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Testing of
Electromagnetic Emissions

per

USA: CFR Title 47, Part 15.253
Canada: IC RSS-251

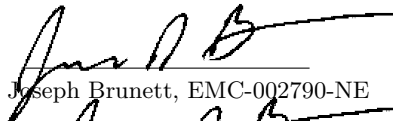
are herein reported for

True Technology LLC
FV100

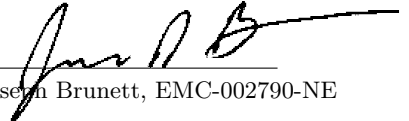
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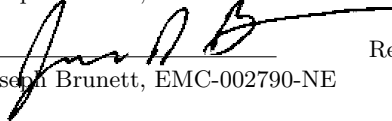
Measured by:


Dr. Joseph Brunett, EMC-002790-NE

Report Approved by:


Dr. Joseph Brunett, EMC-002790-NE

Report by:


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Report Date of Issue:

December 15, 2015

Results of testing completed on (or before) December 8, 2015 are as follows.

Emissions: The transmitter intentional emissions **COMPLY** with the regulatory limit(s) by no less than 24.3 dB.
Transmit chain spurious or harmonic emissions **COMPLY** by no less than 5.5 dB.

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1 Test Specifications, General Procedures, and Location

1.1 Test Specification and General Procedures

The ultimate goal of True Technology LLC is to demonstrate that the Equipment Under Test (EUT) complies with the Rules and/or Directives below. Detailed in this report are the results of testing the True Technology LLC FV100 for compliance to:

Country/Region	Rules or Directive	Referenced Section(s)
United States	Code of Federal Regulations	CFR Title 47, Part 15.253
Canada	Industry Canada	IC RSS-251

True Technology LLC has determined that the equipment under test is subject to the rules and directives above at the date of this testing. In conjunction with these rules and directives, the following specifications and procedures are followed herein to demonstrate compliance (in whole or in part) with these regulations.

ANSI C63.4:2014	"Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"
ANSI C63.10:2013 (USA)	"American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices"
KDB 200443 D02 MMW	"FCC/TCB Council Millimeter Wave Test Procedures"
Industry Canada	"The Measurement of Occupied Bandwidth"

1.2 Test Location and Equipment Used

Test Location The EUT was fully tested by **Willow Run Test Labs, LLC**, 8501 Beck Road, Building 2227, Belleville, Michigan 48111 USA. The Test Facility description and attenuation characteristics are on file with the FCC Laboratory, Columbia, Maryland (FCC Reg. No: 688478) and with Industry Canada, Ottawa, ON (File Ref. No: IC 8719A-1).

Test Equipment Pertinent test equipment used for measurements at this facility is listed in Table 1. The quality system employed at Willow Run Test Labs, LLC has been established to ensure all equipment has a clearly identifiable classification, calibration expiry date, and that all calibrations are traceable to the SI through NIST, other recognized national laboratories, accepted fundamental or natural physical constants, ratio type of calibration, or by comparison to consensus standards.

Table 1: Willow Run Test Labs, LLC Equipment List

Description	Manufacturer/Model	SN	Quality Num.	Last Cal By / Date Due
Spectrum Analyzer	Rhode-Schwarz / FSV30	101660	RSFSV30001	RS / Apr-2016
Biconical	EMCO / 93110B	9802-3039	BICEMCO01	Lib. Labs / April-2016
Log Periodic Antenna	EMCO / 3146	9305-3614	LOGEMCO01	Lib. Labs/ April-2016
Quad Ridge Horn	ETS Lind. / 3164-04	00066988	HRNQR316401	Lib. Labs / Apr-2016
XN-Band Horn	JEF / NRL Std.	001	HRNXN001	WRTL / Jul-2016
X-Band Horn	JEF / NRL Std.	001	HRNX001	WRTL / Jul-2016
KU-Band Horn	JEF / NRL Std.	001	HRNKU001	WRTL / Jul-2016
K-Band Horn	JEF / NRL Std.	001	HRNK001	WRTL / Jul-2016
Ka-Band Horn	JEF / NRL Std.	001	HRNKA001	WRTL / Jul-2016
U-Band Horn	Cust. Micro. / HO19R	-	HRNV001	UM / Jul-2016
V-Band Horn	Cust. Micro. / HO15R	-	HRNV001	UM / Jul-2016
W-Band Horn	Cust. Micro. / HO10R	-	HRNW001	UM / Jul-2016
Harmonic Mixer	Hewlett Packard / 11970K	3003A08327	MIX26TO4001	Agilent / Jan-2016
Harmonic Mixer	Hewlett Packard / 11970U	2332A00500	MIX40TO6001	Agilent / Jan-2016
Harmonic Mixer	Pacific mmWave / VM	291	MIX50TO7501	PMP / Mar-2016
Harmonic Mixer	Hewlett Packard / 11970W	2521A00179	MIX75TO11001	Agilent / Jan-2016
Harmonic Mixer	Pacific mmWave / GMA	26	MIX110TO22001	PMP / Mar-2016

2 Configuration and Identification of the Equipment Under Test

2.1 Description and Declarations

The EUT is an automotive radar. The EUT is approximately 17 x 9 x 5 cm (approx.) in dimension, and is depicted in Figure 1. It is powered by a 13.4 VDC vehicle power system. In use, this device is permanently affixed in a motor vehicle. Table 2 outlines provider declared EUT specifications.



Figure 1: Photos of EUT.

