



TRANSNET FREIGHT RAIL

an Operating Division of **TRANSNET SOC LTD**

[Registration No. 1990/000900/30]

[hereinafter referred to as **Transnet**]

REQUEST FOR QUOTATION [RFQ] No ERAC-EMU-33792-NN-110

MANUFACTURE AND SUPPLY OF: TELECOMMUNICATION RADIO EQUIPMENT.
FOR DELIVERY TO: EMPANGENI DEPOT

ISSUE DATE: 06 JULY 2021
CLOSING DATE: 20 JULY 2021
CLOSING TIME: 10:00

VALIDITY PERIOD 24 NOVEMBER 2021 (90 BUSINESS DAYS)

PREFERENTIAL PROCUREMENT PREQUALIFICATION CRITERIA - ONLY THE FOLLOWING RESPONDENTS MAY RESPOND TO THIS RFQ:

- RESPONDENTS WITH A MINIMUM B-BBEE STATUS LEVEL OF 4 OR BETTER.

SECTION 1: SBD1 FORM**PART A
INVITATION TO BID**

YOU ARE HEREBY INVITED TO BID FOR REQUIREMENTS OF TRANSNET FREIGHT RAIL, A DIVISION TRANSNET SOC LTD							
BID NUMBER:	ERAC-EMU-33792-NN-110	ISSUE DATE:	06 JULY 2021	CLOSING DATE:	20 JULY 2021	CLOSING TIME:	10:00
DESCRIPTION	Supply and deliver Telecommunication radio equipment for Empangeni Depot						
BID RESPONSE DOCUMENTS MAY BE DEPOSITED IN THE BID BOX SITUATED AT (STREET ADDRESS)							
TRANSNET FREIGHT RAIL, SUPPLY CHAIN SERVICES - DURBAN, 100 EEL ROAD, BAYHEAD, DURBAN, 4052							
BIDDING PROCEDURE ENQUIRIES MAY BE DIRECTED TO				TECHNICAL ENQUIRIES MAY BE DIRECTED TO:			
CONTACT PERSON	Nthombi Ngubane			CONTACT PERSON	Nthombi Ngubane		
TELEPHONE NUMBER	035 906 7042			TELEPHONE NUMBER	035 906 7042		
FACSIMILE NUMBER	N/A			FACSIMILE NUMBER	N/A		
E-MAIL ADDRESS	Nthombi.Ngubane@transnet.net			E-MAIL ADDRESS	Nthombi.Ngubane@transnet.net		
SUPPLIER INFORMATION							
NAME OF BIDDER							
POSTAL ADDRESS							
STREET ADDRESS							
TELEPHONE NUMBER	CODE		NUMBER				
CELLPHONE NUMBER							
FACSIMILE NUMBER	CODE		NUMBER				
E-MAIL ADDRESS							
VAT REGISTRATION NUMBER							
SUPPLIER COMPLIANCE STATUS	TAX COMPLIANCE SYSTEM PIN:		OR	CENTRAL SUPPLIER DATABASE	UNIQUE REGISTRATION REFERENCE NUMBER: MAAA		
B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE	TICK APPLICABLE BOX] ☐ Yes ☐ No		B-BBEE STATUS LEVEL SWORN AFFIDAVIT		[TICK APPLICABLE BOX] ☐ Yes ☐ No		
[A B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE/ SWORN AFFIDAVIT (FOR EMES & QSEs) MUST BE SUBMITTED IN ORDER TO QUALIFY FOR PREFERENCE POINTS FOR B-BBEE]							
1 ARE YOU THE ACCREDITED REPRESENTATIVE IN SOUTH AFRICA FOR THE GOODS /SERVICES /WORKS OFFERED?	☐ Yes ☐ No [IF YES ENCLOSE PROOF]		2 ARE YOU A FOREIGN BASED SUPPLIER FOR THE GOODS /SERVICES /WORKS OFFERED?		☐ Yes ☐ No [IF YES, ANSWER QUESTIONNAIRE BELOW]		
QUESTIONNAIRE TO BIDDING FOREIGN SUPPLIERS							
IS THE ENTITY A RESIDENT OF THE REPUBLIC OF SOUTH AFRICA (RSA)?					☐ YES ☐ NO		
DOES THE ENTITY HAVE A BRANCH IN THE RSA?					☐ YES ☐ NO		
DOES THE ENTITY HAVE A PERMANENT ESTABLISHMENT IN THE RSA?					☐ YES ☐ NO		
DOES THE ENTITY HAVE ANY SOURCE OF INCOME IN THE RSA?					☐ YES ☐ NO		
IS THE ENTITY LIABLE IN THE RSA FOR ANY FORM OF TAXATION?					☐ YES ☐ NO		
IF THE ANSWER IS "NO" TO ALL OF THE ABOVE, THEN IT IS NOT A REQUIREMENT TO REGISTER FOR A TAX COMPLIANCE STATUS SYSTEM PIN CODE FROM THE SOUTH AFRICAN REVENUE SERVICE (SARS) AND IF NOT REGISTER AS PER 1.3 BELOW.							

PART B
TERMS AND CONDITIONS FOR BIDDING

1. TAX COMPLIANCE REQUIREMENTS

- 1.1 BIDDERS MUST ENSURE COMPLIANCE WITH THEIR TAX OBLIGATIONS.
- 1.2 BIDDERS ARE REQUIRED TO SUBMIT THEIR UNIQUE PERSONAL IDENTIFICATION NUMBER (PIN) ISSUED BY SARS TO ENABLE THE ORGAN OF STATE TO VERIFY THE TAXPAYER'S PROFILE AND TAX STATUS.
- 1.3 APPLICATION FOR TAX COMPLIANCE STATUS (TCS) PIN MAY BE MADE VIA E-FILING THROUGH THE SARS WEBSITE WWW.SARS.GOV.ZA.
- 1.4 BIDDERS MAY ALSO SUBMIT A PRINTED TCS CERTIFICATE TOGETHER WITH THE BID.
- 1.5 IN BIDS WHERE UNINCORPORATED CONSORTIA / JOINT VENTURES / SUB-CONTRACTORS ARE INVOLVED, EACH PARTY MUST SUBMIT A SEPARATE TCS CERTIFICATE / PIN / CSD NUMBER.
- 1.6 WHERE NO TCS IS AVAILABLE BUT THE BIDDER IS REGISTERED ON THE CENTRAL SUPPLIER DATABASE (CSD), A CSD NUMBER MUST BE PROVIDED.

NB: FAILURE TO PROVIDE / OR COMPLY WITH ANY OF THE ABOVE PARTICULARS MAY RENDER THE BID INVALID.

SIGNATURE OF BIDDER:

CAPACITY UNDER WHICH THIS BID IS SIGNED:

(Proof of authority must be submitted e.g. company resolution)

DATE:

SECTION 2: NOTICE TO BIDDERS

Responses to this RFQ [hereinafter referred to as a **Bid** or a **Proposal**] are requested from persons, companies, close corporations or enterprises [hereinafter referred to as an **Entity, Respondent** or **Bidder**].

DESCRIPTION	Supply and deliver Telecommunication radio equipment for Empangeni Depot [the Goods]
RFP DOWNLOADING	This RFP may be downloaded directly from National Treasury's e-Tender Publication Portal at www.etenders.gov.za free of charge. To download RFP and Annexures: - Click on "Tender Opportunities"; - Select "Advertised Tenders"; - In the "Department" box, select Transnet SOC Ltd; Once the tender has been located in the list, click on the "Tender documents" tab and process to download all uploaded documents. Alternatively, this RFQ may be purchased at R100 (inclusive of VAT) per set for those bidders that require a hard copy from Transnet. Payment is to be made as follows: Bank: Standard Bank Account Number: 203158598 Branch: Braamfontein Branch code: 004805 Account Name: Transnet Freight Rail Reference: ERAC-EMU-33792-NN-110 NOTE – This amount is not refundable. A receipt for such payment made must be presented when collecting the RFP documents and submitted thereafter with your Proposal.
EMAIL ADDRESS FOR COMMUNICATION	Once Bidders download the RFP off the Portal, they are required to send their contact details to the following address: lindiwe.sithole2@transnet.net This is to ensure that any required communication in relation to this RFP reaches those intending to respond. Furthermore, any addenda to the RFP or clarifications will be published on the e-tender portal. Bidders are required to check the etender portal prior to finalising their bid submissions for any changes or clarifications to the RFP. Transnet will not be held liable if Bidders do not receive the latest information regarding this RFP with the possible consequence of either being disadvantaged or disqualified as a result thereof.
ISSUE AND COLLECTION DATE DEADLINE	Bidders are to note that the RFP documents will be available for download from 06 July 2021 or may be collected between 09:00 am and 03:00 pm from 06 July 2021 until 19 July 2021 Bidders wishing to collect a CD, USB or hard copy of such RFP documents from the Transnet issuing office, are required to inform that office at the contact details indicated below on the day before collection in order to allow for timeous reproduction of the documentation. Name: Lindiwe Sithole Email address: Lindiwe.sithole2@transnet.net Tender Office Transnet Freight Rail Bayhead Durban
BRIEFING SESSION	No
CLOSING DATE	10:00 on 20 July 2021 Bidders must ensure that bids are delivered timeously to the correct address. As a general rule, if a bid is late or delivered to the incorrect address, it will not be accepted for consideration.

VALIDITY PERIOD	24 November 2021 - 90 Business Days from Closing Date Bidders are to note that they may be requested to extend the validity period of their bid, at the same terms and conditions, if the internal evaluation process has not been finalised within the validity period. However, once the adjudication body has approved the process and award of the business to the successful bidder(s), the validity of the successful bidder(s)' bid will be deemed to remain valid until a final contract has been concluded. With regard to the validity period of next highest ranked bidders, please refer to Section 2, paragraph 10.
COMMENTS/ COMPLAINT	Kindly note that all comments and complaints regarding all RFx's issued by Transnet may be directed to TFRProcurement.Complaints@transnet.net to be dealt with accordingly

1 Responses to RFQ

Responses to this RFQ [**Quotations**] must not include documents or reference relating to any other quotation or proposal. Any additional conditions must be embodied in an accompanying letter.

2 Formal Briefing

A formal briefing session will not be held but should Respondents have specific queries they should email these to the Transnet employee(s) indicated in paragraph 5 [*Communication*] below:

3 Compulsory Local Content Threshold

In terms of section 8(1) of the Preferential Procurement Regulations, 2017, and the Instruction Note issued by National Treasury on the "Invitation and Evaluation of Bids based on a stipulated minimum threshold for local content and production for the **Content for two way radio terminals and associated equipment** Sector," Transnet is required to set a stipulated minimum threshold be set for this RFQ.

3.1 Local Content Threshold

A Local Content threshold of **60% [Sixty percent] Content for two way radio terminals and associated equipment** will be required for the goods specified in SBD 6.2 to be manufactured by a successful Respondent

3.2 Local Content Notes

- 3.2.1. The exchange rate to be used for the calculation of local production and content must be the exchange rate published by the South African Reserve Bank (SARB) on the date of the advertisement of the tender;
- 3.2.2. Only the South African Bureau of Standards (SABS) approved technical specification number SATS 1286:2011 must be used to calculate local content;
- 3.2.3. The local content (LC) expressed as a percentage of the bid price must be calculated in accordance with the following formula which must be disclosed in the bid documentation:

$$LC = [1 - x/y] * 100$$

Where

x is the imported content in Rand

y is the bid price in Rand excluding value added tax (VAT)

Prices referred to in the determination of x must be converted to Rand (ZAR) by using the exchange rate published by the SARB at 12:00 on the date of advertisement of the bid.

- 3.2.4. The SABS approved technical specification number SATS 1286:2011 and the Guidance on the Calculation of Local Content together with the Local Content Declaration Templates [Annex C (Local Content Declaration: Summary Schedule), D (Imported Content Declaration: Supporting Schedule to Annex C) and E (Local Content Declaration: Supporting Schedule to Annex C)] are accessible to all potential tenderers on the DTI's official website; <http://www.the dti.gov.za/industrial development/ip.jsp> at no cost.
- 3.2.5. The rates of exchange quoted by the tenderer in paragraph 4.1 of Returnable Schedule (the Declaration Certificate for Local Production and Content for Designated Sectors) will be verified for accuracy.
- 3.2.6. Declaration Certificate for Local Production and Content (SBD 6.2) together with the Annex C (Local Content Declaration: Summary Schedule) must be completed, duly signed and submitted at the closing date and time of the bid;
- 3.2.7. Tenderers must familiarise themselves with all the information provided in the Local Content instruction notes with particular reference to paragraph 4 of the instruction notes.
- 3.2.8. Respondents are to ensure that they complete the local content annexures in line with the provisions made in the Guidance Document for the calculation of Local Content. Failure to comply will lead to disqualification.

3.3 **Mandatory RFQ Annexures**

The regulatory and mandatory RFQ Annexures, which must be completed by all Respondents in order to declare Local Content, are as follows:

- Annexure B – Declaration Certificate for Local Production and Content [SBD 6.2]
- Annexure C – Local Content Declaration: Summary Schedule
- Annexure B and C must be completed and submitted even if a complete Local Content exemption letter from DTI has been obtained.
- To the extent that an exemption from Local Content has been granted by the DTI, the exemption letter from DTI will be a mandatory returnable document.
- Annexures D and E are Supporting Schedules to Annexure C. They are named as follows:
 - Annexure D – Imported Content Declaration: Supporting Schedule to Annexure C
 - Annexure E – Local Content Declaration: Supporting Schedule to Annexure C
- Annexure H - Guidance Document for the calculation of Local Content

After completing Declaration D, bidders should complete Declaration E and then consolidate the information on Declaration C. Declaration C should be submitted with the bid documentation at the closing date and time of the bid. Declarations D and E should be kept by Respondents for verification purposes for a period of at least 5 years. The successful Respondent is required to continuously update Declarations C, D and E with the actual values for the duration of the contract. In addition to what is stated above regarding Annexures D and E, please note that these declarations are to be submitted as part of the Essential Returnable Documents - See Section 3 of RFQ.

3.4 **Challenges meeting the Local Content Threshold**

Should, after the award of a Bid, the Supplier experience challenges in meeting the stipulated minimum threshold for Local Content, Transnet is required to inform the DTI accordingly in order for the DTI to verify the circumstances and provide directives in this regard.

3.5 Exchange Rate Verification

The rate of exchange quoted by the Respondent in the declaration certificates (Annexure B – Declaration Certificate for Local Production & Content [SBD 6.2] and Annexure C – Local Content Declaration: Summary Schedule) will be verified for accuracy as per the requirement of National Treasury Instruction Notes and Circulars.

3.6 Local Content Obligations

Respondents are to note that the Local Content commitments made by the successful Respondent(s) will be incorporated as a term of the contract and monitored for compliance. Should the successful Respondent fail to meet its Local obligations, non-compliance penalties shall be applicable as per the contract or Standard RFQ Terms and Conditions for the Supply of Goods and Services. Breach of Local Content obligations also provide Transnet cause to terminate the contract in certain cases where material non-compliance with Local Content requirements are not achieved.

4 Preferential Procurement Prequalification Criteria

4.1 Minimum B-BBEE level

Transnet has set a minimum B-BBEE threshold for participation in this RFQ process. The minimum B-BBEE threshold in this instance is a B-BBEE Level 4 or better, Respondents who do not have at least this B-BBEE status or higher will be disqualified.

5 Communication

- 5.1 Specific queries relating to this RFQ before the closing date of the RFQ should be submitted to [lindiwe.sithole2@transnet.net] before **12:00 pm on 16 July 2021**. In the interest of fairness and transparency Transnet's response to such a query will then be made available to other bidders.
- 5.2 It is prohibited for Respondents to attempt, either directly or indirectly, to canvass any officer or employee of Transnet in respect of this RFQ between the closing date and the date of the award of the business.
- 5.3 Respondents found to be in collusion with one another will be automatically disqualified and restricted from doing business with organs of state for a specified period.
- 5.4 Respondents may also, at any time after the closing date of the RFQ, communicate with the Secretariat of the Transnet Acquisition Council on any matter relating to its RFQ response:

Telephone 031 361 4023

Email: lindiwe.sithole2@transnet.net

6 Legal Compliance

The successful Respondent shall be in full and complete compliance with any and all applicable national and local laws and regulations.

7 Employment Equity Act

Respondents must comply with the requirements of the Employment Equity Act 55 of 1998 applicable to it including (but not limited to) Section 53 of the Employment Equity Act.

8 Changes to Quotations

Changes by the Respondent to its submission will not be considered after the closing date and time.

9 Binding Offer

Any Quotation furnished pursuant to this Request shall be deemed to be an offer. Any exceptions to this statement must be clearly and specifically indicated.

10 Disclaimers

10.1 Respondents are hereby advised that Transnet is not committed to any course of action as a result of its issuance of this RFQ and/or its receipt of a Quotation in response to it. Please note that Transnet reserves the right to:

- modify the RFQ's goods / service(s) and request Respondents to re-bid on any changes;
- reject any Quotation which does not conform to instructions and specifications which are detailed herein;
- disqualify Quotations submitted after the stated submission deadline;
- not necessarily accept the lowest priced Quotation or an alternative bid;
- place an order in connection with this Quotation at any time after the RFQ's closing date;
- award only a portion of the proposed goods which are reflected in the scope of this RFQ;
- split the award of the order/s between more than one Supplier/Service Provider should it at Transnet's discretion be more advantageous in terms of, amongst others, cost or developmental considerations;
- cancel the quotation process;
- validate any information submitted by Respondents in response to this bid. This would include, but is not limited to, requesting the Respondents to provide supporting evidence. By submitting a bid, Respondents hereby irrevocably grant the necessary consent to Transnet to do so;
- request audited financial statements or other documentation for the purposes of a due diligence exercise;
- not accept any changes or purported changes by the Respondent to the bid rates after the closing date and/or after the award of the business, unless the contract specifically provides for it;
- cancel the contract and/request that National Treasury place the Respondent on its Database of Restricted Suppliers for a period not exceeding 10 years, on the basis that a contract was awarded on the strength of incorrect information furnished by the Respondent;

award the business to the next ranked bidder, provided that he/she is still prepared to provide the required Goods/Services at the quoted price, should the preferred bidder fail to sign or commence with the contract within a reasonable period after being requested to do so. Under such circumstances, the validity of the bids of the next ranked bidder(s) will be deemed to remain valid, irrespective of whether the next ranked bidder(s) were issued with a Letter of Regret. Bidders may therefore be requested to advise whether they would still be prepared to provide the required Goods/Services at their quoted price, even after they have been issued with a Letter of Regret.

11 Specification/Scope of Work

Supply and deliver Telecommunication radio equipment for Empangeni Depot (Refer to Annexure: A clause-by-clause compliance schedule and Annexure: F Technical specification and methods of measures for angle modulated radio equipment (BBD8635 Version 8.1)

12 Legal review

A Proposal submitted by a Respondent will be subjected to review and acceptance or rejection of its proposed contractual terms and conditions by Transnet's Legal Counsel, prior to consideration for an award of business.

13 Security clearance

Acceptance of this bid could be subject to the condition that the Successful Respondent, its personnel providing the goods and its subcontractor(s) must obtain security clearance from the appropriate authorities to the level of CONFIDENTIAL/ SECRET/TOP SECRET. Obtaining the required clearance is the responsibility of the Successful Respondent. Acceptance of the bid is also subject to the condition that the Successful Respondent will implement all such security measures as the safe performance of the contract may require.

14 National Treasury's Central Supplier Database

Respondents are required to self-register on National Treasury's Central Supplier Database (CSD) which has been established to centrally administer supplier information for all organs of state and facilitate the verification of certain key supplier information. Transnet is required to ensure that price quotations are invited and accepted from prospective bidders listed on the CSD. Business may not be awarded to a respondent who has failed to register on the CSD. Only foreign suppliers with no local registered entity need not register on the CSD. The CSD can be accessed at <https://secure.csd.gov.za/>.

For this purpose, the attached SBD 1 form must be completed and submitted as a mandatory returnable document by the closing date and time of the bid.

15 Tax Compliance

Respondents must be compliant when submitting a proposal to Transnet and remain compliant for the entire contract term with all applicable tax legislation, including but not limited to the Income Tax Act, 1962 (Act No. 58 of 1962) and Value Added Tax Act, 1991 (Act No. 89 of 1991).

It is a condition of this bid that the tax matters of the successful Respondents be in order, or that satisfactory arrangements have been made with South African Revenue Service (SARS) to meet the Respondents tax obligations.

The Tax Compliance status requirements are also applicable to foreign Respondents/ individuals who wish to submit bids.

It is a requirement that bidders grant a written confirmation when submitting this bid that SARS may on an ongoing basis during the tenure of the contract disclose the bidder's tax compliance status and by submitting this bid such confirmation is deemed to have been granted.

Where Consortia / Joint Ventures / Sub-contractors are involved, each party must be registered on the Central Supplier Database and their tax compliance status will be verified through the Central Supplier Database.

Transnet urges its clients, suppliers and the general public to report any fraud or corruption to

TIP-OFFS ANONYMOUS:

Ethics Helpdesk only one ethics management system

You can choose to be Anonymous or Non-Anonymous on ANY of the platforms
PLEASE RETAIN YOUR REFERENCE NUMBER

Complete a Form	AI Voice Bot "Jack"	What's App	Speak to an Agent	Telegram
Complete a form with all the details, with no data charge.	Speak to our AI Voice Chat Bot "JACK", you converse with him like chatting to a human, with the option to record a message and speak to an agent at anytime.	Speak to an Agent via What's App.	Speak to an Agent via the platform with no call or data charge	Speak to an Agent via Telegram
0800 033 056	086 551 4153	reportit@ethicshelpdesk.com	*120*0785980808#	

16 Protection of Personal Data

In responding to this bid, Transnet acknowledges that it may obtain and have access to personal data of the Respondents. Transnet agrees that it shall only process the information disclosed by Respondents in their response to this bid for the purpose of evaluating and subsequent award of business and in accordance with any applicable law. Furthermore, Transnet will not otherwise modify, amend or alter any personal data submitted by Respondents or disclose or permit the disclosure of any personal data to any Third Party without the prior written consent from the Respondents. Similarly, Transnet requires Respondents to process any personal information disclosed by Transnet in the bidding process in the same manner. The detailed mutual duties of Transnet and the Respondents to protect personal information is contained in paragraph 36 of the General Bid Conditions.

Transnet urges its clients, suppliers and the general public to report any fraud or corruption to

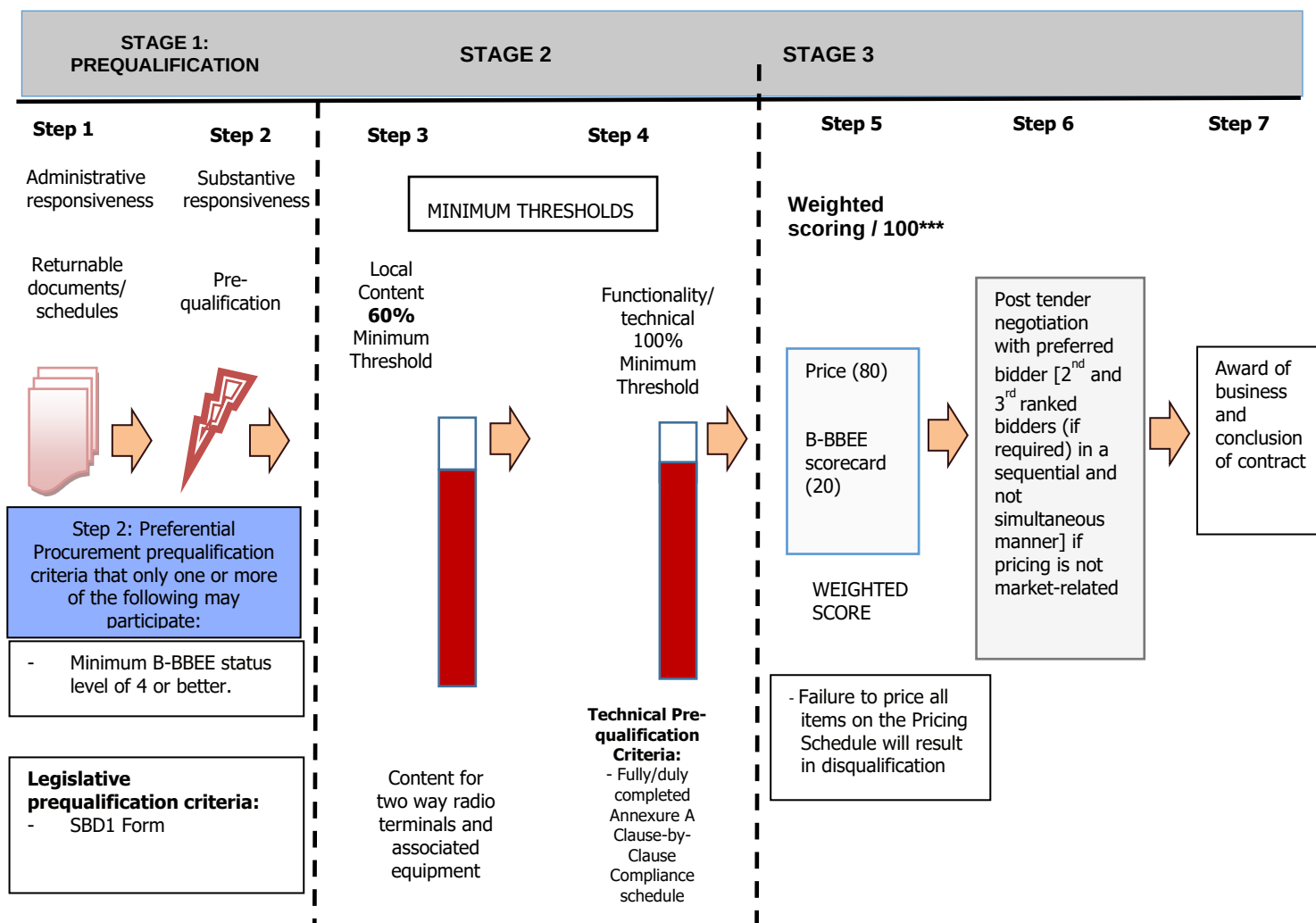
TIP-OFFS ANONYMOUS: 0800 003 05

SECTION 3

EVALUATION METHODOLOGY, CRITERIA AND RETURNABLE DOCUMENTS

1 Evaluation Criteria

Transnet will utilise the following methodology and criteria in selecting a preferred Supplier, if so required:



NB: Evaluation of the various stages will normally take place in a sequential manner. However, in order to expedite the process, Transnet reserves the right to conduct the different stages of the evaluation process in parallel. In such instances the evaluation of bidders at any given stage must not be interpreted to mean that bidders have necessarily passed any previous stage(s).

1.1 STEP ONE: Test for Administrative Responsiveness

The test for administrative responsiveness will include the following:

Administrative responsiveness check	RFQ Reference
• Whether the Bid has been lodged on time	
• Whether all Returnable Documents and/or schedules [where applicable] were completed and returned by the closing date and time	<i>Section 3</i>
• Verify the validity of all returnable documents	<i>Section 3</i>
• Verify if the Bid document has been duly signed by the authorised respondent	<i>All sections</i>

The test for administrative responsiveness [Step One] must be passed for a Respondent's Proposal to progress to Step Two for further pre-qualification

1.2 STEP TWO: Test for Substantive Responsiveness to RFQ

The test for substantive responsiveness to this RFQ will include the following:

Check for substantive responsiveness	RFQ Reference
Whether any general pre-qualification criteria set by Transnet, have been met	<i>All sections including: Section 2 paragraphs 2.2, 4</i>
Whether the Bid contains a priced offer	<i>Section 4 - Quotation Form</i>
- Whether any set prequalification criteria for preferential procurement have been met: - Minimum B-BBEE status level 4 or better.	<i>Section 2 - Paragraph 4</i>
- Whether any set legislative prequalification criteria have been met: - SBD1 Form must be completed in full and submitted	<i>Section 1</i>

The test for substantive responsiveness [Step Two] must be passed for a Respondent's proposal to progress to Step Three for further evaluation

1.3 STEP THREE: Minimum Threshold for Local Content

Local Production and Content Threshold	RFQ REFERENCE
A minimum threshold of 60% is required for Local Content of Goods offered	<i>Section 2, paragraph 3 Annexures B and C</i>

The test for meeting the Local Content threshold [Step Three] must be passed for a Respondent's proposal to progress to Step Four for further evaluation

- Respondents are to note that Transnet will not round off final Local Content scores for the purposes of determining whether the Local Content threshold has been met.
- A bid that fails to meet the minimum stipulated threshold for local production and content will be regarded as an unacceptable bid.

1.4 STEP FOUR: Technical/Functionality Criteria

Check for technical compliance requirements	RFQ Reference
- Whether any Industry related criteria set by Transnet have been met as follows: - Submit proof of Icasa Radio Dealer License in the name of the tenderer <i>Failure to provide all the above mentioned industry related Returnable Documents by the closing date and time of this bid will result in a Respondent's disqualification. All the documents also needs to be compliant in order to achieve 100% compliance</i>	

- Whether any Technical criteria set by Transnet have been met as follows: - Fully/duly completed Annexure A – Clause-by-Clause Compliance schedule - Submit product specification sheet Failure to provide the above mentioned Returnable Document used for purposes of scoring a bid, by the closing date and time of this bid will not result in a Respondent's disqualification. However, Bidders will receive an automatic score of zero for the applicable evaluation criterion	<i>Annexure A - Clause-by-Clause Compliance schedule</i>
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The test for technical compliance [Phase One] must be passed for a Respondent's Proposal to progress to Phase Two for further Technical/Functionality evaluations

1.5 STEP FIVE: Evaluation and Final Weighted Scoring

a) **Price Criteria** [Weighted score 80 points]:

Evaluation Criteria	RFQ Reference
Commercial offer	<i>Section 4</i>

Transnet will utilise the following formula in its evaluation of Price:

$$PS = 80 \left(1 - \frac{Pt - Pmin}{Pmin} \right)$$

Where:

Ps = Score for the Bid under consideration

Pt = Price of Bid under consideration

$Pmin$ = Price of lowest acceptable Bid

b) **Broad-Based Black Economic Empowerment criteria** [Weighted score 20 points]

- B-BBEE - current scorecard / B-BBEE Preference Points Claims Form
- Preference points will be awarded to a bidder for attaining the B-BBEE status level of contribution in accordance with the table indicated in Section 4.1 of the B-BBEE Preference Points Claim Form.

