

Figure 1002: Spurious Emissions at Antenna Terminal QPSK 5MHz B.W.; 1932.5MHz, 30kHz

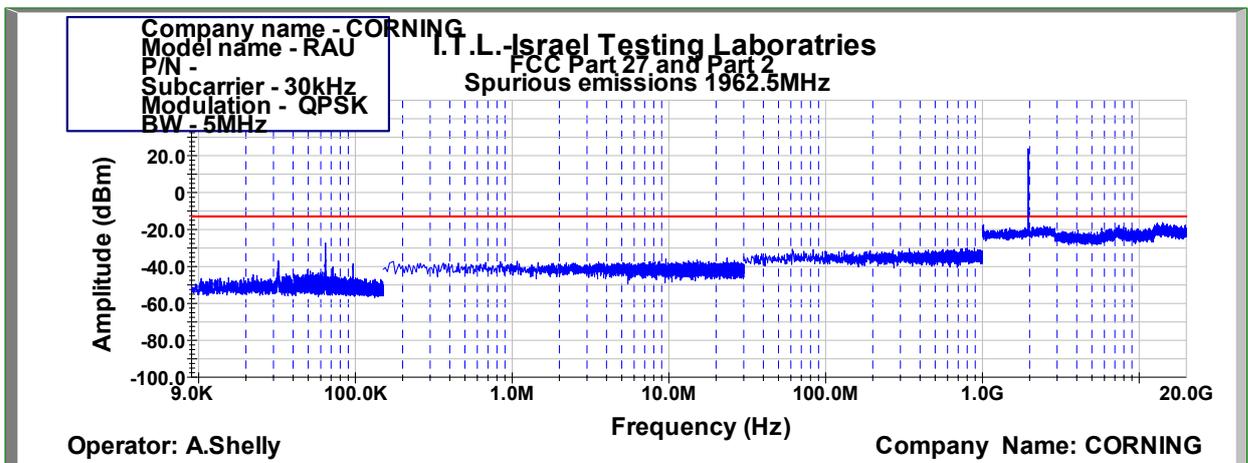


Figure 1003: Spurious Emissions at Antenna Terminal QPSK 5MHz B.W.; 1962.5MHz, 30kHz

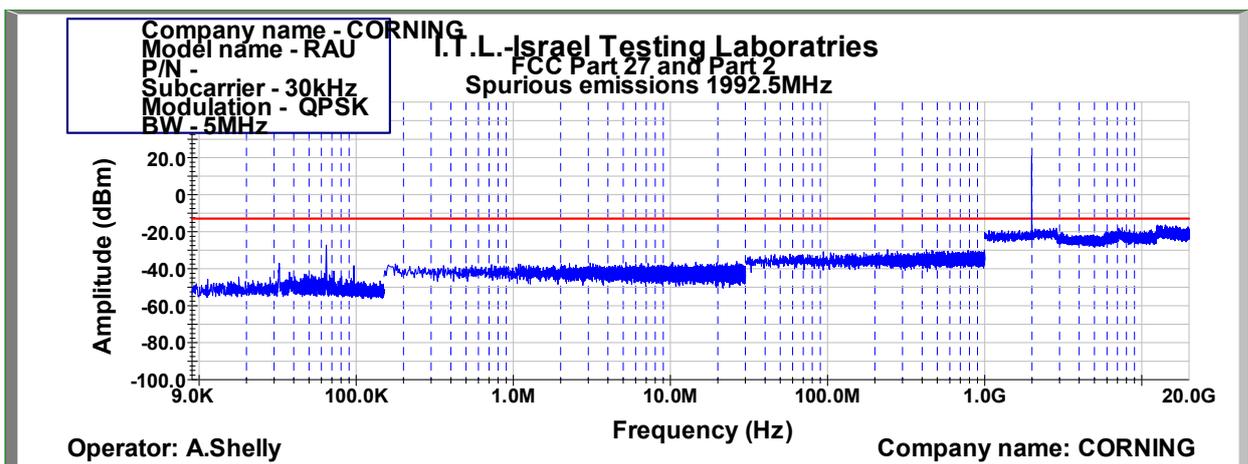


Figure 1004: Spurious Emissions at Antenna Terminal QPSK 5MHz B.W.; 1992.5MHz, 30kHz

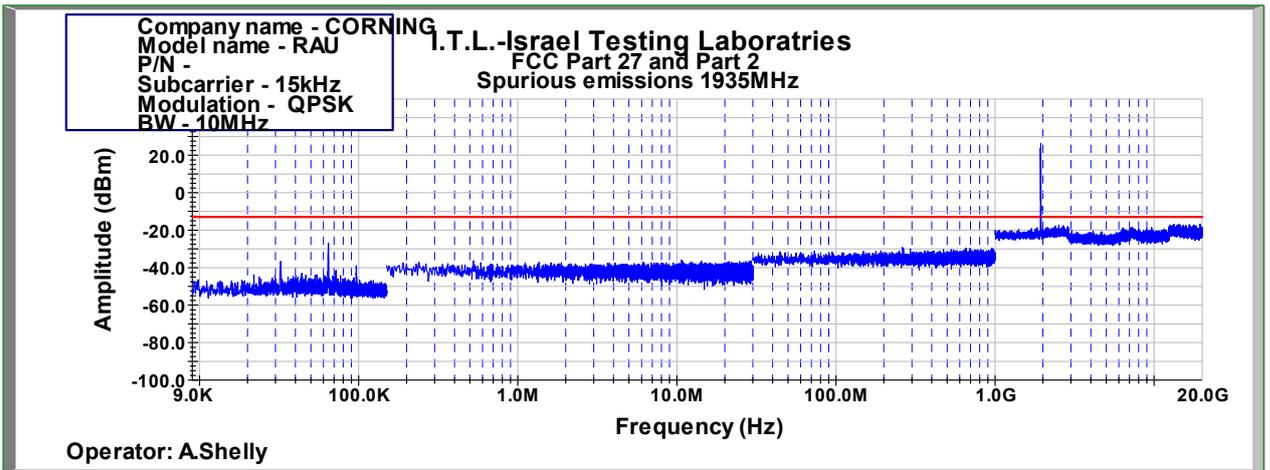


Figure 1005: Spurious Emissions at Antenna Terminal QPSK 10MHz B.W.; 1935.00MHz, 15kHz

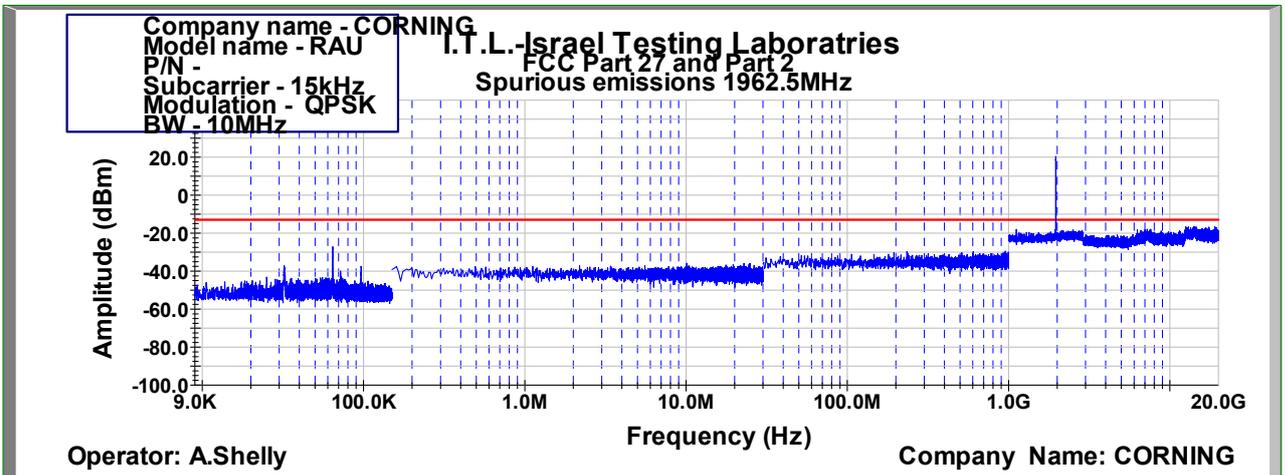


Figure 1006: Spurious Emissions at Antenna Terminal QPSK 10MHz B.W.; 1962.5MHz, 15kHz

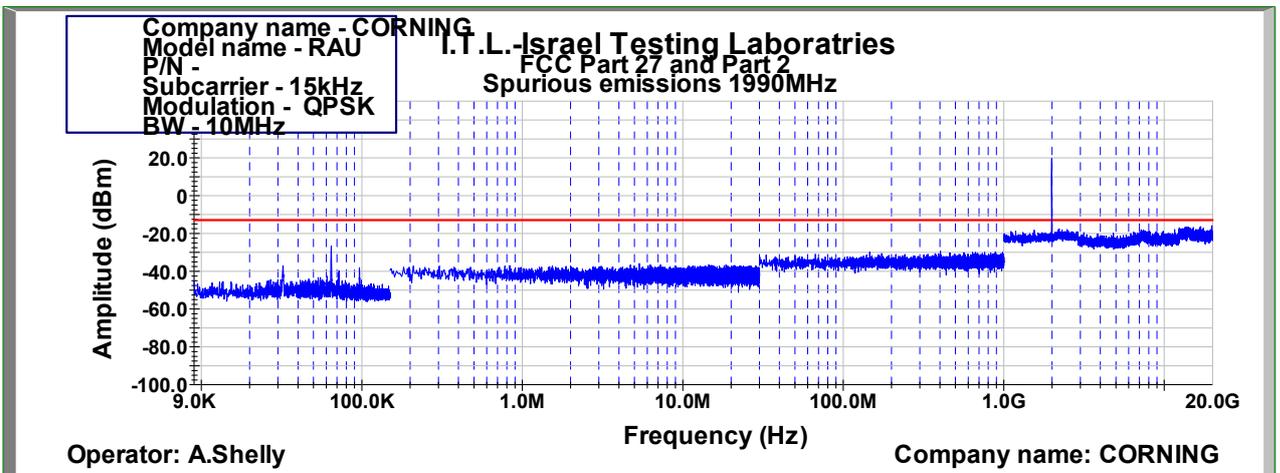


Figure 1007: Spurious Emissions at Antenna Terminal QPSK 10MHz B.W.; 1990.0MHz, 15kHz

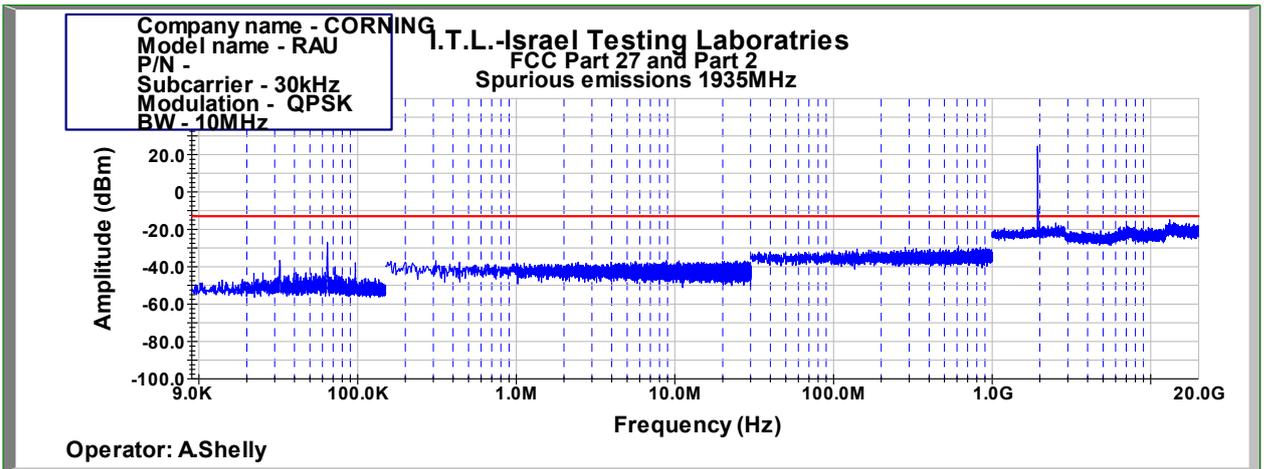


Figure 1008: Spurious Emissions at Antenna Terminal QPSK 10MHz B.W.; 1935.0MHz, 30kHz

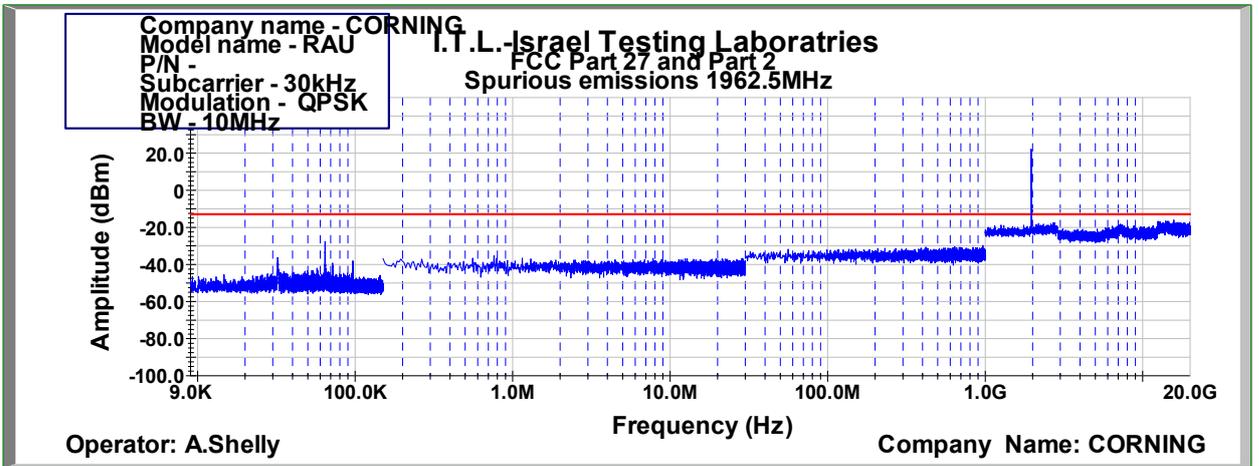


Figure 1009: Spurious Emissions at Antenna Terminal QPSK 10MHz B.W.; 1962.5MHz, 30kHz

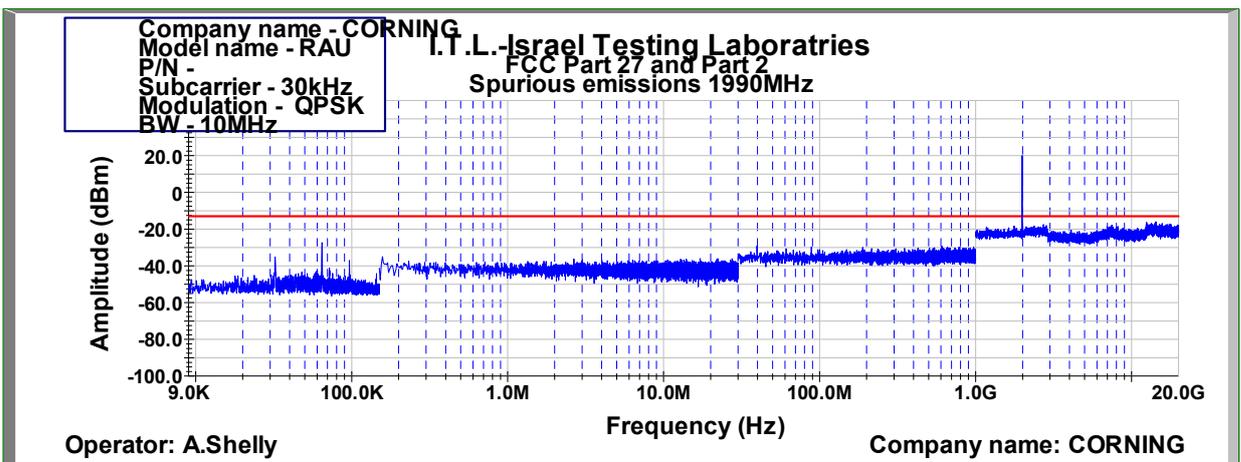


Figure 1010: Spurious Emissions at Antenna Terminal QPSK 10MHz B.W.; 1990.0MHz, 30kHz

