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Testing of

Electromagnetic Emissions

per

USA:	**CFR Title 47, Part 15.253**	(Emissions)
USA:	**CFR Title 47, Part 2.1091;2.1093**	(Exposure)
Canada:	**IC RSS-251**	(Emissions)
Canada:	**ISED RSS-102**	(Exposure)

are herein reported for

Delphi Electronics & Safety
L2C0065TR

Test Report No.: 20150901-RPTWAC010031Ar2

Applicant/Provider:
Delphi Electronics & Safety
One Corporate Center, Kokomo Indiana 46904-9005 USA
Phone: 765 451 5770, Fax: 765-451-0900
Contact Person: Brian Johnson; brian.w.johnson@delphi.com

Measured by:	Dr. Joseph Brunett, EMC-002790-NE	Report Approved by:	Dr. Joseph Brunett, EMC-002790-NE
Report by:	Dr. Joseph Brunett, EMC-002790-NE	Report Date of Issue:	September 1, 2016

Results of testing completed on (or before) August 20, 2016 are as follows.

Emissions: The transmitter intentional emissions **COMPLY** with the regulatory limit(s) by no less than 28.7 dB. Transmit chain spurious or harmonic emissions **COMPLY** by no less than 6.9 dB.

Revision History

Rev. No.	Date	Details	Revised By
r0	9/1/2016	Initial Release.	J. Brunett
r1	10/10/2016	Update Emissions Table.	J. Brunett
r2	10/19/2016	Update Thermal stability data	J. Brunett

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1 Test Specifications, Procedures, Location, and Equipment List

1.1 Test Specification and General Procedures

The ultimate goal of Delphi Electronics & Safety 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 Delphi Electronics & Safety L2C0065TR for compliance to:

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

Delphi Electronics & Safety 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"
CFR 47 2.1091/1093	"447498 D01 General RF Exposure Guidance v06: RF Exposure Procedures and Equipment Authorization Policies for Mobile and Portable Devices"
ISED Canada	"The Measurement of Occupied Bandwidth"
ISED Canada RSS-102	"Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)"

1.2 Test Location

The EUT was fully tested by **Willow Run Test Labs, LLC**, 8501 Beck Road, Building 2227, Belleville, Michigan 48111 USA. Test Facility description and attenuation characteristics are on file with the FCC Laboratory, Columbia, Maryland (FCC Reg. No: 688478) and with ISED Canada, Ottawa, ON (File Ref. No: IC 8719A-1). Table 1 lists all site(s) employed herein. Specific test sites utilized are also listed in the test results sections of this report.

Table 1: Test Site List.

Description	Location	Quality Num.
OATS (3 meter)	8501 Beck Rd. Bldg 2227, Belleville MI 48111	OATSA

1.3 Equipment Used

Pertinent test equipment used for measurements at this facility is listed in Table 2. 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 2: Equipment List.

Description	Manufacturer/Model	SN	Quality Num.	Last Cal By / Date Due
Spectrum Analyzer	Rhode-Schwarz / FSV4	101222	RSFSV4001	RS / Mar-2018
Spectrum Analyzer	Rhode-Schwarz / FSV30	101660	RSFSV30001	RS / May-2018
Amplifier (5–1500 MHz)	Miteq / AM-44-000515	278450	AMP001	WRTL / May-2017
Signal Gen.	HP / 8340B	2730A0064	HPSG2	WRTL / On-Use
Biconical	EMCO / 93110B	9802-3039	BICEMCO01	Lib. Labs / Aug-2017
Log Periodic Antenna	EMCO / 3146	9305-3614	LOGEMCO01	Lib. Labs/ April-2017
Quad Ridge Horn	ETS Lind. / 3164-04	00066988	HRNQR316401	Lib. Labs / April-2017
Quad Ridge Horn	Singer / A6100	C35200	HQR2TO18S01	Lib. Labs / April-2017
K-Band Horn	JEF / NRL Std.	001	HRNK01	WRTL / Jul-2017
Ka-Band Horn	JEF / NRL Std.	001	HRNKA001	WRTL / Jul-2017
Harmonic Mixer	Hewlett Packard / 11970W	2521A00179	MIX70TO11001	Keysight / Mar-2019
Harmonic Mixer	Hewlett Packard / 11970U	2332A01153	MIX40TO7001	Keysight / Mar-2019
Harmonic Mixer	Pacific mmWave / GMA	26	MIX110TO23001	PMP / On-Use
W-Band Horn	Cust. Micro. / HO10R	-	HRNW01	Cust.M. / On-Use
U-Band Horn	Cust. Micro. / HO19R	-	HRNU01	Cust.M. / On-Use
D/G-Band Horn	Cust. Micro. / HO5R	-	HRNG01	Cust.M. / On-Use

2 Configuration and Identification of the Equipment Under Test

2.1 Description and Declarations

The EUT is an automotive radar. The EUT is approximately 10 x 6 x 1.5 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 3 outlines provider declared EUT specifications.

