# FCC Part 15
# EMI TEST REPORT
## *(Part 2 – Bluetooth)*

# of

E.U.T.          : Rugged Tablet PC

Model No.     : ALGIZ 10X

FCC ID.       : YY3-ALGIZ10X

# for

APPLICANT     :   Handheld Group AB.

ADDRESS       :   Kinnegatan 17, 53133, Lidköping, Sweden


Test Performed by

**ELECTRONICS TESTING CENTER, TAIWAN**
NO. 34. LIN 5, DINGFU VIL., LINKOU DIST.,
NEW TAIPEI CITY, TAIWAN, 24442, R.O.C.
Tel:(02)26023052          Fax:(02)26010910
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Report Number : 13-03-RBF-025-07

# TEST REPORT CERTIFICATION

Applicant　　　　　　　:　Handheld Group AB

　　　　　　　　　　　　　　Kinnegatan 17, 53133, Lidköping, Sweden

Manufacture　　　　　:　WINMATE Communication INC.

　　　　　　　　　　　　　　9F, No.111-6, Shing-De Rd., San-Chung District, New Taipei City
　　　　　　　　　　　　　　241 Taiwan

Description of Device　:

　　a)　Type of EUT　　:　Rugged Tablet PC
　　b)　Trade Name　　:　Handheld
　　c)　Model No.　　　:　ALGIZ 10X
　　d)　Power Supply　:　Switching Adapter
　　　　　　　　　　　　　　I/P: 100-240VAC, 50-60Hz, 2.5A
　　　　　　　　　　　　　　O/P: 12VDC, 6.6A

Regulation Applied　　　　:　FCC Rules and Regulations Part 15 Subpart C

I HEREBY CERTIFY THAT: The data shown in this report were made in accordance with the procedures given in ANSI C63.4, and the energy emitted by the device was founded to be within the limits applicable. I assume full responsibility for accuracy and completeness of these data.

Note: 1. The result of the testing report relate only to the item tested.
　　　 2. The testing report shall not be reproduced expect in full, without the written approval of ETC.
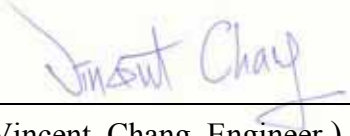
**Summary of Tests**

| Test | Results |
|---|---|
| Radiated Emission | **Pass** |
| Conducted Emission | **Pass** |
| Hopping Channel Separation | **Pass** |
| Number of Hopping frequencies used | **Pass** |
| Hopping Channel Bandwidth | **Pass** |
| Dwell Time of each frequency | **Pass** |
| Output Power Requirement | **Pass** |
| 100 kHz Bandwidth of Frequency Band Edges Requirement | **Pass** |
| Out-of-Band Conducted Emission Requirement | **Pass** |

Date Test Item Received            :   *Mar. 15, 2013*
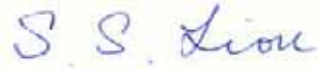
Date Test Campaign Completed   :   *May 29, 2013*

Date of Issue                        :   *Jun. 05 , 2013*


Test Engineer                    :

( Vincent  Chang, Engineer )


Approve & Authorized       :

S. S. Liou, Section Manager

EMC Dept. II of ELECTRONICS

TESTING CENTER, TAIWAN

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# 1 GENERAL INFORMATION

## 1.1 Product Description

| | | | |
|---|---|---|---|
| a) | Type of EUT | : | Rugged Tablet PC |
| b) | Trade Name | : | Handheld |
| c) | Model No. | : | ALGIZ 10X |
| d) | Power Supply | : | Switching Adapter |
| | | | I/P: 100-240VAC, 50-60Hz, 2.5A |
| | | | O/P: 12VDC, 6.6A |

## 1.2 Characteristics of Device

| | | |
|---|---|---|
| Frequency band | : | Bluetooth: 2402MHz~2480MHz |
| Number of channels | : | Bluetooth: 79 channels |
| Channel spacing | : | 1MHz |
| Transmitter antenna source | : | Internal IFA antenna |

## 1.3 Test Methodology

Both conducted and radiated emissions were performed according to the procedures illustrated in ANSI C63.4 (2003). Other required measurements were illustrated in separate sections of this test report for details. FCC DA 00-705 was used as the referencing measurement procedure of RF tests.

## 1.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the roof top of Building at NO. 34. LIN 5, DINGFU VIL., LINKOU DIST., NEW TAIPEI CITY, TAIWAN, 24442, R.O.C.

This site has been fully described in a report submitted to your office, and accepted in a letter dated Jan. 11, 2011.

# 2 PROVISIONS APPLICABLE

## 2.1 Definition

**Unintentional radiator:**

A device that intentionally generates and radio frequency energy for use within the device, or that sends radio frequency signals by conduction to associated equipment via connecting wiring, but which is not intended to emit RF energy by radiation or induction.

Class A Digital Device:

A digital device which is marketed for use in commercial or business environment; exclusive of a device which is market for use by the general public, or which is intended to be used in the home.

Class B Digital Device :

A digital device which is marketed for use in a residential environment notwithstanding use in a commercial, business of industrial environment. Example of such devices that are marketed for the general public.

Note : A manufacturer may also qualify a device intended to be marketed in a commercial, business, or industrial environment as a Class B digital device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B Digital Device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B Digital Device, Regardless of its intended use.

**Intentional radiator:**

A device that intentionally generates and emits radio frequency energy by radiation or induction.

## 2.2 Requirement for Compliance

### (1) Conducted Emission Requirement

Except as shown in paragraphs (b) and (c) of this section, 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 150kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

| Frequency MHz | Quasi Peak dBμ V | Average dBμ V |
|---|---|---|
| 0.15 - 0.5 | 66-56* | 56-46* |
| 0.5 - 5.0 | 56 | 46 |
| 5.0 - 30.0 | 60 | 50 |

* Decreases with the logarithm of the frequency

For intentional device, according to §15.207(a) Line Conducted Emission Limits is same as above table.

### (2) Radiated Emission Requirement

For unintentional device, according to §15.109(a), except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

| Frequency MHz | Distance Meters | Radiated dBμ V/m | Radiated μ V/m |
|---|---|---|---|
| 30 - 88 | 3 | 40.0 | 100 |
| 88 - 216 | 3 | 43.5 | 150 |
| 216 - 960 | 3 | 46.0 | 200 |
| Above 960 | 3 | 54.0 | 500 |

For intentional device, according to §15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

### (3) Antenna Requirement

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

### (4) Hopping Channel Separation

According to 15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

### (5) Number of Hopping frequencies used

According to 15.247(a)(1)(iii), frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

### (6) Hopping Channel Bandwidth

For frequency hopping system operating in the 2400–2483.5 MHz band, there is no requirement for the maximum 20dB bandwidth of the hopping channel. The measurement of the hopping channel bandwidth is for the reference of the hopping channel separation requirement.

### (7) Dwell Time of each frequency

According to 15.247(a)(1)(iii), for frequency hopping system operating in the 2400-2483.5 band, the average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

### (8) Output Power Requirement

According to 15.247(b)(1), for frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

### (9) 100 kHz Bandwidth of Frequency Band Edges Requirement

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 operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the

transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

### (10) Out-of-Band Conducted Emission Requirement

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

## 2.3  Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below :

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090  - 0.110 | 16.42-16.423 | 399.9-410 | 4.5-5.15 |
| 0.495  - 0.505 ** | 16.69475 - 16.69525 | 608-614 | 5.35-5.46 |
| 2.1735 - 2.1905 | 16.80425 - 16.80475 | 960-1240 | 7.25-7.75 |
| 4.125-4.128 | 25.5-25.67 | 1300-1427 | 8.025-8.5 |
| 4.17725-4.17775 | 37.5-38.25 | 1435-1626.5 | 9.0-9.2 |
| 4.20725-4.20775 | 73-74.6 | 1645.5-1646.5 | 9.3-9.5 |
| 6.215-6.218 | 74.8-75.2 | 1660-1710 | 10.6-12.7 |
| 6.26775-6.26825 | 108-121.94 | 1718.8-1722.2 | 13.25-13.4 |
| 6.31175-6.31225 | 123-138 | 2200-2300 | 14.47-14.5 |
| 8.291-8.294 | 149.9-150.05 | 2310-2390 | 15.35-16.2 |
| 8.362-8.366 | 156.52475 - 156.52525 | 2483.5-2500 | 17.7-21.4 |
| 8.37625-8.38675 | 156.7-156.9 | 2655-2900 | 22.01-23.12 |
| 8.41425-8.41475 | 162.0125-167.17 | 3260-3267 | 23.6-24.0 |
| 12.29-12.293 | 167.72-173.2 | 3332-3339 | 31.2-31.8 |
| 12.51975-12.52025 | 240-285 | 3345.8-3358 | 36.43-36.5 |
| 12.57675-12.57725 | 322-335.4 | 3360-4400 | Above 38.6 |
| 13.36-13.41 | | | |

** : Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

## 2.4  Labeling Requirement

The device shall bear the following statement in a conspicuous location on the device :

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions : (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

## 2.5  User Information

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual.

The Federal Communications Commission Radio Frequency Interference Statement includes the following paragraph.

This equipment has been tested and found to comply with the limits for a Class B Digital Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction may cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-- Reorient or relocate the receiving antenna.

-- Increase the separation between the equipment and receiver.

-- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-- Consult the dealer or an experienced radio / TV technician for help.

# 3 SYSTEM TEST CONFIGURATION

## 3.1 Justification

For both radiated and conducted emissions, the system was configured for testing in a typical fashion as a customer would normally use it. The peripherals other than EUT were connected in normally standing by situation. Three highest emissions were verified with varying placement of the transmitting antenna connected to EUT (if applicable) to maximize the emission from EUT.

For conducted and radiated emissions, whichever RF channel is operated, the digital circuits' function identically. As the reason, measurement of emissions from digital circuits is performed with the highest, middle and the lowest channel by transmitting mode.

## 3.2 Devices for Tested System

| Device | Manufacture | Model / FCC ID | Cable Description |
|---|---|---|---|
| Rugged Tablet PC * | HANDHELD GROUP AB. | ALGIZ 10X/ YY3-ALGIZ10X | 1.8m Unshielded AC Adapter |
| Earphone | KINYO | EM3000 | 0.8m Unshielded Earhpone Cable |
| Monitor | BenQ | FP547 | 1.8m Unshielded AC Power Cord  0.8m Shielded D-SUB data line |
| 2.5"USB Disk | PHILIPS | 100GB | 0.3m Unshielded USB Line |
| 2.5"USB Disk | Ministation 3.0 | HD-PCTU3 | 0.3m Unshielded USB Line |

Remark "*" means equipment under test.

# 4 RADIATED EMISSION MEASUREMENT

## 4.1 Applicable Standard

For unintentional radiator, the radiated emission shall comply with §15.109(a).
For intentional radiators, according to §15.247 (a), operation under this provision is limited to frequency hopping and direct sequence spread spectrum, and the out band emission shall be comply with §15.247 (c)

## 4.2 Measurement Procedure

1. Setup the configuration per figure 1 and 2 for frequencies measured below and above 1 GHz respectively.

2. For emission frequencies measured below 1 GHz, a pre-scan is performed in a shielded chamber to determine the accurate frequencies of higher emissions will be checked on a open test site. As the same purpose, for emission frequencies measured above 1 GHz, a pre-scan also be performed with a 1 meter measuring distance before final test.

3. For emission frequencies measured below and above 1 GHz, set the spectrum analyzer on a 100 kHz and 1 MHz resolution bandwidth respectively for each frequency measured in step 2.

4. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0 to 360 with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.

5. Repeat step 4 until all frequencies need to be measured were complete.

6. Repeat step 5 with search antenna in vertical polarized orientations.

7. Check the three frequencies of highest emission with varying the placement of cables associated with EUT to obtain the worse case and record the result.

Figure 1 : Frequencies measured below 1 GHz configuration

Antenna Tower

Search
Antenna

RF Test
Receiver

3m

4m

EUT

Turn
Table

0.8m

1m

Ground Plane
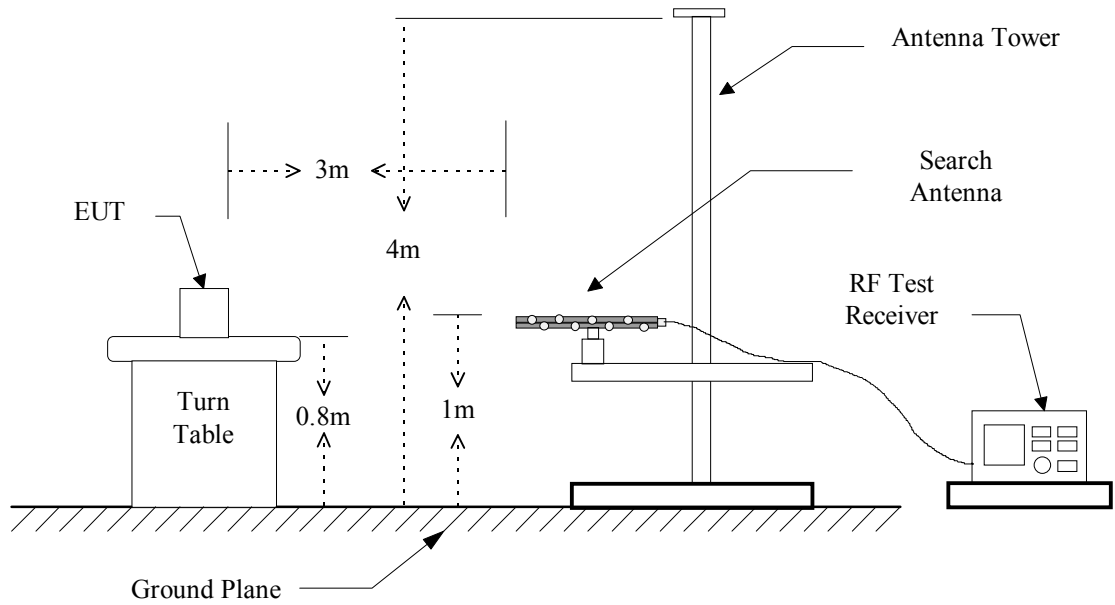
Figure 2 : Frequencies measured above 1 GHz configuration

Antenna Tower

Horn Antenna

Spectrum
Analyzer

EUT

3m

4m

Turn
Table

0.8m

1m

Amplifier
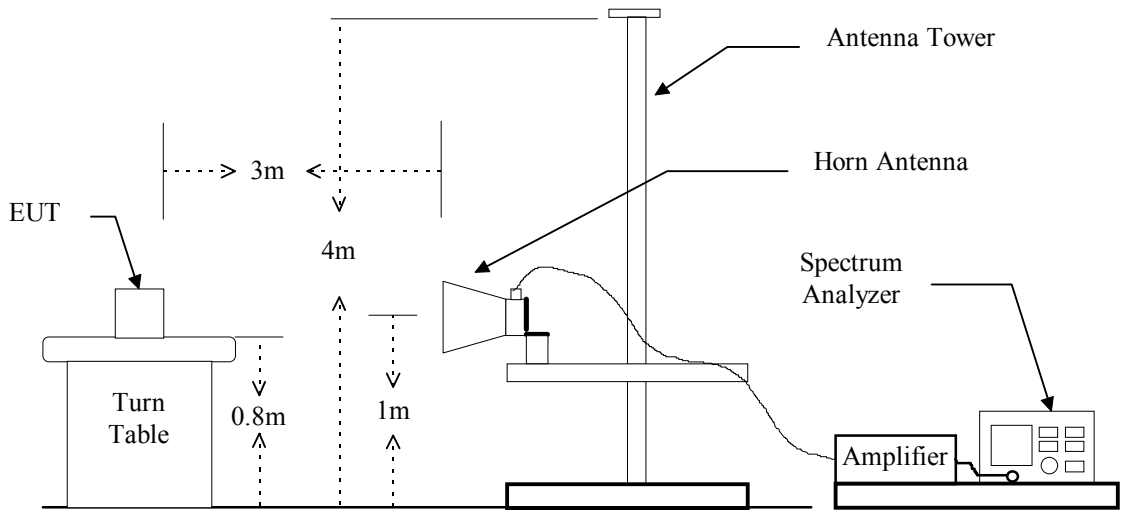
## 4.3 Measuring Instrument

The following instrument are used for radiated emissions measurement:

| Equipment | Manufacturer | Model No. | Calibration Date | Next Cal. Date |
|---|---|---|---|---|
| Test Receiver | Rohde & Schwarz | ESVS30 | 2013/05/06 | 2014/05/05 |
| EMI Test Receiver | Rohde & Schwarz | ESL | 2012/07/30 | 2013/07/30 |
| Bi-Log Antenna | ETC | MCTD 2756 | 2012/01/17 | 2014/01/17 |
| Log-periodic Antenna | EMCO | 3146 | 2012/10/17 | 2013/10/16 |
| Double Ridged Guide Horn Antenna | EMCO | 3116 | 2012/11/23 | 2013/11/22 |
| Biconical Antenna | EMCO | 3110 | 2012/10/17 | 2013/10/16 |
| Double Ridged Antenna | EMCO | 3115 | 2013/04/29 | 2014/04/28 |
| Amplifier | HP | 8449B | 2013/01/09 | 2014/01/08 |
| Amplifier | HP | 83051A | 2013/05/06 | 2014/05/05 |
| Amplifier | HP | 8447D | 2013/05/03 | 2014/05/02 |
| Spectrum | Rohde & Schwarz | FSP40 | 2012/12/07 | 2013/12/06 |

