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November 13, 2018

Andrew Wireless Systems
Industriering 10,
Buchdorf, 86675 Germany

Dear Kent Morrett,

Enclosed is the EMC Wireless test report for compliance testing of the Andrew Wireless Systems, CAPM – 23/23/25/25TDD/ Models 7820689-0001 and 7820689-0002 as tested to the requirements of the FCC Certification rules under Title 47 of the CFR Part 27 Subpart L for Broadband Radio Service (BRS) Devices.

Thank you for using the services of MET Laboratories, Inc. If you have any questions regarding these results or if MET can be of further service to you, please contact me.

Sincerely yours,
MET LABORATORIES, INC.

Joel Huna
Documentation Department

Reference: (\Andrew Wireless Systems\EMC100040-FCC27 Rev. 1)

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Electromagnetic Compatibility Criteria Test Report

for the

Andrew Wireless Systems

Model CAPM – 23/23/25/25TDD/ Models 7820689-0001 and 7820689-0002

Tested under

FCC Certification Rules

Title 47 of the CFR, Part 27 Subpart L

MET Report: EMC100040-FCC27 Rev. 1

November 13, 2018

Prepared For:

Andrew Wireless Systems

Industriering 10,

Buchdorf, 86675 Germany

Prepared By:

MET Laboratories, Inc.

914 West Patapsco Avenue,

Baltimore, MD 21230



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FCC Certification Rules
Title 47 of the CFR, Part 27 Subpart L

Deepak Giri, Project Engineer
Electromagnetic Compatibility Lab

Joel Huna
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 27 L of the FCC Rules under normal use and maintenance.

John Mason,
Director, Electromagnetic Compatibility Lab



Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	November 6, 2018	Initial Issue.
1	November 13, 2018	TCB Review.



Table of Contents

I.	Executive Summary	1
	A. Purpose of Test	2
	B. Executive Summary	2
II.	Equipment Configuration	3
	A. Overview.....	4
	B. References.....	5
	C. Test Site	5
	D. Measurement Uncertainty	5
	E. Description of Test Sample.....	5
	F. Equipment Configuration	6
	G. Support Equipment	6
	H. Ports and Cabling Information.....	6
	I. Mode of Operation.....	7
	J. Method of Monitoring EUT Operation.....	7
	K. Modifications	7
	Modifications to EUT	7
	Modifications to Test Standard.....	7
	L. Disposition of EUT.....	7
III.	Electromagnetic Compatibility Criteria for Intentional Radiators	8
	§ 2.1046 RF Power Output.....	9
	§ 2.1049 Occupied Bandwidth	27
	§ 2.1053 Radiated Spurious Emissions	40
	§ 2.1051 Spurious Emissions at Antenna Terminals	66
	Intermodulation	102
	Filter Response	118
IV.	Test Equipment	121
V.	Certification & User's Manual Information	124
	A. Certification Information	125
	B. Label and User's Manual Information	129



List of Tables

Table 1. Executive Summary of EMC Compliance Testing	2
Table 2. EUT Summary Table	4
Table 3. Standard References.....	5
Table 4. Uncertainty Calculations Summary.....	5
Table 5. Equipment Configuration.....	6
Table 6. Support Equipment.....	6
Table 7. Ports and Cabling Information	6
Table 8. RF Output Power, Part 27, Test Results.....	10
Table 9. Occupied Bandwidth, Test Results	28
Table 10. Test Equipment List	122

List of Plots

Plot 1. RF Power Output, WCS2300, 5 MHz, High, Port 1.....	11
Plot 2. RF Power Output, WCS2300, 5 MHz, High, Port 2.....	11
Plot 3. RF Power Output, WCS2300, 5 MHz, High, SG	11
Plot 4. RF Power Output, WCS2300, 5 MHz, Low, Port 1	12
Plot 5. RF Power Output, WCS2300, 5 MHz, Low, Port 2	12
Plot 6. RF Power Output, WCS2300, 5 MHz, Low, SG.....	12
Plot 7. RF Power Output, WCS2300, 5 MHz, Mid, Port 1	13
Plot 8. RF Power Output, WCS2300, 5 MHz, Mid, Port 2	13
Plot 9. RF Power Output, WCS2300, 5 MHz, Mid, SG.....	13
Plot 10. RF Power Output, WCS2300, 10 MHz, Mid, Port 1	14
Plot 11. RF Power Output, WCS2300, 10 MHz, Mid, Port 2	14
Plot 12. RF Power Output, WCS2300, 10 MHz, Mid, SG.....	14
Plot 13. RF Power Output, Band 41, 5 MHz, High, AGC	15
Plot 14. RF Power Output, Band 41, 5 MHz, High, Port 1.....	15
Plot 15. RF Power Output, Band 41, 5 MHz, High, Port 2.....	15
Plot 16. RF Power Output, Band 41, 5 MHz, Low, AGC.....	16
Plot 17. RF Power Output, Band 41, 5 MHz, Low, Port 1.....	16
Plot 18. RF Power Output, Band 41, 5 MHz, Low, Port 2.....	16
Plot 19. RF Power Output, Band 41, 5 MHz, Mid, AGC.....	17
Plot 20. RF Power Output, Band 41, 5 MHz, Mid, Port 1	17
Plot 21. RF Power Output, Band 41, 5 MHz, Mid, Port 2	17
Plot 22. RF Power Output, Band 41, 10 MHz, High, AGC	18
Plot 23. RF Power Output, Band 41, 10 MHz, High, Port 1	18
Plot 24. RF Power Output, Band 41, 10 MHz, High, Port 2	18
Plot 25. RF Power Output, Band 41, 10 MHz, Low, AGC.....	19
Plot 26. RF Power Output, Band 41, 10 MHz, Low, Port 1.....	19
Plot 27. RF Power Output, Band 41, 10 MHz, Low, Port 2.....	19
Plot 28. RF Power Output, Band 41, 10 MHz, Mid, AGC.....	20
Plot 29. RF Power Output, Band 41, 10 MHz, Mid, Port 1	20
Plot 30. RF Power Output, Band 41, 10 MHz, Mid, Port 2	20
Plot 31. RF Power Output, Band 41, 15 MHz, High, AGC	21
Plot 32. RF Power Output, Band 41, 15 MHz, High, Port 1	21
Plot 33. RF Power Output, Band 41, 15 MHz, High, Port 2	21
Plot 34. RF Power Output, Band 41, 15 MHz, Low, AGC.....	22
Plot 35. RF Power Output, Band 41, 15 MHz, Low, Port 1.....	22
Plot 36. RF Power Output, Band 41, 15 MHz, Low, Port 2.....	22
Plot 37. RF Power Output, Band 41, 15 MHz, Mid, AGC.....	23
Plot 38. RF Power Output, Band 41, 15 MHz, Mid, Port 1	23
Plot 39. RF Power Output, Band 41, 15 MHz, Mid, Port 2	23
Plot 40. RF Power Output, Band 41, 20 MHz, High, AGC	24
Plot 41. RF Power Output, Band 41, 20 MHz, High, Port 1	24



Plot 42. RF Power Output, Band 41, 20 MHz, High, Port 2	24
Plot 43. RF Power Output, Band 41, 20 MHz, Low, AGC	25
Plot 44. RF Power Output, Band 41, 20 MHz, Low, Port 1	25
Plot 45. RF Power Output, Band 41, 20 MHz, Low, Port 2	25
Plot 46. RF Power Output, Band 41, 20 MHz, Mid, AGC	26
Plot 47. RF Power Output, Band 41, 20 MHz, Mid, Port 1	26
Plot 48. RF Power Output, Band 41, 20 MHz, Mid, Port 2	26
Plot 49. Occupied Bandwidth, SG, WCS2300, 5 MHz, High	29
Plot 50. Occupied Bandwidth, SG, WCS2300, 5 MHz, Low	29
Plot 51. Occupied Bandwidth, SG, WCS2300, 5 MHz, Mid	29
Plot 52. Occupied Bandwidth, SG, WCS2300, 10 MHz, Mid	30
Plot 53. Occupied Bandwidth, WCS2300, 5 MHz, High	30
Plot 54. Occupied Bandwidth, WCS2300, 5 MHz, Low	30
Plot 55. Occupied Bandwidth, WCS2300, 5 MHz, Mid	31
Plot 56. Occupied Bandwidth, WCS2300, 10 MHz, Mid	31
Plot 57. Occupied Bandwidth, Band 41, 5 MHz, 2496 – 2690 MHz, High, Port 2	32
Plot 58. Occupied Bandwidth, Band 41, 5 MHz, 2496 – 2690 MHz, Low, Port 2	32
Plot 59. Occupied Bandwidth, Band 41, 5 MHz, Mid, Port 2	32
Plot 60. Occupied Bandwidth, Band 41, 10 MHz, 2496 – 2690 MHz, Low, Port 2	33
Plot 61. Occupied Bandwidth, Band 41, 10 MHz, High, Port 2	33
Plot 62. Occupied Bandwidth, Band 41, 10 MHz, Mid, Port 2	33
Plot 63. Occupied Bandwidth, Band 41, 15 MHz, High, Port 2	34
Plot 64. Occupied Bandwidth, Band 41, 15 MHz, Low, Port 2	34
Plot 65. Occupied Bandwidth, Band 41, 15 MHz, Mid, Port 2	34
Plot 66. Occupied Bandwidth, Band 41, 20 MHz, High, Port 2	35
Plot 67. Occupied Bandwidth, Band 41, 20 MHz, Low, Port 2	35
Plot 68. Occupied Bandwidth, Band 41, 20 MHz, Mid, Port 2	35
Plot 69. Occupied Bandwidth, Band 41, SG, 5 MHz, High	36
Plot 70. Occupied Bandwidth, Band 41, SG, 5 MHz, Low	36
Plot 71. Occupied Bandwidth, Band 41, SG, 5 MHz, Mid	36
Plot 72. Occupied Bandwidth, Band 41, SG, 10 MHz, High	37
Plot 73. Occupied Bandwidth, Band 41, SG, 10 MHz, Low	37
Plot 74. Occupied Bandwidth, Band 41, SG, 10 MHz, Mid	37
Plot 75. Occupied Bandwidth, Band 41, SG, 15 MHz, High	38
Plot 76. Occupied Bandwidth, Band 41, SG, 15 MHz, Low	38
Plot 77. Occupied Bandwidth, Band 41, SG, 15 MHz, Mid	38
Plot 78. Occupied Bandwidth, Band 41, SG, 20 MHz, High	39
Plot 79. Occupied Bandwidth, Band 41, SG, 20 MHz, Low	39
Plot 80. Occupied Bandwidth, Band 41, SG, 20 MHz, Mid	39
Plot 81. Radiated Spurious Emissions, Band 30, 5 MHz, 1 – 18 GHz, High	42
Plot 82. Radiated Spurious Emissions, Band 30, 5 MHz, 1 – 18 GHz, Low	42
Plot 83. Radiated Spurious Emissions, Band 30, 5 MHz, 1 – 18 GHz, Mid	42
Plot 84. Radiated Spurious Emissions, Band 30, 5 MHz, 30 MHz – 1 GHz	43
Plot 85. Radiated Spurious Emissions, Band 30, 10 MHz, 1 – 18 GHz, Mid	43
Plot 86. Radiated Spurious Emissions, Band 30, 10 MHz, 30 MHz – 1 GHz, factors	43
Plot 87. Radiated Spurious Emissions, Band 30, 10 MHz, 30 MHz – 1 GHz	44
Plot 88. Radiated Spurious Emissions, Band 41, 5 MHz, 1 – 18 GHz, High	45
Plot 89. Radiated Spurious Emissions, Band 41, 5 MHz, 1 – 18 GHz, Low	45
Plot 90. Radiated Spurious Emissions, Band 41, 5 MHz, 1 – 18 GHz, Mid	45
Plot 91. Radiated Spurious Emissions, Band 41, 5 MHz, 30 MHz – 1 GHz	46
Plot 92. Radiated Spurious Emissions, Band 41, 10 MHz, 1 – 18 GHz, High	46
Plot 93. Radiated Spurious Emissions, Band 41, 10 MHz, 1 – 18 GHz, Low	46
Plot 94. Radiated Spurious Emissions, Band 41, 10 MHz, 1 – 18 GHz, Mid	47
Plot 95. Radiated Spurious Emissions, Band 41, 10 MHz, 30 MHz – 1 GHz	47
Plot 96. Radiated Spurious Emissions, Band 41, 15 MHz, 1 – 18 GHz, High	47
Plot 97. Radiated Spurious Emissions, Band 41, 15 MHz, 1 – 18 GHz, Low	48



Plot 98. Radiated Spurious Emissions, Band 41, 15 MHz, 1 – 18 GHz, Mid.....	48
Plot 99. Radiated Spurious Emissions, Band 41, 15 MHz, 30 MHz – 1 GHz	48
Plot 100. Radiated Spurious Emissions, Band 41, 20 MHz, 1 – 18 GHz, High.....	49
Plot 101. Radiated Spurious Emissions, Band 41, 20 MHz, 1 – 18 GHz, Low	49
Plot 102. Radiated Spurious Emissions, Band 41, 20 MHz, 1 – 18 GHz, Mid	49
Plot 103. Radiated Spurious Emissions, Band 41, 20 MHz, 30 MHz – 1 GHz	50
Plot 104. Radiated Band Edge, WCS 2300, high channel, port 1, 10 MHz	51
Plot 105. Radiated Band Edge, WCS 2300, high channel, port 2, 10 MHz	51
Plot 106. Radiated Band Edge, WCS 2300, high channel, one signal, port 1, 5 MHz.....	51
Plot 107. Radiated Band Edge, WCS 2300, high channel, one signal, port 2, 5 MHz.....	52
Plot 108. Radiated Band Edge, WCS 2300, high channel, two signal, port 1, 5 MHz	52
Plot 109. Radiated Band Edge, WCS 2300, high channel, two signal, port 2, 5 MHz	52
Plot 110. Radiated Band Edge, WCS 2300, low channel, port 1, 10 MHz	53
Plot 111. Radiated Band Edge, WCS 2300, low channel, port 2, 10 MHz	53
Plot 112. Radiated Band Edge, WCS 2300, low channel, one signal, port 1, 5 MHz.....	53
Plot 113. Radiated Band Edge, WCS 2300, low channel, one signal, port 2, 5 MHz.....	54
Plot 114. Radiated Band Edge, WCS 2300, low channel, two signal, port 1, 5 MHz	54
Plot 115. Radiated Band Edge, WCS 2300, low channel, two signal, port 2, 5 MHz	54
Plot 116. Radiated Band Edge, BRS 2500, high channel, one signal, port 1, 5 MHz.....	55
Plot 117. Radiated Band Edge, BRS 2500, high channel, one signal, port 1, 10 MHz.....	55
Plot 118. Radiated Band Edge, BRS 2500, high channel, one signal, port 1, 15 MHz.....	55
Plot 119. Radiated Band Edge, BRS 2500, high channel, one signal, port 1, 20 MHz.....	56
Plot 120. Radiated Band Edge, BRS 2500, high channel, one signal, port 2, 5 MHz.....	56
Plot 121. Radiated Band Edge, BRS 2500, high channel, one signal, port 2, 10 MHz.....	56
Plot 122. Radiated Band Edge, BRS 2500, high channel, one signal, port 3, 15 MHz.....	57
Plot 123. Radiated Band Edge, BRS 2500, high channel, one signal, port 2, 20 MHz.....	57
Plot 124. Radiated Band Edge, BRS 2500, high channel, two signal, port 1, 5 MHz	57
Plot 125. Radiated Band Edge, BRS 2500, high channel, two signal, port 1, 10 MHz	58
Plot 126. Radiated Band Edge, BRS 2500, high channel, two signal, port 1, 15 MHz	58
Plot 127. Radiated Band Edge, BRS 2500, high channel, two signal, port 1, 20 MHz	58
Plot 128. Radiated Band Edge, BRS 2500, high channel, two signal, port 2, 5 MHz	59
Plot 129. Radiated Band Edge, BRS 2500, high channel, two signal, port 2, 10 MHz	59
Plot 130. Radiated Band Edge, BRS 2500, high channel, two signal, port 2, 15 MHz	59
Plot 131. Radiated Band Edge, BRS 2500, high channel, two signal, port 2, 20 MHz	60
Plot 132. Radiated Band Edge, BRS 2500, low channel, one signal, port 1, 5 MHz.....	60
Plot 133. Radiated Band Edge, BRS 2500, low channel, one signal, port 1, 10 MHz.....	60
Plot 134. Radiated Band Edge, BRS 2500, low channel, one signal, port 1, 15 MHz.....	61
Plot 135. Radiated Band Edge, BRS 2500, low channel, one signal, port 1, 20 MHz.....	61
Plot 136. Radiated Band Edge, BRS 2500, low channel, one signal, port 2, 5 MHz.....	61
Plot 137. Radiated Band Edge, BRS 2500, low channel, one signal, port 2, 10 MHz.....	62
Plot 138. Radiated Band Edge, BRS 2500, low channel, one signal, port 2, 15 MHz.....	62
Plot 139. Radiated Band Edge, BRS 2500, low channel, one signal, port2, 20 MHz.....	62
Plot 140. Radiated Band Edge, BRS 2500, low channel, two signal, port 1, 5 MHz.....	63
Plot 141. Radiated Band Edge, BRS 2500, low channel, two signal, port 1, 10 MHz.....	63
Plot 142. Radiated Band Edge, BRS 2500, low channel, two signal, port 1, 15 MHz.....	63
Plot 143. Radiated Band Edge, BRS 2500, low channel, two signal, port 1, 20 MHz.....	64
Plot 144. Radiated Band Edge, BRS 2500, low channel, two signal, port 2, 5 MHz.....	64
Plot 145. Radiated Band Edge, BRS 2500, low channel, two signal, port 2, 10 MHz.....	64
Plot 146. Radiated Band Edge, BRS 2500, low channel, two signal, port 2, 15 MHz.....	65
Plot 147. Radiated Band Edge, BRS 2500, low channel, two signal, port 2, 20 MHz.....	65
Plot 148. Spurious Emissions at Antenna Terminals, Band 30, 5 MHz, .03 – 13 GHz, High, Port 1.....	67
Plot 149. Spurious Emissions at Antenna Terminals, Band 30, 5 MHz, .03 – 13 GHz, High, Port 2.....	67
Plot 150. Spurious Emissions at Antenna Terminals, Band 30, 5 MHz, .03 – 13 GHz, Low, Port 1	67
Plot 151. Spurious Emissions at Antenna Terminals, Band 30, 5 MHz, .03 – 13 GHz, Low, Port 2	68
Plot 152. Spurious Emissions at Antenna Terminals, Band 30, 5 MHz, .03 – 13 GHz, Mid, Port 1	68
Plot 153. Spurious Emissions at Antenna Terminals, Band 30, .5 MHz, 3 – 13 GHz, Mid, Port 2	68



Plot 154. Spurious Emissions at Antenna Terminals, Band 30, 5 MHz, 13 - 26 GHz, High, Port 1	69
Plot 155. Spurious Emissions at Antenna Terminals, Band 30, 5 MHz, 13 – 26 GHz, High, Port 2.....	69
Plot 156. Spurious Emissions at Antenna Terminals, Band 30, 5 MHz, 13 – 26 GHz, Low, Port 1	69
Plot 157. Spurious Emissions at Antenna Terminals, Band 30, 5 MHz, 13 – 26 GHz, Low, Port 2	70
Plot 158. Spurious Emissions at Antenna Terminals, Band 30, 5 MHz, 13 – 26 GHz, Mid, Port 1	70
Plot 159. Spurious Emissions at Antenna Terminals, Band 30, 5 MHz, 13 – 26 GHz, Mid, Port 2	70
Plot 160. Spurious Emissions at Antenna Terminals, Band 30, 10 MHz, .03 – 13 GHz, Mid, Port 1.....	71
Plot 161. Spurious Emissions at Antenna Terminals, Band 30, 10 MHz, .03 – 13 GHz, Mid, Port 2.....	71
Plot 162. Spurious Emissions at Antenna Terminals, Band 30, 10 MHz, 13 – 26 GHz, Mid, Port 1	71
Plot 163. Spurious Emissions at Antenna Terminals, Band 30, 10 MHz, 13 – 26 GHz, Mid, Port 2	72
Plot 164. Spurious Emissions at Antenna Terminals, Band 41, 5 MHz, .03 – 13 GHz, High, Port 1.....	73
Plot 165. Spurious Emissions at Antenna Terminals, Band 41, 5 MHz, .03 – 13 GHz, High, Port 2.....	73
Plot 166. Spurious Emissions at Antenna Terminals, Band 41, 5 MHz, .03 – 13 GHz, Low, Port 1	73
Plot 167. Spurious Emissions at Antenna Terminals, Band 41, 5 MHz, .03 -13 GHz, Low, Port 2	74
Plot 168. Spurious Emissions at Antenna Terminals, Band 41, 5 MHz, .03 – 13 GHz, Mid, Port 1	74
Plot 169. Spurious Emissions at Antenna Terminals, Band 41, 5 MHz, .03 – 13 GHz, Mid, Port 2	74
Plot 170. Spurious Emissions at Antenna Terminals, Band 41, 5 MHz, 13 – 26 GHz, High, Port 1.....	75
Plot 171. Spurious Emissions at Antenna Terminals, Band 41, 5 MHz, 13 – 26 GHz, High, Port 2.....	75
Plot 172. Spurious Emissions at Antenna Terminals, Band 41, 5 MHz, 13 – 26 GHz, Low, Port 1	75
Plot 173. Spurious Emissions at Antenna Terminals, Band 41, 5 MHz, 13 – 26 GHz, Low, Port 2	76
Plot 174. Spurious Emissions at Antenna Terminals, Band 41, 5 MHz, 13 – 26 GHz, Mid, Port 1	76
Plot 175. Spurious Emissions at Antenna Terminals, Band 41, 5 MHz, 13 – 26 GHz, Mid, Port 2	76
Plot 176. Spurious Emissions at Antenna Terminals, Band 41, 10 MHz, .03 – 13 GHz, High, Port 1.....	77
Plot 177. Spurious Emissions at Antenna Terminals, Band 41, 10 MHz, .03 – 13 GHz, High, Port 2.....	77
Plot 178. Spurious Emissions at Antenna Terminals, Band 41, 10 MHz, .03 – 13 GHz, Low, Port 1	77
Plot 179. Spurious Emissions at Antenna Terminals, Band 41, 10 MHz, .03 – 13 GHz, Low, Port 2	78
Plot 180. Spurious Emissions at Antenna Terminals, Band 41, 10 MHz, .03 – 13 GHz, Mid, Port 1.....	78
Plot 181. Spurious Emissions at Antenna Terminals, Band 41, 10 MHz, .03 – 13 GHz, Mid, Port 2.....	78
Plot 182. Spurious Emissions at Antenna Terminals, Band 41, 10 MHz, 13 – 26 GHz, High, Port 1.....	79
Plot 183. Spurious Emissions at Antenna Terminals, Band 41, 10 MHz, 13 – 26 GHz, High, Port 2.....	79
Plot 184. Spurious Emissions at Antenna Terminals, Band 41, 10 MHz, 13 – 26 GHz, Low, Port 1	79
Plot 185. Spurious Emissions at Antenna Terminals, Band 41, 10 MHz, 13 – 26 GHz, Low, Port 2	80
Plot 186. Spurious Emissions at Antenna Terminals, Band 41, 10 MHz, 13 – 26 GHz, Mid, Port 1	80
Plot 187. Spurious Emissions at Antenna Terminals, Band 41, 10 MHz, 13 – 26 GHz, Mid, Port 2	80
Plot 188. Spurious Emissions at Antenna Terminals, Band 41, 15 MHz, .03 – 13 GHz, High, Port 1.....	81
Plot 189. Spurious Emissions at Antenna Terminals, Band 41, 15 MHz, .03 – 13 GHz, High, Port 2.....	81
Plot 190. Spurious Emissions at Antenna Terminals, Band 41, 15 MHz, .03 – 13 GHz, Low, Port 1	81
Plot 191. Spurious Emissions at Antenna Terminals, Band 41, 15 MHz, .03 – 13 GHz, Low, Port 2	82
Plot 192. Spurious Emissions at Antenna Terminals, Band 41, 15 MHz, .03 – 13 GHz, Mid, Port, 1	82
Plot 193. Spurious Emissions at Antenna Terminals, Band 41, 15 MHz, .03 – 13 GHz, Mid, Port 2.....	82
Plot 194. Spurious Emissions at Antenna Terminals, Band 41, 15 MHz, 13 – 26 GHz, High, Port 1.....	83
Plot 195. Spurious Emissions at Antenna Terminals, Band 41, 15 MHz, 13 – 26 GHz, High, Port 2.....	83
Plot 196. Spurious Emissions at Antenna Terminals, Band 41, 15 MHz, 13 – 26 GHz, Low, Port 1	83
Plot 197. Spurious Emissions at Antenna Terminals, Band 41, 15 MHz, 13 – 26 GHz, Low, Port 2	84
Plot 198. Spurious Emissions at Antenna Terminals, Band 41, 15 MHz, 13 – 26 GHz, Mid, Port 1	84
Plot 199. Spurious Emissions at Antenna Terminals, Band 41, 15 MHz, 13 – 26 GHz, Mid, Port 2	84
Plot 200. Spurious Emissions at Antenna Terminals, Band 41, 20 MHz, .03 – 16 GHz, High, Port 2.....	85
Plot 201. Spurious Emissions at Antenna Terminals, Band 41, 20 MHz, .03 – 13 GHz, Low, Port 2	85
Plot 202. Spurious Emissions at Antenna Terminals, Band 41, 20 MHz, .03 – 13 GHz, Mid, Port 2.....	85
Plot 203. Spurious Emissions at Antenna Terminals, Band 41, 20 MHz, 13 – 26 GHz, High, Port 2.....	86
Plot 204. Spurious Emissions at Antenna Terminals, Band 41, 20 MHz, 13 – 26 GHz, Low, Port 2	86
Plot 205. Spurious Emissions at Antenna Terminals, Band 41, 20 MHz, 13 – 26 GHz, Mid, Port 2	86
Plot 206. Antenna Terminals Band Edge, WCS2300, high channel, port 1, 10 MHz	87
Plot 207. Antenna Terminals Band Edge, WCS2300, high channel, port 2, 10 MHz	87
Plot 208. Antenna Terminals Band Edge, WCS2300, high channel, one signal, port 1, 5 MHz	87
Plot 209. Antenna Terminals Band Edge, WCS2300, high channel, one signal, port 2, 5 MHz	88



