DOC CONTRACTOR REPORT DOC-CR-SP-82-030

TITLE: A Study on the Development and Construction of Low-Power TV-UHF Transmitters for Program Distribution from TVROs

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DOC-CR-SP-82-030

FINAL REPORT

PERFORMANCE TEST DATA

MANUFACTURER: DELTA-BENCO-CASCADE LTD
124 BELFIELD ROAD
REXDALE, ONTARIO
M9W 1G1

MODEL NO: TMU-2020

TYPE OF EQUIPMENT: LOW POWER TV BROADCAST

SERIAL NO:

TESTED TO RADIO STANDARDS SPECIFICAITON NO: 151 ISSUE NO: 1

TEST RESULTS CERTIFIED BY: JOHN VANDERMEY, B.Sc. P.Eng.

DATE: APRIL 7, 1982

TEST REPORT PREPARED FOR: DELTA-BENCO-CASCADE LTD
124 BELFIELD ROAD,
REXDALE
ONTARIO
M9W 1G1

REGISTERED PROFESSIONAL ENGINEER
J. VANDERMEY
PROVINCE OF ONTARIO

A. DESCRIPTION OF CURRENT AND RELATED EQUIPMENT, AND DISCUSSION OF PROBLEMS FACED IN:

i) Developing entirely new equipment, and

ii) Modifying existing equipment

As may be evident from the modulator section of the attached block diagram, it was a modification of the output stage which was required, rather than a development of an entirely new unit. Since modulation and signal processing is done at either baseband, or at the I.F. of 45 MHz in DBC's existing VHF modulator, these two modules remain unchanged in the UHF version. The output converter is described in detail (in Section D - Description of Final Equipment) and it may be added that its topology is equivalent to the one used at VHF, and that differences between the two are a result of the higher operating frequency. For example, a VHF bandpass filter may be constructed with lumped components. While at UHF, parasitic reactances make such a design approach unworkable and distributed element filters are more effective.

The power amplifier is the result of development of an entirely new piece of equipment, however. Push-pull amplifying stages were designed using the industry's newest UHF high power transistors, whereas VHF transistors for TV broadcast applications have existed for 5-10 years. DBC uses TRW devices in its line of VHF amplifiers. These consist of a broadband hybrid pre-driver, followed by a number of single transistor stages tuned with lumped elements, whereas the UHF amplifier was push-pull and distributed element circuitry throughout.

The main problem area which existed in research was in the area of linearity as measured in the tests on intermodulation and differential gain in the attached D.O.C. type approval submission. IM is a form of harmonic distortion, and differential gain degradation is a result of amplifier limiting during peak power excursions of the signal. The IM characteristic was optimized through development of a Germanium diode based pre-correction network, and the differential gain characteristic was optimized by operating all stages up to the final stage at output power levels near 50% of their capability. This yielded greater control over performance as the main contributor to this type of non-linearity would then be the single output stage. As outlined in Section D - Description of Final Equipment, the transistor biasing circuit was carefully designed to provide excess current during short periods of time, which greatly contributes to the linearity of the differential gain characteristic.

B. EXPLANATION OF HOW DESIGN PROBLEMS OUTLINED IN R & D STATEMENT HAVE BEEN SOLVED.

A thorough explanation of operation and design of the complete transmitter is given in Part D of this report.

C. THE APPLICABILITY OF V MOSFET TO THE P.A. AND RELATED ECONOMIC CONSIDERATIONS

Realization of this 20 W UHF P.A. using (Siliconix) V Mosfet devices has been found to be impractical. The reason being that in the common source configuration V-FETs will not perform beyond 300-400 MHz. The common gate application on the other hand would present serious problems with input and output return losses.

Moreover, one of the main reasons for their application was the possibility of using them in a distributed amplifier configuration and subsequent elimination of expensive splitting and combining quadrature hybrid couplers.

These couplers, available at U.S. $60.00 each, are required in quantity of two per each stage, i.e. six per P.A. if the design were to be based on the bipolar push-pull configuration.

It has been found and practically verified that elimination of quadrature couplers in favour of Sage 50 Ohm rigid 2-prong wireline directional couplers yield excellent performance and incomparably low cost (U.S. $24.00 versus U.S. $360.00).

This was the key factor in choosing bipolar transistors rather than V Mosfet.

D. DESCRIPTION OF FINAL EQUIPMENT

1. UHF Modulator

The incoming video signal is applied to a group delay predistortion board. This board generates the required standard receiver correction curve. A buffer stage is used at the input to improve the return loss over that which would be obtained by the all pass circuits. The desired group delay is generated by three all pass circuits in bridged-T form. The solution of the required all pass characteristics was generated by a computer. Additional amplitude rejection at 4.75 MHz is also provided by this board to ensure compliance with the D.O.C. amplitude response requirements if the SAW filter temperature is raised to 50°C.

The video signal is then applied to the modulator board. The level of the signal is controlled by an adjustable resistor so that the modulation depth can be set properly. The video signal is then amplified. The amplifier has feedback and a low output impedance to charge the clamp capacitor. The sync pulse tips are clamped to a constant level by a diode. A high impedance compound emitter follower stage maintains the charge on the clamp capacitor between sync pulses.

A 45.75 MHz carrier is generated by a crystal-controlled oscillator. This is applied to a multiplier circuit along with the video signal to produce a double sideband AM signal. The depth of modulation is controlled by the video level as well as the DC level of the sync pulses.

The audio signal is applied to a pad to reduce the level sufficiently for application to the differential stage. This stage has sufficient common mode rejection at low frequencies to eliminate the need for a balanced input transformer, resulting in improved low frequency response. An RC network provides the required pre-emphasis for FM sound transmission.

The audio signal is applied to a voltage controlled oscillator generating the FM carrier at 41.25 MHz. The average frequency of the signal must be controlled to within 1 KHz. This is accomplished by a phase locked loop circuit.

A portion of the unmodulated video IF crystal oscillator signal and the aural IF signal are mixed together producing an inter-carrier difference of 4.5 MHz. After passing through a bandpass filter, the signal is interfaced to the following logic. This signal is then subjected to binary division (2^{14}) to reduce the maximum phase deviation to 4°. This amount of frequency division is necessary to ensure the phase comporator does not try to follow the audio modulation.

The second input to the phase comparator is obtained from a 4.5 MHz crystal oscillator and a similar divider.

The resulting aural signal will always be locked 4.5 MHz away from the visual carrier.

2. IF Board

The double sideband signal from the video modulator must be filtered to produce the required vestigial sideband signal required for TV transmission. This is done with a surface acoustic wave filter. The filter attenuates the undesired sideband and the higher video frequency components as defined by the D.O.C. specifications. Two amplifier stages produce the required gain to offset the SAW filter losses. A directional coupler is used to add in the aural signal.

3. IF to UHF Converter

A second order bandpass filter eliminates any harmonics from the IF board. The signal is then applied to a double balanced mixer which converts to signal into the UHF band.

The oscillator signal for the mixer is generated from a crystal oscillator and frequency multiplier. Depending on the channel, a multiplying factor of 4 or 6 is used. Considerable filtering is required to reduce the undesired harmonics. This is accomplished with two second order cavity filters.

The UHF signal is amplified by three broadband IC amplifiers. A three-pole bandpass filter is used to attenuate the undesired sidebands and oscillator leakage. The output of the filter is a TV signal with a level of +5 dBm, conforming to D.O.C. standards.

4. Power Amplifier

The input stage of the power amplifier is a broadband IC capable of 100 mW output at -60 IMD with 18 dB gain.

A new method of biasing RF power transistors has been developed and is used in all the discrete power amplifier stages. Biasing RF power transistors is complicated by the fact that the emitters must be soldered directly to the ground plane to achieve the required gain. This means the usual resistor in the emitter cannot be used to stabilize the DC operating point.

The convential solution to this problem has been to add a small value resistor in the collector circuit to monitor the collector current. The base is then fed current in such a manner as to maintain a constant voltage across the collector voltage cropping resistor via a suitable feedback circuit.

There are several problems with this arrangement. If the amplifier is severely overdrawn, the emitter base junction will rectify the signal providing a DC bias for the base. If the levels are sufficient, the current from the bias supply may drop to zero, but the bias developed by the signal may be great enough to exceed the ratings of the transistor. Short transients of a high level may cause the amplifier to fail.

Secondly, the non-linear transfer characteristic of the amplifier transistor introduces a DC component in the collector current. The conventional bias circuit will act to reduce the collector current during the sync pulse peaks reducing the available output power. The V-MOS FET does not have these problems.

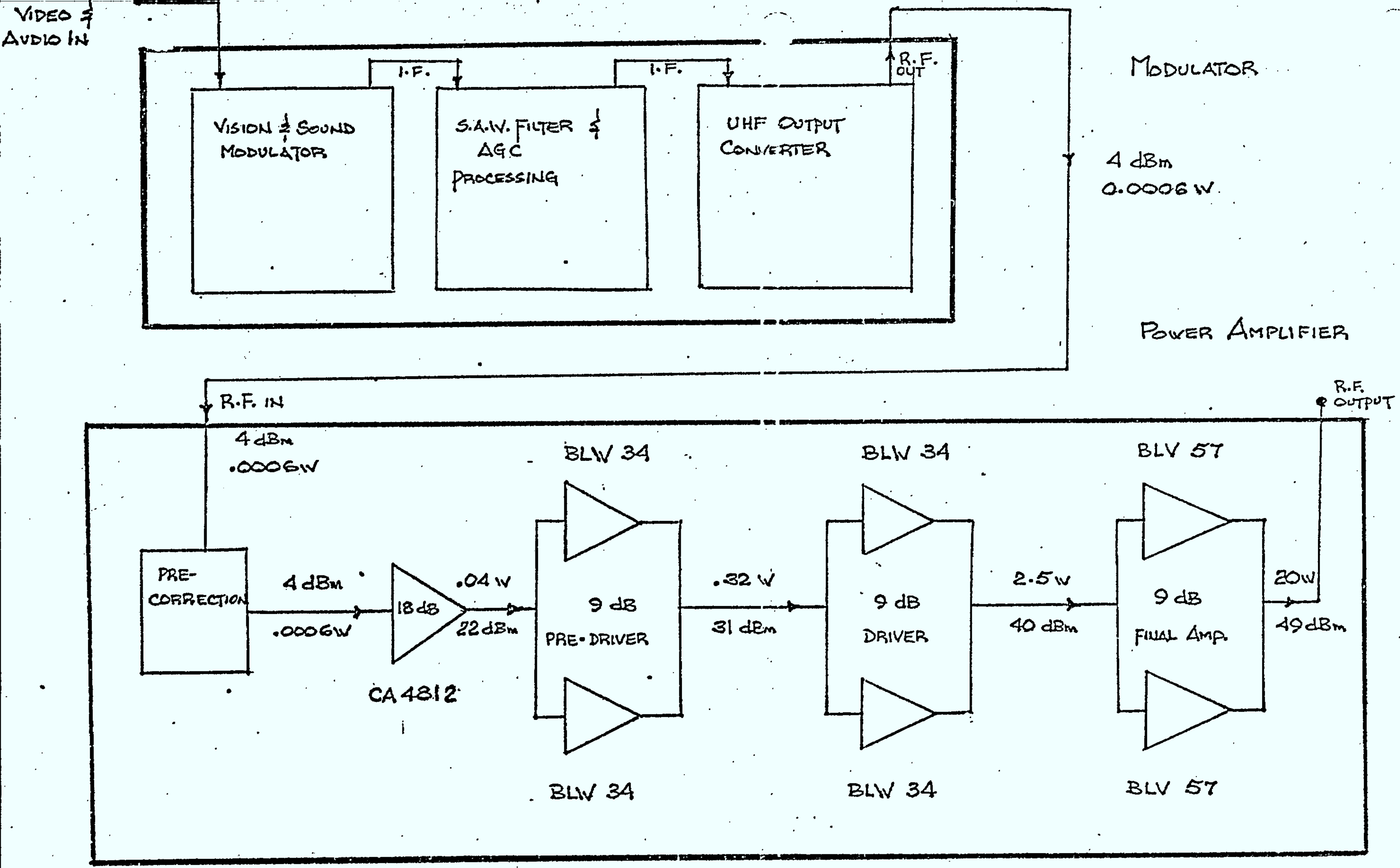
The new biasing arrangement was a current source to supply the collector rather than a voltage source. The collector voltage is defined by a zener diode between the the base and collector.

