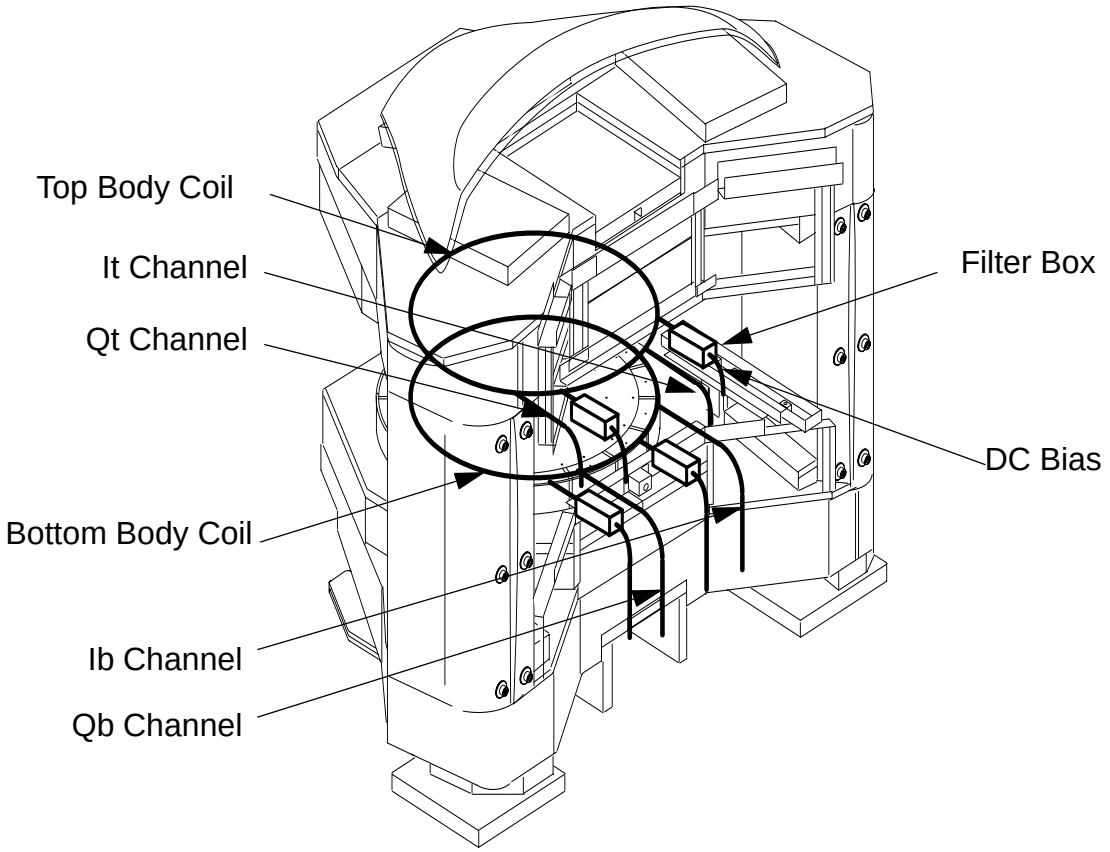
TABLE OF CONTENTS

1. Preparation

1-1 Overview

This procedure describes how to tune the body coil. Body coil consists of **Top Body Coil** and **Bottom Body Coil**. Each coil consists of two channels, namely I channel and Q channel, so there are four channels in all: **It Channel**, **Qt Channel**, **Ib Channel** and **Qb Channel**. Refer to the following illustration for corresponding RF cables. The cables with Filter Box are **DC Bias Cables**.



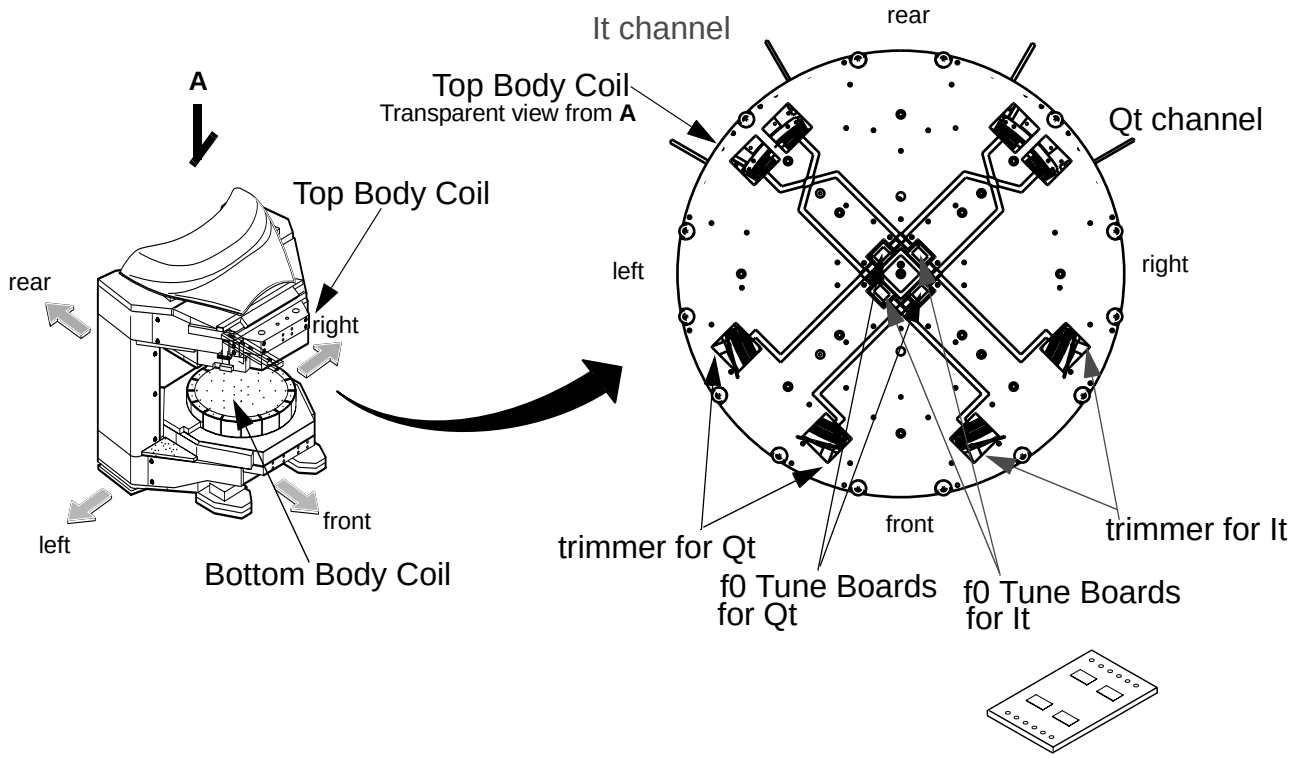
OVERVIEW
ILLUSTRATION 1

1-1 Overview (continued)

The tuning procedure is

a. Top coil rough tuning
b. Top coil fine tuning
c. Bottom coil rough tuning
d. Bottom coil fine tuning
e. Short check

Rough tuning is performed by selecting the best **F0 Tune Boards**. Fine tuning is performed by adjusting the **Trimmers** on Body Coil. A F0 Tune Board is pre-installed in the Body Coil upon delivery. After Body Coil is installed into the Magnet, the frequency of the Body Coil is measured. If the frequency difference of the Body Coil and the site frequency is within the range adjustable by Fine Tuning, Rough Tuning is not necessary. Refer to the following illustration. Details will be explained in following chapters.



F0 TUNE BOARD AND TRIMMER
ILLUSTRATION 2

1-2 Required Tool

TABLE 1-1
REQUIRED TOOL

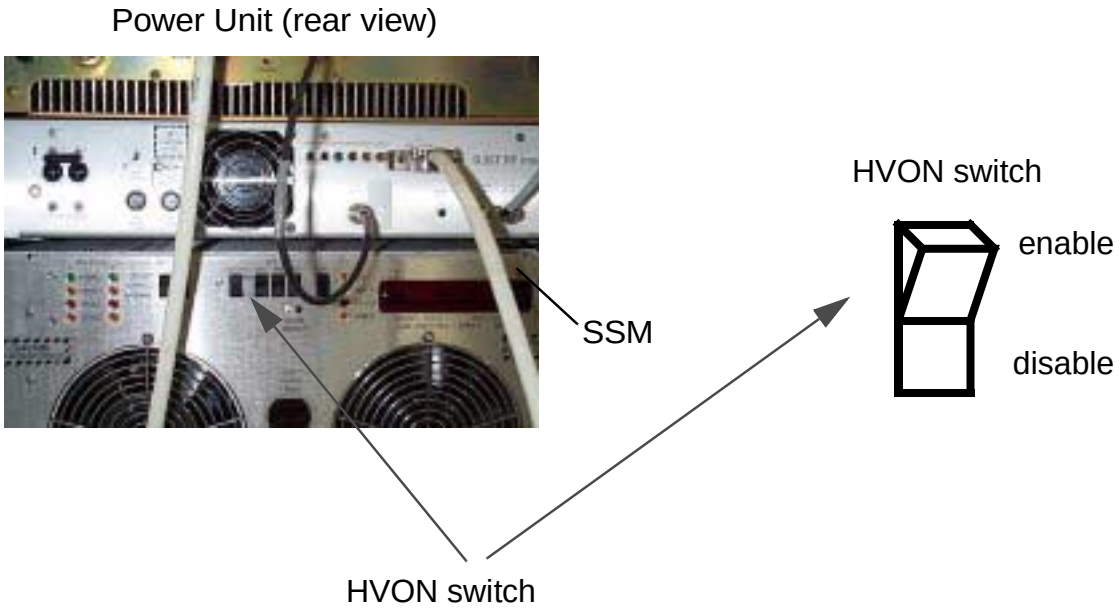
Items	Qty	Check
Shorting Connector (Z9817BK)	3	
N-BNC Connector (2283105)	4	
F0 Board Assy (2283173)	1	
Coil Tuning Cable1 (2284525)	1	
Coil Tuning Cable1-2 (2288849)	1	
VIM (Vector Impedance Meter) - HP 4193(or equivalent)	1	

1-3 Check screws

1. Check the screws of Body Coil that were fixed when it was installed into the magnet, and make sure that they are tightened securely. If Body Coil is not fixed properly, you will not be able to tune the Body Coil.

1-4 Setup

1. Verify that SSM is **OFF**. If not, turn it off according to following steps.
   a. Turn **HVON switch** on SSM to **disable** side.

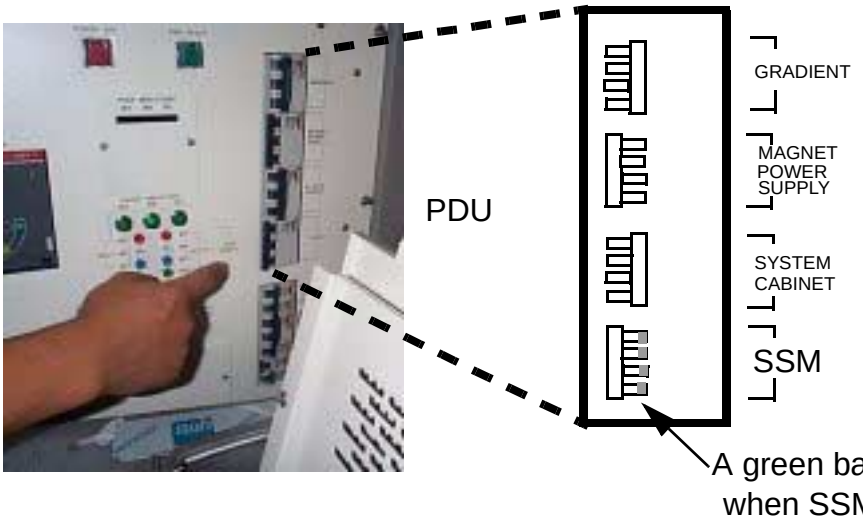


HVON SWITCH DISABLE
ILLUSTRATION 3

1-4 Setup (continued)

b.Turn **SSM** (System Support Module) Power **off**

Power Unit (rear view)



SSM POWER OFF
ILLUSTRATION 4

DANGER!!

