

TEST REPORT

Part 15 Subpart E 15.407 & RSS-247 (Issue 2)

Equipment under test Remote Controller

Model name C4-HALO-TS-BL

Derivative Model name C4-HALO-TS-AS

FCC ID 2AJAC-C4HALOTS

IC Certification No 7848A-C4HALOTS

Applicant Snap One, LLC

Manufacturer Remote Solution Co.,Ltd.

Date of test(s) 2023.02.27 ~ 2023.03.06

Date of issue 2023.03.13

Issued to

Snap One, LLC

1800 Continental Blvd, Suite 300 Charlotte, NC 28273

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Issued by

KES Co., Ltd.

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Test and report completed by :	Report approval by :
	
Do-won, Ahn Test engineer	Young-Jin Lee Technical manager

This test report is not related to KS Q ISO/IEC 17025 and KOLAS

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Revision history

Revision	Date of issue	Test report No.	Description
-	2023.03.13	KES-RF-23T0039	Initial

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1. General information

Applicant: Snap One, LLC
Applicant address: 1800 Continental Blvd, Suite 300 Charlotte, NC 28273
Test site: KES Co., Ltd.
Test site address: ☒ 3701, 40, Simin-daero 365beon-gil, Dongan-gu, Anyang-si,
Gyeonggi-do, 14057, Korea
☒ 473-21, Gayeo-ro, Yeosu-si, Gyeonggi-do, Korea
Test Facility: FCC Accreditation Designation No.: KR0100, Registration No.: 444148
ISED Registration No.: 23298
FCC rule part(s): 15.407
IC rule part(s): RSS-247
FCC ID: 2AJAC-C4HALOTS
IC Certification No: 7848A-C4HALOTS
Test device serial No.: ☒ Production ☐ Pre-production ☐ Engineering

1.1. EUT description

Equipment under test: Remote Controller
Frequency range: 2 412 MHz ~ 2 462 MHz (802.11b/g/n_HT20)
5 180 MHz ~ 5 240 MHz (802.11a/n_HT20/ac_VHT20)
5 260 MHz ~ 5 320 MHz (802.11a/n_HT20/ac_VHT20)
5 500 MHz ~ 5 720 MHz (802.11a/n_HT20/ac_VHT20)
5 745 MHz ~ 5 825 MHz (802.11a/n_HT20/ac_VHT20)
5 190 MHz ~ 5 230 MHz (802.11n_HT40/ac_VHT40)
5 270 MHz ~ 5 310 MHz (802.11n_HT40/ac_VHT40)
5 510 MHz ~ 5 710 MHz (802.11n_HT40/ac_VHT40)
5 755 MHz ~ 5 795 MHz (802.11n_HT40/ac_VHT40)
5 210 MHz (802.11ac_VHT80)
5 290 MHz (802.11ac_VHT80)
5 530 MHz ~ 5 690 MHz (802.11ac_VHT80)
5 775 MHz (802.11ac_VHT80)
Model: C4-HALO-TS-BL
Derivative Model: C4-HALO-TS-AS
Modulation technique: DSSS, OFDM
Antenna specification: PIFA Antenna // 2.4 GHz Peak gain: 1.15 dBi
// 5 GHz Peak gain: 0.62 dBi
Power source: DC 3.8 V

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Number of channels	2 412 MHz ~ 2 462 MHz (802.11b/g/n_HT20): 11 ch 5 180 MHz ~ 5 240 MHz (802.11a/n_HT20/ac_VHT20): 4 ch 5 260 MHz ~ 5 320 MHz (802.11a/n_HT20/ac_VHT20): 4 ch 5 500 MHz ~ 5 720 MHz (802.11a/n_HT20/ac_VHT20): 12 ch 5 745 MHz ~ 5 825 MHz (802.11a/n_HT20/ac_VHT20): 5 ch 5 190 MHz ~ 5 230 MHz (802.11n_HT40/ac_VHT40): 2 ch 5 270 MHz ~ 5 310 MHz (802.11n_HT40/ac_VHT40): 2 ch 5 510 MHz ~ 5 710 MHz (802.11n_HT40/ac_VHT40): 6 ch 5 755 MHz ~ 5 795 MHz (802.11n_HT40/ac_VHT40): 2ch 5 210 MHz (802.11ac_VHT80): 1 ch 5 290 MHz (802.11ac_VHT80): 1 ch 5 530 MHz ~ 5 690 MHz (802.11ac_VHT80): 3 ch 5 775 MHz (802.11ac_VHT80): 1 ch
H/W Version	V1.0
S/W Version	V1.0
Serial No	ST2235000100E1F224

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1.2. Test configuration

The **Snap One, LLC // Remote Controller // C4-HALO-TS-BL**

FCC ID: 2AJAC-C4HALOTS // IC: 7848A-C4HALOTS was tested according to the specification of EUT, the EUT must comply with following standards and KDB documents.

FCC Part 15.407
ISED RSS-247 Issue 2 and RSS-Gen Issue 5
KDB 789033 D02 v02r01
ANSI C63.10-2013

1.3. Derivative Model Information

C4-HALO-TS-AS

1.4. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
-	-	-	-	-

1.5. Sample calculation

Where relevant, the following sample calculation is provided

For all conducted test items :

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

$$\begin{aligned}\text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 1.58 + 10 = 11.58 \text{ (dB)}\end{aligned}$$

For Radiation test :

$$\text{Field strength level (dB}\mu\text{V/m)} = \text{Measured level (dB}\mu\text{V)} + \text{Antenna factor (dB)} + \text{Cable loss (dB)} - \text{Amplifier gain (dB)}$$

1.6. Measurement Uncertainty

Test Item		Uncertainty
Uncertainty for Conduction emission test		2.38 dB
Uncertainty for Radiation emission test (include Fundamental emission)	Below 1GHz	4.50 dB
	Above 1GHz	4.90 dB
Note. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.		

1.7. Frequency/channel operations

Ch.	Frequency (MHz)	Mode
1	2 412	802.11b/g/n_HT20
6	2 437	802.11b/g/n_HT20
11	2 462	802.11b/g/n_HT20

Ch.	Frequency (MHz)	Mode
36	5 180	802.11a/n_HT20/ac_VHT20
40	5 200	802.11a/n_HT20/ac_VHT20
48	5 240	802.11a/n_HT20/ac_VHT20
52	5 260	802.11a/n_HT20/ac_VHT20
56	5 280	802.11a/n_HT20/ac_VHT20
64	5 320	802.11a/n_HT20/ac_VHT20
100	5 500	802.11a/n_HT20/ac_VHT20
120	5 600	802.11a/n_HT20/ac_VHT20
140	5 700	802.11a/n_HT20/ac_VHT20
149	5 745	802.11a/n_HT20/ac_VHT20
157	5 785	802.11a/n_HT20/ac_VHT20
165	5 825	802.11a/n_HT20/ac_VHT20

Ch.	Frequency (MHz)	Mode
38	5 190	802.11n_HT40/ac_VHT40
46	5 230	802.11n_HT40/ac_VHT40
54	5 270	802.11n_HT40/ac_VHT40
62	5 310	802.11n_HT40/ac_VHT40
102	5 510	802.11n_HT40/ac_VHT40
118	5 590	802.11n_HT40/ac_VHT40
134	5 670	802.11n_HT40/ac_VHT40
151	5 755	802.11n_HT40/ac_VHT40
159	5 795	802.11n_HT40/ac_VHT40

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Ch.	Frequency (MHz)	Mode
42	5 210	802.11n_ac_VHT80
58	5 290	802.11n_ac_VHT80
106	5 530	802.11n_ac_VHT80
122	5 610	802.11n_ac_VHT80
155	5 775	802.11n_ac_VHT80

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2. Summary of tests

Section in FCC Part 15	Section in RSS-247 & Gen	Parameter	Test results
15.407(a)	RSS-247 6.2	26 dB bandwidth & 99 % bandwidth	N/A ¹⁾
15.407(a)	-	6 dB bandwidth (UNII-3)	N/A ¹⁾
15.407(a)	RSS-247 6.2	Maximum conducted output power	Pass
15.407(a)	RSS-247 6.2	Power spectral density	N/A ¹⁾
15.407(g)	RSS-Gen 6.11	Frequency stability	N/A ¹⁾
15.205 15.209 15.407(b)	RSS-247 6.2 RSS-Gen 8.9, 8.10	Radiated restricted band and emission	Pass
15.207	RSS-Gen 8.8	AC power line conducted emissions	Pass

Note :

1. This product is equipped with an approved module, please refer to Module Report
Report No. : 1802WSU008-U4
2. This report contains only the worst case results at the request of the applicant with condition below:
Worst case : 802.11a(6 Mbps)
3. This product is powered by DC 3.8 V.

