



| Date: | ESPOO 29.02.2008 | Page: <u>1 (39)</u> Appendices | | | | | |
|---|------------------|---|--|--|--|--|--|
| Number: No. 1 / 1 | 102639 | Date of handing in: 27.02.2008 Measured by: | | | | | |
| | | Timo Hietala, Test Engineer Reviewed by: | | | | | |
| SORT OF EC | QUIPMENT: | Timo Leismala, Test Manager WiMAX Base Station RF module | | | | | |
| MARKETING NAME: TYPE: MANUFACTURER: | | Nokia Siemens Networks Flexi WiMAX BTS RF module 2.5GHz FYRF Nokia Siemens Networks Oy | | | | | |
| FCC ID: CLIENT: ADDRESS: TELEPHONE | :: | VBNFYRF-01 Nokia Siemens Networks Oy P.O.Box 319, FI-90651 OULU, FINLAND +358 7180 08000 | | | | | |
| TEST LABOF FCC REG. N | RATORY: O. | NSN Oulu 411251 | | | | | |
| REFERENCE | Ξ: | FCC Part 27, SUBPART M | | | | | |

SUMMARY:

In regard to the performed tests the equipment under test fulfils the requirements defined in the test specifications, see page 4 for details

The test results are valid for the tested unit only. Without a written permission of Nemko Oy it is allowed to copy this report as a whole, but not partially.

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1. EUT and Accessory Information

1.1 EUT description

The EUT is a WiMAX Base station RF module 2.5 GHz with 2 power amplifier.

1.2 EUT and accessories

| Manufacturer: | Nokia Siemens Networks Oy |
|---------------|---------------------------------------|
| Model: | FYRF, s/n: K7080800004 |
| Other Units: | System module, FYSB, s/n: L9080100305 |

General:

All measurements are traceable to national standards.

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 27, Subpart M.

| $I \times I$ |
|--------------|
| $V \times$ |

New Submission

 \bowtie

Production Unit

Class II Permissive Change Pre-Production Unit

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE. **NONE**

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This report applies only to the items tested.

Summary of Test Data

| NAME OF TEST | SECTION IN CFR 47 | SPEC. | RESULT |
|--|------------------------|---------------------------|----------|
| RF Power Output | 27.50 (h), 2.1046 | 33 dBW+ 10log(X/Y) dBW | Complies |
| 99% Occupied Bandwidth | 2.1049, (i) | Unspecified | Complies |
| Spurious Emissions at Antenna Terminals | 27.53(l)(2)(6), 2.1051 | - 13 dBm | Complies |
| Field Strength of Spurious Emissions | 27.53(l)(2), 2.1053 | - 13 dBm E.I.R.P | Complies |
| Frequency stability | 27.54, 2.1055 | ± 0.05 ppm ¹⁾ | Complies |

Note ¹⁾ Limit is the manufacturer's specification

Measurement uncertainty is expressed to a confidence level of 95%.

| Page | 4 (39) |
|------|------------|
| rage | + (00) |
| Date | 29 02 2008 |
| Duio | 20.02.2000 |

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2. General Equipment Specification

| Supply Voltage Input: | 48 Vdc |
|--------------------------|---|
| Frequency Bands: TX: | 2583 – 2690 MHz Lowest tunable freq. 2588.000 MHz Middle freq. 2636.000 MHz Highest tunable freq. 2685.000 MHz |
| Frequency Bands: RX: | ∑ 2583 – 2690 MHz |
| Emission Designator: | WiMAX (10M0W7D) |
| Maximum No. of Carriers: | 1 |
| Output Impedance: | 50 ohms. |
| RF Power Output: | 43 dBm (20 W) conducted |
| Duty Cycle: | 1:1 to 3:1 |
| Duplex Mode: | Time Division Duplex (TDD) |
| Channel Bandwidth: | 10 MHz |
| Modulation: | QPSK 16QAM 64QAM |
| | |

System Description

Nokia Flexi WiMAX Base Station is based on WiMAX TDD (Time Division Duplex) system and is designed according to IEEE 802.16e-2005 radio access technology. This is a licensed base transceiver station and is designed for use with antennas that are fixed mounted on outdoor permanent structures.

Test setup

Nokia BTS Site Manager is used for the BTS's configuration. The AHTI is used for sending test model and PER measure messages.

Nokia BTS Site Manager has the following features:

- BTS set-up management (e.g. parameter settings, software downloading).
- BTS status monitoring.

The AHTI has the following features:

BTS Testing.

All RF tests were performed in normal temperature by repeating the Frequency Stability in environmental chamber.

Frequency Stability was performed also over a variation in the primary supply voltage 85 percent to 115 percent of the rated supply voltage at a temperature of 20° Celsius.

The test configurations were as close to normal intended use as possible. Cable connections were accordance with the instruction of the manufacturer.

Grounding of the equipment was performed in accordance with the guideline of the manufacturer.

All measurements were performed on the base station downlink signal, when having the base station transmitter active at maximum power level. For all tests test model 67075 was used.

Test model 67075

The WiMAX system protocol utilizes three modulations with various code rates.

Test model 67075 includes modulation types; QPSK, 16-QAM and 64-QAM. The code rate doesn't change the transmitted RF signal, therefore it's not necessary to measure all possible variations.

In Test model 67075 the modulation mode is switched continuously at maximum speed permitted by the system and all the supported modulation schemes are used. Test model 67075 duty cycle was 60%.

Test model 67075 has been specified worst case frame structure and the information presented in this test report is believed to represent a worst case scenario.



Figure TX test setup

The BTS under test (System Module + RF Module) was DC powered and configuration of 1 carrier which rated output power is 20W, 1*1 20W.

The BTS System Module contains the Transport functional block (Transport Sub-module), the Control & Clock functional block and the BB functional block, whereas the RF Module contains the RF functional block. For transmitter measurements, Signal Analyzer Rohde & Schwarz FSQ 26 with K93 WiMAX-option was used.

3. RF Power Output

| NAME OF TEST: RF Power Output | PARA.NO.: 27.50 (h) & 2.1046 |
|-------------------------------|------------------------------|
| TESTED BY: Timo Hietala | DATE: 27/02/2008 |

Test Results:

Complies.

Measurement Data: Refer to attached plot.

| Modulation Type | Frequency | Measured Output | |
|------------------|-----------|-----------------|-------|
| | (MHz) | Power | Power |
| | | (dBm) | (W) |
| Test model 67075 | 2588 | 43.27 | 21.23 |
| Test model 67075 | 2636 | 43.34 | 21.58 |
| Test model 67075 | 2685 | 43.20 | 20.89 |

Note: Test model 67075 includes modulation types; QPSK, 16-QAM and 64-QAM, duty cycle 60%

| Equipment used: | 11, 12, 17, 18 |
|-----------------------------|----------------|
| Measurement Uncertainty: | ± 0.7 dB. |
| Temperature: | 23 °C. |
| Relative Humidity: | 10 %. |

Test Data – RF Power Output

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| Data Plot | | | | R | F POW | ER OU | TPUT | | | | | |
|---------------------------|------------|----------|--|---------------------|--------------|--------------|----------|-------------|--------------|--------------|------------------------|--|
| Page <u>1</u> of <u>7</u> | | | | | | | | | Co | omplete x | | |
| Job No.: | 102639 |) | | | Date: | 27/02/2008 | _ | | Prelim | inary: | | |
| Specification: | PT27 | | | Temperat | ture (°C): | 23 | - | | | | | |
| Tested By: | Timo H | ietala | | Relative Hum | idity (%): | 10 | - | | | | | |
| E.U.T.: | WiMAX | TRANS | MITTER | | | - | - | | | | | |
| Configuration: | TX FUI | I POWE | FR BOTTOM C | HANNEI | | | | | | | | |
| Sample Number | | 1 | | | | | | | | | | |
| Location: | NET/IN | AN Oulu | | | | RBW/· | Refer to | nlots | Measur | ement | | |
| Detector type: | R | me | - | | | VBW/ | Refer to | | Die | tance: N/A | m | |
| Detector type. | | 1115 | - | | | VBVV. | | plots | DIS | | ''' | |
| Test Equipme | ent Used | <u>t</u> | | | Directio | nal Counler: | | | | | | |
| Antenna. Pro Amo: | | | - | | Directio | Coblo #1: | | | | | | |
| Filtor: | | | - | | | Cable #1. | | | | | | |
| Filler. | | 4 | _ | | | Cable #2: | | | | | | |
| Receiver: | | 1 | - | | | Cable #3: | | | | | | |
| Attenuator #1: | | 17 | — | | | Cable #4: | | | | | | |
| Attenuator #2: | | | _ | | | Mixer: | | | | | | |
| Additional equipr | ment use | d: | | | | | | | | | | |
| Measurement Ur | ncertainty | /: | ± 0.7 dB | | | | | | | | | |
| ® | | | | IEEE 80 | 2.16e-20 | 005 OFDM | Α | 1 | | | | |
| Frequency: 2.58 | 88 GHz | | | Signal Leve | I Setting: | 13.2 dBm | | Ref. Level | /Att: | 14.7 dBm / 3 | 2.8 dB | |
| NFT: 102 | 4 | | | Sweep Mod | e: | Continuot | is | I rigger Mo | de / Unset: | Power/0 S | | |
| Zone / Seg: DL- | PUSC, I | D=A, Se | :g=0 | Modulation: | | ALL | | Zone Offse | et / Length: | 1/28 Symbol | S | |
| | | | | Adjacen | it Channel F | Power Relati | ve | | | | | |
| Channel | | E | 3andwidth | Sp | acing | | Lower | | | Upper | | |
| ТХ | | | 10 MHz | | | | | 43.15 dBm | | | | |
| Adjacen | t | | 10 MHz | 10 |) MHz | | -52.11 0 | βB | | -52.32 dB | | |
| Alternate | 1 | | 10 MHz | 20 |) MHz | | -57.41 0 | dΒ | -58.99 dB | | | |
| Alternate | 2 | | 10 MHz | 30 |) MHz | | -60.40 0 | βB | -60.48 dB | | | |
| Alternate | :3 | | | | | | | | | | | |
| Alternate | 4 | | | | | | | | | | | |
| Spectrun | nACP | | | | | RBW 100 | kHz | Marker | 1 | 23.4 c | lBm | |
| | | | | | | VBW 1 M | Hz | | | 2.588 (| GHz | |
| Ref | 14.7 dł | 3m | Att/EL | <u>20.00 / 5.00</u> | dB | SWT 2 s | r – | | Sweep | 1 | of 1 | |
| | | | | | | | | | | | | |
| - 38 | | | <u> </u> | | ω | 0 | | <u> </u> | | | | |
| - 20- | | | d1 | | 1 | | | cu1 | | | | |
| - 20- | | | | | | ····· | | | | | В | |
| - 18 | | | └─── | | | | | | | | | |
| | | | | | d1 | u1 | | | | | GAT | |
| | | 42 | ┟───┼┼ | | <u> </u> | | | | | 2 | | |
| | | 02 T | | | | | | | | 2 | TRG | |
| | | | | | | | | | | | LVL | |
| | | | | | | | | | | | | |
| -12 | | | d2 | | | | | 012 | | | | |
| -22— | | | | | _ | | | | | | | |
| | | | | manna | 4 | ~ | h | | | | u3 | |
| 32 | | | | | _ | | - min | | | | | |
| 40 | | | | | | | | | | | | |
| -42 | | d3 | | | | | | | a | 13 | | |
| 2552 719 | | 4 | <u>↓</u> | | 7 056 1 | /Hz/div | ļ | <u>Į </u> | | 2623 283 | U • MH z | |
| 2002.710 | | | | | | | | | | 02 | | |

Notes:

