Octopus 4G LTE Signal Meter
Octopus Public Safety 4G LTE Signal Meter

User Manual Version 1.8

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Information About 3G and 4G

What is 4G?

4G, short for “Fourth Generation,” is a specification laid down by the International Telecommunications Union (ITU) in 2008. Specifically, this was laid down by the ITU-R (which deals with radio communications). 4G is known today primarily for its broadband capabilities and significantly faster speed than 3G, which introduced data connectivity into the cellular space.

Since there was such an enormous gap between the older 3G standard and the newer 4G, companies wanted to make sure their customer base knew they were receiving better service than just the same old 3G networks, so they came up with a workaround. That workaround was LTE, short for "Long-Term Evolution." The original idea was that it represented a "Long-Term Evolution" toward the 4G standard. What clever marketers figured out was that they could present it as something greater than that standard if they simply added "4G" before it. Hence, "4G LTE."

At this point, the LTE International Standard is loosely defined and frequently updates, making a true LTE standard hard to nail down. So LTE is more like an upgraded 3G, but worse than true 4G. 4G LTE networks send data to 4G LTE phones at a rate lower than 100 Mbps of download speed. Most consumers believe 4G LTE to be an advanced version of 4G, instead of what it really is. Hence the term 4G LTE-A or 4G LTE-Advanced (which is really just 4G). This is the fastest option available on the market in 2021.

How Fast is 4G?

The ITU standard stipulated minimum specifications of 100 Mbps download speed, but at that time, was still hypothetical. Carrier networks are only just now realizing these speeds. To qualify for true 4G, your wireless network has to be able to download at a minimum of 100 Mbps. Some carriers have dubbed this 4G LTE-A (Verizon) or 5Ge (AT&T) to separate it from 4G LTE. As there is no true standard for LTE, it covers the entire range of minimum download speeds from 3G’s 20 Mbps to 4G’s 100 Mbps, giving it a massive range of potential speeds.

What About 3G Networks?

3G networks have been actually been around since the early 00s and have served customers well for voice, text and modest data applications. However, since 4G networks are faster and have now saturated the wireless landscape, 3G networks are being sunsetted, or turned off according to each carrier’s schedule. For instance, AT&T has already shut down their 3G service in early 2022. T-Mobile plans to shut down their 3G UMTS on July 1, 2022 and Verizon plans to shutter their 3G EVDO service on December 31st, 2022. Knowing these dates is important for cellular installers so they have enough lead time to migrate from a 3G to a 4G using the Octopus signal meter.

What About 5G Networks?

As of 2021, 4G is the dominant network in America for most voice, text, and data. This isn't projected to change any time soon. Thus, high-speed 5G phones will continue to use 4G networks for the forseeable future (2030 to 2035 is estimated, but 4G could last even longer). Consumers watching videos and downloading large files wirelessly demand 5G speeds but there are also billions of IoT (Internet of Things) and M2M (Machine to Machine) sensors, devices and networks that function well by piggybacking on slower 3G and 4G networks. Their data needs are required to be steady but modest so cellular installers of EV charging networks, fire and security alarms, smart meters and any cellular booster only need to concern themselves with 3G and 4G cellular network speeds making Octopus signal meter the ideal tool for instant analysis and connectivity.

Information About AT&T FirstNet Emergency Network

What Is FirstNet®?

FirstNet® is a cellular network communications system designed to deliver priority and pre-emptive communications for first responders and other organizations involved in critical infrastructure and public health and safety. Developed in a public-private collaboration between the First Responder Network Authority and AT&T, the network is built to close communications gaps in public emergencies.

The key objective for FirstNet® is to handle maximum first responder traffic even during a peak emergency. Since FirstNet can only be used by those with a specialized device, there is almost no risk of the network going down or for network congestion by non-FirstNet users. This robust design makes it a cornerstone of strategic planning for smart cities.

While communications with emergency responders are critical at any time, the stakes are especially high during catastrophic events that affect a large population. When a city, region, state or the nation experiences a natural disaster or a terrorist attack — most memorably, events such as the 9/11 disaster, Hurricane Katrina and the Boston bombing — cellular networks can quickly become overloaded, preventing dispatchers and first responders from communicating quickly and effectively.

If you are responsible for critical communications in a municipality, in which police stations, fire stations, and other emergency service providers depend on cellular networks for communications, today you have the opportunity to improve your city's disaster preparedness with FirstNet communications.

Many other organizations qualify too, including hospitals, ambulance services and a second tier of services known as "extended primary." These include critical infrastructure systems and services such as water treatment plants, the power grid and security services.

What Is Band 14, and How Does It Work?

The need for a first responder network with dedicated spectrum was recognized in the wake of September 11th 2001, after first responders found it difficult to communicate over the congested cellphone network. In 2012, Congress passed the Spectrum Act. This act set aside 20 MHz of highly desirable spectrum in the 700 MHz frequency band, known as Band 14, which was to be reserved exclusively for emergency communications. Low-band spectrum like the 700 MHz band provides several advantages, including the ability to better penetrate walls and other obstacles. It helps to ensure excellent coverage.

In the decade since the Spectrum Act was passed, the FirstNet network has expanded and can be accessed by 99% of the U.S. population. This rapid expansion in coverage can be attributed to AT&T's strategy to give FirstNet users access to all bands on the AT&T network with priority and pre-emption over non-FirstNet users. This means that if there is a signal, FirstNet users will have coverage, even in remote areas where Band 14 may not be deployed yet.

Who Owns FirstNet and Band 14?

FirstNet is owned by the First Responder Network Authority, an independent authority within the U.S. Department of Commerce. Chartered in 2012, its mission is to ensure the building, deployment, and operation of the nationwide broadband network that equips first responders to save lives and protect U.S. communities.

Band 14 is maintained through a public and private collaboration. The Spectrum Act allocated about $7 billion to kickstart construction. However, a majority of the funding comes from AT&T. Over the course of 25 years, it is expected that AT&T will spend in upwards of $40 billion to build and operate Band 14.

In exchange, AT&T can run normal commercial traffic across the band when everything is working properly. However, in the event of an emergency, AT&T will give FirstNet® users priority and pre-emption over non-FirstNet users and, if necessary, drop all commercial traffic and dedicate the network exclusively to first responders, along with the extended primary group as bandwidth allows. For this reason, a normal cellphone might stop working during a crisis, but a FirstNet-enabled device will continue to work.

How Do I Qualify for FirstNet and Band 14?

The idea behind FirstNet is for important first responders, city services and infrastructure to continue functioning in the event of an emergency. Given that mandate, the list of FirstNet approved organizations is broad. In fact, many organizations are surprised to find they qualify.

For example, drilling and gas wells all qualify for FirstNet, as do Internet connected irrigation systems, waste disposal and septic tank services. Both short and long haul railroad carriers can use the network, as can the postal service and other private postal carriers.

The list of extended primary services also includes highway and bridge construction projects, chemical engineering services, school bus systems, various airport and air control functionaries as well as transportation and licensing providers. It is worth investigating, if you think that your company or organization might qualify.

What Devices Support FirstNet and Band 14?

When it comes to FirstNet compatibility, there are two categories of devices:

1. Products that meet FirstNet requirements, pass certifications, and support FirstNet features but do not support band 14. These do not have a FirstNet Ready designation.
2. Consumer products that meet FirstNet requirements, pass certifications, and support FirstNet features and band 14. These are known as FirstNet Ready™.
3. Products that meet FirstNet requirements, pass certifications, and support FirstNet features and band 14 and are certified for use by qualifying commercial and emergency response users. These are known as FirstNet Capable™.
4. Products that meet FirstNet requirements, pass certifications, and support FirstNet features and band 14, and have an extra layer of certifications for use by qualifying commercial and emergency response users. These are known as FirstNet Trusted™. Digi's FirstNet certified cellular solutions meet these requirements, which include a much stricter level of security compliance.

For best FirstNet performance, you want to select a device that is FirstNet Ready™, if you are a consumer, or a FirstNet Capable™ or FirstNet Trusted™ device if you use the device in a commercial or government capacity. First responders, medical units and critical services should opt for FirstNet Trusted™ devices. You can find Digi FirstNet Trusted solutions on our FirstNet page.

About this user manual

This manual covers both Octopus and Octopus Public Safety models. Both units measure the same bands and generally behave the same. However, the Octopus Public Safety model includes clear identifiers for FirstNet (band 14) signals making it easier to focus on FirstNet measurements. Both units are otherwise the same so this manual will be referring to both as Octopus unless otherwise noted.

Introduction

Octopus signal meter installation tool is designed for both professional and non-professional installers that need to verify the strongest signal for 4G LTE cellular repeater systems. Octopus measures nearby cellular base stations and directional antenna alignment necessary for installing and optimizing site surveys for remote wireless networks used in EV charging stations, wireless fire and security alarms, smart utility meters and any cellular signal boosters for home or office. Octopus measures RSRP, RSSI and RSRQ signal strength in real time making it ideal for migrating from older 3G UMTS to newer 4G LTE networks.

Unboxing

Unpack and completely charge up your Octopus using the supplied power transformer and charging dock. Be sure that the unit is seated firmly in the charging dock so that the metal contacts on the bottom are connecting for a constant charge. The mini-USB port located on the side is for firmware updates via any Windows PC. Check with BVS support to make sure you have the latest firmware and updating instructions. Be sure to only use the provided multiband antenna or other antenna authorized by BVS support. This will ensure that your unit properly scans all bands, carriers and frequencies at maximum sensitivity.

Powering Up/Down Your Unit

Power up Octopus by pressing the white button below the touchscreen. This same button is the only physical button on the unit and also powers down the unit by holding it in for a few seconds. Before powering up, connect the antenna. This ensures that the unit will immediately begin scanning all nearby base stations, even if you do not see those base stations listed. After about 10 seconds of a startup screen, Octopus will display the main screen of carrier choices (Octopus scans all U.S. regional carriers (over 60) but only displays those on the carrier list screen which appears next) while continuing to scan for all nearby signals. Choose your carrier of choice or all 4G LTE. Depending upon your choice and amount of nearby base stations, the list of base stations will usually take about 30 seconds to complete. Three small dots appear in the lower right corner of the screen indicating that scanning is still in progress. You may also go to the settings menu at any time to adjust the vibrating and audible alerts as well as check your current firmware and unit serial number. See other page of this user guide for all screens and their paths.

Operation

Once Octopus has finished completely scanning, you may sort all base station signals by either carrier, frequency or signal strength(s). 4G LTE signal strength is measured in RSSI, RSRP and RSRQ. Pushing the CARRIER, FREQ or measurement buttons will sort the list by any of those choices. If Octopus identifies more than 6 unique base stations, a PAGE down button appears for

additional pages of base stations to search through. PAGE up button appears on the next page allowing users to move through all pages. Octopus also supports a feature that freezes and stores all current measurement list pages allowing users to scroll through and make notes or download stored measurement to a PC for further analysis.

Choosing Your Base Station

Once you have located the base station of interest, touch it to take you to the active single carrier measurement screen. From this screen you can view the channel number, real time signal strength and toggle between measurements displayed (RSRP and RSSI for 4G) as you move around and also to align external antennas to nearby base stations. You can also view the RSRQ value and additional CID information. A green outline around the vertical signal strength bar indicates peak measurement observed during the entire session. Choose between RSRP and RSSI measurements.

Antenna Alignment

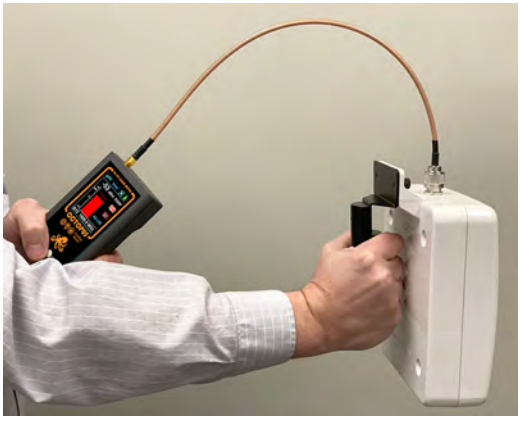
Disconnect your included omni directional SMA antenna and connect directly to your mounted (or soon to be mounted) antenna fixture while viewing the single carrier screen. Begin with broad sweeps and then turn your antenna slower to fine tune adjustment so that it is pointing directly to the base station you want off in the distance. Once your signal strength is at maximum, install and tighten your permanent antenna and connect it directly to your cell booster. You can now move on to scan more base stations and install more cell boosters if needed.

Charging Your Unit

Octopus ships with an AC powered charging dock. Place unit in charging dock and be sure the red LED on top of unit in ON. If red LED is not ON, Octopus is not being charged. Try adjusting Octopus in dock until red LED is ON. Charging takes approximately 4 hours. You may also use the mini-USB port on the side to slowly trickle charge your unit overnight if you do not have access to the charging dock. Octopus runs approximately 10 hours from a full charge. Octopus has smart trickle charging circuity that is always calibrating the battery but if your battery runtime is noticeably short after a full charge, you may need to manually calibrate the battery. Go to BATTERY under MAIN MENU for more details and consult BVS support if you have any questions or concerns.

Optional Accessories

Octopus supports an optional wideband direction finding (DF) antenna that easily screws into the standard SMA connector on top of the unit. The DF antenna allow for increased detection range that can extend beyond visual confirmation of nearby base stations. The DF antenna is useful in locating the direction of distant cellular base stations that are not visible from the survey site. Octopus ships standard with Pelican® 1200 case and omni-directional antenna but many customers prefer the Octopus cellular signal meter kit which includes a larger, rugged Pelican® 1500 case and the wideband DF antenna with SMA cable. Octopus cellular signal meter kit weighs 12 pounds and ships in a 20” x 15” x 7” packing box. Ask your BVS sales representative about this Octopus kit.



(Octopus 4G model)

(Octopus 4G Public Safety model)

Startup

Every time you power up your Octopus unit, you will see this screen first. The three dots next to the octopus indicate that the unit is scanning for all nearby base stations regardless of the choice you make on this screen. That way, the next (measurement list) screen will already be populated with measurements. You can advance from this screen at any time by selecting one of the buttons.

This button will only measure and display AT&T 4G LTE cellular base stations on the next screen.

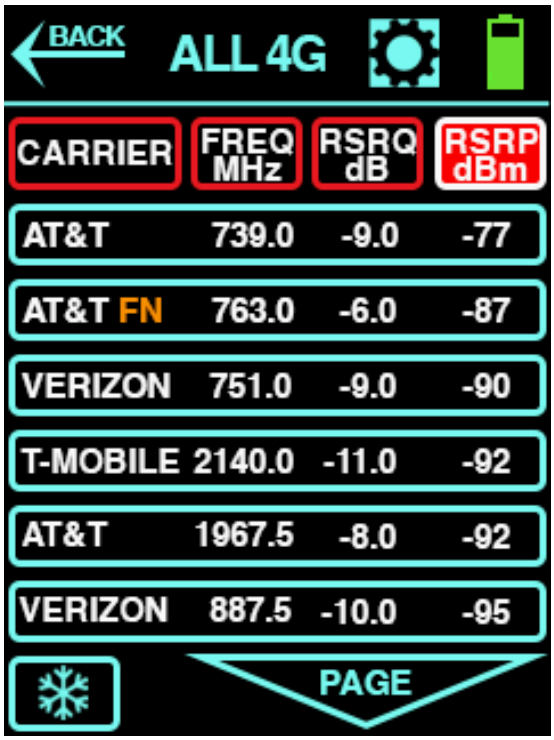
This button will only measure and display Verizon 4G LTE cellular base stations on the next screen.

This button will only measure and display T-Mobile 4G LTE cellular base stations on the next screen.

This button (on either unit) will only measure and display 4G LTE (all carriers) cellular base stations on the next screen.

This button will only list the base stations allocated to Public Safety (band 14) on the next screen.

Note: Since major carriers have already begun or finished sunsetting their 3G networks, Octopus no longer supports 3G measurements. Existing Octopus customers updating to firmware version 2.02 or greater will notice that 3G measurement options have been removed.



Measurement List Screen (4G LTE)
After the startup screen, Octopus generates a list of measurements from all nearby base stations depending upon which button you chose in the previous screen. This screen shows 4G LTE measurements organized by RSRP. Note the buttons (RSRQ and RSRP) at the top. Only 4G LTE measurements can be organized in this way.


Main options menu.

Touch this button to filter all carriers by name in alphabetical order.

Touch this button to sort all frequencies from highest to lowest center frequency.

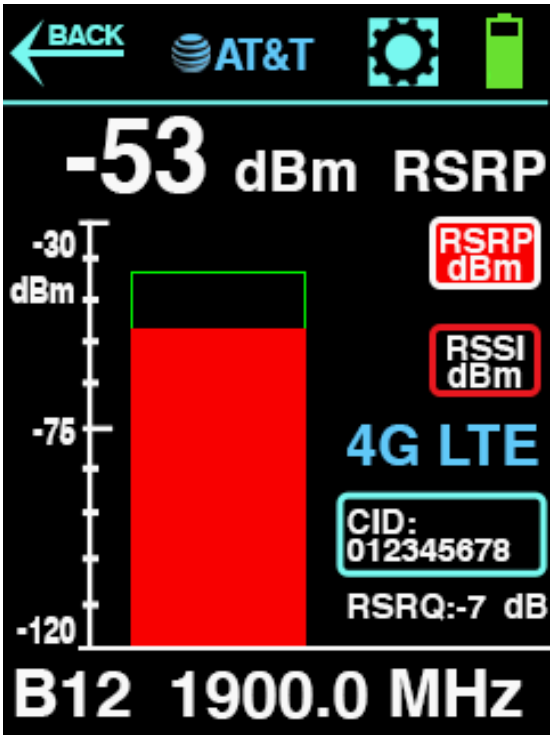
Touch this button to filter all measurements by RSRQ (Reference Signal Received Quality) from strongest to weakest. RSRQ is a C/I type of measurement and indicates the quality of the received reference signal.

Touch this button to filter all measurements by RSRP (Reference Signals Received Power) from strongest to weakest. RSRP is an RSSI type of measurement and the power of the LTE reference signals spread over the full bandwidth and narrowband.

Touch any one of these buttons to go directly to its single measurement screen. This particular button highlights the band used for FirstNet.

Touch this button to freeze and store measurements on all pages in order to scroll through, make notes and download to a PC for analysis. Touch it again to unfreeze measurements.

Touch this button to go to the next page(s) of measurements.



Single Measurement Screen (4G LTE)
Octopus scans all 4G LTE base stations and allows them to be sorted and measured with more detail using this screen (4G LTE base station being measured).

Touch this button on any screen to navigate back to previous screen.

Shows wireless carrier associated with the current base station being measured.

Main settings menu allows users to adjust alerts, check battery status and get more info about their Octopus unit.

Displays current charge to internal battery system. Internal battery lasts about 10 hours.

Dynamically displays signal strength in RSRP (can also display RSSI). This number can update frequently or occasionally depending upon the user's movements, the RF environment or the base station's output power.

Touch this button and measure only RSRP (Reference Signal Receive Power) when this button is red as shown.

Touch this button and measure only RSSI (Received Signal Strength Indicator).

Indicates the generation of wireless base station being measured.

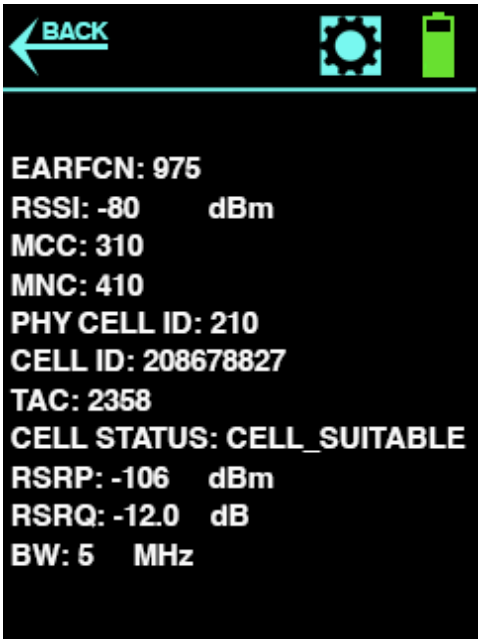
CID (Cell ID) number is used to identify each base transceiver station making it easier to keep track of many base stations all under the AT&T carrier name for instance.

Displays signal quality of the current base station being detected.

Cellular band number of the current base station detected.

Frequency of the current cellular device being detected.

Green outline shows highest signal strength detected so far over the current signal strength while in this screen. Touching anywhere inside the signal bar will reset the green outline to the current value.



Cell ID Information

From the single measurement screen, users can get more information about a single base station by pressing the CID (Cell ID) button. That takes users to a single screen with more details about that particular 4G base station. The screen above shows typical 4G CID data.

Settings Menu
Octopus Settings Menu screen can be reached from nearly any other screen by touching the gear icon. This screen provides measurement alert adjustments as well as the unit's information and battery health.

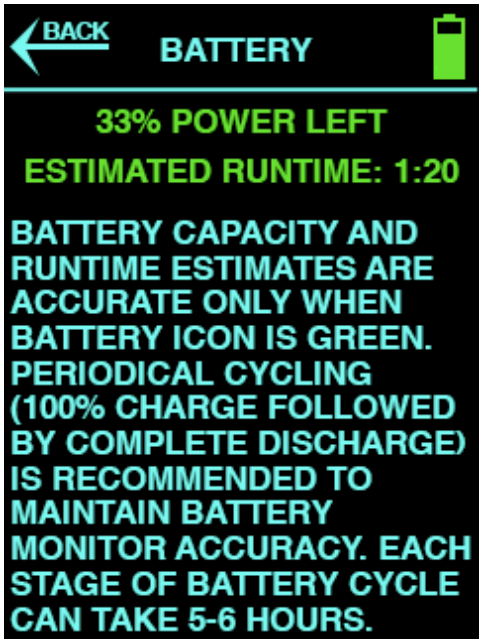
FIRMWARE Check www.bvsystems.com/technical-support for the latest firmware updates for your Octopus unit. Users can update firmware themselves via the included mini-USB cable and port located on the side of the unit and Windows PC. Be sure to watch the Octopus firmware update video on our YouTube for instructions. https://youtu.be/2Hxss7z3glc

S/N Have your serial number handy if you call BVS sales or support with any questions.

AUDIBLE ALERT Check this box if you want to hear an audible beep when the Octopus refreshes the scan or the data in the individual screens.

VIBRATING ALERT Check this box if you want to feel a brief vibration when interacting with your unit.

BATTERY CALIBRATION Touch this button to navigate to the battery health and calibration screen.



Battery Screen

This screen indicates current battery capacity. If you are experiencing noticeably shorter run times for your Octopus, navigate to this screen and follow the instructions. If battery issues persist, contact BVS support at 732-548-3737 or support@bvsystems.com.

Octopus PC Software
Octopus saves screen shots internally and uses the provided PC software to export them into a spreadsheet for further analysis. The steps for installation and operation of this software are shown below.

