

# CCS Call Connection Service

## Developer's Manual for CCS Clients

**Version 04-12.00.2015**

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### **Introduction:**

Basically CCS is an integration of callsign-routing.

The goal is to give an extremely simple to use system to the end user.  
The confusing mixture of different systems are now integrated into one system that is so simple to operate that every ham can use it.

It has some very important advantages compared to the old Icom routing.

- It is seamless integrated into the DCS network,
- A user can talk in a DCS channel and simultaneously in a CCS point-to-point link.
- All connected users will hear each other.
- CCS takes care that no loops are switched by mistake.
- It's not more required for the called user to press the R>CS button since the back-route is switched automatically.

The user puts the destination call into urcall and momentarily presses the PTT.  
In many situations – like mobile - it is even easier to enter the user's CCS-number by DTMF.  
Now the connection will be established and he can listen to the communication on the other end.

Also the CCS server can re-route the communication during a reception (a tiny version of the handover in a GSM network) if the station travels from one repeater to another (short pressing PTT is required of course).

## Change History:

***NEW!***

### **2015/06/20:**

Introduction of “CCS7” which uses a structured 7-digit DTMF code instead of the former 4-digit code. The address space of the 4-digit code is exhausted.

The CCS7 code is the registered standard DMR-ID (lowest ID if the user registered several). It may be used in short notation (4 digits for users) if source and destination are located in the same country, The 3 digit ITU-MCC of the destination country needs to be used for international addressing.

The implementation requires up to 8 digits max for user hotspots including module letters.

Based on this requirement the leading ‘\*’ of DTMF codes like defined in the version 2 specs had to be eliminated. This and a few other changes make the old and the new system incompatible!

The difference between a callsign and a CCS7 number may be checked by the first 3 digits of the destination field, which are all numeric for CCS7 code, but may never be all numeric according to the ITU callsign specs for a valid callsign.

More specs of the valid formats are shown in “DTMF-Coding” below.

### **2015/08/20:**

Server port changed from UDP 30061 to UDP 30062.

This allows running both systems on the same server for the transition time.

For the Gateway and devices it is outgoing traffic and does not require changes in firewall and port-forwarding.

### **2015/09/12:**

Stream-ID of status package should always be 0/0, not random.

Correction of Repeater-IDs 8-262-500 (Repeater-Flag 8 + MCC + ID)

## **CCS Client:**

This describes the functions in the client, the next chapter shows the messages in detail. Please note that even if CCS can be used like D-Plus (Connecting and listening), there is no connection/disconnection required. Sending streams with URCALL is all the client has to do. The CCS server uses the URCALL to route the stream to the right destination, which can be a repeater or a station.

There is very little intelligence required in the client software. This is also defined here because every client must do the same procedures for a consistent operation between different software solutions.

### Connect to CCS:

immediately after the client software is started, it has to register at the CCS server using the registration message.

### Disconnect from CCS:

when the client software gets stopped, it has to cancel the registration at the CCS server using the cancellation message. For performance reasons the client should not disconnect during runtime.

### Heartbeat:

answer each heartbeat message.

### Announce a user to CCS:

when the client software receives any transmission from a station (with or without routing) it announces it to the CCS server. The CCS server uses this information to locate the repeater where this station is active.

Use the "User Status Message" for this purpose. Only a single user status message is sent to CCS for every transmission (usually when the header is completely received).

### During a QSO: send header/voice messages to CCS:

CCS uses combined header/voice messages, as DCS is doing.

### RF → CCS:

When the client receives a station with a callsign in URCALL, then it sends it to the CCS server using this message. (That's all, no connection procedure like in D-Plus is required).

### CCS → RF:

When the client receives a stream from CCS, then it stores the source callsign and sends the stream via RF.

The source callsign is then used for the automatic back-route. If the other station answers with CQCQCQ, then the client replaces it with the previously stored callsign and sends it to CCS.

The client uses a 5 minutes timeout counter. After 5 minutes of inactivity the stored callsign is cleared. Or it is manually cleared (see message description).

### Simultaneous CCS and Reflector operation:

The client forwards the stream from these sources to these destinations:

from RF → CCS and Reflector  
from CCS → RF and Reflector  
from Reflector → RF and CCS

This makes it possible to use callsign routing without disturbing a running communication since the caller can listen before talking.

### Client to Client messages:

There are a few messages which are sent from one client to the other (via the CCS server). These are used to manually terminate a transmission and to check what's going on at the distant client.

## CCS Server Address and Port:

URL: ccs701.xreflector.net  
port: **30062**  
protocol: UDP

**NEW!**

(no port forwarding is required in NAT routers as the communication is always started by the client software, however firewalls must be open for outgoing UDP 30062).

