7.9. Maximum peak output power

7.9.1. Requirements:

The maximum peak output power shall not exceed 1 Watt as required in sec. 15.247 (b). 15.247 (b) (4): The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi. Applying the restrictions from (c)(1)(ii), the conducted output poweris derived as follows:

- The maximum aggregate peak output limit is 30 dBm.
- The maximum peak output limit for each transmit output for each beam is $30 - 10*\log_{10}(6)=22.2$ dBm.

7.9.2. Test procedure:

The measurements were performed in normal (transmitting) mode of operation for carrier (channel) frequency at low, middle and the high of the 5.740-5.835 GHz frequency range at each transmit output that reflect to the worst test results.
Additionally, combined maximum peak output power was calculated and presented in table 10.

7.9.3. Test results:

All test results met the requirements.
The summaries of Peak Power measurements are shown in Tables 8-10.

Frequency MHz	Rate Mbps	Modulation mode	Output 1 Peak Power [dBm]	Output 2 Peak Power [dBm]	Output 3 Peak Power [dBm]	FCC Limit Per 15.247(b) [dBm]	Calculated Limit [dBm]	Margin [dB] Output 1	Plot number	Margin [dB] Output 2	Plot number	Margin [dB] Output 3	Plot number
5740	6	802.11g	19.17	19.51	19.27	30	22.2	3.03	70	2.69	71	2.93	76
5790	6	802.11g	18.47	19.00	18.44	30	22.2	3.73	72	3.2	73	3.76	78
5835	6	802.11g	18.69	19.36	19.24	30	22.2	3.51	74	2.84	75	2.96	80

Table 8.
Peak Power (Outputs 1-3) test results.

Frequency MHz	Rate Mbps	Modulation mode	Output 4 Peak Power [dBm]	Output 5 Peak Power [dBm]	Output 6 Peak Power [dBm]	FCC Limit Per 15.247(b) [dBm]	Calculated Limit [dBm]	Margin [dB] Output 4	Plot number	Margin [dB] Output 5	Plot number	Margin [dB] Output 6	Plot number
5740	6	802.11g	19.45	19.35	19.14	30	22.2	2.75	77	2.85	82	3.06	83
5790	6	802.11g	18.67	18.66	17.93	30	22.2	3.53	79	3.54	84	4.27	85
5835	6	802.11g	18.75	18.63	18.48	30	22.2	3.45	81	3.57	86	3.72	87

Table 9.
Peak Power (Outputs 4-6) test results.

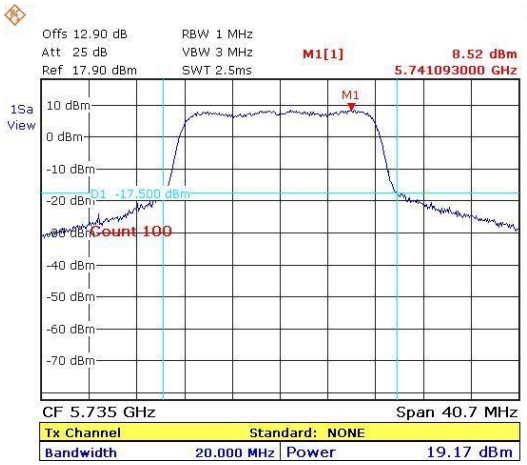
Frequency MHz	Rate Mbps	Modulation mode	FCC Limit Per 15.247(b) [dBm]	FCC Limit Per 15.247(b) [W]	Calculated Combined (max) Output *, Peak Power [W]	Margin [W]
5740	6	802.11g	30	1	0.513	0.487
5790	6	802.11g	30	1	0.429	0.571
5835	6	802.11g	30	1	0.463	0.537

Table 10.
Peak Power (combined output) test results.

(*) - Calculated Combined (max) Output, Peak Power [W] is the sum of the measured Power from all Output terminals, where each result (output power from separate output terminal) mathematically conversed from Logarithm to linear units. The results were present in Watt.
For example, the calculation for 5740 MHz frequency is the following:

1. 19.17dBm = 0.083W; 19.51dBm = 0.089W; 19.27dBm = 0.085W; 19.45dBm = 0.088W; 19.35dBm = 0.086W; 19.14dBm = 0.082W.
2. 0.083+0.089+0.085+0.088+0.086+0.082=0.513[W]

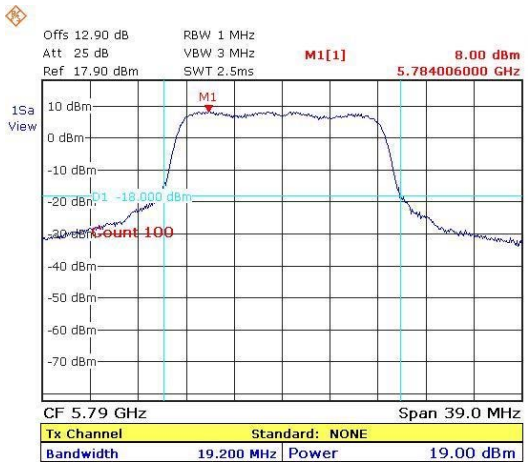
Test Report No.: 8912307342 **Page 39 of 51 Pages**
Title: Test on 5.8 GHz Band Outdoor WiFi (802.11b/g) Wireless Base Station
Model: WBS-5800 **FCC ID: UGM-WBS5800-2**



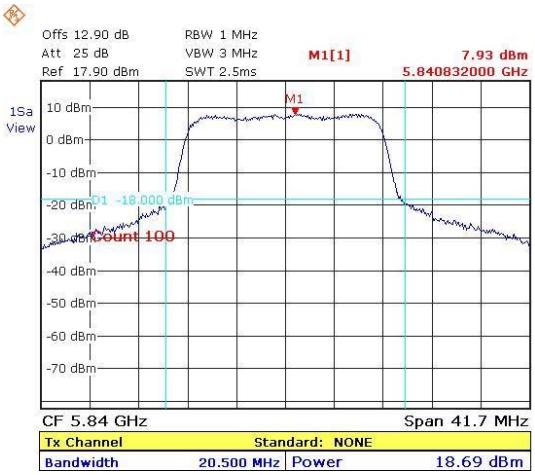
Plot # 70. Output 1 peak power. Lower frequency. 6Mbps rate.

