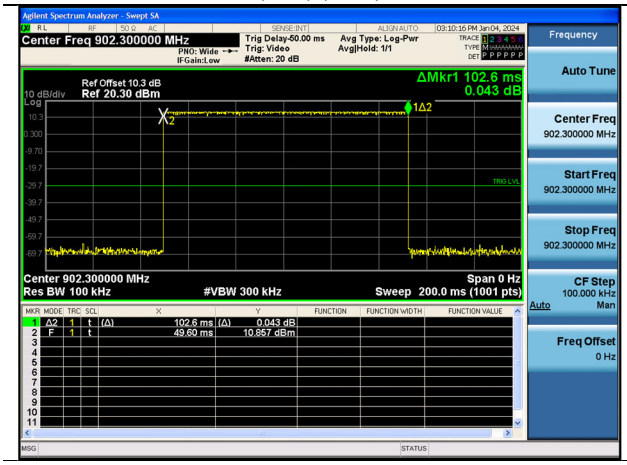
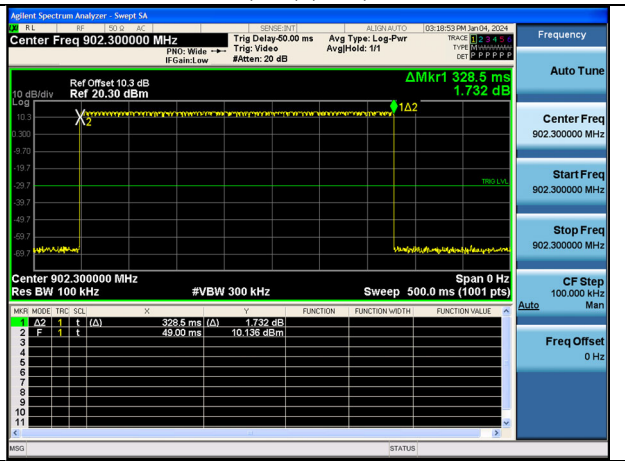
Test Plots (20 dB Bandwidth & Occupied Bandwidth) **-LoRa 125k –**

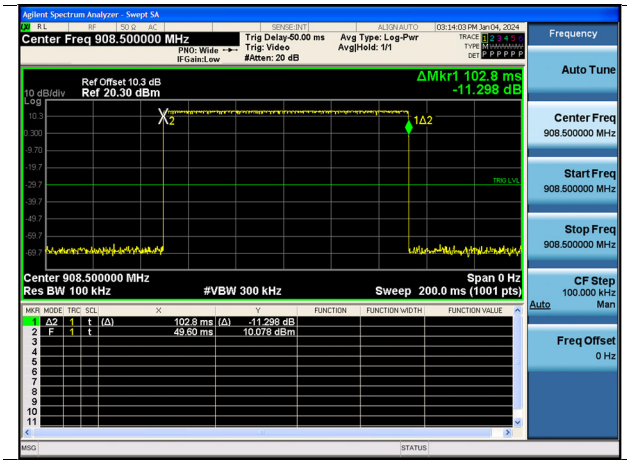
(SF7) (Low)



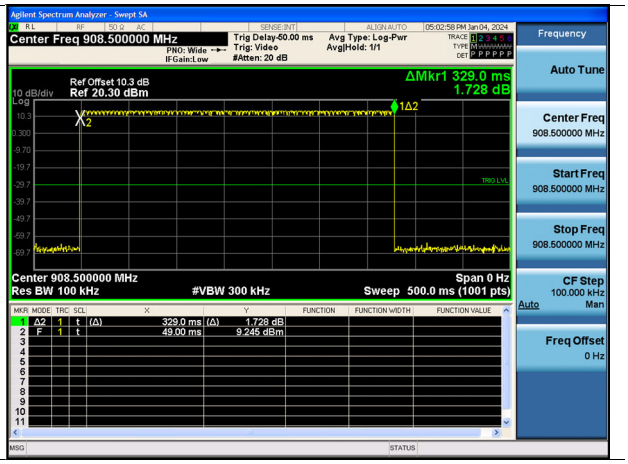
(SF9) (Low)



