

**3.1.4 Test Data:**

**Please refer to ISL report 04LR018FC part 1.**

### 3.2 Bandwidth for DSSS [Section 15.247 (a)(2)]

#### 3.2.1 Test Procedure

The Transmitter output of EUT was connected to the spectrum analyzer. The 6 dB bandwidth of the fundamental frequency was measured. The setting of spectrum analyzer is as follows

|                   |                   |
|-------------------|-------------------|
| Equipment mode    | Spectrum analyzer |
| Detector function | Peak mode         |
| RBW               | 100KHz            |
| VBW               | 100KHz            |

#### 3.2.2 Test Setup



#### 3.2.3 Test Data:

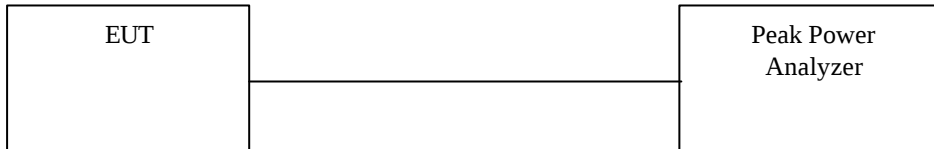
Please refer to ISL report 04LR018FC part 1

### 3.3 DSSS Maximum Peak Output Power [Section 15.247 (b)(1)]

#### 3.3.1 Test Procedure

The Transmitter output of EUT was connected to the peak power analyzer.

#### 3.3.2 Test Setup



#### 3.3.3 Test Data

Please refer to ISL report 04LR018FC part 1

### 3.4 Radiated Emission Measurement [Section [15.247(c)(4)]

#### 3.4.1 EUT Configuration

The equipment under test was set up on the 10 meter chamber with measurement distance of 3 meters. The EUT was placed on a non-conductive table 80cm above ground.

Any changes made to the configuration, or modifications made to the EUT, during testing are noted in the following test record.

#### 3.4.2 Test Procedure

The system was set up as described above, with the EMI diagnostic software running. We found the maximum readings by varying the height of antenna and then rotating the turntable. Both polarization of antenna, horizontal and vertical, are measured.

30M to 1GHz: The highest emissions between 30 MHz to 1000 MHz were also analyzed in details by operating the spectrum analyzer and/or EMI receiver in quasi-peak mode to determine the precise amplitude of the emissions. While doing so, the interconnecting cables and major parts of the system were moved around, the antenna height was varied between one and four meters, its polarization was varied between vertical and horizontal, and the turntable was slowly rotated, to maximize the emission.

1GHz – 25GHz: The highest emissions were also analyzed in details by operating the spectrum analyzer and/or EMI receiver in peak mode to determine the precise amplitude of the emission. While doing so, the interconnecting cables and major parts of the system were moved around, the antenna height was varied between one and four meters, its polarization was varied between vertical and horizontal, and the turntable was slowly rotated, to maximize the emission. During test the EMI receiver and spectrum was setup according to *EMI Receiver/Spectrum Analyzer Configuration*.

For the test of 2<sup>nd</sup> to 10<sup>th</sup> harmonics frequencies, the equipment setup was also refer to *EMI Receiver/Spectrum Analyzer Configuration*. The frequencies were tested using Peak mode first, if the test data is higher than the emissions limit, an additional measurement using Average mode will be performed and the average reading will be compared to the limit and record in test report.

#### 3.4.3 EMI Receiver/Spectrum Analyzer Configuration (for the frequencies tested)

|                             |                 |
|-----------------------------|-----------------|
| Frequency Range Tested:     | 30MHz~1000MHz   |
| Detector Function:          | Quasi-Peak Mode |
| Resolution Bandwidth (RBW): | 120KHz          |
| Video Bandwidth (VBW)       | 1MHz            |

|                             |               |
|-----------------------------|---------------|
| Frequency Range Tested:     | 1GHz – 25 GHz |
| Detector Function:          | Peak Mode     |
| Resolution Bandwidth (RBW): | 1MHz          |
| Video Bandwidth (VBW)       | 1MHz          |

|                             |               |
|-----------------------------|---------------|
| Frequency Range Tested:     | 1GHz – 25 GHz |
| Detector Function:          | Average Mode  |
| Resolution Bandwidth (RBW): | 1MHz          |
| Video Bandwidth (VBW)       | 10 Hz         |

**3.4.4 Test Data (30MHz – 1GHz):****30M – 1GHz Open Field Radiated Emissions (Horizontal) Channel 1, 6, 11**

Operator: Mailes Hsieh

Humidity (%): 46

Temperature (C): 25

| Frequency | Rx_R. | Ant_F. | Cab_L. | PreAmpl | Emission | Limit  | Margin | A.Tower | T.Table |
|-----------|-------|--------|--------|---------|----------|--------|--------|---------|---------|
| MHz       | dBuV  | dB/m   | dB     | dB      | dBuV/m   | dBuV/m | dB     | cm      | deg     |
| 99.84     | 22.11 | 10.27  | 3.02   | 0.00    | 35.39    | 43.50  | -8.11  | 150.00  | 11.00   |
| 198.78    | 25.21 | 8.86   | 4.18   | 0.00    | 38.25    | 43.50  | -5.25  | 150.00  | 49.00   |
| 232.73    | 27.08 | 9.33   | 4.50   | 0.00    | 40.90    | 46.00  | -5.10  | 200.00  | 65.00   |
| 298.69    | 21.99 | 13.57  | 4.69   | 0.00    | 40.26    | 46.00  | -5.74  | 100.00  | 241.00  |
| 325.85    | 18.52 | 13.96  | 4.76   | 0.00    | 37.24    | 46.00  | -8.76  | 100.00  | 32.00   |
| 364.65    | 22.62 | 14.80  | 5.07   | 0.00    | 42.48    | 46.00  | -3.52  | 200.00  | 257.00  |
| 397.63    | 19.98 | 15.92  | 5.30   | 0.00    | 41.20    | 46.00  | -4.80  | 150.00  | 273.00  |
| 431.58    | 18.73 | 16.25  | 5.61   | 0.00    | 40.59    | 46.00  | -5.41  | 100.00  | 208.00  |
| 464.56    | 16.59 | 16.78  | 5.87   | 0.00    | 39.24    | 46.00  | -6.76  | 100.00  | 65.00   |
| 563.5     | 13.96 | 19.05  | 6.56   | 0.00    | 39.57    | 46.00  | -6.43  | 100.00  | 158.00  |