Plot # 71. Output 2 peak power. Lower frequency. 6Mbps rate.

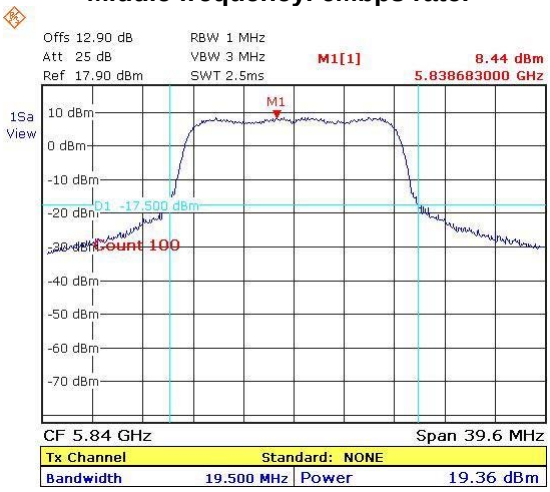
Plot # 72. Output 1 peak power. Middle frequency. 6Mbps rate.



Plot # 73. Output 2 peak power. Middle frequency. 6Mbps rate.

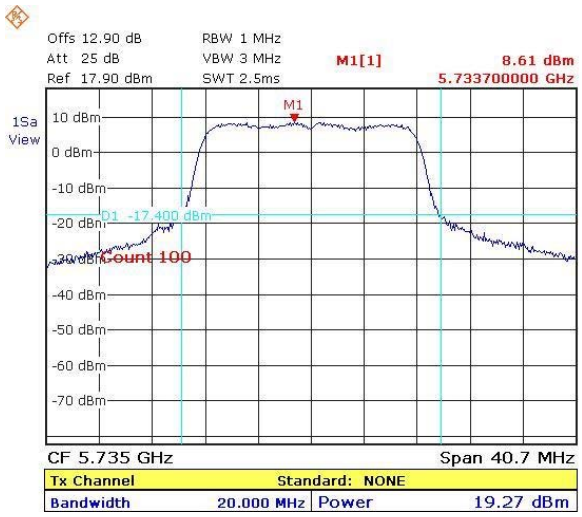


Plot # 74. Output 1 peak power. High frequency. 6Mbps rate.

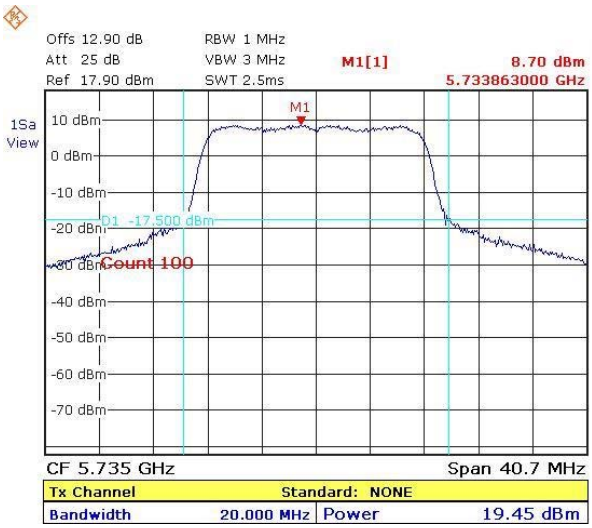


Plot # 75. Output 2 peak power. High frequency. 6Mbps rate.

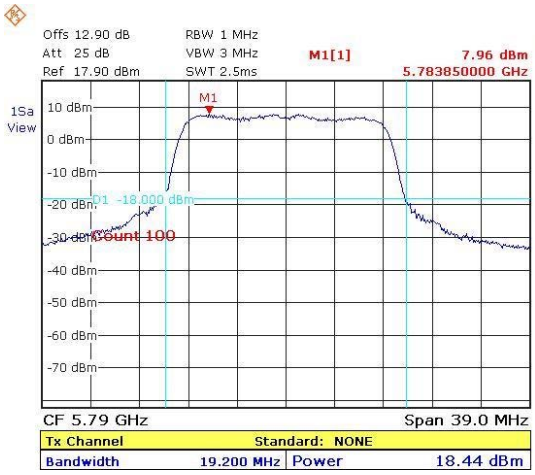
Test Report No.: 8912307342 **Page 40 of 51 Pages**
Title: Test on 5.8 GHz Band Outdoor WiFi (802.11b/g) Wireless Base Station
Model: WBS-5800 **FCC ID: UGM-WBS5800-2**



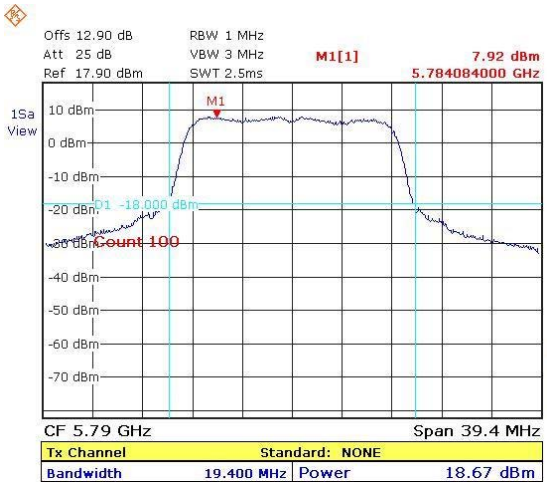
Plot # 76. Output 3 peak power.
Lower frequency. 6Mbps rate.