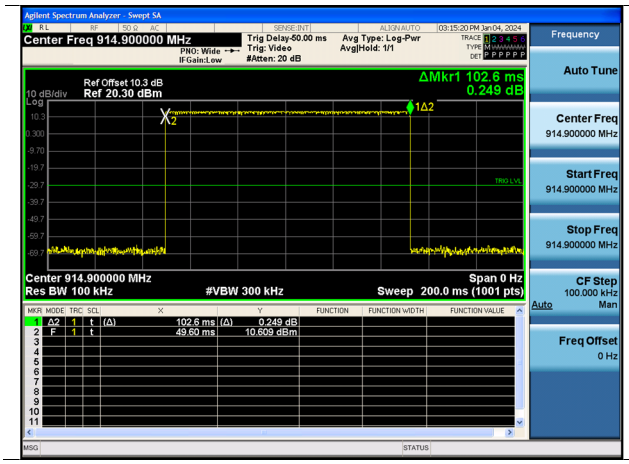
(SF7) (Mid)



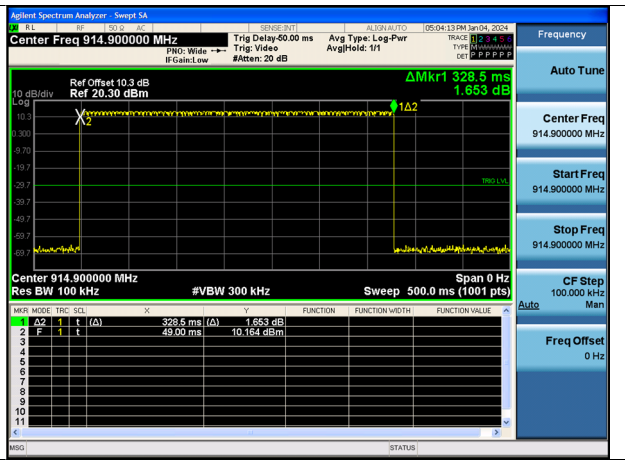
(SF9) (Mid)



(SF7) (High)



(SF9) (High)



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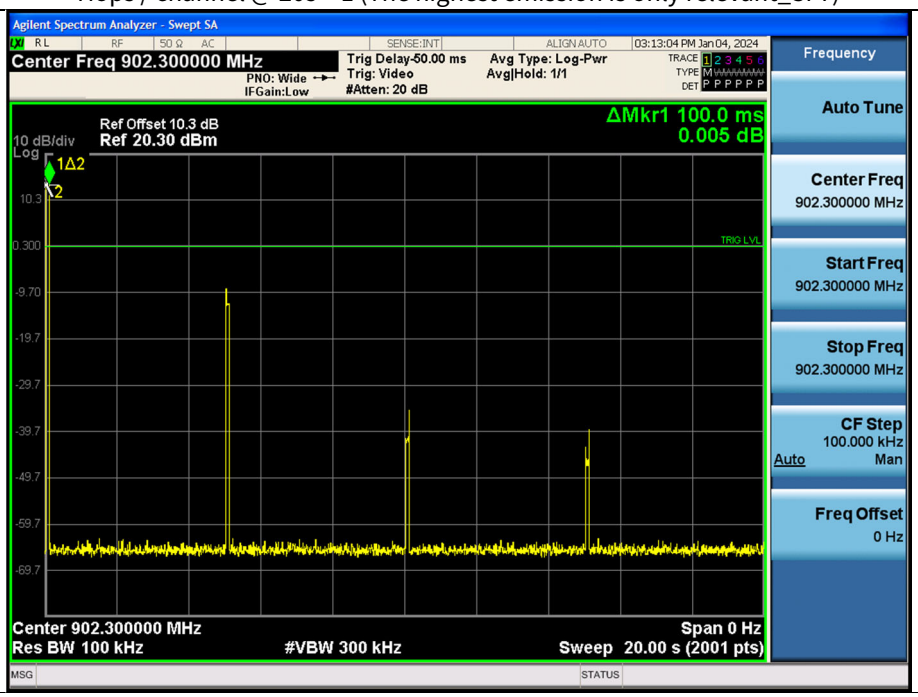
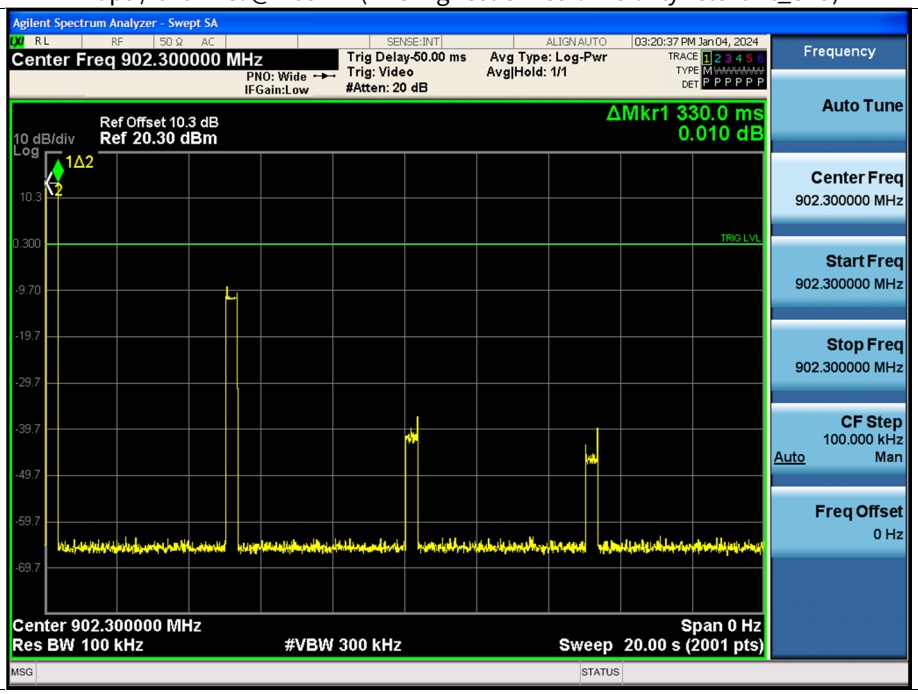
Test Plots(Hops / channel @ 20s = 1)-**LoRa 125k -**