**30M – 1GHz Open Field Radiated Emissions (Vertical) Channel 1, 6, 11**

Operator: Mailes Hsieh

Humidity (%): 46

Temperature (C): 25

| Frequency | Rx_R. | Ant_F. | Cab_L. | PreAmpl | Emission | Limit  | Margin | A.Tower | T.Table |
|-----------|-------|--------|--------|---------|----------|--------|--------|---------|---------|
| MHz       | dBuV  | dB/m   | dB     | dB      | dBuV/m   | dBuV/m | dB     | cm      | deg     |
| 139.61    | 17.62 | 10.44  | 3.56   | 0.00    | 31.62    | 43.50  | -11.88 | 100.00  | 288.00  |
| 232.73    | 20.98 | 9.33   | 4.50   | 0.00    | 34.81    | 46.00  | -11.19 | 150.00  | 222.00  |
| 364.65    | 14.98 | 14.80  | 5.07   | 0.00    | 34.85    | 46.00  | -11.15 | 100.00  | 238.00  |
| 431.58    | 12.94 | 16.25  | 5.61   | 0.00    | 34.80    | 46.00  | -11.20 | 150.00  | 271.00  |
| 497.54    | 14.04 | 17.64  | 6.04   | 0.00    | 37.71    | 46.00  | -8.29  | 100.00  | 353.00  |
| 564.47    | 8.10  | 19.04  | 6.57   | 0.00    | 33.71    | 46.00  | -12.29 | 250.00  | 255.00  |
| 644.01    | 8.85  | 19.08  | 7.01   | 0.00    | 34.94    | 46.00  | -11.06 | 200.00  | 304.00  |
| 652.74    | 13.60 | 19.09  | 7.05   | 0.00    | 39.74    | 46.00  | -6.26  | 150.00  | 304.00  |
| 662.44    | 9.66  | 19.08  | 7.07   | 0.00    | 35.81    | 46.00  | -10.19 | 150.00  | 304.00  |
| 863.23    | 7.37  | 20.55  | 8.23   | 0.00    | 36.15    | 46.00  | -9.85  | 150.00  | 50.00   |

NOTE: During the Pre-test, the EUT has been tested for Channel 1, 6, 11 transmit from Main and Aux antenna respectively to get all the critical emission frequencies. In the final test all the critical emission frequencies has been tested and the test data are listed above.

Margin = Corrected Amplitude – Limit

Corrected Amplitude = Radiated Amplitude + Antenna Correction Factor + Cable Loss - Pre-Amplifier Gain

A margin of -8dB means that the emission is 8dB below the limit

**All frequencies from 30MHz to 1GHz have been tested**

**3.4.5 Test Data ( 1GHz – 25 GHz) .****1GHz~ 25 GHz (Horizontal), Channel 1: 2412 MHz**

Operator: Mailes Hsieh

RBW: 1 MHz  
Humidity (%): 46  
Temperature (C): 25

| Frequency | Rx_R. | Ant_F. | Cab_L. | PreAmpl | Emission | Limit  | Margin | A.Tower | T.Table |
|-----------|-------|--------|--------|---------|----------|--------|--------|---------|---------|
| MHz       | dBuV  | dB/m   | dB     | dB      | dBuV/m   | dBuV/m | dB     | cm      | deg     |
| 2341.16   | 63.32 | 30.93  | 2.59   | 46.21   | 50.64    | 54.00  | -3.36  | 101     | 150     |
| 2503.50   | 62.60 | 30.90  | 2.82   | 46.21   | 50.11    | 54.00  | -3.89  | 102     | 201     |
| 3751.75   | 41.45 | 31.85  | 2.12   | 46.38   | 29.04    | 54.00  | -24.96 | 102     | 164     |
| 4821.68   | 37.35 | 34.92  | 1.28   | 46.88   | 26.67    | 54.00  | -27.33 | 100     | 18      |
| 8396.60   | 34.26 | 41.47  | 3.31   | 42.73   | 36.30    | 54.00  | -17.70 | 101     | 162     |
| 9469.53   | 32.70 | 40.90  | 3.22   | 42.47   | 34.34    | 54.00  | -19.66 | 102     | 11      |

**1GHz~ 25 GHz (Vertical), Channel 1: 2412 MHz**

Operator: Mailes Hsieh

RBW: 1 MHz  
Humidity (%): 46  
Temperature (C): 25

| Frequency | Rx_R. | Ant_F. | Cab_L. | PreAmpl | Emission | Limit  | Margin | A.Tower | T.Table |
|-----------|-------|--------|--------|---------|----------|--------|--------|---------|---------|
| MHz       | dBuV  | dB/m   | dB     | dB      | dBuV/m   | dBuV/m | dB     | cm      | deg     |
| 2126.37   | 45.84 | 30.97  | 2.29   | 46.20   | 32.91    | 54.00  | -21.09 | 100     | 83      |
| 2373.63   | 58.08 | 30.93  | 2.64   | 46.21   | 45.44    | 54.00  | -8.56  | 101     | 160     |
| 2608.39   | 45.35 | 30.94  | 2.82   | 46.29   | 32.82    | 54.00  | -21.18 | 102     | 234     |
| 3793.71   | 48.48 | 31.91  | 2.13   | 46.33   | 36.19    | 54.00  | -17.81 | 102     | 153     |
| 4821.68   | 42.24 | 34.92  | 1.28   | 46.88   | 31.56    | 54.00  | -22.44 | 100     | 18      |
| 7233.77   | 44.48 | 39.47  | 3.15   | 46.21   | 40.90    | 54.00  | -13.10 | 101     | 143     |

Note:

“ \* ”: Fundamental Frequency

“\*\*”: Not in the restricted band, Limit level=Fundamental Emission-20dB

“ pk”: peak reading

“av”: average reading

“---”: No meter reading data due to the emission level is smaller than spectrum noise level.

The Spectrum noise level+Correction Factor &lt; Limit - 6 dB

Margin=Corrected Amplitude – Limit

Corrected Amplitude=Radiated Amplitude+Antenna Correction Factor+Cable Loss-Pre-Amplifier Gain

A margin of -8dB means that the emission is 8dB below the limit.

