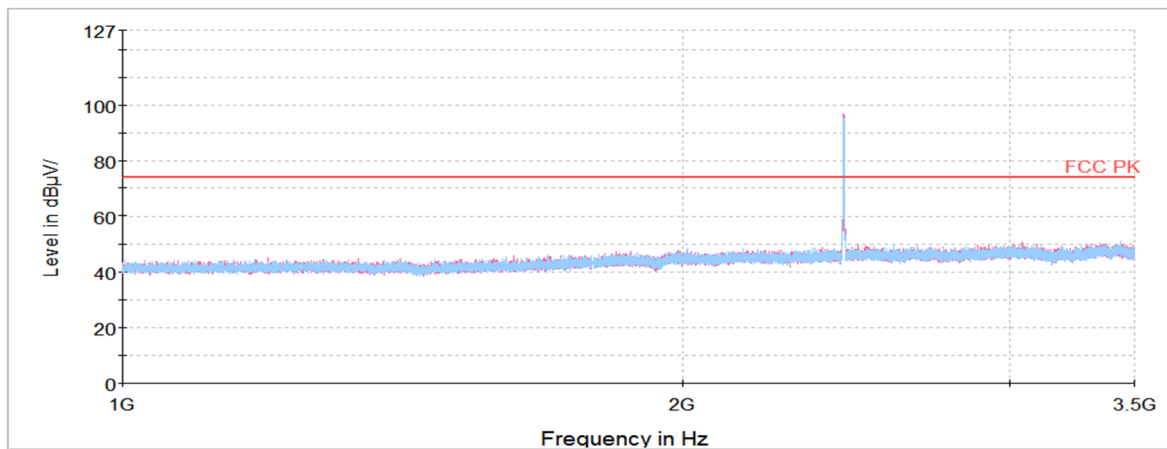
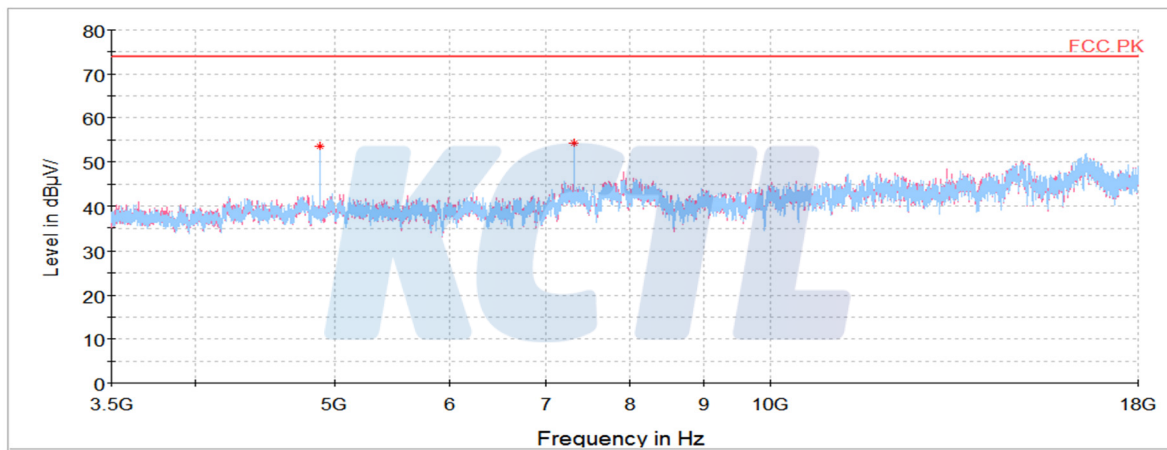
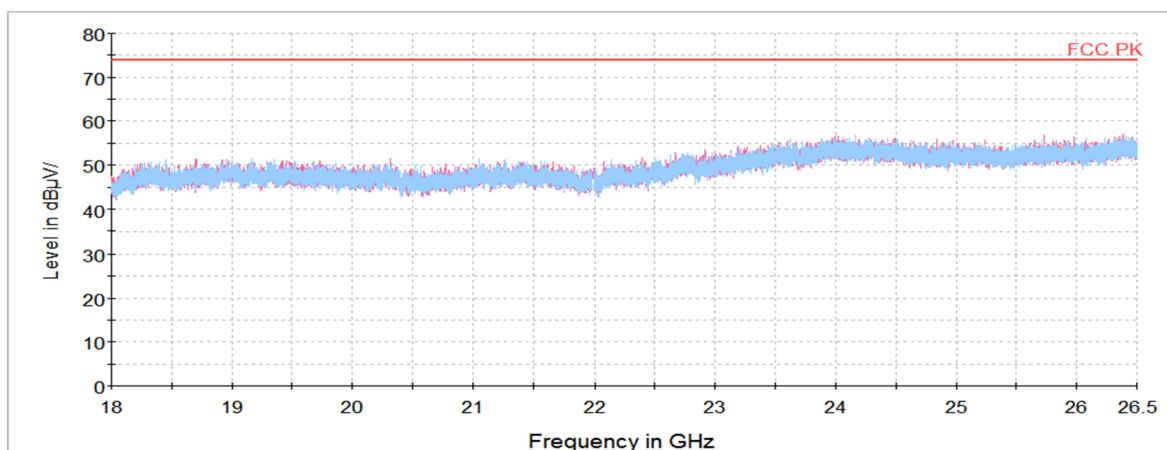


### Middle Channel

| Frequency              | Pol.  | Reading  | Antenna Factor | Amp. + Cable | DCCF   | Result     | Limit      | Margin |
|------------------------|-------|----------|----------------|--------------|--------|------------|------------|--------|
| (MHz)                  | (V/H) | (dB(μV)) | (dB)           | (dB)         | (dB)   | (dB(μV/m)) | (dB(μV/m)) | (dB)   |
| <b>Peak data</b>       |       |          |                |              |        |            |            |        |
| 4 882.03 <sup>1)</sup> | H     | 74.90    | 33.95          | -55.23       | -      | 53.62      | 74.00      | 20.38  |
| 7 322.56 <sup>1)</sup> | H     | 71.54    | 35.40          | -52.65       | -      | 54.29      | 74.00      | 19.71  |
| <b>Average Data</b>    |       |          |                |              |        |            |            |        |
| 7 322.56 <sup>1)</sup> | H     | 71.54    | 35.40          | -52.65       | -22.50 | 31.79      | 54.00      | 22.21  |