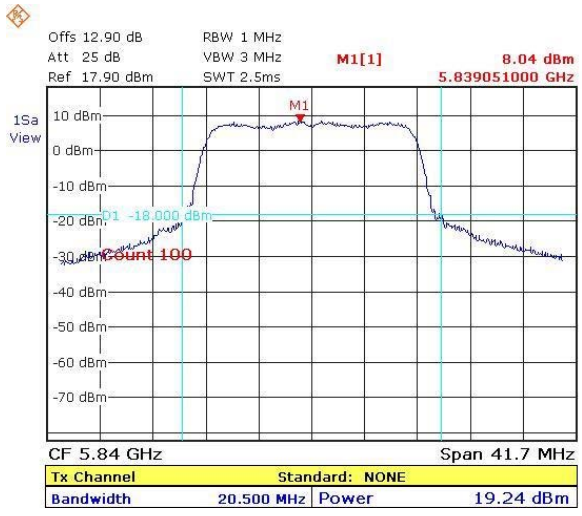
Plot # 77. Output 4 peak power.
Lower frequency. 6Mbps rate.



Plot # 78. Output 3 peak power.
Middle frequency. 6Mbps rate.



Plot # 79. Output 4 peak power.
Middle frequency. 6Mbps rate.

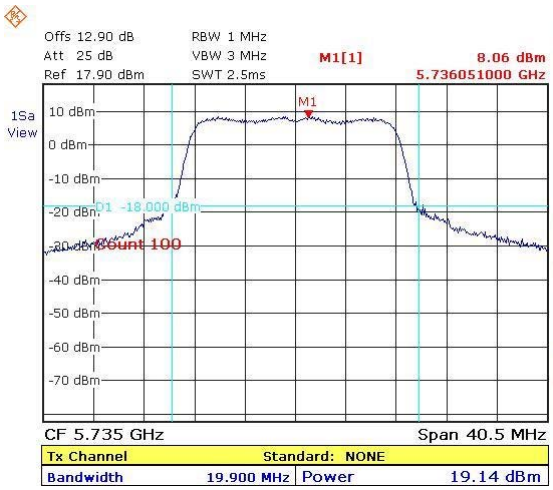


Plot # 80. Output 3 peak power.
High frequency. 6Mbps rate.

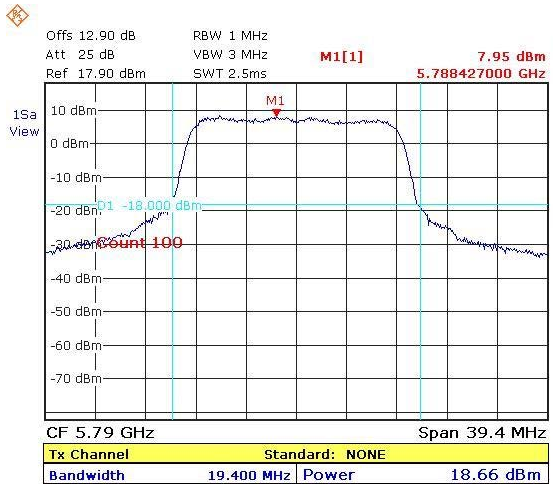
Plot # 81. Output 4 peak power.
High frequency. 6Mbps rate.

Test Report No.: 8912307342 **Page 41 of 51 Pages**
Title: Test on 5.8 GHz Band Outdoor WiFi (802.11b/g) Wireless Base Station
Model: WBS-5800 **FCC ID: UGM-WBS5800-2**

Plot # 82. Output 5 peak power.
Lower frequency. 6Mbps rate.

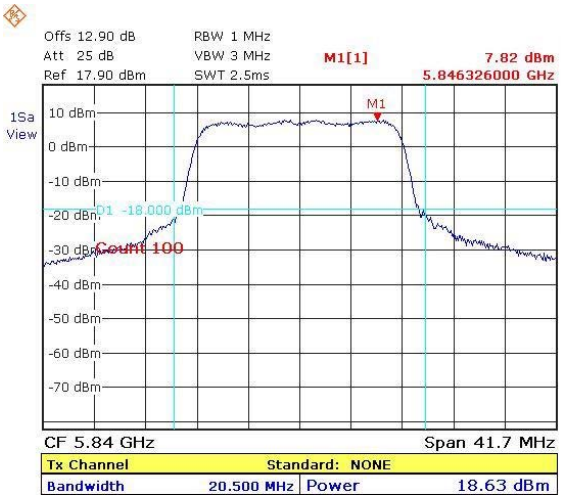


Plot # 83. Output 6 peak power.
Lower frequency. 6Mbps rate.

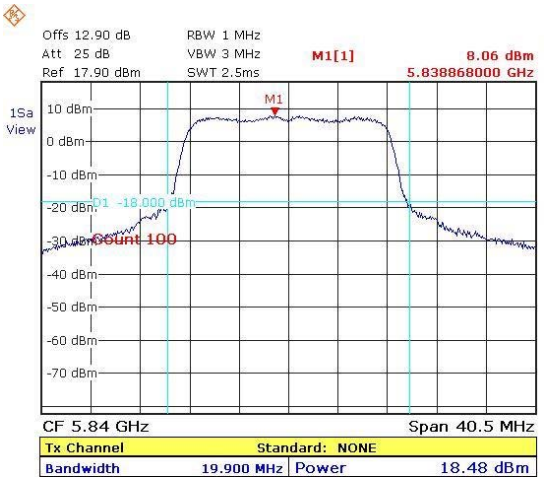


Plot # 84. Output 5 peak power.
Middle frequency. 6Mbps rate.

Plot # 85. Output 6 peak power.
Middle frequency. 6Mbps rate.



Plot # 86. Output 5 peak power.
High frequency. 6Mbps rate.



Plot # 87. Output 6 peak power.
High frequency. 6Mbps rate.