Test Data – RF Power Output

Nemko Oy, Finland

| Data | Plot | | | | | I | RF | POW | /ER | OU | TPUT | [| | | | | | |
|-----------------|---------------|------------------------------|-----------|-------------|-----|------------|--------------|-----------|----------------|---------------------|---------|-------|-----------------|-----------|------------|---------|---------------------------------------|----------------|
| Page <u>2</u> 0 | of <u>7</u> | | | | | | | | | | | | | | | Comp | ete <u>x</u> | _ |
| Job No.: | : | 102639 | Э | | | | | Date: | 27/02/ | 2008 | _ | | | | Pre | limina | y: | _ |
| Specifica | ation: | PT27 | | | | Tempe | eratu | ire (°C): | 23 | 3 | _ | | | | | | | |
| Tested E | By: | Timo H | lietala | | _ F | Relative H | umic | dity (%): | 1(|) | _ | | | | | | | |
| E.U.T.: | | WiMA> | TRANS | MITTER | | | | | | | | | | | | | | |
| Configur | ration: | TX FULL POWER CENTER CHANNEL | | | | | | | | | | | | | | | | |
| Sample | Number: | | 1 | | | | | | | | | | | | | | | |
| Location | n: | NET/I | MN Oulu | _ | | | | | | RBW: | Refer t | o plo | ots | | Meas | sureme | nt | |
| Detector | r type: | F | lms | _ | | | | | | VBW: | Refer t | o plo | ots | | 0 | Distanc | e: N/A | - ^m |
| Test Ed | <u>quipme</u> | nt Use | <u>d</u> | | | | | Diagoti | | | | | | | | | | |
| Antenna | 1: | | | _ | | | | Directi | onal Co | upier: | | | | | | | | |
| Pre-Amp | p: | | | _ | | | | | Cat | le #1: | | | | • | | | | |
| Filter: | | | | _ | | | | | Cat | ie #2: | | | | | | | | |
| Receive | r: | | 1 | _ | | | | | Car | le #3: | | | | • | | | | |
| Attenuat | tor #1: | | 17 | _ | | | | | Cat | ie #4: | | | | | | | | |
| Attenuat | tor #2: | | | _ | | | | | | vixer: | | | | | | | | |
| Addition | al equipn | nent use | ed: /' | + 0 7 dB | | | | | | | | | | | | | | |
| | | | | 20.1 08 | - | | | 160.0 | 0.05.0 | | A | | | | | | | |
| Eroguon | <u></u> | 4 6117 | | | | | | Sotting | 124 | dDm | A | De | FLO | | ++. | 120 |) dDm / 2.2 (| |
| Frequence N | 102 | | | | | Swoon M | odo | Setting: | - 13.0 | inuo | 16 | Re | . Le | wei / A | () Offered | 13.5 | 9 UBITI / 32.0 | 3 OB |
| Zone / S | ea. DI - | | D=A Se | 0=D | | Modulatio | ouc. | | | muot | 13 | 70 | ne (| Offset / | Length | 1/2 | B Symbols | |
| 20110 / 0 | ieg. DL i | 000,1 | 0-11,00 | <u>,g=0</u> | | Adiac | ent | Channel | Power | Relati | ve | 20 | | 5113017 | Length | . 172 | | |
| | Channel | | 6 | Bandwidth | | | Spa | cing | | | Lower | | | | | Up | per | |
| | ТХ | | | 10 MHz | | | | | | 43.26 dBm | | | | | | | | |
| ŀ | Adjacent | | | 10 MHz | | 10 MHz | | | | -55.00 dB -53.37 dB | | | | | | | | |
| A | Iternate | 1 | | 10 MHz | | 20 MHz | | | | -59.23 dB | | | | -58.69 dB | | | | |
| A | Iternate | 2 | | 10 MHz | | 30 MHz | | | | -60.75 dB | | | | | -60.66 dB | | | |
| A | Iternate | 3 | | | | | | | | | | | | | | | | |
| A | Iternate | 4 | | | | | | | | | | | _ | | | | | |
| 5 | spectrum | NACP | | | | | | | RBM | 100 | KHZ | | ма | irker 1 | | | 23.54 dBn | ה - |
| 6 | Ref | 139d | Зm | Att/FI | 21 | 0 00 / 5 (| 0 0 d | IB | V D VV SW/T | 2 5 | пи | | | S | ween | | 2.030 GH | 2 |
| ĺ | | 13.7 0 | | | | 0.0073.0 | Ī | | | 23 | [| | Π | 5 | | | 101 | * |
| | - 37 | | | | | | L (| <u></u> 0 | | <u>.</u> | | | | | | | | _∦∎ |
| | 07 | | | ď | 1 | | | | 1 | | | | cu1 | | | | | |
| | - 21 | | | | | | | · | · · · · · | | | | | | | | | |
| | - 17 | | | | | | | | | + | | | ╟ | | | _ | | |
| 1 RM | _ 7 | | | | | | cl | 1 | | du1_ | | | | | | | | GAT |
| CLRWR | ' | | d2 | | | | | | | | | | | | | cu2 | | TRG |
| | 3 | | | | | | | | | _ | | | ╟ | | _ | _ | | -H.v. |
| | 10 | | | | | | | | | | | | | | | | | |
| | 13 | | | d2 | 1 | | | | | | | | CU ² | 2 | | | | T |
| d | 3 -23- | | | | | | | | | | | | Ť | | _ | _ | | _ll cu3 |
| Ĭ | 33 | | | | L | | لمس | | | \square | mm | | LL. | | | | | 4 |
| | | ~~ | | | | | | | | | | | | · ···· | Jum | | · · · · · · · · · · · · · · · · · · · | |
| | 43 | | - d3 | | | | | | | + | | | ╞┼╴ | | | cu3 | | 1 |
| | 0000 - 12 | | - | | I | | I | 7 0-0 | | | | | Ц | | | - | | |
| | 2000.718 | IVIE | | | | | | 7.056 | ivir⊐z/al\ | | | | | | | | 201 1.282 IVI | Ľ |

Notes:

Test Data – RF Power Output

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| I ICHINO | Ο, | 1 mana |

| Data | a Plot | | | | | F | RF | PO | WER | | TPUT | Γ | | | | | | | |
|--------------------|-------------|----------------|------------|-----------|------|--|-------------|-----------|-------------|---------------|-----------|-----|-------|--------|---------|--------|---------|------------------------|-------------------------------|
| Page 3 | of <u>7</u> | | | | | | | | | | | | | | | С | omple | te <u>x</u> | - |
| Job No | .: | 102639 |) | | | | | Date | e: 27/0 | 2/2008 | | | | | | Prelin | ninary | : | _ |
| Specific | cation: | PT27 | | | | Tempe | ratu | re (°C): | | 23 | _ | | | | | | | | |
| Tested | By: | Timo H | ietala | | _ 1 | Relative H | umic | lity (%): | | 10 | | | | | | | | | |
| E.U.T.: | | WiMAX | TRAN | SMITTER | | | | | | | _ | | | | | | | | |
| Configu | uration: | TX FUI | L POW | ER HIGHES | T Cł | HANNEL | | | | | | | | - | | | | | |
| Sample | Number | : | 1 | | | | | | | | | | | - | | | | | |
| Locatio | n: | NET/II | MN Oulu | l | | | | | - | RBW: | Refer to | ор | lots | | Ν | leasur | remen | t | |
| Detecto | or type: | R | ms | _ | | | | | | VBW: | Refer to | о р | lots | - | | Dis | stance | : <u>N/A</u> | m |
| Test E | quipme | ent Use | <u>t</u> | | | | | | | | | | | | | | | | |
| Antenn | a: | | | _ | | | | Direc | ctional (| Coupler: | | | | | | | | | |
| Pre-Am | np: | | | _ | | | | | C | able #1: | | | | - | | | | | |
| Filter: | | | | | | | | | C | able #2: | | | | - | | | | | |
| Receive | er: | | 1 | | | | | | C | able #3: | | | | - | | | | | |
| Attenua | ator #1: | | 17 | | | | | | C | able #4: | | | | _ | | | | | |
| Attenua | ator #2: | | | | | | | | | Mixer: | | | | - | | | | | |
| Additio | nal equipr | ment use | d: | | | | | | | | | | | | | | | | |
| Measu | rement Ur | ncertainty | <i>ı</i> : | ± 0.7 dB | | | | | | | | | | - | | | | | |
| ¢\$ | | | | | | IEEE 8 | 302 | 2.16e- | 2005 | OFDM | A | | | | | | | | |
| Frequer | ncy: 2.68 | 85 GHz | | | | Signal Le | vel | Setting | : 14 | .1 dBm | 1 | R | ef. L | evel / | Att: | | 15.6 | dBm / 32.8 | dB |
| N _{FFT} : | 102 | 24 | | | | Sweep M | ode: | | Cc | ntinuou | JS | T | rigg | er Mo | de / O | ffset: | Powe | r/0 S | |
| Zone / S | Seg: DL- | PUSC, I | D=A, Se | eq=0 | | Modulatio | on: | | AL | L | | Z | one | Offse | t / Ler | ngth: | 1/28 | Symbols | |
| | | | | J | | Adiac | ent | Channe | Powe | r Relati | ve | | | | | 5. | | ., | |
| | Channel | | | Dondwidth | | | Cnc | | | ritoluti | Lour | | | | | | llor | or | |
| | | I | | | | | эра | cing | | | Lower | | | 4.2.4 | | | opp | | |
| | IX | | 1 | 10 MHz | | | • | | | | | | | 43.0 | 18 gBL | n | | | |
| | Adjacen | t | | 10 MHz | | | 10 | MHz | | | -51.57 (| dB | | | | | -49. | 77 dB | |
| / | Alternate | e1 | | 10 MHz | | | 20 | MHz | | | -58.29 | dB | | | | | -57. | 84 dB | |
| / | Alternate | 2 | | 10 MHz | | | 30 | MHz | | | -60.16 | dB | | | | | -60. | 23 dB | |
| / | Alternate | 93 | | | | | | | | | | | | | | | | | |
| | Alternate | 94 | | | | | | | | | | | | | | | | | |
| | Spectrun | mACP | | | | | | | RBW V BV | / 100 / 1M | kHz Hz | | M | arker | 1 | | | 23.39 dBm 2.685 GHz | 1 |
| | Ref | <u>15.6 dl</u> | 3m | Att/EL | 2 | 20.00/5.0 | <u>)0 c</u> | B | SWI | 2 s | | | | | Swee | р | | 1 of 1 | |
| | | | | | | | | | | | | | | | | | | | |
| | - 38 | | - | <u> </u> | + | | ۲Ľ | .0 I | + | | | | | | | | | | |
| | 20 | | | d | 1 | | | | 1 | | | | cu | 1 | | | | | |
| | _ 28 | | | | | | | · | | _ | | | | | | | | | B |
| | - 18 | | | | | | _ | | | | | | ╈ | | | | | | 1 |
| 1 RM | - 8 | | | | _ | | | | _ | _ cu1 | | | ++ | | | | | | GAI |
| CLRWR | | | d2 | | | | | | | | | | | | | cu | 2 | | TRG |
| | -2 | | + | | + | | - | | + | | | | ╉ | | | | | | ⁺ I ₁ √ |
| | | | 1 | | | | | | | | | | | | | | | | |
| | -12— | | 1 | | + | | | | 1 | | | | ++ | 0 | | | | | # |
| | -22- | | | d | 2 | | | | | | | | | 2 | | | | | 1 |
| C | d3 -22 | | | | | | mon | | | m | mm. | | | | | | | C | xu3 |
| | 32 | | | | ┥╍ | And the second s | <u> </u> | | _ | | | ~~~ | ┶╁╁ | | | | | | |
| | h | | | | | | | | | | | | | | | ~~~~ | | | ╢ |
| | -42- | | | | | | | | + | | - | | ╉ | | | | | | ╢ |
| | | | d3 | | | | | | | | | | | | | CL | 13 I | | 1 |
| | 26/0 710 | | • | • • • | • | | • | 7 054 | | | • | | -++ | | | | - | | -+- |
| | 2043.1 IC | | | | | | | 1.00 | | AI V | | | | | | | 2 | .1 20.202 111 | ∠ |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |

Notes:

| Data Plot | | | | | RF PC | WER (| יטכ | [PU | <u> </u> | | | | |
|---------------------------|----------------------|------------------|------------------|--------------------|--------------------|---|--------|--------------|-----------|-----------------|---|------------------|----------|
| Page <u>4</u> of <u>7</u> | | | | | | | | | | | Compl | ete <u>x</u> | |
| Job No.: | 102639 | | | | Da | ate: 27/02/2 | 800 | i. | | | Preliminar | y: | |
| Specification: | PT27 | | | Temp | erature (°C | c): <u>2</u> 3 | | | | | | | |
| Tested By: | Timo Hietala | | | Relative H | umidity (% | 5): 10 | | | | | | | |
| E.U.T.: | WIMAX TRA | NSMITTER | | | | | | | | | | | |
| Configuration: | TX FULL PO | WER HIGH | IEST C | HANNEL | | | | | | | | | |
| Sample Number: | 1 | | | | | | | | | | | | |
| Location: | NET/IMN Ou | ulu | | | | F | BW: | Refer | to plots | | Measureme | nt | |
| Detector type: | Rms | | | | | ١ | /BW: | Refer | to plots | | Distanc | e: <u>N/A</u> | m |
| Test Equipme | nt Used | | | | | | | | | | | | |
| Antenna: | | | | | Dir | ectional Cou | pler: | | | | | | |
| Pre-Amp: | | | | | | Cabl | e #1: | | | | | | |
| Filter: | | | | | | Cabl | e #2: | | | | | | |
| Receiver: | 1 | | | | | Cabl | e #3: | | | | | | |
| Attenuator #1: | 17 | | | | | Cabl | e #4: | | | | | | |
| Attenuator #2: | | | | | | N | lixer: | | | | | | |
| Additional equip | nent used: | | | | | | | | | | | | |
| Measurement Un | ncertainty: | ± 0.7 | dB | | | | | | | | | | |
| <i>®</i> € | | | | IEEE | 802.16€ | -2005 OI | DMA | 1 | | | | | |
| Frequency: 2.58 | 38 GHz | | | Signal Le | vel Settir | ng: 10 dF | ßm | | Ref. Le | evel / Att | : 20 d | Bm /34 | .2 dB |
| N=T: 102 | 4 | | | Sween M | ode: | Conti | ทนดมร | 5 | Triage | r Mode / | Offset: Powe | er / 0 S | |
| Zone / Sect DL | | Seq-0 | | Modulati | nn [.] | Δ11 | | | 7000 |)ffsot / L | enath: 1/20 | Symbols | |
| Conturo | Momon(| No of | Comple | | 01 | | | | | | Duffor Stort | 7 05 71 4 | |
| Capture | vietnory | Cantu | sample re Tim | es 3000 1e 50 m | 0 I S | Gate | Off | | i inte to | Capture Mark | er 1 | 7.00/14 50.90 | dBm |
| Ref 20 | 0 dBm | Att/El | | 20.00 | -) / 5.00 dl | B Zone/Sea | 10 (| 10) | | | | 30.77 |) s |
| | a di Mahara da da di | المغلب مبادلاتهم | | (Material d | All the set of | Line of the local states of the | | ارادر وروالا | | to and al | . All the set of | Allow and a | |
| | | | | | | | | | | | | | <u> </u> |
| | | | | | | | | | | | | - | A |
| | | | | | | | | | | | | _ | |
| | | | | | h . | | | | | | 1. | | TRG |
| hudt. | tus.te. | Under 1 | T I | d.HN. | M. Hka | N. M. K. | 1 | UNR | | ur. | H.M. | A MARKET | LVL |
| | ╶╎╢╢╢ | | | n, k h i | " − | | | | | •• • • | <u> </u> | <u> </u> | |
| | ╶┨╌┅┼╺╢─ | | | | ┍┌─┼╄┼ | | | | - | | | | |
| | | | | (m) (| | | | | | | | | |
| | | | | | | | | | | | | | |
| 0.0000 m | S | | | | 5.0 | 0000 ms⁄di∨ | | | | | | 50.0000 |) ms |
| Burst Sur | mmary | | | | | | | | | | | | |
| Zone/S | Segment II | D = A | | | | | | | | | | | |
| Frame | Burst 3 | ID Ty | pe | Modul | ation | No.of | Slc | ots | Powe | r[dBm] | EV | /M[dB] | |
| 1 | | 0 E | CH | | QPSK | | | 4 | | 43.07 | - | -43.96 | |
| 1 | | 1 N | IAP | | QPSK | | | 56 | | 43.28 | } - | -44.99 | |
| 1 | | 2 Da | ita | | QPSK | | | 60 | | 43.31 | | -41.25 | |
| 1 | | 3 Da | ita | | 16QAM | | | 36 | | 43.28 | 3 - | -42.42 | |
| 1 | | 4 Da | ita | | 16QAM | | | 42 | | 43.50 |) - | -42.83 | |
| 1 | | 5 Da | ita | | QPSK | | 1 | 68 | | 43.37 | - | -42.57 | |
| 1 | | 6 Da | ita | | 64QAM | | | 54 | | 43.02 | 2 - | -42.54 | |
| Overal | .1 | | | | | | 4 | 20 | | 43.26 | ; - | -42.80 | |
| 2 | | 0 E | CH | | QPSK | | | 4 | | 43.06 | - - | -44.35 | |
| 2 | | 1 N | IAP | | QPSK | | | 56 | | 43.28 | } - | -44.27 | |
| 2 | | 2 Da | ita | | QPSK | | | 60 | | 43.31 | | -41.61 | |
| Running | | | | | | | | | | | | | |
| Notes: | | | | | | | | | | | | | |

| Data Plot | | | | | RF PC | OWER | OU | TPU | <u> </u> | | | | |
|---------------------------|--------------|----------------|------------|--------------|-------------------|-------------|----------|-----------------|----------|------------|--------------|---------------|--------------|
| Page <u>5</u> of <u>7</u> | | | | | | | | | | | Comp | ete x | |
| Job No.: | 102639 | | | | Da | ate: 27/0 | 2/2008 | _ | | | Prelimina | y: | |
| Specification: | PT27 | | | Temp | erature (°C | C): | 23 | - | | | | | |
| Tested By: | Timo Hietala | | | Relative H | lumidity (% | 6): | 10 | _ | | | | | |
| E.U.T.: | WIMAX TRAN | SMITTER | | | | | | | | | | | |
| Configuration: | TX FULL POV | VER CENT | ER CH | HANNEL | | | | | | | | | |
| Sample Number: | 1 | | | | | | | | | | | | |
| Location: | NET/IMN Ou | lu | | | | | RBW: | Refer | to plots | | Measureme | nt | |
| Detector type: | Rms | | | | | | VBW: | Refer | to plots | | Distanc | e: <u>N/A</u> | m |
| Toot Equipmon | | _ | | | | | | | | | | | |
| Antenno: | it Used | | | | | reational C | | | | | | | |
| Pro Ame: | | | | | ווט | | | | | | | | |
| Filter: | | | | | | | | | | | | | |
| Filler: | 4 | | | | | Ca | able #2: | | | | | | |
| Receiver: | 1 | | | | | Ca | | | | | | | |
| Attenuator #1: | 1/ | | | | | Ca | | | | | | | |
| Attenuator #2: | | | | | | | Mixer: | | | | | | |
| Additional equipm | ent used: | | | | | | | | | | | | |
| Measurement Unc | certainty: | ± 0.7 c | IB | | | | | | | | | | |
| ® | | | | IEEE | 802.166 | e-2005 | OFDM | A | | | | | |
| Frequency: 2.636 | 5 GHz | | | Signal Le | evel Settir | ng: 9.2 | dBm | | Ref. Le | evel / Att | 19.2 | 2 dBm / 34 | 1.2 dB |
| NFFT: 1024 | | | | Sweep M | ode: | Со | ntinuou | S | Trigge | r Mode / | Offset: Pow | er/0S | |
| Zone / Seg: DL-P | USC, ID=A, S | Seg=0 | | Modulati | on: | AL | | | Zone C | Offset / L | ength: 1/28 | 3 Symbols | 5 |
| Capture M | emory | No of S | ample | es 5600 | 01 | | | | Time to | Capture | Buffer Start | 7.76786 | ό μs |
| | | Captur | e Time | e 50 ms | 8 | Gate | Off | | | Mark | ter 1 | 51.23 | dBm |
| Ref 19 | .2 dBm | Att/EI | | 20.00 | <u>) / 5.00 d</u> | B Zone/S | eg 10 (| (10) | | | | (| 0 s |
| | _hhilister | -labilitation- | | <u>ileda</u> | | | | | | <u></u> | | | — |
| <mark></mark> | _ | - | _ | | - | _ | | | | | | - | |
| <mark></mark> | _ | - | _ | | - | _ | | | | | | - | _ _ _ |
| <u>-</u> | - | - | _ | | - | _ | | | | | | - | |
| ul t- | | | — <u>"</u> | 1.4 | يقرر أرار | | | يا بي ال | iu | nd. | alte telle | the set | |
| | | | P | | ┉╨ | | -4 | Щ <u>щ</u> ица, | ╺───┛╹╢┙ | | ┛╢╌╫╢╏┼─── | ┛╫╫╢╴ | |
| | ╉╌╨┼╌ | | <u> </u> | Щ'∔— | ╻┽╨┷┿ | | | | | <u>e 1</u> | | <u>↓ " "</u> | |
| -7 | | ┛┫╾╌┥╾┶ | | | | | | <u> </u> | | | - | d | |
| - 15 - | | | | | | | | | | | <u> </u> | | |
| | | | | | | | | | | | | | |
| 0.0000 ms | | | | | 5.0 |)000 ms/d | iv | | | | | 50.000 | 0 ms |
| Burst Sum | mary | | | | | | | | | | | | |
| Zone/Se | egment II |) = A | | | | | | | | | | | |
| Frame | Burst I | D Ty | pe | Modul | ation | No.c | f Slo | ots | Power | r[dBm] | E | VM[dB] | |
| 1 | | 0 F | СН | | QPSK | | | 4 | | 43.26 | , , | -43.27 | |
| 1 | | 1 M | AP | | QPSK | | | 56 | | 43.45 |) | -44.08 | |
| 1 | | 2 Da | ta | | QPSK | | | 60 | | 43.49 |) . | -44.09 | |
| 1 | | 3 Da | ta | | 16QAM | | | 36 | | 43.48 | } . | -44.43 | |
| 1 | | 4 Da | ta | | 16QAM | | | 42 | | 43.68 | } . | -44.23 | |
| 1 | | 5 Da | ta | | QPSK | | - | 168 | | 43.55 |) | -44.66 | |
| 1 | | 6 Da | ta | | 64QAM | | | 54 | | 43.22 | 2 | -44.66 | |
| Overall | L | | | | | | 4 | 420 | | 43.45 | , | -44.18 | |
| 2 | | 0 F | СН | | QPSK | | | 4 | | 43.25 | ; . | -44.81 | |
| 2 | | 1 M | AP | | OPSK | | | 56 | | 43.45 | , . | -45.36 | |
| 2 | | 2 Da | ta | | OPSK | | | 60 | | 43.49 |) . | -42.92 | |
| Running | | | | | 2- 010 | | | | | | | | |
| Notes: | | | | | | | | | | | | | |

