Register No. : MEPS-12520042150101

Date : 3rd February 2015

MARUWA MWSL1252: Product Specification (Preliminary)

Part Identity

Maruwa drawing No.	Customer drawing No.
MEFP125X022A140101	

Customer's Approval

Approved (Manager)	Checked (QA)	Prepared (Engineer)
Date : 03 Feb. 2015	Date : 03 Feb. 2015	Date : 03 Feb. 2015

株式会社 MARUWA
MARUWA Co., Ltd.

Product Specification (Preliminary)		
MARUWA Antenna Products MWSL1252	Document No	MEPS-12520042150101

1. Scope

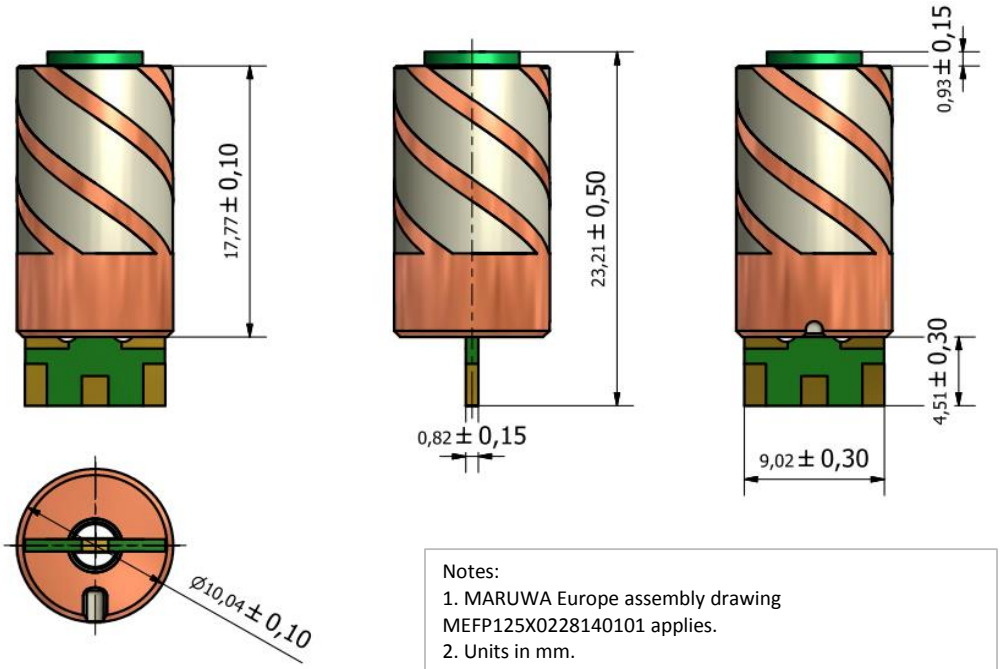
This specification applies to the MARUWA MWSL1252 GPS L1 antenna which is intentionally designed to resonate in free-space at 1593.5MHz so that it can be tuned by the embedding configuration to the GPS L1 frequency: 1575.42MHz. The MWSL1252 part is designed for applications where packaging will cause a moderate level of down-tuning. For applications with a higher degree of detuning the MWSL1251 part should be selected.

2. Specifications

	Minimum	Typical	Maximum	Unit
Part Number	MWSL1251 (MARUWA dwg No: MEFP125X0022A140101)			
Type	Dielectric-loaded Quadrifilar Helix			
Connector Type	Refer to embedding information / connection diagrams			
Free Space Frequency		1593.5		MHz
Embedded Frequency		1575.42		MHz
Polarisation	Right-hand Circular Polarised			
Integrated Gain (evaluation PCB)		-3.0		dBic at zenith
Beamwidth		>115		Degrees
Bandwidth (3dB)		15		MHz
Axial Ratio		<1.5		at zenith
VSWR		<2.0:1	2.3:1	
Impedance		50		Ω
Operating Temperature	-40	20	85	°C
Overall Dimensions	Refer to mechanical drawings			mm
Weight		7.0		grams

3. Dimensions

Basic MWSL1252 form:



Notes:
1. MARUWA Europe assembly drawing MEFP125X0228140101 applies.
2. Units in mm.
3. For connection layout and pad-size, through-hole and connector details please refer to pad layout and designation definitions.