**All frequencies from 1GHz to 25 GHz have been tested.**

**1GHz~ 25 GHz (Horizontal) , Channel 6 : 2437 MHz**

Operator: Mailes Hsieh

RBW: 1 MHz

Humidity (%): 46

Temperature (C): 25

| Frequency | Rx_R. | Ant_F. | Cab_L. | PreAmpl | Emission | Limit  | Margin | A.Tower | T.Table |
|-----------|-------|--------|--------|---------|----------|--------|--------|---------|---------|
| MHz       | dBuV  | dB/m   | dB     | dB      | dBuV/m   | dBuV/m | dB     | cm      | deg     |
| 2353.65   | 63.12 | 30.93  | 2.61   | 46.21   | 50.45    | 54.00  | -3.55  | 101     | 154     |
| 2525.97   | 62.70 | 30.91  | 2.82   | 46.23   | 50.20    | 54.00  | -3.80  | 102     | 208     |
| 4087.41   | 40.07 | 32.46  | 2.04   | 46.20   | 28.38    | 54.00  | -25.62 | 102     | 91      |
| 4870.63   | 38.30 | 35.11  | 1.25   | 46.93   | 27.73    | 54.00  | -26.27 | 100     | 13      |
| 7305.69   | 37.95 | 39.59  | 3.20   | 46.18   | 34.55    | 54.00  | -19.45 | 101     | 154     |
| 8702.30   | 35.05 | 41.38  | 3.30   | 42.62   | 37.10    | 54.00  | -16.90 | 102     | 90      |

**1GHz~ 25 GHz (Vertical), Channel 6 : 2437 MHz**

Operator: Mailes Hsieh

RBW: 1 MHz

Humidity (%): 46

Temperature (C): 25

| Frequency | Rx_R. | Ant_F. | Cab_L. | PreAmpl | Emission | Limit  | Margin | A.Tower | T.Table |
|-----------|-------|--------|--------|---------|----------|--------|--------|---------|---------|
| MHz       | dBuV  | dB/m   | dB     | dB      | dBuV/m   | dBuV/m | dB     | cm      | deg     |
| 2398.60   | 62.41 | 30.92  | 2.68   | 46.21   | 49.80    | 54.00  | -4.20  | 101     | 168     |
| 2775.72   | 46.66 | 31.01  | 2.82   | 46.41   | 34.08    | 54.00  | -19.92 | 102     | 287     |
| 3793.71   | 47.76 | 31.91  | 2.13   | 46.33   | 35.46    | 54.00  | -18.54 | 102     | 153     |
| 4870.63   | 48.04 | 35.11  | 1.25   | 46.93   | 37.47    | 54.00  | -16.53 | 100     | 13      |
| 7305.69   | 46.72 | 39.59  | 3.20   | 46.18   | 43.33    | 54.00  | -10.67 | 101     | 154     |
| 12178.8   | 32.60 | 42.09  | 3.71   | 42.81   | 35.59    | 54.00  | -18.41 | 100     | 132     |

Note:

“ \* ”: Fundamental Frequency

“\*\*”: Not in the restricted band, Limit level=Fundamental Emission-20dB

“pk”: peak reading

“av”: average reading

“---”: No meter reading data due to the emission level is smaller than spectrum noise level.

The Spectrum noise level+Correction Factor &lt; Limit - 6 dB

Margin=Corrected Amplitude – Limit

Corrected Amplitude=Radiated Amplitude+Antenna Correction Factor+Cable Loss-Pre-Amplifier Gain

A margin of -8dB means that the emission is 8dB below the limit.

**All frequencies from 1GHz to 25 GHz have been tested.**

**1GHz~ 25 GHz (Horizontal), Channel 11: 2462 MHz**

Operator: Mailes Hsieh

RBW: 1 MHz

Humidity (%): 46

Temperature (C): 25

| Frequency | Rx_R. | Ant_F. | Cab_L. | PreAmpl | Emission | Limit  | Margin | A.Tower | T.Table |
|-----------|-------|--------|--------|---------|----------|--------|--------|---------|---------|
| MHz       | dBuV  | dB/m   | dB     | dB      | dBuV/m   | dBuV/m | dB     | cm      | deg     |
| 2378.62   | 62.70 | 30.92  | 2.65   | 46.21   | 50.06    | 54.00  | -3.94  | 101     | 162     |
| 2530.97   | 63.08 | 30.91  | 2.82   | 46.23   | 50.58    | 54.00  | -3.42  | 102     | 210     |
| 4923.08   | 45.42 | 35.31  | 1.23   | 46.97   | 34.98    | 54.00  | -19.02 | 100     | 8       |
| 3751.75   | 40.30 | 31.85  | 2.12   | 46.38   | 27.89    | 54.00  | -26.11 | 102     | 164     |
| 7377.62   | 44.00 | 39.70  | 3.24   | 46.14   | 40.80    | 54.00  | -13.20 | 101     | 164     |
| 8744.26   | 34.77 | 41.31  | 3.28   | 42.66   | 36.70    | 54.00  | -17.30 | 102     | 80      |

**1GHz~ 25 GHz (Vertical), Channel 11 : 2462 MHz**

Operator: Mailes Hsieh

RBW: 1 MHz

Humidity (%): 46

Temperature (C): 25

| Frequency | Rx_R. | Ant_F. | Cab_L. | PreAmpl | Emission | Limit  | Margin | A.Tower | T.Table |
|-----------|-------|--------|--------|---------|----------|--------|--------|---------|---------|
| MHz       | dBuV  | dB/m   | dB     | dB      | dBuV/m   | dBuV/m | dB     | cm      | deg     |
| 2298.70   | 46.05 | 30.94  | 2.53   | 46.21   | 33.32    | 54.00  | -20.68 | 101     | 137     |
| 2401.10   | 52.14 | 30.92  | 2.68   | 46.21   | 39.53    | 54.00  | -14.47 | 101     | 169     |
| 2770.73   | 49.02 | 31.01  | 2.82   | 46.41   | 36.44    | 54.00  | -17.56 | 102     | 285     |
| 4923.08   | 50.98 | 35.31  | 1.23   | 46.97   | 40.55    | 54.00  | -13.45 | 100     | 8       |
| 7377.62   | 48.83 | 39.70  | 3.24   | 46.14   | 45.63    | 54.00  | -8.37  | 101     | 164     |
| 12304.7   | 31.93 | 41.93  | 3.76   | 42.86   | 34.76    | 54.00  | -19.24 | 100     | 165     |

Note:

“ \* ”: Fundamental Frequency

“\*\*\*”: Not in the restricted band, Limit level=Fundamental Emission-20dB

“pk”: peak reading

“av”: average reading

“---”: No meter reading data due to the emission level is smaller than spectrum noise level.

The Spectrum noise level+Correction Factor &lt; Limit - 6 dB

Margin=Corrected Amplitude – Limit

Corrected Amplitude=Radiated Amplitude+Antenna Correction Factor+Cable Loss-Pre-Amplifier Gain

A margin of -8dB means that the emission is 8dB below the limit.