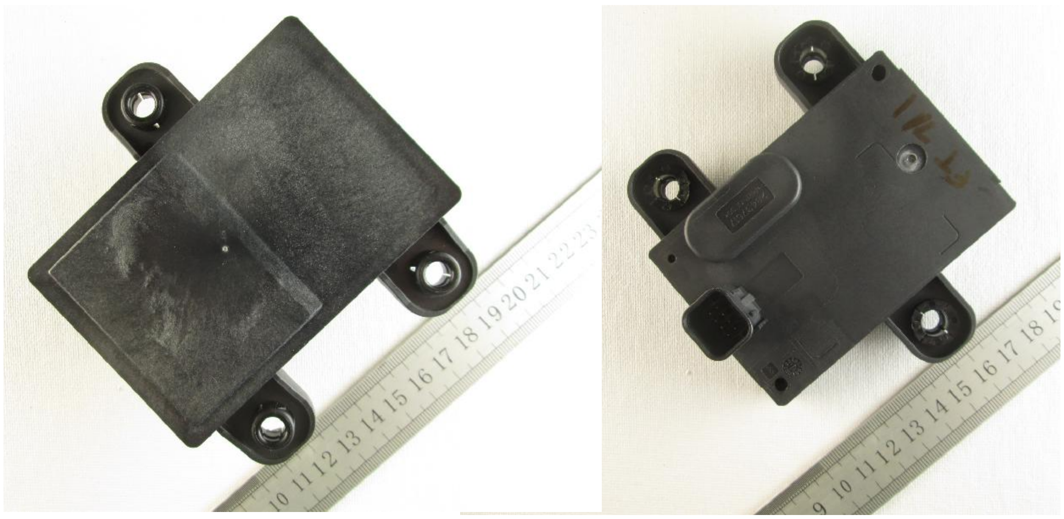


Figure 1: Photos of EUT.

Table 3: EUT Declarations.

General Declarations			
Equipment Type:	FMCW Radar	**Country of Origin:**	Hungary
Nominal Supply:	13.4 VDC	**Oper. Temp Range:**	−40°C to +85°C
Frequency Range:	76.005 to 76.915 GHz	**Antenna Dimension:**	6cm
Antenna Type:	integral patch arrays	**Antenna Gain:**	18 dBi (declared)
Number of Channels:	more than 2	**Channel Spacing:**	Not Applicable
Alignment Range:	Not Declared	**Type of Modulation:**	FMCW
United States			
FCC ID Number:	L2C0065TR	**Classification:**	FDS
Canada			
IC Number:	3432A-0065TR	**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

The manufacturer considers the modes of operation of this product to be of a proprietary nature. Please reference the confidential Modes of Operation exhibit for complete details.

2.1.3 Variants

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

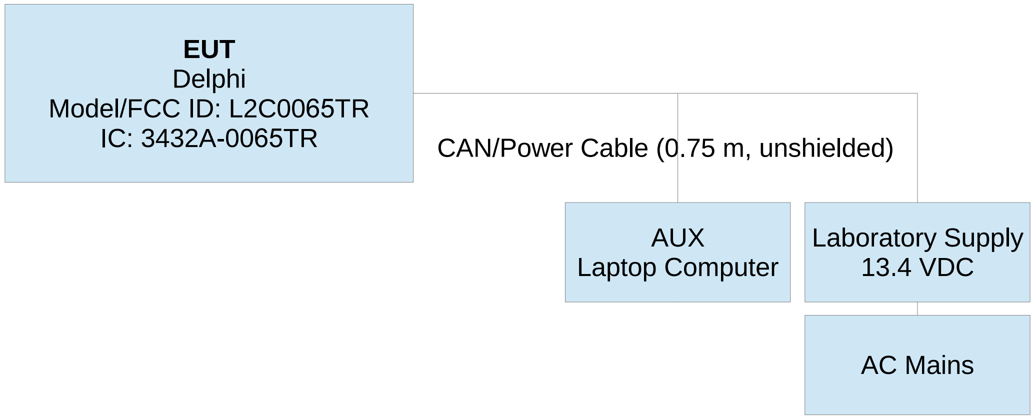


Figure 2: EUT Test Configuration Diagram.

2.1.4 Test Samples

Two samples were provided. One sample was fully functional and could be programmed for CW transmission at select frequencies and normal operating at low, middle, and high operating channels. One further sample was provided, unsealed, for photos.

2.1.5 Functional Exerciser

Normal operating EUT functionality was verified prior to testing by observation of the emissions spectrum.

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). In the mm-wave band, narrow pulses arise 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 either placed into CW mode or when the signal Dwells at a single frequency for an extended period of time. In computation of duty cycle for the FMCW chirp modulation, pulse desensitization may cause the measurement receiver with a narrow IFBW to report wider than actual pulse widths, and thus greater on-time and lower duty cycle based on the calculation method. Duty cycle in the FMCW mode is a worst-case computation, applied to a properly measured peak emission.

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 or GTEM test cell. 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 pre-scan, emission measurements are made on the test site of record. 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.

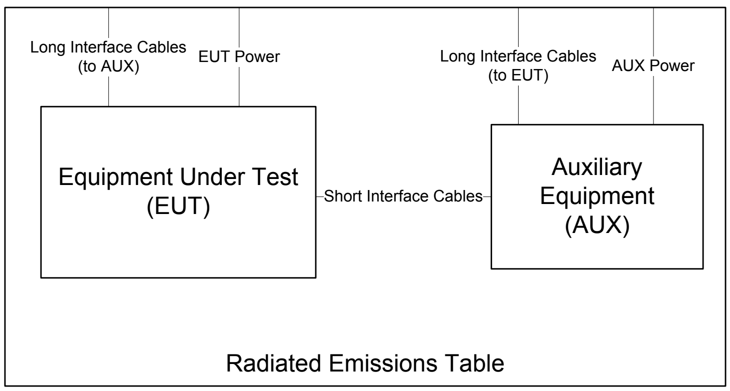


Figure 3: Radiated Emissions Diagram of the EUT.