| Data Plot | | | | | VER OU | TPUT | | | |
|---------------------------|--------------|------------|------------|----------------------|-----------------|----------|-------------------|---|------------|
| Page <u>6</u> of <u>7</u> | | | | | | | | Complete x | _ |
| Job No.: 1 | 02639 | | | Date | 27/02/2008 | - | | Preliminary: | _ |
| Specification: P | T27 | | Tempe | erature (°C): | 23 | _ | | | |
| Tested By: T | imo Hietala | | Relative H | umidity (%): | 10 | _ | | | |
| E.U.T.: W | /iMAX TRANS | MITTER | | | | | | | |
| Configuration: T | X FULL POW | ER HIGHEST | CHANNEL | | | | | | |
| Sample Number: | 1 | | | | | | | | |
| Location: N | NET/IMN Oulu | | | | RBW: | Refer to | plots M | leasurement | |
| Detector type: | Rms | | | | VBW: | Refer to | plots | Distance: N/A | m |
| Test Equipment | llsod | _ | | | | | | | _ |
| Antenna: | 0000 | | | Direc | tional Coupler: | | | | |
| Pre-Amp: | | _ | | Direc | Cable #1: | | | | |
| Filtor: | | _ | | | Cable #1. | | | | |
| | 1 | _ | | | Cable #2. | | | | |
| | 17 | - | | | | | | | |
| Attenuator #1: | 17 | _ | | | Caple #4: | | | | |
| Attenuator #2: | | _ | | | Mixer: | | | | |
| Additional equipmer | nt used: | . 0 7 -10 | | | | | | | |
| weasurement Unce | rtainty: | ± 0.7 dB | - | | | | | | |
| 8 | | | IEEE | 802.16e- | 2005 OFDM | A | | | |
| rrequency: 2.685 | GHZ | | | ever Setting: | : 9.3 dBm | F | ker. Level / Att: | 19.3 dBm / 34.2 | ar ar |
| NFFT: 1024 | | | Sweep M | ode: | Continuou | s 1 | rigger Mode / Of | fset: Power/0S | |
| Zone / Seg: DL-PU | SC, ID=A, Se | eg=0 | Modulati | on: | ALL | Z | Zone Offset / Len | gth: 1/28 Symbols | |
| Capture Me | mory | No of Sam | oles 5600 | 01 | | Ti | me to Capture Bu | iffer Start 7.76786 μ | IS |
| | | Capture Ti | me 50 m | S | Gate Off | ·· | Marker | 1 50.95 d | Bm |
| Ref 19.3 | dBm | Att/EI | 20.00 |) / 5.00 dB | Zone/Seg 10 | (10) | | 2 0 | s T |
| This a | | | | | | | | inter de la contra d | |
| | _ | | | | _ | | | | |
| | _ | | | - | - | _ | | | |
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| (| t orte- | с. н. i.e | sat u | | | | - | that I during | |
| | | | | 7 7 1 1 | | | <mark></mark> | | |
| 2 | ╉┼╧╫╧┥ | ╘╹╧┛╏┥ | <u>шич</u> | ╟┼╵╎╵╎ | | | | | _ |
| -6 | - Luder | | | | A | · · | | | _ |
| 14 | | | | | | | | | |
| | | | | | | | | | |
| 0.0000 ms | | | | 5.000 | 00 ms/div | | | 50.0000 r | ns |
| Burst Summ | nary | | | | | | | | |
| Zone/Seg | gment ID | = A | | | | | | | |
| Frame | Burst II |) Type | Modul | ation | No.of Sl | ots I | Power[dBm] | EVM[dB] | |
| 1 | (|) FCH | | QPSK | | 4 | 43.24 | -43.87 | |
| 1 | 1 | L MAP | | QPSK | | 56 | 43.44 | -43.29 | |
| 1 | 2 | 2 Data | | QPSK | | 60 | 43.50 | -41.33 | |
| 1 | | B Data | | 16QAM | | 36 | 43.49 | -42.65 | |
| 1 | 4 | 1 Data | | 16QAM | | 42 | 43.68 | -41.87 | |
| 1 | 5 | 5 Data | | QPSK | | 168 | 43.54 | -42.86 | |
| 1 | 6 | 5 Data | | 64QAM | | 54 | 43.24 | -42.49 | |
| Overall | | - 2004 | | ~ | | 420 | 43.45 | -42.55 | |
| | | | | | | | | 12.00 | |
| 2 | (|) FCH | | QPSK | | 4 | 43.25 | -44.82 | |
| 2 | 1 | L MAP | | QPSK | | 56 | 43.44 | -45.12 | |
| 2 | 2 | 2 Data | | QPSK | | 60 | 43.49 | -41.24 | |
| Running | | | | ~ ` | | | | | |
| Notes: | | | | | | | | | |



| ta Plot | | | | JVVL | | | | JYUIC | | | |
|--|-------------------------|-----------|------------|--------------|--------------|--------------------------|---------------|--------------|-----------------|-------------------|------------|
| | <u>t</u> | | | | | | | | | | |
| <u>7</u> of <u>7</u> | - | | | | | | | | Cor | nplete <u>x</u> | |
| lo.: | 102639 | | | | Date: | 27/02/2008 | 3 | | Prelimi | nary: | |
| fication: | PT27 | | Temp | perature | (°C): | 23 | _ | | | | |
| d By: | Timo Hietala | | Relative H | Humidity | / (%): | 10 | | | | | |
| .: | WIMAX TRANS | SMITTER | | | | | · | | | | |
| guration: | TX FULL POW | ER CENTER | CHANNEL | | | | | | | | |
| le Number | r: 1 | | | | | | | | | | |
| ion: | NET/IMN Oulu | 1 | | | | RBW | : Refer to | olots | Measure | ment | |
| tor type: | Peak | _ | | | | VBW | /: Refer to | plots | Dista | ance: N/A | |
| Equipme | ent Used | | | | | | | | | | |
| ina: | | | | | Directi | ional Couple | r: | | | | |
| mp: | | | | | | Cable #1 | 1: | | | | |
| | | _ | | | | Cable #2 | 2: | | | | |
| iver: | 1 | | | | | Cable #3 | 3: | | | | |
| uator #1: | 17 | _ | | | | Cable #4 | 4: | | | | |
| uator #2: | | _ | | | | Mixe | r: | | | | |
| ional equip | ment used: | | | | | | | | | | |
| urement U | ncertainty: | ± 0.7 dB | | | | | | | | | |
| | | | | | | RBW 1 | MH 7 | Delta | 2 [m1 · | 1 | |
| • | | | | | | VBW 3 | MH 7 | Derta | L J [II . _3 | 87 dB | |
| Dof | 22 2 dBm | | * 7 + + 2 | ap 0 | | VDW 3 | MHZ 0 mg | | 2 014 | 5.07 UB | |
| Kei | 22.2 0.6.11 | 1 | ALL Z | <u>ив</u> | | SWI I | | | 2.010 | | |
| -20 | | | +eAtt 1 | ∲ dB | | | | Marke | r 1 [T1 |] | |
| | | | | | | | | | -45 | .14 dBm | |
| | | | | | | | | | 2.467 | 949 ms | A |
| 10- | الأراب الماريسي المرزان | h | | | <u>k i</u> l | | ا مىسىلىلىر ا | | 2 [Т1] | MU. | SG |
| * * | ************ | Mallehall | | | MMM | "WHAT WAR | NG MINING WA | | - 0 | .11 d ha n | |
| R | Male Analysis | | | | 1.1.1 | 1 1 1 1 1 1 1 1 1 | . հեռեն է է | 111 | 5.026 | 442 ms | |
| -0 | | | + | | | | | | | | |
| | | | | | | | | | | | |
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| 10- | | | | | | | | | | | |
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| 20 | | | | | | | | | | | |
| 20- | | | | | | | | | | | - |
| 20- | | | | | | | | | | | |
| 20- | | | | | | | | | | | EX |
| 20- 30- | | | | | | | | | | | EX |
| 20- 30- | | | | | | | | | | | EX 3D |
| 20- 30- | | | | | | | | | | | EX 3D |
| 20- 30- 40- | | 1 | | | | | | 2 | | | EX 3D |
| 20- 30- 40- | | | | | 3 | | | 2 | | | EX 3D |
| | | | | | 3 | | | 2 | | | EX 3D |
| | | | | | 5 | | | 2 | | alinala a | EX 3D |
| 20- 30- 40- | | | | | 3 | | | 2 | | alinada a | EX 3D |
| | | | | | 5 | | | 2 | | Pinty A | EX 3D |
| 20- 30- 40- 50- | | | | We dependent | 3 | | | 2 | | Pirty A | EX 3D |
| 20- 30- 40- 50- | | | | We dependent | 3 | | | 2 | | Pirty A | EX 3D |
| 20- 30- 40- 50- 60- | | | | We dependent | 3 | | | 2 | | Pintoj A | EX 3D |
| 20- 30- 40- 50- 60- | | | | | 3 | | | 2 | | Pintoj A | = EX 3D |
| 20- 30- 40- 50- 60- 70- | | | | | 3 | | | 2 | | Pinty P | EX 3D |

Notes: Tx duty cycle 60% ON 40%OFF

🔊 Nemko

4. 99% Occupied Bandwidth

| NAME OF TEST: Occupied Bandwidth | PARA.NO.: 2.1049, (i) |
|----------------------------------|-----------------------|
| TESTED BY: Timo Hietala | DATE: 27/02/2008 |

Test Results:

Complies.

Test Data:

See attached plot(s).

| | Frequency | Measured 99% |
|------------------|-----------|--------------------|
| Modulation Type | (MHz) | Occupied Bandwidth |
| | | (MHz) |
| Test model 67075 | 2636.0 | 9.143 |

Note: Test model 67075 includes modulation types; QPSK, 16-QAM and 64-QAM, duty cycle 60%

| Equipment used: | 1, 17 |
|-----------------------------|-----------|
| Measurement Uncertainty: | ± 0.7 dB. |
| Temperature: | 23 °C. |
| Relative Humidity: | 10 %. |



Test Data – 99% Occupied Bandwidth

Nemko Oy, Finland

| Data | Plo | <u>ot</u> | | | (| 99' | % Occu | pied Ba | an | dwic | lth | | | |
|-----------------|-------------|-----------|------------|-----------|--------|------------|---------------|--|------|---------|--|--------------------------------|---------------------|----------|
| Page <u>1</u> o | of <u>1</u> | | | | | | | | | | | C | Complete | x |
| Job No.: | | 10 | 2639 | | | | Date | e: 01/06/20 | 06 | | | Preli | minary: | |
| Specifica | ation: | PT | 27 | | | Tem | perature (°C) | : 23 | | | | | | |
| Tested E | By: | Ti | mo Hietala | | Rela | ative | Humidity (%) | : 10 | | | | | | |
| E.U.T.: | | W | IMAX TRAN | ISMITTER | | | | | | - | | | | |
| Configur | ration: | Tک | FULL POV | VER CENTE | R CHAN | NEL | | | | | | | | |
| Sample | Numbe | er: | 1 | | | | | | | | | | | |
| Location | n. | N | FT/IMN Ou | u | | | | | sw∙ | Refer t | o plots | Measu | irement | |
| Detector | r type: | | Rms | _ | | | | VE | BW: | Refer t | o plots | Di | stance: N/A | <u> </u> |
| Test Ec | quipn | nent (| Used | | | | | | | | | | | |
| Antenna | l: | | | | | | Dire | ctional Coup | ler: | | | | | |
| Pre-Amp | D : | | | | | | | Cable | #1: | | | | | |
| Filter: | | | | | | | | Cable | #2: | | | | | |
| Receive | r: | | 1 | | | | | Cable | #3: | | | | | |
| Attenuat | tor #1: | | 17 | | | | | Cable | #4: | | | | | |
| Attenuat | tor #2: | | | | | | | Mix | xer: | | | | | |
| Addition | al equi | pmen | t used: | | | | | | | | | | | |
| Measure | ement | Uncer | tainty: | ± 0.7 dE | 3 | | | | | | | | | |
| R | | | | | | | | * RBW 10 | 00 | kHz | Marke | er 2 [T1 |] | |
| V . | | | | | | | | * VBW 1 | MH | Iz | | -36 | 5.77 dBm | |
| | Ref | 47 | .1 dBm | | * Att | 2 | 0 dB | * SWT 50 | 00 | ms | | 2.618500 | 0000 GHz | |
| Í | | OFF | + 2 2 2 | 0 40 | 0744 | 0 | ЧЪ | | | | OBW | 9 142628 | 205 MH7 | |
| | | OLL | sel 32 | . 8 GB | eall | . 0 | ав | | | | Mowley | 9.142020 | 1 | |
| | -40- | | | | - | | | | | | Mark | |] | 2 |
| | | | | | | | | | | | | -36 | .// aBm | A |
| 1 PM * | | | | | | | | | | | _ | 2.618500 | 0000 GHZ | GAT |
| CLRWR | -30- | | | | | | | | | | Temp | 1 [TI OF | BW] | TRG |
| | | | | | | rr 1 | | | Т | 2 | | 21 | .36 dBm | LVL |
| | | | | | | <i>†</i> ∼ | man | +~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ | maP | | | 2.631400 | 641 GHz | |
| | -20- | | | | | | | | | | Temp | 2 [T1 OF | 3W] | |
| | | | | | | | | | | | | 22 | .56 dBm | |
| | | | | | | | | | | | | 2.640543 | 269 GHz | |
| | -10- | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
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| | -0 | | | | | | | | | | | | | |
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| | L 10 | | | | | | | | | | | | | 3DB |
| | -10. | | | | | | | | | | | | | |
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| | 20- | | | | | | | | | | | | | |
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| | 20- | | | | | | | | | Window | i | | | |
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| | mm | ~mMil | W M M | | | | | | | | •••••••••••••••••••••••••••••••••••••• | Men | man man man for the | |
| | 40- | | | | _ | | | | | | | | | |
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| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | Cent | er | 2.636 G | Hz | | | 3.5 1 | MHz/ | | | | Span | 35 MHz | |
| | | | | | | | | | | | | | | |
| L | | | | | | | | | | | | | | |

Notes:_____

5. Spurious Emissions at Antenna Terminals

| NAME OF TEST: | Spurious Emissions @ Antenna Terminals | PARA.NO.: 27.53(I), 2.1051 |
|-----------------|--|----------------------------|
| TESTED BY: Timo | Hietala | DATE: 27/02/2008 |

Test Results:

Complies.

