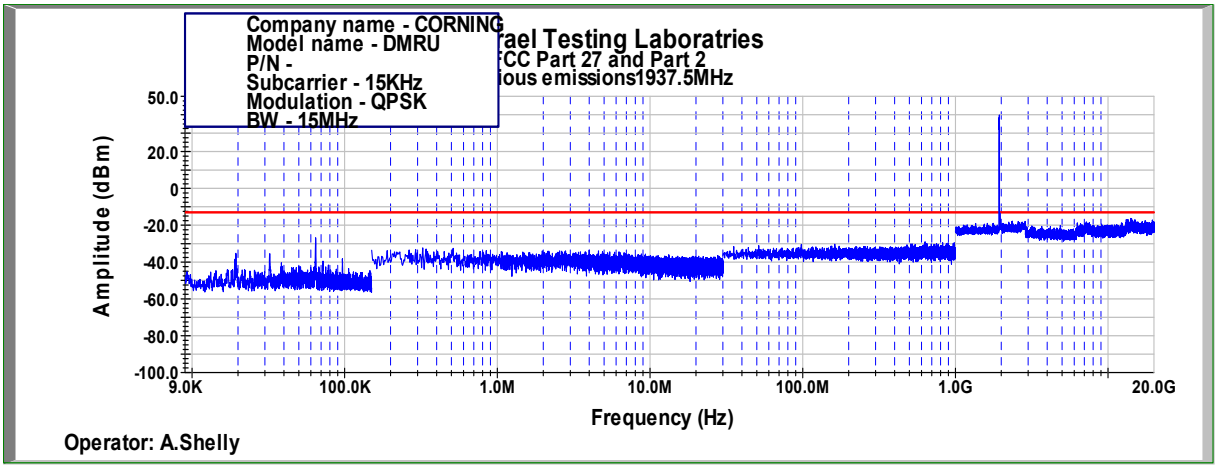

Figure 449: Spurious Emissions at Antenna Terminal QPSK, 1937.5MHz, B.W. 15MHz, Sub Carrier 15kHz

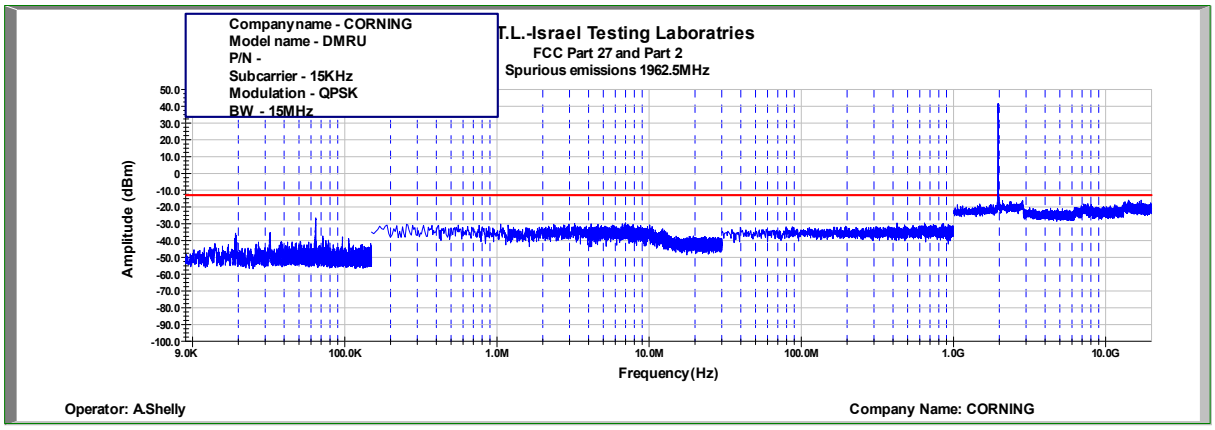

Figure 450: Spurious Emissions at Antenna Terminal QPSK, 1962.5MHz, B.W. 15MHz, Sub Carrier 15kHz

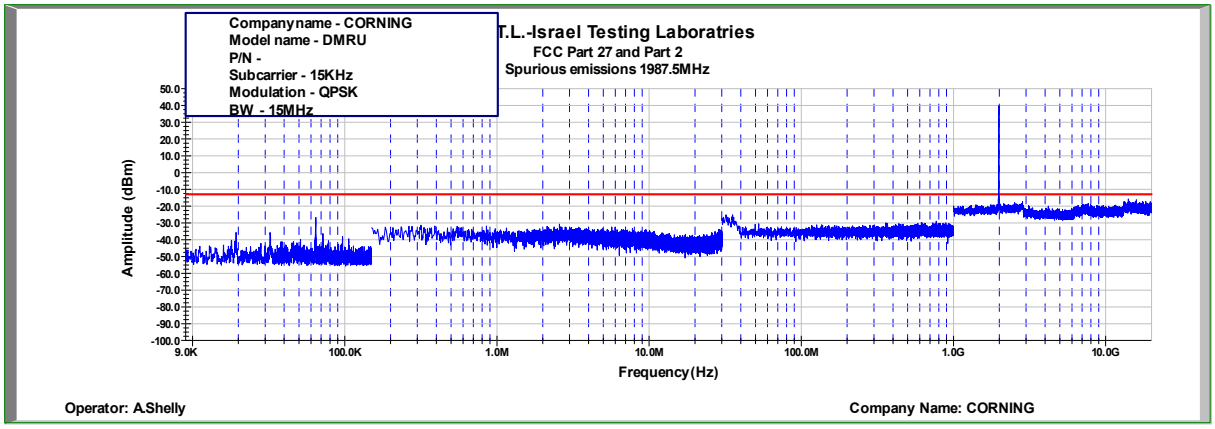

Figure 451: Spurious Emissions at Antenna Terminal QPSK, 1987.5MHz, B.W. 15MHz, Sub Carrier 15kHz

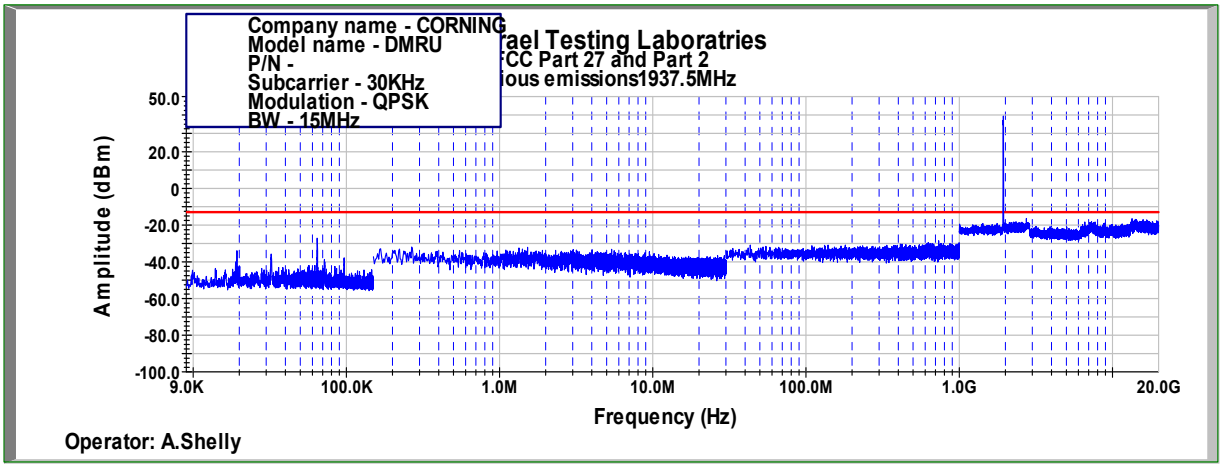

Figure 452: Spurious Emissions at Antenna Terminal QPSK, 1937.5MHz, B.W. 15MHz, Sub Carrier 30kHz

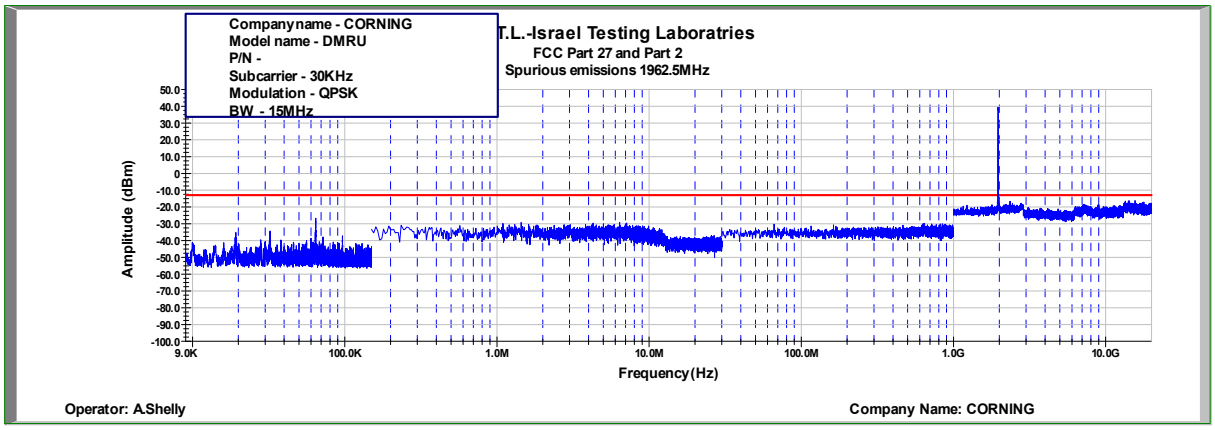

Figure 453: Spurious Emissions at Antenna Terminal QPSK, 1962.5MHz, B.W. 15MHz, Sub Carrier 30kHz