It is the nature of a TV signal that the average power is much less than the peak power. By suitably choosing the bias bypass capacitors, the transistor can draw excess current for short periods of time, but the average current is set by the current source. No transistor failure has occurred under testing with heavy overload conditions.

The driver amplifiers are designed using stripline techniques. The transistors have a gain roll off of 6 dB per octave. The input current is matched at the highest frequency of operation (850 MHz). The input current is designed to appropriately mismatch the lower frequencies to arrive at a flat gain versus frequency characteristic. The output matching circuit is designed for best match over the frequency of interest.

Each stage uses two transistors summing in parallel coupled by 3 dB 90° hybrid couplers. These couplers have the property that when the two outputs are similarly mismatched, the reflected power is absorbed entirely by the isolation port. The effect of mismatching the input circuits at the basic end of the UHF band is masked by the use of these couplers.

The output stage is similar to the driver stages except that the transistors are push pull. These are two balanced circuits coupled in parallel by means of a 3 dB 90° coupler.


VIDEO & AUDIO IN
MODULATOR
I.F.
I.F.
R.F. OUT
VISION & SOUND MODULATOR
S.A.W. FILTER & AGC PROCESSING
UHF OUTPUT CONVERTER
4 dBm
0.0006 W
POWER AMPLIFIER
R.F. IN
4 dBm
.0006W
R.F. OUTPUT
BLW 34
BLW 34
BLV 57
PRE-CORRECTION
4 dBm
.0006W
18dB
CA 4812
.04 w
22 dBm
9 dB
PRE-DRIVER
.32 W
31 dBm
9 dB
DRIVER
2.5 w
40 dBm
9 dB
FINAL AMP.
20W
49 dBm
BLW 34
BLW 34
BLV 57

E. FINAL SPECIFICATIONS

GENERAL EQUIPMENT INFORMATION

TRANSMITTERS	
FREQUENCY RANGE	470 - 805 MHZ
NUMBER OF CHANNELS	1
BANDWIDTH	6 MHZ
TYPE OF EMISSION	A5C, F3
OUTPUT IMPEDANCE	50 OHM
~~CRYSTAL~~ FREQUENCY(IES)	45,75 4.5 128.166[0] ?
POWER OUTPUT: Manufacturing rating	20 W

TEST RESULTS

4. STANDARD TEST CONDITIONS

4.2	Standard Test Voltage	117	V
4.3	Standard Test Temperature	23	°C
4.4	Standard Test Load	50	Ohms
4.5	Standard Test Frequency	723.25	MHz
4.6	Standard Test Input Video	1	V p-p
	Audio	+8	dBm
4.7	Standard Test Equipment	-	See Test Methods
4.8	Standard Test Set-up	-	See 7.22
4.9	Warm-up Time	30	Min

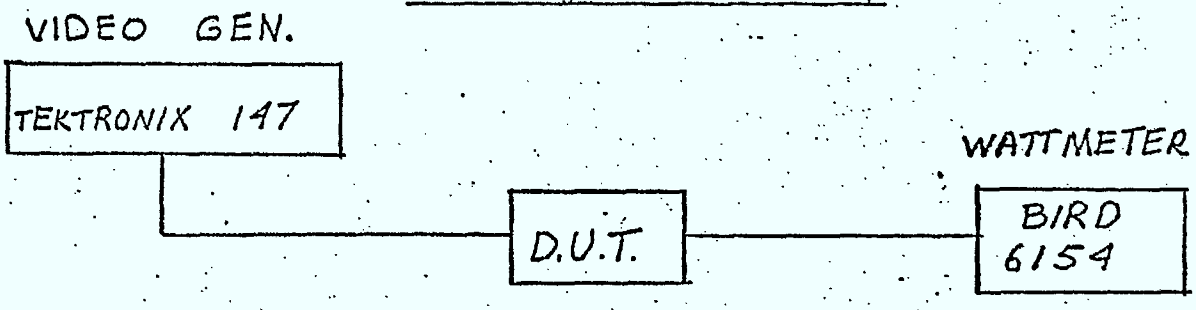
5. TRANSMITTER STANDARDS

5.1	Transmission System	M/NTSC	
5.2	Type of Emission	A5C, F3	
5.3	Power Output Rating	20	Watts
5.4	Audio Pre-emphasis	75	Micro Seconds
5.5	Power Supply Rating	117	V 60 Hz

6. MINIMUM STANDARDS

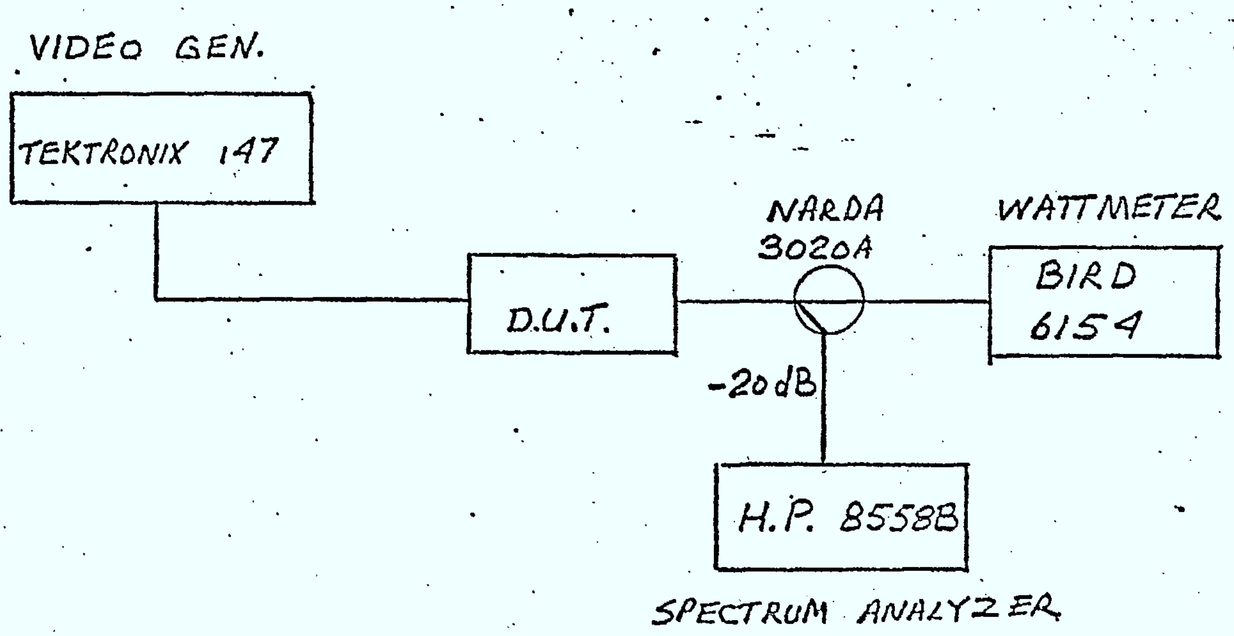
6.1	Visual Power Output Rating	20	W
	Standard	12	W Sync and Blanking
	Test Results	12	W
	Peak Envelope Power = 1.68 X =	20.16	Watts Sync

Block Diagram of Test Set-up



6.2	Aural Power Output Rating		
	Minimum Standard	-13 to - 7	dB of Visual
	Test Result	10	dB of Visual

Block Diagram of Test Set-up

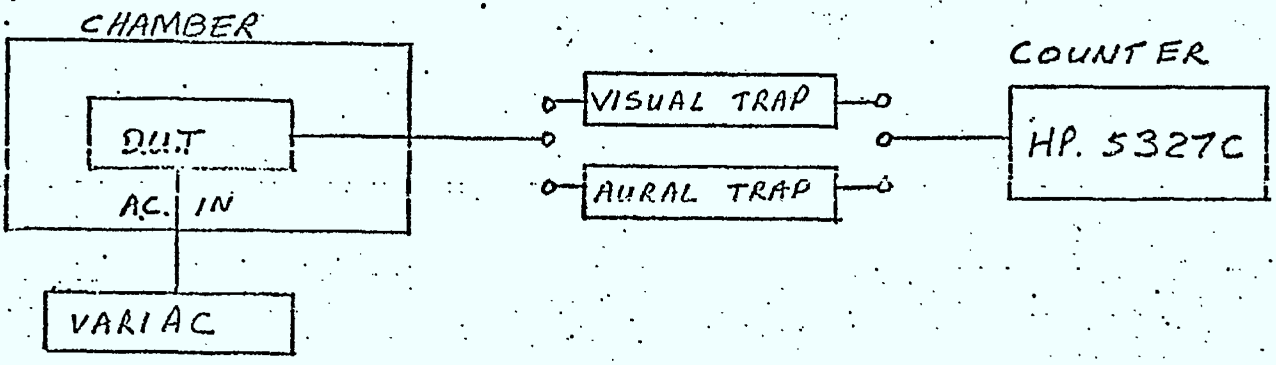


6.3 Carrier Frequency Stability

Minimum Standard	±.003	%
Test Results Visual	.0016	%
Aural	.0015	%
Temperature Range	5 °C	To 50 °C
Category	B	

Test Conditions Environmental Chamber, Temperature - as stated above, one hour allowed for temperature equalization at each new temperature, no modulation.

