

FCC 15.247 DTS

2.4 GHz Report

for

FUTABA Corporation

**1080 Yabutsuka Chosei-son Chosei-gun
Chiba, 299-4395 Japan.**

Brand : Futaba
Product Name : Radio Control
Model Name : T18SZ
FCC ID : AZPT18SZ-24G

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APPENDIX A TEST PHOTOGRAPHS

TEST REPORT CERTIFICATION

Applicant : FUTABA Corporation
Manufacture : FUTABA Corporation
Product Name : Radio Control
Model No. : T18SZ
Serial No. : N/A
Brand : Futaba

Applicable Standards:


FCC Rules and Regulations Part 15 Subpart C, Oct. 2014
ANSI C63.10:2013
KDB 558074 D01 DTS Meas Guidance v03r03

AUDIX Technology Corp. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report. **AUDIX Technology Corp.** does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens and samples.

Date of Test: 2015. 07. 15 ~ 08. 12

Date of Report: 2015. 08. 12

Producer: 
(Annie Yu/Administrator)

Signatory: 
(Ben Cheng/Manager)

1. REPORT HISTORY

Revision	Date	Revision Summary	Report Number
0	2015. 08. 12	Original Report.	EM-F150473

2. SUMMARY OF TEST RESULTS

Rule	Description	Results
15.207	Conducted Emission	N/A, Note
15.247(d)/15.209	Radiated Band Edge and Radiated Spurious Emission	PASS
15.247(a)(2)	6dB Bandwidth	PASS
15.247(b)(3)	Maximum Peak Output Power	PASS
15.247(d)/15.205	Conducted Band Edges and Conducted Spurious Emission	PASS
15.247 (e)	Peak Power Spectral Density	PASS
15.203	Antenna Requirement	PASS
Note: The EUT only employs battery power for operation, so it is unnecessary to test.		

3. GENERAL INFORMATION

3.1. Description of EUT

Product	Radio Control
Model Number	T18SZ
Serial Number	N/A
Brand Name	Futaba
Applicant	FUTABA Corporation 1080 YabutsukaChosei-son Chosei-gun Chiba, 299-4395 Japan.
Manufacture	FUTABA Corporation 1080 YabutsukaChosei-son Chosei-gun Chiba, 299-4395 Japan.
RF Features	2.4GHz
Transmit Type	1T1R
Device Category	<input type="checkbox"/> Outdoor Access Point <input type="checkbox"/> Fixed point-to-point Access Point <input type="checkbox"/> Indoor Access Point <input checked="" type="checkbox"/> Mobile and Portable client device
Date of Receipt of Sample	2015. 06. 15

3.2. EUT Specifications Assessed in Current Report

Fundamental Range (MHz)	Channel Number	Modulation	Data Rate (kbps)
2405.376-2472.960	23	FASSTest	136
2405.376-2477.056	36	FASST	136

Modulation: FASSTest			
Channel List			
Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
0	2405.376	12	2442.240
1	2408.448	13	2445.312
2	2411.520	14	2448.384
3	2414.592	15	2451.456
4	2417.664	16	2454.528
5	2420.736	17	2457.600
6	2423.808	18	2460.672
7	2462.880	19	2463.744
8	2429.952	20	2466.816
9	2433.024	21	2469.888
10	2436.096	22	2472.960
11	2439.168		

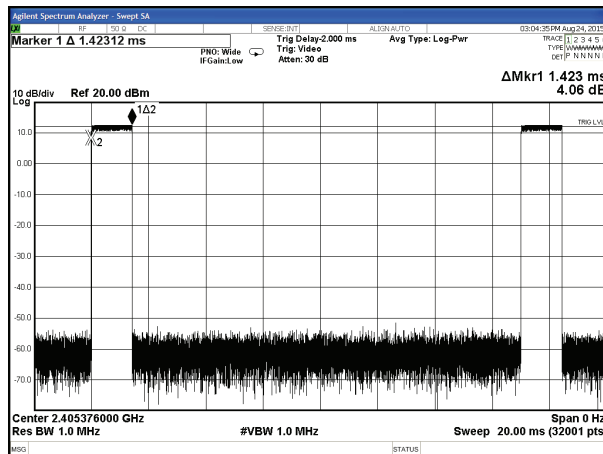
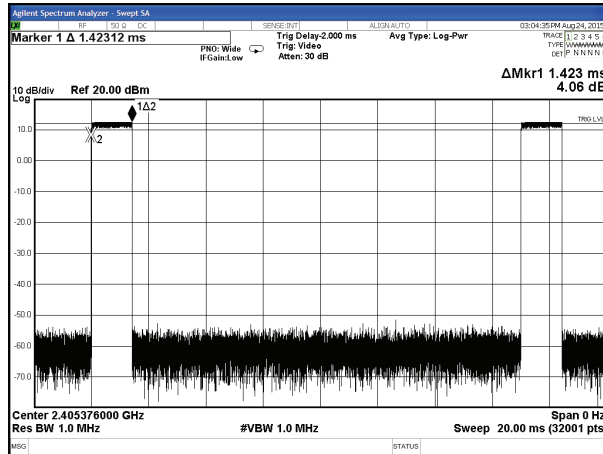
Modulation: FASST			
Channel List			
Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
2	2405.376	38	2442.240
4	2407.424	40	2444.288
6	2409.472	42	2446.336
8	2411.520	44	2448.384
10	2413.568	46	2450.432
12	2415.616	48	2452.480
14	2417.664	50	2454.528
16	2419.712	52	2456.576
18	2421.760	54	2458.624
20	2423.808	56	2460.672
22	2425.856	58	2462.720
24	2427.904	60	2464.768
26	2429.952	62	2466.816
28	2432.000	64	2468.864
30	2434.048	66	2470.912
32	2436.096	68	2472.960
34	2438.144	70	2475.008
36	2440.192	72	2477.056

3.3. Antenna Information

Manufacture	Antenna Type	Frequency	Max Gain (dBi)
SANSEI ELECTRIC CO., LTD	1/2λ Pencil Type	2.4GHz	2.14

3.4. Test Configuration

Modulation	Duty Cycle (x)	T (ms)	Duty Cycle Factor (dB)
FASSTest	0.096	N/A	N/A
FASST	0.28	N/A	N/A



Note: When duty cycle is less than 98% (0.98) that duty cycle factor $10\log(1/x)$ is needed to add in conducted test items measured in average detector.

Item		Modulation	Test Channel
Radiated Test Case	Radiated Band Edge ^{Note1}	FASSTest	0/22
		FASST	2/72
	Radiated Spurious Emission ^{Note1}	FASSTest	0/11/22
		FASST	2/36/72
Conducted Test Case	6dB Bandwidth	FASSTest	0/11/22
		FASST	2/36/72
	Peak Power Spectral Density	FASSTest	0/11/22
		FASST	2/36/72
	Peak Output Power	FASSTest	0/11/22
		FASST	2/36/72
	Band Edge	FASSTest	0/22
		FASST	2/72
	Spurious Emission	FASSTest	0/11/22
		FASST	2/36/72

Note 1:

Mobile Device

Portable Device, and 3 axis were assessed. The worst scenario for Radiated Spurious Emission as follow:

Lie

Side

Stand

3.5. Tested Supporting System List

3.5.1. Support Peripheral Units

No.	Product	Brand	Model No.	Serial No.	Approval
1.	DC Power Supply	TOP WARD	3303A	721773	N/A

3.5.2. Cable Lists

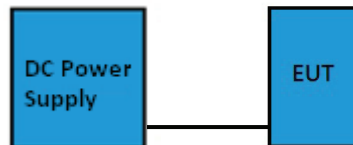
No.	Cable Description Of The Above Support Units
1.	DC Power Cord*2: Unshielded, Detachable, 1.05m

3.6. Setup Configuration

3.6.1. EUT Configuration for Power Line Emission



3.6.2. EUT Configuration for Conducted Test Items



3.7. Operating Condition of EUT

Test program “Futaba Term” is used for enabling EUT RF function under continues transmitting and choosing data rate/ channel.

3.8. Description of Test Facility

Test Firm Name	:	AUDIX Technology Corporation EMC Department No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan
Test Location & Facility	:	No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan
NVLAP Lab. Code	:	200077-0
TAF Accreditation No	:	1724

3.9. Measurement Uncertainty

Test Item	Frequency Range	Uncertainty
Radiation Test (Distance: 3m)	30MHz~300MHz	± 3.64dB
	300MHz~1000MHz	± 4.70dB
	Above 1GHz	± 1.60dB

Remark : Uncertainty = $ku_c(y)$

Test Item	Uncertainty
6dB Bandwidth	± 0.05kHz
Maximum peak output power	± 0.33dB
Power spectral density	± 0.13dB
Conducted Emission Limitations	± 0.13dB

4. MEASUREMENT EQUIPMENT LIST

4.1. Radiated Emission Measurement

4.1.1. Frequency Range 30MHz~1000MHz

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	E4446A	US44300366	2014. 08. 21	1 Year
2.	Test Receiver	R & S	ESCS30	100338	2015. 06. 24	1 Year
3.	Amplifier	HP	8447D	2944A06305	2015. 02. 12	1 Year
4.	Bilog Antenna	TESEQ	CBL6112D	33821	2015. 02. 27	1 Year

4.1.2. Frequency Range 30MHz~1000MHz

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	E4446A	US44300366	2014. 08. 21	1 Year
2.	Pre-Amplifier	HP	8449B	3008A02678	2015. 03. 04	1 Year
3.	2.4GHz Notch Filter	K&L	7NSL10-244 1.5E130.5-0 0	1	2015. 07. 22	1 Year
4.	3G High Pass Filter	Microwave Circuits	H3G018G1	484796	2014. 08. 25	1 Year
5.	Horn Antenna	ETS-Lindgr en	3117	00135902	2015. 03. 06	1 Year
6.	Horn Antenna	EMCO	3116	2653	2014. 10. 14	1 Year

4.2. RF Conducted Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9030A-526	MY53310269	2014. 11. 08	1 Year

5. CONDUCTED EMISSION MEASUREMENT

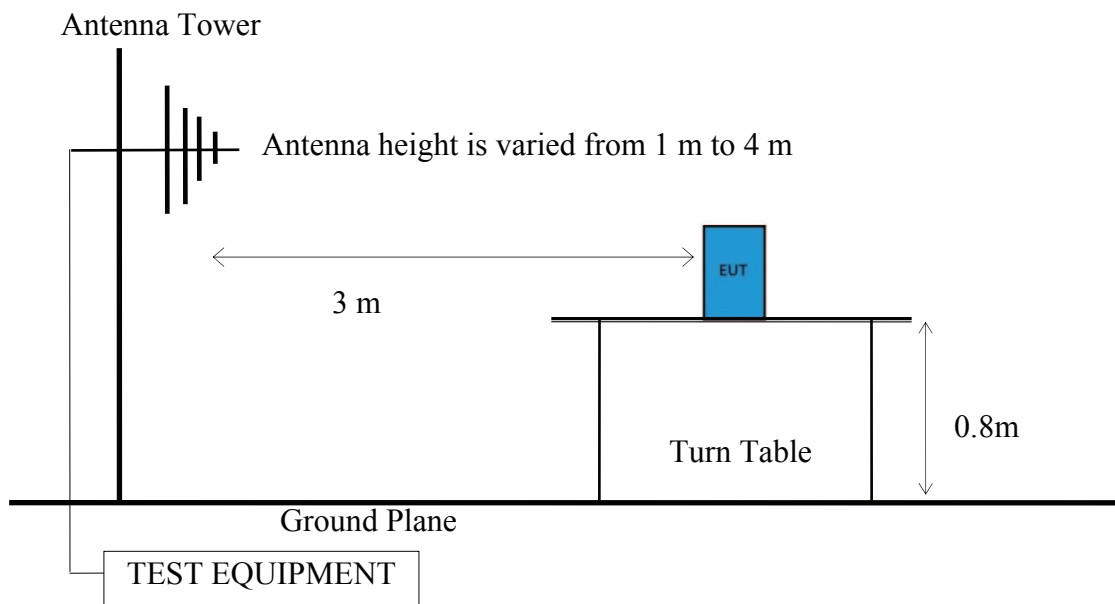
【The EUT only employs battery power for operation, no conductive emission limits are required according to FCC Part 15 Section §15.207】

6. RADIATED EMISSION MEASUREMENT

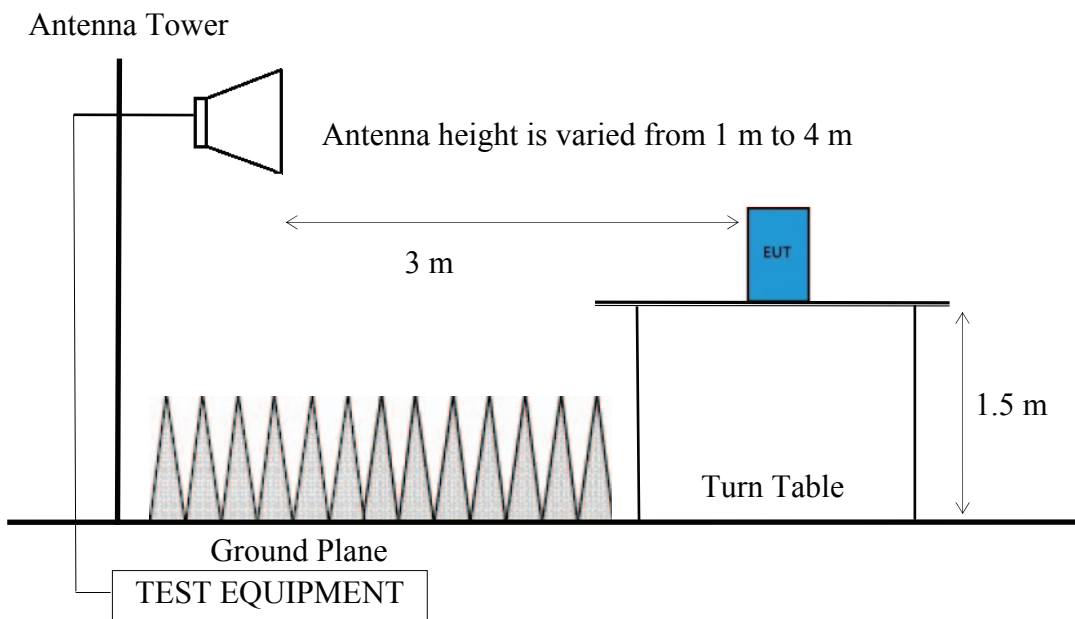
6.1. Block Diagram of Test Setup

6.1.1. Block Diagram of connection between EUT and simulators
Indicated as section 3.7

6.1.2. Setup Diagram for 30-1000 MHz



6.1.3. Semi-Anechoic Chamber (3m) Setup Diagram for above 1GHz



6.2. Radiated Emission Limits

In any 100kHz bandwidth outside the frequency band, the radio frequency power produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified as below.