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01	03 Feb. 15	Issue of the first edition	K.Inagaki	F.Frimpong	O.Leisten

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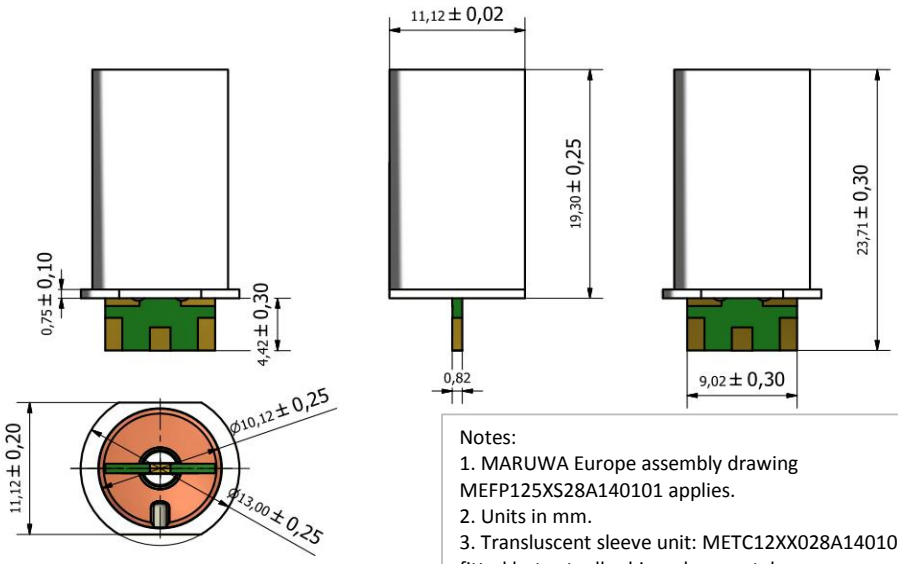
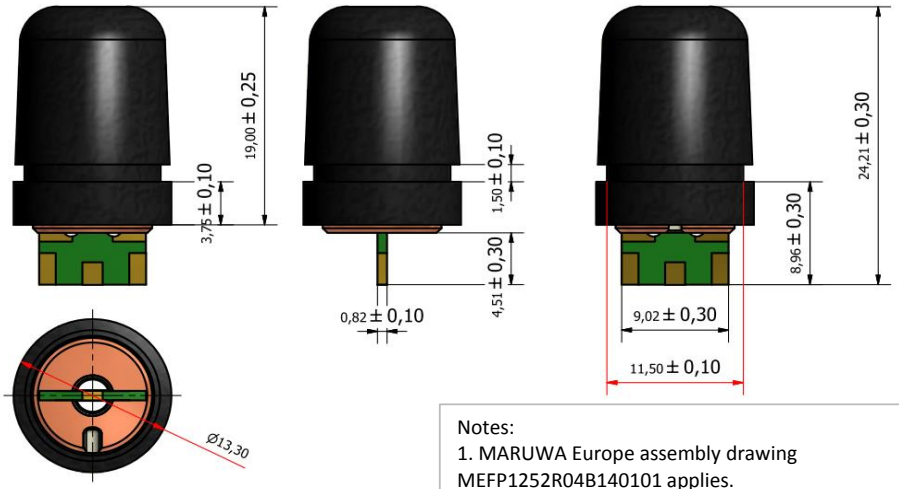
MWSL1252S form with loosely fitting translucent sleeve.



Notes:
1. MARUWA Europe assembly drawing MEFP125XS28A140101 applies.
2. Units in mm.
3. Transluscent sleeve unit: METC12XX028A140101 shown fitted but actually shipped separately.
4. For connection layout and pad-size, through-hole and connector details please refer to pad layout and designation

MWSL1252R form with loosely fitting black radome cap.