Table 2: EUT Declarations.

General Declarations			
Equipment Type:	Radar	Country of Origin:	Not Declared
Nominal Supply:	13.4 VDC	Oper. Temp Range:	-40°C to +85°C
Frequency Range:	76.144 to 76.948 GHz	Antenna Dimension:	Integral
Antenna Type:	Horn	Antenna Gain:	23 dBi (declared)
Number of Channels:	Not Applicable	Channel Spacing:	Not Applicable
Alignment Range:	Not Declared	Type of Modulation:	FMCW
United States			
FCC ID Number:	2AGS7-FV100A	Classification:	FDS
Canada			
IC Number:	20933-FV100A	Classification:	Radar, Vehicular Device

2.1.1 EUT Configuration

The EUT is configured for testing as depicted in Figure 2.

2.1.2 Modes of Operation

There is only a single mode of operation for this product, as an FMCW radar.

2.1.3 Variants

There is only a single variant of the EUT, as tested.

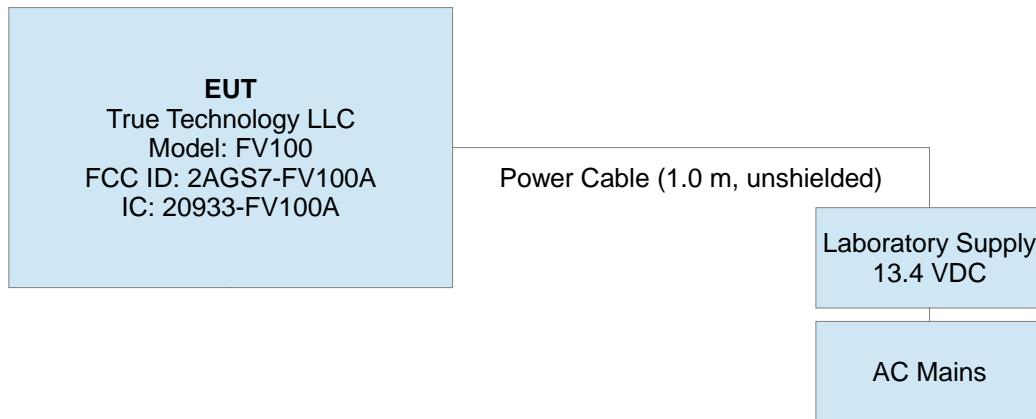


Figure 2: EUT Test Configuration Diagram.

2.1.4 Test Samples

Three samples were provided; one normal operating (modulating) device, one device capable of re-programming via an auxiliary computer into CW transmission at select frequencies, and one provided to be taken apart for photos.

2.1.5 Functional Exerciser

Normal operating EUT functionality was verified by observation of transmitted signal.

2.1.6 Modifications Made

There were no modifications made to the EUT by this laboratory.

2.1.7 Production Intent

The EUT appears to be a production ready sample.

2.1.8 Declared Exemptions and Additional Product Notes

The EUT is permanently installed in a transportation vehicle. As such, digital emissions are exempt from US and Canadian digital emissions regulations (per FCC 15.103(a) and IC correspondence on ICES-003). However, data is presented here demonstrating digital emissions comply with 15.109 on bequest of the applicant. The lowest frequency RF oscillator employed by the EUT is a 38 GHz LO phase locked to its digital 50 MHz crystal.

Also, narrow pulses arise in the mm-wave band for this radar as the FMCW signal chirps past the receiver tuned frequency. To avoid amplitude measurement error due to Pulse Desensitization, we measure peak emissions only when the radar is placed into CW mode. In computation of duty cycle for the FMCW chirp modulation, pulse desensitization will also cause a measurement receiver with a narrow IFBW to report wider than actual pulse widths, and thus incorrect on-time and duty cycle. Herein, duty cycle in a 1 MHz receiver bandwidth is accurately computed based on the total FMCW on-time divided by the operating bandwidth.

3 Emissions

3.1 General Test Procedures

3.1.1 Radiated Test Setup and Procedures

Radiated electromagnetic emissions from the EUT are first pre-scanned in our shielded anechoic chamber. Spectrum and modulation characteristics of all emissions are recorded. Instrumentation, including spectrum analyzers and other test equipment as detailed in Section 1.2 are employed. After indoor pre-scans, emission measurements are made on our outdoor 3-meter Open Area Test Site (OATS). If the EUT connects to auxiliary equipment and is table or floor standing, the configurations prescribed in relevant test standards are followed. Alternatively, a layout closest to normal use (as declared by the provider) is employed if the resulting emissions appear to be worst-case in such a configuration. See Figure 3. All intentionally radiating elements that are not fixed-mounted in use are placed on the test table lying flat, on their side, and on their end (3-axes) and the resulting worst case emissions are recorded. If the EUT is fixed-mounted in use, measurements are made with the device oriented in the manner consistent with installation and then emissions are recorded.

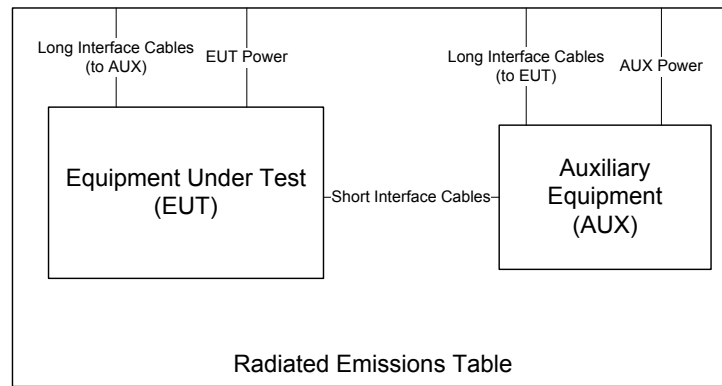


Figure 3: Radiated Emissions Diagram of the EUT.