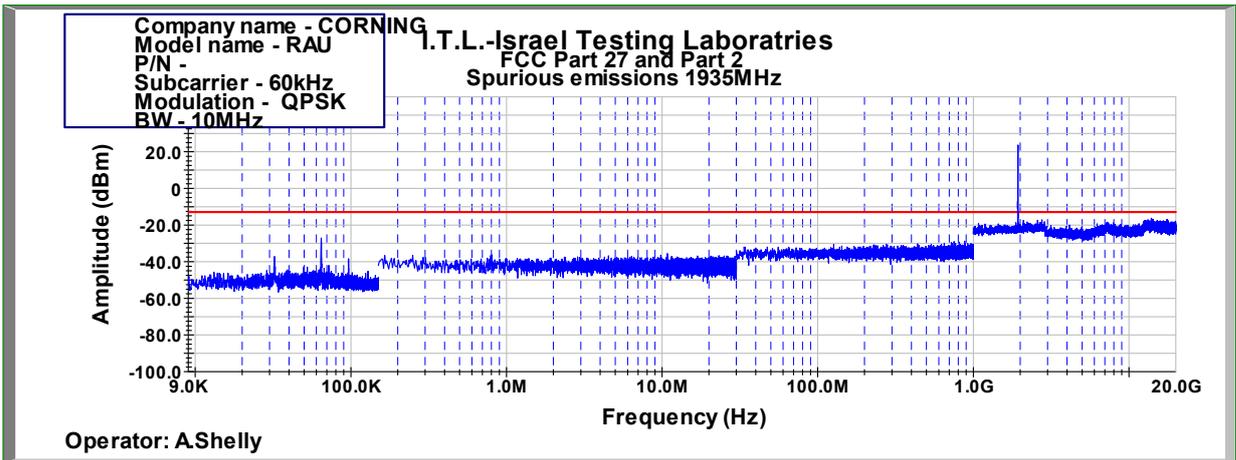


Figure 1011: Spurious Emissions at Antenna Terminal QPSK 10MHz B.W.; 1935.0MHz, 60kHz

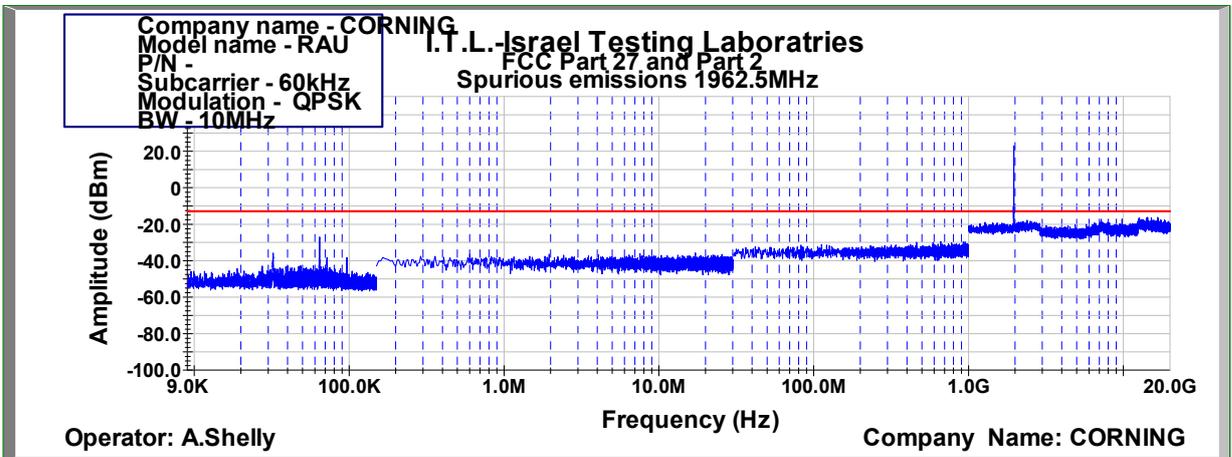


Figure 1012: Spurious Emissions at Antenna Terminal QPSK 10MHz B.W.; 1962.5MHz, 60kHz

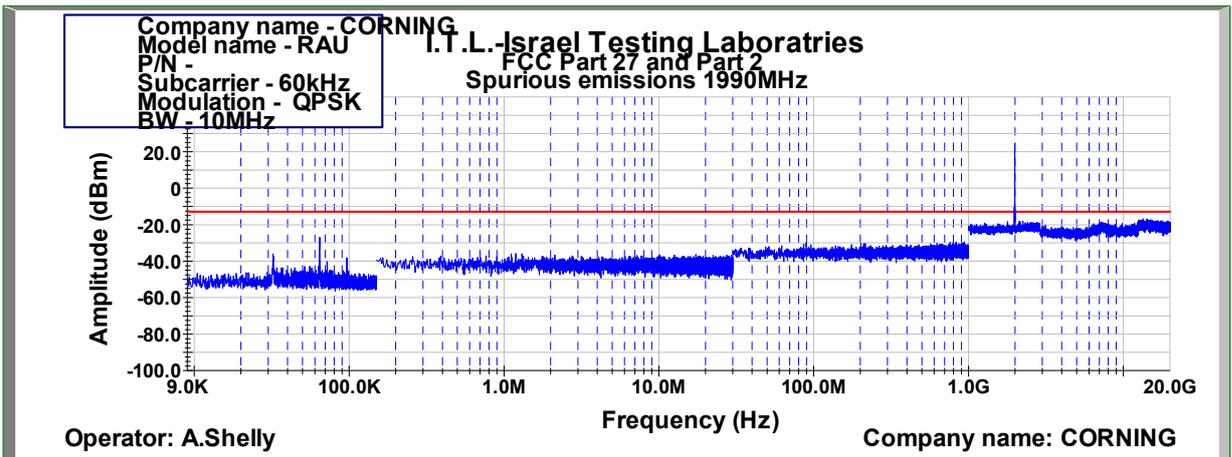


Figure 1013: Spurious Emissions at Antenna Terminal QPSK 10MHz B.W.; 1990.0MHz, 60kHz

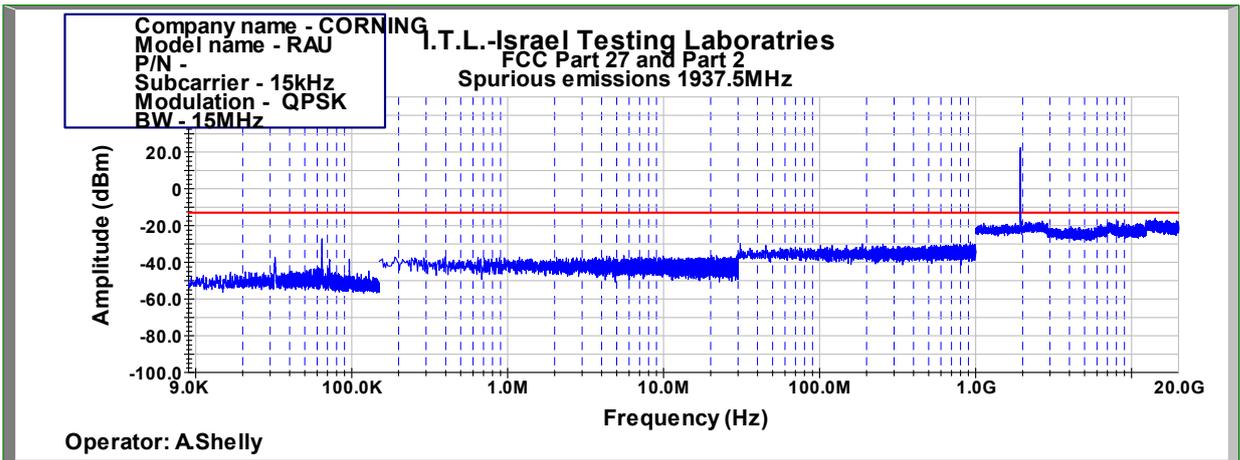


Figure 1014: Spurious Emissions at Antenna Terminal QPSK 15MHz B.W.; 1937.5MHz, 15kHz

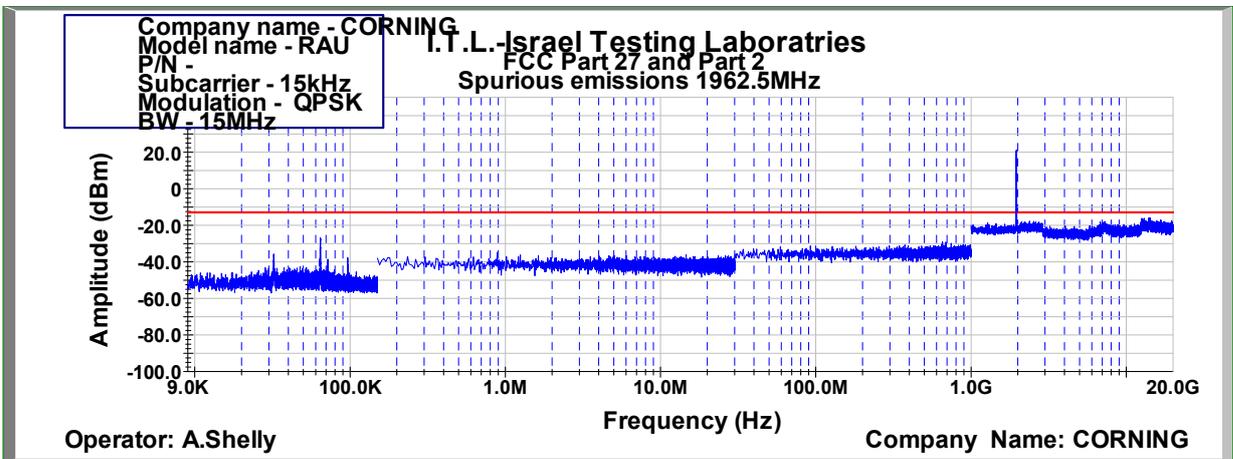


Figure 1015: Spurious Emissions at Antenna Terminal QPSK 15MHz B.W.; 1962.5MHz, 15kHz

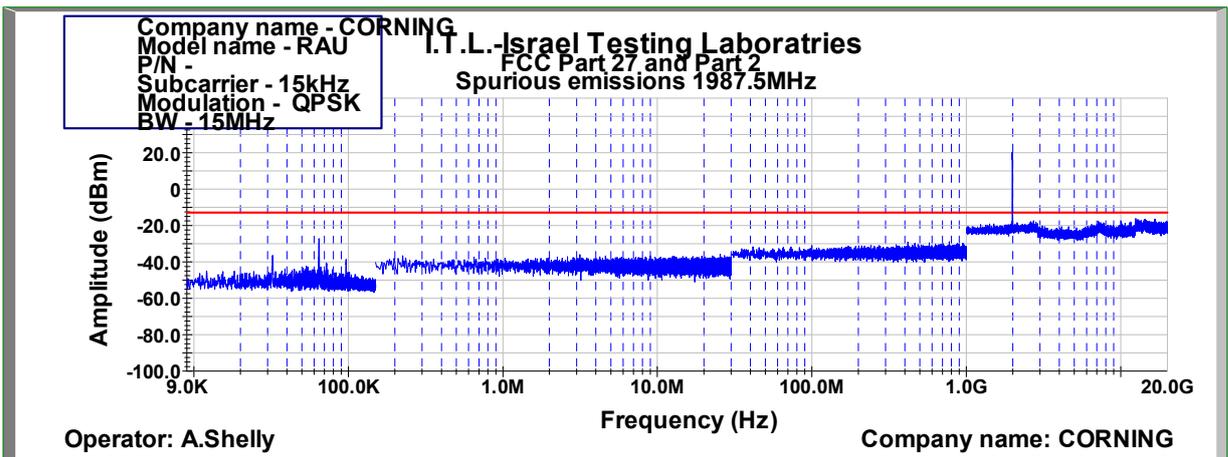


Figure 1016: Spurious Emissions at Antenna Terminal QPSK 15MHz B.W.; 1987.5MHz, 15kHz

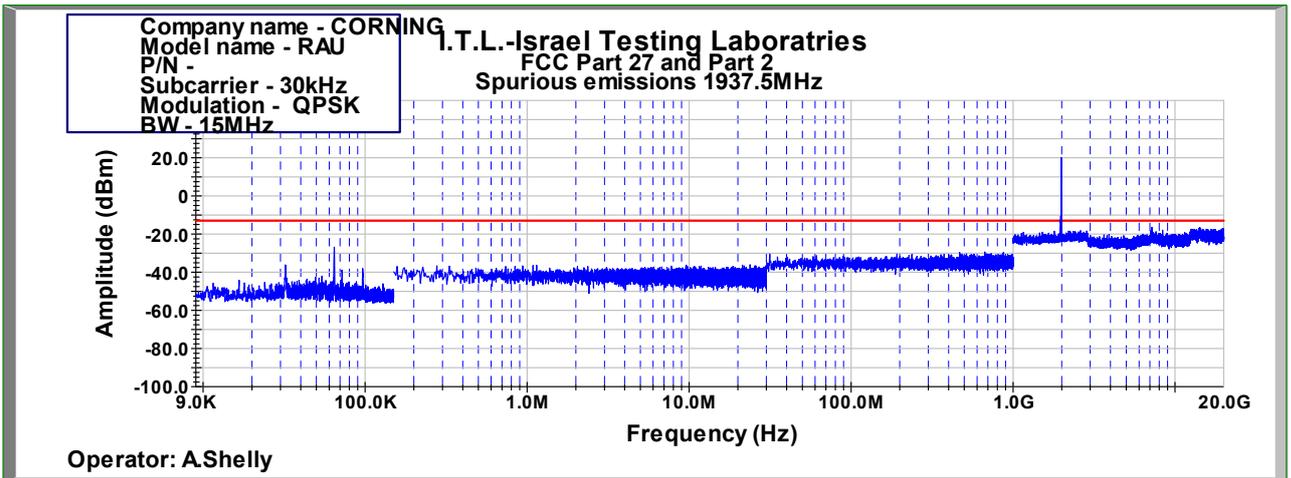


Figure 1017: Spurious Emissions at Antenna Terminal QPSK 15MHz B.W.; 1937.5MHz, 30kHz

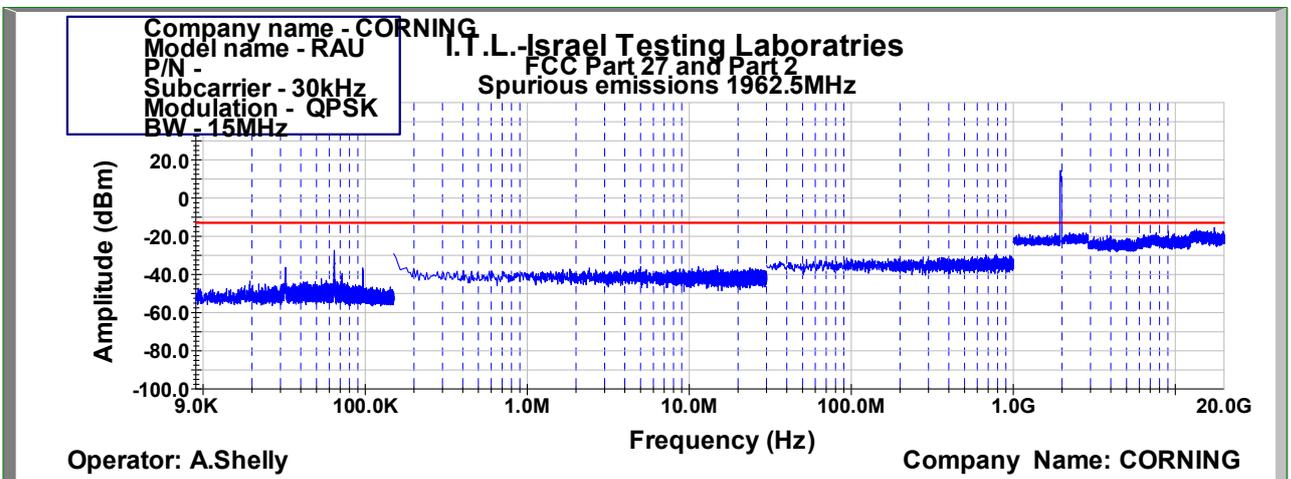


Figure 1018: Spurious Emissions at Antenna Terminal QPSK 15MHz B.W.; 1962.5MHz, 30kHz

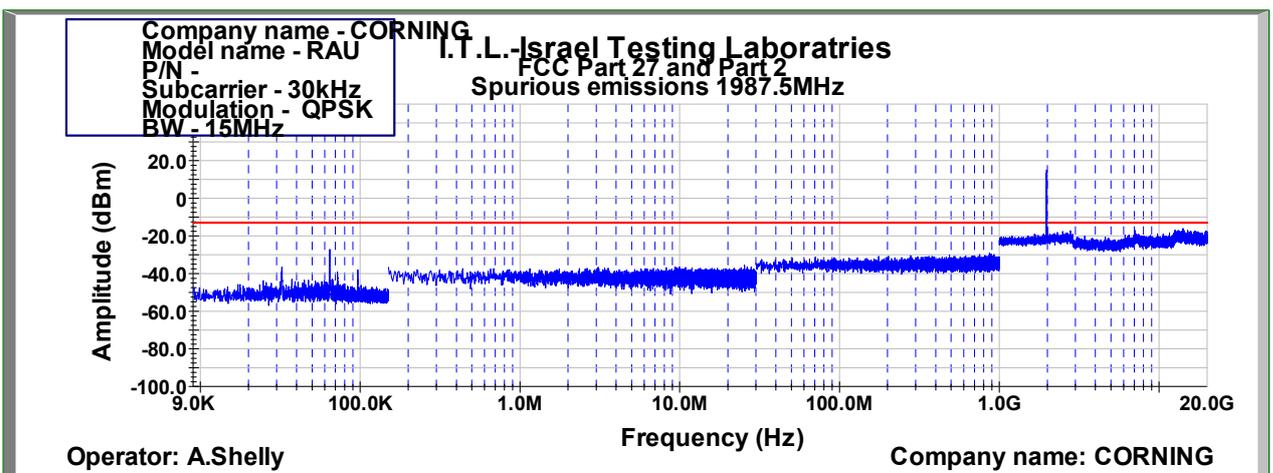


Figure 1019: Spurious Emissions at Antenna Terminal QPSK 15MHz B.W.; 1987.5MHz, 30kHz