Octopus PC Software Installation

Download the Octopus file folder from the provided USB memory stick or the BVS website to a folder on your Desktop. Open the folder.
Double-click on the Octopus file. See Figure 1.

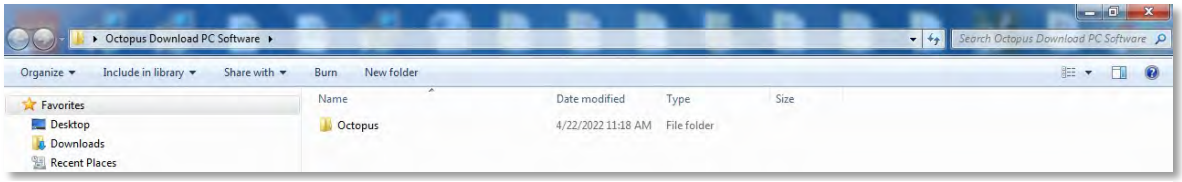


Figure 1

Double-click on "Octopus Setup". See Figure 2.

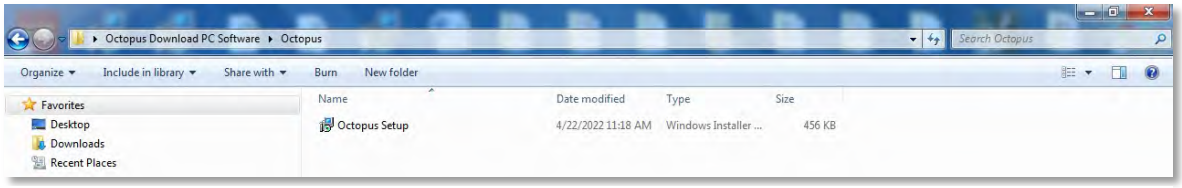


Figure 2

Select
"Run" on the Installer. See Figure 3.

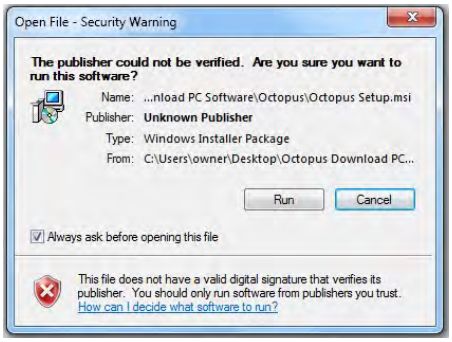


Figure 3

Select "Next" on the Setup Wizard. See Figure 4.

Figure 4

Select the Installation File Folder name. See Figure 5.

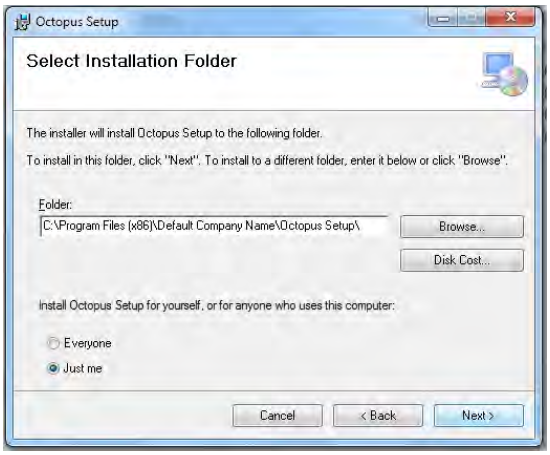


Figure 5

Select “Next” on the Confirm Installation window. See Figure 6.

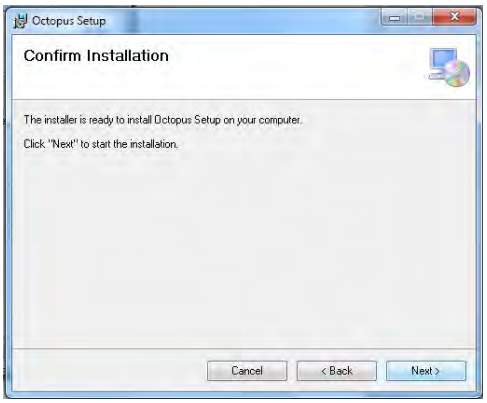


Figure 6

The “Installing Octopus Setup” window will open and show progress in the horizontal bar. See Figure 7.

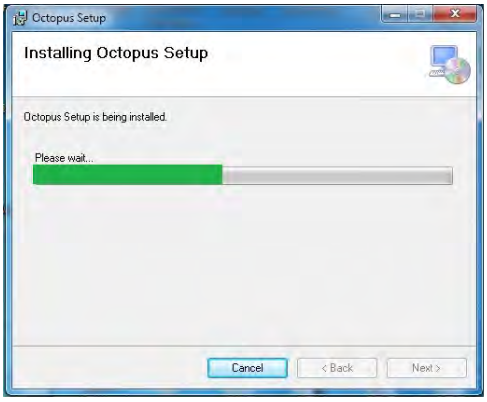


Figure 7

The window will show “Installation Complete” when finished. See Figure 8.

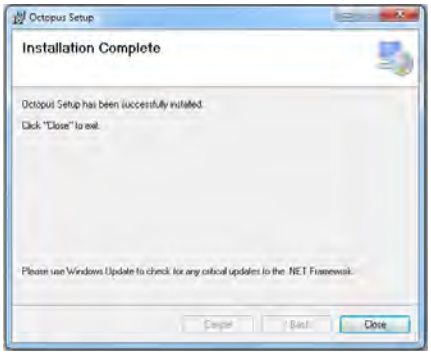


Figure 8

Select “Close” to exit the window.
The software will install in the Program Files (x86) folder under "Default Company Name" or "Berkeley Varitronics Systems, Inc." unless directed by you to a different folder. A shortcut icon for the executable program will be created on the Desktop and it is named "Octopus Download". See Figure 9.

Figure 9

Using the Octopus Download PC Software

Turn on the Octopus by depressing the white button and wait until it displays the main start-up page that lists AT&T, Verizon, T-Mobile and ALL 4G selection boxes. See Figure 10.

Figure 10

Always connect the Octopus to the USB port only after the main page on the Octopus is visible. Failure to do this will corrupt the USB COM Port connection.
Connect the USB cable between the Octopus and the PC.
Run the Octopus Download software by double-clicking on the shortcut icon that was created on your Desktop. See Figure 9.

When the program window opens up, select the COM Port for your USB connection. See Figures 11, 12 & 13.

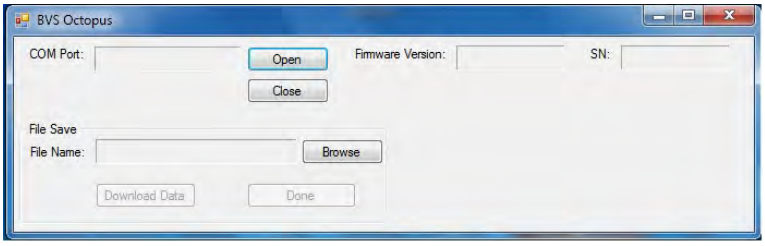


Figure 11

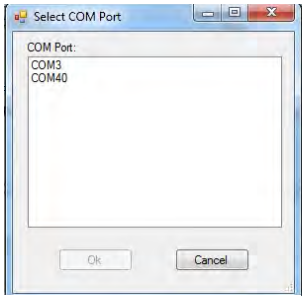


Figure 12

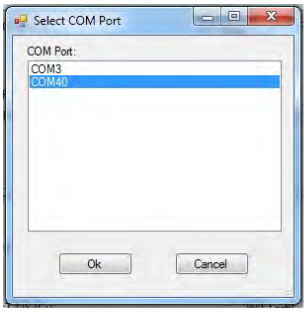


Figure 13

If the USB connection is good, the Octopus will respond by populating the Firmware version and Serial Number (S/N) boxes in the program display window. See Figure 14.

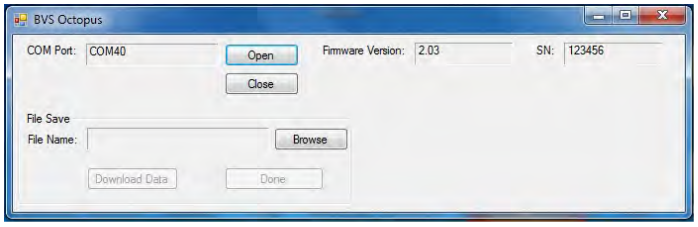


Figure 14

The serial number displayed should match that of your unit. The firmware displayed is what is currently running in your Octopus unit. This Firmware version should show v2.03 in order for the Octopus Download PC Software to work. Prior versions of firmware are not supported by the Octopus Download PC software.

Select the scan mode on the Octopus touch screen that you wish to run (AT&T, Verizon, T-Mobile or ALL 4G). See Figure 10. “All 4G” was used in the balance of this operational description procedure. Select any pre-sort for the data. The following pre-sorts are available; Carrier, Frequency (MHz), RSRQ (dB) and RSRP (dBm). See Figure 15.

Figure 15

Allow the Octopus to scan for a couple of minutes to populate the data pages. Watch the display screen to freeze the data when you see the most data displayed scan-over-scan. A total of 12 items (6 on each page, total of 2 pages) can be displayed on the Octopus. A total of 15 items could be contained in the download buffer memory of the Octopus for transfer to a PC via the Octopus Download software. See Figure 16 for an example.

Figure 16

Once the data page(s) have populated, press the display "Freeze" icon (snowflake) on the lower left hand corner of the Octopus display. See Figure 17.

Figure 17

This action fills the download buffer in the Octopus and keeps the scanning feature suspended. During this time the "Freeze" icon will dim and blink to indicate that the scanning has been suspended and the unit is ready to download the content of the Octopus data buffer to the PC. See Figures 18 & 19 for an example.

Figure 18

Figure 19

On the Octopus Download PC window, "Browse" for or create the file folder that you wish to store the download data in. See Figure 20.

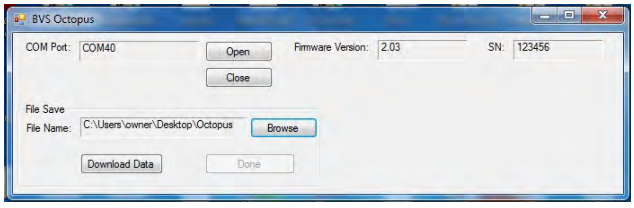


Figure 20

It is suggested to pick file names that will reflect on the data contained in the scan. Some suggestions are the locations or positions where the scan was taken. Work those into the name of the file. This file management will help locate these files long after the data is forgotten. Creating a file folder on the Desktop is recommended.

Click on the "Download Data" box in the Octopus Download PC window to download the frozen data from the Octopus to the PC. See Figure 21.

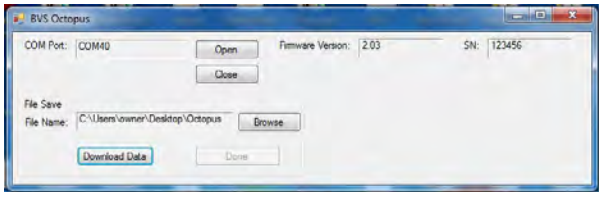


Figure 21

Once completed, the "Done" box in the PC window will become active (backlit). Select "Done" in the PC window to end the download process and clear the status of the PC software for the next download of "Freeze" data from the Octopus. See Figure 22.

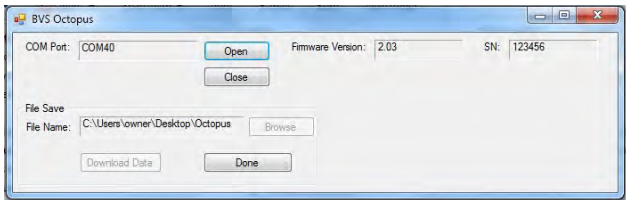


Figure 22

The created data file is in Microsoft Excel format and should be found in the file folder you identified or created in the "Browse" selection prior. See Figure 23.

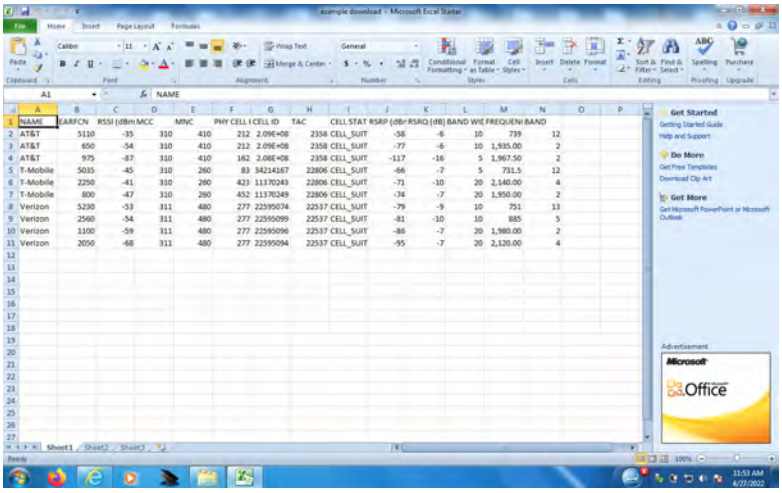


Figure 23

While reviewing the data file using MS Excel, highlight all of the populated rows and columns and execute an Auto Format for the column width. See Figure 24, 25 & 26.

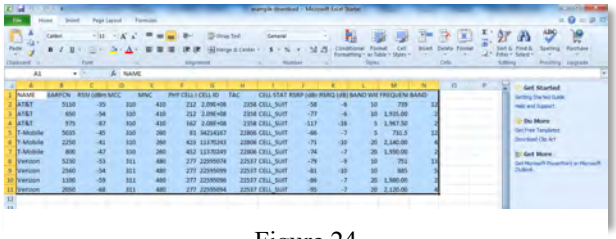


Figure 24

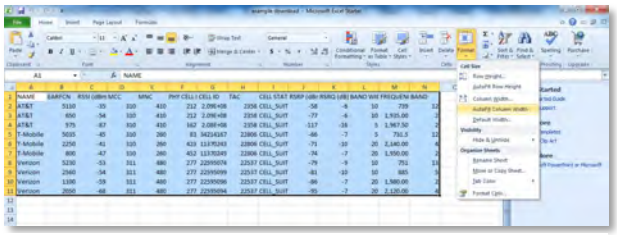


Figure 25

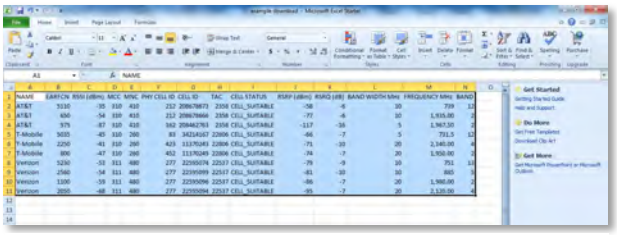
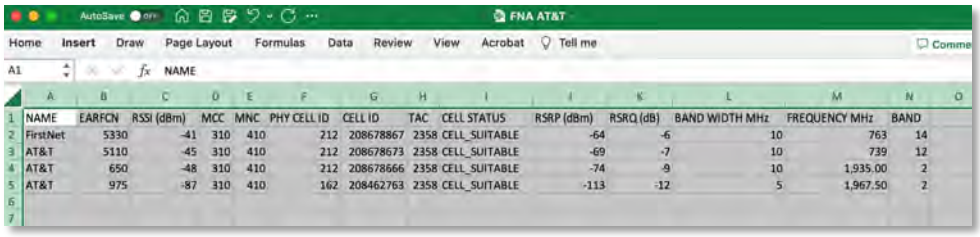


Figure 26

This will make all of the characters in the columns display properly. When closing the file in MS Excel be sure to save your edit so as to maintain the new column width formatting.

To un-freeze the scan on the Octopus, simply tap the "Freeze" icon (see Figure 17) and the Octopus will start scanning again. At this time, you can change your scan pre-sort method (see Figure 15) or go back to the main page (see Figure 10) and select another single carrier or enter the ALL 4G mode. Repeat this process every time you complete a scan, "Freeze" the data and download the data. Save each scan under its own file name in a file folder for that session's activity.

Figures 27, 28 & 29 are all examples of data captures (using the freeze icon) exported into Excel using the Octopus Public Safety unit. Figure 27 depicts a scan for only AT&T base stations so it includes measurements of both regular bands as well as AT&T's FirstNet band 14. Figure 28 displays a measurement of all 4G base station carriers including AT&T (including AT&T's FirstNet), T-Mobile and Verizon. Figure 29 displays only FirstNet network measurements.



NAME	EARFCN	RSSI (dBm)	MCC	MNC	PHY CELL ID	CELL ID	TAC	CELL STATUS	RSRP (dBm)	RSRQ (dB)	BAND WIDTH MHz	FREQUENCY MHz	BAND
FirstNet	5330	-41	310	410	212	208678867	2358	CELL_SUITABLE	-64	-6	10	763	14
AT&T	5110	-45	310	410	212	208678673	2358	CELL_SUITABLE	-69	-7	10	739	12
AT&T	650	-48	310	410	212	208678666	2358	CELL_SUITABLE	-74	-9	10	1,935.00	2
AT&T	975	-87	310	410	162	208462763	2358	CELL_SUITABLE	-113	-12	5	1,967.50	2

Figure 27

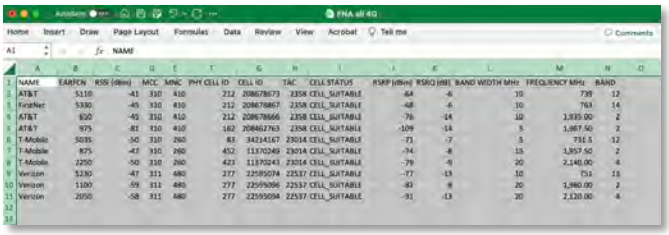
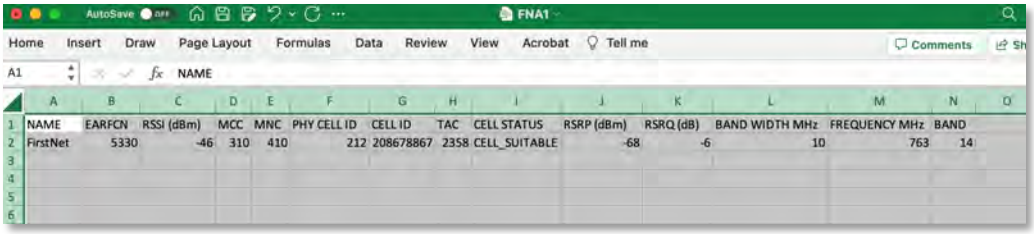


Figure 28



NAME	EARFCN	RSSI (dBm)	MCC	MNC	PHY CELL ID	CELL ID	TAC	CELL STATUS	RSRP (dBm)	RSRQ (dB)	BAND WIDTH MHz	FREQUENCY MHz	BAND
FirstNet	5330	-46	310	410	212	208678867	2358	CELL_SUITABLE	-68	-6	10	763	14

Figure 29

To exit the Octopus Download PC Software, click the "Done" box (if you have not already done so); click the "Close" box (to close the USB Port properly, see Figure 27) and then click on the "X" in the upper right hand corner of the Octopus Download PC window to exit the program. Disconnect the USB cable and shut down the Octopus unit by pressing and holding the white button for a couple of seconds.

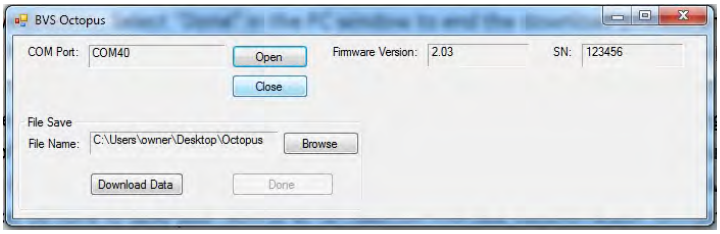


Figure 30

Thank you for your purchase, we look forward to supporting you and your team.

Customer Support

Berkeley Varitronics Systems, Inc.
Liberty Corporate Park
255 Liberty Street
Metuchen, NJ 08840

8:00 AM to 6:00 PM EST
Toll Free: 888-737-4287
Phone: 732-548-3737
Fax: 732-548-3404

24/7 (expect a reply within one day)
email: support@bvsystems.com
www.bvsystems.com

SPECIFICATION

Part No. : **TG.08.0113**

Description : Monopole Passive Antenna
Broadband frequency range for cellular and GNSS

Features : High efficiency at 698 to 960MHz, 1561MHz, 1575.42MHz, 1602MHz, 1710 to 2700MHz.
360◦rotatable with durable brass hinge.
Compatible with:
- 2G (GSM / DCS / PCS)
- 3G (CDMA / WCDMA / UMTS / HSPA)
- 4G (700LTE / 2700LTE)
- GNSS (GPS / GLONASS / Galileo / BeiDou)

Standard with SMA(M) connector
Low profile with 72 ± 1.5mm Length
RoHs Compliant

1. Introduction

The compact TG.08 with hinged rotatable SMA connector, is an impressively high efficiency monopole antenna, which provides wide coverage among cellular and GNSS frequencies.

With its cellular and GNSS function, plus compact design, TG.08 can fit and function perfectly with routers, vehicle tracking devices, telematics devices, and remote monitoring systems. It is also ideal for use with cellular modules with Assisted GPS functionality that can be implemented in various devices.

This 72mm long monopole antenna works efficiently from 700MHz to 2700MHz, widely covering 4G/3G/2G bands, as well as GPS/GLONASS/Galileo /BeiDou. At its maximum efficiency when connected to ground plane, it can achieve 73% and 67% at GPS and LTE bands, respectively.

As all monopole antennas, TG.08 works best while connecting directly to the ground-plane of the device main-board, or with the device's metal enclosure.

The robust brass hinge enables TG.08 to be oriented in all directions, providing users to maximize performance with minimum effort.

TG.08, the small antenna with surprisingly large efficiency, is surely the best candidate in the market for Cellular/GNSS combination terminal antennas.