If the EUT exhibits spurious emissions due to internal receiver circuitry, such emissions are measured with an appropriate carrier signal applied. For devices with intentional emissions below 30 MHz, a shielded loop antenna is used. It is placed at a 1 meter receive height. Emissions between 30 MHz and 1 GHz are measured using tuned dipoles and/or calibrated broadband antennas. For both horizontal and vertical polarizations, the test antenna is raised and lowered from 1 to 4 m in height until a maximum emission level is detected. The EUT is then rotated through 360° in azimuth until the highest emission is detected. The test antenna is then raised and lowered one last time from 1 to 4 m and the worst case value is recorded. Emissions above 1 GHz are characterized using standard gain horn antennas or calibrated broadband ridge-horn antennas on our OATS with a 4 × 5 m rectangle of AN-79 and/or H-4 absorber placed over the ground screen covering the OATS ground screen. Care is taken to ensure that test receiver resolution and video bandwidths meet the regulatory requirements, and that the emission bandwidth of the EUT is not reduced. Photographs of the test setup employed are depicted in Figure 4.

Where regulations allow for direct measurement of field strength, power values (dBm) measured on the test receiver / analyzer are converted to dBμV/m at the regulatory distance, using

$$E_{dist} = 107 + P_R + K_A - K_G + K_E - C_F$$

where P_R is the power recorded on spectrum analyzer, in dBm, K_A is the test antenna factor in dB/m, K_G is the combined pre-amplifier gain and cable loss in dB, K_E is duty correction factor (when applicable) in dB, and C_F is a distance conversion (employed only if limits are specified at alternate distance) in dB. This field strength value is then compared with the regulatory limit. If effective isotropic radiated power (EIRP) is computed, it is computed as

$$EIRP(dBm) = E_{3m}(dB\mu V/m) - 95.2.$$

When presenting data at each frequency, the highest measured emission under all possible EUT orientations (3-axes) is reported.

Where regulations call for substitution method measurements, the EUT is replaced by a substitution if field strength measurements indicate the emission is close to the regulatory limit. This antenna is co-polarized with the test antenna and tuned (when necessary) to the emission frequency, after which the test antenna height is again optimized. The substitution antenna signal level is then adjusted such that its emission is equal to the level measured from the EUT. The signal level applied to the substitution antenna is then recorded. Effective isotropic radiated power (EIRP) and effective radiated power (ERP) in dBm are formulated from

$$EIRP = P_T - G_A = ERP + 2.16, \quad (1)$$

where P_T is the power applied to substitution antenna in dBm, including correction for cable loss, and G_A is the substitution antenna gain, in dBi.

When microwave measurements are made at a range different than the regulatory distance or made at close-range to improve receiver sensitivity, the reading is corrected back to the regulatory distance. This is done using a 20 dB/decade far-field behavior relation and a 40 dB/decade near-field relation, as outlined in the FCCs mm-wave measurement procedures. The near-field/far-field boundary (N/F) is computed based on

$$N/F = 2D^2/\lambda$$

where D is the maximum dimension of the transmitter or receiver antenna, and λ is the wavelength at the measurement frequency. For example, suppose $N/F = 2$ m, but the measurement is made at 1 m. Here, the 40 dB/decade relation would be applied from 1 to 2 m, and the 20 dB/decade relation would be applied from 2 to 3 m. In dB, this gives a 15.6 dB adjustment. Typically, for microwave measurements either the receive antenna is connected directly to the spectrum analyzer, or it is connected to an external mixer followed by an insignificant length of cable. In this case, no cable loss term is used and mixer conversion losses are programmed in the spectrum analyzer to be included in the recorded dB values.

