

# EMC

## TEST REPORT

**Report No.:** 170400069TWN-001  
**Model No.:** SmartPlug SP-A-PH  
**Issued Date:** May 02, 2017

**Applicant:** Cortex Technologies Corporation  
KM 20 East Service Road Cupang Muntinlupa, 1771 Philippines

**Test Method/ Standard:** 47 CFR FCC Part 15.247 & ANSI C63.10 2013  
KDB 558074 D01 v04

**Test Site:** 911880

**Test By:** Intertek Testing Services Taiwan Ltd.,  
Hsinchu Laboratory  
No. 11, Lane 275, Ko-Nan 1 Street, Chia-Tung Li,  
Shiang-Shan District, Hsinchu City, Taiwan

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**The test report was prepared by:**

  
Sunny Liu/ Senior Officer



**These measurements were taken by:**

  
Durant Wei/ Engineer

**The test report was reviewed by:**

  
**Name** Jimmy Yang  
**Title** Group Leader

### Revision History

| Report No.       | Issue Date   | Revision Summary |
|------------------|--------------|------------------|
| 170400069TWN-001 | May 02, 2017 | Original report  |

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## 1. Summary of Test Data

| Test Requirement                                                            | Applicable Rule<br>(Section 15.247) | Result |
|-----------------------------------------------------------------------------|-------------------------------------|--------|
| Minimum 6 dB Bandwidth                                                      | 15.247(a)(2)<br>KDB 558074 D01 v04  | Pass   |
| Maximum Peak Conducted Output Power                                         | 15.247(b)(3)<br>KDB 558074 D01 v04  | Pass   |
| Power Spectral Density                                                      | 15.247(e)                           | Pass   |
| Emissions In Non-Restricted Frequency Bands                                 | 15.247(d)                           | Pass   |
| Emissions In Restricted Frequency Bands<br>(Radiated emission measurements) | 15.247(d), 15.205, 15.209           | Pass   |
| Emission On The Band Edge                                                   | 15.247(d), 15.205                   | Pass   |
| AC Power Line Conducted Emission                                            | 15.207                              | Pass   |
| Antenna Requirement                                                         | 15.203                              | Pass   |

## 2. General Information

### 2.1 Identification of the EUT

Product: SmartPlug  
Model No: SmartPlug SP-A-PH  
Operating Frequency: 2402 MHz ~ 2480 MHz  
Channel Number: 40 channels  
Frequency of Each Channel: 2402+2 k MHz, k=0~39  
Access scheme: GFSK  
Rated Power: 110-220Vac, 50/60Hz  
Power Cord: N/A  
Sample Received: Apr. 10, 2017  
Sample condition: Workable  
Test Date(s): Apr. 10, 2017~ Apr. 25, 2017

Note 1: The test report only allows to be revised within three years from its original issued date unless further standard or the requirement was noticed.

Note 2: When determining the test conclusion, the Measurement Uncertainty of test has been considered.

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### 2.2 Antenna description

The EUT uses a permanently connected antenna.

Antenna Gain: 0.13 dBi  
Antenna Type: Chip Antenna  
Connector Type: N/A

### 2.3 Peripherals equipment

| Peripherals | Brand               | Model No.     | Serial No. | Description of Data Cable |
|-------------|---------------------|---------------|------------|---------------------------|
| Notebook PC | DELL                | Latitude D610 | 5YWZK1S    | Mini USB 0.4 meter        |
| CC Debugger | TEXAS<br>INSTRUMENT | N/A           | N/A        | N/A                       |

## 2.4 Operation mode

TX-MODE is based on the program “SmartRF studio 7” and the program can select different frequency and modulation.

The signal is maximized through rotation and placement in the three orthogonal axes.



**X axis**



**Y axis**

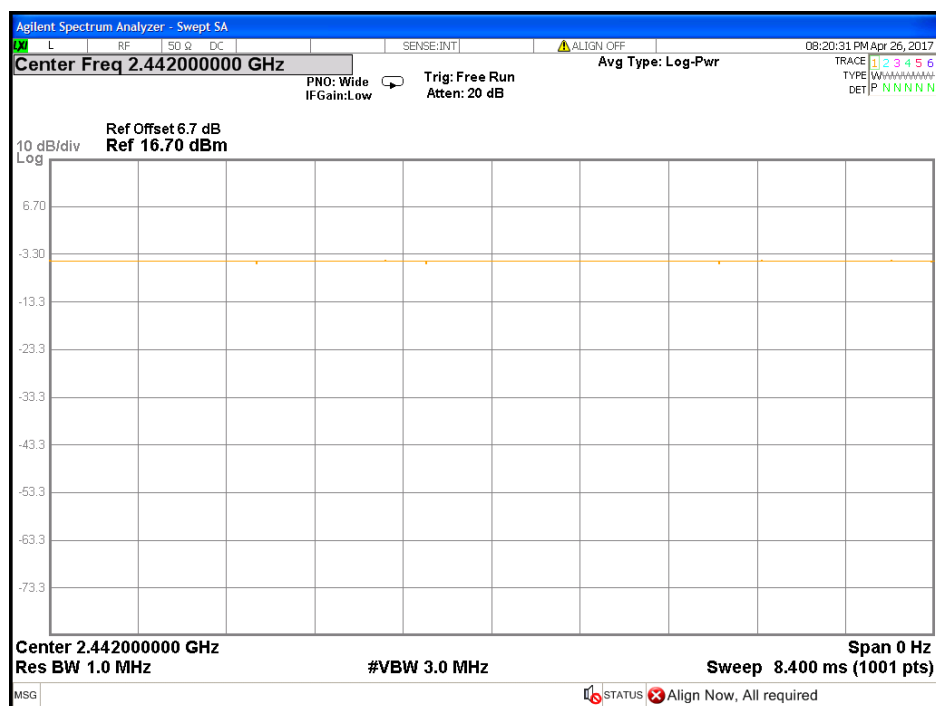


**Z axis**

After verifying three axes, we found the maximum electromagnetic field was occurred at Z axis. The final test data was executed under this configuration.

| Mode   | Channel | Frequency (MHz) | Data rate | Signal on time(s) | Total signal transmit time(s) | Duty cycle | Duty Cycle factor |
|--------|---------|-----------------|-----------|-------------------|-------------------------------|------------|-------------------|
| BT 4.0 | Middle  | 2442            | 1         | 1                 | 1                             | 1.000      | 0.000             |

Chain0 : Duty cycle @ BT 4.0 mode Ch 20



## 2.5 Applied test modes and channels

| Test items                                        | Mode                  | Channel            | Antenna |
|---------------------------------------------------|-----------------------|--------------------|---------|
| Minimum 6 dB Bandwidth                            | BT 4.0                | Low, Middle , High | Chain0  |
| Maximum peak conducted output power               | BT 4.0                | Low, Middle , High | Chain0  |
| Power Spectral Density                            | BT 4.0                | Low, Middle , High | Chain0  |
| RF Antenna Conducted Spurious                     | BT 4.0                | Low, Middle , High | Chain0  |
| Radiated spurious Emission<br>9kHz~1GHz           | Worst case(Ch middle) |                    |         |
| Radiated Spurious Emission<br>10GHz~10th Harmonic | BT 4.0                | Low, Middle , High | Chain0  |
| Restricted-Band Band edge                         | BT 4.0                | Low, Middle , High | Chain0  |
| AC Power Line Conducted Emission                  | Normal Link           |                    |         |

### 3. Minimum 6 dB Bandwidth

#### 3.1 Operating environment

|                           |                                    |     |
|---------------------------|------------------------------------|-----|
| Temperature:              | 25                                 | °C  |
| Relative Humidity:        | 50                                 | %   |
| Atmospheric Pressure      | 1008                               | hPa |
| Requirement & Test method | 15.247(a)(2)<br>KDB 558074 D01 v04 |     |

#### 3.2 Limit for minimum 6dB bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

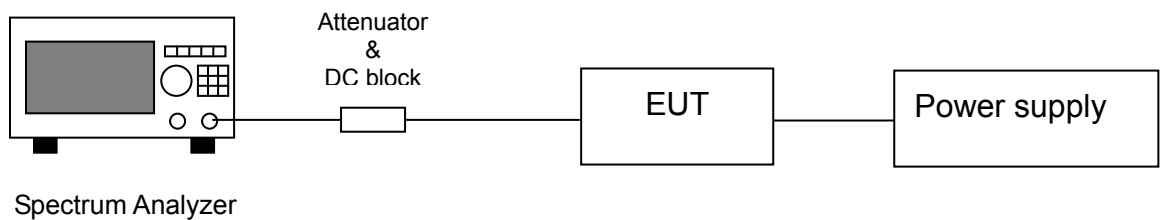
#### 3.3 Measuring instrument setting

| Spectrum analyzer settings |                                                         |
|----------------------------|---------------------------------------------------------|
| Spectrum Analyzer function | Setting                                                 |
| Detector                   | Peak                                                    |
| RBW                        | 100kHz                                                  |
| VBW                        | $\geq 3 \times \text{RBW}$                              |
| Sweep                      | Auto couple                                             |
| Trace                      | Allow the trace to stabilize.                           |
| Span                       | Between two times and five times the occupied bandwidth |
| Attenuation                | Auto                                                    |

#### 3.4 Test procedure

1. The transmitter output was connected to the spectrum analyzer.
2. Test was performed in accordance with clause 8.1 option1 of KDB 558074 D01
3. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