1.6 STEP SIX: Post Tender Negotiations (if applicable)

- Respondents are to note that Transnet may not award a contract if the price offered is not market-related. In this regard, Transnet reserves the right to engage in PTN with the view to achieving a market-related price or to cancel the tender. Negotiations will be done in a sequential manner i.e.:
 - first negotiate with the highest ranked bidder or cancel the bid, should such negotiations fail,
 - negotiate with the 2nd and 3rd ranked bidders (if required) in a sequential manner.
- In the event of any Respondent being notified of such short-listed/preferred bidder status, his/her bid, as well as any subsequent negotiated best and final offers (BAFO), will automatically be deemed to remain valid during the negotiation period and until the ultimate award of business.
- Should Transnet conduct post tender negotiations, Respondents will be requested to provide their best and final offers to Transnet based on such negotiations. A final evaluation will be conducted in terms of 80/20 and the contract will be negotiated and awarded to the successful Respondent(s).

1.7 STEP SEVEN: Award of business and conclusion of contract

- Immediately after approval to award the contract has been received, the successful or preferred bidder(s) will be informed of the acceptance of his/their Quotation by way of a Letter of Award. Thereafter the final contract will be concluded with the successful Respondent(s).
- Otherwise, a final contract will be concluded and entered into with the successful Bidder at the acceptance of a letter of award by the Respondent.

2 Validity Period

Transnet requires a validity period 90 [Ninety] Business Days, 24 November 2021 from the closing date of this RFQ.

Bidders are to note that they may be requested to extend the validity period of their bid, on the same terms and conditions, if the internal evaluation process has not been finalised within the validity period. However, once the adjudication body has approved the process and award of the business to the successful bidder(s), the validity of the successful bidder(s)' bid will be deemed to remain valid until a final contract has been concluded.

3 Disclosure of contract information**Prices Quoted**

Respondents are to note that, on award of business, Transnet is required to publish the tendered prices and preferences claimed of the successful and unsuccessful Respondents *inter alia* on the National Treasury e-Tender Publication Portal, (www.etenders.gov.za), as required per National Treasury Instruction Note 01 of 2015/2016.

Johannesburg Stock Exchange Debt Listing Requirements

Transnet may also be required to disclose information relating to the subsequent contract i.e. the name of the company, goods/services provided by the company, the value and duration of the contract, etc. in compliance with the Johannesburg Stock Exchange (JSE) Debt Listing Requirements.

Domestic Prominent Influential Persons (DPIP) OR Foreign Prominent Public Officials (FPPO)

Transnet is free to procure the services of any person within or outside the Republic of South Africa in accordance with applicable legislation. Transnet shall not conduct or conclude business transactions, with any Respondents without having:

- Considered relevant governance protocols;
- Determined the DPIP or FPPO status of that counterparty; and
- Conducted a risk assessment and due diligence to assess the potential risks that may be posed by the business relationship.

As per the Transnet Domestic Prominent Influential Persons (DPIP) and Foreign Prominent Public Officials (FPPO) and Related Individuals Policy available on Transnet website <https://www.transnet.net/search/pages/results.aspx?k=FPIDP#k=DPIP>, Respondents are required to disclose any commercial relationship with a DPIP or FPPO (as defined in the Policy) by completing the following section:

The below form contains personal information as defined in the Protection of Personal Information Act, 2013 (the "Act"). By completing the form, the signatory consents to the processing of her/his personal information in accordance with the requirements of the Act. Consent cannot unreasonably be withheld.				
Is the Respondent (Complete with a "Yes" or "No")				
A DPIP/FPPO		Closely Related to a DPIP/FPPO		Closely Associated to a

						DPIP/FPPO			
List all known business interests, in which a DPIP/FPPO may have a direct/indirect interest or significant participation or involvement.									
No	Name of Entity / Business	Role in the Entity / Business (Nature of interest/ Participation)	Shareholding %	Registration Number	Status (Mark the applicable option with an X)				
					Active	Non-Active			
1									
2									
3									

Respondents declaring a commercial relationship with a DPIP or FPPO are to note that Transnet is required to annually publish on its website a list of all business contracts entered into with DPIP or FPPO. This list will include successful Respondents, if applicable.

4 Returnable Documents

Returnable Documents means all the documents, Sections and Annexures, as listed in the tables below. There are three types of returnable documents as indicated below and Respondents are urged to ensure that these documents are returned with the quotation based on the consequences of non-submission as indicated below:

Mandatory Returnable Documents	<i>Failure to provide all these Mandatory Returnable Documents at the Closing Date and time of this RFQ <u>will</u> result in a Respondent's disqualification.</i>
Returnable Documents Used for Scoring	<i>Failure to provide all Returnable Documents used for purposes of scoring a bid, by the closing date and time of this bid will not result in a Respondent's disqualification. However, Bidders will receive an automatic score of zero for the applicable evaluation criterion.</i>
Essential Returnable Documents	<i>Failure to provide essential Returnable Documents <u>will</u> result in Transnet affording Respondents a further opportunity to submit by a set deadline. Should a Respondent thereafter fail to submit the requested documents, this may result in a Respondent's disqualification.</i>

All Returnable Sections, as indicated in the header and footer of the relevant pages, must be signed, stamped and dated by the Respondent.

a) Mandatory Returnable Documents

Respondents are required to submit with their Quotations the **Mandatory Returnable Documents**, and also to confirm submission of these documents by so indicating [Yes or No] in the tables below:

Mandatory Returnable Documents	Submitted [Yes/No]
SECTION 1: SBD1 Form	
SECTION 4 : Quotation Form, with all items on the form priced	
ANNEXURE B – Declaration Certificate for Local Production and Content [SBD6.2] (SBD6.2 must be completed and submitted even if a complete Local Content exemption letter from DTI has been obtained)	

Mandatory Returnable Documents	Submitted [Yes/No]
ANNEXURE C – Local Content Declaration: Summary Schedule (Annexure C must be completed and submitted even if a complete Local Content exemption letter from DTI has been obtained)	
A Local Content exemption letter from DTI (If applicable)	
Valid proof of Respondent's compliance to B-BBEE requirements stipulated in Section 7 of this RFQ.	

b) Returnable Documents Used for Scoring

In addition to the requirements of section (a) above, Respondents are further required to submit with their Proposals the following **Returnable Documents Used for Scoring** and also to confirm submission of these documents by so indicating [Yes or No] in the table below:

Returnable documents used for scoring	Submitted [Yes or No]
ANNEXURE A Clause-by-Clause Compliance schedule	
Proof of Icasa Radio Dealer License	
Product specification sheet	

c) Essential Returnable Documents:

Over and the above the requirements of section (a) and (b) mentioned above, Respondents are further required to submit with their Proposals the following **Essential Returnable Documents** and also to confirm submission of these documents by so indicating [Yes or No] in the table below:

Essential Returnable documents & schedules	Submitted [Yes or No]
In the case of Joint Ventures, a copy of the Joint Venture Agreement or written confirmation of the intention to enter into a Joint Venture Agreement	
SECTION 5: Certificate of Acquaintance with RFQ Documents	
SECTION 6: RFQ Declaration and Breach of Law Form	
SECTION 7: B-BBEE Preference Claim Form	
SECTION 8: SBD 9 - Certificate Of Independent Bid Determination	
ANNEXURE D – Imported Content Declaration: Supporting Schedule to Annexure C	
ANNEXURE F – Technical specification and methods of measures for angle modulated radio equipment (BBD8635 Version 8.1)	
Annexure G - Guidance Document For The Calculation Of Local Content	

5 Continued validity of returnable documents

The successful Respondent will be required to ensure the validity of all returnable documents, including but not limited to its valid proof of B-BBEE status, for the duration of any contract emanating from this RFQ. Should the Respondent be awarded the contract **[the Agreement]** and fail to present Transnet with such renewals as and when they become due, Transnet shall be entitled, in addition to any other rights and remedies that it may have in terms of the eventual Agreement, to terminate such Agreement immediately without any liability and without prejudice to any claims which Transnet may have for damages against the Respondent.

SECTION 4
QUOTATION FORM

I/We _____

hereby offer to supply the goods/services at the prices quoted in the Price Schedule below, in accordance with the conditions related thereto.

I/We agree to be bound by those terms and conditions in:

- the Standard RFQ Terms and Conditions for the Supply of Goods or Services to Transnet; and
- any other standard or special conditions embodied in this Request for Quotation.

I/We accept that unless Transnet should otherwise decide and so inform me/us, this Quotation [and, if any, its covering letter and any subsequent exchange of correspondence], together with Transnet's acceptance thereof shall constitute a binding contract between Transnet and me/us. I/We further agree that if, after I/we have been notified of the acceptance of my/our Quotation, I/we fail to deliver the said goods/service/s within the delivery lead-time quoted, Transnet may, without prejudice to any other legal remedy which it may have, cancel the order and recover from me/us any expenses incurred by Transnet in calling for Quotations afresh and/or having to accept any less favourable offer.

Price Schedule

I/We quote as follows for the goods required, on a "delivered nominated destination" Empangeni basis, including VAT:

Item No	Description of Item	Unit	Quantity	Rate	Total Price of item [ZAR]
1	UHF, (440 – 480 MHz band) IPX5, Base station conventional radio operating at 12V, with 12.5 kHz channel spacing. Refer to Annexure: G Specifications BBD8635 version, 8.1 dated 27 June 2014.	Each	8		
2	Programming software, Leads, Adaptors and technical manuals on CD.) Refer to Annexure: G Specifications BBD8635 version, 8.1 dated 27 June 2014.	Each	3		
TOTAL PRICE, exclusive of VAT:					
VAT 15% (if applicable)					
Total Inclusive of VAT (where applicable)					

Delivery Lead-Time from date of purchase order: _____ **[days/weeks]**

Respondents are to note that Transnet will round off final pricing scores to the nearest 2 (two) decimal places.

Notes to Pricing:

- a) Respondents are to note that if the price offered by the highest scoring bidder is not market-related, Transnet may not award the contract to that Respondent. Transnet may-
- (i) negotiate a market-related price with the Respondent scoring the highest points or cancel the RFQ;
 - (ii) if that Respondent does not agree to a market-related price, negotiate a market-related price with the Respondent scoring the second highest points or cancel the RFQ;
 - (iii) if the Respondent scoring the second highest points does not agree to a market-related price, negotiate a market-related price with the Respondent scoring the third highest points or cancel the RFQ.
- If a market-related price is not agreed with the Respondent scoring the third highest points, Transnet must cancel the RFQ.
- b) All Prices must be quoted in South African Rand, exclusive of VAT
- c) Failure to price all items on the Pricing Schedule will result in disqualification**
- d) To facilitate like-for-like comparison bidders must submit pricing strictly in accordance with this price schedule and not utilise a different format. Deviation from this pricing schedule will result in a bid being disqualified.
- e) Please note that should you have offered a discounted price(s), Transnet will only consider such price discount(s) in the final evaluation stage if offered on an unconditional basis.
- f) Bidders are advised that they take responsibility for submitting quotations that are correct and without any arithmetical errors. All line items must reflect the correct unit price and total price, after taking into account the quantity. The sum of all line items must correctly reflect the total of all line items, without VAT and including VAT. Transnet may disqualify bidders that submit bids with arithmetical errors.

SECTION 5

CERTIFICATE OF ACQUAINTANCE WITH RFQ DOCUMENTS

By signing this certificate the Respondent is deemed to acknowledge that he/she has made himself/herself thoroughly familiar with, and agrees with all the conditions governing this RFQ. This includes those terms and conditions contained in any printed form stated to form part hereof, including but not limited to the documents stated below. As such, Transnet will recognise no claim for relief based on an allegation that the Respondent overlooked any such condition or failed properly to take it into account in calculating tendered prices or any other purpose:

1. Transnet's General Bid Conditions
2. Standard RFQ Terms and Conditions for the supply of Goods or Services to Transnet
3. Transnet's Supplier Integrity Pact
4. Non-disclosure Agreement

Existing vendors: existing vendors are required to confirm whether all the information (e.g. company address, contact details, banking details, etc.) relating to the existing vendor number is still correct at the time of submission of this bid or update their information in the table below:

Transnet Operating Division [e.g. TFR, TE, etc]	Vendor Number	Information still current [tick if applicable]	Information change [indicate detail of change/s & attach appropriate proof]

Note: Should a Respondent be successful and awarded the bid, they will be required to complete a Supplier Declaration Form for registration as a vendor onto the Transnet vendor master database.

Should the Bidder find any terms or conditions stipulated in any of the relevant documents quoted in the RFQ unacceptable, it should indicate which conditions are unacceptable and offer alternatives by written submission on its company letterhead, attached to its submitted Bid. Any such submission shall be subject to review by Transnet's Legal Counsel who shall determine whether the proposed alternative(s) are acceptable or otherwise, as the case may be. A material deviation from the Standard terms or conditions could result in disqualification.

Bidders accept that an obligation rests on them to clarify any uncertainties regarding any bid to which they intend to respond, before submitting the bid. The Bidder agrees that he/she will have no claim based on an allegation that any aspect of this RFQ was unclear but in respect of which he/she failed to obtain clarity.

The bidder understands that his/her Bid will be disqualified if this Certificate of Acquaintance with RFQ documents included in the RFQ as a returnable document, is found not to be true and/ or complete in every respect.

SIGNED at _____ on this _____ day of _____ 20____

SIGNATURE OF WITNESSES

ADDRESS OF WITNESSES

1 _____

Name _____

2 _____

Name _____

SIGNATURE OF RESPONDENT'S AUTHORISED REPRESENTATIVE: _____

NAME: _____

DESIGNATION: _____

Respondent's Signature

Date & Company Stamp

SECTION 6**RFQ DECLARATION AND BREACH OF LAW FORM**

NAME OF ENTITY: _____

We _____ do hereby certify that:

1. Transnet has supplied and we have received appropriate responses to any/all questions [as applicable] which were submitted by ourselves for RFQ Clarification purposes;
2. we have received all information we deemed necessary for the completion of this Request for Quotation [RFQ];
3. we have been provided with sufficient access to the existing Transnet facilities/sites and all relevant information relevant to the Supply of the Goods as well as Transnet information and Employees, and has had sufficient time in which to conduct and perform a thorough due diligence of Transnet's operations and business requirements and assets used by Transnet. Transnet will therefore not consider or permit any pre- or post-contract verification or any related adjustment to pricing, service levels or any other provisions/conditions based on any incorrect assumptions made by the Respondent in arriving at his Bid Price.
4. at no stage have we received additional information relating to the subject matter of this RFQ from Transnet sources, other than information formally received from the designated Transnet contact(s) as nominated in the RFQ documents;
5. we have complied with all Obligations of the Bidder/Supplier as indicated in paragraph 3 of the Transnet Supplier Integrity Pact which includes but is not limited to ensuring that we take all measures necessary to prevent corrupt practices, unfairness and illegal activities in order to secure or in furtherance to secure a contract with Transnet;
6. we are satisfied, insofar as our entity is concerned, that the processes and procedures adopted by Transnet in issuing this RFQ and the requirements requested from Bidders in responding to this RFQ have been conducted in a fair and transparent manner;
7. we declare that a family, business and/or social relationship **exists / does not exist** [delete as applicable] between an owner / member / director / partner / shareholder of our entity and an employee or board member of Transnet including any person who may be involved in the evaluation and/or adjudication of this Bid;
8. we declare that an owner / member / director / partner / shareholder of our entity **is / is not** [delete as applicable] an employee or board member of the Transnet;
9. In addition, we declare that an owner / member / director / partner / shareholder/employee of our entity **is / is not** [delete as applicable] a former employee or board member of Transnet in the past 10 years. I further declare that if they were former employee or board member of Transnet in the past 10 years that they **were/were not** involved in the bid preparation or had access to the information related to this RFQ; and
10. If such a relationship as indicated in paragraph 7, 8 and/or 9 exists, the Respondent is to complete the following section:

FULL NAME OF OWNER/MEMBER/DIRECTOR/
PARTNER/SHAREHOLDER/EMPLOYEE:

ADDRESS:

Indicate nature of relationship with Transnet:

[Failure to furnish complete and accurate information in this regard will lead to the disqualification of a response and may preclude a Respondent from doing future business with Transnet]

11. We declare, to the extent that we are aware or become aware of any relationship between ourselves and Transnet [other than any existing and appropriate business relationship with Transnet] which could unfairly advantage our entity in the forthcoming adjudication process, we shall notify Transnet immediately in writing of such circumstances.

DECLARATION OF INTEREST REGARDING PERSONS EMPLOYED BY THE STATE (SBD4)

12. Any legal person, including persons employed by the state¹, or persons having a kinship with persons employed by the state, including a blood relationship, may make an offer or offers in terms of this invitation to bid (includes a price quotation, advertised competitive bid, limited bid or proposal). In view of possible allegations of favouritism, should the resulting bid, or part thereof, be awarded to persons employed by the state, or to persons connected with or related to them, it is required that the bidder or his/her authorised representative declare his/her position in relation to the evaluating/adjudicating authority where-
- the bidder is employed by the state; and/or
 - the legal person on whose behalf the bidding document is signed, has a relationship with persons/a person who are/is involved in the evaluation and or adjudication of the bid(s), or where it is known that such a relationship exists between the person or persons for or on whose behalf the declarant acts and persons who are involved with the evaluation and or adjudication of the bid.

13. In order to give effect to the above, the following questionnaire must be completed and submitted with the bid:

- 13.1. Full Name of bidder or his or her representative:
- 13.2. Identity Number:
- 13.3. Position occupied in the Company (director, trustee, shareholder²):
- 13.4. Company Registration Number:
- 13.5. Tax Reference Number:
- 13.6. VAT Registration Number:

13.7. Are you or any person connected with the bidder presently employed by the state?	YES / NO
13.7.1. If so, furnish the following particulars:	
Name of person / director / trustee / shareholder/ member:	
Name of state institution at which you or the person connected to the bidder is employed :	

¹ "State" means –

- (a) any national or provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act No. 1 of 1999);
- (b) any municipality or municipal entity;
- (c) provincial legislature;
- (d) national Assembly or the national Council of provinces; or
- (e) Parliament.

² "Shareholder" means a person who owns shares in the company and is actively involved in the management of the enterprise or business and exercises control over the enterprise.

Position occupied in the state institution:	
Any other particulars:	
13.8. If you are presently employed by the state, did you obtain the appropriate authority to undertake remunerative work outside employment in the public sector?	YES / NO
13.8.1. If yes, did you attached proof of such authority to the bid document? (Note: Failure to submit proof of such authority, where applicable, may result in the disqualification of the bid.	YES / NO
13.8.2. If no, furnish reasons for non-submission of such proof:	
13.9. Did you or your spouse, or any of the company's directors / trustees / shareholders / members or their spouses conduct business with the state in the previous twelve months?	YES / NO
13.9.1. If so, furnish particulars:	
13.10. Do you, or any person connected with the bidder, have any relationship (family, friend, other) with a person employed by the state and who may be involved with the evaluation and or adjudication of this bid?	YES / NO
13.10.1. If so, furnish particulars:	
13.11. Are you, or any person connected with the bidder, aware of any relationship (family, friend, other) between any other bidder and any person employed by the state who may be involved with the evaluation and or adjudication of this bid?	YES / NO
13.11.1. If so, furnish particulars:	
13.12. Do you or any of the directors / trustees / shareholders / members of the company have any interest in any other related companies whether or not they are bidding for this contract?	YES / NO
13.12.1. If so, furnish particulars:	

The names of all directors / trustees / shareholders / members, their individual identity numbers, tax reference numbers and, if applicable, employee / persal numbers must be indicated in paragraph 14 below.

14. Full details of directors / trustees / members / shareholders.

Full Name	Identity Number	Personal Tax Reference Number	State Employee Number / Persal Number

BREACH OF LAW

15. We further hereby certify that *I/we have/have not been* [delete as applicable] found guilty during the preceding 5 [five] years of a serious breach of law, including but not limited to a breach of the

Competition Act, 89 of 1998, by a court of law, tribunal or other administrative body. The type of breach that the Respondent is required to disclose excludes relatively minor offences or misdemeanours, e.g. traffic offences. This includes the imposition of an administrative fine or penalty.

Where found guilty of such a serious breach, please disclose:

NATURE OF BREACH:

DATE OF BREACH: _____

Furthermore, I/we acknowledge that Transnet SOC Ltd reserves the right to exclude any Respondent from the bidding process, should that person or entity have been found guilty of a serious breach of law, tribunal or regulatory obligation.

SIGNED at _____ on this ____ day of _____ 20__

For and on behalf of _____ duly authorised hereto	AS WITNESS:	
Name:	Name:	
Position:	Position:	
Signature:	Signature:	
Date:	Registration No of Company/CC _____	
Place:	Registration Name of Company/CC _____	

SECTION 7**B-BBEE PREFERENCE POINTS CLAIM FORM**

This preference form must form part of all bids invited. It contains general information and serves as a claim for preference points for Broad-Based Black Economic Empowerment [B-BBEE] Status Level of Contribution.

Transnet will award preference points to companies who provide valid proof of their B-BBEE status using either the latest version of the generic Codes of Good Practice or Sector Specific Codes (if applicable).

NB: BEFORE COMPLETING THIS FORM, BIDDERS MUST STUDY THE GENERAL CONDITIONS, DEFINITIONS AND DIRECTIVES APPLICABLE IN RESPECT OF B-BBEE, AS PRESCRIBED IN THE PREFERENTIAL PROCUREMENT REGULATIONS, 2017.

1. GENERAL CONDITIONS

- 1.1 The following preference point systems are applicable to all bids:
- the 80/20 system for requirements with a Rand value of up to R50 000 000 (all applicable taxes included); and
 - the 90/10 system for requirements with a Rand value above R50 000 000 (all applicable taxes included).
- 1.2 The value of this bid is estimated to not exceed R50 000 000 (all applicable taxes included) and therefore the 80/20 preference point system shall be applicable. Despite the stipulated preference point system, Transnet shall use the lowest acceptable bid to determine the applicable preference point system in a situation where all received acceptable bids are received outside the stated preference point system.
- 1.3 Either the 80/20 preference point system will be applicable to this tender.
- 1.4 Preference points for this bid shall be awarded for:
- (a) Price; and
 - (b) B-BBEE Status Level of Contribution.
- 1.5 The maximum points for this bid are allocated as follows:

	POINTS
PRICE	80
B-BBEE STATUS LEVEL OF CONTRIBUTOR	20
Total points for Price and B-BBEE must not exceed	100

- 1.6 Failure on the part of a bidder to submit proof of B-BBEE status level of contributor together with the bid will be interpreted to mean that preference points for B-BBEE status level of contribution are not claimed.
- 1.7 The purchaser reserves the right to require of a bidder, either before a bid is adjudicated or at any time subsequently, to substantiate any claim in regard to preferences, in any manner required by the purchaser

2. DEFINITIONS

- (a) **"all applicable taxes"** includes value-added tax, pay as you earn, income tax, unemployment insurance fund contributions and skills development levies;
- (b) **"B-BBEE"** means broad-based black economic empowerment as defined in section 1 of the Broad-Based Black Economic Empowerment Act;
- (c) **"B-BBEE status level of contributor"** means the B-BBEE status received by a measured entity based on its overall performance using the relevant scorecard contained in the Codes of Good Practice on Black Economic Empowerment, issued in terms of section 9(1) of the Broad-Based Black Economic Empowerment Act;
- (d) **"bid"** means a written offer in a prescribed or stipulated form in response to an invitation by an organ of

state for the supply/provision of services, works or goods, through price quotations, advertised competitive bidding processes or proposals;

- (e) **"Broad-Based Black Economic Empowerment Act"** means the Broad-Based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003);
- (f) **"EME"** means an Exempted Micro Enterprise as defines by Codes of Good Practice under section 9 (1) of the Broad-Based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003);
- (g) **"functionality"** means the ability of a bidder to provide goods or services in accordance with specification as set out in the bid documents;
- (h) **"Price"** includes all applicable taxes less all unconditional discounts.
- (i) **"Proof of B-BBEE Status Level of Contributor"** means:
 - 1) B-BBBEE status level certificate issued by an unauthorised body or person;
 - 2) A sworn affidavit as prescribed by the B-BBEE Codes of Good Practice;
 - 3) Any other requirement prescribed in terms of the B-BBEE Act.
- (j) **"QSE"** means a Qualifying Small EEnterprise in terms of a Codes of Good Practice under section 9 (1) of the Broad-Based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003);
- (k) **"rand value"** means the total estimated value of a contract in South African currency, calculated at the time of bid invitations, and includes all applicable taxes and excise duties.

3. POINTS AWARDED FOR PRICE

3.1 THE 80/20 PREFERENCE POINT SYSTEMS

A maximum of 80 points is allocated for price on the following basis:

80/20

$$P_s = 80 \left(1 - \frac{P_t - P_{\min}}{P_{\min}} \right)$$

Where

P_s = Points scored for comparative price of bid under consideration
 P_t = Comparative price of bid under consideration
 $P_{\min}$ = Comparative price of lowest acceptable bid

4. POINTS AWARDED FOR B-BBEE STATUS LEVEL OF CONTRIBUTION

- 4.1 In terms of Regulation 6 (2) and 7 (2) of the Preferential Procurement Regulations, preference points must be awarded to a bidder for attaining the B-BBEE status level of contribution in accordance with the table below:

B-BBEE Status Level of Contributor	Number of points (80/20 system)
1	20
2	18
3	14
4	12
5	8
6	6
7	4
8	2
Non-compliant contributor	0

4.2 The table below indicates the required proof of B-BBEE status depending on the category of enterprises:

Enterprise	B-BBEE Certificate & Sworn Affidavit
Large	Certificate issued by SANAS accredited verification agency
QSE	Certificate issued by SANAS accredited verification agency Sworn Affidavit signed by the authorised QSE representative and attested by a Commissioner of Oaths confirming annual turnover and black ownership (only black-owned QSEs - 51% to 100% Black owned) [Sworn affidavits must substantially comply with the format that can be obtained on the DTI's website at www.dti.gov.za/economic_empowerment/bee_codes.jsp .]
EME¹	Sworn Affidavit signed by the authorised EME representative and attested by a Commissioner of Oaths confirming annual turnover and black ownership Certificate issued by CIPC (formerly CIPRO) confirming annual turnover and black ownership Certificate issued by SANAS accredited verification agency only if the EME is being measured on the QSE scorecard

- 4.3 A trust, consortium or joint venture (including unincorporated consortia and joint ventures) must submit a consolidated B-BBEE Status Level verification certificate for every separate bid.
- 4.4 Tertiary Institutions and Public Entities will be required to submit their B-BBEE status level certificates in terms of the specialized scorecard contained in the B-BBEE Codes of Good Practice.
- 4.5 A person will not be awarded points for B-BBEE status level if it is indicated in the bid documents that such a bidder intends sub-contracting more than 25% of the value of the contract to any other enterprise that does not qualify for at least the points that such a bidder qualifies for, unless the intended sub-contractor is an EME that has the capability and ability to execute the sub-contract.
- 4.6 A person awarded a contract may not sub-contract more than 25% of the value of the contract to any other enterprise that does not have an equal or higher B-BBEE status level than the person concerned, unless the contract is sub-contracted to an EME that has the capability and ability to execute the sub-contract.
- 4.7 Bidders are to note that the rules pertaining to B-BBEE verification and other B-BBEE requirements may be changed from time to time by regulatory bodies such as National Treasury or the DTI. It is the Bidder's responsibility to ensure that his/her bid complies fully with all B-BBEE requirements at the time of the submission of the bid.

5. BID DECLARATION

5.1 Bidders who claim points in respect of B-BBEE Status Level of Contribution must complete the following:

6. B-BBEE STATUS LEVEL OF CONTRIBUTION CLAIMED IN TERMS OF PARAGRAPHS 1.4 AND 6.1

6.1 B-BBEE Status Level of Contribution: . =(maximum of 20 points)

(Points claimed in respect of paragraph 6.1 must be in accordance with the table reflected in paragraph 4.1 and must be substantiated by relevant proof of B-BBEE status level of contributor.

7. SUB-CONTRACTING

7.1 Will any portion of the contract be sub-contracted?

(Tick applicable box)

YES		NO	
-----	--	----	--

¹ In terms of the Implementation Guide: Preferential Procurement Regulations, 2017, Version 2, paragraph 11.11 provides that in the Transport Sector, EMEs can provide a letter from accounting officer or get verified and be issued with a B-BBEE certificate by SANAS accredited professional or agency as the Transport Sector Code has not been aligned to the generic Codes. EMEs in the Transport Sector are not allowed to provide a Sworn Affidavit as the generic codes are not applicable to them.

7.1.1 If yes, indicate:

- i) What percentage of the contract will be subcontracted.....%
- ii) The name of the sub-contractor.....
- iii) The B-BBEE status level of the sub-contractor.....
- iv) Whether the sub-contractor is an EME or QSE

(Tick applicable box)

YES		NO	
-----	--	----	--

- v) Specify, by ticking the appropriate box, if subcontracting with an enterprise in terms of Preferential Procurement Regulations, 2017:

Designated Group: An EME or QSE which is at least 51% owned by:	EME ✓	QSE ✓
Black people		
Black people who are youth		
Black people who are women		
Black people with disabilities		
Black people living in rural or underdeveloped areas or townships		
Cooperative owned by black people		
Black people who are military veterans		
OR		
Any EME		
Any QSE		

8. **DECLARATION WITH REGARD TO COMPANY/FIRM**

8.1 Name of company/firm:.....

8.2 VAT registration number:.....

8.3 Company registration number:.....

8.4 **TYPE OF COMPANY/ FIRM**

- ☐ Partnership/Joint Venture / Consortium
- ☐ One person business/sole propriety
- ☐ Close corporation
- ☐ Company
- ☐ (Pty) Limited

[TICK APPLICABLE BOX]

8.5 **DESCRIBE PRINCIPAL BUSINESS ACTIVITIES**

.....

.....

8.6 **COMPANY CLASSIFICATION**

- ☐ Manufacturer
- ☐ Supplier
- ☐ Professional service provider
- ☐ Other service providers, e.g. transporter, etc.

