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Prüfbericht - Nr.: *Test Report No.:*	**19660295 001**		**Seite 1 von 19** *Page 1 of 19*
Auftraggeber: *Client:*	**The Heil Co.** **2030 Hamilton Place Blvd.** **Suite 200** **Chattanooga, TN 37421** **United States**		
Gegenstand der Prüfung: *Test item:*	**3rd Eye Cam**		
Bezeichnung: *Identification:*	**V4**	**Serien-Nr.:** *Serial No.*	**14**
Wareneingangs-Nr.: *Receipt No.:*	**1803223211**	**Eingangsdatum:** *Date of receipt:*	**04.04.2017**
Prüfort: *Testing location:*	**Refer Page 4 of 19 for test facilities**		
Prüfgrundlage: *Test specification:*	**FCC Part 2, Part 22H, Part 24E & Part 27** **ANSI C63.10-2013 & TIA-603-D-2010**		
Prüfergebnis: *Test Result:*	**Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n).** *The test items passed the test specification(s).*		
Prüflaboratorium: *Testing Laboratory:*	**TÜV Rheinland (India) Pvt. Ltd.** 82/A, 3rd Main, West Wing, Electronic City Phase 1 Hosur Road, Bangalore – 560 100. India **FCC Registration No.: 176555 & IC OATS Reg. Number.: 3466E**		

geprüft / *tested by:*

Datum *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*
06.04.2017	Shrikanth S Naik Sr.Engineer	

kontrolliert / *reviewed by:*

Datum *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*
12.04.2017	Saibaba Siddapur Assistant Manager	

Sonstiges /*Other Aspects:* **FCC ID : 2AL99-TECV4 & IC : 22779-TECV4**

Abkürzungen:				***Abbreviations:***			
	P(ass)	=	***entspricht Prüfgrundlage***		***P(ass)***	=	***passed***
	F(ail)	=	***entspricht nicht Prüfgrundlage***		***F(ail)***	=	***failed***
	N/A	=	***nicht anwendbar***		***N/A***	=	***not applicable***
	N/T	=	***nicht getestet***		***N/T***	=	***not tested***

Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.

This test report relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any safety mark on this or similar products.

Test Result Summary

Test Item	Clause		Result
	FCC	IC	
RF Output Power (ERP/EIRP) – Radiated Mode	FCC Part 2.1046, 22.913(a)(2) 24.232(c) 27.50(d) (4),27.50(b)(10),27.50(c)(10)	RSS 132 Issue 3 section 5.4, SRSP-503 section 5.1.3 **&** RSS 133 Issue 6 section 4.1/6.4, SRSP-510.5.1.2 **&** RSS 139 Issue 3 section 6.5, RSS-130 Issue 1 section 4.4	Pass
Field Strength of Spurious Radiation	FCC Part 2.1053(a), 22.917(a)(b), 24.238(a)(b) 27.53(h)	RSS 132 Issue 3 section 5.5 (i)(ii) & RSS 133 Issue 6 section 6.5.1 (i)(ii) & RSS 139 Issue 3 section 6.6(i)(ii), RSS-130 Issue 1 section 4.6	Pass
Radiated Spurious Emission	FCC Part 15.109	ICES 003 Issue 6 Section 6.2.1	Pass

Note: Product contains certified RF module with FCC ID: QIPPLS8-X and IC: 830A-PLS8X, hence antenna port related test cases are not reported.

Content

List of Test and Measurement Instruments

Equipment	Manufacturer	Model Name	Serial Number	Calibration Due Date	Periodicity	Used for Test Items
EMI Test Receiver	Rohde & Schwarz	ESU 40	100288	29.10.2017	Yearly	Field Strength of Spurious Radiation
Broadband Antenna	Frankonia	ALX-4000	814	09.01.2018	Yearly	
Active Loop Antenna	Frankonia	LAX-10	LAX-10-800	22.12.2017	Yearly	
Broadband Horn Antenna	Frankonia	HAX-18	HAX18-802	16.03.2018	Yearly	
Double-Ridged Waveguide Horn Antenna	ETS Lindgren	116706	00107323	02.11.2017	Yearly	
Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	158345	05.11.2017	Yearly	
Anechoic Chamber	Frankonia	-	-		-	

Testing Facilities:

TUV Rheinland (India) Private Limited
108 , Beside ISBR Business School,
Electronic city Phase I
Bangalore - 560 100.

