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14 May 70 (85)

Reg # 1222141

SOME ANOMALIES IN SOVIET FREQUENCY USAGE

by

[redacted]

The United States spends a fair amount of money collecting ELINT data. We also spend a fair amount of time in individual signals' analyses, with highly skilled but too scarce technical talent. However, we spend little time in looking at the big picture of Soviet electronics development because of our essential concentration on detailed problems.

One of the key clues to Soviet electronic progress and future trends is their use and occupancy of the frequency spectrum. This paper considers a most important aspect of this frequency usage, namely the occupancy of the spectrum for high power pulse radar. To chose a given portion of the radar spectrum represents a very considerable investment in development of components which are normally very frequency-sensitive or narrow-band, components such as magnetrons, T-R and anti T-R devices, and many others. The choice of a given radar band is not one casually taken because of this investment. Furthermore, once having made a choice, you will probably use given bands for multiple applications as appropriate. Such decisions made are not easy to change. And they have permanent implications as to your ECM vulnerability.

For a nation that was originally behind us (in 1945-1950) by a substantial margin in microwave technology, it would have been far easier for the Soviets to have rapidly caught up by using the same radar bands with their associated narrow-band components as the U.S. However, as I will indicate they did not take this course, and they are increasingly taking a contrary course.

For the purposes of this paper I am considering only high-power radars, those with peak powers of tens of kilowatts. I am not considering fuzes, altimeters, missile homers and command systems -- for they can generally be diversified in r-f much more easily than the higher power radars. Furthermore I will only provide detailed statistics on radars where the data base was reasonably conclusive to permit good statistics, usually about 30 good intercepts at a minimum. (The radar band designations on the chart are old designations.)

Let us start with J-band (new designation). There are many Soviet radars in this band now, many of them potentially of great Army and national interest. We still need more collection attention to this region, and it certainly remains an unsatisfied challenge to EW planners and developers. I have chosen two radar groups which are characteristic of all Soviet signals in this band thus far intercepted. Slide 1 -- plots U.S. radar usage of this frequency region as compared with the USSR. Note the complete lack of overlap. Slide 2 represents the more recent update of this data, with a comparison of the [redacted] along with the [redacted]. The former radar is strongly suspected to come from the [redacted] on its tracked vehicle. All the data examined in this frequency region demonstrates beyond any doubt that Soviet activity peaks with components in the 14.6-14.85 region. The lastest data examined (Slide 2) shows absolutely no activity above 15,200 Mhz; this includes other signal types as well. The lowest frequency US radar in this region is 15,350 Mhz.

Slide 3 plots the newest radar band developed by the USSR, the 13 Ghz radar nicknamed [redacted] (for the MIG-21 with ELINT notation [redacted]). The peaks in both our and U.K. data are comparable and suggest a single fixed frequency magnetron as the prime source. We intend to re-examine this point however, due to the statistical spread being partly a function of site r-f calibration.

More conventional X-band (new I) data is shown in Slide 4, with stress on signals out of band. The latest statistics (1970) are shown in red with 1300, 300, and 220 intercept cases respectively used as a base. As before, there seems no significant difference as a function of year, and it is suggested that the [redacted] uses similar frequency sources to the [redacted] The [redacted] is obviously different. Within X-band center we note a very definite 60 Mhz separation between signal magnetron peaks (fo = 9430, 9370, 9310 et. seq.) which corresponds with:

1. Soviet tube samples obtained.
2. French CSF tubes and other components.
3. U.S. Raytheon-Litton-Bomac tubes as well.

It is the out-of band emphasis we wish to stress. Two years ago we would have intuitively guessed that, following their prior pattern the Soviets would begin to use radars beyond Western frequency usage on the high frequency side. Surely enough they did. Slide 5 summarizes the very good data on [redacted] which strongly suggests two fixed frequency magnetrons, whose center frequencies are separated by about 190 Mhz (which is three times the indicated standard X-band separation). We would expect to see more activity in this band in the future. Obviously the Soviets are not unduly concerned about absorption problems in the 8-15 Ghz region.