Frequency (MHz)	Distance (m)	Field Strengths Limits	
		$\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
Above 960	3	500	54.0
Above 1000	3	74.0 $\text{dB}\mu\text{V/m}$ (Peak) 54.0 $\text{dB}\mu\text{V/m}$ (Average)	

Remark : (1) $\text{dB}\mu\text{V/m} = 20 \log (\mu\text{V/m})$

- (2) The tighter limit applies to the edge between two frequency bands.
- (3) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
- (4) Fundamental and emission fall within operation band are exempted from this section.
- (5) Pursuant to ANSI C63.10: 6.6.4.3, if the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.

6.3. Test Procedure

The EUT setup on the turn table which has 1.5m height to the ground. The turn table rotated 360 degrees and antenna varied from 1 m to 4 m to find the maximum emission level. Both horizontal and vertical polarization are required. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

Frequency below 1 GHz:

Spectrum Analyzer is used for pre-testing with following setting:

- (1) RBW = 120 kHz
- (2) VBW $\geq 3 \times$ RBW.
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.
- (7) When peak-detected value is lower than limit that the measurement using the Q.P. detector is not required. Otherwise using Q.P. for finally measurement.

Frequency above 1GHz to 10th harmonic:

Peak Detector:

- (1) RBW = 1 MHz
- (2) VBW $\geq 3 \times$ RBW.
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.
- (7) When peak-detected value is lower than limit that the measurement using the average detector is not required. Otherwise using average for finally measurement.

Average Detector:

Option 1:

- (1) RBW = 1 MHz
- (2) VBW = 1/T
- (1) Detector = Peak.
- (2) Sweep time = auto.
- (3) Trace mode = max hold.
- (4) Allow sweeps to continue until the trace stabilizes.

Option 2:

Average Emission Level = Peak Emission Level + D.C.C.F.

6.4. Measurement Result Explanation

Peak Emission Level = Antenna Factor + Cable Loss + Meter Reading

Average Emission Level = Antenna Factor + Cable Loss + Meter Reading

Average Emission Level = Peak Emission Level + DCCF

Duty Cycle Correction Factor (DCCF) = $20 \log (TX_{on} / TX_{on+off})$ presented in section 3.5

EPR = Peak Emission Level - 95.2dB - 2.14dBi

6.5. Test Results

PASSED.

Test Date	2015/08/10	Temp./Hum.	23°C / 41%
Test Voltage	DC 6.6V		

6.5.1. Emissions within Restricted Frequency Bands

6.5.1.1. Frequency Below 1 GHz

Modulation	FASSTest	Frequency	TX 2405.376MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
299.66	13.12	4.65	18.46	36.23	46.00	9.77	Peak
345.25	14.32	5.15	16.67	36.14	46.00	9.86	Peak
996.12	21.07	8.09	2.22	31.38	54.00	22.62	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
112.45	11.82	3.32	17.58	32.72	43.50	10.78	Peak
435.46	16.09	5.96	10.78	32.83	46.00	13.17	Peak
984.48	21.02	8.03	3.24	32.29	54.00	21.71	Peak

Modulation	FASSTest	Frequency	TX 2439.168MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
285.11	12.92	4.56	16.46	33.94	46.00	12.06	Peak
345.25	14.32	5.15	14.20	33.67	46.00	12.33	Peak
971.87	20.95	7.96	1.19	30.10	54.00	23.90	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
110.51	11.68	3.30	14.18	29.16	43.50	14.34	Peak
406.36	15.65	5.71	9.32	30.68	46.00	15.32	Peak
990.30	21.04	8.05	0.73	29.82	54.00	24.18	Peak

Modulation	FASSTest	Frequency	TX 2472.960MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
299.66	13.12	4.65	18.36	36.13	46.00	9.87	Peak
345.25	14.32	5.15	17.13	36.60	46.00	9.40	Peak
979.63	20.99	8.00	2.57	31.56	54.00	22.44	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
112.45	11.82	3.32	17.17	32.31	43.50	11.19	Peak
418.97	15.85	5.82	11.49	33.16	46.00	12.84	Peak
987.39	21.02	8.03	3.05	32.10	54.00	21.90	Peak

Modulation	FASST	Frequency	TX 2405.376MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
56.19	7.02	2.69	20.27	29.98	40.00	10.02	Peak
299.66	13.12	4.65	18.54	36.31	46.00	9.69	Peak
345.25	14.32	5.15	16.67	36.14	46.00	9.86	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
108.57	11.55	3.29	17.37	32.21	43.50	11.29	Peak
435.46	16.09	5.96	10.71	32.76	46.00	13.24	Peak
997.09	21.07	8.09	2.73	31.89	54.00	22.11	Peak

Modulation	FASST	Frequency	TX 2440.192MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
285.11	12.92	4.56	15.92	33.40	46.00	12.60	Peak
345.25	14.32	5.15	14.63	34.10	46.00	11.90	Peak
991.27	21.04	8.05	1.04	30.13	54.00	23.87	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
112.45	11.82	3.32	14.71	29.85	43.50	13.65	Peak
396.66	15.47	5.62	10.05	31.14	46.00	14.86	Peak
990.30	21.04	8.05	1.19	30.28	54.00	23.72	Peak

Modulation	FASST	Frequency	TX 2477.056MHz
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Antenna at Horizontal Polarization

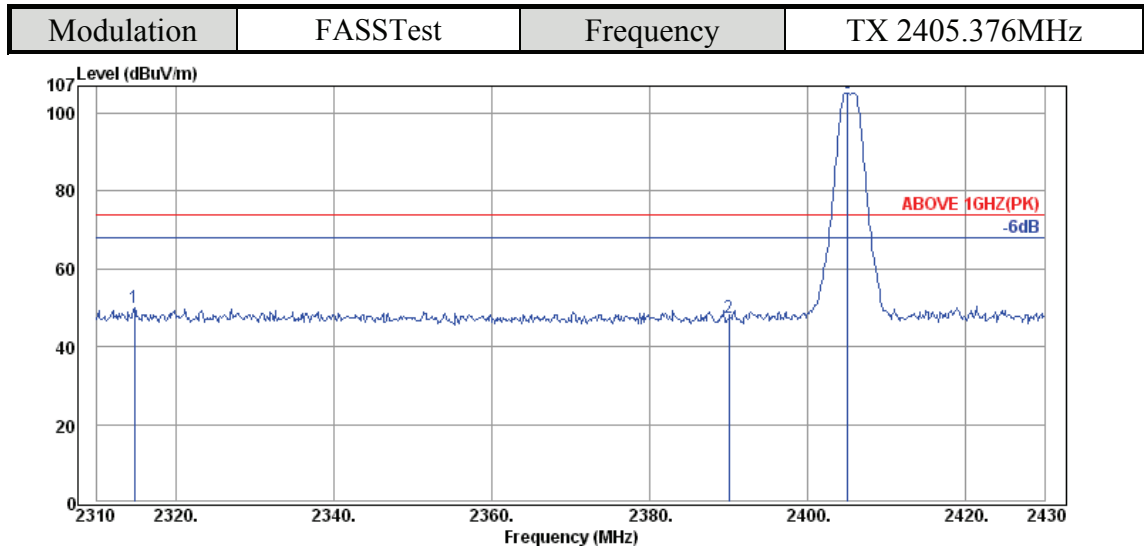
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
285.11	12.92	4.56	18.42	35.90	46.00	10.10	Peak
345.25	14.32	5.15	17.74	37.21	46.00	8.79	Peak
1000.00	21.09	8.11	2.17	31.37	54.00	22.63	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
110.51	11.68	3.30	17.21	32.19	43.50	11.31	Peak
435.46	16.09	5.96	11.88	33.93	46.00	12.07	Peak
975.75	20.97	7.98	2.42	31.37	54.00	22.63	Peak

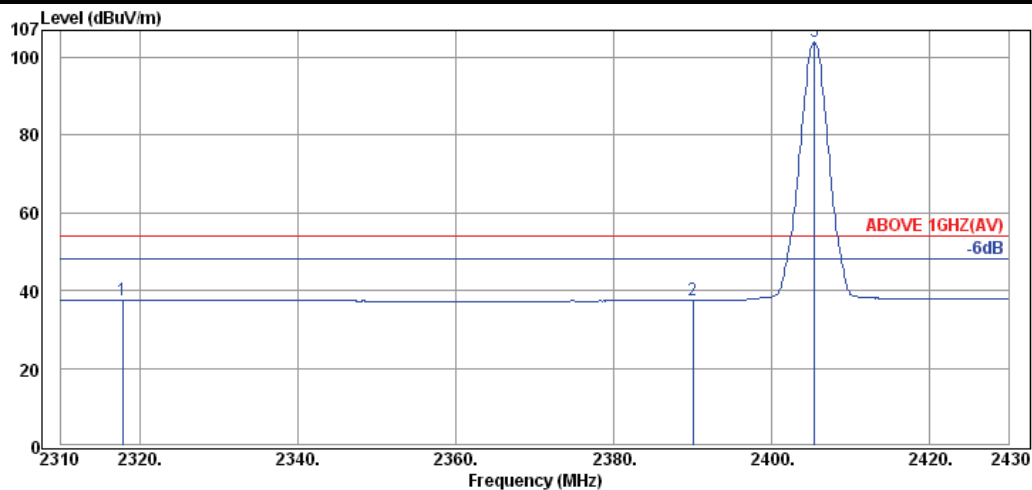
6.5.1.2. Frequency Above 1 GHz to 10th harmonics

Band Edge:



Antenna at Horizontal Polarization

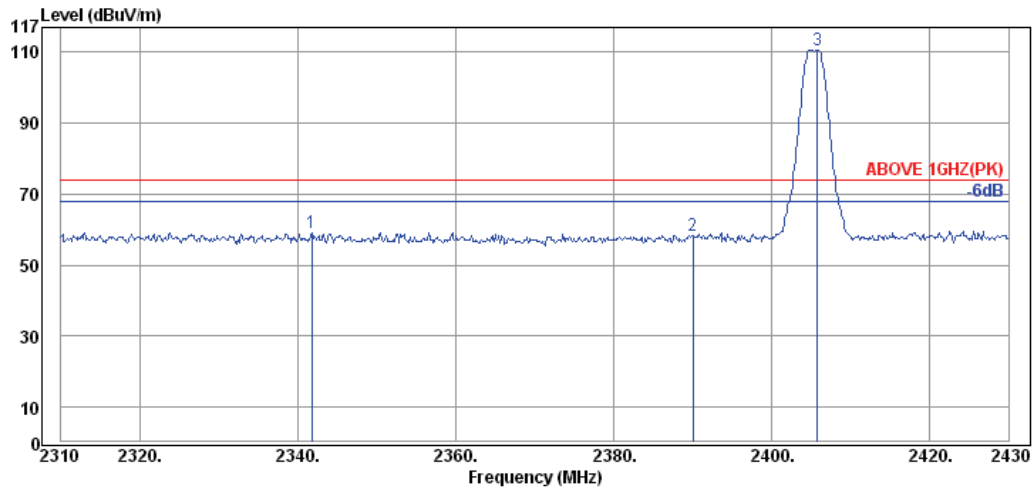
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2314.80	31.59	5.98	12.50	50.07	74.00	23.93	Peak
2390.04	31.68	6.08	9.73	47.49	74.00	26.51	Peak
2405.04	31.70	6.10	67.48	105.28	---	---	Peak



