Intentional Radiator Test Report

Application for Grant of Equipment Authorization

FCC Part 15 Subpart C (15.247)
IC RSS-247 Issue 1

FCC ID:	**YJV-CHG410**
IC ID:	**9073A-CHG410**
Product Name:	**Base Station**
Model:	**MIC-WRL-CHG-410**
APPLICANT:	**Watchguard Video** **415 Century Parkway** **Allen TX, 75013**
TEST SITE(S):	**National Technical Systems - Plano** **1701 E Plano Pkwy #150** **Plano, TX 75074**
REPORT DATE:	**October 25th**
FINAL TEST DATES:	**October 5th 2015**
TOTAL NUMBER OF PAGES:	**23**

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REVISION HISTORY

Rev#	Date	Comments	Modified By
0	October 25 2015	First Draft Release	Armando Del Angel
1	January 19 2016	Added Peak Readings for Rad. Spur. Emissions per TCB request	Armando Del Angel
2	May 25, 2016	Changed Model number and FCC,IC ID per TCB comments.	Armando del Angel

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SCOPE

Tests have been performed on the *Watchguard Video* product *Base Station* Model *MIC-WRL-CHG-410* to demonstrate compliance with the following rules:

FCC Part 15 Subpart C (15.247)
RSS-247 Issue 1

Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in the following reference standards and as outlined in National Technical Systems – Plano test procedures:

ANSI C63.4-2003
FHSS Test Procedures FCC Public Notice DA 00-705, Mar 2000
RSP-100

All intentional radiator parameters were tested in a conducted measurement test setup. Radiated Spurious emissions were performed inside a test chamber with the intended antenna attached to the *Base Station*. During testing the *Base Station* was placed 80cm above the ground plane on a non-conductive RF transparent support structure as shown in relevant test setup photos. Manufacturer specified this position as the only possible installation condition of the *Base Station*.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

OBJECTIVE

The primary objective of the manufacturer is to demonstrate compliance with the regulations outlined in the previous section. This report is intended to support a grant of equipment authorization application of the *Watchguard Video Base Station* model *MIC-WRL-CHG-410*.

STATEMENT OF COMPLIANCE

Watchguard Video Base Station model *MIC-WRL-CHG-410* complied with the applicable requirement listed under the following FCC and IC rules as a 900MHz frequency hopping spread spectrum transmitter:

FCC Part 15 Subpart C (15.247)
RSS-Gen / RSS-247

Maintenance of compliance is the responsibility of the manufacturer. Any modification to the product should be assessed to ensure compliance has been maintained.

Jim Exner was present during all testing to represent the manufacturer.

DEVIATIONS FROM THE STANDARDS

During testing there were no deviations from the regulatory rules and test procedures listed above.

MODIFICATIONS

None

MEASUREMENT UNCERTAINTIES

The measurement of uncertainty is not included with the data in this test report.

TEST RESULTS SUMMARY

FCC Rule Part	IC Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.203	N/A	Antenna connector	SMA	Unique antenna connector, permanently attached antenna, or professionally installed	Complies Note 1
15.207	RSS-Gen 7.2.2	AC Line conducted emissions	N/A	As specified in 15.207(a)	Note 2
15.215(c)	RSS-247	Frequency band of operation	902.25MHz - 927.75MHz	Within 902MHz – 928MHz	Complies
15.247 (a) (1)	RSS-247 5.1.1 5.1.2	20dB Bandwidth	118 kHz	Channel spacing >25kHz or >20dB bandwidth	Complies
		Channel Separation	500 kHz		Complies
15.247 (a) (1) (i)	RSS-247 5.1.3	Number of Channels	50	50 or more	Complies
15.247 (a) (1) (i)	RSS-247 5.1.3	Channel Dwell Time	255.85 milliseconds	< 0.4 seconds within a 20 second period	Complies
15.247 (b) (3)	RSS-247 5.4.1	Conducted Output Power	0.192W EIRP = 0.192W	Conducted < 1.0W EIRP < 4.0W	Complies
15.247 (c)	RSS-247 5.5	Antenna Port Spurious Emissions 30MHz – 9.28 GHz	-35.14dBc at the lower Bandedge	< -20dBc	Complies
15.247(c) 15.209	RSS-247 5.5	Radiated Spurious Emissions 30MHz – 9.28 GHz	13.044dBuV/m at 3m	15.209(a) in restricted bands, all others < -20dBc	Complies

Notes:

1. See “Antenna connector Letter_of_Attestation_CHG400” document.
2. EUT is powered by a 12V Car Battery

- Antenna gain is declared as maximum 0dBi by the manufacturer.
- Compliance to frequency hopping spread spectrum requirements of 15.247(a)(1), 15.247(g) and 15.247(h) are described by the manufacturer in the Operational Description exhibit.
- 15.247(i) RF exposure requirements are addressed in a separate exhibit.
- A separate test report has been issued to demonstrate compliance with FCC 15B unintentional emissions and receiver spurious emissions requirements.

EQUIPMENT UNDER TEST (EUT) DETAILS

Watchguard Video Base Station model *MIC-WRL-CHG-410* is the part of the HiFi Microphone (HiFi Mic) System that is mounted in the vehicle and physically connects to the 4RE DVR and the antenna. All communications, in either direction, between the Base and the Transmitter are in the form of packets. Packets are sequences of bits encoded as BFSK modulated symbols. It employs FSK modulation and uses 50 channels.

EUT OPERATION

During testing, *Watchguard Video Base Station* model *MIC-WRL-CHG-410* was transmitting at its highest power level at full data rate. Hopping function could be enabled or disabled and 3 different channels (low, middle and top) could be selected for continuous transmission as needed.

TEST SITE

Final test measurements were taken at the test sites listed below.

Site	Registration Numbers		Location
	FCC	Canada	
Chamber 1	A2LA Accredited Designation Number US1077	IC 4319A	1701 E Plano Pkwy #150 Plano, TX 75074.

ANSI C63.4 recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement. The test site(s) contain separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements of ANSI C63.4.

TEST EQUIPMENT

NTS Equipment #	**Description**	**Manufacturer**	**Model**	**Calibration Duration**	**Calibration Due Date**
E1529P	PSA	Agilent	E4446A	12 Months	3/3/2016
E1009P	PreAmp (1GHz-26GHz)	HP	8449B	12 Months	1/16/2016
E1524P	Biconilog Antenna (30MHz-1GHz)	ETS Lindgren	3142D	12 Months	3/26/2016
E1149P	Horn Antenna (1GHz-18GHz)	EMCO	3115	12 Months	12/10/2015
E1366P	PreAmp (30MHz – 1GHz)	Miteq	AM-1431-N-1179SC	12 Months	12/12/2015

