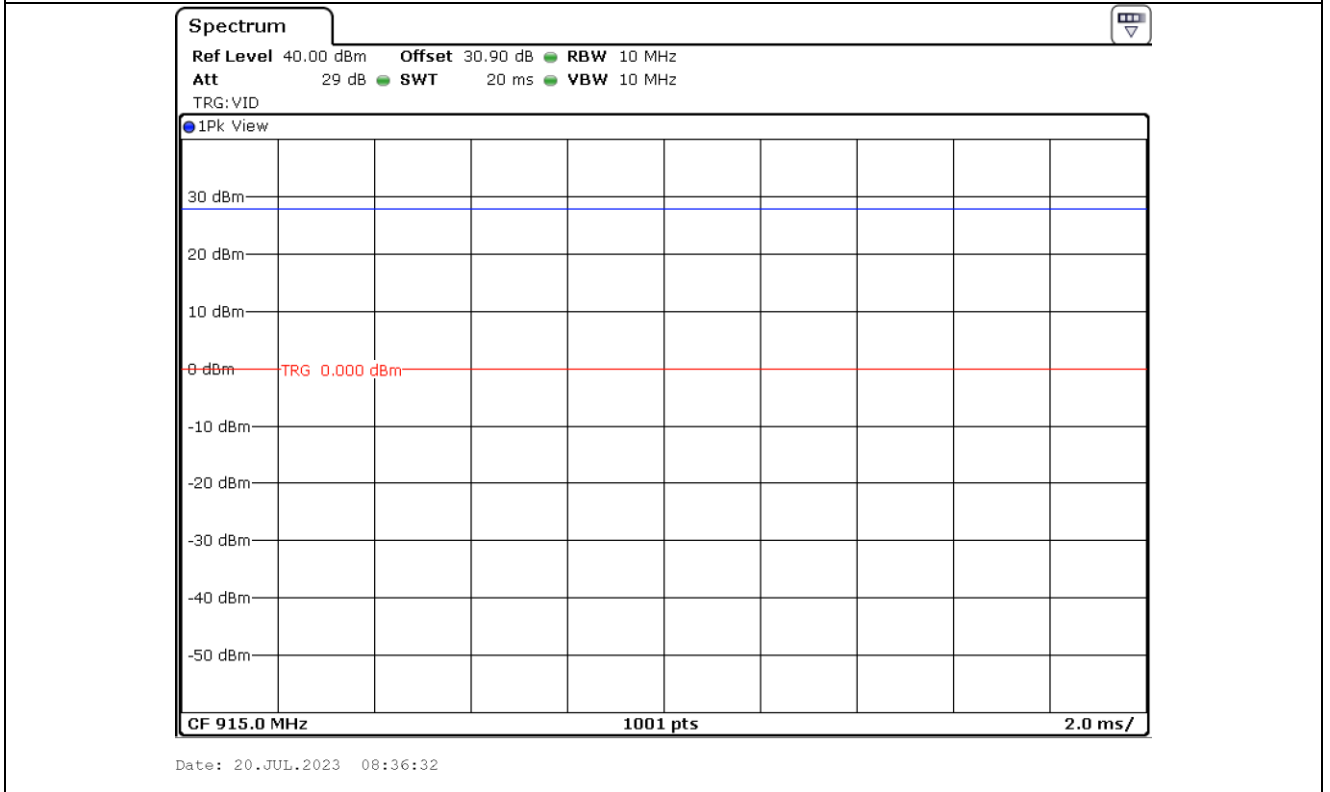
Correction Factor : 10 * Log(1 / (Duty Cycle / 100))

- Test Plot





Sig Fox (Mode 2_Long)



Sig Fox (Mode 3_Repeat)

-. Channel List

[Mode 1_Normal]

Channel	Frequency[MHz]	Channel	Frequency[MHz]	Channel	Frequency[MHz]
20	902.500	96	912.000	172	921.500
24	903.000	100	912.500	176	922.000
28	903.500	104	913.000	180	922.500
32	904.000	108	913.500	184	923.000
36	904.500	112	914.000	188	923.500
40	905.000	116	914.500	192	924.000
44	905.500	120	915.000	196	924.500
48	906.000	124	915.500	200	925.000
52	906.500	128	916.000	204	925.500
56	907.000	132	916.500	208	926.000
60	907.500	136	917.000	212	926.500
64	908.000	140	917.500	216	927.000
68	908.500	144	918.000	220	927.500
72	909.000	148	918.500	-	-
76	909.500	152	919.000	-	-
80	910.000	156	919.500	-	-
84	910.500	160	920.000	-	-
88	911.000	164	920.500	-	-
92	911.500	168	921.000	-	-

[Mode 2_Long]

Channel	Frequency[MHz]	Channel	Frequency[MHz]	Channel	Frequency[MHz]
12	902.400	60	912.000	108	921.600
14	902.800	62	912.400	110	922.000
16	903.200	64	912.800	112	922.400
18	903.600	66	913.200	114	922.800
20	904.000	68	913.600	116	923.200
22	904.400	70	914.000	118	923.600
24	904.800	72	914.400	120	924.000
26	905.200	74	914.800	122	924.400
28	905.600	76	915.200	124	924.800
30	906.000	78	915.600	126	925.200
32	906.400	80	916.000	128	925.600
34	906.800	82	916.400	130	926.000
36	907.200	84	916.800	132	926.400
38	907.600	86	917.200	134	926.800
40	908.000	88	917.600	136	927.200
42	908.400	90	918.000	138	927.600
44	908.800	92	918.400	-	-
46	909.200	94	918.800	-	-
48	909.600	96	919.200	-	-
50	910.000	98	919.600	-	-
52	910.400	100	920.000	-	-
54	910.800	102	920.400	-	-
56	911.200	104	920.800	-	-
58	911.600	106	921.200	-	-

