

Field Strength measurements of Radio Vishnu 90.4cr along different routes with Geographical location registrations

P Ravikumar¹, G.Loshmi², R.Bhuvaneswari³, M.Keerthana⁴, S.Gowthami⁵

¹ Associate Professor, *Department of ECE, Shri Vishnu engineering college for women*

^{2,3,4,5} *B.Tech, Department of ECE, Shri Vishnu engineering college for women*

Abstract-This work presents the measuring the field strength of Radio Vishnu 90.4cr along different routes with geographical location registrations. To determine the signal quality at different locations until we reach the null point and to know the things which we need to change in order to increase the signal quality. We used a field strength meter and there is no frequency selective network present in the field strength meter. In the due time, when we were trying to work with the field strength meter we found that the values we obtained are related to vector sum of the FM signals which are available in that particular location. So, we designed a band pass filter with high quality factor for sharp cut-off frequency of 90.4MHz. We have travelled along 7 directions, up until we obtain the Null point in all the Directions.

I.INTRODUCTION

Radio Vishnu 90.4cr, the first Campus Radio in Andhra Pradesh, is a community radio established on 15th April 2007 at SVECW of Shri Vishnu educational Society, BHIMAVARAM. It broadcasts several programs which are very much helpful for students, both agriculture and aquaculture farmers. Radio Vishnu 90.4 is doing some projects related to UNESCO, UNICEF etc. It received 2nd price under “Community engagement category” from Ministry of Information and Broadcasting, NEW DELHI in 2014. The non-profitable community radio station was set up with a vision to give voice to voiceless. Enabling interaction between community and academia, it enhances inter/intrapersonal skills of the students and social responsibility. Students develop most of the radio programs on many relevant social issues keeping in mind all sections of the society. The programs are a variety mix of education, entertainment and social and community service. They are devised to be

informative, educational and entertaining. Radio Vishnu 90.4 uses Ground wave propagation method for broadcasting.

RADIO VISHNU 90.4 uses an Omni-directional dipole antenna with height of 30mts for broadcasting. There is an app called “RADIO VISHNU 90.4” through which listeners can listen to the programs from any place. They will produce some advertisements too. In some crucial times it helped the people who are prone to floods. Particularly during Covid-19 pandemic it helped people of nearby villages by giving them proper guidelines. The minimum usable RF field strength for Medium wave is 63dBmV/m during day time, 71dBmV/m during night time in rural areas and 77dBmV/m during night time in urban areas. Similarly for Short wave This value of signal strength is generally termed as minimum usable field strength E_{min} . The noise floor to calculate E_{min} is taken as the greatest one among the values of atmospheric noise, man-made noise and intrinsic receiver noise.

The minimum usable field strength E_{min} is determined as the level which is higher by 34 dB than the noise floor. The field strengths for FM band is shown in the Table 1.

Table 1: Field strength of FM band

Area	Mono	Stereo
Rural	48 dB μ V/m	54 dB μ V/m
Urban	60 dB μ V/m	66 dB μ V/m
Large Cities	70 dB μ V/m	74 dB μ V/m

II. RELATED WORK

Broadcast media have the ability to disseminate information to large audiences efficiently; the radio

can be a particularly important channel. Since the radio plays a more important role in public education, Producers should be familiar with the latest and newest programme structures to be able to Meet the needs of people by employing appealing methods [1]. The devolved FM signal strengths device with atmospheric parameters has been achieved and can be installed to log signal strengths sequentially with atmospheric parameters. The device was compared with an available FM signal strength meter and likewise, the air temperature, RH and pressure values compared favorably [2]. Adaptive pre distortion technique can be used to improve the overall transponder pass band response, both in amplitude and group delay. This approach is most effective with narrow-band channels with

fractional bandwidths 0.5%, as are prevalent at -band and higher. This response improvement results in significant increases in channel usable bandwidth for frequency-division multiple-access (FDMA) signals; the narrower the channel, the more advantage provided [3].

