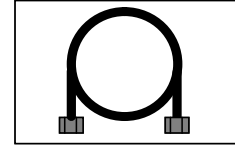


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**3rd Edition**

**Global BTS Transmission Jumper Cable Market Analysis and Forecast, 2013-2017**

**November 2013**



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# EXECUTIVE SUMMARY

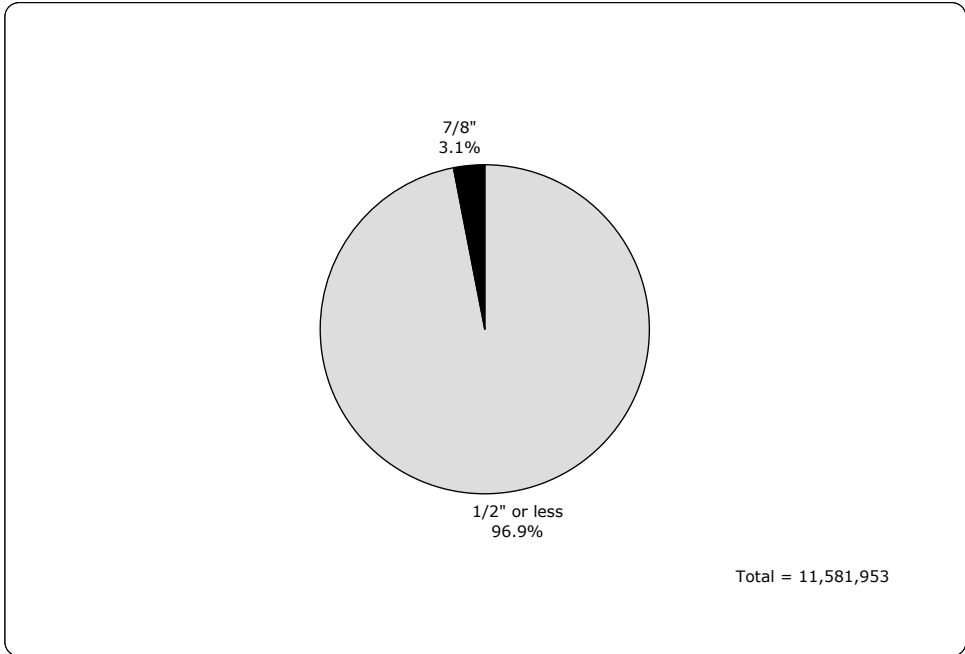
In this third edition of the report, we have continued to analyze our global model and analysis for transmission line (jumper cable) shipments within the wireless infrastructure BTS market. We define the transmission line as extending from the output port of the BTS to the antenna port. We define a jumper cable as a feeder cable connectorised at both ends, ranging from 1/4" to 7/8" in diameter but predominantly 1/2", intended to bridge short distances and/or bring strain relief to the equipment ports.

Our BTS jumper cable analysis is based upon primary research across multiple sources and the forecast is based upon our "Global BTS Antenna Market Analysis & Forecast" and "Global BTS Market Analysis and Forecast" research reports. This report does not include cables that are used for feeder runs and/or are sold from the reel. Please see our report titled "Global Transmission Feeder Cable Analysis and Forecast, 2013-2017" for an in-depth analysis on the feeder cable market.