[TICK APPLICABLE BOX]

8.7 Total number of years the company/firm has been in business:.....

8.8 I/we, the undersigned, who is / are duly authorised to do so on behalf of the company/firm, certify that the points claimed, based on the B-BBEE status level of contribution indicated in paragraphs 4.1 and 6.1 of the foregoing certificate, qualifies the company/ firm for the preference(s) shown and I / we acknowledge that:

- i) The information furnished is true and correct;
- ii) The preference points claimed are in accordance with the General Conditions as indicated in paragraph 1 of this form;

- iii) In the event of a contract being awarded as a result of points claimed as shown in paragraphs 4.1 and 6.1, the contractor may be required to furnish documentary proof to the satisfaction of the purchaser that the claims are correct;
- iv) If the B-BBEE status level of contributor has been claimed or obtained on a fraudulent basis or any of the conditions of contract have not been fulfilled, the purchaser may, in addition to any other remedy it may have-
 - (a) disqualify the person from the bidding process;
 - (b) recover costs, losses or damages it has incurred or suffered as a result of that person's conduct;
 - (c) cancel the contract and claim any damages which it has suffered as a result of having to make less favourable arrangements due to such cancellation;
 - (d) if the successful bidder subcontracted a portion of the bid to another person without disclosing it, Transnet reserves the right to penalise the bidder up to 10 percent of the value of the contract;
 - (e) recommend that the bidder or contractor, its shareholders and directors, or only the shareholders and directors who acted on a fraudulent basis, be restricted by the National Treasury from obtaining business from any organ of state for a period not exceeding 10 years, after the *audi alteram partem* (hear the other side) rule has been applied; and
 - (f) forward the matter for criminal prosecution.

WITNESSES

1.

2.

.....

SIGNATURE(S) OF BIDDERS(S)

DATE:.....

ADDRESS.....

.....

SECTION 8: SBD 9 - CERTIFICATE OF INDEPENDENT BID DETERMINATION

1. Section 4 (1) (b) (iii) of the Competition Act No. 89 of 1998, as amended, prohibits an agreement between, or concerted practice by, firms, or a decision by an association of firms, if it is between parties in a horizontal relationship and if it involves collusive bidding (or bid rigging). Collusive bidding is a per se prohibition meaning that it cannot be justified under any grounds. Bid rigging (or collusive bidding) occurs when businesses, that would otherwise be expected to compete, secretly conspire to raise prices or lower the quality of goods and / or services for purchasers who wish to acquire goods and / or services through a bidding process. Bid rigging is, therefore, an agreement between competitors not to compete.
2. Transnet will take all reasonable steps to prevent abuse of the supply chain management system and to:
 - a. disregard the bid of any bidder if that bidder, or any of its directors have abused the institution's supply chain management system and or committed fraud or any other improper conduct in relation to such system.
 - b. cancel a contract awarded to a supplier of goods and services if the supplier committed any corrupt or fraudulent act during the bidding process or the execution of that contract.
3. This SBD serves as a certificate of declaration that would be used by institutions to ensure that, when bids are considered, reasonable steps are taken to prevent any form of bid-rigging.
4. In order to give effect to the above, the following certificate of Bid Determination (SBD 9) must be completed and submitted with the bid:

CERTIFICATE OF INDEPENDENT BID DETERMINATION

I, the undersigned, in submitting the accompanying bid:

(Bid Number and Description)

in response to the invitation for the bid made by:

(Name of Institution)

do hereby make the following statements that I certify to be true and complete in every respect:

I certify, on behalf of: _____ that:
(Name of Bidder)

1. have read and I understand the contents of this Certificate;
2. I understand that the accompanying bid will be disqualified if this Certificate is found not to be true and complete in every respect;
3. I am authorized by the bidder to sign this Certificate, and to submit the accompanying bid, on behalf of the bidder;
4. Each person whose signature appears on the accompanying bid has been authorized by the bidder to determine the terms of, and to sign the bid, on behalf of the bidder;
5. For the purposes of this Certificate and the accompanying bid, I understand that the word "competitor" shall include any individual or organization, other than the bidder, whether or not affiliated with the bidder, who:
 - a. has been requested to submit a bid in response to this bid invitation;
 - b. could potentially submit a bid in response to this bid invitation, based on their qualifications, abilities or experience; and
 - c. provides the same goods and services as the bidder and/or is in the same line of business as the bidder
6. The bidder has arrived at the accompanying bid independently from, and without consultation, communication, agreement or arrangement with any competitor. However communication between partners in a joint venture or consortium¹ will not be construed as collusive bidding.
7. In particular, without limiting the generality of paragraphs 6 above, there has been no consultation, communication, agreement or arrangement with any competitor regarding:
 - a. prices;
 - b. geographical area where product or service will be rendered (market allocation)
 - c. methods, factors or formulas used to calculate prices;
 - d. the intention or decision to submit or not to submit, a bid;
 - e. the submission of a bid which does not meet the specifications and conditions of the bid; or
 - f. bidding with the intention not to win the bid.

¹ Joint venture or Consortium means an association of persons for the purpose of combining their expertise, property, capital, efforts, skill and knowledge in an activity for the execution of a contract

8. In addition, there have been no consultations, communications, agreements or arrangements with any competitor regarding the quality, quantity, specifications and conditions or delivery particulars of the products or services to which this bid invitation relates.
9. The terms of the accompanying bid have not been, and will not be, disclosed by the bidder, directly or indirectly, to any competitor, prior to the date and time of the official bid opening or of the awarding of the contract.
10. I am aware that, in addition and without prejudice to any other remedy provided to combat any restrictive practices related to bids and contracts, bids that are suspicious will be reported to the Competition Commission for investigation and possible imposition of administrative penalties in terms of section 59 of the Competition Act No 89 of 1998 and or may be reported to the National Prosecuting Authority (NPA) for criminal investigation and or may be restricted from conducting business with the public sector for a period not exceeding ten (10) years in terms of the Prevention and Combating of Corrupt Activities Act No 12 of 2004 or any other applicable legislation.

.....
Signature

.....
Date

.....
Position

.....
Name of Bidder

ANNEXURE F: CLAUSE-BY-CLAUSE COMPLAINT SCHEDULE**Supply and Deliver Telecommunication radio equipment to Empangeni Depot**

The compliance response is to contain ONLY the following statements, "Comply", or "Do not comply".

If the offered product comply with all the Specifications required, the bidder to indicate/insert "Comply" on the "Compliance Response" column.

Where a bidder has indicated/inserted "Do not comply" on the "Compliance Response" column, the bidder must explain the reason for the deviation/non-compliance.

Note: Failure to duly complete and submit this form and fully (100%) comply with all of the Requirements below will result in the respondent's disqualification.

Specification	Compliance response "Comply", or "Do not comply"	Explanation / Deviation / Reason
UHF, (440 – 480 MHz band) IPX5, Base station conventional radio operating at 12V, with 12.5 kHz channel spacing. Must comply with attached Annexure: G Specifications BBD8635 version 8.1 dated 27 June 2014.		
Base station must consists of 50 Watt transceiver (Repeater) with 4wire E&M 600 ohm audio interface, 5 Watt link radio with 4 wire E&M 600 ohm audio interface board		
Transmitter must be able to transmit CTCSS and Receiver must be able to receive CTCSS RSSI output terminal must be provided		
SFE key Advanced profile and Task Manager		
Base station must have SFE key alarm reporting		
Advanced profile and task manager		
Standard microphone		
Programming software, Leads, Adaptors and technical manuals on CD Must comply with attached Annexure: G Specifications BBD8635 version 8 dated 27 June 2014, and SPC-00851-rev 3.40		
Vendor must have a current ICASA Traders licence in their name		
-Tenderer to produce valid ICASA traders licence		
- Licence to be under tenderer's name		
Equipment must be ICASA approved		
-Documentation to be supplied.		

Specification	Compliance response "Comply", or "Do not comply"	Explanation / Deviation / Reason
-ICASA sticker on the equipment		
Supplied repeaters must comply with the latest Transnet Spec and approved by QA		
Technical evaluations must include a subject specialist.		
-Transnet Radio specialist must be present on evaluation		

Respondent's Signature

Date & Company Stamp

SECTION 09**PROTECTION OF PERSONAL INFORMATION**

1. The following terms shall bear the same meaning as contemplated in Section 1 of the Protection of Person information act, No.4 of 2013.(“POPIA”):

consent; data subject; electronic communication; information officer; operator; person; personal information; processing; record; Regulator; responsible party; special information; as well as any terms derived from these terms.
2. Transnet will process all information by the Respondent in terms of the requirements contemplated in Section 4(1) of the POPIA:

Accountability; Processing limitation; Purpose specification; Further processing limitation; Information quality; Openness; Security safeguards and Data subject participation.
3. The Parties acknowledge and agree that, in relation to personal information that will be processed pursuant to this RFQ, the Responsible party is “Transnet” and the Data subject is the “Respondent”. Transnet will process personal information only with the knowledge and authorisation of the Respondent and will treat personal information which comes to its knowledge as confidential and will not disclose it, unless so required by law or subject to the exceptions contained in the POPIA.
4. Transnet reserves all the rights afforded to it by the POPIA in the processing of any of its information as contained in this RFQ and the Respondent is required to comply with all prescripts as detailed in the POPIA relating to all information concerning Transnet.
5. In responding to this bid, Transnet acknowledges that it will obtain and have access to personal information of the Respondent. Transnet agrees that it shall only process the information disclosed by Respondent in their response to this bid for the purpose of evaluating and subsequent award of business and in accordance with any applicable law.
6. Transnet further agrees that in submitting any information or documentation requested in this RFQ, the Respondent is consenting to the further processing of their personal information for the purpose of, but not limited to, risk assessment, assurances, contract award, contract management, auditing, legal opinions/litigations, investigations (if applicable), document storage for the legislatively required period, destruction, de-identification and publishing of personal information by Transnet and/or its authorised appointed third parties.
7. Furthermore, Transnet will not otherwise modify, amend or alter any personal data submitted by the Respondent or disclose or permit the disclosure of any personal data to any third party without the prior written consent from the Respondent. Similarly, Transnet requires the Respondent to process any personal information disclosed by Transnet in the bidding process in the same manner.
8. Transnet shall, at all times, ensure compliance with any applicable laws put in place and maintain sufficient measures, policies and systems to manage and secure against all forms of risks to any information that may be shared or accessed pursuant to this RFQ (physically, through a computer or any other form of electronic communication).
9. Transnet shall notify the Respondent in writing of any unauthorised access to information, cybercrimes or suspected cybercrimes, in its knowledge and report such crimes or suspected crimes to the relevant authorities in accordance with applicable laws, after becoming aware of such crimes or suspected crime. The Respondent must take all necessary remedial steps to mitigate the extent of the loss or compromise of personal information and to restore the integrity of the affected personal information as quickly as is possible.

10. The Respondent may, in writing, request Transnet to confirm and/or make available any personal information in its possession in relation to the Respondent and if such personal information has been accessed by third parties and the identity thereof in terms of the POPIA. The Respondent may further request that Transnet correct (excluding critical/mandatory or evaluation information), delete, destroy, withdraw consent or object to the processing of any personal information relating to the Respondent in Transnet's possession in terms of the provision of the POPIA and utilizing Form 2 of the POPIA Regulations.
11. In submitting any information or documentation requested in this RFQ, the Respondent is hereby consenting to the processing of their personal information for the purpose of this RFQ and further confirming that they are aware of their rights in terms of Section 5 of POPIA.

Respondents are required to provide consent below:

YES		NO	
------------	--	-----------	--

12. Further, the Respondent declares that they have obtained all consents pertaining to other data subject's personal information included in its submission and thereby indemnifying Transnet against any civil or criminal action, administrative fines or other penalty or loss that may arise as a result of the processing of any personal information that the Respondent submitted.
13. The Respondent declares that the personal information submitted for the purpose of this RFQ is complete, accurate, not misleading, is up to date and may be updated where applicable.

Signature of Respondent's authorised representative: _____

Should a Respondent have any complaints or objections to processing of its personal information, by Transnet, the Respondent can submit a complaint to the Information Regulator on <https://www.justice.gov.za/inforeg/>, click on contact us, click on complaints.IR@justice.gov.za

ANNEXURE B**SBD 6.2****DECLARATION CERTIFICATE FOR LOCAL PRODUCTION AND CONTENT FOR DESIGNATED SECTORS**

This Standard Bidding Document (SBD) must form part of all bids invited. It contains general information and serves as a declaration form for local content (local production and local content are used interchangeably).

Before completing this declaration, bidders must study the General Conditions, Definitions, Directives applicable in respect of Local Content as prescribed in the Preferential Procurement Regulations, 2017, the South African Bureau of Standards (SABS) approved technical specification number SATS 1286:2011 (Edition 1) and the Guidance on the Calculation of Local Content together with the Local Content Declaration Templates [Annex C (Local Content Declaration: Summary Schedule), D (Imported Content Declaration: Supporting Schedule to Annex C) and E (Local Content Declaration: Supporting Schedule to Annex C)].

1. General Conditions

- 1.1. Preferential Procurement Regulations, 2017 (Regulation 8) makes provision for the promotion of local production and content.
- 1.2. Regulation 8.(2) prescribes that in the case of designated sectors, where in the award of bids local production and content is of critical importance, such bids must be advertised with the specific bidding condition that only locally produced goods, services or works or locally manufactured goods, with a stipulated minimum threshold for local production and content will be considered.
- 1.3. In terms of Regulation 16(2) of the Preferential Procurement Regulations, 2017, any sector designated and minimum threshold determined for local production and content for purposes of regulation 9 of the 2011 Regulations and in force immediately before the repeal of the 2011 Regulations, are regarded as having been done under regulation 8(1) of the 2017 Regulations.
- 1.4. Where necessary, for bids referred to in paragraph 1.2 above, a two stage bidding process may be followed, where the first stage involves a minimum threshold for local production and content and the second stage price and B-BBEE.
- 1.5. A person awarded a contract in relation to a designated sector, may not sub-contract in such a manner that the local production and content of the overall value of the contract is reduced to below the stipulated minimum threshold.
- 1.6. The local content (LC) expressed as a percentage of the bid price must be calculated in accordance with the SABS approved technical specification number SATS 1286: 2011 as follows:

$$LC = [1 - x / y] * 100$$

Where

x is the imported content in Rand

y is the bid price in Rand excluding value added tax (VAT)

Prices referred to in the determination of x must be converted to Rand (ZAR) by using the exchange rate published by South African Reserve Bank (SARB) at 12:00 on the date of advertisement of the bid as indicated in paragraph 4.1 below.

The SABS approved technical specification number SATS 1286:2011 is accessible on <http://www.thedti.gov.za/industrial development/ip.jsp> at no cost.

- 1.7. A bid will be disqualified if this Declaration Certificate and the Annex C (Local Content Declaration: Summary Schedule) are not submitted as part of the bid documentation;

2. The stipulated minimum threshold(s) for local production and content (refer to Annex A of SATS 1286:2011) for this bid is/are as follows:Description of services, works or goodsStipulated minimum threshold**Content for two way radio terminals and associated equipment****60%****3. Does any portion of the services, works or goods offered have any imported content?****(Tick applicable box)**

YES		NO	
-----	--	----	--

3.1. If yes, the rate(s) of exchange to be used in this bid to calculate the local content as prescribed in paragraph 1.5 of the general conditions must be the rate(s) published by SARB for the specific currency at 12:00 on the date of advertisement of the bid.The relevant rates of exchange information is accessible on www.reservebank.co.za

Indicate the rate(s) of exchange against the appropriate currency in the table below (refer to Annex A of SATS 1286:2011):

Currency	Rates of exchange
US Dollar	
Pound Sterling	
Euro	
Yen	
Other	

NB: Bidders must submit proof of the SARB rate (s) of exchange used.

4. Where, after the award of a bid, challenges are experienced in meeting the stipulated minimum threshold for local content the dti must be informed accordingly in order for the dti to verify and in consultation with the AO/AA provide directives in this regard.

LOCAL CONTENT DECLARATION BY CHIEF FINANCIAL OFFICER OR OTHER LEGALLY RESPONSIBLE PERSON NOMINATED IN WRITING BY THE CHIEF EXECUTIVE OR SENIOR MEMBER/PERSON WITH MANAGEMENT RESPONSIBILITY (CLOSE CORPORATION, PARTNERSHIP OR INDIVIDUAL)**IN RESPECT OF BID NO:** ERAC-EMU-33792-NN-110**ISSUED BY:** TRANSNET SOC LTD T/A TRANSNET FREIGHT RAIL

NB

- 1 The obligation to complete, duly sign and submit this declaration cannot be transferred to an external authorized representative, auditor or any other third party acting on behalf of the bidder.
- 2 Guidance on the Calculation of Local Content together with Local Content Declaration Templates (Annex C, D and E) is accessible on http://www.thdti.gov.za/industrial_development/ip.jsp. Bidders should first complete Declaration D. After completing Declaration D, bidders should complete Declaration E and then consolidate the information on Declaration C. **Declaration C should be submitted with the bid documentation at the closing date and time of the bid in order to substantiate the declaration made in paragraph (c) below.** Declarations D and E should be kept by the bidders for verification purposes for a period of at least 5 years. The successful bidder is required to continuously update Declarations C, D and E with the actual values for the duration of the contract.

I, the undersigned, (full names), do hereby declare, in my capacity asof.....(name of bidder entity), the following:

- (a) The facts contained herein are within my own personal knowledge.
- (b) I have satisfied myself that:
 - (i) the goods/services/works to be delivered in terms of the above-specified bid comply with the minimum local content requirements as specified in the bid, and as measured in terms of SATS 1286:2011; and
- (c) The local content percentage (%) indicated below has been calculated using the formula given in clause 3 of SATS 1286:2011, the rates of exchange indicated in paragraph 4.1 above and the information contained in Declaration D and E which has been consolidated in Declaration C:

Bid price, excluding VAT (y)	R
Imported content (x), as calculated in terms of SATS 1286:2011	R
Stipulated minimum threshold for local content (paragraph 3 above) Two way radio terminal and associated equipment	60%
Local content %, as calculated in terms of SATS 1286:2011	

If the bid is for more than one product, the local content percentages for each product contained in Declaration C shall be used instead of the table above. The local content percentages for each product has been calculated using the formula given in clause 3 of SATS 1286:2011, the rates of exchange indicated in paragraph 4.1 above and the information contained in Declaration D and E.

- (d) I accept that the Procurement Authority / Institution has the right to request that the local content be verified in terms of the requirements of SATS 1286:2011.
- (e) I understand that the awarding of the bid is dependent on the accuracy of the information furnished in this application. I also understand that the submission of incorrect data, or data that are not verifiable as described in SATS 1286:2011, may result in the Procurement Authority / Institution imposing any or all of the remedies as provided for in Regulation 14 of the Preferential Procurement Regulations, 2017 promulgated under the Preferential Policy Framework Act (PPPFA), 2000 (Act No. 5 of 2000).

SIGNATURE: _____**DATE:** _____**WITNESS No. 1** _____**DATE:** _____**WITNESS No. 2** _____**DATE:** _____

ANNEXURE C: LOCAL CONTENT DECLARATION: SUMMARY SCHEDULE

													SATS 1286.2011	
Annex C														
Local Content Declaration - Summary Schedule														
(C1)	Tender No.	ERAC-EMU-33792-NN-110											Note: VAT to be excluded from all calculations	
(C2)	Tender description:	Supply and deliver Telecommunication radio equipment for Empangeni Depott												
(C3)	Designated product(s)	Content for two way radio terminals and associated equipment												
(C4)	Tender Authority:	Transnet Freight Rail												
(C5)	Tendering Entity name:													
(C6)	Tender Exchange Rate:	Pula		EU		GBP								
(C7)	Specified local content %	60%												
		Calculation of local content							Tender summary					
	Tender item no's	List of items	Tender price - each (excl VAT)	Exempted imported value	Tender value net of exempted imported content	Imported value	Local value	Local content % (per item)	Tender Qty	Total tender value	Total exempted imported content	Total Imported content		
	(C8)	(C9)	(C10)	(C11)	(C12)	(C13)	(C14)	(C15)	(C16)	(C17)	(C18)	(C19)		
	1	UHF, (440 – 480 MHz band) IPX5, Base station conventional radio operating at 12V, with 12.5 kHz channel spacing. As per Specifications BBD8635 version 8 dated 27 June 2014, and SPC-00851-rev 3.40												
	2	Programming software, Leads, Adaptors and technical manuals on CD.)												
									(C20) Total tender value R					
									(C21) Total Exempt imported content R					
									(C22) Total Tender value net of exempt imported content R					
									(C23) Total Imported content R					
									(C24) Total local content R					
									(C25) Average local content % of tender					
Date:														

Respondent's Signature

Date & Company Stamp

ANNEXURE D: IMPORTED CONTENT DECLARATION: SUPPORTING SCHEDULE TO ANNEXURE C

SATS 1286.2011												
Annex D												
Imported Content Declaration - Supporting Schedule to Annex C												
(D1)	Tender No.	ERAC-EMU-33792-NN-110						Note: VAT to be excluded from all calculations				
(D2)	Tender description:	Supply and deliver Telecommunication radio equipment for Empangeni Depot										
	Designated Products:	Content for two way radio terminals and associated equipment										
(D3)	Designated Products:	Local production and content for rail signalling system										
(D4)	Tender Authority:	Transnet Freight Rail										
(D5)	Tendering Entity name:											
(D6)	Tender Exchange Rate:	Pula		EU	R 9.00	GBP	R 12.00					
A. Exempted imported content				Calculation of imported content						Summary		
	Tender item no's	Description of imported content	Local supplier	Overseas Supplier	Foreign currency value as per Commercial Invoice	Tender Exchange Rate	Local value of imports	Freight costs to port of entry	All locally incurred landing costs & duties	Total landed cost excl VAT	Tender Qty	Exempted imported value
	(D7)	(D8)	(D9)	(D10)	(D11)	(D12)	(D13)	(D14)	(D15)	(D16)	(D17)	(D18)
										(D19) Total exempt imported value	R	
										This total must correspond with Annex C - C 21		
B. Imported directly by the Tenderer				Calculation of imported content						Summary		
	Tender item no's	Description of imported content	Unit of measure	Overseas Supplier	Foreign currency value as per Commercial Invoice	Tender Rate of Exchange	Local value of imports	Freight costs to port of entry	All locally incurred landing costs & duties	Total landed cost excl VAT	Tender Qty	Total imported value
	(D20)	(D21)	(D22)	(D23)	(D24)	(D25)	(D26)	(D27)	(D28)	(D29)	(D30)	(D31)
										(D32) Total imported value by tenderer	R	
C. Imported by a 3rd party and supplied to the Tenderer				Calculation of imported content						Summary		
	Description of imported content	Unit of measure	Local supplier	Overseas Supplier	Foreign currency value as per Commercial Invoice	Tender Rate of Exchange	Local value of imports	Freight costs to port of entry	All locally incurred landing costs & duties	Total landed cost excl VAT	Quantity imported	Total imported value
	(D33)	(D34)	(D35)	(D36)	(D37)	(D38)	(D39)	(D40)	(D41)	(D42)	(D43)	(D44)
										(D45) Total imported value by 3rd party	R	
D. Other foreign currency payments				Calculation of foreign currency payments						Summary of payments		
	Type of payment	Local supplier making the payment	Overseas beneficiary	Foreign currency value paid	Tender Rate of Exchange						Local value of payments	
	(D46)	(D47)	(D48)	(D49)	(D50)						(D51)	
										(D52) Total of foreign currency payments declared by tenderer and/or 3rd party		
										(D53) Total of imported content & foreign currency payments - (D32), (D45) & (D52) above	R	
										This total must correspond with Annex C - C 23		
Signature of tenderer from Annex B												
Date:												

Respondent's Signature

Date & Company Stamp

Annex E

(E1)	Tender No.	ERAC-EMU-33792-NN-110			Note: VAT to be excluded from all calculations
(E2)	Tender description:	Supply and deliver Telecommunication radio equipment for Empangeni Depot			
	Designated products:	Content for two way radio terminals and associated equipment			
(E4)	Tender Authority:	Transnet Freight Rail			
(E5)	Tendering Entity name:				

(E10)	Manpower costs	(Tenderer's manpower cost)				R
(E11)	Factory overheads	(Rental, depreciation & amortisation, utility costs, consumables etc.)				R
(E12)	Administration overheads and mark-up	(Marketing, insurance, financing, interest etc.)				R
					(E13) Total local content	R
					This total must correspond with Annex C	
					C24	

Date:

**ANNEXURE: G TECHNICAL SPECIFICATION AND METHODS OF MEASURES FOR ANGLE MODULATED
RADIO EQUIPMENT (BBD8635 VERSION 8.1)**

Respondent's Signature

Date & Company Stamp



TRANSNET
freight rail

A Division of Transnet Limited

INFRASTRUCTURE TELECOMS

STANDARD

TECHNICAL SPECIFICATION AND METHODS OF MEASUREMENT FOR ANGLE MODULATED RADIO EQUIPMENT

Author: Senior Engineering Technician
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Date: 27 June 2014

Circulation Restricted To:

Transnet Freight Rail
Transnet and Relevant Third Parties

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I Distribution

Once updated, a copy of the latest revision will be published in the document management system in use. An e-mail to this effect will be sent to the relevant personnel or heads of department.

II Document Change History

ISSUE NO.	DATE ISSUED	ISSUED BY	HISTORY DESCRIPTION
2.00	January 2004	Quality Assurance, Infrastructure	Revision
3.0	June 2006	QA	Convert to ISO Standard
3.1	June 2007	QA	Revision
4.0	July 2008	QA	Revision
5.0	February 2010	QA	New format & revision
6.0	August 2010	QA	New format & revision
6.1	November 2010	QA	Add measurement
6.2	August 2011	QA	Add information, definitions, supply standards & DC-DC Converter
7.0	January 2012	QA	Revision & add Trunking functional tests
8.0	May 2014	QA	Omit the difference between General and Shunt portables, revise the Loudspeaker sound pressure level & Transmitter microphone sensitivity.
8.1	June 2014	QA	Update clauses Numbers

III Changes Since Last Revision

CLAUSES	DESCRIPTION
IV	Add abbreviations
1.3.3.5	Change specification
1.11	Add trunking
2.4.2.3	Change graph
2.5	Add trunking functional tests
1.12	Omit the difference between General and Shunt portables, revise the Loudspeaker sound pressure level & Transmitter microphone sensitivity.

IV List of Abbreviations and Definitions

ABBREVIATIONS	DESCRIPTION
AC	Alternating Current
AF	Audio Frequency
BS	Base Station
CCITT	Consultative Committee for International Telephone and Telegraph (ITU-T)
CTCSS	Continuous Tone Coded Squelch System
dB	Decibel
dB(A)	Sound pressure A-weighted
dBc	Decibel relative to the carrier power
dBd	Decibel relative to a Dipole antenna
dBm	Decibel relative to 1 mW, impedance 50 Ω (power)
dBm	Decibel relative to 0.775 V _{pd} , impedance 600 Ω (audio frequency)
dB_{MUOP}	Decibel relative to the Maximum Useful Output Power
dB_{SOP}	Decibel relative to the Standard Output Power
DC	Direct Current
EMF	Electromotive Force
ERP	Effective Radiated Power
FFSK	Fast Frequency Shift Keying

FM	Frequency Modulation
GSM	Global System for Mobile communication
Hz	Hertz
ITU-T	International Telecommunication Union – Telecommunication Standardization Sector
kHz	Kilohertz
LBU	Line Branching Unit
LS	Loudspeaker
m	Metre
mA	Milliampere
MHz	Megahertz
mm	Millimetre
ms	Millisecond
mVp-p	Millivolt peak-to-peak
mW	Milliwatt
MUOP	Maximum Useful Output Power
pd	Potential Difference
PM	Phase Modulation
PSTN	Private Switching Telephone Network
RF	Radio Frequency
Rx	Radio receiver
SANS	South African National Standards
SINAD	Signal, Noise & Distortion to Noise & Distortion ratio
SOP	Standard Output Power
SPL	Sound Pressure Level
THD	Total Harmonic Distortion
TSC	Trunk Site Controller
Tx	Radio transmitter
V	Voltage
Vp-p	Voltage peak-to-peak
VSWR	Voltage Standing Wave Ratio
W	Wattage
WiFi	Wireless Fidelity
µV	Microvolt
%	Percentage

<u>DEFINITIONS</u>	<u>DESCRIPTION</u>
<u>GENERAL</u>	
Angle Modulation	A term used to encompass both frequency modulation and phase modulation.
Decibel	The decibel is 1/10 of a Bel. Decibel is the logarithm of the ratio between a measured quantity and an agreed reference level.
dBc	The absolute power in decibel with reference to the carrier power.
dBm	The absolute power in decibel with reference to 1 mW.
Land Mobile Radio Services	Radio communication from fixed radio stations to mobile radio stations carried in surface vehicles or portable radio stations, and between mobile and portable radio stations.

DEFINITIONS	DESCRIPTION
Portable Radio Station	A radio station designed to be carried by or on a person.
Mobile Radio Station	A radio station designed for installation in a surface vehicle and capable of operating while the vehicle is in motion and while it is stationary.
Fixed Radio Station	It is a fixed radio station installed in an office or control room, fitted with an external antenna.
Base Station	A radio station designed to be installed in a fixed location and performing the function of a repeater/enhancer.