7.10. Peak power spectral density of digital modulated systems according to § 15.247(e)

7.10.1. Requirements:

The peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission

7.10.2. Test Procedure:

The measurements were performed in normal (transmitting) mode of operation for carrier (channel) frequency at bottom, middle and the top of the 5.740-5.835 GHz frequency range. The EUT RF output was connected to the Spectrum Analyzer and accounted with cable loss in measurement. The maximum level in a 3kHz bandwidth is measured with: RBW=3kHz; VBW>3kHz, sweep time=span/3kHz and video averaging is turned off. The PSD is the highest level found across the emission in any 3kHz band.
Additionally, the peak power spectral density from combined (max.) output was calculated and presented in table 13.

7.10.3. Test Results:

All test results met the requirements.
The summaries of Peak Power measurements are shown in Tables 11-13.

Frequency MHz	Rate Mbps	Modulation mode	Output 1 PSD [dBm]	Output 2 PSD [dBm]	Output 3 PSD [dBm]	Limit [dBm]	Margin [dB] Output 1	Plot number	Margin [dB] Output 2	Plot number	Margin [dB] Output 3	Plot number
5740	6	802.11g	-5.627	-5.486	-3.807	8	13.63	88	13.49	89	11.81	90
5790	6	802.11g	-5.683	-3.349	-5.365	8	13.68	94	11.35	95	13.37	96
5835	6	802.11g	-5.591	-5.154	-5.907	8	13.59	100	13.15	101	13.91	102

Table 11.
PSD (Outputs 1-3) test results.

Frequency MHz	Rate Mbps	Modulation mode	Output 4 PSD [dBm]	Output 5 PSD [dBm]	Output 6 PSD [dBm]	Limit [dBm]	Margin [dB] Output 4	Plot number	Margin [dB] Output 5	Plot number	Margin [dB] Output 6	Plot number
5740	6	802.11g	-6.569	-5.760	-6.560	8	14.57	91	13.76	92	14.56	93
5790	6	802.11g	-5.733	-5.430	-5.529	8	13.73	97	13.43	98	13.53	99
5835	6	802.11g	-5.142	-4.051	-7.079	8	13.14	103	12.05	104	15.08	105

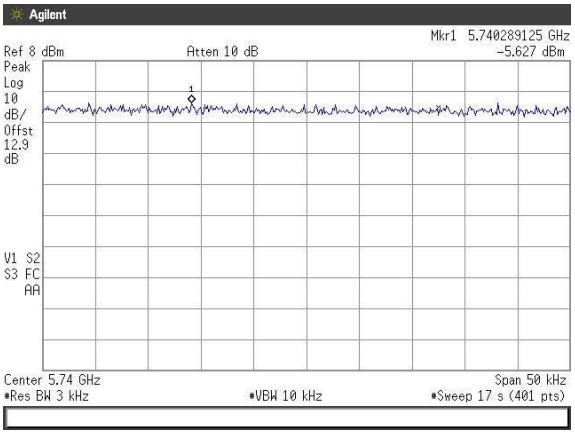
Table 12.
PSD (Outputs 4-6) test results.

Frequency MHz	Rate Mbps	Modulation mode	Limit [dBm]	Calculated Combined (max) Output *, PSD [dBm]	Margin [dB]
5740	6	802.11g	8	2.25	5.75
5790	6	802.11g	8	2.69	5.31
5835	6	802.11g	8	2.39	5.61

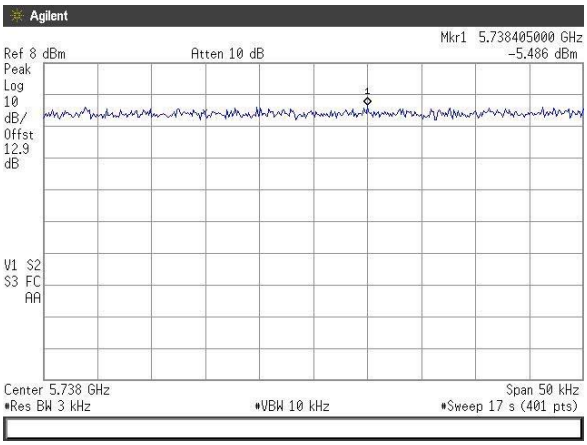
Table 13.
PSD (Combined Output) test results.

(*)- Calculated Combined (max) Output, PSD [dBm] is the sum of the measured PSD from all Output terminals, where each result (PSD from separate output terminal) mathematically conversed from Logarithm to linear units. The results were present in dBm.
For example, the calculation for 5740 MHz frequency is the following:

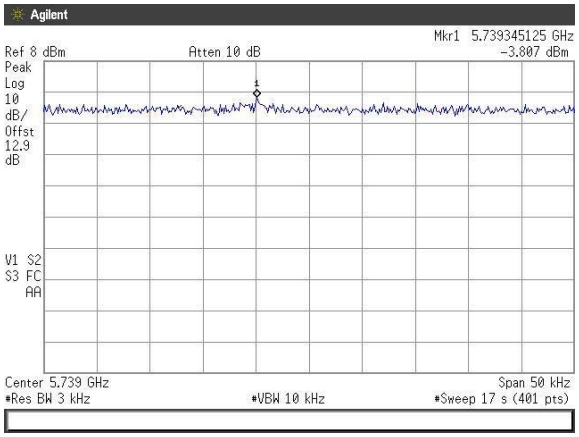
1. (-5.627) dBm = 0.27mW; (-5.486) dBm = 0.28mW; (-3.807) dBm = 0.42mW; (-6.569) dBm = 0.22mW; (-5.760) dBm = 0.27mW; (-6.560) dBm = 0.22 mW
2. 0.27+0.28+0.42+0.22+0.27+0.22 =1.68 [mW]
3. 1.68 mW = 2.25 dBm



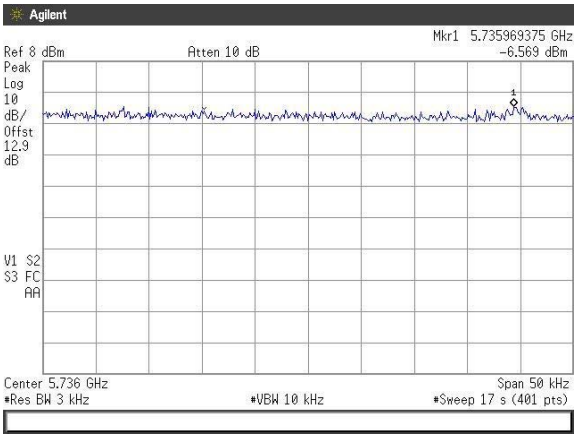
Plot # 88. Transmitter output 1.
Low frequency.