General Product Information

Product Function and Intended Use

This product is intended for vehicle surveillance and records the activities like accidents for investigation. This product can be used to capture driver's behaviour and allowing management to coach driver for safe behaviour. Through video analytics this product provides awareness of what is happening with vehicle and driver all the time with recording of various data such as traffic/stop sign board detection, vehicle proximity detection, Distractions, Driving lane recognition.

Ratings and System Details

Operating Bands	GSM/GPRS/EDGE 850MHz & 1900 MHz UMTS/HSPA+: B2,B4 & B5 LTE: B2,B4,B5,B13 & B17
Number of Antenna -Two	Primary Antenna – One Diversity Antenna - One
Antenna Gain and Antenna type	Refer Page No.10
Supply Voltage to Product	12VDC from Vehicle battery
Dimension Size (WxHxD)	UDU: 192mm x 65mm x 122mm WU: 125mm x 38mm x 75mm Battery Pack: 64mm x 60mm x 121mm
Environmental	•Operating temperature: 0°C to 60°C •Storage temperature: -40°C to 85°C

Note: Device exclusively used in vehicle only, it will operates on vehicle battery & Backup battery is also used to power the device for short duration when vehicle battery power is not available

Test Conditions:

Supply Voltage: 12 VDC

Environmental conditions:

Temperature: +25 º C RH: 62%

Test Set-up and Operation Mode

Principle of Configuration Selection

Transmission was enabled with help of CMW500 on low, mid and high channel

Test Operation and Test Software

No Special Test software used for enabling the Transmission, Test SIM inserted in EUT to communicate with CMW500 simulator

Special Accessories and Auxiliary Equipment

- None

Countermeasures to achieve EMC Compliance

- None

Test Modes – Data Rates and Modulations

For Radiated spurious emissions, the tests were performed for all data rates and only worst case results are reported in this report.

Ethernet cable is not used in vehicle (i.e. in field) but was used during testing for remote debugging from control room. The cable ferrite clamp used over Ethernet cable was 28A2025-0A2 (MFG: Laird-Signal Integrity Products)

Equipment used for testing as identified in below Table.

Equipment Used for	S/N Number	IMEI No.	Hardware Version	Software version
Radiated Mode Testing	14	359677060038116	3.0	1.2.2

GSM/PCS Frequency band details

Frequency Band	Uplink Frequency (MHz)	Downlink Frequency (MHz)
GSM850	824.2 – 849.2	869.2 – 893.8
PCS1900	1850.2 – 1909.8	1930.2 – 1989.8

GSM/PCS - Frequency List of Low/Mid/High channel				
Frequency Band	**Channel/Frequency (MHz)**	**Low**	**Mid**	**High**
GSM850	Channel No.	128	190	251
	Frequency	824.2	836.6	848.8
PCS1900	Channel No.	512	661	810
	Frequency	1850.2	1880	1909.8

W-CDMA Frequency band details

FDD Band	Uplink Frequency (MHz)	Downlink Frequency (MHz)
2	1852.4 – 1907.6	1930 – 1990
4	1712.4 – 1752.6	2110 - 2155
5	826.4 – 846.6	869 -894

W-CDMA - Frequency List of Low/Mid/High channel				
FDD Band	**Channel/Frequency (MHz)**	**Low**	**Mid**	**High**
2	Channel No.	9262	9400	9538
	Frequency	1852.4	1880	1907.6
4	Channel No.	1312	1412	1513
	Frequency	1712.4	1732.4	1752.6
5	Channel No.	4132	4183	4233
	Frequency	826.4	836.6	846.6