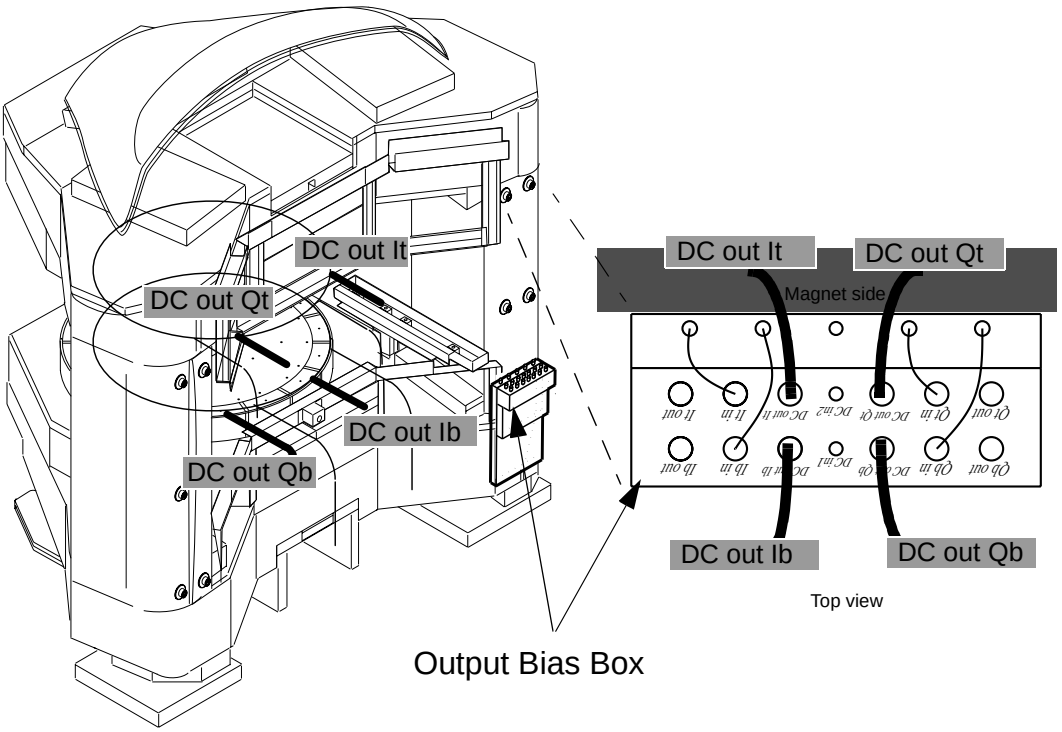
SSM OUTPUTS VERY HIGH VOLTAGE. BE SURE TO TURN THE SSM POWER OFF BEFORE CONNECTING DC BIAS CABLES. HANDLING DC BIAS CABLES WITHOUT TURNING SSM POWER OFF MAY CAUSE SERIOUS INJURY OR DEATH DUE TO ELECTRIC SHOCK.

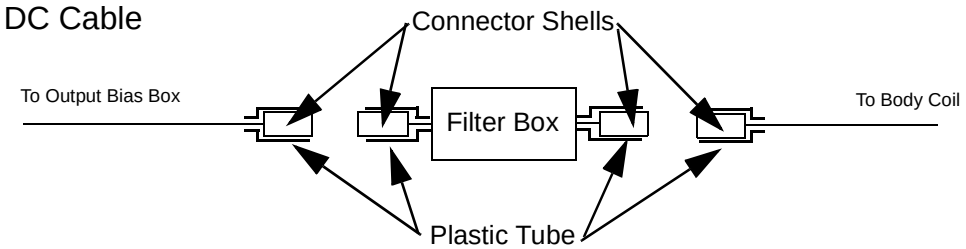
1-4 Setup (continued)

2. Connect DC Bias Cables
   Connect Body Coil, Filter Box, DC Bias Cables and Output Bias Box referring to “Body Coil Installation : DC Bias Cables / RF Cables Wiring”. Do not connect RF Cables yet. Be sure that the connector shells are wrapped with plastic tubes for insulation.

CAUTION

When connecting the DC cables, make sure that connectors DO NOT TOUCH the frame, other connectors, or any other conductive materials.

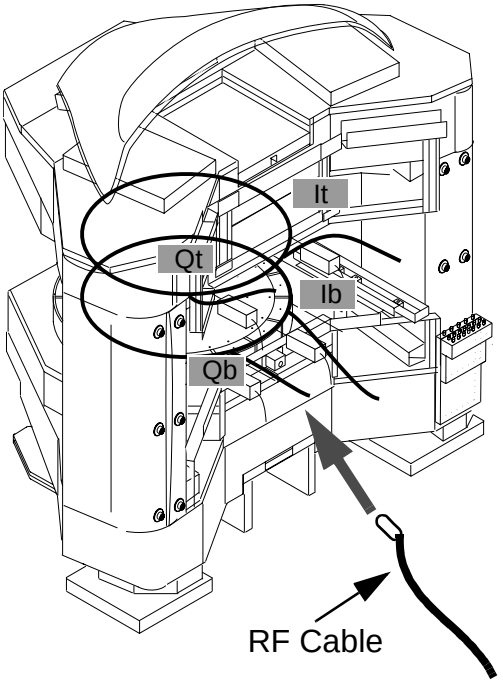




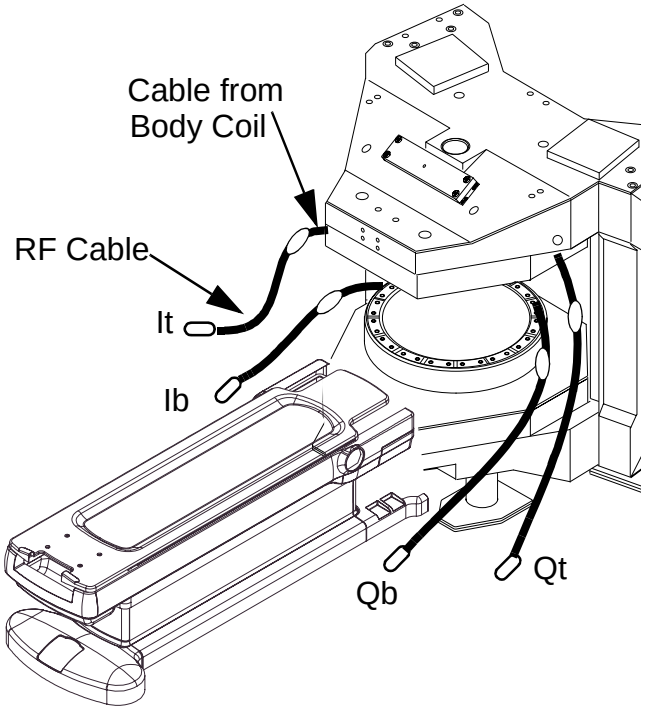
DC CABLE CONNECTION
ILLUSTRATION 5

1-4 Setup (continued)

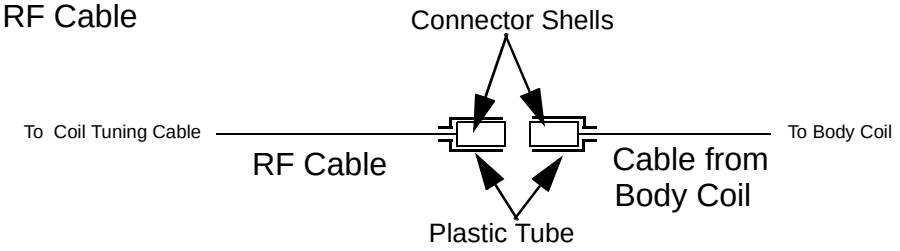
3. Connect RF Cables
   Connect Body Coils to 4 RF Cables. Bring the cables to front of the magnet. Be sure that the connector shells are wrapped with plastic tubes for insulation.



Magnet rear view



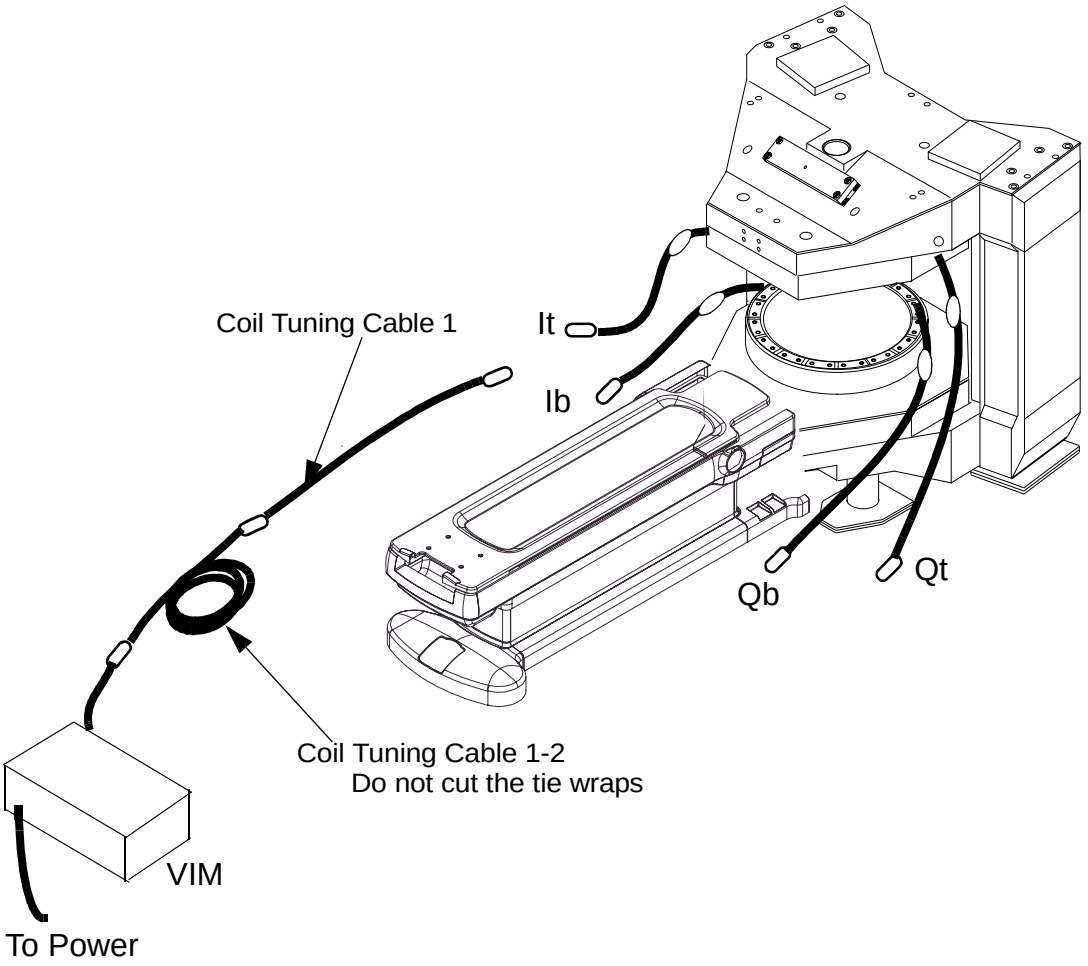
Magnet front view



RF CABLE CONNECTION
ILLUSTRATION 6

1-4 Setup (continued)

4. Setup Measurement Tools
   Setup measurement tools according to the following illustration.
   Do NOT cut the tie wrap on Coil Tuning Cable 1-2. The loop of this cable is intended to achieve good electirc characteristics. To avoid interference to the Magnet, place VIM as far as possible from the Magnet Center. Place front of VIM turned to Magnet for ease of reading measures.



MEASUREMENT TOOL SETUP
ILLUSTRATION 7

NOTE
Do NOT cut the tie wrap on Coil Tuning Cable 1-2.

NOTE
Place VIM as far as possible from the Magnet Center to avoid interference.

