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VERIFICATION TEST REPORT

Report Number: 2009 07130094 FCC

Project Number: 29282-1

Nex Number: 130094

Applicant: DIRECTED ELECTRONICS, INC.
ONE VIPER WAY
VISTA, CA 92081 USA

Equipment Under Test (EUT): INTERFACE MODULE


Model: HY1874, HY1878 AND HY1880

FCC ID: EZSHYU1800

IC Number: 1513A-1800

In Accordance With: FCC Part 15 Subpart C, 15.231
IC RSS-210 Issue 7 June 2007
IC RSS-Gen Issue 2 June 2007

Tested By: Nemko USA Inc.
11696 Sorrento Valley Road, Suite F
San Diego, CA 92121

Authorized By: 
Alan Laudani, EMC/RF Test Engineer

Date: September 25, 2009

Total Number of Pages: 28



Section1: Summary of Test Results

General

All measurements are traceable to national standards

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 15; Subpart C and IC RSS-210. Radiated tests were conducted in accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC and IC.

The assessment summary is as follows:

Apparatus Assessed:	Interface Module
Model:	HY1874, HY1878 and HY1880
Specification:	FCC Part 15 Subpart C, 15.231 IC RSS-210 Issue 7 June 2007
Date Received in Laboratory:	July 24, 2009
Compliance Status:	Complies
Exclusions:	None
Non-compliances:	None





1.1 Report Release History

REVISION	DATE	COMMENTS
-	September 25, 2009	Prepared By: Ferdinand Custodio
-	September 25, 2009	Initial Release: Alan Laudani

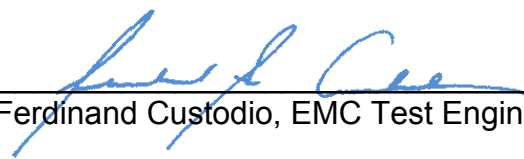
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Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

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TESTED BY: 
Ferdinand Custodio, EMC Test Engineer

Date: September 25, 2009



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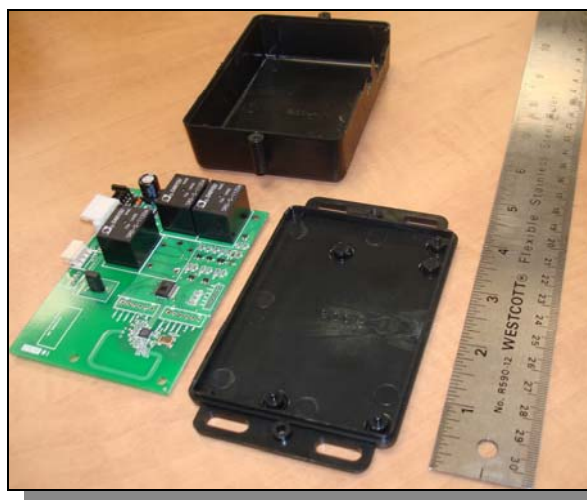
Section 2: Equipment Under Test

2.1 Product Identification

The Equipment Under Test was identified as follows:

Directed Electronics, Inc. Model # HY1874, HY1878 and HY1880 Interface Module

Production sample, serial number not available during assessment:



2.2 Samples Submitted for Assessment

The following sample of the apparatus has been submitted for type assessment:

Sample No.	Description	Serial No.
130094-1	HY1874 Santa Fe (ASK 315MHz)	NA
130094-2	HY1880 Elantra Touring (FSK 315MHz)	NA
130094-3	HY1878 Tucson (FSK 313.85MHz)	NA



2.3 Theory of Operation

The HY1874, HY1878 and HY1880 are Interface Module. Its function is to interface with an automobile OEM car alarm so that the car owner can use an aftermarket car alarm. The EUT was exercised in a test mode-providing a continuously modulated transmission. The EUT is powered by 12VDC.

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To better understand the different models within this family, the following table is provided:

Frequency and Modulation	Car Model	Models
ASK 315MHz	Santa Fe	HY1874*
	Accent	HY1877
FSK 313.85MHz	Sonata	HY1875
	Elantra	HY1876
	Tucson 4 cylinder	HY1878*
	Tucson 6 cylinder	HY1879
FSK 315MHz	Elantra Touring	HY1880*
	Veracruz	HY1881
	Genesis	HY1882

*These are the models verified in this report, which represents the three configurations.



2.4 Technical Specifications of the EUT

Manufacturer:	Directed Electronics, Inc.
Operating Frequency:	315.00MHz or 313.85MHz
Number of Operating Frequencies:	1
Rated Power:	72.5 dB μ V/m @ 3 m
Modulation:	ASK and FSK
Antenna Type:	Internal/Integral
Power Source:	12VDC from external AC Adapter (HP 6216C used for testing purposes only)
Dimensions:	120mm x 75mm x 32mm



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Section 3: Test Conditions

3.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 15 Subpart C, 15.231

Radio Frequency Devices – Intentional Radiators – Radiated Emission Limits:
Periodic operation in the band 40.66–40.70 MHz and above 70 MHz.

IC RSS-210 Issue 7 June 2007

Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands):
Category I Equipment. Annex 8 - Frequency Hopping and Digital Modulation
Systems Operating in the Bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850
MHz

IC RSS-Gen Issue 2 June 2007

General Requirements and Information for the Certification of Radiocommunication
Equipment

3.2 Deviations from Laboratory Test Procedures

No deviations from Laboratory Test Procedure

3.3 Test Environment

All tests were performed under the following environmental conditions:

Temperature range	:	23.3 – 25 °C
Humidity range	:	40-56 %
Pressure range	:	100.9 - 101.3 kPa
Power supply range	:	12VDC



3.4 Test Equipment

Nemko ID	Device	Manufacturer	Model	Serial Number	Cal Date	Cal Due Date
114	Antenna, Bicon	EMCO	3104	2997	10-Feb-09	10-Feb-10
111	Antenna, LPA	EMCO	3146	1382	20-Oct-08	20-Oct-10
877	Antenna, DRG Horn, .7-18GHz	AH Systems	SAS-571	688	28-Jul-08	28-Jul-10
826	Preamplifier	Com-Power	PA-103	161031	30-Jan-09	30-Jan-10
317	Preamplifier	HP	8449A	2749A00167	16-Apr-09	16-Apr-10
911	Spectrum Analyzer	Agilent	E4440A	US41421266	06-Nov-08	06-Nov-09

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Registration of the OATS are on file with the Federal Communications Commission, under Registration Number 90579, the VCCI under registration number R-3027, and are also registered with Industry Canada under Site Numbers 2040B-1 and 2040B-2.



Section 4: Observations

4.1 Modifications Performed During Assessment

No modifications were performed during assessment.

4.2 Record Of Technical Judgements

No technical judgements were made during the assessment.