## 2012 Review

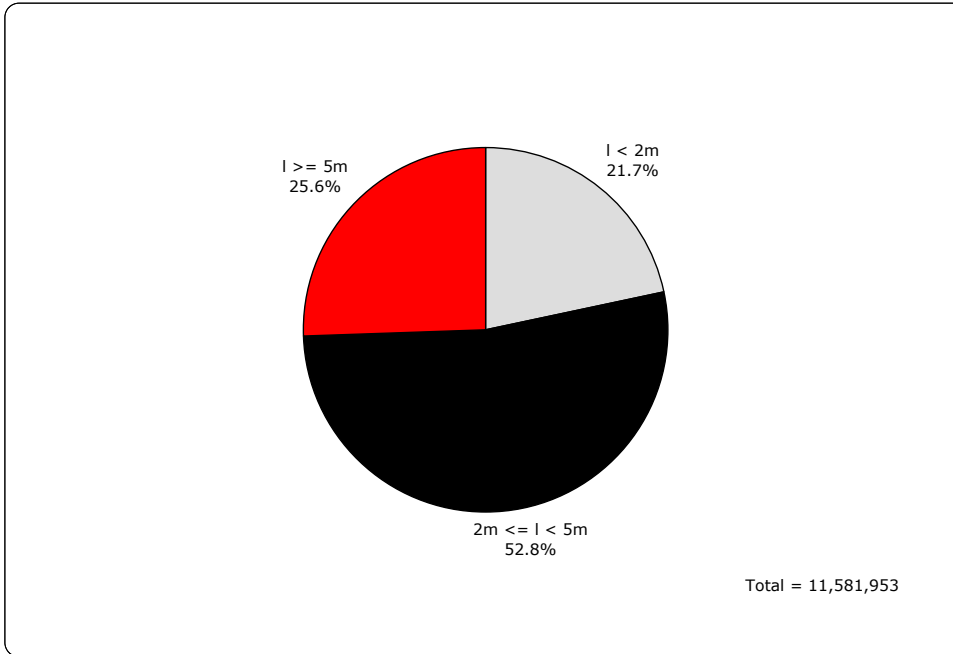
Shipments for jumper cables in 2012 were 11.58 million units with the overwhelming majority continuing to be 1/2" or less diameter products as 7/8" was 3% of the total volume in 2012.

Exhibit 1: Global BTS Jumper Cable Market Share by Nominal Diameter, 2012 (Units)



Source: EJL Wireless Research LLC Estimates (November 2013)

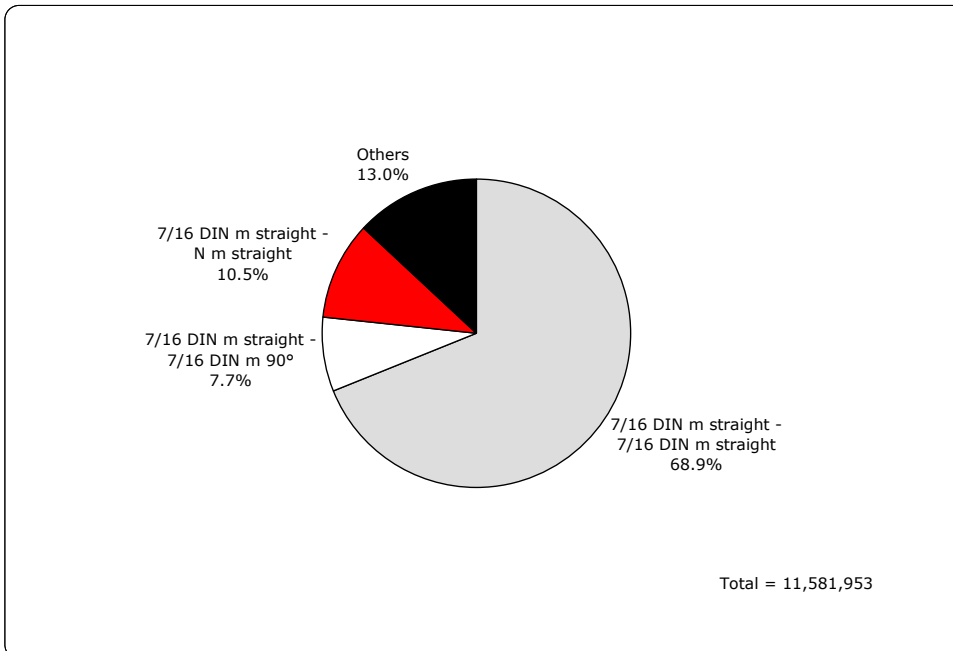
Exhibit 2: Global BTS Jumper Cable Market Share by Length, 2012 (Units)



Source: EJL Wireless Research LLC Estimates (November 2013)

We estimate that the 2-5m segment was 53% of total shipments in 2012. By interface, the DIN male straight to DIN male straight jumper cables remained the majority of shipments with 69% market share.

