Morley Fountain

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Corus Entertainment Ltd.

Global Television Network

Brief History of NTSC

NTSC – National Television Standards Committee.

1941 – the NTSC issued the monochrome television standard.

1953 - the NTSC colour standard was adopted.

1984 BTSC stereo audio was added to the NTSC standard.

Late 1970’s closed captioning standard adopted.

The NTSC standard remains in service today, although far less available since the advances of digital television.

ATSC

Advanced Television Standards Committee

1987 - US Broadcasters petition the FCC for a terrestrial HDTV standard.

1993 – The 7-member Grand Alliance is formed to create the best of the best HDTV standard.

1996 – FCC adopts then new 8VSB tv standard for the US.

2002 – all commercial US DTV stations where on the air

2011 – Canadian mandated markets had to be converted to DTV and their associated analog tv transmitters turned down.

Corus Entertainment has transitioned a total of 81stations from analog to DTV across 9 Canadian Provinces.

ATSC Advantages

Improved video quality along with superior sound.

Ability to multiplex multiple services on a single channel.

Mobile broadcast opportunities.

Can utilize single frequency networks for gap filling.

Less transmit power required for the same single coverage.

The original and major push for a DTV service was to maximize the use of the television spectrum. More channels in less overall spectrum due to each station broadcasting with less effective radiated power.

ATSC Milestones In Canada

August 31, 2011, was the deadline for the Canadian Mandated markets to begin broadcasting DTV.

December 18, 2014, ISED implemented a moratorium on licensing new television services, in anticipation of reclaiming the television spectrum in the 600 MHz band.

April 2017, ISED released the new 600 MHz DTV allotment plan & the DTV transition schedule.

The 600 MHz transition plan had 14 phases in Canada.

April 13, 2019, was the first day to test under the repack transition schedule.

January 14, 2022, was the end of the 600 MHz transition schedule.

Station Planning for DTV Conversion

< The first step in planning for the analog to DTV conversion, is to consider what channels are available in your area and within the current ISED channel plan.

<DT allotments are available in Low Band VHF, High Band VHF and the UHF Band.

<Channel availability will depend largely on geographic area in which you want to broadcast. Densely populated areas have less spectrum options available.

<Each band has its own advantages and disadvantages that need to be considered.

<Tower aperture needs to be considered for antenna replacement.

<Will it be a standalone station or will you be combined in a multiuser antenna system

The Technical Brief

< Once the broadcast location has been selected, the technical brief will need to prepared.

< The technical brief must be prepared by a professional engineer who is licensed in the province of the proposed broadcast location and have credentials on file with ISED.

< The technical brief will contain detailed information about the broadcast transmit operation, coverage maps, interference analysis and demonstrate how the proposed station will function in the existing channel plan.

< In some cases, a broadcaster may want a different allotment, and the brief must demonstrate how using a channel from another location will function with in the allotment plan.

< Any DT applications not in the current channel allotment plan, that are within 500 Km's of the US border must receive coordination approval from the FCC as well as ISED.

< The application to ISED must be submitted along with the application to the CRTC, for approval consideration.

STATION:	PRINCIPAL SERVICE:	Toronto, ON
	CALL SIGN/ORIGINATING STN:	CIII-DT-41 / N/A
	CHANNEL/TSID:	17 / 43A9
SITE:	NAME/CITY/PROV:	CN Tower / Toronto / ON
	COORD (WGS84):	43° 38' 33" N. LAT. / 79° 23' 14" W
TRANSMITTER:	MFG/MDL/ATSC-MH:	GatesAir / ULXTE-16 / Y
	PWR RATED/PWR PROP:	10,800 W / 6312 W (Pre Mask Filt
	EMISSION MASK:	BPR-10 Figure C1
TX LINE:	MFG/MDL:	Commscope (Andrew) / HJ9-50
	LENGTH:	204 m
	LOSS/EFFICIENCY:	0.620 dB/100 m / 73.0% (incl 0.1 c
FLTR/COMB/MISC:	LOSS/EFFICIENCY:	0.6 dB / 87.1%
ANTENNA:	MFG/MDL:	Sira / UTVC-12/X/SP
	POL/BT/D-ND/#BAYS:	70/30 H/V (Approx) / 0.8 Deg / ND
	MAX DIMENSION:	15.2 m
	HOR/AVG/MAX GAIN H-POL:	0.00 dB / 11.73 dBd / 11.73 dBd
	HOR/AVG/MAX GAIN V-POL:	0.00 dB / 9.49 dBd / 9.49 dBd
ERP:	MAX (@BT):	59,800 W H-POL / 35,700 W V-PO
	AVG (@BT):	59,800 W H-POL / 35,700 W V-PO
HEIGHTS:	EHAAT :	504 m
	OVERALL:	543 mAGL
	GND LEVEL:	82 mAMSL
	RC:	526 mAGL / 608 mAMSL
MODE:	Unattended	

tek[nyx]

The CRTC Application

< While ISED is responsible for the technical consideration of a broadcast operation, the CRTC must also license the Television Service.

< The CRTC will look at population counts within the coverage contour of the proposed DT station.

< The CRTC will review / impose certain programming obligations for the proposed broadcast operation.

Transmitter System

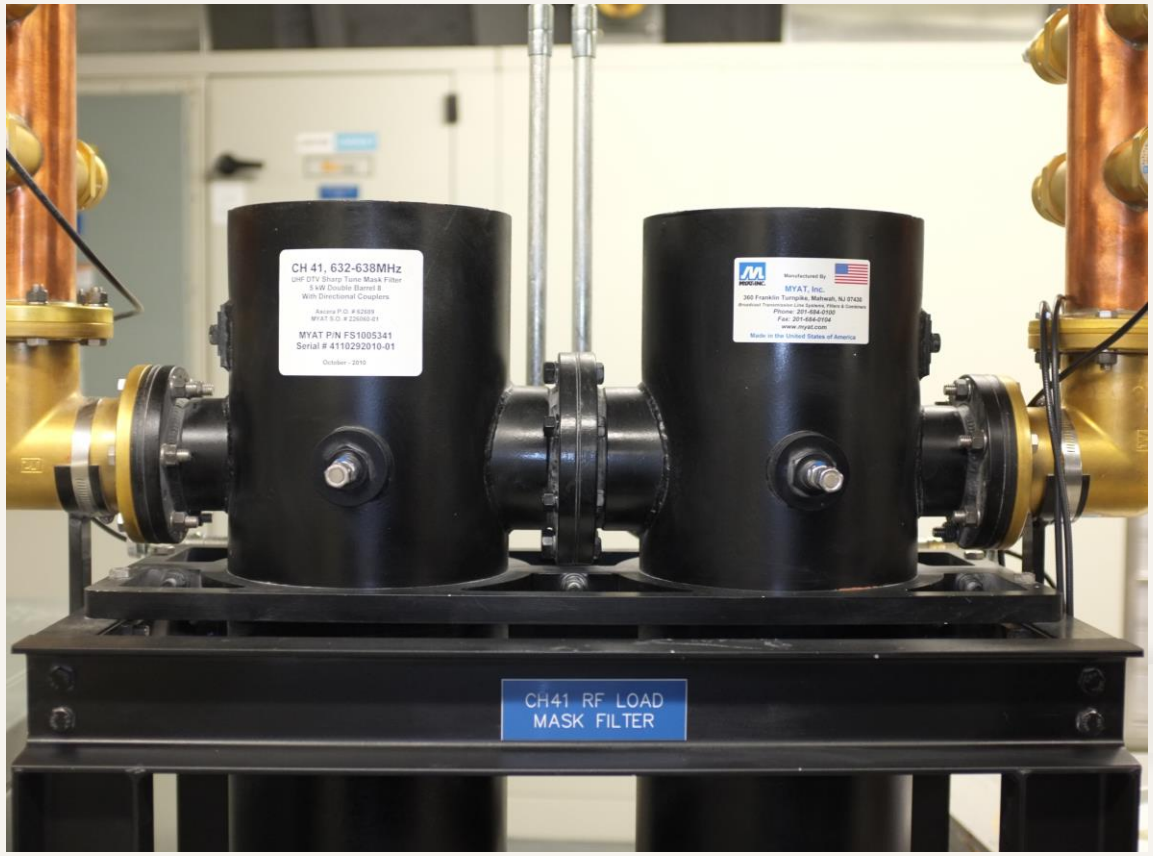
All ATSC transmitter systems contain the following components:

< Transmitter

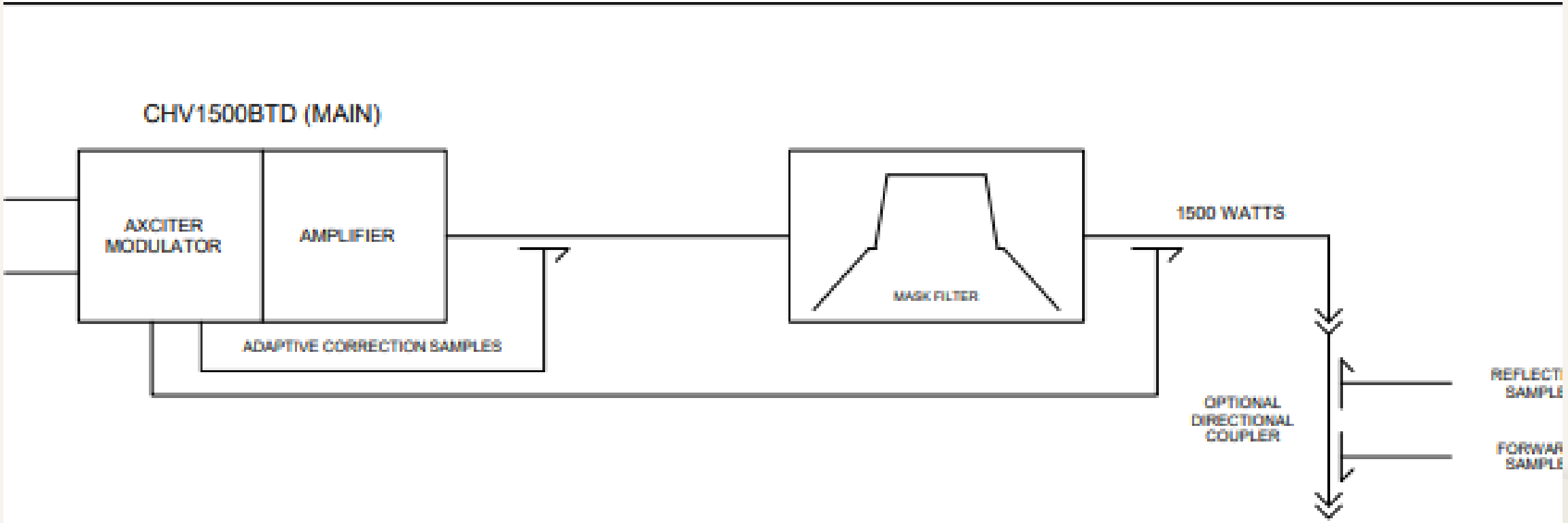
< Low Pass Harmonic Filter

< Mask Filter to meet the ISED mask filter response curve

< Directional couplers for pre & post mask filter samples to the transmitter for adaptive correction.