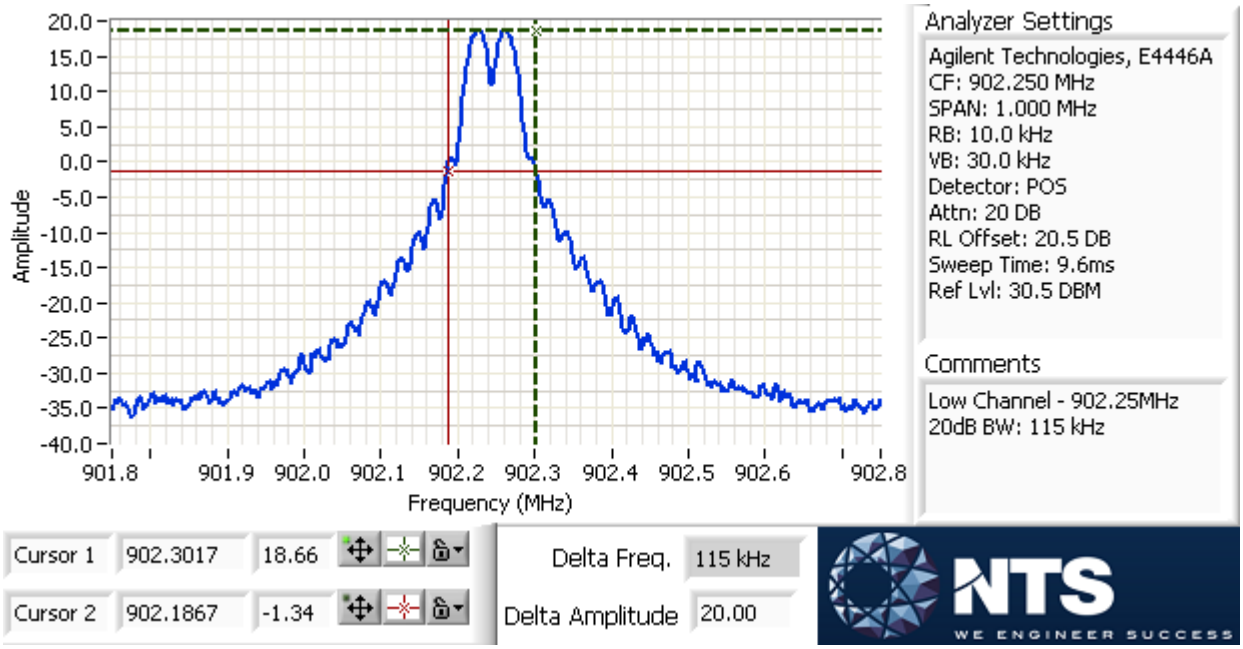
Test Results Section

20dB Bandwidth

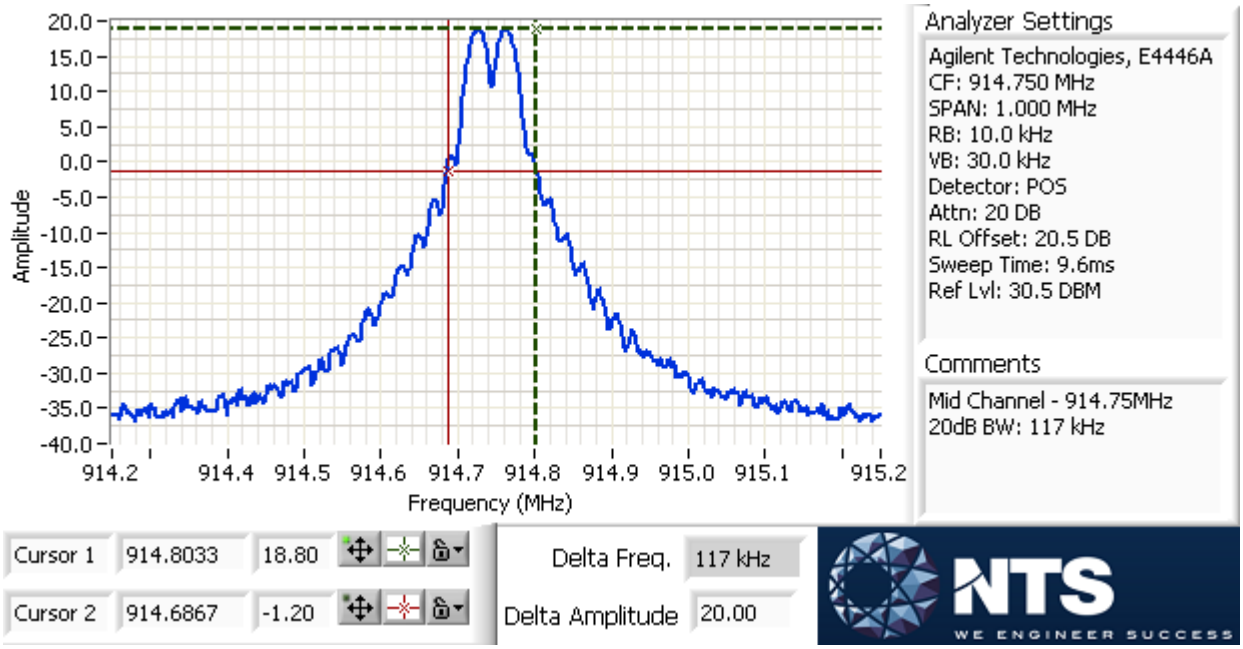
Regulatory Rule / Standard	CFR Title 47 §15.247(a)(1)(i) - RSS-247 5.1.1
Standard / Method of Measurement	FHSS Test Procedures FCC Public Notice DA 00-705, Mar 2000
Specifications	20dB bandwidth shall not exceed 500kHz
Deviations From Method of Measurement	None
Tested By	Armando Del Angel
Date	October 5the, 2015
Test Result	Corresponding plots shown below

Channel	Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)	Verdict
Low	902.25	115	< 500kHz	Complies
Mid	914.75	117	< 500kHz	Complies
High	927.75	118	< 500kHz	Complies

