

OFFGRID[®]

Signal Attenuation Testing

Introduction and Methodology

This document presents the results of testing conducted on OffGrid Faraday Bags to determine their effectiveness in attenuating signals within the frequency range of 10kHz to 40GHz. Offgrid faraday bags are designed to protect electronic devices from electromagnetic interference by blocking all wireless signals, including cellular, Wi-Fi, Bluetooth, RFID and GPS.

In this testing, we aimed to evaluate the performance of offgrid faraday bags in shielding electronic devices from electromagnetic signals that could compromise their security and privacy. All testing was performed by a third party lab, Keystone Compliance, and results were cross referenced and validated by the Wireless Research Center.

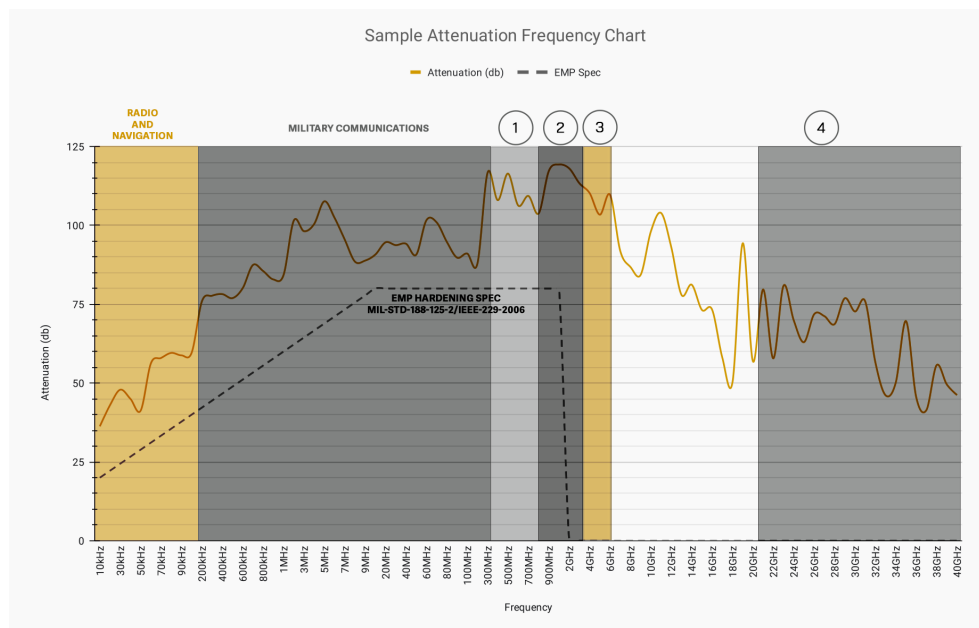
For the test, high-power frequency generators and RF analyzers were utilized to measure the signal strength both before and after the introduction of the bag. The obtained results were calculated by determining the difference between the signal strength with and without the bag. To ensure accuracy, all results were calibrated against known reference samples.

The results of this testing provide valuable insights into the effectiveness of OffGrid Faraday Bags and their suitability for use in different scenarios. It is intended for use by individuals and organizations seeking to protect their electronic devices from potential signal interception or interference.

Interpreting Results

All bags were tested by taking at least ten attenuation measurements at each decade between 10kHz (10×10^3 Hz) and 40GHz (40×10^9 Hz). Attenuation is measured in decibels which is logarithmic, so each 10 decibel increase represents one order of magnitude more shielding (for example, 90db attenuation blocks ten times more energy than 80db attenuation).

The frequency range tested covers all major civilian communication bands and most military communication bands. This range also covers frequencies specified by United States DOD as being present in a high-altitude electromagnetic pulse (HEMP). HEMP is a type of electromagnetic pulse (EMP) that can be caused by a nuclear detonation in the upper atmosphere. HEMP can potentially damage or destroy electronic equipment and infrastructure, including military communication systems.