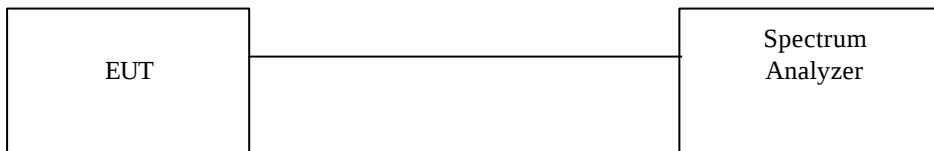
**All frequencies from 1GHz to 25 GHz have been tested.**

### 3.5 Band Edge Measurement

#### 3.5.1 Test Procedure (Conducted)

1. The transmitter output of EUT was connected to the spectrum analyzer.  
Equipment mode: Spectrum analyzer  
Detector function: Peak mode  
SPAN: 100MHz  
RBW: 100KHz  
VBW: 100KHz  
Center frequency: 2.4GHz, 2.4835GHz.
2. Using Peak Search to read the peak power of Carrier frequencies after Maximum Hold function is completed
3. Find the next peak frequency outside the operation frequency band

#### 3.5.2 Test Setup (Conducted)



#### 3.5.3 Test Data:

Please refer to ISL report 04LR018FC part 1

### 3.5.4 Test Procedure (Radiated)

1. Antenna and Turntable test procedure same as Radiated Emission Measurement.  
Equipment mode: Spectrum analyzer  
Detector function: Peak mode  
SPAN: 100MHz  
RBW: 1MHz  
VBW: 1MHz  
Center frequency: 2.395GHz, 2.48GHz.
2. Using Peak Search to read the peak power of Carrier frequencies after Maximum Hold function is completed.
3. Find the next peak frequency outside the operation frequency band
4. For peak frequency emission level measurement in Restricted Band ,  
Change RBW: 1MHz  
VBW: 10Hz  
Span: 100MHz.
5. Get the spectrum reading after Maximum Hold function is completed.

### 3.5.5 Test Setup (Radiated)

Same as *Radiated Emission Measurement*

## 3.5.6 Test Data

Table Band Edge measurement (Radiated)

Temp. (deg. C): 25

Test Engr: Mailes  
Hsieh

Humidity (%): 50

| Channel             | Frequency<br>(MHz) | Spectrum<br>Reading<br>(dBuV) | Correction<br>Factor<br>(dB/m) | Emission<br>Level<br>(dBuV/m) | dBc ( Limit:<br>> 20dBc) | Limit<br>(dBuV/m) | Equip.<br>Setup<br>VBW | Pass<br>or<br>Fail |
|---------------------|--------------------|-------------------------------|--------------------------------|-------------------------------|--------------------------|-------------------|------------------------|--------------------|
| 1(peak mode)        | 2410.8             | 68.76                         | 31.1                           | 99.86                         | ---                      | ---               | 1MHz                   | ---                |
| Outside<br>band     | 2397.5             | 46.93                         | 31.1                           | 78.03                         | 21.83                    | ---               | 1MHz                   | Pass               |
| 1(average<br>mode)  | 2412.6             | 60.39                         | 31.1                           | 91.49                         | ---                      | ---               | 10Hz                   | ---                |
| Restricted<br>band  | 2390               | 9.45                          | 31.1                           | 40.55                         | ---                      | 54                | 10Hz                   | Pass               |
| 11(peak<br>mode)    | 2460.8             | 69.19                         | 31.1                           | 100.29                        | ---                      | ---               | 1MHz                   | ---                |
| Outside<br>band     | 2477               | 42.07                         | 31.1                           | 73.17                         | 27.12                    | ---               | 1MHz                   | Pass               |
| 11(average<br>mode) | 2461.3             | 60.8                          | 31.1                           | 91.9                          | ---                      | ---               | 10Hz                   | ---                |
| Restricted<br>band  | 2483.5             | 9.09                          | 31.1                           | 40.19                         | ---                      | 54                | 10Hz                   | Pass               |

## Note:

The Spectrum plot of emission level measurement in Restricted band is attached.

Emission Level=Spectrum Reading+Correction Factor

Correction Factor=Antenna Factor+cable loss–amplifier gain

Both Horizontal and Vertical polarizaion have been tested and the worst data is listed above.

Band Edge measurement for radiated emission in Restricted Band(Radiated)  
Peak Mode (Channel 1)



Band Edge measurement for radiated emission in Restricted Band(Radiated)  
Average Mode (Channel 1)



Band Edge measurement for radiated emission in Restricted Band(Radiated)  
Peak Mode (Channel 11)



Band Edge measurement for radiated emission in Ristricted Band(Radiated)  
Average Mode (Channel 11)



### **3.6 RF Exposure Measurement [Section 15.247(b)(4) & 1.1307(b)]**

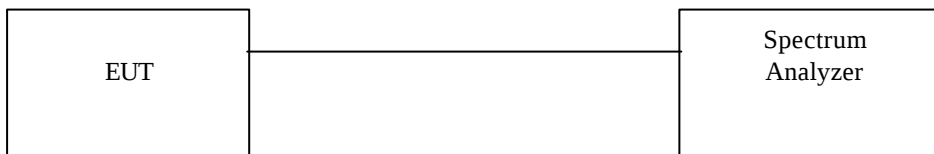
**See MPE report**

### 3.7 DSSS Peak Power Spectral Density [Section 15.247(d) ]

#### 3.7.1 Test Procedure

1. The Transmitter output of EUT was connected to the spectrum analyzer.  
Equipment mode: Spectrum analyzer  
Detector function: Peak mode  
SPAN:1.5MHz  
RBW: 3KHz  
VBW: 30KHz  
Center frequency: fundamental frequency tested.  
Sweep time= 500 sec.
2. Using Peak Search to read the peak power after Maximum Hold function is completed.

#### 3.7.2 Test Setup



#### 3.7.3 Test Data

Please refer to ISL report 04LR018FC part 1.

## 4. TEST RESULTS (802.11g) (for Dual Band WLAN antenna)

### 4.1 Powerline Conducted Emissions [Section 15.207]

#### 4.1.1 EUT Configuration

The conducted emission test setups are in accordance with Figs 9, 10(a) and 10(b) of ANSI C63.4-2001, CFR 47 Part 15 Subpart B; or EN55022:1994/ A1:1995/A2:1997; CISPR 22:1993/A1:1995/A2:1996.

The EUT was set up on the non-conductive table that is 1.0 by 1.5 meter, 80cm above ground. The wall of the shielded room was located 40cm to the rear of the EUT.

Power to the EUT was provided through the LISN. The impedance vs. frequency characteristic of the LISN is complied with the limit shown on the figure 1 of ANSI C63.4-2001.

Both lines (neutral and hot) were connected to the LISN in series at testing. A coaxial-type connector which provides one 50 ohms terminating impedance was provided for connecting the test instrument. The excess length of the power cord was folded back and forth at the center of the lead so as to form a bundle not exceeding 40cm in length.