**Horizontal/Vertical for 1 GHz ~ 3.5 GHz****Horizontal/Vertical for 3.5 GHz ~ 18 GHz****Horizontal/Vertical for 18 GHz ~ 26.5 GHz**

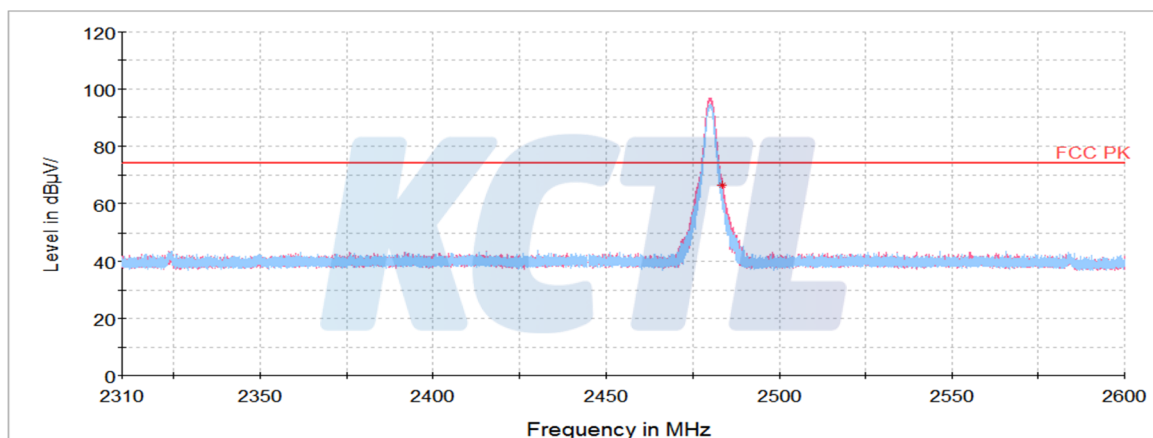
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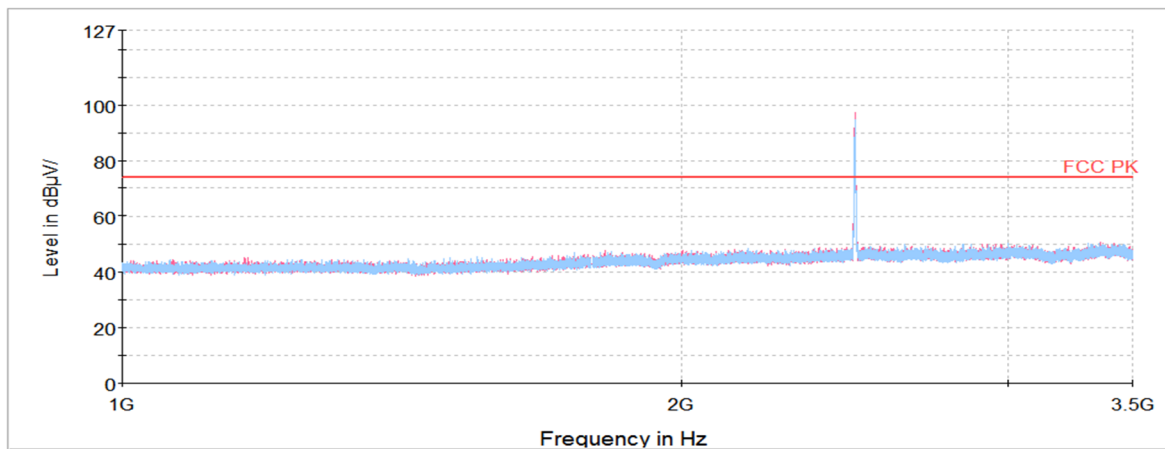
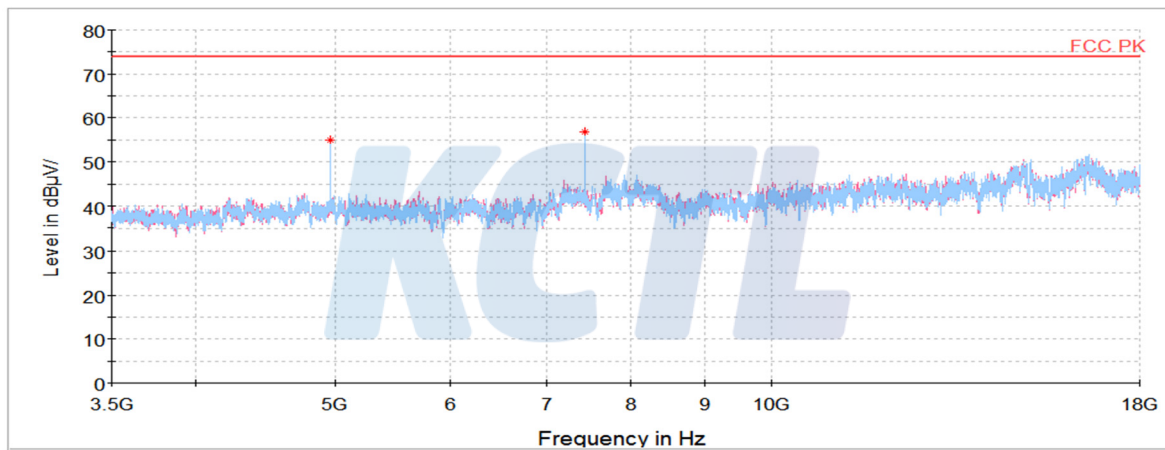
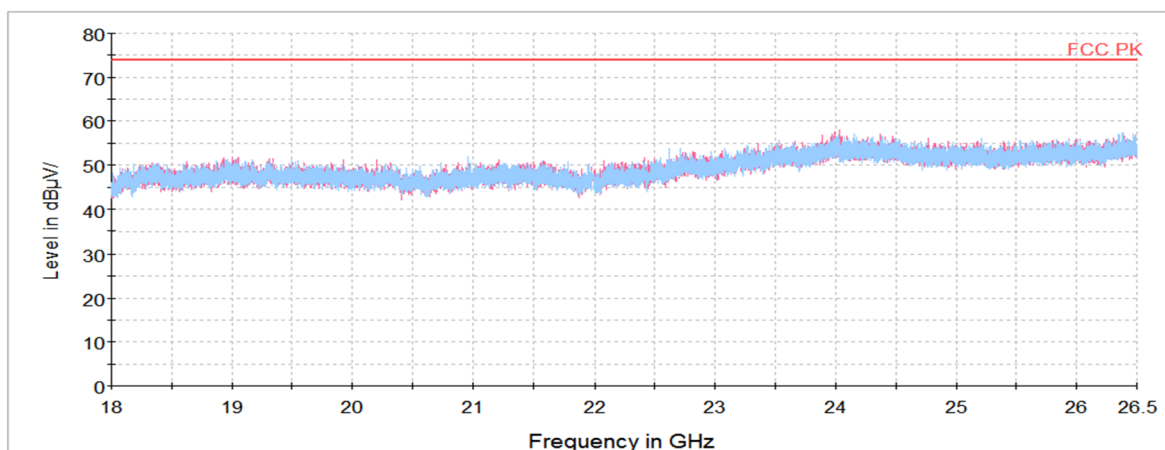
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**KCTL****High Channel**