Test Set-up



Test Results

Time (Min)	Visual Frequency (MHz)	Aural Frequency (MHz)
0		
1	723.250 135	727.750 134
2	723.250 094	727.750 093
3	723.250 098	727.750 097
4	723.250 055	727.750 054
5	723.250 017	727.750 016
6	723.250 040	727.750 039
7	723.249 926	727.749 924
8	723.249 877	727.749 876
9	723.249 841	727.749 840
10	723.249 844	727.749 844
11	723.249 866	727.749 865
12	723.249 890	727.749 889
13	723.249 847	727.749 846
14	723.249 744	727.749 743
15	723.249 723	727.749 722

Mean Frequency	Visual	723.249 936 MHz	at	22 °C
	Aural	727.749 935 MHz	at	22 °C

Frequency at 50 °C

Supply (%)	Visual (MHz)	Aural (MHz)
85	723.243 277	727.743 126
100	723.243 149	727.743 098
115	723.243 173	727.743 122

Frequency at 5 °C

Supply (%)	Visual (MHz)	Aural (MHz)
85	723.261 122	727.761 159
100	723.261 141	727.761 179
115	723.261 197	727.761 235

Maximum Visual Deviation 0.011 261 MHz

.0016 %

Maximum Aural Deviation 0.011 300 MHz

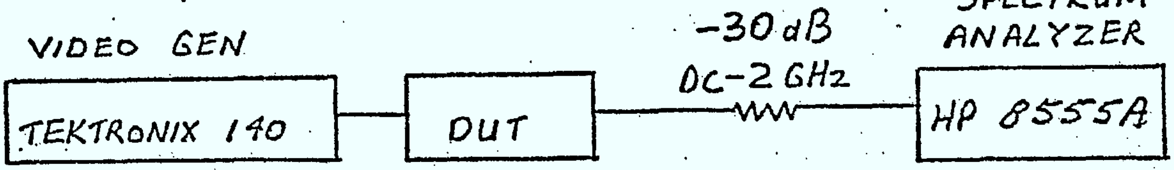
.0015 %

6.4 Spurious Emissions

Minimum Standard 60 dB, 30 dB at -4.5, -3.58, +9.0 +8.08 MHz

Test Result	Second Harmonic	> 70	dB
	Third Harmonic	> 70	dB
	-4.5 MHz	36	dB
	-3.58 MHz	40	dB
	+8.08 MHz	46	dB
	+9.0 MHz	40	dB

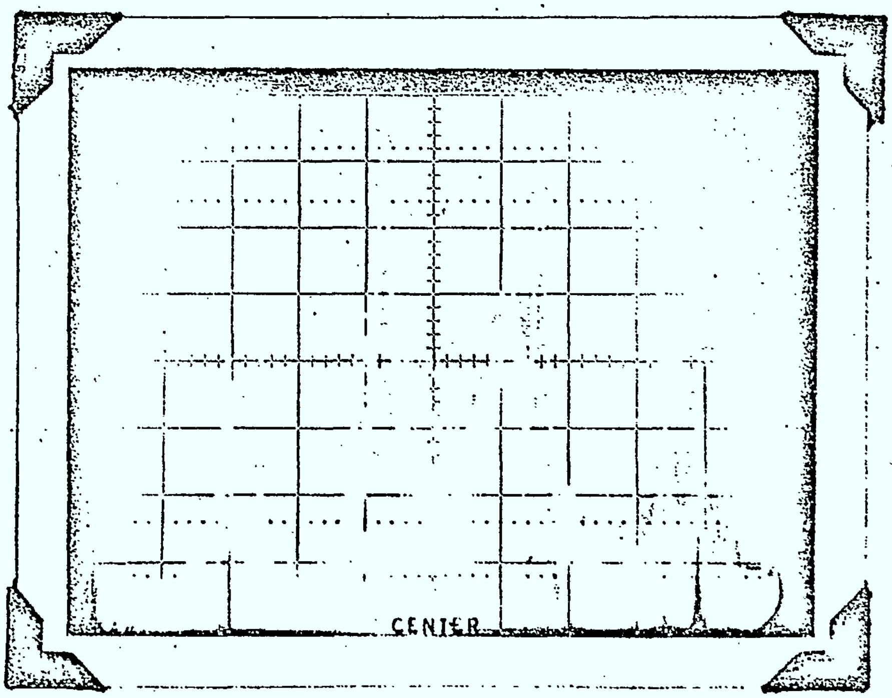
Test Set Up



Note: A Visual and Aural fundamental frequency trap is required between the 30 dB power attenuator and the spectrum analyzer when measuring harmonics due to harmonic generation inside the analyzer.

Spurious Emissions -4.5 to +9.0 MHz

10 dB/Div

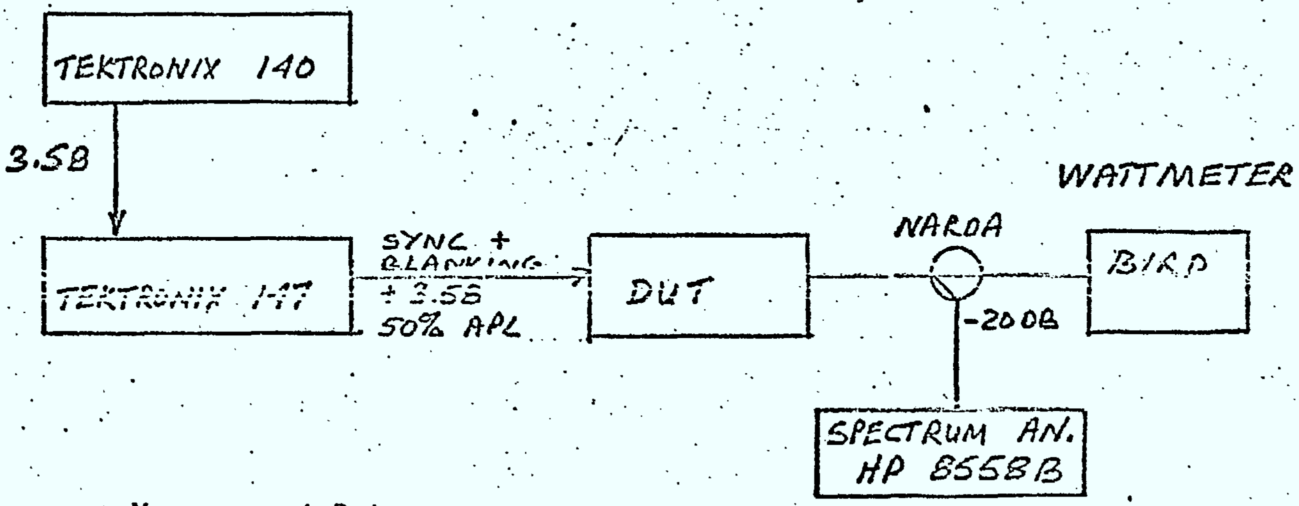


2 MHz/Div

6.5 Intermodulation

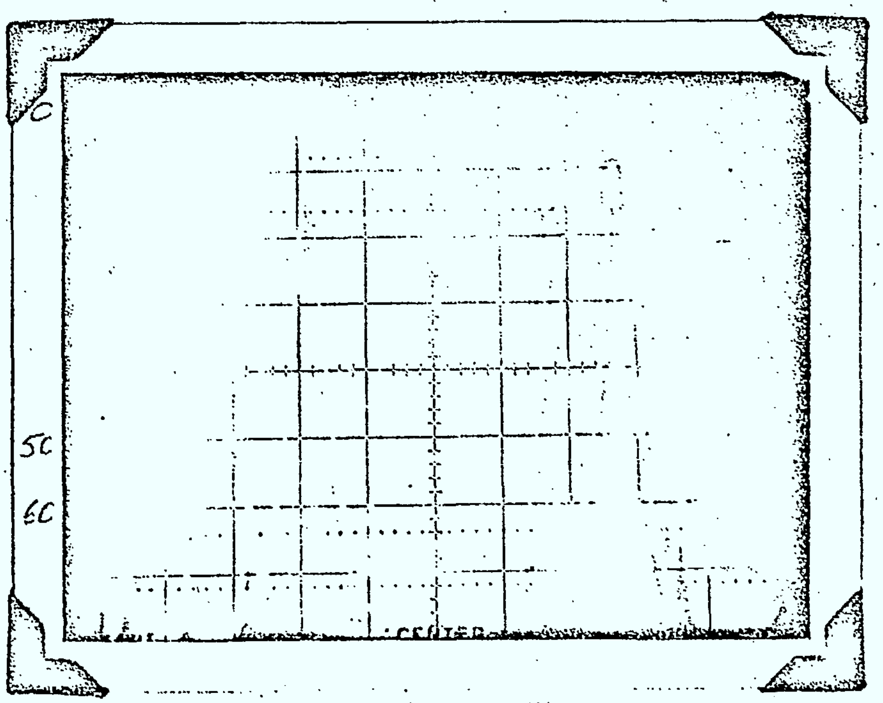
Minimum Standard		50	dB
Test Results	± .920 MHz	58	dB
	± 2.66 MHz	64	dB
	+ 5.42 MHz	57	dB