[Mode 3_Repeat]

Channel	Frequency[MHz]	Channel	Frequency[MHz]	Channel	Frequency[MHz]
20	902.500	92	911.500	164	920.500
24	903.000	96	912.000	168	921.000
28	903.500	100	912.500	172	921.500
32	904.000	104	913.000	176	922.000
36	904.500	108	913.500	180	922.500
40	905.000	112	914.000	184	923.000
44	905.500	116	914.500	188	923.500
48	906.000	120	915.000	192	924.000
52	906.500	124	915.500	196	924.500
56	907.000	128	916.000	200	925.000
60	907.500	132	916.500	204	925.500
64	908.000	136	917.000	208	926.000
68	908.500	140	917.500	212	926.500
72	909.000	144	918.000	216	927.000
76	909.500	148	918.500	220	927.500
80	910.000	152	919.000	-	-
84	910.500	156	919.500	-	-
88	911.000	160	920.000	-	-

5.4 Configuration of Test System

Line Conducted Test: Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions.

Radiated Emission Test: Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 meter Semi Anechoic Chamber.

The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

5.5 Antenna Requirement

For intentional device, according to section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Antenna Construction:

The antenna of the EUT is Helical Antenna on the main board in the EUT, so no consideration of replacement by the user.

6. PRELIMINARY TEST

6.1 AC Power line Conducted Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	X

6.2 General Radiated Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	X

7. MAXIMUM PEAK OUTPUT POWER

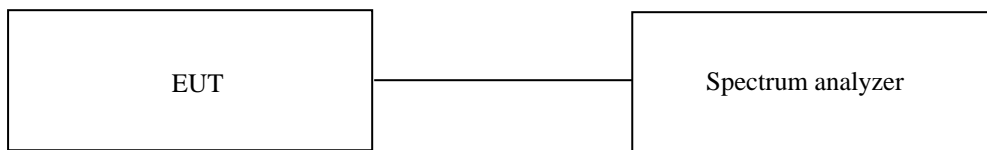
7.1 Operating environment

Temperature : 24 °C
 Relative humidity : 48 % R.H.

7.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer.

The resolution bandwidth is set to ≥ 20 dB Bandwidth, the video bandwidth is set to 3 times the resolution bandwidth.



7.3 Test Date

July 17, 2023 ~ July 21, 2023

7.4 Test data for Mode 1_Normal

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE		LIMIT (mW)	MARGIN (mW)
		(dBm)	(mW)		
LOW	902.50	22.73	187.50	1 000.00	812.50
MIDDLE	915.00	22.51	178.24	1 000.00	821.76
HIGH	927.50	22.14	163.68	1 000.00	836.32

7.5 Test data for Mode 2_Long

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE		LIMIT (mW)	MARGIN (mW)
		(dBm)	(mW)		
LOW	902.40	28.73	746.45	1 000.00	253.55
MIDDLE	914.80	28.01	632.41	1 000.00	367.59
HIGH	927.60	27.79	601.17	1 000.00	398.83

7.6 Test data for Mode 3_Repeat

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE		LIMIT (mW)	MARGIN (mW)
		(dBm)	(mW)		
LOW	902.50	28.17	656.15	1 000.00	343.85
MIDDLE	915.00	27.96	625.17	1 000.00	374.83
HIGH	927.50	27.48	559.76	1 000.00	440.24

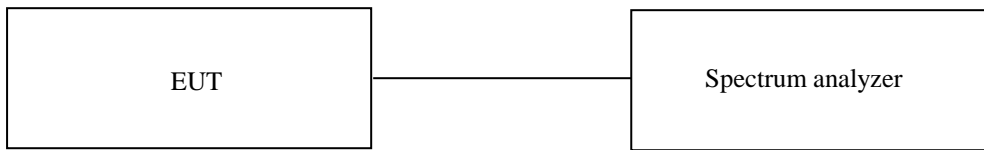
8. MINIMUM 20 dB BANDWIDTH

8.1 Operating environment

Temperature : 24 °C
 Relative humidity : 48 % R.H.

8.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 1 % to 5 % of the OBW, and peak detection was used. The 20 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 20 dB.



8.3 Test Date

July 17, 2023 ~ July 21, 2023

8.4 Test data for Mode 1_Normal

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	20 dB Bandwidth (kHz)	Limit (kHz)
Low	902.50	379.60	500.00
Middle	915.00	379.60	500.00
High	927.50	379.60	500.00

8.5 Test data for Mode 2_Long

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	20 dB Bandwidth (kHz)	Limit (kHz)
Low	902.40	359.60	500.00
Middle	914.80	359.60	500.00
High	927.60	359.60	500.00

8.6 Test data for Mode 3_Repeat

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	20 dB Bandwidth (kHz)	Limit (kHz)
Low	902.50	497.50	500.00
Middle	915.00	497.50	500.00
High	927.50	497.50	500.00

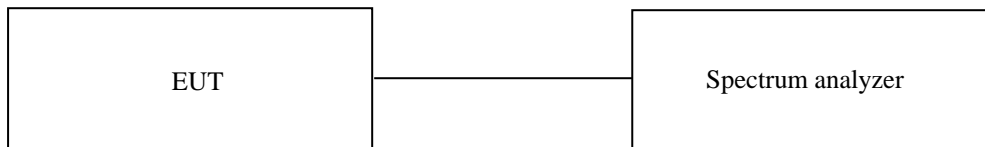
9. HOPPING FREQUENCY SEPARATION

9.1 Operating environment

Temperature : 24 °C
 Relative humidity : 48 % R.H.