As the CCS network grows additional CCS servers will be installed in different countries. These servers will get the URL: ccs702.xreflector.net, ccs703..., ccs704... etc. For performance reasons the device should use one fix CCS server and one that it has been configured it should not be change automatically!

## Registration / cancellation procedure:

Each time a client is started it has to register at the CCS database by sending a registration message. When the client software is stopped it must send a cancellation message to the CCS server. Using this messages the CCS Server knows if a client is online and can be connected.

### *Registration message:*

Length: 39 byte

0 ... this client's callsign (right padded to 8 characters with spaces)  
8 ... module letter of this client  
9 ... 0x41  
10 ... '@'  
11-16 ... QTH-Locator of this client (6 characters ASCII)  
17 ... 0x20  
18 ... '@'  
19-38.. 20 characters long ASCII string containing the client's software name and version. Fill up with spaces, don't use non-ASCII characters.

### *IRPT – Repeater-Info*

The frame is transmitted once per voice repeater module, after the 39 byte registration.

133 Byte

0-3	Identifier	IRPT
4-11	Callsign	DB0LJ
12	Module-ID	B
13-22	latitude	50.4242
23-32	longitude	7.7322
33-42	Frequency in MHz (10.4s)	438.5250
43-52	Offset in MHz (0.0 is valid) (10.4s)	-7.6000
53-72	Description 1 (QTH) (20s)	This is my location
73-92	Description 2 (QTH) (20s)	some extra info
93-132	URL	<a href="http://www.prgm.org/db0lj-ds">http://www.prgm.org/db0lj-ds</a>

*all fields are left justified / right padded with spaces (10x20)*

*- "Description 1" should describe the location of the repeater.*

*This field is used to create memory lists for devices where usually 20 characters are shown in the display.*

*- "Description 2" may be used for some more information about the location.*

*This content is not shown on displays of devices, but on websites.*

*Please note that there is a special field for a URL, do not include any URL in the description fields.*

*Information like "D-Star-Repeater" or the sysop callsign is useless at this place.*

*HTML code or special characters are not recommended.*

*Note that D-Star is an international network, please do not use special local characters!*

### ***Cancellation message:***

Length: 19 byte

0 ...	this client's callsign (right padded to 8 characters with spaces)
8 ...	module letter of this client
9-18...	0x20

### **Heartbeat:**

The CCS server sends a heartbeat message to the client. The client must answer this message. If it is not answered the client will be cancelled and must register again using the registration message.

Length: 25 bytes

CCS-Server → Client: 25 byte message with random content

Client → CCS-Server:

0 ...	this client's callsign (right padded to 8 characters with spaces)
8 ... 24	website, e-mail, name, telephone number or any other contact information of the client operator. This will be used to contact the operator in case of problems.

## User Status Message:

This message has to be sent to the CCS server each time a user presses the PTT. It has nothing to do with routing. This information is only used to know where (on which Repeater or Hotspot) the user is located. Only users coming from the local (RF or dongle) side should generate this message.

Length: 100 byte

0 ...	„0001“ (ASCII characters)
4-6 ...	0x00
7 ...	if the client is connected to a reflector, then fill in the reflector name here. If not then fill with spaces. Right pad the reflector name to 7 characters with spaces.
14 ...	module of above reflector or space.
15 ...	this client's callsign (right padded to 8 characters with spaces)
23 ...	CQCQCQ (8 characters right padded with spaces)
31 ...	mycall (8 characters right padded with spaces)
39 ...	myinfo (4 characters right padded with spaces)
43-44 ...	0x00 0x00 (Stream ID)
45-60 ...	0x00 ...
61 ...	0x01
62 ...	0x00
63 ...	0x21
64-83 ...	0x20
84-92 ..	0x00
93 ...	data source (RF:0x30, XRF:0x31, DCS:0x32,Icom_add_on:0x033 REF:0x34, CCS:0x35)
94-99 ..	0x00

## Header/Voice message:

This message contains a copy of the header and the voice/data bytes and the text message (if available).

This message is ONLY sent if the user wants to do CCS routing. This is the case if the urcall contains any callsign other than CQCQCQ or remote control commands.

The client software should either select between CCS and traditional callsign routing, or maybe remove port 40000 routing completely (Kurt: I removed 40000 completely as almost nobody used it, and people are using CCS already around the clock).