Slide 6 is the data (old C-band, new H-band) that really clinches the Soviet pattern of putting their radars just beyond the frequency reaches of our own. The [redacted] (their best) does over-lap our high-band; but is still on the edge. The [redacted] operates outside the band. The data on [redacted] and other signals is yet inconclusive as to center and exact frequency distribution. The [redacted] and other signals on the low side have for years stopped at about 5100 Mhz. Western usage in this band stops at 5250 Mhz at the low frequency extreme. If this pattern occured once it would have been an accident; occuring so constantly it is hardly a designer's mistake. I expect we will see many more radars in these Soviet bands. Although search yet shows nothing in the 5825-6275 Mhz gap, this region would be an interesting possibility.

Slide 7 shows the new E and F band (formerly S-band) data. It is interesting to note that the nodding height-finders (as in C-band) are outside (or on the edge). The latest [redacted] data is shown in the chart; in contrast to earlier data this radar definitely appears to utilize a single fixed frequency magnetron with very good statistical distribution with 400 1968-69 cases used as base.

Slide 8 summarizes the [redacted] data which shows four reasonably similar r-f distribution peaks. These radars are also outside the Western band. And like so many of these radars, they tend to be of high significance in their defense plans. The [redacted] is presumed to be the large [redacted] and, interestingly enough, uses a unique component to generate r-f from the above early warning radars.

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SECRET [redacted] The data on the [redacted] is shown for two reasons. Native [redacted] radars tend to follow Western usage in frequency distribution (or perhaps we should say [redacted] as well). This particular L-band set obviously uses a fixed frequency L-band magnetron whose frequency and manufacturing tolerances are carefully controlled. We are not discussing the other odd 1.2 Ghz radars such as the [redacted] [redacted] sets.

Slide 9 is a simplified L-band chart to show basic differences in allocation. Below 800 Mhz differences are not quite as significant, because of the greater ease in obtaining wide-band operation. The pattern remains however. Listed separately is the meterological radar, [redacted] which is of particular Army concern due to its [redacted] association. It is also quite narrow in frequency with a center frequency of 1785 Mhz. About 1000 intercepts in 1968-1969 were used for this data.

Slide 10 is a summary on where we stand with the Soviets on this "electronic right of way" scoreboard. Two years ago the U.S. led by about 800-1000 Mhz. They have now just passed us in total breadth of spectrum utilized. This EW technological gap will probably continue to spread to our disadvantage. Whether or nor the "electronic right of way" is as important to the winning of a war as fire power, this is a serious trend. The reader will note the large percentage of the Soviet usage -- almost two-thirds -- which is "out of band" or non-coincident with U.S. usage.

We conclude that:

The Soviets are placing significant radar usage at frequencies differing from those of the U.S. -- often just outside our allocation. This is intentional, not accidental. Furthermore [redacted] they have paid a technological price for such an achievement.

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The purpose of such a move is not entirely clear yet. The most obvious purpose evident would be for counter-countermeasures. To avoid self and Western inadvertent interference is another reason. It certainly does provide diversity to them and some freedom to jam without as much concern with the results on their own radars as is often the case in electronic warfare operations planning. It is tentatively concluded that the purpose is for electronic warfare purposes primarily.

It is interesting to note that these "out of band" equipments are thus far largely, if not entirely, limited to Soviet control only. (Data on [redacted] is uncertain.) Although the "out of band" radars tend to be more important equipments, it is difficult to be conclusive. [redacted] for example does not appear to be a particularly critical equipment. Perhaps we look too hard for completely ordered planning in Soviet allocation of such resources. They make [redacted] bureaucratic errors also.

We must always look for vulnerabilities of such Soviet usage. It would appear that such uniqueness of frequency usage would be a dual-edged sword, from an electronic warfare viewpoint. Certainly from the intercept viewpoint it is most attractive to build a simple receiver covering a discreet band and know that any pulsed signal we receive would be Soviet in origin -- or even possibly a discreet target such as [redacted] or our Army [redacted] With the development of solid state and parametric amplifiers and small filters, together with the current reduced fiscal resources such approaches might be very attractive. Certainly we should use our expensive intelligence to its greatest possible utility against the enemy.