9.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The frequency span is set to 2 MHz. The analyzer is set to peak hold then a pseudo-random hopping sequence of the transmitter is captured. The mark delta function was used to measure the frequency separation between two adjacent hopping channels.



9.3 Test Date

July 17, 2023 ~ July 21, 2023

9.4 Test data for Mode 1_Normal

-. Test Result : Pass

MEASURED VALUE (kHz)	20 dB Bandwidth (kHz)	LIMIT
499.50	379.60	Separated by a minimum of 379.60 kHz

9.5 Test data for Mode 2_Long

-. Test Result : Pass

MEASURED VALUE (kHz)	20 dB Bandwidth (kHz)	LIMIT
401.60	359.60	Separated by a minimum of 359.60 kHz

9.6 Test data for Mode 3_Repeat

-. Test Result : Pass

MEASURED VALUE (kHz)	20 dB Bandwidth (kHz)	LIMIT
499.50	497.50	Separated by a minimum of 497.50 kHz

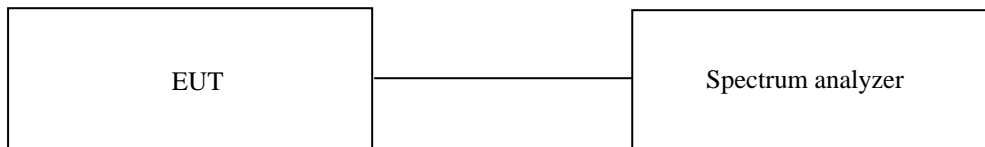
10. NUMBER OF HOPPING FREQUENCY

10.1 Operating environment

Temperature : 24 °C
 Relative humidity : 48 % R.H.

10.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The frequency span is set to 100 kHz and the resolution bandwidth is set to 300 kHz. The analyzer is set to peak hold and then complete pseudo-random hopping sequence of the transmitter is captured.



10.3 Test Date

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10.4 Test data for Mode 1_Normal

-. Test Result : Pass

Measured value (Number)	Limit (Number)	Margin (Number)
51	Minimum of 25	26

10.5 Test data for Mode 2_Long

-. Test Result : Pass

Measured value (Number)	Limit (Number)	Margin (Number)
64	Minimum of 25	39

10.6 Test data for Mode 3_Repeat

-. Test Result : Pass

Measured value (Number)	Limit (Number)	Margin (Number)
51	Minimum of 25	26

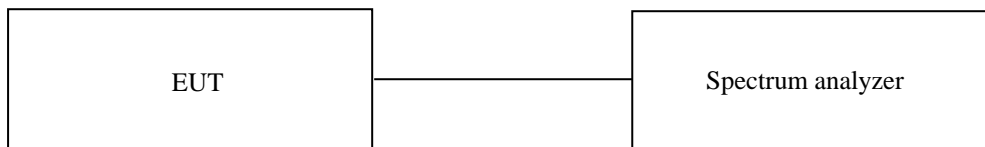
11. TIME OF OCCUPANCY

11.1 Operating environment

Temperature : 24 °C
 Relative humidity : 48 % R.H.

11.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The transmitter is set to operate in its normal frequency hopping mode. The center frequency of the spectrum analyzer is set to one of hopping channels near the center of the operating band and span is set to zero Hz. The sweep time is set to display one complete pulse. The mark delta function is used to measure the duration of the pulses.



11.3 Test Date

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11.4 Test data for Mode 1_Normal

-. Test Result : Pass

Pulse Time (ms)	Number of hops on spectrum analyzer	Period Time (s)	Analyzer sweep time (s)	Total Dwell Time (ms)	Limit (ms)
1.70	7	10.00	2.00	59.50	400.00

Note : Total Dwell Time = Pulse time * (Number of hops on spectrum analyzer * (Period specified in the requirements / Analyzer sweep time))

11.5 Test data for Mode 2_Long

-. Test Result : Pass

Pulse Time (ms)	Number of hops on spectrum analyzer	Period Time (s)	Analyzer sweep time (s)	Total Dwell Time (ms)	Limit (ms)
5.30	3	10.00	2.00	79.50	400.00

Note : Total Dwell Time = Pulse time * (Number of hops on spectrum analyzer * (Period specified in the requirements / Analyzer sweep time))

11.6 Test data for Mode 3_Repeat

-. Test Result : Pass

Pulse Time (ms)	Number of hops on spectrum analyzer	Period Time (s)	Analyzer sweep time (s)	Total Dwell Time (ms)	Limit (ms)
1.20	7	10.00	2.00	42.00	400.00

Note : Total Dwell Time = Pulse time * (Number of hops on spectrum analyzer * (Period specified in the requirements / Analyzer sweep time))

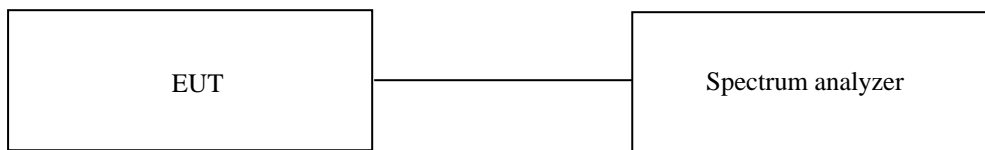
12. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

12.1 Operating environment

Temperature : 24 °C
 Relative humidity : 48 % R.H.