Plot 210. Antenna Terminals Band Edge, WCS2300, high channel, two signal, port 1, 5 MHz	88
Plot 211. Antenna Terminals Band Edge, WCS2300, high channel, two signal, port 2, 5 MHz	88
Plot 212. Antenna Terminals Band Edge, WCS2300, low channel, port 1, 10 MHz	89
Plot 213. Antenna Terminals Band Edge, WCS2300, low channel, port 2, 10 MHz	89
Plot 214. Antenna Terminals Band Edge, WCS2300, Low channel, one signal, port 1, 5 MHz	89
Plot 215. Antenna Terminals Band Edge, WCS2300, low channel, one signal, port 2, 5 MHz	90
Plot 216. Antenna Terminals Band Edge, WCS2300, low channel, two signal, port 1, 5 MHz	90
Plot 217. Antenna Terminals Band Edge, WCS2300, low channel, two signal, port 2, 5 MHz	90
Plot 218. Antenna Terminals Band Edge, BRS 2500, high channel, one signal, port 1, 5 MHz	91
Plot 219. Antenna Terminals Band Edge, BRS 2500, high channel, one signal, port 1, 10 MHz	91
Plot 220. Antenna Terminals Band Edge, BRS 2500, high channel, one signal, port 1, 15 MHz	91
Plot 221. Antenna Terminals Band Edge, BRS 2500, high channel, one signal, port 1, 20 MHz,	92
Plot 222. Antenna Terminals Band Edge, BRS 2500, high channel, one signal, port 2, 5 MHz	92
Plot 223. Antenna Terminals Band Edge, BRS 2500, high channel, one signal, port 2, 10 MHz	92
Plot 224. Antenna Terminals Band Edge, BRS 2500, high channel, one signal, port 2, 15 MHz	93
Plot 225. Antenna Terminals Band Edge, BRS 2500, high channel, one signal, port 2, 20 MHz	93
Plot 226. Antenna Terminals Band Edge, BRS 2500, high channel, two signal, port 1, 5 MHz	93
Plot 227. Antenna Terminals Band Edge, BRS 2500, high channel, two signal, port 1, 10 MHz	94
Plot 228. Antenna Terminals Band Edge, BRS 2500, high channel, two signal, port 1, 15 MHz	94
Plot 229. Antenna Terminals Band Edge, BRS 2500, high channel, two signal, port 1, 20 MHz	94
Plot 230. Antenna Terminals Band Edge, BRS 2500, high channel, two signal, port 2, 5 MHz	95
Plot 231. Antenna Terminals Band Edge, BRS 2500, high channel, two signal, port 2, 10 MHz	95
Plot 232. Antenna Terminals Band Edge, BRS 2500, high channel, two signal, port 2, 15 MHz	95
Plot 233. Antenna Terminals Band Edge, BRS 2500, high channel, two signal, port 2, 20 MHz	96
Plot 234. Antenna Terminals Band Edge, BRS 2500, low channel, one signal, port 1, 5 MHz	96
Plot 235. Antenna Terminals Band Edge, BRS 2500, low channel, one signal, port 1, 10 MHz	96
Plot 236. Antenna Terminals Band Edge, BRS 2500, low channel, one signal, port 1, 15 MHz	97
Plot 237. Antenna Terminals Band Edge, BRS 2500, low channel, one signal, port 1, 20 MHz	97
Plot 238. Antenna Terminals Band Edge, BRS 2500, low channel, one signal, port 2, 5 MHz	97
Plot 239. Antenna Terminals Band Edge, BRS 2500, low channel, one signal, port 2, 10 MHz	98
Plot 240. Antenna Terminals Band Edge, BRS 2500, low channel, one signal, port 2, 15 MHz	98
Plot 241. Antenna Terminals Band Edge, BRS 2500, low channel, one signal, port 2, 20 MHz	98
Plot 242. Antenna Terminals Band Edge, BRS 2500, low channel, two signal, port 1, 5 MHz	99
Plot 243. Antenna Terminals Band Edge, BRS 2500, low channel, two signal, port 1, 10 MHz	99
Plot 244. Antenna Terminals Band Edge, BRS 2500, low channel, two signal, port 1, 15 MHz	99
Plot 245. Antenna Terminals Band Edge, BRS 2500, low channel, two signal, port 1, 20 MHz	100
Plot 246. Antenna Terminals Band Edge, BRS 2500, low channel, two signal, port 2, 5 MHz	100
Plot 247. Antenna Terminals Band Edge, BRS 2500, low channel, two signal, port 2, 10 MHz	100
Plot 248. Antenna Terminals Band Edge, BRS 2500, low channel, two signal, port 2, 15 MHz	101
Plot 249. Antenna Terminals Band Edge, BRS 2500, low channel, two signal, port 2, 20 MHz	101
Plot 250. Intermodulation, WCS 2300, high channel, port 2, 10 MHz	103
Plot 251. Intermodulation, WCS 2300, high channel, port 1, 10 MHz	103
Plot 252. Intermodulation, WCS 2300, high channel, one signal, 1, 5 MHz	103
Plot 253. Intermodulation, WCS 2300, high channel, one signal, 2 5 MHz	104
Plot 254. Intermodulation, WCS 2300, high channel, two signal, port 1, 5 MHz	104
Plot 255. Intermodulation, WCS 2300, high signal, two signal, port 2, 5 MHz	104
Plot 256. Intermodulation, WCS 2300, low channel, port 1, 10 MHz	105
Plot 257. Intermodulation, WCS 2300, low channel, port 2, 10 MHz	105
Plot 258. Intermodulation, WCS 2300, low channel, one signal, port 1, 5 MHz	105
Plot 259. Intermodulation, WCS 2300, low channel, one signal, port 2, 5 MHz	106
Plot 260. Intermodulation, WCS 2300, low channel, two signal, port 1, 5 MHz	106
Plot 261. Intermodulation, WCS 2300, low channel, two signal, port 2, 5 MHz	106
Plot 262. Intermodulation, BRS 2500, high channel, one signal, port 1, 5 MHz	107
Plot 263. Intermodulation, BRS 2500, high channel, one signal, port 1, 10 MHz	107
Plot 264. Intermodulation, BRS 2500, high channel, one signal, port 1, 15 MHz	107
Plot 265. Intermodulation, BRS 2500, high channel, one signal, port 1, 20 MHz	108



Plot 266. Intermodulation, BRS 2500, high channel, one signal, port 2, 5 MHz.....	108
Plot 267. Intermodulation, BRS 2500, high channel, one signal, port 2, 10 MHz.....	108
Plot 268. Intermodulation, BRS 2500, high channel, one signal, port 2, 15 MHz.....	109
Plot 269. Intermodulation, BRS 2500, high channel, one signal, port 2, 20 MHz.....	109
Plot 270. Intermodulation, BRS 2500, high channel, two signal, port 1, 5 MHz.....	109
Plot 271. Intermodulation, BRS 2500, high channel, two signal, port 1, 10 MHz.....	110
Plot 272. Intermodulation, BRS 2500, high channel, two signal, port 1, 15 MHz.....	110
Plot 273. Intermodulation, BRS 2500, high channel, two signal, port 1, 20 MHz.....	110
Plot 274. Intermodulation, BRS 2500, high channel, two signal, port 2, 5 MHz.....	111
Plot 275. Intermodulation, BRS 2500, high channel, two signal, port 2, 10 MHz.....	111
Plot 276. Intermodulation, BRS 2500, high channel, two signal, port 2, 15 MHz.....	111
Plot 277. Intermodulation, BRS 2500, high channel, two signal, port 2, 20 MHz.....	112
Plot 278. Intermodulation, BRS 2500, low channel, one signal, port 1, 5 MHz.....	112
Plot 279. Intermodulation, BRS 2500, low channel, one signal, port 1, 10 MHz.....	112
Plot 280. Intermodulation, BRS 2500, low channel, one signal, port 1, 15 MHz.....	113
Plot 281. Intermodulation, BRS 2500, low channel, one signal, port 1, 20 MHz.....	113
Plot 282. Intermodulation, BRS 2500, low channel, one signal, port 2, 5 MHz.....	113
Plot 283. Intermodulation, BRS 2500, low channel, one signal, port 2, 10 MHz.....	114
Plot 284. Intermodulation, BRS 2500, low channel, one signal, port 2, 15 MHz.....	114
Plot 285. Intermodulation, BRS 2500, low channel, one signal, port 2, 20 MHz.....	114
Plot 286. Intermodulation, BRS 2500, low channel, two signal, port 1, 5 MHz.....	115
Plot 287. Intermodulation, BRS 2500, low channel, two signal, port 1, 10 MHz.....	115
Plot 288. Intermodulation, BRS 2500, low channel, two signal, port 1, 15 MHz.....	115
Plot 289. Intermodulation, BRS 2500, low channel, two signal, port 1, 20 MHz.....	116
Plot 290. Intermodulation, BRS 2500, low signal, two signal, port 2, 5 MHz.....	116
Plot 291. Intermodulation, BRS 2500, low channel, two signal, port 2, 10 MHz.....	116
Plot 292. Intermodulation, BRS 2500, low channel, two signal, port 2, 15 MHz.....	117
Plot 293. Intermodulation, BRS 2500, low channel, two signal, port 2, 20 MHz.....	117
Plot 294. Out of band Rejection, WCS 2300, port 1, 5 MHz.....	119
Plot 295. Out of band Rejection, WCS 2300, port 2, 5 MHz.....	119
Plot 296. Out of band Rejection, BRS 2500, port 1.....	120
Plot 297. Out of band Rejection, BRS 2500, port 2.....	120



List of Terms and Abbreviations

AC	Alternating Current
ACF	Antenna Correction Factor
Cal	Calibration
<i>d</i>	Measurement Distance
dB	Decibels
dB μ A	Decibels above one micro amp
dB μ V	Decibels above one micro volt
dB μ A/m	Decibels above one micro amp per meter
dB μ V/m	Decibels above one micro volt per meter
DC	Direct Current
E	Electric Field
DSL	Digital Subscriber Line
ESD	Electrostatic Discharge
EUT	Equipment Under Test
<i>f</i>	Frequency
FCC	Federal Communications Commission
GRP	Ground Reference Plane
H	Magnetic Field
HCP	Horizontal Coupling Plane
Hz	Hertz
IEC	International Electrotechnical Commission
kHz	kilohertz
kPa	kilopascal
kV	kilovolt
LISN	Line Impedance Stabilization Network
MHz	Megahertz
μ H	micro henry
μ	micro farad
μ s	micro seconds
NEBS	Network Equipment-Building System
PRF	Pulse Repetition Frequency
RF	Radio Frequency
RMS	Root-Mean-Square
TWT	Traveling Wave Tube
V/m	Volts per meter
VCP	Vertical Coupling Plane



I. Executive Summary



A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Andrew Wireless Systems CAPM – 23/23/25/25TDD/ Models 7820689-0001 and 7820689-0002, with the requirements of Part 27. All references are to the most current version of Title 47 of the Code of Federal Regulations in effect. In accordance with §2.1033, the following data is presented in support of the Certification of the CAPM – 23/23/25/25TDD/ Models 7820689-0001 and 7820689-0002. Andrew Wireless Systems should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the CAPM – 23/23/25/25TDD/ Models 7820689-0001 and 7820689-0002, has been **permanently** discontinued.

B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 27, in accordance with Andrew Wireless Systems, purchase order number 8002549647.

Reference	Description	Compliance
§2.1046; §27.50(a)(1) and 27.50(h) (1)	RF Power Output	Compliant
§2.1047	Modulation Characteristics	Not Applicable
§2.1049	Occupied Bandwidth	Compliant
§2.1051; §27.53(m)	Spurious Emissions at Antenna Terminals	Compliant
§2.1051	Emissions in GPS Bands	Not Applicable
§2.1053	Radiated Spurious Emissions	Compliant
§2.1055	Frequency Stability	Not Applicable
Section 3.62 FCC KDB 93510 and section 7.2.2.5.2 ANSI C63.26	Intermodulation Products	Compliant
Section 3.3 FCC KDB 93510 and section 7.2.2.2 ANSI C63.26	Filter Response	Compliant
2.1091	RF Exposure	Not Applicable

Table 1. Executive Summary of EMC Compliance Testing

Note: Only downlink frequencies of the relevant bands have been tested as the uplink side travels directly through a Fiber-optic cable, and is never transmitted over the air.



II. Equipment Configuration



A. Overview

MET Laboratories, Inc. was contracted by Andrew Wireless Systems to perform testing on the CAPM – 23/23/25/25TDD/ Models 7820689-0001 and 7820689-0002, under Andrew Wireless Systems's purchase order number 8002549647.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Andrew Wireless Systems, CAPM – 23/23/25/25TDD/ Models 7820689-0001 and 7820689-0002.

The results obtained relate only to the item(s) tested.

Model(s) Tested:	CAPM – 23/23/25/25TDD/ Models 7820689-0001 and 7820689-0002	
Model(s) Covered:	CAPM – 23/23/25/25TDD/ Models 7820689-0001 and 7820689-0002	
EUT Specifications:	FCC ID: XS5-CAPM23232525	
	Primary Power: 36-60 VDC (Nominal 48VDC) for 7820689-0002 & 85VAC to 264 VAC (Nominal 110VAC) for 7820689-0001	
	Equipment Code:	B2I
	RF Output Power: Watts	36.64 dBm
	EUT Frequency Range:	2350-2360 MHz & 2496-2690 MHz
Analysis:	The results obtained relate only to the item(s) tested.	
Environmental Test Conditions:	Temperature: 15-35° C	
	Relative Humidity: 30-60%	
	Barometric Pressure: 860-1060 mbar	
Evaluated by:	Deepak Giri	
Date(s):	November 13, 2018	

Table 2. EUT Summary Table



B. References

CFR 47, Part 27	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 27: Rules and Regulations for Advanced Wireless Services
ANSI C63.4:2014	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
ISO/IEC 17025:2005	General Requirements for the Competence of Testing and Calibration Laboratories
EIA/TIA-603-A-2001	Land Mobile FM or PM Communication Equipment Measurement and Performance Standards
ANSI C63.26: 2015	American National Standard for Compliance Testing of Transmitters Used in the Licensed Radio Services
KDB 935210 D02 v04r01	Signal Boosters Basic Certification Requirements
KDB 935210 D05 v01r02	Measurements Guidance for Industrial and Non-Consumer Signal Booster, Repeater, and Amplifier Devices

Table 3. Standard References

C. Test Site

All testing was performed at MET Laboratories, Inc., 914 West Patapsco Avenue, Baltimore, MD 21230. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Radiated Emissions measurements were performed in a 3 meter semi-anechoic chamber (equivalent to an Open Area Test Site).

D. Measurement Uncertainty

Test Method	Typical Expanded Uncertainty	K	Confidence Level
RF Frequencies	±4.52 Hz	2	95%
RF Power Conducted Emissions	±2.32 dB	2	95%
RF Power Conducted Spurious Emissions	±2.25 dB	2	95%
RF Power Radiated Emissions	±3.01 dB	2	95%

Table 4. Uncertainty Calculations Summary

E. Description of Test Sample

The Andrew Wireless Systems CAPM – 23/23/25/25TDD/ Models 7820689-0001 and 7820689-0002, Equipment Under Test (EUT), is DAS (Distributed Antenna System) Remote. It does not operate in a stand-alone mode.



F. Equipment Configuration

Ref. ID	Slot #	Name / Description	Model Number	Part Number	Serial Number	Rev. #
		CAP M 23/23/25/25-F-AC	7820689-0001			0001
		CAP M 23/23/25/25-F-DC	7820689-0002			0002
		ION-E WCS-2 Subrack	7635443-00			00
		PSU shelf, AC	7693531-00			00
		ION-E RFD, RF Donor	7633229-01			01
		ION-E OPT, Optical Transport	7642123-00			00
		ION-E SUI, System Interface	7642125-00			00
		JUMPER, RISR, LS, 1.6MM, DPLX, LC/LC, AQ, MT010	FEXLCLC42 -MXM010			00
		SFP+, 10GBase-SR, (MM)	7660511			00

Table 5. Equipment Configuration

G. Support Equipment

Ref. ID	Name / Description	Manufacturer	Model Number	*Customer Supplied Calibration Data
	Laptop			N/A
	Qty 4 - Cat 5 Cable			N/A
	Qty 2 - Signal Generators (2496-2690 MHZ)			Not Available
	Qty 2 - Signal Generators (2350-2360 MHZ)			Not Available
	48VDC Power Supply			N/A

The 'Customer Supplied Calibration Data' column will be marked as either not applicable, not available, or will contain the calibration date supplied by the customer.

Table 6. Support Equipment

H. Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty	Length as tested (m)	Max Length (m)	Shielded? (Y/N)	Termination Box ID & Port Name
1	Fiber Input Cable	Customer supplied Fiber Cable	1	15		Yes	EUT Input
2	48VDC Input	DC power Cable	1	2		No	EUT Power Supply
3	ANT 1 & 2	Test Equipment	1	2		No	Antenna Port

Table 7. Ports and Cabling Information



I. Mode of Operation

The EUT will operate in a continuous emission mode. The unit will be tested to address FCC Part 15 B (Class B) – Unintentional Radiator Conducted and Radiated Emissions.

The EUT will also be operated in a continuous emission mode addressing FCC Part 27 & RSS-131, RSS-139 Intentional Radiator mode for Frequency Band 2350-2360 MHz (Band 30) (Bandwidths 5, 10 MHz) and Frequency Band (2496-2690 MHz (Band 41) (Bandwidths 5, 10, 15, 20 MHz).

J. Method of Monitoring EUT Operation

The LED on the unit will be solid green if the unit is powered on and operational. If the unit is powered on and the LED on the unit is a solid red, the unit is not operational. It will be identified as a major hardware issue and an alarm will be raised on the GUI.

K. Modifications

a) Modifications to EUT

No modifications were made to the EUT.

b) Modifications to Test Standard

No modifications were made to the test standard.

L. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Andrew Wireless Systems upon completion of testing.



III. Electromagnetic Compatibility Criteria for Intentional Radiators



Electromagnetic Compatibility Criteria for Intentional Radiators

§ 2.1046 RF Power Output

Test Requirement(s): §27.50(a)(1) and 27.50(h) (1) --- Mobile and other user stations. Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power.

Test Procedures: The EUT was tested according to the average power integration procedures of ANSI C63.26 7.2.2.4.1. The power measurement function of spectrum analyzer was used and configured in the following manner.

- (a) Frequency = channel cf
- (b) Span = 2-3 x the OBW
- (c) RBW = 1-5 % of the OBW
- (d) VBW 1-3 x the RBW
- (e) Sweep Time = Auto
- (f) Detector = Average

The AGC threshold is to be determined as follows.

In the case of fiber-optic distribution systems, the RF input port of the equipment under test (EUT) refers to the RF input of the supporting equipment RF to optical convertor; see also descriptions and diagrams for typical DAS booster systems in KDB Publication 935210 D02 [R7].

Devices intended to be directly connected to an RF source (donor port) only need to be evaluated for any over-the-air transmit paths.

- a) A signal generator was connected to the input of the EUT.
- b) A spectrum analyzer or power meter was connected to the output of the EUT using appropriate attenuation as necessary.
- c) The signal generator was initially configured to produce either of the required test signals (i.e., broadband or narrowband).
- d) The signal generator frequency was set to the center frequency of the EUT operating band.
- e) While monitoring the output power of the EUT, measured using the methods of 3.5.3 or 3.5.4, the input level was increased until a 1 dB increase in the input signal power no longer caused a 1 dB increase in the output signal power.
- f) This level was recorded as the AGC threshold level.
- g) The procedure was repeated with the remaining test signal.

Test Results: The EUT was found compliant with the requirements of this section.

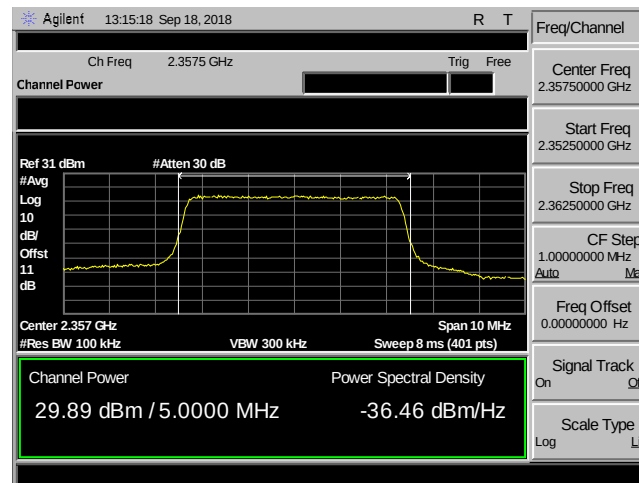
Test Engineer(s): Bradley Jones

Test Date(s): September 18, 2018

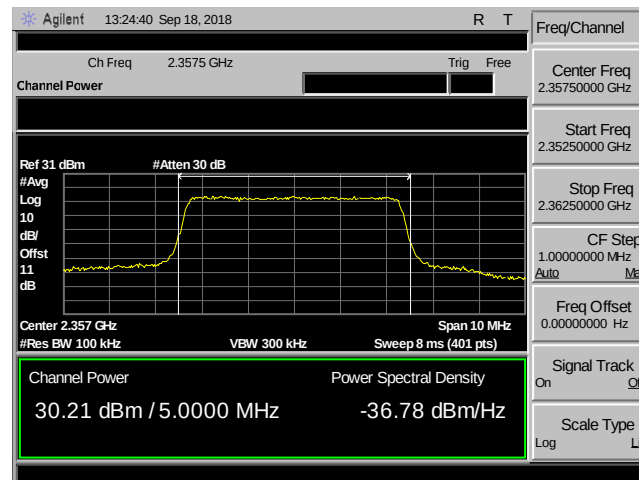
Band 30		frequency	Input Power	Output Port 1	Output Port 2	Output Sum	Gain
5 MHz	Low	2352.5	-5.19	30.89	31.1	34.00656 9	39.1965 7
	Middle	2355	-4.86	29.92	30.53	33.24600 1	38.106
	High	2357.5	-4.78	29.89	30.21	33.06324 7	37.8432 5
10 MHz	Middle	2355	-5.07	29.19	29.73	32.47868 7	37.5486 9
Band 41		frequency	Input Power	Output Port 1	Output Port 2	Output Sum	Gain
5 MHz	Low	2498.5	10.11	33.1	33.18	36.15048 4	26.0404 8
	Middle	2593	10.6	33.49	33.21	36.36255 6	25.7625 6
	High	2687.5	10.61	33.53	33.11	36.33537 5	25.7253 8
10 MHz	Low	2501	10.11	33.18	33.39	36.29656 9	26.1865 7
	Middle	2593	9.95	33.25	32.57	35.93359 5	25.9836
	High	2685	10.06	33.29	33.24	36.27537 2	26.2153 7
15 MHz	Low	2503.5	10.35	33.3	33.26	36.29034 6	25.9403 5
	Middle	2593	10.16	33.6	33.66	36.64040 4	26.4804
	High	2682.5	10.14	33.21	33.09	36.16071 4	26.0207 1
20 MHz	Low	2506	10.13	32.45	32.52	35.49544 1	25.3654 4
	Middle	2593	10.05	33.07	33.3	36.19682 2	26.1468 2
	High	2680	9.97	32.78	32.76	35.78031 1	25.8103 1

Table 8. RF Output Power, Part 27, Test Results

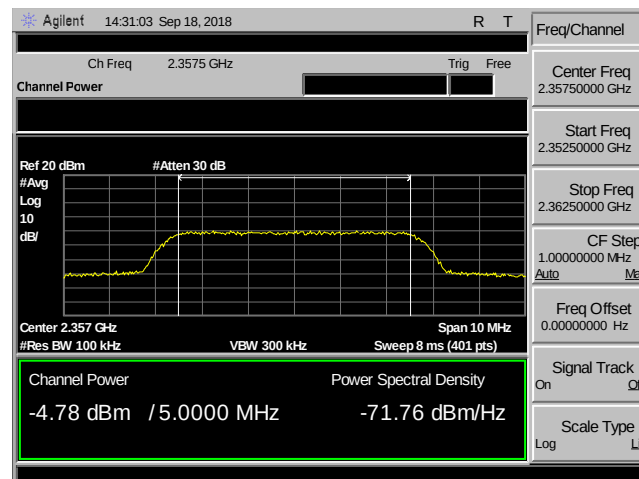
RF Output Power, Band 30



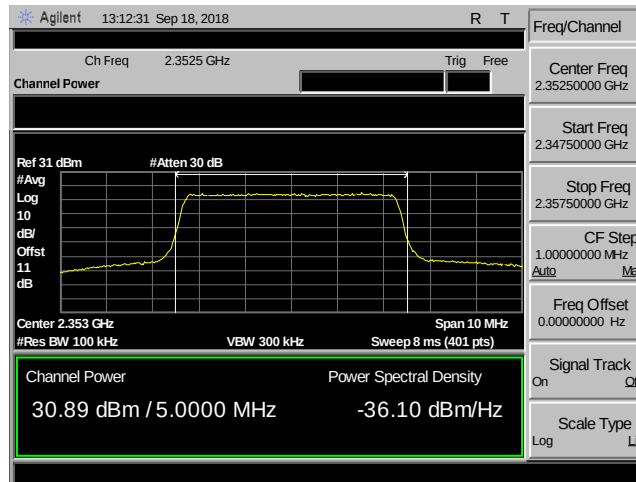
Plot 1. RF Power Output, WCS2300, 5 MHz, High, Port 1



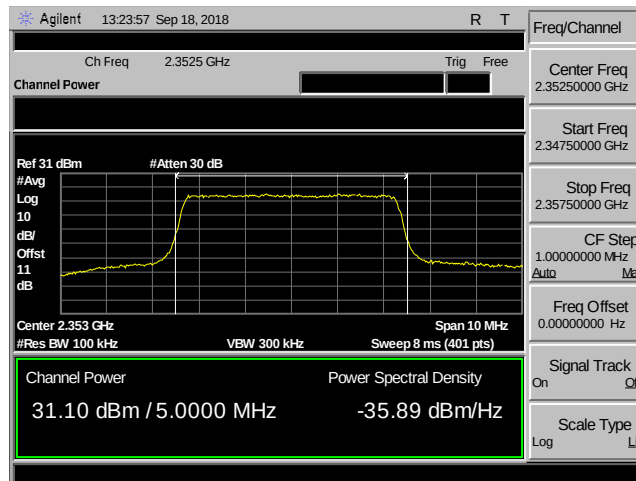
Plot 2. RF Power Output, WCS2300, 5 MHz, High, Port 2



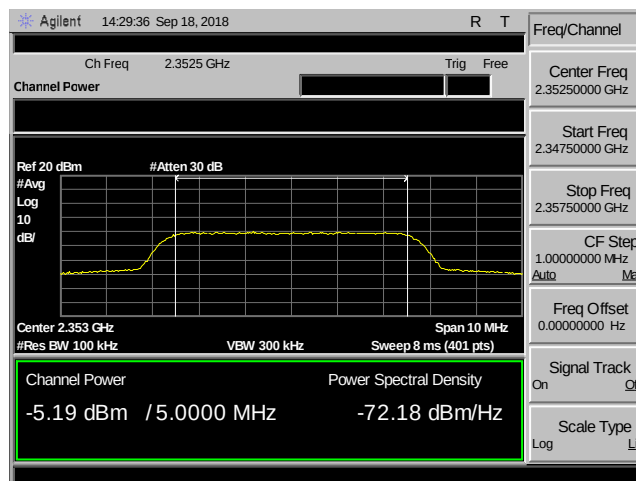
Plot 3. RF Power Output, WCS2300, 5 MHz, High, SG



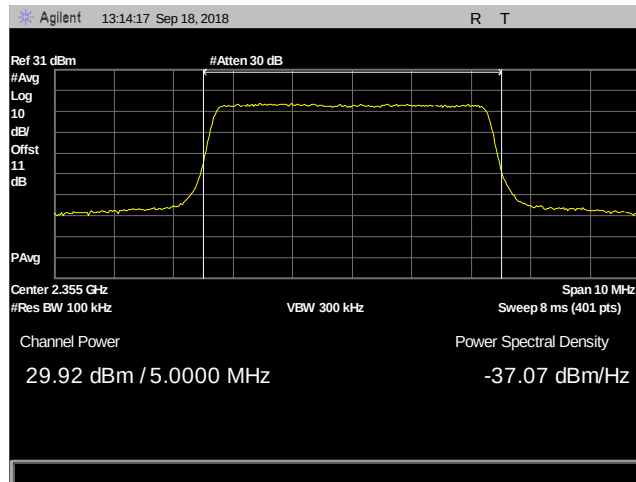
Plot 4. RF Power Output, WCS2300, 5 MHz, Low, Port 1



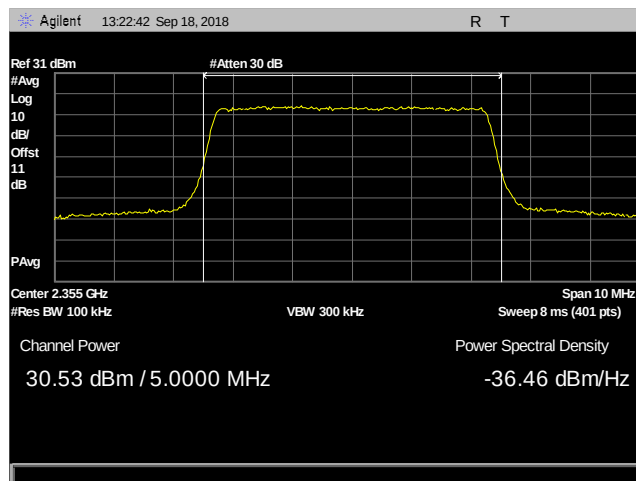
Plot 5. RF Power Output, WCS2300, 5 MHz, Low, Port 2