Antenna at Horizontal Polarization

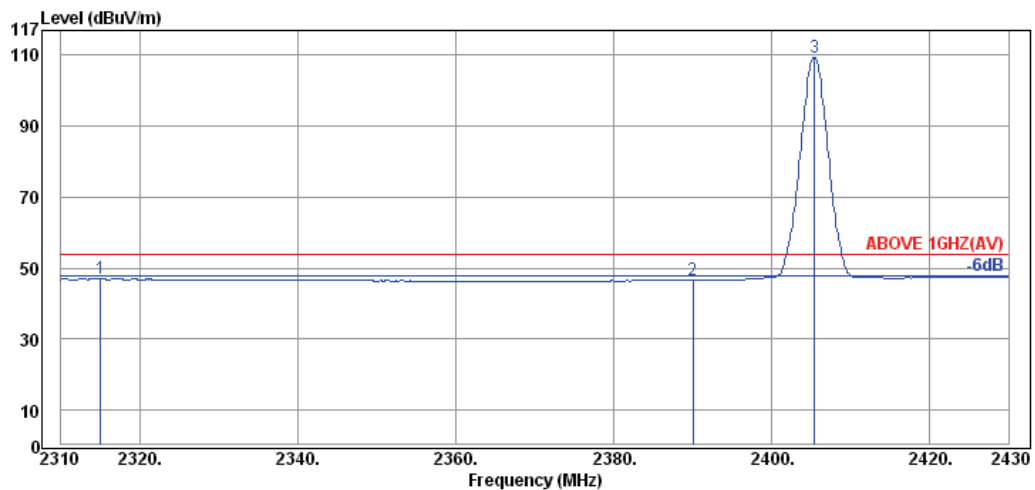
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2317.80	31.60	5.99	0.09	37.68	54.00	16.32	Average
2390.04	31.68	6.08	-0.33	37.43	54.00	16.57	Average
2405.40	31.70	6.10	66.11	103.91	---	---	Average

Modulation	FASSTest	Frequency	TX 2405.376MHz
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Antenna at Vertical Polarization

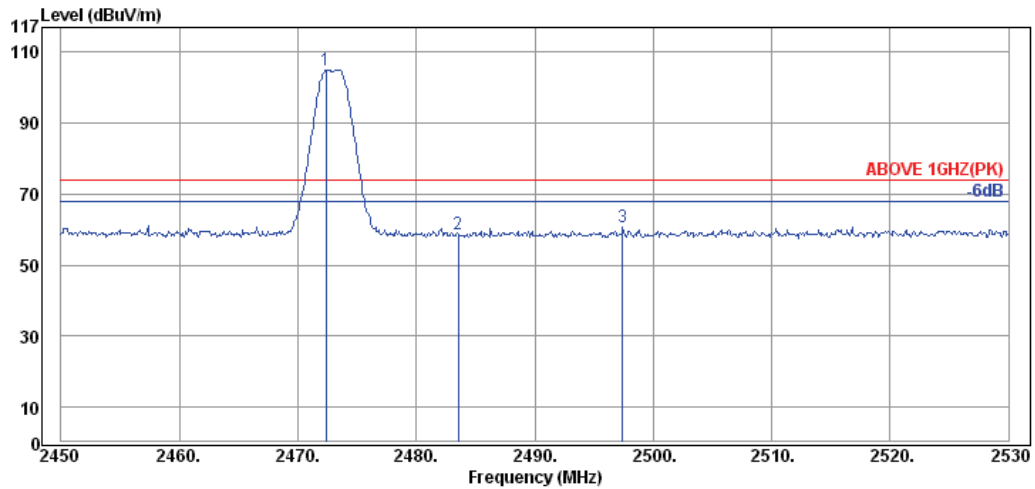
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2341.80	31.62	6.02	21.42	59.06	74.00	14.94	Peak
2390.04	31.68	6.08	20.48	58.24	74.00	15.76	Peak
2405.76	31.70	6.10	72.97	110.77	---	---	Peak



Antenna at Vertical Polarization

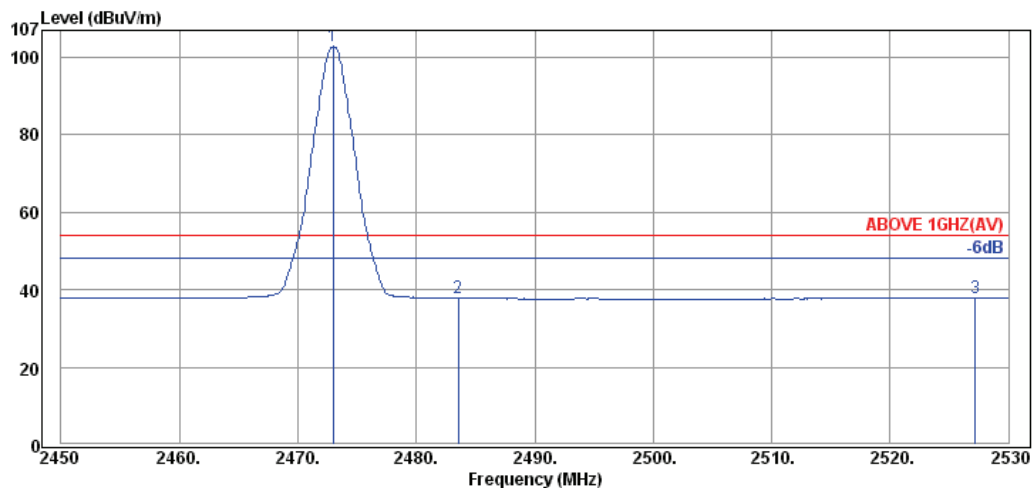
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2315.04	31.59	5.98	9.36	46.93	54.00	7.07	Average
2390.04	31.68	6.08	8.91	46.67	54.00	7.33	Average
2405.40	31.70	6.10	71.58	109.38	---	---	Average

Modulation	FASSTest	Frequency	TX 2472.960MHz
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Antenna at Horizontal Polarization

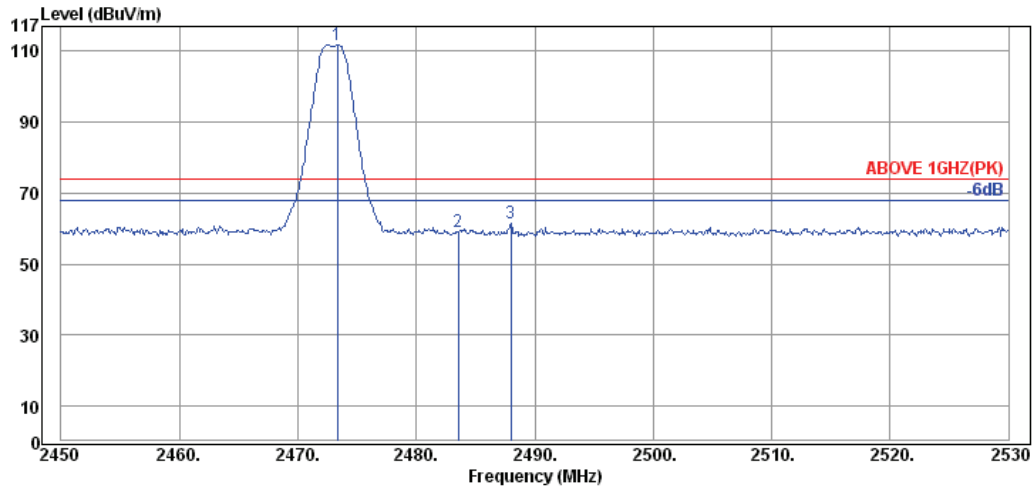
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2472.40	31.77	6.17	67.11	105.05	---	---	Peak
2483.52	31.78	6.19	20.89	58.86	74.00	15.14	Peak
2497.44	31.80	6.20	22.74	60.74	74.00	13.26	Peak



Antenna at Horizontal Polarization

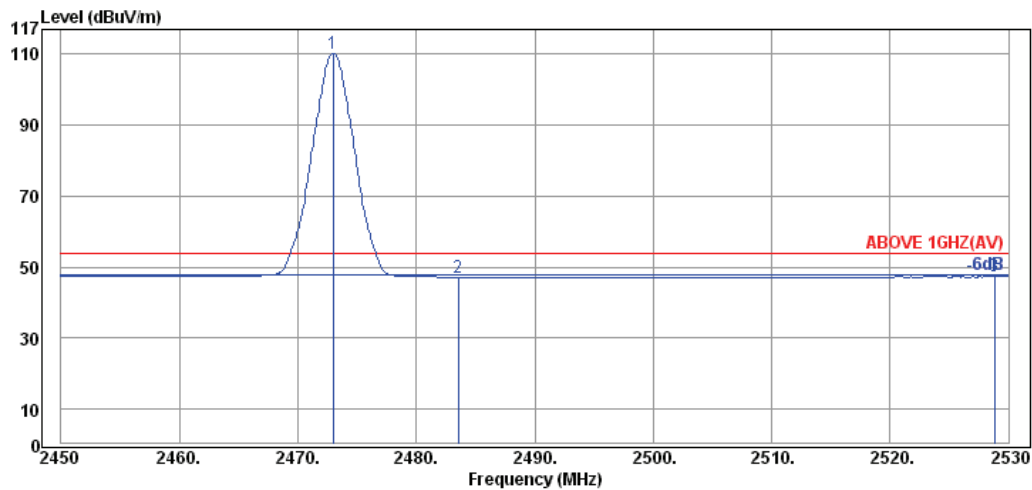
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2472.96	31.77	6.17	64.83	102.77	---	---	Average
2483.52	31.78	6.19	-0.21	37.76	54.00	16.24	Average
2527.20	31.83	6.25	-0.18	37.90	54.00	16.10	Average

Modulation	FASSTest	Frequency	TX 2472.960MHz
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Antenna at Vertical Polarization

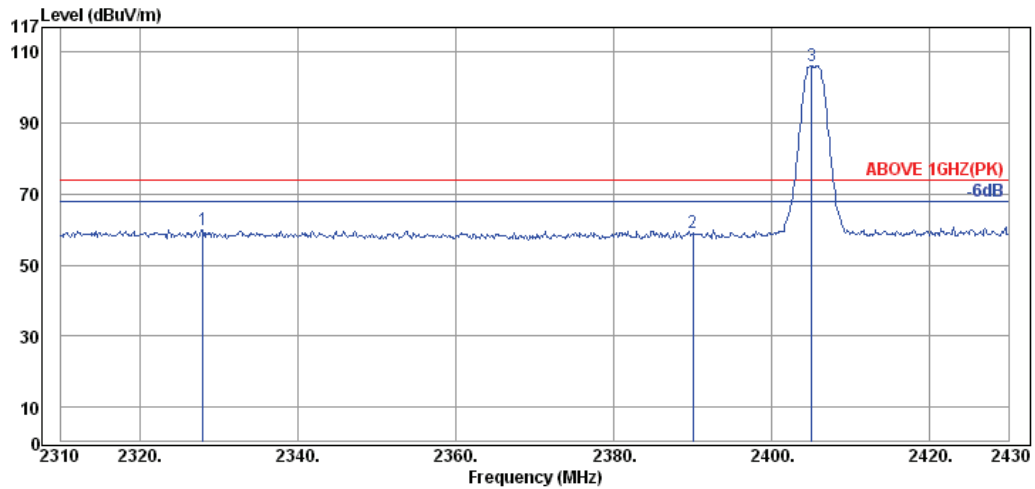
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2473.36	31.77	6.17	73.82	111.76	---	---	Peak
2483.52	31.78	6.19	21.04	59.01	74.00	14.99	Peak
2488.00	31.78	6.19	23.40	61.37	74.00	12.63	Peak



Antenna at Vertical Polarization

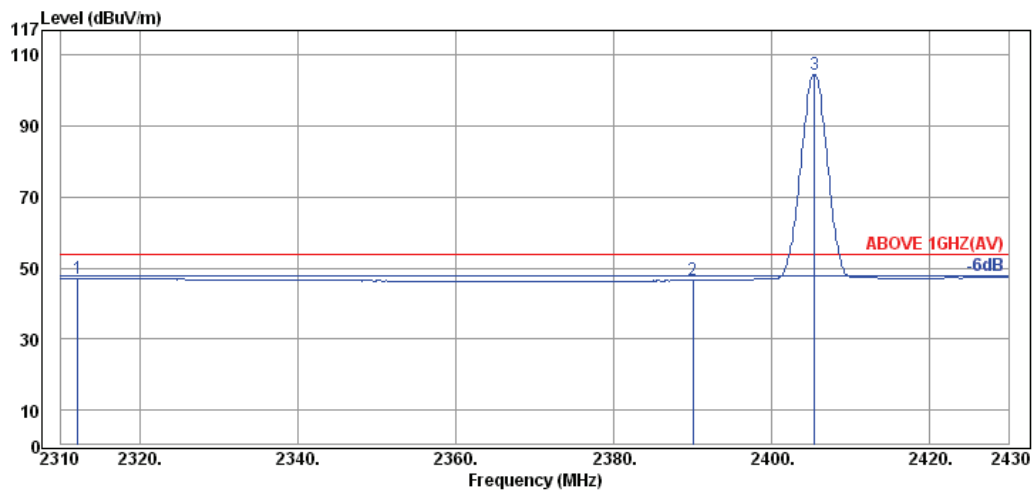
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2472.96	31.77	6.17	72.20	110.14	---	---	Average
2483.52	31.78	6.19	9.08	47.05	54.00	6.95	Average
2528.80	31.83	6.25	9.23	47.31	54.00	6.69	Average

Modulation	FASST	Frequency	TX 2405.376MHz
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Antenna at Horizontal Polarization