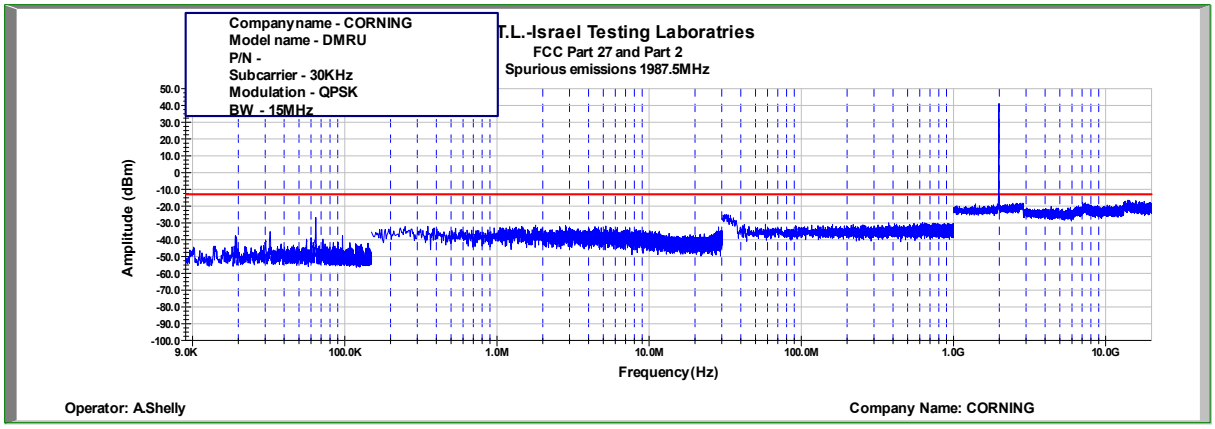

Figure 454: Spurious Emissions at Antenna Terminal QPSK, 1987.5MHz, B.W. 15MHz, Sub Carrier 30kHz

10.5 Test Equipment Used; Spurious Emissions at Antenna Terminals

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Due
EXA signal Analyzer	Keysight	UXA N9040B	MY56080119	January 31, 2020	January 31, 2022
EXG Vector Signal Generator	Agilent Technologies	N5172B	MY53051952	January 17, 2019	January 17, 2022
40 dB Attenuator	Weinschel Associates	WA 39-40-33	-	November 1, 2020	November 1, 2021
RF Coaxial Cable	Huber-Suner	SLLS210B	-	November 1, 2020	November 1, 2021

Table 39 Test Equipment Used

11 Spurious Emissions at Antenna Terminals 3G&4G&5G

11.1 Test Specification

FCC Part 24, Subpart E (24.238(a))

11.2 Test Procedure

(Temperature (22°C)/ Humidity (36%RH))

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (max loss=44dB). Scanning was performed until 20GHz

11.3 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 43+ 10 log (P) dB.

11.4 Test Results

JUDGEMENT: Passed

See additional information in Figure 455 to Figure 484.

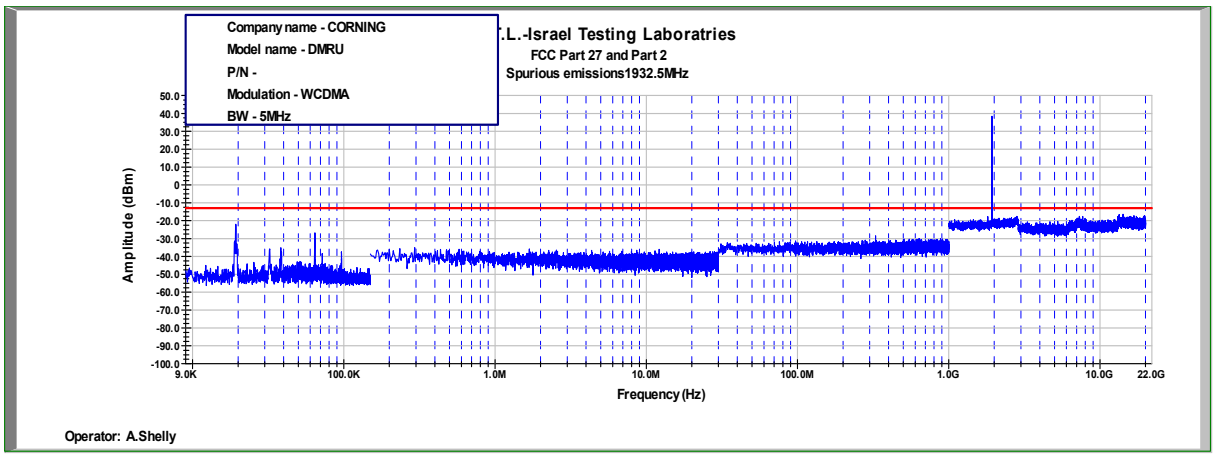

Figure 455: Spurious Emissions at Antenna Terminal WCDMA, 1932.5MHz, B.W. 5MHz – 3G

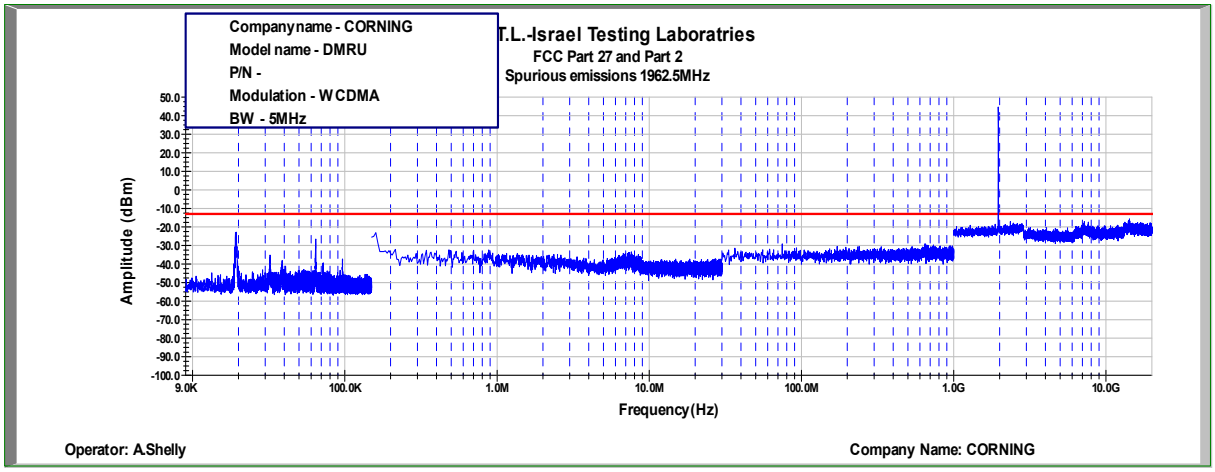

Figure 456: Spurious Emissions at Antenna Terminal WCDMA, 1962.5MHz, B.W. 5MHz – 3G

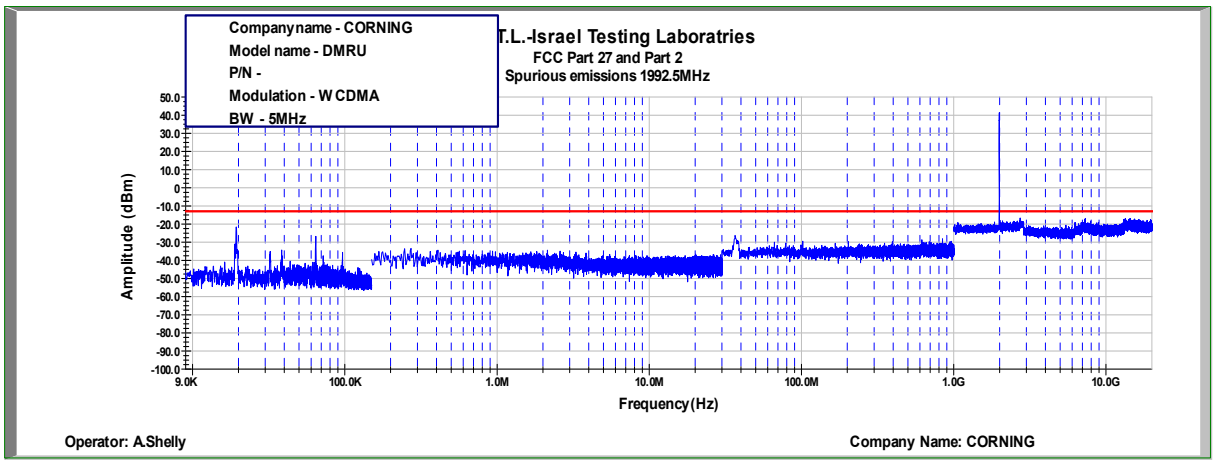

Figure 457: Spurious Emissions at Antenna Terminal WCDMA, 1992.5MHz, B.W. 5MHz- 3G