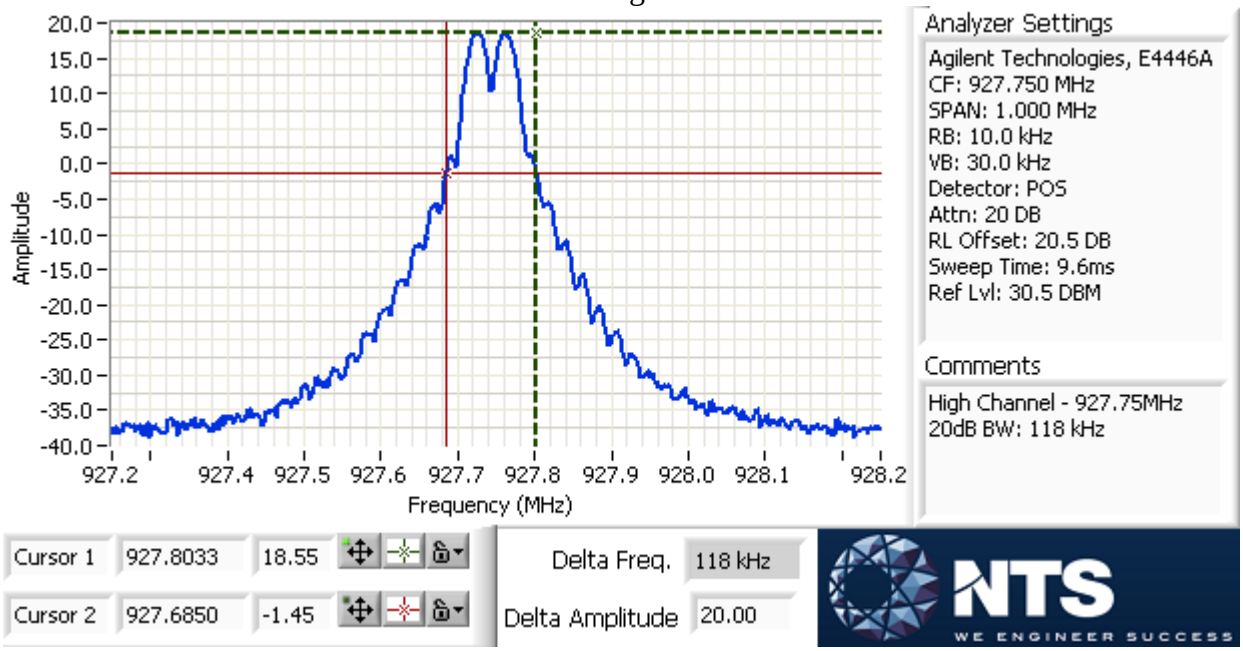
20dB bandwidth of Low channel – 115kHz



20dB bandwidth of Mid channel – 117kHz



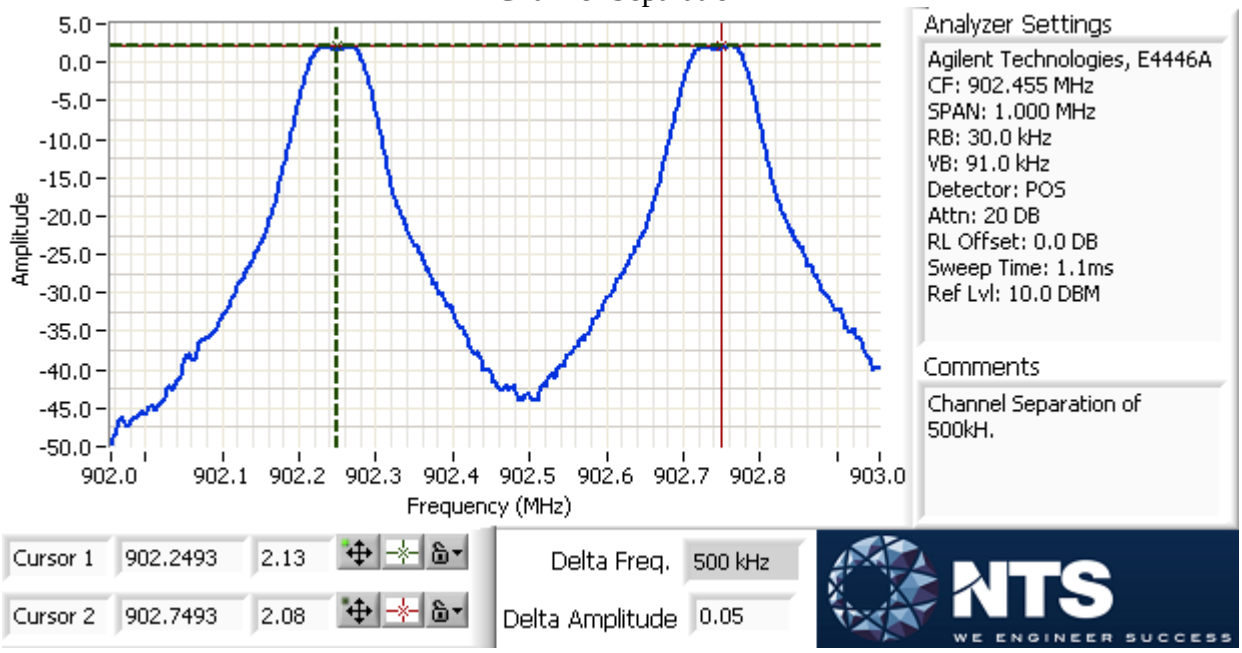
20dB bandwidth of High channel – 118kHz



Channel Separation

Regulatory Rule / Standard	CFR Title 47 §15.247(a)(1) - RSS-247 5.1.2
Standard / Method of Measurement	FHSS Test Procedures FCC Public Notice DA 00-705, Mar 2000
Specifications	Minimum of 25kHz or the 20dB bandwidth, whichever is greater
Deviations From Method of Measurement	None
Tested By	Armando Del Angel
Date	October 5th 2015
Test Result	500kHz

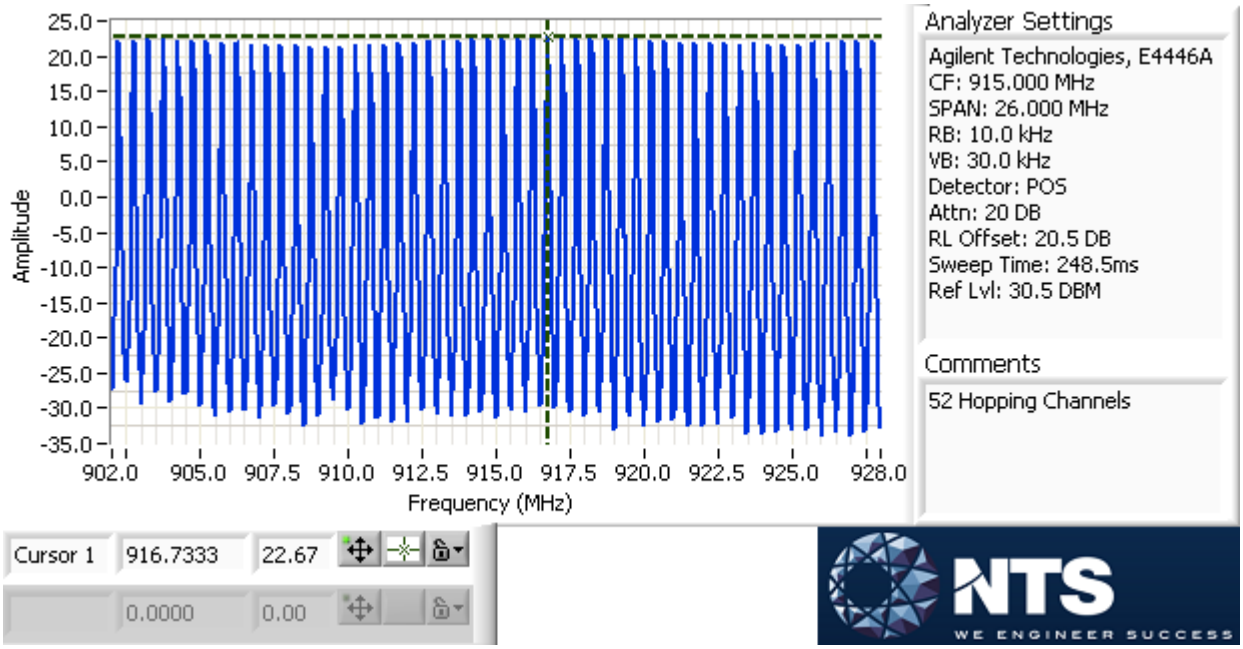
Channel Separation



Number of Hopping Channels

Regulatory Rule / Standard	CFR Title 47 §15.247(a)(1)(i) - RSS-247 5.1.3
Standard / Method of Measurement	FHSS Test Procedures FCC Public Notice DA 00-705, Mar 2000
Specifications	At least 50 hopping frequencies since the 20dB bandwidth is less than 250kHz
Deviations From Method of Measurement	None
Tested By	Armando Del Angel
Date	October 5th 2015
Test Result	Number of hopping channels | Limit | Verdict 50 | At least 50 | Complies Corresponding plot shown below