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One final point should be emphasized. The high frequency limit of this study has been set at 17500 Mhz. This was done because our intercept intelligence virtually ceases here. I have already alluded to our all too modest intercept/EW capability between 11 and 18 Ghz. In the days when we are considering optical/EW intercept programs we should at least consider improved capability beyond our present limits in the radar spectrum. For more than two decades the West has had 8 mm radars; since 1952 the Soviets have been producing suitable components, and suitable components are also available in France and elsewhere. Furthermore at least one Soviet radar is known to exist -- met equipment -- at 34 Ghz. Although these systems are undoubtedly more modest power sets than the ABM or SAM systems at lower radar frequencies, they certainly are equal in concern to the optical devices and more all-weather.

To use Army vernacular, we must avoid being outflanked in the radar spectrum. Our high frequency flank has no scouts out.

Acknowledgement: For the basic data and useful format on which the latest statistics are based, the author wishes to thank the National Security Agency.

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K-BAND

USSR | US

14.0 Ghz 14.5 15.0 15.5 16.0 16.5 17.0

SOVIET USAGE

FTD 1965 - 14,425-15,250 95% Conf Limits
Mean 14,830
500 Cases

ACSI 1966 - 14,400-15,100 95% Conf Limits
Mean 14,600
1382 Cases

US USAGE

15,350-17,250 or 17,500

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K BAND SUPPLEMENT
SOVIET USAGE 1968-9

MHZ	[redacted]	A3242
14,320-15,100	438 CASES	AVG 14,750
14,450-15,200	LATEST EPL	
	[redacted]	
14,590-14,980	23 CASES	MEAN 14,830

NO DATA SHOWS OVER 15,200

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13 Ghz DATA

49 CASES 1968-1969	12,880-13,200	(70% OF CASES)	to 13,020
EPL	12,730-13,420		
UK REPORT	12,645-13,171	[redacted]	12,960

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~~Top Secret~~ [redacted]

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X-BAND

8.0 Ghz　　8.5　　9.0　　9.5

WESTERN USAGE

8400-9600 Mhz

SOVIET DIFFERENCES

[redacted] 8090-8160 Navy Study; 8020-8210

[redacted] NSA E.P.L. 8075-8175
fo=8120

[redacted] 8050-8150
fo=8100

[redacted] 8240-8320 fo=8280
7830-7920 fo=7880

[redacted]

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HIGH X BAND DATA

[redacted]

AF = 9,850 - 9,940 PEAK 9,890

10,000-10,100 PEAK 10,080

110 CASE [redacted] BASE

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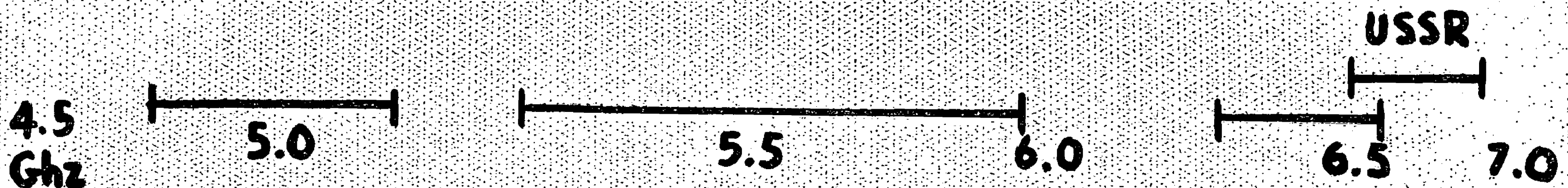
C-BAND



SOVIET USAGE

NSA 1968: 4855-5120 Mhz (100% of Cases)

(All SCA Sites 1 Jan 1966 - Mar 1967)

High Side: 6540-6730 (C3162 [redacted] 1964 95%)

EPL: 6530-6700 6610-6720

fo=6660

6460-6600 [redacted]

6480-6560

fo=6510

US USAGE

[redacted]

5250-5825 Mhz

6275-6575 Mhz

[redacted]

