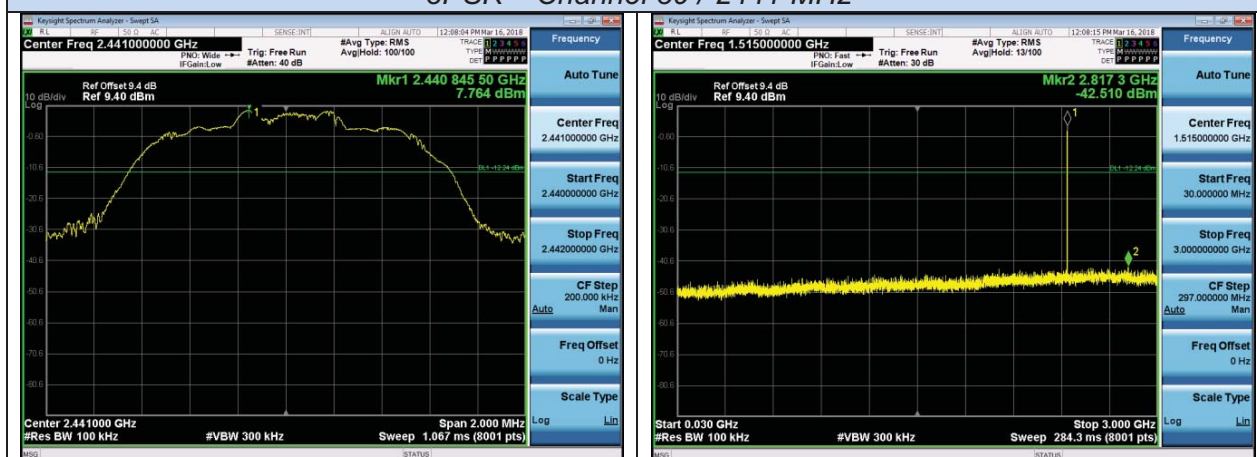
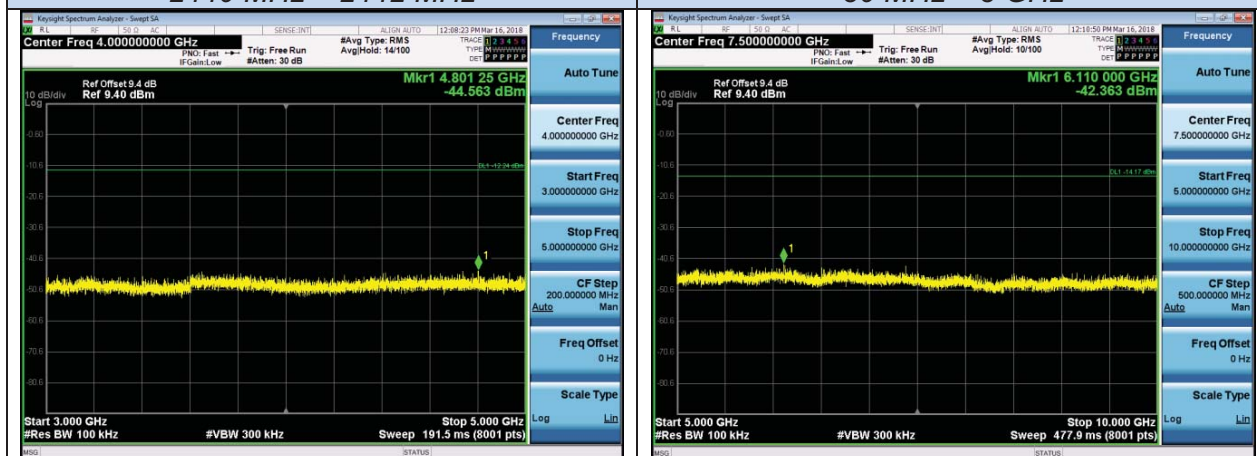