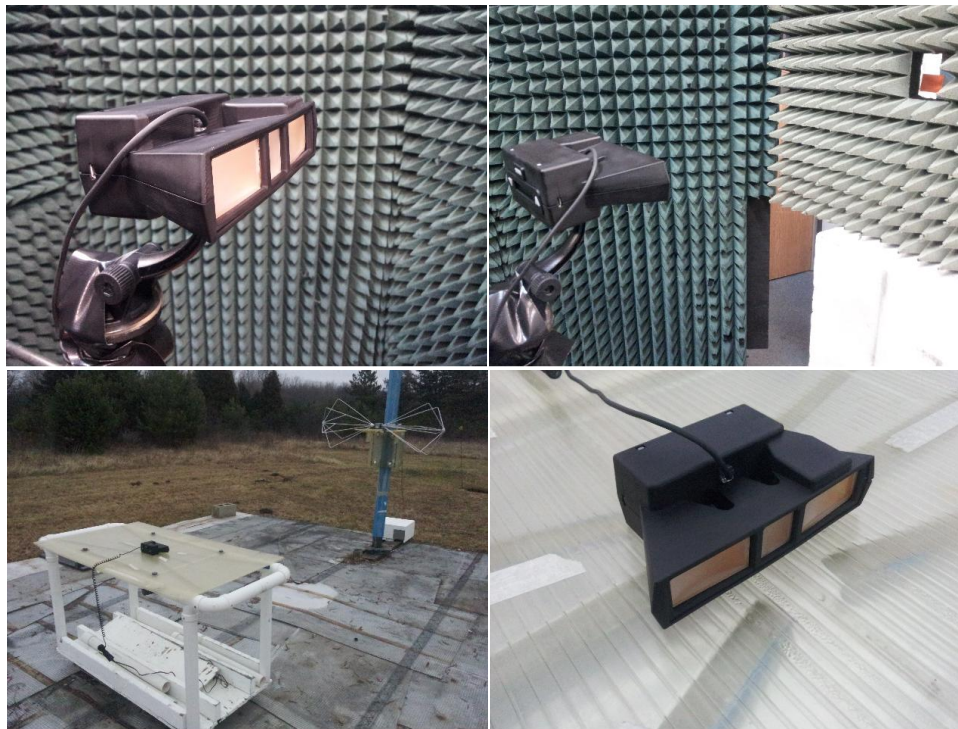


Figure 4: Radiated Emissions Test Setup Photograph(s).

3.1.2 Conducted Emissions Test Setup and Procedures

Vehicle Power Conducted Spurious The EUT is not subject to power line conducted emissions regulations as it is powered solely by the vehicle power system for use in said motor vehicle.

3.1.3 Power Supply Variation

Tests at extreme supply voltages are made if required by the the procedures specified in the test standard, and results of this testing are detailed in this report.

3.1.4 Thermal Variation

Tests at extreme temperatures are made if required by the procedures specified in the test standard, and results of this testing are detailed in this report. The provider has declared that the EUT is designed for operation over the temperature range -40°C to $+85^{\circ}\text{C}$. Before any temperature measurements are made, the equipment is allowed to reach a thermal balance in the test chamber, temperature and humidity are recorded, and thermal balance is verified via a thermocouple-based probe.

3.2 Intentional Emissions

3.2.1 Fundamental Emission Pulsed Operation

The details and results of testing the EUT for pulsed operation are summarized in Table 3. Plots showing the measurements made to obtain these values are provided in Figure 5.

Table 3: Pulsed Emission Characteristics (Duty Cycle).

Frequency Range **Det** **IFBW** **VBW**
 f > 1 000 MHz Pk 1 MHz 3 MHz

Test Date: 18-Nov-15
Test Engineer: Joseph Brunett
 EUT TrueTech Radar
Meas. Distance: 30 cm

Pulsed Operation / Duty Cycle												
Transmit Mode	Voltage (V)	Test Frequency ⁽¹⁾ (GHz)	Total Cycle Time (ms)	Non-FMCW On-Time ⁽²⁾ (ms)	FMCW On-Time ⁽²⁾ (ms)	Exposure Duty Factor ⁽³⁾ (dB)	FMCW Period (ms)	99% OBW (MHz)	Dwell/MHz/Chirp ⁽⁴⁾ (ms)	Chirps / On-Time ⁽⁵⁾ (#)	Max On-Time/Cycle ⁽⁶⁾ (ms)	Spread Duty ⁽⁷⁾ (dB)
UPDWN FMCW (subfigure (a))	13.4	76.542	14.3	0.000	5.25	-4.4	1.227	695.3	0.00177	4.28	0.008	-32.8
Maximum Permissible Duty												-20.0

(1) Chirp Duty is the same for all frequencies within the OBW for this radar, no Dwell was observed at any single frequency.
 (2) Total On-Time = 0 ms dwell + 14.3ms FMCW chirp APPROX 4.25 chirps: (PARTIAL UP) - (DOWN) - (UP) - (PARTIAL DOWN)
 (3) Exposure Duty Correction = 10*Log(Total On-Time/Total Cycle-Time);
 (4) Dwell / MHz / Chirp is the CW time spent in any given 1MHz window within the channel during a single chirp = FMCW Period / 20dB OBW
 (5) Chirps / On-Time = FMCW On-Time / FMCW Period
 (6) Max On-Time / Cycle = Non-FMCW Time + Chirps / On-Time x Dwell / MHz / Chirp
 (7) Spread Duty = 10*log10(Max On-Time/Cycle / Total Cycle Time) = 10*log10(0.007ms/14.3ms) = -32.8 dB
 Equipment Used: RSFSV30001, MIX75TO10001, HRNW01