3. Test results

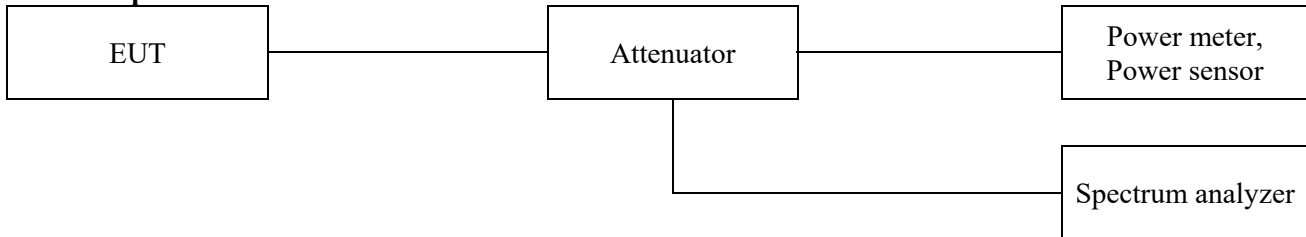
3.1. Maximum conducted output power

Test procedure

KDB 789033 D02 v02r01– Section E.3.a) or b)

Used test method is Section E.3.b)

Test setup



Section E.3.a)

Method PM (Measurement using an RF average power meter):

- i. Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied.
 - The EUT is configured to transmit continuously or to transmit with a constant duty cycle.
 - At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.
 - The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.
- ii. If the transmitter does not transmit continuously, measure the duty cycle, x, of the transmitter output signal as described in section II.B.
- iii. Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
- iv. Adjust the measurement in dBm by adding $10 \log (1/x)$ where x is the duty cycle (e.g., $10 \log (1/0.25)$ if the duty cycle is 25 %).

Section E.3.b)

Method PM-G (Measurement using a gated RF average power meter):

Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

Limit

FCC

Band	EUT Category		Limit
UNII-1		Outdoor access point	1 W (30 dBm)
		Indoor access point	
		Fixed point-to-point access point	
	✓	Mobile and portable client device	250 mW (24 dBm)
UNII-2A			250 mW or 11 dBm + $10 \log B^*$
UNII-2C			250 mW or 11 dBm + $10 \log B^*$
UNII-3			1 W (30 dBm)

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IC

Band	Limit
5150~5250 MHz	EIRP shall not exceed 200 mW or $10+10\log B^*$, dBm
5250~5350 MHz	Conducted output power shall not exceed 250 mW or 11 dBm + $10\log B^*$ EIRP shall not exceed 1.0 W or $17+10\log B^*$, dBm
5470~5600 MHz and 5650~5725 MHz	Conducted output power shall not exceed 250 mW or 11 dBm + $10\log B^*$ EIRP shall not exceed 1.0 W or $17+10\log B^*$, dBm
5725~5850 MHz	Conducted output power shall not exceed 1 W

Note.

1. FCC Limit B is the 26 dB emission bandwidth.
2. IC Limit B is the 99% emission bandwidth in megahertz.

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Test results**Mode : ANT 1**

Mode	Frequency (MHz)	Detector mode	Output power (dBm)	Limit (dBm)	
				FCC	IC
802.11 a	5 180	AV	11.29	23.98	22.51
	5 200	AV	11.20		
	5 240	AV	13.71		
	5 260	AV	13.79	23.26	29.26
	5 280	AV	13.66		
	5 320	AV	11.39		
	5 500	AV	11.67	23.26	29.26
	5 600	AV	13.75		
	5 700	AV	11.55		
	5 745	AV	10.99	30.00	30.00
	5 785	AV	12.11		
	5 825	AV	11.10		
802.11 n_HT20	5 180	AV	10.95	23.98	22.56
	5 200	AV	10.84		
	5 240	AV	13.23		
	5 260	AV	13.47	23.52	29.52
	5 280	AV	13.42		
	5 320	AV	11.01		
	5 500	AV	11.19	23.52	29.52
	5 600	AV	13.49		
	5 700	AV	11.27		
	5 745	AV	10.86	30.00	30.00
	5 785	AV	11.91		
	5 825	AV	10.77		

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Mode	Frequency (MHz)	Detector mode	Output power (dBm)	Limit (dBm)	
				FCC	IC
802.11 n_HT40	5 190	AV	8.99	23.98	23.01
	5 230	AV	13.00		
	5 270	AV	13.06	23.98	30.00
	5 310	AV	9.01		
	5 510	AV	9.05	23.98	30.00
	5 590	AV	13.07		
	5 670	AV	9.15	30.00	30.00
	5 755	AV	8.66		
	5 795	AV	8.87		
802.11 ac_VHT20	5 180	AV	10.95	23.98	22.53
	5 200	AV	10.80		
	5 240	AV	13.42		
	5 260	AV	13.48	23.53	29.53
	5 280	AV	13.46		
	5 320	AV	11.22		
	5 500	AV	11.11	23.53	29.53
	5 600	AV	13.62		
	5 700	AV	11.17		
	5 745	AV	10.67	30.00	30.00
	5 785	AV	11.36		
	5 825	AV	10.91		

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Mode	Frequency (MHz)	Detector mode	Output power (dBm)	Limit (dBm)	
				FCC	IC
802.11 ac_VHT40	5 190	AV	8.76	23.98	23.01
	5 230	AV	12.85		
	5 270	AV	12.98	23.98	30.00
	5 310	AV	8.81		
	5 510	AV	8.85	23.98	30.00
	5 590	AV	12.94		
	5 670	AV	9.12		
	5 755	AV	8.46	30.00	30.00
	5 795	AV	8.64		
802.11 ac_VHT80	5210	AV	8.42	23.98	23.01
	5290	AV	8.50	23.98	30.00
	5 530	AV	8.66	23.98	30.00
	5 610	AV	8.71		
	5 690	AV	8.87		
	5 775	AV	8.11	30.00	30.00

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Test results
Mode : ANT 2

Mode	Frequency (MHz)	Detector mode	Output power (dBm)	Limit (dBm)	
				FCC	IC
802.11 a	5 180	AV	11.08	23.98	22.51
	5 200	AV	11.09		
	5 240	AV	13.26		
	5 260	AV	13.76	23.26	29.26
	5 280	AV	13.67		
	5 320	AV	11.25		
	5 500	AV	10.91	23.26	29.26
	5 600	AV	13.82		
	5 700	AV	11.04		
	5 745	AV	10.48	30.00	30.00
	5 785	AV	12.12		
	5 825	AV	10.57		
802.11 n_HT20	5 180	AV	10.65	23.98	22.56
	5 200	AV	10.71		
	5 240	AV	13.25		
	5 260	AV	13.47	23.52	29.52
	5 280	AV	13.34		
	5 320	AV	11.03		
	5 500	AV	10.44	23.52	29.52
	5 600	AV	13.46		
	5 700	AV	10.58		
	5 745	AV	10.43	30.00	30.00
	5 785	AV	12.11		
	5 825	AV	10.19		

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Mode	Frequency (MHz)	Detector mode	Output power (dBm)	Limit (dBm)	
				FCC	IC
802.11 n_HT40	5 190	AV	8.33	23.98	23.01
	5 230	AV	12.59		
	5 270	AV	12.63	23.98	30.00
	5 310	AV	8.37		
	5 510	AV	8.40	23.98	30.00
	5 590	AV	12.63		
	5 670	AV	8.52	30.00	30.00
	5 755	AV	8.27		
	5 795	AV	8.35		
802.11 ac_VHT20	5 180	AV	10.42	23.98	22.53
	5 200	AV	10.43		
	5 240	AV	13.31		
	5 260	AV	13.44	23.53	29.53
	5 280	AV	13.27		
	5 320	AV	11.00		
	5 500	AV	10.46	23.53	29.53
	5 600	AV	13.51		
	5 700	AV	10.64		
	5 745	AV	10.33	30.00	30.00
	5 785	AV	12.15		
	5 825	AV	10.29		