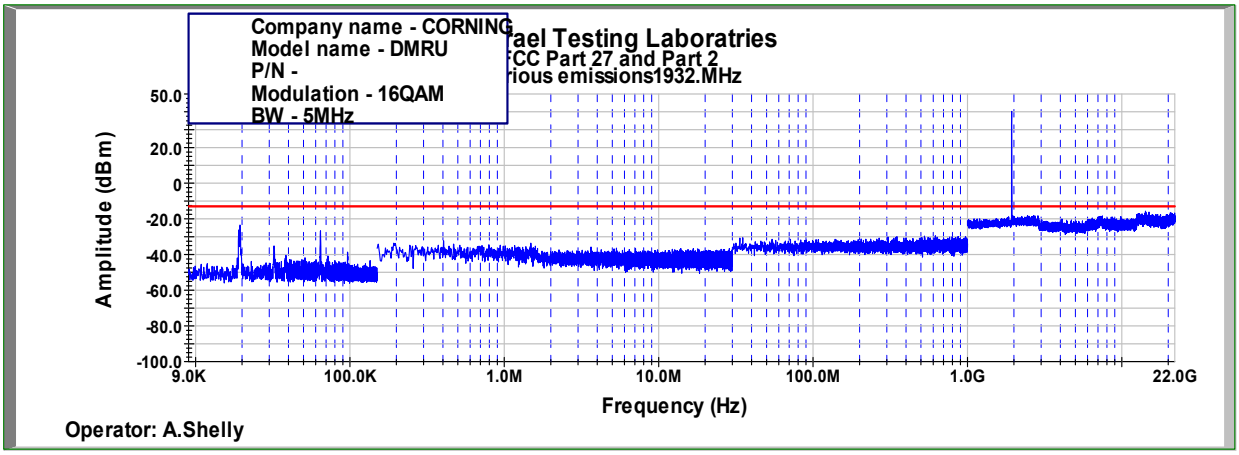

Figure 458: Spurious Emissions at Antenna Terminal 16QAM, 1932.5MHz, B.W. 5MHz

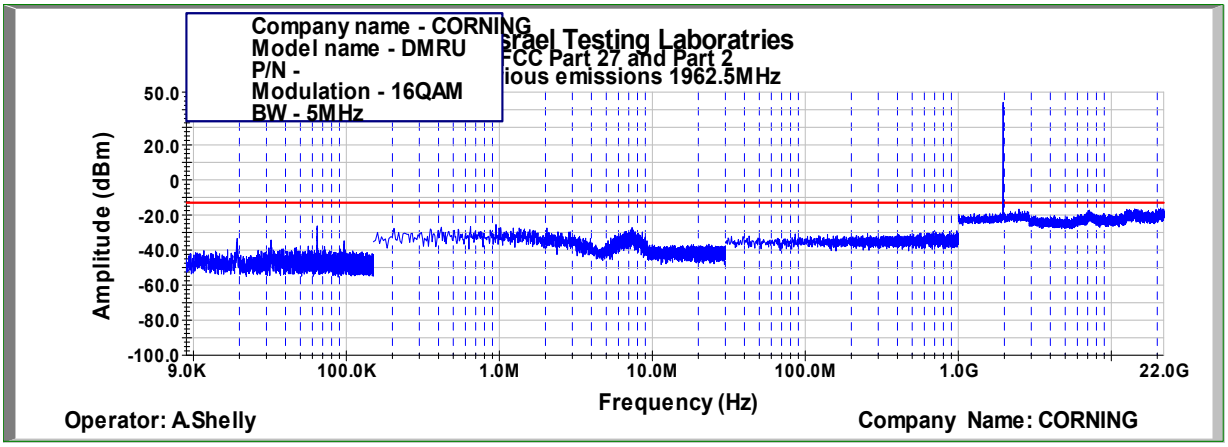

Figure 459: Spurious Emissions at Antenna Terminal 16QAM, 1962.5MHz, B.W. 5MHz

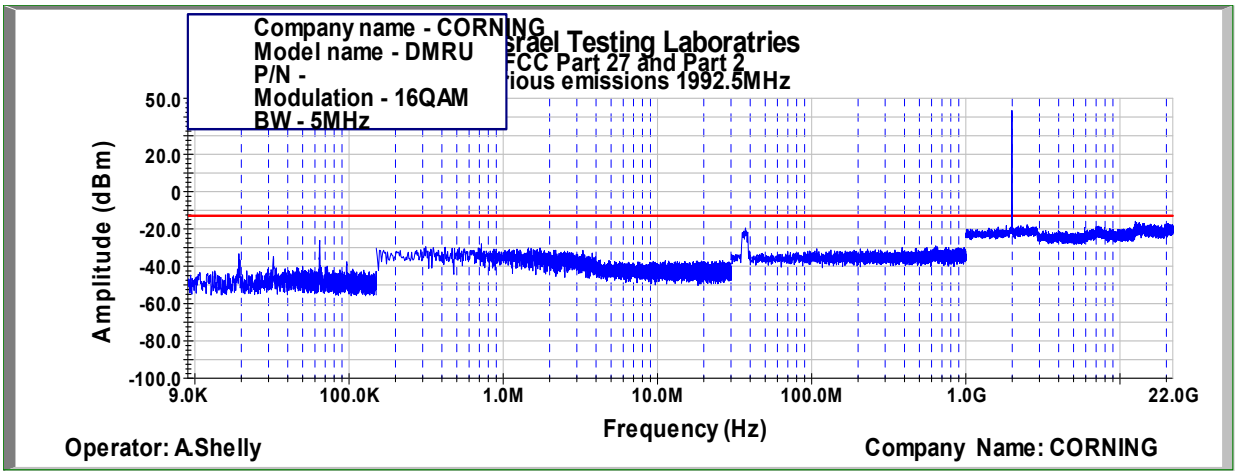

Figure 460: Spurious Emissions at Antenna Terminal 16QAM, 1992.5MHz, B.W. 5MHz

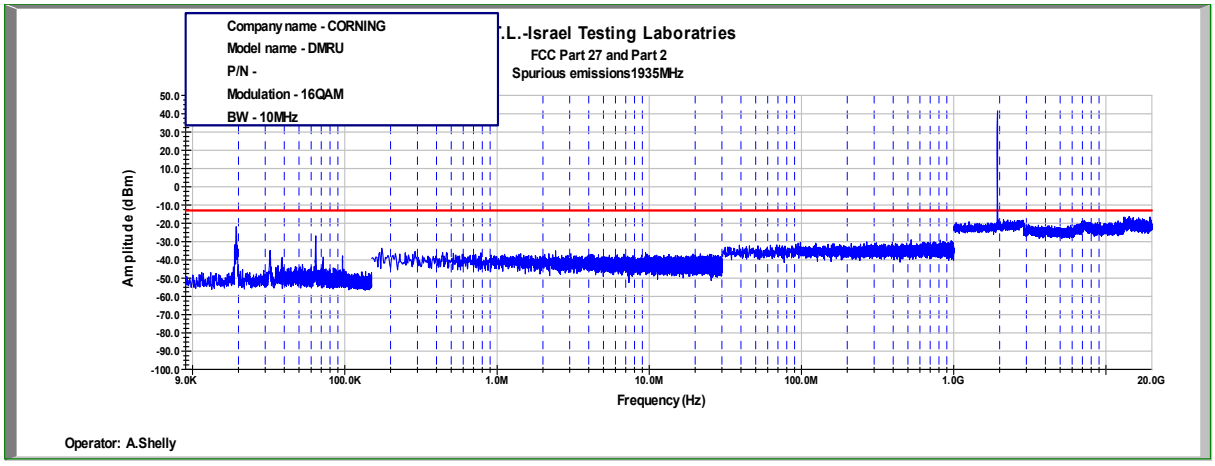

Figure 461: Spurious Emissions at Antenna Terminal 16QAM, 1935MHz, B.W. 10MHz – 4G

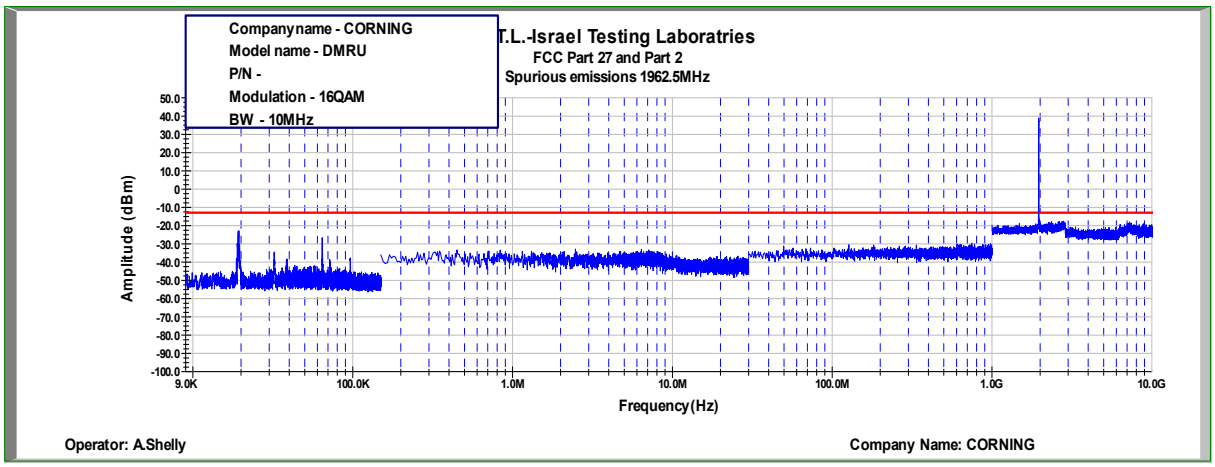

Figure 462: Spurious Emissions at Antenna Terminal 16QAM, 1962.5MHz, B.W. 10MHz – 4G

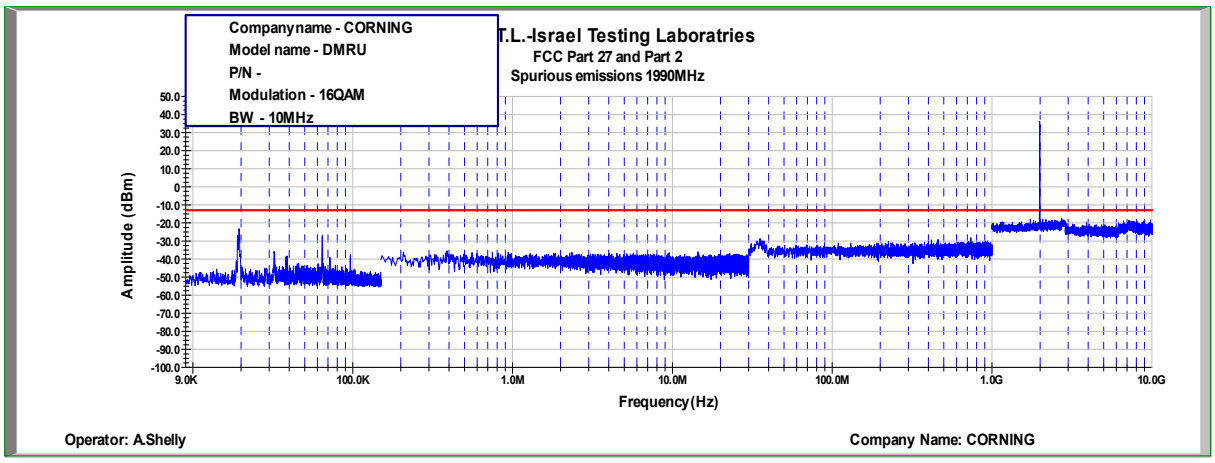

Figure 463: Spurious Emissions at Antenna Terminal 16QAM, 1990MHz, B.W. 10MHz – 4G