Measuring instrument setup in measured frequency band when specified detector function is used :

| Frequency Band (MHz) | Instrument | Function | Resolution bandwidth | Video Bandwidth |
|---|---|---|---|---|
| 30 to 1000 | RF Test Receiver | Quasi-Peak | 120 kHz | N/A |
| | Spectrum Analyzer | Peak | 100 kHz | 100 kHz |
| Above 1000 | Spectrum Analyzer | Peak | 1 MHz | 1 MHz |
| | Spectrum Analyzer | Average | 1 MHz | 10 Hz |

## 4.4 Radiated Emission Data

### 4.4.1 Tx Portion



| | | | |
|---|---|---|---|
| Site | :CHAMBER #2 | Date | :2013-05-10 |
| Limit | :1G TO 40G PEAK | Ant. Pol. | : HORIZONTAL |
| EUT | :10" Tab PC | Temp. | :25 |
| Power Rating | :120V 60Hz | Humi. | :65% |
| Engineer. | :VC | | |
| Test Mode | :TX RX-CHLo:2402MHz,Mi:2441MHz,Hi:2480MHz | | |

| Freq<br><br>MHz | Reading<br><br>dBuV | Correction<br>Factor<br>dB | Result<br><br>dBuV/m | Limits<br><br>dBuV/m | Over limit<br><br>dB | Detector |
|---|---|---|---|---|---|---|
| 4804.0000 | 45.9 | 0.6 | 46.5 | 54.0 | -7.5 | Average |
| 4804.0000 | 55.6 | 0.6 | 56.2 | 74.0 | -17.8 | Peak |
| 4882.0000 | 45.3 | 0.7 | 46.0 | 54.0 | -8.0 | Average |
| 4882.0000 | 55.4 | 0.7 | 56.1 | 74.0 | -17.9 | Peak |
| 4960.0000 | 45.2 | 1 | 46.2 | 54.0 | -7.8 | Average |
| 4960.0000 | 55.1 | 1 | 56.1 | 74.0 | -17.9 | Peak |

Note :

1. Result = Reading + Corrected Factor

2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)

3. The margin value=Limit - Resul

| | | | | | |
|---|---|---|---|---|---|
| Site | :CHAMBER #2 | | Date | :2013-05-10 | |
| Limit | :1G TO 40G PEAK | | Ant. Pol. | : HORIZONTAL | |
| EUT | :10" Tab PC | | Temp. | :25 | |
| Power Rating | :120V 60Hz | | Humi. | :65% | |
| Engineer. | :VC | | | | |
| Test Mode | :TX RX-CHLo:2402MHz,Mi:2441MHz,Hi:2480MHz | | | | |

| Freq | Reading | Correction Factor | Result | Limits | Over limit | Detector |
|---|---|---|---|---|---|---|
| MHz | dBuV | dB | dBuV/m | dBuV/m | dB | |
| 4804.0000 | 45.9 | 0.6 | 46.5 | 54.0 | -7.5 | Average |
| 4804.0000 | 55.6 | 0.6 | 56.2 | 74.0 | -17.8 | Peak |
| 4882.0000 | 45.3 | 0.7 | 46.0 | 54.0 | -8.0 | Average |
| 4882.0000 | 55.4 | 0.7 | 56.1 | 74.0 | -17.9 | Peak |
| 4960.0000 | 45.2 | 1 | 46.2 | 54.0 | -7.8 | Average |
| 4960.0000 | 55.1 | 1 | 56.1 | 74.0 | -17.9 | Peak |

Note :

1. Result = Reading + Corrected Factor

2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)

3. The margin value=Limit - Resul

## 4.4.2 Radiated Emissions in Restricted Bands



| Site | :CHAMBER #2 | Date | :2013-05-10 |
|------|-------------|------|-------------|
| Limit | :1G TO 40G PEAK | Ant. Pol. | :HORIZONTAL |
| EUT | :10" Tab PC | | |
| Temp. | :25 | | |
| Humi. | :65% | | |
| Test Mode | :CH LO & HI - Restricted Bands | | |

| Freq<br><br>MHz | Reading<br><br>dBuV | Correction<br>Factor<br>dB | Result<br><br>dBuV/m | Limits<br><br>dBuV/m | Over limit<br><br>dB | Detector |
|------|------|------|------|------|------|------|
| 2325.1500 | 50.5 | -6.4 | 44.1 | 74 | -29.9 | Peak |
| 2375.2500 | 50.7 | -6.2 | 44.5 | 74 | -29.5 | Peak |
| 2489.6900 | 51.2 | -5.9 | 45.3 | 74 | -28.7 | Peak |
| 2495.8500 | 50.6 | -5.9 | 44.7 | 74 | -29.3 | Peak |

Note :

1. Result = Reading + Corrected Factor

2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
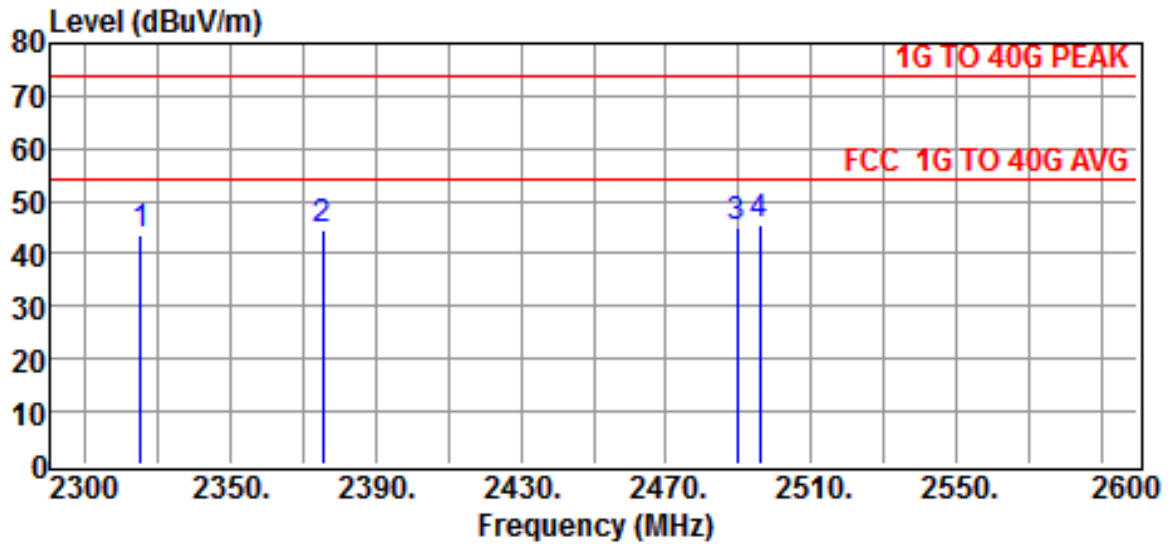
3. The margin value=Limit - Resul
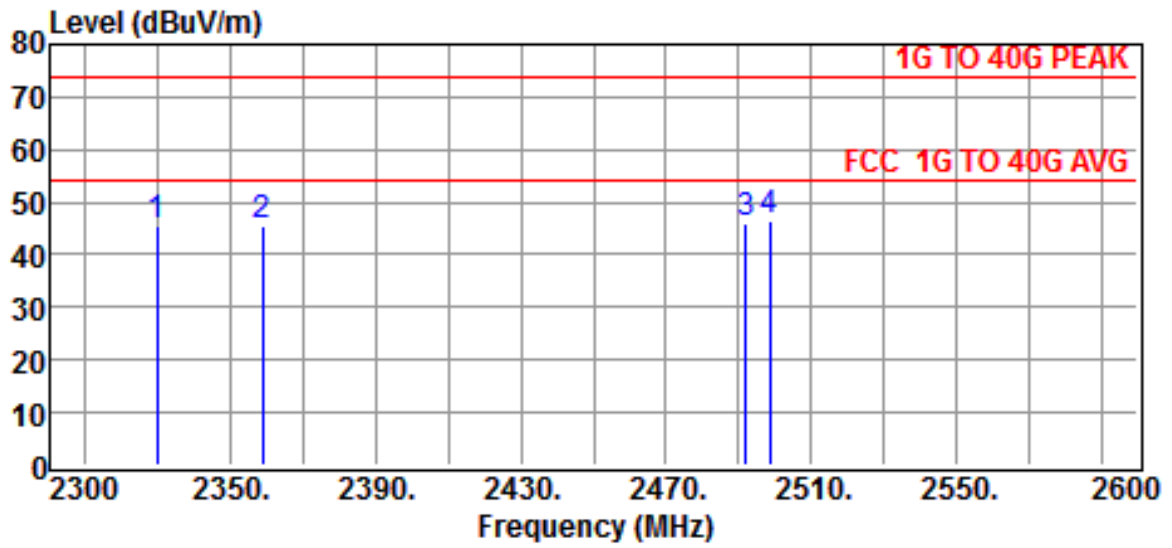
| Site | :CHAMBER #2 | Date | :2013-05-10 |
|------|-----------|------|-------------|
| Limit | :1G TO 40G PEAK | Ant. Pol. | :VERTICAL |
| EUT | :10" Tab PC | | |
| Temp. | :25 | | |
| Humi. | :65% | | |
| Test Mode | :CH LO & HI - Restricted Bands | | |

| Freq | Reading | Correction Factor | Result | Limits | Over limit | Detector |
|------|---------|-------------------|--------|--------|------------|----------|
| MHz | dBuV | dB | dBuV/m | dBuV/m | dB | |
| 2329.5200 | 51.1 | -6.4 | 44.7 | 74 | -29.3 | Peak |
| 2358.5800 | 51.5 | -6.3 | 45.2 | 74 | -28.8 | Peak |
| 2492.2500 | 50.8 | -5.9 | 44.9 | 74 | -29.1 | Peak |
| 2498.6500 | 51 | -5.9 | 45.1 | 74 | -28.9 | Peak |

Note :

1. Result = Reading + Corrected Factor

2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)

3. The margin value=Limit - Resul

### 4.4.3 Other Emissions

### a) Emission frequencies below 1 GHz
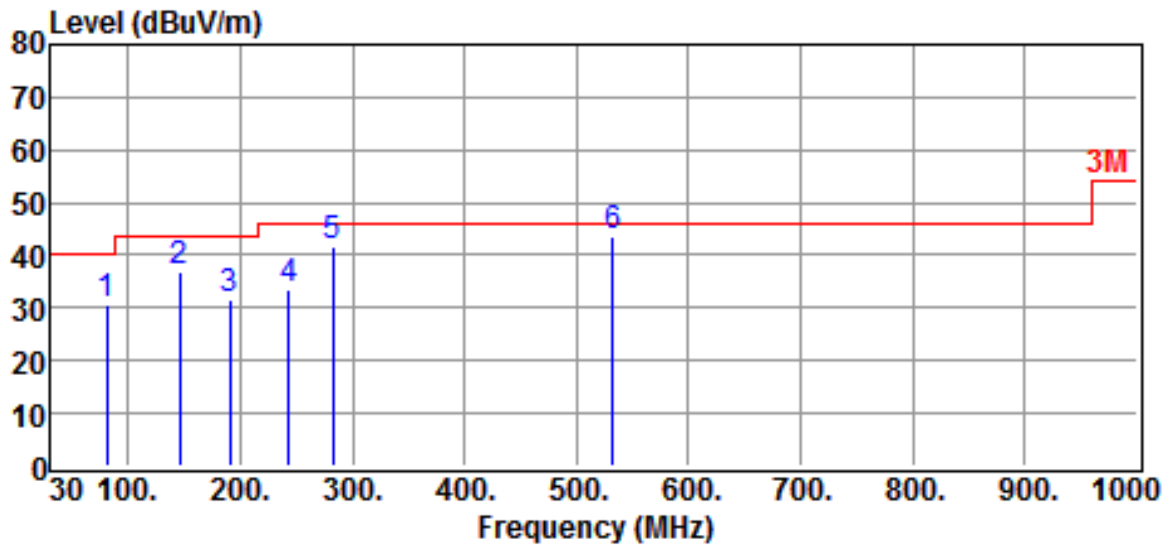


| | | | | |
|---|---|---|---|---|
| Site | :OPEN SITE | Date | :2013-03-19 |
| Limit | :3M | Ant. Pol. | :HORIZONTAL |
| EUT | :10" TABLE PC | Temp. | :20 |
| Power Rating | :100-240V (ADAPTER) | Humi. | :65% |
| Model | : ALGIZ 10X | Engineer. | :VC |
| Test Mode | :CHARGE & FULL SYSTEM & BT LINK MODE | | |

| Freq | Reading | Correction Factor | Result | Limits | Over limit | Detector |
|---|---|---|---|---|---|---|
| MHz | dBuV | dB | dBuV/m | dBuV/m | dB | |
| 80.4400 | 20.2 | 10.4 | 30.6 | 40.0 | -9.4 | QP |
| 146.4000 | 22.8 | 14.2 | 37.0 | 43.5 | -6.5 | QP |
| 191.0200 | 15.2 | 16.3 | 31.5 | 43.5 | -12.0 | QP |
| 243.4000 | 13.7 | 19.7 | 33.4 | 46.0 | -12.6 | QP |
| 282.2000 | 18.8 | 23.0 | 41.8 | 46.0 | -4.2 | QP |
| 532.4600 | 21.7 | 22.1 | 43.8 | 46.0 | -2.2 | QP |

Note :

1. Result = Reading + Corrected Factor

2. Corrected Factor = Antenna Factor + Cable Loss

3. The margin value=Limit - Result
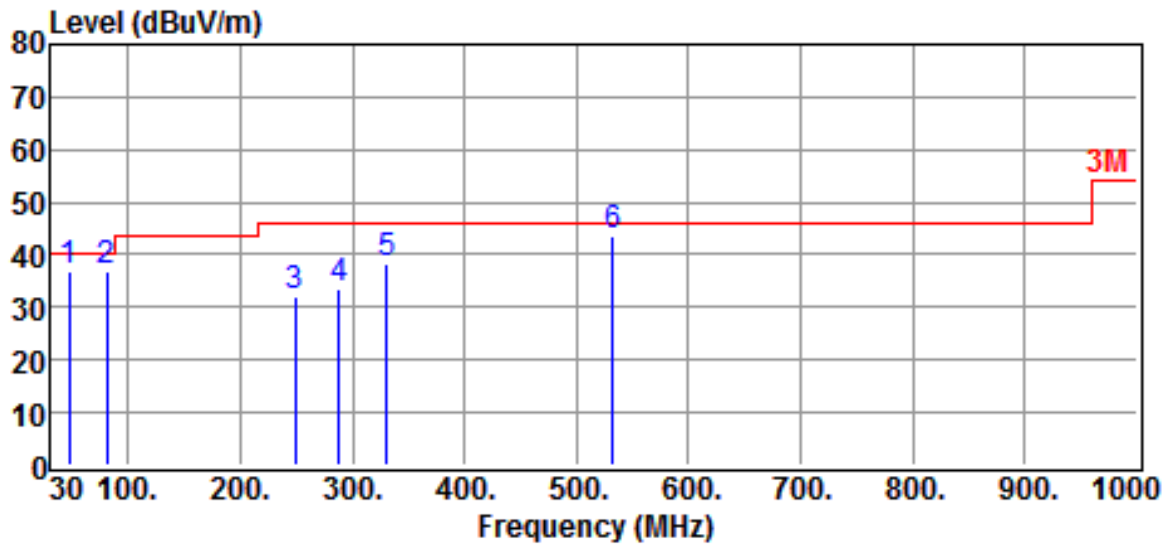
| Site | :OPEN SITE | Date | :2013-03-19 |
|---|---|---|---|
| Limit | :3M | Ant. Pol. | :VERTICAL |
| EUT | :10" TABLE PC | Temp. | :20 |
| Power Rating | :100-240V (ADAPTER) | Humi. | :65% |
| Model | : ALGIZ 10X | Engineer. | :VC |
| Test Mode | :CHARGE & FULL SYSTEM & BT LINK MODE | | |

| Freq<br><br>MHz | Reading<br><br>dBuV | Correction<br>Factor<br>dB | Result<br><br>dBuV/m | Limits<br><br>dBuV/m | Over limit<br><br>dB | Detector |
|---|---|---|---|---|---|---|
| 47.4600 | 24.4 | 12.3 | 36.7 | 40.0 | -3.3 | QP |
| 80.4400 | 26.7 | 10.4 | 37.1 | 40.0 | -2.9 | QP |
| 249.2200 | 12.0 | 20.0 | 32.0 | 46.0 | -14.0 | QP |
| 288.0200 | 10.0 | 23.5 | 33.5 | 46.0 | -12.5 | QP |
| 330.7000 | 20.3 | 17.8 | 38.1 | 46.0 | -7.9 | QP |
| 532.4600 | 21.5 | 22.1 | 43.6 | 46.0 | -2.4 | QP |