| Frequency              | Pol.  | Reading        | Antenna Factor | Amp. + Cable | DCCF   | Result           | Limit            | Margin |
|------------------------|-------|----------------|----------------|--------------|--------|------------------|------------------|--------|
| (MHz)                  | (V/H) | (dB( $\mu$ V)) | (dB)           | (dB)         | (dB)   | (dB( $\mu$ V/m)) | (dB( $\mu$ V/m)) | (dB)   |
| Peak data              |       |                |                |              |        |                  |                  |        |
| 2 483.50 <sup>1)</sup> | V     | 63.38          | 32.07          | -29.21       | -      | 66.24            | 74.00            | 7.76   |
| 4 959.52 <sup>1)</sup> | H     | 75.72          | 33.98          | -54.67       | -      | 55.03            | 74.00            | 18.97  |
| 7 439.92 <sup>1)</sup> | H     | 73.75          | 35.40          | -52.20       | -      | 56.95            | 74.00            | 17.05  |
| Average Data           |       |                |                |              |        |                  |                  |        |
| 2 483.50 <sup>1)</sup> | V     | 63.38          | 32.07          | -29.21       | -22.50 | 43.74            | 54.00            | 10.26  |
| 4 959.52 <sup>1)</sup> | H     | 75.72          | 33.98          | -54.67       | -22.50 | 32.53            | 54.00            | 21.47  |
| 7 439.92 <sup>1)</sup> | H     | 73.75          | 35.40          | -52.20       | -22.50 | 34.45            | 54.00            | 19.55  |

**Horizontal/Vertical for Band-edge**

**Horizontal/Vertical for 1 GHz ~ 3.5 GHz****Horizontal/Vertical for 3.5 GHz ~ 18 GHz****Horizontal/Vertical for 18 GHz ~ 26.5 GHz**

