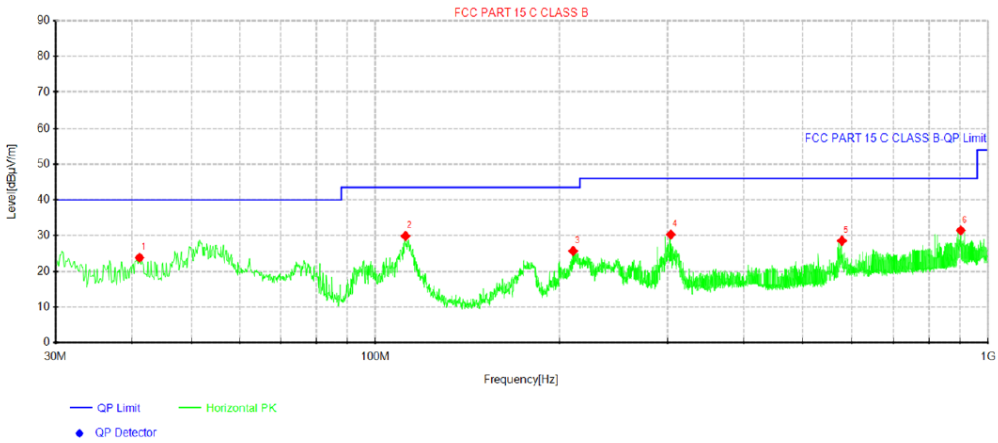
For 30MHz-1GHz

Horizontal



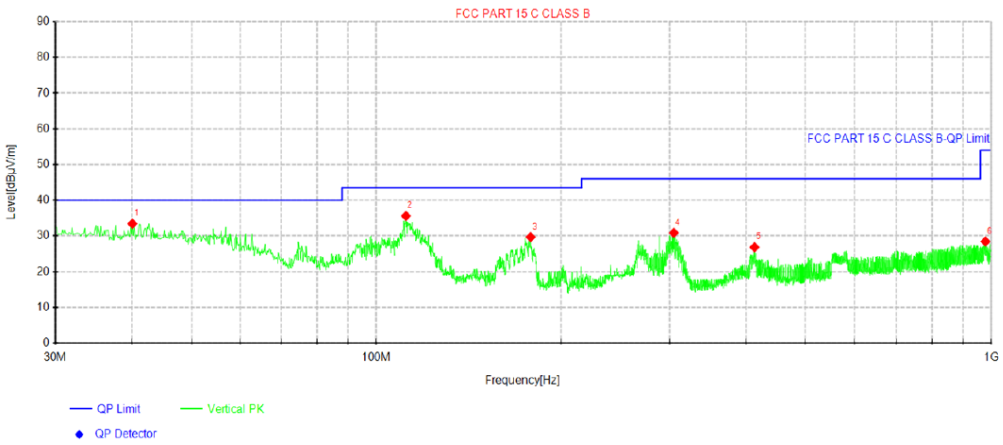
Suspected Data List									
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	41.155	35.67	23.84	-11.83	40.00	16.16	200	360	Horizontal
2	111.965	43.39	29.92	-13.47	43.50	13.58	100	232	Horizontal
3	210.541	38.44	25.72	-12.72	43.50	17.78	100	173	Horizontal
4	303.903	41.19	30.31	-10.88	46.00	15.69	200	69	Horizontal
5	578.898	35.64	28.59	-7.05	46.00	17.41	100	279	Horizontal
6	902.272	34.07	31.49	-2.58	46.00	14.51	100	0	Horizontal

Note:1).Level (dBµV/m)= Reading (dBµV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBµV/m) - Level (dBµV/m)

Vertical



Suspected Data List

NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	40.0638	45.39	33.44	-11.95	40.00	6.56	100	350	Vertical
2	111.722	49.06	35.61	-13.45	43.50	7.89	100	269	Vertical
3	178.288	44.32	29.69	-14.63	43.50	13.81	100	357	Vertical
4	304.995	41.75	30.87	-10.88	46.00	15.13	100	199	Vertical
5	412.786	36.93	26.86	-10.07	46.00	19.14	100	24	Vertical
6	977.811	30.33	28.46	-1.87	54.00	25.54	100	199	Vertical

Note:1).Level (dBµV/m)= Reading (dBµV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBµV/m) - Level (dBµV/m)

For 1GHz to 25GHz

Note: Two models *GFSK , π/4 DQPSK and 8DPSK all have been tested, only worse case GFSK is reported.*

GFSK (above 1GHz)