Test Set Up



Measurement Data

/DIV



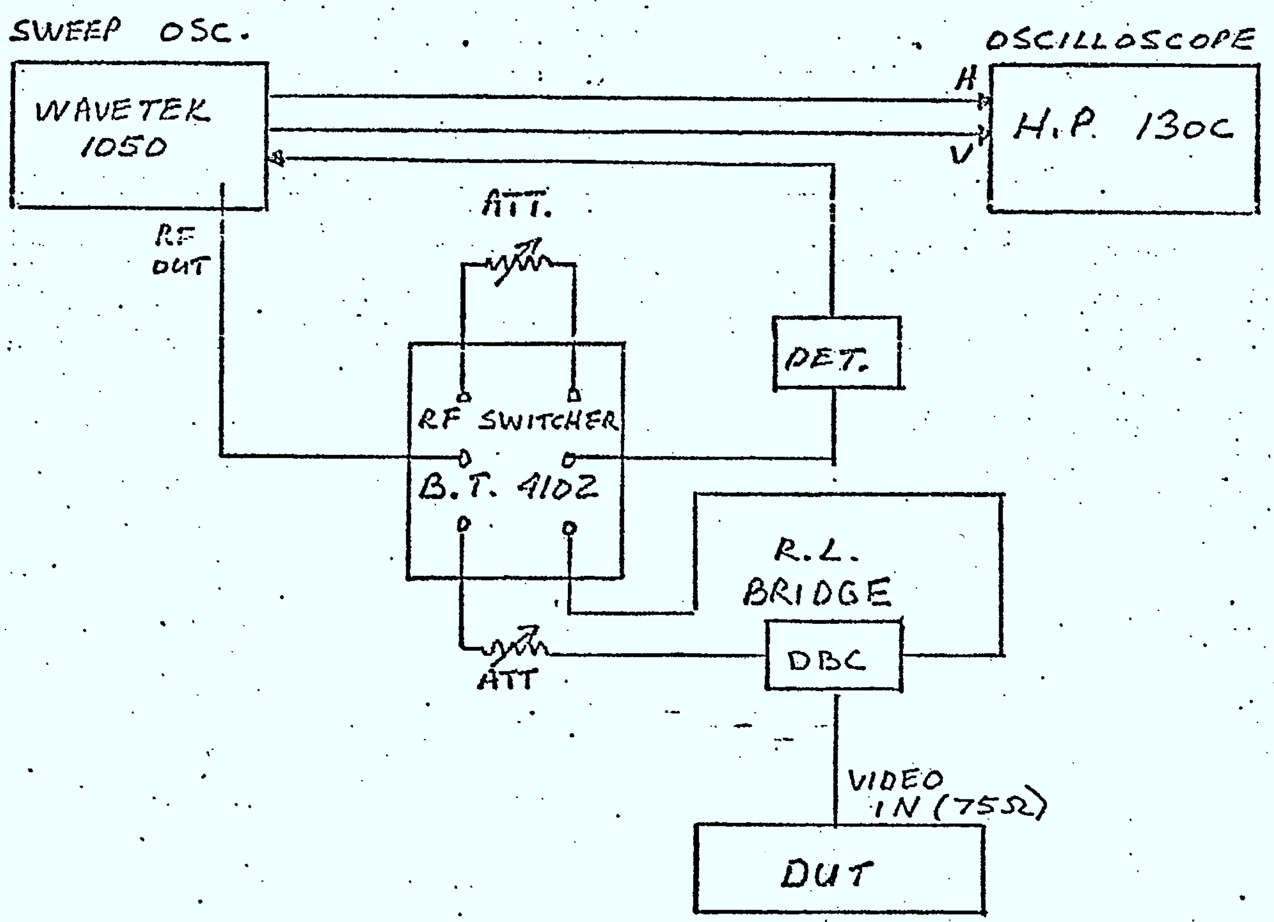
1 MHZ DIV

7. MINIMUM VISUAL PERFORMANCE STANDARD

7.1 Video Input Impedance

Minimum Standard	26 dB to 4.5 MHz
Test Results	36 dB to 4.5 MHz

Test Set Up

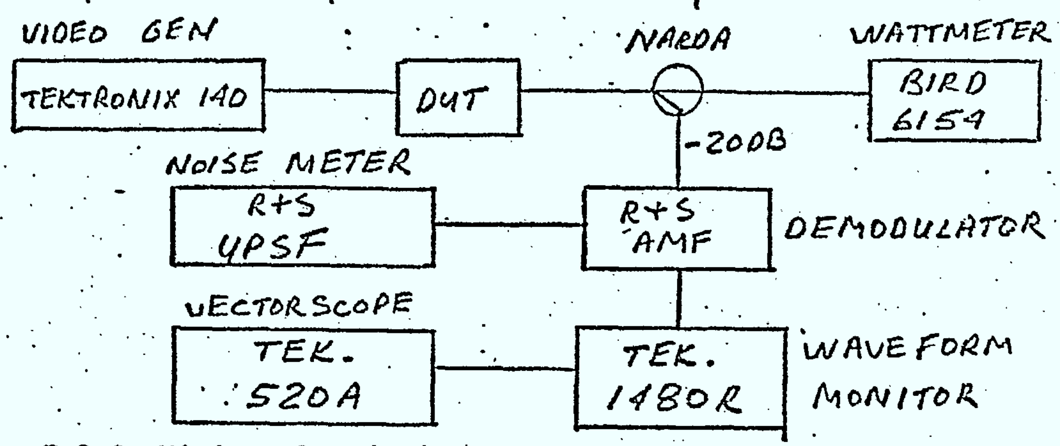


7.2 MODULATION

7.2.1 Video Signal From Tektronix 140, 147 as defined.

7.2.2 Modulation Capability

Test Set Up

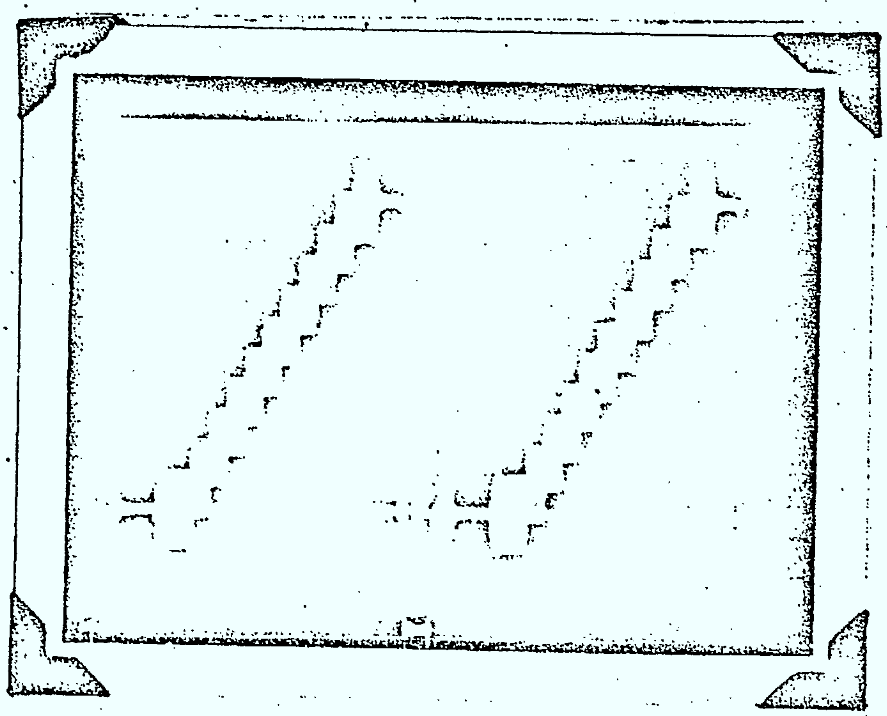


7.2.3 Minimum Standard

Maximum Carrier Level	98 - 102 %
White Level	10 - 15 %

Test Result

Maximum Carrier - 3 IRE	OR	98.125%
White Level		12.5 %



7.2.4 Modulation Stability

Test Set Up - As in 7.2.2

7.2.5 Minimum Standard
Maximum Carrier Level
Variation 5 percent and Maximum Blanking Level Variation
1.5 percent of sync level for APL 10 to 90 percent

Test Result

Maximum Carrier Level Variation	1	% at	10	% APL
Maximum Blanking Level Variation	1	% at	10	% APL
Maximum Carrier Level Variation	2.5	% at	90	% APL
Maximum Blanking Level Variation	1.2	% at	90	% APL

7.2.6 Field Time Distortion

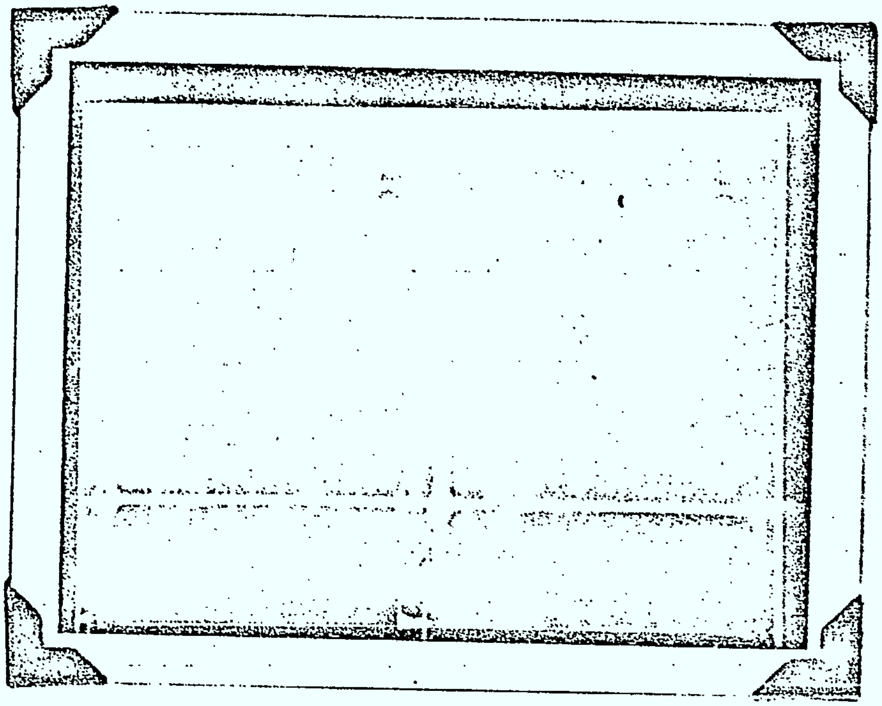
7.2.7 Minimum Standard 2% Maximum Tilt

Test Result Less than 1%

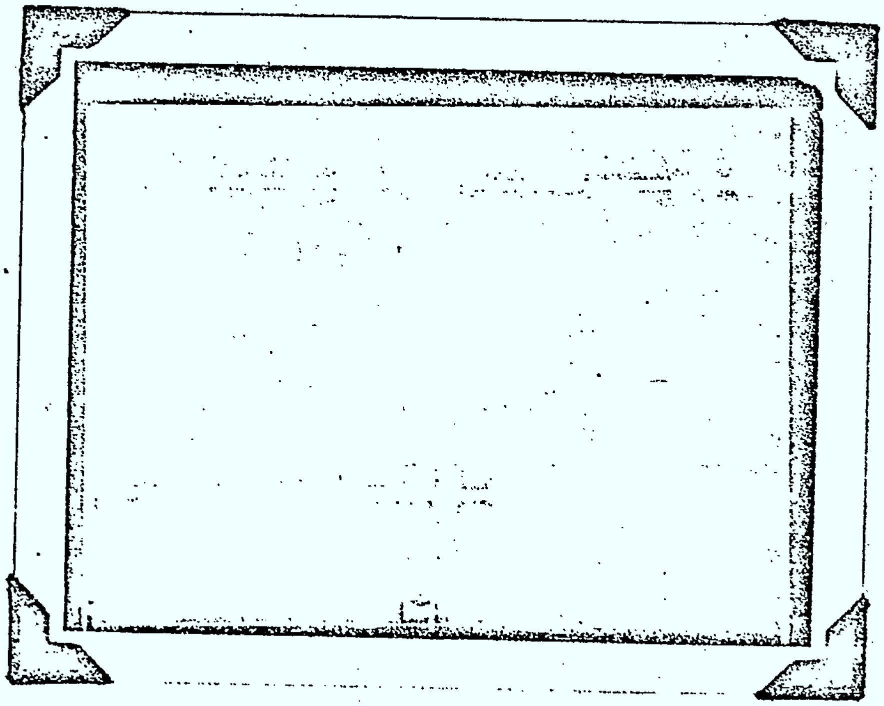
Test Set Up - As in 7.2.2

7.25 MEASUREMENT DATA

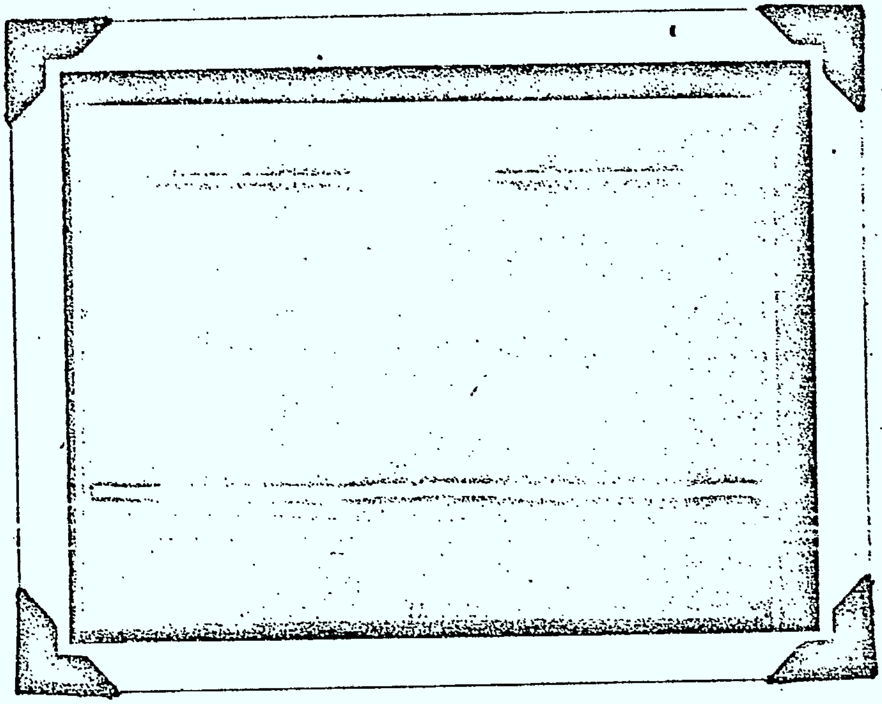
10% APL



90% APL



MEASUREMENT DATA WINDOW SIGNAL TILT



7.2.8 Modulation Hum

Test Set Up - As in 7.2.2

Note: A Noise (Hum) Meter was used because hum was too small to be observed on waveform monitor.