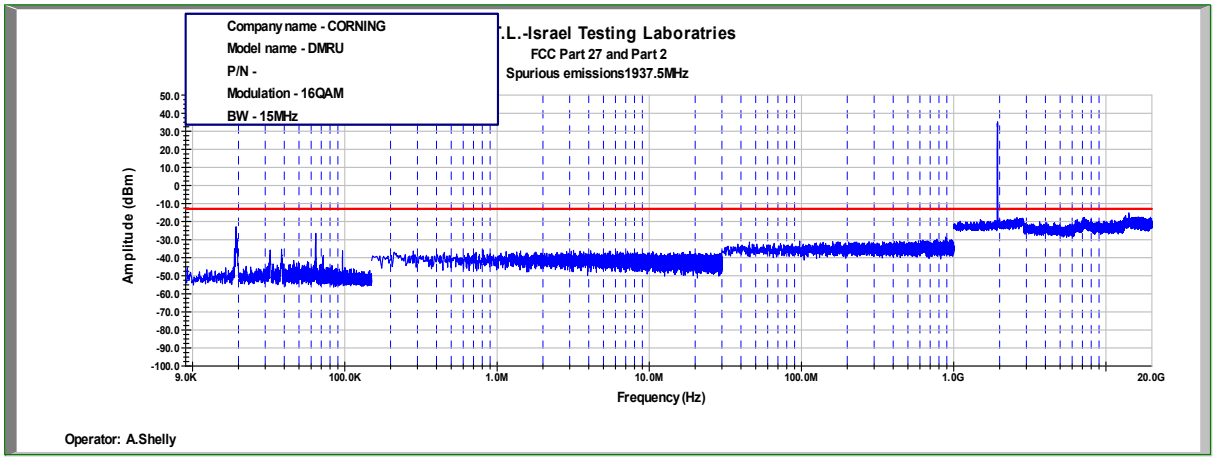

Figure 464: Spurious Emissions at Antenna Terminal 16QAM, 1937.5MHz, B.W. 15MHz – 4G

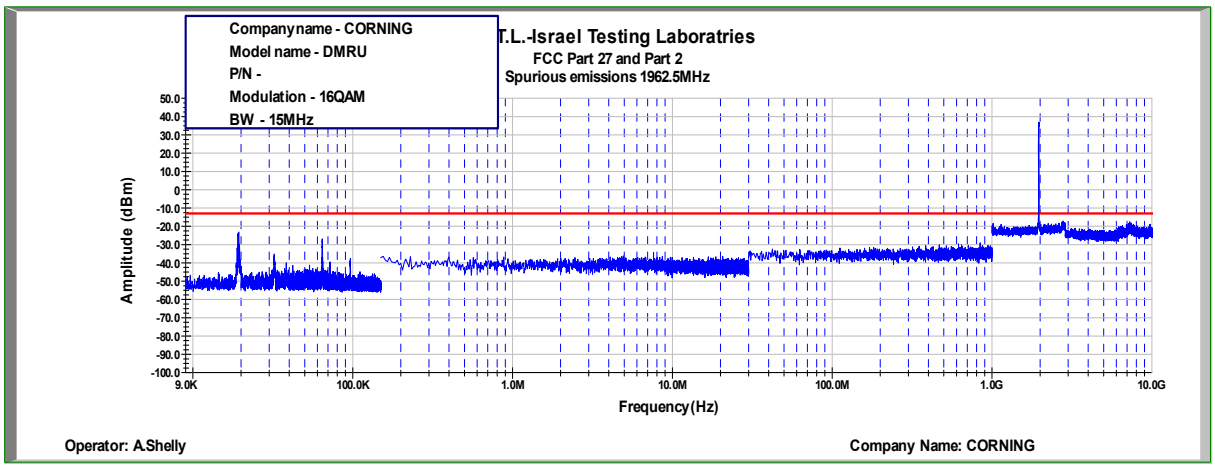

Figure 465: Spurious Emissions at Antenna Terminal 16QAM, 1962.5MHz, B.W. 15MHz – 4G

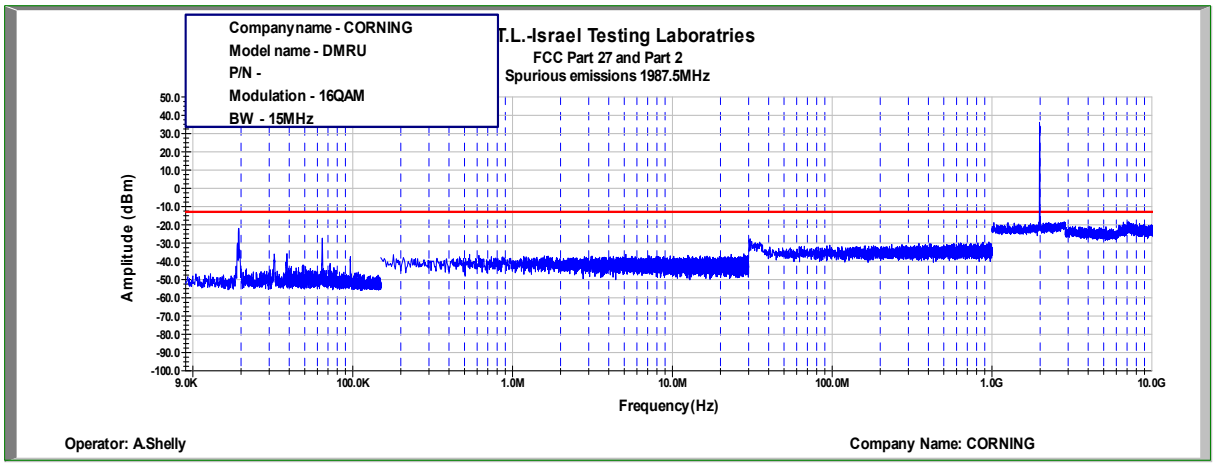

Figure 466: Spurious Emissions at Antenna Terminal 16QAM, 1987.5MHz, B.W. 15MHz – 4G

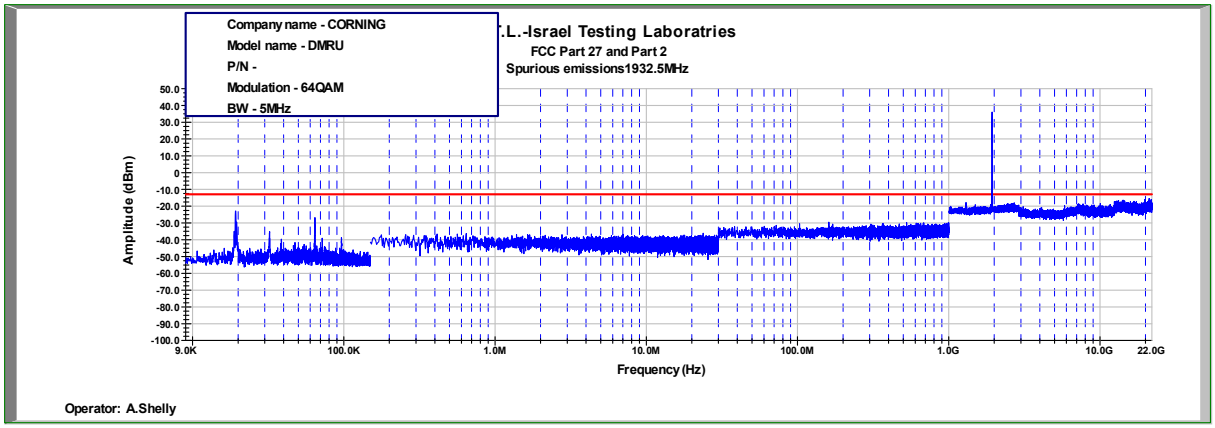

Figure 467: Spurious Emissions at Antenna Terminal 64QAM, 1932.5MHz, B.W. 5MHz – 4G

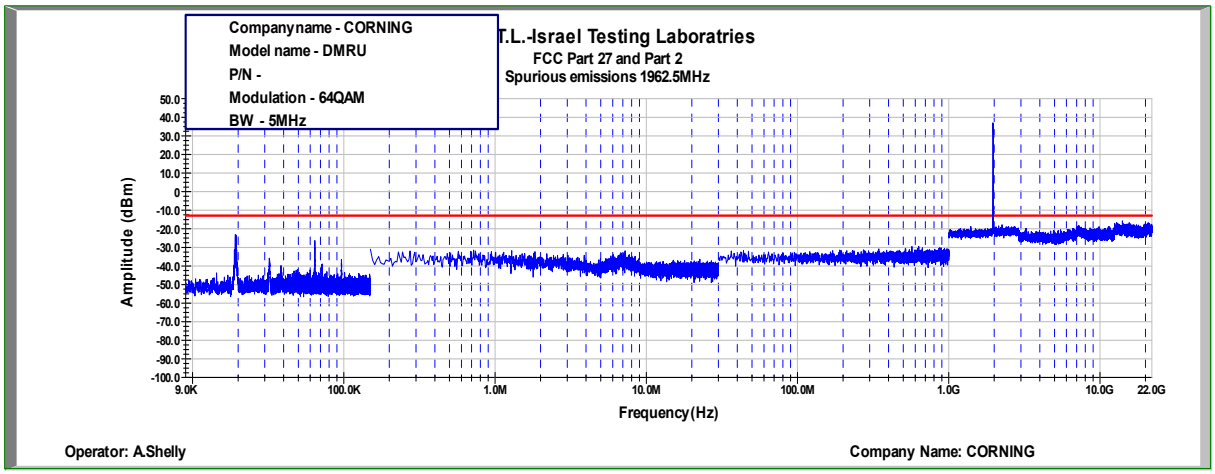

Figure 468: Spurious Emissions at Antenna Terminal 64QAM, 1962.5MHz, B.W. 5MHz – 4G