Hops / channel @ 20s = 1 (The highest emission is only relevant_SF7)



Hops / channel @ 20s = 1 (The highest emission is only relevant_SF9)



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10.6 SPURIOUS EMISSIONS

10.6.1 CONDUCTED SPURIOUS EMISSIONS

Test Result : please refer to the plot below.
In order to simplify the report, attached plots were only the worst case channel and data rate.

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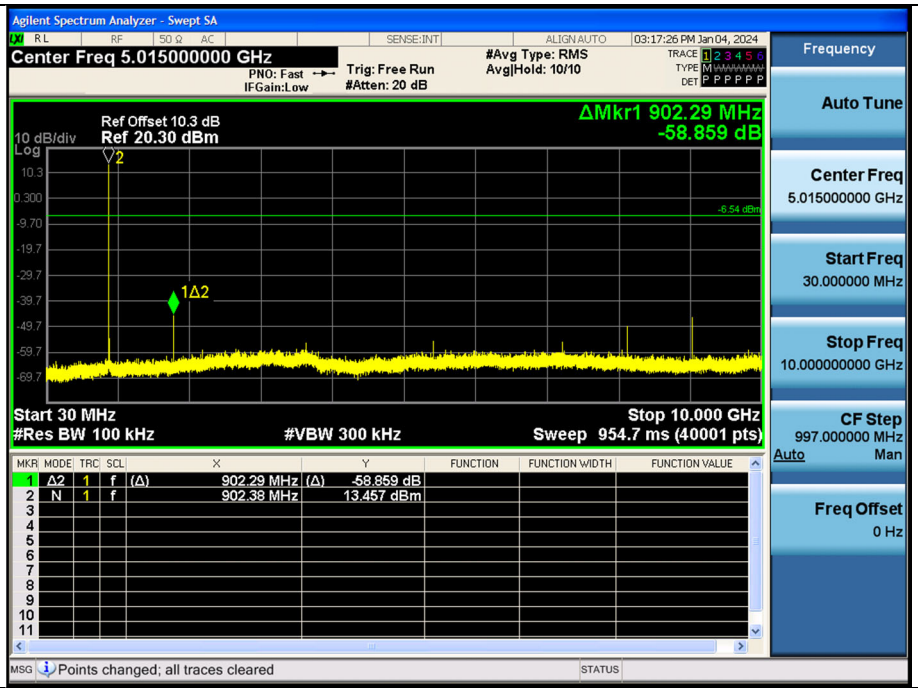
Test Plots(Spurious Emission)-**LoRa 125k -**

Spurious Emission (SF7)



- Limit : -6.543 dBm

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10.6.2 RADIATED SPURIOUS EMISSIONS

Frequency Range : 9 kHz – 30 MHz

Frequency	Measured Value	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBμV/m	dBm/m	dB	(H/V)	dBuV/m	dBuV/m	dB
No Critical peaks found							

Note:

1. The Measured of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to be measured.
2. Distance extrapolation factor = 40log (specific distance / test distance) (dB)
3. Limit line = specific Limits (dBμV) + Distance extrapolation factor
4. Radiated test is performed with hopping off.