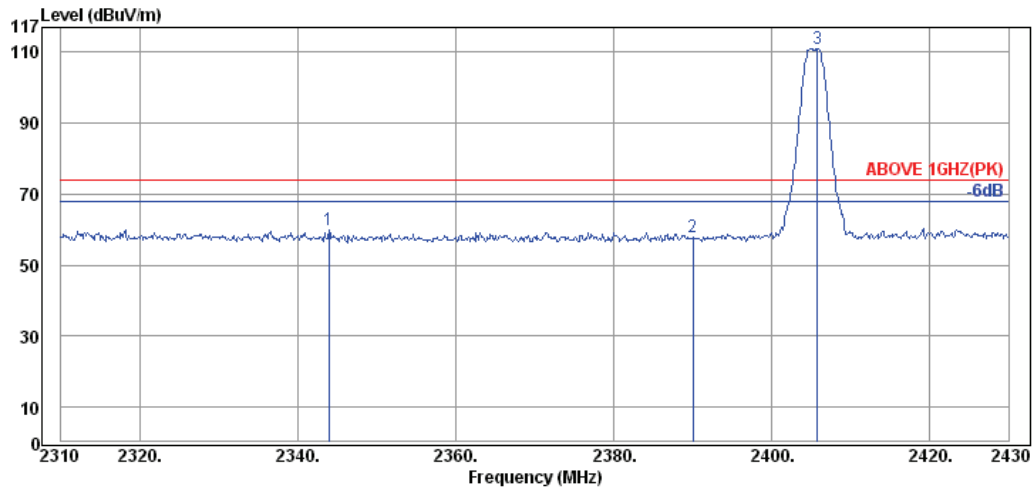
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2328.00	31.61	6.00	22.24	59.85	74.00	14.15	Peak
2390.04	31.68	6.08	21.16	58.92	74.00	15.08	Peak
2405.04	31.70	6.10	68.34	106.14	---	---	Peak



Antenna at Horizontal Polarization

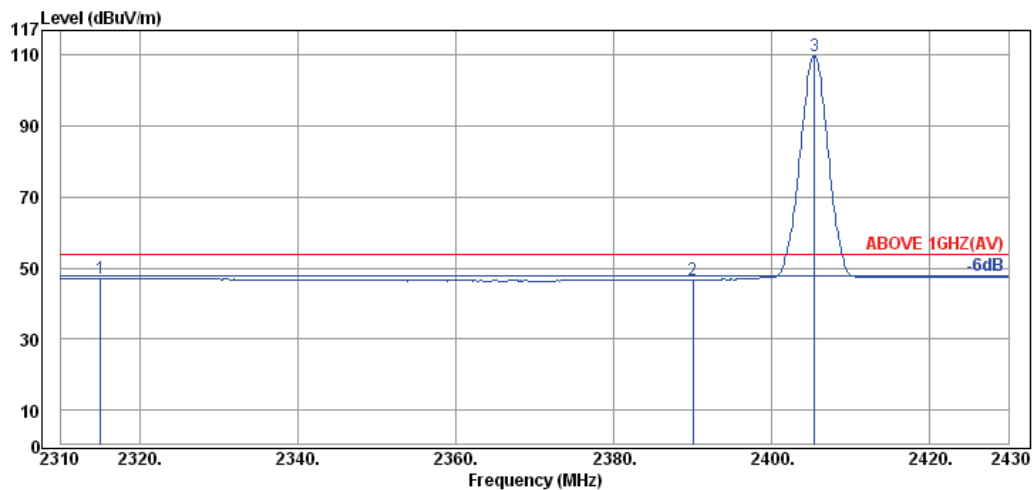
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2312.16	31.59	5.98	9.40	46.97	54.00	7.03	Average
2390.04	31.68	6.08	8.72	46.48	54.00	7.52	Average
2405.40	31.70	6.10	66.86	104.66	---	---	Average

Modulation	FASST	Frequency	TX 2405.376MHz
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Antenna at Vertical Polarization

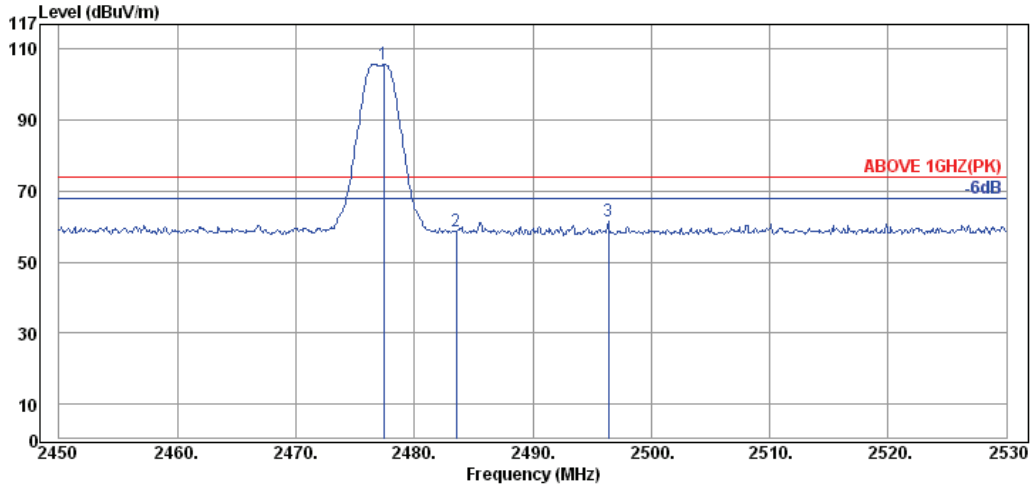
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2343.96	31.63	6.02	22.30	59.95	74.00	14.05	Peak
2390.04	31.68	6.08	19.99	57.75	74.00	16.25	Peak
2405.76	31.70	6.10	73.14	110.94	---	---	Peak



Antenna at Vertical Polarization

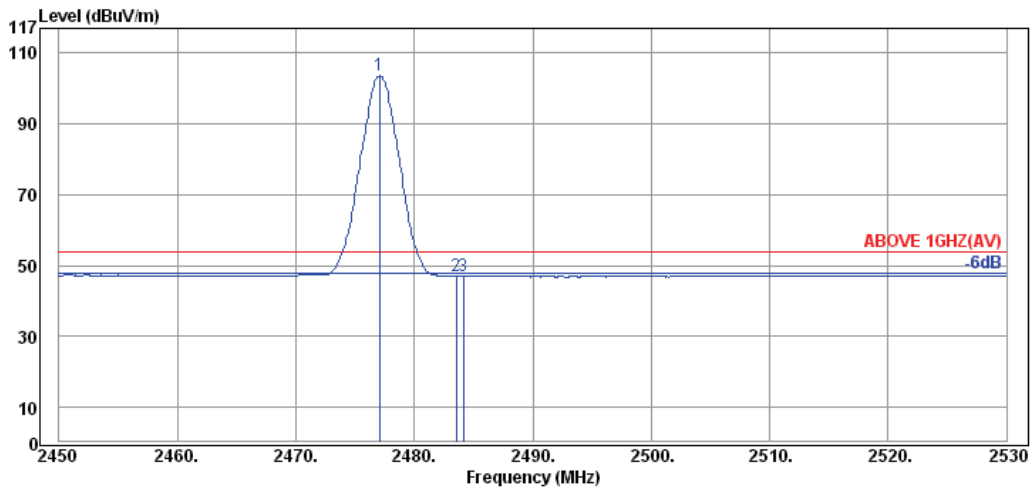
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2315.04	31.59	5.98	9.45	47.02	54.00	6.98	Average
2390.04	31.68	6.08	8.94	46.70	54.00	7.30	Average
2405.40	31.70	6.10	71.90	109.70	---	---	Average

Modulation	FASST	Frequency	TX 2477.056MHz
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Antenna at Horizontal Polarization

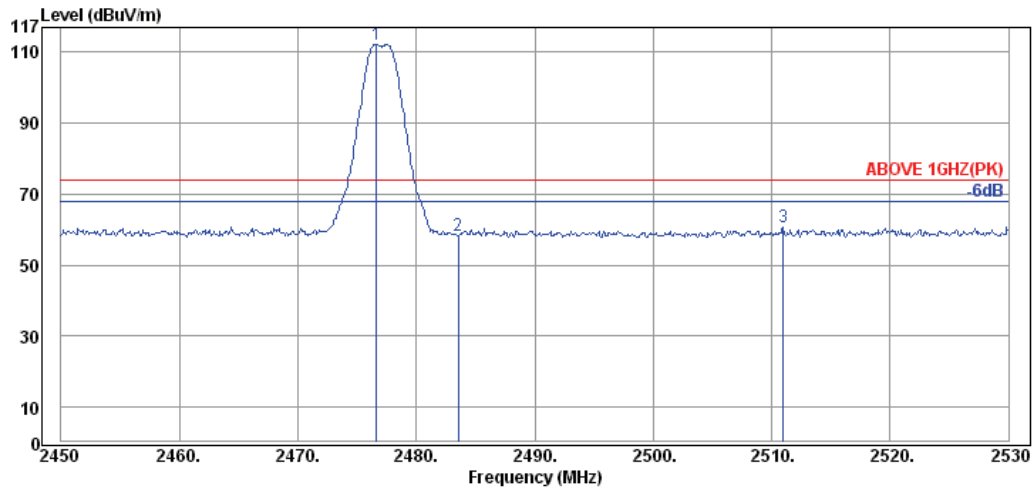
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2477.44	31.78	6.18	67.76	105.72	---	---	Peak
2483.52	31.78	6.19	20.67	58.64	74.00	15.36	Peak
2496.40	31.80	6.20	23.49	61.49	74.00	12.51	Peak



Antenna at Horizontal Polarization

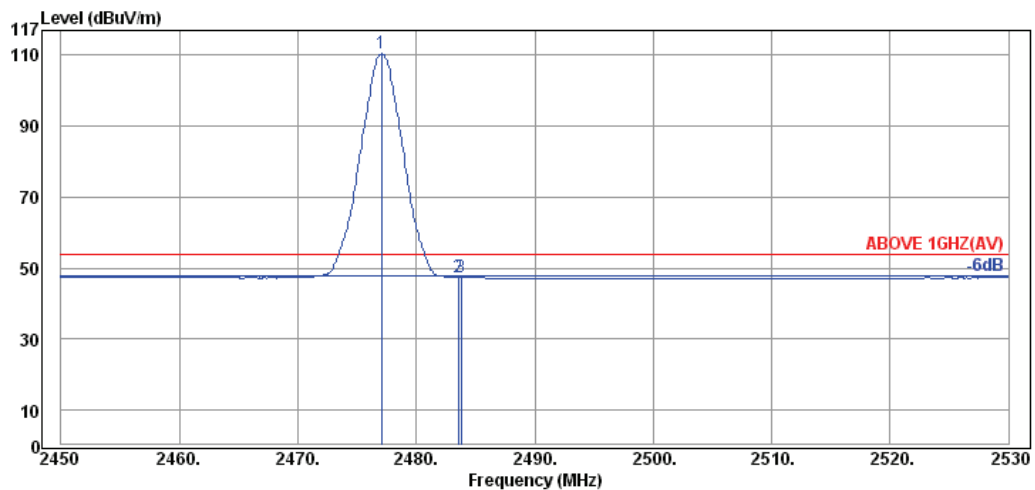
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2477.04	31.78	6.18	65.59	103.55	---	---	Average
2483.52	31.78	6.19	9.20	47.17	54.00	6.83	Average
2484.16	31.78	6.19	9.23	47.20	54.00	6.80	Average

Modulation	FASST	Frequency	TX 2477.056MHz
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Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2476.64	31.78	6.18	74.13	112.09	---	---	Peak
2483.52	31.78	6.19	20.41	58.38	74.00	15.62	Peak
2510.96	31.82	6.22	22.82	60.86	74.00	13.14	Peak



Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2477.04	31.78	6.18	72.41	110.37	---	---	Average
2483.52	31.78	6.19	9.49	47.46	54.00	6.54	Average
2483.76	31.78	6.19	9.48	47.45	54.00	6.55	Average

6.5.2. Emissions outside the frequency band:

The emissions (up to 25GHz) not reported for there is no emission be found.