LTE bands Frequency Details

FDD Band	Transmitter Frequency (Uplink) (MHz)	Receiver Frequency (Downlink) (MHz)
2	1850 – 1910	1930 – 1990
4	1710 – 1755	2110 – 2155
5	824 – 849	869 – 894
17	704 - 716	734 - 746
13	777 – 787	746 – 756

Maximum Measurement Uncertainty (UE) details

Parameter	Uncertainty
Effective radiated RF power between 30MHz to 180MHz	±6 dB
Effective radiated RF power between 180MHz to 20GHz	±3 dB

Antenna gain information:
External antenna with separate antenna connector having a RF cable length of 15feet was used with product for testing.

Frequency	Below 1GHz	1700MHz	1900MHz
Gain (dBi)	-0.25	-1.59	-2.03

Operational description

The product is divided into two main units: UDU (Under Dash Unit) and WU (Window Unit)

WU contains two Internal video camera inside vehicle cabin and various sensors like accelerometers, gyroscope, Ambient Light sensor UDU contains two circuit boards:

1. Power supply board to generate various DC voltages from vehicle battery. Backup battery is also used to power the device for short duration when vehicle battery power is not available.

2. Mother board with SoC and other peripherals like

i. uSD card for storage

ii.Video decoder chips to convert analog audio/video data from two internal and six external camera into digital data for storage and analysis.

iii.PLS8-X 2G/3G/4G-LTE wireless module

iv. HDMI output.