**KCTL Inc.**

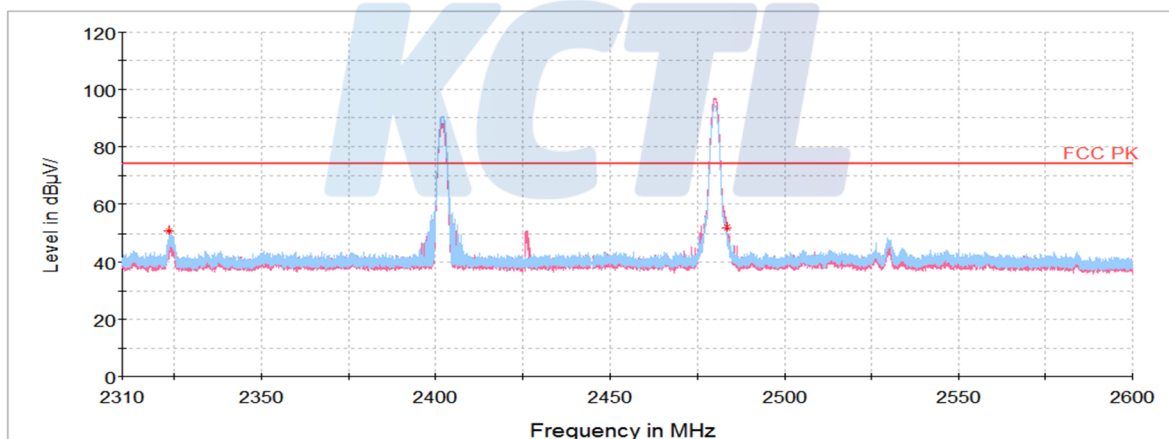
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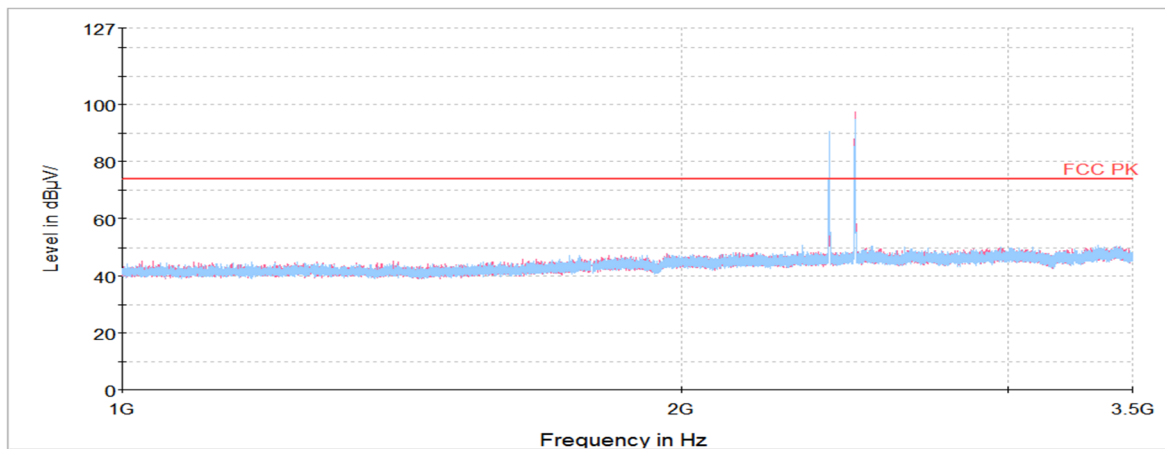
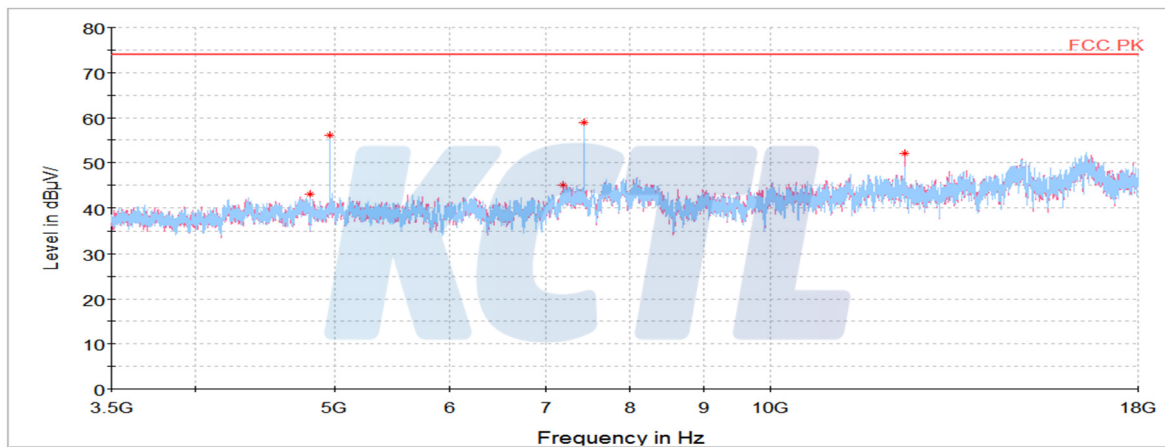
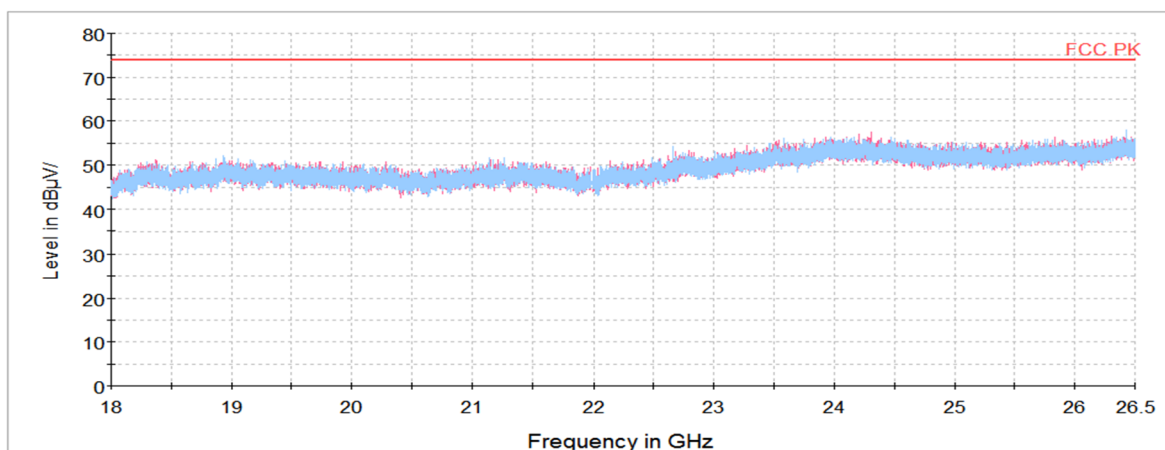
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**KCTL****Simultaneously\_BT,GFSK(2 480 MHz)+ BLE,GFSK(2 402 MHz)**

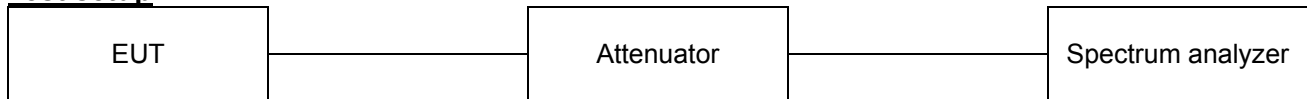
| Frequency               | Pol.  | Reading  | Ant. Factor | Amp.+Cable | DCCF   | Result     | Limit      | Margin |
|-------------------------|-------|----------|-------------|------------|--------|------------|------------|--------|
| (MHz)                   | (V/H) | (dB(μV)) | (dB)        | (dB)       | (dB)   | (dB(μV/m)) | (dB(μV/m)) | (dB)   |
| <b>Peak data</b>        |       |          |             |            |        |            |            |        |
| 2 323.53 <sup>1)</sup>  | H     | 48.62    | 31.75       | -29.40     | -      | 50.97      | 74.00      | 23.03  |
| 2 483.50 <sup>1)</sup>  | V     | 48.96    | 32.07       | -29.21     | -      | 51.82      | 74.00      | 22.18  |
| 4 804.09 <sup>1)</sup>  | V     | 62.09    | 33.92       | -53.02     | -      | 42.99      | 74.00      | 31.01  |
| 4 960.42 <sup>1)</sup>  | V     | 76.81    | 33.98       | -54.66     | -      | 56.13      | 74.00      | 17.87  |
| 7 206.56                | H     | 62.73    | 35.40       | -53.08     | -      | 45.05      | 74.00      | 28.95  |
| 7 440.38 <sup>1)</sup>  | H     | 75.74    | 35.40       | -52.20     | -      | 58.94      | 74.00      | 15.06  |
| 12 399.38 <sup>1)</sup> | V     | 63.24    | 39.08       | -50.32     | -      | 52.00      | 74.00      | 22.00  |
| <b>Average data</b>     |       |          |             |            |        |            |            |        |
| 4 960.42 <sup>1)</sup>  | H     | 76.81    | 33.98       | -54.66     | -22.50 | 33.63      | 54.00      | 20.37  |
| 7 440.38 <sup>1)</sup>  | H     | 75.74    | 35.40       | -52.20     | -22.50 | 36.44      | 54.00      | 17.56  |