RF Conducted Spurious Emissions 8PSK – Channel 39 / 2441 MHz



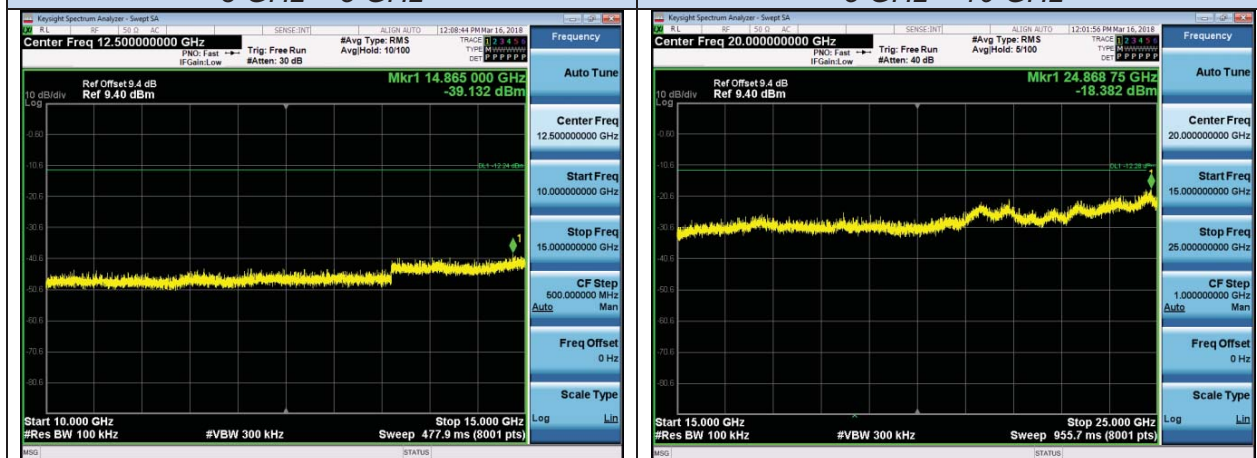
2440 MHz – 2442 MHz

30 MHz – 3 GHz



3 GHz – 5 GHz

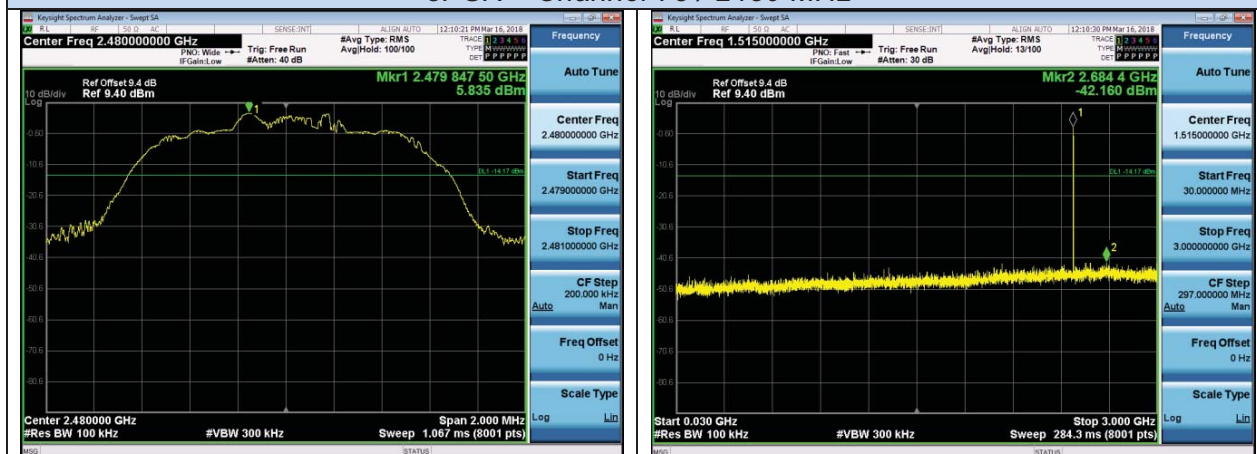
5 GHz – 10 GHz



10 GHz – 15 GHz

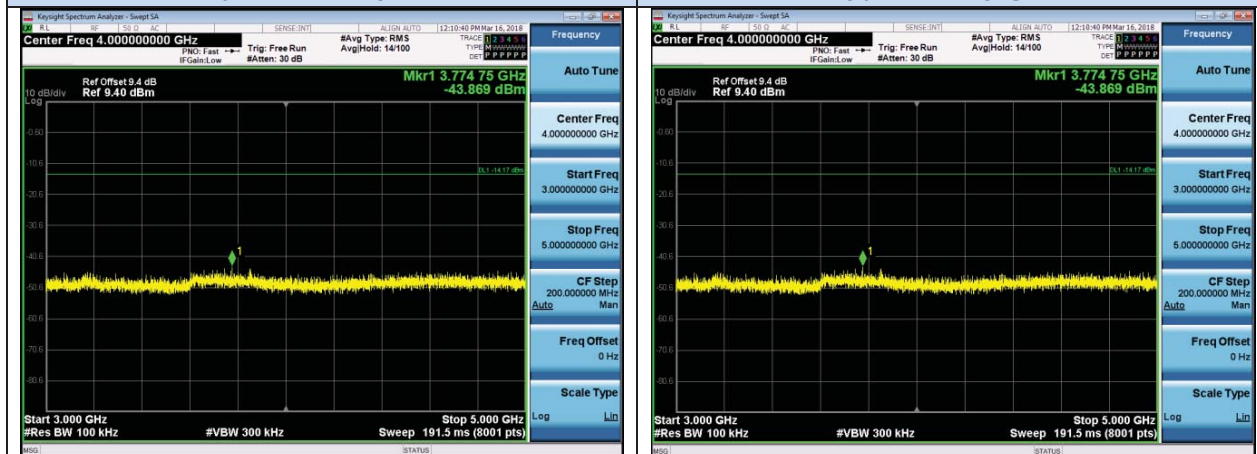
15 GHz – 25 GHz

RF Conducted Spurious Emissions 8PSK – Channel 78 / 2480 MHz



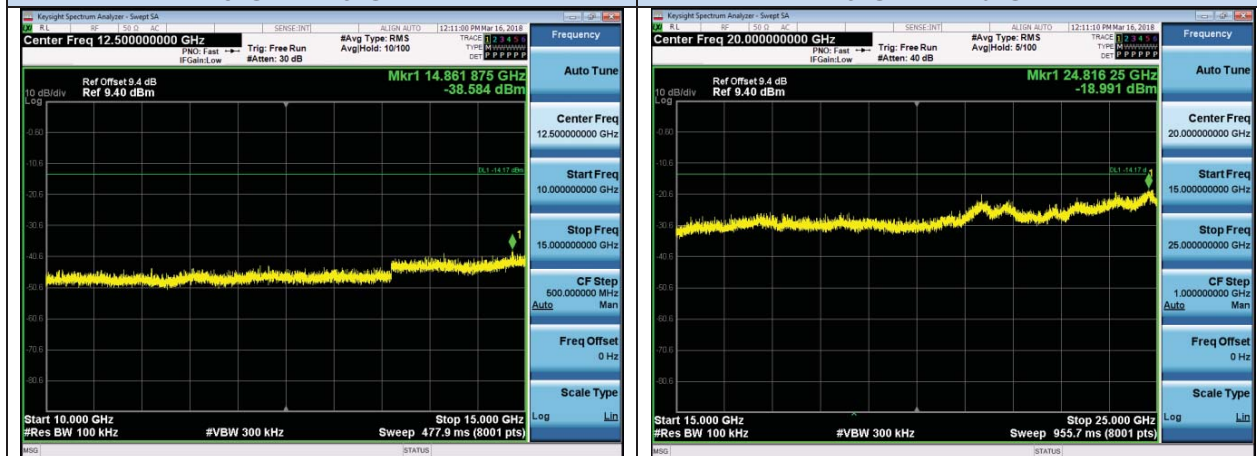
2479 MHz – 2481 MHz

30 MHz – 3 GHz



3 GHz – 5 GHz

5 GHz – 10 GHz

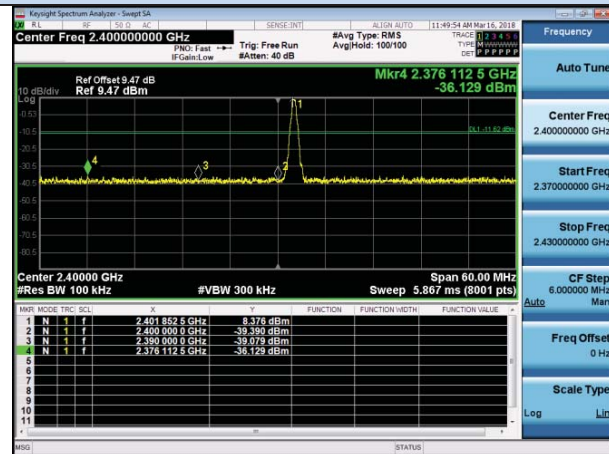


10 GHz – 15 GHz