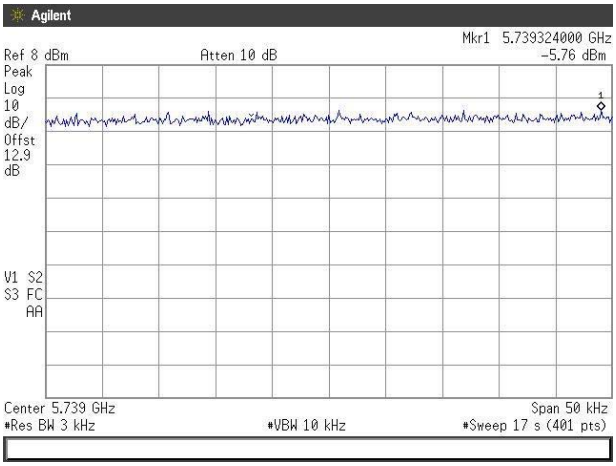
Plot # 89. Transmitter output 2.
Low frequency.



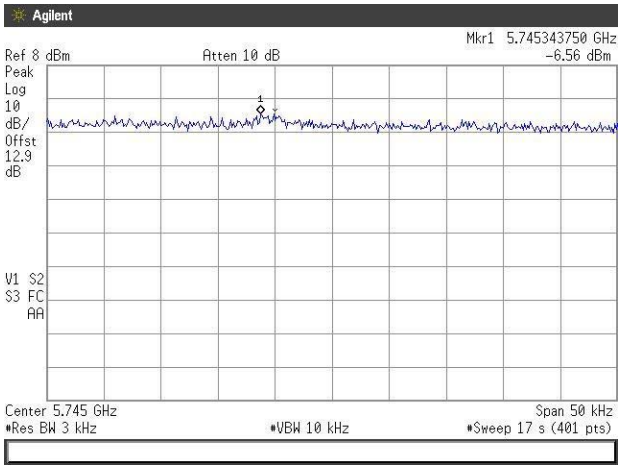
Plot # 90. Transmitter output 3.
Low frequency.



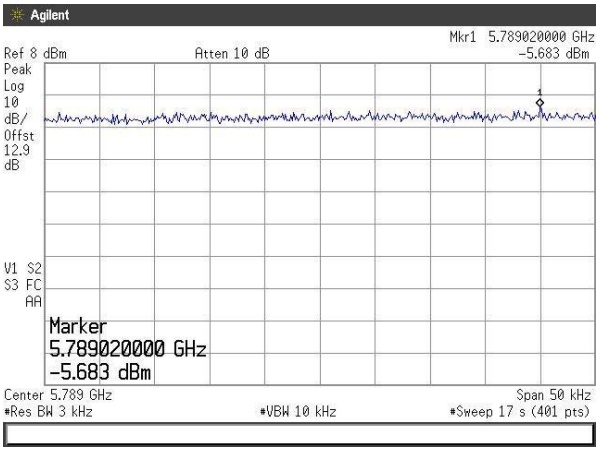
Plot # 91. Transmitter output 4.
Low frequency.



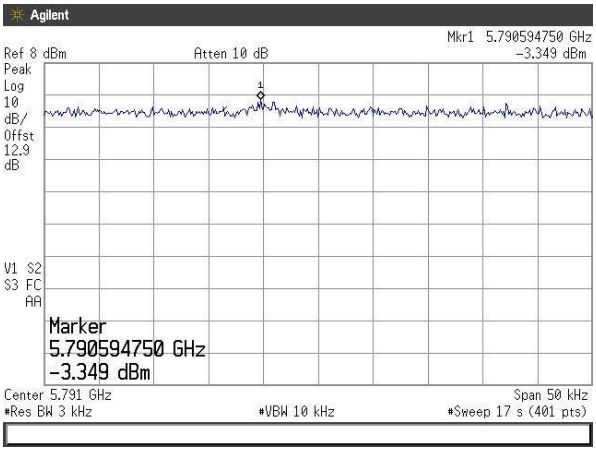
Plot # 92. Transmitter output 5.
Low frequency.



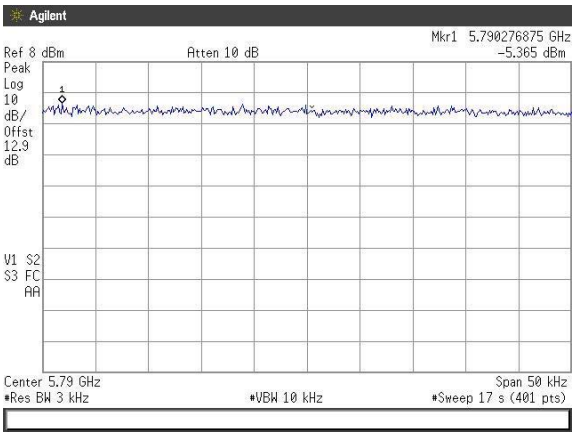
Plot # 93. Transmitter output 6.
Low frequency.



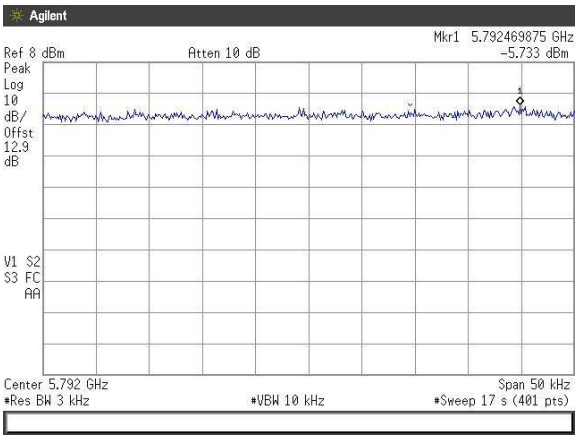
Plot # 94. Transmitter output 1.
Middle frequency.