III. METHODOLOGY

To calculate the RF field strength of Vishnu 90.4 cr we have designed a band pass with cutoff frequency 90.4 Mhz and connected to RF field strength meter. Observed Radio transmission quality in different locations using FM radio along with RF field strength meter which is shown in figure1.[1]

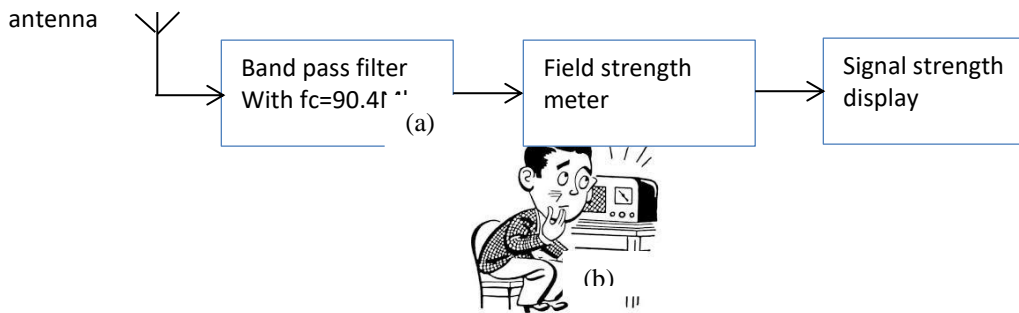


Figure 1 (a) signal strength measurement quality

using RF meter,(b)observing Radio transmission

Calculation of field strength

The output voltage of the antenna (usually measured in dB(uV)), the antenna factor and the attenuation of antenna signal path, the field-strength value can be calculated by the following equation[5]:

$$e = V_o + k + ac \dots (1)$$

where e: electric field-strength component (dB(uV/m)) V_o: output voltage of the antenna (dB(uV))

k: antenna factor (dB(m-1)) ac: attenuation of antenna signal path (dB).

RF power spectrum range: 1Hz to 300GHz

$$V/m = (30 * \text{watts} * 10^{(\text{gain}/10)\text{dB}})^{0.5} / (\text{distance})$$

$$(P)\text{dBm} = 10\log(P1/P2) \quad P2 = 1\text{mV}(\text{reference})$$

$$= 10\log(P1/1\text{mV})$$

$$= 10\log((V/m)^2 * 10^3)$$

$$= 10[3 + \log(V/m)^2] \text{ dBm.}$$

This paper presents field strengths of FM signal at different locations in all directions from the Vishnu 90.4 radio station.

III. FIELD STRENGTH MEASUREMENT IN NORTH DIRECTION TO RADIO VISHNU 90.4 CR

Figure 2.shows the geographical locations in north direction. We travelled in north direction towards

Tadepalligudem covering Garagaparru, Yendagandi, Kesavaram, Pippara, Pentapadu. The thing which we observed is that the hand radio stopped receiving the signal just after reaching Kesavaram which is in 15 km distance from Radio Vishnu 90.4 but still we were able to get the signal to Car receiver. We realized that this

is due to poor receiving capability of the hand radio which we took. Then we continued our journey towards Pippara and Pentapadu. There we obtained the null point which is located at 26 km from Radio Vishnu 90.4. Near Pentapadu police station mobile receiver and car receiver also did not receive the signal from radio Vishnu 90.4. We observed Doppler- effect. Doppler-effect or the Doppler shift describes the changes in the frequency of any sound or light wave produced by a moving source with respect to an observer.

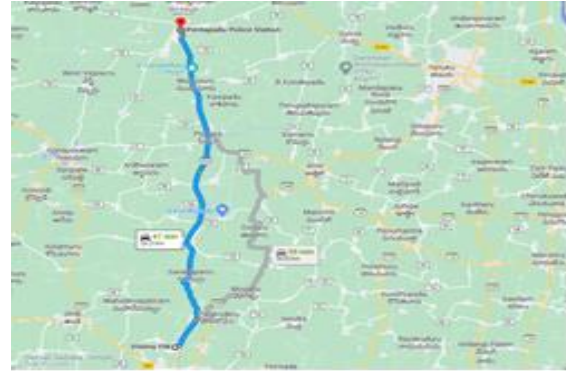


Figure 2: Geographical locations in North direction

Observations

Table 2 : Field strength measurements along north direction.

