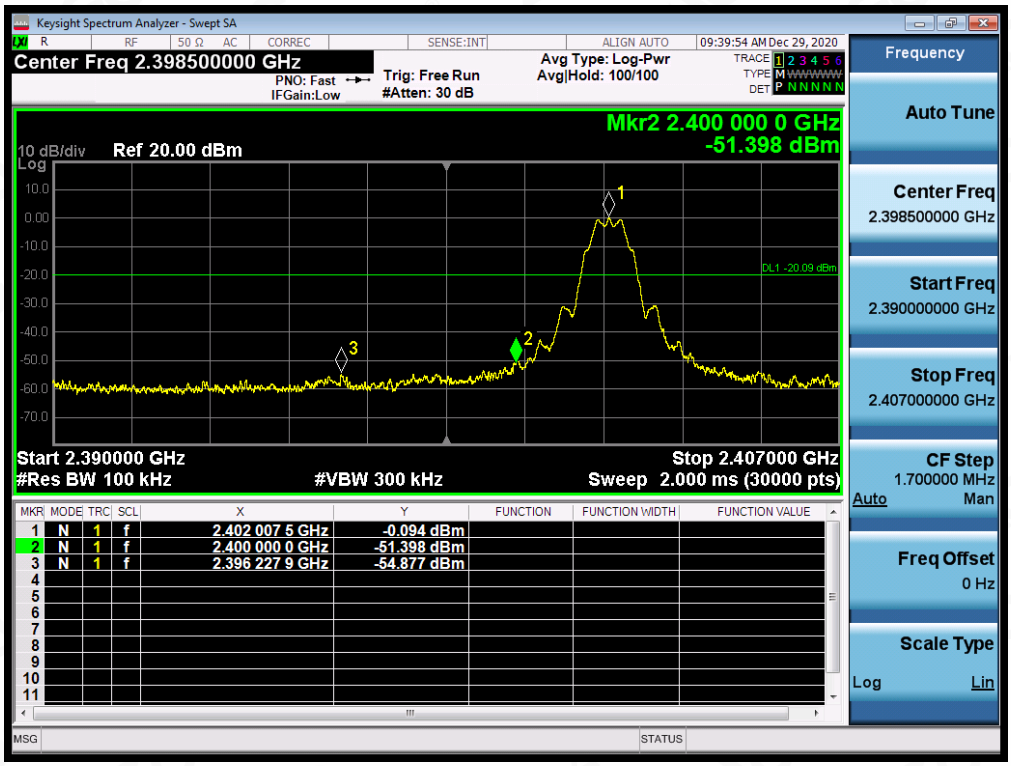
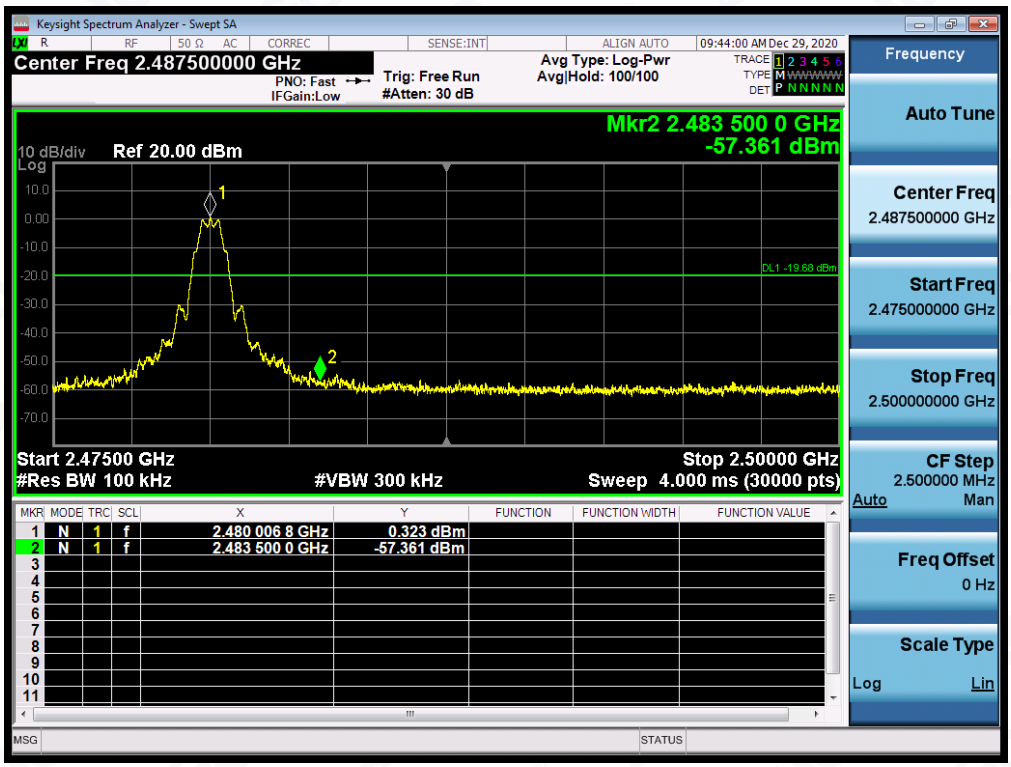
TEST RESULT FOR BAND EDGE