7.2.9	Minimum Standard	40 dB
	Test Result	52

7.2.10 Modulation Noise

Test Set Up - As in 7.2.2

7.2.11 Minimum Standard 50 dB

Test Result 53 dB

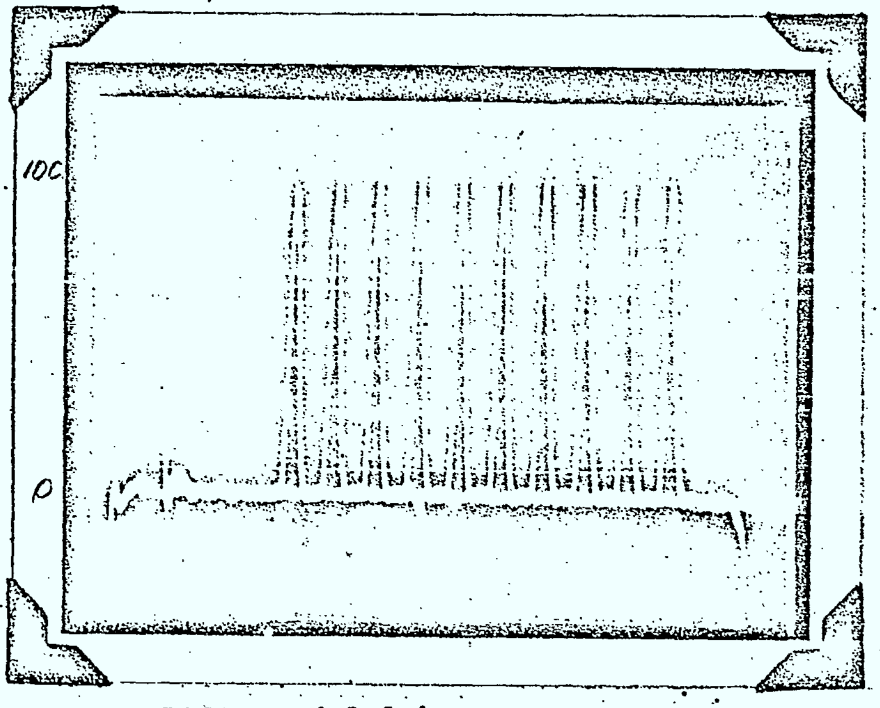
7.2.12 RF Linearity

Test Set Up As In 7.2.2

7.2.13 Minimum Standard 20 %

Test Result 2 %

Measurement Data



7.3 Differential Gain

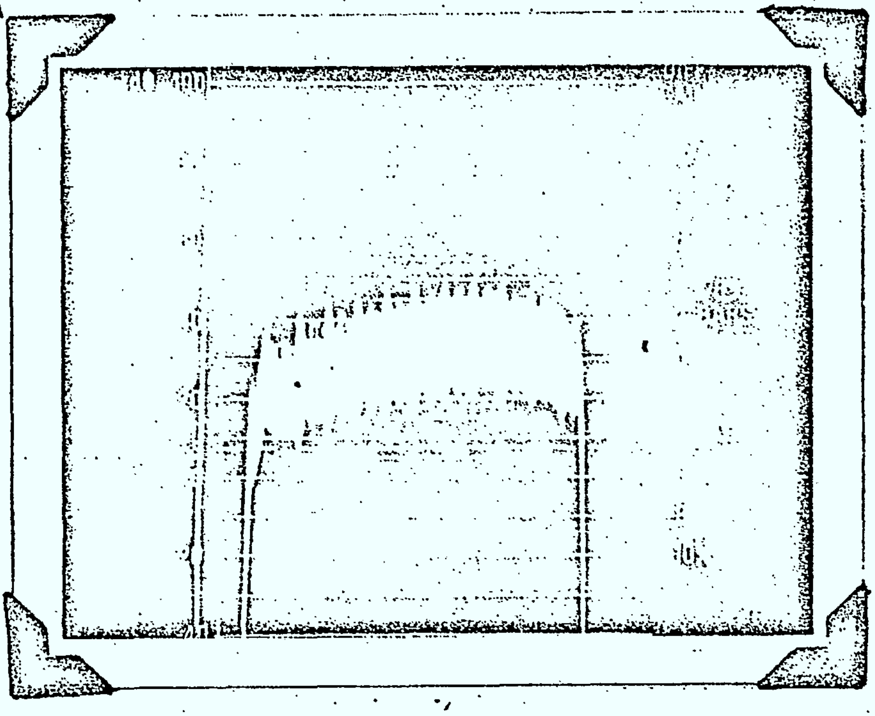
7.3.2 Test Set Up as in 7.2.2

Result Displayed on Vectorscope

7.3.3 Minimum Standard 15%

Test Result 2 % NO CHANGE WITH ANY APL

TEST DATA



7.4 Differential Phase

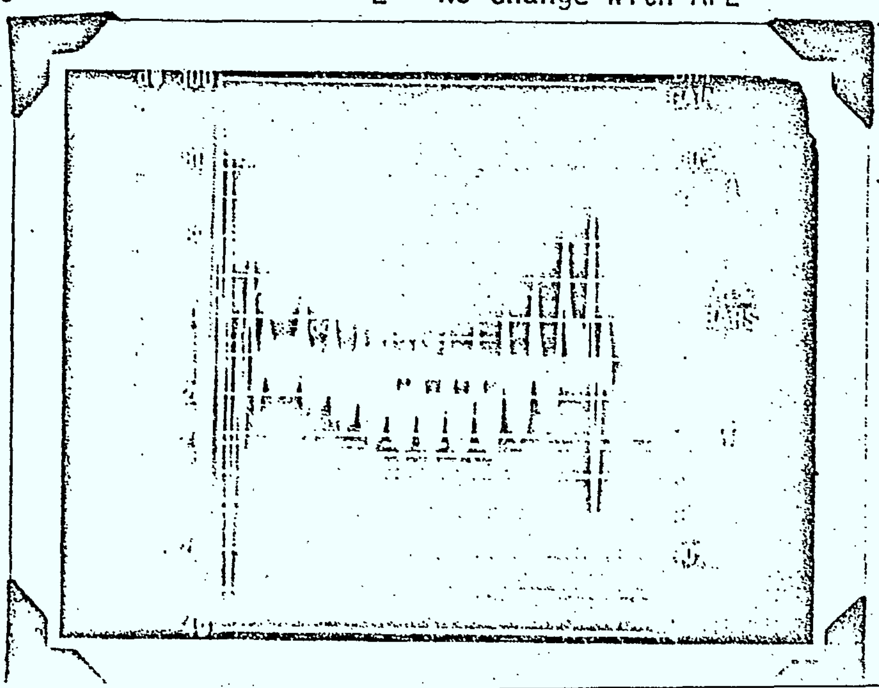
7.4.2 Test Set Up as in 7.2.2

Result displayed on Vectorscope

7.4.3 Minimum Standard 7^o

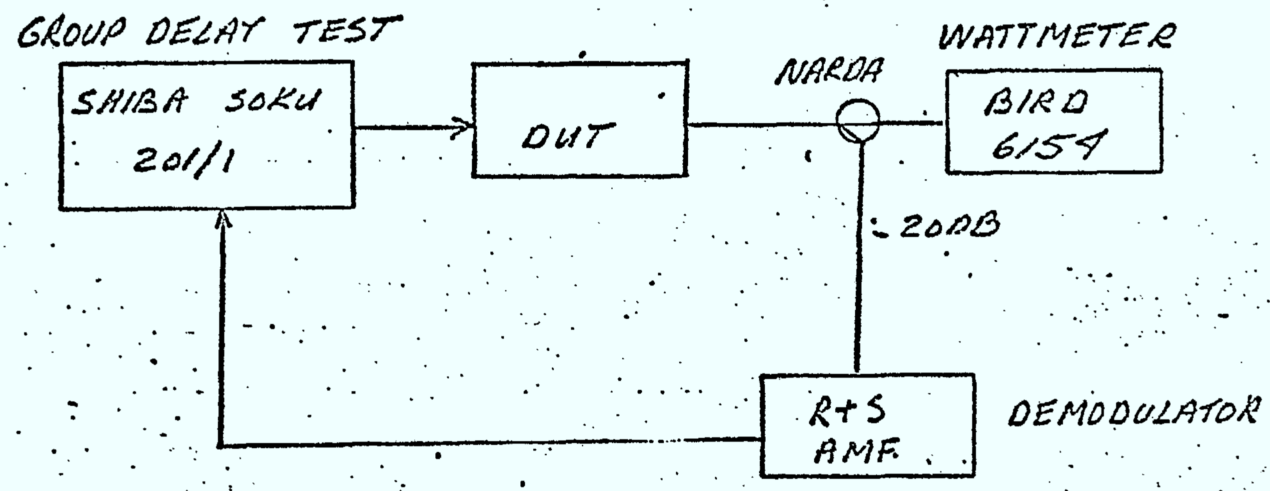
Test Result 2^o No change with APL

Test Data