Basic DTV Transmission Block Diagram



The Harmonic Filter

< The harmonic / low pass filter can be installed either internal or external to the transmitter, depending on the size of the filter

< The filter is required to ensure the out of bands measurements are at or below the -110 db specification.

< The harmonic filter is installed before the mask filter.

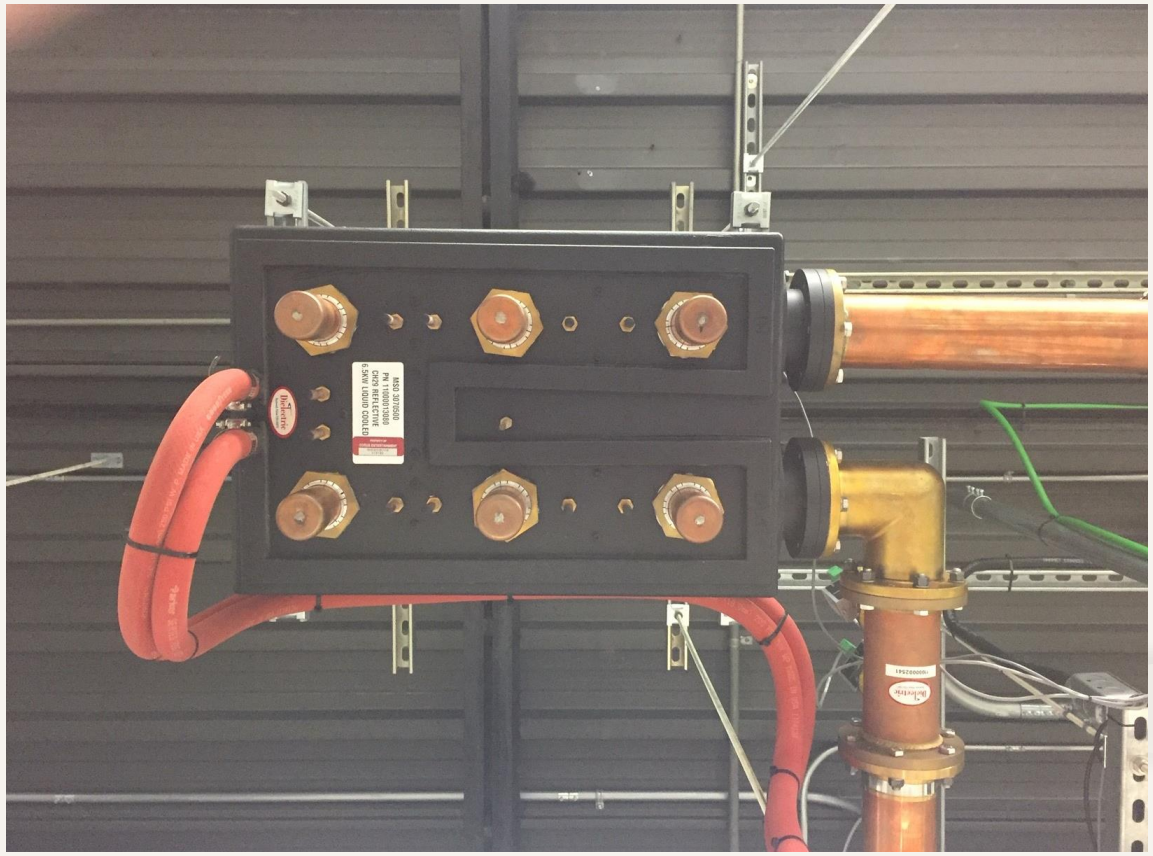
The Mask Filter

< The mask filter is responsible to ensure the DTV signal is attenuated by -47 db minimum at 3.5 Mhz from the center of the channel.

< The mask can be configured as convection cooled, forced air cooled or liquid cooled.

< It is channel specific.

< In a multi station master antenna installation the mask filter is often part of the combiner module.



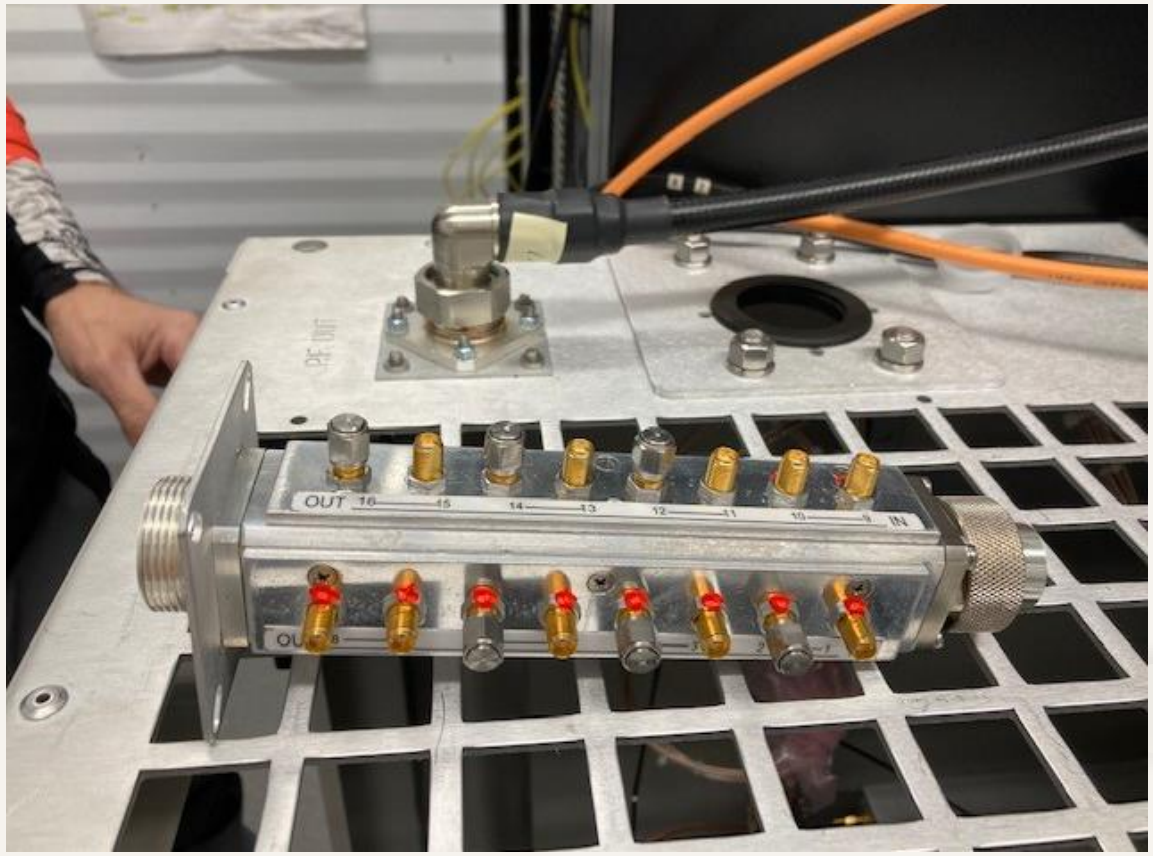
The Directional Couplers

< There will be a minimum of 2 directional couplers installed. 1 each pre and post mask filter.

< The directional couplers will be calibrated to provide known rf samples to be used for precision power measurements and rf metering.

< Additional sample ports are provided for transmitter adaptive pre-correction.

< Directional couplers come in various sizes depending on the installation.



Transmitter Considerations

DTV transmitters fall into 2 general categories:

< Liquid Cooled

< Air Cooled

< Modern transmitters are solid state.

<Transmitter efficiency is a major concern.

< There are very few tube type transmitter still being manufactured.

< Rather than use a high power IOT the trend is to combine multiple transmitters to obtain higher output power.