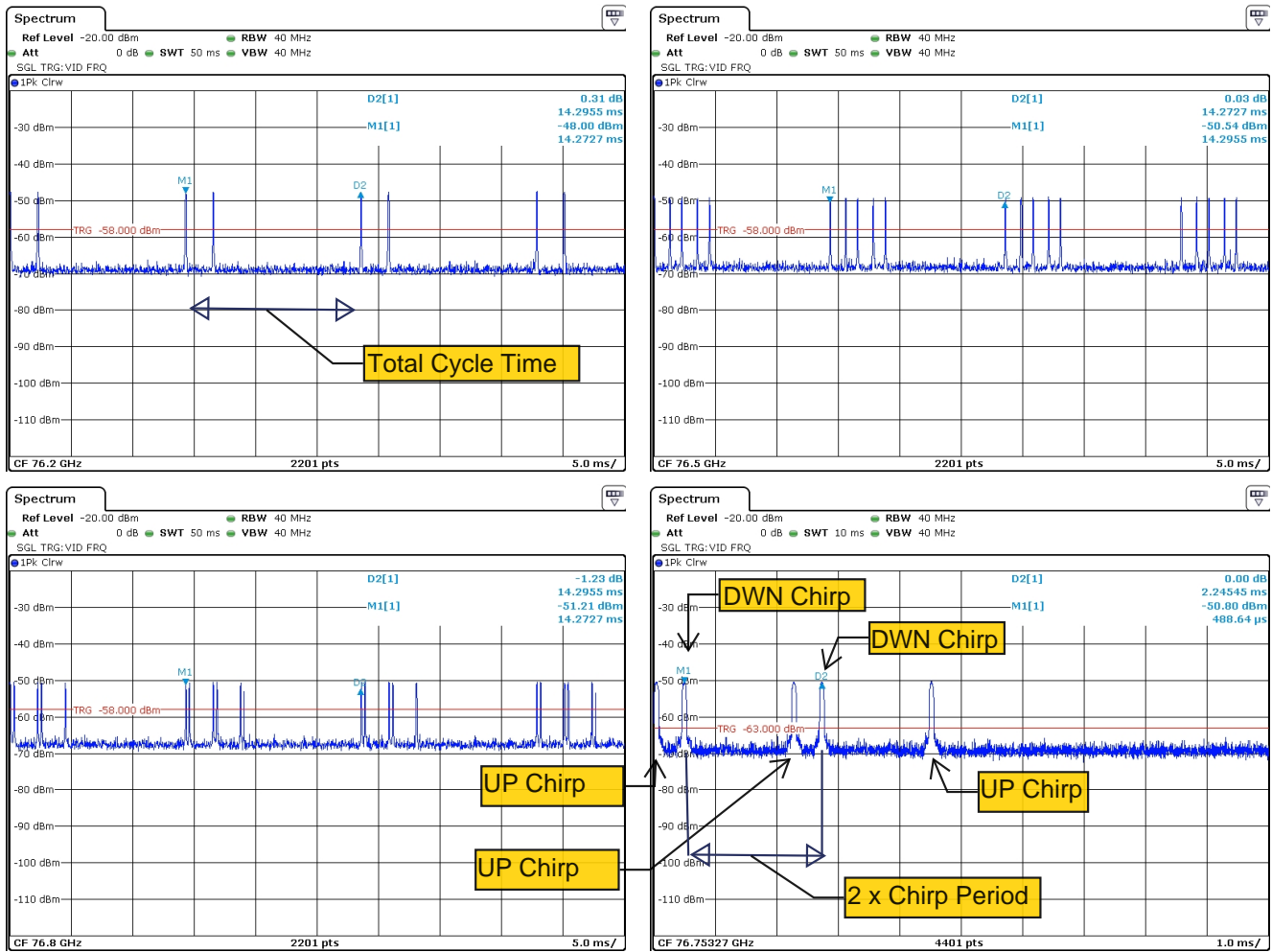


Figure 5: Pulsed Emission Characteristics (Duty Cycle).

3.2.2 Fundamental Emission Bandwidth

Emission bandwidth (EBW) of the EUT is measured with the device placed in the worst case test mode. Radiated emissions are recorded following the test procedures listed in Section 1.1. The 20 dB EBW is measured as the max-held peak-detected signal when the IF bandwidth is greater than or equal to 1% of the receiver span. For complex modulations other than ASK and FSK, the 99% emission bandwidth per IC test procedures has a different result, and is also separately reported. The results of EBW testing are summarized in Table 4. Plots showing measurements employed to obtain the emission bandwidth reported are provided in Figure 6.

Table 4: Intentional Emission Bandwidth.

Frequency Range Freq > 1 GHz	Det Pk	IFBW 1 MHz	VBW 3 MHz	Span 1200 MHz	Test Date: 18-Nov-15
					Test Engineer: Joseph Brunett
					EUT: TrueTech Radar
					Meas. Distance: 60 cm

Occupied Bandwidth										
Transmit Mode	Channel	Temperature (C)	Voltage (V)	fL* (MHz)	fL Limit (MHz)	fH* (MHz)	fH Limit (MHz)	26dB OBW (MHz)	99% OBW (MHz)	Notes/Pass/Fail
FMCW	1	85.0	15.4	76147.7	76000.0	76948.4	77000.0	800.7	695.3	
	1	-40.0	14.4	76144.3	76000.0	76945.0	77000.0			
	1	20.0	13.4	76145.1	76000.0	76945.8	77000.0			
	1	85.0	11.4	76147.5	76000.0	76948.3	77000.0			
	1	-40.0	11.4	76144.3	76000.0	76945.0	77000.0			
			fL_{MIN}	76144.3	fH_{MAX}	76948.4	OBW_{MAX}	800.7	695.3	Pass

* fL and fH computed from measurement of frequency drift using CW sample and the nominal OBW measurement.
 Equipment Used: RSFSV30001, MIX75TO10001, HRNW01