Region	Used By
1. 400 MHz - 800MHz	TV, 5G cell
2. 800MHz - 2.4GHz	2G, 3G, 4G cell, WiFi, Bluetooth, GPS
3. 3.4GHz - 6GHz	4G, 5G cell, WiFi
4. 22GHz - 39GHz	5G High speed

EMP Protection

In the figure above, the dotted line indicates the shielding threshold defined in Mil-STD-188-125-2 for HEMP protection requirements specified for radio communication systems used by the Department of Defense. The standard requires that these systems be designed and built to withstand the effects of HEMP by incorporating appropriate protective measures such as shielding, surge protection, and grounding. Additionally, the standard specifies testing procedures to ensure that the HF radio communication systems meet the required HEMP protection levels.

Communication/Data/Tracking Shielding

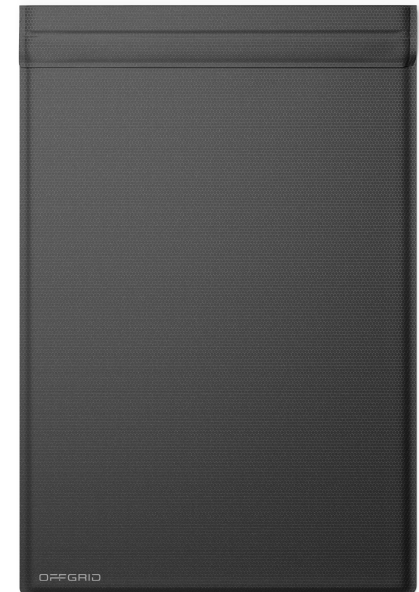
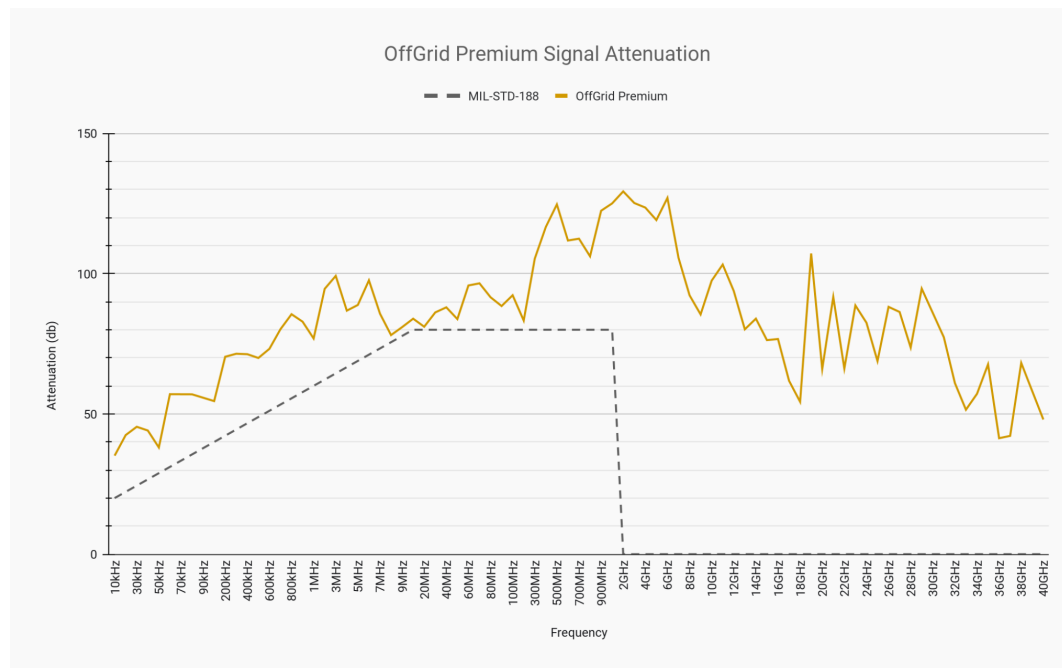
The shaded regions in the figure above highlight common communication/data transmission bands used by military and civilian RF devices. There is no specification that recommends shielding levels to prevent data interference or interception in these bands, but in practice, generally data transmission drops out above 80db attenuation in the far field below 6GHz and above 40db above 20GHz. Medium frequencies (1MHz) and below propagate magnetically more so than electrically and are typically harder to shield with Faraday based technologies.

