9.4 POWER SPECTRAL DENSITY

BLE 125K		Power Spectral Density (PSD)	
Frequency (MHz)	Channel No.	Result (dBm/3kHz)	Limit (dBm/3kHz)
2402	0	-0.139	8.000
2440	19	-0.443	8.000
2480	39	-0.817	8.000

BLE 500K		Power Spectral Density (PSD)	
Frequency (MHz)	Channel No.	Result (dBm/3kHz)	Limit (dBm/3kHz)
2402	0	-0.252	8.000
2440	19	-0.619	8.000
2480	39	-1.033	8.000

BLE 1M		Power Spectral Density (PSD)	
Frequency (MHz)	Channel No.	Result (dBm/3kHz)	Limit (dBm/3kHz)
2402	0	-9.343	8.000
2440	19	-9.719	8.000
2480	39	-10.245	8.000

BLE 2M		Power Spectral Density (PSD)	
Frequency (MHz)	Channel No.	Result (dBm/3kHz)	Limit (dBm/3kHz)
2402	0	-11.715	8.000
2440	19	-12.233	8.000
2480	39	-12.790	8.000

Note :

1. The output power results in plot include the spectrum offset, which is a combination loss of the attenuator and the cable used for testing

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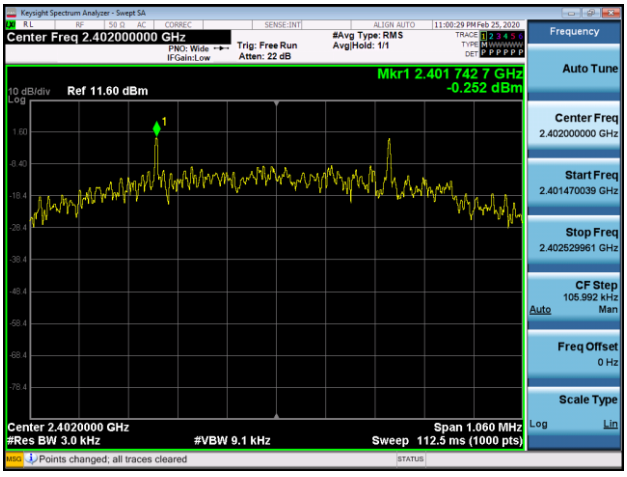
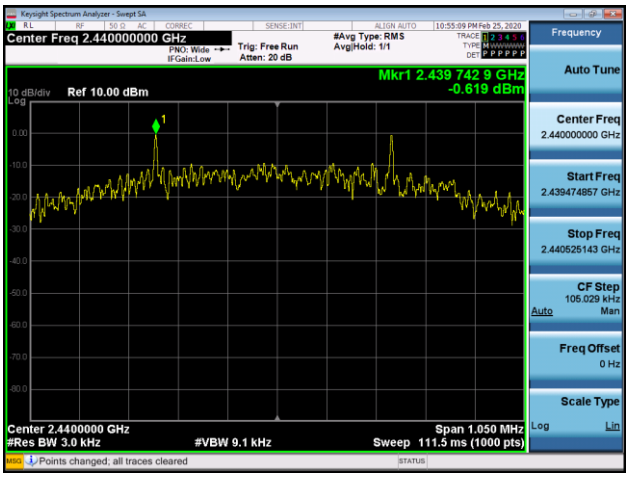
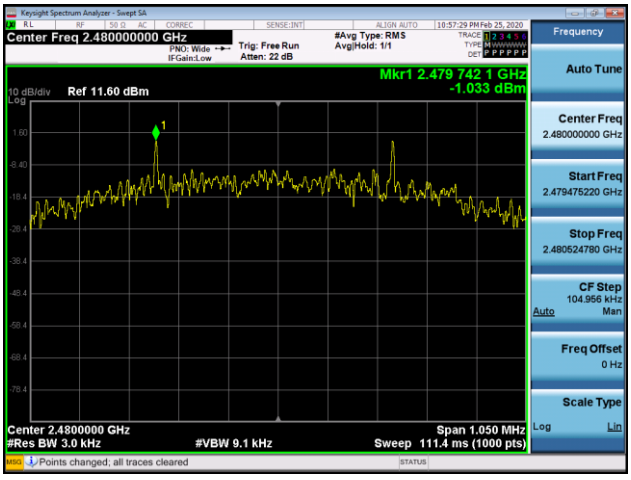
▣ Test Plots (PSD)

BLE 125K (CH0 : 2402 MHz)	BLE 500K (CH0 : 2402 MHz)
	
BLE 125K (CH19 : 2440 MHz)	**BLE 500K (CH19 : 2440 MHz)**
	
BLE 125K (CH39 : 2480 MHz)	**BLE 500K (CH39 : 2480 MHz)**
	

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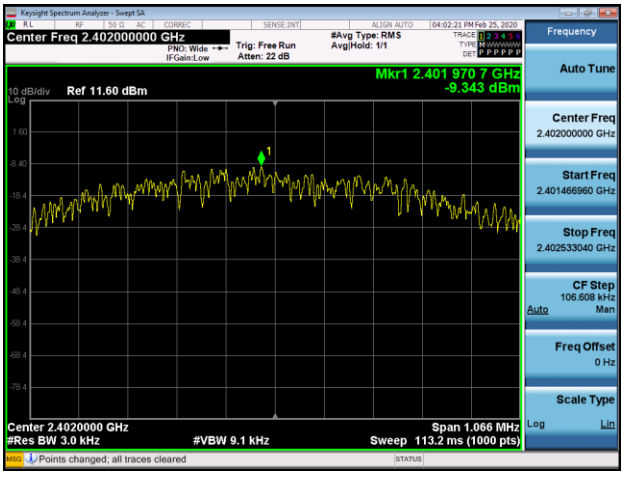
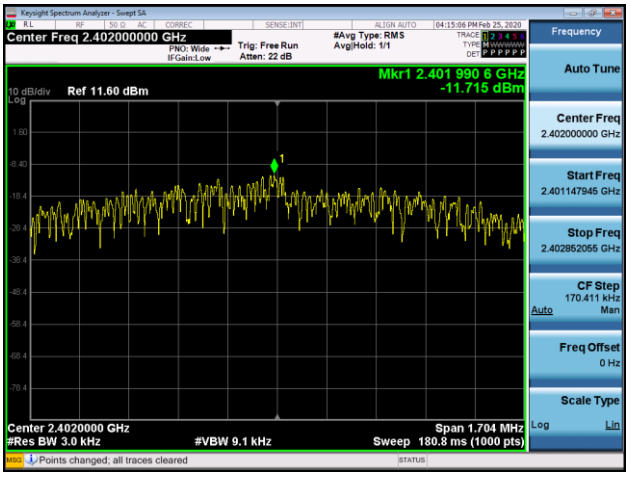
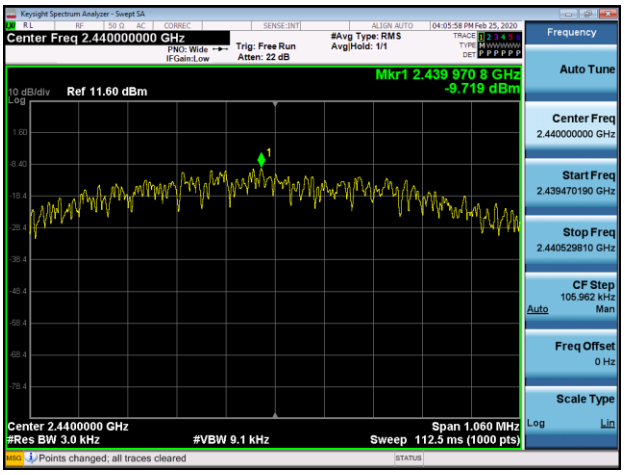
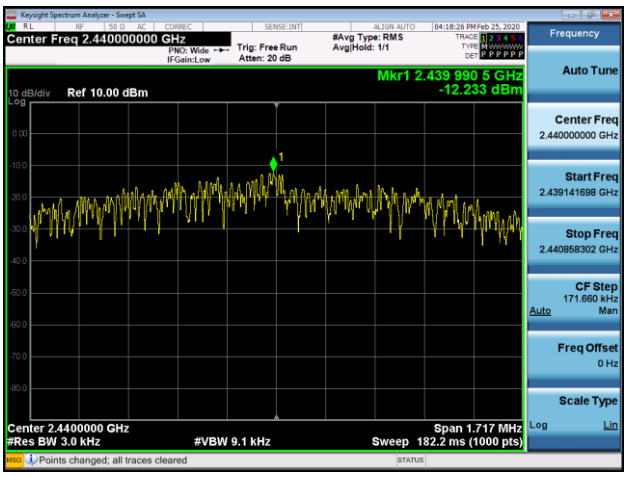
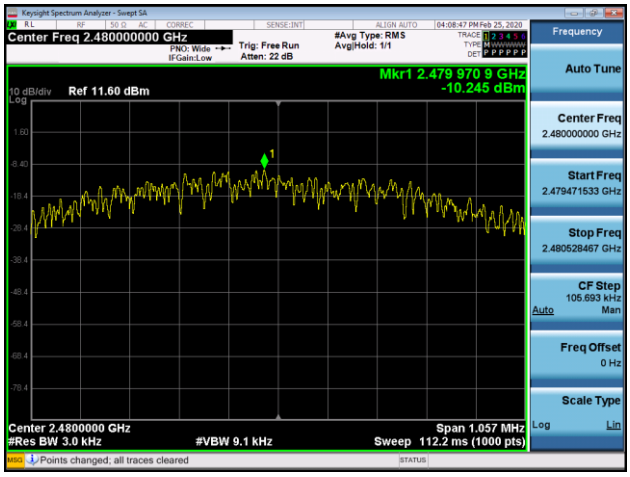
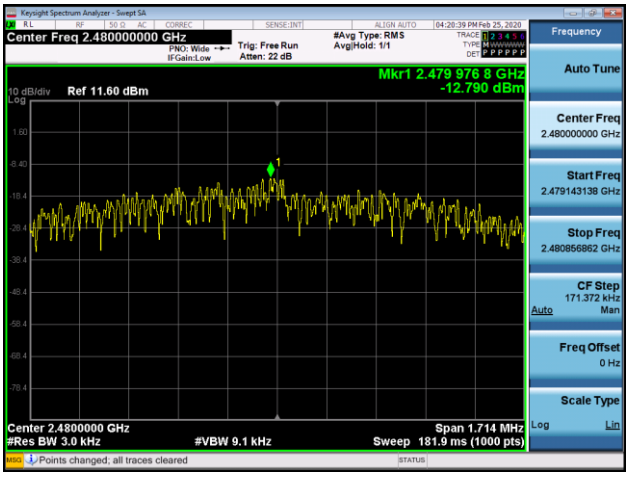
▣ Test Plots (PSD)

