New distance world record on the 134 GHz band
New IARU Region 1 records on the 134 GHz and 241 GHz bands

Foreword

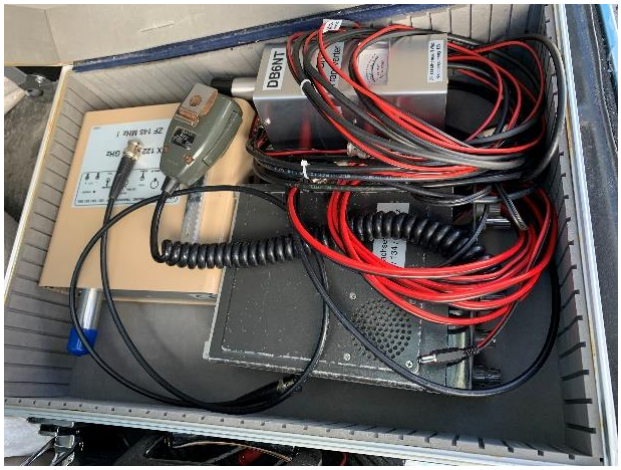
Since our records last year, see https://tinyurl.com/vjyfszmm, my father, Michael DB6NT and me, Matthias DK5NJ, have been thinking about how we could further expand our distance records in the 122, 134 and 241 GHz amateur radio bands.

Our experience so far has shown that we rely on good weather conditions, e.g. very low humidity, no rain, little wind, low dew point and air temperatures that are as cold as possible. Michael DB6NT therefore observed the weather data on various websites on a daily basis, especially during the winter months. The weather conditions meanwhile fluctuate frequently even in the winter months and therefore it was necessary to react quickly if the weather met the conditions. Until August 2021, I, DK5NJ, lived near Munich, but then moved back to my original home in Upper Franconia with my family. So now the spatial proximity to my father and QSO partner Michael, DB6NT was guaranteed and nothing stood in the way of a quick departure with suitable weather conditions.

But of course, the locations must also meet certain requirements for record attempts on the mmWave bands. The two locations must be in sight of each other. In practice, however, the optical view of each other always depends on the weather. That rules out most locations right from the start - as is almost always the case in amateur radio, the higher the mountains, the better.

Unfortunately, high mountains and hills often cause another problem: They are difficult to reach by car (no access possible or permission is missing). The dishes, feeds, transverters, etc. are almost all one-of-a-kind items that were developed in-house or built by friends (e.g. dish tnx to Rudi, OE5VRL). Since our sensitive equipment - which is almost irreplaceable if lost - is stowed in transport-safe boxes and is a bit heavy, it naturally had to be possible to bring and set it up safely on site.

Here is a photo from the trunk of DK5NJ: (Tripod is on the back seat).

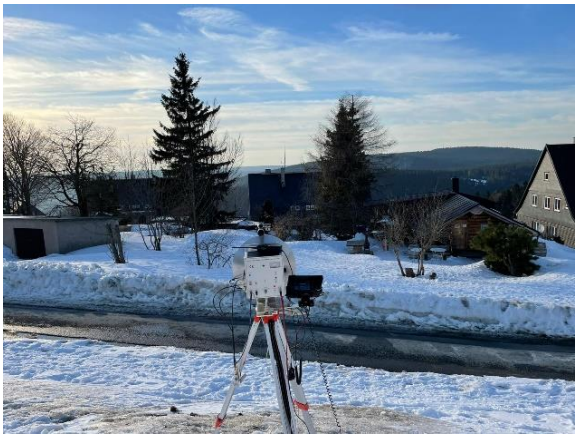


2x battery, case for FT-290 und 76 GHz Transverter und big case for mmWave-station with dish

Distance from the Aschberg to the Leipzig Tower 92.8 km

So, we started looking for a location. After a number of reconnaissance trips and on-site visits, two locations emerged that would be suitable for a spontaneous test (reachable in a max. 2-hour drive) if the weather conditions were right. The weather report on the evening before March 1st, 2022 looked promising and so we decided to give it a try.

Michael DB6NT packed his equipment in the car and drove to the Aschberg (913 m ASL) near Klingenthal in **JO60GJ03RO**.