2. Specification

Parameter										
Straight Position										
Band		700LTE	GSM	BEIDOU	GPS/ GALILEO	GLONASS	DCS	PCS	UMTS/ HSPA	2700LTE
Frequency (MHz)		703~ 803	824~ 960	1561	1575.42	1602	1710~ 1880	1850~ 1990	1920~ 2170	2490~ 2690
Average Gain (dBi)	In Free Space	-9.69	-8.70	-5.77	-5.44	-4.92	-3.84	-3.45	-3.62	-4.39
Efficiency (%)		10.75	13.50	26.48	28.56	32.24	41.40	45.18	43.46	36.73
Peak Gain (dBi)		-6.46	-4.93	-1.42	-1.07	-0.61	-0.02	0.66	0.33	0.36
Return Loss (dB)		< -2	< -3	< -6	< -6	< -10	< -10	< -10	< -8	< 4
Average Gain (dBi)	With 15x9cm Ground	-1.72	-4.35	-1.73	-1.67	-1.54	-1.38	-1.33	-1.70	-1.60
Efficiency (%)		67.86	37.27	67.08	68.13	70.22	72.83	73.67	67.77	69.40
Peak Gain (dBi)		1.24	-1.28	1.99	1.98	1.86	2.48	2.79	2.79	3.25
Return Loss (dB)		< -5		< -8						
Average Gain (dBi)	On 30x30cm Ground Metal Edge	-1.75	-2.55	-1.37	-1.34	-1.37	-1.31	-1.31	-1.70	-2.75
Efficiency (%)		66.98	56.27	73.02	73.38	72.97	74.02	74.05	67.83	53.12
Peak Gain (dBi)		1.53	0.13	3.95	3.86	3.82	2.82	3.22	3.20	2.22
Return Loss (dB)		< -5		< -9						
Average Gain (dBi)	On 30x30cm Ground Metal Center	-4.59	-3.46	-2.79	-2.82	-2.89	-2.71	-2.71	-2.94	-2.65
Efficiency (%)		35.71	45.52	52.63	52.25	51.38	53.68	53.56	50.89	54.39
Peak Gain (dBi)		-0.65	0.77	1.98	1.88	1.61	3.16	2.56	2.33	3.26
Return Loss (dB)		< -2		<-4						
Bent Position										
Average Gain (dBi)	In Free Space	-10.74	-10.14	-5.81	-5.48	-4.99	-4.03	-3.71	-4.00	-4.80
Efficiency (%)		8.44	9.70	26.27	28.29	31.68	39.58	42.60	39.93	33.53
Peak Gain (dBi)		-7.22	-5.54	-1.63	-1.29	-0.75	0.06	0.94	0.69	0.46
Return Loss (dB)		< -2	<-3	<-10	<-10	<-10	<-10	<-10	<-8	<-4
Average Gain (dBi)	With 15x9cm Ground	-1.72	-4.35	-1.73	-1.67	-1.54	-1.38	-1.33	-1.70	-1.60
Efficiency (%)		67.86	37.27	67.08	68.13	70.22	72.83	73.67	67.77	69.40
Peak Gain (dBi)		1.24	-1.28	1.99	1.98	1.86	2.48	2.79	2.79	3.25
Return Loss (dB)		< -5		<-8						

Average Gain (dBi)	On 30x30cm ground Metal Edge	-2.98	-2.87	-1.46	-1.43	-1.42	-1.26	-1.31	-1.81	-3.01
Efficiency (%)		50.73	52.04	71.38	71.90	72.16	74.96	74.01	66.35	50.02
Peak Gain (dBi)		0.74	0.65	3.47	3.51	3.56	3.03	3.56	3.62	2.69
Return Loss (dB)		< -5		<-8						
Average Gain (dBi)	On 30x30cm Ground Metal Center	-8.87	-6.76	-2.61	-2.63	-2.71	-2.80	-3.03	-3.47	-3.29
Efficiency (%)		13.53	21.31	54.89	54.63	53.54	52.53	49.87	45.22	46.93
Peak Gain (dBi)		-4.74	-1.92	1.96	1.89	2.00	3.01	2.26	1.79	2.58
Return Loss (dB)		<-2		<-3						
Radiation		Omni-directional								
Polarization		Linear								
Impedance		50 Ω								
Input Power		10W								

MECHANICAL	
Antenna length	72mm
Antenna Diameter	10mm
Casing	POM
Connector	SMA(M)
Weight	6g
Recommended Torque for Mounting	0.9N·m
Max. Torque for Mounting	1.176N·m

ENVIRONMENTAL	
Operation Temperature	-40°C ~ + 85°C
Storage Temperature	-40°C ~ + 85°C
Humidity	Non-condensing 65°C 95% RH

2.1. LTE Bands – Straight in Free Space

LTE BANDS			
Band Number	LTE / LTE-Advanced / WCDMA / HSPA / HSPA+ / TD-SCDMA		
	Uplink	**Downlink**	**Covered**
1	UL: 1920 to 1980	DL: 2110 to 2170	✓
2	UL: 1850 to 1910	DL: 1930 to 1990	✓
3	UL: 1710 to 1785	DL: 1805 to 1880	✓
4	UL: 1710 to 1755	DL: 2110 to 2155	✓
5	UL: 824 to 849	DL: 869 to 894	✗
7	UL: 2500 to 2570	DL:2620 to 2690	✓
8	UL: 880 to 915	DL: 925 to 960	✗
9	UL: 1749.9 to 1784.9	DL: 1844.9 to 1879.9	✓
11	UL: 1427.9 to 1447.9	DL: 1475.9 to 1495.9	✗
12	UL: 699 to 716	DL: 729 to 746	✗
13	UL: 777 to 787	DL: 746 to 756	✗
14	UL: 788 to 798	DL: 758 to 768	✗
17	UL: 704 to 716	DL: 734 to 746 (LTE only)	✗
18	UL: 815 to 830	DL: 860 to 875 (LET only)	✗
19	UL: 830 to 845	DL: 875 to 890	✗
20	UL: 832 to 862	DL: 791 to 821	✗
21	UL: 1447.9 to 1462.9	DL: 1495.9 to 1510.9	✗
22	UL: 3410 to 3490	DL: 3510 to 3590	✗
23	UL:2000 to 2020	DL: 2180 to 2200 (LTE only)	✓
24	UL:1625.5 to 1660.5	DL: 1525 to 1559 (LTE only)	✗
25	UL: 1850 to 1915	DL: 1930 to 1995	✓
26	UL: 814 to 849	DL: 859 to 894	✗
27	UL: 807 to 824	DL: 852 to 869 (LTE only)	✗
28	UL: 703 to 748	DL: 758 to 803 (LTE only)	✗
29	UL: -	DL: 717 to 728 (LTE only)	✓
30	UL: 2305 to 2315	DL: 2350 to 2360 (LTE only)	✓
31	UL: 452.5 to 457.5	DL: 462.5 to 467.5 (LTE only)	✗
32	UL: -	DL: 1452 - 1496	✗
35	1850 to 1910		✓
38	2570 to 2620		✓
39	1880 to 1920		✓
40	2300 to 2400		✓
41	2496 to 2690		✓
42	3400 to 3600		✗
43	3600 to 3800		✗

*Covered bands represent an efficiency greater than 20%

2.2. LTE Bands – Straight on Edge of 300*300mm Ground Plane

LTE BANDS			
Band Number	LTE / LTE-Advanced / WCDMA / HSPA / HSPA+ / TD-SCDMA		
	Uplink	**Downlink**	**Covered**
1	UL: 1920 to 1980	DL: 2110 to 2170	✓
2	UL: 1850 to 1910	DL: 1930 to 1990	✓
3	UL: 1710 to 1785	DL: 1805 to 1880	✓
4	UL: 1710 to 1755	DL: 2110 to 2155	✓
5	UL: 824 to 849	DL: 869 to 894	✓
7	UL: 2500 to 2570	DL:2620 to 2690	✓
8	UL: 880 to 915	DL: 925 to 960	✓
9	UL: 1749.9 to 1784.9	DL: 1844.9 to 1879.9	✓
11	UL: 1427.9 to 1447.9	DL: 1475.9 to 1495.9	✗
12	UL: 699 to 716	DL: 729 to 746	✓
13	UL: 777 to 787	DL: 746 to 756	✓
14	UL: 788 to 798	DL: 758 to 768	✓
17	UL: 704 to 716	DL: 734 to 746 (LTE only)	✓
18	UL: 815 to 830	DL: 860 to 875 (LET only)	✓
19	UL: 830 to 845	DL: 875 to 890	✓
20	UL: 832 to 862	DL: 791 to 821	✓
21	UL: 1447.9 to 1462.9	DL: 1495.9 to 1510.9	✗
22	UL: 3410 to 3490	DL: 3510 to 3590	✗
23	UL:2000 to 2020	DL: 2180 to 2200 (LTE only)	✓
24	UL:1625.5 to 1660.5	DL: 1525 to 1559 (LTE only)	✓
25	UL: 1850 to 1915	DL: 1930 to 1995	✓
26	UL: 814 to 849	DL: 859 to 894	✓
27	UL: 807 to 824	DL: 852 to 869 (LTE only)	✓
28	UL: 703 to 748	DL: 758 to 803 (LTE only)	✓
29	UL: -	DL: 717 to 728 (LTE only)	✓
30	UL: 2305 to 2315	DL: 2350 to 2360 (LTE only)	✓
31	UL: 452.5 to 457.5	DL: 462.5 to 467.5 (LTE only)	✗
32	UL: -	DL: 1452 - 1496	✗
35	1850 to 1910		✓
38	2570 to 2620		✓
39	1880 to 1920		✓
40	2300 to 2400		✓
41	2496 to 2690		✓
42	3400 to 3600		✗
43	3600 to 3800		✗

*Covered bands represent an efficiency greater than 20%

2.3. LTE Bands – Bent in Free Space

LTE BANDS			
Band Number	LTE / LTE-Advanced / WCDMA / HSPA / HSPA+ / TD-SCDMA		
	Uplink	**Downlink**	**Covered**
1	UL: 1920 to 1980	DL: 2110 to 2170	✓
2	UL: 1850 to 1910	DL: 1930 to 1990	✓
3	UL: 1710 to 1785	DL: 1805 to 1880	✓
4	UL: 1710 to 1755	DL: 2110 to 2155	✓
5	UL: 824 to 849	DL: 869 to 894	✗
7	UL: 2500 to 2570	DL:2620 to 2690	✓
8	UL: 880 to 915	DL: 925 to 960	✗
9	UL: 1749.9 to 1784.9	DL: 1844.9 to 1879.9	✓
11	UL: 1427.9 to 1447.9	DL: 1475.9 to 1495.9	✗
12	UL: 699 to 716	DL: 729 to 746	✗
13	UL: 777 to 787	DL: 746 to 756	✗
14	UL: 788 to 798	DL: 758 to 768	✗
17	UL: 704 to 716	DL: 734 to 746 (LTE only)	✗
18	UL: 815 to 830	DL: 860 to 875 (LET only)	✗
19	UL: 830 to 845	DL: 875 to 890	✗
20	UL: 832 to 862	DL: 791 to 821	✗
21	UL: 1447.9 to 1462.9	DL: 1495.9 to 1510.9	✗
22	UL: 3410 to 3490	DL: 3510 to 3590	✗
23	UL:2000 to 2020	DL: 2180 to 2200 (LTE only)	✓
24	UL:1625.5 to 1660.5	DL: 1525 to 1559 (LTE only)	✗
25	UL: 1850 to 1915	DL: 1930 to 1995	✓
26	UL: 814 to 849	DL: 859 to 894	✗
27	UL: 807 to 824	DL: 852 to 869 (LTE only)	✗
28	UL: 703 to 748	DL: 758 to 803 (LTE only)	✗
29	UL: -	DL: 717 to 728 (LTE only)	✓
30	UL: 2305 to 2315	DL: 2350 to 2360 (LTE only)	✓
31	UL: 452.5 to 457.5	DL: 462.5 to 467.5 (LTE only)	✗
32	UL: -	DL: 1452 - 1496	✗
35	1850 to 1910		✓
38	2570 to 2620		✓
39	1880 to 1920		✓
40	2300 to 2400		✓
41	2496 to 2690		✓
42	3400 to 3600		✗
43	3600 to 3800		✗

*Covered bands represent an efficiency greater than 20%

2.4. LTE Bands – Bent on Edge of 300*300mm Ground plane

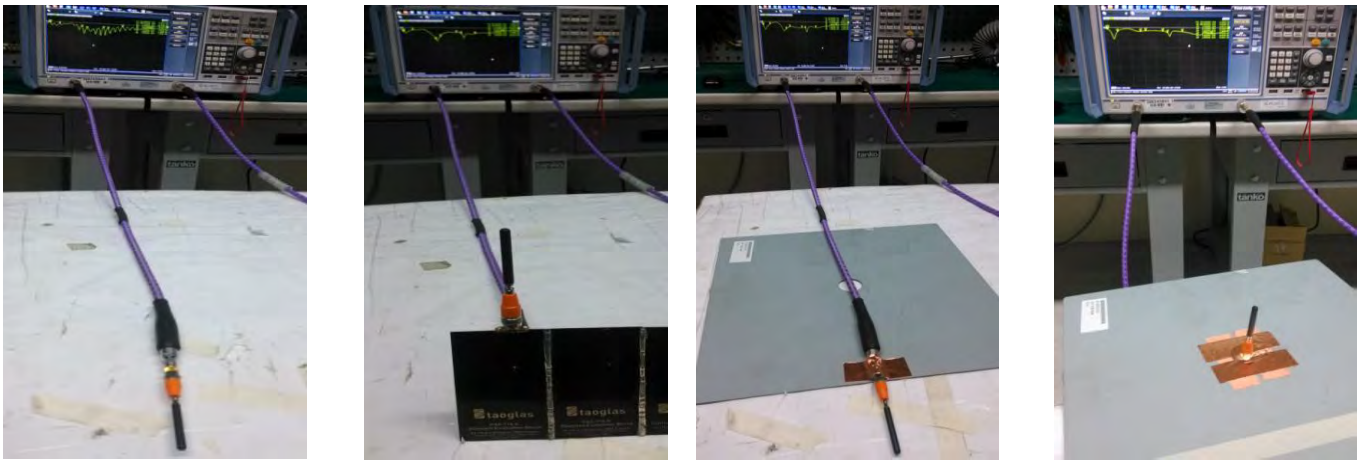
LTE BANDS			
Band Number	LTE / LTE-Advanced / WCDMA / HSPA / HSPA+ / TD-SCDMA		
	Uplink	**Downlink**	**Covered**
1	UL: 1920 to 1980	DL: 2110 to 2170	✓
2	UL: 1850 to 1910	DL: 1930 to 1990	✓
3	UL: 1710 to 1785	DL: 1805 to 1880	✓
4	UL: 1710 to 1755	DL: 2110 to 2155	✓
5	UL: 824 to 849	DL: 869 to 894	✓
7	UL: 2500 to 2570	DL:2620 to 2690	✓
8	UL: 880 to 915	DL: 925 to 960	✓
9	UL: 1749.9 to 1784.9	DL: 1844.9 to 1879.9	✓
11	UL: 1427.9 to 1447.9	DL: 1475.9 to 1495.9	✗
12	UL: 699 to 716	DL: 729 to 746	✓
13	UL: 777 to 787	DL: 746 to 756	✓
14	UL: 788 to 798	DL: 758 to 768	✓
17	UL: 704 to 716	DL: 734 to 746 (LTE only)	✓
18	UL: 815 to 830	DL: 860 to 875 (LET only)	✓
19	UL: 830 to 845	DL: 875 to 890	✓
20	UL: 832 to 862	DL: 791 to 821	✓
21	UL: 1447.9 to 1462.9	DL: 1495.9 to 1510.9	✗
22	UL: 3410 to 3490	DL: 3510 to 3590	✗
23	UL:2000 to 2020	DL: 2180 to 2200 (LTE only)	✓
24	UL:1625.5 to 1660.5	DL: 1525 to 1559 (LTE only)	✓
25	UL: 1850 to 1915	DL: 1930 to 1995	✓
26	UL: 814 to 849	DL: 859 to 894	✓
27	UL: 807 to 824	DL: 852 to 869 (LTE only)	✓
28	UL: 703 to 748	DL: 758 to 803 (LTE only)	✓
29	UL: -	DL: 717 to 728 (LTE only)	✓
30	UL: 2305 to 2315	DL: 2350 to 2360 (LTE only)	✓
31	UL: 452.5 to 457.5	DL: 462.5 to 467.5 (LTE only)	✗
32	UL: -	DL: 1452 - 1496	✗
35	1850 to 1910		✓
38	2570 to 2620		✓
39	1880 to 1920		✓
40	2300 to 2400		✓
41	2496 to 2690		✓
42	3400 to 3600		✗
43	3600 to 3800		✗

*Covered bands represent an efficiency greater than 20%

3. Antenna Characteristics

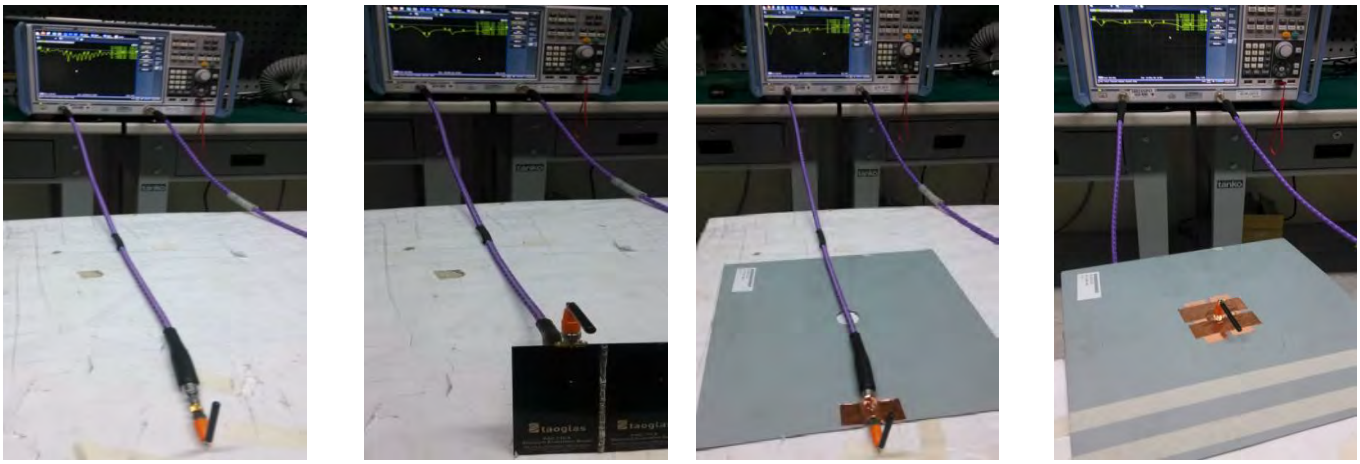
3.1. Testing setup

Antenna Straight Position



a) In free space | b) With 15*9cm Ground | c) With 30*30cm Ground Metal Edge | d) With 30*30cm Ground Metal Center

Antenna Bent Position



a) In free space | b) With 15*9cm Ground | c) With 30*30cm Ground Metal Edge | d) With 30*30cm Ground Metal Center