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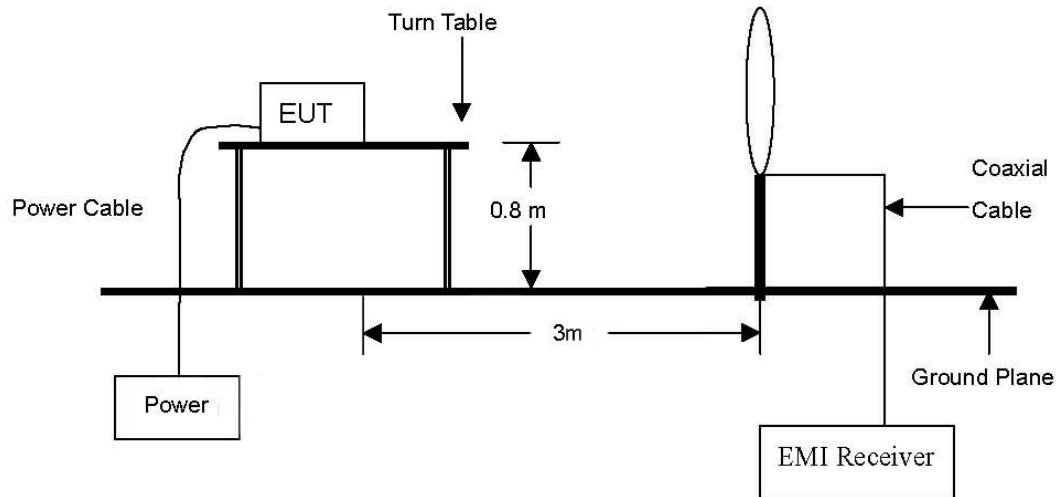
Mode	Frequency (MHz)	Detector mode	Output power (dBm)	Limit (dBm)	
				FCC	IC
802.11 ac_VHT40	5 190	AV	8.25	23.98	23.01
	5 230	AV	12.62		
	5 270	AV	12.64	23.98	30.00
	5 310	AV	8.51		
	5 510	AV	8.46	23.98	30.00
	5 590	AV	12.52		
	5 670	AV	5.65		
	5 755	AV	8.24	30.00	30.00
	5 795	AV	8.26		
802.11 ac_VHT80	5210	AV	8.87	23.98	23.01
	5290	AV	8.91	23.98	30.00
	5 530	AV	9.06	23.98	30.00
	5 610	AV	9.13		
	5 690	AV	9.24		
	5 775	AV	8.63	30.00	30.00

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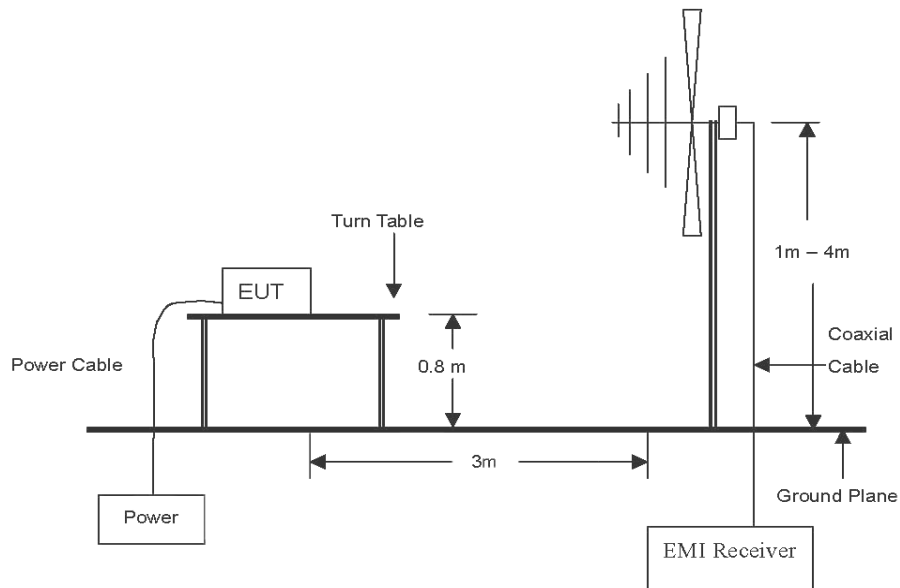
3.2. Radiated restricted band and emissions

Test setup

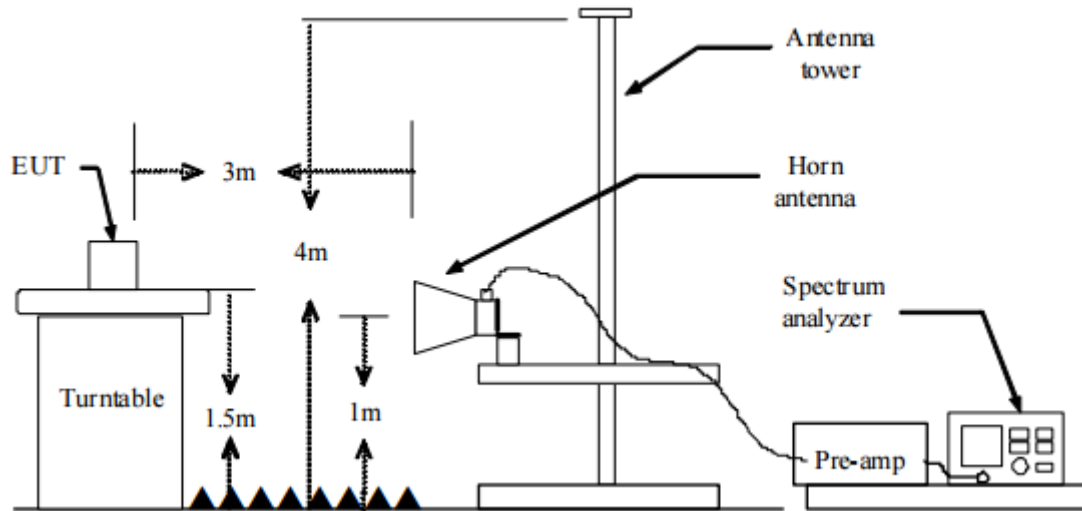
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz emissions, whichever is lower.



Test procedure

Radiated emissions from the EUT were measured according to the dictates in section 11.11 & 11.12 of ANSI C63.10-2013.

Test procedure below 30 MHz

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel, ground parallel and perpendicular of the antenna are set to make the measurement. It was determined that parallel was worst-case orientation; therefore, all final radiated testing was performed with the EUT in parallel.
3. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
4. The test-receiver system was set to average or quasi peak detect function and Specified Bandwidth with Maximum hold mode.

Test procedure above 30 MHz

1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The antenna is a bi-log antenna, a horn antenna, and its height are varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
3. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
4. The test receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
5. Spectrum analyzer settings for $f < 1$ GHz:

-
- ① Span = wide enough to fully capture the emission being measured
 - ② RBW = 100 kHz
 - ③ VBW $\geq$ RBW
 - ④ Detector = quasi peak
 - ⑤ Sweep time = auto
 - ⑥ Trace = max hold
6. Spectrum analyzer settings for $f \geq 1$ GHz: Peak
- ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
 - ② RBW = 1 MHz
 - ③ VBW $\geq$ 3 MHz
 - ④ Detector = peak
 - ⑤ Sweep time = auto
 - ⑥ Trace = max hold
 - ⑦ Trace was allowed to stabilize
7. Spectrum analyzer settings for $f \geq 1$ GHz: Average
- ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
 - ② RBW = 1 MHz
 - ③ VBW $\geq 3 \times$ RBW
 - ④ Detector = RMS, if span/(# of points in sweep) $\leq$ (RBW/2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.
 - ⑤ Averaging type = power(i.e., RMS)
 - 1) As an alternative, the detector and averaging type may be set for linear voltage averaging.
 - 2) Some instruments require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.
 - ⑥ Sweep = auto
 - ⑦ Trace = max hold
 - ⑧ Perform a trace average of at least 100 traces.
 - ⑨ A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:
 - 1) If power averaging (RMS) mode was used in step ⑤, then the applicable correction factor is $10 \log(1/x)$, where x is the duty cycle.
 - 2) If linear voltage averaging mode was used in step ⑤, then the applicable correction factor is $20 \log(1/x)$, where x is the duty cycle.
 - 3) If a specific emission is demonstrated to be continuous (≥ 98 percent duty cycle) rather than turning on and off with the transmit cycle, then no duty cycle correction is required for that emission.
-

Note.