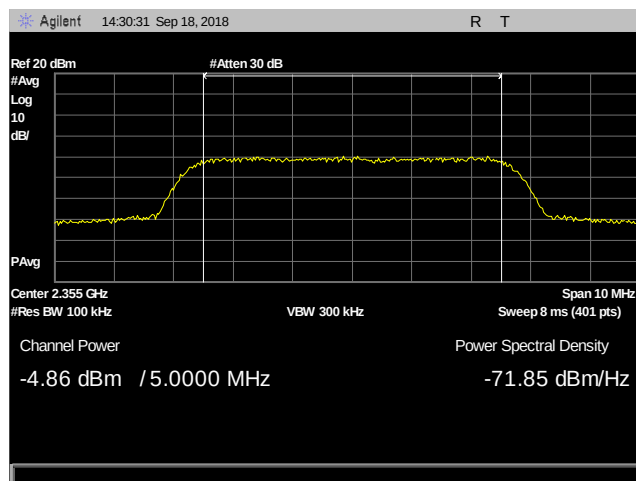
Plot 6. RF Power Output, WCS2300, 5 MHz, Low, SG



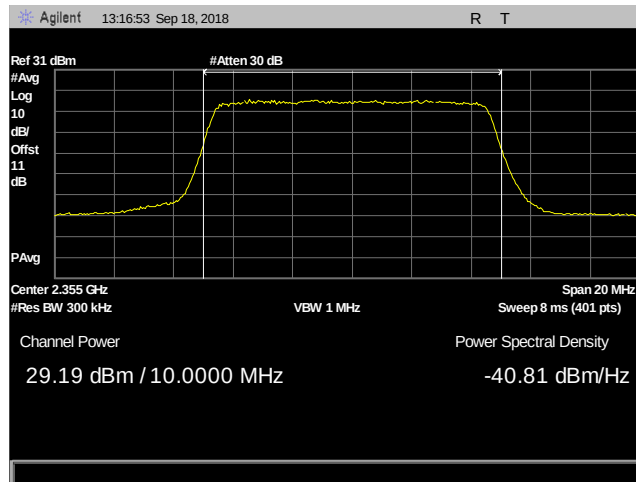
Plot 7. RF Power Output, WCS2300, 5 MHz, Mid, Port 1



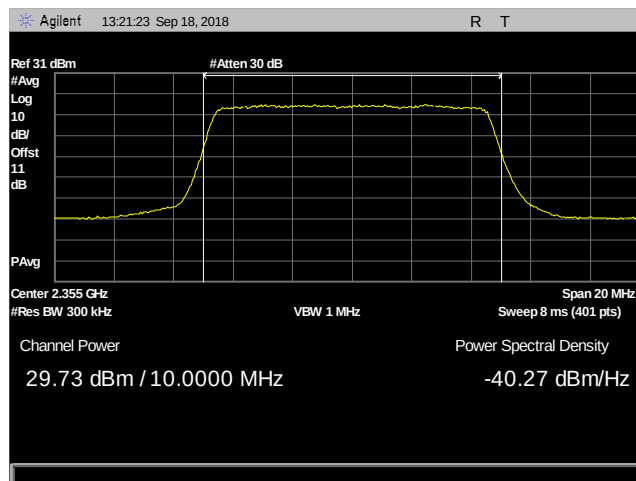
Plot 8. RF Power Output, WCS2300, 5 MHz, Mid, Port 2



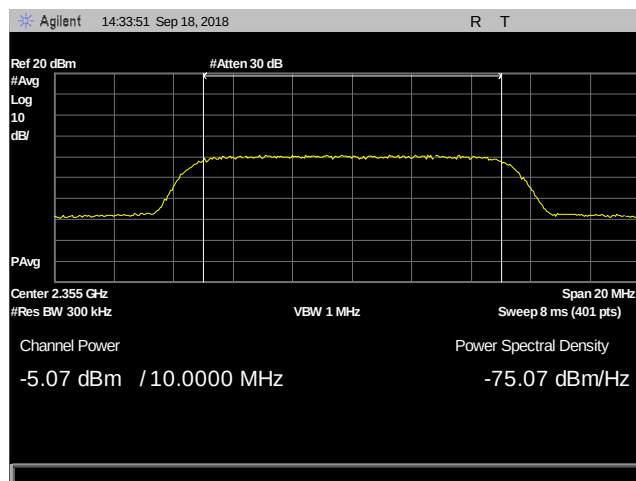
Plot 9. RF Power Output, WCS2300, 5 MHz, Mid, SG



Plot 10. RF Power Output, WCS2300, 10 MHz, Mid, Port 1

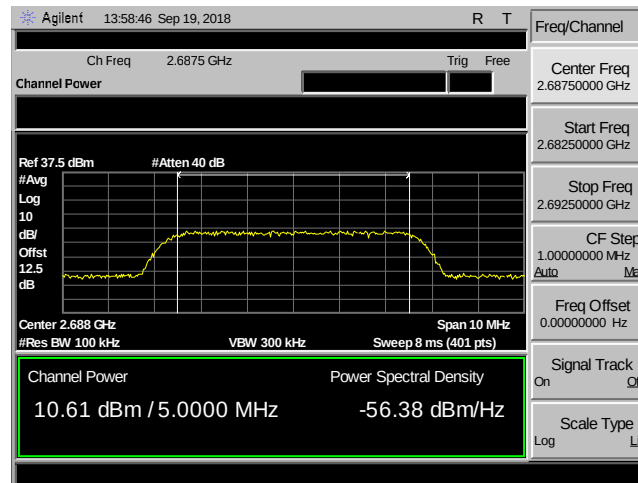


Plot 11. RF Power Output, WCS2300, 10 MHz, Mid, Port 2

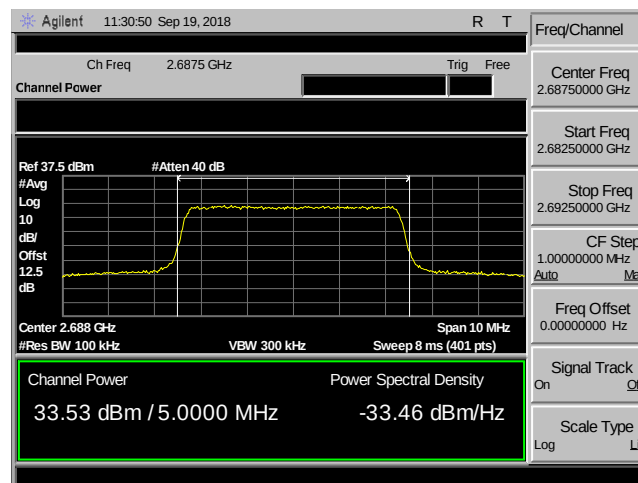


Plot 12. RF Power Output, WCS2300, 10 MHz, Mid, SG

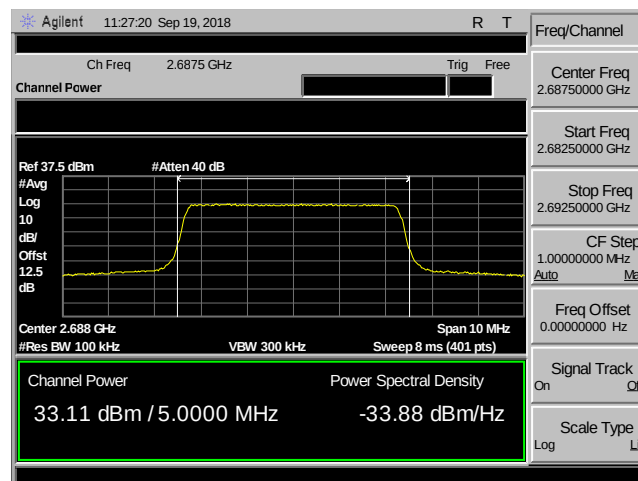
RF Output Power, Band 41



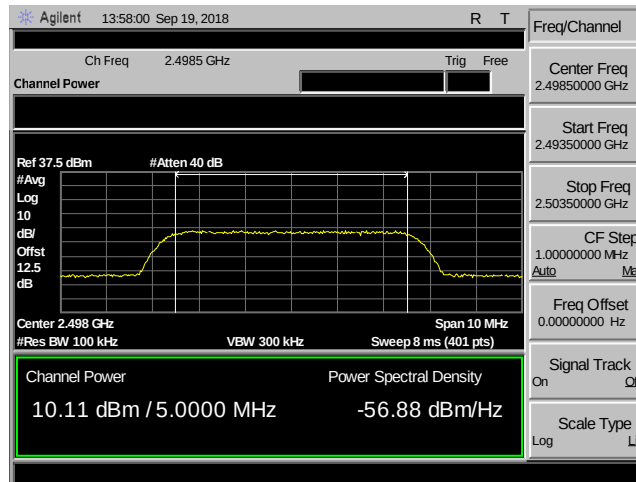
Plot 13. RF Power Output, Band 41, 5 MHz, High, AGC



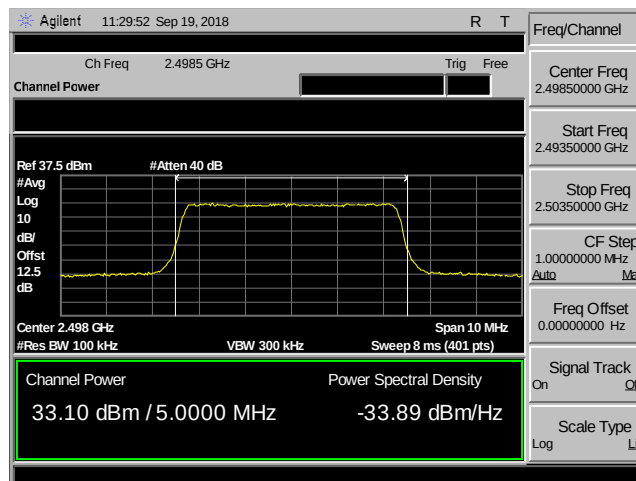
Plot 14. RF Power Output, Band 41, 5 MHz, MHz, High, Port 1



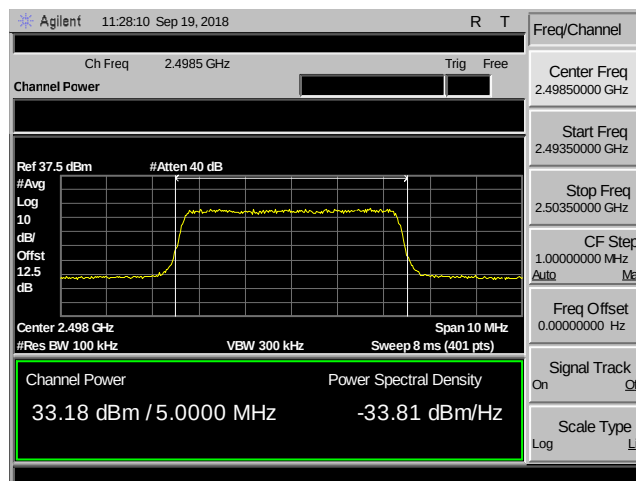
Plot 15. RF Power Output, Band 41, 5 MHz, High, Port 2



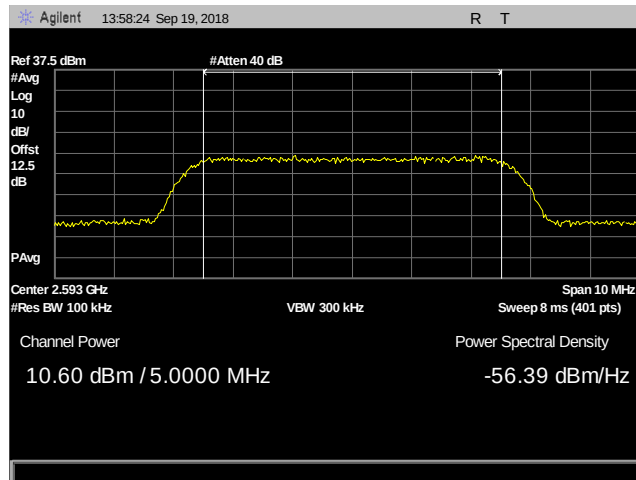
Plot 16. RF Power Output, Band 41, 5 MHz, MHz, Low, AGC



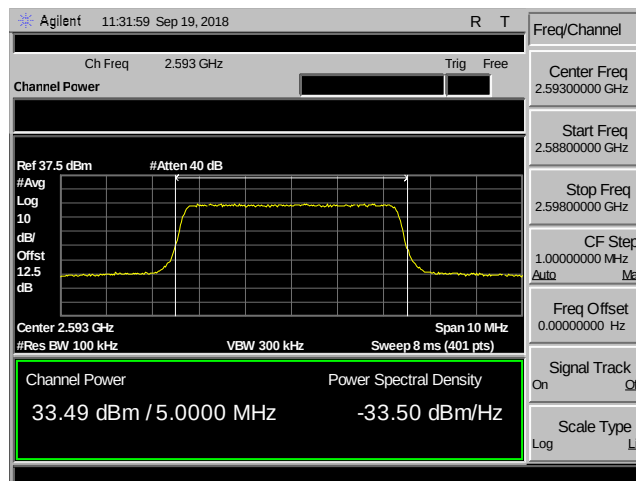
Plot 17. RF Power Output, Band 41, 5 MHz, Low, Port 1



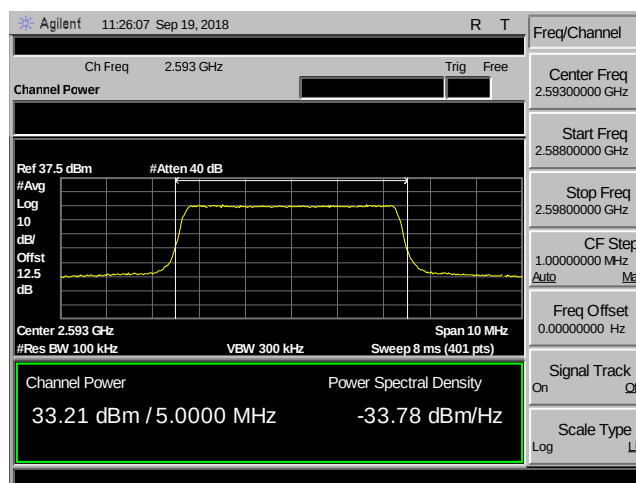
Plot 18. RF Power Output, Band 41, 5 MHz, Low, Port 2



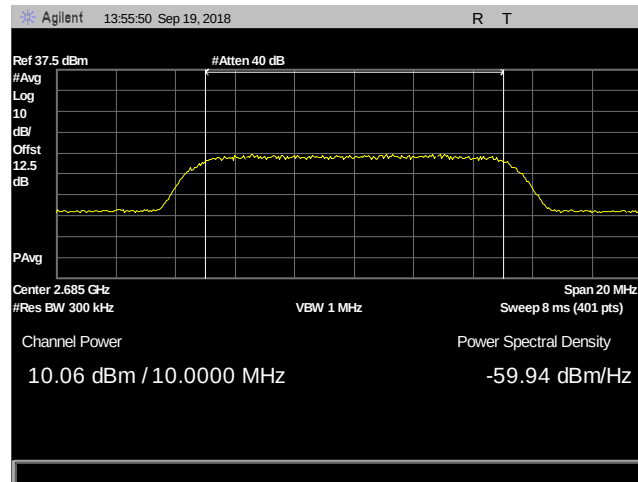
Plot 19. RF Power Output, Band 41, 5 MHz, Mid, AGC



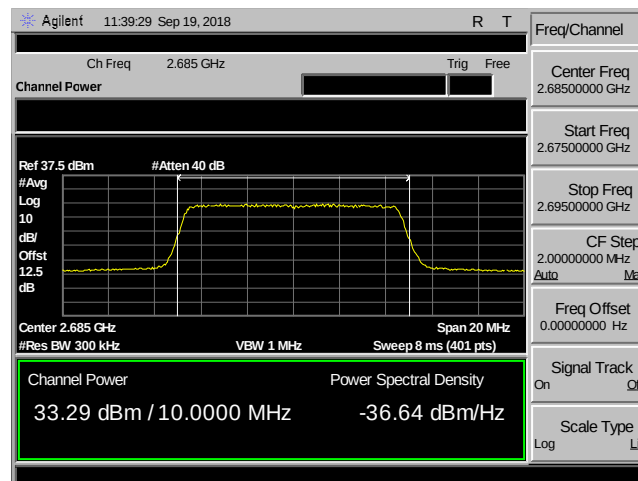
Plot 20. RF Power Output, Band 41, 5 MHz, Mid, Port 1



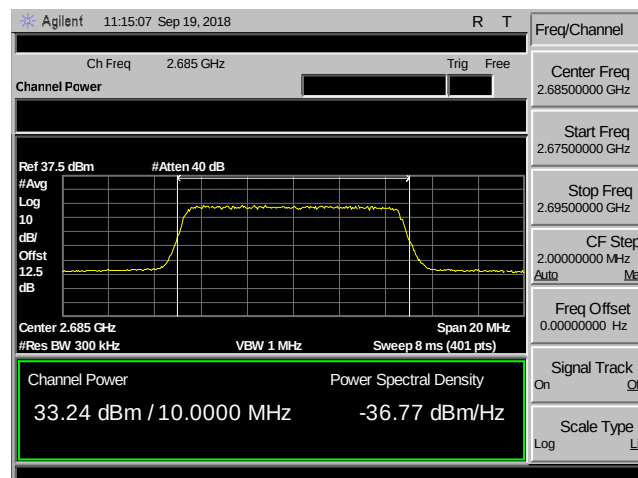
Plot 21. RF Power Output, Band 41, 5 MHz, Mid, Port 2



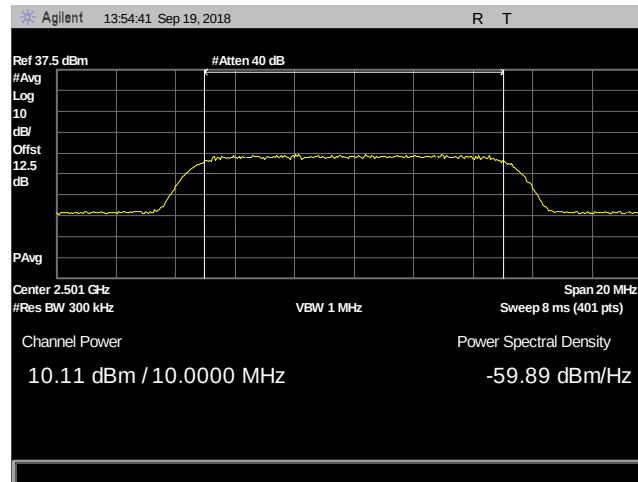
Plot 22. RF Power Output, Band 41, 10 MHz, High, AGC



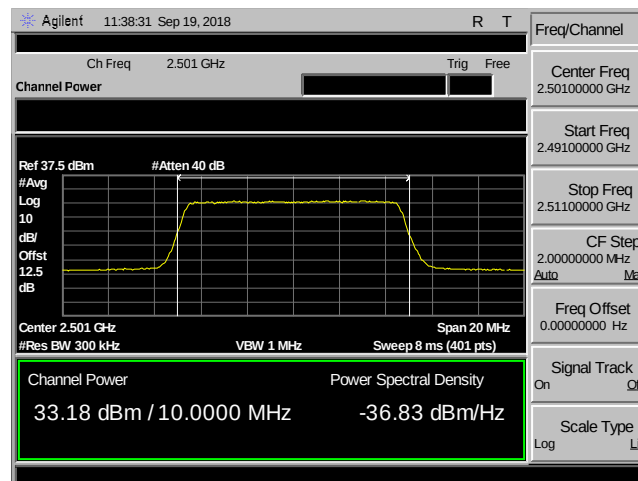
Plot 23. RF Power Output, Band 41, 10 MHz, High, Port 1



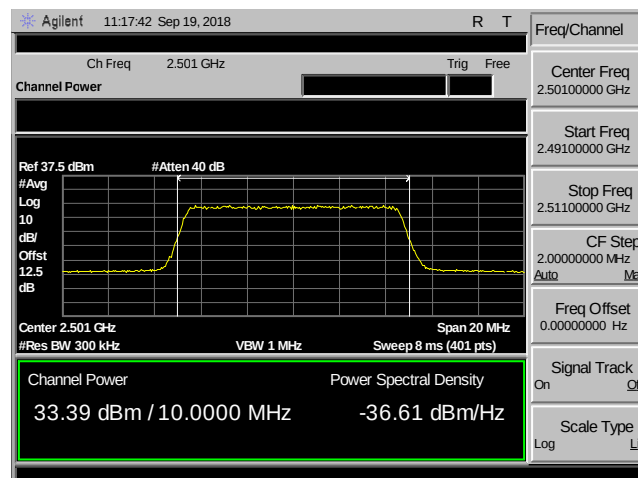
Plot 24. RF Power Output, Band 41, 10 MHz, High, Port 2



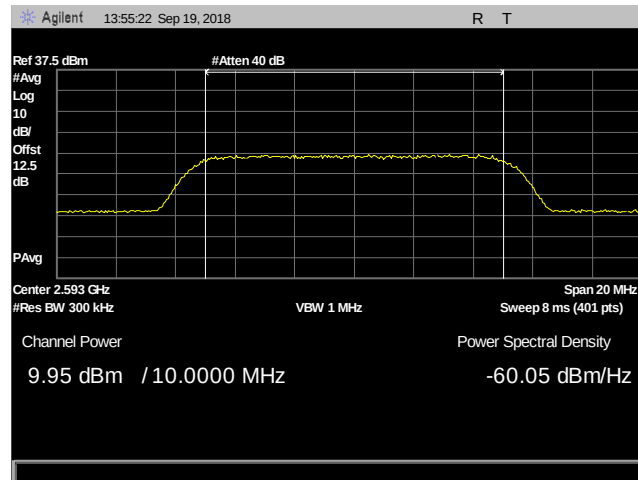
Plot 25. RF Output Power, Band 41, 10 MHz, Low, AGC



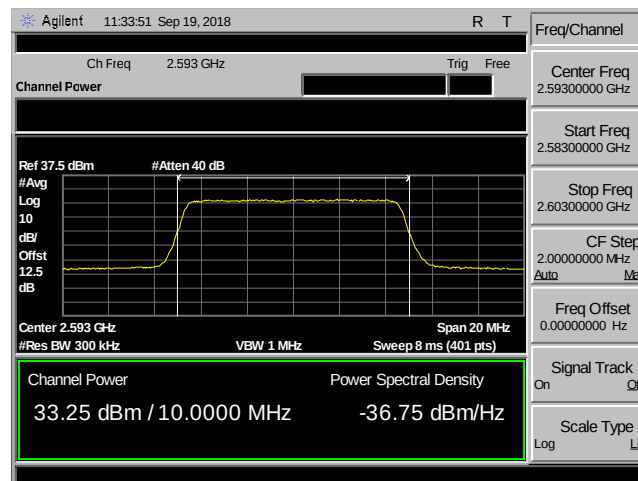
Plot 26. RF Power Output, Band 41, 10 MHz, Low, Port 1



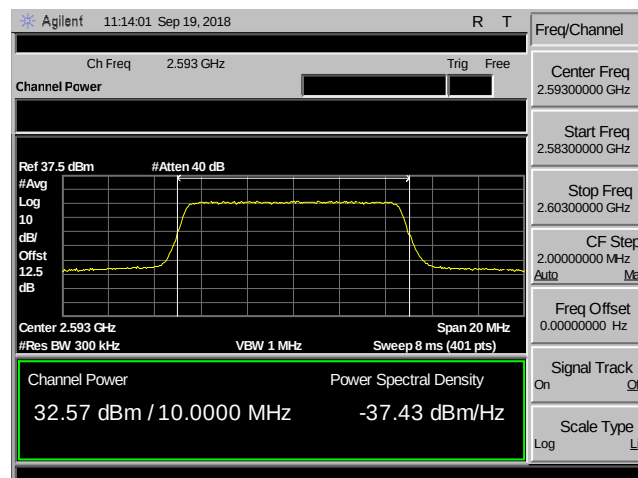
Plot 27. RF Power Output, Band 41, 10 MHz, Low, Port 2



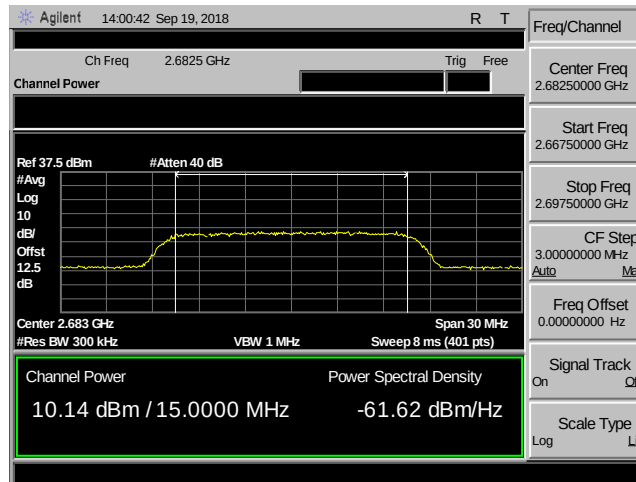
Plot 28. RF Power Output, Band 41, 10 MHz, Mid, AGC



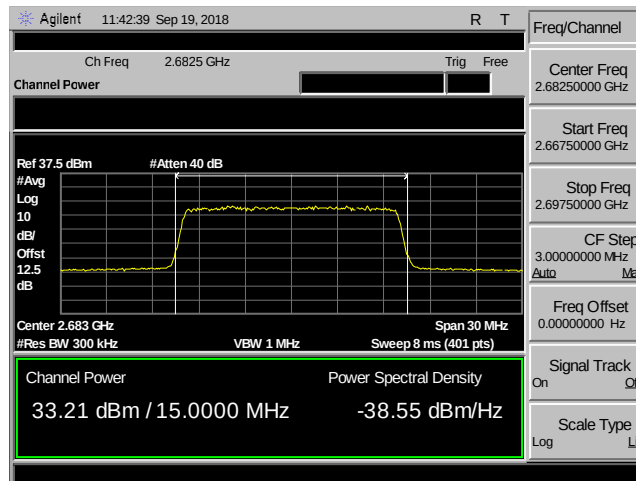
Plot 29. RF Power Output, Band 41, 10 MHz, Mid, Port 1



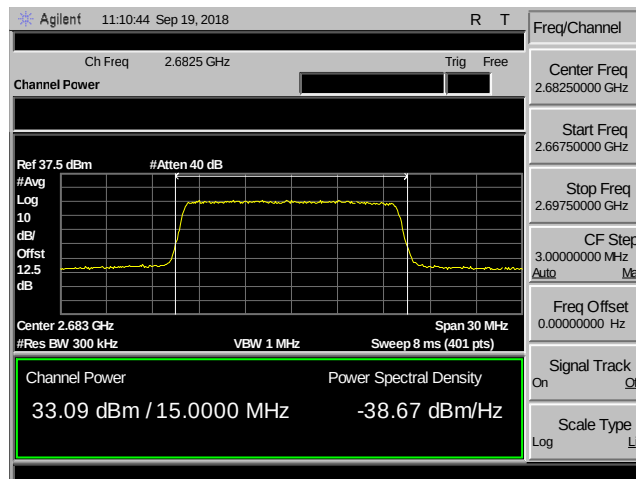
Plot 30. RF Power Output, Band 41, 10 MHz, Mid, Port 2