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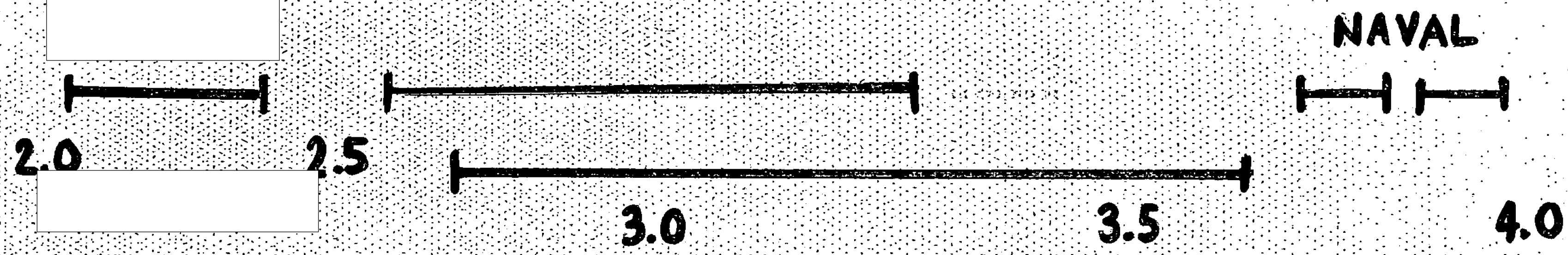
S-BAND

[redacted]



[redacted]

WESTERN USAGE

2700-3750 Mhz
(Except for a few Classified Sets)

SOVIET DIFFERENCES

2600-2700 Mhz Nodders Generally
3250 Limit Generally; Except [redacted]
3920-3975 fo=3950 [redacted]
2060-2470 [redacted]

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L BAND AND LOW S BAND SUPPLEMENT

[redacted] 1240-1260 Mhz fo=1250 (3025 CASES)

[redacted]	[redacted]
2075-2110 (2090 fo)	2060-2130 (2090 fo)
2200-2235 (2215 fo)	2200-2220 (2205 fo)
2320-2355 (2335 fo)	2320-2345 (2335 fo)
2430-2470 (2445 fo)	2410-2460 (2430 fo)

[redacted] 2138,2158

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L-BAND SIMPLIFIED

SOV IFF	SOV PRIME RADAR	WESTERN IFF	WESTERN PRIME RADAR

[redacted]

0.5 Ghz 1.0 1.5

SOVIET USAGE

565-610 [redacted]/NYSA types
660-680 IFF Peak; Region of secondary radars
820-920 L-Band prime radar
1770-1800 [redacted] fo=1785)

WESTERN USAGE

570-630 Current prime radars
950-1150 IFF and secondary radars; IFF peak 990-1040
1200-1535 L-Band prime radar; peak 1250-1350

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APPROX SPECTRUM 550-17,500 Mhz USED FOR HIGH POWER RADAR

MHZ

	WEST	SOVIETS	SOV OUT OF BAND
L-BAND	400	200	150
S-BAND	1000	1400	700
C-BAND	900	600	500
X-BAND	1200	2000	800
K-BAND	1900	1600	1600
TOTAL	5400	5800	3750

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Slide 10

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Page 1
Total Pages: 10

To:

Date: 25 May 1970

Subject: (Preliminary) Soviet Emitter Threat Models

From:

This memo describes the postulated, exotic emitter threat models for the 1972-80 era, to be used in the exotic signal intercept study being conducted by Project Headquarters (PH).

This memo is prepared for review and discussion. It will be revised following discussions with Contractors 2, and 3, AFAL, NRL and NSA.

1.0 SUMMARY OF ASSUMPTIONS AND GROUND RULES

1.1 Priorities

(Priorities for intercept are classified TS/E. Accordingly priorities are deleted from the memo and will be sent via TWX to the memo recipients in order that this memo can be classified SECRET/E.

This memo should be reviewed in context with the priorities.)

1.2 General Soviet Trends

1. The Soviets are extremely competent and conservative in development-deployment of new radar types.[1,2]

2. Totally new Soviet ABM radars are not likely to appear as replacements for ABM radars known today. However, we can expect to observe modifications and new operating modes of existing ABM radars.

3. The Soviets lag the U.S. in phased array steering technology (as opposed to frequency steering) but they may deploy phased array steering to replace frequency steering in some of their ABM radars.