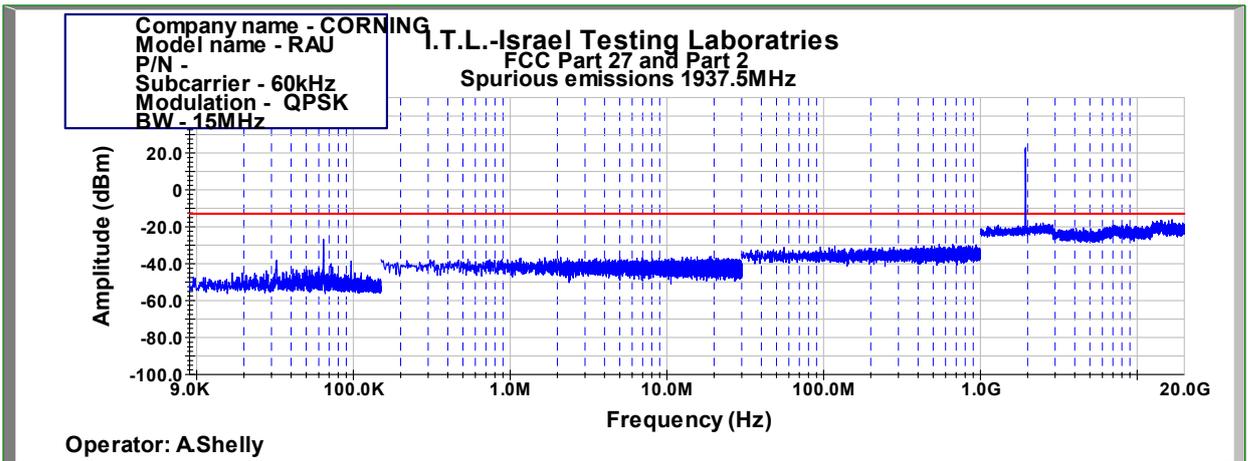


Figure 1020: Spurious Emissions at Antenna Terminal QPSK 15MHz B.W.; 1937.5MHz, 60kHz

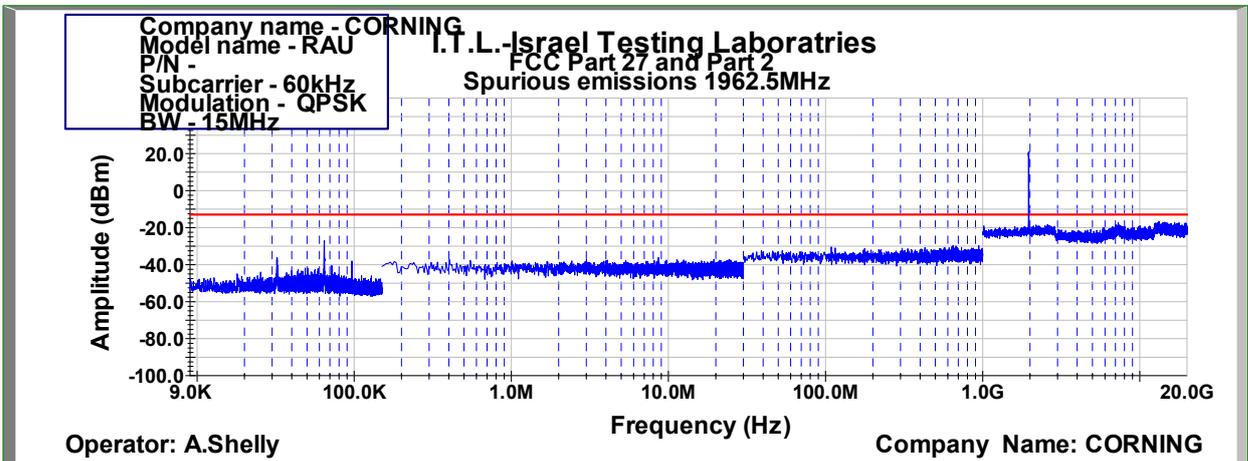


Figure 1021: Spurious Emissions at Antenna Terminal QPSK 15MHz B.W.; 1962.5MHz, 15kHz

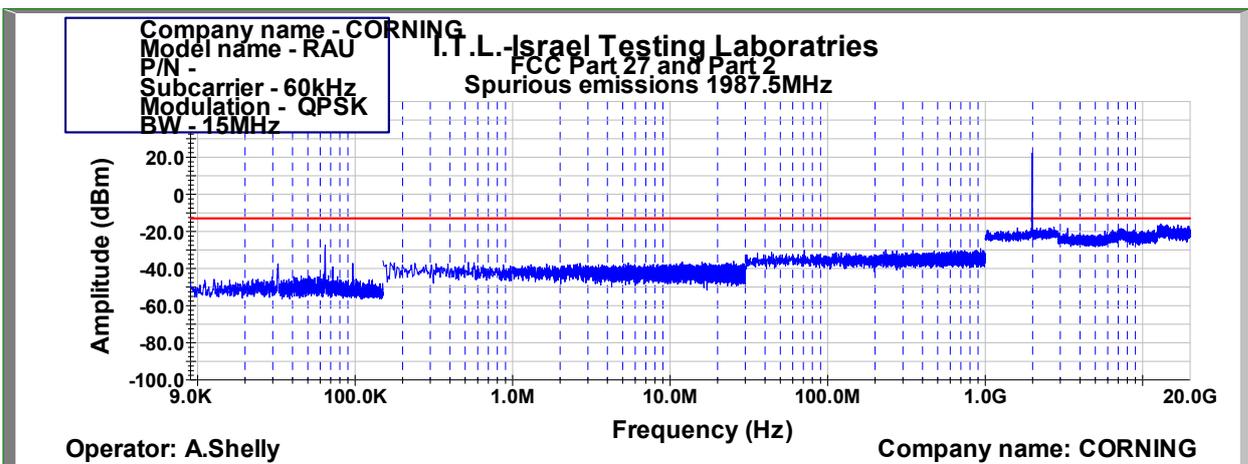


Figure 1022: Spurious Emissions at Antenna Terminal QPSK 15MHz B.W.; 1987.5MHz, 60kHz

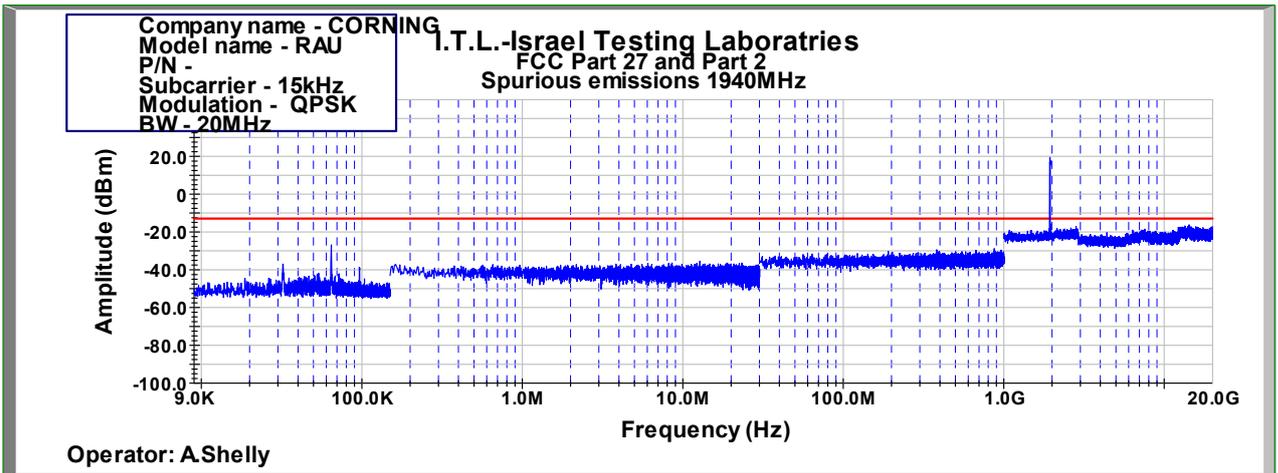


Figure 1023: Spurious Emissions at Antenna Terminal QPSK 20MHz B.W.; 1940.0MHz, 15kHz

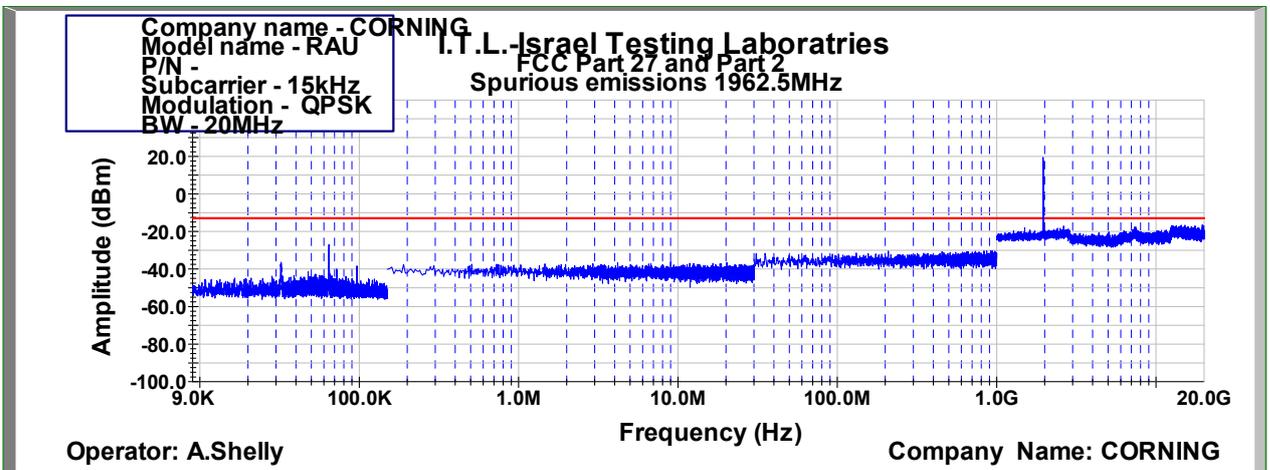


Figure 1024: Spurious Emissions at Antenna Terminal QPSK 20MHz B.W.; 1962.5MHz, 15kHz

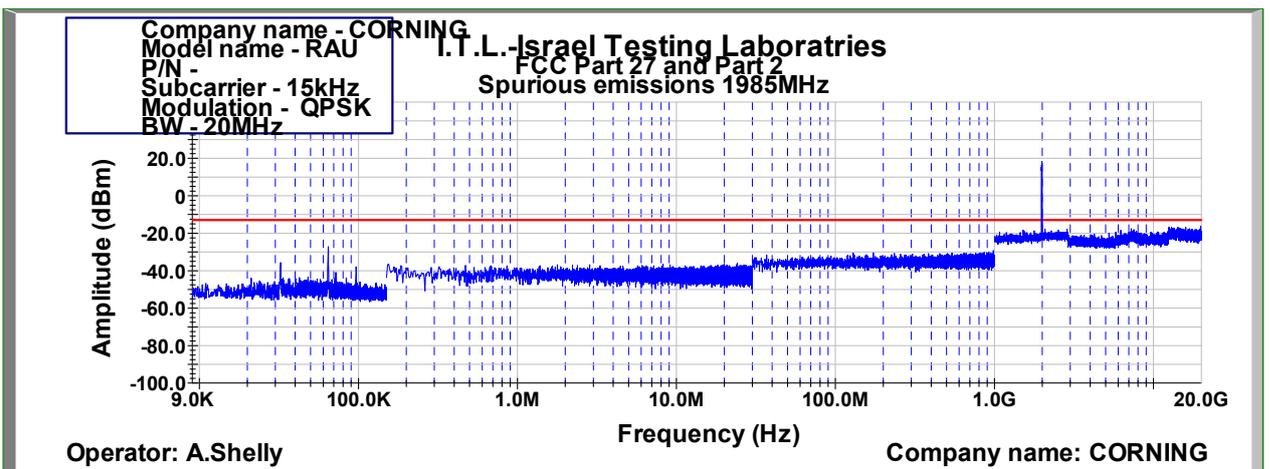


Figure 1025: Spurious Emissions at Antenna Terminal QPSK 20MHz B.W.; 1985.0MHz, 15kHz

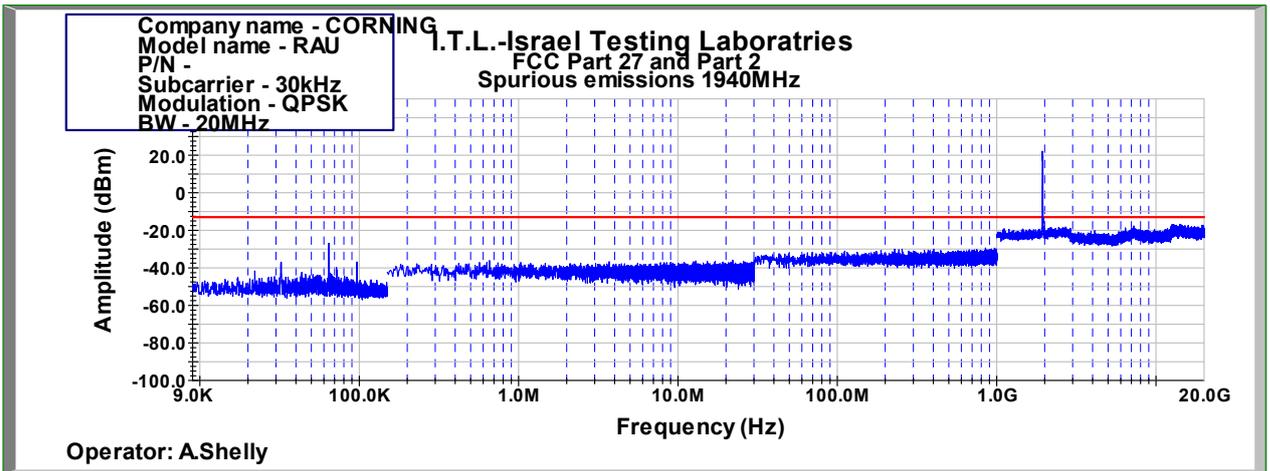


Figure 1026: Spurious Emissions at Antenna Terminal QPSK 20MHz B.W.; 1940.0MHz, 30kHz

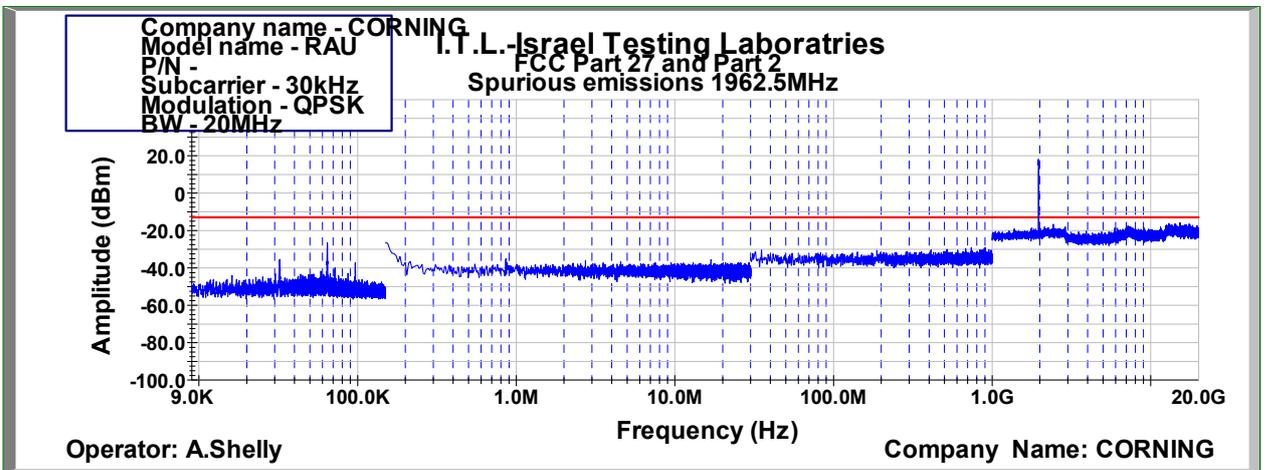


Figure 1027: Spurious Emissions at Antenna Terminal QPSK 20MHz B.W.; 1962.5MHz, 30kHz