Frequency(MHz):			2402		Polarity:		HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4804.00	61.73	PK	74	12.27	66.00	32.33	5.12	41.72	-4.27
4804.00	44.42	AV	54	9.58	48.69	32.33	5.12	41.72	-4.27
7206.00	53.67	PK	74	20.33	54.19	36.6	6.49	43.61	-0.52
7206.00	42.06	AV	54	11.94	42.58	36.6	6.49	43.61	-0.52

Frequency(MHz):			2402		Polarity:		VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4804.00	59.82	PK	74	14.18	64.09	32.33	5.12	41.72	-4.27
4804.00	43.07	AV	54	10.93	47.34	32.33	5.12	41.72	-4.27
7206.00	51.34	PK	74	22.66	51.86	36.6	6.49	43.61	-0.52
7206.00	40.20	AV	54	13.80	40.72	36.6	6.49	43.61	-0.52

Frequency(MHz):			2441		Polarity:		HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4882.00	61.06	PK	74	12.94	64.94	32.6	5.34	41.82	-3.88
4882.00	45.42	AV	54	8.58	49.30	32.6	5.34	41.82	-3.88
7323.00	52.37	PK	74	21.63	52.48	36.8	6.81	43.72	-0.11
7323.00	41.61	AV	54	12.39	41.72	36.8	6.81	43.72	-0.11

Frequency(MHz):			2441		Polarity:		VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4882.00	59.38	PK	74	14.62	63.26	32.6	5.34	41.82	-3.88
4882.00	43.88	AV	54	10.12	47.76	32.6	5.34	41.82	-3.88
7323.00	52.14	PK	74	21.86	52.25	36.8	6.81	43.72	-0.11
7323.00	41.31	AV	54	12.69	41.42	36.8	6.81	43.72	-0.11

Frequency(MHz):			2480		Polarity:		HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4960.00	60.33	PK	74	13.67	63.41	32.73	5.66	41.47	-3.08
4960.00	44.62	AV	54	9.38	47.70	32.73	5.66	41.47	-3.08
7440.00	53.60	PK	74	20.40	53.15	37.04	7.25	43.84	0.45
7440.00	41.84	AV	54	12.16	41.39	37.04	7.25	43.84	0.45

Frequency(MHz):			2480		Polarity:		VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4960.00	58.97	PK	74	15.03	62.05	32.73	5.66	41.47	-3.08
4960.00	42.33	AV	54	11.67	45.41	32.73	5.66	41.47	-3.08
7440.00	51.18	PK	74	22.82	50.73	37.04	7.25	43.84	0.45
7440.00	41.96	AV	54	12.04	41.51	37.04	7.25	43.84	0.45

REMARKS:
1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)- Pre-amplifier
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.

Results of Band Edges Test (Radiated)

Note: GFSK, π/4 DQPSK and 8DPSK all have been tested, only worse case GFSK is reported.

GFSK

Frequency(MHz):			**2402**		**Polarity:**		**HORIZONTAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2390.00	61.80	PK	74	12.20	72.22	27.42	4.31	42.15	-10.42
2390.00	43.36	AV	54	10.64	53.78	27.42	4.31	42.15	-10.42
Frequency(MHz):			**2402**		**Polarity:**		**VERTICAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2390.00	60.23	PK	74	13.77	70.65	27.42	4.31	42.15	-10.42
2390.00	41.71	AV	54	12.29	52.13	27.42	4.31	42.15	-10.42
Frequency(MHz):			**2480**		**Polarity:**		**HORIZONTAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2483.50	61.01	PK	74	12.99	71.12	27.7	4.47	42.28	-10.11
2483.50	43.57	AV	54	10.43	53.68	27.7	4.47	42.28	-10.11
Frequency(MHz):			**2480**		**Polarity:**		**VERTICAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2483.50	59.63	PK	74	14.37	69.74	27.7	4.47	42.28	-10.11
2483.50	41.97	AV	54	12.03	52.08	27.7	4.47	42.28	-10.11

REMARKS:
1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)- Pre-amplifier
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.

4.3 Maximum Peak Output Power

Limit

The Maximum Peak Output Power Measurement is 125mW (20.97).

Test Procedure

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the powersensor.

Test Configuration

Test Results

Please refer to Appendix RF Test Data for BT

Note: 1.The test results including the cable loss.

4.4 20dB Bandwidth

Limit

For frequency hopping systems operating in the 2400MHz-2483.5MHz no limit for 20dB bandwidth.

Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30 KHz RBW and 100 KHz VBW.

The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

Test Configuration

Test Results

Please refer to Appendix RF Test Data for BT

4.5 Frequency Separation

LIMIT

According to 15.247(a)(1),frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.

TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with300 KHz RBW and 300 KHz VBW.