12.2 Test set-up for conducted measurement

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz and video bandwidth is set to 300 kHz, and peak detection was used.



12.3 Test set-up for radiated measurement

The radiated emissions measurements were performed on the 3 m semi anechoic chamber. The EUT was placed on turntable approximately 1.5 m above the ground plane.

The frequency spectrum from 30 MHz to 26.5 GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.

12.4 Test Date

July 17, 2023 ~ July 21, 2023

12.5 Test data for conducted emission

Please refer to the Annex.

12.6 Test data for Transmitting mode radiated emission

12.6.1 Spurious & Harmonic Radiated Emission above 1 GHz

12.6.1.1 Test data for Mode 1_Normal

- . Resolution bandwidth : 1 MHz for Peak and Average Mode
- . Video bandwidth : 3 MHz for Peak Mode(Peak Detector), 3 MHz for Average Mode(RMS Detector)
- . Frequency range : 1 GHz ~ 10.0 GHz
- . Measurement distance : 3 m
- . Duty cycle : 100%
- . Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	AMP Factor	Duty Factor (dB)	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel										
1 805.280	55.70	Peak	H	25.32	6.65	45.10	-	42.57	74.00	31.43
1 804.970	50.41	Average	H	25.32	6.65	45.10	-	37.28	54.00	16.72
1 804.760	56.80	Peak	V	25.32	6.65	45.10	-	43.67	74.00	30.33
1 804.990	52.21	Average	V	25.32	6.65	45.10	-	39.08	54.00	14.92
Test Data for Middle Channel										
1 830.045	55.09	Peak	H	25.42	6.74	45.10	-	42.15	74.00	31.85
1 829.880	49.93	Average	H	25.42	6.74	45.10	-	36.99	54.00	17.01
1 829.865	55.50	Peak	V	25.42	6.74	45.10	-	42.56	74.00	31.44
1 829.975	50.08	Average	V	25.42	6.74	45.10	-	37.14	54.00	16.86
Test Data for High Channel										
1 854.785	56.19	Peak	H	25.51	6.73	45.10	-	43.33	74.00	30.67
1 854.900	51.40	Average	H	25.51	6.73	45.10	-	38.54	54.00	15.46
1 855.215	58.53	Peak	V	25.51	6.73	45.10	-	45.67	74.00	28.33
1 854.915	55.44	Average	V	25.51	6.73	45.10	-	42.58	54.00	11.42

Remark: “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} + \text{Duty Factor} - \text{Amp Factor}$$

12.6.1.2 Test data for Mode 2_Long

- . Resolution bandwidth : 1 MHz for Peak and Average Mode
- . Video bandwidth : 3 MHz for Peak Mode(Peak Detector), 3 MHz for Average Mode(RMS Detector)
- . Frequency range : 1 GHz ~ 10.0 GHz
- . Measurement distance : 3 m
- . Duty cycle : 100%
- . Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	AMP Factor	Duty Factor (dB)	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel										
1 804.860	59.36	Peak	H	25.32	6.65	45.10	-	46.23	74.00	27.77
1 804.790	56.44	Average	H	25.32	6.65	45.10	-	43.31	54.00	10.69
1 804.630	60.23	Peak	V	25.32	6.65	45.10	-	47.10	74.00	26.90
1 804.765	57.55	Average	V	25.32	6.65	45.10	-	44.42	54.00	9.58
Test Data for Middle Channel										
1 829.925	57.99	Peak	H	25.42	6.74	45.10	-	45.05	74.00	28.95
1 829.470	54.58	Average	H	25.42	6.74	45.10	-	41.64	54.00	12.36
1 829.440	60.86	Peak	V	25.42	6.74	45.10	-	47.92	74.00	26.08
1 829.540	58.15	Average	V	25.42	6.74	45.10	-	45.21	54.00	8.79
Test Data for High Channel										
1 855.030	61.25	Peak	H	25.51	6.73	45.10	-	48.39	74.00	25.61
1 855.115	58.80	Average	H	25.51	6.73	45.10	-	45.94	54.00	8.06
1 855.040	63.61	Peak	V	25.51	6.73	45.10	-	50.75	74.00	23.25
1 855.145	61.75	Average	V	25.51	6.73	45.10	-	48.89	54.00	5.11

Remark: “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} + \text{Duty Factor} - \text{Amp Factor}$$

12.6.1.3 Test data for Mode 3_Repeat

- . Resolution bandwidth : 1 MHz for Peak and Average Mode
- . Video bandwidth : 3 MHz for Peak Mode(Peak Detector), 3 MHz for Average Mode(RMS Detector)
- . Frequency range : 1 GHz ~ 10.0 GHz
- . Measurement distance : 3 m
- . Duty cycle : 100%
- . Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	AMP Factor	Duty Factor (dB)	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel										
1 804.715	59.56	Peak	H	25.32	6.65	45.10	-	46.43	74.00	27.57
1 804.925	56.27	Average	H	25.32	6.65	45.10	-	43.14	54.00	10.86
1 804.805	60.48	Peak	V	25.32	6.65	45.10	-	47.35	74.00	26.65
1 804.910	57.65	Average	V	25.32	6.65	45.10	-	44.52	54.00	9.48
Test Data for Middle Channel										
1 830.115	58.73	Peak	H	25.42	6.74	45.10	-	45.79	74.00	28.21
1 829.960	55.24	Average	H	25.42	6.74	45.10	-	42.30	54.00	11.70
1 829.750	60.66	Peak	V	25.42	6.74	45.10	-	47.72	74.00	26.28
1 829.925	57.99	Average	V	25.42	6.74	45.10	-	45.05	54.00	8.95
Test Data for High Channel										
1 854.685	60.96	Peak	H	25.51	6.73	45.10	-	48.10	74.00	25.90
1 854.965	58.23	Average	H	25.51	6.73	45.10	-	45.37	54.00	8.63
1 854.825	63.02	Peak	V	25.51	6.73	45.10	-	50.16	74.00	23.84
1 854.920	61.13	Average	V	25.51	6.73	45.10	-	48.27	54.00	5.73