S.No	Location	Distance In (km)	Power in dB	Field Strength in (uV/m)	Quality of the signal in %
1.	Sanjana Developers	1.3	-34.3	855	100
2.	Gollalakoderu	3	-39.4	950	100
3.	Garagaparru	6.4	-43.8	637	90
4.	Yendagandi	10	-51.3	720	80
5.	Kesavaram centre	15	-68.3	560	60
6.	Pippara	17	-71.8	464	50
7.	Pentapadu	25.6	-82.6	480	Full Noise

From the Table-2, We analyzed that the field strength decreases as we are moving far from the FM station. We know that as field strength decreases, power value decreases power is nothing but signal to noise ratio, as signal to noise ratio decreases, signal strength decreases.

In some places SNR is decreasing rapidly, noise is affecting more and more. But at some places, it is good but at some places it is varying a lot, mainly in the outskirts of the village. This variation is due to several environmental factors like humidity and temperature effects and surrounding noise effects due to traffic and buildings. That’s why the signal variations in in urban areas are more compared with rural areas.

IV. FIELD STRENGTH MEASUREMENT IN WEST DIRECTION TO RADIO VISHNU 90.4 CR

We travelled in west direction towards Akiveedu covering Narsimhapuram, Undi, Cherukuwada, Akividu. The thing which we observed is the Hand radio stopped receiving the signal just after reaching Cherukuwada which is in 12 km distance from Radio Vishnu 90.4, but still we were able to get the signal to car receiver. We realized that this is due to poor receiving capability of the hand radio which we took. Then we continued our journey towards Akiveedu. There we obtained the null point. During this we observed that the RJ’s voice is clear but whereas caller’s voice is distorted with noise because of the adjustment of gain of both RJ and caller voice is different. For this we came up with the solution that is to adjust the gain equally. Table 3 depicts the observations.

Observations

Table 3. Field strength measurements along west direction

S.No	Location	Distance	Power in dB	Field Strength (v/m)	Quality of the signal (%)
1.	College	110m	-34.6	650u	100
2.	Bv Raju Statue	650m	-39.6	1.6m	100
3.	Bhimavara M Bypass Road	2.1Km	-41.4	930u	100
4.	Narasimha Puram	3km	-46.9	850u	90
5.	Kvk	6.5Km	-52	680u	75
6.	Undi	6Km	-51.3	630u	63
7.	Cherukuwada	12Km	-68.5	590u	50
8.	Thellavantena	13Km	-73.4	1.1m	25

9.	Akiveedu	17Km	-79.3	610u	Null Point
----	----------	------	-------	------	------------

From the above table we analyzed that field strength decreases, as field strength decreases power decreases, as power decreases SNR decreases noise increases but here we observed another spectacular thing as we compared with before that is the RJ's voice completely clear and audible to the listener whereas the caller voice is not clear their voice signal to the receiver. But the response of caller voice from the RJ is synchronized but it is not clear to the listener. This was the main problem we observed when we are moving towards the west direction apart from FM station due to synchronized gains of the caller and anchor.

As from analog electronics circuits, the devices which are designed for the communication purpose has to meet some characters like low cost, impedance matching, gain, no load effect. As a part of that gain is the main parameter which was affecting. Figure 3 shows the measuring of filed strength using power meter and comparing with the FM radio audio quality.



