MetOp Second Generation Front-End Receivers

Statement of Work for Flight Waveguides

Issue 2.0

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CHANGE LOG

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10 Oct 2018	1	0		First Issue
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Applicable Documents

AD #	APPLICABLE DOCUMENT TITLE	DOCUMENT ID	ISSUE
14b	MetOp SG PA requirements for suppliers	MOS.SP.ASF.SYS.00401	3.0

Reference Documents

RD #	REFERENCE DOCUMENT TITLE	DOCUMENT ID	ISSUE
1	Requirement Specification for Flight Waveguides	**M**OS-RS-RAL-MWS-FERX0017	2.0
2			
3			

Abbreviations and Definitions

FERX	Front End Receiver
FMn	Flight Model n (n=2, 3)
FRM	Frequency Multiplier
FS	Flight Spare
ICI	Ice Cloud Imager
MRR	Manufacturing Readiness Review
MWI	Microwave Imager
MWS	Microwave Sounder
PA	Product Assurance
PFM	Protoflight Model

1. INTRODUCTION

1.1 Purpose

The STFC RAL Space Department Millimetre-wave Technology Group (MMTG) is presently embarked on a major equipment supply programme for the MetOp Second Generation (MetOp-SG) series of Earth observation satellites. MetOp-SG will deliver complex multi-wavelength instrument payloads into low Earth orbit via a series of repeat satellite deployments to be initiated in 2021. MMTG are leading a consortium to deliver Front End Receivers (FERX) at frequencies from 166GHz to 325GHz for three different instruments – Microwave Sounder (MWS), Microwave Imager (MWI) and Ice Cloud Imager (ICI). STFC's customers are Airbus UK, Airbus France and Radiometer Physics GmbH (Germany) respectively. The receivers will be integrated into instruments which will ultimately be delivered to the European Space Agency for launch. The FERX for MWS and MWI incorporate high-frequency waveguides with complex geometries which must be manufactured to tight tolerances.

1.2 Scope

This document describes the work to be performed in delivering flight waveguide assemblies for the FERX units to be provided for the MWS and MWI instruments.

2. WORK TO BE PERFORMED

2.1 Overview

The supplier will be responsible for:

- Manufacture of waveguide assemblies to the requirements of [RD1]
- Inspection and performance testing of waveguide assemblies to the requirements of [RD1]
- Any necessary qualification of in-house processes (e.g. plating, soldering / brazing / welding) to the requirements of [AD14b]
- Supply of all required test pieces to support related process qualification activities at RAL.
- Holding sufficient stock of materials to be able to furnish optional spare units should this option be required.

2.2 Options

2.2.1 Plated Finish

High conductivity surface coating of the inside of the waveguide is required to meet the MetOP SG performance requirements [RD1].

As RAL have a proprietary in-house process for plating the inside of hollow nickel-plated waveguides, RAL's requirement is for the supply of nickel-plated waveguide assemblies, to be post-plated at RAL.

2.2.2 Support for Process Qualification

RAL has extensive environmental test capability, including thermal cycling, climatic test chambers, vibration test facility, load pull facility etc.

Should the supplier require to qualify any of their in-house processes to meet the requirements of [AD14b], RAL can support this activity. The supplier is invited to specify where such support may be required, and RAL will consider its associated costs when reviewing the proposal.

As RAL will undertake final gold-plating (ref section 2.2.1), RAL will require additional nickel / nickel-plated samples to perform adhesion and other qualification testing. This is detailed in section 2.3.

A draft qualification plan (assuming supply to RAL of nickel-plated copper waveguide assemblies) is presented in [RD1].

2.3 Deliverables

2.3.1 Flight waveguide assemblies

A total of thirty two flight waveguide assemblies are required; types and quantities are listed in Table 2-1.

2.3.2 Additional spares

The supplier is also requested to quote for the following options:

- Manufacture & supply of a complete set of 8 parts, to be manufactured immediately following the final flight units
- Future manufacture and supply of individual replacements waveguide assemblies.