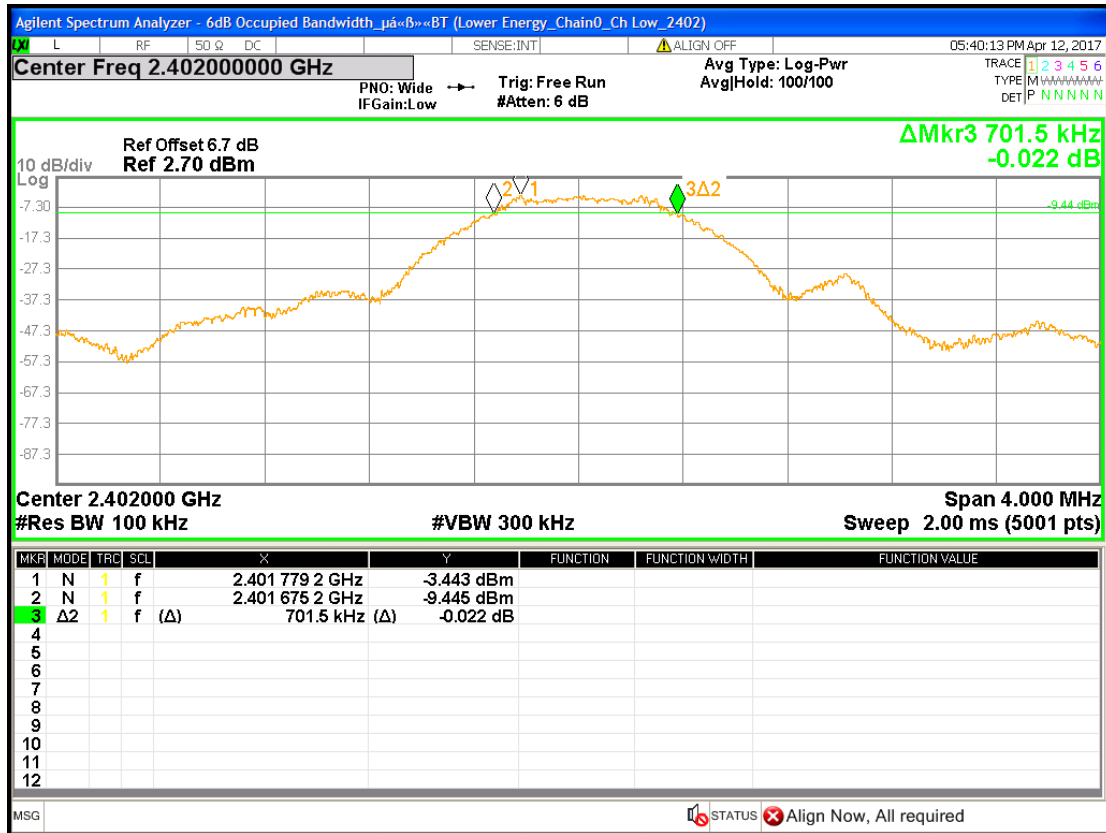
3.5 Test diagram



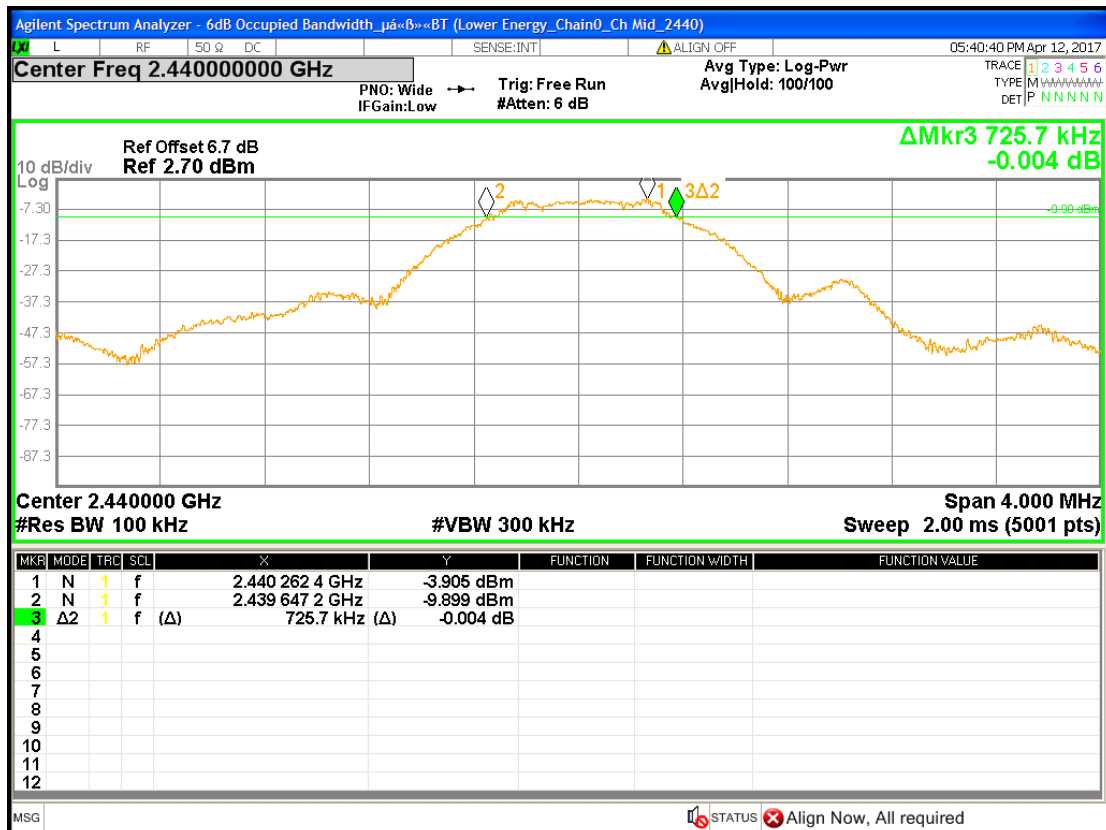
3.6 Test results

| Mode  | Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | Limit (MHz) |
|-------|---------|-----------------|---------------------|-------------|
| BT4.0 | Low     | 2402            | 0.7015              | >0.5        |
|       | Middle  | 2442            | 0.7257              | >0.5        |
|       | High    | 2480            | 0.6943              | >0.5        |

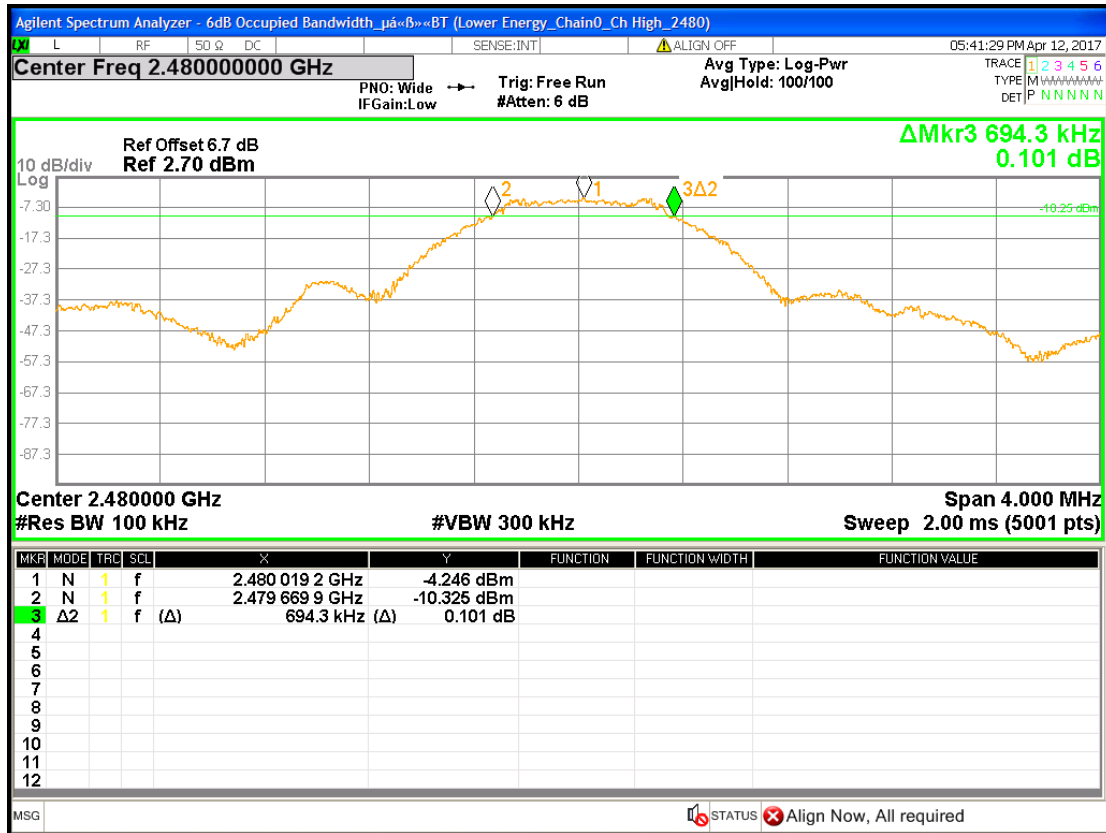
### Chain0 : 6dB Bandwidth @ Lower Energy mode Ch low



### Chain0 : 6dB Bandwidth @ Lower Energy mode Ch middle



**Chain0 : 6dB Bandwidth @ Lower Energy mode Ch high**



## 4. Maximum Peak Conducted Output Power

### 4.1 Operating environment

|                           |                                    |     |
|---------------------------|------------------------------------|-----|
| Temperature:              | 25                                 | °C  |
| Relative Humidity:        | 50                                 | %   |
| Atmospheric Pressure      | 1008                               | hPa |
| Requirement & Test method | 15.247(b)(3)<br>KDB 558074 D01 v04 |     |

### 4.2 Limit for maximum peak conducted output power

For systems using digital modulation in the 2400-2483.5 MHz: 1 Watt (30dBm)

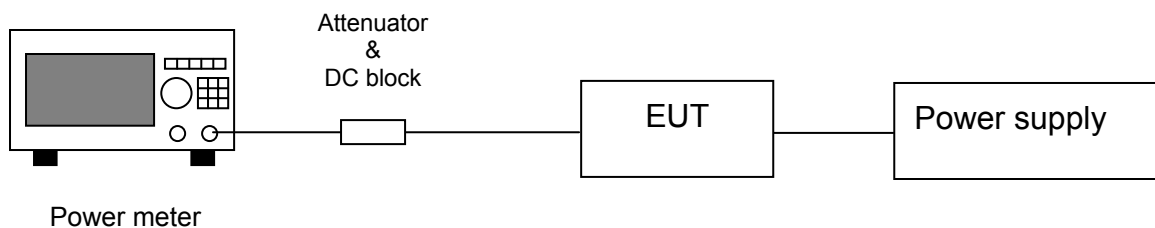
### 4.3 Measuring instrument setting

| Power meter |                                                            |
|-------------|------------------------------------------------------------|
| Power meter | Setting                                                    |
| Bandwidth   | 65MHz bandwidth is greater than the EUT emission bandwidth |
| Detector    | Peak & Average                                             |

### 4.4 Test procedure

Test procedures refer to clause 9.1.3 peak power meter method and clause 9.2.3.2 measurement using a gated RF average power meter of KDB 558074 D01.

### 4.5 Test diagram



#### 4.6 Test result

| Mode   | Channel | Frequency (MHz) | Output Power (AV) (dBm) | Total Power (AV) (mW) | Maximun power (PK) (dBm) | Maximun power (PK) (mW) | Limit (dBm) | Margin (dB) |
|--------|---------|-----------------|-------------------------|-----------------------|--------------------------|-------------------------|-------------|-------------|
| BT 4.0 | 0       | 2402            | -2.87                   | 0.52                  | -2.35                    | 0.58                    | 30          | -32.35      |
|        | 20      | 2442            | -3.13                   | 0.49                  | -2.62                    | 0.55                    | 30          | -32.62      |
|        | 39      | 2480            | -3.52                   | 0.44                  | -2.66                    | 0.54                    | 30          | -32.66      |

## 5. Power Spectral Density

### 5.1 Operating environment

|                           |                                 |     |
|---------------------------|---------------------------------|-----|
| Temperature:              | 25                              | °C  |
| Relative Humidity:        | 50                              | %   |
| Atmospheric Pressure      | 1008                            | hPa |
| Requirement & Test method | 15.247(e)<br>KDB 558074 D01 v04 |     |

### 5.2 Limit for power spectrum density

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission

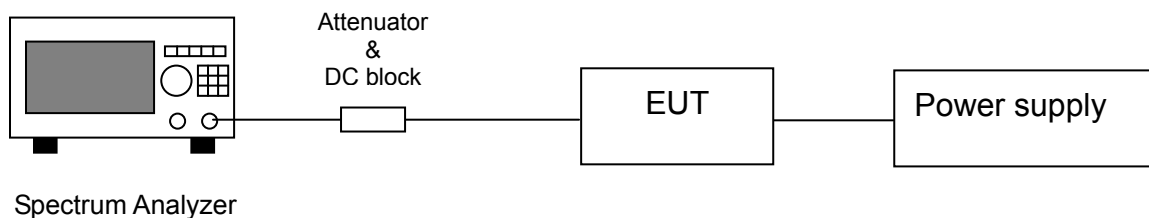
### 5.3 Measuring instrument setting

| Spectrum analyzer settings |                           |
|----------------------------|---------------------------|
| Spectrum Analyzer function | Setting                   |
| Detector                   | Peak                      |
| RBW                        | $\geq 3$ kHz              |
| VBW                        | $\geq 3 \times$ RBW       |
| Sweep                      | Auto couple               |
| Trace                      | Max hold                  |
| Span                       | 1.5 times x 6dB bandwidth |
| Attenuation                | Auto                      |

## 5.4 Test procedure

1. Test procedure refer to clause 10.2 method PKPSD (peak PSD) of KDB 558074 D01.
2. Using the maximum conducted output power in the fundamental emission demonstrates compliance. The EUT must be configured to transmit continuously at full power over the measurement duration.
3. Use the peak marker function to determine the maximum amplitude level within the RBW.