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^o 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 or broadband ridge-horn antennas on our OATS with a 4×5 m rectangle of 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 antenna 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's signal level is 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

$$EIRP = P_T - G_A = ERP + 2.16, \tag{1}$$

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 field behavior as dictated by the test procedures. When measurements are made in the near-field, the near-field/far-field boundary (N/F) is reported. It is computed as

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

where D is the maximum dimension of the transmitter or receive antenna, and λ is the wavelength at the measurement frequency. Typically for high frequency measurements the receive antenna is connected to test receiver / analyzer through an external mixer. In this case, cable loss, IF amplifier gain, and mixer conversion losses are corrected for in the data table, or directly in the spectrum analyzer.

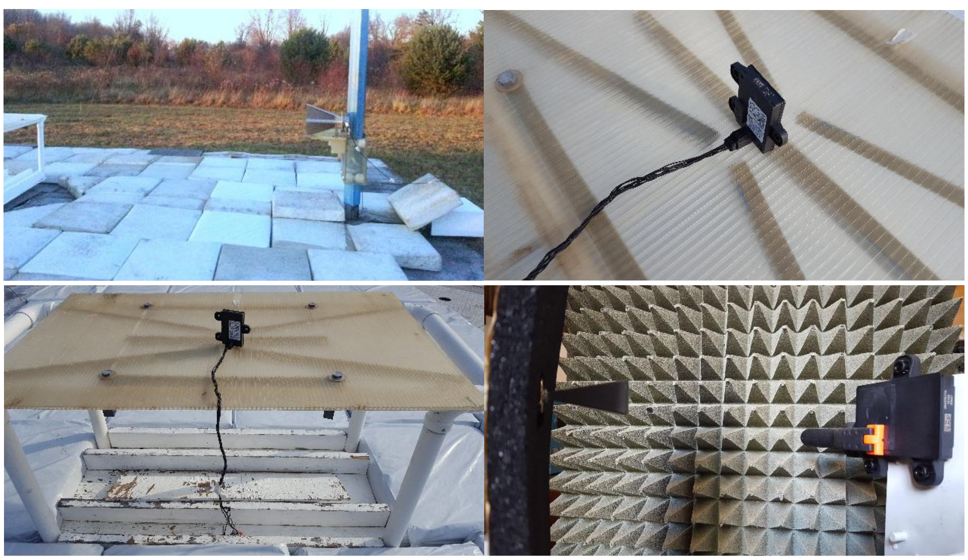


Figure 4: Radiated Emissions Test Setup Photograph(s).

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^{o}C to $+85^{o}$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 4. Plots showing the measurements made to obtain these values are provided in Figure 5.

Table 4: Pulsed Emission Characteristics (Duty Cycle).

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

Test Date:	24-Aug-16
Test Engineer:	Joseph Brunett
EUT	Delphi MRR1
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)	CHIRP BW (MHz)	Dwell/MHz/Chirp[4] (ms)	Chirps / On-Time[5] (#)	Max On-Time/Cycle[6] (ms)	Spread Duty[7] (dB)
LR FMCW (subfigure (b))	13.4	76.202	30.0	0.240	14.16	**-3.3**	0.033	109.4	0.00030	429	0.369	**-19.1**
MR FMCW (subfigure (c))	13.4	76.350	30.0	0.236	14.06	**-3.3**	0.033	460.7	0.00007	426	0.266	**-20.5**

(1) LR, MR Chirp Duty is worst-case at highest emission detected due to longest dwell time at these frequencies.
(2) Total On-Time = 14.16 ms FMCW chirp + 0.240 ms Non-FMCW Dwell = 14.4 ms.
(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 / CHIRP BW
(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(0.369ms/30.0ms) = -19.1
Equipment Used: RSFSV30001, MIX75TO10001, HRNW01