Matthias, DK5NJ drove together with the equipment to the Leipziger Turm/Sachsenturm near Schmiedefeld am Rennsteig in **JO50ON60BJ.**

The tower itself was not accessible here and the restaurant was closed. However, this had the advantage that apart from a few hikers, there was not much public traffic to be expected. After many years of portable experience as an amateur radio operator, the polite inquiries of less passing tourists such as e.g. B. "Excuse me, what are you doing here" can be processed quickly and routinely 😊

Here are a few pictures of the station setup at DK5NJ below the Leipzig tower:

To be on the safe side, we had - as we are used to from other DXpeditions - some of the equipment with us twice. So were e.g. 2 batteries, 2x FT-290 etc. taken up the mountain as a backup. As cross frequency we used the 70cm relay DB0NAI and two handheld radios.

On this cross-connection, we told each other that one had now arrived at the location, had set up and was QRV. On the mmWave bands it is extremely important that the parabolic antennas of both stations are precisely aligned with each other. So, it is usual to start "beaming" on a lower frequency band, then slowly optimize it and only switch to a higher band after the antenna has been perfectly adjusted.

To turn in the approximate direction of the antenna, Michael and I each used a conventional compass. We had calculated the corresponding angles at home beforehand. The first SKED should take place on the .200 in the 76 GHz band. However, the first CW carrier signal from DB6NT in the 76 GHz band arrived shockingly weak with just S5 very quiet. Disappointment spread and doubts arose: Were the weather conditions not as good as announced? I went through all the scenarios in my head: Did I wire everything correctly? In our beacon tests a few weeks earlier, was the scope set up correctly? Is the receiver working correctly?

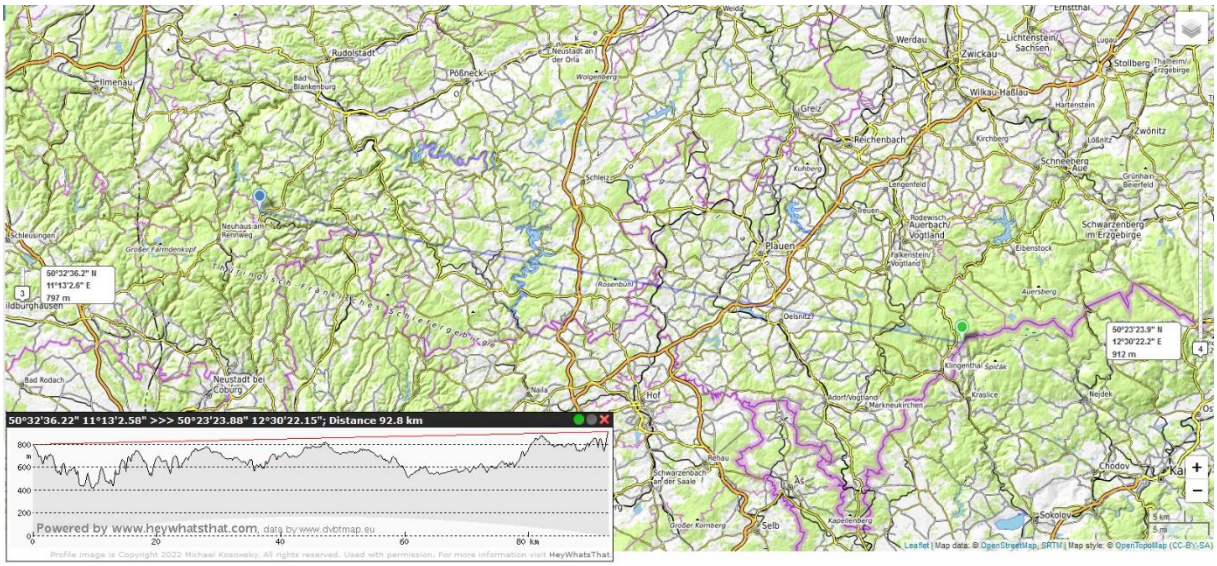
Now that we had come a long way and everything was set up, we didn't want to give up yet. Michael went to receive and I sent a continuous FM carrier on 76 GHz. My signal with S4 was similarly weak. We just didn't want to believe it was going so weak. I asked DB6NT to provide another FM carrier and simply beamed (rotated the antenna) back and forth in a large radius of about 25 degrees. Suddenly his signal could easily be heard with several dB over S9. Apparently, the compass was deflected by surrounding metal and thus the original alignment was not correct. On these bands, every degree counts. But it doesn't matter - the joy of the extremely strong signal immediately motivated me to continue. Now we turned the transmission/reception around again and then it was a matter of "weakening" the signal a little bit in order to be able to turn the mirror in even more precisely when the signal was quieter.