Test Results

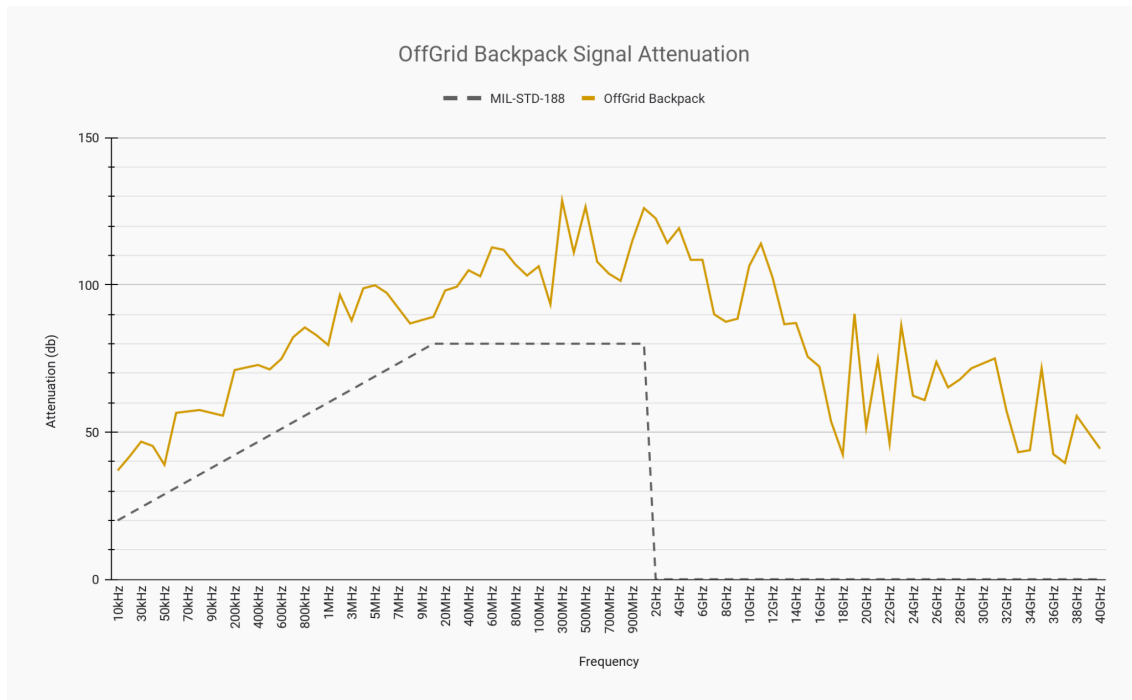
A representative set of products were selected for testing. Generally speaking, the larger the bag is, the less it will shield, so large bags were chosen from each to test the worst case scenario. These include the following:

- **OffGrid Premium Laptop**- Representative of all [OffGrid Premium bags](#) and sizes (laptop, mobile, keyfob, tablet).
- **OffGrid Backpack**- Representative of [OffGrid Backpack](#) and Made in the USA [Utility bags](#) in all sizes
- **OffGrid Duffel**- Representative of [OffGrid Duffel](#) and [Utility Duffel](#)
- **OffGrid Fold**- Representative of **OffGrid Fold bags** in all sizes (laptop, mobile, keyfob, tablet) [OffGrid Switch Wallet](#) and [OffGrid Extract](#)