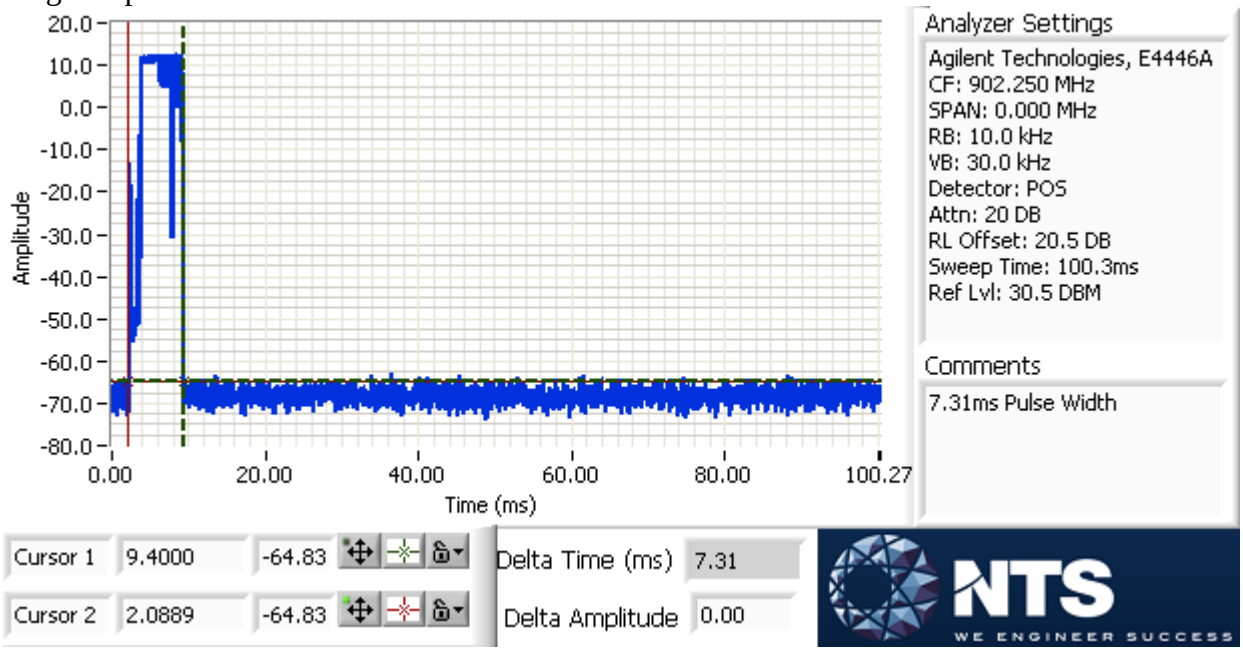
50 channels



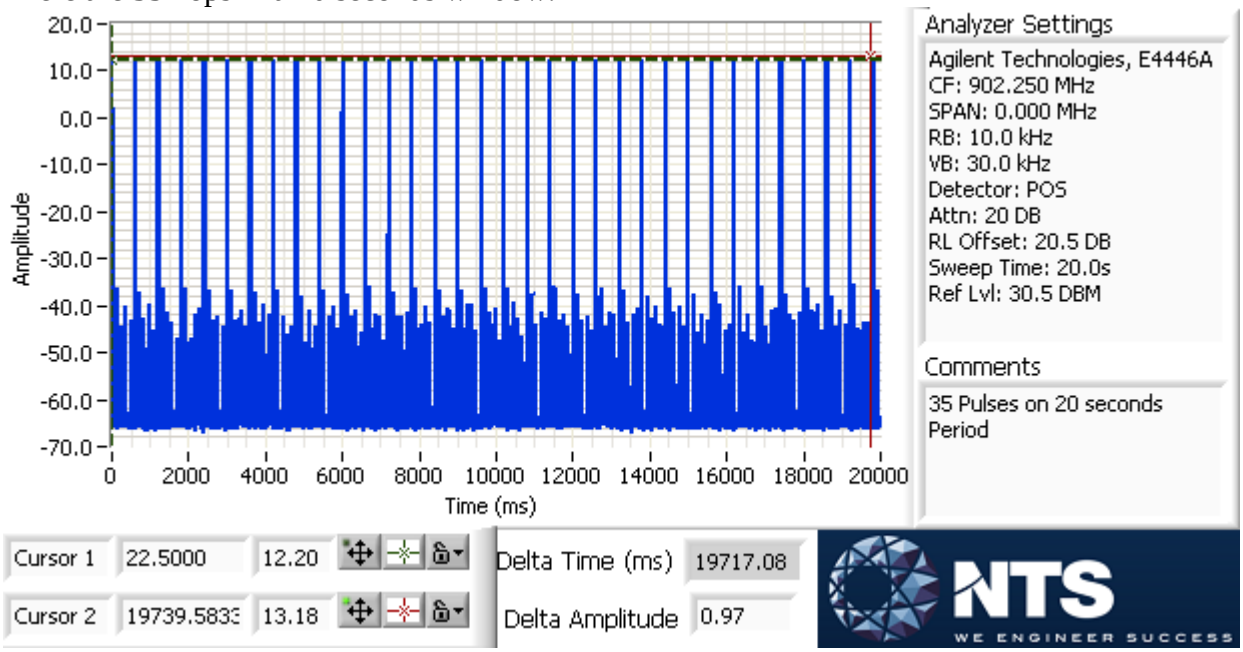
Dwell Time

Regulatory Rule / Standard	CFR Title 47 §15.247(a)(1)(i) - RSS-247 5.1.3
Standard / Method of Measurement	FHSS Test Procedures FCC Public Notice DA 00-705, Mar 2000
Specifications	The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second time period since the 20dB bandwidth is less than 250kHz
Deviations From Method of Measurement	None
Tested By	Armando Del Angel
Date	October 5th 2015
Test Result	Total dwell time within a 20 second period: 255.85 milliseconds; Limit: 400 milliseconds; Verdict: Complies Duty Cycle Correction Factor = 20 log (7.31/100) = -22.72 dB Corresponding plots and calculation shown below

Single hop duration is 7.31 milliseconds.



There are 35 hops in a 20 seconds window.



Since there a Thirty five 7.31ms hops in a 20 seconds window, the total time of occupancy within a 20 seconds period is 255.85 milliseconds.