Notes:
1. MARUWA Europe assembly drawing MEFP1252R04B140101 applies.
2. Units in mm.
3. Black cap/radome unit: METC120X158140101 shown fitted but actually shipped separately.
4. For connection layout and pad-size, through-hole and connector details please refer to pad layout and designation

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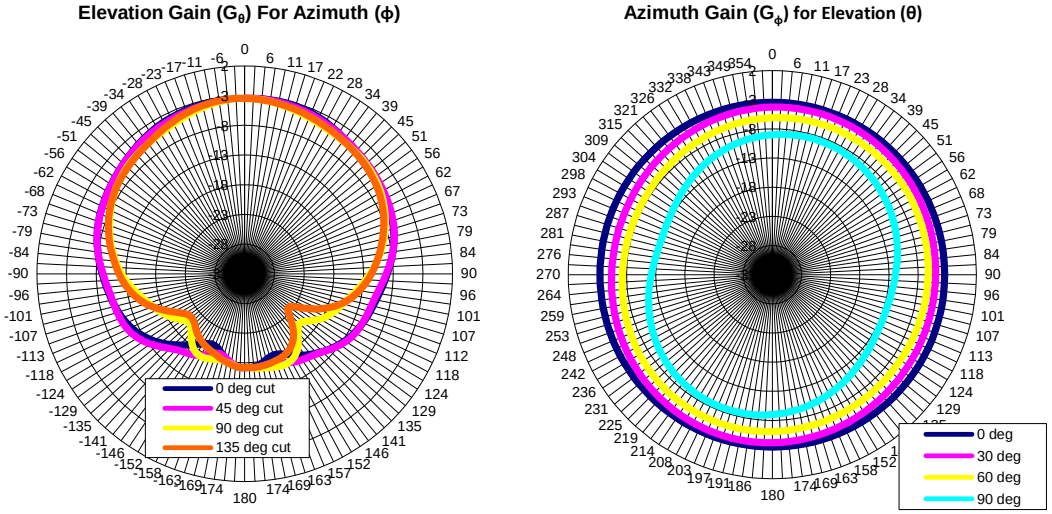
4. Product Description

The MWSL1252 GPS L1 miniature dielectric-loaded antenna uses MARUWA's distinctive materials technology to provide high circularly-polarised gain in a small size for particularly tightly integrated applications. It enables excellent GPS performance in such tightly integrated devices that require good positional accuracy. Useful gain uplift, due to near-field reflections, can be achieved through installation according to MARUWA design guidelines.

The MWSL1252 antenna has a sharp filtering response and is particularly suitable for applications where:

* The device is hand-held, body-worn, or otherwise surrounded by materials of high relative dielectric-constant which would de-tune other antennas.
* The antenna is installed in close proximity to other antennas sharing the same device housing and ground-plane: for example Bluetooth®, WiFi, LTE, WiMax and other cellular radio antennas.
* The antenna must fit into a very small installation volume with close proximity to other components and little or no space available for a ground-plane.
* The orientation of the device is random.
* The antenna must be embedded into the device.

The MWSL1252 antenna is balanced, which isolates it from the device ground enabling it to reject common-mode noise present on the device ground-plane. The construction and materials of the antenna constrain its near-field region to occupy a very small volume so that materials near the antenna cause negligible de-tuning effects. Therefore the antenna maintains its pattern and efficiency in the presence of dielectric loading. As a dielectric-loaded antenna the MWSL1252 has a stable filtering effect; attenuating signals from common cellular and ISM frequency bands by as much as 30dB without external filtering.



Typical Gain Pattern

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The MARUWA MWSL1252 antenna is designed for two modes of installation. The first (and preferred) configuration is as a stand-alone extenally mounted antenna (outside of the housing) with the black-cap radome fitted (MARUWA part number: METC120X0158140101). The antenna can be incorporated into a stand-alone package with a co-axial connector output as might be configured in a screw-on package format. In such a configuration the MWSL1252 part may be embedded within a plastic over-moulding. Alternatively the antenna can be connected to an internal circuit board using the connection pads but with the product housing closing into the groove of the black cap radome. As an another alternative the customer may choose to design a radome of a different style. Such a design must be implemented with a suitable low-loss material which has the same dielectric loading effect as the MARUWA METC120X0158141010 black cap/radome.