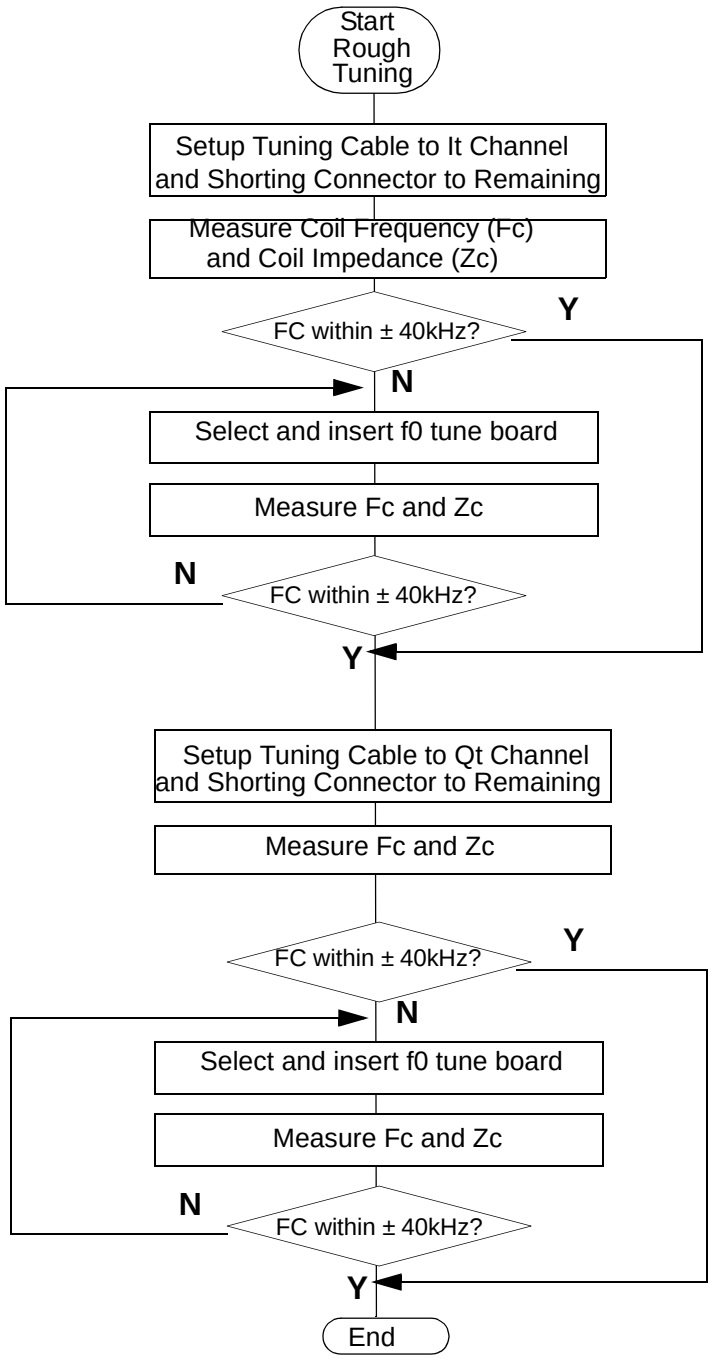
5. Determine Site Frequency
   Find Site Frequency from data sheet. You will need it for later calculation.

TABLE 1-1
F(SITE) : SITE FREQUENCY

F(site): Data (MHz)	F(site): Specification
	14.85 MHz ± 10 KHz

2. Top Body Coil Rough Tuning

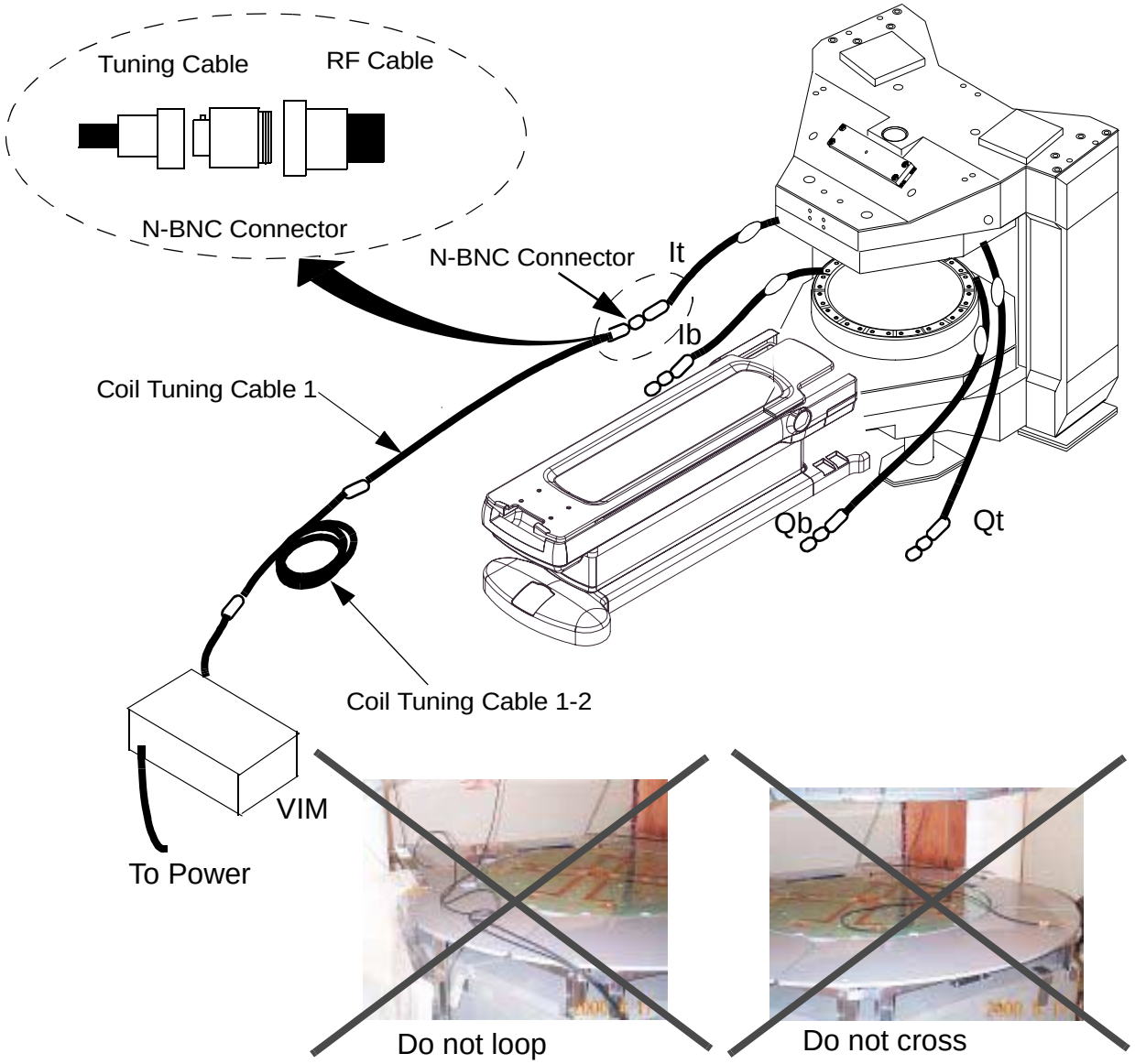
2-1 Flow Chart



ROUGH TUNING FLOWCHART
ILLUSTRATION 8

2-2 Setup Tuning Cable to It Channel and Shorting Connector to Remaining Cables

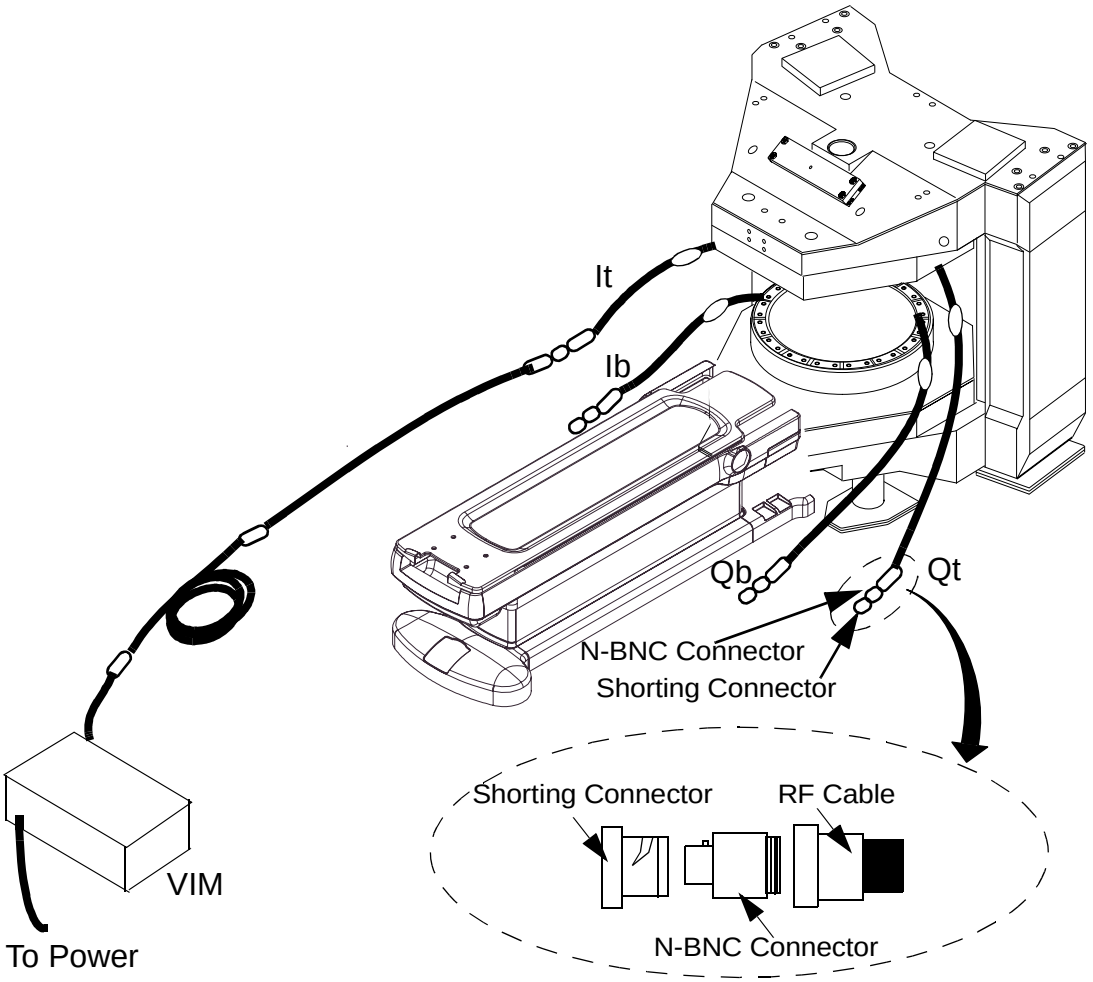
1. Connect Tuning Cable to It Channel using a N-BNC Connector. Refer to the following illustration. Be careful that the cables **do not loop or cross**. Make sure that **connectors do not touch** the frame, other connectors, or any other conductive materials.



IT CABLE SETUP
ILLUSTRATION 9

2-2 Setup Tuning Cable to It Channel and Shorting Connector to Remaining Cables (continued)

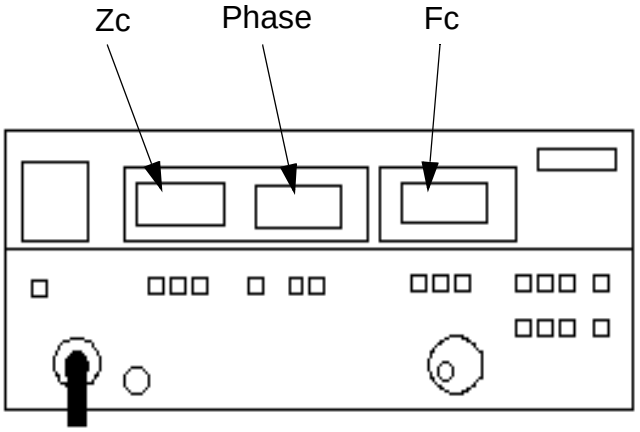
2. Connect Shorting Connectors to remaining cables (Ib, Qt, Qb) using N-BNC Connectors. Refer to the following illustration. Make sure that **connectors do not touch** the frame, other connectors, or any other conductive materials.



SHORTING CONNECTORS (QT,IB,QB)
ILLUSTRATION 10

2-3 Measure Coil Frequency (Fc) and Coil Impedance (Zc) of It channel

1. Adjust the phase on VIM as near as possible to 0degrees
2. Record the correspondent frequency: Fc **Fc =**_____
3. Record the correspondent impedance:Zc **Zc =**_____
   Specification of Zc (in Ohms) : 71 ≤ Zc ≤ 130



VIM FRONT VIEW
ILLUSTRATION 11

2-4 Determining the necessity to change f0 tune board

If -40kHz ≤ Fc - F(Site) ≤ + 40kHz:
The f0 tune boards preset to the Body Coil upon installation is OK. There is no need to change f0 tune board.
Go to section 2-8.

