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अनुदेशक का अधाक्षर
Instructor Initial :

STUDY OF PCL DIGITAL RADIO

AFH-150 is a PCL digital radio using the technology of ALCATEL FRANCE. This equipment is operational in the 7GHz band. It works in the frequency band 7.1 to 7.7 GHz. It employs OQPSK modulation technique. Modulation is done direct at microwave frequency. The output power of the transmitter is 500 mW. This equipment is designated as 34 Mb/s + 2 Mb/s. In addition to the transmission of 34 Mb/s + 2 Mb/s it provides four Analog Service channels and seven Digital Service channels. The analog service channels are functional in the frequency band 0 to 16 KHz. The digital service channels are operated at a data rate of 64 Kb/s.

The allocation of analog service channels is:

Ch. 1 For EOW working (0 - 4 KHz band).

Ch. 2 For supervisory system (4 - 8 KHz band).

Ch. 3 An optional channel which can be used as an Express order wire (8 - 12 KHz band).

Ch. 4 An optional channel, which can be used as an Express order, wire 12 - 16 KHz band).

The digital service channels are either used as express order wire or as a data channel.

The 34 Mb/s signal is called as Main Data signal and the 2 Mb/s signal is called as wayside signal.

The frequency stability of TLO and RLO is +/- 50 ppm.

For monitoring the parameters of the system an LED bar graph is provided. Remote monitoring and controlling is done through NMS. This equipment works on - 48 V DC with an input variation of -40 to -60 V.

Now study the digital radio equipment and identify the various units as given below and give a brief description of each.

1. BEA 750 : Name of the unit ----------

2. BEA 310 : Name of the unit ----------

3. BEN 401 : Name of the unit ----------

4. BEN 301 : Name of the unit ----------

5. BEN 101 : Name of the unit ----------

6. BEA 141 : Name of the unit ----------

7. BEA 120 : Name of the unit ----------

8. BEA 601 : Name of the unit ----------

9. BEA 610 : Name of the unit ----------

10. WGA 508 : Name of the unit ----------

11. WGA 602 : Name of the unit ----------

12. WGA 592 : Name of the unit ----------

Record the readings for the various parameters in the table given below by the operation of Thumb Wheel.

TABLE

Thumb Wheel position.	Information.	Standard reading. LED display on Bar graph.	Measured value.
0.	Stop	-	
1.	-48 V DC	7 - 9	
2.	-16 V DC	7 - 9	
3.	- 8 V DC	7 - 9	
4.	+ 8 V DC	7 - 9	
5.	+ 5 V DC	7 - 9	
6.	TX Power	7 - 9	
7.	TLO Power	7 - 9	

8.	RX LO Power	7 - 9
9.	VCO feedback voltage	7 - 9
10.	AGC Voltage	Link measurement
11.	Error rate value	0 - 1
	Reception Frame	
12.	Reset to zero of parity	Link measurement
13.	Error counting parity	0 - 1 (10 -6)
	discrepancy	9 -10 (10 -6)
14.	Unused	-
15.	Unused	-

Q.1 Identify the Input and Output points for 34 Mb/s.

Q.2 How many ASCs are provided in this equipment?

Q.3 Give the TX and RX frequencies of this equipment and output power.

Q.4 How many VF channels can be transmitted in this equipment?

Q.5 What is the purpose of 2 Mb/s?

Q.6 What are the working voltages and permissible variations of the input voltage?