Table 2-1 List of Deliverable Waveguide Assemblies

Drawing number	Description	Used on	PFM	FM2	FM3	FS	*Optional Spare*
KE-0282-015-A	166 GHz LO chain waveguide	MWS-FERX166	1	1	1	1	*1*
KE-0282-018-A	183 GHz LO chain waveguide	MWS-FERX183	1	1	1	1	*1*
KE-0282-026-C	229 GHz LO chain waveguide	MWS-FERX229	1	1	1	1	*1*
KE-0282-038-C	229 GHz LO test port waveguide	MWS-FERX229	1	1	1	1	*1*
KE-0282-123-C	166 GHz LO test port waveguide	MWS-FERX166	1	1	1	1	*1*
KE-0282-220-D	183 GHz LO test port waveguide	MWS-FERX183	1	1	1	1	*1*
KE-0282-433-D	166 GHz LO test port waveguide	MWI-FERX166	1	1	1	1	*1*
KE-0282-533-D	183 GHz LO test port waveguide	MWI-FERX183	1	1	1	1	1

All deliverable parts shall be accompanied by the following:

- Certificate of Conformance
- Inspection & Metrology report confirming compliance to the drawing
- Test report stating RF performance
- All other Product Assurance (PA) documentation as detailed in [RD1]

2.3.3 Qualification test pieces

In addition to the flight waveguides, further items will be required in order to support qualification of the supplier nickel plating (and RAL gold-plating as appropriate).

2.3.3.1 Bend Test Pieces

6 test pieces are required for bend test, as defined in [RD1] Appendix 3.

2.3.3.2 Complex Test Pieces

8 complex test pieces are required as defined in [RD1] Appendix 4

3. REQUIREMENTS FOR MANAGEMENT, REPORTING, MEETINGS AND DELIVERABLES

3.1 Management

The Supplier shall interface with the RAL Space project team. Formal interface points will be:

- Brian Moyna (Project Manager)
- Joseph Hampton (Mechanical Lead)
- Simon Rea (Systems Lead)
- Fabian Aparicio (PA Manager)

Contact details thereof shall be provided upon award of contract.

The Supplier shall be responsible for the management of all activities under the Contract.

3.2 Deliverables and Milestones

The following Milestone Payment Plan is proposed; note that a separate payment plan is presented for the process qualification activity, if required.

Table 3-1 MPP for Process Qualification Activity

Task	Deliverable	Milestone Payment (%)
Process qualification report and all waveguide assemblies	Acceptance of Qualification Report and acceptance of all deliverable waveguide assemblies	100%

4. SCHEDULE

The required deliverable dates are as follows:

Table 4-1 Need-By Dates for Flight Waveguide Assemblies at RAL

Model	FERX	Waveguide Assembly	Need-by date
PFM	MWS-FERX166	KE-0282-015-A	15/03/19
	MWS-FERX166	KE-0282-123-C	15/03/19
	MWS-FERX229	KE-0282-038-C	15/03/19
	MWS-FERX229	KE-0282-123-C	15/03/19
	MWS-FERX183	KE-0282-018-A	22/03/19
	MWS-FERX183	KE-0282-220-D	22/03/19
	MWI-FERX166	KE-0282-433-D	29/03/19
	MWI-FERX183	KE-0282-533-D	29/03/19
FS	All	All (8 total)	24/05/19
FM2	All	All (8 total)	26/07/19
FM3	All	All (8 total)	30/08/19

Suppliers should state compliance with these dates or, if non-compliant, supply dates which can be met. In either case the supplier shall provide project planning information in the form of a Gantt chart or equivalent, plus the required resourcing, so that RAL can assess the proposed manufacturing workflow.

Manufacture of the flight waveguides will be subject to a successful Manufacturing Readiness Review (MRR).

It is preferable that all qualification activity is completed and the Qualification Test Report accepted prior to MRR. However it is understood that the required delivery timescale is compressed and RAL may therefore give approval for PFM waveguide assembly manufacture at risk if this is required to meet the PFM delivery deadlines, provided progress on qualification activities up to the point of MRR has been satisfactory.