Any changes made to the configuration, or modifications made to the EUT, during testing are noted in the following test record.

If the EUT is a Personal Computer or a peripheral of personal computer, and the personal computer has an auxiliary AC outlet which can be used for providing power to an external monitor, then all measurements will be made with the monitor power from first the computer-mounted AC outlet and then a floor-mounted AC outlet.

#### 4.1.2 Test Procedure

The system was set up as described above, with the EMI diagnostic software running. The main power line conducted EMI tests were run on the hot and neutral conductors of the power cord and the results were recorded. The effect of varying the position of the interface cables has been investigated to find the configuration that produces maximum emission.

At the frequencies where the peak values of the emissions were higher than 6dB below the applicable limits, the emissions were also measured with the quasi-peak detectors. At the frequencies where the quasi-peak values of the emissions were higher than 6dB below the applicable average limits, the emissions were also measured with the average detectors.

The highest emissions were analyzed in details by operating the spectrum analyzer in fixed tuned mode to determine the nature of the emissions and to provide information which could be useful in reducing their amplitude.

#### 4.1.3 EMI Receiver/Spectrum Analyzer Configuration (for the frequencies tested)

|                   |                    |
|-------------------|--------------------|
| Frequency Range   | 150 KHz--30MHz     |
| Detector Function | Quasi-Peak/Average |
| Bandwidth (RBW)   | 9KHz               |

**4.1.4 Test Data:**

**Please refer to ISL report 04LR018FC part 1.**

## 4.2 Bandwidth for DSSS [Section 15.247 (a)(2)]

### 4.2.1 Test Procedure

The Transmitter output of EUT was connected to the spectrum analyzer. The 6 dB bandwidth of the fundamental frequency was measured. The setting of spectrum analyzer is as follows

|                   |                   |
|-------------------|-------------------|
| Equipment mode    | Spectrum analyzer |
| Detector function | Peak mode         |
| RBW               | 100KHz            |
| VBW               | 100KHz            |

### 4.2.2 Test Setup



### 4.2.3 Test Data:

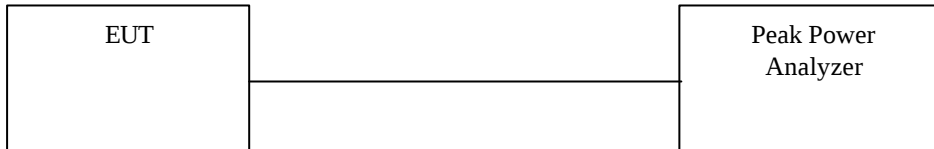
Please refer to ISL report 04LR018FC part 1.

### 4.3 DSSS Maximum Peak Output Power [Section 15.247 (b)(1)]

#### 4.3.1 Test Procedure

The Transmitter output of EUT was connected to the peak power analyzer.

#### 4.3.2 Test Setup



#### 4.3.3 Test Data

Please refer to ISL report 04LR018FC part 1.

## 4.4 Radiated Emission Measurement [Section [15.247(c)(4)]

### 4.4.1 EUT Configuration

The equipment under test was set up on the 10 meter chamber with measurement distance of 3 meters. The EUT was placed on a non-conductive table 80cm above ground.

Any changes made to the configuration, or modifications made to the EUT, during testing are noted in the following test record.

### 4.4.2 Test Procedure

The system was set up as described above, with the EMI diagnostic software running. We found the maximum readings by varying the height of antenna and then rotating the turntable. Both polarization of antenna, horizontal and vertical, are measured.

30M to 1GHz: The highest emissions between 30 MHz to 1000 MHz were also analyzed in details by operating the spectrum analyzer and/or EMI receiver in quasi-peak mode to determine the precise amplitude of the emissions. While doing so, the interconnecting cables and major parts of the system were moved around, the antenna height was varied between one and four meters, its polarization was varied between vertical and horizontal, and the turntable was slowly rotated, to maximize the emission.

1GHz – 25GHz: The highest emissions were also analyzed in details by operating the spectrum analyzer and/or EMI receiver in peak mode to determine the precise amplitude of the emission. While doing so, the interconnecting cables and major parts of the system were moved around, the antenna height was varied between one and four meters, its polarization was varied between vertical and horizontal, and the turntable was slowly rotated, to maximize the emission. During test the EMI receiver and spectrum was setup according to *EMI Receiver/Spectrum Analyzer Configuration*.

For the test of 2<sup>nd</sup> to 10<sup>th</sup> harmonics frequencies, the equipment setup was also refer to *EMI Receiver/Spectrum Analyzer Configuration*. The frequencies were tested using Peak mode first, if the test data is higher than the emissions limit, an additional measurement using Average mode will be performed and the average reading will be compared to the limit and record in test report.

### 4.4.3 EMI Receiver/Spectrum Analyzer Configuration (for the frequencies tested)

|                             |                 |
|-----------------------------|-----------------|
| Frequency Range Tested:     | 30MHz~1000MHz   |
| Detector Function:          | Quasi-Peak Mode |
| Resolution Bandwidth (RBW): | 120KHz          |
| Video Bandwidth (VBW)       | 1MHz            |

|                             |               |
|-----------------------------|---------------|
| Frequency Range Tested:     | 1GHz – 25 GHz |
| Detector Function:          | Peak Mode     |
| Resolution Bandwidth (RBW): | 1MHz          |
| Video Bandwidth (VBW)       | 1MHz          |

|                             |               |
|-----------------------------|---------------|
| Frequency Range Tested:     | 1GHz – 25 GHz |
| Detector Function:          | Average Mode  |
| Resolution Bandwidth (RBW): | 1MHz          |
| Video Bandwidth (VBW)       | 10 Hz         |