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1.3 Soviet ABM Radars

1. Deployment of phased arrays in some ABM type radars will be assumed. One result of phased array steering, e.g., in azimuth, would be that a given frequency, known to us a priori, no longer need represent a given azimuth beam position.

2. Pulse compression on the second [redacted] pulse is likely.[2] Both FMOP and phase reversal keying should be considered to be possible.

For PRK a 13-bit, Barker code (0.46 microsecond compressed pulse width) or a 31-bit "maximal length sequence" (0.24 microsecond compressed pulse width) are candidates. However, it seems unlikely that the Soviets would employ a code length (e.g. the 13-bit code) which has no possible code variations because knowledge that a 13-bit code exists constitutes a priori knowledge of the code sequence and we would have a distinct advantage in attempting to jam the radar.

3. Spread spectrum emissions coupled with phased array steering is possible.[2]

4. Frequency jump for ECCM is not thought to be too likely because:

a. Other methods involving only radar control software appear to be easier to implement and are effective as AJ features. For example, it is believed that changing the code for a signal using phase reversal keying is readily accomplished.

b. Operational USAF re-entry vehicles (RV) are not known to use jammers. (The U.S. has experimented with active jammers for RV's, but there appears to be technical reasons why active jammers are less desirable than other ECM devices.)

However, an apparent FJ caused by irregular dwells (for tracking) by frequency steered arrays is thought likely.

5. New simultaneous combinations of fast scan/slow scan/irregular dwells for track is likely.

6. Deployment of a new ABM radar having some characteristics of [redacted] (875 MHz band) is thought possible. This radar might function together with [redacted] in an ABM defense complex which utilizes the shipborne [redacted] for mobility.

1.4 <u>Soviet SAM Radars</u>

1. Anti-jam features such as jittered PRF and FJ are likely, subject to some limitations described in (2) and (3).

2. Low altitude, moving target indicator (MTI) capability is likely. However MTI characteristics tend to be incompatible with (1). The implications of MTI are:

a. Use of coherent, pulse-to-pulse emissions with pulse groups.

b. Use of CW radar.

3. A pulse radar which is coherent, pulse-to-pulse, but appears to be non-coherent is thought to be technically feasible. The "non-coherent" nature of the pulses is accomplished by transmitted random phase pulses and locking an LO to the phase of the last pulse transmitted. Such a concept has been investigated experimentally by the U.S.

4. It is believed likely that newer SAM radars have or will have spectral analysis capability for jamming and the capability to switch to other frequencies using a push button. Examples are thought to be [redacted][3]

The implication is that exotic intercept systems need a capability to detect almost instantaneous frequency shifts within a large bandwidth.

5. The possibility of FJ combined with coherent radar for MTI needs further definition

6. CW radar will not be simulated initially because:
   a. More effort is needed to develop a model
   b. The baseline receiver sensitivity may be marginal for expected CW transmitter power levels.

1.5 Soviet AI Radar

1. In the late 1960's, the Soviets have emphasized updating their interceptor force in the direction of:
   a. High performance interceptors for long range (100 NM) intercepts using air-to-air missiles (AAM).
   b. Low altitude AMTI capability.

2. The initial phases of (1a) included deployment of the YAK-28P, TU-28 and Flagon A interceptors using SPIN SCAN B radars.[4]

3. The long range interceptor with reasonable AMTI capability implies a high PRF, pulse doppler radar such as the F-111 radar or the former F-108 concept. Initially, no attempt will be made to simulate this type of radar because:
   a. Additional effort is needed to develop a model.
   b. The AI radars of the recently deployed interceptors, "modified" to include certain exotic characteristics should be "tested" initially.

4. Soviet missile firing AI radars of major interest are reported to have many characteristics similar to those of USAF AI radars. These include jittered PRF and sliding RF (pilot pushes a magnetron tune switch when he observes jamming).

5. FJ is postulated for:

a. Search mode only of AI radars firing radar seeking missiles. Radar seekers in general require constant frequency, constant PRI for maintaining missile range gate lockon. Range gate lockon is a pre-condition for AAM firing.

b. Search-track modes for AI radars firing IR seekers.