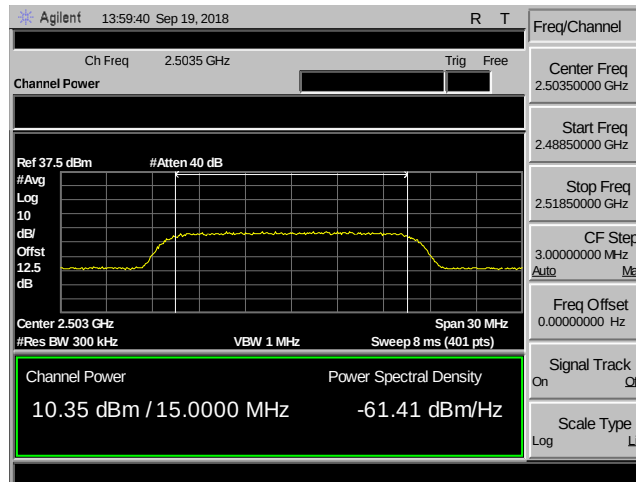
Plot 31. RF Power Output, Band 41, 15 MHz, High, AGC



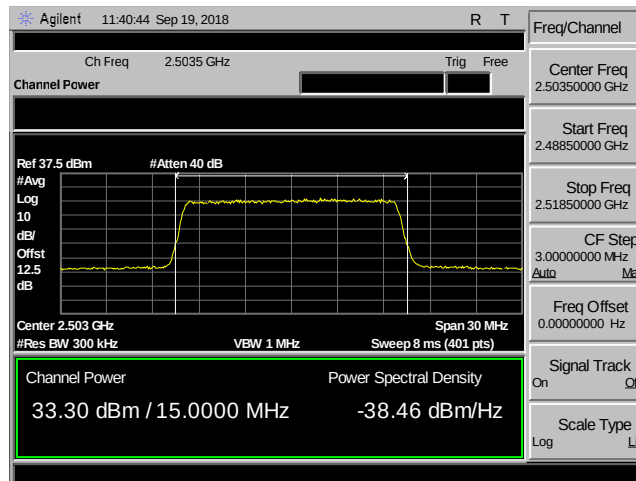
Plot 32. RF Power Output, Band 41, 15 MHz, High, Port 1



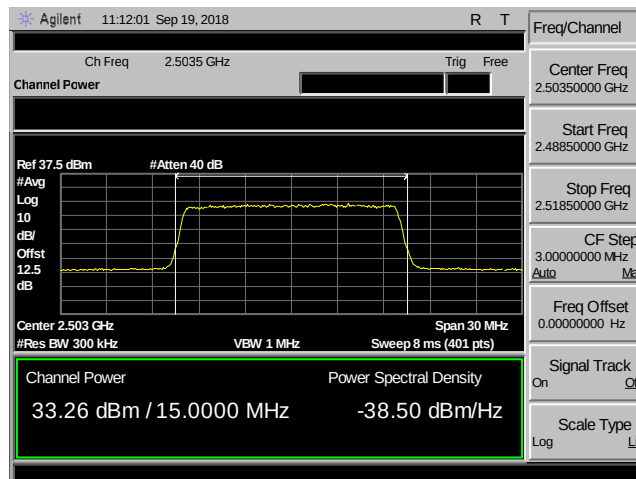
Plot 33. RF Power Output, Band 41, 15 MHz, High, Port 2



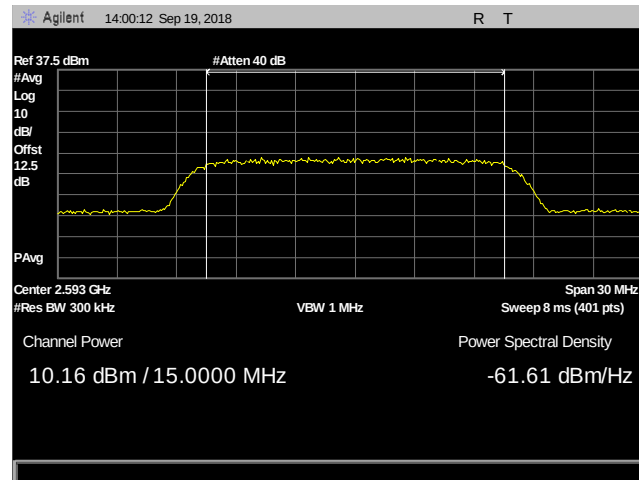
Plot 34. RF Power Output, Band 41, 15 MHz, Low, AGC



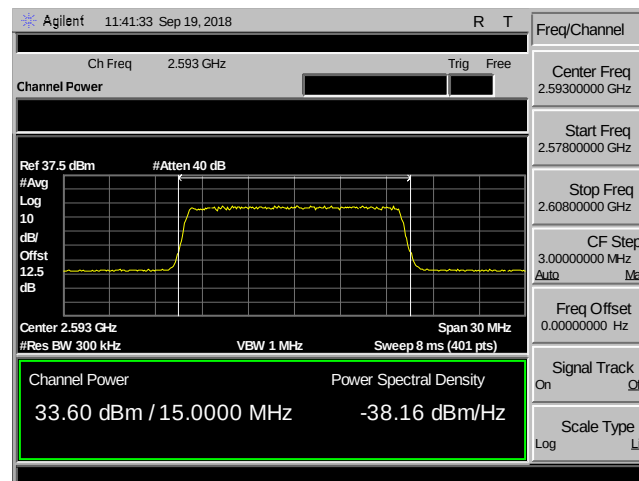
Plot 35. RF Power Output, Band 41, 15 MHz, Low, Port 1



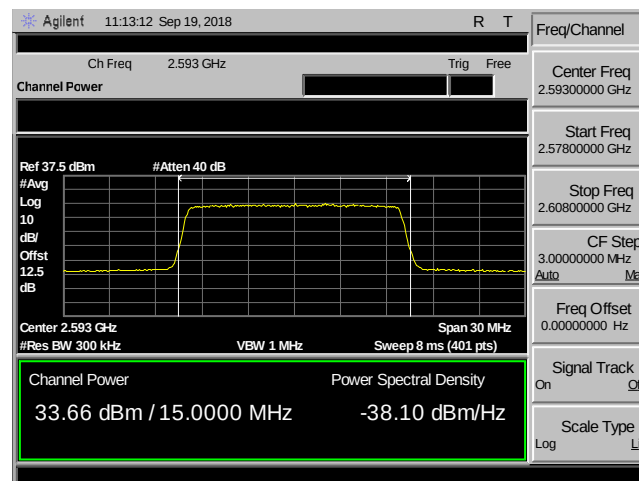
Plot 36. RF Power Output, Band 41, 15 MHz, Low, Port 2



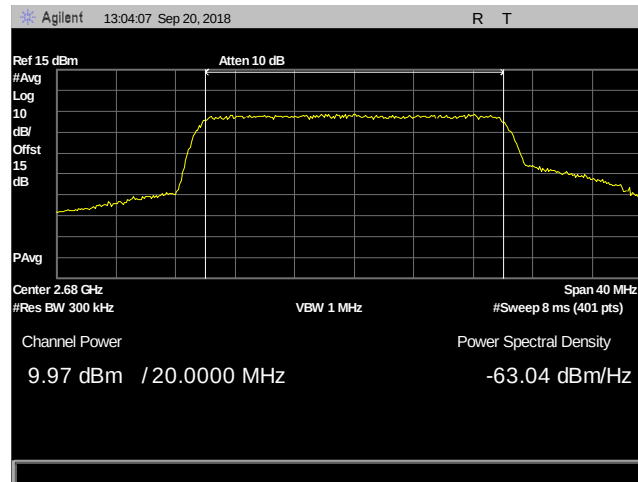
Plot 37. RF Power Output, Band 41, 15 MHz, Mid, AGC



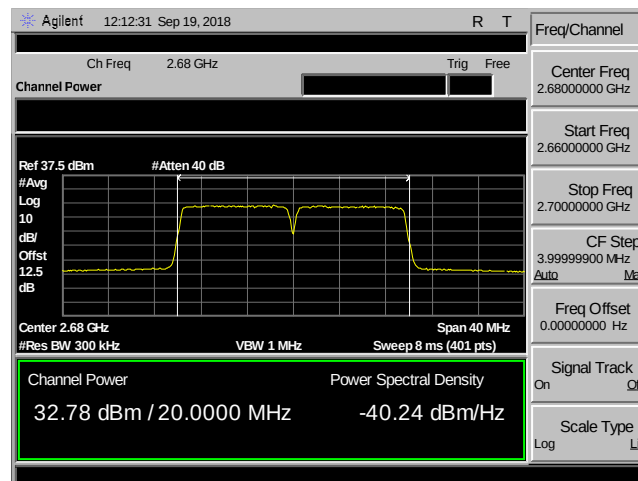
Plot 38. RF Power Output, Band 41, 15 MHz, Mid, Port 1



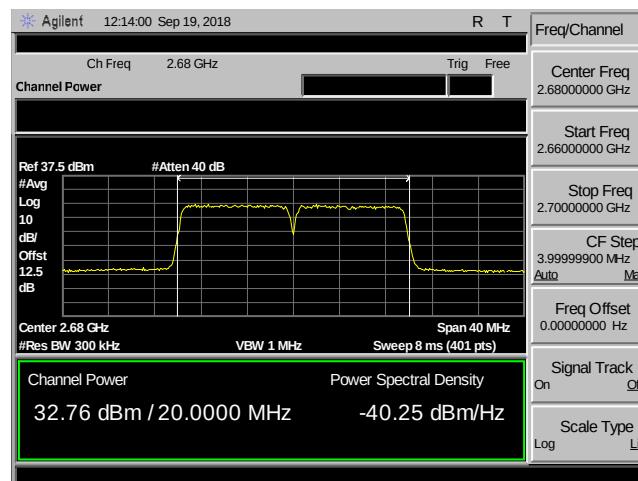
Plot 39. RF Power Output, Band 41, 15 MHz, Mid, Port 2



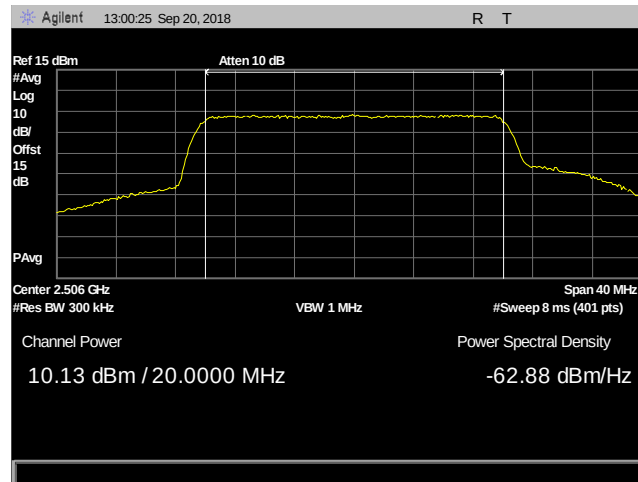
Plot 40. RF Power Output, Band 41, 20 MHz, High, AGC



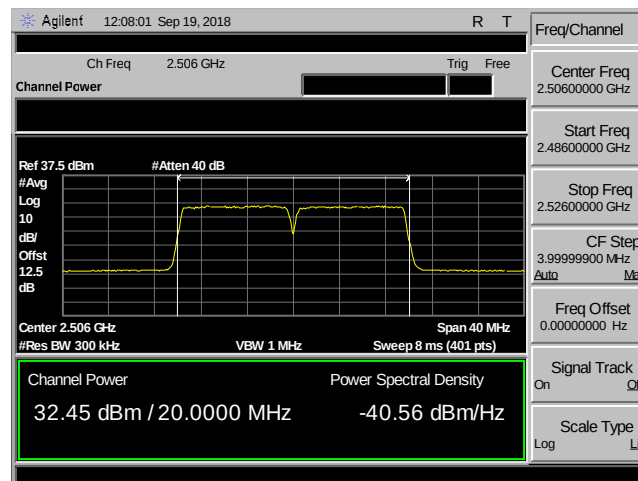
Plot 41. RF Power Output, Band 41, 20 MHz, High, Port 1



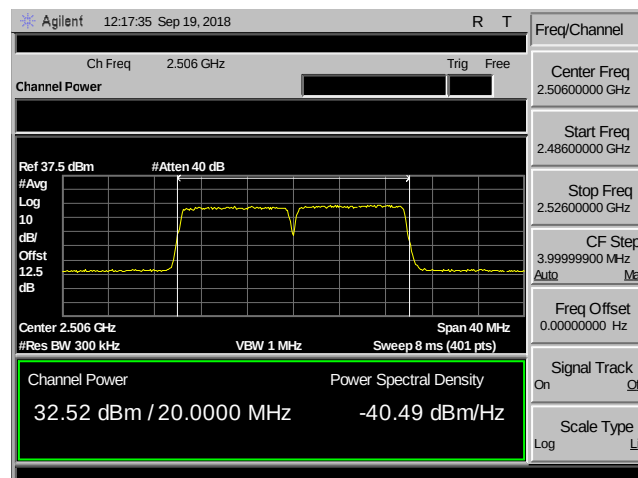
Plot 42. RF Power Output, Band 41, 20 MHz, High, Port 2



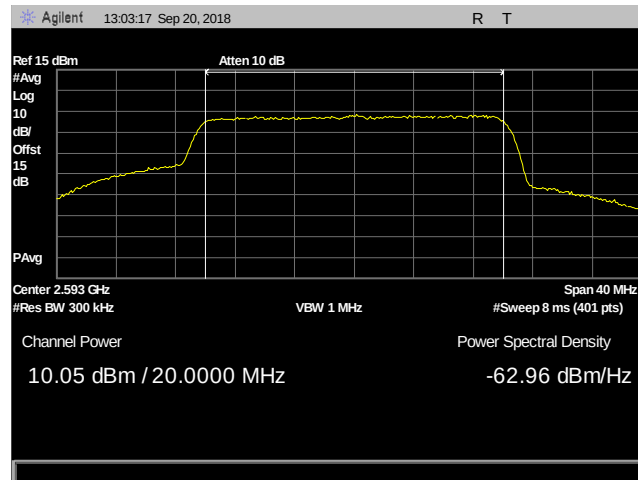
Plot 43. RF Power Output, Band 41, 20 MHz, Low, AGC



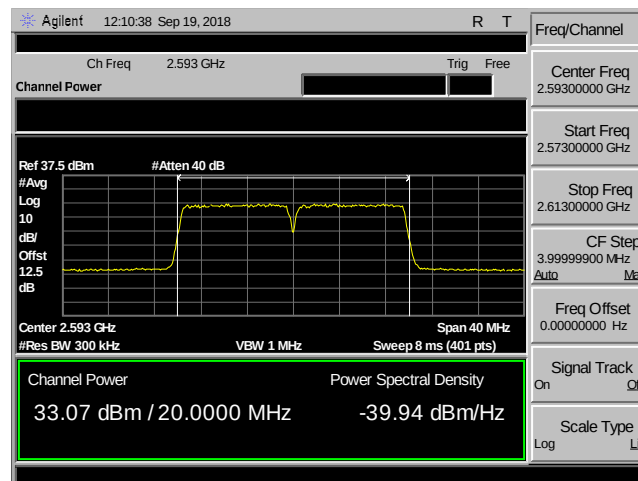
Plot 44. RF Power Output, Band 41, 20 MHz, Low, Port 1



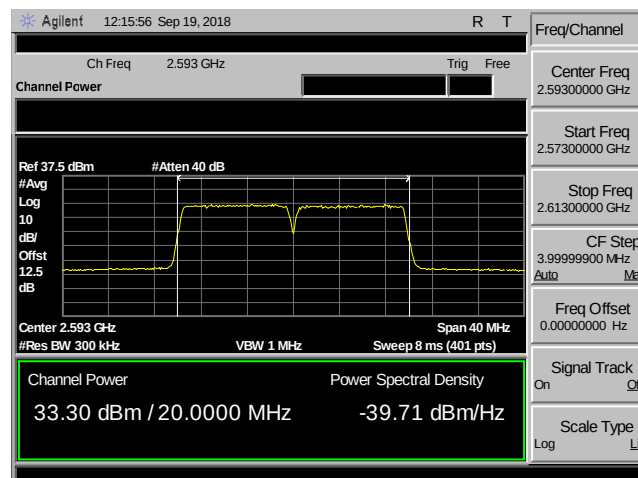
Plot 45. RF Power Output, Band 41, 20 MHz, Low, Port 2



Plot 46. RF Power Output, Band 41, 20 MHz, Mid, AGC



Plot 47. RF Power Output, Band 41, 20 MHz, Mid, Port 1



Plot 48. RF Power Output, Band 41, 20 MHz, Mid, Port 2

§ 2.1049 Occupied Bandwidth

Test Requirement(s): § 2.1049 **Measurements required: Occupied bandwidth:** The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the specified conditions of § 2.1049 (a) through (i) as applicable.

Test Procedures: The EUT was tested according to relative measurement procedure of KDB935210 D05 section 3.4 or C63.26-2015 section 7.2.2.3. The OBW measurement function of the spectrum analyzer was used and configured in the following manner.

- (a) Frequency = channel cf
 - (b) Span = 2-5 x the OBW
 - (c) RBW = 1-5 % of the OBW
 - (d) VBW 1-3 x the RBW
 - (e) Sweep Time = Auto
 - (f) Detector = peak
 - (g) $-X \text{ dB} = 26$
- a) A signal generator was connected to the input of the EUT.
- b) The signal generator was configured to transmit the AWGN signal.
- c) The signal amplitude was configured to be just below the AGC threshold level (see 3.2), but not more than 0.5 dB below.
- d) A spectrum analyzer was connected to the output of the EUT using appropriate attenuation.
- e) The spectrum analyzer center frequency was set to the center frequency of the operational band under test. The span range of the spectrum analyzer was between 2 times to 5 times the emission bandwidth (EBW) or alternatively, the OBW.
- f) The nominal RBW was in the range of 1 % to 5 % of the anticipated OBW, and the VBW was $\geq 3 \times \text{RBW}$.
- g) The reference level of the instrument was set as required to preclude the signal from exceeding the maximum spectrum analyzer input mixer level for linear operation. In general, the peak of the spectral envelope must be more than $[10 \log (\text{OBW} / \text{RBW})]$ below the reference level.
- Steps f) and g) may require iteration to enable adjustments within the specified tolerances.
- h) The noise floor of the spectrum analyzer at the selected RBW were at least 36 dB below the reference level.
- i) Spectrum analyzer detection function was set to positive peak.
- j) The trace mode was set to max hold.
- k) The reference value was determined: the trace to stabilize was allowed. The spectrum analyzer marker was set to the highest amplitude level of the displayed trace (this is the reference value) and the associated frequency was recorded as f_0 .
- l) Two markers were placed, one at the lowest and the other at the highest frequency of the envelope of the spectral display, such that each marker was at or slightly below the -26 dB down amplitude. The 26 dB EBW (alternatively OBW) is the positive frequency difference between the two markers. If the spectral envelope crossed the -26 dB down amplitude at multiple points, the lowest or highest frequency were selected as the frequencies that are the furthest removed from the center frequency at which the spectral envelope crosses the -26 dB down amplitude point.



- m) Steps e) to l) were repeated with the input signal connected directly to the spectrum analyzer (i.e., input signal measurement).
- n) The spectral plot of the input signal (determined from step m) was compared to the output signal (determined from step l) to affirm that they are similar (in passband and rolloff characteristic features and relative spectral locations), and plot(s) and descriptions were included in test report.
- o) The procedure was repeated [steps e) to n)] with the input signal amplitude set to 3 dB above the AGC threshold.
- p) Steps e) to o) were repeated with the signal generator set to the narrowband signal.
- q) Steps e) to p) were repeated for all frequency bands authorized for use by the EUT.

Test Results: Equipment was found compliant with Section 2.1049. The following pages show measurements of 99% and -26 dB Occupied Bandwidth plots.

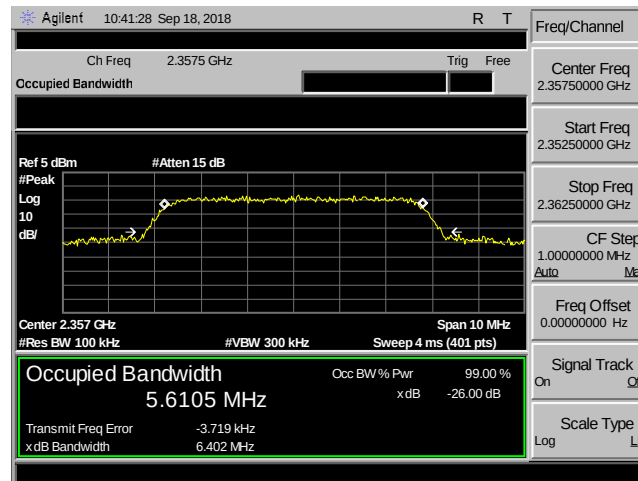
Test Engineer(s): Bradley Jones

Test Date(s): September 20, 2018

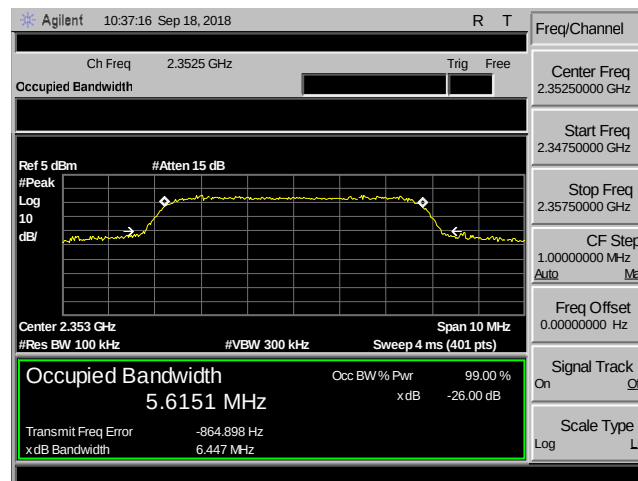
Band 30		frequency	OBW Input	OBW Output	% diff
5 MHz	Low	2352.5	6.447	4.937	-23.4217
	Middle	2355	6.435	4.934	-23.3256
	High	2357.5	6.402	4.924	-23.0865
10 MHz	Middle	2355	12.812	10.178	-20.5589
Band 41		frequency	OBW Input	OBW Output	% diff
5 MHz	Low	2498.5	6.37	4.919	-22.7786
	Middle	2593	6.43	4.899	-23.8103
	High	2687.5	6.335	4.928	-22.2099
10 MHz	Low	2501	12.637	10.07	-20.3134
	Middle	2593	12.766	10.113	-20.7818
	High	2685	12.705	10.102	-20.488
15 MHz	Low	2503.5	18.903	14.662	-22.4356
	Middle	2593	18.982	14.426	-24.0017
	High	2682.5	18.825	14.657	-22.1408
20 MHz	Low	2506	25.082	20.123	-19.7712
	Middle	2593	27.372	20.073	-26.6659
	High	2680	24.873	20.081	-19.2659

Table 9. Occupied Bandwidth, Test Results

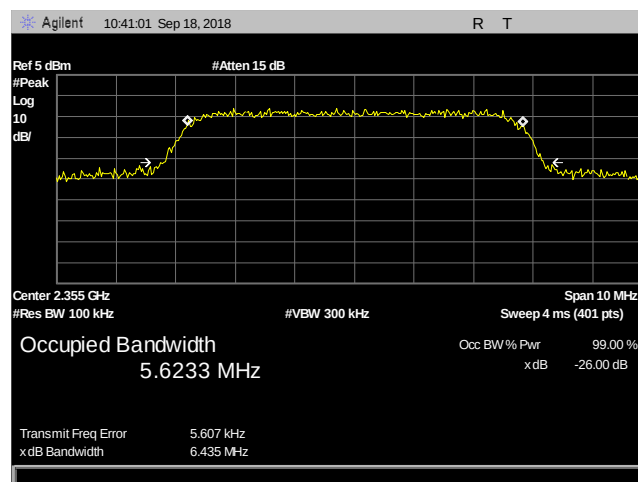
Occupied Bandwidth, Band 30



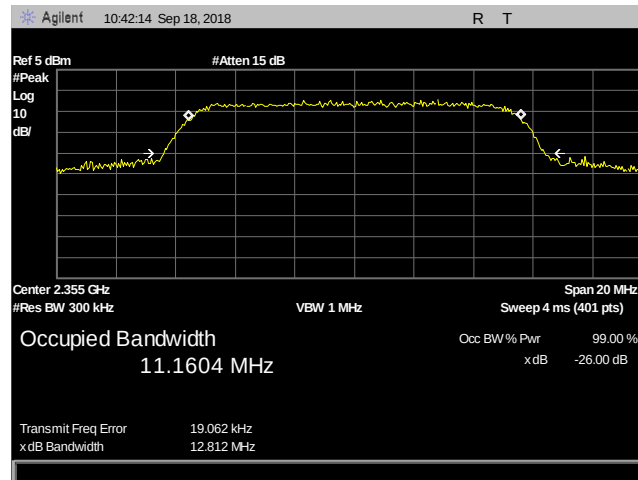
Plot 49. Occupied Bandwidth, SG, WCS2300, 5 MHz, High



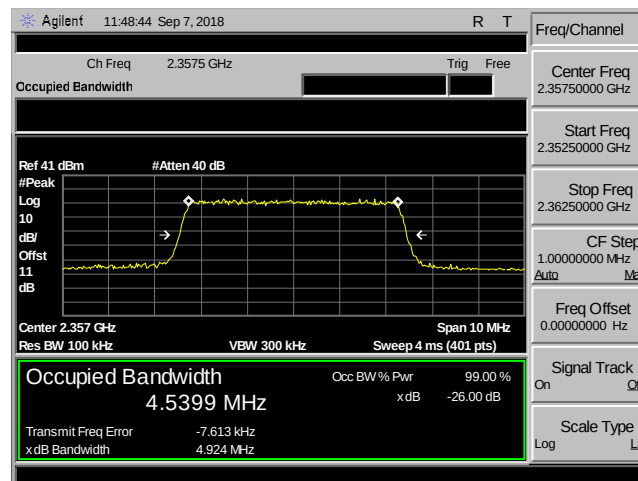
Plot 50. Occupied Bandwidth, SG, WCS2300, 5 MHz, Low



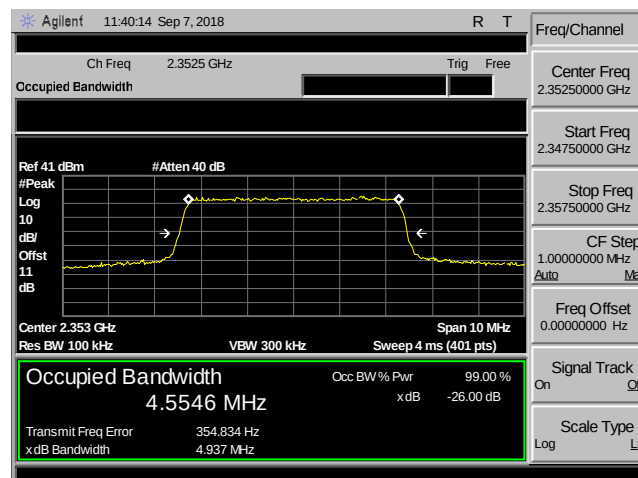
Plot 51. Occupied Bandwidth, SG, WCS2300, 5 MHz, Mid