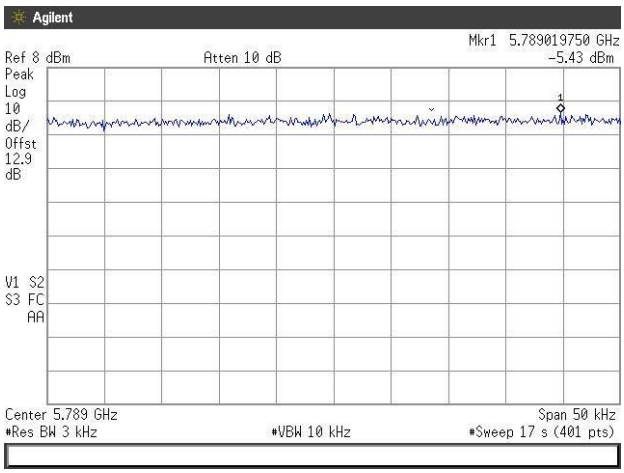
Plot # 95. Transmitter output 2.
Middle frequency.



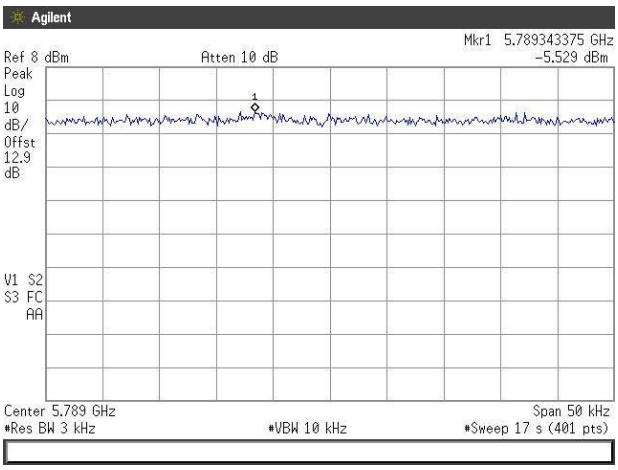
Plot # 96. Transmitter output 3.
Middle frequency.



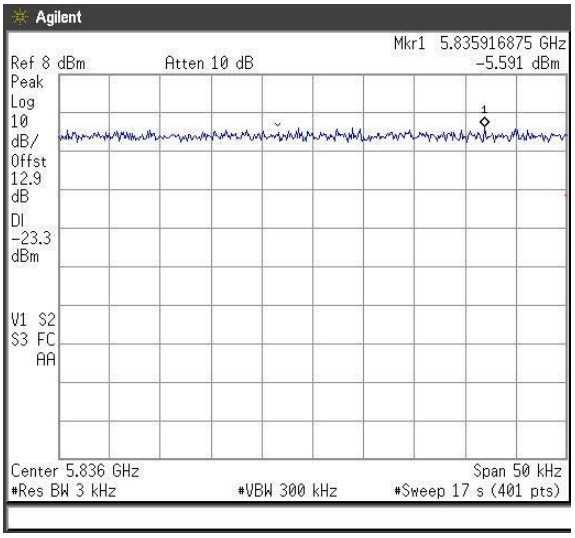
Plot # 97. Transmitter output 4.
Middle frequency.



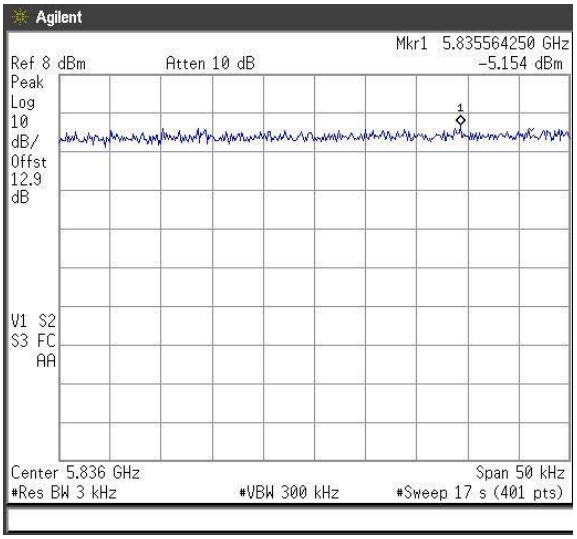
Plot # 98. Transmitter output 5.
Middle frequency.



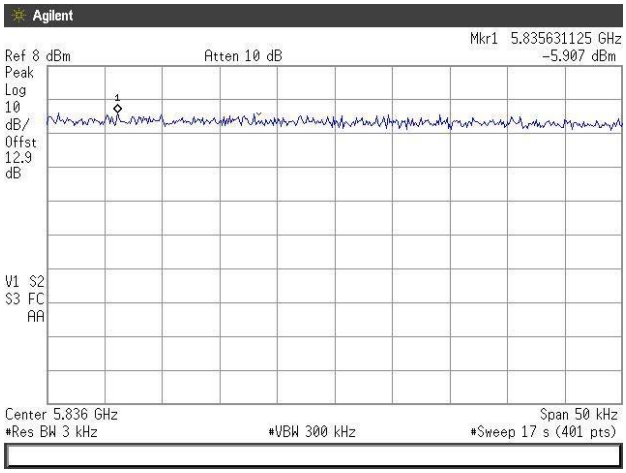
Plot # 99. Transmitter output 6.
Middle frequency.