Frequency Range : Below 1 GHz

Frequency	Measured Value	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBμV/m	dBm/m	dB	(H/V)	dBuV/m	dBuV/m	dB
No Critical peaks found							

Note:

1. Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Quasi peak detector mode.
2. Radiated test is performed with hopping off.

The report shall not be (partly) reproduced except in full without approval of the laboratory.

Frequency Range : Above 1 GHz

Channel : SF7_Low 902.3 MHz (LoRa 125k)

Frequency	Measured Value	A.F+C.L-A.G+D.F	ANT. POL	Total	Limit	Margin	Detect
[MHz]	[dBμV]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
1804.6	56.48	-9.79	V	46.70	Non restricted Band		PK
1804.6	55.62	-9.79	V	45.84	Non restricted Band		AV
2706.9	58.10	-6.06	V	52.05	73.98	21.94	PK
2706.9	56.02	-6.06	V	49.97	53.98	4.01	AV
3609.2	49.11	-4.79	V	44.32	73.98	29.66	PK
3609.2	43.17	-4.79	V	38.38	53.98	15.60	AV
4511.5	48.53	0.76	V	49.29	73.98	24.69	PK
4511.5	44.28	0.76	V	45.04	53.98	8.94	AV
5413.8	46.84	4.98	V	51.82	73.98	22.16	PK
5413.8	39.63	4.98	V	44.61	53.98	9.37	AV
6316.1	39.88	10.32	V	50.20	Non restricted Band		PK
6316.1	27.05	10.32	V	37.37	Non restricted Band		AV
7218.4	41.55	12.13	V	53.68	Non restricted Band		PK
7218.4	36.03	12.13	V	48.16	Non restricted Band		AV
8120.7	42.49	11.87	V	54.36	73.98	19.62	PK
8120.7	36.56	11.87	V	48.43	53.98	5.55	AV
9023	40.06	14.50	V	54.56	73.98	19.42	PK
9023	30.27	14.50	V	44.77	53.98	9.21	AV

#Note :

1. Non Restricted Band refer to Conducted Spurious emission test result (20dBc)
2. _ : Restricted band

The report shall not be (partly) reproduced except in full without approval of the laboratory.

Frequency	Measured Value	A.F+C.L-A.G+D.F	ANT. POL	Total	Limit	Margin	Detect
[MHz]	[dBμV]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
1804.6	58.54	-9.79	H	48.76	Non restricted Band		PK
1804.6	56.75	-9.79	H	46.97	Non restricted Band		AV
2706.9	59.42	-6.06	H	53.37	73.98	20.62	PK
2706.9	57.89	-6.06	H	51.84	53.98	2.15	AV
3609.2	48.89	-4.79	H	44.10	73.98	29.88	PK
3609.2	42.37	-4.79	H	37.58	53.98	16.40	AV
4511.5	49.61	0.76	H	50.37	73.98	23.61	PK
4511.5	44.81	0.76	H	45.57	53.98	8.41	AV
5413.8	46.22	4.98	H	51.20	73.98	22.78	PK
5413.8	39.96	4.98	H	44.94	53.98	9.04	AV
6316.1	40.02	10.32	H	50.34	Non restricted Band		PK
6316.1	27.77	10.32	H	38.09	Non restricted Band		AV
7218.4	40.88	12.13	H	53.01	Non restricted Band		PK
7218.4	35.46	12.13	H	47.59	Non restricted Band		AV
8120.7	41.69	11.87	H	53.56	73.98	20.42	PK
8120.7	34.53	11.87	H	46.40	53.98	7.58	AV
9023	39.38	14.50	H	53.88	73.98	20.10	PK
9023	30.62	14.50	H	45.12	53.98	8.86	AV

#Note :

1. Non Restricted Band refer to Conducted Spurious emission test result (20dBc)
2. _ : Restricted band

The report shall not be (partly) reproduced except in full without approval of the laboratory.