Air Cooled Transmitters

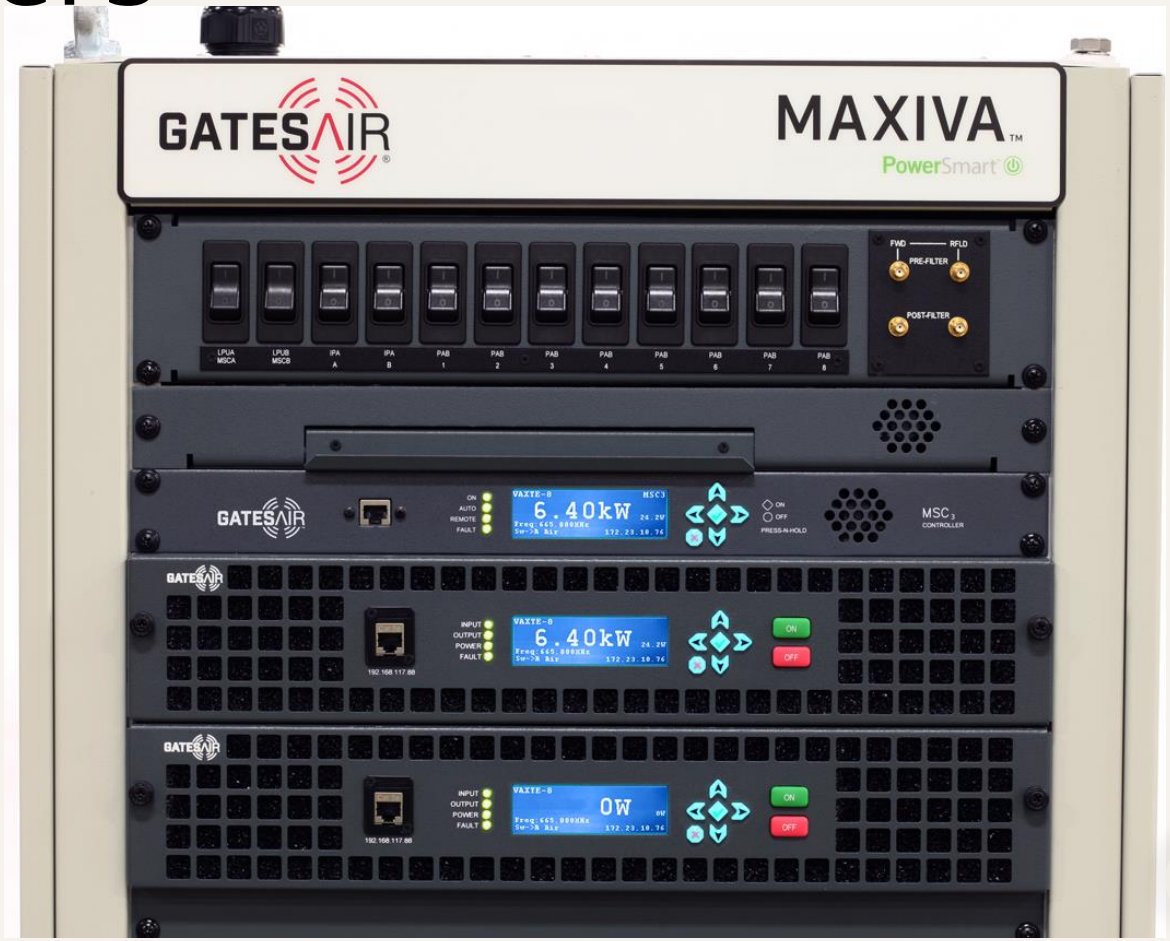
< Air cooled transmitters are available in either VHF or UHF versions.

< Air cooled transmitters range from 10-watts average output power and can go as high as 10kw in a single cabinet.

< Multiple transmitter cabinets can be externally combined to obtain higher powers.

< Air cooled transmitters tend to be noisy due to the cooling fans.

< Easier to maintain, as you have no external cooling system.



Liquid Cooled Transmitters

< Liquid cooled transmitters are available in either VHF or UHF versions.

< Liquid cooled transmitters range from 1.5 Kw average output power and can go as high as 19kw in a single cabinet.

< Multiple transmitter cabinets can be externally combined to obtain higher powers.

< Liquid cooled transmitters have a much smaller footprint so a better choice for a high-power install in a small space.

< More difficult to maintain as you have an external cooling system.

Liquid Cooled Transmitter installation considerations.

< Liquid cooled requires space for the heat exchanger ideally outdoors.

< You need to consider heat exchanger protection from vandalism and/or falling ice.

< Liquid cooled transmitters tend to be more efficient than air cooled, a benefit to total cost of operation.

< The liquid cooling system can be used to cool a water column load and / or the mask filter.

Air Cooled Transmitter installation considerations.

< Air cooled transmitters generally require a greater building HVAC system to maintain acceptable building temperature.

< Air Cooled typically have lots of small fans that require maintenance and replacement.

< Your installation is restricted to using an air-cooled mask filter and air-cooled load.

Antenna Systems for DTV

< There are several selection choices that need to be considered when selecting a DTV antenna.

< How much tower aperture is available for antenna mounting?

< Is the antenna going to be a single channel antenna or multi channel?

< Directional or omni pattern?

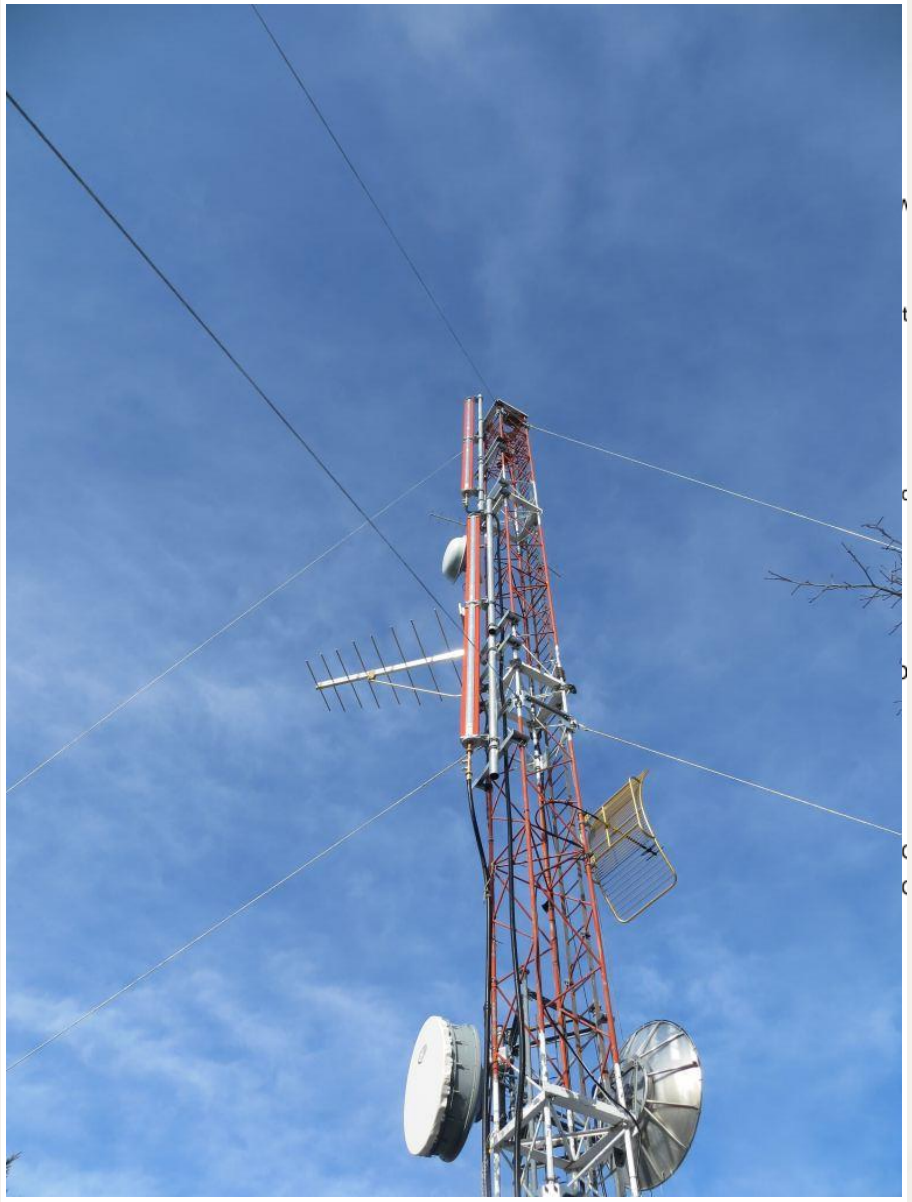
< Polarization for the antenna. Horizontal only, elliptical or circular?

< Gain required?

< Provisions to prevent effects from icing.

< Capital cost.

< Installation and ongoing maintenance cost.



Slot Antenna

< Slot antenna is typically used where you have a single channel, however there are some slots at UHF that will cover multiple channels.

< They are available in various patterns, with various gains.

< Can be equipped with electric slot heater and / or slot covers to prevent de-tuning with icing.

< They are very reliable, require minimal maintenance.

< Present a small wind load to the tower.

< Easy to install.

< Icing can de-tune the antenna due to its narrow bandwidth.

Broad banded Antenna

<Broad banded antenna will cover several channels within a band.

< VSWR is less impacted from icing.

< Have higher wind loading on towers.

< More difficult to install.

< More difficult to maintain.

< More expensive to purchase.

< Broad banded antennas are generally used where you combine multiple stations.

Antenna Fine Matcher

< Typically, there will be an antenna fine matcher Installed at the base of the antenna.

< The fine matcher is tuned to minimize the vswr of the antenna system following installation.

Transmission Line

< Comes in foam filled or air dielectric.

< Size ranges from ½ foam to 5-inch air.

< Transmission line larger than 5 inch will be rigided line.

< Often there will be a dual run of line to increase the power handling and provide some redundancy.

< Choosing the size depends on input power required, channel frequency, length of run and acceptable signal loss limits.

< Air dielectric transmission line must be pressurized.