**Horizontal/Vertical for BLE Band-edge**

**Horizontal/Vertical for 1 GHz ~ 3.5 GHz****Horizontal/Vertical for 3.5 GHz ~ 18 GHz****Horizontal/Vertical for 18 GHz ~ 26.5 GHz**

## 7.7. Conducted Spurious Emission

### Test setup



### Limit

According to §15.247(d), In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operation, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation specified in §15.209(a) is not required. In addition, radiated emission limits specified in §15.209(a) (see §15.205(c)).

Limit : 20 dBc

### Test procedure

ANSI C63.10-2013 - Section 6.10.4, 7.8.8

### Test settings

#### ▪ Band-edge

- 1) Span : Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation
- 2) Reference level : As required to keep the signal from exceeding the maximum instrument input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than  $[10 \log(\text{OBW}/\text{RBW})]$  below the reference level.
- 3) Attenuation: Auto (at least 10 dB preferred)
- 4) Sweep time = Coupled
- 5) RBW : 100 kHz
- 6) VBW : 300 kHz
- 7) Detector : Peak
- 8) Trace : Max hold

#### ▪ Spurious emissions

- 1) Span : 30 MHz to 10 times the operating frequency in GHz
- 2) RBW : 100 kHz
- 3) VBW : 300 kHz
- 4) Sweep time : Coupled
- 5) Detector : Peak

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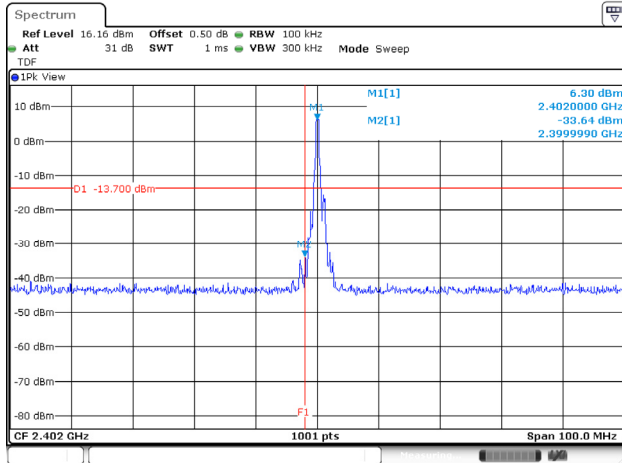
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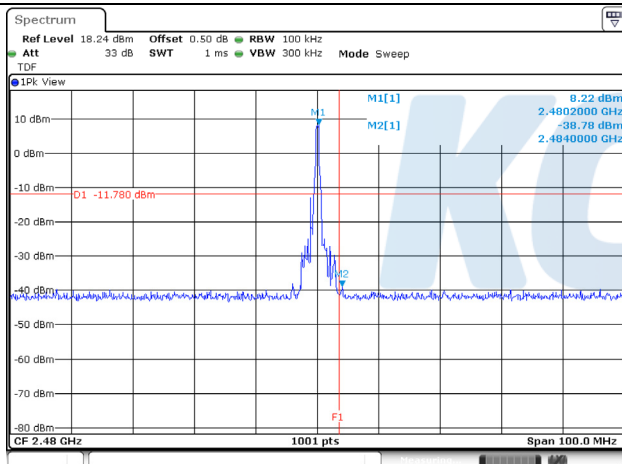
## Test results

