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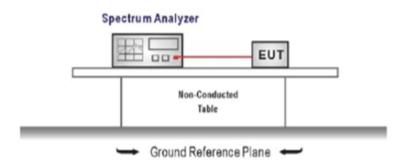
5.3. Peak Output Power

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (b)(1):

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

TEST CONFIGURATION



TEST PROCEDURE

- 1. The transmitter output was connected to the spectrum analyzer through an attenuator, the pathloss was compensated to the results for each measurement.
- 2. Set to the maximum power setting and enable the EUT transmit continuously
- 3. Use the following spectrum analyzer settings: Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel RBW≥ the 20 dB bandwidth of the emission being measured, VBW≥RBW Sweep = auto, Detector function = peak, Trace = max hold
- 4. Measure and record the results in the test report.

TEST MODE

Please refer to the clause 4.3

TEST RESULT

TEST DATA

Please refer to appendix A on the appendix report

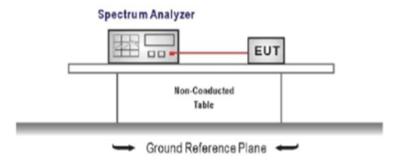
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5.4. 20 dB Bandwidth

LIMIT

N/A

TEST CONFIGURATION



TEST PROCEDURE

- 1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
- 2. Set to the maximum power setting and enable the EUT transmit continuously
- 3. Use the following spectrum analyzer settings: Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel RBW ≥ 1% of the 20 dB bandwidth, VBW ≥ RBW Sweep = auto, Detector function = peak, Trace = max hold
- 4. Measure and record the results in the test report.

TEST MODE

Please refer to the clause 4.3

TEST RESULT

 $oxed{oxed}$ Passed $oxed{oxed}$ Not Applicable

TEST DATA

Please refer to appendix B on the appendix report

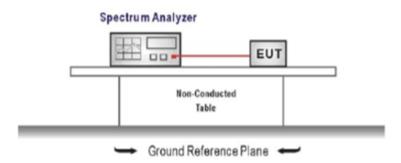
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5.5. 99% Occupied Bandwidth

LIMIT

N/A

TEST CONFIGURATION



TEST PROCEDURE

- 1. Connect the antenna port(s) to the spectrum analyzer input.
- Configure the spectrum analyzer as shown below (enter all losses between the transmitter output andthe spectrum analyzer).

Center Frequency = channel center frequency

Span≥1.5 x OBW

RBW = 1%~5%OBW

VBW ≥ 3 × RBW

Sweep time= auto couple

Detector = Peak

Trace mode = max hold

3. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter waveform on the spectrum analyzer.

TEST MODE

Please refer to the clause 4.3

TEST RESULT

TEST DATA

Please refer to appendix C on the appendix report

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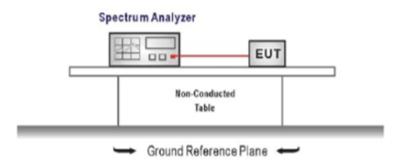
5.6. Carrier Frequencies Separation

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

TEST CONFIGURATION



TEST PROCEDURE

- 1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
- 2. Set to the maximum power setting and enable the EUT transmit continuously
- 3. Use the following spectrum analyzer settings:
 - Span = wide enough to capture the peaks of two adjacent channels
 - RBW ≥ 1% of the span, VBW ≥ RBW
 - Sweep = auto, Detector function = peak, Trace = max hold
- 4. Measure and record the results in the test report.

TEST MODE

Please refer to the clause 4.3

TEST RESULTS

TEST DATA

Please refer to appendix D on the appendix report

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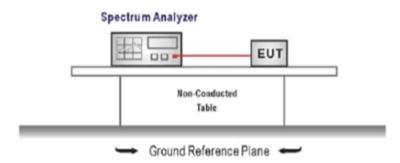
5.7. Hopping Channel Number

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

TEST CONFIGURATION



TEST PROCEDURE

- 1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
- 2. Set to the maximum power setting and enable the EUT transmit continuously
- 3. Use the following spectrum analyzer settings:
 - Span = the frequency band of operation
 - RBW ≥ 1% of the span, VBW ≥ RBW
 - Sweep = auto, Detector function = peak, Trace = max hold
- 4. Measure and record the results in the test report.

TEST MODE

Please refer to the clause 4.3

TEST RESULTS

TEST DATA

Please refer to appendix E on the appendix report

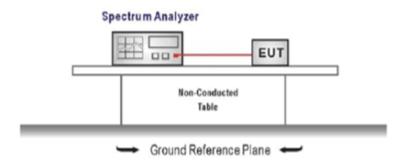
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5.8. Dwell Time

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):The average time of occupancy on any channel shall not be greater than 0.4 seconds within a pe-riod of 0.4 seconds multiplied by the number of hopping channels employed.