Modulation	FASSTest	Frequency	TX 2405.376MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
3205.36	32.21	7.27	10.69	50.17	54.00	3.83	Peak
4810.00	33.82	8.87	6.48	49.17	54.00	4.83	Peak
9621.00	36.84	12.69	5.76	55.29	74.00	18.71	Peak
9621.00	36.84	12.69	-2.76	46.77	54.00	7.23	Average

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
3208.00	32.86	7.30	14.62	54.78	74.00	19.22	Peak
3208.00	32.86	7.30	11.64	51.80	54.00	2.20	Average
4810.00	33.82	8.87	4.63	47.32	54.00	6.68	Peak
9621.00	36.61	12.69	1.41	50.71	54.00	3.29	Average

Modulation	FASSTest	Frequency	TX 2439.168MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
3251.56	32.19	7.40	10.04	49.63	54.00	4.37	Peak
4877.50	33.85	9.14	8.94	51.93	54.00	2.07	Peak
9757.50	36.75	13.48	1.51	51.74	54.00	2.26	Peak
12193.50	39.01	14.92	1.67	55.60	74.00	18.40	Peak
12193.50	39.01	14.92	-7.17	46.76	54.00	7.24	Average

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
3251.56	32.19	7.40	13.85	53.44	54.00	0.56	Peak
4877.50	33.85	9.14	10.01	53.00	54.00	1.00	Peak
12193.50	38.71	14.92	0.97	54.60	74.00	19.40	Peak
12193.50	38.71	14.92	-8.05	45.58	54.00	8.42	Average

Modulation	FASSTest	Frequency	TX 2472.960MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
3297.76	32.18	7.42	12.35	51.95	54.00	2.05	Peak
4948.00	33.88	9.35	4.43	47.66	54.00	6.34	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
3297.76	32.84	7.42	15.52	55.78	74.00	18.22	Peak
3297.76	32.84	7.42	11.76	52.02	54.00	1.98	Average
4948.00	33.88	9.35	6.12	49.35	54.00	4.65	Peak

Modulation	FASST	Frequency	TX 2405.376MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
3208.00	32.21	7.30	12.61	52.12	54.00	1.88	Peak
4810.00	33.82	8.87	7.03	49.72	54.00	4.28	Peak
9621.00	36.84	12.69	6.71	56.24	74.00	17.76	Peak
9621.00	36.84	12.69	-2.28	47.25	54.00	6.75	Average

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
3208.00	32.86	7.30	14.70	54.86	74.00	19.14	Peak
3208.00	32.86	7.30	11.54	51.70	54.00	2.30	Average
4813.00	33.83	8.87	5.66	48.36	54.00	5.64	Peak

Modulation	FASST	Frequency	TX 2440.192MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
3254.20	32.19	7.40	10.00	49.59	54.00	4.41	Peak
4880.50	33.85	9.14	9.21	52.20	54.00	1.80	Peak
12204.00	39.02	14.92	1.54	55.48	74.00	18.52	Peak
12204.00	39.02	14.92	-7.61	46.33	54.00	7.67	Average

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
3251.56	32.19	7.40	14.18	53.77	54.00	0.23	Peak
4880.50	33.85	9.14	10.05	53.04	54.00	0.96	Peak
12204.00	38.73	14.92	-0.27	53.38	54.00	0.62	Peak

Modulation	FASST	Frequency	TX 2477.056MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
3303.04	32.18	7.42	12.68	52.28	54.00	1.72	Peak
4952.50	33.88	9.35	4.23	47.46	54.00	6.54	Peak
12382.50	38.84	15.44	1.54	55.82	74.00	18.18	Peak
12382.50	39.14	15.44	-5.88	48.70	54.00	5.30	Average

Antenna at Vertical Polarization

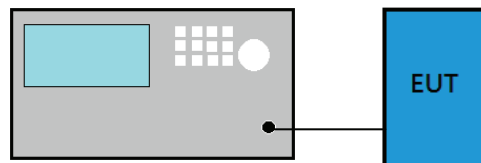
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
3303.04	32.84	7.42	15.39	55.65	74.00	18.35	Peak
3303.04	32.84	7.42	11.93	52.19	54.00	1.81	Average
4955.50	33.88	9.35	6.12	49.35	54.00	4.65	Peak
12382.50	38.84	15.44	2.49	56.77	74.00	17.23	Peak
12382.50	38.84	15.44	-5.73	48.55	54.00	5.45	Average

6.5.3. Emissions in Non-restricted Frequency Bands

Pursuant to KDB 558074 D01 v03r03 that emission levels below the 15.209 general radiated emissions limits is not required.

7. 6dB BANDWIDTH MEASUREMENT

7.1. Block Diagram of Test Setup



7.2. Specification Limits

The minimum 6dB bandwidth shall be at least 500kHz.

7.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v03r03:

■ Option 2

- (1) Set RBW = 100 kHz.
- (2) Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- (3) Detector = Peak.
- (4) Trace mode = max hold.
- (5) Sweep = auto couple.
- (6) Allow the trace to stabilize.
- (7) Setting channel bandwidth function x dB to -6 dB to record the final bandwidth.

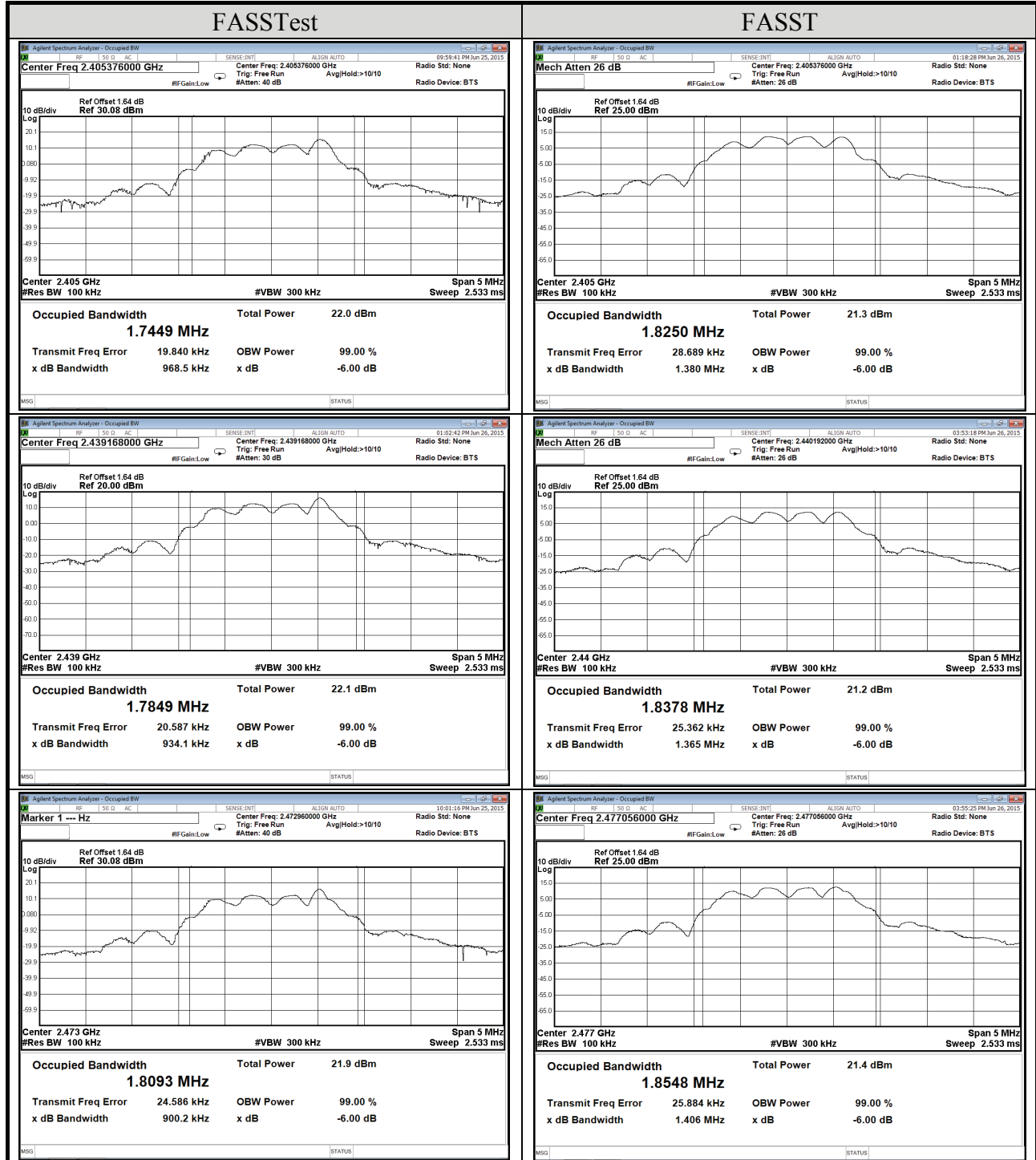
7.4. Test Results

Test Date	2015/07/25 ~ 2015/07/26	Temp./Hum.	25°C/58%
Cable Loss	1.64dB	Test Voltage	DC 6.6V

7.4.1. 6dB Bandwidth Result

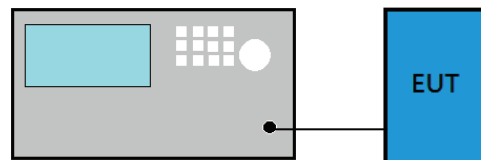
Modulation Type	Centre Frequency (MHz)	6 dB Bandwidth (MHz)
FASSTest	2405.376	0.9685
	2439.168	0.9341
	2472.960	0.9002
FASST	2405.376	1.380
	2440.192	1.365
	2477.056	1.406

7.4.2. Measurement Plots



8. MAXIMUM PEAK OUTPUT POWER MEASUREMENT

8.1. Block Diagram of Test Setup



8.2. Specification Limits

The Limits of maximum Peak Output Power for digital modulation in 2400-2483.5MHz is : 1Watt. (30dBm)

8.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v03r03:

PKPM1 Peak power meter method:

EUT is connected to power sensor and record the maximum output power.

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

EUT is connected to power sensor and record the maximum average output power and duty cycle factor is added when duty cycle presented in section 3.5 is < 98%.

Method $RBW \geq DTS\ BW$

- (1) Set span to at least 3 times the OBW
- (2) Set $RBW \geq OBW$
- (3) Set the video bandwidth (VBW) $\geq 3 \times RBW$.
- (4) Detector = Peak
- (5) Trace mode = max hold
- (6) Sweep = auto couple.
- (7) To find the peak amplitude level.

8.4. Test Results

Test Date	2015/08/12	Temp./Hum.	25°C/50%
Cable Loss	2.36dB	Test Voltage	DC 6.6V

8.4.1. Peak Output Power

Modulation Type	Centre Frequency (MHz)	Peak Output Power		Limit
		(dBm)	(W)	
FASSTest	2405.376	14.502	0.028197	< 30 dBm (1 W)
	2439.168	14.558	0.028563	
	2472.960	14.860	0.030620	
FASST	2405.376	14.703	0.029532	< 30 dBm (1 W)
	2440.192	14.780	0.030061	
	2477.056	15.112	0.032449	

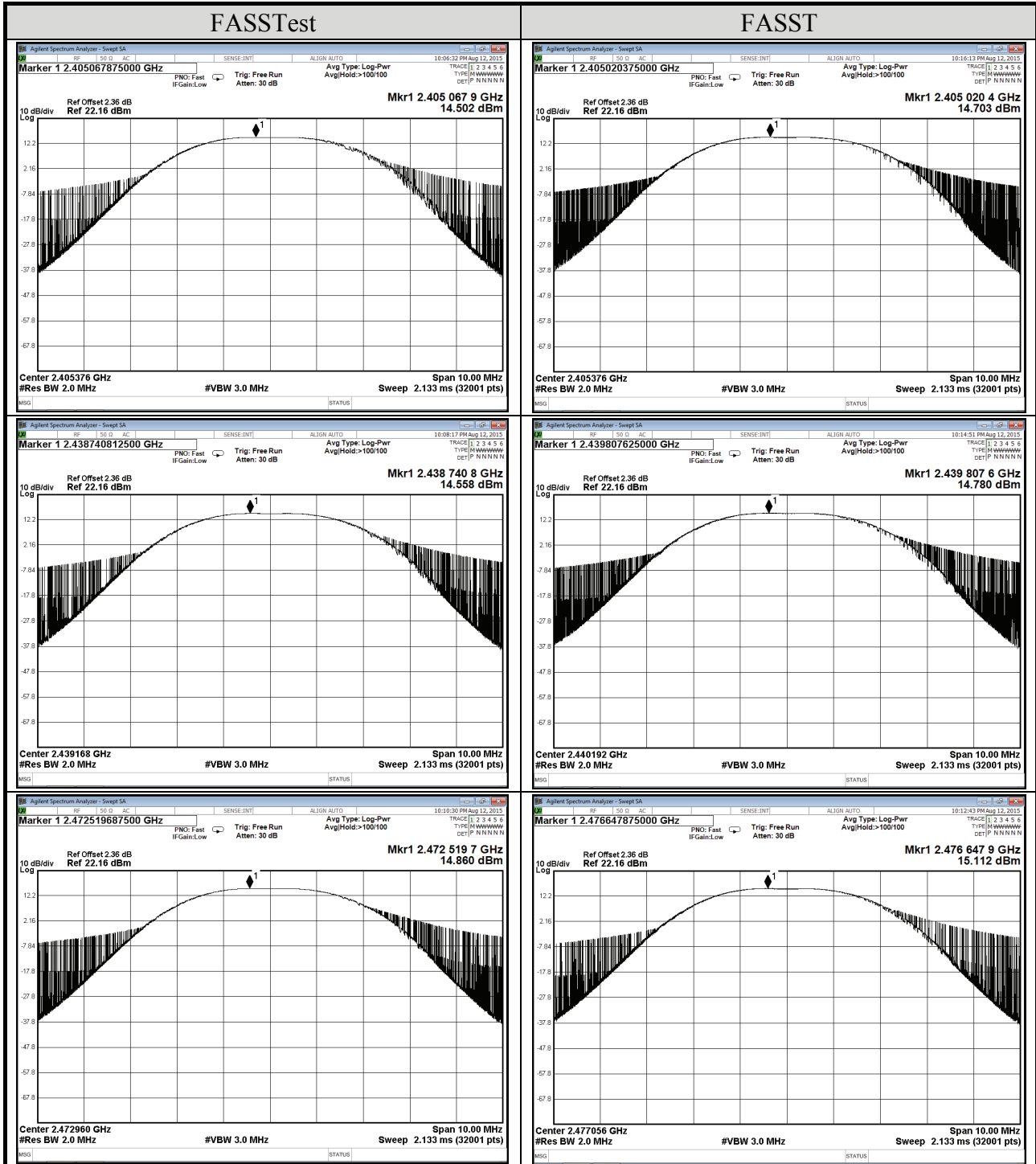
Note: The results have been included cable loss.