1. $f < 30$ MHz, extrapolation factor of 40 dB/decade of distance. $F_d = 40\log(D_m/D_s)$
 $f \geq 30$ MHz, extrapolation factor of 20 dB/decade of distance. $F_d = 20\log(D_m/D_s)$
 Where:
 F_d = Distance factor in dB
 D_m = Measurement distance in meters
 D_s = Specification distance in meters
2. Field strength(dB μ V/m) = Level(dB μ V) + CF (dB) + or DCF(dB)
3. Margin(dB) = Limit(dB μ V/m) - Field strength(dB μ V/m)
4. Emissions below 18 GHz were measured at a 3 meter test distance while emissions above 18 GHz were measured at a 1 meter test distance with the application of a distance correction factor.
7. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z, it was determined that **X orientation** was worst-case orientation; therefore, all final radiated testing was performed with the EUT in **X orientation**.
8. The worst-case emissions are reported however emissions whose levels were not within 20 dB of respective limits were not reported.
9. According to exploratory test no any obvious emission were detected from 9 kHz to 30 MHz. Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30 m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

Limit

According to 15.209(a), for an intentional radiator devices, the general required of field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values :

Frequency (MHz)	Distance (Meters)	Radiated (μ V/m)
0.009 ~ 0.490	300	2400/F(kHz)
0.490 ~ 1.705	30	24000/F(kHz)
1.705 ~ 30.0	30	30
30 ~ 88	3	100**
88 ~ 216	3	150**
216 ~ 960	3	200**
Above 960	3	500

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 ~ 72 MHz, 76 ~ 88 MHz, 174 ~ 216 MHz or 470 ~ 806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

According to 15.407(b), (b) Undesirable emission limits: Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

- (1) For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an e.i.r.p. of –27 dBm/MHz.
- (2) For transmitters operating in the 5.25–5.35 GHz band: All emissions outside of the 5.15–5.35 GHz band shall not exceed an e.i.r.p. of –27 dBm/MHz.
- (3) For transmitters operating in the 5.47–5.725 GHz band: All emissions outside of the 5.47–5.725 GHz band shall not exceed an e.i.r.p. of –27 dBm/MHz.
- (4) For transmitters operating in the 5.725–5.85 GHz band:
 - i) All emissions shall be limited to a level of –27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.
 - ii) Devices certified before March 2, 2017 with antenna gain greater than 10 dBi may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease by March 2, 2018. Devices certified before March 2, 2018 with antenna gain of 10 dBi or less may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease before March 2, 2020.
- (5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.
- (6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in § 15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in § 15.207.
- (7) The provisions of §15.205 apply to intentional radiators operating under this section.
- (8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

According to RSS-247 6.2 The equipment output power and e.i.r.p. shall be measured in terms of average value. If the transmission is in bursts, the provisions of RSS-Gen for pulsed operation shall apply.

(1) For transmitters with operating frequencies in the band 5150-5250 MHz, all emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. Any unwanted emissions that fall into the band 5250-5350 MHz shall be attenuated below the channel power by at least 26 dB, when measured using a resolution bandwidth between 1 and 5% of the occupied bandwidth (i.e. 99% bandwidth), above 5250 MHz. The 26 dB bandwidth may fall into the 5250-5350 MHz band; however, if the occupied bandwidth also falls within the 5250-5350 MHz band, the transmission is considered as intentional and the devices shall comply with all requirements in the band 5250-5350 MHz including implementing dynamic frequency selection (DFS) and TPC, on the portion of the emission that resides in the 5250-5350 MHz band.

(2) For transmitters operating in the band 5250-5350 MHz Devices shall comply with the following:

- a) All emissions outside the band 5250-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p.; or
- b) All emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. and its power shall comply with the spectral power density for operation within the band 5150-5250 MHz. The device, except devices installed in vehicles, shall be labelled or include in the user manual the following text “for indoor use only.”

(3) For transmitters operating in the band 5470-5600 MHz and 5650-5725 MHz, Emissions outside the band 5470-5725 MHz shall not exceed -27 dBm/MHz e.i.r.p. However, devices with bandwidth overlapping the band edge of 5725 MHz can meet the emission limit of -27 dBm/MHz e.i.r.p. at 5850 MHz instead of 5725 MHz.

(4) For the band 5725-5850 MHz, Devices operating in the band 5725-5850 MHz with antenna gain greater than 10 dBi can have unwanted emissions that comply with either the limits in this section or in section 5.5 until six (6) months after the publication date of this standard for certification. Certified devices that do not comply with emission limits in this section shall not be manufactured, imported, distributed, leased, offered for sale or sold after April 1, 2018.

Devices operating in the band 5725-5850 MHz with antenna gain of 10 dBi or less can have unwanted emissions that comply with either the limits in this section or in section 5.5 until April 1, 2018 for certification. Certified devices that do not comply with emission limits in this section shall not be manufactured, imported, distributed, leased, offered for sale or sold after April 1, 2020.

Devices operating in the band 5725-5850 MHz shall have e.i.r.p. of unwanted emissions comply with the following:

- a) 27 dBm/MHz at frequencies from the band edges decreasing linearly to 15.6 dBm/MHz at 5 MHz above or below the band edges;
- b) 15.6 dBm/MHz at 5 MHz above or below the band edges decreasing linearly to 10 dBm/MHz at 25 MHz above or below the band edges;
- c) 10 dBm/MHz at 25 MHz above or below the band edges decreasing linearly to -27 dBm/MHz at 75 MHz above or below the band edges; and
- d) -27 dBm/MHz at frequencies more than 75 MHz above or below the band edges.

Duty cycle

Regarding to KDB 789033 D02 v02r01, B)2)b), the maximum duty cycles of all modes were investigated and set the spectrum analyzer as below.

Set $RBW \geq OBW$ if possible; otherwise, set RBW to the largest available value. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are $> 50/T$, where T is defined in II.B.1.a), and the number of sweep points across duration T exceeds 100.

Test mode	T _{on} time (ms)	Period (ms)	Duty cycle (Linear)	Duty cycle (%)	Duty cycle correction factor (dB)
802.11a	2.054	2.089	0.983	98.325	-
802.11n_HT20	1.914	1.949	0.982	98.204	-
802.11ac_VHT20	0.939	0.974	0.964	96.407	0.16
802.11n_HT40	1.918	1.954	0.982	98.158	-
802.11ac_VHT40	0.942	0.977	0.964	96.418	0.16
802.11ac_VHT80	0.459	0.482	0.952	95.228	0.21