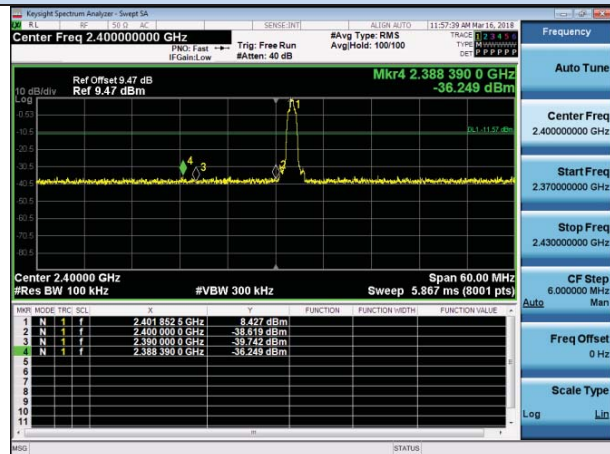
15 GHz – 25 GHz

Band-edge for RF conducted emissions

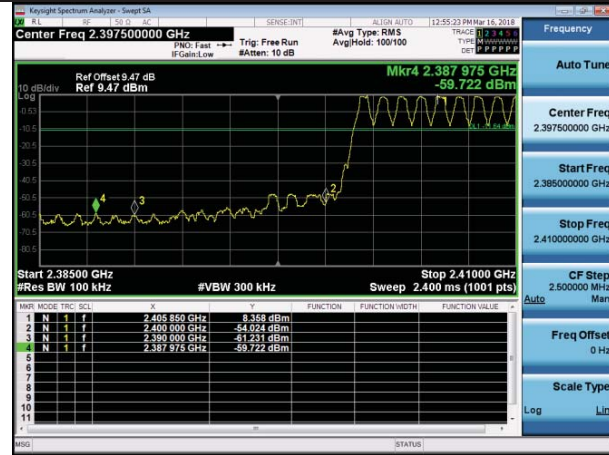
GFSK



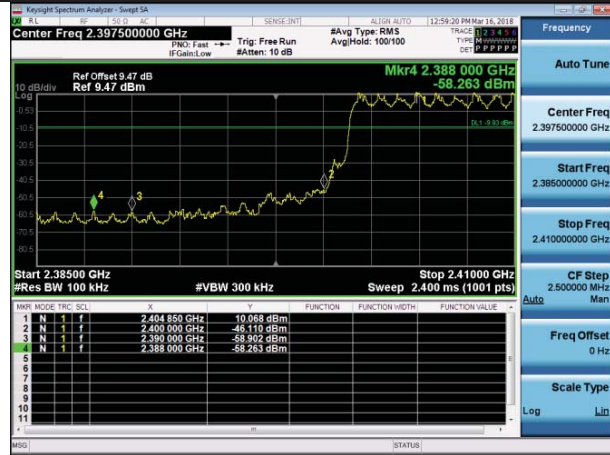
$\pi/4$ -DQPSK



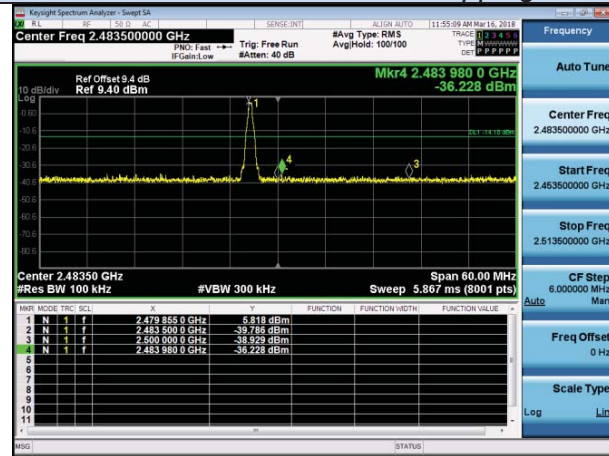
Channel 0 / 2402 MHz – Non-Hopping



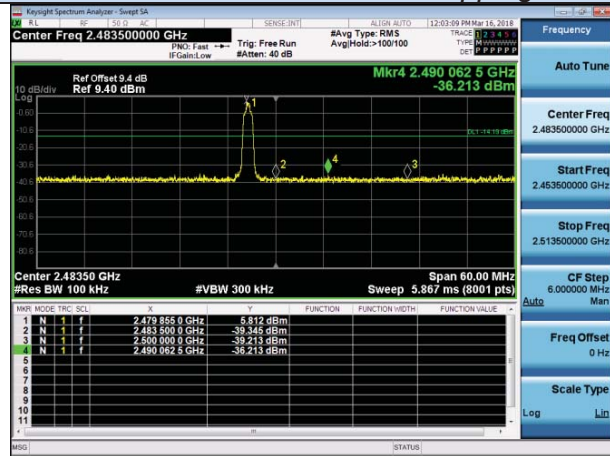
Channel 0 / 2402 MHz – Non-Hopping



Channel 0 / 2402 MHz – Hopping



Channel 0 / 2402 MHz – Hopping

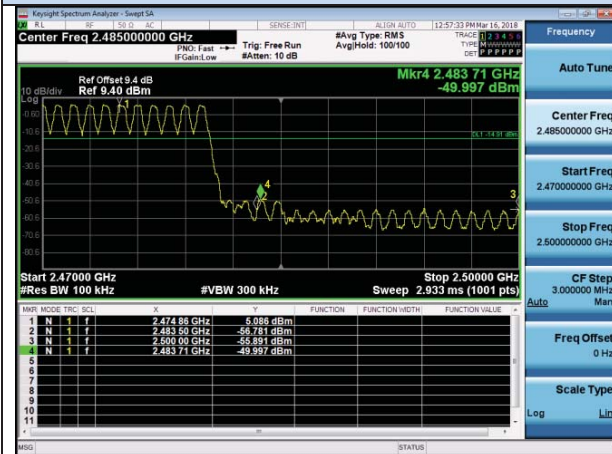
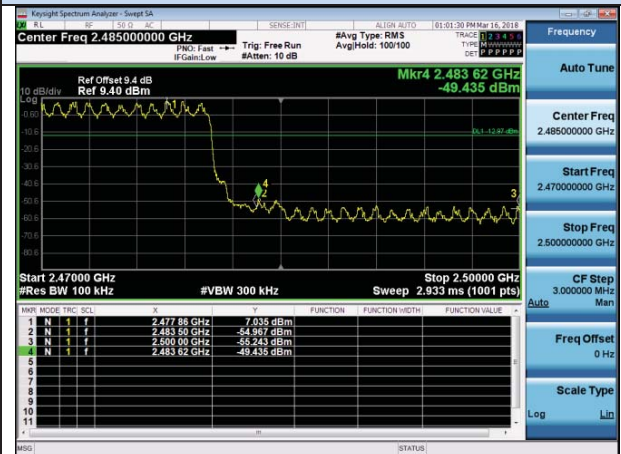