4.3 EUT Parameters Affecting Compliance

The user of the apparatus could not alter parameters that would affect compliance.

4.4 Test Deleted

No Tests were deleted from this assessment.

4.5 Additional Observations

There were no additional observations made during this assessment.





Section 5: Results Summary

This section contains the following:

FCC Part 15 Subpart C: Test Results

§ 15.231 Periodic operation in the band 40.66–40.70 MHz and above 70 MHz.

The column headed “Required” indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

N No: not applicable / not relevant

Y Yes: Mandatory i.e. the apparatus shall conform to these test.

N/T Not Tested, mandatory but not assessed. (See section 4.4 Test deleted)

The results contained in this section are representative of the operation of the apparatus as originally submitted.

5.1 Test Results

Part 15C	RSS 210	Test Description	Required	Result
15.209 (a)	Clause 2.6	Unintentional Radiator Radiated Emission Limits	Y	Pass
15.231 (a)(1)	A1.1.1(b)	Transmitter deactivation within 5 seconds	Y	Pass
15.231 (a)(3)		Transmission Time	N*	
15.231 (b)	A1.1.2	Field strength of emissions	Y	Pass
15.231 (c)	Clause 4.6.1 RSS Gen.	20 dB Bandwidth	Y	Pass
15.231 (e)		Field strength of emissions (if 15.231 (a) is not met)	N**	

*EUT does not transmit at predetermined intervals or polling (supervision transmissions)

**EUT satisfies 15.231 (a)





Appendix A: Test Results

Section 15.209 – Radiated Emission Limits

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100**	3
88–216	150**	3
216–960	200**	3
Above 960	500	3

**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., §§15.231 and 15.241.

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Test Conditions:

Sample Number:	HY1874, HY1878 and HY1880	Temperature:	21.0°C
Date:	July 24, 2009	Humidity:	66%
Modification State:	Transmit @ max power	Tester:	FSCustodio
		Laboratory:	SOATS

Test Results:

No spurious emission detected.

Additional Observations:

- Emissions were searched over a range of 30 MHz to 5000 MHz while in transmit mode on each model. There are no emissions found that do not comply to the restricted bands defined in FCC Part 15 Subpart C, 15.205 or Part 15.209(a).
- Investigations were made at 3 meters. Each model investigated was maximized in the OATS.
- The EUT was measured on three orthogonal axes.



Section 15.231(a)(1) – Transmitter deactivation within 5 seconds

(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

Test Conditions:

Sample Number:	HY1874, HY1878 and HY1880	Temperature:	25.0°C
Date:	July 24, 2009	Humidity:	40%
Modification State:	Transmit @ max power	Tester:	FSCustodio
		Laboratory:	Shield Room #1

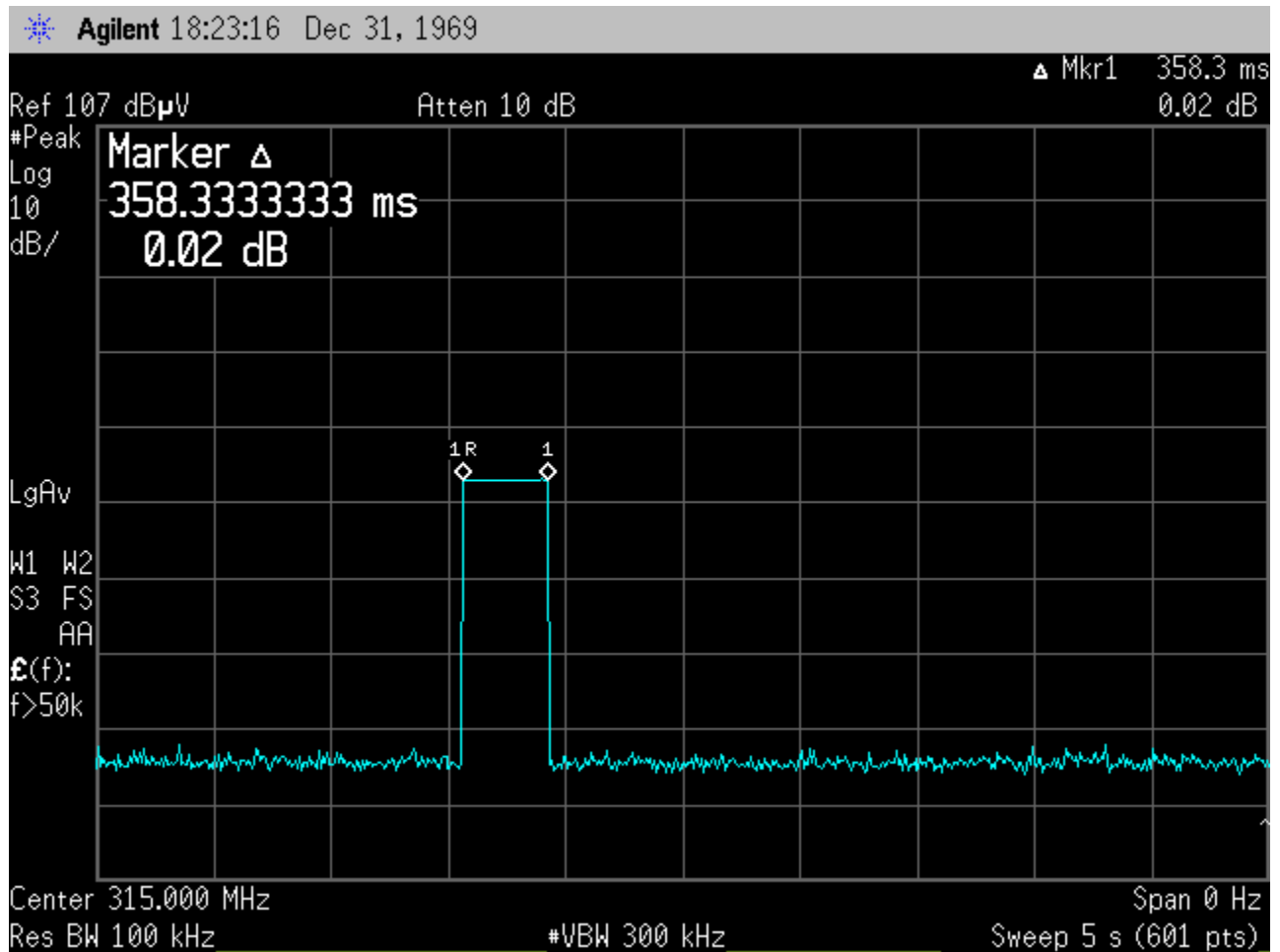
Test Results:

See attached plots.