### GFSK

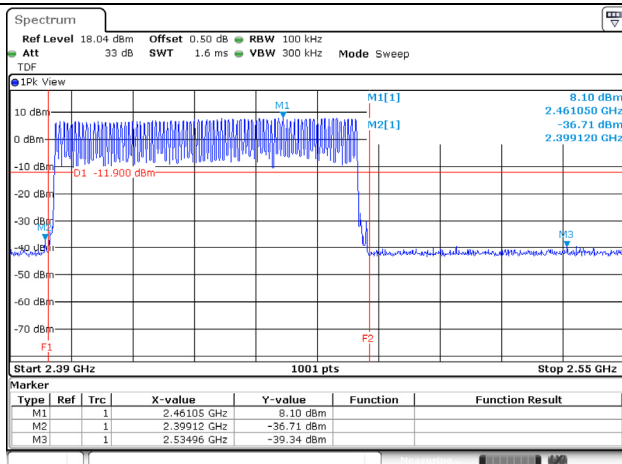
#### Conducted band-edge



Lowest

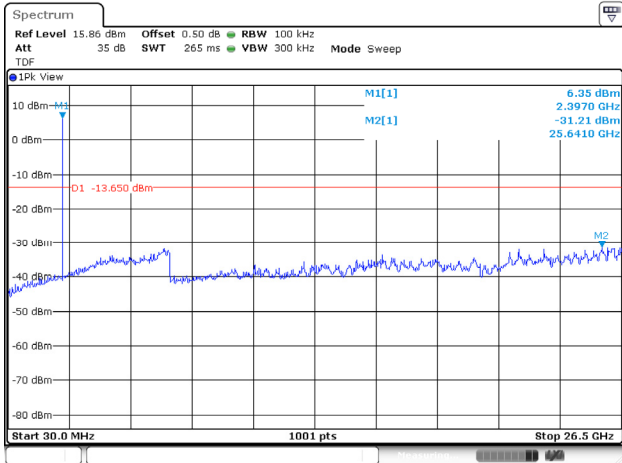


Highest

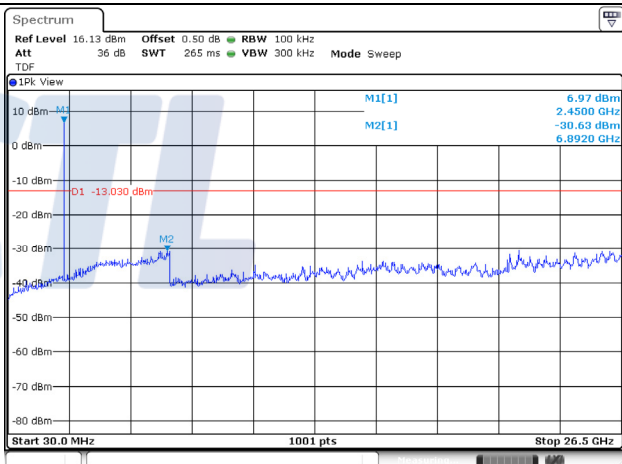


With Hopping Band-edge

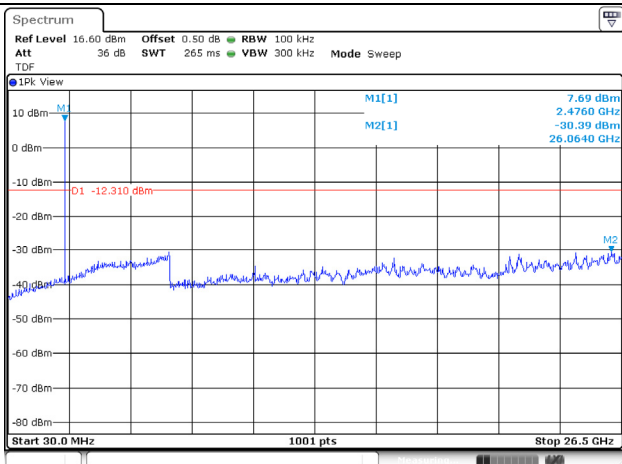
#### Conducted spurious



Lowest



Middle



Highest

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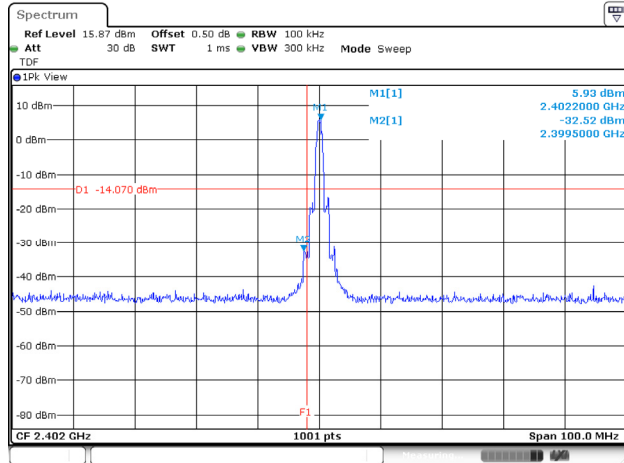
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# KCTL