Test Methodology

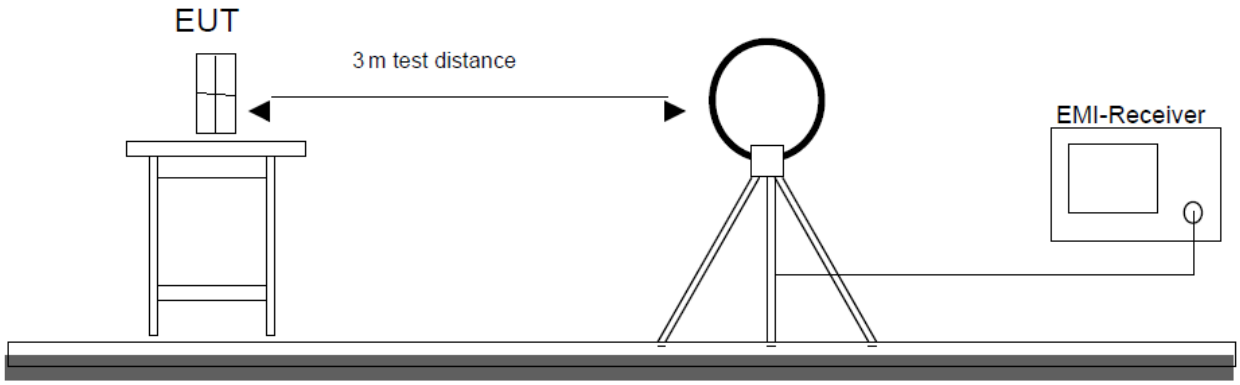
Frequency Range 9 kHz -30 MHz

Test performed as per ANSI C63.10-2013 section 6.4

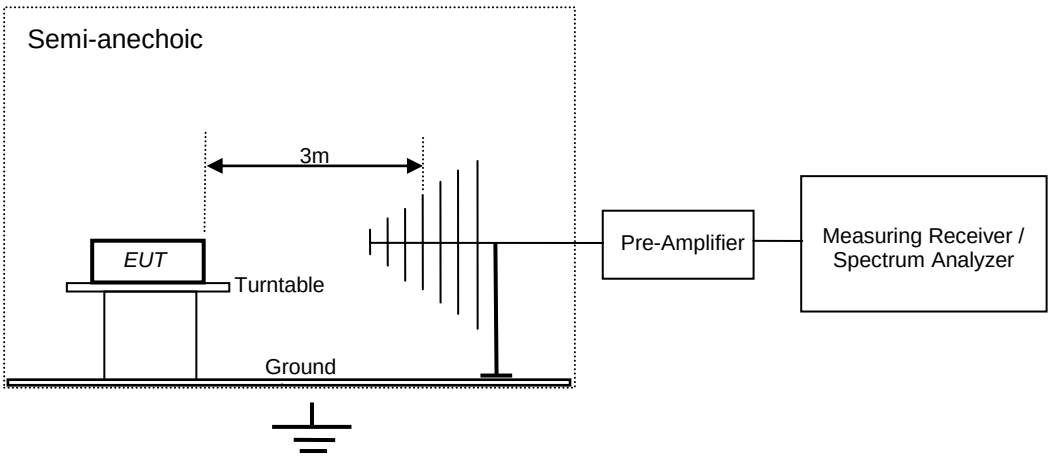
The loop Antenna was placed at 1m above the ground plane & EUT is 3 meters far from the measuring antenna. With 3m measurement distance, correction data were applied to the measured results. The test arrangement, measuring antenna guidelines and operational configurations in 6.3.1 and 6.3.2, shall be followed. The measurement antenna shall be positioned with its plane perpendicular to the ground at the Specified distance, when perpendicular to the ground plane, the lowest height of the magnetic antenna shall be 1 m above the ground and shall be positioned at the specified distance from the EUT.EUT & its associates are placed on non-conducting table of 0.8m height which is placed on the turn table, For each measurement antenna alignment, the EUT shall be rotated through 0° to 360° on a turntable. The report shall list worst case emission results, for each of the parallel & perpendicular orientations.

Test Setup Configuration

Frequency Range 9 kHz -30 MHz



Frequency Range 30MHz -1GHz



Frequency Range 30MHz to 10th harmonics of the highest fundamental frequency

Test performed as per ANSI/TIA-603-D-2010 Clause 2.2.12/17

ERP/EIRP Radiated Power & Radiated spurious emission test are performed as below.

The equipment under test is placed on non-conductive table at 3m away from the receive antenna in accordance with above mentioned standard. Turn table is rotated through 360 degree, and receiver antenna height is varied in order to determine the level of maximum emission. The maximum emission level and position of the maximized emission is recorded with use of spectrum analyzer.

The EUT is substituted by a substitution antenna. The substitute antenna is connected to a signal generator. Adjust the output level of the signal generator to get the same power recorded in with EUT and record the power level of Signal Generator. The cable loss at the test frequency should be compensated

The Power is calculated by the following formula

Pd (dBm) =Pg (dBm)-Cable Loss (dB) +Antenna Gain (dB)