125 KHz

GFSK MODULATION IN LOW CHANNEL

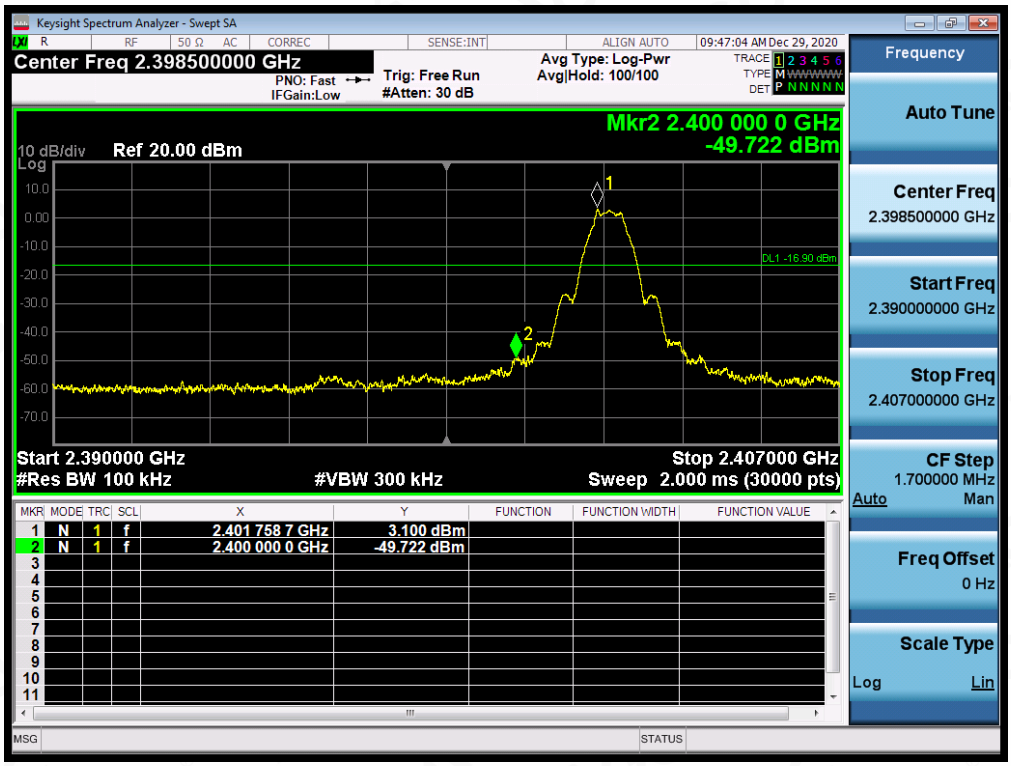


GFSK MODULATION IN HIGH CHANNEL

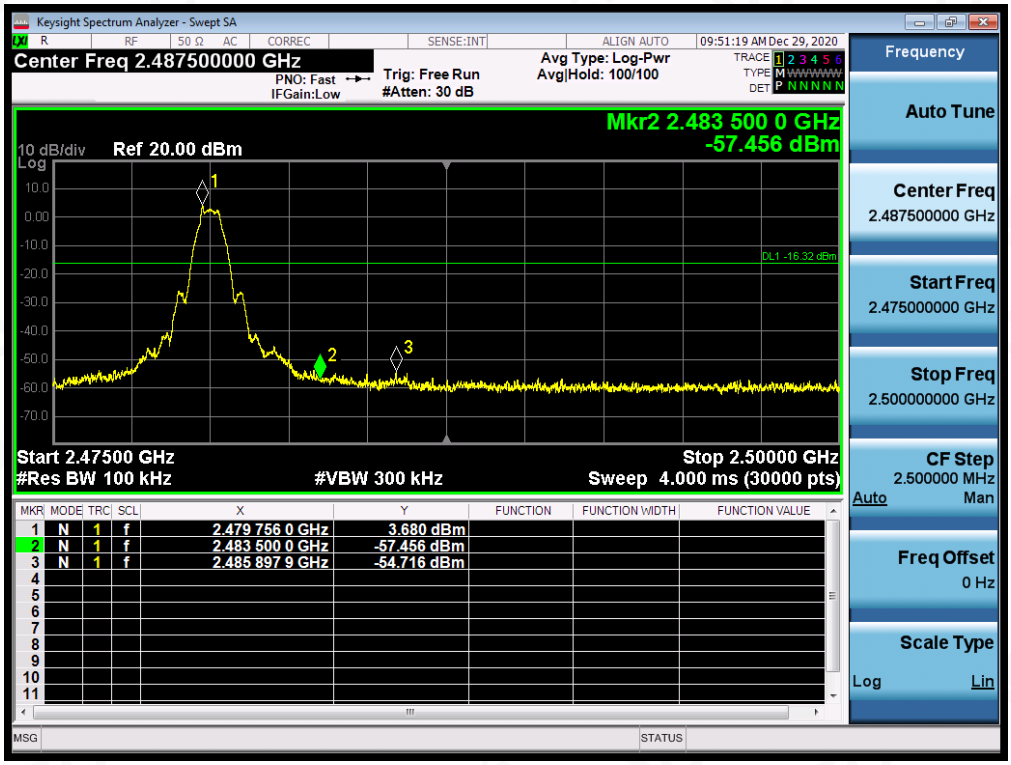


500 KHz

GFSK MODULATION IN LOW CHANNEL

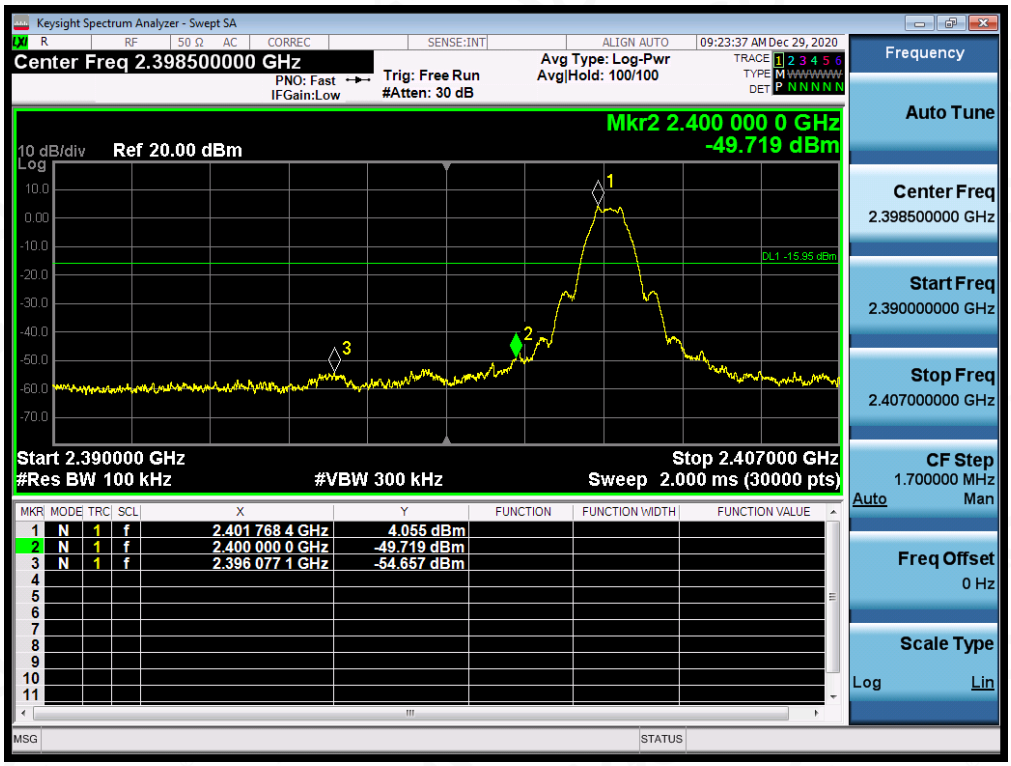


GFSK MODULATION IN HIGH CHANNEL

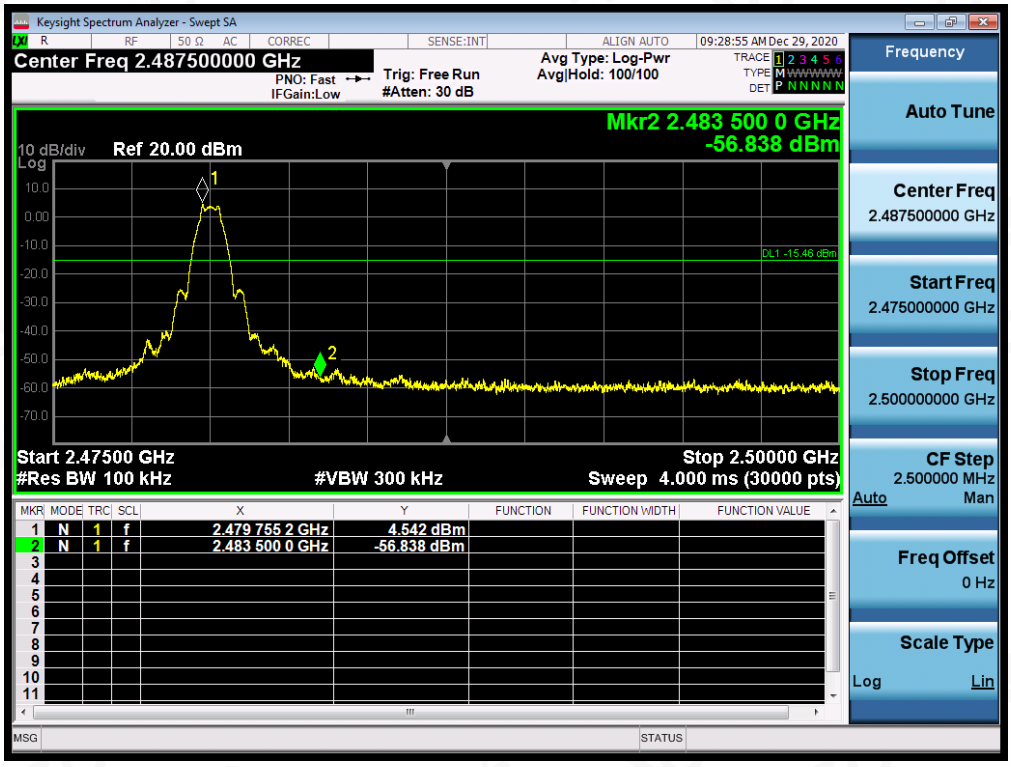


1M

GFSK MODULATION IN LOW CHANNEL

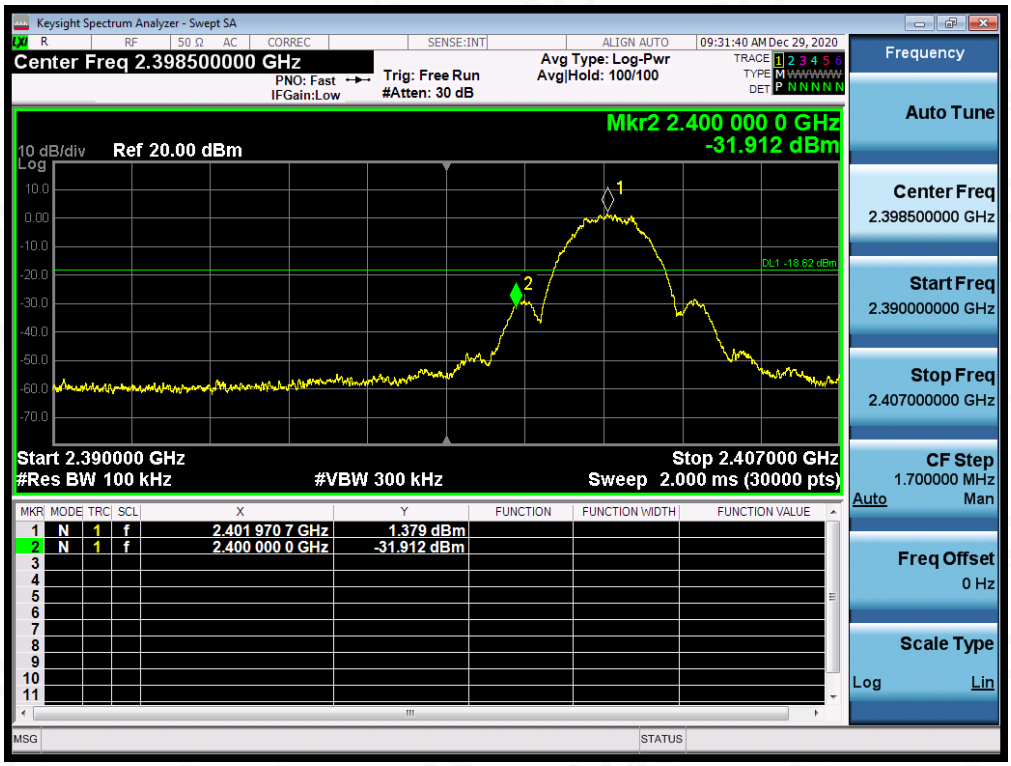


GFSK MODULATION IN HIGH CHANNEL

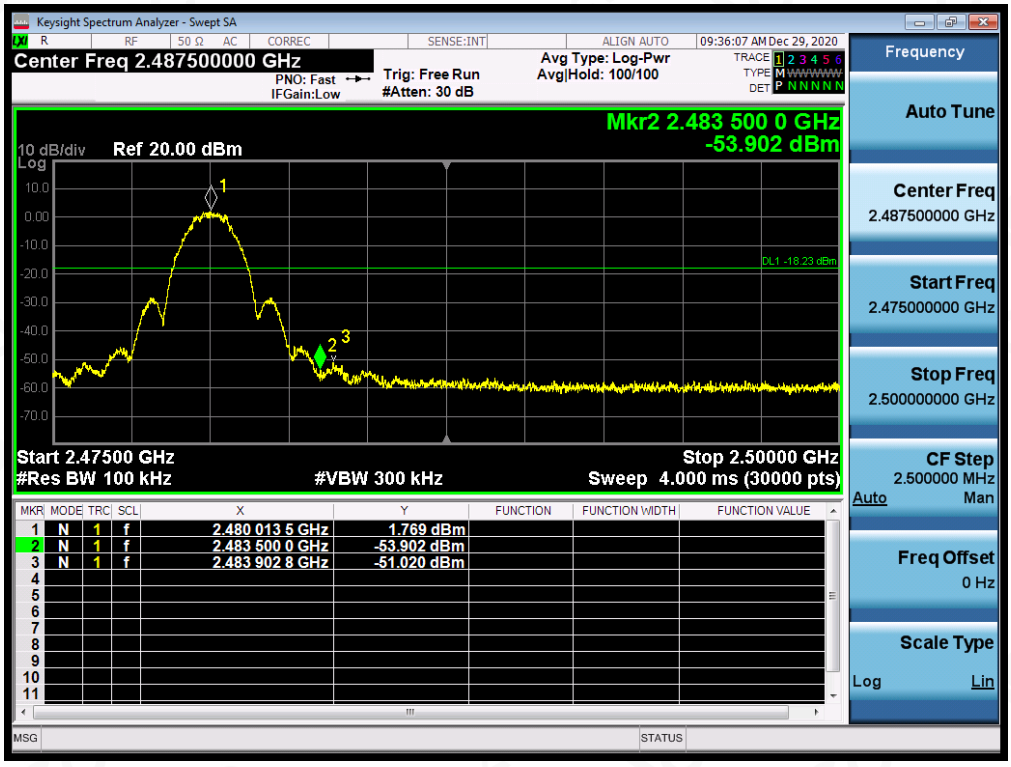


2M

GFSK MODULATION IN LOW CHANNEL



GFSK MODULATION IN HIGH CHANNEL



10. MAXIMUM CONDUCTED OUTPUT POWER SPECTRAL DENSITY

10.1. MEASUREMENT PROCEDURE

(1). Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator

(2). Set the EUT Work on the top, the middle and the bottom operation frequency individually.

(3). Set the SPA Trace 1 Max hold, then View.

Note: The method of PKPSD in the KDB 558074 item 10.2 was used in this testing.

10.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

Refer to Section 7.2.

10.3. MEASUREMENT EQUIPMENT USED

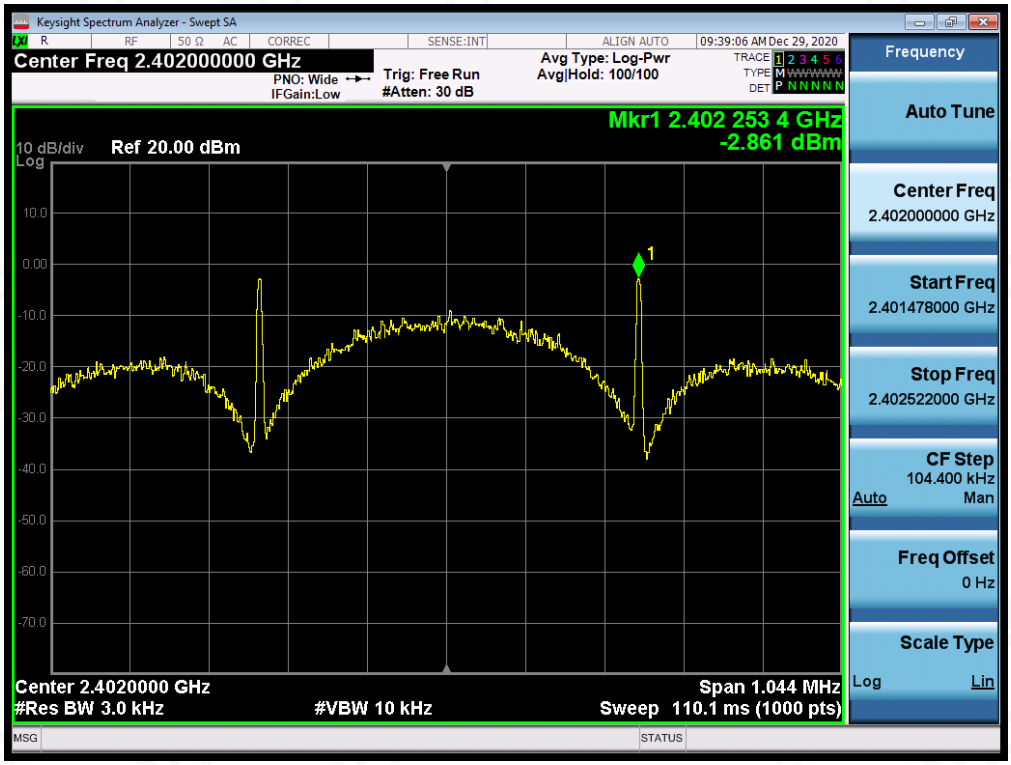
Refer to Section 6.

10.4. LIMITS AND MEASUREMENT RESULT

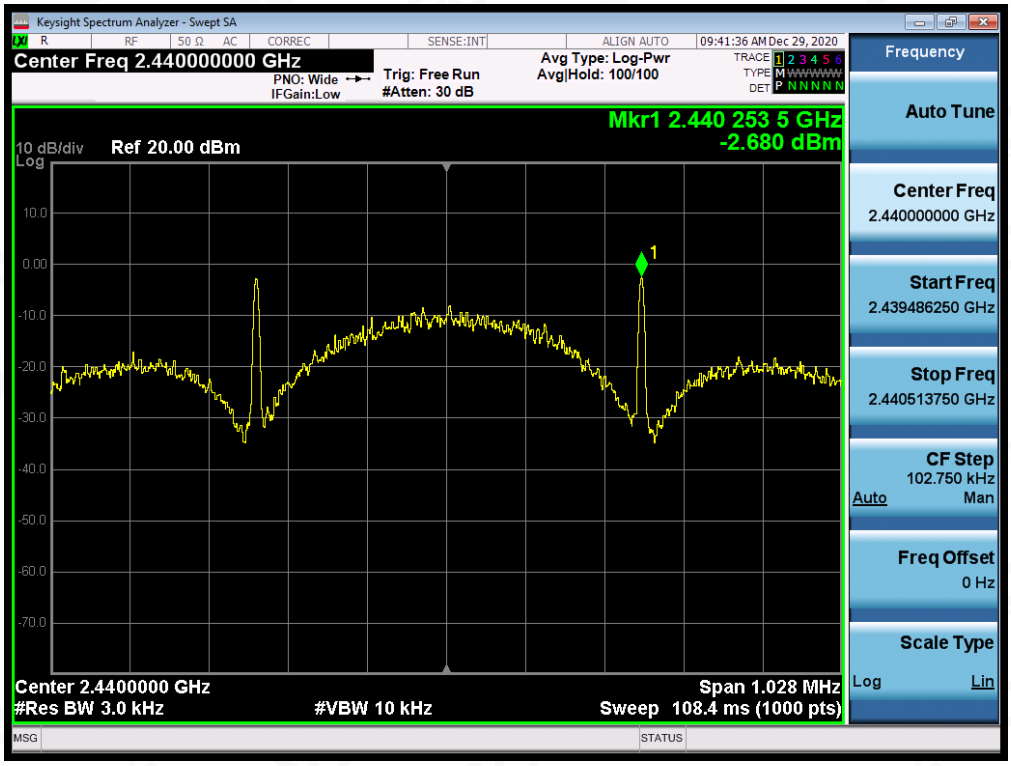
125KHz

Channel No.	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
Low Channel	-2.861	8	Pass
Middle Channel	-2.680	8	Pass
High Channel	-2.273	8	Pass