Note :

1. Result = Reading + Corrected Factor

2. Corrected Factor = Antenna Factor + Cable Loss

3. The margin value=Limit - Result
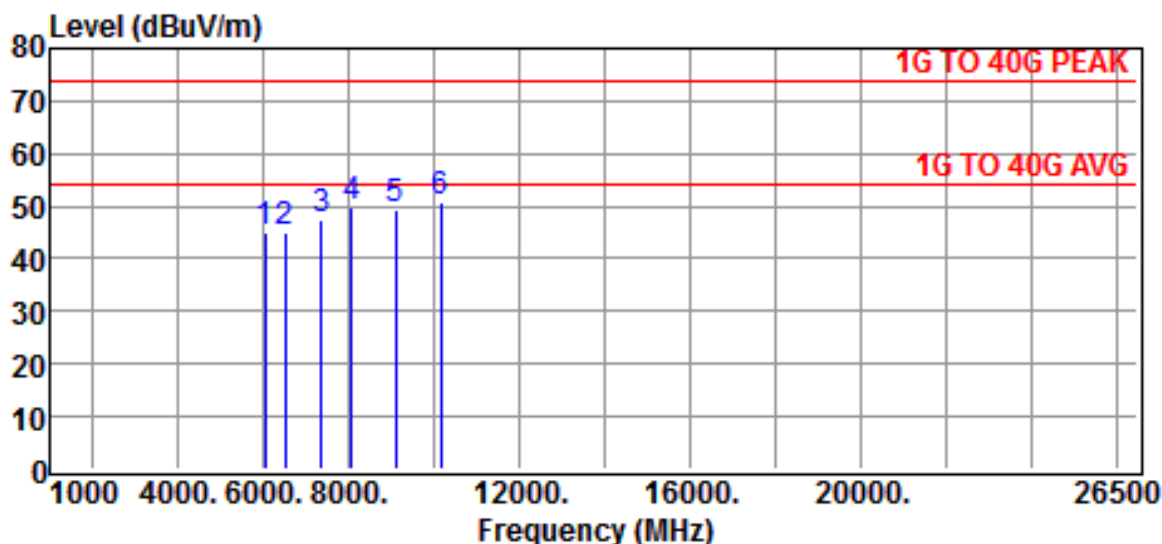
Rev. No 2.1

**b) Emission frequencies above 1 GHz**



| | |
|---|---|
| Site | :CHAMBER #2 |
| Limit | :1G TO 40G PEAK |
| EUT | :10" TABLE PC |
| Power Rating | :100-240V (ADAPTER) |
| Model | : ALGIZ 10X |
| Test Mode | :CHARGE & FULL SYSTEM & BT LINK MODE |

| | |
|---|---|
| Date | :2013-03-20 |
| Ant. Pol. | :HORIZONTAL |
| Temp. | :20 |
| Humi. | :65% |
| Engineer. | :VC |

| Freq<br><br>MHz | Reading<br><br>dBuV | Correction<br>Factor<br>dB | Result<br><br>dBuV/m | Limits<br><br>dBuV/m | Over limit<br><br>dB | Detector |
|---|---|---|---|---|---|---|
| 6049.0000 | 41.3 | 3.6 | 44.9 | 74.0 | -29.1 | Peak |
| 6508.0000 | 41.1 | 3.8 | 44.9 | 74.0 | -29.1 | Peak |
| 7375.0000 | 41.3 | 6.0 | 47.3 | 74.0 | -26.7 | Peak |
| 8089.0000 | 42.6 | 7.1 | 49.7 | 74.0 | -24.3 | Peak |
| 9109.0000 | 41.1 | 8.2 | 49.3 | 74.0 | -24.7 | Peak |
| 10180.0000 | 41.3 | 9.3 | 50.6 | 74.0 | -23.4 | Peak |

Note :

1. Result = Reading + Corrected Factor

2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)

3. The margin value=Limit - Result

4. Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
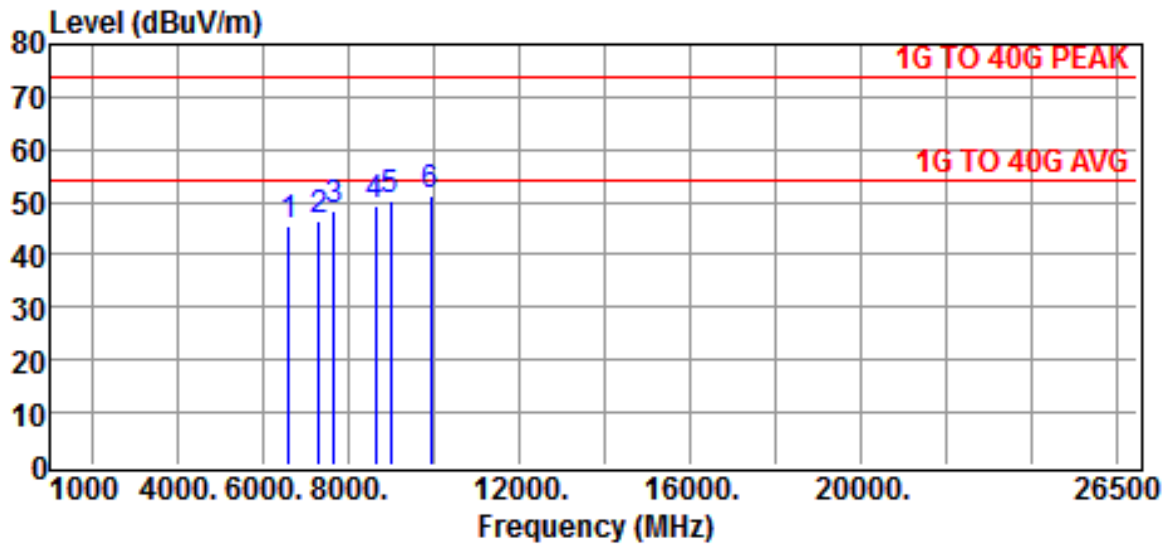
| Site | :CHAMBER #2 | Date | :2013-03-20 |
|---|---|---|---|
| Limit | :1G TO 40G PEAK | Ant. Pol. | :VERTICAL |
| EUT | :10" TABLE PC | Temp. | :20 |
| Power Rating | :100-240V (ADAPTER) | Humi. | :65% |
| Model | : ALGIZ 10X | Engineer. | :VC |
| Test Mode | :CHARGE & FULL SYSTEM & BT LINK MODE | | |

| Freq MHz | Reading dBuV | Correction Factor dB | Result dBuV/m | Limits dBuV/m | Over limit dB | Detector |
|---|---|---|---|---|---|---|
| 6610.0000 | 41.4 | 4.0 | 45.4 | 74.0 | -28.6 | Peak |
| 7324.0000 | 40.5 | 5.9 | 46.4 | 74.0 | -27.6 | Peak |
| 7681.0000 | 41.7 | 6.5 | 48.2 | 74.0 | -25.8 | Peak |
| 8650.0000 | 41.4 | 7.9 | 49.3 | 74.0 | -24.7 | Peak |
| 9007.0000 | 42.1 | 8.2 | 50.3 | 74.0 | -23.7 | Peak |
| 9925.0000 | 42.3 | 8.8 | 51.1 | 74.0 | -22.9 | Peak |

Note :

1. Result = Reading + Corrected Factor

2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)

3. The margin value=Limit - Result

4. Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.

## 4.5  Field Strength Calculation

The field strength is calculated by adding the Antenna Factor, High Pass Filter Loss (if used) and Cable Loss, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation calculation is as follows:

*Result = Reading + Corrected  Factor*

where  Corrected Factor

= Antenna FACTOR + Cable Loss + High Pass Filter Loss - Amplifier Gain

## 4.6 Photos of Radiation Measuring Setup

# 5 CONDUCTED EMISSION MEASUREMENT

## 5.1 Standard Applicable

According to §15.207(a), except as shown in paragraphs (b) and (c) of this section, 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 150kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

| Frequency MHz | Quasi Peak dBμ V | Average dBμ V |
|---|---|---|
| 0.15 - 0.5 | 66-56* | 56-46* |
| 0.5 - 5.0 | 56 | 46 |
| 5.0 - 30.0 | 60 | 50 |

　* Decreases with the logarithm of the frequency

## 5.2 Measurement Procedure

1. Setup the configuration per figure 5.

2. A preliminary scan with a spectrum monitor is performed to identify the frequency of emission that has the highest amplitude relative to the limit by operating the EUT in selected modes of operation, typical cable positions, and with a typical system configuration.

3. Record the 6 or 8 highest emissions relative to the limit.

4. Measure each frequency obtained from step 3 by a test receiver set on quasi peak detector function, and then records the accuracy frequency and emission level. If all emissions measured in the specified band are attenuated more than 20 dB from the limit, this step would be ignored, and the peak detector function would be used.

5. Confirm the highest three emissions with variation of the EUT cable configuration and record the final data.

6. Repeat all above procedures on measuring each operation mode of EUT.

Figure 5: Conducted emissions measurement configuration
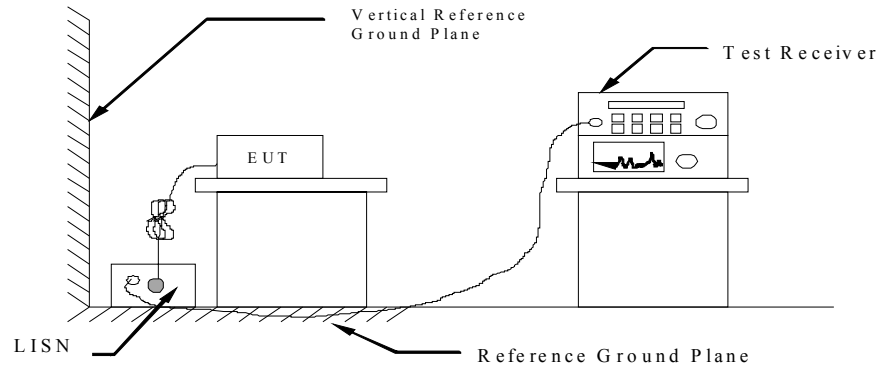
## 5.3 Conducted Emission Data
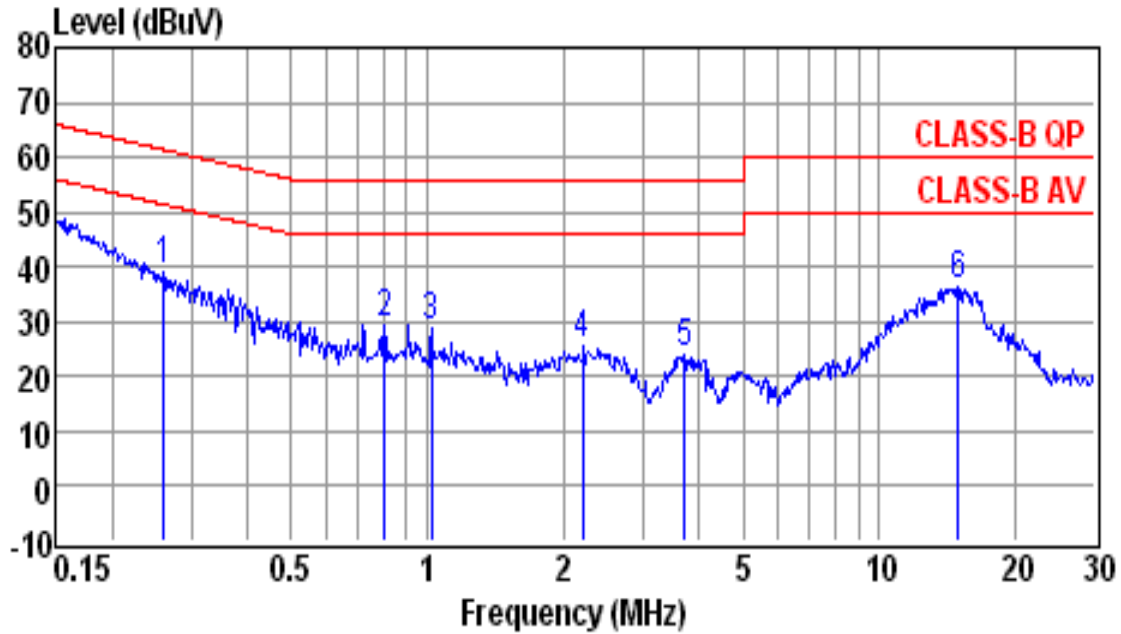


| Site | : conducted #1 | | Date | : 05-29-2013 |
| Condition | : CLASS-B QP | | LISN | : NEUTRAL |

Tem / Hum　　　　: 25　　/ 65%

Test Mode　　　　: CHARGE & FULL SYSTEM & BLUETOO LINK MODE

EUT　　　　　　 : 10" Tab PC

Power Rating　　　: 100-240V (Adapter)

Memo　　　　　　:　　　　　　　　　　　　　Memo　　　　　　:

| Freq (MHz) | Reading (dBuV) | Factor (dB) | Emission Level (dBuV) | Limit Line (dBuV) | Over Limit (dB) | Remark |
|---|---|---|---|---|---|---|
| 0.2616 | 28.7 | 10.3 | 39.0 | 61.4 | -22.4 | QP |
| 0.8045 | 19.3 | 10.3 | 29.6 | 56.0 | -26.4 | QP |
| 1.0210 | 18.5 | 10.5 | 29.0 | 56.0 | -27.0 | QP |
| 2.2130 | 14.8 | 10.5 | 25.3 | 56.0 | -30.7 | QP |
| 3.7200 | 13.4 | 10.5 | 23.9 | 56.0 | -32.1 | QP |
| 14.9860 | 25.7 | 10.7 | 36.4 | 60.0 | -23.6 | QP |

Note :

1. Result = Reading + Factor

2. Factor = LISN Factor + Cable Loss
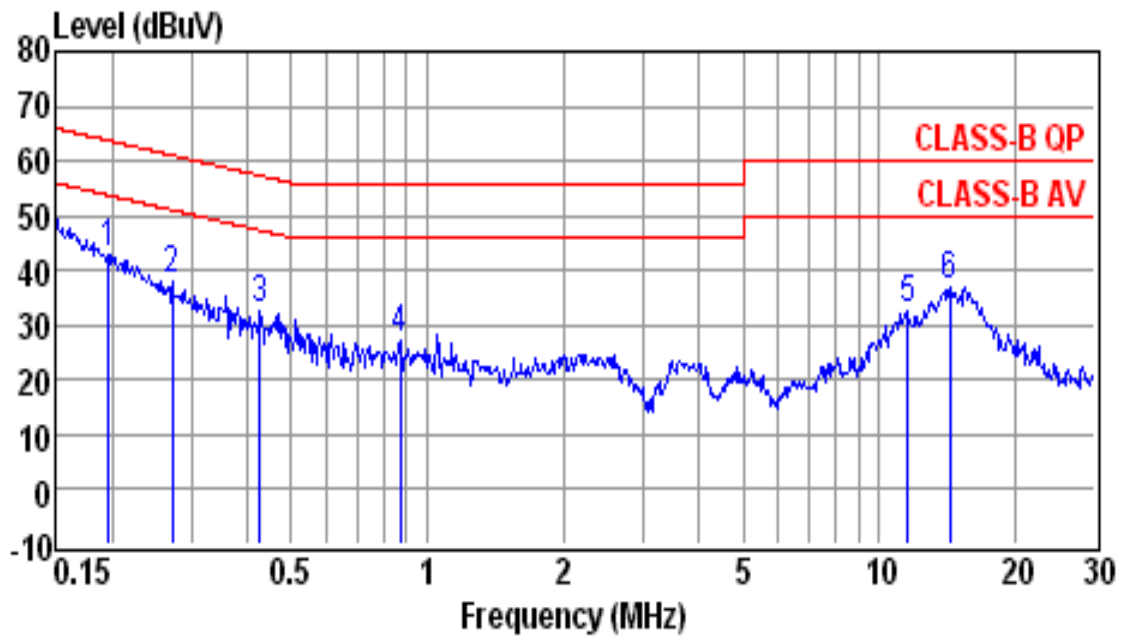
| Site | : conducted #1 | Date | : 05-29-2013 |
|---|---|---|---|
| Condition | : CLASS-B QP | LISN | : LINE |
| Tem / Hum | : 25　/ 65% | | |
| Test Mode | : CHARGE & FULL SYSTEM & BLUETOO LINK MODE | | |
| EUT | : 10" Tab PC | | |
| Power Rating | : 100-240V (Adapter) | | |
| Memo | : | Memo | : |

| Freq (MHz) | Reading (dBuV) | Factor (dB) | Emission Level (dBuV) | Limit Line (dBuV) | |
|---|---|---|---|---|---|
| 0.1965 | 32.4 | 10.3 | 42.7 | 63.8 | |
| 0.2730 | 27.8 | 10.3 | 38.1 | 61.0 | |
| 0.4260 | 22.1 | 10.3 | 32.4 | 57.3 | |
| 0.8710 | 16.7 | 10.3 | 27.0 | 56.0 | |
| 11.5590 | 21.8 | 10.7 | 32.5 | 60.0 | |
| 14.3640 | 26.0 | 10.8 | 36.8 | 60.0 | |

Note :

1. Result = Reading + Factor

2. Factor = LISN Factor + Cable Loss

## 5.4 Result Data Calculation

The result data is calculated by adding the LISN Factor to the measured reading. The basic equation with a sample calculation is as follows:

**_RESULT = READING + LISN FACTOR_**

Assume a receiver reading of 22.5 dBμ V is obtained, and LISN Factor is 0.1 dB, then the total of disturbance voltage is 22.6 dBμ V.