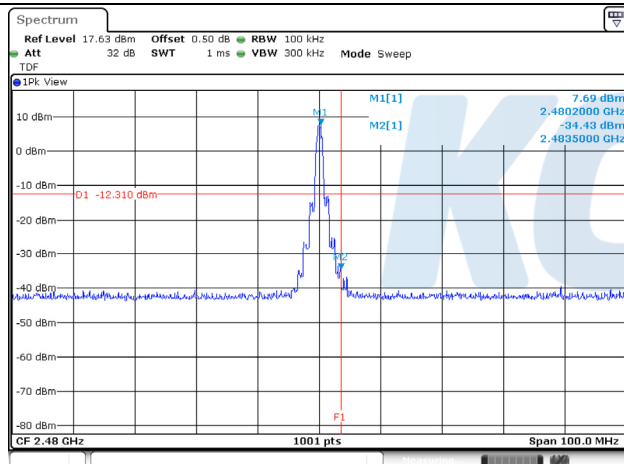
## Test results

### 8DPSK

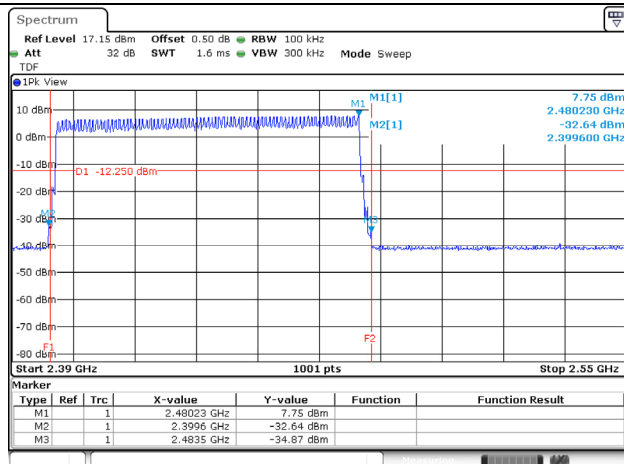
#### Conducted band-edge



Lowest

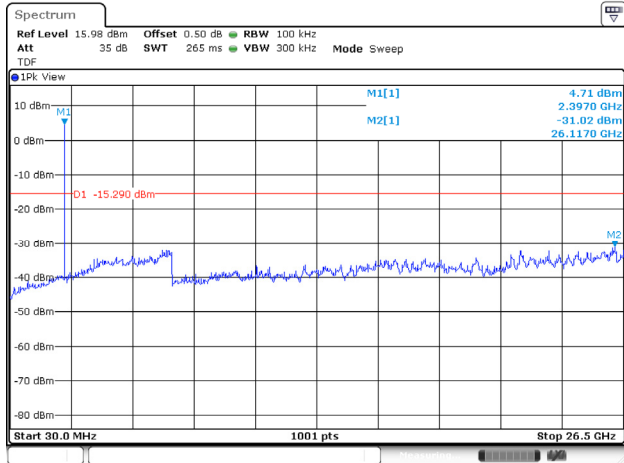


Highest

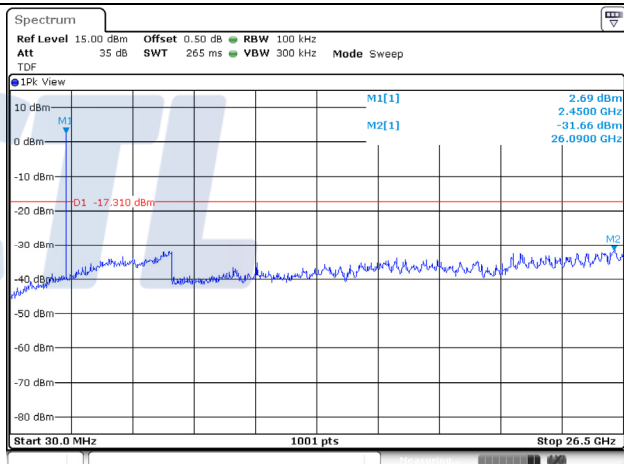


With Hopping Band-edge

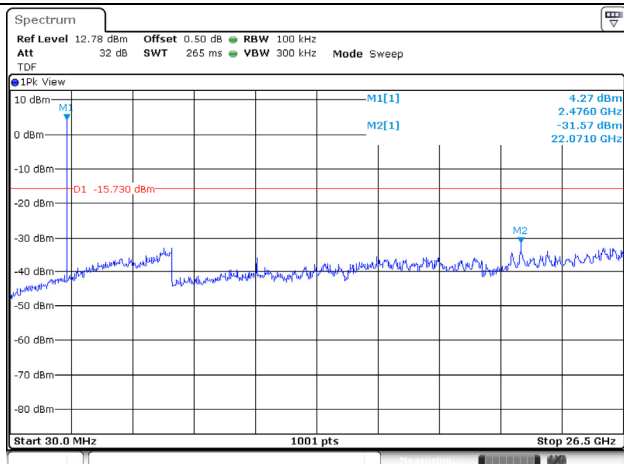
#### Conducted spurious



Lowest



Middle



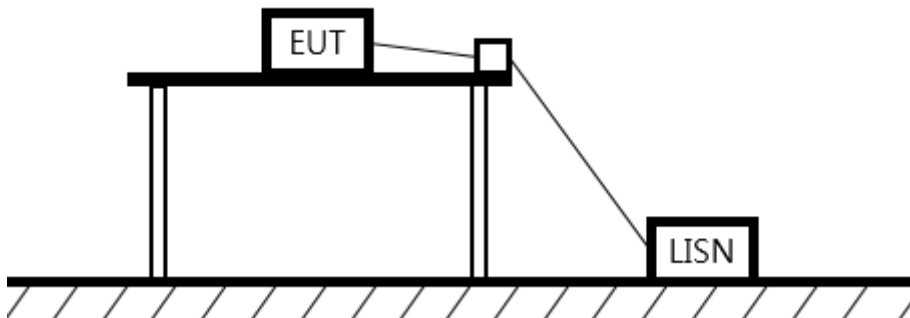
Highest

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## 7.8. AC Conducted emission

### Test setup



### Limit

According to 15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 $\mu$ H/50 ohm line impedance stabilization network (LISN). Compliance with the provision of this paragraph shall be on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequencies ranges.

| Frequency of Emission (MHz) | Conducted limit (dB $\mu$ V/m) |          |
|-----------------------------|--------------------------------|----------|
|                             | Quasi-peak                     | Average  |
| 0.15 – 0.50                 | 66 - 56*                       | 56 - 46* |
| 0.50 – 5.00                 | 56                             | 46       |
| 5.00 – 30.0                 | 60                             | 50       |

### Measurement procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50 $\Omega$ /50 $\mu$ H LISN, which is an input transducer to a spectrum analyzer or an EMI/Field Intensity Meter, to the input power source.
3. Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment in the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
5. The measurements were made with the detector set to peak amplitude within a bandwidth of 10 kHz or to quasi-peak and average within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

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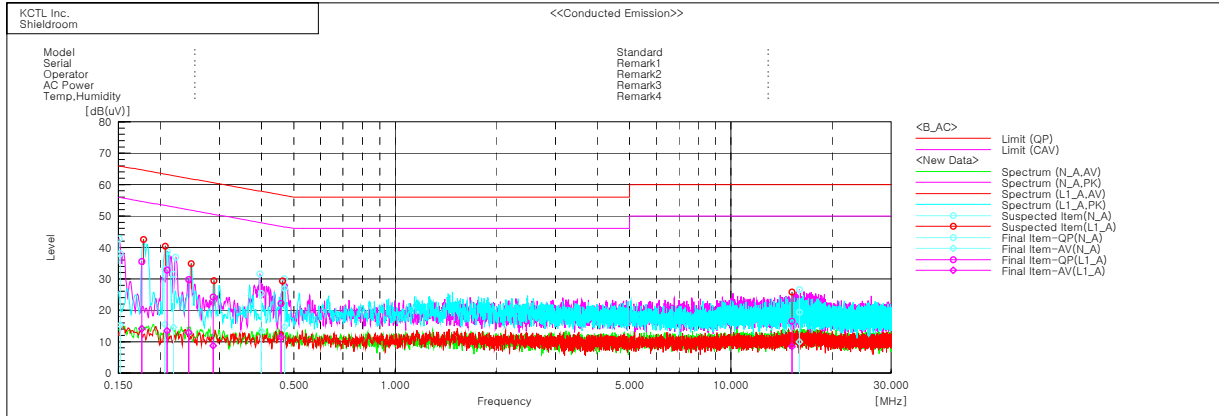
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# KCTL