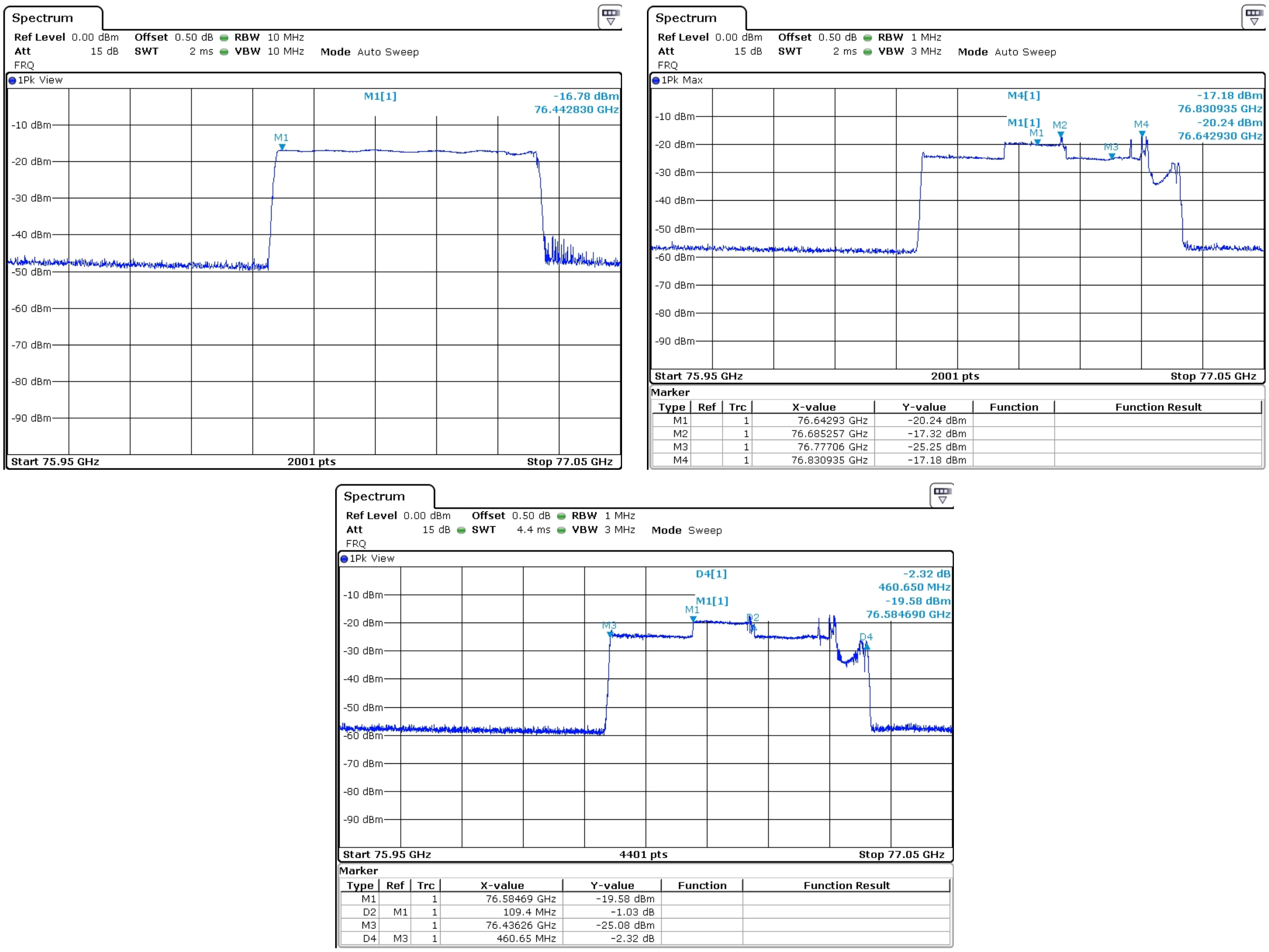


Figure 5(a): Pulsed Emission Characteristics (Duty Cycle).

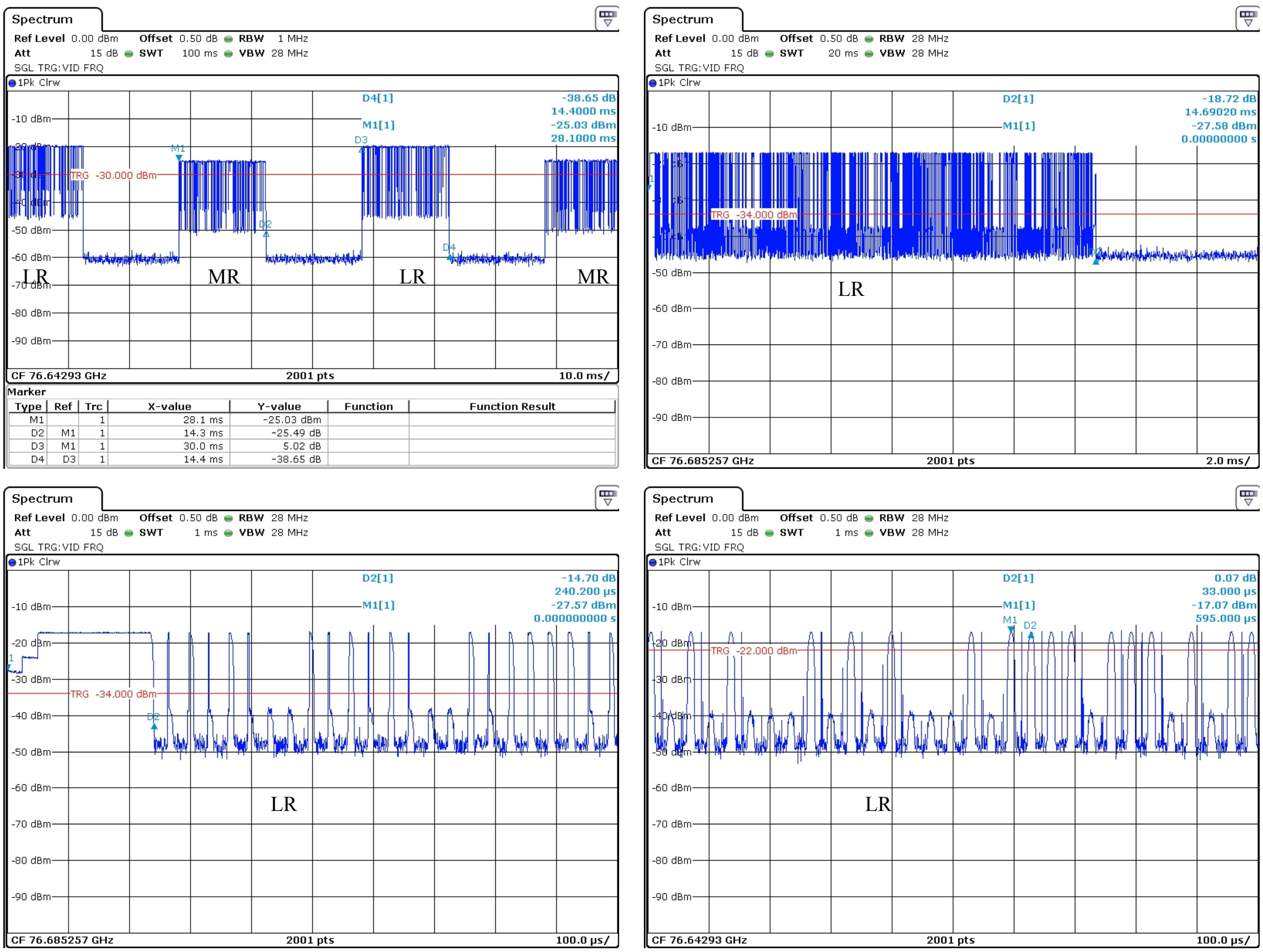


Figure 5(b): Pulsed Emission Characteristics (Duty Cycle).

