

**Detector of mobile communication**

# **DMC - 3**

**User Manual**

**Read this manual before use**

Version S1.7

DMC-3 is a highly sensitive selective radio frequency analyzer automatically monitoring frequency range from 860 to 2500 MHz. DMC-3 is designed for detection of mobile phone activity and for protection of objects in which is usage of mobile wireless terminals prohibited. The detected frequency spectrum is divided into 4 sections according to the ETSI telecommunication standard - GSM, UMTS, DECT+TDD, WiFi+Video+Bluetooth. Each frequency segment has its own gain adjustment, its own visual alarm signaling, and common audible warning. The usage of the detector is very simple: after turning the device ON the local radio frequency background is automatically stored and the device goes immediately to protection mode. There is a possibility to connect external signaling or other devices which can register or can be activated by mobile phone signal. The optional DMC-3Q devices can be connected to an object bus and then all events and parameters can be monitored and controlled from a master PC.

## ***1. Controls, Inputs, Outputs and their function***

### **Front panel**

1. red LED GSM - signaling GSM signals in 900 and 1800 MHz band
2. red LED UMTS - signaling 3G signals in 1900 MHz band
3. yellow LED DECT+TDD - signaling DECT and TDD signals in 1900 MHz band
4. yellow LED WIFI+VIDEO - signaling WiFi, Video, Bluetooth signals in 2400 MHz band

### **Bottom side**

5. 2.1/5.5mm connector - power supply 10.7 to 17V, center = +pole
6. 3mm hole - behind is the RESET button
7. 4mm hole – behind is the audible warning volume trimmer

### **Inside the device**

8. 8pin connector - fix power supply, external ALARM output, bus (version Q)
9. 2pin connector AUDIO - ON/OFF of audible warning, external piezoelement
10. 4 x trimmer - sensitivity adjustment, separately GSM, 3G, DECT, W+V
11. 2pin antenna connector - allows to connect an external antenna
12. 4pin unmarked connector - DO NOT USE, for manufacturer service only

## ***2. Adjusting and setting parameters***

### **2.1 Setting volume and switching OFF of audible warning**

Volume of the audible warning can be set by a trimmer behind the 4mm hole (7) on the bottom side. Turning anti-clock-wise to the end is switching OFF the audible warning. To adjust the required volume raise an alarm for example by a mobile phone and set the trimmer by a small screwdriver.

For an office use it is recommended to switch the AUDIO warning off or to adjust lower volume to avoid acoustic disturbance during own mobile calls.

## 2.2 External piezoelement

Disconnect the 2pin connector (9) of the internal piezoelement and connect the external piezoelement cable to the AUDIO connector.

## 2.3 Power supply

For portable usage connect the standard 12V DC power supply to the 2.1/5.5 mm connector (5) on the bottom side. For the fixed installation direct connection of 12V DC to the internal connector (8) should be preferred (see chapter 3.2 Fixed installation).

## 2.4 Sensitivity adjustment

Four trimmers marked GSM, 3G, DECT and W+V inside the device are adjusting detection sensitivity in corresponding frequency segments. Turning clock-wise is adjusting higher sensitivity (maximum), anti-clock-wise lower sensitivity. To switch the selected frequency segment OFF turn the corresponding trimmer anti-clock-wise to the end.

Following table and Figure 1 show the default setting for detection range of approximately 30 meters:

| Trimmer | Adjusting                        | Setting max. -0 deg.<br>min. -200 deg. |
|---------|----------------------------------|--|
| GSM     | GSM 900 and 1800 MHz             | - 100 degrees (1/2)                    |
| 3G      | 3G (UMTS)                        | - 0 degrees<br>(max. sensitivity)      |
| DECT    | DECT + TDD (system 4G)           | - 100 degrees (1/2)                    |
| W+V     | WiFi, Bluetooth, Video (2.4 GHz) | - 40 degrees                           |

Adjustment described in the table is corresponding to the average detection range 30 meters. It is necessary to take in consideration that especially 3G and GSM mobile terminals significantly change the output power according to the base station distance. The real detection range can be different (for more information see chapter 5. Special adjustment).