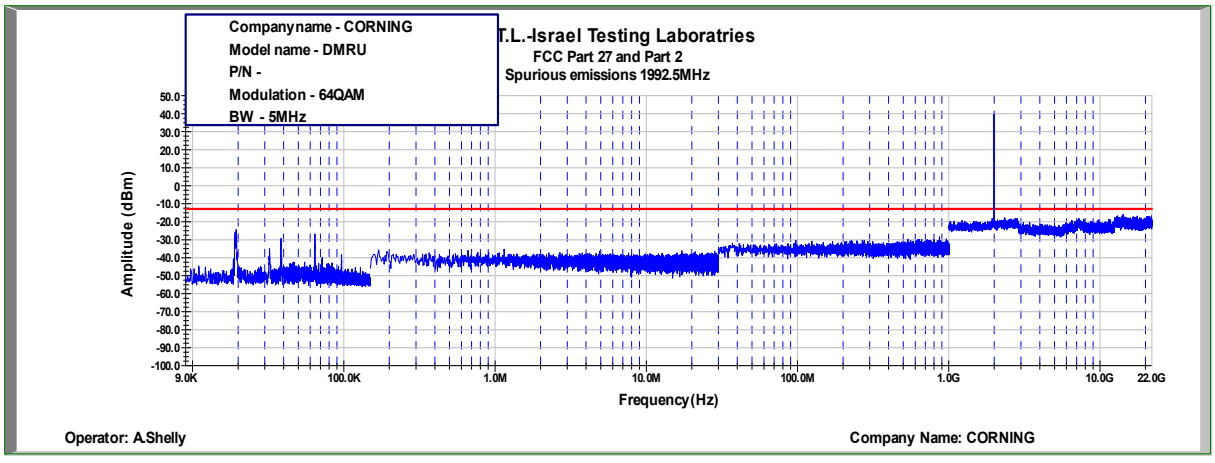

Figure 469: Spurious Emissions at Antenna Terminal 64QAM, 1992.5MHz, B.W. 5MHz – 4G

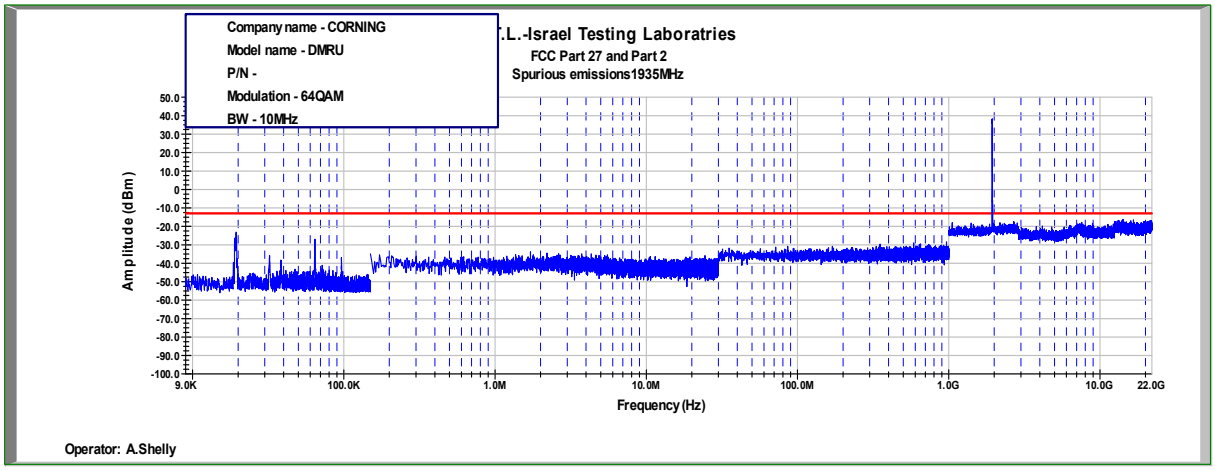

Figure 470: Spurious Emissions at Antenna Terminal 64QAM, 1935MHz, B.W. 10MHz – 4G

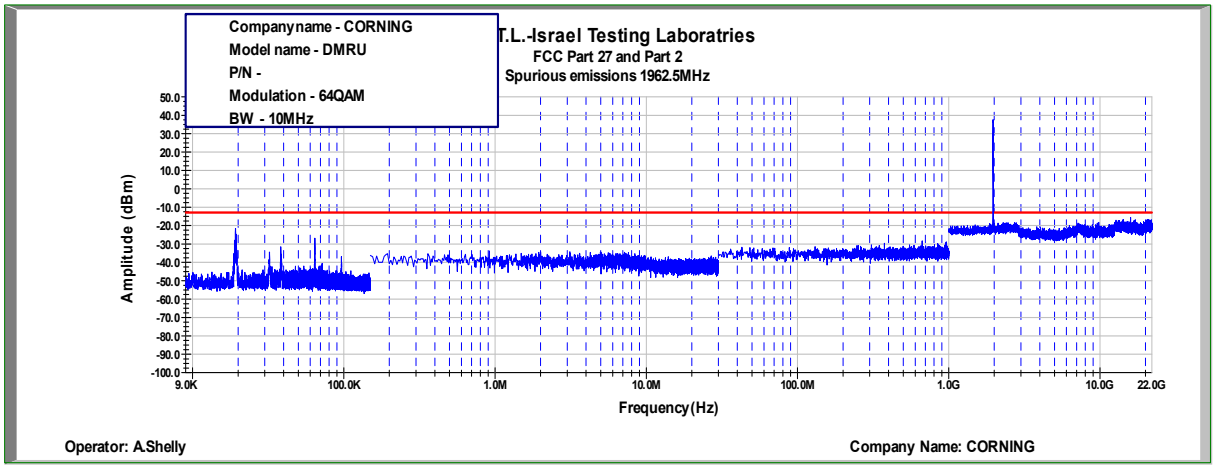

Figure 471: Spurious Emissions at Antenna Terminal 64QAM, 1962.5MHz, B.W. 10MHz – 4G

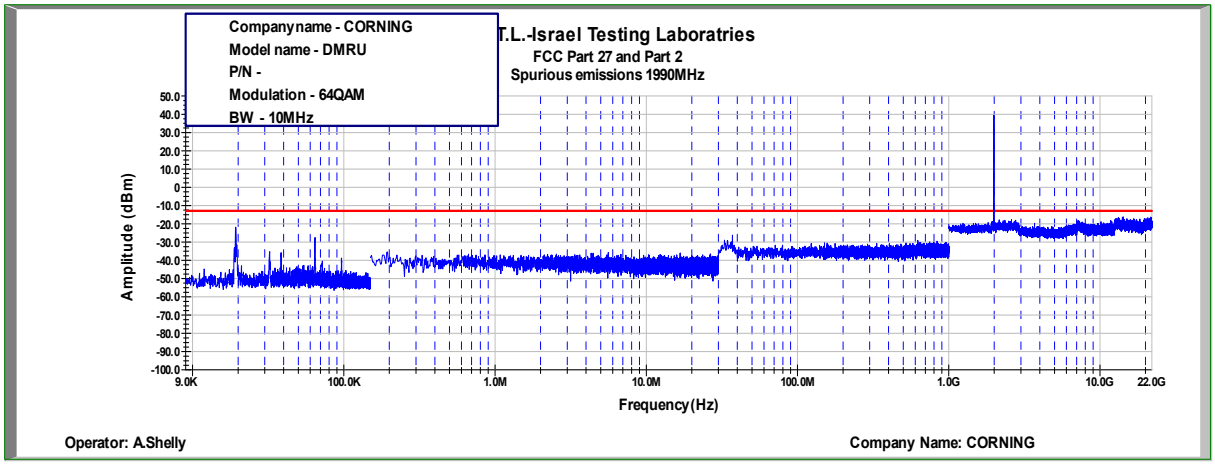

Figure 472: Spurious Emissions at Antenna Terminal 64QAM, 1990MHz, B.W. 10MHz – 4G

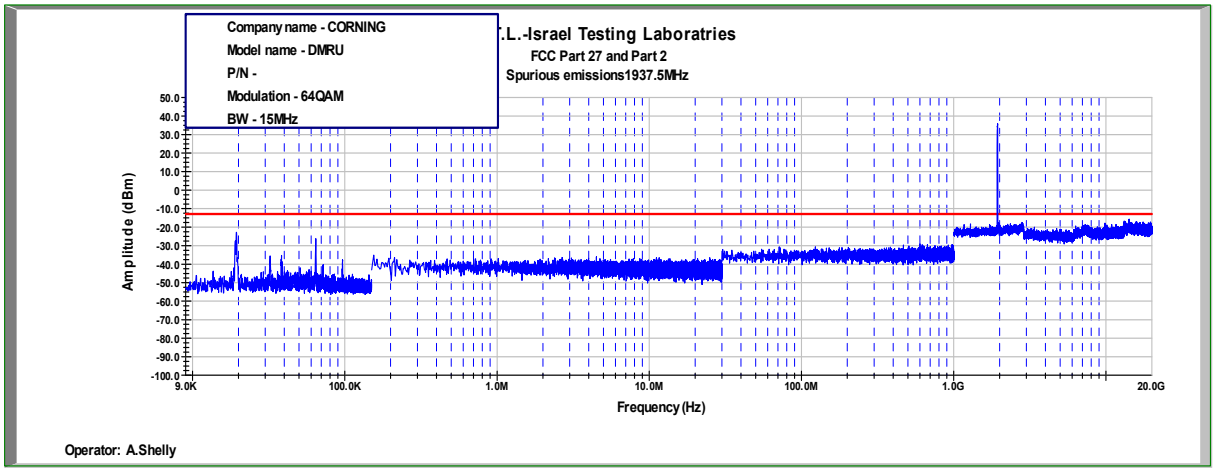

Figure 473: Spurious Emissions at Antenna Terminal 64QAM, 1937.5MHz, B.W. 15MHz – 4G

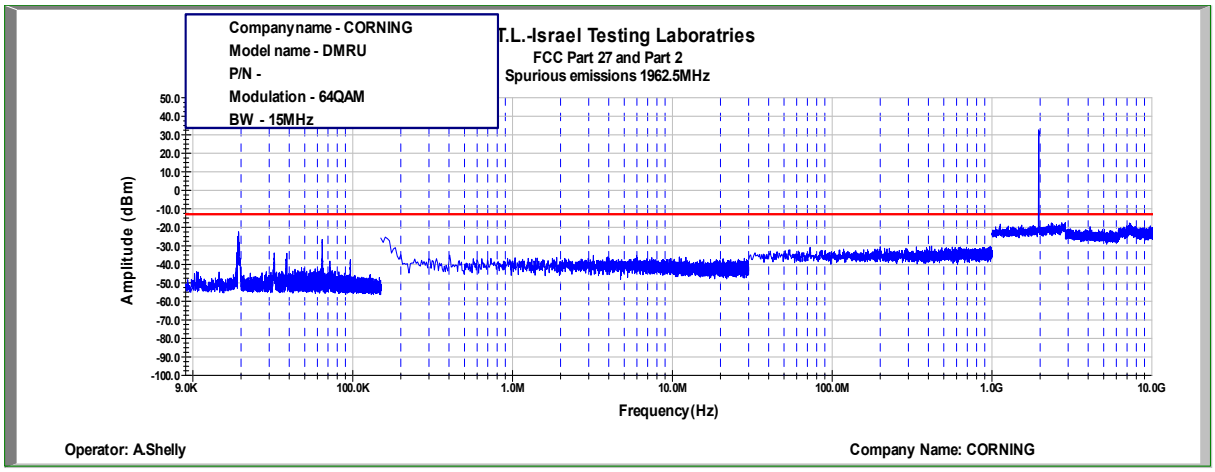

Figure 474: Spurious Emissions at Antenna Terminal 64QAM, 1962.5MHz, B.W. 15MHz – 4G