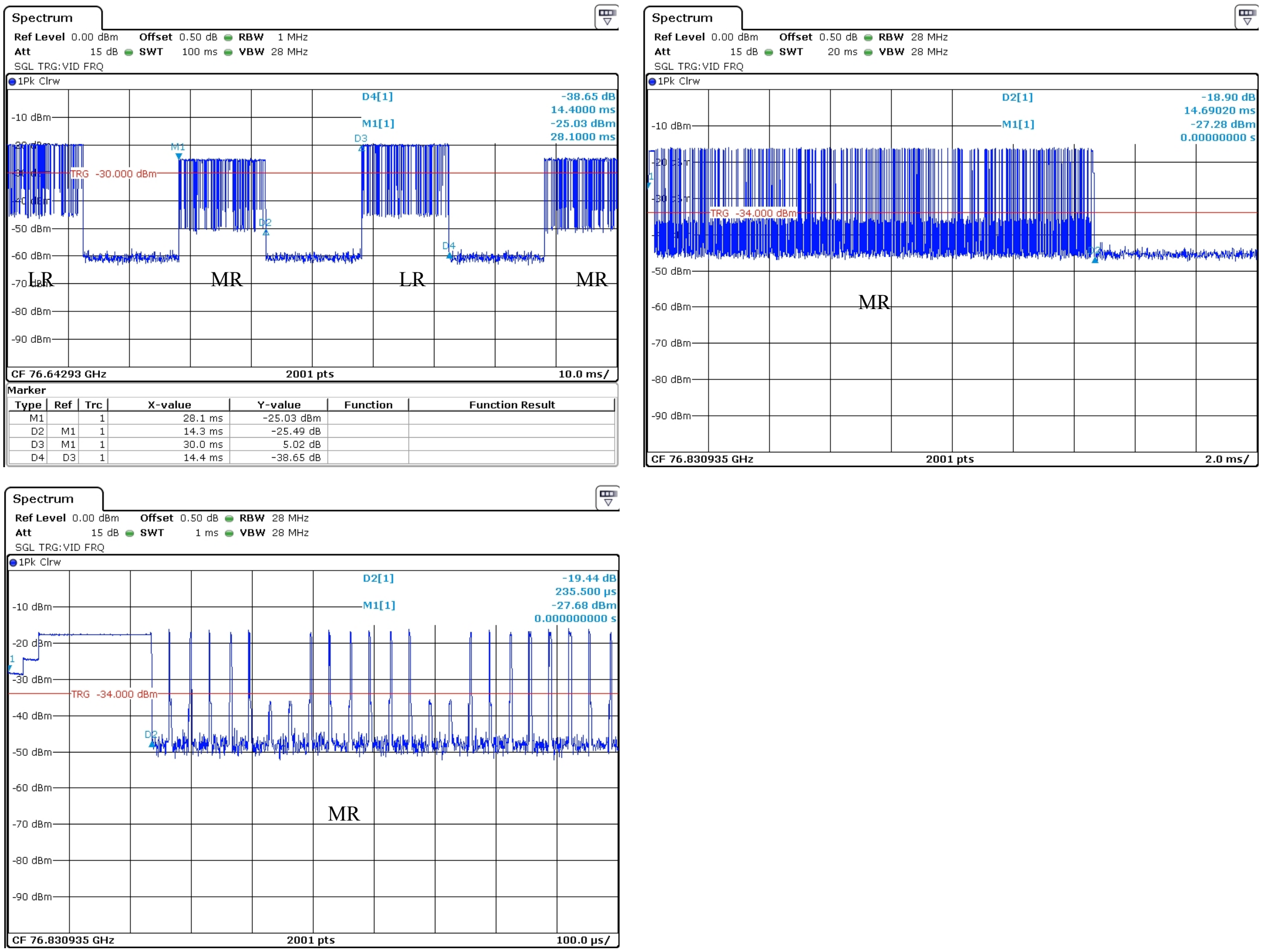


Figure 5(c): Pulsed Emission Characteristics (Duty Cycle).

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 5. Plots showing measurements employed to obtain the emission bandwidth reported are provided in Figure 6.

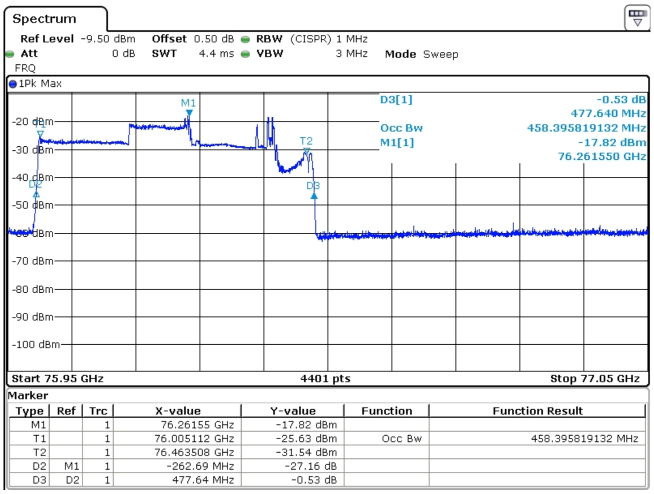
Table 5: Intentional Emission Bandwidth.