Calculating ERP

ERP – Effective Radiated Power

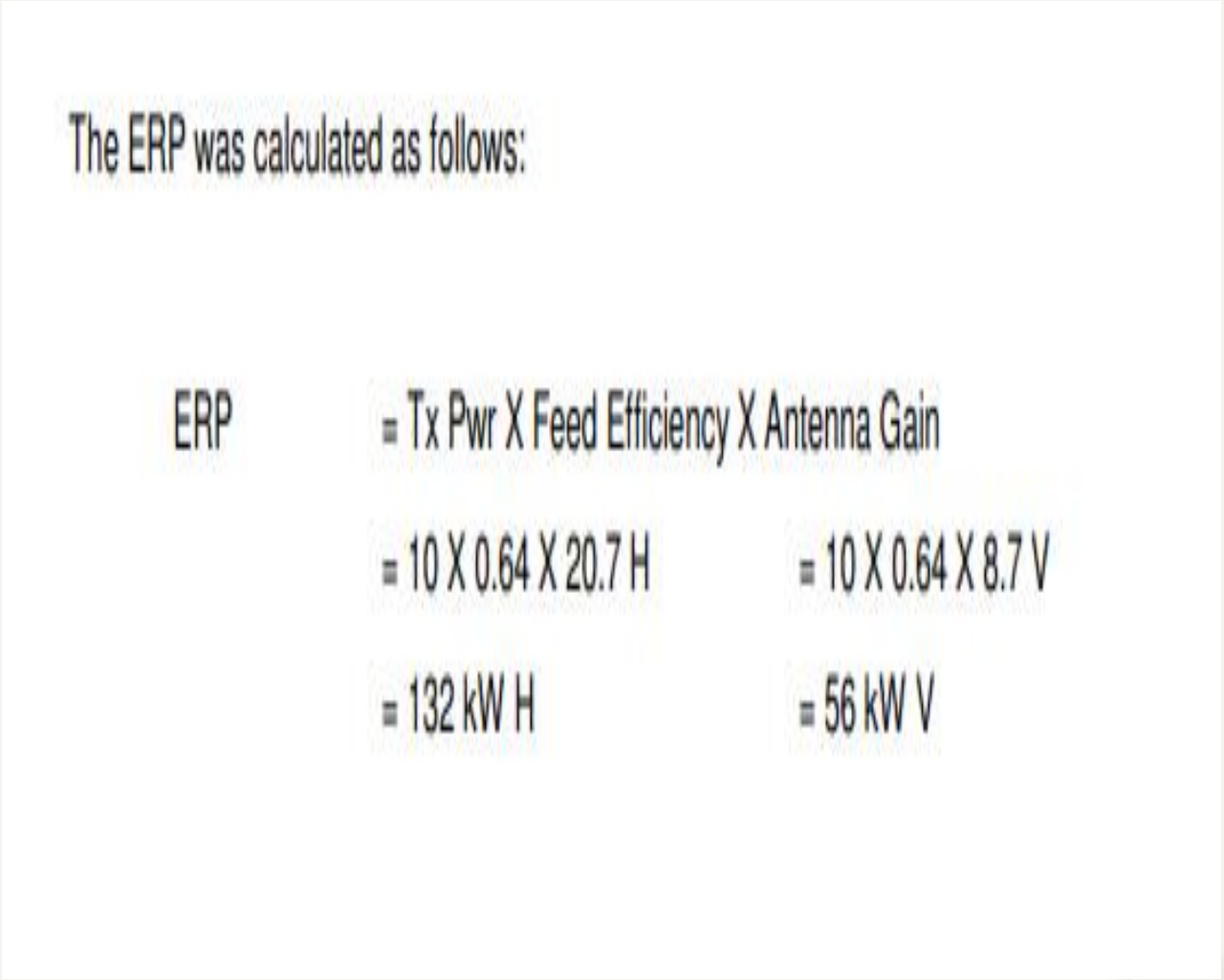
< 3 factors that influence ERP

< TPO – transmitter output power

< Line efficiency, (includes actual line loss), connector loss, mask filter loss and / or combiner loss

< Gain of the antenna.

ERP= Tx Pwr X Feed Efficiency X antenna gain

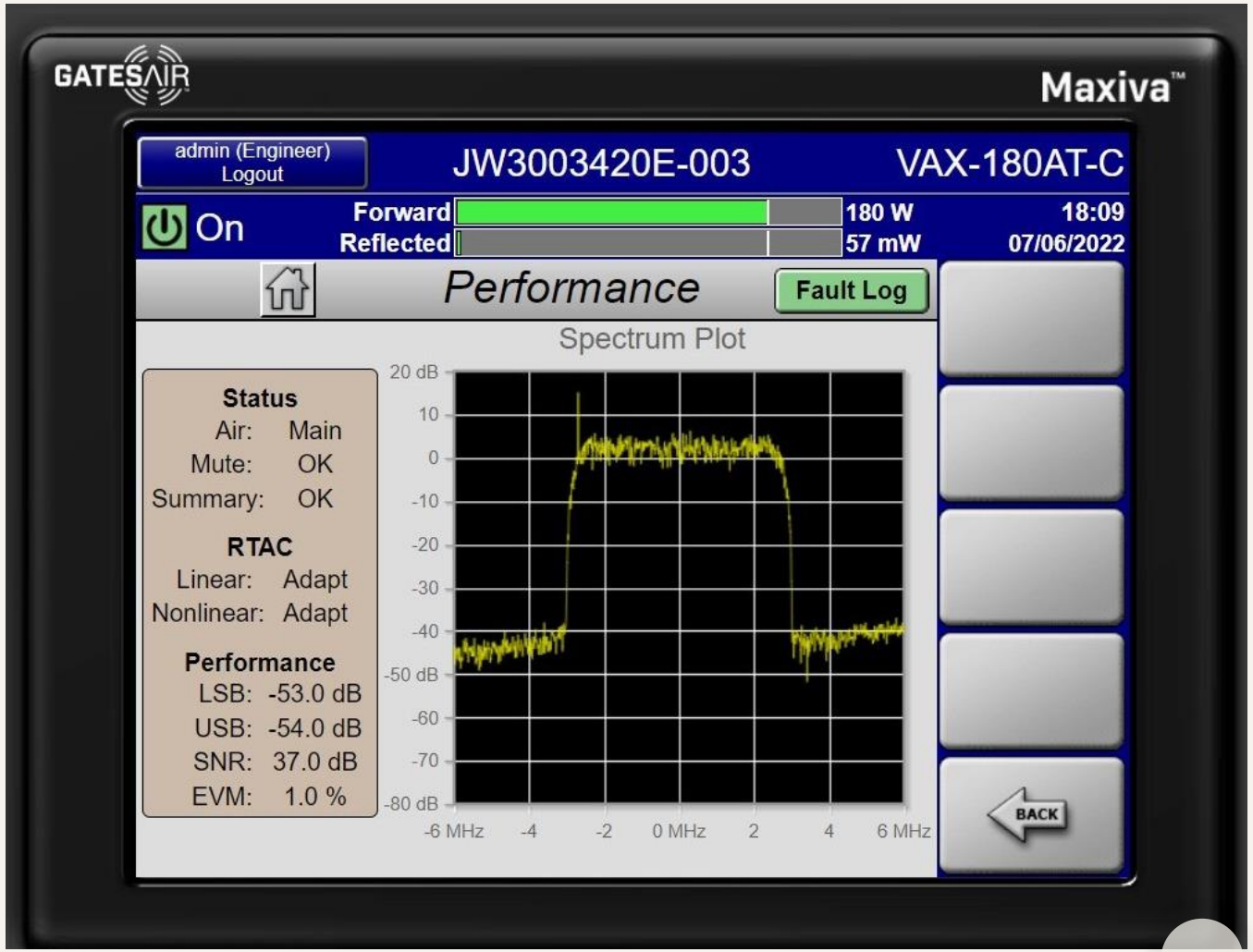


ATSC Standards

< SNR – signal to noise ratio => 27db

< EVM – Error Vector Measurement < 4.5%

< Threshold of visibility is = 15db

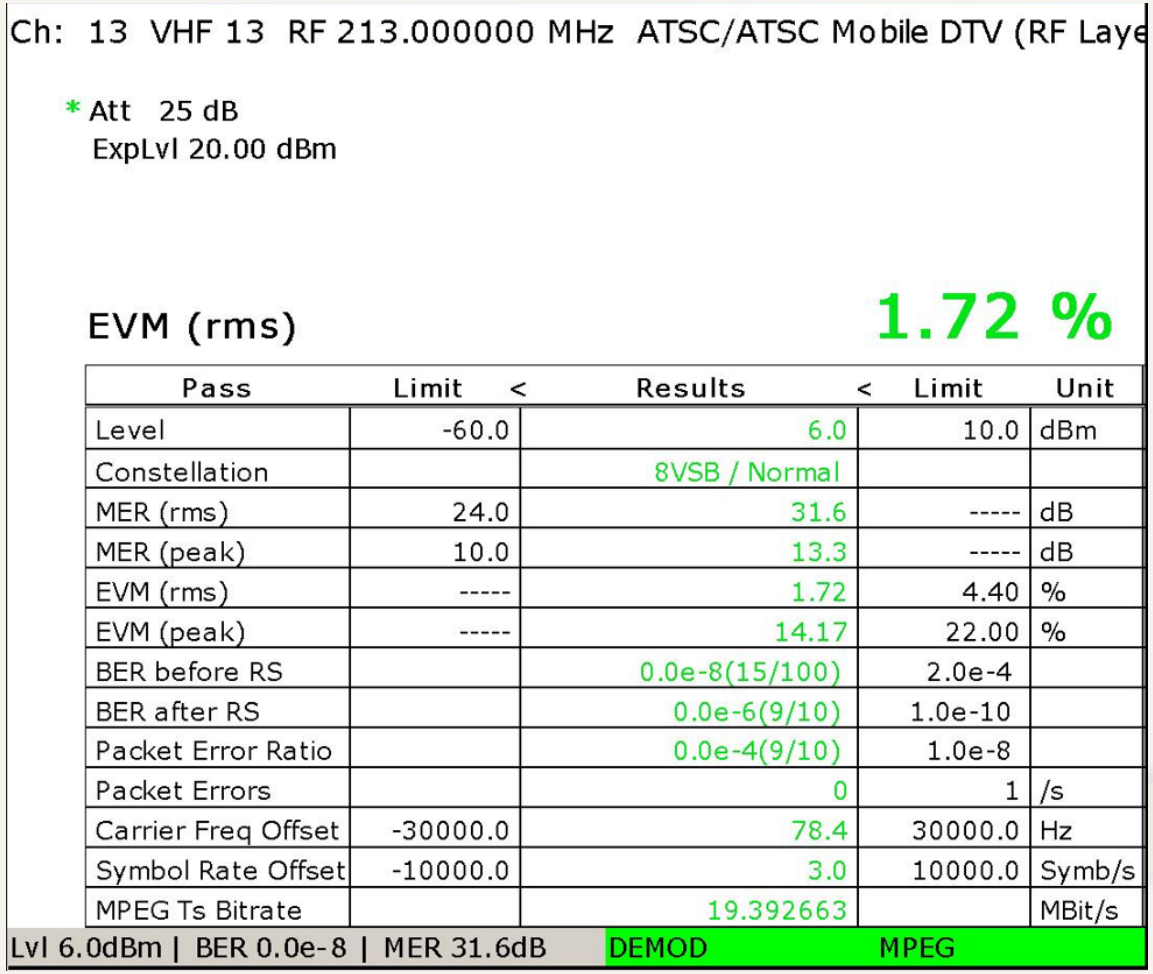


Transmitter Precorrection

< EVM is 1.72 %

< SNR (MER) is 31.6 db.