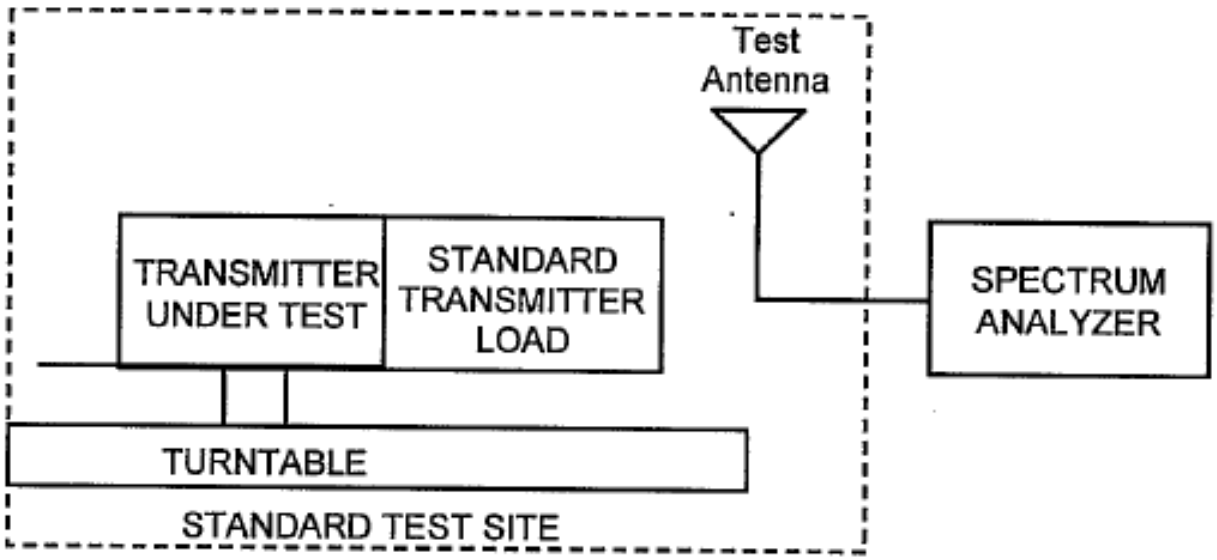
Where

Pd is the dipole equivalent power.

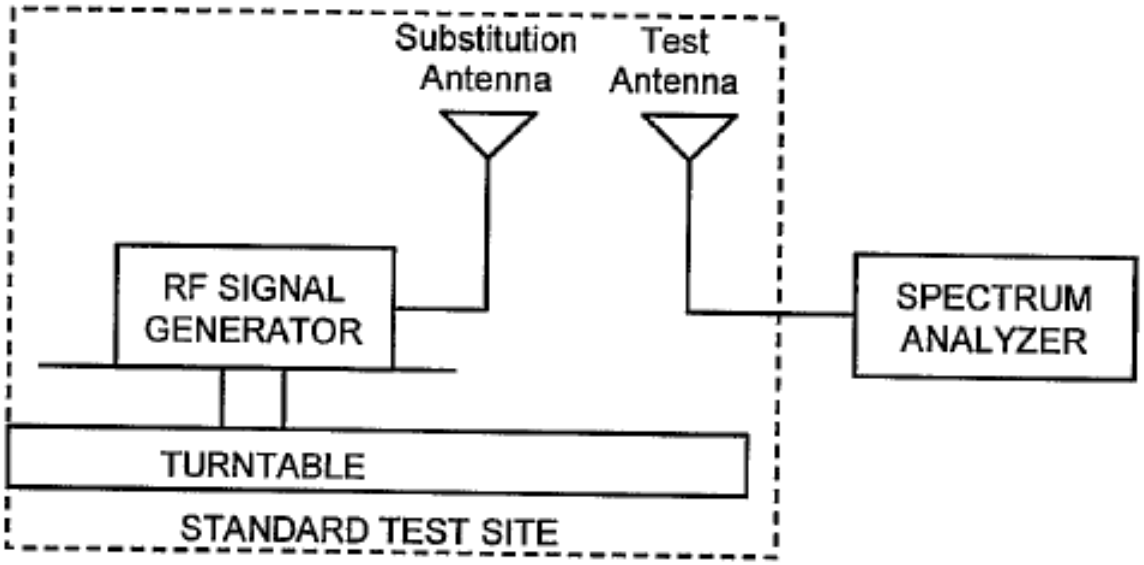
Pg is the generator output power into the substitution antenna

These steps are repeated with the receiving antenna in the both vertical & horizontal polarization

Measurement Method



Substitute measurement method



Test Results

RF Power (ERP/EIRP) – Radiated Mode
Result **Pass**

Specification	Refer Below Table 1
Measurement Bandwidth (RBW)	100KHz/1MHz
Detector Function	Peak
Requirement	Refer Below Table 1