Then I converted my feed to the transmitter module for 122 GHz and put a CW beacon signal as a continuous carrier on the .200. You have to be extremely careful not to twist the laboriously aligned antenna again when changing the feed modules. The CW signals were very loud and on 122 GHz it worked with 59+. The signals in the 134 GHz were even louder due to the lower path attenuation caused by physical factors. At 241 GHz it was a bit quieter but still very loud. Out of sheer euphoria, we also exchanged the reports 599 here, which we corrected to 559 in the second round. To the great joy of both sides, we can now successfully announce that we were able to set 2 new IARU Region 1 records on the 134 and 241 GHz bands that day.

Here is the table with the data:

Tuesday, March 1st 2022	
DK5NJ at the Leipigerturm (797 m ASL) near Schmiedefeld **JO50ON60BJ**	
DB6NT at the Aschberg (913 m ASL) near Klingenthal **JO60GJ03RO**	
distance **92,8 km**	
Air temperature 6°C at Aschberg	
Relative humidity 29% on the Aschberg	
DK5NJ and DB6NT worked in CW QSO on 76 GHz at 14:45 UTC with 599 QSO on 122 GHz at 15:01 UTC with 599 QSO on 134 GHz at 15:03 UTC with 599 QSO on 241 GHz at 15:38 UTC with 559	 **IARU 1 Record** **IARU 1 Record**

Here is a picture of the bridged route:



Route from Schneekopf (Thuringian Forest) to Fichtelberg (near Klingenthal)

When we came home from our experiments on the Aschberg and the Leipzig Tower, we were full of energy and very happy. I called Roland, DK4RC to report the successful attempt. A few days earlier, Michael had already spoken to him about the upcoming interesting weather conditions and the locations from tests already carried out in 2021 should be activated again.

Since height is now known to be the measure of all things, we decided to go to even higher mountains on the next day, Wednesday, March 2nd, 2022, due to the persistently good weather conditions and to increase the distance again significantly.

So, it came about that Roland, DK4RC agreed and drove with me to the Schneekopf (977 m ASL) in the Thuringian Forest the next day. He picked me up at home and together we made our way to the hiking car park on the Schneekopf. Herbert, DL4AWK, was already waiting for us there. He is known in a figurative sense as the "caretaker" of the Schneekopf Tower, since he has been operating the ATV and relay radio stations there with extraordinary commitment for many years and therefore also has access. He and Roland also know each other through the activities of the contest group DL0GTH and Herbert showed interest and enthusiasm from the beginning to be able to help with a record attempt.

When we arrived at the parking lot, an ice sheet about 5 cm thick awaited us, but with a combined effort we managed to fix the necessary equipment on sleds and start the further ascent on foot.

Here are pictures of the equipment loaded onto sleds:

Arriving at the top, Herbert unlocked the gate to the tower area and freed the entrance door to the tower from the snow by vigorously shoveling. We then carried the equipment into a room with a window facing Fichtelberg.

The weather was very good up on the mountain and we were able to set up the station with good visibility and sunshine. As always, to be on the safe side, I had brought all the important components such as batteries, transceivers, etc. with me twice, but fortunately there were no failures.
The weather was very good up on the mountain and we were able to set up the station with good visibility and sunshine. As always, to be on the safe side, I had brought all the important components such as batteries, transceivers, etc. with me twice, but fortunately there were no failures.

Here is a view from said window at Schneekopf and a view through the scope on the mirror:

In the meantime, Michael also arrived safely at the Fichtelberg, as we found out thanks to our cross-connection in the 70cm band. He also found excellent weather and a suitable place to set up his station. Here are some pictures from the Fichtelberg at DB6NT:

As with the tests the day before (Leipziger Turm – Aschberg), we set each other CW carrier signals (beacons) on the 76 GHz band. This time, however, it turned out to be much more difficult to find the signal and then to find a suitable maximum by aligning the antennas. Michael's 76 GHz signal only arrived at DK5NJ and DK4RC on the Schneekopf with S5 and thus abruptly dampened expectations.