If Fc - F(site) < - 40kHz or **Fc - F(site) > + 40kHz:**
The f0 tune boards preset to the Body Coil upon installation is not OK. There is need to change f0 tune board.
Go to section 2-5

2-5 Select and Insert f0 tune board

1. Select F0 tune board

   Note that the preset f0 tune board is missing from the f0 tune board assy.

If Fc - F(site) < - 40kHz:

Pick the f0 tune board UP one row in the table than the one missing from the box.

Example:

If F(site) is 14.85MHz and the f0 tune board set to Top Body Coil upon installation is Board No.3, and current Fc is 14.80 MHz,

14.80MHz -14.85MHz = -50kHz

In this case, select Board No.2, which is one row up in the table.

If Fc - F(site) > + 40kHz:

Pick the f0 tune board DOWN one row in the table than the one missing from the box.

Example:

If F(site) is 14.85MHz and the f0 tune board set to Top Body Coil upon installation is Board No.3, and current Fc is 14.90 MHz,

14.90MHz - 14.85MHz = 50kHz

In this case, select Board No.4, which is one row down in the table.

TABLE 2-1

F0 TUNE BOARD SELECTION

Fc - F(site)	F0 tune board no.
-200kHz thru -120kHz	No. (X-2)
-120kHz thru -40kHz	No. (X-1)
-40kHz thru 40kHz	No. X
40kHz thru 120kHz	No. (X+1)
120kHz thru 200kHz	No. (X+2)

Note :

X (X=1,2,3,4 or 5) indicates No. of F0 tune board that is pre-installed in Body Coil. (X-2),(X-1),(X+1),(X+2) may not exist depending on the pre-installed board No..

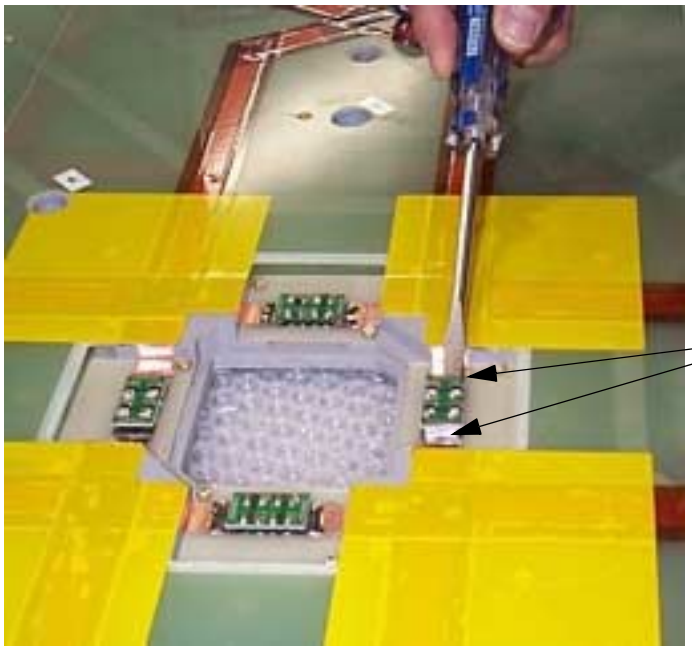
Note :

If value of Fc - F(site) is too big that there is no board to select, there is a possibility that screws of Body Coil are not tightened securely. Check the screws once again.

2-5 Select and Insert f0 tune board (continued)

2. Remove two F0 tune board of the channel that is being tuned from Body Coil. Use a non-ferrous flat-bladed screwdriver to lift the F0 tune board so as not to damage or bend the pins of F0 Tune Board. Do NOT remove the F0 tune board of the channel that is NOT being tuned. Refer to illustration below on how to identify the F0 tune board of the channel that is being tuned.

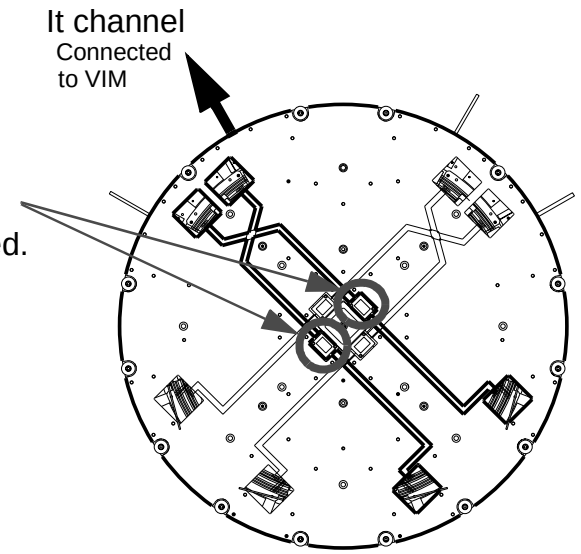
.



Lift F0 tune board using a non-ferrous flat-bladed screwdriver.

Lift F0 tune board from both sides of F0 tune board slowly and carefully.

When It channel is tuned, remove only the F0 tune boards of the It channel. Do NOT remove the F0 tune board of the channel that is NOT being tuned.



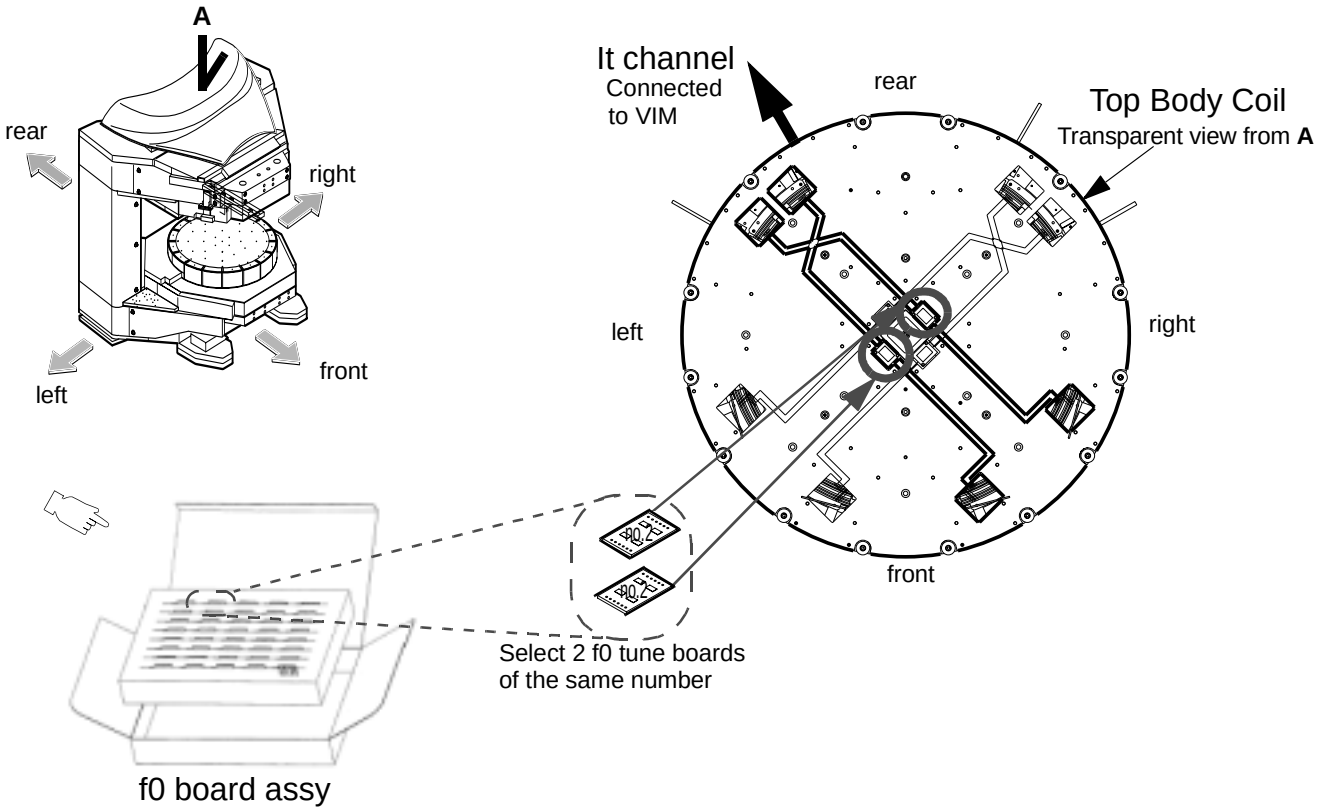
Remove the F0 tune boards that are found on the pattern of the channel that is being tuned.

REMOVE F0 TUNE BOARD
ILLUSTRATION 12

2-5 Select and Insert f0 tune board (continued)

3. Insert the selected f0 tune boards to Top Body Coil at the channel that is being tuned. Be sure to select 2 f0 tune boards of the same number from f0 board assy.

.



How to insert board

INSERT IT F0 TUNE BOARDS
ILLUSTRATION 13

Note:Be careful not to damage or bend the pins of f0 tune boards

2-6 Measure Coil Frequency (Fc) and Coil Impedance (Zc) of It channel

1. Adjust the phase on VIM as near as possible to 0degrees
2. Record the correspondent frequency: Fc **Fc =**_____
3. Record the correspondent impedance:Zc **Zc =**_____
   Specification of Zc (in Ohms) : $71 \leq Zc \leq 130$

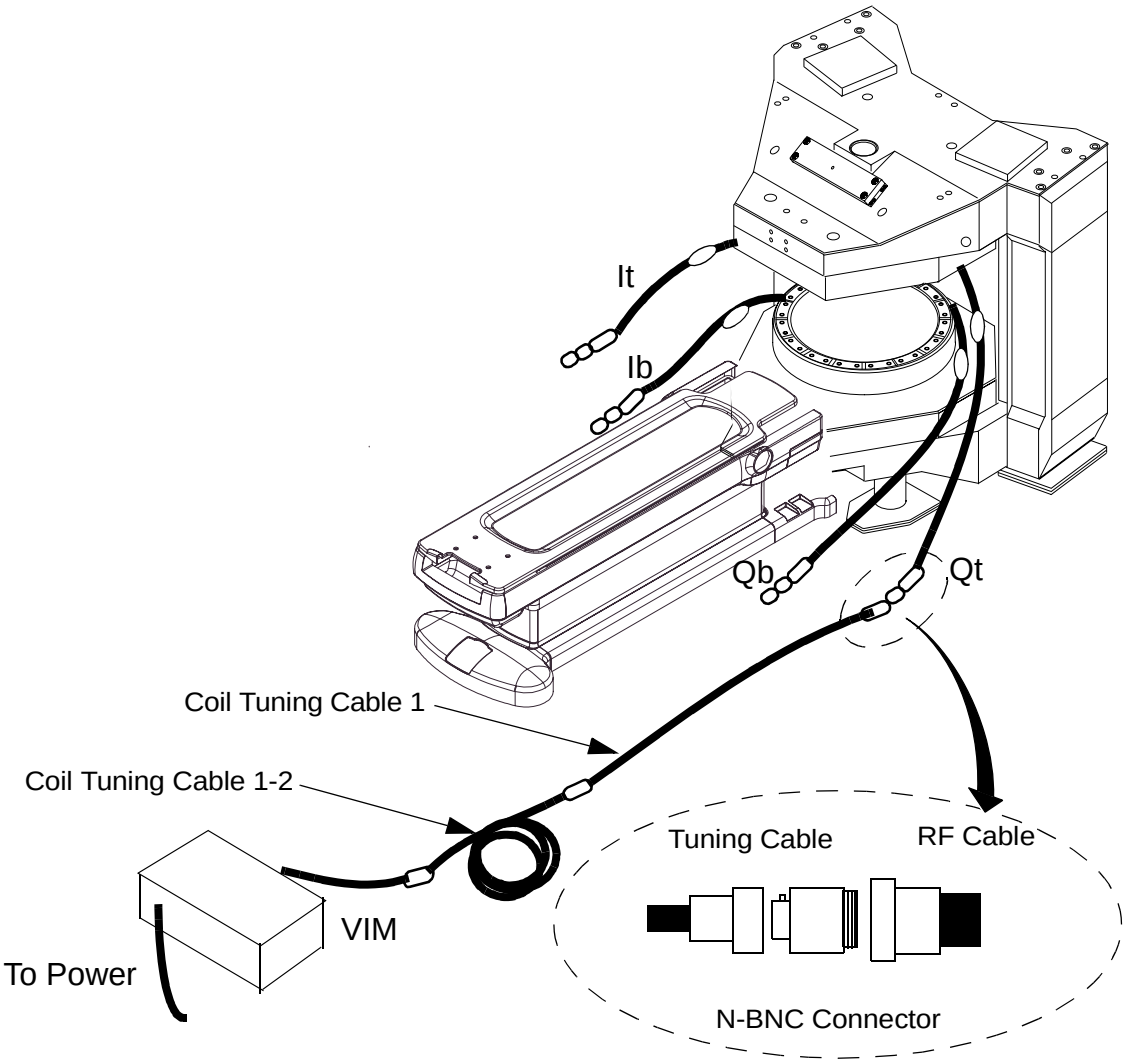
2-7 Determining the necessity to change f0 tune board

If -40kHz ≤ Fc - F(Site) ≤ + 40kHz:
The f0 tune boards set to the Body Coil is now OK.
Go to section 2-8.