Test Limits, Test Clause – Table 1

Cellular Bands	FCC Rule Part	IC Rule Part	Limits	
			Watt	dBm
GSM850	FCC Part 2.1046, 22.913(a)(2) 24.232(c)	RSS 132 Issue 3 section 5.4, SRSP-503 section 5.1.3 & RSS 133 Issue 6 section 4.1/6.4, SRSP-510.5.1.2	7 for FCC, 11.5 for IC	38.4 for FCC, 40.60 for IC
PCS1900			2	33
WCDMA Band 2	FCC Part 2.1046, 22.913(a)(2) 24.232(c),27.50(d)(4)	RSS 132 Issue 3 section 5.4, SRSP-503 section 5.1.3 & RSS 133 Issue 6 section 4.1/6.4, SRSP-510.5.1.2 &RSS 139 Issue 3 section 6.5	2	33
WCDMA Band 4			1	30
WCDMA Band 5			7 for FCC, 11.5 for IC	38.4 for FCC, 40.60 for IC
LTE Band 2	FCC Part 2.1046, 22.913(a)(2) 24.232(c) 27.50(d) (4),27.50(b)(10), 27.50(c)(10)	RSS 132 Issue 3 section 5.4, SRSP-503 section 5.1.3 & RSS 133 Issue 6 section 4.1/6.4, SRSP-510.5.1.2 & RSS 139 Issue 3 section 6.5, RSS-130 Issue 1 section 4.4	2	33
LTE Band 4			1	30
LTE Band 5			7 for FCC, 11.5 for IC	38.4 for FCC, 40.60 for IC
LTE Band 13			3 for FCC, 5 for IC	34.77 for FCC, 36.98 for IC
LTE Band 17			3 for FCC, 5 for IC	34.77 for FCC, 36.98 for IC

Note: For measurement of RF Output Power, Test performed as per ANSI/TIA-603-D-2010 Clause 2.2.17.

Test Results

Note: The output power is measured with configuration of maximum conducted output power.

GSM bands

Mode	Channel No.	Frequency (MHz)	Polarization	RF Power (dBm)	Limit (dBm)	Limit (Watts)
GSM_GPRS_850	128	824.2	Vertical	20.01	38.4	7
			Horizontal	28.1	38.4	7
	251	848.8	Vertical	19.51	38.4	7
			Horizontal	27.91	38.4	7
GSM_EGPRS_850	128	824.2	Vertical	17.32	38.4	7
			Horizontal	25.35	38.4	7
	251	848.8	Vertical	15.44	38.4	7
			Horizontal	24.23	38.4	7
GSM_GPRS_1900	512	1850.2	Vertical	22.07	33	2
			Horizontal	25.9	33	2
	810	1909.8	Vertical	21.89	33	2
			Horizontal	27.17	33	2
GSM_EGPRS_1900	512	1850.2	Vertical	16.06	33	2
			Horizontal	20.58	33	2
	810	1909.8	Vertical	17.51	33	2
			Horizontal	22.05	33	2

WCDMA Bands

Test Case : Release 99 12.2kbps RMC						
Band	**UARFCN Channel No.**	**UARFCN Channel Frequency (MHz)**	**Polarization**	**RF Power (dBm)**	**Limit (dBm)**	**Limit (Watts)**
2	9262	1852.4	Vertical	20.18	33	2
			Horizontal	19.79	33	2
	9538	1907.6	Vertical	21.15	33	2
			Horizontal	20.54	33	2
4	1312	1712.4	Vertical	20.25	30	1
			Horizontal	23.02	30	1
	1513	1752.6	Vertical	19.83	30	1
			Horizontal	23.16	30	1
5	4132	826.4	Vertical	8.48	38.5	7
			Horizontal	15.27	38.5	7