A second mode of installation is one in which the MWSL1252 is embedded into the housing with features surrounding the antenna causing a moderate degree of down-tuning. Though it is electrically isolated from the device ground plane, through the action of an integrated balun, the MWSL1252 antenna can be expected to increase efficiency by up to 100% when integrated into a ground plane due to constructive near-field signal reflections. This product is generally used in a class of small portable devices that have slim styling so that there is no space for a ground-plane that is laterally disposed with respect to the antenna-axis. It is therefore specified as embedded into a ground-plane that is co-planar with the antenna axis.

The MWSL1252 is designed for applications with embedding configurations that tune the antenna from the free-space resonant frequency of 1593.5MHz to the GPS L1 frequency of 1575.42MHz. Such configurations include the co-planar ground-plane as shown above with 10mm offset between the circuit-board copper-ground plane and the side of the antenna together with further de-tuning caused by the plastic housing of the product.
For applications with more tight embedding MARUWA offers the MWSL1251 part which is tuned to a free-space frequency of 1603.5MHz.

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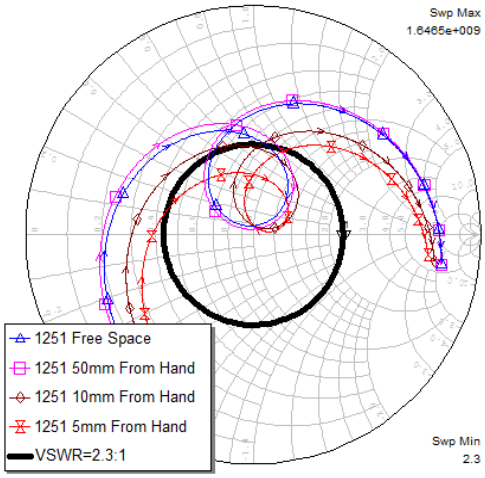
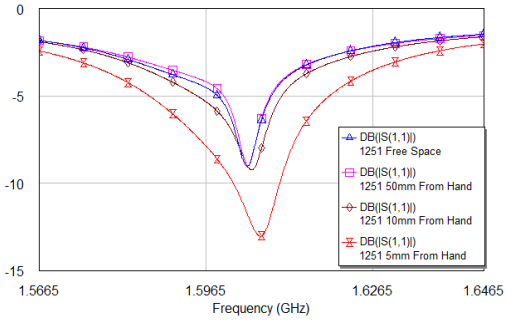
This MARUWA dielectric-loaded antenna technology delivers a major advantage with regard to immunity to de-tuning when brought into close proximity to human tissues and other "in-use" causes of dielectric loading. The MWSL1252 antenna retains efficiency and polarisation near the human body. Conventional antennas may lose 5-10dB of gain or efficiency in similar circumstances of use.



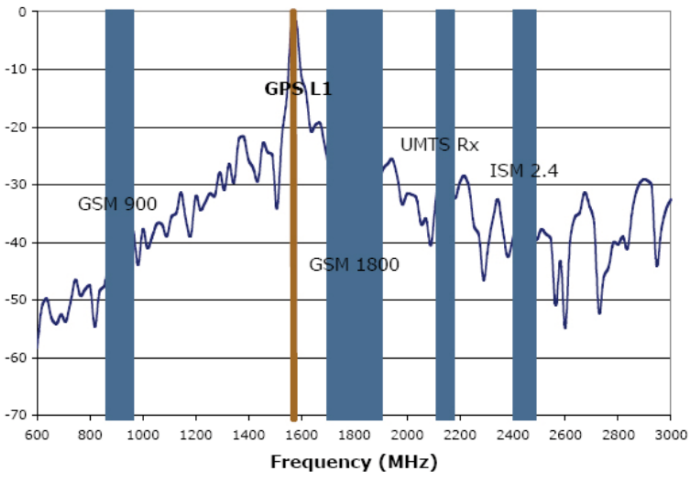
Typical Impedance Response

A set of match loci for a typical MWSL1252 antenna is shown as plotted on a Smith chart which is normalised to 50Ω. The dielectric-loaded structure of the antenna causes the match characteristic not to change significantly when is close proximity to the human body. For example the $|S_{11}|$ response is remarkably unchanged as a human hand is brought as close as 5mm from the antenna.