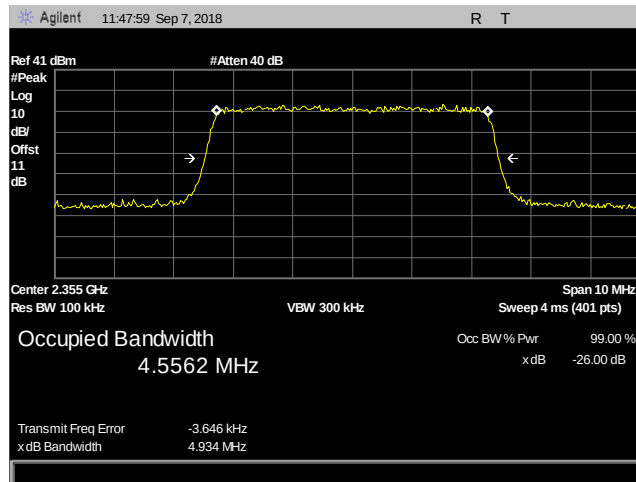
Plot 52. Occupied Bandwidth, SG, WCS2300, 10 MHz, Mid



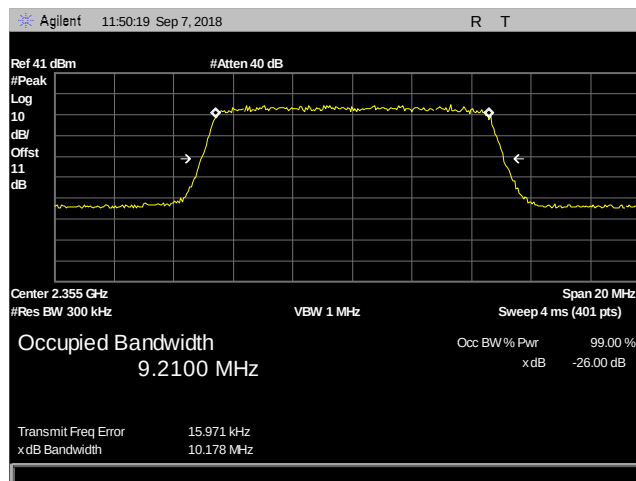
Plot 53. Occupied Bandwidth, WCS2300, 5 MHz, High



Plot 54. Occupied Bandwidth, WCS2300, 5 MHz, Low

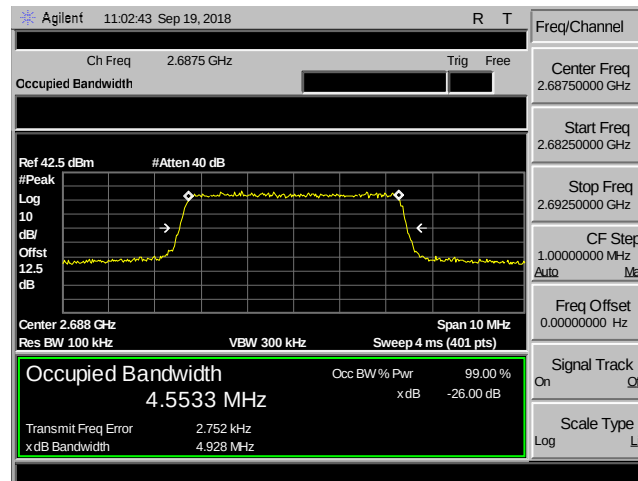


Plot 55. Occupied Bandwidth, WCS2300, 5 MHz, Mid

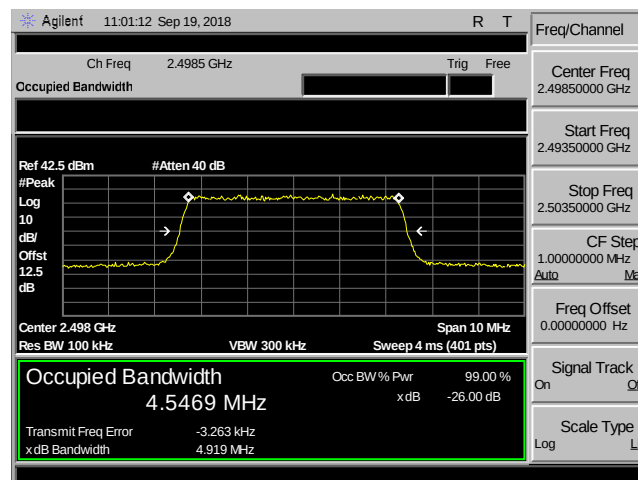


Plot 56. Occupied Bandwidth, WCS2300, 10 MHz, Mid

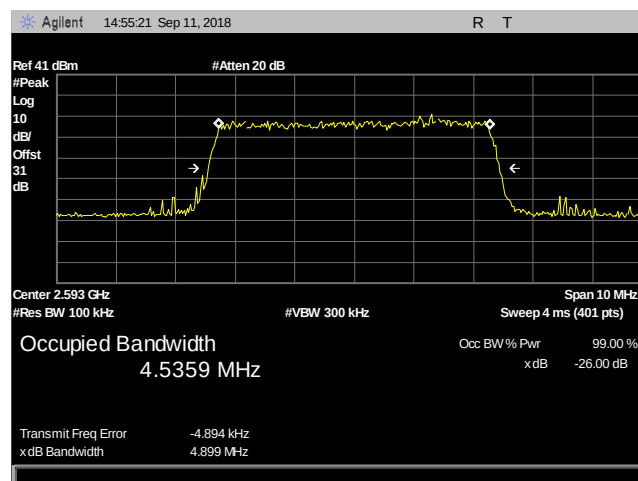
Occupied Bandwidth, Band 41



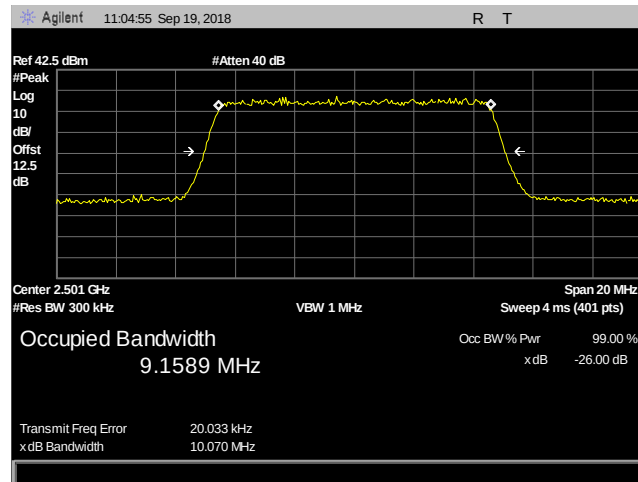
Plot 57. Occupied Bandwidth, Band 41, 5 MHz, 2496 – 2690 MHz, High, Port 2



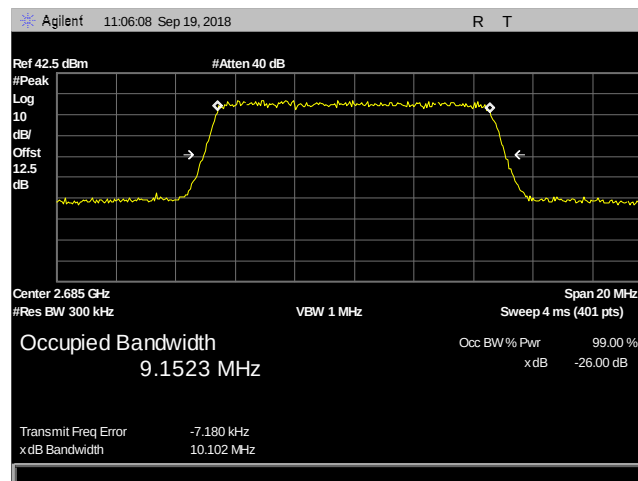
Plot 58. Occupied Bandwidth, Band 41, 5 MHz, 2496 – 2690 MHz, Low, Port 2



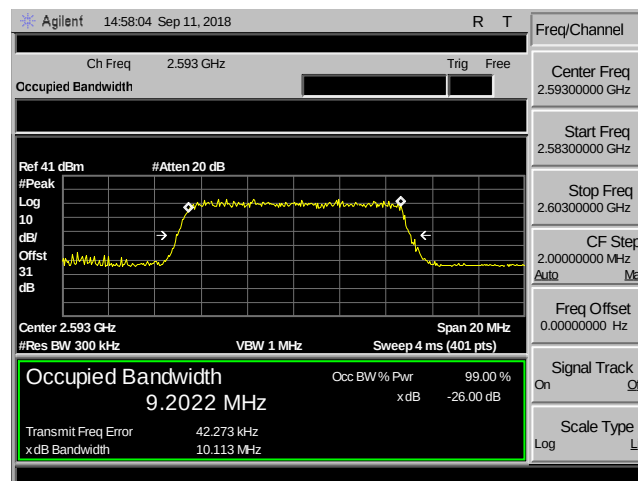
Plot 59. Occupied Bandwidth, Band 41, 5 MHz, Mid, Port 2



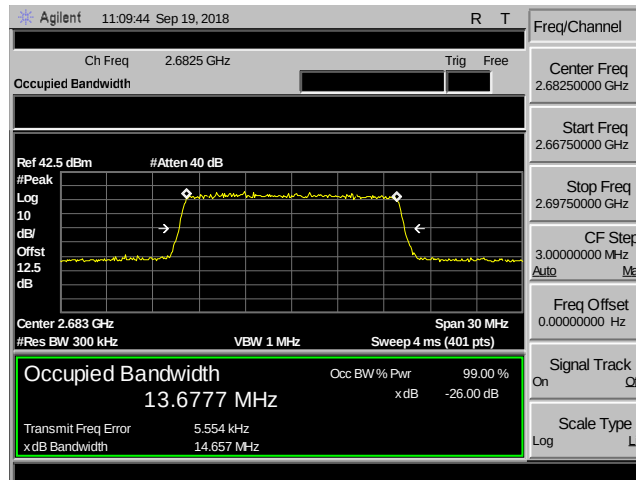
Plot 60. Occupied Bandwidth, Band 41, 10 MHz, 2496 – 2690 MHz, Low, Port 2



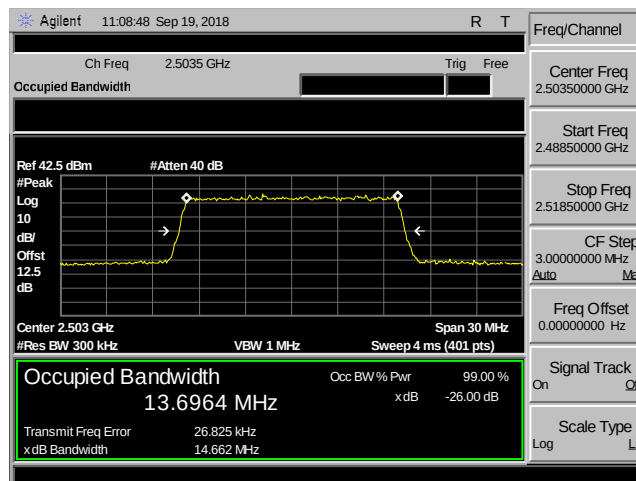
Plot 61. Occupied Bandwidth, Band 41, 10 MHz, High, Port 2



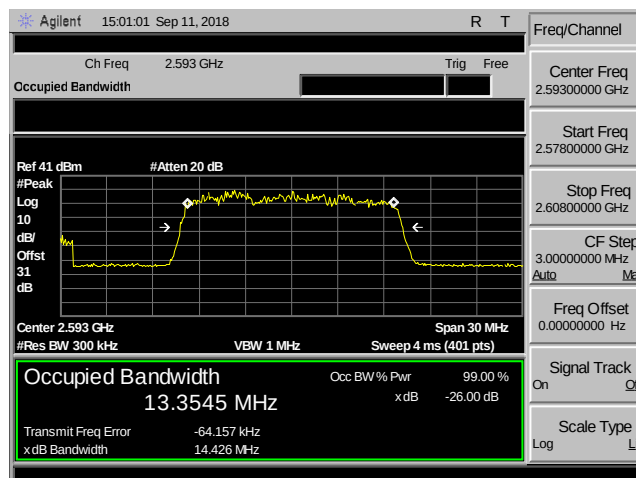
Plot 62. Occupied Bandwidth, Band 41, 10 MHz, Mid, Port 2



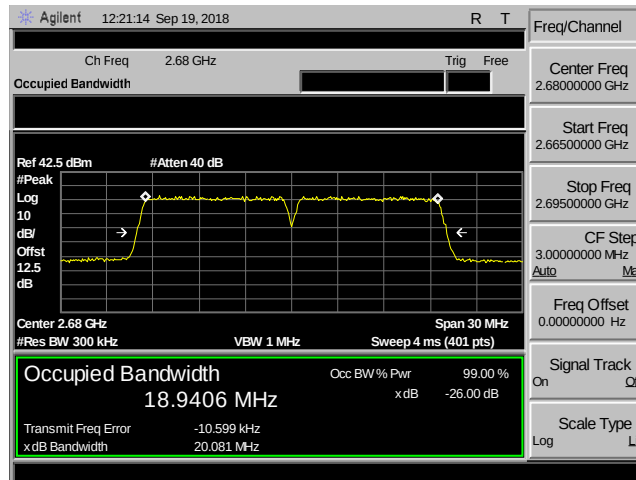
Plot 63. Occupied Bandwidth, Band 41, 15 MHz, High, Port 2



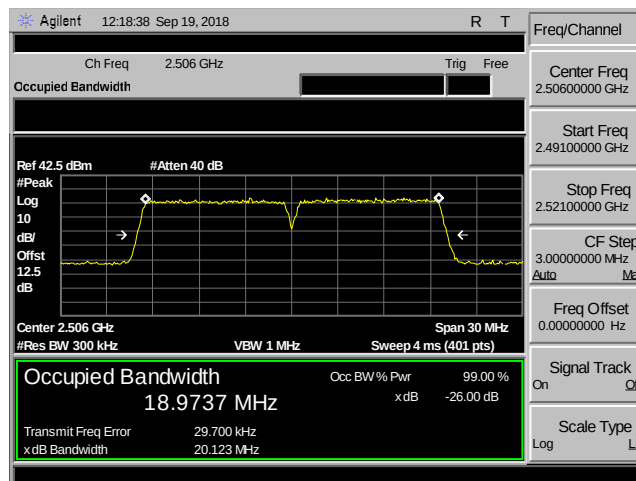
Plot 64. Occupied Bandwidth, Band 41, 15 MHz, Low, Port 2



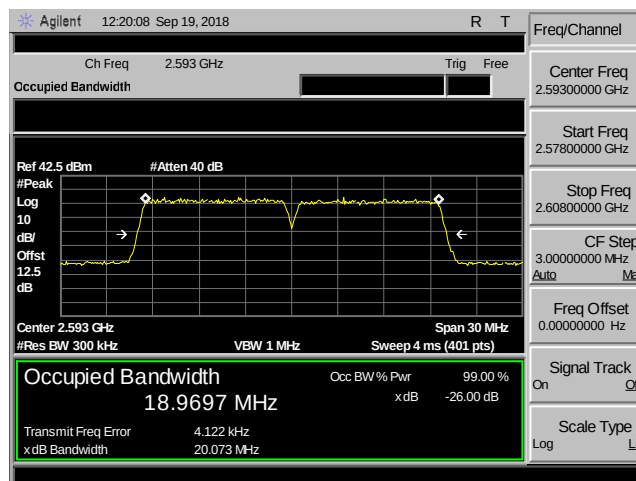
Plot 65. Occupied Bandwidth, Band 41, 15 MHz, Mid, Port 2



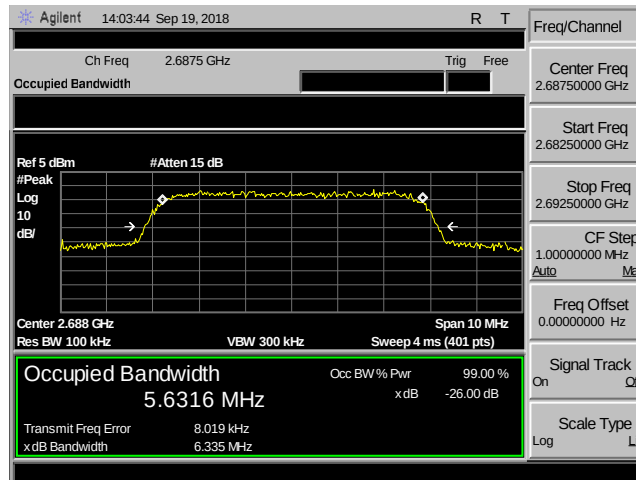
Plot 66. Occupied Bandwidth, Band 41, 20 MHz, High, Port 2



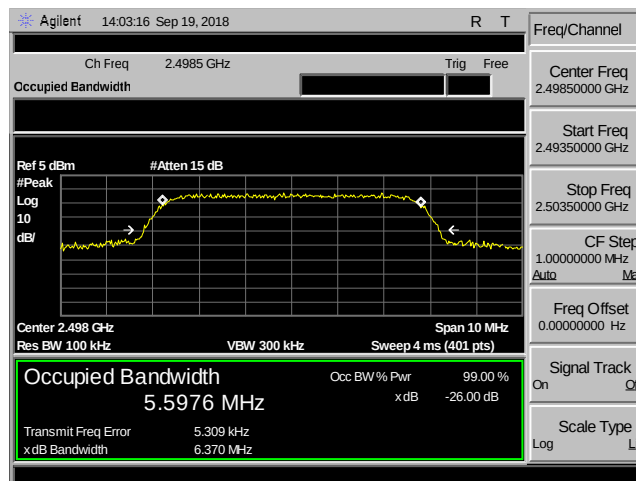
Plot 67. Occupied Bandwidth, Band 41, 20 MHz, Low, Port 2



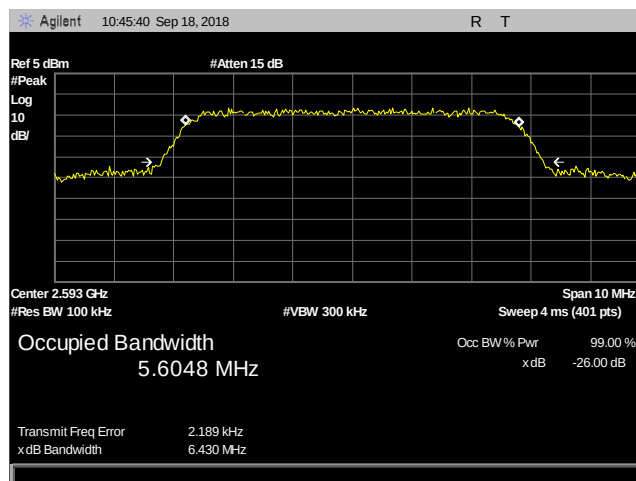
Plot 68. Occupied Bandwidth, Band 41, 20 MHz, Mid, Port 2



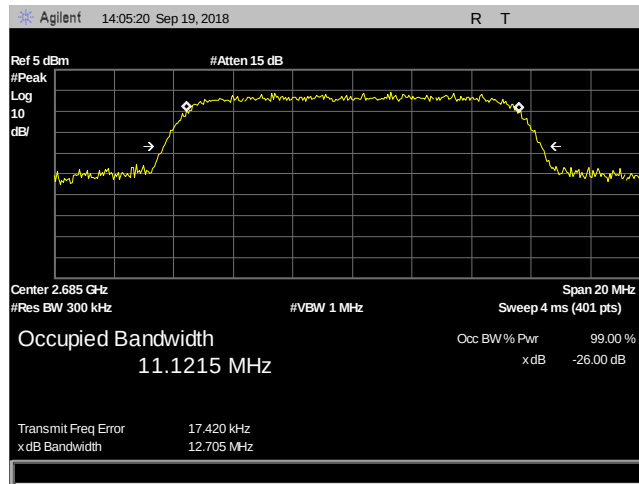
Plot 69. Occupied Bandwidth, Band 41, SG, 5 MHz, High



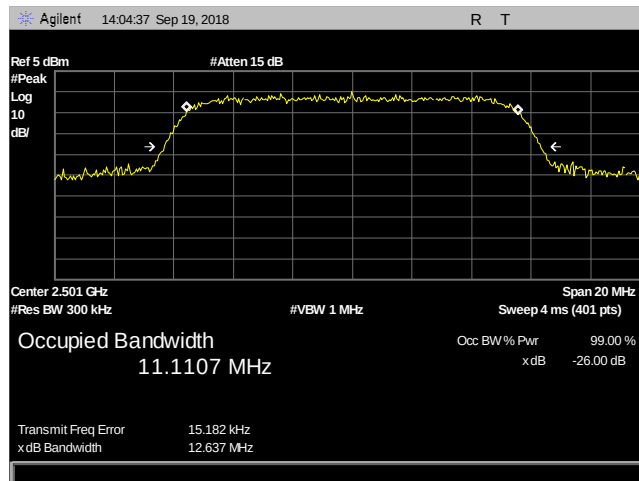
Plot 70. Occupied Bandwidth, Band 41, SG, 5 MHz, Low



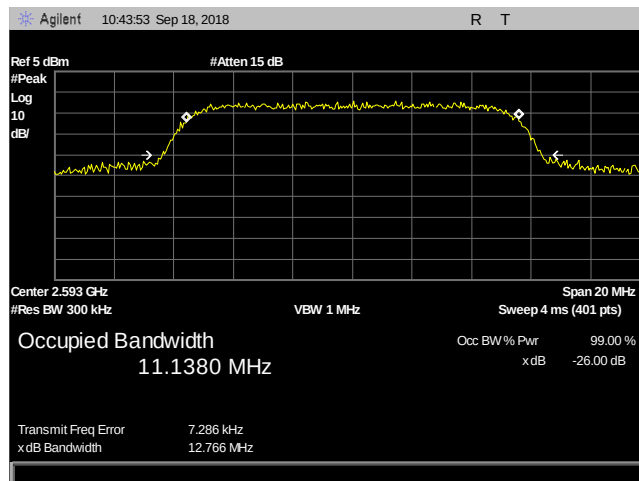
Plot 71. Occupied Bandwidth, Band 41, SG, 5 MHz, Mid



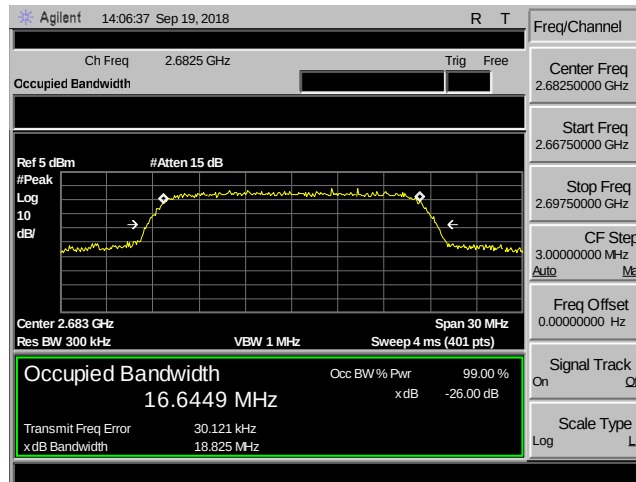
Plot 72. Occupied Bandwidth, Band 41, SG, 10 MHz, High



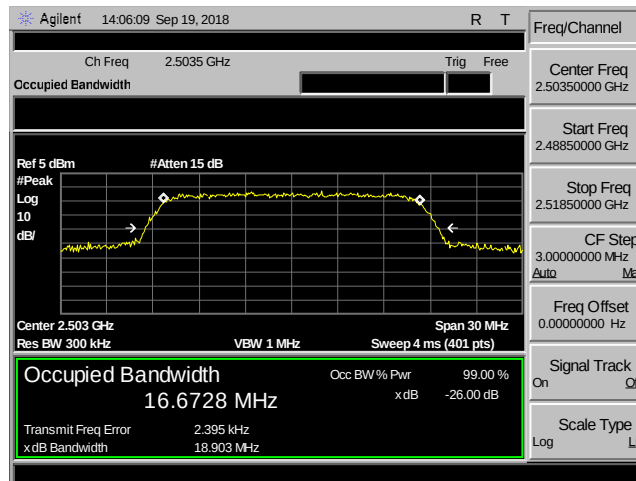
Plot 73. Occupied Bandwidth, Band 41, SG, 10 MHz, Low



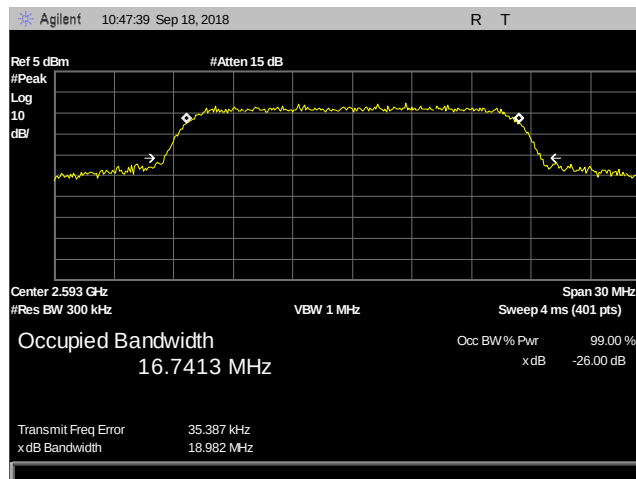
Plot 74. Occupied Bandwidth, Band 41, SG, 10 MHz, Mid



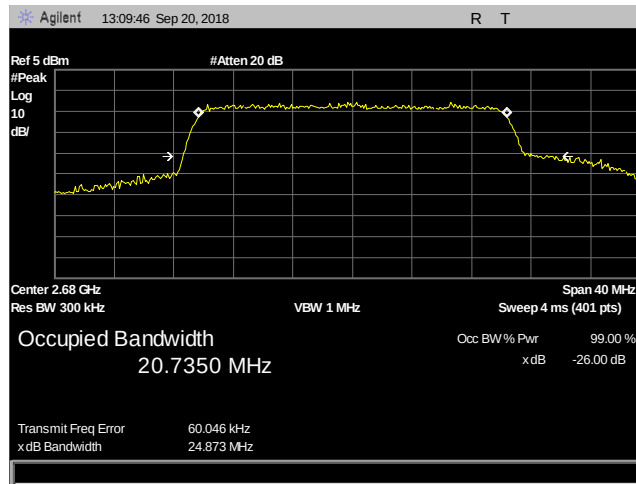
Plot 75. Occupied Bandwidth, Band 41, SG, 15 MHz, High



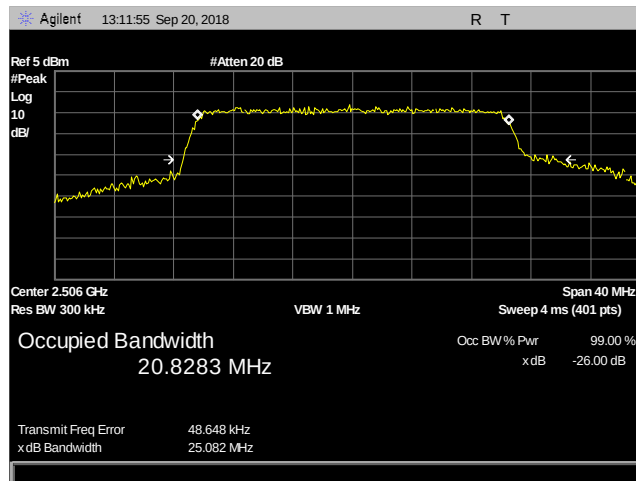
Plot 76. Occupied Bandwidth, Band 41, SG, 15 MHz, Low



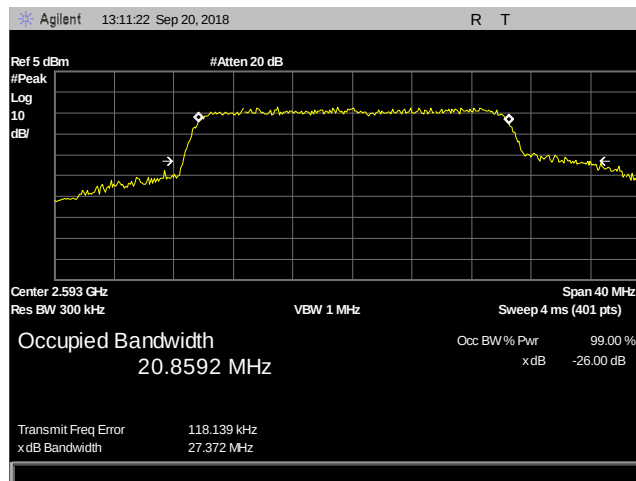
Plot 77. Occupied Bandwidth, Band 41, SG, 15 MHz, Mid



Plot 78. Occupied Bandwidth, Band 41, SG, 20 MHz, High



Plot 79. Occupied Bandwidth, Band 41, SG, 20 MHz, Low



Plot 80. Occupied Bandwidth, Band 41, SG, 20 MHz, Mid



Electromagnetic Compatibility Criteria for Intentional Radiators

§ 2.1053 Radiated Spurious Emissions

Test Requirement(s): § 2.1053 Measurements required: Field strength of spurious radiation.