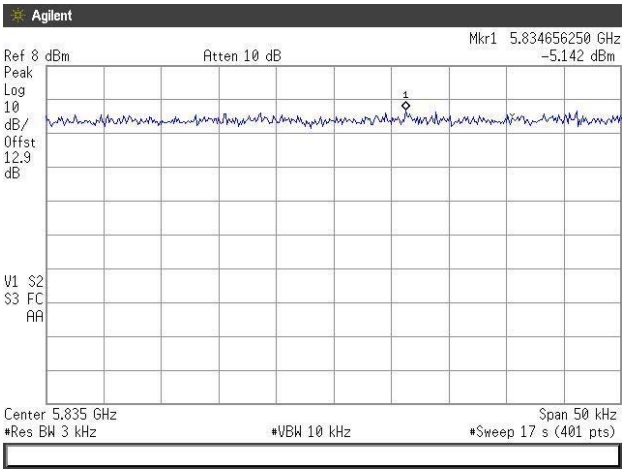
Plot # 100. Transmitter output 1.
High frequency.



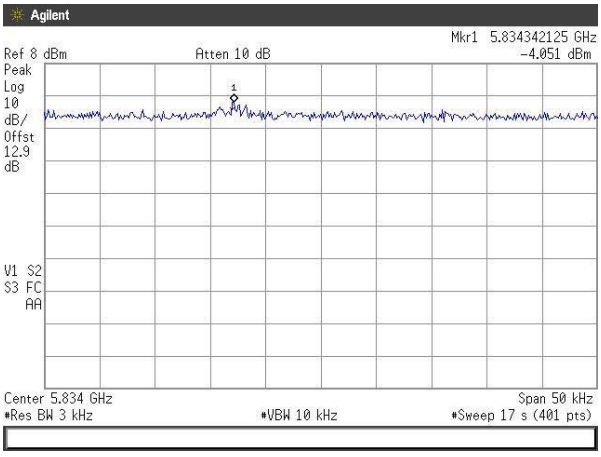
Plot # 101. Transmitter output 2.
High frequency.



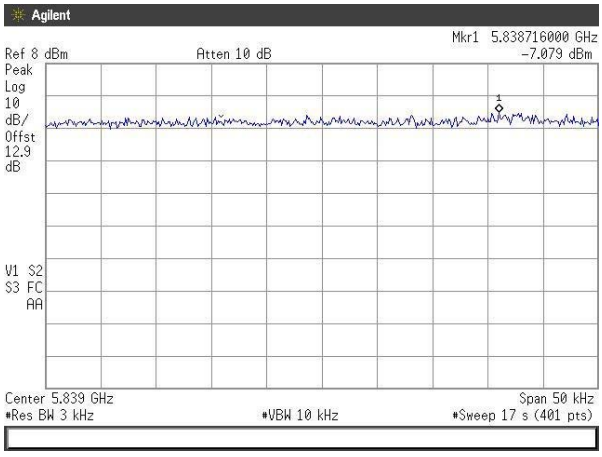
Plot # 102. Transmitter output 3.
High frequency.



Plot # 103. Transmitter output 4.
High frequency.



Plot # 104. Transmitter output 5.
High frequency.



Plot # 105. Transmitter output 6.
High frequency.

8. Appendix 1: Test equipment used

All measurements equipment is on SII calibration schedule with a recalibration interval not exceeding once a year.

Instrument	Manufacturer	Model	Serial No.	Due calibration date
Spectrum Analyzer	Rohde&Schwarz	FSL	-	07/09
Spectrum Analyzer	HP	8565E	3835A01359	06/09
EMI Analyzer	HP	E7405A	SII 4944	11/09
Antenna Double Ridge 1-18 GHz	EMCO	3115	SII 4873	09/09
Antenna SHF-EHF Horn 14-40 GHz	Schwarzbeck	BBHA 9170	SII 5854	09/09
Biconilog Antenna 30 – 2000 MHz	Schaffner-Chase	CBL-6112D	S/N 23181	09/09
Antenna Mast	R&S	HCM	-	N/A
Metallic turntable	R&S	HCT12	100001	N/A
Positioning controller	R&S	HCC	-	N/A
LISN 9 kHz – 30 MHz	FCC	LISN-50/250-32-4-16	SII 5023	03/09
Transient limiter 0.009-200 MHz	HP	11947A	31074A3105	03/09

9. Appendix 2. Antenna Factor and Cable Loss

Cable Loss (10m cable + Mast)

Point	Frequency (MHz)	Cable Loss (dB)	Point	Frequency (MHz)	Cable Loss (dB)
1	30	0.53	21	1000	3.68
2	50	0.75	22	1100	3.82
3	100	1.08	23	1200	4.07
4	150	1.39	24	1300	4.24
5	200	1.61	25	1400	4.43
6	250	1.752	26	1500	4.6
7	300	2.00	27	1600	4.7
8	350	2.15	28	1700	4.85
9	400	2.26	29	1800	4.98
10	450	2.383	30	1900	5.19
11	500	2.52	31	2000	5.34
12	550	2.606	32	2100	5.51
13	600	2.75	33	2200	5.69
14	650	2.856	34	2300	5.89
15	700	3.06	35	2400	6.07
16	750	3.201	36	2500	6.22
17	800	3.27	37	2600	6.28
18	850	3.38	38	2700	6.41
19	900	3.46	39	2800	6.53
20	950	3.55	40	2900	6.84

Antenna Factors:

For Bilog Antenna, Model Number: CBL 6112D, S/N: 23181

No.	f / MHz	AF / dB/m	f / MHz	AF / dB/m
1	30	19.1	160	10.0
2	35	16.0	180	9.5
3	40	13.4	200	9.4
4	45	10.4	250	12.0
5	50	8.3	300	13.1
6	60	6.8	400	15.7
7	70	6.3	500	17.2
8	80	6.8	600	18.3
9	90	8.7	700	19.1
10	100	10.8	800	19.8
11	120	12.2	900	20.7
12	140	11.3	1000	21.2