## 5.5 Test diagram

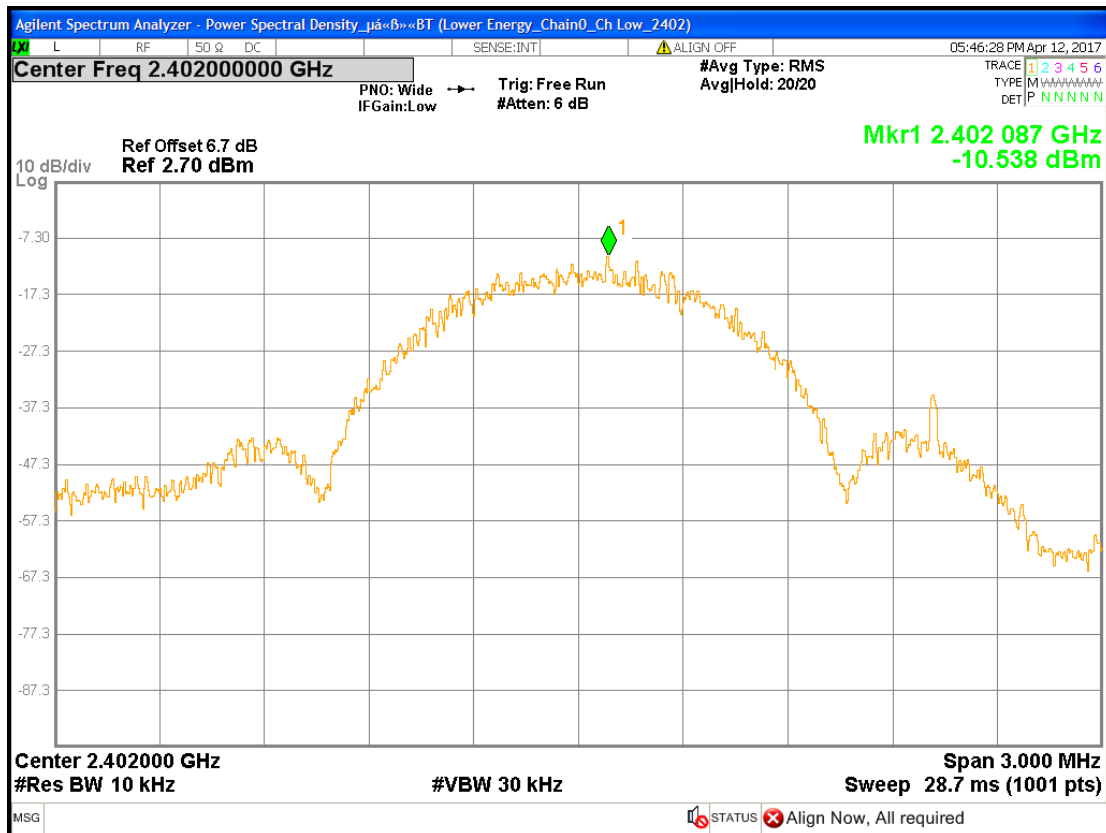


## 5.6 Test results

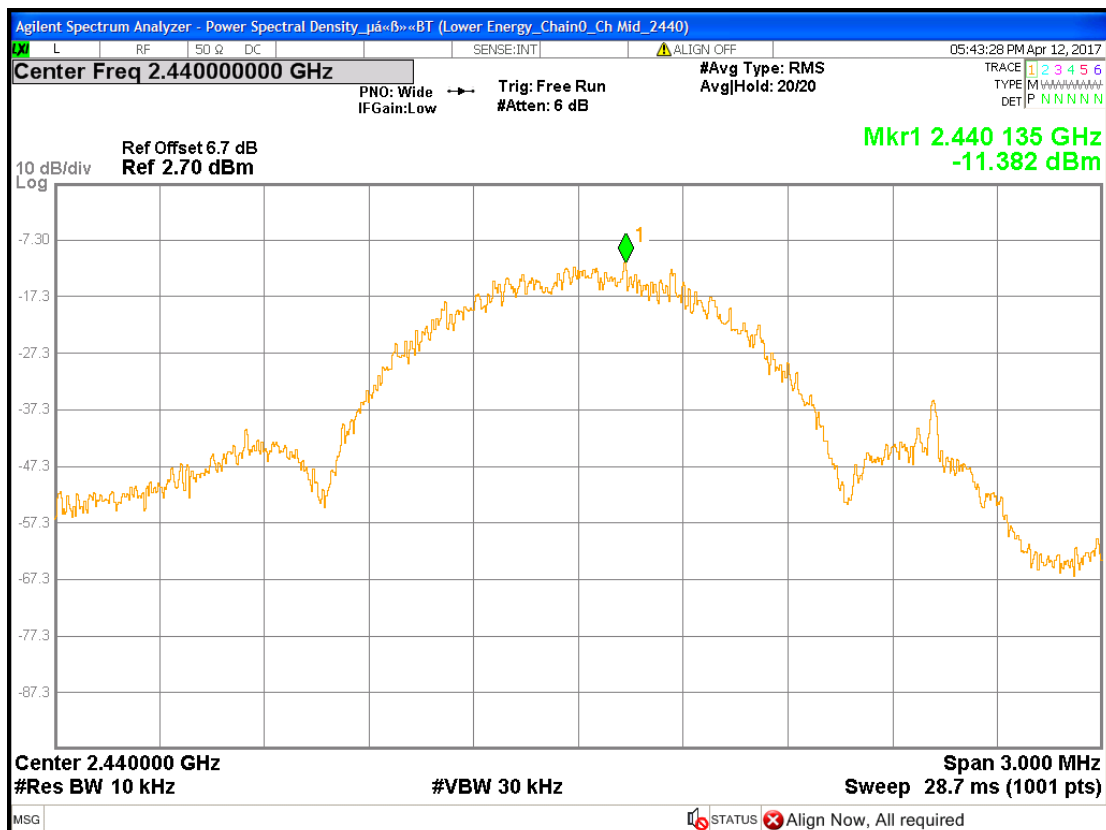
| Mode   | Channel | Frequency (MHz) | RBW factor | PSD in 10kHz | PSD in 3kHz |      | Limit (dBm) | Margin (dB) |
|--------|---------|-----------------|------------|--------------|-------------|------|-------------|-------------|
|        |         |                 |            |              | (dBm)       | (mW) |             |             |
| BT 4.0 | Low     | 2402            | 5.23       | -10.538      | -15.77      | 0.03 | 8           | -23.77      |
|        | Middle  | 2442            | 5.23       | -11.382      | -16.61      | 0.02 | 8           | -24.61      |
|        | High    | 2480            | 5.23       | -12.374      | -17.60      | 0.02 | 8           | -25.60      |

Remark: RBW Correction:  $10 \cdot \log(10\text{kHz}/3\text{kHz})$

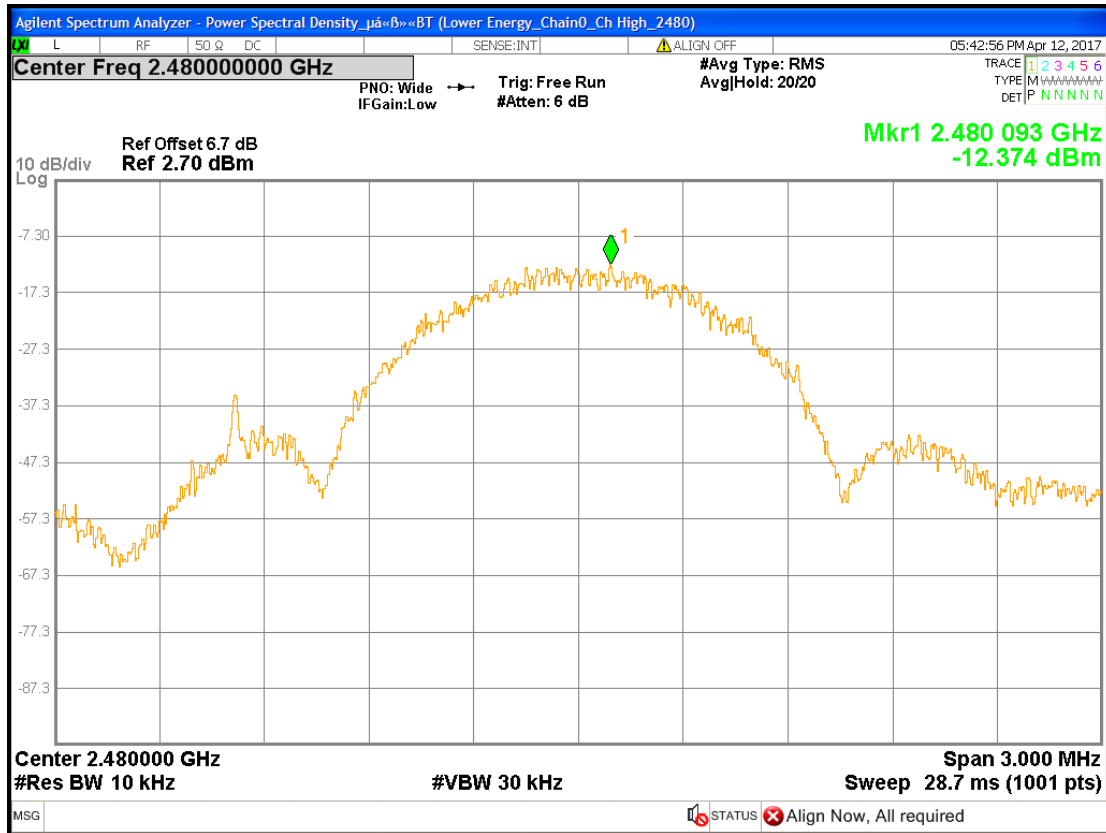
### Chain0 : Power Spectral Density @ Lower Energy mode Ch low



### Chain0 : Power Spectral Density @ Lower Energy mode Ch middle



**Chain0 : Power Spectral Density @ Lower Energy mode Ch high**



## 6. Emissions In Non-Restricted Frequency Bands

### 6.1 Operating environment

|                      |           |     |
|----------------------|-----------|-----|
| Temperature:         | 20        | °C  |
| Relative Humidity:   | 55        | %   |
| Atmospheric Pressure | 1008      | hPa |
| Requirement          | 15.247(d) |     |

### 6.2 Limit for emissions in non-restricted frequency bands

The peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz

### 6.3 Measuring instruments setting

#### Reference level measurement

| Spectrum analyzer settings |                               |
|----------------------------|-------------------------------|
| Spectrum Analyzer function | Setting                       |
| Detector                   | Peak                          |
| RBW                        | $\geq 100$ kHz                |
| VBW                        | $\geq 3 \times$ RBW           |
| Sweep                      | Auto couple                   |
| Trace                      | Max hold                      |
| Span                       | $\geq 1.5$ time 6dB bandwidth |
| Attenuation                | Auto                          |

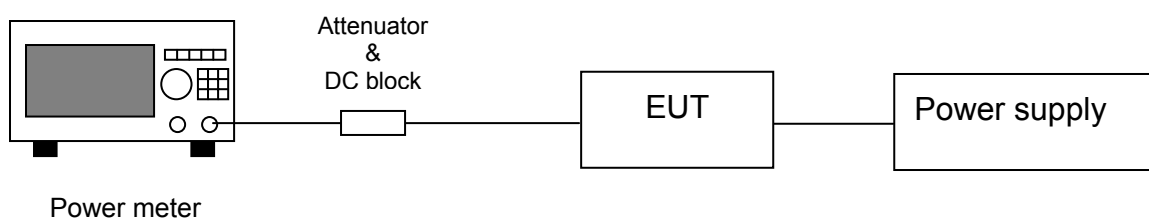
## Emission level measurement

| Spectrum analyzer settings |                     |
|----------------------------|---------------------|
| Spectrum Analyzer function | Setting             |
| Detector                   | Peak                |
| RBW                        | $\geq 100$ kHz      |
| VBW                        | $\geq 3 \times$ RBW |
| Sweep                      | Auto couple         |
| Trace                      | Max hold            |
| Attenuation                | Auto                |

### 6.4 Test procedure

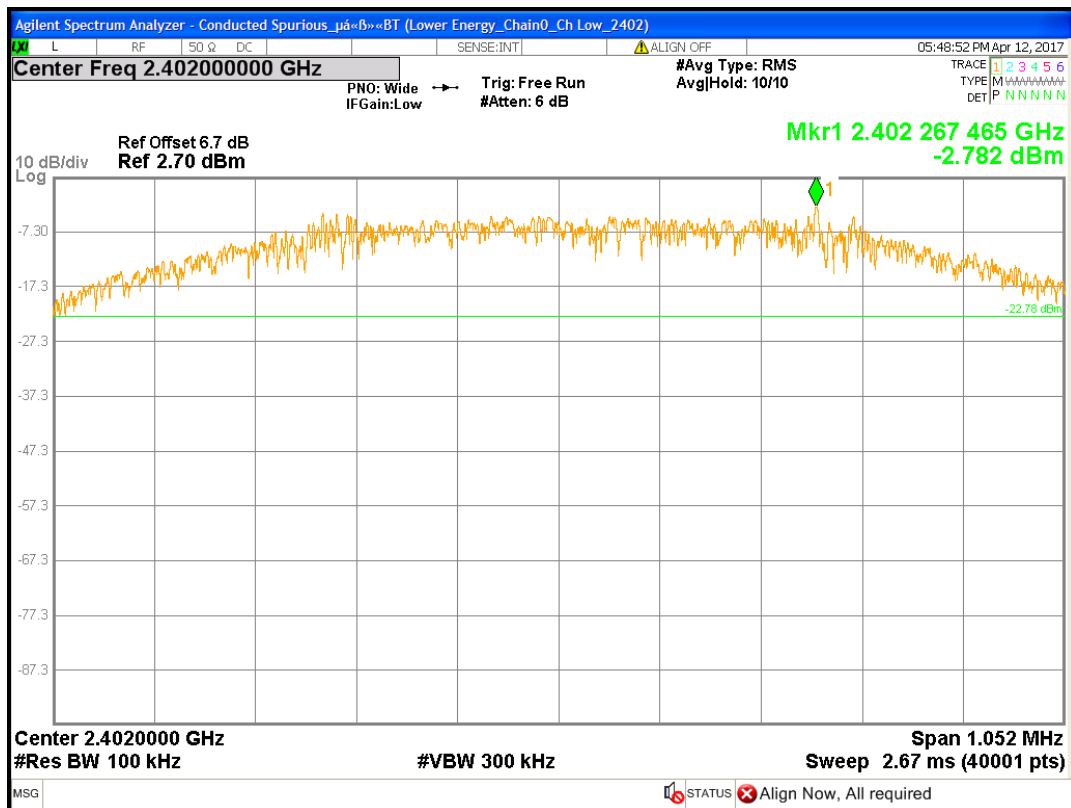
1. The procedure was used in antenna-port conducted and connected to the spectrum analyzer.
2. Set instrument center frequency to center frequency
3. Use the parameter configured in clause 6.3 to measure
4. Use the peak marker function to determine the maximum amplitude level.