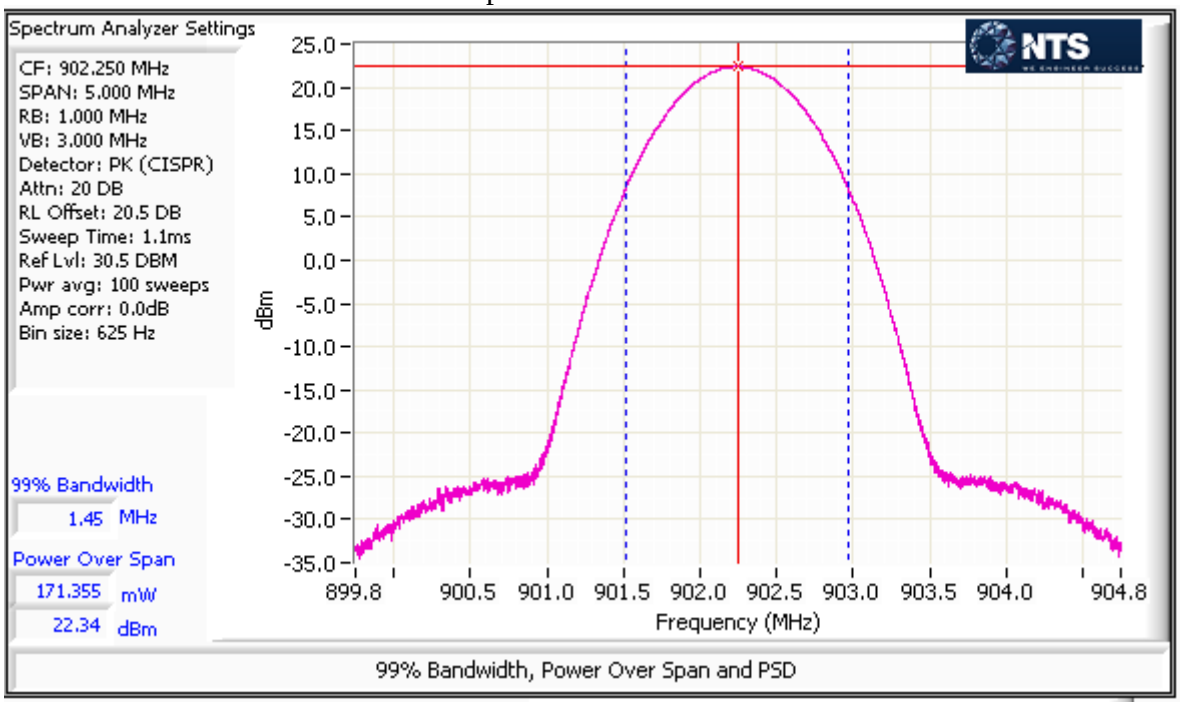
Peak Conducted Output Power

Regulatory Rule / Standard	CFR Title 47 §15.247(b)(2) - RSS-247 5.4.1
Standard / Method of Measurement	FHSS Test Procedures FCC Public Notice DA 00-705, Mar 2000
Specifications	1.0W peak conducted and 4.0W EIRP since the EUT employs at least 50 hopping channels
Deviations From Method of Measurement	None
Tested By	Armando Del Angel
Date	October 5th 2015
Test Result	Complies - Tabular data shown below

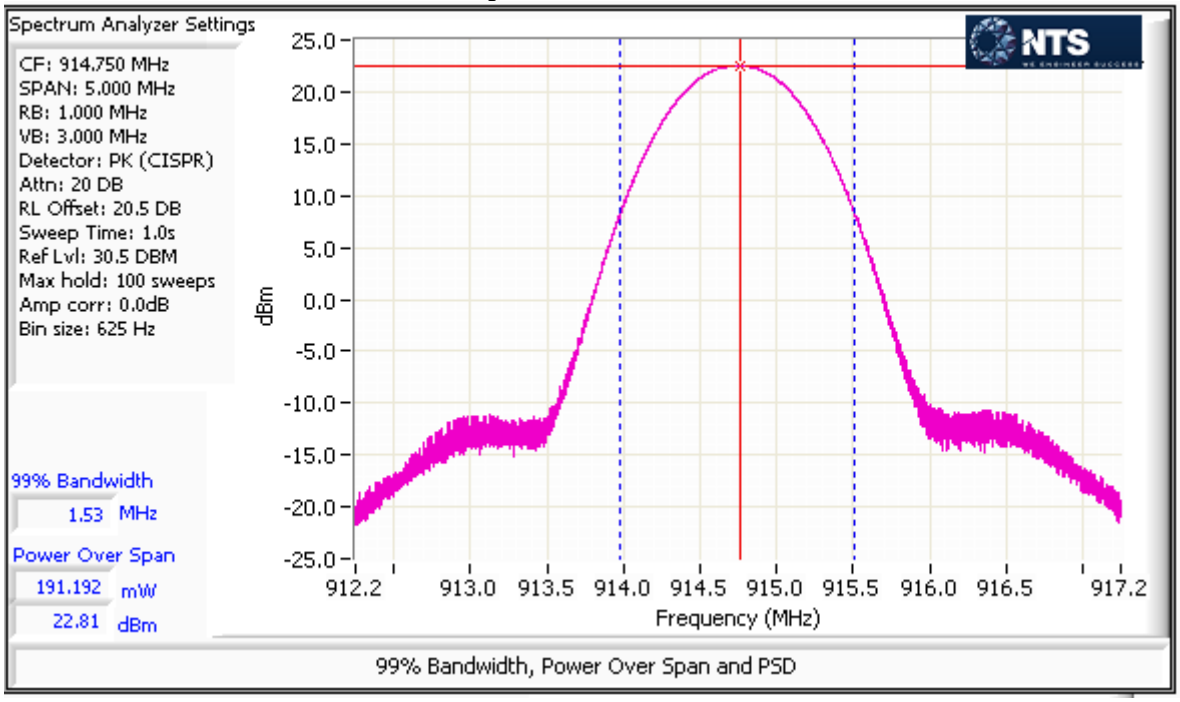
Channel	Frequency (MHz)	Peak Output Power	Limit Conducted	Antenna Gain of EUT (dBi)	Output Power EIRP	Limit EIRP	Verdict
Low	902.25	171.355mW	1W	0 (unity)	171.355mW	4W	Complies
Mid	914.75	191.192mW	1W	0 (unity)	191.192mW	4W	Complies
High	927.75	179.706mW	1W	0 (unity)	179.706mW	4W	Complies