6. All AAM's are either IR or radar seekers, i.e., beam rider guidance is not used.

1.6 Postulated FMOP Assumptions and Ground Rules

1. Soviets have demonstrated interest in FMOP and are likely to use FMOP for some ground radars.

2. Initial $\beta\tau$ values are likely to range from 10 to 100. Maximum values of 300 to 500 are most probable.

3. Low deviation FMOP for reasons other than pulse compression, e.g., lobe switching is reasonably likely.

1.7 Postulated Trends and Ground Rules for PRK

1. Phase reversal keying (PRK) has advantages and its use is likely to continue. Codes which obey $L = 2^n - 1$ bits (n= an integer) are likely. Use of the Barker codes is less likely because of resolution limitations.[2]

2. Minimum baud length is thought to be $\gtrsim$ 0.1 microsecond.

3. Where the propagation time <u>difference</u> from elements of the antenna array is significant compared to the baud interval, PRK sidelobe intercepts may not be sufficiently phase coherent to detect the PRK code. (An example might be [redacted]) For such emitters, main beam intercepts will be necessary to detect the PRK code structure.

1.8 Miscellaneous Ground Rules

1. It is desirable that the mix of exotic signals in one emitter set represent a graduated level of difficulty to intercept and process. For example, AI radars with pulse groups (PG) only; PG and jittered PRF only; and PG, jittered PRF and FJ would be desirable to "test" the receiver-processing concepts.

2. Also desirable is an abrupt operating mode change during the simulated intercept to determine if a change to a more exotic mode can be detected. An example might be an AI radar which suddenly exhibits sliding RF (linear frequency change caused by the pilot pressing his AJ or magnetron retune switch).

2.0 POSTULATED EXOTIC SIGNALS

This section describes postulated signals for the 1970-80 time period. The signals are designed for the five frequency bands listed.

	Center Frequency (MHz)	Bandwidth
1.	169.7	20%
2.	876.4	20%
3.	2146	20%
4.	2863.8	5%
5.	9451.6	5%

The center frequencies were chosen because they represent a varied cross-section of radar types and ELINT antenna concepts, given that the initial investigation will be confined to a total of five bands.

The bandwidths were selected to limit emitter density (for processing) or limit instantaneous bandwidth (9451.6 MHz).

Where a code designator in ( ) follows the type number, the model is one of Contractor 2's emitter models.

2.1 169.7 MHz Band

1. ABM early warning and acquisition (PHH-3). Phased array steering, random PRI (41,000 to 82,000 μ sec), FJ (154 to 162 MHz), ERP = 132dbm, PW = 1024 μsec, [redacted]

2. Improved EW radar - some characteristics similar to [redacted] (PTK-1) RF = 165 MHz, 10 MHz linear FMOP, ERP = 135dbm, PW = 10 μsec; PRI = double stagger with PRI = 5 msec, PRI_2 = 7 msec, PRI_3 = 11 msec.

2.2 876.4 MHz Band

1. Space track radar (PST-1 model). RF≅860 MHz, narrow band FJ over 200 KHz, 40 pulse groups of 5 μ sec pulses, PG PRI = 41, msec, PG duration = 1200 μsec, ERP = 140dbm.

2. New ABM search-track radar. RF = 810 to 990 MHz, phased array, PRF = 30, PW = 400 μsec, compressed to 0.4 μsec with PRK, Peak power = 10 megawatts, G_t = 34db, ERP= ___dbm, antenna beam = 0.5° az x 25° elev, coverage = 32° az x 30° el. (5° to 30° with 25° beam).

3. ABM search-track radar with phased array.

a. Search Mode
RF = 900 Mhz, PRF = 100 μ sec, ERP = 134 dbm
Coverage and beam shape to be defined

b. Track Mode
RF = 900 MHz, PRF = 52, PW = 50 μsecs with 10 MHz linear FMOP. Has capability to switch to new frequencies within 5% bandwidth to avoid interference.

2.3 2146 MHz Band

1. New terminal tracking, ABM radar. (PABM-1). RF = 2148 MHz, pulse doublet - 0.4 μsec and 6.25 μsec with 2.5 MHz linear FMOP on second pulse (compressed to 0.4 μsec), pulse A ERP = 149 dbm, pulse B ERP - 152dbm, PRI = 10,960 μsec.