8.4.2. Average Output Power (Reporting only)

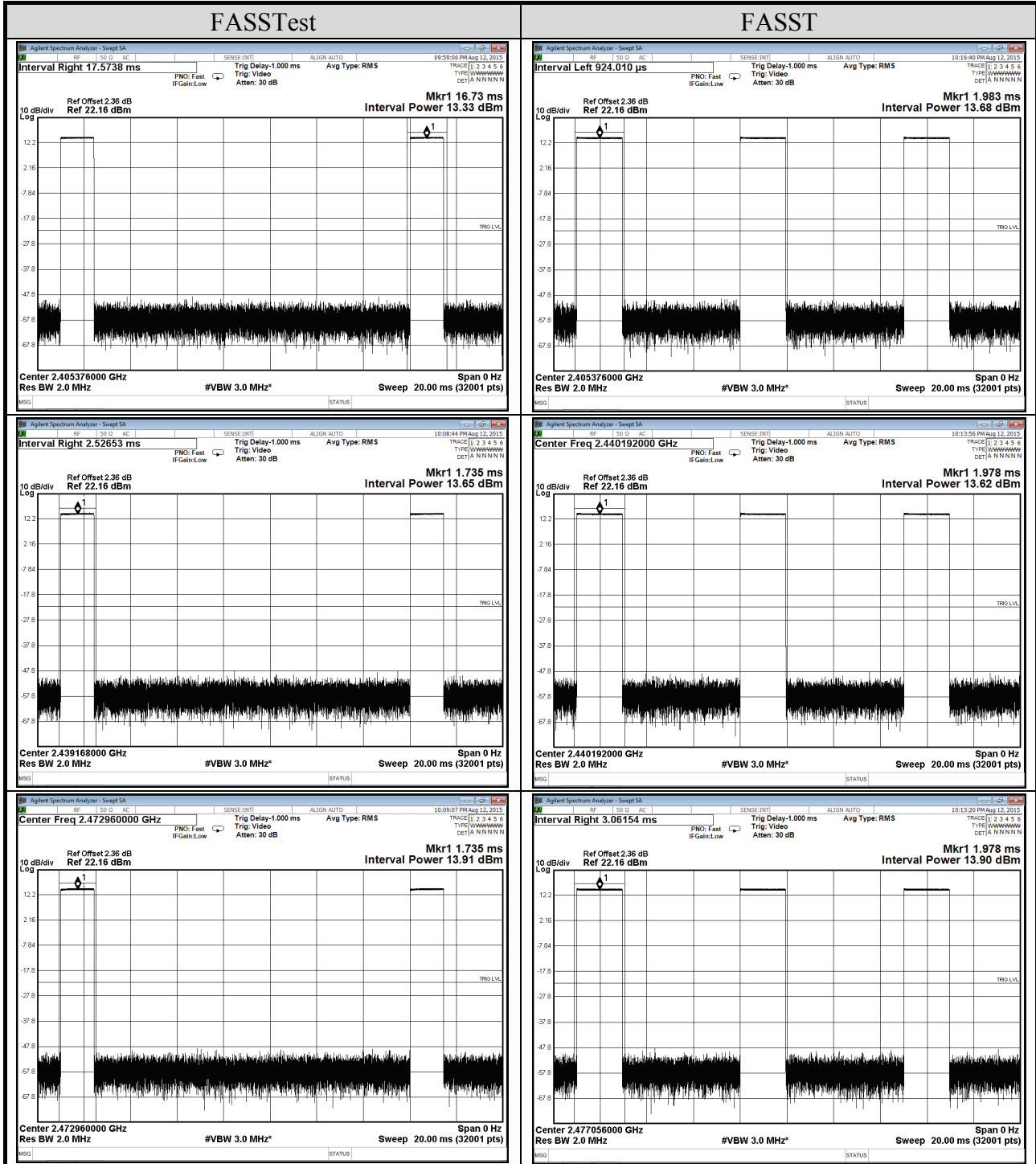
Modulation Type	Centre Frequency (MHz)	Average Output Power		Limit
		(dBm)	(W)	
FASSTest	2405.376	13.33	0.021528	< 30 dBm (1 W)
	2439.168	13.65	0.023174	
	2472.960	13.91	0.024604	
FASST	2405.376	13.68	0.023335	< 30 dBm (1 W)
	2440.192	13.62	0.023014	
	2477.056	13.90	0.024547	

Note: The results have been included cable loss.

8.4.3. Peak Measurement Plots

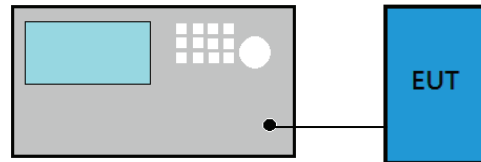


8.4.4. Average Measurement Plots (Reporting only)



9. EMISSION LIMITATIONS MEASUREMENT

9.1. Block Diagram of Test Setup



9.2. Specification Limits

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (See Section 15.205(c)).

9.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v03r03:

■ Reference Level

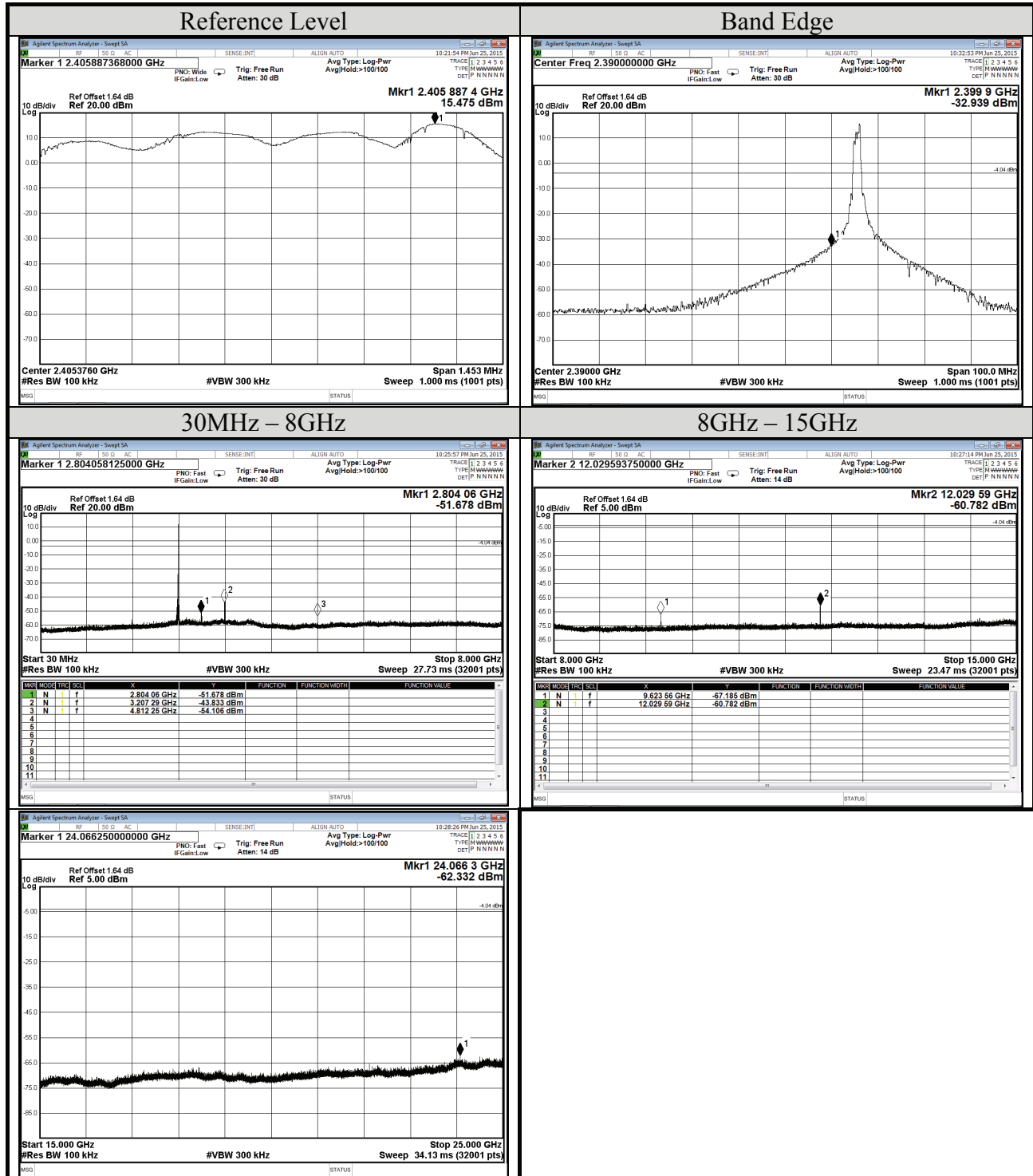
- (1) Set analyzer center frequency to DTS channel center frequency.
- (2) Set the span to 1.5 times the DTS bandwidth.
- (3) Set the RBW to: 100 kHz.
- (4) Set the VBW $\geq 3 \times$ RBW.
- (5) Detector = peak.
- (6) Sweep time = auto couple.
- (7) Trace mode = max hold.
- (8) Allow trace to fully stabilize to find the max PSD as reference level.

■ Emission Level Measurement

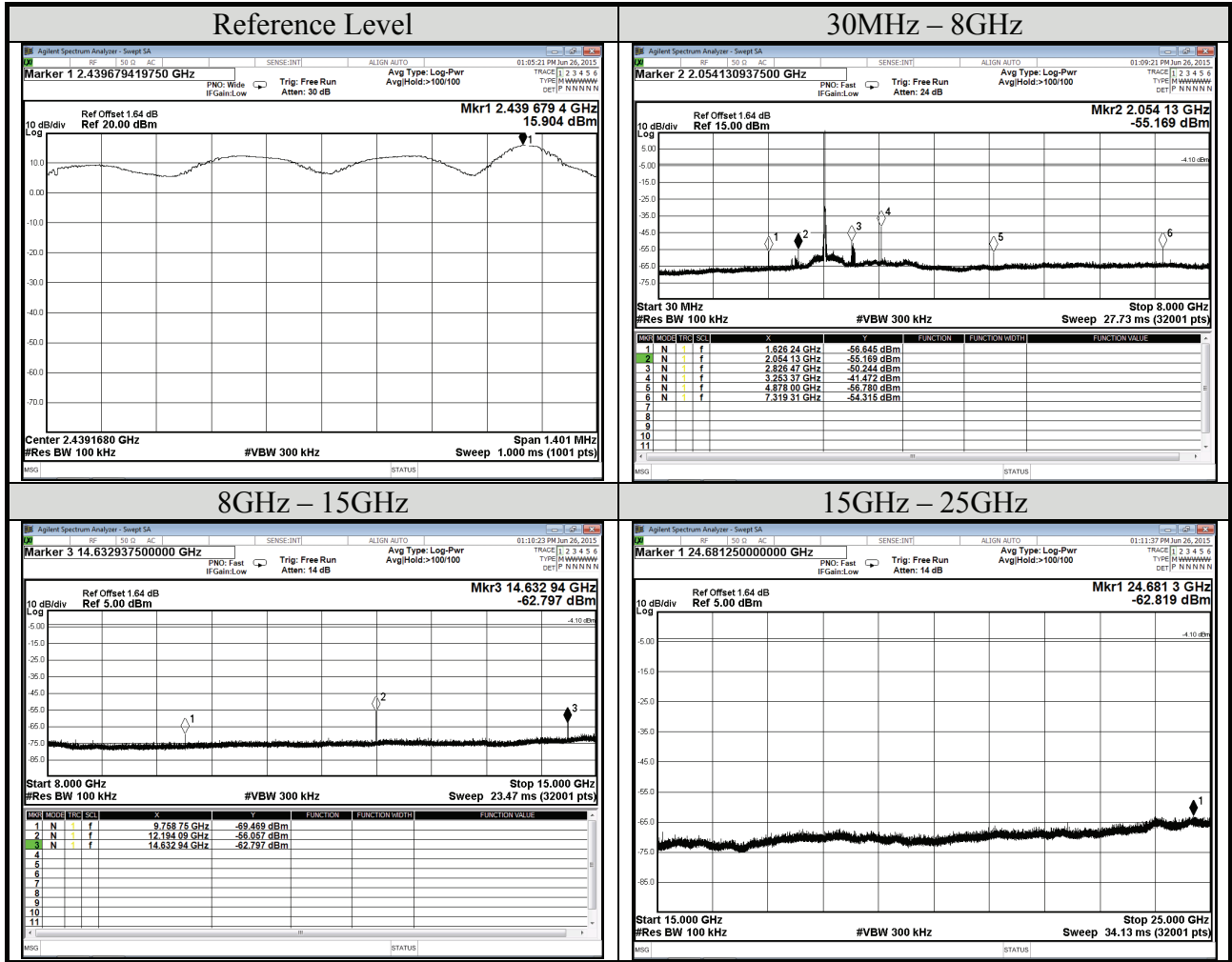
- (1) Set analyzer center frequency to DTS channel center frequency.
- (2) Set the span to 1.5 times the DTS bandwidth.
- (3) Set the RBW to: 100 kHz.
- (4) Set the VBW $\geq 3 \times$ RBW.
- (5) Detector = peak.
- (6) Sweep time = auto couple.
- (7) Trace mode = max hold.
- (8) Allow trace to fully stabilize to find the max level.