Channel : SF7_High 914.9 MHz (LoRa 125k)

Frequency	Measured Value	A.F+C.L-A.G+D.F	ANT. POL	Total	Limit	Margin	Detect
[MHz]	[dBμV]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
1829.8	58.39	-9.63	V	48.76	Non restricted Band		PK
1829.8	55.97	-9.63	V	46.34	Non restricted Band		AV
2744.7	58.28	-6.03	V	52.25	73.98	21.73	PK
2744.7	56.14	-6.03	V	50.11	53.98	3.87	AV
3659.6	48.93	-3.46	V	45.47	73.98	28.51	PK
3659.6	42.25	-3.46	V	38.79	53.98	15.19	AV
4574.5	49.73	0.87	V	50.60	73.98	23.38	PK
4574.5	45.86	0.87	V	46.73	53.98	7.25	AV
5489.4	43.86	5.63	V	49.49	Non restricted Band		PK
5489.4	35.44	5.63	V	41.07	Non restricted Band		AV
6404.3	40.59	11.04	V	51.63	Non restricted Band		PK
6404.3	28.69	11.04	V	39.73	Non restricted Band		AV
7319.2	39.74	11.27	V	51.01	73.98	22.97	PK
7319.2	31.26	11.27	V	42.53	53.98	11.45	AV
8234.1	37.85	12.36	V	50.21	73.98	23.77	PK
8234.1	28.54	12.36	V	40.90	53.98	13.08	AV
9149	38.02	13.92	V	51.94	73.98	22.04	PK
9149	25.29	13.92	V	39.21	53.98	14.77	AV

#Note :

1. Non Restricted Band refer to Conducted Spurious emission test result (20dBc)
2. _ : Restricted band

The report shall not be (partly) reproduced except in full without approval of the laboratory.

Frequency	Measured Value	A.F+C.L-A.G+D.F	ANT. POL	Total	Limit	Margin	Detect
[MHz]	[dBμV]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
1829.8	60.28	-9.63	H	50.65	Non restricted Band		PK
1829.8	58.80	-9.63	H	49.17	Non restricted Band		AV
2744.7	**59.97**	**-6.03**	**H**	**53.94**	**73.98**	**20.04**	**PK**
2744.7	**58.29**	**-6.03**	**H**	**52.26**	**53.98**	**1.72**	**AV**
3659.6	47.61	-3.46	H	44.15	73.98	29.83	PK
3659.6	39.96	-3.46	H	36.50	53.98	17.48	AV
4574.5	50.03	0.87	H	50.90	73.98	23.08	PK
4574.5	46.02	0.87	H	46.89	53.98	7.09	AV
5489.4	42.61	5.63	H	48.24	Non restricted Band		PK
5489.4	34.29	5.63	H	39.92	Non restricted Band		AV
6404.3	41.01	11.04	H	52.05	Non restricted Band		PK
6404.3	29.62	11.04	H	40.66	Non restricted Band		AV
7319.2	41.96	11.27	H	53.23	73.98	20.75	PK
7319.2	35.65	11.27	H	46.92	53.98	7.06	AV
8234.1	38.80	12.36	H	51.16	73.98	22.82	PK
8234.1	28.89	12.36	H	41.25	53.98	12.73	AV
9149	38.41	13.92	H	52.33	73.98	21.65	PK
9149	25.92	13.92	H	39.84	53.98	14.14	AV

#Note :

1. Non Restricted Band refer to Conducted Spurious emission test result (20dBc)
2. _ : Restricted band

The report shall not be (partly) reproduced except in full without approval of the laboratory.

Channel : SF9_Low 902.3 MHz (LoRa 125k)

Frequency	Measured Value	A.F+C.L-A.G+D.F	ANT. POL	Total	Limit	Margin	Detect
[MHz]	[dBμV]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
1804.6	57.61	-9.79	H	47.83	Non restricted Band		PK
1804.6	55.72	-9.79	H	45.94	Non restricted Band		AV
2706.9	57.88	-6.06	H	51.83	73.98	22.16	PK
2706.9	56.03	-6.06	H	49.98	53.98	4.01	AV
3609.2	47.91	-4.79	H	43.12	73.98	30.86	PK
3609.2	41.01	-4.79	H	36.22	53.98	17.76	AV
4511.5	49.75	0.76	H	50.51	73.98	23.47	PK
4511.5	45.05	0.76	H	45.81	53.98	8.17	AV
5413.8	47.02	4.98	H	52.00	73.98	21.98	PK
5413.8	40.76	4.98	H	45.74	53.98	8.24	AV
6316.1	39.94	10.32	H	50.26	Non restricted Band		PK
6316.1	27.50	10.32	H	37.82	Non restricted Band		AV
7218.4	40.49	12.13	H	52.62	Non restricted Band		PK
7218.4	33.71	12.13	H	45.84	Non restricted Band		AV
8120.7	40.37	11.87	H	52.24	73.98	21.74	PK
8120.7	32.51	11.87	H	44.38	53.98	9.60	AV
9023	39.34	14.50	H	53.84	73.98	20.14	PK
9023	31.72	14.50	H	46.22	53.98	7.76	AV

#Note :

1. Non Restricted Band refer to Conducted Spurious emission test result (20dBc)
2. _ : Restricted band

The report shall not be (partly) reproduced except in full without approval of the laboratory.