TEST CONFIGURATION



TEST PROCEDURE

- 1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
- 2. Set to the maximum power setting and enable the EUT transmit continuously
- 3. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel, RBW= 1 MHz, VBW ≥ RBW Sweep = as necessary to capture the entire dwell time per hopping channel, Detector function = peak, Trace = max hold
- 4. Measure and record the results in the test report.

TEST MODE

Please refer to the clause 4.3

TEST RESULTS

TEST DATA

Please refer to appendix F on the appendix report

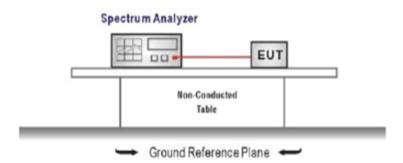
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5.9. Duty Cycle Correction Factor (DCCF)

LIMIT

N/A

TEST CONFIGURATION



TEST PROCEDURE

- 1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
- 2. Set to the maximum power setting and enable the EUT transmit continuously
- 3. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel, RBW= 1 MHz, VBW ≥ RBW Sweep = as necessary to capture the entire dwell time per hopping channel, Detector function = peak, Trigger mode
- 4. Measure and record the duty cycle data

TEST MODE

Please refer to the clause 4.3

TEST DATA

Please refer to appendix G on the appendix report

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5.10. Pseudorandom Frequency Hopping Sequence

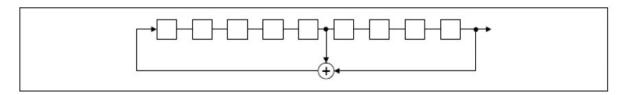
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):Frequency hopping systems shall have hopping channel carrier fre-quencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping channel, whichever is greater. Al-ternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier fre-quencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to chan-nel frequencies that are selected at the system hopping rate from a pseudo ran-domly ordered list of hopping fre-quencies. Each frequency must be used equally on the average by each trans-mitter. The system receivers shall have input bandwidths that match the hop-ping channel bandwidths of their cor-responding transmitters and shall shift frequencies in synchronization with the transmitted signals.

TEST RESULTS

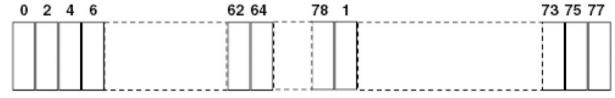
The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the friststage. The sequence begins with the frist one of 9 consecutive ones, for example: the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence:29-1=511 bits
- Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An explame of pseudorandom frequency hopping sequence as follows:



Each frequency used equally one the average by each transmitter.

The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shift frequencies in synchronization with the transmitted signals.

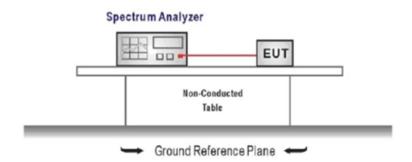
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5.11. Conducted Band edge and Spurious Emission

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section15.247 (d):In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

TEST CONFIGURATION



TEST PROCEDURE

- 1. Connect the antenna port(s) to the spectrum analyzer input.
- 2. Emission level measurement

Set the center frequency and span to encompass frequency range to be measured

RBW = 100 kHz, VBW \geq 3 x RBW

Detector = peak, Sweep time = auto couple, Trace mode = max hold

Allow trace to fully stabilize

Use the peak marker function to determine the maximum amplitude level.

- 3. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter waveform on the spectrum analyzer.
- 4. Ensure that the amplitude of all unwanted emission outside of the authorized frequency band excluding restricted frequency bands) are attenuated by at least the minimum requirements specified (at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz). Report the three highest emission relative to the limit.

TEST MODE

Please refer to the clause 4.3

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TEST RESULT

 $oxed{oxed}$ Passed $oxed{oxed}$ Not Applicable

TEST DATA

Please refer to appendix H on the appendix report

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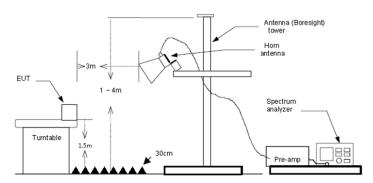
5.12. Radiated Band edge Emission

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d):

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, Radiated Emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the Radiated Emissions limits specified in §15.209(a) (see §15.205(c)).