BLE 1M (CH0 : 2402 MHz)	BLE 2M (CH0 : 2402 MHz)
	
BLE 1M (CH19 : 2440 MHz)	**BLE 2M (CH19 : 2440 MHz)**
	
BLE 1M (CH39 : 2480 MHz)	**BLE 2M (CH39 : 2480 MHz)**
	

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9.5 CONDUCTED BAND EDGE & SPURIOUS EMISSIONS

Out of Band Emissions at the Band Edge

BLE 125K			Test Result		
Frequency [MHz]	Channel No.	Position	Measured Level [dB]	Limit [dBc]	Pass/Fail
2402	0	Lower	48.52	20	Pass
2480	39	Upper	52.88	20	Pass

BLE 500K			Test Result		
Frequency [MHz]	Channel No.	Position	Measured Level [dB]	Limit [dBc]	Pass/Fail
2402	0	Lower	48.60	20	Pass
2480	39	Upper	46.73	20	Pass

BLE 1M			Test Result		
Frequency [MHz]	Channel No.	Position	Measured Level [dB]	Limit [dBc]	Pass/Fail
2402	0	Lower	47.66	20	Pass
2480	39	Upper	47.74	20	Pass

BLE 2M			Test Result		
Frequency [MHz]	Channel No.	Position	Measured Level [dB]	Limit [dBc]	Pass/Fail
2402	0	Lower	32.65	20	Pass
2480	39	Upper	48.01	20	Pass

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Conducted Spurious Emissions

BLE 125K			Test Result		
Frequency [MHz]	Channel No.	Position	Measured Level [dBc]	Limit [dBc]	Pass/Fail
2402	0	Lower	45.22	20	Pass
2440	19	Middle	48.86	20	Pass
2480	39	Upper	49.71	20	Pass

BLE 500K			Test Result		
Frequency [MHz]	Channel No.	Position	Measured Level [dBc]	Limit [dBc]	Pass/Fail
2402	0	Lower	51.70	20	Pass
2440	19	Middle	52.89	20	Pass
2480	39	Upper	50.25	20	Pass

BLE 1M			Test Result		
Frequency [MHz]	Channel No.	Position	Measured Level [dBc]	Limit [dBc]	Pass/Fail
2402	0	Lower	51.69	20	Pass
2440	19	Middle	50.08	20	Pass
2480	39	Upper	51.89	20	Pass

BLE 2M			Test Result		
Frequency [MHz]	Channel No.	Position	Measured Level [dBc]	Limit [dBc]	Pass/Fail
2402	0	Lower	51.25	20	Pass
2440	19	Middle	52.29	20	Pass
2480	39	Upper	51.18	20	Pass

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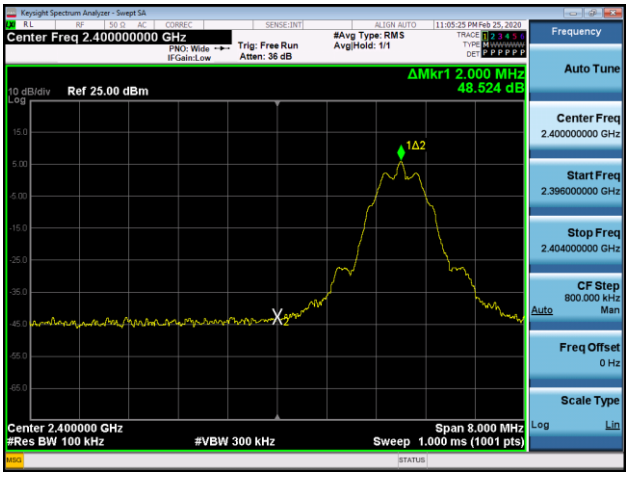
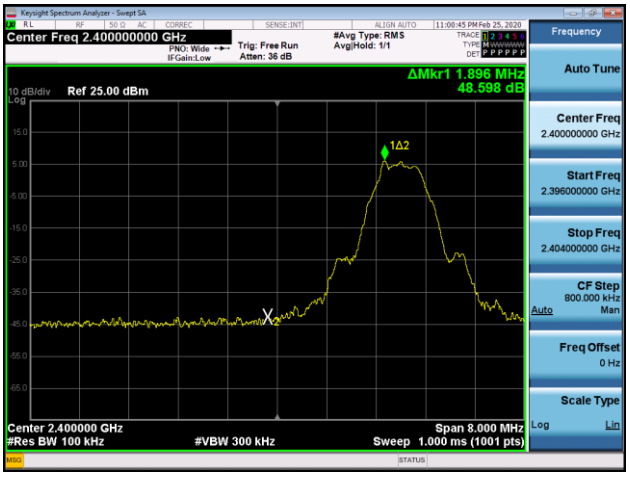
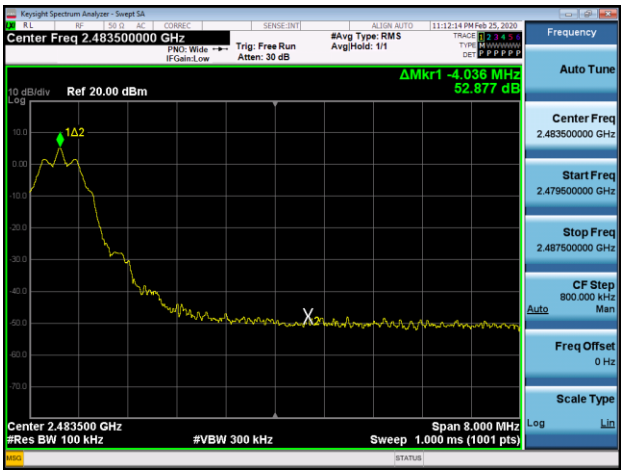
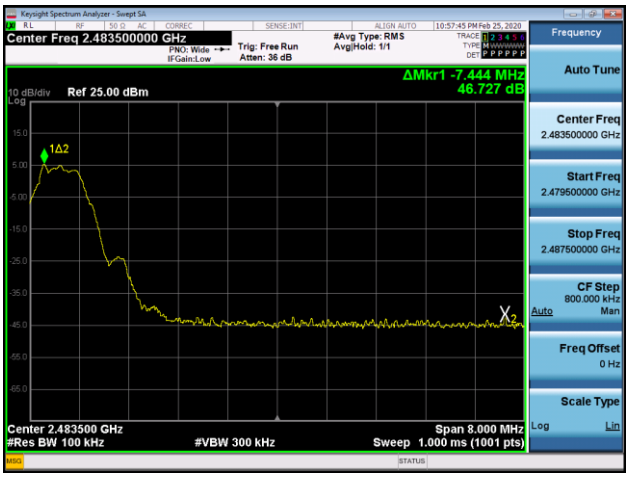
▣ Test Plots (Conducted Band Edge)

BLE 125K (CH0 : 2402 MHz)	BLE 500K (CH0 : 2402 MHz)
	