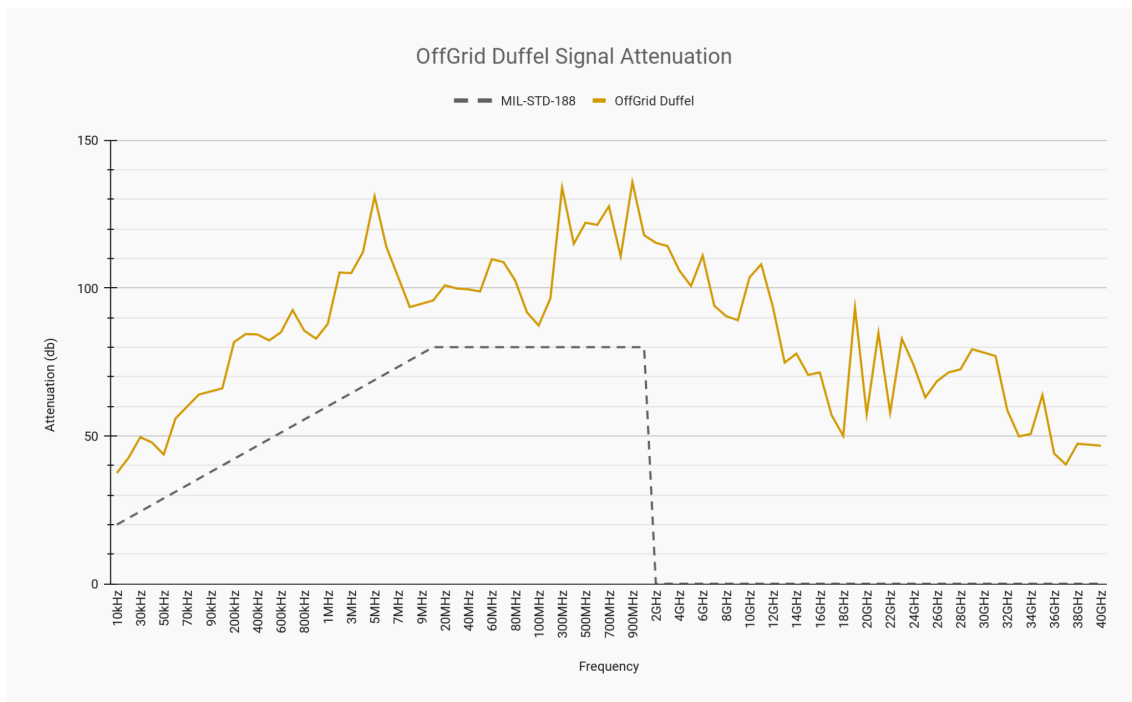
OffGrid Premium Test Results



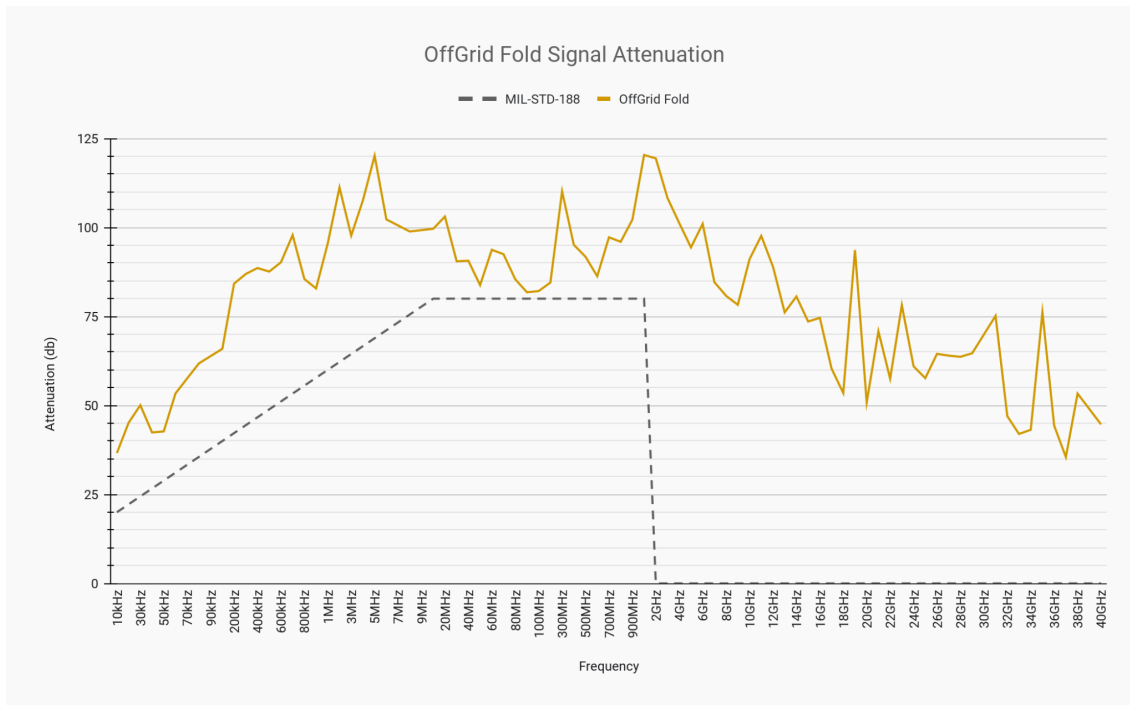
OffGrid Backpack Test Results