Test Data:

See attached plots.

| Frequency | | Spurious Emission |
|-----------|------------------|--|
| (MHz) | Modulation | (dBm) rms det. |
| 321.109 | Test model 67075 | -23.11 |
| 7909.615 | Test model 67075 | -49.10 |
| All other | Test model 67075 | More than 20 dB below limit -13 dBm |

Lower Band Edge

| Frequency | | Peak Emission |
|-----------|------------------|----------------------|
| (MHz) | Modulation | Level (dBm) rms det. |
| 2583.000 | Test model 67075 | -25.28 |

Upper Band Edge

| | Frequency | | Peak Emission |
|-----------------------------|--------------|------------------------|----------------------|
| | (MHz) | Modulation | Level (dBm) rms det. |
| | 2690.000 | Test model 67075 | -24.93 |
| | | | |
| Equipment used | : 1, 2, 3, 4 | 4, 7, 8, 9, 12, 13, 14 | |
| Measurement Uncertainty: | ± 0.7 dE | 3. | |
| Temperature: | 23 °C. | | |
| Relative Humidity: | 10 %. | | |

Note: Test model 67075 includes modulation types; QPSK, 16-QAM and 64-QAM, duty cycle 60%

The spectrum was searched from 9 kHz to the 10th harmonic of the carrier.



Nemko Oy, Finland

| Data | Plo | <u>ot</u> | | <u>Spuri</u> | ous Emi | issic | ons | at Ante | enn | a Teri | ninals | | | | |
|-----------------|-------------|-----------|------------|--------------|------------|---------|---------|------------|-------------------|----------|--------|----------------|-----------------|-----|-----|
| Page <u>1</u> 0 | of <u>8</u> | | | | | | | | | | | Co | mplete | х | |
| Job No.: | | 10 | 2639 | | | | Date | : 27/02/2 | 800 | | | Prelim | inary: | | |
| Specifica | ation: | PT | 27 | | Temp | beratur | e (°C): | 23 | | | | | | | |
| Tested E | By: | Tin | no Hietala | | Relative H | Humidi | ty (%): | 10 | | - | | | | | |
| E.U.T.: | , | WI | MAX TRANS | SMITTER | | | , () | | | - | | | | | |
| Configur | ration. | тх | FULL POW | FRIOWEST | CHANNEL | | | | | | | | | | |
| Sample | Numb | or: 17 | 1 | | ONAMILE | | | | | | | | | | |
| Jacotion | inumb. | UI. | | | | | | - | | Deferte | nloto | Magaur | | | |
| Location | | INI | | <u> </u> | | | | ĸ | BVV: | Refer to | plots | Measure | ement | | |
| Detector | type: | | Rms | _ | | | | V | BW: | Refer to | plots | Dist | ance: N | I/A | m |
| Test Ed | quipn | nent l | Jsed | | | | | | | | | | | | |
| Antenna | : | | | | | | Direc | tional Cou | pler: | | | | | | |
| Pre-Amp | D: | | | _ | | | | Cable | e #1: | | | | | | |
| Filter: | | | | _ | | | | Cable | e #2: | | | | | | |
| Receive | r: | | 1 | | | | | Cable | e #3: | | | | | | |
| Attenuat | or #1: | _ | 17 | | | | | Cable | #4: | | | | | | |
| Attenuat | or #2: | | | _ | | | | М | ixer: | | | | | | |
| Addition | al equi | pment | used: | _ | | | | | | | | | | | |
| Measure | ement | Uncert | ainty: | ± 0.7 dB | _ | | | | | | | | | | |
| R | | | | | | | | * RBW | 100 | kHz | Marke | er 2 [T1 |] | | |
| N N | | | | | | | | * VBW | 100 | kHz | | -27 | 7.72 d | Bm | |
| | Ref | 52 | 4 dBm | | * A++ 20 | 0 dB | | * SWT | 2 5 | | | 2 582000 | 0000 G | Hz | |
| | | 55 | | 1 | 1.00 2. | | 1 | 5.11 | | | 1 | 1 | 1 | | |
| | -40- | Off | et 32 | 8 dB | | | | | _ | | Marke | <u>r 1 [T1</u> |] | | |
| | | | | | | | | | | | | -25 | .28 d | Bm | |
| | | | | | | | | | | | | 2.583000 | 000 G | Hz | A |
| | -30- | | | | | | | | | | | | | s | GL |
| 1 RM * | | | | | | | | | | | | | | G | JAT |
| CLRWR | | | | | | | | | ~ ~~ | ~~~~~ | | | | т | RG |
| | -20- | | | | | | | | _ | | | | $ \rightarrow $ | I | LVL |
| | | | | | | | | | | | | | | | |
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| | -10- | | | | | | | | _ | | | | | | |
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| | -0 | | | | | | | | _ | | | | | | |
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| | 10 | | | | | | | | _ | | | | | | |
| | | | D1 -13 (| 1Bm —— | | | | | _ | | | | | | NDB |
| | | | | | | | | | | | | | | Ĩ | |
| | 20 | | | | | | | | | | | | | | |
| | 20 | | D2 - | 23 dBm — | | | : | l | | | | | | | |
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| | 30 | | | hanne | umun | puth | m | | | | | | | | |
| | ~~~~ | _nmm | mm | | | | | | | | | | | | |
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| | | | | | | | F | ц | | | | | | | |
| | | | | | | | | | | | | | | | |
| | Cent | er | 2.583 GI | Hz | | 1 | 2.2 | MHz/ | | | | Span | 22 M | Hz | |
| | | | | | | | | | | | | | | | |

Notes: Tx 2588 MHz, LOWER BANDEDGE. RBW of 100kHz was used 1-11MHz from band edge and the limit was adjusted from -13dBm to -23dBm for compensate the reduced bandwidth.



Nemko Oy, Finland

| Data | Plo | ot | | <u>Spur</u> | ious E | missic | ons a | at An | tenn | a Tei | minals | <u>5</u> | | |
|------------|---------------------|--------|------------|-------------|---------|-------------|---------|-----------|---------|---------|---------|-----------|---------------|-----|
| Page 2 of | f <u>8</u> | | | | | | | | | | | C | omplete | x |
| Job No.: | | 10 | 2639 | | | | Date | : 27/02/ | /2008 | _ | | Prelir | ninary: | |
| Specificat | tion: | PT | 27 | | Т | emperatur | e (°C): | 23 | 3 | _ | | | | |
| Tested By | y: | Tir | no Hietala | | Relat | tive Humidi | ty (%): | 10 | 0 | - | | | | |
| E.U.T.: | | WI | MAX TRA | NSMITTER | | | | | | - | | | | |
| Configura | ation: | ТХ | FULL PO | WER HIGHE | ST CHAN | NEL | | | | | | | | |
| Sample N | Jumbe | -r. | 1 | | | | | | | | | | | |
| Location: | | NI | ET/IMN OI | du | | | | - | RBW. | Refer f | o nlots | Measu | rement | |
| Dotoctor t | tuno: | | | | | | | | 1/B/// | Pofor t | | Nicasu | stanco: N/A | m |
| Delector l | type. | | KIVIO | | | | | | V D VV. | Relefi | | Di | | 111 |
| Test Eq | uipm | nent l | Jsed | | | | | | | | | | | |
| Antenna: | | | | | | | Direc | tional Co | oupler: | | | | | |
| Pre-Amp: | | | | | | | | Cab | ole #1: | | | | | |
| Filter: | | | | | | | | Cat | ole #2: | | | | | |
| Receiver: | | | 1 | | | | | Cat | ole #3: | | | | | |
| Attenuato | or #1: | | 17 | | | | | Cat | ole #4: | | | | | |
| Attenuato | or #2: | | | | | | | | Mixer: | | | | | |
| Additional | l equi | nment | used. | | | | | | | | | | | |
| Measuren | nent l | Uncert | ainty: | ± 0.7 dF | 3 | | | | | | | | | |
| Modouron | nont | oncon | anty. | 10.1 0 | | | | | | | | | | |
| R | | | | | | | | * RBW | 100 | kHz | Marl | ser 2 [T] | 1 | |
| MS/ | | | | | | | | * VBW | 100 | געי | FIGE 1 | -2' | , 7 17 dBm | |
| | of | 52 | 1 dPm | | * 7++ | 20 dB | | * CMT | 2 9 | 14112 | | 2 691000 | | |
| | (ET | 52 | . 4 0.000 | | ALL | 20 0.8 | | SWI | 2 5 | | | 2.091000 | JOOU GHZ | 2 |
| – | 50- | Off | set 3 | 2 8 dB | | | | | | | Marl | cer 1 [T1 |] | |
| | | | | | | | | | | | | -24 | .98 dBm | |
| | | | | | | | | | | | | 2.69000 | 000 GHz | A |
| ŀ | 40- | | | | | | | | | | | | | SGL |
| 1 RM * | | | | | | | | | | | | | | GAT |
| CLRWR | | | | | | | | | | | | | | TRG |
| - | 30- | | | | | | | | | | | | | LVL |
| | | _ | | | | | | | | | | | | |
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| | 20- | 1 | | | | | | | | | | | | |
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| | 10- | | | | | | | | | | | | | |
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| Ι Γ | -0 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | 3DB |
| | 10- | | | | | | | | | | | | | |
| | -10 | | D1 -13 | d Bm | | | | | | | | | | |
| | | | | 1 | | | | | | | | | | |
| | -20 | | | | | | | | | | | | | |
| | | | D2 | -23 dBm | | | | | | | | | | |
| | | | | | | | L | ~~~ | | | | | | |
| <u>~</u> | سس ے -30- | | | | | | | *** | m | ······ | | | | |
| | | | | | | | | | | | min | -from man | minan | |
| | | | | | | | | | | | | | | |
| L | 40- | | | | | | | - F2- | | | | | | |
| | 10 | | | | | | F1 | . | | | | | | |
| | | | | | | | | | | | | | | |
| | Cent | er | 2.69 G | Hz | | 5 | 2.2 M | Hz/ | | | | Span | 22 MHz | - |
| | | | | - | | - | | , | | | | 0rail | 2 | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |

Notes: Tx 2685 MHz, UPPER BANDEDGE . RBW of 100kHz was used 1-11MHz from band edge and the limit was adjusted from -13dBm to -23dBm for compensate the reduced bandwidth.