RESULT = 22.5 + 0.1 = 22.6 dBμ V

Level in μ V = Common Antilogarithm[(22.6 dBμ V)/20]

= 13.48 μ V

## 5.5 Conducted Measurement Equipment

The following test equipments are used during the conducted test.

| Equipment | Manufacturer | Model No. | Calibration Date | Next Cal. Date |
|---|---|---|---|---|
| EMI Test Receiver | Rohde & Schwarz | ESCI | 2012/07/16 | 2013/07/16 |
| LISN | EMCO | 3825/2 | 2012/11/02 | 2013/11/01 |
| LISN | Rohde & Schwarz | ESH2-Z5 | 2013/04/12 | 2014/04/11 |

## 5.6 Photos of Conduction Measuring Setup

# 6 ANTENNA REQUIREMENT

## 6.1 Standard Applicable

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

## 6.2 Antenna Construction

Please see photos submitted in Exhibit.

The antenna was embedded in the EUT. No consideration of replacement. The antenna gain is 3.8dBi. No need to reduce the peak output power.

# 7 HOPPING CHANNEL SEPARATION

## 7.1 Standard Applicable

According to 15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

## 7.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. The EUT must have its hopping function enabled. Then set it to any one convenient frequency within its operating range.
3. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels
   Resolution (or IF) Bandwidth (RBW) ≥ 1% of the span
   Video (or Average) Bandwidth (VBW) ≥ RBW
   Sweep = auto
   Detector function = peak
   Trace = max hold
4. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. Plot the result on the screen of spectrum analyzer.
5. Repeat above procedures until all frequencies measured were complete.

Figure 4 : Measurement configuration.
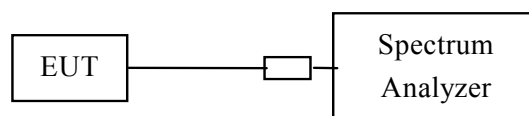
## 7.3 Measurement Equipment

| Equipment | Manufacturer | Model No. | Calibration Date | Next Cal. Date |
|---|---|---|---|---|
| Spectrum Analyzer | Rohde & Schwarz | FSP40 | 2012/12/07 | 2013/12/06 |
| Attenuator | Weinschel Engineering | 1 | N/A | N/A |

## 7.4 Measurement Data

Test Date : <u>May 14, 2013</u>    Temperature    : <u>25</u> °C    Humidity : <u>65</u> %

    a) Channel Low     : Adjacent Hopping Channel Separation is 1.004 MHz

    b) Channel Middle   : Adjacent Hopping Channel Separation is 1.004 MHz

    c) Channel High    : Adjacent Hopping Channel Separation is 1.004 MHz

*Note : The expanded uncertainty: frequency $\times 1.65 \times 10^{-6}$ (1 GHz $\leq f \leq 18$ GHz).*

## *Channel Low*
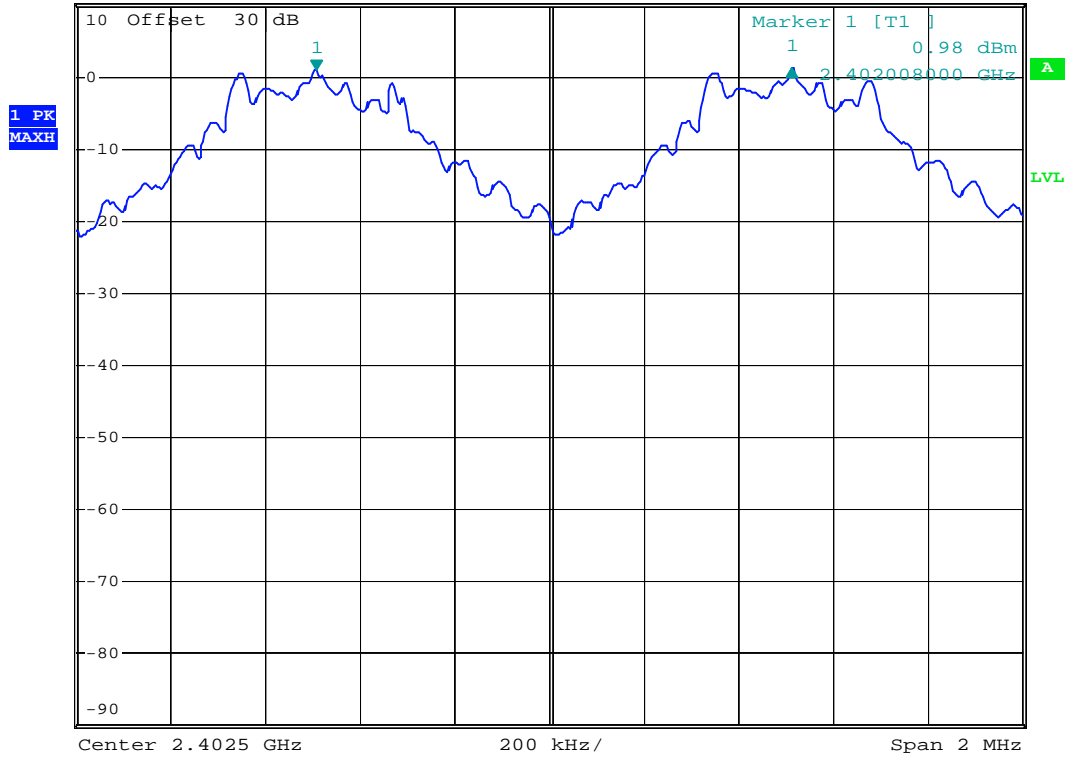


Date: 14.MAY.2013  09:12:12

## Channel Middle
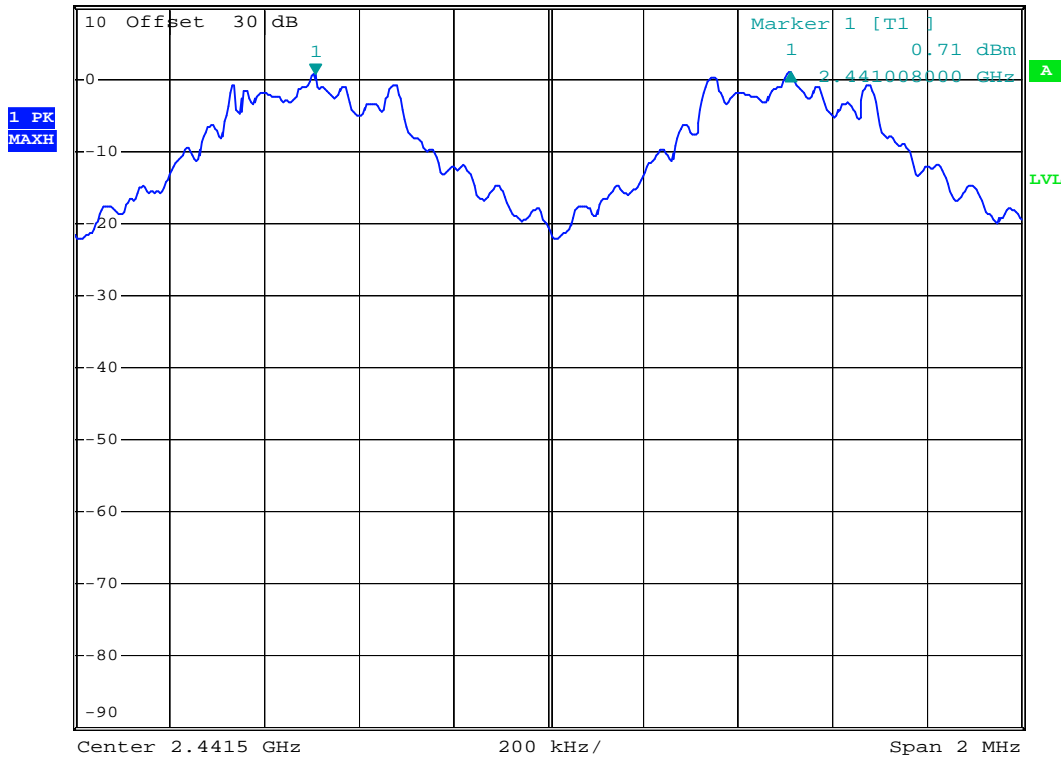


Date: 14.MAY.2013  09:14:03

## *Channel High*
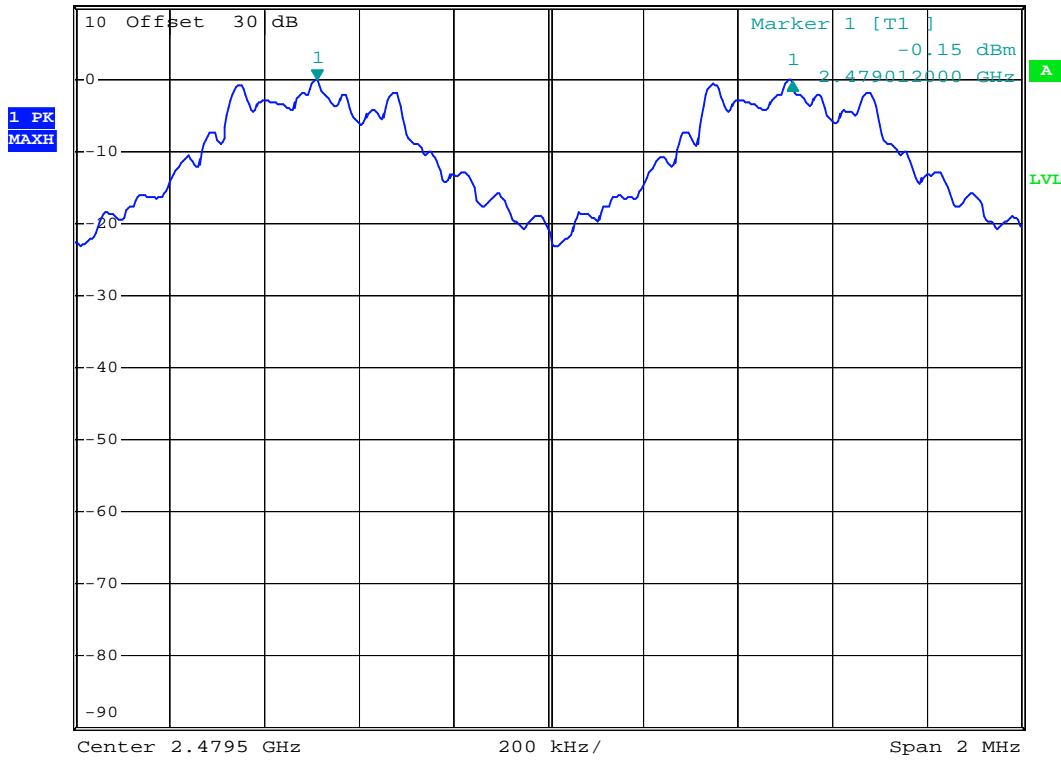


Date: 14.MAY.2013  09:15:57

## 8 NUMBER OF HOPPING FREQUENCY USED

### 8.1 Standard Applicable

According to 15.247(a)(1)(iii), frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

### 8.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. The EUT must have its hopping function enabled.
3. Use the following spectrum analyzer settings:

   Span = the frequency band of operation

   RBW ≥ 1% of the span

   VBW ≥ RBW

   Sweep = auto

   Detector function = peak

   Trace = max hold
4. Allow the trace to stabilize. Plot the result on the screen of spectrum analyzer.
5. Repeat above procedures until all frequencies measured were complete.

### 8.3 Measurement Equipment

| Equipment | Manufacturer | Model No. | Calibration Date | Next Cal. Date |
|---|---|---|---|---|
| Spectrum Analyzer | Rohde & Schwarz | FSP40 | 2012/12/07 | 2013/12/06 |
| Attenuator | Weinschel Engineering | 1 | N/A | N/A |

## 8.4  Measurement Data

Test Date  :  <u>May  14, 2013</u>　　　Temperature　:  <u>25</u>  °C　　Humidity  :  <u>65</u>  %

There are 79 hopping frequencies used.

*Note : The expanded uncertainty: frequency $\times 1.65 \times 10^{-6}$ (1 GHz $\quad f \leq 18$ GHz).*

## Channel Low



Date: 14.MAY.2013  09:28:34

## Channel Middle

```
                                              * RBW 30 kHz
                                                VBW 100 kHz
Ref  10 dBm                  Att  10 dB        SWT 35 ms
```



```
Start 2.4295 GHz              3 MHz/          Stop 2.4595 GHz
```
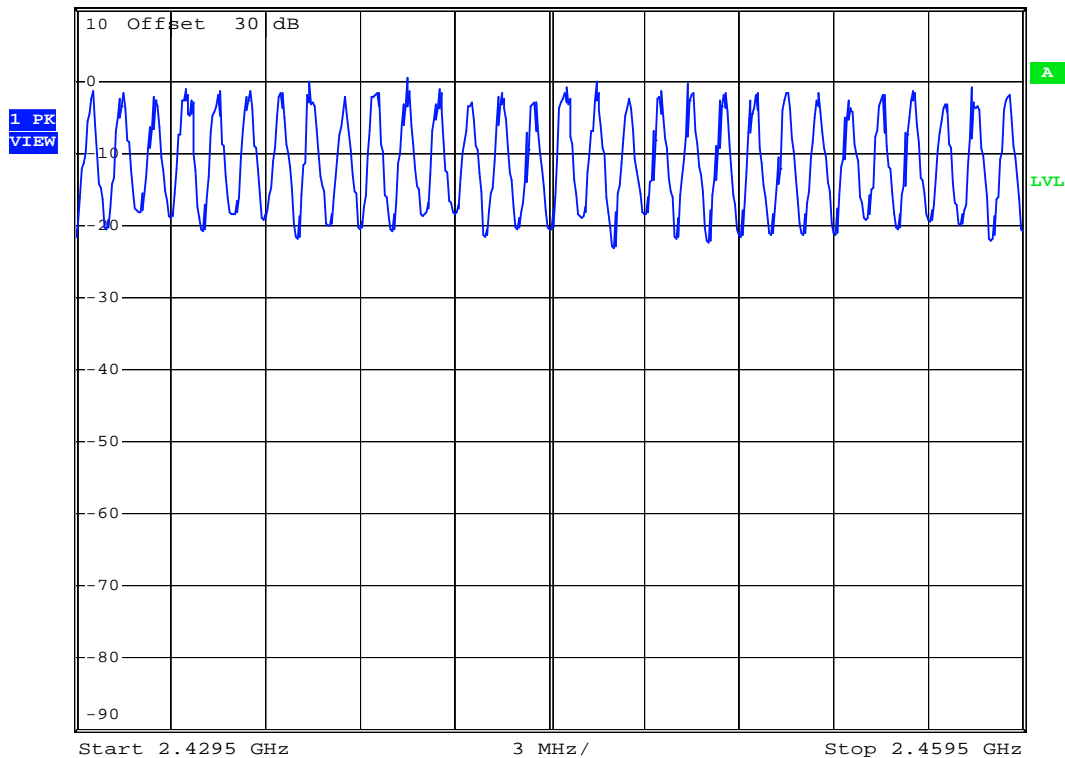
Date: 14.MAY.2013  09:30:03

**Channel High**
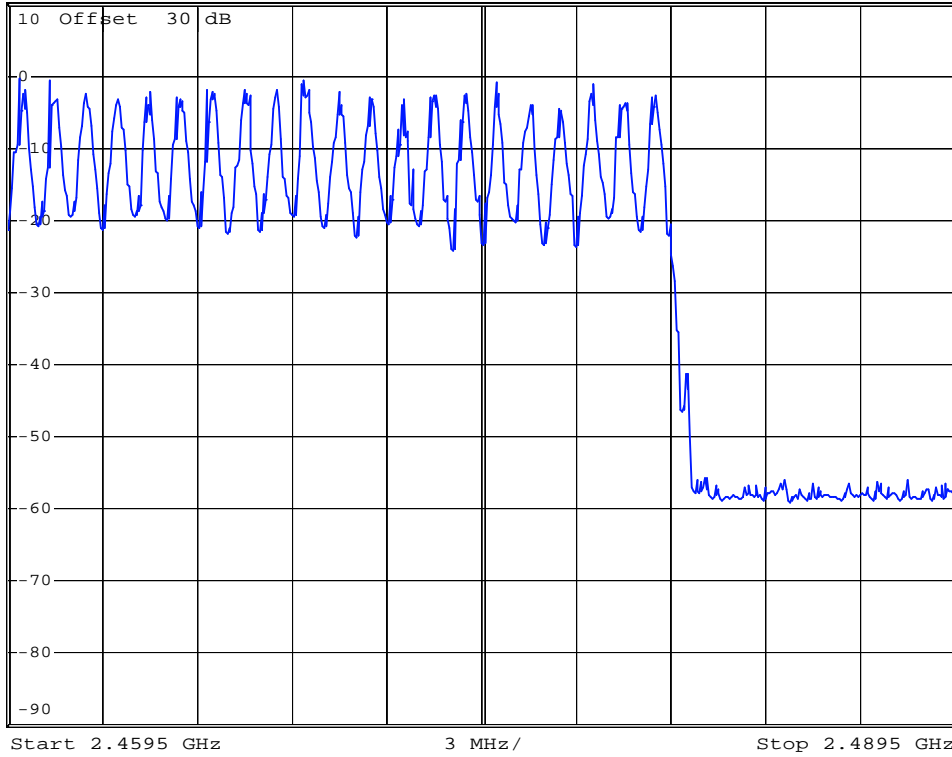


Date: 14.MAY.2013  09:31:04

# 9 CHANNEL BANDWIDTH

## 9.1 Standard Applicable

For frequency hopping system operating in the 2400–2483.5 MHz band, there is no requirement for the maximum 20dB bandwidth of the hopping channel. The measurement of the hopping channel bandwidth is for the reference of the hopping channel separation requirement.