### 6.5 Test diagram

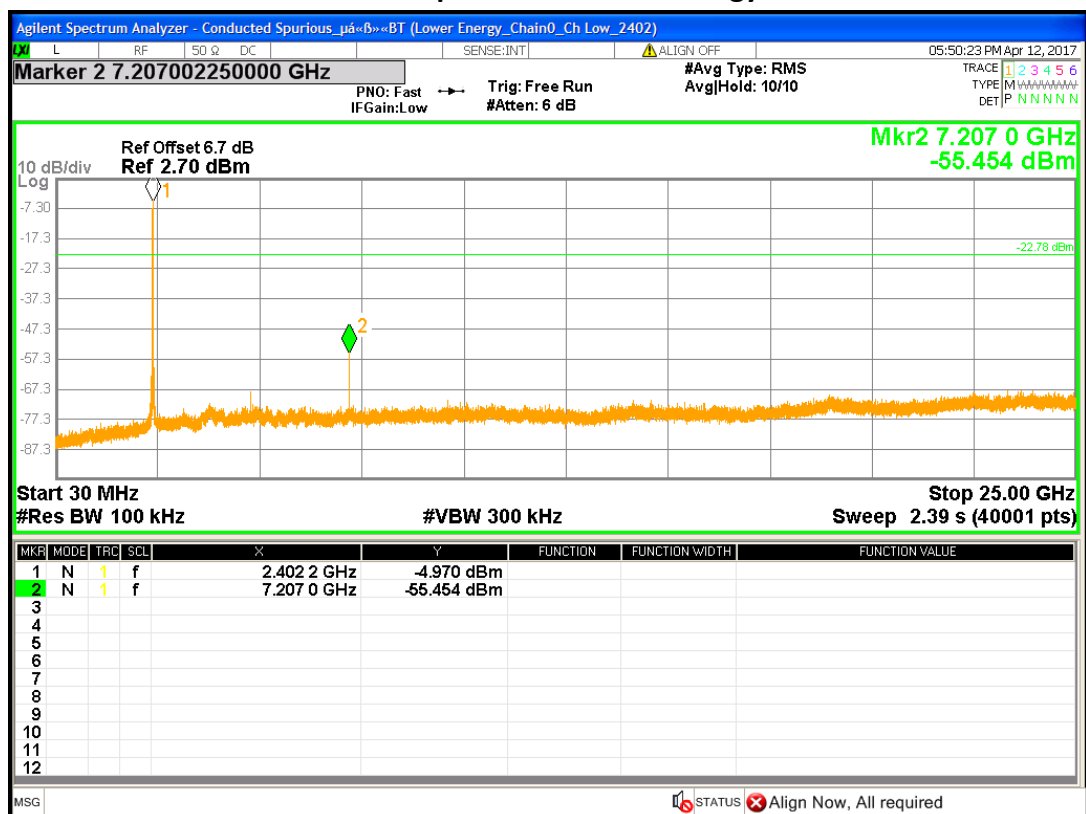


## 6.6 Test results

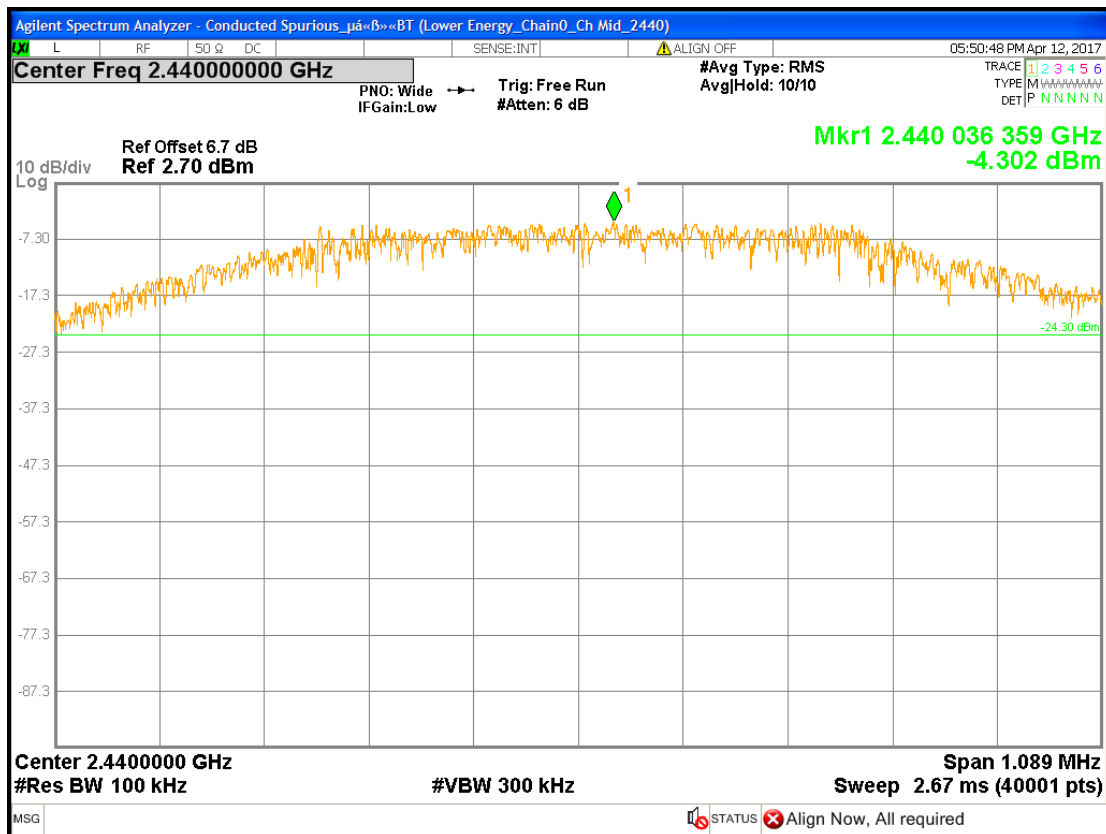
### Chain0 : Conducted Spurious @ Lower Energy mode Ch low



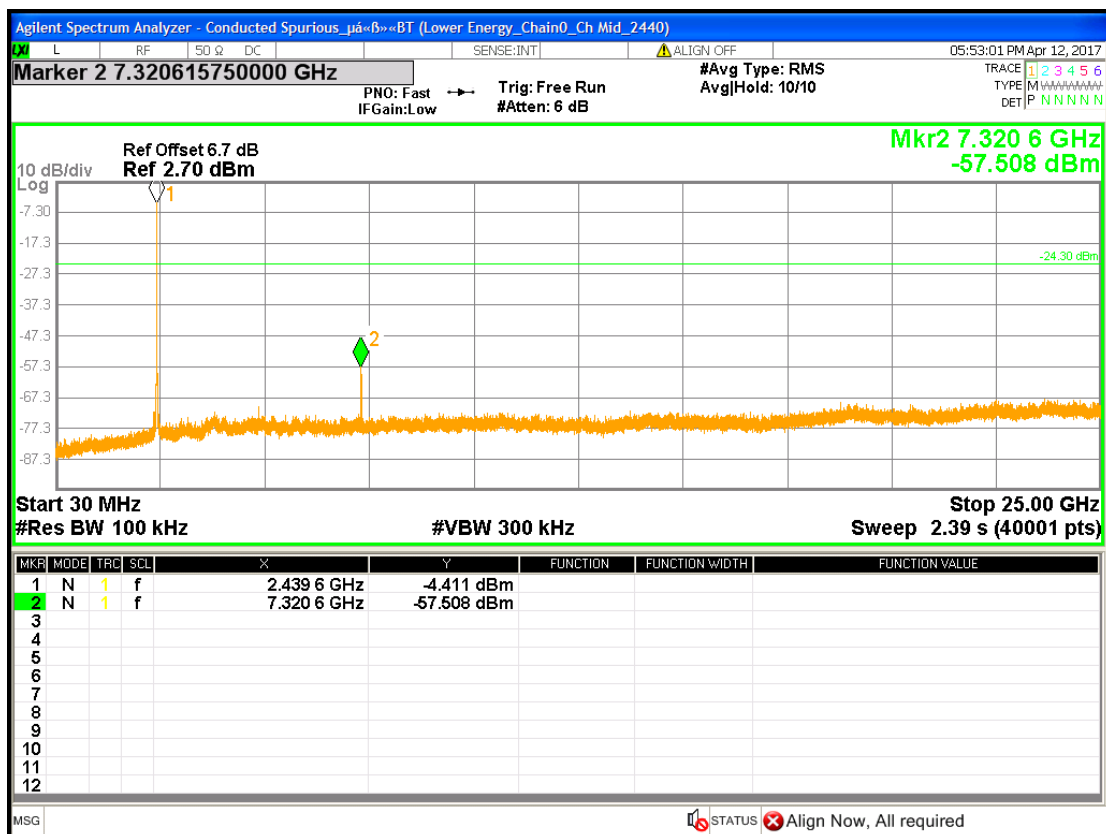
### Chain0 : Conducted Spurious @ Lower Energy mode Ch low



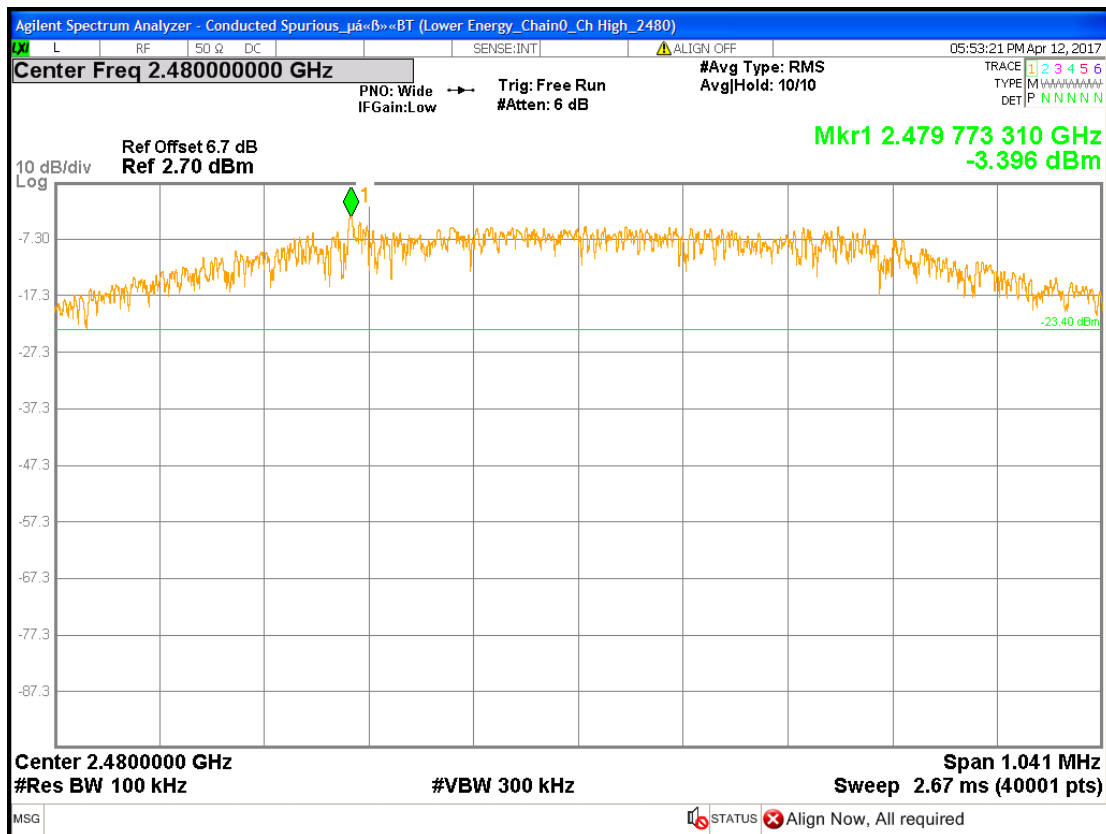
**Chain0 : Conducted Spurious @ Lower Energy mode Ch middle**



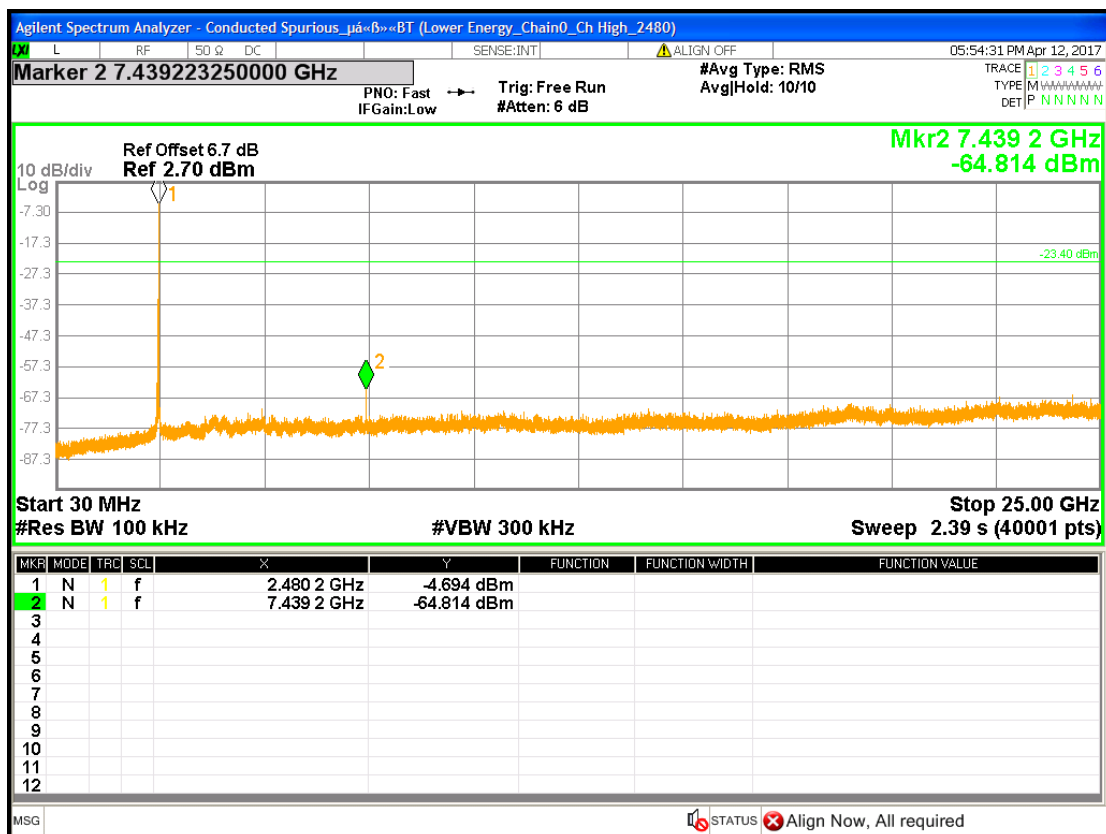
**Chain0 : Conducted Spurious @ Lower Energy mode Ch middle**