< Frequency +78.4 Hz



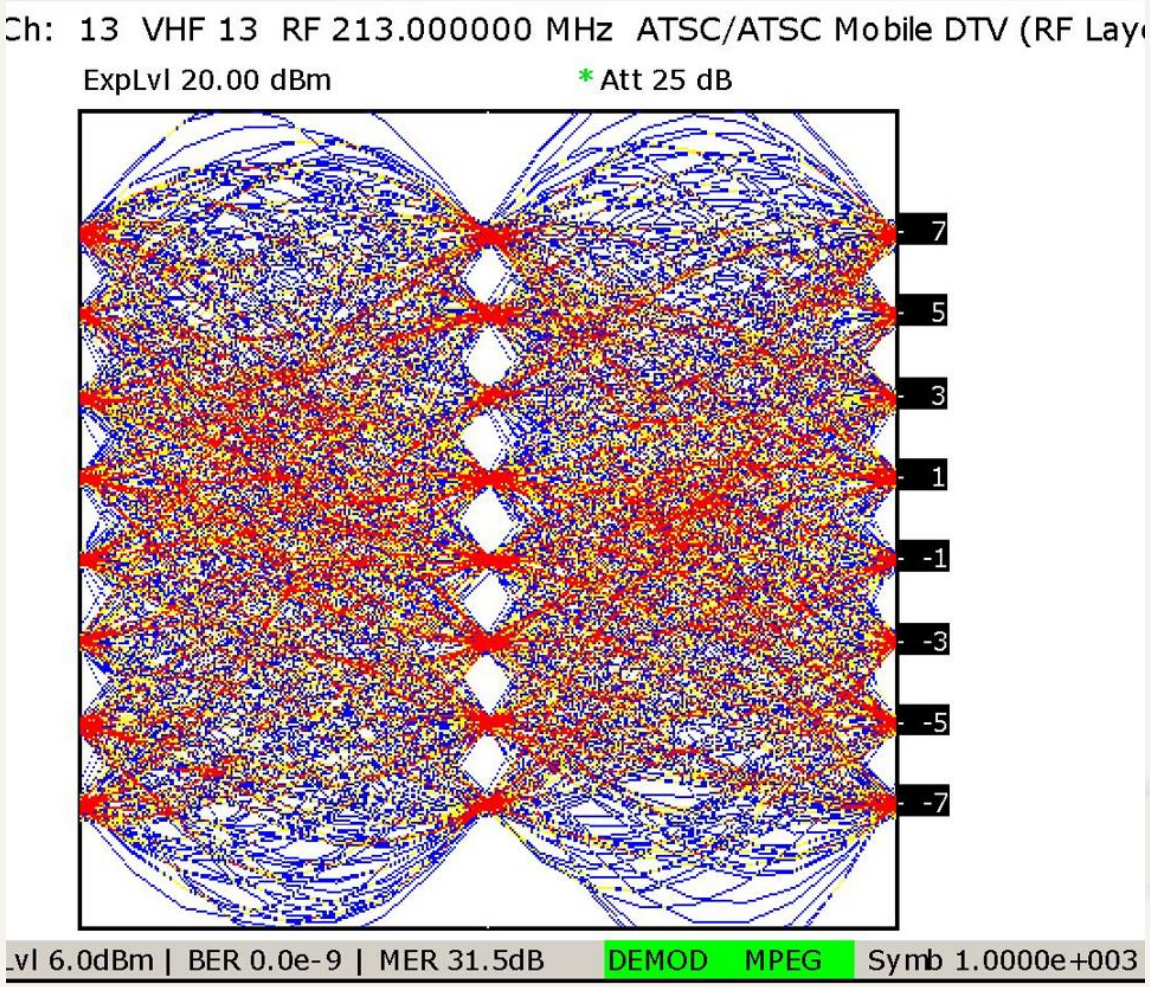
Pass	Limit <	Results	< Limit	Unit
Level	-60.0	6.0	10.0	dBm
Constellation		8VSB / Normal		
MER (rms)	24.0	31.6	-----	dB
MER (peak)	10.0	13.3	-----	dB
EVM (rms)	-----	1.72	4.40	%
EVM (peak)	-----	14.17	22.00	%
BER before RS		0.0e-8(15/100)	2.0e-4	
BER after RS		0.0e-6(9/10)	1.0e-10	
Packet Error Ratio		0.0e-4(9/10)	1.0e-8	
Packet Errors		0	1	/s
Carrier Freq Offset	-30000.0	78.4	30000.0	Hz
Symbol Rate Offset	-10000.0	3.0	10000.0	Symb/s
MPEG Ts Bitrate		19.392663		MBit/s

Transmitter Precorrection

< EVM is 1.72 %

< SNR (MER) is 31.6 db.

< Frequency +78.4 Hz

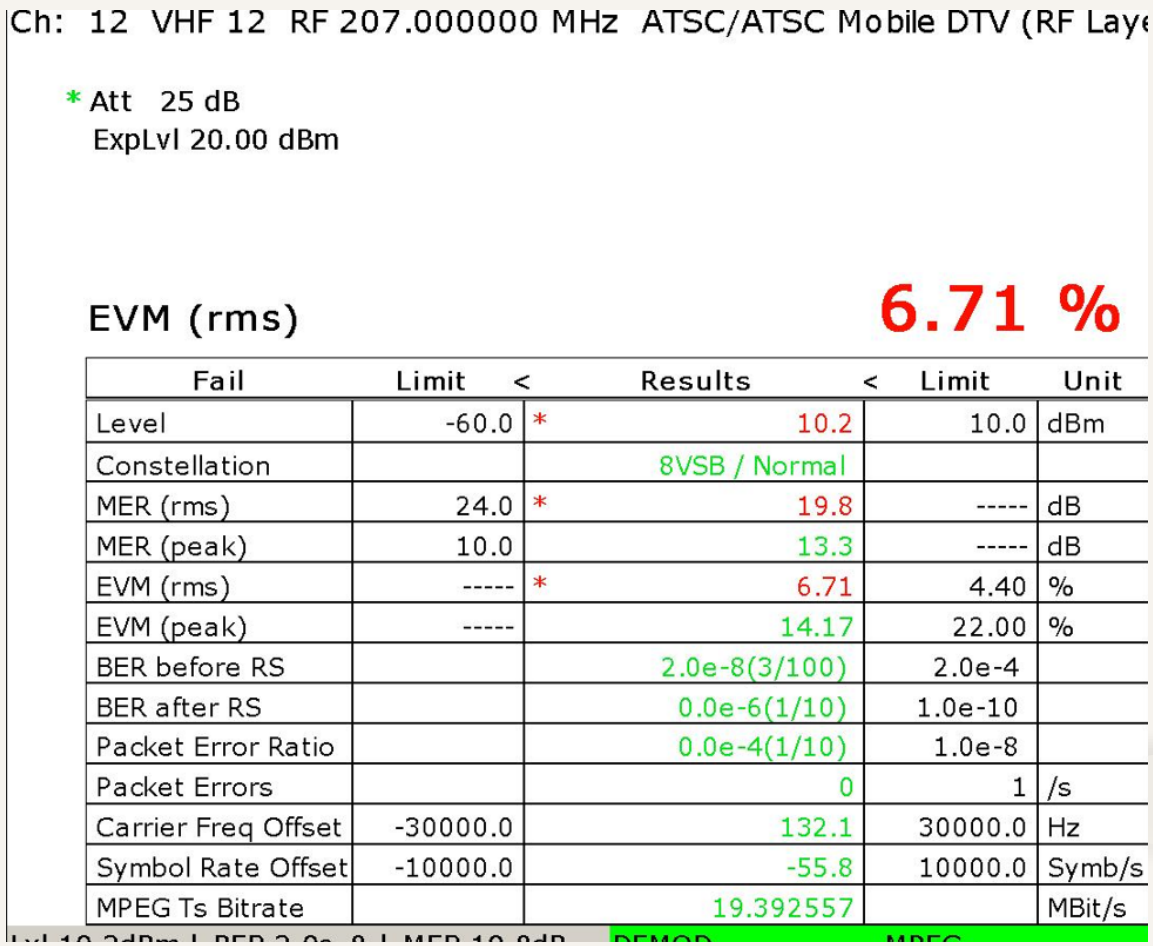


Incorrect Transmitter Precorrection

< EVM is 6.71 %

< SNR (MER) is 19.8 db.

< Frequency is + 132.1 Hz.