RADIO RECEIVER

Adjacent Channel Selectivity and Desensitization Ratio	A measure of the ability of a radio receiver to receive the modulated standard input signal in the presence of modulated signals that differ in frequency from the standard input signal frequency by the spacing of one channel.
Amplitude Characteristics	The relationship between the radio frequency input level of a specified modulated signal and the audio frequency level at a radio receiver output.
Attack Time	The time required to produce an audio output level of $-0.5 \text{ dB}_{\text{SOP}}$ after application of a RF signal level, 12 dB above usable sensitivity, modulated with standard test modulation.
Audio Frequency Response	The relationship between the modulation factor of a received signal and the audio output level of the demodulated signal at various audio frequencies.
Audio Frequency Total Harmonic Distortion	The change in harmonic content of an audio signal as a result of its passing through the audio frequency and radio frequency circuits of a radio.
Blocking or Desensitisation	A reduction in the wanted audio output power of a radio receiver, or a reduction in the SINAD ratio, owing to an unwanted signal on another frequency.
Co-channel Rejection Ratio	A measure of the capability of a radio receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal, both signals being at the nominal frequency of the receiver.
Conducted Spurious Radiation	It is radiation components at any frequency generated by a radio receiver and radiated by the radio's antenna.
Desensitisation	Is a condition where off-channel transmitting energy passes through the front-end of the radio receiver, causing a reduction in receiver gain.
High RF Signal Level Interference	A measure of the ability of a radio receiver to oppose high RF signal levels at frequencies other than the normal frequency of the receiver.
Intermodulation Spurious Response Attenuation/Rejection	The ability of a radio receiver to receive a modulated standard input signal, in the presence of two interfering signals of which the carrier frequencies are so separated from the standard input signal frequency and from each other that n 'th order mixing of the two undesired signals can occur in the non-linear elements of the receiver, producing a third signal whose frequency is equal to that of the standard input signal frequency, or intermediate frequency.
Maximum Useful Output Power	The greatest average audio output power supplied to the rated load, which power does not exceed 10 % of the total harmonic distortion.
Modulation Acceptance Bandwidth	The selectivity characteristic of an angle modulated radio receiver that limits the maximum permissible modulation deviation of the radio frequency input signal that a receiver can accept, without degradation of the 12 dB SINAD ratio, when the radio frequency input signal is 6 dB greater than the usable sensitivity level.
Modulation Factor	The ratio of the maximum positive or negative peak variation of the modulating variable, to the maximum rated system-modulating variable, expressed as a

DEFINITIONS	DESCRIPTION
	percentage.
Signal, Noise & Distortion to Noise & Distortion Ratio	The ratio, expressed in decibels of the signal power, plus noise power, plus distortion power, to noise power plus distortion power produced at the output of a radio receiver resulting from a modulated signal input.
Signal to Hum and Noise Ratio	The ratio of residual receiver audio output power to standard output power.
Spurious Response Attenuation/ Rejection	A measure of the ability of a radio receiver to discriminate between the standard input signal frequency and an undesired signal at any other frequency to which it is also responsive, excluding the two adjacent channels.
Squelch Closing Time	The period of time between the removal of the RF signal and the squelch closure.
Squelch Operating Threshold	The RF signal input level, modulated with standard test modulation, at which the squelch opens and closes.
Standard Output Power	An audio output level 3 dB below maximum useful output power used to define a reference level for test purposes.
Usable Sensitivity	The minimum radio frequency input signal level modulated with standard test modulation that will produce, at a radio receiver, a SINAD ratio of at least 12 dB and an audio output signal power of at least $-3 \text{ dB}_{\text{SOP}}$.
RADIO TRANSMITTER	
Adjacent Channel Power	The part of the total power output of a radio transmitter that, under defined conditions of modulation, falls within a specified bandwidth centred on the normal frequency of either of the adjacent channels.
Amplitude Modulation Hum & Noise Level	A measure of the unwanted amplitude modulation of a carrier resulting from hum and noise.
Angle Modulation Hum & Noise Ratio	The ratio of residual angle modulation to standard test modulation.
Audio Frequency Response	The relationship between the modulation factor of a transmitted signal and the input level of the modulating signal at various audio frequencies.
Audio Frequency Total Harmonic Distortion	The change in harmonic content of an audio signal as a result of its passing through the audio frequency and radio frequency circuits of a radio.
Carrier Attack Time	The time required, changing the state of a radio transmitter from standby to a state where the unmodulated carrier voltage level reaches a value 6 dB below the steady state.
Carrier Frequency Error	Is the difference between the measured unmodulated carrier frequency from the assigned frequency.
Carrier Power	The mean power available at the output terminal of a radio transmitter in the absence of modulation.
Conducted Spurious Emissions	Emissions at the antenna terminal of a radio transmitter on a frequency or frequencies that are outside the channel on which the transmitter is operating.
Extreme Transmitter Loads	Conditions under which the radio transmitter operates into an open circuit or short circuit.
Intermodulation Attenuation	The ability of a radio transmitter to attenuate signals generated in its non-linear elements by the presence of the carrier and a parasitic signal arriving at the transmitter through its antenna.
Microphone sensitivity	It is the amount of modulation that the radio transmitter produces when a specified audio signal level is present at the microphone.

<u>DEFINITIONS</u>	<u>DESCRIPTION</u>
Mismatch between Transmitter and Antenna System	A condition in which the impedance as presented to the radio transmitter by the transmission line and antenna is not the same as the designed system impedance.
Modulation Limiting (Tx deviation)	A measure of the ability of radio transmitter circuits to prevent a transmitter from producing modulation such that the modulation factor exceeds the maximum rated system modulation factor.

TALK THROUGH SIGNAL

Modulation Factor Linearity	The relationship between the modulation factor of a received signal and the transmitted modulation factor.
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FILTERS

Duplexer/Combiner	Is a filter system providing RF isolation to allow the sharing of a single antenna for both transmission and reception.
Insertion Loss	It is the amount of loss to a signal passing through a filter at a designated frequency.
Receiver Isolation at Transmitter Frequencies	It is the ability of the duplexer/combiner to suppress the transmitter carrier power at the receiver port. It is also called the selectivity of the duplexer/combiner.

ANTENNAS

Effective Radiated Power	It is the mean power radiated by the antenna in the direction of maximum radiation.
dBd	The power gain of an antenna in decibel with reference to a Dipole antenna.

TRUNK CONTROL SIGNAL

Fast Frequency Shift Keying	Bit 0 = 1.8 kHz Bit 1 = 1.2 kHz
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AUDIO LINE BRANCHING UNIT

Common-mode Rejection Ratio	Is the ratio of the differential gain over the common-mode gain.
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POWER SUPPLY UNIT, DC-DC CONVERTER AND BATTERY CHARGER

Noise Voltage	Is irregular amplitude voltages superimposed on the output DC voltage line.
Output Voltage Regulation	It is the ability of a power supply device to keep the output voltage constant over a range of applied loads.
Ripple Voltage	Is AC voltage superimposed on the output DC voltage line.
Variac	A device that supply a variable AC voltage from 0 V to 260 V.

ACOUSTIC

A-weighted	It is a network that weights an audio signal in a manner, which approximates to an inverted equal loudness contour (it approximates the human ear's response to sound).
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<u>DEFINITIONS</u>	<u>DESCRIPTION</u>
Sound Pressure	It is the force (N) of sound on a surface area (m^2) perpendicular to the direction of the sound. SPL is express as N/m^2 or Pascal (Pa).

1. TECHNICAL SPECIFICATION

Where not specifically indicated, this specification only applies for open channel and Trunked radio systems.

1.1 Radio Receiver: 12.5 kHz channel spacing; operating frequency band 450 MHz to 470 MHz.

1.1.1 Normal condition (see clause 2.1.1)

	Characteristics	Portable	Mobile & Fixed Radio Station	Base Station (Repeater)
1.1.1.1	Maximum Useful Audio Output Power	Maximum power not exceeding 10 % THD.		
1.1.1.2	Audio Frequency THD at Low Output Power Level 500 Hz & 1.0 kHz	≤ 5 %	≤ 2 %	≤ 2 %
1.1.1.3	Usable Sensitivity	≤ -115 dBm		
1.1.1.4	Squelch Operating Threshold Open Close	- 115 dBm minimum ≤ 3 dB lower than the opening threshold		See clause 1.3.1.1 ≤ 3 dB lower than the opening threshold
1.1.1.5	Attack Time	≤ 150 ms		
1.1.1.6	Squelch Closing Time	≤ 250 ms		
1.1.1.7	Modulation Acceptance Bandwidth	≥ 3.75 kHz		
1.1.1.8	Adjacent Channel Selectivity and Desensitization Ratio	≥ 60 dB	≥ 65 dB	≥ 70 dB
1.1.1.9	Spurious Response Attenuation/Rejection	≥ 70 dB	≥ 75 dB	≥ 75 dB
1.1.1.10	Intermodulation Spurious Response Attenuation/Rejection	≥ 65 dB	≥ 65 dB	≥ 70 dB
1.1.1.11	Co-channel Rejection Ratio	≤ 12 dB		
1.1.1.12	Blocking	≥ 84 dB		
1.1.1.13	Conducted Spurious Radiation	≤ - 57 dBm		
1.1.1.14	Audio Frequency Response (6 dB/octave) 300 to 900 Hz 1.1 to 2.5 kHz 3.0 kHz	+ 1 dB to - 3 dB + 1 dB to - 3 dB + 1 dB to - 4.5 dB		
1.1.1.15	Signal to Hum and Noise Ratio Squelched Unsquelched	≥ 60 dB ≥ 39 dB		
1.1.1.16	Amplitude Characteristics	≤ 3 dB		

1.1.2 Extreme conditions (see clause 2.1.2)

	Characteristics	Portable	Mobile & Fixed Radio Station	Base Station (Repeater)
1.1.2.1	Power Supply			
1.1.2.1.1	Usable Sensitivity variation	$\leq \pm 3$ dB		
1.1.2.1.2	Adjacent Channel Selectivity and Desensitisation Ratio	≥ 60 dB	≥ 65 dB	≥ 70 dB
1.1.2.2	Temperature			
1.1.2.2.1	Usable Sensitivity variation	$\leq \pm 3$ dB		
1.1.2.2.2	Adjacent Channel Selectivity and Desensitisation Ratio	≥ 60 dB	≥ 65 dB	≥ 70 dB
1.1.2.3	Selectivity at High RF Signal Level			
1.1.2.3.1	Input signal level	- 47 dBm to - 7 dBm		

1.2 Radio Transmitter: 12.5 kHz channel spacing; operating frequency band 450 MHz to 470 MHz.

1.2.1 Normal condition (see clause 2.1.1)

	Characteristics	Portable	Mobile & Fixed Radio Station	Base Station (Repeater)
1.2.1.1	Carrier Power (conducted)	$\leq \pm 1$ dB from manufacturer's claim		
1.2.1.2	Conducted Spurious Emissions Operating Standby	≤ -36 dBm ≤ -57 dBm		
1.2.1.3	Carrier Frequency Error	≤ 1.5 kHz	≤ 1.5 kHz	≤ 1.0 kHz
1.2.1.4	Carrier Attack Time	≤ 100 ms		
1.2.1.5	Adjacent Channel Power	≤ -60 dBc	≤ -70 dBc	≤ -70 dBc
	Or	- 37 dBm maximum.		
1.2.1.6	Intermodulation Attenuation	n.a.	n.a.	≥ 40 dB
1.2.1.7	Modulation Limiting (Tx Deviation) Modulating freq. 0.3 to 2.55 kHz 3 to 6 kHz 6 to 12.5 kHz	2.5 kHz maximum 0.75 kHz maximum at 6 kHz - 14 dB/octave		
1.2.1.8	CTCSS Deviation	250 Hz		
1.2.1.9	Audio Frequency THD 500 Hz 1.0 kHz	≤ 5 %	≤ 2 %	≤ 2 %

	Characteristics	Portable	Mobile & Fixed Radio Station	Base Station (Repeater)
1.2.1.10	Audio Frequency Response (6 dB/octave) 300 to 900 Hz 1.1 to 2.5 kHz 3.0 kHz	+ 3 dB to - 1 dB + 3 dB to - 1 dB + 4.5 dB to - 1 dB		
1.2.1.11	Angle Modulation Hum & Noise Ratio	≥ 34 dB		
1.2.1.12	Amplitude Modulation Hum & Noise Level	≤ -34 dB		

1.2.2 Extreme conditions (see clause 2.1.2)

	Characteristics	Portable	Mobile & Fixed Radio Station	Base Station (Repeater)
1.2.2.1	Power Supply			
1.2.2.1.1	Carrier Power Variation	$\leq \pm 2$ dB		
1.2.2.1.2	Conducted Spurious Emissions Operating Standby	≤ -36 dBm ≤ -57 dBm		
1.2.2.1.3	Carrier Frequency Error	≤ 1.5 kHz	≤ 1.5 kHz	≤ 1.0 kHz
1.2.2.2	Temperature			
1.2.2.2.1	Carrier Power Variation	$\leq \pm 2$ dB		
1.2.2.2.2	Conducted Spurious Emissions Operating Standby	≤ -36 dBm ≤ -57 dBm		
1.2.2.2.3	Carrier Frequency Error	≤ 1.5 kHz	≤ 1.5 kHz	≤ 1.0 kHz
1.2.2.3	Antenna Terminal Loads			
1.2.2.3.1	Short Circuit and Open Circuit Carrier Power Variation	$\leq \pm 1$ dB		

1.3 Radio Base Station (Repeater): 12.5 kHz channel spacing; operating frequency band 450 MHz to 470 MHz.

The receiver and transmitter specifications are referred to in clauses 1.1 and 1.2 respectively.

1.3.1 Receiver

Characteristics	Base Station (Repeater)
Squelch operating threshold calculation Open Close	– 115 dBm minus coaxial cable loss minus duplexer loss plus antenna gain. ≤ 3 dB lower than the opening threshold

1.3.2 Receiver and transmitter

Characteristics	Base Station (Repeater)
Response time	≤ 300 ms

1.3.3 Talk Through Signal

Characteristics	Base Station (Repeater)
Audio input and output terminals Impedance Return Loss	600 Ω balanced ≤ – 25 dB
Audio Levels RTO & Trunking (local & intersite) Old Trunking Teletra system	– 10 dBm $\pm$ 0.5 dBm – 4 dBm $\pm$ 0.7 dBm
Audio Frequency Response (With de-emphasis and pre-emphasis) Modulating frequency 300 to 900 Hz 1.1 to 3.0 kHz	$\pm$ 3.0 dB $\pm$ 3.0 dB
Audio Frequency Response (Without de-emphasis and pre-emphasis) Modulating frequency 300 to 900 Hz 1.1 to 3.0 kHz	$\pm$ 2.0 dB $\pm$ 2.0 dB
Modulation Factor Linearity Modulation 0.5 kHz 1.0 kHz 1.5 kHz 2.0 kHz 2.5 kHz	0.5 kHz $\pm$ 100 Hz 1.0 kHz $\pm$ 100 Hz 1.5 kHz $\pm$ 100 Hz 2.0 kHz $\pm$ 100 Hz 2.5 kHz – 250 Hz (not to exceed 2.5 kHz)
Audio Frequency THD	≤ 5 %

1.4 Filters

1.4.1 Duplexer (Radio Train Order)

	Characteristics	Base Station (Repeater)
1.4.1.1	Insertion Loss (Tx & Rx)	≤ 1.2 dB
1.4.1.2	Rx Isolation at Tx Frequencies	≥ 65 dB (operating band) ≥ 80 dB (single channel)
1.4.1.3	Impedance Matching, 50 Ω (all ports)	VSWR $\leq 1.5:1$ Return Loss ≤ -14 dB
1.4.1.4	* Operating Frequency Band Receiver Transmitter	465.0500 MHz to 465.9875 MHz 455.0500 MHz to 455.9875 MHz

* Duplexer for link operation is channelized.

1.4.2 Combiner (Trunked)

	Characteristics	Base Station (Repeater)
1.4.2.1	Insertion Loss - Receiver path	0 dB $\pm$ 0.5 dB
1.4.2.2	Insertion Loss - Transmit path	≤ 10 dB
1.4.2.3	Rx Isolation at Tx Frequencies	≥ 85 dB
1.4.2.4	Isolation between Rx ports	≥ 20 dB
1.4.2.5	Isolation between Tx ports	≥ 60 dB
1.4.2.6	Impedance Matching, 50 Ω (all ports)	VSWR $\leq 1.5:1$ Return Loss ≤ -14 dB
1.4.2.7	Operating Frequency Band Receiver Transmitter	465.0000 MHz to 466.6375 MHz 455.0000 MHz to 456.6375 MHz

1.5 Coaxial Cable

	Characteristics	Mobile & Fixed Radio Station	Base Station (Repeater)
1.5.1	Impedance	50 Ω	
1.5.2	Impedance matching	VSWR $\leq 1.5:1$ Return Loss ≤ -14 dB	
1.5.3	Insertion loss	≤ 1 dB	≤ 5 dB

1.6 Antenna

	Characteristics	Various
1.6.1	Impedance	50 Ω
1.6.2	Impedance matching VHF & UHF GSM & WiFi	VSWR $\leq 1.5:1$ Return Loss ≤ -14 dB VSWR $\leq 2.0:1$ Return Loss ≤ -9.54 dB

Characteristics	Various
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1.6.3	* Antenna gain Mobile Fixed station Radio link: Point to point Point to multipoint Base station	0 dBd ≤ 12 dBd 9 dBd minimum Not specified ≤ 12 dBd
1.6.4	# Antenna vertical separation	$\geq 4 \lambda$
1.6.5	* Antenna height above ground level Mobile & Fixed station Radio link: Point to point Point to multipoint Base station	10 m maximum 20 m maximum 20 m maximum 20 m maximum

Based on 20 W ERP and antennae having a Dipole as a live element. Distance measured from centre to centre of dipoles.

* Licence conditions

1.7 Transmitting Power

	Characteristics	Various
1.7.1	* Conducted power at transmitter terminal Radio link: Point to point Point to multipoint	1 W maximum 1 W maximum
1.7.2	* Effective Radiated Power (ERP) Mobile & Fixed station Radio link: Point to point Point to multipoint Base station	20 W maximum 8.2 W maximum 8.2 W maximum 20 W maximum

* Licence conditions

1.8 Receiver Desensing

	Characteristics	Various
1.8.1	Desensing	≤ 1 dB
1.8.2	Desensing at high receiving signal level (radio links only) ≥ -100 dBm	≤ 20 dB

1.9 Audio Line Branching Unit

	Characteristics	Base Station (Repeater)
1.9.1	Audio input and output terminals Impedance Return Loss	600 Ω balanced ≤ -25 dB
1.9.2	Input and output audio signal level	-10 dBm ± 0.5 dB
1.9.3	Audio frequency response 300 Hz to 3 kHz	± 0.5 dB
1.9.4	Audio total harmonic distortion (THD)	≤ 0.5 %
1.9.5	Audio signal to hum and noise ratio	≥ 70 dB
1.9.6	Channel cross talk	≥ 60 dB
1.9.7	Common-mode rejection ratio	≥ 60 dB at 1 kHz
1.9.8	E-signal	Up to 50 V DC, 10 mA Opto coupler

	Characteristics	Base Station (Repeater)
		Bi-directional polarity
1.9.9	M-signal	Up to 50 V DC, 10 mA Voltage free contact

1.10 Power Supply Unit, DC-DC Converter and Battery Charger

	Characteristics	Various
1.10.1	Operating conditions Temperature range Relative humidity	– 10 °C to 60 °C Up to 85 %
1.10.2	Input power AC Voltage Frequency DC Voltage	220 V AC $\pm$ 10 % 50 Hz $\pm$ 2 % Nominal $\pm$ 10 %
1.10.3	Output voltage regulation (Intermittent & continuous)	13.8 V $\pm$ 5 % (12 V system) 27.6 V $\pm$ 5 % (24 V system) 55.2 V $\pm$ 5 % (48 V system)
1.10.4	Efficiency	$\geq$ 70 %
1.10.5	Output voltage ripple & noise	$\leq$ 200 mVp-p (12 V system) $\leq$ 400 mVp-p (24 V system) $\leq$ 800 mVp-p (48 V system)
1.10.6	Radiation of spurious frequencies	$\leq$ – 119 dBm in radio operating band
1.10.7	Desensing of receiver	$\leq$ 1 dB
1.10.8	Load shedding (when required) Shed Restore	11.0 V (12 V system) 22.0 V (24 V system) 44.0 V (48 V system) 13.0 V (12 V system) 26.0 V (24 V system) 52.0 V (48 V system)

1.11 Trunking

1.11.1 Functional Tests

	Characteristics	Various
1.11.1.1	Registration	Register on instrument Register on trunk system
1.11.1.2	Local call to radio with the same prefix number	Establish call to instrument Establish call through the trunk system
1.11.1.3	Local call to radio with an interprefix number	Establish call to instrument Establish call through the trunk system
1.11.1.4	Local call to radio with the same prefix number using short form dialling	Establish call to instrument Establish call through the trunk system
1.11.1.5	Intersite call to radio with the same prefix number	Establish call through the trunk system
1.11.1.6	Intersite call to radio with an interprefix number	Establish call through the trunk system
1.11.1.7	Intersite call to radio with the same prefix number using short form dialling	Establish call through the trunk system

1.11.1.8	PSTN call	Establish call to instrument Establish call through the trunk system
1.11.1.9	Call the radio under test	Establish call from instrument Establish call through the trunk system
1.11.1.10	Handoff	Reregister on new control channel with Instrument Reregister on new control channel on the trunk system

1.11.2 Control Signal - Trunk Site Controller

	Characteristics	Base Station (Repeater)
1.11.2.1	FFSK level from TSC	1 Vp-p $\pm$ 0.2 Vp-p
1.11.2.2	FFSK frequency from TSC	1.2 kHz $\pm$ 100 Hz 1.8 kHz $\pm$ 100 Hz
1.11.2.3	Tx deviation at FFSK level For channel dragging problem	1.5 kHz $\pm$ 100 Hz 800 Hz $\pm$ 100 Hz
1.11.2.4	FFSK level from Rx measured at TSC (Modulation 1.5 kHz) (Modulating frequency 1.2 kHz)	1 Vp-p $\pm$ 0.2 Vp-p

1.12 Acoustical measurements

	Characteristics	Portable
1.12.1	Receiver	
	Loudspeaker sound pressure level	$\geq$ 84 dB(A) at 300 mm
1.12.2	Transmitter	
	Transmitter deviation	Between 300 and 500 Hz from a SPL of 80 dB(A) at the microphone

1.13 Co-channel Interference

	Characteristics	Various
1.13.1	Speech	
	Level difference between signals	$\geq$ 15 dB
1.13.2	Data (FFSK)	
	Level difference between signals	$\geq$ 20 dB

2. METHODS OF MEASUREMENT

Applied Standard

2.1 Normal condition

Temperature	: 23 °C ± 3 °C
Relative Humidity	: 45 to 85 %
Lead acid battery	: 2.3 V per cell
Lithium-ion battery	: 3.6 V per cell
Nickel cadmium	: 1.2 V per cell
Nickel Metal Hydrate battery	: 1.2 V per cell
Mains	: 220 V AC 50 Hz

2.2 Extreme conditions

Temperature	: - 10 °C and 60 °C
Relative humidity	: 45 to 95 %
Lead acid battery	: 1.8 V minimum & 2.6 V maximum per cell
Lithium-ion battery	: 3.0 V minimum & 4.2 V maximum per cell
Nickel Cadmium battery	: 1.0 V minimum & 1.5 V maximum per cell
Nickel Metal Hydrate battery	: 1.0 V minimum & 1.5 V maximum per cell
Mains	: 220 V AC ± 10 % 50 Hz ± 2 %

Power Supply Systems

12 V system	: Minimum 11.0 V	Nominal 13.8 V	Maximum 15.6 V
24 V system	: Minimum 22.0 V	Nominal 27.6 V	Maximum 31.2 V
48 V system	: Minimum 44.0 V	Nominal 55.2 V	Maximum 62.4 V

2.3 Warm up time

As specified by the manufacturer.

2.4 Temperature stabilising period

One hour minimum.

2.5 Power source tolerance

≤ ± 3 %.

2.6 Standard RF Test Signal

2.6.1 Standard test modulation

Modulating frequency	: 1.0 kHz.
Modulation	: 1.5 kHz (60 % of maximum rated system deviation).

2.6.2 Standard RF Signal Input Level

– 60 dBm (223.6 μ V_{pd} or 447.2 μ V_{EMF}).

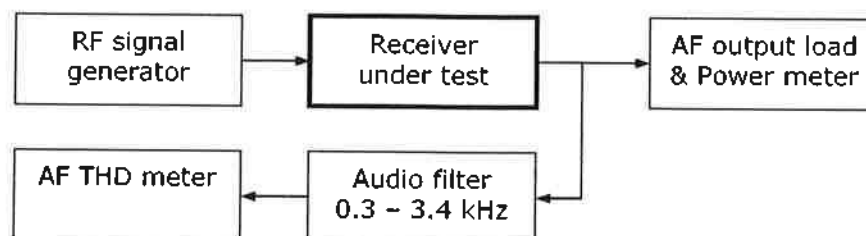
2.7 Audio Output Level

SOP = – 3 dB_{MUOP}.

2.2 Radio Receiver

2.2.1 Maximum Useful Output Power

Connect the equipment as shown below.



2.2.1.1 Inject a standard RF test signal from the RF signal generator.

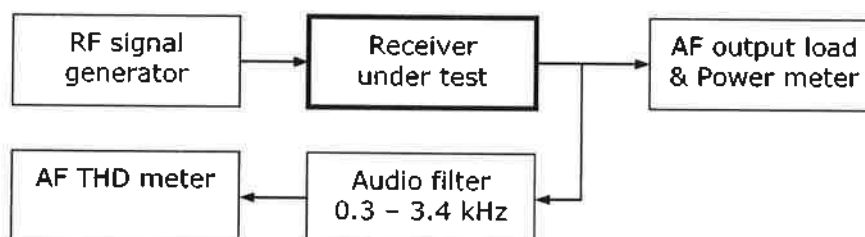
2.2.1.2 Adjust the volume control of the radio until the THD is 10 % or the volume control reaches its maximum travel, whichever occurs first.

2.2.1.3 Measure the audio output power (MUOP).

Note: The impedance of the AF output load must be the same value as the load (loudspeaker) with which the receiver normally operates.

2.2.2 Audio frequency total harmonic distortion

Connect the equipment as shown below.



2.2.2.1 Standard measurement

2.2.2.1.1 Test 1.

2.2.2.1.1.1 Inject a standard RF test signal from the RF signal generator into the receiver.

2.2.2.1.1.2 Adjust the volume control of the radio to obtain SOP.

2.2.2.1.1.3 Measure the THD.

2.2.2.1.2 Test 2.

2.2.2.1.2.1 Change the modulating frequency to 500 Hz using the same modulation factor as in test 1, except that in the case of PM receivers, the modulation factor should be reduced by 50 %.

2.2.2.1.2.2 Repeat the procedure given in test 1.

2.2.2.1.2.3 Measure the THD.

2.2.2.2 600 Ω balanced line

Where a 600 Ω balanced line is provided, the THD must be measured on this line.

2.2.2.2.1 Inject a standard RF test signal from the RF signal generator into the receiver.

2.2.2.2.2 Load the line with a 600 Ω resistive load or equivalent impedance, provided by the measuring instrument.

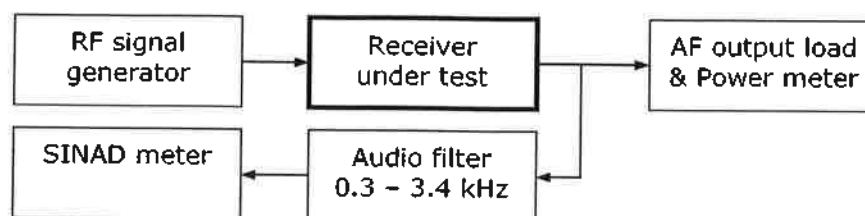
2.2.2.2.3 Adjust the audio signal level to measure -10 dBm on the line.

2.2.2.2.4 Measure the THD.

2.2.2.2.5 Repeat the THD measurement when applying test 2.

2.2.3 Usable sensitivity

Connect the equipment as shown below.

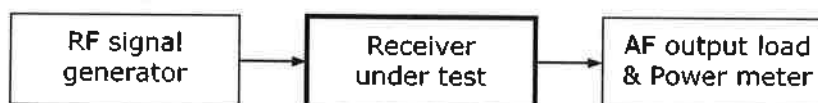


- 2.2.3.1 Adjust the RF signal generator to produce a standard RF input signal level.
- 2.2.3.2 Adjust the volume control of the radio to obtain SOP.
- 2.2.3.3 Reduce the RF signal level until the SINAD ratio is 12 dB.
- 2.2.3.4 Without readjustment of the volume control check whether the audio output level is less than $-3 \text{ dB}_{\text{SOP}}$.
- 2.2.3.5 If the audio output is less than $-3 \text{ dB}_{\text{SOP}}$, increase the RF signal level until $-3 \text{ dB}_{\text{SOP}}$ is obtained.
- 2.2.3.6 Take the RF signal output level from the signal generator at this setting as the usable sensitivity.
- 2.2.3.7 The measurement shall be made under the extreme test conditions as well.
Under the extreme test conditions, the receiver audio output power shall be within $\pm 3 \text{ dB}$ of the value obtained under normal test condition.

Note: The impedance of the AF output load must be the same value as the load (loudspeaker) with which the receiver normally operates.

2.2.4 Squelch operating threshold

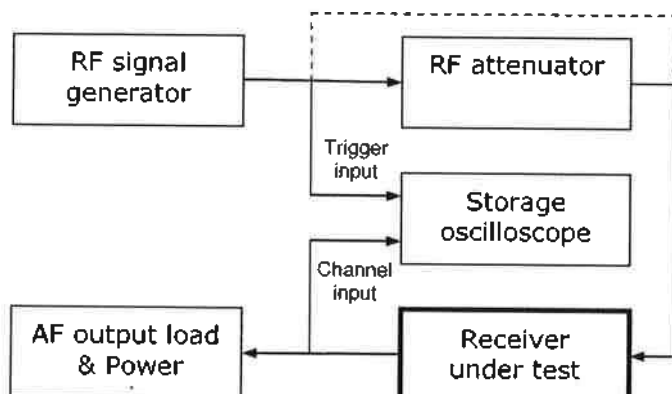
Connect the equipment as shown below.



- 2.2.4.1 Apply a standard RF test signal to the receiver under test and adjust the volume control of the radio to obtain SOP.
- 2.2.4.2 Reduce the RF signal level **slowly** until the squelch closes and record this RF signal level as the squelch closing level in dBm.
- 2.2.4.3 Increase the RF signal level **slowly** until the squelch opens and record this RF signal level as the squelch opening level in dBm.

2.2.5 Attack time

Connect the equipment as shown below.