Channel 78 / 2480 MHz – Non-Hopping

Channel 78 / 2480 MHz – Non-Hopping

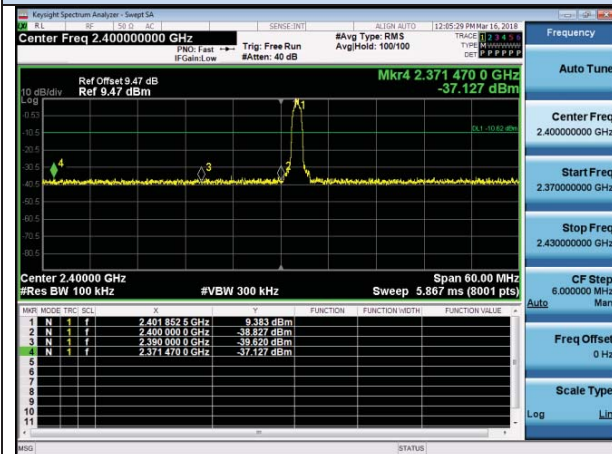
Band-edge for RF conducted emissions

GFSK

 $\pi/4$ -DQPSK

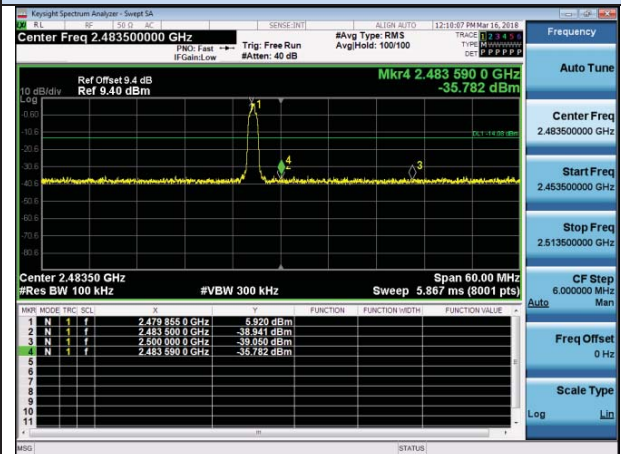
Channel 78 / 2480 MHz – Hopping

8DPSK

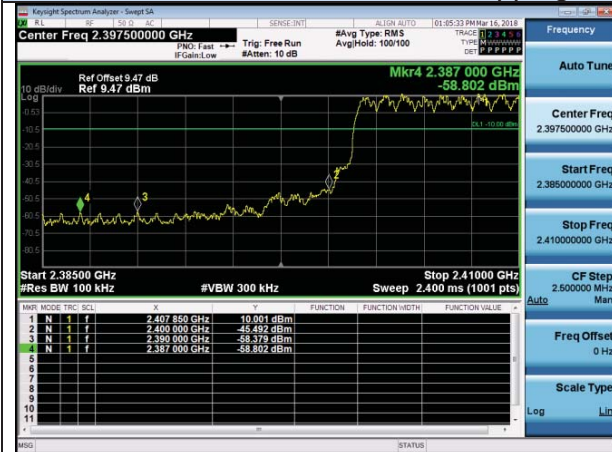


Channel 78 / 2480 MHz – Hopping

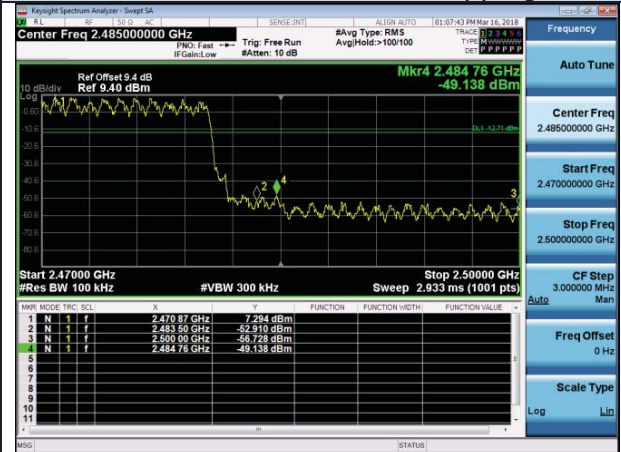
8DPSK



Channel 0 / 2402 MHz – Non-Hopping



Channel 0 / 2402 MHz – Hopping

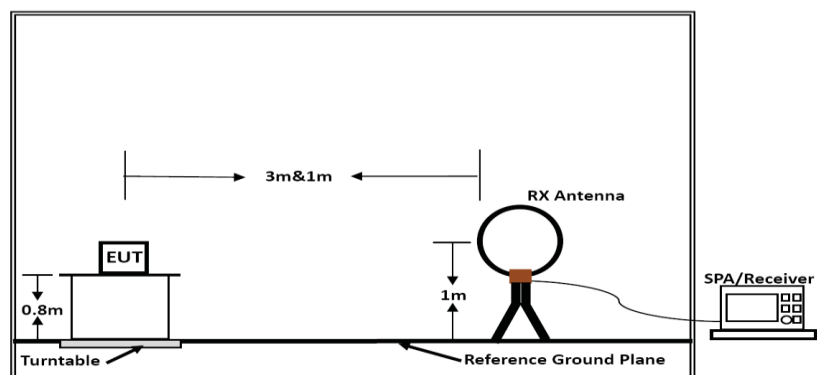


Channel 78 / 2480 MHz – Non-Hopping

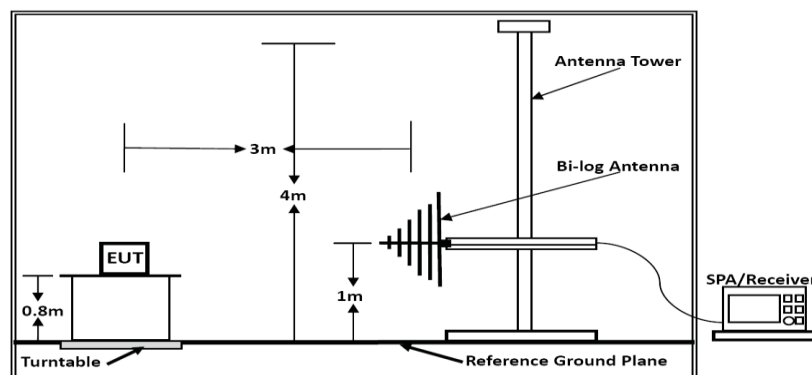
Channel 78 / 2480 MHz – Hopping

7. RADIATED MEASUREMENT

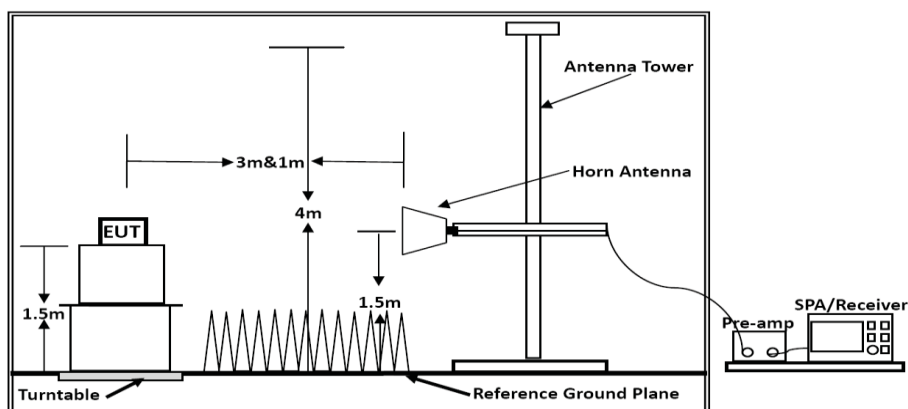
7.1 Block Diagram of Test Setup



Below 30MHz



Below 1GHz



Above 1GHz

Above 18 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade from 3m to 1m.