Ch: 12 VHF 12 RF 207.000000 MHz ATSC/ATSC Mobile DTV (RF Laye

* Att 25 dB
ExpLvl 20.00 dBm

EVM (rms) **6.71 %**

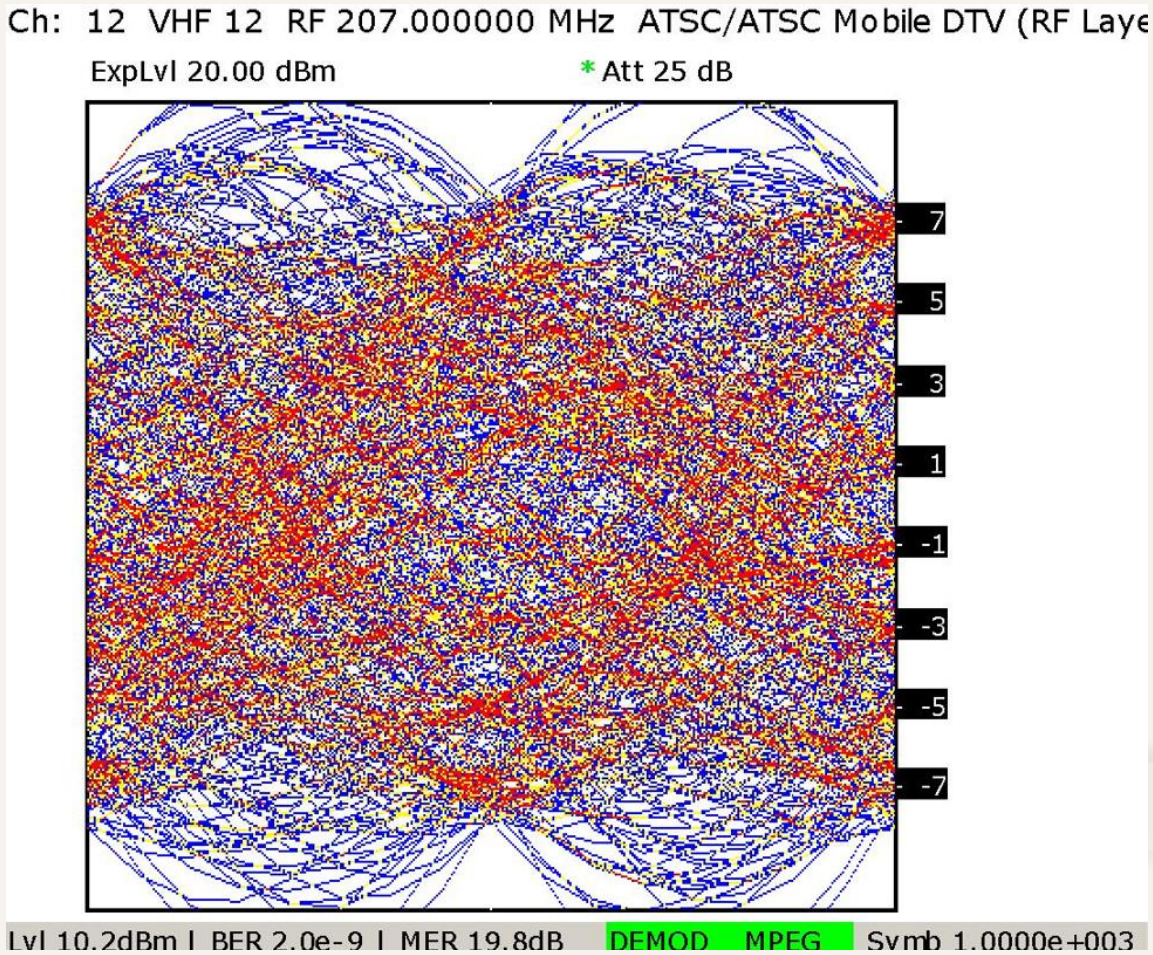
Fail	Limit	<	Results	<	Limit	Unit
Level	-60.0	*	10.2		10.0	dBm
Constellation			8VSB / Normal			
MER (rms)	24.0	*	19.8		-----	dB
MER (peak)	10.0		13.3		-----	dB
EVM (rms)	-----	*	6.71		4.40	%
EVM (peak)	-----		14.17		22.00	%
BER before RS			2.0e-8(3/100)		2.0e-4	
BER after RS			0.0e-6(1/10)		1.0e-10	
Packet Error Ratio			0.0e-4(1/10)		1.0e-8	
Packet Errors			0		1	/s
Carrier Freq Offset	-30000.0		132.1		30000.0	Hz
Symbol Rate Offset	-10000.0		-55.8		10000.0	Symb/s
MPEG Ts Bitrate			19.392557			MBit/s

Incorrect Transmitter Precorrection

< EVM is 6.71 %

< SNR (MER) is 19.8 db.

< Frequency is + 132.1 Hz.



ISED Compliance Measurements

< Output power is as per the Technical Brief or as built approvals.

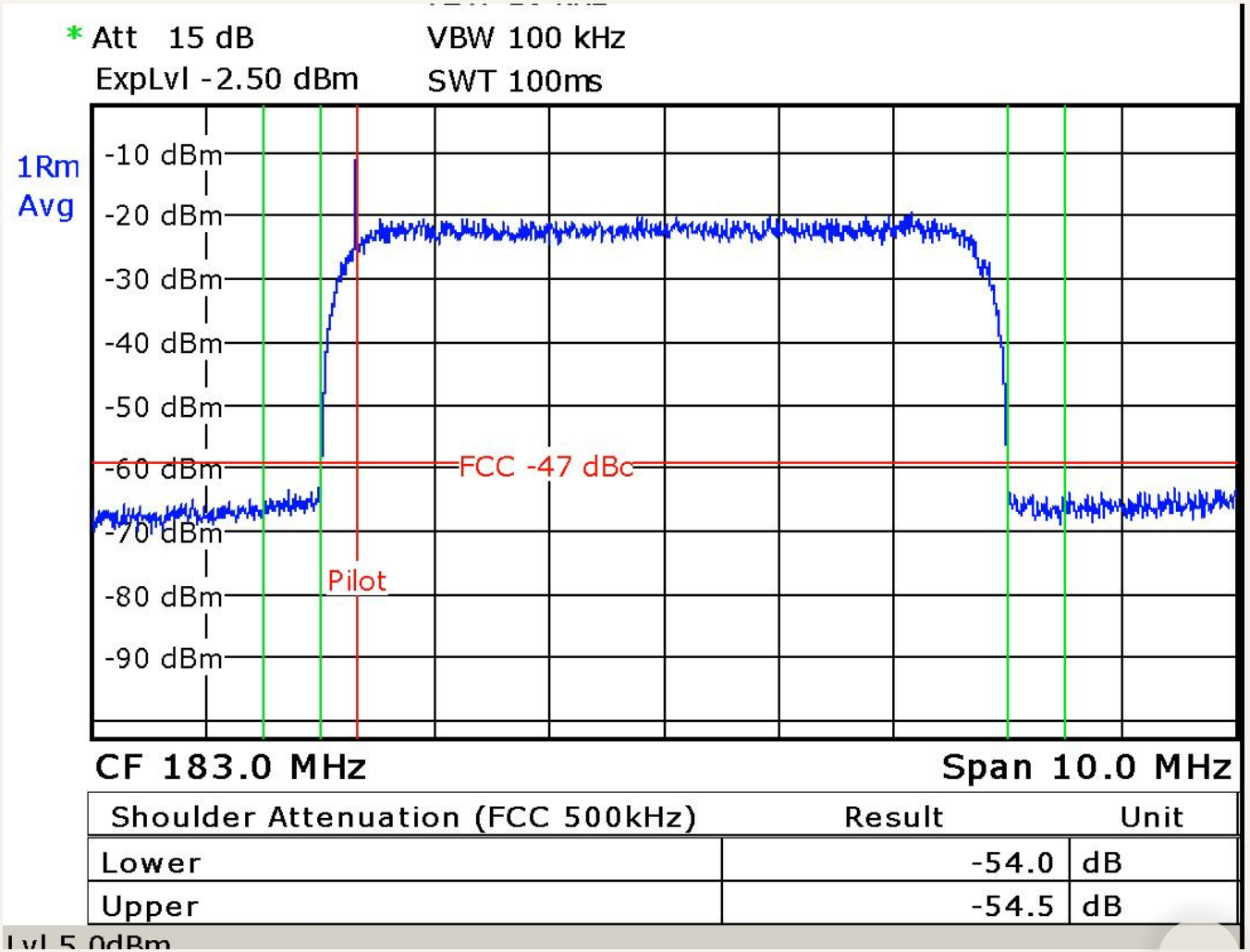
< Frequency +/ - 1000 Hz in a non-adjacent channel operation.

< Frequency +/ - 1 Hz in an adjacent channel operation.

< Mask filter shoulders minimum – 47db from 3.5 MHz from the channel center.

< Out of band measurements -110 db.

< DTV transmitters require no ISED type approval.



Frequency Measurement

< The frequency for any channel is measured using the pilot.

< The pilot is located at 0.309441 MHz above the lower channel side band.