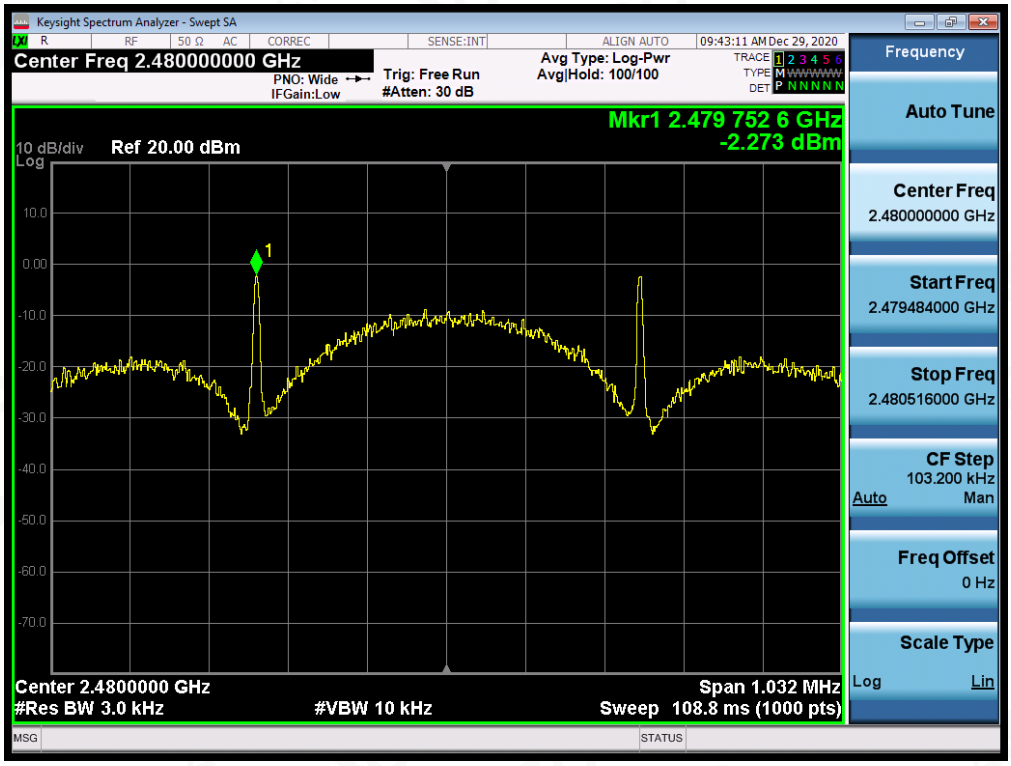
TEST PLOT OF SPECTRAL DENSITY FOR LOW CHANNEL



TEST PLOT OF SPECTRAL DENSITY FOR MIDDLE CHANNEL



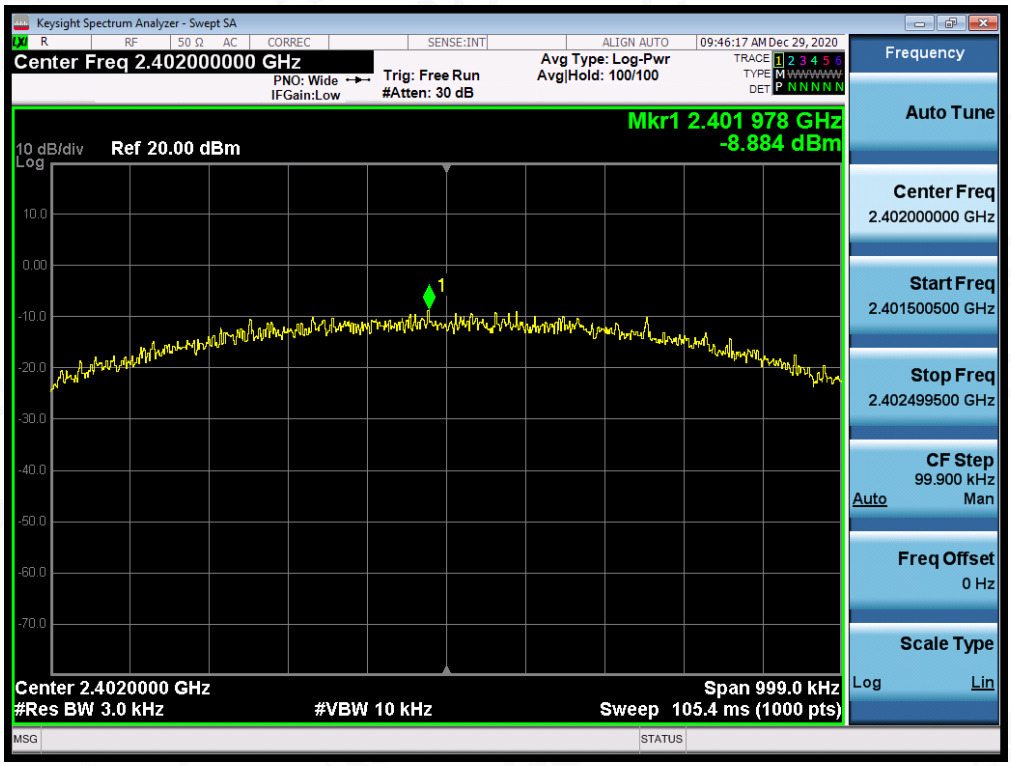
TEST PLOT OF SPECTRAL DENSITY FOR HIGH CHANNEL



500 KHz

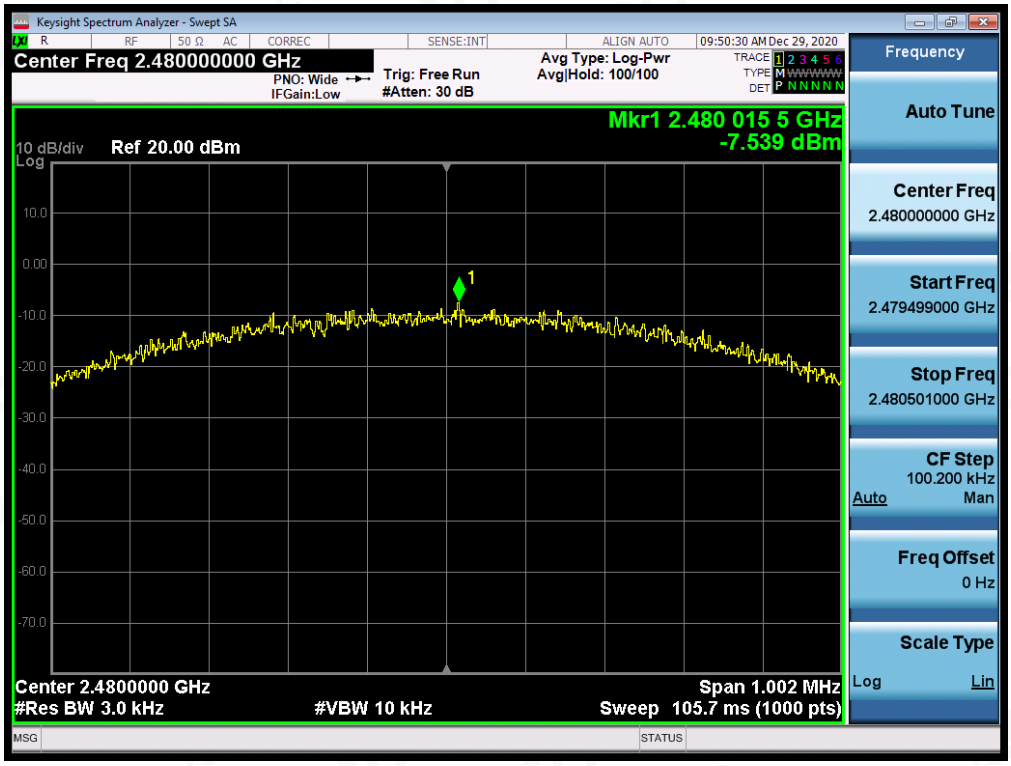
Channel No.	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
Low Channel	-8.884	8	Pass
Middle Channel	-8.448	8	Pass
High Channel	-7.539	8	Pass

TEST PLOT OF SPECTRAL DENSITY FOR LOW CHANNEL



TEST PLOT OF SPECTRAL DENSITY FOR MIDDLE CHANNEL

TEST PLOT OF SPECTRAL DENSITY FOR HIGH CHANNEL



1M

Channel No.	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
Low Channel	-4.209	8	Pass
Middle Channel	-4.518	8	Pass
High Channel	-5.501	8	Pass

TEST PLOT OF SPECTRAL DENSITY FOR LOW CHANNEL

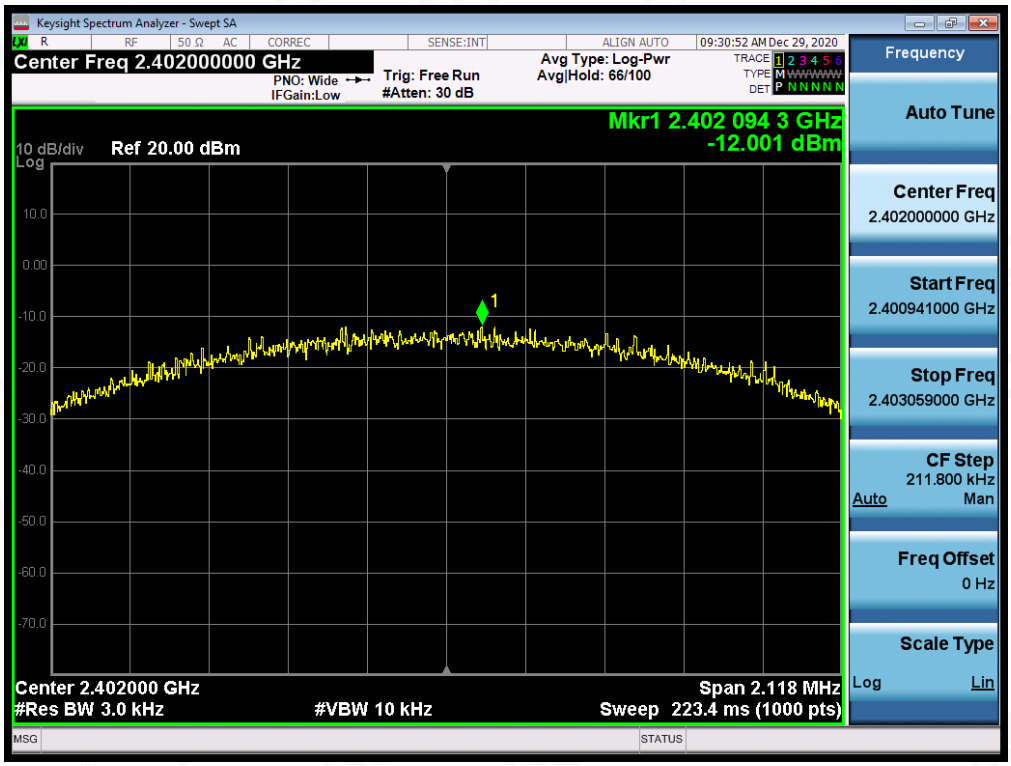
TEST PLOT OF SPECTRAL DENSITY FOR MIDDLE CHANNEL

TEST PLOT OF SPECTRAL DENSITY FOR HIGH CHANNEL

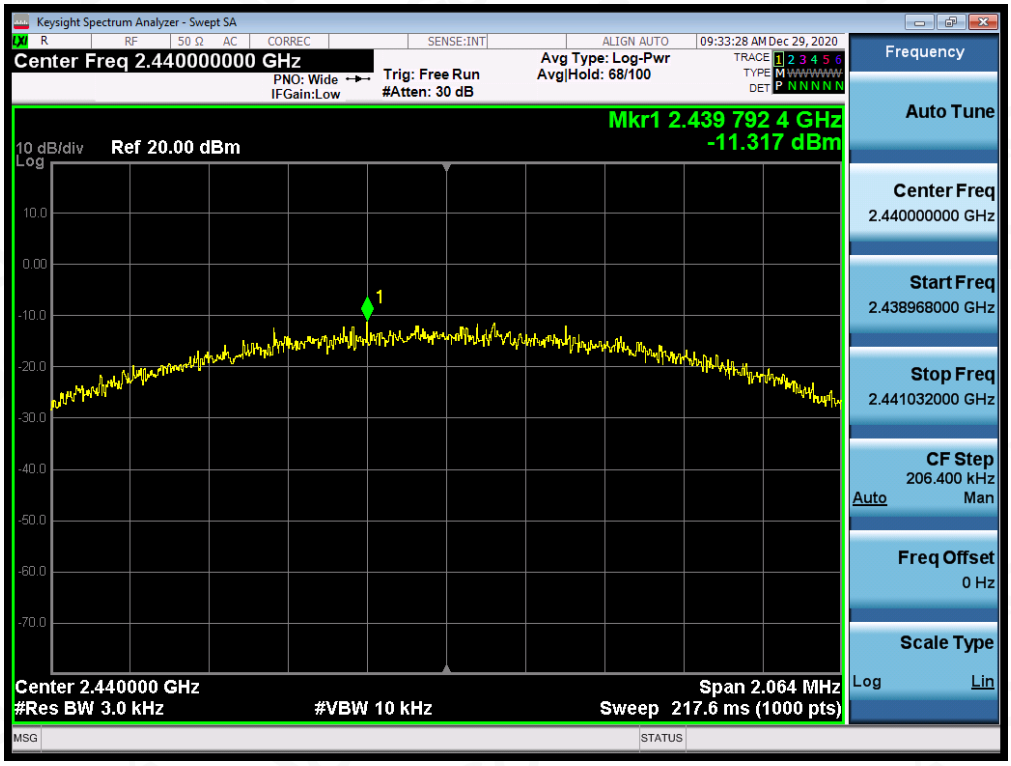
2M

Channel No.	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
Low Channel	-12.001	8	Pass
Middle Channel	-11.317	8	Pass
High Channel	-11.562	8	Pass

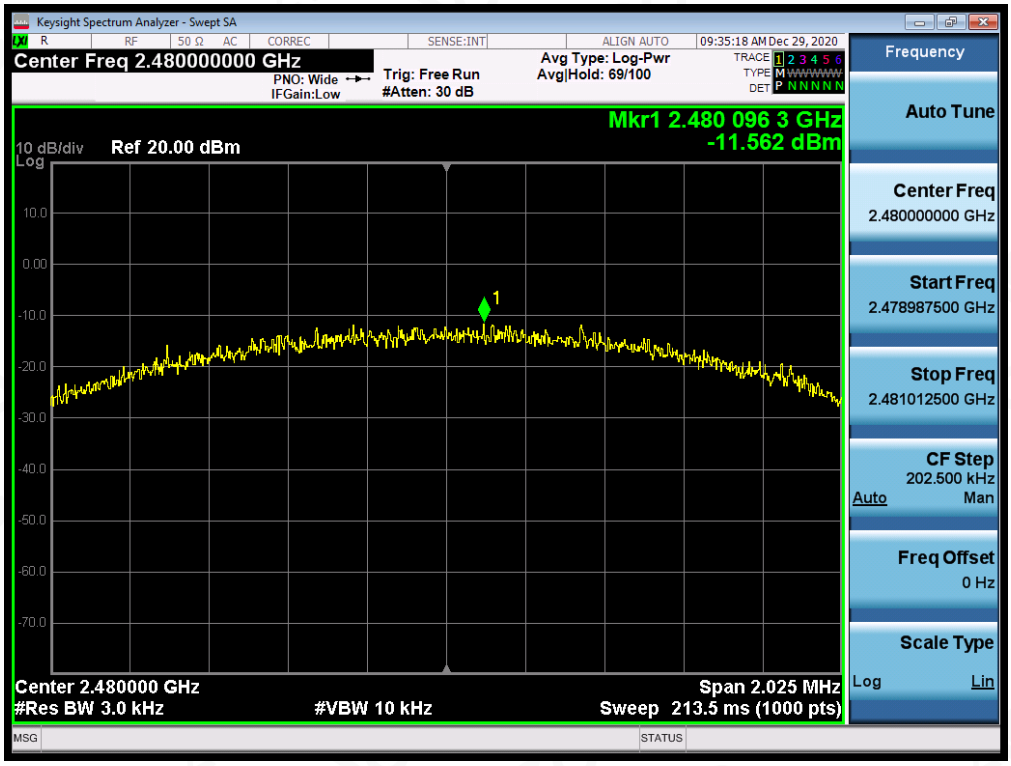
TEST PLOT OF SPECTRAL DENSITY FOR LOW CHANNEL



TEST PLOT OF SPECTRAL DENSITY FOR MIDDLE CHANNEL



TEST PLOT OF SPECTRAL DENSITY FOR HIGH CHANNEL



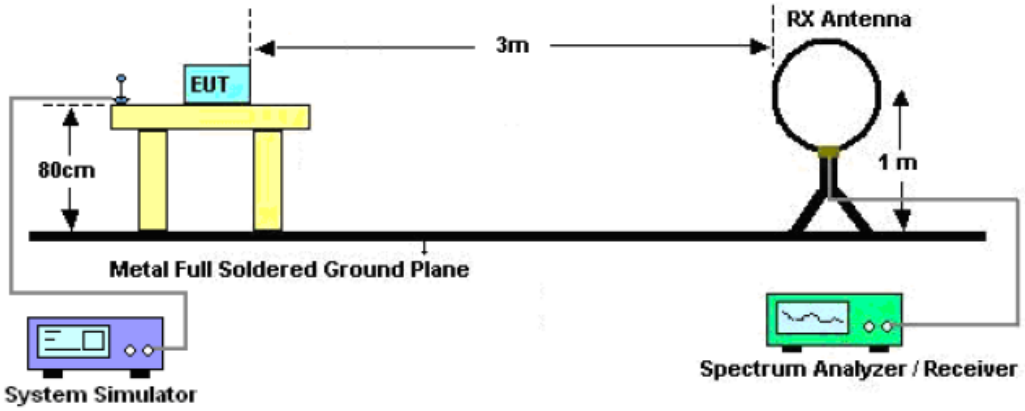
11. RADIATED EMISSION

11.1. MEASUREMENT PROCEDURE

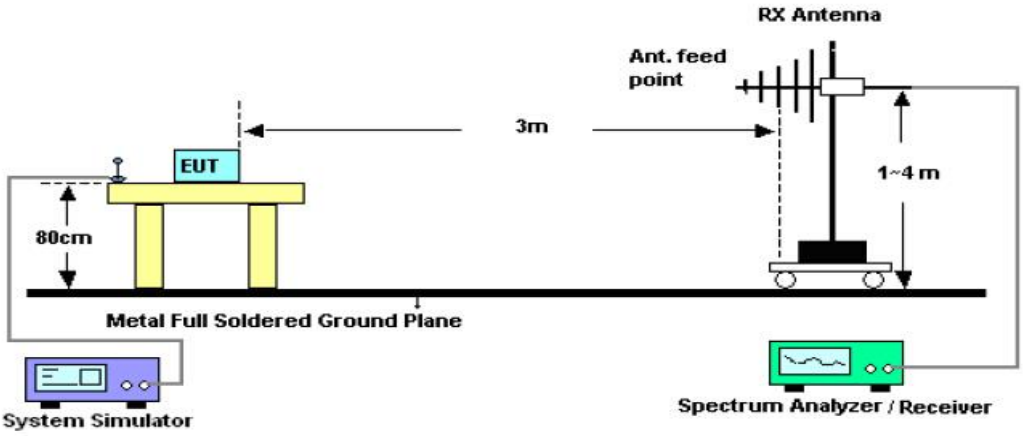
1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emission, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz RBW and 3MHz VBW for peak reading. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