Distance extrapolation factor = $20 \log (\text{specific distance [3m]} / \text{test distance [1.5m]})$ (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

7.2 Restricted Band Emission Limit

15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
\1\ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(\2\)
13.36-13.41			

\1\ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

\2\ Above 38.6

According to §15.247 (d): 20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below 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

7.3 Instruments Setting

Please refer to equipment list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10 th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB/VB 200Hz/1KHz for QP/AVG
Start ~ Stop Frequency	150kHz~30MHz / RB/VB 9kHz/30KHz for QP/AVG
Start ~ Stop Frequency	30MHz~1000MHz / RB/VB 120kHz/1MHz for QP

7.4 Test Procedures

1) Sequence of testing 9 kHz to 30 MHz

Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.
- If the EUT is a floor standing device, it is placed on the ground.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

Premeasurement:

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 0.8 meter.
- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).
- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.
- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

2) Sequence of testing 30 MHz to 1 GHz

Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

Premeasurement:

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 to 3 meter.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ($\pm 45^\circ$) and antenna movement between 1 and 4 meter.
- The final measurement will be done with QP detector with an EMI receiver.
- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

3) Sequence of testing 1 GHz to 18 GHz

Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

Premeasurement:

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height scan range is 1 meter to 2.5 meter.
- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ($\pm 45^\circ$) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.
- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.
- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

4) Sequence of testing above 18 GHz

Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 1 meter.
- The EUT was set into operation.

Premeasurement:

- The antenna is moved spherical over the EUT in different polarizations of the antenna.

Final measurement:

- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.
- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

7.5 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

7.6 Test Results

Radiated Emissions (9 KHz~30MHz)

Temperature	25℃	Humidity	60%
Test Engineer	Tom Liu	Configurations	BT

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Over Limit (dBuV)	Remark
-	-	-	-	See Note

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

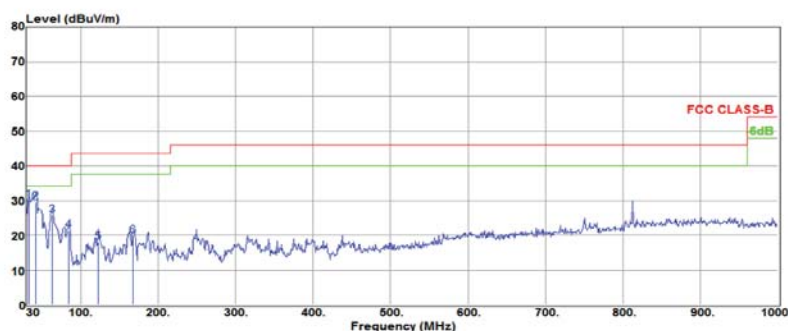
PASS.

Pre-scan all modes and recorded the worst case results in this report (TX-High Channel (1Mbps)).
The test data please refer to following page.

Below 1GHz (Worst case: GFSK, High Channel)

Vertical:

Data : 2



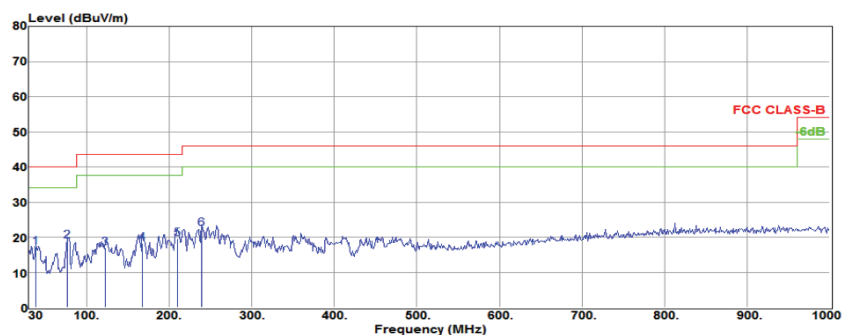
Item (Mark)	Freq (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	32.91	61.92	0.00	32.47	0.77	30.22	40.00	-9.78	QP	VERTICAL
2	41.64	61.10	0.00	32.43	0.78	29.45	40.00	-10.55	QP	VERTICAL
3	62.98	56.94	0.00	32.43	1.24	25.75	40.00	-14.25	QP	VERTICAL
4	84.32	52.29	0.00	32.49	1.46	21.26	40.00	-18.74	QP	VERTICAL
5	123.12	48.69	0.00	32.48	1.85	18.06	43.50	-25.44	QP	VERTICAL
6	167.74	49.93	0.00	32.35	2.20	19.78	43.50	-23.72	QP	VERTICAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor

2. If QP Result comply with AV limit, AV Result is deemed to comply with AV limit

Horizontal:

Data : 1



Item (Mark)	Freq (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	38.73	34.98	13.92	32.44	0.71	17.17	40.00	-22.83	QP	HORIZONTAL
2	76.56	40.28	9.82	32.47	1.39	19.02	40.00	-20.98	QP	HORIZONTAL
3	123.12	35.21	12.39	32.48	1.85	16.97	43.50	-26.53	QP	HORIZONTAL
4	167.74	34.87	13.43	32.35	2.20	18.15	43.50	-25.35	QP	HORIZONTAL
5	210.42	39.09	10.21	32.26	2.56	19.60	43.50	-23.90	QP	HORIZONTAL
6	239.52	40.80	11.09	32.27	2.73	22.35	46.00	-23.65	QP	HORIZONTAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor

2. If QP Result comply with AV limit, AV Result is deemed to comply with AV limit

Note:

1). Pre-scan all modes and recorded the worst case results in this report (GFSK (High Channel)).
Emission level (dBuV/m) = 20 log Emission level (uV/m).

2). Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

Above 1GHz

Note: Only recorded the worst test result.

The worst test result for GFSK, Channel 0 / 2402 MHz:

Freq. MHz	Reading dBuV	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4804.00	47.53	33.06	35.04	3.94	49.49	74.00	-24.51	Peak	Horizontal
4804.00	34.29	33.06	35.04	3.94	36.25	54.00	-17.75	Average	Horizontal
4804.00	51.01	33.06	35.04	3.94	52.97	74.00	-21.03	Peak	Vertical
4804.00	36.53	33.06	35.04	3.94	38.49	54.00	-15.51	Average	Vertical

The worst test result for GFSK, Channel 39 / 2441 MHz:

Freq. MHz	Reading dBuV	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4882.00	48.81	33.16	35.15	3.96	50.78	74.00	-23.22	Peak	Horizontal
4882.00	31.52	33.16	35.15	3.96	33.49	54.00	-20.51	Average	Horizontal
4882.00	50.99	33.16	35.15	3.96	52.96	74.00	-21.04	Peak	Vertical
4882.00	36.93	33.16	35.15	3.96	38.9	54.00	-15.10	Average	Vertical

The worst test result for GFSK, Channel 78 / 2480 MHz:

Freq. MHz	Reading dBuV	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4960.00	48.28	33.26	35.14	3.98	50.38	74.00	-23.62	Peak	Horizontal
4960.00	33.38	33.26	35.14	3.98	35.48	54.00	-18.52	Average	Horizontal
4960.00	49.96	33.26	35.14	3.98	52.06	74.00	-21.94	Peak	Vertical
4960.00	37.23	33.26	35.14	3.98	39.33	54.00	-14.67	Average	Vertical

Notes:

- 1). Measuring frequencies from 9 KHz - 10th harmonic (ex. 26GHz), No emission found between lowest internal used/generated frequency to 30 MHz.
- 2). Radiated emissions measured in frequency range from 9 KHz - 10th harmonic (ex. 26GHz) were made with an instrument using Peak detector mode.
- 3). 18~25GHz at least have 20dB margin. No recording in the test report.