Distance: N/A m

3DB

mana

Stop 1 GHz

-: -4 .: E 4 D

| Nemko | o Oy, F | inland | d d | | | | | | | | | | | | |
|--------------|-------------|-----------|--------|------------|----------|----------|------------|--------------|------------|------------|--------|-----------|---------|------|-----|
| Data | Plot | | - | <u>Spu</u> | irious I | Emise | sions | at Ante | nn | a Tern | ninals | | | | |
| Page 3 | of <u>8</u> | 400000 | | | | | | 07/00/00 | | | | C | omplete | | X |
| Job No.: | : | 102639 |) | | | - | Dat | e: 27/02/20 | 800 | - | | Prelir | ninary: | | |
| Specific | ation: | P127 | | | Dala | i empera | ature (°C) | : 23 | | - | | | | | |
| | ву: | | | | Rela | tive Hur | niaity (%) | : 10 | | - | | | | | |
| E.U.T. | rotion: | | | | | | | | | | | | | | |
| Sampla | Numbor: | IAFUL | 1 | | | | | | | | | | | | |
| Location | | NET/I | | | | | | | R1\\/∙ | Refer to r | nlots | Measu | rement | | |
| Detector | r type: | REI/II | MS | - | | | | 1/6 | 3₩. 3₩. | Refer to | | Die | stanco. | Ν/Δ | |
| Delecto | r type. | | IVIO | _ | | | | VL | JVV. | Refer to | 01013 | Di | stance. | 11/7 | |
| Test E | quipme | nt Used | d | | | | | | | | | | | | |
| Antenna | a: | | | _ | | | Dire | ctional Coup | oler: | | | | | | |
| Pre-Am | p: | | | _ | | | | Cable | #1: | | | | | | |
| Filter: | | | | _ | | | | Cable | #2: | | | | | | |
| Receive | er: | | 1 | _ | | | | Cable | #3: | | | | | | |
| Attenuat | tor #1: | | 17 | _ | | | | Cable | #4: | | | | | | |
| Attenuat | tor #2: | | | _ | | | | Mi | xer: | | | | | | |
| Addition | al equipn | nent use | d: | | | | | | | | | | | | |
| Measure | ement Un | certainty | /: | ± 0.7 d | B | | | | | | | | | | |
| R | | | | | | | | *RBW 1 | 00 | kHz | Marke | er 1 [T1 |] | | |
| XY - | | | | | | | | * VBW 1 | 00 | kHz | | -36 | 5.27 | dBm | |
| | Ref | 10.6 | dBm | | * Att | 30 c | lВ | *SWT 2 | s | | 32 | 24.715035 | 5256 1 | MHz | |
| | 10 O | ffset | 31. | 3 dB | _ | | | | | | Marke | r 2 [T1 |] | | |
| | | | | | | | | | | | | -37 | 1.66 0 | dBm | |
| | -0 | | | | | | | | | | | 1.000000 | 000 1 | MHz | A |
| 4 - D. C. A. | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| CHRWIC | 10 | | | | | | | | | | | | | | LVL |
| | | D1 | -13 d | .Bm — | | | | | | | | | | | |
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| | 20 | | | | | | | | | | | | | | |
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| | | | | | 1 | | | | | | | | | | |
| 1 | F | | | | | | | | 1 | | | | 1 | | |

Start 9 kHz

40

-50

-60**-**

-70-

-80

99.9991 MHz/

Notes: Tx 2636 MHz



Nemko Oy, Finland

| Data P | lot | <u>Spu</u> | rious Er | nissions | at Antenr | na Termina | als_ | | |
|---------------------------|-----------------|------------|-----------|------------------|-------------------|----------------|------------|-------------|-----|
| Page <u>4</u> of <u>8</u> | | | | | | | C | omplete | x |
| Job No.: | 102639 | | | Da | ite: 27/02/2008 | _ | Preli | minary: | |
| Specification | : PT27 | | Te | mperature (°C | :):23 | _ | | | |
| Tested By: | Timo Hietala | a | Relativ | e Humidity (% | b): 10 | _ | | | |
| E.U.T.: | WIMAX TRA | ANSMITTER | | | | | | | |
| Configuratio | n: TX FULL PO | OWER MIDDL | E CHANNEI | L | | | - | | |
| Sample Nun | ber: 1 | - | - | | | | - | | |
| Location: | NET/IMN C |)ulu | | | | Refer to plots | Measu | rement | |
| Detector typ | e: RMS | | | | VBW: | Refer to plots | Di | stance: N/A | A m |
| T (F) | | | | | | | • | | |
| Test Equip | oment Used | | | Dia | | | | | |
| Antenna: | | | | Dir | ectional Coupler: | | | | |
| Pre-Amp: | | | | | Cable #1: | | - | | |
| Filter: | | | | | Cable #2: | | - | | |
| Receiver: | 1 | | | | Cable #3: | | - | | |
| Attenuator # | 1:17 | | | | Cable #4: | | - | | |
| Attenuator # | 2: | | | | Mixer | : | | | |
| Additional ed | uipment used: | | | | | | _ | | |
| Measureme | nt Uncertainty: | ± 0.7 d | <u>B</u> | | | | | | |
| | | | | | *RBW 1 M | Hz Ma | rker 1 [T1 |] | |
| × Y | | | | | *VBW 1 M | Hz | -23 | .11 dBm | |
| Rei | 10.6 dBm | | * Att | 30 dB | *SWT 2 s | | 321.109266 | 026 MHz | |
| 10 | Offeet 3 | 1 3 dB | | 1 | 1 | Ma | rker 2 [T] | 1 | 1 |
| 10 | OIISEC 3 | | | | | 110 | -21 | , 24 dBm | |
| | | | | | | | 200 715025 | DEG MUR | A |
| -0- | | | | | | | 239.713033 | 230 MHZ | |
| 1 RM * | | | | | | | | | |
| махн | | | | | | | | | |
| 1 | 0 | | | | | | | | LVL |
| | DI -13 | авт — — | | | | | | | |
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| 4 | 0 | | | | | | | | |
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| 6 | 0 | | | | | | | | |
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| 7 | 0 | | | _ | | | | | |
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| 8 | 0 | | | | | | | | |
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| | | | | 1 | J | | | | |
| Ce | nter 321.67 | 01635 MH | Z | 5 N | MHz/ | | Span | 50 MHz | |
| | | | | | | | | | |
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Notes: Tx 2636 MHz



| <u>Data</u> | I Plo | <u>ot</u> | | Spuri | ous En | nissions | at Ante | nna | Termin | <u>als</u> | | | |
|-------------|-------------|-----------|-------------|-----------|----------|----------------|---------------|----------------|---------------|------------|--------------|----------|-----|
| Page 5 | of <u>8</u> | | | | | | | | | | Corr | plete x | |
| Job No.: | : | 10 | 2639 | | | Dat | te: 27/02/20 | 08 | | | Prelimin | ary: | |
| Specific | ation: | PT | 27 | | Ter | mperature (°C) |): 23 | | | | | | |
| Tested I | By: | Tin | no Hietala | | Relative | e Humidity (%) |): 10 | | | | | | |
| E.U.T.: | | WI | MAX TRANS | SMITTER | | | | | | _ | | | |
| Configu | ration: | TX | FULL POW | ER MIDDLE | CHANNEL | | | | | _ | | | |
| Sample | Numbe | er: | 1 | | | | _ | | | | | | |
| Location | ר: | N | ET/IMN Oulu | <u> </u> | | | RE | 3W: <u>R</u> e | efer to plots | _ | Measuren | nent | |
| Detector | r type: | | RMS | _ | | | VE | 3W: <u>R</u> e | efer to plots | - | Dista | nce: N/A | m |
| Test E | quipn | nent L | <u>Jsed</u> | | | | | | | | | | |
| Antenna | a: | | | _ | | Dire | ectional Coup | oler: | | | | | |
| Pre-Am | p: | | | _ | | | Cable | #1: | | - | | | |
| Filter: | | | - | _ | | | Cable | #2: | | _ | | | |
| Receive | er: | | 1 | | | | Cable | #3: | | _ | | | |
| Attenuat | tor #1: | | 17 | | | | Cable | #4: | | _ | | | |
| Attenuat | tor #2: | | | _ | | | Mi | xer: | | | | | |
| Addition | al equi | pment | used: | | | | | | | - | | | |
| weasure | ement | Uncert | anty: | ± 0.7 dB | _ | | | | | | | | |
| R R | | | | | | | *RBW | 1 MHz | 1 | Marker | 2 [Т1] |] | |
| XY . | | | | | | | * VBW | 1 MHz | | | -24. | .10 dBm | |
| | Ref | 41 | .7 dBm | | * Att | 10 dB | *SWT 2 | 2 s | | 2 | .9871794 | 187 GHz | |
| | - 10- | <u></u> | | | | | | | , | arter | 1 [77] . | 1 | 1 |
| | 40 | OIIS | set 33 | ав | PALL | 20 aB | | | 1 | Marker | ± [±±]. | 70 dpm | |
| | | | | | | | | | | 2 | 1 6246103 | | 2 |
| | -30- | | | | | | | | | 4 | 0340153 | SOS GHZ | A |
| 1 RM * | | | | | | | | | | | | | |
| CLRWR | | | | | | | | | | | | | |
| | -20- | | | | | | | | | | \vdash | | LVL |
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| | | | D1 -13 | dBm | | | | | | | | | |
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| | Star | rt 1 | GHz | | | 200 | MHz/ | | | | Stop | 3 GHz | |
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| Data Pl | ot | <u>Spurious</u> | Emissions | at Antenna | a Termina | ls | |
|---------------------------|----------------|-----------------|---|--------------------------|----------------|------------------|----------------------|
| Page <u>6</u> of <u>8</u> | | | | | | C | complete x |
| Job No.: | 102639 | | Da | te: 27/02/2008 | | Preli | minary: |
| Specification | : PT27 | | Temperature (°C |): 23 | | | |
| Tested By: | Timo Hietala | Re | ative Humidity (% |):10 | | | |
| E.U.T.: | WIMAX TRAN | NSMITTER | | | | | |
| Configuration | n: TX FULL PO | VER MIDDLE CHAN | NEL | | | | |
| Sample Num | ber: 1 | | | | | | |
| Location: | NET/IMN Ou | lu | | RBW: | Refer to plots | Measu | rement |
| Detector type | e: RMS | | | VBW: | Refer to plots | Di | stance: <u>N/A</u> m |
| Test Equip | ment Used | | 5 | | | | |
| Antenna: | | | Dire | ectional Coupler: | | | |
| Pre-Amp: | | | | Cable #1: | | | |
| Filter: | 13 | | | Cable #2: | | | |
| Receiver: | 1 | | | Cable #3: | | | |
| Attenuator #* | 1: 15 | | | Cable #4: | | | |
| Attenuator #2 | 2: | | | Mixer: | | | |
| Additional eq | uipment used: | | | | | | |
| Measuremen | t Uncertainty: | ± 0.7 dB | | | | | |
| | | • 244 | | *RBW 1 MHz *VBW 1 MHz | z Mar | ker 1 [T1 -48 |] .33 dBm |
| Rei | 3.3 dBm | * Att | U dB | *SWT 5 s | | 7.903846 | 154 GHz |
| - 0- | Offset 18 | .3 dB | | | | | |
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| | | | | | | | A |
| 1 | 0 | | | | | | |
| 1 RM * | D1 -13 | dBm — | | | | | |
| CLRWR | | | | | | | T.VT. |
| 2 | 0 | | | | | | |
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| 3 | 0 | | | | | | |
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| 4 | 0 | | | | | | |
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| 9 | 0 | | | | | | |
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| Sta | art 3 GHz | | . 1.7 | GHz/ | • | Stop | 20 GHz |
| 500 | | | ±• / | / | | Scop | |
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| Data | l Plo | <u>ot</u> | | <u>Spuri</u> | ous Em | issions | at Ante | nna T | erminals | <u>s</u> | | |
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| Page <u>7</u> | of <u>8</u> | | | | | _ | | | | (| Complete | x |
| Job No. | : | 10 | 2639 | | | Dat | te: 27/02/20 | 08 | | Preli | minary: | |
| Specific | ation: | PT | 27 | | Tem | perature (°C) |): 23 | | | | | |
| Tested | By: | Tir | no Hietala | | Relative | Humidity (%) |):10 | | | | | |
| E.U.T.: | | W | IMAX TRAN | SMITTER | | | | | | | | |
| Configu | ration: | ТХ | FULL POW | ER MIDDLE | CHANNEL | | | | | | | |
| Sample | Numb | er: | 1 | | | | | | | | | |
| Location | n: | Ν | ET/IMN Oulu | 1 | | | RE | BW: Refe | er to plots | Measu | irement | |
| Detecto | r type: | | RMS | _ | | | VE | BW: Refe | er to plots | Di | stance: N/A | <u> </u> |
| Test E | quipn | nent l | <u>Jsed</u> | | | 5 | | | | | | |
| Antenna | a: | | | | | Dire | ectional Coup | oler: | | | | |
| Pre-Am | p: | | | | | | Cable | #1: | | | | |
| Filter: | | | 13 | _ | | | Cable | #2: | | | | |
| Receive | er: | | 1 | | | | Cable | #3: | | | | |
| Attenua | tor #1: | | 15 | _ | | | Cable | #4: | | | | |
| Attenua | tor #2: | | | _ | | | Mi | xer: | | | | |
| Addition | nal equi | ipment | t used: | | | | | | | | | |
| Measur | ement | Uncer | tainty: | <u>± 0.7 dB</u> | | | | | | | | |
| R | | | | | | | * RBW 1 | MHz | Mark | er 1 [T] | 1 | |
| MS/ | | | | | | | * VBW 1 | MH 7 | Mark | | , 10 dem | |
| | Pof | _1 (| 9 dpm | | * 7 + + 0 | dP | * CMT 5 | rinz a | | 7 90961 | | |
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| | | Offs | et 13. | 2 dB | | | | | | | | |
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| 1 RM * | | | | | | | | | | | | |
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| | Cent | cer | 7.908573 | 3718 GHz | | 5 M | Hz/ | | | Span | 50 MHz | |
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| Data P | lot | | <u>Spur</u> | ious E | missic | ons a | t Ant | enn | a Termi | nals | | | |
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| Page <u>8</u> of <u>8</u> | | | | | | _ | | | | | (| Complete | x |
| Job No.: | 10 |)2639 | | _ | | Date: | 27/02/2 | 2008 | - | | Preli | minary: | |
| Specificatio | n: P | Γ27 | | Te | emperatur | e (°C): | 23 | | - | | | | |
| Tested By: | Ti | mo Hietala | | Relati | ve Humidi | ty (%): | 10 | | - | | | | |
| E.U.T.: | W | IMAX TRAN | SMITTER | | | | | | | | | | |
| Configuratio | on: <u>T</u> | K FULL POW | ER MIDDLE | E CHANNE | L | | | | | | | | |
| Sample Nur | nber: | 1 | | | | | | | | | | | |
| Location: | N | ET/IMN Ould | u | | | | I | RBW: | Refer to plo | ots | Measu | irement | |
| Detector typ | be: | RMS | | | | | , | VBW: | Refer to plo | ots | D | stance: N/ | A m |
| <u>Test Equi</u> | pment | Used | | | | | | | | | | | |
| Antenna: | | | _ | | | Direct | ional Co | upler: | | | | | |
| Pre-Amp: | | | _ | | | | Cab | le #1: | | | | | |
| Filter: | | 14 | | | | | Cab | le #2: | | | | | |
| Receiver: | | 1 | | | | | Cab | le #3: | | | | | |
| Attenuator # | <i>‡</i> 1: | 16 | | | | | Cab | le #4: | | | | | |
| Attenuator # | #2: | | | | | | r | Aixer: | | | | | |
| Additional e | quipmen | t used: | | | | | | | | | | | |
| Measureme | nt Uncer | tainty: | ± 0.7 dB | | | | | | | | | | |
| R | | | | | | | * RBW | 1 MH | Iz | Markeı | с 1 [Т1 |] | |
| XY - | | | | | | | * VBW | 1 MH | Iz | | -50 |).33 dBm | |
| Re | f 14 | dBm | | * Att | 0 dB | | * SWT | 5 s | | 26 | 5.156250 | 000 GHz | |
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| 1 RM * -0- | | | | | | | | - | | | | | |
| CLRWR | | | | | | | | | | | | | |
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| | 10 | D1 _13 | Bm — | | | | | | | | | | |
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6. Field Strength of Spurious