Remark: “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} + \text{Duty Factor} - \text{Amp Factor}$$

13. RADIATED EMISSION TEST

13.1 Operating environment

Temperature : 24 °C
 Relative humidity : 48 % R.H.

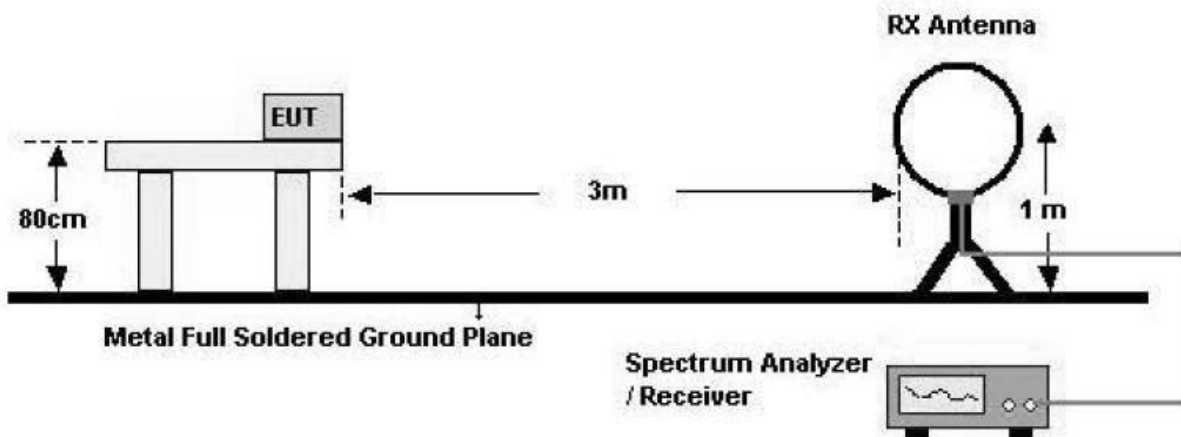
13.2 Test set-up

The radiated emissions measurements were on the 3 m semi anechoic chamber. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

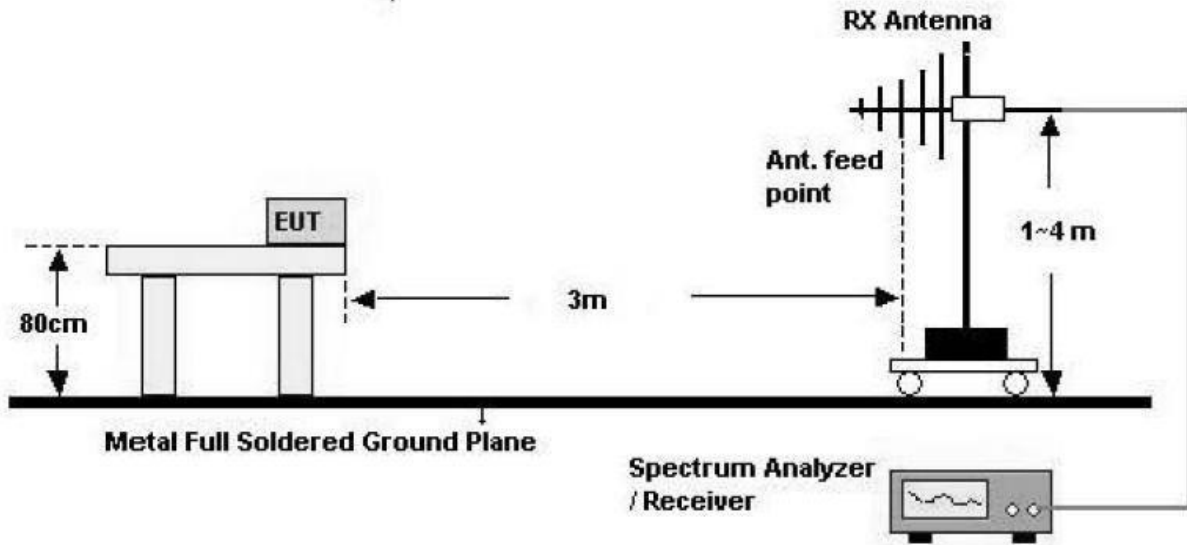
The frequency spectrum from 9 kHz to 10.0 GHz was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