Length: 100 byte

### Client → CCS-Server:

0 ...	„0001“ (ASCII characters)	
4-6 ...	0x00	
7 ...	if the client is connected to a reflector, then fill in the reflector name here. If not then fill with spaces. Right pad the reflector name to 7 characters with spaces.	
14 ...	module of above reflector or space.	
15 ...	this client's callsign (right padded to 7 characters with spaces)	<b>NEW!</b>
22 ...	this client's module (one character)	
23 ...	urcall (8 characters right padded with spaces), or alternative the DTMF number of the called station <b>preceded with a * (i.e.: *1234) and</b> followed by spaces	
31 ...	mycall (8 characters right padded with spaces)	
39 ...	myinfo (4 characters right padded with spaces)	
43 ...	Stream ID low	
44 ...	Stream ID high	
45 ...	Frame Counter (0..20)	
46 ...	AMBE data (9 Bytes)	
55 ...	Slow Data (3 Bytes)	
58 ...	Frame Counter low (the 3 byte frame counter starts with 000000 with the first message and increments by 1 with every other message)	
59 ...	Frame Counter mid	
60 ...	Frame Counter high	
61 ...	0x01	
62 ...	0x00	
63 ...	0x21	
64-83 ...	Message Text (20 Bytes) of the user. The client extracts this message from the user's slow data and then adds it here. Right pad to 20 characters with spaces.	
84-92 ..	0x00	
93 ...	data source (RF:0x30, XRF:0x31, DCS:0x32,Icom_add_on:0x033 REF:0x34, CCS:0x35)	
94-99 ..	0x00	

### CCS-Server → Client:

same as above, with one difference:

85 ...           distant repeater callsign (the repeater where the user is talking)  
92 ...           module of the distant repeater

**NEW!**

### DTMF-Coding:

DTMF Code	Content	Description
<b>A</b>	1 digit char	Control sequence A= disconnect CCS connection
<b>520</b>	3 digit numeric	Repeater ID short, no MCC
<b>5007A</b>	4 digit numeric + 1 digit A-D	User-ID short, no MCC + Module ID (private Hotspot)
<b>8262520</b>	7 digit numeric	Repeater ID long incl. Repeater Flag (8) and MCC
<b>8262520A</b>	7 digit numeric + 1 digit A-D	Repeater ID long incl. Repeater Flag (8) and MCC + Module ID
<b>2625007</b>	7 digit numeric	User ID long incl MCC
<b>2625007A</b>	7 digit numeric + 1 digit A-D	User ID long incl MCC + Module ID

(MCC = Mobile Country Code)

The short form without mobile country code may be used if source and destination are from the same country. The server will add the MCC of the source to the short address of the destination.

The long form has to be used to set up international connections.

# DEMO:

## DEMO:1 to CCS

Send to CCS from DM0HMB Modul A User is DN5SAT,

```
0000 30 30 30 31 00 00 00 44 43 53 30 31 35 20 59 44 0001...DCS015 YD
0010 4d 30 48 4d 42 20 41 44 47 31 48 54 20 20 20 44 M0HMB ADG1HT D
0020 4e 35 53 41 54 20 20 38 34 33 36 0c 1d 02 ca 21 N5SAT 8436....!
0030 a0 ca af 50 8c 37 8f 70 0b de 17 00 00 01 00 21 ...P.7.p.....!
0040 77 77 77 2e 44 56 52 50 54 52 2e 64 65 20 20 20 www.DVRPTR.de
0050 20 20 20 20 00 00 00 00 00 00 00 00 00 30 00 00 .....0..
0060 00 00 00 00
```

What is the value of: ccs\_buf + 07...14 DCS015 Y  
What is the value of: ccs\_buf + 15...22 DM0HAM A  
What is the value of: ccs\_buf + 23...30 DG1HT  
What is the value of: ccs\_buf + 31...38 DN5SAT  
What is the value of: ccs\_buf + 39...43 8436  
What is the value of: ccs\_buf + 64...83 www.DVRPTR.de  
What is the value of: ccs\_buf + 85...92 8x 0x20  
....

## DEMO:2 from CCS

From CCS to DM0HMB Modul A User is DG1HT on DG1HT Modul B,

```
0000 30 30 30 31 00 00 00 20 20 20 20 20 20 20 20 44 0001... D
0010 47 31 48 54 20 20 42 44 4d 30 48 4d 42 20 41 44 G1HT BDM0HMB AD
0020 47 31 48 54 20 20 20 31 31 31 31 9c 7b 05 9e 8d G1HT 1111.{...
0030 32 88 26 1a 3f 61 e8 32 1b f6 05 00 00 21 00 21 2.&.?a.2.....!!
0040 68 65 61 72 64 3a 44 47 31 48 54 20 20 20 2f 31 heard:DG1HT /1
0050 31 31 31 20 00 44 4d 30 48 4d 42 20 41 30 00 00 111 .DM0HMB A0..
0060 00 00 00 00 ....
```

What is the value of: ccs\_buf + 07...14  
What is the value of: ccs\_buf + 15...22 DB1HT B  
What is the value of: ccs\_buf + 23...30 DM0HMB A  
What is the value of: ccs\_buf + 31...38 DG1HT

What is the value of: ccs\_buf + 39...43 1111

What is the value of: ccs\_buf + 64...83 heard:DG1HT

What is the value of: ccs\_buf + 85...92 DM0HMB A

## Find User message:

This message can be used to get the repeater where a user is located.