| NAME OF TEST: | Field Strength of Spurious Emissions | PARA.NO.: 27.53(I), 2.1053 |
|-----------------|--------------------------------------|----------------------------|
| TESTED BY: Timo | Hietala | DATE: 28/02/2008 |

Test Results:

Complies.

Test Data:

See attached table.

| Frequency | Spurious Emission |
|-----------|--|
| (MHz) | EIRP (dBm) ave |
| All | More than 20 dB below limit -13 dBm |

| Equipment used: | 19, 20, 21, 22, 24, 29, 30, 31, 32 |
|-----------------------------|------------------------------------|
| Measurement Uncertainty: | ± 5.2 dB. |
| Temperature: | 23 °C. |
| Relative Humidity: | 10 %. |

Note: Test model 67075 includes modulation types; QPSK, 16-QAM and 64-QAM, duty cycle 60%

The spectrum was searched from 30 MHz to the 10th harmonic of the carrier.

Test Data – Radiated Emissions

Nemko Oy, Finland

| Data Plot | | <u>Radia</u> | ted Emissio | ns Substituti | on Method | <u>k</u> | | | |
|---------------------------|--------------|--------------|-------------------|----------------------|-----------|----------|------------|---------------|---|
| Page <u>1</u> of <u>4</u> | | | | | | | Comple | ete <u>x</u> | |
| Job No.: | 102639 | | | Date: 28/02/2008 | - | | Preliminar | y: | |
| Specification: | PT27 | | Temperature | (°C): 23 | - | | | | |
| Tested By: | Timo Hietala | l | Relative Humidity | / (%):10 | - | | | | |
| E.U.T.: | WIMAX TRA | NSMITTER | | | | | | | |
| Configuration: | TX FULL PC | WER MIDDLE | CHANNEL | | | | | | |
| Sample Number: | 1 | | | | | | | | |
| Location: | NET/IMN O | ulu | | RBW: | 1 MHz | | Measureme | nt | |
| Detector type: | Ave | | | VBW: | 1 MHz | | Distance | e: <u>3</u> m | |
| Test Equipme | nt Used | | | | | | | | |
| Antenna: | 21, 22, 24 | 1 | | Directional Coupler: | | | | | |
| Pre-Amp: | 29, 30 | | | Cable #1: | | | | | |
| Filter: | | | | Cable #2: | | | | | |
| Receiver: | 19 | | | Cable #3: | | | | | |
| Attenuator #1: | - | | | Cable #4: | | | | | |
| Attenuator #2: | | | | Mixer: | | | | | |
| Additional equipr | nent used: | 31, 32 | | | | | | | |
| Measurement Ur | certainty: | ± 5.2 dB | _ | | | | | | |
| | - | | - | - | | | - | | |
| Frequency | Meter | Correction | Gen. | Substitution | EIRP | EIRP | Polarity | Comments | 5 |
| | Desilies | Fastar | 1 | | | | | | |
| | Reading | Factor | Levei | Antenna Gain | | | | _ | - |
| (MHz) | (dBm) | (dB) | (dBm) | (dBi) | (dBm) | (µW) | | | |
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Notes: Pre measurement in stack installation Tx 2636 MHz, transmitters full power terminated 50Ω

| Page | 27 (39) |
|------|------------|
| Date | 29.02.2008 |



Test Data – Radiated Emissions 30 MHz - 26.5 GHz

Nemko Oy, Finland

| Dat | a Plot | | | Ra | ndia | ted | Em | issio | ons S | ubsti | tutio | n Me | thod | | | | | | |
|----------|---------------|-------------|--------|-------------|--------------|-----------|---------|---------|-----------|----------|----------|-------|--------|--------|----------|-------|-------------|---------|---------|
| Page 2 | <u>2 of 4</u> | | | | | | | | | | | | | | Corr | plete | х | _ | |
| Job No | o.: | 102639 | | | | | | | Date: | 28/02/2 | 2008 | | | | Prelimin | ary: | | | |
| Specif | ication: | PT27 | | | | | Tem | peratur | e (°C): _ | 23 | | | | | | | | | |
| Testec | d By: | Timo Hie | etala | | | R | elative | Humidi | ty (%): | 10 | | | | | | | | | |
| E.U.T. | : | WIMAX | TRANS | MITTE | R | | | | | | | | | | | | | | |
| Config | uration: | TX FULL | - POWE | ER MIE | DDLE | CHA | NNEL | | | | | | | | | | | | |
| Sampl | e Number | : 1 | | | | | | | | | | | | | | | | | |
| Locatio | on: | NET/IM | N Oulu | _ | | | | | | F | RBW: | 120 k | Hz | N | easuren | nent | | | |
| Detect | or type: | Pe | ak | - | | | | | | Ň | /BW: | | | | Dista | nce: | 3 | r | n |
| Test I | Equipme | ent Used | - | | | | | | Discoti | | | | | | | | | | |
| Antenr | na: | | 2 | - | | | | | Directi | onal Col | | | | | | | | | |
| Pre-Ar | np: | 2 | 9 | _ | | | | | | Cab | e #1: | | | | | | | | |
| Flitter: | | | 0 | _ | | | | | | Cab | e #2: | | | | | | | | |
| Receiv | /er: | 2 | 0 | _ | | | | | | Cab | e #3: | | | | | | | | |
| Attenu | ator #1: | | | _ | | | | | | Cab | e #4: | | | | | | | | |
| Attenu | ator #2: | | | - | ~~ | | | | | P | /lixer: | | | | | | | | |
| Additio | mai equipi | ment used | • | 31 | , ა:2 ეკე | | | | | | | | | | | | | | |
| weasu | | icentainty: | | ± 5. | ∠ub | _ | | | | | | | | | | | | | |
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Notes: Limit line (84.4 dBuV/m) is converted from substitution limit (-13 dBm) to unit dBuV/m in 3 meter measurement distance

| Data | Plot | | Radi | ated Em | issio | ns S | ubstit | ution | Metho | <u>d</u> | | | | |
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| Page <u>3</u> c | of <u>4</u> | | | | | | | | | | _ | Comp | lete | x |
| Job No.: | | 102639 | | _ | | Date: | 28/02/20 | 800 | | | Pre | eliminai | ry: | |
| Specifica | ation: | PT27 | | Tem | nperature | e (°C): | 23 | | | | | | | |
| Tested E | By: | Timo Hietala | | Relative | Humidit | y (%): _ | 10 | | | | | | | |
| E.U.T.: | | WIMAX TRANSM | ITTER | | | | | | | _ | | | | |
| Configur | ration: | TX FULL POWER | RMIDDL | E CHANNEL | | | | | | _ | | | | |
| Sample | Number: | 1 | | | | | _ | | | | | | | |
| Location | n: | NET/IMN Oulu | | | | | R | BW: | 1 MHz | - | Meas | sureme | ent | |
| Detector | r type: | Peak | | | | | V | BW: | 1 MHz | - | L | Jistanc | :e: | <u> </u> |
| Test Ec | quipme | nt Used | | | | | | | | | | | | |
| Antenna | ť. | 24 | | | | Directi | ional Cou | pler: | | | | | | |
| Pre-Amp | o: . | 29 | | | | | Cable | e #1: | | _ | | | | |
| Filter: | | | | | | | Cable | #2: | | _ | | | | |
| Receiver | r: | 20 | | | | | Cable | #3: | | _ | | | | |
| Attenuat | tor #1: | - | | | | | Cable | e #4: | | _ | | | | |
| Attenuat | tor #2: | | | | | | М | ixer: | | | | | | |
| Additiona | al equipn | nent used: | 31, 32 | | | | | | | _ | | | | |
| Measure | ement Un | certainty: | ± 5.2 dE | 3 | | | | | | | | | | |
| Lev | el [dB | µV/m] | | | | | | | | | | | | |
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| 40 - | G | | 20 | <u> </u> | 3 | | 10 | 2 5 | | C 7 | <u>_</u> | | 1 | 2 750 |
| ' | 0 | | 20 | - - | 5 | | | | | | 0 | | 1. | 2.750 |
| | | | | Fr | equer | ncy [H | ΗΖ] | | | | | | | |
| | | | | | | | | | | | | | | |
| I | MES | HE280208 (|)2_pre | e PK | | | | | | | | | | |
| II | LIM F | CC 47 CFR | 24 F | Field | Stren | ght L | .imit | | | | | | | |
| | | | | | | - | | | | | | | | |

Notes: Tx 2636 MHz

| Data | a Plot | | Radiate | d Emi | <u>ssions S</u> | ubstitu | tion Met | hod | | | | |
|-------------------------|--------------|---------------------------|------------------|--------------|-----------------|----------------|--|----------|--------|---------|----------|-------|
| Page 4 | of <u>4</u> | | | | | | | | С | omplete | X | |
| Job No | o.: | 102639 | | | Date: | 28/02/2008 | 3 | | Prelir | ninary: | | |
| Specifi | cation: | PT27 | | Temp | erature (°C): | 23 | | | | | | |
| Tested | By: | Timo Hietala | | Relative H | - | 10 | | | | | | ļ |
| E.U.T.: | , | WIMAX TRANSMI | TTER | | | | | | | | | |
| Config | uration. | TX FULL POWER | | IANNEI | | | | | | | | |
| Sample | Number | 1 | | | | | | | | | | |
| Locatio | n. | NFT/IMN Oulu | | | | RBV | /· 1 MHz | , | Measu | rement | | |
| Detecto | or type: | Peak | | | | VBW | /· 1 MHz | | Die | stance: | з | m |
| Dotool | or type. | 1 out | | | | 101 | | | DR | | <u> </u> | |
| Test E | Equipme | nt Used | | | | | | | | | | |
| Antenn | ia: | 21 | | | Directi | ional Couple | r: | | | | | |
| Pre-Am | np: | 30 | | | | Cable # | l: | | | | | |
| Filter: | | | | | | Cable #2 | 2: | | | | | |
| Receiv | er: | 20 | | | | Cable #3 | 3: | | | | | |
| Attenua | ator #1: | - | | | | Cable #4 | 1: | | | | | |
| Attenua | ator #2: | | | | | Mixe | r: | | | | | |
| Additio | nal equipn | nent used: | 31, 32 | | | | | | | | | |
| Measu | rement Un | certainty: | ± 5.2 dB | | | | | | | | | |
| Le [،] 90 ر | vel [dB | µV/m] | | | | | | 1 | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 85 | | | | | | | | | | | | |
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| 80 | | | | | | | | | | why hym | 1 May M | nh ym |
| 75 | | | | | | | | | | | | |
| 70 | | | | | | helder whether | and the second | WWWWWWWW | WW | | | |
| 65 | W.W. | www.wathin | Wahand Mente | hhi yaha | | | | | | | | |
| 60 | | | | | | | | | | | | |
| | 12.75G | i 1 | 6G | 18 | G | 20G | 22 | 2G | 24G | 6 2 | 26.5G | • |
| | | | | Fre | quency [H | Ηz] | | | | | | |
| | | | | | . , . | • | | | | | | |
| | MES LIM F | HE280208_0 CC 47 CFR 2 | 03_pre P 24 F | K Field S | Strenght L | .imit | | | | | | |