Frequency	Measured Value	A.F+C.L-A.G+D.F	ANT. POL	Total	Limit	Margin	Detect
[MHz]	[dBμV]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
1804.6	57.06	-9.79	V	47.28	Non restricted Band		PK
1804.6	54.96	-9.79	V	45.18	Non restricted Band		AV
2706.9	58.98	-6.06	V	52.93	73.98	21.06	PK
2706.9	57.29	-6.06	V	51.24	53.98	2.75	AV
3609.2	48.38	-4.79	V	43.59	73.98	30.39	PK
3609.2	41.29	-4.79	V	36.50	53.98	17.48	AV
4511.5	48.78	0.76	V	49.54	73.98	24.44	PK
4511.5	44.46	0.76	V	45.22	53.98	8.76	AV
5413.8	45.62	4.98	V	50.60	73.98	23.38	PK
5413.8	38.38	4.98	V	43.36	53.98	10.62	AV
6316.1	39.77	10.32	V	50.09	Non restricted Band		PK
6316.1	27.36	10.32	V	37.68	Non restricted Band		AV
7218.4	41.18	12.13	V	53.31	Non restricted Band		PK
7218.4	35.24	12.13	V	47.37	Non restricted Band		AV
8120.7	41.74	11.87	V	53.61	73.98	20.37	PK
8120.7	34.59	11.87	V	46.46	53.98	7.52	AV
9023	38.91	14.50	V	53.41	73.98	20.57	PK
9023	31.55	14.50	V	46.05	53.98	7.93	AV

#Note :

1. Non Restricted Band refer to Conducted Spurious emission test result (20dBc)
2. _ : Restricted band

The report shall not be (partly) reproduced except in full without approval of the laboratory.

Channel : SF9_High 914.9 MHz (LoRa 125k)

Frequency	Measured Value	A.F+C.L-A.G+D.F	ANT. POL	Total	Limit	Margin	Detect
[MHz]	[dBμV]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
1829.8	60.17	-9.63	V	50.54	Non restricted Band		PK
1829.8	58.76	-9.63	V	49.13	Non restricted Band		AV
2744.7	59.93	-6.03	V	53.90	73.98	20.08	PK
2744.7	58.20	-6.03	V	52.17	53.98	1.81	AV
3659.6	48.71	-3.46	V	45.25	73.98	28.73	PK
3659.6	42.23	-3.46	V	38.77	53.98	15.21	AV
4574.5	48.62	0.87	V	49.49	73.98	24.49	PK
4574.5	44.81	0.87	V	45.68	53.98	8.30	AV
5489.4	43.19	5.63	V	48.82	Non restricted Band		PK
5489.4	33.47	5.63	V	39.10	Non restricted Band		AV
6404.3	40.98	11.04	V	52.02	Non restricted Band		PK
6404.3	27.25	11.04	V	38.29	Non restricted Band		AV
7319.2	40.93	11.27	V	52.20	73.98	21.78	PK
7319.2	33.63	11.27	V	44.90	53.98	9.08	AV
8234.1	38.47	12.36	V	50.83	73.98	23.15	PK
8234.1	26.84	12.36	V	39.20	53.98	14.78	AV
9149	37.35	13.92	V	51.27	73.98	22.71	PK
9149	24.23	13.92	V	38.15	53.98	15.83	AV

#Note :

1. Non Restricted Band refer to Conducted Spurious emission test result (20dBc)
2. _ : Restricted band

The report shall not be (partly) reproduced except in full without approval of the laboratory.