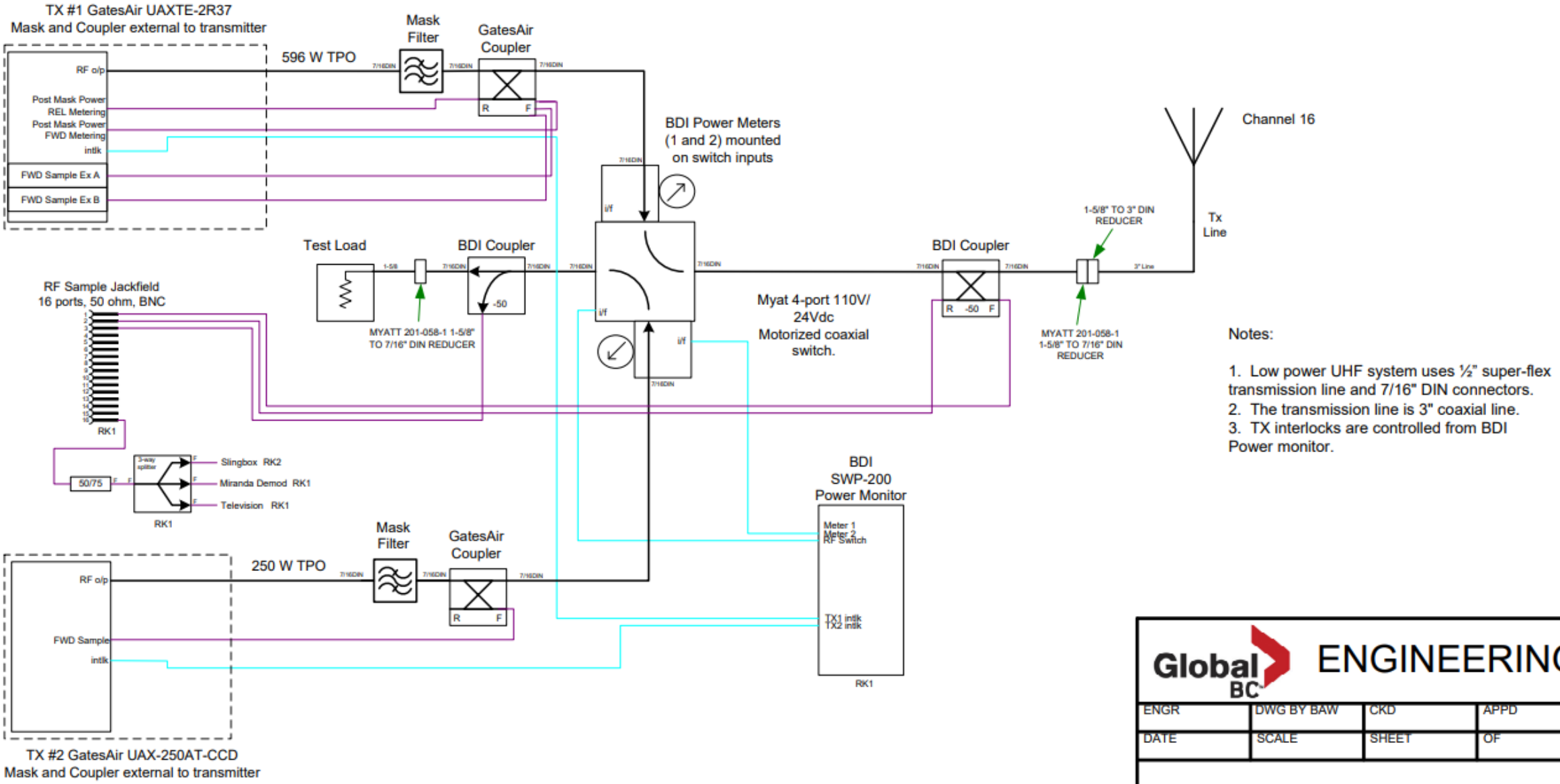
Mask Filter Compliance Measurement

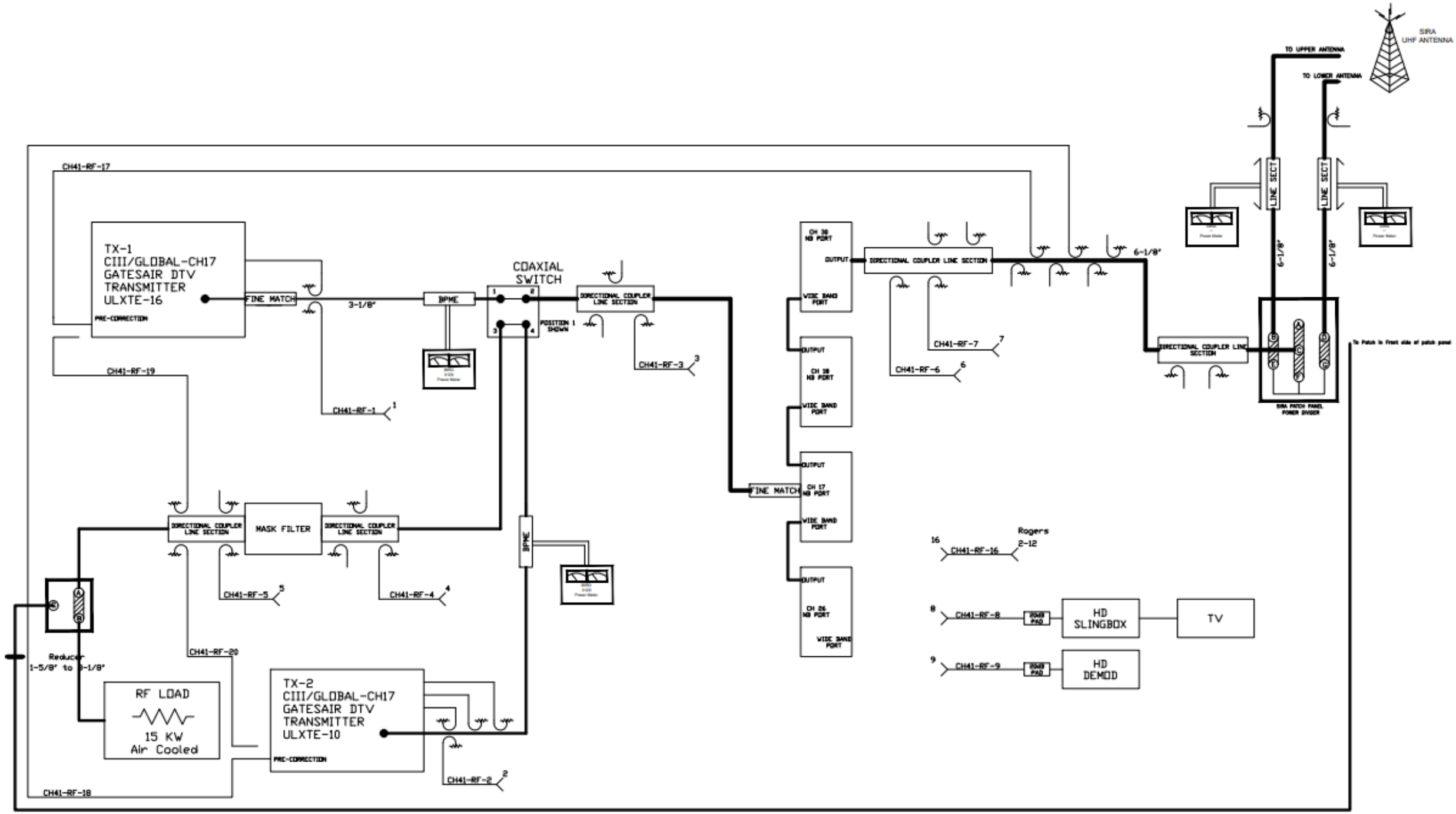
Exciter A									
	Filter Response			Transmitter Response before filter					
Frequency	Analyzer Reading	Center Freq. Reference	Filter Response	Analyzer Reading	Center Freq. Reference	Transmitter Response	Net Response	FCC Full Service Mask Response	Negative # Is out of FCC Specifications
626.00	-69.360	-0.590	-68.77	-108.30	-39.27	-69.03	-137.80	-99.40	38.40
627.00	-54.970	-0.590	-54.38	-104.81	-39.27	-65.54	-119.92	-88.60	31.32
628.00	-44.330	-0.590	-43.74	-104.04	-39.27	-64.77	-108.51	-77.10	31.41
629.00	-35.980	-0.590	-35.39	-103.64	-38.88	-64.76	-100.15	-65.60	34.55
630.00	-28.290	-0.590	-27.70	-99.53	-38.88	-60.65	-88.35	-54.10	34.25
630.50	-24.620	-0.590	-24.03	-99.98	-38.88	-61.10	-85.13	-48.40	36.73
631.00	-21.730	-0.590	-21.14	-97.21	-39.80	-57.41	-78.55	-42.60	35.95
631.50	-25.510	-0.590	-24.92	-97.80	-39.80	-58.00	-82.92	-36.40	46.52
631.75	-18.190	-0.590	-17.60	-94.11	-39.80	-54.31	-71.91	-36.40	35.51
638.25	-17.430	-0.590	-16.84	-97.91	-42.03	-55.88	-72.72	-36.40	36.32
638.50	-28.610	-0.590	-28.02	-101.99	-42.03	-59.96	-87.98	-36.40	51.58
639.00	-22.290	-0.590	-21.70	-101.90	-42.03	-59.87	-81.57	-42.60	38.97
639.50	-25.860	-0.590	-25.27	-101.27	-38.34	-62.93	-88.20	-48.40	39.80
640.00	-29.760	-0.590	-29.17	-103.62	-38.34	-65.28	-94.45	-54.10	40.35
641.00	-38.130	-0.590	-37.54	-104.12	-38.34	-65.78	-103.32	-65.60	37.72
642.00	-47.320	-0.590	-46.73	-104.29	-38.37	-65.92	-112.65	-77.10	35.55
643.00	-61.110	-0.590	-60.52	-105.45	-38.37	-67.08	-127.60	-88.60	39.00
644.00	-66.100	-0.590	-65.51	-104.34	-38.37	-65.97	-131.48	-99.40	32.08