8. POWER LINE CONDUCTED EMISSIONS

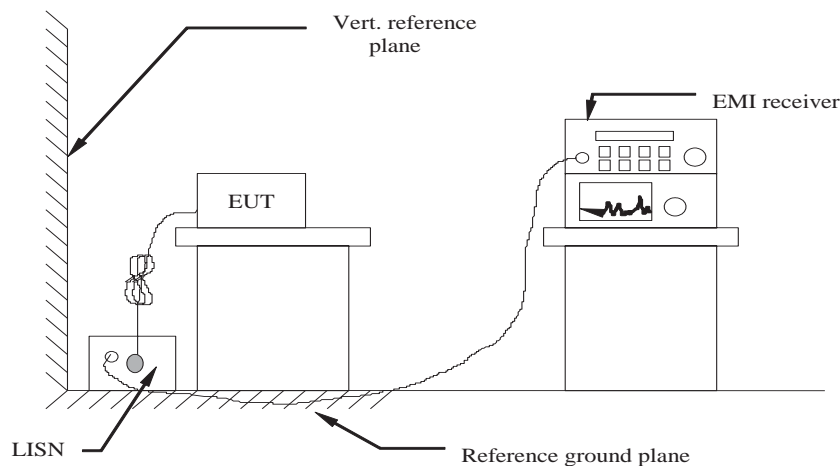
8.1 Standard Applicable

According to §15.207 (a): For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 KHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range are listed as follows:

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

* Decreasing linearly with the logarithm of the frequency

8.2 Block Diagram of Test Setup



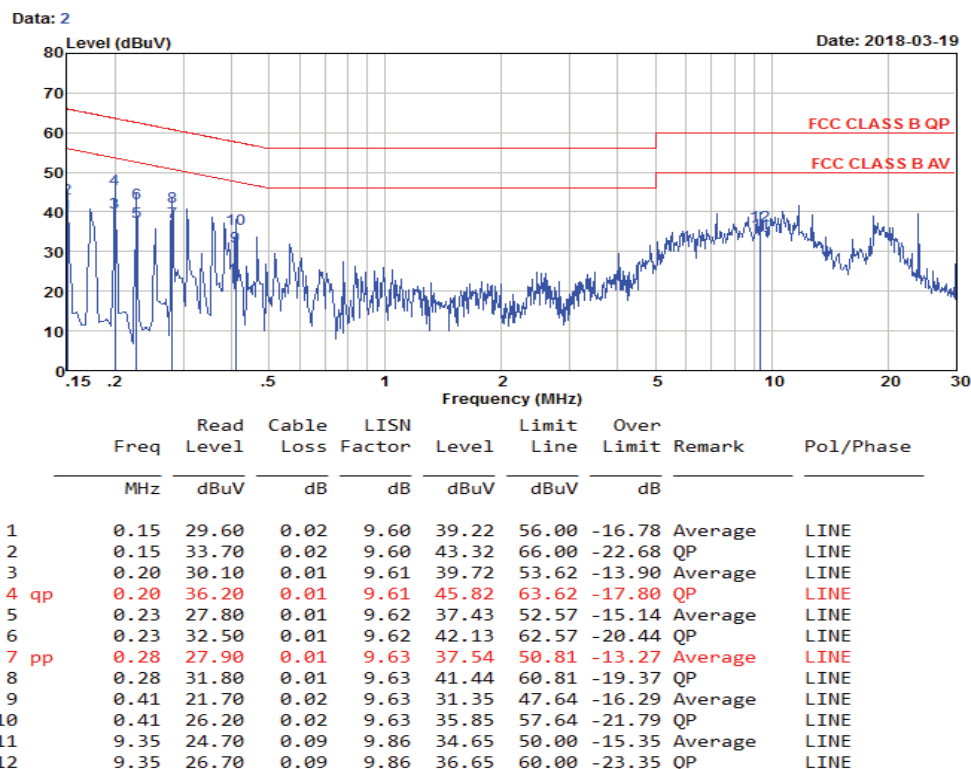
8.3 Test Results

PASS.

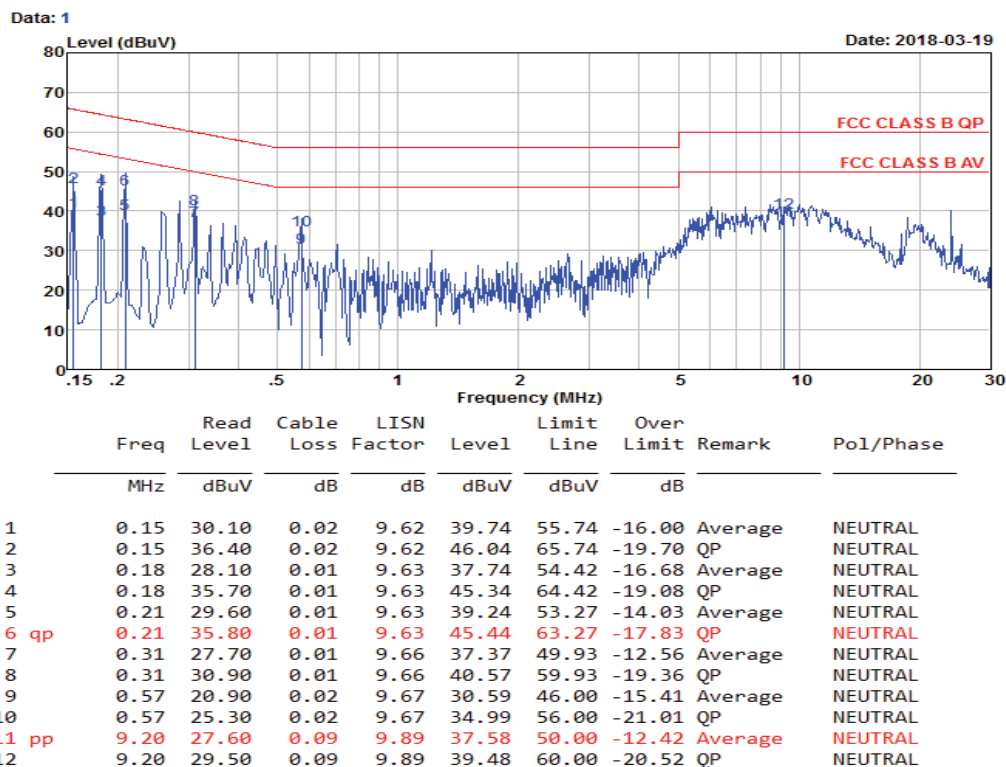
The test data please refer to following page.

AC Conducted Emission of power adapter @ AC 120V/60Hz @ GFSK (worst case)

Line:



Neutral:



***Note: Pre-scan all modes and recorded the worst case results in this report;

9. RESTRICT-BAND BAND-EDGE MEASUREMENTS FOR RADIATED EMISSIONS

9.1 Standard Applicable

Per the requirement of ANSI C63.10:2013 §6.10.5, Restricted-band band-edge tests shall be performed as radiated measurements, however, §12.7.2 that allowed a converted method from conducted measurement function, for conducted measurements above 1000 MHz, EIRP shall be computed as specified in §12.7.4.2, and then field strength shall be computed as follows:

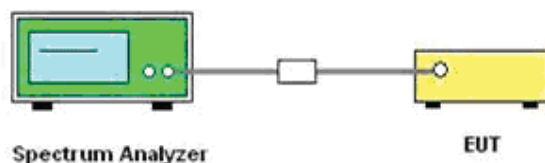
1) $E [\text{dBuV/m}] = \text{EIRP}[\text{dBm}] - 20 \log (d[\text{m}]) + 104.77$, where E is field strength and d is distance at which the field strength limit is specified in the applicable requirements.