Notes: Tx 2636 MHz

7. Frequency stability

| RA.NO.: 27.54, & 2.1055 |
|-------------------------|
| TE: 28/02/2008 |
| |

| Test Results: | Complies. |
|--------------------------|------------------------------|
| Standard Test Frequency: | 2636.000 MHz. |
| Standard Test Voltage: | 48 V DC. |
| Equipment used: | 1, 5, 6, 7, 8, 17 |
| EUT: | WIMAX TRANSMITTER. |
| Configuration: | TX FULL POWER MIDDLE CHANNEL |

Measurement Data:

Frequency stability with voltage variation.

| Voltage (V DC) | Temp (°C) | Rated (Hz/ppm) | Deviation (Hz) | Deviation (ppm) |
|----------------|-----------|----------------|----------------|-----------------|
| 48.0 | 20 | 132 / 0.05 | 27.2 | 0.0103 |
| 55.2 | 20 | 132 / 0.05 | 33.1 | 0.0126 |
| 40.8 | 20 | 132 / 0.05 | 26.8 | 0.0102 |

| Measurement Uncertainty: | |
|-----------------------------|--|
| Relative | |

± 0.001 ppm (± 2.0 Hz).

RelativeHumidity:10 %.

Note: Test model 67075 includes modulation types; QPSK, 16-QAM and 64-QAM, duty cycle 60%

| NAME OF TEST: Frequency stability | |
|-----------------------------------|--|
| TESTED BY: Timo Hietala | |

PARA.NO.: 27.54, & 2.1055

DATE: 28/02/2008

| Complies. |
|-------------------------------|
| 2636.000 MHz. |
| 48 V DC. |
| 1, 5, 6, 7, 8, 17 |
| WIMAX TRANSMITTER. |
| TX FULL POWER MIDDLE CHANNEL. |
| |

Measurement Data:

Frequency stability with temperature variation.

| Voltage (V DC) | Temp (°C) | Rated (Hz/ppm) | Deviation (Hz) | Deviation (ppm) |
|----------------|-----------|----------------|----------------|-----------------|
| 48.0 | 50 | 132 / 0.05 | -34.7 | -0.0132 |
| 48.0 | 40 | 132 / 0.05 | -19.8 | -0.0075 |
| 48.0 | 30 | 132 / 0.05 | 16.3 | 0.0062 |
| 48.0 | 10 | 132 / 0.05 | 32.5 | 0.0123 |
| 48.0 | 0 | 132 / 0.05 | 28.8 | 0.0109 |
| 48.0 | -10 | 132 / 0.05 | 21.9 | 0.0083 |
| 48.0 | -20 | 132 / 0.05 | -17.0 | -0.0064 |
| 48.0 | -30 | 132 / 0.05 | -33.7 | -0.0128 |

Measurement Uncertainty:

± 0.001 ppm (± 2.0 Hz).

Note: Test model 67075 includes modulation types; QPSK, 16-QAM and 64-QAM, duty cycle 60%

8. List of test equipment

Each active test equipment is calibrated annually.

| Nr. | Equipment | Name of equipment | Serial number |
|-----|----------------------------|---|---|
| 1 | Signal analyzer | Rohde & Schwarz:FSQ26/K93 | 100364 |
| 2 | Network analyzer | Hewlett-Packard:HP8753E | US38431868 |
| 3 | Network analyzer | Hewlett-Packard:HP8720ES | US39172107 |
| 4 | Calibration kit | Hewlett-Packard:HP85032B | 2919A04843 |
| 5 | Environmental chamber | Weiss technick DU 22/500/80 | 221/19600 |
| 6 | Frequency standard | Datum 8040 | 23006282 |
| 7 | DC power | Sörensen | 9950C0085 |
| 8 | Temperature/humidity meter | VAISALA HMI 31 | P3730008 |
| 9 | Vector Network analyzer | Rohde & Schwarz:ZVA40 | 100102 |
| 10 | Calibration kit | Rohde & Schwarz:ZV-Z34 | 100026 |
| 11 | Power meter | Rohde & Schwarz:NRVD | 832025/034 |
| 12 | Power sensor | Rohde & Schwarz:NRVZ | 839913/010 |
| 13 | High Pass filter | Reactel 9HSX-3/20-S11 | 0531 |
| 14 | High Pass filter | BSC MCN-S8282/02 | 1182501 |
| 15 | Attenuator | Weinschel 66-10-34 | BK1136 |
| 16 | Attenuator | Aeroflex/Weinschel 68-20-11 | 401 |
| 17 | Attenuator | Narda FSCM 99899 | 08275 |
| 18 | Attenuator | Narda 752-30 | FSCM99899 |
| 19 | Semianechoic chamber | Siemens Matsushita 9m × 5m × 6m (room 0039) | Product No S&M B83317- C6019-T232 |
| 20 | EMI Test Receiver | R&S ESIB 26 | 100335 |
| 21 | LogPer Antenna | R&S HL025 | 349048/002 (1-26 GHz) |
| 22 | Bilog Antenna | Chase CBL6112B | 2694 |
| 23 | Horn Antenna | Emco 3115 | 6346 |
| 24 | Horn Antenna | Emco 3115 | 000075697 |
| 25 | Biconical Antenna | R&S HK116 | 836891/009 |
| 26 | Dipole VHF | Mess-Elektronik VHA9103 | |
| 27 | Dipole UHF | Mess-Elektronik UHA9105 | |
| 28 | Signal Generator | R&S SMR 20 | 1715 |
| 29 | Amplifier | Miteq AFSX4 | 791117 |
| 30 | Amplifier | HP 83017A | 3123A00444 |
| 31 | Antenna Mast | Deisel HD240 | 2401323194 |
| 32 | Mast Controller | Deisel HD100 | 1001331 |

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9. Photographs of Test Setup



Photograph 1: Radiated spurious emissions test

10. ANNEX A, TEST DETAILS

NAME OF TEST: RF Power Output PARA. NO.: 2.1046

Minimum Standard:Para. No. 27.50 (h).(1) Main, booster and base stations. (i) The
maximum EIRP of a main, booster or base station shall not exceed
33 dBW + 10log(X/Y) dBW, where X is the actual channel width in
MHz and Y is either 6 MHz if prior to transition or the station is in the
MBS following transition or 5.5 MHz if the station is in the LBS and
UBS following transition, except as provided in paragraph (h)(1)(ii) of
this
section.
Sample calculation: 33dBW+ 10log(10 MHz / 5.5 MHz) dBW =34.26
dBW = ~2667 W.

Method Of Measurement:

CDMA Per ANSI/J-STD-014 TDMA Per ANSI/J-STD-010

Antenna terminal:

The power at antenna terminal is measured by using the R&S NRVD broad-band power meter and power sensor NRV-Z1. At Test model 67075 pulse mode duty cycle 60% was used.

| NAME OF TEST: Occupied Bandwidth | | PARA. NO.: 2.1049 |
|----------------------------------|---|---|
| Minimum Standard: | Para. No. 2.1049. The 99% occu frequency band such that, below frequency limits, the mean power the emitted power. | pied bandwidth is the width of a the lower and above the upper rs emitted are each equal to 0.5% of |

Method Of Measurement:

The 99% occupied bandwidth of the carrier emission is measured using a signal analyzer with Resolution Bandwidth set to 1% of the necessary bandwidth of the transmitted carrier. R&S FSQ 26 signal analyzer with WiMAX K93 option was used.

NAME OF TEST: Spurious Emission at Antenna Terminals PARA. NO.: 2.1051

Minimum Standard:Para. No. 27.53(I). For BRS and EBS stations, the power of any
emissions outside the licensee's frequency bands of operation
shall be attenuated below the transmitter power (P) measured in
watts.
(I)(2) For fixed and temporary fixed digital stations, the attenuation
shall be not less than 43 + 10 log (P) dB

Method Of Measurement:

Spectrum analyzer settings: RBW: 1 MHz VBW: 1 MHz Within 1 MHz of the upper and lower edges of the assigned band of operation the resolution bandwidth is lowered to 1 % of the 26 dB occupied bandwidth of the transmitted carrier. A pre-measurement was performed with the max peak detector and spurious emissions closer than 20 dB to the limit was measured with rms detector.

| NAME OF TEST: Field Strength of Spurious Radiation PARA. |
|--|
|--|

| Minimum Standard: | Para. No. 27.53(I). For BRS and EBS stations, the power of any emissions outside the licensee's frequency bands of operation shall be attenuated below the transmitter power (P) measured in watts. |
|-------------------|--|
| | shall be not less than $43 + 10 \log (P) dB$ |

Test Method:

TIA/EIA-603-C-2004, Section 2.2.12

The test was performed in a semi-anechoic shielded room. The EUT was placed on a non-conductive 0.8 m high table standing on the turntable. During the test in the frequency range 30-26500 MHz the distance from the EUT to the measuring antenna was 3 m. In order to find the maximum levels of the disturbance radiation the angle of the turntable, the height of the measuring antenna were varied during the tests. The test was performed with the measuring antenna being both in horizontal and vertical polarizations.

Vertical and horizontal polarizations in the frequency range 30 - 26500 MHz was first measured by using the peak detector. During the peak detector scan the turntable was rotated from 0° to 360° with 30° step with the antenna heights 1.0 m and 2.5 m.

The limit of -13 dBm has been calculated to correspond 84.4 dB(μ V/m). Spurious emissions closer than 20 dB to the limit were measured with average detector.

The antenna substitution method was used to determine the equivalent radiated power at spurious frequencies. The EUT was replaced with a reference substitution antenna with a known gain referenced to an isotropic radiator $G_{Antenna[dBi]}$. This antenna was fed with a signal at the spurious frequency $P_{Gen[dBm]}$. The level of the signal was adjusted to repeat the previously measured level. The resulting EIRP is the signal level fed to the reference antenna corrected for gain referenced to an isotropic. The formula below was used to calculate the EIRP of the EUT.

 $P_{EIRP[dbm]} = P_{Gen[dBm]} - L_{Cable[dB]} + G_{Antenna[dBi]}$

NAME OF TEST: Frequency Stability

PARA. NO.: 2.1055

Minimum Standard: Para. No. 27.54. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Method Of Measurement:

Frequency Stability With Voltage Variation

The E.U.T. is placed in an environmental chamber and allowed to stabilize at +20 degrees Celsius for at least 15 minutes. With the voltage input to the E.U.T. set to 85% S.T.V., the frequency error is measure. This procedure is repeated at 100% S.T.V. and 115% S.T.V.

Frequency Stability With Temperature Variation

The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency error is measured.

| Paga | 27 (20) |
|------|------------|
| гауе | 37 (39) |
| Data | 20 02 2008 |
| Dale | 29.02.2000 |



11. ANNEX B, TEST DIAGRAMS

RF Power Output PARA. NO.: 2.1046



Occupied Bandwidth PARA. NO.: 2.1049



Spurious Emission at Antenna Terminals PARA. NO.: 2.1051





Field Strength of Spurious Radiation PARA. NO.: 2.1053



Frequency Stability PARA. NO.: 2.1055

Frequency Stability With Voltage Variation



Frequency Stability With Temperature Variation