## 9.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
3. Use the following spectrum analyzer settings:
   Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
   RBW ≥ 1% of the 20 dB bandwidth
   VBW ≥ RBW
   Sweep = auto
   Detector function = peak
   Trace = max hold
4. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission. Plot the result on the screen of spectrum analyzer.
5. Repeat above procedures until all frequencies measured were complete.

## 9.3 Measurement Equipment

| Equipment | Manufacturer | Model No. | Calibration Date | Next Cal. Date |
|---|---|---|---|---|
| Spectrum Analyzer | Rohde & Schwarz | FSP40 | 2012/12/07 | 2013/12/06 |
| Attenuator | Weinschel Engineering | 1 | N/A | N/A |

## 9.4 Measurement Data

Test Date : <u>May 14, 2013</u>　　　Temperature : <u>25</u> °C　　Humidity : <u>65</u> %

a)  Channel Low　　　 : Channel Bandwidth is 888 kHz
b)  Channel Middle　　: Channel Bandwidth is 884 kHz
c)  Channel High　　　: Channel Bandwidth is 892 kHz

*Note : The expanded uncertainty: frequency $\times 1.65 \times 10^{-6}$ (1 GHz $f \le 18$ GHz).*

## Channel Low
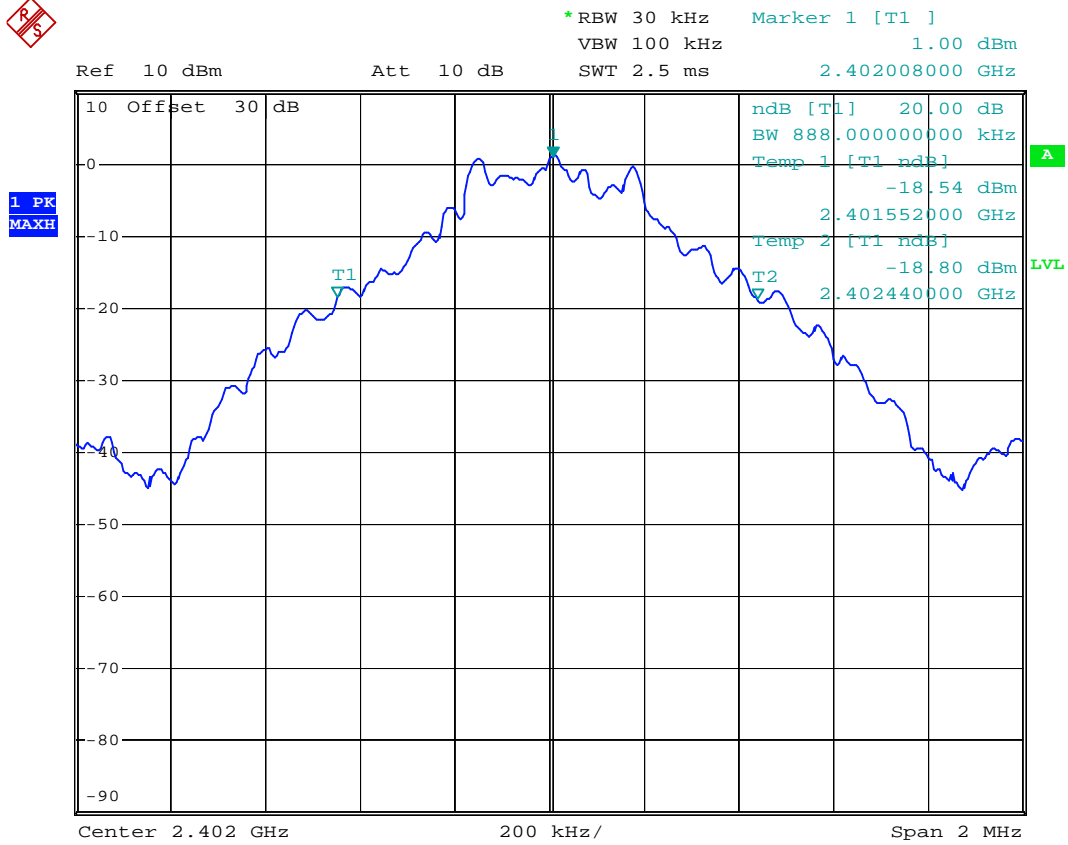


Date: 14.MAY.2013   09:11:21
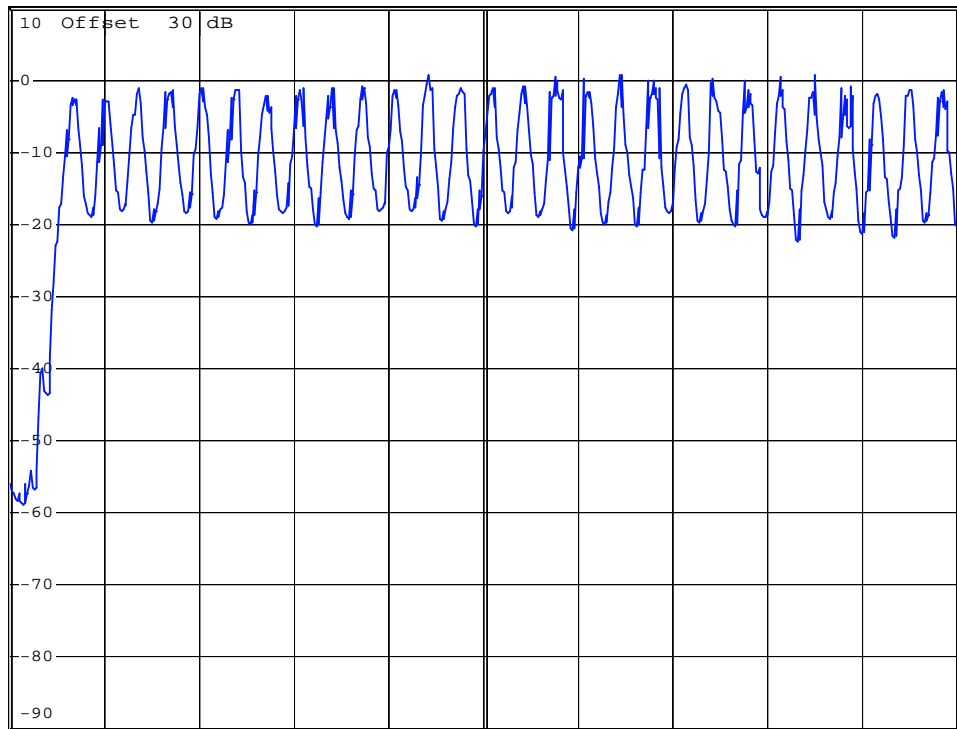
## Channel Middle



Date: 14.MAY.2013  09:13:15

## Channel High



```
                                    * RBW 30 kHz      Marker 1 [T1 ]
                                      VBW 100 kHz                  -0.32 dBm
        Ref  10 dBm          Att  10 dB    SWT 2.5 ms       2.480012000 GHz

        10 Offset  30 dB                   ndB [T1]      20.00 dB
                                           BW 892.000000000 kHz          A
          0                                Temp 1 [T1 ndB]
                                                         -20.60 dBm
                                                 2.479548000 GHz
        -10                                Temp 2 [T1 ndB]
                                                         -20.30 dBm     LVL
        -20                                T2  2.480440000 GHz

        -30

        -40

        -50

        -60

        -70

        -80

        -90
        Center 2.48 GHz            200 kHz/              Span 2 MHz
```
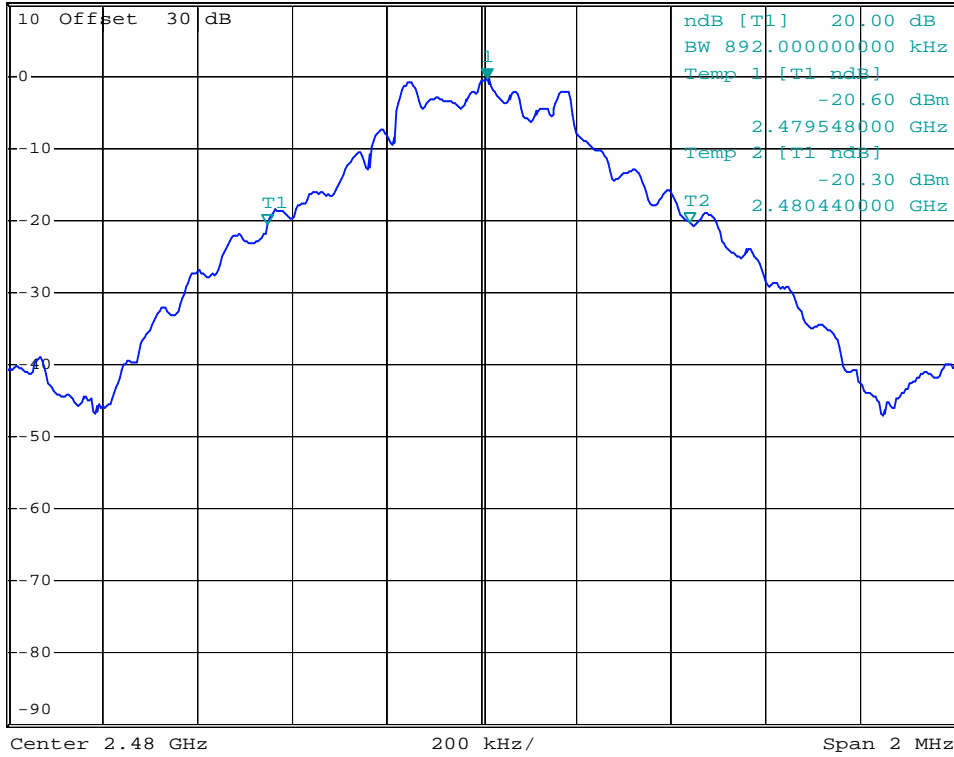
Date: 14.MAY.2013  09:16:50

## 10  DWELL TIME ON EACH CHANNEL

### 10.1  Standard Applicable

According to 15.247(a)(1)(iii), for frequency hopping system operating in the 2400-2483.5 band, the average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

### 10.2  Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. The EUT must have its hopping function enabled.
3. Use the following spectrum analyzer settings:
   Span = zero span, centered on a hopping channel
   RBW = 1 MHz
   VBW ≥ RBW
   Sweep = as necessary to capture the entire dwell time per hopping channel
   Detector function = peak
   Trace = max hold
4. Use the marker-delta function to determine the dwell time. Plot the result on the screen of spectrum analyzer.
5. Repeat above procedures until all frequencies measured were complete.

### 10.3  Measurement Equipment

| Equipment | Manufacturer | Model No. | Calibration Date | Next Cal. Date |
|-----------|--------------|-----------|------------------|----------------|
| Spectrum Analyzer | Rohde & Schwarz | FSP40 | 2012/12/07 | 2013/12/06 |
| Attenuator | Weinschel Engineering | 1 | N/A | N/A |

## 10.4  Measurement Data

Test Date  :  <u>May  14, 2013</u>      Temperature    : <u>25</u>  °C     Humidity  :  <u>65</u>  %

### Period = 0.4(seconds) x 79(channels) = 31.6 seconds

#### A.  DH1 Mode

The Bluetooth system hops at a rate of 1600 times per second. This means there are 1600 timeslots in one second. The DH1 data rate operates on a one-slot transmission and one-slot receiving basis. Thus there are 1600/(1+1) = 800 transmissions per second. In one period for each particular channel there are 10.13 x 31.6 = 320.1 times of transmissions.

    a)  Channel Low   : the dwell time is  0.460ms x 320.1   = 147.246   ms
    b)  Channel Middle : the dwell time is  0.460ms x 320.1   = 147.246   ms
    c)  Channel Hi    : the dwell time is  0.460ms x 320.1   = 147.246   ms

The maximum time of occupancy for a particular channel is 153.9ms in any 31.6 second period, which is less than the 400ms allowed by the rules; therefore, it meets the requirements of this section.

#### B.  DH3 Mode

The Bluetooth system hops at a rate of 1600 times per second. This means there are 1600 timeslots in one second. The DH3 data rate operates on a three-slot transmission and one-slot receiving basis. Thus there are 1600/(3+1) = 400 transmissions per second. In one period for each particular channel there are 5.06 x 31.6 = 159.9 times of transmissions.

    a)  Channel Low   : the dwell time is  1.74ms x 159.9   = 278.226   ms
    b)  Channel Middle : the dwell time is  1.74ms x 159.9   = 278.226   ms
    c)  Channel Hi    : the dwell time is  1.74ms x 159.9   = 278.226   ms

The maximum time of occupancy for a particular channel is 307.0ms in any 31.6 second period, which is less than the 400 ms allowed by the rules; therefore, it meets the requirements of this section.

#### C.  DH5 Mode

The Bluetooth system hops at a rate of 1600 times per second. This means there are 1600 timeslots in one second. The DH5 data rate operates on a five-slot transmission and one-slot receiving basis. Thus there are 1600/(5+1) = 266.7 transmissions per second. In one period for each particular channel there are 3.38 x 31.6 = 106.81 times of transmissions.

    a)  Channel Low   : the dwell time is 3.06ms x 106.81   = 326.8386 ms
    b)  Channel Middle : the dwell time is 3.06ms x 106.81   = 326.8386 ms
    c)  Channel Hi    : the dwell time is 3.06ms x 106.81   = 326.8386 ms

The maximum time of occupancy for a particular channel is 342.9ms in any 31.6 second period, which is less than the 400 ms allowed by the rules; therefore, it meets the requirements of this section.