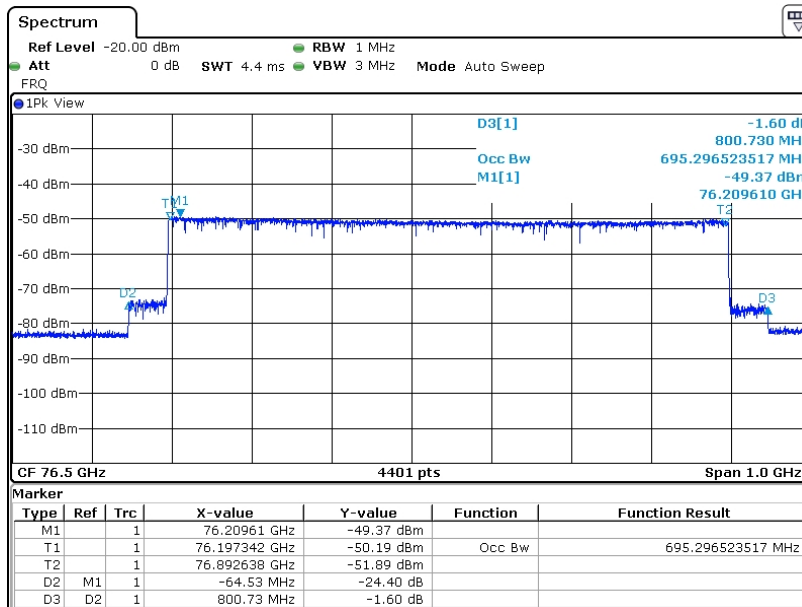


Figure 6: Intentional Emission Bandwidth.

3.2.3 Fundamental Emission

Following the test procedures listed in Section 1.1, radiated emissions measurements are made on the EUT for both Horizontal and Vertical polarized fields. Table 5 details the results of these measurements.

Table 5: Fundamental Radiated Emissions.

Frequency Range	Det	IF Bandwidth	Video Bandwidth	Test Date:	18-Nov-15
25 MHz f 1 000 MHz	Pk/QPk	120 kHz	300 kHz	Test Engineer:	Joseph Brunett
f > 1 000 MHz	Pk	1 MHz	3 MHz	EUT:	TrueTech Radar
f > 1 000 MHz	RMS (Avg)	1 MHz	3 MHz	Mode:	CW
				Meas. Distance:	See Table.

#	Env.		Frequency Band		Antenna + Cable				Rx. Power		Range Correction ⁽²⁾				E3-Field		EIRP ⁽³⁾		S3 ⁽⁵⁾		S3 Limit		Pass By	Comments		
	Temp. (C)	Volt. (V)	Start MHz	Stop MHz	Type	Pol. H/V	Dim. ⁽⁴⁾ cm	Ka dB/m	Kg dB	Pk dBm	Avg ⁽¹⁾ dBm	MR m	DR m	N/F m	CF dB	Pk dBuV/m	Avg dBuV/m	Pk dBm	Avg dBm	Pk dBm/cm2	Avg dBm/cm2	Pk dB			Avg dB	
1	20	13.4	76200.0	76200.0	Horn W	H/V	3.0	45.3	-36.0	-48.4	-68.4	0.6	3.0	0.5	-14.0	125.9	105.9	30.7	10.7	-29.8	-49.8	-5.5	-10.6	24.3	CW	
2	20	13.4	76550.0	76550.0	Horn W	H/V	3.0	45.3	-36.0	-50.3	-70.3	0.6	3.0	0.5	-14.0	124.0	104.0	28.8	8.8	-31.7	-51.7	-5.5	-10.6	26.2	CW	
3	20	13.4	76900.0	76900.0	Horn W	H/V	3.0	45.3	-36.0	-52.3	-72.3	0.6	3.0	0.5	-14.0	122.0	102.0	26.8	6.8	-33.7	-53.7	-5.5	-10.6	28.2	CW	
4																										
5																										
6																										
7																										

(1) Avg. is computed from the Peak measurement via the worst-case Spread Duty Cycle detailed in the Duty Cycle section of this test report.
 (2) CF is computed assuming a 40 dB/decade Near-Field Decay Rate and a 20 dB/Decade Far-field Decay Rate. DR is Regulatory Range Distance. MR is Measurement Distance. N/F is near-far boundary.
 (3) EIRP is computed from field strength at 3 meter distance. If emission is within 6 dB of regulatory limit, then substitution method measurement is employed to determine exact EIRP.
 (4) Dimension of antenna is taken to be the larger of the test antenna and the DUT antenna; DUT antenna is 3cm in dimension.
 (5) Spacial Power Density S @ 3m (dBm/cm²) = EIRP (dBm) - 10*log10(4*pi*(300cm)²) = EIRP (dBm) - 60.5 dB
 Equipment Used: RSFSV30001, MIX75TO10001, HRNW01

3.2.4 Exposure and Potential Health Hazard

To demonstrate compliance with with regulations that place limitations on human electromagnetic field exposure for both the general public and for workers, we measured localized field strength in close proximity to the EUT. These levels are compared with limits placed by the directives and recommendations detailed in Section 1.1. Table 6 details the results of these computations.

Table 6: Electromagnetic Field Exposure.

		Level	Units			Test Date:	18-Nov-15		
MPE Field Strength Limit		61	V/m			Test Engineer:	Joseph Brunett		
MPE Power Density Limit		1.0	mW/cm2			EUT Mode:	CW		
						Meas. Distance:	3m		

Freq. MHz	Temp °C	EIRP (Pk) dBm	Exposure Duty dB	EIRP (Avg) dBm	EUT Ant. Dim. cm	Far-field Distance m	S = 1mW/cm2 Dist.* cm	S @ 20 cm Distance mW/cm2	Comments
76200	20	30.7	-4.4	26.4	3.00	0.46	5.9	0.086	CW
76550	20	28.8	-4.4	24.5	3.00	0.46	4.7	0.056	CW
76900	20	26.8	-4.4	22.5	3.00	0.46	3.8	0.035	CW

$S @ 20cm = EIRP - 10 * \log_{10}(4 * \pi * 20^2)$

$S = 1mW/cm2 \text{ Distance} = \sqrt{30 * (EIRP(Avg)/1000)} / 61 * 100$

S = 1mW/cm2 Distance is an overestimated value(when less than the DUT far field distance, and demonstrates compliance with FCC Part 1.1307, 1.1310, 2.1091, and 2.0193 requirements when the DUT is mounted into the motor vehicle.