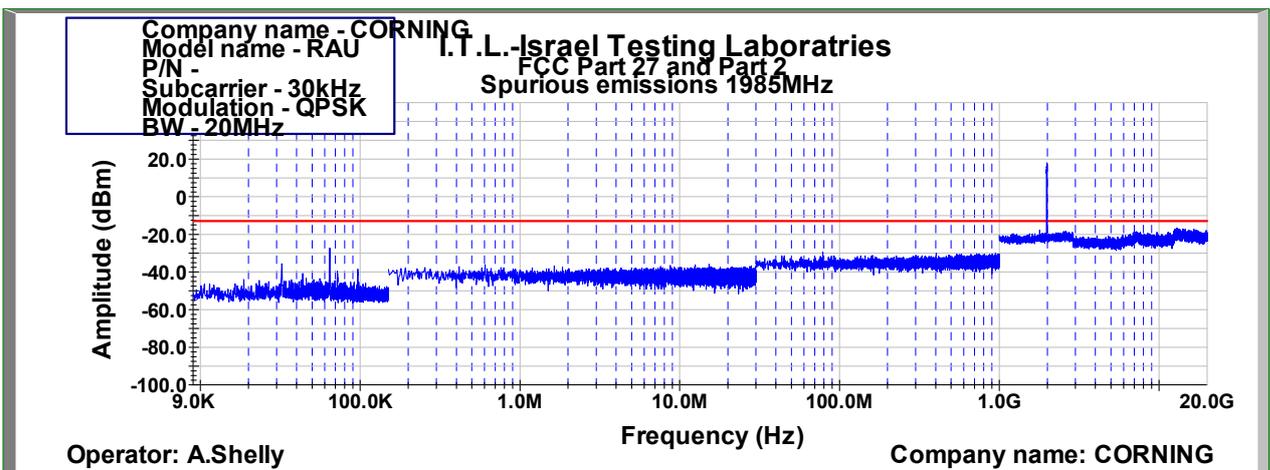


Figure 1028: Spurious Emissions at Antenna Terminal QPSK 20MHz B.W.; 1985.0MHz, 30kHz

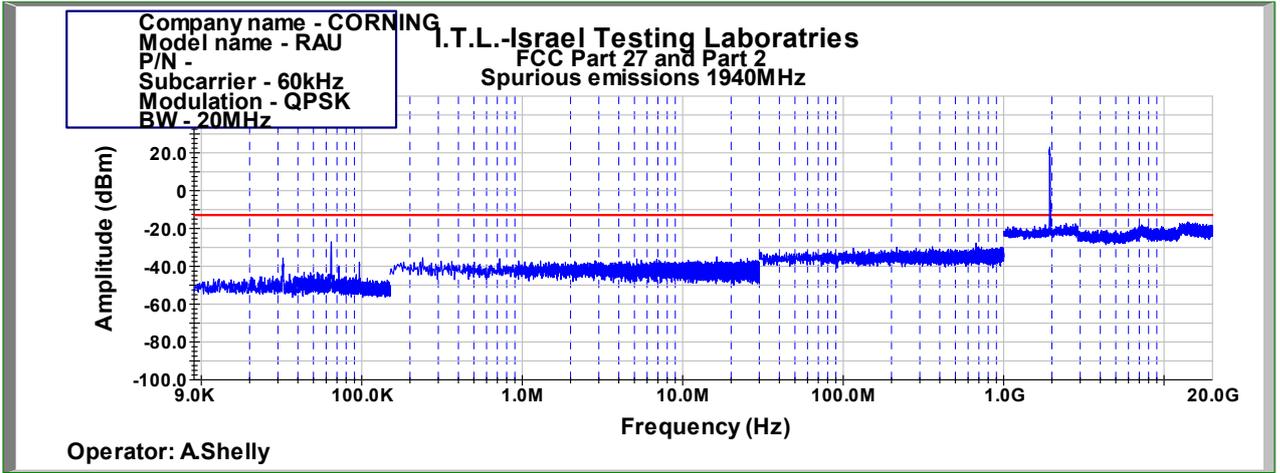


Figure 1029: Spurious Emissions at Antenna Terminal QPSK 20MHz B.W.; 1940.0MHz, 60kHz

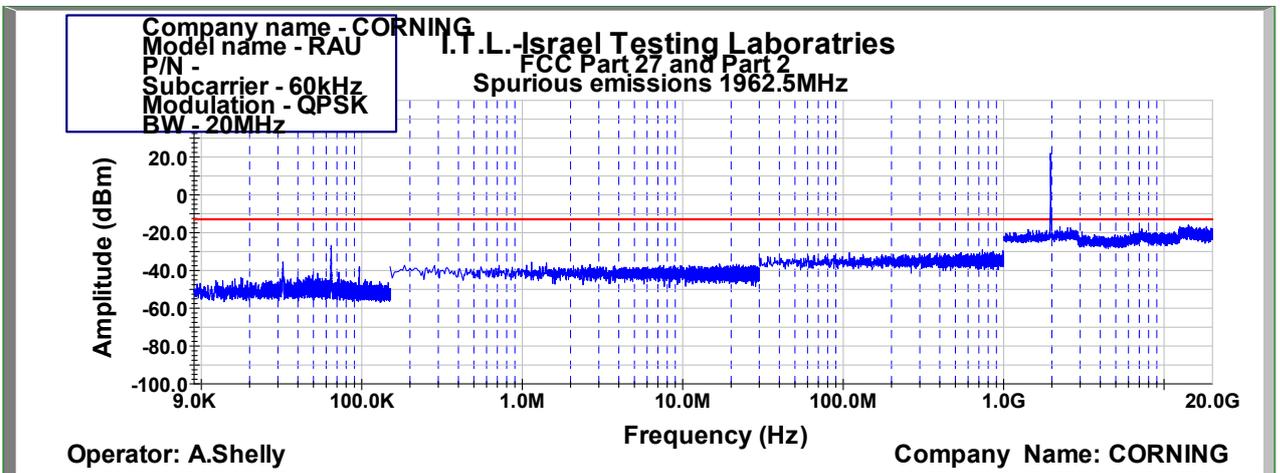


Figure 1030: Spurious Emissions at Antenna Terminal QPSK 20MHz B.W.; 1962.5MHz, 60kHz

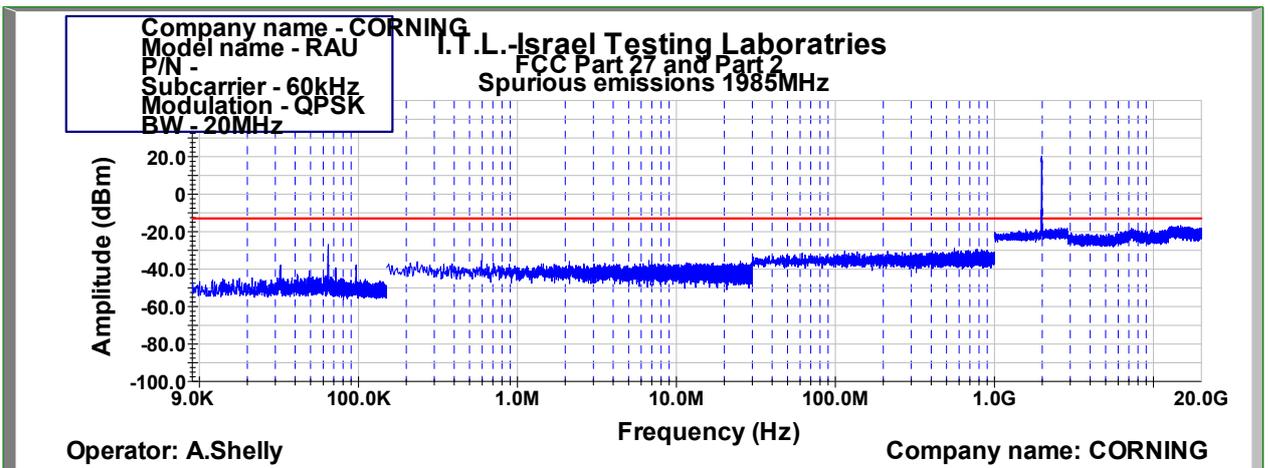


Figure 1031: Spurious Emissions at Antenna Terminal QPSK 20MHz B.W.; 1985.0MHz, 60kHz

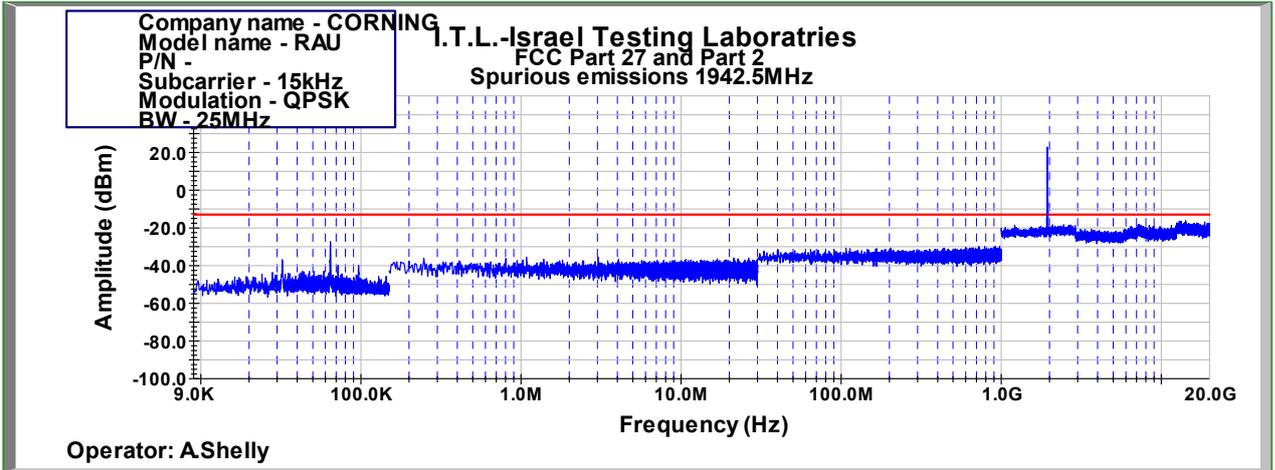


Figure 1032: Spurious Emissions at Antenna Terminal QPSK 25MHz B.W.; 1942.5MHz, 15kHz

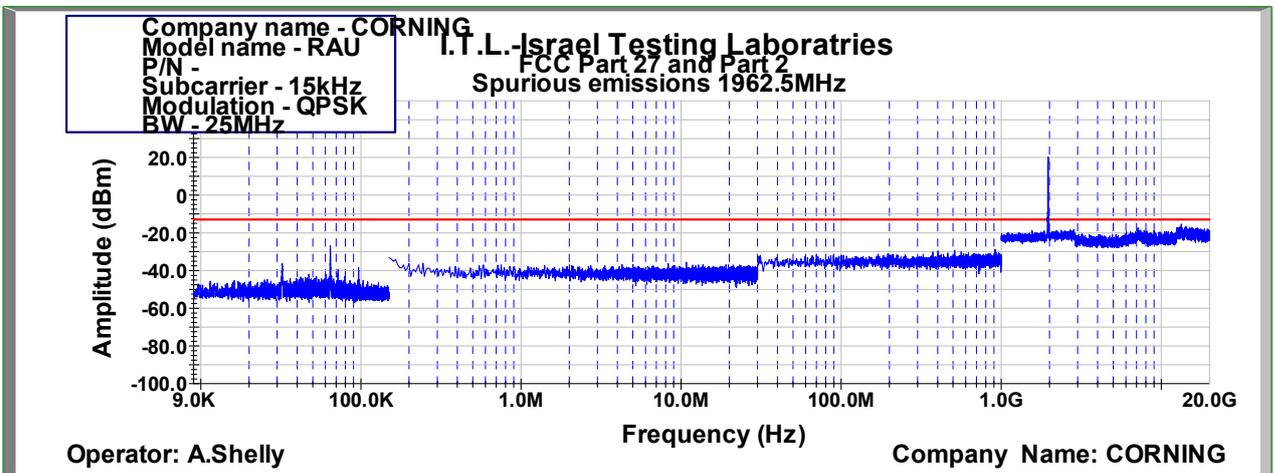


Figure 1033: Spurious Emissions at Antenna Terminal QPSK 25MHz B.W.; 1962.5MHz, 15kHz

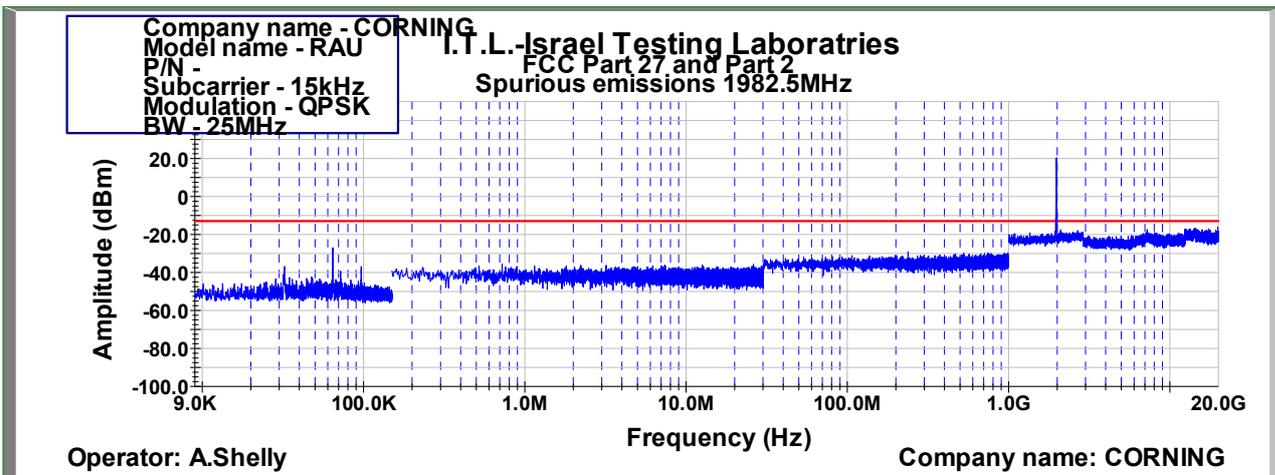


Figure 1034: Spurious Emissions at Antenna Terminal QPSK 25MHz B.W.; 1982.5MHz, 15kHz

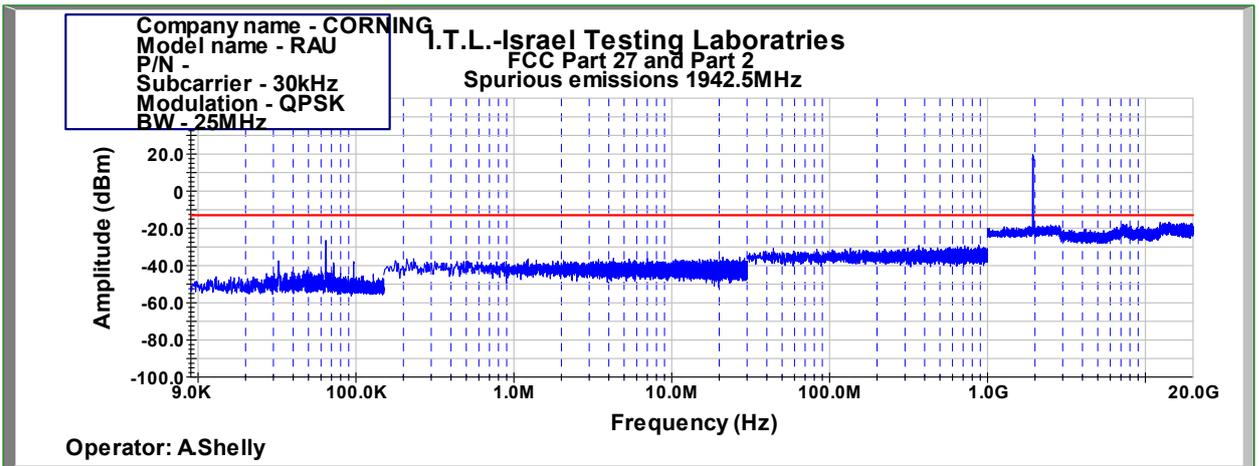


Figure 1035: Spurious Emissions at Antenna Terminal QPSK 25MHz B.W.; 1942.5MHz, 30kHz