9.4. Test Results

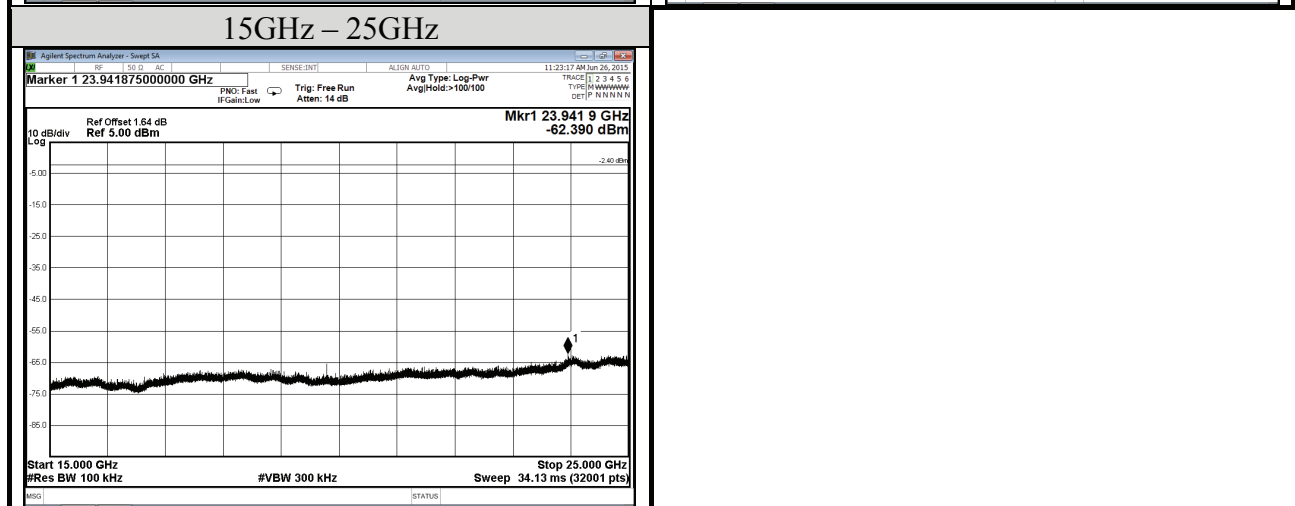
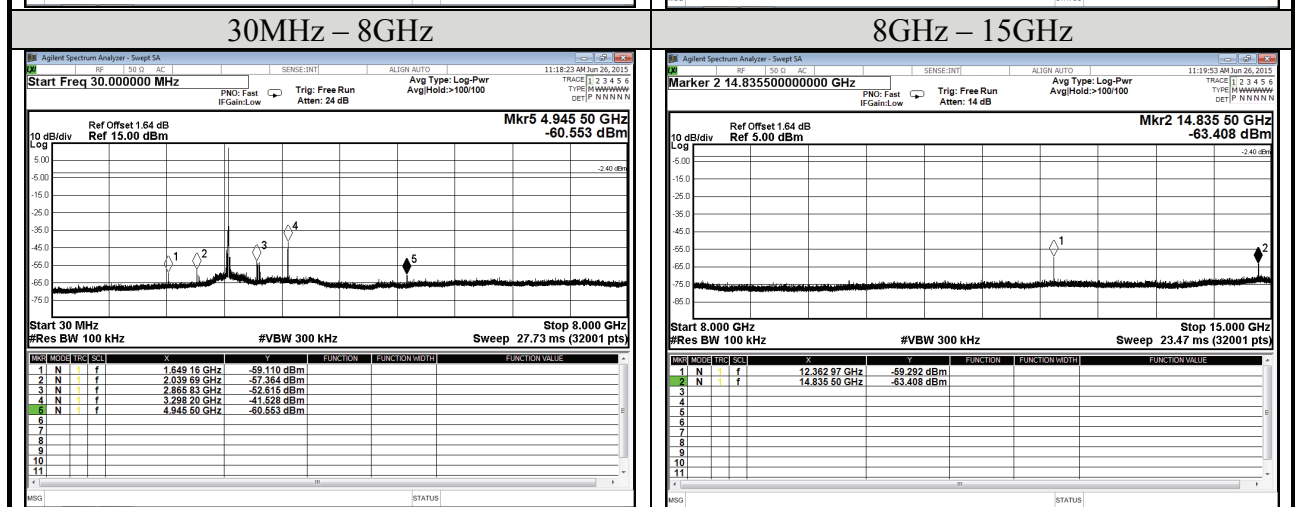
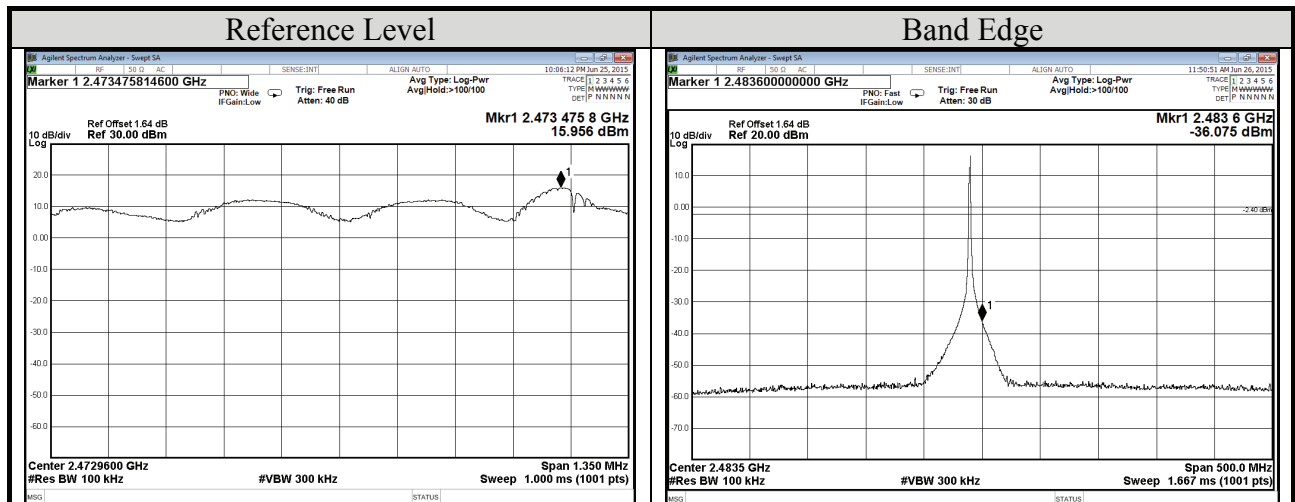
Test Date	2015/07/25	Temp./Hum.	25°C/58%
Modulation	FASSTest	Frequency	TX 2405.376MHz
Cable Loss	1.64dB	Test Voltage	DC 6.6V



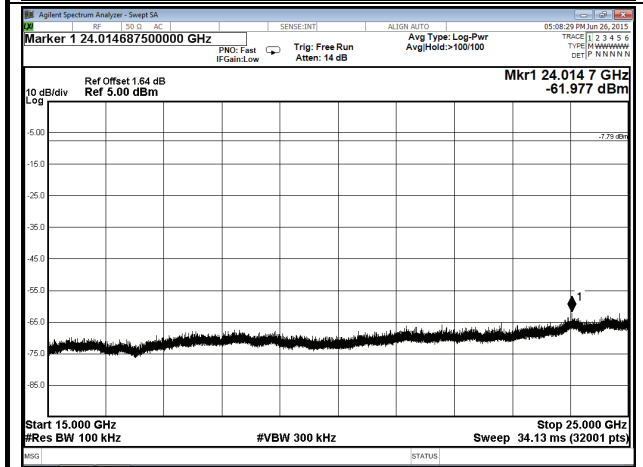
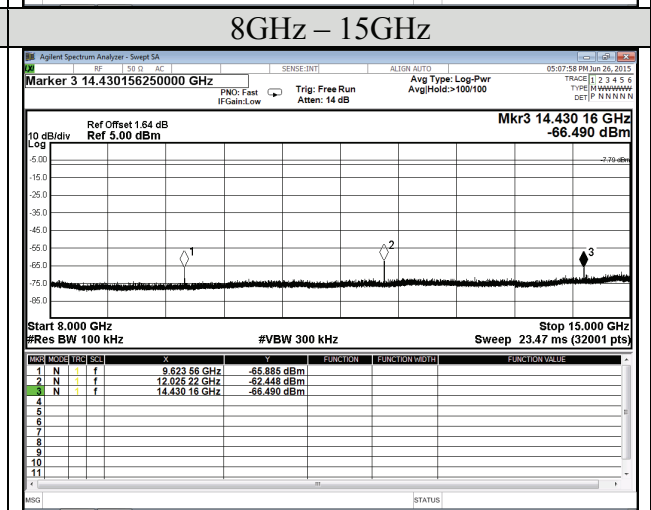
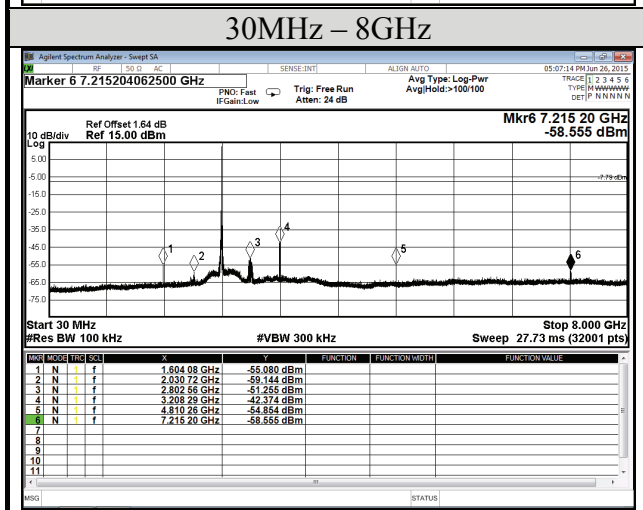
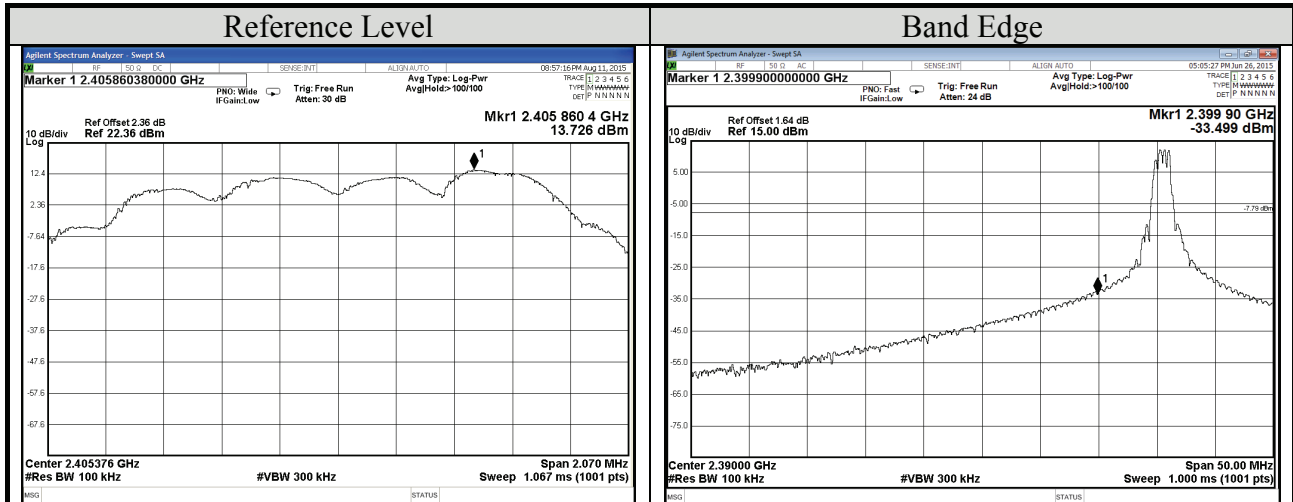
Test Date	2015/07/26	Temp./Hum.	25°C/58%
Modulation	FASSTest	Frequency	TX 2439.168MHz
Cable Loss	1.64dB	Test Voltage	DC 6.6V