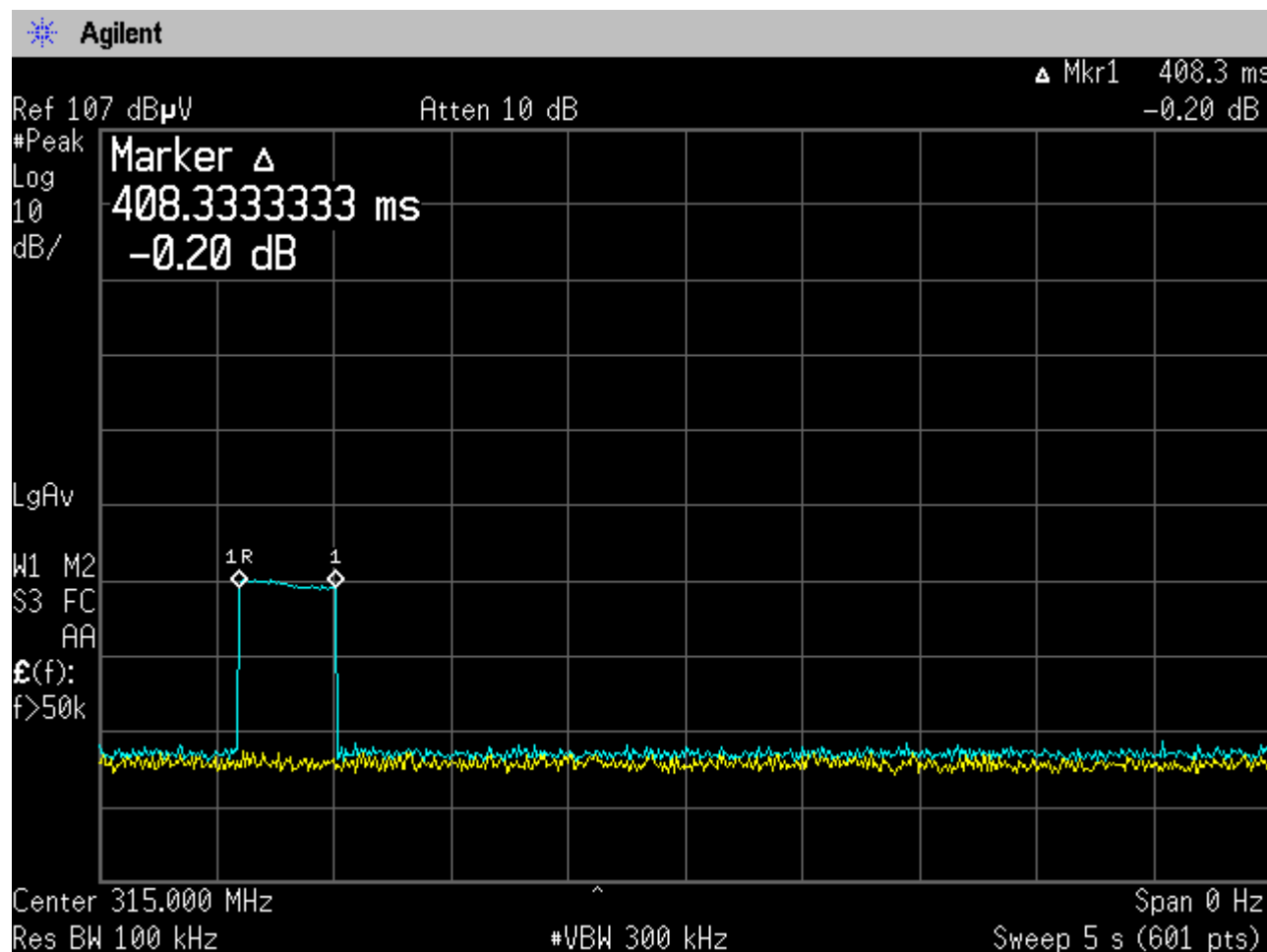
Additional Observations:

- Using a 5 seconds sweep, the EUT was activated and the transmit button released. The transmission was observed to verify that the unit ceases transmitting within 5 seconds.
- RBW was set to 100kHz; VBW was set at 3 times RBW.
- Span is set to zero.
- Detector function is peak with a secondary trace set at Max Hold.
- Verification was done inside a shielded room with the receiving antenna distance adjusted to obtain a satisfactory signal from the EUT.

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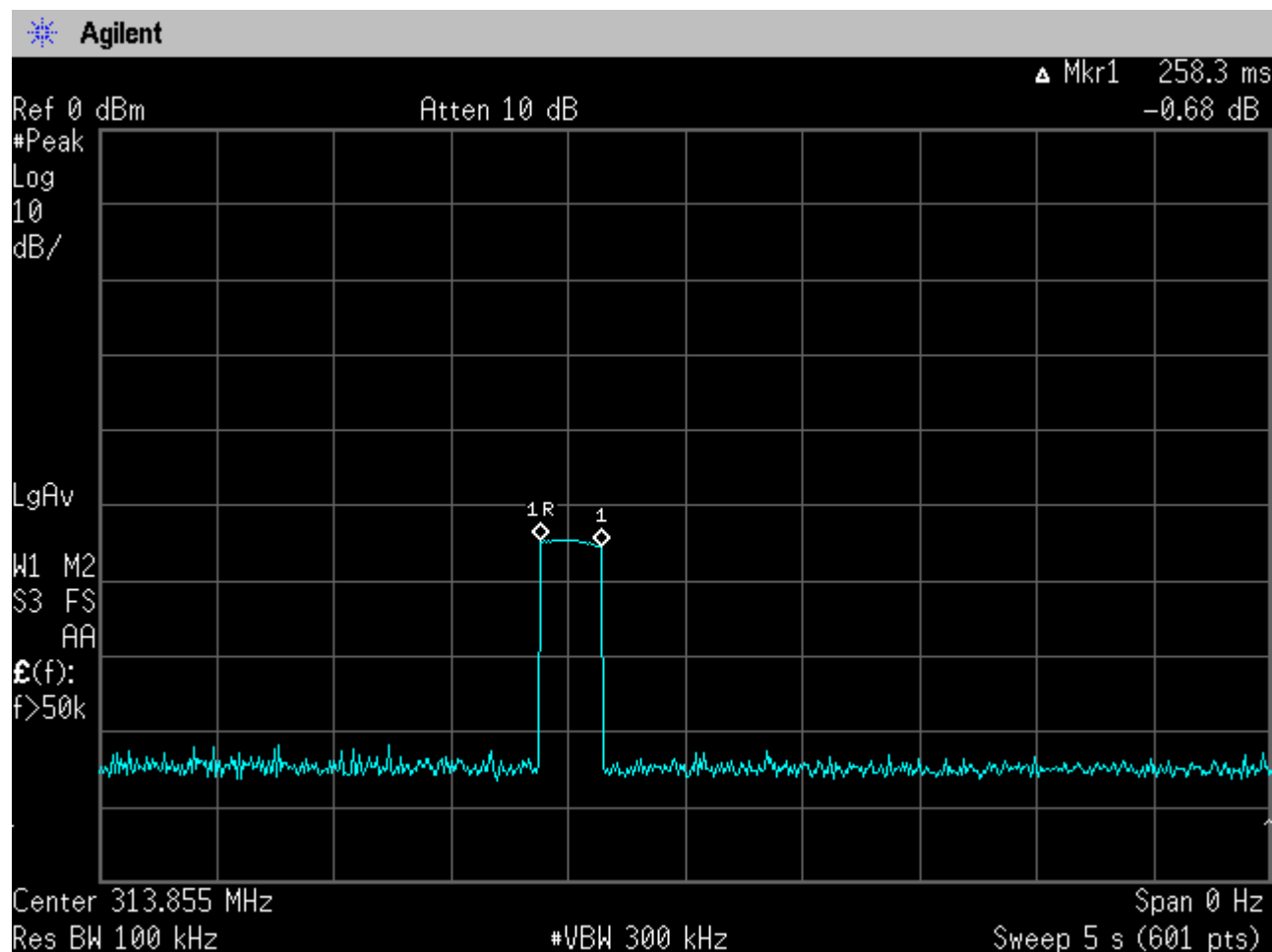
Santa Fe (HY1874) – Total transmit on time is 358.33ms