2) $E [\text{dBuV/m}] = \text{EIRP}[\text{dBm}] + 95.2$, for $d = 3 \text{ m}$.

Then the radiated field strength E can be calculated as

$$E = \text{EIRP} [\text{dBm}] + 95.2$$

9.2 Block Diagram of Test Setup



9.3 Measuring Instruments and Setting

Please refer to equipment list in this report. The following table is the setting of Spectrum Analyzer.

9.4. Test Procedures

1. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
2. Repeat above procedures until all measured frequencies were complete.
3. Measure the conducted output power (in dBm) using the detector specified by the appropriate regulatory agency for guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).
4. Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see 12.2.5 for guidance on determining the applicable antenna gain)
5. Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies $\leq 30 \text{ MHz}$, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies $> 1000 \text{ MHz}$).
6. For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW).
7. Compare the resultant electric field strength level to the applicable regulatory limit.
8. Perform radiated spurious emission test duress until all measured frequencies were complete.
9. Spectrum analyzer setup:
 Resolution bandwidth: 1MHz
 Video bandwidth: $3 \times \text{RBW}$
 Detector: Peak and average above 1 GHz

9.5. Test Results

GFSK – Non-Hopping							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Ground Reflection Factor (dB)	Convert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Verdict
2313.286	-44.21	2.000	0.000	52.99	Peak	74.00	PASS
2313.286	-57.43	2.000	0.000	39.77	Average	54.00	PASS
2390.000	-44.49	2.000	0.000	52.71	Peak	74.00	PASS
2390.000	-57.11	2.000	0.000	40.09	Average	54.00	PASS
2483.500	-46.51	2.000	0.000	50.69	Peak	74.00	PASS
2483.500	-56.59	2.000	0.000	40.61	Average	54.00	PASS
2486.178	-46.67	2.000	0.000	50.53	Peak	74.00	PASS
2486.178	-56.42	2.000	0.000	40.78	Average	54.00	PASS

$\pi/4$DQPSK – Non-Hopping							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Ground Reflection Factor (dB)	Convert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Verdict
2313.286	-46.56	2.000	0.000	50.64	Peak	74.00	PASS
2313.286	-57.35	2.000	0.000	39.85	Average	54.00	PASS
2390.000	-44.87	2.000	0.000	52.33	Peak	74.00	PASS
2390.000	-57.20	2.000	0.000	40.00	Average	54.00	PASS
2483.500	-46.37	2.000	0.000	50.83	Peak	74.00	PASS
2483.500	-56.77	2.000	0.000	40.43	Average	54.00	PASS
2486.178	-46.63	2.000	0.000	50.57	Peak	74.00	PASS
2486.178	-56.82	2.000	0.000	40.38	Average	54.00	PASS

8DPSK – Non-Hopping							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Ground Reflection Factor (dB)	Convert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Verdict
2313.286	-45.67	2.000	0.000	51.53	Peak	74.00	PASS
2313.286	-57.44	2.000	0.000	39.76	Average	54.00	PASS
2390.000	-45.64	2.000	0.000	51.56	Peak	74.00	PASS
2390.000	-57.11	2.000	0.000	40.09	Average	54.00	PASS
2483.500	-45.85	2.000	0.000	51.35	Peak	74.00	PASS
2483.500	-56.71	2.000	0.000	40.49	Average	54.00	PASS
2486.178	-45.27	2.000	0.000	51.93	Peak	74.00	PASS
2486.178	-56.83	2.000	0.000	40.37	Average	54.00	PASS

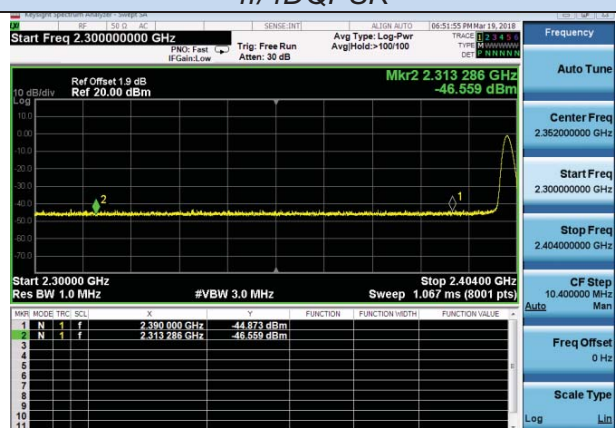
Remark:

1. Measured at difference Packet Type for each mode and recorded worst case for each mode.
2. Worst case data at DH5 for GFSK, 2DH5 for $\pi/4$ DQPSK, 3DH5 for 8DPSK modulation type;
3. Measured at Hopping and Non-Hopping mode, recorded worst at Non-Hopping mode.
4. The other emission levels were very low against the limit.
5. The average measurement was not performed when the peak measured data under the limit of average detection.
6. Detector AV is setting spectrum/receiver. RBW=1MHz/VBW=330KHz/Sweep time=Auto/Detector=Peak;

- 7. Since the out-of-band characteristics of the EUT transmit antenna will often be unknown, the use of a conservative antenna gain value is necessary. Thus, when determining the EIRP based on the measured conducted power, the upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands, or 2 dBi, whichever is greater. However, for devices that operate in multiple frequency bands while using the same transmit antenna, the highest gain of the antenna within the operating band nearest in frequency to the restricted band emission being measured may be used in lieu of the overall highest gain when the emission is at a frequency that is within 20 percent of the nearest band edge frequency, but in no case shall a value less than 2 dBi be used.*
- 8. Please refer to following test plots;*