Duty cycle (Linear) = T_{on} time/Period

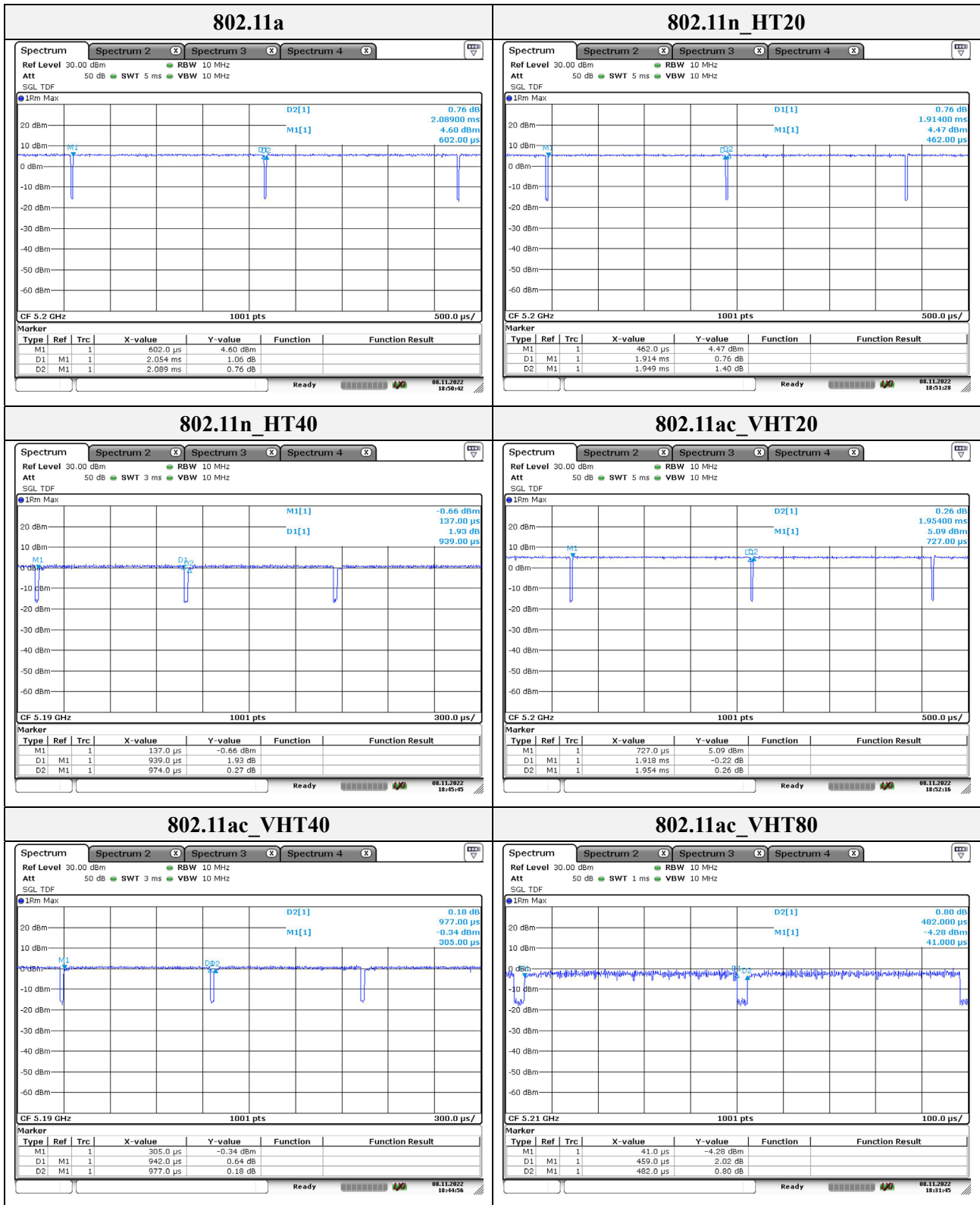
DCF(Duty cycle correction factor (dB)) = $10\log(1/\text{duty cycle})$



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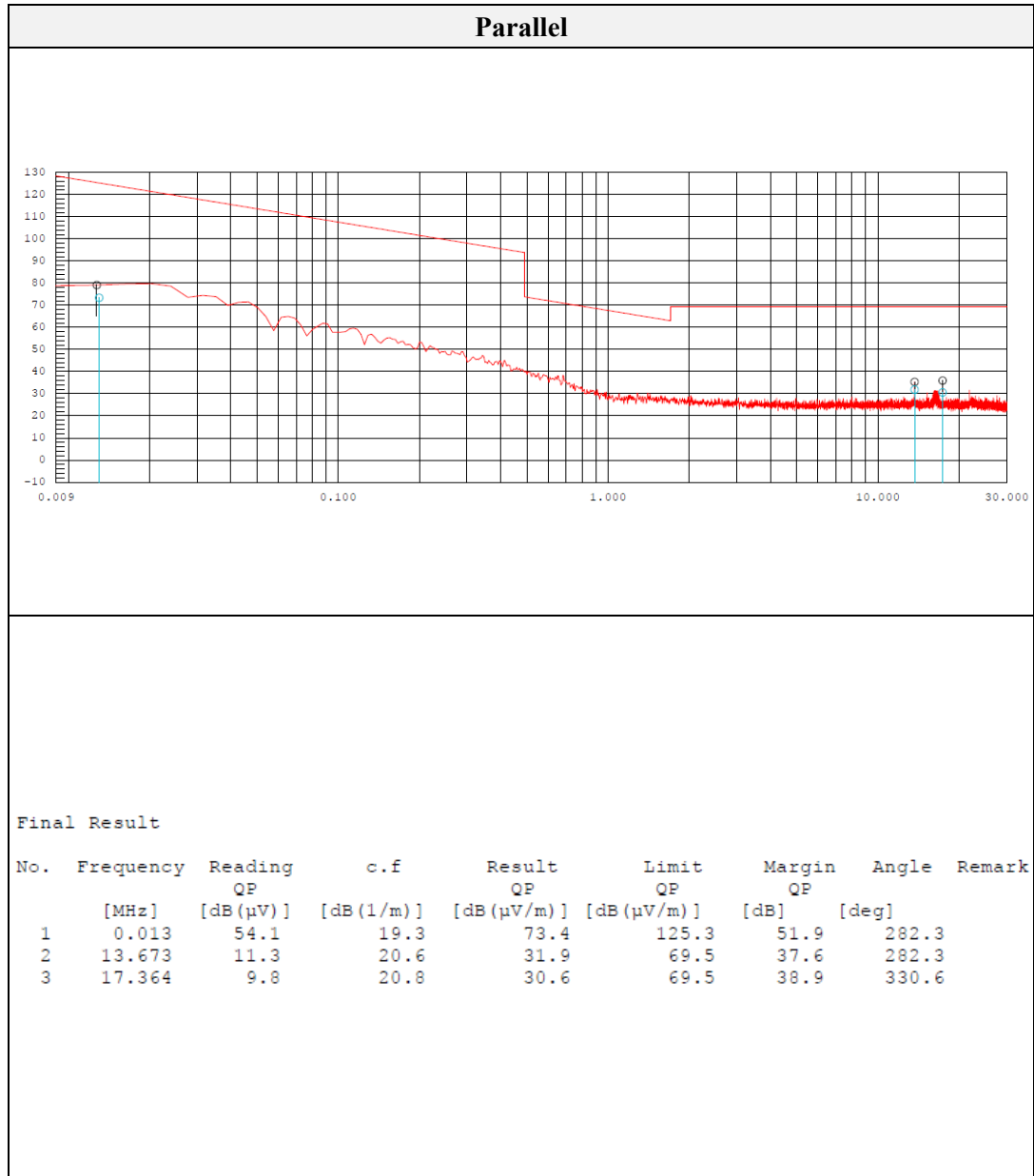
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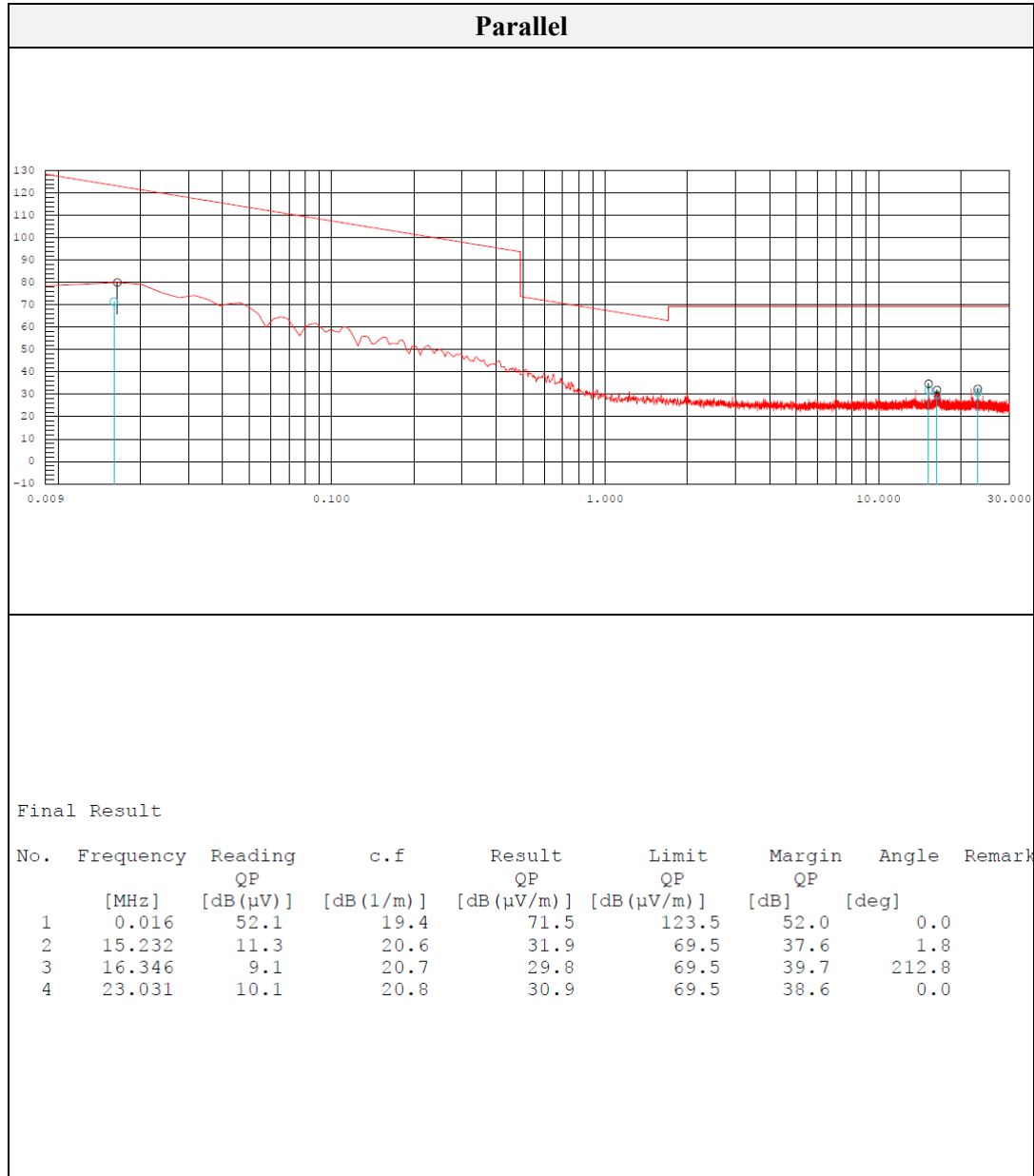
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Test results (Below 30 MHz)