2. Modified [redacted] RF = 2150, PRF = 89.6, pulse duration (doublet) = 0.5 and 6.0 with 31 bit PRK on second pulse, ERP = 152dbm, antenna = 60 foot X-Y mount, peak power = 20 Mw, antenna beam = 0.6° x 0.6°, antenna coverage = 360° az x 180° elev.

3. New ABM terminal tracking radar

a. Acquisition Search Mode

RF = 1900-2300 MHz, PRF = 81.3 PPS, PW = 24 μsec, ERP = 146 dbm, peak power = 5 Mw. Antenna coverage = 360° az x 180° elev.

b. Track Mode

RF = 1900 - 2300 MHz, PRF = 162.6 PPS, PW = 12 μsec with 12 MHz linear FMOP. Other parameters same as in (a).

2.4 2863.6 MHz Band

1. AAA fire control radar (PFC-1). Sliding, triangular shaped PRI function (vs. time) from 550 to 700 μsec at intervals of 20 msec, sliding RF from 2810 to 2890 MHz synchronized to sliding PRI, ERP = 125dbm, PW = 0.5 μsec, no MOP.

2. [redacted] with continuous, sliding RF from 2880 to 3080 MHz.

3. [redacted] with random FJ 5% bandwidth, centered at 2863.6 MHz.

4. [redacted] with random FJ over 5% bandwidth, centered at 2850 MHz.

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5. [redacted] with random FJ using 40 discrete frequencies over 10% bandwidth, centered at 2840 MHz.

6. ABM beacon track. RF = 2900 MHz, fixed frequency nominal PRF = 325.2 pulse groups/second, three 2.0 μsec pulses per group, pulse spacing - 2.0 μsec PRF jittered with 60 cps sinusoidal signal providing maximum PRI jitter of $\pm$ 16 μsec ERP = 137 dbm, peak power = 100 KW.

7. ABM command. RF = 2870 MHz, fixed PRF = 325.2, pulse width = 1.0 μsec, random pulse groups 1 to 6 pulses per group. Pulse spacing - 2.0 μsec ERP = 137 dbm, peak power = 100 KW.

2.5 <u>9451 MHz Band</u>

1. Two MIG-21's in tandem formation, 2 mile separation using Spin Scan B (A-311C) search mode.

2. One YAK-28P in track mode, abrupt shift from constant frequency to sliding RF at 50 MHz/second. Interceptor uses [redacted]

3. One MIG-19 using [redacted] in normal mode.

4. Two MIG-21's (same as 1) except that [redacted] has 10% bandwidth FJ. Mission starts in normal [redacted] signal and shifts abruptly to FJ mode.

5. One [redacted] - Badger C, ASM missile guidance.

6. SAM engagement/track radar (PSAM-1). FJ at 15 discrete RF's from 9100 to 9300 MHz, ERP = 132dbm, PW = 0.3 μsec, nominal PRI = 2000 μ secs with $\pm$ 10%, random PRI jitter. Low altitude track mode with FJ in groups of ______ pulses or upon manual command of operator.

~~SECRET/E~~

3.0 REFERENCES

1. Memo N13/106/70, N. Taussig to File, "Exotic Radar Modeling for Data Processing Study", 4/14/70

2. Contractor 2 Report 69-1C-PD1, "Estimates of Technological Characteristics of Advanced Soviet Radars (1970-80)", 4/30/70

3. AFSC FTD Bulletin, 4/17/70

4. CIA Report SR IR 69-3, "New Interceptors Increase Effectiveness of Soviet Air Defense (FTD File "CIA-25)"

DOCUMENT CONTROL LOG

Sealed Package Number ____________ Control Number BIF-107W-44046-70

Name of Courier ____________ Copy Number 5

Source
SP-6

Addressee
NRL

Description, Date, Subject, cy number, number of pages, any other identifying control number.

Rpt, 25 May 70, Pre Soviet Emitter, cy 5, 10 pgs.......

Attachments

Remarks
4200-70

Cy #	Receipt Signature	Date	Inventory Date	Disposition
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DESTRUCTION CERTIFICATION

Cy #	Attachments	Date	Certifying Official