7.5 Group Delay

7.5.1 Test Set Up



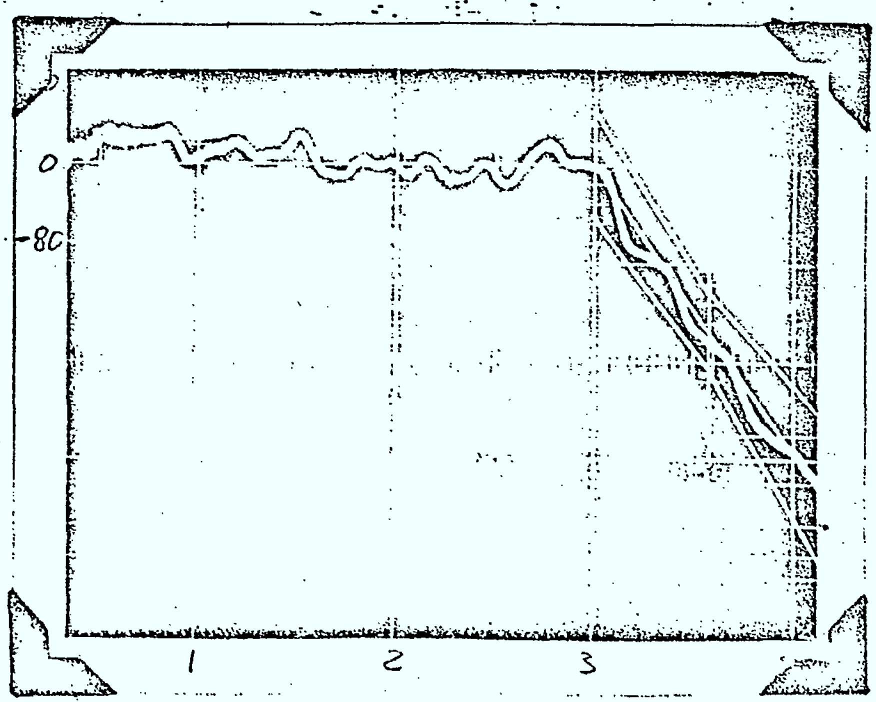
Minimum Standard ± 100 nS

± 80 nS at 3.58 MHz

As in Appendix C

Test Result Within RSS 154 limits
Maximum Excursion +40 ns at 0.8 MHz

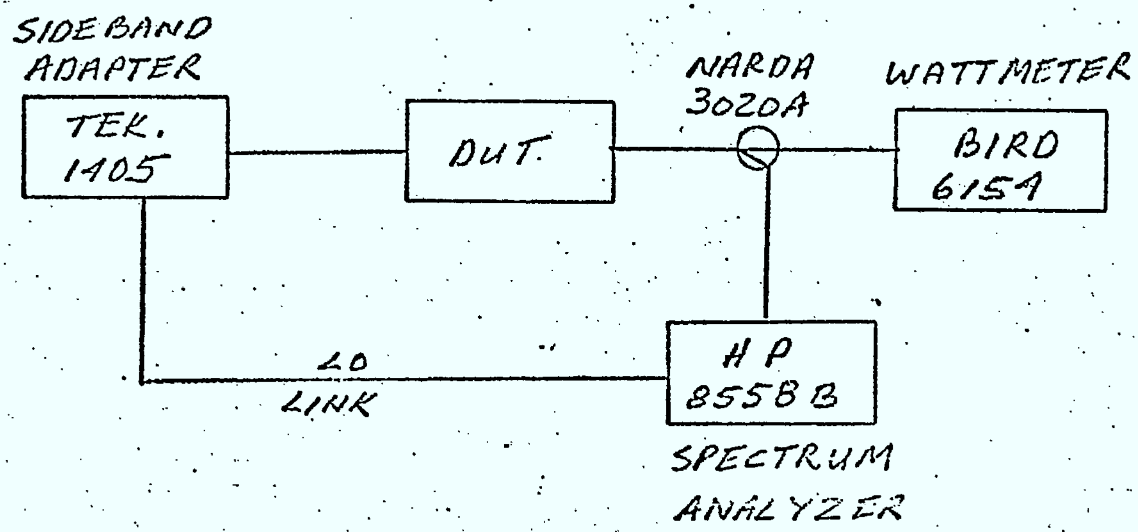
Test Data



NOTE: Graticule on photograph is to RSS 154 Specification (±80 nS To 2 MHz, ± 55 nS at 3.0 MHz, ± 40 at 3.58 MHz, ± 80 at 4.18 MHz)

7.6 Amplitude/Frequency Characteristics including side band attenuation.

7.6.2 Test Set Up

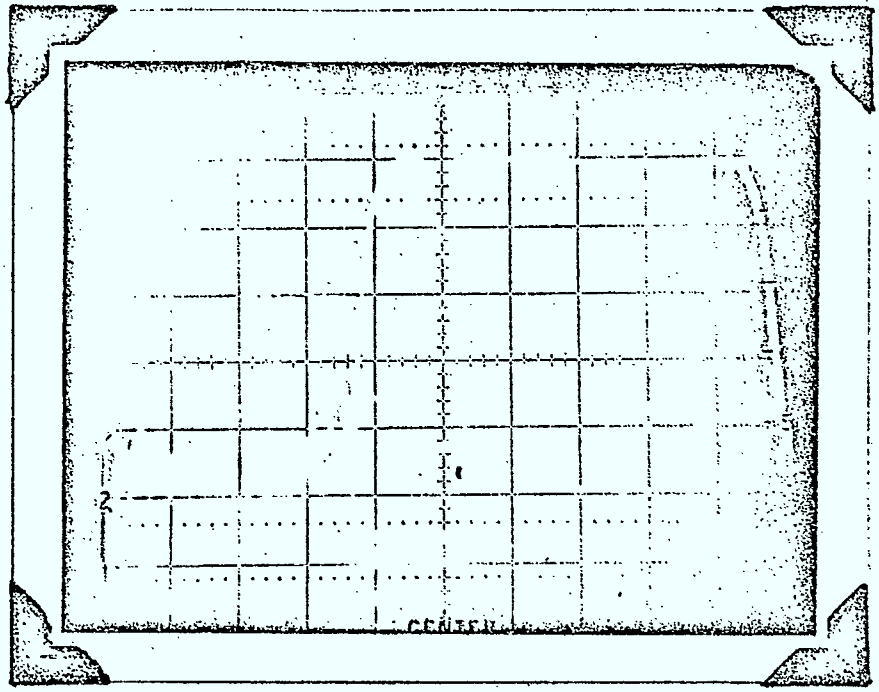


7.63 Minimum Standard Appendix E

Test Result Appendix E

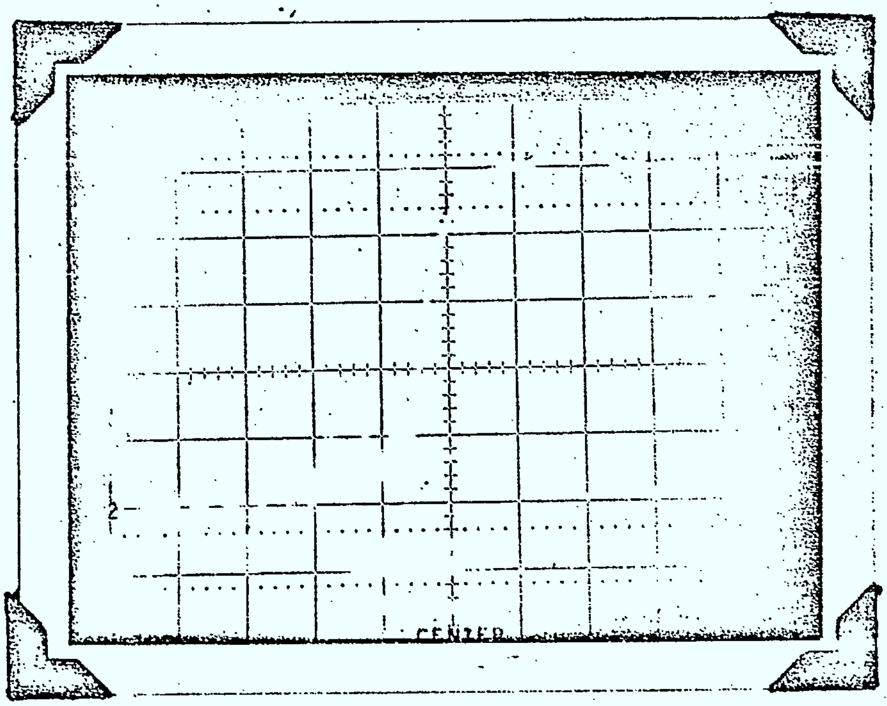
MEASUREMENT DATA

10dB/Div.



± 5 MHz Sweep 1 MHz Div

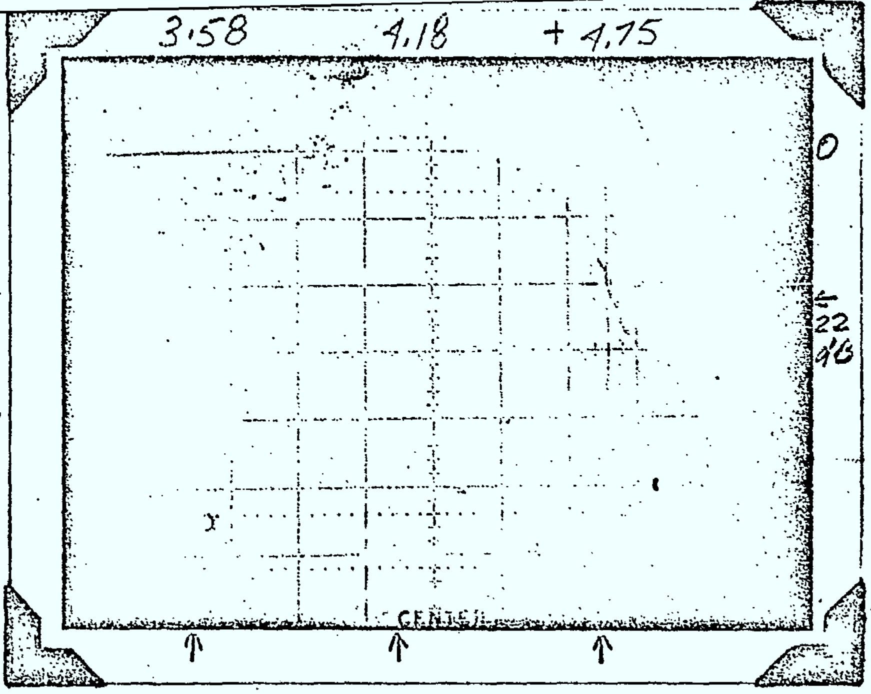
10dB/Div



.5 MHz.Div.