Figure 3.Observation of field strength

V. FIELD STRENGTH MEASUREMENT IN EAST DIRECTION TO RADIO VISHNU 90.4 CR

We travelled along east direction towards Palakollu via Srungavruksham, Veeravasaram, Palakollu..etc. We were moving with a Speed of 30 kmph. The thing which we noticed that the speed of the vehicle also determined the quality of the signal. One more major thing which we noticed at Palakollu Bypass Bridge is as the altitude of the receiver is increasing the quality of reception also increased. Environmental conditions also determined the signal quality. At one place in Palakollu where the density of trees is more, the signal reception is poor. Fading is the fluctuation in signal strength at a receiver. At one place in Srungavruksham (near temple) we observed rapid fading.

Observations

Table 2: Field strength measurements along west direction

S.no	Location	Distance	Power in dB	Field Strength in v/m	Quality of the signal in %
1	Bhimavaram	1.2Km	-50	560u	100
2.	Vendra	4.8Km	-50	830u	100
3	Gundlavariveedhi	15Km	-45.5	730u	50
4.	Digamaru	31km	-46	750	25
5.	Kallgamudi Bypass	36km	-51.5	550u	75
6	Chenchinadu	37km	-42.2	1.75m	FULL NOISE

We travelled towards the east direction from FM station as compared with previous analysis of west and north direction it was different as we move so long distance of FM signal was absolutely fine up to 15km and around.Though the FM signal was absolutely fine to listeners we found some minute delegations they are some noise effects at the outskirts of the village the noise effect is about 20% only .It is what we observed in case of forest areas the signal strength of mobile phone is can be reduced this is what happened here similar to the forest areas therefore in outskirts of the

villages the signal strength is poor.

VI. FIELD STRENGTH MEASUREMENT IN SOUH EAST DIRECTION TO RADIO VISHNU 90.4 CR

We travelled along towards Yanamaduru over Sriramapuram, SriSatyaIndustries, Garespudi, Addaparra. etc. We were moving with a Speed of 30km/hr. The thing which we noticed that the speed of the vehicle also determined the quality of the signal.

One more major thing which we noticed at Lakshmipuram, as the altitude of the receiver is increasing the quality of reception also increased. Environmental conditions and road also determined the signal quality. At some place in Ontillu where the

density of trees is more, the signal reception is poor. Fading is the fluctuation in signal strength at a receiver. At one place in Tokatitippa, We observed rapid fading.

Observations

Table 3: Field strength measurements along south east direction

S.no	Location	Distance(km)	Power in dBm	Field Strength In (v/m)	Quality of the Signal
1.	Sriramapuram	8	-36.8	1.09m	100
2.	Dongapindi	10	-34.2	680u	100
3.	Yanamaduru	11	-39.5	740u	100
4.	Gollavani Tippa	15	-45.6	880u	50
5.	Thokatippa	18	-49.3	740u	80
6.	Pallepallem	24	-41.5	1.1m	100
7.	Garisepudi	30	-56.4	450u	50
8.	Setanapalli	35	-76.2	750u	80
9.	Sanagamudi	38	-67.5	540u	60
10.	Addaparra	40	-86.2	370u	Null point

From the above result, we analyzed that field strength decreases, as field strength decreases power decreases, as power decreases SNR decreases noise increases but here we observed another spectacular thing as we compared with before that is the RJ voice completely clear and audible to the listener whereas the caller voice is not clear their voice signal to the receiver. But the response of caller voice from the anchor is synchronized but it is not clear to the listener. This was the main problem we observed when we are moving towards the west direction apart from FM station due to synchronized gains of the caller and anchor. As from analog electronics circuits, the devices which are designed for the communication purpose has to meet some characters like low cost, impedance matching, gain, no load effect. As a part of that gain is the main parameter which was effecting. To compensate this problem the gain of the caller and anchor are adjusted at same level. However, their bandwidths are also in the same frequency range.