If Fc - F(site) < - 40kHz or **Fc - F(site) > + 40kHz::**
The f0 tune boards set to the Body Coil is not OK. There is need to change f0 tune board.
Go back to section 2-5

2-8 Setup Tuning Cable to Qt Channel and Shorting Connector to Remaining Cables

1. Connect Tuning Cable to Qt Channel using a N-BNC Connector. Refer to the following illustration. Be careful that the cables **do not loop or cross**. Make sure that **connectors do not touch** the frame, other connectors, or any other conductive materials.

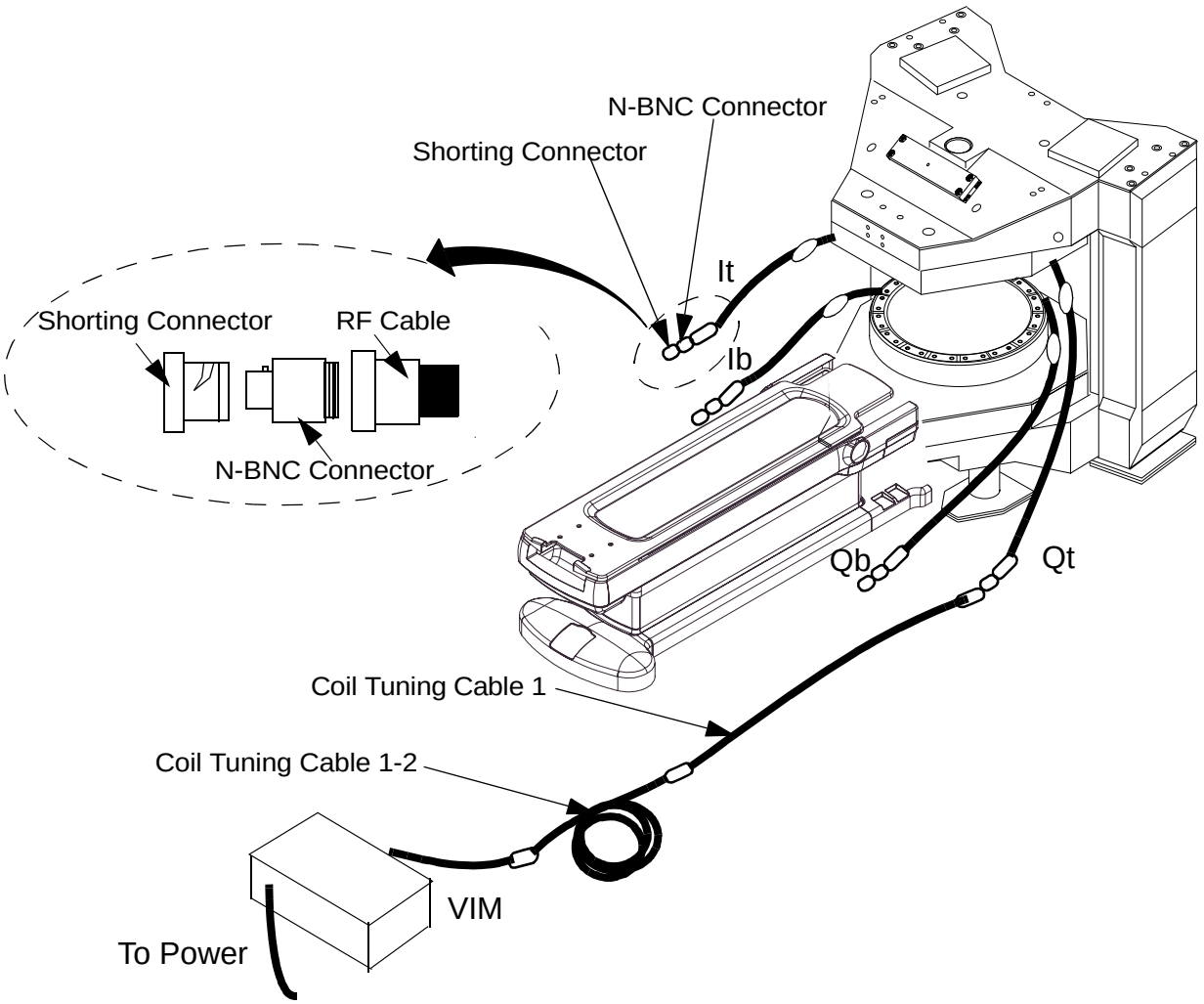


QT CABLE SETUP
ILLUSTRATION 14

2-8 Setup Tuning Cable to Qt Channel and Shorting Connector to Remaining Cables (continued)

2. Connect Shorting Connectors to remaining cables (It, Qt, Qb) using N-BNC Connectors. Refer to the following illustration. Make sure that **connectors do not touch** the frame, other connectors, or any other conductive materials.

SHORTING CONNECTORS



SHORTING CONNECTORS (IT,IB,QB)
ILLUSTRATION 15

2-9 Measure Coil Frequency (Fc) and Coil Impedance (Zc) of Qt channel

1. Adjust the phase on VIM as near as possible to 0degrees
2. Record the correspondent frequency: Fc **Fc =**_____
3. Record the correspondent impedance:Zc **Zc =**_____
   Specification of Zc (in Ohms) : 71 ≤ Zc ≤ 130

2-10Determining the necessity to change f0 tune board

If -40kHz ≤ Fc - F(Site) ≤ + 40kHz:
The f0 tune boards preset to the Body Coil upon installation is OK. There is no need to change f0 tune board.
Go to section 3-1.

If Fc - F(site) < - 40kHz or **Fc - F(site) > + 40kHz:**
The f0 tune boards preset to the Body Coil upon installation is not OK. There is need to change f0 tune board.
Go to section 2-11

2-11Select and Insert f0 tune board

1. Select F0 tune board
   Note that the preset f0 tune board is missing from the f0 tune board assy.

If Fc - F(site) < - 40kHz:
Pick the f0 tune board UP one row in the table than the one missing from the box.

If Fc - F(site) > + 40kHz:
Pick the f0 tune board DOWN one row in the table than the one missing from the box.

TABLE 2-1
F0 TUNE BOARD SELECTION

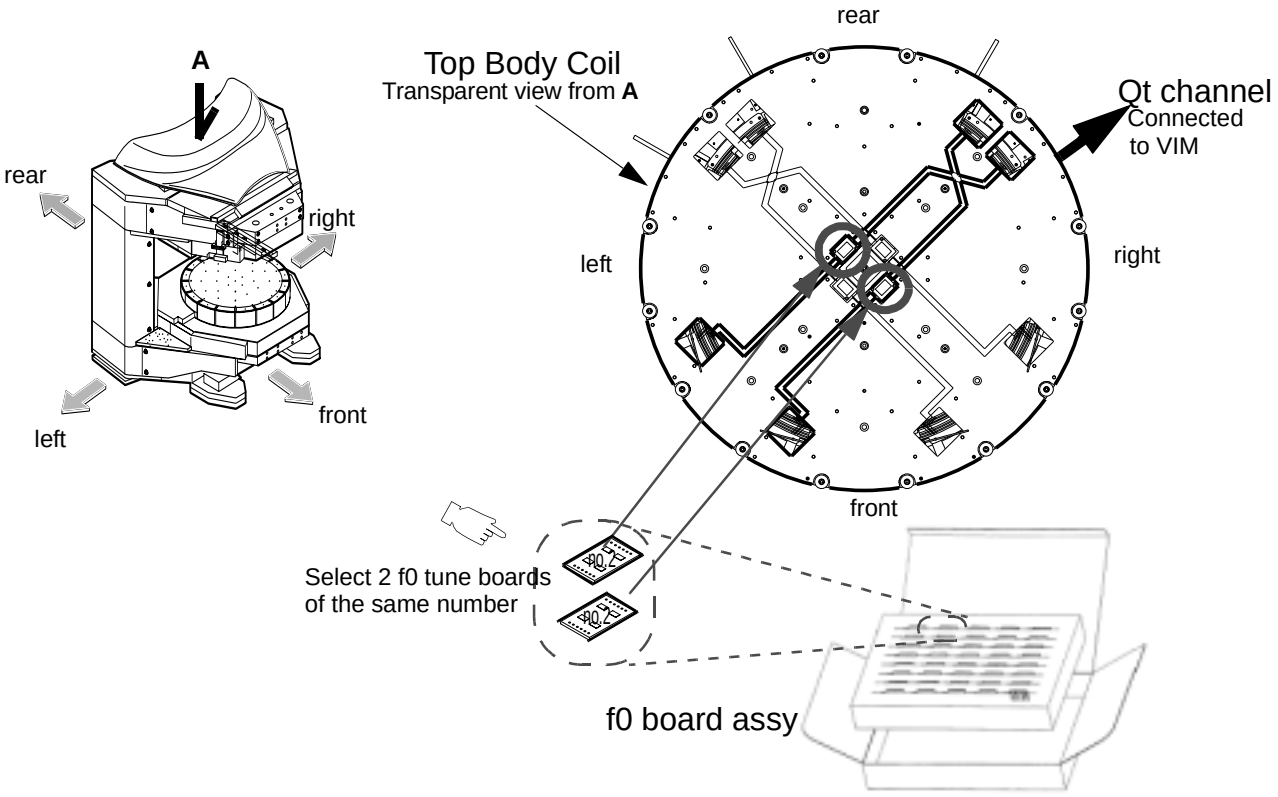
Fc - F(site)	F0 tune board no.
-200kHz thru -120kHz	No. (X-2)
-120kHz thru -40kHz	No. (X-1)
-40kHz thru 40kHz	No. X
40kHz thru 120kHz	No. (X+1)
120kHz thru 200kHz	No. (X+2)

Note :
X (X=1,2,3,4 or 5) indicates No. of F0 tune board that is pre-installed in Body Coil.
(X-2),(X-1),(X+1),(X+2) may not exist depending on the pre-installed board No..

2-11Select and Insert f0 tune board (continued)

2. Remove the F0 tune board from Body Coil. Use a non-ferrous flat-bladed screwdriver to lift the F0 tune board so as not to damage or bend the pins of F0 Tune Board.
3. Insert the selected f0 tune boards to Top Body Coil at the channel that is being tuned. Be sure to select 2 f0 tune boards of the same number from f0 board assy.

.