Mode: 802.11a_ANT 1
Channel: 100 (Worst Case)
Distance of measurement: 3 meter



Mode: 802.11a_ANT 2
 Channel: 100 (Worst Case)
 Distance of measurement: 3 meter

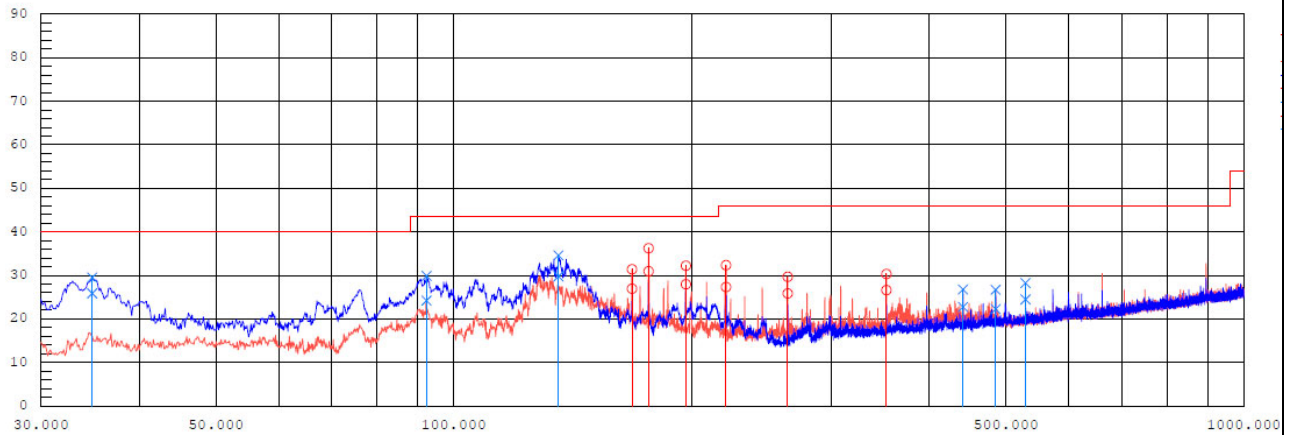


Test results (Below 1 000 MHz) – Worst case

Mode: 802.11a_ANT 1

Channel: 100 (Worst Case)

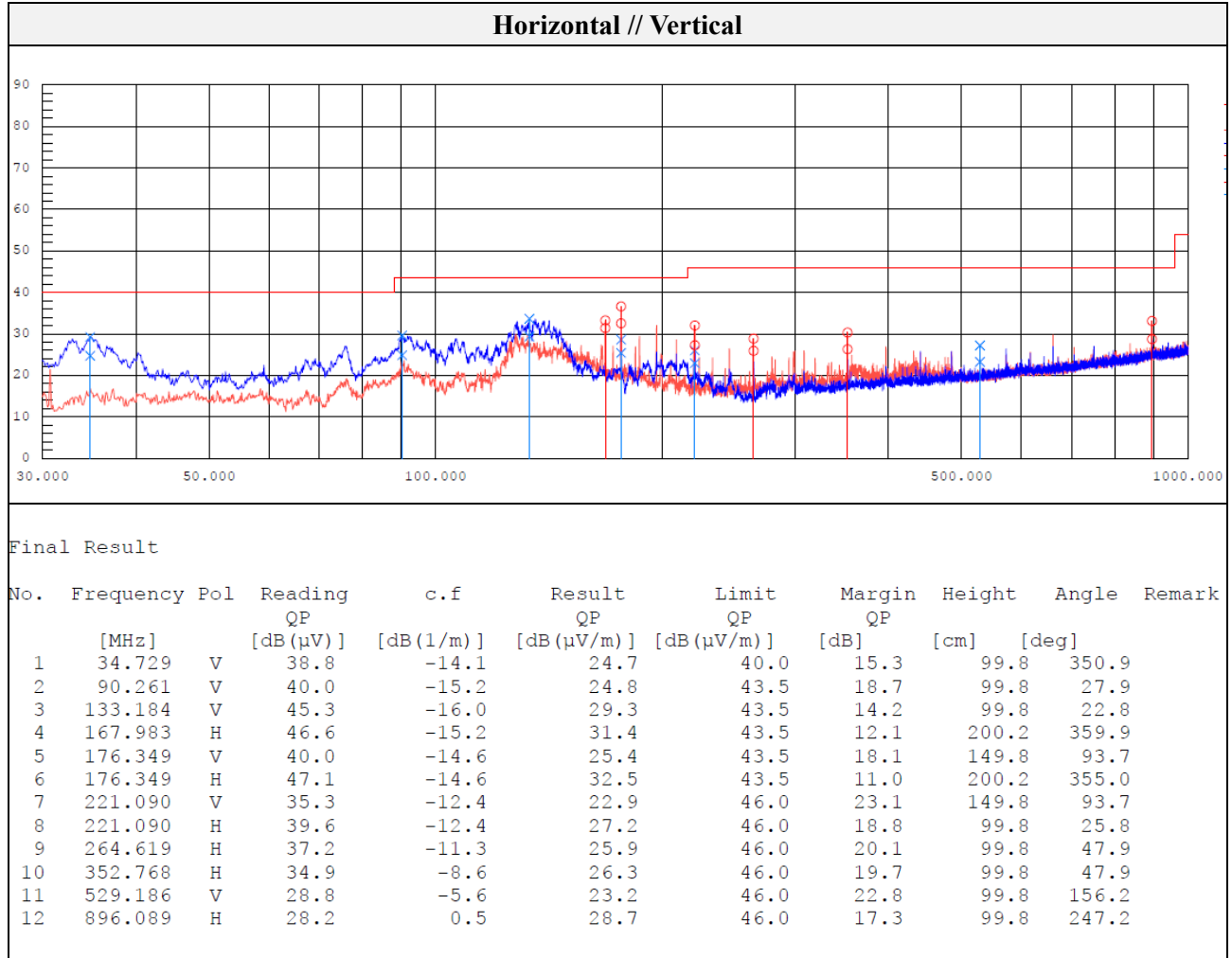
Distance of measurement: 3 meter

Horizontal // Vertical

Final Result

No.	Frequency	Pol	Reading	c.f	Result	Limit	Margin	Height	Angle	Remark
	[MHz]		QP		QP	QP	QP			
			[dB (μV)]	[dB (1/m)]	[dB (μV/m)]	[dB (μV/m)]	[dB]	[cm]	[deg]	
1	34.850	V	39.9	-14.1	25.8	40.0	14.2	99.8	142.2	
2	92.323	V	39.0	-14.8	24.2	43.5	19.3	99.8	0.0	
3	135.609	V	45.8	-16.1	29.7	43.5	13.8	99.8	53.5	
4	167.983	H	42.1	-15.2	26.9	43.5	16.6	99.7	359.9	
5	176.349	H	45.5	-14.6	30.9	43.5	12.6	199.8	0.1	
6	196.598	H	41.2	-13.3	27.9	43.5	15.6	99.7	359.9	
7	221.090	H	39.7	-12.4	27.3	46.0	18.7	99.7	359.9	
8	264.619	H	37.1	-11.3	25.8	46.0	20.2	99.7	22.8	
9	352.768	H	35.2	-8.6	26.6	46.0	19.4	99.7	113.1	
10	441.038	V	30.0	-7.3	22.7	46.0	23.3	99.8	165.9	
11	485.051	V	28.5	-6.3	22.2	46.0	23.8	99.8	76.0	
12	529.186	V	30.0	-5.6	24.4	46.0	21.6	99.8	185.4	