**4.4.4 Test Data (30MHz – 1GHz):****30M – 1GHz Open Field Radiated Emissions (Horizontal) Channel 1, 6, 11**

Operator: Mailes Hsieh

Humidity (%): 46

Temperature (C): 25

| Frequency | Rx_R. | Ant_F. | Cab_L. | PreAmpl | Emission | Limit  | Margin | A.Tower | T.Table |
|-----------|-------|--------|--------|---------|----------|--------|--------|---------|---------|
| MHz       | dBuV  | dB/m   | dB     | dB      | dBuV/m   | dBuV/m | dB     | cm      | deg     |
| 99.84     | 22.23 | 10.27  | 3.02   | 0.00    | 35.51    | 43.50  | -7.99  | 150.00  | 312.00  |
| 198.78    | 25.09 | 8.86   | 4.18   | 0.00    | 38.13    | 43.50  | -5.37  | 200.00  | 312.00  |
| 232.73    | 26.98 | 9.33   | 4.50   | 0.00    | 40.81    | 46.00  | -5.19  | 150.00  | 18.00   |
| 298.69    | 22.35 | 13.57  | 4.69   | 0.00    | 40.62    | 46.00  | -5.38  | 150.00  | 182.00  |
| 397.63    | 19.93 | 15.92  | 5.30   | 0.00    | 41.15    | 46.00  | -4.85  | 100.00  | 165.00  |
| 431.58    | 18.78 | 16.25  | 5.61   | 0.00    | 40.64    | 46.00  | -5.36  | 100.00  | 182.00  |
| 464.56    | 14.52 | 16.78  | 5.87   | 0.00    | 37.17    | 46.00  | -8.83  | 250.00  | 336.00  |
| 478.14    | 18.12 | 17.13  | 5.93   | 0.00    | 41.18    | 46.00  | -4.82  | 100.00  | 336.00  |
| 498.51    | 18.95 | 17.66  | 6.04   | 0.00    | 42.66    | 46.00  | -3.34  | 100.00  | 296.00  |
| 564.47    | 13.62 | 19.04  | 6.57   | 0.00    | 39.23    | 46.00  | -6.77  | 100.00  | 312.00  |

**30M – 1GHz Open Field Radiated Emissions (Vertical) Channel 1, 6, 11**

Operator: Mailes Hsieh

Humidity (%): 46

Temperature (C): 25

| Frequency | Rx_R. | Ant_F. | Cab_L. | PreAmpl | Emission | Limit  | Margin | A.Tower | T.Table |
|-----------|-------|--------|--------|---------|----------|--------|--------|---------|---------|
| MHz       | dBuV  | dB/m   | dB     | dB      | dBuV/m   | dBuV/m | dB     | cm      | deg     |
| 99.84     | 18.43 | 10.27  | 3.02   | 0.00    | 31.71    | 43.50  | -11.79 | 200.00  | 91.00   |
| 137.67    | 18.02 | 10.63  | 3.55   | 0.00    | 32.20    | 43.50  | -11.30 | 100.00  | 238.00  |
| 232.73    | 20.99 | 9.33   | 4.50   | 0.00    | 34.82    | 46.00  | -11.18 | 100.00  | 157.00  |
| 364.65    | 14.98 | 14.80  | 5.07   | 0.00    | 34.84    | 46.00  | -11.16 | 200.00  | 190.00  |
| 498.51    | 13.66 | 17.66  | 6.04   | 0.00    | 37.36    | 46.00  | -8.64  | 200.00  | 272.00  |
| 643.04    | 8.22  | 19.07  | 7.00   | 0.00    | 34.29    | 46.00  | -11.71 | 100.00  | 222.00  |
| 652.74    | 14.69 | 19.09  | 7.05   | 0.00    | 40.83    | 46.00  | -5.17  | 100.00  | 238.00  |
| 660.5     | 10.61 | 19.08  | 7.07   | 0.00    | 36.75    | 46.00  | -9.25  | 100.00  | 238.00  |
| 733.25    | 7.66  | 19.73  | 7.54   | 0.00    | 34.93    | 46.00  | -11.07 | 150.00  | 272.00  |
| 864.2     | 5.59  | 20.54  | 8.24   | 0.00    | 34.38    | 46.00  | -11.62 | 100.00  | 9.00    |

**NOTE:**

During the Pre-test, the EUT has been tested for Channel 1, 6, 11 transmit from Main and Aux antenna respectively to get all the critical emission frequencies. In the final test all the critical emission frequencies has been tested and the test data are listed above.

Margin = Corrected Amplitude – Limit

Corrected Amplitude = Radiated Amplitude + Antenna Correction Factor + Cable Loss - Pre-Amplifier Gain

A margin of -8dB means that the emission is 8dB below the limit

**All frequencies from 30MHz to 1GHz have been tested**

**4.4.5 Test Data ( 1GHz – 25 GHz) .****1GHz~ 25 GHz (Horizontal), Channel 1: 2412 MHz**

Operator: Mailes Hsieh

RBW: 1 MHz  
Humidity (%): 46  
Temperature (C): 25

| Frequency | Rx_R. | Ant_F. | Cab_L. | PreAmpl | Emission | Limit  | Margin | A.Tower | T.Table |
|-----------|-------|--------|--------|---------|----------|--------|--------|---------|---------|
| MHz       | dBuV  | dB/m   | dB     | dB      | dBuV/m   | dBuV/m | dB     | cm      | deg     |
| 2311.19   | 55.49 | 30.94  | 2.55   | 46.21   | 42.78    | 54.00  | -11.22 | 101     | 141     |
| 2316.18   | 58.41 | 30.94  | 2.56   | 46.21   | 45.70    | 54.00  | -8.30  | 101     | 142     |
| 2515.98   | 54.19 | 30.91  | 2.82   | 46.22   | 41.69    | 54.00  | -12.31 | 102     | 205     |
| 4073.43   | 41.27 | 32.42  | 2.06   | 46.18   | 29.57    | 54.00  | -24.43 | 102     | 93      |
| 5381.12   | 35.48 | 35.90  | 1.13   | 47.29   | 25.23    | 54.00  | -28.77 | 100     | 109     |
| 8816.18   | 34.09 | 41.19  | 3.25   | 42.71   | 35.82    | 54.00  | -18.18 | 102     | 63      |

**1GHz~ 25 GHz (Vertical), Channel 1: 2412 MHz**

Operator: Mailes Hsieh

RBW: 1 MHz  
Humidity (%): 46  
Temperature (C): 25

| Frequency | Rx_R. | Ant_F. | Cab_L. | PreAmpl | Emission | Limit  | Margin | A.Tower | T.Table |
|-----------|-------|--------|--------|---------|----------|--------|--------|---------|---------|
| MHz       | dBuV  | dB/m   | dB     | dB      | dBuV/m   | dBuV/m | dB     | cm      | deg     |
| 1796.70   | 60.30 | 29.29  | 2.00   | 46.21   | 45.38    | 54.00  | -8.62  | 100     | 57      |
| 1961.54   | 46.70 | 30.68  | 2.09   | 46.20   | 33.26    | 54.00  | -20.74 | 100     | 46      |
| 2228.77   | 46.28 | 30.95  | 2.43   | 46.20   | 33.47    | 54.00  | -20.53 | 101     | 115     |
| 4821.68   | 37.75 | 34.92  | 1.28   | 46.88   | 27.06    | 54.00  | -26.94 | 100     | 18      |
| 7233.77   | 37.87 | 39.47  | 3.15   | 46.21   | 34.28    | 54.00  | -19.72 | 101     | 143     |
| 9679.32   | 32.35 | 40.51  | 3.16   | 41.98   | 34.03    | 54.00  | -19.97 | 102     | 6       |

Note:

“ \* ”: Fundamental Frequency

“\*\*”: Not in the restricted band, Limit level=Fundamental Emission-20dB

“ pk”: peak reading

“av”: average reading

“---”: No meter reading data due to the emission level is smaller than spectrum noise level.