11.2. TEST SETUP

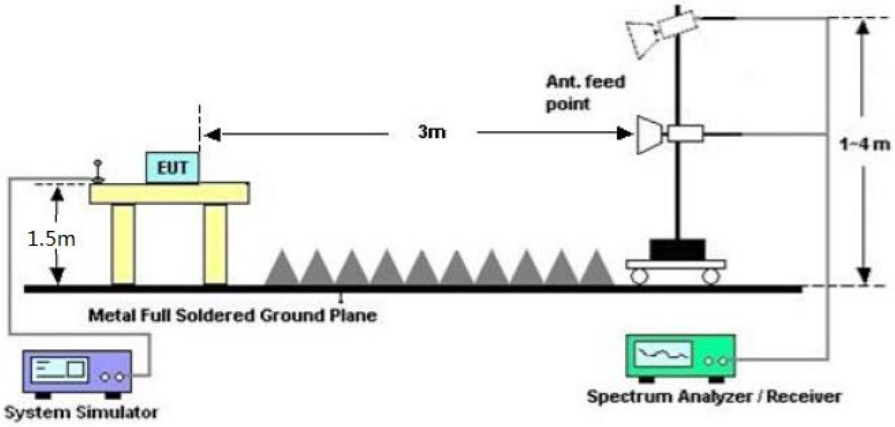
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



11.3. LIMITS AND MEASUREMENT RESULT

15.209 Limit in the below table has to be followed

Frequencies (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

Note: All modes were tested for restricted band radiated emission, the test records reported below are the worst result compared to other modes.

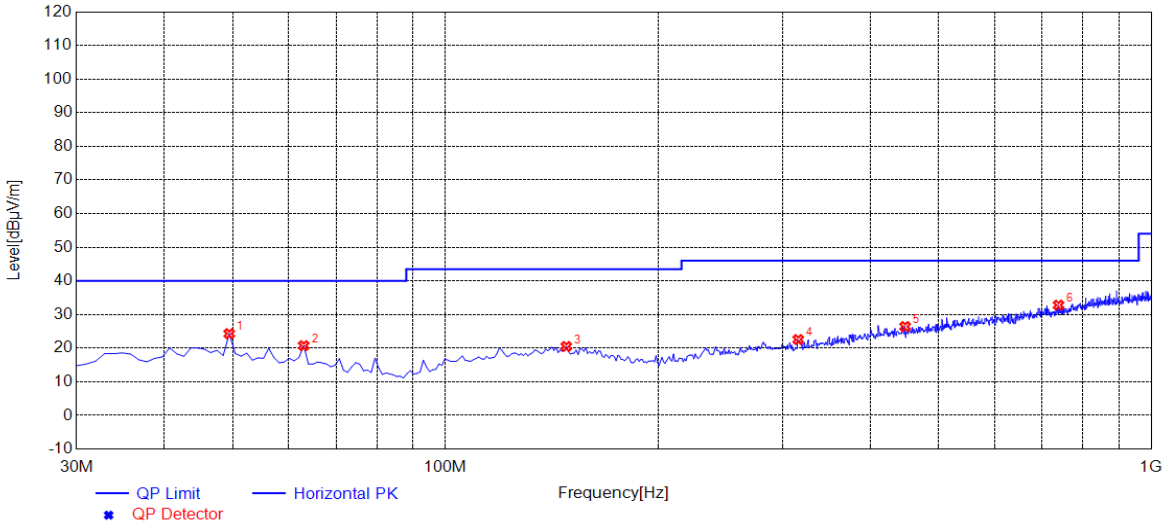
11.4. TEST RESULT

RADIATED EMISSION BELOW 30MHz

The amplitude of spurious emissions from 9kHz to 30MHz which are attenuated more than 20 dB below the permissible value need not be reported.

RADIATED EMISSION BELOW 1GHZ

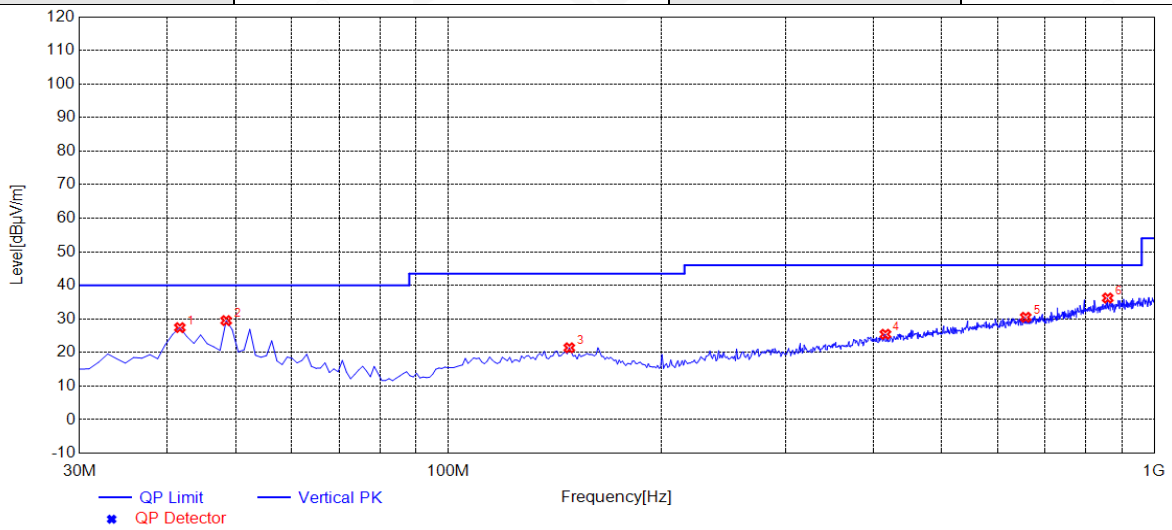
EUT	Multiprotocol 2.4G Wireless Module - Industrial Grade	Model Name	BDE-RFM207B
Temperature	21.8° C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Horizontal



NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	49.4000	24.31	11.69	40.00	15.69	100	200	Horizontal
2	62.9800	20.74	10.42	40.00	19.26	100	260	Horizontal
3	148.3400	20.50	14.88	43.50	23.00	100	270	Horizontal
4	316.1500	22.56	16.52	46.00	23.44	100	40	Horizontal
5	448.0700	26.42	20.95	46.00	19.58	100	350	Horizontal
6	739.0700	32.81	26.95	46.00	13.19	100	180	Horizontal

RESULT: PASS

EUT	Multiprotocol 2.4G Wireless Module - Industrial Grade	Model Name	BDE-RFM207B
Temperature	21.8° C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical



NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	41.6400	27.41	11.89	40.00	12.59	100	130	Vertical
2	48.4300	29.50	11.71	40.00	10.50	100	310	Vertical
3	148.3400	21.40	14.88	43.50	22.10	100	340	Vertical
4	416.0600	25.43	20.14	46.00	20.57	100	180	Vertical
5	657.5900	30.50	25.27	46.00	15.50	100	230	Vertical
6	859.3500	36.22	29.51	46.00	9.78	100	160	Vertical

RESULT: PASS

Note:

1. Factor=Antenna Factor + Cable loss, Margin=Limit-Level.
2. All test modes of rate had been tested. The mode 1 at 125KHz is the worst case and recorded in the report.

RADIATED EMISSION ABOVE 1GHZ

EUT	Multiprotocol 2.4G Wireless Module - Industrial Grade	**Model Name**	BDE-RFM207B
Temperature	21.8° C	**Relative Humidity**	58%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 1	**Antenna**	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4804.000	46.28	0.08	46.36	74	-27.64	peak
4804.000	35.27	0.08	35.35	54	-18.65	AVG
7206.000	41.56	2.21	43.77	74	-30.23	peak
7206.000	30.95	2.21	33.16	54	-20.84	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	Multiprotocol 2.4G Wireless Module - Industrial Grade	**Model Name**	BDE-RFM207B
Temperature	21.8° C	**Relative Humidity**	58%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 1	**Antenna**	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4804.000	45.29	0.08	45.37	74	-28.63	peak
4804.000	36.87	0.08	36.95	54	-17.05	AVG
7206.000	40.91	2.21	43.12	74	-30.88	peak
7206.000	30.13	2.21	32.34	54	-21.66	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	Multiprotocol 2.4G Wireless Module - Industrial Grade	Model Name	BDE-RFM207B
Temperature	21.8° C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 2	Antenna	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4880.000	46.89	0.14	47.03	74	-26.97	peak
4880.000	35.12	0.14	35.26	54	-18.74	AVG
7320.000	41.52	2.36	43.88	74	-30.12	peak
7320.000	30.67	2.36	33.03	54	-20.97	AVG

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

EUT	Multiprotocol 2.4G Wireless Module - Industrial Grade	Model Name	BDE-RFM207B
Temperature	21.8° C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 2	Antenna	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4880.000	46.59	0.14	46.73	74	-27.27	peak
4880.000	37.22	0.14	37.36	54	-16.64	AVG
7320.000	40.37	2.36	42.73	74	-31.27	peak
7320.000	30.91	2.36	33.27	54	-20.73	AVG

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

EUT	Multiprotocol 2.4G Wireless Module - Industrial Grade	Model Name	BDE-RFM207B
Temperature	21.8° C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4960.000	45.93	0.22	46.15	74	-27.85	peak
4960.000	35.74	0.22	35.96	54	-18.04	AVG
7440.000	38.12	2.64	40.76	74	-33.24	peak
7440.000	29.43	2.64	32.07	54	-21.93	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	Multiprotocol 2.4G Wireless Module - Industrial Grade	Model Name	BDE-RFM207B
Temperature	21.8° C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4960.000	44.69	0.22	44.91	74	-29.09	peak
4960.000	34.28	0.22	34.5	54	-19.5	AVG
7440.000	39.41	2.64	42.05	74	-31.95	peak
7440.000	30.15	2.64	32.79	54	-21.21	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

RESULT: PASS

Note:

The amplitude of other spurious emissions from 1G to 25 GHz which are attenuated more than 20 dB below the permissible value need not be reported.

Factor = Antenna Factor + Cable loss - Amplifier gain, Over=Measure-Limit.

The “Factor” value can be calculated automatically by software of measurement system.

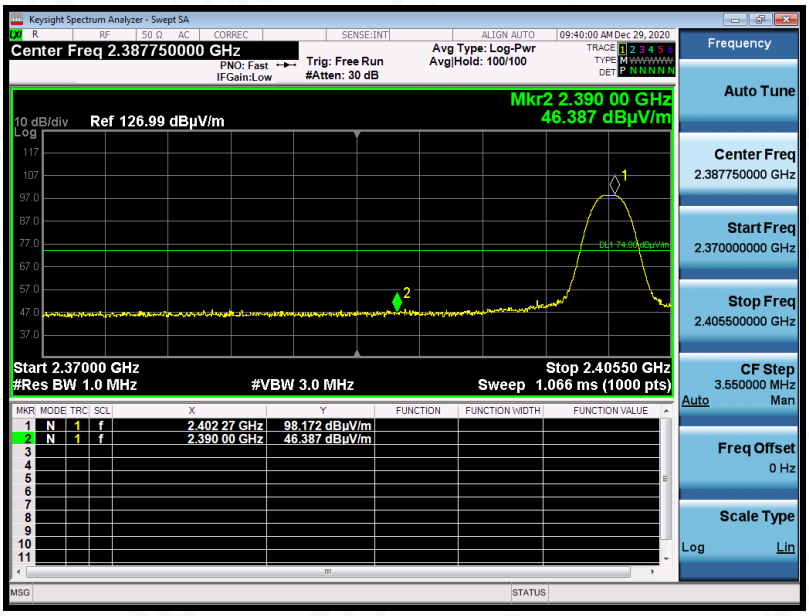
All test modes of rate had been tested. The mode 1 at 125KHz is the worst case and recorded in the report.