Elantra Touring (HY1880) – Total transmit on time is 408.33ms



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Tucson (HY1878) – Total transmit on time is 258.3ms



Section 15.231(c) – 20 dB Bandwidth

(c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier

Test Conditions:

Sample Number:	HY1874, HY1878 and HY1880	Temperature:	25.0°C
Date:	July 24, 2009	Humidity:	40%
Modification State:	Transmit @ max power	Tester:	FSCustodio
		Laboratory:	Shield Room #1

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Test Results:

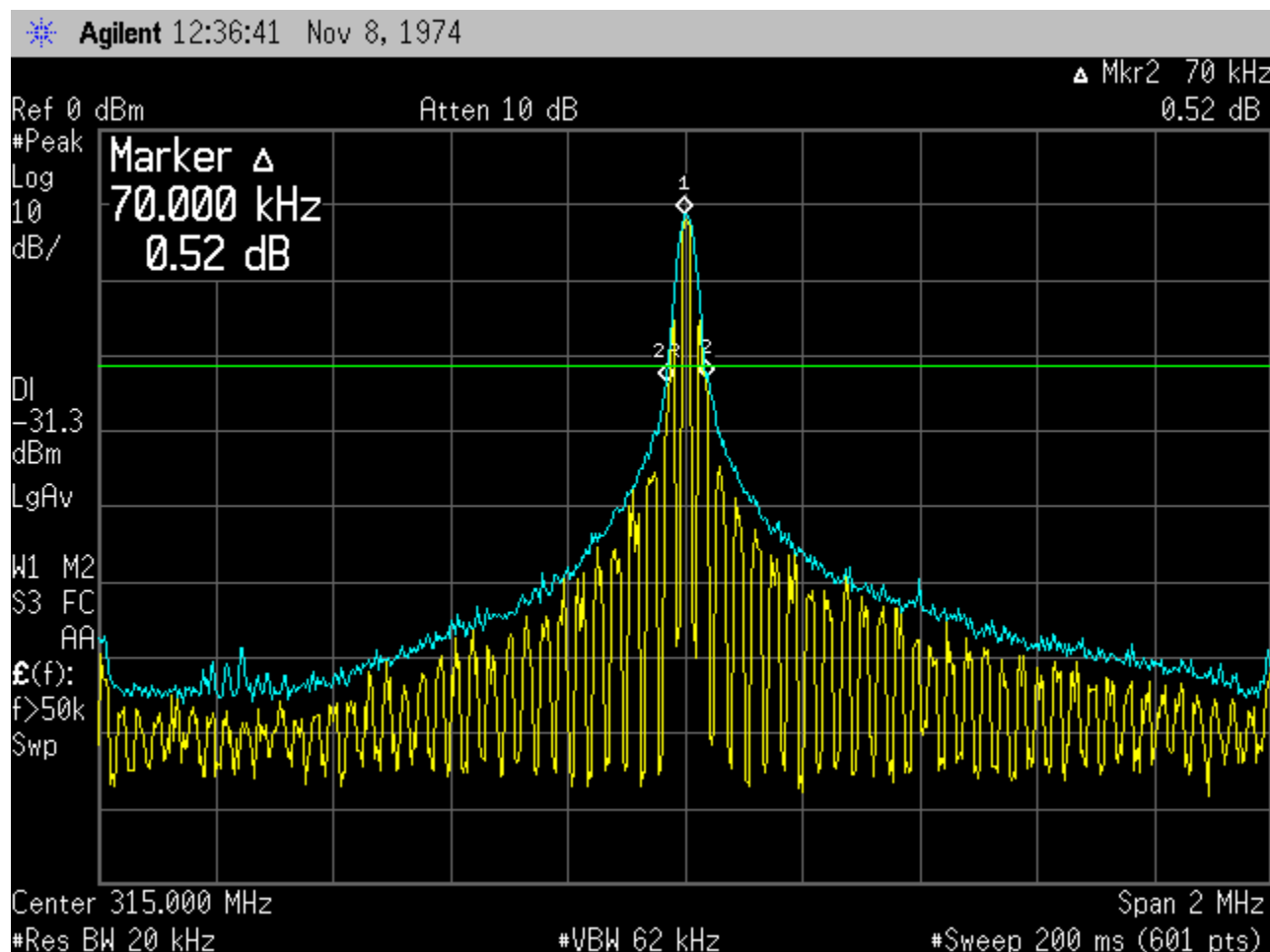
See attached plots.