*Note : The expanded uncertainty 1 μs.*

### Channel Low; DH1



```
                                    RBW 1 MHz      Delta 1 [T1 ]
                                   *VBW 1 MHz              -1.93 dB
  Ref  10 dBm        Att  10 dB     SWT 10 ms       460.000000 µs

  10 Offset  30 dB                         Marker 1 [T1 ]
                                                    -45.94 dBm        A
 -0                                          9.400000 ms            SGL

 1 PK*
 CLRWR
  -10                                                               LVL

  -20

  -30

  -40

  -50

  -60

  -70

  -80

  -90
  Center 2.402 GHz                           1 ms/
```

Date: 14.MAY.2013  09:55:24

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## Channel Middle; DH1

| | | RBW 1 MHz | Delta 1 [T1 ] |
|---|---|---|---|
| | | *VBW 1 MHz | -2.79 dB |
| Ref 10 dBm | Att 10 dB | SWT 10 ms | 460.000000 µs |

```
10  Offset   30 dB                          Marker 1 [T1 ]
                                                -47.60 dBm        A
 0                                              9.260000 ms      SGL
1 PK*
CLRWR
-10                                                              LVL

-20

-30

-40

-50

-60

-70

-80

-90
Center 2.441 GHz                    1 ms/
```
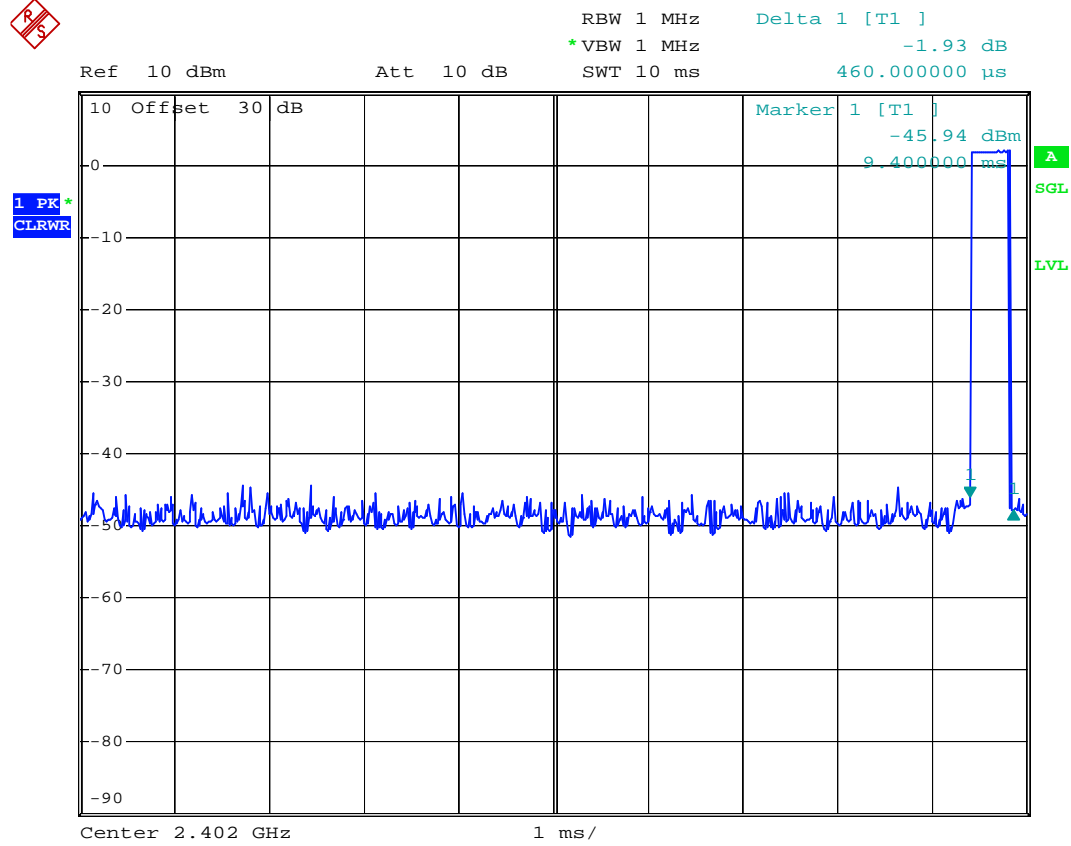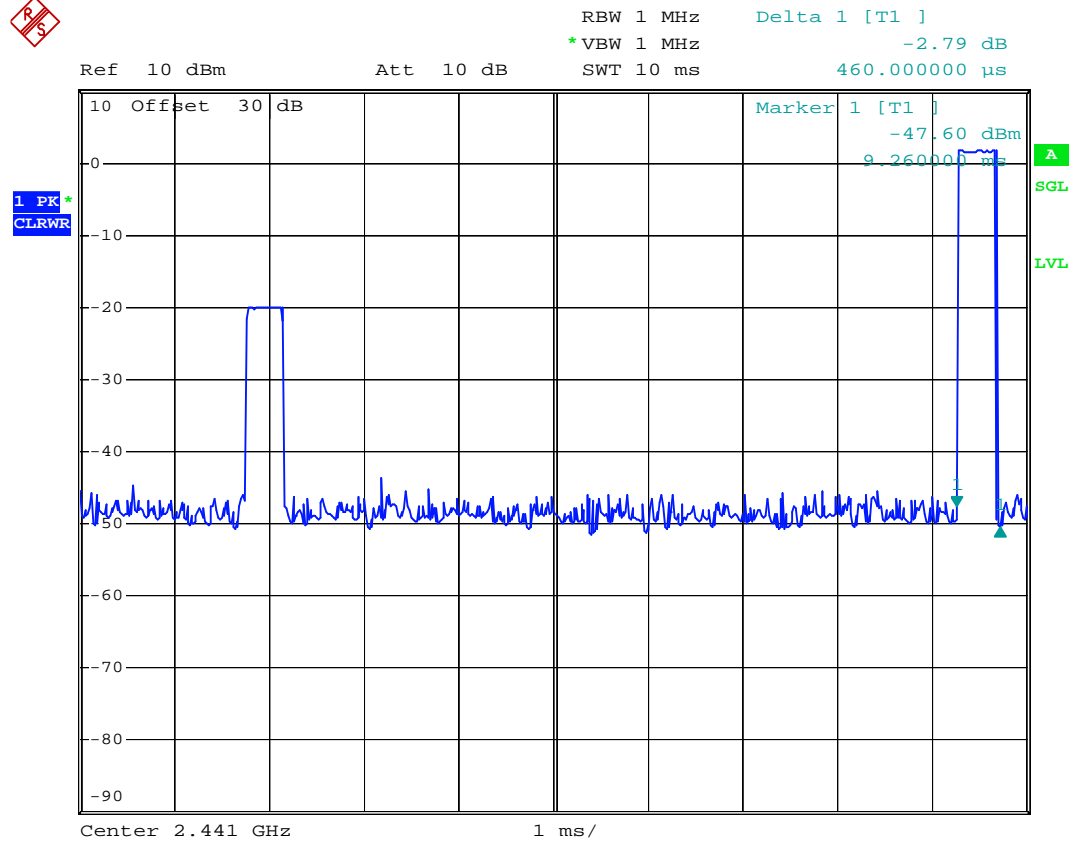
Date: 14.MAY.2013  09:57:11

Rev. No 2.1
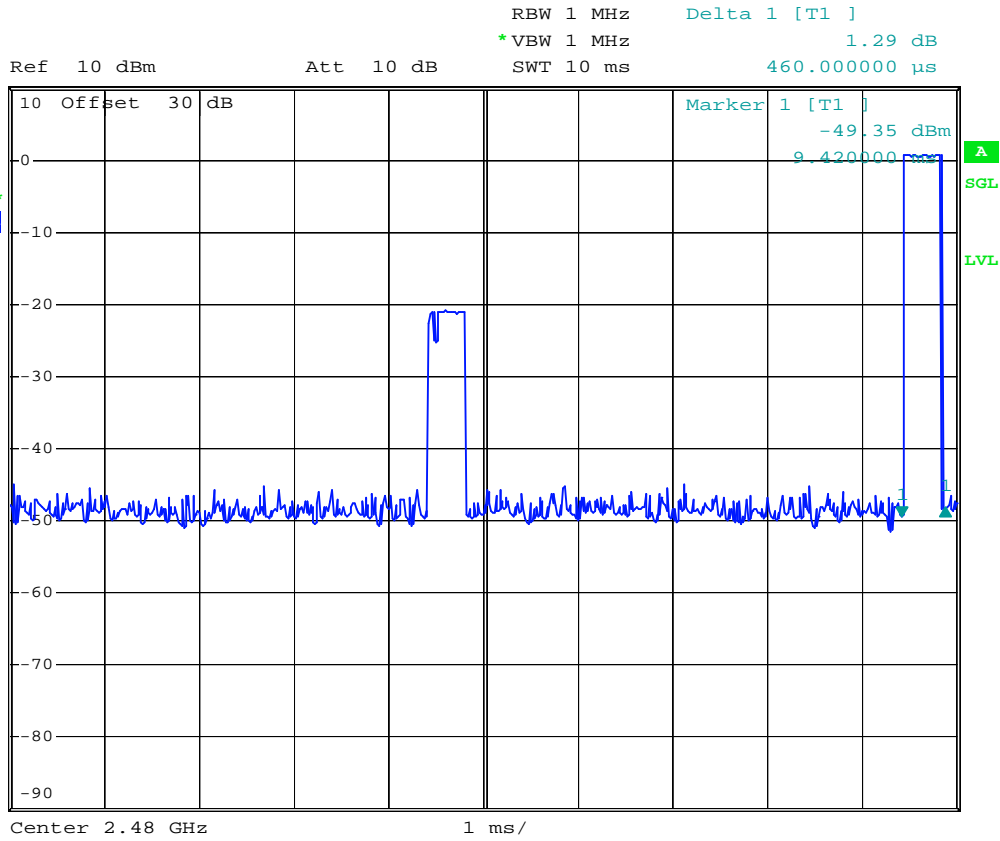
## Channel High; DH1



Date: 14.MAY.2013   09:58:20

## Channel Low; DH3



```
                                    RBW 1 MHz    Delta 1 [T1 ]
                                  * VBW 1 MHz              -2.10 dB
    Ref  10 dBm        Att  10 dB   SWT 15 ms          1.740000 ms

    10 Offset   30 dB                  Marker 1 [T1 ]
                                                    -47.73 dBm      A
    0                                               7.560000 ms    SGL
    -10                                                            LVL
    -20
    -30
    -40
    -50
    -60
    -70
    -80
    -90
    Center 2.402 GHz              1.5 ms/
```
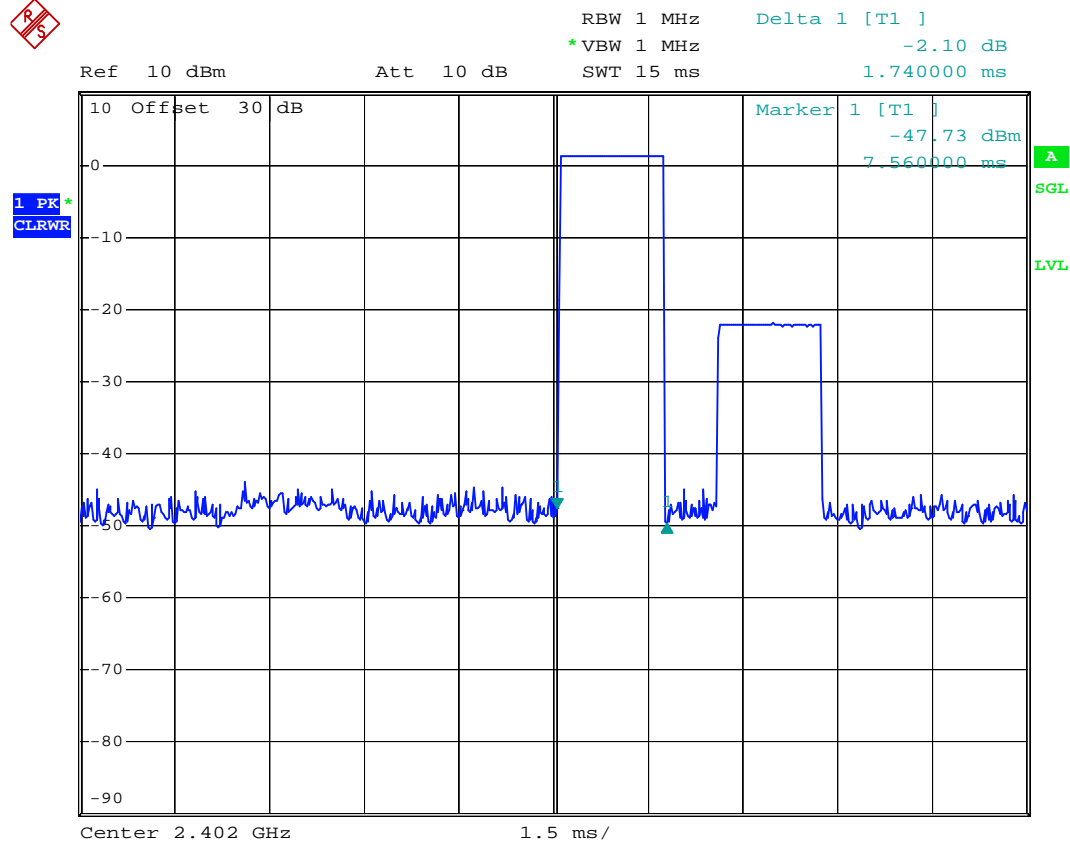
Date: 14.MAY.2013   09:42:38

### Channel Middle; DH3
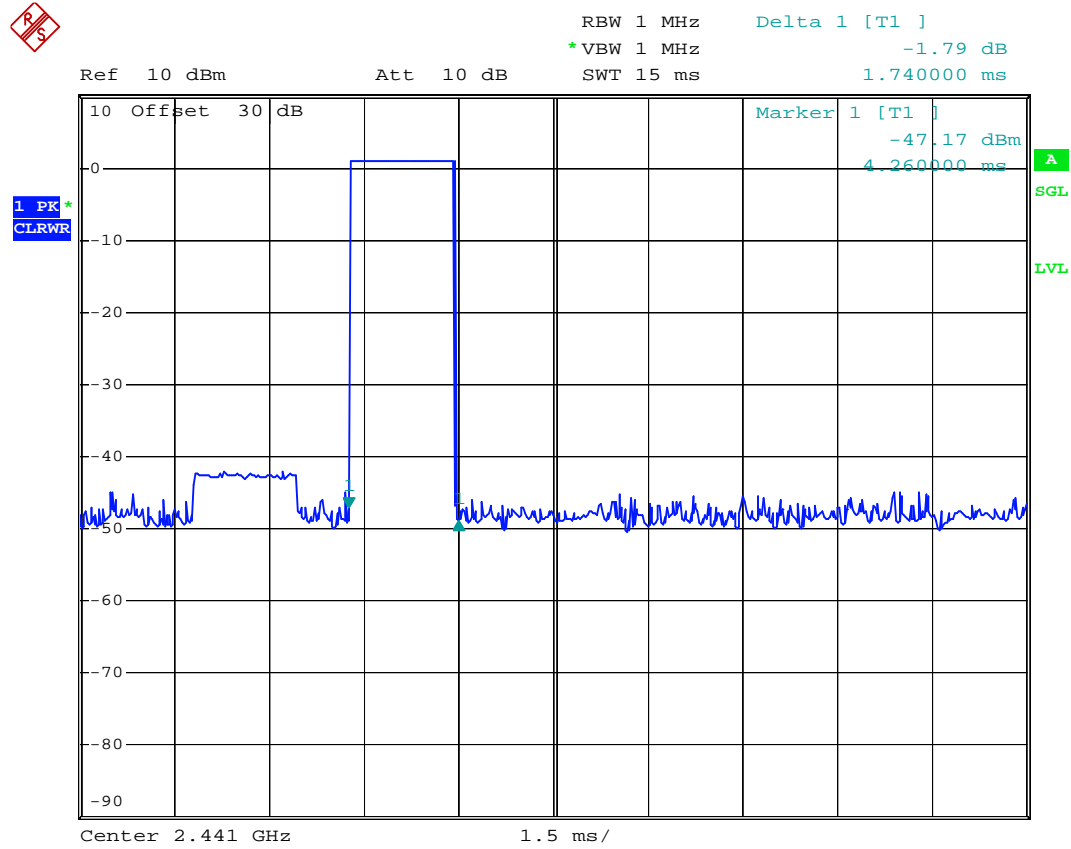


Date: 14.MAY.2013   09:43:45

## Channel High; DH3



| | | |
|---|---|---|
| RBW 1 MHz | Delta 1 [T1 ] | |
| *VBW 1 MHz | | 0.95 dB |
| Ref 10 dBm    Att 10 dB    SWT 15 ms | | 1.740000 ms |