## 2.5 Disassembling and assembling of the back cover

Unscrew the 4 screws and disassemble the back cover. Before re-assembling be sure that the aluminum layer (antenna reflector) is up, behind the internal antenna.

## 3. Placement of DMC-3

### 3.1 Temporary or portable usage

Place the device on the table or close to the persons who can abuse the mobile phone.

### 3.2 Fixed installation

Hang the device on the wall, the front panel oriented to the room. Use one of the 3 holes on the back side for the connection cable. Upper hole (holes) use for the hanging screw which was fixed to the wall before. Usually use 1x DMC-3 for one office. For large rooms (meeting rooms, conference halls, etc.) more devices can be used, recommended distance between devices is 8 to 15 meters. The power supply can be realized either by individual 12V DC power supplies, connector (5), or by common 12V DC bus connected to pins marked +12V and GND of the internal 8pin connector (8). To connect wires to the female of the 8pin connector (8) push out the connection springs using a needle and solder the wires. After soldering push the springs back to the female connector case.

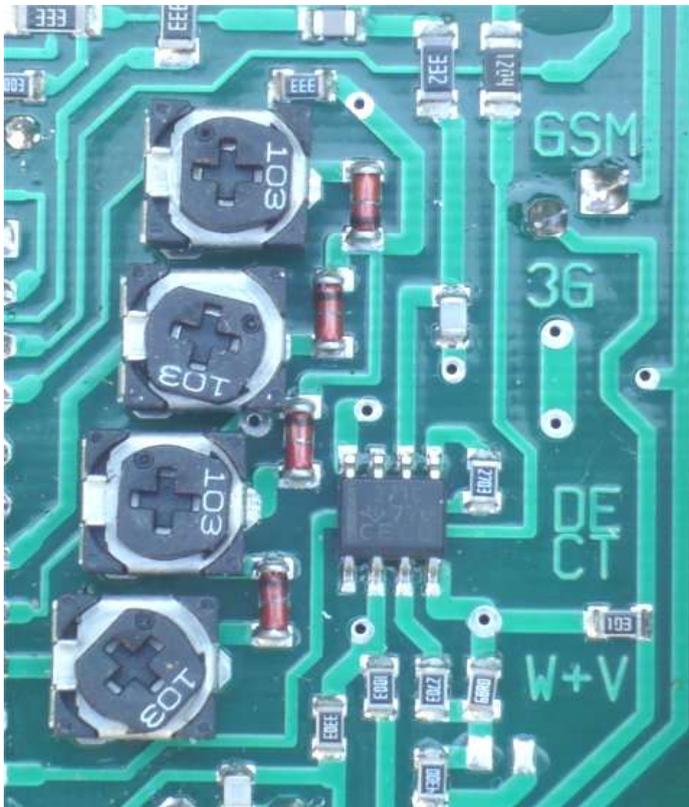


Figure 1. Trimmers - default setting for detection range 30m

## **4. Power ON - Detection - Alarm**

### **4.1 Power ON and background record**

After switching ON (connection of power supply) all LEDs are tested and local radio frequency background is automatically recorded into the device memory. Initialization test and spectrum record takes 15 seconds. **During this time all mobile phone activities are prohibited** in the protected area. If WiFi + Video detection is required all wireless PC connections and bluetooth must be switched off.

### **4.2 Overloading by disturbing signal**

If after initialization process some of the alarm LEDs is quickly and non-periodically flashing the corresponding frequency segment is overloaded by a strong signal. The overloading is usually caused by somebody's mobile phone call or by some wireless equipment which is active in the room (DECT, GSM gate, WiFi, Bluetooth, Video camera etc.). In case of overloading of some frequency segment repeat initialization by switching ON or by pushing the RESET button which is behind 3mm hole on the bottom side of the device. If certain frequency segment is repeatedly overloaded reduce the sensitivity of this segment (chapter 2.4) and repeat initialization. In case that the source of disturbing signal (DECT base, GSM gate, wireless PC connection, wireless camera, etc.) is in the room either switch off that disturbing device or switch off the corresponding frequency segment in the DMC-3 (see chapter 2.4 Sensitivity adjustment).