Additional Observations:

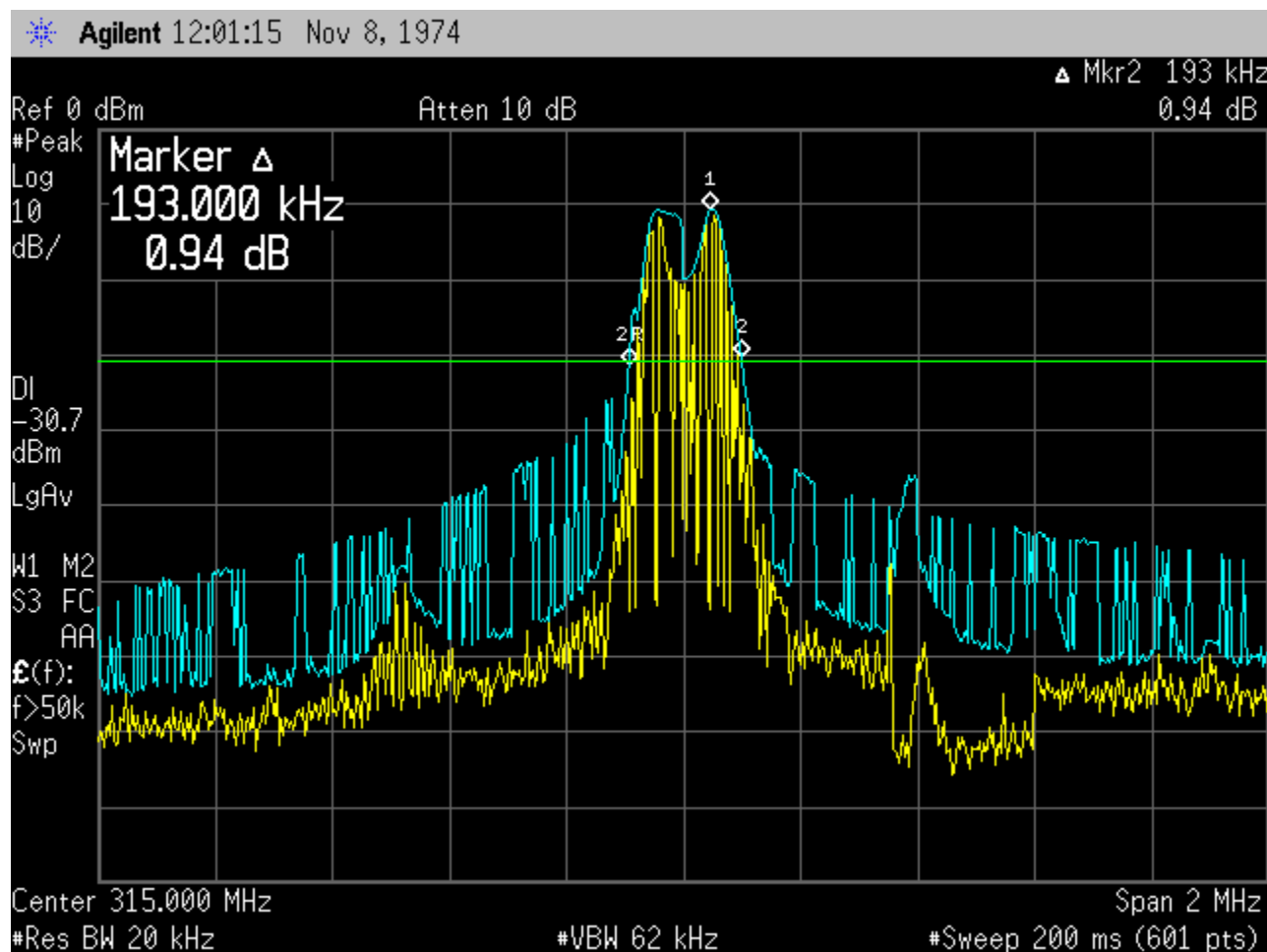
- RBW was set to 1% of the span while VBW was set at 3 times RBW.
- Detector function is peak with a secondary trace set at Max Hold.
- Verification was done inside a shielded room with the receiving antenna distance adjusted to obtain a satisfactory signal from the EUT.
- The spectrum analyzer center frequency was set to the channel carrier. After a PEAK max hold output reading was taken, a line was drawn 20 dB lower than PEAK level. The bandwidth was determined from where the channel output spectrum intersected the display line.
- Limit is 785kHz base from a center frequency of 313.85MHz (worst case 0.25% of carrier frequency).

Model	20 dB BW	Results (<785kHz)
Santa Fe (HY1874)	70 kHz	Pass
Elantra Touring (HY1880)	193 kHz	Pass
Tucson (HY1878)	177 kHz	Pass