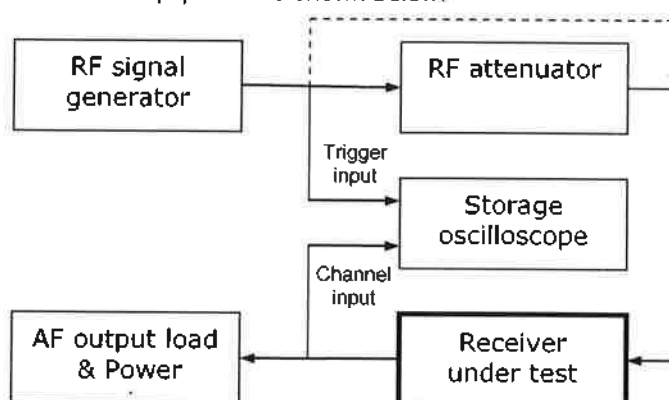


- 2.2.5.1 Apply a standard RF test signal to the receiver under test.

- 2.2.5.2 Adjust the volume control of the radio to obtain SOP.
- 2.2.5.3 Determine the usable sensitivity as described in clause 2.2.3.
- 2.2.5.4 Adjust the squelch to open at a RF signal level of -115 dBm, measured at the antenna terminal.
- 2.2.5.5 Set the RF signal level from the signal generator to 0 dBm.
- 2.2.5.6 Set the value of the RF attenuator to decrease the signal level to 12 dB above the usable sensitivity level, measured at the antenna terminal and switch the output of the signal generator off.
- 2.2.5.7 Set the storage oscilloscope to single sweep operation.
- 2.2.5.8 Switch the RF output on and measure the time required for the audio output to reach -0.5 dB_{SOP}.
- 2.2.5.9 Repeat the measurement three times and take the average of the three measurements as the receiver attack time.

2.2.6 Squelch Closing Time

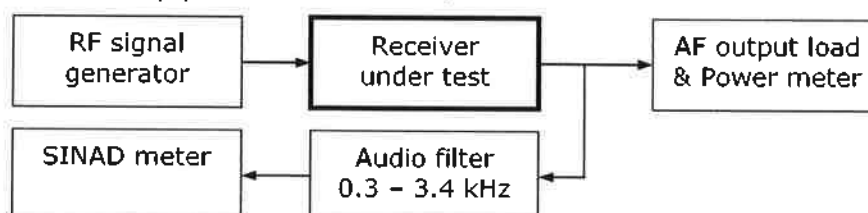
Connect the equipment as shown below.



- 2.2.6.1 Apply a standard RF test signal to the receiver under test.
- 2.2.6.2 Adjust the volume control of the radio to obtain SOP.
- 2.2.6.3 Determine the usable sensitivity as described in clause 2.2.3.
- 2.2.6.4 Adjust the squelch to open at a RF signal level of -115 dBm, measured at the antenna terminal.
- 2.2.6.5 Set the RF signal level from the signal generator to 0 dBm.
- 2.2.6.6 Set the value of the RF attenuator to decrease the signal level to 12 dB above the usable sensitivity level, measured at the antenna terminal.
- 2.2.6.7 Set the storage oscilloscope to single sweep operation.
- 2.2.6.8 Switch the output of the signal generator off and measure the time required for the audio output to be reduced by 10 dB from the SOP value.
- 2.2.6.9 Repeat the measurement three times and take the average of the three measurements as the squelch closing time.

2.2.7 Modulation acceptance bandwidth

Connect the equipment as shown below.

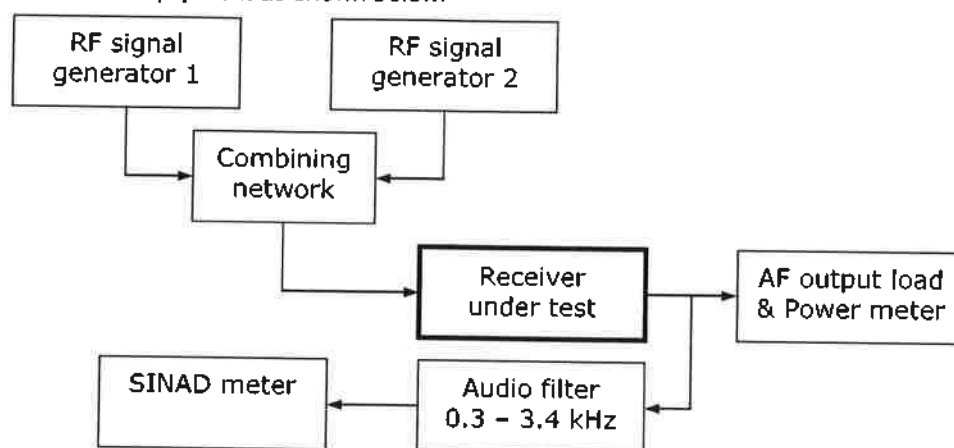


- 2.2.7.1 Apply a standard RF test signal to the receiver under test.
- 2.2.7.2 Adjust the receiver volume control to obtain SOP.

- 2.2.7.3 Reduce the RF signal level until the SINAD ratio is 12 dB.
- 2.2.7.4 Increase the RF signal level by 6 dB.
- 2.2.7.5 Increase the modulation factor until the SINAD ratio is again 12 dB.
- 2.2.7.6 Record this value of the modulation factor as the modulation acceptance bandwidth.

2.2.8 Adjacent channel selectivity and desensitization ratio

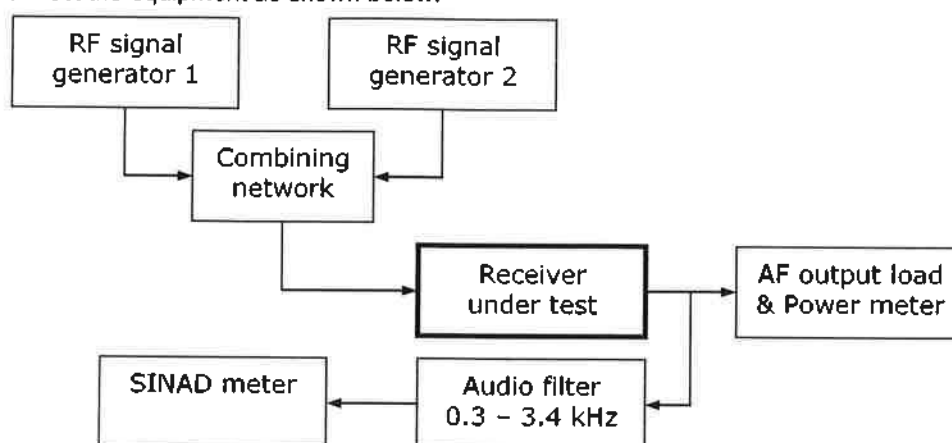
Connect the equipment as shown below.



- 2.2.8.1 Switch the RF signal output of signal generator 2 off.
- 2.2.8.2 RF signal generator 1:
 - 2.2.8.2.1 Apply a standard RF test signal to the receiver under test.
 - 2.2.8.2.2 Adjust the volume control of the radio to obtain SOP.
 - 2.2.8.2.3 Reduce the RF signal until the SINAD ratio is 12 dB (wanted signal).
 - 2.2.8.2.4 Note this RF signal level.
- 2.2.8.3 RF signal generator 2:
 - 2.2.8.3.1 Switch the RF signal output on (unwanted signal).
 - 2.2.8.3.2 Modulate the RF signal with 400 Hz at the standard modulation factor.
 - 2.2.8.3.3 Set the frequency (unwanted signal) to a frequency one-channel width above the assigned frequency (wanted signal).
 - 2.2.8.3.4 Adjust the RF signal level such that the SINAD ratio is degraded to 6 dB.
 - 2.2.8.3.5 Note this RF signal level.
 - 2.2.8.3.6 Repeat for the unwanted signal set to a frequency one-channel width below the assigned frequency.
- 2.2.8.4 Calculate the difference between the unwanted and wanted signal levels in dB, as the adjacent channel selectivity and desensitization ratio.
- 2.2.8.5 Take the worst case of the two measurements as the result.
- 2.2.8.6 The measurements shall be made under the extreme test conditions as well.

2.2.9 Spurious response attenuation/rejection

Connect the equipment as shown below.



2.2.9.1 Switch the RF signal output of signal generator 2 off.

2.2.9.2 RF signal generator 1:

2.2.9.2.1 Adjust the RF signal generator to produce a standard RF test signal.

2.2.9.2.2 Adjust the volume control of the radio to obtain SOP.

2.2.9.2.3 Reduce the RF signal to the receiver until the SINAD ratio is 12 dB.

2.2.9.3 RF signal generator 2:

2.2.9.3.1 Switch the RF signal output on and adjust the signal level to 80 dB (portable) or 85 dB (mobile and base) higher than that of signal generator 1.

2.2.9.3.2 Modulate the RF signal with 400 Hz at standard modulation factor.

2.2.9.3.3 Slowly sweep the carrier frequency over the range 100 kHz to 1 GHz in 12.5 kHz steps (channels) excluding the assigned channel and the two adjacent channels.

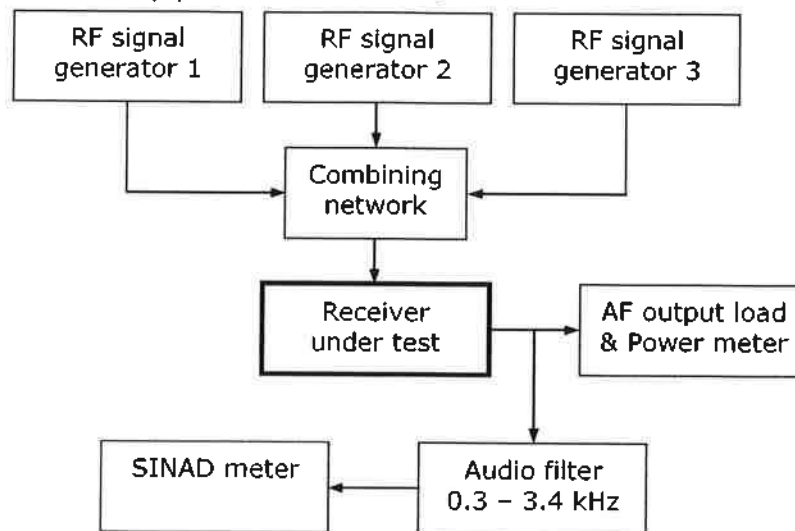
2.2.9.3.4 When the receiver is responsive to a spurious signal, adjust the RF signal level until the SINAD ratio is 6 dB.

2.2.9.4 Note the frequency and the RF signal levels of the two signal generators and take the difference between the two levels expressed in dB as the measure of the spurious response attenuation at that frequency.

Note: Ensure that the measured response is not caused by spurious signals from the RF signal generators or Intermodulation products between the two signals.

2.2.10 Intermodulation spurious response attenuation/rejection

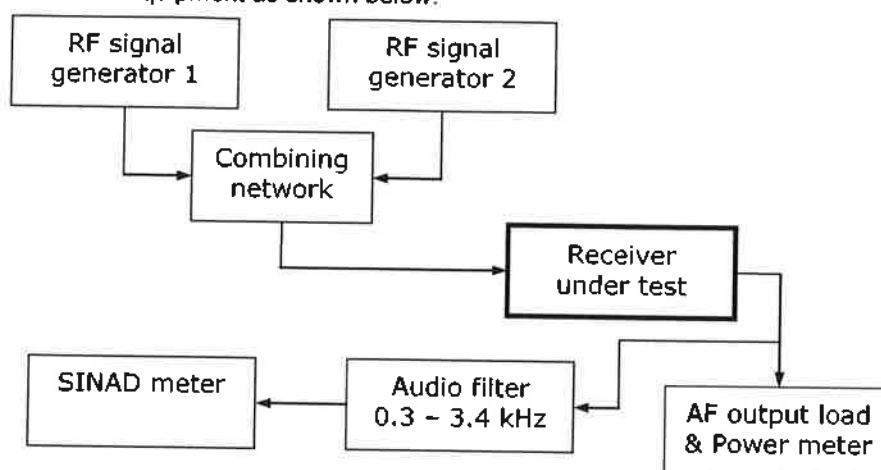
Connect the equipment as shown below.



- 2.2.10.1 Switch the RF signal output of signal generators 2 & 3 off.
- 2.2.10.2 RF signal generator 1:
 - 2.2.10.2.1 Adjust the RF signal generator to produce a standard RF test signal.
 - 2.2.10.2.2 Adjust the volume control of the radio to obtain SOP.
 - 2.2.10.2.3 Reduce the RF signal to the receiver until the SINAD ratio is 12 dB.
- A. 2.2.10.3 RF signal generator 2:
 - 2.2.10.3.1 Adjust the unmodulated frequency of the RF signal generator to the second adjacent channel above the nominal carrier frequency.
- 2.2.10.4 RF signal generator 3:
 - 2.2.10.4.1 Modulate the RF signal with 400 Hz at standard modulation factor.
 - 2.2.10.4.2 Adjust the frequency of the RF signal generator to the fourth adjacent channel above the nominal carrier frequency.
- 2.2.10.5 Switch the RF signal output of signal generators 2 & 3 on.
- 2.2.10.6 Maintain the outputs of RF signal generators 2 & 3 at equal levels.
- 2.2.10.7 Adjust the RF signal levels to reduce the SINAD ratio to 6 dB.
- 2.2.10.8 Adjust the frequency of RF signal generator 3 slightly to produce the maximum interfering signal.
- 2.2.10.9 Note the difference in dB between the RF signal output level from RF signal generator 1 and the RF signal output level from RF signal generators 2 & 3.
- B. 2.2.10.10 Repeat these measurements with RF signal generators 2 & 3 adjusted to the fourth adjacent and eighth adjacent channels above the nominal carrier frequency.
- C. 2.2.10.11 The measurements described in A & B shall be repeated with RF signal generators 2 & 3 set to the appropriate channels below the nominal frequency of the receiver.
- 2.2.10.12 Record the worst ratio in dB as the measure of the intermodulation spurious response attenuation.

2.2.11 Co-channel rejection ratio

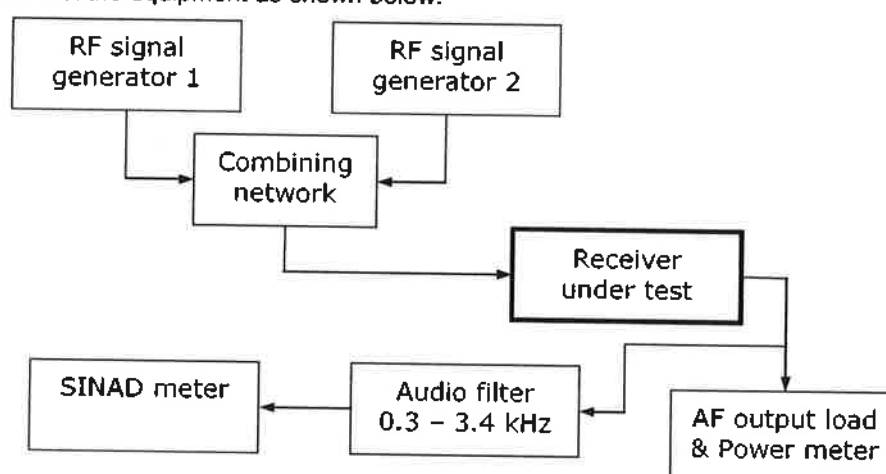
Connect the equipment as shown below.



- 2.2.11.1 Switch the RF signal output of signal generator 2 off.
- 2.2.11.2 RF signal generator 1:
 - 2.2.11.2.1 Adjust the RF signal generator to produce a standard RF test signal.
 - 2.2.11.2.2 Adjust the volume control of the radio to obtain SOP.
 - 2.2.11.2.3 Reduce the RF signal until the SINAD ratio is 12 dB (wanted signal).
- 2.2.11.3 RF signal generator 2:
 - 2.2.11.3.1 Switch the RF signal output on (unwanted signal).
 - 2.2.11.3.2 Set the frequency to the assigned receiver frequency.
 - 2.2.11.3.3 Modulate the RF signal with 400 Hz at standard modulation factor.
 - 2.2.11.3.4 Adjust the RF signal level such that the SINAD ratio is reduced to 6 dB.
- 2.2.11.4 Record the co-channel rejection ratio as the difference in dB, between the wanted and unwanted signal levels.
- 2.2.11.5 Repeat the measurement with signal generator 2 set to frequencies 1.5 kHz and 3.0 kHz above and below the assigned frequency.
- 2.2.11.6 The highest value of the five measurements shall be recorded as the co-channel rejection ratio.

2.2.12 Blocking or Desensitisation

Connect the equipment as shown below.



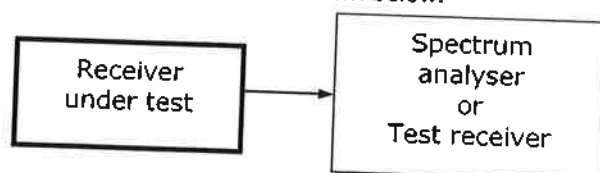
- 2.2.12.1 Switch the RF signal output of signal generator 2 off.

- 2.2.12.2 RF signal generator 1:

- 2.2.12.2.1 Adjust the RF signal generator to produce a standard RF test signal.
 - 2.2.12.2.2 Adjust the volume control of the radio to obtain SOP.
 - 2.2.12.2.3 Reduce the RF signal until the SINAD ratio is 12 dB (wanted signal).
 - 2.2.12.3 RF signal generator 2:
 - 2.2.12.3.1 Switch the unmodulated RF signal output on (unwanted signal).
 - 2.2.12.3.2 Set the RF signal to a level 84 dB higher than signal generator 1.
 - 2.2.12.3.3 Vary the frequency from 1 MHz to 10 MHz on either side of the assigned carrier frequency.
 - 2.2.12.4 Monitor the variation in the audio output level and the SINAD ratio.
 - 2.2.12.5 Record the difference in dB between the signal output levels from the two RF signal generators at which the audio output power decreased with 3 dB or the SINAD ratio decreases to 6 dB, whichever occurs first.
- Note: Ensure that the measured response is not caused by spurious signals from the RF signal generators.

2.2.13 Conducted Spurious radiation

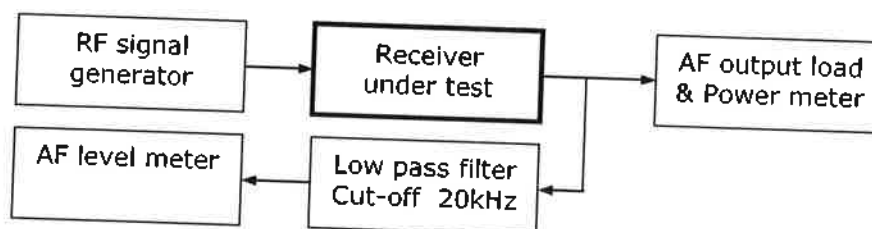
Connect the equipment as shown below.



- 2.2.13.1 Switch the receiver on.
- 2.2.13.2 The receiver must be in standby mode.
- 2.2.13.3 Slowly sweep the measuring instrument over the range 9 kHz to 4 GHz.
- 2.2.13.4 Record the frequencies and measure the absolute levels of the conducted spurious radiation.

2.2.14 Audio frequency response

Connect the equipment as shown below.

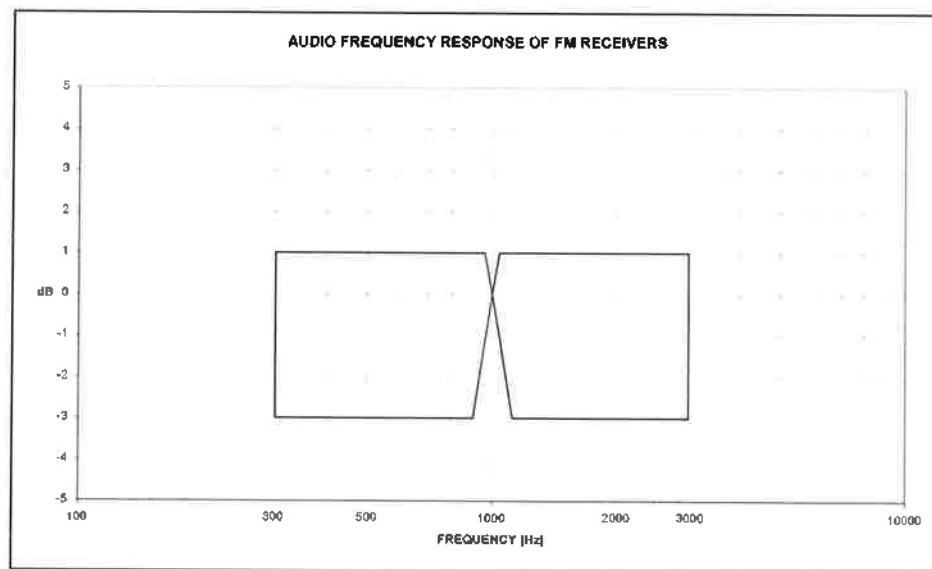
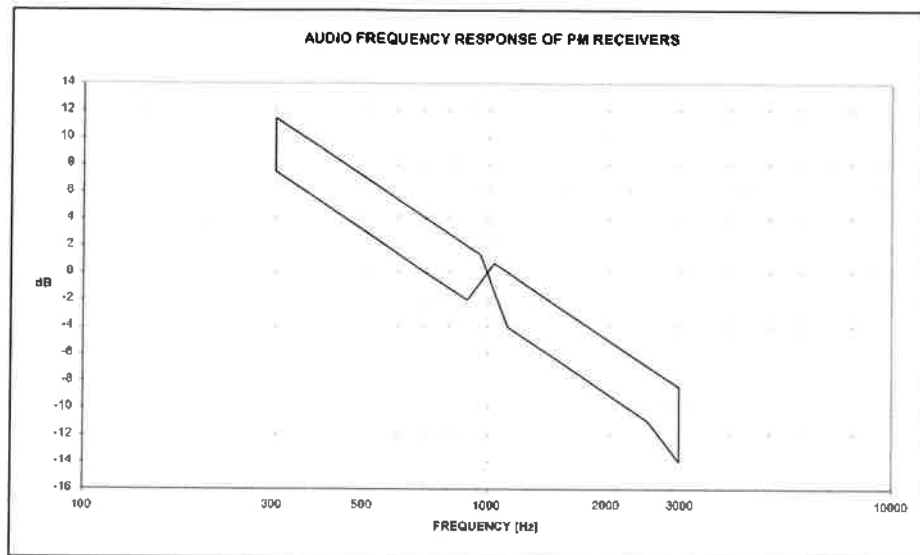


- 2.2.14.1 Standard measurement
 - 2.2.14.1.1 Adjust the RF signal generator to produce a standard RF test signal and inject it into the receiver.
 - 2.2.14.1.2 Adjust the volume control of the radio to obtain SOP.
 - 2.2.14.1.3 Adjust the modulation of the RF signal generator to 20 % of the maximum system deviation.
 - 2.2.14.1.4 While keeping the modulation factor constant vary the modulating frequency over the range 300 Hz to 3 kHz.
 - 2.2.14.1.5 Record the variation of the audio output power over this range in dB with reference to the corresponding level at 1 kHz.
- 2.2.14.1 600 Ω balanced line

Where a 600 Ω balanced line is provided, the audio frequency response must be measured on this line.

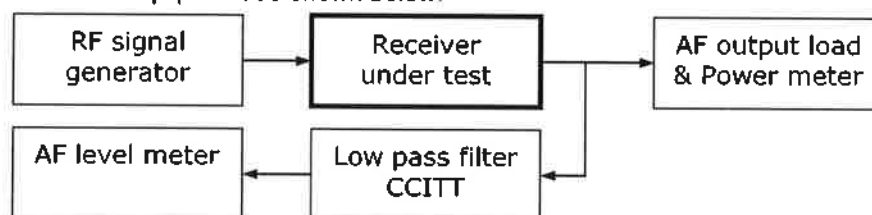
 - 2.2.14.2.1 Inject a standard RF test signal from the RF signal generator into the receiver.
 - 2.2.14.2.2 Load the line with a 600 Ω resistive load or equivalent impedance, provided by the measuring instrument.

- 2.2.14.2.3 Adjust the audio signal level to measure – 10 dBm on the line.
 2.2.14.2.4 Proceed with clauses 2.2.14.1.3 and 2.2.14.1.5.



2.2.15 Signal to hum and noise ratio

Connect the equipment as shown below.

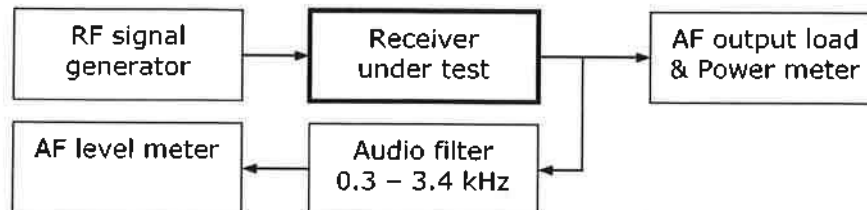


- 2.2.15.1 Select the CCITT filter (low pass filter).
 2.2.15.2 Adjust the RF signal generator to produce a standard RF test signal.
 2.2.15.3 Adjust the volume control of the radio to obtain SOP.

- 2.2.15.4 Adjust the squelch to its minimum (unsquelched).
- 2.2.15.5 Remove the modulation and measure the audio output power.
- 2.2.15.6 Adjust the squelch to its maximum (squelched).
- 2.2.15.7 If the receiver remains unsquelched remove the RF signal.
- 2.2.15.8 Measure the audio output power.
- 2.2.15.9 Record the ratio in dB between the audio output powers without modulation, and the SOP level as the signal to hum and noise ratio.

2.2.16 Amplitude characteristics

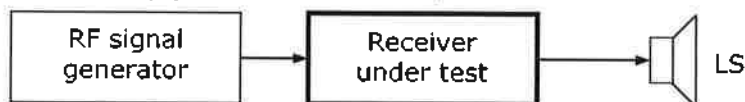
Connect the equipment as shown below.



- 2.2.16.1 Adjust the RF signal generator to produce a standard RF test signal.
- 2.2.16.2 Increase the RF output signal level to -13 dBm.
- 2.2.16.3 Adjust the volume control of the radio to obtain SOP.
- 2.2.16.4 Decrease the RF signal output level from -13 dBm to -107 dBm and measure the change in the audio output level in dB.

2.2.17 High RF signal level interference

Connect the equipment as shown below.



- 2.2.17.1 Set the radio to operate on the lowest channel.
- 2.2.17.2 Adjust the RF signal generator to produce a standard RF test signal.
- 2.2.17.3 Adjust the squelch to open at a RF signal level of -115 dBm.
- 2.2.17.4 Increase the RF signal level to -7 dBm.
- 2.2.17.5 Scan the frequencies of 132 channels above the receiving channel, excluding the assigned channel and the adjacent channels.
- 2.2.17.6 Record the channel and the RF signal level, at which the squelch opens in the window of -47 dBm to -7 dBm.
- 2.2.17.7 Set the radio to operate on the highest channel.
- 2.2.17.8 Scan the frequencies of 132 channels below the receiving channel, excluding the assigned channel and the adjacent channels.
- 2.2.17.9 Record the channel and the RF signal level, at which the squelch opens in the window of -47 dBm to -7 dBm.

Note: Where the interfering channels correspond with the intermodulation free channel groups, interference could occur.

Intermodulation free channel groups**High site channels**Duplex, 5th order, 132 channels

Group A	1	2	6	8	22	37	54	61	79	80	88	91	101	124	129
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Duplex, 5th order, 132 channels

Group B	3	4	7	23	45	73	75	85	96	102	120	128
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Duplex, 5th order, 132 channels

Group C	16	41	57	59	74	78	83	110	122	123	130
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Duplex, 5th order, first 52 channels

Group D	17	18	21	31	40	46	48
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Duplex, 5th order, first 52 channels

Group E	19	28	32	43	44	49	51
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Duplex, 5th order, first 52 channels

Group F	29	30	35	42	50	52
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Duplex, 5th order, first 52 channels

Group G	11	14	24	26
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Duplex, 5th order, first 52 channels

Group H	34	36	47
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Shunting channelsSimplex, 5th order, last 80 channels

Group A	53	56	60	71	97	99	109	118	126	131	132
Group B	55	58	62	63	72	84	112	125			
Group C	64	67	69	76	95	103	116	127			
Group D	68	77	82	90	107	113	114	117			
Group E	65	66	70	94	100	121					
Group F	81	87	89	92	104	108					

2.3 Radio Transmitter

2.3.1 Carrier power (conducted)

Connect the equipment as shown below.

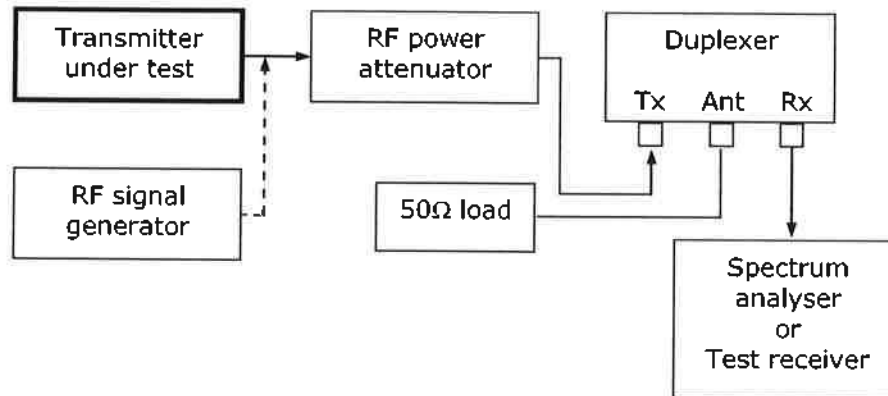


2.3.1.1 Measure the carrier power in the absence of modulation.

2.3.1.2 The measurement shall be made under the extreme test conditions as well.

2.3.2 Conducted spurious emissions

Connect the equipment as shown below.



2.3.2.1 The duplexer must be tuned to the operating band. See specifications in clause 1.4.1.

2.3.2.2 The value of the RF attenuator (including the duplexer) must be such to limit the carrier level at the spectrum analyser/test receiver to approximately – 60 dBm.

2.3.2.3 With the transmitter transmitting an unmodulated carrier, measure and record the frequencies and absolute levels of the conducted spurious up to the 5th harmonic.

2.3.2.4 Replace the transmitter with the RF signal generator.

2.3.2.5 Tune the RF signal generator to the recorded frequency and adjust the output level to obtain the recorded level on the spectrum analyser/test receiver.

2.3.2.6 Record the output level of the RF signal generator as the conducted spurious emission at that specific frequency.