	4233	846.6	Vertical	7.1	38.5	7
			Horizontal	17.87	38.5	7

LTE Bands

Band	Bandwidth (MHz)	Frequency (MHz)	Polarization	RF Power (dBm)	Limit (dBm)	Limit (Watts)
LTE Band 2	1.4	1880	Vertical	15.7	33	2
			Horizontal	21.3	33	2
	3		Vertical	17.15	33	2
			Horizontal	20.73	33	2
	5		Vertical	15.6	33	2
			Horizontal	20.54	33	2
	10		Vertical	14.55	33	2
			Horizontal	19.59	33	2
	15		Vertical	13.77	33	2
			Horizontal	18.89	33	2
	20		Vertical	13.09	33	2
			Horizontal	16.88	33	2
LTE Band 4	1.4	1732.5	Vertical	17.1	30	1
			Horizontal	21.04	30	1
	3		Vertical	14.77	30	1
			Horizontal	19.35	30	1
	5		Vertical	13.24	30	1
			Horizontal	18.47	30	1
	10		Vertical	12.64	30	1
			Horizontal	16.61	30	1
	15		Vertical	11.9	30	1
			Horizontal	16.55	30	1
	20		Vertical	12.08	30	1
			Horizontal	15.85	30	1
LTE Band 5	1.4	836.6	Vertical	7.84	38.5	7
			Horizontal	17.09	38.5	7
	3		Vertical	6.24	38.5	7
			Horizontal	13.94	38.5	7
	5		Vertical	4.52	38.5	7
			Horizontal	12.05	38.5	7
	10		Vertical	1.46	38.5	7
			Horizontal	9.57	38.5	7
LTE Band 13	10	782	Vertical	0.57	36.98	3
			Horizontal	8.47	36.98	3
LTE Band 17	5	710	Vertical	-2.76	36.98	3
			Horizontal	8.69	36.98	3
	10		Vertical	-3.43	36.98	3
			Horizontal	7.37	36.98	3

Field Strength of Spurious Radiation
Result **Pass**

Specification	FCC Part 2.1053(a), 22.917(a)(b), 24.238(a)(b) & RSS 132 Issue 3 section 5.5,RSS 133 Issue 6 section 6.5
Measurement Bandwidth (RBW)	100KHz/1MHz
Detector Function	Peak
Requirement	Shall be attenuated below the transmitter power (P in watt) by at least 43+10 log(P) dBm,

Note: For measurement of RF Output Power, Test performed as per ANSI/TIA-603-D-2010 Clause 2.2.12.

Test Results

Test Results below 1GHz

Worst case test results are reported.

Polarization	Frequency (MHz)	Spurious Emission (dBm)	Limit (dBm)	Margin(dB)
Vertical	37.76	-62.00	-13	-49.00
	43.96	-64.56	-13	-51.56
	148.43	-71.34	-13	-58.34
	324	-72.55	-13	-59.55
	374.93	-71.05	-13	-58.05
	624.9	-60.42	-13	-47.42
	869.24	-53.59	-13	-40.59
Horizontal	31.35	-61.98	-13	-48.98
	38.53	-65.11	-13	-52.11
	43.96	-65.58	-13	-52.58
	324	-67.85	-13	-54.85
	374.92	-61.43	-13	-48.43
	624.99	-64.82	-13	-51.82
	869.24	-54.86	-13	-41.86

Test Result above 1GHz

Band	Channel No.	Channel Frequency (MHz)	Emission Frequency (MHz)	Polarization	Spurious Emission (dBm)	Limit (dBm)	Margin (dB)
GPRS 850	128	824.2	1648.4	Vertical	-58.05	-13	-45.05
				Horizontal	-53.32	-13	-40.32
			2472.6	Vertical	-55.32	-13	-42.32
				Horizontal	-52.41	-13	-39.41
	251	848.8	1697.6	Vertical	-57.74	-13	-44.74
				Horizontal	-55.19	-13	-42.19
			2546.4	Vertical	-59.22	-13	-46.22
				Horizontal	-57.10	-13	-44.10
EGPRS 850	128	824.2	1648.4	Vertical	-57.46	-13	-44.46
				Horizontal	-57.39	-13	-44.39
			2472.6	Vertical	-55.27	-13	-42.27
				Horizontal	-54.44	-13	-41.44
GPRS1900	661	1880	3760	Vertical	-52.97	-13	-39.97
				Horizontal	-53.31	-13	-40.31
EGPRS1900	661	1880	3760	Vertical	-53.11	-13	-40.11
				Horizontal	-53.20	-13	-40.20
W-CDMA_Band 2	9262	1852.4	3704.8	Vertical	-58.32	-13	-45.32
				Horizontal	-57.27	-13	-44.27
	9538	1907.5	3704.8	Vertical	-60.36	-13	-47.36
				Horizontal	-59.29	-13	-46.29
W-CDMA_Band 4	1312	1712.4	3424.8	Vertical	-53.32	-13	-40.32
				Horizontal	-52.84	-13	-39.84
	1513	1752.6	3505.2	Vertical	-52.74	-13	-39.74
				Horizontal	-53.06	-13	-40.06
W-CDMA_Band 5	4132	826.4	1652.8	Vertical	-42.05	-13	-29.05
				Horizontal	-40.30	-13	-27.30
			2479.2	Vertical	-55.48	-13	-42.48
				Horizontal	-55.73	-13	-42.73
			3305.6	Vertical	-53.06	-13	-40.06
				Horizontal	-53.36	-13	-40.36
	4233	846.6	1693.2	Vertical	-42.88	-13	-29.88
				Horizontal	-37.70	-13	-24.70
			2539.8	Vertical	-54.86	-13	-41.86
				Horizontal	-54.72	-13	-41.72
LTE Band 2_1.4MHz	18607	1850.7	370134	Vertical	-57.78	-13	-44.78
				Horizontal	-56.64	-13	-43.64
	19193	1909.3	3818.6	Vertical	-58.12	-13	-45.12
				Horizontal	-57.33	-13	-44.33