For Double Ridged Guide Antenna mfr EMCO model 3115

No.	F MHz	AF dB/m	F MHz	AF dB/m	F MHz	AF dB/m
1	1000	23.9	7000	36	13000	39.8
2	1500	25.4	7500	37.4	13500	40.9
3	2000	27.7	8000	37.8	14000	42.5
4	2500	28.8	8500	38.1	14500	41.5
5	3000	30.5	9000	38.2	15000	39.3
6	3500	32	9500	38.3	15500	38.5
7	4000	32.9	10000	38.5	16000	38.7
8	4500	32.9	10500	38.4	16500	39.5
9	5000	33.9	11000	38.7	17000	41.6
10	5500	34.7	11500	39.4	17500	45
11	6000	35.3	12000	39.4	1800	46.8
12	6500	34.5	12500	39.1		

For SHF-EHF Horn Antenna Model Number: BBHA 9170, S/N: 5854
1m Calibration (Vertical and Horizontal polarizations)

Point	Frequency (GHz)	Antenna Factor (dB/m)
1	15	38.5
2	16	37.7
3	17	38.1
4	18	37.9
5	19	38.0
6	20	38.0
7	21	37.9
8	22	38.2
9	23	39.6
10	24	39.6
11	25	39.3
12	26	39.5
13	28	39.6
14	30	40.1
15	32	41.2
16	34	41.5
17	35	41.9
18	36	42.2
19	38	43.8
20	40	43.2

10. Appendix 3: Test configuration illustration

Photo # 1.
Radiated emission test set up.

Photo # 2.
Radiated emission test. General view

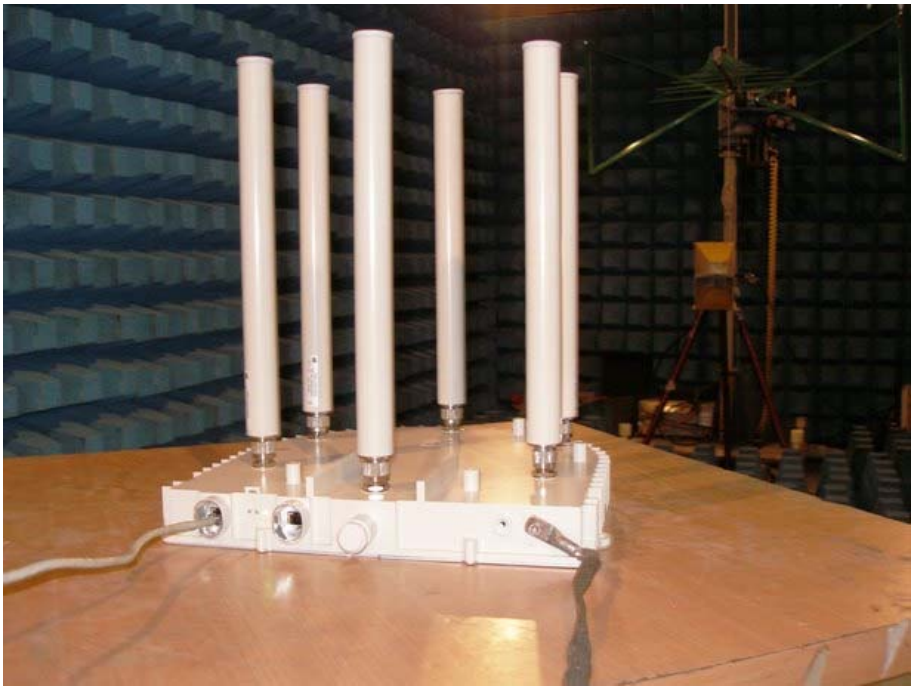


Photo # 3. Radiated emission test on Outdoor Radio Unit: spurious & restricted bands.

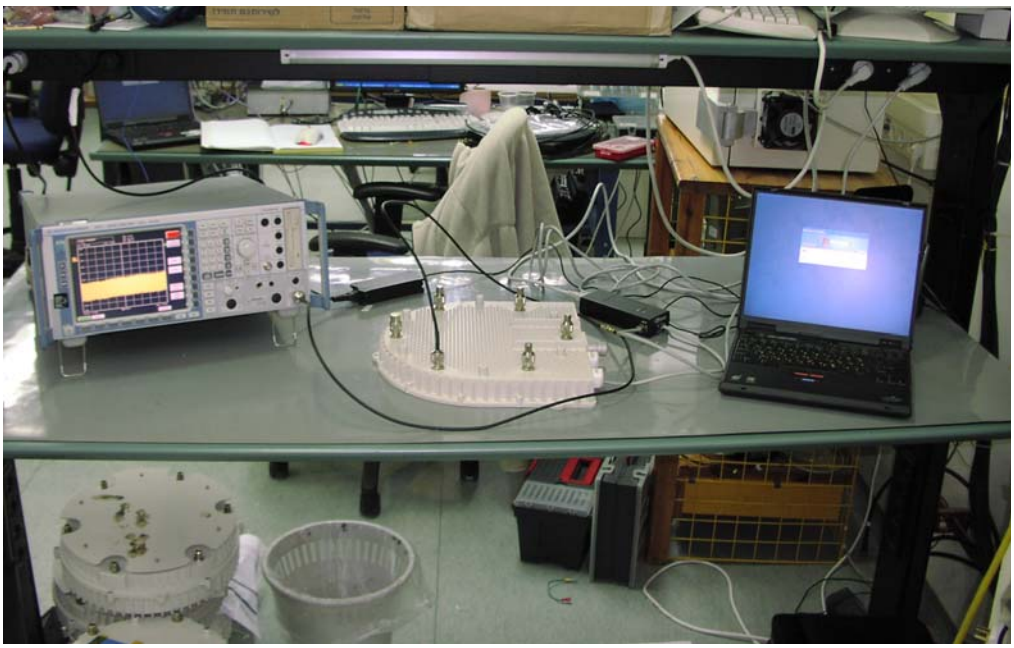


Photo # 4.
Transmitter conducted measurements.