TEST RESULT FOR RESTRICTED BANDS REQUIREMENTS

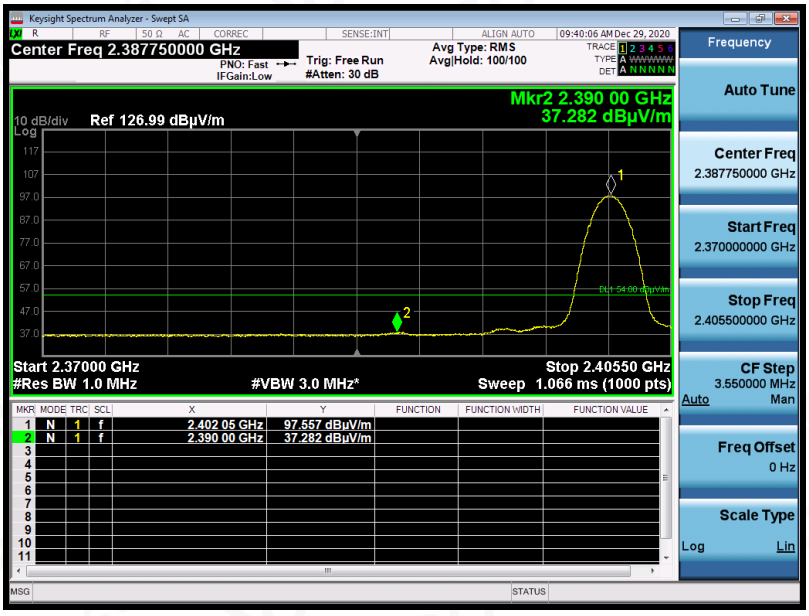
125 KHz

EUT	Multiprotocol 2.4G Wireless Module - Industrial Grade	Model Name	BDE-RFM207B
Temperature	21.8° C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Horizontal

PK



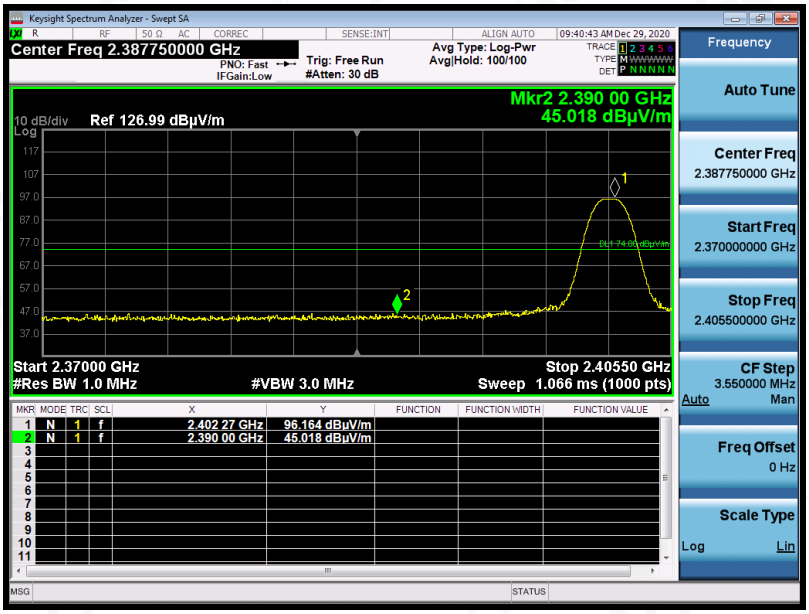
AV



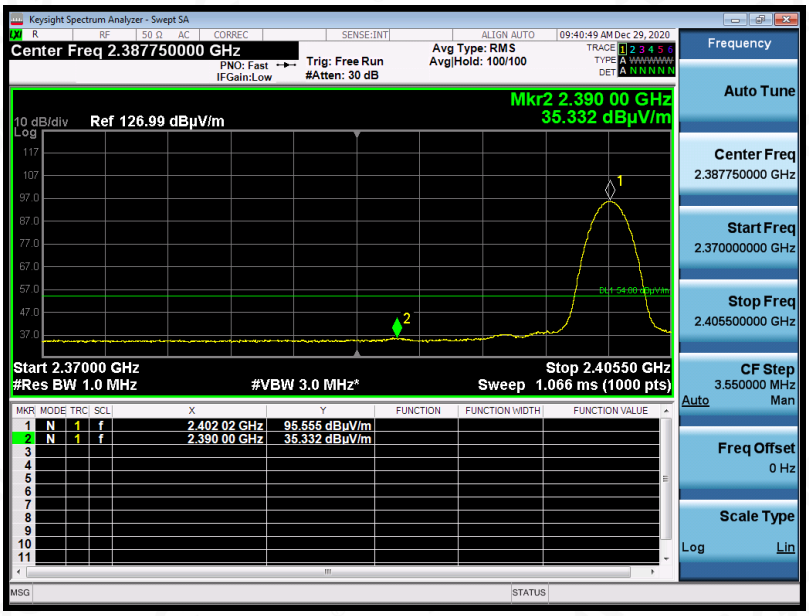
RESULT: PASS

EUT	Multiprotocol 2.4G Wireless Module - Industrial Grade	Model Name	BDE-RFM207B
Temperature	21.8° C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical

PK



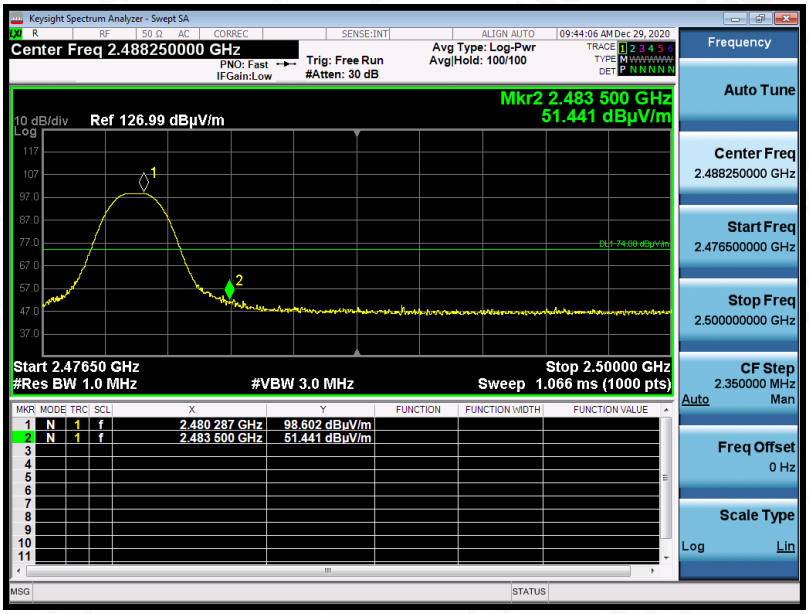
AV



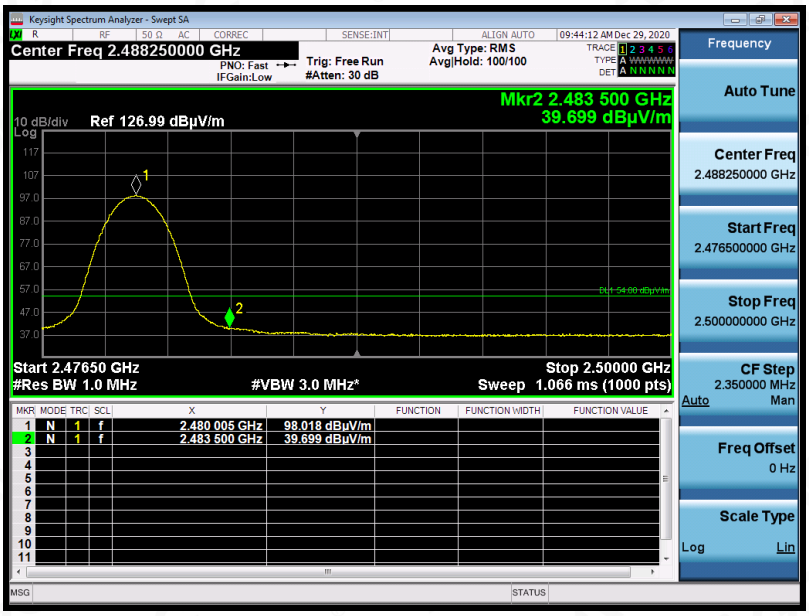
RESULT: PASS

EUT	Multiprotocol 2.4G Wireless Module - Industrial Grade	Model Name	BDE-RFM207B
Temperature	21.8° C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Horizontal

PK



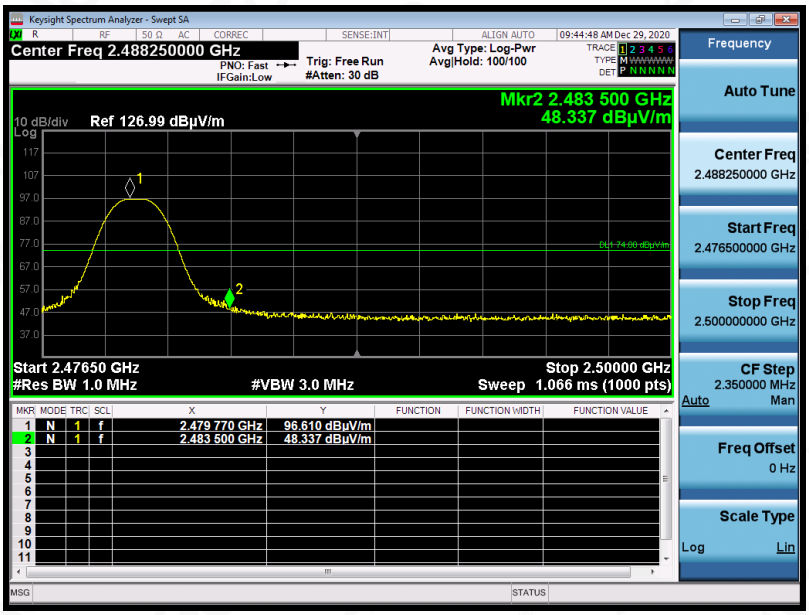
AV



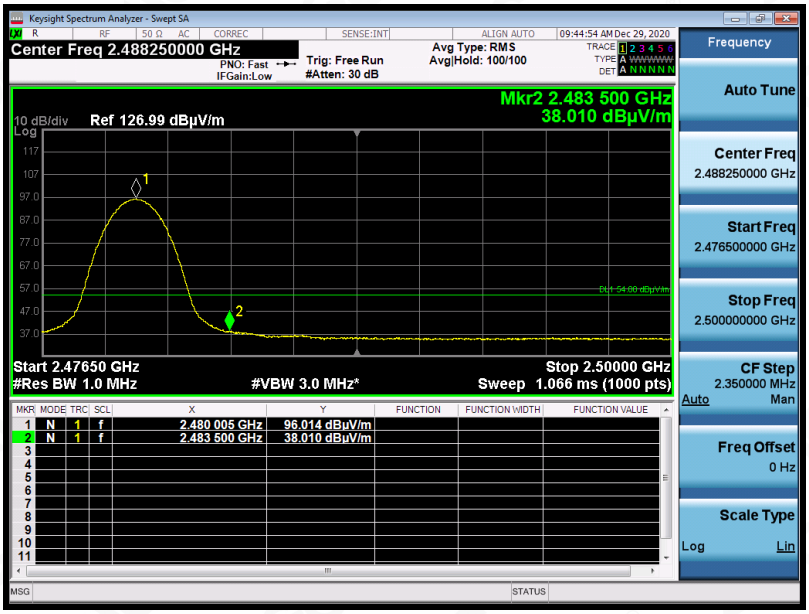
RESULT: PASS

EUT	Multiprotocol 2.4G Wireless Module - Industrial Grade	Model Name	BDE-RFM207B
Temperature	21.8° C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical

PK



AV

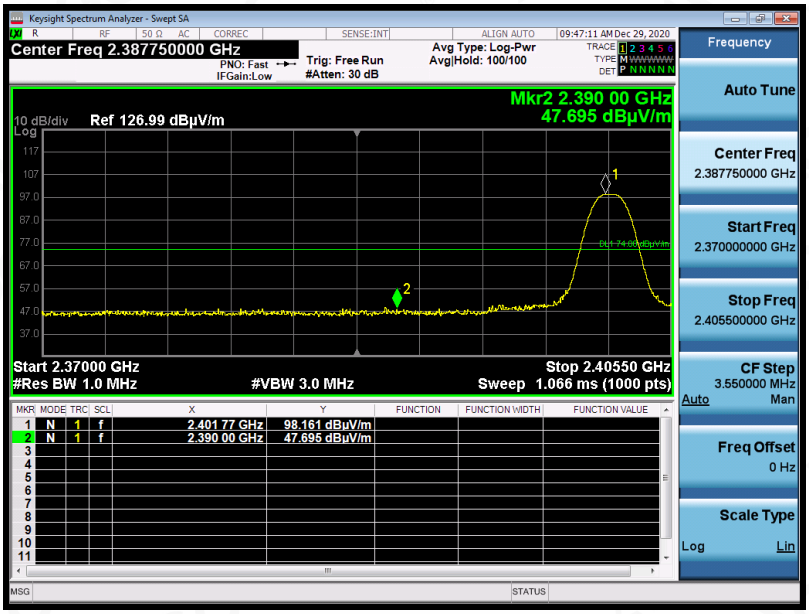


RESULT: PASS

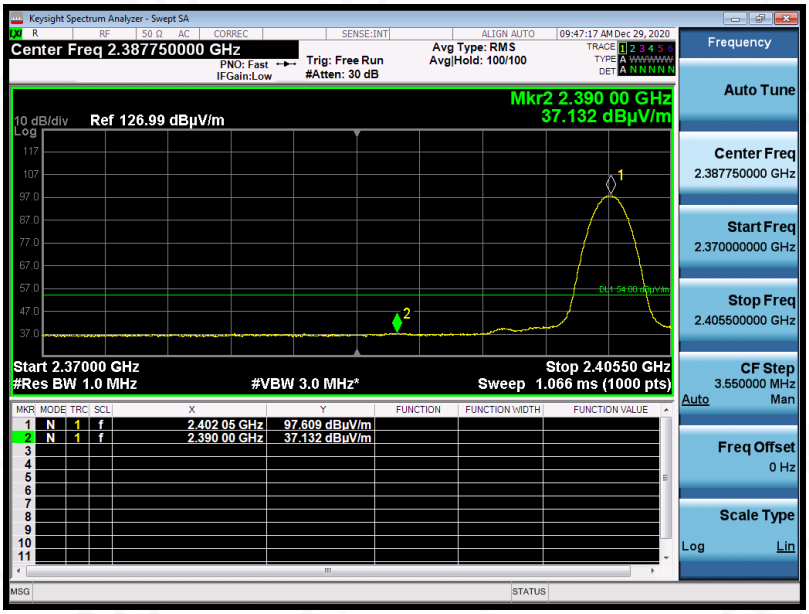
500 KHz

EUT	Multiprotocol 2.4G Wireless Module - Industrial Grade	Model Name	BDE-RFM207B
Temperature	21.8° C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Horizontal

PK



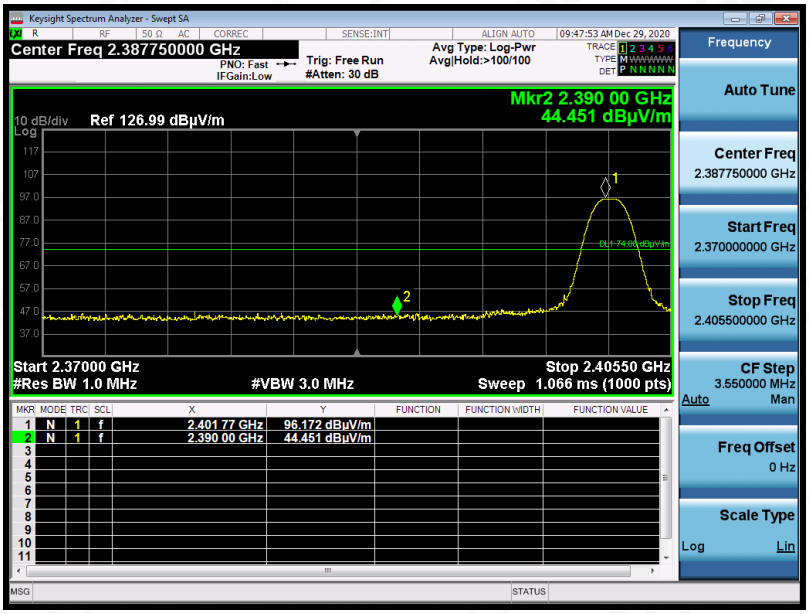
AV



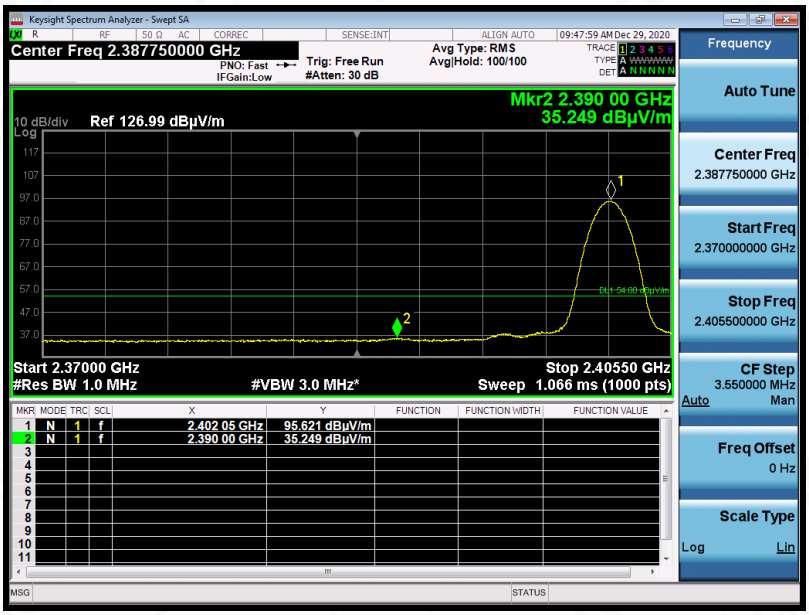
RESULT: PASS

EUT	Multiprotocol 2.4G Wireless Module - Industrial Grade	Model Name	BDE-RFM207B
Temperature	21.8° C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical

PK



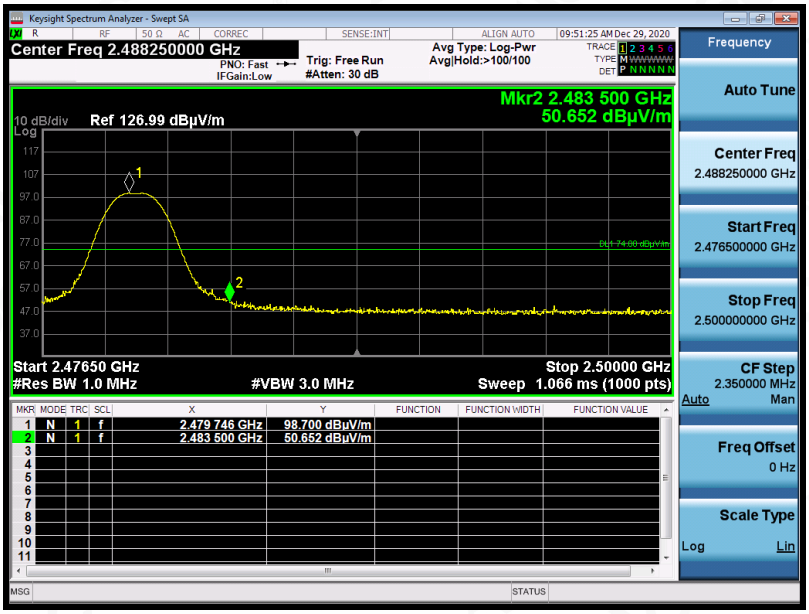
AV



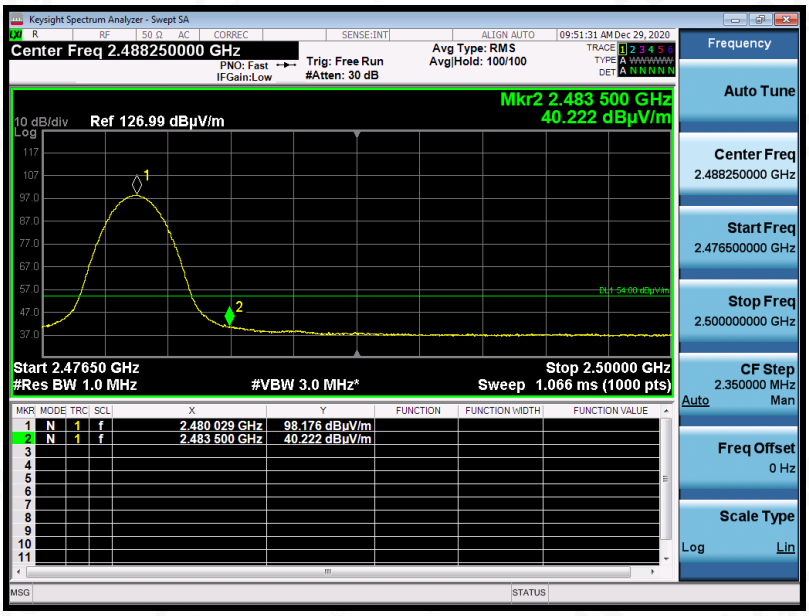
RESULT: PASS

EUT	Multiprotocol 2.4G Wireless Module - Industrial Grade	Model Name	BDE-RFM207B
Temperature	21.8° C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Horizontal

PK



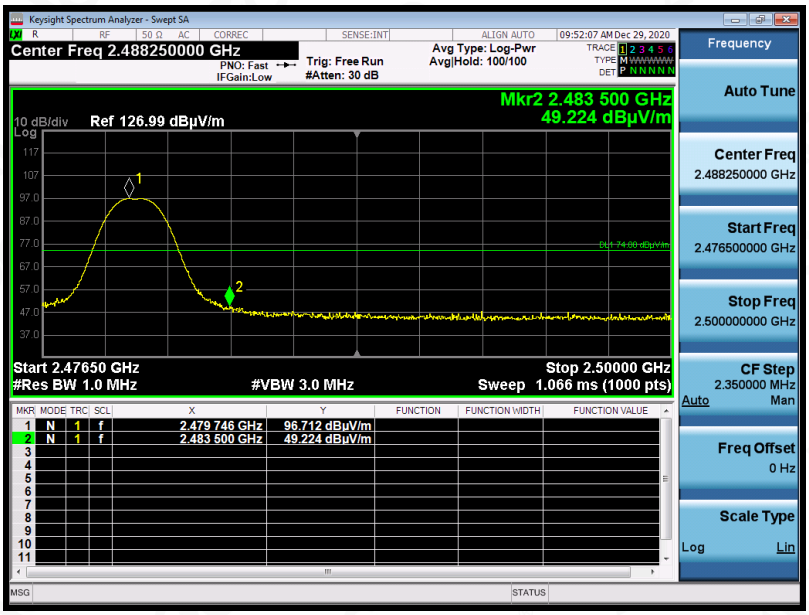
AV



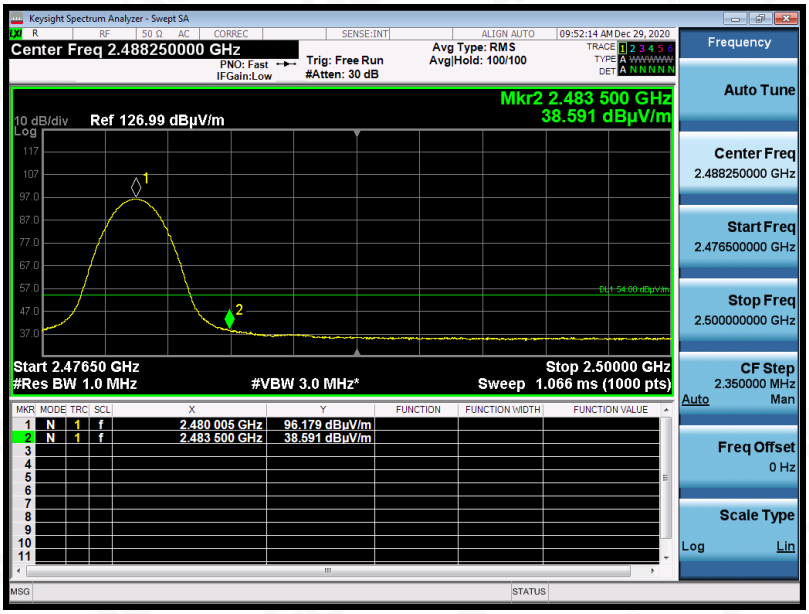
RESULT: PASS

EUT	Multiprotocol 2.4G Wireless Module - Industrial Grade	Model Name	BDE-RFM207B
Temperature	21.8° C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical

PK



AV

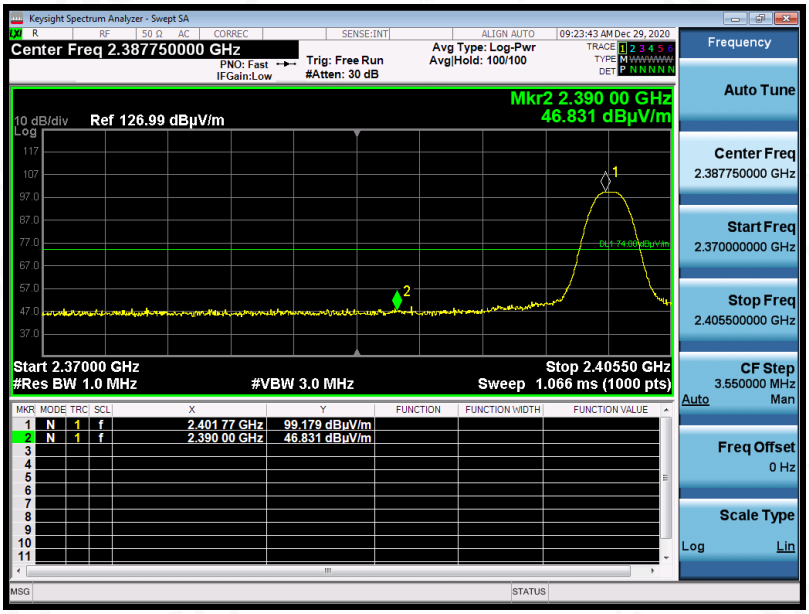


RESULT: PASS

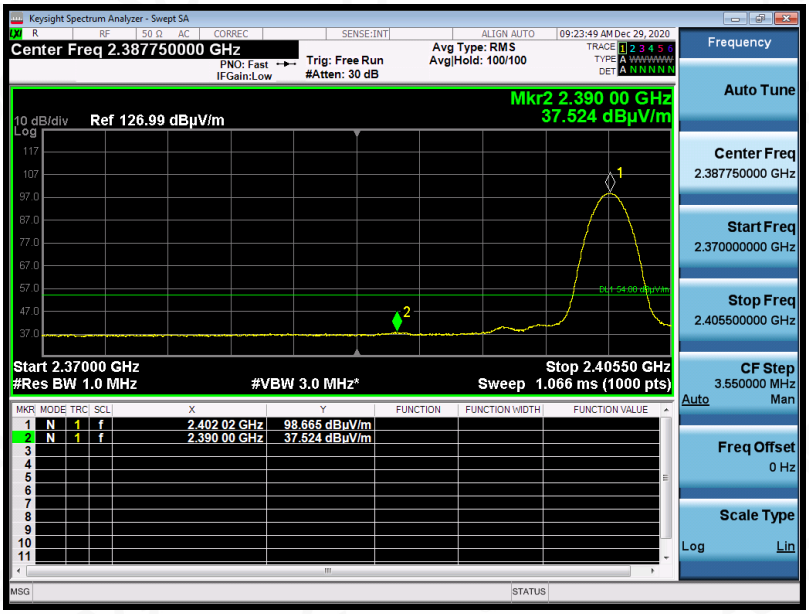
1M

EUT	Multiprotocol 2.4G Wireless Module - Industrial Grade	**Model Name**	BDE-RFM207B
Temperature	21.8° C	**Relative Humidity**	58%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 1	**Antenna**	Horizontal

PK



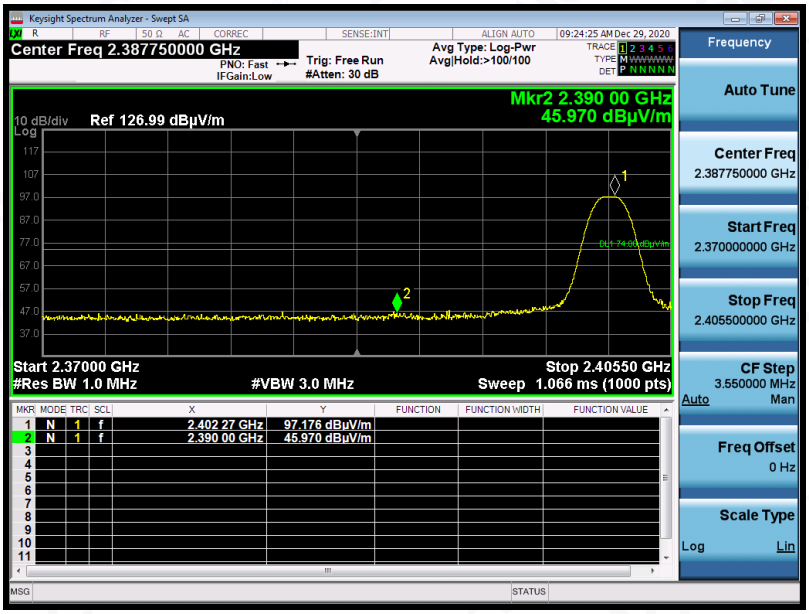
AV



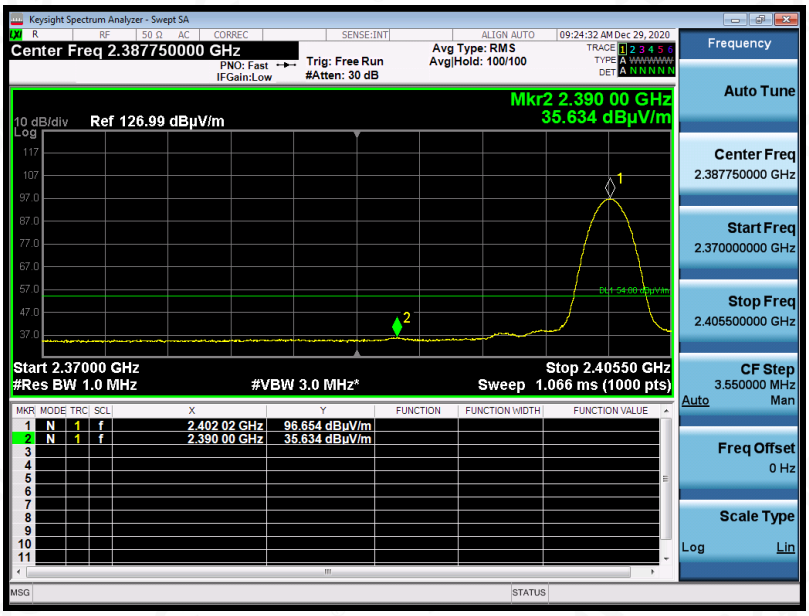
RESULT: PASS

EUT	Multiprotocol 2.4G Wireless Module - Industrial Grade	Model Name	BDE-RFM207B
Temperature	21.8° C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical

PK



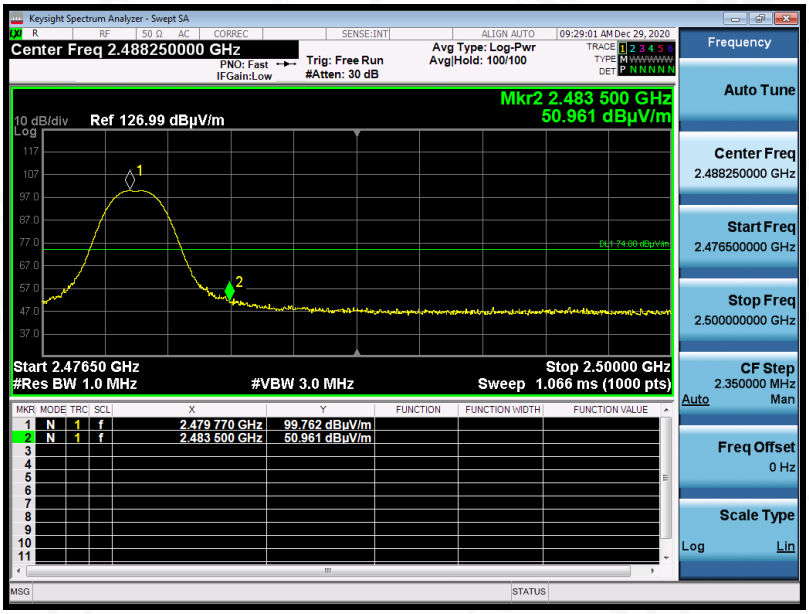
AV



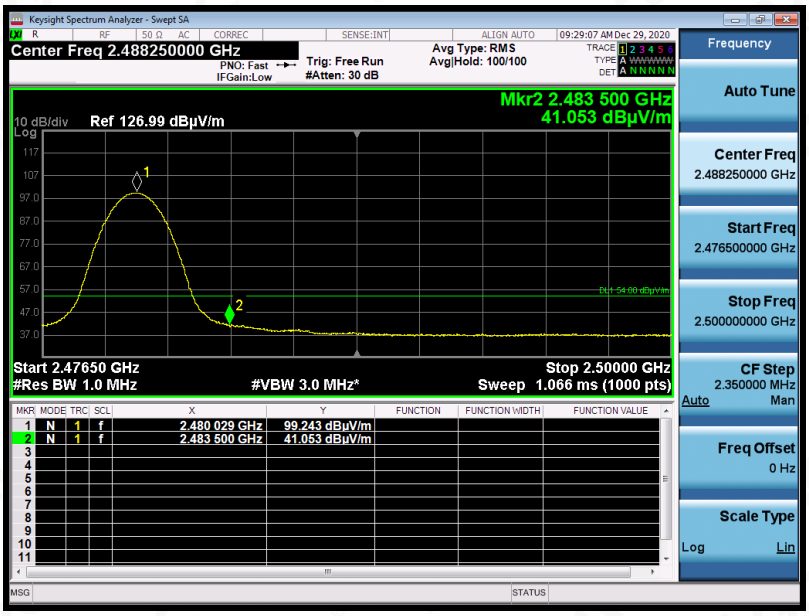
RESULT: PASS

EUT	Multiprotocol 2.4G Wireless Module - Industrial Grade	Model Name	BDE-RFM207B
Temperature	21.8° C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Horizontal

PK



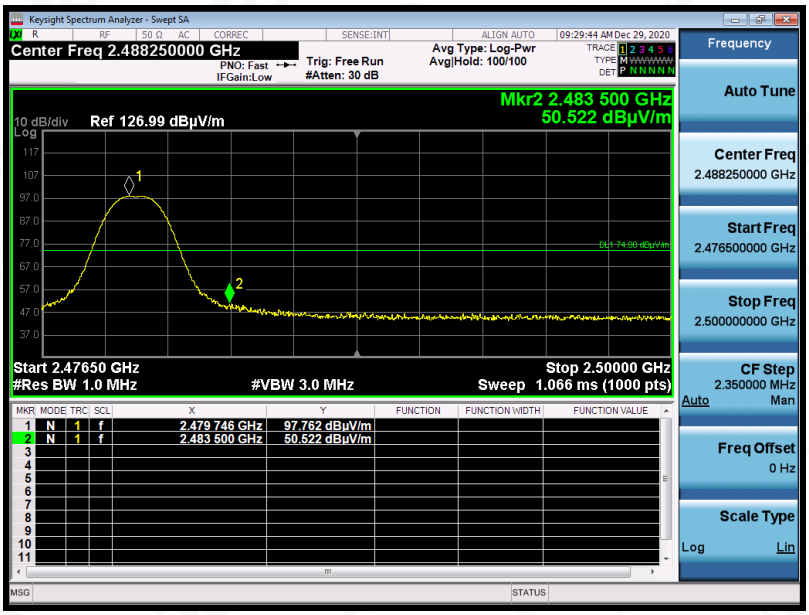
AV



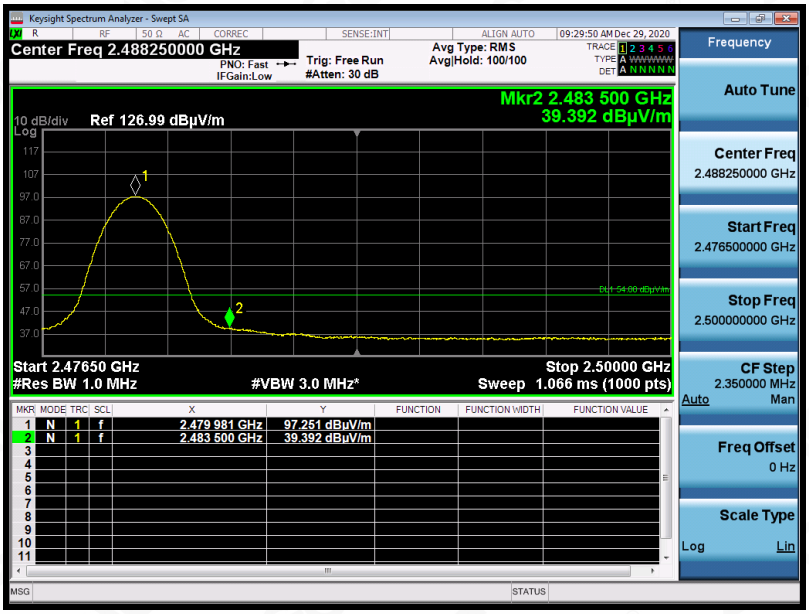
RESULT: PASS

EUT	Multiprotocol 2.4G Wireless Module - Industrial Grade	Model Name	BDE-RFM207B
Temperature	21.8° C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical

PK



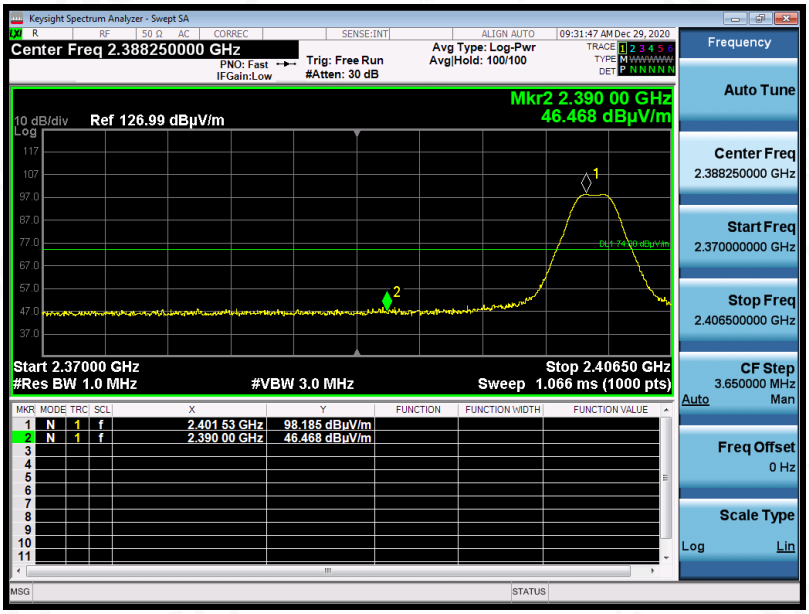
AV



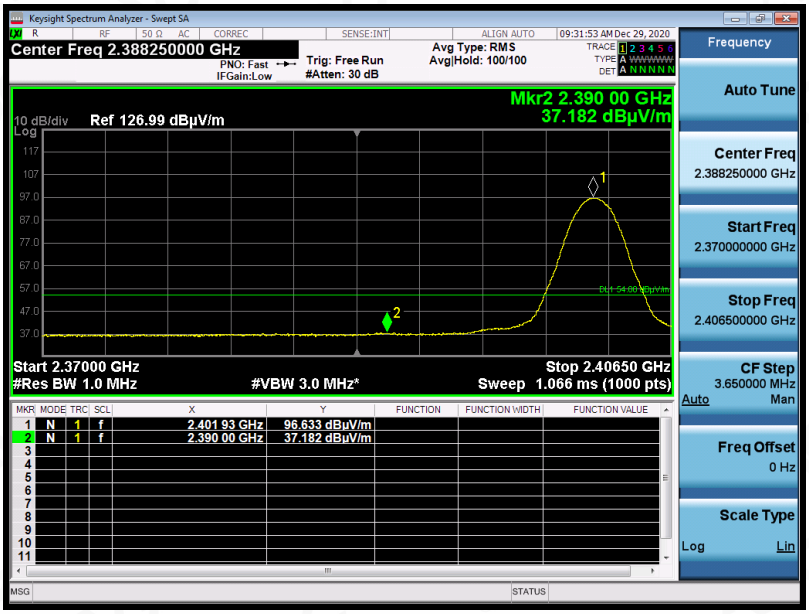
2M

EUT	Multiprotocol 2.4G Wireless Module - Industrial Grade	**Model Name**	BDE-RFM207B
Temperature	21.8° C	**Relative Humidity**	58%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 1	**Antenna**	Horizontal

PK



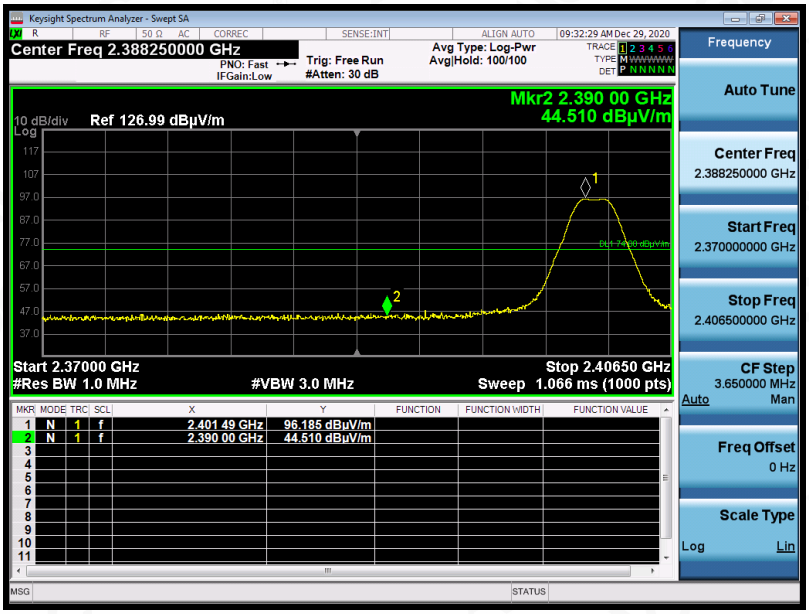
AV



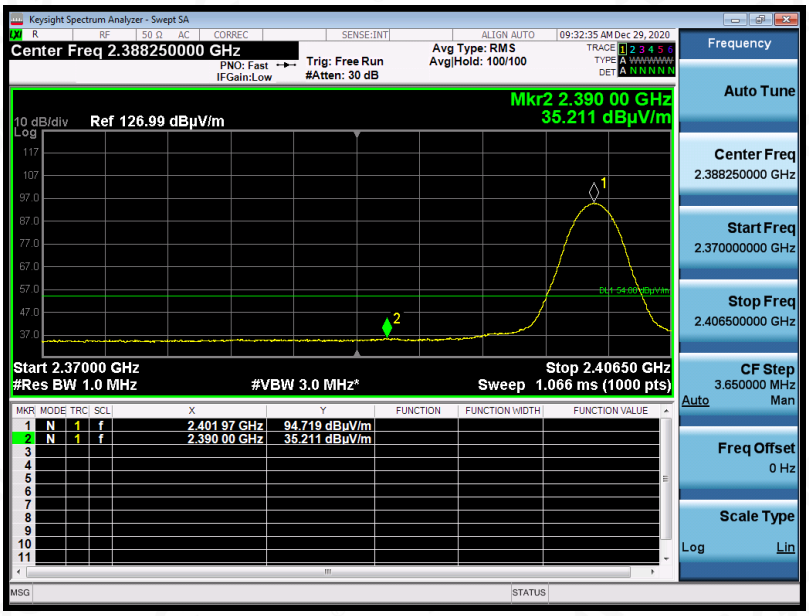
RESULT: PASS

EUT	Multiprotocol 2.4G Wireless Module - Industrial Grade	Model Name	BDE-RFM207B
Temperature	21.8° C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical

PK



AV

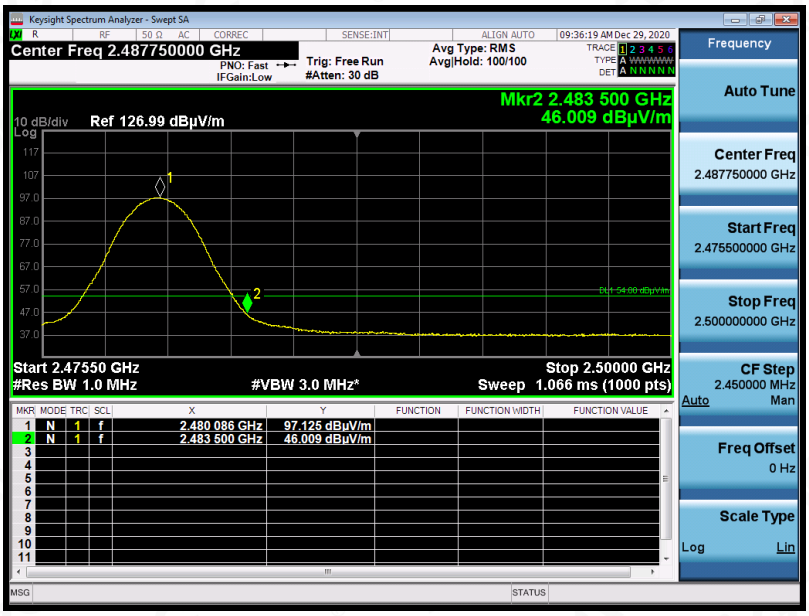


RESULT: PASS

EUT	Multiprotocol 2.4G Wireless Module - Industrial Grade	Model Name	BDE-RFM207B
Temperature	21.8° C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Horizontal