EXPANDED LOWER SIDEBAND ATTENUATION

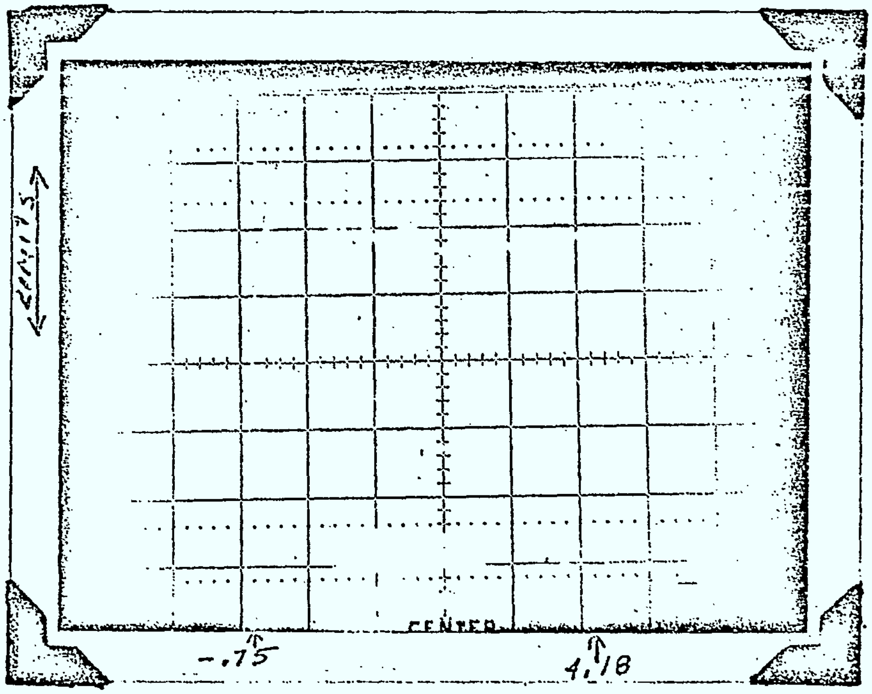
10 dB/DIV



200 KHZ DIV

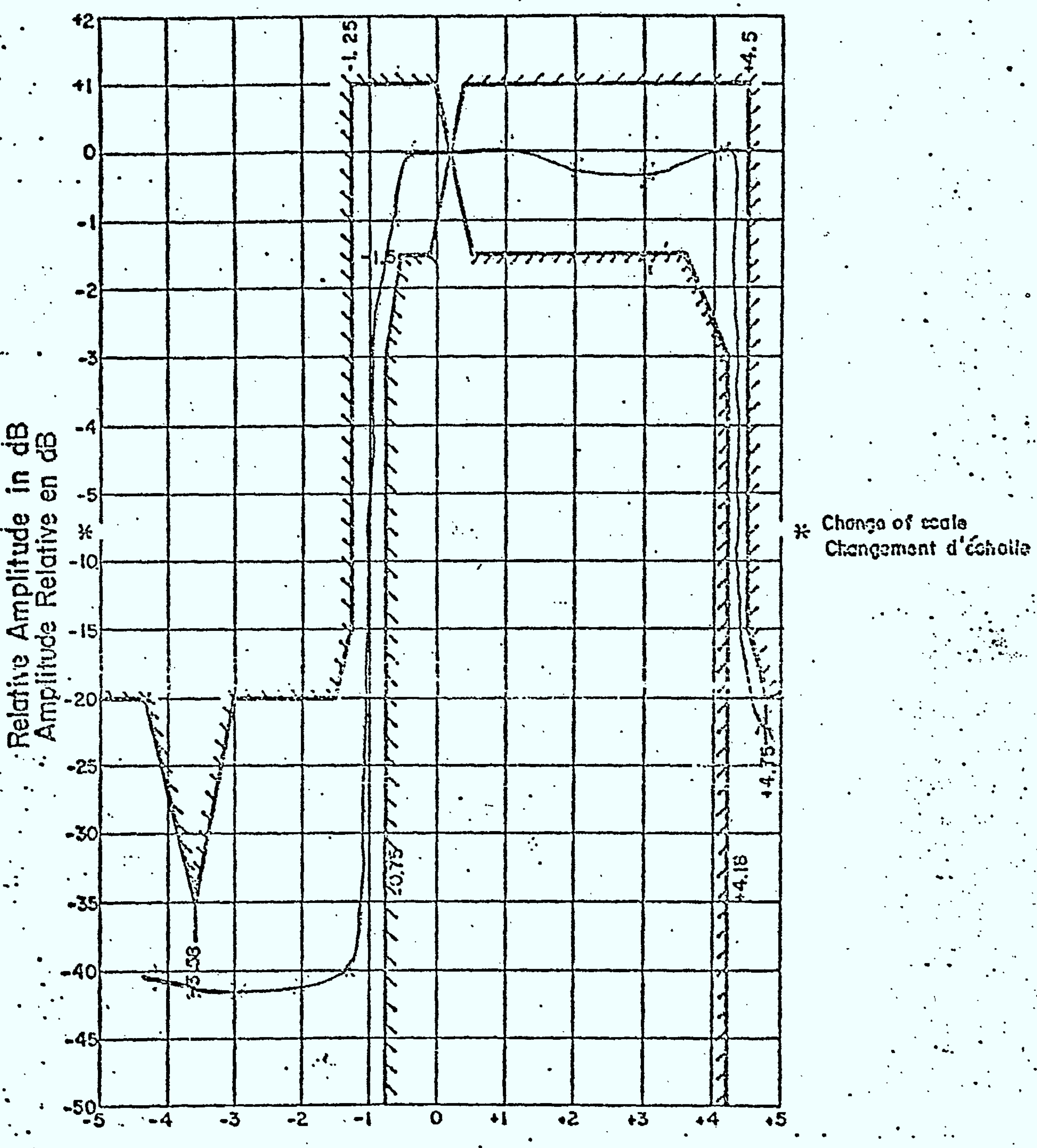
EXPANDED UPPER SIDEBAND

1 dB/Div



1 MHz/Div

PASSBAND



Frequency Relative to Visual Carrier in MHz
Fréquence Relative à la Porteuse Vision en MHz

AMPLITUDE VS. FREQUENCY CHARACTERISTIC
(INCLUDING SIDEBAND ATTENUATION)

CARACTERISTIQUE AMPLITUDE / FRÉQUENCE
(ATTÉNUATION DES BANDES LATÉRALES SUPÉRIEURE ET INFÉRIEURE INCLUE)

8. MINIMUM AURAL PERFORMANCE

8.1 Audio Input Impedance

Standard 600 OHms Balanced

Test Result   317 + 318 = 635 Ohms

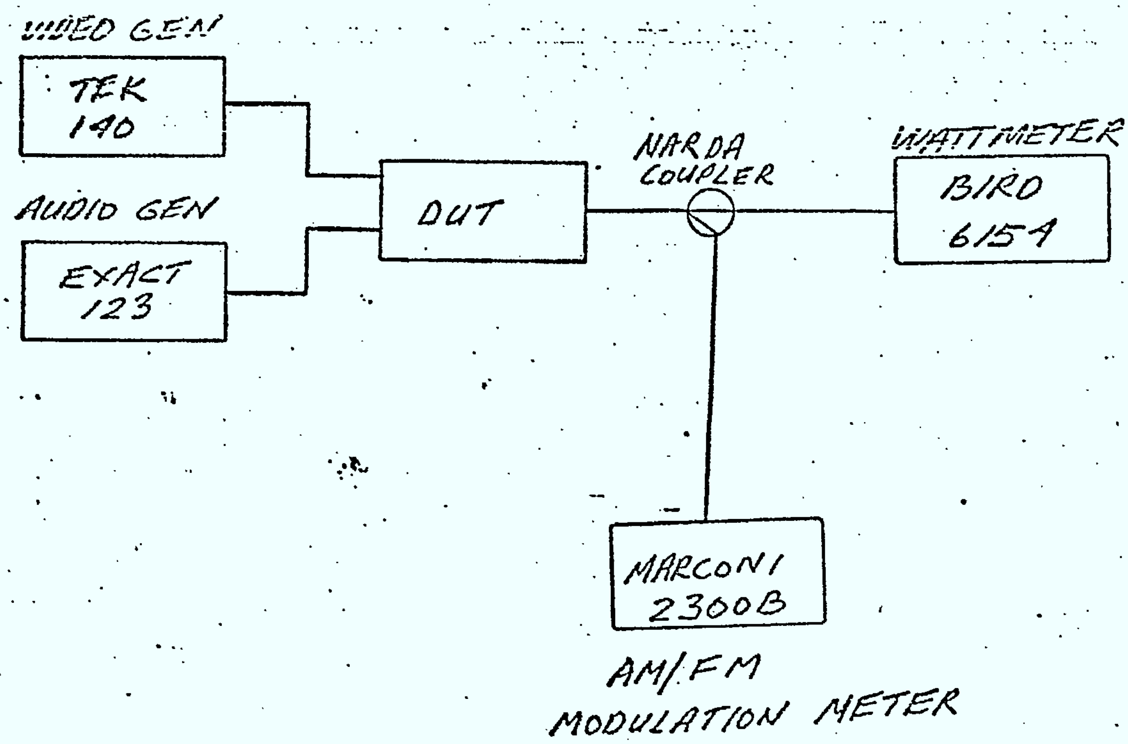
Test Method   Ohm Meter (Applicable for DC Coupled Transformerless Circuits Only)