Marker 1 [T1 ]
-48.32 dBm
2.760000 ms

Center 2.48 GHz                    1.5 ms/
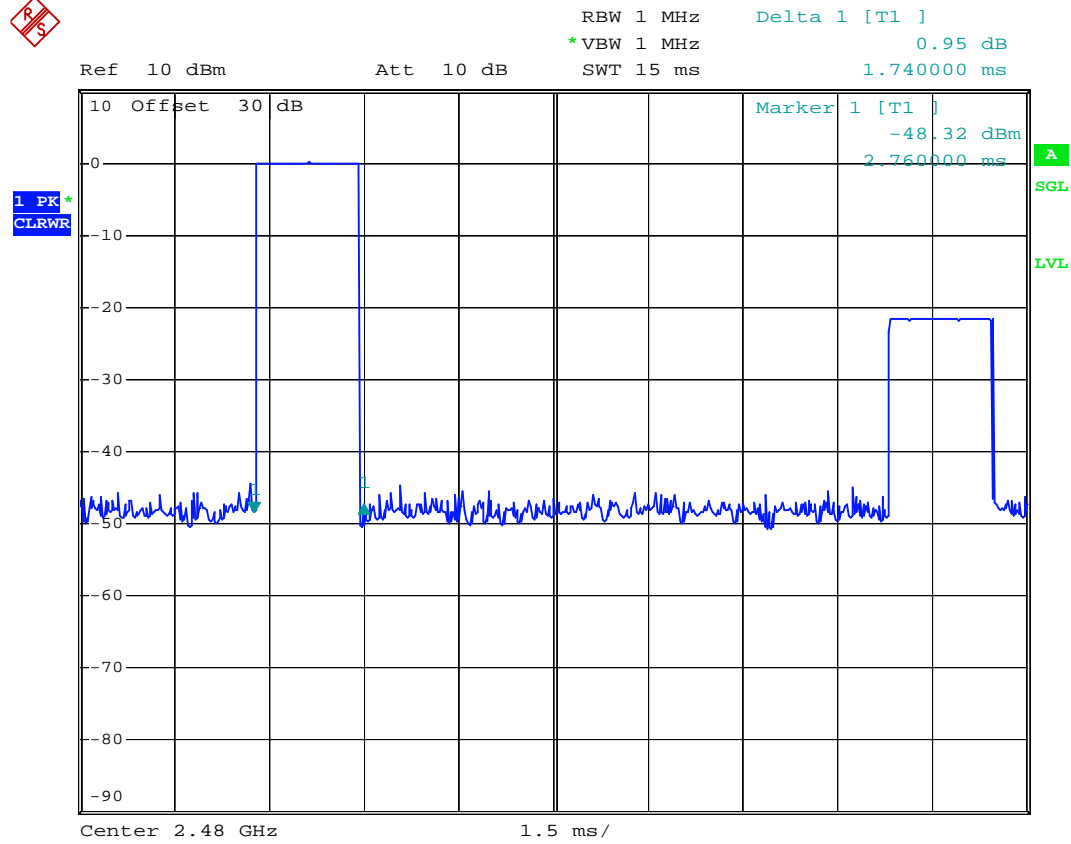
Date: 14.MAY.2013   09:45:03

## *Channel Low; DH5*
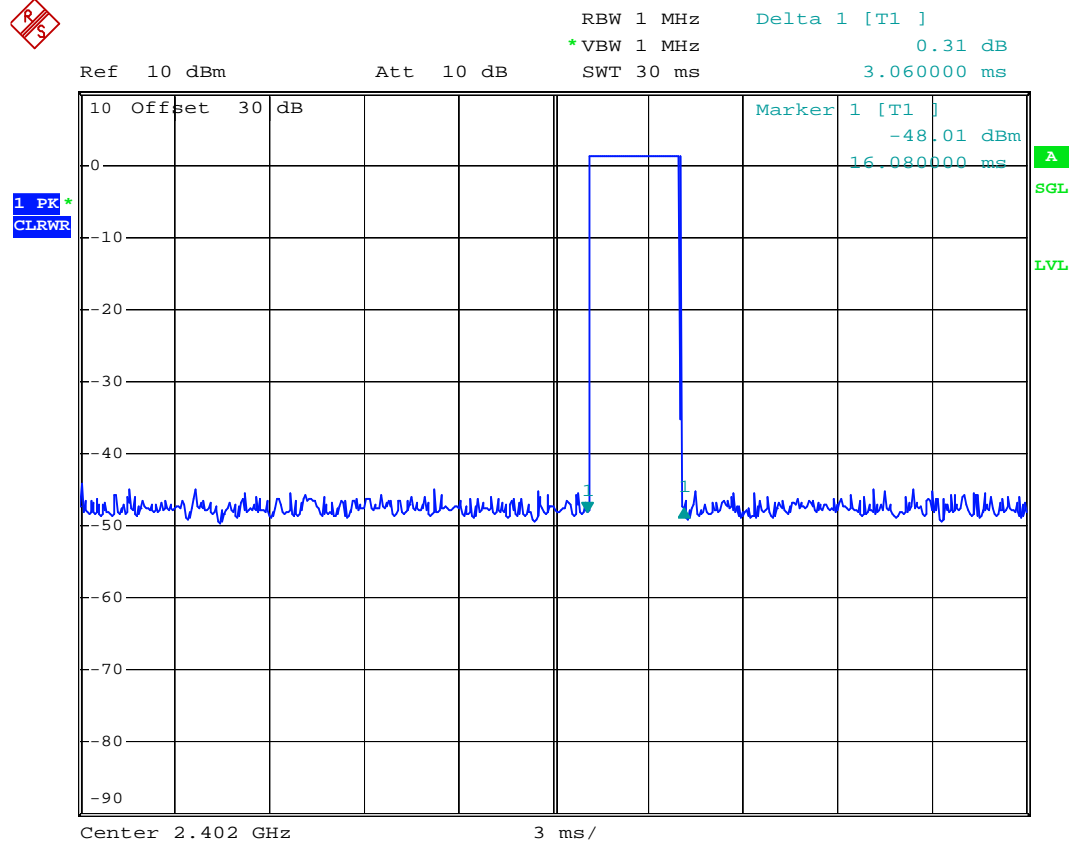


Date: 14.MAY.2013   09:32:26

## Channel Middle; DH5



```
                                    RBW 1 MHz     Delta 1 [T1 ]
                                   *VBW 1 MHz              -1.81 dB
   Ref  10 dBm         Att  10 dB   SWT 30 ms           3.060000 ms
```

Center 2.441 GHz                    3 ms/
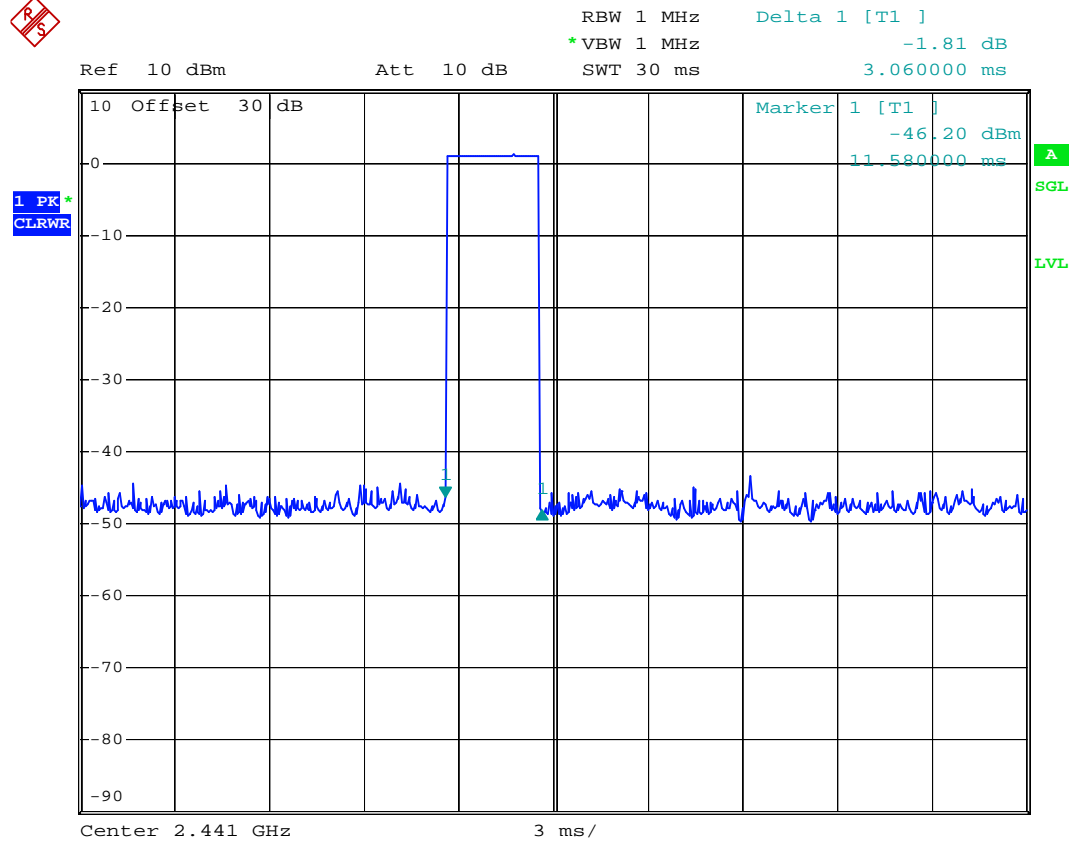
Date: 14.MAY.2013   09:33:30

### Channel High; DH5



```
                                    RBW 1 MHz      Delta 1 [T1 ]
                                  * VBW 1 MHz               -0.37 dB
       Ref   10 dBm        Att  10 dB  SWT 30 ms          3.060000 ms
```

Center 2.48 GHz                    3 ms/
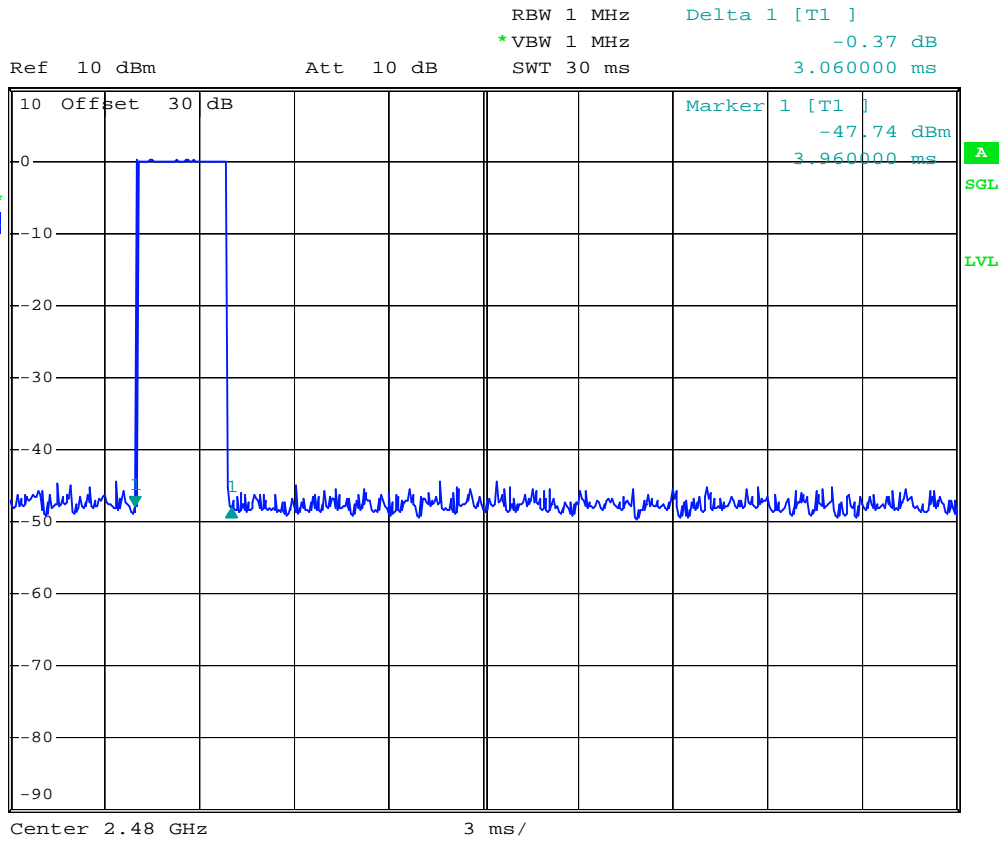
Date: 14.MAY.2013   09:34:38

# 11 OUTPUT POWER MEASUREMENT

## 11.1 Standard Applicable

According to 15.247(b)(1), for frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

## 11.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Use the following spectrum analyzer settings:
   Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
   RBW > the 20 dB bandwidth of the emission being measured
   VBW ≥ RBW
   Sweep = auto
   Detector function = peak
   Trace = max hold
4. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power. Plot the result on the screen of spectrum analyzer.
5. Repeat above procedures until all frequencies measured were complete.

## 11.3 Measurement Equipment

| Equipment | Manufacturer | Model No. | Calibration Date | Next Cal. Date |
|-----------|--------------|-----------|------------------|----------------|
| Spectrum Analyzer | Rohde & Schwarz | FSP40 | 2012/12/07 | 2013/12/06 |
| Attenuator | Weinschel Engineering | 1 | N/A | N/A |

## 11.4 Measurement Data

Test Date  : <u>May 14, 2013</u>     Temperature    : <u>25</u> °C    Humidity : <u>65</u> %

    a)    Channel Low        : Output Peak Power is    2.00 dBm = **1.585**     mW

    b)    Channel Middle     : Output Peak Power is    1.39 dBm = **1.476**     mW

    c)    Channel High       : Output Peak Power is    0.41 dBm = **1.099**     mW

*Note : The expanded uncertainty: 2dB.*

## Channel Low
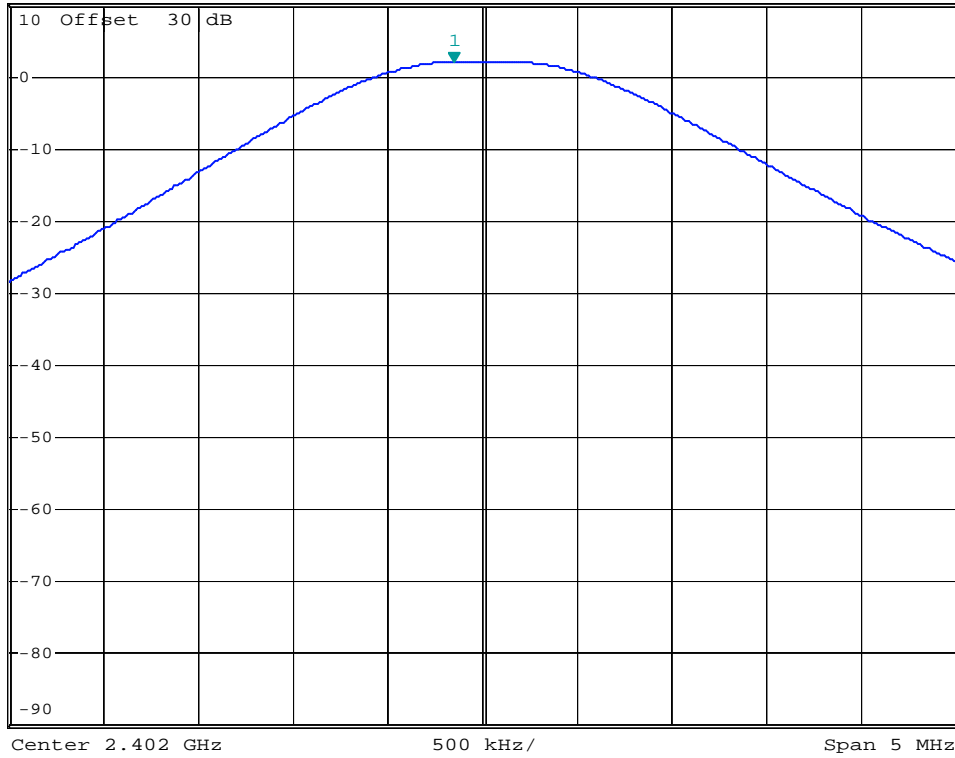


Date: 14.MAY.2013   09:10:36

### Channel Middle



```
                                    *RBW  1 MHz      Marker 1 [T1 ]
                                     VBW  3 MHz                1.69 dBm
        Ref  10 dBm        Att  10 dB   SWT 2.5 ms       2.441120000 GHz

        10 Offset  30 dB
1 PK
VIEW

        Center 2.441 GHz        500 kHz/              Span 5 MHz
```
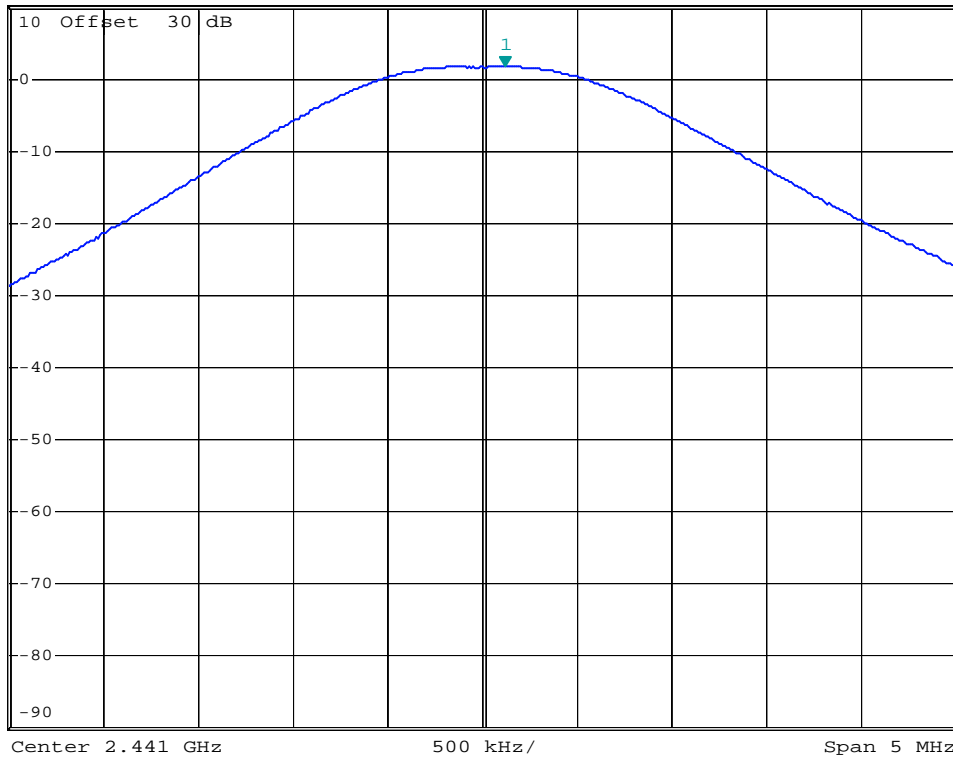
Date: 14.MAY.2013  09:12:51