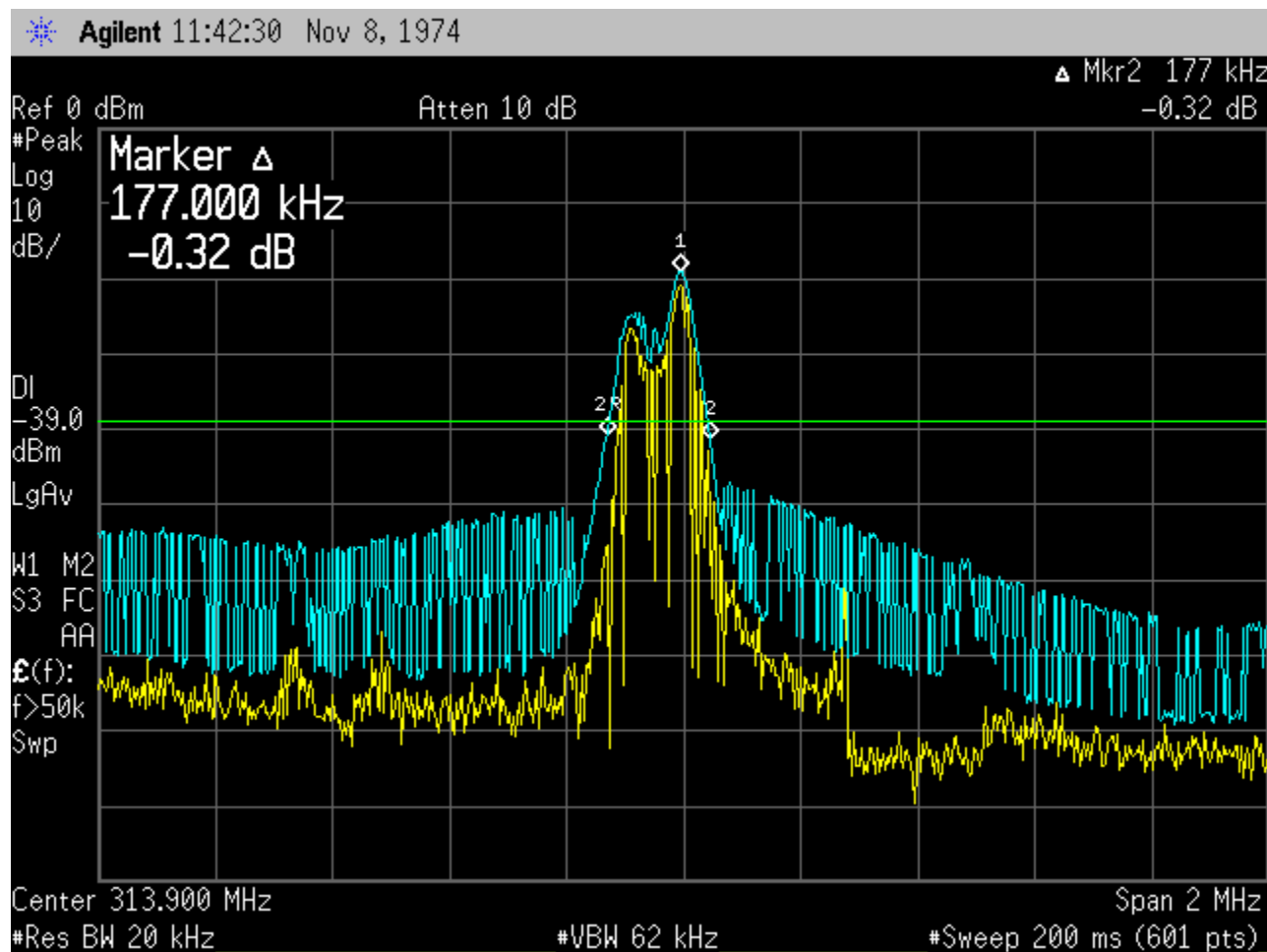




Santa Fe (HY1874) – Measured 20dB Bandwidth is 70kHz



Elantra Touring (HY1880) – Measured 20dB Bandwidth is 193kHz



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Tucson (HY1878) – Measured 20dB Bandwidth is 177kHz



Section 15.231(b) – Field Strength of Emissions

(b) In addition to the provisions of §15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66–40.70	2,250	225
70–130	1,250	125
130–174	¹ 1,250 to 3,750	¹ 125 to 375
174–260	3,750	375
260–470	¹ 3,750 to 12,500	¹ 375 to 1,250
Above 470	12,500	1,250

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¹Linear interpolations.

(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

(2) Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in §15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.

(3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.

Test Conditions:

Sample Number:	HY1874, HY1878 and HY1880	Temperature:	23.3°C
Date:	September 24, 2009	Humidity:	56%
Modification State:	Transmit @ max power	Tester:	FSCustodio
		Laboratory:	SOATS

Test Results:

See attached plots.

Additional Observations:

- Emissions were searched over a range of 30 MHz to 5000 MHz while in transmit mode. No other emissions found above 1GHz..
- Investigations were made at 3 meters. The EUT was investigated and maximized in the OATS.



- Detector used for fundamental measurement is peak using a RBW greater than the measured occupied bandwidth. The EUT was investigated in three orthogonal axes.
- The Average measurements were calculated from peak measurements less the duty cycle correction factor.

Average = Peak – DCCF (Duty Cycle Correction Factor)

- A correction factor was added to compensate for the antenna factor and cable loss at the fundamental frequencies, example below.
- There were no other emissions observed other than the fundamental.
- Sample Computation (Santa Fe/HY1874):

Correction factor @ 315.00MHz = Antenna factor + Cable loss – Preamp gain
= 17.1 + 2.9 – 32.7 = -12.7

Corrected reading = Max. reading + Correction factor
= 90.3 + (-12.7) = 70.6 dBμV/m





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Radiated Emissions Data

Job # : 29348-1 Date : 09/25/2009 Page 1 of 1
 NEX # : 132098 Time : 2PM
 Staff : FSC

Client Name : Directed Electronics EUT Voltage : 12VDC
 EUT Name : Interface Module EUT Frequency :
 EUT Model # : Santa Fe (HY1874) Phase:
 EUT Serial # : N/A NOATS
 EUT Config. : Continuously transmitting modulated SOATS X
 signal at max power Distance < 1000 MHz: 3 m
 Distance > 1000 MHz: 3 m

Specification : CFR47 Part 15, Subpart B, Class B

Loop Ant. #: NA
 Bicon Ant.#: 114_3m Temp. (°C) : 29.5
 Log Ant.#: 111_3m Humidity (%) : 16
 DRG Ant. # 877 Spec An.#: 911
 Cable LF#: SOATS Spec An. Display #: NA
 Cable HF#: SOATS QP #: 911
 Preamp LF#: 826 PreSelect#: NA
 Preamp HF# 317 DCCF: 5.28

Peak	RBW: 1 MHz
Video Bandwidth 1 MHz	
Average = Peak -DCCF	

Meas. Freq. (MHz)	Meter Reading Vertical	Meter Reading Horizontal	Det.	EUT Side F/L/R/B	Ant. Height m	Max. Reading (dBµV)	Corrected Reading (dBµV/m)	Spec. limit (dBµV/m)	CR/SL Diff. (dB)	Pass Fail	Comment
315.0	86.2	90.3	P	Top	1.0	90.3	77.6	95.0	-17.4	Pass	X
315.0	80.9	85.0	A	Top	1.0	85.02	72.3	75.0	-2.7	Pass	X
315.0	87.6	90.2	P	Front	1.0	90.2	77.5	95.0	-17.5	Pass	Y
315.0	82.3	84.9	A	Front	1.0	84.92	72.2	75.0	-2.8	Pass	Y
315.0	90.5	84.7	P	Top	1.0	90.5	77.8	95.0	-17.2	Pass	Z
315.0	85.2	79.4	A	Top	1.0	85.22	72.5	75.0	-2.5	Pass	Z

Test Notes: No other emissions detected other than the fundamental.



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Radiated Emissions Data

Job # : 29348-1 Date : 09/25/2009 Page 1 of 1
 NEX # : 132098 Time : 3PM
 Staff : FSC

Client Name : Directed Electronics EUT Voltage : 12VDC
 EUT Name : Interface Module EUT Frequency :
 EUT Model # : Tucson (HY1878) Phase:
 EUT Serial # : N/A NOATS
 EUT Config. : Continuously transmitting modulated SOATS X
 signal at max power Distance < 1000 MHz: 3 m
 Distance > 1000 MHz: 3 m

Specification : CFR47 Part 15, Subpart B, Class B

Loop Ant. #: NA
 Bicon Ant.#: 114_3m Temp. (°C) : 29.5
 Log Ant.#: 111_3m Humidity (%) : 16
 DRG Ant. # : 877 Spec An.#: 911
 Cable LF#: SOATS Spec An. Display #: NA
 Cable HF#: SOATS QP #: 911
 Preamp LF#: 826 PreSelect#: NA
 Preamp HF# : 317 DCCF: 5.28

Peak	RBW: 1 MHz
Video Bandwidth 1 MHz	
Average = Peak -DCCF	

Meas. Freq. (MHz)	Meter Reading Vertical	Meter Reading Horizontal	Det.	EUT Side F/L/R/B	Ant. Height m	Max. Reading (dBµV)	Corrected Reading (dBµV/m)	Spec. limit (dBµV/m)	CR/SL Diff. (dB)	Pass Fail	Comment
313.9	83.2	89.2	P	Top	1.0	89.17	76.3	95.5	-19.2	Pass	X
313.9	77.9	83.9	A	Top	1.0	83.89	71.1	75.5	-4.4	Pass	X
313.9	82.2	87.1	P	Front	1.0	87.1	74.3	95.5	-21.2	Pass	Y
313.9	76.9	81.8	A	Front	1.0	81.82	69.0	75.5	-6.5	Pass	Y
313.9	87.2	84.6	P	Back	1.0	87.2	74.4	95.5	-21.1	Pass	Z
313.9	81.9	79.3	A	Back	1.0	81.92	69.1	75.5	-6.4	Pass	Z

Test Notes: No other emissions detected other than the fundamental.