Nevertheless: Now that you had driven up the mountain, you should also test it. In the 122 GHz band, Michael didn't hear our beacon at first. Even when he sent it afterwards, we couldn't find his signal. As a result, our mood was much more subdued, but we still wanted to try one more thing: For physical reasons, the line attenuation in the 134 GHz band is lower than in the 122 GHz band. Here is a graphic for this:

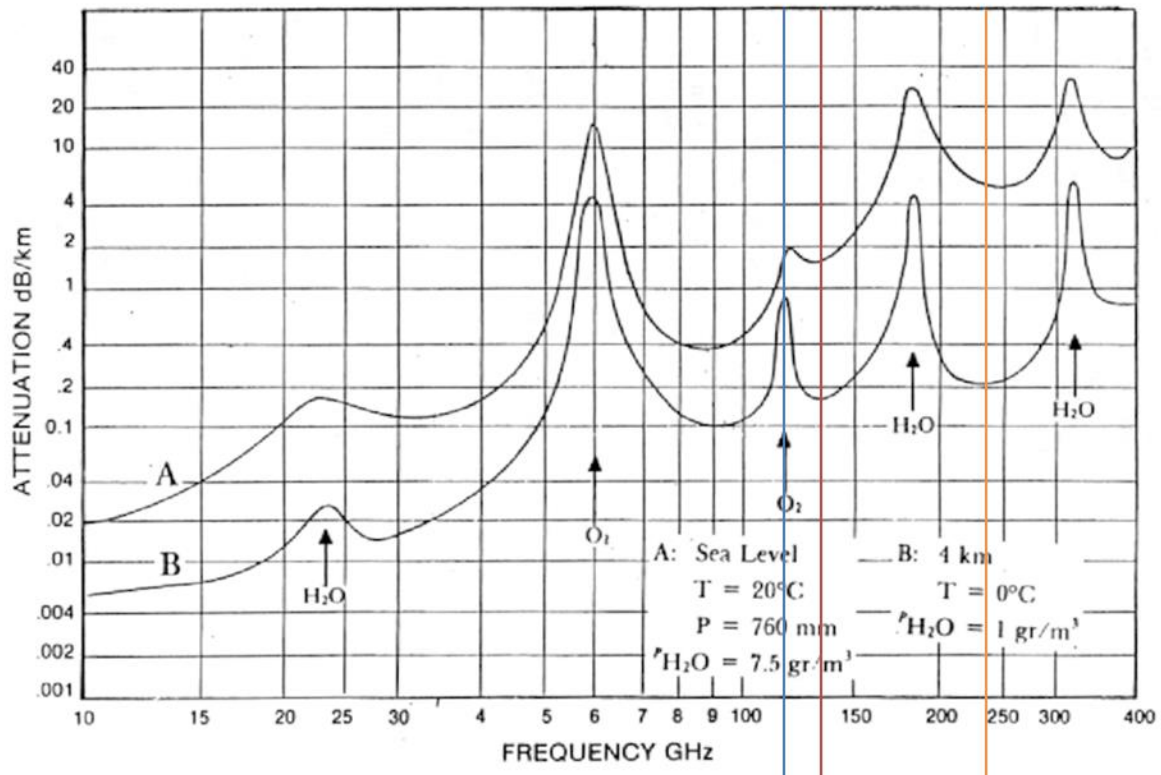


Figure 4: **Average Atmospheric Absorption of Millimeter Waves.**

Quelle_wikimedia.org

122 GHz | 134 GHz | 241 GHz

So, we switched and put a beacon signal in the 134 GHz band on the .200 in the direction of Fichtelberg. Michael promptly informed DB6NT on the cross frequency that he could hear us. The joy was huge and the feed with the receiver module was inserted into the mirror. Subsequently, a CW QSO could be carried out successfully:

Wednesday, March 2nd 2022 at 14:23 UTC
DK5NJ (with DK4RC and DL4AWK) on the Scheekopf (977 m ASL) near Gehlberg **JO50JP19QU**
DB6NT on the Fichtelberg (1210 m ASL) near Klingenthal **JO60LK43LC**
distance **157,0 km**
temperature 2°C at the Fichtelberg
humidity 24 % at the Fichtelberg
DK5NJ und DB6NT worked QSO on 76 GHz at 14:00 UTC with 599 QSO on 134 GHz at 14:23 UTC with 599 ➔ **World record!**

Then, after setting up the antennas again, Roland DK4RC tried to establish a connection in the 122 GHz band:


Roland, DK4RC at giving CW on 122 GHz Band.