BLE 125K (CH39 : 2480 MHz)	**BLE 500K (CH39 : 2480 MHz)**
	

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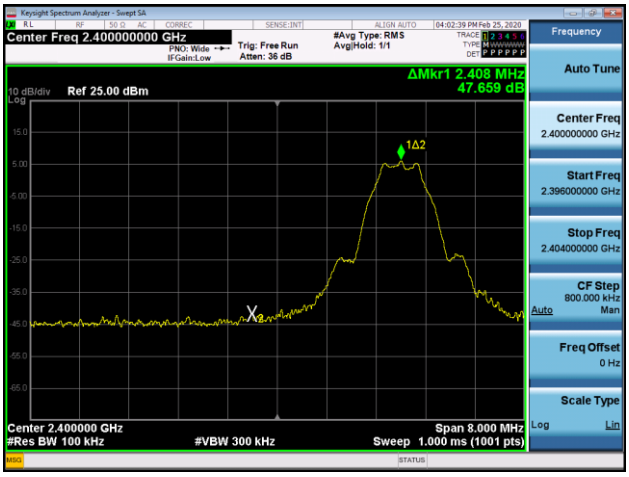
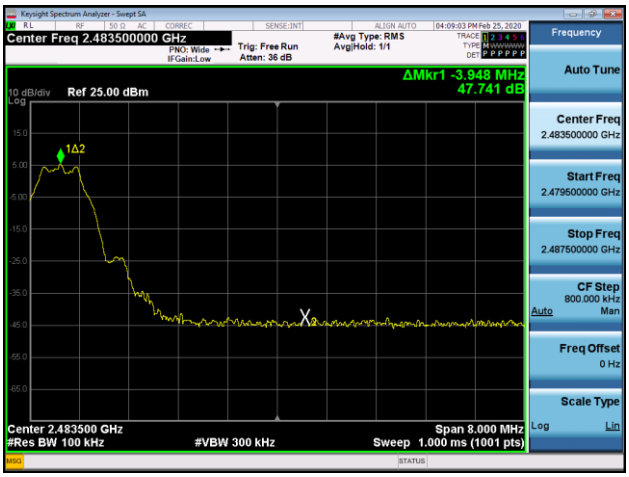
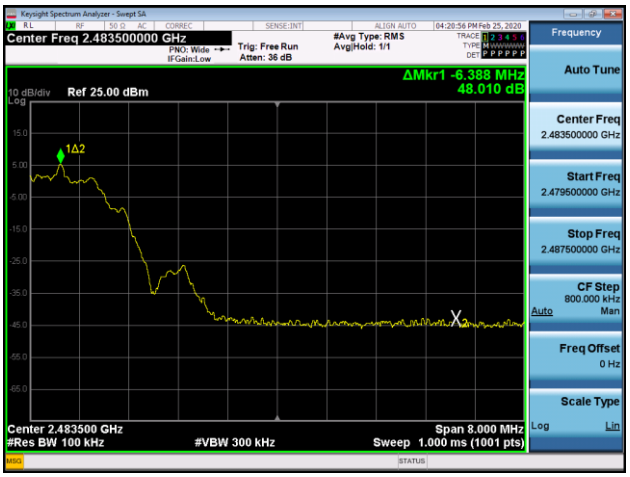
▣ Test Plots (Conducted Band Edge)

BLE 1M (CH0 : 2402 MHz)	BLE 2M (CH0 : 2402 MHz)
	
BLE 1M (CH39 : 2480 MHz)	**BLE 2M (CH39 : 2480 MHz)**
	

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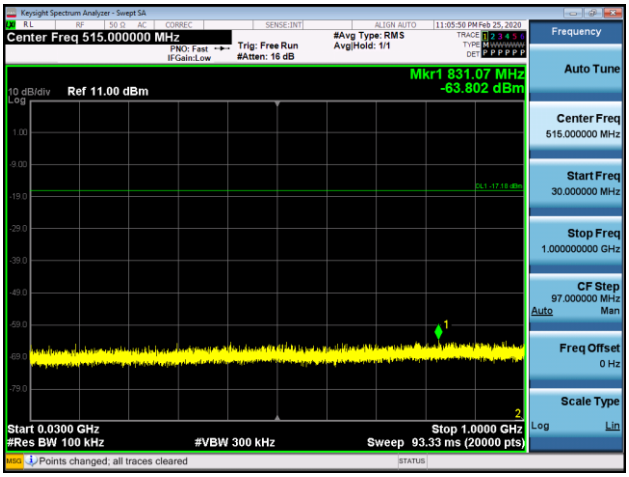
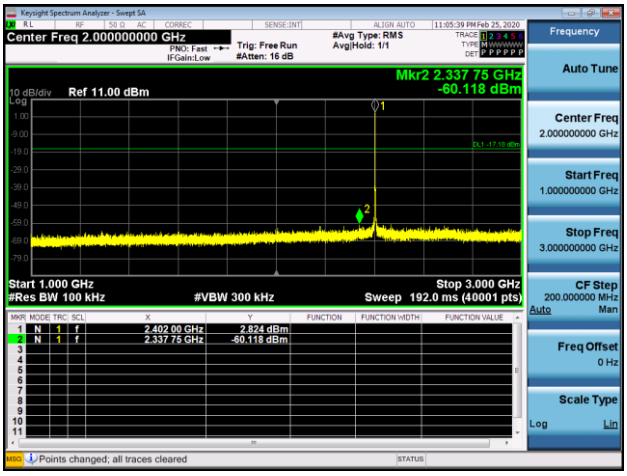
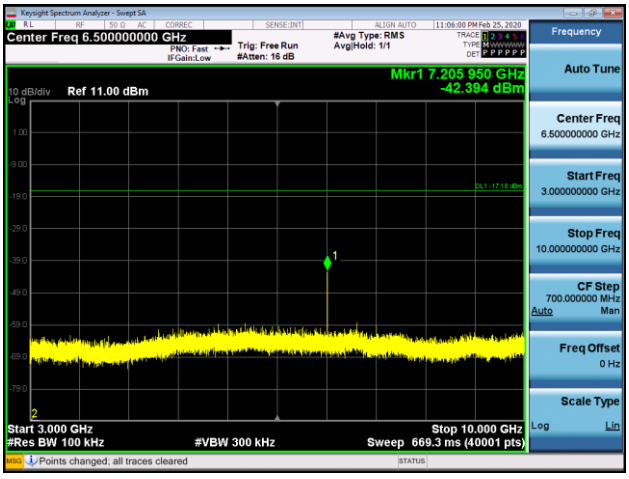
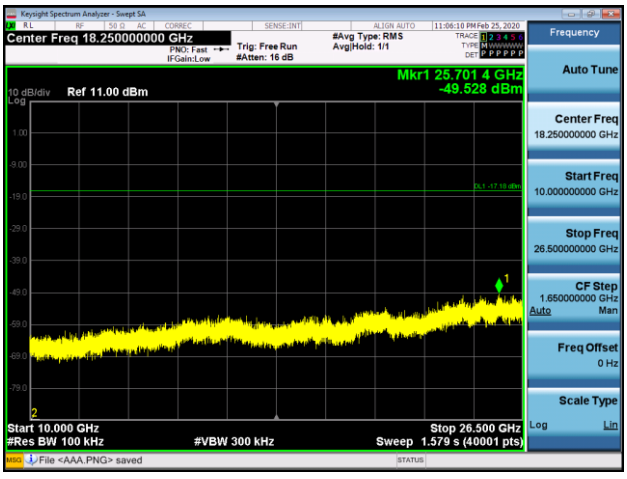
▣ Test Plots (Conducted Spurious Emission)

BLE 125K (CH0 : 2402 MHz)	
30 MHz – 1 GHz	**1 GHz – 3 GHz**
	
3 GHz – 10 GHz	**10 GHz – 26.5 GHz**
	

Note:
The plots included in this report are only at the worst-case channel and data rate

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9.6 RADIATED SPURIOUS EMISSIONS

Frequency Range : 9 kHz – 30MHz

CH 0

Frequency (MHz)	Polarization	Reading (dBuV)	Corr.[1)] (dB)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement Type
0.036	H	7.0	20.9	27.9	116.5	88.6	QP
0.036	V	7.6	20.9	28.5	116.5	88.0	QP
0.068	H	-6.7	20.2	13.5	110.9	97.4	QP
0.155	H	2.6	19.8	22.4	103.8	81.4	QP
0.158	V	-7.9	19.8	11.9	103.6	91.7	QP

Notes:
1. The measurement distance is 3 meters.
2. Distance extrapolation factor = 40 log (specific distance / test distance) (dB)
3. Limit line = Specific Limits (dBuV) + Distance extrapolation factor
4. Correction Factor: Antenna Factor + Cable loss
5. The other Frequencies are attenuated more than 20 dB below the permissible limits.
   In order to simplify the report, attached worst-case mode result.

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Frequency Range : Below 1 GHz

CH 0

Frequency (MHz)	Polarization	Reading (dBuV)	Corr.[1)] (dB)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement Type
33.977	V	24.7	-2.5	22.2	40	17.8	QP
499.965	H	33.2	-2.1	31.1	46	14.9	QP
499.965	V	37.1	-2.1	35.0	46	11.0	QP
624.998	H	35.3	-0.2	35.1	46	10.9	QP
624.998	V	40.5	-0.2	40.3	46	5.7	QP
875.064	H	26.8	3.6	30.4	46	15.6	QP

CH 19

Frequency (MHz)	Polarization	Reading (dBuV)	Corr.[1)] (dB)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement Type
32.891	V	31.5	-1.7	29.8	40	10.2	QP
499.965	V	37.0	-2.1	34.9	46	11.1	QP
500.002	H	35.2	-2.1	33.1	46	12.9	QP
624.999	H	35.9	-0.2	35.7	46	10.3	QP
625.010	V	41.1	-0.2	40.9	46	5.1	QP
875.017	H	30.6	3.6	34.2	46	11.8	QP

CH 39

Frequency (MHz)	Polarization	Reading (dBuV)	Corr.[1)] (dB)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement Type
34.082	V	31.0	-2.5	28.5	40	11.5	QP
499.999	H	35.1	-2.1	33.0	46	13.0	QP
500.012	V	38.6	-2.1	36.5	46	9.5	QP
625.005	V	41.2	-0.2	41.0	46	5.0	QP
625.007	H	35.6	-0.2	35.4	46	10.6	QP
875.011	H	30.8	3.6	34.4	46	11.6	QP

Notes:

1. Correction Factor: Antenna Factor + Cable loss + Preamplifier Gain

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Frequency Range : Above 1 GHz