**Chain0 : Conducted Spurious @ Lower Energy mode Ch high**



**Chain0 : Conducted Spurious @ Lower Energy mode Ch high**



## 7. Emissions In Restricted Frequency Bands (Radiated emission measurements)

### 7.1 Operating environment

|                      |                              |     |
|----------------------|------------------------------|-----|
| Temperature:         | 20                           | °C  |
| Relative Humidity:   | 55                           | %   |
| Atmospheric Pressure | 1008                         | hPa |
| Requirement          | 15.247(d), 15.205,<br>15.209 |     |

### 7.2 Limit for emission in restricted frequency bands (Radiated emission measurement)

| Frequency<br>(MHz) | Field Strength<br>(microvolts/meter) | Measurement distance<br>(meters) |
|--------------------|--------------------------------------|----------------------------------|
| 0.009~0.490        | 2400/F(kHz)                          | 300                              |
| 0.490~1.705        | 2400/F(kHz)                          | 30                               |
| 1.705~30           | 30                                   | 30                               |
| 30-88              | 100                                  | 3                                |
| 88-216             | 150                                  | 3                                |
| 216-960            | 200                                  | 3                                |
| Above 960          | 500                                  | 3                                |

Remark:

1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

### 7.3 Measuring instrument setting

#### Below 1GHz measurement

| Receiver settings |                                                                             |
|-------------------|-----------------------------------------------------------------------------|
| Receiver function | Setting                                                                     |
| Detector          | QP                                                                          |
| RBW               | 9-150 kHz ; 200-300 Hz<br>0.15-30 MHz; 9-10 kHz<br>30-1000 MHz; 100-120 kHz |
| VBW               | $\geq 3 \times \text{RBW}$                                                  |
| Sweep             | Auto couple                                                                 |
| Attenuation       | Auto                                                                        |

#### Above 1GHz measurement

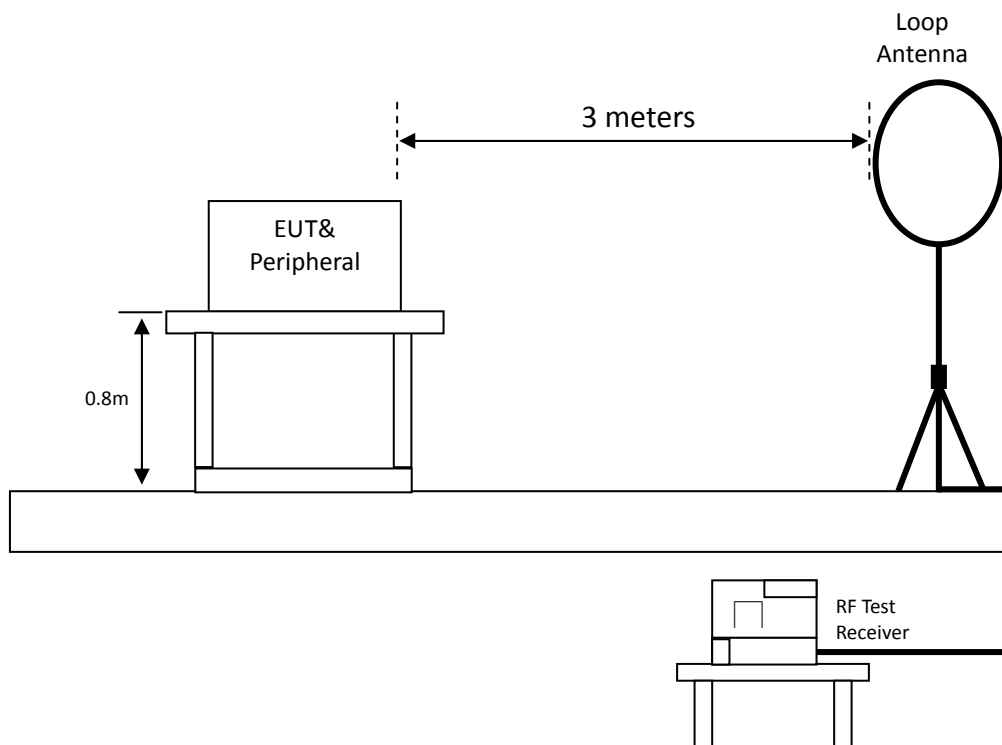
| Spectrum analyzer settings |                           |
|----------------------------|---------------------------|
| Spectrum Analyzer function | Setting                   |
| Detector                   | Peak                      |
| RBW                        | 1MHz                      |
| VBW                        | 3MHz for Peak and Average |
| Sweep                      | Auto couple               |
| Start Frequency            | 1GHz                      |
| Stop Frequency             | Tenth harmonic            |
| Attenuation                | Auto                      |

#### **7.4 Test procedure**

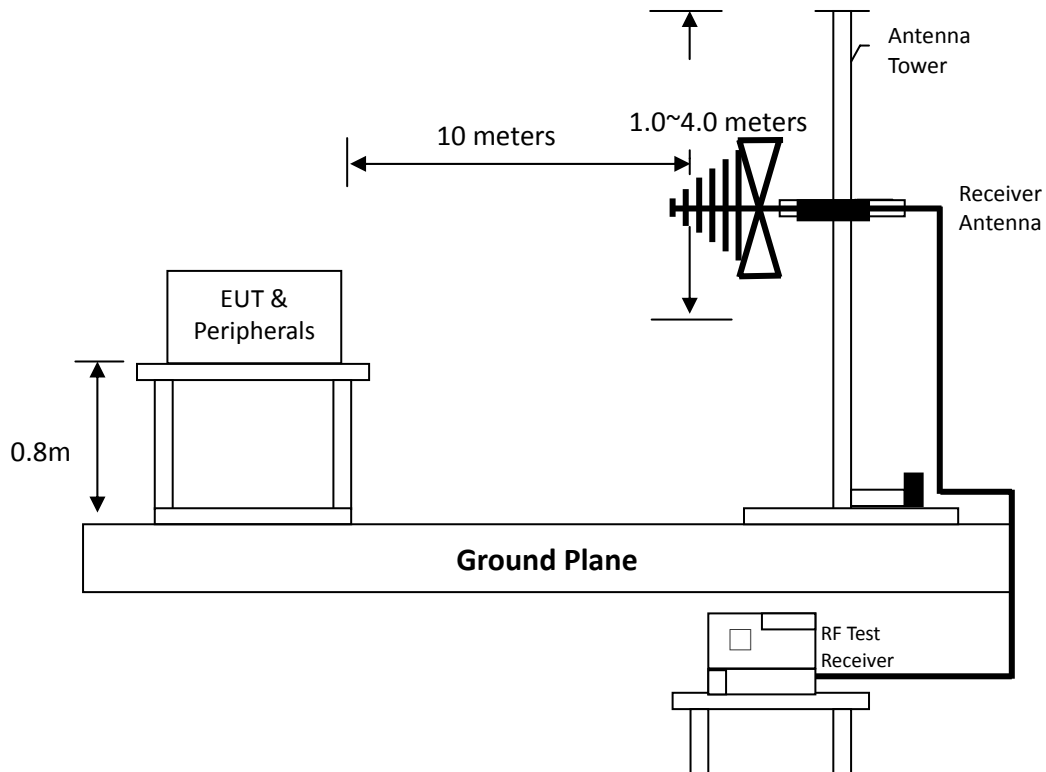
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 0.8 meter or 1.5 meter above ground. The center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the companion devices. The turntable was rotated by 360 degree to find the position of the maximum emission level.
3. The height of the receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of the both horizontal and vertical polarization
4. If find the frequencies above the limit or below within 3dB, the antenna tower was scan (from 1m to 4m) and then the turntable was rotated to find the maximum reading.
5. Set the test-receiver system to peak or CISPR quasi-peak detector with specified bandwidth under maximum hold mode.
6. For emissions above 1GHz, use 1MHz VBW and 3MHz RBW for peak and average reading  
Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response.
7. If the emissions level of the EUT in peak mode was 3dB lower than the average limit specified then testing will be stopped and peak values of the EUT will be reported. Otherwise, the emissions which do not have 3dB margin will be measured using the quasi-peak method for below 1GHz.
8. For testing above 1GHz, The emissions level of the EUT in peak mode was lower than average limit, then testing will be stopped and peak values of the EUT will be reported, otherwise, the emission will be measured in average mode again and reported.
9. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be quasi-peak measured by receiver.

## 7.5 Test configuration

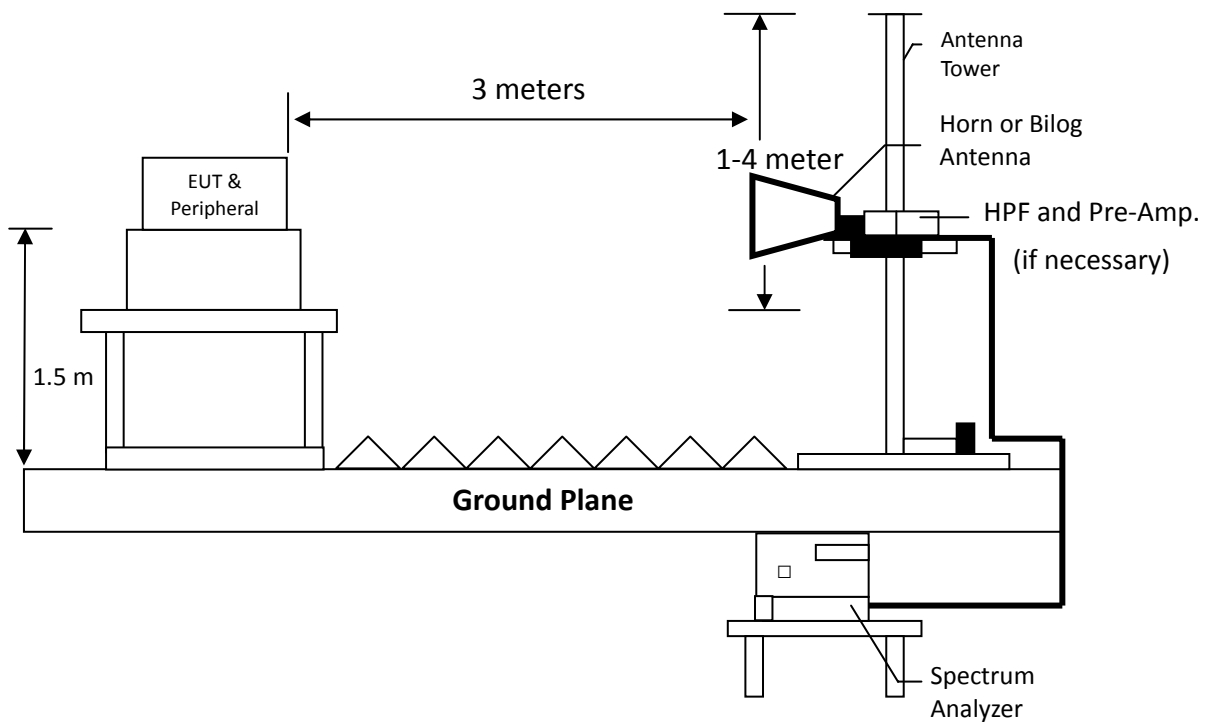
### 7.5.1 Radiated emission from 9kHz to 30MHz uses Loop Antenna:



### 7.5.2 Radiated emission below 1GHz using Bilog Antenna



### 7.5.3 Radiated emission above 1GHz using Horn Antenna



## 7.6 Test result

### 7.6.1 Measurement results: frequencies 9kHz to 30MHz

The test was performed on EUT under GFSK continuously transmitting mode. The worst case occurred at channel middle

EUT : SmartPlug SP-A-PH  
Worst Case : GFSK at channel middle

| Polarity<br>(circle) | Frequency<br>(MHz) | Detection<br>Value | Factor<br>(dB/m) | Reading<br>(dBμV) | Value<br>(dBμV/m) | Limit<br>@ 3m<br>(dBμV/m) | Tolerance<br>(dB) |
|----------------------|--------------------|--------------------|------------------|-------------------|-------------------|---------------------------|-------------------|
| Plane                | 0.01               | QP                 | 95.30            | -38.99            | 56.31             | 127.60                    | -71.29            |
| Plane                | 0.03               | QP                 | 85.90            | -31.69            | 54.21             | 118.06                    | -63.85            |
| Plane                | 0.04               | QP                 | 83.20            | -33.61            | 49.59             | 115.56                    | -65.97            |
| Plane                | 0.06               | QP                 | 79.24            | -29.19            | 50.05             | 112.04                    | -61.99            |
| Plane                | 0.09               | QP                 | 75.46            | -30.54            | 44.92             | 108.52                    | -63.60            |
| Plane                | 0.11               | QP                 | 73.72            | -28.69            | 45.03             | 106.78                    | -61.75            |
| Plane                | 0.15               | QP                 | 71.78            | -19.05            | 52.73             | 104.08                    | -51.35            |
| Plane                | 0.45               | QP                 | 61.35            | -8.51             | 52.84             | 94.54                     | -41.70            |
| Plane                | 0.99               | QP                 | 54.81            | -9.07             | 45.74             | 67.69                     | -21.95            |
| Plane                | 1.11               | QP                 | 54.18            | -10.41            | 43.77             | 66.70                     | -22.93            |
| Plane                | 1.46               | QP                 | 52.54            | -11.52            | 41.02             | 64.32                     | -23.30            |
| Plane                | 1.70               | QP                 | 51.41            | -11.42            | 39.99             | 63.00                     | -23.01            |