The Spectrum noise level+Correction Factor &lt; Limit - 6 dB

Margin=Corrected Amplitude – Limit

Corrected Amplitude=Radiated Amplitude+Antenna Correction Factor+Cable Loss-Pre-Amplifier Gain

A margin of -8dB means that the emission is 8dB below the limit.

**All frequencies from 1GHz to 25 GHz have been tested.**

**1GHz~ 25 GHz (Horizontal) , Channel 6 : 2437 MHz**

Operator: Mailes Hsieh

RBW: 1 MHz

Humidity (%): 46

Temperature (C): 25

| Frequency | Rx_R. | Ant_F. | Cab_L. | PreAmpl | Emission | Limit  | Margin | A.Tower | T.Table |
|-----------|-------|--------|--------|---------|----------|--------|--------|---------|---------|
| MHz       | dBuV  | dB/m   | dB     | dB      | dBuV/m   | dBuV/m | dB     | cm      | deg     |
| 2323.68   | 52.36 | 30.94  | 2.57   | 46.21   | 39.66    | 54.00  | -14.34 | 101     | 145     |
| 2346.15   | 58.75 | 30.93  | 2.60   | 46.21   | 46.08    | 54.00  | -7.92  | 101     | 152     |
| 2685.81   | 53.27 | 30.97  | 2.82   | 46.35   | 40.72    | 54.00  | -13.28 | 102     | 258     |
| 4877.62   | 34.66 | 35.13  | 1.25   | 46.93   | 24.12    | 54.00  | -29.88 | 100     | 12      |
| 7863.14   | 36.14 | 40.41  | 3.11   | 44.39   | 35.27    | 54.00  | -18.73 | 100     | 235     |
| 9571.43   | 32.36 | 40.74  | 3.19   | 42.26   | 34.03    | 54.00  | -19.97 | 102     | 9       |

**1GHz~ 25 GHz (Vertical), Channel 6 : 2437 MHz**

Operator: Mailes Hsieh

RBW: 1 MHz

Humidity (%): 46

Temperature (C): 25

| Frequency | Rx_R. | Ant_F. | Cab_L. | PreAmpl | Emission | Limit  | Margin | A.Tower | T.Table |
|-----------|-------|--------|--------|---------|----------|--------|--------|---------|---------|
| MHz       | dBuV  | dB/m   | dB     | dB      | dBuV/m   | dBuV/m | dB     | cm      | deg     |
| 2203.80   | 45.86 | 30.96  | 2.40   | 46.20   | 33.01    | 54.00  | -20.99 | 101     | 107     |
| 2505.99   | 45.84 | 30.90  | 2.82   | 46.21   | 33.34    | 54.00  | -20.66 | 102     | 202     |
| 2773.23   | 48.98 | 31.01  | 2.82   | 46.41   | 36.40    | 54.00  | -17.60 | 102     | 286     |
| 3790.21   | 47.95 | 31.91  | 2.13   | 46.34   | 35.64    | 54.00  | -18.36 | 102     | 154     |
| 4881.12   | 42.47 | 35.15  | 1.25   | 46.94   | 31.93    | 54.00  | -22.07 | 100     | 12      |
| 7317.68   | 42.02 | 39.61  | 3.20   | 46.17   | 38.66    | 54.00  | -15.34 | 101     | 155     |

Note:

“ \* ”: Fundamental Frequency

“\*\*”: Not in the restricted band, Limit level=Fundamental Emission-20dB

“pk”: peak reading

“av”: average reading

“---”: No meter reading data due to the emission level is smaller than spectrum noise level.

The Spectrum noise level+Correction Factor &lt; Limit - 6 dB

Margin=Corrected Amplitude – Limit

Corrected Amplitude=Radiated Amplitude+Antenna Correction Factor+Cable Loss-Pre-Amplifier Gain

A margin of -8dB means that the emission is 8dB below the limit.

**All frequencies from 1GHz to 25 GHz have been tested.**

**1GHz~ 25 GHz (Horizontal), Channel 11: 2462 MHz**

Operator: Mailes Hsieh

RBW: 1 MHz

Humidity (%): 46

Temperature (C): 25

| Frequency | Rx_R. | Ant_F. | Cab_L. | PreAmpl | Emission | Limit  | Margin | A.Tower | T.Table |
|-----------|-------|--------|--------|---------|----------|--------|--------|---------|---------|
| MHz       | dBuV  | dB/m   | dB     | dB      | dBuV/m   | dBuV/m | dB     | cm      | deg     |
| 2328.67   | 50.92 | 30.93  | 2.58   | 46.21   | 38.23    | 54.00  | -15.77 | 101     | 146     |
| 2343.66   | 51.88 | 30.93  | 2.60   | 46.21   | 39.21    | 54.00  | -14.79 | 101     | 151     |
| 2356.14   | 58.82 | 30.93  | 2.62   | 46.21   | 46.16    | 54.00  | -7.84  | 101     | 155     |
| 4926.57   | 37.48 | 35.32  | 1.23   | 46.98   | 27.06    | 54.00  | -26.94 | 100     | 7       |
| 6996.50   | 31.66 | 39.08  | 2.99   | 46.31   | 27.43    | 54.00  | -26.57 | 101     | 110     |
| 8828.17   | 36.05 | 41.17  | 3.24   | 42.72   | 37.74    | 54.00  | -16.26 | 102     | 60      |

**1GHz~ 25 GHz (Vertical), Channel 11 : 2462 MHz**

Operator: Mailes Hsieh

RBW: 1 MHz

Humidity (%): 46

Temperature (C): 25

| Frequency | Rx_R. | Ant_F. | Cab_L. | PreAmpl | Emission | Limit  | Margin | A.Tower | T.Table |
|-----------|-------|--------|--------|---------|----------|--------|--------|---------|---------|
| MHz       | dBuV  | dB/m   | dB     | dB      | dBuV/m   | dBuV/m | dB     | cm      | deg     |
| 2396.10   | 49.71 | 30.92  | 2.67   | 46.21   | 37.10    | 54.00  | -16.90 | 101     | 167     |
| 2403.60   | 48.78 | 30.92  | 2.68   | 46.21   | 36.18    | 54.00  | -17.82 | 101     | 170     |
| 2593.41   | 45.58 | 30.94  | 2.82   | 46.28   | 33.06    | 54.00  | -20.94 | 102     | 229     |
| 3751.75   | 50.88 | 31.85  | 2.12   | 46.38   | 38.48    | 54.00  | -15.52 | 102     | 164     |
| 4923.08   | 43.31 | 35.31  | 1.23   | 46.97   | 32.87    | 54.00  | -21.13 | 100     | 8       |
| 7383.62   | 42.02 | 39.71  | 3.25   | 46.14   | 38.84    | 54.00  | -15.16 | 101     | 165     |

Note:

“ \* ”: Fundamental Frequency

“\*\*”: Not in the restricted band, Limit level=Fundamental Emission-20dB

“ pk”: peak reading

“av”: average reading

“---”: No meter reading data due to the emission level is smaller than spectrum noise level.