CH 0

Frequency (MHz)	Polarization	Reading (dBuV)		Factor (dB)		Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		AV	PK	Corr.[1)]	Duty	AV	PK	AV	PK	AV	PK
4801.284	H	33.8	46.6	-0.2	0.82	34.4	46.4	54	74	19.6	27.6
4803.654	V	33.7	46.8	-0.2	0.82	34.3	46.6	54	74	19.7	27.4
24820.64	H	36.1	49.3	12.1	0.82	49.0	61.4	54	74	5.0	12.6
24818.61	V	36.3	49.7	12.1	0.82	49.2	61.8	54	74	4.8	12.2

CH 19

Frequency (MHz)	Polarization	Reading (dBuV)		Factor (dB)		Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		AV	PK	Corr.[1)]	Duty	AV	PK	AV	PK	AV	PK
4880.004	H	33.9	47.1	-0.2	0.82	34.5	46.9	54	74	19.5	27.1
4880.091	V	33.9	47.5	-0.2	0.82	34.5	47.3	54	74	19.5	26.7
24822.81	H	36.8	50.4	12.1	0.82	49.7	62.5	54	74	4.3	11.5
24819.28	V	36.7	49.7	12.1	0.82	49.6	61.8	54	74	4.4	12.2

CH 39

Frequency (MHz)	Polarization	Reading (dBuV)		Factor (dB)		Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		AV	PK	Corr.[1)]	Duty	AV	PK	AV	PK	AV	PK
4960.933	H	33.3	46.4	0.0	0.82	34.1	46.4	54	74	19.9	27.6
4961.698	V	33.4	46.4	0.0	0.82	34.2	46.4	54	74	19.8	27.6
24819.07	H	36.7	50.0	12.1	0.82	49.6	62.1	54	74	4.4	11.9
24818.63	V	36.6	50.5	12.1	0.82	49.5	62.6	54	74	4.5	11.4

Notes:

1. Correction Factor: Antenna Factor + Cable loss + Preamplifier Gain
2. AV Level = Measured Power(dBm) + Correction Factor(dB) + Duty Cycle Factor(dB)

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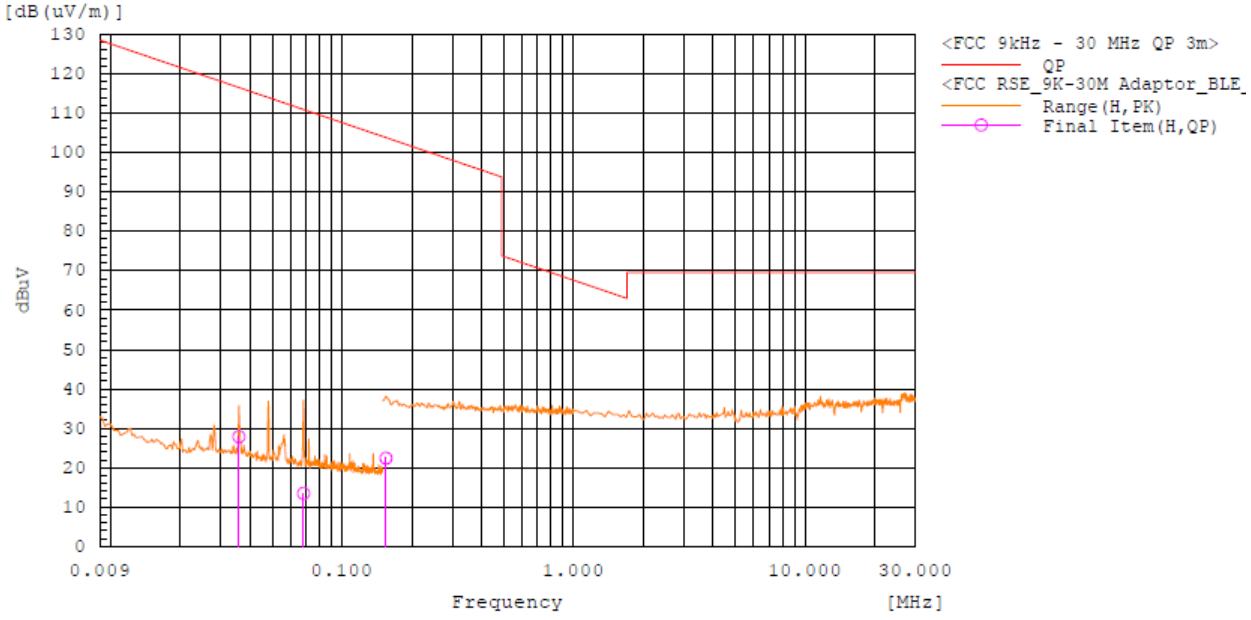
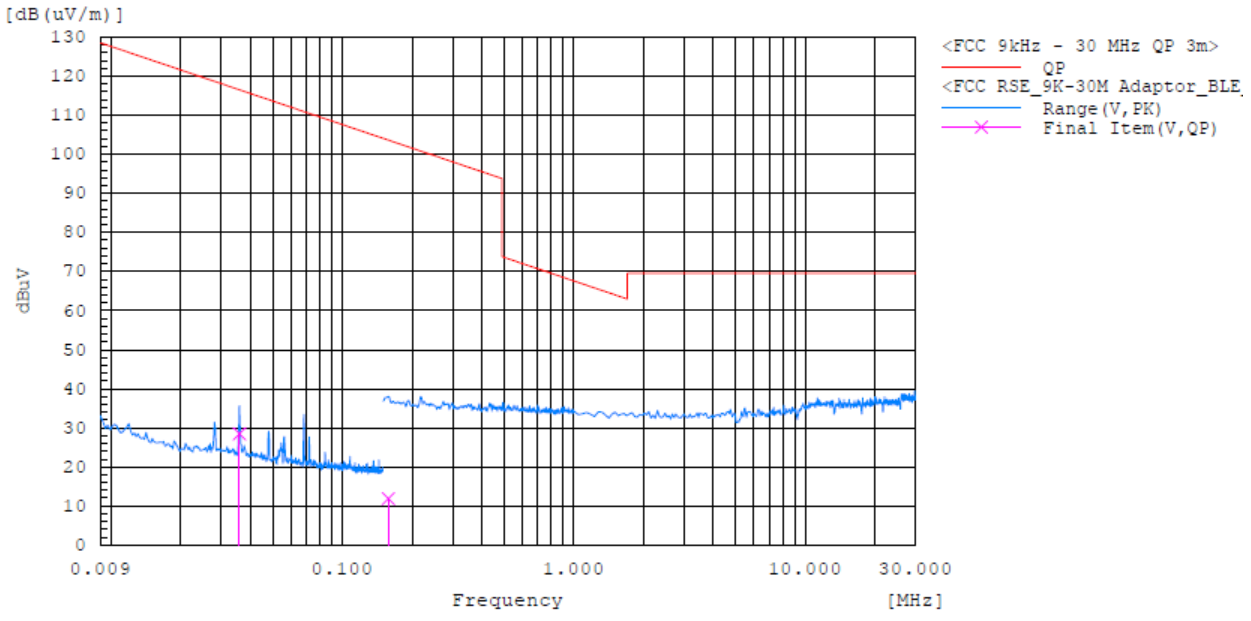
▣ Test Plots

Radiated Spurious Emission 9 kHz – 30 MHz (Antenna Position 90°)



Radiated Spurious Emission 9 kHz – 30 MHz (Antenna Position 180°)