3.3 Unintentional Emissions

3.3.1 Transmit Chain Spurious Emissions

The results for the measurement of transmit chain spurious emissions at the nominal voltage and temperature are provided in Table 7.

Table 7: Transmit Chain Spurious Emissions.

Frequency Range	Det	IF Bandwidth	Video Bandwidth	Test Date:	11/18/15
25 MHz f 1 000 MHz	Pk/QPk	120 kHz	300 kHz	Test Engineer:	Joseph Brunett
f > 1 000 MHz	Pk	1 MHz	3 MHz	EUT:	TrueTech Radar
f > 1 000 MHz	Avg (RMS)	1 MHz	3 MHz	Mode:	FMCW
				Meas. Distance:	See Table.

1 GHz < FREQ < 40 GHz																										
#	Env.		Frequency Band		Antenna + Cable***					Rx. Power		Range Correction*				E-Field @ DR		EIRP*		S @ DR		E-Field Limit		Pass By	Comments	
	Temp. (C)	Volt. (V)	Start MHz	Stop MHz	Quality Number	Pol. H/V	Dim. cm	Ka dB/m	Kg dB	Pk dBm	Avg dBm	MR m	DR m	N/F m	CF dB	Pk dBuV/m	Avg dBuV/m	Pk dBm	Avg dBm	Pk dBm/cm2	Avg dBm/cm2	Pk dBuV/m	Avg dBuV/m			
1	20	13.4	1000	3000	HRNQR316401	H/V		24.1	-0.2	-90.2	-89.1	3.0	3.0			41.1	42.2					74.0	54.0	11.8	background	
2	20	13.4	3000	6000	HRNQR316401	H/V		36.4	-0.3	-92.1	-95.2	3.0	3.0			51.6	48.5					74.0	54.0	5.5	background	
3	20	13.4	6000	8400	HRNXN001	H/V	25.0	27.1	-0.6	-98.4		3.0	3.0	3.5	0.0	36.3	36.3					74.0	54.0	17.7	noise	
4	20	13.4	8400	12500	HRNX001	H/V	19.4	32.0	-0.8	-100.1		3.0	3.0	3.1	0.0	39.7	39.7					74.0	54.0	14.3	noise	
5	20	13.4	12500	18000	HRNKU001	H/V	15.2	35.4	-1.1	-98.9		3.0	3.0	2.8	0.0	44.6	44.6					74.0	54.0	9.4	background	
6	20	13.4	18000	26500	HRNK001	H/V	10.2	33.7	-1.6	-91.0		0.3	3.0	1.8	-35.7	15.5	15.5					74.0	54.0	38.5	noise	
7	20	13.4	38000	38000	HRNKA001	H/V	9.2	36.9	0.0	-77.4		0.3	3.0	2.1	-37.1	29.4	29.4					74.0	54.0	24.6	VCO/LO (noise)	
8	20	13.4	26500	40000	HRNKA001	H/V	9.2	37.2	0.0	-75.7		0.3	3.0	2.3	-37.5	31.0	31.0					74.0	54.0	23.0	noise	
40 GHz < FREQ < 220 GHz																										
#	Env.		Frequency Band		Antenna + Cable***					Rx. Power		Range Correction*				E-Field @ DR		EIRP*		S @ DR		S Limit		Pass By	Comments	
	Temp. (C)	Volt. (V)	Start GHz	Stop GHz	Quality Number	Pol. H/V	Dim. cm	Ka dB/m	Kg dB	Pk dBm	Avg dBm	MR m	DR m	N/F m	CF dB	Pk dBuV/m	Avg dBuV/m	Pk dBm	Avg dBm	Pk dBm/cm2	Avg dBm/cm2	Pk dBm/cm2	Avg dBm/cm2			
9	20	13.4	40.0	60.0	HRNU001	H/V	6.3	39.1	0.0	-62.6		0.30	3.0	1.6	-34.5	49.0		-46.2		-106.7		-62.2	44.5		max all, FMCW Chirp Active	
10	20	13.4	50.0	75.0	HRNV001	H/V	4.0	40.1	0.0	-65.1		0.30	3.0	0.8	-28.5	53.5		-41.7		-102.3		-62.2	40.0		max all, FMCW Chirp Active	
11	20	13.4	75.0	76.0	HRNW001	H/V	3.0	45.3	0.0	-56.4	-67.9	0.30	3.0	0.5	-23.6	72.3	60.8	-22.9	-34.4	-83.5	-95.0	-62.2	21.3		max all, FMCW Chirp Active	
12	20	13.4	77.0	110.0	HRNW001	H/V	3.0	46.4	0.0	-48.2	-66.8	0.30	3.0	0.7	-26.8	78.4	59.8	-16.8	-35.4	-77.4	-96.0	-62.2	15.2		max all, FMCW Chirp Active	
13	20	13.4	110.0	140.0	HRNG001	H/V	3.0	54.0	0.0	-59.2	-68.2	0.30	3.0	0.8	-28.9	72.9	63.9	-22.3	-31.3	-82.9	-91.9	-62.2	20.7		max all, FMCW Chirp Active	
14	20	13.4	152.4	152.4	HRNG001	H/V	3.0	54.0	0.0	-53.8	-53.8	0.23	3.0	0.9	-34.3	72.9	72.9	-22.3	-22.3	-82.8	-82.8	-62.2	20.6		CW Low	
15	20	13.4	153.1	153.1	HRNG001	H/V	3.0	54.0	0.0	-57.9	-57.9	0.23	3.0	0.9	-34.3	68.8	68.8	-26.4	-26.4	-87.0	-87.0	-62.2	24.8		CW Mid	
16	20	13.4	153.8	153.8	HRNG001	H/V	3.0	54.0	0.0	-53.5	-53.5	0.23	3.0	0.9	-34.4	73.1	73.1	-22.1	-22.1	-82.6	-82.6	-62.2	20.4		CW High	
17	20	13.4	140.0	200.0	HRNG001	H/V	3.0	54.0	0.0	-53.5	-63.9	0.23	3.0	1.2	-36.7	70.8	60.4	-24.4	-34.8	-84.9	-95.3	-62.2	22.7		max all, FMCW Chirp Active	
18	20	13.4	200.0	231.0	HRNG001	H/V	3.0	54.0	0.0	-60.2	-69.4	0.30	3.0	1.4	-33.3	67.5	58.3	-27.7	-36.9	-88.2	-97.4	-60.0	28.2		max all, FMCW Chirp Active	
19																										