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Mode: 802.11a_ANT 2
Channel: 120 (Worst Case)
Distance of measurement: 3 meter



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Test results (Above 1 000 MHz)

Mode: 802.11a_ANT 1
Distance of measurement: 3 meter
Channel: 36

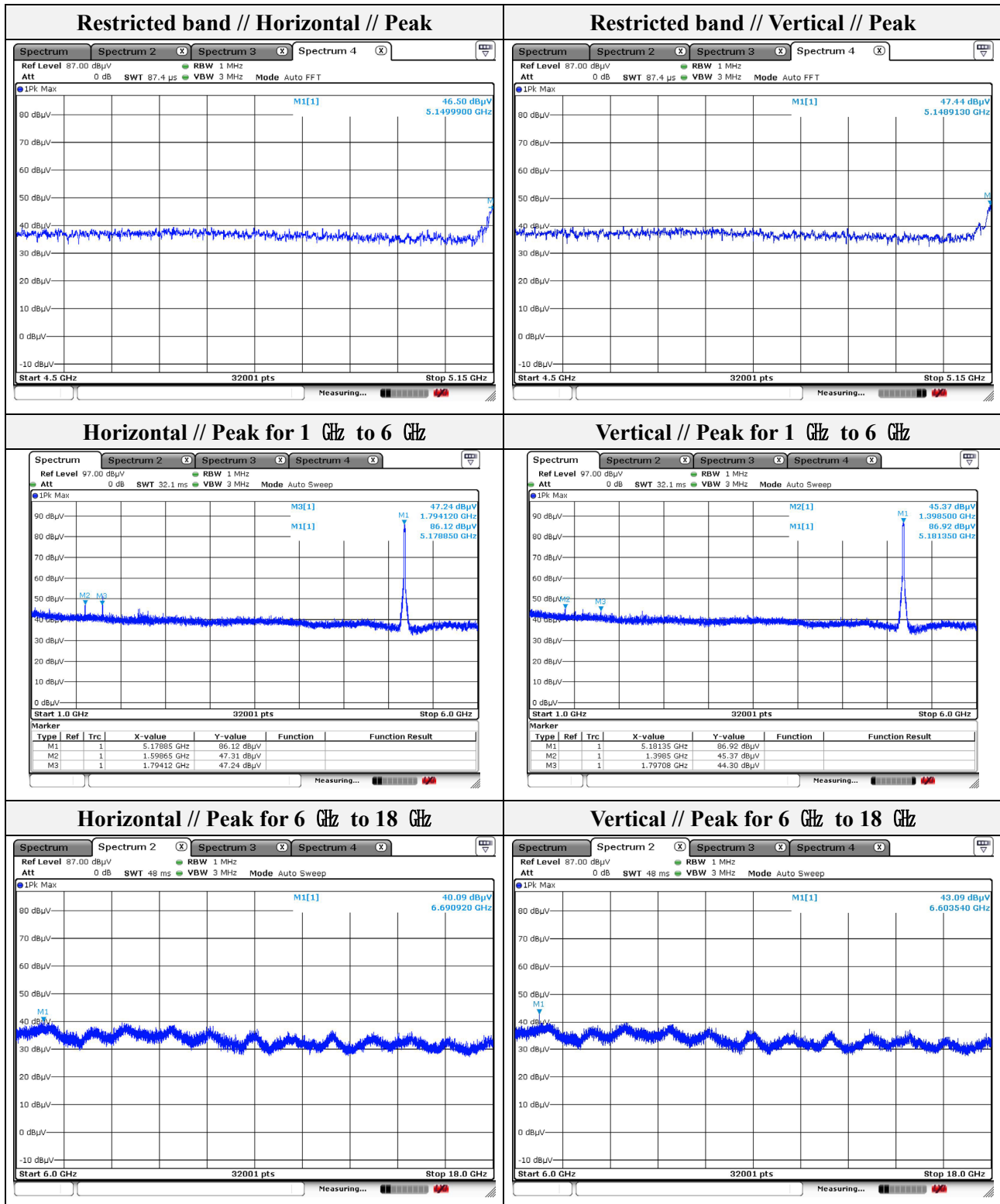
- Spurious

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1 398.50	45.37	Peak	V	-6.98	-	38.39	74.00	35.61
1 598.65	47.31	Peak	H	-6.04	-	41.27	74.00	32.73
1 794.12	47.24	Peak	H	-3.59	-	43.65	68.23	24.58
1 797.08	44.30	Peak	V	-3.56	-	40.74	68.23	27.49
6 603.54	43.09	Peak	V	8.62	-	51.71	68.23	16.52
6 690.92	40.09	Peak	H	8.73	-	48.82	68.23	19.41

- Band edge

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 149.99	46.50	Peak	V	6.45	-	52.95	74.00	21.05
5 148.91	47.44	Peak	H	6.45	-	53.89	74.00	20.11

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Note.

1. Average test would be performed if the peak result were greater than the average limit.

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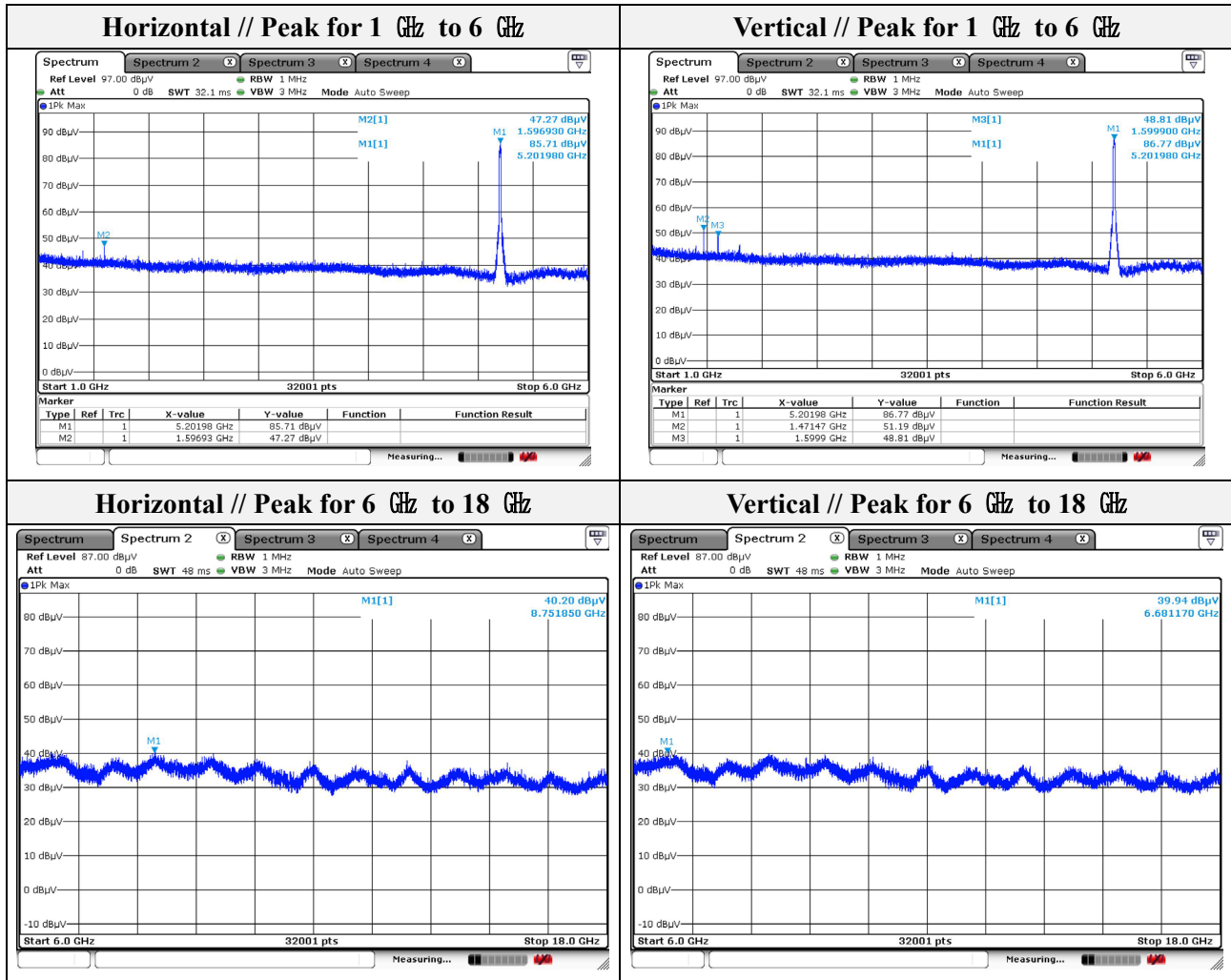
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Mode: 802.11a_ANT 1
Distance of measurement: 3 meter
Channel: 40