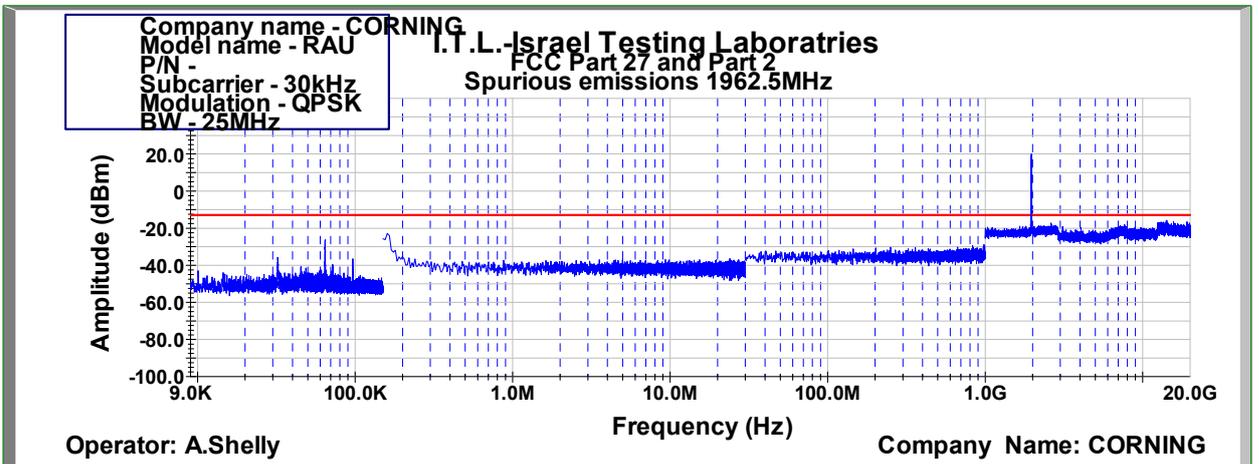


Figure 1036: Spurious Emissions at Antenna Terminal QPSK 25MHz B.W.; 1962.5MHz, 30kHz

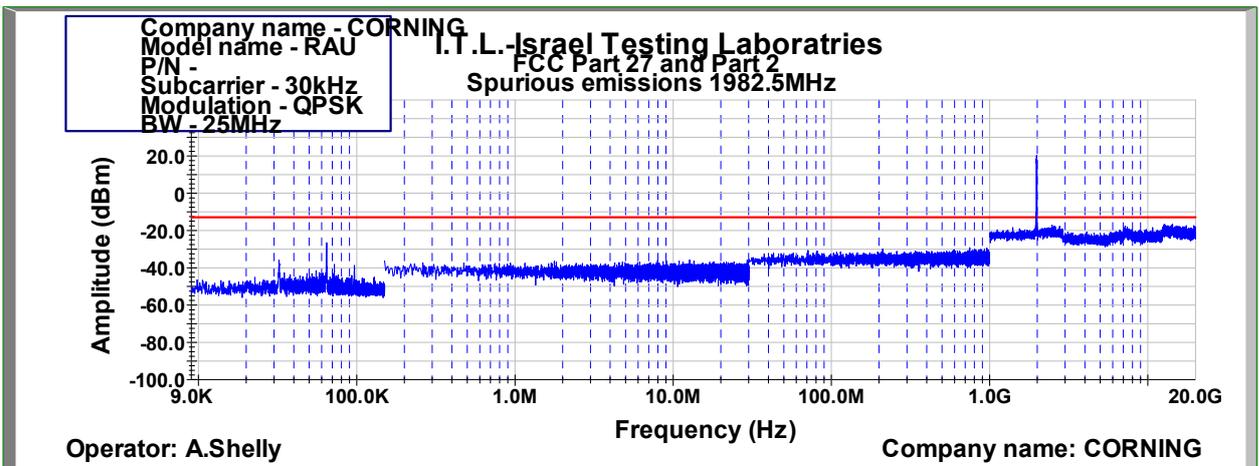


Figure 1037: Spurious Emissions at Antenna Terminal QPSK 25MHz B.W.; 1982.5MHz, 30kHz

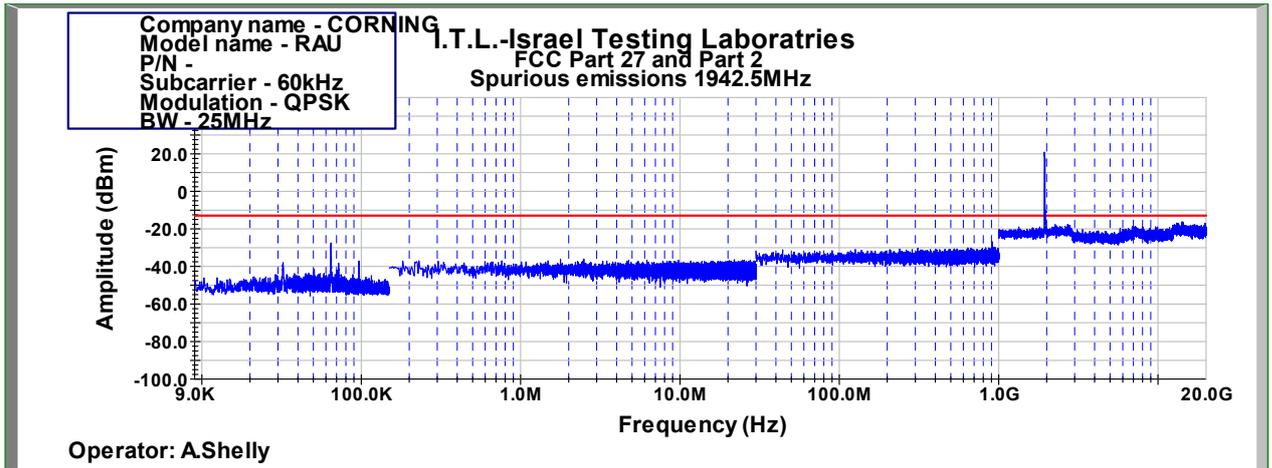


Figure 1038: Spurious Emissions at Antenna Terminal QPSK 25MHz B.W.; 1942.5MHz, 60kHz

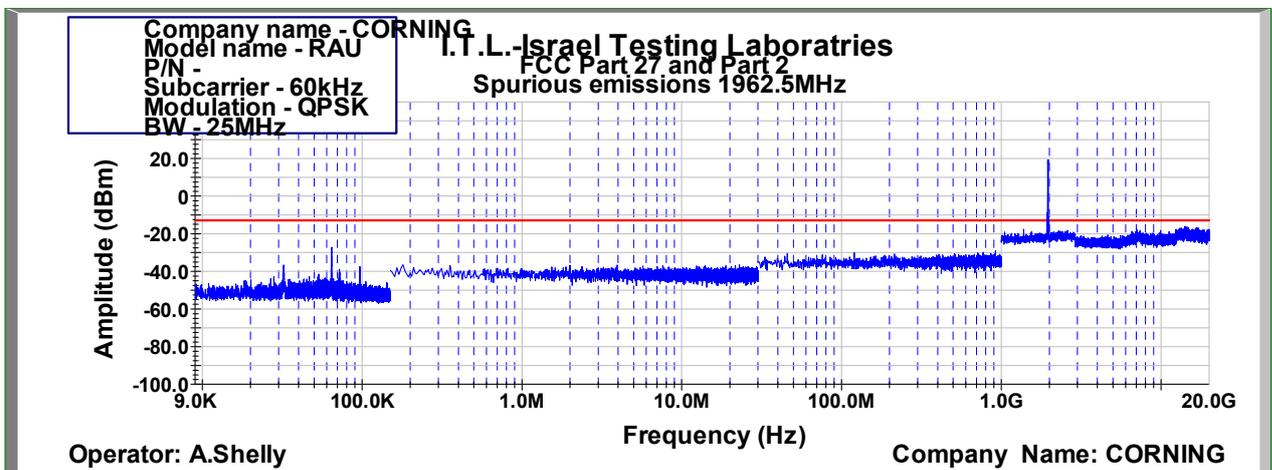


Figure 1039: Spurious Emissions at Antenna Terminal QPSK 25MHz B.W.; 1962.5MHz, 30kHz

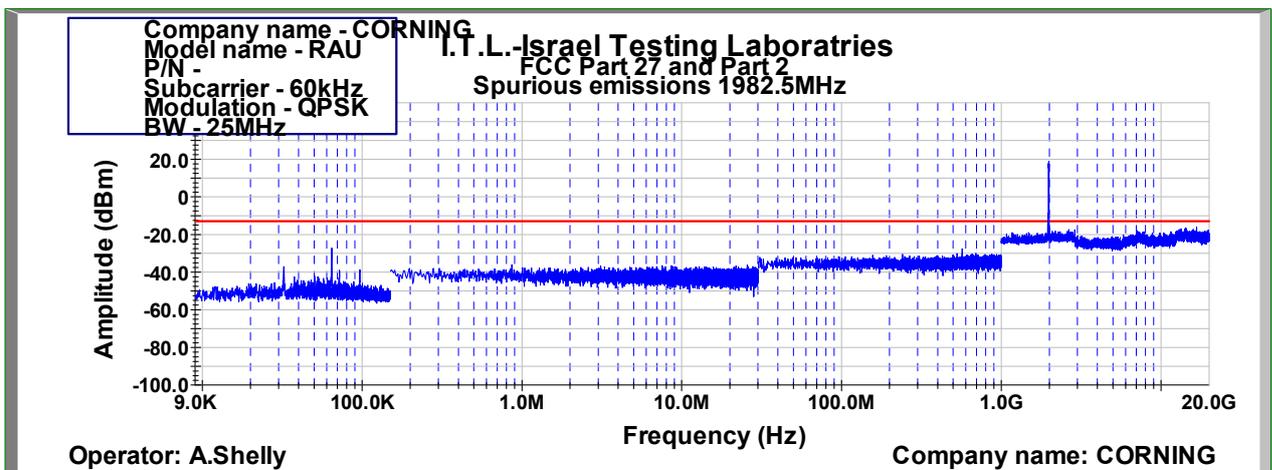


Figure 1040: Spurious Emissions at Antenna Terminal QPSK 25MHz B.W.; 1982.5MHz, 60kHz

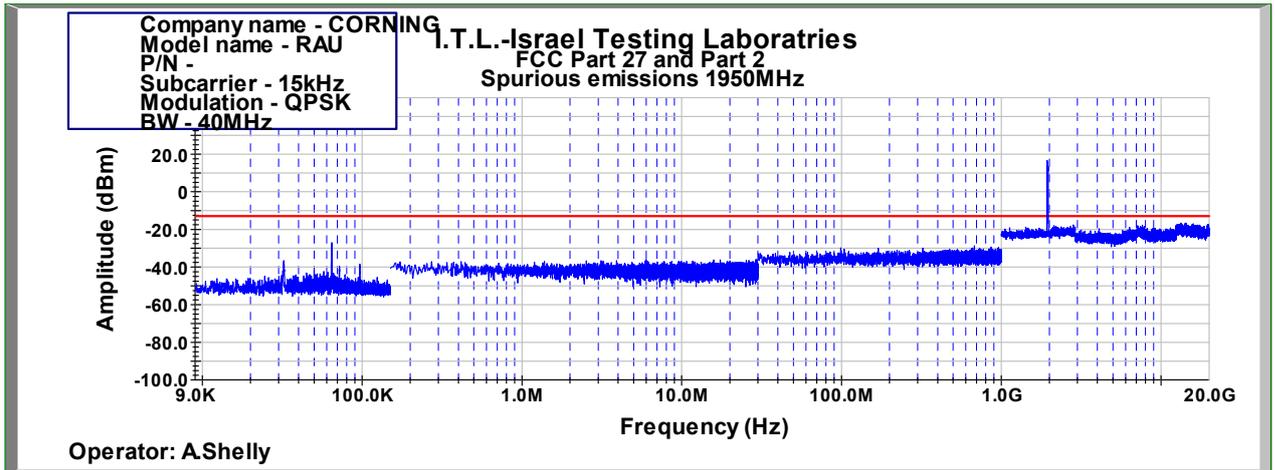


Figure 1041: Spurious Emissions at Antenna Terminal QPSK 40MHz B.W.; 1950.0MHz, 15kHz

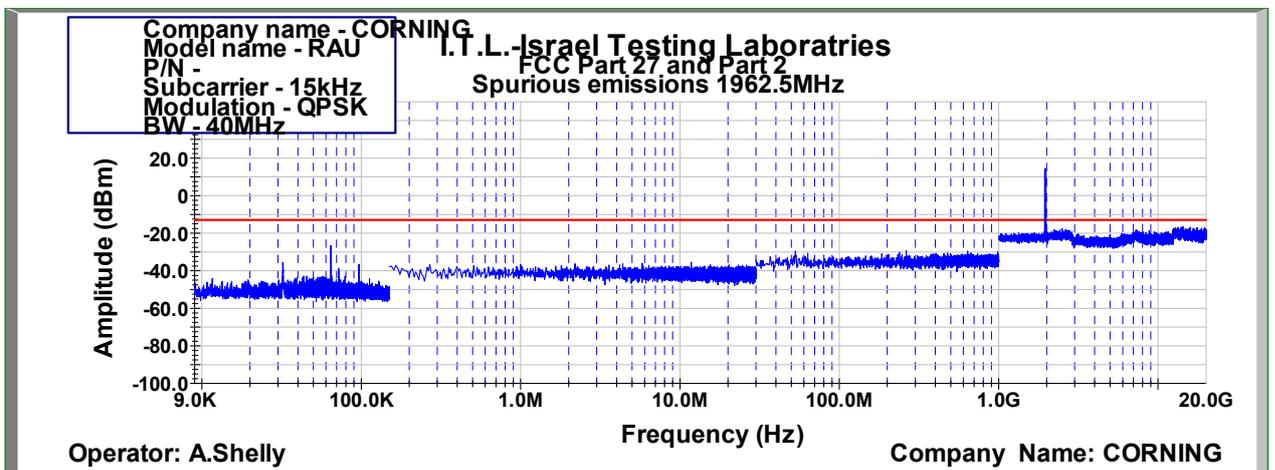


Figure 1042: Spurious Emissions at Antenna Terminal QPSK 40MHz B.W.; 1962.5MHz, 15kHz

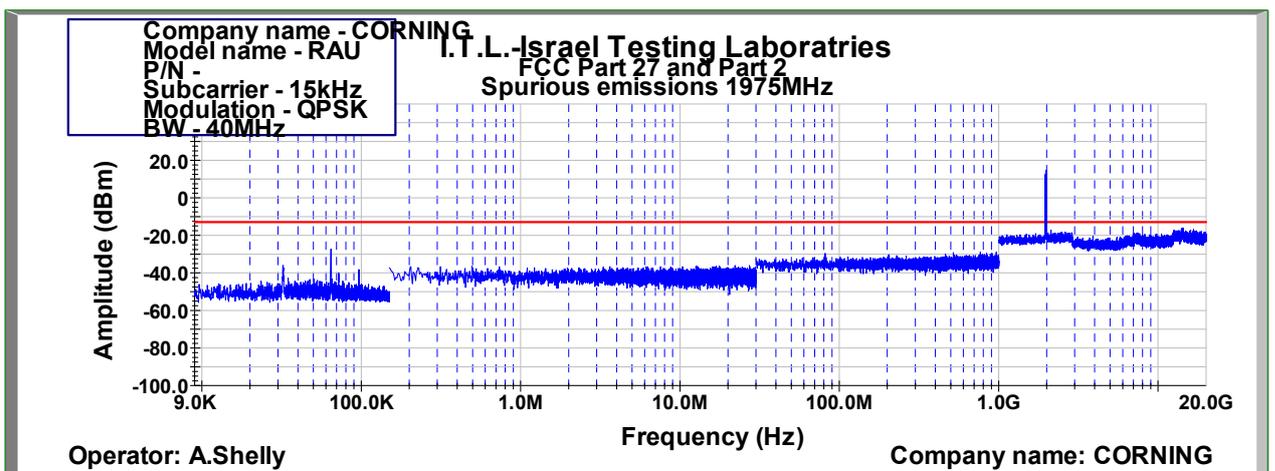


Figure 1043: Spurious Emissions at Antenna Terminal QPSK 40MHz B.W.; 1975.0MHz, 15kHz