TEST CONFIGURATION



TEST PROCEDURE

- 1. The EUT was setup and tested according to ANSI C63.10.
- 2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
- The EUT waspositioned such that the distance from antenna to the EUT was 3 meters.
- 4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. Thisis repeated for both horizontal and vertical polarization of the antenna. In order to find themaximum emission, all of the interface cables were manipulated according to ANSI C63.10 on radiated measurement.
- 5. Use the following spectrum analyzer settings:
 - a) Span shall wide enough to fully capture the emission being measured
 - b) Set RBW=100kHz for <1GHz, VBW=3*RBW, Sweep time=auto, Detector=peak, Trace=max hold
 - c) Set RBW=1MHz, VBW=3MHz for >1GHz, Sweep time=auto, Detector=peak, Trace=max hold for Peak measurement

For average measurement: use duty cycle correction factor method (DCCF)

Averager level = Peak level + DCCF

TEST MODE

Please refer to the clause 4.3

TEST RESULT

Note:

- 1) Level= Reading + Factor; Factor = Antenna Factor + Cable Loss- Preamp Factor
- 2) Over Limit = Level- Limit
- Average measurement was not performed if peak level is lower than average limit(54 dBuV/m).

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Test chan	nel:	CH00			Polarity			Horizor	ntal
Mark	Frequency MHz	Reading dBuV/m	Antenna dB	Cable dB	Preamp dB	Level dBuV/m	Limit dBuV/m		Remark
1	2310.00	39.91	27.96			35.74			Peak
2	2390.03	39.58	27.72	5.53	37.45	35.38	74.00	-38.62	Peak

Test channel:		CH00	CH00					Vertical		
Mark	Frequency MHz	Reading dBuV/m	Antenna dB	Cable dB	Preamp dB	Level dBuV/m	Limit dBuV/m		Remark	
1	2310.00	40.99	27.96	5.43	37.56	36.82	74.00	-37.18	Peak	
2	2390.03	39.26	27.72	5.53	37.45	35.06	74.00	-38.94	Peak	

Test channel:		CH78	CH78					Horizontal		
Mark	Frequency MHz	Reading dBuV/m	Antenna dB	Cable dB	Preamp dB	Level dBuV/m	Limit dBuV/m	Over limit	Remark	
1	2483.50	41.58	27.43	5.64	37.26	37.39	74.00	-36.61	Peak	
2	2484.37	46.13	27.43	5.64	37.26	41.94	74.00	-32.06	Peak	
3	2500.00	40.02	27.40	5.66	37.26	35.82	74.00	-38.18	Peak	

Test channel:		CH78	CH78					Vertical		
Mark	Frequency MHz	Reading dBuV/m	Antenna dB	Cable dB	Preamp dB	Level dBuV/m	Limit dBuV/m	Over limit	Remark	
1	2483.50	45.63	27.43	5.64	37.26	41.44	74.00	-32.56	Peak	
2	2484.75	48.17	27.43	5.64	37.26	43.98	74.00	-30.02	Peak	
3	2500.00	39.83	27.40	5.66	37.26	35.63	74.00	-38.37	Peak	

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5.13. Radiated Spurious Emission

<u>LIMIT</u>

FCC CFR Title 47 Part 15 Subpart C Section 15.209

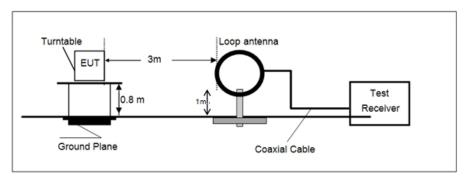
Frequency	Limit (dBuV/m)	Value
0.009 MHz ~0.49 MHz	2400/F(kHz) @300m	Quasi-peak
0.49 MHz ~ 1.705 MHz	24000/F(kHz) @30m	Quasi-peak
1.705 MHz ~30 MHz	30 @30m	Quasi-peak

Note: Limit dBuV/m @3m = Limit dBuV/m @300m + 40*log(300/3)= Limit dBuV/m @300m +80, Limit dBuV/m @3m = Limit dBuV/m @30m +40*log(30/3)= Limit dBuV/m @30m + 40.