DMW RADIO EQPT (PCL/ALCATEL MAKE) (34+2) MB

BEN - 301 - TRANSMITTER

BEN - 101 - RECEIVER

BEA - 310 - Tx DPU

BEN - 401 - TLO

BEA - 141 - REGENERATOR

BEA - 610 - POWER SUPPLY

BEA - 601 - OPERATION BOARD

BEA - 120 - Rx DPU

WGA - 592 - VOICE CALL AMP & HANDSET

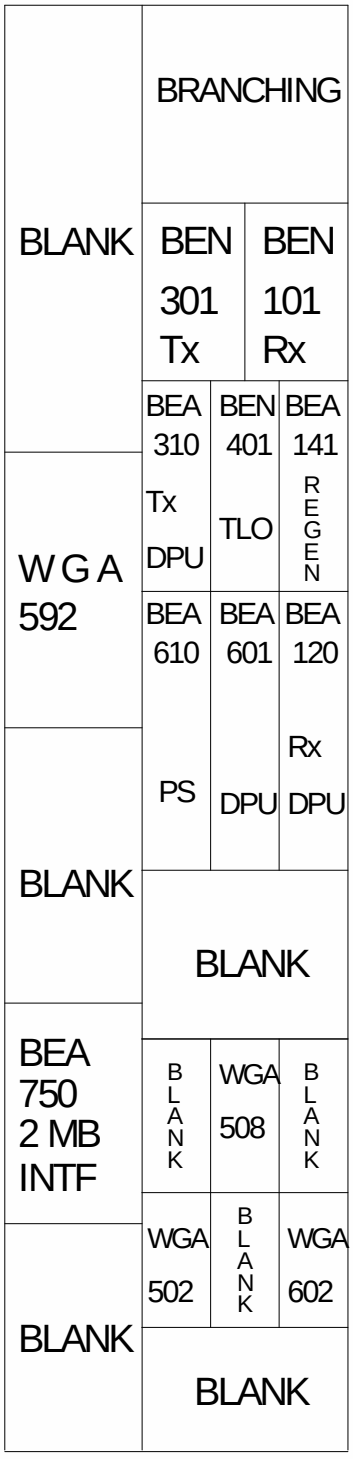
BEA - 750 - 2 MB INTERFACE UNIT

WGA - 508 - BASIC ORDER WIRE UNIT

WGA - 502 - CHANNEL MODEM

WGA - 602 - 48/12V & -12V

BATTERY POWER SUPPLY



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अनुदेशक का अधाक्षर
Instructor Initial :

STUDY OF ORDERWIRE RESPONSE ON PCL DMW RADIO

INSTRUMENTS REQUIRED

1. Selective Level Oscillator.

2. Selective Level Meter.

STEPS

1. Connect the level Oscillator to the Order wire In of station 01.

2. Connect the Selective level meter to Order wire Out of station 02.

3. Feed the test tone at a level of - 13 dBm at Order wire IN at 600 Ohms impedance for different frequencies given below.

4. Measure the levels at Order wire Out test point and tabulate.

5. Repeat the experiment for Station 02 to 01 direction.

TABLE - A (Direction 01 - 02)

Frequency at O/W IN in Hz.	Level at O/W Out in dBm.
300	
600	
800	
1000	
1400	
1800	
2000	
2500	
3000	
3100	
3200	
3300	
3400	
3500	
3600	
3700	
3800	
4000	
4100	
4200	

TABLE - B (Direction 02 - 01)

Frequency at O/W IN in Hz.	Level at O/W Out in dBm.
300	
600	
800	
1000	
1400	
1800	
2000	
2500	
3000	
3100	
3200	
3300	
3400	
3500	
3600	
3700	
3800	
4000	
4100	
4200	

Review Questions:

Q. 1 Plot a graph for the above readings.

Q. 2 What inference that can be drawn from the above graph?

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Marks Awarded :

अनुदेशक का अधाक्षर
Instructor Initial :

COMPUTING AGC CHARACTERISTICS ON PCL DGITAL RADIO

INSTRUMENTS REQUIRED:

1. Microwave Signal Generator.

2. Frequency counter.

3. Digital Multimeter.

STEPS

1. Connect the frequency counter to the frequency monitoring point of the signal generator.

2. Tune the generator the required frequency by observing the frequency counter.

3. Adjust the signal generator output level to - 35 dBm.

4. Connect the Signal Generator to the Coaxial cable adaptor of the equipment located at the bay top of the equipment.

5. Connect the Digital Multimeter at Pin No. 5 of J 17 with respect to ground.

6. Vary the output level of the signal generator in steps of 5 dB as given in the table below.

7. Note down the readings of the voltmeter and LED Bar graph for each level.

TABLE

MW input level in dBm.	AGC Voltage at Pin No. 5 of J 17	LED Bar graph reading.
- 35		
- 40		
- 45		
- 50		
- 55		
- 60		
- 65		
- 70		
- 75		
- 80		
- 85		
- 88		
- 90		

Q.1 Plot graphs input level vs. AGC Voltage and input level vs. LED Bar graph reading. Comment on the results.

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अनुदेशक का अधाक्षर
Instructor Initial :

STUDY OF NEC/BEL 7 GHz DIGITAL RADIO

M/s BEL and M/s ITI in India supply the 7 GHz digital radio equipment. The technology is from M/s NEC Japan. This equipment is available as

a) 1 + 1 Hot Standby system.

b) 1 + 1 Hot Standby with space diversity system.