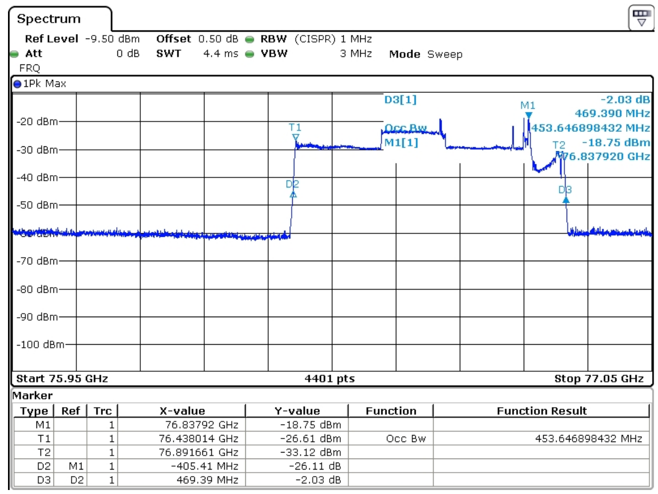
Frequency Range	**Det**	**IFBW**	**VBW**	**Span**		
Freq > 1 GHz	Pk	1 MHz	3 MHz	1200 MHz	**Test Date:**	17-Aug-16
					Test Engineer:	Joseph Brunett
					EUT:	Delphi MRR1
					Meas. Distance:	10 cm

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
LR + MR	Low	85.0	15.4	76006.9	76000.0	76463.5	77000.0	456.6	476.3	
	Low	-40.0	11.4	76005.1	76000.0	76463.5	77000.0	458.4	477.6	
	Mid	20.0	13.4	76438.0	76000.0	76891.7	77000.0	453.6	469.4	
	High	85.0	15.4	76463.3	76000.0	76915.2	77000.0	451.9	469.1	
	High	-40.0	11.4	76461.5	76000.0	76913.1	77000.0	451.7	455.4	
			fL_{MIN}	**76005.1**	**fH_{MAX}**	**76915.2**	**OBW_{MAX}**	**458.4**	**477.6**	Pass

Equipment Used: RSFSV30001, MIX75TO10001, HRNW01





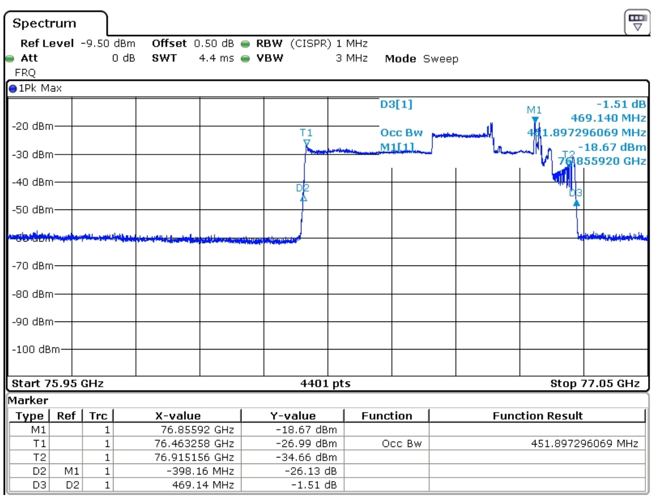


Figure 6: Intentional Emission Bandwidth.

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 6 details the results of these measurements.

Table 6: Fundamental Radiated Emissions.

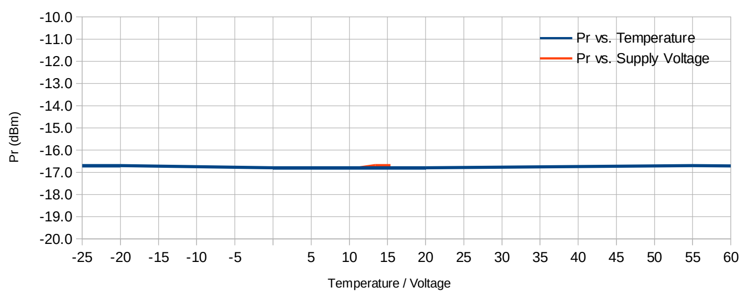
Frequency Range	Det	IF Bandwidth	Video Bandwidth
25 MHz ≤ f ≤ 1 000 MHz	Pk/QPk	120 kHz	300 kHz
f > 1 000 MHz	Pk	1 MHz	3 MHz
f > 1 000 MHz	RMS (Avg)	1 MHz	3 MHz

Test Date:	15-Aug-16
Test Engineer:	Joseph Brunett
EUT:	Delphi MRR1
Mode:	CW
Meas. Distance:	See Table.