§ 2.1053 (a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of § 2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.

§ 2.1053 (b): The measurements specified in paragraph (a) of this section shall be made for the following equipment:

- (1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.
- (2) All equipment operating on frequencies higher than 25 MHz.
- (3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
- (4) Other types of equipment as required, when deemed necessary by the Commission.



Test Procedures: The EUT was tested according to field strength method of ANSI C63.26 5.5.4. The spectrum analyzer was used and configured in the following manner:

- (a) Frequency Range = Lowest Generated – 10th Harmonic
- (b) RBW = 1MHz
- (c) VBW 1-3 x the RBW
- (d) Detector = Average

Radiated emission measurements were performed inside a 3 meter chamber that satisfies the site requirements of ANSI C63.4-2014. The EUT was placed on an rf transparent 80 cm table for measurements below 1GHz and an rf transparent 1.5 meter table for measurements above 1GHz. The EUT's RF ports were terminated to 50ohm load. The EUT was tested using all modulations and at the low, mid, and high channels. The EUT was rotated about 360° and the receiving antenna scanned from 1-4m in order to capture the maximum emission. The plots are corrected for cable loss, antenna correction factor, and distance correction. The field strength was mathematically corrected to an E.I.R.P.

Emissions below 30MHz and above 18GHz were more than 20dB below the limit. The worse-case configurations are reported.

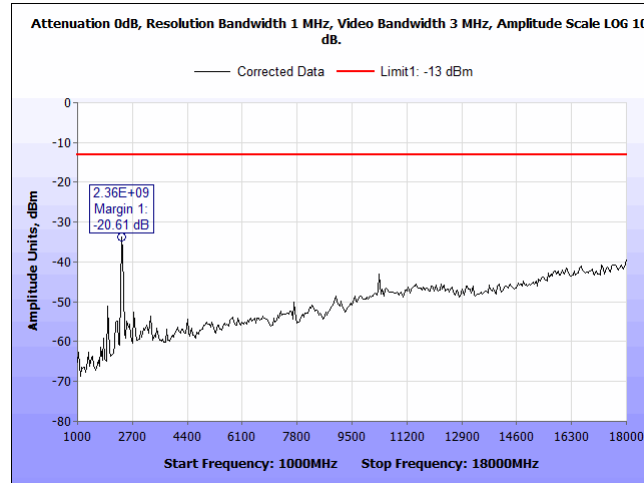
Test Results: The EUT was found compliant with the requirements of this section.

Measurements were made in each configuration. Data is presented for the worse case configuration.

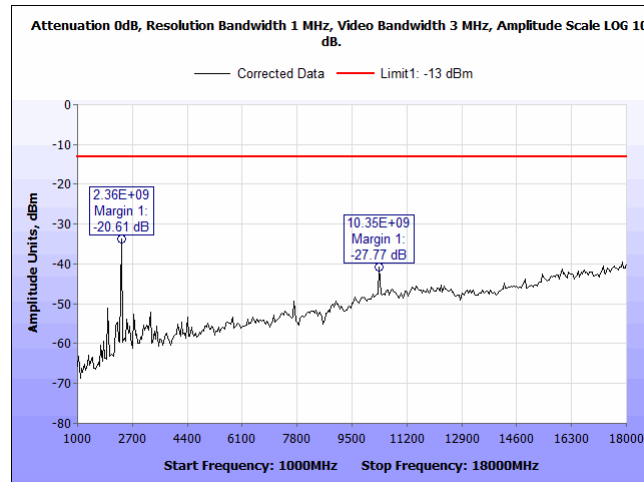
Test Engineer: Bradley Jones

Test Date(s): September 26, 2018

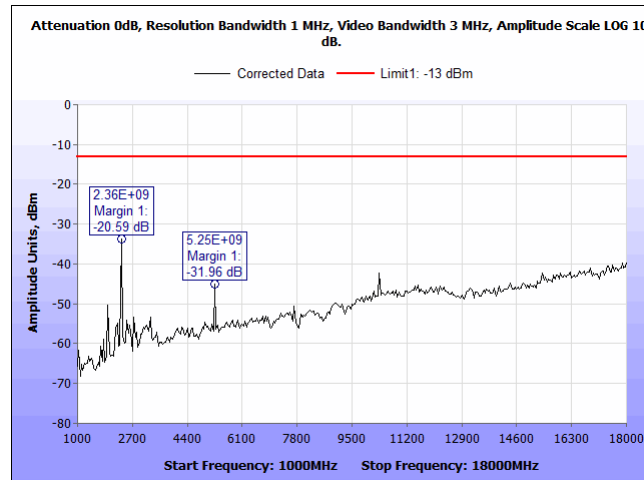
Radiated Spurious Emissions



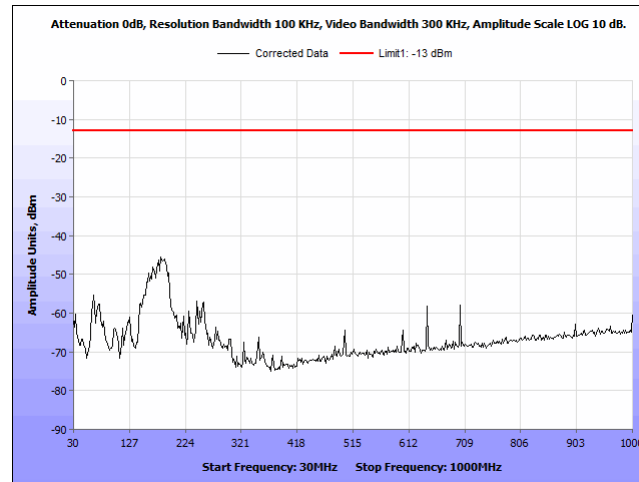
Plot 81. Radiated Spurious Emissions, Band 30, 5 MHz, 1 – 18 GHz, High



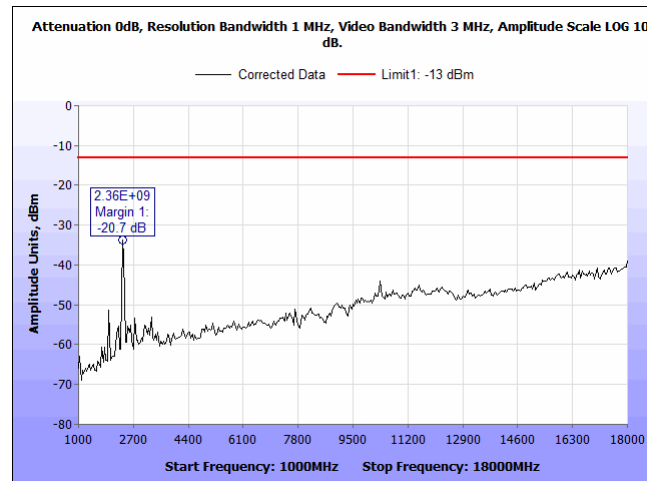
Plot 82. Radiated Spurious Emissions, Band 30, 5 MHz, 1 – 18 GHz, Low



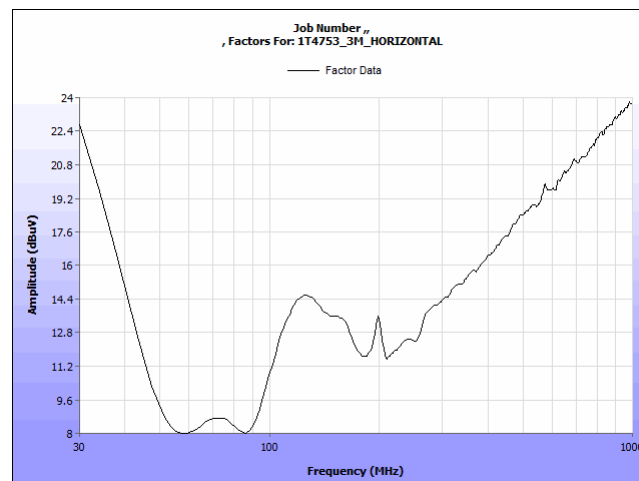
Plot 83. Radiated Spurious Emissions, Band 30, 5 MHz, 1 – 18 GHz, Mid



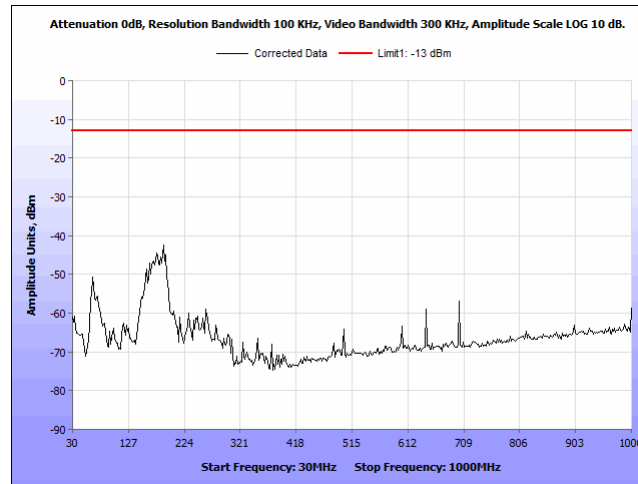
Plot 84. Radiated Spurious Emissions, Band 30, 5 MHz, 30 MHz – 1 GHz



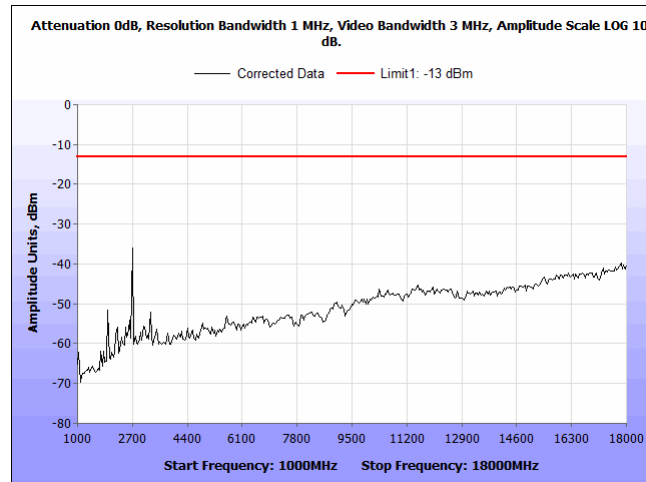
Plot 85. Radiated Spurious Emissions, Band 30, 10 MHz, 1 – 18 GHz, Mid



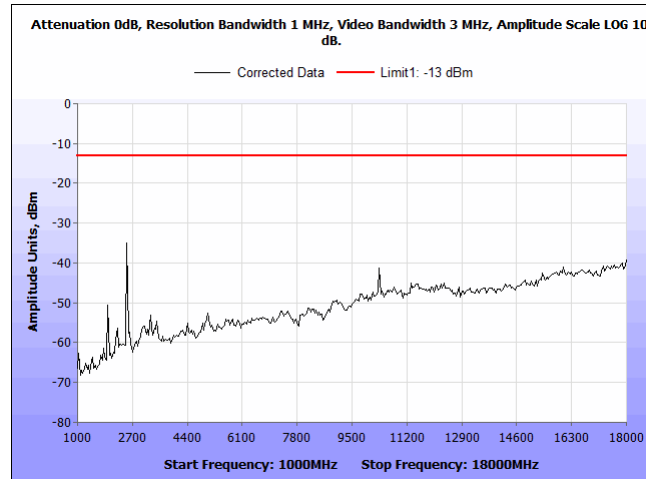
Plot 86. Radiated Spurious Emissions, Band 30, 10 MHz, 30 MHz – 1 GHz, factors



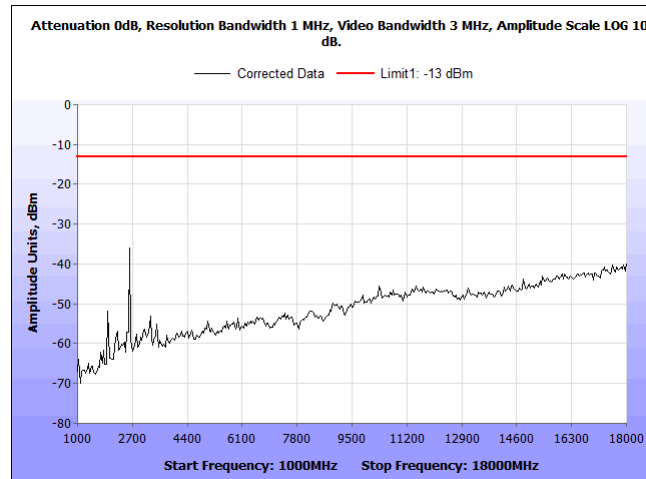
Plot 87. Radiated Spurious Emissions, Band 30, 10 MHz, 30 MHz – 1 GHz



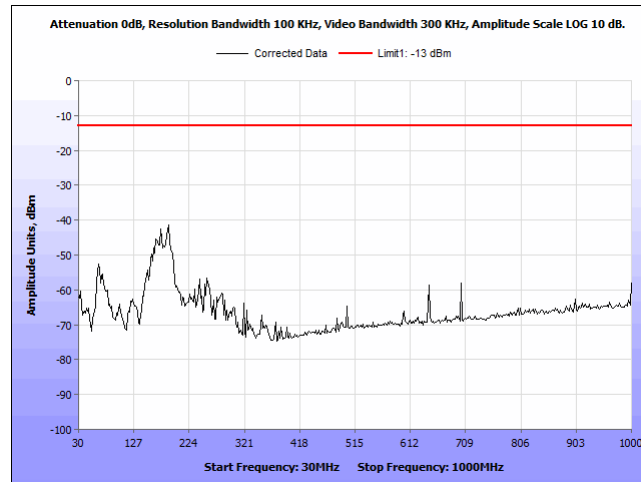
Plot 88. Radiated Spurious Emissions, Band 41, 5 MHz, 1 – 18 GHz, High



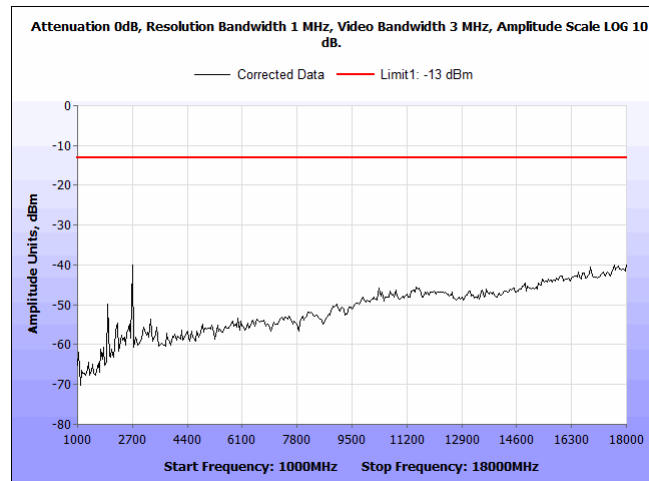
Plot 89. Radiated Spurious Emissions, Band 41, 5 MHz, 1 – 18 GHz, Low



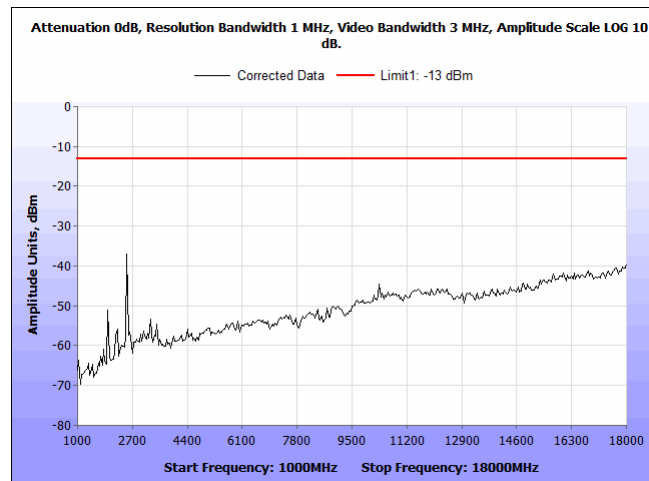
Plot 90. Radiated Spurious Emissions, Band 41, 5 MHz, 1 – 18 GHz, Mid



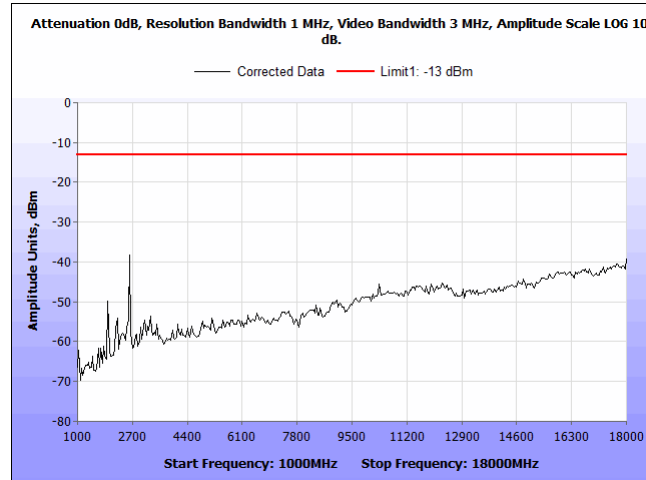
Plot 91. Radiated Spurious Emissions, Band 41, 5 MHz, 30 MHz – 1 GHz



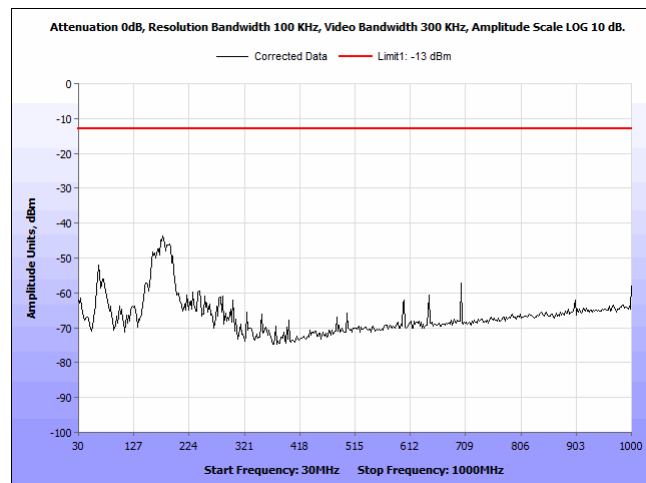
Plot 92. Radiated Spurious Emissions, Band 41, 10 MHz, 1 – 18 GHz, High



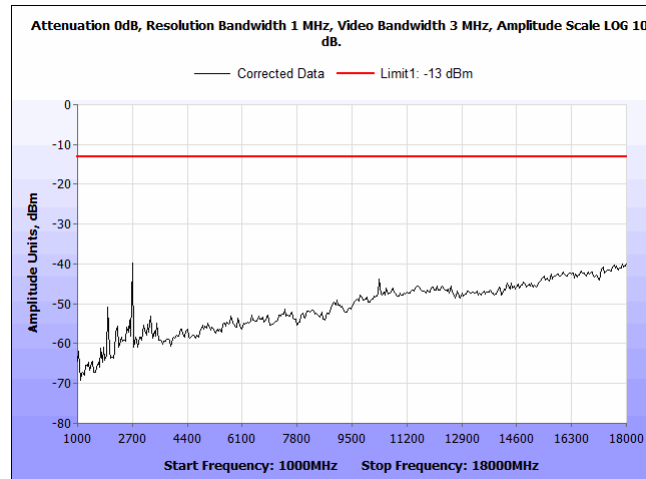
Plot 93. Radiated Spurious Emissions, Band 41, 10 MHz, 1 – 18 GHz, Low



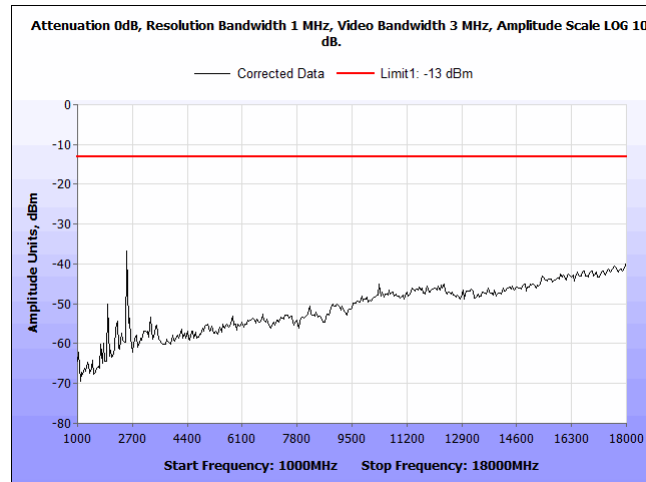
Plot 94. Radiated Spurious Emissions, Band 41, 10 MHz, 1 – 18 GHz, Mid



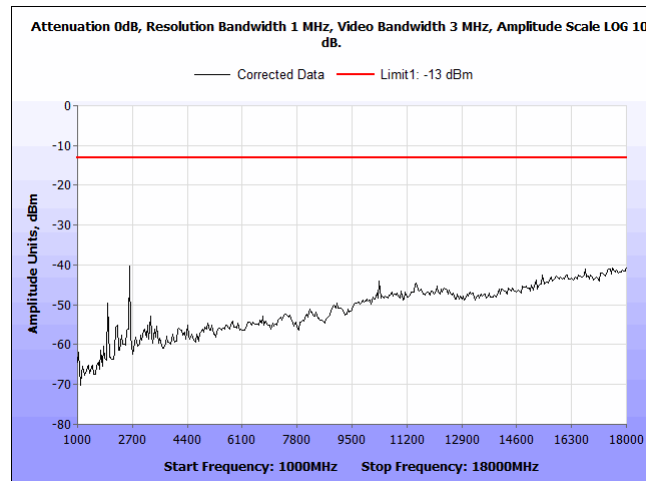
Plot 95. Radiated Spurious Emissions, Band 41, 10 MHz, 30 MHz – 1 GHz



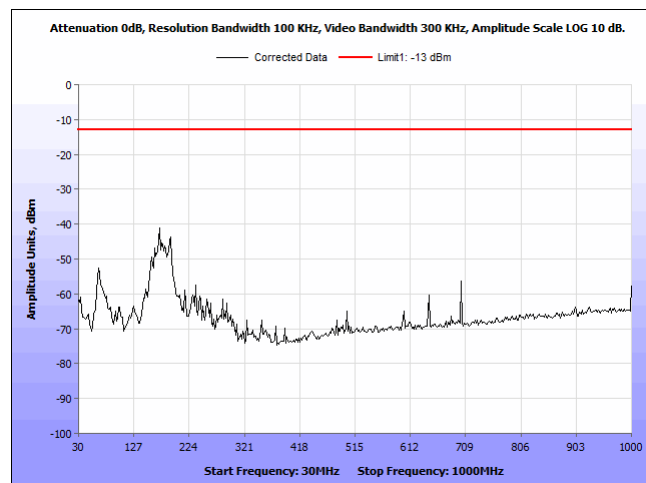
Plot 96. Radiated Spurious Emissions, Band 41, 15 MHz, 1 – 18 GHz, High



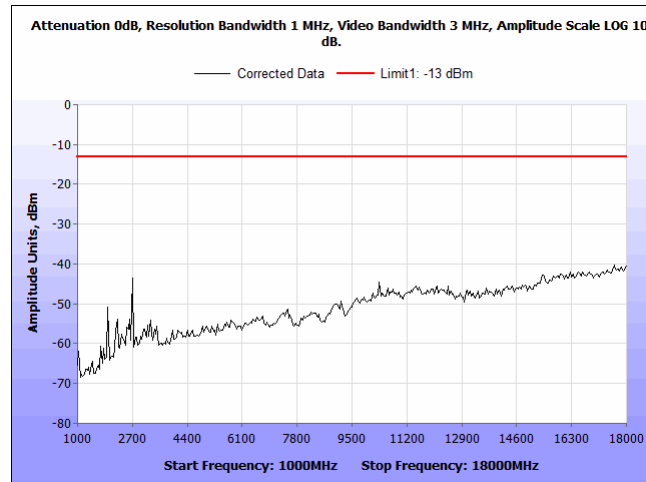
Plot 97. Radiated Spurious Emissions, Band 41, 15 MHz, 1 – 18 GHz, Low



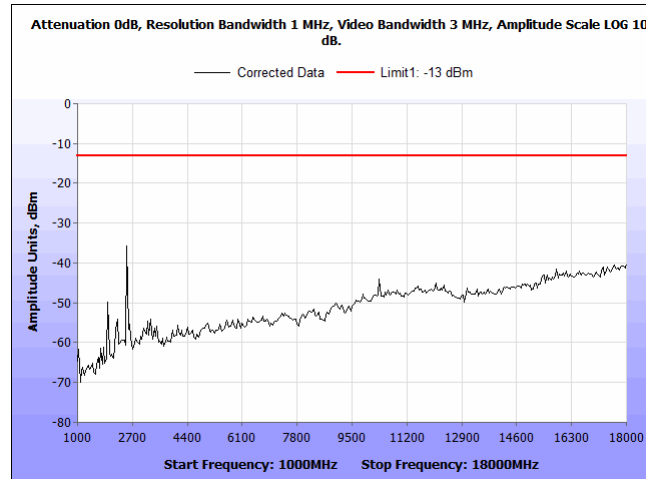
Plot 98. Radiated Spurious Emissions, Band 41, 15 MHz, 1 – 18 GHz, Mid



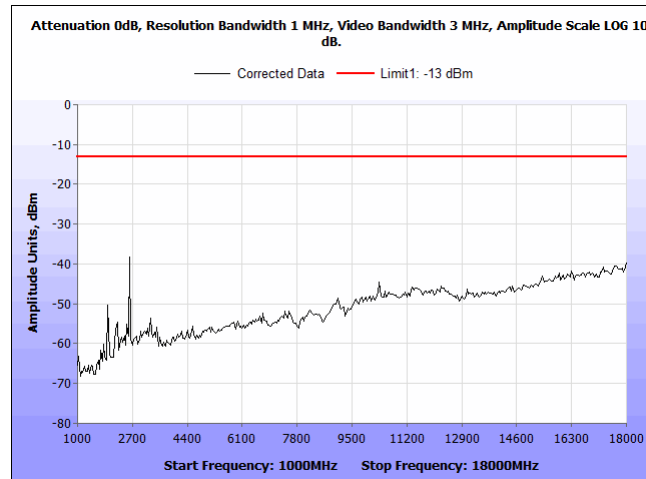
Plot 99. Radiated Spurious Emissions, Band 41, 15 MHz, 30 MHz – 1 GHz



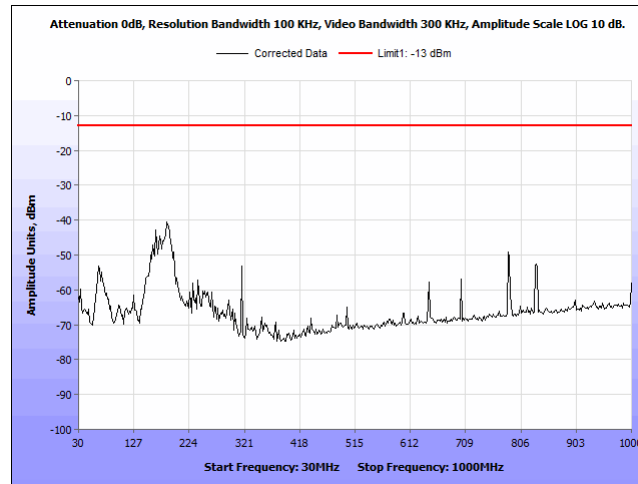
Plot 100. Radiated Spurious Emissions, Band 41, 20 MHz, 1 – 18 GHz, High