Frequency	Measured Value	A.F+C.L-A.G+D.F	ANT. POL	Total	Limit	Margin	Detect
[MHz]	[dBμV]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
1829.8	58.66	-9.63	H	49.03	Non restricted Band		PK
1829.8	57.12	-9.63	H	47.49	Non restricted Band		AV
2744.7	59.21	-6.03	H	53.18	73.98	20.80	PK
2744.7	57.34	-6.03	H	51.31	53.98	2.67	AV
3659.6	48.42	-3.46	H	44.96	73.98	29.02	PK
3659.6	40.38	-3.46	H	36.92	53.98	17.06	AV
4574.5	50.14	0.87	H	51.01	73.98	22.97	PK
4574.5	46.07	0.87	H	46.94	53.98	7.04	AV
5489.4	42.27	5.63	H	47.90	Non restricted Band		PK
5489.4	31.69	5.63	H	37.32	Non restricted Band		AV
6404.3	41.12	11.04	H	52.16	Non restricted Band		PK
6404.3	27.95	11.04	H	38.99	Non restricted Band		AV
7319.2	41.60	11.27	H	52.87	73.98	21.11	PK
7319.2	36.11	11.27	H	47.38	53.98	6.60	AV
8234.1	38.55	12.36	H	50.91	73.98	23.07	PK
8234.1	28.52	12.36	H	40.88	53.98	13.10	AV
9149	36.28	13.92	H	50.20	73.98	23.78	PK
9149	24.20	13.92	H	38.12	53.98	15.86	AV

#Note :

1. Non Restricted Band refer to Conducted Spurious emission test result (20dBc)
2. _ : Restricted band

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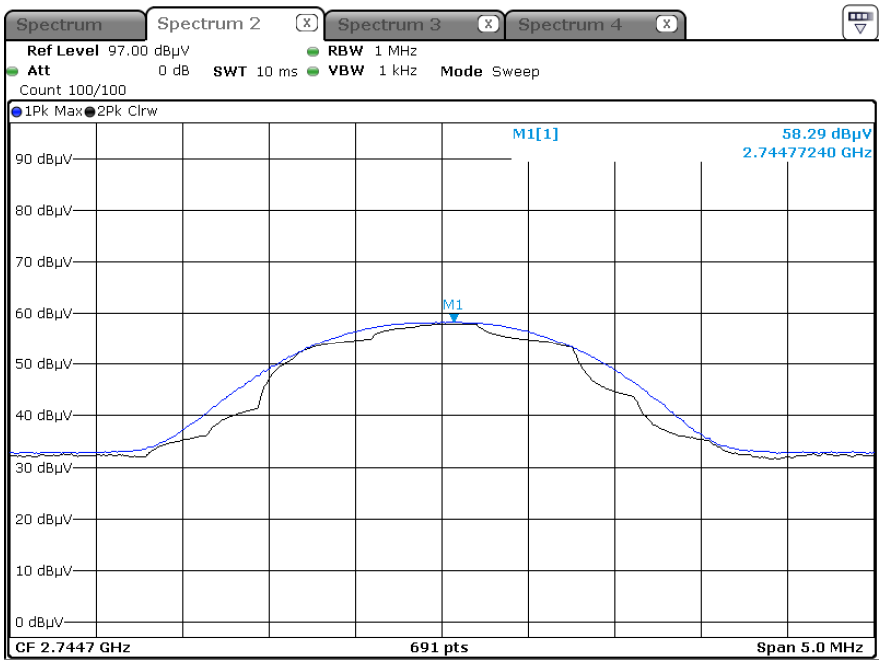
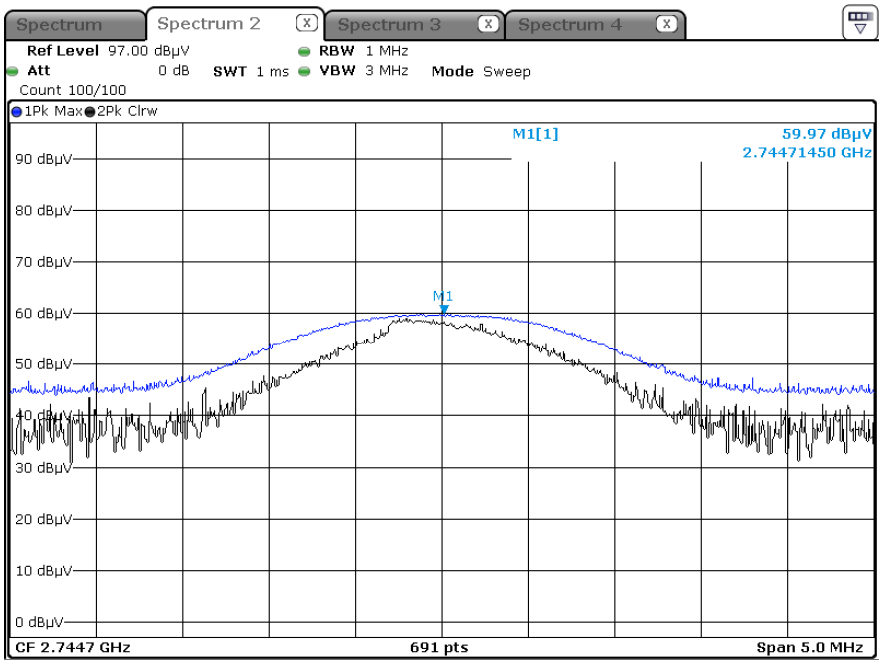
RESULT PLOTS