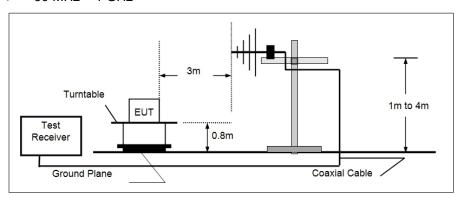
Frequency	Limit (dBuV/m @3m)	Value		
30MHz~88MHz	40.00	Quasi-peak		
88MHz~216MHz	43.50	Quasi-peak		
216MHz~960MHz	46.00	Quasi-peak		
960MHz~1GHz	54.00	Quasi-peak		
Above 1GHz	54.00	Average		
Above IGHZ	74.00	Peak		

TEST CONFIGURATION

> 9 kHz ~ 30 MHz

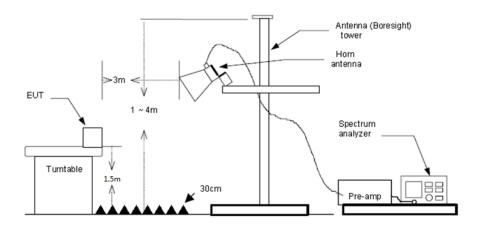


> 30 MHz ~ 1 GHz



Above 1 GHz

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TEST PROCEDURE

- The EUT was setup and tested according to ANSI C63.10 .
- 2. The EUT is placed on a turn table which is 0.8 meter above ground for below 1 GHz, and 1.5 m for above 1 GHz. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
- 3. The EUT was set 3 meters from the receiving antenna, which was mounted on the top of a variable height antenna tower.
- 4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
- 5. Set to the maximum power setting and enable the EUT transmit continuously.
- 6. Use the following spectrum analyzer settings
 - a) Span shall wide enough to fully capture the emission being measured;
 - b) Below 1 GHz:
 - RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold;
 - If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
 - Set RBW=1MHz, VBW=3MHz for >1GHz, Sweep time=auto, Detector=peak, Trace=max hold for Peak measurement

For average measurement: use duty cycle correction factor method (DCCF)

Averager level = Peak level + DCCF

TEST MODE

Please refer to the clause 4.3

TEST RESULT

Note:

- Level= Reading + Factor/Transd; Factor/Transd = Antenna Factor+ Cable Loss- Preamp Factor
- 2) Over Limit = Level- Limit
- Average measurement was not performed if peak level is lower than average limit(54 dBuV/m) for above 1GHz.

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For 9 kHz ~ 30 MHz

The EUT was pre-scanned this frequency band, found the radiated level 20dB lower than the limit, so don't show data on this report.

For 30 MHz ~ 1000 MHz

Have pre-scan all test channel, found CH39 which it was worst case, so only show the worst case's data on this report.

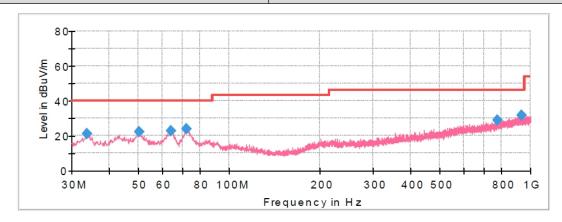
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Frequency in Hz

Final Result

Frequency (MHz)	MaxPeak (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
40.185000	17.65	40.00	22.35	300.0	Н	359.0	-9.7
53.522500	18.73	40.00	21.27	100.0	Н	296.0	-9.4
60.797500	17.38	40.00	22.62	300.0	Н	74.0	-10.2
491.720000	23.85	46.00	22.15	300.0	Н	338.0	-2.3
684.022500	27.07	46.00	18.93	300.0	Н	132.0	1.9
920.096250	32.51	46.00	13.49	300.0	Н	279.0	6.8

Polarization: Vertical



Final_Result

Frequency	MaxPeak	Limit	Margin	Height	Pol	Azimuth	Corr.
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	(cm)		(deg)	(dB/m)
33.880000	21.36	40.00	18.64	100.0	V	5.0	-11.5
50.127500	22.09	40.00	17.91	100.0	V	39.0	-9.1
64.192500	22.88	40.00	17.12	100.0	V	0.0	-11.2
72.437500	23.78	40.00	16.22	100.0	V	226.0	-13.9
775.930000	28.89	46.00	17.11	100.0	V	226.0	3.8
933.433750	31.47	46.00	14.53	100.0	V	354.0	7.0