Remark: Corr. Factor = Antenna Factor + Cable Loss - PreAmplifier Gain

## 7.6.2 Measurement results: frequencies below 1 GHz

The test was performed on EUT under GFSK continuously transmitting mode. The worst case occurred at channel middle

EUT : SmartPlug SP-A-PH  
Worst Case : GFSK at channel middle

| Polarization<br>(circle) | Frequency<br>(MHz) | Detector | Corr.<br>Factor<br>(dB/m) | Reading<br>(dBμV) | Calculated<br>level<br>(dBμV/m) | Limit<br>@ 3m<br>(dBμV/m) | Margin<br>(dB) |
|--------------------------|--------------------|----------|---------------------------|-------------------|---------------------------------|---------------------------|----------------|
| Vertical                 | 95.96              | QP       | 11.05                     | 26.12             | 37.17                           | 43.50                     | -6.33          |
| Vertical                 | 123.12             | QP       | 14.17                     | 20.35             | 34.52                           | 43.50                     | -8.98          |
| Vertical                 | 194.90             | QP       | 13.90                     | 17.98             | 31.88                           | 43.50                     | -11.62         |
| Vertical                 | 710.94             | QP       | 25.88                     | 11.87             | 37.75                           | 46.00                     | -8.25          |
| Vertical                 | 730.34             | QP       | 26.21                     | 11.99             | 38.20                           | 46.00                     | -7.80          |
| Vertical                 | 800.18             | QP       | 27.31                     | 15.77             | 43.08                           | 46.00                     | -2.92          |
| Horizontal               | 95.96              | QP       | 11.05                     | 22.86             | 33.91                           | 43.50                     | -9.59          |
| Horizontal               | 127.00             | QP       | 14.58                     | 24.12             | 38.69                           | 43.50                     | -4.81          |
| Horizontal               | 173.56             | QP       | 15.64                     | 19.42             | 35.06                           | 43.50                     | -8.44          |
| Horizontal               | 732.28             | QP       | 26.24                     | 12.87             | 39.11                           | 46.00                     | -6.89          |
| Horizontal               | 798.24             | QP       | 27.28                     | 12.32             | 39.60                           | 46.00                     | -6.40          |
| Horizontal               | 848.68             | QP       | 28.01                     | 10.75             | 38.76                           | 46.00                     | -7.24          |

Remark: Corr. Factor = Antenna Factor + Cable Loss

### 7.6.3 Measurement results: frequency above 1GHz

EUT :SmartPlug SP-A-PH

| Mode            | Frequency<br>(MHz) | Spectrum<br>Analyzer<br>Detector | Ant.<br>Pol.<br>(H/V) | Preamp.<br>Gain<br>(dB) | Corr.<br>Factor<br>(dB/m) | Reading<br>(dBμV) | Corrected<br>Reading<br>(dBμV/m) | Limit<br>@ 3m<br>(dBμV/m) | Margin<br>(dB) |
|-----------------|--------------------|----------------------------------|-----------------------|-------------------------|---------------------------|-------------------|----------------------------------|---------------------------|----------------|
| BT 4.0<br>Ch_0  | 4804               | PK                               | V                     | 40.13                   | -0.10                     | 49.30             | 49.20                            | 74.00                     | -24.80         |
|                 | 4804               | PK                               | H                     | 40.13                   | -0.10                     | 55.65             | 55.55                            | 74.00                     | -18.45         |
|                 | 4804               | AV                               | H                     | 40.13                   | -0.10                     | 53.53             | 53.43                            | 54.00                     | -0.57          |
| BT 4.0<br>Ch_20 | 3990               | PK                               | V                     | 40.38                   | -1.57                     | 45.00             | 43.43                            | 74.00                     | -30.57         |
|                 | 4884               | PK                               | V                     | 39.99                   | 0.16                      | 46.40             | 46.56                            | 74.00                     | -27.44         |
|                 | 4884               | PK                               | H                     | 39.99                   | 0.16                      | 49.96             | 50.12                            | 74.00                     | -23.88         |
| BT 4.0<br>Ch_39 | 3990               | PK                               | V                     | 40.38                   | -1.57                     | 42.60             | 41.03                            | 74.00                     | -32.97         |
|                 | 4960               | PK                               | V                     | 39.84                   | 0.41                      | 44.01             | 44.42                            | 74.00                     | -29.58         |
|                 | 4960               | PK                               | H                     | 39.84                   | 0.41                      | 46.24             | 46.65                            | 74.00                     | -27.35         |

Remark: Correction Factor = Antenna Factor + Cable Loss + High Pass Filter Loss - Pre\_Amplifier Gain

## 8. Emission On Band Edge

### 8.1 Operating environment

|                      |                   |     |
|----------------------|-------------------|-----|
| Temperature:         | 25                | °C  |
| Relative Humidity:   | 50                | %   |
| Atmospheric Pressure | 1008              | hPa |
| Requirement          | 15.247(d), 15.205 |     |

### 8.2 Measuring instrument setting

| Spectrum analyzer settings |                                    |
|----------------------------|------------------------------------|
| Spectrum Analyzer function | Setting                            |
| Detector                   | Peak                               |
| RBW                        | 1MHz                               |
| VBW                        | 3MHz for peak and 10Hz for average |
| Sweep                      | Auto couple                        |
| Restrict bands             | 2310~2390MHz                       |
|                            | 2483.5 ~2500MHz                    |
| Attenuation                | Auto                               |

### 8.3 Test procedure

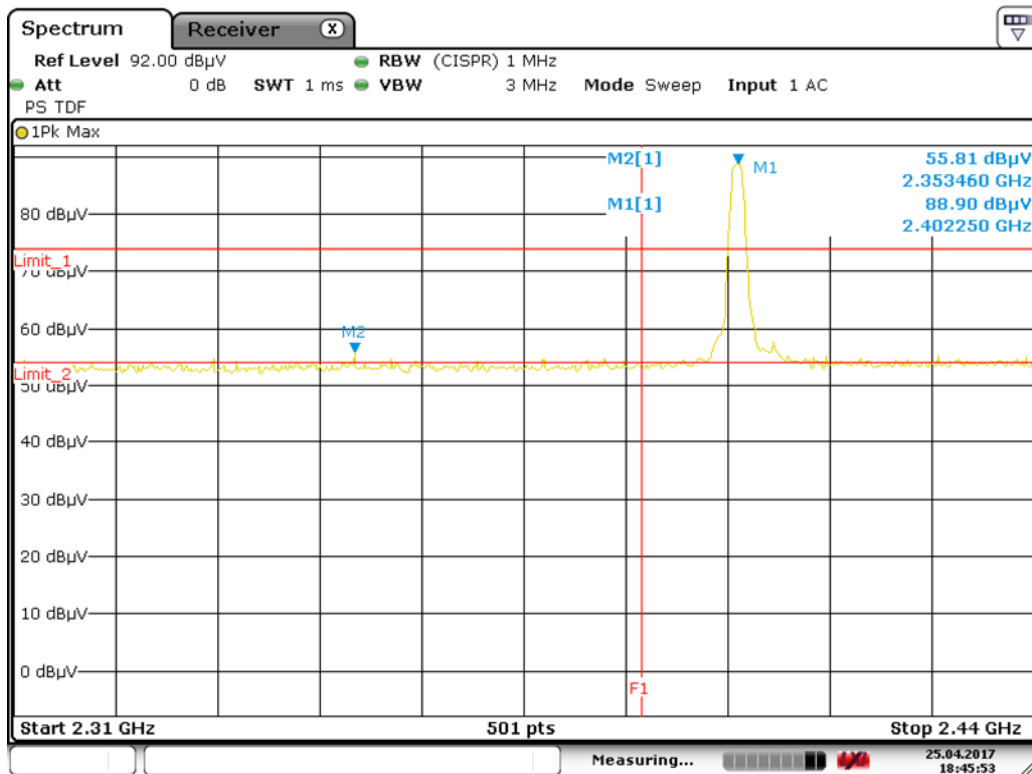
The test procedure is the same as clause 7.4

## 8.4 Test results

EUT :SmartPlug SP-A-PH

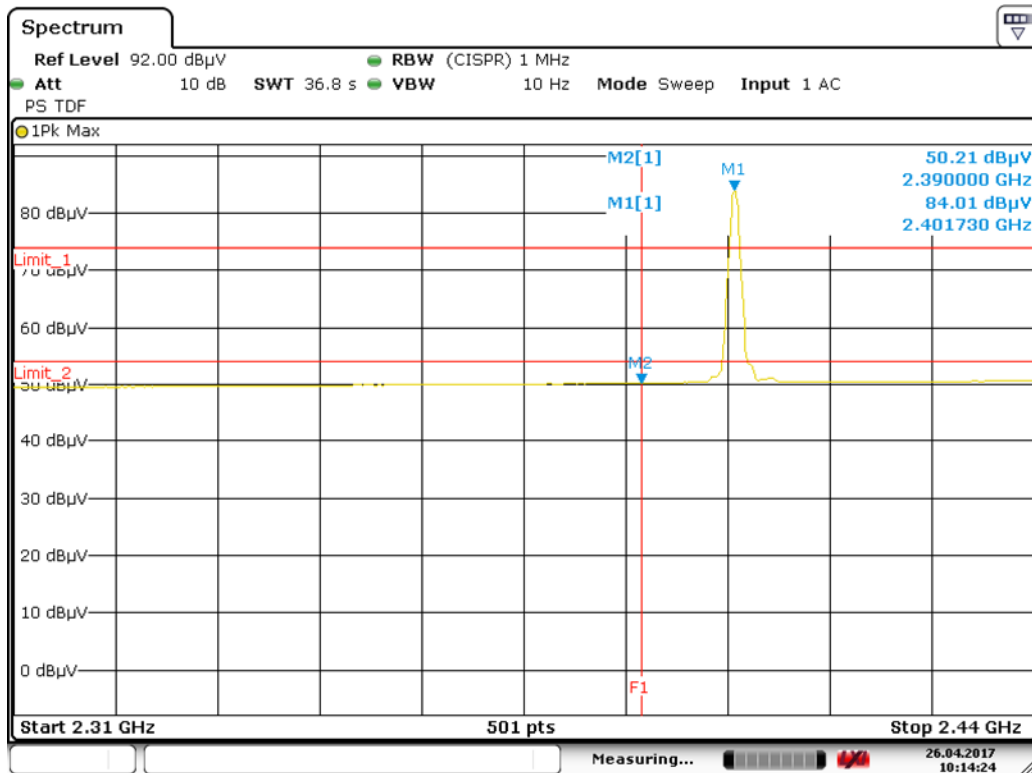
| Mode                                                    | Frequency<br>(MHz) | Spectrum<br>Analyzer<br>Detector | Ant.<br>Pol.<br>(H/V) | Correction<br>Factor<br>(dB/m) | Reading<br>(dBμV) | Corrected<br>Reading<br>(dBμV/m) | Limit<br>@ 3 m<br>(dBμV/m) | Margin<br>(dB) | Restricted<br>band<br>(MHz) |
|---------------------------------------------------------|--------------------|----------------------------------|-----------------------|--------------------------------|-------------------|----------------------------------|----------------------------|----------------|-----------------------------|
| BT4.0                                                   | 2353.46            | PK                               | V                     | 33.68                          | 22.13             | 55.81                            | 74                         | -18.19         | 2310~2390                   |
|                                                         | 2390.00            | AV                               | V                     | 33.85                          | 16.36             | 50.21                            | 54                         | -3.79          |                             |
|                                                         | 2484.24            | PK                               | V                     | 34.30                          | 22.70             | 57.00                            | 74                         | -17.00         | 2483.5~2500                 |
|                                                         | 2484.80            | AV                               | V                     | 34.31                          | 16.96             | 51.27                            | 54                         | -2.73          |                             |
| Remark: Correction Factor = Antenna Factor + Cable Loss |                    |                                  |                       |                                |                   |                                  |                            |                |                             |