Restrict-Band Band-edge measurements for radiated emissions

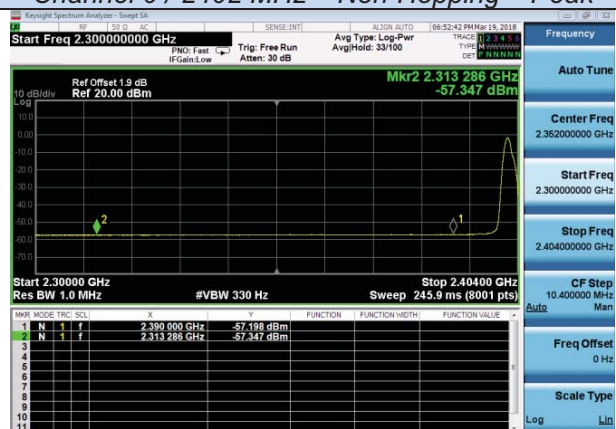
GFSK

 $\pi/4$ QPSK

Channel 0 / 2402 MHz – Non-Hopping – Peak



Channel 0 / 2402 MHz – Non-Hopping – Peak



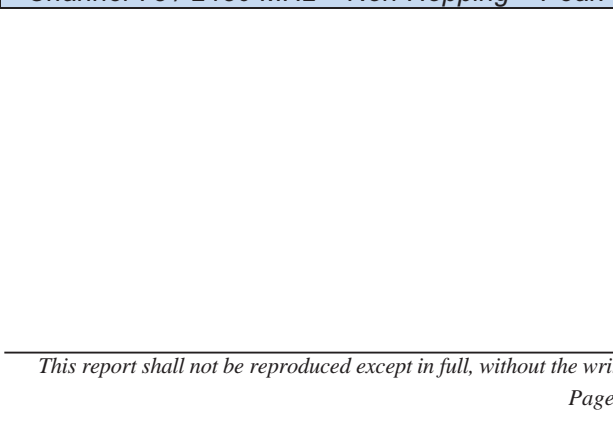
Channel 0 / 2402 MHz – Non-Hopping – Average



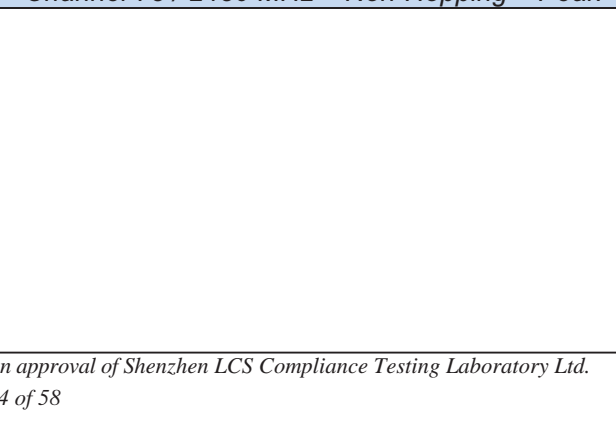
Channel 0 / 2402 MHz – Non-Hopping – Average

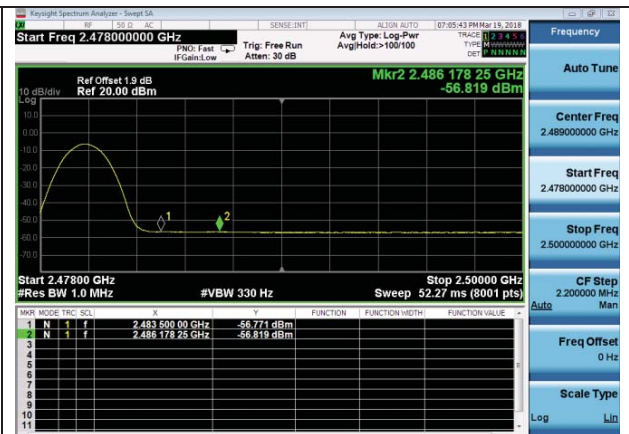
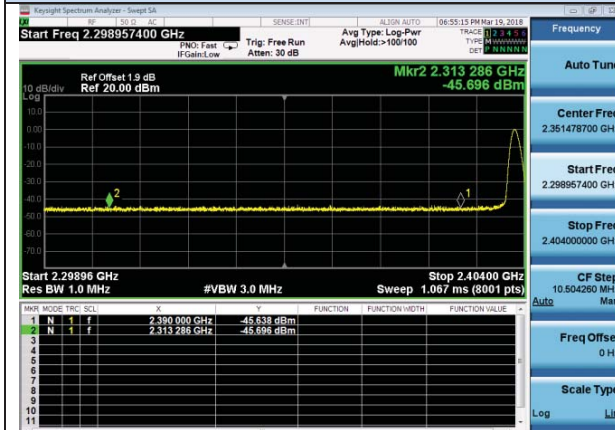


Channel 78 / 2480 MHz – Non-Hopping – Peak



Channel 78 / 2480 MHz – Non-Hopping – Peak

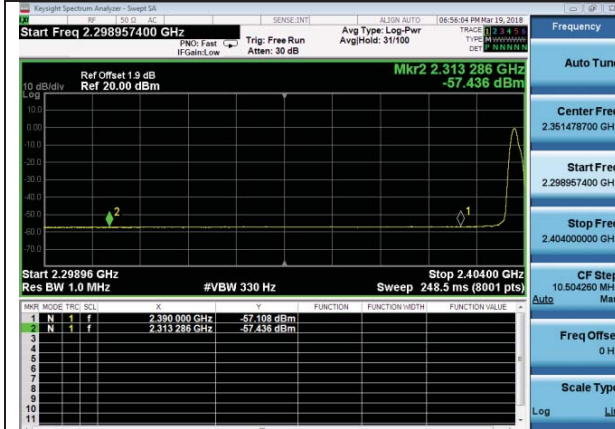


Channel 78 / 2480 MHz – Non-Hopping-Average
8DPSKChannel 78 / 2480 MHz – Non-Hopping-Average
8DPSK

Channel 0 / 2402 MHz – Non-Hopping – Peak



Channel 78 / 2480 MHz – Non-Hopping – Peak



Channel 0 / 2402 MHz – Non-Hopping – Average



Channel 78 / 2480 MHz – Non-Hopping-Average

10. ANTENNA REQUIREMENT

10.1 Standard Applicable

According to antenna requirement of §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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be re-placed by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

And according to §15.247(4)(1), system operating in the 2400-2483.5MHz bands that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

10.2 Antenna Connected Construction

10.2.1. Standard Applicable

According to § 15.203 & RSS-Gen, 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.

10.2.2. Antenna Connector Construction

The directional gains of antenna used for transmitting is 2.0dBi, and the antenna is a PIFA antenna connect to PCB board and no consideration of replacement. Please see EUT photo for details. The WLAN and BT share same antenna;

10.2.3. Results: Compliance.

Measurement

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module.

Conducted power refers ANSI C63.10:2013 Output power test procedure for FHSS devices.

Radiated power refers to ANSI C63.10:2013 Radiated emissions tests.

Measurement parameters

Measurement parameter	
Detector:	Peak
Sweep Time:	Auto
Resolution bandwidth:	1MHz
Video bandwidth:	3MHz
Trace-Mode:	Max hold

Note: The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module. For FHSS devices, the GFSK mode is used;

Limits

FCC	ISED
Antenna Gain	
6 dBi	

Tnom	Vnom	Lowest Channel 2402 MHz	Middle Channel 2441 MHz	Highest Channel 2480 MHz
Conducted power [dBm] Measured with GFSK modulation		8.570	7.953	6.068
Radiated power [dBm] Measured with GFSK modulation		10.372	9.700	7.863
Gain [dBi] Calculated		1.802	1.747	1.795
Measurement uncertainty			± 1.6 dB (cond.) / ± 3.8 dB (rad.)	

11. TEST SETUP PHOTOGRAPHS OF EUT

Please refer to separated files for Test Setup Photos of the EUT.

12. EXTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for External Photos of the EUT.

13. INTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for Internal Photos of the EUT.

-----THE END OF REPORT-----