## Test results

### Worst case: GFSK / Highest frequency



#### Final Result

##### --- N\_A Phase ---

| No. | Frequency [MHz] | Reading QP [dB(μV)] | Reading CAV [dB(μV)] | c.f [dB] | Result QP [dB(μV)] | Result CAV [dB(μV)] | Limit QP [dB(μV)] | Limit AV [dB(μV)] | Margin QP [dB] | Margin CAV [dB] |
|-----|-----------------|---------------------|----------------------|----------|--------------------|---------------------|-------------------|-------------------|----------------|-----------------|
| 1   | 0.1517          | 28.0                | 5.3                  | 10.0     | 38.0               | 15.3                | 65.9              | 55.9              | 27.9           | 40.6            |
| 2   | 0.20618         | 23.0                | 5.4                  | 10.1     | 33.1               | 15.5                | 63.4              | 53.4              | 30.3           | 37.9            |
| 3   | 0.21898         | 21.4                | 4.6                  | 10.0     | 31.4               | 14.6                | 62.9              | 52.9              | 31.5           | 38.3            |
| 4   | 0.39923         | 15.2                | 3.3                  | 10.2     | 25.4               | 13.5                | 57.9              | 47.9              | 32.5           | 34.4            |
| 5   | 0.46905         | 16.8                | 4.5                  | 10.2     | 27.0               | 14.7                | 56.5              | 46.5              | 29.5           | 31.8            |
| 6   | 15.99953        | 8.4                 | -1.0                 | 11.0     | 19.4               | 10.0                | 60.0              | 50.0              | 40.6           | 40.0            |

##### --- L1\_A Phase ---

| No. | Frequency [MHz] | Reading QP [dB(μV)] | Reading CAV [dB(μV)] | c.f [dB] | Result QP [dB(μV)] | Result CAV [dB(μV)] | Limit QP [dB(μV)] | Limit AV [dB(μV)] | Margin QP [dB] | Margin CAV [dB] |
|-----|-----------------|---------------------|----------------------|----------|--------------------|---------------------|-------------------|-------------------|----------------|-----------------|
| 1   | 0.17637         | 25.2                | 3.8                  | 10.3     | 35.5               | 14.1                | 64.7              | 54.7              | 29.2           | 40.6            |
| 2   | 0.20942         | 22.7                | 3.4                  | 10.1     | 32.8               | 13.5                | 63.2              | 53.2              | 30.4           | 39.7            |
| 3   | 0.24322         | 19.8                | 3.0                  | 9.9      | 29.7               | 12.9                | 62.0              | 52.0              | 32.3           | 39.1            |
| 4   | 0.28763         | 14.2                | -1.3                 | 10.0     | 24.2               | 8.7                 | 60.6              | 50.6              | 36.4           | 41.9            |
| 5   | 0.4573          | 12.0                | 1.2                  | 10.2     | 22.2               | 11.4                | 56.7              | 46.7              | 34.5           | 35.3            |
| 6   | 15.20149        | 5.6                 | -2.4                 | 10.9     | 16.5               | 8.5                 | 60.0              | 50.0              | 43.5           | 41.5            |

## 8. Measurement equipment

| Equipment Name           | Manufacturer      | Model No.              | Serial No.  | Next Cal. Date |
|--------------------------|-------------------|------------------------|-------------|----------------|
| Spectrum Analyzer        | R&S               | FSV40                  | 100988      | 21.01.03       |
| Spectrum Analyzer        | R&S               | FSV30                  | 100806      | 20.07.30       |
| Pulse Power Meter        | ANRITSU           | ML2495A                | 1608009     | 20.07.31       |
| Attenuator               | API Inmet         | 40AH2W-10              | 17          | 20.05.15       |
| EMI TEST RECEIVER        | R&S               | ESCI7                  | 100732      | 20.08.22       |
| Bi-Log Antenna           | SCHWARZBECK       | VULB 9168              | 583         | 20.05.04       |
| Amplifier                | SONOMA INSTRUMENT | 310N                   | 284608      | 20.08.22       |
| COAXIAL FIXED ATTENUATOR | Agilent           | 8491B-003              | 2708A18758  | 20.05.04       |
| Horn antenna             | ETS.lindgren      | 3116                   | 00086632    | 21.02.17*      |
| Horn antenna             | ETS.lindgren      | 3117                   | 155787      | 20.10.24       |
| Attenuator               | API Inmet         | 40AH2W-10              | 12          | 20.05.15       |
| Broadband PreAmplifier   | SCHWARZBECK       | BBV9718                | 216         | 20.07.30       |
| AMPLIFIER                | L-3 Narda-MITEQ   | AMF-7D-01001800-22-10P | 2031196     | 21.02.12       |
| AMPLIFIER                | L-3 Narda-MITEQ   | JS44-18004000-33-8P    | 2000996     | 21.01.22       |
| LOOP Antenna             | R&S               | HFH2-Z2                | 100355      | 20.08.24       |
| Antenna Mast             | Innco Systems     | MA4640-XP-ET           | -           | -              |
| Turn Table               | Innco Systems     | DT2000                 | 79          | -              |
| Antenna Mast             | Innco Systems     | MA4000-EP              | 303         | -              |
| Turn Table               | Innco Systems     | DT2000                 | 79          | -              |
| Highpass Filter          | WT                | WT-A1698-HS            | WT160411001 | 20.05.14       |
| TWO-LINE V - NETWORK     | R&S               | ENV216                 | 101358      | 20.04.05       |
| EMI TEST RECEIVER        | R&S               | ESCI                   | 100001      | 20.08.22       |
| Vector Signal Generator  | R&S               | SMBV100A               | 257566      | 20.07.16       |
| Signal Generator         | R&S               | SMR40                  | 100007      | 20.05.13       |
| Cable Assembly           | RadiAll           | 2301761768000PJ        | 1724.659    | -              |
| Cable Assembly           | gigalane          | RG-400                 | -           | -              |
| Cable Assembly           | HUER+SUHNER       | SUCOFLEX 104           | MY4342/4    | -              |

\*The equipment was used after finished calibration

**End of test report**