Figure.1 Measurement environments

3.2. Return loss

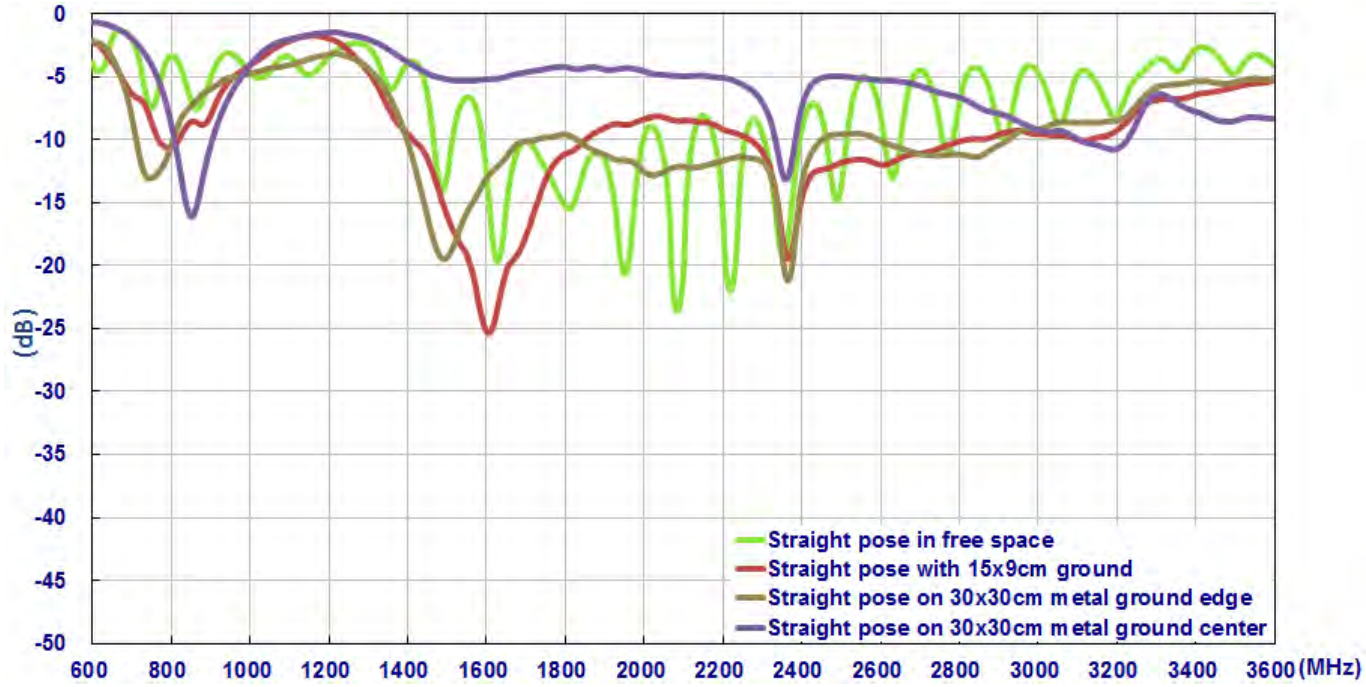


Figure2. Return loss of TG.08 antenna with straight Position

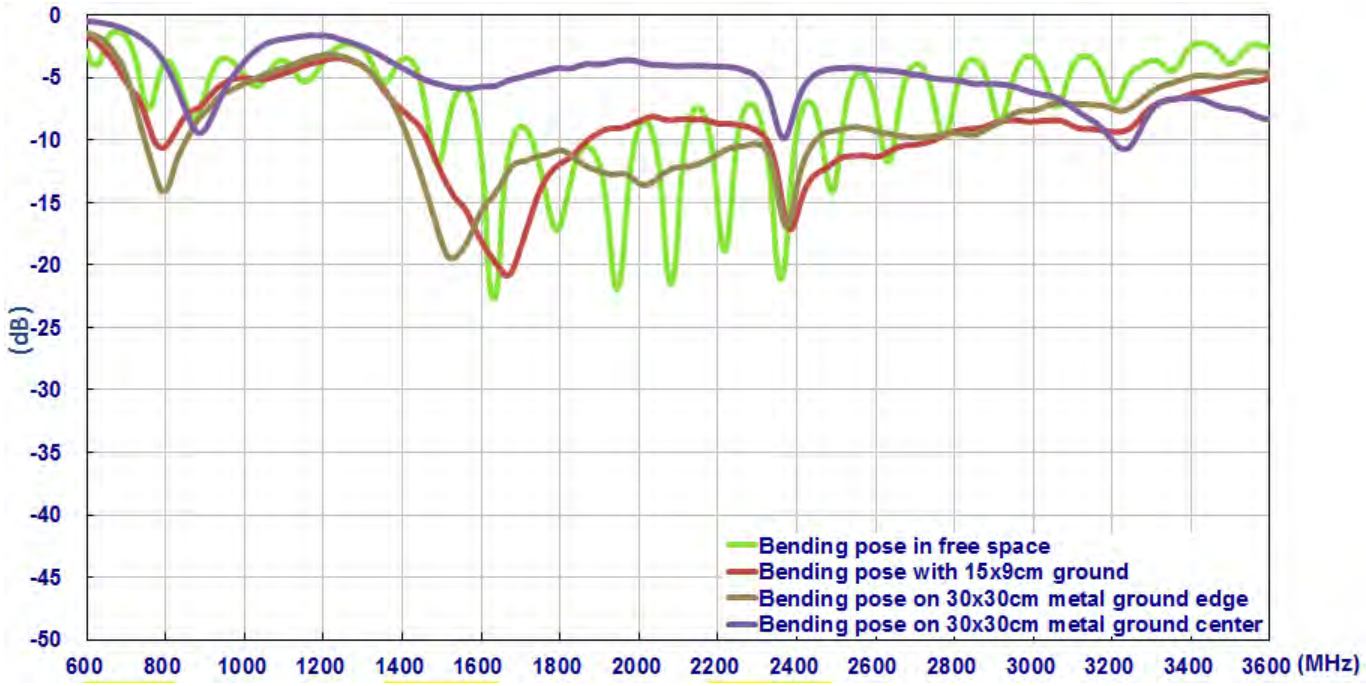


Figure3. Return loss of TG.08 antenna with bent Position

3.3. Efficiency

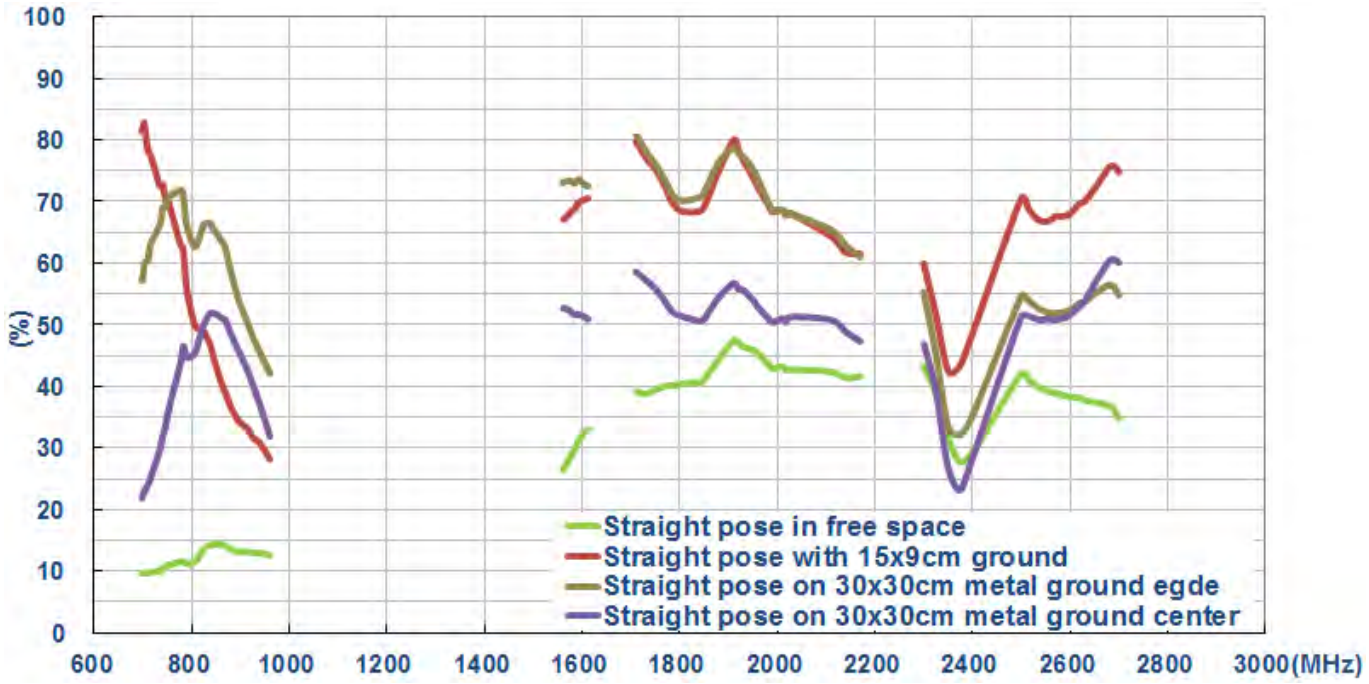


Figure4. Efficiency of TG.08 antenna with straight Position

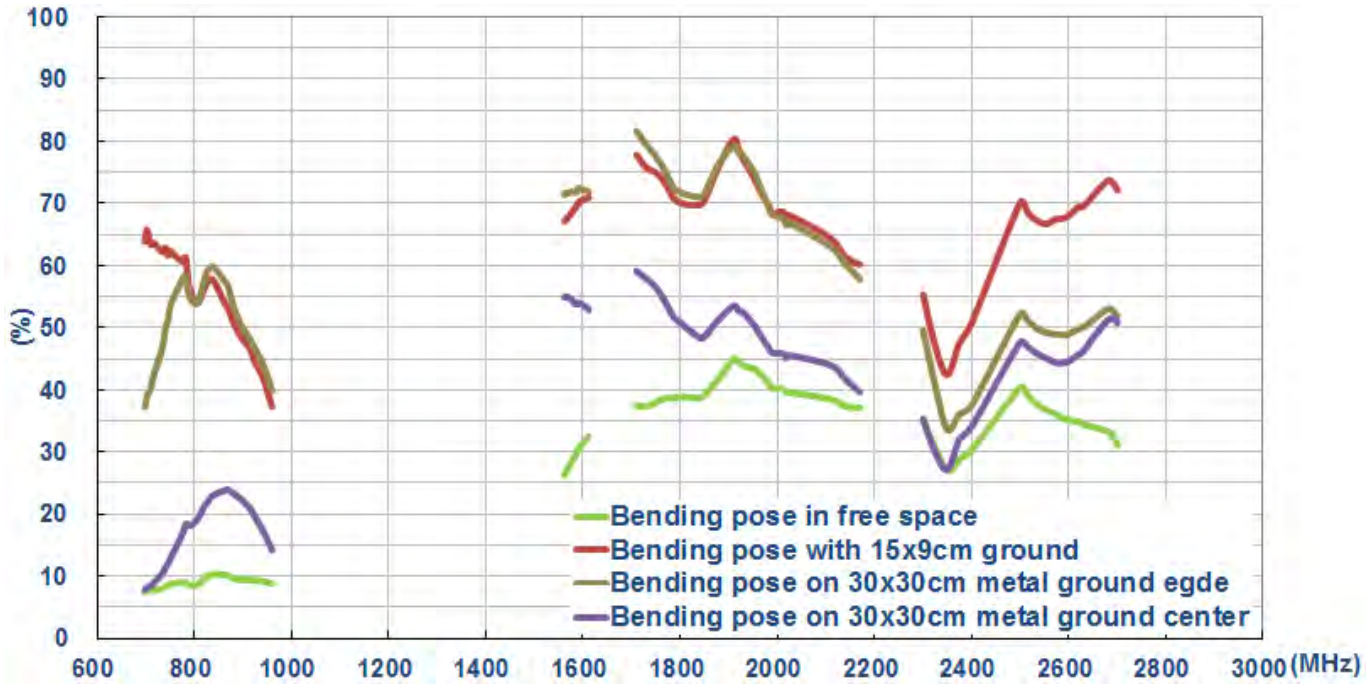


Figure5. Efficiency of TG.08 antenna with bent Position

3.4. Peak gain

Figure6. Peak gain of TG.08 antenna with straight Position

Figure7. Peak gain of TG.08 antenna with bent Position

3.5. Average gain

Figure8. Average gain of TG.08 with antenna straight Position

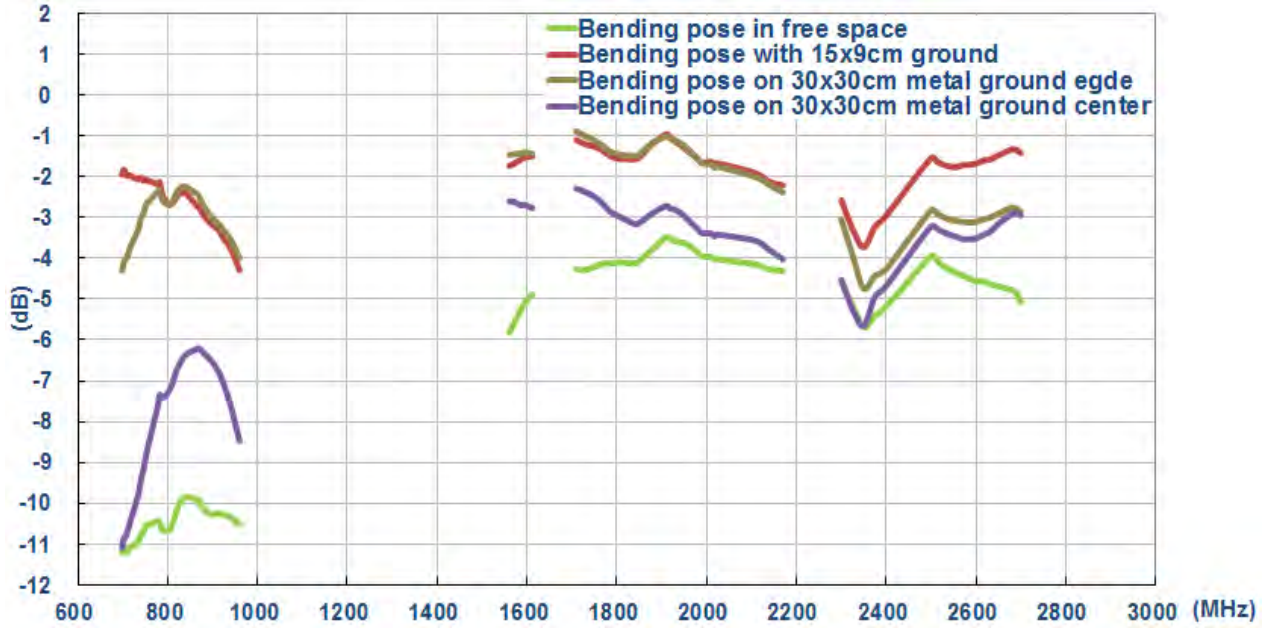
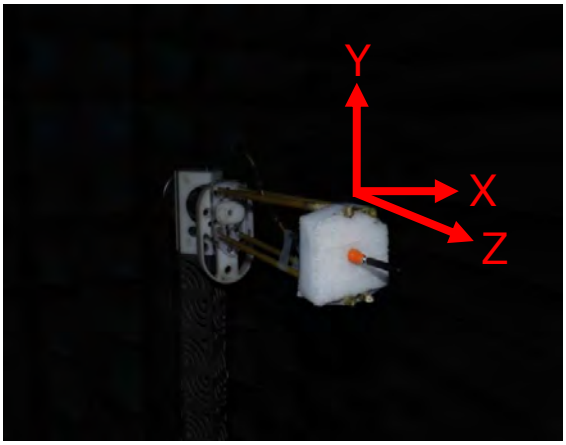


Figure9. Average gain of TG.08 antenna with bent Position

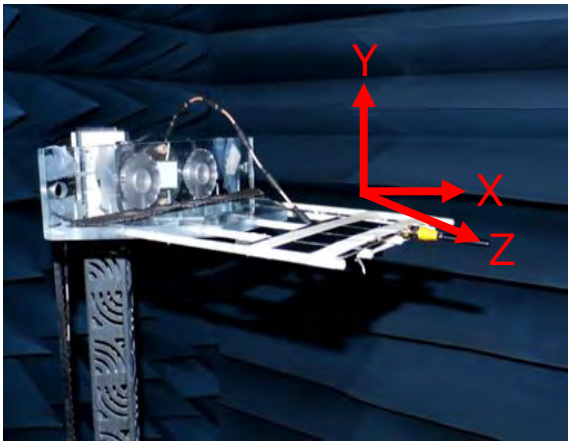
4. Antenna Radiation Patterns

The antenna radiation patterns were measured in a CTIA certified ETS Anechoic Chamber. The measurement setups are shown below.

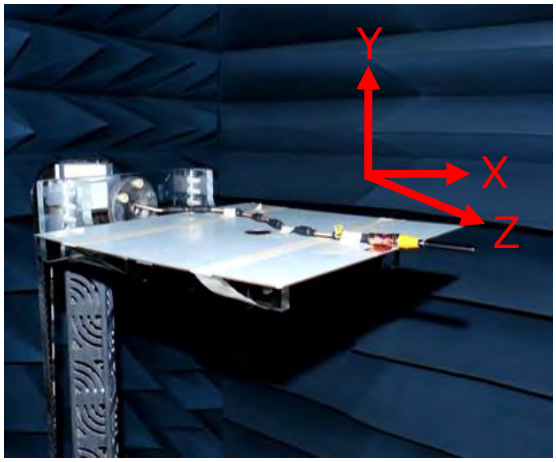
Antenna with Straight Position



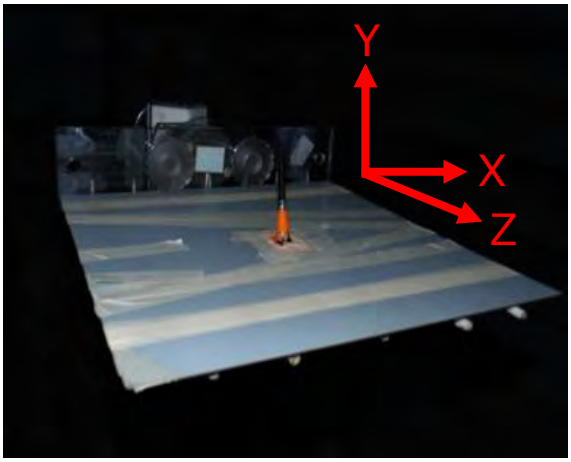
In free space



On 15x9cm ground plane

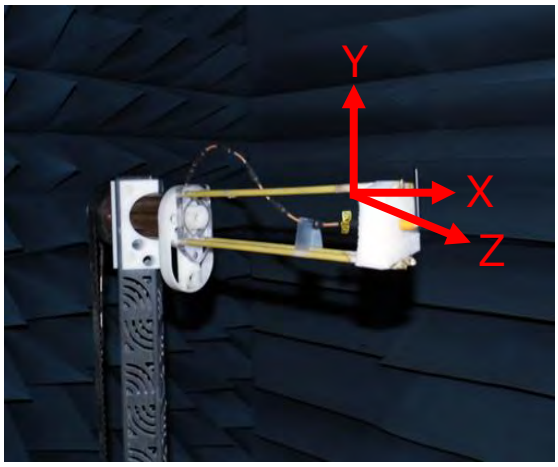


On 30x30cm metal ground center

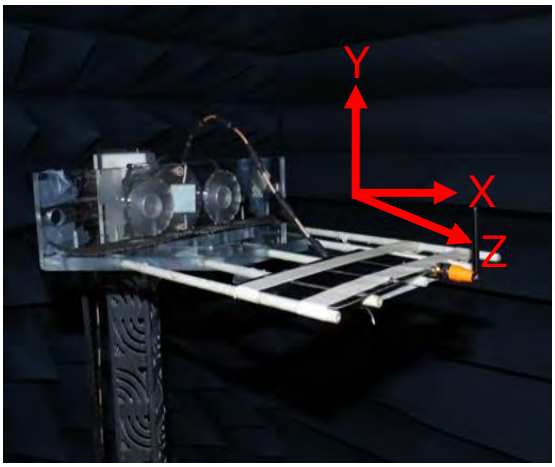


On 30x30cm metal ground edge

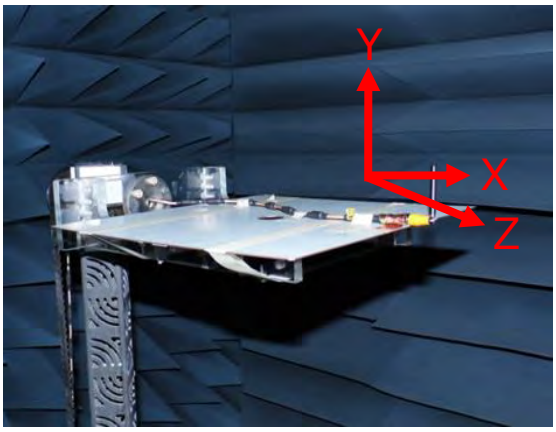
Antenna with Bent Position



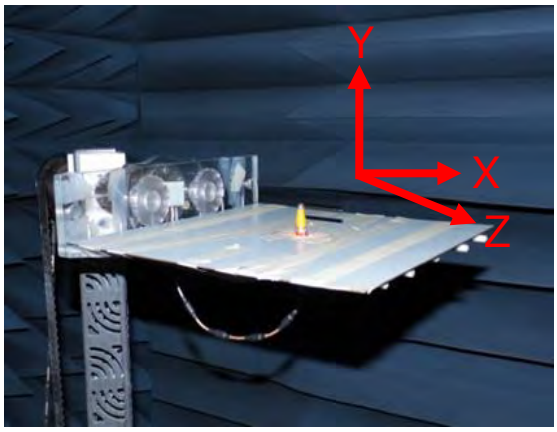
In free space



On 15x9cm ground plane



On 30x30cm metal ground center

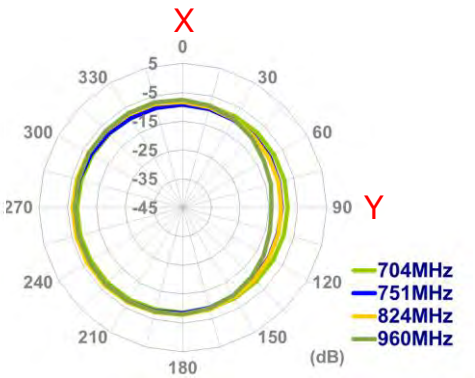


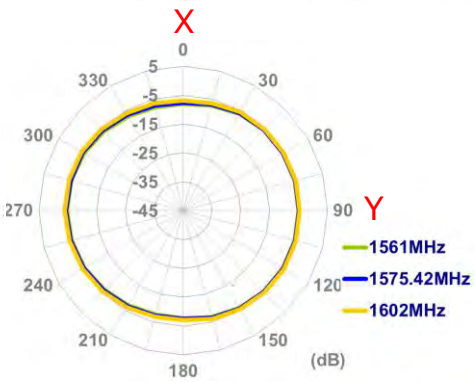
On 30x30cm metal ground edge

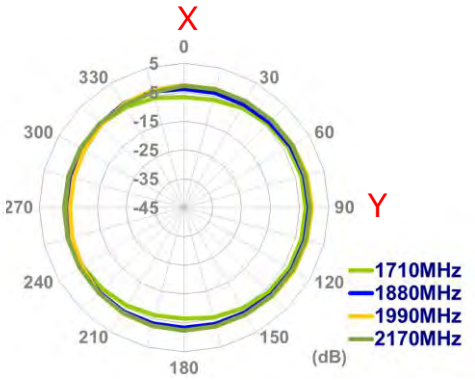
Figure.10. Testing Setup in ETS Anechoic Chamber

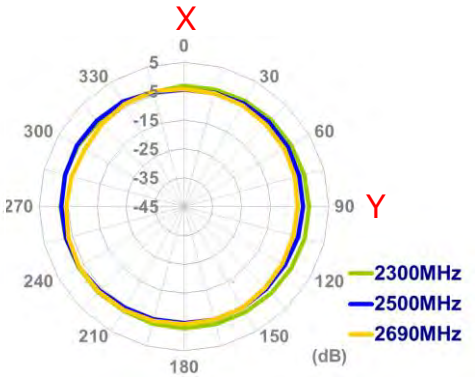
4.1. 2D Radiation pattern (Straight Position in free space)