This equipment is designated as 7 GHz 34 + 2 Mb/s System. The transmitting capacity of the equipment is 480 + 30 channels. The modulation technique used is QPSK. Modulation is done at 70 MHz IF stage. This 70 MHz modulated signal is translated into a 7 GHz signal by employing an up converter. The up converted 7 GHZ signal is amplified by a series of FET amplifier and are transmitted at a power level of + 30 dBm. In the receiving side Coherent detection is employed to demodulate the data signals from the IF signal. There is a provision for 3 Analog service channels operating the frequency band 0 - 12 KHz and optional Digital service channels up to 4.

The allocation for the Analog service channels is:

0 - 4 KHz	For Engineering Order wire
4 - 8 KHz	For Supervisory channel.
8 - 12 KHz	Used as Exp. Order wire and is available on optional basis.

These Analog Service channels are frequency modulated direct at 7 GHz frequency.

The optional digital service channels when available are used as either Exp. Order wire or as Data Channels.

This equipment works on -48 V DC power supply with an input variation of -36 to -75 V DC.

Now study the digital microwave radio equipment and identify the various units shown in the attached diagram and give a brief description of each unit given below.

1. TX DPU (Transmitter digital processor unit).
2. PH MOD (Phase Modulator).
3. TX RF (Transmitter Radio Frequency).
4. SC AMP (Service channel Amplifier).
5. RX RF (Receiver Radio Frequency).
6. Delay Equalizer.
7. Transversal Equalizer.
8. PH DEM (Phase Demodulator).
9. BIT COMB (Bit Combiner).
10. RX DPU (Receiver Digital Processor Unit).
11. SWO (Switch Over).
12. SWO CONT (Switch Over Control).

Fill in the blanks in the specifications given below.

1. Operating frequency ----------

2. Channel transmission capacity ----------

3. TX Output Power ----------

4. TX output frequency stability ----------

5. Bit error rate

a) at -79.5 dBm receiver input level ----------

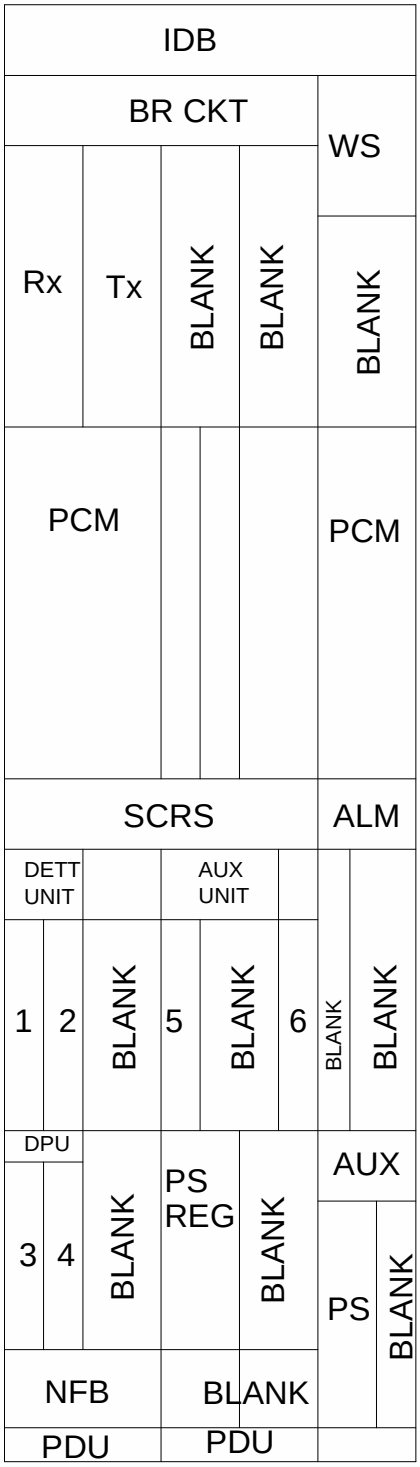
b) at -83.5 dBm receiver input level ----------

6. Type of Modulation ----------

7. Type of Demodulation ----------

8. Type of RF Switching ----------

9. Input power source ----------



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अनुदेशक का अधाक्षर
Instructor Initial :

MEASUREMENT OF TRANSMITTER POWER OUTPUT AND FREQUENCY

INSTRUMENTS REQUIRED

1. MW Power meter with Sensor.

2. MW Frequency counter.

3. Appropriate Connecting cables.

Power Measurement

There are three popular devices to convert the RF power to a measurable DC.