2.3.2.7 Repeat 2.3.2.5 & 2.3.2.6 for all the other spurious emissions detected.

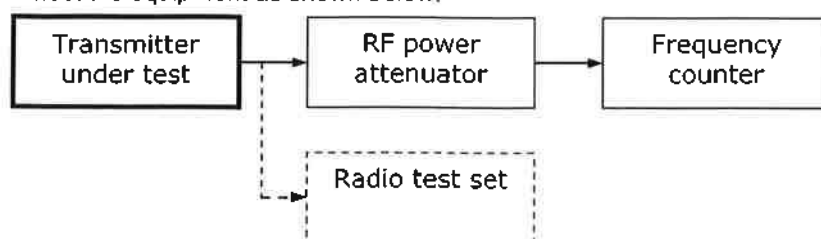
2.3.2.8 Remove the RF attenuator and duplexer and repeat the measurements when the transmitter is in the standby mode.

2.3.2.9 The measurements shall be made under the extreme test conditions as well.

2.3.1.10 With the above circuit the reverse channels can also be tested.

2.3.3 Carrier frequency error

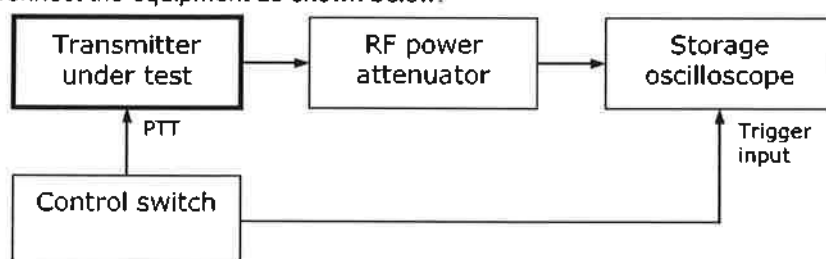
Connect the equipment as shown below.



- 2.3.3.1 Measure the carrier frequency in the absence of modulation.
- 2.3.3.2 Repeat the measurement on each channel on which the transmitter is equipped to operate.
- 2.3.3.3 Calculate the carrier frequency error as the difference between the assigned frequency and the measured frequency. (Some test instruments can be set to measure the frequency error directly).
- 2.3.3.4 Record the worst case as the result.
- 2.3.3.5 The measurement shall be made under the extreme test conditions as well.

2.3.4 Carrier attack time

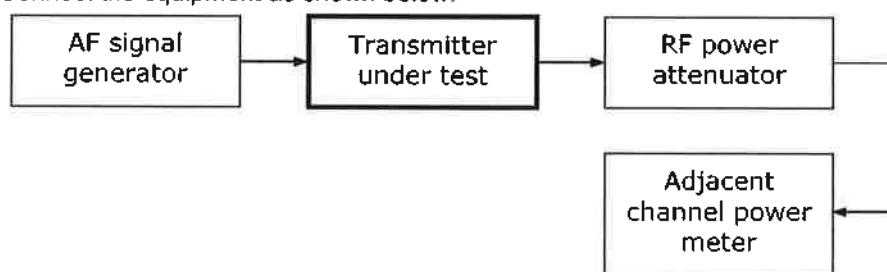
Connect the equipment as shown below.



- 2.3.4.1 Set the storage oscilloscope to single sweep operation.
- 2.3.4.2 Operate the control switch and measure the time interval for the unmodulated carrier voltage level to reach a value 6 dB (50 %) below the steady state level.

2.3.5 Adjacent channel power

Connect the equipment as shown below.



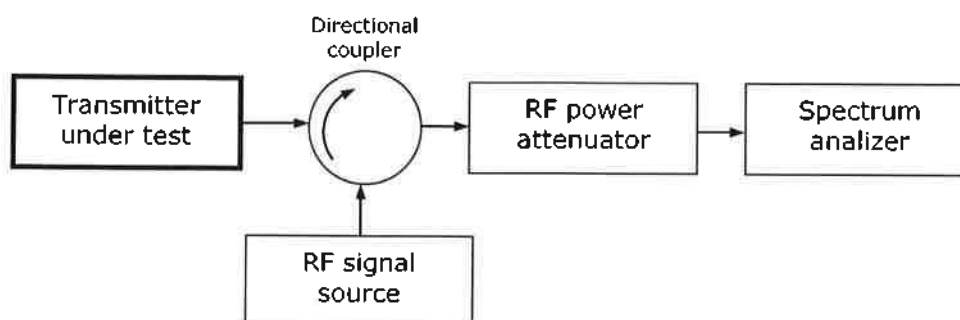
- 2.3.5.1 Ensure that the modulation limiting (Tx deviation) is set correctly (see clause 2.3.7).
- 2.3.5.2 Measure the unmodulated carrier power level.
- 2.3.5.3 Modulate the transmitter with a 1 250 Hz signal at a level 20 dB greater than that required to produce the standard test modulation factor.
- 2.3.5.4 Measure the mean power produced by the modulation, hum and noise of the transmitter in the adjacent channels.
- 2.3.5.5 Express the adjacent channel power in dB with reference to the measured carrier power.
- 2.3.5.6 Record the worst ratio as the measure of the adjacent channel power.

Or: When the measured level does not comply with the specification:

The adjacent channel power not to exceed a level of -37 dBm irrespective of the carrier power level.

2.3.6 Intermodulation attenuation (fixed radio stations only)

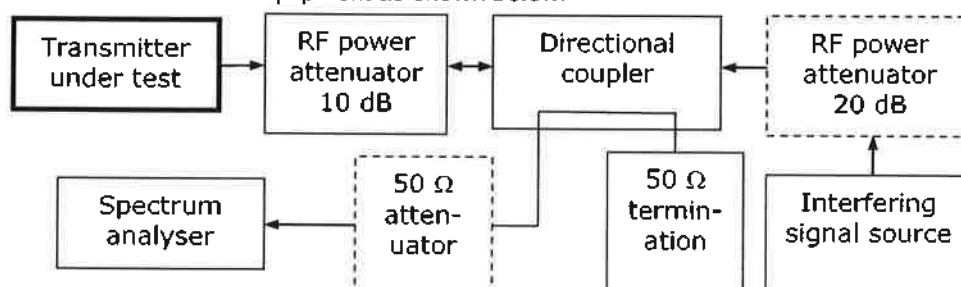
Method A: Connect the equipment as shown below.



- 2.3.6.1 Set the unmodulated signal level from the RF signal source to give a level, measured at the transmitter output terminal, 30 dB below the output carrier level.
- 2.3.6.2 With the transmitter transmitting an unmodulated carrier, vary the frequency of the RF signal source between 50 kHz and 100 kHz, above and below the carrier frequency.
- 2.3.6.3 Measure the levels of the Intermodulation components.
- 2.3.6.4 The Intermodulation attenuation is expressed as the ratio of the carrier level to the level of the largest Intermodulation product (third order) observed.
- 2.3.6.5 Record the worst case as the result.

Note: Ensure that the measured response is not caused by spurious signals from the RF signal source.

Method B: Connect the equipment as shown below.



- 2.3.6.6 The coupling between the transmitter under test and the 10 dB RF power attenuator must be as short as possible to minimize mismatching.
- 2.3.6.7 The directional coupler must have an insertion loss of ≤ 1 dB, directivity of ≥ 20 dB and sufficient bandwidth.
- 2.3.6.8 The transmitter under test and the interfering signal source must have sufficient physical separation to prevent the measurement being influenced by direct radiation.
- 2.3.6.9 The RF signal level from the interfering signal source must have the same level as that of the transmitter. Alternatively, the RF signal level from the interfering signal source must be 20 dB lower than that of the transmitter – omit the 20 dB RF power attenuator.
- 2.3.6.10 The transmitter under test shall be unmodulated.
- 2.3.6.11 The spectrum analyser must be adjusted to give a maximum indication (amplitude) with a frequency scan of 500 kHz.
- 2.3.6.12 The interfering signal source must be unmodulated and the frequency must be varied between 50 kHz to 100 kHz above and below the frequency of the transmitter under test.

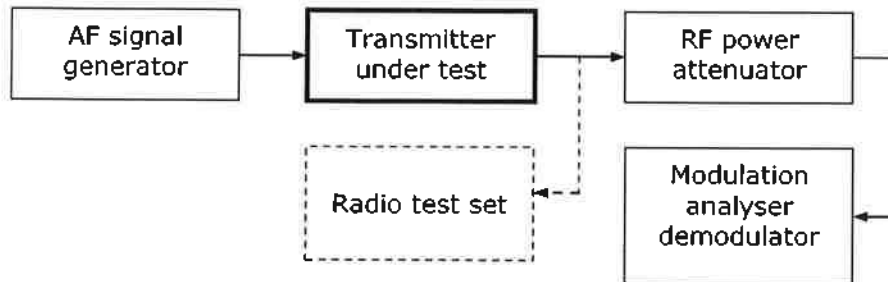
- 2.3.6.13 Measure the levels of the Intermodulation components on the spectrum analyser and determine the ratio of the carrier level to the level of the largest Intermodulation product (third order) observed, in dB.

- 2.3.6.14 Record the worst case as the result.

Note: Ensure that the measured response is not caused by spurious signals from the RF signal source.

2.3.7 Modulation limiting (Tx deviation)

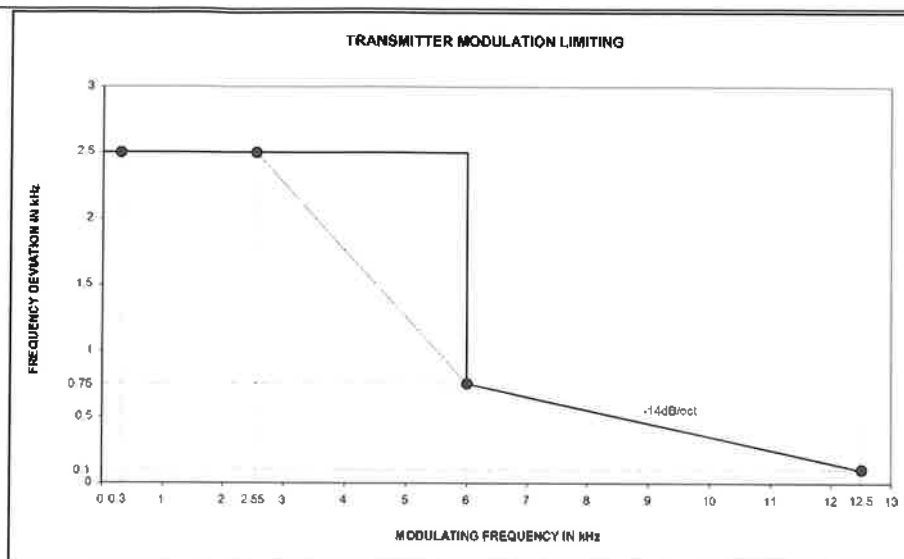
Connect the equipment as shown below.



- 2.3.7.1 Ensure that the maximum deviation is set correctly and according to the manufacturer's procedure.
- 2.3.7.2 Apply electrically a 1 kHz audio test signal to the microphone input of the transmitter at a level sufficient to produce the standard test modulation factor.
(When an electrical input signal cannot be applied this may be replaced by an acoustical signal.)
- 2.3.7.3 Set the audio filter of the modulation analyser to Low Pass cut-off 15 kHz or 20 kHz.
- 2.3.7.4 Note the level of the audio test signal (reference).
- 2.3.7.5 Modulating frequency 0.3 kHz to 2.55 kHz:
- 2.3.7.5.1 Increase the audio test signal with 20 dB. Ensure that the measured deviation equals the maximum system deviation.
- 2.3.7.5.2 Without changing the audio input signal level vary the modulating frequency between 300 Hz and 2.55 kHz.
- 2.3.7.5.3 Record the largest positive or negative peak deviation obtained, as the modulation limit.
- 2.3.7.6 Modulating frequency 2.55 kHz to 6.0 kHz:
- 2.3.7.6.1 Decrease the audio test signal to obtain the standard test modulation factor (reference).
- 2.3.7.6.2 Without changing the audio input signal level vary the modulating frequency between 2.55 kHz and 6.0 kHz.
- 2.3.7.6.3 Record the largest positive or negative peak deviation obtained, as the modulation limit for the specific modulating frequency band.
- Note: The deviation produced by the modulating frequencies between 2.55 kHz and 6.0 kHz must not exceed that of the deviation produced by the modulating frequency 2.55 kHz.
- 2.3.7.7 Modulating frequency 6.0 kHz to 12.5 kHz:
- 2.3.7.7.1 Obtain the standard test modulation factor (reference).
- 2.3.7.7.2 Without changing the audio input signal level vary the modulating frequency between 6.0 kHz and 12.5 kHz.
- 2.3.7.7.3 Record the decrease in the positive or negative peak deviation, as the modulation limit for the specific modulating frequency band.

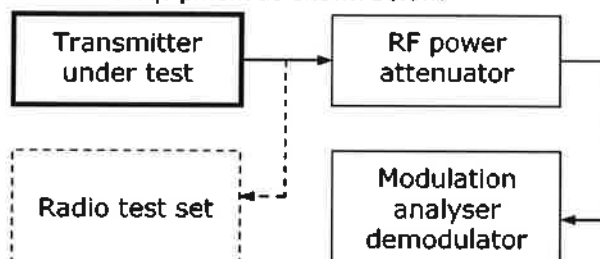
Note: Care must be taken not to generate hum when the audio signal is connected electrically.

It must be ensured that the acoustical audio source has a flat response throughout the bandwidth.



2.3.8 CTCSS deviation

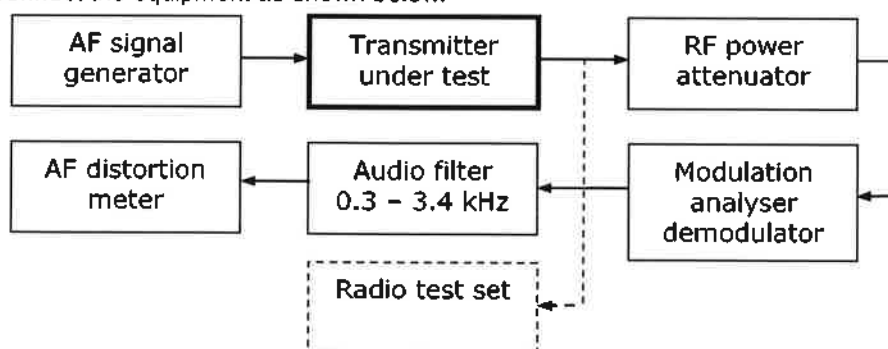
Connect the equipment as shown below.



- 2.3.8.1 Select the CTCSS frequency and activate the function.
- 2.3.8.2 Set the audio filter of the modulation analyser to Low Pass cut-off 15 kHz or 20 kHz.
- 2.3.8.3 In the absence of an audio input signal (modulating signal) transmit a carrier.
- 2.3.8.4 Measure and record the deviation of the sub-audible tone.

2.3.9 Audio frequency total harmonic distortion (THD)

Connect the equipment as shown below.



- 2.3.9.1 Standard measurement
 - 2.3.9.1.1 Apply electrically a 1 kHz audio test signal to the microphone input of the transmitter at a level sufficient to produce the standard test modulation factor.
 - 2.3.9.1.2 Record the distortion obtained.
 - 2.3.9.1.3 Adjust the audio signal generator frequency to 500 Hz.

- 2.3.9.1.4 Set the audio output signal at a level sufficient to produce the standard test modulation factor.
- 2.3.9.1.5 Record the distortion obtained.

Note: Care must be taken not to generate hum when the audio signal is connected electrically.

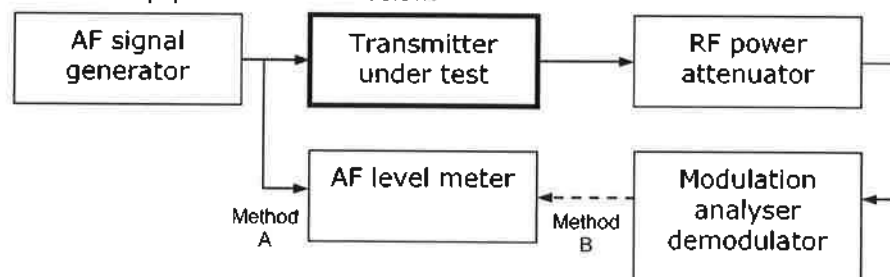
2.3.9.2 600 Ω balanced line input

Where a 600 Ω balanced line is provided, the THD must be measured on this line.

- 2.3.9.2.1 Load the line with a 600 Ω resistive load or equivalent impedance, provided by the test instrument.
- 2.3.9.2.2 Inject a 1 kHz audio test signal into the line at a level of -10 dBm.
- 2.3.9.2.3 Ensure that the transmitting signal deviation comply with the standard test modulation factor.
- 2.3.9.2.4 Measure and record the THD.

2.3.10 Audio frequency response

Connect the equipment as shown below.



2.3.10.1 Standard measurement

Method A.

- 2.3.10.1.1 Apply electrically a 1 kHz audio test signal to the microphone input of the transmitter at a level sufficient to obtain 20 % of the maximum system deviation.
- 2.3.10.1.2 Select the low pass filter (cut-off 20 kHz) at the modulation analyser.
- 2.3.10.1.3 Vary the modulating frequency (audio signal) from 300 Hz to 3 kHz.
- 2.3.10.1.4 Adjust the modulating frequency level (audio signal) to maintain the modulation factor constant.
- 2.3.10.1.5 Record the variation in the audio output level of the AF signal generator in dB with reference to the corresponding level at 1 kHz.

Method B.

- 2.3.10.1.6 Apply electrically a 1 kHz audio test signal to the microphone input of the transmitter at a level sufficient to obtain 20 % of the maximum system deviation.
- 2.3.10.1.7 Select the low pass filter (cut-off 20 kHz) at the modulation analyser.
- 2.3.10.1.8 Keeping the audio signal level constant, vary the frequency from 300 Hz to 3 kHz.
- 2.3.10.1.9 Record the variation in the audio output level from the demodulator in dB with reference to the corresponding level at 1 kHz.

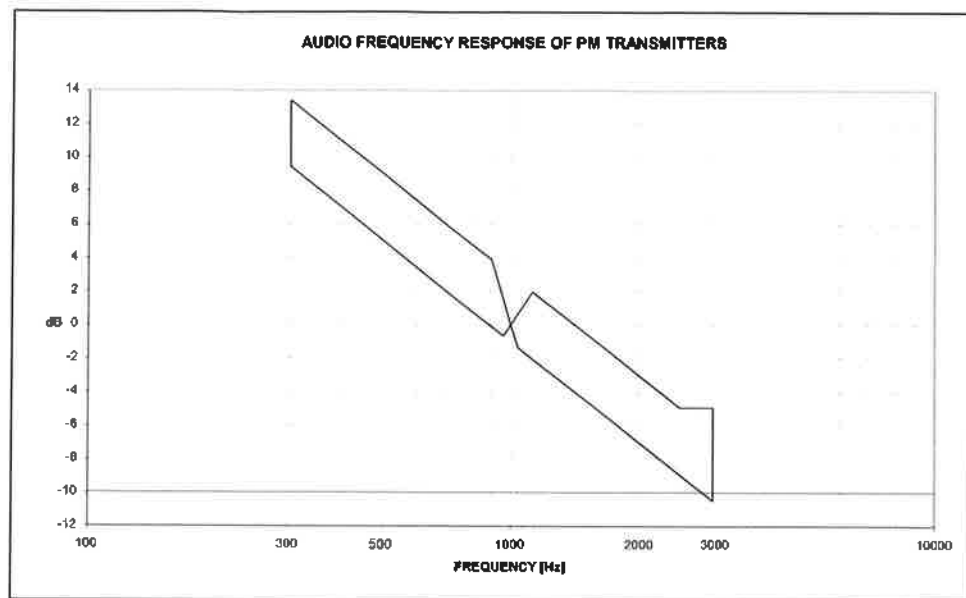
Note: The + and – signs must be inverted to be able to apply the graph.

2.3.10.2 600 Ω balanced line input

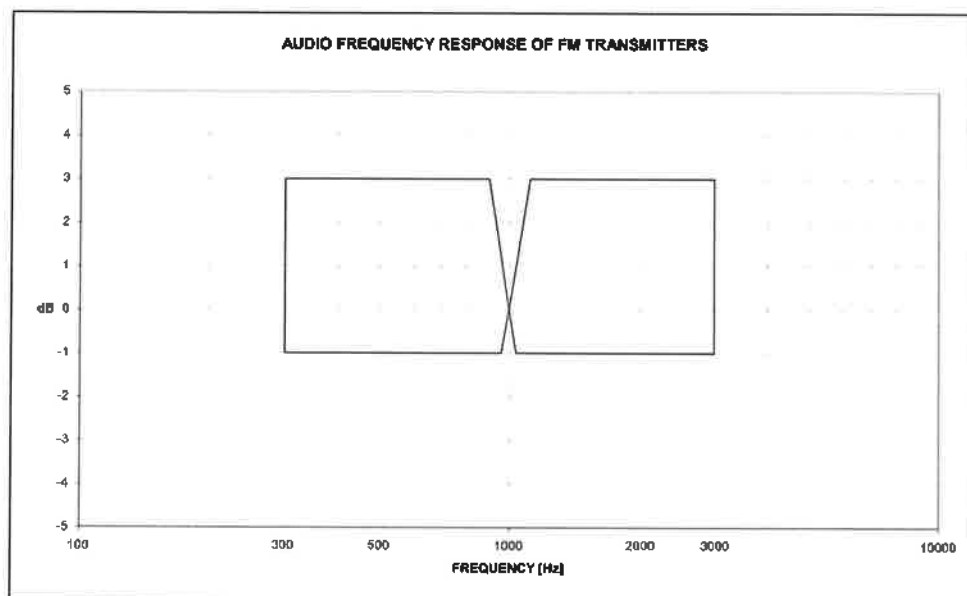
Where a 600 Ω balanced line is provided, the audio frequency response must be measured on this line.

- 2.3.10.2.1 Load the line with a 600 Ω resistive load or equivalent impedance, provided by the test instrument.
- 2.3.10.2.2 Inject a 1 kHz audio test signal into the line at a level of -10 dBm.
- 2.3.10.2.3 Ensure that the transmitting signal deviation comply with the standard test modulation factor.
- 2.3.10.2.4 Reduce the audio signal level to obtain 20 % of the maximum system deviation.

2.3.10.2.5 Proceed with test method A (2.3.10.1.2 to 2.3.10.1.5) or test method B (2.3.10.1.7 to 2.3.10.1.9)

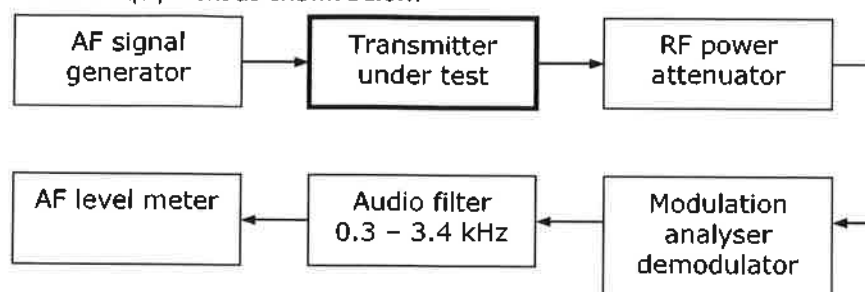


6dB/octave slope



2.3.11 Angle modulation hum and noise ratio

Connect the equipment as shown below.



- 2.3.11.1 Apply electrically a 1 kHz audio test signal to the microphone input of the transmitter at a level sufficient to produce the standard test modulation factor.
- 2.3.11.2 Record the audio output level from the modulation analyser demodulator.
- 2.3.11.3 Remove the modulation from the transmitter.
- 2.3.11.4 Again record the audio output level from the modulation analyser demodulator.
- 2.3.11.5 Calculate the angle modulation hum and noise ratio by determining the difference between the two measurements in dB.

Note: Care must be taken not to generate hum when the audio signal is connected electrically.

Short circuit the audio input connections of the radio transmitter when the audio signal is removed.

2.3.12 Amplitude modulation hum and noise level

Connect the equipment as shown below.

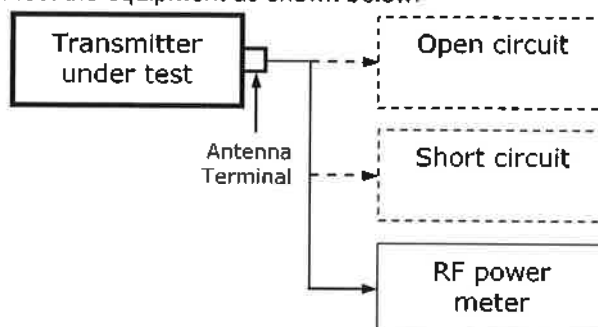


- 2.3.12.1 Set the modulation analyser to measure the RMS AM modulation factor (m %).
- 2.3.12.2 In the absence of an audio input signal (modulating signal) measure the modulation factor.
- 2.3.12.3 Calculate the AM hum and noise level as follow:

$$\text{AM hum and noise level (dB)} = 20\text{Log}(2 m/100)$$

2.3.13 Extreme transmitter loads

Connect the equipment as shown below.



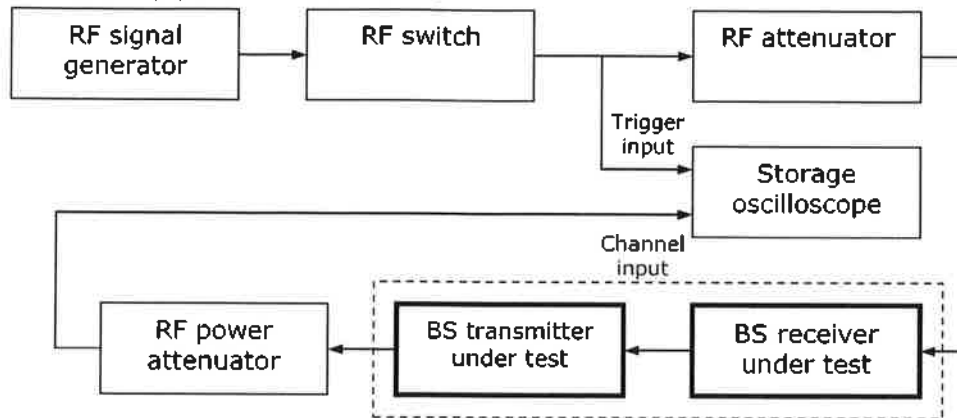
- 2.3.13.1 Measure the carrier power in the absence of modulation.
- 2.3.13.2 Operate the transmitter under open and short circuit load conditions for a period of:
 - 2.3.13.2.1 One minute each in the case of a transmitter rated for intermittent duty cycle.
 - 2.3.13.2.2 Five minutes each in the case of a transmitter rated for continuous operation.

-
- 2.3.13.3 After each exposure to the extreme load measure the carrier power in the absence of modulation.
 - 2.3.13.4 Calculate the variation of the carrier power in dB with reference to clause 2.3.13.1.

2.4 High Site Equipment

2.4.1 Radio Base Station Response Time

Connect the equipment as shown below.

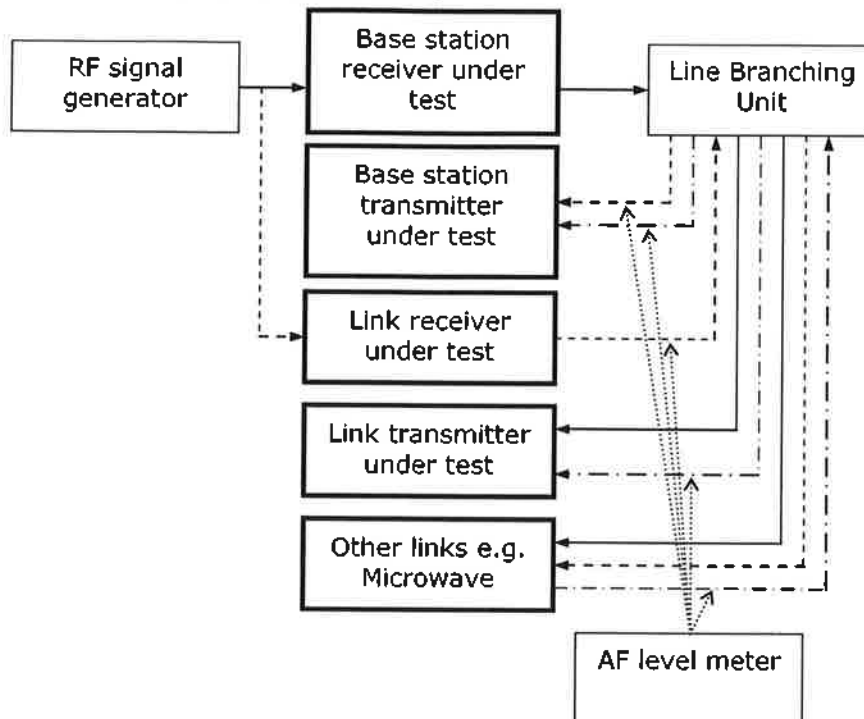


- 2.4.1.1 Apply a standard RF test signal to the receiver under test.
- 2.4.1.2 Determine the usable sensitivity as described in clause 2.2.3.
- 2.4.1.3 Adjust the squelch to open at a RF signal level of -115 dBm, measured at the antenna terminal.
- 2.4.1.4 Set the RF signal level 12 dB above the usable sensitivity level.
- 2.4.1.5 Set the storage oscilloscope to single sweep operation.
- 2.4.1.6 Enable the RF switch and measure the time required for the unmodulated transmit carrier voltage level to reach a value 6 dB (50 %) below the steady state level.
- 2.4.1.7 Repeat the measurement three times and take the average of the three measurements as the repeater attack time.

2.4.2 Talk Through Signal

2.4.2.1 Audio levels

Connect the equipment as shown below.