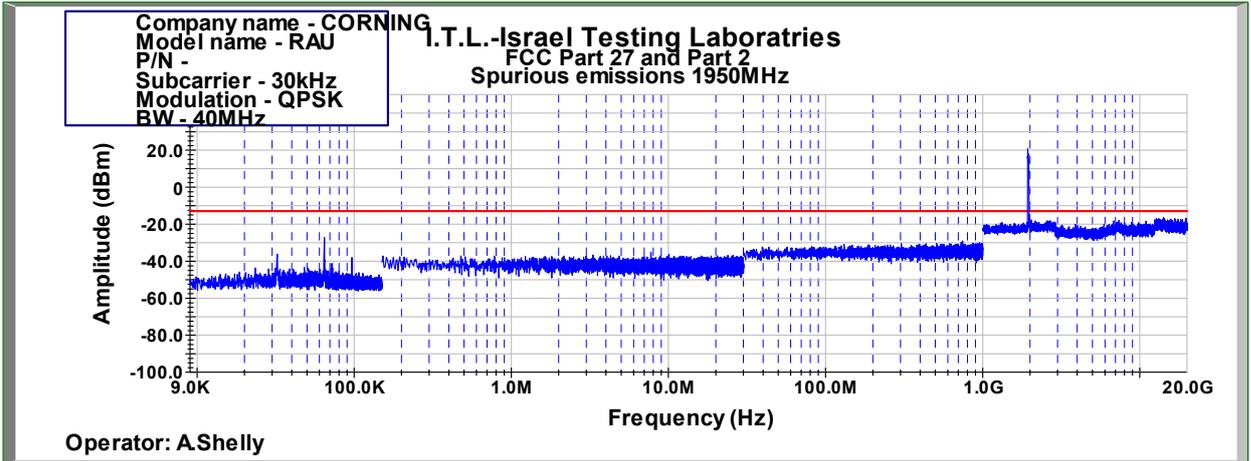


Figure 1044: Spurious Emissions at Antenna Terminal QPSK 40MHz B.W.; 1950.0MHz, 30kHz

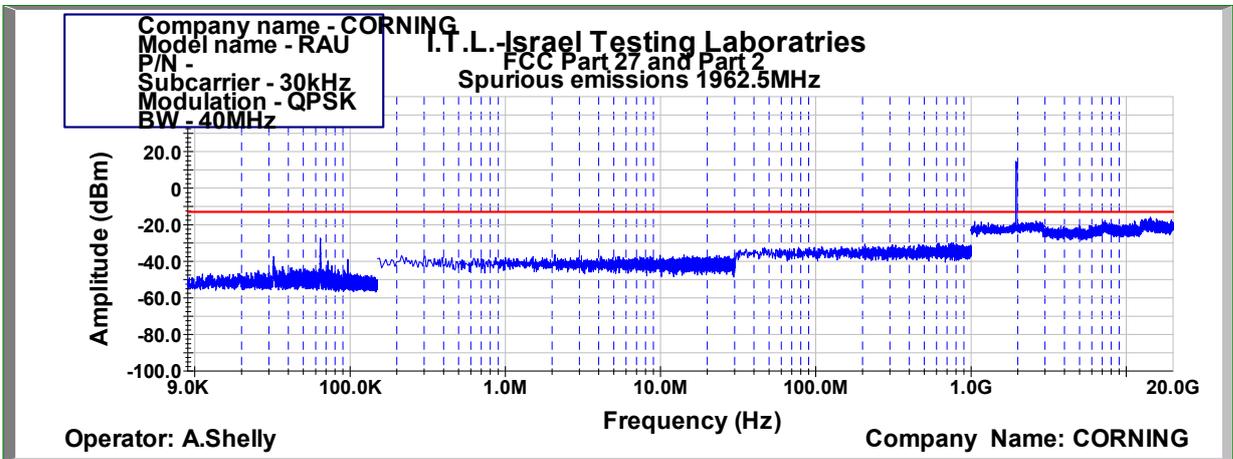


Figure 1045: Spurious Emissions at Antenna Terminal QPSK 40MHz B.W.; 1962.5MHz, 30kHz

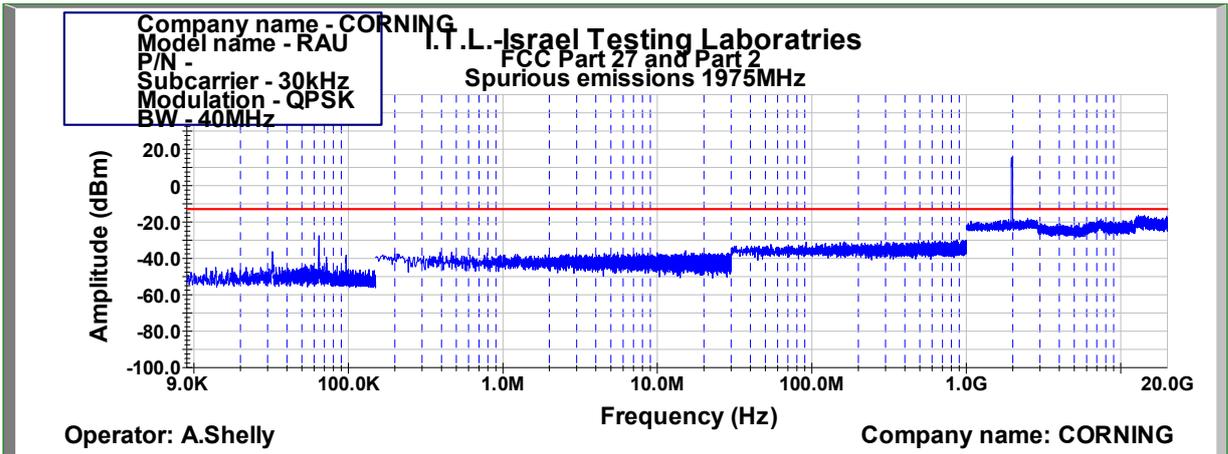


Figure 1046: Spurious Emissions at Antenna Terminal QPSK 40MHz B.W.; 1975.0MHz, 30kHz

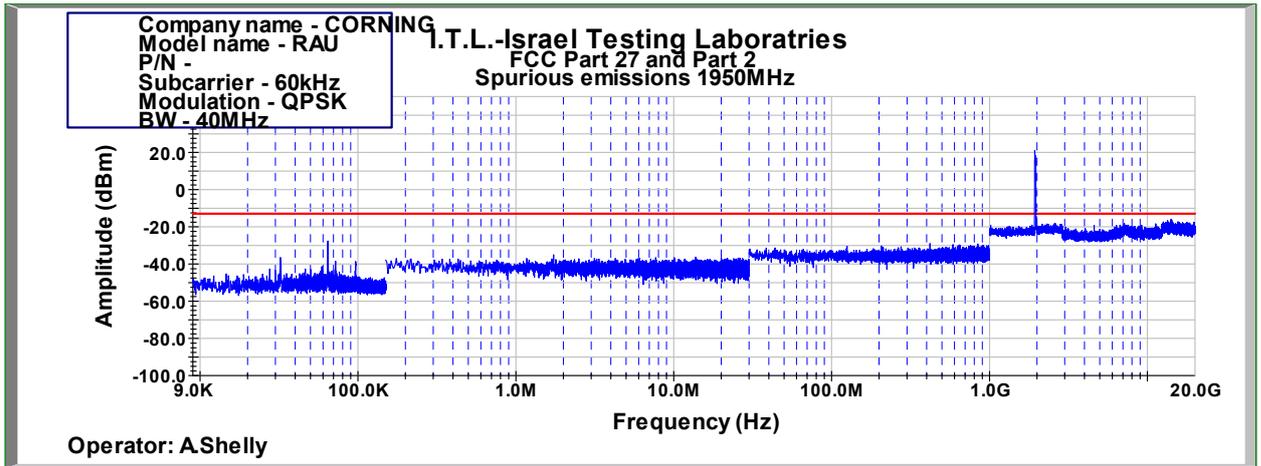


Figure 1047: Spurious Emissions at Antenna Terminal QPSK 40MHz B.W.; 1975.0MHz, 15kHz

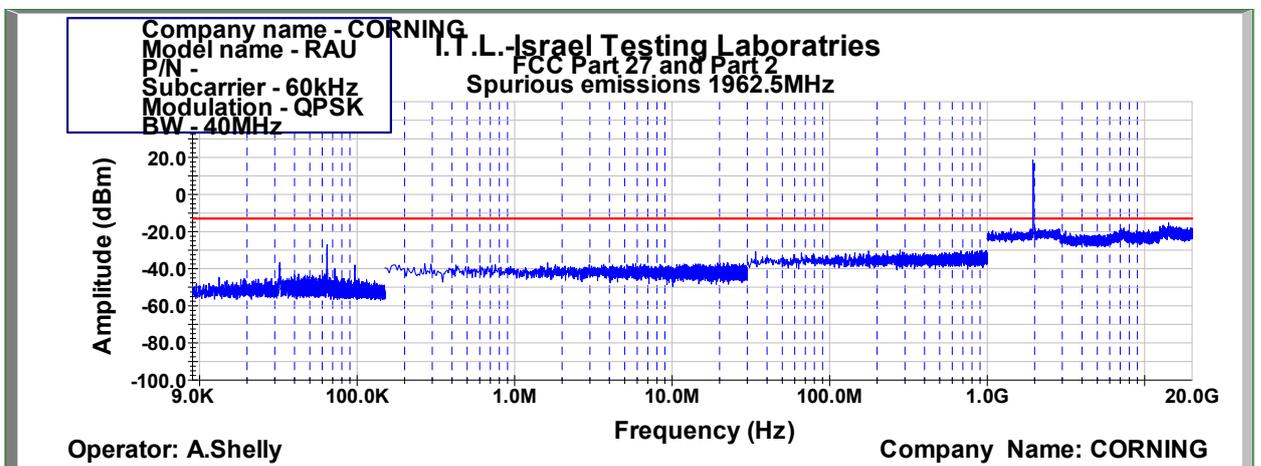


Figure 1048: Spurious Emissions at Antenna Terminal QPSK 40MHz B.W.; 1975.0MHz, 30kHz

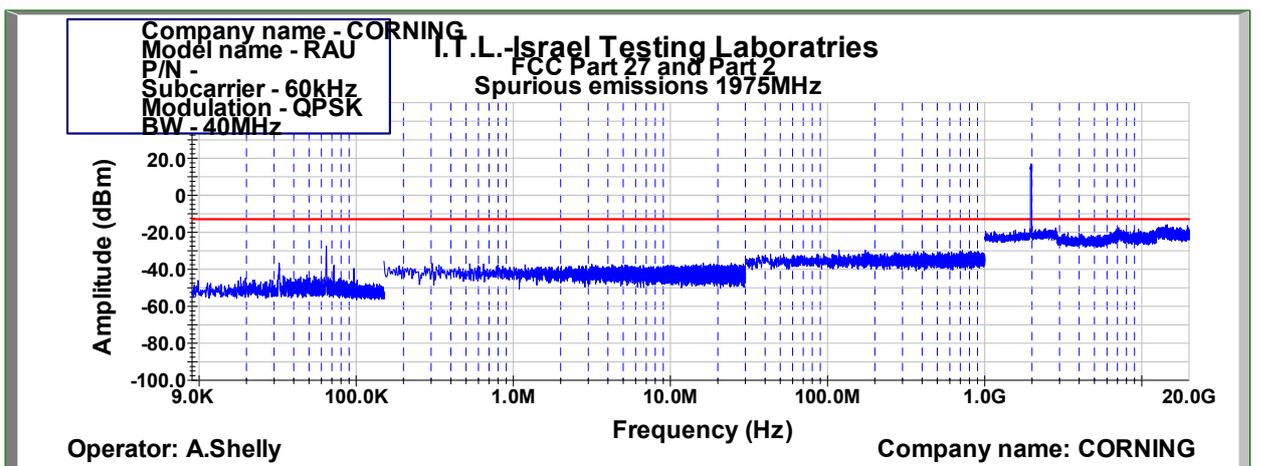


Figure 1049: Spurious Emissions at Antenna Terminal QPSK 40MHz B.W.; 1975.0MHz, 60kHz

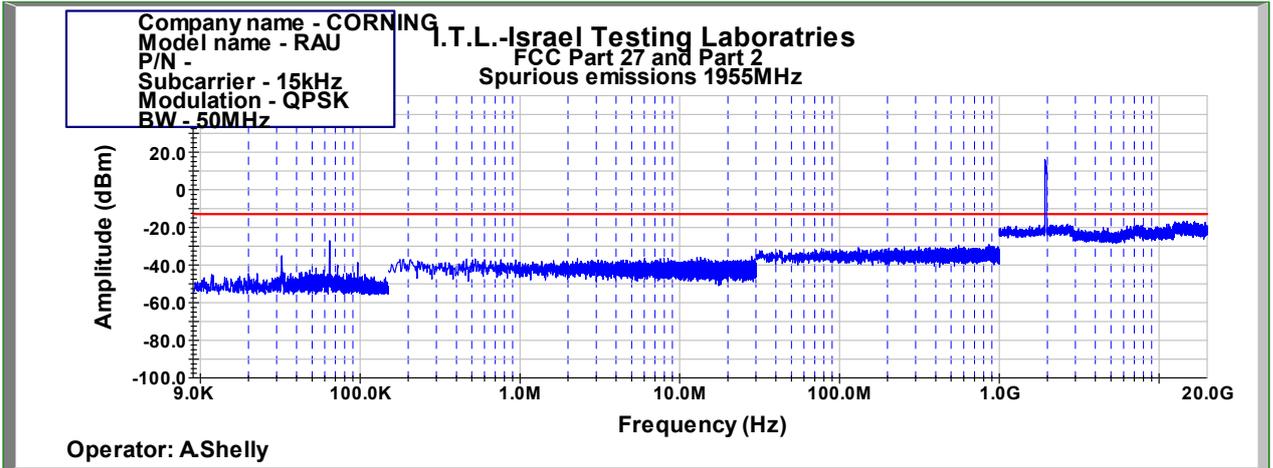


Figure 1050: Spurious Emissions at Antenna Terminal QPSK 50MHz B.W.; 1955.0MHz, 15kHz

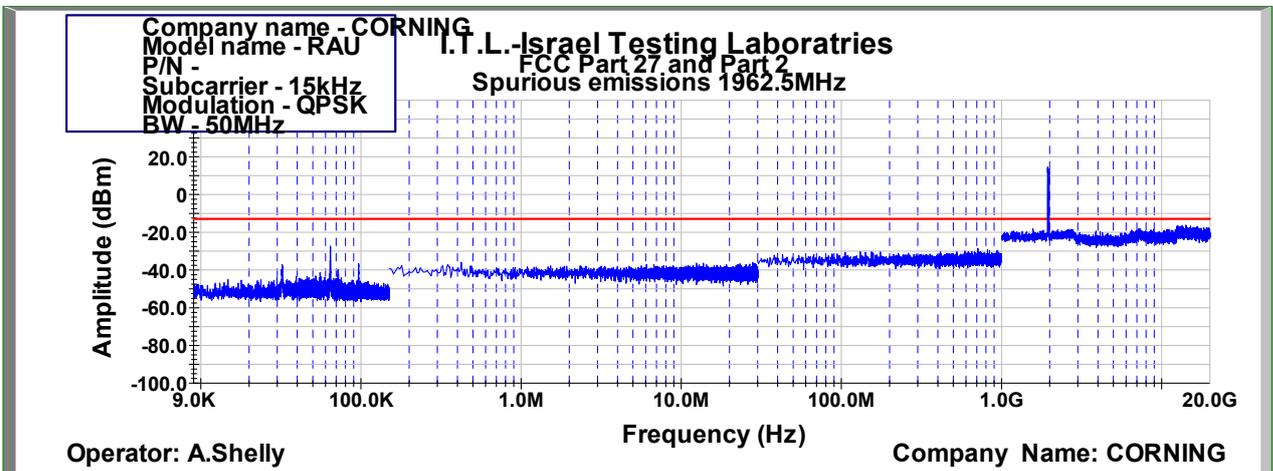


Figure 1051: Spurious Emissions at Antenna Terminal QPSK 50MHz B.W.; 1962.5MHz, 15kHz

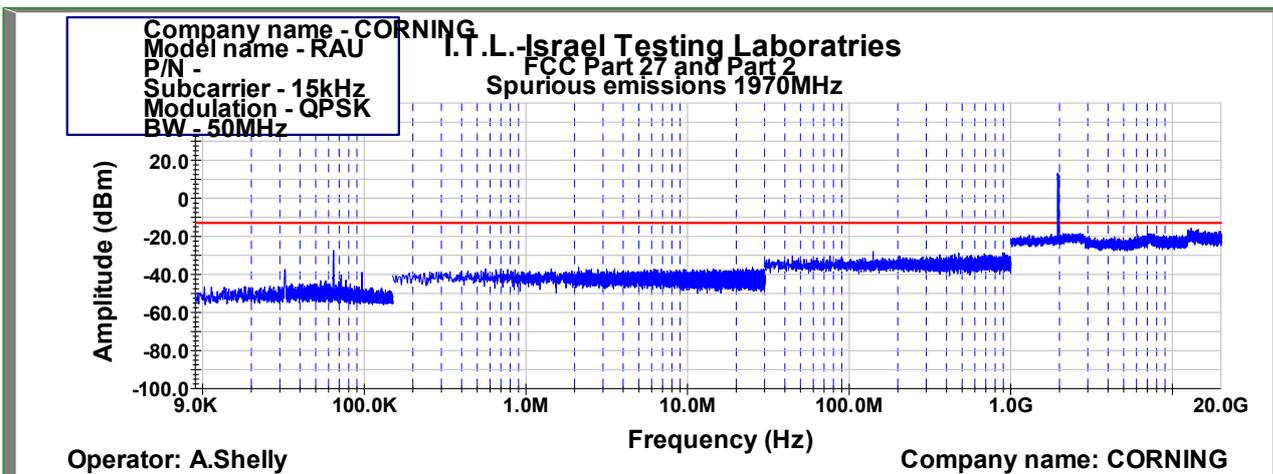


Figure 1052: Spurious Emissions at Antenna Terminal QPSK 50MHz B.W.; 1970.0MHz, 15kHz