INSERT QT F0 TUNE BOARDS
ILLUSTRATION 16

Note:Be careful not to damage or bend the pins of f0 tune boards

2-12Measure Coil Frequency (Fc) and Coil Impedance (Zc) of Qt channel

1. Adjust the phase on VIM as near as possible to 0degrees
2. Record the correspondent frequency: Fc **Fc =**_____
3. Record the correspondent impedance:Zc **Zc =**_____
   Specification of Zc (in Ohms) : 71 ≤ Zc ≤ 130

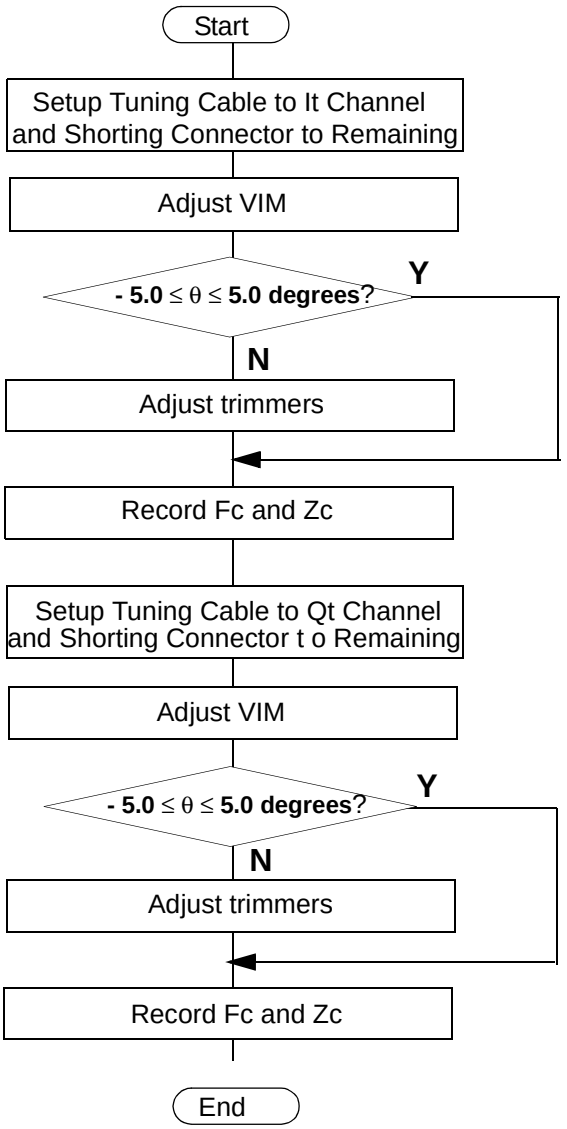
2-13Determining the necessity to change f0 tune board

If -40kHz ≤ Fc - F(Site) ≤ + 40kHz:
The f0 tune boards set to the Body Coil is now OK.
Go to section 2-8.

If Fc - F(site) < - 40kHz or **Fc - F(site) > + 40kHz:**
The fo tune boards set to the Body Coil is not OK. There is need to change f0 tune board.
Go back to section 2-5

3. Top Body Coil Fine Tuning

3-1 Flow Chart



FINE TUNING FLOWCHART
ILLUSTRATION 17

3-2 Setup Tuning Cable to It Channel and Shorting Connector to Remaining Cables

1. Setup Tuning Cable to It Channel according to the illustration in section 2-2.
2. Connect shorting connectors to remaining cables according to the illustration in section 2-2.

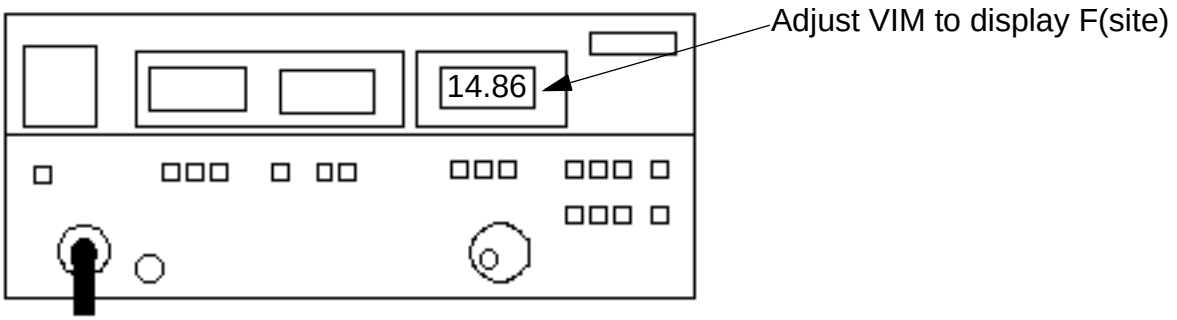
3-3 Adjust VIM

1. Adjust VIM so that VIM frequency value displays F(site)

   Note:

   Note that VIM HP4193 can display only 4 digits for frequency. If F(site) is 14.856MHz, adjust the VIM so that the value for frequency displays 14.86MHz, which is rounded off value of 14.856MHz.

Front View of Vector Impedance Meter



ADJUST VIM FREQUENCY
ILLUSTRATION 18

3-4 Determining whether necessary to adjust the trimmer

If phase θ is within following specification:

- 5.0 ≤ θ ≤ 5.0 degrees

The It channel trimmer setting preset to the Body Coil upon delivery is OK. There is no need to adjust trimmer on It channel.

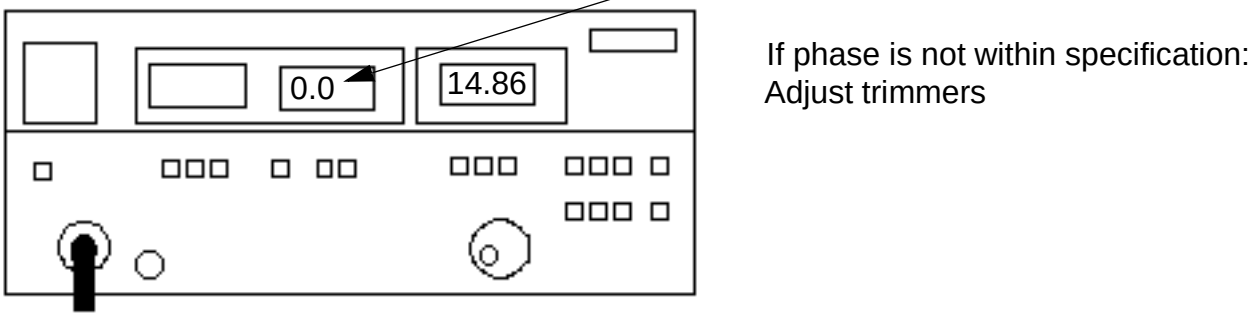
Go to section 3-6.

If phase θ is not within the specification:

The It channel trimmer setting preset to the Body Coil upon delivery is not OK.There is need to adjust trimmer on It channel.

Go to section 3-5.

Front View of Vector Impedance Meter



PHASE DISPLAY ON VIM
ILLUSTRATION 19

3-5 Adjust trimmers of It Channel

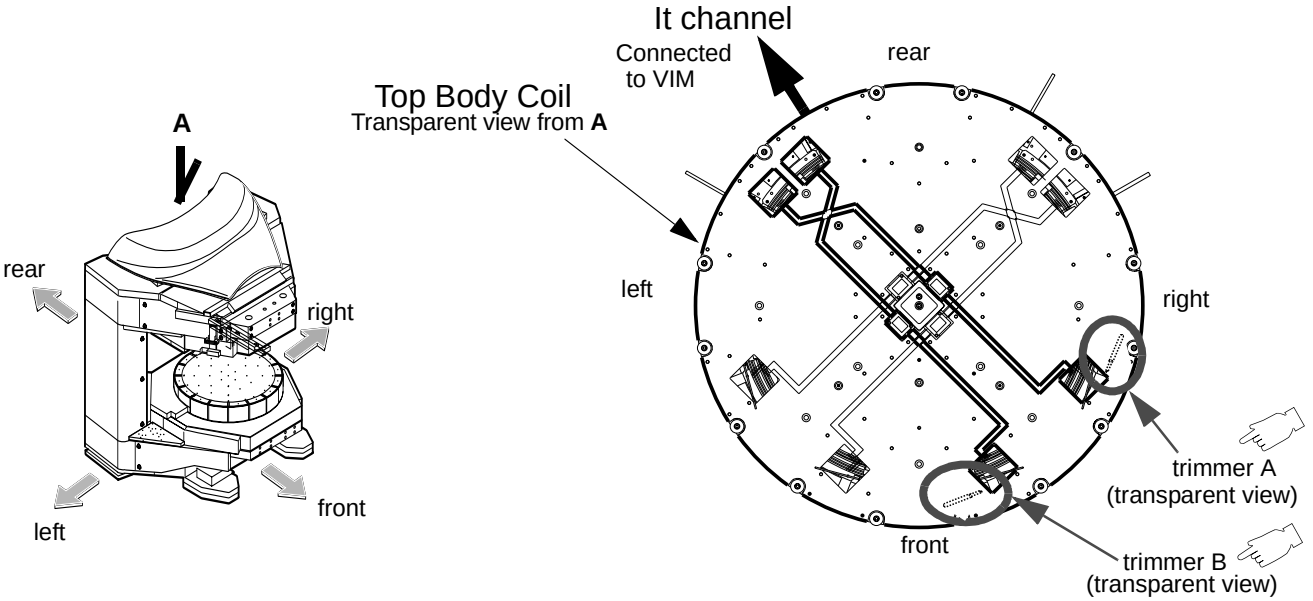
1. Adjust the trimmers of It channel until the VIM phase value displays as close as possible to 0.0 degrees.
   Use the following table to record number of turns of each trimmer.

TABLE 3-1
NUMBER OF TURNS)

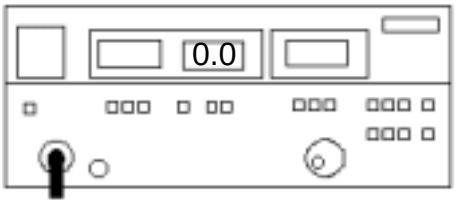
	Number of turns
Trimmer A	
Trimmer B	

Note : Be sure to adjust 2 trimmers with the same number of turns. The difference of number of turns between the 2 trimmers should be less than 5 turns

.



Adjust trimmers until phase displays as close as possible to 0.0 degrees on VIM



Front View of Vector Impedance Meter

ADJUST IT TRIMMERS
ILLUSTRATION 20

3-6 Record Coil Frequency (Fc) and Coil Impedance (Zc) of It channel

1. Record the correspondent frequency: Fc **Fc =**_____
2. Record the correspondent impedance:Zc **Zc =**_____
   Specification of Zc (in Ohms) : $71 \leq Zc \leq 130$

3-7 Setup Tuning Cable to Qt Channel and Shorting Connector to Remaining Cables

1. Setup Tuning Cable to Qt Channel according to the illustration in section 2-8.
2. Connect shorting connectors to remaining cables according to the illustration in section 2-8.

3-8 Adjust VIM

1. Adjust VIM so that VIM frequency value displays F(site)

3-9 Determining whether necessary to adjust the trimmer

f phase θ is within following specification:

$-5.0 \leq \theta \leq 5.0$ degrees

The Qt channel trimmer setting preset to the Body Coil upon delivery is OK. There is no need to adjust trimmer on It channel.

Go to section 3-11.

If phase θ is not within the specification:

The Qt channel trimmer setting preset to the Body Coil upon delivery is not OK.There is need to adjust trimmer on Qt channel.

Go to section 3-10.

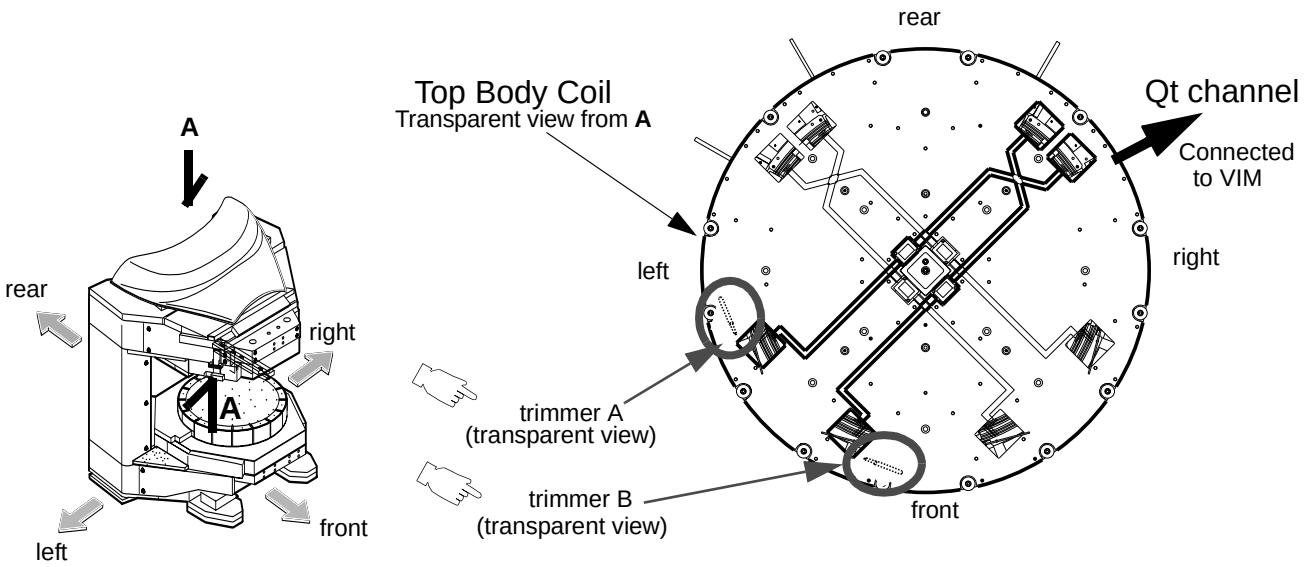
3-10 Adjust trimmers of Qt Channel

1. Adjust the trimmers of Qt channel until the VIM phase value displays as close as possible to 0.0 degrees.
   Use the following table to record number of turns of each trimmer.