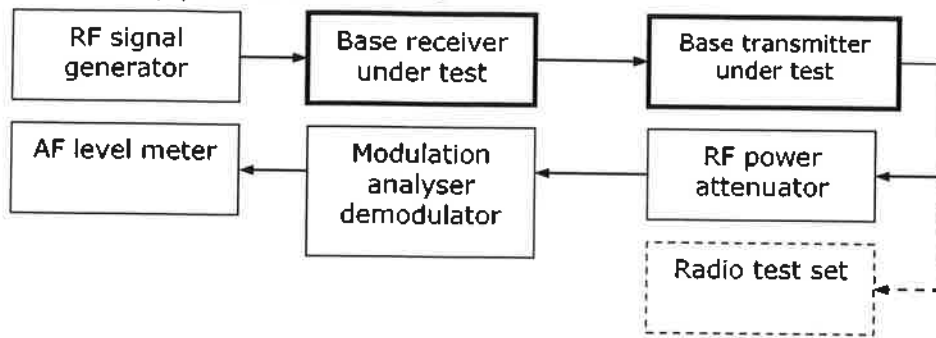


- 2.4.2.1.1 Adjust the RF signal generator to produce the standard RF test signal.
- 2.4.2.1.2 Connect the audio lines to the units as it would be connected when in operation. This is to ensure that the lines are correctly loaded.
- 2.4.2.1.3 Set the audio frequency level meter to high impedance/bridge mode. This is to ensure that the level meter does not load the lines.
- 2.4.2.1.4 Measure the audio level from the source (Rx) first. Adjust the level if necessary.
- 2.4.2.1.5 Measure all the outgoing lines from the LBU and adjust the levels if necessary.
- 2.4.2.1.6 Use the method described in clauses 2.4.2.1.1 to 2.4.2.1.4 to measure and adjust the audio level from the link receiver.
- 2.4.2.1.7 Measure the audio level from the microwave and adjust if necessary.

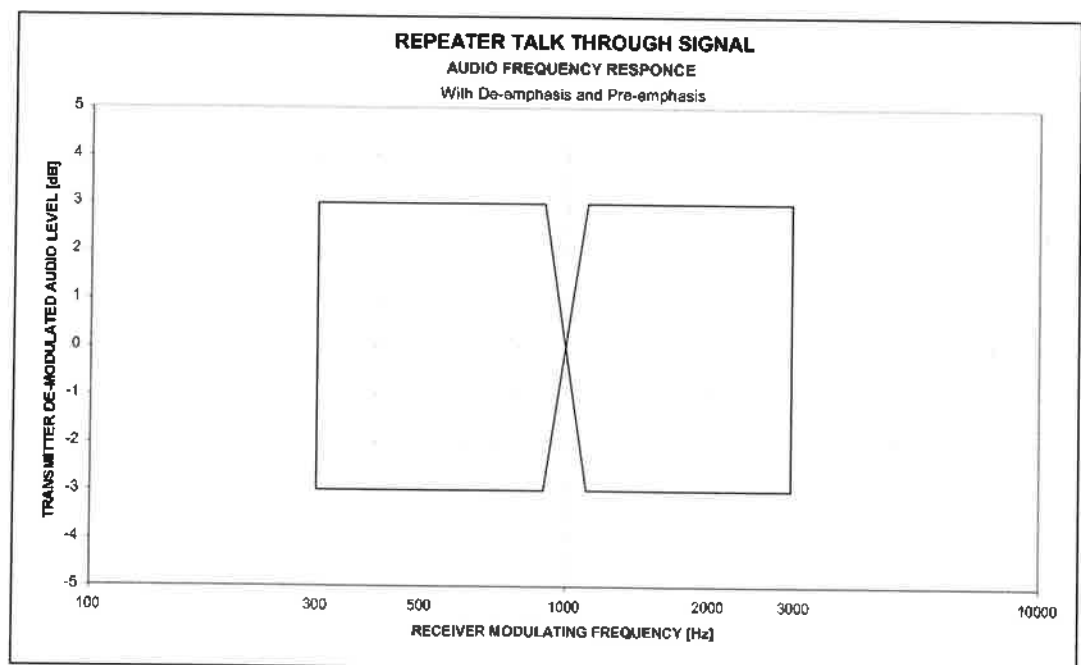
Note: The same measuring method is used on the Trunked radio equipment.

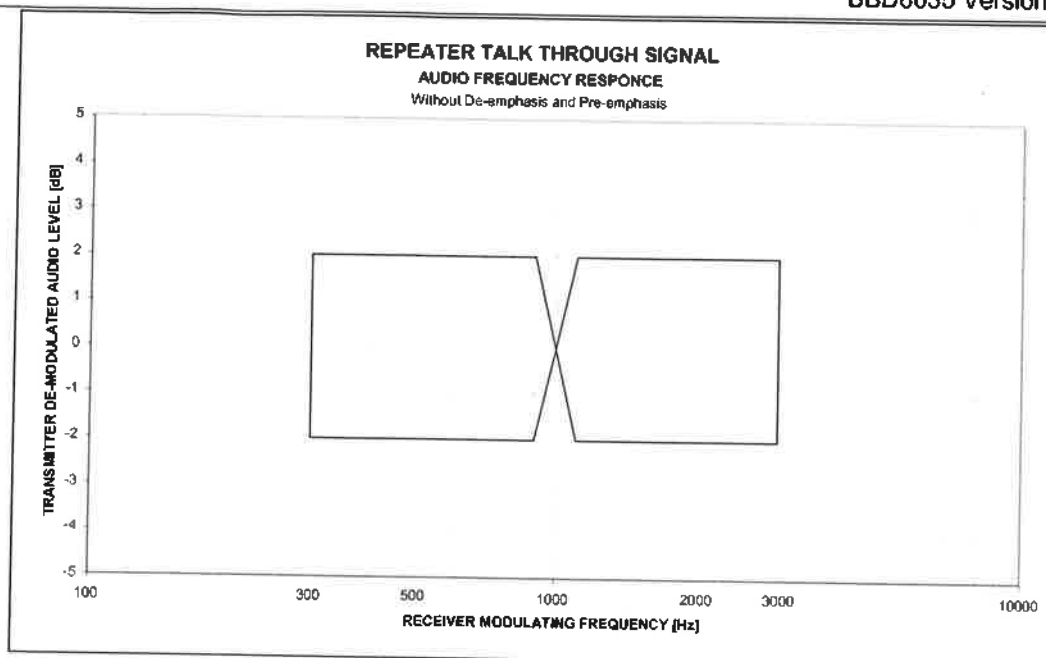
2.4.2.2 Audio Frequency Response

Connect the equipment as shown below.



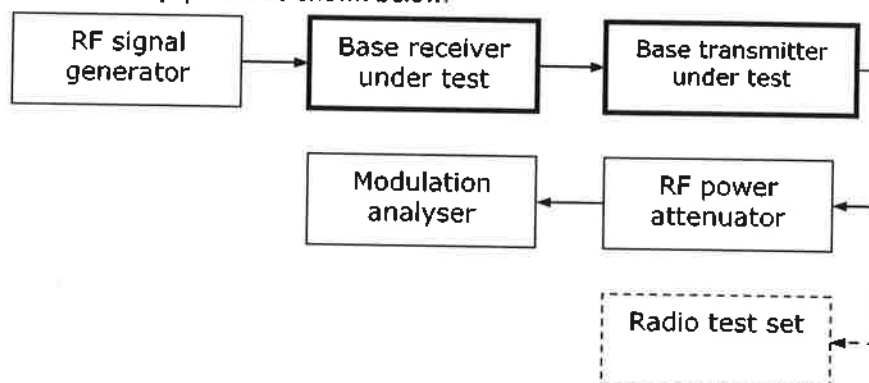
- 2.4.2.2.1 Ensure that all the audio level settings have been set correctly.
- 2.4.2.2.2 Adjust the RF signal generator to produce the standard RF test signal.
- 2.4.2.2.3 Select the low pass filter (cut-off 20 kHz) at the modulation analyser.
- 2.4.2.2.4 While keeping the modulation factor constant vary the modulating frequency over the range 300 Hz to 3 kHz.
- 2.4.2.2.5 Record the variation in the audio output power from the demodulator over this range in dB with reference to the corresponding level at 1 kHz.
- 2.4.2.2.6 Branches to the link radio and other links must also be measured.



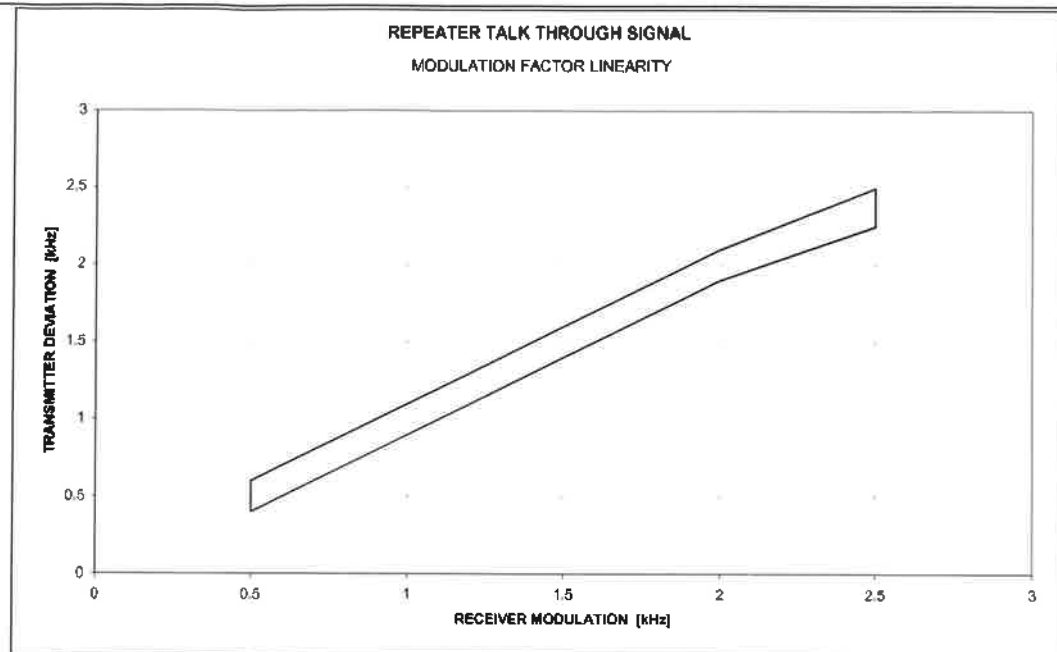


2.4.2.3 Modulation factor linearity

Connect the equipment as shown below.

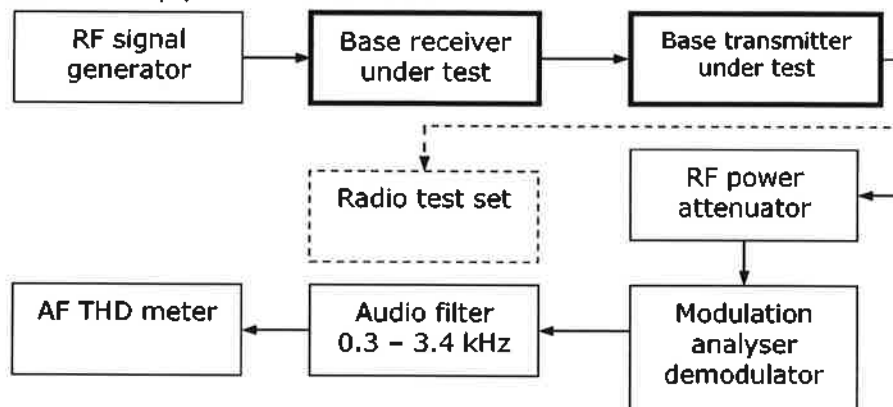


- 2.4.2.3.1 Ensure that the transmitter modulation limiting (deviation) has been set correctly (see clause 2.3.7).
- 2.4.2.3.2 Ensure that all the audio levels have been set correctly (see clause 2.4.2.1).
- 2.4.2.3.3 Apply a standard RF test signal from the RF signal generator to the receiver.
- 2.4.2.3.4 Vary the modulation of the RF input signal between 0.5 kHz and 2.5 kHz and measure the transmitter deviation.
- 2.4.2.3.5 Branches to the link radio and other links must also be measured.



2.4.2.4 Audio frequency THD

Connect the equipment as shown below.



- 2.4.2.4.1 Ensure that all the audio levels are set correctly.
- 2.4.2.4.2 Apply a standard RF test signal to the receiver under test.
- 2.4.2.4.3 Record the audio total harmonic distortion from the transmitter.
- 2.4.2.4.4 Branches to the link radio and other links must also be measured.

2.4.3 **Filters**

2.4.3.1 **Duplexer**

The best method to check or tune a duplexer is to use a Transmission Line Analyser. This measuring method will not be covered in this document.

If any problem is detected the duplexer/combiner must be sent to a facility with the proper equipment and competency. Do not attempt to tune the unit.

A RF signal generator and a test receiver/spectrum analyser could be used to make measurements.

2.4.3.1.1 **Calibration**

2.4.3.1.1.1 Connect the RF signal generator with the two connecting cables to the test receiver or spectrum analyser.

2.4.3.1.1.2 Tune the RF signal generator and the test receiver/spectrum analyser to the in-band receiving/transmitting frequency to be measured.

2.4.3.1.1.3 Set the output level of the RF signal generator as required:

e.g. Low-level : ≤ -60 dBm

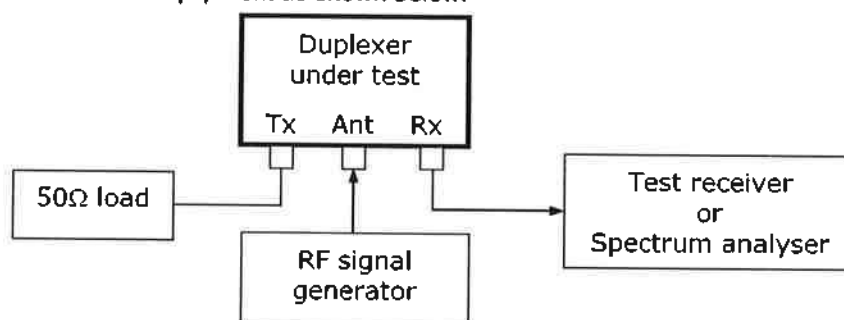
High-level : 0 dBm.

2.4.3.1.1.4 Record the difference between the applied and measured signal level. The difference must be included in the calculations.

Note: This method compensates for differences and the connecting cable losses.

2.4.3.1.2 **Insertion loss - Rx**

Connect the equipment as shown below.



2.4.3.1.2.1 Tune the RF signal generator and the test receiver/spectrum analyser to the in-band receiving frequency to be measured.

2.4.3.1.2.2 Inject the signal at the antenna port (low level) and measure the level at the receiving port.

2.4.3.1.2.3 Calculate the insertion loss by determining the difference between the injected signal level and the measured level in dB.

2.4.3.1.2.4 The insertion loss must comply throughout the operating band.

At the high site this measurement can be made in the following way:

2.4.3.1.2.5 Connect the RF signal generator directly to the receiver.

2.4.3.1.2.6 Adjust the RF signal generator to produce a standard RF test signal.

2.4.3.1.2.7 Decrease the RF signal level till the squelch closes.

2.4.3.1.2.8 Increase the RF signal level **slowly** and note the level when the squelch open.

2.4.3.1.2.9 Connect the RF signal generator to the receiver via the duplexer (Ant port).

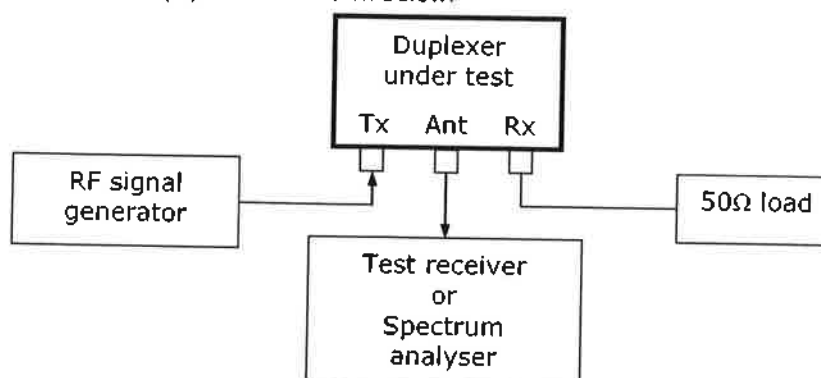
2.4.3.1.2.10 Repeat the procedure from clause 2.4.3.1.2.6 to 2.4.3.1.2.8.

2.4.3.1.2.11 Calculate the insertion loss by determining the difference between the two recorded signal levels in dB.

Note: When the result is within specification, the insertion loss through the coaxial cable between the receiver and duplexer can be ignored.

2.4.3.1.3 Insertion loss - Tx

Connect the equipment as shown below.



2.4.3.1.3.1 Tune the RF signal generator and the test receiver/spectrum analyser to the in-band transmitting frequency to be measured.

2.4.3.1.3.2 Inject the signal at the transmitting port (high level) and measure the level at the antenna port.

2.4.3.1.3.3 Calculate the insertion loss by determining the difference between the injected signal level and the measured level in dB.

2.4.3.1.3.4 The insertion loss must comply throughout the operating band.

At the high site this measurement can be made in the following way:

2.4.3.1.3.5 Connect a terminated wattmeter directly to the transmitter.

2.4.3.1.3.6 Measure the un-modulated carrier power from the transmitter.

2.4.3.1.3.7 Connect the same terminated wattmeter to the transmitter via the duplexer (Antenna port).

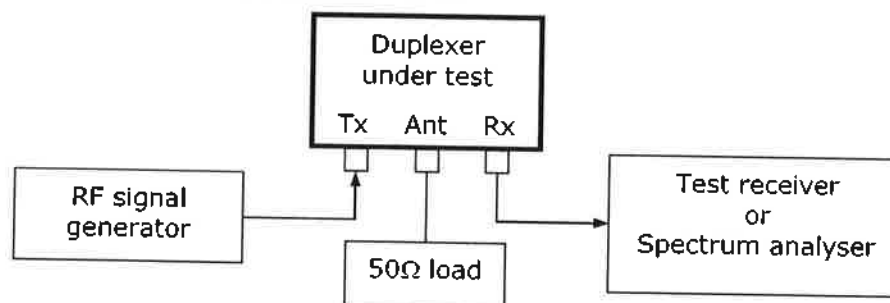
2.4.3.1.3.8 Measure the un-modulated carrier power from the transmitter.

2.4.3.1.3.9 Calculate the insertion loss by determining the difference between the two measured power levels in dB.

Note: When the result is within specification, the insertion loss through the coaxial cable between the transmitter and duplexer can be ignored.

2.4.3.1.4 Isolation between the transmitting and receiving paths

Connect the equipment as shown below.



2.4.3.1.4.1 Tune the RF signal generator and the test receiver/spectrum analyser to the in-band transmitting frequency to be measured.

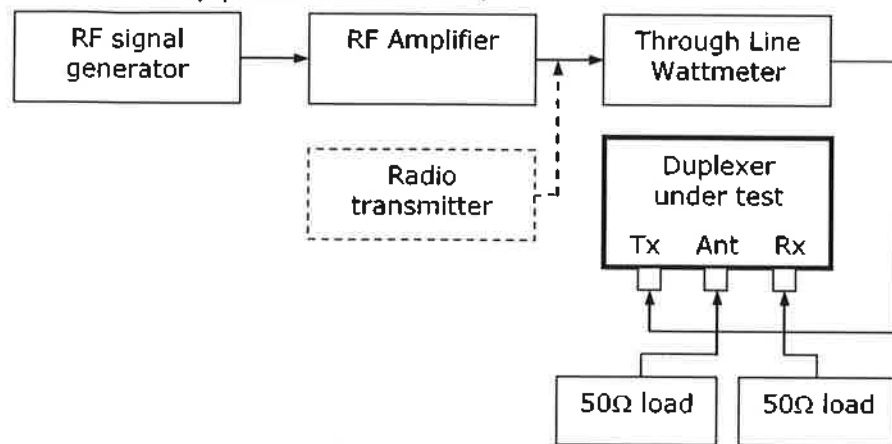
2.4.3.1.4.2 Inject the signal at the transmitting port (high level) and measure the level at the receiving port.

2.4.3.1.4.3 Calculate the isolation by determining the difference between the injected signal level and the measured level in dB.

2.4.3.1.4.4 The isolation must comply throughout the operating band.

2.4.3.1.5 Impedance matching

Connect the equipment as shown below.



2.4.3.1.5.1 Tune the RF signal generator to the in-band transmitting frequency to be measured.

2.4.3.1.5.2 Measure the Voltage Standing Wave Ratio (VSWR) with a through line wattmeter.

2.4.3.1.5.3 If the wattmeter does not indicate the VSWR, note the forward and reflected power and calculate the VSWR.

$$(1 + \sqrt{\text{Power reflected/Power forward}}) / (1 - \sqrt{\text{Power reflected/Power forward}})$$

2.4.3.1.5.4 The impedance matching must comply throughout the operating band.

2.4.3.1.5.5 Use the same method to measure the impedance at the receiver and antenna terminals.

2.4.3.2 Combiner**2.4.3.2.1 Insertion loss - Rx**

2.4.3.2.1.1 The insertion loss can be measured as explained in clause 2.4.3.1.2.

2.4.3.2.1.2 Fifty-ohm loads must be connected to all open transmitting and receiving ports.

2.4.3.2.1.3 The injected signal level at the antenna port must be low (≤ -80 dBm) to prevent the RF amplifier in the receiving path being saturated.

2.4.3.2.1.4 All the receiving ports must be measured.

2.4.3.2.1.5 The insertion loss must comply throughout the operating band.

2.4.3.2.2 Insertion loss - Tx

2.4.3.2.2.1 The insertion loss can be measured as explained in clause 2.4.3.1.3.

2.4.3.2.2.2 Fifty-ohm loads must be connected to all open transmitting and receiving ports.

2.4.3.2.2.3 All the transmitting ports must be measured.

2.4.3.2.2.4 The insertion loss must comply throughout the operating band.

2.4.3.2.3 Isolation between the transmitting and receiving paths

2.4.3.2.3.1 The isolation between the transmitting and receiving paths can be measured as explained in clause 2.4.3.1.4.

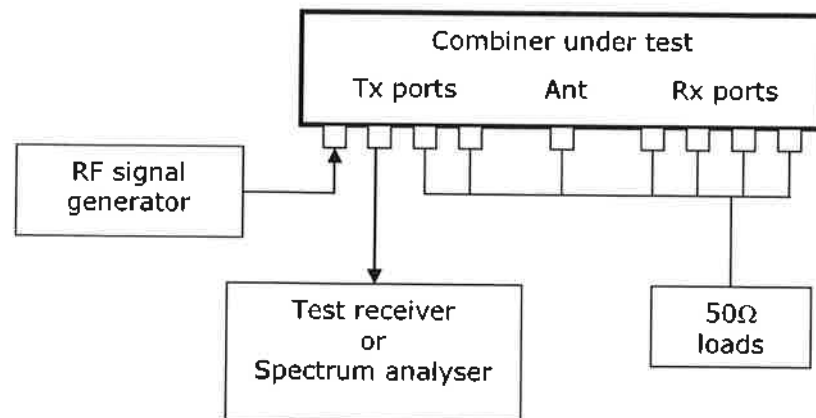
2.4.3.2.3.2 Fifty-ohm loads must be connected to all open transmitting and receiving ports.

2.4.3.2.3.3 All the ports must be measured.

2.4.3.2.3.4 The isolation must comply throughout the operating band.

2.4.3.2.4 Isolation between the transmitting ports

Connect the equipment as shown below



- 2.4.3.2.4.1 Tune the RF signal generator and the test receiver/spectrum analyser to the in-band transmitting frequency to be measured.
- 2.4.3.2.4.2 Fifty-ohm loads must be connected to the antenna- and all open transmitting and receiving ports.
- 2.4.3.2.4.3 Inject the signal at the first transmitting port (high level) and measure the level at the other transmitting ports.
- 2.4.3.2.4.4 Repeat step 2.4.3.2.4.3 when injecting the signal at ports 2 to 4.
- 2.4.3.2.4.5 Calculate the isolation by determining the difference between the injected signal level and the measured level in dB.
- 2.4.3.2.4.6 The isolation must comply throughout the operating band.

2.4.3.2.5 Impedance matching

- 2.4.3.2.5.1 The impedance matching can be determined as explained in clause 2.4.3.1.5.
- 2.4.3.2.5.2 Fifty-ohm loads must be connected to all open transmitting and receiving ports.
- 2.4.3.2.5.3 All the transmitting ports must be measured.

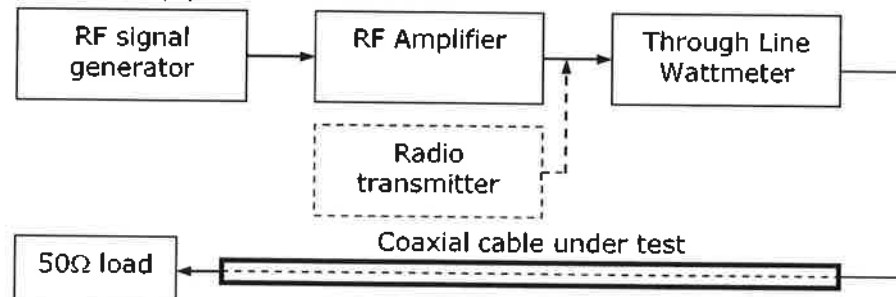
Note: **Do not** use this method to determine the impedance matching at the receiver and antenna terminals. If a problem is suspected, the combiner must be sent to a facility with the proper equipment and competency.

2.4.4 Coaxial Cable

2.4.4.1 Impedance matching

The best method to measure the impedance and insertion loss of the coaxial cable is to use a Transmission Line Analyser. This measuring method will not be covered in this document.

Connect the equipment as shown below.

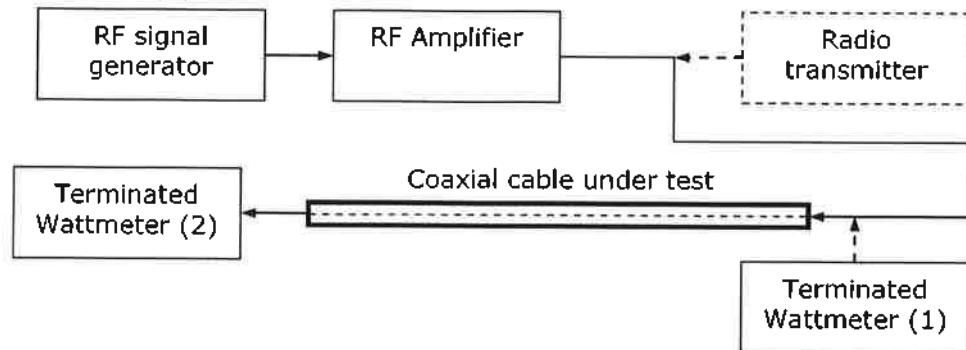


- 2.4.4.1.1 Tune the RF signal generator to the in-band transmitting frequency.
- 2.4.4.1.2 Measure the Voltage Standing Wave Ratio (VSWR) with a through line wattmeter.
- 2.4.4.1.3 If the wattmeter does not indicate the VSWR, note the forward and reflected power and calculate the VSWR (see clause 2.4.3.1.5.3).

- 2.4.4.1.4 Tune the RF signal generator to the in-band receiving frequency.
- 2.4.4.1.5 Measure the Voltage Standing Wave Ratio as above.
- 2.4.4.1.6 The impedance matching must comply throughout the operating band.
- 2.4.4.1.7 Record the worst case as the impedance matching.

2.4.4.2 **Insertion loss**

Connect the equipment as shown below.



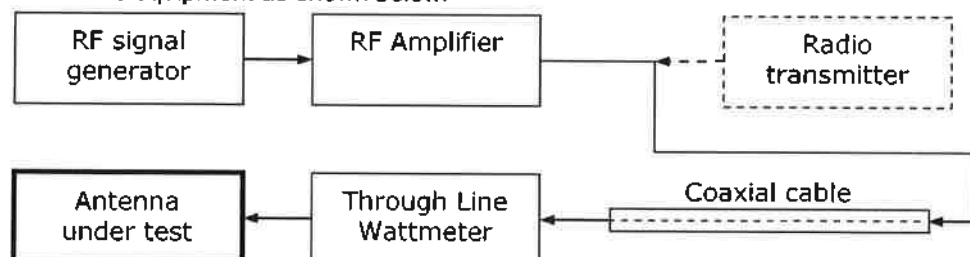
- 2.4.4.2.1 Tune the RF signal generator to the in-band transmitting frequency.
- 2.4.4.2.2 Measure the power at the near end of the coaxial cable using the terminated wattmeter (1).
- 2.4.4.2.3 Measure the power at the far end of the coaxial cable using the same terminated wattmeter (2).
- 2.4.4.2.4 Calculate the insertion loss by determining the difference between the power levels measured in dB.
- 2.4.4.2.5 Tune the RF signal generator to the in-band receiving frequency.
- 2.4.4.2.6 Repeat the measurements as above.
- 2.4.4.2.7 The insertion loss must comply throughout the operating band.
- 2.4.4.2.8 Record the highest loss measured, as the insertion loss.

2.4.5 **Antenna**

2.4.5.1 **Impedance matching**

The best method to measure the impedance of the antenna is to use a Transmission Line Analyser. This measuring method will not be covered in this document.

Connect the equipment as shown below.



- 2.4.5.1.1 The impedance matching of the coaxial cable (clause 2.4.4.1) must be measured first.
- 2.4.5.1.2 Tune the RF signal generator to the in-band transmitting frequency.
- 2.4.5.1.3 Measure the Voltage Standing Wave Ratio (VSWR) with a through line wattmeter.
- 2.4.5.1.4 If the wattmeter does not indicate the VSWR, note the forward and reflected power and calculate the VSWR (see clause 2.4.3.1.5.3).
- 2.4.5.1.5 Tune the RF signal generator to the in-band receiving frequency.
- 2.4.5.1.6 Measure the Voltage Standing Wave Ratio as above.