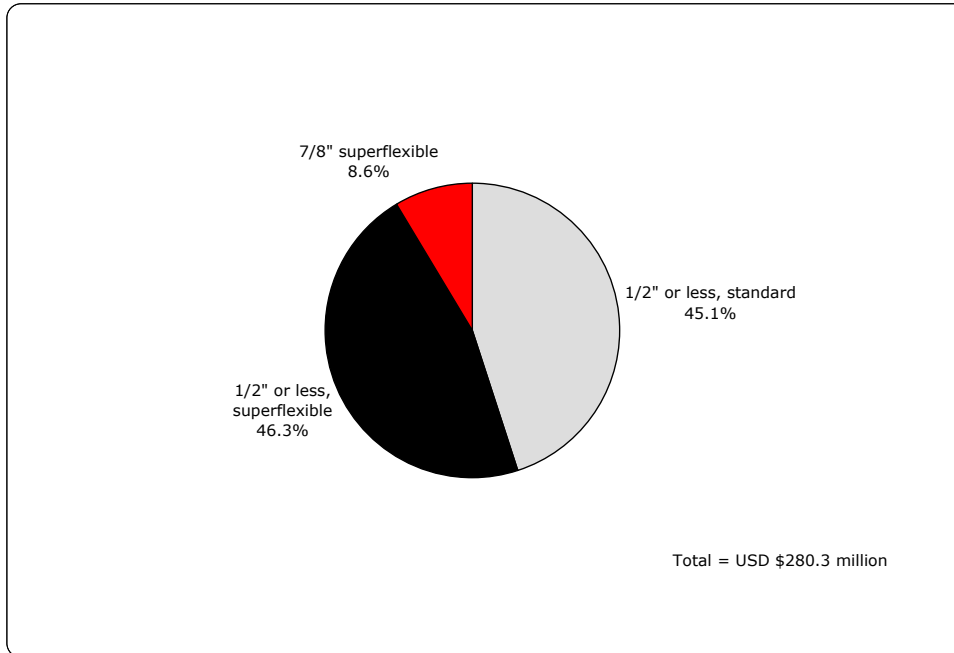
Exhibit 3: Global BTS Jumper Cable Market Share by Interface, 2012 (Units)



Source: EJL Wireless Research LLC Estimates (November 2013)

We estimate that the global revenues for jumper cables was USD \$280.3 million in 2012 with 46% being 1/2" superflex, 45% being 1/2" standard, and 9% as 7/8" superflex.

Exhibit 4: Global BTS Jumper Cable Market Share by Type, 2012 (USD Millions)



Source: EJL Wireless Research LLC Estimates (November 2013)

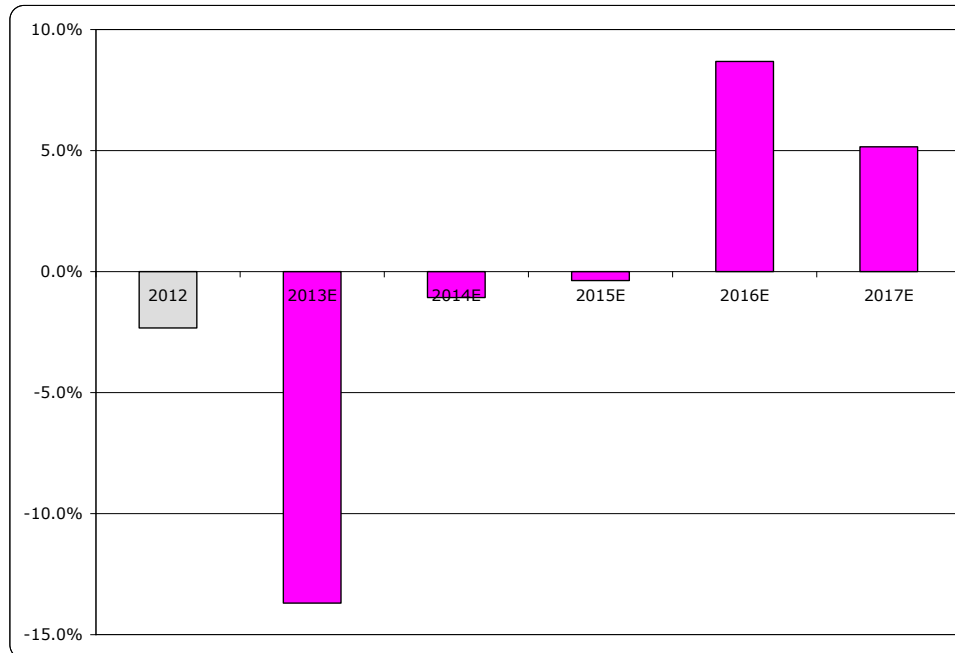
## BTS Jumper Cable 2013-2017 Forecast

Our current BTS transmission line RF jumper cable forecast in shipment volumes (units) is:

- 🌀 **2013 -13.7%**
- 🌀 **2014 -1.1%**
- 🌀 **2015 -0.4%**
- 🌀 **2016 +8.7%**
- 🌀 **2017 +5.2%**

We forecast that the market will dip in 2013 and then stabilize in 2014 and 2015 and then see growth again in 2016 and 2017.

Exhibit 5: Global BTS Jumper Cable Shipment Forecast (Units) 2013-2017, (% YoY Growth)



Source: EJM Wireless Research LLC Estimates (November 2013)

**Our forecast DOES NOT account for potential small cell deployments beginning in 2014/2015. We do not believe that extensive jumper cables will be required for outdoor microcell base station deployments.**

## ***Demand Drivers for Our Forecast***

The current drivers and assumptions for our BTS jumper cable forecast include:

### **4G**

- Continued Deployments of LTE700 Bands 12/13 in North America
- Initial Deployments of LTE750 Band 28 in Latin America and Asia Pacific
- Continued Deployments of LTE800 Band 20 in Europe
- Continued Deployments of LTE2600 FDD Band 7 in Europe and Asia Pacific
- Continued Deployments of LTE1500 Band 11 in Japan
- Continued Deployments of LTE1700 Band 9 in Japan
- Continued Deployments of LTE1800 Band 3 in Europe and Asia Pacific
- Continued Deployments of LTE1900 Band 2/25 in North America
- Continued Deployments of LTE2100AWS Band 4/10 in North America
- Initial Deployments of LTE2300WCS band in North America
- Initial Deployments of TDD-LTE2300 Band 40 in India
- Initial Deployments of TDD-LTE2600 Band 41 in China
- Initial Deployments of TDD-LTE1900 Band 39 in China

### **3G**

- Phase 2 & 3 UMTS Network Expansion for Existing W-CDMA Networks Already Launched
- Capacity upgrades for HSPA+ and DC-HSPA+ networks
- China Unicom continues to deploy W-CDMA Technology
- China Telecom continues to deploy CDMA2000 1x EVDO Rev. A Technology
- India continues W-CDMA deployments
- Continued Deployment of W-CDMA in United States with AWS Spectrum
- Continued Deployment of CDMA2000 1x EVDO Rev. A with AWS Spectrum
- Continued Deployment of W-CDMA900 in Europe and Asia Pacific

### **2G/2.5G**

- Swap out of low capacity single mode GSM BTS to next generation high capacity single mode GSM BTS

The continued upgrades to HSPA/HSPA+ technology will have both a positive and negative impact on BTS jumper cable shipments during the forecasted period. The higher speeds may drive increased subscriber growth which will drive both capacity and coverage expansion.

The eventually transition of global WiMAX networks to TD-LTE technology is expected to have a positive impact on the demand for BTS jumper cables. We believe that the existing jumper cables will be replaced during this transition.

We also note the next generation TD-LTE jumper cables being developed for China Mobile's TD-LTE deployment using MCIC connectors.

## **Summary**

We expect to see a fairly positive outlook for jumper cables over the next five years. Migration to tower top RRU BTS site architectures should be neutral to demand, whilst the migration to LTE-Advanced with the implementation of 4x4 MIMO technology will be favorable to demand. We estimate that timing for LTE-Advanced for the 4x4 MIMO implementation may not initially occur until 2015/2016; however implementation of 2x4 MIMO may occur beginning in 2014 and have a positive impact to demand. The advent of TD-LTE networks which are typically 4x4 MIMO and 8x8 MIMO should positively impact demand however absolute jumper shipments for the TD-LTE market may shrink as technology migrates from traditional to MCIC connector based jumpers.