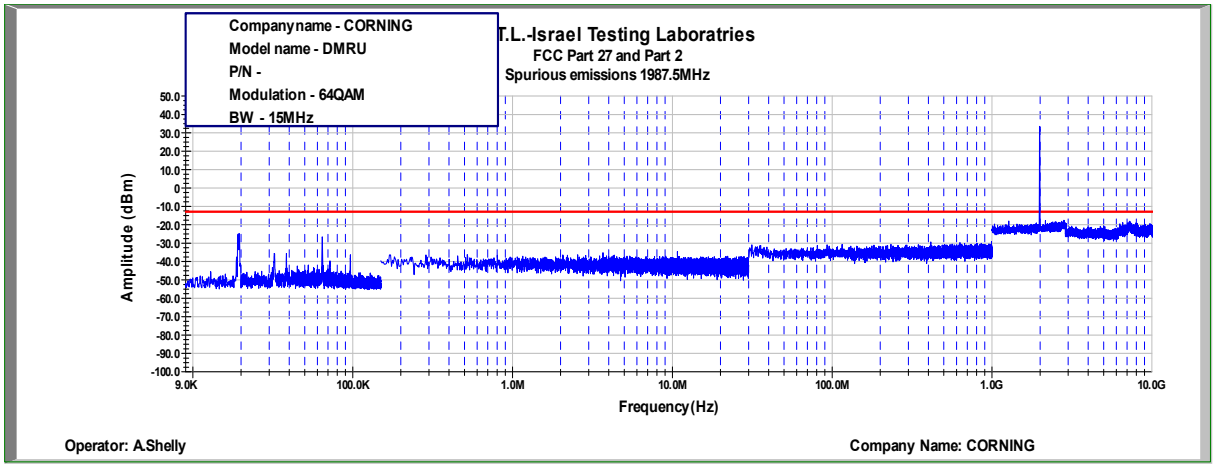

Figure 475: Spurious Emissions at Antenna Terminal 64QAM, 1987.5MHz, B.W. 15MHz – 4G

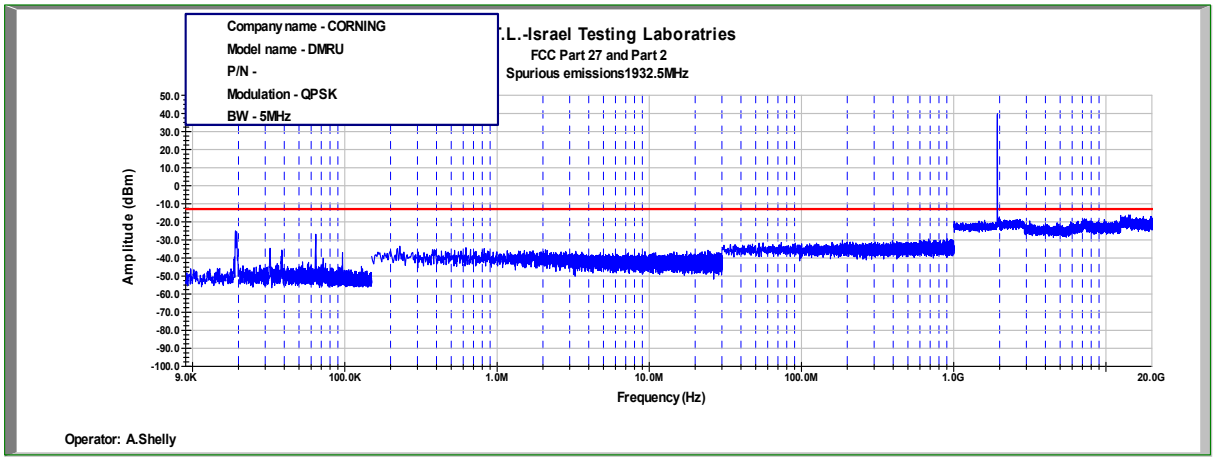

Figure 476: Spurious Emissions at Antenna Terminal QPSK, 1932.5MHz, B.W. 5MHz – 4G

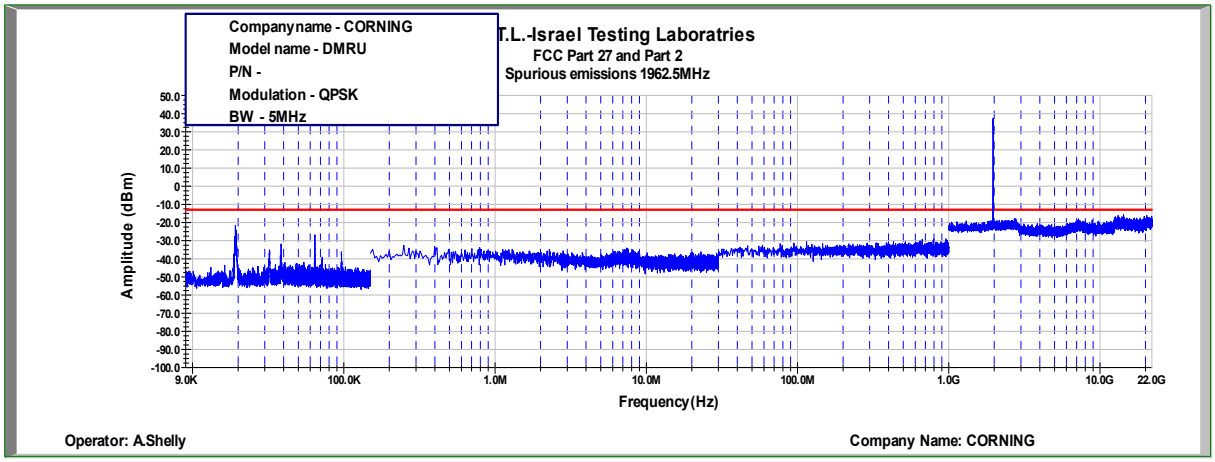

Figure 477: Spurious Emissions at Antenna Terminal QPSK, 1962.5MHz, B.W. 5MHz – 4G

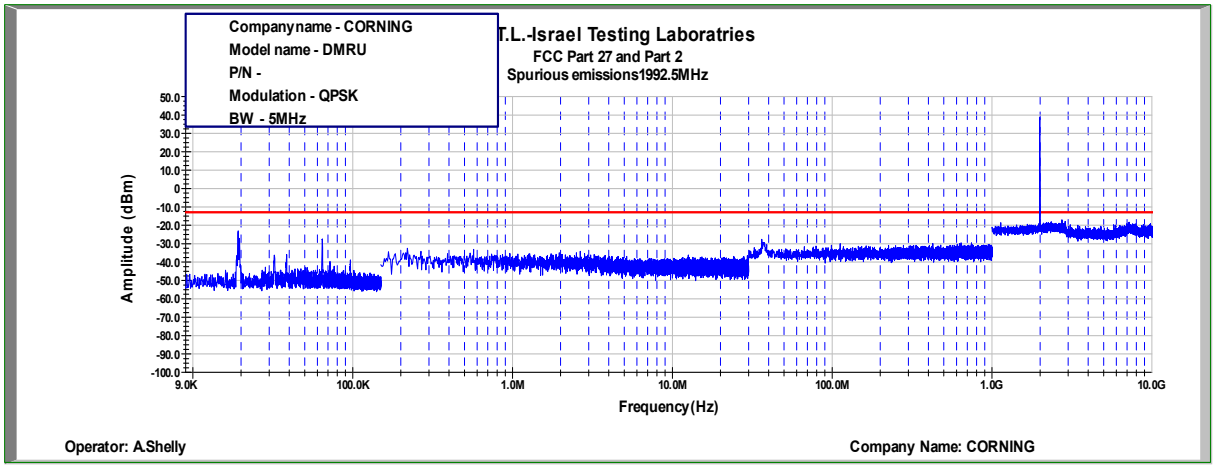

Figure 478: Spurious Emissions at Antenna Terminal QPSK, 1992.5MHz, B.W. 5MHz – 4G

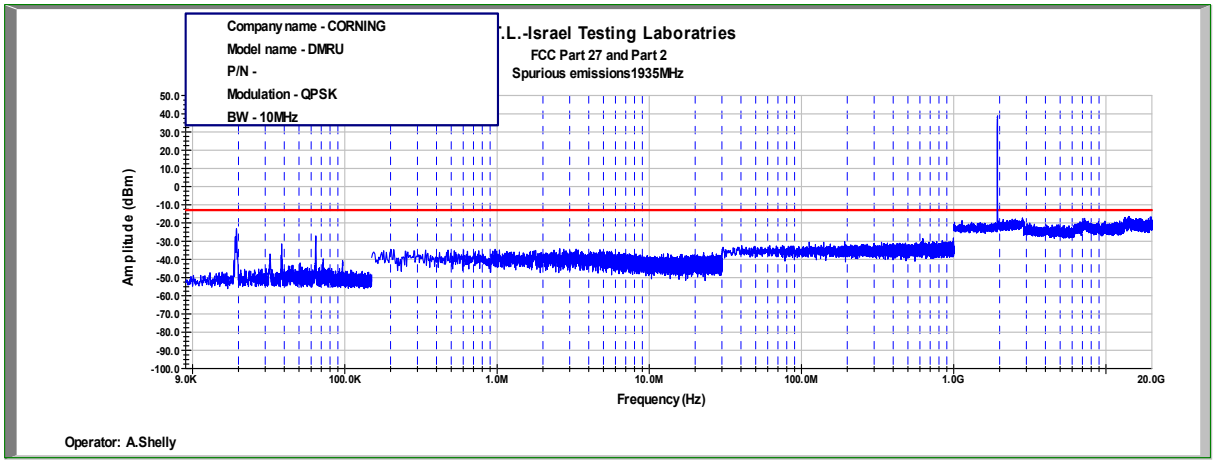

Figure 479: Spurious Emissions at Antenna Terminal QPSK, 1935MHz, B.W. 10MHz – 4G