* CF is computed assuming a 40 dB/decade Near-Field Decay Rate and a 20 dB/Decade Far-field Decay Rate. DR is Regulatory Range Distance. MR is Measurement Distance.
 ** EIRP is computed from field strength at 3 meter distance. If emission is within 6 dB of regulatory limit, then substitution method measurement is employed to determine exact EIRP.
 *** Dimension of antenna is taken to be larger of the test antenna and the DUT antenna; DUT antenna is 3cm in dimension.

Equipment Used: RSFSV30001, MIX26TO4001, MIX40TO600W, MIX50TO7501, MIX75TO10001, ASSORTED ANTENNAS LISTED ABOVE

3.3.2 Radiated Digital Spurious

The results for the measurement of digital spurious emissions (emissions arising from digital circuitry) at the nominal voltage and temperature are provided in Table 8. Radiation from digital components has been measured to 1000 MHz or to the highest frequency required by the applied standards, whichever is greater.

Table 8: Radiated Digital Spurious Emissions.

Frequency Range	Det	IF Bandwidth	Video Bandwidth	Test Date:	18-Nov-15
25 MHz f 1 000 MHz	Pk/QPk	120 kHz	300 kHz	Test Engineer:	Joseph Brunett
f > 1 000 MHz	Pk	1 MHz	3 MHz	EUT:	TrueTech Radar
f > 1 000 MHz	Avg (RMS)	1 MHz	3 MHz	Mode:	Active
				Meas. Distance:	3 meters

Digital Spurious Emissions																		FCC/IC + CE(CISPR)	
#	Test Freq. MHz	Antenna		Pr (Pwr Rx.)		E-Field @ 3m		FCC/IC Class B		CE Class B		FCC/IC Class A		CE Class A		Comments			
		Quality Number	Test Pol.	Pk dBm	QPk/Avg	Ka dB/m	Kg dB	Pk dBμV/m	QPk/Avg dBμV/m	E3lim dBμV/m	Pass dB	E3lim dBμV/m	Pass dB	E3lim dBμV/m	Pass dB				
1	122.0	BICEMCO01	V			11.6	36.8	27.2	43.5	16.3	40.5	13.3	54.0	26.8	50.5	23.3			
2	125.5	BICEMCO01	V			11.9	36.8	31.9	43.5	11.6	40.5	8.6	54.0	22.1	50.5	18.6			
3	129.0	BICEMCO01	V			12.0	36.7	33.1	43.5	10.4	40.5	7.4	54.0	20.9	50.5	17.4			
4	132.7	BICEMCO01	H			12.2	36.6	28.1	43.5	15.4	40.5	12.4	54.0	25.9	50.5	22.4			
5	134.1	BICEMCO01	V			12.2	36.6	32.3	43.5	11.2	40.5	8.2	54.0	21.7	50.5	18.2			
6	136.5	BICEMCO01	V			12.3	36.6	29.9	43.5	13.6	40.5	10.6	54.0	24.1	50.5	20.6			
7	210.8	BICEMCO01	V			15.7	35.3	27.2	43.5	16.3	40.5	13.3	54.0	26.8	50.5	23.3			
8	227.7	BICEMCO01	V			16.4	35.0	27.6	46.0	18.4	40.5	12.9	56.9	29.3	50.5	22.9			
9	649.0	LOGEMCO01	H			19.7	30.3	27.1	46.0	18.9	47.5	20.4	56.9	29.8	57.5	30.4			
10	706.7	LOGEMCO01	H			20.5	29.7	29.8	46.0	16.2	47.5	17.7	56.9	27.1	57.5	27.7			
11	734.5	LOGEMCO01	H			20.8	29.5	28.6	46.0	17.4	47.5	18.9	56.9	28.3	57.5	28.9			
12	893.4	LOGEMCO01	H			22.5	28.0	32.9	46.0	13.1	47.5	14.6	56.9	24.0	57.5	24.6			
13	932.2	LOGEMCO01	H			23.0	27.6	34.1	46.0	11.9	47.5	13.4	56.9	22.8	57.5	23.4			
14																			
15																			
16																			

*QPk detection below 1 GHz, Avg detection at or above 1 GHz with receiver bandwidth as specified at top of table.