LTE Band 4_1.4MHz	19957	1710.7	3421.4	Vertical	-59.73	-13	-46.73
				Horizontal	-59.14	-13	-46.14
	20393	1754.3	3508.6	Vertical	-59.27	-13	-46.27
				Horizontal	-58.91	-13	-45.91
LTE Band 5_1.4MHz	20526	836.5	1673.2	Vertical	-51.40	-13	-38.40
				Horizontal	-50.38	-13	-37.38
			2509.8	Vertical	-51.25	-13	-38.25
				Horizontal	-51.62	-13	-38.62
LTE Band 17_5MHz	23790	710	1420	Vertical	-53.56	-13	-40.56
				Horizontal	-56.33	-13	-43.33
			2130	Vertical	-51.39	-13	-38.39
				Horizontal	-50.60	-13	-37.60
LTE Band 13_5MHz	23230	782	1564	Vertical	-52.30	-13	-39.30
				Horizontal	-55.06	-13	-42.06
			2346	Vertical	-49.84	-13	-36.84
				Horizontal	-50.97	-13	-37.97

Radiated Spurious Emissions
Result **Pass**

Test Specification	FCC Part 15.109 & ICES 003 Issue 6 ,Section 6.2.1
Test Method	ANSI C63.10-2013
Measurement Location	Semi Anechoic Chamber
Measuring Distance	3m
Detection	QP for frequency below 1GHz, Average for frequency above 1GHz
Requirement	As per the limits mentioned in the bellow table

Radiated Spurious Emission Limits:

Frequency (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Distance of Measurement (m)
0.009 – 0.490	2400/F(kHz)	48.50 – 13.80	300*
0.490 – 1.705	24000/F(kHz)	33.80 – 23.00	30*
1.705 -30	30	29.54	30*
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Remark: * The limit shows in the table above of frequency range 0.009 – 0.490, 0.490 – 1.705 MHz and 1.705-30MHz is at 300 meter, 30 meter and 30 meter range respectively, which corresponds to 88.50 – 53.80, 53.80 – 43.00 and 49.5dBµV/m at 3m range by extrapolation calculation and the measurement of loop antenna.

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector.

Test results:

For Frequency Range 9kHz – 30MHz

No emissions found in this frequency range.

For Frequency Range 30MHz – 1GHz

Polarization	Frequency (MHz)	Radiated Spurious Emission (dBm)	Limit (dBµV/m)	Margin (dB)
Vertical	30	39.42	40	-0.58
	31.12	3827	40	3787
	31.37	35.84	40	-4.16
	37.41	30.85	40	-9.15
Horizontal	30	39.53	40	-0.47
	30.06	38.59	40	-1.41
	31.02	34.67	40	-5.33

*****END OF TEST REPORT*****