We emphasize that in contrast to the feeder cable market which faces a replacement technology such as fiber optic cables, the jumper cable market is only partially exposed to the impact of this technology. However, the jumper market would be fully exposed (i.e. fully replaced) and therefore in the same situation as the feeder cable market in the case of a potential transition to semi-active antennas and integrated active antennas (IAA) as the integration of the RRU with the BTS antenna will completely eliminate the need for coaxial jumper cables. We believe that the migration to semi-active antenna technology is proceeding now faster than we had initially forecasted and will have some impact on the jumper cable market but the fully active antenna deployment impact will still be minimal through 2017.

# RESEARCH METHODOLOGY

We have gathered data through exhaustive channel checks and interviews with key players in the global wireless infrastructure BTS jumper cable market sector in order to understand the ever changing dynamics of the jumper cable market. We have also gathered public data as well using our proprietary contacts to construct what we believe is a realistic forecast for the global BTS jumper cable market.

The report focuses on transmission line jumper cables employed for cellular BTS macro sites using indoor/outdoor BTS cabinets and remote radio units (RRU) and cellular BTS micro sites using indoor/outdoor BTS cabinets.

Jumper cables tend to be installed or replaced when BTS equipment is installed, upgraded or replaced. Cases where the RF transmission path is upgraded independently or any other equipment replacement at the site do occur occasionally but are very rare. Our forecast and historical shipment figures are largely based upon BTS shipments globally.

- 🚫 We are NOT providing market share analysis on jumper cable vendors.
- 🚫 We are NOT distinguishing between standard and flame retardant jacket material for jumper cables.
- 🚫 We are NOT including cables used for distributed antenna systems (DAS) for indoor applications.
- 🚫 We are NOT distinguishing between jumpers using copper and aluminum outer conductors as we believe usage of the latter is very small.

Our analysis of jumper cables does NOT include other accessories and components that may be used in the installation of the transmission line. Examples of components and accessories which are not included in our analysis are clamps, grounding kits, weatherproofing, surge arrestors, bias tees, diplexers and tower mast amplifiers (TMAs).

## Market Size Assumptions

A number of assumptions have been made concerning the market size. We have used typical ASPs in the market and currency conversion rates as of September 2013. It should be noted that the ASPs vary strongly by region and the type of jumpers chosen.

**Table 1: Global Average Selling Price for BTS Jumper Cables (USD/unit)**

Length	2012	2013E	2014E	2015E	2016E	2017E
1/2" or less, standard	24.94	22.92	21.94	21.69	21.41	21.32
1/2" or less, superflexible	21.07	20.03	19.36	19.21	19.06	19.25
7/8"	67.64	62.17	60.28	58.47	56.36	54.78
<b>Average</b>	<b>24.20</b>	<b>23.12</b>	<b>22.54</b>	<b>22.61</b>	<b>22.15</b>	<b>22.37</b>

Source: EJL Wireless Research LLC Estimates (November 2013)



## ***Jumper Cable Categories***

As jumper cables are not dependent on frequencies, we have created our model based upon nominal cable diameter and outer conductor material. The nominal diameter dimensions of jumper cable are specified in inches following common global market parlance and not in millimeters. However, their lengths are given in meters rather than feet, as the latter unit is not used outside North America.

Our analysis focuses on two major product segments in jumper cable diameter:

- 🌀 1/2" or smaller (includes 1/4" and 3/8")
- 🌀 7/8"

We have also analyzed the type of jumper cable by three product segments:

- 🌀 1/2" or smaller standard
- 🌀 1/2" or smaller superflex
- 🌀 7/8" superflex

Superflex coaxial cables are easier to bend, and therefore easier to install, than the standard ones. Most suppliers offer both versions. In the case of 1/2", where the inner conductor is solid, this is achieved by imposing a deeper corrugation depth on the outer conductor. For larger cables, where the inner conductor is a tube, it may be achieved by corrugating the tube versus leaving it smooth, or imposing a deeper corrugation on the outer conductor, or further measures, or a combination of these.

Superflexible versions tend to exhibit higher attenuation than their standard counterparts, so that superflex is preferred for short lengths in difficult installation situations whilst standard versions are used more frequently for the longer runs without sharp bends.