	Env.		Frequency Band		Antenna + Cable					Rx. Power		Range Correction(2)				E3-Field		EIRP(3)		S3(5)		S3 Limit (6)			
	Temp.	Volt.	Start	Stop	Type	Pol.	Dim.(4)	Ka	Kg	Pk	Avg(1)	MR	DR	N/F	CF	Pk	Avg	Pk	Avg	Pk	Avg	Pk	Avg	Pass By	
#	(C)	(V)	MHz	MHz		H/V	cm	dB/m	dB	dBm		m	m	m	dB	dBuV/m		dBm		dBm/cm2		dBm/cm2		dB	Comments
1	20	13.4	76005.0	76005.0	Horn W	H/V	6.0	45.3	0.0	-16.9	-36.0	0.6	3.0	1.8	-14.0	121.4	102.3	26.2	7.1	-34.3	-53.4	-5.5	-10.6	28.8	CW
2	20	13.4	76500.0	76500.0	Horn W	H/V	6.0	45.3	0.0	-16.8	-35.9	0.6	3.0	1.8	-14.0	121.5	102.4	26.3	7.2	-34.2	-53.3	-5.5	-10.6	**28.7**	CW
3	20	13.4	76915.0	76915.0	Horn W	H/V	6.0	45.3	0.0	-17.1	-36.2	0.6	3.0	1.8	-14.0	121.2	102.1	26.0	6.9	-34.5	-53.6	-5.5	-10.6	29.0	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 20 dB/decade 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/cm^2) = EIRP (dBm) – 10*log10(4*pi*((300cm)^2)) = EIRP (dBm) – 60.5 dB
(6) 279 uW/cm2 = -5.5 dBm/cm2, 88 uW/cm2 = -10.6 dBm/cm2
Equipment Used: RSFSV30001, MIX75TO10001, HRNW01

#	Mode	Channel (MHz)	Temp. (C)	Pr (dBm)	Volt. (V)	Pr (dBm)	
8	CW	76500	85	-16.8	15.4	-16.7	
9			55	-16.7	13.4	-16.7	
10			20	-16.8	11.4	-16.8	
11			.0	-16.8			
12			-20	-16.7			
13			-40	-16.7			
14							
15							
16							
17							
18							
19							



Equipment Used: HP8560E1, HP8593E1, HP11970W1, WBAND1

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 7 details the results of these computations.

Table 7: Electromagnetic Field Exposure.

	Level	Units
MPE Field Strength Limit	61	V/m
MPE Power Density Limit	1.0	mW/cm2

Test Date:	15-Aug-16
Test Engineer:	Joseph Brunett
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
76005	20	26.2	-3.3	23.0	6.00	1.82	4.0	0.039	CW
76500	20	26.3	-3.3	23.1	6.00	1.84	4.0	0.040	CW
76915	20	26.0	-3.3	22.8	6.00	1.85	3.9	0.038	CW

S @ 20cm = EIRP – 10*log10(4 * PI * 20^2)

S = 1mW/cm2 Distance = sqrt(EIRPmW/(4*PI*1mW/cm2))

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 8.

Table 8: Transmit Chain Spurious Emissions.

Frequency Range	Det	IF Bandwidth	Video Bandwidth
25 MHz ≤ f ≤ 1 000 MHz	Pk/QPk	120 kHz	300 kHz
f > 1 000 MHz	Pk	1 MHz	3 MHz
f > 1 000 MHz	Avg (RMS)	1 MHz	3 MHz

Test Date:	10/08/16
Test Engineer:	Joseph Brunett
EUT:	Delphi MRR1
Mode:	Modulated
Meas. Distance:	See Table.