## *Channel High*



```
                                              *RBW 1 MHz     Marker 1 [T1 ]
                                               VBW 3 MHz            0.41 dBm
        Ref  10 dBm            Att  10 dB      SWT 2.5 ms     2.480140000 GHz
```
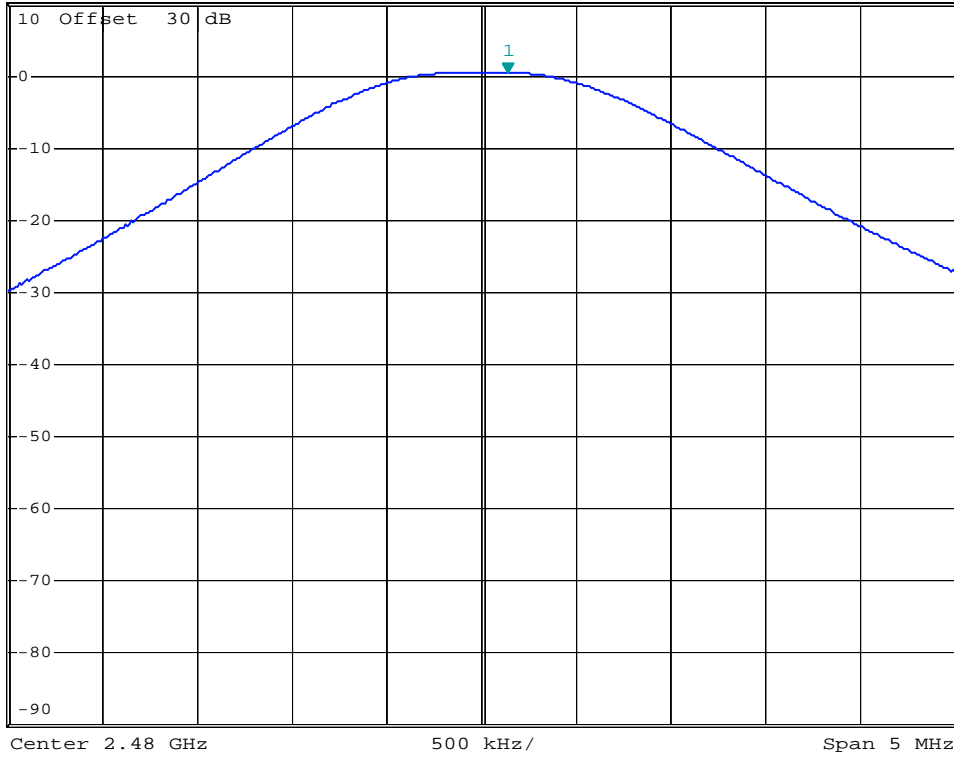
Center 2.48 GHz                    500 kHz/                      Span 5 MHz

Date: 14.MAY.2013  09:16:17

# 12  100 kHz BANDWIDTH OF BAND EDGES MEASUREMENT

## 12.1  Standard Applicable

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

## 12.2  Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation
   RBW ≥ 1% of the span
   VBW ≥ RBW
   Sweep = auto
   Detector function = peak
   Trace = max hold
4. Allow the trace to stabilize. Set the marker on the emission at the bandedge, or on the highest modulation product outside of the band, if this level is greater than that at the bandedge.  Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission. Plot the result on the screen of spectrum analyzer.
5.  Repeat above procedures until all measured frequencies were complete.

## 12.3  Measurement Equipment

| Equipment | Manufacturer | Model No. | Calibration Date | Next Cal. Date |
|---|---|---|---|---|
| Spectrum Analyzer | Rohde & Schwarz | FSP40 | 2012/12/07 | 2013/12/06 |
| Attenuator | Weinschel Engineering | 1 | N/A | N/A |

## 12.4  Measurement Data

Test Date  :  May  14, 2013        Temperature       : 25  °C     Humidity  : 65  %

a)  Lower Band Edge : All emissions in this 100kHz bandwidth are attenuated more than 20dB from the carrier.

b)  Upper Band Edge : All emissions in this 100kHz bandwidth are attenuated more than 20dB from the carrier.

*Note :  The expanded uncertainty: 2dB.*

## Lower Band Edge (Hoppin off)



```
                                        *RBW 100 kHz   Marker 1 [T1 ]
                                         VBW 300 kHz              -52.59 dBm
    Ref  10 dBm          Att  10 dB      SWT 2.5 ms        2.398100000 GHz
```

Start 2.393 GHz                    1 MHz/                    Stop 2.403 GHz

Date: 14.MAY.2013   09:21:56

## Upper Band Edge (Hoppin off)



```
                                    *RBW 100 kHz    Marker 1 [T1 ]
                                     VBW 300 kHz              -52.71 dBm
Ref  10 dBm          Att  10 dB     SWT 2.5 ms        2.484572000 GHz
```

Start 2.479 GHz                1 MHz/              Stop 2.489 GHz

Date: 14.MAY.2013   09:19:54

## Lower Band Edge (Hoppin on)



```
                                    *RBW 100 kHz    Marker 1 [T1 ]
                                     VBW 300 kHz              -51.84 dBm
       Ref  10 dBm          Att  10 dB    SWT 2.5 ms     2.399020000 GHz
```

Start 2.394 GHz                    1 MHz/              Stop 2.404 GHz

Date: 14.MAY.2013   09:24:04

Rev. No 2.1

### Upper Band Edge (Hoppin on)



| | |
|---|---|
| *RBW 100 kHz | Marker 1 [T1 ] |
| VBW 300 kHz | -51.40 dBm |
| SWT 2.5 ms | 2.484080000 GHz |

Ref 10 dBm     Att 10 dB

10 Offset 30 dB

02-B

Start 2.478 GHz     1 MHz/     Stop 2.488 GHz

Date: 14.MAY.2013  09:26:10

Rev. No 2.1

## 13  CONDUCTED SPURIOUS EMISSION MEASUREMENT

### 13.1  Standard Applicable

According to 15.247(c), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.

### 13.2  Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
   RBW = 100 kHz
   VBW ≥ RBW
   Sweep = auto
   Detector function = peak
   Trace = max hold.
4. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded. Plot the result on the screen of spectrum analyzer.
5. Repeat above procedures until all measured frequencies were complete.

### 13.3  Measurement Equipment

| Equipment | Manufacturer | Model No. | Calibration Date | Next Cal. Date |
|---|---|---|---|---|
| Spectrum Analyzer | Rohde & Schwarz | FSP40 | 2012/12/07 | 2013/12/06 |
| Attenuator | Weinschel Engineering | 1 | N/A | N/A |

## 13.4 Measurement Data

Test Date : <u>May 14, 2013</u>    Temperature    : <u>25</u> °C    Humidity : <u>65</u> %

**Mode : Low Channel**

a)  1 GHz to 26.5 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.

**Mode : Middle Channel**

a)  1 GHz to 26.5 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.

**Mode : High Channel**

a)  1 GHz to 26.5 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.
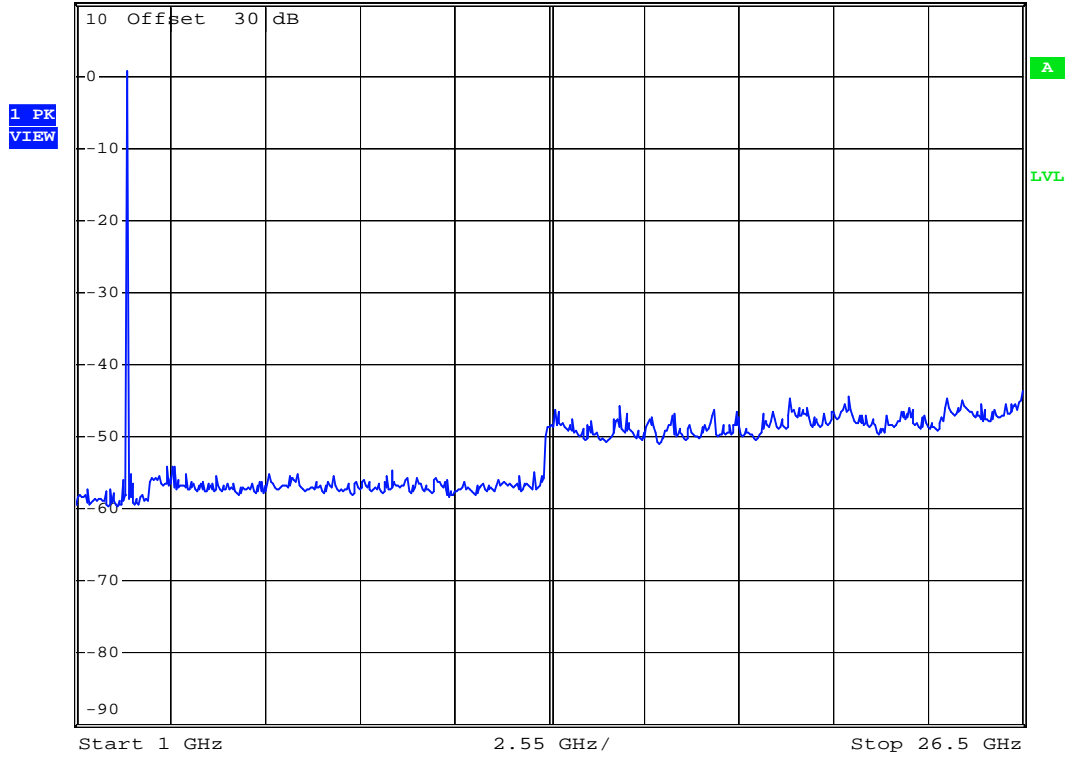
*Note :  The expanded uncertainty: 2dB.*

## Channel Low



```
                                          *RBW 100 kHz
                                          *VBW 1 MHz
   Ref  10 dBm            *Att  0 dB      SWT 2.6 s
```
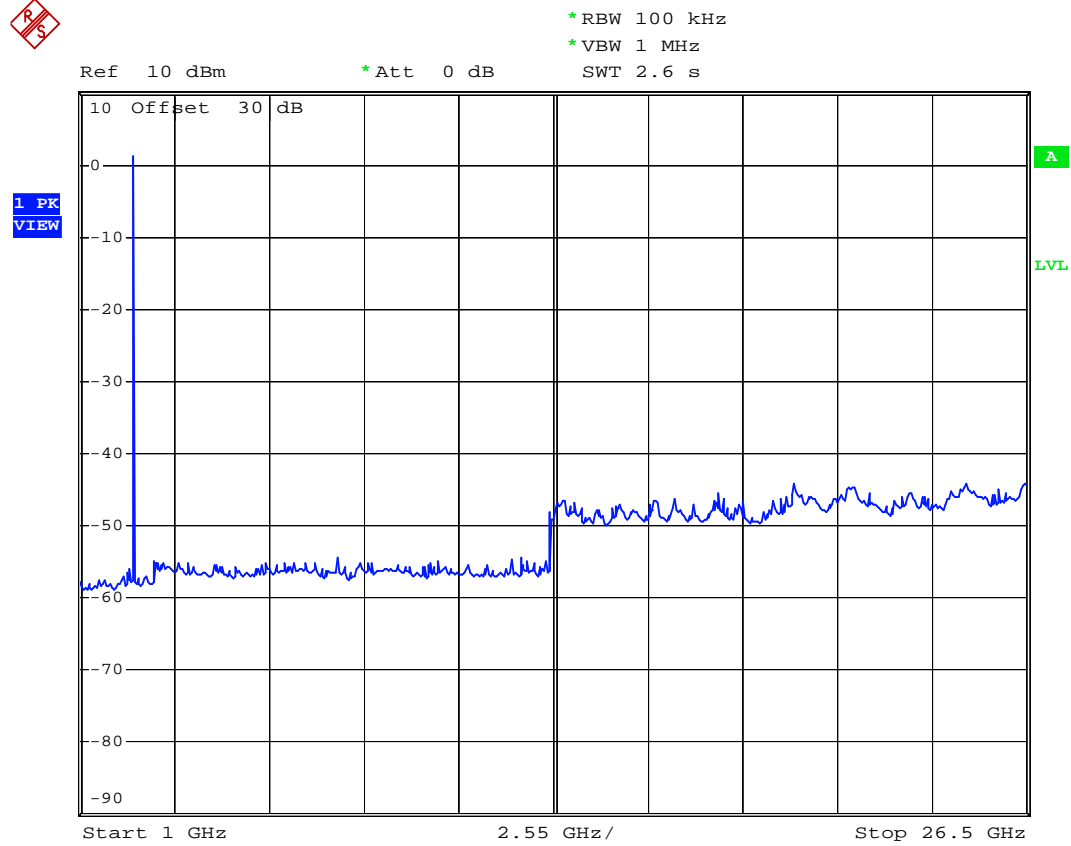
Date: 14.MAY.2013  13:33:22

## Channel Middle
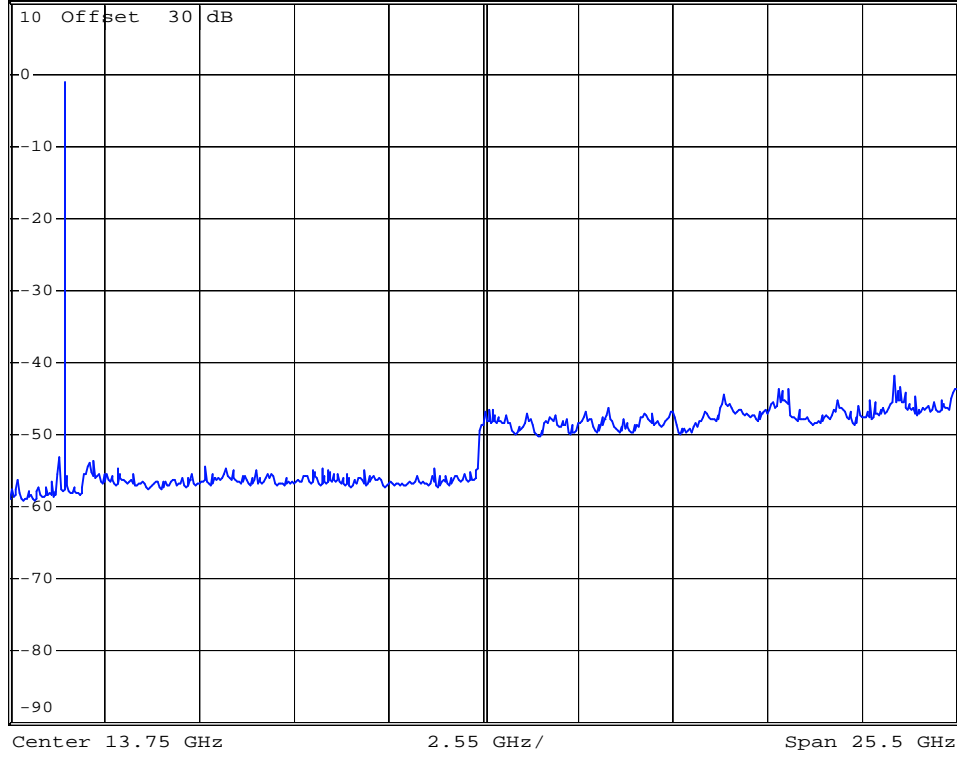


```
                                            *RBW 100 kHz
                                            *VBW 1 MHz
Ref  10 dBm              *Att  0 dB     SWT 2.6 s
 10 Offset  30 dB                                              A

1 PK
VIEW                                                          LVL



Start 1 GHz              2.55 GHz/           Stop 26.5 GHz
```

Date: 14.MAY.2013  13:35:11

### Channel High

```
                                      *RBW 100 kHz
                                      *VBW 1 MHz
  Ref  10 dBm          *Att  0 dB     SWT 2.6 s
```



```
  Center 13.75 GHz        2.55 GHz/         Span 25.5 GHz
```

Date: 14.MAY.2013  13:37:39