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For 1 GHz ~ 25 GHz

Test channel		CH00			Polarity	,		Horizonta	ıl
Mark 1 2 3 4	Frequency MHz 1267.82 2681.98 8133.18 12013.98	Reading dBuV/m 40.42 39.36 33.58 39.59	dB 25.94 27.89 37.07	Cable dB 3.98 5.87 11.27	dB 36.43 37.08 33.38	dBuV/m 33.91 36.04 48.54	Limit dBuV/m 74.00 74.00 74.00 74.00	Over limit -40.09 -37.96 -25.46 -18.04	Remark Peak Peak Peak Peak
Frequency (MHz)	Peak Level (dBuV/M)	DCCF (dB)	Average leven (dBuV/M)	el	Limit Line (dBuV/M)	Over Limit	Po	larization	Remark
12013.98	55.96	-30.78	25.18		54	-28.82	Н	orizontal	Average
Test channel		CH00			Polarity		·	Vertical	
Mark 1 2 3 4	Frequency MHz 1209.32 2796.31 7210.80 12013.98	Reading dBuV/m 40.71 39.59 36.77 42.79	dB 25.66 28.39 36.48 1	Cable dB 3.88 6.03 10.01	dB 36.63 37.25 34.01	dBuV/m 33.62 36.76 49.25	imit dBuV/m 74.00 74.00 74.00 74.00	Over limit -40.38 -37.24 -24.75 -14.84	Remark Peak Peak Peak Peak
Frequency (MHz)	Peak Level (dBuV/M)	DCCF (dB)	Average leven (dBuV/M)		Limit Line (dBuV/M)	Over Limit	Po	larization	Remark
12013.98	59.16	-30.78	28.38		54	-25.62	,	Vertical	Average

Test channel		CH39			Polarity	/		Horizonta	al
Mark	Frequency MHz	Reading dBuV/m		Cabl dB	e Preamp dB	Level dBuV/m	Limit dBuV/m	Over limit	Remark
1	1267.82	40.42	25.94	3.98	36.43	33.91	74.00		Peak
2	2681.98	39.36	27.89	5.87	37.08	36.04	74.00	-37.96	Peak
3	8051.03	33.67	37.20	11.04	33.32	48.59	74.00	-25.41	Peak
4	12207.17	36.28	39.78	13.18	36.04	53.20	74.00	-20.80	Peak
Test channel		CH39			Polarity	/		Vertical	
 Mark	Frequency	Reading	Antenna	Cabl	e Preamp	Level	Limit	Over	Remark
ridi K	MHz	dBuV/m		dB	dB dB	dBuV/m	dBuV/m		Kellidi K
1	1209.32	40.71	25.66	3.88		33.62	74.00	-40.38	Peak
2	2796.31	39.59	28.39	6.03	37.25	36.76	74.00	-37.24	Peak
3	7326.76	36.85	36.45	10.08	34.09	49.29	74.00	-24.71	Peak
4	12207.17	40.74	39.78	13.18	36.04	57.66	74.00	-16.34	Peak
Frequency	Peak Level	DCCF	Average le	evel	Limit Line	Over Lir	nit		_
(MHz)	(dBuV/M)	(dB)	(dBuV/M		(dBuV/M)	(dB)	Po	olarization	Remark
12207.17	57.66	-30.78	26.88		54	-27.12	2	Vertical	Average

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Test channel		CH78			Polarity	/		Horizonta	al
Mark	Frequency MHz	Reading dBuV/m		able dB	Preamp dB	Level dBuV/m	Limit dBuV/m	Over limit	 Remar <mark>k</mark>
1	1267.82	40.42	25.94 3	.98	36.43	33.91	74.00	-40.09	Peak
2	2681.98	39.36	27.89 5	.87	37.08	36.04	74.00	-37.96	Peak
3	8051.03	34.36	37.20 11	.04	33.32	49.28	74.00	-24.72	Peak
4	12403.47	37.06	39.29 13	.41	35.68	54.08	74.00	-19.92	Peak
Frequency (MHz)	Peak Level (dBuV/M)	DCCF (dB)	Average leve (dBuV/M)		mit Line IBuV/M)	Over Lim		olarization	Remark
12403.47	54.08	-30.78	23.30		54	-30.70	H	lorizontal	Average
Test channel		CH78			Polarity	/		Vertical	
Mark	Frequency MHz	Reading dBuV/m	,	 Cable dB	Preamp dB	Level dBuV/m	Limit dBuV/m	Over limit	Remark
1	1209.32	40.71		3.88	36.63	33.62	74.00	-40.38	Peak
2	2796.31	39.59	28.39	6.03	37.25	36.76	74.00	-37.24	Peak
3	8109.62	33.93	37.16 1	1.23	33.34	48.98	74.00	-25.02	Peak
4	12403.47	41.03	39.29 1	3.41	35.68	58.05	74.00	-15.95	Peak
Frequency	Peak Level	DCCF	Average leve	l Li	mit Line	Over Lim		olarization	Remark
(MHz)	(dBuV/M)	(dB)	(dBuV/M)	(0	BuV/M)	(dB)	' `	Janzadon	Koman
12403.47	58.05	-30.78	27.27		54	-26.73		Vertical	Average