Warning: Some microwave ovens can cause overloading or false alarms in the WIFI+VIDEO frequency segment because their spurious radiation in 2.4GHz frequency band is often exceeding relevant limits.

### **4.3 Detection**

15 seconds after the power ON or after RESET the active detection status is indicated by green LED READY. Short off-blinks of the green LED light indicate a correct function of the detection system.

### **4.4 Alarm**

If any signal in certain frequency segment exceeds the alarm gate level which is at the average background + 8dB the ALARM signaling is activated. The alarm is indicated by corresponding LED and if the audible warning is ON also by a tone.

### **4.5 External alarm & DMC-PSW JAMMER control switch**

The signal at the ALARM pin of connector (8) is a logical sum of all alarm outputs (all LEDs) and is corresponding to the audible alarm warning. To allow proper function of a **jammer** the continuing alarm is each 30 seconds interrupted for 5 seconds. The logical level of the ALARM output is +5V/2mA. An external indication 2mA LED or other device controlled by DMC-3 can be directly connected between pins ALARM and GND of connector (8).The optional power switch **DMC-PSW** is parallelly connected to pins +12V, GND and ALARM of connector (8).The output contacts of a relay COM, NO (normally open) and NC (normally closed) can switch 15A load.

## 5. Special adjustment

### 5.1 Sensitivity

Table of sensitivity for different trimmer settings, measured in 1900MHz band:

| Trimmer setting<br>- 0 to - 200degrees | RF input voltage for<br>ALARM indication | Attenuation<br>-dB | Resistance measured<br>between terminals<br>B and X |
|--|--|--------------------|---|
| - 0 degrees                            | 14 uV                                    | - 0 dB             | -   |
| - 40 degrees                           | 80 uV                                    | - 15 dB            | -   |
| - 100 degrees                          | 200 uV                                   | - 23 dB            | -   |
| - 140 degrees                          | 700 uV                                   | - 33 dB            | 2.8 k $\Omega$                                      |
| - 170 degrees                          | 2000 uV                                  | - 43 dB            | 1.3 k $\Omega$                                      |
| - 180 degrees                          | 8000 uV                                  | - 55 dB            | 0.5 k $\Omega$                                      |
| - 190 degrees                          | 14000 uV                                 | -60 dB             | 0.2 k $\Omega$                                      |
| -200 degrees                           | detection OFF                            | -                  | 0 k $\Omega$  |

Chapter 2.4 described the default sensitivity setting for average detection range 30m at each frequency segment. The fundamental problem of GSM and specifically 3G detection is the automatic power control of mobile terminals according to the base station distance and local conditions. The range of output power control is 36dB for GSM, it represents radiated power 0.5mW to 2 Watts, the power ratio is 1:4000. A much worse situation occurs with the UMTS system: the power control of mobile terminal is 80dB, it means 1:100 000 000. The detection range is theoretically varying more than 1000x (for UMTS). In the real conditions the situation is better because detection is provided inside buildings and even if the base station is very close there is additional attenuation of walls and windows and the radiated power of the mobile phone does not reach the theoretical minimum.

For more accurate sensitivity setting, for example 700uV (attenuation 33dB) it is recommended to use ohmmeter and in the switched off DMC-3 to adjust corresponding resistance between trimmer terminals B and X (see Figure 2 and the table of sensitivity). The adjustment of the gain trimmers by the ohmmeter is much more accurate especially for higher attenuation because it is hard to estimate the position in degrees due to the trimmer's small size.

## 5.2 Time responses

- Initialization + background entry : 15 sec.
- Full SCAN cycle (GSM, 3G, DECT+TDD, W+V): 2.6 sec.

Compressed scan cycle for following frequency segments:

- GSM only: 1.2 sec.
- 3G only: 1 sec.
- DECT+TDD only 0.8 sec.
- WIFI+VIDEO only 1.1 sec.
- GSM + 3G 1.5 sec.

## 5.3 External antenna

Disconnect the internal antenna (Figure 3) and connect the 2pin female connector with soldered coaxial cable. The connections must be as short as possible; shielding of the coaxial cable is connected to the GND pin and the hot wire to the ANT pin.