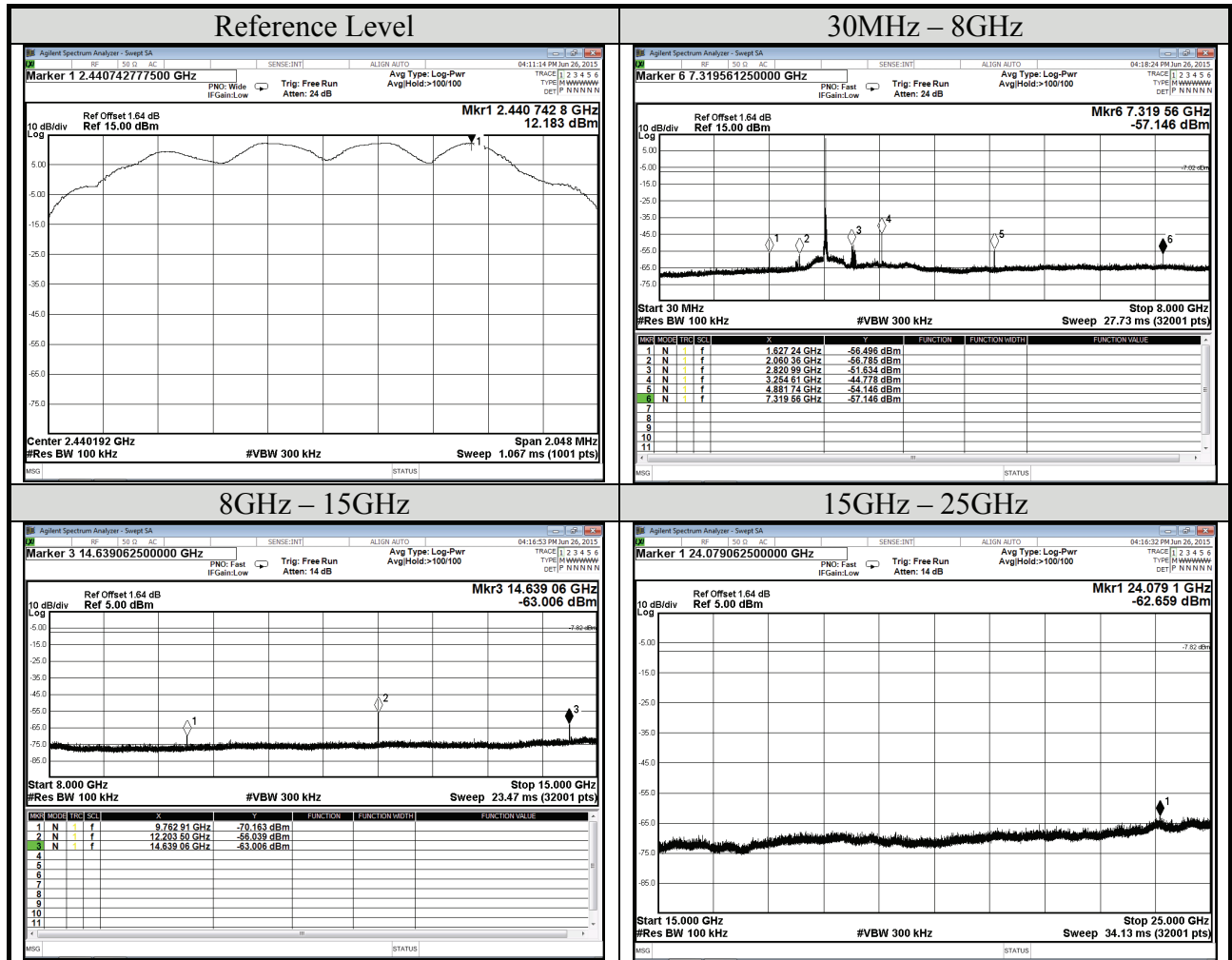
Test Date	2015/07/25 ~ 2015/07/26	Temp./Hum.	25°C/58%
Modulation	FASSTest	Frequency	TX 2472.960MHz
Cable Loss	1.64dB	Test Voltage	DC 6.6V



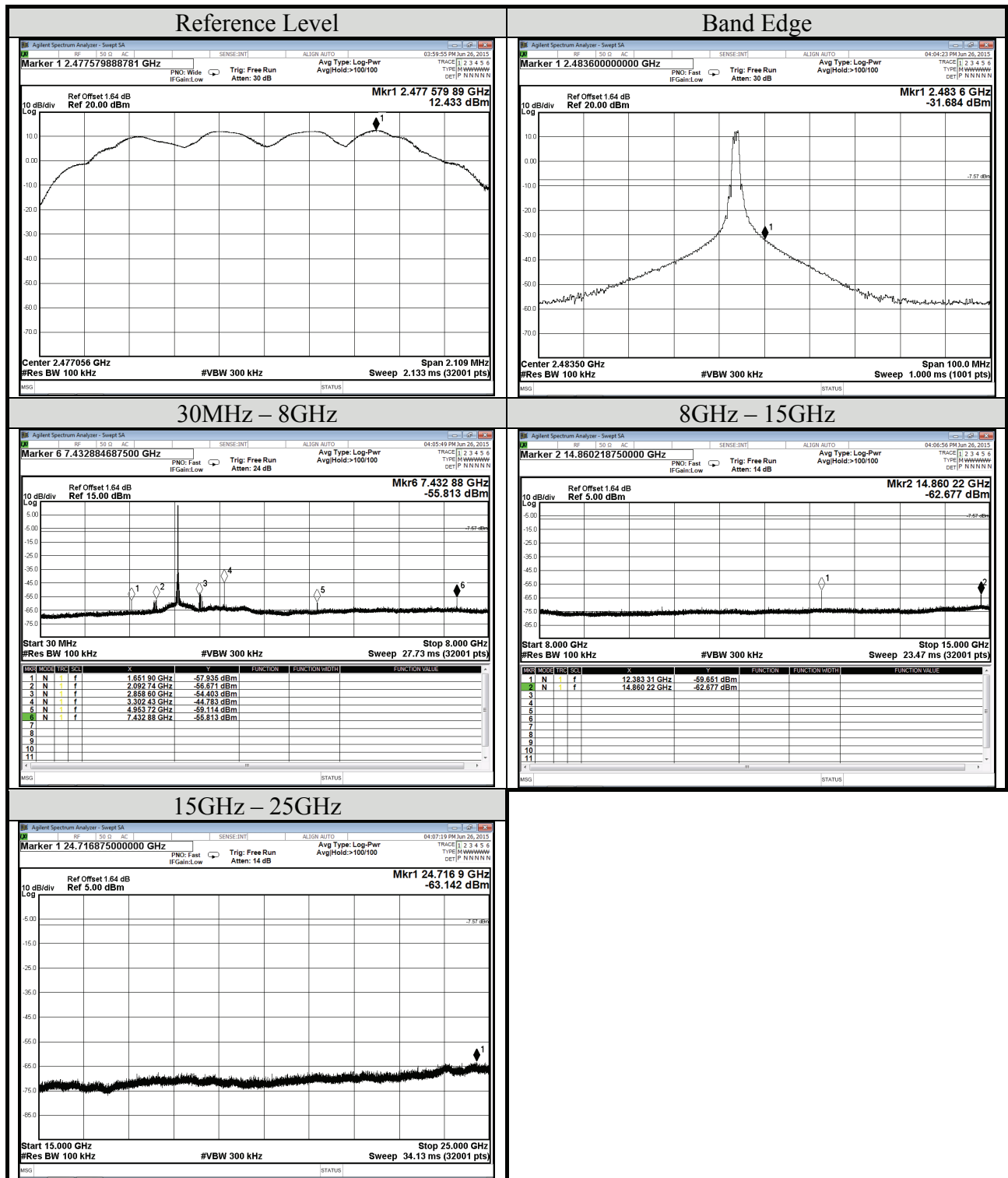
Test Date	2015/07/25 ~ 2015/08/11	Temp./Hum.	25°C/58%
Modulation	FASST	Frequency	TX 2405.376MHz
Cable Loss	2.36dB, 1.64dB	Test Voltage	DC 6.6V



Test Date	2015/07/26	Temp./Hum.	25°C/58%
Modulation	FASST	Frequency	TX 2440.192MHz
Cable Loss	1.64dB	Test Voltage	DC 6.6V

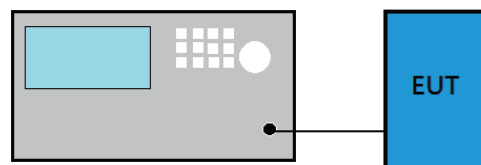


Test Date	2015/07/26	Temp./Hum.	25°C/58%
Modulation	FASST	Frequency	TX 2477.056MHz
Cable Loss	1.64dB	Test Voltage	DC 6.6V



10. POWER SPECTRAL DENSITY

10.1. Block Diagram of Test Setup



10.2. Specification Limits

The peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band.

10.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v03r03:

■ Method PKPSD (peak PSD)

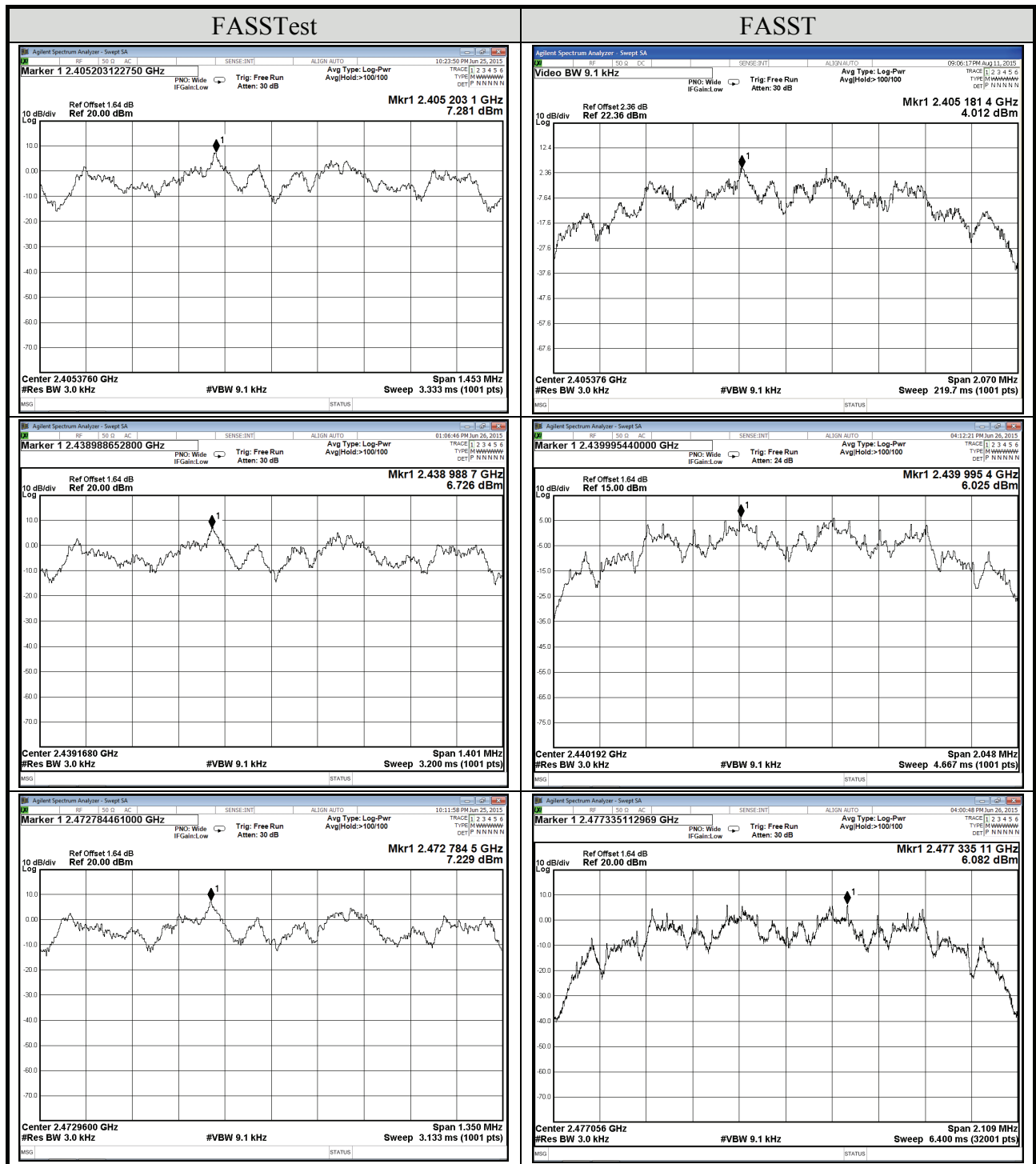
- (1) Set analyzer center frequency to DTS channel center frequency.
- (2) Set the span to 1.5 times the DTS bandwidth.
- (3) Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- (4) Set the VBW $\geq 3 \times \text{RBW}$.
- (5) Detector = peak.
- (6) Sweep time = auto couple.
- (7) Trace mode = max hold.
- (8) Allow trace to fully stabilize.
- (9) Use the peak marker function to determine the maximum amplitude level.
- (10) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

□ Method AVGPSD-2

- (1) Using peak PSD procedure step 1 to step 4.
- (2) Detector = RMS detector
- (3) Sweep time = auto couple
- (4) Trace mode = trace averaging over a minimum of 100 traces
- (5) Use the peak marker function to determine the maximum amplitude level.
- (6) Duty cycle factor is added when duty cycle presented in section 3.5.1. < 98%.
- (7) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

10.4. Test Results

Test Date	2015/07/25 ~ 2015/08/11	Temp./Hum.	25°C/58%
Cable Loss	1.64dB, 2.36dB	Test Voltage	DC 6.6V



11. DEVIATION TO TEST SPECIFICATIONS

【NONE】