Plot 101. Radiated Spurious Emissions, Band 41, 20 MHz, 1 – 18 GHz, Low

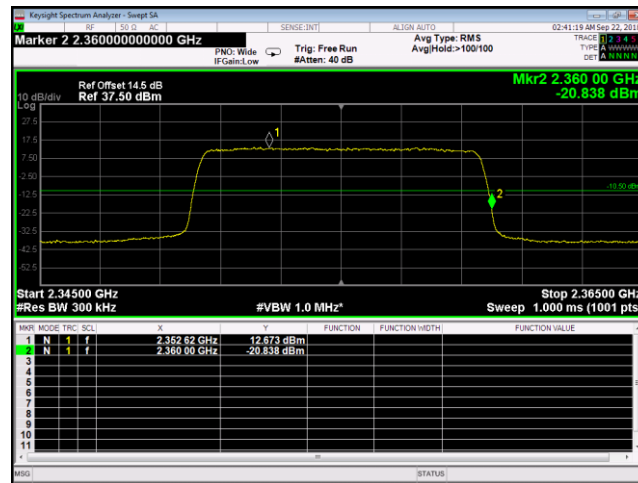


Plot 102. Radiated Spurious Emissions, Band 41, 20 MHz, 1 – 18 GHz, Mid

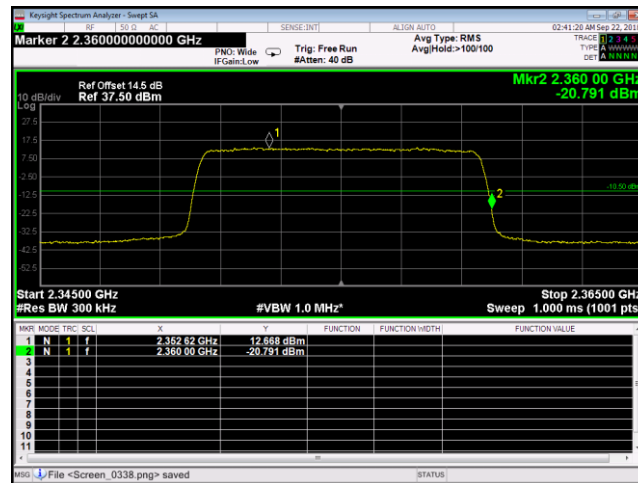


Plot 103. Radiated Spurious Emissions, Band 41, 20 MHz, 30 MHz – 1 GHz

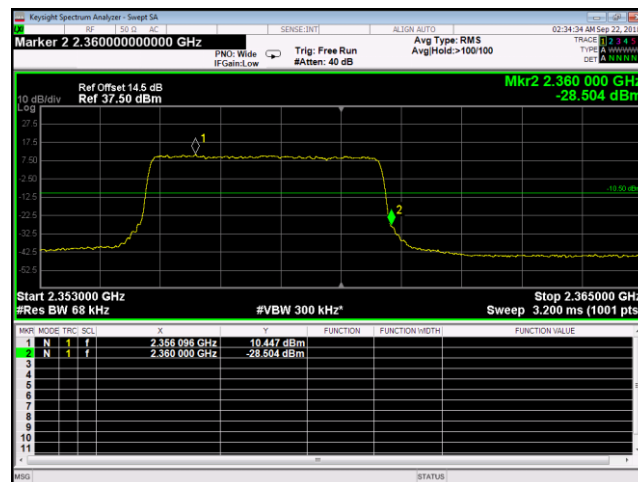
Radiated Band Edge, Band 30



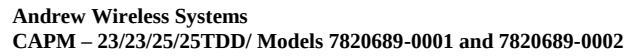
Plot 104. Radiated Band Edge, WCS 2300, high channel, port 1, 10 MHz



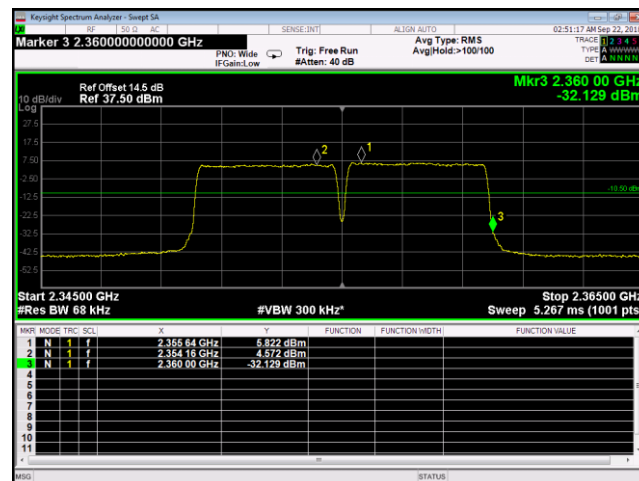
Plot 105. Radiated Band Edge, WCS 2300, high channel, port 2, 10 MHz



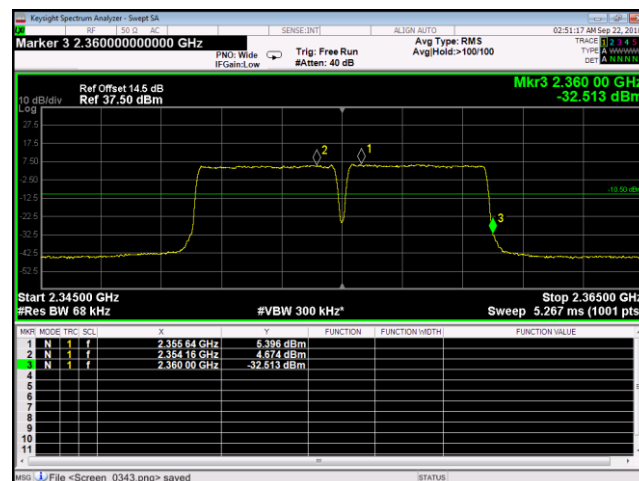
Plot 106. Radiated Band Edge, WCS 2300, high channel, one signal, port 1, 5 MHz



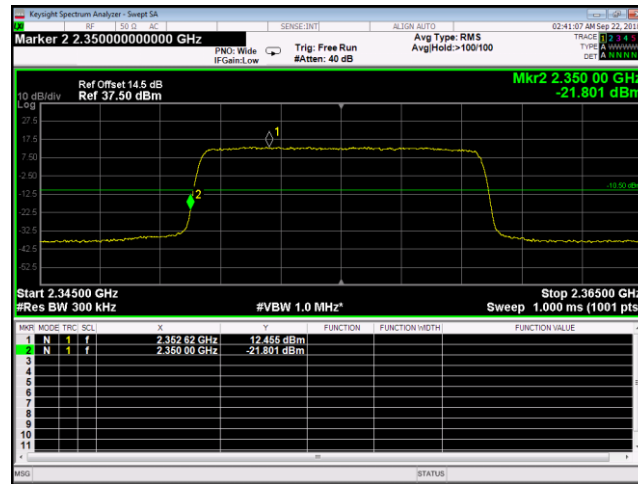
Plot 107. Radiated Band Edge, WCS 2300, high channel, one signal, port 2, 5 MHz



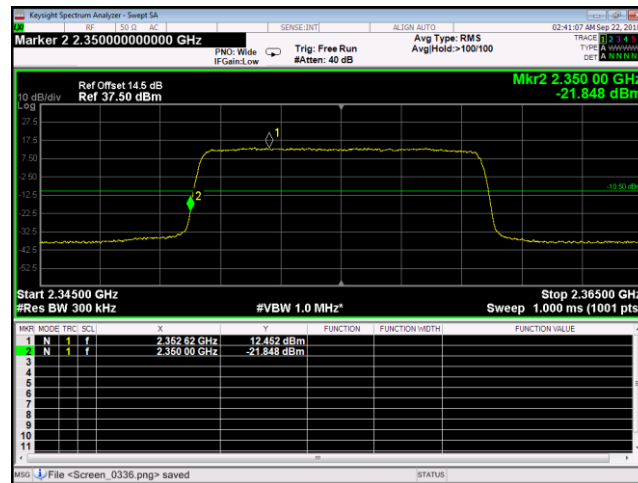
Plot 108. Radiated Band Edge, WCS 2300, high channel, two signal, port 1, 5 MHz



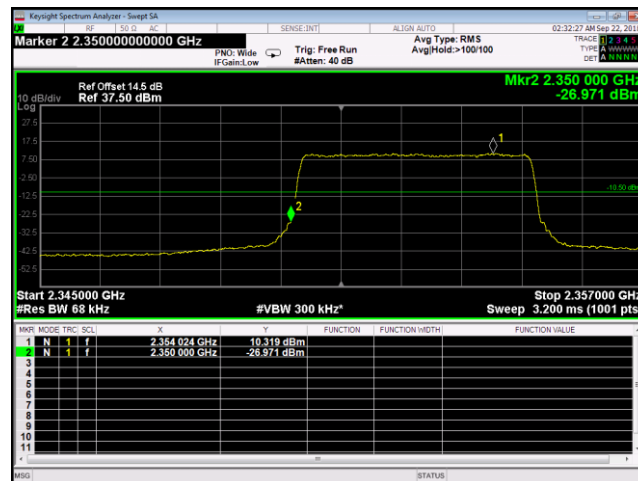
Plot 109. Radiated Band Edge, WCS 2300, high channel, two signal, port 2, 5 MHz



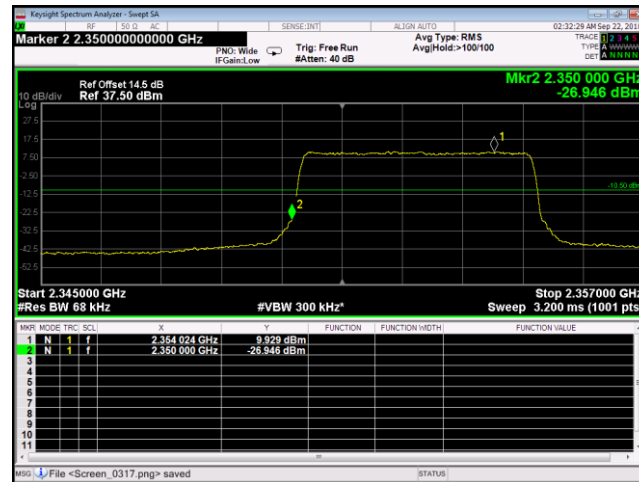
Plot 110. Radiated Band Edge, WCS 2300, low channel, port 1, 10 MHz



Plot 111. Radiated Band Edge, WCS 2300, low channel, port 2, 10 MHz



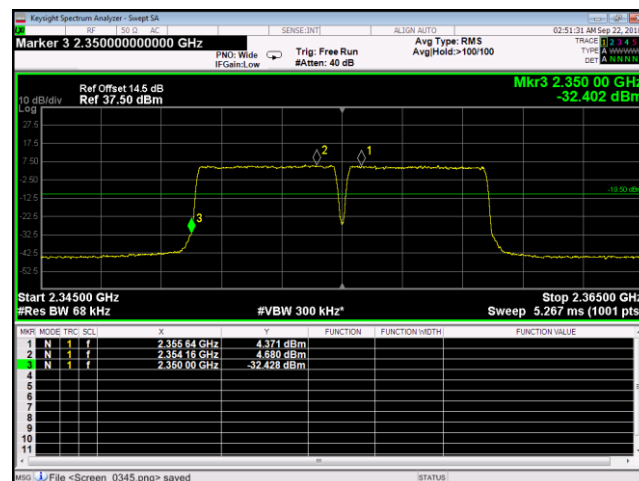
Plot 112. Radiated Band Edge, WCS 2300, low channel, one signal, port 1, 5 MHz



Plot 113. Radiated Band Edge, WCS 2300, low channel, one signal, port 2, 5 MHz

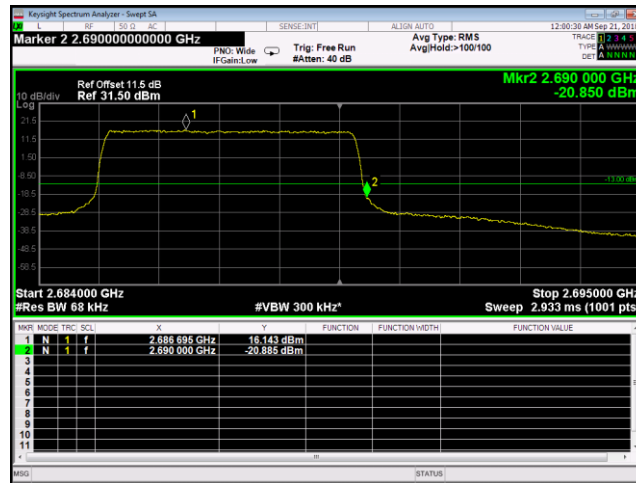


Plot 114. Radiated Band Edge, WCS 2300, low channel, two signal, port 1, 5 MHz

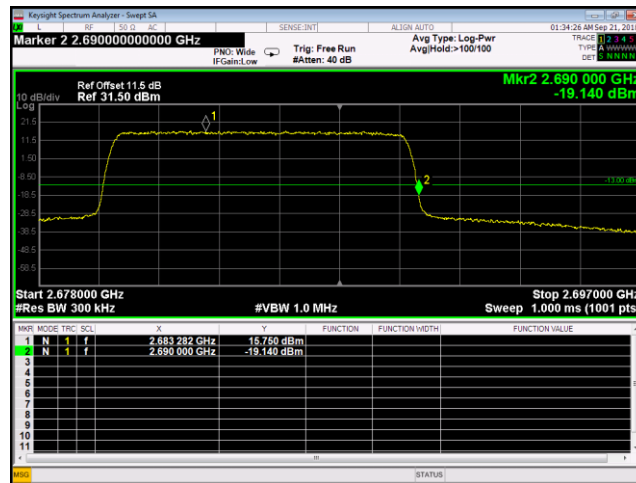


Plot 115. Radiated Band Edge, WCS 2300, low channel, two signal, port 2, 5 MHz

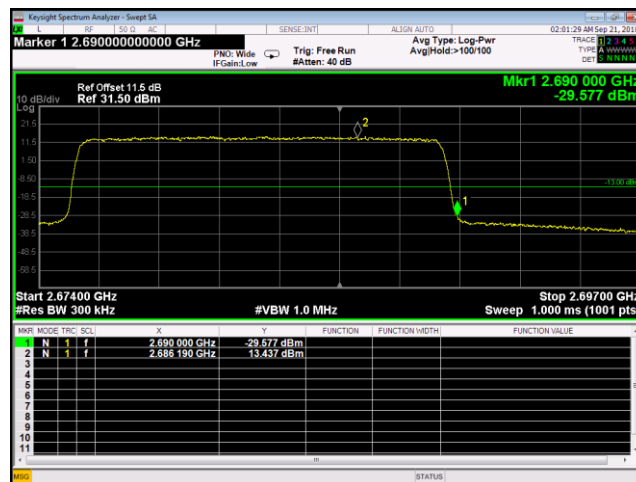
Radiated Band Edge, Band 41



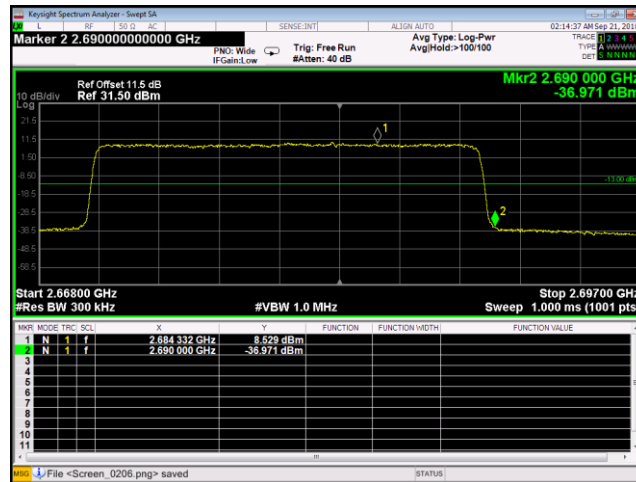
Plot 116. Radiated Band Edge, BRS 2500, high channel, one signal, port 1, 5 MHz



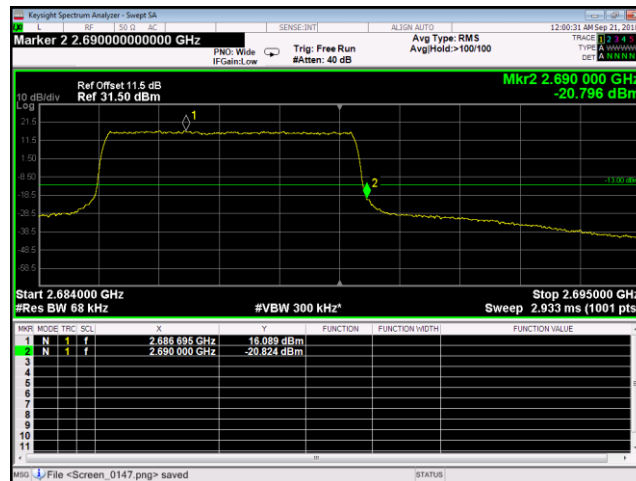
Plot 117. Radiated Band Edge, BRS 2500, high channel, one signal, port 1, 10 MHz



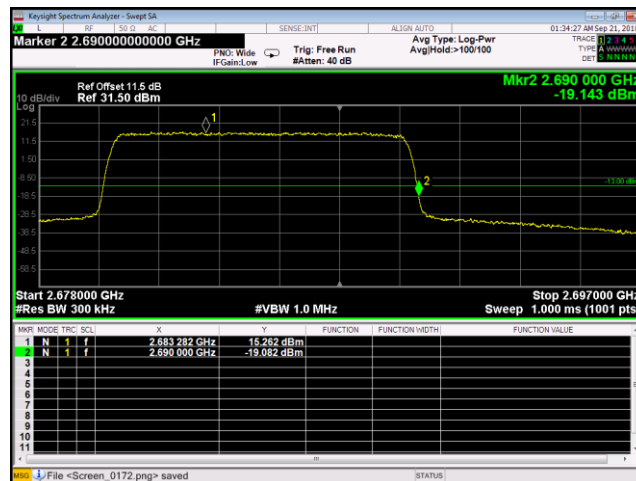
Plot 118. Radiated Band Edge, BRS 2500, high channel, one signal, port 1, 15 MHz



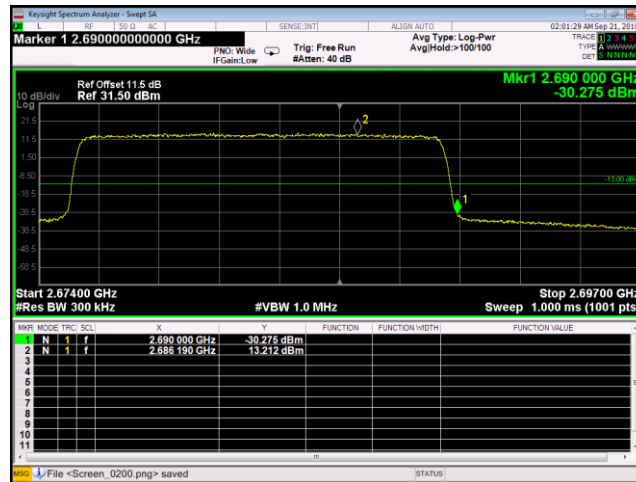
Plot 119. Radiated Band Edge, BRS 2500, high channel, one signal, port 1, 20 MHz



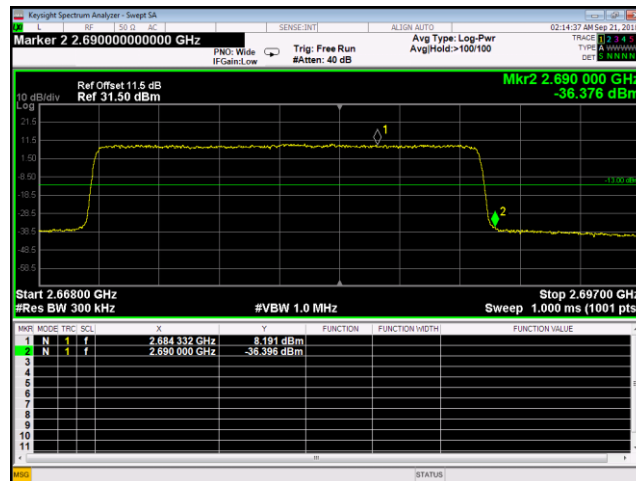
Plot 120. Radiated Band Edge, BRS 2500, high channel, one signal, port 2, 5 MHz



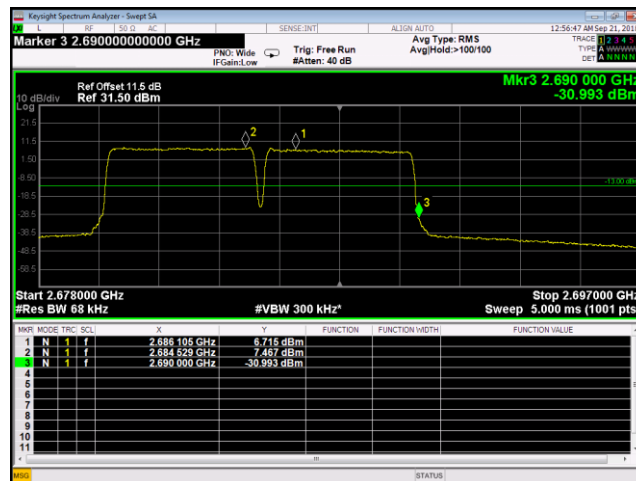
Plot 121. Radiated Band Edge, BRS 2500, high channel, one signal, port 2, 10 MHz



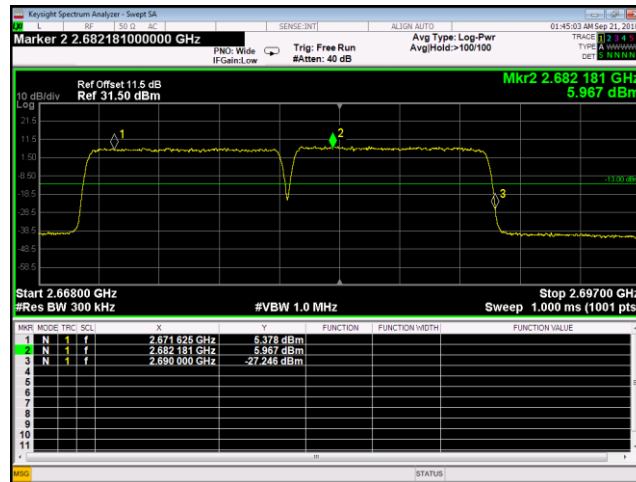
Plot 122. Radiated Band Edge, BRS 2500, high channel, one signal, port 3, 15 MHz



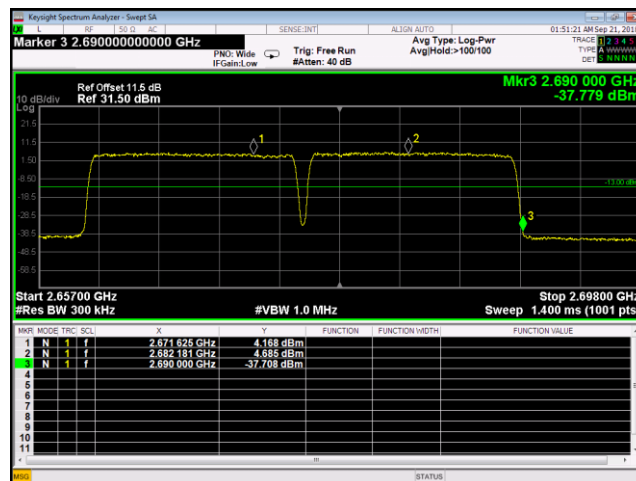
Plot 123. Radiated Band Edge, BRS 2500, high channel, one signal, port 2, 20 MHz



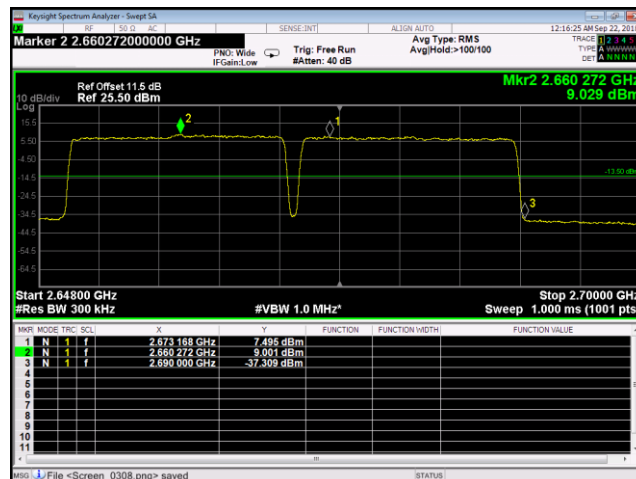
Plot 124. Radiated Band Edge, BRS 2500, high channel, two signal, port 1, 5 MHz



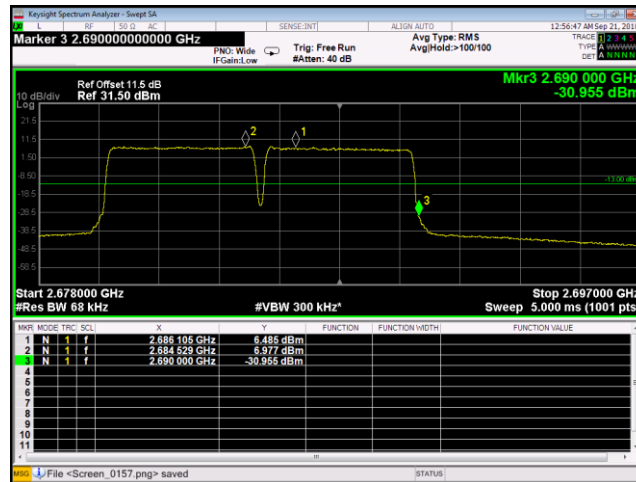
Plot 125. Radiated Band Edge, BRS 2500, high channel, two signal, port 1, 10 MHz



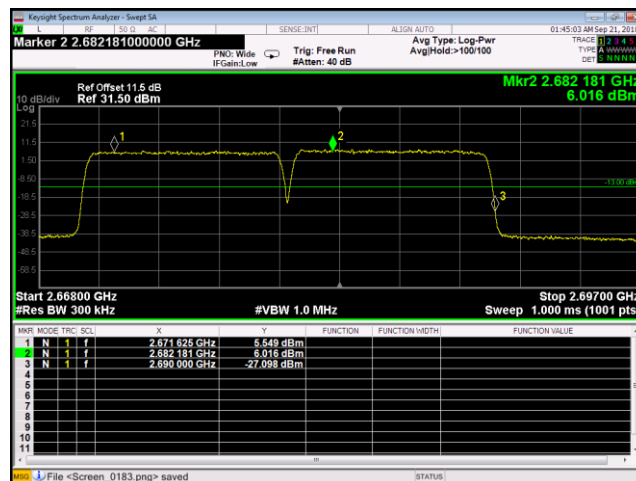
Plot 126. Radiated Band Edge, BRS 2500, high channel, two signal, port 1, 15 MHz