- Test Configuration

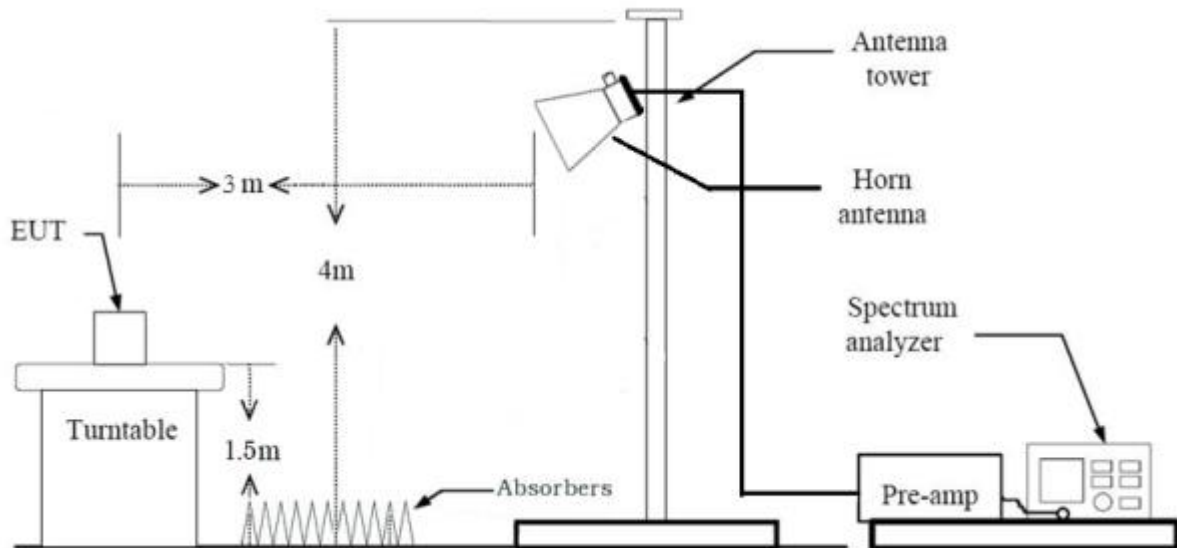
1. Below 30 MHz



2. 30 MHz - 1 GHz



3. Above 1 GHz

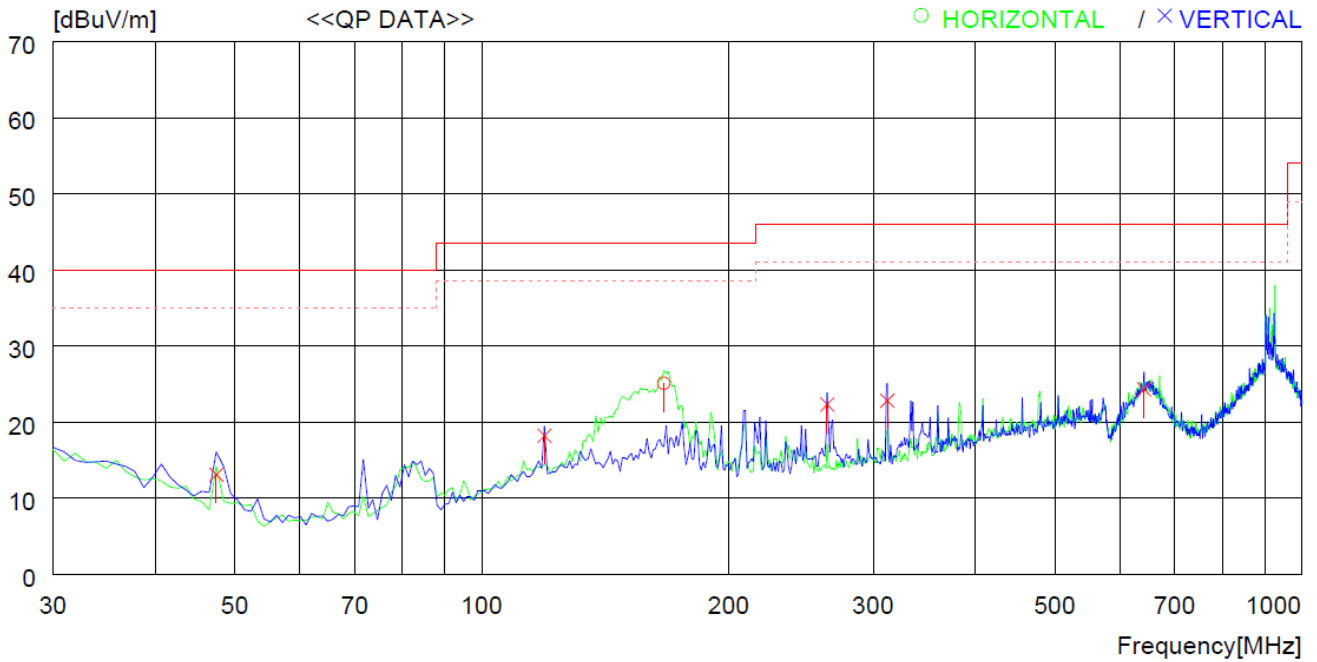


13.3 Test Date

July 17, 2023 ~ July 21, 2023

13.4 Test data for 30 MHz ~ 1 000 MHz

- Resolution bandwidth : 120 kHz
- Frequency range : 30 MHz ~ 1 000 MHz
- Measurement distance : 3 m
- Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247
- The highest value is the fundamental.



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	166.770	38.3	17.4	2.5	33.1	25.1	43.5	18.4	400	98
----- Vertical -----										
2	47.460	30.8	14.0	1.4	33.1	13.1	40.0	26.9	100	43
3	119.240	30.5	18.6	2.2	33.1	18.2	43.5	25.3	200	0
4	263.770	34.5	17.9	3.2	33.3	22.3	46.0	23.7	300	359
5	312.270	33.2	19.3	3.5	33.2	22.8	46.0	23.2	300	320
6	642.067	27.6	25.0	5.0	33.3	24.3	46.0	21.7	400	56

13.5 Test data for Below 30 MHz

- Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)
- Frequency range : 9 kHz ~ 30 MHz
- Measurement distance : 3 m

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Amp Gain	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
Emission from the EUT more than 20 dB below the limit in each frequency range.								