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Radiated Emissions Data

Job # : 29348-1 Date : 09/25/2009 Page 1 of 1
 NEX # : 132098 Time : 4PM
 Staff : FSC

Client Name : Directed Electronics EUT Voltage : 12VDC
 EUT Name : Interface Module EUT Frequency :
 EUT Model # : Elantra Touring (HY1880) Phase:
 EUT Serial # : N/A NOATS
 EUT Config. : Continuously transmitting modulated SOATS X
 signal at max power Distance < 1000 MHz: 3 m
 Distance > 1000 MHz: 3 m

Specification : CFR47 Part 15, Subpart B, Class B

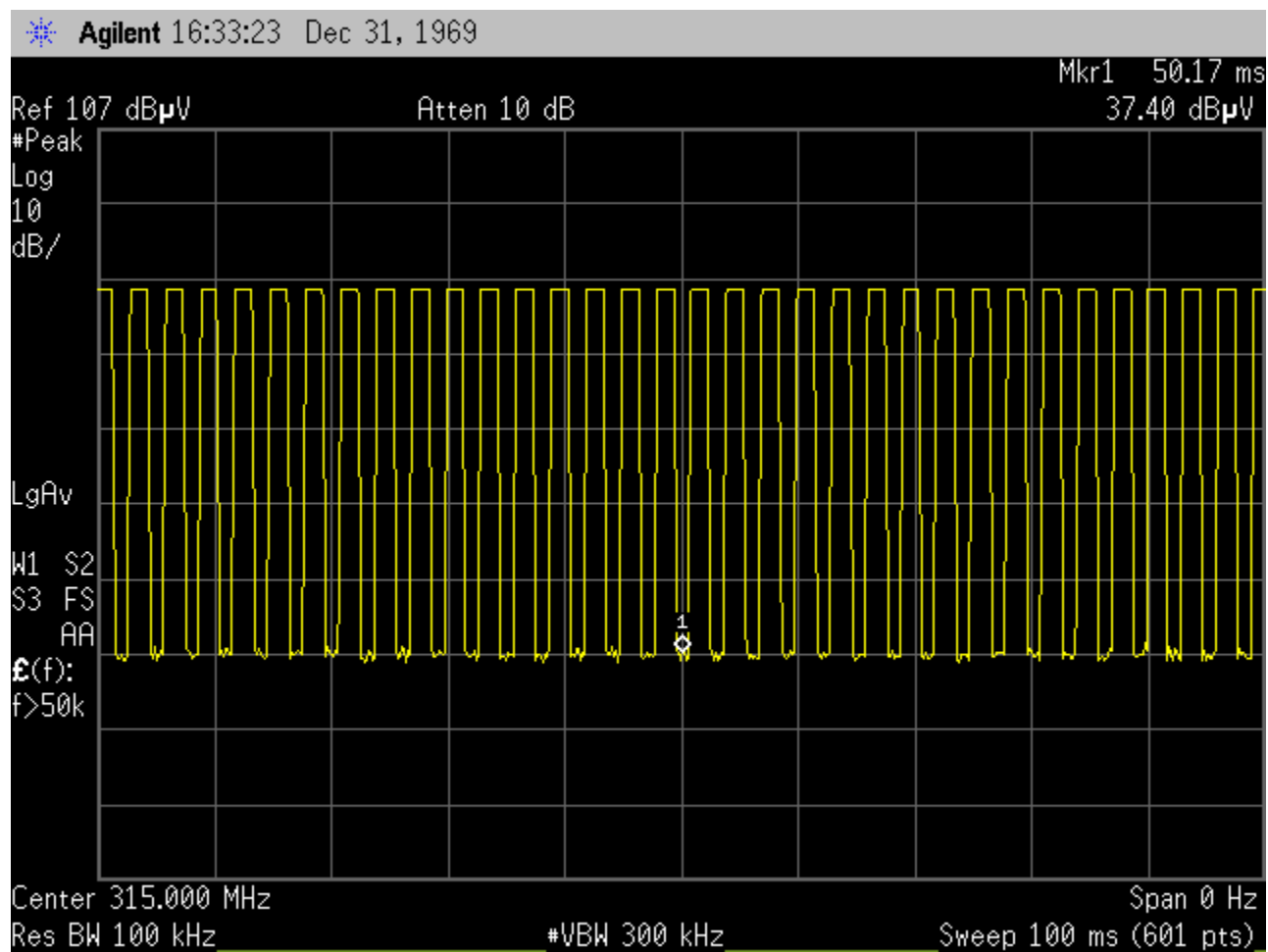
Loop Ant. #: NA
 Bicon Ant.#: 114_3m Temp. (°C) : 29.5
 Log Ant.#: 111_3m Humidity (%) : 16
 DRG Ant. # 877 Spec An.#: 911
 Cable LF#: SOATS Spec An. Display #: NA
 Cable HF#: SOATS QP #: 911
 Preamp LF#: 826 PreSelect#: NA
 Preamp HF# 317 DCCF: 5.28

Peak	RBW: 1 MHz
Video Bandwidth 1 MHz	
Average = Peak -DCCF	

Meas. Freq. (MHz)	Meter Reading Vertical	Meter Reading Horizontal	Det.	EUT Side F/L/R/B	Ant. Height m	Max. Reading (dBµV)	Corrected Reading (dBµV/m)	Spec. limit (dBµV/m)	CR/SL Diff. (dB)	Pass Fail	Comment
315.0	82.4	86.4	P	Top	1.0	86.4	73.7	95.0	-21.3	Pass	X
315.0	77.1	81.1	A	Top	1.0	81.12	68.4	75.0	-6.6	Pass	X
315.0	83.2	80.1	P	Right	1.0	83.23	70.6	95.0	-24.4	Pass	Y
315.0	78.0	74.8	A	Right	1.0	77.95	65.3	75.0	-9.7	Pass	Y
315.0	86.8	76.5	P	Right	1.0	86.76	74.1	95.0	-20.9	Pass	Z
315.0	81.5	71.3	A	Right	1.0	81.48	68.8	75.0	-6.2	Pass	Z

Test Notes: No other emissions detected other than the fundamental.