TEST CONFIGURATION

TEST RESULTS

Please refer to Appendix RF Test Data for BT

Note:

We have tested all mode at high, middle and low channel, and recorded worst case at middle

4.6 Number of hopping frequency

Limit

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. Set spectrum analyzer start 2400MHz to 2483.5MHz with 300 KHz RBW and 300 KHz VBW.

Test Configuration

Test Results

Please refer to Appendix RF Test Data for BT

4.7 Time of Occupancy (Dwell Time)

Limit

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. Set center frequency of spectrum analyzer=operating frequency with 1MHz RBW and 1MHz VBW, Span 0Hz.

Test Configuration

Test Results

Please refer to Appendix RF Test Data for BT

Note:We have tested all mode at high,middle and low channel,and recoreded worst case at middle channel.

Dwell time=Pulse time (ms) × (1600 ÷ 2 ÷ 79) ×31.6 Second for DH1, 2-DH1, 3-DH1

Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 79) ×31.6 Second for DH3, 2-DH3, 3-DH3

Dwell time=Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second for DH5, 2-DH5, 3-DH5

4.8 Out-of-band Emissions

Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF con-ducted or a radiated measurement, pro-vided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter com-plies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

Test Procedure

Connect the transmitter output to spectrum analyzer using a low loss RF cable, and set the spectrum analyzer to RBW=100 kHz, VBW= 300 kHz, peak detector , and max hold. Measurements utilizing these setting are made of the in-band reference level, bandedge and out-of-band emissions.

Test Configuration

Test Results

Remark: The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandage measurement data.
We measured all conditions (DH1, DH3, DH5) and recorded worst case at DH5

Please refer to Appendix RF Test Data for BT

4.9 Pseudorandom Frequency Hopping Sequence

TEST APPLICABLE

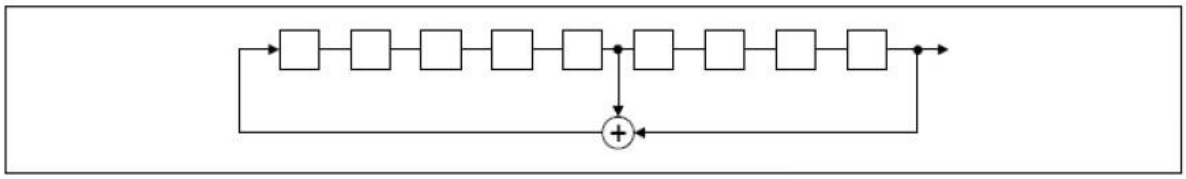
For 47 CFR Part 15C section 15.247 (a) (1) requirement:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hop-ping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

EUT Pseudorandom Frequency Hopping Sequence Requirement

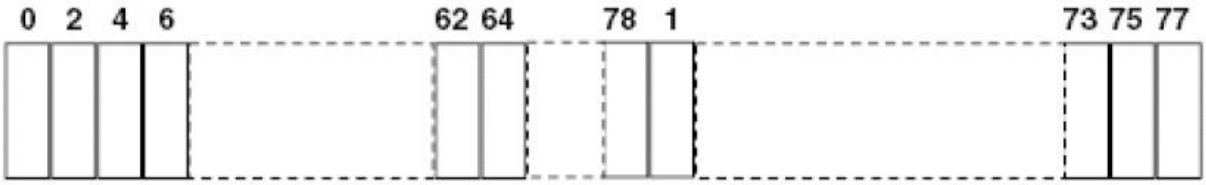
The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones, for example: the shift register is initialized with nine ones.

- Number of shift register stages:9
- Length of pseudo-random sequence:29-1=511 bits
- Longest sequence of zeros:8(non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of pseudorandom frequency hopping sequence as follows:



Each frequency used equally one the average by each transmitter.

The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shift frequencies in synchronization with the transmitted signals.

4.10 Antenna Requirement

Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Refer to statement below for compliance

The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

Antenna Connected Construction

The maximum gain of antenna was 2.86 dBi

Remark:The antenna gain is provided by the customer , if the data provided by the customer is not accurate, Shenzhen CTA Testing Technology Co., Ltd. does not assume any responsibility.

4.11 On Time and Duty Cycle

Standard Applicable

None; for reporting purpose only.

TEST CONFIGURATION

Test Procedures

1). Set the Centre frequency of the spectrum analyzer to the transmitting frequency;
2). Set the span=0MHz, RBW=1MHz, VBW=1MHz, Sweep time=10ms;
3). Detector = peak;
4). Trace mode = Single hold.

Please refer to Appendix RF Test Data for BT

5 Test Setup Photos of the EUT

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

6 External and Internal Photos of the EUT

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

.....End of Report.....