8.2 Input Level for 100% Modulation

Standard   8 dB ± 2 dB

Test Result   8 dBm

Test Method



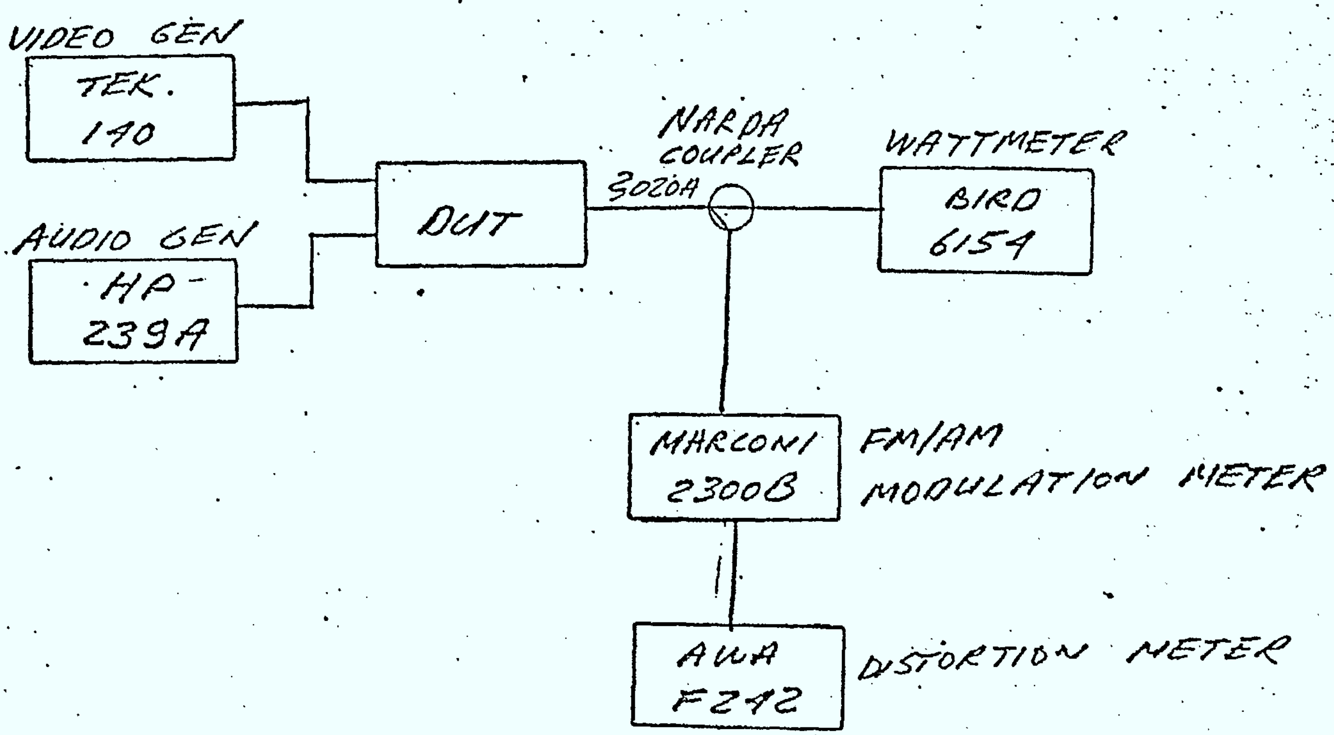
8.3 FREQUENCY RESPONSE

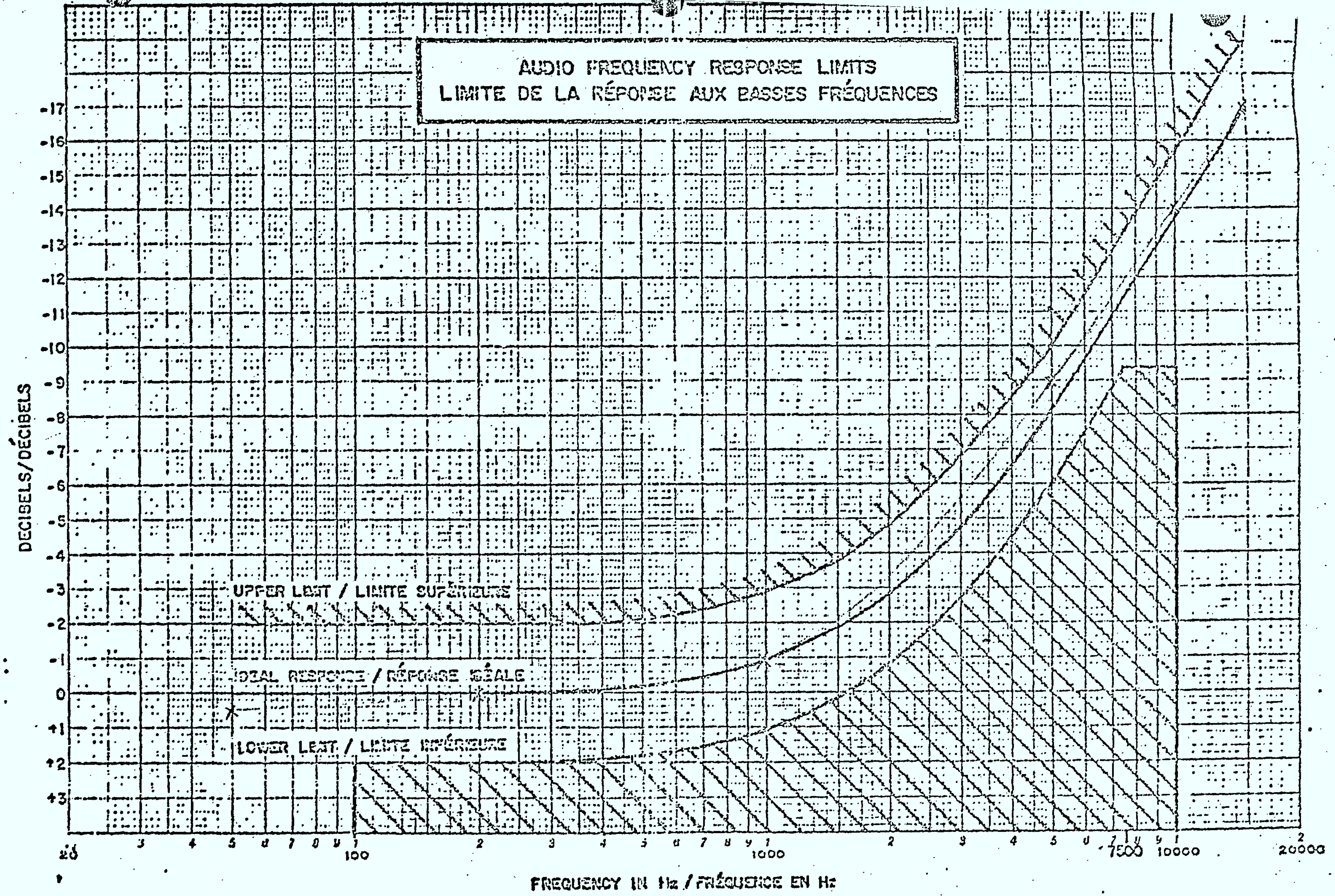
Minimum Standard Appendix F

Test Result Appendix F

8.4 Audio Frequency Harmonic Distortion

Test Method




AUDIO FREQUENCY RESPONSE LIMITS
LIMITE DE LA RÉPONSE AUX BASSES FRÉQUENCES
DECIBELS/DÉCIBELS
-17
-16
-15
-14
-13
-12
-11
-10
-9
-8
-7
-6
-5
-4
-3
-2
-1
0
+1
+2
+3
UPPER LIMIT / LIMITE SUPÉRIEURE
IDEAL RESPONSE / RÉPONSE IDÉALE
LOWER LIMIT / LIMITE INFÉRIEURE
20
100
1000
7500
10000
20000
FREQUENCY IN Hz / FRÉQUENCE EN Hz

8.4.3 Minimum Standard 5%

Test Result at 25 KHz Deviation

Frequency (Hz)	Distortion %
50	.25
100	.25
400	.25
1000	.27
4000	.35
10000	.80
15000	.60

8.5 FREQUENCY MODULATION NOISE LEVEL

ON FM CARRIER

Test Set Up	As in 8.4
Minimum Standard	50 dB
Test Result	57 dB

F. SUGGESTED PRICE LIST

UHF 20 WATT TRANSMITTER

QUANTITY	PRICE
1 to 5	$7,820.00 each
6 to 19	$7,038.00 each
20 up	$6,647.00 each

TENTATIVE SPECIFICATIONS (CCIR SYSTEM M (NTSC)

RF CHARACTERISTICS:	
Frequency Range	Any Specified UHF Channel 14 to 69
Frequency Response (one channel)	± 0.5 dB
Rated Video Output Power	20 Watts
Rated Audio Output Power	2 Watts
Output Impedance	50 Ohms
Frequency Stability	<± .003% , 5°C to 45°C
Spurious Output *	> 60 dB down from visual carrier
Three Tone Intermodulation	>56 dB below rated power output
NTSC VIDEO CHARACTERISTICS:	
Input Level (for 87.5% modulation)	1.0 Vp-p
Input Return Loss	26 dB
Input Impedance	75 Ohms
Differential Gain (at 87.5% modulation)	5%
Differential Phase (at 87.5% modulation)	± 3°
Group Delay	<± 40 nS
Video Group Delay Pre-emphasis	Conforms to DOC Standards for Colour Broadcast
K-Factor	1.5% for 2T Pulse
Hum and Noise	55 dB below visual carrier
AURAL CHARACTERISTICS:	
Input Level Range for 25 KHz Deviation	0 to +13 dBm
Frequency Response (standard pre-emphasis curve)	± 1 dB
Harmonic Distortion (25 KHz deviation)	< 1%, 50 Hz to 15 KHz
AM Modulation Noise	> 50 dB
FM Modulation Noise	> 60 dB
Intercarrier Stability	± 250 Hz
Power Requirements	100-130 VAC, 50/60 Hz 320 W
PHYSICAL:	
Operating Temperature	0° to +50°C (32°F to 122°F)
Dimensions	49 X 42 X 34 cm (19 X 16¼ X 14 Inches)
Connectors:	
Video Input, Test Points, Output	BNC
Audio Input, (600 Ohms Balanced)	Stereo Jack
RF Output	N Type
Weight:	
Net	Approx. 26 Kg
Shipping	35 Kg

NOTE:

* The emissions at minus 3.58 MHz, minus 4.5 MHz, plus 8.08 MHz, plus 9.0 MHz from the visual carrier shall be a minimum of 40 dB below rated power output.

technical specifications subject to change without notice

DELTA·BENCO·CASCADE
124 Belfield Road, Rexdale, Ontario, Canada M9W 1G1
Telephone (416) 241-2651 Telex 06-965552

...Communications Ministère des Communications

RADIO EQUIPMENT CERTIFICATION/TESTING APPLICATION AND AGREEMENT

DEMANDE ET ACCORD RELATIFS AUX ESSAIS ET À LA CERTIFICATION DE MATÉRIEL RADIO

...UÉRANT	CONTACTS NAME/COMMUNIQUER AVEC	TEL. NO./N° DE TEL.
...lta Benco Cascade	J. Vandermey	416-241-2651
...ICANT'S ADDRESS/ADRESSE DU REQUÉRANT	FILE NUMBER/DOSSIER N°	PURCHASE ORDER/BON D'ACHAT
124 Belfield Rd.,Rexdale, Ont.		

...UIPMENT — MATÉRIEL

...UFACTURER/FABRICANT		ADDRESS/ADRESSE
Delta Benco Cascade Ltd.		124 Belfield Rd.
...DE NAME/NOM COMMERCIAL	TYPE OR MODEL/TYPE OU MODÈLE	KIND OF EQUIPMENT/GENRE DE MATÉRIEL
DBC LTD.	TMU-2020/B	Low Power TV Broadcast Transmitter

...UIPMENT MAINTENANCE FACILITY — SERVICE D'ENTRETIEN DU MATÉRIEL

...E/NOM	ADDRESS/ADRESSE
DBC LTD.	124 Belfield Rd.

...VICE REQUESTED — SERVICE REQUIS

CERTIFIED UNDER / CERTIFIÉ EN VERTU ▶ RSS 151

...TIFICATION BASED ON TEST REPORT FROM / ...TIFICATION FONDÉE SUR UN RAPPORT D'ESSAIS

- ☐ THE DOC LABORATORY / DU LABORATOIRE DU MDC
- ☐ OTHER LABORATORY / D'UN AUTRE LABORATOIRE

PERFORMED ON A / EFFECTUÉS SUR UN

- ☐ PRODUCTION MODEL / MODÈLE DE PRODUCTION
- ☐ PRODUCTION PROTOTYPE / PROTOTYPE DE PRODUCTION
- ☒ ENGINEERING PROTOTYPE / PROTOTYPE TECHNIQUE

CERTIFICATION ASSESMENT FEE PAYABLE TO RECEIVER GENERAL, ATTACHED
DROITS D'ÉVALUATION DE CERTIFICATION À L'ORDRE DU RECEVEUR GÉNÉRAL, CI-JOINTS

...RATORY TESTING ONLY: SPECIFY TESTS REQUIRED: UNLESS OTHERWISE REQUESTED, ALL APPLICABLE TESTS AS FOR CERTIFICATION WILL BE CARRIED OUT.
...LABORATOIRE SEULEMENT: PRÉCISER LES ESSAIS REQUIS: À MOINS D'INDICATION CONTRAIRE, TOUS LES ESSAIS DE CERTIFICATION SERONT EFFECTUÉS.

...REEMENT

The applicant warrants that:
(A) The unit of equipment tested, if a production model, is a randomly selected representative sample.
(B) The test results submitted are a true representation of the characteristics of the equipment type for which certification is requested.

The applicant agrees to:
(A) Accept full responsibility for all initial and subsequent departmental charges arising from this application.
(B) Fulfil all conditions and responsibilities in accordance with Radio Standards Procedure 100.

ACCORD

1. Le requérant atteste que
   (A) S'il s'agit d'un modèle de production, le matériel qui fait l'objet de l'essai est un échantillon représentatif choisi au hasard.
   (B) Les résultats de l'essai présentés illustrent d'une façon exacte les caractéristiques du type de matériel pour lequel la certification est demandée.
2. Le requérant convient
   (A) D'accepter la pleine responsabilité quant à tous les droits initiaux et subséquents fixés par le ministère conséquemment à la présente demande;
   (B) De remplir toutes les conditions et de s'acquitter de toutes les responsabilités conformément à la procédure concernant les normes radioélectriques N° 100.

...E OF APPLICANT / ...DU REQUÉRANT ▶ X [signature]

DATE

PLEASE PRINT OR TYPE — DACTYLOGRAPHIER OU ÉCRIRE EN LETTRES MOULÉES

...E AND TITLE OF APPLICANT / ...ET TITRE DU REQUÉRANT ▶ DENNIS ATHA, PRESIDENT

16-660(579)