XY Plane

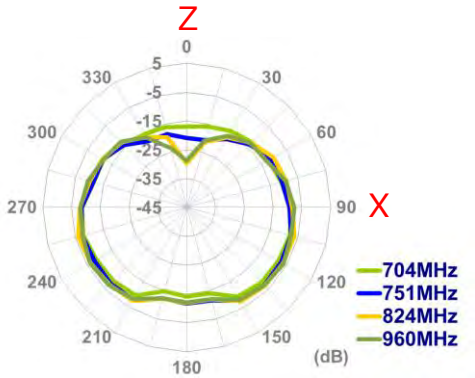


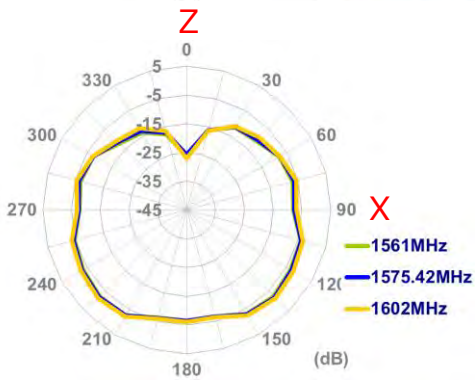


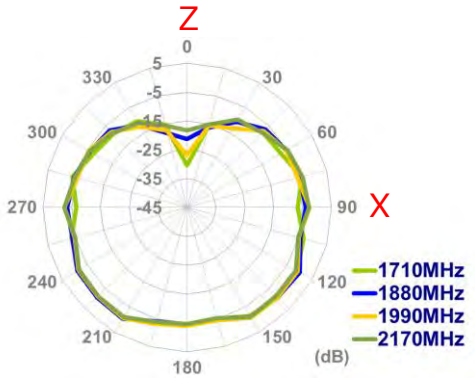


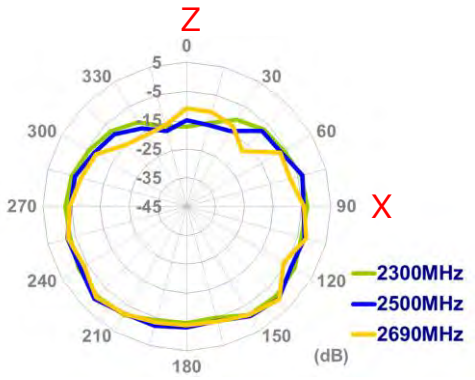


XZ Plane

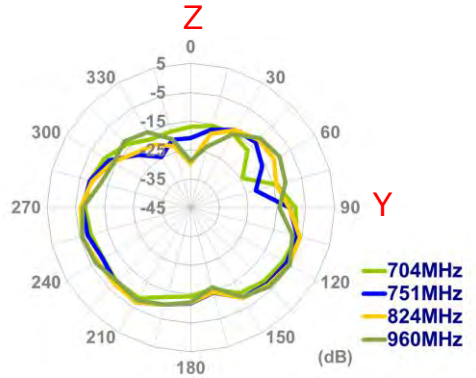


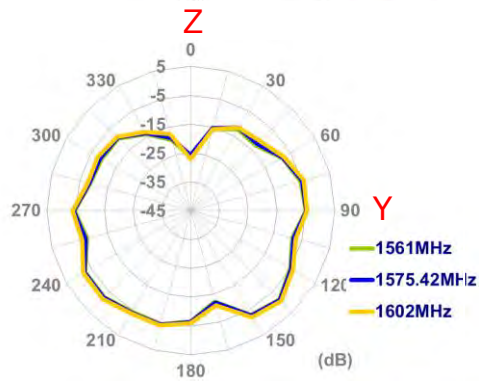


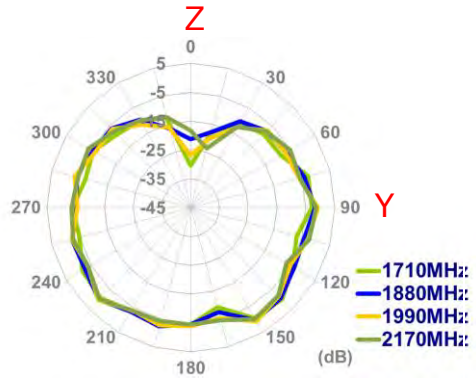


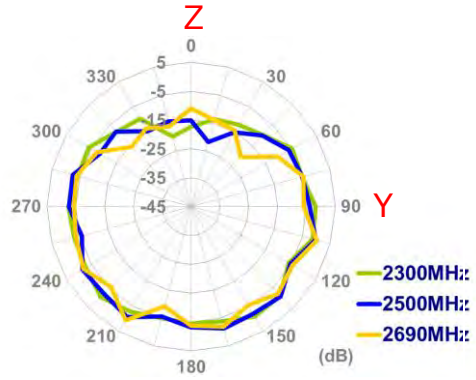


YZ Plane



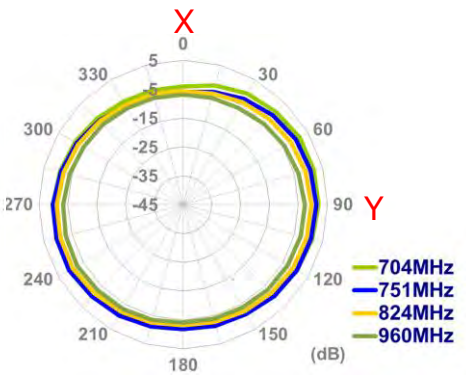


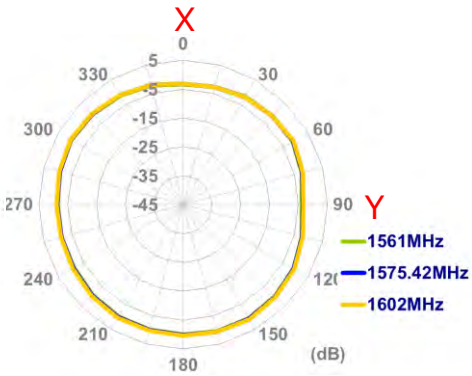


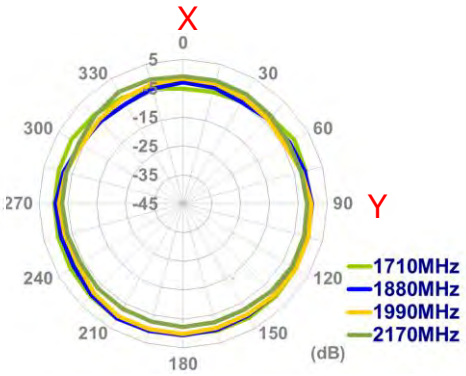


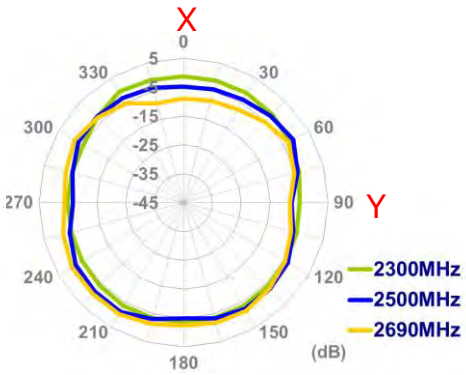
4.2. 2D Radiation pattern (Straight Position with 15x9cm ground)

XY Plane

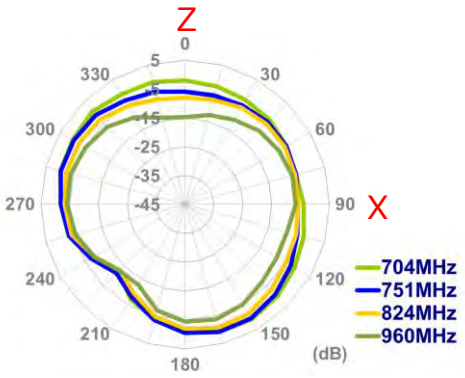


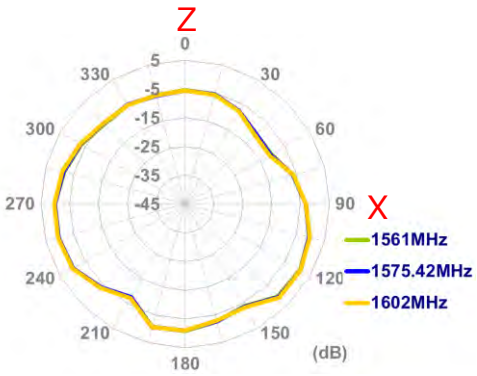


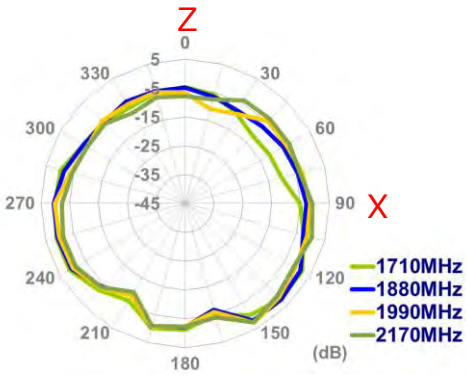


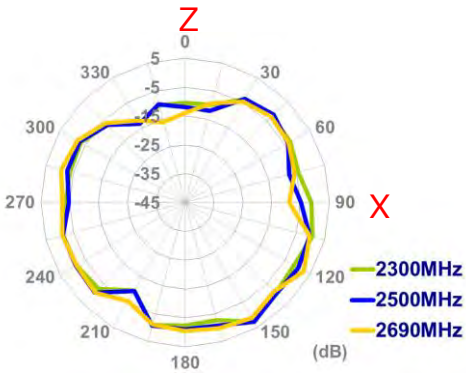


XZ Plane

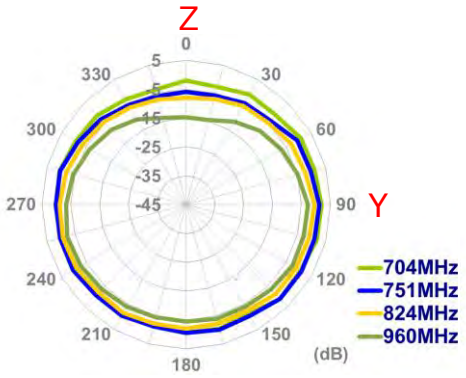


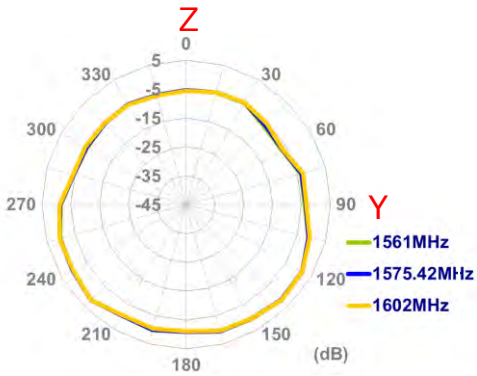


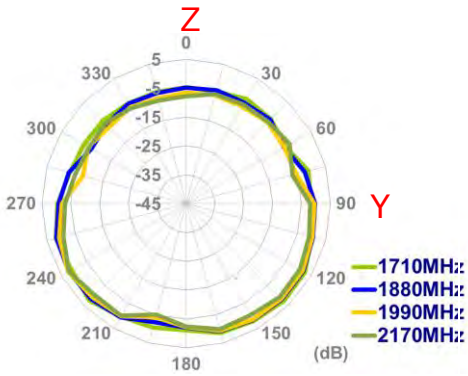


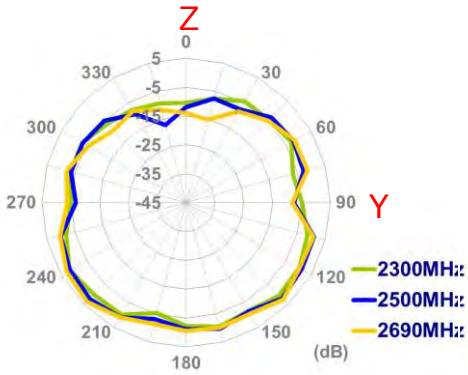


YZ Plane



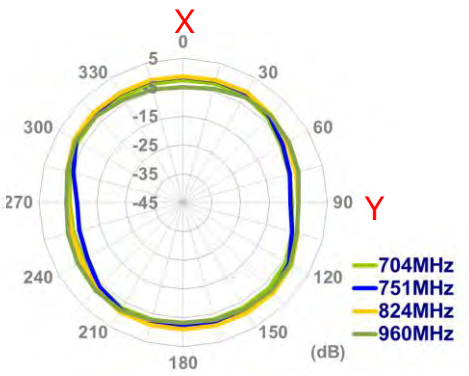




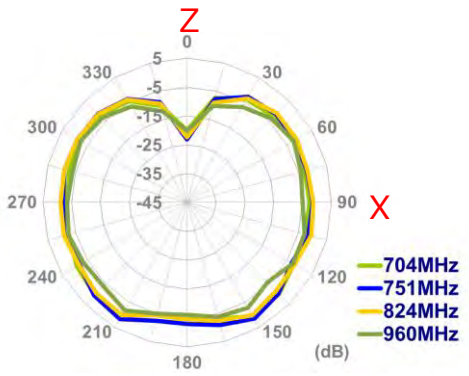


4.3. 2D Radiation pattern (Straight Position with 30x30cm Metal Ground Edge)

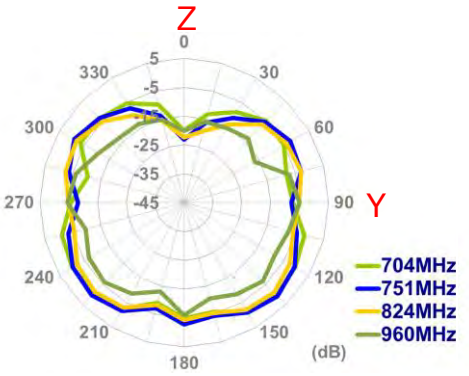
XY Plane

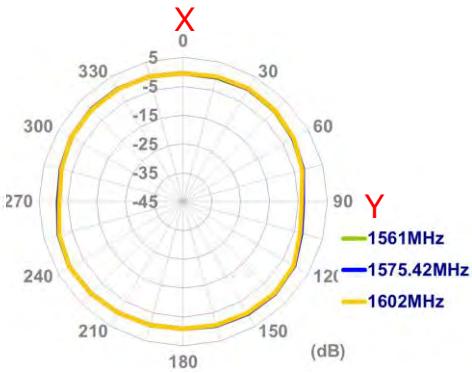


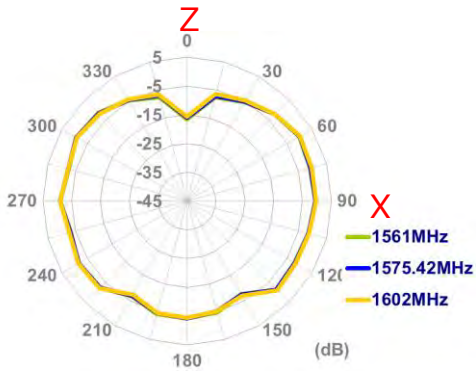
XZ Plane

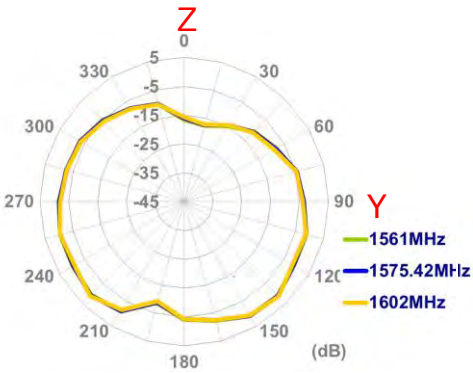


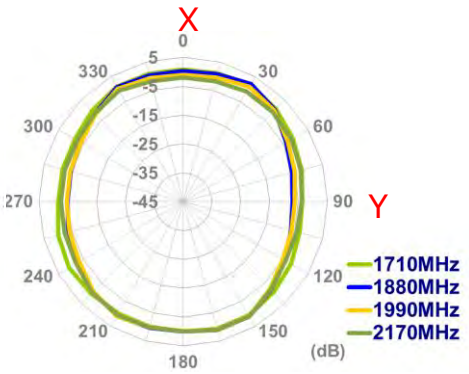
YZ Plane

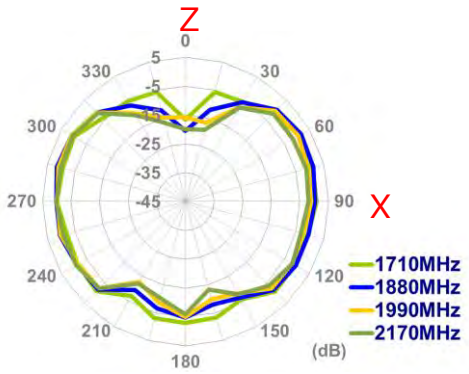


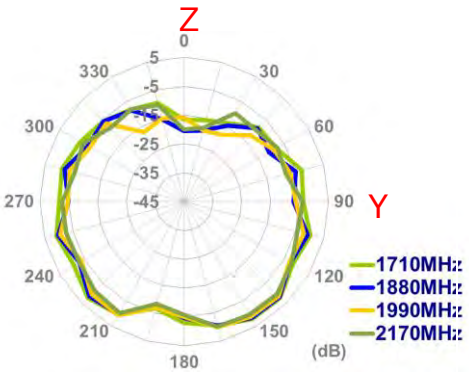


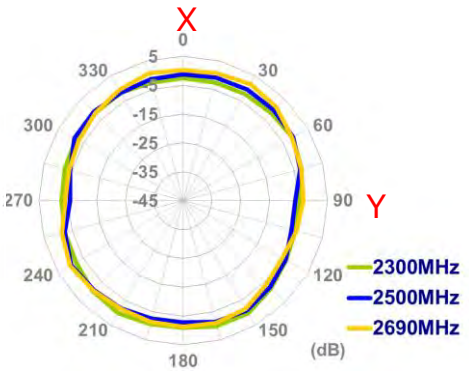


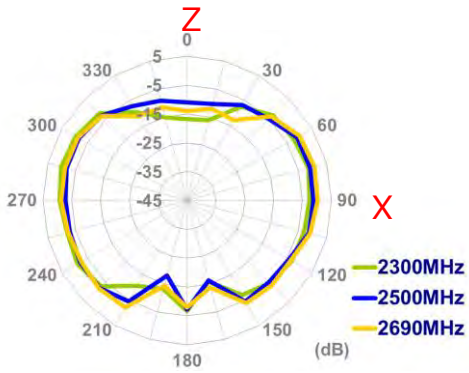


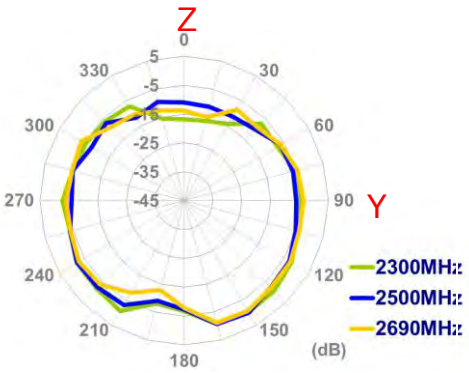






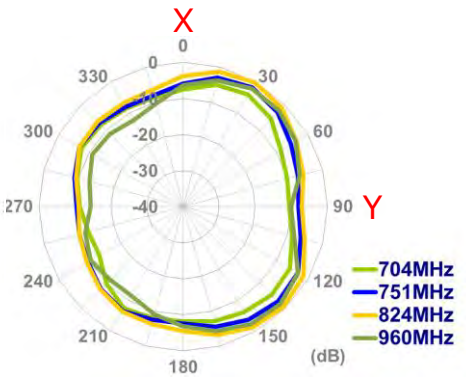


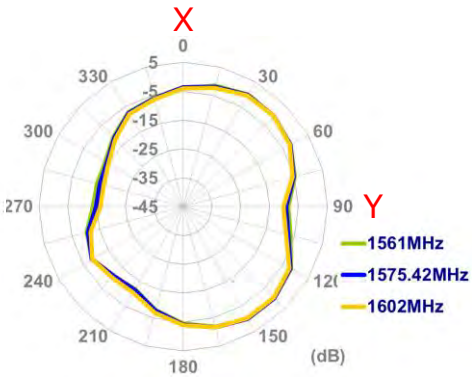


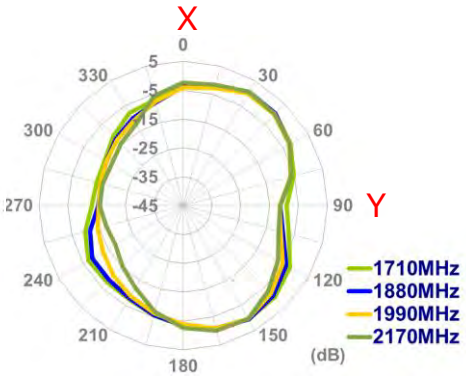


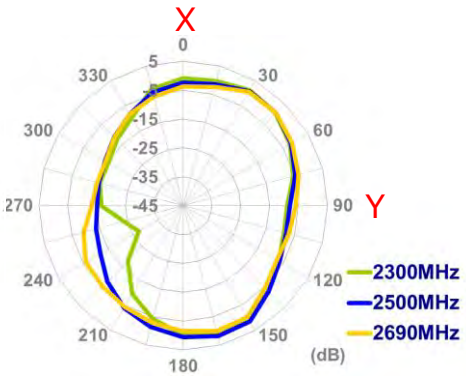
4.4. 2D Radiation pattern (Straight Position with 30x30cm metal ground center)

XY Plane

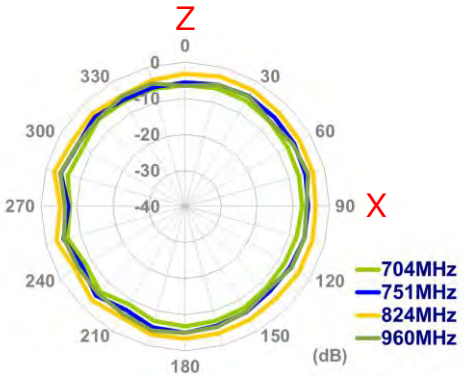


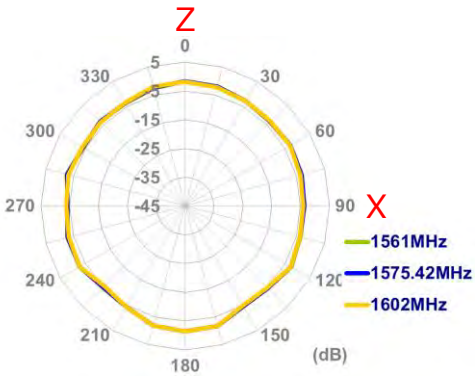


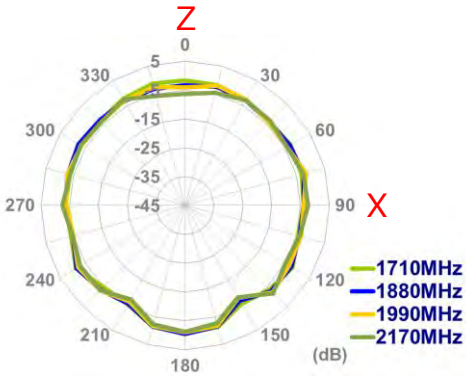


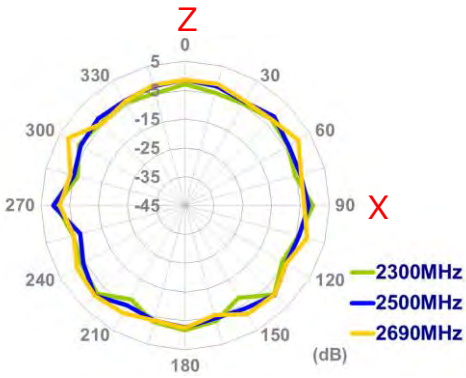


XZ Plane

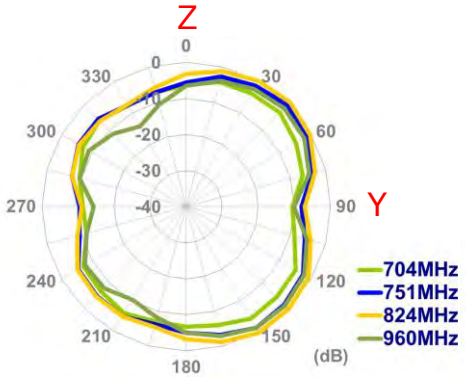


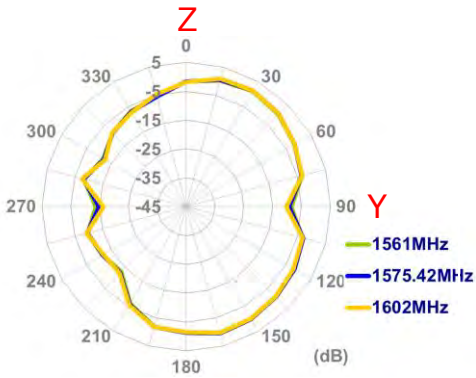


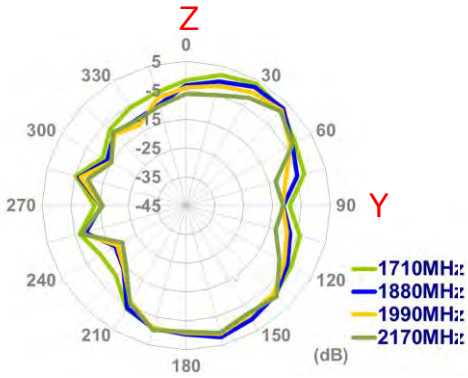


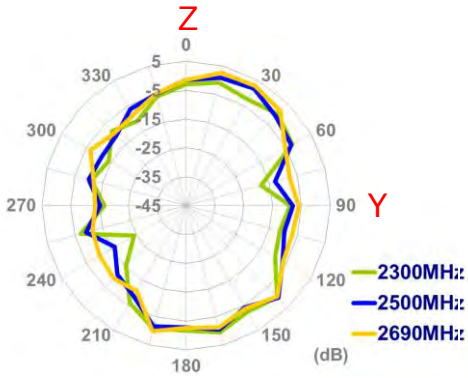


YZ Plane



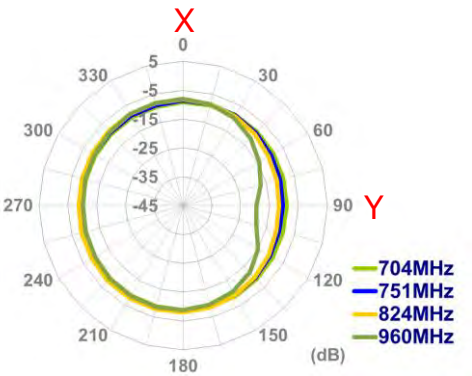


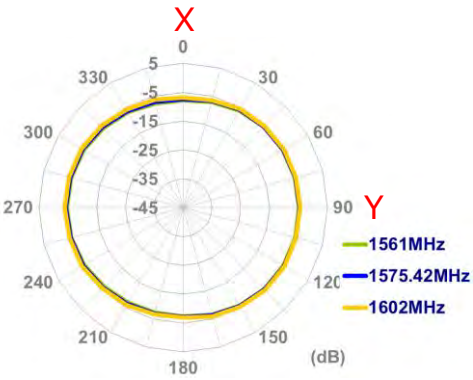


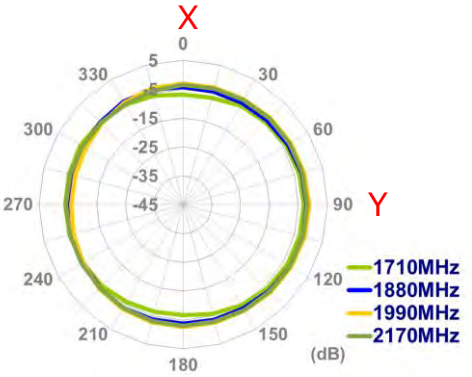


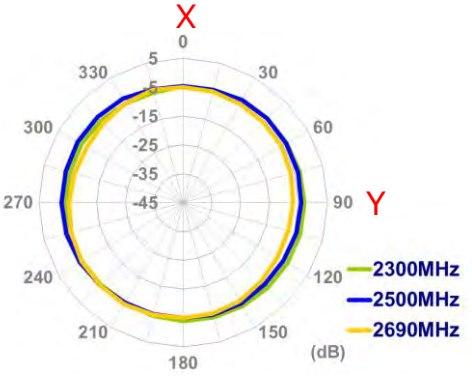
4.5. 2D Radiation pattern (Bent Position in free space)