### Chain0 : Restricted-Band Band edge @ BLE Ch low Peak



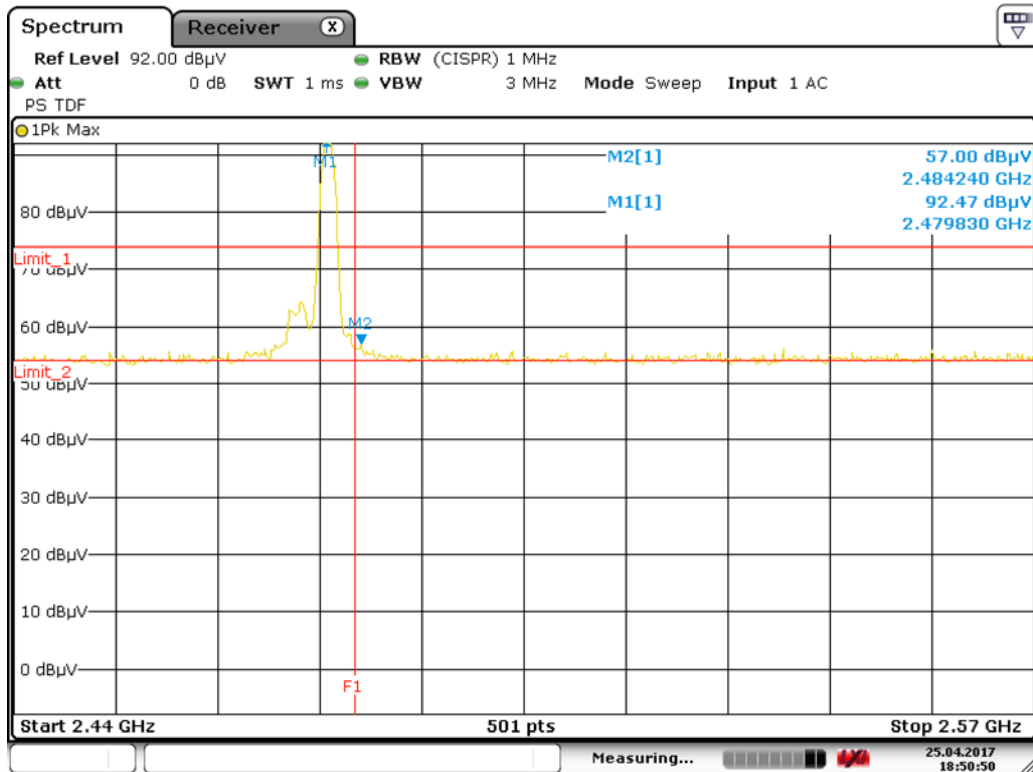
Date: 25.APR.2017 18:45:53

### Chain0 : Restricted-Band Band edge @ BLE Ch low Average



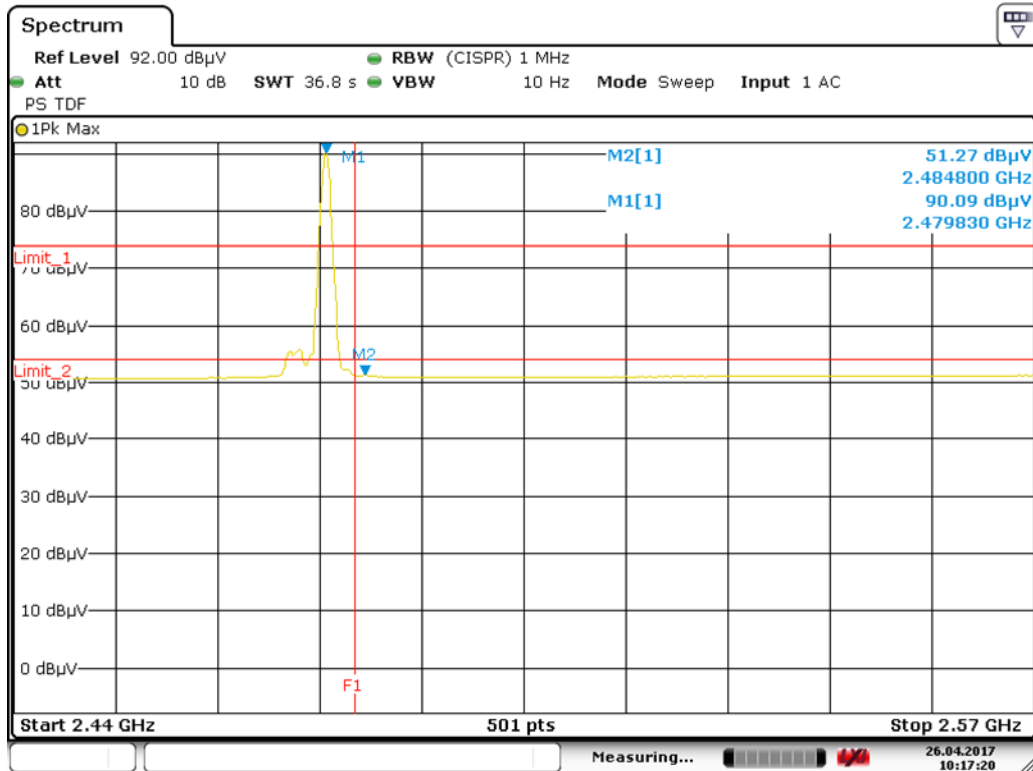
Date: 26.APR.2017 10:14:23

### Chain0 : Restricted-Band Band edge @ BLE Ch high Peak



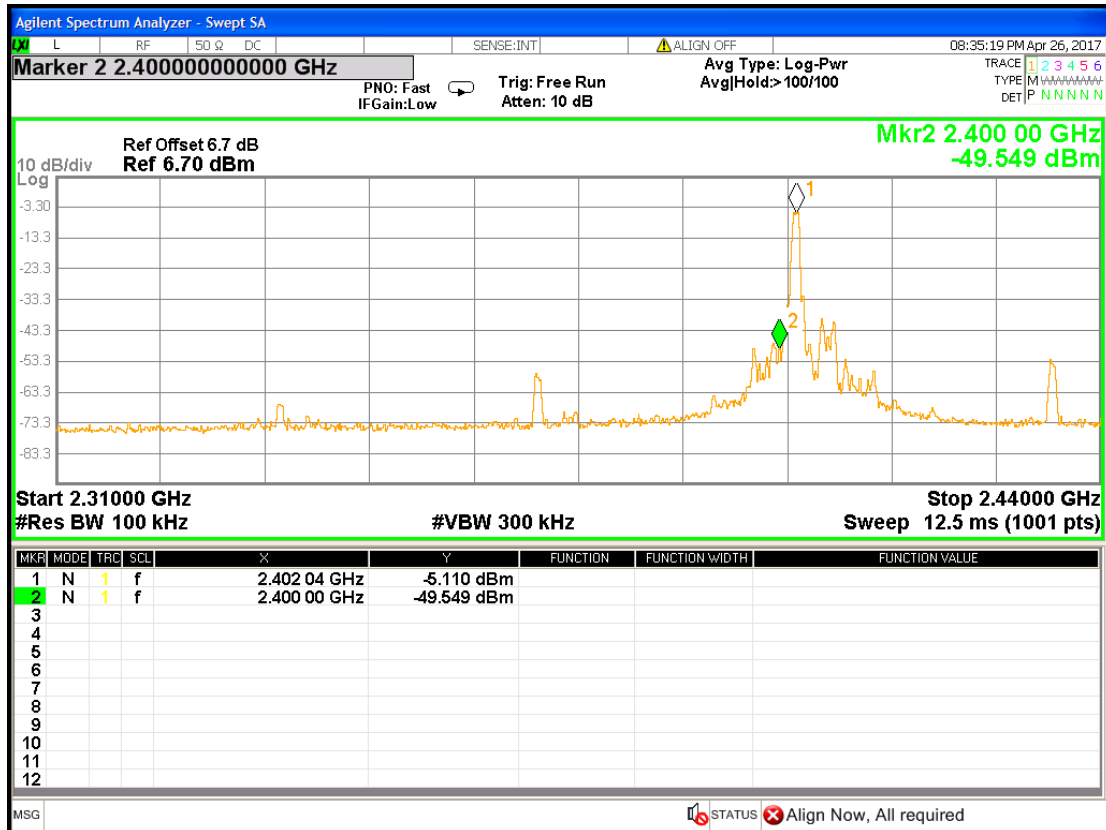
Date: 25.APR.2017 18:50:50

### Chain0 : Restricted-Band Band edge @ BLE Ch high Average

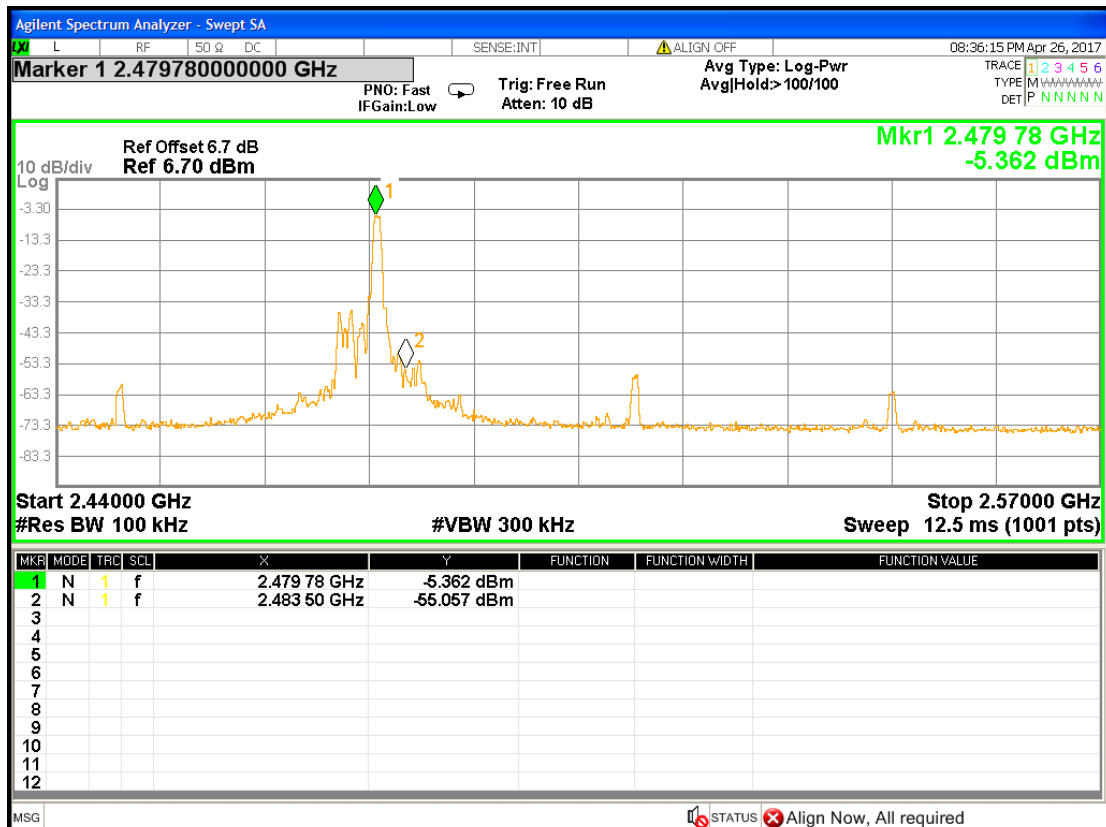


Date: 26.APR.2017 10:17:20

### Chain0 : Authorized-Band Band edge @ Lower Energy mode Ch low



### Chain0 : Authorized-Band Band edgeh @ Lower Energy mode Ch high



## 9. AC Power Line Conducted Emission

### 9.1 Operating environment

|                      |        |     |
|----------------------|--------|-----|
| Temperature:         | 20     | °C  |
| Relative Humidity:   | 58     | %   |
| Atmospheric Pressure | 1009   | hPa |
| Requirement          | 15.207 |     |

### 9.2 Limit for AC power line conducted emission

| Freq.<br>(MHz) | Conducted Limit (dBuV) |          |
|----------------|------------------------|----------|
|                | Q.P.                   | Ave.     |
| 0.15~0.50      | 66 – 56*               | 56 – 46* |
| 0.50~5.00      | 56                     | 46       |
| 5.00~30.0      | 60                     | 50       |

### 9.3 Measuring instrument setting

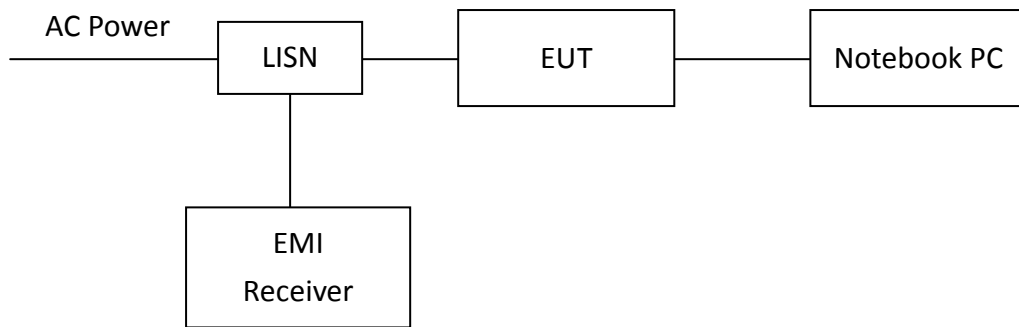
| Receiver settings |         |
|-------------------|---------|
| Receiver function | Setting |
| Detector          | QP      |
| Start frequency   | 0.15MHz |
| Stop frequency    | 30MHz   |
| IF bandwidth      | 9 kHz   |
| Attenuation       | 10dB    |

### 9.4 Test procedure

1. Configure the EUT according to ANSI C63.10:2013. The EUT or host of EHT has to be placed 0.4 meter far from the conducting wall of the shielding room and at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT or host of EUT to the power mains through a line impedance stabilization network.