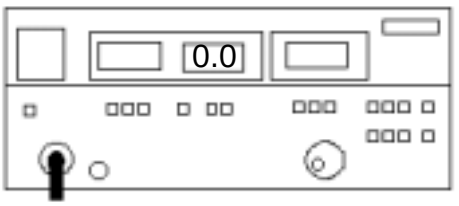
TABLE 3-1
NUMBER OF TURNS)

	Number of turns
Trimmer A	
Trimmer B	

Note : Be sure to adjust 2 trimmers with the same number of turns. The difference of number of turns between the 2 trimmers should be less than 5 turns.



Adjust trimmers until phase displays
as close as possible to 0.0 degrees on VIM



Front View of Vector Impedance Meter

ADJUST QT TRIMMERS
ILLUSTRATION 21

3-11 Measure Coil Frequency (Fc) and Coil Impedance (Zc) of Qt channel

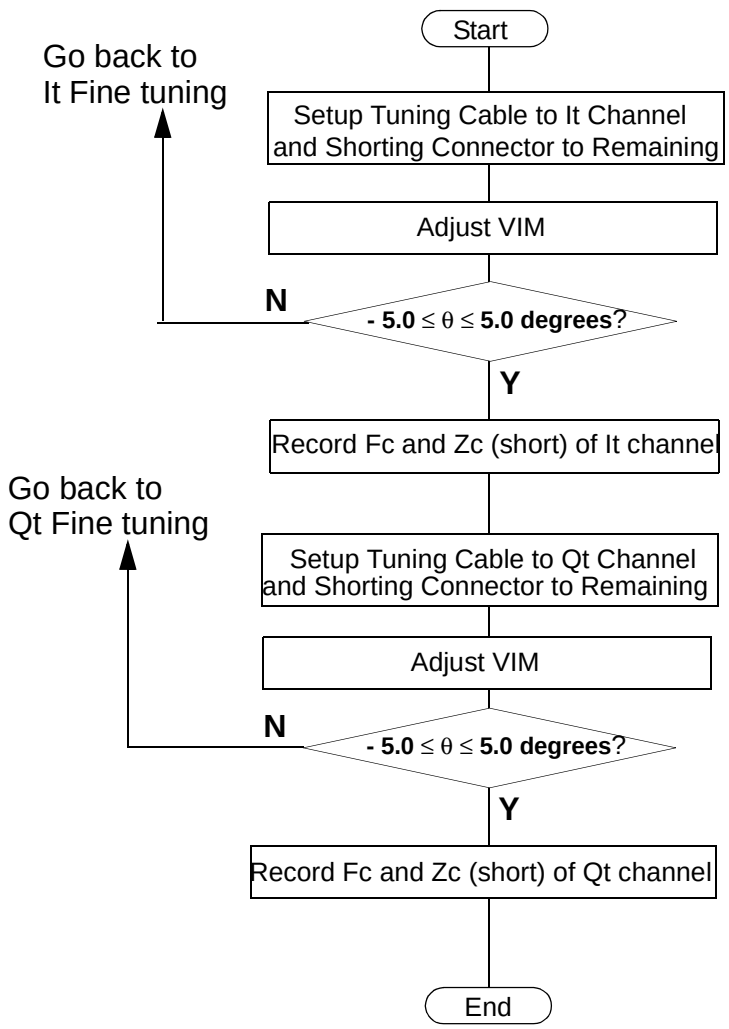
1. Record the correspondent frequency: Fc **Fc =**_____
2. Record the correspondent impedance:Zc **Zc =**_____
   Specification of Zc (in Ohms) : $71 \leq Zc \leq 130$

4. Bottom Body Coil Tuning

4-1 Repeat 2-1 through 3-11 for Bottom Body Coil.

5. Top Body Coil Fc and Zc Check

5-1 Flowchart



FLOWCHART OF TOP BODY COIL OPEN SHORT CHECK
ILLUSTRATION 22

5-2 Setup Tuning Cable to It Channel and Shorting Connector to Remaining Cables

1. Setup Tuning Cable to It Channel according to the illustration in section 2-2.
2. Connect shorting connectors to remaining cables according to the illustration in section 2-2.

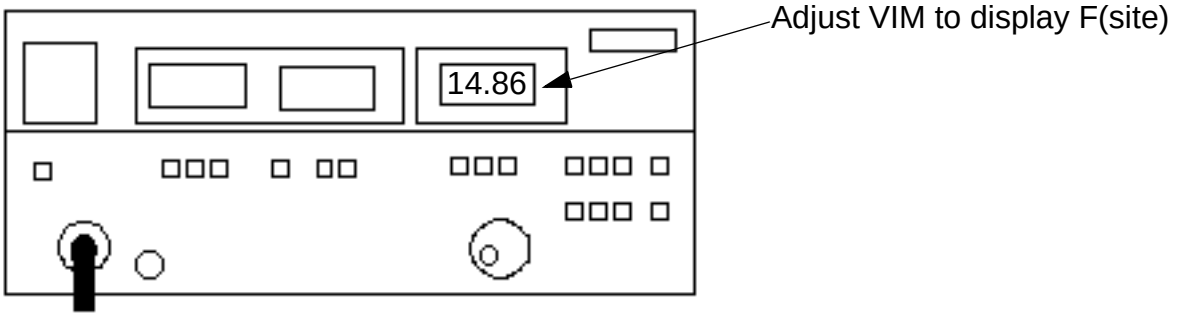
5-3 Adjust VIM

1. Adjust VIM so that VIM frequency value displays F(site)

   Note:

   Note that VIM HP4193 can display only 4 digits for frequency. If F(site) is 14.856MHz, adjust the VIM so that the value for frequency displays 14.86MHz, which is rounded off value of 14.856MHz.

Front View of Vector Impedance Meter



ADJUST VIM FREQUENCY
ILLUSTRATION 23

5-4 Verify that phase is within specification

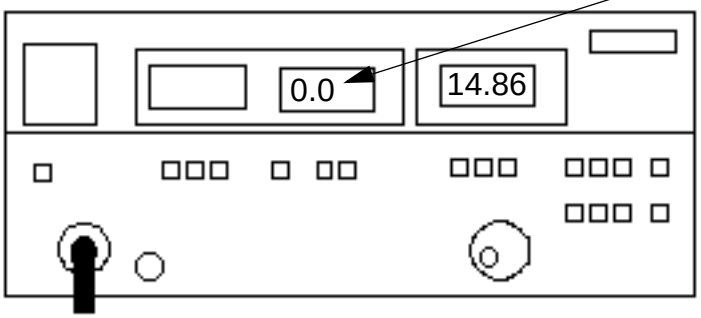
Verify that phase θ is within following specification:

$-5.0 \leq \theta \leq 5.0$ degrees

If not, there is need to adjust trimmer on It channel. In this case, go back to section 3-5.

Front View of Vector Impedance Meter

Verify that phase θ is within spec:
$-5.0 \leq \theta \leq 5.0$ degrees



PHASE DISPLAY ON VIM
ILLUSTRATION 24

5-5 Record Fc and Zc.

1. Record Fc and Zc (Qt, Ib, Qb: short) in Table 5-1.

5-6 Setup Tuning Cable to Qt Channel and Shorting Connector to Remaining Cables

1. Setup Tuning Cable to Qt Channel according to the illustration in section 2-8.
2. Connect shorting connectors to remaining cables according to the illustration in section 2-8.

5-7 Adjust VIM

1. Adjust VIM so that VIM frequency value displays F(site)

5-8 Verify that phase is within specification

Verify that phase θ is within following specification:

$-5.0 \leq \theta \leq 5.0$ degrees

If not, there is need to adjust trimmer on Qt channel. In this case, go back to section 3-10.

5-9 Record Fc and Zc.

1. Record Fc and Zc (It, Ib, Qb: short) in Table 5-2.

TABLE 5-1
FC AND ZC (FINE TUNE IT) (QT,IB,QB:SHORT)

	Fc	Zc
Data		
Specification	14.84 or 14.85 or 14.86	$71 \leq Zc \leq 130$ (in Ohms)

TABLE 5-2
FC AND ZC (FINE TUNE QT) (IT,IB,QB:SHORT)

	Fc	Zc
Data		
Specification	14.84 or 14.85 or 14.86	$71 \leq Zc \leq 130$ (in Ohms)

6. Bottom Body Coil Fc and Zc Check

6-1 Repeat 5-1 through 5-9 for Bottom Body Coil.

TABLE 6-1

FC AND ZC (FINE TUNE IB) (IT,QT,QB:SHORT)

	Fc	Zc
Data		
Specification	14.84 or 14.85 or 14.86	$71 \leq Zc \leq 130$ (in Ohms)

TABLE 6-2

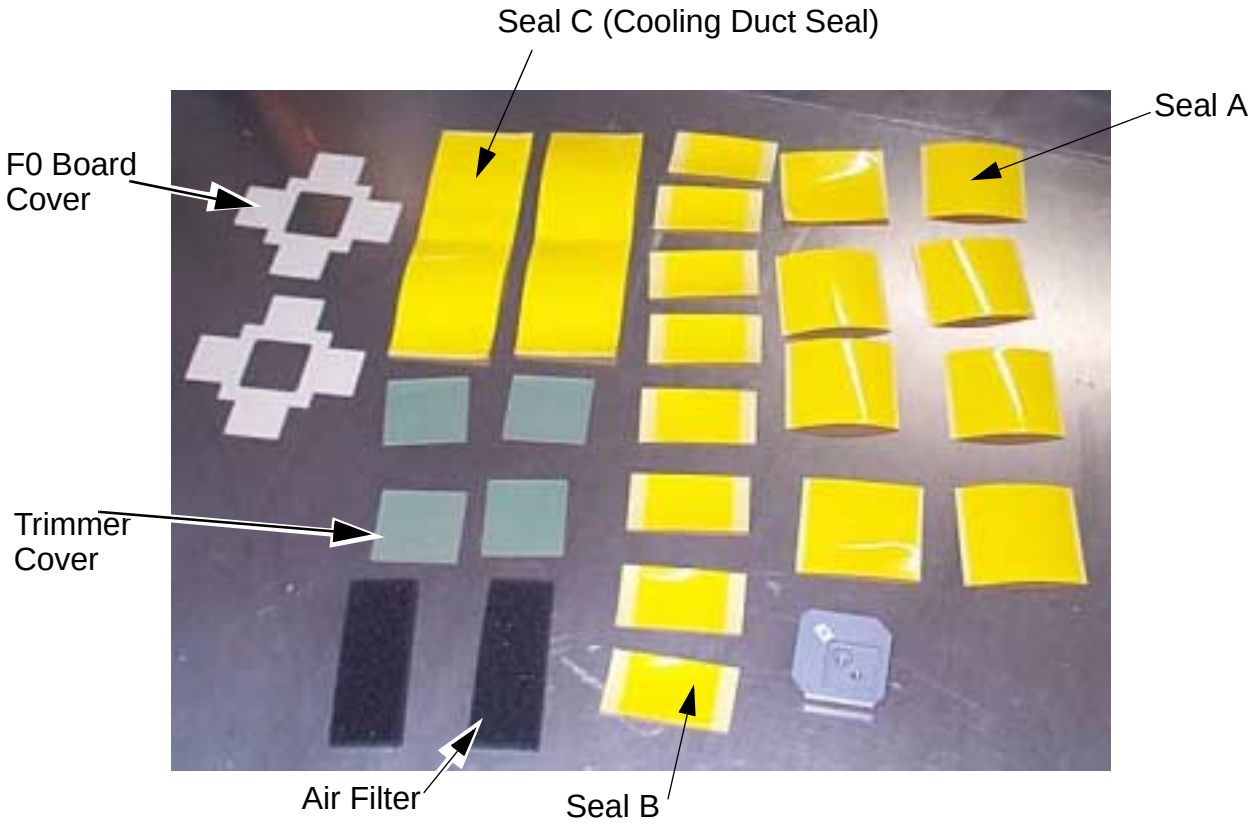
FC AND ZC (FINE TUNE QB) (IT,QT,IB:SHORT)

	Fc	Zc
Data		
Specification	14.84 or 14.85 or 14.86	$71 \leq Zc \leq 130$ (in Ohms)

Note: Do not discard the f0 tuning boards. Keep them on site. You will need them when replacing or retuning the body coil.