XY Plane

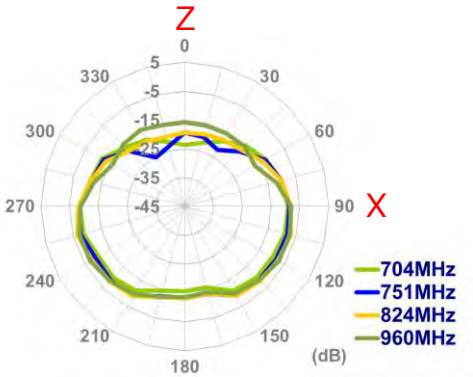


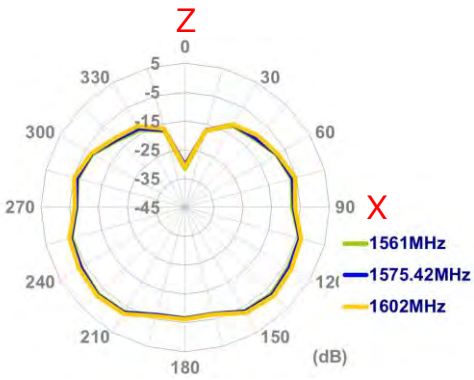


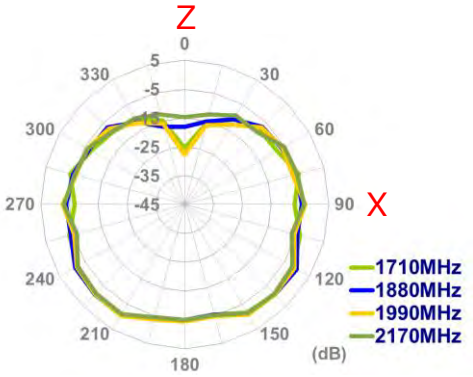


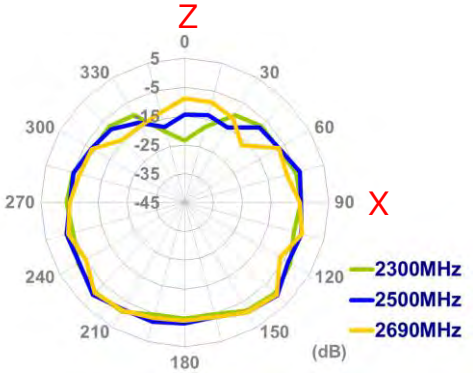


XZ Plane

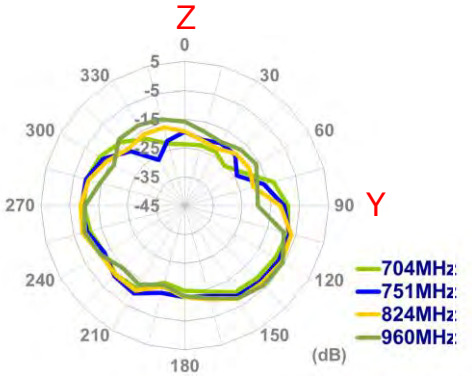


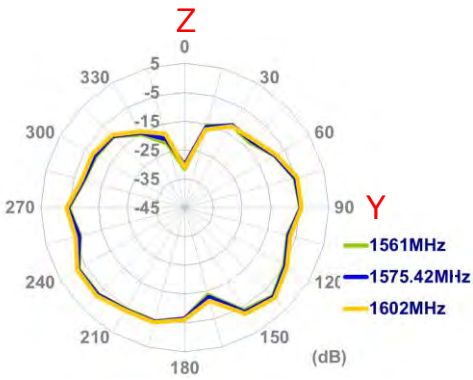


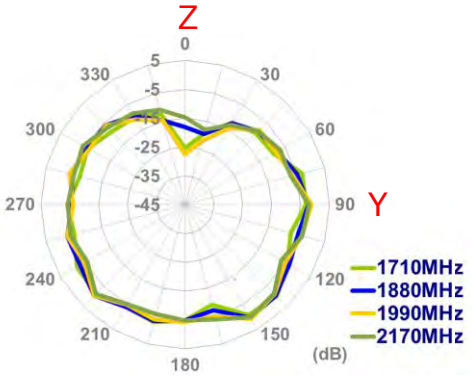


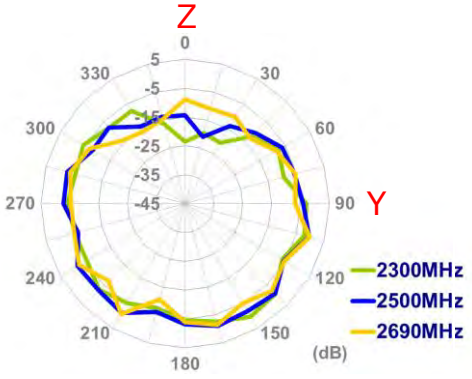


YZ Plane



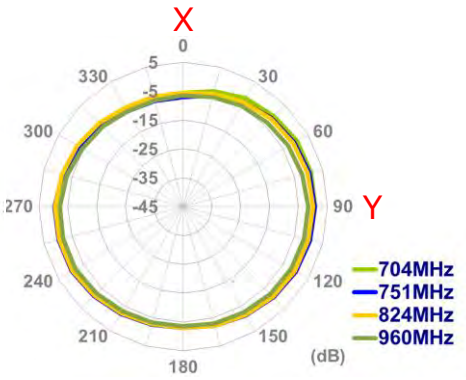


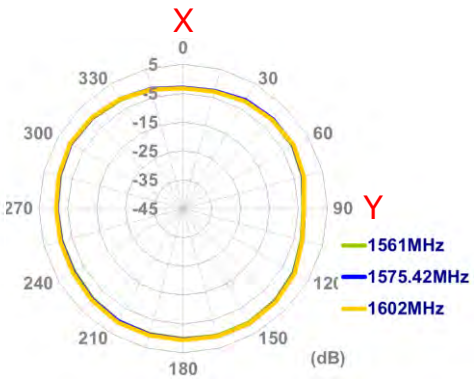


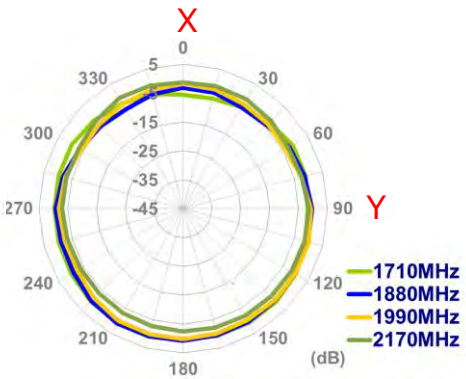


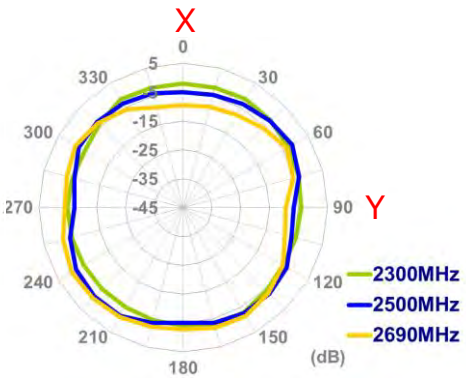
4.6. 2D Radiation pattern (Bent Position with 15x9cm ground)

XY Plane

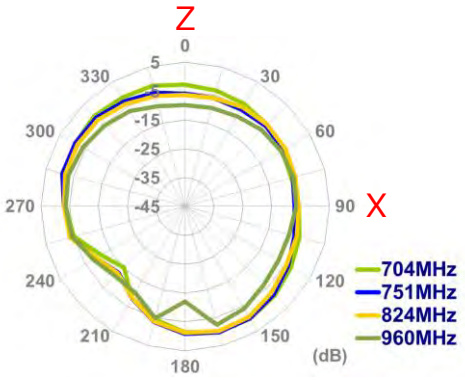


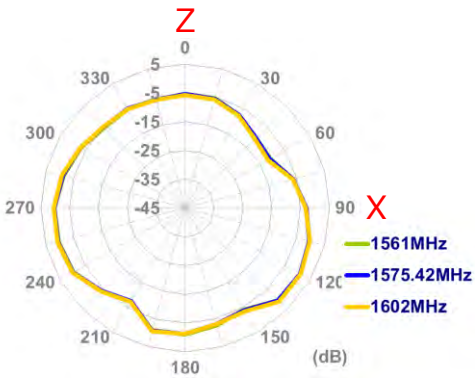


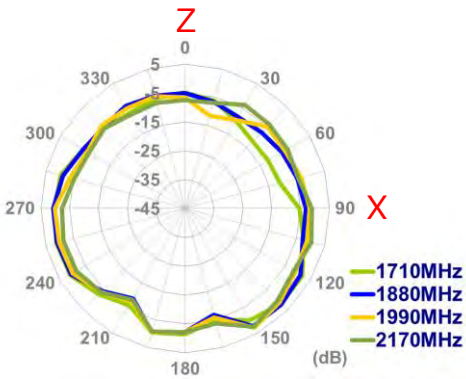


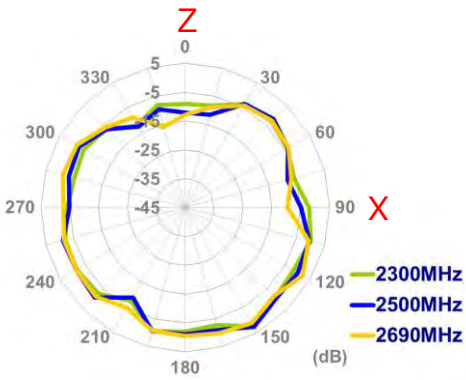


XZ Plane

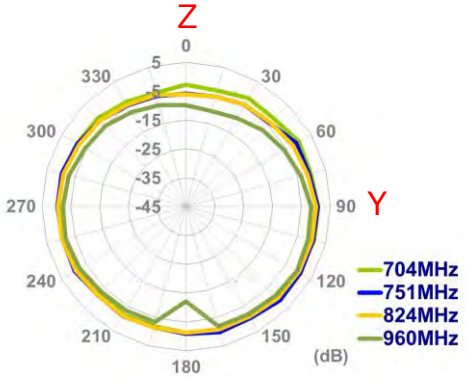


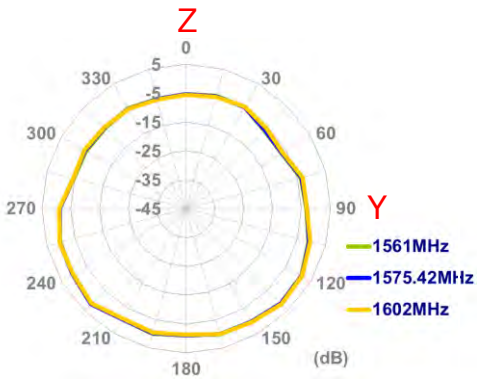


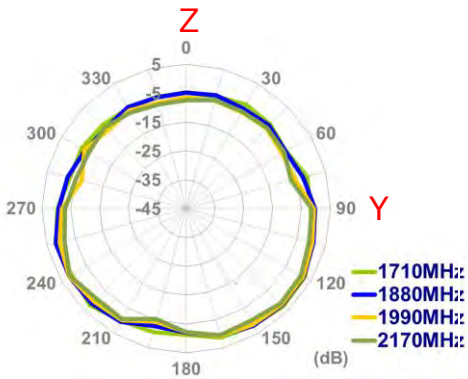


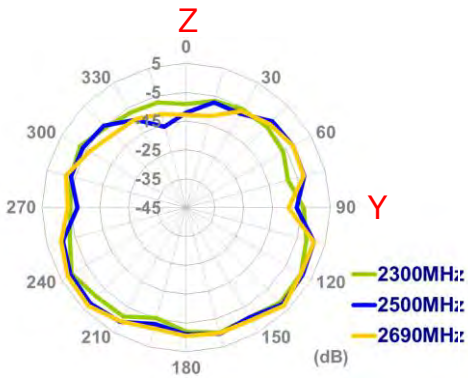


YZ Plane



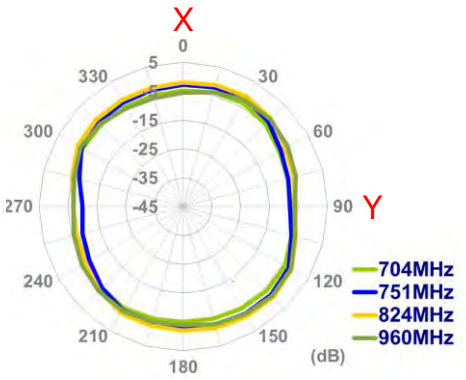




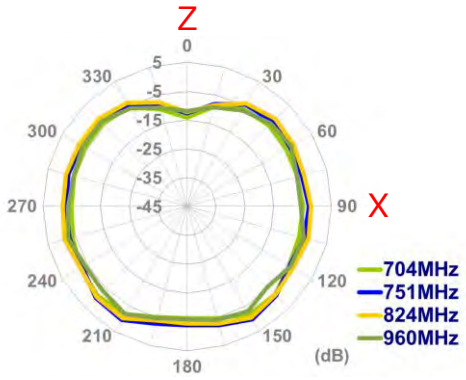


4.7. 2D Radiation pattern (Bent Position with 30x30cm metal ground edge)

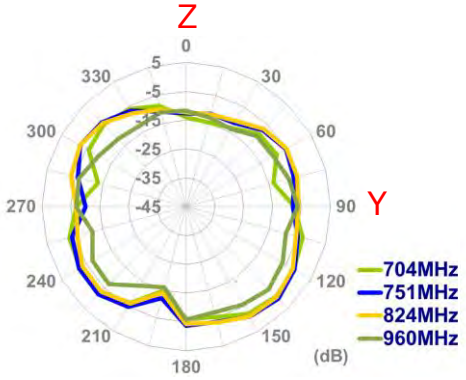
XY Plane

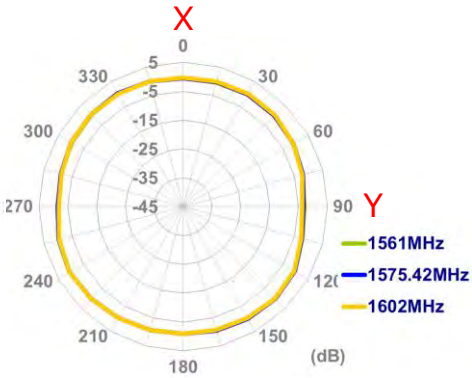


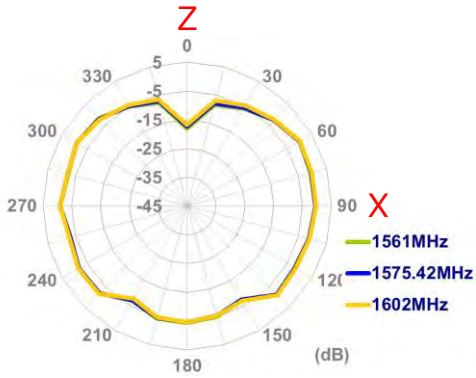
XZ Plane

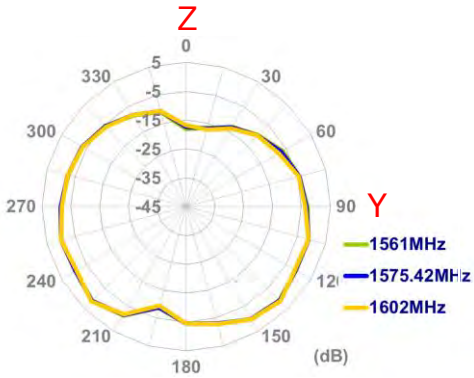


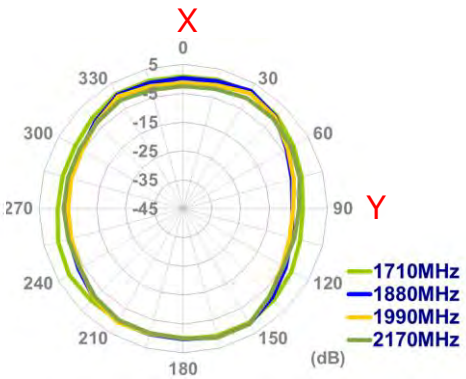
YZ Plane

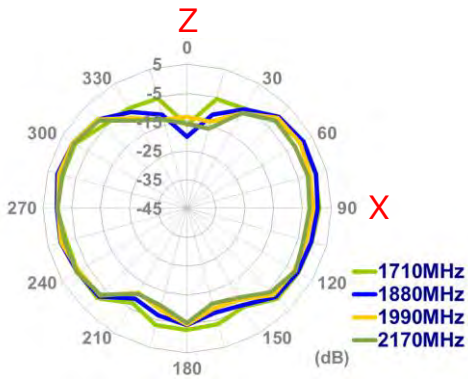


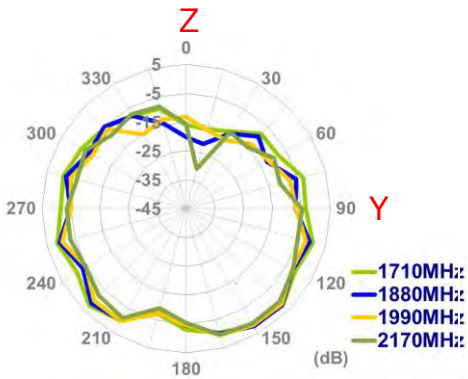


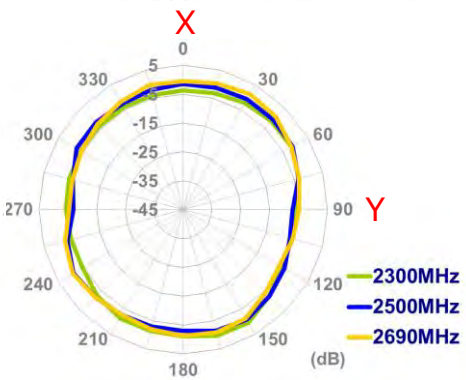


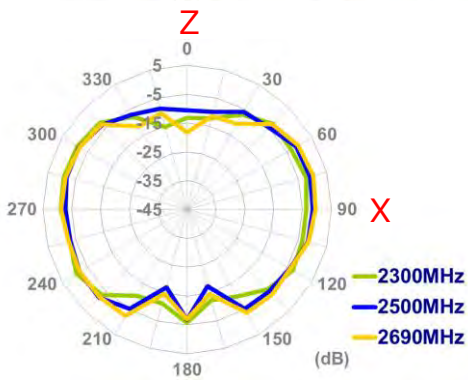


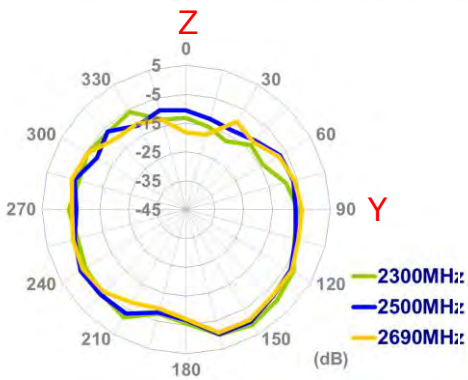






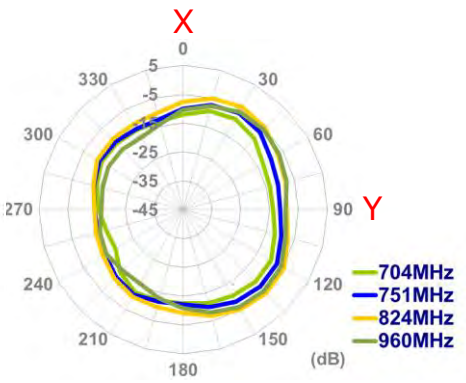


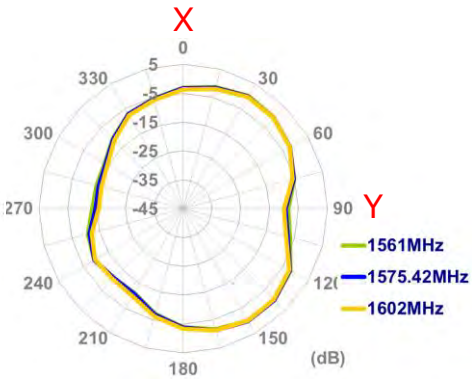


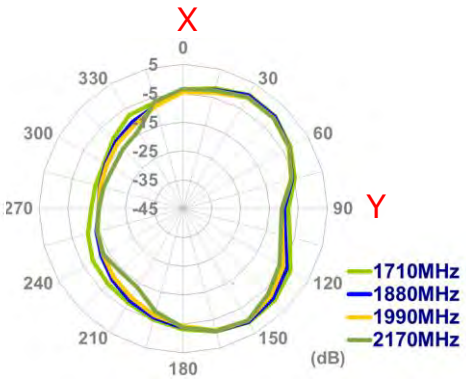


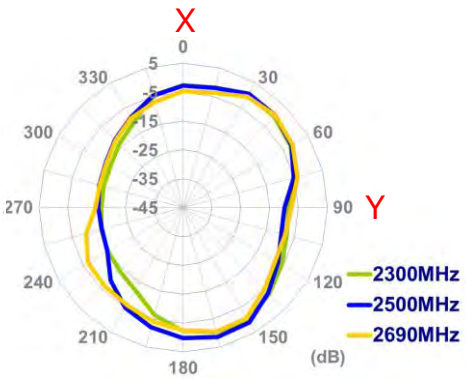
4.8. 4.8 2D Radiation pattern (Bent Position with 30*30cm metal ground center)