OffGrid Duffel Test Results



OffGrid Fold Test Results



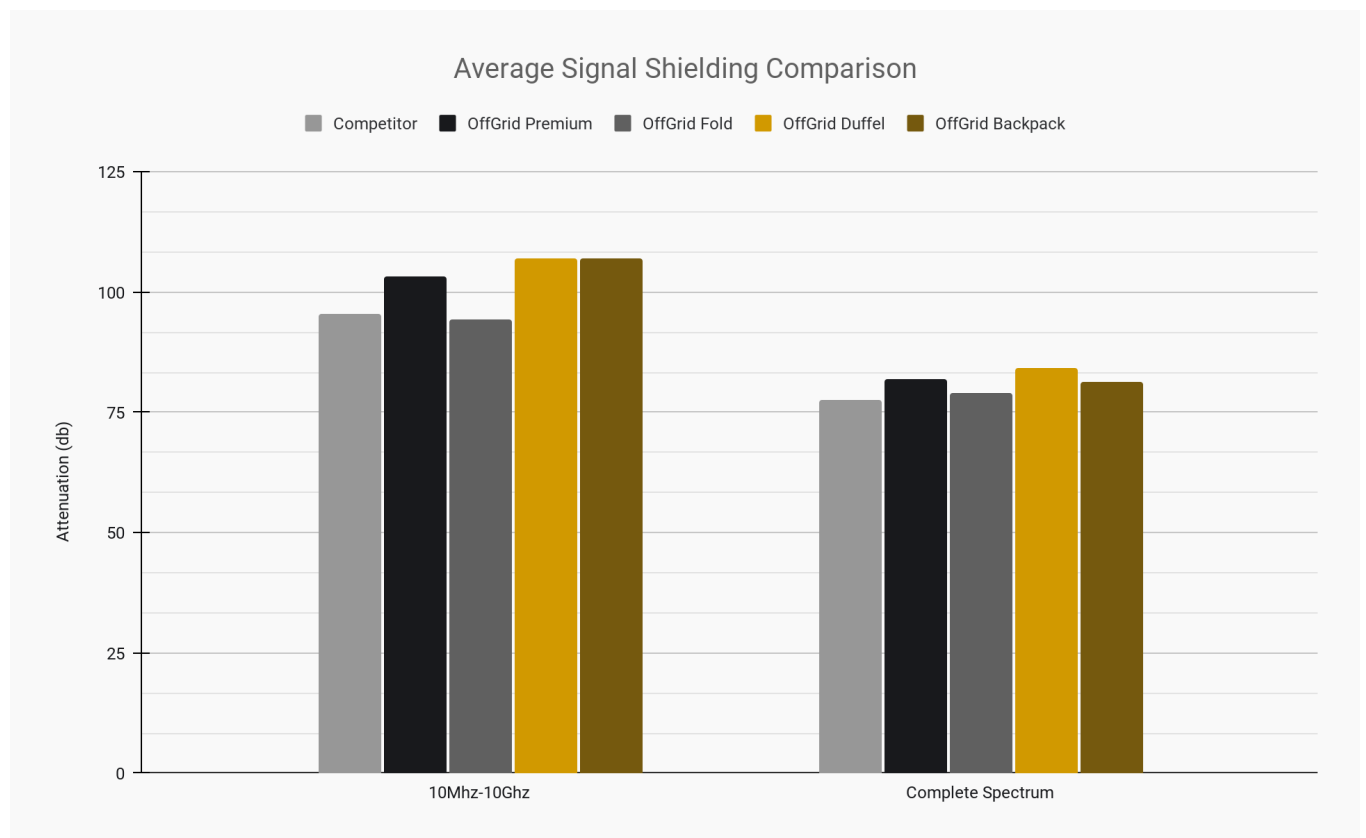
*Raw data for all tests provided at the end of this document.