1. Thermistor.

2. Thermocouple.

3. Diode detector.

The general measurement technique for average power is to attach a properly calibrated Sensor to the transmission line and power Sensor is connected to an appropriate Power Meter. The HP Power Meter used in the laboratory is along with a thermocouple sensor. Thermocouple generates a voltage due to temperature difference along the thermocouple. A thermocouple is usually made up of two different materials in which one junction is exposed to heat and the other not. The total effect, which produces the thermoelectric voltage, is called as See-back effect. The HP sensor is a thin film resistor made up of Tantalum Nitride and deposited on the surface of Silicon Chip converting the microwave energy into heat. The power range of Sensor is - 30 to + 20 dBm and the frequency range is 10 MHz to 18 GHz.

STEPS

1. Switch on the Power meter. It will have a self-test.

2. Preset the power meter by pressing the PRESET key to set the meter to known conditions for resolution duty cycle etc. (See booklet)

3. Zero is used to adjust the power meter internal circuitry for zero power indication when no power is connected.

4. The CAL Key is used to calibrate the power meter and any compatible power sensor to a known reference.

a). Connect the power sensor to the power REF connector.

b). Press CAL (SHIFT ZERO).

c). The power meter will display the current reference calibration factor with one blinking digit.

d). Enter the Sensor's REF CAL FACTOR.

e). Press ENTER and the power meter will display CAL

f). When the display disappears the calibration is finished.

5. The CAL FAC key is used to enter a calibration factor that will compensates for mismatch losses and effective efficiency of the power sensor.

a). Press CAL FAC (SHIFT FREQ.). The power meter will display he current calibration factor with one of the digits blinking.

b). Key the desired calibration factor of the power sensor for the input frequency.

c). Press ENTER.

6. Now the power meter is ready for measurement.

Now connect the sensor to the transmitter output point at the coaxial connector on the variable RF attenuator.

OBSERVATIONS:

1. The power output displayed on MS display is ----------

2. The losses due to connecting cable + branching filter is ----------

3. Attenuation provided on the equipment is ----------

4. Power displayed on the power meter is ----------

5. The specified output power of the transmitter is ----------

FREQUENCY MEASUREMENT

STEPS

1. Connect the frequency counter to the RLO measuring point. Note the reading.

2. Connect the frequency counter to the TLO measuring point. Note the reading.

3. Connect the frequency counter to the point at which the power is measured. Note the reading.

OBSERVATIONS:

1. TLO frequency measured is ----------

2. Specified TLO frequency is ----------

3. RLO frequency measured is ----------

4. Specified RLO frequency is ----------

5. Center carrier frequency measured is ----------

6. Specified carrier frequency is ----------

Q.1. Draw the connecting diagrams for power and frequency measurements.

Q.2. What is the permissible input level for the given Power meter and frequency counter?

Q.3. Convert 2W power into dBm.

Signature of the Candidate

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अनुदेशक का अधाक्षर
Instructor Initial :

COMPUTING AGC CHARACTERISTICS ON NEC/BEL/ITI DIGITAL RADIO

INSTRUMENTS REQUIRED:

1. Variable attenuator.
2. MW Signal Generator.
3. Digital Multimeter.
4. MSA.

STEPS

· Connect the MW Signal Generator to the coaxial cable adopter of the equipment located at the bay top.

· Tune the signal generator to the required Microwave receive frequency of the equipment.

· Vary the microwave output level of the signal generator from –35 dBm to –90 dBm in steps of 5 dB.

· Connect the digital Multimeter between the points H and G or L and G.

· Connect the MSA receiver's IF out point to the IF OUT point of the digital radio receiver.

Note the readings in the digital Multimeter and IF out level in the MSA for various values of input levels in the table given below.

TABLE

MW Input signal level (dBm)	AGC Voltage (mV)	IF Out level (dBm)
- 35		
- 40		
- 45		
- 50		
- 55		
- 60		
- 65		
- 70		
- 75		
- 80		
- 88		
- 90		

Plot the graphs between receive input level vs. AGC Voltage and receive input level vs. IF out level. Give your comments.

Q.1. What is AGC range?

Q.2. Draw the connecting diagram for AGC measurement.

Signature of the Candidate