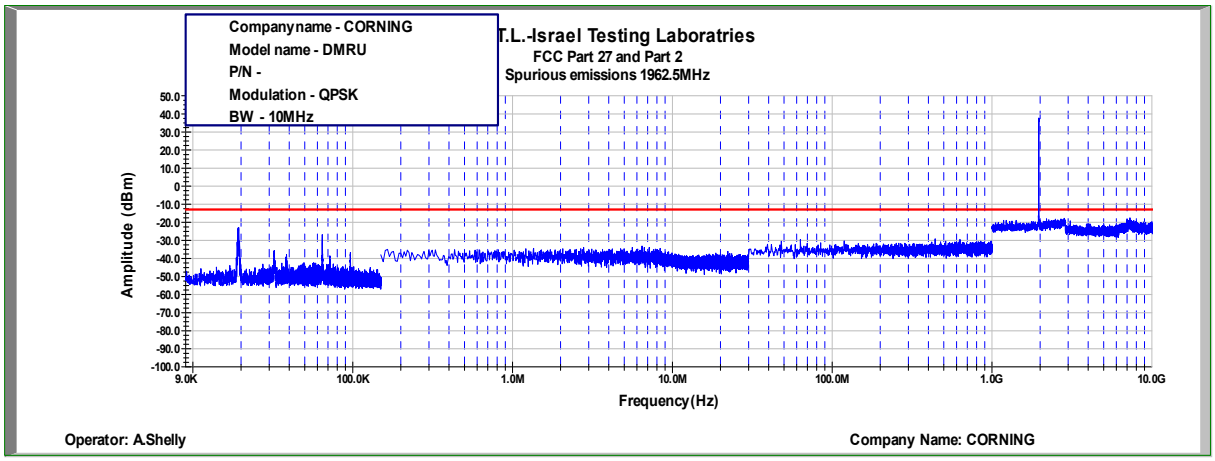

Figure 480: Spurious Emissions at Antenna Terminal QPSK, 1962.5MHz, B.W. 10MHz – 4G

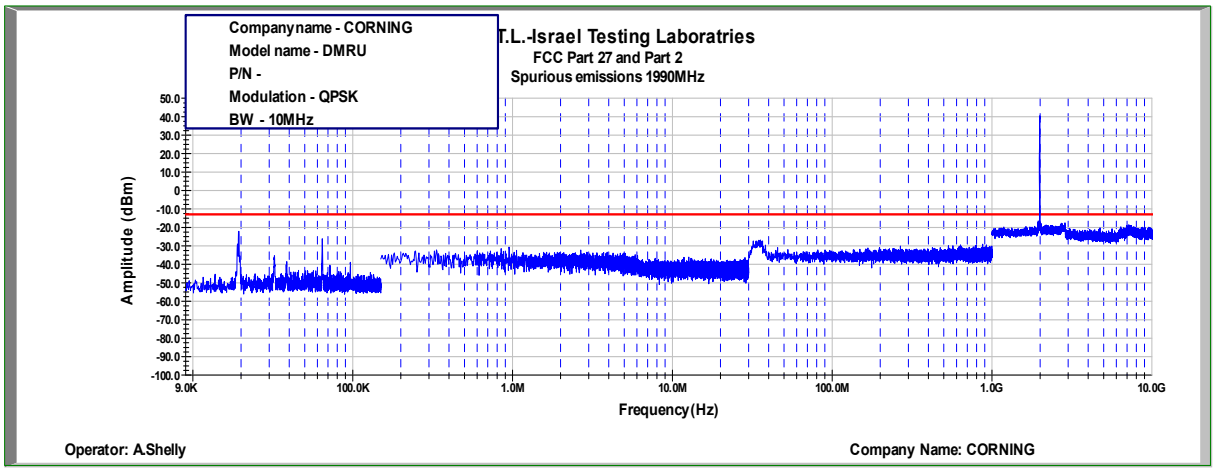

Figure 481: Spurious Emissions at Antenna Terminal QPSK, 1990MHz, B.W. 10MHz – 4G

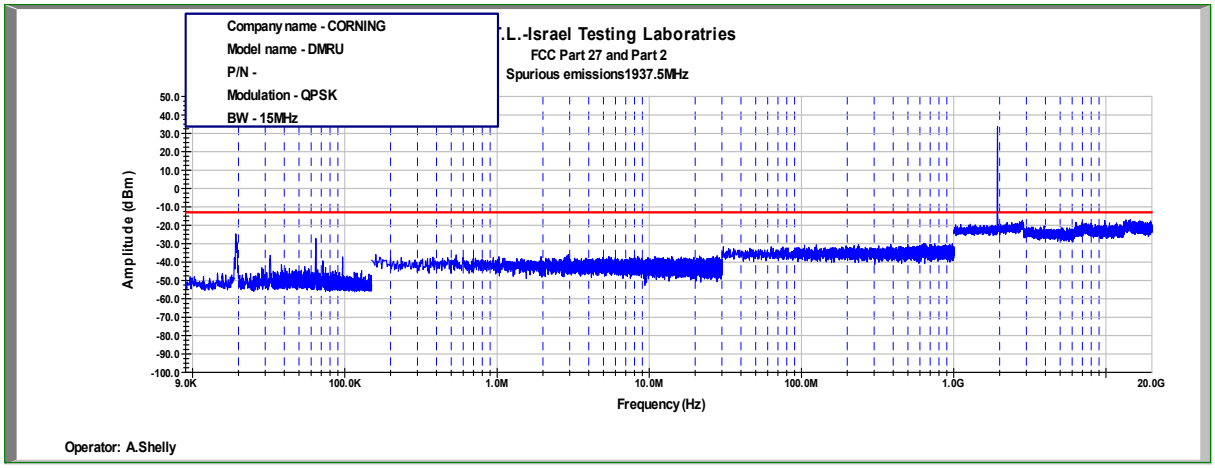

Figure 482: Spurious Emissions at Antenna Terminal QPSK, 1937.5MHz, B.W. 15MHz – 4G

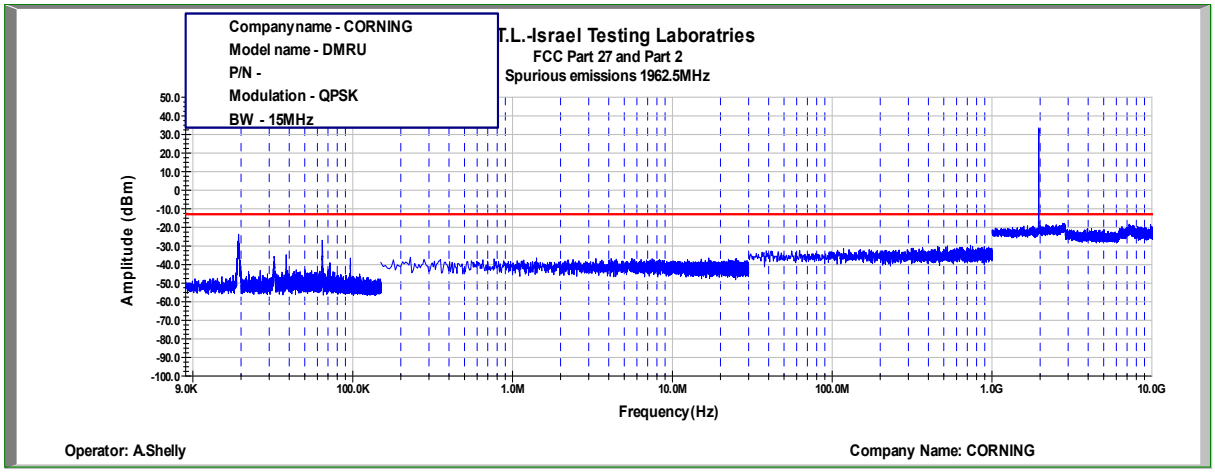

Figure 483: Spurious Emissions at Antenna Terminal QPSK, 1962.5MHz, B.W. 15MHz – 4G

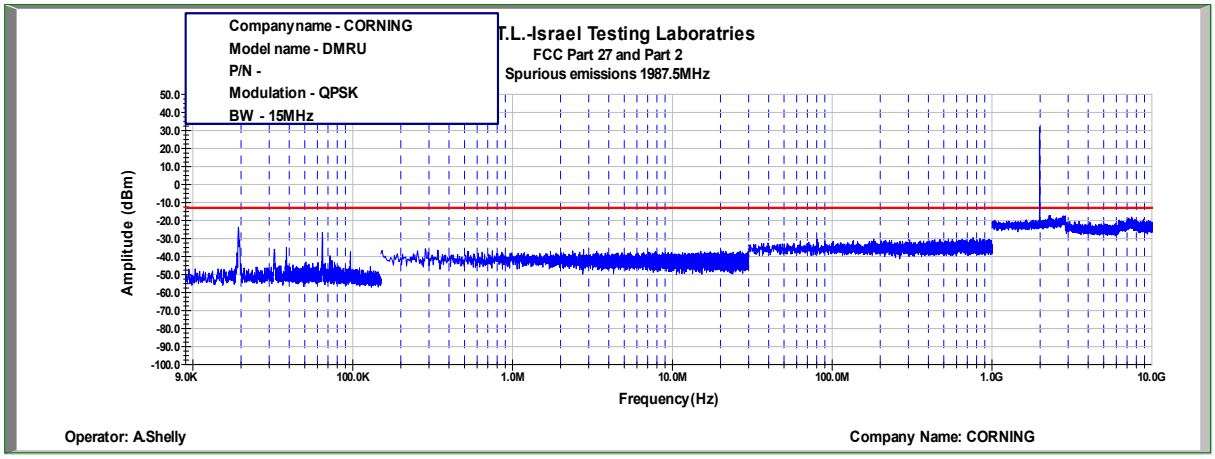

Figure 484: Spurious Emissions at Antenna Terminal QPSK, 1987.5MHz, B.W. 15MHz – 4G

11.5 Test Equipment Used; Spurious Emissions at Antenna Terminals

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Due
EXA signal Analyzer	Keysight	UXA N9040B	MY56080119	January 31, 2020	January 31, 2022
EXG Vector Signal Generator	Agilent Technologies	N5172B	MY53051952	January 17, 2019	January 17, 2022
40 dB Attenuator	Weinschel Associates	WA 39-40-33	-	November 1, 2020	November 1, 2021
RF Coaxial Cable	Huber-Suner	SLLS210B	-	November 1, 2020	November 1, 2021

Table 40 Test Equipment Used

12 Spurious Radiated Emission 3G&4G&5G

12.1 Test Specification

FCC Part 24, Subpart E (24.238(a))

12.2 Test Procedure

(Temperature (20°C)/ Humidity (49%RH))

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

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-20.0.0GHz:

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.