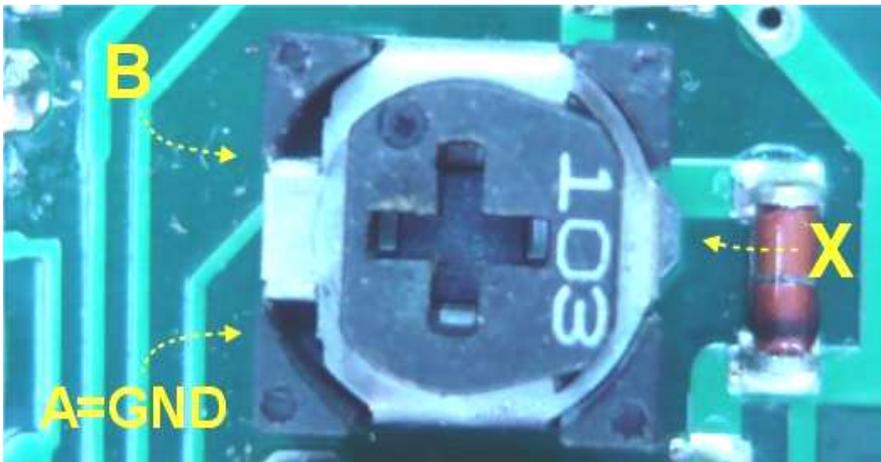


Figure 2. Detail of gain control trimmer: left up B, left down A, right X

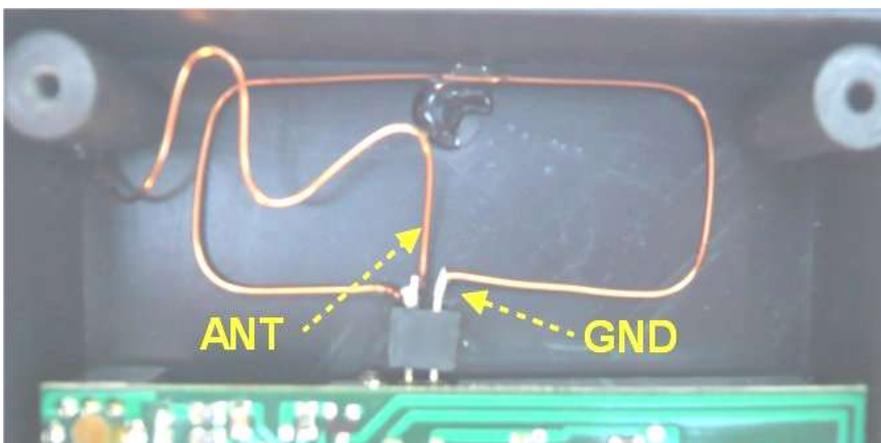


Figure 3. Detail of internal antenna: left ANT input, right GND (shielding of the coaxial cable)

## DMC-3 Abbreviated User Instruction

- 1) Power supply: 10.7 - 17V 52mA, plus to +12V minus to GND
- 2) Common alarm output: ALARM (+5V max.2mA to GND)
- 3) Individual alarm outputs (GSM, UMTS, D+T, W+V): +5V to LEDs via 2k2
- 4) Gain: 4x trimmer, maximum clock-wise  
Default setting (detection range 30m):  
GSM -100 degrees (1/2)  
3G (UMTS) maximum  
DECT -100 degrees (1/2)  
W+V - 40 degrees  
Setting to the minimum end is switching off corresponding frequency segment
- 5) Audible warning: Set volume by a trimmer on the bottom side. Maximum is clock-wise.
- 6) After switching ON (after RESET) avoid any mobile phone activity for 15 seconds, the background is recorded
- 7) Continues fast flashing of an alarm LED immediately after background record is indicating signal overloading of corresponding frequency segment:
  - find and remove the reason (phone call ... etc.)
  - reduce the sensitivity of the overloaded frequency segment
- 8) Behind the 3mm hole is the RESET button, pushing is causing reset and a new background record. Same like switching OFF/ON.
- 9) Do not use the 4pin unmarked connector, it is just for manufacturer's service