Corresponding plots shown below

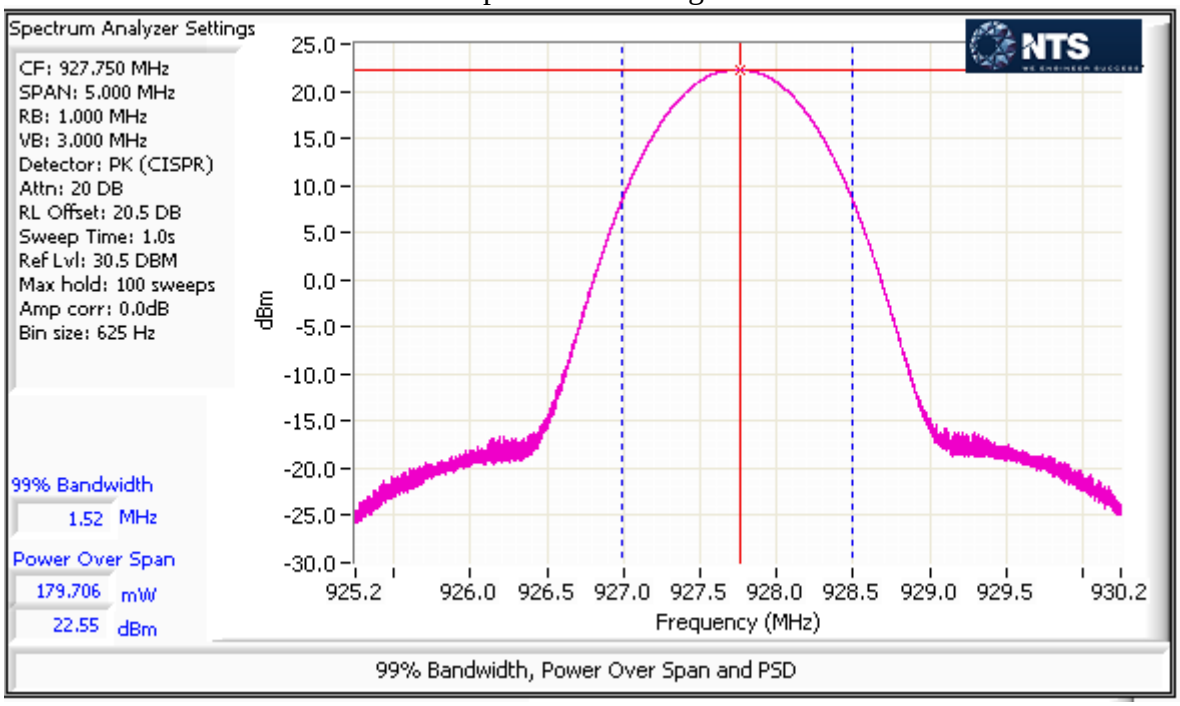
Peak Output Power of Low channel



Peak Output Power of Mid channel



Peak Output Power of High channel



Conducted Spurious Emissions & Bandedge Compliance

Regulatory Rule / Standard	CFR Title 47 §15.247(d) - RSS-247 5.5
Standard / Method of Measurement	FHSS Test Procedures FCC Public Notice DA 00-705, Mar 2000
Specifications	20dB below the fundamental in any 100kHz bandwidth
Deviations From Method of Measurement	None
Tested By	Armando Del Angel
Date	October 5th 2015
Test Result	Corresponding plots shown below

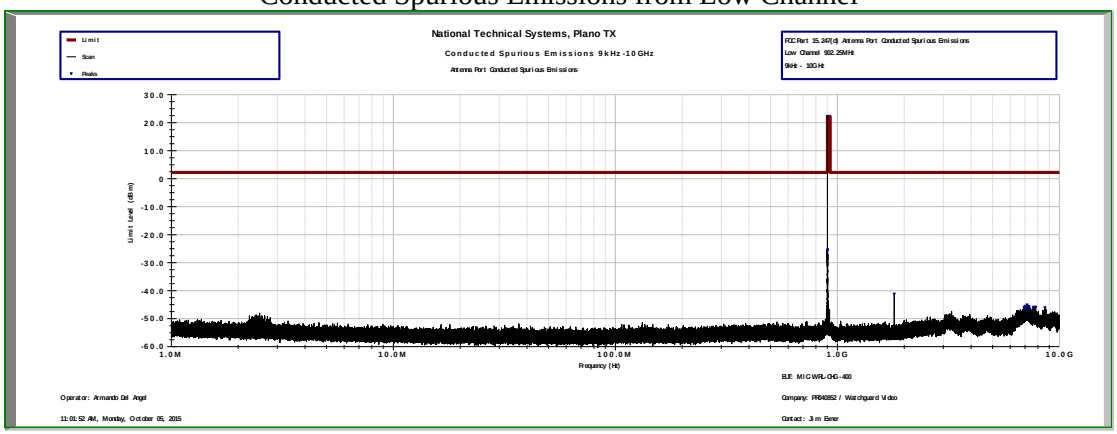
Conducted Spurious Emissions

Frequency	Level	Delta from fundamental (dBc)	Limit	Verdict
1.804GHz	-41.16dBm	-63.36	< -20dBc	Complies
1.830GHz	-46.39dBm	-68.62	< -20dBc	Complies
2.746GHz	-48.59dBm	-70.97	< -20dBc	Complies
1.855GHz	-48.10dBm	-70.24	< -20dBc	Complies

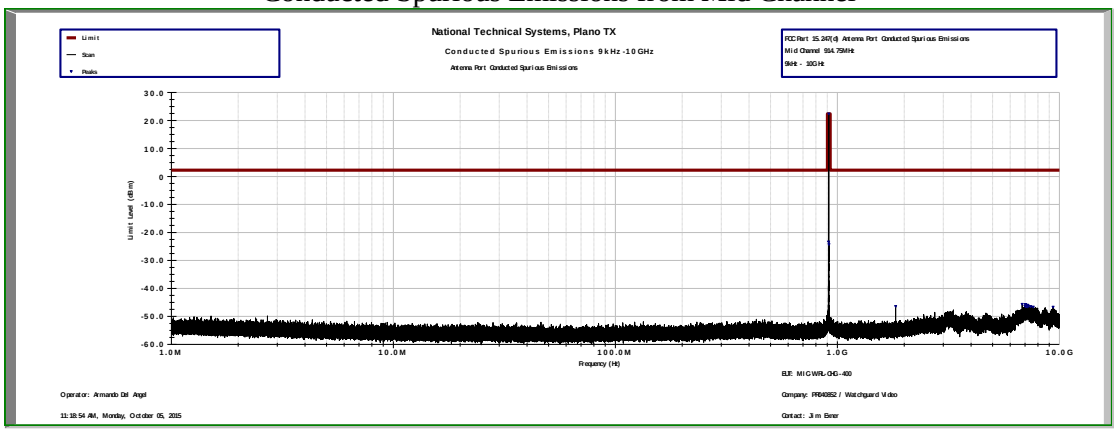
Bandedge

Channel	Bandedge Frequency (MHz)	Delta at Bandedge (dBc)	Limit	Verdict
Low	902.0	-35.15	< -20dBc	Complies
High	928.0	-40.86	< -20dBc	Complies

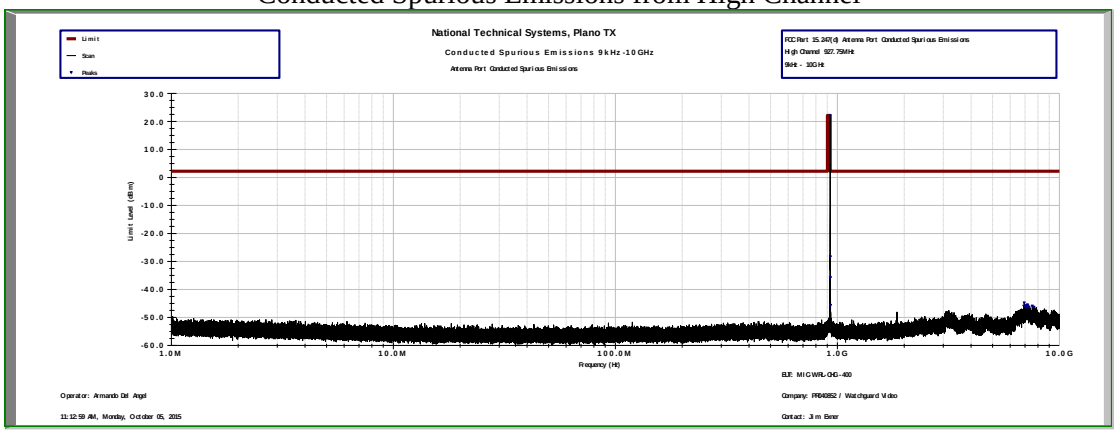
Conducted Spurious Emissions from Low Channel