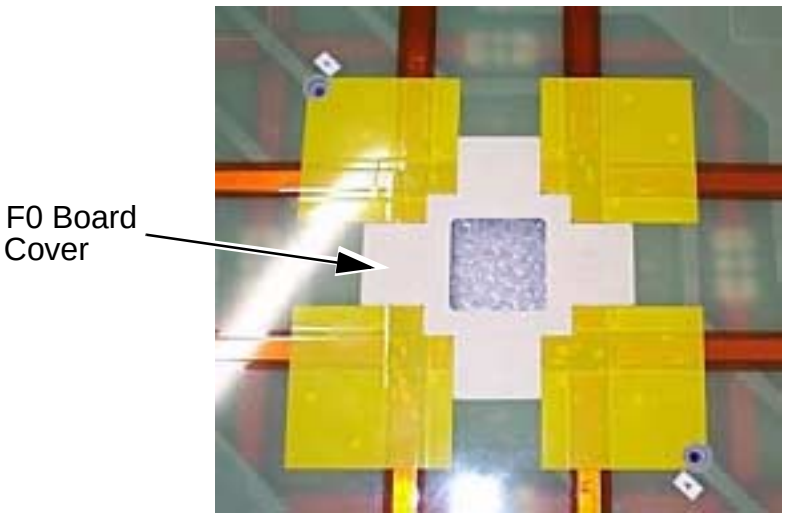
7. Install Covers and Seals

Note: The seals are intended to keep the Body Coil airtight so that cooling air will flow through Body Coil. **Be sure to stick the seals to Body Coil securely.**



SEALS AND COVERS KIT
ILLUSTRATION 25

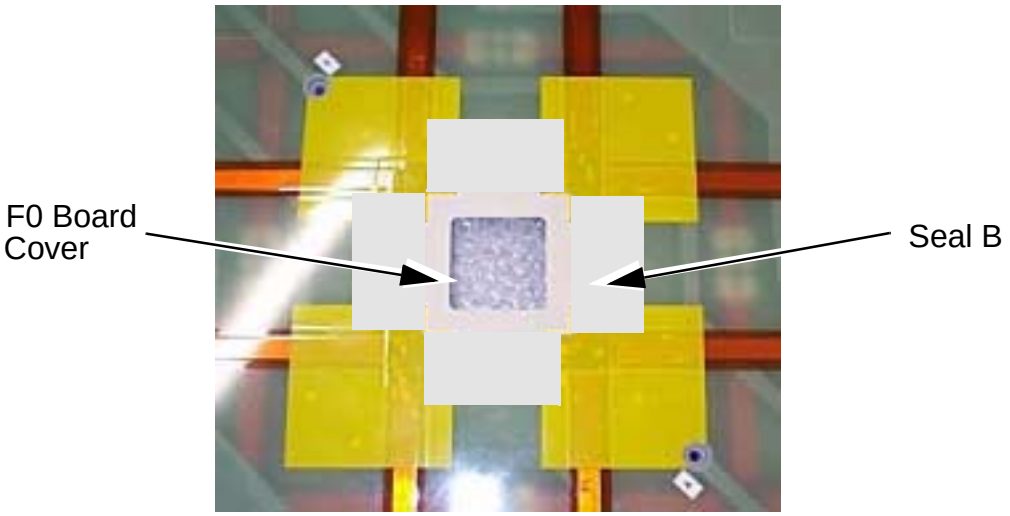
1. Peel off backing paper from F0 Board Cover. Stick it to the center of Top and Bottom Body Coil.



F0 BOARD COVER
ILLUSTRATION 26

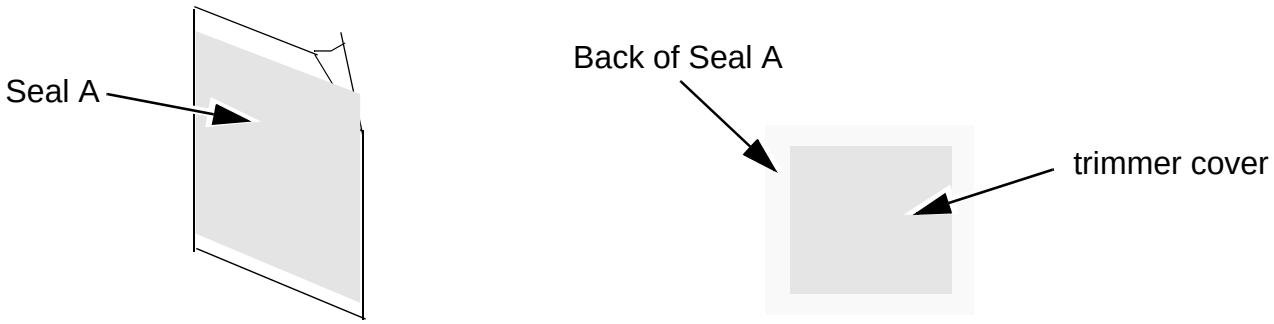
7. Install Covers and Seals (continued)

2. Seal F0 Board Cover to Top and Bottom Body Coil with four Seal B each.



SEAL B
ILLUSTRATION 27

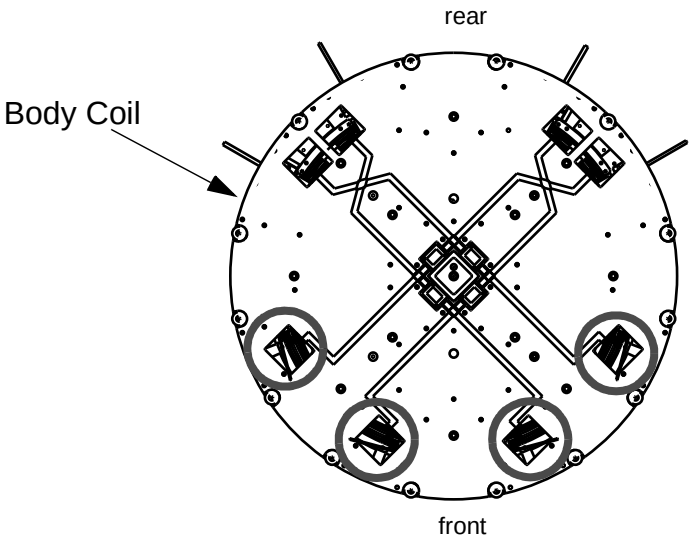
3. Peel off backing paper from Seal A. Stick trimmer cover to back of Seal A.



SEAL A AND TRIMMER COVER
ILLUSTRATION 28

7. Install Covers and Seals (continued)

4. Install the trimmer cover with seal to top and bottom Body Coil.

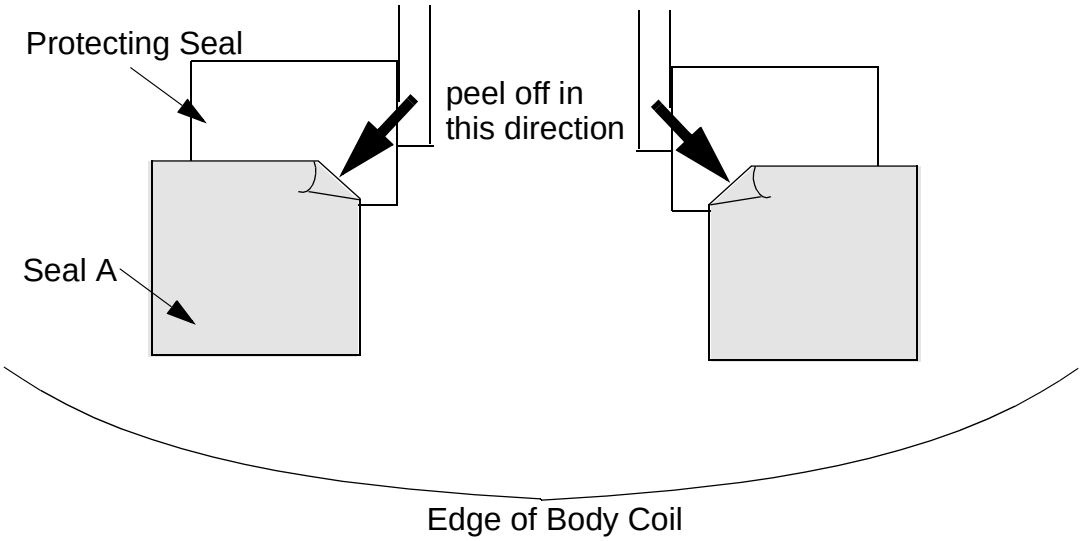


Install trimer covers to locations indicated by ○

TRIMMER COVERS
ILLUSTRATION 29

Note: Do NOT discard remaining seals and covers. Keep them on site. Use them when retuing the Body Coil.

Note: When you need to peel off Seal A for retuning, be sure to peel it in the direction indicated below so as not to peel off the protecting seal underneath.



PEELING DIRECTION
ILLUSTRATION 30

8. Connect RF Cables

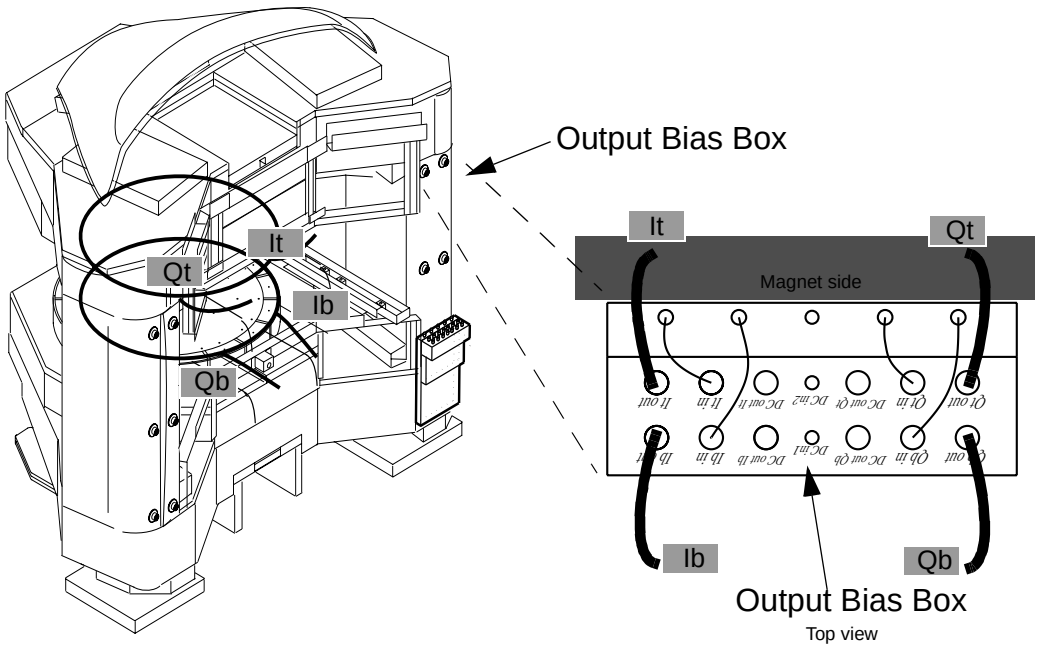
1. Connect RF cables according to “Body Coil Installation : DC Bias Cables / RF Cables Wiring”.

DANGER!!

SSM OUTPUTS VERY HIGH VOLTAGE. BE SURE THAT SSM POWER IS OFF BEFORE CONNECTING CABLES. HANDLING CABLES WITHOUT TURNING SSM POWER OFF MAY CAUSE SERIOUS INJURY OR DEATH DUE TO ELECTRIC SHOCK.

CAUTION

When connecting the RF cables, make sure that connectors DO NOT TOUCH the frame, other connectors, or any other conductive materials.



CABLE CONNECTION
ILLUSTRATION 31

Revision History

Rev	Date	Author	Primary Reasons For Change
0	Feb 9, 2001	M. Ikeda	Initial Release
1	Mar 22, 2001	M. Ikeda	Added note on Tuning Cable
2	Oct 26, 2001	M. Ikeda	Added how to identify F0 tune boards of the channel that is being tuned. Deleted open check.
3	Jun 30, 2002	M. Ikeda	Corrected illustration of f0 board assy and trimmers. Added specification of F(site)