XY Plane

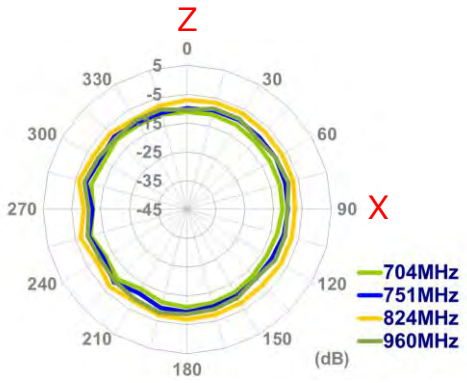


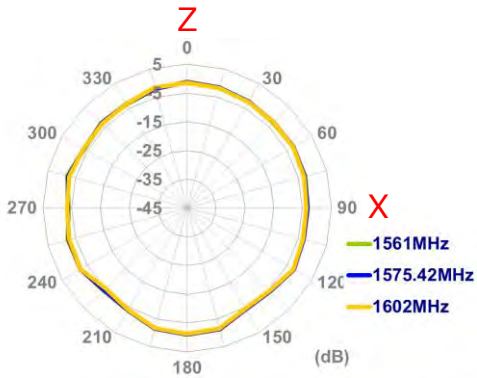


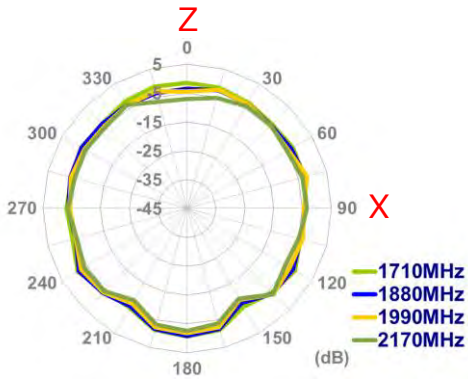


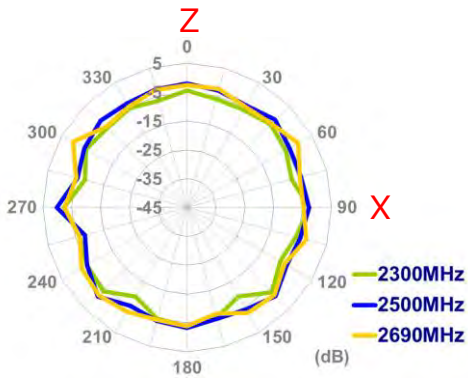


XZ Plane

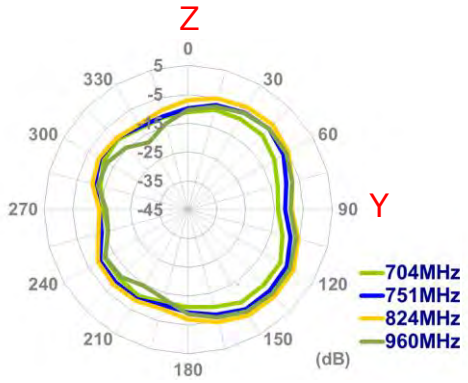


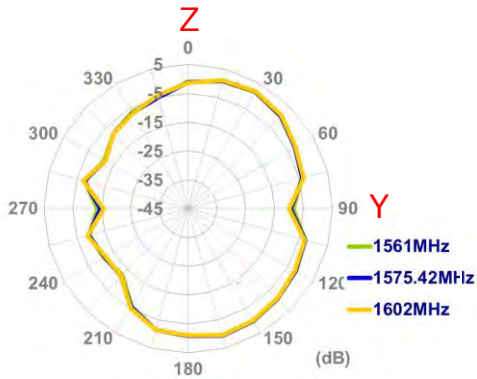


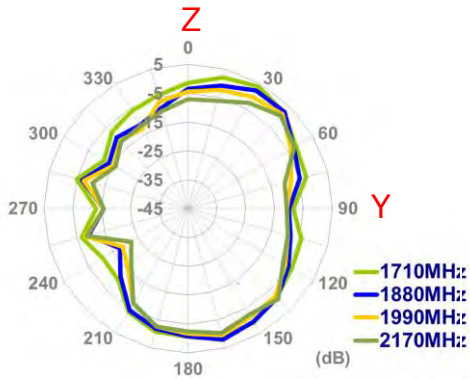


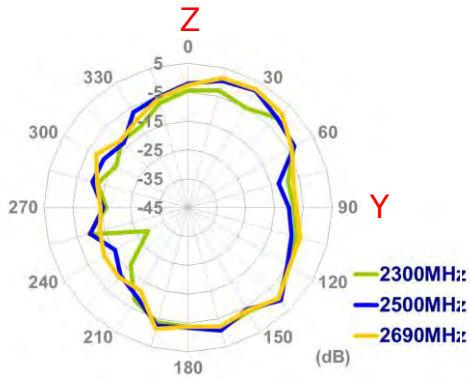


YZ Plane

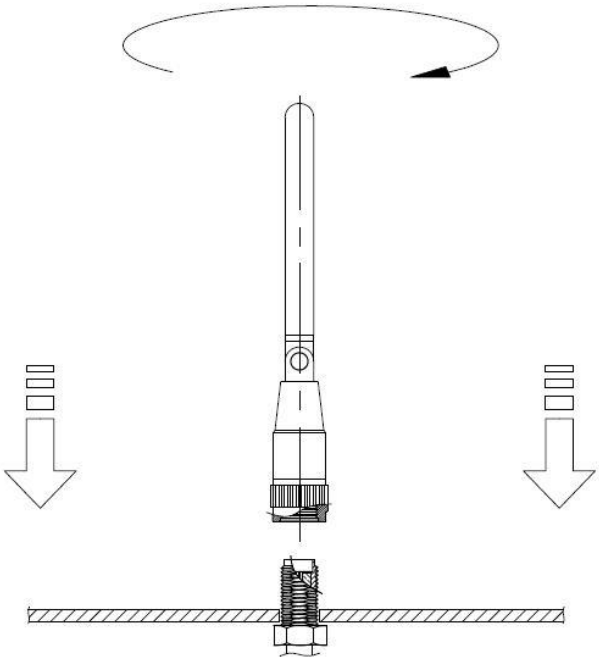






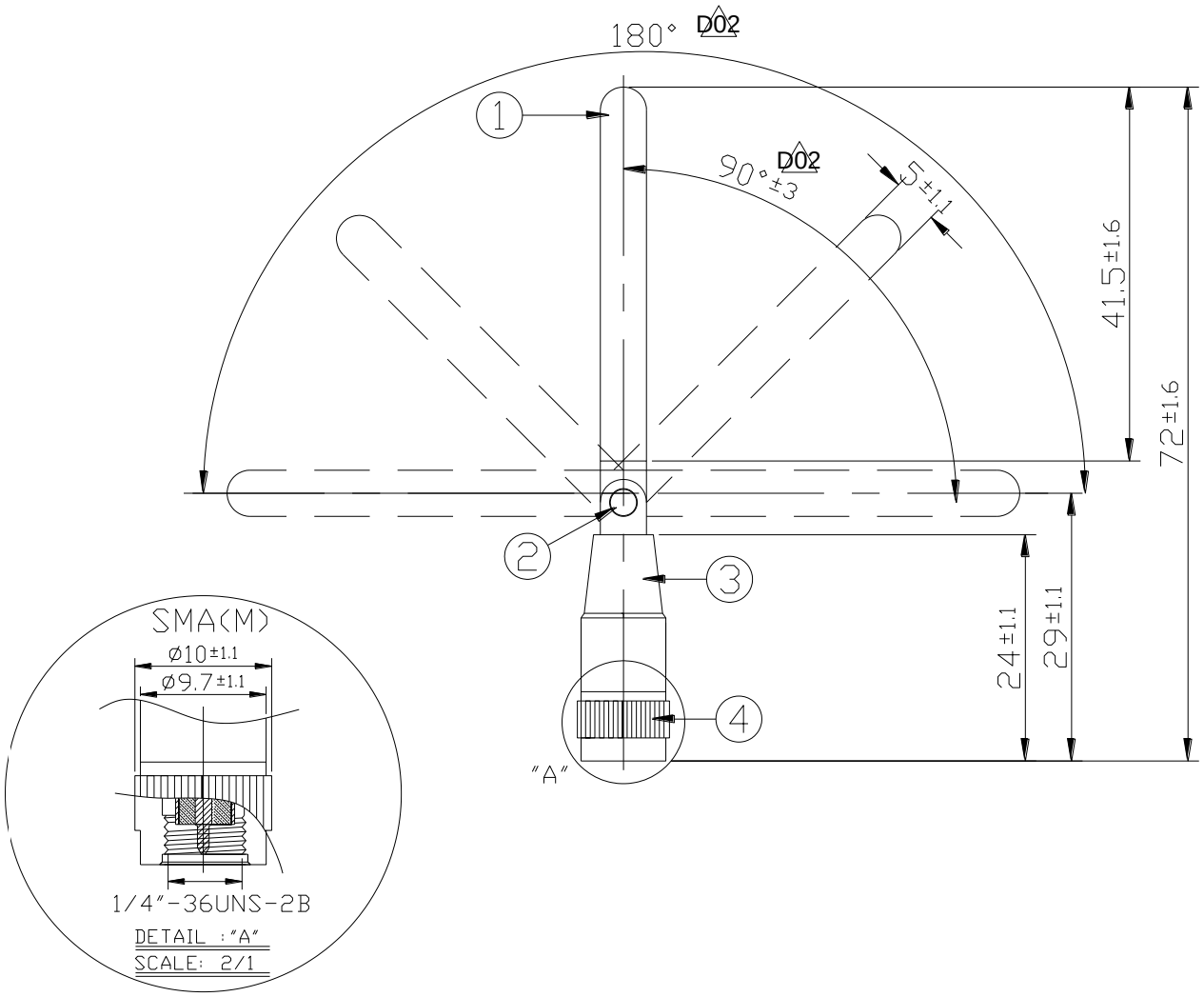


5. Installation



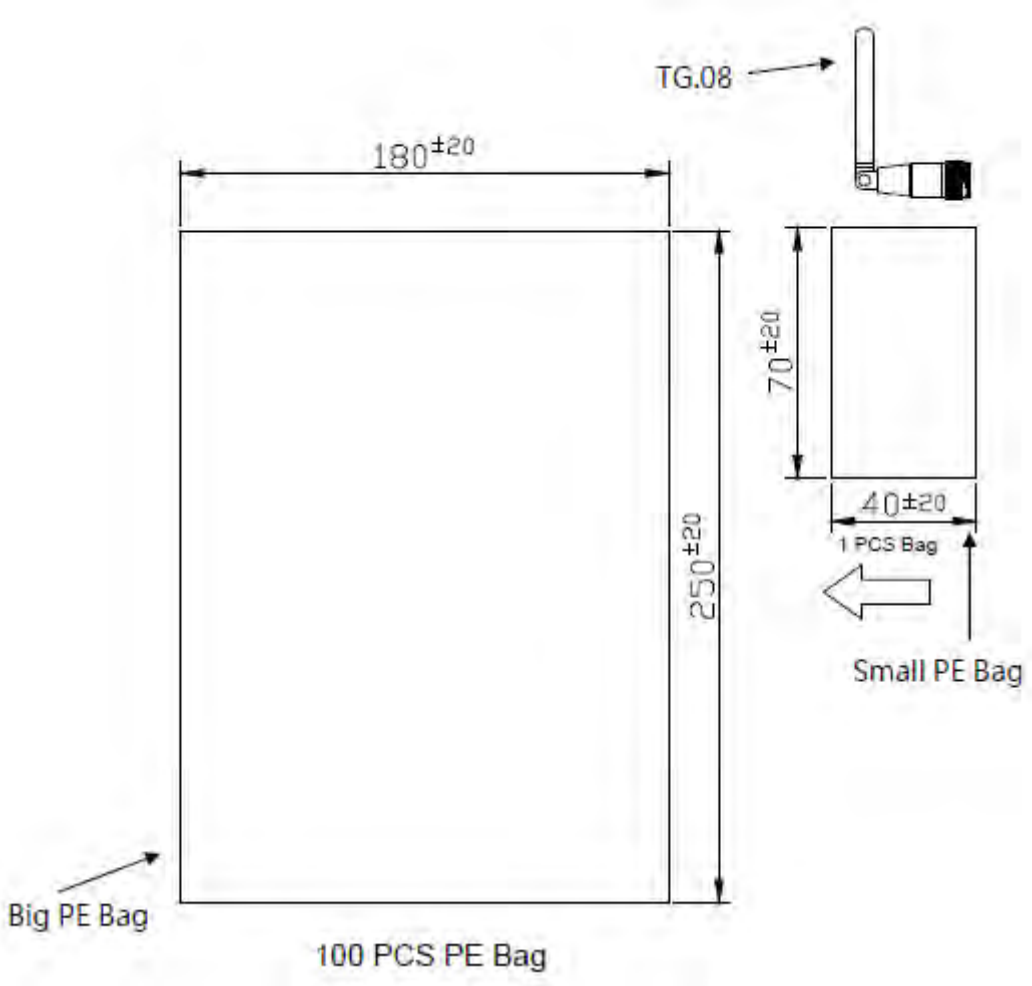
Recommended torque for mounting is 0.9 N-m
Maximum torque for mounting is 1.176 N.m

6. Drawing



	Name	P/N	Material	Finish	QTY
1	Housing	001013F000002A	POM	Black	1
2	Hinge	000613F000002A	Brass	Ni Plated	1
3	Cap	000713G000002A	POM	Orange D03	1
4	SMA(M) ST	200213F000002A	Brass	Ni Plated	1

7. Packaging



Inbuilding

Low PIM Directional Antenna

WM8-BADEP3G-26-NJ

CELLPOWER

WM8-BADEP3G-26-NJ

High gain

Mast mount or wall mount

Low PIM & SAR tested to EN50385:2002

Integrate wireless services into one antenna

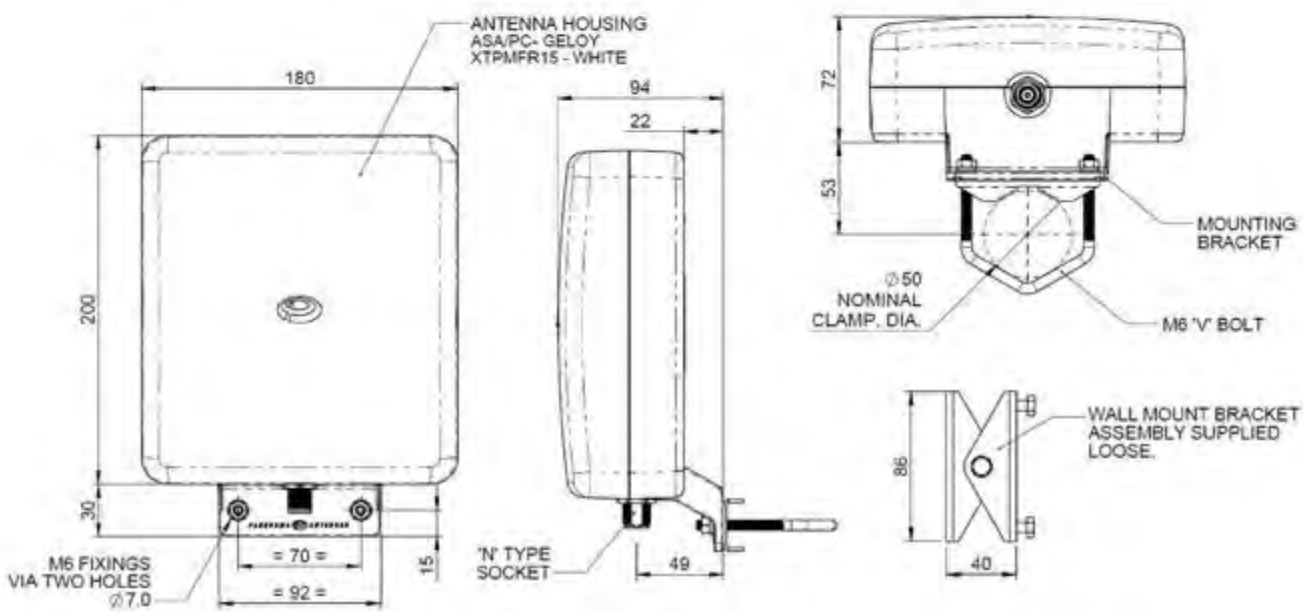
A versatile high gain directional antenna for in building applications, Panorama's WM8 range allows businesses and facilities to support multi-service/multi-operator wireless coverage. The WM8-BADEP3G-26-NJ supports 2G, 3G, 3G+ and 4G technologies including LTE, AMPS, PCS, GSM, UMTS & AWS with lower gain coverage of WIFI 2.4GHz and LTE 2.6GHz.

The WM8 range is housed in impact resistant, UV light stabilised plastic. The features a heavy duty N female connector making the product ideal for indoor and outdoor deployment, for inbuilding coverage or network infill applications.

PIMGuard Technology

This product features Panorama Antennas' PIM Guard Technology and will meet or exceed a third order intermodulation level of < -140dBc.

Technical Drawing

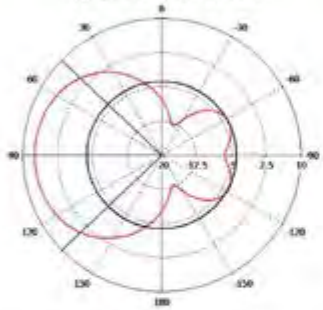


In Building Antennas

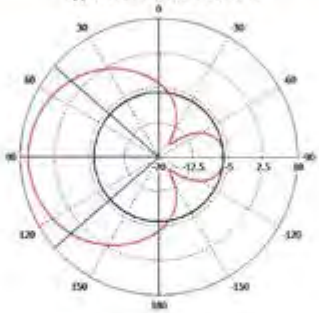
Low PIM Directional Antenna

Polar radiation plots

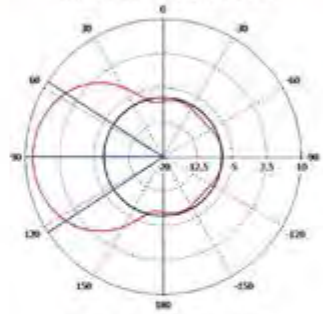
Typical H Plane 700MHz



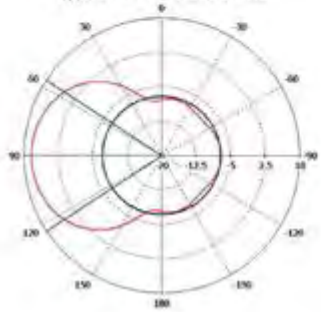
Typical H Plane 850MHz



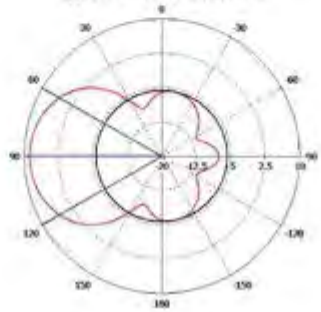
Typical H Plane 1700MHz



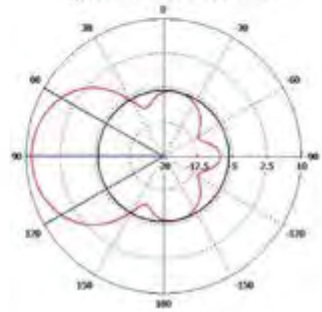
Typical H Plane 1800MHz



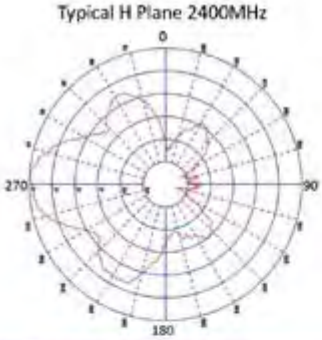
Typical H Plane 1900MHz



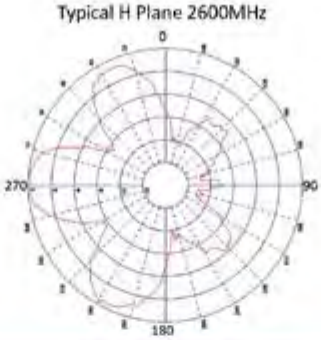
Typical H Plane 2100MHz



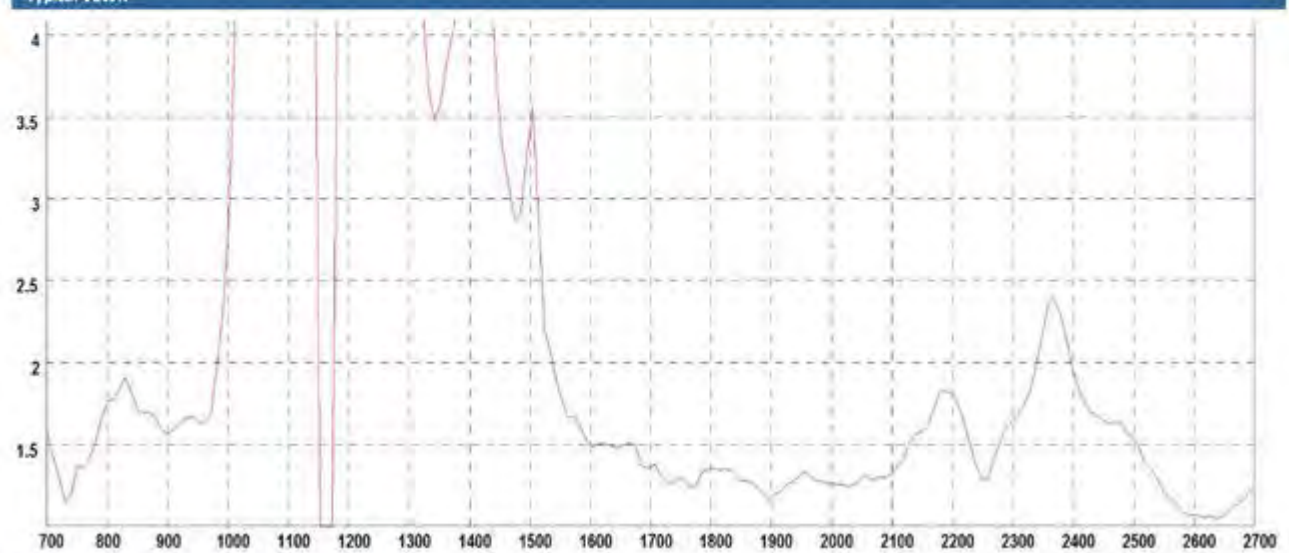
Typical H Plane 2400MHz



Typical H Plane 2600MHz



Typical VSWR



*Measurements taken looking directly into N connector on antenna housing.