- Spurious

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1 471.47	51.19	Peak	V	-6.76	-	44.43	74.00	29.57
1 596.93	47.27	Peak	H	-6.05	-	41.22	74.00	32.78
1 599.90	48.81	Peak	V	-6.03	-	42.78	74.00	31.22
6 681.17	39.94	Peak	V	8.72	-	48.66	68.23	19.57
8 751.19	40.20	Peak	H	12.37	-	52.57	68.23	15.66

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Note.

1. Average test would be performed if the peak result were greater than the average limit.

Mode: 802.11a_ANT 1

Distance of measurement: 3 meter

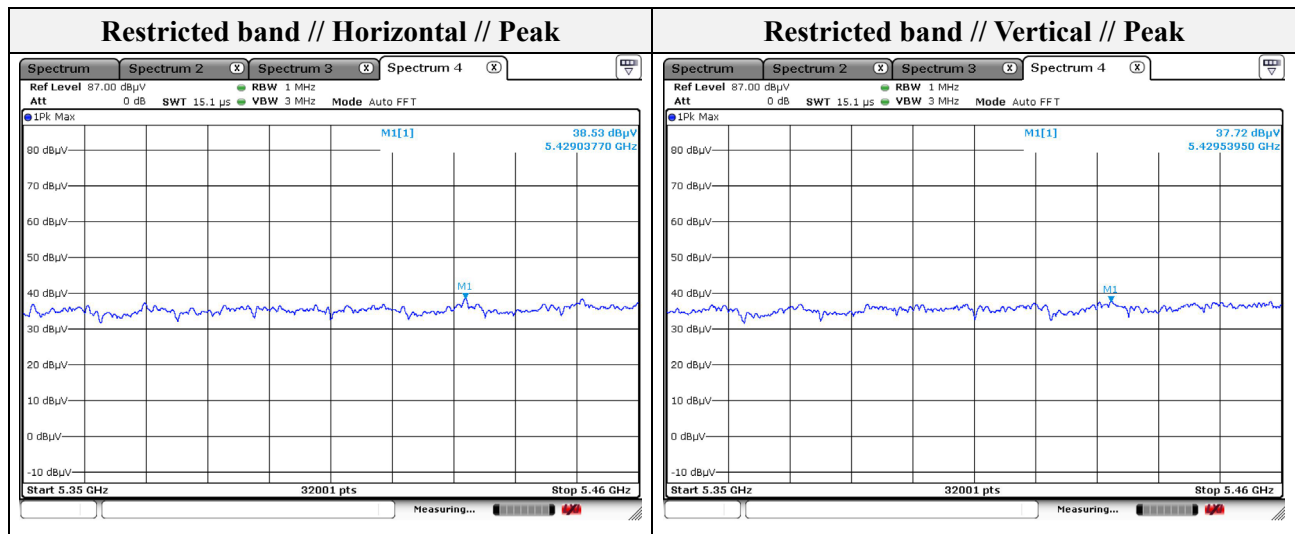
Channel: 48

- Spurious

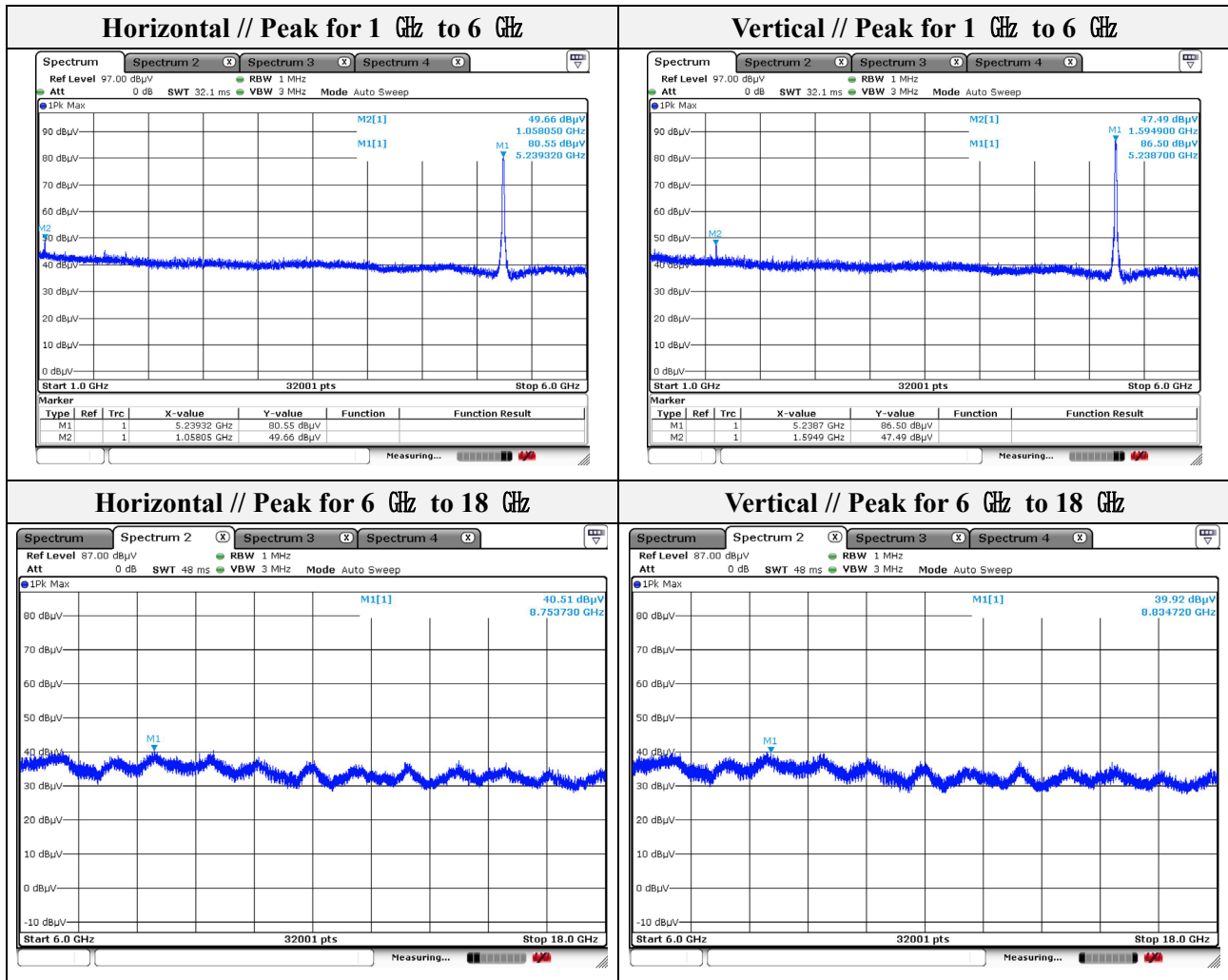
Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1 058.05	49.66	Peak	H	-9.59	-	40.07	74.00	33.93
1 594.90	47.49	Peak	V	-6.07	-	41.42	74.00	32.58
8 753.73	40.51	Peak	H	12.36	-	52.87	68.23	15.36
8 834.72	39.92	Peak	V	12.20	-	52.12	68.23	16.11

- Band edge

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 429.04	38.53	Peak	H	7.12	-	45.65	74.00	28.35
5 429.54	37.72	Peak	V	7.12	-	44.84	74.00	29.16



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Note.

1. Average test would be performed if the peak result were greater than the average limit.