The Spectrum noise level+Correction Factor &lt; Limit - 6 dB

Margin=Corrected Amplitude – Limit

Corrected Amplitude=Radiated Amplitude+Antenna Correction Factor+Cable Loss-Pre-Amplifier Gain

A margin of -8dB means that the emission is 8dB below the limit.

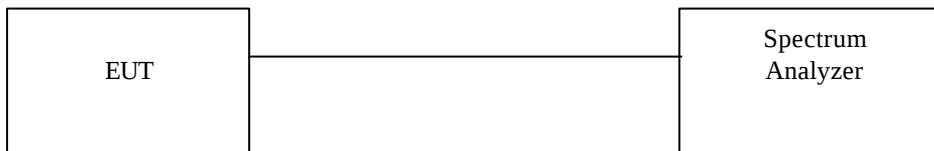
**All frequencies from 1GHz to 25 GHz have been tested.**

## 4.5 Band Edge Measurement

### 4.5.1 Test Procedure (Conducted)

1. The transmitter output of EUT was connected to the spectrum analyzer.  
Equipment mode: Spectrum analyzer  
Detector function: Peak mode  
SPAN: 100MHz  
RBW: 100KHz  
VBW: 100KHz  
Center frequency: 2.4GHz, 2.4835GHz.
2. Using Peak Search to read the peak power of Carrier frequencies after Maximum Hold function is completed
3. Find the next peak frequency outside the operation frequency band

### 4.5.2 Test Setup (Conducted)



### 4.5.3 Test Data:

Please refer to ISL report 04LR018FC part 1

#### 4.5.4 Test Procedure (Radiated)

1. Antenna and Turntable test procedure same as Radiated Emission Measurement.  
Equipment mode: Spectrum analyzer  
Detector function: Peak mode  
SPAN: 100MHz  
RBW: 1MHz  
VBW: 1MHz  
Center frequency: 2.395GHz, 2.48GHz.
2. Using Peak Search to read the peak power of Carrier frequencies after Maximum Hold function is completed.
3. Find the next peak frequency outside the operation frequency band
4. For peak frequency emission level measurement in Restricted Band ,  
Change RBW: 1MHz  
VBW: 10Hz  
Span: 100MHz.
5. Get the spectrum reading after Maximum Hold function is completed.

#### 4.5.5 Test Setup (Radiated)

Same as *Radiated Emission Measurement*

## 4.5.6 Test Data

Table Band Edge measurement (Radiated)

Temp. (deg. C): 25

Test Engr: Mailes  
Hsieh

Humidity (%): 50

| Channel             | Frequency<br>(MHz) | Spectrum<br>Reading<br>(dBuV) | Correction<br>Factor<br>(dB/m) | Emission<br>Level<br>(dBuV/m) | dBc ( Limit:<br>> 20dBc) | Limit<br>(dBuV/m) | Equip.<br>Setup<br>VBW | Pass<br>or<br>Fail |
|---------------------|--------------------|-------------------------------|--------------------------------|-------------------------------|--------------------------|-------------------|------------------------|--------------------|
| 1(peak mode)        | 2407               | 61.73                         | 31.1                           | 92.83                         | ---                      | ---               | 1MHz                   | ---                |
| Outside<br>band     | 2400               | 41.13                         | 31.1                           | 72.23                         | 20.6                     | ---               | 1MHz                   | Pass               |
| 1(average<br>mode)  | 2405.1             | 51.82                         | 31.1                           | 82.92                         | ---                      | ---               | 10Hz                   | ---                |
| Restricted<br>band  | 2390               | 8.66                          | 31.1                           | 39.76                         | ---                      | 54                | 10Hz                   | Pass               |
| 11(peak<br>mode)    | 2455.6             | 62.49                         | 31.1                           | 93.59                         | ---                      | ---               | 1MHz                   | ---                |
| Outside<br>band     | 2476.2             | 34.8                          | 31.1                           | 65.9                          | 27.69                    | ---               | 1MHz                   | Pass               |
| 11(average<br>mode) | 2455.6             | 52.31                         | 31.1                           | 83.41                         | ---                      | ---               | 10Hz                   | ---                |
| Restricted<br>band  | 2483.5             | 8.11                          | 31.1                           | 39.21                         | ---                      | 54                | 10Hz                   | Pass               |

## Note:

The Spectrum plot of emission level measurement in Restricted band is attached.

Emission Level=Spectrum Reading+Correction Factor

Correction Factor=Antenna Factor+cable loss–amplifier gain

Both Horizontal and Vertical polarizaion have been tested and the worst data is listed above.

Band Edge measurement for radiated emission in Restricted Band(Radiated)  
Peak Mode (Channel 1)



Band Edge measurement for radiated emission in Restricted Band(Radiated)  
Average Mode (Channel 1)



Band Edge measurement for radiated emission in Restricted Band(Radiated)  
Peak Mode (Channel 11)



Band Edge measurement for radiated emission in Restricted Band(Radiated)  
Average Mode (Channel 11)



#### **4.6 RF Exposure Measurement [Section 15.247(b)(4) & 1.1307(b)]**

See MPE report

## 4.7 DSSS Peak Power Spectral Density [Section 15.247(d) ]

### 4.7.1 Test Procedure

1. The Transmitter output of EUT was connected to the spectrum analyzer.  
Equipment mode: Spectrum analyzer  
Detector function: Peak mode  
SPAN:1.5MHz  
RBW: 3KHz  
VBW: 30KHz  
Center frequency: fundamental frequency tested.  
Sweep time= 500 sec.
2. Using Peak Search to read the peak power after Maximum Hold function is completed.

### 4.7.2 Test Setup



### 4.7.3 Test Data

Please refer to ISL report 04LR018FC part 1

#### **4.8 Appendix : Antenna Spec.**

Please refer to the attached file.