Note:
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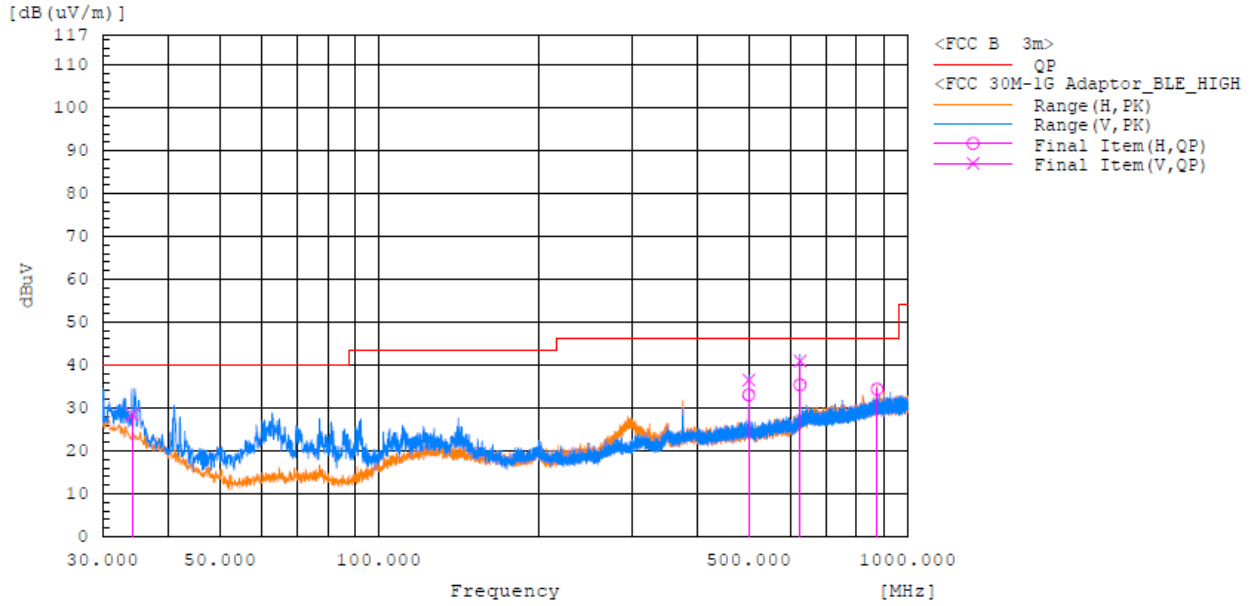
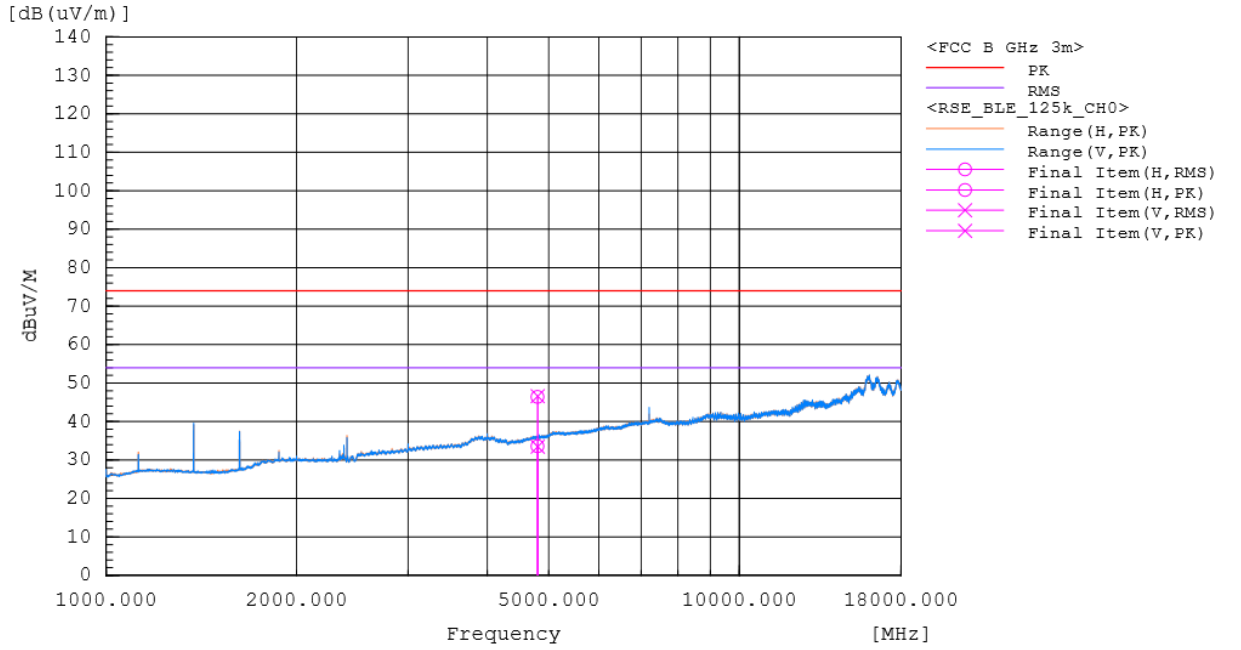
▣ Test Plots

Radiated Spurious Emission 30 MHz – 1 GHz



Radiated Spurious Emission 1 GHz – 18 GHz



Note:
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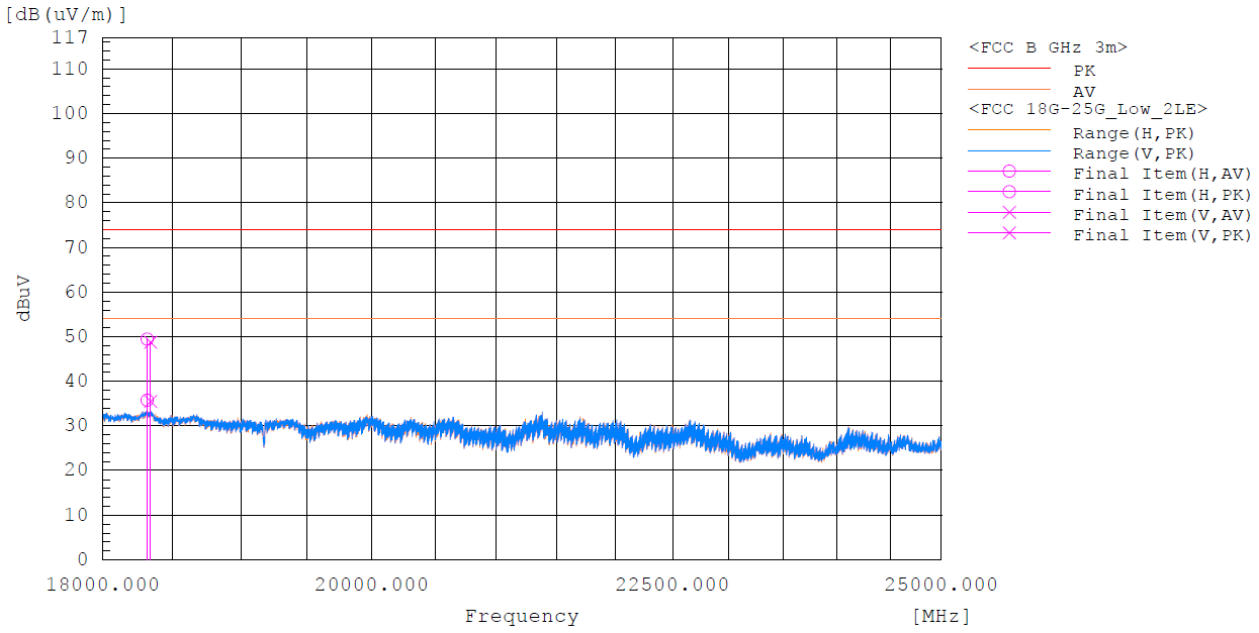
▣ Test Plots

Radiated Spurious Emission 18 GHz – 25 GHz



Note:
The worst-case plots are included in this report.

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9.7 RADIATED RESTRICTED BAND EDGES

Operating Frequency: 2402 MHz
Channel No.: CH 0
Data Rate: 125K

Frequency (MHz)	Polarization	Reading (dBuV)		Factor (dB)		Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		AV	PK	Corr.[1)]	Duty	AV	PK	AV	PK	AV	PK
2390	H	35.6	48.7	-6.1	0.82	30.3	42.6	54	74	23.7	31.4
2390	V	35.0	48.7	-6.1	0.82	29.7	42.6	54	74	24.3	31.4

Operating Frequency: 2480 MHz
Channel No.: CH 39
Data Rate: 125K

Frequency (MHz)	Polarization	Reading (dBuV)		Factor (dB)		Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		AV	PK	Corr.[1)]	Duty	AV	PK	AV	PK	AV	PK
2483.5	H	42.7	61.3	-5.6	0.82	37.9	55.7	54	74	16.1	18.3
2483.5	V	42.8	61.7	-5.6	0.82	38.0	56.1	54	74	16.0	17.9

Notes:
1. Correction Factor: Antenna Factor + Cable loss
2. AV Level = Measured Power(dBm) + Correction Factor(dB) + Duty Cycle Factor(dB)

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Operating Frequency 2402 MHz
Channel No. CH 0
Data Rate 500K

Frequency (MHz)	Polarization	Reading (dBuV)		Factor (dB)		Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		AV	PK	Corr.[1)]	Duty	AV	PK	AV	PK	AV	PK
2390	H	34.0	47.8	-6.1	0.82	28.7	41.7	54	74	25.3	32.3
2390	V	33.8	48.2	-6.1	0.82	28.5	42.1	54	74	25.5	31.9

Operating Frequency 2480 MHz
Channel No. CH 39
Data Rate 500K

Frequency (MHz)	Polarization	Reading (dBuV)		Factor (dB)		Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		AV	PK	Corr.[1)]	Duty	AV	PK	AV	PK	AV	PK
2483.5	H	40.8	61.4	-5.6	0.82	36.0	55.8	54	74	18.0	18.2
2483.5	V	41.1	61.6	-5.6	0.82	36.3	56.0	54	74	17.7	18.0

Notes:
1. Correction Factor: Antenna Factor + Cable loss
2. AV Level = Measured Power(dBm) + Correction Factor(dB) + Duty Cycle Factor(dB)

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Operating Frequency 2402 MHz

Channel No. CH 0

Data Rate 1M

Frequency (MHz)	Polarization	Reading (dBuV)		Factor (dB)		Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		AV	PK	Corr.[1)]	Duty	AV	PK	AV	PK	AV	PK
2390	H	35.1	49.3	-6.1	0.82	29.8	43.2	54	74	24.2	30.8
2390	V	34.8	48.8	-6.1	0.82	29.5	42.7	54	74	24.5	31.3

Operating Frequency 2480 MHz

Channel No. CH 39

Data Rate 1M

Frequency (MHz)	Polarization	Reading (dBuV)		Factor (dB)		Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		AV	PK	Corr.[1)]	Duty	AV	PK	AV	PK	AV	PK
2483.5	H	41.2	61.9	-5.6	0.82	36.4	56.3	54	74	17.6	17.7
2483.5	V	41.0	61.4	-5.6	0.82	36.2	55.8	54	74	17.8	18.2

Notes:

1. Correction Factor: Antenna Factor + Cable loss
2. AV Level = Measured Power(dBm) + Correction Factor(dB) + Duty Cycle Factor(dB)

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Operating Frequency 2402 MHz
Channel No. CH 0
Data Rate 2M