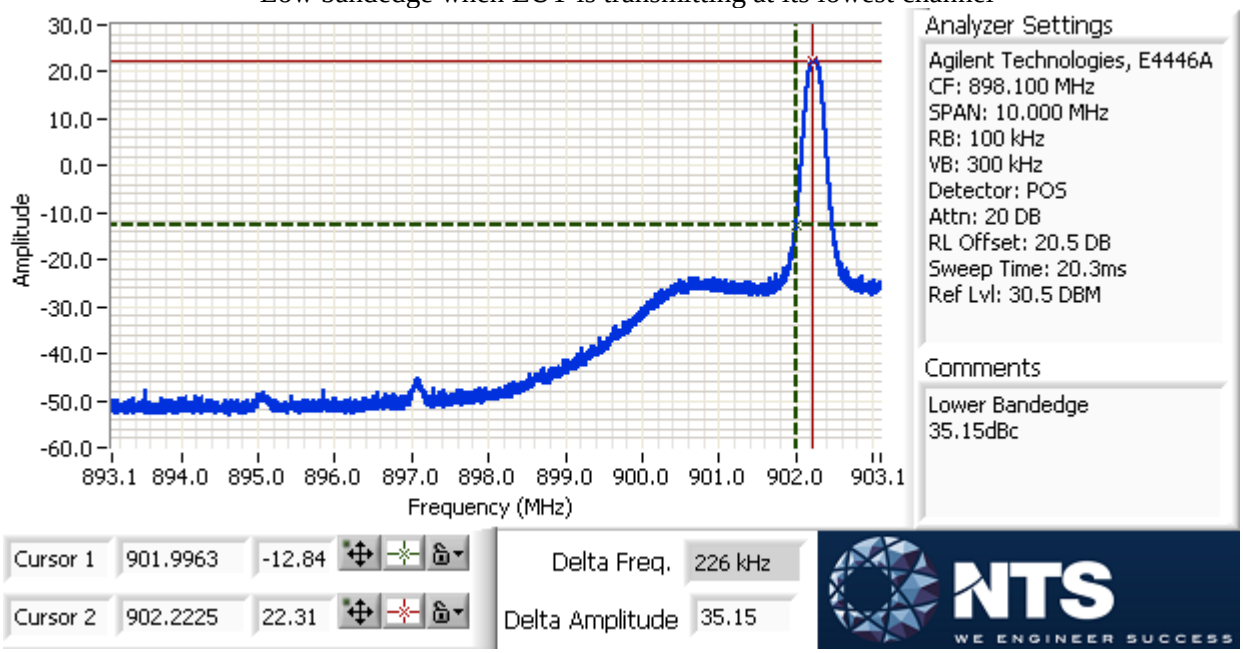
Conducted Spurious Emissions from Mid Channel



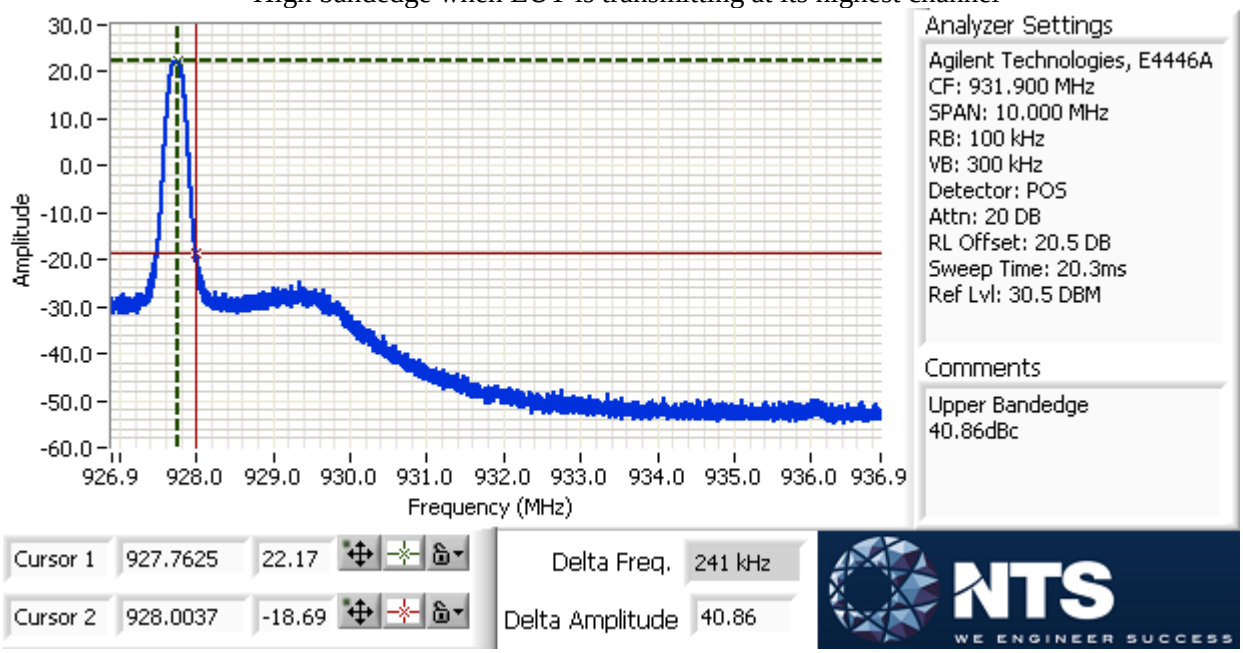
Conducted Spurious Emissions from High Channel



Low bandedge when EUT is transmitting at its lowest channel



High bandedge when EUT is transmitting at its highest channel



Radiated Spurious Emissions

Regulatory Rule / Standard	CFR Title 47 §15.247(d) and §15.209(a) - RSS-247 5.5
Standard / Method of Measurement	FHSS Test Procedures FCC Public Notice DA 00-705, Mar 2000
Specifications	20dB below the fundamental in any 100kHz bandwidth in non-restricted bands and 15.209(a) limits in all restricted bands as specified in 15.205(a)
Deviations From Method of Measurement	None
Tested By	Armando Del Angel
Date	October 5th 2015
Test Result	Complies - Tabular data shown below

All spurious emissions in 30MHz-1GHz range were at noise floor level based on pre-scan results. The noise floor of the measurement system in this frequency range was below the generic 15.209(a) limits.

In 1GHz-10GHz range all spurious emissions other than the harmonics listed below were at noise floor level. The noise floor of the measurement system in this frequency range was below the generic 15.209(a) limits as well.