FREQ < 40 GHZ																									
	Env.		Frequency Band		Antenna + Cable***					Rx. Power		Range Correction*				E-Field @ DR		EIRP*		S @ DR		E-Field Limit			
	Temp.	Volt.	Start	Stop	Quality	Pol.	Dim.	Ka	Kg	Pk	Qpk	MR	DR	N/F	CF	Pk	Qpk	Pk	Avg	Pk	Avg	Pk	Qpk	Pass By	
#	(C)	(V)	MHz	MHz	Number	H/V	cm	dB/m	dB	dBm		m	m	m	dB	dBuV/m		dBm		dBm/cm2		dBuV/m		dB	Comments
1	20	13.4	30.0	88.0	BICEMCO01	H/V	22.0	16.9	35.0			3.0	3.0	0.0	0.0	37.0	28.2						40.0	11.8	LMH Channels (max all), background
2	20	13.4	88.0	216.0	BICEMCO01	H/V	22.0	16.9	35.0			3.0	3.0	0.1	0.0	37.0	31.3						43.5	12.2	LMH Channels (max all), background
3	20	13.4	216.0	1000.0	LOGEMCO01	H/V	22.0	20.1	29.9			3.0	3.0	0.3	0.0	38.2	32.1						46.0	13.9	LMH Channels (max all), background
	Env.		Frequency Band		Antenna + Cable***					Rx. Power		Range Correction*				E-Field @ DR		EIRP*		S @ DR		E-Field Limit			
	Temp.	Volt.	Start	Stop	Quality	Pol.	Dim.	Ka	Kg	Pk	Avg	MR	DR	N/F	CF	Pk	Avg	Pk	Avg	Pk	Avg	Pk	Avg	Pass By	
#	(C)	(V)	MHz	MHz	Number	H/V	cm	dB/m	dB	dBm		m	m	m	dB	dBuV/m		dBm		dBm/cm2		dBuV/m		dB	Comments
4	20	13.4	1000.0	6000.0	HRNQR316401	H/V	22.0	24.1	-1.3			3.0	3.0	1.9	0.0	47.1						74.0	54.0	26.9	LMH Channels (max all)
5	20	13.4	6000.0	18000.0	HQR2TO18S01	H/V	15.0	35.0	-2.5			3.0	3.0	2.7	0.0	66.2	47.1					74.0	54.0	**6.9**	LMH Channels (max all), background
6	20	13.4	18000.0	26500.0	Horn K	H/V	10.2	33.7	0.0			3.0	3.0	1.8	0.0	64.9	46.7					74.0	54.0	7.3	LMH Channels (max all), background
7	20	13.4	26500.0	40000.0	Horn Ka	H/V	9.2	37.2	36.0			0.6	3.0	2.3	-14.0	62.1	42.3					74.0	54.0	11.7	LMH Channels (max all), noise
FREQ >= 40 GHZ																									
	Env.		Frequency Band		Antenna + Cable***					Rx. Power		Range Correction*				E-Field @ DR		EIRP*		S @ DR		S Limit****			
	Temp.	Volt.	Start	Stop	Quality	Pol.	Dim.	Ka	Kg	Pk	Avg	MR	DR	N/F	CF	Pk	Avg	Pk	Avg	Pk	Avg	Pk	Avg	Pass By	
#	(C)	(V)	GHz	GHz	Number	H/V	cm	dB/m	dB	dBm		m	m	m	dB	dBuV/m		dBm		dBm/cm2		dBm/cm2		dB	Comments
8	20	13.4	40.0	70.0	HRNU001	H/V	6.3	39.1	0.0	-62.9		0.30	3.0	1.9	-20.0	63.2		-32.0		-92.5			-62.2	30.3	LMH Channels (max all)
9	20	13.4	70.0	75.0	HRNW001	H/V	6.0	40.1	0.0	-61.0		0.30	3.0	1.8	-20.0	66.1		-29.1		-89.6			-62.2	27.4	LMH Channels (max all)
10	20	13.4	75.0	76.0	HRNW001	H/V	6.0	45.3	0.0	-37.0	-64.5	0.30	3.0	1.8	-20.0	95.3	67.8	0.1	-27.4	-60.4	-87.9		-62.2	25.7	LowCH (low band edge)
11	20	13.4	75.0	76.0	HRNW001	H/V	6.0	45.3	0.0	-59.2	-70.1	0.30	3.0	1.8	-20.0	73.1	62.2	-22.1	-33.0	-82.6	-93.5		-62.2	31.3	MidCH (low band edge)
12	20	13.4	75.0	76.0	HRNW001	H/V	6.0	45.3	0.0	-60.1	-71.3	0.30	3.0	1.8	-20.0	72.2	61.0	-23.0	-34.2	-83.5	-94.7		-62.2	32.5	HighCH (low band edge)
13	20	13.4	77.0	110.0	HRNW001	H/V	6.0	46.4	0.0	-62.1	-72.0	0.30	3.0	2.6	-20.0	71.3	61.4	-23.9	-33.8	-84.4	-94.3		-62.2	32.1	LowCH (high band edge)
14	20	13.4	77.0	110.0	HRNW001	H/V	6.0	46.4	0.0	-61.2	-72.2	0.30	3.0	2.6	-20.0	72.2	61.2	-23.0	-34.0	-83.5	-94.5		-62.2	32.3	MidCH (high band edge)
15	20	13.4	77.0	110.0	HRNW001	H/V	6.0	46.4	0.0	-53.3	-70.5	0.30	3.0	2.6	-20.0	80.1	62.9	-15.1	-32.3	-75.6	-92.8		-62.2	30.6	HighCH (high band edge)
16	20	13.4	110.0	140.0	HRNG001	H/V	6.0	54.0	0.0	-55.2	-65.2	0.30	3.0	3.4	-20.0	85.8	75.8	-9.4	-19.4	-69.9	-79.9		-62.2	17.7	LMH Channels (max all)
17	20	13.4	140.0	200.0	HRNG001	H/V	6.0	54.0	0.0	-53.1	-63.2	0.30	3.0	4.8	-20.0	87.9	77.8	-7.3	-17.4	-67.8	-77.9		-62.2	15.7	LMH Channels (max all)
18	20	13.4	200.0	231.0	HRNG001	H/V	6.0	54.0	0.0	-50.9	-60.9	0.30	3.0	5.5	-20.0	90.1	80.1	-5.1	-15.1	-65.6	-75.6		-60.0	15.6	LMH Channels (max all)
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* CF is computed assuming a 20 dB/decade 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 6cm in dimension.

**** 600 pW/cm2 = -62.2 dBm/cm2, 1000 pW/cm2 = -60 dBm/cm2

Equipment Used: RSFSV30001, MIX26TO4001, MIX40TO7001, MIX70TO10001, HRNU001, HRNW001, HRNG001

4 Measurement Uncertainty

The maximum values of measurement uncertainty for the laboratory test equipment and facilities associated with each test are given in the table below. This uncertainty is computed for a 95.45% confidence level based on a coverage factor of $k = 2$.

Table 9: Measurement Uncertainty.

Measured Parameter	**Measurement Uncertainty**†
Radio Frequency	$\pm(f_{Mkr}/10^7 + RBW/10 + (SPN/(PTS-1))/2 + 1\,\text{Hz})$
Conducted Emm. Amplitude	$\pm 1.8\,\text{dB}$
Radiated Emm. Amplitude $(30 - 200\,\text{MHz})$	$\pm 2.7\,\text{dB}$
Radiated Emm. Amplitude $(200 - 1000\,\text{MHz})$	$\pm 2.5\,\text{dB}$
Radiated Emm. Amplitude $(f > 1000\,\text{MHz})$	$\pm 3.7\,\text{dB}$
DC and Low Frequency Voltages	±2%
Temperature	±0.5°C
Humidity	±5%

†Ref: CISPR 16-4-2:2011+A1:2014