Frequency (MHz)	Polarization	Reading (dBuV)		Factor (dB)		Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		AV	PK	Corr.[1)]	Duty	AV	PK	AV	PK	AV	PK
2390	H	35.3	52.1	-6.1	0.82	30.0	46.0	54	74	24.0	28.0
2390	V	35.1	51.3	-6.1	0.82	29.8	45.2	54	74	24.2	28.8

Operating Frequency 2480 MHz
Channel No. CH 39
Data Rate 2M

Frequency (MHz)	Polarization	Reading (dBuV)		Factor (dB)		Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		AV	PK	Corr.[1)]	Duty	AV	PK	AV	PK	AV	PK
2483.5	H	42.5	62.7	-5.6	0.82	37.7	57.1	54	74	16.3	16.9
2483.5	V	42.2	62.8	-5.6	0.82	37.4	57.2	54	74	16.6	16.8

Notes:
1. Correction Factor: Antenna Factor + Cable loss
2. AV Level = Measured Power(dBm) + Correction Factor(dB) + Duty Cycle Factor(dB)

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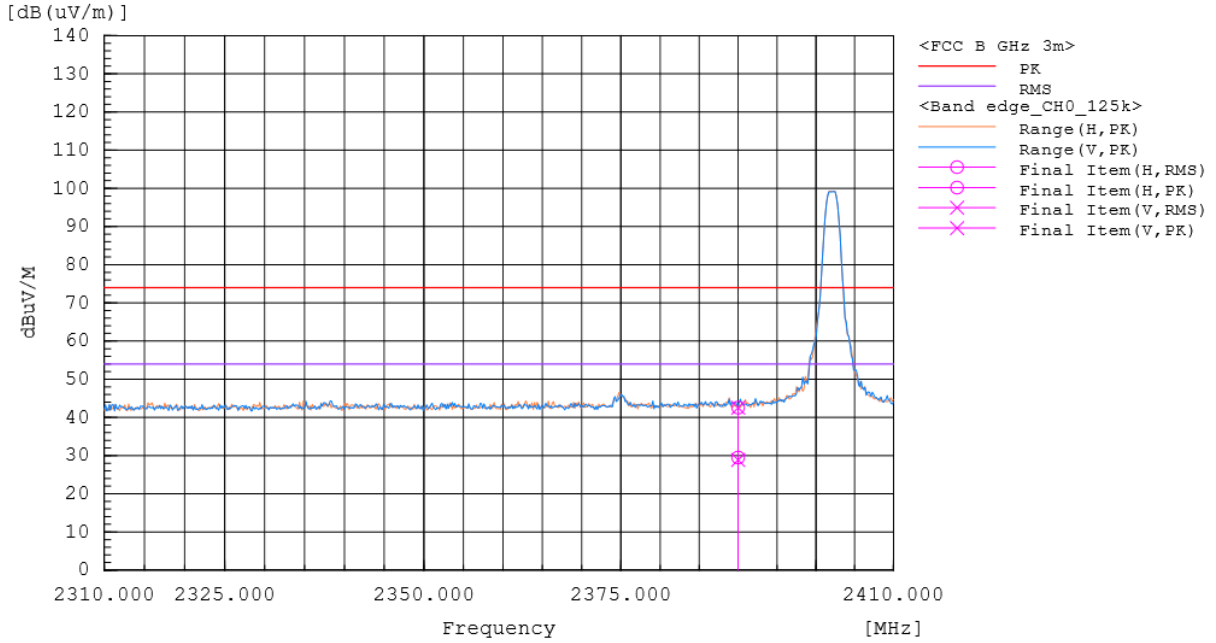
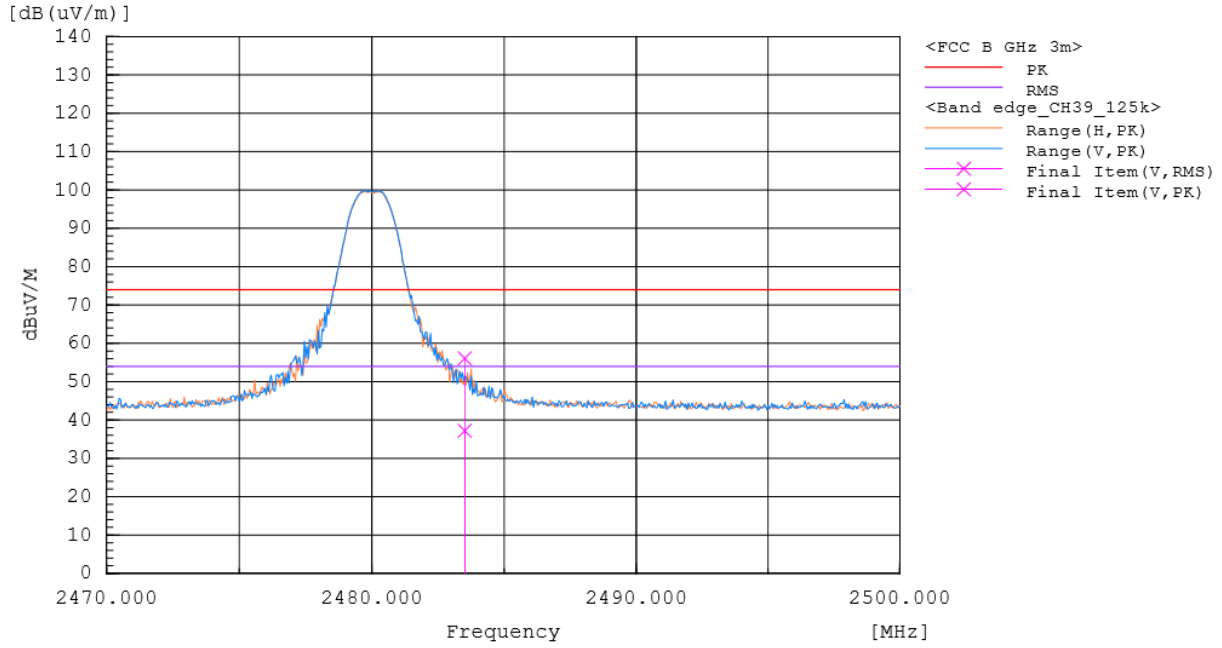
▣ Test Plots

Radiated Restricted Band Edges (CH 0)



Radiated Restricted Band Edges (CH 39)



Note:
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9.8 RECEIVER SPURIOUS EMISSIONS

Frequency Range : Below 1 GHz

Frequency (MHz)	Polarization	Reading (dBuV)	Corr.[1)] (dB)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement Type
32.891	V	32.9	-1.7	31.2	40	8.8	QP
499.996	V	39.2	-2.1	37.1	46	8.9	QP
500.002	H	36.9	-2.1	34.8	46	11.2	QP
624.985	V	41.3	-0.2	41.1	46	4.9	QP
625.01	H	35.7	-0.2	35.5	46	10.5	QP
875.064	H	23.4	3.6	27.0	46	19.0	QP

Note:

1. Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Quasi peak detector mode.

Frequency Range : Above 1 GHz

Frequency (MHz)	Polarization	Reading (dBuV)		Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
		AV	Corr.[1)]	AV	AV	AV
15953.36	H	29.3	16.7	46.0	54	8.0
15951.25	V	29.2	16.7	45.9	54	8.1

Notes:

1. Correction Factor: Antenna Factor + Cable loss + Preamplifier

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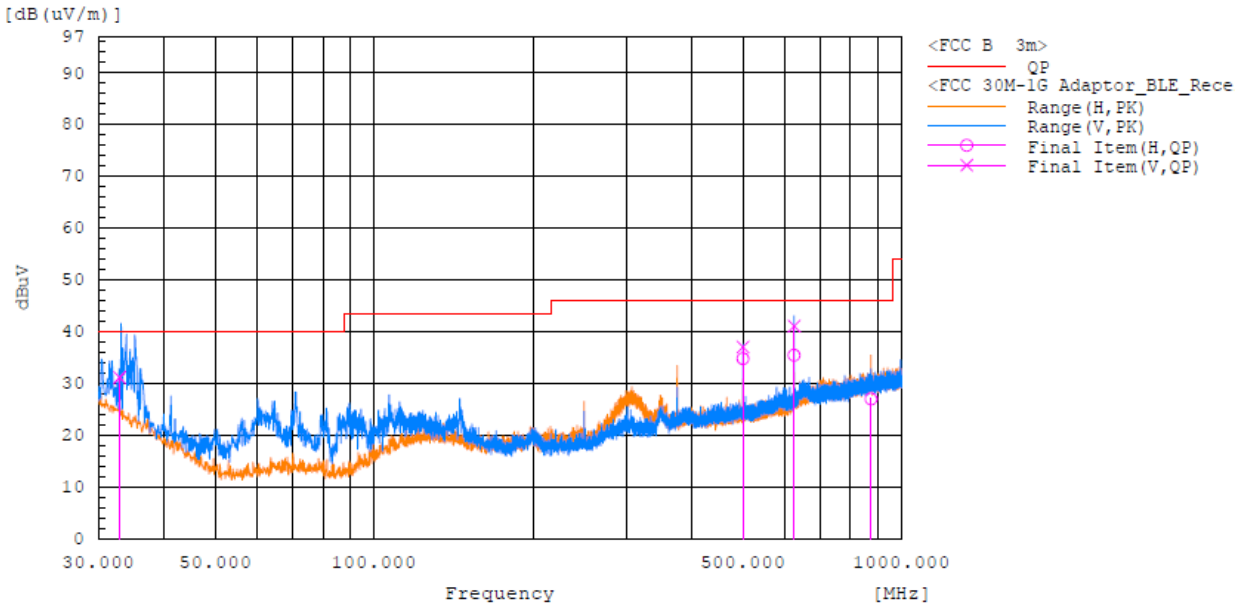
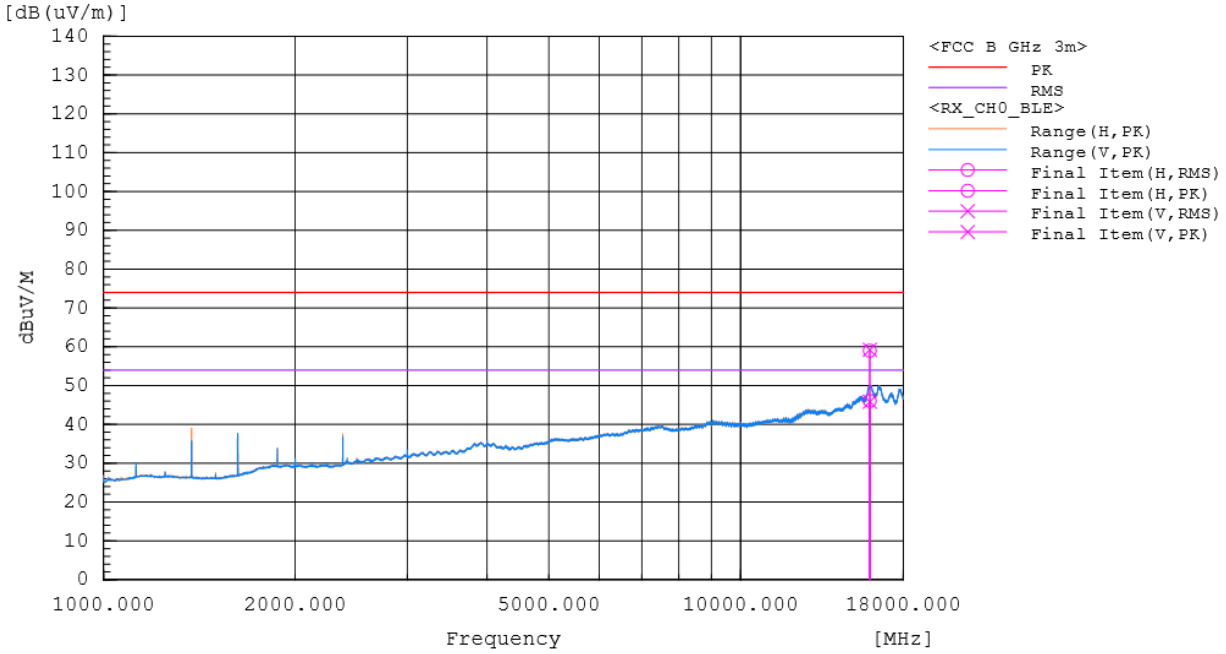
▣ Test Plots

Receiver Spurious Emission below 1 GHz



Receiver Spurious Emission above 1 GHz



Note:
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9.9 POWERLINE CONDUCTED EMISSIONS

AC Adapter

Frequency (MHz)	Line	Reading (dBµV)		Corr. (dB)	Level (dBµV)		Limit (dBµV)		Margin (dB)	
		QP	CAV		QP	CAV	QP	CAV	QP	CAV
0.153	L1	36.7	24.7	9.8	46.5	34.5	65.8	55.8	19.3	21.3
0.362	L1	24.2	18.9	9.7	33.9	28.6	58.7	48.7	24.8	20.1
1.206	L1	24.1	22.1	9.8	33.9	31.9	56.0	46.0	22.1	14.1
2.411	L1	21.8	17.8	9.8	31.6	27.6	56.0	46.0	24.4	18.4
3.316	L1	22.3	18.4	9.8	32.1	28.2	56.0	46.0	23.9	17.8
14.471	L1	22.8	22.0	10.1	32.9	32.1	60.0	50.0	27.1	17.9
17.183	L1	19.9	18.4	10.2	30.1	28.6	60.0	50.0	29.9	21.4

Frequency (MHz)	Line	Reading (dBµV)		Corr. (dB)	Level (dBµV)		Limit (dBµV)		Margin (dB)	
		QP	CAV		QP	CAV	QP	CAV	QP	CAV
0.154	N	37.1	23.9	9.8	46.9	33.7	65.8	55.8	18.9	22.1
0.179	N	32.7	18.2	9.7	42.4	27.9	64.5	54.5	22.1	26.6
0.365	N	24.5	19.5	9.7	34.2	29.2	58.6	48.6	24.4	19.4
1.206	N	23.6	21.9	9.8	33.4	31.7	56.0	46.0	22.6	14.3
2.413	N	21.7	17.8	9.7	31.4	27.5	56.0	46.0	24.6	18.5
3.318	N	22.4	18.4	9.8	32.2	28.2	56.0	46.0	23.8	17.8
4.826	N	19.6	16.1	9.9	29.5	26.0	56.0	46.0	26.5	20.0
14.177	N	23.3	22.7	10.1	33.4	32.8	60.0	50.0	26.6	17.2
17.194	N	20.0	18.5	10.2	30.2	28.7	60.0	50.0	29.8	21.3

Note : Quasi-peak(Final Result) = Reading Value + Correction Factor

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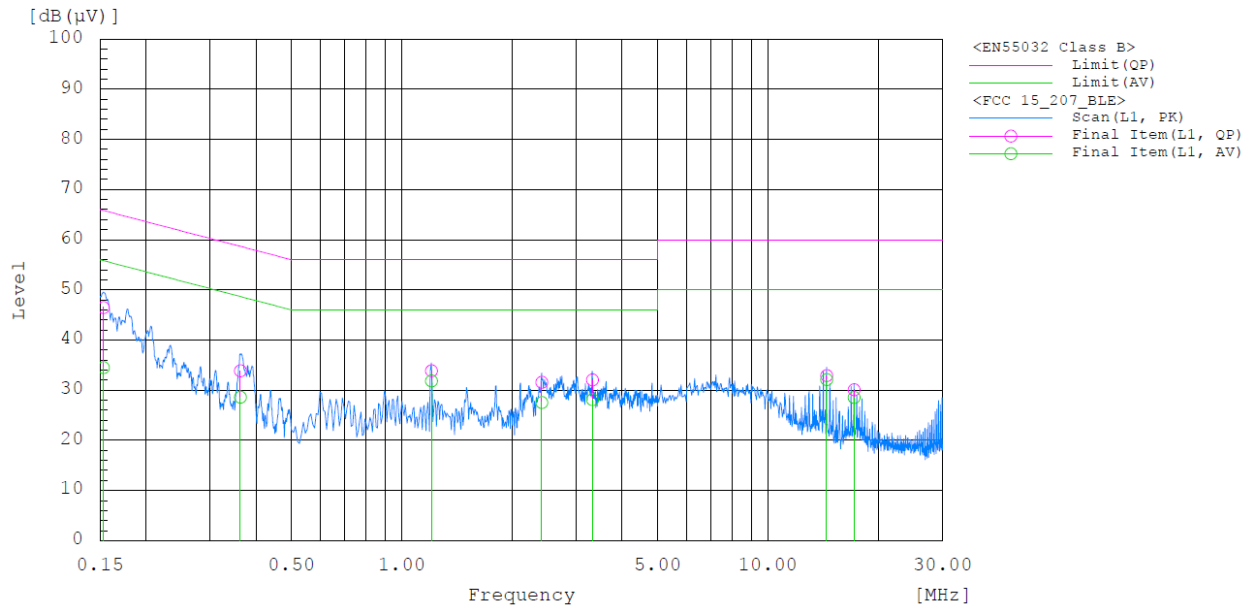
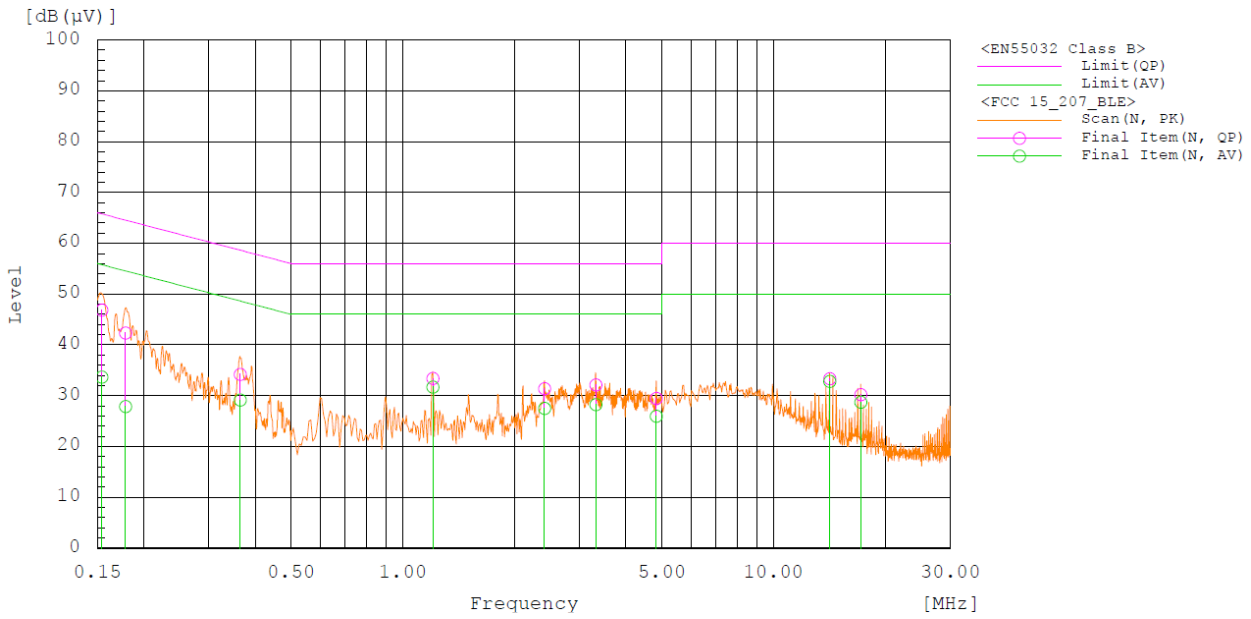
▣ Test Plots