RMS detector was used for this test.

Testing was performed when the RF port was connected to 50 Ω termination

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

Only the highest spurious radiation value describes in the table results

12.3 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 + 10 log (P) dB, yielding –13dBm

12.4 Test Results

JUDGEMENT: Passed

Carrier Channel	Freq.	Antenna Pol.	Maximum Peak Level	Signal Generator RF Output	Cable Loss	Antenna Gain	Effective Radiated Power Level	Limit	Margin
(MHz)	(MHz)	(V/H)	(dBµV/m)	(dBm)	(dB)	(dBd)	(dBm)	(dBm)	(dB)
1932.5 (WCDMA/5M)	3865.0	V	81.0	-24.0	1.0	7.4	-17.6	-13.0	-4.6
	3865.0	H	70.8	-34.0	1.0	7.4	-27.6	-13.0	-14.6
	5797.5	V	70.1	-36.9	1.0	7.4	-30.5	-13.0	-17.5
	5797.5	H	67.7	-33.0	1.0	7.4	-26.6	-13.0	-13.6
1962.5 (WCDMA/5M)	3925.0	V	82.0	-23.0	1.0	7.4	-16.6	-13.0	-3.6
	2925.0	H	73.2	-32.0	1.0	7.4	-25.6	-13.0	-12.6
	5887.5	V	71.3	-35.0	1.0	7.4	-28.6	-13.0	-15.6
	5887.5	H	65.5	-35.0	1.0	7.4	-28.6	-13.0	-15.6
1992.5 (WCDMA/5M)	3985.0	V	82.9	-22.0	1.0	7.4	-15.6	-13.0	-2.6
	3985.0	H	75.8	-30.0	1.0	7.4	-23.6	-13.0	-10.6
	5777.5	V	72.8	-34.0	1.0	7.4	-27.6	-13.0	-14.6
	5777.5	H	64.7	-35.0	1.0	7.4	-28.6	-13.0	-15.6

Figure 485 Spurious Emission tabular, 3G mode

Carrier Channel	Freq.	Antenna Pol.	Maximum Peak Level	Signal Generator RF Output	Cable Loss	Antenna Gain	Effective Radiated Power Level	Limit	Margin
(MHz)	(MHz)	(V/H)	(dBµV/m)	(dBm)	(dB)	(dBd)	(dBm)	(dBm)	(dB)
1932.5 (QPSK/5M)	3865.0	V	84.1	-21.0	1.0	7.4	-14.6	-13.0	-1.6
	3865.0	H	75.8	-30.0	1.0	7.4	-23.6	-13.0	-10.6
	5797.5	V	73.3	-34.0	1.0	7.4	-27.6	-13.0	-14.6
	5797.5	H	69.1	-32.0	1.0	7.4	-25.6	-13.0	-12.6
1962.5 (QPSK/5M)	3925.0	V	84.5	-21.0	1.0	7.4	-14.6	-13.0	-1.6.0
	2925.0	H	74.0	-31.0	1.0	7.4	-24.6	-13.0	-11.6
	5887.5	V	72.9	-34.0	1.0	7.4	-27.6	-13.0	-14.6
	5887.5	H	69.0	-32.0	1.0	7.4	-25.6	-13.0	-12.6
1962.5 (QPSK/5M)	3925.0	V	82.5	-23.0	1.0	7.4	-16.6	-13.0	-3.6
	2925.0	H	73.1	-32.0	1.0	7.4	-25.6	-13.0	-12.6
	5887.5	V	70.5	-36.9	1.0	7.4	-30.5	-13.0	-17.5
	5887.5	H	63.9	-37.0	1.0	7.4	-30.6	-13.0	-17.6

Figure 486 Spurious Emission tabular, 4G mode

Carrier Channel	Freq.	Antenna Pol.	Maximum Peak Level	Signal Generator RF Output	Cable Loss	Antenna Gain	Effective Radiated Power Level	Limit	Margin
(MHz)	(MHz)	(V/H)	(dBµV/m)	(dBm)	(dB)	(dBd)	(dBm)	(dBm)	(dB)
1962.5 (QPSK/5M)	3925.0	V	82.3	-23.0	1.0	7.4	-16.6	-13.0	-3.6
	2925.0	H	73.2	-32.0	1.0	7.4	-25.6	-13.0	-12.6
	5887.5	V	71.3	-35.0	1.0	7.4	-28.6	-13.0	-15.6
	5887.5	H	68.1	-33.0	1.0	7.4	-26.6	-13.0	-13.6
1962.5 (QPSK/5M)	3925.0	V	82.5	-23.0	1.0	7.4	-16.6	-13.0	-3.6
	2925.0	H	73.9	-32.0	1.0	7.4	-25.6	-13.0	-12.6
	5887.5	V	72.0	-35.0	1.0	7.4	-28.6	-13.0	-15.6
	5887.5	H	67.2	-33.0	1.0	7.4	-26.6	-13.0	-13.6
1932.5 (256QAM/5M)	3865.0	V	82.5	-23.0	1.0	7.4	-16.6	-13.0	-3.6
	3865.0	H	74.9	-30.0	1.0	7.4	-23.6	-13.0	-10.6
	5797.5	V	72.0	-35.0	1.0	7.4	-28.6	-13.0	-15.6
	5797.5	H	66.2	-35.0	1.0	7.4	-28.6	-13.0	-15.6

Figure 487 Spurious Emission tabular, 5G mode

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Amp" includes correction factor.

** "Correction Factor" = Antenna Factor + Cable Loss- Low Noise Amplifier Gain*

12.5 Test Instrumentation Used; Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Due
EMI Receiver	HP	8542E	3906A00276	March 11, 2020	March 31, 2021
RF Filter Section	HP	85420E	3705A00248	March 11, 2020	March 31, 2021
EMI Receiver	R&S	ESCI7	100724	March 9, 2020	March 31, 2021
Spectrum Analyzer	HP	8593EM	3826A00265	March 9, 2020	March 31, 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
Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	August 23, 2020	August 31, 2021
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 24, 2020	August 31, 2021
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 41 Test Equipment Used

13 Out-of-Band Rejection

13.1 Test Specification

KDB 935210 D05 v01r04, Section 3.3

13.2 Test Procedure

(Temperature (21°C)/ Humidity (35%RH))

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (max Loss= 41.1dB).

The signal and spectrum analyzer frequency range was set to ±250% of the passband, Dwell time set to approximately 10msec.

RBW was set between 1% to 5% of the E.U.T passband and VBW set to ≥3*RBW.

13.3 Test Limit

N/A

13.4 Test Results

JUDGEMENT: Passed

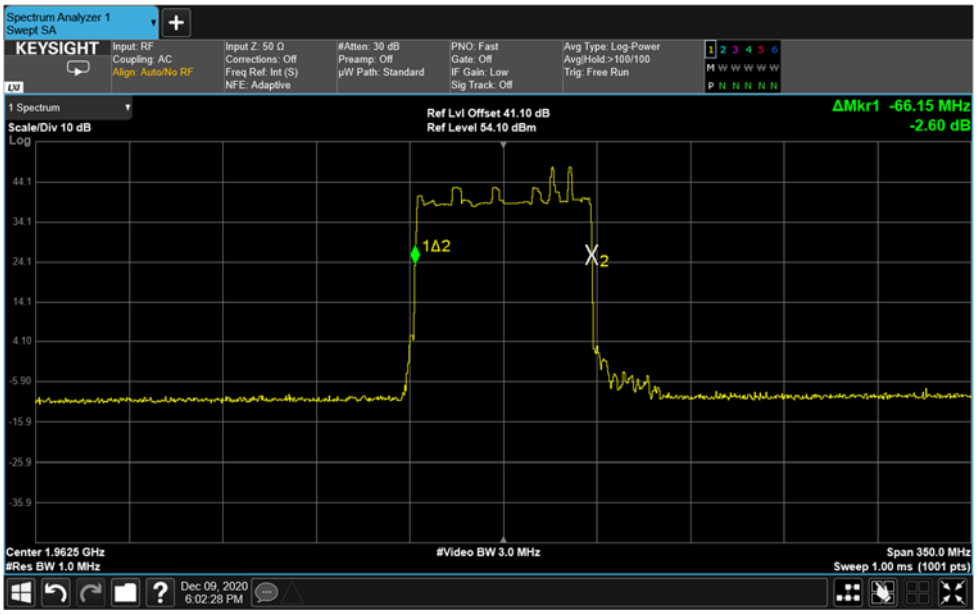

Figure 488. — Out-of-Band Rejection Plot

13.5 Test Equipment Used; Out-of-Band Rejection

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Due
EXA signal Analyzer	Keysight	UXA N9040B	MY56080119	January 31, 2020	January 31, 2022
EXG Vector Signal Generator	Agilent Technologies	N5172B	MY53051952	January 17, 2019	January 17, 2022
40 dB Attenuator	Weinschel Associates	WA 39-40-33	-	November 1, 2020	November 1, 2021
RF Coaxial Cable	Huber-Suner	SLLS210B	-	November 1, 2020	November 1, 2021

Table 42 Test Equipment Used

14 APPENDIX A - CORRECTION FACTORS

14.1 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

14.2 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

14.3 Correction factors for Horn Antenna

Model: SWH-28
at 1 meter range.

FREQUENCY (GHz)	AFE (dB /m)	Gain (dB1)
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

14.4 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

14.5 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

14.6 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

14.7 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