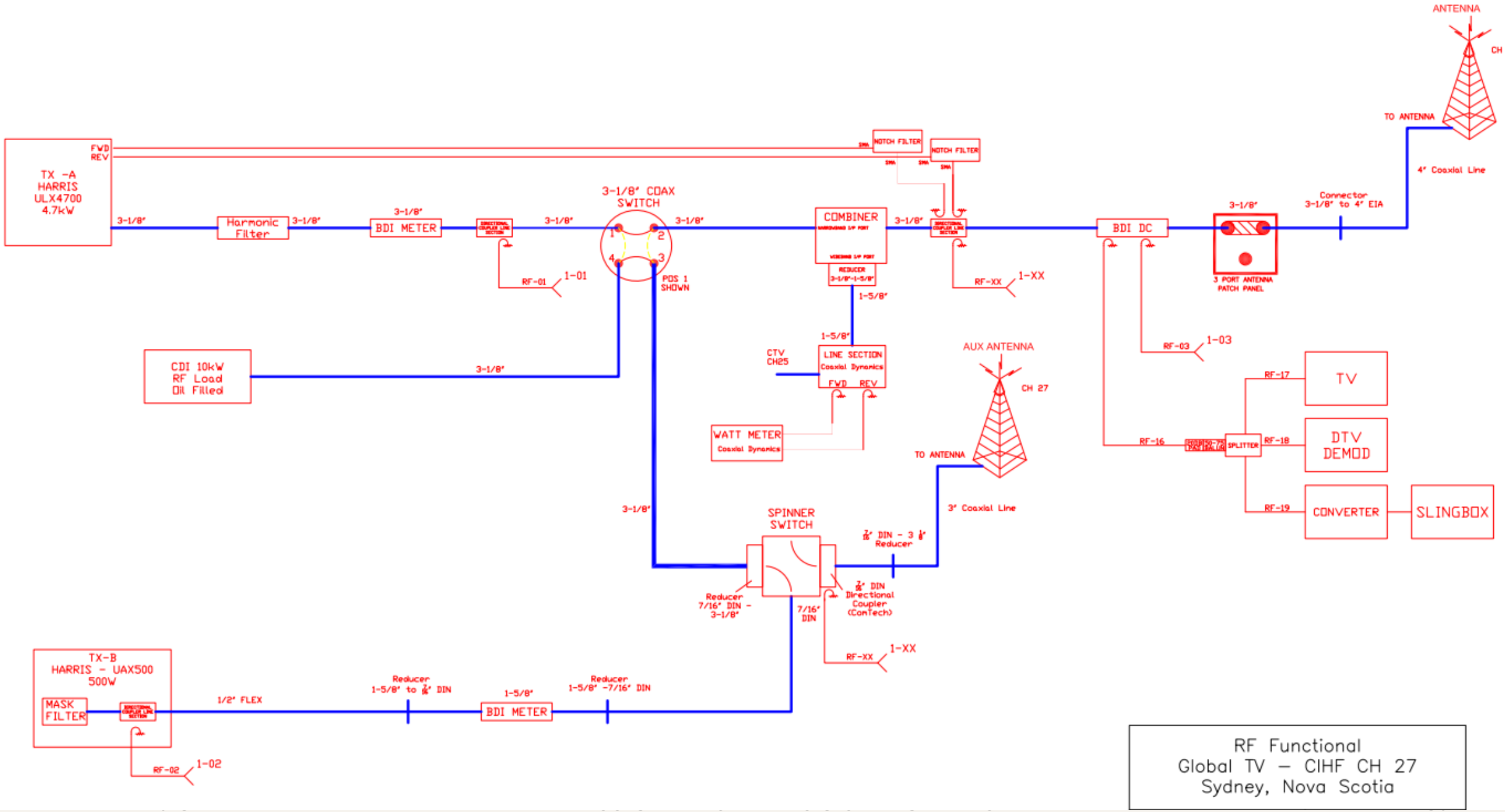
Out of Band Compliance Measurement

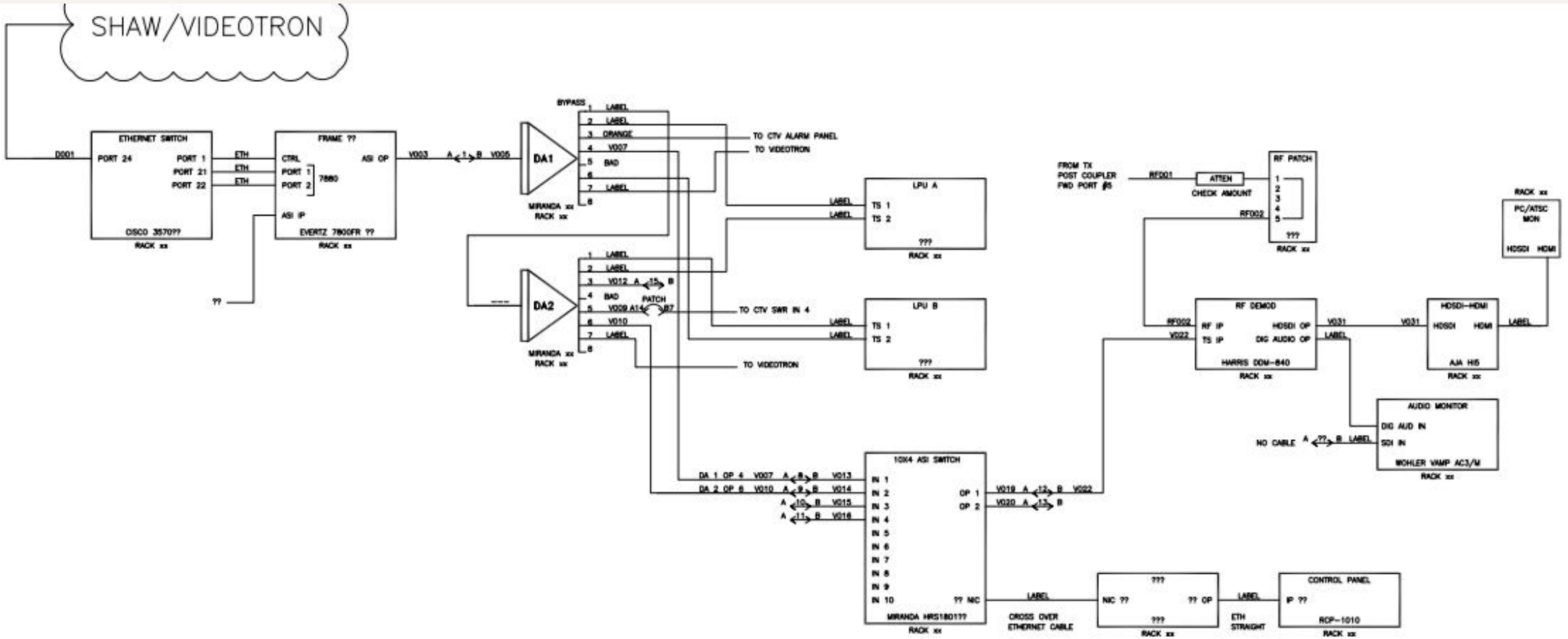
635.00MHz :Measured Center Frequency (MHz)

	CIII-DT-41 (Exciter A)												
	Frequency	Measured Level	Losses (dB)				Loss Correction	Measurement RBW (kHz)	RBW Correction	TPO Reference Measurement After Corrections	dBc	FCC Limit	FCC Margin
			Coupler	Cable	Signal Pad	Inline Filter							
Fundamental	635.00MHz	-25.940dBm	39.420dB	0.620dB	20.000dB		60.040dB	10kHz	27.782dB	61.882dBm	0.0dBc	0.000dBc	0.0dB
2nd Harmonic	1270.00MHz	-119.570dBm	49.790dB	1.460dB	0.000dB	0.670dB	51.920dB	10kHz	16.990dB	-50.660dBm	-112.5dBc	-110.000dBc	2.5dB
3rd Harmonic	1905.00MHz	-110.980dBm	39.930dB	1.670dB	0.000dB	0.650dB	42.250dB	10kHz	16.990dB	-51.740dBm	-113.6dBc	-110.000dBc	3.6dB


TX #1 GatesAir UAXTE-2R37
Mask and Coupler external to transmitter
RF o/p
Post Mask Power
REL Metering
Post Mask Power
FWD Metering
intlk
FWD Sample Ex A
FWD Sample Ex B
596 W TPO
Mask Filter
GatesAir Coupler
R
F
BDI Power Meters
(1 and 2) mounted
on switch inputs
Channel 16
Tx Line
1-5/8" TO 3" DIN REDUCER
Test Load
BDI Coupler
-50
MYATT 201-058-1 1-5/8" TO 7/16" DIN REDUCER
Myat 4-port 110V/ 24Vdc Motorized coaxial switch.
BDI Coupler
-50
MYATT 201-058-1 1-5/8" TO 7/16" DIN REDUCER
RF Sample Jackfield
16 ports, 50 ohm, BNC
RK1
50/75
3-way splitter
Slingbox RK2
Miranda Demod RK1
Television RK1
RK1
BDI
SWP-200
Power Monitor
Meter 1
Meter 2
RF Switch
TX1 intlk
TX2 intlk
RK1
Mask Filter
GatesAir Coupler
250 W TPO
RF o/p
FWD Sample
intlk
TX #2 GatesAir UAX-250AT-CCD
Mask and Coupler external to transmitter
Notes:
1. Low power UHF system uses ½" super-flex transmission line and 7/16" DIN connectors.
2. The transmission line is 3" coaxial line.
3. TX interlocks are controlled from BDI Power monitor.
Global BC
ENGINEERING
ENGR
DWG BY BAW
CKD
APPD
DATE
SCALE
SHEET
OF
Fredericton, NB RF Signal Flow
Functional Drawing


SIRA
UHF ANTENNA
TO UPPER ANTENNA
TO LOWER ANTENNA
LINE SECT
LINE SECT
6-1/8"
6-1/8"
6-1/8"
SIRA PATCH PANEL
POWER DIVIDER
To Patch in Front side of patch panel
CH41-RF-17
TX-1
CIII/GLOBAL-CH17
GATESAIR DTV
TRANSMITTER
ULXTE-16
PRE-CORRECTION
FINE MATCH
3-1/8"
BPME
COAXIAL
SWITCH
POSITION 1
SHOWN
DIRECTIONAL COUPLER
LINE SECTION
CH41-RF-1
CH41-RF-3
CH41-RF-19
CH 30
NB PORT
OUTPUT
WIDE BAND
PORT
DIRECTIONAL COUPLER LINE SECTION
CH41-RF-7
CH41-RF-6
CH 28
NB PORT
CH 17
NB PORT
CH 26
NB PORT
FINE MATCH
DIRECTIONAL COUPLER
LINE SECTION
MASK FILTER
DIRECTIONAL COUPLER
LINE SECTION
BPME
CH41-RF-5
CH41-RF-4
Reducer
1-5/8" to 3-1/8"
CH41-RF-20
RF LOAD
15 KW
Air Cooled
TX-2
CIII/GLOBAL-CH17
GATESAIR DTV
TRANSMITTER
ULXTE-10
PRE-CORRECTION
CH41-RF-2
CH41-RF-18
Rogers
2-12
CH41-RF-16
CH41-RF-8
20dB
PAD
HD
SLINGBOX
TV
CH41-RF-9
20dB
PAD
HD
DEMOD


ANTENNA
CH 27
TO ANTENNA
4" Coaxial Line
TX -A
HARRIS
ULX4700
4.7kW
FWD
REV
3-1/8"
Harmonic Filter
BDI METER
3-1/8" COAX SWITCH
POS 1 SHOWN
RF-01
1-01
NOTCH FILTER
NOTCH FILTER
COMBINER
REDUCER 3-1/8"-1-5/8"
RF-XX
1-XX
BDI DC
3 PORT ANTENNA PATCH PANEL
Connector 3-1/8" to 4" EIA
1-5/8"
RF-03
1-03
CDI 10kW
RF Load
Oil Filled
CTV
CH25
LINE SECTION
Coaxial Dynamics
FWD REV
AUX ANTENNA
CH 27
WATT METER
Coaxial Dynamics
TO ANTENNA
3" Coaxial Line
RF-17
TV
RF-16
SPLITTER
RF-18
DTV DEMOD
RF-19
CONVERTER
SLINGBOX
SPINNER SWITCH
7/8" DIN - 3 1/8" Reducer
Reducer 7/16" DIN - 3-1/8"
7/8" DIN Directional Coupler (Contech)
7/16" DIN
RF-XX
1-XX
TX-B
HARRIS - UAX500
500W
MASK FILTER
1/2" FLEX
Reducer 1-5/8" to 7/8" DIN
1-5/8"
BDI METER
Reducer 1-5/8" -7/16" DIN
RF-02
1-02
RF Functional
Global TV – CIHF CH 27
Sydney, Nova Scotia



ENGR	DWG BY: BAW	CKD	APPD
DATE: 08/18/2022	SCALE: NTS	SHEET: 1	OF: 1

Montreal, PQ
ASI & Monitoring Signal Flow Functional Drawing

Questions ?

+ Thanks for having me.