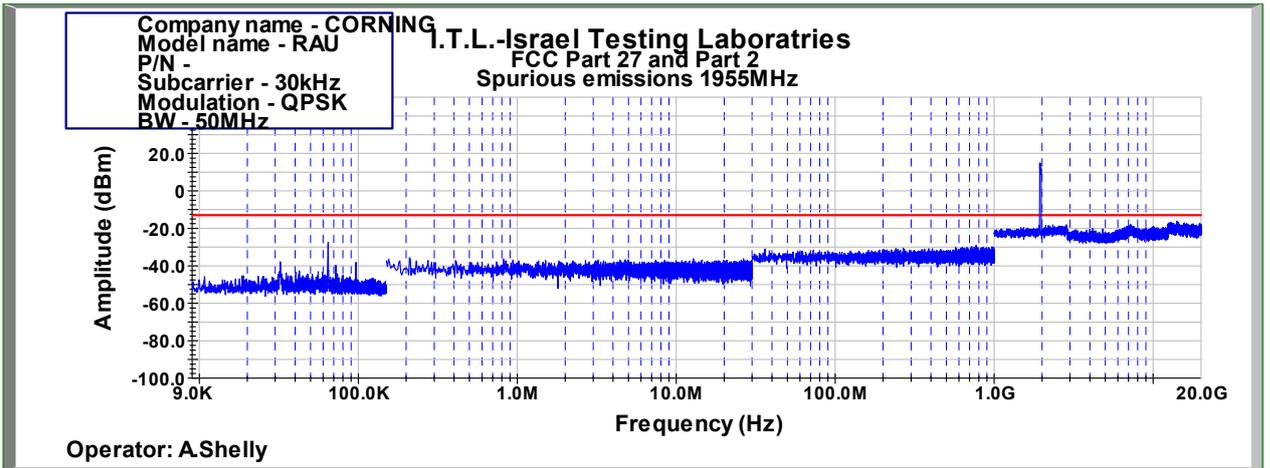


Figure 1053: Spurious Emissions at Antenna Terminal QPSK 50MHz B.W.; 1955.0MHz, 30kHz

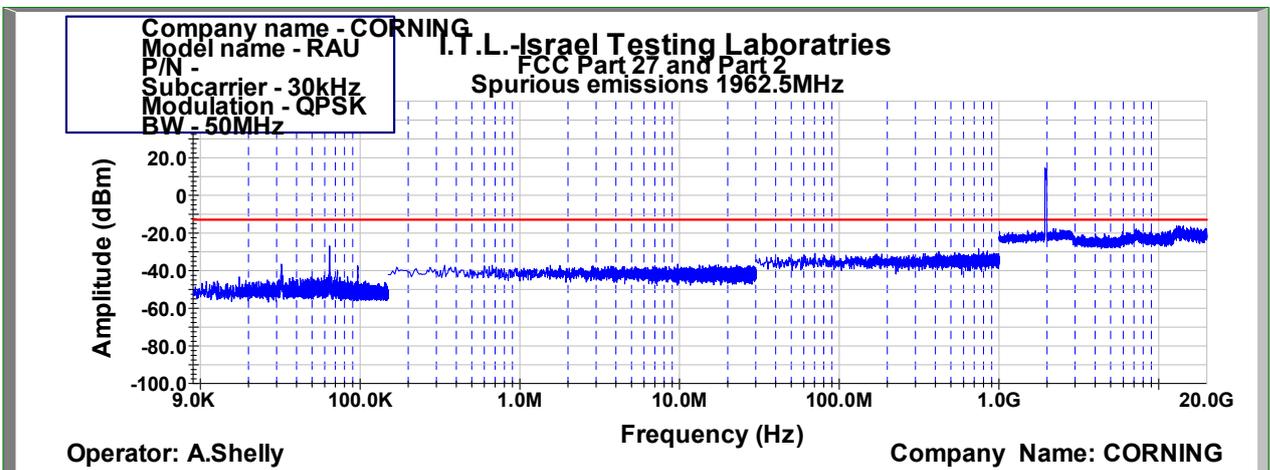


Figure 1054: Spurious Emissions at Antenna Terminal QPSK 50MHz B.W.; 1962.5MHz, 30kHz

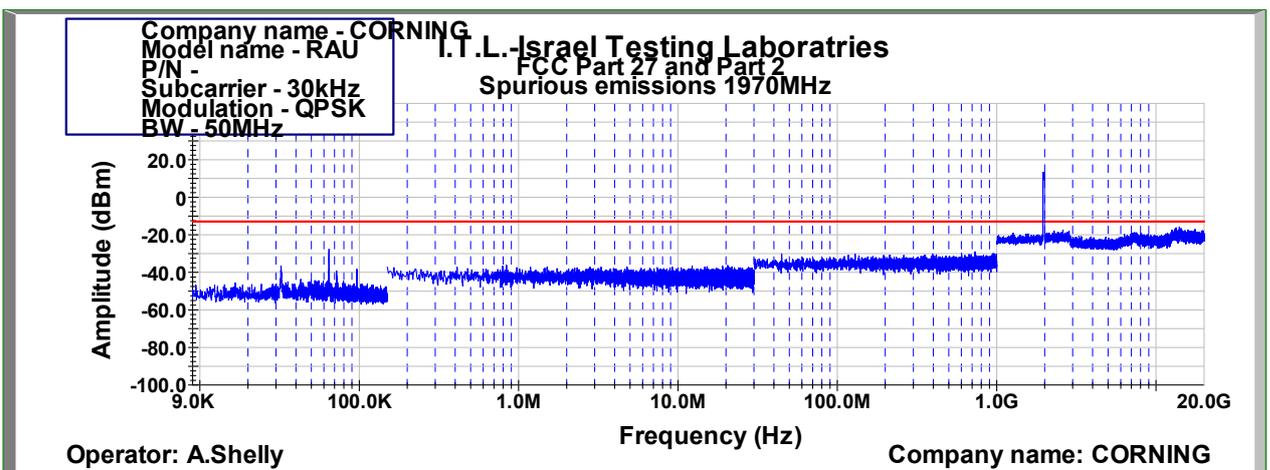


Figure 1055: Spurious Emissions at Antenna Terminal QPSK 50MHz B.W.; 1970.0MHz, 30kHz

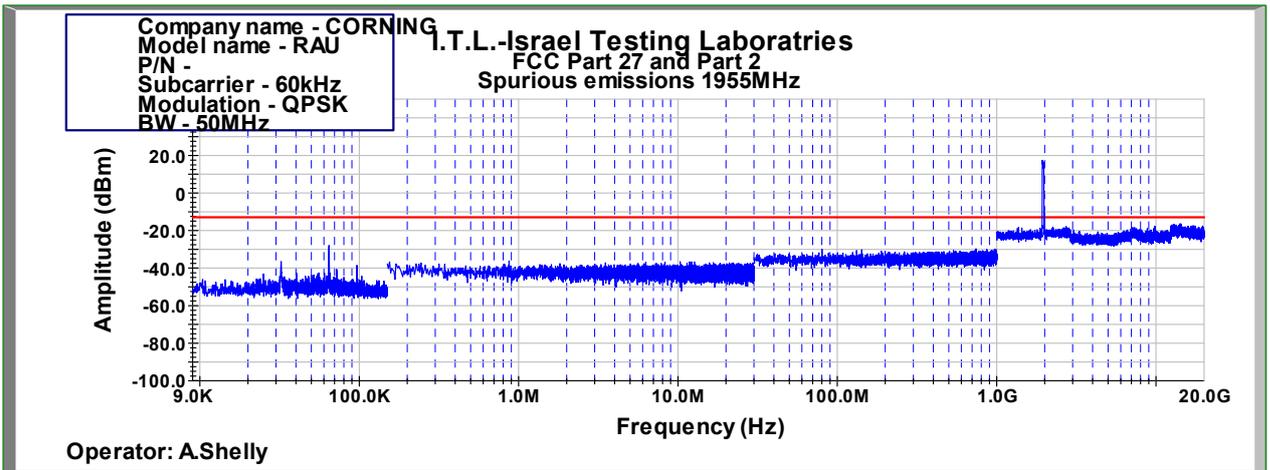


Figure 1056: Spurious Emissions at Antenna Terminal QPSK 50MHz B.W.; 1955.0MHz, 60kHz

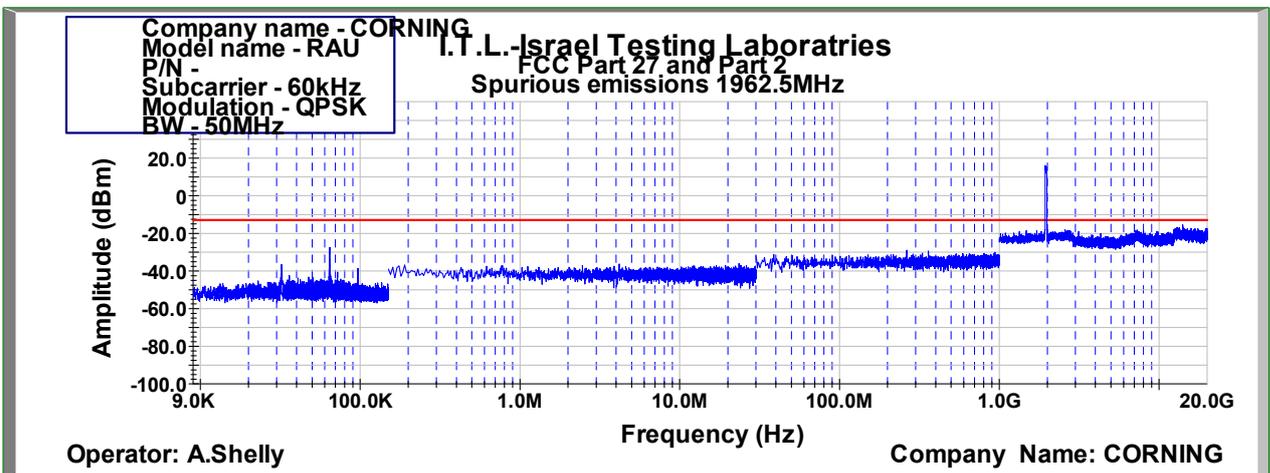


Figure 1057: Spurious Emissions at Antenna Terminal QPSK 50MHz B.W.; 1962.5MHz, 60kHz

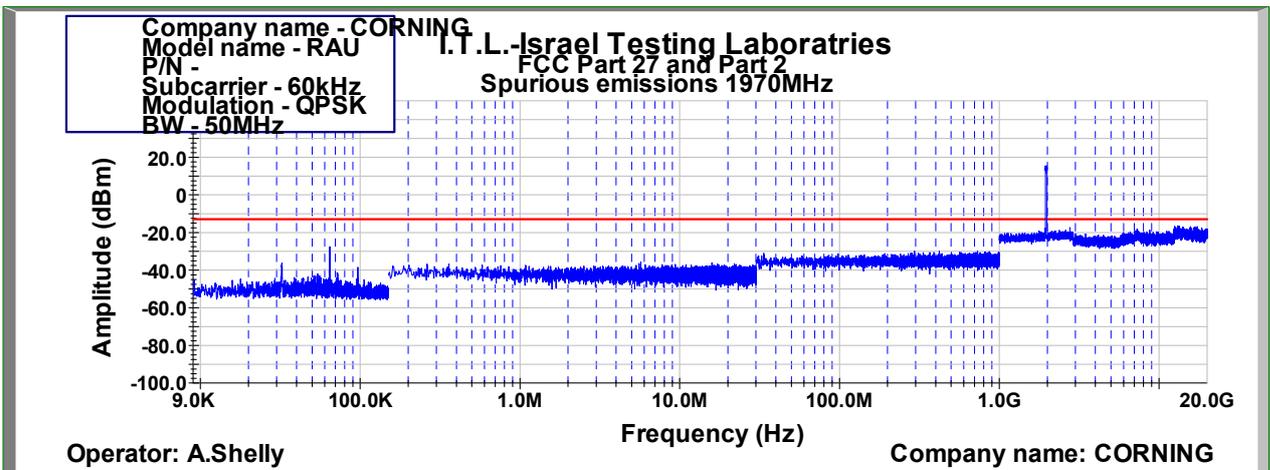


Figure 1058: Spurious Emissions at Antenna Terminal QPSK 50MHz B.W.; 1970.0MHz, 60kHz

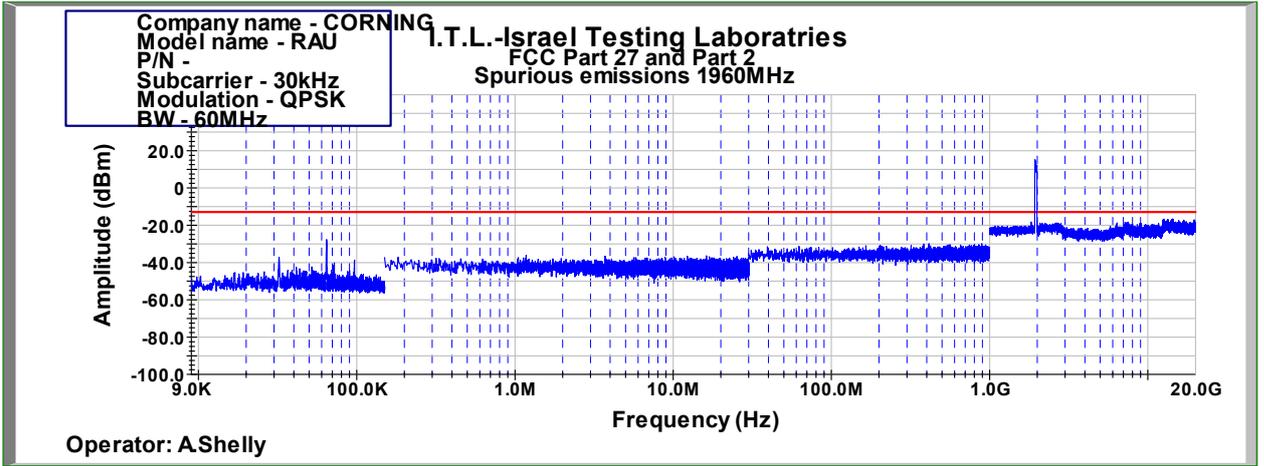


Figure 1059: Spurious Emissions at Antenna Terminal QPSK 60MHz B.W.; 1960.0MHz, 30kHz

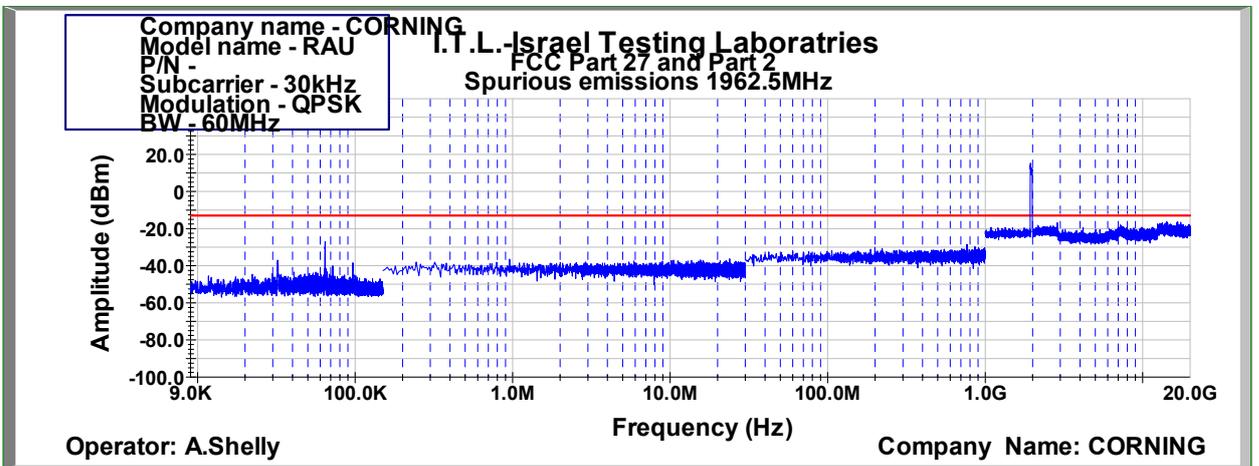


Figure 1060: Spurious Emissions at Antenna Terminal QPSK 60MHz B.W.; 1962.5MHz, 30kHz