AC Adapter : AC Line Conducted Emission (L1)



AC Adapter : AC Line Conducted Emission (N)



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PoE Adapter

Frequency (MHz)	Line	Reading (dBµV)		Corr. (dB)	Level (dBµV)		Limit (dBµV)		Margin (dB)	
		QP	CAV		QP	CAV	QP	CAV	QP	CAV
0.152	L1	39.4	20.2	9.8	49.2	30.0	65.9	55.9	16.7	25.9
0.182	L1	36.3	19.0	9.8	46.1	28.8	64.4	54.4	18.3	25.6
0.253	L1	26.9	8.2	9.7	36.6	17.9	61.7	51.7	25.1	33.8
2.957	L1	9.5	1.3	9.8	19.3	11.1	56	46	36.7	34.9
4.900	L1	11.5	7.8	9.9	21.4	17.7	56	46	34.6	28.3
16.095	L1	34.3	29.7	10.2	44.5	39.9	60	50	15.5	10.1
16.399	L1	34.9	33.8	10.2	45.1	44.0	60	50	14.9	6.0
17.008	L1	33.0	23.0	10.2	43.2	33.2	60	50	16.8	16.8

Frequency (MHz)	Line	Reading (dBµV)		Corr. (dB)	Level (dBµV)		Limit (dBµV)		Margin (dB)	
		QP	CAV		QP	CAV	QP	CAV	QP	CAV
0.151	N	39.0	20.0	9.8	48.8	29.8	65.9	55.9	17.1	26.1
0.327	N	22.1	6.0	9.7	31.8	15.7	59.5	49.5	27.7	33.8
0.402	N	18.1	1.9	9.7	27.8	11.6	57.8	47.8	30.0	36.2
2.690	N	7.2	1.6	9.8	17.0	11.4	56	46	39.0	34.6
4.985	N	13.5	9.7	9.9	23.4	19.6	56	46	32.6	26.4
16.097	N	34.7	29.8	10.2	44.9	40.0	60	50	15.1	10.0
16.400	N	35.1	33.9	10.2	45.3	44.1	60	50	14.7	5.9
16.704	N	33.2	30.8	10.2	43.4	41.0	60	50	16.6	9.0

Note : Quasi-peak(Final Result) = Reading Value + Correction Factor

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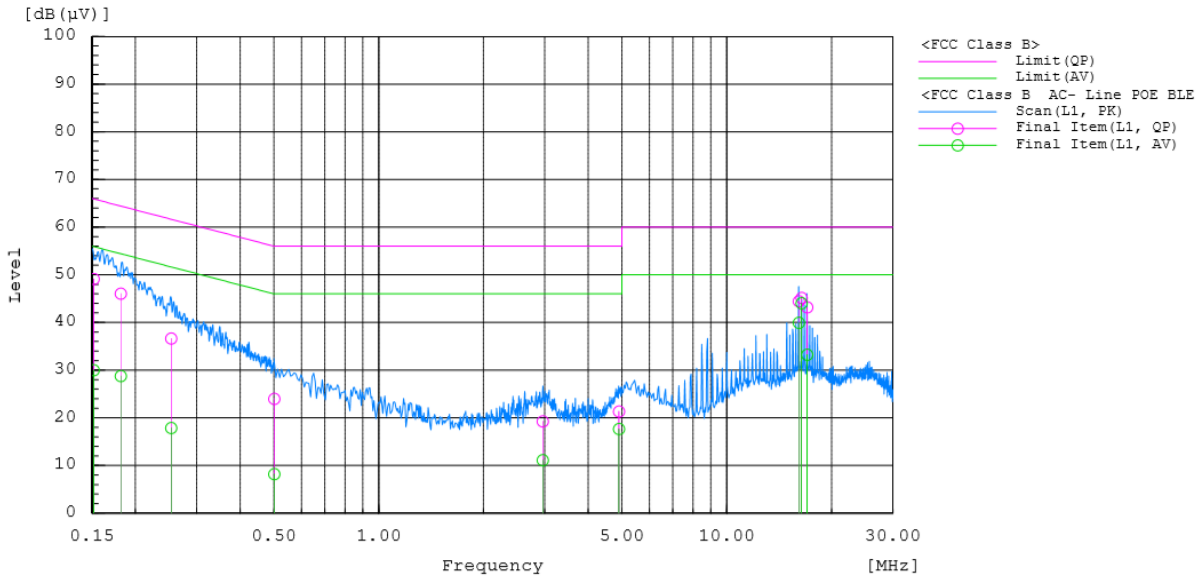
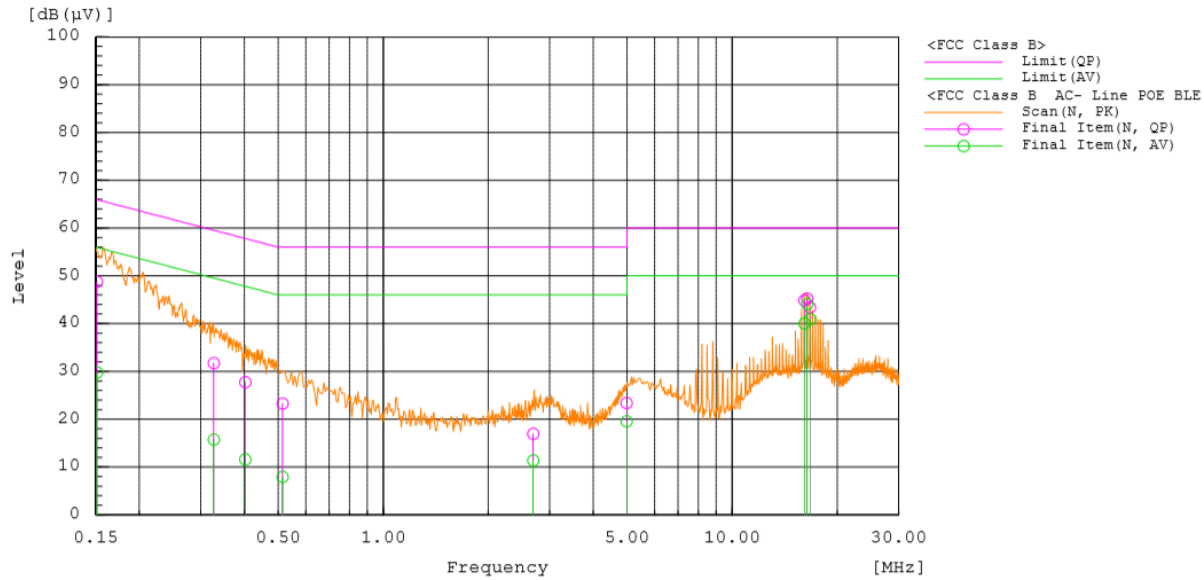
▣ Test Plots

PoE Adapter : AC Line Conducted Emission (L1)



PoE Adapter : AC Line Conducted Emission (N)



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10. LIST OF TEST EQUIPMENT

No.	Instrument	Model No.	Calibration Due (mm/dd/yy)	Manufacture	Serial No.
☒	Signal Analyzer (20 Hz ~ 40.0 GHz)	ESU40	12/20/2020	ROHDE & SCHWARZ	100529
☒	Signal Analyzer (10 Hz ~ 26.5 GHz)	N9020A	11/08/2020	Keysight	MY52091291
☒	BI-LOG Antenna (30 MHz ~ 1 GHz)	JB6	11/29/2020	Sunol	A071116
☒	Attenuator (20 dB, DC ~ 26.5 GHz)	8493C	12/13/2020	HP	09072
☒	POWER AMP (1 GHz ~ 18 GHz)	PAM-118A	08/22/2020	Com-Power Corporation	18040074
☒	POWER AMP (0.3GHz ~ 1GHz)	8447D	10/08/2020	HP	2944
☒	Horn Antenna (1 GHz ~ 18 GHz)	DRH-118	08/28/2020	Sunol	A070516
☒	Loop Antenna (0.009 ~ 30 MHz)	HLA 6121	08/27/2020	TESEQ	43964
☒	Horn Antenna (18 GHz ~ 40 GHz)	DRH-1840	02/20/2021	Sunol	17120
☒	POWER AMP (18 GHz ~ 40 GHz)	CBL184050-45-01	02/04/2021	CERNEX, Inc.	43964
☒	ISM Band Reject filter (2370 ~ 2400 - 2483.5 ~2520 MHz)	WRCJV12	01/18/2021	Wainwright	4
☒	EMI Test Receiver	ESR3	12/20/2020	Rohde & Schwarz	102363
☒	LISN	3816/2SH	01/19/2021	EMCO	00205729
☒	LISN	ENV216	01/19/2021	Rohde & Schwarz	101349

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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11. ANNEX A TEST SETUP PHOTO

The setup photos are provided as a separate document

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