Measurement System Settings:
30MHz – 1GHz: Peak, RBW = 100kHz, VBW = 300kHz
1GHz – 10GHz: Peak, RBW = 1MHz, VBW = 3MHz (VBW=10Hz for Average)

EUT transmitting on its lowest channel at 910.0MHz

Frequency	Polarity	Antenna	Cable	Duty Cycle	PreAmp	Raw Ave	Corrected	Limit	Margin
GHz	H/V	dB	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dB
1.804	V	26.847	2.646	-22.72	-44.683	50.25	11.279	53.98	-42.701
1.804	H	26.848	2.646	-22.72	-44.683	50.43	11.459	53.98	-42.521
2.707	V	29.293	3.27	-22.72	-43.918	44.71	7.771	53.98	-46.209
2.707	H	29.293	3.27	-22.72	-43.918	46.16	9.221	53.98	-44.759
3.609	V	31.497	3.971	-22.72	-43.351	39.55	4.643	53.98	-49.337
4.511	H	32.387	4.216	-22.72	-43.685	40.25	7.374	53.98	-46.606
4.511	V	32.387	4.216	-22.72	-43.686	40.9	8.024	53.98	-45.956
5.413	V	34.203	4.912	-22.72	-43.882	37.14	6.296	53.98	-47.684
6.316	V	34.508	5.497	-22.72	-43.712	33.88	5.068	53.98	-48.912

Frequency	Polarity	Antenna	Cable	PreAmp	Raw Peak	Corrected	Limit	Margin
GHz	H/V	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dB
1.804	V	26.847	2.646	-44.683	52.4	37.21	53.98	-36.77
1.804	H	26.848	2.646	-44.683	52.62	37.431	53.98	-36.549
2.707	V	29.293	3.27	-43.918	48.12	36.766	53.98	-37.214
2.707	H	29.293	3.27	-43.918	49.71	38.356	53.98	-35.624
3.609	V	31.497	3.971	-43.351	46.14	38.257	53.98	-35.723
4.511	H	32.387	4.216	-43.685	46.5	39.418	53.98	-34.562
4.511	V	32.387	4.216	-43.686	46.69	39.607	53.98	-34.373
5.413	V	34.203	4.912	-43.882	45.83	41.064	53.98	-32.916
6.316	V	34.508	5.497	-43.712	44.41	40.702	53.98	-33.278

Corrected Reading (dBuV/m) = Raw Reading (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) + Preamp Gain (dB) + Duty Cycle Factor (dB)
Margin (dB) = Corrected Reading (dBuV/m) – Limit (dBuV/m)
Negative margin indicates a passing result

EUT transmitting on its medium channel at 914.75MHz

Frequency	Polarity	Antenna	Cable	Duty Cycle	PreAmp	Raw Ave	Corrected	Limit	Margin
GHz	H/V	dB	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dB
1.829	H	27.008	5.154	-22.72	-44.643	49.22	12.806	53.98	-41.174
1.829	V	27.008	5.154	-22.72	-44.643	48.53	12.116	53.98	-41.864
2.744	V	29.194	5.783	-22.72	-43.85	42.83	8.476	53.98	-45.504
2.744	H	29.194	5.783	-22.72	-43.85	46.06	11.706	53.98	-42.274
3.659	V	31.834	6.311	-22.72	-43.31	41.14	8.845	53.98	-45.135
3.659	H	31.834	6.311	-22.72	-43.31	40.82	8.525	53.98	-45.455
4.574	V	32.527	6.582	-22.72	-43.801	40.51	10.275	53.98	-43.705
4.574	H	32.527	6.582	-22.72	-43.801	40.61	10.375	53.98	-43.605
5.488	V	34.241	7.464	-22.72	-44.078	40.09	11.914	53.98	-42.066

Frequency	Polarity	Antenna	Cable	PreAmp	Raw Peak	Corrected	Limit	Margin
GHz	H/V	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dB
1.829	H	27.008	5.154	-44.643	51.72	39.238	53.98	-14.742
1.829	V	27.008	5.154	-44.643	51.1	38.619	53.98	-15.361
2.744	V	29.194	5.783	-43.85	47.09	38.216	53.98	-15.764
2.744	H	29.194	5.783	-43.85	49.34	40.466	53.98	-13.514
3.659	V	31.834	6.311	-43.31	46.54	41.375	53.98	-12.605
3.659	H	31.834	6.311	-43.31	45.5	40.335	53.98	-13.645
4.574	V	32.527	6.582	-43.801	46.04	41.349	53.98	-12.631
4.574	H	32.527	6.582	-43.801	46.26	41.569	53.98	-12.411
5.488	V	34.241	7.464	-44.078	45.9	43.527	53.98	-10.453

Corrected Reading (dBuV/m) = Raw Reading (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) + Preamp Gain (dB) + Duty Cycle Factor (dB)
Margin (dB) = Corrected Reading (dBuV/m) – Limit (dBuV/m)
Negative margin indicates a passing result

EUT transmitting on its highest channel at 927.75MHz

Frequency	Polarity	Antenna	Cable	Duty Cycle	PreAmp	Raw Ave	Corrected	Limit	Margin
GHz	H/V	dB	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dB
1.855	H	27.175	5.162	-22.72	-44.607	49.4	13.044	53.98	-40.936
1.856	V	27.175	5.162	-22.72	-44.607	45.63	9.274	53.98	-44.706
2.783	H	29.09	5.796	-22.72	-43.76	44.52	10.253	53.98	-43.727
2.783	V	29.09	5.796	-22.72	-43.76	41.23	6.964	53.98	-47.016
3.711	V	32.165	6.228	-22.72	-43.299	39.06	6.883	53.98	-47.097
3.711	H	32.166	6.229	-22.72	-43.299	39.09	6.913	53.98	-47.067
4.639	V	32.643	6.707	-22.72	-43.698	40.44	10.351	53.98	-43.629
4.639	H	32.643	6.708	-22.72	-43.697	36.63	6.542	53.98	-47.438
5.566	V	34.165	7.626	-22.72	-44.137	39.47	11.47	53.98	-42.51

Frequency	Polarity	Antenna	Cable	PreAmp	Raw Peak	Corrected	Limit	Margin
GHz	H/V	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dB
1.855	H	27.175	5.162	-44.607	51.66	39.39	53.98	-14.59
1.856	V	27.175	5.162	-44.607	49.41	37.14	53.98	-16.84
2.783	H	29.09	5.796	-43.76	47.76	38.886	53.98	-15.094
2.783	V	29.09	5.796	-43.76	44.47	35.597	53.98	-18.383
3.711	V	32.165	6.228	-43.299	44.85	39.944	53.98	-14.036
3.711	H	32.166	6.229	-43.299	45.62	40.716	53.98	-13.264
4.639	V	32.643	6.707	-43.698	46.3	41.952	53.98	-12.028
4.639	H	32.643	6.708	-43.697	45.29	40.945	53.98	-13.035
5.566	V	34.165	7.626	-44.137	46.55	44.204	53.98	-9.776

Corrected Reading (dBuV/m) = Raw Reading (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) + Preamp Gain (dB) + Duty Cycle Factor (dB)
Margin (dB) = Corrected Reading (dBuV/m) – Limit (dBuV/m)
Negative margin indicates a passing result

End of Report

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And marks the last page of this report