2.4.5.1.7 The impedance matching must comply throughout the operating band.

2.4.5.1.8 Record the worst case as the impedance matching.

2.4.5.2 **Effective Radiated Power (ERP)**

2.4.5.2.1 The effective radiated power is calculated as follows:

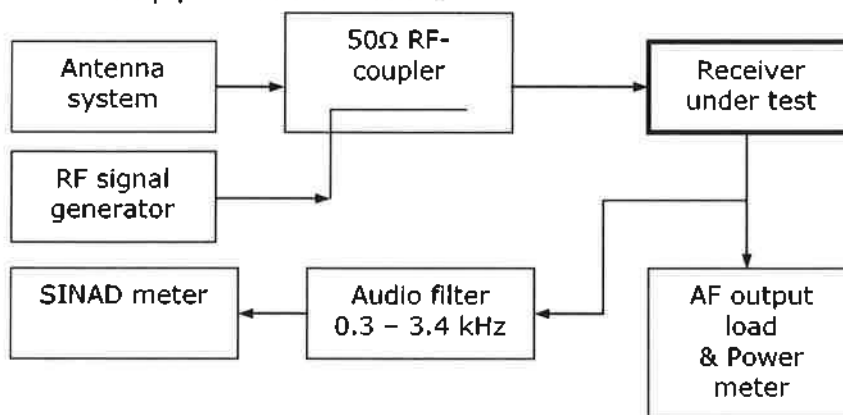
The RF power measured into a 50 Ω load that replaces the antenna, times the gain of the antenna with reference to a Dipole antenna (dBd).

2.4.5.2.2 The following calculation could also be used:

Antenna gain (dBd) - Duplexer/combiner insertion loss (dB) - Coaxial cable insertion loss (dB) + Transmitting power at transmitter (dBm). Convert the result to Watts ($0.001 \times \text{Antilog}(\text{dB}/10)$).

2.4.6 **Receiver Desensitisation (Desensing)**

Connect the equipment as shown below.



2.4.6.1 The transmitting power of all the transmitters must be set correctly.

2.4.6.2 The insertion loss of the RF-coupler must be ≤ 1 dB.

2.4.6.3 Adjust the RF signal generator to produce the standard test signal and apply it to the receiver via the RF-coupler.

2.4.6.4 Reduce the RF signal output level until the SINAD ratio is 12 dB.

2.4.6.5 Note the RF signal level at which the 12 dB SINAD is obtained.

2.4.6.6 Transmit from the other transmitters situated on the site.

2.4.6.7 Note if the SINAD ratio is degrading.

2.4.6.8 If so, while transmitting increase the RF signal output from the generator to obtain a SINAD ratio of 12 dB.

2.4.6.9 Note the RF signal level.

2.4.6.10 Calculate the desensing level by determining the difference between the two measurements in dB.

2.4.7 **Audio Line Branching Unit (LBU)**

2.4.7.1 **Impedance matching**

Connect the equipment as shown below.



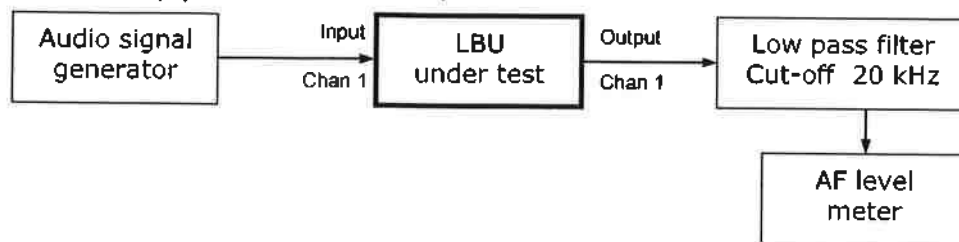
2.4.7.1.1 Switch the power of the LBU on.

2.4.7.1.2 Measure the return loss of the input transformer to determine the impedance matching.

- 2.4.7.1.3 Repeat the measurement to determine the impedance matching of the other input and output terminals.

2.4.7.2 Audio levels

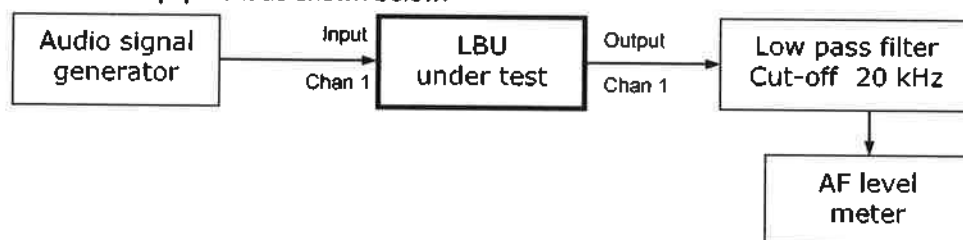
Connect the equipment as shown below.



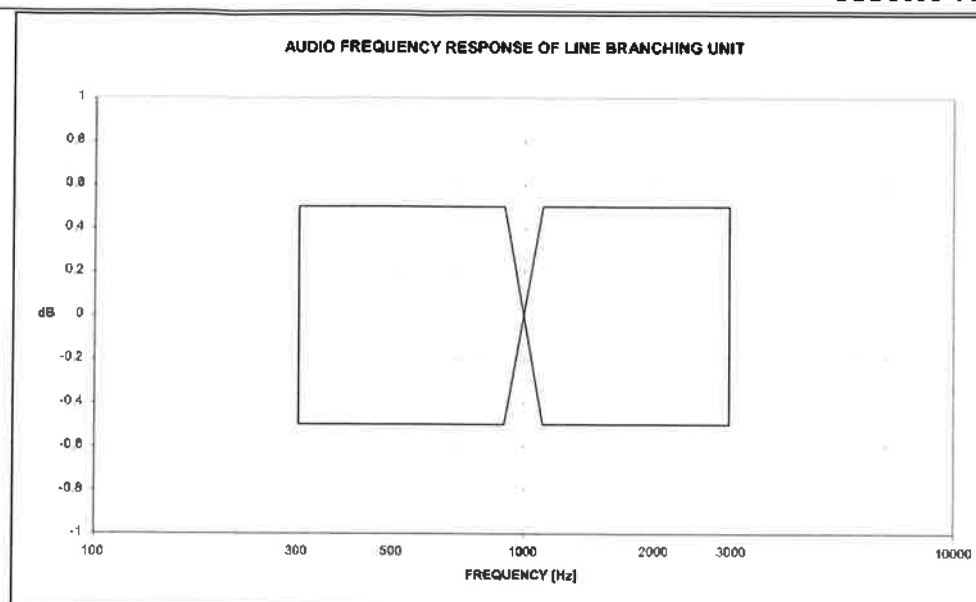
- 2.4.7.2.1 Ensure that the audio signal generator and audio level meter are set to the correct impedance.
- 2.4.7.2.2 Route all the input terminals to all the output terminals. This is required for the tests that follow.
- 2.4.7.2.3 Apply a 1 kHz signal at a level of – 10 dBm into channel 1 of the LBU.
- 2.4.7.2.4 Measure the signal level at the output terminals of the LBU.
- 2.4.7.2.5 Adjust the output levels to obtain – 10 dBm if necessary.
- 2.4.7.2.6 Repeat the measurements with the audio signal applied to the other input terminals.
- 2.4.7.2.7 All output levels should be – 10 dBm without readjustment.

2.4.7.3 Audio frequency response

Connect the equipment as shown below.

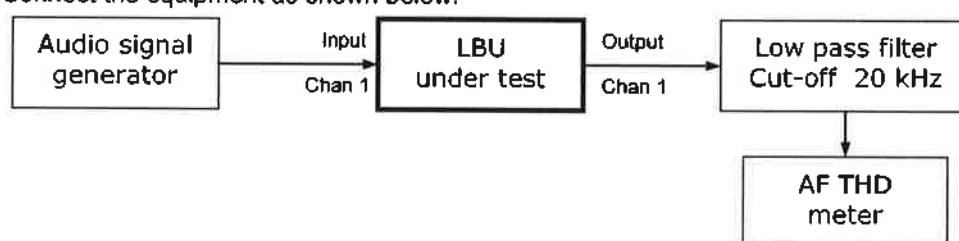


- 2.4.7.3.1 Ensure that all the audio levels are set correctly.
- 2.4.7.3.2 Apply a 1 kHz signal at a level of – 10 dBm into channel 1 of the LBU.
- 2.4.7.3.3 Measure the signal level at the output terminal of channel 1.
- 2.4.7.3.4 While keeping the audio signal level constant vary the frequency from 300 Hz to 3 kHz.
- 2.4.7.3.5 Record the variation of the audio output level in dB with reference to the corresponding level at 1 kHz.
- 2.4.7.3.6 Repeat the measurements with the audio signal applied to the other input terminals.



2.4.7.4 Audio total harmonic distortion (THD)

Connect the equipment as shown below.



2.4.7.4.1 Ensure that all the audio levels are set correctly.

2.4.7.4.2 Route all the input terminals to all the output terminals.

2.4.7.4.3 Ensure that the audio signal generator and THD meter are set to the correct impedance.

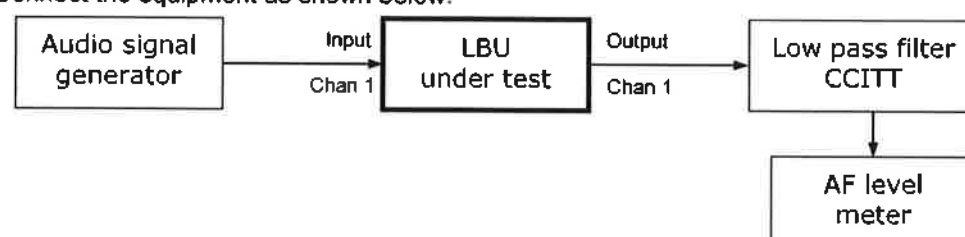
2.4.7.4.4 Apply a 1 kHz signal at a level of -10 dBm into channel 1 of the LBU.

2.4.7.4.5 Record the audio total harmonic distortion obtained at the output terminals.

2.4.7.4.6 Repeat the measurements with the audio signal applied to the other input terminals.

2.4.7.5 Audio signal to hum and noise ratio

Connect the equipment as shown below.



2.4.7.5.1 Ensure that all the audio levels are set correctly.

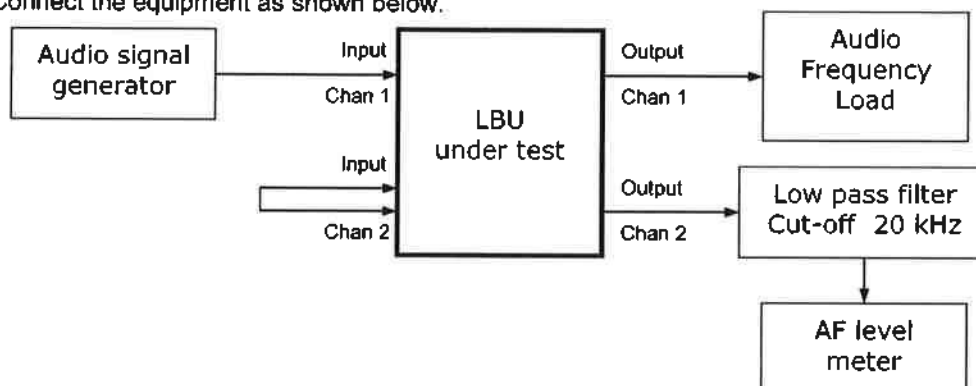
2.4.7.5.2 Route all the input terminals to all the output terminals.

2.4.7.5.3 Apply a 1 kHz signal at a level of -10 dBm into channel 1 of the LBU.

- 2.4.7.5.4 Short-circuit all the other input terminals.
- 2.4.7.5.5 Measure the signal level at the output terminals of the LBU.
- 2.4.7.5.6 Remove the audio signal generator and short circuit the input terminal (1) of the LBU.
- 2.4.7.5.7 Measure the signal level at the output terminals of the LBU.
- 2.4.7.5.8 Calculate the ratio in dB between the audio output levels obtained with and without the applied audio signal, as the signal to hum and noise ratio.
- 2.4.7.5.9 Repeat the measurements with the audio signal applied to the other input terminals.
- 2.4.7.5.10 Record the lowest ratio as the result.

2.4.7.6 **Channel cross talk**

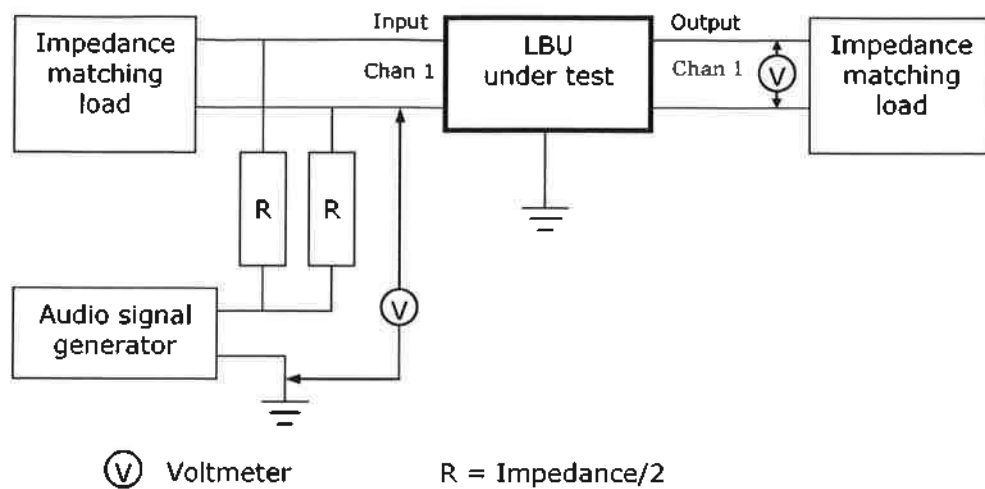
Connect the equipment as shown below.



- 2.4.7.6.1 Route all the channels to operate separately e.g. Channel 1 input terminal to channel 1 output terminal; channel 2 input terminal to channel 2 output terminal; etc.
- 2.4.7.6.2 Ensure that all the level settings are correct for each channel.
- 2.4.7.6.3 Inject a 1 kHz signal at a level of -10 dBm into channel 1 of the LBU.
- 2.4.7.6.4 Short-circuit all the other input terminals.
- 2.4.7.6.5 Calculate the ratio in dB between the audio input signal level and that measured at the other output terminals, except that of channel 1.
- 2.4.7.6.6 Repeat the measurements with the audio signal injected into the other input terminals.
- 2.4.7.6.7 Record the worst case as the result.

2.4.7.7 Common-mode rejection ratio

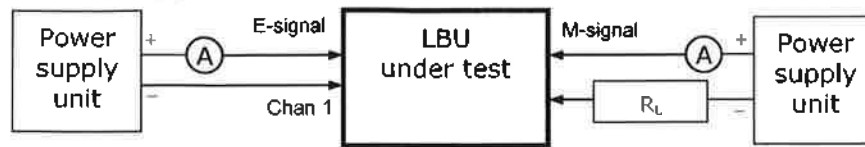
Connect the equipment as shown below.



- 2.4.7.7.1 Adjust the amplification of the LBU to unity gain.
If the gain cannot be adjusted, measure the input and output voltage levels and calculate the gain.
- 2.4.7.7.2 Set the audio signal generator frequency to 1 kHz and set the output impedance to HIGH.
- 2.4.7.7.3 Increase the signal output level of the audio generator till the level measured on the output line of the LBU, also increases.
- 2.4.7.7.4 Record the input and output signal voltage levels.
- 2.4.7.7.5 If the LBU is set for unity gain, calculate the ratio in dB between the audio input signal level and that measured on the output line of the LBU.
OR
- 2.4.7.7.6 If the LBU has a gain, calculate the ratio by dividing the input voltage level by the output voltage level.
Multiply the calculated ratio with the gain of the LBU under tests and express the ratio in dB.
e.g. Input voltage/Output voltage = R:1
 $R \times \text{Gain} = T:1$
 $\text{dB} = 20\text{Log}_{10}(T/1)$
- 2.4.7.7.7 Repeat the measurement on the other channels.
- 2.4.7.7.8 Record the worst case as the result.

2.4.7.8 E & M-signalling

Connect the equipment as shown below.

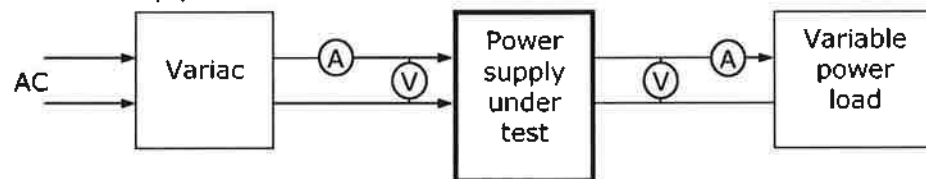


(A) Ammeter

- 2.4.7.8.1 Route the E-signal of channel 1 to activate the M-signal of all the channels.
- 2.4.7.8.2 The value of the load resistor R_L must be such to permit a current flow of 8 mA to 10 mA.
- 2.4.7.8.3 Apply a DC voltage at the appropriate level to the M signal terminal.
- 2.4.7.8.4 Apply a DC voltage at the appropriate level to the E signal terminal and measure the current.
- 2.4.7.8.5 Measure the current flow at all the M-signal terminals.
- 2.4.7.8.6 Reverse the voltage polarity at the E & M-signal terminals and repeat the test.
- 2.4.7.8.7 Repeat the above tests with other routing combinations.
- 2.4.7.8.8 Measure the resistance between the E & M-signal terminals and the LBU earth. The resistance must be infinity.

2.4.8 Power Supply & Battery Charger Unit**2.4.8.1 Output voltage regulation**

Connect the equipment as shown below.



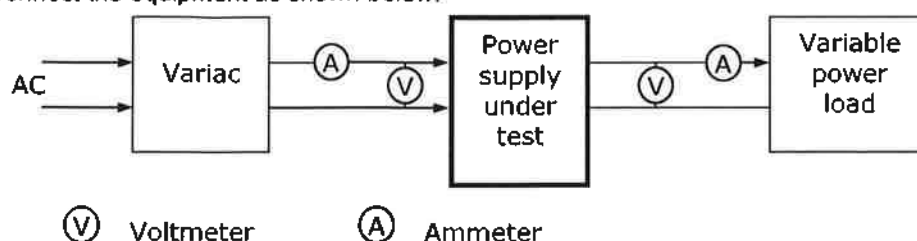
(V) Voltmeter

(A) Ammeter

- 2.4.8.1.1 Intermittent:
 - 2.4.8.1.1.1 Adjust the Variac to obtain the nominal input voltage to the power supply/battery charger.
 - 2.4.8.1.1.2 Vary the power load to obtain a current drain from 0 ampere to maximum current while recording the output voltage.
 - 2.4.8.1.1.3 The measurement shall be made under the extreme test conditions as well.
- 2.4.8.1.2 Continuous:
 - 2.4.8.1.2.1 Adjust the Variac to obtain the nominal input voltage to the power supply/battery charger.
 - 2.4.8.1.2.2 Set the power load to obtain the maximum current drain and record the output voltage level for a period of four hours.

2.4.8.2 **Efficiency**

Connect the equipment as shown below.

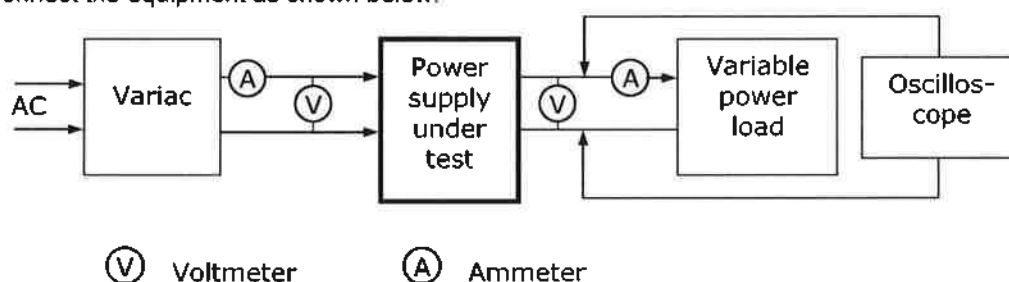


- 2.4.8.2.1 Adjust the Variac to obtain the nominal input voltage to the power supply/battery charger.
- 2.4.8.2.2 Vary the power load to obtain a current drain from 0 ampere to maximum current while recording the input and output voltages and currents.
- 2.4.8.2.3 Calculate the efficiency in percentage.

$$\text{Efficiency} = (\text{Power out} / \text{Power in}) \times 100 \%$$
- 2.4.8.2.4 Repeat the test with the specified minimum and then the maximum input voltage to the power supply/battery charger.
- 2.4.8.2.5 Record the worst case as the result.

2.4.8.3 **Output voltage ripple**

Connect the equipment as shown below.

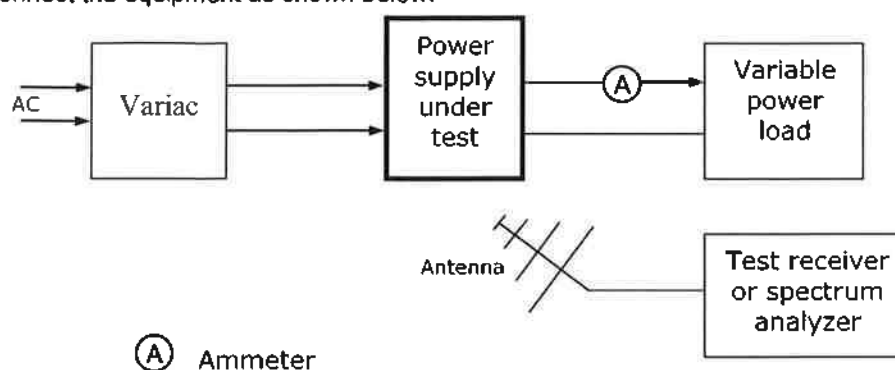


- 2.4.8.3.1 Adjust the Variac to obtain the nominal input voltage to the power supply/battery charger.
- 2.4.8.3.2 Vary the power load to obtain a current drain from 0 ampere to maximum current while recording the output voltage ripple with the oscilloscope.
- 2.4.8.3.3 The measurement shall be made under the extreme test conditions as well.
- 2.4.8.3.4 Record the worst case as the result.

Note: Some battery chargers apply high instantaneous pulses of short duration. In a Lead-acid battery, this breaks down lead-sulphate crystals, thus extending the battery service life. This function must be noted.

2.4.8.4 Radiation of spurious frequencies

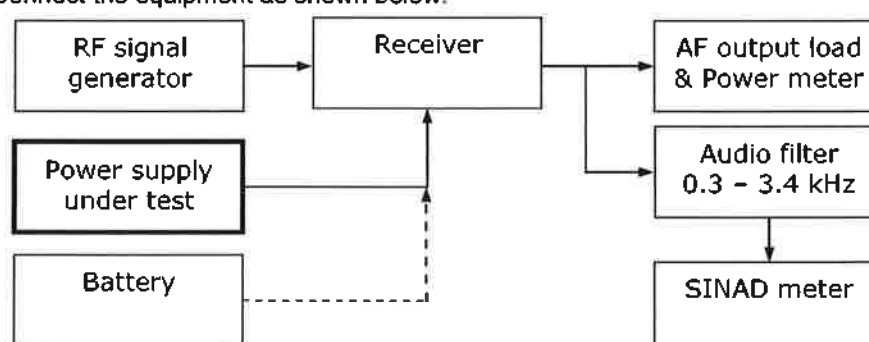
Connect the equipment as shown below.



- 2.4.8.4.1 This test has to be performed inside a Faraday cage (RF shielding).
- 2.4.8.4.2 All the instruments and electrical equipment inside the cage not used for the test have to be switched off to prevent interference with the frequencies to be scanned. Ideally, all the equipment except the power supply under test and the antenna should be on the outside of the cage.
- 2.4.8.4.3 The measuring antenna to be placed 1 m from the power supply/battery charger.
- 2.4.8.4.4 Vary the power load to obtain a current drain from 0 ampere to maximum current while scanning the radio-operating band (455.0000 MHz to 467.0000 MHz).
- 2.4.8.4.5 Record the frequencies and levels of all the detected signals.

2.4.8.5 Desensing of receiver (conductive)

Connect the equipment as shown below.



- 2.4.8.5.1 Use a battery to power the receiver.
- 2.4.8.5.2 Adjust the RF signal generator to produce a standard RF test signal.
- 2.4.8.5.3 Adjust the volume control of the radio to give SOP.
- 2.4.8.5.4 Reduce and record the RF signal input level at which 12 dB SINAD ratio is obtained.
- 2.4.8.5.5 Replace the battery with the power supply under test.
- 2.4.8.5.6 The length of the power leads to the radio must be 1.0 m.
- 2.4.8.5.7 Place the power supply as far as possible from the radio.
- 2.4.8.5.8 Readjust and record the RF signal output level at which 12 dB SINAD ratio is obtained.
- 2.4.8.5.9 Record the difference in dB between the recorded RF signal levels as the receiver desensing.

2.5 Trunking functional tests

Programme the radio under test with the correct trunking parameters and with a validated number on the trunk network.

1.5.1 On instrument

Connect the radio under test to the trunk enabled instrument.

1.5.1.1 Registration

Switch the radio on and ensure that it register on the instrument. The radio will display a registered indication and the instrument will display the radio's trunking number.

1.5.1.2 Make a call with the same prefix number (e.g. 2052001203 to 2052001204).

The instrument will display the called radio's prefix and the *derived* identification number.

1.5.1.3 Make a call with the interprefix number (e.g. interfleet call: 2052001203 to 2142001301).

The instrument will display the called radio's prefix and the *derived* identification number.

1.5.1.4 Short form dialling (e.g. 204)

Repeat 1.5.1.2 using the short form dialling.

1.5.1.5 PSTN call (e.g. 0117748227)

The dialled number must be presided with 0 (e.g. 00117748227). The instrument will display the called number.

1.5.1.6 Call the radio under test

Make a call to the radio from the instrument.

1.5.1.7 Handoff

Change the control channel on the instrument and ensure that the radio re-register on the new channel.

1.5.2 On trunk system

Two trunk radios and a PSTN telephone must be available and dedicated to the tests.

One trunk radio must be programmed with the same prefix number as the radio under test and the second radio with an interprefix number.

1.5.2.1 Registration

Switch the radio under test on and ensure that it register on the trunk system.

The radio will display a registered indication.

1.5.2.2 Local call

Ensure that all the trunk radios are registered on the same local site.

1.5.2.2.1 Call a radio with the same prefix number

Call the radio having the same prefix number. Have a conversation with the second party.

1.5.2.2.2 Call a radio with an interprefix number

Call the radio having the interprefix number. Have a conversation with the second party.

1.5.2.2.3 Short form dialling

Repeat 1.5.2.2.1 using the short form dialling. Have a conversation with the second party.

1.5.2.2.4 Call the radio under test

Make a call to the radio under test from the other radios.

1.5.2.3 Intersite call

Move the radio under test to a distant site.

Ensure that the radio is registered on that site.

1.5.2.3.1 Call a radio with the same prefix number

Call the radio having the same prefix number. Have a conversation with the second party.

1.5.2.3.2 Call a radio with an interprefix number

Call the radio having the interprefix number. Have a conversation with the second party.

1.5.2.3.3 Short form dialling

Repeat 1.5.2.3.1 using the short form dialling. Have a conversation with the second party.

1.5.2.3.4 PSTN call

Call the PSTN telephone. Have a conversation with the second party.

1.5.2.3.5 Call the radio under test

Call the radio under test from the other radios. Have a conversation with the second party.

1.5.2.3.6 Handoff

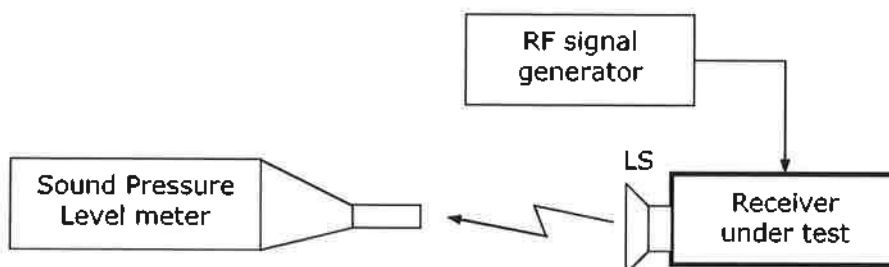
Travel between sites and ensure that the radio under test re-register on the different sites.

Note: Call failures must be confirmed through different trunk sites.

2.6 Acoustical Measurements

2.6.1 Receiver loudspeaker sound pressure level

Connect the equipment as shown below.



2.6.1.1 Adjust the RF signal generator to produce a standard RF test signal.

2.6.1.2 Increase the modulation to 2.5 kHz (maximum system modulation).

2.6.1.3 Adjust the volume control of the radio to obtain MUOP.

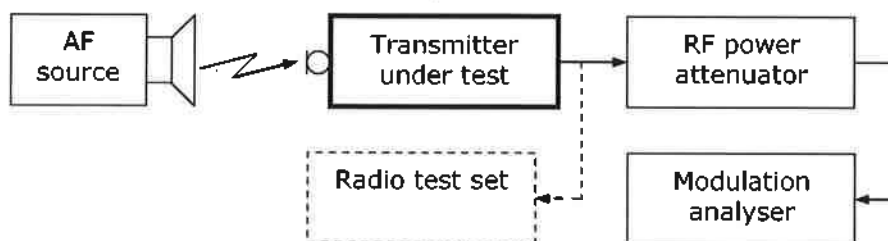
2.6.1.4 Place the Sound Pressure Level (SPL) meter at a distance of 300 mm in front of the radio loudspeaker.

2.6.1.5 Record the SPL in dB(A).

Note: Sound wave reflections should be kept to a minimum by measuring in an open area.

2.6.2 Transmitter modulation (deviation)

Connect the equipment as shown below.



2.6.2.1 Ensure that the transmitter modulation limiting has been set correctly (see clauses 2.3.7).

2.6.2.2 Generate a 1 kHz tone with the AF source at a level of 80 dB(A), measured at the radio microphone.

2.6.2.3 Transmit and record the measured deviation.

Note: Sound wave reflections should be kept to a minimum by measuring in an open area.

3. RELEVANT DOCUMENTATION**APPLICABLE**

DOCUMENT NO.	DESCRIPTION	LOCATION
SANS 300086-1:2005	Electromagnetic compatibility and Radio Spectrum Matters (ERM); Land Mobile Service; Radio equipment with an internal or external RF connector intended primarily for analogue speech Part 1: Technical characteristics and methods of measurement.	External

RELEVANT

DOCUMENT NO.	DESCRIPTION	LOCATION

END OF DOCUMENT