3. All the companion devices are connected to the other LISN. The LISN should provide 50 $\mu$ H/50ohms coupling impedance.
4. The frequency range from 150 kHz to 30MHz was searched
5. Set the test-receiver system to peak detector and specified bandwidth with maximum hold mode.
6. The measurement has to be done between each power line and ground at the power terminal.

### 9.5 Test diagram



**Note:** The EUT was tested while in normal communication mode.

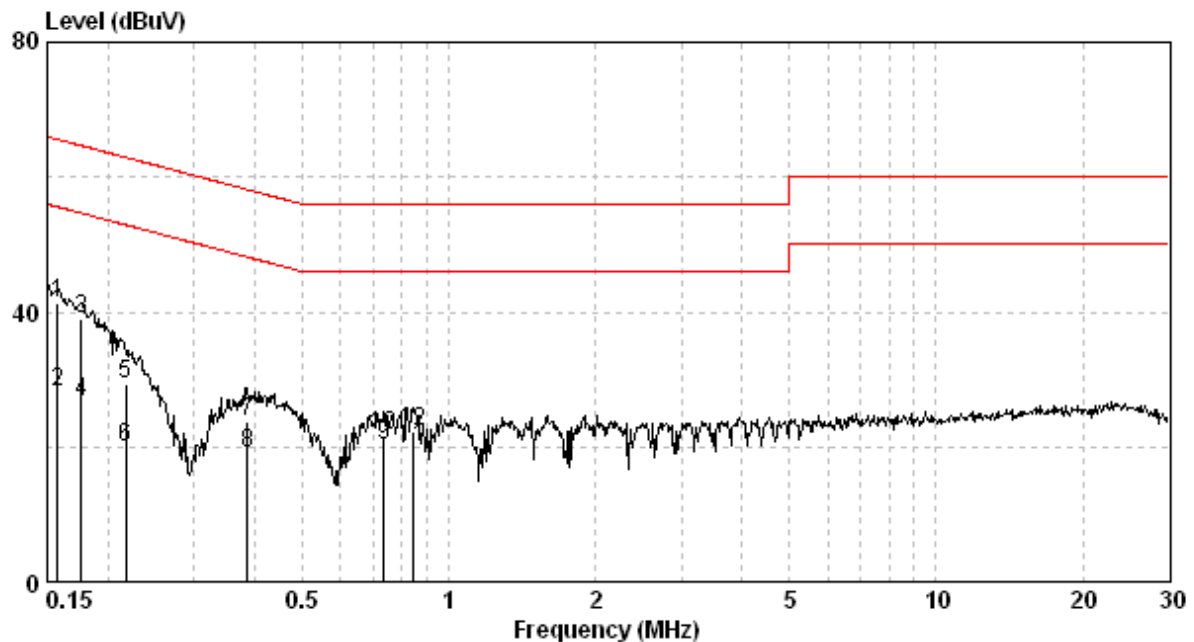
## 9.6 Test results

Phase: Live Line  
Model No.: SmartPlug SP-A-PH  
Test Condition: Normal communication

| Frequency<br>(MHz) | Corr.<br>Factor<br>(dB) | Level<br>Qp<br>(dBuV) | Limit<br>Qp<br>(dBuV) | Level<br>Av<br>(dBuV) | Limit<br>Av<br>(dBuV) | Margin<br>(dB)<br>Qp | Av     |
|--------------------|-------------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------------------|--------|
| 0.157              | 9.74                    | 41.26                 | 65.60                 | 28.14                 | 55.60                 | -24.35               | -27.46 |
| 0.176              | 9.74                    | 38.92                 | 64.68                 | 26.54                 | 54.68                 | -25.76               | -28.14 |
| 0.217              | 9.74                    | 29.27                 | 62.92                 | 19.83                 | 52.92                 | -33.65               | -33.09 |
| 0.387              | 9.77                    | 23.78                 | 58.12                 | 18.92                 | 48.12                 | -34.34               | -29.20 |
| 0.735              | 9.79                    | 21.67                 | 56.00                 | 20.14                 | 46.00                 | -34.33               | -25.86 |
| 0.844              | 9.80                    | 22.15                 | 56.00                 | 19.81                 | 46.00                 | -33.85               | -26.19 |

Remark:

1. Correction Factor (dB)= LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)

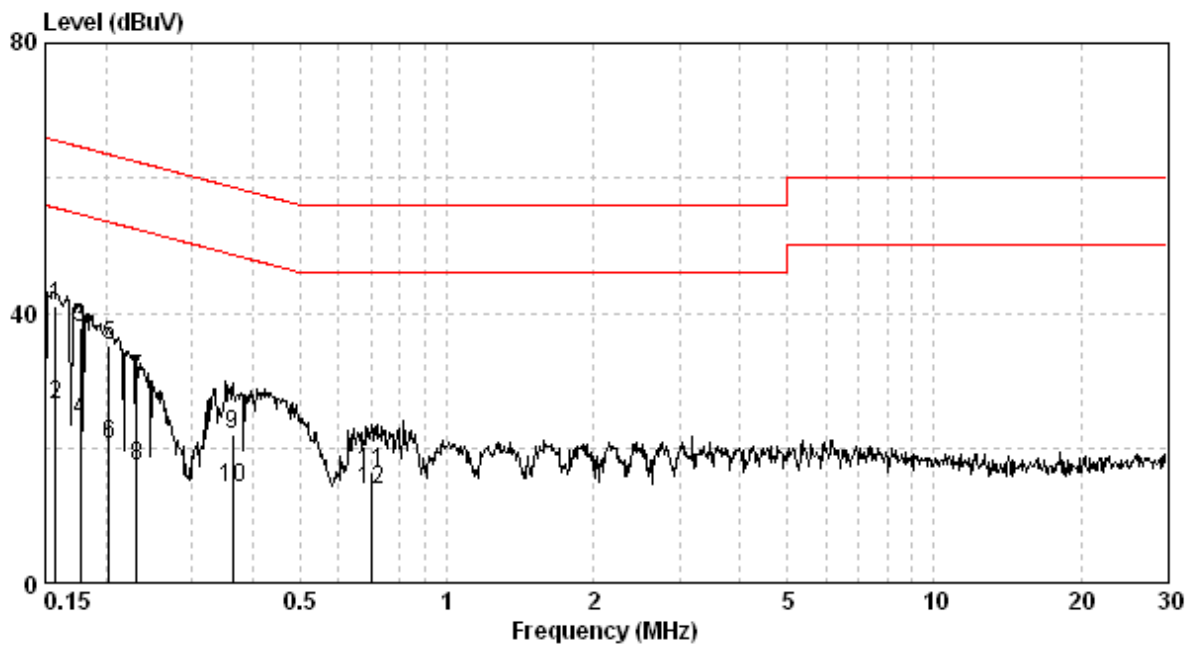


Phase: Neutral Line  
Model No.: SmartPlug SP-A-PH  
Test Condition: Normal communication

| Frequency<br>(MHz) | Corr.<br>Factor<br>(dB) | Level<br>Qp<br>(dBuV) | Limit<br>Qp<br>(dBuV) | Level<br>Av<br>(dBuV) | Limit<br>Av<br>(dBuV) | Margin<br>(dB)<br>Qp | Av     |
|--------------------|-------------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------------------|--------|
| 0.157              | 9.74                    | 40.93                 | 65.60                 | 26.29                 | 55.60                 | -24.68               | -29.32 |
| 0.177              | 9.74                    | 37.92                 | 64.64                 | 24.13                 | 54.64                 | -26.72               | -30.50 |
| 0.203              | 9.74                    | 35.14                 | 63.49                 | 20.58                 | 53.49                 | -28.35               | -32.91 |
| 0.232              | 9.75                    | 30.16                 | 62.39                 | 17.36                 | 52.39                 | -32.23               | -35.03 |
| 0.363              | 9.76                    | 21.96                 | 58.65                 | 13.97                 | 48.65                 | -36.70               | -34.68 |
| 0.701              | 9.82                    | 16.36                 | 56.00                 | 13.77                 | 46.00                 | -39.64               | -32.23 |

Remark:

1. Correction Factor (dB)= LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)



## Appendix A: Test equipment list

| Equipment                      | Brand                       | Model No.           | Serial No.  | Calibration Date | Next Calibration Date |
|--------------------------------|-----------------------------|---------------------|-------------|------------------|-----------------------|
| ESCI EMI Test Receiver         | Rohde & Schwarz             | ESCI                | 100018      | 2016/11/30       | 2017/11/29            |
| Spectrum Analyzer              | Rohde & Schwarz             | FSP30               | 100137      | 2016/08/16       | 2017/08/15            |
| Horn Antenna (1-18G)           | SHWARZBECK                  | BBHA 9120 D         | 9120D-456   | 2014/08/29       | 2017/08/27            |
| Horn Antenna (14-42G)          | SHWARZBECK                  | BBHA 9170           | BBHA9170159 | 2014/09/16       | 2017/09/14            |
| Broadband Antenna              | SHWARZBECK                  | VULB 9168           | 9168-172    | 2017/04/05       | 2018/04/04            |
| Pre-Amplifier                  | EMC Co.                     | EMC12635SE          | 980205      | 2016/10/08       | 2017/10/07            |
| Pre-Amplifier                  | MITEQ                       | JS4-26004000--27-8A | 828825      | 2016/09/12       | 2017/09/11            |
| Power Meter                    | Anritsu                     | ML2495A             | 0844001     | 2016/11/09       | 2017/11/08            |
| Power Sensor                   | Anritsu                     | MA2411B             | 0738452     | 2016/11/09       | 2017/11/08            |
| Signal Analyzer                | Agilent                     | N9030A              | MY51380492  | 2016/09/13       | 2017/09/12            |
| 966-2(A) Cable 9kHz~26.5GHz    | SUHNER                      | SMA / EX 100        | N/A         | 2016/05/05       | 2017/05/04            |
| 966-2(B) Cable 9kHz~26.5GHz    | SUHNER                      | SUCOFLEX 104P       | CB0005      | 2016/05/04       | 2017/05/03            |
| RF Cable 9kHz~26.5GHz          | SUHNER                      | SUCOFLEX 102        | CB0006      | 2016/05/05       | 2017/05/04            |
| 966-2_3m Semi-Anechoic Chamber | 966_2                       | CEM-966_2           | N/A         | 2017/03/29       | 2018/03/28            |
| High Pass Filter               | Reactel                     | 7HS-3G/18G-S11      | N/A         | 2016/06/03       | 2017/06/02            |
| Active Loop Antenna            | SCHWARZBECK MESS-ELEKTRONIC | FMZB1519            | 1519-067    | 2017/03/30       | 2018/03/29            |
| Attenuator                     | PASTERNAK                   | N/A                 | PA7001-20   | 2016/05/06       | 2017/05/05            |
| Attenuator                     | EMCI                        | N/A                 | AT-N0619    | 2016/05/06       | 2017/05/05            |

| Test Equipment/<br>Test site       | Brand     | Model No.    | Serial No.   | Calibration<br>Date | Next<br>Calibration |
|------------------------------------|-----------|--------------|--------------|---------------------|---------------------|
| EMI Receiver                       | R&S       | ESCI         | 100059       | 2016/11/21          | 2017/11/20          |
| Two-Line<br>V-Network              | R&S       | ENV216       | 101159       | 2016/06/02          | 2017/06/01          |
| Artificial Mains<br>Network (LISN) | SCHAFFNER | MN2050D      | 1586         | 2016/05/25          | 2017/05/24          |
| CON-1<br>Shielded Room             | N/A       | N/A          | N/A          | NCR                 | NCR                 |
| CON-1 Cable                        | SUHNER    | SUCOFLEX-104 | 26438414     | 2016/05/05          | 2017/05/04          |
| Test software                      | Audix     | e3           | 4.2004-1-12k | NCR                 | NCR                 |

Note: No Calibration Required (NCR).

## Appendix B: Measurement Uncertainty

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of  $k=2$ .

| Item                                                                                                         | Uncertainty |
|--------------------------------------------------------------------------------------------------------------|-------------|
| Vertically polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m    | 5.14 dB     |
| Horizontally polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m  | 5.22 dB     |
| Vertically polarized Radiated disturbances from 1GHz~18GHz in a semi-anechoic chamber at a distance of 3m    | 3.64 dB     |
| Horizontally polarized Radiated disturbances from 1GHz~18GHz in a semi-anechoic chamber at a distance of 3m  | 3.64 dB     |
| Vertically polarized Radiated disturbances from 18GHz~40GHz in a semi-anechoic chamber at a distance of 3m   | 2.68 dB     |
| Horizontally polarized Radiated disturbances from 18GHz~40GHz in a semi-anechoic chamber at a distance of 3m | 2.68 dB     |
| Radiated disturbances from 9kHz~30MHz in a semi-anechoic chamber at a distance of 3m                         | 3.54 dB     |
| Emission on the Band Edge Test                                                                               | 3.64 dB     |
| Minimum 6 dB Bandwidth                                                                                       | 1.22 dB     |
| Maximum Peak Conducted Output Power                                                                          | 1.22 dB     |
| Power Spectral Density                                                                                       | 1.22 dB     |
| Emissions In Non-Restricted Frequency Bands                                                                  | 1.22 dB     |
| AC Power Line Conducted Emission                                                                             | 2.48 dB     |