13.6 Test data for above 1 GHz

- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode
1 MHz and RMS Detector for Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Frequency range : 1 GHz ~ 10.0 GHz
- Measurement distance : 3 m

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Amp Gain	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
Emission from the EUT more than 20 dB below the limit in each frequency range.								

14. CONDUCTED EMISSION TEST

14.1 Operating environment

Temperature : 24 °C
Relative humidity : 48 % R.H.

14.2 Test set-up

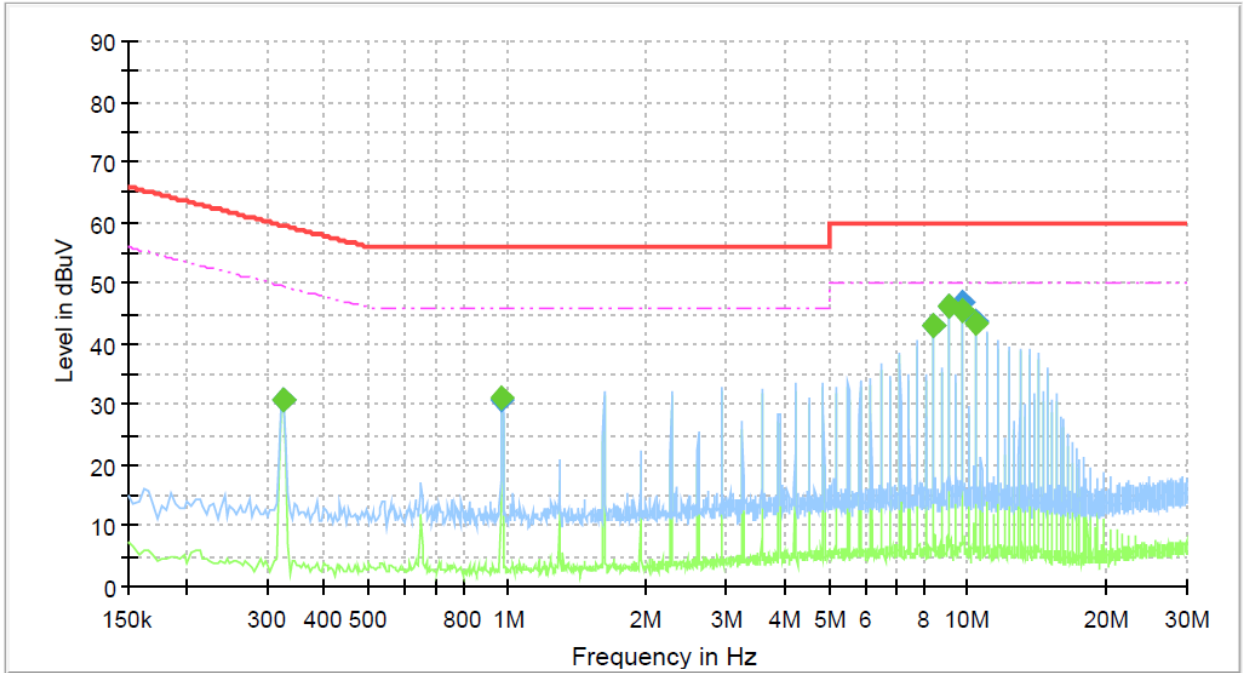
The EUT was placed on a wooden table, 0.8 m height above the floor. Power was fed to the EUT through a 50 Ω / 50 μ H + 5 Ω Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

14.3 Test Date

July 17, 2023 ~ July 21, 2023

14.4 Test Data for Trasmitting Mode

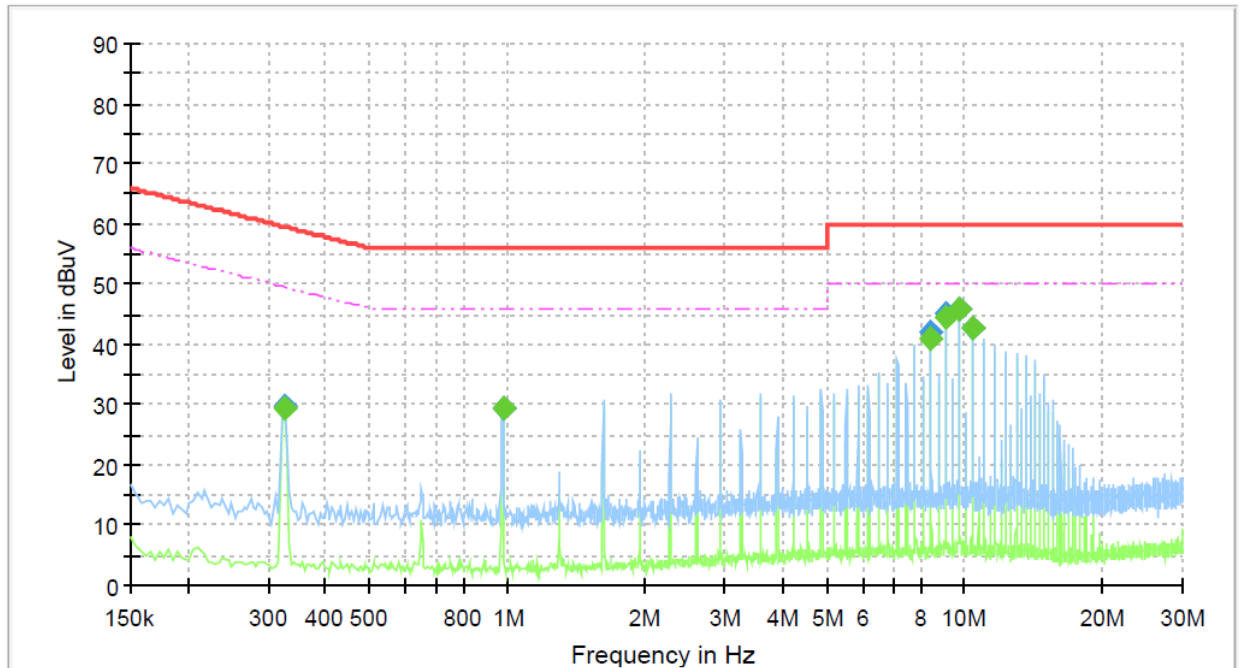
- Resolution bandwidth : 9 kHz
- Frequency range : 0.15 MHz ~ 30 MHz
- Tested Line : HOT LINE



Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.325	---	30.71	49.57	18.86	3000.0	9.0	L1	10.09
0.325	30.74	---	59.57	28.82	3000.0	9.0	L1	10.09
0.972	---	31.08	46.00	14.92	3000.0	9.0	L1	10.15
0.972	30.92	---	56.00	25.08	3000.0	9.0	L1	10.15
8.438	42.95	---	60.00	17.05	3000.0	9.0	L1	10.53
8.438	---	43.21	50.00	6.79	3000.0	9.0	L1	10.53
9.087	46.34	---	60.00	13.66	3000.0	9.0	L1	10.56
9.087	---	46.33	50.00	3.67	3000.0	9.0	L1	10.56
9.733	---	45.69	50.00	4.31	3000.0	9.0	L1	10.59
9.737	47.06	---	60.00	12.94	3000.0	9.0	L1	10.59
10.382	---	43.43	50.00	6.57	3000.0	9.0	L1	10.61
10.386	43.83	---	60.00	16.17	3000.0	9.0	L1	10.61

- Tested Line : NEUTRAL LINE



Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.325	---	29.58	49.57	19.98	3000.0	9.0	N	10.10
0.325	29.64	---	59.57	29.92	3000.0	9.0	N	10.10
0.976	---	29.37	46.00	16.63	3000.0	9.0	N	10.15
0.976	29.39	---	56.00	26.61	3000.0	9.0	N	10.15
8.442	---	41.01	50.00	8.99	3000.0	9.0	N	10.54
8.446	42.18	---	60.00	17.82	3000.0	9.0	N	10.54
9.095	45.23	---	60.00	14.77	3000.0	9.0	N	10.58
9.095	---	44.52	50.00	5.48	3000.0	9.0	N	10.58
9.741	---	45.84	50.00	4.16	3000.0	9.0	N	10.61
9.745	45.90	---	60.00	14.10	3000.0	9.0	N	10.61
10.390	---	42.84	50.00	7.16	3000.0	9.0	N	10.63
10.394	42.77	---	60.00	17.23	3000.0	9.0	N	10.63

Remark: Margin (dB) = Limit – Level (Result)

The emission level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

15. LIST OF TEST EQUIPMENT

Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
FSVA40	Rohde & Schwarz	Signal Analyzer	101593	Apr. 03, 2023 (1Y)
FSVA40	Rohde & Schwarz	Signal Analyzer	101586	Apr. 03, 2023 (1Y)
ZUP36-6	NEMIC-LAMBDA	DC Power Supply	YJV-535Z14-0018	Apr. 04, 2023 (1Y)
ESR	Rohde & Schwarz	EMI Test Receiver	101470	Oct. 18, 2022 (1Y)
310N	Sonoma Instrument	Pre-Amplifier	392756	Oct. 13, 2022 (1Y)
SCU18	Rohde & Schwarz	Signal Conditioning unit	102266	Jul. 11, 2023 (1Y)
SCU40A	Rohde & Schwarz	Signal Conditioning unit	100436	Jan. 18, 2023 (1Y)
8498A	HP	30dB ATTENUATOR	1801A05225	Jul. 11, 2023 (1Y)
Band Reject Filter	PHELCOM.CO	Band Reject Filter (600MHz ~ 1 000MHz)	N/A	Jan. 17, 2023 (1Y)
HPF 1.5GHz	Rohde & Schwarz	High Pass Filter	N/A	Jan. 16, 2023 (1Y)
FMZB 1513	Schwarzbeck	Loop Antenna	1513-235	Mar. 24, 2022 (2Y)
HLP-2008	TDK	Hybrid Antenna	131316	Mar. 07, 2022 (2Y)
BBHA9120D	Schwarzbeck	Horn Antenna	9120D-1366	Jun. 22, 2023 (1Y)
BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170179	Jan. 25, 2023 (1Y)
DT3000	Innco System	Turn Table	DT3000/093	N/A
MA4000-EP	Innco System	Antenna Master	MA4000/332/27030611/L	N/A
CO3000	Innco System	Controller	CO3000/904/37211215/L	N/A
ESR	Rohde & Schwarz	EMI Test Receiver	102602	Mar. 15, 2023 (1Y)
ESH3-Z2	Rohde & Schwarz	PULSE LIMITER	100655	Mar. 13, 2023 (1Y)
NSLK8126	Schwarzbeck	LISN	8126404	Mar. 15, 2023 (1Y)
3825/2	EMCO	AMN	9109-1869	Mar. 15, 2023 (1Y)