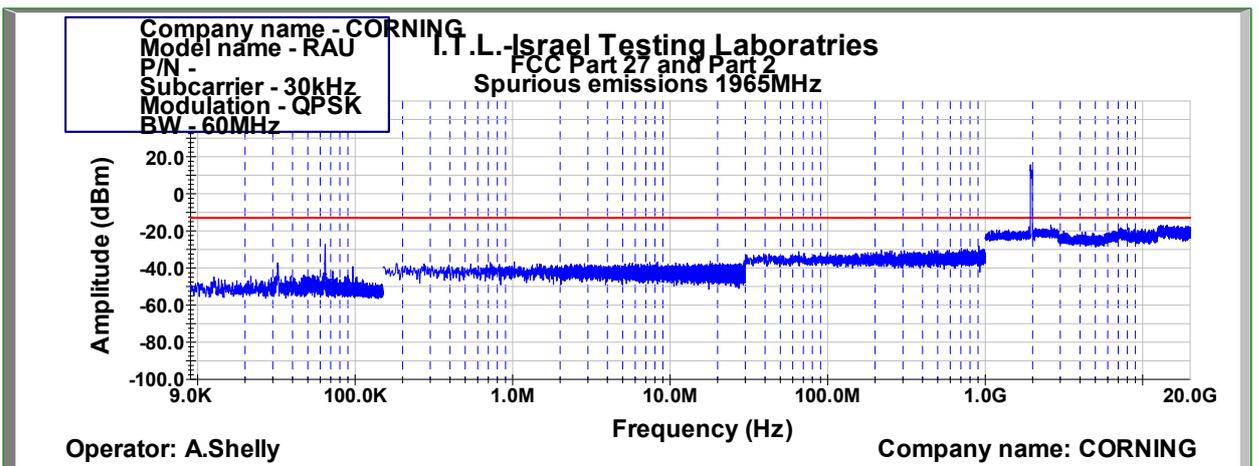


Figure 1061: Spurious Emissions at Antenna Terminal QPSK 60MHz B.W.; 1965.0MHz, 30kHz

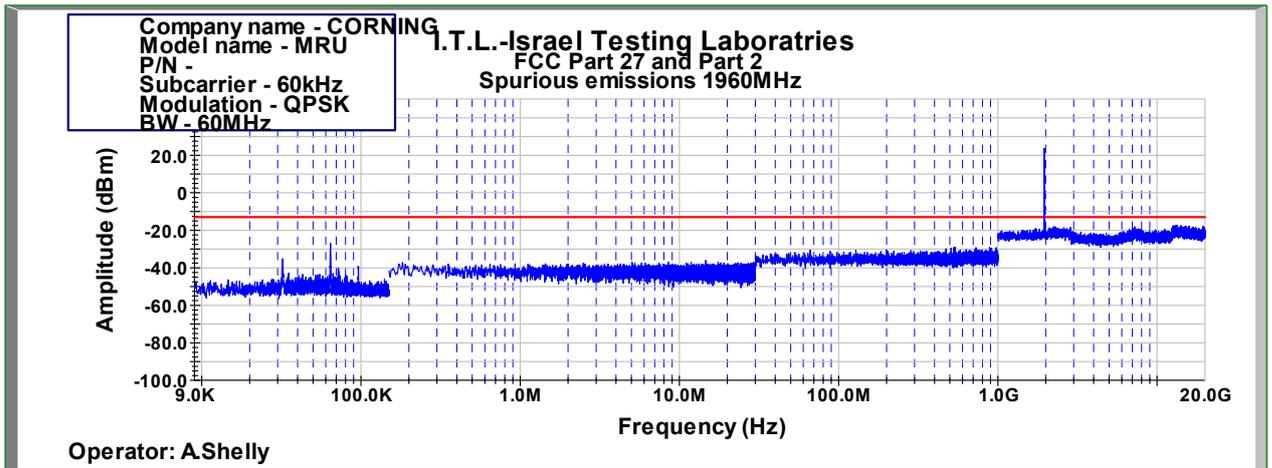


Figure 1062: Spurious Emissions at Antenna Terminal QPSK 60MHz B.W.; 1960.0MHz, 60kHz

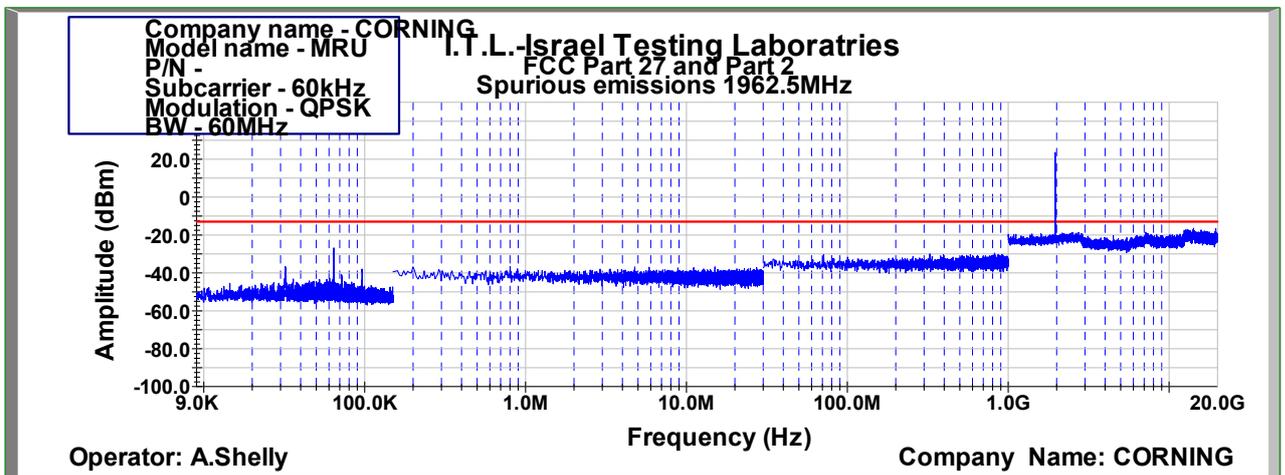


Figure 1063: Spurious Emissions at Antenna Terminal QPSK 60MHz B.W.; 1962.5MHz, 60kHz

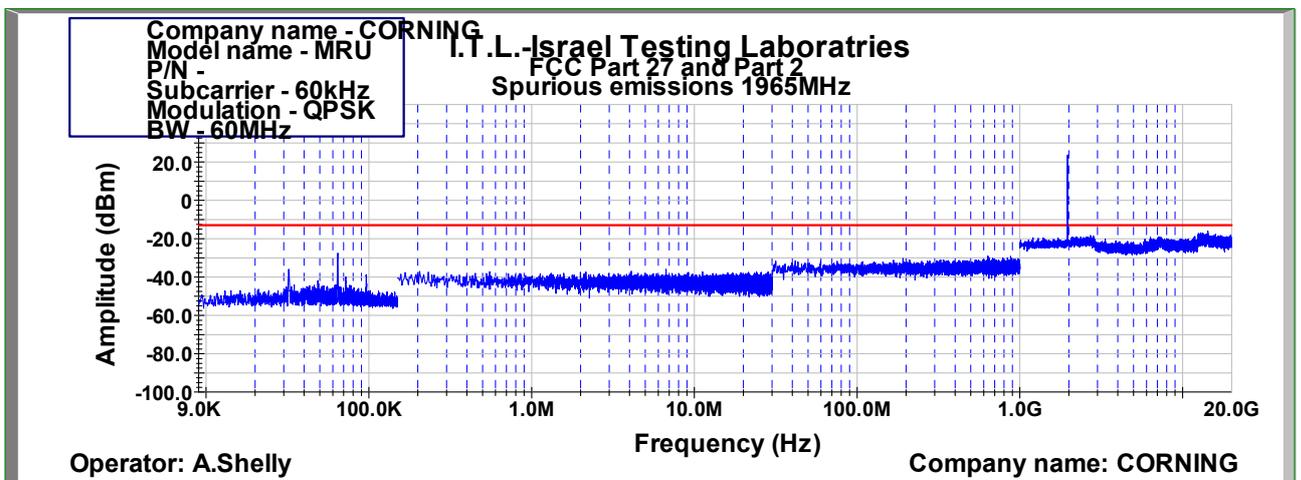


Figure 1064: Spurious Emissions at Antenna Terminal QPSK 60MHz B.W.; 1965.0MHz, 60kHz



**6.5 Test Equipment Used; Spurious Emissions at Antenna Terminals**

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Due
EXA Signal Analyzer	Agilent Technologies	N9010A	MY52220686	November 28, 2018	May 30, 2021
Vector Signal Generator	R&S	SMBV100B	1423.1003K02-101470-XE	October 2, 2019	October 2, 2022
40 dB Attenuator	Weinschel	WA 39-40-33	A1323	July 7, 2020	July 31, 2021
RF Cable	Huber Suner	Sucofelex	27504/4PEA	August 23, 2020	August 31, 2021

**Table 26 Test Equipment Used**



## 7 Spurious Radiated Emission

### 7.1 Test Specification

FCC, Part 27, Subpart C, Section 27.53 (g)

### 7.2 Test Procedure

(Temperature (23°C)/ Humidity (47%RH))

The test method was based on ANSI/TIA-603-D: 2010, Section 2.2.12 Unwanted Emissions: Radiated Spurious.

#### **For measurements between 0.009MHz-30MHz:**

The E.U.T was tested inside the shielded room at a distance of 3 meters and the E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The frequency range 0.009MHz-30MHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The emissions were measured at a distance of 3 meters.

#### **For measurements between 30.0MHz-1.0GHz:**

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The frequency range 30.0MHz -1.0GHz was scanned and the list of the highest emissions was verified and updated accordingly.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

The emissions were measured at a distance of 3 meters.

#### **For measurements between 1.0GHz-20.0GHz:**

The E.U.T was tested inside the shielded room at a distance of 3 meters and the E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The frequency range 1.0GHz -20.0GHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The emissions were measured at a distance of 3 meters.

The E.U.T. was replaced by a substitution antenna (dipole 30MHz-1GHz, Horn Antenna above 1GHz) driven by a signal generator.

The height was readjusted for maximum reading. The signal generator level was adjusted to obtain the same reading on the EMI receiver as in step (a).

The signals observed in step (a) were converted to radiated power using:

$$P_d(\text{dBm}) = P_g(\text{dBm}) - \text{Cable Loss (dB)} + \text{Substitution Antenna Gain (dBd)}$$

$P_d$  = Dipole equivalent power (result).

$P_g$  = Signal generator output level.

A Peak detector was used for this test.

Testing was performed when the RF port was connected to 50  $\Omega$  termination.

Evaluation was performed for all possible modulations, bandwidths, and sub carriers.



### **7.3 Test Limit**

The power of any emission outside of the authorized operating frequency ranges (1930 - 1995 MHz) must be attenuated below the transmitting power (P) by a factor of at least  $43 + \log (P)$  dB, yielding  $-13\text{dBm}$ .

### **7.4 Test Results**

No emissions were detected above the EMI receiver noise level which is at least 20 dB margin below the limit.

JUDGEMENT:      Passed



### 7.5 Test Instrumentation Used; Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Due
EMI Receiver	HP	8542E	3906A00276	March 03, 2020	March 03, 2021
RF Filter Section	HP	85420E	3705A00248	March 03, 2020	March 03, 2021
Spectrum Analyzer	HP	8593EM	3536A00120ADI	March 10, 2020	March 10, 2021
Active Loop Antenna	EMCO	6502	9506-2950	February 5, 2019	February 28, 2021
Antenna Biconical	EMCO	3110B	9912-3337	May 21, 2019	May 31, 2021
Antenna Log Periodic	EMCO	3146	9505-4081	May 31, 2018	May 31, 2021
Horn Antenna 1G-18G	ETS	3115	29845	May 31, 2018	May 31, 2021
Horn Antenna 18G-26.5G	ARA	SWH-28	1007	December 13, 2017	December 31, 2020
Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	December 24, 2019	December 31, 2020
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	December 24, 2019	December 31, 2020
Vector Signal Generator	VIAVI	MTS 5800	WMNK0071690263	July 1, 2018	July 1, 2021
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR
Antenna Mast	ETS	2070-2	-	NCR	NCR
Turntable	ETS	2087	-	NCR	NCR
Mast & Table Controller	ETS/EMCO	2090	9608-1456	NCR	NCR

Table 27 Test Equipment Used



## 8 APPENDIX A - CORRECTION FACTORS

### 8.1 Correction factors for RF OATS Cable 35m ITL #1784

Frequency ( MHz)	Cable loss (dB)
10.0	0.3
20.0	0.2
50.0	-0.1
100.0	-0.6
200.0	-1.2
500.0	-2.3
1000.0	-3.6



**8.2 Correction factors for RF OATS Cable 10m**  
**ITL #1794**

Frequency(MHz)	Cable loss(dB)
10.0	-0.3
20.0	-0.3
50.0	-0.5
100.0	-0.7
200.0	-1.1
500.0	-1.8
1000.0	-2.7



**8.3 Correction factors for**

**Horn Antenna**

**Model: SWH-28  
at 1 meter range.**

<b>FREQUENCY (GHz)</b>	<b>AFE (dB /m)</b>	<b>Gain (dB1)</b>
18.0	40.3	16.1
19.0	40.3	16.3
20.0	40.3	16.1
21.0	40.3	16.3
22.0	40.4	16.8
23.0	40.5	16.4
24.0	40.5	16.6
25.0	40.5	16.7
26.0	40.6	16.4



#### 8.4 Correction factors for Horn Antenna

Model: 3115

Antenna serial number: 29845

3 meter range

f(GHz)	AF(dB/m)	GA(dB)
0.75	25	3
1G	23.5	7
1.5G	26	8
2G	29	7
2.5G	27.5	10
3G	30	10
3.5G	31.5	10
4G	32.5	9.5
4.5G	32.5	10.5
5G	33	10.5
5.5G	35	10.5
6G	36.5	9.5
6.5G	36.5	10
7G	37.5	10
7.5G	37.5	10
8G	37.5	11
8.5G	38	11
9G	37.5	11.5
9.5G	38	11.5
10G	38.5	11.5
10.5G	38.5	12
11G	38.5	12.5
11.5G	38.5	13
12G	38	13.5
12.5G	38.5	13
13G	40	12
13.5G	41	12
14G	40	13
14.5G	39	14
15G	38	15.5
15.5G	37.5	16
16G	37.5	16
16.5G	39	15
17G	40	15
17.5G	42	13.5
18G	42.5	13



**8.5 Correction factors for Log Periodic Antenna**  
**EMCO, Model 3146,**  
**Serial #9505-4081**

Frequency [MHz]	AF [dB/m]
200.0	11.47
250.0	12.06
300.0	14.77
400.0	15.77
500.0	18.01
600.0	18.84
700.0	20.93
800.0	21.27
900.0	22.44
1000.0	24.10



**8.6 Correction factors for Biconical Antenna**  
**EMCO, Model 3110B,**  
**Serial #9912-3337**

Frequency [MHz]	AF [dB/m]
30.0	14.18
35.0	13.95
40.0	12.84
45.0	11.23
50.0	11.10
60.0	10.39
70.0	9.34
80.0	9.02
90.0	9.31
100.0	8.95
120.0	11.53
140.0	12.20
160.0	12.56
180.0	13.49
200.0	15.27



**8.7 Correction factors for ACTIVE LOOP ANTENNA**

**Model 6502  
S/N 9506-2950**

f(MHz)	MAF(dBs/m)	AF(dB/m)
0.01	-33.1	18.4
0.02	-37.2	14.3
0.03	-38.2	13.3
0.05	-39.8	11.7
0.1	-40.1	11.4
0.2	-40.3	11.2
0.3	-40.3	11.2
0.5	-40.3	11.2
0.7	-40.3	11.2
1	-40.1	11.4
2	-40	11.5
3	-40	11.5
4	-40.1	11.4
5	-40.2	11.3
6	-40.4	11.1
7	-40.4	11.1
8	-40.4	11.1
9	-40.5	11
10	-40.5	11
20	-41.5	10
30	-43.5	8



### 8.8 Correction Factors for Horn Antenna Model ARA SWH-28 ITL # 1353

#### CALIBRATION DATA

3 m distance

Frequency, MHz	Measured antenna factor, dB/m <sup>1)</sup>
18000	32.4
18500	32.0
19000	32.3
19500	32.4
20000	32.3
20500	32.8
21000	32.8
21500	32.7
22000	33.1
22500	33.0
23000	33.1
23500	33.8
24000	33.5
24500	33.5
25000	33.8
25500	33.9
26000	34.2
26500	34.7

<sup>1)</sup> The antenna factor shall be added to receiver reading in dB $\mu$ V to obtain field strength in dB $\mu$ V/m.