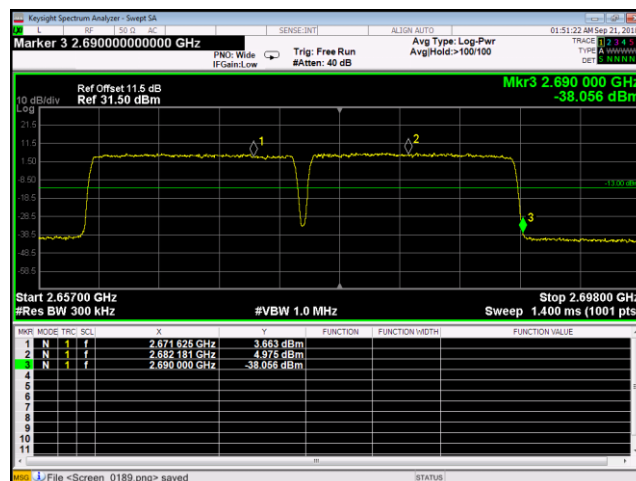
Plot 127. Radiated Band Edge, BRS 2500, high channel, two signal, port 1, 20 MHz



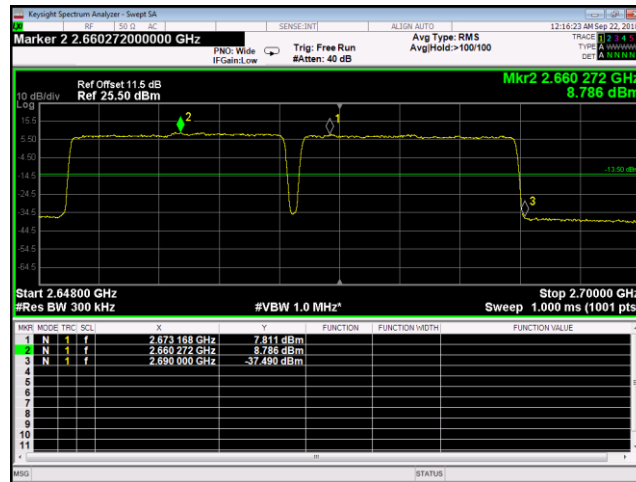
Plot 128. Radiated Band Edge, BRS 2500, high channel, two signal, port 2, 5 MHz



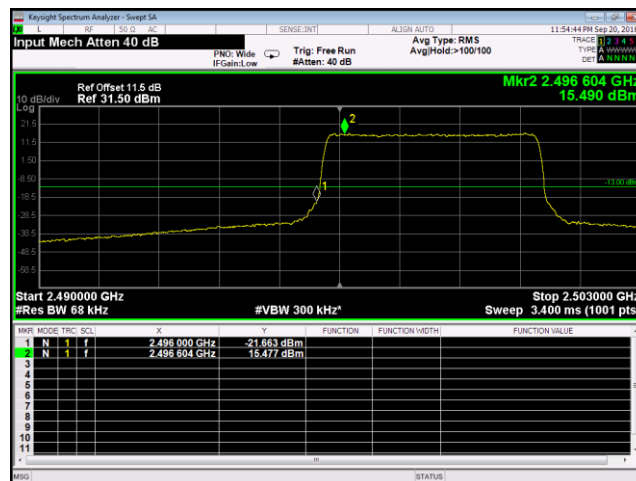
Plot 129. Radiated Band Edge, BRS 2500, high channel, two signal, port 2, 10 MHz



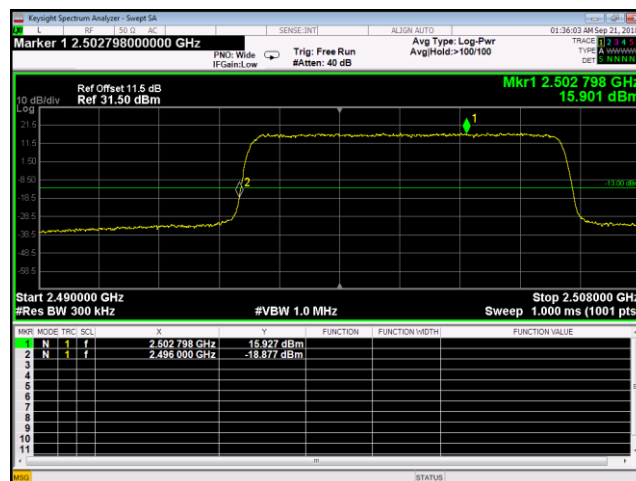
Plot 130. Radiated Band Edge, BRS 2500, high channel, two signal, port 2, 15 MHz



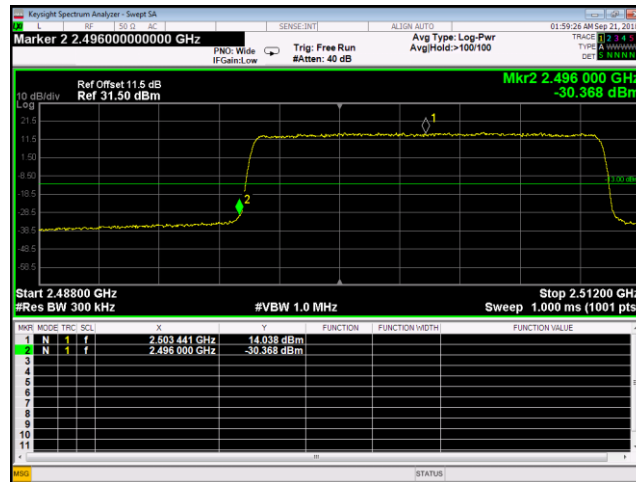
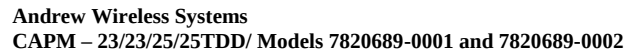
Plot 131. Radiated Band Edge, BRS 2500, high channel, two signal, port 2, 20 MHz



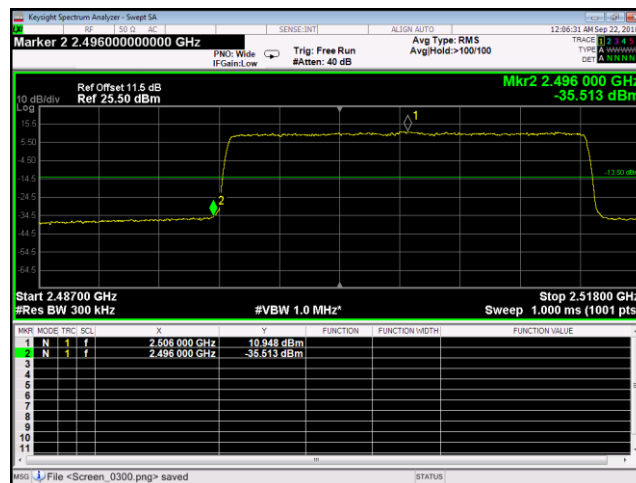
Plot 132. Radiated Band Edge, BRS 2500, low channel, one signal, port 1, 5 MHz



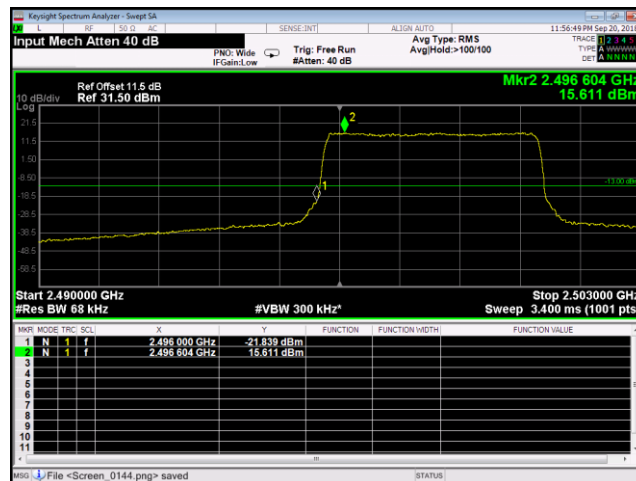
Plot 133. Radiated Band Edge, BRS 2500, low channel, one signal, port 1, 10 MHz



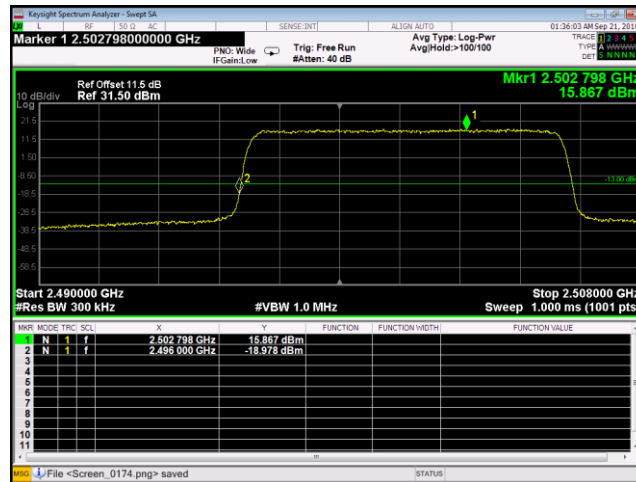
Plot 134. Radiated Band Edge, BRS 2500, low channel, one signal, port 1, 15 MHz



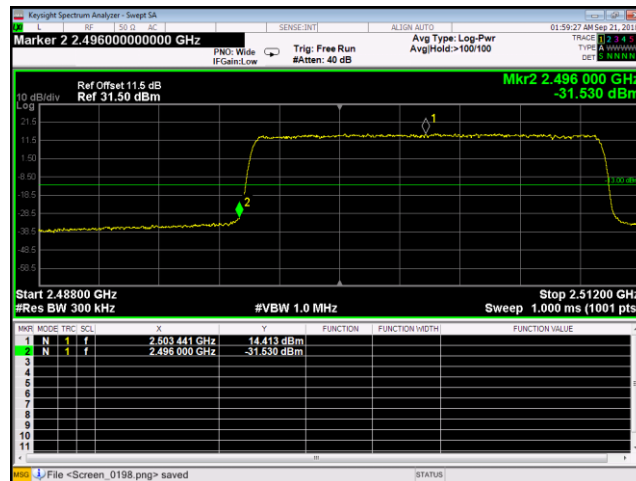
Plot 135. Radiated Band Edge, BRS 2500, low channel, one signal, port 1, 20 MHz



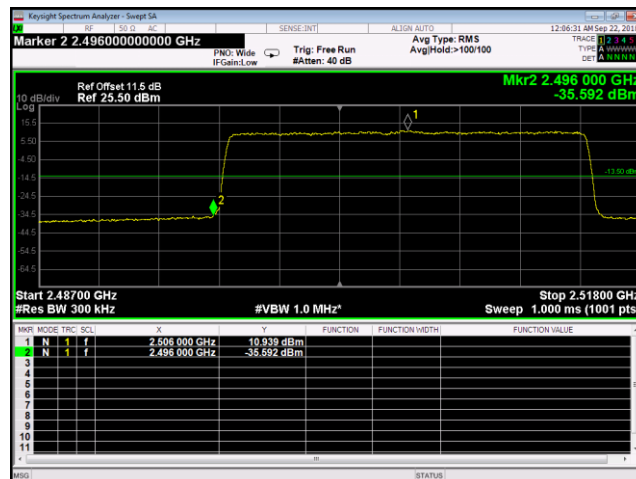
Plot 136. Radiated Band Edge, BRS 2500, low channel, one signal, port 2, 5 MHz



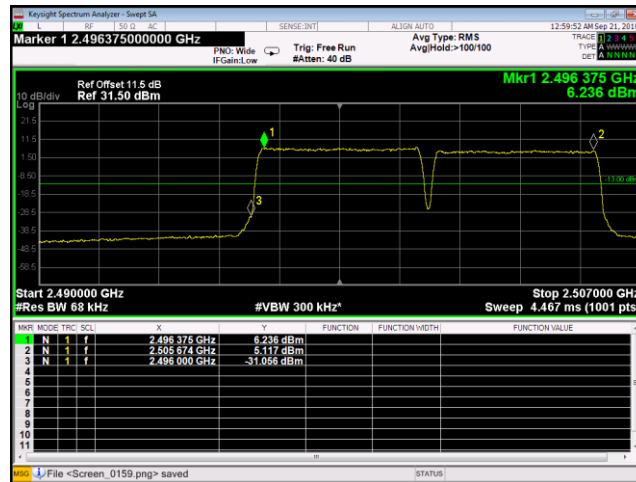
Plot 137. Radiated Band Edge, BRS 2500, low channel, one signal, port 2, 10 MHz



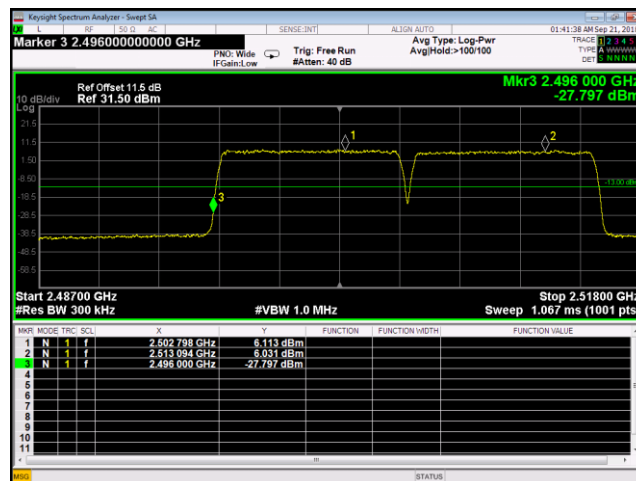
Plot 138. Radiated Band Edge, BRS 2500, low channel, one signal, port 2, 15 MHz



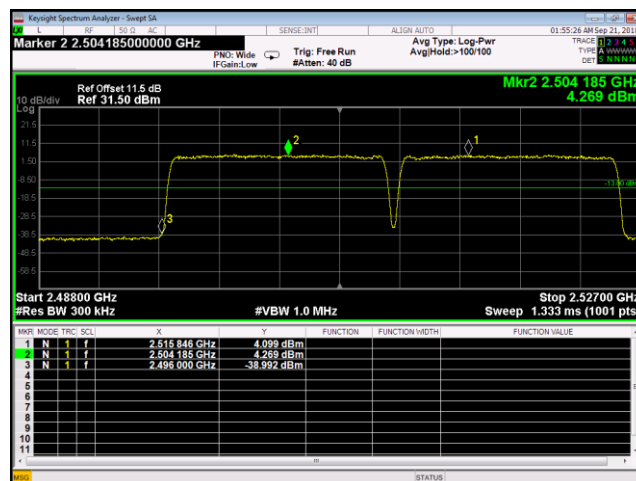
Plot 139. Radiated Band Edge, BRS 2500, low channel, one signal, port2, 20 MHz



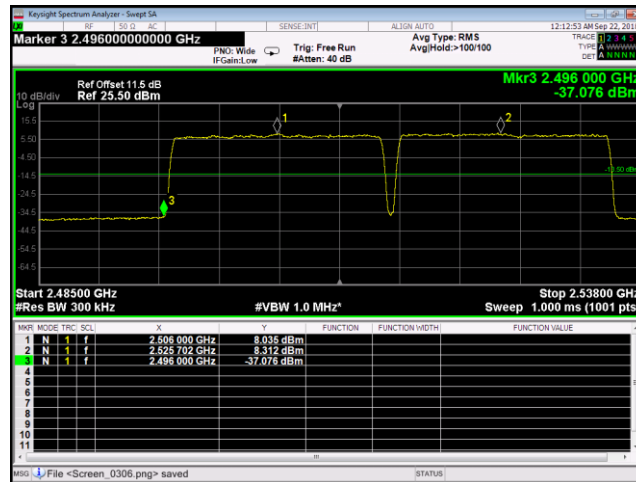
Plot 140. Radiated Band Edge, BRS 2500, low channel, two signal, port 1, 5 MHz



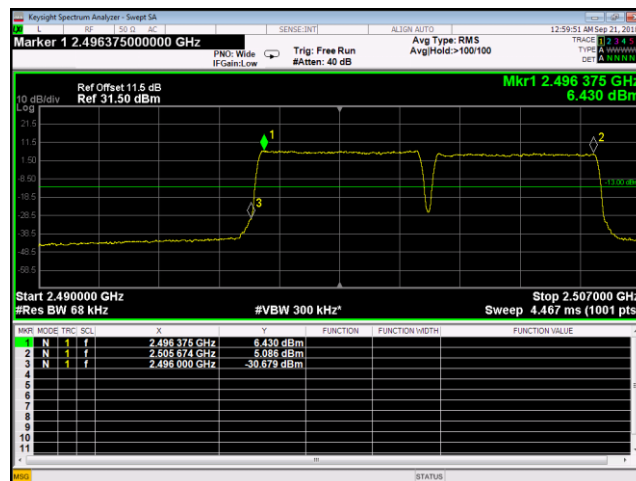
Plot 141. Radiated Band Edge, BRS 2500, low channel, two signal, port 1, 10 MHz



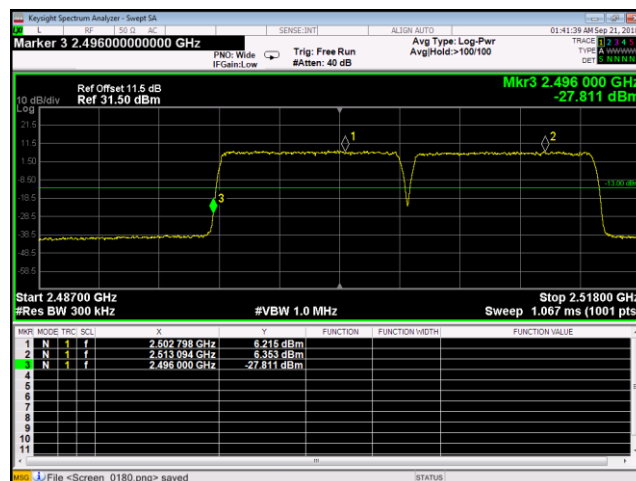
Plot 142. Radiated Band Edge, BRS 2500, low channel, two signal, port 1, 15 MHz



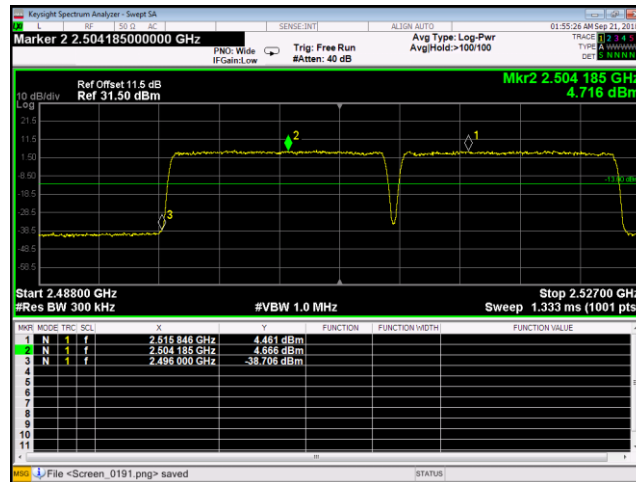
Plot 143. Radiated Band Edge, BRS 2500, low channel, two signal, port 1, 20 MHz



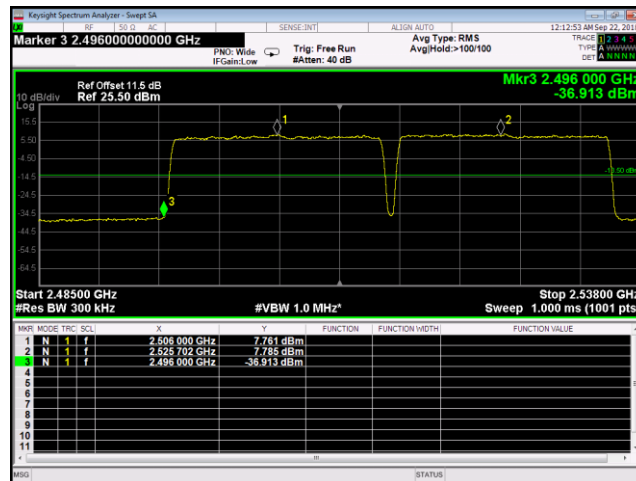
Plot 144. Radiated Band Edge, BRS 2500, low channel, two signal, port 2, 5 MHz



Plot 145. Radiated Band Edge, BRS 2500, low channel, two signal, port 2, 10 MHz



Plot 146. Radiated Band Edge, BRS 2500, low channel, two signal, port 2, 15 MHz



Plot 147. Radiated Band Edge, BRS 2500, low channel, two signal, port 2, 20 MHz



Electromagnetic Compatibility Criteria for Intentional Radiators

§ 2.1051 Spurious Emissions at Antenna Terminals

Test Requirement(s): § 2.1051 and 27.53(m) **Measurements required: Spurious emissions at antenna terminals:**
The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in § 2.1049 as appropriate.

Test Procedures: The EUT was tested according to the unwanted emissions procedures of ANSI C63.26 5.7.3. The spectrum analyzer was used and configured in the following manner:

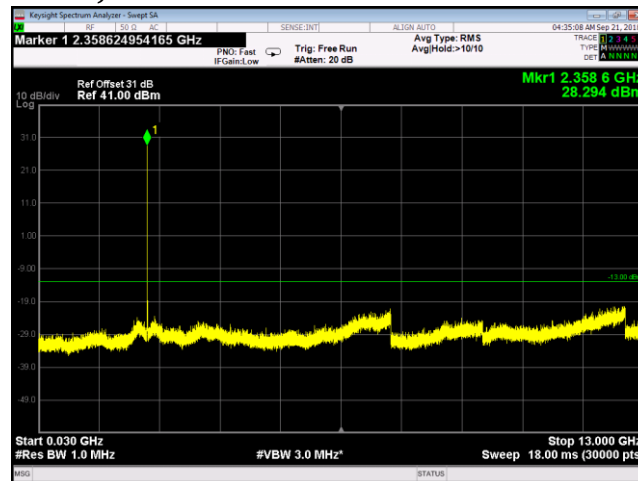
- (a) Frequency Range = 30MHz – 10th Harmonic
- (b) RBW = 1% of the OBW, or greater
- (c) VBW 1-3 x the RBW
- (d) Detector = Peak
- (e) Sweet Time = Auto

Test Results: The equipment was found compliant with the requirements of this section.

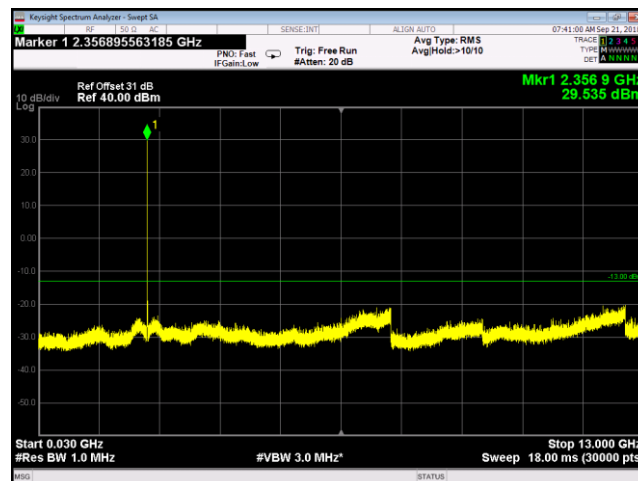
Test Engineer(s): Deepak Giri and Bradley Jones

Test Date(s): September 20, 2018

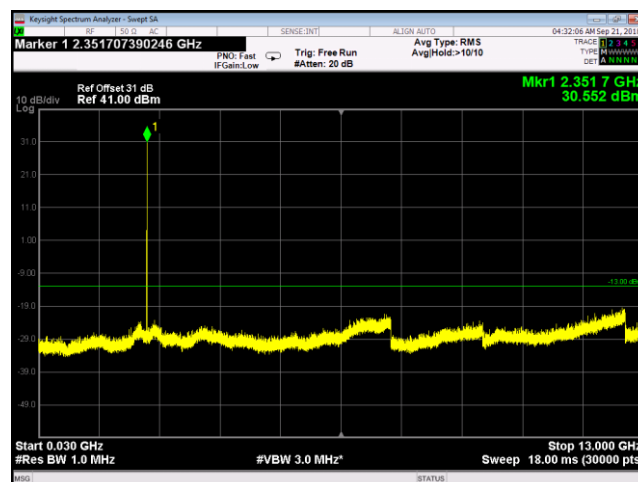
Conducted Spurious Emissions, Band 30



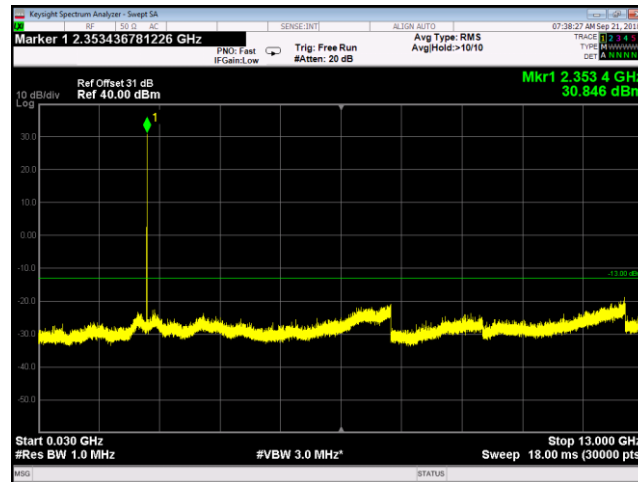
Plot 148. Spurious Emissions at Antenna Terminals, Band 30, 5 MHz, .03 – 13 GHz, High, Port 1



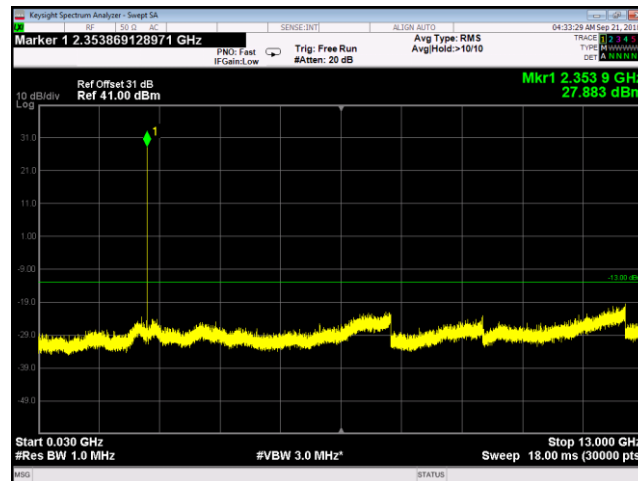
Plot 149. Spurious Emissions at Antenna Terminals, Band 30, 5 MHz, .03 – 13 GHz, High, Port 2



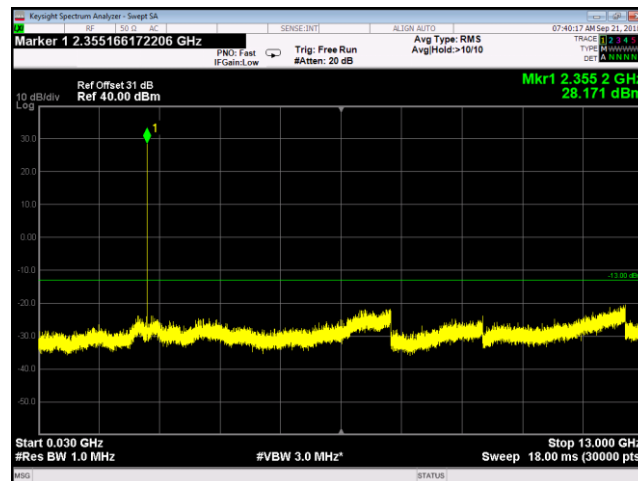
Plot 150. Spurious Emissions at Antenna Terminals, Band 30, 5 MHz, .03 – 13 GHz, Low, Port 1



Plot 151. Spurious Emissions at Antenna Terminals, Band 30, 5 MHz, .03 – 13 GHz, Low, Port 2



Plot 152. Spurious Emissions at Antenna Terminals, Band 30, 5 MHz, .03 – 13 GHz, Mid, Port 1



Plot 153. Spurious Emissions at Antenna Terminals, Band 30, .5 MHz, 3 – 13 GHz, Mid, Port 2