Length: 12 byte

### Client → CCS-Server:

0 ... „Find“ (ASCII characters)

4 ... Callsign of the user (Right padded to 8 characters with spaces)

### CCS-Server → Client:

0 ... „Find“ (ASCII characters)

4 ... Callsign of the repeater (variable length)

## Client to Client Communication:

This set of messages is used to transfer information from one client to another. It is mainly used to let the user know if a client is busy or not (i.e. The client can use it to generate a busy tone/message or similar). These messages are mandatory for CCS communication.

Send a 38 byte long packet to the CCS server. The CCS server routes this packet to the other station. The CCS server extends this packet to 100 byte, but only the first 38 bytes have contents, so the receiving station gets a 100 byte packet but only uses the first 38 bytes.

### ***Terminate a CCS communication:***

When a communication starts (packets are transferred) the called client must automatically switch the back-route for the called user. This back-route must be terminated at both ends when the communication has finished. Using this message a client can signal to the client at the other end that the communication is finished.

A CCS communication ends either by user action (urcall entry or DTMF ...) or by clicking a button in the client or by timeout. Send this message in case of termination of the communication.

3 ways to terminate a CCS communication:

- 1) URCALL entry to terminate a communication: “ X” (the 'X' is the 8th character, all other are spaces)
- 2) DTMF: to be defined
- 3) Timeout by the client software: 5 minutes of inactivity

Message length client→CCS server: 38 byte

Message length CCS server→client: 100 byte (byte index 38-99 has random contents)

0 ..	Remote Callsign (7 characters right padded with spaces)
7 ..	Remote Module (1 character)
8 ..	“0001”
12 ..	this client's callsign (7 characters right padded with spaces)
19 ..	this client's module (1 character)
20-37 ..	0x00

### ***Query status of remote station***

Can be useItzik Gurd to check the status of the other station, to see if the other end is available or busy and how long it may take until the station is available again. Using this message is optional. However the following “Answer to Query Status” is mandatory.

Message length client→CCS server: 38 byte

Message length CCS server→client: 100 byte (byte 38-99 has random contents)

0 ..	Remote Callsign (7 characters right padded with spaces)
7 ..	Remote Module (1 character)
8 ..	“0002”
12 ..	this client's callsign (7 characters right padded with spaces)
19 ..	this client's module (1 character)
20-37 ..	0x00

### ***Answer to Query Status***

Answer to above query. If a station receives the Query “0002” then it responds with this packet:

Message length client→CCS server: 38 byte

Message length CCS server→client: 100 byte (byte 38-99 has random contents)

0 ..	Remote Callsign (7 characters right padded with spaces)
7 ..	Remote Module (1 character)
8 ..	“1002”
12 ..	currently connected Reflector (7 characters right padded with spaces), or SPC
19 ..	Module of currently connected Reflector (1 character) or SPC
20 ..	Status Byte (see below)
21 ..	talking to station via CCS (7 characters right padded with spaces), or SPC
28 ..	module of above station (1 character) or SPC

29-37 ... actual timeout value until this station could be available again (as ASCII text), this is usually the remaining value of the 5-minutes counter.

## *Answer to Query Status2*

Answer to above query. If a station receives the Query "0002" then it responds with this packet:

Message length client→CCS server: 60 byte

Message length CCS server→client: 100 byte (byte 47-99 has random contents)

0 ..	Remote Callsign (7 characters right padded with spaces)
7 ..	Remote Module (1 character)
8 ..	"1002"
12 ..	currently connected Reflector (7 characters right padded with spaces), or SPC
19 ..	Module of currently connected Reflector (1 character) or SPC
20 ..	Status Byte (see below)
21 ..	talking to station via CCS (7 characters right padded with spaces), or SPC
28 ..	module of above station (1 character) or SPC
29-37 ...	actual timeout value until this station could be available again (as ASCII text), this is usually the remaining value of the 5-minutes counter.
38 ..	to client's callsign (7 characters right padded with spaces)
46 ..	to client's module (1 character)
47-60 ..	0x00

### Status Byte (ASCII character):

"0" ... ok (Station is not busy via CCS and available)

"1" ... busy (Station is currently busy via CCS)

if the state is "busy" then enter the callsign of the other station in index 21-27.

Example:

DB0ABC is talking to VK1XYZ.

Now K1AB is calling via CCS to DB0ABC.

Then the client (repeater) of DB0ABC inserts "VK1XYZ" in bytes 21-27.

The client receiving this messages can make a busy announcement, a busy tone or send a text message containing i.e. "DB0ABC <> VK1XYZ".

Another idea could be to send a text message: "DB0ABC at DCS001D" because the reflector is available in index 12.

Using this information the repeater can inform the user about the actual status of the called station.