Radiated Spurious Emissions plot – Average Result (SF7_High 3rd Harmonic, Z-H)



Radiated Spurious Emissions plot – Peak Result (SF7_High 3rd Harmonic, Z-H)



Note : Only the worst case plots for Radiated Spurious Emissions.

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11. LIST OF TEST EQUIPMENT

Conducted Test

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
LISN	ENV216	Rohde & Schwarz	102245	08/02/2024	Annual
EMI Test Receiver	ESR	Rohde & Schwarz	101910	05/26/2024	Annual
Temperature Chamber	SU-642	ESPEC	0093008124	02/22/2024	Annual
Signal Analyzer	N9030A	Keysight	MY49431210	12/19/2024	Annual
Power Measurement Set	OSP 120	Rohde & Schwarz	101231	06/09/2024	Annual
Power Meter	N1911A	Agilent	MY45100523	03/06/2024	Annual
Power Sensor	N1921A	Agilent	MY57820067	03/06/2024	Annual
Power Splitter	11667B	Hewlett Packard	05001	04/19/2024	Annual
DC Power Supply	E3632A	H.P	KR75303243	04/24/2024	Annual
Attenuator(10 dB)	8493C	Hewlett Packard	07560	06/12/2024	Annual
Software	EMC32	Rohde & Schwarz	N/A	N/A	N/A
FCC WLAN&BT&BLE Conducted Test Software v3.0	N/A	HCT CO., LTD.	N/A	N/A	N/A

Note:

1. Equipment listed above that calibrated during the testing period was set for test after the calibration.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

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Radiated Test

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
Controller(Antenna mast)	CO3000	Innco system	CO3000-4p	N/A	N/A
Antenna Position Tower	MA4640/800-XP-EP	Innco system	N/A	N/A	N/A
Controller	EM1000	Audix	060520	N/A	N/A
Turn Table	N/A	Audix	N/A	N/A	N/A
Loop Antenna	FMZB 1513	Rohde & Schwarz	1513-333	03/17/2024	Biennial
Hybrid Antenna	VULB 9168	Schwarzbeck	760	02/24/2025	Biennial
Horn Antenna	BBHA 9120D	Schwarzbeck	02299	03/24/2024	Biennial
Horn Antenna (15GHz ~ 40 GHz)	BBHA9170	Schwarzbeck	BBHA9170342	09/29/2024	Biennial
Spectrum Analyzer	FSV40	Rohde & Schwarz	100901	03/27/2024	Annual
Signal Analyzer	N9030A	Agilent	MY52350879	04/13/2024	Annual
RF Switching System	FMSR-04B (3G HPF+LNA)	T&M SYSTEM	S2L1	12/27/2024	Annual
RF Switching System	FMSR-04B (10dB ATT+LNA)	T&M SYSTEM	S2L2	12/27/2024	Annual
RF Switching System	FMSR-04B (3dB ATT+LNA)	T&M SYSTEM	S2L3	12/27/2024	Annual
RF Switching System	FMSR-04B (LNA)	T&M SYSTEM	S2L4	12/27/2024	Annual
RF Switching System	FMSR-04B (7G HPF+LNA)	T&M SYSTEM	S2L5	12/27/2024	Annual
Power Amplifier	CBL18265035	CERNEX	22966	11/17/2024	Annual
Power Amplifier	CBL26405040	CERNEX	25956	03/02/2024	Annual
High Pass Filter	WHKX10-900-1000-15000-40SS	Wainwright Instruments	16	08/01/2024	Annual

Note:
1. Equipment listed above that calibrated during the testing period was set for test after the calibration.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.
3. Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5(Version : 2017).

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12. ANNEX A_ TEST SETUP PHOTO

Please refer to test setup photo file no. as follows;

No.	Description
1	HCT-RF-2402-FC022-P

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