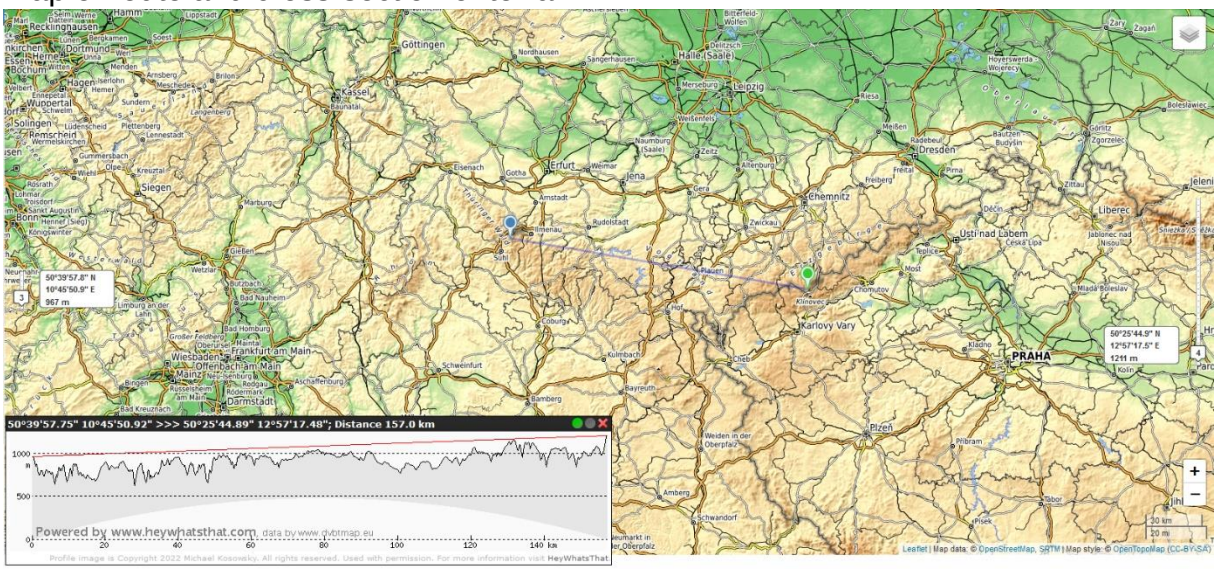

Left to right: DK5NJ, DL4AWK und DK4RC after a successful descent from the Schneekopf

The hope flared up briefly that there might still be a connection in the 122 GHz band, because Michael DB6NT heard Roland's CW signal with 529. Unfortunately, however, no QSO was made because we didn't hear anything from Michael's signal. At 122 GHz, the receiver of DK5NJ has significantly worse properties (approx. 2 S-levels) than that of DB6NT. However, we want to further improve the station for the future and install a preamplifier in the receiver module for the 122/134 GHz bands.

The cross-section of the route also shows that there are points in the middle of the route where the signal is only sent a few hundred meters above the ground. Of course, this can have significant negative effects on the connection in relation to rising damp:

DB6NT

Map of route and cross-section of terrain:



In the 241 GHz band, unfortunately, it was just a try. Neither DK5NJ nor DB6NT could pick up a signal here. It was not always possible to determine an exact maximum of the antenna direction on the 134 GHz band due to the weather conditions - probably rising moisture fields in the middle range. Normally you set the antenna direction with micrometer screws and at these frequencies it is about antenna accuracy in the tenth of a degree range. We switched the station from receiving to transmitting and from band to band countless times that day. The feed module has to be changed in the mirror every time, which is why I refrain from describing the test runs in more detail.

The stations used for all QSOs on both sides are almost identically equipped - except for the receiver on 122/134 GHz:

Station data from DK5NJ and DB6NT

76 GHz 0,3 Watt

122 GHZ 0.15 Watt

134 GHz 0,1 Watt

241 GHz 50 mW

Each 40 cm parabolic mirrow, (1x optical dish 1x dish made by OE5VRL)

DB6NT Transverter

Nevertheless, all participants see it as a great success to be able to bring a world record in the 134 GHz band "home" 😊 Many thanks to the support and spontaneity of our families, without whose support such "special operations" would not be possible.
Videos of the individual signals are published on my website https://dk5nj.de/

We will continue to experiment on these still little researched frequency bands and say as always: …to be continued!

73 de DK5NJ, Matthias

cross references:

The station description is available for download on the DB6NT website.

German: http://www.db6nt.de/download-archiv.html

English: http://www.db6nt.de/index.php?id=855&L=1

The existing records

Europa IARU Region 1:

https://vushf.dk/iaru-reg-1-dx/

ARRL:

http://www.arrl.org/files/file/WA50-Standings/Distance-Records-4-Jan-2022.pdf

RSGB:

https://www.microwavers.org/?records.htm

Program for calculating the path loss of OE2IGL:
„Microwave link budget calculation“
https://wettersat.bplaced.net/software.html

Website of the author:
https://dk5nj.de/