Typical Return Loss Response

The frequency stability of the MWSL1252 antenna is further illustrated in the graph of return-loss magnitude (in dB) for four different levels of dielectric loading (mm offset from a phantom hand). Once again it demonstrates that minimal detuning occurs until the antenna is within 10 mm of the phantom hand.



Filtering Response

Frequency (MHz)		S_{21} (dB)
860	Cellular 900	-46
970		-40
1575	**GPS L1**	-3
1700	Cellular 1800	-26
1800		-36
1900		-29
2110	3G Rx	-32
2170		-30
2400	ISM 2.4	-40
2480		-38

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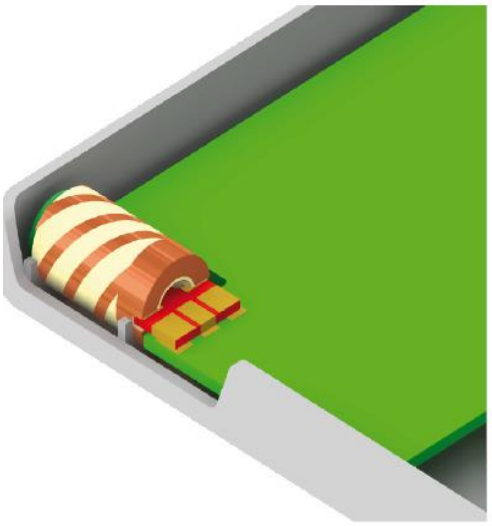
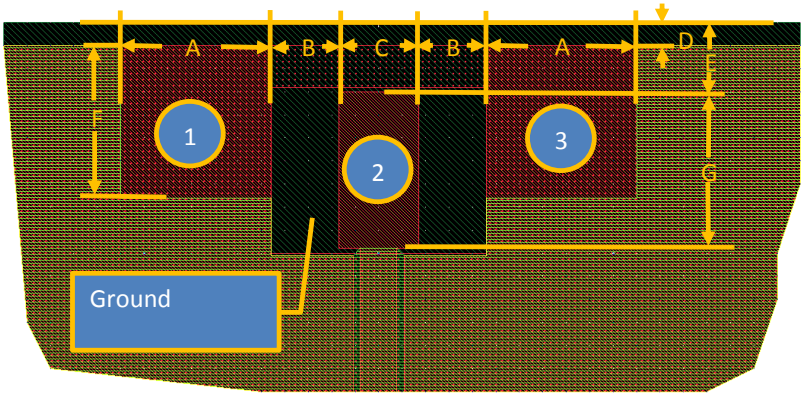
Embedding Information



A typical installation into a plastic housing is shown. It embodies the combination of a hand-soldered electrical connection to the host PCB with mechanical support, in the form of plastic cradle-ribs, to implement a shock-resistant structure. Of course it is important to ensure that the assembly is not under strain when the parts are fitted together. If accurate assembly jigs are available, the antenna can be soldered to the board and thereafter the board-assembly can be fitted into the housing. Alternatively the MWSL1252 can be soldered to the board which is itself fitted into the housing. The installation is completed when the lid half of the housing, with the opposing antenna ribs, is fitted. Further installation information can be obtained from MARUWA's integration guideline documents.

Pad Layout and designation



Pad Number	Function
1	Ground
2	Signal
3	Ground

Dimensions	mm ± 0.1
A	3.2
B	1.45
C	1.7
D	0.5
E	1.5
F	3.5
G	3.5

The "ground exclusion area" applies to all PCB layers. Ground-plane within this region degrades the 50Ω match.

Ordering Guide for the MWSL1252 Antenna

Maruwa Part	Description	MOQ	Pack Size
MWSL1252	MWSL1252 with PBC-feed connection.	400	400
MWSL1252S	MWSL1252 with sleeve (for embedded use)	400	400
MWSL1252R	MWSL1252 with radome (for external use).	400	400

Please note that when MWSL1252S or MWSL1252R parts are ordered the sleeve/radome parts shall be delivered in separate packaging and will not be fitted to the MWSL1252 product. The radome and sleeve parts are designed to fit loosely.

5. Notes

1. The contents of this document assure the characteristics and quality of the antenna components themselves.
2. Please ensure that they work correctly in the installed configuration and method of use of your equipment.

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