Duty Cycle

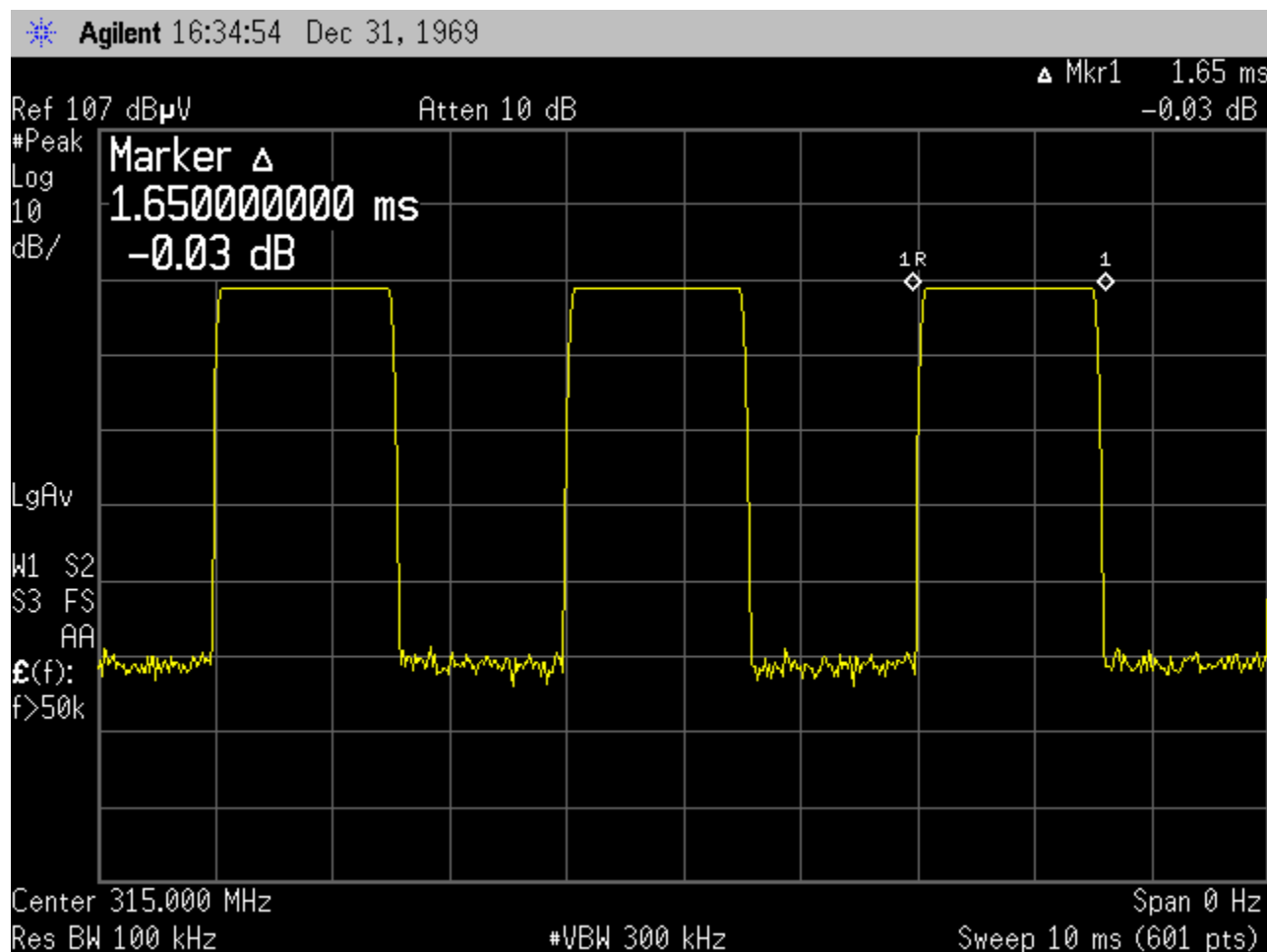


33 emissions in 100ms



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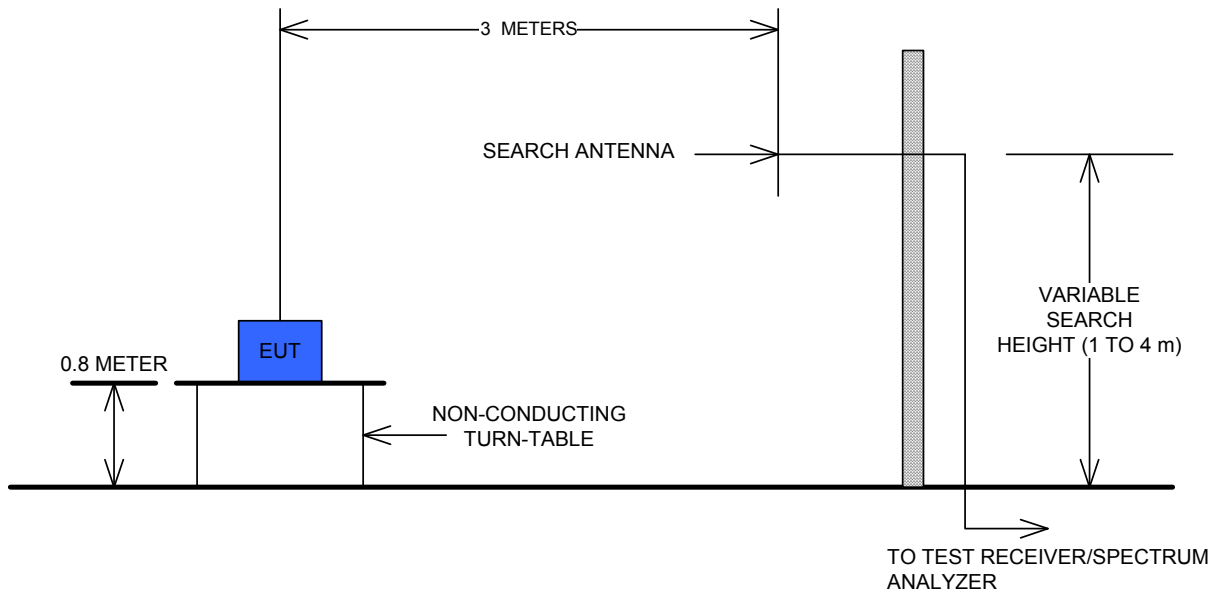
1.65 ms per emission

Duty cycle correction factor computation:

$$\begin{aligned} &= 1.65 \times 33 \\ &= 54.45 \text{ ms or } 54.45\% \text{ (duty cycle)} \\ &= 20 \log (0.5445) \\ &= \mathbf{-5.28} \end{aligned}$$

Appendix B: Block Diagram of Test Setups

Test Site For Radiated Emissions



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