Average Shielding and Competitor Comparison

Average shielding was calculated in two regions of the frequency spectrum. The region between 10MHz and 10GHz was chosen due to the number of commercial and military communication protocols that fall within this region. This region also represents the bottom end of where faraday shielding is fully effective (as opposed to shielding via magnetic absorption).

The average shielding of **OffGrid Faraday bags is 103db on average between 10MHz and 10GHz** compared to competitors' average shielding 95.5db in the same region. The **average shielding across the full testing spectrum is 82db for OffGrid Faraday bags** vs competitors average shielding of 77.5db.

Competitors' test results taken from a major industry player and data was published on their site. Competitors testing was performed by the same third party lab using the same test methods.



103 DB
AVERAGE SHIELDING 10MHZ-10GHZ

82 DB
AVERAGE SHIELDING FULL SPECTRUM

Raw Data

Frequency	Competitor	OffGrid Premium	OffGrid Fold	OffGrid Duffel	OffGrid Backpack
10kHz	35.29	35.12	36.62	37.45	36.95
20kHz	43.3	42.46	45.13	42.63	41.63
30kHz	47.74	45.41	50.07	49.57	46.74
40kHz	45.41	44.08	42.41	47.75	45.25
50kHz	43.03	38.03	42.7	43.7	38.86
60kHz	58.37	57.03	53.37	55.87	56.53
70kHz	58.3	57.005	57.59	59.925	57.005
80kHz	57.64	56.98	61.81	63.98	57.48
90kHz	52.8	55.775	63.86	65.025	56.525
100kHz	56.07	54.57	65.91	66.07	55.57
200kHz	72.21	70.37	84.21	81.71	71.04
300kHz	73.77	71.44	86.94	84.44	71.94
400kHz	74.11	71.28	88.61	84.28	72.78
500kHz	73.61	69.94	87.61	82.27	71.27
600kHz	77.2	73.2	90.2	85.04	74.87
700kHz	84.37	80.2	97.87	92.54	82.2
800kHz	85.53	85.53	85.53	85.53	85.53
900kHz	82.87	82.87	82.87	82.87	82.87
1MHz	81.37	76.87	95.54	87.87	79.54
2MHz	99.74	94.58	111.24	105.24	96.58
3MHz	101.04	99.2	97.7	105.04	87.87
4MHz	96.8	86.8	107.63	112.13	98.8
5MHz	98.34	88.84	120.17	131	99.84
6MHz	100.94	97.61	102.27	113.94	97.27
7MHz	95.37	85.74	100.57	103.74	92.07
8MHz	85.21	78.092892	98.87	93.54	86.87
9MHz	81.38	80.928291	99.255	94.67	88.005
10MHz	85.3	83.929883	99.64	95.8	89.14
20MHz	90.07	81.07	103.07	100.91	98.07