PK

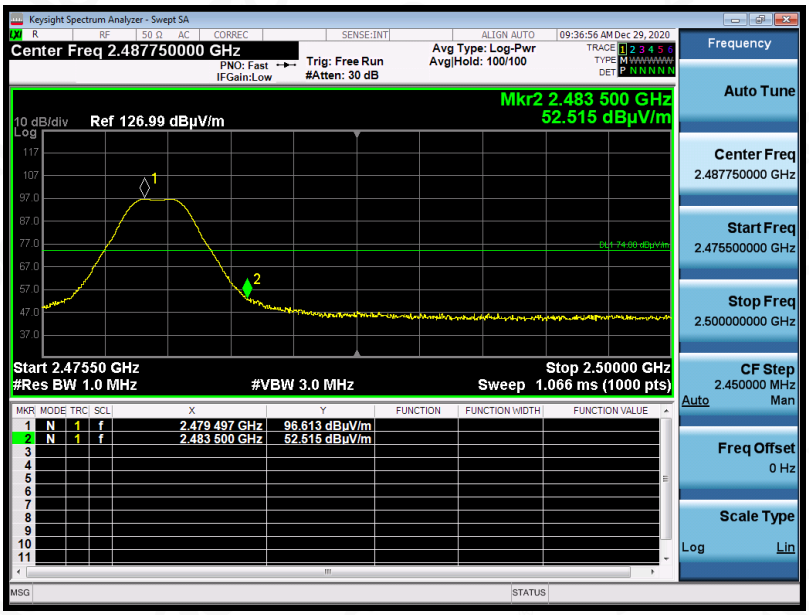
AV



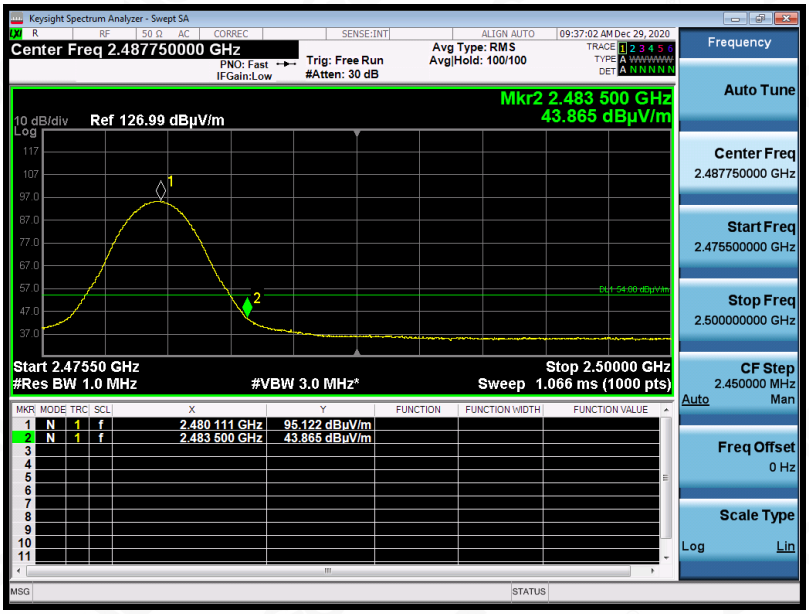
RESULT: PASS

EUT	Multiprotocol 2.4G Wireless Module - Industrial Grade	Model Name	BDE-RFM207B
Temperature	21.8° C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical

PK



AV



RESULT: PASS

Note: The factor had been edited in the “Input Correction” of the Spectrum Analyzer.

12. FCC LINE CONDUCTED EMISSION TEST

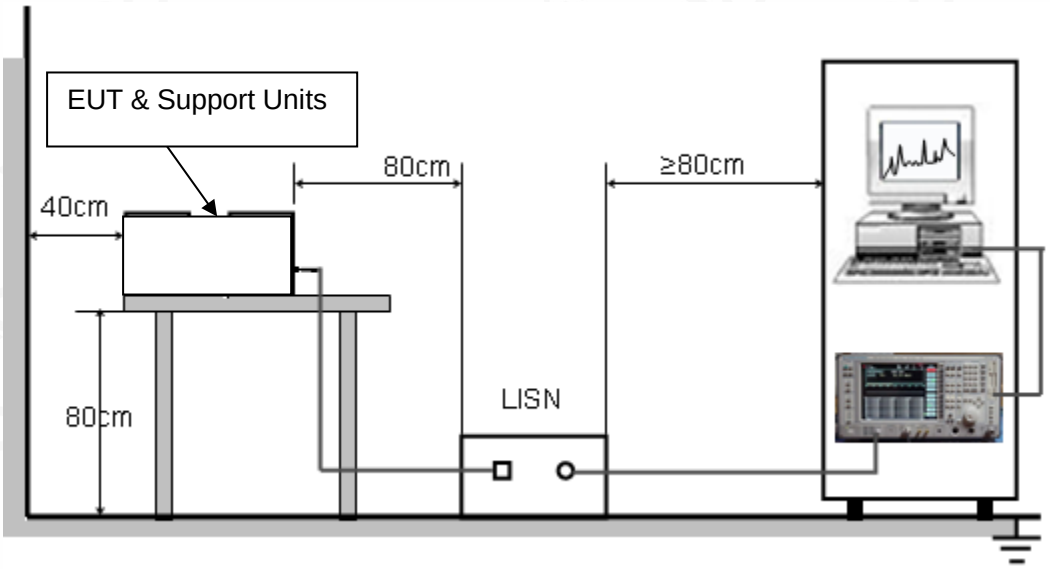
12.1. LIMITS OF LINE CONDUCTED EMISSION TEST

Frequency	Maximum RF Line Voltage	
	Q.P.(dBuV)	Average(dBuV)
150kHz~500kHz	66-56	56-46
500kHz~5MHz	56	46
5MHz~30MHz	60	50

Note:

1. The lower limit shall apply at the transition frequency.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

12.2. BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST



12.3. PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
2. Support equipment, if needed, was placed as per ANSI C63.10.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4. All support equipment received AC120V/60Hz power from a LISN, if any.
5. The EUT received DC 3.3V power from control board which received AC120V/60Hz power from a LISN.
6. The test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.
9. The test mode(s) were scanned during the preliminary test.

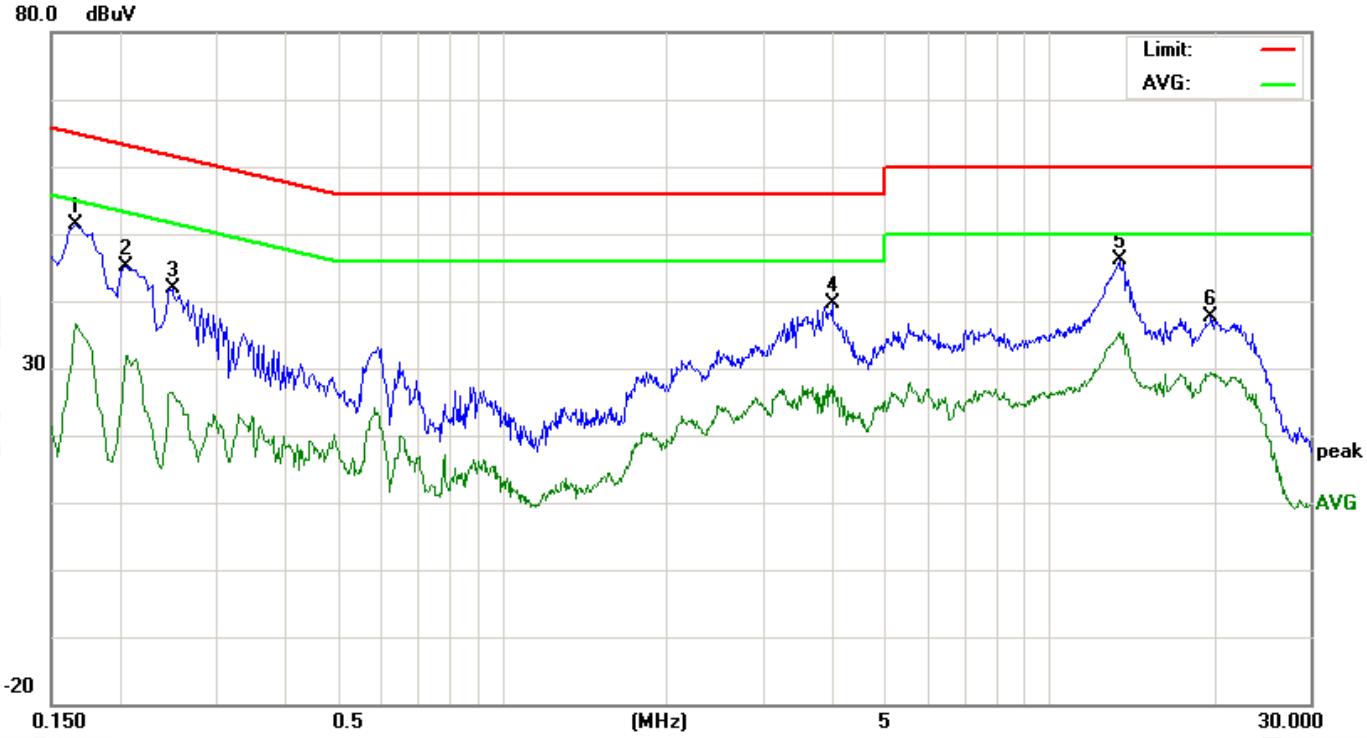
Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

12.4. FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST

1. EUT and support equipment was set up on the test bench as per step 2 of the preliminary test.
2. A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. If EUT emission level was less –2dB to the A.V. limit in Peak mode, then the emission signal was re-checked using Q.P and Average detector.
3. The test data of the worst case condition(s) was reported on the Summary Data page.

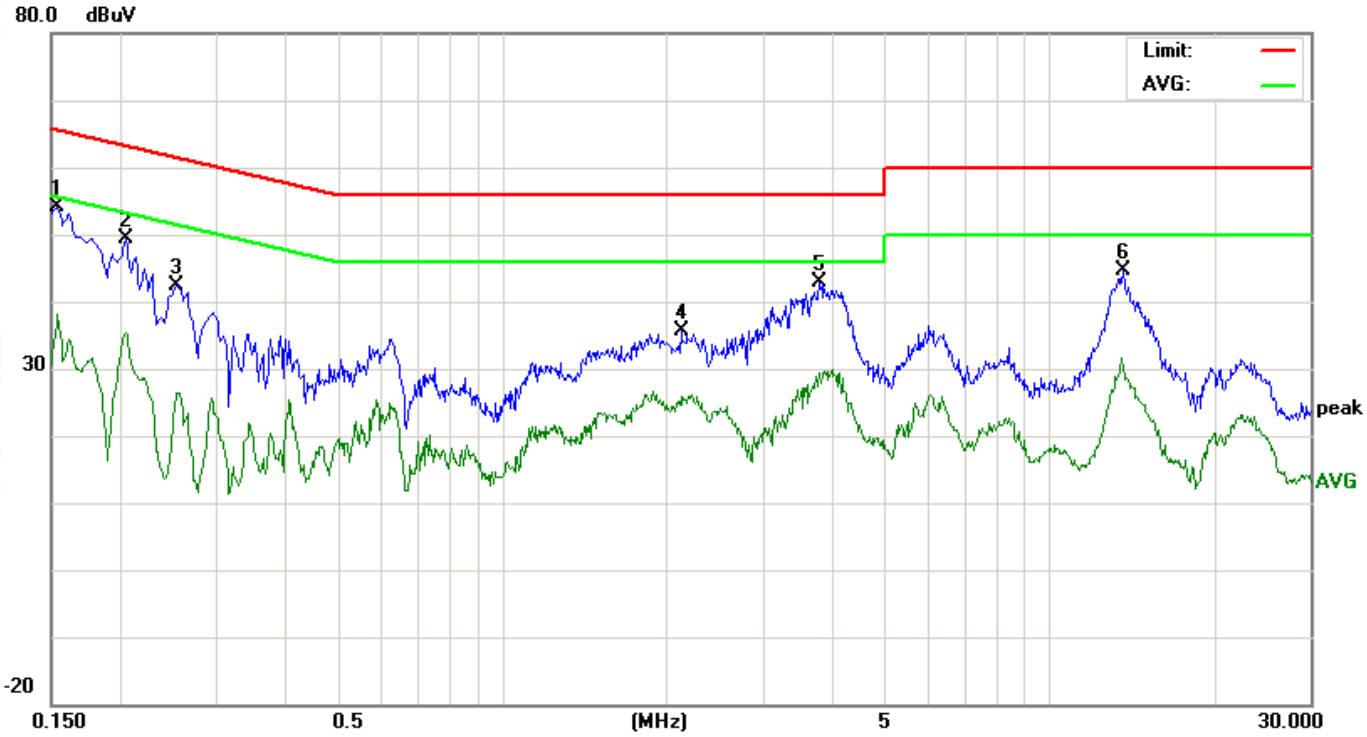
12.5. TEST RESULT OF LINE CONDUCTED EMISSION TEST

Line Conducted Emission Test Line 1-L



No.	Freq. (MHz)	Reading_Level (dBuV)			Correct Factor	Measurement (dBuV)			Limit (dBuV)		Margin (dB)		P/F
		Peak	QP	AVG	dB	Peak	QP	AVG	QP	AVG	QP	AVG	
1	0.1660	38.49	N/A	23.78	12.81	51.30	N/A	36.59	65.15	55.15	-13.85	-18.56	P
2	0.2060	32.33	N/A	19.09	12.87	45.20	N/A	31.96	63.36	53.36	-18.16	-21.40	P
3	0.2500	28.83	N/A	13.53	12.95	41.78	N/A	26.48	61.75	51.75	-19.97	-25.27	P
4	4.0140	27.68	N/A	15.51	11.93	39.61	N/A	27.44	56.00	46.00	-16.39	-18.56	P
5	13.4500	32.54	N/A	22.03	13.47	46.01	N/A	35.50	60.00	50.00	-13.99	-14.50	P
6	19.7740	24.41	N/A	16.19	13.11	37.52	N/A	29.30	60.00	50.00	-22.48	-20.70	P

Line Conducted Emission Test Line 2-N



No.	Freq. (MHz)	Reading_Level (dBuV)			Correct Factor	Measurement (dBuV)			Limit (dBuV)		Margin (dB)		P/F
		Peak	QP	AVG	dB	Peak	QP	AVG	QP	AVG	QP	AVG	
1	0.1539	41.46	N/A	25.32	12.79	54.25	N/A	38.11	65.78	55.78	-11.53	-17.67	P
2	0.2060	36.37	N/A	22.46	12.88	49.25	N/A	35.34	63.36	53.36	-14.11	-18.02	P
3	0.2540	29.44	N/A	13.49	12.95	42.39	N/A	26.44	61.62	51.62	-19.23	-25.18	P
4	2.1220	22.12	N/A	12.34	13.63	35.75	N/A	25.97	56.00	46.00	-20.25	-20.03	P
5	3.8100	30.59	N/A	17.19	12.29	42.88	N/A	29.48	56.00	46.00	-13.12	-16.52	P
6	13.6300	31.09	N/A	16.36	13.48	44.57	N/A	29.84	60.00	50.00	-15.43	-20.16	P

RESULT: PASS

Note: All test modes of rate had been tested. The mode 1 at 125KHz is the worst case and recorded in the report.