## DMC-3 Technical specification

- power voltage 10.7 to 17 V DC
- current consumption 52 mA
- frequency range
  - GSM 871-915 MHz, 1710-1790 MHz
  - 3G 1920-1982 MHz
  - DECT+TDD 1880-1900, 1900-1920 MHz
  - WIFI+VIDEO+BLUETOOTH 2399-2485 MHz
- sensitivity for alarm gate activation 14 uV / 50ohm (-84 dBm)
- manual sensitivity adjustment (4 segments -0 to -60 dB)
- automatic dynamic range of sensitivity 50 dB
- alarm gate activation: background + 8 dB, +/- 2 dB dynamic optimization
- scan cycle 0.8 to 2.6 sec. (depends on number of active segments)
- 4 x LED alarm notification (GSM, UMTS, DECT+TDD, WIFI+VIDEO)
- adjustable internal audible alarm warning
- external ALARM warning 5V / 2mA
- optional external power switch DMC-PSW, output: relay 15A
- internal multi band antenna
- external antenna option Z = 50ohm
- size 168 x 83 x 35 mm
- weight 260 g

## Appendix for option DMC-3Q

### 5.4 Connection to object system QM4000

Up to 128 MRA-3Q and DMC-3Q can be connected to the common bus in the QM4000 control system.

#### Layout of the DMC-3Q 8-pin connector and connection to the common bus:

| pin<br>DMC-3Q | signal   | pin<br>CAN-9 on QMI-2   | wire color<br>QMI/MRA cable |
|---------------|--|---|-----------------------------|
| +12V          | power +11 až 17V                                     | 4   | red                         |
| GND           | power - pole   | 3   | white                       |
| B 485         | RS485 - pole   | 7   | green                       |
| A 485         | RS485 + pole   | 8   | orange                      |
| ALARM         | Alarm LED or jammer output, not connected to the bus |   |                             |
| GND           | audio ground   | 2   | gray                        |
| AUDIO         | audio output   | 1   | yellow                      |
| GND           | - pole = ground                                      | GND pins are parallely connected, can be connected by one wire to the bus |                             |

#### ID setting:

ID of the DMC-3Q can be set up or changed by the QM4000 SW (version V3.x or higher) only. To check or change the ID connect the DMC-3Q to the bus, wait min. 40 sec. and in the Qmaster (QM4000 SW) provide instruction "Scan Bus". Active device will be displayed in the left window. Select device and click in the left top corner on "Device". The Qmaster will offer "Change device ID". After changing the ID note the new ID on the DMC-3Q box or on its board. If 2 or more devices with the same ID are connected to the same bus no one will properly work! The DMC-3Q are usually delivered with the same ID = 17.

Summary: before connection to the common QM4000 system **each DMC-3Q (and also MRA-3Q) has to be separately re-numbered** to avoid more identical IDs on the same bus.

#### QM4000 functions with DMC-3Q detectors:

- change of placement identification
- alarm history with detected signal level record in specific frequency segments: 3G, DECT, GSM, WIFI+VIDEO
- **SCAN = basic function**, DMC-3Q is analyzing RF spectrum and is protecting
- Store BG: deletes old background and stores a new one
- Update BG: adds new signals to original background
- Signal level indicators for specific frequency sectors:  
L/TH L = current signal level TH = automatically adjusted threshold
- Bar graph signal level indicator ("Tune") , manually tuned signal level 0 až 100%
- Manual tuning with audio monitoring of detected signal  
Low band: F = frequencies in GSM 900 / GSM 1800 MHz bands  
High band: F = currently received frequency in DECT, 3G, WIFI+VIDEO bands  
The number between fast and slow tuning arrows can be set to quickly tune up a known signal

#### 5.5 Connector option

Detector DMC-3 is primarily designed for fix installation and for a fix connection to the bus via the internal 8-pin connector. On request the DMC-3Q can be supplied with 3.5mm connector OPTION, which is placed on the left bottom side. Using this connector and the power connector (5) the DMC-3Q can be connected to the QMI-2 by the cable which is equal to the QMI/MRA cable.