30MHz	92.84	86.17	90.5	99.84	99.34
40MHz	87.84	87.99	90.65	99.54	104.94
50MHz	84.19	83.79	83.81	98.83	102.9
60MHz	96.13	95.78	93.73	109.76	112.71
70MHz	95.29	96.54	92.5	108.74	111.87
80MHz	87.53	91.58	85.46	102.54	106.91
90MHz	83.8	88.45	81.8	91.78	103.15
100MHz	87.3	92.3	82.13	87.3	106.3
200MHz	81.7	83.26	84.52	96.46	93.37
300MHz	105.5	105.33	110.16	133.99	128.66
400MHz	102.3	116.63	95.13	114.96	110.96
500MHz	117.17	124.67	91.77	122.09	126.49
600MHz	104.27	111.8	86.31	121.33	107.82
700MHz	105.6	112.45	97.24	127.62	103.78
800MHz	104.84	106.16	95.98	110.69	101.34
900MHz	111.06	122.4	102.2	135.81	114.89
1GHz	107.2	125.03	120.37	117.87	126.03
2GHz	103.74	129.31	119.42	115.28	122.54
3GHz	104.93	125.17	108.26	114.17	114.2
4GHz	101.23	123.53	101.23	105.96	119.21
5GHz	94.4	119.09	94.4	100.68	108.46
6GHz	101.03	126.99	101.03	110.95	108.49
7GHz	85.26	105.65	84.63	93.94	89.98
8GHz	83	92.28	80.79	90.49	87.45
9GHz	80.3	85.46	78.27	89.11	88.5
10GHz	91.77	97.49	91.1	103.61	106.41
11GHz	96.83	103.23	97.64	108.01	113.99
12GHz	86.6	93.79	88.99	93.49	102.41
13GHz	72.16	80.15	76.15	74.77	86.63
14GHz	76.6	83.95	80.61	77.81	87.02
15GHz	69.99	76.29	73.58	70.6	75.59
16GHz	71.44	76.69	74.61	71.45	72.22
17GHz	57.6	61.81	60.35	57.03	53.58

18GHz	51.16	54.32	53.49	49.99	42.32
19GHz	87.34	107.17	93.67	93.34	90.17
20GHz	58.83	65.99	50.83	57.33	51.49
21GHz	76.34	91.68	70.84	84.84	74.67
22GHz	61.5	66.17	57.49	57.83	46.16
23GHz	68.5	88.67	78.17	82.84	86.17
24GHz	69.66	82.5	61	74	62.33
25GHz	64.5	68.84	57.67	63	60.84
26GHz	64.16	88.16	64.49	68.49	73.82
27GHz	69.16	86.33	63.99	71.49	65.16
28GHz	65.83	73.66	63.66	72.49	67.83
29GHz	74.16	94.65	64.66	79.32	71.66
30GHz	56.16	85.99	69.915	78.16	73.33
31GHz	75.17	77.33	75.17	77	75
32GHz	58.99	60.99	46.99	58.66	57.16
33GHz	44.16	51.49	41.99	49.83	43.16
34GHz	56	57.16	43.16	50.66	43.83
35GHz	69	67.66	76.17	63.83	71.67
36GHz	55.51	41.34	44.34	44.01	42.51
37GHz	49.66	42.17	35.5	40.33	39.5
38GHz	54	68.17	53.34	47.34	55.5
39GHz	43.82	58.09	49.01	47.01	49.92
40GHz	47.35	48.01	44.68	46.68	44.34