VI. FIELD STRENGTH MEASUREMENT IN

Observations

Table 5: Field strength measurements along south direction

S.No	Location	Distance in km	Power in dBm	Field Strength(v/m)	Quality of the signal
1	Jakkaram	6.2	-50.3	1.28m	100
2	Seesali	11	-45.6	640u	80
3	Kalla	15	-50.1	750u	30

SOUTH DIRECTION TO RADIO VISHNU 90.4 CR
We travelled towards south direction that is towards Vijayawada via Jakkaram, Guravapalem, kalidindi. etc. We exclusively followed the car radio along with the mini radio receiver which we got from the radio Vishnu. But even though we can receive the signal from the car radio, the mini radio receiver stopped responding. So, we followed the car radio along with the Mobile radio. Compared to the other directions, in this direction the signal fluctuations are very high and very irregular. At same time and same location, the signal strength varied very much. It became difficult for us to draw a perfect conclusion about the values which we obtained. Up until we crossed the Bhimavaram the signal strength is good. But after that the signal strength got fluctuated drastically. To be more clear its value changed from 80% to 30% and then to 50% again. To our surprise, this is the direction in which the signal is more unclear. At kalidindi we observed the null point which is 30 km from Radio Vishnu 90.4. Observations in south direction is shown in Table 5.

4	Kallakuru	19	-47.8	620u	50
5	Elurupadu	22	-41.6	1.26m	60
6	Guravaipalem	27	-40.6	850u	45
7	Kalidindi	30	-38.4	950u	Null

VI. CONCLUSION

In this paper, We have presented details of the signal strength of radio Vishnu 90.4 CR at different routes with geographical locations. We covered around 40 km in all the 7 directions from the FM station and observed signal quality, fluctuations in the signal, several environmental factors and altitude factors affecting the FM signal. Perfect Null points in all the 7 seven directions has been observed. Towards Akividu which is in west side of radio station, we observed the null point at Akividu centre which is 19 km from the Radio station. The coverage area towards west direction is less compared to all other directions because te direction of the dipole antenna is opposite. We noticed that the coverage area in East direction is more because of the orientation of the Dipole antenna and we got the null point at Chinchinada , which is 36 km from the radio station.

REFERENCE

[1].FORDE, D. S., FOXWELL, M. K. & MEADOWS, M. 2001. Commitment To Community: Results from A National Survey of the Community Radio Sector. Australian Broadcasting Authority Conference Radio, Television and the New Media' Canberra.

[2.]. NAZARI, M. R. & HASBULLAH, A. H. 2010. Radio as an Educational Media: Impact on Agricultural Development. The Journal of the South East Asia Research centre for Communication and Humanities., 2, 13-20.

[3]. Silicon Laboratories (2018). SI4703 Broadcast FM Radio Tuner for Portable Applications, www.sparkfun.com

[4] Federal university of technology, Development of Field Strength Meter for FM signals with Atmospheric Parameters. T.O Familusi, Theophilus Ewetumo, Kayode Adedayo, Joseph Sunday Ojo, Journal of Engineering and Technology Management

[5]. Bolli, S. Mohammed, Z., and Ali, K.. (2014). "RMSE comparison of path loss models for UHF/VHF bands in India", IEEE REGION 10 SYMPOSIUM,

330 – 335

[6]. ROWE, H.E., and PRABHU, V.K.: 'Power spectrum of a digital, frequency-modulation signal'; Bell Syst. Tech. J., 1975, 54, pp. 1095-112

[7] GREENSTEIN, L.J.: 'Spectra of PSK signals with overlapping base-band pulses'; ibid., 1977, COM-25, pp. 523-5308

[8]. W. J. Feng, W. Q. Che, Y. M. Chang, S. Y. Shi, and Q.Xue, "High selectivity fifth-order wideband Band-pass filters with multiple transmission zeros based on transversal signal-interaction concepts," IEEE Trans. Microw Theory Techn., vol. 61, no. 1, pp. 89–97, Jan. 2013.

[9]. M. Yu, W. C. Tang, A. Malarky, V. Dokas, R. J. Cameron and Y. Wang, "Predistortion technique for cross-coupled filters and its application to satellite communication systems & quot;, IEEE Trans. Microw. Theory Tech., vol. 51, no. 12, pp. 2505-2515, Dec. 2003.