7/8" jumpers are only expected to be the superflex version as the standard version is too rigid for jumper usage. The emergence of the 7/8" jumper is the result of two major factors. One is the use of higher frequencies than in the past (up to 2.6 GHz), where a larger diameter jumper will compensate the increased attenuation due to frequency. The other is migration to tower top technology. Wherever the distance between the RRU and the antenna is greater than the distance to the top of a classical feeder, the jumper will be longer and therefore have higher attenuation. This, coupled with the fact that a tower-top RRU has a lower output power than a classical BTS, fuels the demand for low loss (i.e. 7/8") jumpers.

We have also analyzed the type of jumper cable by three product length (l) segments:

- 🌀  $l < 2m$
- 🌀  $2m < l < 5m$
- 🌀  $l \geq 5m$

Finally we have analyzed the jumper cable interfaces by four product categories:

- 🌀 7/16 DIN male straight - 7/16 DIN male straight
- 🌀 7/16 DIN male straight - 7/16 DIN male 90°
- 🌀 7/16 DIN male straight - N male straight
- 🌀 Others

We wish to caution our readers that we are erring on the side of conservatism in our forecast assumptions and are attempting to define a lower boundary range of many possible outcomes over the next five years through 2017. We will be highlighting any possible upside potential to our estimates throughout the report to remind readers what could be potential swing factors that could positively and negatively impact our assumptions and forecast.

Our market statistics and unit data have been sanitized through many cross checks and examinations in order to fully correlate the data. We believe that our data represents a very realistic view on BTS jumper cable shipments for 2011-2012.

## ***BTS Site Definitions***

We define the two architectures used to deploy BTS equipment as:

- 🌀 Classical BTS Tower Bottom Sites
- 🌀 New BTS Tower Top Sites

### **Classical BTS Tower Bottom BTS Sites**

This was the original cell site architecture. Classical tower bottom BTS sites position the radio portion of the BTS at the bottom of the tower or building. A conventional installation will typically connect the BTS/Node B to a main, low loss feeder line via short flexible jumper cables. At the top of the feeder line, further jumper cables will connect the feeder line to the antenna, often via further components such as TMAs and diplexers.

In a greenfield situation, each of these components will be newly installed. If the site is already occupied, the main feeder lines may be shared with other services and/or operators, particularly if the new service is in a similar band for which the attenuation of the existing feeder is appropriate.

In an equipment swap out situation, the operator will deliberate whether to swap out the main transmission line system also. In a large number of cases, the total transmission line system is retained. Sometimes different system architecture and interfaces require that jumpers at the bottom and/or at the top be replaced. The main feeder lines are very rarely replaced as they remain functional, at least for the frequency bands for which they were dimensioned, for most systems and do not demonstrate noticeable aging. In case of main feeder sharing, additional jumpers are required to attach the new equipment to the main line via combining units.

## **New BTS Tower Top Sites**

In recent years there has been an increasing trend towards using Remote Radio Units (RRUs) at the top of the tower. In contrast to a classical site, the signals are converted into RF energy at the tower top rather than at the tower bottom. This has several advantages for the operator, notably avoiding the losses in RF energy due to the attenuation of the main feeder line, thus saving energy and also reducing the footprint at the tower bottom thereby reducing rent costs.

The disadvantage of increased maintenance costs due to having active equipment at the top of the tower have to some extent delayed the adoption of tower top RRUs. Many conservatively-minded operators may still prefer to install their RRUs at the tower bottom, resulting in a transmission line architecture similar to a classical site.

As the RRU further matures, however, its use at the tower top is on the rise. The RRU is connected via jumpers, occasionally via additional components, to the antenna. In contrast to classical site, therefore, the main feeder lines and the bottom jumpers are no longer needed.

The migration from classical to tower top architecture is the dominating trend influencing the market size of RF transmission line systems over the next 5 years. A further migration from the RRU to the integrated antenna array (IAA) leads to a situation where not even the tower top jumpers are required. As the total percentage of IAAs is still expected to be very low in the period up to 2017, the effect is negligible in this report.

The jumper cable market is less negatively affected by the migration to tower top technology than feeder lines or connectors. Although a number of tower-bottom jumpers are cannibalized, the demands on the quality of tower-top jumpers to support 4G will increase, thus increasing the expected ASP. Also the introduction of 4X4 MIMO increases the number of tower-top jumpers required at each site.

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