In Building

Low PIM Directional Antenna

Part No.		
		WMR-BADEP3G-25-NJ
Electrical Data		
Frequency Range (MHz)		698-960, 1710-2700
Operational Band		LTE 700, AMPS 850, CDMA 800, GSM1800, PCS1900, 3G UMTS, AWS, WiFi, LTE 2.6
Peak Gain: Isotropic	LTE 700MHz, AMPS800 & GSM900	6.5dBi
	GSM 1800, PCS1900, 3G UMTS / AWS 2100	8dBi
	WiFi 2400, LTE 2600	6dBi
VSWR		<2.5:1
Polarisation		Vertical
Pattern		Directional
Typical Passive Intermod. (2x20W, 3rd ord.) dBc*		-140
SAR and 'Touch Safe' Test Data		According to 50385:2007 (Bands: 850, 900, 1800, 2100, 2600MHz)
Impedance		50Ω
Max Input Power (W)		50
Mechanical Data		
Dimensions (mm)	Height	230mm (9.05")
	Width	180mm (7.08")
	Length	94mm (3.7")
Operating Temp (°C)		30°/ 170°C (22° /158°F)
Material		PC/ASA
Colour		White
Connector Data		
Type		N Socket
Mounting Data		
Fixing		Pole Mount / Wall Mount
Pole Diameter		20-50 mm (0.8 - 1.96")

*Range PIM performance verified under controlled conditions by Anritsu PIM Master test equipment.

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E: sales@panorama-antennas.com
www.panorama-antennas.com

Migrating to 4G LTE?

Choose the right carrier tester

Berkeley Varitronics Systems
Wireless Detection

By Scott Schober

CEO of Berkeley Varitronics Systems
Innovator behind the
Octopus Installation Tools

CONTENTS

The Evolving Wireless Backbone

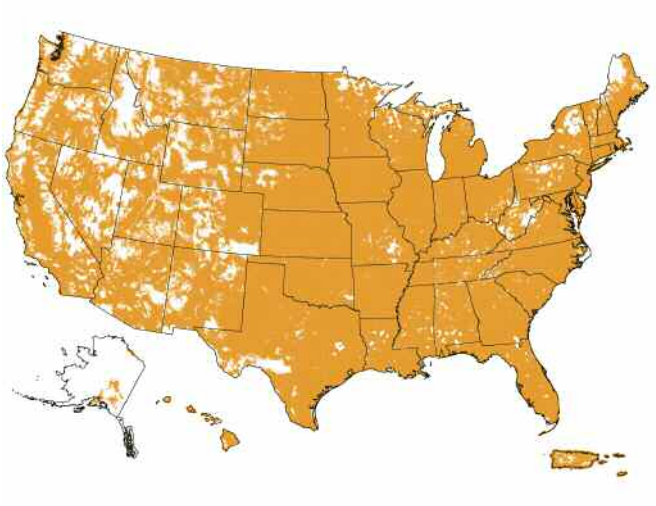
Expansion causes problems

The development and expansion of cellular networks in the last few decades has transformed the face of industry and commerce. Wireless carriers have paved the way for non-stop data communications providing services for billions of transactions. This is very beneficial to consumers and businesses but also adds another layer of technical difficulty in maintaining network uptime and continuous operation. From energy distribution to ATMs to vending machines, 3G and 4G wireless networks provide extensive data to the central information system. However:

"when the communication system integrating all these moving parts fails, the repercussions can have a costly impact on business."

The adage, "A chain is only as strong as its weakest link" holds true. Even though the daily dispatch of information and data is no longer performed by manual labor, these networks require human oversight and maintenance to perform at peak capacity.

New companies and devices are constantly released into the market every year to address these issues. The carriers, computing systems, electronic data collectors, and software all compete for market share, and promise the most satisfying and reliable service. However, **e**ven technology created within the last few years can be irrelevant or outdated. Ownership and functionality of cellular towers, system upgrades or new radio signal interference can cause "state of the art" equipment to fail or perform sporadically.



Reliability is worthless if the infrastructure in the field does not support the required signal strength and quality for reliable connectivity.

Click on this link to watch:
https://youtu.be/-9X5_YgIhgM)

Since the 1980's, Berkeley worked with carriers, installers and maintenance crews all the way back to the the initial build-outs of analog cellular networks. Over the years we have worked with industry leaders to solve in real word problems. In this video, Scott Schober, CEO and President relays the story of how BVS got its start in the cellular test equipment business back in the mid 80s.

Berkeley Varitronics Systems

https://bit.ly/2yVislu

Selecting a carrier by using bars on cell phones is NOT accurate

How accurate do you really think those tiny signal strength bars on your cell phone are?
You might recall when Consumer Reports removed their recommendation for Apple's top selling iPhone 4 back in 2010 after users reported dropped calls. And while '**Antenna-Gate**' was overblown and addressed by Apple, it illustrated the inherent weakness in wireless consumer electronics. It was further revealed that each carrier used their own algorithms to calculate signal strength. So AT&T's (4) signal bars might only equate to (2) signal bars on a Verizon phone. In addition, antennas on consumer phones are embedded and do not allow for an external antenna connection or proper amplification of that signal for test measurements.

It was discovered that by simply holding the iPhone 4 the wrong way, users would experience dropped calls and decreased data throughput... **regardless of the amount of bars on their phone**.

In order to accurately assess various carriers' coverage, you'd need to be like an octopus, holding a half dozen different phones (one for each carrier as well as a SIM for each) and visually comparing all the bars simultaneously for coverage. It's why we named our product Octopus - one handheld unit that does it all. While comparing carriers, one quickly learns that they establish geographic competitive advantages by strategically placing cell towers along densely populated stretches, cities and areas that will maximize customer coverage. They also tend to focus build-outs in markets where their competition does not have coverage. All of this leaves one with the same question when determining the best wireless carrier.

Watch "Cell Booster Installation Dos and Don'ts" at:
https://youtu.be/kDa0N6YxTDA

Are you really going to trust the cell phone signal strength?
Suppose you're installing a cellular booster in an office building where cellular coverage is spotty? Are you really going to trust a cell phone to determine the best spot and direction for the antenna when the cellular coverage is spotty to begin with? Modern cell phones are expensive but that's because they contain so many bells and whistles that installers do not care about. These same phones also skimp on quality components and features that professional installers require in the field.

Installs done right the first time to reduce expensive truck rolls

A poor installation affects the company's bottom line
When you think of the cost of choosing the wrong carrier, one that you've signed a long-term contract with, the time and effort to change can get messy. Then there is the downtime of the wireless networking equipment not performing at its peak whether it is an ATM, vending machine, charging station, wireless alarm system or smartmeter. It all adds up to lost revenue.

Wireless network Installers of cellular modems often face a daunting task that requires not only the physical and electrical connection of their equipment but also many RF (Radio Frequency) factors in determining which carrier at a given spot has the best signal strength coverage. With Octopus, installers do not need to guess which carrier has the best coverage. They measure **actual signal strength** at each independent site to provide the answer to the question before the trucks and crews roll in.

Low cost receivers only offer RSSI measurements but this only tells half of the story. Octopus offers RSRP and RSRQ in addition to RSSI for 4G network measurement. Octopus also includes true RSCP and Ec/Io measurements for 3G UMTS wireless networks. This means that one device will not only allow installers to choose the best carrier but also easily migrate from older 3G to newer 4G networks without additional measurement hardware.

Antenna placement and directionality is also critical.
The position of the antenna ensures that the radio communication link is optimal to neighboring cell towers. In some instances, there may be other considerations such as physical constraints where the installation requires antenna placement at the highest point but away from physical and wireless interference. Some installers only have limited options for antenna placement, but for those with multiple choices, a dedicated measurement tool can save huge amounts of time and money.

Once you decide on your carrier network and base station, simply disconnect the supplied multi-band omni antenna that comes with the Octopus and connect your site's permanent antenna directly to the unit. Now you can precisely align that antenna so that it is pointing directly at the cellular tower even if you cannot visibly see the tower.

CONSTANT CHANGE
Radio signal parameters and RF propagation conditions frequently change. New towers are erected, carriers change the power and geometry of the antennas, new buildings are built that can cause shadowing of a signal at the particular location and network capacity changes daily due to user needs. Even changing foliage on the trees can greatly attenuate the signals from season to season. Periodic signal strength measurement and/or the ability to troubleshoot a problem due to the changing conditions is a necessity and a simple task with our Octopus.

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6 THE PROBLEM

Unseen Consequences of Lost Data

Think about a mobile phone signal breaking up and how a conversation gets miscommunicated...

Now, think about 3,000 ATM machines "talking" to the terminal or a network of EV charging POS terminals trying to simultaneously "handshake" with a distant cell tower. The challenge is to place these modems and antennae where they experience the best signal coverage so the data stream is not interrupted or lost. Add to this, the challenge of placing ATMs in 'prime real estate' spots let alone in line-of-sight to the closest cell tower. Often the ATM is placed in a 2' x 2' corner down the hall where there is an empty space.

A modem without signal is sometimes more easily recognized and fixed whereas delayed delivery of data, or lost and irrecoverable data, just disappears.

A poor connection can result in "corrupted" data; much like a bad or dropped phone call and poor user experience. Some of the information may make it through, but it may be unusable, inaccurate and incomplete. Even if it eventually goes through, it takes longer than expected. Consumers waiting around for their ATM transaction to go through are impatient, unhappy and a possible target for nearby thieves.

If all the stages of the data collection system are set up properly, data is sent wirelessly to a cellular network, transmitted through the Internet and to a server in your monitoring station or headquarters. And all is well.
But we're talking about real life here.

The cost of bad connections are high because…

- "Truck rolls" require travel, gear and humans at every site
- New wireless site studies must be performed
- New modems, antennas and network gear must be purchased
- Downtime directly results in lost revenue

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A Comparison of Carrier Testers

Features	Consumer Smart Phones	SureCall (low cost signal meter)	Octopus
Supports all U.S. carriers (including rural)	NO	NO	YES
All day (8+ hours) battery operation	NO	NO	YES
True RSRP measurements	NO	NO	YES
Removable SMA antenna	NO	YES	YES
Color touch screen operation	YES	NO	YES
Antenna alignment support	NO	NO	YES
Additional measurements (EC/IO, RSRQ, RSCP)	NO	NO	YES
Support for both 3G UMTS and 4G LTE	YES	NO	YES
Fits in any pocket	YES	NO	YES
No SIMs or subscriptions required	NO	YES	YES

Do it right the first time!

- Choose the best sites
- Save on labor
- Choose the best carrier
- Get accurate antenna placement
- Eliminate unnecessary service calls
- Avoid downtime

Purchasing the right gear requires less training and less troubleshooting

Quick start-up guide for reliable Carrier Signals

On start-up Octopus will display the main screen of carrier choices

Choose carrier directly or **ALL 4G** or **ALL 3G UMTS** base stations. Unit scans all 4G in background by default.

AT&T

verizon

T•••Mobile

ALL 4G

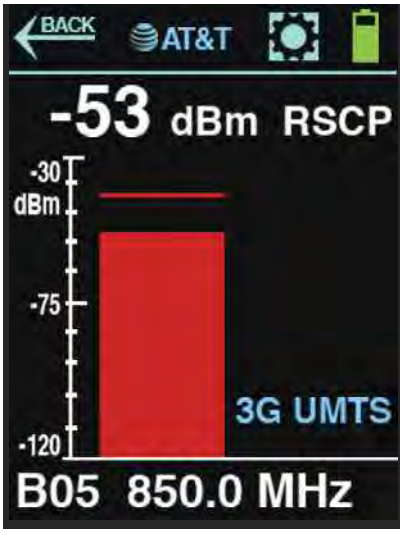
ALL 3G UMTS

Sort through **ALL 4G** by carrier, Frequency, RSRQ or RSRP (shown)

Sort through **ALL 3G UMTS** by carrier, Frequency, EC/IO or RSCP (see screen on next page)

Direct measurement of **AT&T** 4G LTE base station in RSRP

Sort through the individual carrier's Base Stations
(AT&T, Verizon, T-Mobile)
by Frequency, RSRQ or RSRP (shown)



Direct measurement of **AT&T 3G UMTS** base station in RSCP assisting with external antenna alignment

Why is RSRP better than RSSI?

It's technical.

What is RSRP? It is an LTE (4G) specific metric that averages the RF power in all of the reference signals in the passband. RSRP is the average power of resource elements that carry cell specific Reference Signals (RS) over the entire bandwidth, (i.e. RSRP is only measured in the symbols carrying RS. A resource element is one OFDM subcarrier for the duration of one OFDM symbol.

What about RSSI? This is an valid metric but more fittingly used to display signal strength for 3G technologies (GSM, CDMA1X. etc.) and it integrates all of the RF power within the channel passband. In other words, for LTE, RSSI measurement bandwidth is ALL active subcarriers, measured in all symbols. By definition, RSSI includes power of all interference and thermal noise.

The Octopus - a reliable carrier signal tester

- Support for AT&T, Verizon, T-Mobile and all U.S. regional carriers
- No subscriptions, SIM cards or multiple phones required
- True RSCP and Ec/Io (3G) and RSRP, RSRQ and RSSI (4G) measurements

SMA Antenna Input
Easily remove omni-directional antenna (included) and connect directly to your external antenna for precise alignment

Handheld and Pocket-sized
Weighs only ounces and fits in your pocket

Color Touchscreen
for instant navigation and visible measurements from a distance

Sort Carriers by
RSRP, RSRQ or RSSI in dBm for 4G
RSCP and Ec/Io for 3G UMTS

Battery Powered - Rechargeable
Runs all day (12 hours) on internal rechargeable Li-Ion battery

Includes a water resistant, high impact carrying case

USB Port
Install powerful firmware updates directly from support on www.bvsystems.com

Designed and manufactured in the U.S.A.

Also available at amazon

Why Purchasing, Maintenance and Installation Departments request the Octopus

1. Why do Purchasing Offices specify the Octopus?

To ensure customer satisfaction and long term profitability

Reduced costs up front and down the line
Up to now you are at the mercy of the cellular carriers and their coverage maps. Now, with one device any technician can drive to multiple sites in a day and record which network, carrier and cellular bandwidth is optimal for that specific location, ensuring a quality connection.
Plus:

- No monthly carrier subscription costs
- No expensive software to purchase or lease
- No multiple devices to calibrate and maintain

2. Why does the Maintenance Department specify the Octopus?

Infrastructure maintenance personnel are no strangers to the advantages of wireless and cellular technology. Using wireless technology is much more cost effective than traditional hardwiring methods and allows for increased functionality.

Pat Smith, from Data-Command shares, “In one instance, a properly installed wireless network cut the City’s monitoring costs for a segment of their water supply system by 50%.

The Octopus carrier testing tool allows quick signal audits of existing installations. When performing routine maintenance checks, technicians can review signal strength and note in maintenance logs whether there have been changes in carrier or signal quality.

3. Why do The Installers specify the Octopus?

No more “you guys screwed up”

How do you streamline the installation? For example, your bid may include an option to use 2 different carriers. Do you have the appropriate SIM chips in your truck? How do you make the judgment call on which carrier to select so that there are minimal callbacks for service?

We have heard of installers using:

- Expensive subscription software that create signal “maps"
- Expensive hardware to run the “signal survey” programs
- Multiple mobile devices subscribed to each main carrier
- Their personal or company phones to track “signal bar” strength
- Purchasing up to (4) cellular modem USB sticks with (4) carrier contracts

Does that sound like reliable quality control? The Octopus focuses only on cellular signal detection and strength analysis. Now they can “**Do it right the first time.”**

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Flip Phones (2000)
Inexpensive consumer flip phones offer only crude signal bars

Modern Smartphones (2007)
Limited to their carrier support, antenna design and confusing field test mode software

Squid-PRO (2012)
Provides 2G and 3G measurements for all major carriers

Octopus (2018)
Pocket-sized with touch screen interface and perfectly timed for 4G network migration

2000 2005 2010 2015

Dedicated Testers (2010)
Portable, dedicated RF signal meters appear but lack refinements of consumer electronics

Squid-4G (2014)
Enhanced for 4G LTE networks and includes GPS and export for analysis software

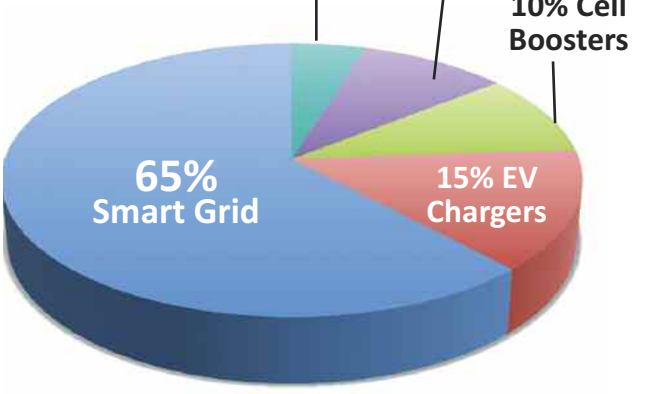
Ready for the 3G Sunset.

The 3G Sunset refers to manufacturers and carriers making the transition from 3G to 4G LTE (long term evolution) networks. Eventually they will stop making and supporting devices that use 3G networks. It's like the 3G network is a major interstate and the cut-off dates are when the Dept. of Transportation will close the road. For companies that use older devices, the 3G network coverage they have relied on may not work.

While some carriers won't drop 3G support till after 2022, there are some like Verizon, that will drop it after 2019. In the next few years, cellular service providers plan to phase out 3G service entirely. If you haven't started migrating, you should start as soon as possible.

Some of the most common Applications

The future is expanding daily. While it is beyond the scope of this document to describe the thousands of daily applications and potentials for Cellular Networks, below are some of the most common we encounter.



Commercial
- Vending Machine
- ATMs
- Fleet monitoring
- Delivery Services: Propane, Concrete
- Taxi Services:
  - Better allocation of driver
- Construction Company:
  - Labor, material supply

Industrial
- Warehouse Management: Inventory
- Water Supply Systems
- Agribusiness Irrigation Systems: Moisture sensors
- Manufacturing Supply Chain Management

Food Production
- Livestock feed systems
- Agriculture Flood Management
- Consumer Goods
- Beverage Manufacturing
- Orchard Moisture Sensors

Infrastructure
- Electric Car Charging Stations
- Electric Grid Distribution Lines
- Railway Systems: maintenance and monitoring
- Smart Meters: Natural gas, Water and Electricity
- Weather Monitoring Systems
- Water Treatment Plants
- Critical Building Systems: HVAC, Water, Sewage, Electric
- Personnel Traffic Patterns

Remote Monitoring
- US Geological Survey
- Water Réservoir Levels
- Healthcare ICU Patients in their homes

Security
- Home Security Systems
- Sensors
- Business Security/Alarms

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Energy / Smart Meter / Utility
- ABM Electrical & Lighting Solutions
- American Electric Power
- Apollo Electric
- Badger Meter
- Baker Hughes
- Baker Utility Supply
- BC Hydro
- Bloom energy
- Boardwalk Pipeline Partners
- Carolina Meter and Supply
- Christenson Electric
- Clifford Electric
- Cooper Power Systems
- Duke Energy
- Electricians, Inc.
- Florida Power & Light
- First Energy
- First Solar, Inc.
- Gulf South Pipeline Company, LP
- Houston Electric
- Itron
- Memphis Light, Gas & Water Division
- Minnesota Power
- National Meter Automation
- Northwest Edison
- Pacific Gas and Electric Co
- Progress Energy
- Rowe Electric Inc
- San Diego Gas and Electric Utility
- Schneider Electric
- Sunoco Logistics
- Texas Gas Transmission, LLC

Electric Vehicle Charger installers
- Autochargers.ca Corporation
- ChargePoint
- EV Charge Solutions
- Garner Meter Operations
- LilyPadEV
- National Car Charging

Miscellaneous
- Arbitron, Inc.
- Atlantic Aviation
- BNSF Railway Company
- Centra Health
- Coin Acceptors, Inc.
- Davis Instruments
- Dairy Cheq Inc
- Instrumentation Services, Inc.
- General Electric
- Minutekey
- New York City BikeShare
- NIST
- NOAA's National Ocean Service
- Pepsi-Cola
- Phoenix Contact
- ProLift Industrial Equipment
- Restaurant Technologies, Inc.
- TESCO
- UNM Parking & Transportation Services
- U. S. Geological Survey
- Video Voice Data Communications

“This year, we started to deploy directional cellular antennas and have started using the Octopus for the installations. The Octopus is easy to use and ensures that the directional antenna is positioned correctly. The tool has been a great help in completing installations quickly and correctly.”

Frank Brown
Senior Operation Analyst,
PG&E, CA

Have you ever thought about how Redbox® knows whether the DVD you want is at the corner store or the McDonalds® down the street? Cellular networks are keeping websites, software management systems and databases up-to-date with real time information.

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About Scott Schober

Author, Inventor and CEO of Berkeley Varitronics Systems

"Ever since I was a child, I've always been fascinated with how things work. That same curiosity that drove my early exploration has made me a relentless scientist, engineer and innovator who sees challenges as opportunities."

Scott Schober

Award Winning Inventor

New Jersey Technical Council
"Cool Products"

M2M Evolution
Product of the Year
Award Winner

Cybersecurity Expert on TV & Radio

Scott is a highly sought after Cybersecurity subject matter expert for media appearances and commentary. He is often seen on ABC News, Bloomberg TV, Al Jazeera America, CBS This Morning News, CCTV America, CNBC, CNN, Fox Business, Fox News, Good Morning America, Inside Edition, MSNBC and many more.

Acclaimed Author of "Hacked Again" and "Cyber Security is Everybody's Business"

Read about Scott's personal experiences as well as his advice to global brands and the Department of Defense. If you are connected to the internet (as we all are), both of Scott's book are "must reads." Scott describes the reality of cyber threats and provides tips and techniques that will help protect you and your business interests from a devastating cyber security breach.

Feel free to reach out to Scott Schober directly at Scott@BVsystems.com or call 732-548-3737

For more information visit www.ScottSchober.com

Visit https://bit.ly/2yVislu to see all product details
Talk to a product expert call: **732-548-3737 (ask about quantity discounts)**
or email: **sales@BVSystems.com**

For technical specifications and additional white papers,
visit our website: **www.BVSystems.com**

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Thank you for your purchase, we look forward to supporting you and your team.

Customer Support

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